
**Geographic information —
Metadata —**

**Part 2:
Extensions for acquisition and
processing**

Information géographique — Métadonnées —

Partie 2: Extensions pour l'acquisition et le traitement



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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 211, *Geographic information/Geomatics*.

This second edition cancels and replaces the first edition (ISO 19115-2:2009), which has been technically revised.

The following is a summary of major changes to this document during the revision process:

- The name and scope were changed to better describe the purpose of the document;
- QE_CoverageResult and QE_Useability were moved to ISO 19157;
- All extended classes now extend ISO 19115-1:2014;
- Whereas the XML Schema encoding for ISO 19115-2:2009 was provided in ISO/TS 19139-2; the link and information about the XML schema for this revision is provided in [Annex C](#) of this document;
- A specified class of MI_Instrument – MI_Sensor was defined. A list of all the parts in the ISO 19115 series, can be found on the ISO website.

Introduction

This document replaces the previous edition (ISO 19115-2:2009) *Geographic information — Metadata — Extension for imagery and gridded data*, which focused on metadata for imagery and gridded data as they are important information sources and products used within a geospatial environment by geographic information systems. During the revision process it was noted that this metadata applied to the acquisition and processing of geographic information from all sources not just imagery and gridded data. Hence, the new title *Geographic information — Metadata — Extensions for acquisition and processing*. The production of all geographic information, including imagery and gridded data, follows one or more process chains that begins with remote sensing data, scanned maps, field data collection or other sensing methods and ends with the creation of the end data products. The production process needs to be documented 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 to support the production process.

The object of this document is to provide the additional structure needed to more extensively describe the acquisition and processing of geographic information from all sources. This structure is intended to augment ISO 19115-1. This document also provides an XML schema for implementing this document using ISO/TS 19115-3.

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Geographic information — Metadata —

Part 2: Extensions for acquisition and processing

1 Scope

This document extends ISO 19115-1:2014 by defining the schema required for an enhanced description of the acquisition and processing of geographic information, including imagery. Included are the properties of measuring systems and the numerical methods and computational procedures used to derive geographic information from the data acquired by them. This document also provides the XML encoding for acquisition and processing metadata thereby extending the XML schemas defined in ISO/TS 19115-3.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 19103:2015, *Geographic information — Conceptual schema language*

ISO 19115-1:2014, *Geographic information — Metadata — Part 1: Fundamentals*

ISO 19157:2013, *Geographic information — Data quality*

ISO/IEC 19501:2005, *Information technology — Open Distributed Processing — Unified Modeling Language (UML) Version 1.4.2*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19115-1:2014 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

attribute

named property of an entity

Note 1 to entry: Describes a geometrical, topological, thematic, or other characteristic of an entity.

[SOURCE: ISO/IEC 2382:2015, 2121440, modified — Note 1 to entry replaces Notes 1 and 2 to entry.]

3.2

band

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

[SOURCE: ISO/TS 19101-2:2008, 4.1]

3.3

class

description of a set of objects that share the same *attributes* (3.1), operations, methods, relationships, and semantics

[SOURCE: ISO 19103:2015, 4.7]

3.4

coverage

feature that acts as a function to return *values* (3.29) from its range for any direct position within its spatial, temporal or spatiotemporal *domain* (3.8)

EXAMPLE Raster *image* (3.18), polygon overlay, or digital elevation matrix.

[SOURCE: ISO 19123:2005, 4.1.7, modified — NOTE deleted.]

3.5

data type

specification of a *value domain* (3.30) with operations allowed on *values* (3.29) in this *domain* (3.8)

[SOURCE: ISO 19103:2015, 4.14, modified — EXAMPLE and Note 1 to entry deleted.]

3.6

dataset

identifiable collection of data

[SOURCE: ISO 19115-1:2014, 4.3, modified — Note 1 to entry deleted.]

3.7

dataset series

collection of *datasets* (3.6) sharing common characteristics

[SOURCE: ISO 19115-1:2014, 4.4]

3.8

domain

well-defined set

[SOURCE: ISO 19109:2015, 4.8, modified — Note 1 to entry deleted.]

3.9

event

action which occurs at an instant

[SOURCE: ISO 19108:2002, 4.1.6]

3.10

geolocation information

information used to determine geographic location corresponding to *image* (3.18) location

3.11

georectified

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

3.12

georeferencing

geopositioning an object using a Correspondence Model derived from a set of points for which both ground and *image* (3.18) coordinates are known

[SOURCE: ISO/TS 19130:2010, 4.37]

3.13**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

Note 1 to entry: The curves partition a space into grid cells.

[SOURCE: ISO 19123:2005, 4.1.23]

3.14**grid coordinate system**

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

3.15**grid coordinates**

sequence of two or more numbers specifying a position with respect to its location on a *grid* ([3.13](#))

3.16**gridded data**

data whose *attribute* ([3.1](#)) *values* ([3.29](#)) are associated with positions on a *grid coordinate system* ([3.14](#))

3.17**ground control point**

point on the earth that has an accurately known geographic position

3.18**image**

gridded *coverage* ([3.4](#)) whose *attribute* ([3.1](#)) *values* ([3.29](#)) are a numerical representation of a physical parameter

Note 1 to entry: The physical parameters are the result of measurement by a *sensor* ([3.27](#)) or a prediction from a model.

3.19**imagery**

representation of phenomena as *images* ([3.18](#)) produced by electronic and/or optical techniques

Note 1 to entry: In this document, it is assumed that the objects and phenomena have been sensed or detected by radar, cameras, photometers, and infrared and multispectral scanners, or similar devices.

[SOURCE: ISO 19101-2:2008, 4.14]

3.20**metadata**

information about a resource

[SOURCE: ISO 19115-1:2014, 4.10]

3.21**pass**

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

Note 1 to entry: In this document, the measuring system will usually be a *remote sensing* ([3.25](#)) *platform* ([3.23](#)). In a navigation context, the measuring system might be a GPS satellite.

3.22**pixel**

smallest element of a digital *image* ([3.18](#)) to which *attributes* ([3.1](#)) are assigned

Note 1 to entry: It is the smallest unit of display for a visible image.

[SOURCE: ISO/TS 19101-2:2008, 4.28, modified — Note 1 to entry replaces NOTES 1 and 2.]

3.23

platform

structure which supports a *sensor* (3.27) or sensors

3.24

polarization

restricting radiation, especially light, vibrations to a single plane

3.25

remote sensing

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

[SOURCE: ISO/TS 19101-2:2008, 4.33]

3.26

resolution (of a sensor)

smallest difference between indications of a *sensor* (3.27) that can be meaningfully distinguished

Note 1 to entry: For *imagery* (3.19), resolution refers to radiometric, spectral, spatial and temporal resolutions.

[SOURCE: ISO/TS 19101-2:2008, 4.34]

3.27

sensor

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

[SOURCE: ISO/IEC Guide 99:2007, 3.8, modified — EXAMPLES and NOTE deleted.]

3.28

spectral width

specific wavelength interval within the electromagnetic spectrum

EXAMPLE Band (3.2) 1 of Landsat TM lies between 0,45 µm and 0,52 µm in the visible part of the spectrum.

3.29

value

element of a type *domain* (3.8)

[SOURCE: ISO/IEC 19501:2005, 0000_5]

3.30

value domain

set of accepted *values* (3.29)

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

[SOURCE: ISO 19103:2015, 4.37]

4 Symbols and abbreviated terms

4.1 Abbreviated terms

IDL Interface Definition Language

OCL Object Constraint Language

UML Unified Modelling Language

5 Conformance

5.1 Conformance requirements

Metadata shall be provided as specified in [Clause 6](#) and [Annex B](#) of this document and ISO 19115-1:2014, Clause 6 and Annex B.

User-defined metadata extensions to this document shall be defined and provided as specified in ISO 19115-1:2014, Annex C.

