The
Digital Geographic Information Exchange Standard (DIGEST)

Part 2 - Annex B
ISO 8824 ENCAPSULATION SPECIFICATION

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Annex B
ISO 8824 Encapsulation Specification

Annex B - Contents page

Annex B - Figures page

B.1 INTRODUCTION

This annex presents an encoding of DIGEST for the purpose of efficient telecommunications. This annex contains exactly the same information content as DIGEST Annex A, except that the hierarchical style of presentation inherent with the Abstract Syntax Notation (ASN) is used, and that some fields included in Annex A for backward compatibility with earlier Annex A based products are not included.

In order to efficiently communicate geographic data over telecommunications media, the ISO 8824 Abstract Syntax Notation and the ISO 8825 Encoding Rules are used for the encapsulation of DIGEST data. This permits the handling of optional data fields and of geographic coordinates in a compact and efficient manner. Telecommunications applications are particularly sensitive to the volume of data that must be handled in any particular communication data transfer.

ISO 8825 (ASN.1 encoding rules) makes use of a tag length encoding scheme for the identification of data elements as components of a communication stream. Each piece of information is identified by a preceding tag and a number defining the length of the element. Such tag length combinations may be nested to any level. The sending and receiving communications entities follow identical syntactic trees in composing and parsing the data stream. The syntactic tree is a property of the standard and is not communicated. The tag codes permit the communicating entities to skip through the syntactic description. Therefore only actual data elements need be transferred. There is no overhead involved in the self-description of the syntactic tree or the identification of optional but missing elements. This makes the ISO 8824/5 encoding of DIGEST particularly useful in the communications of map segments or updates to previously communicated maps.

B.2 THE DIGEST TELECOMMUNICATIONS ENCAPSULATION

The basic information elements of the interchange format are information fields composed of specific data elements. The fields used in this ISO 8824 description of DIGEST are equivalent to the data fields used in the ISO 8211 description. Where possible the same field names and tags have been used to make it easy to compare the Annex B encapsulation to Annex A.

The following example shows the "Security-and-Release" data field expressed in ISO 8824 (ASN.1) form followed by the same data field in ISO 8211 (as used in DIGEST Annex A). This illustrates the similarity of the two descriptions at the syntactic level.

ISO 8824

```
Security-and-Release-Field       --QSR
      ::= SEQUENCE     {
qss        Security-Level,           --Highest security classification
qod        Basic-Text-String (Y|N),  --Downgrading instructions
cdv10      Date,                     --Date of downgrading value
qle        Basic-Text-String         --Releasability
      }

Security-Level                     --QSS
     ::= Basic-Text-String              (top-secret("T")|
                                        secret("S")|
                                        confidential("C")|
                                        restricted("R")|
                                        unclassified("U"))
```

In the description above "QSR" is a field tag, and "qss", "qod", "cdv10", and "qle" are subfield labels. In ISO 8824, field tags and subfield labels are optional and are included here to provide a reference back to the fields described in ISO 8211 DIGEST described in Annex A. The text following the double hyphen "--" are comments. Note also that in this particular example "Security Level" is defined as a separate element in order to show the use and definition of syntactic sub-elements. Allowable values for an element are given in brackets e.g. (Y|N). The equivalent ISO 8211 encapsulation for the above example is:

ISO 8211

3[C,M]	0	QSR	001	;& SECURITY_AND_RELEASE
4[C,M]	1	QSS	A 1	Security classification { T | S | C | R | U }
4[C,M]	2	QOD	A 1	Downgrading instructions { Y | N }
4[C,O]	3	CDV10	A 8	Downgrading date value
4[C,M]	4	QLE	A	Releasability Statement
	999			

The USE (i.e. Vector, Matrix, or Raster) classifications in the ISO 8211 notation have been handled by separating out these subfields in the Header Data Subset. Within the Geo Dataset, the Topological Vector Subset may contain only vector data and similarly, the Raster and Matrix Geo Data Subsets may contain only their corresponding data.

B.2.1 ASN.1 Meta Notation

The ISO Abstract Syntax Notation (ASN.1) is a meta language used to provide a data interchange format in a context-independent manner. ASN.1 itself is similar to the compiler description languages used in computer science to define programming languages. In fact the structure is similar to a programming language and a particular data file is analogous to a particular program written in the language. Like a language, the definition of a data file in DIGEST Annex B makes use of only those words in the language that apply in a given situation.

Words, or statements composed of sequences of words, may be used as often as needed, in accordance with the syntactic rules of Annex B. These rules are effectively the grammar of the DIGEST Annex B "language".

A number of basic data types make up the "vocabulary" of the "language". These data types are coded according to the rules of supporting data syntaxes (see DIGEST Part 3 Clause 5). For example, a string of basic text is a primitive data type. The syntax of DIGEST is defined in a rigorous and formal way in the ASN meta language.

A complete description of the Abstract Syntax Notation would take some space to present. However in the specification of DIGEST only a subset of the ASN commands need be used. This subset is identified below:

- Assignment
- CHOICE
- SEQUENCE
- SEQUENCE OF
- SET
- SET OF
- MACRO

Quite complex data types are required to support DIGEST data interchange. This is accomplished by defining a small number of simple data types. The complete range of values of these simple data types may be defined, and then the manner of combining these simple data types into the more complex data types is specified. A data type defined in this manner may be assigned a tag so that it may be identified in the communication or otherwise distinguished. Encoding rules described separately from the syntax of the data format define the manner in which the data types are encoded and delimited in terms of octets of data that are communicated.

The Abstract Syntax Notation defines a communications format in terms of a syntactic tree. At the highest level the entire dataset that is interchanged is described as a sequence of sub-sections. These sub-sections are then broken down into their component elements and so on, until each of the primitive data elements is identified. Each data element has a particular data type such as a basic text string, an integer etc. When data is communicated, it is parsed by the receiving device in the order specified by the syntactic tree. Many branches of the syntactic tree may be optional. In communicating information, it is not necessary to pad the communications with null fields to accommodate information fields that are not used. The tag numbers associated with data elements allow the parser to skip over sections of the syntactic tree, so that only the relevant information needs to be communicated. This approach also allows for recursive definitions, so that there is no limit to the number or length of parameter data.

Branches of the syntactic tree are defined in terms of expressions in the Abstract Syntax Notation. The Assignment operator **::=** equates a reference name to a series of more basic commands or primitive data elements. An entire syntax is described in terms of successive refinement. A data file consists of a number of named sections, each of which consists of a number of sub-sections etc. down to the level of the primitive data elements.

The basic operator in an assignment statement is the **SEQUENCE** command. The SEQUENCE operator specifies that a branch of the syntactic tree consists of a defined number of elements in a fixed order, that is a list of mandatory or optional elements. The **SEQUENCE OF** operator specifies that number of elements is variable but that the order is fixed, that is it indicates a repeated element or list of elements. The **SET** operator specifies that a branch of the syntactic tree consists of a defined number of elements in any order. It is equivalent to a sequence but the order is not fixed. The **SET OF** operator specifies that number of elements is variable and that the order is variable. The **CHOICE** operator specifies that an instance of the syntactic tree permits the inclusion of one data element (or sub-branch) out of a fixed set of choices.

Elements in a SEQUENCE or SET may be optional. This is indicated by the keyword **OPTIONAL** immediately following the element name in the sequence or set. If a default value is defined for an optional element, then the keyword **DEFAULT** replaces the term OPTIONAL and the value of the default is specified following the DEFAULT keyword.

A **MACRO** definition allows a primitive data type to be constructed out of other primitive data types. It also allows a default value notation to be defined for the constructed primitive so that the DEFAULT specification may be used with this new element.

Tag numbers are used to identify branches of the syntactic tree. A tag number is expressed in square brackets [ ] preceding an element name. Tag numbers are not necessary in a fixed SEQUENCE with no OPTIONAL elements since the order is known; however, in other cases, tag numbers must be supplied for each element. There are four classes of identifier tag codes: Universal, Context Specific, Application, and Private. **Universal tags** are used to identify operators such as CHOICE or SEQUENCE or basic data elements such as a GRAPHIC STRING. **Context Specific tags** are assigned in each branch of the syntactic tree to number the elements of the tree in that branch. The same tag numbers are used over and over in different levels of the syntactic tree, and it is the responsibility of the syntax parser interpreting data encoded in terms of the ASN defined syntax to keep track of the levels of the tree and the local meaning of each tag. **Application wide tags** are used to define unique identifiers to specific elements. The parser does not need to keep track of the level of the syntax to identify the particular data element. Since Application-wide tags are unique to a particular data element, long tag numbers would result if they were used extensively throughout a particular syntax. Therefore their use is restricted to a few strategic places within the DIGEST syntax. **Private tags** are used to build proprietary extensions to an existing standard, and they are not used in DIGEST.

In certain situations, redundant tags are generated. For example, a Universal tag may immediately follow a Context Specific tag. The keyword **IMPLICIT** is used to suppress the generation of a universal tag in those situations where the tag is unnecessary. An **IMPLICIT SEQUENCE** of two tagged elements would be encoded using only the context specific tags identifying each of the elements. The tag identifying the overall sequence would not be included.

The following is a summary of the notations used in the grammar, which is used to formally describe DIGEST in Annex B.

::= - is the production symbol of the grammar and can be read "is produced by" or "is composed of". A production allows the definition of a syntactic entity by the assignment of a name to a collection of data types or other entities. Entities placed on the right of the production symbol are taken together to define the composite entity. By the use of production statements, the elements of the grammar may be defined by successive refinement.

CHOICE { } - is the alternative indicator in a production definition. It can be read as "or". Alternate data entities are separated by commas within the brackets of the CHOICE indicator. Each of these entities must be identified by a TAG, so that the particular entity communicated may be distinguished. For example, the data entity Type consists of a choice of data element Type-1, Type-2, or Type-3. The TAG numbers are enclosed in square brackets.

```
Type    ::=  CHOICE   {     [1]     Type-1,
                            [2]     Type-2,
                            [3]     Type-3
             }
```

SEQUENCE { } - is the cumulative indicator in a production definition. It can be read as "and". Data entries in a sequence are separated by commas within the brackets of the SEQUENCE indicator. For example, data entity Process consists of the ordered sequence of entities Step-1, Step-2, Step-3. Explicit TAGs are not required since the order of the sequence is fixed.

```
Process  ::=  SEQUENCE   {     Step-1,
                               Step-2,
                               Step-3
              }
```

SET { } - is also a cumulative indicator in a production definition, which can also be read as "and". It is similar to the SEQUENCE indicator except that the order of the elements is not fixed. Therefore TAG codes must be used to distinguish the elements. For example, data entity Flock consists of the unordered sequence of entities Bird-1, Bird-2, Bird-3.

```
Flock    ::=   SET     {     [1]     Bird-1,
                             [2]     Bird-2,
                             [3]     Bird-3
               }
```

SEQUENCE OF - is a series indicator in a production definition. It can be read as iteration or repetition. It permits zero or more data entities of the same type to be part of a production. The end of the sequence is determined when there are no more data elements of the same type. For example, a data element List is composed of a series of Entries (Entry-1, Entry-2, Entry-3,…).

```
List     ::=   SEQUENCE OF    Entries
```

Data entities in a SEQUENCE or a SET may be optional. Optional data elements are indicated by the keyword OPTIONAL after the data element name. A default value may also be defined for an optional data element. This is indicated by the keyword DEFAULT after the data element name followed by the value of the default state. The keyword DEFAULT implies the keyword OPTIONAL. For example, data entity Group consists of the ordered sequence of entities Element-1, Element-2, Element-3, Element-4, where Element-2 is optional and Element-3 is optional and takes on the default value 1. Explicit TAGs are required in order to distinguish which elements are included.

```
Group   ::=  SEQUENCE   {  [1]  Element-1,
                           [2]  Element-2 OPTIONAL,
                           [3]  Element-3 DEFAULT (1),
                           [4]  Element-4
                }
```

-- signifies the beginning of comments that are not part of the grammar, but are included to clarify the semantic meaning and context.

Keywords - such as SEQUENCE, SET, CHOICE etc. are expressed in capital letters.

identifier name - the name of an identifier consists of a string of letters, digits and hyphens beginning with a lower case letter. Identifier names may be used to identify particular elements of an entity or to assign a value to a particular element of an entity.

Entity Name - the name of an entity consists of a string of letters, digits and hyphens beginning with an upper case letter.

The primitive level of the Abstract Syntax Notation consists of a number of built-in data types. These can be classified into several categories as shown below:

```
Numerical Data Types    - BOOLEAN          - True or False
                          INTEGER          - Integer number
                                             (a signed integer number
                                             of arbitrary length)

Bit Oriented Data Types - BIT STRING       - String of bits
                          OCTET STRING     - String of 8-bit bytes
```

General Data Types	- NULL ANY	- Null string - Any data string
Time / Date Data Type	- GENERALIZED TIME	- Date / Time (universal time expressed as year, month, day, hour, minutes, seconds, fractions of seconds and a time zone differential from Greenwich)
Character Data Types	- GRAPHIC STRING	- A string of characters (see Part 3 clause 5)

This description of the Meta Notation only identifies the principal functions used in DIGEST Annex B. A more comprehensive description is given in the ISO standard ISO 8824.

B.2.2 ASN.1 Encoding Rules

The Abstract Syntax Notation defines the syntactic structure of the interchange format. However, the structure itself is not communicated. What is communicated are values of the data elements along with delimiting codes and identifier (TAG) numbers that indicate where the data elements are in terms of the syntactic tree. A separate parallel standard to ASN defines the encoding rules for identifying and delimiting data elements for communication in a particular eight-bit transparent communications environment. This is sufficient for communicating DIGEST over a data transparent data communications channel.
The ASN.1 encoding rules make use of an identifier (TAG) and a length code for each data element. The length codes define a nesting structure that corresponds to the relationship of the data elements in the interchange format.

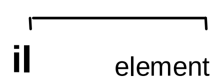

Figure B-1 ASN.1 Tag Length Structure

In the illustration above, **i** is the identifier TAG code and **l** is the length. The range of the length is indicated by a bar above the data elements, starting at the length indicator and proceeding to the end of its range.

