INTERNATIONAL STANDARD

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Information technology — Digital compression and coding of continuous-tone still images: Registration of JPEG profiles, SPIFF profiles, SPIFF tags, SPIFF colour spaces, APPn markers, SPIFF compression types and Registration Authorities (REGAUT)

Technologies de l'information — Compression numérique et codage des images fixes de nature photographique: Enregistrement des profils JPEG, profils SPIFF, «SPIFF tags», espaces de couleur SPIFF, marqueurs APPn, types de compression SPIFF et autorités d'enregistrement (REGAUT)

Reference number
ISO/IEC 10918-4:1999(E)

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 10918 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 10918-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation T.86.

ISO/IEC 10918 consists of the following parts, under the general title *Information technology — Digital compression and coding of continuous-tone still images*:

— *Part 1: Requirements and guidelines*

— *Part 2: Compliance testing*

— *Part 3: Extensions*

— *Part 4: Registration of JPEG profiles, SPIFF profiles, SPIFF tags, SPIFF colour spaces, APPn markers, SPIFF compression types and Registration Authorities (REGAUT)*

— *Part 5: MHEG subset for base level implementation*

Annexes A to C of this part of ISO/IEC 10918 are for information only.

Please note that the following definitions were omitted in subclause 3.2 “Abbreviations and Acronyms”:

JBIG	Joint Bi-level Image experts Group
JPEG	Joint Photographic Experts Group
PTSMCR	Profiles, Tags, colour Spaces, Markers, Compression type and REGAUT
REGAUT	REGistration AUThority
SPIFF	Still Picture Interchange File Format

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INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – DIGITAL COMPRESSION AND CODING OF CONTINUOUS-TONE STILL IMAGES: REGISTRATION OF JPEG PROFILES, SPIFF PROFILES, SPIFF TAGS, SPIFF COLOUR SPACES, APPn MARKERS, SPIFF COMPRESSION TYPES AND REGISTRATION AUTHORITIES (REGAUT)

1 Scope

This Recommendation | International Standard provides for the unique registration of JPEG and SPIFF Profiles, SPIFF Tags, SPIFF colour Spaces, application specific Markers, SPIFF Compression types and images Registration authorities as defined in the CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3. Unless otherwise specified, (P)rofiles, (T)ags, colour (S)paces, (M)arkers, (C)ompression types and image (R)egistration authorities will be referred to as PTSMCR items. ISO/IEC JTC 1 SC 29 will delegate to a designated Authority the role to collect, study, approve, register and disseminate the relevant information to allow for the customization of JPEG standard.

The following table gives an overview of the main issues about registration of PTSMCR items.

	Designation	Origin of requests	Qty range	Notes
P	Profile	std. implementers	units	fundamental issue
T	index Tag	application field	tens	various contents (Note 1)
S	colour Space	std implementers	units	technical issue
M	Marker	std implementers	units	restricted use
C	Compression	conceptor	units	standards use
R	REGAUT	institutions	thousands	through National Bodies (Note 2)

NOTE 1 – Tags can create a language problem, and this Recommendation | International Standard stipulates that only the English version of the content can be registered to avoid misunderstanding. The National Bodies should provide translation facilities for registrants in their countries.

NOTE 2 – Due to the large number of potential applicants, the PTSMCR Authority delegates the National Bodies to register new REGAUTs. This disposition solves the language and the legal problems raised from different countries.

2 Normative references

The following Recommendations and International Standards contain provisions which, through references in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical ITU-T Recommendations | International Standards

- CCITT Recommendation T.81 (1992) | ISO/IEC 10918-1:1994, *Information technology – Digital compression and coding of continuous-tone still images: Requirements and guidelines*.
- ITU-T Recommendation T.82 (1993) | ISO/IEC 11544:1993, *Information technology – Coded representation of picture and audio information – Progressive bi-level image compression [plus Technical Corrigendum 1 (1995)]*.

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- ITU-T Recommendation T.83 (1994) | ISO/IEC 10918-2:1995, *Information technology – Digital compression and coding of continuous-tone still images: Compliance testing*.
- ITU-T Recommendation T.84 (1996) | ISO/IEC 10918-3:1997, *Information technology – Digital compression and coding of continuous-tone still images: Extensions*.

2.2 Additional references

- ITU-T Recommendation T.85 (1995), *Application profile for Recommendation T.82 – Progressive bi-level image compression (JBIG coding scheme) for facsimile apparatus*.
- ITU-T Recommendation T.87 (1998) | ISO/IEC 14495-1: 1998, *Information technology – Lossless and near-lossless compression of continuous-tone still images – Baseline*.
- ISO 3166-1:1997, *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes*.
- ISO 8601:1988, *Data elements and interchange formats – Information interchange – Representation of dates and times*.
- ISO 8859-1:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 1: Latin alphabet No. 1*.
- ISO 8859-2:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 2: Latin alphabet No. 2*.
- ISO 8859-3:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 3: Latin alphabet No. 3*.
- ISO 8859-4:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 4: Latin alphabet No. 4*.
- ISO 8859-5:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 5: Latin/Cyrillic alphabet*.
- ISO 8859-6:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 6: Latin/Arabic alphabet*.
- ISO 8859-7:1987, *Information processing – 8-bit single-byte coded graphic character sets – Part 7: Latin/Greek alphabet*.
- ISO 8859-8:1988, *Information processing – 8-bit single-byte coded graphic character sets – Part 8: Latin/Hebrew alphabet*.
- ISO/IEC 8859-9:1989, *Information processing – 8-bit single-byte coded graphic character sets – Part 9: Latin alphabet No. 5*.
- ISO/IEC 8859-10:1992, *Information technology – 8-bit single-byte coded graphic character sets – Part 10: Latin alphabet No. 6*.
- ISO/IEC 10646-1:1993, *Information technology – Universal Multiple-Octet Coded Character Set (UCS) – Part 1: Architecture and Basic Multilingual Plane*.
- CIE 1976 (L* a* b*) space, *CIE Publication No. 15.2, Colorimetry, 2nd Ed. (1986)*.

3 Definitions, abbreviations, and symbols

3.1 Definitions

In addition to the definitions used in CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3, the following definitions used in this Recommendation | International Standard are listed below.

3.1.1 License Plate (LP): A unique identifier, appearing in the SPIFF directory, delivered by a REGAUT in compliance with ITU-T Rec. T.84 | ISO/IEC 10918-3 containing COPIR_ID, REGCON, REGAUT and REGID. The length is 8 + 64 bits.

3.1.2 PROFILE: A specific set of capabilities, parameter values or ranges, and optionally file format. A specific implementation of the encoding processes in CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3.

3.1.3 PTSMCR Authority: ISO/IEC JTC1/SC29/WG1 or its delegate is the PTSMCR Authority.

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3.1.4 PTSMCR Registration: Official unique listing of a profile, tag, colour space, marker, compression type, or image Registration Authorities (REGAUT).

3.1.5 Joint Bi-level Image experts Group (JBIG): The joint ISO/ITU committee responsible for developing standards for bi-level image coding. It also refers to the standard produced by this committee: ITU-T Rec. T.82 | ISO/IEC 11544.

3.1.6 Joint Photographic Experts Group (JPEG): The joint ISO/ITU committee responsible for developing standards for continuous tone still picture coding. It also refers to the standards produced by this committee: CCITT Rec. T.81 | ISO/IEC 10918-1, ITU-T T.83 | ISO/IEC 10918-2, and ITU-T Rec. T.84 | ISO/IEC 10918-3.

3.1.7 REGistration AUThority (REGAUT): An identifier specifying a particular registration authority as designated by ISO/IEC JTC1/SC29.

3.1.8 Still Picture Interchange File Format (SPIFF): A file format defined by ITU-T Rec. T.84 | ISO/IEC 10918-3 intended for use by a wide variety of applications to exchange still pictures.

3.2 Abbreviations and acronyms

For the purposes of this Recommendation | International Standard, the following abbreviations apply.

3.3 Symbols

For a listing of symbols used in this Recommendation | International Standard see CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3.

4 General

This Specification provides for the unique registration of JPEG and SPIFF profiles, SPIFF tags, SPIFF colour spaces, SPIFF compression types, image registration authorities, and application specific markers found in the CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3. Unless otherwise specified, (P)rofiles, (T)ags, colour (S)paces, (M)arkers, (C)ompression type, and (R)egistration Authorities (REGAUT) will be referred to as PTSMCR items. A registration authority, hereafter referred to as the PTSMCR Authority, shall collect all approved markers and disseminate this information to allow for the customization of JPEG.

Registration of JPEG and SPIFF profiles and APPn markers gives implementers the ability to document the capabilities and requirements of their JPEG and SPIFF implementations. The PTSMCR authority serves as a repository of this information which may be queried by implementers to ensure interoperability. Registration of SPIFF tags, SPIFF colour spaces and SPIFF compression types allows for the extension of SPIFF capabilities without requiring that new standards be written. Image registration authorities provide producers of digital imagery unique identifiers to be inserted inside image files for legal protection of content. Any institution which servers as an image registration authority must empowered to do so by the PTSMCR Authority via the registration process.

4.1 JPEG and SPIFF profiles (see ITU-T Rec. T.84 | ISO/IEC 10918-3, F.2.1)

Profiles shall define a specific set of capabilities and parameter values or ranges that are a subset of the JPEG standard. A profile specifies the exact value, a range of values or an excluded status for every marker allowed in JPEG parts 1 and 3. For example, a JPEG profile could require restart markers, at certain intervals in the image, whereas the basic standard provides that markers are optional.

These profiles may be assigned a SPIFF profile ID number (see the SPIFF file header syntax). There is a number reserved for profiles that have not yet been registered and a number reserved to indicate that a profile number is defined in a special tag. A profile ID number of 254 (X'FE') is reserved for use in unregistered profiles. This profile ID may be used provisionally while an applicant awaits assignment of a permanent profile ID from the PTSMCR Authority. The profile ID number 255 (X'FF') is reserved for future use and shall indicate that the profile ID number follows in a special tag.

