



AEROSPACE STANDARD

AS6171™/1

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Suspect/Counterfeit Test Evaluation Method

RATIONALE

This document is intended to provide guidance and requirements for the test laboratory in the evaluation of counterfeit parts detection testing performed by the test laboratory. This evaluation includes the determination of the Counterfeit Defect Coverage (CDC), the Counterfeit Type Coverage (CTC), the Under-Covered Defects (UCD), and the Not-Covered Defects (NCD). A method is also described to select a sequence of tests for a given resource utilization.

INTRODUCTION

Many test plans have been developed by organizations to screen for counterfeit parts. There is a need to evaluate the effectiveness of different test plans to provide a common comparison of testing deployments utilized by different organizations. This document provides a framework to assess a test plan to report CDC, CTC, NCDs, and UCDs which measure the effectiveness of the specified test plan for counterfeit parts detection.

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1. SCOPE

This document describes an assessment of the effectiveness of a specified test plan used to screen for counterfeit parts. The assessment includes the determination of the types of defects detected using a specified test plan along with the related counterfeit type coverage. The output of this evaluation will produce Counterfeit Defect Coverage (CDC), Counterfeit Type Coverage (CTC), Not-Covered Defects (NCDs), and Under-Covered Defects (UCDs). This information will be supplied to the test laboratory's customer in both the test report and the Certificate of Quality Conformance (CoQC). This evaluation method does not address the effectiveness of detecting tampered type devices.

The Test Evaluation Method also describes an Optimized Test Sequence Selection, in which a test sequence is selected that maximizes the CDC utilizing test cost and time as constraints, for any tier level except the Critical Risk Level. The constraints can be adjusted until the desired CDC is achieved. The output of the Optimized Test Sequence Selection also includes CTC, NCDs, and UCDs.

If AS6171/1 is invoked in the contract, the base document, AS6171 General Requirements shall also apply.

2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS6171 Test Methods Standard: General Requirements, Suspect/Counterfeit, Electrical, Electronic, and Electromechanical Parts

3. REQUIREMENTS

3.1 Key Elements

Key elements of the assessment framework are summarized below.

Test Methods (M) - All test methods defined in AS6171 are taken into account by the CDC algorithm.

$M = [M_1 M_2 \dots M_m]$, where, m is the number of test methods.

Counterfeit Defects (D) - The counterfeit related defects and anomalies present in counterfeit parts. By ensuring detection of one or more defects, counterfeit detection confidence is increased. Refer to Appendix A for definitions of defects addressed.

$D = [D_1 D_2 \dots D_n]$, where, n is the number of counterfeit defects.

Test Cost (C) - Each test method is associated with a test cost.

$C = [C_1 C_2 \dots C_m]$, where, m is the number of test methods.

Test Time (T) - Each test method is associated with a test time.

$T = [T_1 T_2 \dots T_m]$, where, m is the number of test methods.

Disclaimer: Test costs and test times are used in the CDC calculation as a basis for optimization of test method selection and are not to be used to determine actual test cost and/or test time. Actual test costs and test times vary with device complexity, test requirements, and laboratory overhead; if needed, test costs and test times should be obtained from an approved test laboratory. In addition, the cost of the parts consumed in testing is not a consideration of the CDC algorithm.

Target Confidence (TC) - The level of confidence to be achieved for each defect by performing a set of tests. It is established by the tier level breakpoints (TL) defined in 3.1, Risk Assessment of AS6171 General Requirements.

Table 1 - Target confidence values

Tier Level	Target Confidence (TC)
Critical	≥90%
High	80%-90%
Moderate	65%-80%
Low	50%-65%
Very Low	35%-50%

Confidence Level Matrix (CL) - This matrix represents the capability of test methods to detect counterfeit defects. Each entry of the matrix CL represents the confidence level of detecting a defect by a test method.

$$CL = [x_{ij}] = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1j} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2j} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{i1} & x_{i2} & \cdots & x_{ij} & \cdots & x_{in} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mj} & \cdots & x_{mn} \end{bmatrix}$$

where, x_{ij} is the probability of detecting a defect j by a method i , and x_{mn} defines the upper limits of the matrix. (m represents the total number of test methods and n represents the total number of defects.)

$$x_{ij} \in \{ High, Medium, Low \} = \{0.9, 0.7, 0.5\}$$

If two or more methods detect a defect j , then the resultant confidence (x_{Rj}) will be increased and is given by the equation:

$$x_{Rj} = 1 - \prod_{i=1}^m (1 - x_{ij}) \quad (\text{Eq. 1})$$

NOTE: In certain instances, the tests performed may have enough commonality that the resultant confidence may be overestimated since the same defect characteristics may be detected by multiple tests resulting in duplication of coverage instead of increased scope of coverage.

