X9 REGISTRY FOR CHECK IMAGE TESTS

CONTROLLING SPECIFICATION: ANS X9.100-40 Parts 1 & 2

Image Test Name:	IBM MICR AuxOnUs Validation
Image Test Number:	037.00
Image Test Version:	00
Image Test Status: *Where:* *A = Active (approved for use)* *W = Withdrawn (not for use)* *S = Superseded (not for use - replaced by specified test)*	A

1	**Applicant Information**	
1.1	Organization Name:	IBM Corporation
1.2	Organization Address:	8501 IBM Drive MG83/202-3 Charlotte, NC 28262
1.3	Organization Web Site URL:	http://www.ibm.com

Approved by: X9 RMG for Check Image Tests March 30, 2007

2	**Image Test Description**	
2.1	**Image Test Name:**	MICR Aux OnUs Validation
2.2	**Image Test XML Name:**	auxonus
2.3	**Image Test Definition:**	A metric used to validate that the Auxiliary OnUs field of the image matches the expected data.
2.4	**Image Test Applicability:** Check all that apply.	☒*Front Image* ☐ *Rear Image* ☒*B/W Image* ☒*Grayscale Image* ☐ *Color Image*
2.5	**Intended Use:** Intended business use/ application, business context, and business impact when test fails.	This metric will report a failure if the number of substitutions or digit errors exceeds a programmable threshold. This can be used to verify that the codeline data for the image was correctly captured by the image capture device. It can also be utilized to help detect out of sync conditions, where the image and codeline data somehow get unsynchronized.
2.6	**Possible Causes for Condition Being Tested:**	This test will be executed by the Image Quality Analysis software if the user decides to perform codeline matching on the image. If the user does not explicitly ask for this function, the test will not be performed.

2.7	**Additional (or Repetitive) Information:**	This check is performed whenever a user requests that the test be executed on the image.
		An example of the XML output generated by IQA for this metric is shown below:
		`<auxonus>`
		`  <chars>45</chars>`
		`  <raw>1.0000</raw>`
		`  <score>10.0</score>`
		`</auxonus>`
		
		The parameters associated with this test are the values that are used to determine the quality of the match of the characters provided for this field with the characters that IQA OCR found in the image.

2.8	**Test Results Reported** *A test result is the outcome realized from executing an image test. The outcome will typically be the observed or measured value of some attribute pertaining to the image being tested.* *Any dependency of a test result on an image side (front or rear), image rendition (B/W, Gray, Color), or other condition shall be fully defined in the Additional Information section.* *Data types allowed are as defined in ANS X9.100-180-2006, but are typically alphabetic, numeric, alphanumeric, signed numeric (using "+" and "-" to denote sign), etc.*

2.8.1 First Image Test Result

Test Result Name: Detected Characters

Test Result XML Name:	Data Type:	Data Units:	Data Range:	Margin of Error (in Data Units) (Where Applicable):
chars	Alphanumeric	None		

Description:

This value provides the characters that the IQA OCR (**O**ptical **C**haracter **R**ecognition) functions detected within the image under test..

Formula and/ or Algorithm:

The characters that were detected within the AuxOnUs field (if any exists) on the item under test. This field is located to the left of the Routing/Transit field. It is defined as the field that is between two On-Us symbols and to the left of the Routing/Transit field. In the following sample, the AuxOnUs field that will be reported is "000067894". The On-Us symbols are *not* included in the reported field.

Additional Information:

There are 15 characters that can be included in this field. Numeric values are presented normally. There are five other characters and conditions that can be included in this field. Those are shown in the following table

Symbol Name	Symbol	Representation	Description and Interpretation
Amount		a	This symbol is used as the identifier for the field in the document that contains the dollar amount of the document.
On-Us		b	This symbol is used as the identifier for the field in the document that contains information unique to the issuing financial institution
Transit		c	This symbol is used as the identifier for the routing field.
Dash		-	Dash symbol.
Digit Error	N/A	Q	Whenever IQA cannot identify the character in the codeline, but can tell that a character is detected, the "**Q**" will be placed in the codeline

These characters would not normally be included in reporting the results. However they could possibly be reported due to a printing error of the item being processed or some other type of anomalous condition.

