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## **GML Application Schema for EO Products**

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## **i. Preface**

This document defines an application schema of the Geography Markup Language (GML) version 3.1.1 for describing Earth Observation products (EO products) within the HMA (Heterogeneous EO Missions Accessibility) Application Profile for the OGC™ Catalogue Services Specification v2.0.0 (with Corrigendum) [OGC 04-021r3]

Suggested additions, changes, and comments on this draft report are welcome and encouraged. Such suggestions may be submitted by email message or by making suggested changes in an edited copy of this document.

## **ii. Document terms and definitions**

This document uses the specification terms defined in Subclause 5.3 of [OGC 05-008]. In particular, the word “shall” (not “must”) is the verb form used to indicate a requirement to be strictly followed to conform to this specification.

## **iii. Submitting organizations**

This application schema is being submitted to the OGC by the following organizations:

- **ESA – European Space Agency**
- **CNES – French Space Agency**
- **EUSC**
- **Spacebel s.a.**
- **Spot Image**

The editors would like to acknowledge that this work is the result of collaboration and review of many organizations and would like to thank for the comments and contributions from :

- **ASI**
- **Conterra**
- **DLR**

- **Eumetsat**
- **MDA**

Note : this does not imply a complete endorsement from these organizations).

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#### **v. Revision history**

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11 May 2006	0.1.0	Jerome Gasperi	N/A	Initial document
29 May 2006	0.1.1	Jerome Gasperi	N/A	Updated after telecom meeting

#### **vi. Changes to OGC Specifications**

The previously approved OGC™ Specifications do not need changes to accommodate the technical contents of this document.

#### **vii. Future work**

At this stage, this document is a working document that will be filled with the ongoing work on schemas definition.

## **Foreword**

This document specifies an application schema of the existing OGC Implementation Specification for the Geometry Markup Language (GML) version 3.1.1 [OGC 03-105r1 and 04-092r4]. It is a GML application schema as specified in Subclause 23 of [OGC 03-105r1].

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The OGC shall not be held responsible for identifying any or all such patent rights.

## **Introduction**

The Geography Markup Language is an XML grammar written in XML Schema for the modelling, transport, and storage of geographic information.

From the GML specification, “GML provides a variety of kinds of objects for describing geography including features, coordinate reference systems, geometry, topology, time, units of measure and generalized values. A geographic feature is an abstraction of a real world phenomenon; it is a geographic feature if it is associated with a location relative to the Earth”.

EO data product collections are usually structured to contain data items derived from a sensor onboard a satellite or series of sensors. The key characteristics differentiating these products are date of acquisition, location and in some cases, such as the optical imagery, the possible presence of cloud, haze, smokes or other atmospheric or on ground phenomena obscuring the image. These are the key characteristics; there are however other metadata that are required to identify products of interest.

From a user point of view, an EO data product can be naturally described with a spatial extension (e.g. the geographic footprint of a satellite acquisition) and several attributes describing the metadata (e.g. date of acquisition, etc.). Indeed this point of view is consistent with a GML representation of the data.

The intent of this document is to describe a core interface for EO data product described as a GML version 3.1.1 application schema that can be supported by many data providers (satellite operators, data distributors ...).

In addition, this document describes the mechanism used to extend the general core interface to thematic EO product such as optical, radar and atmospheric missions and to very specific mission such as the French Pleiades mission.



# GML Application Schema for EO Products

## 1 Scope

This application schema document describes the encodings required to describe Earth Observation (EO) products from general to mission specific characteristics.

This document specifies three compliance levels :

- The general level, or “hma” level, describes the general EO Products schema;
- The thematic level extends the “hma” level to describes thematic EO Products such as optical, radar or atmospheric products (respectively “ohr”, “sar”, “atm” levels);
- The mission specific level extends one of the “thematic” level to describes mission specific EO Products. For instance the French Pleiades mission uses the “phr” level that extends the “ohr” thematic level.

## 2 Compliance

EO Products data encoded using this application schema shall produce XML documents that are fully compliant with normative XML Schema Documents associated with this specification (i.e. *hma.xsd* for general EO Products, *ohr.xsd*, *sar.xsd* and *atm.xsd* for optical, radar and atmospheric products respectively).

More specifically, compliance with this specification shall be checked using all the relevant tests specified in Annex A (normative).

## 3 Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of this document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

OGC 03-105r1, *OpenGIS Geography Markup Language (GML) Implementation Specification*, Version 3.1.0,

OGC 04-092r4, *GML 3.1.1 schemas*

OGC 05-008, *OGC Web Services Common Specification*, Version 1.0.0

OGC 05-010, *URNs of definitions in ogc namespace* (Recommendation Paper), Version 1.0.0

W3C, *Extensible Markup Language (XML) 1.0* (Second Edition), W3C Recommendation, 6 October 2000, <http://www.w3.org/TR/REC-xml>

W3C, *XML Schema Part 1: Structures*, <http://www.w3.org/TR/xmlschema-1>

W3C, *XML Schema Part 2: Datatypes*, <http://www.w3.org/TR/xmlschema-2>

W3C, *Namespaces in XML*, <http://www.w3.org/TR/1999/REC-xml-names-19990114>

In addition to this document, this specification includes several normative XML Schema files. Following approval of this document, these schemas will be posted online at the URL: **TBD**. These XML Schema files are also bundled with the present document. In the event of a discrepancy between the bundled and online versions of the XML Schema files, the online files shall be considered authoritative.

## 4 Terms and definitions

For the purposes of this specification, the definitions specified in Clause 4 of the OWS Common Implementation Specification [OGC 05-008] shall apply. In addition, the following terms and definitions apply.

### 4.1

#### **client**

software component that can invoke an **operation** from a **server**

### 4.2

#### **datastrip**

A satellite acquisition

### 4.3

#### **geographic information**

information concerning phenomena implicitly or explicitly associated with a location relative to the Earth [ISO 19128 draft]

### 4.4

#### **identifier**

a character string that may be composed of numbers and characters that is exchanged between the client and the server with respect to a specific identity of a resource

### 4.5

#### **qualified name**

name that is prefixed with its naming context

EXAMPLE The qualified name for the road no attribute in class Road defined in the Roadmap schema is RoadMap.Road.road\_no. [ISO 19118].

#### 4.6

##### **request**

invocation of an **operation** by a **client**

#### 4.7

##### **response**

result of an **operation**, returned from a **server** to a **client**

#### 4.8

##### **scene**

The cutting of a datastrip into part. For PHR mission, a scene is a 20x20 km<sup>2</sup> square part.

#### 4.9

##### **schema**

formal description of a model [ISO 19101, ISO 19103, ISO 19109, ISO 19118]

## 5 Conventions

### 5.1 Abbreviated terms

The abbreviated terms used in this document include:

ATM Atmospheric

EO Earth Observation

GML Geography Markup Language

HMA Heterogeneous Mission Accessibility

OGC Open Geospatial Consortium

PHR Pleiades High Resolution

OHR Optical High Resolution

SAR Synthetic Aperture Radar

XML eXtensible Markup Language

## 6 Overview

This section focuses on the purpose of the document. In particular, it describes the context of use of the EO Product application schema.

### 6.1 General concepts

Our approach consists in modelling each EO data product as a geographical feature described in a GML representation, using ISO definitions for attributes where available, although not using the full ISO schema for the structural definitions, which would lead to a less efficient overall structure.

The general mechanism is to create a GML application schema with a dedicated namespace for each level of specificity from a general description which is common to each EO Product to a restricted description for specific mission EO Product. Each level of specificity is an extension of the previous one.

The General EO product schema is the main application schema for EO Product data. It is associated with the “hma” (TBC) namespace.

Each Thematic EO product schemas extends the “hma” schema :

- The Optical EO Product schema is used to describe optical products. It is associated with the “ohr” namespace;
- The SAR EO Product schema is used to describe radar products. It is associated with the “sar” namespace;
- The Atmospheric EO Product schema is used to describe atmospheric products. It is associated with the “atm” namespace;

The idea behind this set of layered levels approach, is

- 1) to create an efficient schema set that describes EO Product metadata concentrating on the core metadata that key characteristics differentiate a products within a collection.
- 2) to profit by the widespread use of GML so that our products can be displayed by a large variety of GML viewer from generic one, which will see EO Products as features with footprint and “unknown” metadata, to EO Product specific one, which will understand the semantic of these metadata (cf. Figure 1)

More precisely, a generic GML viewer will only understand the “gml” vocabulary of the GML document; a “Generic EO Products viewer” will understand the “gml” and “hma” vocabulary of the GML document; an “Optical EO Products viewer” will understand the “gml”, “hma” and “ohr” vocabulary of the GML document. The “phr” vocabulary will only be understood by a “Specific PHR Viewer” that extends the “Optical EO Products Viewer”.

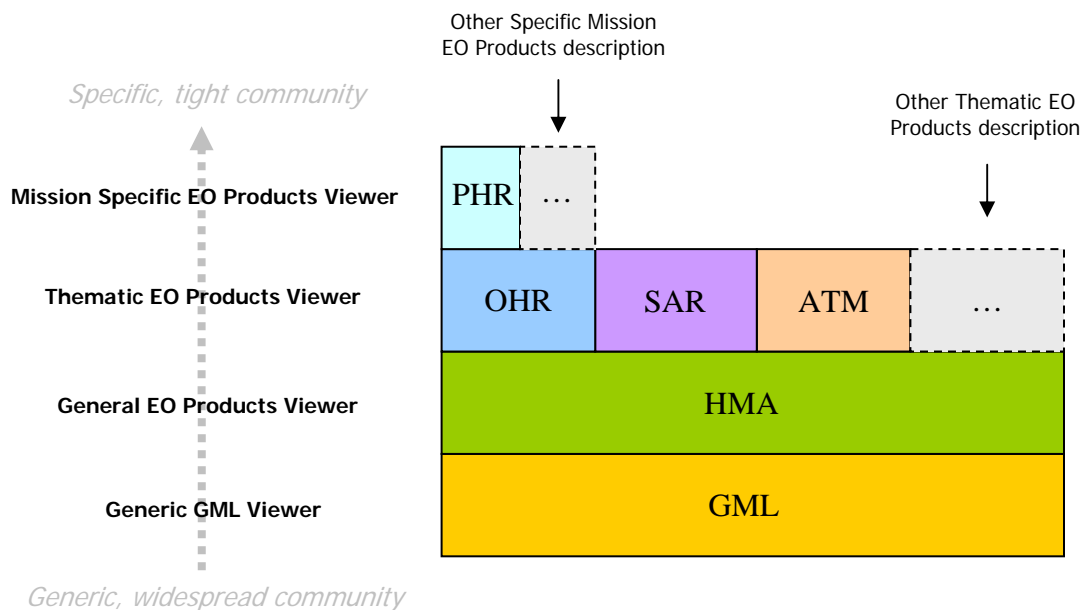


Figure 1 : A layered view of GML EO Products data..

## 6.2 General rules

We defined the following rules for creating the application schemas.

### 6.2.1 Language rules

Natural language used as far as possible for property names. For instance, complete names for properties are preferred to abbreviations.

Property name “hasXXX” is used to define structural links to extended metadata. For instance a “phr:Datastrip” is logically splitted into one or more ”phr:Scene”. Thus, each Scene in the “phr:Datastrip” schema is referenced with the “hma:hasScene” property.

Property name “fromXXX” is used to define structural links to “father” metadata. For instance in the previous example, the “phr:Datastrip” is referenced within the “phr:Scene” by the “hma:fromDatastrip” property name.

### 6.2.2 General extension rule

A thematic feature shall always extend its “hma” counterpart, i.e. a “ohr:EarthObservationProduct” extends “hma:EarthObservationProduct”. In the same way, a specific feature shall always extend its thematic counterpart, i.e. a “phr:Datastrip” extends “ohr:EarthObservationProduct”;

Benefits :

- the hma/ohr properties are identical in a phr:Datastrip;
- as a consequence, a “hma” enabled reader will find every hma/ohr property in its proper place and can neglect every other (i.e not hma/ohr) property.

### 6.2.3 Properties extension rule

Properties shall never be extended. New properties in extended namespaces shall be created (if needed) to handle specific data.

