Vodafone Deutschland
pNTP Interface Specification

Version: 1.05
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Die vorliegende Schnittstellenspezifikation gilt für folgende Vodafone Gesellschaften (im Folgenden Vodafone):

XXX

Schnittstellenkonform sind Endgeräte ausschließlich, wenn diese durch geeignete technische Maßnahmen so gesichert werden, dass diese weder durch Software- oder Hardware-Manipulationen in einer Weise verändert werden können, dass sie den Anforderungen dieser Schnittstellenbeschreibung nicht mehr entsprechen. Insbesondere ist das Einspielen veränderter Firmware wirksam zu unterbinden.

Mit der Veröffentlichung einer neuen Version dieser Schnittstellenbeschreibung verlieren vorherige Versionen Ihre Gültigkeit.

Zur technischen Erprobung behält sich die Vodafone vor, in räumlich begrenzten Regionen jederzeit abweichende Implementierungen vorzunehmen.

Vodafone übernimmt keine Haftung für die Richtigkeit der im Dokument aufgeführten Referenzspezifikationen.

Hinweise:

Diese Schnittstellenspezifikation für passive Netzabschlusspunkte (pNTP) für den direkten Anschluss von Geräten setzt § 41c des Telekommunikationsgesetzes (TKG) vom 22. Juni 2004 (BGBI, I S. 1190), das zuletzt durch Artikel 10 Absatz 12 des Gesetzes vom 30. Oktober 2017 (BFBI, I S. 3618) geändert worden ist um und richtet sich ausschließlich an Hersteller. Für diese bestehen Testmöglichkeiten in den Laboren der Vodafone Kabel Deutschland zu FRAND Konditionen. Die Erklärung der Konformität mit den Inhalten dieser Schnittstellenbeschreibung erfolgt in Eigenverantwortung der Hersteller. Ein indirekter Anschluss von Geräten wird nicht unterstützt (siehe BNetzA 01).

Contents

Conventions

Throughout this document, the words that are used to define the significance of particular requirements are capitalized. These words are:

"MUST, SHALL"	This word means that the item is an absolute requirement of this specification.
"MUST NOT"	This phrase means that the item is an absolute prohibition of this specification.
"SHOULD"	This word means that there MAY exist valid reasons in particular circumstances to ignore this item, but the full implications SHOULD be understood and the case carefully weighed before choosing a different course.
"SHOULD NOT"	This phrase means that there MAY exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications SHOULD be understood and the case carefully weighed before implementing any behavior described with this label.
"MAY"	This word means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

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1 Scope

This document describes the protocol requirements for the Internet Access Service over the Vodafone cable networks at the dedicated data RF Interface and the main characteristics of the dedicated data RF interface in the Vodafone cable networks at the user's coaxial passive network termination point in Germany. This document describes the typical limits or values within which the RF characteristics can be expected to remain for networks that are built according to Vodafone specifications at installation time. Detail specification for higher level protocol data that require logical instances beyond the passive network termination point are given in 0. Performance parameters for higher level protocols are out of scope of this document.

The interface specification does not apply under abnormal operating conditions such as:

- operating conditions arising as a result of operating services other than DOCSIS 3.x over the dedicated data RF interface.
- operating conditions arising as a result of a fault, maintenance and construction work or to minimize the extend of interruption of service.
- operating conditions arising as a result of force majeure or third-party interference.
- operating conditions arising as a result of test signal injection governed by regulation.
- operating conditions beyond the passive network termination point.
- In case of non-compliance of a network user's installation or non-compliance of equipment with the relevant standards or non-compliance with the technical requirements for connection, established either by this interface specification or the public authorities including the relevant limits for electromagnetic compatibility.

BILD Verantwortlichkeiten.

The characteristics given in this interface specification are intended to be used to derive and specify requirements for equipment such as coaxial cables and cable modems to connect them to the dedicated data RF interface interface. The values in this interface specification take precedence over requirements in equipment product standards and installation standards. The given characteristics are not intended to be used as electromagnetic compatibility levels or user emission limits in the Vodafone networks.