Any metadata claiming conformance with this document shall pass the requirements described in [Annex A](#) of this document and the abstract test suite presented in ISO 19115-1:2014, Annex A.

5.2 Metadata profiles

Any profile conforming to this document shall conform to the rules for creating a profile given in ISO 19115-1:2014, C.6.

6 Acquisition and processing metadata

6.1 Metadata for acquisition and processing requirements

ISO 19115-1 identifies the metadata required to describe digital geographic resources. This document extends the metadata identified in ISO 19115-1 and identifies additional metadata required to describe the acquisition and processing of geographic resources.

6.2 Acquisition and processing metadata packages and dependencies

The ISO geographic information series of standards are defined using one or more UML packages and are maintained in a single integrated UML model. This document utilizes and extends concepts defined in several of these other standards' packages. [Figure 1](#) illustrates the UML packages upon which this document is dependent. Dependencies between packages not defined in this document are not displayed. Metadata for acquisition and processing are defined and provided by one or more packages; each package provides a separate component of metadata information. There are four packages that are used to define and provide the metadata that is defined in this document: Acquisition information, Extended lineage information, Extended spatial representation information, and Extended content information.

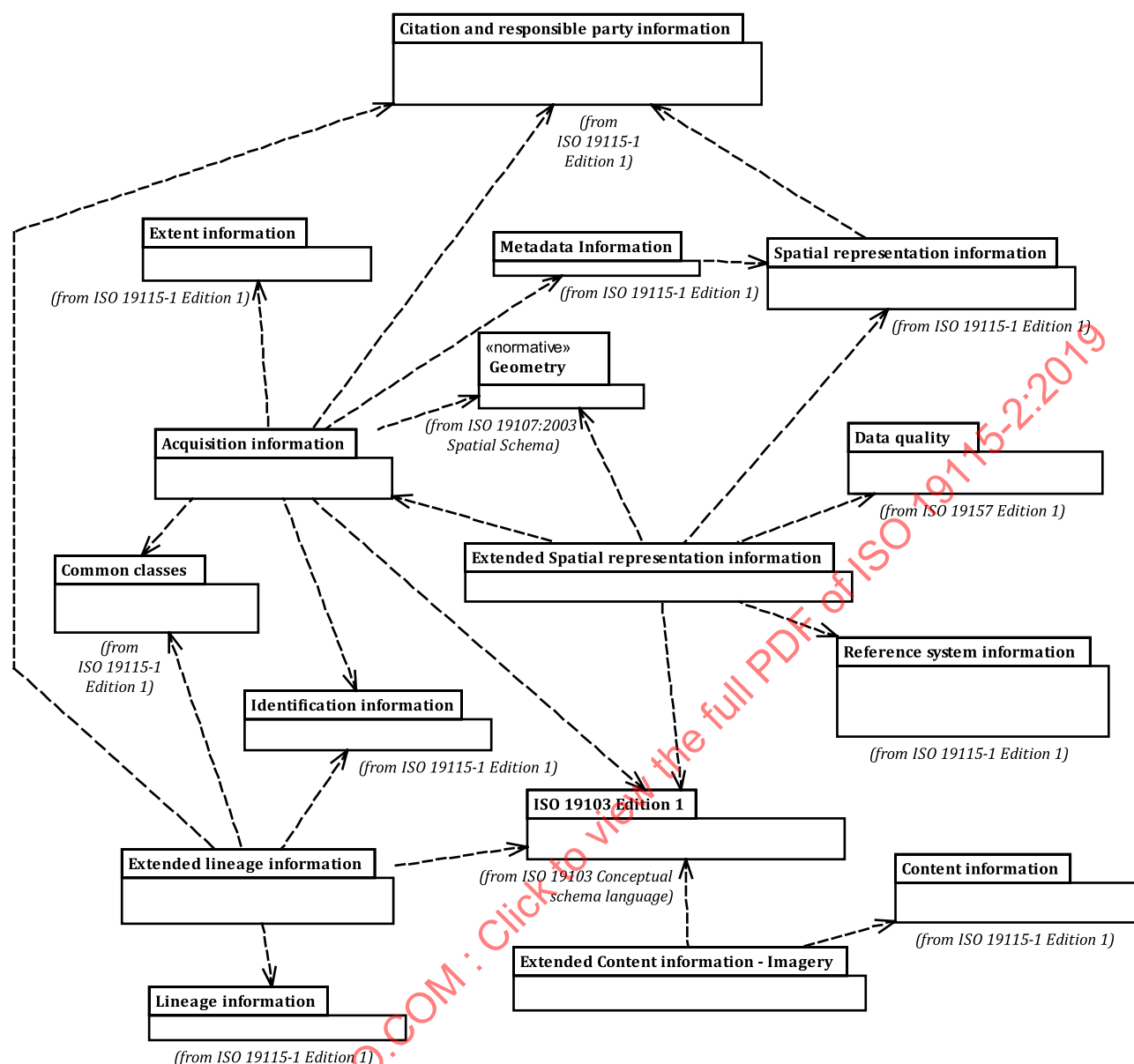


Figure 1 — Metadata packages

6.3 Acquisition and processing metadata class diagrams by package

6.3.1 Introduction

Metadata are composed of one or more metadata packages containing one or more metadata classes containing attributes. The relationships between metadata packages and between metadata classes are specified by composition and aggregation relationship symbols. Class attributes and relationships are referred to collectively as metadata elements. The diagrams in 6.3.2 through 6.3.5 provide “views”, which are portions of the total abstract model for metadata. Each diagram defines a metadata UML package of related classes, elements, data types, and code lists. Related external classes are shown with attributes relevant for this document and the package where they are fully specified identified by the package name proceeding a double colon (::). In some cases, this package may be from another standard identified by a labelled boxed outline. Since the classes in ISO 19115-1 being extended cannot be modified the class being modified is redefined in this document using a similar name. To differentiate between ISO 19115-1 and entities of this document, this part uses different prefixes. The prefixes used are MI (to denote an extended MD class), LE (LI extended) and CE (CI_Extended).

The classes from ISO 19115-1, being extended, are contained in a box labelled as such. The metadata are fully specified by the UML model diagrams and an associated data dictionary for each package in [Annex B](#). Abstract classes (which are classes that are defined for schematic organization purposes, i.e. only their subclasses are implemented) are identified with their names in *italic*. Codelists and their values provided in this document are normative. User extensions to codelists shall follow the rules as described in ISO 19115-1:2014, Annex C.

NOTE In some cases, optional classes can have mandatory elements; those elements become mandatory only if the optional element is used.

6.3.2 Acquisition Information

6.3.2.1 Acquisition overview

This package extends MD_Metadata in ISO 19115-1 and provides details specific to the acquisition of geospatial data using imagery, sensors, and other acquisition methods. MI_AcquisitionInformation is an aggregate of the following entities:

- MI_Instrument, designations of the measuring instruments used to acquire the data;
- MI_Sensor, a specific type of MI_Instrument;
- 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_InstrumentEventList, which lists events affecting MI_Platform and MI_Instrument;
- MI_InstrumentEvent which identifies events affecting MI_Platform and MI_Instrument;
- MI_Revision which identifies the revision history of events;
- 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.

[Figure 2](#) defines an overview of the metadata classes required to define the acquisition of data. The data dictionary for this diagram is provided in [B.2.1](#).