The reason is that an “hma” enabled reader must encounter well-known structures under a “hma” properties. One drawback of this approach is the artificial separation between data from two different namespaces that could be described in the same object. For example, “ohr” thematic EO Products metadata include the solar azimuth angle, named “illuminationAzimuthAngle” (cf. Table 2). This data would naturally be described under the hma:acquisitionParameters with an extension as follows (ohr:Acquisition would extend and act as a substitution for hma:Acquisition) :

```
<hma:acquisitionParameters>
  <ohr:Acquisition>
    [...]
    <hma:orbitDirection>ASCENDING</hma:orbitDirection>
    [...]
    <ohr:illuminationAzimuthAngle>56,67</ohr:illuminationAzimuthAngle>
  </ohr:Acquisition>
</hma:acquisitionParameters>
```

Since it is not possible to extend this property, we need to duplicate the hma:acquisitionParameters into an ohr:acquisitionParameters property :

```
<hma:acquisitionParameters>
  <hma:Acquisition>
    [...]
    <hma:orbitDirection>ASCENDING</hma:orbitDirection>
    [...]
  </hma:Acquisition>
</hma:acquisitionParameters>
[...]
<ohr:acquisitionParameters>
  <ohr:Acquisition>
    <ohr:illuminationAzimuthAngle>56,67</ohr:illuminationAzimuthAngle>
    [...]
  </ohr:Acquisition>
</ohr:acquisitionParameters>
```

### 6.2.4 CodeList

Property that shall be described within a given codeSpace shall use the <hma:CodeWithAuthorityType>. Note that this type will be replaced by the incoming <gml:CodeWithAuthorityType> (shall be available in GML 3.2).

```
<xs:complexType name="CodeWithAuthorityType">
```

```

<xs:annotation>
  <xs:documentation>From GML 3.2 draft</xs:documentation>
</xs:annotation>
<xs:simpleContent>
  <xs:extension base="xs:string">
    <xs:attribute name="codeSpace" type="xs:anyURI" use="required"/>
  </xs:extension>
</xs:simpleContent>
</xs:complexType>

```

Example : to guarantee the uniqueness of the EarthObservationProduct identifier within HMA, the `<hma:identifier>` includes the ground segment namespace through the `codeSpace` attribute.

```

<hma:identifier
codeSpace="urn:HMA:PHR:catalog:TLS:id">DS_PHR1A_20010822110247_TLS_PX_E123N45_0101_012
34</hma:identifier>

```

### 6.2.5 Units of measure

Each non-angle property concerned by a unit of measure shall use the existing GML type `<gml:MeasureType>`.

Example : image resolution

```

<xs:element name="resolution" type="gml:MeasureType">
  <xs:annotation>
    <xs:documentation>Image resolution</xs:documentation>
  </xs:annotation>
</xs:element>

```

Each angle property shall use the existing GML type `<gml:AngleType>`.

Example : Across Track incidence angle

```

<xs:element name="acrossTrackPointingAngle" type="gml:AngleType" minOccurs="0">
  <xs:annotation>
    <xs:documentation>Across Track Incidence angle given in degrees.</xs:documentation>
  </xs:annotation>
</xs:element>

```

### 6.2.6 Use of xlink

Properties that shall only describe an urn shall use the `<hma:HrefPropertyType>`. This complex type is a restriction of `<gml:FeaturePropertyType>` that only includes the “xlink” attribute.

```

<xs:complexType name="HrefPropertyType">
  <xs:complexContent>
    <xs:restriction base="gml:FeaturePropertyType">
      <xs:sequence/>
      <xs:attribute ref="xlink:href" use="required"/>
    </xs:restriction>
  </xs:complexContent>
</xs:complexType>

```

```

</xs:complexContent>
</xs:complexType>

```

Example : browse image path

```

<xs:complexType name="BrowseInformationType">
  <xs:sequence>
    [...]
    <xs:element name="path" type="hma:HrefPropertyType">
      <xs:annotation>
        <xs:documentation>Xlink to the browse image</xs:documentation>
      </xs:annotation>
    </xs:element>
    [...]
  </xs:sequence>
</xs:complexType>

```

Properties that shall describe either an urn or the content of that urn shall use an extension of `<gml:AbstractFeatureType>`.

Example : “hasMask” property reference either the urn or the GML content of one of the vector mask associated to the product (quality mask, cloud mask, etc.). Thus in `<hma:EarthObservationProduct>` the element “hasMask” is defined as a list of `<hma:Mask>` objects which extend `<gml:AbstractFeatureType>`.

```

<xs:element name="hasMask" type="hma:MaskPropertyType" minOccurs="0"
  maxOccurs="unbounded"/>
<xs:complexType name="MaskPropertyType">
  <xs:sequence>
    <xs:element ref="hma:Mask" minOccurs="0"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>

<xs:element name="Mask" type="hma:MaskType" substitutionGroup="gml:_Feature"></xs:element>
<xs:complexType name="MaskType">
  <xs:complexContent>
    <xs:extension base="gml:AbstractFeatureType">
      [...]
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

```



### 6.3 GML restrictive use

We restricted the use of GML types to those relevant to the EO Products metadata description, i.e. :

- gml:AngleType ;
- gml:CodeListType
- gml:MeasureType ;
- gml:centerOf (expected structure : gml:Point/gml:pos);
- gml:extentOf (expected structure : gml:Polygon/gml:exterior/gml:LinearRing/gml:posList)

See chapter 7.3 for discussion about this restrictive use of GML.

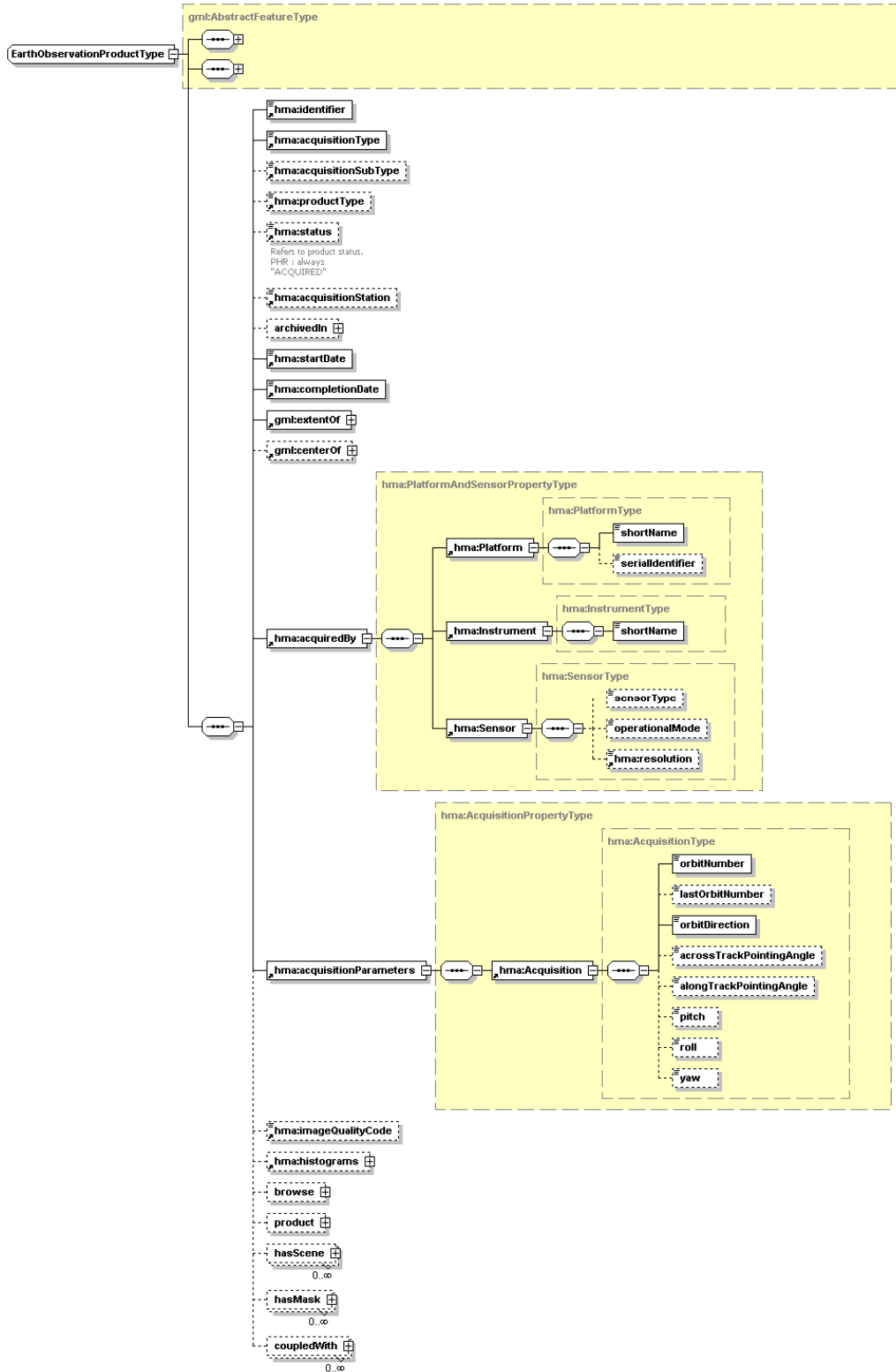
## 7 EO Products application schemas

### 7.1 General EO product data schema

The “hma” schema provides the description of metadata common to all EO Products derived from satellite based remote sensing. Thus it describes very generic fields such as the location or the date of a satellite acquisition (cf. Figure 2)

The root element of the “hma” schema, named `<hma:EarthObservationProduct>` extends the `<gml:AbstractFeatureType>` type as follows :

```
<xs:element name="EarthObservationProduct" type="hma:EarthObservationProductType"
            substitutionGroup="gml:_Feature"/>
<xs:complexType name="EarthObservationProductType">
  <xs:complexContent>
    <xs:extension base="gml:AbstractFeatureType">
      <xs:sequence>
        [...]
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
```



Generated with XMLSpy Schema Editor [www.xmlspy.com](http://www.xmlspy.com)

Figure 2: `<hma:EarthObservationProductType>` diagram

Fields taxonomy and semantic are described in Table 1.

Name space	Field name	Field description	ISO 19115-2 definition	ISO mapping	Cardinality
hma	identifier	Identifier for metadata item, includes ground segment namespace to guarantee uniqueness within HMA		no	1
hma	acquisitionType	Used to distinguish at a high level the appropriateness of the acquisition for "general" use, whether the product is a nominal acquisition, special calibration product or other.  Values: - NOMINAL - CALIBRATION - OTHER		no	1
hma	acquisitionSubType	The broad value is however too restrictive, so mission specific type definition should refer to mission/ground segment dedicated codeSpace		no	0..1
hma	productType	Describes product type in case that mixed types are available within a single collection, this is ground segment specific definition	MD_ContentInformation/ MD_CoverageDescription/ MD_CoverageContentType	no	1
hma	status	Refers to product status.  Values : - ARCHIVED - ACQUIRED - PLANNED	MD_Identification/ MD_ProgressCode	no	1

