Part 2: Methodology

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Preamble

This report was prepared by TÜV Rheinland for the Federal Ministry of Transport and Digital Infrastructure.
It was informed by existing methodological know-how and significant project experience. The use of this approach and methodology, in particular for commercial purposes, is not permitted. When using figures and illustrations, the copyright notice - © TÜV Rheinland / BMVI 2016 - must be provided near the figures / illustrations used or the author's own illustrations derived from them, not merely in the list of references / Annex.

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1 Methodology

1.1 Main aspects of the methodology

The collection of data on the coverage situation was carried out using a methodology developed by TÜV Rheinland on the basis of a coverage raster. For this purpose, a nation-wide, uniform coverage raster with an edge length of 250 metres was created using the ESRI Shapefile format (ETRS89 / UTM Zone 32N). Ideally, broadband providers supply their broadband availability information for each raster cell.

The Broadband Atlas displays raster cells that contain populated areas. The definition of a raster cell as being populated is based on all geo-coded individual addresses of the Federal Agency for Cartography and Geodesy as well as on information on the number of private households in the raster cell provided by the Nexiga company. In particular in the case of wireless solutions, broadband may also be available in non-populated areas in addition to what is shown in the coverage raster. Such availability is not displayed in the Broadband Atlas, except in LTE view.

The main focus of the Broadband Atlas is the availability for private households. Since 2015, information on commercial broadband availability has also been collected. The specific features of commercial broadband availability are outlined in chapter 1.8.

1.2 The procedure

The telecommunications companies were provided with a web GIS application[1] or special tools for easy and user-friendly entry of broadband availability information and its assignment to the raster cells. Once supplied, data are constantly available and can be edited and updated at any time. The survey was carried out for the following bandwidth categories (bandwidth information always refers to the minimum downstream bandwidth):

[1] Using a web GIS application, spatial data can be displayed and entered via a web browser. The collection of data can, for example, take place on the basis of a map or aerial photographs.

Bandwidth
≥ 1 Mbit/s
≥ 2 Mbit/s
≥ 6 Mbit/s
≥ 16 Mbit/s
≥ 30 Mbit/s
≥ 50 Mbit/s

Table 1: Bandwidth categories

When collecting data, the following technologies are distinguished (more detailed information on definitions and attenuation values of the technologies are provided in the Annex):

Fixed-line	Wireless
Digital Subscriber Line (DSL, VDSL)	Broadband UMTS (HSDPA)
Fibre technology (FTTH/B)	Long Term Evolution (LTE)
Cable network (CATV)	Satellite
Powerline (PLC)	WiMAX
	Wireless Local Area Network (WLAN) Wireless Fidelity (WiFi)
	Microwave link

Table 2: Broadband technologies

The individual rasters supplied by the broadband providers are merged into an overall raster, which serves as a basis for the analyses and visualizations. Only this raster is displayed in the online version. In each case, the highest availability value in the relevant raster cell is determined and displayed, based on the selected technology and bandwidth.

The information on the broadband providers operating in the region is displayed at municipal level and not individually for each raster cell or at community level in order to protect the trade secrets of the telecommunications companies. The user can retrieve information on the broadband providers operating in a municipality from the Broadband Atlas in a user-friendly manner. Following a link, the user can, moreover, directly visit the websites of the broadband providers.

1.3 Basic data used

The Broadband Atlas aims to have as broad a foundation of detailed official statistics and sources as possible to support the basic data it uses. To this end and in close cooperation with the Federal Ministry of Transport and Digital Infrastructure, a wide range of geobase data were obtained and various government agencies involved.

The most important basic data are shown in the figure below. To be able to perform evaluations for widely varying spatial units, the individual coverage raster cells were enriched with a wide range of administrative information. In this context, the most important connection is the assignment of each raster cell to the municipality in which the cell is located. For raster cells in boundary areas between two or more municipalities, a weighted assignment was performed based on the number of addresses of the municipality concerned in the relevant cell. The connection to the corresponding district or federal state is also established through the association with a municipality.

The number of households per raster cell was determined using the data base provided by Nexiga. This approach was opted for because, at the official level, household figures for the whole of Germany are only available down to the municipal category level while the Broadband Atlas required a more fine-grained data base with as much detail as possible. A second reason in favour of using these data was that many telecommunications companies also prepared their coverage data on the basis of household figures from Nexiga. Moreover, random checks against available information were performed on the data. All data are regularly updated and adapted if possible.

Figure 1: Enriching the coverage raster with data

The background cartography in the Broadband Atlas is based on data from the OpenStreetMap project. With a view to the expected number of page views, the OpenStreetMap map was im-

plemented as a Tiled Map Service and made available, in line with the specifications, in a highly performant format enhanced with colour-coding and in terms of content. The maximum scale of 1:20,000 was defined to comply with the needs of the telecommunications companies.

Data source	Data used
Federal Agency for Cartography and Geodesy	All addresses geocoded in Germany
	Administrative units (federal state, district, municipality, locality)
Federal Statistical Office	Inhabitants per municipality
	Average number of household members per municipal size category and federal state
Federal Network Agency	Dialling codes
Deutsche Telekom AG	Access areas
	Main distribution frames
Deutsche Post AG	Postcode areas
Nexiga	Number of households per raster cell
	Further statistical data per raster cell
Broadband providers	Broadband coverage data
OpenStreetMap	WMS background cartography / road network

Table 3: Basic data used

1.4 Data collection approach

There are various options for the companies to enter their broadband coverage data. The four standard approaches are outlined in the figure below.

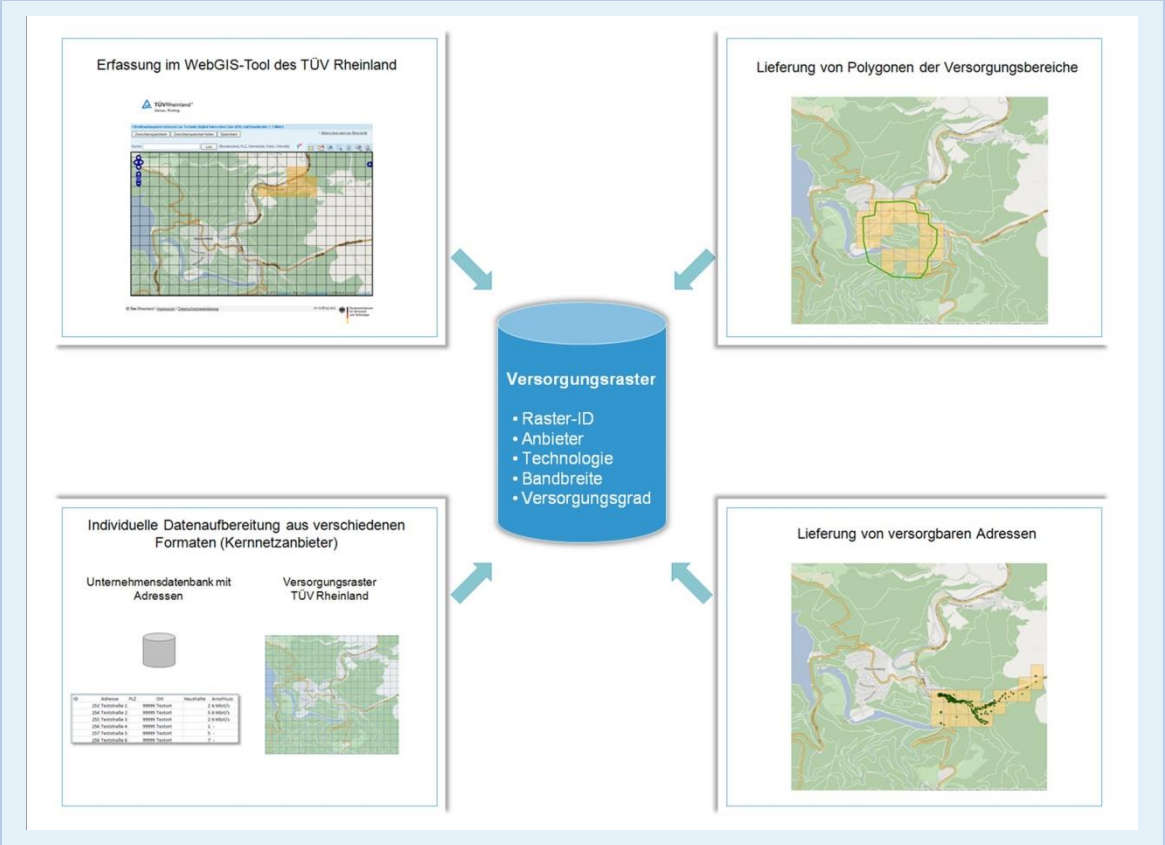


Figure 2: Data entry / data delivery options

In addition to the individual data processing carried out by the core network providers, the broadband providers have three further options for transmitting their broadband coverage data. The majority of companies chose to enter their data using the web GIS. In this application, providers can use a search function to navigate to the regions in which they offer broadband products. Subsequently, they can mark the cells in which they can offer broadband access in a very simple manner. Data is entered based on the technology and bandwidth offered for each provider.

