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To:

Task Group M1.3 at INCITS Technical Committee M1

Technical Contributions towards Amendment 1 of  
“Finger Minutiae Format for Data Interchange”

(Ref. [M1/05-0018](#))

Reply to:

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## **1. Purpose**

Motorola values the role of interoperability standards as an important basis for exchange and collaboration on both entity and system levels, and actively participates in both the ANSI/INCITS and ISO standardization processes.

Regarding [M1/05-0018](#) and ANSI INCITS 378-2004 – “Finger Minutiae Format for Data Interchange”, we noted some issues while reviewing the standard and implementing it as part of our product family.

This document provides a list of those issues, with comments, and communicates Motorola’s proposal for amendments as a contribution to the M1 project.

## **2. Comments classification**

The comments are classified using the following categories.

- Definitional (misleading definitions) - D
- Technical (mostly issues on the format) - T
- Editorial (typographical errors) - E

### 3. Comments

Nr	Category	Reference to standard	Statement in Standard	Comment	Proposal for change
01	D	5.3.2	The minutia for a ridge ending shall be defined as the point of forking of the medial skeleton of the valley area immediately in front of the ridge ending	Under certain circumstances finger prints can have interruptions in ridges that are big enough to be considered as minutiae. In this case two ridge endings (on both sides of the interruption) may be plotted on the same location, which is confusing. This representation doesn't reflect the natural human approach and the common practice in law enforcement facilities	Plot ridge endings on the ending of the ridge skeleton. This is common practice in over 80% of the state law enforcement agencies. This is also common practice when minutia charts are being plotted for submittal in courts of law.
02	D	5.1, 5.2 Figure 1	(5.1) Algorithms conforming to the standard are supposed to produce consistent data extraction regardless of image polarity.  (5.2) Each minutia has a type associated with it.	The problem is clear in figure 1. The types of the minutiae in figure 1 change, e.g., from bifurcation to ridge ending or vice versa, if the polarity of image is inverted. This problem cannot be avoided without knowing the polarity of the original image. As an added consequence, minutia type cannot be used as a match criterion.	Drop the requirement that algorithms should be insensitive to polarity. The situation is not inherently ambiguous. The polarity of the image should be recorded at the time the image is captured so that white-ridge-black-valley images can be inverted prior to processing.
03	D	5.4.2, 5.4.3, Figure 1	Definitions of the tail angles of ridge endings and ridge bifurcation points.	The tail angle definitions have several problems.  1. The direction of the tail angle changes with the feature type. For example, if a ridge approaches another ridge forming an asymmetric valley, similar to rightmost example shown in figure 1, the direction of the tail angle will vary significantly, depending upon whether the	<ol style="list-style-type: none"> <li>1. Change the definition of ridge ending tail angle to be the direction of a line segment starting at the ridge ending and traveling into the ridge a specified distance.</li> <li>2. Adopt the Minex04 definition of bifurcation angle direction, e.g., include the requirement that the legs be followed for 32 pixels. Apply the same requirement to ridge endings.</li> <li>3. In the example given, the tail angle</li> </ol>

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				<p>minutia point is labeled as a ridge ending or bifurcation.</p> <p>2. The angle of the bifurcation minutia is not completely defined – how far should one travel along the legs of the bifurcation?</p> <p>3. We believe the current definition of ridge ending tail angle is sensitive to noise</p>	<p>will only vary slightly using the new definitions, thus increasing the robustness of the representation.</p>
04	D	5.1, 6.6.2 Figure 2	<p>The standard is designed to treat ridges and valleys as interchangeable. That is the principle put forth in section 5.1. In particular, algorithms conforming to the standard are supposed to produce the same results regardless of whether ridges are black or white without having any polarity information available - in other words, the program is not supposed to invert a white-ridge-black-valley image before processing it.</p>	<p>The problem is that ridges and valleys are not really interchangeable. The problem is clear in Figure 2 on page 12. If ridges are taken to be black, then the ridge count between points B and C is 2, as stated. However, if the ridges are taken to be white, the ridge count becomes 1. This problem cannot be avoided without knowing the actual polarity of the image.</p>	<p>Drop the requirement ("principle") that fingerprinting algorithms be insensitive to polarity. The situation is not inherently ambiguous. The polarity of the image should be recorded at the time the image is captured and white-ridge-black-valley images should be inverted before being processed to produce consistent results.</p>
05	D	5.1, 6.6.2 Figure 2	<p>Each ridge count is associated with a pair of minutiae contained in the minutiae data area defined in 6.5.2; no ridge information may be contained that is associated with minutiae not included in the corresponding minutiae area. Ridge counts shall not include the ridges represented by either of the associated minutiae. Refer to Figure 2 for clarification</p>	<p>The problem is that ridge counts for minutiae on adjacent ridges and ridge count for two minutiae on one and the same ridge can be both zero.</p>	
06	D	5.2	<p>“This standard defines a category of “other” minutia for points that <u>are not</u> clearly a ridge ending or a bifurcation.”</p>	<p>Since type “other” assumes that the minutia is neither a ridge ending nor a bifurcation, the type “Unknown” is needed for cases when the type is</p>	<p>Define minutiae type “unknown” which can be represented in the record by the 2bit value 11.</p>