Additionally, during the selection of tests, the optimization goes in the order of the defects in the table. If the order of defects in the table were changed, it could result in a different sequence of tests due to the different optimization computed by the algorithm.

Decision Index (DI) -The probability that a counterfeit type contains one or more known defect types. CTC equals DI if all defects present in a counterfeit type are detectable. DI may approach zero for counterfeit types such as overproduced and cloned due to the rare occurrence of defects. See Table 7 for DI values.

Table 2 - Decision index

Counterfeit Type	Decision Index (DI)
Recycled	0.98
Remarked	0.90
Overproduced	0.03
Out-of-Spec/Defective	0.50
Cloned	0.10
Forged Documentation	0.70
Tampered	0.98

Weighting (W) - Identifies the presence of a defect in a counterfeit type. Weighting equals 1 if the defect is present for the counterfeit type and 0 if the defect is not present. Weighting values are shown in Appendix C.



Counterfeit Defect Coverage (CDC) - Defined as the ratio of possible detectable defects to the total number of known counterfeit related defects (see Appendix A for a list of known counterfeit related defects). It gives a cumulative assessment of multiple test methods in terms of their capability of detecting defects and provides an overall confidence after performing a sequence of tests. The CDC can be expressed as:

$$CDC = \frac{\text{Possible Detectable Defects}}{\text{Total Defects}} \times 100\%$$

The total confidence of finding a part as counterfeit, CDC, becomes the ratio of the cumulative sum of the resultant confidence of all the defects to the total number of defects. Thus, it can be expressed by the following equation:

$$CDC = \frac{\sum_{j=1}^n x_{Rj}}{n} \times 100 \quad (\text{Eq. 2})$$

where x_{Rj} is the resultant confidence level for defect j after performing the recommended test set, and n is the total number of defects.

Counterfeit Type Coverage - The ability to detect a counterfeit type (see 2.2 of AS6171 General Requirements for definitions of counterfeit types) based on the defects present given the test methods performed. CTC can be expressed as:

$$CTC = DI \times \frac{\text{Possible Detectable Defects for a CT}}{\text{Total Defects for a CT}} \times 100\%$$

where CT is counterfeit type and DI is the decision index.

The purpose of CTC is to establish the effectiveness of a test plan to detect a particular counterfeit type. Counterfeit types are defined in 2.2 and include recycled, remarked, overproduced, out of spec/defective, cloned, forged documentation, and tampered devices. For the purposes of this document, tampered devices are not addressed. Mathematically CTC can be expressed as:

$$CTC_k = DI_k * \frac{\sum (x_{Rj} * w_{jk})}{\sum w_{jk}} * 100 \quad (\text{Eq. 3})$$

where:

CTC_k = Counterfeit type coverage for counterfeit type k

DI_k = Decision index for counterfeit type k (see Table 2)

x_{Rj} = Resultant confidence (see Equation 1)

w_{jk} = Weighting for defect j and counterfeit type k

Not-Covered Defects (NCDs) - Defects are classified as NCDs when a set of tests cannot detect them. A counterfeit defect j will be a NCD if $x_{Rj} = 0$ after performing a set of tests.

Under-Covered Defects (UCDs) - Defects are classified as UCDs when a set of tests cannot provide the desired target confidence level (TC). The defect is detectable by the tests performed, but not to the confidence level required by TC.

$$x_{Rj} < TC \quad (\text{Eq. 4})$$

3.2 Test Sequence Evaluation

In Test Sequence Evaluation, the User/Requester specifies the test methods to be assessed. The output of this test sequence evaluation is CDC, CTC, NCDs, and UCDs as assessment metrics. The details of test sequence evaluation is described in Table 3.