In addition to the direct collection of data via the web GIS, the providers can use an upload function to transmit their existing coverage polygons or other maps they have at their disposal to TÜV Rheinland, which will then perform the conversion to raster level. The same applies to the transmission of addresses that can be served with coverage both in geocoded and non-geocoded form. In the latter case, TÜV Rheinland performs the geocoding[2] and the subsequent

[2] During geocoding, the individual addresses are assigned XY coordinates so that they can subsequently be spatially placed.

conversion of broadband coverage to raster level. The telecommunications companies deliver their data in a wide range of different standard GIS and CAD formats.

With regard to the collection of data, satellite providers are a special case. Broadband via satellite is available in the whole of Germany. Therefore, broadband coverage via satellite plays an important role in eliminating the remaining “white areas”. The only limit to availability is the capacity the satellites can provide. Since broadband coverage via satellite is particularly important for the insufficiently covered regions in Germany, the available coverage capacity was distributed among the raster cells with a coverage ratio of below 50% in the ≥ 6 Mbit/s bandwidth category. Every raster cell affected was assigned an additional number of servable households depending on the total number of unserved households in the raster cell, i.e. raster cells with a high number of households were assigned more additional servable households. The additional availability via satellite was not included in the Broadband Atlas illustrations and analyses at municipal level - such as, for instance, in the PDF maps in the download section of the Broadband Atlas - in order to avoid showing a distorted picture of the local situation. Satellite availability was included in the calculation of the total availability in the ≥ 6 Mbit/s category in Germany.

1.5 Calculation of broadband availability

All raster cells entered or delivered by the companies were combined with the information of the technology offered, the bandwidth as well as the availability to form one central table. The broadband coverage raster was created on the basis of this table by listing for each raster cell the maximum broadband availability irrespective of provider for each of the three technology categories (all, fixed-line, wireless) and for all six bandwidth categories.

All illustrations, analyses and availability calculations are performed based on this raster so that no direct conclusions can be drawn regarding the data of the corresponding companies. The availability raster shown in the Broadband Atlas thus always indicates, through the colour graduation, the highest broadband availability value of a raster cell based on the selected technology and bandwidth. Broadband availability for a spatial unit, such as a municipality, a federal state or the whole of Germany, is calculated based on how many served households are there in proportion to the total number of households in all raster cells of the respective spatial unit.

1.6 Error analysis and quality assurance

The Broadband Atlas data are based on voluntary data deliveries by the broadband providers. The companies are under no statutory obligation to provide data.

By mid-2016, approximately 350 telecommunications companies had supplied detailed broadband coverage data, which were subsequently incorporated. Thanks to the detailed data collection methodology, the obtained results are highly valid. TÜV Rheinland applies a complex data verification process after every data transmission to identify, clarify and correct possible inconsistencies in the broadband coverage data. This includes, apart from a formal check of the data, plausibility checks regarding logic and consistency with existing infrastructure and topographical

features. Moreover, additional information, such as on the main distribution frames and other available information and reports, are taken into account.

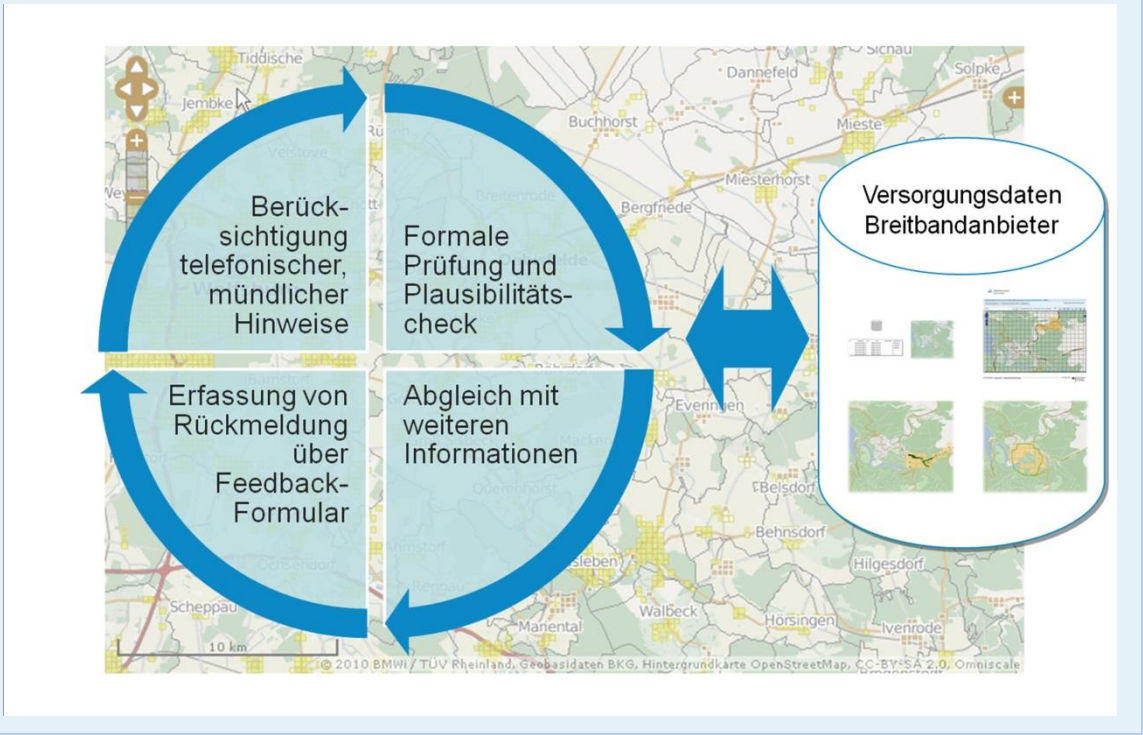


Figure 3: Data verification and quality assurance

A known source of error in the Broadband Atlas is the broadband capacities of broadband providers that have not yet actively contributed to the Broadband Atlas. These are in particular smaller companies that, for the most part, serve small spatially limited regions. Companies offering broadband access for purely commercial use have been taken into account since 2015, which is when the functionality of the Broadband Atlas was expanded to also include commercial enterprises and provide the corresponding illustrations. The actual broadband availability will be slightly higher than the consumer and commercial broadband availability calculated and indicated in the survey.

At this time, the error value for the outstanding data deliveries can only be estimated. Based on the previous data deliveries and the analyses derived from them, an error rate of < 0.5 percentage points is expected for the broadband availability in the ≥ 1 Mbit/s bandwidth category. In order to minimize and limit this source of error, TÜV Rheinland and the Federal Ministry of Transport and Digital Infrastructure are continuing their efforts to encourage the remaining companies to supply their coverage data.

In addition to the described source of error resulting from the outstanding data deliveries of the few remaining telecommunications companies, the following error groups / sources, which can affect the outcome of the broadband availability illustration and calculation, have been identified:

- Discrepancies in the data delivered by the companies.
- Delayed transmission of up-to-date coverage data (processing of data can take up to 3 months, in some cases); in some cases, this causes minor time lags.

- Delayed provision and transmission of information on new development areas by official surveyors; in some cases, this causes time lags.

- Household figures / basic statistical data differ from the actual local situation.