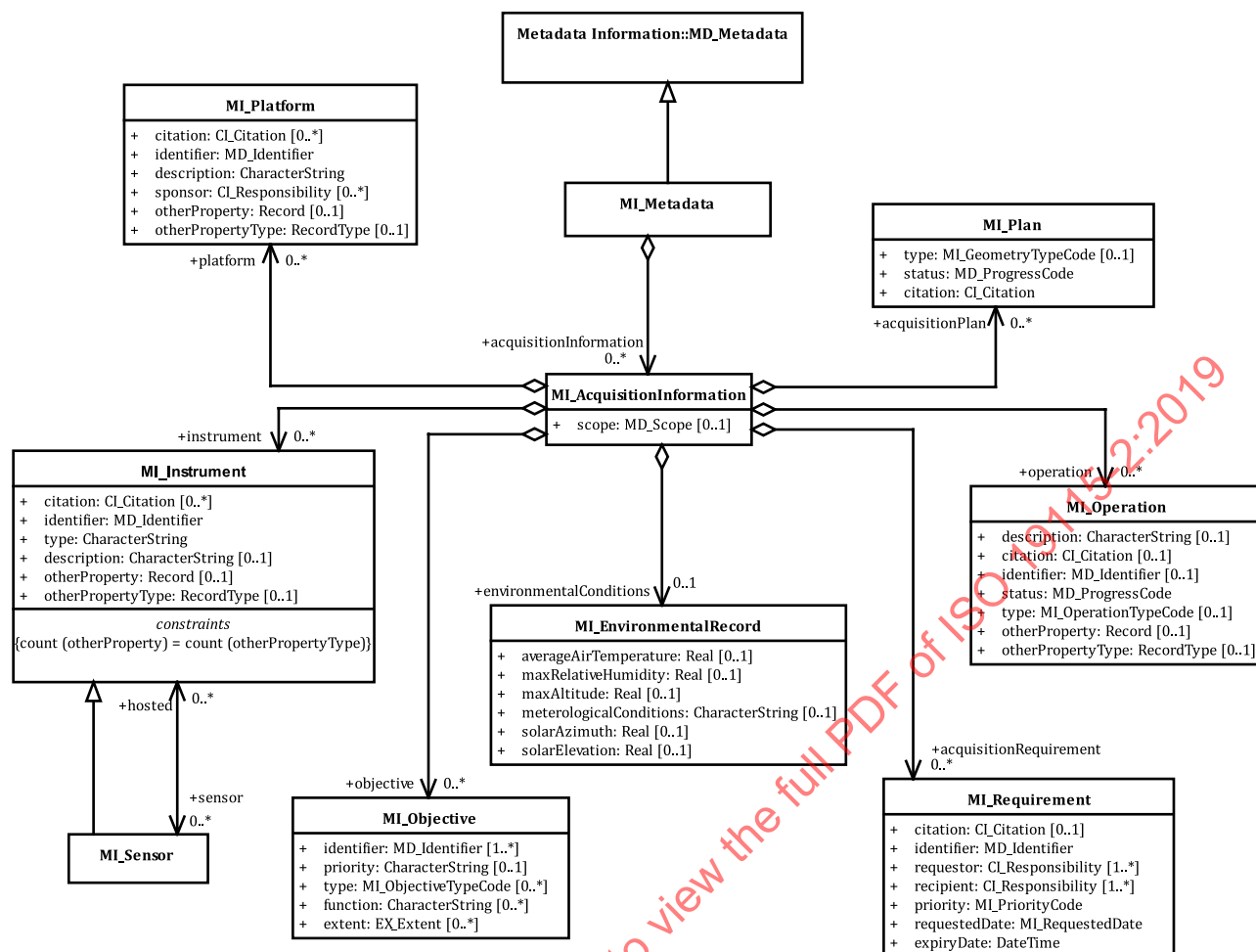


Figure 2 — Acquisition Overview

6.3.2.2 Acquisition Details

Figure 3 defines, in additional detail, the metadata classes necessary to define the acquisition of data. The data dictionary for this diagram is provided in B.2.1.

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6.3.3 Extended Lineage information

This package extends Lineage information (LI_Lineage) defined in ISO 19115-1; it supports the provision of additional information about the sources and production processes used in producing geospatial data.

- 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 and LE_ProcessingParameter which provides information about the parameters affecting the processing;
 - 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.

[Figure 4](#) defines the extensions required to specify additional lineage information. The additional elements provide information about the processing of the raw data that was performed to produce the data in the data set. The data dictionary for this diagram is given in [B.2.2](#).

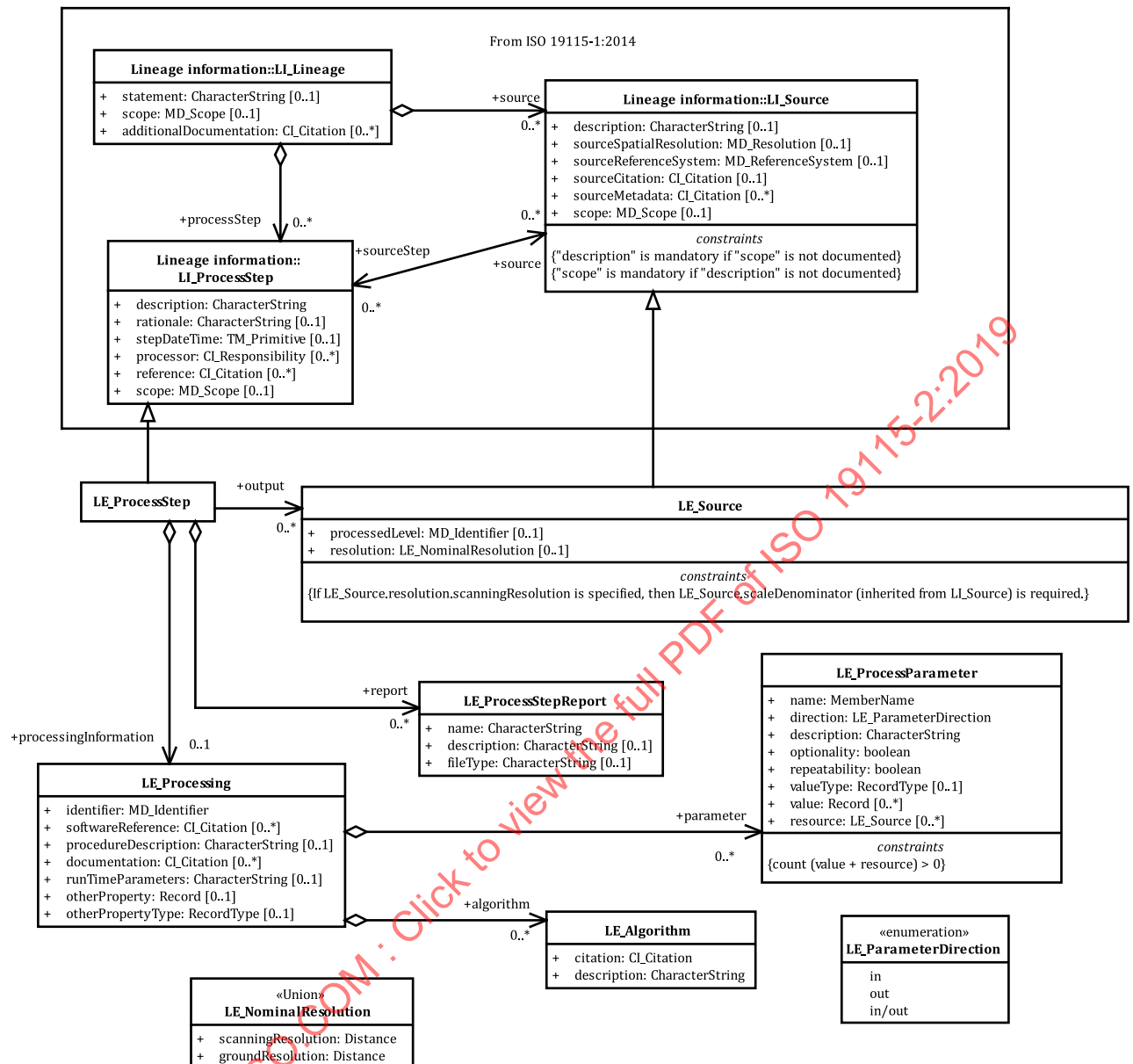


Figure 4 — Lineage extensions

6.3.4 Extended spatial representation information — Geolocation information

The spatial representation package contains information concerning the mechanisms used to represent spatial information. This extension supports the addition of metadata about the ground control points used to geo-locate data and consists of the following entities:

- MI_Georectified is an extension of MD_Georectified that contains check point information to further specify georectification details of the data. MI_Georectified aggregates MI_GCP;
- MI_Georeferenceable is an extension of MD_Georeferenceable that includes additional information that can be used to geo-locate data. MI_Georeferenceable aggregates MI_GeolocationInformation which can be specified as a MI_GCPCollection.

