

Tele2 CarrierLine

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1 General

The **Tele2 CarrierLine** service offers customers a digital dedicated line connection between two locations with a defined **interface** and bandwidth from 64 kbps to n*155 Mbps.

Tele2 CarrierLine is an “isochronous” service, which means that data (information units or bits) are sent from the sender to the receiver at a constant bitrate (realtime) in the proper order.

The Tele2 CarrierLine service is provided exclusively and is a basic service upon which other, higher-level services are based.

Tele2 provides the customer with a connection to the Tele2 CarrierLine service at the desired locations within the limits of the existing technical and operational facilities.

The location of a connection is designated by the exact address and a description of the rooms at the location. Tele2 CarrierLine connections are provided by Tele2 between the locations in accordance with the information provided by the customer.

2 Basic Tele2 CarrierLine Service

2.1 Features

The basic Tele2 CarrierLine service includes the following features:

- a) the provision of a dedicated digital connection between two customer locations with a defined bandwidth
- b) the provision of a defined interface at each customer location

A quality agreement can also be concluded for Tele2 CarrierLine connections in the form of a service level agreement.

2.2 Line Quality

The HRX model (hypothetical reference connection) as per ITU-T Recommendation G.821 and G.826 is used to evaluate the line quality.

A digital data connection normally consists of multiple sections with different quality classes. There are two different quality classes within the Tele2 network:

- “high grade” in the backbone network and distribution network
- “local grade” in the access network

3 Tele2 CarrierLine Interfaces

Tele2 CarrierLine provides the following bandwidths and interfaces:

Bandwidth	Interface	
n*64 kbps, unstructured 64 kbps, 128 kbps, 256 kbps, 512 kbps, 1024 kbps, 1984 kbps, 2048 kbps	electrical	X.21/V.11, symmetrical
n*64 kbps, structured 64 kbps, 128 kbps, 256 kbps, 512 kbps, 1024 kbps and 1984 kbps	electrical	2048 kbps G.703/704, 120 Ohm, symmetrical
2 Mbps, structured equivalent to a 2,048kbps digital structured leased line as per ONP (DS2048S)	electrical	2048 kbps G.703/704, 120 Ohm, symmetrical
2 Mbps, structured equivalent to a 2,048kbps digital unstructured leased line as per ONP (DS2048U)	electrical	2048 kbps G.703, 120 Ohm, symmetrical
34 Mbps, unstructured	electrical	34.368 kbps G.703, 75 Ohm, coaxial
45 Mbps, unstructured	electrical	44.736 kbps G.703, 75 Ohm, coaxial
140 Mbps, unstructured	electrical	139.264 kbps G.703, 75 Ohm, coaxial
155 Mbps (STM-1), structured (on request)	electrical	155.520 kbps G.703/G.707, 75 Ohm, coaxial
155 Mbps (STM-1), structured	optical	155.520 kbps G.957/G.707

Table 1: Tele2 CarrierLine Interfaces

4 Tele2 CarrierLine Service Management

The scope of service management is defined by the service level and the support level. Details can be found in the attached document "Service Level Description".

4.1 Service Level

Tele2 offers the following service levels for Tele2 CarrierLine connections:

- Service level **ECONOMY**: standard for all Tele2 CarrierLine connections
- Service level **BUSINESS**: only available for connections ≥ 2 Mbps

4.2 Support Level

A support level can be agreed separately for every Tele2 CarrierLine connection. The following support levels are available for the Tele2 CarrierLine service:

- Standard Support SS
- Full Support FS

The correction of faults in a Tele2 CarrierLine connection is completed during the agreed support times (support level).

If expressly requested by the customer, faults can also be corrected outside of the support times defined in the selected support level for an extra fee. The fees for such work are based on the current Tele2 price list. Fault reports are accepted 24 hours a day.

Tele2's backbone network is monitored and operated 24 hours a day, 365 days a year by Tele2's own operation management center.