- If a raster cell of 250 * 250 metres is served by several companies, only the data of the company providing the greater proportion of broadband coverage in the raster cell are used. Thus, the real availability in the raster cell can be slightly higher in individual cases. The following error analysis and estimation was carried out: calculation of the unlikely assumption that all provided coverage data within a raster cell add up and do not overlap. Under this assumption, there would be a theoretical increase in broadband availability by 0.4 percentage points.

- Wireless broadband coverage is made available by the telecommunications companies, in part by providing a percentage of the raster areas covered by wireless broadband solutions. Here, the provided percentage of coverage is combined with the populated area within the raster cell with the households. The following assumptions are possible: A. The households in the raster cell are fully located within the aforementioned area, i.e. a proportion of area of approx. 30% could also serve 100% of the households. B. The households in the raster cell are partially located within the aforementioned area, i.e. the proportion of area could match the proportion of households that can be served with broadband (selected approach). C. The households in the raster cell are fully located outside the aforementioned area, i.e. the proportion of area does not match the proportion of households that can be served with broadband. The conservative and realistic approach B. was chosen for the analysis. The calculated difference between B. and A. is 1.2 percentage points and 1.1 percentage points between B. and C.

The sources of error described cannot be calculated and evaluated by way of a mathematical error analysis. An overlapping of error sources is possible. Moreover, an empirical verification of the data based on random checks is not appropriate because of the large data quantities and areas. However, based on the low volume of justified and qualified error feedback from the federal states and individuals (the feedback concerns approx. 0.05% of the raster cells) in combination with the comprehensive verification routines described and the comparison against further available datasets as well as the chosen approach, the error tolerance for the aforementioned sources can be assumed to be very small.

1.7 Data visualization and analysis

The combined data of the broadband coverage raster are visualized in a freely accessible state-of-the-art application on the Internet - the Broadband Atlas (www.breitbandatlas.de). The integrated search function permits simple and user-friendly searches for various spatial units which can then be navigated to on the map. The following spatial searches are possible:

Search function	Example
Federal state	Nordrhein-Westfalen
District	Aachen
Municipality	Monschau
Community	Monschau-Mützenich
Landscape names	Eifel
Postcode area	52156
Dialling code	02472

Table 4: Spatial search functions

Moreover, it is possible to freely navigate the map by adjusting the map section using the options *zoom in, zoom out* and *move*.

The displayed map is enriched with supplementary information, such as the option of searching for the parties involved in the roll-out or the availability figures of each municipality. Thus, users can find out with just one click which bandwidths and technologies are available in their area - be it DSL or UMTS or even fibre or WLAN.

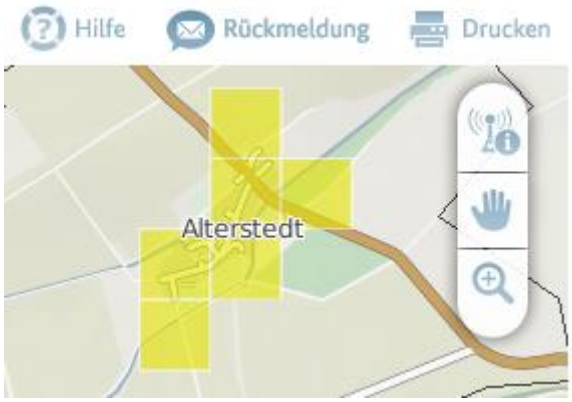


Figure 4: Broadband Atlas tools

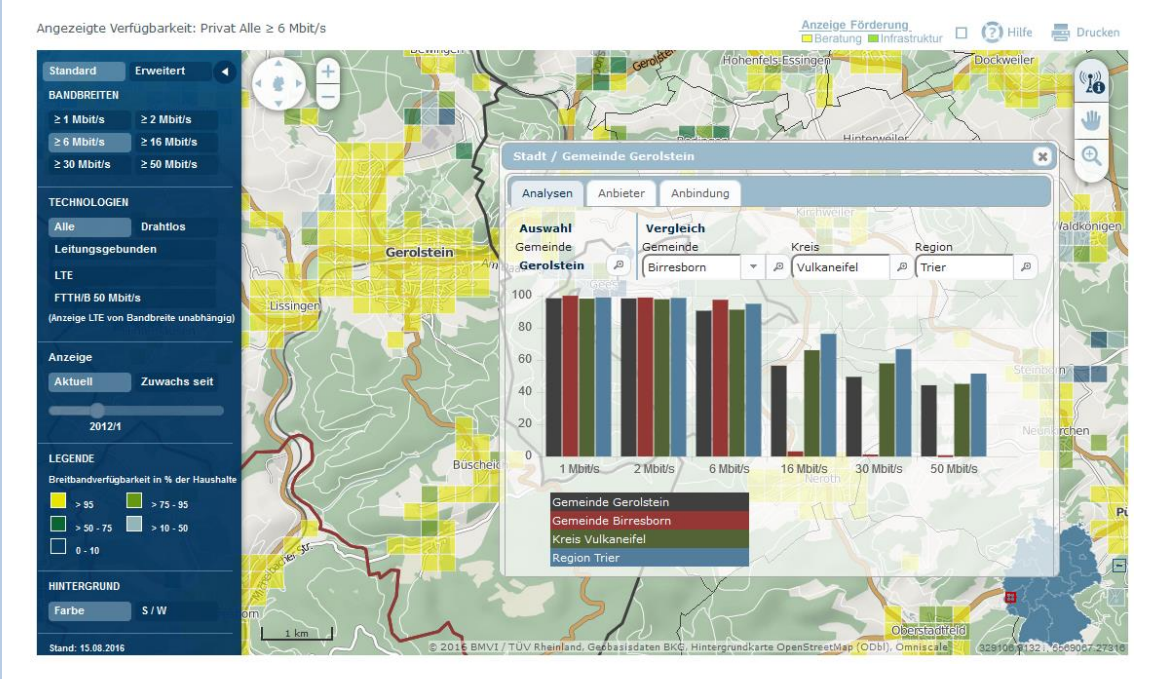


Figure 5: Detailed search for broadband availability

All tools available in the Broadband Atlas are illustrated in the figure above. There are the following tools:

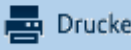
Tool	Description
	Perform dynamic analyses and search for broadband providers and availability in the municipality
	Move map section
	Zoom in on map section
	Switch to nation-wide view
	Help
	Print screen section

Table 5: Individual Broadband Atlas tools

In addition to being shown in the Broadband Atlas, the broadband coverage raster can also be made available as a Web Map Service (WMS). Addressees of the WMS services provided are all public bodies (Federal Government, federal states, local authorities, municipal associations) in Germany that deal with broadband coverage topics and / or are entrusted with the roll-out or the promotion of the roll-out as their statutory task. For this circle of users, use and provision of the services are free of charge.

In addition to the visualization of the broadband coverage raster in the Broadband Atlas, high-definition PDF maps on broadband availability at municipal level are available as a free download from the webpages for Germany and for each federal state. The maps are available for all bandwidth categories and types of technology (fixed-line, wireless, all). Moreover, the Broadband Atlas provides users with the option of printing individual areas and content as a PDF file.

The various usage options for the availability data in the Broadband Atlas are outlined in the following figure.