Table 3 - Test sequence evaluation for a test plan

Step #	Name	Description
1	Select tier level	Select the desired tier level for assessment. This initializes TL with a specific value. For an example, TL will be 0.90 for critical tier applications.
2	Select test methods	Select the desired test methods per the SOW or test plan.
3	Establish CL matrix	Establish the CL matrix for each defect in Appendix A based on test coverage from step 2. Confidence levels are established from Appendix B taking the average of lower and upper limit. (High = 93%, Medium = 67.5%, Low = 37.5%, Very Low = 15%, Very Very Low = 2.5%, and N/A=0%).
4	Determine TC	Determine the target confidence (TC) defined in Table 1 based on the TL selected in step 1.
5	Determine resultant testing confidence	Calculate x_{Rj} (resultant confidence level) for all defects using the CL matrix from step 3 and Equation 1.
6	Determine if a defect is an NCD or UCD	If $x_{Rj} = 0$, then the defect is an NCD. If $x_{Rj} < TC$, then the defect is a UCD.
7	Calculate CDC	Calculate CDC using Equation 2.
8	Determine decision index	Determine the decision index based on the counterfeit type under evaluation. See Table 2 for DI values.
9	Identify weighting (W)	Select weighting values from the Weighting Table in Appendix C).
10	Calculate CTC	Calculate CTC using Equation 3.
11	Report results	Report CDC, CTC, NCDs, and UCDs.

3.2.1 Test Sequence Evaluation Example 1

This example demonstrates the basic process for deriving CDC, CTC, NCD, and UCD for a critical (tier 4) tier level selection. For simplicity, five test methods and four defects are considered. The confidence level matrix is shown in Table 4 where each entry can take a value of N/A (0.0%), Low (50% or 0.5), Medium (70% or 0.7), and High (90% or 0.9). For actual calculations, this data is provided in Appendix B.

Table 4 - Simplified Appendix B table

Test Methods	Defect #A	Defect #B	Defect #C	Defect #D
Test Method #1	High (0.9)	Low (0.5)	N/A	N/A
Test Method #2	N/A	N/A	High (0.9)	Medium (0.7)
Test Method #3	N/A	High (0.9)	N/A	N/A
Test Method #4	High (0.9)	N/A	N/A	N/A
Test Method #5	N/A	N/A	Medium (0.7)	N/A

In addition, we assume three counterfeit types (#X, #Y, and #Z) are to be evaluated. Weighting (W) and decision index (DI) data for this example is shown in Table 5.

Table 5 - Simplified weighting and decision index table

Defect	Counterfeit Type #X	Counterfeit Type #Y	Counterfeit Type #Z
Defect #A	1	0	0
Defect #B	0	1	0
Defect #C	1	0	0
Defect #D	1	1	1
Decision Index	0.98	0.5	0.03

This means that defect #A is present in only counterfeit type #X, #B is present in only counterfeit type #Y, #C is present in only counterfeit type #X, and #D is present in all counterfeit types. For actual calculations, this data is provided in Appendix C.