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		- POTENTIAL			
hma	startDate	Acquisition start date time dateTime in ISO 8601 format (CCYY-MM-DDThh:mm[:ss[.cc]]Z)	MI_AcquisitionInformation/ MI_MissionIdentification/ startDate	yes	1
hma	completionDate	Acquisition end date time dateTime in ISO 8601 format (CCYY-MM-DDThh:mm[:ss[.cc]]Z)	MI_AcquisitionInformation/ MI_MissionIdentification/ completionDate	yes	1
gml	extentOf	Acquisition footprint coordinates, described by a closed polygon (last point=first point), using CRS:WGS84, Latitude,Longitude pairs (per-WGS84 definition of point ordering, not necessarily per all WFS implementations)		no	1
gml	centerOf	Acquisition centre coordinates	MD_CoverageDescription/ MI_CoverageDescription/ MD_ImageDescription/ MI_ImageDescription/ nadir	no	0..1
hma	acquiredBy/ Platform/ shortName	Platform short name (e.g. PHR)	MD_DataIdentification/ MI_DataIdentification/ MI_AcquisitionInformation/MI_PlatformIdentification/ shortName	yes	1
hma	acquiredBy/ Platform/ serialIdentifier	Platform serial identifier (e.g. for PHR : 1A)	MD_DataIdentification/ MI_DataIdentification/ MI_AcquisitionInformation/MI_PlatformIdentification/ serialIdentifier	yes	0..1

hma	acquiredBy/ Instrument/ shortName	Instrument (Sensor) name	MD_DataIdentificati on/ MI_DataIdentificatio n/ MI_AcquisitionInfor mation/ MI_PlatformIdentifict ation/ MI_InstrumentIdentif ication/ shortName	yes	1
hma	acquiredBy/ Sensor/ sensorType	Sensor type. This field should contain an enumeration : - OPTICAL - RADAR - ALTIMETRIC - ATMOSPHERIC	MD_CoverageDescr iption/ MI_CoverageDescri ption/ MI_Sensor/ sensorType	yes	0..1
hma	acquiredBy/ Sensor/ operationalMode	Sensor mode. Possible values are mission specific and should be retrieved using codeSpace. (e.g. PHR : PA, XS or PX).	MD_CoverageDescr iption/ MI_CoverageDescri ption/ MI_Sensor/ operationalMode	yes	0..1
hma	acquiredBy/ Sensor/ resolution	Sensor resolution.		no	0..1
hma	acquisitionStatio n	Acquisition / receiving station code. Possible values are mission specific and should be retrieved using codeSpace.		no	0..1
hma	archivedIn/ ArchivingInforma tion/ archivingCentre	Archiving centre code. Possible values are mission specific and should be retrieved using codeSpace.		no	1  (with ArchivingInformat ion 0..n)
hma	archivedIn/ ArchivingInforma tion/ archivingDate	Archiving date time.		no	1
hma	archivedIn/ ArchivingInforma tion/ archivingId	Local archiving id as created by the mission ground segment that		no	0..1

	archivingIdentifier	may required to allow subsequent order processing			
hma	acquisitionParameters/ Acquisition/ orbitNumber	Acquisition orbit number		no	0..1
hma	acquisitionParameters/ Acquisition/ lastOrbitNumber	Acquisition last orbit number		no	0..1
hma	acquisitionParameters/ Acquisition/ orbitDirection	Acquisition orbit direction (Ascending or descending)	MD_ContentInformation/ MD_CoverageDescription/ MD_ImageDescription/ platformDescending	no  ( keep text rather than boolean, prefer alignment with other acquisition parameters)	0..1
hma	acquisitionParameters/ Acquisition/ acrossTrackPointingAngle	Acquisition incidence angle given in degrees (i.e. uom='deg')	MD_ContentInformation/ MD_CoverageDescription/ MD_ImageDescription/ relativeAzimuth	no	0..1
hma	acquisitionParameters/ Acquisition/ alongTrackPointingAngle	Acquisition incidence angle given in degrees (i.e. uom='deg')	MD_ContentInformation/ MD_CoverageDescription/ MD_ImageDescription/ TBD	no  (consistency in HMA between two angle definitions)	0..1
hma	acquisitionParameters/ Acquisition/ pitch	Satellite pitch angle given in degrees (i.e. uom='deg')		no	0..1
hma	acquisitionParameters/ Acquisition/ yaw	Satellite pitch angle given in degrees (i.e. uom='deg')		no	0..1
hma	acquisitionParameters/ Acquisition/ roll	Satellite pitch angle given in degrees (i.e. uom='deg')		no	0..1

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hma	qualityQuotation	Quality notation percentage (i.e. uom='%%')	MD_ContentInformation/ MD_CoverageDescription/ MD_ImageDescription/ imageQualityCode	yes  (if ISO code is a percentage)	0..1
hma	browse/ BrowseInformation/ type	Browse type.  Possible values are : - THUMBNAIL - QUICKLOOK - ALBUM.	MD_Identification/ MD_BrowseGraphic  ?	no	1  (with browse 1..n)
hma	browse/ BrowseInformation/ subType	Browse subType. Value is mission specific. Value list can be retrieved with codeSpace (e.g. For MODIS : OPTICAL, THERMAL)	MD_Identification/ MD_BrowseGraphic  ?	no	0..1
hma	browse/ BrowseInformation/ referenceSystemIdentifier	Indicates if browse is geo-referenced, and thus can be assumed to be displayed directly on a map (in which case should point to a code space for the CRS), when not supplied it is assumed that the browse is provided in "raw" satellite frame of reference	MD_Identification/ MD_BrowseGraphic  ?	no	1
hma	browse/ BrowseInformation/ fileName	Path to the browse image (could be any kind of URL : direct link to the image or WMS/WCS interface), it is assumed that if a client is prepared to "manage" a browse delivered by e.g. WMS they would parse the URL to identify that it contains the OGC standard SERVICE=WMS	MD_Identification/ MD_BrowseGraphic/ fileName	yes	1
hma	product/ ProductInformation/ on/	Path to the actual product data if available online (could	MD_ServiceIdentification	no  (use filename	0..1

	fileName	be any kind of URL : direct link to the image or WMS/WCS interface), it is assumed that if a client is prepared to "manage" a product delivered by e.g. WCS they would parse the URL to identify that it contains the OGC standard SERVICE=WCS		definition as per browse)	
hma	product/ProductInformation/referenceSystemIdentifier	Indicates if product is geo-referenced, (in which case should point to a code space for the CRS), when not supplied it is assumed that the browse is provided in "raw" satellite frame of reference	MD_DataIdentification/MD_SpatialRepresentationTypeCode  (propose adding a code for un-georeferenced) (The CRS is part the geometry. Including it here will create maintenance difficulties)	no	0..1
hma	product/ProductInformation/version	Product version	MD_DataIdentification/supplementalInformation	no	0..1
hma	product/ProductInformation/size	Product size (bytes) allowing the user to realise how long a download is likely to take	MD_DataIdentification/supplementalInformation	no	0..1
hma	histograms/Histogram/bandId	Histogram specific : identifier of the spectral band used to compute histogram values		no	0.. 1  (with Histogram 1..n)
hma	histograms/Histogram/min	Histogram specific : minimum value		no	1
hma	histograms/Histogram/max	Histogram specific : maximum value		no	1
hma	histograms/Histogram/	Histogram specific : mean value		no	1



	mean				
hma	histograms/ Histogram/ stdDeviation	Histogram specific : standard deviation value		no	1
hma	hasScene	Xlink to the scenes metada. Scenes framing is a logical cutting of the datastrip		no	0..n
hma	hasMask	Xlink to the mask metada (expressed in GML). Masks can be any of cloud cover, snow cover and quality mask.		no	0..n
hma	coupledWith	Xlink to the coupled datastrip with coupling information (stereo, tri- stereo, mosaic)		no	0..n
hma	localAttribute	Container for ad-hoc metadata that does not merit a mission specific schema or extension, the localAttribute describes the name of the attribute		no	0..n
hma	localValue	Container for ad-hoc metadata that does not merit a mission specific schema or extension, the localAttribute describes the value of the attribute		no	0..n

**Table 1 : fields description for “hma” schema**

## 7.2 Thematic EO product data schema

The Thematic EO Product schemas provide the description of metadata common to thematic category of General EO Products derived. Thus, the Thematic EO Products schema extends the “hma” schema.

### 7.2.1 Optical EO Product data schema

The “ohr” schema provide the description of metadata common to all EO Products derived from optical satellite based remote sensing. Thus, it describes the same fields as the “hma” schema plus optical specific fields such as the cloud coverage percentage (cf. Figure 3)

The root element of the “ohr” schema, named <ohr:EarthObservationProduct> extends the <hma:EarthObservationProductType> type as follows :

```

<xs:element name="EarthObservationProduct" type="ohr:EarthObservationProductType"
            substitutionGroup="hma:EarthObservationProduct"/>
<xs:complexType name="EarthObservationProductType">
  <xs:complexContent>
    <xs:extension base="hma:EarthObservationProductType">
      <xs:sequence>
        [...]
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

```

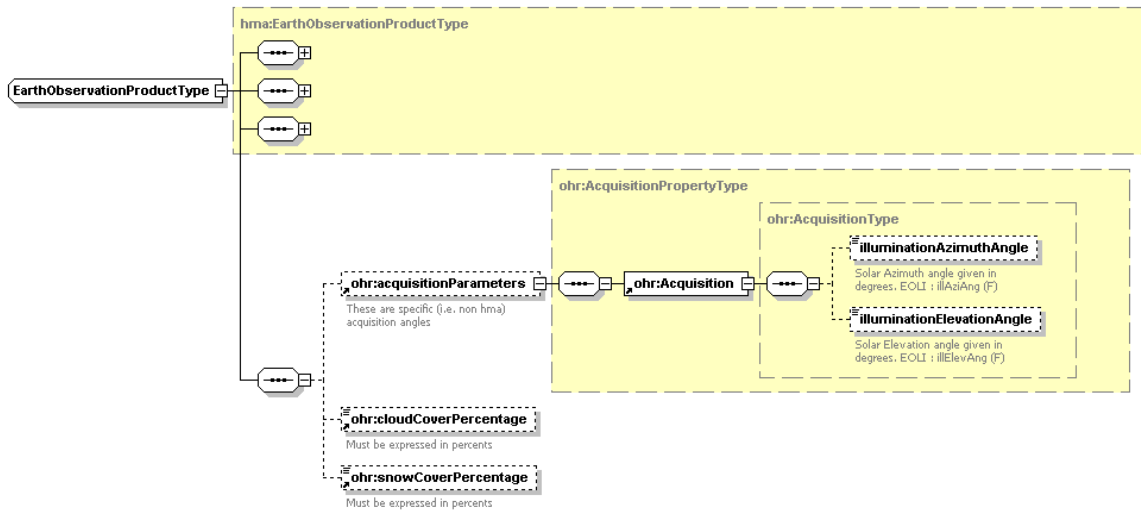


Figure 3: <ohr:EarthObservationProductType> diagram

General fields taxonomy and semantic are described in Table 1. Specific “ohr” fields taxonomy and semantic are described in Table 2.

Name space	Field name	Field description	ISO 19115-2 definition	ISO mapping	Cardinality
ohr	acquisitionParameters/illuminationAzimuth	Azimuth angle given in degrees (i.e. uom='deg')	MD_ContentInformation/MD_CoverageDescription/MD_ImageDescription/illuminationAzimuth	yes	0..1
ohr	acquisitionParameters/illuminationElevation	Elevation angle given in degrees (i.e. uom='deg')	MD_ContentInformation/MD_CoverageDescription/MD_ImageDescription/illuminationElevation	yes	0..1
ohr	cloudCoveragePercentage	Snow cover percentage (i.e. uom='%')	MD_ContentInformation/MD_CoverageDescription/MD_ImageDescription/cloudCoveragePercentage	yes	0..1
ohr	snowCoveragePercentage	Cloud cover percentage (i.e. uom='%')		no	0..1

**Table 2 : fields description for “ohr” schema**

### 7.2.2 Radar EO Product data schema

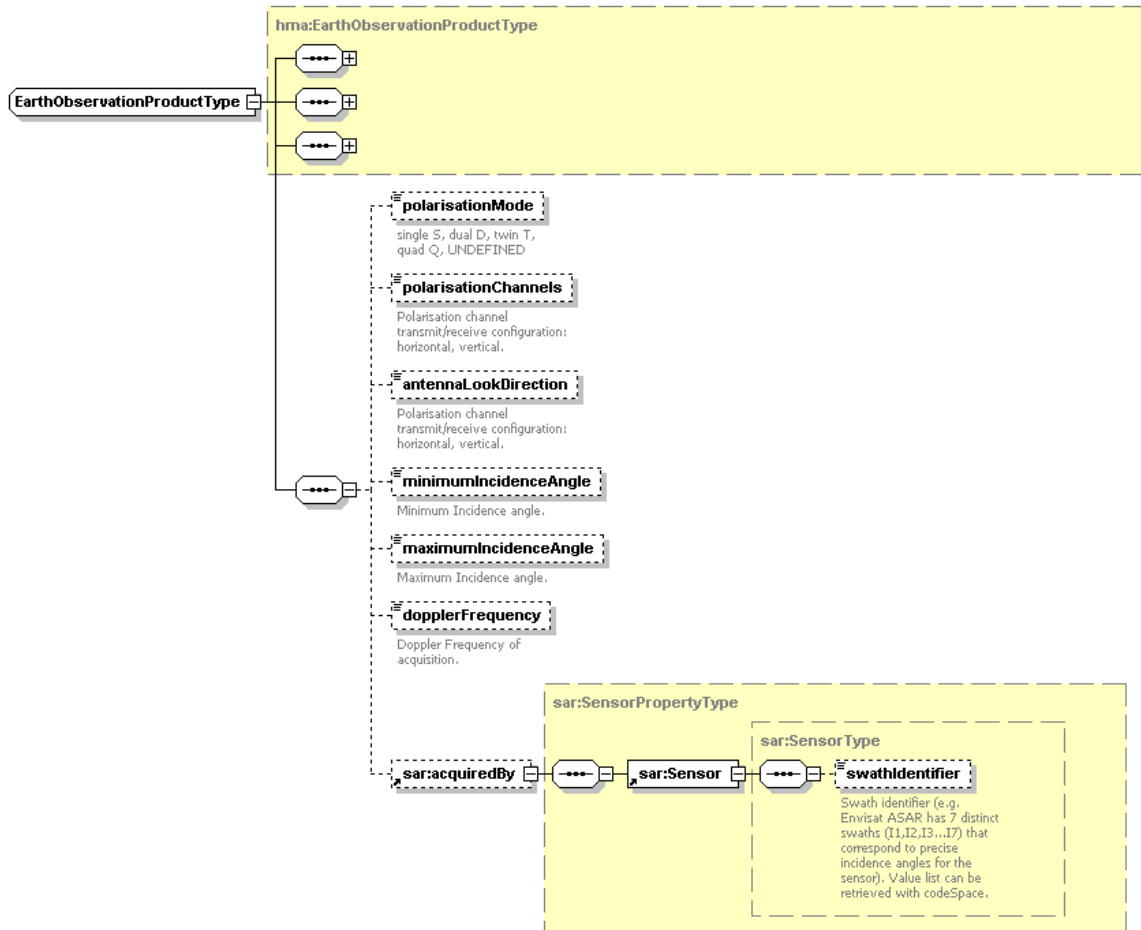
The “sar” schema provide the description of metadata common to all EO Products derived from radar satellite based remote sensing. Thus, it describes the same fields as the “hma” schema plus radar specific fields such as the polarisation mode (cf. Figure 4)