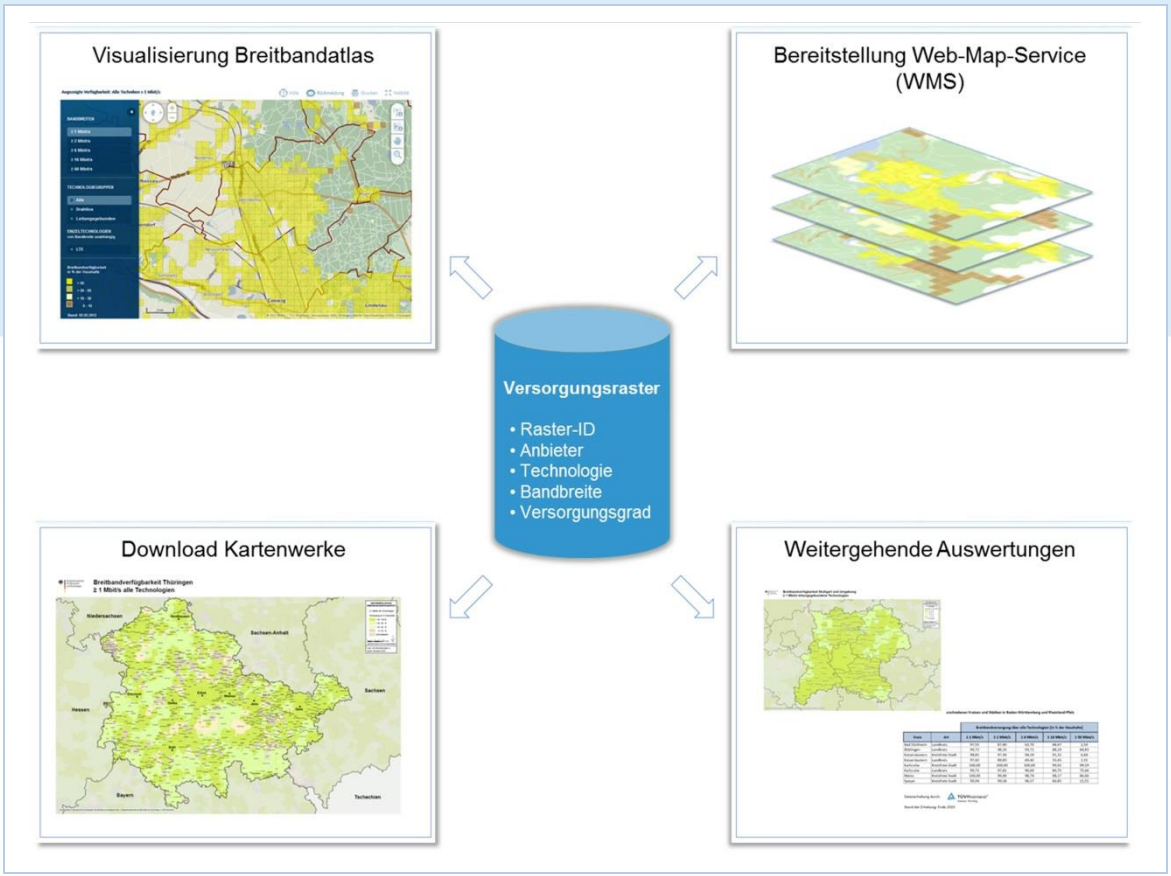


Figure 6: Usage options for the Broadband Atlas data base

1.8 Commercial broadband availability

Commercial broadband availability refers to the symmetrical bandwidth or the maximum upload bandwidth of broadband connections. Availability data is collected both in business and industrial as well as in mixed-use areas, where private households and companies are present. Since there is no official dataset in Germany that covers these requirements, the data base was generated by combining data from various sources and subsequently refined and partially cleansed. The data base does not claim to be complete.

The commercial broadband coverage displayed is based on data obtained from the broadband providers and subsequently processed by TÜV Rheinland. As commercial broadband solutions are often highly customized, the actual local coverage situation may be different. For this reason, the Broadband Atlas indicates whether commercial broadband connections are available in a cell or not. There is no further differentiation by percentage. Information on the real local coverage situation in each specific case should therefore be requested from the broadband providers.

Broadband availability information is collected for the following bandwidth categories:

Bandwidth
≥ 2 Mbit/s
≥ 10 Mbit/s
≥ 30 Mbit/s
≥ 50 Mbit/s
≥ 100 Mbit/s

Table 6: Commercial bandwidth categories

Information on commercial broadband availability is collected for the following technologies:

Fixed-line	Wireless
Digital Subscriber Line (DSL, VDSL)	WiMAX
Fibre technology (FTTH/B)	Wireless Local Area Network (WLAN) Wireless Fidelity (WiFi)
Cable network (CATV)	Microwave link

Table 7: Commercial broadband technologies

So far, the broadband providers have not made available data on the Long Term Evolution (LTE) and satellite solution technologies; moreover, these technologies are currently inadequate for use in commercial applications.

In addition to indicating commercial broadband availability, the Broadband Atlas provides information on the availability of consumer solutions at business locations.

2 Annex

Providers of data for the Broadband Atlas

The following companies have actively contributed and provided data:

1&1 Internet AG	GA-Struth-Helmershof/ Schnellbach e.V.	Photonium NetSolutions GmbH
4steps systems (Hannes Bienewitz)	GELSEN-NET Kommunikationsgesellschaft mbH	pop-interactive GmbH
ACO Computerservice GmbH	Gemeindewerke Hohenwestedt	PrimaCom Berlin GmbH
ACS Antennen- und Computerservice Hartmann	Gemeinschaftsantenne e.V. Schmalkalden	Project66 IT-Service - Brehna.net Internetservices
ADDIX Internet Services GmbH	Gemeinschaftsantennenanlage Hohndorf/Großolbersdorf	QSC AG
ADDIX Internet Services GmbH Reseller	Genias Internet	Radio Bachmann GmbH
AEP Plückhahn Service GmbH	GGEW net GmbH	Regionalantenne Cunnersdorf e.V.
AGILIScom AG	Giga DSL GmbH	RegioNet Schweinfurt GmbH
AIRDATA AG	GmündCom	regionetz.net Norbert Herter
AirNet Internet Service	GP-Elektronik	RelAix Networks GmbH
AirSpace Communications GmbH	Großgemeinschaftsantennenanlage "Oberes Sprottental e.V."	RFT kabel Brandenburg
AJE Consulting GmbH & Co. KG	GWS Stadtwerke Hameln GmbH	RhönEnergie Fulda GmbH
Allgäu DSL	HeLi NET Telekommunikation GmbH & Co. KG	RIKOM GmbH
Alto Netz GmbH	Herzo Media GmbH & Co. KG	R-KOM
Amplus AG	Herzo Werke GmbH	RMS-systems Datenverarbeitungs GmbH
Amplus Reseller AG	HFO Telecom AG	Rohrmüller Computer
André Helbig Solartechnik & Energiemanagement	HL komm Telekommunikations GmbH	RSM Freilassing
Andreas Muth Antennenbaubetrieb	HochrheinNET GmbH	RST-Datentechnik GmbH
annexe business services limited	HSE MediaNet GmbH	RWE FiberNet GmbH
ANTEC - Antennentechnik & Kabelnetze	htp GmbH	S+K ServiceKabel GmbH
Antennen Schulze OHG	HUD IT / Kommunication	Sat Internet Services GmbH
Antennengemeinschaft "Schreiersgrün" e.V.	IBH IT-Service GmbH	SAT-Kabel GmbH
Antennengemeinschaft Chemnitz/Ebersdorf w.V.	Ilm-Provider UG	Schleusinger Media Servive GmbH
Antennengemeinschaft Flöha e.V.	imos	Schnell-im-netz.de GmbH & Co.KG
Antennengemeinschaft Langewiesen (ATGL)	inexio	Schönenberg-Computer GmbH