A particular string of data, structured in accordance with a tree-oriented syntax, might be illustrated as shown below:

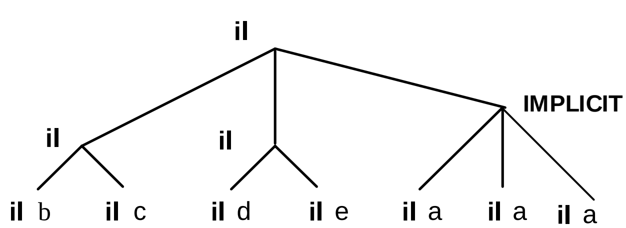

Figure B-2 Syntactic Tree

In each case the identifier specifies the type of the data value or how to relate it to the syntactic tree, and the length defines how to find the end of the string or sub-string. This structure can be expressed in a serial manner as:

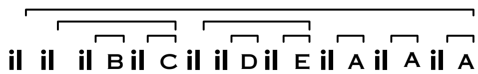

Figure B-3 Serialized Syntactic Tree

The syntactic tree expressed in ASN corresponding to this expression would be:

```
SEQUENCE { SEQUENCE {b,c}, SEQUENCE {d,e}, IMPLICIT SEQUENCE OF {a}}
```

Universal codes are defined within ASN and indicate the particular tree-node type or the type of the built-in data elements, such as INTEGER or GENERALIZED TIME. The Universal identifier codes of interest in DIGEST are:

Universal Identifier Type Code	Syntactic Tree Node Type
16	SEQUENCE and SEQUENCE OF
17	SET and SET OF
5	NULL
4	OCTET STRING
2	INTEGER
25	GRAPHIC STRING
27	GENERAL STRING
24	GENERALIZED TIME

The DIGEST Annex B specification uses Context Specific identifier codes and a small number of Application identifier codes. No Private identifier codes are used.

Universal tags identify data elements by type. At times this is sufficient to match the data element to the syntactic tree. However in some situations, such as the case of OPTIONAL elements of the same type, it is necessary to make use of Context specific tags in the syntax. An IMPLICIT command may be used to eliminate the redundant universal tag. For example:

```
[6] INTEGER            [6] IMPLICIT INTEGER
```

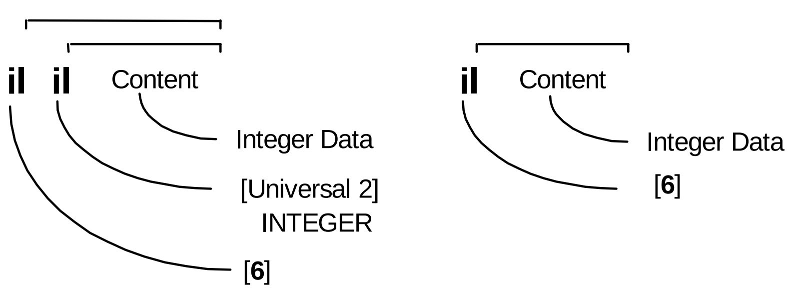

Figure B-4 Universal and Implicit Tags

The coding of the identifier **i** takes on the form illustrated below:

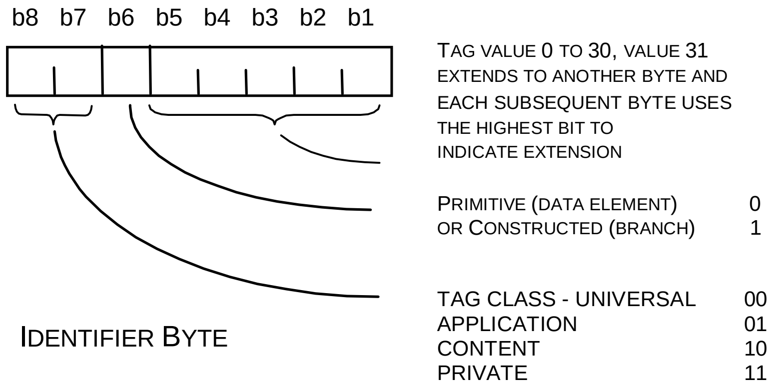

Figure B-5 Tag Bit Pattern

The length code contains a count of the number of octets (8-bit bytes) in the particular construct (branch) or primitive (element). For a length of 1 to 127, one octet may be used. For longer lengths, bit 8 in the first octet is 1 and the low order bits contain the length of the string of length octets. Subsequent octets in the length field taken together give the range of the construct or primitive. Note that the special value 255 in the first octet is reserved and the value 128 indicates an indefinite length range. Such a range is terminated by a special identifier of Universal class 0.

Note that a length code of zero for a data item is permitted and that for numeric data items such usage indicates that the value is zero.

B.2.3 Normalized Coordinates

An important aspect of the communication efficiency built into the ISO 8824 / 5 encapsulation of DIGEST is the use of normalized coordinates for the handling of coordinate data and other numbers of fixed range. In some encoding schemes, which are not tuned for a high level of communications efficiency, numbers such as coordinates are handled as real numbers. If only a small range of numbers is valid, this is a potential waste of "code space" and therefore efficiency. For example, if a number could validly range from 0 to 5 then values such as 25 or $2.94*10^{43}$ would be illegal. However, the real number coding system would assign potential bit combinations to handle these potential values. Since these values would never be encountered in an actual communication, the encoding of the real numbers would be larger than required to handle the actual data.

If a number has a fixed range, such as the 0 to 5 in our example, then it can always be normalized to a corresponding 0 to 1 range. All values in the range would be fractions of 0 to 1. This can be efficiently encoded as a binary fraction. A number in the range 0 (inclusive) to 1 (exclusive) is equivalent to the mantissa part of a real number, and can be termed a fraction number. In an actual implementation there is always a fixed number of bits of precision assigned. A fraction number can therefore easily be implemented by scaling the number up by the number of bits of precision assigned. That is, the decimal point (or more correctly binary point) can be shifted by multiplying by 2^n where n is the number of bits of precision available in the number field. The number therefore can be represented as an integer number in a fixed-length binary field.

Since integer numbers are normally encoded using fewer bits, for equivalent precision, this provides a significant improvement in efficiency. Also, since the number range is a better fit to the value range of the data, it is sometimes possible to use short integers rather than long integers and therefore achieve a four-fold increase in the efficiency of encoding a particular real number.

Coordinate data is normally handled as a Cartesian pair (or triple) of real numbers. Latitude and Longitude are normally represented as degrees, however in other projections, northings and eastings in terms of meters from the equator are at times communicated. Great efficiencies can be achieved by normalizing the coordinate data to the possible number range and carrying that as a pair of normalized binary fractions. For example, if we were interested in a map area with a minimum bounding rectangle of 63° to 62° longitude and 44° to 45° latitude, then we could represent that as a unit square from 0 to 1 and from 0 to 1. Note that both positive and negative normalized number ranges are permitted.

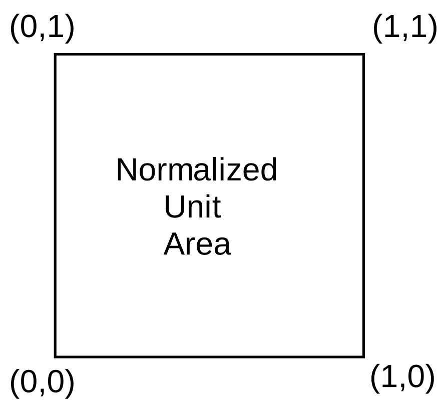

Figure B-6 Normalized Coordinate Space

Normalized unit areas are always square to maintain the aspect ratio of the projected data. Therefore if the map area of interest is not square, it is circumscribed within the minimum bounding square area.

In the DIGEST ISO 8824/5 encapsulation normalized coordinates are used to handle most of the spatial information in the body of the data exchange. This covers the vast majority of the spatial data elements in a dataset. Certain data elements in the header are excluded to make the dataset easier to interpret. In addition, the specification of the Minimum Bounding Rectangle (see Map-Boundary-Coordinates-Subfield in General-Information-Record) for the whole map in the header is specified using real numbers for the coordinate values, because these numbers may be used to calculate the dimensions of the Normalized Unit Area corresponding to the whole map. In effect, all the coordinate information in this encapsulation is defined as fractions of the minimum bounding rectangle. For most coordinate oriented data, such as "Node" positions, the dimensions of the Minimum Bounding Rectangles (MBRs) around "Features", etc., fraction numbers in a normalized coordinate space are adequate. However the "Edge" topological primitive is a special case.

An edge carries a string of vertices as a spatial attribute defining the shape of the edge. Due to the nature of geographical data each vertex tends to be "near" its neighbor in a mathematical sense. Therefore, an additional efficiency can be achieved for strings of vertices. Three special types of coordinate encoding are defined for edges. These are **absolute, relative** and **differential** coordinate strings.

Absolute-coordinate-string(s) are sets of X,Y or X,Y,Z coordinates represented as pairs or triplets of numbers in normalized coordinate space. The number of bits of precision used to specify an absolute coordinate is defined in the tag length structure of the OCTETSTRING used to encode the coordinate. Absolute coordinates are fractions of the normalized whole world map represented as Lat / Long coordinates. See Figure B-2. Note that 64 bits of precision (8 bytes), including both X and Y interleaved, are required to represent a position to 1 millimetre resolution (at the equator).

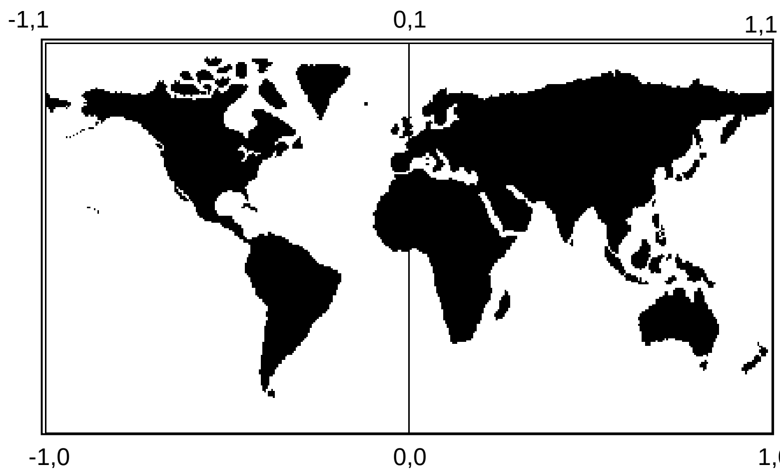

Figure B-7 Normalized Area for the Whole World

Relative-Coordinate-String(s) are a set of X,Y coordinates specified as relative to a local coordinate system. The origin of the local coordinate system is defined for a Layer/Coverage as part of the metadata of the Layer/Coverage [see part 2 sub-clause 10.2]. Since the possible range of values in a local coordinate system is less than the full absolute coordinate system it requires fewer bits to encode coordinates. A relative coordinate string begins with a sub-string length indicator, which specifies the number of bits of each coordinate element. This is followed by an OCTETSTRING containing the bit packed coordinate information. All of these values are in terms of the normalized coordinate space. For example, an edge might consist of 299 X,Y vertices. This edge might be restricted to a local region that can be represented in 14 bits (7 bits for X and 7 bits for Y). The reference position and scale factor of the coordinate system would be set as part of the metadata for the Layer/Coverage. The relative coordinate string would consist of an integer number indicating that the following relative coordinate sub-strings are each 14 bits long, followed by a string of 4186 bits, packed into an OCTETSTRING of 524 bytes, representing the 299 vertices. Note that there are 6 remaining leftover bits in the octet string that are padded with 0 and ignored.

Note that the origin and scale factor defining the local coordinate system are defined using an Application Tag [A 20] in DIGEST B. This means that before using a relative coordinate string, the local coordinate system should be set up using the element identified by Application Tag [A 20].

Differential-Coordinate-String(s) provide an even higher level of compaction for that class of edge in which there is both a maximum and minimum vectorial displacement between vertices. If the edge is "well behaved" and varies only locally, then it can be represented very efficiently in terms of short vectors that are defined as relative to the preceding vector in a chain of such vectors. Actually, due to the manner in which geographic data is often gathered, this is a very common situation. A differential coordinate defines a differential factor that indicates the increment step size. For example, if each relative coordinate displacement is a minimum of 3-bit increments, for the numerical precision used in the Normalized Unit Coordinate system as defined by the Scale factor for the local coordinate system, then the differential factor of 3 can be divided out of each of the coordinate positions. Also if the maximum increment size is 3 bits, this would mean in the example used above, that each coordinate could be represented as 6 bits (3 bits for X and 3 bits for Y). Therefore the string would consist of an initial coordinate (Coord) position, followed by an integer number specifying a differential factor of 3, followed by an integer number indicating that the following differential coordinate sub-strings are each 6 bits long. This is followed by a string of 1794 bits, packed into an OCTETSTRING of 225 bytes, representing the 299 vertices. Note that there are 6 remaining leftover bits in the octet string that are padded with 0 and ignored.

Coordinates are stored as interleaved normalized binary fractions. That is, a number ranging from 0 (inclusive) to 1 (exclusive) may be stored as a binary fraction encoded in an integer field with the implied binary point at the most significant position. This is illustrated below.