The root element of the “sar” schema, named <sar:EarthObservationProduct> extends the <hma:EarthObservationProductType> type as follows :

```

<xs:element name="EarthObservationProduct" type="sar:EarthObservationProductType"
            substitutionGroup="hma:EarthObservationProduct"/>
<xs:complexType name="EarthObservationProductType">
  <xs:complexContent>
    <xs:extension base="hma:EarthObservationProductType">
      <xs:sequence>
        [...]
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

```



**Figure 4:** <sar:EarthObservationProductType> diagram

General fields taxonomy and semantic are described in Table 1. Specific “sar” fields taxonomy and semantic are described in Table 3.

Names pace	Field name	Field description	ISO 19115-2 definition	ISO mapping	Cardinality
sar	polarisationMode	single S, dual D, twin T, quad Q, UNDEFINED	MD_CoverageDescription/ MD_RangeDimension/ MD_Band/ MI_Band/ MI_PolarizationCharacteristics	no	1
sar	polarisationChannels	polarisation channel transmit/receive configuration: horizontal, vertical. Valid: HH, HV, VH, VV, HH/VV, HH/VH, HH/HV, HV/VV, VH/VV, VH/HV, UNDEFINED	MD_CoverageDescription/ MD_RangeDimension/ MD_Band/ MI_Band/ MI_PolarizationCharacteristics	no	1
sar	antennaLookDirection	LEFT or RIGHT		no	1
sar	minimumIncidenceAngle	minimum incidence angle		no	1
sar	maximumIncidenceAngle	maximum incidence		no	1

	ngle	angle			
sar	dopplerFrequency	Doppler Frequency of acquisition		no	1
sar	acquiredBy/ Sensor/ swathIdentifier	Swath identifier (e.g. Envisat ASAR has 7 distinct swaths (I1,I2,I3...I7) that correspond to precise incidence angles for the sensor). Value list can be retrieved with codeSpace		no	0..1
sar	beamModeMnemonic	Abbreviations for individual beam or combination of beams used in imaging. (e.g. "S1" or "IS1")		no	0..1

**Table 3: fields description for “sar” schema**

### 7.2.3 Atmospheric EO Product data schema

The “atm” schema provide the description of metadata common to all EO Products derived **from atmospheric based remote sensing**. Thus, it describes the same fields as the “hma” schema plus atmospheric specific fields (cf. Figure 5)

The root element of the “atm” schema, named <atm:EarthObservationProduct> extends the <hma:EarthObservationProductType> type as follows :

```

<xs:element name="EarthObservationProduct" type="atm:EarthObservationProductType"
              substitutionGroup="hma:EarthObservationProduct"/>
<xs:complexType name="EarthObservationProductType">
  <xs:complexContent>
    <xs:extension base="hma:EarthObservationProductType">
      <xs:sequence>
        [...]
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

```

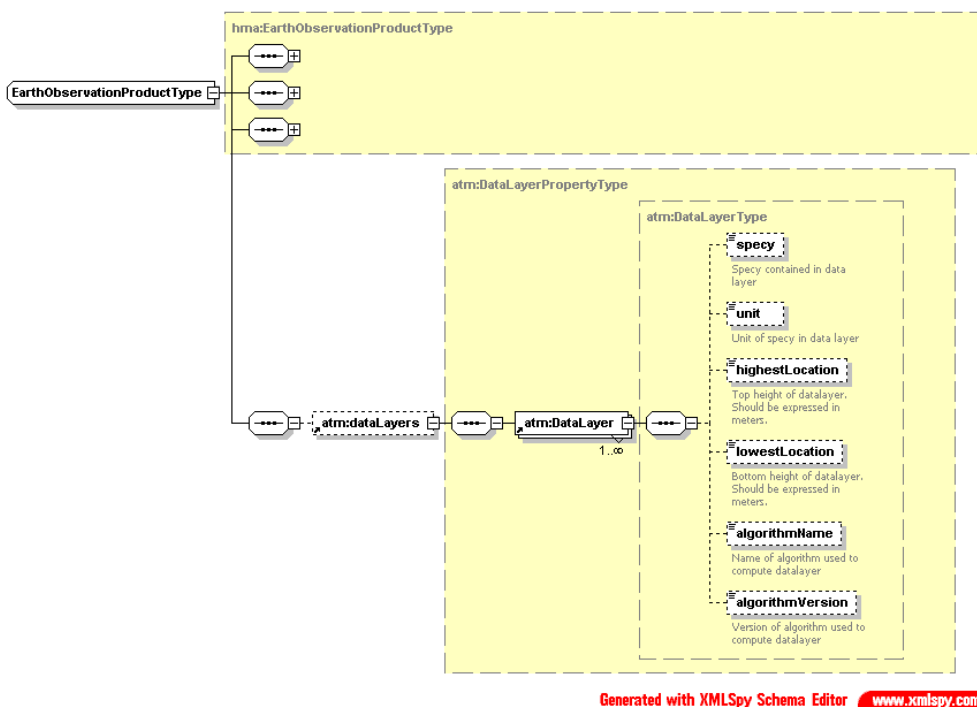


Figure 5 : <atm:EarthObservationProductType> diagram

General fields taxonomy and semantic are described in Table 1. Specific “atm” fields taxonomy and semantic are described in Table 4.

Name space	Field name	Field description	ISO 19115-2 definition	ISO mapping	Cardinality
atm	dataLayers/ DataLayer/ specy	Specy contained in dataLayer		no	1
atm	dataLayers/ DataLayer/ unit	Unit of specy in dataLayer		no	1
atm	dataLayers/ DataLayer/ highestLocati on	Top height of datalayer (in meters)	EX_VerticalExtent/ EE_VerticalExtentLocati ons/ highestLocation	yes	1

atm	dataLayers/ DataLayer/ bottomLocation	Bottom height of datalayer (in meters)	EX_VerticalExtent/ EE_VerticalExtentLocations/ bottomLocation	yes	1
atm	dataLayers/ DataLayer/ algorithmName	Name of algorithm used to compute datalayer		no	1
atm	dataLayers/ DataLayer/ algorithmVersion	Algorithm version used to compute datalayer		no	1

**Table 4: fields description for “atm” schema**

### 7.3 Issues

At the moment, the restriction of the use of GML types is purely informative (i.e. describe in the annotation of the application schema).

In particular, we use the <gml:extentOf> property to describe the footprint of the feature. This footprint should be simply described by a Polygon object. Thus the expected structure under the <gml:extentOf> should be gml:Polygon/gml:exterior/gml:LinearRing/gml:posList, which is one of the numerous possible structures allowed by the schema.

It should be discussed whether or not this Application schema should reference a specific GML Implementation Profile taking into account this issues.

### 7.4 XML schema documents

The different GML application schema are specified in the normative XML Schema Documents included in the zip file with this text document, which are named:

- a) hma.xsd
- b) atm.xsd
- c) ohr.xsd
- d) sar.xsd
- e) phr.xsd



All these XML Schema Documents contain documentation of the meaning of each element and attribute, and this documentation shall be considered normative as specified in Subclause 11.6.3 of [OGC 05-008].

These XML Schema Documents are bundled in a zip file with this document. After OGC acceptance of a Version 1.0.0 of this specification, these XML Schema Documents will also be posted online at the URL **TBD**. In the event of a discrepancy between the bundled and online versions of the XML Schema Documents, the online files shall be considered authoritative.

**Annex A**  
(normative)

**Abstract test suite**

An abstract test suite is not provided in this version of this Implementation Specification, but will be provided in version 1.0.0.

## **Annex B** (normative)

### **Examples using “hma” application schema**

#### **B.1 Introduction**

This annex contains several example XML documents encoded using the “hma” application schema.

#### **B.2 Example of “hma” EO Product**

**TBD**

#### **B.3 Example of a “phr” EO Product**

**TBD**

## Annex C (normative)

### Reference schemas for EO Products GML application schemas

#### D.1 Application schema for General EO Products

The following schema document, called *hma.xsd*, contains elements to describe General EO Products using GML 3.1.1

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by jrom (CNES) -->
<xs:schema targetNamespace="http://earth.esa.int/hma" xmlns:hma="http://earth.esa.int/hma"
xmlns:gml="http://www.opengis.net/gml" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xlink="http://www.w3.org/1999/xlink" elementFormDefault="qualified"
attributeFormDefault="unqualified" version="0.7">
  <xs:import namespace="http://www.opengis.net/gml"
schemaLocation="../../gml/3.1.1/base/feature.xsd"/>
  <xs:import namespace="http://www.opengis.net/gml"
schemaLocation="../../gml/3.1.1/base/measures.xsd"/>
  <xs:import namespace="http://www.w3.org/1999/xlink" schemaLocation="../../xlink/1.0.0/xlinks.xsd"/>
  <!-- ===== -->
  <!-- EarthObservationProduct feature -->
  <!-- ===== -->
  <xs:element name="EarthObservationProduct" type="hma:EarthObservationProductType"
substitutionGroup="gml:_Feature"/>
  <xs:complexType name="EarthObservationProductType">
    <xs:complexContent>
      <xs:extension base="gml:AbstractFeatureType">
        <xs:sequence>
          <xs:element ref="hma:identifier"/>
          <xs:element ref="hma:acquisitionType"/>
          <xs:element ref="hma:acquisitionSubType" minOccurs="0"/>
          <xs:element ref="hma:productType"/>
          <xs:element ref="hma:status"/>
          <xs:element ref="hma:acquisitionStation" minOccurs="0"/>
          <xs:element name="archivedIn" type="hma:ArchivingInformationArrayPropertyType"
minOccurs="0"/>
          <xs:element ref="hma:startDate"/>
          <xs:element ref="hma:completionDate"/>
          <xs:element ref="gml:extentOf">
            <xs:annotation>
              <xs:documentation>Acquisition footprint coordinates, described by a closed
polygon (last point=first point), using CRS:WGS84, Latitude,Longitude pairs (per-WGS84 definition of point
ordering, not necessarily per all WFS implementations). Expected structure is
gml:Polygon/gml:exterior/gml:LinearRing/gml:posList.
HMA/EOLI : polygon/coordinates (F B b s)
            </xs:documentation>
            </xs:annotation>
          </xs:element>
          <xs:element ref="gml:centerOf" minOccurs="0">
            <xs:annotation>

```

`<xs:documentation>`Acquisition center coordinates. Expected structure is  
 gml:Point/gml:pos.

