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Information technology — Office equipment — Method for measuring digital copying productivity

Technologie de l'information — Équipements de bureau — Méthode de mesure de la productivité d'un photocopieur numérique

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 24735 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 28, *Office equipment.*

This second edition cancels and replaces the first edition (ISO/IEC 24735:2009), which has been technically revised. It also incorporates the Technical Corrigendum ISO/IEC 24735:2009/Cor.1:2009.

Introduction

Many digital copying devices produce copied pages at a different rate than their nominal speed when running with different modes (simplex, duplex, copying quality modes), different substrate weight and collating and/or finishing options. The degree to which a reduction in productivity is experienced depends significantly on other parameters of the job stream. The most dominant of the parameters of the job stream are: the number of original pages in a set to be printed, whether ouput pages are single-sided or double-sided, image quality modes selected, B&W and colour reproduction job stream, number of print sets to be produced, substrate size used, run length and finishing options. The existing International Standard (ISO/IEC 14545) only addresses the productivity issues for light-lens B&W copying device/duplicators and does not take into account these important machine and job related factors for digital copying devices.

Information technology — Office equipment — Method for measuring digital copying productivity

1 Scope

This International Standard specifies a method for measuring the "productivity" of digital copying devices and multifunctional devices with various copying modes. It is applicable to digital copying devices and multifunctional devices equipped with automatic document feeder and collating function. This International Standard is intended to be used for black and white (B&W) as well as colour digital copying devices and multifunctional devices of any underlying marking technology. It allows comparison of the throughput copying rates for a machine operated in various available operating modes (simplex, duplex, size of substrates, 2-up, etc) and various available digital image processing configurations. This International Standard includes test files, test setup procedures, test procedures, and reporting requirements for digital copying productivity measurements.

This International Standard is not intended to be used for devices which are not able to copy on a media size of A4/8.5"x11", devices that do not have an automatic document feeder (ADF), or devices which are not able to collate multiple copies of original prints from a test set.

This International Standard is not intended to replace manufacturer's rated speeds.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2470-1:2009, *Paper, board and pulps — Measurement of diffuse blue reflectance factor — Part 1: Indoor daylight conditions (ISO brightness)*

ISO 536:1995, *Paper and board — Determination of grammage*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
duplex copying
use of a copying device to make a number of copies with the copying being done on both sides of the sheet

NOTE An equivalent term is "two-sided copying" and referred to as 1:2 mode or 2:2 mode.

3.2
effective throughput
EFTP
average speed at which a device produces pages measured from the initiation of the job through the complete exit of the last page of the last test set

NOTE EFTP is expressed in images per minute (ipm). EFTP can be affected by the digital processing time of the test set as well as the run time of the test set.

3.3
estimated saturated throughput
ESAT
rate at which a device produces pages measured from the complete exit of the last page of the first test set through the complete exit of the last page of the last test set

NOTE ESAT is expressed in images per minute (ipm).

3.4
feature performance test
optional test used to evaluate productivity changes with various copying and finishing features enabled by providing FSOT and ESAT

NOTE The feature performance test suite is run with default copying system settings to establish a base line, and then with the selected feature (e.g. stapling) ON, for comparison.

3.5
first set out time
FSOT
number of seconds between the initiation of the job to the complete exit of the last page of the first test set

NOTE There is a different definition called “FCOT" (first copy out time). “FCOT” and “continuous copying speed” for EP (electrophotographic) copying machines are defined in ISO/IEC 21117. For reference, the extension of these definitions, also applied for out of scope copying devices, is shown in Annex D (informative).

3.6
full detailed report
presentation of information including machine setup and measured test results

3.7
full report
presentation of results including the FSOT, ESAT and EFTP values in general performance tests or the FSOT and ESAT values in feature performance tests as well as the calculated averages for each value

3.8
general performance test
test used to evaluate productivity by providing FSOT, ESAT and EFTP without using any special feature or mode, and which includes both the simplex copying mode and the duplex copying modes 1:2 and 2:2, if available

3.9
last set out time
LSOT
number of seconds between the initiation of the job to the complete exit of the last page of the last test set

3.10
nominal copying speed
copying rate, excluding time to first page copied, measured when producing pages in a continuous copying mode with a single static document using a nominal weight substrate

NOTE Nominal copying speed is expressed in copies per minute or images per minute.

3.11
simplex copying
use of a copying device when only a single side of a sheet is copied on

NOTE Other equivalent terms are “one-sided copying” or “simplex to simplex” referred to as 1:1 mode.

3.12
summary report
presentation of results, including the average overall FSOT and ESAT in general performance tests or the ratio of the copying performance such as FSOT and ESAT with the subject feature ON versus the copying device default base line performance (without the subject feature ON) in feature performance tests

3.13
test file
digital file used for creating test targets

3.14
test set
all of the pages of a test target

3.15
test target
hard copy document used for testing per the test method, and created from a test file

NOTE An equivalent term is “test chart”.

4 Test Parameters and Conditions

4.1 Environment

The test environment, including temperature and humidity, shall be within the ranges recommended by the manufacturer for operating the device. If no recommendation is available, the following ranges shall apply.

Temperature: 18 °C to 25 °C
Relative humidity: 30% to 70%

NOTE The temperature and humidity of the test environment should be recorded in the full detailed report (Annex B).

4.2 Voltage

The copying device shall be connected to a voltage supply within the manufacturer specified operating voltage range for the copying device under test.

NOTE The measurement should be made under no-load condition prior to each test.

4.3 Copying Device Setup

Place the copying device on a horizontal surface and set up the copying device according to the manufacturer's recommendations.

The copying device shall be fully enclosed in its normal exterior cover. The machine and all of it's necessary supplies shall be acclimated in the test environment prior to conducting the test(s) at least 8 hours. All supplies used in the test(s), included copy paper, shall be those specified by the manufacturer. All image and copying modes should be at their factory pre-set configuration for the copying device. It is assumed that the settings listed in Table 1 are common to all copying devices. These listed settings shall be set to the manufacturer's default or pre-set condition for the device. If a device has settings not listed in Table 1, they too shall be set to default settings. For copying devices that have additional print quality and digital image processing features, those features must be set to match their normal default condition, and included in the result reporting. Disabling manufacturer default installed features, routines or applications, is not allowed. Examples include, but are not limited to the following: automatic cleaning or calibration cycles, and energy save settings. If the system has automatic media detect(automatic paper type selection), it can be disabled, and paper used in the test shall be selected manually. This must be noted in the full detailed report (Annex B). The following pre-set values in the test will be noted on this report format.

If the copying device is setup with internal or external options such as memory, sorter, or finisher as default, then these options shall be noted on the full detailed report format in the configuration options as shown in Annex B, for example “Finisher as default” or “160GB HDD installed”.

