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**Geographic information — Metadata —  
Part 2:  
Extensions for imagery and gridded data**

*Information géographique — Métadonnées —*

*Partie 2: Extensions pour les images et les matrices*

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Published in Switzerland

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 19115-2 was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*.

ISO 19115 consists of the following parts, under the general title *Geographic information — Metadata*:

- *Geographic information — Metadata*
- *Part 2: Extensions for imagery and gridded data*

## Introduction

Imagery and gridded data are important information sources and products used within a geospatial environment by geographic information systems. The production of imagery and gridded data follows one or more process chains that begin with remote sensing data, scanned maps, field data collection or other sensing methods and end with the creation of the end data products. The production process needs to be documented in order to maintain quality control over the end products. In addition, metadata about the geometry of the measuring process and the properties of the measuring equipment need to be retained with the raw data in order to support the production process.

Within the suite of ISO geographic information standards, ISO 19115 defines the guidelines for describing geographic information and services. While the ISO 19115 metadata model does provide some provisions for imagery and gridded data, the requirements were not fully developed at the time ISO 19115:2003 was drafted. To permit the development of ISO 19115 to proceed, inclusion of metadata definitions for imagery and gridded data was deferred until the framework for these data was more fully specified within the suite of ISO geographic information standards. Additionally, other standards that implement metadata for imagery and gridded data have been surveyed and are described in ISO/TR 19121.

The object of this part of ISO 19115 is to provide the additional structure to more extensively describe the derivation of geographic imagery and gridded data. This structure is intended to augment ISO 19115.

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# Geographic information — Metadata —

## Part 2:

## Extensions for imagery and gridded data

### 1 Scope

This part of ISO 19115 extends the existing geographic metadata standard by defining the schema required for describing imagery and gridded data. It provides information about the properties of the measuring equipment used to acquire the data, the geometry of the measuring process employed by the equipment, and the production process used to digitize the raw data. This extension deals with metadata needed to describe the derivation of geographic information from raw data, including the properties of the measuring system, and the numerical methods and computational procedures used in the derivation. The metadata required to address coverage data in general is addressed sufficiently in the general part of ISO 19115.

### 2 Conformance

#### 2.1 Conformance requirements

Metadata shall be provided as specified in Clause 6 and Annexes A and B of this part of ISO 19115 and ISO 19115:2003, Clause 6 and Annexes A and B.

User-defined metadata extensions to this part of ISO 19115 shall be defined and provided as specified in ISO 19115:2003, Annex C.

Any metadata claiming conformance with this part of ISO 19115 shall pass the requirements described in Annex C of this part of ISO 19115 and the abstract test suite presented in ISO 19115:2003, Annex D.

#### 2.2 Metadata profiles

Any profile conforming to this part of ISO 19115 shall conform to the rules for creating a profile given in ISO 19115:2003, C.6.

### 3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TS 19103:2005, *Geographic information — Conceptual schema language*

ISO 19107:2003, *Geographic information — Spatial schema*

ISO 19115:2003, *Geographic information — Metadata*

ISO/TS 19139:2007, *Geographic information — Metadata — XML schema implementation*

## 4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19115:2003 and the following apply.

### 4.1

#### **attribute**

named property of an entity

[ISO/IEC 2382-17:1999]

NOTE Describes a geometrical, topological, thematic, or other characteristic of an entity.

### 4.2

#### **band**

range of wavelengths of electromagnetic radiation that produce a single response by a sensing device

[ISO/TS 19101-2:2008]

### 4.3

#### **class**

description of a set of objects that share the same **attributes**, operations, methods, relationships, and semantics

[ISO/TS 19103:2005]

### 4.4

#### **coverage**

feature that acts as a function to return **values** from its range for any direct position within its spatial, temporal or spatiotemporal **domain**

[ISO 19123:2005]

EXAMPLE Examples include a raster **image**, polygon overlay, or digital elevation matrix

### 4.5

#### **data**

reinterpretable representation of information in a formalised manner suitable for communication, interpretation, or processing

[ISO/IEC 2382-1:1993]

### 4.6

#### **data type**

specification of a **value domain** with operations allowed on **values** in this **domain**

[ISO/TS 19103:2005]

### 4.7

#### **dataset**

identifiable collection of **data**

[ISO 19115:2003]

### 4.8

#### **dataset series**

collection of **datasets** sharing the same product specification

[ISO 19115:2003]

### 4.9

#### **domain**

well-defined set

[ISO/TS 19103:2005]

**4.10****event**

action which occurs at an instant

[ISO 19108:2002]

**4.11****geolocation information**

information used to determine geographic location corresponding to **image** location

**4.12****georectified**

corrected for positional displacement with respect to the surface of the earth

**4.13****georeferencing**

process of determining the relation between the position of **data** in the image coordinates and its geographic or map location

**4.14****grid**

network composed of two or more sets of curves in which the members of each set intersect the members of the other sets in an algorithmic way

[ISO 19123:2005]

NOTE The curves partition a space into **grid** cells.

**4.15****grid coordinate system**

**coordinate system** in which a position is specified relative to the intersection of curves

**4.16****grid coordinates**

sequence of two or more numbers specifying a position with respect to its location on a **grid**

**4.17****gridded data**

**data** whose **attribute values** are associated with positions on a **grid coordinate system**

**4.18****ground control point**

point on the earth that has an accurately known geographic position

**4.19****image**

gridded **coverage** whose **attribute values** are a numerical representation of a physical parameter

NOTE The physical parameters are the result of measurement by a **sensor** or a prediction from a model.

**4.20****imagery**

representation of phenomena as **images** produced by electronic and/or optical techniques

[ISO 19101-2:2008]

NOTE In this part of ISO 19115, it is assumed that the objects and phenomena have been sensed or detected by camera, infrared and multispectral scanners, radar and photometers, or similar devices.

**4.21**

**metadata**

**data** about data

[ISO 19115:2003]

**4.22**

**pass**

single instance of a remote, mobile measuring system going by a target of interest

NOTE In this part of ISO 19115, the measuring system will usually be a remote sensing platform. In a navigation context, the measuring system might be a GPS satellite.

**4.23**

**pixel**

smallest element of a digital image to which attributes are assigned

[ISO/TS 19101-2:2008]

NOTE It is the smallest unit of display for a visible image.

**4.24**

**platform**

structure which supports a **sensor**, or sensors

**4.25**

**polarization**

restricting radiation, especially light, vibrations to a single plane

**4.26**

**remote sensing**

collection and interpretation of information about an object without being in physical contact with the object

**4.27**

**resolution** (of a **sensor**)

smallest difference between indications of a **sensor** that can be meaningfully distinguished

NOTE For imagery, resolution refers to radiometric, spectral, spatial and temporal resolutions.

[ISO/TS 19101-2:2008]

**4.28**

**sensor**

element of a measuring system that is directly affected by a phenomenon, body, or substance carrying a quantity to be measured

[ISO/IEC GUIDE 99:2007]

**4.29**

**sensor model**

description of the radiometric and geometric characteristics of a **sensor**

[ISO 19101-2:2008]

**4.30**

**spectral resolution**

specific wavelength interval within the electromagnetic spectrum

EXAMPLE Band 1 of Landsat TM lies between 0,45 and 0,52  $\mu\text{m}$  in the visible part of the spectrum.

**4.31**

**value**

element of a type **domain**

[ISO/TS 19103:2005]

**4.32****value domain**set of accepted **values**

[ISO/TS 19103:2005]

EXAMPLE The range 3-28, all integers, any ASCII character, enumeration of all accepted values (green, blue, white).

**5 Symbols and abbreviated terms****5.1 Abbreviations**

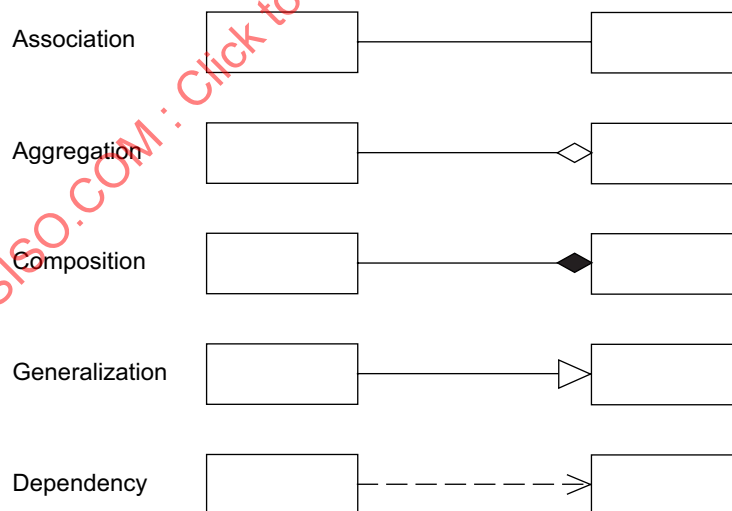
IDL Interface Definition Language

OCL Object Constraint Language

UML Unified Modeling Language

**5.2 UML notations**

The diagrams that appear in this part of ISO 19115 are presented using the Unified Modelling Language (UML) static structure diagram with the ISO Interface Definition Language (IDL) basic type definitions and the UML Object Constraint Language (OCL) as the conceptual schema language. The UML notations used in this part of ISO 19115 are described in Figure 1.

**Figure 1 — UML notation**

## 5.3 UML model relationships

### 5.3.1 Associations

An association is used to describe a relationship between two or more classes. UML defines three different types of relationships, called association, aggregation and composition. The three types have different semantics. An ordinary association shall be used to represent a general relationship between two classes. The aggregation and composition associations shall be used to create part-whole relationships between two classes. The direction of an association must be specified. If the direction is not specified, it is assumed to be a two-way association. If one-way associations are intended, the direction of the association can be marked by an arrow at the end of the line.

An aggregation association is a relationship between two classes in which one of the classes plays the role of container and the other plays the role of a containee.

A composition association is a strong aggregation. In a composition association, if a container object is deleted, then all of its containee objects are deleted as well. The composition association shall be used when the objects representing the parts of a container object cannot exist without the container object.

### 5.3.2 Generalization

A generalization is a relationship between a superclass and the subclasses that may be substituted for it. The superclass is the generalized class, while the subclasses are specified classes.

### 5.3.3 Instantiation/Dependency

A dependency relationship shows that the client class depends on the supplier class/interface to provide certain services, such as:

- client class accesses a value (constant or variable) defined in the supplier class/interface;
- operations of the client class invoke operations of the supplier class/interface;
- operations of the client class have signatures whose return class or arguments are instances of the supplier class/interface.

An instantiated relationship represents the act of substituting actual values for the parameters of a parameterized class or parameterized class utility to create a specialized version of the more general item.

### 5.3.4 Roles

If an association is navigable in a particular direction, the model shall supply a “role name” that is appropriate for the role of the target object in relation to the source object. Thus in a two-way association, two role names will be supplied. Figure 2 represents how role names and cardinalities are expressed in UML diagrams.