4.3 Service Level Agreement (SLA)

If desired by the customer, a service level agreement for service level Business can be concluded for Tele2 CarrierLine connections with a bandwidth ≥ 2 Mbps. Please consult the attached document "Tele2 CarrierLine Service Level Agreement" for details on the service level agreements.

Limitations:

For technical reasons, not all Tele2 CarrierLine connections can be monitored proactively by Tele2 on an end-to-end basis. This means that all service level agreements can only be concluded for reactive fault correction, i.e. the customer reports any faults, at which point down time begins.

4.4 Customer Questions and Fault Reports

Upon activation of the service, the customer will be given information (contact person, telephone number, etc.) for contacting Tele2 in the event of faults or for questions.

5 Installation of the Tele2 CarrierLine Connection

Tele2 will install a Tele2 CarrierLine connection at any location in Austria, provided that this can be done with justifiable expense. The type of access technology (copper, fiber optic cable, LOS radio, MSA, etc.) and the options for using existing line infrastructure must be taken into account.

The installation of the connection is coordinated with the customer. See item 5 of our General Terms and Conditions.

UNBUNDLING Connection

Customers for whom the connection will be realized over unbundled copper lines must terminate their contract with their existing provider, and the existing operator must switch the line over to Tele2. The termination of the contract with the existing provider is not effective until the line is switched over to Tele2. The line cannot be switched over and the account terminated until the respective unbundling form is completed and signed by the owner of the connection.

Customers with an unbundled connection are not entitled to any claims or other legal measures against Tele2 in the event of faults or errors during the switchover of the line.

MSA (Multi-service Connection)

Through the use of a multiplexer, Tele2 customers can use a connection with a bandwidth of 2 Mbps as a Tele2 CarrierLine connection with $n \times 64$ kbps and a Tele2 telephone service (*Tele2 Business direkt*) simultaneously. When the connection is used in this manner, the connection bandwidth is divided up between both services.

When combining the *Tele2 CarrierLine* data service with the Tele2 voice service *Tele2 Business direkt*, a number of 64 kbps channels (in accordance with the connection bandwidth) in the 2 Mbps signal of the connection line are assigned to Tele2 CarrierLine. This joint usage of the line means that the maximum possible 30 voice channels of an ISDN-PRA (multi-connection) are not available, as the maximum number of available voice channels is reduced by the number of 64 kbps units required for Tele2 CarrierLine. An additional voice channel is required for the management of the connection device. (Example: Tele2 CarrierLine 128 kbps: that means 2 channels for data + 1 channel for management, which means that there are only 27 channels available for the voice service *Tele2 Business direkt*)

When selecting the MSA connection, the traffic requirements of the Tele2 Business direkt service must be taken into account. If the voice traffic over the connection can be limited, and therefore the MSA access variant, the PBX must be programmed so that the 64 kbps channels required for the Tele2 CarrierLine connection are not seized.

The connection of the MSA multiplexer requires that the existing *Tele2 Business direkt* service is interrupted. The interruption is coordinated with the customer.

Customers who have an MSA connection installed are not entitled to any claims or other legal measures against Tele2 in the event of faults or errors during switchover.

The MSA connection can be offered together with the UNBUNDLING connection, Tele2 will simply install a connection device that transfers both of these services to a single unit (normally X.21 jack for Tele2 CarrierLine, G.703/704 jack for telephony).

5.1 General Structural Requirements

The installation of a Tele2 CarrierLine connection requires a clean and dry installation area or room at the customer location that is sufficiently ventilated. The customer must guarantee that the operating temperature is between +5°C and +40°C at all times and that the temperature in the room does not fall below the condensation point. The customer is responsible for the installation and operation of any necessary climate control equipment.

5.2 Access and Connection Device

General

The design of the access and connection device is dependent on the type of access and the required Tele2 CarrierLine interface. Access and connection equipment can be in separate devices and rooms, or combined in a single unit. The access and connection device is normally a tabletop unit that can also be mounted on a wall. The access and connection equipment will be selected by Tele2.

Example of LOS radio connection: a LOS radio antenna is installed outside the building and connected to the corresponding equipment in the building by means of a coaxial cable.