A profile is not intended to replace the normal signalling in a JPEG data stream. All necessary tags must still be present even though they are redundant to a decoder that comprehends the profile.

NOTE – Signalling a profile shall be done either in the SPIFF header or in a separately registered APPn marker.

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4.1.1 Purpose of a profile

Profiles define conforming subsets or combinations of the specific markers and tags used to provide particular JPEG functionality. The choice of options and ranges should be restricted so as to maximize the probability of achieving the objective of the profile. A profile can also describe file format or non-JPEG functionality (e.g. colour spaces).

4.1.2 Criteria for acceptance of a profile

A proposed new profile shall meet the following criteria:

- Unique – It shall not duplicate a profile already defined.
- Valid – It shall be a valid instantiation of the JPEG standard or SPIFF format.
- Correct submission – It shall be a syntactically correct submission that includes appropriate explanations of purpose.
- Utility – It shall demonstrate utility to the user.

Given these criteria are met, the profile shall be accepted.

4.1.3 Contents of the submission

The profile description shall include a normative section and an informative section. The normative section contains information necessary to properly decode the data file. This section can point to other standards or describe, in detail, application specific information necessary to understand the file. The normative section defines which markers and tags are required, excluded, or allowed. For each tag that is required or allowed, the value, set of values, and/or range of values is specified for each parameter. This section can also specify a file structure.

When a profile registrant contacts the PTSMCR Authority, they will be required to complete two sets of tables. The first set (three tables) describe which JPEG markers and SPIFF tags are required, allowed, or excluded in the profile. An example of the use of these tables is given in B.1. The second set of tables consist of the marker and tag tables from CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3.

The submission must also include an informative section that describes why this profile is important, what it is used for, and how to optimally use it. This may include special processing used by the applications of the profile that is not described in the JPEG standard. Pre- and post-processing of the compressed image that improves quality is an example of informative information. The informative section could also suggest file format, a particular parameterization, pre and post-processing, etc. Note that a new informative section can be registered to an existing profile.

An example of a JPEG profile is supplied in Annex B. This profile is included for informative purposes and illustrates the level of detail that may be contained in a profile.

4.1.4 Normative section

The normative section of a profile consists of two parts: marker and tag usage, and parameter specification. Additionally a file structure specification may be included.

4.1.4.1 Marker and tag usage

Tables A.1 to A.3 provide a format for registrants to specify marker and tag usage. Each marker and tag is listed. The registrant indicates whether a marker or tag is "required" (req.), "capable" (cap.), or "excluded" (exc.) A marker or tag that is "required" must be used with the proper parameterization in the file. A marker or tag that is "capable" may or may not be used in the file and a profile compliant application must be able to decode a stream with this marker or tag. If it is used it must have the proper parameterization. A marker or tag that is "excluded" shall not be used in the file.

4.1.4.2 Parameterization

Each marker that is "required" or "capable" in a profile must be parameterized according to its table as described in CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3. These tables allow the registrant to specify a single value, a set of values, a range of values, or sets of ranges of values allowed for each parameter. These values could be the full range allowed by the standard.

4.1.4.3 File structure

A description of file structure (i.e. placement of APPn markers and RSTn markers within the encoded file) should be complete with all variants described. The file structure descriptions of SPIFF in ITU-T Rec. T.84 | ISO/IEC 10918-3 provide a good example.

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4.2 SPIFF tags (see ITU-T Rec. T.84 | ISO/IEC 10918-3, F.2.2)

New SPIFF tags shall be defined and registered for any purpose as long as they conform to the directory syntax of SPIFF. Note that these tags can only be used in a SPIFF directory. Such a tag would allow the addition of metadata or image information to the file format. The ETAG value X'00E00000' is reserved for unregistered tag usage. This value shall be used provisionally while an applicant awaits assignment of a permanent ETAG from the PTSMCR Authority.

4.2.1 Purpose of a SPIFF tag

In order to make SPIFF as flexible as possible, a provision has been made to allow specific applications to add information to a SPIFF conformant file that could not be described using the tag values defined in the ITU-T Rec. T.84 | ISO/IEC 10918-3. It should be noted, however, that such use is application specific and other applications may not recognize these entries. Unrecognized application specific tags should be ignored. However, many implementations can take advantage of registered tags.

4.2.2 Criteria

A proposed new SPIFF tag must meet the following criteria:

- Unique – It must not duplicate the function of another existing tag.
- Correct submission – The syntactically correct submission along with all appropriate explanations of purpose must be submitted.
- Utility – The SPIFF tag should demonstrate utility to the user.

Given these criteria are met, the tag will be accepted.

4.2.3 Contents of the submission

The submission must include a normative section that conforms to the syntax of ITU-T Rec. T.84 | ISO/IEC 10918-3, F.2.2. It must include a description of the parameters and the sizes of the parameters. The PTSMCR Authority assigns the ETAG parameter.

The submission must include an informative section that describes the reason for this tag. It should also explain and demonstrate proper usage of the tag.

4.3 SPIFF colour space (see ITU-T Rec. T.84 | ISO/IEC 10918-3, F.2.1.1)

A number of colour spaces are defined in the SPIFF file header. As this list does not contain all possible colour spaces, there is a facility for registering new ones. This Specification allows a broad interpretation of the term "colour space." For example, it could include multi-band description, or it could simply describe the character of the bands. A colour space number of 254 (X'FE') is reserved for use in unregistered colour spaces. This value may be used provisionally while an applicant awaits assignment of a permanent colour space number from the PTSMCR Authority. The colour space number 255 (X'FF') is reserved for future use and shall indicate that the colour space number follows in a special tag.

4.3.1 Purpose of a SPIFF colour space

In order to make the colour space conversion as flexible as possible, a provision has been made that allows specific applications to add information to a SPIFF colour space conversion that could not be described using the tag values defined in the ITU-T Rec. T.84 | ISO/IEC 10918-3. It should be noted, however, that such use is application specific and other applications may not recognize these colour spaces. Unrecognized application specific colour spaces should be ignored.

NOTE – This is a parameter in a SPIFF header.

4.3.2 Criteria

A proposed new SPIFF colour space must meet the following criteria:

- Unique – It must not duplicate a colour space already defined.
- Correct submission – The syntactically and technically correct submission along with all appropriate explanations of purpose must be submitted.
- Utility – The SPIFF colour space should demonstrate utility to the user.

Given these criteria are met, the SPIFF colour space will be accepted.

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4.3.3 Contents of the submission

The submission should include a normative section or reference, if possible, that defines a colour space or defines an exact relation to another colour space.

The submission must also include an informative section that describes the reason for this colour space. It should also explain and demonstrate proper usage of this colour space.

Note that although the term colour space is used throughout, this identification number can designate any multi-component decorrelation or pre-processing. It could also indicate band types, such as indexed colour.

4.4 APPn marker (see CCITT Rec. T.81 | ISO/IEC 10918-1, B.2.4.6)

This Specification allows for the unique registration and promulgation of the APPn markers as defined in CCITT Rec. T.81 | ISO/IEC 10918-1. These markers were originally "reserved for application use." Since these segments could be defined differently in different applications, the previous standard recommended (but did not require) that these markers be removed for interchange. This Recommendation | International Standard offers the user a method of registering an APPn marker so that it can be understood by another application.

4.4.1 Purpose of an APPn marker

In order to make the JPEG file format as flexible as possible, a provision has been made that allows specific applications to add information to an application marker. It should be noted, however, that such use is application specific and other applications may not recognize these entries. Unrecognized application specific tags should be ignored. However, many implementations can take advantage of registered markers.

APPn markers can be used to signal anything that the registrant desires. However, understanding the marker should not be fundamental to decoding the image. This allows enhanced or expanded capabilities to be implemented without rendering useless a JPEG implementation that already conforms to the standard. More precisely, the use of an APPn marker shall not prevent the expansion of the coded image when the marker is not recognized by a given implementation. The utility of the resulting image, however, may be limited by failure to recognize an APPn marker.

4.4.2 Criteria

A proposed new APPn marker must meet the following criteria:

- Unique – It must not duplicate the null terminate identification string of another APPn marker (with the same n value).
- Correct submission – The syntactically and technically correct submission along with all appropriate explanations of purpose must be submitted.
- Utility – The APPn marker should demonstrate utility to the user.

Given these criteria are met, the APPn marker will be accepted.

4.4.3 Contents of the submission

The submission must include a normative section that specifies the value of n and a unique null terminated string for identification. Figure 4-1 shows the syntax of the marker. Also, the character and syntax of the information, if any, after the identification string must be specified.

The submission must also include an informative section that describes the reason for this tag. It should also explain and demonstrate proper usage of the tag. APPn markers can be used for anything. (Note that the APP_8 marker is specific to SPIFF and will not be assigned to another tag).

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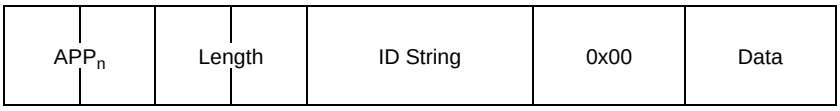

Figure 4-1 – Syntax of the APPn markers

4.5 SPIFF compression type (see ITU-T Rec. T.84 | ISO/IEC 10918-3, F.2.1)

A number of compression spaces are defined in the SPIFF file header. As this list does not contain all possible compression types, there is a facility for registering new ones. A compression type number of 254 (X'FE') is reserved for provisional use with compression technologies undergoing the registration process. This value may be used until assignment of a permanent compression type number from the PTSMCR Authority. The compression type number 255 (X'FF') is reserved for future use and shall indicate that the compression type number follows in a special tag.

4.5.1 Purpose of SPIFF compression type registration

This mechanism does not allow the registration of application specific compression technologies. Its purpose is to allow the addition of other standardized compression technologies to the SPIFF format. Of all PTSMCR types, the addition of new compression types will be the most strictly controlled. Applicants may suggest standardized technologies that they wish to be included in the SPIFF format.

NOTE – The compression type is a parameter in the SPIFF header.