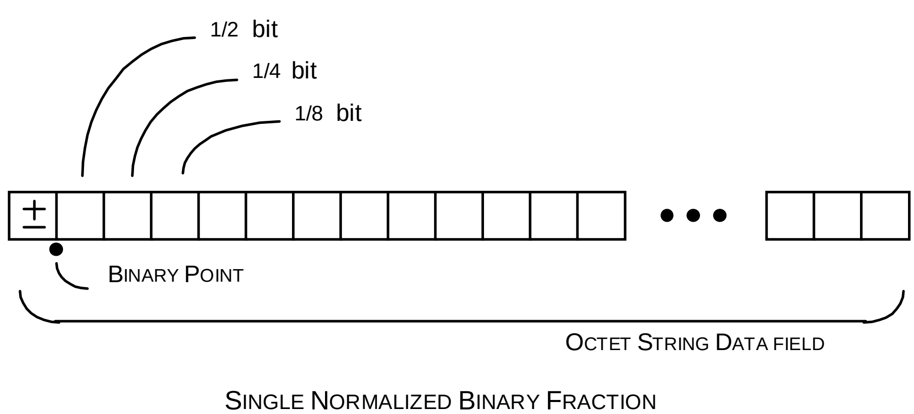

Figure B-8 Binary Fraction

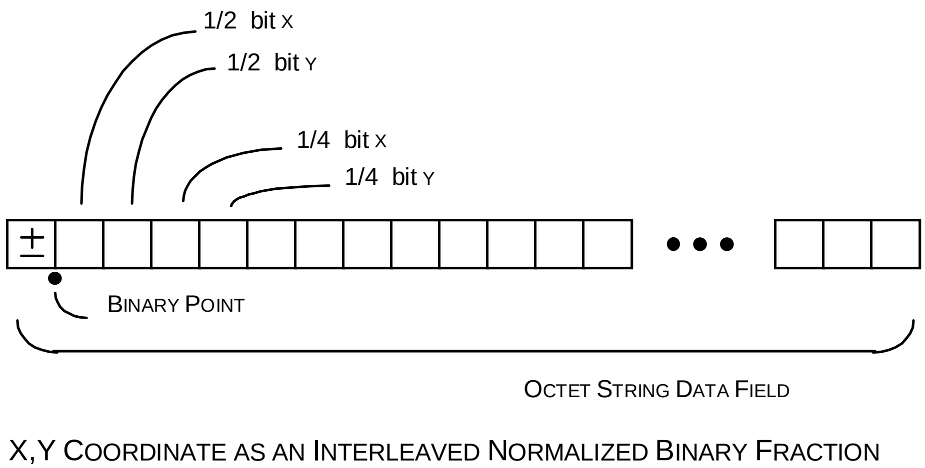

Figure B-9 X,Y Interleaved Binary Fractions

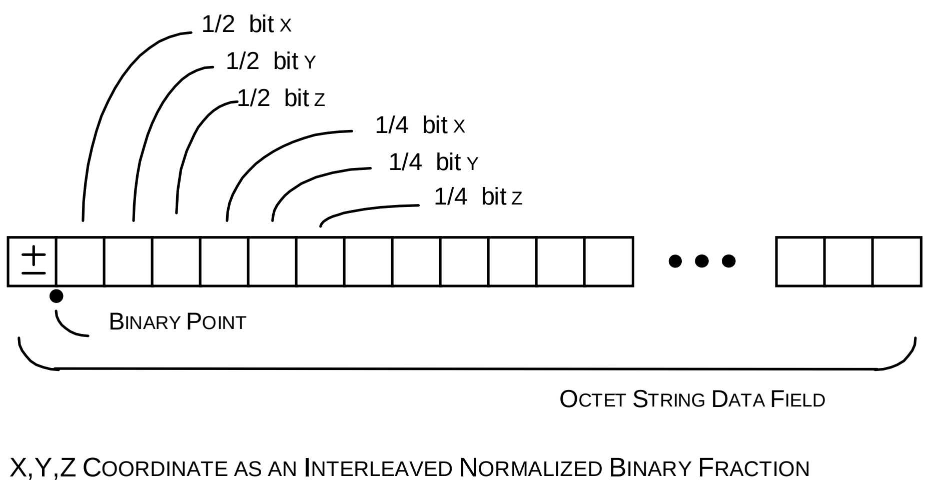

Figure B-10 X,Y,Z Interleaved Binary Fractions

The details of the encoding of coordinate information are given in DIGEST Part 3 clause 5.

B.3 OVERALL STRUCTURE

The DIGEST geographical data interchange standard allows the definition of entire maps or charts, or parts of maps or charts, to be exchanged. The interchange unit corresponding to an entire map or chart is called an "Exchange Set." Such an entity can be broken down into several components for the purpose of defining the various elements that compose a map or chart specified according to the DIGEST format.

If an entire map or chart is being communicated, then it is expected that the full exchange set is being transmitted. This is making use of DIGEST B in the same manner as one would use DIGEST A (ISO 8211) or DIGEST C (VRF) to exchange a dataset. However, it is more likely that DIGEST B would be used to exchange only a part of a dataset. This may occur in the situation where an update is being applied to an already communicated map, or where a portion of a map is extracted from a database or data warehouse. In an update situation, it can be assumed that the entire map already exists at the destination end of the communications, and that only the new information needs to be communicated. In a situation where data is being extracted from a database, the information is in the context of the extraction.

The following is a description of the entire DIGEST specification described in terms of ISO 8824. To communicate an entire map, begin at the exchange set level. To communicate a component of a map, select the appropriate elements as identified by the Application Tags.

The Exchange set is represented schematically below in a form similar to that used in Part 2 Annex A clause 1.1.

The following is a general description of the Exchange set:

```
Exchange set: DIGEST
|
|- File: TRANSMITTAL HEADER
|
|- R Geo Dataset
      |
      |- File: GENERAL INFORMATION
      |
      |- File: GEO REFERENCE
      |
      |-R File: SOURCE
      |
      |- File: QUALITY
      |
      |-R  Layer
              |
              *-R File: VECTOR GEO DATA
              |
              *-R File: RASTER GEO DATA
              |
              *-R File: MATRIX GEO DATA
```

This is encapsulated in ISO 8824 in the following sections and subsections.

Note: The term "File" in this exchange encapsulation is a logical grouping of data, not a physical file on an exchange media. The term is retained to make the correspondence between encapsulations clearer.

B.3.1 Exchange Set Structure

```
Exchange-set
        ::= [A 0] SEQUENCE       {
             Transmittal-Header-File,
             SEQUENCE OF
                  Geo-Dataset-File
       }
```

Note: **[A n]** represents the application-wide tag [APPLICATION n], where n is an integer. These tag numbers are unique and may be used to identify independent segments of ISO 8825 encoded data.

B.3.2 Geo Dataset Structure

```
Geo-Dataset-File
     ::=  SEQUENCE         {
           General-Information-File,
           Geo-Reference-File,
           SEQUENCE OF
              Source-File,
           Quality-File,
           SEQUENCE OF
              Layer-Section
     }

Layer-Section
     ::=  CHOICE    {
          [0] Vector-Geo-Data-File,
          [1] Raster-Geo-Data-File,
          [2] Matrix-Geo-Data-File
     }
```

B.4 TRANSMITTAL HEADER FILE

The Transmittal-Header describes general information encompassing the entire transmittal dataset.

```
Transmittal-Header-File
|
|- Transmittal-Description-Record
      |
      |-    Transmittal-Header-Field
      |-R  Dataset-Description-Field
|
|-  Security-and-Update-Record
      |
      |-    Security-and-Release-Field
      |-R  Up-to-Dateness-Field
```

```
Transmittal-Header-File
     ::= SEQUENCE    {
thf          Transmittal-Description-Record,
lcf          Security-and-Update-Record
      }
```

B.4.1 Transmittal-Description-Record

```
Transmittal-Description-Record     --THF
       ::= SEQUENCE    {
vdr          Transmittal-Header-Field,
fdr          SEQUENCE OF
                Dataset-Description-Field
       }
Transmittal-Header-Field           --VDR
       ::= SEQUENCE    {
             Originator-Subfield       OPTIONAL,
                                          --Originator - addressee
nof          Integer-Number,              --Number of datasets
urf          Basic-Text-String,           --Transmittal Identifier
edn          Integer-Number,              --Edition number
cdv07        Date                         --Creation date value
       }

Originator-Subfield
       ::= SEQUENCE    {
voo          Basic-Text-String,           --Originator
adr          Basic-Text-String          OPTIONAL,
                                          --Addressee
       }

Dataset-Description-Field          --FDR
       ::=SEQUENCE     {
nam         Basic-Text-String,            --Dataset ID
str         Integer-Number,               --Structure code
              ( Matrix-values(1),
                Matrix-coded(2),
                Raster-RGB(3),
                Raster-color-coded(4),
                Cartographic-Spaghetti(5), --Vector: Level 0 Topology
                Non-Planar-Graph(6),       --Vector: Level 1 Topology
                Chain-node(7),             --Vector: Level 2 Topology
                Full-Topology(8)           --Vector: Level 3 Topology
                                          )
prt         Basic-Text-String,            --Dataset type
enc         Basic-Text-String,  (B|X)     --Encapsulation B only or Mixed
                                          --see Dependency condition 1.1
swo         Fraction-Number,              --Westernmost longitude
swa         Fraction-Number,              --Southernmost latitude
neo         Fraction-Number,              --Easternmost longitude
nea         Fraction-Number               --Northernmost latitude
          }
```

B.4.2 Security-and-Update-Record

```
Security-and-Update-Record         --LCF
      ::= SEQUENCE    {
qsr         Security-and-Release-Field,
            SEQUENCE OF
quv            Up-to-Dateness-Field
     }
```

```
Security-and-Release-Field         --QSR
     ::= SEQUENCE    {
qss       Security-Level,                  --Security classification
qod       Basic-Text-String,  (Y|N)        --Downgrading instructions
cdv10     Date                             OPTIONAL,
                                           --Date of Downgrading
qle       Basic-Text-String                --Releasability
     }

Up-to-Dateness-Field               --QUV
     ::= SEQUENCE    {
          [0]  DIGEST_specification_Up_to_Dateness,
          [1]  Product_specification_Up_to_Dateness   OPTIONAL
     }
DIGEST_specification_Up_to_Dateness
     ::= SEQUENCE    {
src1          Basic-Text-String,           --DIGEST Edition ID
cdv12         Date,                        --DIGEST Edition Date
spa1          Basic-Text-String            --DIGEST Amendment Number
     }
Product_specification_Up_to_Dateness
     ::= SEQUENCE    {
src2          Basic-Text-String            --Specification Edition ID;
cdv22         Date                         --Specification edition
spa2          Basic-Text-String            --Specification Amendment
     }

Security-Level                     --QSS
     ::= Basic-Text-String              (top-secret("T"),
                                        secret("S"),
                                        confidential("C"),
                                        restricted("R"),
                                        unclassified("U"))
```

Dependency conditions (list 1):
1-1 Encapsulation:
Must be present when the encapsulation is not homogeneous within the transmittal.

B.5 GENERAL-INFORMATION-FILE

```
General-Information-File
|
|-R General-Information-Record
      |
      |- Dataset-ID-Field
      |
      |-   Vector-General
      |
      |-   Raster-General
      |
      |-   Matrix-General
|
|- Dataset-Description-Record
      |
      |- Dataset-Description-Field
```

Note: The USE (i.e., Vector, Matrix, or Raster) classifications in the ISO 8211 notation in the general information record have been handled by breaking out the Vector, Raster and Matrix components into separate elements.

```
General-Information-File
     ::= [A 1] SEQUENCE    {
               [0] SEQUENCE OF
gin                   General-Information-Record,
dss            [1] Dataset-Description-Record      OPTIONAL
     }
```

B.5.1 General-Information-Record

```
General-Information-Record     --GIN
     ::= SEQUENCE    {
dsi          Dataset-ID-Field,      --Dataset name
gen          CHOICE    {            --General-Information-Field
gen-v               [0] Vector-General,
gen-r               [1] Raster-General,
gen-m               [2] Matrix-General
             }
     }

Dataset-ID-Field                  --DSI
     ::= SEQUENCE    {
prt-d          Basic-Text-String,     --Dataset type
nam-d          Basic-Text-String      --Dataset ID
     }


Vector-General                   --GEN-V
                                      --General-Information-Field for
                                      --Vector type data
     ::= SEQUENCE    {
str-v          [0] IMPLICIT-INTEGER,  {Cartographic-Spaghetti(5),
                                       Non-Planar-Graph(6),
                                       Chain-node(7),
                                       Full-Topology(8)
                                      --Structure of data within layer
enc-v          [1] Basic-Text-String  OPTIONAL,  {A|B|C|D}
                                      --Encapsulation of the layer
                                      --see Dependency condition 2-1
mbu-v          [2] Basic-Text-String  OPTIONAL,
                                      --Units of GRP and MBR,
cov-v          [3] Integer-Number     OPTIONAL,
                                      --Data cover MBR in percent
fec-v          [4] Integer-Number     OPTIONAL,
                                      --Feature count total in dataset
poc-v          [5] Integer-Number     OPTIONAL,
                                      --Point feature count
lic-v          [6] Integer-Number     OPTIONAL,
                                      --Linear feature count
alc-v          [7] Integer-Number     OPTIONAL,
                                      --Area feature count
sgc-v          [8] Integer-Number     OPTIONAL,
                                      --Segment / Edge Record Count
nec            [9] Integer-Number     OPTIONAL,
                                      --Node record count
fcc            [10] Integer-Number     OPTIONAL,
                                      --Face record count
sft            [11] Integer-Number    OPTIONAL,
                                      --Simple feature count
```

```
               [12] Map-Boundary-Coordinates-Subfield,  -- in WGS84
sca-v          [13] Integer-Number    OPTIONAL,
                                      --Source graphic scale reciprocal
lcs-v          [14] Local-Coordinate-System-Definition,
                               OPTIONAL,
                                      --Local Coordinate System for
                                      --Layer or Coverage
txt-v          [15] Basic-Text-String
                                      OPTIONAL,
                                      --Free text
spr-v          [16] Vector-Dataset-Parameters  --Dataset Parameters
      }
```

Local-Coordinate-System-Definition

```
     ::= [A 20] SEQUENCE    {
lso-v          Fraction-Number         --Longitude / Eastings of Origin
pso-v          Fraction-Number         --Latitude / Northings of Origin
csf-v          Integer-Number          --Coordinates scale factor
      }

     --Note:  Latitude and Longitude are coded as a fraction of 360
     --degrees with the usual directional conventions.
```