The access and connection device(s) provided by Tele2 remain the property of Tele2 or the property of third parties engaged by Tele2.

Access Device

The access device connects the network subscriber to the next Tele2 network node.

Connection Device

The connection device provides the customer with the desired Tele2 CarrierLine interface.

Equipment Access

Access to Tele2 equipment is subject to item 5 of our General Terms and Conditions.

Power Supply

The grounding and power supply required for the access and connection equipment (230VAC) must be provided by the customer in the form of a grounded electrical socket no farther than 1.5m from the installation site of the equipment. The power supply for the access and connection equipment and the associated terminal equipment should be in a separate, fused power circuit, if possible. If the customer wishes to have the Tele2 CarrierLine service available during power outages, a corresponding uninterruptible power supply (230VAC) must also be provided by the customer.

5.3 Network Connection Point

The network connection point is the connection point for the Tele2 CarrierLine service and the limit of responsibility of Tele2.

The network connection point is realized in the form of a connection jack (e.g. jack of the connection device). Tele2 CarrierLine connections with bitrates ≥ 2 Mbps may be installed without a connection device. The network connection point for such installations is realized in the form of a panel with a RJ-45 jack, coaxial connection or fiber optic cable connection.

All network equipment provided by Tele2 up to the network connection point (on the network side) and the connection device itself are the responsibility of Tele2.

If the in-house cabling is installed by the customer, this section of the network connection is the responsibility of the customer.

5.4 Installation

The equipment for the Tele2 CarrierLine connection will be installed in accordance with the standard installation regulations. All equipment will be installed surface-mounted. Cable classification in accordance with EN 50173.

Any existing cabling may be used by Tele2 after being checked for suitability.

If the customer wishes to have the connection cables inside the building laid in conduit or cable channels, or if this is necessary for reasons not attributable to Tele2 (such as requirements of the building owner), the required conduit or cable channels must be provided by the customer. If cables are installed by Tele2 in this manner, the resulting fees will be billed separately.

5.5 Safety Measures

If the customer location is in an area particularly prone to lightning strikes, all lightning protection equipment necessary for the protection of the Tele2 equipment must be installed by a licensed electrician. The costs for this shall be borne by the customer.

5.6 Service Activation

After the completion of all installation work, the availability of the Tele2 CarrierLine service will be checked against the quality requirements in accordance with the order by means of a service activation test. After the successful conclusion of the test, the service is transferred to the customer by means of a transfer report, which the customer must countersign.

5.7 Terminal Equipment

The customer must connect the desired terminal equipment to the Tele2 CarrierLine network connection point by means of the corresponding cable. This provides the customer access to the Tele2 CarrierLine service. The terminal equipment and the connection cable itself are the responsibility of the customer.

Only CE-certified terminal equipment that complies with the respective interface conditions may be connected to the Tele2 CarrierLine interface.

Consult Tele2 for their approval in cases of doubt.

6 Technical Description and Interfaces

6.1 General

The most important technical features of a Tele2 CarrierLine interface are:

- the bandwidth
- the physical characteristics
- the data structure
- the clock synchronization
- the interface jack

6.1.1 Bandwidth

This is indicated in kbps or Mbps and indicates the rate at which the data is transferred over the Tele2 CarrierLine interface. Data is transferred at higher rates within the transport network.

6.1.2 Physical Characteristics

The connection of data equipment to the Tele2 CarrierLine interface is subject to the required physical guidelines, which are based on generally accepted standards.

6.1.3 Data Structure

Structured and unstructured connections are available.

For an unstructured connection, data is transmitted over the transport network. There are no limits on the content that can be transmitted by the customer.

Structured data connections require that a standardized data structure is maintained at the Tele2 CarrierLine interface.

6.1.4 Clock Synchronization

The offered quality of the data to be transferred requires that all associated equipment, including the customer's equipment (data terminal equipment) is synchronized. The following options are available for the configuration of the customer's data terminal equipment.

Master: the clock synchronization is controlled by the data terminal equipment. The clock accuracy of the data terminal equipment must be within the specifications of the respective interface.