Figure 5 defines the extensions required to provide metadata about the ground control used for geo-locating data. The data dictionary for this diagram is given in B.2.3.

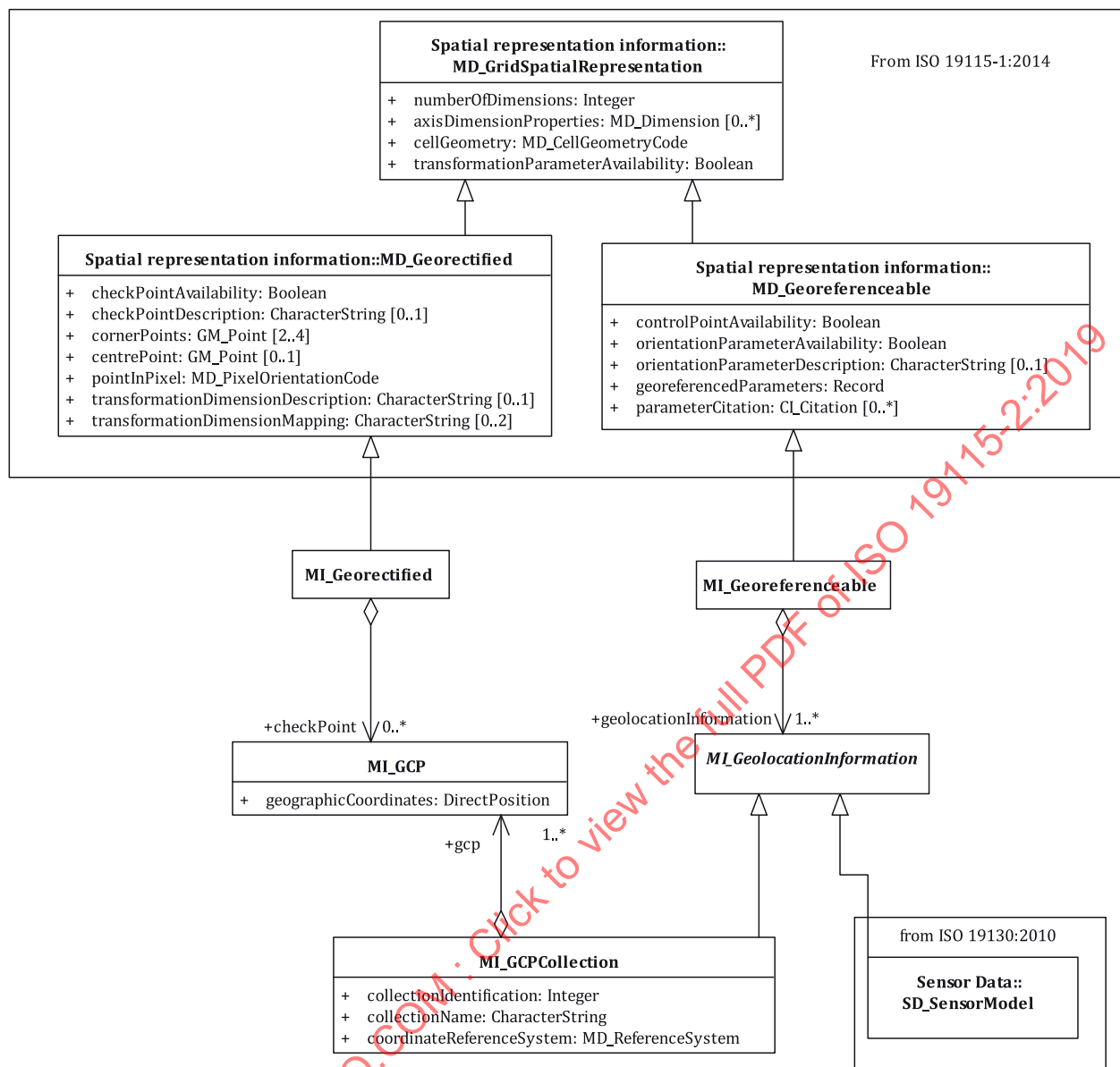


Figure 5 — Spatial representation information

6.3.4.1 Ground control point quality

Figure 6 defines the extensions required to describe the quality of ground control points using data quality classes from ISO 19157. The data dictionary for this diagram is given in B.2.4.

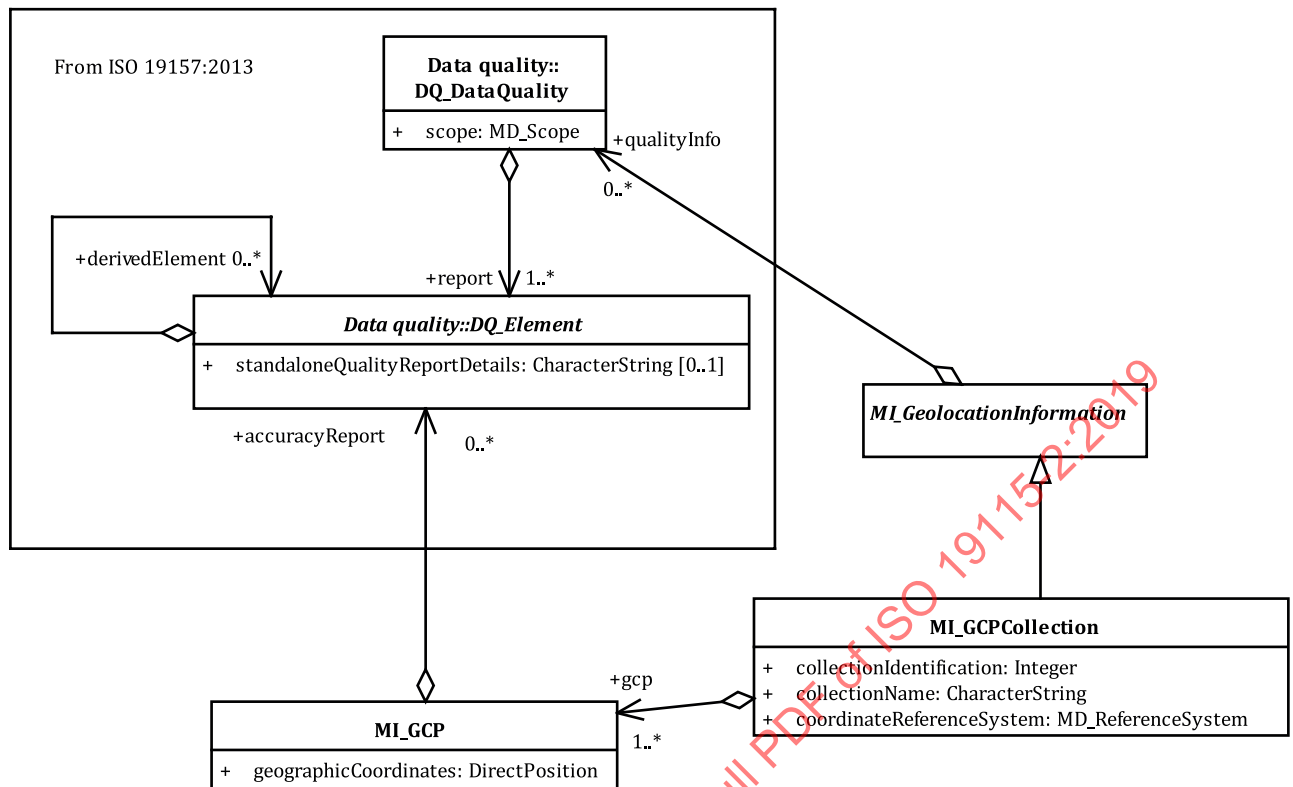


Figure 6 — Quality of ground control points

6.3.5 Extended Content information — Imagery

The package Content information is defined in ISO 19115-1 and describes the content of a coverage data set. This document extends:

- **MI_Band** is an extension of **MD_Band** defining additional attributes for specifying properties of individual wavelength bands in an imagery and gridded data set;
- **MI_ImageDescription** is an extension of **MD_ImageDescription** used to aggregate **MI_RangeElementDescription**;
- **MI_CoverageDescription** is an extension of **MD_CoverageDescription** used to aggregate **MI_RangeElementDescription**;
- **MI_RangeElementDescription** provides identification of the range elements used in a coverage data set.