Raster-General **--GEN-R**

```
     ::= SEQUENCE    {
          Raster-General-Information-Field
                                      --General-Information-Field
                                      --for Raster type data
spr-r     Dataset-Parameters-Field    --Dataset Parameters
bdf-r     Band-ID-Subfield            --Band ID
tim-r     Tile-Index-Map-Subfield     OPTIONAL,
                                      --Tile Index Map
                                      --see dependency condition 2-6
cid-r     Compression-ID-Subfield     OPTIONAL,
                                      --Compression ID
                                      --see dependency condition 2-7
ltd-r     Compression-Lookup-Table-Description  OPTIONAL,
                                      --Compression Lookup
                                      --Table Description
                                      --see dependency condition 2-8
ltv-r     Compression-Lookup-Table-Values  OPTIONAL,
                                      --Compression Lookup
                                      --Table Description
                                      --see dependency condition 2-8
cpm-r     Compression-Parameters      OPTIONAL,
                                      --Compression Parameters
                                      --see dependency condition 2-9
      }

Raster-General-Information-Field
     ::= SEQUENCE    {
str-r     [0] IMPLICIT-INTEGER,    {raster-RGB(3),raster-color-coded(4)}
                                      --Structure of data within layer
enc-r     [1] Integer-Number          OPTIONAL,  {A|B|C|D}
                                      --Encapsulation of the layer
                                      --see Dependency condition 2-1
          [2] Data-Density-Subfield   OPTIONAL,
                                      --see Dependency condition 2-2
          [3] Map-Boundary-Coordinates-Subfield,
sca-r     [4] Integer-Number,         --Source graphic scale reciprocal
psp-r     [5] Real-Number,            --Sample Pixel Spacing in microns
                                      --at capture stage
```

```
imr-r     [6] Basic-Text-String       OPTIONAL,
                                      {  rectified("Y"),
                                      unrectified("N")    }
                                      --Image Rectified during Scanning

          [7] Pixel-Ground-Spacing-Subfield
                                      OPTIONAL,
                                      --see Dependency condition 2-4
lso-r     [8] Fraction-Number,        --Longitude / Eastings of Origin
pso-r     [9] Fraction-Number,        --Latitude / Northings of Origin
txt-r     [10] Basic-Text-String      OPTIONAL,
                                      --Free text
     }
     --Note: Latitude and Longitude are coded as a fraction of 360
     --degrees with the usual directional conventions.
```

```
Matrix-General                  --GEN-M
     ::= SEQUENCE    {
          Matrix-General-Information-Field
                                      --General-Information-Field
                                      --for Matrix type data
spr-a     Dataset-Parameters-Field    --Dataset Parameters
bdf-a     Band-ID-Subfield            --Band ID
tim-a     Tile-Index-Map-Subfield     OPTIONAL,
                                      --Tile Index Map
                                      --see dependency condition 2-6
cid-a     Compression-ID-Subfield     OPTIONAL,
                                      --Compression ID
                                      --see dependency condition 2-7
ltd-a     Compression-Lookup-Table-Description  OPTIONAL,
                                      --Compression Lookup
                                      --Table Description
                                      --see dependency condition 2-8
ltv-a     Compression-Lookup-Table-Values  OPTIONAL,
                                      --Compression Lookup
                                      --Table Description
                                      --see dependency condition 2-8
cpm-a     Compression-Parameters      OPTIONAL,
                                      --Compression Parameters
                                      --see dependency condition 2-9
      }
Matrix-General-Information-Field
     ::= SEQUENCE    {
str-a     [0] IMPLICIT-INTEGER,   {matrix-values(1),matrix-coded(2)}
                                      --Structure of data within layer
enc-a     [1] Integer-Number          OPTIONAL,  {A|B|C|D}
                                      --Encapsulation of the layer
                                      --see Dependency condition 2-1

          [2] Data-Density-Subfield   OPTIONAL,
                                      --see Dependency condition 2-2
unimat-a  [3] Integer-Number,         --Unit of measure for Matrix data
                                      --null if not relevant
                                      --see Dependency condition 2-3
cov-a     [4] Integer-Number          OPTIONAL,
                                      --Data cover MBR in percent
zna-a     [5] Integer-Number          OPTIONAL,
                                      --Zone number; see Dependency
                                      --condition 2-4
          [6] Map-Boundary-Coordinates-Subfield,
sca-a     [7] Integer-Number          OPTIONAL,
                                      --Source graphic scale reciprocal
          [8] Pixel-Ground-Spacing-Subfield     OPTIONAL,
                                      --see Dependency condition 2-4
```

```
lso-a     [9] Fraction-Number ,       --Longitude / Eastings of Origin
pso-a     [10] Fraction-Number,       --Latitude / Northings of Origin
txt-a     [11] Basic-Text-String      OPTIONAL,
     }
     --Note: Latitude and Longitude are coded as a fraction of 360
     --degrees with the usual directional conventions

Data-Density-Subfield
     ::= SEQUENCE    {
lod       [0] Real-Number,            --Data interval in E / W direction
lad       [1] Real-Number,            --Data interval in N / S direction
uniloa    [2] Basic-Text-String       --Unit of measure for LOD and LAD
     }

Pixel-Ground-Spacing-Subfield
     ::= SEQUENCE    {
arv          Integer-Number,          --Longitude density: Number of
                                      --pixels in 360 degrees (E-W)
brv          Integer-Number           --Latitude density: Number of
                                      --pixels in 360 degrees (N-S)
     }

Map-Boundary-Coordinates-Subfield
     ::= SEQUENCE    {
swo-mb       Fraction-Number,         --Westernmost Longitude
swa-mb       Fraction-Number,         --Southernmost Latitude
neo-mb       Fraction-Number,         --Easternmost Longitude
nea-mb       Fraction-Number          --Northernmost Latitude
     }
             }
```

```
Vector-Dataset-Parameters       --SPR-V
     ::= SEQUENCE    {
bad-v     Basic-Text-String,     --Layer file name
             }

Dataset-Parameters-Field        --SPR
     ::= SEQUENCE    {
           [0] Corners-Subfield     OPTIONAL,
nfl        [1] Integer-Number,    --Number of Sub-blocks vertically
nfc        [2] Integer-Number,    --Number of Sub-blocks horizontally
pnc        [3] Integer-Number,    --Number of Pixels / Sub-block line (Q)
pnl        [4] Integer-Number,    --Number of Scan lines / Sub-block
cod        [5] Integer-Number,    --Column sequence
rod        [6] Integer-Number,    --Row sequence
por        [7] Integer-Number,    --Pixel order
pcb        [8] Integer-Number,    --Size of Pixel / Element count in bits
pvb        [9] Integer-Number,    --Size of Pixel / Element value in bits
bad-d      [10] Basic-Text-String,--Layer file name for use in the
                                  --General Information File
                                  -- (ZZZZZZDD.xxx) or
                                  --Image File name for use
in the
                                  --Source File (ZZZZZZDD.Lxx)
tif        [11] Basic-Text-String  {Y|N}  --Tile index map image
     }
Corners-Subfield
     ::= SEQUENCE    {
nul        Integer-Number,     --Row #, Upper Right Corner of MBR
nus        Integer-Number,     --Column #, Upper Right Corner of MBR
nll        Integer-Number,     --Row #, Lower left Corner of MBR
nls        Integer-Number      --Column #, Lower left Corner of MBR
     }
```

```
Band-ID-Subfield                --BDF
                               --Raster and Matrix Applications
     ::= SEQUENCE OF
         SEQUENCE    {
bid        [0] Basic-Text-String     OPTIONAL,
                               --Band identification
           [1] SEQUENCE    {
                               --Band Description; see Dependency
                               -- condition 2-5
ws1                 Integer-Number,     --ON color code value or
                                        --Lower limit wavelength in
                                        --nanometers
ws2                 Integer-Number      --OFF color code value or
                                        --Upper limit wavelength in
                                        --nanometers

                    }          OPTIONAL
           }

Tile-Index-Map-Subfield         --TIM
                               --Raster and Matrix Applications
     ::= SEQUENCE OF
tsi        Integer-Number      --Tile Index Map Value

Compression-ID-Subfield         --CID
                               --Raster and Matrix Applications
     ::= SEQUENCE    {
com        [0] Integer-Number     --Compression Algorithm ID
cpr        [1] Basic-Text-String, OPTIONAL
                                  --Compression Ratio
      }

Compression-Lookup-Table-Description  --LTD
                               --Raster and Matrix Applications
     ::= SEQUENCE    {
lti        [0] Integer-Number,    --Compression Lookup ID
nlr        [1] Integer-Number,    --Number of Compression Lookup
                                  --Table Rows
nva        [2] Integer-Number,    --Number of Values per Compression
                                  --Lookup Table Row
vlb        [3] Integer-Number,    OPTIONAL
                                  --Number of Bits per Values
      }

Compression-Lookup-Table-Values   --LTV
                               --Raster and Matrix Applications
     ::= SEQUENCE  OF
clv        Integer-Number      --Compression Lookup Table Value
```

```
Compression-Parameters            --CPM
                                --Raster and Matrix Applications
     ::= SEQUENCE OF
           SEQUENCE    {
cqi             Integer-Number,        --Compression Parameters ID
cpv             Integer-Number         --Compression Parameter Value
           }
      }
```

Dependency conditions (list 2):

2-1 Encapsulation:
Must be present when the encapsulation is not homogeneous within the transmittal.

2-2 Data-Density-Subfield: see Pixel Ground Spacing
Raster and matrix data consist of arrays of information pertaining to pixels or points at regularly identified intervals. The dimension of these pixels or intervals must be transmitted. If the dimension of these intervals is based on cartographic coordinates or Cartesian coordinates (USRP), the LOD, LAD and UNIloa subfields must be used. There is no default value for UNIloa.

2-3 Unit of measurement for Matrix Data:
Must be present when matrix values are actual values.

2-4 Pixel-Ground-Spacing-Field: see data density
Raster and matrix data consist of arrays of information pertaining to pixels or points at regularly identified intervals. The dimension of these pixels or intervals must be transmitted. If the dimension of these intervals is based on geographic coordinates (ASRP), the ARV and BRV subfields must be used.

2-5 Band-Description-Field:
The Band identification must be present for any raster or matrix data: counting the number of BID subfields is the only way to know the number of raster or matrix bands. WS1 and WS2 are mandatory in case of multi-banded raster data.

2-6 Tile-Index-Map-Field:
Mandatory if TIF = "Y".

2-7 Compression ID:
Mandatory if Geo data layer is compressed.

2-8 Compression Look Up Table:
Mandatory if the compression algorithm requires it.

2-9 Compression parameters:
Mandatory if the compression algorithm requires it.

B.5.2 Dataset-Description-Record

```
Dataset-Description-Record           --DSS
        ::= Dataset-Description

Dataset-Description                  --DRF
        ::= SEQUENCE    {
nsh          Integer-Number,          --number of horizontal accuracy
                                      --sub-regions
nsv          Integer-Number,          --number of vertical accuracy sub-
                                      --regions
nsp          Integer-Number,          --number of position accuracy sub-
                                      --regions
noz          Integer-Number,          --number of layers
nos          Integer-Number,          --number of source graphics
       }
```

B.6 GEO-REFERENCE-FILE

```
Geo-Reference-File
|
|- R Geo-Reference-Record
   |
   |- Geo-Parameters-Field
   |- Projection-Field
   |- Registration-Points-Field
   |- Diagnostic-Points-Field
|
|- R Grid Description
   |
   |-Grid Information
   |-General Information
   |-Dataset Parameters
   |-Band Identification
```

```
Geo-Reference-File
     ::= [A 2] SEQUENCE    {
               [0] SEQUENCE OF
geo                   Geo-Reference-Record,
               [1] SEQUENCE OF
grd                   Dataset-Description-Record      OPTIONAL
                                        --Raster and Matrix data only
     }
```

B.6.1 Geo-Reference-Record

```
Geo-Reference-Record                  --GEO
     ::= SEQUENCE    {
gep          [0] Geo-Parameters-Field  --geographic reference info;
prr          [1] Projection-Field      OPTIONAL,
                                       --projection information; see
                                       --Dependency condition 3-3
rpr          [2] Registration-Points-Field
                                       OPTIONAL,
dpr          [3] Diagnostic-Points-Field
                                       OPTIONAL
     }
```

```
Geo-Parameters-Field                    --GEP
     ::= SEQUENCE    {
typ        [0] Basic-Text-String,       --Data Type
uni        [1] Basic-Text-String,       --Unit of measure for coordinates
           [2] Geodetic-Ellipsoid-Subfield,
           [3] Vertical-Datum-Subfield  OPTIONAL,
                                        --see Dependency condition 3-1
           [4] Sounding-Datum-Subfield  OPTIONAL,
                                        --see Dependency condition 3-2
           [5] Geodetic-Datum-Subfield
           [6] Grid-System-Subfield
           }

Geodetic-Ellipsoid-Subfield
     ::= SEQUENCE    {
ell           Basic-Text-String,        --Ellipsoid name
elc           Basic-Text-String         --Ellipsoid code
     }

Vertical-Datum-Subfield
     ::= SEQUENCE    {
dvr           Basic-Text-String,        --Vertical Datum Reference
vdcdvr        Integer-Number            --Vertical Datum Code
     }
Sounding-Datum-Subfield
     ::= SEQUENCE    {
sda           Basic-Text-String,        --Sounding Datum Name
vdcsda        Integer-Number            --Sounding Datum Code
     }
Geodetic-Datum-Subfield
     ::= SEQUENCE    {
dag           Basic-Text-String,        --Geodetic Datum Name
dcd           Basic-Text-String         --Geodetic Datum Code
     }
Grid-System-Subfield
     ::= SEQUENCE    {
grd-c        Basic-Text-String,         --Geodetic Datum Name
grn-c        Basic-Text-String,         --Geodetic Datum Code
zna          Integer-Number             --Grid Zone number
     }

Projection-Field                        --PRR
     ::= SEQUENCE    {
prn          [0] Basic-Text-String,     --Projection name
pco          [1] Basic-Text-String,     --Projection Codes(Part 3-6)
paa          [2] Real-Number,           --Projection Parameter 1
pab          [3] Real-Number,           OPTIONAL
                                        --Projection Parameter 2
                                        --see Dependency condition 3-4
pac          [4] Real-Number,           OPTIONAL
                                        --Projection Parameter 3
                                        --see Dependency condition 3-5
pae          [5] Real-Number,           OPTIONAL
                                        --Projection Parameter 4
                                        --see Dependency condition 3-6
                                        --Note: List of Projection
                                        --Parameters may be extended as
                                        --required. Additional subfield
                                        --labels will range from
                                        --paf to paz.
             [6] Projection-False-Origin-Subfield     OPTIONAL,
                                        --see Dependency condition 3-7
zor          [7] Real-Number            OPTIONAL,
                                        --Z-values false Origin
                                        --see Dependency condition 3-8
     }
```

```
Projection-False-Origin-Subfield
     ::= SEQUENCE    {
xor          Real-Number,                --Easting false Origin
yor          Real-Number                 --Northing false Origin
     }
```

Registration-Points-Field **--RPR**

```
     ::= SEQUENCE OF
     SEQUENCE    {
pid-rp       [0] Basic-Text-String,      --Registration Point ID
lon-rp       [1] Fraction-Number ,       --Longitude / Easting of
                                         --Registration Point
lat-rp       [2] Fraction-Number ,       --Latitude / Northing of
                                         --Registration Point

zvl-rp       [3] Real-Number             OPTIONAL,
                                         --Elevation of Registration Point;
                                         --see Dependency condition 3-9
dix-rp       [4] Real-Number,            --Local X Coordinate of
                                         --Registration Point
diy-rp       [5] Real-Number,            --Local Y Coordinate of
                                         --Registration Point
diz-rp       [6] Real-Number,            OPTIONAL
                                         --Local Z Coordinate of
                                         --Registration Point;
                                         --see Dependency condition 3-9
bad-rp       [7] Basic-Text-String       OPTIONAL
                                         --Located File Name
                                         --see Dependency condition 3-10
     }
```

Diagnostic-Points-Field **--DPR**

```
     ::= SEQUENCE OF
     SEQUENCE    {
dpd-dp       [0] Basic-Text-String,       --Diagnostic Point ID
lon-dp       [1] Fraction-Number,         --Longitude / Easting of
                                            Diagnostic
                                          --Point
lat-dp       [2] Fraction-Number,         --Latitude / Northing of
                                            Diagnostic
                                          --Point
zvl-dp       [3] Real-Number              OPTIONAL,
                                          --Elevation of Diagnostic Point
                                          --see Dependency condition 3-11

dix-dp       [4] Real-Number,             --Local X Coordinate of
                                          --Diagnostic Point
diy-dp       [5] Real-Number,             --Local Y Coordinate of
                                          --Diagnostic Point
diz-dp       [6] Real-Number              OPTIONAL
                                          --Local Z Coordinate of
                                          --Diagnostic Point;
                                          --see Dependency condition 3-11

bad-dp       [7] Basic-Text-String        OPTIONAL
                                          --Controlled File Name
                                          --see Dependency condition 3-12
     }
```