Table 1 — Pre-set Settings

	Pre-set item	Pre-set value
Mode	Output resolution	default
	Output Quality	default
	Copying mode	default
	Auto density adjustment	default
	Collating function	Activated (if not activated in default mode.)
Paper	Paper sending direction	default
	Paper type setting	default
Paper-path	Paper feeding	Standard cassette
	Paper exit	Standard exit tray
	Face up exit	default
	Duplex copying unit	default (used in 1:2 mode and 2:2 mode).
Temporary stop	Fixing capability	default
	Image quality stability	default
	Capacity of paper	default
	Others	default

4.4 Paper

The output paper used in this test shall be within the range of, and/or not violate, specific written attribute guidelines and recommendations provided by the copying device manufacturer, which may include but are not be limited to: size, weight, composition, paper manufacturer(s), paper type, part number and other physical characteristics. Care must be taken to use a paper that conforms to the copying device manufacturers' paper specifications for the default copying device settings. The paper used for the general performance test [section 5.4] shall be cut-sheet, A4 and/or 8.5"x11" size. Optional paper sizes may be used in the feature performance tests such as 8.5"x14", A3, and/or 11"x17" size as appropriate for the test mode. The paper manufacturer, weight, size and paper type/name used in each test shall be noted on the full detailed report.

When sheets of paper of the size other than A4/A3 are used, the sizes shall be indicated in the places of A4 and A3 in the measurement results tables. When a comparison need to be made between the productivity of one machine with that of other machines the measurement shall be done with the same paper sizes. If the copying device employs “thick paper mode” for copying, then this optional mode shall be noted in the machine setup information of full detailed report specified in Annex B.

4.5 Maintenance

Copying device maintenance shall be performed throughout testing per the manufacturer's recommendations on an as needed basis. (For example, cleaning routines or consumables replacement).

4.6 Preparation of Test Targets (Test Charts)

The copying test file is outlined in Annex C (normative).

The test file consists of 4 single sided pages. When using the test file for the copying productivity test, the test targets must be created by printing the most recent electronic test file. If the intended machine does not have

a printer function, then record the name of printer which is used to print out the actual test targets. The most recent official electronic file (ISO_IEC_24735_Test_Pages.pdf) can be located at http://standards.iso.org/ittf/PubliclyAvailableStandards/SC28_Test_Pages/.

The quality of test targets may affect the productivity measurement. You should create test targets according to the following notes.

1) The test targets shall be printed by the equipment to be tested itself in its default-printing mode.

2) The paper used for creating the test targets shall have a brightness of at least 80% to eliminate the influence of background.

3) The paper used for creating the test targets shall be 64 g/m^2 or above and sufficiently opaque to prevent copying of images on the backside.

4) The paper used for creating the test targets shall be free of wrinkles or other surface defects.

5) Confirm that the there are no defects such as unexpected dots or contaminations.

6) Page scaling shall not be used in general performance test. Typically, this is done by setting page scaling to “none”. Options such as “Fit to printable area” shall not be used in general performance test, either.

The brightness shall be measured according to ISO 2470-1:2009. The paper weight shall be measured according to ISO 536:1995.

5 Test Method

5.1 Test Setup

Before test, the machine under test shall be preconditioned as follows.

1) Install the copying device following the manufacturer's recommendations.

2) Clean the surface of the image scanning device if needed.

3) The default required tests shall be run after the copying device has warmed-up and entered a “ready” state. Use of warm-up copying (that means at least one page is copied just before testing) to ready the copying device is acceptable.

4) Set the system parameters (such as paper weight selection, paper size and feed orientation, quality mode) for test. Record the copying device model, configuration (options), default condition and any other variations if selected. If the system has automatic media detect (automatic paper type selection), it can be disabled, and paper used in the test shall be selected manually. This must be noted in the full detailed report.

Refer to Annex B for an example of settings to record. Refer to section 5.4 for information on required tests and 5.5 for information on running the optional feature performance tests. Refer to section 6 for information on the calculation and treatment of data. Refer to section 7 for information on data reporting.

NOTE Measurement of printing productivity in MFD should be measured according to ISO/IEC 24734 International Standard. Only copying productivity function can be measured according to this International Standard.

5.2 Test Measurement Procedure

A single set of each test target is copied and measured to determine $FSOT_{1set}$. Multiple, N sets, of each test target are measured for the 1 Set + 30 Seconds Test run to calculate $ESAT_{30sec}$ and $EFTP_{30sec}$, where N is the

number of sets needed to meet $LSOT_{30sec}$–$FSOT_{30sec}$ ≥ 30 seconds. This method is used to provide varying tests for products across varying segments. This simple approach allows faster products to be tested with more sets and slower products to be tested with less sets without defining and categorizing products by segment. The 1 Set + 4 Minutes Test is a similar concept used to calculate $EFTP_{4min}$ and is intended to provide a test to illustrate that differences in productivity can occur for longer copying times compared to shorter copying times. It is understood and recognized that 4 minutes may be a long test for some devices, but a short test for other, higher end devices. The 4 minutes time is a compromise to meet the needs of the many products across many segments covered in the scope of this International Standard.

(1) Before test, the machine under test shall be preconditioned as described in section 5.1.

(2) Prepare and set the test targets (test charts) that will be used in the test, identified as described in Section 4.6.

(3) Refer to sections 5.4 and 5.5 to decide what tests are to be run.

1 Set Test Procedure to measure $FSOT_{1set}$ and $EFTP_{1set}$:

1) Enter Copy Set count = 1 required for this specific test run on the copying device operation panel.

2) [Start Test run] Press copy start button and simultaneously start the timing device (watch or otherwise).

3) Record the time for completion of one set to at least two decimal places.

4) [End Test run]

5) Run the 1 Set Test [steps 2 – 4] twice. Calculate the average $FSOT_{1set}$ and $EFTP_{1set}$ according to section 6.

6) Determine if the results are consistent within +/- 5% according to section 5.3.3, and perform a third Test run if required. (The data from the test is average of the individual runs. Three iterations are the max and the results from all iterations are averaged to get the required data.)

7) Calculate the average $FSOT_{1set}$ and $EFTP_{1set}$ according to section 6.

8) Repeat steps 2 – 7 for each required copying mode (1:1, 1:2, 2:2) that is available on the copying device under test.

NOTE The average $FSOT_{1set}$ for this test set is reported in the Summary Report, the Full Report and the Full Detailed Report as FSOT. For detail, see Annex A and Annex B for an example of report presentation.

1 Set + 30 Seconds Test Procedure to measure $ESAT_{30sec}$ and $EFTP_{30sec}$:

1) Enter Copy Set count = N required to for $LSOT_{30sec}$–$FSOT_{30sec}$ ≥ 30 Seconds. Select any necessary collate options to insure that multiple set runs copy the output in collated order (1234..., 1234 ...). For the second and third tests, use the same set count as used in the first test.