4.5.2 Criteria

A proposed new SPIFF compression type must meet the following criteria:

- Unique – It must not duplicate a compression type already defined.
- Correct submission – The syntactically and technically correct submission along with all appropriate explanations of purpose must be submitted. The proposed compression technology must be a standardized algorithm.
- Utility – The SPIFF compression type should demonstrate utility to the user.

Given these criteria are met, the SPIFF compression type will be considered.

4.5.3 Contents of the submission

The submission should include a normative section with a reference to the standards document describing the compression algorithm.

The submission must also include an informative section that describes the reason for inclusion of this compression type. It should also explain and demonstrate proper usage of this compression type within the SPIFF format.

4.6 Registration Authority (see ITU-T Rec. T.84 | ISO/IEC 10918-3, F.2.3.2.13)

The image registration authority is defined in ITU-T Rec. T.84 | ISO/IEC 10918-3 and referred to as REGAUT. It is in charge of delivering unique identifiers to be inserted inside image files for legal protection of content. Image registration authorities provide a means by which producers of digital imagery may register and uniquely identify their imagery. For this purpose, it delivers an image "License Plate" (LP) to each accepted request for an image ID. The License Plate is structured as shown in Figure 4-2. As stated in the Scope (clause 1) of this Recommendation | International Standard, due to the fact that a very large number of registration applications are foreseen, the PTSMCR Authority will delegate the task of certifying such REGAUTs to the National Bodies. A REGAUT is defined by two bytes representing the number, from 1 to 65K, of the registered REGAUT in the National Body registers. The registration authority is therefore fully defined by association of the Country code (REGCON as per ITU-T Rec. T.84 | ISO/IEC 10918-3) with the REGAUT number and appears in full inside the contact information tag (see ITU-T Rec. T.84 | ISO/IEC 10918-3, Table F.17).

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COPY RID	REGCON	REGAUT	REGID

Figure 4-2 – License Plate concept

4.6.1 Purpose of Image Registration Authority (REGAUT) IDs

Institutions wishing to serve as image registration authorities must be empowered to do so by the PTSMCR Authority. This mechanism allows the National Body, on behalf of the PTSMCR Authority, to deliver a certificate of validity to the registrant upon receipt of the input form duly completed and checked. The information contained in the input form is then disseminated to users. Multiple REGAUT allocations are possible inside a given country, provided that the registrants fulfil the exploitation conditions. A collective right society, an image agency, a public or private institution may apply for qualification as a REGAUT.

4.6.2 Criteria

A proposed new REGAUT ID must meet the following criteria:

- Unique – It must not duplicate a REGAUT ID already assigned.
- Correct submission – The syntactically and technically correct submission along with all appropriate explanations of purpose must be submitted.
- Suitability – The proposed image registration authority must be a well-known institution recognized as a professional in the digital imagery domain. Furthermore, this institution must be willing to fulfil its obligation as a registration authority.

Given these criteria are met, the REGAUT ID will be considered.

4.6.3 Contents of the submission

The registration Authority called REGAUT in the JPEG-3 standard is in charge of delivering the license plates to identify the applicable multimedia objects, in this case, still pictures. Figure 4-2 shows the content of a license plate. The license plate uniquely identifies an image and indicates whether the image owner has retained copyright protection (see F.2.3.2.11 and F.2.3.2.13 in ITU-T Rec. T.84 | ISO/IEC 10918-3). The National Body of the country where the REGAUT is to be established has responsibility for approving the request of an institution or organization to become a REGAUT. In applying for approval to become a REGAUT, the registrant will be required to complete a request form, containing information such as:

- identification and contact information for the registrant;
- object of the registration and foreseen flow;
- operational information;
- security and legal information;
- means of communication and coordination;
- means of financial support for the operation.

When the appropriate National Body accepts the request, a probationary authorization is given to start operation of the REGAUT. During this probationary period, the REGAUT will be required to provide the appropriate National Body with registered images, based on non-disclosure agreements as deemed necessary. The National Body will determine compliance of the registered images to the standard. Following the successful demonstration of compliance, the probationary number is updated to a definitive, final number and the actual REGAUTs operations may begin. The registration numbers will be clearly differentiated when applied to probationary REGAUTs and final REGAUTs.

Once approved and operational, the REGAUT shall create a number of registers for private and/or public use, and will be required to provide information regarding the items in the register. The REGAUT, at a minimum shall provide:

- registration process description (maybe some particular conditions);
- registration content in terms of quantity and numbering;
- on-going test period news and recommendations to users;

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- final acceptance date as previewed;
- listing of Registrants;
- access to IPR tags for the registered images.

NOTE – REGAUT IDs are made public by the relevant National Body or by ISO. Each registrant should be able to access his own registration status and review his registered images. To reduce the size of the registered files and the risk of getting it disclosed, a typical registration process only registers vignettes, which are small representations of the original images, carrying all the tags for IPR protection and a native sample taken into the original file for authentication purposes.

5 Submission, review, and appeal process

This clause provides requirements for the submission and approval of new or updated profiles, tags, colour spaces, markers and compression types as defined previously. Additionally, this clause recommends ways for the establishment of a new REGAUT (Registration Authority) whose purpose will be to register images.

All the registration processes have a common set of requirements for the submitter as well as requirements and processes based on the category of submission (PTSMCR) and are described in detail below.

5.1 Submission process

The registration submission process conforms to the specifications described in clause 4 and is graphically shown in Figure 5-1, which shows the process flow for submission of a new item to the relevant PTSMCR Authority. This process flow is focused on access based on an Internet based submission and approval system, but could be applied to other (non-electronic) processes as provided for by the Authority.

The registrant (individual or institution) shall submit a request for registration of a new item to the PTSMCR Authority, possibly via Internet access, for example. The first operation is the identification of the registrant, which takes the steps shown on the block diagram: either the registrant is unknown to the PTSMCR Authority, or previously registered an item and is listed in the PTSMCR Authority registers. If it is the first time the registrant provided a submission to the Authority, they must complete a general identification form.

In order to provide some level of security to the registration process, a password is set by the registrant and must be used every time the registrant contacts the PTSMCR Authority for an active operation (this exclude consultation of the contents for example). Only the registrant will be allowed modification of the password and all the registered information regarding his personal identification (name, company, etc.). The registrant may also request, under certain conditions to be defined by the Authority and registration submission form, that the input information remains undisclosed.

5.2 Review process

Following validation of the individual's right to access the Authority's Registration System, the actual registration of the desired item begins. This is done according to the conformity of the submission to the specific contents. The PTSMCR Authority verifies (manually or automatically) the conformity of the request to the specifications, and notifies the registrant of a positive or negative response to the registration request. The Authority must respond within one month to the registrant's request. If no response is received within one month, the probationary period shall begin.

The response of the PTSMCR Authority shall be **positive** if the item has not been registered (i.e. is new and unique), and if the contents of the submission conform to the applicable standard and specification (see CCITT Rec. T.81 | ISO/IEC 10918-1 or ITU-T Rec. T.84 | ISO/IEC 10918-3). This positive response, however, is not final. It does allow the submitter to implement the proposed item for a probationary "validation" period to be defined by the Authority. This probationary period may last for three to six months, for example. It is during this time that the contents of the submission are made accessible to the public. This may be done via an Internet WWW page or through some defined WG1 process, and will be coordinated and established by the WG1 and Authority.

During the validation period, the registration is temporary, and the PTSMCR Authority may require more information from the registrant regarding the submission. During this period, omissions or errors in the submission, lack of implementation support, or related problems, may cause the rejection of the submission. However, if after the probationary period no inconsistencies or concerns are raised, the submission shall be considered accepted and formally approved by Authority and will be accordingly marked on the public register. Any individual reviewing the public register shall be clearly informed if a submission has successfully completed its probationary period based on a "status" field or similar notification method.

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The response of the PTSMCR Authority may also be **negative** if the submission is not acceptable as received, due to errors, inconsistencies or technical concerns with the proposed content. Examples of why the Authority would reject a submitted item include:

- If an approved, registered item already exists that contains the identical contents of the submission.
- The Authority considers that there is not enough originality in the proposed item and that the submitter could easily implement with an existing, approved item.
- If the submission contains errors or is not compliant with the specifications or standard it is based on.

5.3 Notification and appeal process

A negative response may be appealed if the submitter believes that there was an error made in the rejection, or that further information is required to clarify issues or concerns. If the submitter requires additional review beyond the Authority's process, they may submit their case for review by the WG1 at the next appropriate WG1 group meeting. They may then be required to provide additional information at the request of the experts, who, under the authority of WG1, will provide a final, definitive response of acceptance or rejection. A refused item may still be used by the registrant, but it will not be allowed to claim standards compliance and hence, may become *de facto* a proprietary item. In order to have a rejected item reviewed by the WG1, the registrant must re-submit the proposal through their National Body, specifying why the submission requires consideration by WG1.