[Figure 7](#) defines the extensions required to further describe the content of coverages. The data dictionary for this diagram is given in [B.2.4](#).

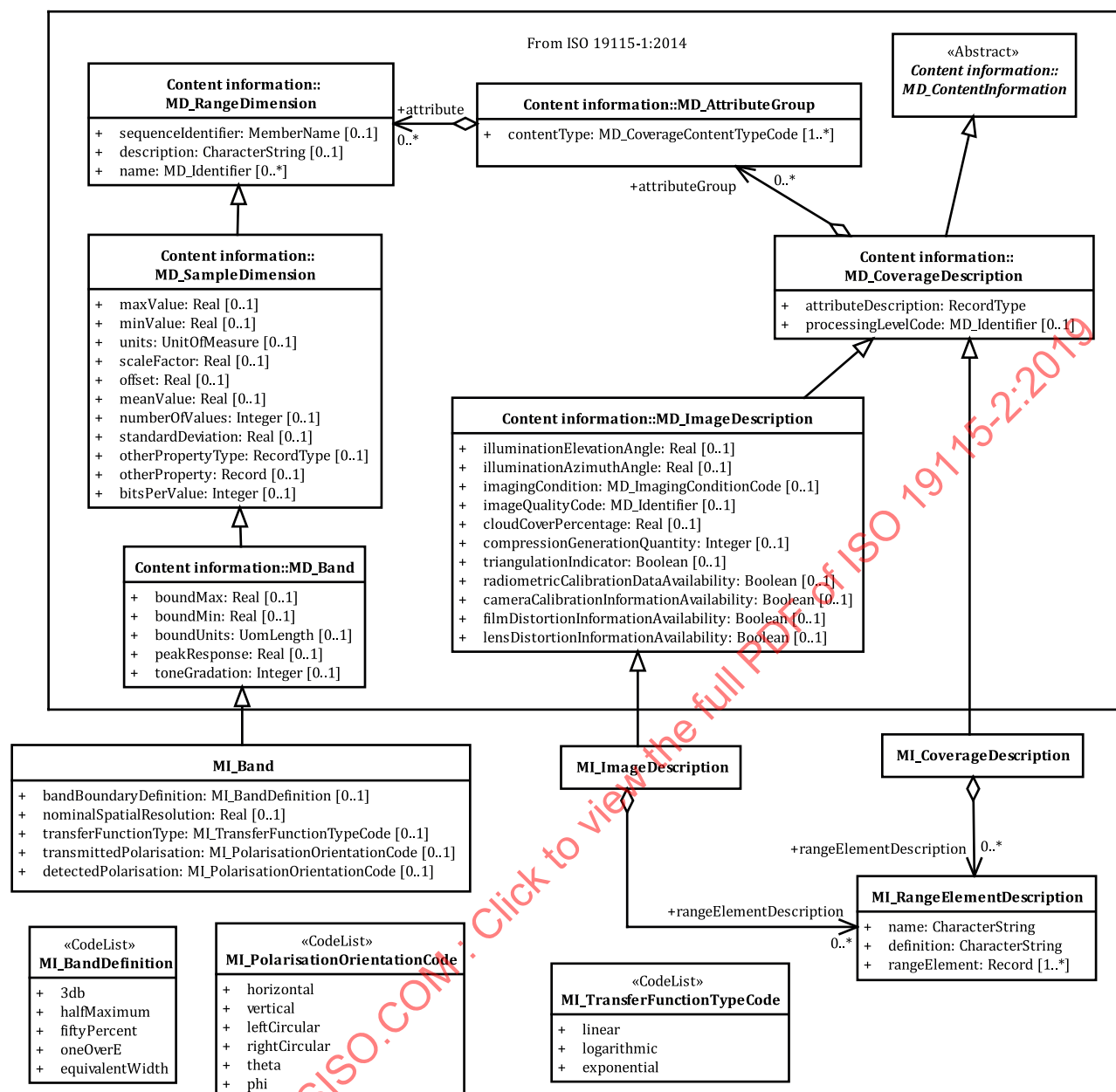


Figure 7 — Content information

Annex A (normative)

Conformance

A.1 Introduction

The abstract test suite in this document includes the abstract test suite specified in ISO 19115-1:2014 by reference. Metadata in compliance with this document shall meet the conformance requirements of ISO 19115-1:2014 and shall be provided as specified in [Clause 6](#) and [Annex B](#) of this document. User-defined metadata shall be defined and provided as specified in ISO 19115-1:2014, Annex C. User-defined metadata shall satisfy the requirements of [C.3](#).

A.2 Metadata test suite

A.2.1 Test case identifier: completeness test

- a) Test purpose: to determine conformance by the inclusion of all metadata sections, metadata entities, and metadata elements that are specified with an obligation of “mandatory” or mandatory under the conditions specified.

NOTE Many elements designated as mandatory are contained within optional entities. These elements become mandatory only when their containing entity is used.

- b) Test method: a comparison between this document and a subject metadata set to be tested shall be performed to determine if all metadata defined as mandatory in [Annex B](#) are present. A comparison test shall also be performed to determine if all metadata elements defined as conditional in [Annex B](#) are present if the conditions set out in this document apply.
- c) Reference: [Clause 6](#) and [Annex B](#) and ISO 19115-1:2014, Clause 6 and Annex B.
- d) Test type: basic.

The following test cases apply at all levels of obligation – mandatory, conditional, and optional.

A.2.2 Test case identifier: maximum occurrence test

- a) Test purpose: to ensure each metadata element occurs no more than the number of times specified in this document.
- b) Test method: examine a subject metadata set for the number of occurrences of each metadata section, metadata entity, and metadata element provided. The number of occurrences for each shall be compared with its “maximum occurrence” attribute specified in [Clause 6](#) and [Annex B](#).
- c) Reference: [Clause 6](#) and [Annex B](#).
- d) Test type: basic.

A.2.3 Test case identifier: data type test

- a) Test purpose: to determine if each metadata element within a subject metadata set uses the specified data type.
- b) Test method: the value of each provided metadata element is tested to ensure its data type adheres to the data type specified.

c) Reference: [Clause 6](#) and [Annex B](#).

d) Test type: basic.

A.2.4 Test case identifier: domain test

a) Test purpose: to determine if each provided metadata element within a subject metadata set falls within the specified domain.

b) Test method: the values of each metadata element are tested to ensure they fall within the specified domain.

c) Reference: [Clause 6](#) and [Annex B](#).

d) Test type: basic.

A.2.5 Test case identifier: schema test

a) Test purpose: to determine if a subject metadata set follows the schema specified in this document.

b) Test method: test each metadata element and ensure it is contained within the specified metadata entity.

c) Reference: [Clause 6](#) and [Annex B](#).

d) Test type: basic.

A.3 User-defined extension metadata test suite

A.3.1 Test case identifier: exclusiveness test

a) Test purpose: to verify that each user-defined metadata package, metadata class, and metadata element is unique and not already defined in this or any other document.

b) Test method: each user-defined metadata entity and metadata element is tested to ensure it is unique and not previously used.

c) Reference: [Clause 6](#) and [Annex B](#) and ISO 19115-1:2014, Clause 6 and Annex B.

d) Test type: basic.