B.6.2 Grid-Description-Record

Grid-Description-Record **--GRD**

```
     ::= SEQUENCE    {
gri          Grid-Information-Field,      --Grid information;
```

```
gen-g         Grid-General-Information-Field,
                                         --General grid information;
spr           Grid-Dataset-Parameters-Field,
                                         --Grid parameter information;
bdf           Band-ID-Field
                                         --Band identification
                                         --information;
     }

Grid-Information-Field                    --GRI
     ::= SEQUENCE    {
zvl           [0] Integer-Number,        OPTIONAL,
                                         --Grid elevation
bad-g         [1] Basic-Text-String      --Located image filename
     }
Grid-General-Information-Field            --GEN-G
     ::= SEQUENCE    {
lod-g         Real-Number,               --Data density in columns;
lad-g         Real-Number,               --Data density in rows;
lso           Real-Number,               --Origin in columns;
pso           Real-Number,               --Origin in rows;
     }


Grid-Dataset-Parameters-Field             --SPR
     ::= SEQUENCE    {
              Location-Grid-Corners,     --used to compute the number of
                                         --rows and columns of the
                                         --location grid.
nfl-g         Integer-Number,            --number of subblocks vertically
nfc-g         Integer-Number,            --number of subblocks
                                         --horizontally
pcn-g         Integer-Number,            --number of elements per profile
                                         --total number of grid elements
                                         --left to right
pnl-g         Integer-Number,            --number of profiles per subblock
                                         --total number of grid elements
                                         --top to bottom
cod-g         Integer-Number,     {0|1}  --column sequence
rod-g         Integer-Number,     {0|1}  --row sequence
por-g         Integer-Number,  {0|1|4|5} --pixel order
pcb-g         Integer-Number,            --size of pixel count in bits
pvb-g         Integer-Number,            --size of pixel value in bits

pvt-g         Basic-Text-String  {INT|SI|R},
                                         --Type of Pixel / Element Value

bad-l         Basic-Text-String          --Location Grid File Name
                                         -- (zzzzzzdd.Gcc)
     }
Location-Grid-Corners
     ::= SEQUENCE    {
nul-g         Integer-Number,            --Row number of the upper right
                                         --hand corner of Location Grid.
nus-g         Integer-Number,            --Column number of the upper
                                         --right hand corner of Location
                                         --Grid.
nll-g         Integer-Number,            --Row number of the lower left
                                         --hand corner of Location Grid.
nls-g         Integer-Number,            --Column number of the lower
                                         --left hand corner of Location
                                         --Grid.
     }
```

```
Band-ID-Field                       --BDF
     ::= SEQUENCE  OF
bid-g         Basic-Text-String   {GGX|GGX|CGY|CGY}
                                         --Band Identification
```

Dependency conditions (list 3):

3-1 Vertical-Datum:
Mandatory if elevation information is present in the dataset (z values).

3-2 Sounding-Datum-Subfield:
Mandatory is sounding information is present in the dataset (depth values).

3-3 Projection-Field:
The Projection-Field is mandatory when the coordinates type is MAP (cartographic coordinates) and forbidden otherwise.

3-4 Parameter 2:
see Part 3, Clause 6.

3-5 Parameter 3:
see Part 3, Clause 6.

3-6 Parameter 4:
see Part 3, Clause 6.

3-7 Projection False Origin:
only when relevant (usually the case).

3-8 Z Values False Origin:
only when relevant.

3-9 Elevation Registration Point:
Mandatory if z coordinates must be registered. In this case the Local coordinates will have a Z value.

3-10 Located File Name:
Mandatory if the Registration Point does not apply to the whole dataset.

3-11 Elevation Diagnostic Point:
Mandatory if z coordinates must be controlled. In this case the Local coordinates will have a Z value.

3-12 Controlled File Name:
Mandatory if the Diagnostic Point does not apply to the whole dataset.

B.7 SOURCE-FILE

```
Source-File
|
|- Source-Record
       |
       |- Source Summary
       |- Source-Field
       |- Magnetic-Rate-Field
       |-R Bounding-Polygon-Coordinates-Field
       |- Projection-Field
       |- Security-and-Release-Field
       |- Inset-Field
       |- Copyright-Field
|
|-R Legend-Record
       |
       |- Legend-Field
       |- Legend-Parameters-Field
       |- Tile-Index-Map-Field
|
|- R Metric-Support-Record
       |
       |- Normalization-Constants-Field
       |- Source-Datum-Coefficients-Data-Field
       |- Map-Projections-Coefficients-Data-Field
       |- Datum-Change-Constants-Field
       |- Source-Datum-Coefficients-Counter-Field
       |- Source-Datum-Long.-Coefficients-Field
       |- Source-Datum-Lat.-Coefficients-Field
       |- Grid-Rotation-Coefficients-Field
|
|- Supplementary-Text-Record
       |
       |- Supplementary-Text-Field
|
|- Auxiliary-Parameters-Record
       |- Source-Summary
       |- R Bounding-Polygon-Coordinates
       |- Original-Scene-Band-ID
     |        |- Resolution-and-Ground-Sample-Distance
       |- Basic-Auxiliary-Parameters
       |- Additional-Auxiliary-Parameters
```

```
Source-File
      ::= SEQUENCE    {
sou         [A 3] Source-Record         OPTIONAL,
                                         --Source Graphic Description Only
            [A 4] SEQUENCE OF
leg                   Legend-Record      OPTIONAL,
                                         --Source Graphic Description Only
msd         [A 5] Metric-Support-Record
                                         OPTIONAL,
                                         --Source Graphic Description Only
spt         [A 6] Supplementary-Text-Record
                                         OPTIONAL
                                         --Source Graphic Description Only
aup         [A 7] Auxiliary-Parameters-Record
                                         OPTIONAL
                                         --Sensor Parameters Description
                                         --Only
     }
```

B.7.1 Source-Record

```
Source-Record      --SOU
      ::= SEQUENCE    {
sgf          [0] Source-Summary-Field    OPTIONAL,
sor          [1] Source-Field,
mag          [2] Magnetic-Rate-Field     OPTIONAL,
rci          [3] SEQUENCE OF
                 Bounding-Polygon-Coordinates-Field
                                         OPTIONAL,
                                         --Coordinates of the Source
                                         --Bounding Polygon;
                                         --see dependency condition 4-6
prr-s        [4] Projection-Field        OPTIONAL,
                                         --strongly recommended for Raster
qsr-s        [5] Security-and-Release-Field
                                         OPTIONAL,
                                         --strongly recommended
ins          [6] Inset-Field             OPTIONAL,
                                         --see dependency condition 4-11
cpy          [7] Copyright-Field         OPTIONAL
Source-Summary-Field      --SGF
     ::= SEQUENCE    {
bad-s        [0] Basic-Text-String    OPTIONAL,

                                      --Name of derived layer; see
                                      --Dependency condition 4-1
nmi          [1] Integer-Number       OPTIONAL,
                                      --Number of magnetic information
                                      --Raster applications only
nst          [2] Integer-Number       OPTIONAL,
                                      --Number of supplementary text
                                      --records
nli          [3] Integer-Number       OPTIONAL,
                                      --Number of legend images; Raster
                                      --applications only

nin          [4] Integer-Number       OPTIONAL
                                      --Number of insets; Raster
                                      --applications only
    }
```

```
Source-Field     --SOR
     ::= SEQUENCE    {
prt-s        [0] Basic-Text-String     OPTIONAL,
                                       --Series Designator for the
                                       --Series; strongly recommended
urf-s        [1] Basic-Text-String     --Unique Source ID;
edn-s        [2] Basic-Text-String     --Source Edition Number;
nam-s        [3] Basic-Text-String     OPTIONAL
                                       --Full name of source document;
                                       --strongly recommended
cdp-s        [4] Integer-Number        --Type of significant date;
cdv-s        [5] Date                  --Significant date value;
cdv27-s      [6] Date                  OPTIONAL
                                       --Perishable information date
                                       --value; strongly recommended

sca-s        [7] Integer-Number        OPTIONAL,
                                       --Cartographic Scale; (grid system)
                                       --strongly recommended
             [9] Carto-Grid-Subfield   OPTIONAL,
                                       --Cartographic Grid Code
            [10] Area-Coverage-Subfield
                                       OPTIONAL,
            [11] Contour-Interval-Subfield
                                       OPTIONAL,
wpc         [12] Integer-Number        OPTIONAL,
                                       --Percentage covered by water
nst-s       [13] Integer-Number        OPTIONAL,
                                       --Navigational System Type
            [14] Geodetic-Ellipsoid-Subfield
                                       OPTIONAL,
                                       --see Dependency condition 4-2
            [15] Vertical-Datum-Subfield
                                       OPTIONAL,
                                       --see Dependency condition 4-3
            [16] Sounding-Datum-Subfield
                                       OPTIONAL,
                                       --see Dependency condition 4-4
            [17] Geodetic-Datum-Subfield
                                       OPTIONAL,
                                       --see Dependency condition 4-5
srn-s       [18] Basic-Text-String     OPTIONAL,
                                       --Library / Source Reference Number
            [19] Highest-Elevation-Subfield
                                       OPTIONAL
                                       --Raster applications only
     }
Carto-Grid-Subfield
     ::= SEQUENCE    {
grd-s       Basic-Text-String,         --Grid Code
grn-s       Basic-Text-String,         --Grid Description
zna-s       Integer-Number             --Grid Zone Number
     }
Area-Coverage-Subfield
     ::= SEQUENCE    {
squ          Integer-Number,           --Area Coverage
unisqu       Basic-Text-String         --Unit of Measure for Area
                                       --Coverage
     }

Contour-Interval-Subfield
```

```
     ::= SEQUENCE     {
pci         Integer-Number,           --Predominant Contour Interval
unipci      Basic-Text-String         --Unit of Measure for Contour
                                      --Interval
     }

--Geodetic-Ellipsoid-Subfield         see Geo-Reference-Record

--Vertical-Datum-Subfield             see Geo-Reference-Record

--Sounding-Datum-Subfield             see Geo-Reference-Record

--Geodetic-Datum-Subfield             see Geo-Reference-Record

Highest-Elevation-Subfield
     ::= SEQUENCE    {
hke         [0] Integer-Number,       --Highest known elevation of
                                      --source
unihke      [1] Basic-Text-String,    --Units of elevation value
            [2] Highest-Elevation-Point
                                      OPTIONAL
                                      --strongly recommended
     }

Highest-Elevation-Point
     ::= SEQUENCE    {
lon-h      Fraction-Number,           --Longitude / Easting of HKE
lat-h      Fraction-Number            --Latitude / Northing of HKE
     }
```

Magnetic-Rate-Field **--MAG**

```
     ::= SEQUENCE OF
          SEQUENCE    {
cdp         [0] Integer-Number,       --Type of magnetic date rate
cdv         [1] Date,                 --Magnetic rate Date value
rat         [2] Real-Number,          --Annual magnetic rate of change
unirat      [3] Basic-Text-String,    --Units of annual rate of change
gma         [4] Real-Number,          --Grid north-magnetic north
unigma      [5] Basic-Text-String,    --Units of grid magnetic angle
            [6] Magnetic-Rate-Reference-Point-Subfield
                                      OPTIONAL,
                                      --strongly recommended

            [7] Grid-Convergence-Subfield
                                      OPTIONAL
          }

Magnetic-Rate-Reference-Point-Subfield
     ::= SEQUENCE    {
lon-m       Fraction-Number,          --Longitude / Easting of the G-M
                                      --angle reference point
lat-m       Fraction-Number           --Latitude / Northing of the G-M
                                      --angle reference point
     }
Grid-Convergence-Subfield
     ::= SEQUENCE    {
gca         Real-Number,              --Grid convergence angle
unigca      Basic-Text-String         --Units of grid convergence angle
     }
```

```
Bounding-Polygon-Coordinates-Field   --RCI
     ::= SEQUENCE OF
          SEQUENCE   {
lon           Fraction-Number,        --Longitude / Easting coordinate
lat           Fraction-Number         --Latitude / Northing coordinate
          }
--Projection-Field                   --PRR
                                       --see Geo-Reference-Record
--Security-and-Release-Field         QSR
                                       --see Security-and-Update-Record
Inset-Field                          --INS
     ::= SEQUENCE OF
          SEQUENCE    {
int          Basic-Text-String,       --Unique ID of an Inset
sca          Integer-Number,          --Cartographic Scale of Inset
nam-i        Basic-Text-String,       --Name of Inset
ntl          Fraction-Number,         --Abs. lon. lower left corner
ttl          Fraction-Number,         --Abs. lat. lower left corner
nvl          Fraction-Number,         --Abs. lon. upper left corner
tvl          Fraction-Number,         --Abs. lat. upper left corner
ntr          Fraction-Number,         --Abs. lon. upper right corner
ttr          Fraction-Number,         --Abs. lat. upper right corner
nvr          Fraction-Number,         --Abs. lon. lower right corner
tvr          Fraction-Number,         --Abs. lat. lower right corner
nrl          Fraction-Number,         --Rel. lon. lower left corner
trl          Fraction-Number,         --Rel. lat. lower left corner
nsl          Fraction-Number,         --Rel. lon. upper left corner
tsl          Fraction-Number,         --Rel. lat. upper left corner
nrr          Fraction-Number,         --Rel. lon. upper right corner
trr          Fraction-Number,         --Rel. lat. upper right corner
nsr-i        Fraction-Number,         --Rel. lon. lower right corner
tsr          Fraction-Number          --Rel. lat. lower right corner
          }

Copyright-Field                      --CPY
cpz     ::= General-Text-String       --Copyright statement
```

B.7.2 Legend-Record

```
Legend-Record                        --LEG
                                      --Source Graphic Description Only
     ::= SEQUENCE    {
lgi         [0] Legend-Field,         --Legend info captured for easier
                                      --interpretation of source to
                                      --which it relates
spr-l       [1] Legend-Parameters-Field,
                                      --Parameters to interpret Legend
                                      --Image Data
tim-l       [2] Tile-Index-Map-Subfield
                                      OPTIONAL
                                      --Info regarding empty subblocks;
                                      --see Dependency condition 4-12
     }

Legend-Field                         --LGI
     ::= SEQUENCE    {
nam-l      [0] Basic-Text-String      OPTIONAL,
                                      --Legend name
str-l      [1] Integer-Number         --Structure class code
     }

Legend-Parameters-Field              --SPR-L
spr-p     ::= Dataset-Parameters-Subfield
                                      --see General-Information-Record

--Dataset-Parameters-Field           --SPR
```

```
                                              --see General-Information-Record

--Tile-Index-Map-Subfield                    --TIM
                                              --see General-Information-Record
```