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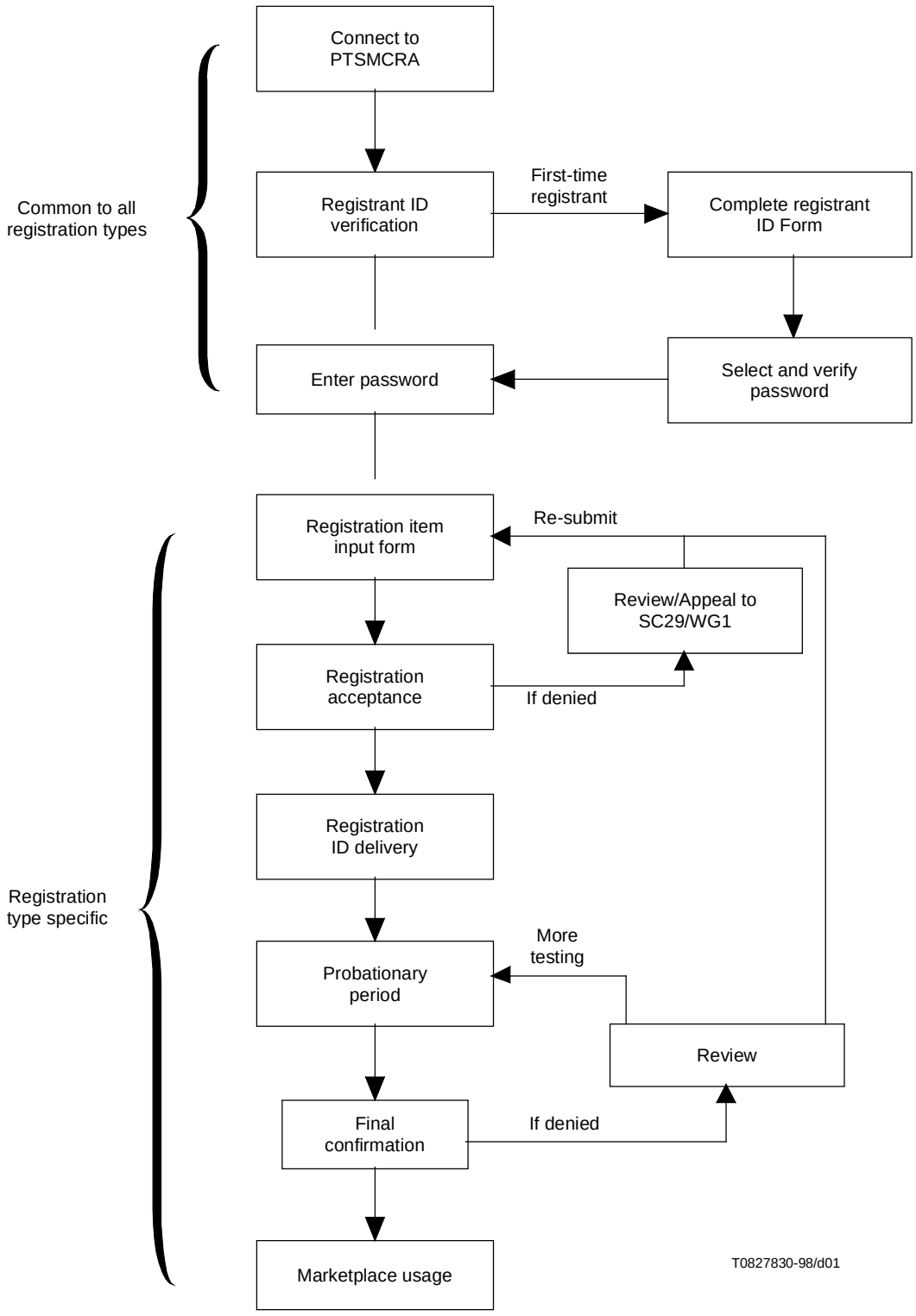

Figure 5-1 – PTSMCR registration process

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Annex A

JPEG marker and SPIFF tag usage tables

Tables A.1 to A.3 from CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3 are provided for the use of registration applicants. They are to be filled out by an applicant as part of a JPEG or SPIFF profile submission to the PTSMCR Authority. Applicants are to indicate which JPEG markers and SPIFF tags are required, capable, or excluded in the submitted profile.

Specific parameterizations of JPEG marker segments and SPIFF tags are also to be included in any JPEG or SPIFF profile. These tables may be found in CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3. All applicants are required to complete each marker usage and parameterization table. If a particular feature is not used, indicate this by using "N/A" (not applicable) in the table fields. This requirement ensures the PTSMCR Authority that an applicant has not overlooked any requirements in their profile. For an example of how to fill out the tables, see the examples in Annex B.

Table A.1 – Marker usage

(See CCITT Rec. T.81 | ISO/IEC 10918-1, JPEG, Part 1)

Symbol	Description	Parameters	Req.	Cap.	Exc.
Start of Frame markers, non-differential, Huffman coding					
SOF_0	Baseline DCT	Table B.2			
SOF_1	Extended sequential DCT				
SOF_2	Progressive DCT				
SOF_3	Lossless (sequential)				
Start of Frame markers, differential, Huffman coding					
SOF_5	Differential sequential DCT				
SOF_6	Differential progressive DCT				
SOF_7	Differential lossless (sequential)				
Start of Frame markers, non-differential, arithmetic coding					
SOF_9	Extended sequential DCT				
SOF_{10}	Progressive DCT				
SOF_{11}	Lossless (sequential)				
Start of Frame markers, differential, arithmetic coding					
SOF_{13}	Differential sequential DCT				
SOF_{14}	Differential progressive DCT				
SOF_{15}	Differential lossless (sequential)				
Huffman table specification					
DHT	Define Huffman Table(s)	Table B.5			
Arithmetic coding conditioning specification					
DAC	Define Arithmetic Coding Conditioning(s)	Table B.6			
Restart interval termination					
RST_m	Restart with modulo 8 count *m*				
Other markers					
SOI	Start of Image		X		
EOI	End of Image		X		
SOS	Start of Scan	Table B.3			
DQT	Define Quantization Table(s)	Table B.4			
DNL	Define Number of Lines	Table B.10			
DRI	Define Restart Interval	Table B.7			
DHP	Define Hierarchical Progression	see CCITT Rec. T.81 | ISO/IEC 10918-1			
EXP	Expand reference component(s)	Table B.11			
APP_n	Reserved for application segments	Table B.9			
COM	Comment	Table B.8			

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Table A.2 – Marker usage

(See ITU-T Rec. T.84 | ISO/IEC 10918-3, JPEG, Part 3)

Symbol	Description	Parameters	Req.	Cap.	Exc.
Version 1 extensions					
VER	Version	Table B.3			
DTI	Define Tiled Image	Table B.8			
DTT	Define Tile	Table B.9			
SRF	Selectively Refined Frame	Table B.6			
SRS	Selectively Refined Scan	Table B.7			
DCR	Define Component Registration	Table B.10			
DQS	Define Quantizer Scale Selection	Table B.11			

Table A.3 – SPIFF header and tags usage

(See ITU-T Rec. T.84 | ISO/IEC 10918-3, JPEG, Part 3)

SPIFF header and tags	Parameters	Req.	Cap.	Exc.
SPIFF header[a)]	Table F.1			
Transfer characteristics	Table F.6			
Component registration	Table F.7			
Image orientation	Table F.8			
Thumbnail	Table F.9			
Image title	Table F.10			
Image description	Table F.11			
Time stamp	Table F.12			
Version identifier	Table F.13			
Creator identification	Table F.14			
Protection indicator	Table F.15			
Copyright information	Table F.16			
Contact information	Table F.17			
Tile index	Table F.18			
Scan index	Table F.19			
Set reference	Table F.20			

a) Includes "end-of-header" tag.

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Annex B

Examples of registered PTSMCR items

B.1 Example of a JPEG profile: NITFS Lossless JPEG Profile

B.1.1 Normative description

B.1.1.1 Scope

This Recommendation | International Standard establishes the requirements to be met by National Imagery Transmission Format Standard (NITFS) compliant systems when image data is compressed using the JPEG lossless mode image compression algorithm as described in CCITT Rec. T.81 | ISO/IEC 10918-1, "Digital compression and coding of continuous-tone still images".

B.1.1.2 Content

This Recommendation | International Standard provides a profile of CCITT Rec. T.81 | ISO/IEC 10918-1 for the NITFS compression algorithm designated by the code C5 in the Image Compression field of the NITF file image subheader for 2 to 16-bit gray scale imagery and 24-bit colour imagery.

B.1.1.3 Applicable documents

B.1.1.3.1 United States Government documents

The following standards form a part of this Recommendation | International Standard to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplements thereto, cited in the solicitation.

B.1.1.3.1.1 Specifications, standards, and handbooks

FEDERAL STANDARDS

FED-STD-1037B	–	Telecommunications: Glossary of Telecommunication Terms, 3 June 1991.

(Copies of the referenced Federal Standards are available from General Services Administration, GSA Specification Section, Room 6654, 7th and D Streets, SW Washington, D.C. 20407; telephone (202) 472-2205.

MILITARY STANDARDS

MIL-STD-2500A	–	National Imagery Transmission Format (Version 2.0) for the National Imagery Transmission Format Standard, 18 June 1993.

MILITARY HANDBOOKS

MIL-HDBK-1300A	–	Military Handbook National Imagery Transmission Format Standard, 18 June 1993.

B.1.1.3.1.2 Other Government documents, drawings, and publications

The following other Government documents form a part of this Recommendation | International Standard to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation.

DISA/JIEO Circular 9008	–	National Imagery Transmission Format Standard Certification Test and Evaluation Program Plan, 30 June 1993.

B.1.1.3.2 International and national publications

The following documents form a part of this Recommendation | International Standard to the extent specified herein. Unless otherwise specified, the issues of the documents which are Department of Defense (DOD) adopted are those listed in the issue of the DODISS cited in the solicitation.

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B.1.1.3.2.1 Recommendations | International Standards

CCITT Rec. T.81 | ISO/IEC 10918-1	–	Digital compression and coding of continuous-tone still images. September 1992
ITU-T Rec. T.84 | ISO/IEC 10918-3	–	Digital compression and coding of continuous-tone still images: Extensions, July 1996

(Copies may be obtained from X3 Secretariat, Computer and Business Equipment Manufacturers Association, 311 First Street NW, Suite 500, Washington, D.C. 20001-2178)

B.1.1.3.2.2 National standards

None.

B.1.1.3.3 Order of precedence

In the event of a conflict between the text of this profile and the references cited herein, the text of this profile shall take precedence. Nothing in this profile, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

B.1.1.4 Definitions, Abbreviations, and Symbols

The following definitions are applicable for the purpose of this profile. In addition, terms used in this profile and defined in the FED-STD-1037B shall use the FED-STD-1037B definition unless noted.

B.1.1.4.1 Definitions

See CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3 for definition of terms used in this profile.

B.1.1.4.2 Abbreviations

JIEO	Joint Interoperability and Engineering Organization (formerly JTC^{3}A)
NITF	National Imagery Transmission Format
NITFS	National Imagery Transmission Format Standard
RGB	Red, Green, Blue

See CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3 for other abbreviations used in this profile.