Slave: the clock synchronization for the data terminal equipment is taken from the received signal.

The following operating modes are available:

- Network-synchronous operation:
 - The transport network is the master for synchronizing all equipment. The customer data terminal equipment that is connected to the interfaces must synchronize with the network clock.
 - The network clock in the Tele2 backbone corresponds to the primary reference clock specification as per ITU-T G.811.
 - The typical configuration of the data terminal equipment is: Slave – Slave
- Data-synchronous operation:
 - The time at the interface is specified by the data terminal equipment and transmitted over the transport network to the other side of the connection. The clock accuracy of the data terminal equipment must be within the specifications of the respective interface.
 - The typical configuration of the data terminal equipment is: Master – Slave
 - Note: see chapter 6.2 for interface-specific restrictions for clock synchronization.

6.1.5 Interface Jack

The design of the interface jack is dependent on the selected interface and the connection device used.

6.2 Technical description of the offered Interfaces

6.2.1 Subrate n*64kbps, X21

Bandwidth:	64, 128, 256, 512, 1024 or 1984 kbps
Physical interface:	electrical, X.21/V.11
Data structure:	unstructured
Clock synchronization:	network-synchronous, the clocks are synchronized by the Tele2 network (typical terminal equipment configuration: Slave-Slave)
Interface jack:	D-Sub 15 jack (ISO 4903)

Special characteristics: The X.21 control signals C and I are not transmitted over the transport network.

6.2.2 2048kbps, X21

Bandwidth: 2048kbps
Physical interface: electrical, X.21/V.11
Data structure: unstructured
Clock synchronization: network-synchronous, the clocks are synchronized by the Tele2 network
(typical terminal equipment configuration: Slave-Slave)
Interface jack: D-Sub 15 jack (ISO 4903)
Special characteristics: The X.21 control signals C and I are not transmitted over the transport network.

6.2.3 2048kbps, G.703

Bandwidth: 2048kbps \pm 50ppm
Physical interface: electrical, as per ITU-T G.703, 120 Ohm
Data structure: unstructured
Clock synchronization: Data-synchronous, the clock time is transmitted over the transport network
(typical terminal equipment configuration: Master-Slave)
Interface jack: depends on the connection device
Special characteristics: transparent clock time and data transmission

6.2.4 2048kbps, G.703/G.704:

Bandwidth: 2048kbps \pm 50ppm
Physical interface: electrical, as per ITU-T G.703, 120 Ohm
Data structure: structured as per ITU-T G.704
Clock synchronization: network-synchronous, the clocks are synchronized by the Tele2 network
(typical terminal equipment configuration: Slave-Slave)
Interface jack: depends on the connection device
Special characteristics: The timeslot 0 is not transmitted transparently over the transport network, which means that the effective bandwidth is max. 1984kbps.

6.2.5 34Mbps, G.703

Bandwidth: 34 368kbps \pm 20ppm
Physical interface: electrical, as per ITU-T G.703, 75 Ohm
Data structure: unstructured
Clock synchronization: Data-synchronous, the clock time is transmitted over the transport network
(typical terminal equipment configuration: Master-Slave)
Interface jack: Nortel type 43, or
coaxial Siemens 1.6/5.6, or
BNC 75 Ohm
Special characteristics: transparent clock time and data transmission

6.2.6 140Mbps, G.703

Bandwidth:	139 264 kbps \pm 15ppm
Physical interface:	electrical, as per ITU-T G.703, 75 Ohm
Data structure:	unstructured
Clock synchronization:	Data-synchronous, the clock time is transmitted over the transport network (typical terminal equipment configuration: Master-Slave)
Interface jack:	Nortel type 43, or coaxial Siemens 1.6/5.6, or or BNC 75 Ohm
Special characteristics:	transparent clock time and data transmission

6.2.7 155Mbps, G.703/G.707

Bandwidth:	155 520 kbps \pm 20ppm
Physical interface:	electrical, as per ITU-T G.703, 75 Ohm
Data structure:	structured as per ITU-T G.707
Clock synchronization:	network-synchronous, the clocks are synchronized by the Tele2 network (typical terminal equipment configuration: Slave-Slave)
Interface jack:	Nortel type 43, or coaxial Siemens 1.6/5.6, or BNC 75 Ohm
Special characteristics:	Configuration for VC4, VC3 and VC12 must be taken into account.