NOTE This $FSOT_{30sec}$ should not be confused with the $FSOT_{1set}$ from the 1 Set Test. The $FSOT_{30sec}$ measured is used to verify $LSOT_{30sec}$–$FSOT_{30sec}$ ≥ 30 seconds and to calculate $ESAT_{30sec}$.

2) [Start Test run] Press copy start button and simultaneously start the timing device (watch or otherwise).

3) Record the time for completion of the $FSOT_{30sec}$ to at least two decimal places. This is the time from pressing copy button until the fourth page of the 1st test set is fully ejected from the machine.

NOTE If the output paper tray size is less than the number of pages to be copied, remove the output paper during the test.

4) Record the time for completion of the $LSOT_{30sec}$ to at least two decimal places. This is the time from pressing copy button until the last page of the test set is fully ejected from the machine.

5) [End Test run]

6) Run the 1 set + 30 Seconds test [steps 2 – 5] twice. Calculate $ESAT_{30sec}$ and $EFTP_{30sec}$ for each Test run according to section 6.

7) Determine if the results are consistent within +/- 5% according to section 5.3.3, and perform a third Test run if required. (The data from the test is average of the individual runs. Three iterations are the max and the results from all iterations are averaged to get the required data.)

8) Calculate the average $ESAT_{30sec}$ and $EFTP_{30sec}$ according to section 6.

9) Repeat steps 2 – 8 for each required copying mode (1:1, 1:2, 2:2) that is available on the copying device under test.

NOTE The average $ESAT_{30sec}$ for this test set is reported in the Summary Report, the Full Report and the Full Detailed Report as ESAT. For detail, see Annex A and Annex B for an example of report presentation.

1 Set + 4 Minutes Test Procedure to measure $EFTP_{4min}$:

1) Enter Print Set count = N required to for $LSOT_{4min}$–$FSOT_{4min}$ ≥ 4 minutes. Select any necessary collate options to insure that multiple set runs copy the output in collated order (1234..., 1234 ...). For the second and third tests, use the same set count as used in the first test.

NOTE This $FSOT_{4min}$ should not be confused with the $FSOT_{1set}$ from the 1 Set Test. The $FSOT_{4min}$ measured here is only used to verify $LSOT_{4min}$–$FSOT_{4min}$ ≥ 4 minutes.

2) [Start Test run] Press copy button and simultaneously start the timing device (watch or otherwise).

3) Record the time for completion of the $FSOT_{4min}$ to at least two decimal places. This is the time from pressing copy button until the fourth page of the 1st test set is fully ejected from the machine.

NOTE If the output paper tray size is less than the number of pages to be copied, remove the output paper during the test.

4) Record the time for completion of the $LSOT_{4min}$ to at least two decimal places. This is the time from pressing copy button until the last page of the test set is fully ejected from the machine.

5) [End Test run]

6) Run the 1 Set + 4 Minutes Test [steps 2 – 5] twice. Calculate $EFTP_{4min}$ for each Test Run according to section 6.

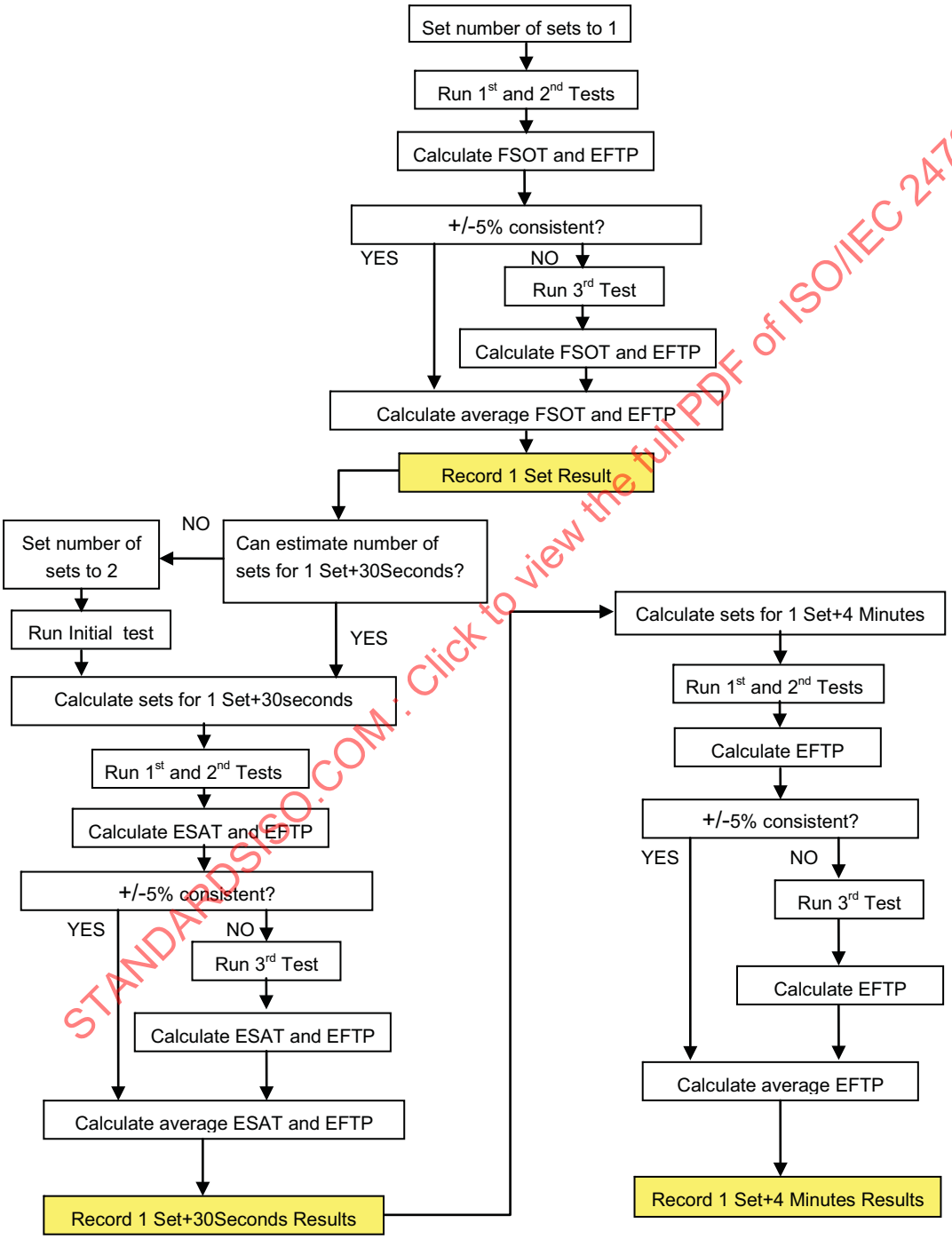
7) Determine if the results are consistent within +/- 5% according to section 5.3.3, and perform a third Test run if required. (The data from the test is average of the individual runs. Three iterations are the max and the results from all iterations are averaged to get the required data.)