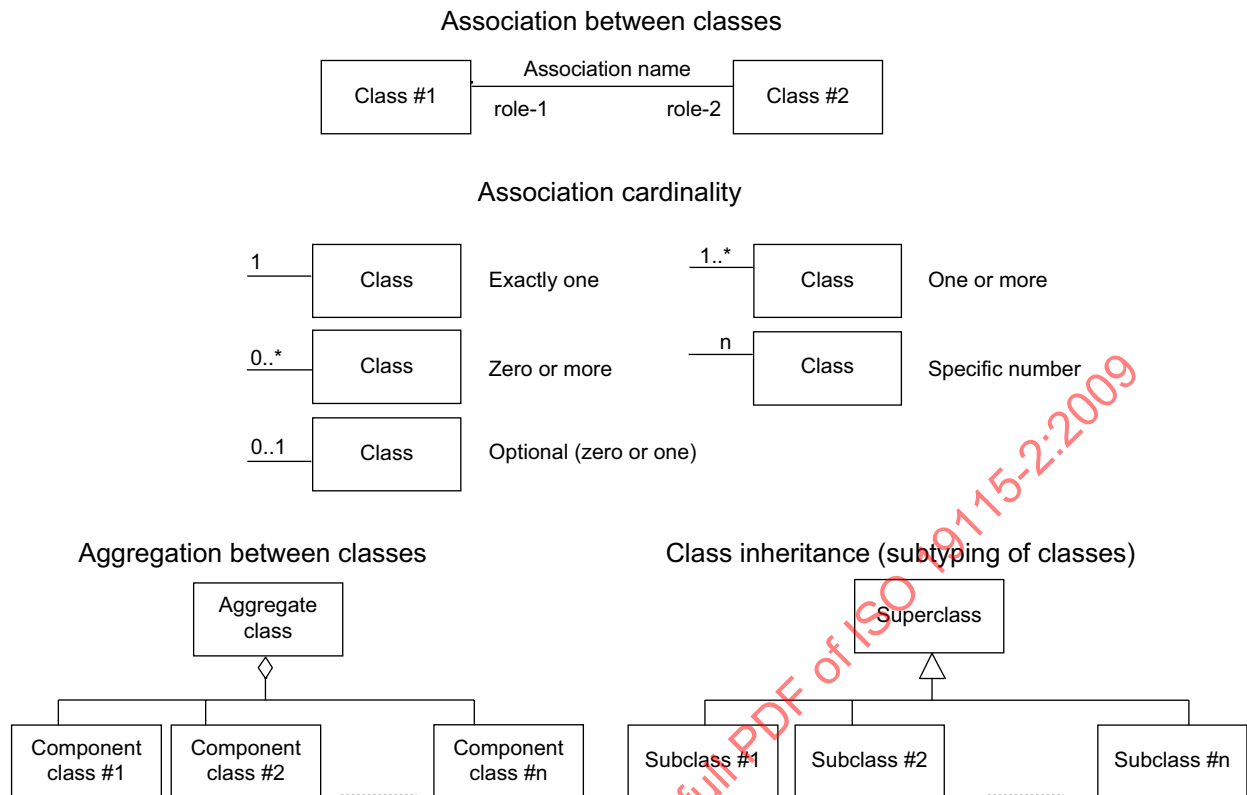


Figure 2 — UML roles

## 5.4 UML model stereotypes

A UML stereotype is an extension mechanism for existing UML concepts. It is a model element that is used to classify (or mark) other UML elements so that they in some respect behave as if they were instances of new virtual or pseudo metamodel classes whose form is based on existing base metamodel classes. Stereotypes augment the classification mechanisms on the basis of the built-in UML metamodel class hierarchy. Below are brief descriptions of the stereotypes used in this part of ISO 19115. For more detailed descriptions consult ISO/TS 19103.

In this part of ISO 19115 the following stereotypes are used.

- a) <<Type>> class used for specification of a domain of instances (objects), together with the operations applicable to the objects. A type may have attributes and associations.
- b) <<Enumeration>> data type whose instances form a list of named literal values. Both the enumeration name and its literal values are declared. Enumeration means a short list of well-understood potential values within a class.
- c) <<DataType>> a descriptor of a set of values that lack identity and whose operations do not have side effects. Datatypes include primitive pre-defined types and user-definable types. Pre-defined types include numbers, string, and time. User-definable types include enumerations.
- d) <<CodeList>> used to describe a more open enumeration. <<CodeList>> is a flexible enumeration. Code lists are useful for expressing a long list of potential values. If the elements of the list are completely known, an enumeration should be used; if only the likely values of the elements are known, a code list should be used.

- e) <<Union>> describes a selection of one of the specified types. This is useful to specify a set of alternative classes/types that can be used, without the need to create a common super-type/class.
- f) <<Abstract>> class (or other classifier) that cannot be directly instantiated. UML notation for this to show the name in italics.
- g) <<Metaclass>> class whose instances are classes. Metaclasses are typically used in the construction of metamodels. A metaclass is an object class whose primary purpose is to hold metadata about another class.
- h) <<Interface>> named set of operations that characterize the behaviour of an element.
- i) <<Package>> cluster of logically related components, containing sub-packages.
- j) <<Leaf>> package that contains definitions, without any sub-packages.

## 6 Imagery and gridded data metadata

### 6.1 Metadata for geospatial imagery and gridded data requirement

ISO 19115 identifies the metadata required to describe digital geographic data. This part of ISO 19115 extends the metadata identified in ISO 19115 and identifies the metadata required to describe digital geospatial imagery and gridded data. ISO 19115 identifies some of the metadata for imagery and gridded data and this part of ISO 19115 builds upon that foundation. The extended metadata shall be provided for geographic images and gridded datasets which include the geospatial imagery and gridded data and may optionally be provided for aggregations of datasets.

### 6.2 Imagery and gridded data metadata packages

#### 6.2.1 Introduction

Figure 3 illustrates the relationships among the packages described in this part of ISO 19115 and the relevant packages specified in ISO 19115. The ISO 19115 UML model diagrams and data dictionary for each package are fully specified in ISO 19115. The additional metadata for geospatial imagery and gridded data is fully specified in the UML model diagrams and data dictionary for each additional package, which is given in Annex A and Annex B, respectively. If a discrepancy between the two annexes exists, Annex A shall be considered authoritative.

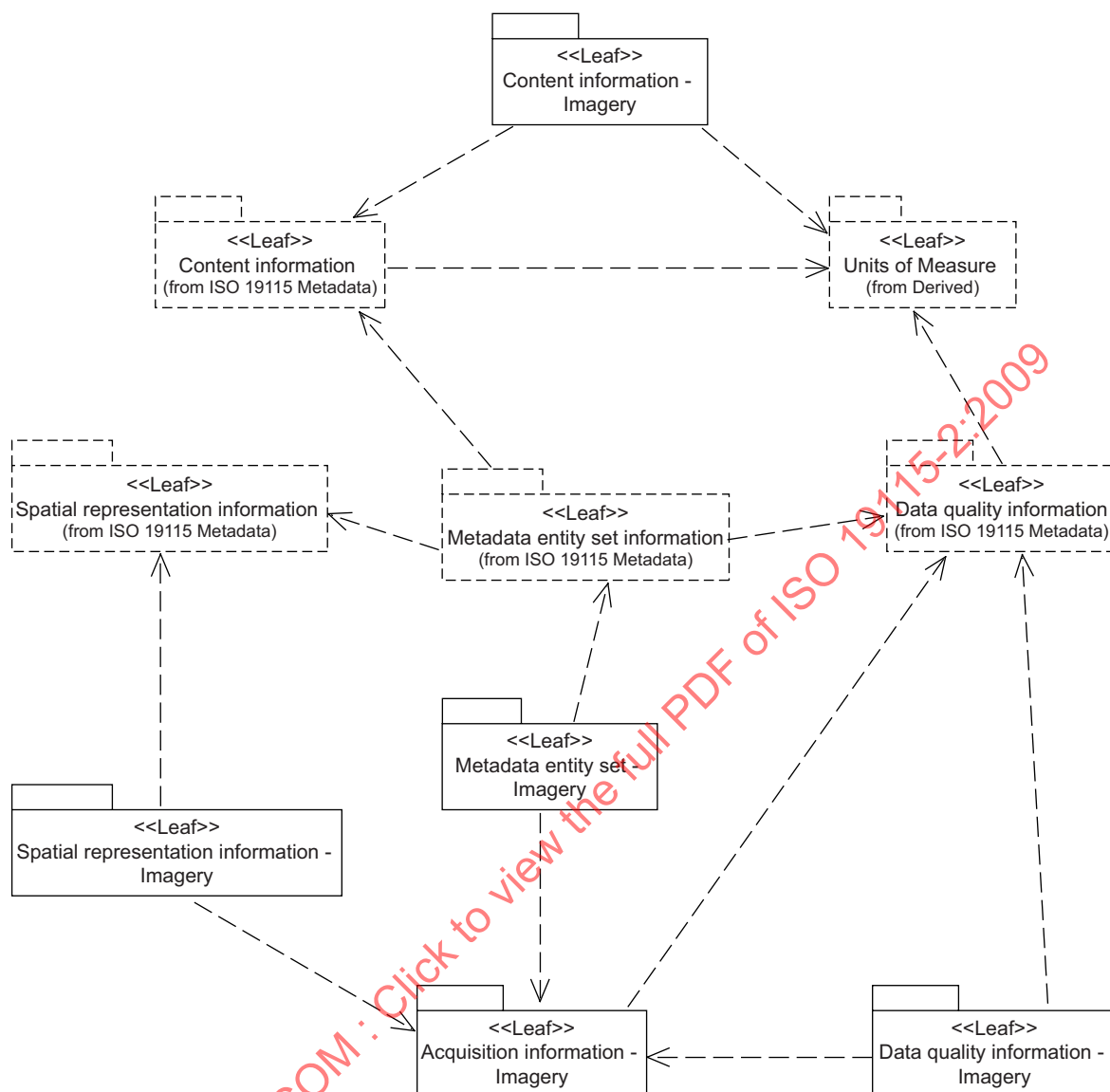


**Figure 3 — Metadata packages**

To ensure global uniqueness of class names, ISO/TS 19103 requires that all class names be defined with a bi-alpha prefix that identifies the package in which the class is defined. ISO 19115 uses the prefixes MD (Metadata), CI (Citation), DQ (Data quality), EX (Extent), and LI (Lineage). To differentiate between ISO 19115 and entities of this part of ISO 19115, this part uses different prefixes. The prefixes used are MI (Metadata for imagery and gridded data), LE (Lineage extended) and QE (Data quality extended). Table 1 contains the list of package identifiers for the classes used in this part of this part of ISO 19115.

**Table 1 —UML Package Identifiers**

| Identifier | Information Type      | Standard     |
|------------|-----------------------|--------------|
| CI         | Citation              | ISO 19115    |
| DQ         | Data Quality          | ISO 19115    |
| EX         | Extent                | ISO 19115    |
| GM         | Geometry              | ISO 19107    |
| LE         | Lineage Extended      | ISO 19115-2  |
| LI         | Lineage               | ISO 19115    |
| MD         | Metadata              | ISO 19115    |
| MI         | Metadata for Imagery  | ISO 19115-2  |
| MX         | Metadata — XML schema | ISO/TS 19139 |
| QE         | Data quality Extended | ISO 19115-2  |

## 6.2.2 Package Descriptions

### 6.2.2.1 Metadata Entity Set — Imagery

An additional package of metadata is specified here. MI\_Metadata is a specified subclass of MD\_Metadata and aggregates the optional entity MI\_AcquisitionInformation. This additional package is described in A.2.1.

### 6.2.2.2 Data quality information — Imagery

The original data quality package is defined in ISO 19115 as a container of a general assessment of the quality of the dataset. In addition, the package contains information about the sources and production processes used in producing a dataset, which is of particular importance for imagery and gridded data. The data quality packages specified in this part of ISO 19115 add the following classes to those specified in ISO 19115:

- QE\_CoverageResult is a specified subclass of DQ\_Result and aggregates information required to report data quality for a coverage. From ISO 19115, the classes MD\_SpatialRepresentation, MD\_CoverageDescription, and MD\_Format are aggregated as a description of the coverage data quality result. In addition, an association with MX\_DataFile (defined in ISO/TS 19139) provides a means to identify a complete report of the quality of the coverage;
- QE\_Usability is a specified subclass of DQ\_Element used to provide user specific quality information about a dataset's suitability for a particular application;
- LE\_ProcessStep is a specified subclass of LI\_ProcessStep and contains additional information on the history of the algorithms used and processing performed to produce the data. LE\_ProcessStep aggregates the following entities;
  - LE\_Processing, describes the procedure (such as software used, parameters, and processing documentation) by which the algorithm is applied to generate the data from the source data. LE\_Processing aggregates LE\_Algorithm, which describes the methodology used to derive the data from the source data;
  - LE\_ProcessStepReport identifies external information describing the processing of the data;
  - LE\_Source, is a specified subclass of LI\_Source and describes the output of a process step.