B.1.1.4.3 Symbols

See CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3 for definition of symbols used in this profile.

B.1.1.5 General requirements

B.1.1.5.1 Interoperability

The profile specified in this Recommendation | International Standard is intended to enable the interchange in the NITFS format, of 2- to 16-bit gray scale imagery and 24-bit colour imagery. CCITT Rec. T.81 | ISO/IEC 10918-1 represents a collection of lossy and lossless compression techniques, a subset of the lossless procedures are used in generation of the compressed image data stream shown. Unless expressly forbidden in this profile, any procedure in CCITT Rec. T.81 | ISO/IEC 10918-1 applicable to lossless encoding may be applied. Any optional processes in CCITT Rec. T.81 | ISO/IEC 10918-1 required by this profile will be detailed.

B.1.1.5.2 Encoders

Encoders shall output to the image data field of the NITF file a full interchange format that includes the compressed image data and all table specifications used in the encoding process.

B.1.1.5.3 Decoders

All decoders shall interpret full interchange format. Abbreviated interchange format decoders are not a requirement of this profile.

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B.1.1.6 Markers and tags

Tables B.1-1 to B.1-3 specify the markers and tag usage from CCITT Rec. T.81 | ISO/IEC 10918-1 and ITU-T Rec. T.84 | ISO/IEC 10918-3 applicable to the NITFS Lossless JPEG profile.

Table B.1-1 – Marker usage

(CCITT Rec. T.81 | ISO/IEC 10918-1, JPEG, Part 1)

Symbol	Description	Parameters	Req.	Cap.	Exc.
Start of frame markers, non-differential, Huffman coding					
SOF_0	Baseline DCT				X
SOF_1	Extended sequential DCT				X
SOF_2	Progressive DCT				X
SOF_3	Lossless (sequential)		X		
Start of frame markers, differential, Huffman coding					
SOF_5	Differential sequential DCT				X
SOF_6	Differential progressive DCT				X
SOF_7	Differential lossless (sequential)				X
Start of frame markers, non-differential, arithmetic coding					
SOF_9	Extended sequential DCT				X
SOF_{10}	Progressive DCT				X
SOF_{11}	Lossless (sequential)				X
Start of frame markers, differential, arithmetic coding					
SOF_{13}	Differential sequential DCT				X
SOF_{14}	Differential progressive DCT				X
SOF_{15}	Differential lossless (sequential)				X
Huffman table specification					
DHT	Huffman table specification			X	
Arithmetic coding conditioning specification					
DAC	Define arithmetic coding conditioning(s)				X
Restart interval termination					
RST_m	Restart with modulo 8 count *m*		X		
Other markers					
SOI	Start of Image		X		
EOI	End of Image		X		
SOS	Start of Scan		X		
DQT	Define Quantization Table(s)				X
DNL	Define Number of Lines				X
DRI	Define Restart Interval		X		
DHP	Define Hierarchical Progression				X
EXP	Expand reference component(s)				X
APP_n	Reserved for application segments			X	
COM	Comment			X	

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Table B.1-2 – Marker usage

(ITU-T Rec. T.84 | ISO/IEC 10918-3, JPEG, Part 3)

Symbol	Description	Parameters	Req.	Cap.	Exc.
Version 1 extensions					
VER	Version				X
DTI	Define Tiled Image				X
DTT	Define Tile				X
SRF	Selectively Refined Frame				X
SRS	Selectively Refined Scan				X
DCR	Define Component Registration				X
DQS	Define Quantizer Scale Selection				X

Table B.1-3 – SPIFF header and tags usage

(ITU-T Rec. T.84 | ISO/IEC 10918-3, JPEG, Part 3)

SPIFF header and tags	Parameters	Req.	Cap.	Exc.
SPIFF header				X
Transfer characteristics				X
Component registration				X
Image orientation				X
Thumbnail				X
Image title				X
Image description				X
Time stamp				X
Version identifier				X
Creator identification				X
Protection indicator				X
Copyright information				X
Contact information				X
Tile index				X
Scan index				X
Set reference				X

B.1.1.7 Marker and tag parameterization

The marker and tag parameterization tables specify the values and range of values allowed for all required and capable markers indicated in B.1.1.6. The complete set of tables of this profile may be obtained from the PTSMCR registration authority. Applicants may find that their profile contains sets of parameterizations. This could occur if an applicant registers a profile that deals with both gray scale and colour imagery. For clarity, whenever a parameterization is between one of a few choices that significantly alters a table's size or structure, multiple versions of that table should be included, one for each parameterization. If a given table is not applicable to a profile, it is indicated by "N/A" in its parameter specifications.

B.1.1.8 Colour space

The JPEG processes in CCITT Rec. T.81 | ISO/IEC 10918-1 are colour blind. In this profile two types of imagery are specified, 2 to 16 bit gray scale and 24 bit RGB colour. The IREP and IREPBAND fields (defined in MIL-STD-2500A) within the NITF image subheader are used to identify the colour space for each component present in the image; these components may be interleaved or not. When the components are interleaved, the order shall be R, G, and B with each MCU containing three data units, one from each component. In the non-interleaved case, each MCU consists of just one data unit from any of the components.

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B.1.1.9 APPn marker usage

B.1.1.9.1 NITF APP_6 application data segment

NITF requires the use of an NITF APP_6 application data segment. This APP_6 application data segment may be identified by the null-terminated (0x00) string "NITF" immediately following the length parameter L_p (see Table B.1.4). The NITF application data segment shall immediately follow the first SOI marker in the Image Data Field. The NITF application data segment contains information that is needed by an interpreter but not supported by the ISO/ITU-T JPEG format. Most of this information is also present in some fields of the NITF image sub-header (COMRAT, IREPBAND, NBPP, etc.). For a description of the fields in the APP_6 marker segment see MIL-STD 2500A.

Since no default Huffman tables are defined in this Recommendation | International Standard, the tables to be used by the decoder must always be present in the compressed stream. The Huffman table specification can optionally be embedded in the NITF application data segment (shaded area in Table B.1.4). Multiple Huffman tables may be specified (up to three) in the application data segment. In this case the table(s) will provide "default" table specification(s) for subsequent image blocks (for an explanation of image blocks see MIL-STD 2500A). The DHT marker segment need not be embedded in the APP_6 data segment and may appear in the appropriate places in the bitstream as specified in CCITT Rec. T.81 | ISO/IEC 10918-1.

Only DHT marker segments embedded in APP_6 will be considered defaults. Huffman tables defined outside of APP_6 are considered "custom" tables. NITFS does not allow the carryover of custom Huffman tables from one image block to the next. Custom tables must be included in each block where default tables are not used. Any Huffman table defined with a previously used table identifier shall replace the previously defined table. The format is shown in Table B.1-4 with the Huffman table segment variable fields specified in Table B.1-5 for the different image types. If no DHT marker segment is embedded in the APP_6 data segment, the length parameter, L_p, shall be equal to 20.

A second variation of the APP_6 application data segment is given in Table B.1-6. Here the length of the APP_6 data segment equals that of the NITF lossy JPEG APP_6 data segment as defined in paragraph B.4.1.4. The length parameter, L_p, is always equal to 25. Zero (NULL) byte padding is used to achieve this length. This variation of the NITF profile is identical to that described above with the exception that Huffman tables (DHT marker segment) may not appear in the APP_6 data segment. The form of this second type of APP_6 application data segment is given in Table B.1.6.

B.1.1.9.2 NITF0003.A APP_7 directory data segment

NITF applications may use an NITF0003.A APP_7 directory segment. This APP_7 application data segment may be identified by the null-terminated (0x00) string "NITF0003.A" immediately following the length parameter L_p (see Table B.1-7). The directory segments are used to provide random access to the variable length compressed data segments. These segments contain a directory of offset information for a series of scans or restart intervals depending on the directory type. In all cases, offsets are measured from the beginning of the Image Data Field in the NITF file to the beginning of the element. The number of entries depends on the directory type and is the number of (restart intervals per scan) or (scans per block) for directory types: 'R' and 'S', respectively. The format is shown in Table B.1-7. The number of directory entries can be very large for restart interval directories. In these cases it is possible for a directory to exceed the ≈ 64 Kbytes segment limitation imposed by the 2-byte L_p field offset in any JPEG application data segment. Since each element requires 4 bytes in the directory, this translates to a maximum of 16 379 entries.

When a logical directory contains more than 16 379 elements, they must be split between more than one directory. In this case, multiple directory segments must follow each other with no other intervening data and they must be of the same directory type (restart interval). Each additional directory contains those elements, in the same order, that would have been present in the directory had there been no size limitation. Another mechanism called, blocked image masking, may be used in the NITF data format to provide direct access to image blocks, in the same spirit that directory segments provide access to entropy coded data. Blocked image masking requires the use of an image data mask subheader in the NITF file. The content, structure and use of block image masking may be found in MIL-STD-2500A.

B.1.1.10 Control procedures

The control procedures for encoding and decoding an image using this profile may be found in CCITT Rec. T.81 | ISO/IEC 10918-1. It is required by this profile that an NITF APP_6 application data segment be placed in the compressed data stream. This data segment immediately follows the first SOI marker in the Image Data Field (see Figure B.1-1). The format and content of this data segment are discussed in B.1.1.9.1. This profile also requires the use of restart intervals for the purposes of error confinement and data resynchronization. Restart intervals are discussed in B.1.1.11.2.4. NITF compressed imagery may include an optional APP_7 directory segment in the JPEG data stream, the format and content of this marker segment is discussed in B.1.1.9.2.