```

HMA/EOLI : scCenter/coordinates (F B b s)</xs:documentation>
    </xs:annotation>
    </xs:element>
    <xs:element ref="hma:acquiredBy"/>
    <xs:element ref="hma:acquisitionParameters"/>
    <xs:element ref="hma:imageQualityCode" minOccurs="0"/>
    <xs:element ref="hma:histograms" minOccurs="0"/>
    <xs:element name="browse" type="hma:BrowseInformationArrayPropertyType"/>
    <xs:element name="product" type="hma:ProductInformationArrayPropertyType"
minOccurs="0"/>
    <xs:element name="hasScene" type="hma:ScenePropertyType" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="hasMask" type="hma:MaskPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="coupledWith" type="hma:CouplePropertyType" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
    </xs:extension>
    </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<!-- Scene : feature -->
<!-- ===== -->
<xs:element name="Scene" type="hma:SceneType" substitutionGroup="gml:_Feature"/>
<xs:complexType name="SceneType">
    <xs:complexContent>
        <xs:extension base="gml:AbstractFeatureType">
            <xs:sequence>
                <xs:element ref="hma:identifier"/>
                <xs:element ref="hma:startDate"/>
                <xs:element ref="hma:completionDate"/>
                <xs:element ref="gml:extentOf"/>
                <xs:element ref="gml:centerOf"/>
                <xs:element name="fromEarthObservationProduct"
type="hma:EarthObservationProductPropertyType"/>
                <xs:element ref="hma:acquisitionParameters" minOccurs="0"/>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="ScenePropertyType">
    <xs:sequence>
        <xs:element ref="hma:Scene" minOccurs="0"/>
    </xs:sequence>
    <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<!-- Identifier -->
<!-- ===== -->
<xs:element name="identifier" type="hma:CodeWithAuthorityType">
    <xs:annotation>
        <xs:documentation>Feature identifier for metadat item. Should includes ground segment
namespace to guarantee uniqueness within HMA
    
```

- Note 1 : will be replaced by gml:identifier in GML 3.2).
- Note 2 : not redundant but complementary with gml:id attribute :
- gml:id is an XML ID, has a unicity constraint within the document and can be used to get the subjacent XML element (see documentation of gml:id).
  - hma:identifier (and upcoming gml:identifier) act as a unique identifier for the delivering Authority (i.e. the WFS Catalog).

PHR : gml:id and hma:identifier share the same values.

HMA/EOLI : resTitle (F B b s)

```

</xs:documentation>
</xs:annotation>
</xs:element>
<xs:complexType name="CodeWithAuthorityType">
  <xs:annotation>
    <xs:documentation>From GML 3.2 draft</xs:documentation>
  </xs:annotation>
  <xs:simpleContent>
    <xs:extension base="xs:string">
      <xs:attribute name="codeSpace" type="xs:anyURI" use="required"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
<!-- ===== -->
<!-- EarthObservationProductPropertyType -->
<!-- ===== -->
<xs:complexType name="EarthObservationProductPropertyType">
  <xs:sequence>
    <xs:element ref="hma:EarthObservationProduct" minOccurs="0"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<!-- BrowseInformation -->
<!-- ===== -->
<xs:complexType name="BrowseInformationArrayPropertyType">
  <xs:sequence>
    <xs:element ref="hma:BrowseInformation" maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>
<xs:element name="BrowseInformation" type="hma:BrowseInformationType"/>
<xs:complexType name="BrowseInformationType">
  <xs:sequence>
    <xs:element name="type">
      <xs:annotation>
        <xs:documentation>Browse type. Possible values are : THUMBNAIL, QUICKLOOK and
ALBUM. </xs:documentation>
      </xs:annotation>
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="THUMBNAIL"/>
          <xs:enumeration value="QUICKLOOK"/>
          <xs:enumeration value="ALBUM"/>
        </xs:restriction>
      </xs:simpleType>
    </xs:element>
    <xs:element name="subType" type="gml:CodeListType" minOccurs="0">
      <xs:annotation>
        <xs:documentation>Value is mission specific. Value list can be retrieved with codeSpace.
Not used by PHR. For MODIS : OPTICAL, THERMAL</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="referenceSystemIdentifier" type="hma:CodeWithAuthorityType">
      <xs:annotation>
        <xs:documentation>Indicates if browse is geo-referenced, and thus can be assumed to
be displayed directly on a map (in which case should point to a code space for the CRS), when not supplied
it is assumed that the browse is provided in "raw" satellite frame of reference</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="fileName" type="xs:string">

```

```

        <xs:annotation>
          <xs:documentation>Path to the browse image (could be any kind of URL :
direct link to the image or WMS/WCS interface), it is assumed that if a client is prepared to "manage" a
browse delivered by e.g. WMS they would parse the URL to identify that it contains the OGC standard
SERVICE=WMS</xs:documentation>
        </xs:annotation>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
<!-- ===== -->
<!-- ProductInformation -->
<!-- ===== -->
<xs:complexType name="ProductInformationArrayPropertyType">
  <xs:sequence>
    <xs:element ref="hma:ProductInformation" maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>
<xs:element name="ProductInformation" type="hma:ProductInformationType"/>
<xs:complexType name="ProductInformationType">
  <xs:sequence>
    <xs:element name="referenceSystemIdentifier" type="hma:CodeWithAuthorityType"
minOccurs="0">
      <xs:annotation>
        <xs:documentation>Indicates if product is geo-referenced, (in which case should point to
a code space for the CRS), when not supplied it is assumed that the browse is provided in "raw" satellite
frame of reference</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="fileName" type="xs:string" minOccurs="0">
      <xs:annotation>
        <xs:documentation>Path to the actual product data if available online (could be any kind
of URL :
direct link to the image or WMS/WCS interface), it is assumed that if a client is prepared to "manage" a
product delivered by e.g. WCS they would parse the URL to identify that it contains the OGC standard
SERVICE=WCS</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="version" type="xs:string" minOccurs="0">
      <xs:annotation>
        <xs:documentation>Product version</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="size" type="gml:MeasureListType" minOccurs="0">
      <xs:annotation>
        <xs:documentation>Product size (bytes) allowing the user to realise how long a download
is likely to take</xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:sequence>
</xs:complexType>
<!-- ===== -->
<!-- acquisitionType -->
<!-- ===== -->
<xs:element name="acquisitionType">
  <xs:annotation>
    <xs:documentation>Used to distinguish at a high level the appropriateness of the acquisition for
"general" use, whether the product is a nominal acquisition, special calibration product or other. Values:
- NOMINAL
- CALIBRATION
- OTHER
  </xs:annotation>

```

More specific information (i.e. platform and sensor specific values) are expressed within the imageSubType tag.</xs:documentation>

```

</xs:annotation>
<xs:simpleType>
  <xs:restriction base="xs:string">
    <xs:enumeration value="NOMINAL"/>
    <xs:enumeration value="CALIBRATION"/>
    <xs:enumeration value="OTHER"/>
  </xs:restriction>
</xs:simpleType>
</xs:element>
<xs:element name="acquisitionSubType" type="gml:CodeListType">
  <xs:annotation>
    <xs:documentation>The mission specific type definition should refer to mission/ground segment
dedicated codeSpace.

```

PHR values are :

```

"CALIBRATION - UNNORMALIZED"
"CALIBRATION - DARKNESS SEQUENCE"
"CALIBRATION - ASTRAL"
"CALIBRATION - AMETHIST"
"CALIBRATION - REFOCUSING SEQUENCE"
"MTSR MODE"
"DAS FILE"
"SPECIFIC-1"
"SPECIFIC-2"
"SPECIFIC-3"
"SPECIFIC-4"

```

```

</xs:documentation>
  <xs:annotation>
</xs:element>
<xs:element name="productType" type="xs:string">
  <xs:annotation>
    <xs:documentation>Describes product type in case that mixed types are available within a single
collection. This is ground segment specific definition</xs:documentation>
  </xs:annotation>
</xs:element>
<!-- ===== -->
<!-- begin / end -->
<!-- ===== -->
<xs:element name="startDate" type="xs:dateTime">
  <xs:annotation>
    <xs:documentation>Acquisition begin dateTime in ISO 8601 format (CCYY-MM-
DDThh:mm[:ss[.cc]]Z).

```

```

HMA/EOLI : begin (F B b s)</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="completionDate" type="xs:dateTime">
  <xs:annotation>
    <xs:documentation>Acquisition end dateTime in ISO 8601 format (CCYY-MM-
DDThh:mm[:ss[.cc]]Z).

```

```

HMA/EOLI : End (F B b s)</xs:documentation>
  </xs:annotation>
</xs:element>
<!-- ===== -->
<!-- Archiving / Acquisition -->
<!-- ===== -->
<xs:complexType name="ArchivingInformationArrayPropertyType">
  <xs:sequence>
    <xs:element ref="hma:ArchivingInformation" maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>
<xs:element name="ArchivingInformation" type="hma:ArchivingInformationType"/>

```



```

<xs:complexType name="ArchivingInformationType">
  <xs:sequence>
    <xs:element name="archivingCenter" type="gml:CodeListType">
      <xs:annotation>
        <xs:documentation>Archiving centre code. Possible values are mission specific
and should be retrieved using codespace.

PHR : value is a valid station code
HMA/EOLI : N/A</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="archivingDate" type="xs:dateTime">
      <xs:annotation>
        <xs:documentation>EOLI : N/A</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="archivingIdentifier" type="hma:CodeWithAuthorityType" minOccurs="0">
      <xs:annotation>
        <xs:documentation>Local archiving id as created by the mission ground segment that
may required to allow subsequent order processing</xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:sequence>
</xs:complexType>
<xs:element name="acquisitionStation" type="gml:CodeListType">
  <xs:annotation>
    <xs:documentation>Acquisition / receiving station code. Possible values are mission specific
and should be retrieved using codespace.

PHR : value is a valid station code
HMA/EOLI : N/A</xs:documentation>
  </xs:annotation>
</xs:element>
<!-- ===== -->
<!-- quality quotation -->
<!-- ===== -->
<xs:element name="imageQualityCode" type="gml:MeasureType">
  <xs:annotation>
    <xs:documentation>Must be expressed in percents. EOLI N/A (attTypes/attName
?)</xs:documentation>
  </xs:annotation>
</xs:element>
<!-- ===== -->
<!-- Platform / Sensor -->
<!-- ===== -->
<xs:element name="acquiredBy" type="hma:PlatformAndSensorPropertyType"/>
<xs:complexType name="PlatformAndSensorPropertyType">
  <xs:sequence>
    <xs:element ref="hma:Platform"/>
    <xs:element ref="hma:Instrument"/>
    <xs:element ref="hma:Sensor"/>
  </xs:sequence>
</xs:complexType>
<xs:element name="Platform" type="hma:PlatformType"/>
<xs:complexType name="PlatformType">
  <xs:sequence>
    <xs:element name="shortName" type="xs:string">
      <xs:annotation>
        <xs:documentation>Platform short name (eg. PHR) </xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="serialIdentifier" type="xs:string" minOccurs="0">
      <xs:annotation>

```

```

        <xs:documentation>Platform serial identifier (eg. for PHR : 1A)</xs:documentation>
    </xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>
<xs:element name="Instrument" type="hma:InstrumentType"/>
<xs:complexType name="InstrumentType">
    <xs:sequence>
        <xs:element name="shortName" type="xs:string">
            <xs:annotation>
                <xs:documentation>Instrument short name
    EOLI : instShNm</xs:documentation>
            </xs:annotation>
        </xs:element>
    </xs:sequence>
</xs:complexType>
<xs:element name="Sensor" type="hma:SensorType"/>
<xs:complexType name="SensorType">
    <xs:sequence>
        <xs:element name="sensorType" type="hma:SensorTypePropertyType" minOccurs="0"/>
        <xs:element name="operationalMode" type="gml:CodeListType" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Sensor mode. Possible values are mission specific and should
    be retrieved using codespace. (eg. PHR : PA, XS or PX).</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element ref="hma:resolution" minOccurs="0"/>
    </xs:sequence>
</xs:complexType>
<xs:simpleType name="SensorTypePropertyType">
    <xs:restriction base="xs:string">
        <xs:enumeration value="ALTIMETRIC"/>
        <xs:enumeration value="ATMOSPHERIC"/>
        <xs:enumeration value="OPTICAL"/>
        <xs:enumeration value="RADAR"/>
    </xs:restriction>
</xs:simpleType>
<xs:element name="resolution" type="gml:MeasureType">
    <xs:annotation>
        <xs:documentation>Image resolution</xs:documentation>
    </xs:annotation>
</xs:element>
<!-- ===== -->
<!-- Acquisition parameters -->
<!-- ===== -->
<xs:element name="Acquisition" type="hma:AcquisitionType"/>
<xs:element name="acquisitionParameters" type="hma:AcquisitionPropertyType"/>
<xs:complexType name="AcquisitionPropertyType">
    <xs:sequence>
        <xs:element ref="hma:Acquisition"/>
    </xs:sequence>
</xs:complexType>
<xs:complexType name="AcquisitionType">
    <xs:sequence>
        <xs:element name="orbitNumber" type="xs:int" minOccurs="0">
            <xs:annotation>
                <xs:documentation>EOLI : orbit (F B b s)</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="lastOrbitNumber" type="xs:int" minOccurs="0">
            <xs:annotation>
                <xs:documentation>EOLI : lastOrbit (F)</xs:documentation>

```