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				unknown.	
07	D	Table 6	The standard doesn't provide for the case when no image quality is available. There is no definition in the standard, which determines how image quality is to be calculated.	The definitions of minutiae and finger quality are confusing.	INTERPRET Image quality = 0 as no image quality available, which would unify this definition with the definition for minutia quality.
08	D		Missing exact definition of Octant and Quadrant	The standard is missing exact definition for octant and quadrant	Adopt the definitions used in MINEX04 API Specification, section 2.4
09	D		Missing exact definition of Core and Delta	The standard is missing exact definition for core and delta	Provide definition. Motorola's Biometric Business Unit is willing to cooperate.
10	D		Missing exact definition of Core and Delta Angles	Core and Delta angle definition	Provide definition. Motorola's Biometric Business Unit is willing to cooperate.
11	D	6.4.8 - 6.4.10	The record contains only one image description field.	Since the standard introduces the concept of the finger view, allowing more than one print per finger, and defining the record as containing up to 176 finger views, it is reasonable to store the image description on a finger view level.	Allow a separate image description for each finger view.
12	D	6.1.	One of the two following CBEFF Format Type values shall be used in the CBEFF Header. The sixteen-bit value 0x0201 shall be used for records with no extended data area (as determined by the Extended Data Block Length in 6.6.1.1 represented as the sixteen-bit value 0x0000) and the sixteen-bit value 0x0202 shall be used for records that contain an extended data area (as specified in the Extended Data Type Identification Code in 6.6.1.2 by a sixteen-bit value other than 0x0000)	With the current two CBEFF IDs there is no way to embed multiple 378-2004 records in one and the same CBEFF if some of them have extended data and others don't.	Use only one ID, indicating, that the record is from type 378-2004. Presence of extended data fields can be easily extracted, based on the value in the field  "6.6.1.1 Extended Data Block Length"

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13	T	Table 6	The number of finger views is 0-255	Only 11 finger positions and only 16 finger views per single position are defined. Max Number of finger views is $16 \cdot 11 = 176$	Change field value of this field to 1-176
14	T	6.3	“A fixed-length (26-byte) record header containing information about the overall record, including the number of fingers represented and the overall record length in bytes”	The header incorporates the record length field, which is of variable length, depending on the size of the record. This means that the record header varies in size too.	Make the field for record length have a constant length of 4 Byte and have a fixed length header of 28 Byte. This would also make the field easier to parse.
15	T	6.6.3.5	The bits“00” will indicate that the delta has angular information while “01” will indicate that no angular information is relevant for the delta type. If this field is “00”, then the angle fields shall not be present for the deltas.	This is not what Table 6 and graph 6.6.3.9 shows.	Correct the text of 6.6.3.5
16	T	6.4.2, B2	Upon approval of this specification, the version number shall be “20” (an ASCII space followed by an ASCII ‘2’ and an ASCII ‘0’).	In table B2 the value is “0 2 0 \0”	Change value in text to “0 2 0 \0”
17	T	B.3	Angles do not correspond to values from table B.1		Provide some clarification. Provide reliable sample data
18	T	6.6.3.6 6.6.3.9	Different definition of the field for number of deltas	The verbal definition shows a field length of 4 bits, but the diagram shows 6 bits	Change number in the diagram to 4
19	E	6.4.3	Different values for record length in the example record on page 20 and 22	May be a typographical error	Make values identical.
20	E	6.5.1.1. Table 6	Possible finger positions. 6.5.1.1 indicates that valid values are 0-10	Table 6 states that those values are 0-11	Change the text in Table 6