



Vendor-Neutral Performance Description of Desktop PCs

Guideline Version 4.0

■ Imprint

Publisher:	BITKOM Federal Association for Information Technology, Telecommunications and New Media Albrechtstraße 10 10117 Berlin-Mitte Tel.: +49 30.27576-0 Fax: +49 30.27576-400 bitkom@bitkom.org www.bitkom.org	Purchasing Authority of the Federal Ministry of the Interior Brühler Straße 3 53119 Bonn Tel.: +49 228.99610-0 Fax: +49 228.9910610-0 itk-beschaffung@bescha.bund.de www.beschaffungsamt.de
Contact:	Felix Zimmermann Tel.: +49 30.27576-526 f.zimmermann@bitkom.org	Carsten Kolbe Tel.: +49 228.99610-2900 itk-beschaffung@bescha.bund.de
Copyright:	BITKOM / Purchasing Authority of the Federal Ministry of the Interior Version 4.0 (April 2015) Last reviewed: 13.04.2015	
Graphics/Layout:	Design Bureau kokliko / Sabrina Steppan (BITKOM)	
Cover image:	Daniela Stanek (BITKOM)	

This publication constitutes general, non-binding information. The contents represent the view of BITKOM at the time of publication. While great care is taken in preparing this information, no guarantee can be provided as to its accuracy, completeness, and/or currency. In particular, this publication does not take into consideration the specific circumstances of individual cases. The reader is therefore personally responsible for its use. Any liability is excluded.

Vendor-Neutral Performance Description of Desktop PCs

Guideline Version 4.0

Inhaltsverzeichnis

1	Introduction	3
2	Benchmarks	5
2.1	Description of Computer Performance	5
2.2	Choice of Benchmarks	5
2.3	BAPCo SYSmark 2014	6
2.4	Futuremark PCMark 8	7
2.5	Compliance with the UfAB V [German Guideline for Tendering and Evaluating IT Services] when Using Benchmark Values	8
2.6	Procedure for Performing Benchmarks	8
2.7	Installing the Operating System (MS Windows 7) for Correct Benchmarking	8
2.8	Installation of the Benchmark Program on the Operating Systems	10
3	Minimum Requirements based on Sample User Profiles	11
4	Minimum Technical Requirements for Vendor-Neutral Product Description	12
4.1	Benchmarks	13
4.2	Casing	13
4.3	Motherboard	13
4.4	Processor	13
4.5	Optical Drives	14
4.6	Memory (DRAM)	14
4.7	Hard Disks	14
4.8	Network Connections	15
4.9	Graphics	15
4.10	Interfaces	15
4.11	Input/Output Devices	16
4.12	BIOS, Drivers, Operating System	16
4.13	System Management, Security	17
4.14	Power Supply	18
4.15	Electricity Consumption	18
5	»Non-technical« Requirements	19
5.1	Other Services	19
5.2	Support	19
5.3	Logistics	20
6	Evaluation of Offers	21
6.1	Measuring Protocols (esp. Benchmarks)	21
6.2	Evaluation Process for Measuring Protocols	22
6.3	Performing the Measurement	22

1 Introduction

This guide was created as a result of a working group led by the Purchasing Authority of the Federal Ministry of the Interior and the Bundesverband Informationstechnik, Telekommunikation und neue Medien e. V. (Federal Association of Information Technology, Telecommunications and New Media – BITKOM).

The aim of this document is to give public authorities a reliable and intelligible tool for the wording in official tenders for the procurement of information and communications technologies in a non-proprietary manner. It should be possible to formulate current technical requirements of the products to be procured without having to use specific product names, brand names or manufacturers. This initiates non-discriminatory competition between providers which maintains the short-term and long-term efficiency of tenders and ensures their technical quality.

This guide covers desktop PCs or desktop workstation PCs in various performance classes. In addition to the guide available for desktop workstation PCs, you can also, for example, access other guides for notebooks, servers and thin clients.

Both European and German law forbids the use of brand names within the scope of public tenders. This is due to the European anti-discrimination laws pursuant to the EU procurement directive 2014/18/EU and EU contracts. In the German legal framework, this obligation is established in § 7 VOL/A and 8 EU VOL/A. The directives are aimed at preventing the type of discriminating wording in calls to tender that excludes particular manufacturers and suppliers from the group of potential bidders.

Exceptions can be made in accordance with § 8(7) EU VOL/A only where it is not possible to describe performance using sufficiently precise and generally intelligible terms.

However, in this case, the description must be supplemented by the words »or equivalent«. Legislation also expressly states that technical specifications must in any case ensure open competition:

»The technical specifications created by purchasers in public offices should make it possible to open up public procurement markets to competition. To enable this, it must be possible to submit tenders which reflect the diversity of technical solution options.«¹

Wording documents for official tenders is not an easy task, especially in the field of procurement of IT systems. The technical complexity of the material, the quick succession of product cycles, and above all the problem of describing the required system performance in a precise manner, taking all technical requirements into consideration, are often a major challenge to purchasers in public offices. That is why product and service descriptions have often relied on naming »tried and tested« proprietary product names or requesting technical specifications which actually then exclude the use of good products that are fit for purpose by other competitors.

These are precisely the points on which the guide focuses. It offers a compact tool to ensure compliance with legal requirements and thus promote fair competition. It achieves this by identifying and describing state-of-the-art technical standards in accordance with current practice. To measure performance in so doing, this approach leverages generally accepted benchmarks as a major element of a non-proprietary product description.