### 6.2.2.3 Spatial representation information — Imagery

The spatial representation package contains information concerning the mechanisms used to represent spatial information. MI\_GeoreferencingDescription is a specified subclass of MD\_Georeferenceable that contains additional information used to support georectification of the data. MI\_GeoreferencingDescription is an aggregation of the following entities:

- MI\_Georectified is a specified subclass of MD\_Georectified that contains check point information to further specify georectification details of the imagery or gridded data. MI\_Georectified aggregates MI\_GCP;
- MI\_Georeferenceable is a specified subclass of MD\_Georeferenceable that includes additional information that can be used to geolocate the data. MI\_Georeferenceable aggregates MI\_GeolocationInformation.

### 6.2.2.4 Content information — Imagery

The package content information is defined in ISO 19115 and describes the content of a coverage dataset. This part of ISO 19115 expands it:

- MI\_Band is a specified subclass of MD\_Band defining additional attributes for specifying properties of individual wavelength bands in an imagery and gridded dataset;
- MI\_ImageDescription is a specified subclass of MD\_ImageDescription used to aggregate MI\_RangeElementDescription;
- MI\_CoverageDescription is a specified subclass of MD\_CoverageDescription used to aggregate MI\_RangeElementDescription;
- MI\_RangeElementDescription provides identification of the range elements used in a coverage dataset.

### 6.2.2.5 Acquisition Information — Imagery

This package is particular to this part of ISO 19115 and provides details specific to the acquisition of imagery and gridded data. MI\_AcquisitionInformation is an aggregate of the following entities:

- MI\_Instrument, designations of the measuring instruments used to acquire the data;
- MI\_Operation, designations of the overall data gathering program to which the data contribute;
- MI\_Platform, designations of the platform from which the data were taken;
- MI\_Objective, the characteristics and geometry of the intended object to be observed;
- MI\_Requirement, the user requirements used to derive the acquisition plan;
- MI\_Plan, the acquisition plan that was implemented to acquire the data.

Two additional classes are required to provide information on the acquisition of the data. These are:

- MI\_Event, describes a significant event that occurred during data acquisition. An event can be associated with an operation, objective, or platform pass, and
- MI\_PlatformPass, identifies a particular pass made by the platform during data acquisition. A platform pass is used to provide supporting identifying information for an event and for data acquisition of a particular objective.

### 6.3 Unified Modeling Language (UML) diagrams

Annex A provides the metadata schemas in the form of Unified Modeling Language (UML) class diagrams. These diagrams illustrate the extension entities defined in this part of 19115 and augment the UML diagrams in ISO 19115. Annex A includes the packages specified in this part of ISO 19115. When classes from ISO 19115 are extended to meet the requirements of this part of the standard, the classes from ISO 19115 are included in the diagrams in this annex. Combined with the data dictionary in Annex B and the UML diagrams and data dictionary in ISO 19115:2003, this part of ISO 19115 fully defines the total abstract model for metadata.

### 6.4 Data dictionary

Annex B contains the element and entity definitions for the metadata schemas defined in this part of the standard. This dictionary, in conjunction with the diagrams presented in Annex A and in combination with the UML diagrams and data dictionary presented in ISO 19115, serves to fully define the total abstract model for metadata.

Codelists and their values provided in this part of ISO 19115 are normative. User extensions to codelists shall follow the rules as described in ISO 19115 and Annex C. ISO/IEC 11179-6 defines the information to be specified, conditions to be fulfilled, and procedures to be followed for registering data elements.

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## Annex A (normative)

### Imagery and gridded data metadata schemas

#### A.1 Metadata UML models

Metadata for describing geographic data, geospatial imagery and gridded data is defined using an abstract object model in the Unified Modeling Language (UML). The diagrams in the following subclauses provide views, which are portions of the total abstract model for metadata. Each diagram defines the extensions for a metadata section (UML package) of related entities, elements, data types, and code lists augmenting the corresponding metadata section in ISO 19115. Related entities, which are defined in another diagram, are shown with elements suppressed and the defining package specified under the entity name in parentheses. Throughout the following models, entities may have mandatory and/or optional elements and associations. In some cases, optional entities may have mandatory elements; those elements become mandatory only if the optional entity is used.

Entities, elements and associations shown in light grey are defined in their entirety in ISO 19115:2003. They are shown here for informational purposes.

#### A.2 Imagery and gridded data metadata package UML diagrams

##### A.2.1 Metadata entity set extension

Figure A.1 defines MI\_Metadata, which is an extension to the MD\_Metadata class. The MI\_Metadata class is used to provide information describing imagery and gridded data. The extension provided through MI\_Metadata adds an association to the MI\_AcquisitionInformation class, the root class of the Acquisition Information package. The data dictionary for this extension is given in B.2.1.

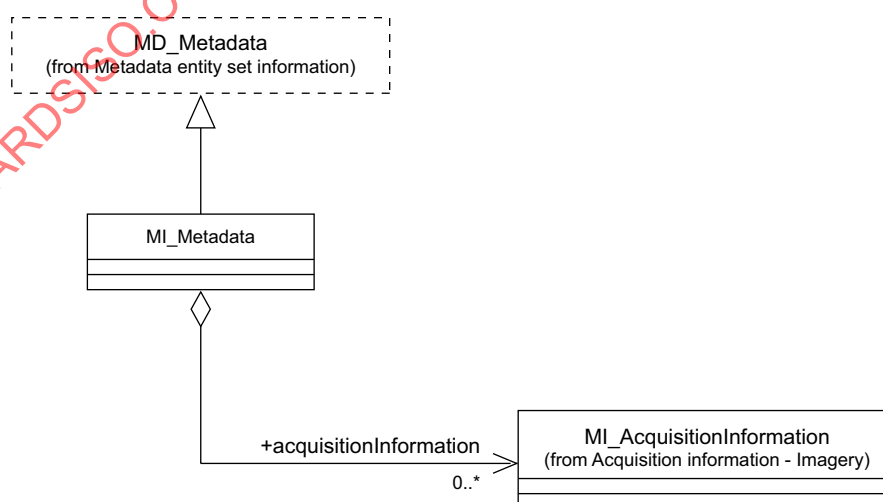


Figure A.1 — Metadata entity set extension

## A.2.2 Data quality information

### A.2.2.1 Extension to data quality result to support coverage quality

Figure A.2 defines an extension required to specify the reported quality for coverage data. The additional elements provide information about the representation of the quality result documenting the data in the dataset. The data dictionary for this diagram is given in B.2.2.1.

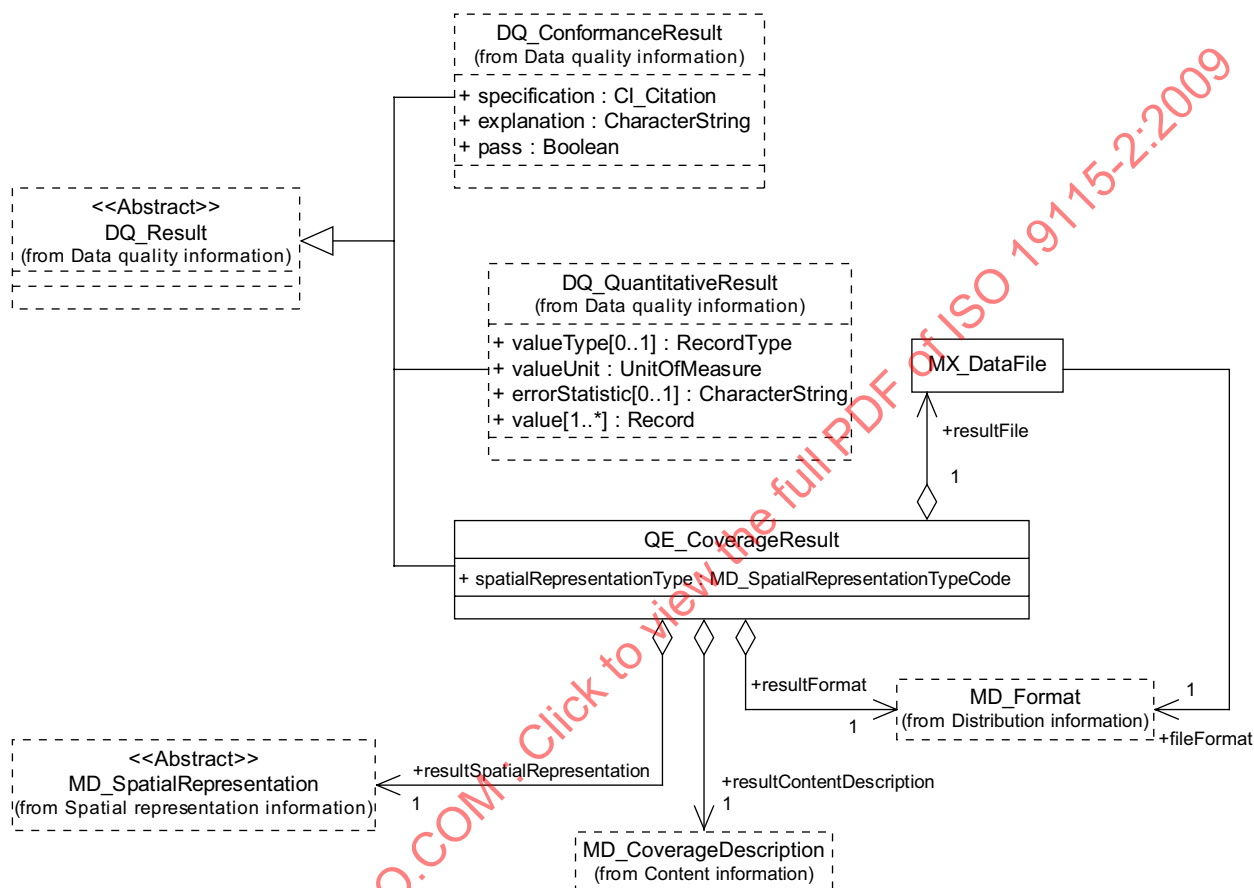


Figure A.2 — Data quality result

The following specification of **QE\_CoverageResult** is simply based on existing concepts from ISO 19115 and ISO/TS 19139.

- The coverage result has a spatial representation which, in some cases, can be exactly the same as the resource spatial representation or may differ (e.g. coverage result computed on a vector database or coverage result using a sample of the resource). The construct used to describe the spatial representation of the coverage result is the **MD\_SpatialRepresentation** class. The **resultSpatialRepresentation** property is mandatory but can be implemented as a reference to the instance of **MD\_SpatialRepresentation** related to the resource.
- The coverage result has a content description. The construct used to describe the content of the result coverage is **MD\_CoverageDescription**. The resulting coverage will often be defined by the distribution of a single attribute over the result coverage domain, but it is anticipated that the range type of the result coverage can comprise many attributes.

- The coverage result has a format which is expressed through the **MD\_Format** class.
- The coverage result is associated to a data file containing the coverage result data. The construct used to describe the result coverage data file is **MX\_DataFile** (from ISO/TS 19139).

### A.2.2.2 Lineage information

Figure A.3 defines the extensions required to specify the lineage of imagery and gridded data datasets. The additional elements provide information about the processing of the raw data that was performed to produce the data in the dataset. The data dictionary for this diagram is given in B.2.2.2.