This interface specification may be changed at any time and may break backward compatibility with previous versions. Manufacturers are therefore asked to provide regular software updates. The user of this interface specification has to check for the newest version available from Vodafone. This interface specification supersedes Vodafone Kabel Deutschland Version 1.4 and UM TS 411a and may be superseded in total or in part by the terms of a contract with the individual network user.

2 References

In the case of a conflict between specific requirements in this document with requirements in any of the directly or indirectly referenced documents, the specific requirements of this document are applicable.

2.1 Normative References

ANGA 100 001	ANGA 100 001 v1.01: Specification for the passive Network Termination Point in DOCSIS 3.0 Environment Network and Provisioning requirements
ANGA 100 002	Specification for a passive Network Termination Point in DOCSIS 3.1 Environments; Network and Provisioning requirements v1.0
BNetzA 01	Stellungnahme der BNetzA zur „Schnittstellenbeschreibungen gemäß §41c TKG"
CL-SP-CANN-DHCP	CableLabs' DHCP Options Registry (newest version)
CM-SP-OSSIv3	CableLabs "Data Over Cable Service Interface Specifications, DOCSIS 3.0 Operations Support System Interface Specification CM-SP-OSSIv3.0-I28-151210"
ETSI ES 203 311-2	ETSI ES 203 311-2 V1.1.1 (2019-05): Integrated broadband cable telecommunication networks (CABLE); Fourth generation transmission systems for interactive cable television services - IP cable modems; Part 2: Physical layer; DOCSIS® 3.1 [ANSI/SCTE 220-1 2016]
DIN VDE 0100-410	DIN VDE 0100-410 VDE 0100-410:2018-10: Errichten von Niederspannungsanlagen Teil 4-41: Schutzmaßnahmen - Schutz gegen elektrischen Schlag (IEC 60364-4-41:2005, modifiziert + A1:2017, modifiziert); Deutsche Übernahme HD 60364-4-41:2007 + A11:2017
DIN ISO 8601	DIN ISO 8601:2006-09: Datenelemente und Austauschformate - Informationsaustausch - Darstellung von Datum und Uhrzeit (ISO 8601:2004)
IEC 61196-2	Radio-frequency cables - Specifications - Part 2: Semi-rigid radio-frequency and coaxial cables with polytetrafluoroethylene (PTFE) insulation - Sectional specification
VDE 0855-1	VDE 0855-1:2019-01: Kabelnetze für Fernsehsignale, Tonsignale und interaktive Dienste,Teil 11: Sicherheitsanforderungen (IEC 60728-11:2016 + COR1:2016); Deutsche Fassung EN 60728-11:2017 + A11:2018