¹ Recital 27, EU procurement directive 2004/18/EU

To keep the guide up to date, the guide will be revised at regular intervals. Revisions will take the latest technical developments into consideration and adapt benchmarks to reflect the current state of the art.

The most recent version of this guide can be found at www.itk-beschaffung.de.

Creating this document would not have been possible without the close cooperation of those involved in the project group »Non-Proprietary Performance Description«.

Special thanks go to:

- Roberto Dognini, AMD GmbH
- Jens Füssel, Lenovo Deutschland GmbH
- Dirk Hahn, Fujitsu Technology Solutions GmbH
- Carsten Kolbe, Beschaffungsamt des BMI
[Procurement Office of the BMI]
- André Kuhlmann, Acer Computer GmbH
- Ulrich Norf, Intel GmbH
- Ute Riester, Dell GmbH
- Jörg Roskowetz, AMD GmbH
- Marko Rost, Hewlett-Packard GmbH
- Thomas Scholz, Dell GmbH
- Bernhard Wolz, Bundesagentur für Arbeit
[The Federal Agency for Employment]
- Arno Zelesniack, Techniker Krankenkasse
- Thomas Zapala, Bundesamt für Ausrüstung, Informationstechnik und Nutzung der Bundeswehr
(BAAINBw) [Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support]
- Felix Zimmermann, BITKOM

2 Benchmarks

■ 2.1 Description of Computer Performance

The only way to guarantee savings in procurement processes is by fair and open competition. It gives purchasers more freedom of choice and increases the number of bidders competing for the tender. To ensure that public procurement officers really do profit from fair and open competition, and that the legal requirements of the tender process are complied with, it is imperative to have non-proprietary, objective evaluation criteria for a precise analysis of performance.

The best approach to describing performance relies on standardised and generally accepted benchmarks. Benchmarks are based on strict test methods developed by independent industrial consortia and software manufacturers, and recognised and supported by manufacturers of ITC products.

A benchmark is a program, or a suite of programs, that measures the overall performance of a system, or individual components such as processor, graphics, memory, hard disk, etc. The advantage of benchmarks is that they provide a specific, comparable and reproducible method of objectively measuring the performance of a computer.

■ 2.2 Choice of Benchmarks

The free market offers a wealth of different benchmark procedures. The majority of them are intended for specific uses and few of them are suitable for the typical requirements of a public tender. Choosing an unsuitable benchmark could result in computer systems being purchased which do not fulfil users' requirements. The BITKOM committee of experts on non-proprietary tenders recommends using one of the benchmark procedures, SYSmark 2014 or PCMark 8, which are described in more detail below, in order to measure the performance of desktop PCs. Both benchmark procedures produce test scenarios that are of relevance to the typical

requirements of a public tender, are generally available in stable versions and are transparently documented, can be reproduced and yield comprehensibly adjusted benchmark results.

When using this guide, the purchaser must choose between one of the benchmark procedures recommended here. Although both benchmark procedures are generally suitable for measuring the performance of desktop PCs, generated benchmark values cannot be directly compared with each other. This is because different technologies and valuation standards are used. The comparison must therefore be limited to the values of a single benchmark procedure.

The benchmark procedures used in this guide are aimed at a typical office workstation. There are other benchmark procedures, which are not included in this guide, for special requirements such as extremely high graphics performance as opposed to a typical office environment.

The following criteria are important when selecting a suitable benchmark:

The benchmark must:

- Measure the overall performance of the system and not just the performance of individual components so that it does not weight the individual components disproportionately,
- Test scenarios geared to the intended use. In the case of this guide, this refers to desktop computers, i.e. applications used in a typical office environment,
- Represent all relevant manufacturers and computer platforms; its development process is independent and transparent,
- Reflect, in a balanced manner, the performance that can be expected during the term of use of the PC.

2.2.1 The BAPCo Consortium

BAPCo is an open, non-profit industrial consortium that has developed a number of application-based benchmarks to evaluate the performance of office PCs and notebooks on the basis of current software applications and Microsoft operating systems. The development follows a previously established plan with main and interim objectives. Each member has one vote when voting (majority decision) and has equal rights during the entire development process. A current list of BAPCo members can be found at <http://www.bapco.com/about/members>.

Via its BAPCo Government Network, BAPCo offers a free collaboration with authorities. Information about this can be found at <http://www.bapco.com/bgn>.

The significant benchmark procedure from BAPCo of relevance to this guide is **SYSmark 2014**.

2.2.2 Futuremark

Futuremark is a software company that produces various benchmark procedures for different application areas. Futuremark collaborates with the most important technology companies in order to develop industry-standard benchmarks which reflect the efficiency of respective systems, such as desktop PCs and notebooks, in an application-relevant and cross-platform manner. The Futuremark benchmark development process (Benchmark Development Program - BDP) is transparent, independent and open to inspection. A current list of BDP members can be found on the following website:

Link: <http://www.futuremark.com/business/benchmark-development-program>

The significant Futuremark benchmark procedure of relevance to this guide is **PCMark 8 V. 2.1.274**.

