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Bank of England

Framework for the Testing of Automatic Banknote Handling Machines

1. Introduction

Maintaining confidence in the currency requires that cash users trust the physical integrity of the Bank of England's banknotes. This document describes the Framework implemented to verify that machines in use do not give value for counterfeit notes. The framework sets minimum standards, which manufacturers of such machines will be able to demonstrate that their machines are capable of meeting. The Framework is not intended to exhaustively test or give guidance on the performance of machines with respect to genuine notes. Business owners are requested to conduct their own tests to ensure that machines meet expected performance.

2. Objectives.

2.1 To test example models of automatic banknote handling machines sold for use into the UK market do not give value for counterfeit notes according to minimum standards set by us and to verify this at least annually.

2.2 To facilitate these objectives we will:

- (a) Check that machines are set up correctly by testing with circulated fit notes.
- (b) Check that machines either reject or separate any suspect banknotes from genuine notes depending on their end use/functionality and do not give value for them.
- (c) Check that, where appropriate, customer information relating to the deposit of counterfeit banknotes is retained for customer operated deposit and recycling machines and that the retained notes are identified to such a transaction.

Further details of the tests are set out in Section 7 and Appendix 1.

3. Scope

- 3.1 Tests will be carried out on banknote handling machines that accept banknotes issued by the Bank of England only. Only banknotes issued by the Bank of England will be used in tests and references in this framework to “**notes**” or “**banknotes**” are to banknotes issued by the Bank of England.
- 3.2 Manufacturers of banknote handling machines described in Section 3.3 below, including manufacturers of host machines incorporating another manufacturer’s authentication device, will be permitted to submit machines for testing. Agents, suppliers or distributors are not eligible to submit machines for testing, but the Bank may, at its discretion, extend testing to a supplier or distributor that is officially nominated by the Manufacturer, such nomination to be confirmed by the Manufacturer, if the Manufacturer is based outside the United Kingdom and cannot participate in person.
- 3.3 The following types of banknote handling machines are eligible for testing (and for the purposes of this framework are referred to as “**machines**”):
- (a) Point of sale machines (manual or automatic insertion) where an automatic indication is made that a suspect banknote is identified.
 - (b) Desktop note counters with authentication sensors.
 - (c) Desktop fitness sorters with authentication sensors.
 - (d) Note acceptors/bill validators (single note readers).
 - (e) Business machines (bunch note acceptors, customer self service and teller assist).
 - (f) Recycling machines (note accepting and recycling and those that also fitness sort).
 - (g) Medium speed note sorters (around 10-15 banknotes per second).
 - (h) High speed note sorters (around 40 banknotes per second).
 - (i) Recycling machines for anonymous customer transactions.
 - (j) Any other machines where the machine differentiates between genuine and counterfeit and/or fit and unfit notes without human assistance.

3.4 The following types of banknote handling machines are not eligible for testing as part of this framework:

- (a) Equipment where a person makes a judgement about whether a note is suspect, e.g. magnifying equipment, UV lamps, IR viewers, felt-tip detector pens.
- (b) Automatic Teller Machines (ATM's) that dispense only without authentication.
- (c) Equipment not CE marked (European Safety Directive).
- (d) Equipment not intended to handle Bank of England banknotes.

4. Conditions for participation in the testing framework

4.1 Each manufacturer wishing to take part in the framework shall enter into a bilateral agreement with the Bank before testing commences in respect of a machine. The form of the agreement includes provisions, among others, in respect of confidentiality, the publication of test results by the Bank and a disclaimer of liabilities. This framework document and the agreement shall together form the terms and conditions applicable to manufacturers in respect of their participation in the testing framework. This framework may be revised or amended by the Bank at any time. The Bank will endeavour to give notice of any amendment but reserves the right to introduce amendments with immediate effect if necessary.

4.2 Admission to the framework is conditional on manufacturers submitting certain information on the equipment to be tested before testing takes place. The information required to be submitted is available on request. If the manufacturer is not able to disclose the information required because of confidentiality obligations that it might have to a supplier then the Bank would engage directly with that supplier to receive this information prior to testing taking place. Information shared with the Bank will be considered confidential unless otherwise indicated by the manufacturer. We will however seek permission to publish information required as part of the publication of test results described in Section 8 and Appendix 2.