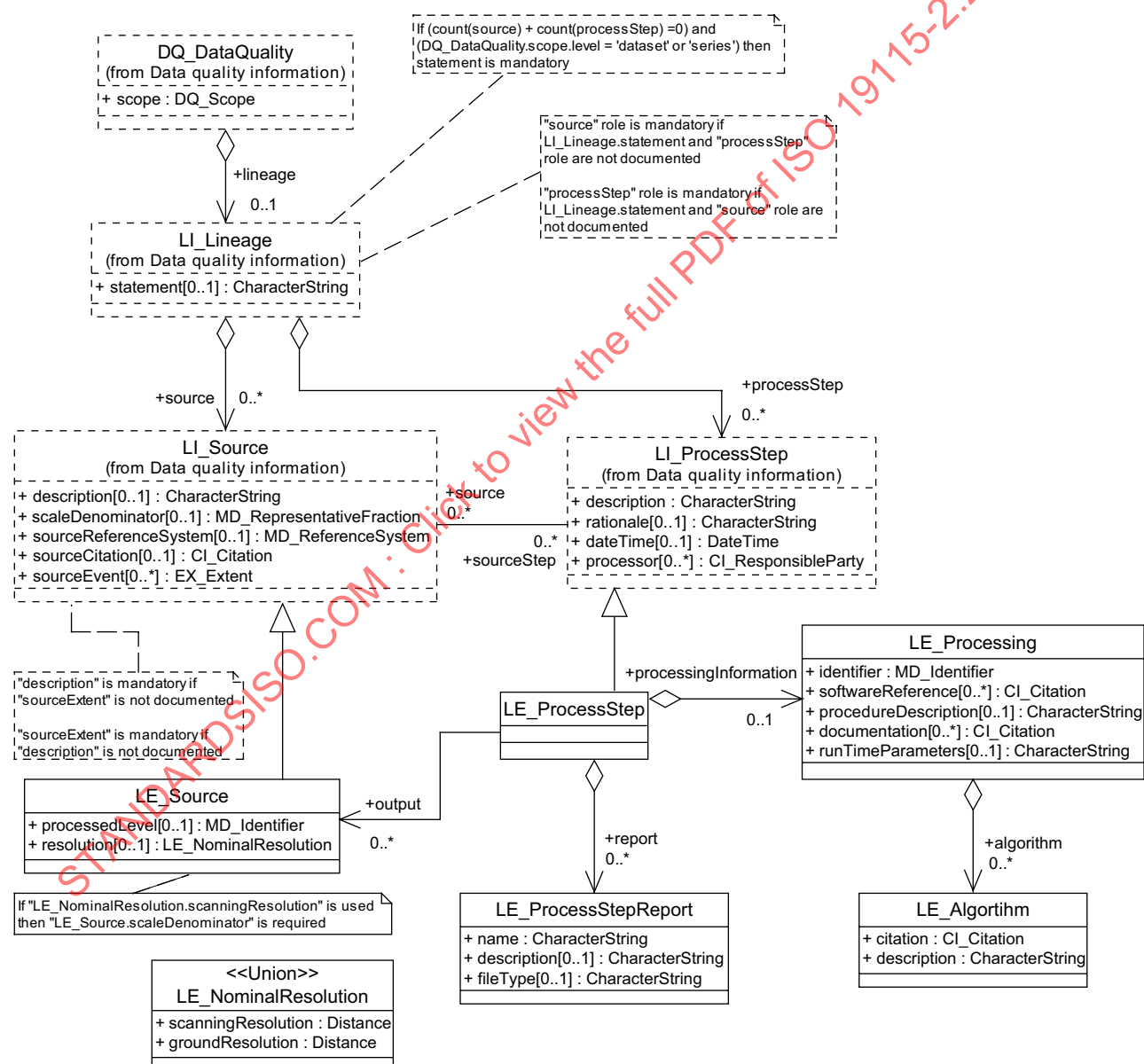


Figure A.3 — Data quality information lineage

## A.2.2.3 Extension to data quality classes and subclasses

Figure A.4 defines an extension required to provide information on the usability of a dataset. QE\_Usability provides information about the dataset indicating that it can be used in a specific user context. This data quality measure differs from those specified in the base standard in that it provides a measure of the data quality complementary to those in the base standard but containing a set of measures specific to a user's requirements. The data dictionary for this diagram is given in B.2.2.3.

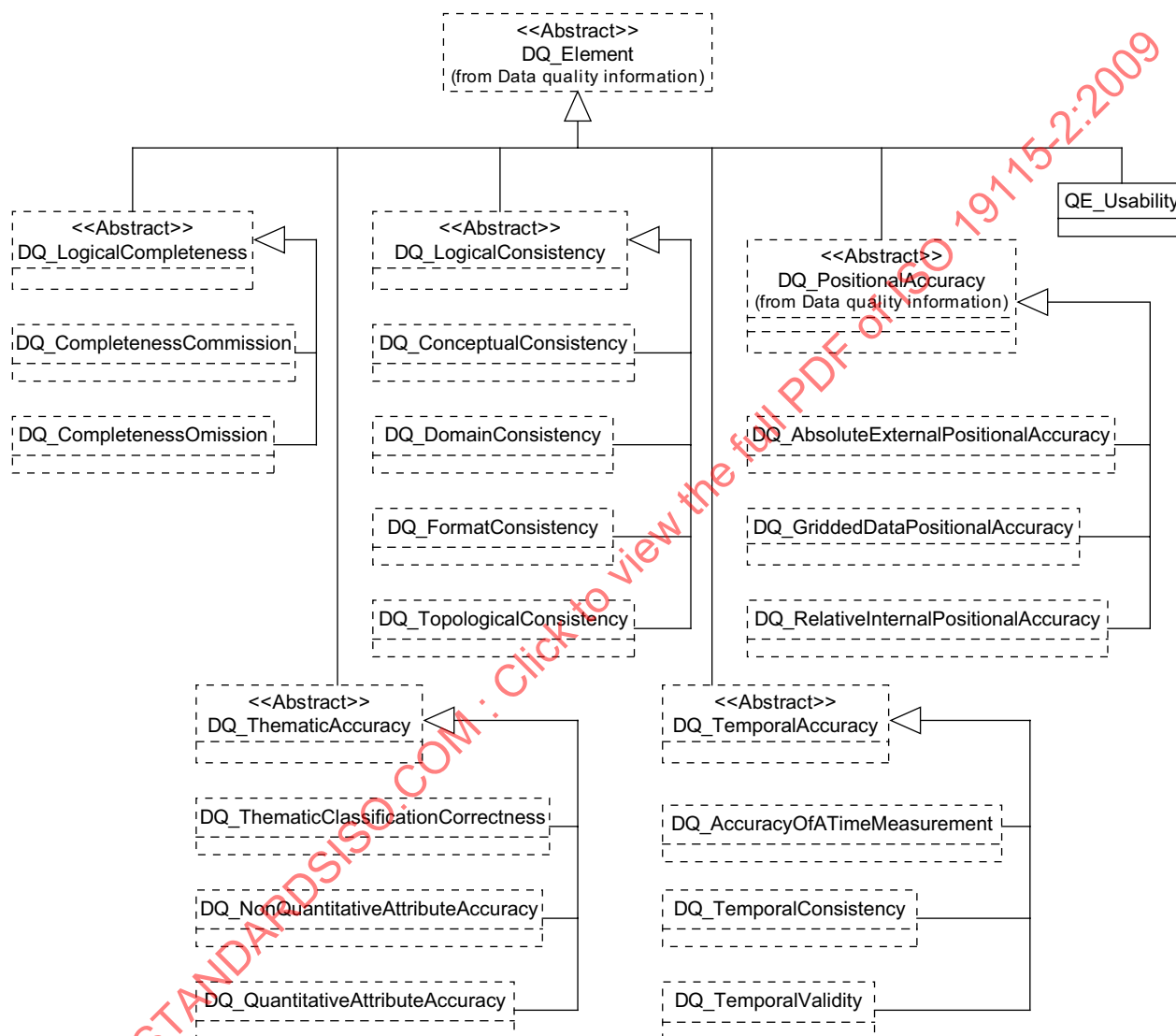


Figure A.4 — Extension to data quality subclasses

### A.2.3 Spatial representation information

#### A.2.3.1 Extension to georectified and georeferenceable classes

Figure A.5 defines the extensions required to specify the spatial representation for imagery and gridded data. The data dictionary for this diagram is given in B.2.3.

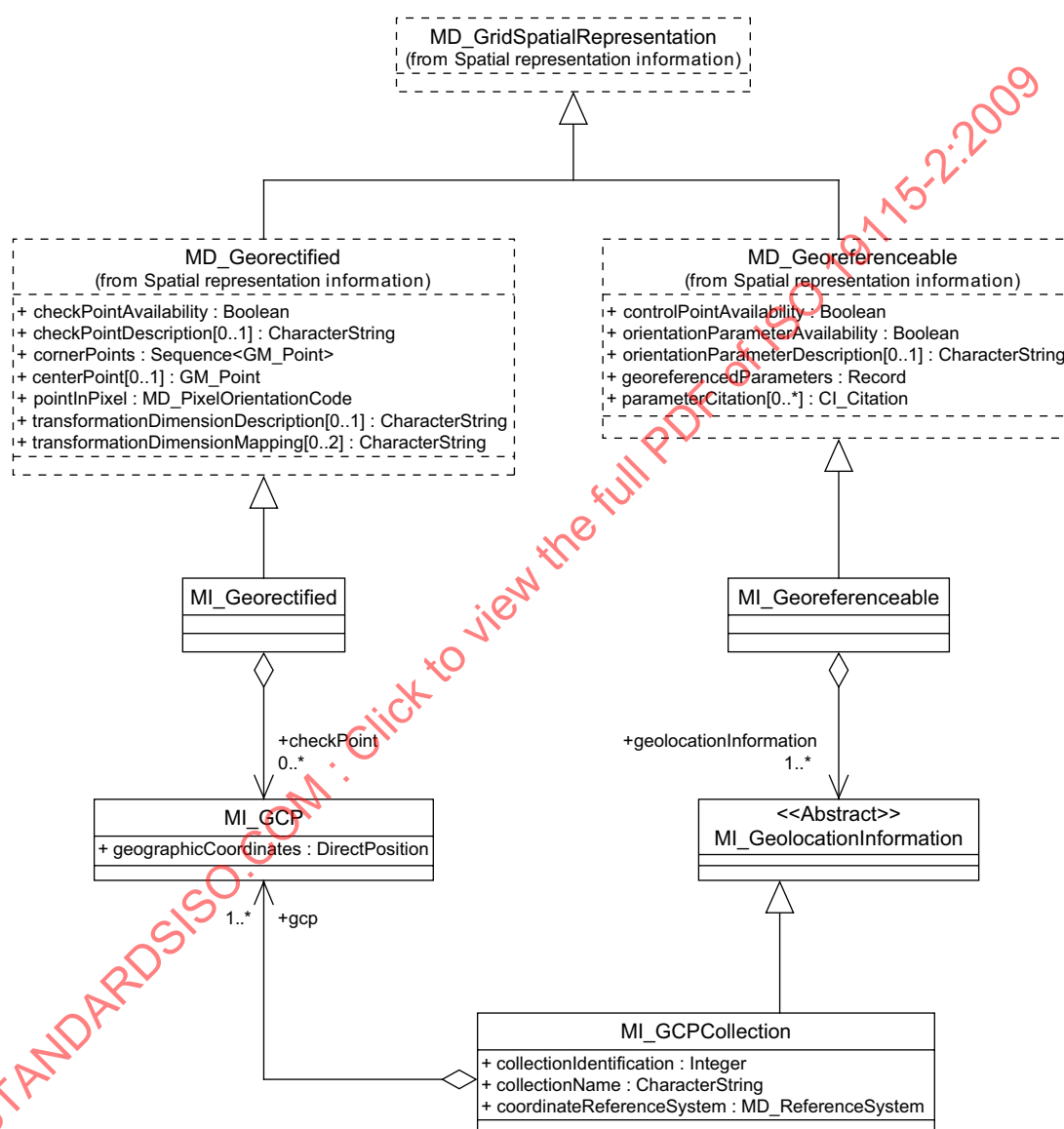


Figure A.5 — Spatial representation information

## A.2.3.2 Ground control point quality

Figure A.6 defines the extensions required to describe the quality of ground control points. The data dictionary for this diagram is given in B.2.3.