Table 6 - Example 1 test sequence evaluation

Step #	Name	Description																				
1	Select tier level	Assume the tier level selected for this example is critical tier level (tier 4).																				
2	Select Test Methods	Five test methods are selected as shown in Table 4.																				
3	Establish CL Matrix	Test coverage confidence is shown in Table 4 for all combinations of the five tests and four defects. The confidence level matrix (CL) is established with the data from Table 4: $CL = \begin{bmatrix} 0.9 & 0.5 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9 & 0.7 \\ 0.0 & 0.9 & 0.0 & 0.0 \\ 0.9 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.7 & 0.0 \end{bmatrix}$ This data can be interpreted as follows: Each row of the CL matrix represents a test method. Each column represents a defect. The values entered are the confidence of detecting a specific defect using the test method. This means that test #1 has a 0.9 probability of detecting defect #A, 0.5 probability of detecting defect #B, 0 probability of detecting defect #C and 0 probability of detecting defect #D.																				
4	Initialize TC	Target Confidence (TC) = 0.90 based on critical tier level selected in step 1 and Table 1.																				
5	Determine resultant testing confidence	Calculate x_{Rj}(resultant confidence level) for all defects using the CL matrix from step 3 and Equation 1. x_{RA} for defect #A $x_{RA} = 1 - (1 - 0.9)(1 - 0.9) = 0.99$ x_{RB} for defect #B $x_{RB} = 1 - (1 - 0.5)(1 - 0.9) = 0.95$ x_{RC} for defect #C $x_{RC} = 1 - (1 - 0.9)(1 - 0.7) = 0.97$ x_{RD} for defect #D $x_{RD} = 1 - (1 - 0.7) = 0.7$																				
6	Determine if a defect is an NCD or UCD	Determine if a defect is an NCD or UCD for all defects If $x_{Rj} = 0$, then the defect is an NCD If $x_{Rj} < TC$ (0.90, from step 4) then the defect is a UCD $x_{RA} = 0.99$, which is ≥ 0.90 (TC), not an NCD or UCD $x_{RB} = 0.95$, which is ≥ 0.90 (TC), not an NCD or UCD $x_{RC} = 0.97$, which is ≥ 0.90 (TC), not an NCD or UCD $x_{RD} = 0.7$, which is < 0.90 (TC), not an NCD, is a UCD																				
7	Calculate CDC	Calculate CDC using Equation 2. $CDC = \frac{\sum_{j=1}^n x_{Rj}}{n} \times 100$ $CDC = \frac{0.99 + 0.95 + 0.97 + 0.7}{4} \times 100 = 90.25\%$																				
8	Determine Decision Index	Determine the decision index based on the counterfeit type under evaluation. See Table 5 for DI values for this example. DI#X = 0.98; DI#Y = 0.5; DI#Z = 0.03																				
9	Identify Weighting	Select Weighting values from the Weighting Table shown in Table 5 for this example. <table><tr><th>Defect</th><th>Counterfeit Type #X</th><th>Counterfeit Type #Y</th><th>Counterfeit Type #Z</th></tr><tr><td>Defect #A</td><td>1</td><td>0</td><td>0</td></tr><tr><td>Defect #B</td><td>0</td><td>1</td><td>0</td></tr><tr><td>Defect #C</td><td>1</td><td>0</td><td>0</td></tr><tr><td>Defect #D</td><td>1</td><td>1</td><td>1</td></tr></table>	Defect	Counterfeit Type #X	Counterfeit Type #Y	Counterfeit Type #Z	Defect #A	1	0	0	Defect #B	0	1	0	Defect #C	1	0	0	Defect #D	1	1	1
Defect	Counterfeit Type #X	Counterfeit Type #Y	Counterfeit Type #Z																			
Defect #A	1	0	0																			
Defect #B	0	1	0																			
Defect #C	1	0	0																			
Defect #D	1	1	1																			

10	Calculate CTC	Calculate CTC using Equation 3. $CTC_k = DI_k * \frac{\sum (x_{Rj} * w_{jk})}{\sum w_{jk}} * 100$ $CTC_X = 0.98 * \frac{(0.99 * 1) + (0.95 * 0) + (0.97 * 1) + (0.7 * 1)}{1 + 0 + 1 + 1}$ $CTC_X = 86.89$ $CTC_Y = 0.5 * \frac{(0.99 * 0) + (0.95 * 1) + (0.97 * 0) + (0.7 * 1)}{0 + 1 + 0 + 1}$ $CTC_Y = 42.25$ $CTC_Z = 0.03 * \frac{(0.99 * 0) + (0.95 * 0) + (0.97 * 0) + (0.7 * 1)}{0 + 0 + 0 + 1}$ $CTC_Z = 2.10$
11	Report results	Report CDC, CTC, NCDs, and UCDs. CDC = 90.25% $CTC_X = 86.89$; $CTC_Y = 42.25$; $CTC_Z = 2.10$ NCD: None UCD: Defect #D

3.2.2 Test Sequence Evaluation Example 2

This example demonstrates the basic process for deriving CDC, CTC, NCD, and UCD for a low (tier 1) tier level selection. For this example, use the test method and defect confidence data provided in Table 7. For actual calculations, this data is provided in Appendix B.

Table 7 - Simplified Appendix B table

Test Methods	Defect #A	Defect #B	Defect #C	Defect #D
Test Method #6	High (0.9)	Low (0.5)	N/A	N/A
Test Method #7	N/A	N/A	Low (0.5)	N/A
Test Method #8	N/A	N/A	Low (0.5)	N/A
Test Method #9	Medium (0.7)	N/A	N/A	N/A
Test Method #10	N/A	N/A	Low (0.5)	N/A

In addition, we assume three counterfeit types (#L, #M, and #N) are to be evaluated. Weighting (W) and decision index (DI) data for this example is shown in Table 8.