B.7.3 Metric-Support-Data-Record

```
Metric-Support-Record                        --MSD
     ::= CHOICE    {
          [0] Arc-System-Metric-Support-Record,
          [1] UTM / UPS-System-Metric-Support-Record
     }
```

B.7.3.1 Arc-System-Metric-Support-Record

```
Arc-System-Metric-Support-Record
     ::= SEQUENCE    {
ncd          Normalization-Constants-Field,
sdc          Source-Datum-Coefficients-Data-Field,
mpc          Map-Projection-Coefficients-Field
     }

Normalization-Constants-Field                 --NCD
     ::= SEQUENCE    {
tsf           [0] Real-Number,                 --Latitude Scale Factor
gsf           [1] Real-Number,                 --Longitude Scale Factor
ttt           [2] Real-Number,                 --Latitude Translation Term
gtt           [3] Real-Number,                 --Longitude Translation Term
nsf           [4] Real-Number,                 --Northing Scale Factor
esf           [5] Real-Number,                 --Easting Scale Factor
ntt           [6] Real-Number                  --Northing Translation Term
ett           [7] Real-Number,                 --Easting Translation Term
     }

Source-Datum-Coefficients-Field             --SDC
     ::=SEQUENCE    {
ax1           [0] Real-Number,                --Latitude coefficient 1
ax2           [1] Real-Number,                --Latitude coefficient 2
ax3           [2] Real-Number,                --Latitude coefficient 3
ax4           [3] Real-Number,                --Latitude coefficient 4
ax5           [4] Real-Number,                --Latitude coefficient 5
ax6           [5] Real-Number,                --Latitude coefficient 6
ax7           [6] Real-Number,                --Latitude coefficient 7
bx1           [7] Real-Number,                --Longitude coefficient 1
bx2           [8] Real-Number,                --Longitude coefficient 2
bx3           [9] Real-Number,                --Longitude coefficient 3
bx4           [10] Real-Number,               --Longitude coefficient 4
bx5           [11] Real-Number,               --Longitude coefficient 5
bx6           [12] Real-Number,               --Longitude coefficient 6
bx7           [13] Real-Number                --Longitude coefficient 7
     }
Map-Projection-Coefficients-Field             --MPC
     ::= SEQUENCE    {
cx1           [0] Real-Number,                --Northing coefficient 1
cx2           [1] Real-Number,                --Northing coefficient 2
cx3           [2] Real-Number,                --Northing coefficient 3
cx4           [3] Real-Number,                --Northing coefficient 4
cx5           [4] Real-Number,                --Northing coefficient 5
cx6           [5] Real-Number,                --Northing coefficient 6
cx7           [6] Real-Number,                --Northing coefficient 7
cx8           [7] Real-Number,                --Northing coefficient 8
cx9           [8] Real-Number,                --Northing coefficient 9
cxA           [9] Real-Number,                --Northing coefficient 10
dx1           [10] Real-Number,               --Easting coefficient 1
dx2           [11] Real-Number,               --Easting coefficient 2
```

```
dx3          [12] Real-Number,        --Easting coefficient 3
dx4          [13] Real-Number,        --Easting coefficient 4
dx5          [14] Real-Number,        --Easting coefficient 5
dx6          [15] Real-Number,        --Easting coefficient 6
dx7          [16] Real-Number,        --Easting coefficient 7

dx8          [17] Real-Number,        --Easting coefficient 8
dx9          [18] Real-Number,        --Easting coefficient 9
dxA          [19] Real-Number         --Easting coefficient 10
     }
```

B.7.3.2 UTM / UPS-System-Metric-Support-Record

```
UTM / UPS-System-Metric-Support-Record
     ::= SEQUENCE    {
dcc          [0] Datum-Change-Constants-Field,
scc          [1] Source-Datum-Coefficients-Counter-Field,
slg          [2] Source-Datum-Longitude-Coefficients-Field,
slt          [3] Source-Datum-Latitude-Coefficients-Field,
grc          [4] Grid-Rotation-Coefficients-Field     OPTIONAL
     }

Datum-Change-Constants-Field        --DCC
                                     --(Note:  Units for all datum change
                                     --constants are in degrees and
                                     --decimal part of a degree.)
     ::= SEQUENCE    {
tof          Real-Number,     --Latitude normalizing offset
gof          Real-Number,     --Longitude normalizing offset
nzt          Real-Number,     --Normalizing factor
elv          Real-Number,     --Eastern limit of validity to use
                              --multiple regression equations
wlv          Real-Number,     --Western limit of validity to use

                              --multiple regression equations
nlv          Real-Number,     --Northern limit of validity to use
                              --multiple regression equations
slv          Real-Number      --Southern limit of validity to use
                              --multiple regression equations
     }

Source-Datum-Coefficients-Counter-Field
                                --SCC
     ::= SEQUENCE    {
bct          Integer-Number,  --Number of longitude coefficients
act          Integer-Number   --Number of latitude coefficients
     }

Source-Datum-Longitude-Coefficients-Field   --SLG
     ::= SEQUENCE OF
          SEQUENCE    {
cbi          Integer-Number,   --i index of the coefficient of MRE b[i,j]
cbj          Integer-Number,   --j index of the coefficient of MRE b[i,j]
lgc          Real-Number       --Coefficient of MRE b[i,j] ( b[i,j]
                               --coefficients are ordered with respect
                               --to increasing i then j )
           }

Source-Datum-Latitude-Coefficients-Field     --SLT
::= SEQUENCE OF
          SEQUENCE    {
cai          Integer-Number,   --i index of the coefficient of MRE a[i,j]
caj          Integer-Number,   --j index of the coefficient of MRE a[i,j]
```

```
ltc          Real-Number       --Coefficient of MRE a[i,j] ( a[i,j]
                               --coefficients are ordered with respect
                               --to increasing i then j )
           }
```

```
Grid-Rotation-Coefficients-Field     --GRC
     ::= SEQUENCE    {
nes          Real-Number,      --Normalized Eastings Shift
nns          Real-Number,      --Normalized Northings Shift
aor          Real-Number       --Angle of orientation from source
                                 positive if clockwise
                               --datum grid to WGS84 UTM grid
     }
```

B.7.4 Supplementary-Text-Record

```
                                        --Source Graphic Description Only
Supplementary-Text-Record              --SPT
sup          ::= Supplementary-Text-Field

Supplementary-Text-Field               --SUP
     ::= SEQUENCE OF
           SEQUENCE    {
try          [0] Basic-Text-String,     --Supplementary text record type
tri          [1] Basic-Text-String      OPTIONAL,
                                        --Supplementary text field
                                        --reference identifier
txt          [2] General-Text-String    --Supplementary text
     }
```

B.7.5 Auxiliary-Parameters-Record

```
                                   --Sensor Parameters Description Only
Auxiliary-Parameters-Record            --AUP
     ::= SEQUENCE    {
sgf          [0] Source-Summary,
rci-a        [1] Bounding-Polygon-Coordinates    OPTIONAL,
                                   --see Dependency Condition 4-6
bdf          [2] Original-Scene-Band-ID,
rsd          [3] Resolution-and-Ground-Sample-Distance,
bap          [4] Basic-Auxiliary-Parameters,
aap          [5] Additional-Auxiliary-Parameters
      }

Source-Summary                         --SGF
                                   --see Dependency Condition 4-1
     ::= SEQUENCE OF
bad-x        Basic-Text-String     --Name of Derived Layer

Bounding-Polygon-Coordinates-Field     --RCI
                                        --see Source Record
Original-Scene-Band-ID                 --BDF
     ::= SEQUENCE OF
           SEQUENCE    {
bid-f        Basic-Text-String,    --Orig-Scene-Band-Identification
             SEQUENCE    {
ws1             Integer-Number,    --Signal Lower Limit
ws2             Integer-Number,    --Signal Upper Limit,
           }
```

```
Resolution-and-Ground-Sample-Distance --RSD
     ::= SEQUENCE    {
rex          Real-Number,      --Resolution at Source E-W Direction
rey          Real-Number,      --Resolution at Source N-S Direction
gsx          Real-Number       --Ground Sample Distance at Source E-W
                               --Direction
gsy          Real-Number,      --Ground Sample Distance at Source N-S
                               --Direction
gsl          Real-Number,      --Ground Sample Distance Measurement
                               --Location
unires       Real-Number       --Unit of Resolution measurement
     }

Basic-Auxiliary-Parameters             --BAP
     ::= SEQUENCE    {
vec          [0] Basic-Text-String,     --Vector or Mission name
sns          [1] Basic-Text-String      --Sensor or Instrument Name
mod          [2] General-Text-String    --Spectral Mode
prl          [3] Basic-Text-String,     --Processing Level
cdv07        [4] Basic-Text-String      --Acquisition Date
atm          [5] General-Text-String    --Acquisition Time
             [6] Incidence-Angle-Subfield   OPTIONAL,
             [7] Altitude-Subfield      OPTIONAL,
             [8] Scene-Coord            OPTIONAL,
                                        --Coordinates of the Original
                                        --Scene Centre
             [9] Solar-Angle            OPTIONAL,
                                        --Solar Angles at the Original
                                        --Scene Centre
            [10] Attitude-Angle         OPTIONAL,
                                        --Attitude Angles at the Original
                                        --Scene Centre in the Local
                                        --Orbital Reference
            [11] Pixel-Time             OPTIONAL,
                                        --Start Time of Acquisition
            [12] Attitude-Speed         OPTIONAL,
                                        --Attitude Speed at the Original
                                        --Scene Centre in the Local
                                        --Orbital Reference
     }
Incidence-Angle-Subfield
     ::= SEQUENCE    {
ang          Real-Number,               --Incidence Angle
uniang       Real-Number                --Unit of Incidence Angle
     }
Altitude-Subfield
     ::= SEQUENCE    {
ant          Real-Number,               --Altitude
unialt       Basic-Text-String          --Unit of Altitude
     }

Scene-Coord
     ::= SEQUENCE    {
lon-sc       Real-Number,               --Longitude
lat-sc       Real-Number                --Latitude
     }

Solar-Angle
     ::= SEQUENCE    {
saz          Real-Number,               --Solar Azimuth
sel          Real-Number,               --Solar Elevation
unisae       Basic-Text-String          --Unit of Solar Angles
     }
```

```
Attitude-Angle
     ::= SEQUENCE    {
rol          Real-Number,               --Roll
pit          Real-Number,               --Pitch
yaw          Real-Number,               --Yaw
unirpy       Basic-Text-String          --Unit of Attitude Angles
     }

Pixel-Time
     ::= SEQUENCE    {
pxt          Basic-Text-String,         --Pixel Time
unipxt       Basic-Text-String          --Unit of Pixel-Time
     }

Attitude-Speed
     ::= SEQUENCE    {
ros          Real-Number,               --Roll Speed
pis          Real-Number,               --Pitch Speed
yas          Real-Number,               --Yaw Speed
unispe       Basic-Text-String          --Unit of Attitude-Speed
     }

Additional-Auxiliary-Parameters       --AAP
::= SEQUENCE OF
          SEQUENCE    {
api            [0] Basic-Text-String,    --Auxiliary Parameter ID
uniapx         [1] Basic-Text-String     OPTIONAL,
                                         --Unit of Auxiliary Parameters
                                         -- see Dependency Condition
apf            [2] CHOICE  {

apn                [0] Integer-Number    --Auxiliary Par Integer Value
apr                [1] Real-Number,      --Auxiliary Par Real Value
apa                [2] Basic-Text-String --Auxiliary Par Character
                                         --String Value
                                         -- Note: Type of Parameter
                                         -- is encoded implicitly in
                                         -- ISO 8825 encapsulation
               }
           }
```

Dependency conditions (list 4):

4-1 Name of derived layer:

Name of the derived layer will be transmitted whenever the source described in the source record does not apply to all layers in the dataset.

4-2 Ellipsoid:

Mandatory if the Projection-Field is transmitted.

4-3 Vertical Datum:

Strongly recommended if elevation information is present on the source (e.g. contour lines on a raster map). Forbidden if no elevation information is present on the source.

4-4 Sounding Datum:

Mandatory if sounding information is present in the source (depth values or sounding information on a raster map). Forbidden if no sounding information is present on the source.

4-5 Geodetic Datum:

Mandatory if the Projection-Field is transmitted.

4-6 Bounding Polygon:

Mandatory when the source information is not valid for the whole dataset extension.

4-7 Parameter 2: see part 3 clause 6

4-8 Parameter 3: see part 3 clause 6

4-9 Parameter 4: see part 3 clause 6

4-10 Projection False origin:

when relevant only (usually the case).

4-11 Inset:

mandatory when relevant only.

4-12 Tile-Index-Map:

mandatory if TIF = "Y".

4-13 Unit of Auxillary Parameter:

mandatory for Integer or Real parameters.