2.2 Informative References

1 TR 110-1	Deutsch Telekom 1 TR 110-1
ANSI/TIA/EIA 568-B	Commercial Buildings Telecommunications Cabling Standard
BSI 01	Testkonzept für Breitband-Router, (DSL-, Kabel-, SOHO-, CE-, CPE-Router, IADs); May/2016
CFR Pt. 68	FCC CFR Pt. 68; 1999
CL-SP-sRouter	CL-SP-sRouter-I02-170111: Standalone Router Specification
CM-SP-SECv3.0	CM-SP-SECv3.0-I15-130808: Data-Over-Cable Service Interface Specifications DOCSIS 3.0; Security Specification
ETSI ES 203 311-3	ETSI ES 203 311-3 V1.1.1 (2019-05): Integrated broadband cable telecommunication networks (CABLE); Fourth generation transmission systems for interactive cable television services - IP cable modems; Part 3: MAC and upper layer protocols interface; DOCSIS® 3.1 [ANSI/SCTE 220-2 2016]
ETSI ES 203 311-4	ETSI ES 203 311-4 V1.1.1 (2019-05): Integrated broadband cable telecommunication networks (CABLE); Fourth generation transmission systems for interactive cable television services - IP cable modems; Part 4: Cable modem operations support system interface; DOCSIS® 3.1 [ANSI/SCTE 220-3 2016]
ETSI ES 203 311-6	ETSI ES 203 311-6 V1.1.1 (2019-05): Integrated broadband cable telecommunication networks (CABLE); Fourth generation transmission systems for interactive cable television services - IP cable modems; Part 6: Security; DOCSIS® 3.1 [ANSI/SCTE 220-5 2016]
IEEE 802.3	802.3-2015 - IEEE Standard for Ethernet, ISBN 978-1-5044-0078-7
IEC 61169-2	IEC 61169-2:2007: Radio-frenquency connectors - Part 2: Sectional specification - Radio frequency coaxial connectors of type 9,52
KDG 1 TR 8-8	Regelungen für Auftragnehmer der Kabel Deutschland zur Beurteilung bzw. Herstellung des Potenzialausgleichs im Zusammenhang mit der Einrichtung von Kabel Highspeed und Kabel Phone, Ausgabe 2005[1]
RFC 1058	Routing Information Protocol
RFC 1389	RIP Version 2 MIB Extension
RFC 2082	RIP-II MD5 Authentication
RFC 2453	RIP Version 2
RFC 3663	IPv6 Prefix Options for Dynamic Host Configuration Protocol (DHCP) version 6
RFC 6333	Dual-Stack Lite Broadband Deployments Following IPv4 Exhaustion
RFC 6334	Dynamic Host Configuration Protocol for IPv6 (DHCPv6) Option for Dual-Stack Lite
TLV 202	eRouter Operating Mode encoding
VDE 0627-603-7	Steckverbinder für elektronische Einrichtungen - Teil 7: Bauartspezifikation für ungeschirmte freie und feste Steckverbinder, 8polig (IEC 60603-7:2008 + A1:2011 + A2:2019); Deutsche Fassung EN 60603-7:2009 + A1:2011 + A2:2019

WN 744-747	WISI Werknorm Wiclick Buchse

[1] available under NDA

2.3 Reference Acquisition

- 1 TR 110-1: https://www.telekom.de/hilfe/downloads/schnittstellenbeschreibung-1tr110-1
- ANGA specifications: http://www.vodafone.de/hersteller-info
- Stellungnahme der BNetzA zur „Schnittstellenbeschreibungen gemäß §41c TKG": https://www.bundesnetzagentur.de/SharedDocs/FAQs/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Technik/ATRT/Stellungnahme.pdf
- BSI Router Testkonzept: https://www.bsi.bund.de/SharedDocs/Downloads/DE/BSI/Cyber-Sicherheit/Themen/Testkonzept-Breitbandrouter.html
- CableLabs specifications: http://www.cablelabs.com
- DIN and EN standards: https://www.beuth.de/de
- ETSI standards: http://etsi.org
- FCC: https://www.fcc.gov
- IEEE: http://www.ieee.org
- IETF RFCs: http://www.ietf.org
- ITU recommendations: http://www.itu.int
- Telecommunications Industry Association: https://www.tiaonline.org/
- VDE standards: https://www.vde-verlag.de

3 Definitions and Abbreviations

3.1 Definitions

The definitions in ANGA 100 001, subclause 3.1 apply.

Service Flows
A MAC layer transport service which provides unidirectional transport of packets from the upper layer service entity to the RF and shapes, polices, and prioritizes traffic according to QoS traffic parameters defined for the Flow.

Bootfiles
Docsis Config File which contains Classifiers for QoS and schedule, Baseline Privacy (BPI) etc.

3.2 Abbreviations

The abbreviations in ANGA 100 002, subclause 3.2 apply.