Antennengemeinschaften ERZNET AG	INFO-Kanal Königsee	sdt.net AG
Antennen-Interessengemeinschaft Geroldsgrün (AIG)	InfraLeuna GmbH	secano.net e.K.
Antennenservice B. Thomas	InfraServ GmbH & Co. Gendorf KG	Sewikom
Antenntengemeinschaft Ursprung	InSysCo Datensysteme GmbH	skyDSL Deutschland GmbH
AP-WDSL GbR	Internet & Go	SKYTRON Communications GmbH & Co. KG
Arche NetVision GmbH	INTERNETWELLE HARZ	smart-DSL GmbH
ASAMnet e.V.	intersaar GmbH	Snellstar GmbH
Asser-Antennentechnik	iP SOFTCOM LTD	Snellstar GmbH Reseller
AT Aggertechnik GmbH	ip-fabric GmbH	SOCO Network Solutions GmbH
ATL Antennentechnik Lubmin	IT World Oehme	SP:Homann
atn Partie GmbH	IT-Department	Sparkassen Informationstechnologie
AVACOMM Systems GmbH	ITfM GmbH	Speedloc Datacenter
BiBinetz GmbH	IT-Systeme Schuller	Stadtnetz Bamberg
Bisping & Bisping GmbH & Co. KG	Jens Schneeweiss	Stadtnetze Barmstedt GmbH
BITel Gesellschaft für Telekommunikation mbH	Jobst-DSL	Stadtwerke Annaberg-Buchholz GmbH
bn:t Blatzheim Networks Telecom GmbH	KAB-COM	Stadtwerke Dorfen GmbH
BORnet GmbH	Kabel + Satellit Bergen Kommunikationstechnik GmbH	Stadtwerke Einbeck GmbH
Brandl Services GmbH	Kabel Baden-Württemberg GmbH & Co. KG	Stadtwerke Engen GmbH
Breitbandservice Gantert GmbH & Co. KG	Kabel Deutschland Vertrieb und Service GmbH & Co. KG	Stadtwerke Geesthacht GmbH
Breitbandversorgung Pfalz GmbH	Kabel DSL-Ludwigsstadt	Stadtwerke Hammelburg GmbH
Bremen Briteline GmbH	Kabelcom Andreas Stolle	Stadtwerke Konstanz GmbH
BündelNet Mobilfunk GmbH	Kabelmax	Stadtwerke Marburg GmbH
Bunsieck & Partner GmbH	Kabel-TV Aue e.V.	Stadtwerke Nürtingen GmbH
BürgerBreitbandNetz	Kabel-TV-Binz GmbH & Co.KG	Stadtwerke Radolfzell GmbH
Bürgernetz Dillingen e.V.	Kabelweida ? electronic-anders	Stadtwerke Schwedt GmbH -SDT Telecom
BWnet GmbH	Karsten Siebrecht, Bodenfelde-DSL	Stadtwerke Schwerte GmbH
Casa GmbH	KEVAG Telekom GmbH	Stadtwerke Sindelfingen GmbH
CEMI Service GmbH	KKS-Kabel-Kommunikations Service GmbH	Stadtwerke Steinfurt GmbH
City TV-Kabelservice GmbH	km3 teledienst GmbH	Stadtwerke Trostberg GmbH & Co. KG
CM System GmbH	KMM-Kabel-Multi-Media e.K.	StarDSL

CNS	KNH-TV Ltd.	Steffen Kellner Informationssysteme GbR
complete internet & security GmbH	KNÖV-NetT (Breitband) GmbH & Co. KG	Sternkom GmbH
Comtec OHG Bautzen	komDSL - Gemeindewerke Wendelstein	süc // dacor GmbH
COS-on-Air OHG	komDSL - LUK-Helmbrechts	SWaP GmbH Surf, Watch & Phone
CramNET.de - DSL aufs LAND	komDSL - Stadtwerke Bad Nauheim GmbH	SWN Stadtwerke Neumünster GmbH
CSL Computer Service Langenbach GmbH	KOMNEXX GmbH	SWP Stadtwerke Pforzheim GmbH & Co. KG
CS-Telecom Deutschland GmbH	komro GmbH	SWU TELENET GmbH
d+p breitbandconcept UG	KSP Kabel Service Prenzlau	TeamCom Goch UG & Co. KG
Dachau CityCom GmbH	Landnetz e.V.	Tegro Kabelbau GmbH
dasNetz AG	Landnetz Hoher Berg e.V.	Tele Columbus GmbH
DAVOnet GmbH	LANstream GmbH	Telecab Henken & Hormann GmbH
DDLAN	Lausitzer Kabel Service GmbH	Teleco GmbH Cottbus Telekommunikation
DEGNET GmbH	level421 GmbH	TeleData GmbH
Deltaweb	LF.net Netzwerksysteme GmbH	Telefónica Germany: Alice und O2-DSL
Deutsche Glasfaser	LKG Lausitzer Kabelbetriebsgesellschaft mbH	Telefónica Germany: O2
Deutsche Telekom AG	LüneCom Kommunikationslösungen GmbH	Telekommunikationsgesellschaft Südwestfalen mbH
disquom funktechnik GmbH	Marienberg GmbH	TeleMark Telekomunikationsgesellschaft Mark mbH
DJ-Computer Service Dhom und Johannsen Gbr	MDDSL - Mitteldeutsche Gesellschaft für Kommunikation mbH	Telenec Telekommunikation Neustadt GmbH
DNS:NET Internet Service GmbH	MDTK Martens Deutsche Telekabel GmbH	Teleos GmbH & Co. KG
Doergi.Net - Steffen Allstädt	Medicom Dreieich GmbH	Telepark-Passau GmbH
DOKOM Gesellschaft für Telekommunikation mbH	mieX Deutschland GmbH	teliko GmbH
Drahtlos-DSL GmbH Mittelsachsen	Milde Software Solutions	telsakom GmbH
DSL mobil	MITGAS GmbH	TELTA Citynetz GmbH
DTK Deutsche Telekabel GmbH	Mitteldeutsche Breitbandsysteme	Thüga MeteringService GmbH
DTK Deutsche Telekabel Riesa GmbH	MK Netzdienste GmbH & Co. KG	Thüringer Netkom GmbH
e.discom	mm-dsl UG (haftungsbeschränkt) & Co. KG	tiski-IT-CONSULT
easybell GmbH	M-net Telekommunikations GmbH	Titan Networks GmbH
Econtec GmbH & P2 Systems	Mobile Breitbandnetze GmbH	TKN Deutschland GmbH

EDV Team Oberland	MUENET GmbH	T-M-Net.de Marco Bungalski GmbH
EFN eifel-net Internet-Provider GmbH	MURGTEL	TNG AG
Elektro Center Torgau e.G.	NeckarCom	Transkom Kommu-nikationsnetzwerke GmbH
Elektronik Labor Nord	Nerd Patrol	TraveKom
EMOTEC NETWORKS GmbH	NES-Elektro & Service GmbH	true global communications GmbH
encoLine GmbH	net.art communications GmbH	TWL-KOM GmbH
ENSO AG	NetAachen GmbH	Unitymedia NRW GmbH
Epcan GmbH	NetCologne Gesellschaft für Telekommunikation mbH	Unser Ortsnetz GmbH
E-Plus Mobilfunk GmbH & Co. KG	NetCom BW GmbH	VegaSystems GbR
eServ Marita Hinckel	Netcom Kassel Gesellschaft für Telekommunikation mbH	Vereinigte Stadtwerke Media GmbH
EspenauNet e.V.	neu-medianet GmbH	Versatel AG
EURO-SAT Manfred Casper	NEW AG	VGM net - Verbandsgemeinde Montabaur Netz und Infrastruk-tur
Eusanet GmbH	Newone GmbH	Vodafone GmbH
Eusanet GmbH (SAT)	nexiu GmbH	VSE NET GmbH
Eutelsat VisAvision GmbH	nordCom - EWE TEL GmbH	Vype GmbH
EWE TEL GmbH	Norman Dietzen, Wireless-DSL	WDSL-Oberlausitz
EWR AG	Northern Access GmbH	WDTK Wikom Deutsche Teleka-bel
EZV GmbH & Co. KG	NU Informationssysteme GmbH	WEBoverAIR
FAG Fernseh-Antennen-Gemeinschaft Bad Steben e.V.	omnidat GmbH	WEMACOM Telekommunikation GmbH
FBLAN	OR Network GmbH	WIBAXX GmbH
FELKATEC Software GmbH & Co. KG	osnatel GmbH	wilhelm.tel.GmbH
Feuchter Gemeindewerke GmbH	Ost Tel Com GmbH	Wilmschen Webdesign
Filiago GmbH & Co KG	Outland-net	wilscom.net
FPS - InformationsSysteme GmbH	overturn broadband networks UG (haftungsbeschränkt)	WiSoTEL GmbH
FreiDSL	overturn technologies GmbH	WITCOM GmbH
Freikom GbR	p2-systems GmbH	wittenberg-net GmbH
FREITALER STROM+GAS GMBH	PC-Notdienst Matthias Herberg	WMB - Kabelservice GmbH
Funk und Technik GmbH Forst	PerlNet	WOBCOM GmbH
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GARTHOFF	PfalzConnect GmbH	YPLAY Germany GmbH