```

    </xs:annotation>
  </xs:element>
  <xs:element name="orbitDirection" minOccurs="0">
    <xs:annotation>
      <xs:documentation>EOLI : orbitDir (F B b s)</xs:documentation>
    </xs:annotation>
    <xs:simpleType>
      <xs:restriction base="xs:string">
        <xs:enumeration value="ASCENDING"/>
        <xs:enumeration value="DESCENDING"/>
      </xs:restriction>
    </xs:simpleType>
  </xs:element>
  <xs:element name="acrossTrackPointingAngle" type="gml:AngleType" minOccurs="0">
    <xs:annotation>
      <xs:documentation>Across Track Incidence angle given in degrees.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="alongTrackPointingAngle" type="gml:AngleType" minOccurs="0">
    <xs:annotation>
      <xs:documentation>Along Track Incidence angle given in degrees.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="pitch" type="gml:AngleType" minOccurs="0">
    <xs:annotation>
      <xs:documentation>Pitch angle given in degrees.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="roll" type="gml:AngleType" minOccurs="0">
    <xs:annotation>
      <xs:documentation>Roll angle given in degrees.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="yaw" type="gml:AngleType" minOccurs="0">
    <xs:annotation>
      <xs:documentation>Yaw angle given in degrees.</xs:documentation>
    </xs:annotation>
  </xs:element>
</xs:sequence>
</xs:complexType>
<!-- ===== -->
<!-- Histograms -->
<!-- ===== -->
<xs:element name="histograms" type="hma:HistogramArrayAssociationType"/>
<xs:element name="Histogram" type="hma:HistogramType" substitutionGroup="gml:_Object"/>
<xs:complexType name="HistogramArrayAssociationType">
  <xs:complexContent>
    <xs:restriction base="gml:ArrayAssociationType">
      <xs:sequence>
        <xs:element ref="hma:Histogram" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:restriction>
  </xs:complexContent>
</xs:complexType>
<xs:complexType name="HistogramType">
  <xs:sequence>
    <xs:element name="bandId" type="xs:string" minOccurs="0"/>
    <xs:element name="min" type="xs:int"/>
    <xs:element name="max" type="xs:int"/>
    <xs:element name="mean" type="xs:double"/>
    <xs:element name="stdDeviation" type="xs:double"/>
  </xs:sequence>
</xs:complexType>

```

```

<!-- ===== -->
<!-- mask -->
<!-- ===== -->
<xs:complexType name="MaskPropertyType">
  <xs:sequence>
    <xs:element ref="hma:Mask" minOccurs="0"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<!-- ===== -->
<!-- Various : 2006-02-28 : base changed from gml:AssociationType to gml:FeaturePropertyType -->
<!-- ===== -->
<xs:complexType name="HrefPropertyType">
  <xs:complexContent>
    <xs:restriction base="gml:FeaturePropertyType">
      <xs:sequence/>
      <xs:attribute ref="xlink:href" use="required"/>
    </xs:restriction>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<!-- Mask : featureCollection -->
<!-- ===== -->
<xs:element name="Mask" type="hma:MaskType" substitutionGroup="gml:_Feature">
  <xs:annotation>
    <xs:documentation>Mask defined as a feature collection (in the GML 3.2 sense : a feature
collection is a feature having a property derived by extension from gml:AbstractFeatureMemberType).
Mandates the following optional gml properties inherited from gml:_Feature :
- gml:id attribute
- gml:name
- gml:boundedBy
Note : the upcoming gml:identifier will replace hma:identifier in GML 3.2</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:complexType name="MaskType">
  <xs:complexContent>
    <xs:extension base="gml:AbstractFeatureType">
      <xs:sequence>
        <xs:element ref="hma:identifier"/>
        <xs:element ref="hma:maskMembers"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<!-- members : FeatureArrayPropertyType -->
<!-- ===== -->
<xs:element name="maskMembers" type="hma:MaskMembersPropertyType"
substitutionGroup="gml:featureMembers"/>
<xs:complexType name="MaskMembersPropertyType">
  <xs:complexContent>
    <xs:restriction base="gml:FeatureArrayPropertyType">
      <xs:sequence>
        <xs:element ref="hma:MaskFeature" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:restriction>
  </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<!-- MaskFeature : feature -->
<!-- ===== -->
<xs:element name="MaskFeature" type="hma:MaskFeatureType" substitutionGroup="gml:_Feature">

```

```

    <xs:annotation>
      <xs:documentation>Mask member : . Mandates the following optional gml properties inherited
from gml:_Feature :
- gml:id attribute
- gml:name
- gml:boundedBy

```

Note : the upcoming gml:identifier will replace hma:identifier in GML 3.2</xs:documentation>

```

    </xs:annotation>
  </xs:element>
  <xs:complexType name="MaskFeatureType">
    <xs:complexContent>
      <xs:extension base="gml:AbstractFeatureType">
        <xs:sequence>
          <xs:element ref="hma:maskType"/>
          <xs:element ref="gml:extentOf">
            <xs:annotation>
              <xs:documentation>Mask member extent. Expected structure is
gml:Polygon/gml:exterior/gml:LinearRing/gml:posList with 0 to n
gml:Polygon/gml:interior/gml:LinearRing/gml:posList elements representing the holes.</xs:documentation>
            </xs:annotation>
          </xs:element>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <!-- ===== -->
  <!-- maskType -->
  <!-- ===== -->
  <xs:element name="maskType" type="gml:CodeListType">
    <xs:annotation>
      <xs:documentation>Mask type. Value list can be retrieved with codeSpace.

```

PHR values are :

```

"CLOUD"
"SNOW"
"QT_LOST_PIXELS_PA"
"QT_DEGRADED_PIXELS_PA"
"QT_LOST_PIXELS_B0"
"QT_DEGRADED_PIXELS_B0"
"QT_LOST_PIXELS_B1"
"QT_DEGRADED_PIXELS_B1"
"QT_LOST_PIXELS_B2"
"QT_DEGRADED_PIXELS_B2"
"QT_LOST_PIXELS_B3"
"QT_DEGRADED_PIXELS_B3"
"QT_DEGRADED_ATTITUDE_DATA"
"QT_DEGRADED_OTHER_AUXILIARY_DATA"
"QT_SATURATED_PIXELS"
"QT_XS_HOLE"
"OVER_ILLUMINATION"

```

```

    </xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="status">
  <xs:annotation>
    <xs:documentation>Refers to product status. PHR : always "ACQUIRED"</xs:documentation>
  </xs:annotation>
  <xs:simpleType>
    <xs:restriction base="xs:string">
      <xs:enumeration value="ACQUIRED"/>
      <xs:enumeration value="ARCHIVED"/>
      <xs:enumeration value="PLANNED"/>
    </xs:restriction>
  </xs:simpleType>

```

```
        <xs:enumeration value="POTENTIAL"/>
      </xs:restriction>
    </xs:simpleType>
  </xs:element>
  <xs:complexType name="CouplePropertyType">
    <xs:sequence>
      <xs:element ref="hma:Couple"/>
    </xs:sequence>
  </xs:complexType>
  <xs:element name="Couple" type="hma:CoupleType"/>
  <xs:complexType name="CoupleType">
    <xs:sequence>
      <xs:element name="couplingMode" type="gml:CodeListType">
        <xs:annotation>
          <xs:documentation>coupling mode. Value list can be retrieved with codeSpace.
```

PHR values are :

"STEREO"

"TRI-STEREO"

"ONEPASSMOSAIC"

```
    </xs:documentation>
  </xs:annotation>
  </xs:element>
</xs:sequence>
</xs:complexType>
</xs:schema>
```

## D.2 Application schema for Thematic Optical EO Products

The following schema document, called *ohr.xsd*, contains elements to describe Thematic Optical EO Products using GML 3.1.1

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by jrom (CNES) -->
<xs:schema targetNamespace="http://earth.esa.int/ohr" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gml="http://www.opengis.net/gml"
xmlns:hma="http://earth.esa.int/hma" xmlns:ohr="http://earth.esa.int/ohr" elementFormDefault="qualified"
attributeFormDefault="unqualified" version="0.7">
  <xs:import namespace="http://earth.esa.int/hma" schemaLocation="./hma.xsd"/>
  <xs:import namespace="http://www.opengis.net/gml"
schemaLocation="../../gml/3.1.1/base/feature.xsd"/>
  <xs:import namespace="http://www.opengis.net/gml"
schemaLocation="../../gml/3.1.1/base/measures.xsd"/>
  <xs:import namespace="http://www.w3.org/1999/xlink" schemaLocation="../../xlink/1.0.0/xlinks.xsd"/>
  <!-- ===== -->
  <!-- EarthObservationProduct : feature -->
  <!-- ===== -->
  <xs:element name="EarthObservationProduct" type="ohr:EarthObservationProductType"
substitutionGroup="hma:EarthObservationProduct">
    <xs:annotation>
      <xs:documentation>EarthObservationProduct feature. Uses the following optional gml properties
inherited from gml:_Feature :
- gml:id attribute
- gml:name
- gml:boundedBy (TBC)
    </xs:documentation>
  </xs:annotation>
</xs:element>
<xs:complexType name="EarthObservationProductType">
  <xs:complexContent>
    <xs:extension base="hma:EarthObservationProductType">
      <xs:sequence>
        <xs:element ref="ohr:acquisitionParameters" minOccurs="0"/>
        <xs:element ref="ohr:cloudCoverPercentage" minOccurs="0"/>
        <xs:element ref="ohr:snowCoverPercentage" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:complexType name="EarthObservationProductPropertyType">
  <xs:sequence>
    <xs:element ref="ohr:EarthObservationProduct" minOccurs="0"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<xs:element name="cloudCoverPercentage" type="gml:MeasureType">
  <xs:annotation>
    <xs:documentation>Must be expressed in percents</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="snowCoverPercentage" type="gml:MeasureType">
  <xs:annotation>
    <xs:documentation>Must be expressed in percents</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="Acquisition" type="ohr:AcquisitionType"/>
<xs:element name="acquisitionParameters" type="ohr:AcquisitionPropertyType">
  <xs:annotation>
```

Note : the upcoming gml:identifier will replace hma:identifier in GML 3.2</xs:documentation>

```
</xs:annotation>
</xs:element>
<xs:complexType name="EarthObservationProductType">
  <xs:complexContent>
    <xs:extension base="hma:EarthObservationProductType">
      <xs:sequence>
        <xs:element ref="ohr:acquisitionParameters" minOccurs="0"/>
        <xs:element ref="ohr:cloudCoverPercentage" minOccurs="0"/>
        <xs:element ref="ohr:snowCoverPercentage" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:complexType name="EarthObservationProductPropertyType">
  <xs:sequence>
    <xs:element ref="ohr:EarthObservationProduct" minOccurs="0"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<xs:element name="cloudCoverPercentage" type="gml:MeasureType">
  <xs:annotation>
    <xs:documentation>Must be expressed in percents</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="snowCoverPercentage" type="gml:MeasureType">
  <xs:annotation>
    <xs:documentation>Must be expressed in percents</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="Acquisition" type="ohr:AcquisitionType"/>
<xs:element name="acquisitionParameters" type="ohr:AcquisitionPropertyType">
  <xs:annotation>
```

```

        <xs:documentation>These are specific (i.e. non hma) acquisition angles</xs:documentation>
    </xs:annotation>
</xs:element>
<xs:complexType name="AcquisitionPropertyType">
    <xs:sequence>
        <xs:element ref="ohr:Acquisition"/>
    </xs:sequence>
</xs:complexType>
<xs:complexType name="AcquisitionType">
    <xs:sequence>
        <xs:element name="illuminationAzimuthAngle" type="gml:AngleType" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Solar Azimuth angle given in degrees. EOLI : illAziAng
(F)</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="illuminationElevationAngle" type="gml:AngleType" minOccurs="0">
            <xs:annotation>
                <xs:documentation>Solar Elevation angle given in degrees. EOLI : illElevAng
(F)</xs:documentation>
            </xs:annotation>
        </xs:element>
    </xs:sequence>
</xs:complexType>
</xs:schema>