5. Scheduling

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- 5.1 The Bank aims to accommodate testing as quickly as scheduling will allow on a first-come–first-served basis. We will notify manufacturers when a particular machine is scheduled for an annual re-test and the manufacturer should then contact the Bank to schedule a re-test as soon as possible before the expiry of the last annual test. The Bank reserves the right to remove the results in respect of a machine(s) from the list of test results published on the Bank’s website if the manufacturer of that machine does not re-schedule the annual re-test within this time frame.
- 5.2 If a machine fails a test, the manufacturer should schedule a re-test as soon as practicable and the Bank will accommodate the re-test as soon as a free slot becomes available. The Bank reserves the right to remove the results in respect of a machine(s) from the list of test results published on the Bank’s website if the manufacturer fails a test, until such time that it passes a re-test.
- 5.3 In addition to the above, manufacturers can re-submit their machines at any time, for example following an update to their software, subject to there being available slots in the testing schedule and subject to paragraph 6.2 below.

6. Location, duration and cost of testing

- 6.1 Tests are conducted at the Bank of England, Debden and/or via the self-certification method, subject to Section 6.2 and for the self-certification method Section 6.9 below, will be free of charge.
- 6.2 If the Bank of England receives requests for multiple testing, such as during the development phase of new equipment outside of normal regular tests, then in such cases the Bank reserves the right to charge for such tests. The amount of any such charge will be notified in advance and will cover the Bank’s reasonable costs in carrying out the tests requested.

Tests conducted at the Bank of England (Debden)

- 6.3 Tests are conducted by Bank personnel in the presence of a nominated official of a manufacturer, or two Bank personnel if the nominated official of the manufacturer cannot attend, in accordance with the test procedures set out in Section 7 and Appendix 1. We would normally expect this to take place over the course of one day.

- 6.4 Manufacturers will pay for their own expenses e.g. travel and accommodation, and the packaging and transportation of machines to and from the testing location in all circumstances.
- 6.5 Large machines that are logistically difficult to move will be tested at a mutually agreeable location. The Bank reserves the right to charge for travel and accommodation in such circumstances.
- 6.6 Manufacturers are encouraged to loan their machines to the Bank so that additional tests with new counterfeit types can be checked by the Bank in-between regular testing. In the event of a failure being found with a new counterfeit type, the manufacturer will be asked to update their machine as appropriate and re-submit for testing; section 5.2 above would apply to such re-test.
- 6.7 Manufacturers will be able to access the counterfeit library to record and analyse information for later evaluation (“data grabbing exercises”) outside of the testing regime.

Self-certification tests

- 6.8 For the purposes of the self-certification tests at the manufacturer’s premises, the Bank will supply test packs of counterfeit notes, which the Bank will update from time to time.
- 6.9 All costs for the supply of the test packs (logistics costs including subsequent updates and returns) and supplying the manufacturer’s machine to the Bank of England as set out in Section 6.10, will be the responsibility of the manufacturer. The Bank will be responsible for scheduling the supply of the test packs.
- 6.10 The Bank reserves the right to request, via written notification, that the manufacturer provide its machine to Bank of England, Debden, for the purposes of auditing the test results submitted via the self-certification tests. The manufacturer will supply the machine to the Bank of England, Debden within 6 weeks of the Bank of England’s written notification. This Section 6.10 does not apply to high speed note sorters which are considered too large to move.

7. Types of tests and testing procedures.

7.1 Prior to the commencement of testing, manufacturers must enter into the agreement with the Bank referred to in Section 4.1 above and supply the information referred to in Section 4.2¹. Once the agreement has been signed and the information provided, the manufacturer will undertake either testing method outlined in Sections 7.1.1 and 7.1.2. :

7.1.1. On-site Tests conducted at the Bank (Debden):

Tests will be conducted in the following order:

- (a) Recognition test with genuine banknotes – all machines
- (b) Detection test with counterfeit banknotes – all machines

7.1.2. Self-certification test:

Test will be conducted in the following order:

- (a) Recognition test with genuine banknotes² – all machines
- (b) Detection test with counterfeit banknotes – all machines
- (c) Manufacturer to complete the self-certification form in Appendix 3 – all machines

Details of each of these tests and the procedures are set out in Appendix 1.