2.8.2 Second Image Test Result				
Test Result Name: Raw Score				
Test Result XML Name:	**Data Type:**	**Data Units:**	**Data Range:**	**Margin of Error (in Data Units) (Where Applicable):**
raw	Numeric	None	0 through 100	

Description:	This value provides the "raw" value of the match of the provided codeline data with the data located. The "raw" score is based on a 0-100% scale. If the raw score is 100% we have a perfect match.
Formula and/ or Algorithm:	This value is calculated by initializing the value to 100. This score is then adjusted in several steps to arrive at an intermediate value. Once the intermediate value is derived, this intermediate value is adjusted by a penalty multiplier to derive the final raw score. The following steps are taken to derive this raw score: 1. The "raw score" is initialized to 1.0 2. If the number of character mismatches or the length of the fields to be compared is not zero, then from the "raw score" we subtract the following: $\frac{((Number\_of\_Character\_Mismatches)+(Field\_Length\_Difference))}{((Number\_of\_Characters\_Compared)+(Field\_Length\_Difference))}$ Since the number of character mismatches is guaranteed to be less than or equal to the number of characters compared, this number is guaranteed to be less than '1'. This gives us the "intermediate" raw score. 3. The "intermediate" raw score is then adjusted for any digit errors that may have been detected in the image field. The specific form of this adjustment is controllable by the user through the use of a "Confidence Multiplier" Boolean value. If this value is *true*, then the equation used is: $iRawScore = iRawScore * \left(\frac{(Number\_of\_DigitErrors)}{(Number\_of\_Characters\_Compared)} \right)$ If this value is *false*, then the equation used is: $iRawScore = iRawScore * \left(\frac{(Number\_of\_DigitErrors)-(AcceptableNumberOfDE)}{(Number\_of\_Characters\_Compared)} \right)$ where *AcceptableNumberOfDE* is the user-settable acceptable number of Digit Errors. 4. A "penalty multiplier" value is then generated. This penalty multiplier is derived by subtracting 3 user-definable values: **Miscompare Penalty** – Penalty to be assessed whenever we have *any* mismatches in the expected and detected field. **Mismatch Length Penalty** – Penalty to be assessed whenever the expected and detected fields are of differing lengths. **Acceptable Digit Error Penalty** – This penalty will be assessed whenever the detected field contains more digit

	errors than a user settable threshold. 5. Once both the *iRawScore* and *penaltyMultiplier* are generated, these two values are multiplied by each other to give the field's "**Raw Score**". When reporting this result, the value is normalized to a scale of 0 through 100, where 100 indicates a perfect match.
Additional Information:	

2.8.3 Third Image Test Result				
Test Result Name: Field Score				
Test Result XML Name:	**Data Type:**	**Data Units:**	**Data Range:**	**Margin of Error (in Data Units) (Where Applicable):**
score	Numeric	None	0 through 1000	
Description:	This value provides the "score" of the match of the provided codeline data with the data for this field that was located by the IQA OCR functions.			
Formula and/ or Algorithm:	This value is derived by comparing the "raw" score (see 2.8.2) with the scale shown in paragraph 2.10. In order to provide this value in a standard numeric format, the actual score (on a 0-10 scale) is multiplied by 100 and converted to integer format.			
Additional Information:				

2.9	**Test Parameters Reported** *Examples of image test parameters are threshold values used to compute a pass/fail image test flag condition, and constant values used in a formula or algorithm to compute an image test result*. *Any dependency of a test parameter on an image side (front or rear), image rendition (B/W, Gray, Color), or other condition shall be fully defined in the Additional Information section.* *Any dependency of recommended values on an image side (front or rear), image rendition (B/W, Gray, Color), or other condition shall be fully defined in the Recommended Values section.* *Data types allowed are as defined in ANS X9.100-180-2006, but are typically alphabetic, numeric, alphanumeric, signed numeric (using "+" and "-" to denote sign), etc.*

2.9.1 First Test Parameter				
Test Parameter Name: Test Threshold				
Test Parameter XML Name:	**Data Type:**	**Data Units:**	**Data Range:**	**Recommended Value(s) (Where Applicable):**
	Numeric	None	0-1000	700 *(default)*
Description:	This reported parameter is the threshold used to make the pass/fail decision. This value is settable by the user. If the calculated "score" is greater than or equal to the threshold, the test passes. If the "score" is lower than the threshold, the test fails.			
Additional Information:	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution. The value may be set to any floating point value between 0 and 10.0 by the user. In reporting this parameter, the value used internally by the image quality analysis software is multiplied by 100 and converted to an integer.			