List of abbreviations

ADSL	Asymmetric DSL: downstream data rate higher than upstream data rate
ANGA	Verband Deutscher Kabelnetzbetreiber e.V.
BITKOM	Bundesverband Informationswirtschaft, Telekommunikation und neue Medien e.V.
BMVI	Federal Ministry of Transport and Digital Infrastructure
Breko	Bundesverband Breitbandkommunikation e. V.
BUGLAS	Bundesverband Glasfaseranschluss e.V.
CAD	Computer aided design
CATV	Cable TV
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer - facility for active technology outside the CO, usually at the location of the SAI
eco	Verband der deutschen Internetwirtschaft e.V.
ETRS89	European Terrestrial Reference System 1989, geodetic reference frame
FRK	Fachverband für Rundfunkempfangs- und Kabelanlagen
FTTB	Fiber To The Building
FTTC	Fiber To The Curb (VDSL)
FTTH	Fiber To The Home
FTTN	Fiber To The Node/Neighbourhood
FTTx	Synonym for all fibre-based solutions
GIS	Geographic Information System
GSM	Global System for Mobile Communication - the 2nd generation mobile communication system (2G)
HH	Households
HSDPA	High Speed Downlink Packet Access - UMTS expansion stage for higher downstream data rates

HSPA	High Speed Packet Access - generic term for HSDPA and HSUPA technologies
HSUPA	High Speed Uplink Packet Access - UMTS expansion stage for higher upstream data rates
MDF	Main distribution frame - central distribution frame of a communication wiring installation in the central office
SAI	Serving area interface - facility at the interface between feeder and distribution cable network in the local access network
LTE	Long Term Evolution - UMTS/HSPA successor technology
Mbit/s	Megabits per second
OGC	Open Geospatial Consortium - organization whose aim is to define standards for spatial data
OSM	Open Street Map - project collecting and making available freely usable geodata
PLC	Powerline Communications - network access type that relies on the electricity grid
LL	Local loop - usually copper-based section of a local access network between MDF and customer
TC	Telecommunications
CO	Central office - contains the technical systems (e.g. the MDF) linking local access network and wide area network
UMTS	Universal Mobile Telecommunication System - the 3rd generation mobile communication system (3G) and GSM successor standard
UTM	Universal Transverse Mercator, coordinate system
VATM	Verband der Anbieter von Telekommunikations- und Mehrwertdiensten e. V.
Web GIS	GIS application displaying geodata via web services, e.g. in a browser
WiFi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access
WLAN	Wireless Local Area Network
WMS	Web Map Service

Broadband technologies - definitions

Fixed-line

- Digital Subscriber Line (DSL)

  The attenuation value ranges for achieving the transmission bandwidths using ADSL, ADSL2+, VDSL2 or VDSL vectoring technologies

≥	1 Mbit/s	max. 43.0 to 55.0 dB for ADSL	Range 4,500 m
≥	2 Mbit/s	max. 36.5 to 42.0 dB for ADSL	Range 4,000 m
≥	6 Mbit/s	max. 18.0 to 34.0 dB for ADSL	Range 3,000 m
≥	16 Mbit/s	max. 17.0 to 18.0 dB for ADSL2+	Range 2,000 m
≥	30 Mbit/s	for VDSL2	Range 600 m
≥	50 Mbit/s	for VDSL2	Range 300 m
≥	50 Mbit/s	for VDSL2 Vectoring	Range 600 m

  are complied with for the individual bandwidth categories.

- Fibre-optic technology (FTTH/B)

  Sufficient connection capacities for each household are installed in the coverage raster and are available for use or can, in many cases, be made available at the building entry point within a reasonable period (< 3 months) and without additional costs or longer minimum contract periods for the customer.

  In FTTB technology, the optical fibre cable ends within the building at the minimum point of entry (MPOE). In FTTH technology, the optical fibre cable ends in the customer's home.

- Cable network (CATV)

  Sufficient connection capacities for each household are installed in the coverage raster and can, in many cases, be made available at the building entry point within a reasonable period (< 3 months) and without additional costs or longer minimum contract periods for the customer.

- Powerline (PLC)

  This bandwidth category can be made available using the home's electricity connection.

Wireless

- Broadband UMTS (HSDPA)

  In the relevant raster, a received signal strength of -85 dBm can be achieved for outdoor HSDPA in the UMTS frequency band I 2000 MHz.

- Long Term Evolution (LTE)

  In the relevant raster, a received signal strength of -85 dBm can be achieved for outdoor LTE in the 800, 1800, 2600 MHz frequency bands.

- Satellite

  A two-way connection can be established. An uncompressed transponder-dependent bandwidth can be guaranteed for each user.

- Wireless Local Area Network (WLAN) / Wireless Fidelity (WiFi)

  The WLAN is not only available for occasional use (e.g. hotel hotspot, train station, cafe, etc.) but is made available to the user for permanent use (including always on functionality).

  In the relevant raster, a received signal strength of -85 dBm can be achieved in the 2400 and 5000 MHz frequency bands.

- WiMAX

  In the relevant raster, an outdoor received signal strength of -85 dBm can be achieved in the 3400 to 3600 MHz frequency bands.

Frequently asked questions and answers

General questions

What is the purpose of the Broadband Atlas?

The primary purpose of the Broadband Atlas is to provide a market overview of broadband coverage for private households and businesses in Germany. In addition, the Broadband Atlas aims to identify gaps in broadband coverage, which are referred to as “white areas”, and to provide further information on the subject of broadband coverage.

-No responsibility is taken for the correctness of the information provided-

Who uses the Broadband Atlas?

The Broadband Atlas is used by policy makers, the business and academic communities and the general public

Why can’t I get a broadband connection although the coverage raster shows an availability of > 10 to 50% for my house / flat?

An availability of > 10 to 50% means that, at most, every second household in the raster cell can be provided with broadband access. It is up to the broadband providers to increase broadband coverage in such municipalities and to expand their broadband network.

Why can’t I get a broadband connection although the coverage raster shows that broadband is available for my business?

If commercial broadband access is shown as available, this is a reliable indicator that at least one provider in this raster cell can offer commercial broadband coverage. As commercial broadband solutions are often highly customized, the actual local coverage situation may be different. Information on the real local coverage situation in each specific case should therefore always be requested from the broadband providers. We would like to ask the inquiring businesses to individually request an offer from the indicated broadband providers.

Whom should I contact to report changes in the broadband coverage situation?

Please contact the Broadband Atlas team, which works on behalf of the Federal Ministry of Transport and Digital Infrastructure.

The information provided is collected via the telephone number 0800 - 66 477 60 (toll-free from German landlines) and then analysed.

What is the difference between the Infrastructure Atlas and the Broadband Atlas?

The *Infrastructure Atlas* is created by the Federal Network Agency within the framework of the implementation of the Federal Government's broadband strategy and, in part, contains sensitive infrastructure data of the participating companies.

Therefore, the Infrastructure Atlas is *not* accessible to the public.

The Federal Network Agency, telecommunications companies and regional or local authorities are entitled to access the system and data. Due to strict data protection requirements, the data are not used for other purposes, with no exception for the Broadband Atlas.

The *Broadband Atlas,* on the other hand, does not contain infrastructure data but publicly accessible, generalised and anonymized data on broadband coverage and availability in the Federal Republic of Germany. The Broadband Atlas is published by the Federal Ministry of Transport and Digital Infrastructure.

For which browsers has the application been optimized?

The application has been optimized for Mozilla Firefox 45.0 and Internet Explorer version 10 or higher.

Who is responsible for the technical implementation?

TÜV Rheinland has been commissioned by the Federal Ministry of Transport and Digital Infrastructure to carry out the technical implementation.

In what way may the maps and data be used?

Only in combination with the following copyright notice:

Geoinformation © Bundesamt für Kartographie und Geodäsie (www.bkg.bund.de) / © Bundesministerium für Verkehr und digitale Infrastruktur / © TÜV Rheinland

When were the PDF maps last updated?

Information on the time of the last update is provided on the individual maps themselves.

Illustration

Why are some areas not covered by the coverage raster?

Only officially registered households, i.e. populated / inhabited areas, are accounted for in the raster cell illustration. Where there are no households, there are no raster cells.

In particular in the case of wireless solutions, broadband may also be available beyond the displayed coverage rasters. In the added section entitled “Breitband Mobilfunk” (broadband mobile communications), which can be found in the section “Erweitert” (advanced), wireless coverage extending beyond the populated area is displayed.