B.8 QUALITY-FILE

```
Quality-File
|
      |- Quality-Record
      |
      |- Security-and-Release-Field
      |- Quality-Up-To-Dateness-Field
      |- Other-Quality-Information-Field
      |-
      |-R Vector-Quality-Section
             |- Completeness-and-Consistency-Field
             |- Attribute-Accuracy-Field
      |
      |-R Raster-Quality-Section
             |- Color-Patch-Description-Field
             |- Color-Code-ID-Field
      |-
      |-R Matrix-Quality-Section
             |- Nominal-Code-ID-Field
|
|- Accuracy-Record
      |- Positional-Accuracy-Field
      |-R  Bounding-Polygon-Coordinates-Field
|
      |- Component-Accuracies
             |- Horizontal-Accuracies-Record
             |- Vertical-Accuracies-Record
```

```
Quality-File
     ::= SEQUENCE    {
            SEQUENCE OF
qal             [A 8] Quality-Record,
            SEQUENCE OF
                 [A 9] CHOICE   {      --see Dependency condition 5-6
qai                          [0] Accuracy-Record
                                       OPTIONAL,
car                          [1] Component-Accuracies-Record
                                       OPTIONAL
                            }
     }
```

B.8.1 Quality-Record

```
Quality-Record                        --QAL
     ::= SEQUENCE    {
qsr-q       [0] Security-and-Release-Field,
                                       --Security classification,
                                       --handling, and release info.
                                       --see Security-and-Update-Record
quv-q       [1] Quality-Up-To-Dateness-Field
                                       OPTIONAL,
                                       --describes currency of Geo Data
                                       --Subset
qoi         [2] Other-Quality-Information-Field
                                      OPTIONAL,
                                      --Free text
```

```
          [3] CHOICE    {
             [0] Vector-Quality-Section,
             [1] Raster-Quality-Section,
             [2] Matrix-Quality-Section
          }
     }

Vector-Quality-Section
     ::= SEQUENCE    {
qcc-v           [0] Completeness-and-Consistency-Field
                                      OPTIONAL,
qaa-v           [1] Attribute-Accuracy-Field
                                      OPTIONAL
     }

Raster-Quality-Section
     ::= SEQUENCE    {
           [0] Color-Patch-Description-Field
                                      OPTIONAL,
col        [1] Color-Code-ID-Field    OPTIONAL,
                                      --see Dependency condition 5-5
     }

Matrix-Quality-Section               --NOM-M
     ::= Nominal-Code-ID-Field

Completeness-and-Consistency-Field   --QCC
     ::= SEQUENCE OF
     SEQUENCE    {
bad-c        [0] Basic-Text-String    OPTIONAL,
                                      --Layer name; see Dependency
                                       --condition 5-1
qfc          [1] Integer-Number       OPTIONAL,
                                      --Feature Completeness percent
qac          [2] Integer-Number       OPTIONAL,
                                      --Attribute Completeness percent
qlc          [3] Basic-Text-String    OPTIONAL
                                      --Logical Consistency
     }

Quality-Up-to-Dateness-Field         --QUQ
     ::= SEQUENCE    {
edn-u           [0] Integer-Number,   --Edition Number of dataset
cdv07-u         [1] Date,             --Creation of dataset date value
cdv24           [2] Date,             --Revision or Update date value
rec-u           [3] Integer-Number    OPTIONAL,
                                      --Recompilation count
rev-u           [4] Integer-Number    OPTIONAL,
                                      --Revision count
src-u           [5] Basic-Text-String, --Specification ID
cdv22-u         [6] Date              OPTIONAL,
                                      --Specification date value; see
                                       --Dependency condition 5-2
spa-u           [7] Basic-Text-String OPTIONAL,
                                      --Specification amendment; see
cdv20           [8] Date              OPTIONAL,
                                      --Earliest source date value
cdv21           [9] Date              OPTIONAL
                                      --Latest source date value
     }
```

```
Attribute-Accuracy-Field              --QAA
     ::= SEQUENCE OF
     SEQUENCE    {
bad-a   [0] Basic-Text-String          OPTIONAL,
                                       --Layer name; see Dependency
                                       --condition 5-3
qut     [1] Integer-Number             OPTIONAL,
                                       --Standard Deviation of
                                       --Quantitative Attributes
qul     [2] Integer-Number             OPTIONAL,
                                       --Percent Reliability of
                                       --Qualitative Attributes
ccr     [3] Basic-Text-String          OPTIONAL,
                                       --Collection Criteria
     }

Color-Patch-Description-Field
     ::= SEQUENCE    {
cpt     [0] Color-Patch-Type-Subfield,
cpi     [1] Color-Patch-ID-Subfield   OPTIONAL,
spr-c   [2] Dataset-Parameters-Subfield
                                       OPTIONAL
                                       --see Dependency condition 5-4
                                       --see General-Information-Record

     }

Color-Patch-Type-Subfield             --CPT
scr     ::= Basic-Text-String          --Standard color patch reference

Color-Patch-ID-Subfield               --CPI
     ::= SEQUENCE OF
     SEQUENCE    {
pnm     Basic-Text-String,             --Color Patch Name (e.g. Red)
pir     Integer-Number,                --Patch Intensity Value - Red
pig     Integer-Number,                --Patch Intensity Value - Green
pib     Integer-Number                 --Patch Intensity Value - Blue
     }Color-Code-ID-Field                   --COL
     ::= SEQUENCE OF
     SEQUENCE    {
cbd       [0] Basic-Text-String,       --Name and / or Description of
                                         Color
                                       --Code
ccd       [1] Integer-Number,          --Color Code Assigned in Dataset
                                       --(0-255)
          [2] CIE-Color-Description-Subfield
                                       OPTIONAL,
          [3] RGB-Color-Description-Subfield
                                       OPTIONAL,
     }

CIE-Color-Description-Subfield
     ::= SEQUENCE    {
           [0] SEQUENCE    {
cr1                Integer-Number,     --CIEx
cr2                Integer-Number,     --CIEy
cr3                Integer-Number      --CIE Reflectivity (y)
           }
frm        [1] Basic-Text-String       OPTIONAL,
                                       --mathematical relation to other
                                       --colour codes (free text)
                                       --see part 2 sec. 10.4
     }
```

```
RGB-Color-Description-Subfield
     ::= SEQUENCE    {
           [0] SEQUENCE    {
nsr                 Integer-Number,      --Color Intensity - Red
                                         -- actual (0-255)
nsg                 Integer-Number,      --Color Intensity - Green
                                         -- actual (0-255)
nsb                 Integer-Number       --Color Intensity - Blue
                                         -- actual (0-255)
           }
bad-rg     [1] Basic-Text-String         OPTIONAL,
                                         --Layer name
     }

Nominal-Code-ID-Field                         --NOM
     ::= SEQUENCE OF
           SEQUENCE    {
nci                Basic-Text-String,    --Code Identifier
nbd                Basic-Text-String,    --Description / meaning of code
ncd-n              Integer-Number        --Nominal code assigned in dataset
bad-rg             Basic-Text-String     OPTIONAL,
                                         --Layer name
           }

Other-Quality-Information-Field     --QOI
oqi      ::= General-Text-String         --Free Text
```

B.8.2 Accuracy-Record

```
Accuracy-Record                          --QAI
     ::= SEQUENCE OF
     SEQUENCE    {
qap      [0] Positional-Accuracy-Field, --Positional accuracy of the
                                         --dataset file
         [1] SEQUENCE OF
rci-a                  Bounding-Polygon-Coordinates-Field
                                          OPTIONAL
                                          --Coordinates of the polygon
                                          --delineating the accuracy
                                          --region; see Dependency
                                          --condition 5-8
     }

Positional-Accuracy-Field          --QAP
     ::= SEQUENCE    {
aah-p        [0] Integer-Number,     --Accuracy Absolute Horizontal
uniaah       [1] Integer-Number,     --Unit of measure
aav          [2] Integer-Number,     --Accuracy Absolute Vertical
uniaav       [3] Integer-Number,     --Unit of measure
aph          [4] Integer-Number,     --Accuracy Point to Point Horizontal
uniaph       [5] Integer-Number,     --Unit of measure
apv          [6] Integer-Number,     --Accuracy Point to Point Vertical
uniapv       [7] Integer-Number,     --Unit of measure
bad-p        [8] Basic-Text-String   OPTIONAL
                                     --Layer name; see Dependency
                                     --condition 5-7
     }
```

```
--Bounding-Polygon-Coordinates-Field     RCI
                                           --see Source-Record
```

B.8.3 Component-Accuracies-Record

```
Component-Accuracies-Record              --CAR
     ::= SEQUENCE    {
          Horizontal-Accuracies-Record OPTIONAL,
                                    --see Dependency Condition 5-6
          Vertical-Accuracies-Record   OPTIONAL
                                    --see Dependency Condition 5-6
     }
```

B.8.3.1 Horizontal-Accuracies-Record

```
Horizontal-Accuracies-Record        --HOR
     := SEQUENCE OF
         SEQUENCE    {
ash            [0] Horizontal-Accuracies-Field,
rci-h          [1] SEQUENCE OF
                      Bounding-Polygon-Coordinates-Field
                                      OPTIONAL
                                      --see Dependency condition 5-8
         }

Horizontal-Accuracies-Field         --ASH
     ::= SEQUENCE    {
aah-h      [0] Integer-Number,         --Absolute Horizontal Accuracy
uniaah-h   [1] Integer-Number,         --Unit of measure
aph-h      [2] Integer-Number,         --Relative Horizontal Accuracy
uniaph-h   [3] Integer-Number,         --Unit of measure
bad-h      [4] Basic-Text-String      OPTIONAL
                                       --Layer name; see Dependency
                                       --condition 5-7
     }

--Bounding-Polygon-Coordinates-Field     RCI
                                           --see Source-Record
```

B.8.3.2 Vertical-Accuracies-Record

```
Vertical-Accuracies-Record             --VER
     := SEQUENCE OF
         SEQUENCE    {
asv            [0] Aertical-Accuracies-Field,
rci-h          [1] SEQUENCE OF
                      Bounding-Polygon-Coordinates-Field
                                      OPTIONAL
                                      --see Dependency condition 5-8
         }

Vertical-Accuracies-Field         --ASV
     ::= SEQUENCE    {
aav-v      [0] Integer-Number,         --Absolute Vertical Accuracy
uniaav-v   [1] Integer-Number,         --Unit of measure
apv-v      [2] Integer-Number,         --Relative Vertical Accuracy
uniapv-v   [3] Integer-Number,         --Unit of measure
bad-v      [4] Basic-Text-String      OPTIONAL
                                       --Layer name; see Dependency
                                       --condition 5-7
     }
```

```
--Bounding-Polygon-Coordinates-Field     RCI
                                           --see Source-Record
```

Dependency conditions (list 5):

5-1 Name of layer:
The name of the layer will be transmitted whenever the completeness and consistency information does not apply to all layers in the dataset.

5-2 Revision date:
If relevant only.

5-3 Name of layer:
The name of the layer will be transmitted whenever the completeness and consistency information does not apply to all layers in the dataset.

5-4 Color patch dataset parameters:
The color patch dataset parameters will be transmitted if the color patch image file exits.

5-5 Color coded:
Must be defined when raster color-coded data is transmitted (STR = 2). Forbidden otherwise.

5-6 Accuracy record:
Must be used when both horizontal and vertical accuracy are known and homogeneous on the same area. If it is absent then both horizontal and vertical accuracy records must be present.

5-7 Name of layer:
The name of the layer will be transmitted whenever the completeness and consistency information does not apply to all layers in the dataset.

5-8 Bounding polygon:
Mandatory when the source information is not valid for the whole dataset extent.

B.9 VECTOR-GEO-DATA-FILE

```
Vector-Geo-Data-File
|
|-R Edge-Record
      |- Edge-Implicit-Relation-Pointers-Field
      |- Implicit-Relations-Pointer-Field
      |- Implicit-Attributes-Field
      |- Explicit-Attribute-Labels-and-Values-Field
      |- Coordinates-Field
|
|-R Node-Record
      |- Node-Implicit-Relation-Pointer-Field
      |- Implicit-Relations-Pointer-Field
      |- Explicit-Attribute-Labels-and-Values-Field
      |- Coordinates-Field
|
|-R Face-Record
      |- Implicit-Relations-Pointer-Field
      |- Implicit-Attributes-Field
      |- Explicit-Attribute-Labels-and-Values-Field
|
|-R Spatial-Data-Record
      |- Implicit-Relations-Pointer-Field
      |- Implicit-Attributes-Field
      |- Explicit-Attribute-Labels-and-Values-Field
      |- Coordinates / elevation-Field
|
|-R Feature-Record
      |- Implicit-Relation-Pointer-Field
      |- Feature-Implicit-Attributes-Field
      |- Feature-Explicit-Attribute-Labels-and-Values-Field
             |-R -  Explicit-Relation-Pointer-Field
             |-R -  Explicit-Relation-Value-Field
|
|-R Text-Placement-Record
      |- Implicit-Relations-Pointers-Field
      |- Explicit-Attribute-Labels-and-Values-Field
      |- Text-Field
      |- Coordinates-Field
|
|-R Feature / Attribute-Entry-Record
      |- Feature-Attribute-Entry-Field
|
|-R Feature / Attribute-Association-Record
      |- Feature-Association-Field
      |- Attribute-Association-Field
|
|-R Attribute / Value-Association-Record
      |- Attribute-Format-Description-Field
      |- Attribute-Value-Description-Field
```

```
Vector-Geo-Data-File
     := SEQUENCE    {
          [0] SEQUENCE OF
ed              Edge-Record           OPTIONAL,
                                      --see Dependency condition 6-1
          [1] SEQUENCE OF
no              Node-Record           OPTIONAL,
                                      --see Dependency condition 6-4
          [2] SEQUENCE OF
fe              Face-Record           OPTIONAL,
                                      --for Level 3 topology only;
                                      --Levels 0-2: not included
sp        [3] SEQUENCE OF
                Spatial-Data-Record   OPTIONAL,
                                      --Optional for Level 0 topology;
                                      --see Dependency condition 6-3;
                                      --Levels 1-3: not included
          [4] SEQUENCE OF
                Feature-Record,
          [5] SEQUENCE OF
tp              Text-Placement-Record
                                      OPTIONAL,
          [6] SEQUENCE OF
dd              Feature / Attribute-Entry-Record
                                      OPTIONAL,
                    --see Dependency condition 6-10
          [7] SEQUENCE OF
df               Feature / Attribute-Association-Record
                                      OPTIONAL,
          [8] SEQUENCE OF
da               Attribute / Value-Association-Record
                                      OPTIONAL
                                      --see Dependency condition 6-11
     }
```