2.9.2 Second Test Parameter				
Test Parameter Name: Expected AuxOnUs				
Test Parameter XML Name:	**Data Type:**	**Data Units:**	**Data Range:**	**Recommended Value(s) (Where Applicable):**
	Alphanumeric	None		
Description:	This is the codeline data that was provided to the IQA software to determine the match for AuxOnUs.			
Additional Information:	This value is provided to the IQA software with each front image that is to be tested.			

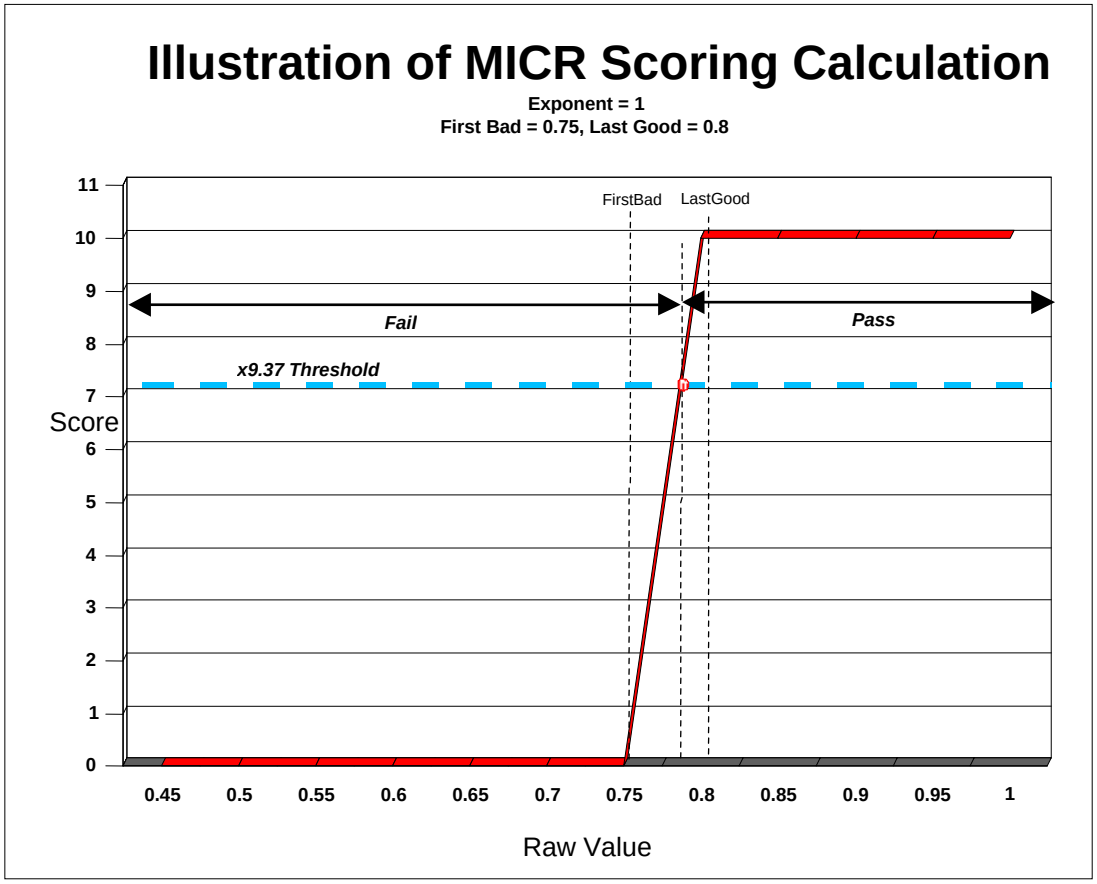
2.9.3 Third Test Parameter				
Test Parameter Name: Acceptable Number of Digit Errors				
Test Parameter XML Name:	**Data Type:**	**Data Units:**	**Data Range:**	**Recommended Value(s) (Where Applicable):**
	Numeric	Digit Errors		1
Description:	This is the number of acceptable Digit Errors that occur when performing OCR that will be allowed before the IQA software begins to penalize the results due to Digit Errors.			
Additional Information:	This value is settable by the user.			