Table 8 - Simplified weighting and decision index table

Defect	Counterfeit Type #L	Counterfeit Type #M	Counterfeit Type #N
Defect #A	0	1	0
Defect #B	0	0	1
Defect #C	1	0	1
Defect #D	1	1	0
Decision Index	0.9	0.7	0.1

Table 9 - Example 2 test sequence evaluation

Step #	Name	Description																				
1	Select tier level	Assume the tier level selected for this example is low tier level (tier 1).																				
2	Select Test Methods	Five test methods are selected as shown in Table 7.																				
3	Establish CL Matrix	Test coverage confidence is shown in Table 5 for all combinations of the five tests and four defects. The confidence level matrix (CL) is established with the data from Table 5: $CL = \begin{bmatrix} 0.9 & 0.5 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.5 & 0.0 \\ 0.0 & 0.0 & 0.5 & 0.0 \\ 0.7 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.5 & 0.0 \end{bmatrix}$ This data can be interpreted as follows: Each row of the CL matrix represents a test method. Each column represents a defect. The values entered are the confidence of detecting a specific defect using the test method. This means that test #6 has a 0.9 probability of detecting defect #A, 0.5 probability of detecting defect #B, 0 probability of detecting defect #C and 0 probability of detecting defect #D.																				
4	Initialize TC	Target Confidence (TC) = 0.5 based on low tier level selected in step 1 and Table 1.																				
5	Determine resultant testing confidence	Calculate x_{Rj} (resultant confidence level) for all defects using the CL matrix from step 3 and Equation 1. x_{RA} for defect #A $x_{RA} = 1 - (1 - 0.9)(1 - 0.7) = 0.97$ x_{RB} for defect #B $x_{RB} = 1 - (1 - 0.5) = 0.5$ x_{RC} for defect #C $x_{RC} = 1 - (1 - 0.5)(1 - 0.5)(1 - 0.5) = 0.875$ x_{RD} for defect #D $x_{RD} = 0$																				
6	Determine if a defect is an NCD or UCD	Determine if a defect is an NCD or UCD for all defects If $x_{Rj} = 0$, then the defect is an NCD If $x_{Rj} < TC$ (0.5, from step 4) then the defect is a UCD $x_{RA} = 0.97$, which is ≥ 0.5 (TC), not an NCD or UCD $x_{RB} = 0.5$, which is ≥ 0.5 (TC), not an NCD or UCD $x_{RC} = 0.875$, which is ≥ 0.5 (TC), not an NCD or UCD $x_{RD} = 0$, which is < 0.5 (TC), is an NCD																				
7	Calculate CDC	Calculate CDC (Equation 2) $CDC = \frac{\sum_{j=1}^n x_{Rj}}{n} \times 100$ $CDC = \frac{0.97 + .5 + 0.875 + 0}{4} \times 100 = 58.63\%$																				
8	Determine Decision Index	Determine the decision index based on the counterfeit type under evaluation. See Table 8 for Decision Index values for this example. $DI_{\#L} = 0.9$; $DI_{\#M} = 0.7$; $DI_{\#N} = 0.1$																				
9	Identify Weighting	Select Weighting values from the Weighting Table shown in Table 8 for this example. <table><tr><th>Defect</th><th>Counterfeit Type #L</th><th>Counterfeit Type #M</th><th>Counterfeit Type #N</th></tr><tr><td>Defect #A</td><td>0</td><td>1</td><td>0</td></tr><tr><td>Defect #B</td><td>0</td><td>0</td><td>1</td></tr><tr><td>Defect #C</td><td>1</td><td>0</td><td>1</td></tr><tr><td>Defect #D</td><td>1</td><td>1</td><td>0</td></tr></table>	Defect	Counterfeit Type #L	Counterfeit Type #M	Counterfeit Type #N	Defect #A	0	1	0	Defect #B	0	0	1	Defect #C	1	0	1	Defect #D	1	1	0
Defect	Counterfeit Type #L	Counterfeit Type #M	Counterfeit Type #N																			
Defect #A	0	1	0																			
Defect #B	0	0	1																			
Defect #C	1	0	1																			
Defect #D	1	1	0																			
10	Calculate CTC	Calculate CTC from Equation 3. $CTC_k = DI_k * \frac{\sum (x_{Rj} * w_{jk})}{\sum w_{jk}} * 100$ $CTC_L = 0.9 * \frac{(0.97*0)+(0.5*0)+(0.875*1)+(0.0*1)}{0+0+1+1} * 100$ $CTC_L = 39.38$ $CTC_M = 0.7 * \frac{(0.99*1)+(0.95*0)+(0.97*0)+(0.7*1)}{1+0+0+1} * 100$ $CTC_M = 59.15$ $CTC_N = 0.1 * \frac{(0.99*0) + (0.95*1) + (0.97*1) + (0.7*0)}{0+1+1+0} * 100$ $CTC_N = 9.60$																				