```



### D.3 Application schema for Thematic Radar EO Products

The following schema document, called *sar.xsd*, contains elements to describe Thematic Radar EO Products using GML 3.1.1

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by jrom (CNES) -->
<xs:schema targetNamespace="http://earth.esa.int/sar" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gml="http://www.opengis.net/gml"
xmlns:hma="http://earth.esa.int/hma" xmlns:sar="http://earth.esa.int/sar" elementFormDefault="qualified"
attributeFormDefault="unqualified" version="0.7">
  <xs:import namespace="http://earth.esa.int/hma" schemaLocation="./hma.xsd"/>
  <xs:import namespace="http://www.opengis.net/gml"
schemaLocation="../../gml/3.1.1/base/feature.xsd"/>
  <xs:import namespace="http://www.opengis.net/gml"
schemaLocation="../../gml/3.1.1/base/measures.xsd"/>
  <xs:import namespace="http://www.w3.org/1999/xlink" schemaLocation="../../xlink/1.0.0/xlinks.xsd"/>
  <!-- ===== -->
  <!-- SAR EarthObservationProduct -->
  <!-- ===== -->
  <xs:element name="EarthObservationProduct" type="sar:EarthObservationProductType"
substitutionGroup="hma:EarthObservationProduct">
    <xs:annotation>
      <xs:documentation>Namespace for SAR products EarthObservationProduct.
This is a first minimum set suggested by DLR. The configuration of EOWEB User Services for TerraSAR-X
is ongoing as well as the definition of Feature applicable to catalogue services.
Sources: DLR TerraSAR-X PGS SAR L1B Archive Product Specification, SAR Raw Exchange Product
Specification</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:complexType name="EarthObservationProductType">
    <xs:complexContent>
      <xs:extension base="hma:EarthObservationProductType">
        <xs:sequence>
          <xs:element name="polarisationMode" type="sar:PolarisationModePropertyType"
minOccurs="0">
            <xs:annotation>
              <xs:documentation>single S, dual D, twin T, quad Q,
UNDEFINED</xs:documentation>
            </xs:annotation>
          </xs:element>
          <xs:element name="polarisationChannels" type="sar:PolarisationChannelsPropertyType"
minOccurs="0">
            <xs:annotation>
              <xs:documentation>Polarisation channel transmit/receive configuration:
horizontal, vertical.</xs:documentation>
            </xs:annotation>
          </xs:element>
          <xs:element name="antennaLookDirection" minOccurs="0">
            <xs:annotation>
              <xs:documentation>Polarisation channel transmit/receive configuration:
horizontal, vertical.</xs:documentation>
            </xs:annotation>
            <xs:simpleType>
              <xs:restriction base="xs:string">
                <xs:enumeration value="LEFT"/>
                <xs:enumeration value="RIGHT"/>
              </xs:restriction>
            </xs:simpleType>
          </xs:element>
          <xs:element name="minimumIncidenceAngle" type="gml:AngleType" minOccurs="0">
```

```

        <xs:annotation>
          <xs:documentation>Minimum Incidence angle.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="maximumIncidenceAngle" type="gml:AngleType" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Maximum Incidence angle.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="dopplerFrequency" type="gml:MeasureType" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Doppler Frequency of acquisition.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element ref="sar:acquiredBy" minOccurs="0"/>
      <xs:element name="beamModeMnemonic" type="xs:string"/>
    </xs:sequence>
  </xs:extension>
</xs:complexType>
<xs:complexType name="EarthObservationProductPropertyType">
  <xs:sequence>
    <xs:element ref="sar:EarthObservationProduct" minOccurs="0"/>
  </xs:sequence>
  <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
</xs:complexType>
<xs:simpleType name="PolarisationChannelsPropertyType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="HH"/>
    <xs:enumeration value="HV"/>
    <xs:enumeration value="VH"/>
    <xs:enumeration value="VV"/>
    <xs:enumeration value="HH/VV"/>
    <xs:enumeration value="HH/HV"/>
    <xs:enumeration value="HV/VV"/>
    <xs:enumeration value="VH/VV"/>
    <xs:enumeration value="VH/HV"/>
    <xs:enumeration value="UNDEFINED"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="PolarisationModePropertyType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="D"/>
    <xs:enumeration value="Q"/>
    <xs:enumeration value="S"/>
    <xs:enumeration value="T"/>
    <xs:enumeration value="UNDEFINED"/>
  </xs:restriction>
</xs:simpleType>
<xs:element name="acquiredBy" type="sar:SensorPropertyType"/>
<xs:complexType name="SensorPropertyType">
  <xs:sequence>
    <xs:element ref="sar:Sensor"/>
  </xs:sequence>
</xs:complexType>
<xs:element name="Sensor" type="sar:SensorType"/>
<xs:complexType name="SensorType">
  <xs:sequence>
    <xs:element name="swathIdentifier" type="gml:CodeListType" minOccurs="0">
      <xs:annotation>
        <xs:documentation>Swath identifier (e.g. Envisat ASAR has 7 distinct swaths
(I1,I2,I3...I7) that correspond to precise incidence angles for the sensor). Value list can be retrieved with
codeSpace.</xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:sequence>
</xs:complexType>

```

```
</xs:annotation>  
</xs:element>  
</xs:sequence>  
</xs:complexType>  
</xs:schema>
```

## D.4 Application schema for Specific Pleiades EO Products

The following schema document, called *atm.xsd*, contains elements to describe Thematic Atmospheric EO Products using GML 3.1.1

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by jrom (CNES) -->
<xs:schema targetNamespace="http://earth.esa.int/atm" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gml="http://www.opengis.net/gml"
xmlns:hma="http://earth.esa.int/hma" xmlns:atm="http://earth.esa.int/atm" elementFormDefault="qualified"
attributeFormDefault="unqualified" version="0.7">
  <xs:import namespace="http://earth.esa.int/hma" schemaLocation="./hma.xsd"/>
  <xs:import namespace="http://www.opengis.net/gml"
schemaLocation="../../gml/3.1.1/base/feature.xsd"/>
  <xs:import namespace="http://www.opengis.net/gml"
schemaLocation="../../gml/3.1.1/base/measure.xsd"/>
  <xs:import namespace="http://www.w3.org/1999/xlink" schemaLocation="../../xlink/1.0.0/xlinks.xsd"/>
  <!-- ===== -->
  <!-- Atmospheric EarthObservationProduct -->
  <!-- ===== -->
  <xs:element name="EarthObservationProduct" type="atm:EarthObservationProductType"
substitutionGroup="hma:EarthObservationProduct">
    <xs:annotation>
      <xs:documentation>Namespace for Atmospheric products
EarthObservationProduct.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:complexType name="EarthObservationProductType">
    <xs:complexContent>
      <xs:extension base="hma:EarthObservationProductType">
        <xs:sequence>
          <xs:element ref="atm:dataLayers" minOccurs="0"/>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <xs:element name="dataLayers" type="atm:DataLayerPropertyType"/>
  <xs:complexType name="DataLayerPropertyType">
    <xs:sequence>
      <xs:element ref="atm:DataLayer" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
  <xs:element name="DataLayer" type="atm:DataLayerType"/>
  <xs:complexType name="DataLayerType">
    <xs:sequence>
      <xs:element name="specy" type="xs:string" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Specy contained in data layer</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="unit" type="xs:string" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Unit of specy in data layer</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="highestLocation" type="gml:MeasureType" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Top height of datalayer. Should be expressed in
meters.</xs:documentation>
        </xs:annotation>
      </xs:element>
    </xs:sequence>
  </xs:complexType>

```

```

<xs:element name="lowestLocation" type="gml:MeasureType" minOccurs="0">
  <xs:annotation>
    <xs:documentation>Bottom height of datalayer. Should be expressed in
meters.</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="algorithmName" type="xs:string" minOccurs="0">
  <xs:annotation>
    <xs:documentation>Name of algorithm used to compute datalayer</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="algorithmVersion" type="xs:string" minOccurs="0">
  <xs:annotation>
    <xs:documentation>Version of algorithm used to compute datalayer</xs:documentation>
  </xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:schema>

```

## D.5 Application schema for Specific Pleiades EO Products

The following schema document, called *phr.xsd*, contains elements to describe Specific Pleiades HR EO Products using GML 3.1.1

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by jrom (CNES) -->
<xs:schema targetNamespace="http://hma.cnes.fr/phr" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gml="http://www.opengis.net/gml"
xmlns:ohr="http://earth.esa.int/ohr" xmlns:phr="http://hma.cnes.fr/phr" xmlns:hma="http://earth.esa.int/hma"
elementFormDefault="qualified" attributeFormDefault="unqualified" version="0.5">
  <xs:import namespace="http://earth.esa.int/ohr" schemaLocation="../../hma/0.7/ohr.xsd"/>
  <xs:import namespace="http://earth.esa.int/hma" schemaLocation="../../hma/0.7/hma.xsd"/>
  <xs:import namespace="http://www.opengis.net/gml"
schemaLocation="../../gml/3.1.1/base/feature.xsd"/>
  <xs:import namespace="http://www.opengis.net/gml"
schemaLocation="../../gml/3.1.1/base/measures.xsd"/>
  <xs:import namespace="http://www.w3.org/1999/xlink" schemaLocation="../../xlink/1.0.0/xlinks.xsd"/>
  <!-- ===== -->
  <!-- Datastrip feature -->
  <!-- ===== -->
  <xs:element name="Datastrip" type="phr:DatastripType"
substitutionGroup="ohr:EarthObservationProduct">
    <xs:annotation>
      <xs:documentation>PHR Data-strip feature. Inherit from ohr:EOPProduct</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:complexType name="DatastripType">
    <xs:complexContent>
      <xs:extension base="ohr:EarthObservationProductType">
        <xs:sequence>
          <xs:element ref="phr:geoposition" minOccurs="0"/>
          <xs:element ref="phr:cloudCoverAssessmentConfidence" minOccurs="0"/>
          <xs:element ref="phr:cloudCoverQuotationMode" minOccurs="0"/>
          <xs:element ref="phr:imageQualityCodeQuotationMode" minOccurs="0"/>
          <xs:element ref="phr:swathType" minOccurs="0"/>
          <xs:element ref="phr:viewingAttemptIdentifier" minOccurs="0"/>
          <xs:element ref="phr:programmingRequestIdentifier" minOccurs="0"/>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <!-- ===== -->
  <!-- Scene feature -->
  <!-- ===== -->
  <xs:element name="Scene" type="phr:SceneType" substitutionGroup="hma:Scene">
    <xs:annotation>
      <xs:documentation>PHR Data-strip feature. Inherit from ohr:Feature</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:complexType name="SceneType">
    <xs:complexContent>
      <xs:extension base="hma:SceneType">
        <xs:sequence>
          <xs:element ref="phr:geoposition" minOccurs="0"/>
          <xs:element ref="hma:imageQualityCode" minOccurs="0"/>
          <xs:element ref="ohr:snowCoverPercentage" minOccurs="0"/>
          <xs:element ref="ohr:snowCoverPercentage" minOccurs="0"/>
          <xs:element ref="phr:cloudCoverAssessmentConfidence" minOccurs="0"/>
          <xs:element ref="phr:cloudCoverQuotationMode" minOccurs="0"/>
          <xs:element ref="phr:imageQualityCodeQuotationMode" minOccurs="0"/>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>

```

```

        <xs:element ref="phr:sixteenthSceneQuotations" minOccurs="0"/>
    </xs:sequence>
</xs:extension>
</xs:complexType>
</xs:complexType>
<!-- ===== -->
<!-- Coverage feature -->
<!-- ===== -->
<xs:element name="Coverage" type="phr:CoverageType" substitutionGroup="gml:_Feature"/>
<xs:complexType name="CoverageType">
    <xs:complexContent>
        <xs:extension base="gml:AbstractFeatureType">
            <xs:sequence>
                <xs:element ref="gml:extentOf"/>
                <xs:element ref="phr:coverageRate"/>
                <xs:element ref="phr:stereoscopicRatioMaximumTreshold"/>
                <xs:element ref="phr:coverageMember" minOccurs="0" maxOccurs="unbounded"/>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<!-- ===== -->
<!-- DTM Tile feature -->
<!-- ===== -->
<xs:element name="DTMTile" type="phr:DTMTileType" substitutionGroup="gml:_Feature"/>
<xs:complexType name="DTMTileType">
    <xs:complexContent>
        <xs:extension base="gml:AbstractFeatureType">
            <xs:sequence>
                <xs:element ref="phr:identifier"/>
                <xs:element name="DTMType">
                    <xs:annotation>
                        <xs:documentation>DTM tile type.</xs:documentation>
                    </xs:annotation>
                    <xs:simpleType>
                        <xs:restriction base="xs:string">
                            <xs:enumeration value="DTED-0"/>
                            <xs:enumeration value="DTED-1"/>
                            <xs:enumeration value="DTED-2"/>
                        </xs:restriction>
                    </xs:simpleType>
                </xs:element>
                <xs:element ref="gml:extentOf">
                    <xs:annotation>
                        <xs:documentation>DTMTile extent. Expected structure is
gml:Polygon/gml:exterior/gml:LinearRing/gml:posList.</xs:documentation>
                    </xs:annotation>
                </xs:element>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:element name="identifier" type="phr:CodeWithAuthorityType">
    <xs:annotation>
        <xs:documentation>DTM Tile identifier.

```

Note 1 : will be replaced by gml:identifier in GML 3.2).

Note 2 : not redundant but complementary with gml:id attribute :

- gml:id is an XML ID, has a unicity constraint within the document and can be used to get the subjacent XML element (see documentation of gml:id).

- phr:identifier (and upcoming gml:identifier) act as a unique identifier for the delivering Authority (i.e. the WFS Catalog).