8) Calculate the average $EFTP_{4min}$ according to section 6.

9) Repeat steps 2 – 8 for each required copying mode (1:1, 1:2, 2:2) that is available on the copying device under test.

5.3 Test Method Process

5.3.1 Suggested Test Method Process Flow Chart



5.3.2 Estimating the Set Count

1 Set + 30 Seconds Test:

The test may begin with an initial set count $N_{initial}$ = 2 or by estimating the number of sets needed, provided that the tester has sufficient information for estimation beforehand. If the N = 2 test result did not meet the LSOT–FSOT ≥ 30 seconds requirement, then calculate necessary set count $estN_{30sec}$ as follows and test using the new $estN_{30sec}$ as the set count. The following equation can be used to estimate the number of sets needed:

$$estN_{30\,sec} = RoundUp\left[\frac{30\times(N_{initial}-1)}{LSOT_{initial}-FSOT_{initial}}+1\right]$$

where $LSOT_{initial}$ and $FSOT_{initial}$ are the data acquired in the Initial Test.

The number of sets tested should result in $LSOT_{30sec}$–$FSOT_{30sec}$ ≥ 30 seconds as close as possible. If the results of a test run gives $LSOT_{30sec}$–$FSOT_{30sec}$ < 30 seconds the number of sets shall be increased and all runs re-tested.

NOTE The 1 Set + 30 Seconds Test is devised to make $LSOT_{30sec}$–$FSOT_{30sec}$ long enough to minimize measurement error of ESAT and short enough to avoid stop caused by calibration etc.

1 Set + 4 Minutes test:

Calculate necessary set count $estN_{4min}$ as follows by using the results of the 1 Set + 30 Seconds Test and test using the $estN_{4min}$ as the set count.

$$estN_{4\,min} = RoundUp\left[\frac{240\times(N_{30\,sec}-1)}{LSOT_{30\,sec}-FSOT_{30\,sec}}+1\right]$$

where $LSOT_{30sec}$ and $FSOT_{30sec}$ are the data acquired in the 1 Set + 30 Seconds Test.

The number of sets tested should result in $LSOT_{4min}$ –$FSOT_{4min}$ ≥ 4 minutes. If the results of a test run give $LSOT_{4min}$ –$FSOT_{4min}$ < 4 minutes the number of sets shall be increased and all runs re-tested.

If 1 Copy + 4 Minutes Test estimated copy count is greater than the maximum copy count or input tray capacity, this test shall not be run and reported as N/A in the test report.

5.3.3 5% Consistency Criteria

If the first two test runs are not consistent within +/-5%, then a third test run is required. Equations for ESAT and EFTP can be found in section 6.

$$Consistency = \frac{2\times FSOT_1}{FSOT_1+FSOT_2}-1$$

$$Consistency = \frac{2\times ESAT_1}{ESAT_1+ESAT_2}-1$$

$$Consistency = \frac{2\times EFTP_1}{EFTP_1+EFTP_2}-1$$

If 1 Set + 4 Minutes Test estimated copy count is greater than the maximum copy count or input tray capacity, this test shall not be run and reported as N/A in the test report.

5.4 General Performance Test

The General Performance Tests require using the 1 Set Test, 1 set + 30 Seconds Test and 1set + 4 Minutes Test procedures in section 5.2.

There are two key parameters, FSOT and ESAT, reported in Summary Report and three key parameters, FSOT, ESAT and EFTP, reported in Full Report of General Performance Test. This "Full Report" provides detailed information including, EFTP, FSOT and ESAT for the various test runs. (FSOT and ESAT values are the same in the both Reports.)

(1) Measurement of FSOT and ESAT

The productivity test(s) shall be done in the 1:1, 1:2 and 2:2 modes, insofar as they are available on the machine of interest. Each test will be done in full colour mode (required) in addition to monochrome copying mode (optional), only if the machine is a colour copying device. Only monochrome copying mode will be done if the machine is a B&W copying device.

Prepare the test targets (described in 4.6) for this measurement. 1 set consists of 4 images, that is 4 simplex pages for 1:1/1:2 mode and 2 duplex pages for 2:2 mode.

(2) Measurement of EFTP

The time required in each mode to produce the completed copying is measured in seconds and recorded. First set out time is included inherently in the measurements of overall multicopy time to reflect the effective throughput (EFTP) of the machine under test.

The time measurement is started when the “copy start button” is pressed, and is concluded when the last print is fully ejected from the machine. The measured intervals of time should be recorded to 2 decimal places. Measurement shall be done for 4 images in 1:1/1:2/2:2 modes.

(3) Table format and required data for Summary Report in General Performance Test

The minimum required presentation of results shall include a Summary Report Form as displayed in Table 2. A Summary Report includes the averages of FSOT and ESAT in a given test. The system setting for the copying modes and test preset conditions shall be identified (default and all non-default and optional test mode settings) and reported as shown in full detailed report (Annex B). An example of a Summary Report table is shown in Annex A. When appropriate, rows may be deleted from the Summary Report. Specifically, if a device does not have the ability to duplex, the duplex rows may be deleted. Similarly, a monochrome only copying device does not need to report data for a colour copying mode.

Table 2 — Table of Summary Report (for colour copying device with duplex copying function)

	Copying mode	FSOT	ESAT
Colour	1:1	R	R
	1:2	R	R
	2:2	R	R
B&W	1:1	O	O
	1:2	O	O
	2:2	O	O

where “R” is Required to report when available on the copying device, “O” is Optional and not necessary to report.

(4) Table format and required data for Full Report in General Performance Test

The presentation of results is recommended to include a Full Report Form as displayed in Table 3. A Full Report includes the averages of FSOT, ESAT and EFTP in a given test. The system setting for the copying modes and test preset conditions shall be identified (default and all non-default and optional test mode settings) and reported as shown in full detailed report (Annex B). An example of a Full Report table is shown in Annex A. When appropriate, rows may be deleted from the Full Report. pecifically, if a device does not have the ability to duplex, the duplex rows may be deleted. Similarly, a monochrome only copying device does not need to report data for a colour copying mode.

Table 3 — Table of Full Report (Colour copying device with duplex copying function)

Colour mode	FSOT(s)	EFTP (ipm)			ESAT(ipm)
		1set	1set+30seconds	1set+4minutes	
1:1	R	R	R	R	R
			X sets	A sets	
1:2	R	R	R	R	R
			Y sets	B sets	
2:2	R	R	R	R	R
			Z sets	C sets	
where “R” is Required to report when available on the Copying device					
B&W mode	FSOT(s)	EFTP (ipm)			ESAT(ipm)
		1set	1set+30seconds	1set+4minutes	
1:1	R	R	R	R	R
			X sets	A sets	
1:2	R	R	R	R	R
			Y sets	B sets	
2:2	R	R	R	R	R
			Z sets	C sets	
where “R” is Required to report when available on the copying device					

NOTE X, Y, Z, A, B, and C are set counts used for each tests. They may vary in colour and B&W results. FSOT and ESAT are the same value as in “Summary Test Report”.