Step #	Name	Description
11	Report results	Report CDC, NCDs, and UCDs. CDC = 58.63% $CTC_L = 39.38$; $CTC_M = 59.15$; $CTC_N = 9.60$ NCD: Defect #D UCD: None

3.3 Optimized Test Sequence Selection

The objective of the Optimized Test Sequence Selection is to identify a test sequence with user constraints such as desired CDC, test time, and test cost utilizing the test sequence evaluation algorithm. The details of test sequence evaluation are described in 3.2. In the following, we will describe the selection of test methods.

Method Selection Algorithm

Select a set of test methods $M^S \subset M$ to maximize CDC

Subjected to:

$$x_{Rj} \geq TC, \forall j \in \{1:n\} \quad \text{for critical tier level}$$

or

$$\begin{cases} x_{Rj} \geq TC, \forall j \in \{1:n\} \\ M_1C_1 + M_2C_2 + \dots + M_nC_n \leq C_{user} \\ M_1T_1 + M_2T_2 + \dots + M_nT_n \leq T_{user} \end{cases} \quad \text{for other tier levels}$$

where:

i : Test method index

j : Defect index

m : Number of test methods

n : Number of defects

x_{Rj} : Resultant confidence for defect j

TC : Target confidence

M_i : Test method i ; $M_i \in \{0,1\} = \{\text{Not selected}, \text{selected}\}$

C_i : Test cost for test method i

T_i : Test time for test method i

C_{user} : User/Requester specified test cost

T_{user} : User/Requester specified test time

$\subset, \forall, \text{and} \in$ represent 'subset', 'for all', and 'belongs to' respectively

Table 10 - Optimized test sequence selection

	Step #	Name	Description
Method Selection	1	Select tier level	Select the desired tier level for assessment. This initializes TL with a specific value. For an example, TL will be 0.90 for critical tier applications.
	2	Establish CL matrix	Establish the CL matrix for each defect in Appendix A based on test coverage from step 2. Confidence levels are established from Appendix B taking the average of lower and upper limit. (High = 93%, Medium = 67.5%, Low = 37.5%, Very Low = 15%, Very Very Low = 2.5%, and N/A=0%).
	3	Determine TC	Determine the target confidence (TC) defined in Table 1 based on the TL selected in step 1.
	4	Method selection	Set defect index $j = 0$ to point the first defect;
	5	Method selection	Set method index $i = 0$
	6	Method selection	Sort methods according to individual CDC contribution for critical tier, and test cost and time for other tier levels.
	7	Method selection	Select a method from the top of the sorted method array unless it is selected before; Verify test and time constraint except for critical tier level. Exit if violated.
	8	Method selection	Calculate x_{Rj}
	9	Method selection	If $x_{Rj} \geq TC$ Increase defect index ($j=j+1$) to point the next defect; Go to step 5; Else Select a method from the top of the sorted method array; Verify test and time constraint except for critical tier level and undo selection if violated. Increase method index ($i=i+1$); Go to step 9;
	10	Method selection	All methods selected for custom assessment.
Custom Assessment	11	Determine resultant testing confidence	Calculate x_{Rj} (resultant confidence level) for all defects using the CL matrix from step 3 and Equation 1.
	12	Determine if a defect is an NCD or UCD	If $x_{Rj} = 0$, then the defect is an NCD. If $x_{Rj} < TC$, then the defect is a UCD.
	13	Calculate CDC	Calculate CDC using Equation 2.
	14	Determine decision index	Determine the decision index based on the counterfeit type under evaluation. See Table 2 for DI values.
	15	Identify weighting (W)	Select weighting values from the Weighting Table in Appendix C).
	16	Calculate CTC	Calculate CTC using Equation 3.
	17	Report results	Report CDC, CTC, NCDs, and UCDs.

3.3.1 Optimized Test Sequence Selection Example 1

This example demonstrates the basic process for deriving CDC, CTC, NCD, and UCD for a critical (tier 4) tier level selection. For simplicity, five test methods and four defects are considered, as shown in Table 11. The confidence level matrix is shown in Table 4 where each entry can take a value of N/A (0.0%), Low (50% or 0.5), Medium (70% or 0.7), and High (90% or 0.9). For actual calculations, this data is provided in Appendix B.