B.9.1 Edge-Record

```
Edge-Record                           --ED
     ::= [A 10] SEQUENCE    {
         [0] Record-ID-Number,
ire-e    [1] Edge-Implicit-Relation-Pointers-Field
                                       OPTIONAL,
                                       --Mandatory for Level 3 topology,

                                       --Levels 1 and 2:  Optional Level
                                       --0: not included
irs-e    [2] Implicit-Relations-Pointer-Field
                                       OPTIONAL,
                                       --Optional for all levels of
                                       --topology
iat-e    [3] Implicit-Attributes-Field
                                       OPTIONAL,
                                       --Optional for all levels of
                                       --topology
att-e    [4] Explicit-Attribute-Labels-and-Values-Field
                                       OPTIONAL,
                                       --Optional for all levels of
                                       --topology
cor-e    [5] Edge-Coordinates-Field    --Mandatory for all levels of
                                       --topology
     }
```

```
Record-ID-Number
     ::= Integer-Number                --Unique ID number of the record

Edge-Implicit-Relation-Pointers-Field   --IRE
     ::= SEQUENCE    {
          [0] Face-Topology-Subfield      OPTIONAL,
                                       --Level 3 topology : Mandatory;
                                       --Levels 0-2: not included
          [1] Edge-Node-Topology-Subfield
                                       OPTIONAL,
                                       --Level 3 topology: Mandatory ;
                                       --Levels 1 and 2: Optional;
                                       --Level 0: Not included
          [2] Winged-Edge-Topology-Subfield
                                       OPTIONAL
                                       --Levels 1, 2, and 3 topology:
                                       --Optional,
                                       --Level 0: Not included
     }

Face-Topology-Subfield
     ::= SEQUENCE    {
fal           Integer-Number,          --Left-Face-Pointer
far           Integer-Number           --Right-Face-Pointer
     }

Edge-Node-Topology-Subfield
     ::= SEQUENCE    {
nos-e          Integer-Number,         -- Start-Node-Pointer,
noe-e          Integer-Number          -- End-Node-Pointer
     }

Winged-Edge-Topology-Subfield
     ::= SEQUENCE    {
ner           Integer-Number,          --Pointer-to-Next-Right-Edge,
nel           Integer-Number           --Pointer-to-Previous-Left-Edge
     }

-- Note: In DIGEST B pointer information is considered to be
-- Unclassified. Only DIGEST A provides the capability of defining
-- Security at the pointer field level.

Implicit-Relations-Pointer-Field  --IRS
                                       --Optional reverse pointer back to
                                       --Line feature or Area feature
                                       --(Level 2, 1 or 0) for Edges, and
                                       --back to Point feature for Nodes
     ::= SEQUENCE OF
rid-COS      Integer-Number,           --Record ID; Mandatory for all
                                       --levels of topology

Implicit-Attributes-Field         --IAT
     ::= SEQUENCE    {
mie     [0] Fraction-Number,           --Minimum Easting / Longitude
                                         Value
                                       --of the MBR; mandatory for all
                                       --levels of topology
min     [1] Fraction-Number,           --Minimum Northing / Latitude
                                         Value
                                       --of the MBR; mandatory for all
                                       --levels of topology
```

```
zwi     [2] Fraction-Number            OPTIONAL,
                                       --Minimum Elevation Value of the
                                       --MBR;see Dependency condition
                                       -- 6-2, 6-6, 6-7
mae     [3] Fraction-Number,           --Maximum Easting / Longitude
                                         Value
                                       --of the MBR; mandatory for all
                                       --levels of topology
man     [4] Fraction-Number,           --Maximum Northing / Latitude
                                         Value
                                       --of the MBR;
                                       --mandatory for all levels of
                                       --topology
zv2     [5] Fraction-Number            OPTIONAL
                                       --Maximum Elevation Value of the
                                       --MBR;see Dependency condition
                                       -- 6-2, 6-6, 6-7
     }
```

```
Explicit-Attribute-Labels-and-Values-Field
                                  --ATT
     ::= SEQUENCE OF
           SEQUENCE    {
atc          Basic-Text-String,        --Attribute label; Mandatory for
                                       --all levels of topology
val          CHOICE    {               --Attribute Value; consistent with
                                       --value of for subfield;
                                       --Mandatory for all levels of
                                       --topology.  The value format can
                                       --be determined from the choice.
               [0] Basic-Text-String,
               [1] Integer-Number,
               [2] Real-Number
             }
           }
```

```
Edge-Coordinates-Field            --COR-E
     ::= CHOICE   {
               [0] Abs-Coordinate-String,
               [1] Rel-Coordinate-String,
               [2] Dif-Coordinate-String
                                       --see Dependency condition 6-6.
     }
```

B.9.2 Node-Record

```
Node-Record                     --NO
     ::= [A 11] SEQUENCE    {
            [0] Record-ID-Number,
irn         [1] Node-Implicit-Relation-Pointer-Field
                                      OPTIONAL,
                                      --Level 3 topology: Mandatory ;
                                      --Levels 0-2: Not included
irs-n       [2] Implicit-Relations-Pointer-Field
                                      OPTIONAL,
                                      --Optional for all levels of
                                      --topology
att-n       [3] Explicit-Attribute-Labels-and-Values-Field
                                      OPTIONAL,
                                      --Optional for all levels of
                                      --topology
cor-n       [4] Coordinate-Field      --Mandatory for all levels of
                                      --topology
     }
```

```
--Record-ID-Number                   --see Edge-Record

Node-Implicit-Relation-Pointer-Field    --IRN
     ::=  Integer-Number            OPTIONAL,
                                      --Containment pointer, only for
                                      --isolated nodes. see Dependency
                                      --condition 6-5
     }

--Implicit-Relations-Pointer-Field      --IRS
                                      --Optional reverse pointer back
                                      --to point feature; --see
                                      --Edge-Record

--Explicit-Attribute-Labels-and-Values-Field   --ATT
                                      --see Edge-Record

Coordinate-Field                      --COR
       ::= SEQUENCE OF
            SEQUENCE    {
lon-f          [0] Fraction-Number,    --Longitude / Easting
lat-f          [1] Fraction-Number,    --Latitude / Northing
ele-f          [2] Real-Number         OPTIONAL
                                       --Elevation
     }
```

B.9.3 Face-Record

```
Face-Record                           --FE
                                       --for Level 3 topology only
     ::= [A 12] SEQUENCE    {
          [0] Record-ID-Number,
irs-r     [1] Implicit-Relations-Pointer-Field
                                       OPTIONAL,
iat-r     [2] Implicit-Attributes-Field
                                       OPTIONAL,
att-r     [3] Explicit-Attribute-Labels-and-Values-Field
                                       OPTIONAL
     }
--Record-ID-Number                    --see Edge-Record

--Implicit-Relations-Pointer-Field     IRS
                                       --see Edge-Record

--Explicit-Attributes-Labels-and-Values-Field
                                       ATT
                                       --see Edge-Record
--Implicit-Attributes-Field            IAT
                                       --see Edge-Record
```

B.9.4 Feature-Record

```
Feature-Record                       --FL for line feature, FP for
                                       --point feature, FA for area
                                       --feature, FC for complex feature;
                                       --for all levels of topology
```

```
     ::= [A 13] SEQUENCE    {
          [0] Record-ID-Number,
irs-f     [1] Feature-Implicit-Relations-Pointer-Field,
iat-f     [2] Feature-Implicit-Attributes-Field,
att-fe    [3] Feature-Explicit-Attribute-Labels-and-Values-Field
                                        OPTIONAL,
          [4] SEQUENCE OF
r1l             Explicit-Relation-Pointers-Field
                                        OPTIONAL
     }

--Record-ID-Number                   --see Edge-Record

Feature-Implicit-Relations-Pointer-Field  --IAT-F
     ::= Basic-Text-String      {FL|FP|FA|FC}
                                        --Feature Type: Line, Point,
                                        --Area, Complex

Feature-Implicit-Attributes-Field     --IAT-F
     ::= SEQUENCE    {
fac        [0] Basic-Text-String,       --FACC identifier code
iat-i      [1] Implicit-Attributes-Field
                                        OPTIONAL,
           [2] Control-Point-Subfield
                                        OPTIONAL
     }

--Implicit-Attributes-Field             --IAT
                                        --see Edge-Record

Control-Point-Subfield
     ::= SEQUENCE    {
glo          Real-Number,               --Longitude / Easting of
                                        --geographic reference point
gla          Real-Number                --Latitude / Northing of
                                        --geographic reference point
     }

Feature-Explicit-Attribute-Labels-and-Values-Field
                                       --ATT-F
     ::= SEQUENCE OF
           SEQUENCE    {
                 [0] Ordered-Rooted-Tree-Links
                                        OPTIONAL,
                                        --see Dependency condition 6-9
att-f            [1] Explicit-Attribute-Labels-and-Values-Field
           }

Ordered-Rooted-Tree-Links
     ::= SEQUENCE OF
           SEQUENCE    {
llk              Integer-Number,        --Left link
rlk              Integer-Number         --Right link
           }
Note: These two subfields are maintained for backward compatibility.

--Explicit-Attribute-Labels-and-Values-Field     ATT
                                        --see Edge-Record

Explicit-Relation-Pointers-Field     --R1L
     ::= SEQUENCE    {
ert          Basic-Text-String          --Relation type
                                        --see Dependency condition 6-8
r1v          Explicit-Relation-Value-Field
     }
```

```
Explicit-Relation-Value-Field        --R1V
     ::=SEQUENCE OF
rid-e          Integer-Number,         --Record ID Number
```

B.9.5 Text-Placement-Record

```
Text-Placement-Record                 --TP
                                       --for all levels of topology
     ::= [A 14] SEQUENCE    {
          [0] Record-ID-Number,
irs-t     [1] Implicit-Relations-Pointer-Field
                                       OPTIONAL,
att-t     [2] Explicit-Attribute-Labels-and-Values-Field
                                       OPTIONAL,
txt-t     [3] Text-Field,              --Text
cor-t     [4] Coordinate-Field
     }

--Record-ID-Number                   --see Edge-Record

--Implicit-Relation-Pointer-Field     --IRS
                                       --see Edge-Record

--Explicit-Attribute-Labels-and-Values-Field
                                      --ATT
                                       --see Edge-Record

Text-Field                            --TXT
ftx     ::= General-Text-String        --Text

--Coordinate-Field                    COR
                                       --see Node-Record
```

B.9.6 Feature / Attribute-Entry-Record

```
Feature / Attribute-Entry-Record        --DD
                                       --see Dependency condition 6-10
     ::= [A 15] SEQUENCE    {
          Record-ID-Number,
dfa          Feature / Attribute-Entry-Field
     }
```

```
--Record-ID-Number                    see Edge-Record

Feature / Attribute-Entry-Field         --DFA
     ::= SEQUENCE    {
faq          [0] Integer-Number,       --Feature or attribute ( 1 =
                                       --Feature; 2 = Attribute )
lab          [1] Basic-Text-String,    --Feature code / name or Attribute
                                       --label
sog          [2] Basic-Text-String    OPTIONAL,
                                       --Source for the feature or
                                       attribute
des          [3] Basic-Text-String    OPTIONAL,
                                       --Description of originator and /
                                       --or source
fan          [4] Basic-Text-String    OPTIONAL,
                                       --Short name for the feature or
                                       --attribute
def          [5] General-Text-String  --Attribute or feature definition
     }
```

B.9.7 Feature / Attribute-Association-Record

```
Feature / Attribute-Association-Record   --DF
     ::= [A 16] SEQUENCE    {
           Record-ID-Number,
daa        Feature-Association-Field,
aad        Attribute-Association-Field
     }

--Record-ID-Number                 --see Edge-Record

Feature-Association-Field             --DAA
lab-f     ::= Basic-Text-String       --Feature label

Attribute-Association-Field          --AAD
     ::= SEQUENCE OF
alb-f          Basic-Text-String      --Attribute label
     B.9.8   Attribute / Value-Association-Record

Attribute / Value-Association-Record    --DA
                                      --see Dependency condition 6-11
     ::= [A 17] SEQUENCE    {
          [0] Record-ID-Number,
dav       [1] Attribute-Format-Description-Field,
vad       [2] Attribute-Value-Description-Field
                                      OPTIONAL
                                      --see Dependency condition 6-12
     }

--Record-ID-Number                 --see Edge-Record
```

```
Attribute-Format-Description-Field    --DAV
     ::= SEQUENCE    {
lab-a         [0] Basic-Text-String,   --Attribute label
avt           [1] Basic-Text-String,   --enumerated "EN" or
                                       --actual value "AV"
avf           [2] Basic-Text-String    OPTIONAL
                                       --Attribute value format
                                       --see Dependency condition 10-2
avu           [3] Basic-Text-String    OPTIONAL
                                       --Attribute measurement unit
                                       --see Dependency condition 10-2
     }
Attribute-Value-Description-Field    --VAD
     ::= SEQUENCE OF
           SEQUENCE    {
alb-v           Integer-Number,        --Attribute values; enumerated
                                       --values of Integer only
avd-v           General-Text-String    --Attribute value definition
           }
```

Dependency conditions (list 6):

6-1 Edge-Record:
Vector geodata files containing only nodes and no edges or faces may exist. Edge record is mandatory if Vector geodata file contains Line or Area feature records.

6-2 Elevation MBR subfield (edge record):
Minimum and maximum elevation must be transmitted if the transmitted coordinates (COR) contain elevation value(s).

6-3 Elevation Coordinates subfield:
Elevation must be absent or present for all transmitted coordinates; that is, either elevation is present for all transmitted coordinates, or for none, but not for some.

6-4 Node-Record:
Vector geodata files without any node record may exist. Node record is mandatory if Vector geodata file contains Point feature records or if Edge record contains edge-node topology description.

6-5 Connected node IRN:
Containment pointers are allowed only for isolated nodes at level three topology.

6-6 Elevation MBR subfield (face record):
Minimum and maximum elevation must be transmitted if the bordering edges are transmitted with elevation value(s) in their coordinates field (COR).

6-7 Elevation MBR subfield (feature record):
If any of the topological entities, composing or bordering the simple feature or any of the simple feature composing the complex feature, contains elevation values in its coordinates field, maximum and minimum elevation values will be transmitted.

6-8 Relationship Type Restriction:
Complex Feature (FC) type is not appropriate for stacked on / stacked under (STK / STU) relationship type.

6-9 Left / Right Link:
Left and right link subfield will exist for all attributes, if there is at least one multi-level attribute.

6-10 Feature / Attribute-Entry-Record:
Will be present if any Feature (or attribute) transmitted in the Vector Geodata file is not described in FACC (DIGEST Part 4).

6-11 Attribute / Value-Association-Record:
Will be present for each attribute transmitted in the Vector Geodata file that is not present in FACC.

6-12 Attribute value format / Attribute measurement unit:
Depends on type of attribute.

B.10 RASTER-GEO-DATA-FILE

```
Raster-Geo-Data-Field
|
|-R Image-Record
      |- Record-ID-Number
      |- Pixel-Field
```

```
Raster-Geo-Data-File

     ::= [A 18] SEQUENCE OF
img         Image-Record
```

B.10.1 Image-Record

```
Image-Record                        --IMG
      ::= SEQUENCE    {
            Record-ID-Number,
scn         Pixel-Field
     }
--Record-ID-Number                 --see Edge-Record

Pixel-Field                         --SCN
      ::= OCTETSTRING                 --Pixel values
```

B.11 MATRIX-GEO-DATA-FILE

```
Matrix-Geo-Data-File
|
|-R Matrix-Record
      |- Record-ID-Number
      |- Element-Field
```

```
Matrix-Geo-Data-File
        ::= [A 19] SEQUENCE OF
var          Matrix-Record
```

B.11.1 Matrix-Record

```
Matrix-Record                         --VAR
       ::= SEQUENCE    :
             Record-ID-Number,
scn-m        Element-Field
       }

--Record-ID-Number                    --see Edge-Record

Element-Field                         --SCN-M
       ::= OCTETSTRING                   --Element values
```