NOTE The measurement date, start time and finish time of measurement should be included in full detailed report (an example shown in Annex B).

5.5 Feature Performance Test

An optional Feature Performance Test is provided as a convenient means to evaluate productivity differences with various copying and finishing features enabled. Examples of such features may include but are not limited to “Mixed originals copying”, “2-up copying”, stapling, hole punching, etc.

Copying 2-up simplex with larger size media means that 2 A4 sized images are copied on one side of the larger sheet A3. In the case of 2-up simplex copying with A4 sized media, two of the A4 size images are resized (by the reduction mode) and copied on one side of the A4 sized media.

The results when copying with a feature enabled shall be reported as a comparison to the performance when copying from a copying device in the default mode and the feature disabled. The Feature Performance Test is done in full colour mode, only if the machine is a colour copying device. Only monochrome copying mode will be done if the machine is a B&W copying device.

(1) Example of Features Setting conditions

The feature setting conditions and test preset conditions shall be identified (default and all non-default and optional test mode settings) and reported as shown in full detailed report (Annex B).

Mixed Originals mode:

Some of the original document characters, especially when the document consists of mixed size hardcopies, affect the productivity of copying devices. In order to defining the effectiveness of original document size mixed, some other factors are fixed as in the following table.

For this test, test targets (charts) A,B,C and D pages of the test file are printed. The sizes of charts are defined in the following table. When you use A3 chart, each assigned chart size shall be magnified and printed in A3 size.

Table 4 — Factors for Mixed Originals mode

Factors	Selected condition
Original Size and combination	1) A4 4 pages in A4 size (all A4 size in ABCD order)
	2) A3+A4 2 pages in A3 + 2 pages in A4 (A3 size A and B, then A4 size C and D)
	3) A3 4 pages in A3 size (all A3 size in ABCD order)
Direction of original setting	Default
Original Image side	One-sided
Paper path setting	Set A4 at the shortest path, A3 at the second shortest path if available (when using by-pass/manual feed unit, it shall be noted in full detailed report.)
Coping mode	Collating mode only (without any other mode)

2-up mode:

Some of images combination to one copy affects the productivity of copying devices. In order to define the effectiveness of such a N-up process, some other factors are fixed as in the following table. 2-up mode can be representative for this N-up mode and be measured as for the measurement of this mode.

For this test, test targets (charts) A,B,C and D pages of the test file are printed.

Table 5 — Factors for 2-up mode

Factors	Selected condition
Original Size and combination	1) A4 4 pages in A4 size (all A4 size in ABCD order)
	2) A4 at 2-up mode 4 pages in A4 size into 2 pages (all A4 size in ABCD order)
Direction of original setting	Default
Original Image side	One-sided
Coping mode	2-up mode. Collating mode only (without any other mode)

Other special modes:

Some other modes such as “Stapling”, “Heavy paper copying usage”, “Various colour originals usage”, “Paper size unifying mode in mixed size originals” can be added as a special mode. In addition, testing of digital

image processing configurations can be added as a special mode.

The set count may be modified from that required for the 1 Set+30 Seconds run as needed to provide an appropriate test for the feature being evaluated. The modified set count is used for the Feature Mode Test run.

NOTE When any other conditions such as “Various character of paper”, “Various path of feeding paper”, “Auto density adjust”, “% enlargement”, “% reduction”, which are different from the pre-set conditions, those values in the test will be noted on the full detailed report format as shown in Annex B.

For this test, test targets (charts) A,B,C and D pages of the test file are printed.

Table 6 — Factors for Other special mode

Factors	Selected condition
Original Size and combination	1) A4 4 pages in A4 size (all A4 size in ABCD order)
	2) A4 at special mode 4 pages in A4 size (all A4 size in ABCD order)
Direction of original setting	Default
Original Image side	One-sided
Coping mode	Selected special mode. (without any other mode)

(2) Measurement of FSOT and ESAT in Feature Performance Test

The Feature Performance Tests require using the 1 Set and 1 Set + 30 Seconds Test procedures in section 5.2.

First, complete a simplex test run using the manufacturer’s default copying settings, (the Base Copying Mode Test). The Base Copying Mode test is run consisting 4 pages as 1 set without the feature and needs only be executed once for each base mode (consisting of 2 or 3 runs as needed to satisfy the 5% consistency criteria). Next, complete the tests for each feature copying mode selected (the Feature Mode Test). The minimum required presentation of results shall include data showing the ratio of FSOT and ESAT for Base Copying Mode to FSOT and ESAT for Feature Copying Mode test results.

If a feature needs to use more than 4 pages in a set, FSOT for Base Copying Mode shall be measured using the same number of pages in the set as the Feature Copying Mode.

ESAT data from the General Performance Test can be used for the Base Copying Mode.

The set count is determined using 4 pages simplex as 1 set for the Base Copying Mode Test run as in 5.2. The ESAT data for the Base Copying Mode Test are the same as in the General Performance Test in 5.4.

The set count may be modified from that required for the 1 Set + 30 Seconds run as needed to provide an appropriate test for the feature being evaluated. The modified set count is used only for the Feature Mode Test run.

(3) Table format and required data for Summary and Full Report in Feature Performance Test

The required presentation of results includes FSOT and ESAT ratios in a Summary Report Form and ratios and values in a Full Report Form as displayed as follows. The system setting for the copying modes shall be identified. The test preset conditions shall be reported as shown in full detailed report (Annex B).

NOTE Individual manufacturer can choose whether to display Summary Report or Full Report on his brochure or spec sheet. If the report is shown on them, following table format is recommended to be used. A pointer to the full detailed report (an example shown in Annex B) and the test date should be included in his brochure or spec sheet.

Table 7 — Summary Report for Feature Performance Test

Copying Modes	Feature Performance Ratio	
	Title of tested mode	
	$\frac{FSOT_{base}}{FSOT_{feature}}$ (%)	$\frac{ESAT_{feature}}{ESAT_{base}}$ (%)
Explanation of tested mode	R*	R*

where “R*" is Required to report when reported for Feature Performance

Table 8 — Full Report for Feature Performance Test

Copying Modes	Base Copying Mode		Feature Performance Ratio			
			Title of tested mode			
	FSOT (s)	ESAT (ipm)	FSOT (s)	ESAT (ipm)	$\frac{FSOT_{base}}{FSOT_{feature}}$ (%)	$\frac{ESAT_{feature}}{ESAT_{base}}$ (%)
Explanation of tested mode	R*	R*	R*	R*	R*	R*

where “R*" is Required to report when reported for Feature Performance

6 Calculations and Treatment of Data

The time intervals for each Test run are recorded during the test operation. A spreadsheet format that records the time for the tests run is useful for this purpose but is not required.