```

</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:complexType name="CodeWithAuthorityType">
  <xs:annotation>
    <xs:documentation>From GML 3.2 draft</xs:documentation>
  </xs:annotation>
  <xs:simpleContent>
    <xs:extension base="xs:string">
      <xs:attribute name="codeSpace" type="xs:anyURI" use="required"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
<!-- ===== -->
<!-- ===== -->
<!-- ===== -->
<!-- LocationModel -->
<!-- ===== -->
<xs:element name="LocationModel" type="phr:LocationModelType"/>
<xs:element name="DirectModelDefinition" type="phr:DirectModelDefinitionType"/>
<xs:element name="InverseModelDefinition" type="phr:InverseModelDefinitionType"/>
<xs:element name="geoposition" type="phr:LocationModelPropertyType">
  <xs:annotation>
    <xs:documentation>The direct and indirect location models are used to map the Album image
inside its geographical footprint (gml:extentOf) in the Access Unit map view </xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="directLocationModel" type="phr:DirectLocationModelPropertyType"/>
<xs:element name="inverseLocationModel" type="phr:InverseLocationModelPropertyType"/>
<xs:complexType name="LocationModelPropertyType">
  <xs:sequence>
    <xs:element ref="phr:LocationModel"/>
  </xs:sequence>
</xs:complexType>
<xs:complexType name="LocationModelType">
  <xs:sequence>
    <xs:element ref="phr:directLocationModel"/>
    <xs:element ref="phr:inverseLocationModel"/>
    <xs:element name="antimeridianLongitudeConvention" minOccurs="0">
      <xs:annotation>
        <xs:documentation>Used only if Features crosses the antimeridian line.
The Location Model is continuous and ignores the antimeridian discontinuity : longitudes may be greater
than +180 or lower than -180.
This tag gives the sign of the longitude used by the location model.
If POSITIVE, longitudes are extended beyond +180 (example : -177 is expressed as +183).
If NEGATIVE, longitudes are extended below -180.</xs:documentation>
      </xs:annotation>
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="POSITIVE"/>
          <xs:enumeration value="NEGATIVE"/>
        </xs:restriction>
      </xs:simpleType>
    </xs:element>
  </xs:sequence>
</xs:complexType>
<xs:complexType name="DirectLocationModelPropertyType">
  <xs:sequence>
    <xs:element ref="phr:DirectModelDefinition"/>
  </xs:sequence>
</xs:complexType>
<xs:complexType name="InverseLocationModelPropertyType">
  <xs:sequence>

```



```

        <xs:element ref="phr:InverseModelDefinition"/>
    </xs:sequence>
</xs:complexType>
<xs:complexType name="InverseModelDefinitionType">
    <xs:sequence>
        <xs:element name="rowDegree" type="xs:int"/>
        <xs:element name="rowCoefficients" type="gml:doubleList">
            <xs:annotation>
                <xs:documentation>The length of the list must be degree+1, first is constant
coefficient</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="columnDegree" type="xs:int"/>
        <xs:element name="columnCoefficients" type="gml:doubleList">
            <xs:annotation>
                <xs:documentation>The length of the list must be degree+1, first is constant
coefficient</xs:documentation>
            </xs:annotation>
        </xs:element>
    </xs:sequence>
</xs:complexType>
<xs:complexType name="DirectModelDefinitionType">
    <xs:sequence>
        <xs:element name="lambdaDegree" type="xs:int"/>
        <xs:element name="lambdaCoefficients" type="gml:doubleList">
            <xs:annotation>
                <xs:documentation>The length of the list must be degree+1, first is constant
coefficient</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="phiDegree" type="xs:int"/>
        <xs:element name="phiCoefficients" type="gml:doubleList">
            <xs:annotation>
                <xs:documentation>The length of the list must be degree+1, first is constant
coefficient</xs:documentation>
            </xs:annotation>
        </xs:element>
    </xs:sequence>
</xs:complexType>
<!-- ===== -->
<!-- OverIlluminationMask -->
<!-- ===== -->
<xs:element name="OverIlluminationMask" type="phr:OverIlluminationMaskType"
substitutionGroup="gml:_FeatureCollection">
    <xs:annotation>
        <xs:documentation>Over-illumination mask defined as a feature collection. Mandates the
following optional gml properties inherited from gml:_Feature :
- gml:id attribute
- gml:name
- gml:boundedBy

Note : the upcoming gml:identifier will replace hma:identifier in GML 3.2</xs:documentation>
    </xs:annotation>
</xs:element>
<xs:complexType name="OverIlluminationMaskType">
    <xs:complexContent>
        <xs:restriction base="gml:AbstractFeatureCollectionType">
            <xs:sequence>
                <xs:element ref="gml:description" minOccurs="0"/>
                <xs:element ref="gml:name"/>
                <xs:element ref="gml:boundedBy"/>
                <xs:element ref="phr:maskMembers"/>
            </xs:sequence>
        </xs:restriction>
    </xs:complexContent>
</xs:complexType>

```

```

        <xs:attribute ref="gml:id" use="required"/>
      </xs:restriction>
    </xs:complexContent>
  </xs:complexType>
  <xs:element name="maskMembers" type="phr:OverIlluminationMaskMembersPropertyType"
substitutionGroup="gml:featureMembers"/>
  <xs:complexType name="OverIlluminationMaskMembersPropertyType">
    <xs:complexContent>
      <xs:restriction base="gml:FeatureArrayPropertyType">
        <xs:sequence>
          <xs:element ref="phr:OverIllumination" minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
      </xs:restriction>
    </xs:complexContent>
  </xs:complexType>
  <xs:element name="OverIllumination" type="phr:OverIlluminationType"
substitutionGroup="gml:_Feature"/>
  <xs:complexType name="OverIlluminationType">
    <xs:complexContent>
      <xs:extension base="hma:MaskFeatureType">
        <xs:sequence>
          <xs:element name="order">
            <xs:annotation>
              <xs:documentation>Order of the circle of over-illumination. Main illumination circle
order is 0</xs:documentation>
            </xs:annotation>
            <xs:simpleType>
              <xs:restriction base="xs:int">
                <xs:enumeration value="0"/>
                <xs:enumeration value="1"/>
                <xs:enumeration value="2"/>
                <xs:enumeration value="3"/>
                <xs:enumeration value="4"/>
                <xs:enumeration value="5"/>
              </xs:restriction>
            </xs:simpleType>
          </xs:element>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <!-- ===== -->
  <!--   Miscellaneous   -->
  <!-- ===== -->
  <xs:element name="cloudCoverAssessmentConfidence" type="gml:MeasureType">
    <xs:annotation>
      <xs:documentation>Cloud cover assessment confidence computed from the LUTIN module
(Album_NCN LAI). Expressed in percents.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="cloudCoverQuotationMode" type="phr:quotationMode">
    <xs:annotation>
      <xs:documentation>Should be AUTOMATIC in nominal mode. Set to MANUAL if the cloud mask
is modified by the VNC operator</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="imageQualityCodeQuotationMode" type="phr:quotationMode">
    <xs:annotation>
      <xs:documentation>Should be AUTOMATIC in nominal mode. Set to MANUAL if the synthetic
mask is modified by the VNC operator</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="swathType" type="phr:SwathTypePropertyType">

```

```

    <xs:annotation>
      <xs:documentation>In nominal mode, swath type is "full".</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="viewingAttemptIdentifier" type="xs:string">
    <xs:annotation>
      <xs:documentation>Only for internal users</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="programmingRequestIdentifier" type="xs:string">
    <xs:annotation>
      <xs:documentation>Only for internal users</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:simpleType name="SwathTypePropertyType">
    <xs:restriction base="xs:string">
      <xs:enumeration value="FULL"/>
      <xs:enumeration value="REDUCED"/>
    </xs:restriction>
  </xs:simpleType>
  <xs:simpleType name="quotationMode">
    <xs:restriction base="xs:string">
      <xs:enumeration value="AUTOMATIC"/>
      <xs:enumeration value="MANUAL"/>
    </xs:restriction>
  </xs:simpleType>
  <xs:element name="LineQuotation" type="phr:LineQuotationType"/>
  <xs:element name="sixteenthSceneQuotations" type="phr:LineQuotationArrayPropertyType">
    <xs:annotation>
      <xs:documentation>Sixteenth scene quotation values : quality quotation, cloud and snow cover
percentage </xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:complexType name="LineQuotationArrayPropertyType">
    <xs:sequence>
      <xs:element ref="phr:LineQuotation" maxOccurs="4"/>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="LineQuotationType">
    <xs:sequence>
      <xs:element name="lineNumber">
        <xs:annotation>
          <xs:documentation>A complete scene is splitted in 4 line. Each line is splitted in 4
cell</xs:documentation>
        </xs:annotation>
        <xs:simpleType>
          <xs:restriction base="xs:int">
            <xs:minInclusive value="1"/>
            <xs:maxInclusive value="4"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
      <xs:element name="cloudCoverPercentages" type="gml:MeasureListType" minOccurs="0">
        <xs:annotation>
          <xs:documentation>List of up to four cloud cover percentage (one for each cell of the
current line) </xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="snowCoverPercentages" type="gml:MeasureListType" minOccurs="0">
        <xs:annotation>
          <xs:documentation>List of up to four snow cover percentage (one for each cell of the
current line) </xs:documentation>
        </xs:annotation>
      </xs:element>
    </xs:sequence>
  </xs:complexType>

```

```

    </xs:element>
    <xs:element name="cloudCoverAssessmentConfidences" type="gml:MeasureListType"
minOccurs="0">
      <xs:annotation>
        <xs:documentation>List of up to four cloud cover assessment confidence percentage
(one for each cell of the current line) </xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="qualityQuotations" type="gml:MeasureListType" minOccurs="0">
      <xs:annotation>
        <xs:documentation>List of up to four quality quotation percentage (one for each cell of
the current line) </xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:sequence>
</xs:complexType>
<xs:element name="coverageMember" type="phr:CoverageMemberPropertyType"
substitutionGroup="gml:featureMember"/>
<xs:complexType name="CoverageMemberPropertyType">
  <xs:complexContent>
    <xs:restriction base="gml:FeaturePropertyType">
      <xs:choice>
        <xs:element ref="phr:Datastrip" minOccurs="0"/>
        <xs:element ref="phr:Scene" minOccurs="0"/>
      </xs:choice>
      <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
    </xs:restriction>
  </xs:complexContent>
</xs:complexType>
<xs:element name="minimumCoverageArea" type="gml:MeasureType">
  <xs:annotation>
    <xs:documentation>Minimum covered area.</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="coverageRate" type="gml:MeasureType" default="100">
  <xs:annotation>
    <xs:documentation>Covered area. Expressed in percents of coverage without clouds within the
ROI (gml:extentOf)</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="stereoscopicRatioMaximumTreshold" type="xs:double">
  <xs:annotation>
    <xs:documentation>B/H maximum treshold between data-strips or scenes</xs:documentation>
  </xs:annotation>
</xs:element>
</xs:schema>

```

## **Bibliography**

TBD