6.2.8 155Mbps, G.957/G.707

Bandwidth:	155 520 kbps \pm 20ppm
Physical interface:	optical, as per ITU-T G.957, Interface: I-1, S-1.1, S-1.2, L-1.1, L-1.2 or L-1.3
Data structure:	structured as per ITU-T G.707
Clock synchronization:	network-synchronous, the clocks are synchronized by the Tele2 network (typical terminal equipment configuration: Slave-Slave)
Interface jack:	optical, FC/PC or SC/PC
Special characteristics:	Configuration for VC4, VC3 and VC12 must be taken into account.

Interface jack X.21 (ISO 4903)

Jack 15-pin Sub-D jack (female)			
Pin No.	Interface line	Function	Direction
1		free	
2	Ta	transmission data a,	Tele2 DCE \rightarrow customer DTE
3	Ca	control line a,	Tele2 DCE \rightarrow customer DTE
4	Ra	received data a,	Tele2 DCE \leftarrow customer DTE
5	la	record circuit a,	Tele2 DCE \leftarrow customer DTE
6	Sa	bit timing DTE,	Tele2 DCE \leftarrow customer DTE
7	Xa*	bit timing DTE, octet timing DTE,	Tele2 DCE \rightarrow customer DTE Tele2 DCE \leftarrow customer DTE
8	G	GND	
9	Tb	transmission data b,	Tele2 DCE \rightarrow customer DTE
10	Cb	control line b,	Tele2 DCE \rightarrow customer DTE
11	Rb	received data b,	Tele2 DCE \leftarrow customer DTE
12	lb	record circuit b,	Tele2 DCE \leftarrow customer DTE
13	Sb	bit timing,	Tele2 DCE \leftarrow customer DTE
14	Xb*	bit timing DTE, octet timing DTE,	Tele2 DCE \rightarrow customer DTE Tele2 DCE \leftarrow customer DTE
15		free	

Loop plug 15-pin Sub-D plug (male)	
Pin No.	Function
1	free
2, 4	connected
3, 5	connected
6, 7	connected
9, 11	connected
10,12	connected
13, 14	connected
8	free
15	free

* The connections are dependent on the configuration.

7 Standards

- [1] ITU-T G.703: Physical/electrical characteristics of hierarchical digital interfaces
- [2] ITU-T G.704: Synchronous frame structures used at 1544, 6312, 2048, 8488 and 44 736 kbps hierarchical levels
- [3] ITU-T G.707: Network node interface for the synchronous digital hierarchy (SDH)
- [4] ITU-T G.811: Timing requirements at the outputs of primary reference clocks suitable for pliesochronous operation of international digital links
- [5] ITU-T G.821: Error performance of an international digital connection operating at a bit rate below the primary rate and forming part of an ISDN
- [6] ITU-T G.826: Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate
- [7] ITU-T G.957: Optical interfaces for equipments and systems relating to the synchronous digital hierarchy
- [8] ITU-T G.958: Digital line systems based on the synchronous digital hierarchy for use on optical fibre cables
- [9] ITU-T X.21: Interface between Data Terminal Equipment and Data Circuit-terminating Equipment for synchronous operation on public data networks
- [10] EN 50173: Leistungsanforderungen an anwendungsneutrale Verkabelungssysteme
- [11] ISO 4903: Information Technology; Data Communication. 15 pin DTE/DCE interface connector and contact number assignments.

8 Abbreviations

DTE	Data Terminal Equipment
DCE	Data Communication Equipment
ISO	International Organization for Standardization
ITU-T	International Telecommunication Union
ONP	Open Network Provision
SDH	Synchronous Digital Hierarchy
SLA	Service Level Agreement
STM-1	Synchronous Transport Module – 1
Tele2	Tele2 Telecommunication GmbH