Data and calculations may include as many decimal places as desired. Dropping fractions is allowed, but rounding to a faster time (sec) or throughput (ipm) is not allowed. Recorded and reported numbers shall never be better than actual measurement (higher for ESAT and EFTP or lower for FSOT).

Averages are calculated by averaging the results (FSOT, ESAT, EFTP), not by averaging the times, and then calculating a result. For example, calculate ESAT of test run one and ESAT from test run two (and of test run three if required), and then average $ESAT_1$ and $ESAT_2$ (and $ESAT_3$) to yield $ESAT_{ave}$.

The number of ESAT and EFTP is expressed in ipm in the following way.

A) Less than 10 ipm: Round down at two decimal places and express as two significant figures (X,X).

B) 10 ipm to 99 ipm: Express with either of the methods below:

   1) Round down at one decimal place and express as two significant figures (XX).

   2) Round down at two decimal places and express as three significant figures (XX,X).

C) 100 ipm or more: Round down at one decimal place and express as three significant figures (XXX).

For example, if 34,99 is the measured and calculated average of ESAT, then a report could record 34,9 or 34 ipm, but NOT 35 ipm.

6.1 General Performance Test

6.1.1 1 Set Test

$FSOT_{1set}$ and $EFTP_{1set}$ shall be calculated using data from a single set test run.

For test runs using 4 pages file and 1 set count test run:

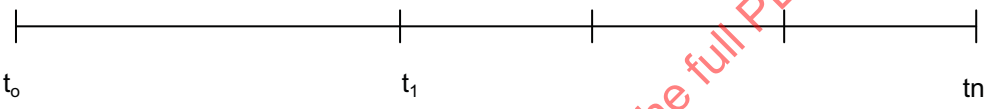
$FSOT_{1set}$= t_1 (seconds)

$$EFTP_{1set} = \frac{240}{FSOT_{1set}} \quad \text{(ipm)}$$

6.1.2 1 Set + 30 Seconds Test

$ESAT_{30sec}$ and $EFTP_{30sec}$ shall be calculated using the data of 1 Set + 30 seconds Test.

For test runs using 4 pages file and N set count test run:



First Set Out Time = $FSOT_{30sec}$ = t_1 (seconds)

Last Set Out Time = $LSOT_{30sec}$ = tn (seconds)
N_{30sec}=Set count

240= 4 pages x 60 seconds

$ESAT_{30sec}$ and $EFTP_{30sec}$ shall be calculated from the 1 Set + 30 Seconds Test data from the following equation.

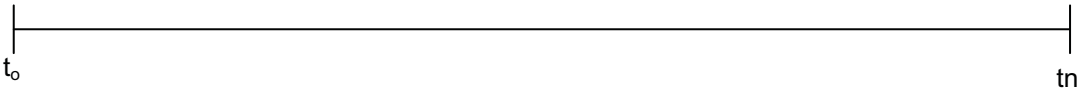
$$ESAT_{30\,sec} = \frac{240 \times (N_{30\,sec} - 1)}{LSOT_{30\,sec} - FSOT_{30\,sec}} \quad \text{(ipm)}$$

$$EFTP_{30sec} = \frac{240 \times N_{30\,sec}}{LSOT_{30\,sec}} \quad \text{(ipm)}$$

6.1.3 1 Set + 4 Minutes Test

$EFTP_{4min}$ shall be calculated using the data of 1 Set + 4 Minutes Test.

For test runs using 4 pages file and N_{4min} set count test run:



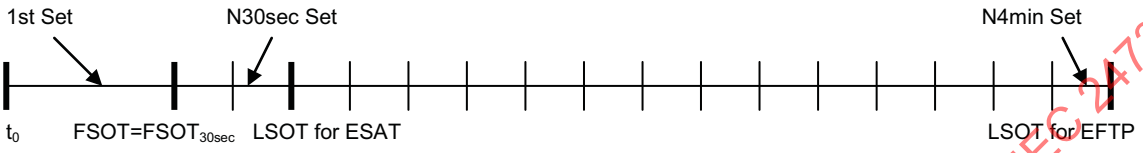
Last Set Out Time = $LSOT_{4min}$ = tn (seconds)

N_{4min}=Set count

240= 4 pages x 60 seconds

$$EFTP_{4\,\min} = \frac{240 \times N_{4\,\min}}{LSOT_{4\,\min}} \quad \text{(ipm)}$$

NOTE In case the first set out time is constant regardless of set counts, i.e. $FSOT_{30sec}$=$FSOT_{4min}$=FSOT, it is possible to combine 1 Set Test, 1 Set + 30 Seconds Test (and 1 Set + 4 Minutes Test) to one Combined Test, whose set count should be at least N_{30sec} (or N_{4min} in case 1 Set + 4 Minutes Test is combined). Measurement should be done at each timing of 1 Set Test, 1 Set + 30 Seconds Test (and 1 Set + 4 Minutes Test). If this option is adopted, it should be noted in the full detailed report.



6.2 Feature Performance Test

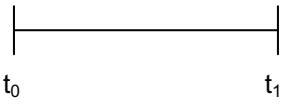
Feature Performance Test itself is optional. However, when conducted, 1 Set Test and 1 Set + 30 Seconds Test are required for the Base Copying Mode and for each Feature Performance Test.

The set count is determined using 4 pages simplex as 1 set for the Base Copying Mode Test run as in 5.2. But the set count may be modified from that required for the 1 set+30 seconds run as needed to provide an appropriate test for the feature being evaluated. The modified set count is used for the Feature Mode Test run.

6.2.1 1 Set Test

$FSOT_{1set}$ shall be calculated using data from a single set test run.

For test runs using 4 pages file and 1 set count test run:



$FSOT_{1set} = t_1$ (seconds)

For each feature tested, the percentage of the Feature Copying Mode to Base Copying Mode is calculated as follows:

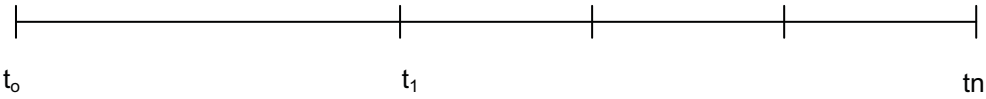
$$\text{Feature Percentage FSOT} = \frac{FSOT_{base}}{FSOT_{feature}} \times 100 \quad (\%)$$

NOTE The $FSOT_{1set}$ for 1 Set Test in Feature Performance Test is reported as FSOT. For FSOT percentage, the base time is in the numerator so that a slower feature FSOT results in a % < 100. This maintains consistency with the percentage of ESAT.

6.2.2 1 Set + 30 Seconds Test

$ESAT_{30sec}$ shall be calculated using the data of 1 Set + 30 seconds Test.