■ 2.3 BAPCo SYSmark 2014

SYSmark 2014 is the immediate follow-on product of SYSmark 2012 and its predecessor SYSmark 2007 with updated applications. SYSmark 2014 supports the Windows operating systems 7 / 8 / 8.1, in each case 32 and 64 bit with 32 / 64 bit applications. These are: Microsoft Office 2013 (including Notes 2013), Google Chrome, WinZIP 17.5, Adobe Acrobat XI PRO, Adobe Photoshop CS6 and Adobe Premiere Pro CS5 (32 bit) or CS6 (64 bit) depending on which operating system is installed.

SYSmark 2014 is an application-based benchmark that measures the overall performance of computers based on typical office software applications using the CPU. The graphics part of modern CPU architectures is taken into consideration to a much lesser extent, as these are dependent on the software.

Each run of the benchmark produces several different results:

- Office Productivity
- Media Creation
- Data / Financial Analysis
- and an overall value (»Overall«)

The overall value consists of the individual components and therefore is not identical to the Office Productivity Value.

Important notice:

- The SYSmark 2014 value mentioned in this guide refers exclusively to the overall value.
- The benchmark values from SYSmark 2007 / 2012 and SYSmark 2014, insofar as they are available, cannot be compared with each other!
- If the same system is used, but the operating system is MS Windows 8 / 8.1 (32 or 64 bit), then the benchmark results from SYSmark 2014 will be different. The reasons for this are the incongruent code basis of the operating systems and the different device drivers.

- It is therefore crucial that the call to tender specifies both the operating system, including the current service pack, and the current version of SYSmark 2014.
- This guideline will be regularly checked to ensure it is up to date. These regular checks will also cover the benchmark recommendation.

Recommendation:

In order to ensure the comparability of test results with SYSmark 2014 as well as with the involvement of international providers, we recommend using benchmark measurements under Windows 7 64 bit in the English version.

■ 2.4 Futuremark PCMark 8

PCMark 8 measures the overall performance of computers with the aid of typical office applications and scenarios. The benchmark is divided into the various categories (home, work, creative) and these are used to measure the PC performance in different application scenarios.

For the entry-level systems described in this guide, PCMark 8 V. 2.1.274 Work is used exclusively and available at <http://www.futuremark.com/benchmarks/pcmark8/setup>.

In doing so, two different versions of the benchmark can be used: Conventional and Accelerated. The purchaser must decide on one of the two PCMark 8 versions before publishing tenders.²

Conventional

In the conventional version, the benchmark only uses the CPU. The acceleration of applications due to the graphics part of modern CPU architectures, like via OpenCL, is not taken into consideration in this procedure.

Accelerated

Compared to the conventional version, the accelerated version uses both the CPU itself as well as the graphics part of the CPU. Typical applications which may be experienced in the office application of such a graphics acceleration are web browsing, compression programmes, the rapid compressing of photographs or videos for e-mail dispatch, video conferencing, MS PowerPoint animations, a smoother scrolling through large documents as well as a generally smoother operating manner using the now typical full HD resolutions. The accelerated version should be implemented if the intention is to use software which will benefit from hardware graphics acceleration as defined.

PCMark 8 can be used on the following operating systems:

- MS Windows 7 (32 and 64 Bit)
- MS Windows 8 (32 and 64 Bit)
- MS Windows 8.1 (32 and 64 Bit)

In doing so, it is not necessary to determine the language version of Windows.

Important notice:

- This guide recommends the use of version 2.1.274 of PCMark 8, available at <http://www.futuremark.com/benchmarks/pcmark8/setup>.
 - Benchmark values of earlier or later versions of PCMark are not comparable with PCMark 8 version 2.1.274.
 - Due to the use of different technologies, it is not possible to compare the benchmark values between the PCMark 8 »conventional« and »accelerated« versions.
 - This guide will be regularly amended to ensure that it is up to date. These regular checks will also cover the benchmark recommendation.
-

² The BITKOM members, Dell GmbH and Intel GmbH, do not share this opinion. They think that the purchaser should promote the use of both benchmarking versions according to PCMark 8, »Work Conventional« and »Work Accelerated«, accumulatively in the tender documents. The devices offered would then have to achieve both of the minimum values specified in the guide for »Work Conventional« and »Work Accelerated«.

Recommendation:

In order to achieve a test result that is as realistic as possible with PCMark 8, we recommend that benchmark measurements are conducted using Windows 7 Professional SP1 64Bit.

■ 2.5 Compliance with the UfAB V [German Guideline for Tendering and Evaluating IT Services] when Using Benchmark Values

UfAB V («Unterlage für Ausschreibungen und Bewertung von IT-Leistungen» – Document for the Tender Process and Evaluation of IT Performance) of the Purchasing Authority of the Federal Ministry of the Interior does not refer specifically to the use of benchmarks. According to the UfAB V classification of criteria, the following options are available to take due consideration of benchmarks in public tenders:

- The minimum benchmark value is an »A« (knockout) criterion. Any system offered must achieve this minimum benchmark value. No points are awarded for performance above this level.
- If the system offered does not achieve the required minimum benchmark value, it must be precluded from this tender.
- The values proposed in this guide ensure that the devices provide adequate performance for a typical period of use as a standard office device.

If, due to specific performance requirements, there is a need to evaluate the performance as a »B« criterion, the following should be taken into consideration: The recommended benchmark procedures refer to a different scaling when using different CPU architectures. There is the danger of an unintentional restriction of potential tenders and therefore reduced efficiency of tenders. It is therefore recommended, when using benchmark values as a »B« criterion, that you discuss in advance the precise function of the respective benchmark procedures while taking into consideration the software that is to be used.