If there is at least one business location in a raster cell, this is taken into consideration for displaying commercial broadband raster cells. Where there are no business locations, no raster cells are visualized in the Broadband Atlas -businesses-.

Why is my neighbourhood not shown on the map?

The Broadband Atlas mainly uses official data. Addresses are taken from the official data of the Federal Agency for Cartography and Geodesy. They are updated regularly by the authority. These updates are based on contributions by the federal states. In particular for new developments at “greenfield sites”, there is a significant time lag. This lag can easily result in delays of two years. Therefore, we cannot always assign new development sites to raster cells (as inhabited homes).

We would like to ask for your patience until the data have been collected by the Federal Agency for Cartography and Geodesy and made available to us as an update.

What is the level of detail of the displayed data?

The resolution of the map is limited to 1:20,000. Users can identify roads, rivers and settlement structures as well as communities.

Why do the broadband coverage rasters disappear when zooming out?

To improve clarity, the broadband coverage rasters are automatically replaced by information on municipal availability and then district and federal state availability below a certain zoom level.

Why doesn’t the map show community boundaries?

Official community boundaries are unfortunately not available in a uniform manner for the whole of Germany. Therefore, no community boundaries are displayed.

On what basis are the data displayed?

Users can choose whether to view information on fixed-line (e.g. DSL, cable network, fibre) or wireless (e.g. UMTS-HSDPA) technologies in the following freely selectable bandwidth categories:

≥ 1 Mbit/s

≥ 2 Mbit/s

≥ 6 Mbit/s

≥ 16 Mbit/s

≥ 30 Mbit/s

≥ 50 Mbit/s

Which technologies are displayed?

You can choose to view three different technology combinations:

1. All

    All available technologies, except for satellite.

2. Fixed-line

    DSL / VDSL (telephone network)

    Cable network (coaxial cable)

    Powerline (electricity grid)

    Fibre (FTTH/B)

3. Wireless

    UMTS-HSDPA

    LTE

    WiMAX

    WLAN/WiFi

The satellite technology option is available in the whole of Germany. Therefore, this technology is not displayed. However, the providers that offer broadband access via satellite are shown for each municipality when searching for the broadband providers.

Moreover, you can select and view individual technologies, such as LTE and FTTH/B, separately.

How is the LTE technology displayed?

Long Term Evolution (LTE) is assigned to the ≥ 2 Mbit/s and, in some cases, to the ≥ 6 Mbit/s wireless bandwidth categories. It is also possible to view the area where LTE technology is available by using the LTE view mode, which can be selected separately.

In the separate LTE view, the relevant cell is displayed in accordance with the coverage categories. -Deviations are the result of many different parameters that interact with radio field planning, which is a complex mathematical, field-tested model of the individual mobile communications providers. For LTE, all frequency bands (800MHz, 1.8 and 2.6 GHz) are displayed jointly.

How is the FTTH/B technology displayed?

Fibre To The Home or Fibre To The Building/Basement (FTTH/B) is assigned to the ≥ 50 Mbit/s fixed-line bandwidth category. It can also be viewed using the FTTH/B view mode, which can be selected separately.

In the separate FTTH/B view, the relevant cell is displayed in accordance with the coverage categories. Deviations are the result of different local connection situations, i.e. homes passed or homes connected.

Thus, in a “homes passed” situation, fibre may have been laid alongside the house. To be able to use it, investments are necessary to lay fibre into the house (here, the earthworks are the significant factor).

What coverage situations are there?

There are four broadband availability categories:

0% - 10%:	This raster cell is not covered.
> 10% - 50%:	This raster cell is partially covered (up to 50% of the households in the raster cell).
> 50% - 75%:	This raster cell is mostly covered (up to 75% of the households in the raster cell).
> 75% - 95%:	This raster cell is almost fully covered (up to 95% of the households in the raster cell).
> 95% -100%:	This raster cell is covered (up to 100% of the households in the raster cell).

Why can I only zoom in to a scale of 1:20,000?

The viewing scale is limited to 1:20,000.

What is the meaning of the coloured raster cells?

The coloured raster cells show the broadband availability as the percentage of available households in each raster cell. The colours reflect the availability categories 0-10%, > 10 - 50%, > 50 - 75%, > 75 - 95% and > 95%.

If a raster cell is yellow, that means that at least 95% of the households in the cell can be served with broadband access of the selected bandwidth category using the selected technology.

The background map does not reflect the actual situation - why is that?

The background map is based on data from the OpenStreetMap project and thus on the information and data entered by users who are voluntarily contributing to the project. It is not claimed that the contents of the map are complete. Further details on the OpenStreetMap project are available from www.osm.org.

Functions

How can I change the displayed map section?

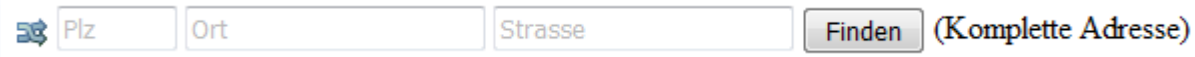
The map is viewed using a zoom function.

For this purpose, there is a plus/minus button in the upper left corner of the map that can be used to zoom in or out. As an option, the zoom button can be used to zoom in freely.

What spatial search functions are available?

- by landscape name (e.g. Spreewald)
- by federal state (e.g. Rheinland-Pfalz)
- by city (e.g. Hamburg)
- by municipality (e.g. Stendal)
- by community (e.g. Monschau-Mützenich) Note: if available
- by dialling code (e.g. 0221)
- by district (e.g. Teltow-Fläming)
- by postcode (e.g. 51105)
- by landscape unit (e.g. Schneifel)

Searching by street name is supported if the symbol is activated and the view changes for the entry of the address:



How can I search for the broadband availability in my municipality?

The broadband availability of a municipality can be retrieved from the online map using a tool ( symbol) by selecting the tool and clicking on the desired municipality on the map.

Which broadband providers are available in my municipality?

Broadband providers can be retrieved from the online map using a tool ( symbol) by selecting the tool and clicking on the desired municipality on the map. Not all providers necessarily offer broadband coverage in the whole municipality. However, at least one of the listed providers serves a raster cell that is marked as covered.

Which technologies are available in my municipality?

The technologies available in your municipality can be retrieved from the online map using a tool ( symbol) by selecting the tool and clicking on the desired municipality on the map.

How can I switch the legend back on?

The legend can be switched off and on by clicking on the arrow button in the upper right-hand corner of the legend.

How can I save the current map view?

For this purpose, the Broadband Atlas offers a print function (

symbol). The function generates a PDF map from the current map window. The data usage rules indicated on the printed document apply. The print date and data status of the broadband data are inserted.

What is special about the business view mode?

The business view mode shows the broadband availability in raster cells in which businesses are located according to Nexiga GmbH. In addition, raster cells located in business areas are displayed. Data on business areas were combined from different sources. No responsibility is taken for the completeness of the business and industrial areas as well as for areas that have possibly been recorded additionally. The availability of commercial broadband is displayed in two parts. Commercial broadband products at business locations indicate the symmetrical bandwidth or the maximum upload bandwidth of broadband connections. The colouring of the rasters indicates whether commercial broadband connections are likely to be available or not. The commercial broadband coverage displayed is based on data obtained from the broadband providers and subsequently processed by TÜV Rheinland. As commercial broadband products are often highly customized solutions, the actual local coverage situation may be different. Information on the real local coverage situation in each specific case should therefore always be requested from the broadband providers. The commercial products are shown for the ≥ 2, ≥ 10, ≥ 30, ≥ 50 and ≥ 100 Mbit/s bandwidth categories.

Consumer solutions at business locations indicate the availability of consumer broadband solutions in raster cells with companies or in business areas. They are of particular interest to smaller companies and are displayed for the ≥ 30, ≥ 50 and ≥ 100 Mbit/s bandwidth categories.

What does the time slider indicate?

The time slider shows the growth in broadband availability since one of the six-monthly updates in percentage points. You can activate it by clicking on “Zuwachs seit” (growth since). Then, you can click on different points on the timeline to choose the update status for which you would like the growth to be displayed. Growth is indicated in percentage point categories 0 – 1, > 1 – 5, > 5 – 10, > 10 – 50 and > 50.