A.3.2 Test case identifier: definition test

a) Test purpose: to verify that user-defined metadata entities and metadata elements have been defined as specified in ISO 19115-1.

b) Test method: each user-defined metadata entity and metadata element is tested to ensure that all attributes have been defined.

c) Reference: ISO 19115-1:2014, Annex C.

d) Test type: basic.

A.3.3 Test case identifier: standard metadata test

a) Test purpose: to verify that user-defined metadata within a subject metadata set fulfils the same requirements as ISO 19115-1 standard metadata.

b) Test method: all user-defined metadata in a subject metadata set is tested in accordance with ISO 19115-1:2014, C.2.

- c) Reference: ISO 19115-1:2014, C.2.
- d) Test type: basic.

A.4 Metadata profiles

A.4.1 Test case identifier: metadata profiles

- a) Test purpose: to verify that a profile follows the rules specified in ISO 19115-1:2014, C.5 and C.6.
- b) Test method: apply tests defined in ISO 19115-1:2014, C.6.
- c) Reference: ISO 19115-1:2014, C.6.
- d) Test type: basic.

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Annex B (normative)

Acquisition and processing 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](#). 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: acquisition information, lineage information, spatial representation information, and content information. Each model diagram in [Clause 6](#) has a set of tables within the data dictionary. Each UML model class along with its sub-class equates to a table in this data dictionary. Rows with bold type define UML classes. The elements within the data dictionary are defined by six attributes (those attributes are defined in [B.1.2](#) to [B.1.7](#)).

B.1.2 Name/role name

A label assigned to a metadata class or to a metadata element. Metadata class names start with an upper-case letter. Spaces do not appear in a metadata class name. Instead, multiple words are concatenated, with each new subword starting with a capital letter (example: XnnnYmmm). Metadata class names are unique within the entire data dictionary of ISO 19115-1 and this document. Metadata element names are unique within a metadata class, not the entire data dictionary of ISO 19115-1 and this document. Metadata element names are made unique, within an application, by the combination of the metadata class 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 document.

B.1.3 Definition

The metadata class/element description.

B.1.4 Obligation/condition

B.1.4.1 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 values: M (mandatory) or O (optional).

B.1.4.2 Mandatory (M):

The metadata class or metadata element shall be documented.

B.1.4.3 Optional (O):

The metadata class or the metadata element may be documented or may not be documented. Optional metadata classes 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 class is not used, the elements contained within that class (including mandatory elements) will also not be used.

Optional classes may have mandatory elements; those elements only become mandatory if the optional class is used.

B.1.5 Maximum occurrence

Specifies the maximum number of instances the metadata class 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.1.6 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 19103:2015, 6.5.2.

B.1.7 Domain

For a class, the domain indicates the line numbers covered by that class.

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.

B.2 Acquisition and processing metadata package data dictionaries

B.2.1 Acquisition information

Table B.1 — MD_Metadata extension

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
1.	MI_Metadata	root entity that defines information about acquisition and processing of geographic information (MD_Metadata extended)	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Metadata)	Line 2 plus MD_Metadata ISO 19115-1:2014, Table B.2)
2.	<i>Role name:</i> acquisitionInformation	provides information about the acquisition of the data	0	N	Association	MI_AcquisitionInformation (Table B.2)
NOTE The UML model for this table is shown in Figure 2 .						

Table B.2 — Acquisition information

Name	Definition	Obligation	Maximum occurrence	Data type	Domain
3. MI_AcquisitionInformation	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 4 to 11
4. scope	the specific data to which the acquisition information applies	0	N	Class	MD_Scope
5. <i>Role name:</i> acquisitionPlan	identifies the plan as implemented by the acquisition	0	N	Association	MI_Plan (Table B.7)
6. <i>Role name:</i> acquisitionRequirement	identifies the requirement the data acquisition intends to satisfy	0	N	Association	MI_Requirement (Table B.12)
7. <i>Role name:</i> environmentalConditions	a record of the environmental circumstances during the data acquisition	0	1	Association	MI_EnvironmentalRecord (Table B.3)
8. <i>Role name:</i> instrument	general information about the instrument used in data acquisition	0	N	Association	MI_Instrument (Table B.4)
9. <i>Role name:</i> objective	identification of the area or object to be sensed	0	N	Association	MI_Objective (Table B.5)
10. <i>Role name:</i> operation	general information about an identifiable activity which provided the data	0	N	Association	MI_Operation (Table B.6)
11. <i>Role name:</i> platform	general information about the platform from which the data were taken	0	N	Association	MI_Platform (Table B.9)

NOTE The UML model for this table is shown in Figure 2.

Table B.3 — Environmental record

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
12.	MI_EnvironmentalRecord	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 13 to 18
13.	averageAirTemperature	average air temperature along the flight pass during the photo flight	0	1	Real	Real
14.	maxRelativeHumidity	maximum relative humidity along the flight pass during the photo flight	0	1	Real	Real
15.	maxAltitude	maximum altitude during the photo flight	0	1	Real	Real
16.	meteorologicalConditions	meteorological conditions in the photo flight area, in particular clouds, snow and wind	0	1	CharacterString	Free Text
17.	solarAzimuth	clockwise angle in degrees from north to the centre of the sun's disc Note: This angle is calculated from the nadir point of the sensor, not at the centre point of the image.	0	1	Real	Real
18.	solarElevation	angle between the horizon and the centre of the Sun's disk	0	1	Real	Real
NOTE The UML model for this table is shown in Figure 2 .						

Table B.4 — Instrument identification

Name	Definition	Obligation	Maximum occurrence	Data type	Domain
MI_Instrument	characteristics of the measuring instrument	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Platform)	Lines 20 to 28
19.					
20.	citation	complete citation of the instrument	0	N	Class < <Data Type> > CI_Citation (ISO 19115-1:2014, Table B.16)
21.	identifier	unique identification of the instrument	M	1	Class < < Date Type > > MD_Identifier (ISO 19115-1:2014, Table B.17.2)
22.	type	name of the type of instrument Examples: framing, line-scan, push-broom, pan-frame	M	1	CharacterString Free text
23.	description	textual description of the instrument	0	1	CharacterString Free text
24.	otherProperty	instance of other property type not included in MI_Instrument	0/otherProperty-Type exists	1	Class Record (ISO 19103)
25.	otherPropertyType	type of other property description	C/otherProperty exists	1	Class RecordType (ISO 19103)
26.	Role name: mountedOn	platform on which the instrument is mounted	0	1	Association MI_Platform (Table B.9)
27.	Role name: sensor	instrument is a sensor	0	N	Association MI_Instrument (Table B.4)
28.	Role name: history	list of events associated with instrument	0	N	Association MI_InstrumentationEventList (Table B.13)
29.	MI_Sensor	specific type of instrument	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified class (MI_Instrument) Line 20–28 and 30
30.	Role name: hosted	instrument on which sensors are hosted	0	N	Association MI_Instrument (Table B.4)

NOTE The UML model for this table is shown in Figure 3.

Table B.5 — Objective information

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
31.	MI_Objective	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, MI_Operation)	Lines 32 to 39
32.	identifier	code used to identify the objective	M	N	Class	<<DataType>> MD_Identifier (ISO 19115-1:2014, Table B.17.2)
33.	priority	priority applied to the target	0	1	CharacterString	Free text
34.	type	collection technique for the objective	0	N	Class	<<CodeList>> MI_Objective-TypeCode (Table B.34)
35.	function	role or purpose performed by or activity performed at the objective	0	N	CharacterString	Free text
36.	extent	extent information including the bounding box, bounding polygon, vertical and temporal extent of the objective	0	N	Class	<<DataType>> EX_Extent (ISO 19115-1:2014, Table B.15)
37.	Role name: objectiveOccurrence	event or events associated with objective completion	0	N	Association	MI_Event (Table B.8)
38.	Role name: pass	pass of the platform over the objective	0	N	Association	MI_PlatformPass (Table B.10)
39.	Role name: sensingInstrument	instrument which senses the objective data	0	N	Association	MI_Instrument (Table B.4)
NOTE The UML model for this table is shown in Figure 3.						