7.2 For tests conducted at the Bank of England, Debden, immediately following a test taking place, the Bank and the manufacturer shall agree the results and the manufacturer shall confirm its agreement of the results by signing an acceptance in the form set out in Appendix 2. For self-certification tests, the manufacturer will be required to sign the self-certification form set out in Appendix 3. Signature must be provided by a senior manager or director for the manufacturer. For both tests conducted at the Bank of England, Debden and self-certification tests, the acceptance form contains a confirmation that the manufacturer agrees to the publication on the Bank's external web site of the test results in respect of a machine that passes a test

¹ Available on request as a separate document.

² For self certification, tests with genuine notes are recommended but not mandatory if these are unavailable to the manufacturer on the day of the self-test. Manufacturers must certify in writing that the machine is in good working order and set up to accept current genuine notes correctly before testing with the counterfeit notes test deck as part of the self-certification sign off.

along with certain information that identifies the machine model and software version tested described in Section 8.

7.3 In the event that (i) a machine fails a test, or (ii) the Bank and a manufacturer are unable to agree the results of a test, the Bank will not publish the results of that particular test in respect of the relevant machine. In the event that a currently listed software/firmware or note set version fails a re-test, the manufacture must assign a different reference number to the updated version³.

7.4 Results are published within one month of the date on which a test took place.

8. Web page:

8.1 We will publish the following information with the test results with the manufacturers consent:

- (a) Manufacturer/address/contact details.
- (b) Machine category or type; and intended use.
- (c) Model number .
- (d) Software and or firmware and or table set version and whether the user can check this.
- (e) Test date; test pack issue number/version; and the date the test packs were created.
- (f) The issue number/version and date of the latest counterfeit test pack in use by the Bank of England.
- (g) The results and the standard to which the machines meet. Failed machines will not be reported on.
- (h) The date of the next test due date

9. Disclaimer

9.1 Manufacturers are responsible for updating and re-testing machine(s) regularly in accordance with the framework.

³ This is to ensure that owners of machines can check whether the existing software version is the latest version which passes the tests.

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- 9.2 Business owners and/or users of machines are responsible for checking that the machines they use are still supported by the manufacturer and that they have the latest updates installed.
- 9.3 The publication or non-publication of results in respect of a machine does not contain or imply a recommendation or endorsement by the Bank for the use or non-use of such machine and manufacturers may not represent or imply that the Bank has given or made such an endorsement or recommendation.
- 9.4 No warranty or representation is given or implied by the Bank that all machines of the model type tested will in use detect, correctly identify and/or reject or separate counterfeit and/or genuine and/or composed banknotes without error and/or is fit for purpose and manufacturers may not represent or imply that the Bank has given or made such a warranty or representation.
- 9.5 The Bank accepts no liability for any claim, loss, damage or expense of any kind or nature suffered or incurred by a manufacturer or any third party howsoever caused in respect of the participation of the manufacturer in this framework.
- 9.6 No permission express or implied is given by the Bank to a manufacturer to, and the manufacturer may not, make use of the Bank's name, logo or brand or any information about the Bank acquired by the manufacturer through its dealings with the Bank for any purpose.
- 9.7 The Bank may at its sole discretion and without notice terminate the agreement and remove a manufacturer's machine from the published list of test results if it considers that there has been a breach of Sections 9.3, 9.4 or 9.6 above. Without prejudice to this Section or Sections 9.3, 9.4 or 9.6, manufacturers may create a hyperlink from its website to this framework on the Bank's website, and may inform its customers that its machine(s) has been tested.

Appendix 1 Tests to be carried out.