2.9.4 Fourth Test Parameter				
Test Parameter Name: Ignore Leading Zeroes				
Test Parameter XML Name:	**Data Type:**	**Data Units:**	**Data Range:**	**Recommended Value(s) (Where Applicable):**
	Numeric	None	0 or 1	0 (*default*)
Description:	This is a “Boolean” value that tells IQA to ignore leading zeroes in both the match data and the OCR data obtained from the image. If this test parameter is ‘1’, then leading zeroes for this field are ignored when performing the match. If this parameter is ‘0’, then leading zeroes **are** considered when performing the match.			
Additional Information:	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.			

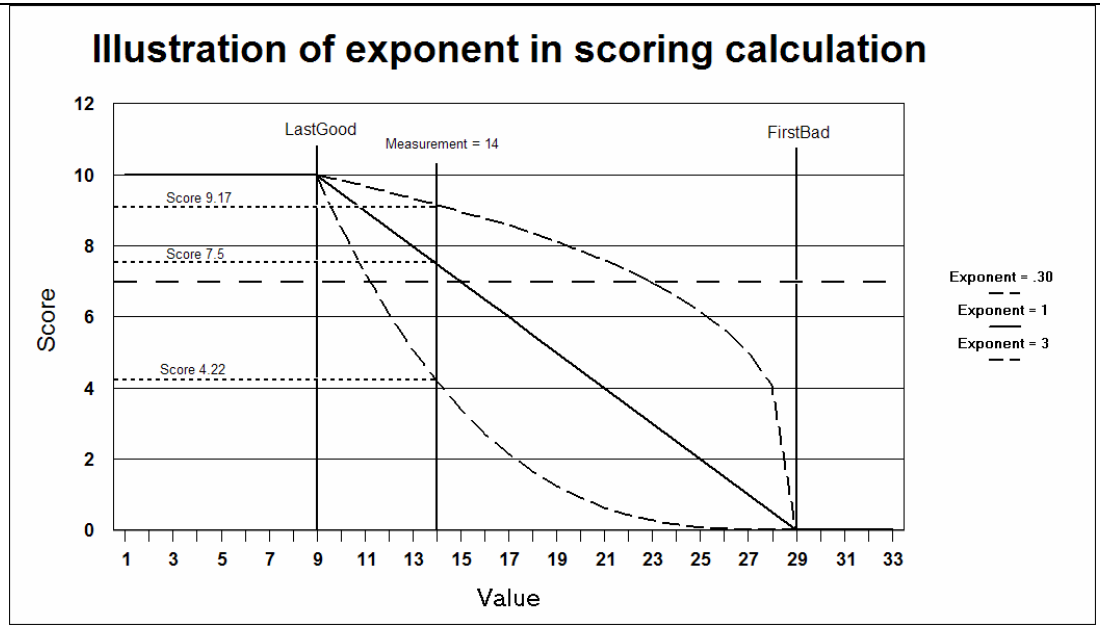
2.9.5 Fifth Test Parameter				
Test Parameter Name: Ignore Selector Field Digit Errors				
Test Parameter XML Name:	**Data Type:**	**Data Units:**	**Data Range:**	**Recommended Value(s) (Where Applicable):**
	Numeric	None	0 or 1	0 (*default*)
Description:	This is a “Boolean” value that tells IQA to ignore digit errors provided in the match data that is given to IQA with the image for comparison to the OCR data obtained from the image. If this parameter is ‘1’, then digit errors in the match data provided to IQA for this field do not enter into consideration when character matching is performed. If this parameter is ‘0’, then digit errors in the match data provided to IQA for this field are considered when character matching is performed.			
Additional Information:	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.			

2.9.6 Sixth Test Parameter				
Test Parameter Name: Include Dashes				
Test Parameter XML Name:	**Data Type:**	**Data Units:**	**Data Range:**	**Recommended Value(s) (Where Applicable):**
	Numeric	None	0 or 1	0 (*default*)
Description:	This is a “Boolean” value that tells IQA whether or not to ignore dashes when making comparisons. If this value is ‘1’, then any dashes provided in either the match data or the OCR data are removed before performing the comparison functions. If this parameter is ‘0’, then dashes are *not* removed from either the match data provided to IQA or for the OCR data detected in the image.			
Additional Information:	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.			