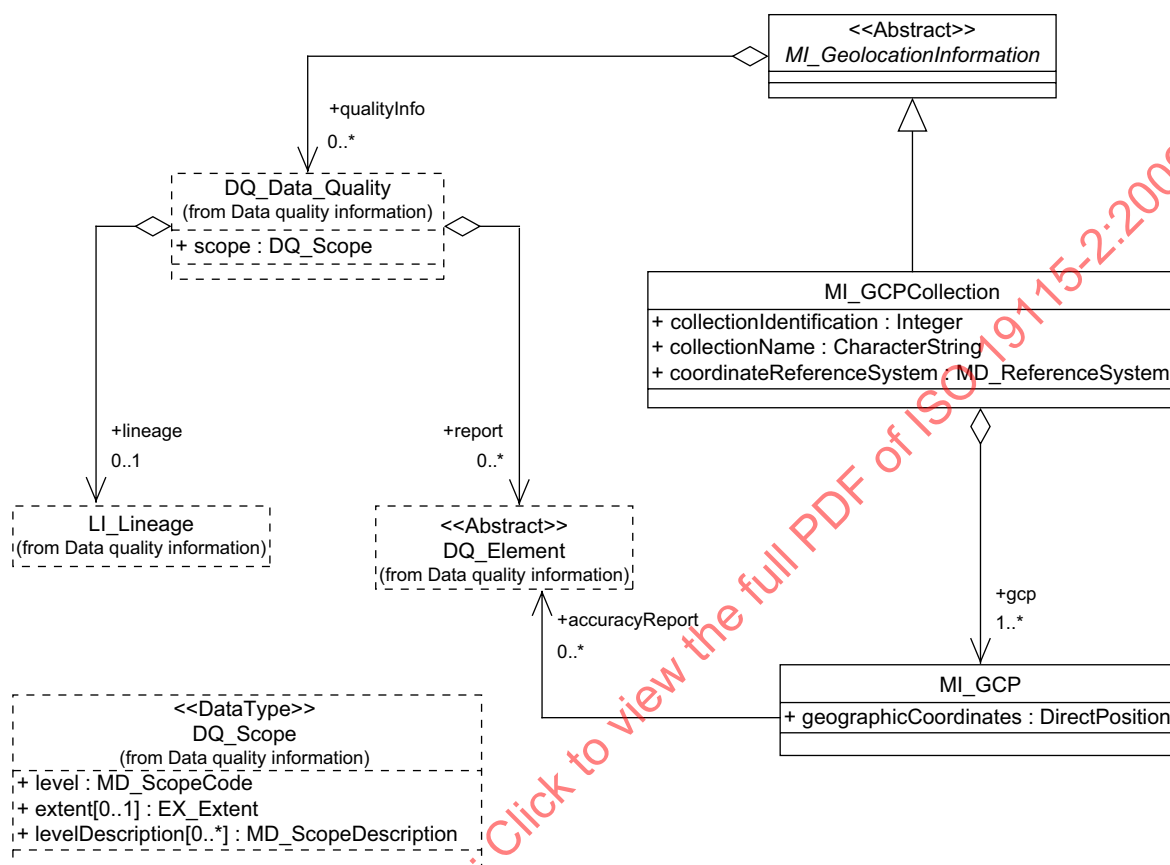


Figure A.6 — Quality of ground control points

## A.2.4 Content information

Figure A.7 defines the extensions required to describe the content of imagery and gridded data datasets. The data dictionary for this diagram is given in B.2.4.

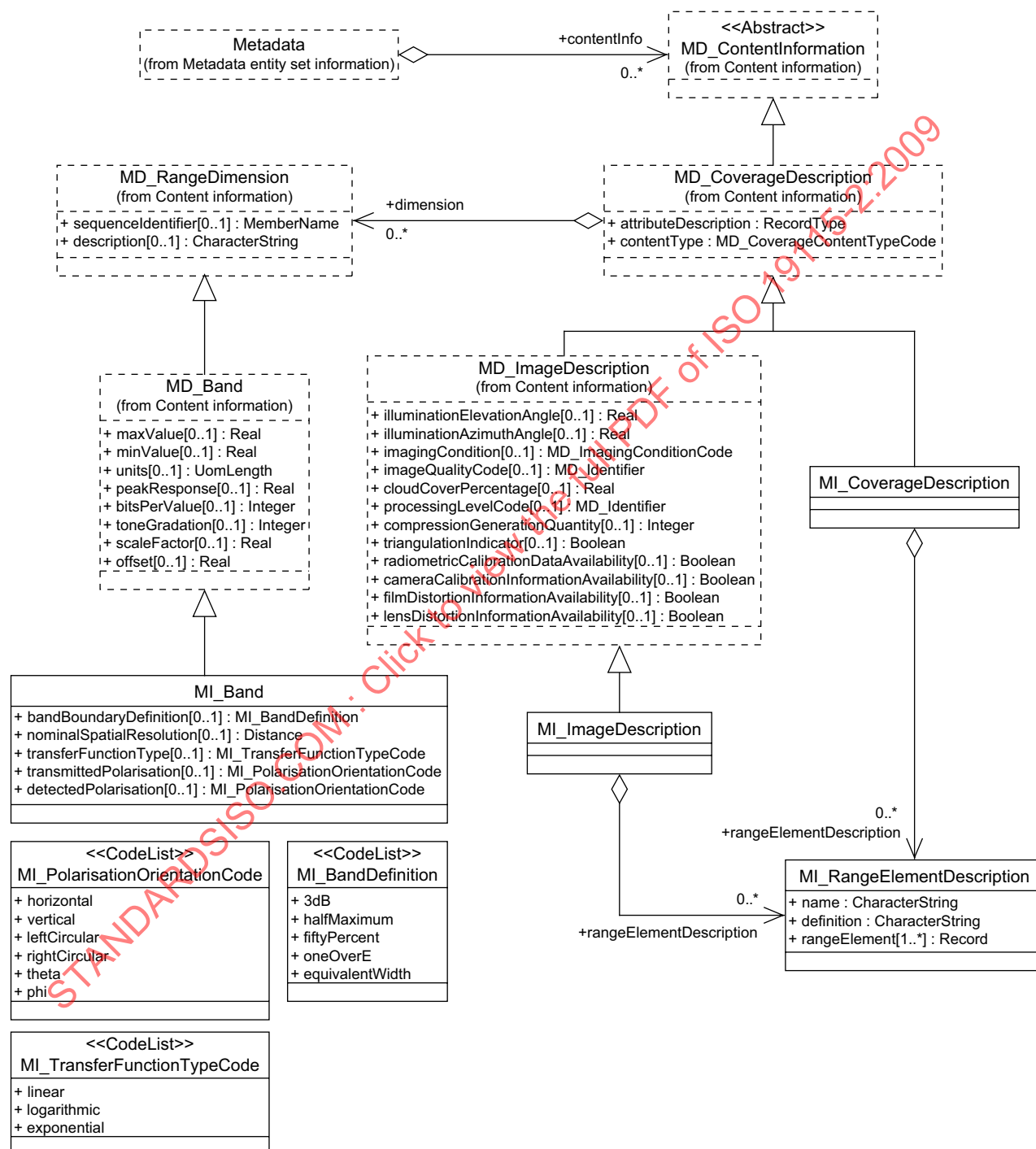


Figure A.7 — Content information

## A.2.5 Acquisition Information

### A.2.5.1 Acquisition Overview

Figure A.8 defines an overview of the metadata classes required to define the acquisition of imagery and gridded datasets. The data dictionary for this diagram is given in B.2.5.

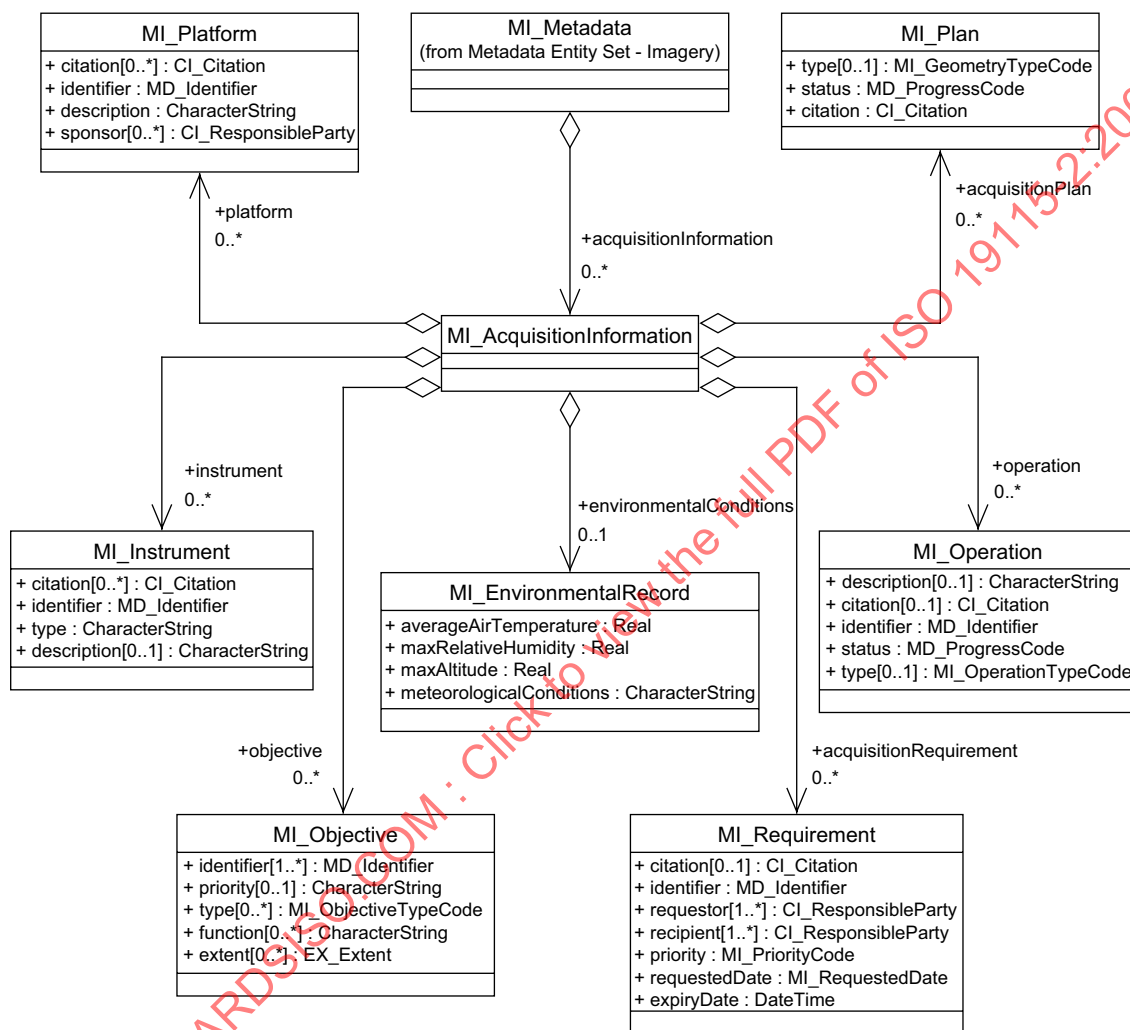
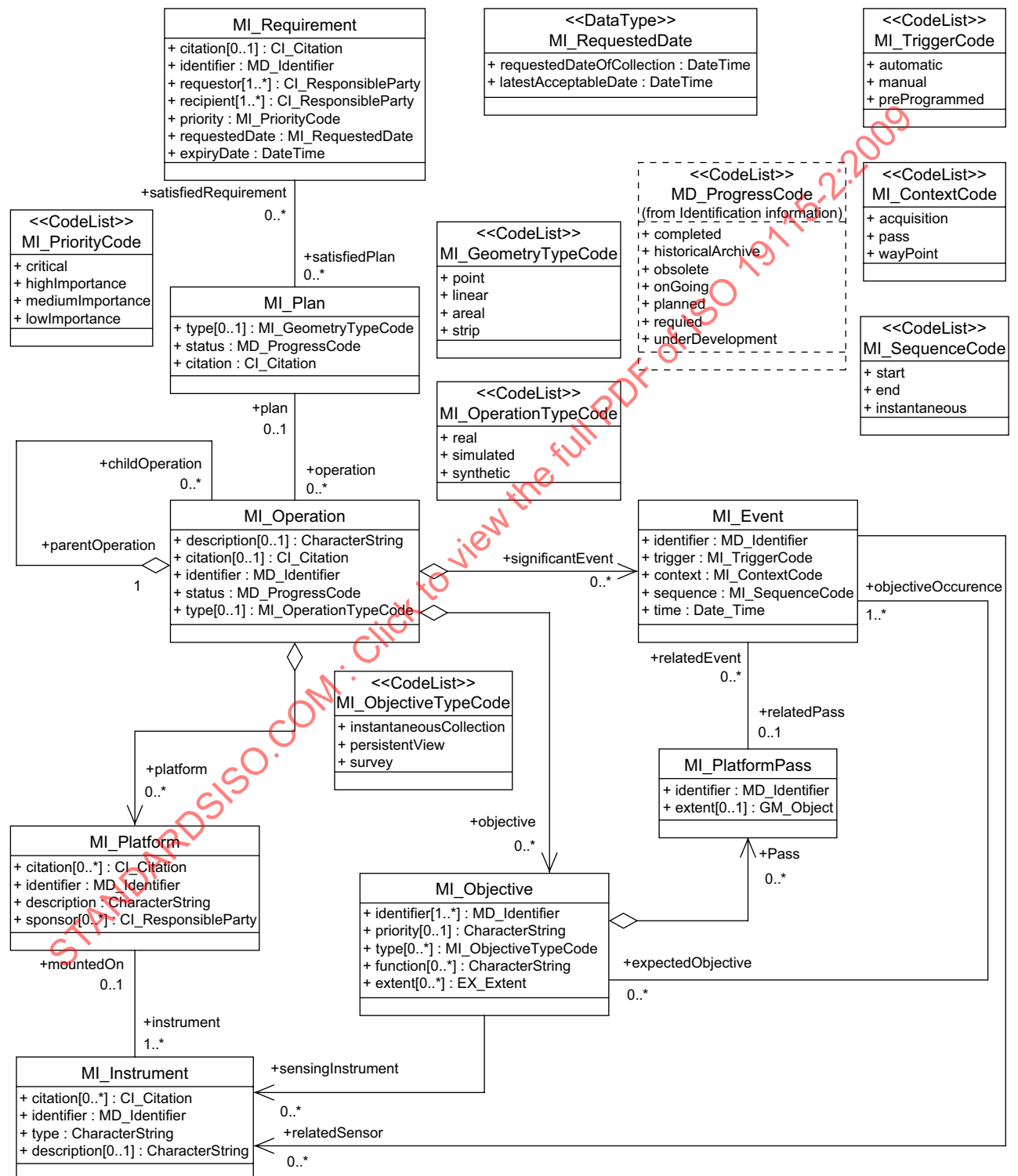