For the purposes of these tests the following definitions and actions are defined:-

Category	Classification	Properties	Treatment	Treatment
1	Not recognised as a Bank of England banknote	Machine does not recognise the image as a Bank of England banknote	Reject	No value to be given
2	Suspect counterfeit banknotes	Machine recognises the image but it does not conform to the template for a genuine banknote and one or more authentication features missing or clearly out of tolerance	<p>Customer operated business machines with a sorting and retention facility: Suspect counterfeit notes⁴ should be retained⁵ and not given back to the customer.</p> <p>Notes should be identified to the particular customer and removed from circulation and handed to the police in accordance with the Forgery and Counterfeiting Act 1981⁶.</p> <p>Staff operated sorting machines: Suspect counterfeit notes should be outsourced or clearly identified to the user that they are suspect and removed from circulation and handed to the police in accordance with the Forgery and Counterfeiting Act 1981.</p> <p>All other machines : Suspect counterfeit notes should be rejected by the machine, in some cases such as manual desktop devices a visual or audible signal is sufficient. Where a member of staff is present, they should retain the notes and hand them to the police in accordance with the Forgery and Counterfeiting Act 1981.</p> <p>More information on what to do with a counterfeit banknote can be found at www.bankofengland.co.uk/banknotes</p>	No value to be given

⁴ These are notes where the machine knows or has sufficient reason to believe that the note is counterfeit. Manufacturers should obtain their own legal advice with respect to the Forgery and Counterfeiting Act 1981.

⁵ Some exceptions apply; please see the relevant section 2.

⁶ National Crime Agency guidelines state that financial institutions are allowed to return suspect notes back to the Bank of England via the banking system, if there is no reasonable chance of a successful prosecution, i.e. if the notes cannot be identified to a particular person. (These are known as 'dead utterings'.)

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1 Recognition of genuine banknotes.

This test is designed to check that the machines being tested are set up correctly prior to testing the counterfeit notes. It is not designed to test the performance of the machine with respect to genuine notes. Testing performance of machines is outside of the scope of the Framework.

The test pack size is determined by the type of machine to be tested, i.e. single manual feed or bunch note feed/accept and will contain notes fit for circulation. Unfit notes will not be used.

The large test pack will comprise 10 notes of each design/denomination in circulation.

The small test pack will comprise 5 notes of each design/denomination in circulation.

Results:

There is no pass/ fail mark for this test.

All machine types: We report the percentage of genuine notes accepted in all orientations by the machine. e.g. 90% accepted in all orientations.

For the self-certification test Manufacturers must instead certify that their machines are in good working order (via the form in Appendix 3) and have been tested to accept genuine notes (if available) ahead of the detection of counterfeit notes test, as detailed in Section 7.1.

2 Detection of counterfeit notes

The counterfeit test pack will comprise counterfeit notes removed from circulation and 'artificial' counterfeits created by the Bank of England. The Bank will decide when to include a counterfeit note type according to a perceived threat level, based on quantity **and/ or** quality of notes detected from circulation. The test pack will contain at least five notes of each of the counterfeit classes that make up 90% of the total number of counterfeits in the last 12 months; and at least one of each of the remaining classes considered relevant. In addition, if a counterfeit class is deemed to be a threat but is seen in very few numbers at least five notes will be included. In addition, the test pack may contain composed notes that are more than 50% composed of counterfeit parts if they are available. Artificial counterfeits are created to simulate potential future threats and to test machines to a higher standard (Silver standard).

Results.

1. Cash validation only machines:

- Pass if all circulation and 'artificial' counterfeit notes rejected by the machine for all orientations accepted

- 2. **Business machines.** (Machines that are used for re-issuance of banknotes, i.e. those likely to be used and owned by professional cash handlers, finance and credit institutions, whether operated by customers or staff only)
 - Staff operated machines: Pass if all circulation and 'artificial' counterfeit notes rejected and or outsourced as suspect counterfeit notes for all orientations accepted.

 - Customer operated machines: Pass if all circulation and 'artificial' counterfeit notes retained as suspect counterfeit by the machine for all orientations accepted.
 - *Exception 1 Withdrawn series counterfeit notes can be rejected if the machine does not contain a template for that genuine banknote. This must be tested with genuine withdrawn series notes to verify.*

 - *Exception 2 In certain cases, when it can be demonstrated by physical evidence, the machine is allowed to reject a counterfeit note back to the customer if the machine is not able to identify the document as being one object, for example, due*

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to thickness⁷ or is not able to identify the document as a valid item⁸, for example if the size of the banknote is smaller or bigger than the tolerance of a genuine banknote of that denomination.

3 Tracing system test

This test is an additional test for manufacturers of customer operated deposit and recycling machines. These machines should additionally retain the transaction details for counterfeit notes which are retained.