For test runs using 4 pages test targets and N_{30sec} set count test run:



First Set Out Time = $FSOT_{30sec}$ = t_1 (seconds)

Last Set Out Time = $LSOT_{30sec}$ = tn (seconds)

N_{30sec}=Set count

240= 4 pages x 60 seconds

$ESAT_{30sec}$ shall be calculated from the 1 Set + 30 Seconds Test data from the following equation.

$$ESAT_{30\,\mathrm{sec}} = \frac{240 \times (N_{30\,\mathrm{sec}} - 1)}{LSOT_{30\,\mathrm{sec}} - FSOT_{30\,\mathrm{sec}}} \quad \text{(ipm)}$$

If a feature test is performed on large sizes media (A3) then the ESAT calculation must be corrected for the 2-up copies. That is A3 shall be counted as 2 pages of A4.

For each feature tested, the percentage of the Feature Copying Mode to Base Copying Mode is calculated as follows:

$$\text{Feature Percentage ESAT} = \frac{ESAT_{feature}}{ESAT_{base}} \times 100 \quad (\%)$$

7 Presentation of Results

7.1 General Performance Test

“Full Report” and “Full Detailed Report” should be “Report” to be presented if requested.

“Summary Report” should be “Declaration” to be used in marketing materials or packaging. “Declaration” of the whole “Summary Report” is recommended.

However, the minimum requirement of “Declaration” shall include the following three items.

(1) Description that the productivity has been determined in accordance with ISO/IEC 24735.

(2) The average of ESAT in a General Performance Test for the default simplex mode.

(3) Pointer to the Full detailed report or contact information.

Summary Report

The minimum required presentation of results is that displayed in **Table 9**, FSOT(s) and ESAT (ipm). Each test should be also done optionally in monochrome mode in addition to required in full colour copying mode, only if the machine is a colour copying device.

The measured intervals of time should be recorded to 2 decimal places. The figure of average results is rounded down at two decimal places to the final results of FSOT and ESAT.

Table 9 — Results of Summary Report

	Copying mode	FSOT(s)	ESAT(ipm)
Colour	1:1	R	R
	1:2	R	R
	2:2	R	R
B&W	1:1	O	O
	1:2	O	O
	2:2	O	O

where “R” is Required to report when available on the copying device, “O” is Optional and not necessary to report.

Table for colour copying device

NOTE If a device does not have the ability to duplex, the duplex rows may be deleted or “NA” is put in a corresponding column. Similarly, for a colour copying device, B&W measurement is optional, so B&W rows can be omitted.

Full Report

The required presentation of results is that displayed in Table 10. Each test should be also done optionally in monochrome mode in addition to required in full colour copying mode, only if the machine is a colour copying device.

The Full Report reports averages for the test results. Averages are calculated by adding the totals (of EFTP) and dividing by the number of tests.

Table 10 — Results of Full Report

Colour mode	FSOT(s)	EFTP (ipm)			ESAT(ipm)
		1set	1set+30seconds	1set+4minutes	
1:1	R	R	R	R	R
			# sets	# sets	
1:2	R	R	R	R	R
			# sets	# sets	
2:2	R	R	R	R	R
			# sets	# sets	

where “R” is Required to report when available on the copying device.

Colour results for Colour copying device

B&W mode	FSOT(s)	EFTP (ipm)			ESAT(ipm)
		1set	1set+30seconds	1set+4minutes	
1:1	O	O	O	O	O
			# sets	# sets	
1:2	O	O	O	O	O
			# sets	# sets	
2:2	O	O	O	O	O
			# sets	# sets	

where “O” is Optional and not necessary to report.

B&W results for Colour copying device

NOTE Single values from the required General Performance test such as FSOT or ESAT may be reported as long as these values include a pointer to the full detailed report.

Individual manufacturer can choose whether or not to display Summary Report or Full Report on his brochure or spec sheet. If the report is shown on them, above table formats are recommended to be used. A pointer to the full detailed report (an example shown in Annex B) shall be included in his brochure or spec sheet.

7.2 Feature Performance Test

The minimum required presentation of results shall include data showing the ratio of the results of Feature Copying Mode to the results of the Base Copying Mode test, as displayed in the Summary Report, Table 11.

The system setting for the copying modes shall be identified (default and all non-default and optional test mode settings identified) in a full detailed report (Annex B). In a Full Report, the FSOT and ESAT numbers as well as the ratio for each of the individual test ratio shall be reported as displayed in Table 12.

Averages are calculated by adding the totals (of FSOT and ESAT) and dividing by the number of tests. Reported numbers may include as many decimal places as desired.

An example of a Summary Report and Full Report table is shown below. A typical example of copying device settings that are recorded is shown in Annex A.

Table 11 — Feature Performance Test Summary Report
(Form shows 2-up as example, Feature Modes may vary)

Copying Modes	Feature Performance Ratio	
	2-up	
	$\frac{FSOT_{base}}{FSOT_{feature}}$ (%)	$\frac{ESAT_{feature}}{ESAT_{base}}$ (%)
2-up mode (4 pages → 2 pages)	R*	R*

R* Required test if optional Feature Performance Test is run

Table 12 — Feature Performance Test Full Report
(Form shows 2-up as example, Feature Modes may vary)

Copying Modes	Base Printing Mode		Feature Performance Ratio			
			2-up			
	FSOT (s)	ESAT (ipm)	FSOT (s)	ESAT (ipm)	$\frac{FSOT_{base}}{FSOT_{feature}}$ (%)	$\frac{ESAT_{feature}}{ESAT_{base}}$ (%)
2-up mode (4 pages → 2 pages)	R*	R*	R*	R*	R*	R*

R* Required test if optional Feature Performance Test is run

Annex A
(informative)

Examples of report presentation

This ANNEX shows how to present the results of measurement in the following tables according to "7. Presentation of results".

NOTE The following data are not real data from copying device or MFD; they are just an example showing how to present the results.

(1) Measurement Results for Summary Report

A.1 35 cpm colour copying device equipped with ADF and duplex copying unit.

Table A.1 — Example of measurement results

	Copying mode	FSOT(s)	ESAT(ipm)
Colour	1:1	15,7	34,7
	1:2	20,7	27,3
	2:2	23,9	27,9
B&W	1:1	11,4	43,9
	1:2	15,4	36,1
	2:2	17,6	36,0

A.2 75 cpm B&W copying device equipped with ADF and duplex copying unit.

Table A.2 — Example of measurement results

	Copying mode	FSOT(s)	ESAT(ipm)
B&W	1:1	8,9	76,0
	1:2	12,4	75,7
	2:2	13,2	75,5

(2) Measurement Results for Full Report

A.3 35cpm colour copying device equipped with ADF and duplex copying unit.