2.9.7 Seventh Test Parameter				
Test Parameter Name: Missing Field Matches				
Test Parameter XML Name:	**Data Type:**	**Data Units:**	**Data Range:**	**Recommended Value(s) (Where Applicable):**
	Numeric	None	0 or 1	0 (*default*)
Description:	This is a “Boolean” value that tells IQA whether or not to consider a “missing” AuxOnUs field to be OK. If this value is ‘1’, then if IQA is provided match data for an expected AuxOnUs field and the field is not recognized by the OCR routines in the image, the test will still pass. If the value is ‘0’ and this situation occurs, then the test will fail.			
Additional Information:	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.			

2.10	**Image Test Flag Pass/Fail Criteria:** *The Image Test Flag (see ANS X9.100-40-1-2006 for details) will convey one of the following four test conditions:* • *Condition not tested* • *Condition tested and result = fail* • *Condition tested and result = pass* • *Condition tested and result=indeterminate*	The software will report this result whenever the user is performing codeline matching on the images under test. When the test executes, there will be two possible results: • *Condition tested and result = fail* This test will **fail** when the Raw value (shown on the x-axis below) falls below the point indicated by the dot (about .76). • *Condition tested and result = pass* This test will **pass** when the Raw value is higher than the point indicated by the dot (about .76) The chart below shows the way in which the test score is derived. It also shows the correlations between the MICR Raw value, the score and the pass/fail decision. 

		In the chart above, the items that the user can set are: • X9.37 threshold (*set to 7.0 in this example*) • LastGood (*set to 0.8 in this example*) • FirstBad (*set to 0.75 in this example*) • The Exponent in this case (which controls the shape of the line between the LastGood and FirstBad parameters) is set to '*1*'. • Any item that has a raw score above 0.76 will pass this test with the given parameters. In addition to the items shown above, the shape line between the LastGood and FirstBad elements may be set by the Exponent value. The "Last Good" parameter is the point beyond which the judgment of the measurement results begins to decrease from a "10.0". The "First Bad" parameter beyond which the measurement results will be a "0.0". The "direction" from "Last Good" to "First Bad" is determined by the relative size of the two parameters. If the "LastGood" is less than "First Bad", then the score will get worse as its measurement grows from the "LastGood" measurement point. If "FirstBad" is less than "LastGood", then the score will get better as its measurement grows from the "FirstBad" measurement point. The scoring of items with values that fall between the relevant "LastGood" and "FirstBad" values is performed in two steps: • The first step generates the preliminary score, which is a linear interpolation between the LastGood and FirstBad elements. This preliminary score is normalized to a value of between 0 and 1. • After the preliminary score is calculated, it is finalized by raising that score to the value of the Exponent and multiplied by 10 to yield the final result. This results in a curved shape of the score. An example of this scoring method is shown in the following diagram:



For this example, we have a “LastGood” value of 9 and a “FirstBad” value of 29. If the user selects an exponent value for this measurement of ‘1’, we see the linear slope between the “LastGood” point and the “FirstBad” point. If the exponent is other than 1, we see an exponential curve between the two points. For this particular example, with a measured value of 14, we score the result as 9.17 with an exponent value of .3. It scores as a 7.5 with an exponent value of 1, and it scores 4.22 with an exponent value of 3. If the score value is at or above the x9.37Threshold value of 7, then the test is graded as a “**pass**”. If the score value is below the x9.37Threshold, then the test is graded as a “**fail**”.

3	**Restrictions & Intellectual Property**	
3.1	Are there any known restrictions in the use of the submitted check image test and related technology (technical, performance, legal, business, platform, etc.)?	☒ No ☐ Yes - *please provide details:*
3.2	Are proprietary Intellectual Property (IP) rights in the form of Patents associated with the description and use of the submitted check image test?	☒ No ☐ Yes – *Please provide patent and/or patent application numbers and indicate who owns the IP. Also provide evidence that the patent holder agrees to comply with the X9 Procedures including the X9 patent policy:*
3.3	Are proprietary Intellectual Property (IP) rights in the form of proprietary material and/or other intellectual property (e.g. specific to a vendor tool, device, or product) associated with the description and use of the submitted check image test?	☒ No ☐ Yes – *Please provide evidence that the owner agrees to provide the Proprietary IP Holder Statement contained in Annex B of ANS X9.100-40-2006 Part 2:*

Notice: *By accepting a check image test for registration, ASC X9 is not endorsing, certifying validity, certifying performance, nor providing any warranty for the registered check image test. The organization using the test shall determine which test(s) to use based on their own business needs, perceived benefit, and validation/ assessment of any test results provided by the check image test supplier, their own testing, or a third party.*