Pass if it can be demonstrated that the machine has the capability to identify retained suspect counterfeit notes to a particular transaction.

4 Minimum Sensor Standard

This involves verifying that the machine is capable of meeting a Minimum Sensor Standard by checking the number and type of sensors used in the machine against a standard laid down by the Bank.

5 Silver standard

Machines which are able to identify 100% of the circulation and artificial counterfeits and treat them accordingly as described in this Framework are considered to have met the Silver standard. This is mandatory for all machines from January 2024.

6 Gold standard

Machines which meet the Silver standard plus the Minimum Sensor Standard are considered to have met the Gold standard. This is mandatory for all existing machines from January 2029. For new models not previously sold into the UK market prior to 2024 it is mandatory from January 2024.

⁷ This exception was made on 12th October 2010 to allow for limitations in the capability of machines, and may be withdrawn in the future when the capability of machines has improved.

⁸ This exception was made on 9th September 2015 to allow for limitations in the capability of machines, and may be withdrawn in the future when the capability of machines has improved.

Appendix 2

Framework for the Testing of Banknote Handling Machines (for on-site testing at Debden)

End of Day Test Results (version June 2019)

1. Date of the test:
2. Name of the Manufacturer:
3. Type of machine:
4. Model number:
5. Software and or Firmware and or Note/Table Set:
6. Additional machine Settings (at time of test):
7. Additional machines models (untested) also included ⁹:
8. Test pack versions used during the test: Genuine _____ CFT _____
MAC _____
9. Results of the **standard** tests are:
 - i. Recognition of genuine notes: ___ % accepted in all orientations
 - ii. Detection of circulation counterfeit notes: pass fail
 - iii. Tracing system test: pass fail not applicable

Mandatory from January 2024 for all machines

Silver standard Detection of artificial counterfeit notes: pass fail N/A

10. Software/Firmware that will be de-listed (in accordance with section 8.2b):
11. Schedule 1 has been supplied and is up to date [This is a mandatory check]

Mandatory from January 2024 for new models not yet in the market and from January 2029 for existing models

Gold Standard Verified that the model meets the Minimum Sensor Standard yes no

12. Number of machines currently in use: _____ - UK

We hereby agree that the information set out above is correct and the company agrees to the publication of this information¹⁰ (if full pass awarded) by the Bank on its web site.

Signed by..... For and on behalf of

Signed by..... For and on behalf of the Bank

Date

⁹ The manufacture signs this agreement to certify that the additional untested machines contain the exact same bill validator unit and authentication software version as the tested machine and will perform as the tested machine.

¹⁰ Schedule 1 information is confidential and will not be published.

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1. Counterfeit Test

The machine must not give value for any counterfeit note in all orientations. Record fails only on this table.

Counterfeit Test Pack

Circulation or Artificial	Counterfeit Type	Qty	Orientation			
			FUHF	FUFF	FDHF	FDFD

100% PASS in all orientations

2. Retention and Traceability Test (customer facing banking deposit and recycling)

The machine must retain all counterfeit banknotes and not give value for any note in all orientations and the deposit must be demonstrated as being traceable to the customer deposit card.

Pass

Fail

Not applicable

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Genuine note Recognition Test

Large test pack

Denomination	Circulated Notes
£5 G	10
£10 G	10
£20 G	10
£50 G	10
Total	40

Small test pack

Denomination	Circulated Notes
£5 G	5
£10 G	5
£20 G	5
£50 G	5
Total	20

Results – count of notes not accepted in all orientations

Denomination	Orientation			
	FUHF	FUFF	FDHF	FDFF
£5G				
£10G				
£20G				
£50G				

Pass rate: Number of genuine notes accepted in all orientations

= number of notes accepted in all orientations (*exclude designs not handled by the machine*) / total number in pack used *100%

Pass Rate for machine: _____ % small large

Appendix 3

Framework for the Testing of Banknote Handling Machines (self-certification tests only)

End of Day Test Results (version x)

Date of test:

Manufacturer Name:

Address testing took place:

Type of machine:

Model number:

Software and/or Firmware and/or Note/Table Set:

Additional Machine Settings (**results are only valid at these settings if not default**):

Additional machines models (untested) also included¹¹:

Number of machines currently in use in the UK: _____

1. Pre-test certification:

By signing this form, we certify that the machine listed above has been set up correctly and is in good working order, including acceptance of all current circulating Bank of England banknote designs according to the advertised specifications of the machine.