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Table B.1-4 – NITF APP_6 application data segment

Offset	Field value	Field name	Length (bytes)	Comments	
0	0xFFE6	APP_6	2	NITF application data marker	
2	Table B.1-5	L_p	2	Segment length (2 + length of application data)	
4	0x4E49 0x5446 0x00	Identifier	5	Null terminated string: "NITF"	
9	0x0200	Version	2	Version number. The most significant byte is used for major revisions, the least significant byte for minor revisions. Version 2.00 is the current revision level.	
11	0x42, 0x50 or 0x53	IMODE	1	Image Format. Three values are defined at this time: 'B' – IMODE = B 'P' – IMODE = P 'S' – IMODE = S	
12	1-9999	H	2	Number of image blocks per row	
14	1-9999	V	2	Number of image blocks per column	
16	0-1	Image colour	1	Original image colour representation. Two values are defined at this time: 0 – monochrome 1 – RGB	
17	1-16	Image bits	1	Original image sample precision	
18	0-99	Image class	1	Image data class (0-99). One value is defined at this time: 0 – general purpose	
19	1-29	JPEG process	1	JPEG coding process. The values of this field are defined to be consistent with ITU-T Rec. T.83 | ISO/IEC 10918-2: 14 – Sequential lossless	
20	0xFFC4	DHT	2	Define Huffman table marker	
22	Table B.1-5	L_h	2	Length of parameters	
24	Table B.1-5	T_cT_h	1	T_c: Table class = 0 T_h: Huffman table identifier (0-2).	First table
25	0-255	L_i	16	Number of codes of each length (BITS array)	First table
41	0-255	$V_{i,j}$	Table B.1-5	Symbols (HUFFVAL array)	First table
		T_cT_h	1	T_c: Table class = 0 T_h: Huffman table identifier (0-2).	Last table
	0-255	L_i	16	Number of codes of each length (BITS array)	Last table
	0-255	$V_{i,j}$	Table B.1-5	Symbols (HUFFVAL array)	Last table
	0	Flags	2	Reserved for future use	

Table B.1-5 – APP_6 and DHT lengths

Field name	N-bit grey scale $N \in [2, 3, \ldots, 15]$	16-bit grey scale	RGB colour (N = 8)	
L_p	$20, 22 + L_h$	20, 58	$20, 22 + L_h$	
L_h	$19 + m_t$	36	$2 + \sum_{t=1}^{n} (17 + m_t)$	
T_cT_h	0x00	0x00	0x0X, $X \in [0, 1, 2]$	
# of $V_{i,j}$ (m_t)	$m_t = N + 1$	17	$m_t = 9$	Predictors 1-3 and 7
	$m_t = N + 2$	17	$m_t = 10$	Predictors 4-6

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Table B.1-6 – NITF APP_6 application data segment (second type)

Offset	Field value	Field name	Length (bytes)	Comments
0	0xFFE6	APP_6	2	NITF application data marker
2	Table B.1-5	L_p	2	Segment length (2 + length of application data)
4	0x4E49 0x5446 0x00	Identifier	5	Null terminated string: "NITF"
9	0x0200	Version	2	Version number. The most significant byte is used for major revisions, the least significant byte for minor revisions. Version 2.00 is the current revision level.
11	0x42, 0x50 or 0x53	IMODE	1	Image Format. Three values are defined at this time: 'B' – IMODE = B 'P' – IMODE = P 'S' – IMODE = S
12	1-9999	H	2	Number of image blocks per row
14	1-9999	V	2	Number of image blocks per column
16	0-1	Image colour	1	Original image colour representation. Two values are defined at this time: 0 – monochrome 1 – RGB
17	1-16	Image bits	1	Original image sample precision
18	0-99	Image class	1	Image data class (0-99). One value is defined at this time: 0 – general purpose
19	1-29	JPEG process	1	JPEG coding process. The values of this field are defined to be consistent with ITU-T Rec. T.83 | ISO/IEC 10918-2 14 – Sequential lossless
20-26	0x00		7	NULL padding bytes

Table B.1-7 – NITF APP_7 directory segments

Offset	Field value	Field name	Length (bytes)	Comments
0	0xFFE7	APP_7	2	NITF directory segment marker
2	4N + 16	L_p	2	Segment length (2 + length of application data)
4	0x4E495446 0x30303033 0x2E4100	Identifier	11	Null-terminated string "NITF0003.A"
15	0x52, 0x53	directory Type	1	Directory type. Two values are defined at this time: 'R' – Restart Interval Directory 'S' – Scan Directory
16	1-16379	N	2	Number of directory entries. Note 0 is not allowed. Maximum value of N (16 379) maximizes L_p at 65 532.
18		1st offset	4	Offset to first element in this directory (restart interval, scan)
22		2nd offset	4	Offset to second element in this directory
4N + 14		Last offset	4	Offset to last element in this directory

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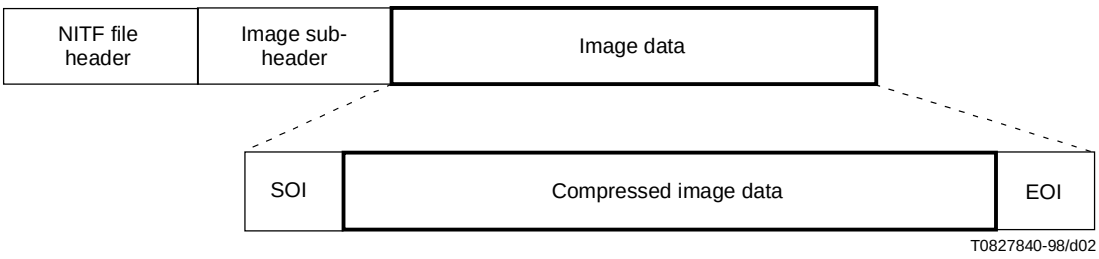

Figure B.1-1 – NITF file structure

B.1.1.11 File format

B.1.1.11.1 Format of a JPEG compressed image within an NITF file

The format for NITF image data compressed with the sequential lossless JPEG mode differs based on the number of blocks, bands, and IMODE value (B, P, S, see MIL-STD-2500A). These different cases are described below.

B.1.1.11.2 Single block JPEG compressed format

The format for NITF single block image data compressed with the sequential lossless JPEG mode is shown in Figure B.1-2**.**

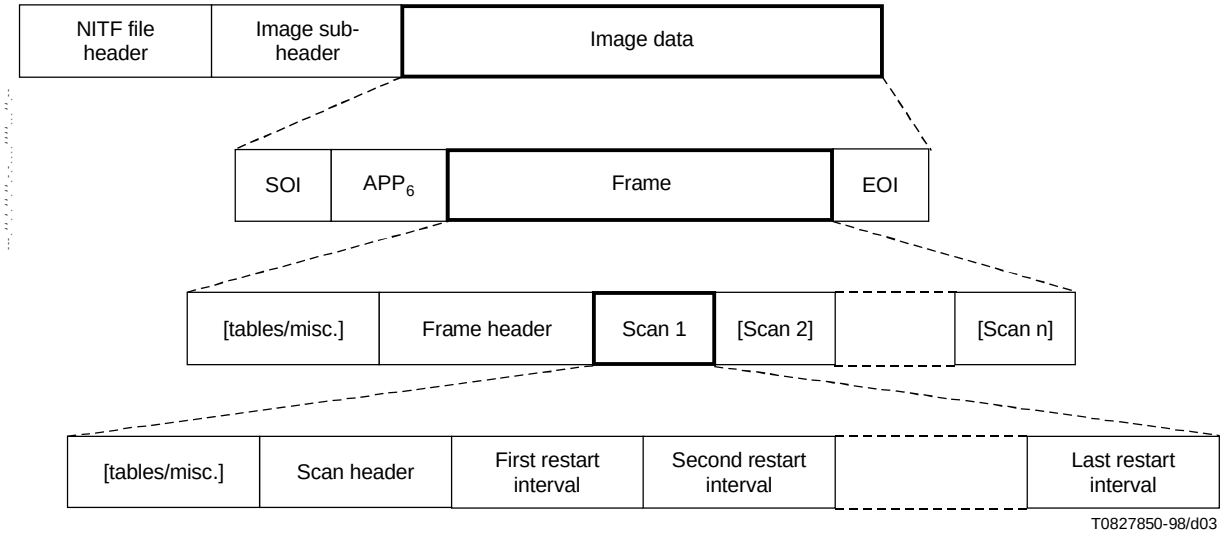

Figure B.1-2 – NITF single block file structure (IMODE = B or P)

B.1.1.11.2.1 Single block image data format

The top level of Figure B.1-2 specifies that the JPEG compressed data is contained in the Image Data Field of the NITF file. The second level of Figure B.1-2 specifies that the single block image format shall begin with an SOI marker, shall contain one frame, and shall end with an EOI marker. Between the SOI/EOI marker pair, the data stream is compliant with CCITT Rec. T.81 | ISO/IEC 10918-1 subject to the requirements and constraints of this profile.

B.1.1.11.2.2 Frame format

The third level of Figure B.1-2 specifies that a frame shall begin with a frame header and shall contain one or more scans. A frame header may be preceded by one or more table-specification or miscellaneous marker segments. NITF does not allow the use of the JPEG DNL segment which, when present, would follow the first scan in the frame.

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B.1.1.11.2.3 Scan format

The fourth level of Figure B.1-2 specifies that a scan shall begin with a scan header and shall contain one or more restart intervals. A scan header may be preceded by one or more table-specification or miscellaneous marker segments. When the NITF image sub-header IMODE field is set to B, there shall be n scans within the frame, one for each of the components (n = 1 or 3). When the IMODE field is set to P, there shall be a single scan within the frame consisting of three interleaved components.

B.1.1.11.2.4 Restart intervals

Following the scan header, each scan shall be encoded as a series of one or more restart intervals. A restart interval is a self-contained entropy-coded data segment that can be decoded independently from the other intervals. Restart intervals are used for error recovery. If the image were encoded as a single interval, then any transmission error would render all subsequent image data unusable. When several restart intervals are used, the effects of an error can be contained within a single interval. The restart interval is defined by the DRI marker as specified in CCITT Rec. T.81 | ISO/IEC 10918-1. In the ISO/IEC restart intervals are optional, but NITF requires the use of restart marker codes with a restart interval which is a multiple of the number of MCUs per row and not exceeding a maximum of 8 sample rows. Byte alignment is achieved between restart intervals per CCITT Rec. T.81 | ISO/IEC 10918-1.

B.1.1.11.3 Multiple blocks JPEG compressed format

The format for NITF multiple block image data compressed with the sequential lossless JPEG mode is shown in Figure B.1-3 for IMODE = B or P. The corresponding format when IMODE = S is shown in Figure B.1-4**.**

B.1.1.11.3.1 Multiple block image data format (IMODE = B or P)

The top level of Figure B.1-3 specifies that the JPEG compressed data is contained in the Image Data Field of the NITF file. The second level of Figure B.1-3 specifies that this multiple block image format shall begin with the compressed data for the first image block and shall be followed by the compressed data for each image block, one after the other, left to right, top to bottom. The third level of Figure B.1-3 specifies that each compressed block shall begin with an SOI marker, shall contain one frame, and shall end with an EOI marker. The format below this level is identical to the single block case previously described in B.1.1.11.2.

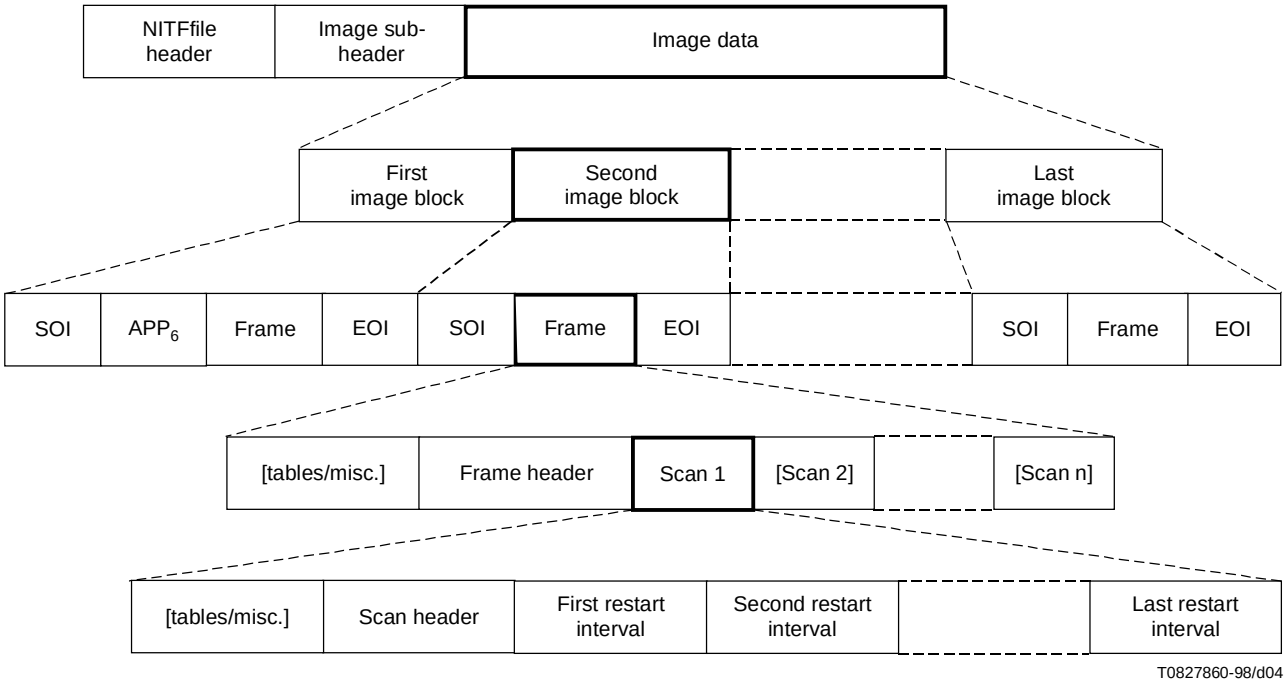

Figure B.1-3 – NITF multiple block file structure (IMODE = B or P)

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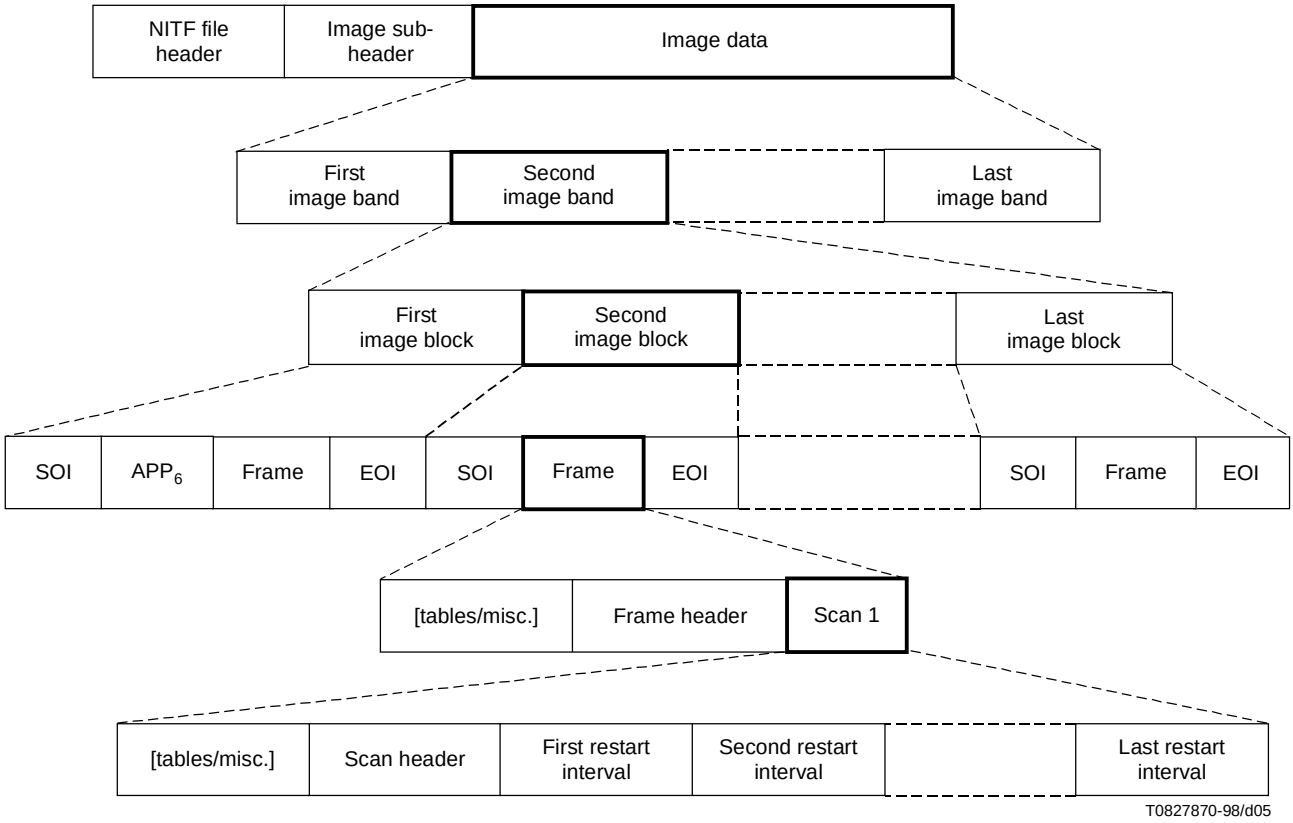

Figure B.1-4 – NITF multiple block file structure (IMODE = S)

B.1.1.11.3.2 Multiple block image data format (IMODE = S)

The use of this IMODE requires that the image contains multiple blocks and multiple bands, otherwise IMODE shall be set to B or P. The top level of Figure B.1-4 specifies that the JPEG compressed data is contained in the Image Data Field of the NITF file. The second level of Figure B.1-4 specifies that this multiple block image format shall begin with the compressed data for the first image band and shall be followed by the compressed data for each image band, one after the other, first to last. The third level of Figure B.1-4 specifies that each compressed image band shall consist of the compressed data (for that band) for each image block, one after the other, left to right, top to bottom. The fourth level of Figure B.1-4 specifies that each compressed block shall begin with an SOI marker, shall contain one frame, and shall end with an EOI marker. The format below this level is identical to the single block case previously described in B.1.1.11.2 with each frame containing only one scan that contains the compressed data from only one band.

B.1.1.11.3.3 Similarities with ITU-T Rec. T.84 | ISO/IEC 10918-3 "simple tiling"

In ITU-T Rec. T.84 | ISO/IEC 10918-3, extensions to the JPEG processes of CCITT Rec. T.81 | ISO/IEC 10918-1 are defined. One of these extensions deals with the tiling (blocked images in NITFS terminology) of images. Of the tiling formats present in ITU-T Rec. T.84 | ISO/IEC 10918-3, simple tiling, is conceptually equivalent to the blocked image concept in NITF. It is important to note that the bitstreams generated by simple tiling in ITU-T Rec. T.84 | ISO/IEC 10918-3 and blocked images in NITF are not compatible. In ITU-T Rec. T.84 | ISO/IEC 10918-3 simple tiled images are treated as multiple frames within a single SOI/EOI marker pair. Image blocks in NITF are treated as separate images each with an SOI/EOI marker pair. Within the SOI/EOI marker pairs each image block data stream conforms to CCITT Rec. T.81 | ISO/IEC 10918-1 subject to the requirements and constraints of this profile.

B.1.2 Informative description

B.1.2.1 Applicability

This profile is applicable to the Intelligence Community and the Department of Defense. It is mandatory for all Secondary Imagery Dissemination Systems in accordance with the memorandum by the Assistant Secretary of Defense for C^3I, Subject: National Imagery Transmission Format Standard (NITFS), 12 August 1991. This directive shall be implemented in accordance with the Joint Interoperability and Engineering Organization (JIEO) Circular 9008, NITFS Certification Test and Evaluation Program Plan, and the MIL-HDBK-1300A. New equipment and systems, those undergoing major modification, or those capable of rehabilitation shall conform to this profile.

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B.1.2.2 Critical data

The JPEG marker segments (frame header, scan header, DHT, DRI, APP_6) are critical data. Corruption will result if these data are lost.

B.1.2.3 Use of restart intervals

Restart intervals introduce some overhead into the data stream to provide a level of error protection. A "smart decoder" will detect a transmission error as an invalid data stream during the decoding process and then skip forward looking for the next restart marker code to resynchronize. There is a tradeoff between the amount of overhead and the level of protection obtained. Neglecting the effects of packet size and error handling in the communications protocol, errors can be contained to a single restart interval. The overhead introduced by each restart interval is 20 bits on average for Huffman coding.

B.2 Example of SPIFF tag

B.2.1 Normative description

This tag will be used to include in the tags of an image file the inventory number of an artwork as it appears in the owners registers. Its generic name is "inventory number".

B.2.2 Origin of request

The MENHIR (European ESPRIT programme) partners, require unique references for images (of artwork or objects) which are available from different sources, image agencies, digital libraries or Museum digital archives. MENHIR is managed by Museums On Line, which can be contacted at http://www.club-internet.fr/MOL

B.2.3 Typical application

A very famous image of artwork is the Leonardo da Vinci "Gioconda", available through different image agencies, although existing (hopefully) in only one place: the Louvre Museum in Paris. The inventory number included in a tag allows for a general search in a large database in order to retrieve all existing representations of the painting.

B.2.4 Content

This tag is a text tag compliant to the syntax of all similar tags, such as "title". It contains the inventory number that is an internal unique identifier, which can only be used if attached to the localization information. Indeed a number of Museums have an "INV. 1847" object in their collection, but Le Louvre has only one.

B.3 Example of a SPIFF colour space

B.3.1 Origin of request

For use within MIL-STD 188-198A of the Department of Defense of the United States Government.

B.3.2 Typical application

NITFS-JPEG RGB colour imagery may be coded in a YCbCr colour space. This colour space is derived from the CCIR 601-1 colour space. The following equations specify the ideal functional definition of the forward and inverse transformations. Note that unlike CCIR 601-1, (Y, Cb, and Cr) have full 8-bit dynamic ranges (0-255) in this Recommendation | International Standard with no headroom or footroom.

Forward YCbCr601 transformation:

$$Y = 0.299R + 0.587G + 0.114B$$

$$C_b - 128 = 0.1687R - 0.3313G + 0.500B$$

$$C_r - 128 = 0.500R - 0.4187G - 0.0813B$$

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The chrominance components can be computed alternatively as colour differences:

$$C_b - 128 = 0.5643(B - Y)$$

$$C_r - 128 = 0.7133(R - Y)$$

Inverse RGB transformation:

$$R = Y + 1.402(C_r - 128)$$

$$G = Y - 0.34414(C_b - 128) - 0.71414(C_r - 128)$$

$$B = Y + 1.772(C_b - 128)$$

These equations contain terms that cannot be represented with perfect accuracy. The accuracy requirements for the combined YCbCr conversion, FDCT, and quantization procedures are specified in JIEO Circular 9008.

B.4 Example of APPn markers

Following are examples of two different APP_6 marker usages.

B.4.1 Example 1

This example defines parameters that are useful in decoding National Imagery Transmission Format Standard (NITFS) JPEG compressed imagery.

B.4.1.1 Descriptive title

NITFS JPEG APP_6 marker specification for colour space, default quantization, and Huffman tables.

B.4.1.2 Origin of request

Central Imagery Office, Department of Defense of the United States Government.

B.4.1.3 Typical application

NITF requires the use of the APP_6 application data segment for the definition of colour space and NITFS default quantization and Huffman tables. This marker also includes other information that is present in the NITF image sub-header but is used to improve the speed of decompression of the image.

B.4.1.4 Content of NITFS JPEG APP6 (Extension NITF)

See Table B.4-1.

B.4.2 Example 2

This example defines procedures and parameters that are used in the pre- and post-processing of NITFS JPEG compressed imagery.

B.4.2.1 Descriptive title

NITFS JPEG APP_6 marker specification for amplitude re-mapping.

B.4.2.2 Origin of request

Central Imagery Office, Department of Defense of the United States Government.

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Table B.4-1 – APP6 NITFS application data segment marker

Offset	Field value	Field name	Length (bytes)	Comments
0	0xFFE6	APP_6	2	NITF application data marker
2	25	L_p	2	Segment length (2 + length of application data)
4	NITF. (Hex Representation) 0x4E49 0x5446 0x00	Identifier	5	Zero terminated string: "NITF"
9	0x0200	Version	2	Version number. The most significant byte is used for major revisions, the least significant byte for minor revisions. Version 2.00 is the current revision level.
11	0x42, 0x50 or 0x53	IMODE	1	Image format. Three values are defined at this time: 'B' – IMODE = B 'P' – IMODE = P 'S' – IMODE = S
12	1-9999	H	2	Number of image blocks per row
14	1-9999	V	2	Number of image blocks per column
16	0-1	Image colour	1	Original image colour representation. Two values are defined at this time: 0 – monochrome 1 – RGB
17	1-16	Image bits	1	Original image sample precision
18	0-99	Image class	1	Image data class (0-99). One value is defined at this time: 0 – general purpose
19	1-29	JPEG process	1	JPEG coding process. The values for this field are defined to be consistent with ITU-T Rec. T.83 | ISO/IEC 10918-2. Two values are defined at this time: 1 – baseline sequential DCT, Huffman coding, 8-bit sample precision 4 – extended sequential DCT, Huffman coding, 12-bit sample precision
20	0-5	Quality	1	Image default quantization tables used. Quality values 1-5 select specific tables (in conjunction with the Image Class, Stream Colour, and Stream Bits). The value 0 indicates no defaults and all quantization tables must then be present in the stream.
21	0-2	Stream colour	1	Compressed colour representation. Three values are defined at this time: 0 – monochrome 1 – RGB 2 – YCbCr601
22	8 or 12	Stream bits	1	Compressed image sample precision
23	1	Horizontal filtering	1	This field specifies the filtering used in the horizontal direction prior to sub-sampling the chrominance samples. One value is defined at this time: 1 – Centered samples, [1/2, 1/2] filter
24	1	Vertical filtering	1	This field specifies the filtering used in the vertical direction prior to sub-sampling the chrominance samples. One value is defined at this time: 1 – Centered samples, [1/2, 1/2] filter
25	0	Flags	2	Reserved for future use

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B.4.2.3 Typical application

This marker is used to remap blocks of an image (subtract the minimum) before compression to improve the subjective quality of the expanded and remapped 12-bit image. The NITFS APP_6 re-mapping process JPEG marker contains the minimum values for each scan of an original uncompressed image block before any preprocessing or compression steps are performed. The ID string follows the form NITFxxxx.V, where xxxx is 0001 and the current version identifier is A. This application segment also stores the image block index values which specify the relative image block row and image block column position of the frame. The index values are 1 based, with the first block (1,1) at position upper-left part of the image. For decompression, the min_val is added to the given scan block.

B.4.2.4 Content of NITFS JPEG APP6 (Extension NITF0001.A)

See Table B.4-2.

Table B.4-2 – APP6 NITFS application data segment marker

Offset	Field value	Field name	Length (bytes)	Comments
0	0xFFE6	APP_6	2	NITF application data marker
2	$27 \le L_p \le 2^{16}-1$	L_p	2	Segment length (2 + length of application data)
4	NITF0001.A (Hex representation) 0x4E495446 0x30303031 0x2E41 0x00	IID String	11	NITF0001.A identification string
15	$0 \le IBR \le 2^{32}-1$	IBR	4	Image block row Number used in NITFS blocking
19	$0 \le IBC \le 2^{32}-1$	IBC	4	Image block column Number used in NITFS blocking
23	$0 \le IBC \le 2^{16}-1$	Nscan	2	Number of scans per frame
25	$0 \le Min_Val_1 \le 4096$	Min_Val_1	2	Minimum Value of Scan One (for 12-bit imagery)
25 + (2*scan #–1)	$0 \le Min_Val_n \le 4096$	Min_Val_n	2	Minimum Value of Scan number n (for 12-bit imagery)
23 + (2*Nscan)	$0 \le Min_Val_{Nscan} \le 4096$	Min_Val_{Nscan}	2	Minimum Value of the Last Scan (# Nscan) (for 12-bit imagery)
25 + (2*Nscan)		Flags	2	Reserved for future use

B.5 Example of compression type

B.5.1 Normative description

The SPIFF header compression type "C6" has been reserved for incorporation of the JPEG-LS compression standard, ISO/IEC 14995, into the SPIFF file format.

B.5.2 Origin of request

Joint Photographics Expert Group (ISO/IEC JTC1 SC 29 WG1).

B.5.3 Typical application

In the compression type field, "**C**" (see ITU-T Rec. T.84 | ISO/IEC 10918-3), of the SPIFF file header when using the JPEG-LS compression algorithm.

B.5.4 Content

C6.

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B.6 Example of REGAUT application

B.6.1 Normative description

This REGAUT will be called "NETIMAGEXPERT".

NOTE – It is not mandatory to designate a REGAUT by a name as it is identified by the REGAUT number.

B.6.2 Origin of request

The request was sent to AFNOR by NETIMAGE in order to create the conditions to test the REGAUT functionnalities in actual environment. The address of the registrant is:

NETIMAGE
La billardiere
36190 Gargilesse (France)
email 100432.2231@compuserve.com

B.6.3 Typical application

The request concerns a test and demo REGAUT devoted to the company use only. It may be later on transformed into a regular REGAUT to offer registration service to the company customers.

B.6.4 Content

The REGAUT identifier required by NETIMAGE is FR 17. Operation should start as of August 1st, 1997 for a test period of 3 months after which it should be transformed into REGAUT # 1017 for operational use.

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Annex C

Registered marker information

Access to the PTSMCR Authority and other Registration Authorities (REGAUTs) shall be provided through the IAO/IEC JTC1/SC29/WG1 website. The URL for this site is www.jpeg.org. Additional inquires should be forwarded to WG1 or the applicable National Body.

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