Table B.6 — Operation information

Name	Definition	Obligation	Maximum occurrence	Data type	Domain
40. MI_Operation	designations for the operation used to acquire the data set	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition, MI_Operation)	Lines 41 to 53
41.	description	0	1	CharacterString	Free text
42.	citation	0	1	Class	< <DataType> > CI_Citation (ISO 19115-1:2014, Table B.16)
43.	identifier	0	1	Class	< <DataType> > MD_Identifier (ISO 19115-1:2014, Table B.17.2)
44.	status	M	1	Class	< <CodeList> > MD_ProgressCode (ISO 19115-1:2014, Table B.3.25)
45.	type	0	1	Class	< <CodeList> > MI_Operation-TypeCode (Table B.35)
46.	otherProperty	C/otherProperty Type exists	1	Class	Record (ISO 19103)
47.	otherPropertyType	C/OtherProperty exists	1	Class	RecordType (ISO 19103)
48.	<i>Role name:</i> childOperation	0	N	Association	MI_Operation (Table B.6)
49.	<i>Role name:</i> objective	0	N	Association	MI_Objective (Table B.5)
50.	<i>Role name:</i> parentOperation	M	1	Association	MI_Operation (Table B.6)
51.	<i>Role name:</i> plan	0	1	Association	MI_Plan (Table B.7)
52.	<i>Role name:</i> platform	0	N	Association	MI_Platform (Table B.9)
53.	<i>Role name:</i> significantEvent	0	N	Association	MI_Event (Table B.8)

NOTE The UML model for this table is shown in Figure 3.

Table B.7 — Plan information

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
54.	MI_Plan	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 (MI_Acquisition Information)	Lines 55 to 59
55.	type	manner of sampling geometry that the planner expects for collection of objective data	0	1	Class	< <CodeList> > MI_Geometry- TypeCode (Table B.33)
56.	status	current status of the plan (pending, completed, etc.)	M	1	Class	< <CodeList> > MD_ProgressCode (ISO 19115-1:2014, Table B.3.25)
57.	citation	identification of authority requesting target collection	M	1	Class	< <DataType> > CI_Citation (ISO 19115-1:2014, Table B.16)
58.	Role name: operation	identification of the activity of activities that satisfy a plan	0	N	Association	MI_Operation (Table B.6)
59.	Role name: satisfiedRequirement	requirement satisfied by the plan	0	N	Association	MI_Requirement (Table B.12)

NOTE The UML model for this table is shown in [Figure 3](#).

Table B.8 — Event identification

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
60.	MI_Event	identification of a significant collection point within an operation			Aggregated Class (MI_Operation)	Lines 61 to 68
61.	identifier	event name or number	M	1	Class	< <DataType> > MD_Identifier (ISO 19115-1:2014, Table B.17.2)
62.	trigger	initiator of the event	M	1	Class	< <CodeList> > MI_TriggerCode (Table B.41)
63.	context	meaning of the event	M	1	Class	< <CodeList> > MI_ContextCode (Table B.31)
64.	sequence	relative time ordering of the event	M	1	Class	< <CodeList> > MI_SequenceCode (Table B.39)
65.	time	time the event occurred	M	1	Class	< <Type> > DateTime
66.	Role name: expectedObjective	objective or objectives satisfied by an event	0	N	Association	MI_Objective (Table B.5)
67.	Role name: relatedPass	pass during which an event occurs	0	1	Association	MI_PlatformPass (Table B.10)
68.	Role name: relatedInstrument	instrument or instruments for which the event is meaningful	0	N	Association	MI_Instrument (Table B.4)

NOTE The UML model for this table is shown in Figure 3.

Table B.9 — Platform identification

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
69.	MI_Platform	designation of the platform used to acquire the data set	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition, MI_Operation)	Lines 70 to 76
70.	citation	source where information about the platform is described	0	1	Class	<<DataType>> CI_Citation (ISO 19115-1:2014, Table B.16)
71.	identifier	unique identification of the platform	M	1	Class	<<DataType>> MD_Identifier (ISO 19115-1:2014, Table B.17.2)
72.	description	narrative description of the platform supporting the instrument	M	1	CharacterString	Free text
73.	sponsor	organization responsible for building, launch, or operation of the platform	0	N	Class	<<DataType>> CI_Responsibility (ISO 19115-1:2014, Table 16.1)
74.	otherProperty	instance of other property type not included in MI_Sensor	0	1	Class	Record (ISO 19103)
75.	otherPropertyType	type of other property description	0	1	Class	RecordType (ISO 19103)
76.	Role name: instrument	instrument(s) mounted on a platform	M	N	Association	MI_Instrument (Table B.4)

NOTE The UML model for this table is shown in Figure 3.

Table B.10 — Platform pass identification

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
77.	MI_PlatformPass	identification of collection coverage	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Objective)	Lines 78 to 80
78.	identifier	unique name of the pass	M	1	Class	<<DataType>> MD_Identifier (ISO 19115-1:2014, Table B.17.2)
79.	extent	temporal and spatial extent of the pass	0	1	Class	<<DataType>> EX_Extent (ISO 19115-1:2014, Table B.15)
80.	<i>Role name:</i> relatedEvent	occurrence of one or more events for a pass	0	N	Association	MI_Event (Table B.8)

NOTE The UML model for this table is shown in [Figure 3](#).

Table B.11 — Request date range

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
81.	MI_RequestedDate	range of date validity	Use obligation from referencing object	Use maximum occurrence from referencing object	Class < <DataType> >	Lines 82 to 83
82.	requestedDateOfCollection	preferred date and time of collection	M	1	Class	< <Type> > DateTime (ISO 19103)
83.	latestAcceptableDate	latest date and time collection must be completed	M	1	Class	< <Type> > DateTime (ISO 19103)
NOTE The UML model for this table is shown in Figure 3 .						

Table B.12 — Requirement information

Name	Definition	Obligation	Maximum occurrence	Data type	Domain
MI_Requirement	Requirement to be satisfied by the planned data acquisition	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition Information)	Lines 85 to 92
84.					
citation	identification of reference or guidance material for the requirement	0	1	Class	< <DataType> > CI_Citation (ISO 19115-1:2014, Table B.16)
85.					
identifier	unique name, or code, for the requirement	M	1	Class	< <DataType> > MD_Identifier (ISO 19115-1:2014, Table B.17.2)
86.					
requestor	origin of requirement	M	N	Class	< <DataType> > CI_Responsibility (ISO 19115-1:2014, Table B.15.1)
87.					
recipient	person(s), or body(ies), to receive results of requirement	M	N	Class	< <DataType> > CI_Responsibility (ISO 19115-1:2014, Table B.15.1)
88.					
priority	relative ordered importance, or urgency, of the requirement	M	1	Class	< <CodeList> > MI_PriorityCode (Table B.36)
89.					
requestedDate	required or preferred acquisition date and time	M	1	Class	< <DataType> > MI_Requested-Date (Table B.11)
90.					
expiryDate	date and time after which collection is no longer valid	M	1	Class	< <Type> > DateTime (ISO 19103)
91.					
Role name: satisfiedPlan	plan that identifies solution to satisfy the requirement	0	N	Association	MI_Plan (Table B.7)
92.					

NOTE The UML model for this table is shown in Figure 3.