Data base

How accurate are the data?

The data are based on voluntary data deliveries by the broadband providers and have been processed and assigned to the raster cells by TÜV Rheinland. Here, the households that can be served were determined per raster cell for each broadband provider, bandwidth and technology. They were then compared against and combined with the households present in each raster cell.

Based on the type of data delivery by the provider, the data should be highly accurate. Quality checks have confirmed this. However, in individual cases, the local coverage situation may differ due to current measures being carried out. You can report such deviations to TÜV Rheinland via the feedback function for each individual raster cell.

You should always contact the broadband providers to obtain information on the real coverage situation.

How up to date are the broadband coverage data?

All broadband providers are able to continuously enter their coverage data in accordance with the current roll-out status via an online web tool.

Thus, the Broadband Atlas will always have the most current coverage data available in the market and display them in the form of updated maps.

At which intervals are the data updated?

The broadband providers are able to continuously document their roll-out progress. The maps are updated regularly. The date of the last update is indicated in the legend of the Broadband Atlas.

Is the availability calculated for each municipality?

Yes, the availability is calculated for each municipality on the basis of the available data. The availability is shown for each bandwidth category across all technologies or separately for the fixed-line and wireless technology categories.

Which geobase data are used?

The calculation of broadband availability was performed on the basis of official geodata. In addition to the municipal boundaries provided by the Federal Agency for Cartography and Geodesy, in particular all of the authority's address coordinates (approx. 22 million) were used for the calculation. The household figures are based on surveys carried out by the Federal Statistical Office. The distribution of households within a municipality was performed with the help of the

addresses provided by the Federal Agency for Cartography and Geodesy as well as using building category information provided by Nexiga.

Data providers

Which companies are listed in the provider directory?

The provider directory only lists companies which provided the Federal Ministry of Transport and Digital Infrastructure and TÜV Rheinland with broadband coverage data.

Why are there broadband providers missing in the provider directory?

All broadband providers in Germany are regularly requested to make available their data. Some providers have not yet transmitted any data, in particular due to lack of time. Data are transmitted and provided on a voluntary basis. Companies which are currently not listed will be included in the list as soon as they provide data. You are welcome to inform us of missing broadband providers (telecommunications companies), for example via the service telephone number.

Are the companies obliged to make their data available?

No. Telecommunications companies make available their broadband coverage data to the Federal Ministry of Transport and Digital Infrastructure on a voluntary basis. Thus, municipalities that are actually covered may be displayed as not covered in individual cases. The following fictional example illustrates how this affects the displayed nationwide broadband availability: if a municipality with 500 households is not recorded in the Broadband Atlas, the total availability for the whole of Germany changes by 0.00125%.

How can broadband providers contribute?

The broadband data portal, which was set up specially for broadband providers, offers various options for easily and quickly entering or updating availability data.

Providers which still do not have access to the data portal can request access via the contact form under the menu item “Anleitung und Hilfe” (instructions and help). Furthermore, providers can reach us via phone at 0800 – 66 477 60 (toll-free from German landlines) or via email at breitbandatlas@de.tuv.com.

Terminology

What is DSL / VDSL?

DSL stands for Digital Subscriber Line. DSL technology takes advantage of the fact that conventional analogue telephone communication via copper wire only uses the frequencies up to 4 kHz. Using a modem, the bandwidth of the copper wire is split into different channels (voice and data), thus making the higher frequencies available for the DSL technology.

The most common technologies are ADSL and SDSL. In ADSL, the speed of data transmission to the user (download) is much higher than the other way around. Therefore, it is referred to as asymmetric DSL and mainly used in consumer households. In SDSL, which is symmetric DSL, the data transmission speed is the same for both directions. This type of DSL is mainly used by businesses and is of particular importance for the transmission of video conferences or the upload of larger amounts of data to webservers. The Broadband Atlas shows the availability of ADSL technology under the fixed-line technologies in the ≥ 1, ≥ 2, ≥ 6 and ≥ 16 Mbit/s categories.

VDSL (Very High Speed Digital Subscriber Line) - the VDSL2 standard has been offered by providers in Germany since 2006. Depending on the provider and the individual customer contract, speeds of ≥ 25 Mbit/s as well as ≥ 50 Mbit/s are possible. The Broadband Atlas shows the availability of this technology under the fixed-line technologies in the ≥ 16, ≥ 30, ≥ 6 and ≥ 50 Mbit/s categories.

However, for DSL/VDSL2, the influence of wire diameter or corrosion etc. of the local copper loop (LL) has to be taken into account. These parameters influence the maximum achievable speed.

What is FTTH/B?

FTTH/B stands for a number of different fibre-based data transmission methods, i.e. data transmission using light signals. The “F” in the abbreviation stands for the term “fibre”.

- FTTB Fibre To The Building
  i.e. laying optical fibre cable up to the building.

- FTTH Fibre To The Home
  i.e. laying optical fibre cable into the subscriber’s house or flat.

What is cable or CATV?

Cable refers to broadband data transmission via TV cable.

Depending on the technology roll-out level of the provider, the Broadband Atlas shows the availability of this technology under the fixed-line technologies in the ≥ 16, ≥ 30, ≥ and ≥ 50 Mbit/s categories.

What is Powerline Communication (PLC)?

PLC is the transmission of data via the electrical cable between socket and transformer station. Powerline is currently only available in some regions as a kind of pilot project.

What is UMTS?

UMTS stands for Universal Mobile Telecommunications System. It is a mobile communications standard that has been improved three times and now permits significantly higher data transmission rates.

What is HSDPA?

HSDPA stands for High Speed Downlink Packet Access and is an evolution of UMTS; it allows mobile users to transmit data at download speeds similar to those of DSL. Depending on the provider and the individual customer contract, speeds of ≥ 3.6; 7.2; 21.6 and 42.2 Mbit/s are possible under ideal conditions.

The Broadband Atlas shows the availability of this technology under the wireless technologies in the ≥ 1 Mbit/s and, in part, in the ≥ 2 Mbit/s category. This approach was chosen in coordination with the parties involved to ensure that these bandwidths are actually available to users in practice.

What is LTE?

LTE stands for Long Term Evolution. LTE is a mobile communications data transmission method and an evolution of the UMTS-HSDPA transmission technology in the 800 MHz, 1.8 and 2.6 GHz frequency bands. Depending on the provider and the individual customer contract, speeds of ≥ 3, 6, 7.2, 21.6, 42.2, 50, 100 or 150 Mbit/s are possible.

The Broadband Atlas shows the availability of this technology under the wireless technologies in the ≥ 2 Mbit/s and ≥ 6 Mbit/s categories.

This approach was chosen in coordination with the parties involved to ensure that these bandwidths are actually available to users in practice.

What is WLAN?

WLAN stands for wireless local area networks. WLAN is a wireless local area network operating in the 2.4 or 5 GHz frequency range (see IEEE 802.11 standard).

The Broadband Atlas shows the availability of this technology under the wireless technologies in the ≥ 1, ≥ 2, ≥ 6, ≥ 16, ≥ 30 and ≥ 50 Mbit/s categories, depending on the roll-out stage.

What is WiMAX?

WiMAX stands for Worldwide Interoperability for Microwave Access. WiMAX is a wireless broadband connection operating in the 3.4 to 3.6 GHz frequency band (see IEEE 802.16 standard). Unlike the WLAN standards of the 802.11 family, WiMAX bridges greater distances, which permits better broadband coverage in remote and rural regions.
The Broadband Atlas shows this technology under the wireless technologies in the ≥ 1, ≥ 2, ≥ 6 and ≥ 16 Mbit/s categories, depending on the roll-out stage.

What does “satellite” mean?

Satellite means Internet access via a geostationary satellite, where the geostationary satellite is constantly connected to the Internet. The subscriber can connect to the Internet via a satellite dish and a satellite modem (two-way technology). In one-way technology, the download takes place via satellite while an additional Internet connection is used for the upload. Only two-way satellites were considered in the Broadband Atlas. The satellite technology share was taken into consideration in the calculation of broadband availability. However, this does not mean that all unserved German households have the option of using this technology. Technical capacity limits also apply to DSL, CATV and wireless solutions.