The UfAB V can be downloaded free of charge from www.cio.bund.de.

■ 2.6 Procedure for Performing Benchmarks

For all benchmark values it must be assumed that fluctuations in the range of 2% – 5% will occur in each round of the test.

Multiple measurements achieve greater accuracy. For this reason, at least three benchmark measurements should be taken. It may be necessary to adjust the number of test runs accordingly in the configuration menu of the benchmark. The arithmetic means used to calculate the test runs can be found in the benchmark protocol.

Above and beyond the basic settings of the reference system, operating systems provide many setting options that may lead to significantly different results. We therefore recommend creating a protocol of the optional settings used and submitting the protocol along with the tender documents.

In order to achieve comparable results, it is necessary to comply precisely with the specified procedure for performing the benchmark.

■ 2.7 Installing the Operating System (MS Windows 7) for Correct Benchmarking

Do not install an »image«.

Take the following steps into consideration:

- Enable and save the BOOT options (CD/DVD drive) in the BIOS.
- HDD: format with NTFS on one partition.
- This partition does not have to cover the whole disk.
- Installation of drivers: Motherboard (INF / chipset driver), data and storage (RAID/AHCI).

- During the installation, please note that additional drivers might be needed under Windows 7, which must be installed using external media. This takes place at the start of the installation. Examples of such drivers are: AHCI/RAID, LAN, USB, graphics card, audio.
- Using the device manager, checks must be conducted to ensure that all drivers are installed and all devices are listed (without error notifications): Start, Setting, Control Panel, System Properties, Hardware-Device Manager.
- To conclude the installation, remove files: Start, All Programs, Accessories, System Tools, »Disk Cleanup« – enabling all items.
- If using magnetic hard drive space (HDD): Defragmenting of the hard disk: Run `c:\defrag c: -f` or Start, All Programs, Accessories, System Tools, Defragmentation.

Additional notes for all operating systems:

Before starting the benchmark run on the device, please check the following items:

- The required drivers have to be provided by the respective manufacturers and must be up to date.
- Overclocking of components through BIOS setup is not permitted.
- If possible, perform BIOS and firmware updates (via the Internet). The updates should be available from the Internet.
- Additional optimisation by using specific drivers or software and BIOS setups is not permitted.

2.7.1 Configuration of the Operating System (MS Windows 7 Professional SP1 64Bit English)

SYSmark 2014 from the BAPCo configuration program

- Screen resolution: the screen resolution has only a minimal effect on the overall result, so this can be ignored. As a standard solution, with an aspect ratio of 4:3, a resolution of 1280x1024 is used.
- The next step is the configuration of the operating system: BAPCo provides an automatic configuration program which runs automatically at the start of each benchmark. No further optimisation is required. Attention: always use the latest program version (<http://www.bapco.com>).
- The configuration settings will be selected and executed directly in the main program, BAPCo Sysmark 2014, under »CONFIGURE«. The default standard values should not be changed.

PCMark 8

- Set the Windows power profile to »maximum performance«; deactivate Windows updates

■ 2.8 Installation of the Benchmark Program on the Operating Systems

SYSmark 2014

- Installation of benchmark software and patches.
- Defragmenting of the hard disk: Run `c:\defrag c:-f` or Start, All Programs, Accessories, System Tools, Defragmentation.
- Launch the benchmark software SYSmark 2014. Do not use the system when running.

PCMark 8

- Install the Windows 7 patches listed below for Internet Explorer 10:
 - KB-2729094 (64 Bit):
<http://go.microsoft.com/fwlink/p/?LinkId=258385>
 - KB-2731771 (64 Bit):
<http://go.microsoft.com/fwlink/p/?LinkId=272351>
 - KB-2670838 (64 Bit):
<http://go.microsoft.com/fwlink/p/?LinkId=272354>
 - KB-2786081 (64 Bit):
<http://go.microsoft.com/fwlink/p/?LinkId=285866>
- Install Internet Explorer 10:
<http://download.microsoft.com/download/C/E/o/CEoAB8AE-E6B7-43F7-9290-F8EBoEA54FB5/IE10-Windows6.1-x64-en-us.exe>
- Installation of benchmark software and patches.
- Defragmenting of the hard disk:
Run `C:\defrag c:-f` oder Start, All Programs, Accessories, System Tools, Defragmentation.

3 Minimum Requirements based on Sample User Profiles

The device to be purchased must be capable of fully executing applications from the following categories:

User profile	Typical Applications
Office worker with administrative tasks	<ul style="list-style-type: none"> (1) Client e-mail, (2) Web-browser, (3) Word processing, (4) Simple spreadsheets, (5) Presentation software, (6) PDF-reader, (7) Virus scanner, (8) Stand-alone custom applications (e.g. time management, telephone information system), (9) Browser-based custom applications.

4 Minimum Technical Requirements for Vendor-Neutral Product Description

A summary of the minimum technical requirements can be found below. They are explained in detail in the sections that follow.

System components		User profile – office worker with administrative tasks
	SYSmark 2014	600
	PCMark 8 Work Conventional	2200
	PCMark 8 Work Accelerated	3000
4.2	Casing (for information purposes only)	Small form faktor, tower, ultra slim desktop
4.3	Motherboard	Appropriate casing
4.4	Processor	x86-architecture
4.5	SATA optical drives	DVD multi norm burner*
4.6	Memory (RAM) DDR 3	4 GB (recommended 2 x 2; alternative 1 x 4 GB)
4.7	SATA hard disk	≥ 250 GB SATA
4.8	Network connections RJ45 onboard/PCIe	10/100/1000
4.9	PCIe graphics card	Integrated in the CPU («on chip»), 512 MB, DirectX 11
4.10	Interfaces	DVI / HDMI Display-Port 6 x USB 2.0 RJ45
4.11	Virtualisation	CPU-supported hardware virtualisation (e.g. AMD-V or Intel VT-x)
4.12	Security	e.g. AES-NI

Note: The designs for the casing are for informational purposes. Due to technical considerations and developments by the manufacturer, the casing design should not show any kick-out criteria. In special circumstances, the awarding entity must check whether specific casing designs are required.

* The awarding entity must check whether optical drives are prohibited for security reasons.

■ 4.1 Benchmarks

Technical requirement	Benchmark	
Standards	BAPCo® SYSmark® 2014	PCMark 8 v2 2.1.274
Link	www.bapco.com	http://www.futuremark.com/benchmarks/pcmark8/setup

See chapter 2 of this guide for details. The benchmark results provided are minimum requirements. See also chapter 2.4 of this guide.

■ 4.2 Casing

Technical requirement	Form factor
Standards	Small form factor, tower, ultra slim desktop

The form factor depends on the work station where the computer is to be deployed. Tower cases are more suitable for deployment under the desk, and desktops for deployment as a rule should be on the desk.

Ensure the casings are large enough if the user group is planning extensions using add-on cards or drives.

■ 4.3 Motherboard

Technical requirement	Motherboard
Standards	Manufacturer-specific and adapted to the casing design

Your choice of a form factor not only determines the size of the PC, but also the number of internal slots available for extension cards.

The standard interfaces for plug-in cards are PCI and PCI Express.

A PCIe x16 slot should be available as a minimum for graphics cards. AGP is an obsolete standard for graphics cards. Cards are no longer available and should not be requested. Additionally, no service/support is available.

The motherboard should integrate components such as e.g. sound, LAN, USB 2.0, SATA2.

PS/2, serial and parallel interfaces are to be retrofitted with adapters if necessary.

The chipset used determines the driver that is required. In the case of extended rollouts (e.g. due to framework agreements), ensure the selection takes into consideration sufficient platform stability (durability of the chipset components), in order to keep the variety of operating systems that need to be installed to an acceptable level.

■ 4.4 Processor

Technical requirement	Processor
Standards	x86-architecture

The processor (also CPU or Central Processing Unit) is the central component of a computer. Desktop systems typically use x86-architecture.

■ 4.5 Optical Drives

Technical requirement	Optical drives
Standard	DVD multiple standard burning device

2015 state-of-the-art technologies:

- DVD-ROM drive.
- DVD multiple standard burning device.
- Multi-Blu-Ray burning device.

Please note:

The awarding entity must check whether optical drives are prohibited for security reasons.

If the RAM is increased to over 2 GB for a 32-bit operating system which is able to manage a maximum RAM of 3 GB, we recommend an increase to 4 GB (2x2 GB or 1x4 GB) due to the increased performance caused when using the same storage modules in dual channel mode.

Please note:

- Dual channel: The term dual channel refers to the ability of the storage controller to operate two RAM modules simultaneously, thus achieving higher data transfer rates.
- To avoid performance hits to the RAM, make sure that both memory banks are populated symmetrically.
- At present a clock speed of 1066 / 1333 / 1600 MHz is standard for DDR 3.
- To guarantee that the investment is protected, it should be possible to expand the PC up to 16 GB.

■ 4.6 Memory (DRAM)

Technical requirement	Memory (DRAM)
Standard	DDR 3

- ≤4 GB DDR 3 for 32-bit operating systems.
- ≥4 GB DDR 3 for 64-bit operating systems.

The following memory module sizes are typical today:

- 2 GB DDR 3-SDRAM
- 4 GB DDR 3-SDRAM

The industry offers PC systems with 3 or 4 memory banks. The following is recommended for all systems with a 32-bit operating system:

- 2 GB (2x1GB DDR3)

■ 4.7 Hard Disks

Technical requirement	Hard disks
Standard	Industry standard SATA
Link	www.sata-io.org

For all systems, we recommend ≥ 250 GB. Hard disks are currently offered with the following rotational speeds:

- 5400 U/min.
- 7200 U/min.

A higher rotational speed (maintaining the same capacity) results in a higher transfer rate – the higher the cache sizes 4 / 8 / 16 / 32 MB per hard disk, the better the data transfer rate.

Latest technology:

SSD (Solid State Disk). The nanotechnology-based storage technology multiplies the disk's reading and writing speeds. However, this technology is currently relatively expensive compared with hard disks. Nonetheless, SSD with smaller data volumes in particular is now considered attractive as regards the increase in performance.

■ 4.8 Network Connections

Technical requirement	Network connections
Standards	Ethernet; Gigabit (10 / 100 / 1.000) RJ45

The PC should support »Wake on LAN« (WOL) and »Preboot Execution Environment« (PXE).

■ 4.9 Graphics

Technical requirement	Graphics
Standard	Integrated graphics are sufficient for office applications.

In the majority of desktop PCs available today, the graphics chip is already integrated in the CPU (»on chip«). In individual cases, a plug-in graphics card can also be installed if a higher graphics output is required.

»On chip« graphics solutions should fulfil the following minimum hardware requirements:

- DirectX 11 or higher.
- OpenGL 4.2 or higher.
- MB graphics memory (minimum 256 MB, however) addressable from the main memory (Unified Memory Architecture (UMA)).

Plug-in cards must fulfil the following minimum hardware requirements:

- A graphics card with PCI Express (16 line bus width).
- DirectX 11.
- OpenGL 4.2.
- 512-MB graphics memory (minimum 256 MB, however).

Graphics resolution:

- The standards VGA, XGA and WXGA should be adhered to while maintaining a refresh rate of 75 Hz.
- Graphics interfaces: see next section.

Please note:

External graphics cards increase the system's electricity consumption considerably.

■ 4.10 Interfaces

Technical requirement	Interfaces (external I / O port)
Standards	USB 2.0 and / or 3.0; RJ 45 and a digital interface (DVI, HDMI, Display-Port)

Mandatory interfaces should be:

- USB-2.0 and / or 3.0 interfaces (should be available at the front and back of the device, 3.0 interfaces only on the back are sufficient), in doing so, at least 6 are recommended (whilst taking into consideration the security requirements). This is in line with the current market.

- A digital interface (DVI, HDMI, display port): We differentiate between DVI-I and DVI-D. A DVI-I interface is the same as a DVI-D interface plus a VGA interface.
- VGA or alternative adapter, provided older screens are to be used.
- Ethernet (RJ45; see network).

Optional interfaces depending on individual needs and security requirements:

- Parallel (old plotter / printer).
- PS/2.
- Serial port (e.g. plotter).
- Audio-in/out.
- Bluetooth.
- Firewire.

Serial, parallel and PS/2 interfaces are generally interfaces with a decreasing share of the market (as of 2009). It is important not to emulate these interfaces using a USB adapter. In the past, emulated USB interfaces have proven to be susceptible to faults, particularly when measuring and control devices are connected.

■ 4.11 Input/Output Devices

Technical requirement	Input/output devices
Standards	Keyboard, mouse

Optional for all systems, depending on requirements:

- Data carrier (DVD).
- Loudspeakers; microphone.
- Card reader (signature card, memory card).
- Biometric sensor.
- Scanner.
- Braille keyboard.

■ 4.12 BIOS, Drivers, Operating System

BIOS

The BIOS (Basic Input Output System) checks all system components for functionality during the POST (Power On Self Test).

In the BIOS setup, the system sets system functions and hardware configurations such as security and energy-saving functions, boot sequence, etc.

It should be possible to query the information of the BIOS manufacturer, as the setting options depend on the manufacturer's hardware configuration.

UEFI

The BIOS successor is the Unified Extensible Firmware Interface (UEFI). The UEFI is the key interface between the firmware, the individual components of the desktop PC and the operating system. Logically, it sits beneath the operating system and represents the BIOS successor with a focus on the 64-bit systems. Secure Boot is a component of the current UEFI versions. It restricts the booting to a previously signed boot loader and therefore prevents malware or other undesirable programs at the start.

The most important new features are:

- A BIOS emulation is embedded in order to ensure compatibility with the BIOS.
- High-resolution graphics cards will already be supported when the computer starts up.
- With the UEFI, different operating systems installed on the system can be selected and launched without the need for a specific boot loader.
- Instead of the standard master boot record required until now, a GUID partition table is now used, which makes it possible to boot hard disks which are larger than 2 TB.

- A universal network boot system (Preboot Execution Environment) offers an alternative for starting local media.
- To introduce Windows 8, functions for the Secure Boot mechanism required by Microsoft were added, which restrict booting on previously specified and therefore signed boot loaders. This increases the security of the system start, as the malware can be prevented from causing any damage before the system has actually started.

Drivers

All system drivers of the major versions of the operating system must be up to date and support conflict-free operations. Driver updates of individual standard components must not cause system conflicts.

In accordance with the built-in components, these updates should be available offline or online.

Operating system

No reference will be made to the functionality of market-standard operating systems at this point. The components should be entered on the hardware compatibility list of the respective operating system manufacturer.

■ **4.13 System Management, Security**

Technical requirement	System management, security
Standards:	None

In individual cases, system management or special system protection (security) may be desirable.

System management:

Should system management / remote maintenance / remote control be implemented, the following functions – which we define as remote functions – are necessary:

- Comprehensive system inventory by remote access includes e.g. the serial number of the display, the memory slots, the processor and the installed software:
 - Pre-defined inventory reports.
 - Off/online data support.
 - Graphics user interface.
- BIOS / UEFI- Management
 - Deployed with active operating system.
 - Automatic detection of suitable BIOS / UEFI.
 - BIOS / UEFI update via LAN.
- Modification of:
 - BIOS / UEFI passwords.
 - Boot sequence.
 - Enabling/Locking of USB memory devices.
- Fan monitoring, temperature (processor and casing), voltage (CMOS battery).
- Alarm function for LAN / ASF: Casing break-in (optional), processor, heartbeat, error on commissioning system.
- Energy management:
 - Client power-off.
 - Switch to other energy state (e.g. S5).
- PXE 2.0 Boot Code
- Boot from S5 mode (powered off mode).
- Flash EPROM: local BIOS / UEFI update.

Security:

In case of special security requirements, the following options are available:

In order to do justice to the increased requirements on data security in modern IT infrastructures, the processor to be used should have a strong, generally valid encryption and decryption standard. A current standard, which is supported both by Intel as well as by AMD processors, is AES-NI (http://en.wikipedia.org/wiki/AES_instruction_set). The hardware acceleration also guarantees that the additional encryption work will have no negative influence on performance.

Support for hardware virtualisation:

If the APC to be purchased is used in virtualisation environments, the CPU should include hardware virtualisation technologies so as to be able to execute guest operating systems and applications reliably and quickly. Current standards are AMD-V (<http://sites.amd.com/de/business/it-solutions/virtualization/Pages/amd-v.aspx>) and Intel VT-x (<http://ark.intel.com/de/Products/Virtualization-Technology>). In order to create product-neutral technical specifications, either both technologies should be specified or generically »Support for hardware virtualisation« is required.

- Physical protection:
 - Theft protection: casing lock (wire locks, casing locks, seals).
 - Casing alarms.
 - Inventory marking.
- User and data security:
 - User identification.
 - System detection.
 - Encryption of files and directories.
 - TPM 1.2 (Trusted platform module), a chip that stores keys, passwords and digital certificates.
- Separate activation/deactivation of the USB interfaces:

- Start-up password (directly after PowerON).
 - Pre-boot hard disk password.
 - BIOS passwords (supervisor PW, user PW).
- SmartCard/biometrics.
- Operating system password.
- Secure standby (securing system against power failure in standby mode).
- Encryption software.
- PC security (threat from outside viruses, spyware, spam hackers).
- SW firewalls, antivirus SW, anti-spyware SW, anti-spam SW.

■ 4.14 Power Supply

Technical requirement	Power supply
Standards	Manufacturer-specific and adapted to the casing design

- Mains side 220/230 V; 50 Hz.
- Sufficiently dimensioned for full extensibility of an office system.
- Active PFC (Power Form Correction Factor).
- This requirement conforms to Energy Star.

■ 4.15 Electricity Consumption

For more information on the system's electricity consumption, please see the guidelines on environmentally-friendly procurement, also available at www.itk-beschaffung.de.

5 »Non-technical« Requirements

■ 5.1 Other Services

In the case of tenders for other services in the scope of PC procurement, the following versions can be distinguished:

- Pre-installation of software and/or hardware provided by purchaser.
- Installation on site.
- BIOS defaults according to customer specifications.
- Free delivery of serial number and MAC address in digital format, i.e. as an Excel file.
- Inventory stickers according to customer specifications (e.g. serial number and MAC address as a barcode on the box and the device).

The following variants are popular:

- Pre-installation of the PC, operating system.
- Pre-installation of the PC, operating system, surcharge with software.

As required:

- Creation of a »Golden Disk« (image) with basic components (operating system, Office ...) incl. description of use.

Pre-installations performed by the manufacturer/vendor are elements of the purchasing contract. The EVB IT purchasing contract explicitly provides pre-installations, even installation services.

If, alongside the actual supply and installation, other services e.g. the installation or configuration at the client's site, are required, the EVB-IT system delivery contract should instead be used (see decision support for integrating the BVB or EVB IT contract types in IT procurement contracts at http://www.cio.bund.de/cae/servlet/contentblob/83250/publicationFile/19754/entscheidungshilfe_pdf_download.pdf).

The EVB-IT as well as information on its use is available on the website for the German government's commissioner for information technology at: http://www.cio.bund.de/Web/DE/IT-Beschaffung/EVB-IT-und-BVB/evb-it_bvb_node.html.

There you will find additional information on legal issues in connection with the purchase of hardware.

■ 5.2 Support

If needed, support should be agreed specifying the response times / repair times.

Typical market offers differ with respect to:

- Duration of contract.
- Response time (time between reporting the malfunction and initial reaction by supports).
- Repair time (time between reporting the malfunction and restoring of system functionality).
- Spare parts logistics.
- Additional technical services on a pro rata basis (hourly rates, travelling expenses).

Requirements could be as follows, depending on needs:

- Three, four or five years on-site service, if required, including hard disk handling (no passing on of data carriers to third parties so as to minimise the danger of data leakage).
- On-site service with a response time of x hours.
- On-site service with a repair time of x hours.
- Availability of the hotline x hours and y days in the week.
- Spare parts supply without replacement by the service technician.
- Spare parts availability at the customer's.

Within the scope of the procurement of high-availability or security-relevant solutions, individual agreements can be met. In this case, the need for specifications must be weighed up against the costs incurred by them.

■ 5.3 Logistics

The following logistics features can be agreed if needed:

- Specification of maximum delivery time.
- Delivery franco domicile.
- Delivery abroad.
- Delivery to different destinations.
- Delivery to specific rooms.
- Asset management.

6 Evaluation of Offers

Sections 4 and 5 describe the criteria for evaluating a non-proprietary description of services and performance. Bidders draft their offers based on this description of services and performance.

These offers are validated and evaluated by a contracting authority. The contracting authority is obliged to accept the most economical offer. With reference to the evaluation matrix, the current version (IV) of the »Unterlage zur Ausschreibung und Bewertung von IT-Leistungen« (Document for the Tender Process and Evaluation of IT Performance - UfAB) offers considerable support. Please refer to http://www.cio.bund.de/Web/DE/IT-Beschaffung/UfAB/ufab_node.html for further information.

■ 6.1 Measuring Protocols (esp. Benchmarks)

For many evaluation criteria, evaluation on the basis of written offers is feasible and usually sufficient. However, for some performance requirements, measurements performed on the subject of the offer, are required for better and more sustainable validation of the fulfilment of requirements. These evaluation criteria include, for example:

- Noise emissions, (see guideline »Recommendations for the environmentally friendly procurement of desktop PCs«),
- Radiation emissions (see guide »Legal requirements for PCs«), and, in particular,
- Benchmark values.

According to procurement laws, if the requirements necessitate, it is permissible to ask the bidders to conduct measurements and compile corresponding measuring protocols. However, the contracting authority must consider whether such measuring protocols:

- Must be provided by every bidder,
- Must be provided only by the most economic bidder(s) to verify the offer, or
- If the authority waives the requirement to submit measuring protocols.

Obtaining measuring protocols can help to identify potential defects with respect to the capabilities of the PCs offered in the bid evaluation phase – that is prior to issuing of order.

Requiring each bidder to produce a measuring protocol constitutes a considerable effort on the part of each bidder with respect to the measurements to be performed. Only the successful bidder can compensate for this effort by being given an order. The contracting authority should therefore carefully consider to what extent this requirement for all bidders is reasonable with respect to the object of the tender.

As an alternative, a requirement by the contracting authority for the most economic bidder, based on sighting of submitted tender documents to provide a measuring protocol, could be considered (the request could also be issued to several economic bidders).

A general waiver of the requirement for measuring protocols can only be considered for small volumes.

Recommendation:

For small volume orders, we urgently recommend waiving the requirement for all bidders to submit measuring protocols! The effort associated with the measurement can significantly reduce the number of competing tenders. The following table provides a non-binding guideline:

Number of PCs	Measuring Protocol
Less than 100	General waiver of measuring protocols
Less than 1000	Only from the most economic bidder based on the requirements of the contracting authority
Greater than 1000	From all bidders

■ 6.2 Evaluation Process for Measuring Protocols

For cases (see above) in which measuring protocols are required, the objective is to verify the details of the written offer by reference to the protocol.

- If all bidders are required to submit measuring protocols with their bids, the contracting authority can reach a decision on the basis of the written offers.
- The following applies to cases where the most economic bidder is required to submit a measuring protocol:
 - If the measurements confirm the details in the offer, the offer remains valid and is therefore the most economic offer. The conditions for allocating the order to the offer have therefore been provided.
 - If the measurement fails to confirm the object of the bid, this will lead to a devaluation of the bid. In such a case, the ranking of the bids may change. The most economic bidder based on the new ranking must now be asked to submit a measurement protocol to support their bid. These process steps must be repeated until one measurement confirms the details of the submitted bid.

■ 6.3 Performing the Measurement

If a measurement is to be conducted, then all the relevant requirements must be provided to the bidders in the tender documents, ensuring that these are precise and transparent.

Systems can either be measured by the bidder, independent third parties or by the contracting authority. In the latter case, the measurements to be performed on the test system can either be performed by the contracting authority's internal experts or by third-party experts.

Depending on the party performing the test (bidder or contracting authority), the following details are integral parts of the measurement:

- Test method (which test methods were applied, including all relevant ambient conditions, test procedure).
- Schedule for tests (when to request the test, how quickly the test system must be provided by the bidder on request etc.)
- If appropriate, cost of test (e.g. who bears the costs in the event of an unsuccessful test).
- If appropriate, cost of test (e.g. who bears the costs in the event of an unsuccessful test).
- Option/obligation of bidder's participation in the test.

BITKOM represents more than 2,200 companies in the digital sector, including 1,400 direct members. With more than 700,000 employees, our members generate a domestic turnover of 140 billion Euros a year, exporting high-tech goods and services worth another 50 billion Euros. Comprising 1,000 small and medium-sized businesses as well as more than 250 start-ups and nearly all global players, BITKOM' members offer a wide range of software technologies, IT-services, and telecommunications or internet services. They produce hardware and consumer electronics or operate in the sectors of digital media and the network industry. 76 percent of the companies' headquarters are located in Germany with an additional amount of 10 percent in other countries of the EU and 9 percent in the USA as well as 5 percent in other regions. BITKOM supports an innovative economic policy by focussing the modernization of the education sector and a future-oriented network policy.

The Purchasing Authority of the Federal Ministry of the Interior purchases goods and services for 26 federal authorities, government-funded foundations and internationally active organisations. Its product portfolio is extremely wide-ranging, including items as diverse as alarm technology, tents and helicopters, as well as a great variety of services. In 2010, the Purchasing Authority of the Federal Ministry of the Interior awarded an overall volume of 1,111 contracts with a total volume of EUR 1,046.3 million.



Federal Association for Information Technology,
Telecommunications and New Media

Albrechtstraße 10
10117 Berlin-Mitte
Tel.: +49 30.27576-0
Fax: +49 30.27576-400
bitkom@bitkom.org
www.bitkom.org