Table B.13 — Instrument event list

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
93.	MI_InstrumentEventList	list of events related to platform/instrument/sensor	Use obligation from referencing object	Use maximum occurrence from referencing object	Class	Lines 94 to 98
94.	citation	citation to the instrumentationEventList	0	N	Class	MD_Citation (ISO 19115-1:2014 Table B.16)
95.	description	description of the language and character-Set used for the instrumentationEventList	M	1	CharacterString	Free text
96.	locale	description of the language and character-Set used for the instrumentationEventList	0	1	Class	PT_Locale (ISO 19115-1:2014, Table B.18.2)
97.	constraints	use and access constraints	0	N	Class	MD_Constraints (ISO 19115-1:2014, Table B.4)
98.	Role name: instrumentationEvent	event(s) in the list of events	0	N	Association	MI_InstrumentEvent (Table B.14)
NOTE The UML model for this table is shown in Figure 3 .						

Table B.14 — Instrument event

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
99.	MI_InstrumentEvent	an event related to a platform/instrument/sensor	Use obligation from referencing object	Use maximum occurrence from referencing object	Class	Lines 100 to 104
100.	citation	citation to the instrumentationEvent	0	N	Class	MD_Citation (ISO 19115-1:2014 Table B.16)
101.	description	description of the instrumentationEvent	M	1	CharacterString	Free Text
102.	extent	extent of the instrumentation event	0	N	Class	EX_Extent (ISO 19115-1:2014, Table B.15)
103.	type	type of the instrumentationEvent	M	1	Codelist	MI_EventTypeCode (Table B.32)
104.	Role name: revisionHistory	history of revisions to the instrumentationEvent	0	N	Class	MI_Revision (Table B.15)

NOTE The UML model for this table is shown in [Figure 3](#).

Table B.15 — Revision

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
105.	MI_Revision	history of the revision of an event	Use obligation from referencing object	Use maximum occurrence from referencing object	Class	Lines 106 to 108
106.	description	description of the revision	M	1	CharacterString	Free text
107.	responsibleParty	individual or organization responsible for the revision	M	N	Class	CI_Responsibility (ISO 19115-1:2014, Table B.15.1)
108.	dateInfo	information about dates related to the revision	M	N	Class	CI_Date (ISO 19115-1:2014, Table B.16.5)
NOTE The UML model for this table is shown in Figure 3 .						

B.2.2 Lineage extensions

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Table B.16 — Algorithm

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
109.	LE_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 110 and 111
110.	citation	information identifying the algorithm and version or date	M	1	Class	<<DataType>> > CL_Citation (ISO 19115-1:2014, Table B.16)
111.	description	information describing the algorithm used to generate the data	M	1	CharacterString	Free text
NOTE The UML model for this table is shown in Figure 4 .						

Table B.17 — Nominal resolution

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
112.	LE_NominalResolution	distance between consistent parts of (centre, left side, right side) adjacent pixels	Use obligation from referencing object	Use maximum occurrence from referencing object	Class < <Union> >	Lines 113 and 114
113.	scanningResolution	distance between consistent parts of (centre, left side, right side) adjacent pixels in the scan plane	M	1	Class	< <Type> > Distance
114.	groundResolution	distance between consistent parts of (centre, left side, right side) adjacent pixels in the object space	M	1	Class	< <Type> > Distance
NOTE The UML model for this table is shown in Figure 4 .						

Table B.18 — Processing

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
115.	LE_Processing identifier	comprehensive information about the procedure(s), process(es) and algorithm(s) applied in the process step			Aggregated Class (LE_ProcessStep)	Lines 116 to 123
116.		information to identify the processing package that produced the data	M	1	Class	< <DataType> > MD_Identifier (ISO 19115-1:2014, Table B.17.2)
117.	softwareReference	reference to document describing processing software	0	N	Class	< <DataType> > CI_Citation (ISO 19115-1:2014, Table B.16)
118.	procedureDescription	additional details about the processing procedures	0	1	CharacterString	Free text
119.	documentation	reference to documentation describing the processing	0	N	Class	< <DataType> > CI_Citation (ISO 19115-1:2014, Table B.16)
120.	runTimeParameters	parameters to control the processing operations, entered at run time	0	1	CharacterString	Free text
121.	otherProperty	instance of other property type not included in processing	0	1	Class	Record (ISO 19103)
122.	otherPropertyType	type of other property description	0	1	Class	RecordType (ISO 19103)
123.	Role name: algorithm	details of the methodology by which geographic information was derived from the instrument readings	0	N	Association	LE_Algorithm (Table B.16)

NOTE The UML model for this table is shown in Figure 4.

Table B.19 — ProcessParameter

Name	Definition	Obligation	Maximum occurrence	Data type	Domain
124. LE_ProcessParameter	parameter (value or resource) used in a process	Use obligation from referencing object	Use maximum occurrence from referencing object	Class	Lines 125 to 132
125. name	Name/type of parameter	M	1	Class	MemberName
126. direction	indication the parameter is an input to the process, an output or both	M	1	Enumeration	LE_Parameterdirection (Table B.36)
127. description	narrative explaining the role of the parameter	0	1	CharacterString	Free text
128. optionality	indication the parameter is required	M	1	Boolean	Yes, no
129. repeatability	indication if more than one value of the parameter may be provided	M	1	Boolean	Yes, no
130. valueType	data type of the value	0	1	Class	RecordType (ISO 19103)
131. value	constant value	0	1	Class	Record (ISO 19103)
132. resource	resource to be processed	0	M	Class	LE_Source (Table B.22)

NOTE The UML model for this table is shown in Figure 4.

Table B.20 — Process step

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
133.	LE_ProcessStep	information about an event or transaction in the life of the data set 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 134 to 136 plus (LI_ProcessStep, ISO 19115-1:2014, Table B.5.1)
134.	<i>Role name:</i> output	description of the product generated as a result of the process step	0	N	Association	LE_Source (Table B.22)
135.	<i>Role name:</i> processing information	comprehensive information about the procedure by which the algorithm was applied to derive geographic data from the raw instrument measurements, such as data sets, software used, and the processing environment	0	1	Association	LE_Processing (Table B.18)
136.	<i>Role name:</i> report	report generated by the process step	0	N	Association	LE_ProcessStepReport (Table B.21)
NOTE The UML model for this table is shown in Figure 4.						

Table B.21 — Process step report

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
137.	LE_ProcessStepReport	report of what occurred during the process step	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LE_ProcessStep)	Lines 138 to 140
138.	name	name of the processing report	M	1	CharacterString	Free text
139.	description	textual description of what occurred during the process step	0	1	CharacterString	Free text
140.	fileType	type of file that contains the processing report	0	1	CharacterString	Free text
NOTE The UML model for this table is shown in Figure 4 .						

Table B.22 — Source extensions

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
141.	LE_Source	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 142 and 143 plus LI_Source, ISO 19115-1:2014, B.5.2
142.	processedLevel	processing level of the source data	0	1	Class	< <DataType> > MD_Identifier (ISO 19115-1:2014, Table B.17.2)
143.	resolution	distance between consistent parts (centre, left side, right side) of two adjacent pixels	0	1	Class	< <Union> > LE_NominalResolution (Table B.17)
NOTE 1 If LE_Source.resolution.scanningResolution is specified, then LE_Source.scaleDenominator (inherited from LI_Source) is required.						
NOTE 2 The UML model for this table is shown in Figure 4 .						

B.2.3 Extended spatial representation information

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Table B.23 — Georectified – Extension

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
144.	MI_Georectified	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 145 plus (MD_SpatialRepresentation, ISO 19115-1:2014, Table B.7)
145.	<i>Role name:</i> checkPoint	geographic references used to validate georectification of the data	0	N	Association	MI_GCP (Table B.26)
NOTE The UML model for this table is shown in Figure 5 .						

Table B.24 — Georeferenceable – Extension

	Name	Definition	Obligation	Maximum occurrence	Data type	Domain
146.	ML_Georeferenceable	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 147 plus MD_Spatialrepresentation, ISO 19115-1:2014, Table B.7
147.	<i>Role name:</i> geolocationInformation	information that can be used to geo-locate the data	M	N	Association	ML_GeolocationInformation (Table B.25)

NOTE The UML model for this table is shown in [Figure 5](#).