Figure A.8 — Acquisition Overview

### A.2.5.2 Acquisition Details

Figure A.9 defines, in detail, the metadata classes necessary to define the acquisition of imagery and gridded datasets. The data dictionary for this diagram is given in B.2.5.



### Figure A.9 — Acquisition Details

## Annex B (normative)

### Imagery and gridded data metadata data dictionary

#### B.1 Data dictionary overview

##### B.1.1 Introduction

This data dictionary describes the characteristics of the metadata defined in Clause 6 and Annex A. The dictionary is specified in a hierarchy to establish relationships and an organization for the information. The dictionary is categorised into sections by UML model package diagram: Metadata entity set, data quality, spatial representation, content and acquisition. The titles of several of the tables have been expanded to reflect class specification within the respective diagram. Each model diagram from Annex A has a section within the data dictionary. Each UML model class equates to a data dictionary entity. Each UML model class attribute equates to a data dictionary element. The shaded rows define entities. The entities and elements within the data dictionary are defined by seven attributes (those attributes are listed below and are based on those specified in ISO/IEC 11179-3 for the description of data element concepts, i.e. data elements without representation). The term “dataset”, when used as part of a definition, is synonymous with all types of geographic data resources (aggregations of datasets, individual features and the various classes that compose a feature).

##### B.1.2 Name/role name

A label assigned to a metadata entity or to a metadata element. Metadata entity names start with an upper case letter. Spaces do not appear in a metadata entity name. Instead, multiple words are concatenated, with each new subword starting with a capital letter (example: XnnnYmmm). Metadata entity names are unique within the entire data dictionary of ISO 19115 and this part of ISO 19115. Metadata element names are unique within a metadata entity, not the entire data dictionary of ISO 19115 and this part of ISO 19115. Metadata element names are made unique, within an application, by the combination of the metadata entity and metadata element names (example: MD\_Metadata.characterSet). Role names are used to identify metadata abstract model associations and are preceded by “Role name:” to distinguish them from other metadata elements. Names and role names may be in a language other than that used in this part of ISO 19115.

##### B.1.3 Short name and domain code

Those classes that are not CodeList stereotypes are provided with a short name for each element. These short names are unique within ISO 19115 and this part of ISO 19115 and may be used with the Extensible Markup Language (XML) and Standard Generalized Markup Language (SGML)<sup>[3]</sup> or other similar implementation techniques. A naming convention similar to that used to create the longer entity and element names was used to create the short names.

**NOTE** Implementation using SGML and XML is not mandatory; other implementation methods are accommodated. For codelist stereotypes, a code is provided for each possible selection. These domain codes are numerical, unique within the codelist and 3 digits long. Row one of each codelist contains an alphabetic short name, described above, as row one is the name of the codelist.

##### B.1.4 Definition

The metadata entity/element description.

## B.1.5 Obligation/condition

### B.1.5.1 General

This is a descriptor indicating whether a metadata entity or metadata element shall always be documented in the metadata or sometimes be documented [i.e. contains value(s)]. This descriptor may have the following values: M (mandatory) or O (optional).

### B.1.5.2 Mandatory (M):

The metadata entity or metadata element shall be documented.

### B.1.5.3 Optional (O):

The metadata entity or the metadata element may be documented or may not be documented. Optional metadata entities and optional metadata elements have been defined to provide a guide to those looking to fully document their data. (Use of this common set of defined elements will help promote interoperability among geographic data users and producers world-wide.) If an optional entity is not used, the elements contained within that entity (including mandatory elements) will also not be used. Optional entities may have mandatory elements; those elements only become mandatory if the optional entity is used.

## B.1.6 Maximum occurrence

Specifies the maximum number of instances the metadata entity or the metadata element may have. Single occurrences are shown by "1"; repeating occurrences are represented by "N". Fixed number occurrences other than one are allowed, and will be represented by the corresponding number (i.e. "2", "3" ... etc.).

## B.1.7 Data type

Specifies a set of distinct values for representing the metadata elements; for example, integer, real, string, DateTime, and Boolean. The data type attribute is also used to define metadata entities, stereotypes, and metadata associations.

NOTE Data types are defined in ISO/TS 19103:2005, 6.5.2.

## B.1.8 Domain

For an entity, the domain indicates the line numbers covered by that entity.

For a metadata element, the domain specifies the values allowed or the use of free text. "Free text" indicates that no restrictions are placed on the content of the field. Integer-based codes shall be used to represent values for domains containing codelists.

## B.2 Imagery and gridded data metadata package data dictionaries

### B.2.1 Metadata entity set information extension

- UML model shown in Figure A.1.

|    | Name                                     | Short name      | Definition                                                                                | Obligation                             | Maximum occurrence                             | Data type                     | Domain                                      |
|----|------------------------------------------|-----------------|-------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|-------------------------------|---------------------------------------------|
| 1. | MI_Metadata                              | MIMetadata      | root entity that defines information about imagery or gridded data (MD_Metadata extended) | Use obligation from referencing object | Use maximum occurrence from referencing object | Specified Class (MD_Metadata) | Line 2 (MD_Metadata, ISO 19115:2003, B.2.1) |
| 2. | <i>Role name:</i> acquisitionInformation | acquisitionInfo | provides information about the acquisition of the data                                    | O                                      | N                                              | Association                   | MI_AcquisitionInformation                   |

### B.2.2 Data quality information

#### B.2.2.1 Coverage result

- UML model shown in Figure A.2.

|    | Name                                          | Short name     | Definition                                                                                                            | Obligation                             | Maximum occurrence                             | Data type                   | Domain                                                                       |
|----|-----------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|-----------------------------|------------------------------------------------------------------------------|
| 3. | QE_CoverageResult                             | CoverageResult | result of a data quality measure organising the measured values as a coverage (DQ_Result extended)                    | Use obligation from referencing object | Use maximum occurrence from referencing object | Specified class (DQ_Result) | Lines 4 to 8 (DQ_Result, ISO 19115:2003, B.2.4.4)                            |
| 4. | spatialRepresentationType                     | spaRepType     | method used to spatially represent the coverage result                                                                | M                                      | 1                                              | Class                       | MD_SpatialRepresentationTypeCode<br><<CodeList>><br>(ISO 19115:2003, B.5.26) |
| 5. | <i>Role name:</i> resultSpatialRepresentation | resSpaRep      | provides the digital representation of data quality measures composing the coverage result                            | M                                      | 1                                              | Association                 | MD_SpatialRepresentation<br><<Abstract>><br>(ISO 19115:2003, B.2.6)          |
| 6. | <i>Role name:</i> resultContentDescription    | resCntDesc     | provides the description of the content of the result coverage, i.e. semantic definition of the data quality measures | M                                      | 1                                              | Association                 | MD_CoverageDescription<br>(ISO 19115:2003, B.2.8.1)                          |
| 7. | <i>Role name:</i> resultFormat                | resFmt         | provides information about the format of the result coverage data                                                     | M                                      | 1                                              | Association                 | MD_Format<br>(ISO 19115:2003, B.2.10.4)                                      |
| 8. | <i>Role name:</i> resultFile                  | resFile        | provides information about the data file containing the result coverage data                                          | M                                      | 1                                              | Association                 | MX_DataFile<br>(ISO/TS 19139:2007, B.2.3.3)                                  |

**B.2.2.2 Lineage extensions****B.2.2.2.1 Introduction**

- UML model shown in Figure A.3.

**B.2.2.2.2 Algorithm**

|     | Name         | Short name | Definition                                                                                          | Obligation                             | Maximum occurrence                             | Data type                        | Domain                                                 |
|-----|--------------|------------|-----------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|----------------------------------|--------------------------------------------------------|
| 9.  | LE_Algorithm | Algorithm  | details of the methodology by which geographic information was derived from the instrument readings | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class (LE_Processing) | Lines 10 and 11                                        |
| 10. | citation     | algId      | information identifying the algorithm and version or date                                           | M                                      | 1                                              | Class                            | <<DataType>><br>CI_Citation<br>(ISO 19115:2003, B.3.2) |
| 11. | description  | algDesc    | information describing the algorithm used to generate the data                                      | M                                      | 1                                              | CharacterString                  | Free text                                              |

**B.2.2.2.3 Nominal resolution**

|     | Name                 | Short name | Definition                                                                                               | Obligation                             | Maximum occurrence                             | Data type          | Domain               |
|-----|----------------------|------------|----------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|--------------------|----------------------|
| 12. | LE_NominalResolution | NomRes     | distance between consistent parts of (centre, left side, right side) adjacent pixels                     | Use obligation from referencing object | Use maximum occurrence from referencing object | Class<br><<Union>> | Lines 13 and 14      |
| 13. | scanningResolution   | scanRes    | distance between consistent parts of (centre, left side, right side) adjacent pixels in the scan plane   | M                                      | 1                                              | Class              | <<Type>><br>Distance |
| 14. | groundResolution     | groundRes  | distance between consistent parts of (centre, left side, right side) adjacent pixels in the object space | M                                      | 1                                              | Class              | <<Type>><br>Distance |

## B.2.2.2.4 Processing

|     | Name                 | Short name       | Definition                                                                                                 | Obligation                             | Maximum occurrence                             | Data type                         | Domain                                                     |
|-----|----------------------|------------------|------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|-----------------------------------|------------------------------------------------------------|
| 15. | LE_Processing        | Procsg           | comprehensive information about the procedure(s), process(es) and algorithm(s) applied in the process step | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class (LE_ProcessStep) | Lines 16 to 21                                             |
| 16. | identifier           | procInfoId       | information to identify the processing package that produced the data                                      | M                                      | 1                                              | Class                             | <<DataType>><br>MD_Identifier<br>(ISO 19115:2003, B.2.7.3) |
| 17. | softwareReference    | procInfoSoftware | reference to document describing processing software                                                       | O                                      | N                                              | Class                             | <<DataType>><br>CI_Citation<br>(ISO 19115:2003, B.3.2)     |
| 18. | procedureDescription | procInfoDesc     | additional details about the processing procedures                                                         | O                                      | 1                                              | CharacterString                   | Free text                                                  |
| 19. | documentation        | procInfoDoc      | reference to documentation describing the processing                                                       | O                                      | N                                              | Class                             | <<DataType>><br>CI_Citation<br>(ISO 19115:2003, B.3.2)     |
| 20. | runTimeParameters    | procInfoParam    | parameters to control the processing operations, entered at run time                                       | O                                      | 1                                              | CharacterString                   | Free text                                                  |
| 21. | Role name: algorithm | algorithm        | details of the methodology by which geographic information was derived from the instrument readings        | O                                      | N                                              | Association                       | LE_Algorithm                                               |

