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## **Summary of Conformance Requirements for ANSI-INCITS 377-2004 – Finger Pattern Data Interchange Format**

Section 2 - Must satisfy mandatory requirements for:

- 1) Generation of finger pattern cell information (Section 5)
  - 5.2 - If image is re-sampled: Origin of raw image and re-sampled one must be in upper left corner, re-sampling resolution  $\geq 78.8$  ppcm (200 ppi)
  - 5.3 – Image divided into cells with each cell represented by closest matching 2D cosinusoidal pattern with:
    - a. Direction Angle,  $\theta$ , clockwise from y-axis<sup>1</sup>,  $0 < \theta < 180^\circ$
    - b. Wavelength,  $\lambda$ ,  $0 < \lambda < \text{Max Spatial Frequency}$  (Based on Cell Size)
    - c. Phase,  $\delta$ ,  $0 < \delta < 360^\circ$ , where 0 indicates ridge center at origin of cell
  - 5.4 – Each group of  $A \times A$  cells shall have a finger quality scaled from 0 to  $2^N - 1$  where A is quality granularity parameter, N is number of bits for quality, 0 is lowest possible quality and  $2^N - 1$  is highest possible quality. Overall quality values shall be set in accordance with 2.1.46 of ANSI/INCITS 358.
- 2) Generation of data record format (Section 6)
  - 6.1 – Biometric data shall be contained as a BDB in a CBEFF compliant data structure
    - a. CBEFF Format Owner shall be 0x001B
    - b. CBEFF Format Type shall be 0x0301 for record with no extended data
    - c. CBEFF Format Type shall be 0x0302 for record with extended data
  - 6.1 – File format is as described below, beginning with a Record Header which shall be fixed length (36 bytes) and structured as indicated in Table 1:

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<sup>1</sup> Problem: Standard does not properly define X and Y axis anywhere

| <b>Record Header</b>                                    |             |   |                         |
|---|-------------|---|-------------------------|
| <b>Field</b>  | <b>Size</b> | <b>Valid values</b>                         | <b>Reference in 377</b> |
| Format Identifier                                       | 4 bytes     | 0x46505200<br>( 'F 'P 'R 0x0)               | 6.2.1                   |
| Version Number  | 4 bytes     |   | 6.2.2                   |
| Length of Record  | 4 bytes     |   | 6.2.3                   |
| CBEFF Product Identifier (PID)                          | 4 bytes     |   | 6.2.4                   |
| Number of Finger Patterns in Record                     | 1 byte      | 1-255                                       | 6.2.5                   |
| Size of finger pattern in x-direction (pixels)          | 1 byte      | 1-255                                       | 6.2.6                   |
| Size of finger pattern in y-direction (pixels)          | 1 byte      | 1-255                                       | 6.2.7                   |
| Resolution of finger pattern in x-direction ROUND(ppcm) | 2 bytes     | 1-788                                       | 6.2.8                   |
| Resolution of finger pattern in y-direction ROUND(ppcm) | 2 bytes     | 1-788                                       | 6.2.9                   |
| Number of Cells in x-direction                          | 1 byte      | 1-(size of finger pattern in x-direction)   | 6.2.10                  |
| Number of Cells in y-direction                          | 1 byte      | 1-(size of finger pattern in y-direction)   | 6.2.11                  |
| Number of Pixels in Cells in x-direction                | 1 byte      | 1-(size of finger pattern in x-direction)   | 6.2.12                  |
| Number of Pixels in Cells in y-direction                | 1 byte      | 1-(size of finger pattern in y-direction)   | 6.2.13                  |
| Cellular x-offset                                       | 1 byte      | 0 - (size of finger pattern in x-direction) | 6.2.14                  |
| Cellular y-offset                                       | 1 byte      | 0 - (size of finger pattern in y-direction) | 6.2.15                  |
| Bit-depth of Cell Structure Angle                       | 1 byte      | 1-8   | 6.2.16                  |

| <b>Record Header</b>                     |             |                     |                         |
|--|-------------|---------------------|-------------------------|
| <b>Field</b>                             | <b>Size</b> | <b>Valid values</b> | <b>Reference in 377</b> |
| Bit-depth of Cell Structure Wavelength   | 1 byte      | 1-8                 | 6.2.17                  |
| Bit-depth of Cell Structure Phase Offset | 1 byte      | 1-8                 | 6.2.18                  |
| Bit-depth of Cell Structure Quality      | 1 byte      | 1-8                 | 6.2.19                  |
| Cell Quality Granularity                 | 1 byte      | 1-8                 | 6.2.20                  |
| Reserved Bytes                           | 2 bytes     |                     | 6.2.21                  |