2. Recognition of Genuine Notes Test (Version 34):

A Recognition Test with genuine notes according to the table below is recommended but not mandatory.

We confirm that the machine was tested for acceptance of notes according to the table below ahead of the Counterfeit Notes test: Small pack Large pack No pack used

We certify that all of the notes were free from defects (tears, holes, graffiti, tape) before the test took place
 Yes No

Denomination	ATM Fit Notes	
	Single note feeding machines	Bulk note feeding machines
<i>Choose the right test pack according to the feeder mechanism →</i>		
£5G Churchill	5	10
£10G Austen	5	10
£20G Turner	5	10
£50G Turing	5	10
Total	20	40

Results of the Recognition Test:

We certify that the number of notes accepted in all orientations was _____% of the total in the test pack.

¹¹ The manufacture certifies that the additional untested machines contain the exact same validator unit and authentication software version as the tested machine and will perform as the tested machine.

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4. Silver Standard : Detection of Counterfeit Notes (Machine Artificial Counterfeits, MAC)

A pass in this test is mandatory from January 2024

We certify that all of the notes were free from defects (tears, holes, graffiti, tape) before the test took place

Yes No

Test: The machine must not give value for any counterfeit note in all orientations. Record fails only on the table below. Notes can be recognised by the last two digits of the serial number.

Counterfeit Test Pack (MAC notes – Version x)

Counterfeit Type	Qty	Orientation			
		Queen face up Queen First	Queen face up Queen last	Queen face down Queen first	Queen face down Queen last
Total					

We certify that the machine detected and rejected all of the MAC notes supplied in the test pack in each orientation and no face value was attributed. Not Applicable Yes No

We additionally certify that the machine is a banking use deposit and recycling machine and all of the MAC notes supplied in the test deck were detained in the machine and no face value was attributed to the transaction. Not Applicable Yes No

5. Tracing System Test

We certify that the machine is a banking use deposit and recycling machine and retained counterfeit notes are traceable to the customer and card account used in the transaction. Not Applicable Yes No

6. Gold Standard

A pass in this test is mandatory from January 2024 for new models not yet in the market beforehand and January 2029 for existing models in the market before January 2024.

We certify that the model meets the Minimum Sensor Standard and we have signed and provided the appropriate Schedule 1 form accordingly Yes No N/A

7. Obsolete Software/Firmware

We confirm the following software/firmware/data set versions can be deleted from the published list :

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8. Formal Declaration:

We certify and agree under the terms of the Machine Testing Framework and associated legal agreement 'Cash Machine Testing- Agreement with Manufacturers' that the information provided in this form by us is true and correct.

We agree that, once validated by the Bank to their satisfaction, that if a pass is awarded the information as defined in the agreement 'Cash Machine Testing- Agreement with Manufacturers' can be published by the Bank on its web page to state they have met the required.

We also agree to meet an audit request from the Bank as defined in the agreement 'Cash Machine Testing- Agreement with Manufacturers' if such is requested.

The Bank requires authorisation and signature from a second person who will be held accountable for the test results and this declaration. This must be a manager, director or other company official with the appropriate designated authority.

Test completed by:

Print Name

Signed

Position

Authorised by:

Print Name

Signed

Position

Completed forms should be sent securely to Cash.MachineTesting@bankofengland.co.uk

Publication of successful test results will be authorised and noted to you in due course, and we will return a copy for your records.

For BANK OF ENGLAND Staff use only

All sections completed : Yes No

Schedule 1 provided : Yes No

Standard Counterfeit test : Pass Fail

Silver Test : Pass Fail not applicable

Gold Test : Pass Fail not applicable

Tracing system test : Pass Fail not applicable

Gold Test schedule 1 provided : Yes No not applicable

Appropriate sign off provided : Yes No

Authorised for publication Yes No

Checked by:

Print Name

Signed

Position

Authorised by :

Print Name

Signed

Position

Date: