



Vendor-neutral tendering of notebooks

Guidelines for public IT procurement

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Project management

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1 Introduction

1.1 Application of these guidelines

These guidelines are designed to offer an overview of the basis and criteria for the procurement of notebooks by public bodies. It was created as a result of a working group led by the Procurement Agency of the Federal Ministry of the Interior and the Federal Association for Information Technology, Telecommunications and New Media e.V. (Bitkom e.V.). This document aims to provide public contracting entities at the federal, state as well as municipal levels with a reliable and understandable resource so as to allow them to formulate their tenders for the procurement of notebooks in a non-proprietary manner, i.e. in a way that avoids the use of protected brand names or the reference to a specific manufacturer, while taking into account current technical standards.

The core element of these guidelines is a list of technical criteria that can be used to describe and compare the notebooks as well as the requirements for their working environments and other characteristics. It should be noted, however, that the listed technical criteria and requirements are subject to constant change and should be evaluated differently depending on where the equipment to be purchased is going to be used. Higher demands on the product will tend to produce a higher offer price, and accordingly, the range of products on the market will decrease. These guidelines are therefore not to be considered as a replacement for professional considerations and prioritising of the individual criteria corresponding to the personal needs.

Nevertheless, the authors of these guidelines would like to support procurers of the public administration insofar as they draw particular attention to sensitive criteria and requirements, that may lead to market restrictions, as well as cost-related decisions. The following symbols are used for this purpose:

Symbol	Meaning
	Criteria with this symbol may result in cost increases or market restrictions.
	This symbol indicates the clarification of a common misconception or highlights critical statements in the text.
	This symbol indicates whether certificates can be used to verify specific criteria.

1.2 Vendor-neutral product tendering as a legal requirement

Under public procurement law, the equal treatment of economic operators and offered products is obligatory. The legal framework foresees that the procurement object is described based on factual and non-discriminatory criteria, i. e. in a non-proprietary manner (cf. Section 97(2) GWB and Section 31(6) VgV for Europe-wide procurement procedures as well as Section 55(1) BHO and Section 2(2) UVgO for sub-threshold procurement).¹ Tenders may only refer to specific product or brand names in duly substantiated exceptional cases if a description cannot be made with adequate precision using common designations or general criteria.

Vendor-neutral tenders can also be viewed as an opportunity. They ensure fair and open competition, prevent premature technical determination as well as consequential lock-in-effects. The number of competing providers increases if the procurement takes place according to the general, factual, and technical criteria. This leads to better options, cost-saving measures for procurement; moreover, market opportunities caused by a change of provider can be utilised with minimal difficulty.

For public invitations to tender, the awarding office should create a list of criteria for the product to be procured that permits a comparison of the different offers, and if possible, their sufficient differentiation. The awarding authority is free to decide on the criteria for determining the products or services to be procured, however, the award criteria must be needs-based, vendor-neutral, and transparent.

The vendor-neutral invitation to tender for IT products is not a straightforward task. The concerned public authorities often struggle with uncertainties. The technical complexity of the topic, short product cycles, but also the difficulty of describing the desired performance of a system, taking account of all the technical requirements, often pose a substantial challenge to public procurers.

These guidelines address precisely this issue by providing a compact tool to support compliance with legal requirements when formulating technical specifications and thus ensure fair competition. They identify and explain current technical standards that enable a description of notebooks following general pertinent characteristics. In the process, it will draw on the use of generally accepted benchmarks as an essential part of the vendor-neutral performance specification. The product features and technical requirements are presented in a compact, tabular form. The guidelines will be reviewed at regular intervals with the aim of keeping them up to date. Any revisions will consider the latest technical developments and adopt the proposed benchmark values to reflect the current state of the art.

¹ Unless justified by the subject-matter of the contract, technical specifications shall not refer to a specific make or source, or a particular process which characterises the products or services provided by a specific economic operator, or to trade marks, patents, types or a specific origin or production with the effect of favouring or eliminating certain undertakings or certain products.

2 Notebooks as a procurement object

2.1 Benchmarks for evaluating the procurement object

The performance of notebooks can be described with the help of benchmarks. Benchmarks and applications are programs that measure the overall performance of a system or individual components like a graphics card, memory, drive. The benchmark should be recognised by all competitors, such as hardware manufacturers, and developed independently of industry consortia or software manufacturers. The advantage of such benchmarks is that they provide a specific, comparable and reproducible method for objectively measuring the performance of a computer.

Benchmarks must be updated annually to reflect the rapid development of computer technology, its underlying CPU architecture, and applications. These guidelines recommend the use of SYSmark by BAPCo and PCMark by Futuremark to compare the performance of notebooks.

Benchmarks for determining notebook performance

The continuous evolution of computer technology has made it increasingly difficult to compare the performance of individual computer systems only in terms of their technical specifications. For instance, a processor with a higher clock rate does not necessarily provide more processing power. The fact that the clock rate alone is no longer sufficient to compare the performance of different processors from different manufacturers with distinct internal architecture has led to the development of tests, so-called benchmarks, to improve comparability of the performance. The restriction to certain technical peculiarities of system components no longer suffices to make an informed decision in the context of an award process.

Benchmarks are specialised computer programs that run on the system whose performance is to be determined. The benchmark program performs a series of standardized tests that simulate specific application-typical tasks, and finally generates a score for the performance of that system. This score reflects the current performance of this system for the measured use case, thereby facilitating objective, data-driven comparability.

Comparing products instead of a clock rate or model number with the help of benchmarking programs can lead to more informed choices. Benchmarks that pertain to specific application scenarios provide a solid foundation for determining the performance of computer hardware to be used by end users in public agencies.

Benchmark overview

There are a whole series of different benchmarking programs and it is not always easy for the awarding authority to choose the most appropriate benchmark(s) for its invitation to tender.

Choosing an unsuitable benchmark increases the risk of procuring computer systems that are inappropriate for the user and exclude providers from the procurement procedure in a discriminatory manner, which are, in themselves, suitable.

Regardless which benchmark the awarding office chooses, it is indispensable that the use of those benchmarks coincides with the creation and maintenance of a coherent and reproducible methodology. Discrepancies may render the results unreliable and uncomparable. This may even lead to a complaint in the procurement procedure.

There are two basic types of benchmarks:

- System level benchmarking measures the overall performance of a computer system by applying a defined user scenario.
- Component level benchmarking measures the performance of individual components, such as the CPU (Central Processing Unit), memory, or graphics card.

Notwithstanding this subdivision, a benchmark must:

- Measure the overall system performance and not only rate single components, while not disproportionately emphasising individual parts.
- Test scenarios that are aimed at the intended usage, which in the case of these guidelines for notebooks refers to applications in the context of typical office environments.
- Represent all relevant manufacturers and computer platforms; its development process is independent and transparent.
- Adequately reflect the balance of the expected performance during the lifetime of the computer.
- Be acknowledged and developed in consultation with all the relevant stakeholders: awarding offices should choose benchmarks from acknowledged standardisation bodies with an independent, transparent, and fair development process that was created with the help of all relevant stakeholders.
- Be relevant and representative: awarding offices should choose benchmarks that reflect the intended purpose of the systems to be procured.
- Be up to date: awarding offices should always rely on the versions of these guidelines.

Proper benchmarks are frequently updated. New benchmarks are regularly introduced to keep up with the rapid development of the computer industry. Outdated benchmarks are unable to assess new technologies and their effect on the performance of a computer system (like multithreading).

The use of a dated benchmark can lead to misleading results when comparing computer systems. For example, the use of benchmarks that are unable to factor in new technology would disadvantage state of the art computer technology, which serves to improve performance. The system with the older technology could even receive a higher (better) score compared to the newer one, that comes with more modern, improved, and faster technology. In short: Outdated benchmarks can disadvantage innovative and more powerful products.

Benchmark developers

The following criteria can classify benchmark developers:

- Charitable (non-profit) benchmark consortia, e. g., BAPCo[®], SPEC[®], and EEMBC[®]
- Non-profit open-source benchmarks, for example, Principled Technologies[®]
- Commercially independent benchmark developers, for example, Futuremark[®] (UL Benchmarks), and Kishonti[®] Informatics
- Small commercial developers like AnTuTu[®]

Benchmark recommendations

- SYSmark 2014 1.5 (performance measurement only)²
- MobileMark 2014 1.5 (only for battery life)
- PCMark 8³ Work (Conventional or Accelerated) (performance measurement only)

² Die SYSmark2014SE results are not comparable to SYSmark2014 results.

³ These guidelines recommend the version PCMark 8 v2.1.274.

Benchmark description

SYSmark 2014 1.5 is a benchmark by the BAPCo consortium that measures the performance of Windows versions. SYSmark tests three application scenarios: office productivity, media creation, as well as data/financial analysis. SYSmark contains applications by independent software developers like Microsoft and Adobe.

Measurement results: The total result by SYSmark 2014 as well as an individual score for each scenario (higher values are better). Supported operating systems: 32-Bit and 64-Bit Microsoft Windows 7, 8, and 10.

The full list of all applications, weighting, and benchmark methodology can be found in the »white paper« by BAPCos on SYSmark 2014.

PCMark 8 is a benchmark by Futuremark (UL Benchmarks) that tests the everyday use of Windows applications on notebooks, desktops, or tablets. The PCMark 8 Work test measures the ability of the system to perform basic office work tasks like writing documents, browsing websites, creating spreadsheets, and the use of video chat. PCMark 8 contains LibreOffice Calc by the Document Foundation as well as the internally developed applications that utilise standard tools from Microsoft and the Microsoft Media Foundation. The benchmark is suitable for measuring the application performance of typical office computers that do not rely on multimedia functionality. PCMark 8 comes in two execution modes: Conventional and Accelerated.

Measurement results: each execution mode generates a value (higher is better). The measuring values of each execution mode (Conventional and Accelerated) cannot be compared to one another. On top of the »Work« test scenario recommended for these guidelines, PCMark 8 further offers scenarios like Home, Creative, Storage, as well as a measurement option to test the battery life. Supported operating systems: Microsoft Windows 7, 8, and 10.

The full list of all applications, weighting, and benchmark methodology can be found in the »technical guide« by PCMark 8.

MobileMark 2014 1.5 is a benchmark by the BAPCo consortium that measures the battery life under Windows. MobileMark offers two application scenarios to test battery discharge: Office Productivity and Media Creation. MobileMark contains applications by independent software developers like Microsoft and Adobe. Measurement results (depending on the application scenario): Battery Life Rating and Performance Qualification Rating (higher is better). Supported operating systems: 32-Bit and 64-Bit Microsoft Windows 7, 8, 8.1, and 10.

2.2 Comparing benchmarks

It must be assumed that benchmarking scores for all tests fluctuate between two and five percent each round. Repeated measurements yield greater accuracy. For this reason, at least three benchmark measurements should be conducted. Some tests allow to set up repeated test runs (e. g., SYSmark 2014 1.5 in the benchmark's menu »Configuration«). The arithmetic means for the calculation of the test runs can be found in the benchmark protocol. There are numerous ways to set up the operating systems, beyond the original settings of the reference system, that can lead to substantially different test results. Thus, we recommend creating a protocol of the applied settings and to send this protocol together with the tender documents. It is essential to follow the provided benchmark procedure precisely to achieve comparable results.

Operating system installation for correct benchmarking

- Please do not install from an »image«.

Please follow the following steps:

- Activate and save the boot options (CD/DVD drive) in the BIOS.
- Drive: create a single partition and format the drive as NTFS.
- (This partition must not cover the entire disk capacity.)
- Install the operating system from the original source (DVD, downloaded .iso).

After the operating system is installed:

- Update all the newest drivers (chipset, LAN, graphics, audio, USB, TPM, ...) that were provided by the manufacturer.
- Use the Device Manager to ensure that all drivers are installed, and devices are listed (without error message).

To conclude the operating system installation:

- Perform a disk cleanup.
- (We recommend concluding by defragmenting the drive, in cases where an HDD is used.)

Summary for all operating systems:

Please test for the following before executing any benchmarks on the device:

- Latest BIOS version is installed. If necessary, update the BIOS and any firmware updates (via internet).
- Required drivers are installed and up to date.

IMPORTANT:

- Optimisations are not accepted.
- Overclocking components via the BIOS settings is not permitted.
- Additional optimisations using specific drivers, software, and BIOS settings are not permitted.

Install the selected benchmarking software after successful installation of the operating system and start the test. We recommend three runs.

Exception: One test run must be accepted when using MobileMark to reassure the battery life.

SYSmark 2014 1.5 configuration

BAPCo offers a configuration program in SYSmark 2014 1.5 under the option »Configure«; it launches at the beginning of each benchmark. The default settings should not be changed. The configuration settings are executed directly from the main application BAPCo Sysmark 2014. No further adjustments are necessary.

The screen resolution has little influence on the overall result and can be ignored. The native screen resolution of the display is used (HD, Full HD). We recommend running the benchmark in Full HD for displays with higher resolutions.

Attention: Please visit ([↗ http://www.bapco.com](http://www.bapco.com)) to see if a patch is available.

PCMark 8 configuration

Futuremark does not provide configuration options.

Select the Windows »High Performance« power profile and deactivate »Windows Update«.

MobileMark 2014 1.5 configuration (battery operation test)

BAPCo offers a configuration program in MobileMark 2014 1.5 under the option »Configure«; it launches at the beginning of each benchmark. The default settings should not be changed. The configuration settings are executed directly from the main application BAPCo MobileMark 2014 1.5.

Attention: Please visit ([↗http://www.bapco.com](http://www.bapco.com)) to see if a patch is available.

The following essential settings/infrastructure must be set up for testing to be successful.

Wireless connection

The systems wireless network adapter must be enabled and connected to a wireless network that has no Internet connection for the duration of the test to successfully run the test Office Productivity or Media Creation.

Ambient Light Sensors (ALS)

The use of ALS to adjust the screen brightness is not permitted and must be deactivated before the test is started. Refers to the screen brightness.

Screen brightness

The screen brightness must be set to a fixed value of at least 150 cd/m². Measured at the screen centre with a white background.

The setting must be maintained for the duration of the test, unless dimming, turning off the screen, or standby is used (see below).

In cases where 150 cd/m², measured at the screen centre with a white background during battery operation, cannot be reached, the screen must be set to maximum brightness for the duration of the test (see below).

Attention: It must be noted if a system is unable to reach 150 cd/m² during battery operation.

Dimming the screen

Use of an operating system that supports screen dimming is permitted, provided the user is using:

- Microsoft Windows 7 or Windows 8.0.
- The original screen brightness is set up as described in the section »Screen brightness«.
- Dimming the screen: the timeout value must be at least two minutes in battery operation.
- The dimmed-out value cannot be below 45 cd/m², measured in battery operation.
- Dimming the screen is not permitted under Windows 8.1 and Windows 10.

Switching off the screen

Use of an operating system that supports switching the screen off is permitted, provided the user is using:

- Microsoft Windows 8.1 or Windows 10.
- The screens timeout value must be at least five minutes in battery operation.
- The screen is switched off during the idle period of the benchmark and only after the idle phase was active for five minutes.
- Switching the screen off is not permitted when using Windows 7 or Windows 8.0.

Connected standby mode

The operating system's supported standby mode can be used optionally if the following requirements are met:

- Where Microsoft Windows 8.1 or Windows 10 is used.
- The screens timeout value for switching the screen off must be at least five minutes in battery operation.
- The connected standby mode activates during the idle period of the benchmark and only after the idle phase was active for five minutes.
- The test system complies with the standby requirements specified by Microsoft. The requirements can be found here: ↗ <http://msdn.microsoft.com/enus/library/windows/hardware/jj248729.aspx>
- Standby/Idle state: Use of the operating system's standby/idle state is not permitted, apart from the connected standby mode and following the above rules.

Windows 10 Battery saver mode

The use of Windows 10 »Battery saver mode« is permitted if »Turn battery saver on automatically if my battery falls below« is set to 20% or below and the checkbox for »Lower screen brightness while in battery saver« is deactivated. The use of the operating system's standby/idle state option is not permitted, apart from the connected standby mode (see above).

The performance evaluation of a notebook can be determined with PCMark 8 or SYSmark 2014 1.5 as described above.

2.3 Commercial models of procurement

The procurement of a notebook can be done by renting, purchasing, or leasing the object. Leasing in contrast to renting tends to provide one with the option to purchase the leased object at the end of the contract. Which approach the procurer chooses depends not least on whether a budget is only available once or over several years.

A decision for one of these procurement models shall precede a procurement policy within the framework of a feasibility study. It is also important to consider whether the hardware and software should be obtained from one single source in the framework of uniform contractual agreement (bundling) or different providers. Software manufacturers might offer specific licencing models for software used in public administration.

Following the German statutory provisions on income tax, a notebook use of three years is permitted.⁴ The directive on the operating life, singling out and recycling of IT devices and software⁵ also stipulates a minimum use of three years for notebooks in public administration. The procurement costs can therefore be estimated based on that operating life.⁶

4 Cf. [AFA-Tabelle \[tax depreciation table\] by the German Federal Ministry of Finance for general-purpose assets](#)

5 Cf. [IT-Ratsbeschluss 2013/07 \[IT council order\]](#)

6 In its [position of June 2016](#), the German Federal Environment Agency, however, notes that a short operating life, in the framework of ten years, leads to higher life cycle as well as external costs (e.g., costs based on greenhouse gas emissions).

Of no little consequence in this regard is how the choice of the procurement model affects VAT. Hire is subject to VAT based on and payable with the respective rental rates. The purchase is subject to the entire VAT upon delivery (= transfer of the equipment to the contracting authority). VAT as a whole also arises upon delivery of the device if the contract foresees that the title to the device shall only be transferred after payment of several instalments. If the transfer of title for rent-to-own depends on the exercise of a purchase option, VAT is payable on the total unit price upon exercise of the option as stipulated by the contract. Where rental payments have already been rendered before the option is exercised, the accumulated VAT payments are to be reversed if the rental payments are counted towards the purchase price. Leasing is subject to VAT at the time when the leased device is attributable to the contracting authority according to tax provisions.⁷

	Commercial models		
	Hardware and software from different providers	Bundling	Financing (hire / leasing)
Hardware	Purchase	Purchase	Hire or leasing
Operating system	Purchase and licensing (note the licensing model)	Purchase and licensing (note the licensing model)	Hire or leasing (note the licensing model)
Costs for hardware service (e. g., repair, maintenance)	Borne by the contracting authority	Borne by the contracting authority	Payment covers services
Costs for software services (e. g., deployment and installing of updates)	Borne by the contracting authority	Borne by the contracting authority	Payment covers services
Ownership of hardware	Contracting authority	Contracting authority	Contractor

Table 1: Commercial models and procurement

⁷ Cf. comments on these taxation-related consequences by the tax administration in section 3.5 (5) and (6) of the VAT Application Decree (UStAE).

2.4 Services

The service portfolio of the provider must not be limited to hardware and software but can also include additional services connected to the delivered object. For example, an offer based on a separate service contract or extended warranty for the delivered hardware, or potentially the maintenance of the bundled software. Furthermore, extra services like troubleshooting or hotline services can be ordered on top of the hardware and software procurement.

Appropriate support should be clarified, where necessary, specifying the response or repair time.

Common offers differ depending on:

- Term of the contract.
- Response time (time between failure reporting and first support response).
- Recovery time (time between failure reporting and recovery of the operational system).
- Spare parts logistics.
- Additional technical services offered (invoicing according to expenditure at hourly rates and travel costs).

Requirements, based on demand, can be:

- Three, four, or five-year on-site service.
- On-site service with a response time of x hours. A response time of one hour is typical (can also take place as an auto response) within regular office hours (e. g., between 9:00 and 17:00). Otherwise, the next working day.
- On-site service with a recovery time of x hours (type and scope depending on the intended purpose. Lower surcharge for recovery times of two working days, shorter times are also possible but affect the pricing).



- Availability of a German-speaking hotline x hours and x days per week.
- Spare part supply without exchange by a service technician.
- Customer stores spare parts.

Individual arrangements can be made concerning the procurement of highly available or safety-relevant solutions. For this, a needs assessment must be made to compare requirements against created costs.

The purchase of notebooks, if required, can follow additional requirements such as:

- Maximum delivery time
- Free delivery
- International delivery
- Delivery to different locations
- Delivery to individual rooms
- Pre-installation of bundled operating system
- Pre-installation of additional software
- Backup creation of the bundled operating system

3 User profiles as a basis for usage scenarios

Computing power and mobility are essential factors for notebooks. Accordingly, these guidelines recommend the classification of the essential needs into different performance classes. The recommended performance classes tend to correspond to usage scenarios in companies and public administration. There is a wide variety of offers and a plethora of devices on the market, which fall within the range of the recommended requirements of the performance classes.

3.1 Mobility classes

The appropriateness of a notebook for mobile use depends mainly on its weight and battery life.

Category	Out of office use (e.g., during business trips)	Features
Moderate mobility	Occasionally	Ability to work at least five hours on battery life alone, according to benchmarking, screen size from 14 inches.
Medium mobility	Periodically	Weight up to 2.3 kg (excluding power supply), ability to work at least six hours on battery life alone, according to benchmarking, screen size up to 15.6 inches.
High mobility	Frequently	Weight up to 1.8 kg (excluding power supply), ability to work at least seven hours on battery life alone, according to benchmarking, screen size up to 14 inches, limited connectivity.

Table 2: Mobility classes

A lower weight can be used as evaluation criteria respectively.

3.2 Performance and battery life

The following table compares the performance requirements and battery life in each mobility class according to benchmarking.

	Moderate mobility	Medium mobility	High mobility
SYSmark® 2014 overall score	900 points (for all mobility classes)		
PCMark 8 work, Conventional	2,800 points (for all mobility classes)		
PCMark 8 work, Accelerated	3,200 points (for all mobility classes)		
MobileMark 2014	5 hours	6 hours	7 hours

Table 3: Performance requirements and battery life for each mobility class

4 Technical criteria and requirements

The contracting authority shall describe the procurement object according to general characteristics in a way that permits a comparison between subsequent offers. These guidelines lay out various criteria that constitute suitable parameters for the description of notebooks, presented in a tabular format. These criteria are assigned technical requirements to make these parameters assessable and comparable. The total of all minimum requirements produces a standard, which can be expected according to the current state of the art and is achieved by all newly designed devices currently offered on the market, which it is necessary to avoid undershooting. The last column provides further information, as well as specifications, about the technical requirements.

In addition to the minimum requirements, recommended here, further conditions can be formulated within the framework of weighted evaluation criteria. Moreover, the contracting authority may define further criteria and requirements in the tender documents if particular conditions are placed on the procurement object. Specific requirements are particularly relevant to notebooks. The individual technical aspects will be considered below.

4.1 Display


No.	Criterion	Requirements	Suited as	Comments/Explanation
1	Display resolution	<ul style="list-style-type: none"> 1,366 × 768 pixel (HD) or 1,920 × 1,080 pixel (Full HD) 	Minimum requirement	Higher values are available on the market. Common for screen sizes greater than 12.5 inches. The display UI tends to decrease with higher resolutions. The adjustment of fonts and symbols might be possible in the operating system.
		<ul style="list-style-type: none"> Greater than full HD 	Evaluation criterion	
2	Anti-reflective coating	<ul style="list-style-type: none"> Anti-reflective (non-glare) 	Minimum requirement	Insisting on touch capable anti-reflective screens will lead to market restrictions. 
3	Viewing angle	<ul style="list-style-type: none"> Minimum +/- 40 degrees horizontal, +10/- 30 degree vertical 	Minimum requirement	For example, TN displays For more information, see the panel datasheet.
		<ul style="list-style-type: none"> Minimum +/- 85 degrees horizontal and vertical 	Evaluation criterion	Wide Viewing Angle (WVA) displays (e.g., IPS technology).
4	Luminosity	<ul style="list-style-type: none"> 200 cd/m² 	Minimum requirement	Using higher brightness settings tends to increase power consumption, currently available approx. 200 cd/m ² to 350 cd/m ²
5	Contrast ratio (static)	<ul style="list-style-type: none"> 200 : 1 	Minimum requirement	Currently available approx. 200 : 1 to 900 : 1

Table 4: Criteria and requirements for displays

4.2 Processor and memory


No.	Criterion	Requirements	Suited as	Comments
1	Type of processor (CPU)	▪ x86 architecture	Minimum requirement	
		▪ Multi-Core	Minimum requirement	
2	Memory (RAM)	▪ 8 GB ▪ DDR 4 or LPDDR3	Minimum requirement	
		▪ Expandability	Evaluation criterion	An upgrade of the memory, particularly in small and slim notebooks, is no longer common but can be used as an evaluation criterion.
3	Mass storage	▪ 200 GB Solid State Drive (SSD)	Minimum requirement	
4	Optical drive	▪ Internal	Evaluation criterion	Internal optical drives no longer conform to the state of the art. 

Table 5: Criteria and requirements, processor and memory

4.3 Network connections


No.	Criterion	Requirements	Suited as	Comments
1	Ethernet	▪ RJ45 Ethernet 10/100/1000 Mbit/s, possible via adapter	Minimum requirement	Small and slim notebooks, in particular, tend to omit the RJ45 interface owing to the form factor, an adapter can therefore be regarded as an equivalent.
		▪ Wake-on-LAN (WOL) / PXE 2.x	Minimum requirement	Wake-on-LAN (WOL) should be possible from energy saving modes S4 and S5
2	WLAN	▪ WLAN according to IEEE 802.11n (Dual Band 2.4 GHz and 5 GHz)	Minimum requirement	The WLAN-standard IEEE 802.11 (AC A, B, G, N) must be supported.
3	Bluetooth	▪ Version 4.x	Minimum requirement	WLAN/Bluetooth tend to be combo-modules.
4	WWAN	▪ 4G LTE (integrated), data transfer rates \geq 100 Mbit/s for download and \geq 50 Mbit/s for upload	Minimum requirement or evaluation criterion	Higher data transfer rates are available on the market. 

Table 6: Criteria and requirements for network connections

4.4 Interfaces/Features

No.	Criterion	Requirements	Suited as	Comments
1	USB	<ul style="list-style-type: none"> 2× USB 3.x, at least 1× Type A 	Minimum requirement	Please keep in mind, if one of the USB-C type ports is also used to charge the notebook, this socket cannot be used to connect additional devices in the meantime.
2	Display output	<ul style="list-style-type: none"> 1 Digital connection for screens 	Minimum requirement	The exact type should be specified, e. g., HDMI, mini HDMI, USB-C, DisplayPort, mini DisplayPort. Adapters should be permitted to ensure a broad spectre of competition. The 15-pin VGA connector no longer conforms to the state of the art.
3	Audio	<ul style="list-style-type: none"> Audio-in & Audio-out 	Minimum requirement	Available through a combined interface.
4	Keyboard	<ul style="list-style-type: none"> German (or respective) keyboard layout 	Minimum requirement	15-inch models and larger tend to include a number pad.
		<ul style="list-style-type: none"> Backlit keyboard 	Evaluation criterion	
5	Front camera	<ul style="list-style-type: none"> Resolution 720p HD 	Minimum requirement	
6	Smart card reader	<ul style="list-style-type: none"> Safety class 1, credit card sized: ID1 (85.60 mm × 53.98 mm) 	Evaluation criterion	Not available in every height and no longer common, nevertheless, can be used as an evaluation criterion.
7	SD card reader	<ul style="list-style-type: none"> SD version >= 3.0 	Evaluation criterion	Not available in every height and no longer common, nevertheless, can be used as an evaluation criterion.
8	Biometric sensor	<ul style="list-style-type: none"> Fingerprint sensor 	Evaluation criterion	
		<ul style="list-style-type: none"> Infrared webcam 	Evaluation criterion	
9	Speaker	<ul style="list-style-type: none"> Stereo 	Minimum requirement	
	Microphone	<ul style="list-style-type: none"> Mono 	Minimum requirement	
10	Touchpad	<ul style="list-style-type: none"> Two-button click 	Minimum requirement	

Table 7: Criteria and requirements interfaces/features

4.5 Operating system

Criterion	Requirement	Suited as	Comments
Operating system	<ul style="list-style-type: none"> OEM license 	Minimum requirement	<p>Windows 10 is the current standard operating system.</p> <p>The general support for Window 7 expired already (end of lifecycle), the software can receive extended support. Further information can be found on https://support.microsoft.com/de-de/help/13853/windows-lifecycle-fact-sheet.</p> <p>The notebook procurement could be used as a reason to upgrade to a new operating system, assuming that versions older than Windows 10 are still in use.</p>

Table 8: Criterion and requirements operating system

4.6 Graphics card


Criterion	Requirements	Suited as	Comments
Graphics card	<ul style="list-style-type: none"> Integrated into CPU DirectX 12 capable 	Minimum requirement	The graphics card is integrated in the CPU/APU unit.
	<ul style="list-style-type: none"> Discreet DirectX 12 capable 	Evaluation criterion	<p>The graphics card is an independent unit on the logic board. For example, for workstations, e. g., CAD/CAM workspaces</p> 

Table 9: Criterion and requirements graphics card

4.7 Docking functionality

The manufacturer description for docking stations is not uniform. Different manufacturers may use descriptions like port-replicator, travel dock, or mini dock. The connection to the docking station occurs either through a manufacturer-specific (proprietary) interface or via USB or USB-C (universal). The used docking interface dictates the number as well as the speed of the offered connections but also if the notebook can or cannot be charged via the dock.

No.	Criterion	Requirements	Suited as	Comments
1	Docking port	<ul style="list-style-type: none"> Proprietary or universal (USB/USB-C) 	Minimum requirement	
2	Docking functionality	<ul style="list-style-type: none"> Charging function 	Minimum requirement	
		<ul style="list-style-type: none"> Mechanical theft protection of the docking station 	Minimum requirement	Docking station possesses the option to connect a cable lock
		<ul style="list-style-type: none"> Mechanical theft protection of the docked docking station 	Evaluation criterion	Ability to lock the notebook with the docking station.
		<ul style="list-style-type: none"> Wake-on-LAN (WOL) / PXE 2.x 	Minimum requirement	Wake-on-LAN (WOL) should be possible from energy saving modes S4 and S5.
		<ul style="list-style-type: none"> The utilisation of device-specific MAC addresses (MAC address pass-through) 	Evaluation criterion	
3	Ports	<ul style="list-style-type: none"> 2× digital connections for screens (parallel use) 	Minimum requirement	The exact type should be specified, e.g., HDMI, mini HDMI, USB-C, DisplayPort, mini DisplayPort. Adapters should be permitted to ensure a broad spectre of competition.
		<ul style="list-style-type: none"> RJ45 	Minimum requirement	
		<ul style="list-style-type: none"> 4× USB, at least 2× USB3.x and 2× Type A 	Minimum requirement	
		<ul style="list-style-type: none"> Audio-in & Audio-out 	Minimum requirement	Function available through a combined interface or adapter (splitter).
4	AC adapter	<ul style="list-style-type: none"> A power supply matching the docking station 	Minimum requirement	The docking station must come with a sufficiently dimensioned power supply.

Table 10: Criterion and requirements docking functionality

4.8 Power supply

No.	Criterion	Requirements	Suited as	Comments
1	Weight of power supply and cable	<ul style="list-style-type: none"> High mobility: max. 430 g Medium & low mobility No specific recommendation, can be heavier than 430 g 	Minimum requirement	If the total length (socket to notebook) of cable and power supply is supposed to be greater than 1.80 m, the overall weight of power supply and cable must be increased. The weight depends on the performance of the power supply.
2	The total length of cable and power supply (socket to notebook)	<ul style="list-style-type: none"> 1.80 m 	Minimum requirement	
3	Performance	<ul style="list-style-type: none"> A battery with a charge of 10 percent must be charged at least at 90 percent within three hours while running an office suite. 	Minimum requirement	Battery charging times depend on the power supplies and batteries performance.
4	Replaceable battery	<ul style="list-style-type: none"> Can be exchanged with tools (even specialised tools if necessary) 	Evaluation criterion	The chassis of the notebook must be opened for this purpose.
		<ul style="list-style-type: none"> Can be changed without tools 	Evaluation criterion	The chassis must not be opened for this. Furthermore, only limited market availability.

Table 11: Criterion and requirements power supply

4.9 Drives



No.	Criterion	Requirements	Suited as	Comments
1	Mass storage	<ul style="list-style-type: none"> 200 GB Solid State Drive (SSD) 	Minimum requirement	The choice of drive can lead to market restrictions.
2	Optical drive	<ul style="list-style-type: none"> Internal 	Evaluation criterion	Internal optical drives no longer conform to the state of the art. 

Table 12: Criterion and requirements drives

5 Safety

Notebooks can become the target of cyberattacks, data theft, and data misuse. Such attacks can threaten the confidentiality, availability, and integrity of the data that is processed and stored with the devices as well as the functionality of the devices themselves. The manufacturer can equip modern notebooks with security functions that support the user in meeting the security requirements. Data protection and security for notebooks can only be established by implementing a combination of organisational measures, due diligence of the user, as well as internal security functions of the device.

No.	Criterion	Requirements	Suited as	Comments
1	Mechanical theft protection	<ul style="list-style-type: none"> ▪ Fixture to mount a mechanical protection against theft ▪ Mounted in the notebook frame 	Minimum requirement	<p>Matching locks, and so forth, must be bought separately.</p> <p>Can affect the design/thickness/measurements of the device. For additional locking options, see docking functionality.</p>
2	TPM	<ul style="list-style-type: none"> ▪ TPM 1.2/2.0 ▪ If TPM available: ability to switch off via firmware (see TCG PC Client Platform Firmware Profile 6.1). The operating system must not be permitted to revert this kind of switch-off. <p>Or</p> <ul style="list-style-type: none"> ▪ No TPM or deactivated irrevocably 	Minimum requirement	<p>The Trusted Platform Module (TPM) is a function that saves keys, passwords, and digital certificates.</p> <p>TPM 2.0 is recommended for the use of Windows 10. TPM 1.2 is recommended for the use of Windows 7. No or deactivated TPM is recommended for other usages (virtualisation, Linux).</p> <p>Refer to the Microsoft website since each operating system and version might be limited in functions.</p> <p>An upgrade or downgrade (TPM 1.2 to TPM 2.0 and vice versa) might be required depending on the intended purpose.</p>
		<ul style="list-style-type: none"> ▪ Pre-boot password option for disks within the firmware 	Evaluation criterion	If correctly configured, drive access is only permitted after entering a password.
		<ul style="list-style-type: none"> ▪ Password option for firmware access, e.g. BIOS/UEFI 	Minimum requirement	<p>Firmware access with restricted-rights via firmware passwords.</p> <p>Depending on the consumer's internal security policy, a password should be set during the first use.</p>
		<ul style="list-style-type: none"> ▪ Individual firmware settings 	Evaluation criterion	The factory settings can contain default preset BIOS/UEFI/coreboot, which were provided by the contracting authority.
		<ul style="list-style-type: none"> ▪ Secure boot for checking the integrity of hardware components ▪ Can be disabled in the firmware 	Minimum requirement	Secure Boot must be disabled when using Windows 7. Please refer to the chapter »Operating systems« of these guidelines for the use of Windows 7.
3	Out-of-band management	<ul style="list-style-type: none"> ▪ If available, shipped deactivated in the factory settings; can only be disabled with the firmware password 	Minimum requirement	Where present, remote servicing functions that can change the firmware/data irrespective of the operating system must be shipped deactivated. The firmware password must protect the activation of this function. When deactivated, functions are not permitted to send or receive network connections.
4	BIOS/UEFI/coreboot tamper protection	<ul style="list-style-type: none"> ▪ Tamper recognition and protection, reliable notification of the owner or user 	Minimum requirement	<p>The system must be able to prevent the manipulation of the firmware, (e.g., by write-protection), or recognise the manipulation (e.g., by verifying the signature) and contact the owner or user.</p> <p></p>



No.	Criterion	Requirements	Suited as	Comments
5	Firmware, Hardware	<ul style="list-style-type: none"> Existing patch management and information on patch management for weak spots in firmware and hardware 	Minimum requirement	<p>Firmware describes the code that runs via the central processor (e.g., BIOS/UEFI/coreboot) or can influence it (for example Intel, ME, AMD, PSP).</p> <p>The tenderer provides detailed documentation on how to handle weaknesses in hardware and firmware, including third-party dependency (e.g., suppliers). The expected turnaround time to fix these issues is part of this documentation.</p>
		<ul style="list-style-type: none"> The firmware must rectify any vulnerabilities immediately after they have become publicly known (CVSS 2.0 Base Score 7.0-10.0) 	Minimum requirement	
6	Encryption	<ul style="list-style-type: none"> Hardware based disk encryption 	Minimum requirement	<p>Integrated hardware and software provide automatic data encryption (e.g., OPAL). The support from the operating system or separate software installation is not required.</p>
7	Interface protection	<ul style="list-style-type: none"> Interfaces can be deactivated via BIOS/UEFI/coreboot 	Minimum requirement	<p>For example, Ethernet, USB, WLAN, WWAN, Bluetooth, camera, microphone, fingerprint sensor, and so forth.</p>
8	User authentication	<ul style="list-style-type: none"> Availability of multi-factor authentication 	Minimum requirement	<p>For example, smart card, fingerprint, and other biometric features.</p>
9	Webcam cover	<ul style="list-style-type: none"> Integrated physical webcam cover 	Evaluation criterion	
10	Screen protection	<ul style="list-style-type: none"> Screen privacy protector 	Minimum requirement	<p>Solution depends on system manufacturer.</p> 

Table 13: Criterion and requirements safety

6 Award criteria

The award must be granted to the most economically advantageous tender as per Section 127 of the Legislation prohibiting restriction of competition. The determination of the most economically advantageous tender takes place following the best price-performance ratio. Apart from price or cost, this consideration can also take into account qualitative, environmental or social award criteria. Energy-relevant tender performances must also adequately account for the energy consumption of the devices as award criterion, as per Section 67(5) VgV.

The performance requirements may be expressed within the framework of award criteria with minimum technical specifications or within the framework of evaluation criteria. The procurer decides what individual performance characteristics belong to which category. Criteria tend to show minimum requirements that are essential for the operation of the device. Whenever tables of these guidelines list the minimum requirements for the devices, they label them as »minimum requirement«. The guideline recommends to only use the requirements within the framework of the evaluation criteria if the criteria/requirements are labelled with »evaluation criterion«.

The wording of the performance requirements with the help of the evaluation criteria can provide competitors with specific leeway. This wiggle room permits a differentiated consideration of the tendered services in the evaluation. In doing so, the individual forms of services can be taken into account; this is favourable for the latitude of the competition. The wording of the performance requirements should be concise, comprehensible, and objectively appraisable.

The increased or exclusive use of minimum technical requirements in the terms of reference can result in undesired restriction of competition. The guidelines recommend the use of evaluation criteria to promote a diverse competition.

7 Contractual provisions⁸

7.1 Supplementary terms of contract for the procurement of it supplies/services

Relevant contracts govern the provision of the advertised services or delivery of the advertised products after the successful completion of the procurement procedures. The Federal Ministry of the Interior and Bitkom have developed several contracts that can be used to support the awarding bodies. The contracts can be found on the website of the Federal Commissioner for Information Technology ([↗ https://www.cio.bund.de/Web/DE/IT-Beschaffung/EVB-IT-und-BVB/Aktuelle_EVB-IT](https://www.cio.bund.de/Web/DE/IT-Beschaffung/EVB-IT-und-BVB/Aktuelle_EVB-IT)).

7.2 Social sustainability

The procurement procedures must consider the economic and ecological criteria as well as social aspects (Section 97 (3) German Act Against Restraints of Competition, Section 31 (3) German Public Tender Regulation on the award of contracts within the upper-value limit, Sections 2 (3), 22 (2) Sub-Threshold Procurement Regulation on the award of contracts within the lower-value limit. Such social aspects include, in particular, labour rights, the ban on child labour, discrimination against employees, but also the observance of bandwidth working hours by the tenderer as well as its suppliers. The awarding office can ask each bidder to provide a statement concerning the social IT sustainability to ensure that the aspects of the procurement procedures for IT products and services are guaranteed. The declaration, a corresponding text block for the contract design, and scope of application explanation can be found on the website of the Federal Commissioner for Information Technology

⁸ Only applies to procurement procedures under German legislation.

Bitkom represents more than 2,500 companies of the digital economy, including 1,700 direct members. Through IT- and communication services alone, our members generate a domestic annual turnover of 190 billion Euros, including 50 billion Euros in exports. The members of Bitkom employ more than 2 million people in Germany. Among these members are 1,000 small and medium-sized businesses, over 400 start-ups and almost all global players. They offer a wide range of software technologies, IT-services, and telecommunications or internet services, produce hardware and consumer electronics, operate in the digital media sector or are in other ways affiliated with the digital economy. 80 percent of the members' headquarters are located in Germany with an additional 8 percent both in the EU and the USA, as well as 4 percent in other regions of the world. Bitkom promotes the digital transformation of the German economy, as well as of German society at large, enabling citizens to benefit from digitalisation. A strong European digital policy and a fully integrated digital single market are at the heart of Bitkom's concerns, as well as establishing Germany as a key driver of digital change in Europe and globally.

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