Table 1 – Record Header Elements and Values

- 6.1 – The Record header shall be followed by one Finger Pattern Record for each finger, consisting of a 6 byte header (as given in Table 2), followed by a finger pattern data block and (if present) an extended data block.

| <b>Finger Pattern Record Header</b>                     |             |                     |                         |
|---|-------------|---------------------|-------------------------|
| <b>Field</b>  | <b>Size</b> | <b>Valid Values</b> | <b>Reference in 377</b> |
| Finger Location   | 1 byte      | 0-11                | Table 1                 |
| Impression Type   | 1 byte      | 0-5                 | Table 2                 |
| Number of Views in Finger Pattern Record                | 1 byte      | 0-255               | 6.3.1.3                 |
| Fingerprint Pattern Quality                             | 1 byte      | 0-100               | 6.3.1.4                 |
| Length of data block (in bytes) including extended data | 2 bytes     |                     | 6.3.1.5                 |

Table 2 – Finger Pattern Record Header Elements and Values

- 6.1 – All multi-byte values shall be Big Endian
- 6.1 – All numeric values are fixed-length, unsigned integers
- 6.2.2 – Current Version Number shall be ASCII “ 10” followed by a zero byte
- 6.2.4 – CBEFF Product ID is a copy of what may be in the CBEFF header (but may not be, depending on which patron format is used). The two most significant bytes shall define the owner of the encoding equipment or transforming application. This can’t be zero. The two least significant bytes shall define the specific version of the finger pattern algorithm used

- 6.2.21 – There are two Reserved Bytes and for now, they shall be zero
- The following data values shall be used within each Finger Pattern Record Header
  - 6.3.1.1 – Finger Location – Values from 0-10 as shown in Table 3 below

| <b>Finger location</b> | <b>Code</b> |
|------------------------|-------------|
| Unknown finger         | 0           |
| Right thumb            | 1           |
| Right index finger     | 2           |
| Right middle finger    | 3           |
| Right ring finger      | 4           |
| Right little finger    | 5           |
| Left thumb             | 6           |
| Left index finger      | 7           |
| Left middle finger     | 8           |
| Left ring finger       | 9           |
| Left little finger     | 10          |

Table 3 – Finger Location Values

- 6.3.1.2 – The impression type shall be taken from Table 4, in accordance with the way the fingerprint was captured.

| <b>Impression Type</b> | <b>Code</b> |
|------------------------|-------------|
| Live-scan plain        | 0           |
| Nonlive-scan<br>rolled | 3           |
| Swipe                  | 8           |
| 3-D Live-Scan          | 9           |

Table 4 – Impression Type Codes

- 6.3.1.4 – Finger Pattern Quality shall be between 0 and 100, with 0 representing the poorest quality and 100 representing the highest quality. Numeric values shall be determine in accordance with guidelines contained in 2.1.46 of ANSI/INCITS 358
- 6.3.2 - The finger pattern data record contains one or more views
- 6.3.2.1.1 - Each view begins with one byte containing a monotonically increasing number, starting with 0, that indicates the view number
- 6.3.2.1.2 – Cell data shall be stored in a packed format with the cell on the upper left of the image first, then the cells moving right along the first row of cells and then subsequent rows<sup>2</sup>

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<sup>2</sup> Problem: The standard does not appear to define the order in which the angle, wavelength and phase values are to be stored. It also gives fairly limited details on how too compute them.

- 6.3.2.1.3 – Cell quality data shall immediately follow cell data and shall be packed in the same manner (left to right along rows, starting with the top row)
- 6.3.2.2 – Finger pattern extended data shall be present only if CBEFF format type 0x0302 was used and is limited to one extended data record per finger pattern data record and shall come after the cell quality data of the final view in the data record