Table A.3 — Example of measurement results

mode	FSOT(s)	EFTP (ipm)			ESAT(ipm)
		1set	1set+30seconds	1set+4minutes	
1:1	15,7	15,3	28,7	32,5	34,7
			6 sets	36 sets	
1:2	20,7	11,6	21,5	24,7	27,3
			5 sets	27 sets	
2:2	23,9	10,0	20,6	25,2	27,9
			5 sets	27 sets	

Colour results for Colour copying device

mode	FSOT(s)	EFTP (ipm)			ESAT(ipm)
		1set	1set+30seconds	1set+4minutes	
1:1	11,4	21,1	38,7	42,4	43,9
			8 sets	45 sets	
1:2	15,4	15,6	29,6	33,4	36,1
			6 sets	36 sets	
2:2	17,6	13,6	28,2	33,1	36,0
			6 sets	36 sets	

B&W results for Colour copying device

A.4 75 cpm B&W copying device equipped with ADF and duplex copying unit.

Table A.4 — Example of measurement results

mode	FSOT(s)	EFTP (ipm)			ESAT(ipm)
		1set	1set+30seconds	1set+4minutes	
1:1	8,9	26,9	65,2	73,8	76,0
			11 sets	77 sets	
1:2	12,4	19,4	59,9	72,8	75,7
			11 sets	77 sets	
2:2	13,2	18,3	58,8	72,6	75,5
			11 sets	77 sets	

B&W results for B&W copying device

(3) Measurement Results for Feature Performance Test

A.5 26 cpm copying device equipped with ADF and duplex copying unit.

Table A.5 — Example of measurement results

Mixed Originals mode

Summary Report

Copying Modes	Feature Performance Ratio	
	Mixed Original mode	
	$\frac{FSOT_{base}}{FSOT_{feature}}$ (%)	$\frac{ESAT_{feature}}{ESAT_{base}}$ (%)
A4:A3 = 2pages : 2pages	71,3	76,1
A3 = 4 pages	67,2	100,5

Full Report

Copying Modes	Base Copying Mode		Feature Performance Ratio			
			Mixed Original mode			
	FSOT (s)	ESAT (ipm)	FSOT (s)	ESAT (ipm)	$\frac{FSOT_{base}}{FSOT_{feature}}$ (%)	$\frac{ESAT_{feature}}{ESAT_{base}}$ (%)
A4:A3 = 2pages : 2pages	19,5	26,6	27,2	20,2	71,3	76,1
A3 = 4 pages	19,5	26,6	28,9	26,7	67,2	100,5

Other special modes

Summary Report

Copying Modes	Feature Performance Ratio	
	Special mode	
	$\frac{FSOT_{base}}{FSOT_{feature}}$ (%)	$\frac{ESAT_{feature}}{ESAT_{base}}$ (%)
Stapler	67,1	79,6

Full Report

Copying Modes	Base Copying Mode		Feature Performance Ratio			
			Special mode			
	FSOT (s)	ESAT (ipm)	FSOT (s)	ESAT (ipm)	$\frac{FSOT_{base}}{FSOT_{feature}}$ (%)	$\frac{ESAT_{feature}}{ESAT_{base}}$ (%)
Stapler	19,5	26,6	29,0	21,2	67,1	79,6

A.6 35 cpm copying device equipped with ADF and duplex copying unit.

Table A.6 — Example of measurement results

2-up mode

Summary Report

Copying Modes	Feature Performance Ratio	
	2-up	
	$\frac{FSOT_{base}}{FSOT_{feature}}$ (%)	$\frac{ESAT_{feature}}{ESAT_{base}}$ (%)
2up mode (4 pages → 2 pages)	78,4	209,9

Full Report

Copying Modes	Base Copying Mode		Feature Performance Ratio			
			2-up			
	FSOT (s)	ESAT (ipm)	FSOT (s)	ESAT (ipm)	$\frac{FSOT_{base}}{FSOT_{feature}}$ (%)	$\frac{ESAT_{feature}}{ESAT_{base}}$ (%)
2-up mode (4 pages → 2 pages)	8,7	30,4	11,1	63,8	78,4	209,9

Annex B
(informative)

Example of full detailed report

B.1 General

This Annex B shows how to present an example presentation of full detailed report of measurement. When Summary Report or Full Report is provided for users, the following full detailed report is recommended to provide in response to user's request.

NOTE The following data are not real data from copying device or MFD; they are just an example showing how to present the full detailed report. And the machine under measurement is not the same one as described in Annex A.

B.2 Machine Setup Information and Pre-set items

Table B.1 — Machine Setup Information

Test Start Date and Time:	4/September/2007 10:30 am
Tester	XXXXXX
Machine name/model:	MFX-2635
Colour or B&W:	Colour MFD
configuration (options)	ADF, Duplex copying Unit, Finisher(Staple) as default
Test temperature	23 °C
Test humidity	60%
Test End Date and Time:	4/September/2007 03:00 pm

Table B.2 — Preset Items

	Pre-set item	Pre-set value
Mode	Output resolution	default
	Output Quality	default
	Copying mode	default
	Auto density adjustment	default
	Collating function	Activated (if not activated in default mode.)
Paper	Paper sending direction	default
	Paper type setting	default
Paper-path	Paper feeding	Standard cassette
	Paper exit	Standard exit tray
	Face up exit	default
	Duplex copying unit	default (used in 1:2 mode and 2:2 mode).

Table B.2 (*continued*)

	Pre-set item	Pre-set value
Temporary stop	Fixing capability	default
	Image quality stability	default
	Capacity of paper	default
	Others	default
Paper	Manufacturer	Office Paper Co.
	Weight	60 g/m^2
	Size	A4 and A3
	paper type/name	A44FG48A

B.3 Measurement Results for General Performance Test

Table B.3 — Full Report table

Colour mode	FSOT(s)	EFTP (ipm)			ESAT(ipm)
		1set	1set+30seconds	1set+4minutes	
1:1	19,5	12,3	21,6 5 sets	25,5 26 sets	26,7
1:2	30,1	8,0	18,1 5 sets	23,8 26 sets	26,4
2:2	33,4	7,2	17,1 5 sets	23,4 26 sets	26,1

B&W mode	FSOT(s)	EFTP (ipm)			ESAT(ipm)
		1set	1set+30seconds	1set+4minutes	
1:1	14,0	17,1	30,2 6 sets	34,6 37 sets	35,7
1:2	23,6	10,2	25,1 6 sets	32,5 37 sets	35,5
2:2	27,0	8,9	23,6 6 sets	32,0 36 sets	35,1

B.4 Measurement Results for Feature Performance Test

Table B.4 — Test conditions

Mixed Originals mode

Factors	Selected condition
Original Size and combination	1) A4 4 pages in A4 size (all A4 size in ABCD order)
	2) A3+A4 2 pages in A3 + 2 pages in A4 (A3 size A and B, then A4 size C and D)
	3) A3 4 pages in A3 size (all A3 size in ABCD order)
Direction of original setting	Default
Original Image side	One-sided
Paper path setting	Set A4 at the shortest path, A3 at the second shortest path if available (when using by-pass/manual feed unit, it shall be noted in full detailed report.)
Coping mode	Collating mode only (without any other mode)