## B.2.2.2.5 Process step

|     | Name                             | Short name     | Definition                                                                                                                                                                                                       | Obligation                             | Maximum occurrence                             | Data type                        | Domain                                                        |
|-----|----------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|----------------------------------|---------------------------------------------------------------|
| 22. | LE_ProcessStep                   | DetailProcStep | information about an event or transformation in the life of the dataset including details of the algorithm and software used for processing (LI_ProcessStep extended)                                            | Use obligation from referencing object | Use maximum occurrence from referencing object | Specified class (LI_ProcessStep) | Lines 23 to 25<br>(LI_ProcessStep, ISO 19115:2003, B.2.4.2.2) |
| 23. | Role name: output                | procStepOut    | description of the product generated as a result of the process step                                                                                                                                             | O                                      | N                                              | Association                      | LE_Source                                                     |
| 24. | Role name: processingInformation | procInfo       | comprehensive information about the procedure by which the algorithm was applied to derive geographic data from the raw instrument measurements, such as datasets, software used, and the processing environment | O                                      | 1                                              | Association                      | LE_Processing                                                 |
| 25. | Role name: report                | procReport     | report generated by the process step                                                                                                                                                                             | O                                      | N                                              | Association                      | LE_ProcessStepReport                                          |

**B.2.2.2.6 Process Step Report**

|     | Name                  | Short name    | Definition                                                   | Obligation                             | Maximum occurrence                             | Data type                         | Domain         |
|-----|-----------------------|---------------|--------------------------------------------------------------|----------------------------------------|------------------------------------------------|-----------------------------------|----------------|
| 26. | LE_ProcessStep Report | ProcStepRep   | report of what occurred during the process step              | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class (LE_ProcessStep) | Lines 27 to 29 |
| 27. | name                  | procRepName   | name of the processing report                                | M                                      | 1                                              | CharacterString                   | Free text      |
| 28. | description           | procRepDesc   | textual description of what occurred during the process step | O                                      | 1                                              | CharacterString                   | Free text      |
| 29. | fileType              | procRepFilTyp | type of file that contains the processing report             | O                                      | 1                                              | CharacterString                   | Free text      |

**B.2.2.2.7 Source extensions**

|     | Name           | Short name | Definition                                                                               | Obligation                             | Maximum occurrence                             | Data type                  | Domain                                                 |
|-----|----------------|------------|------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|----------------------------|--------------------------------------------------------|
| 30. | LE_Source      | SourceExt  | information on data sets input to or output by the processing step (LI_Source extended)  | Use obligation from referencing object | Use maximum occurrence from referencing object | SpecifiedClass (LI_Source) | Lines 31 and 32 (LI_Source, ISO 19115:2003, B.2.4.2.3) |
| 31. | processedLevel | procLevel  | processing level of the source data                                                      | O                                      | 1                                              | Class                      | <<DataType>> MD_Identifier (ISO 19115:2003, B.2.7.3)   |
| 32. | resolution     | procResol  | distance between consistent parts (centre, left side, right side) of two adjacent pixels | O                                      | 1                                              | Class                      | <<Union>> LE_NominalResolution                         |

NOTE If LE\_Source.resolution.scanningResolution is specified, then LE\_Source.scaleDenominator (inherited from LI\_Source) is required.

**B.2.2.3 Data quality element extension for usability**

- UML model shown in Figure A.4.

|     | Name         | Short name | Definition                                                                                    | Obligation                             | Maximum occurrence                             | Data type                    | Domain                                |
|-----|--------------|------------|-----------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|------------------------------|---------------------------------------|
| 33. | QE_Usability | Usability  | degree of adherence of a dataset to a specific set of user requirements (DQ_Element extended) | Use obligation from referencing object | Use maximum occurrence from referencing object | Specified class (DQ_Element) | (DQ_Element, ISO 19115:2003, B.2.4.3) |

### B.2.3 Spatial representation information

#### B.2.3.1 Introduction

- UML models shown in Figure A.5 and A.6

#### B.2.3.2 Georectified – Extensions

|     | Name                         | Short name | Definition                                                                                         | Obligation                             | Maximum occurrence                             | Data type                         | Domain                                             |
|-----|------------------------------|------------|----------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|-----------------------------------|----------------------------------------------------|
| 34. | MI_Georectified              | IGeorect   | extends georectified grid description to include associated checkpoints (MD_Georectified extended) | Use obligation from referencing object | Use maximum occurrence from referencing object | Specified Class (MD_Georectified) | Line 35 (MD_Georectified, ISO 19115:2003, B.2.6.1) |
| 35. | <i>Role name:</i> checkPoint | chkPt      | geographic references used to validate georectification of the data                                | O                                      | N                                              | Association                       | MI_GCP                                             |

#### B.2.3.3 Georeferenceable – Extensions

|     | Name                                     | Short name | Definition                                                                                                                                                   | Obligation                             | Maximum occurrence                             | Data type                             | Domain                                                 |
|-----|------------------------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|---------------------------------------|--------------------------------------------------------|
| 36. | MI_Georeferenceable                      | IGeoref    | description of information provided in metadata that allows the geographic or map location of the raster points to be located (MD_Georeferenceable extended) | Use obligation from referencing object | Use maximum occurrence from referencing object | Specified Class (MD_Georeferenceable) | Line 37 (MD_Georeferenceable, ISO 19115:2003, B.2.6.2) |
| 37. | <i>Role name:</i> geolocationInformation | geolocInfo | information that can be used to geolocate the data                                                                                                           | M                                      | N                                              | Association                           | MI_GeolocationInformation                              |

#### B.2.3.4 Ground Control Point Collection

|     | Name                          | Short name | Definition                                                                        | Obligation                             | Maximum occurrence                             | Data type                                   | Domain                                 |
|-----|-------------------------------|------------|-----------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|---------------------------------------------|----------------------------------------|
| 38. | MI_GeolocationInformation     | GeolocInfo | information used to determine geographic location corresponding to image location | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class (MI_Georeferenceable)      | Line 39                                |
| 39. | <i>Role name:</i> qualityInfo | geolocQual | provides an overall assessment of quality of geolocation information              | O                                      | N                                              | Association                                 | DQ_DataQuality (ISO 19115:2003, B.2.4) |
| 40. | MI_GCPCollection              | GCPColl    | information about a control point collection                                      | Use obligation from referencing object | Use maximum occurrence from referencing object | Specified Class (MI_GeolocationInformation) | Lines 41-44                            |
| 41. | collectionIdentification      | collID     | identifier of the GCP collection                                                  | M                                      | 1                                              | Integer                                     | Integer                                |

|     | Name                      | Short name | Definition                                                       | Obligation | Maximum occurrence | Data type       | Domain             |
|-----|---------------------------|------------|------------------------------------------------------------------|------------|--------------------|-----------------|--------------------|
| 42. | collectionName            | collName   | name of the GCP collection                                       | M          | 1                  | CharacterString | Free text          |
| 43. | coordinateReferenceSystem | collCRS    | coordinate system in which the ground control points are defined | M          | 1                  | Class           | MD_ReferenceSystem |
| 44. | <i>Role name:</i><br>gcp  | collGCP    | ground control point(s) used in the collection                   | M          | *                  | Association     | MI_GCP             |

### B.2.3.5 Ground Control Points

|     | Name                                | Short name   | Definition                                                                         | Obligation                             | Maximum occurrence                             | Data type                           | Domain                               |
|-----|-------------------------------------|--------------|------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|-------------------------------------|--------------------------------------|
| 45. | MI_GCP                              | gcp          | information on ground control point                                                | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class (MI_GCPCollection) | Lines 46-47                          |
| 46. | geographicCoordinates               | gcpGeoCoords | geographic or map position of the control point, in either two or three dimensions | M                                      | 1                                              | Class                               | Direct Position (ISO/TS 19103)       |
| 47. | <i>Role name:</i><br>accuracyReport | gcpAccRep    | accuracy of a ground control point                                                 | O                                      | N                                              | Association                         | DQ_Element (ISO 19115:2003, B.2.4.3) |

## B.2.4 Content information

### B.2.4.1 Introduction

- UML model shown in Figure A.7.

### B.2.4.2 Wavelength band information

|     | Name                     | Short name | Definition                                                                                              | Obligation                             | Maximum occurrence                             | Data type                 | Domain                                              |
|-----|--------------------------|------------|---------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|---------------------------|-----------------------------------------------------|
| 48. | MI_Band                  | BandExt    | extensions to electromagnetic spectrum wavelength description (MD_Band extended)                        | Use obligation from referencing object | Use maximum occurrence from referencing object | Specified Class (MD_Band) | Lines 49 to 53<br>MD_Band, ISO 19115:2003, B.2.8.2) |
| 49. | bandBoundaryDefinition   | bBndDef    | designation of criterion for defining maximum and minimum wavelengths for a spectral band               | O                                      | 1                                              | Class                     | <<CodeList>><br>MI_BandDefinition                   |
| 50. | nominalSpatialResolution | bndSpatRes | smallest distance between which separate points can be distinguished, as specified in instrument design | O                                      | 1                                              | Class                     | <<DataType>><br>Distance                            |

|     | Name                    | Short name        | Definition                                                                             | Obligation | Maximum occurrence | Data type | Domain                                             |
|-----|-------------------------|-------------------|----------------------------------------------------------------------------------------|------------|--------------------|-----------|----------------------------------------------------|
| 51. | transferFunctionType    | scalXfrFunc       | type of transfer function to be used when scaling a physical value for a given element | O          | 1                  | Class     | <<CodeList>><br>MI_TransferFunctionType<br>Code    |
| 52. | transmittedPolarization | transPolarization | polarization of the radiation transmitted                                              | O          | 1                  | Class     | <<CodeList>><br>MI_PolarizationOrientation<br>Code |
| 53. | detectedPolarization    | detPolarization   | polarization of the radiation detected                                                 | O          | 1                  | Class     | <<CodeList>><br>MI_PolarizationOrientation<br>Code |

#### B.2.4.3 Coverage and image description – Extensions

|     | Name                                         | Short name | Definition                                                                                                                          | Obligation                             | Maximum occurrence                             | Data type                                                          | Domain                                                       |
|-----|----------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------|
| 54. | MI_CoverageDescription                       | CCovDesc   | information about the content of a coverage, including the description of specific range elements (MD_CoverageDescription extended) | Use obligation from referencing object | Use maximum occurrence from referencing object | Specified class (MD_CoverageDescription)                           | Line 55<br>(MD_CoverageDescription, ISO 19115:2003, B.2.8.1) |
| 55. | <i>Role name:</i><br>rangeElementDescription | cRgEltDesc | provides the description of the specific range elements of a coverage                                                               | O                                      | N                                              | Association                                                        | MI_RangeElementDescription                                   |
| 56. | MI_ImageDescription                          | ICovDesc   | information about the content of an image, including the description of specific range elements (MD_ImageDescription extended)      | Use obligation from referencing object | Use maximum occurrence from referencing object | Specified class (MD_ImageDescription)                              | Line 57<br>(MD_ImageDescription, ISO 19115:2003, B.2.8.1)    |
| 57. | <i>Role name:</i><br>rangeElementDescription | iRgEltDesc | provides the description of the specific range elements of an image                                                                 | O                                      | N                                              | Association                                                        | MI_RangeElementDescription                                   |
| 58. | MI_RangeElementDescription                   | RgEltDesc  | description of specific range elements                                                                                              | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated class:<br>(MI_CoverageDescription, MI_ImageDescription) | Lines 59 to 61                                               |
| 59. | name                                         | rgEltName  | designation associated with a set of range elements                                                                                 | M                                      | 1                                              | CharacterString                                                    | Free text                                                    |
| 60. | definition                                   | rgEltDef   | description of a set of specific range elements                                                                                     | M                                      | 1                                              | CharacterString                                                    | Free text                                                    |
| 61. | rangeElement                                 | rgElt      | specific range elements, i.e. range elements associated with a name and their definition                                            | M                                      | N                                              | Class                                                              | Record<br>(ISO/TS 19103)                                     |

## B.2.5 Acquisition Information

### B.2.5.1 General

- UML model shown in Figures A.8 and A.9.

|     | Name                                         | Short name  | Definition                                                                                                            | Obligation                             | Maximum occurrence                             | Data type                      | Domain                  |
|-----|----------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|--------------------------------|-------------------------|
| 62. | MI_AcquisitionInformation                    | AquisitInfo | designations for the measuring instruments, the platform carrying them, and the mission to which the data contributes | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class (MI_Metadata) | Lines 63 to 69          |
| 63. | <i>Role name:</i><br>acquisitionPlan         | acquisPlan  | identifies the plan as implemented by the acquisition                                                                 | O                                      | N                                              | Association                    | MI_Plan                 |
| 64. | <i>Role name:</i><br>acquisitionRequirement  | acquisReq   | identifies the requirement the data acquisition intends to satisfy                                                    | O                                      | N                                              | Association                    | MI_Requirement          |
| 65. | <i>Role name:</i><br>environmentalConditions | environCon  | a record of the environmental circumstances during the data acquisition                                               | O                                      | 1                                              | Association                    | MI_Environmental Record |
| 66. | <i>Role name:</i><br>instrument              | instrId     | general information about the instrument used in data acquisition                                                     | O                                      | N                                              | Association                    | MI_Instrument           |
| 67. | <i>Role name:</i><br>objective               | objId       | identification of the area or object to be sensed                                                                     | O                                      | N                                              | Association                    | MI_Objective            |
| 68. | <i>Role name:</i><br>operation               | operationId | general information about an identifiable activity which provided the data                                            | O                                      | N                                              | Association                    | MI_Operation            |
| 69. | <i>Role name:</i><br>platform                | platformId  | general information about the platform from which the data were taken                                                 | O                                      | N                                              | Association                    | MI_Platform             |

### B.2.5.2 Environmental record

|     | Name                     | Short name | Definition                                                                              | Obligation                             | Maximum occurrence                             | Data type                                     | Domain      |
|-----|--------------------------|------------|-----------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|-----------------------------------------------|-------------|
| 70. | MI_Environmental Record  | EnvironRec | information about the environmental conditions during the acquisition                   | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class (MI_Acquisition Information) | Lines 71-74 |
| 71. | averageAirTemperature    | avgAirTemp | average air temperature along the flight pass during the photo flight                   | M                                      | 1                                              | Real                                          | Real        |
| 72. | maxRelativeHumidity      | maxRelHum  | maximum relative humidity along the flight pass during the photo flight                 | M                                      | 1                                              | Real                                          | Real        |
| 73. | maxAltitude              | maxAlt     | maximum altitude during the photo flight                                                | M                                      | 1                                              | Real                                          | Real        |
| 74. | meteorologicalConditions | meterCond  | meteorological conditions in the photo flight area, in particular clouds, snow and wind | M                                      | 1                                              | CharacterString                               | Free Text   |

## B.2.5.3 Event identification

|     | Name                         | Short name | Definition                                                           | Obligation                             | Maximum occurrence                             | Data type                       | Domain                                                     |
|-----|------------------------------|------------|----------------------------------------------------------------------|----------------------------------------|------------------------------------------------|---------------------------------|------------------------------------------------------------|
| 75. | MI_Event                     | Event      | identification of a significant collection point within an operation | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class (MI_Operation) | Lines 76 to 83                                             |
| 76. | identifier                   | evtId      | event name or number                                                 | M                                      | 1                                              | Class                           | <<DataType>><br>MD_Identifier<br>(ISO 19115:2003, B.2.7.3) |
| 77. | trigger                      | evtTrig    | initiator of the event                                               | M                                      | 1                                              | Class                           | <<CodeList>><br>MI_TriggerCode                             |
| 78. | context                      | evtCntxt   | meaning of the event                                                 | M                                      | 1                                              | Class                           | <<CodeList>><br>MI_ContextCode                             |
| 79. | sequence                     | evtSeq     | relative time ordering of the event                                  | M                                      | 1                                              | Class                           | <<CodeList>><br>MI_SequenceCode                            |
| 80. | time                         | evtTime    | time the event occurred                                              | M                                      | 1                                              | Class                           | <<Type>><br>DateTime                                       |
| 81. | Role name: expectedObjective | evtObj     | objective or objectives satisfied by an event                        | O                                      | N                                              | Association                     | MI_Objective                                               |
| 82. | Role name: relatedPass       | evtPass    | pass during which an event occurs                                    | O                                      | 1                                              | Association                     | MI_PlatformPass                                            |
| 83. | Role name: relatedSensor     | evtSnsr    | instrument or instruments for which the event is meaningful          | O                                      | N                                              | Association                     | MI_Instrument                                              |

## B.2.5.4 Instrument identification

|     | Name                 | Short name   | Definition                                                                                | Obligation                             | Maximum occurrence                             | Data type                                     | Domain                                                      |
|-----|----------------------|--------------|-------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------|
| 84. | MI_Instrument        | InstrumentId | designations for the measuring instruments                                                | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class (MI_Acquisition Information) | Lines 85 to 89                                              |
| 85. | citation             | instNam      | complete citation of the instrument                                                       | O                                      | N                                              | Class                                         | <<DataType>><br>CI_Citation<br>(ISO 19115:2003, B.3.2)      |
| 86. | identifier           | instId       | unique identification of the instrument                                                   | M                                      | 1                                              | Class                                         | <<Date Type>><br>MD_Identifier<br>(ISO 19115:2003, B.2.7.3) |
| 87. | type                 | instType     | name of the type of instrument<br><br>Examples: framing, line-scan, push-broom, pan-frame | M                                      | 1                                              | CharacterString                               | Free text                                                   |
| 88. | description          | instDesc     | textual description of the instrument                                                     | O                                      | 1                                              | CharacterString                               | Free text                                                   |
| 89. | Role name: mountedOn | instPlatform | platform on which the instrument is mounted                                               | O                                      | 1                                              | Association                                   | MI_Platform                                                 |

## B.2.5.5 Objective information

|     | Name                           | Short name   | Definition                                                                                                     | Obligation                             | Maximum occurrence                             | Data type                                                   | Domain                                               |
|-----|--------------------------------|--------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| 90. | MI_Objective                   | TargetId     | describes the characteristics, spatial and temporal extent of the intended object to be observed               | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class (MI_Acquisition Information, MI_Operation) | Lines 91 to 98                                       |
| 91. | identifier                     | targetId     | code used to identify the objective                                                                            | M                                      | N                                              | Class                                                       | <<DataType>> MD_Identifier (ISO 19115:2003, B.2.7.3) |
| 92. | priority                       | trgtPriority | priority applied to the target                                                                                 | O                                      | 1                                              | CharacterString                                             | Free text                                            |
| 93. | type                           | trgtType     | collection technique for the objective                                                                         | O                                      | N                                              | Class                                                       | <<CodeList>> MI_ObjectiveType Code                   |
| 94. | function                       | trgtFunct    | role or purpose performed by or activity performed at the objective                                            | O                                      | N                                              | CharacterString                                             | Free text                                            |
| 95. | extent                         | trgtExtent   | extent information including the bounding box, bounding polygon, vertical and temporal extent of the objective | O                                      | N                                              | Class                                                       | <<DataType>> EX_Extent (ISO 19115:2003, B.3.1)       |
| 96. | Role name: objectiveOccurrence | trgtEvt      | event or events associated with objective completion                                                           | M                                      | N                                              | Association                                                 | MI_Event                                             |
| 97. | Role name: pass                | trgtPass     | pass of the platform over the objective                                                                        | O                                      | N                                              | Association                                                 | MI_PlatformPass                                      |
| 98. | Role name: sensingInstrument   | trgtInstr    | instrument which senses the objective data                                                                     | O                                      | N                                              | Association                                                 | MI_Instrument                                        |

## B.2.5.6 Operation information

|      | Name         | Short name | Definition                                                                                                | Obligation                             | Maximum occurrence                             | Data type                                                   | Domain                                           |
|------|--------------|------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------|
| 99.  | MI_Operation | MssnId     | designations for the operation used to acquire the dataset                                                | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class (MI_Acquisition Information, MI_Operation) | Lines 100 to 110                                 |
| 100. | description  | mssnDesc   | description of the mission on which the platform observations are made and the objectives of that mission | O                                      | 1                                              | CharacterString                                             | Free text                                        |
| 101. | citation     | mssnNam    | identification of the mission                                                                             | O                                      | 1                                              | Class                                                       | <<DataType>> CI_Citation (ISO 19115:2003, B.3.2) |

|      | Name                                  | Short name    | Definition                                         | Obligation | Maximum occurrence | Data type   | Domain                                                     |
|------|---------------------------------------|---------------|----------------------------------------------------|------------|--------------------|-------------|------------------------------------------------------------|
| 102. | identifier                            | mssnId        | unique identification of the operation             | M          | 1                  | Class       | <<DataType>><br>MD_Identifier<br>(ISO 19115:2003, B.2.7.3) |
| 103. | status                                | mssnStatus    | status of the data acquisition                     | M          | 1                  | Class       | <<CodeList>><br>MD_ProgressCode                            |
| 104. | type                                  | mssnType      | collection technique for the operation             | O          | 1                  | Class       | <<CodeList>><br>MI_OperationType Code                      |
| 105. | <i>Role name:</i><br>childOperation   | subMission    | sub-missions that make up part of a larger mission | O          | N                  | Association | MI_Operation                                               |
| 106. | <i>Role name:</i><br>objective        | mssnObj       | object(s) or area(s) of interest to be sensed      | O          | N                  | Association | MI_Objective                                               |
| 107. | <i>Role name:</i><br>parentOperation  | parentMission | heritage of the operation                          | M          | 1                  | Association | MI_Operation                                               |
| 108. | <i>Role name:</i><br>plan             | mssnPlan      | plan satisfied by the operation                    | O          | 1                  | Association | MI_Plan                                                    |
| 109. | <i>Role name:</i><br>platform         | mssnPltfrm    | platform (or platforms) used in the operation      | O          | N                  | Association | MI_Platform                                                |
| 110. | <i>Role name:</i><br>significantEvent | mssnSigEvt    | record of an event occurring during an operation   | O          | N                  | Association | MI_Event                                                   |

### B.2.5.7 Plan information

|      | Name                                      | Short name | Definition                                                                                     | Obligation                             | Maximum occurrence                             | Data type                                        | Domain                                                      |
|------|-------------------------------------------|------------|------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------|
| 111. | MI_Plan                                   | PlanId     | designations for the planning information related to meeting the data acquisition requirements | Use obligation from referencing object | Use maximum occurrence from referencing object | Aggregated Class<br>(MI_Acquisition Information) | Lines 112 to 116                                            |
| 112. | type                                      | planType   | manner of sampling geometry that the planner expects for collection of objective data          | O                                      | 1                                              | Class                                            | <<CodeList>><br>MI_GeometryType Code                        |
| 113. | status                                    | planStatus | current status of the plan (pending, completed, etc.)                                          | M                                      | 1                                              | Class                                            | <<CodeList>><br>MD_ProgressCode<br>(ISO 19115:2003, B.5.23) |
| 114. | citation                                  | planReqId  | identification of authority requesting target collection                                       | M                                      | 1                                              | Class                                            | <<DataType>><br>CI_Citation<br>(ISO 19115:2003, B.3.2)      |
| 115. | <i>Role name:</i><br>operation            | planOper   | identification of the activity or activities that satisfy a plan                               | O                                      | N                                              | Association                                      | MI_Operation                                                |
| 116. | <i>Role name:</i><br>satisfiedRequirement | planReq    | requirement satisfied by the plan                                                              | O                                      | N                                              | Association                                      | MI_Requirement                                              |