AD	Frequency dependent Amplitude Distortion (Peak to Peak)
AFTR	Address Family Transition Router
ANGA	Arbeitsgemeinschaft für Betrieb und Nutzung von Gemeinschaftsantennen- und -verteileranlagen
ASCII	American Standard Code for Information Interchange
BER	Bit Error Rate
BPI+	Baseline Privacy Plus
BSI	Bundesamt für Sicherheit in der Informationstechnik
C/(N+IM)	Carrier (C) to Noise (N) and Intermodulation (IM) ratio
CableLabs	Cable Television Laboratories, Inc.
CM	Cable Modem
CMTS	Cable Modem Termination System
CPE	Customer Premise Equipment
CVC	Code Verification Certificate
DHCP	Dynamic Host Configuration Protocol
DIN	Deutsches Institut für Normung
DNS	Domain Name System
DOCSIS	Data Over Cable Service Interface Specification
DS	Downstream
DS-Lite	Dual-Stack Lite
ERMI	European Retail Market Information
eRouter	embedded Router
FCC	Federal Communications Commission

FQDN	Fully Qualified Domain Name
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IP	Internet Protocol
ITU	International Telecommunication Union
KDG	Kabel Deutschland GmbH
MAC	Media Access Control
MER	Modulation Error Rate
MICE	Mechanical, Ingress, Climatic and Chemical, Electromagnetic
MTA	Multimedia Terminal Adapter
OFDM	Orthogonal Frequency-Division Multiplexing
PD	Frequency dependent Phase Distortion (Peak to Peak)
pNTP	passive network termination point
pRMCD	passive Ready Made Connecting Device (cable assembly)
QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
RCP	Receive Channel Profile
RF	Radio Frequency
RFC	Request For Comments
SC	Single Carrier
SI	Système international d'unités
SNMP	Simple Network Management Protocol
TLV	Type Length Value
TR	Technische Richtlinie
TTL	Time To Live
UGS	Unsolicited Grant Synchronization
US	Upstream
VAC	Volt Alternating Current
VDC	Volt Direct Current
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e. V.
VF KD	Vodafone Kabel Deutschland GmbH
WAN	Wide Area Network

4 Interface connectors

4.1 General

The location of the customer's pNTP within the hybrid fibre/coaxial network for DOCSIS is shown in ANGA 100 001, subclause 4.1 for type A, B and D pNTP (coaxial pNTP).

Note: For devices behind the cable modem, implementers SHOULD NOT rely on the availability of C type pNTP interfaces (IEEE 802.3) or interfaces according to 1 TR 110-1, CFR Pt. 68, ANSI/TIA/EIA 568-B, VDE 0627-603-7 or an CMCI as defined by ETSI EN 302 878-1, V1.1.1, subclause 1.2.5.

4.2 Environmental Profile and Safety

The technical specification of the present document applies under the environmental profiles and MICE classification in ANGA 100 002, subclause 4.2. Equipotential bonding of the pNTP according to KDG 1 TR 8-8 MAY be assumed for broadband cable networks under Vodafone Kabel Deutschland control.

Note: Equipotential bonding according to DIN VDE 0100-410 SHOULD NOT be assumed for all installations. As a consequence, overvoltage protection MUST NOT be assumed.

4.3 Mechanical Interface Description

See informative Annex B.

4.4 Electrical performance characteristics

The values given in ANGA 100 002, subclause 4.4 for coaxial pNTP apply. In this case the nominal rated values conditions are 24 VAC (max. 65 VAC) or 34 VDC (max. 120 VDC) (Note: see VDE 0855-1, 8.2).

5 DOCSIS 3.x Network RF characteristics

5.1 Downstream RF characteristics

5.1.1 Downstream frequency range

The Downstream Frequency Range specification at the customer's coaxial pNTP in ANGA 100 001, subclause 5.1.1 applies.

Note: CM configured for different fixed DS frequency ranges (fixed diplex filter) MUST NOT be used (frequency band selection is mutual exclusive).

The channel spacing takes into account downstream path channel bandwidths 8 MHz.for digital TV and DOCSIS QAM channels. DOCSIS 3.1 channels are OFDM channels of up to 192 MHz wide.

The DOCSIS 3.1 downstream frequency range is 110 to 1218 MHz (edge frequency).

Nominal minimum DS channel count for DOCSIS 3.0 services are given in the table below:

Table 1: Minimum DS 3.0 channel count

Network type	Nominal minimum DS channel count	Maximum DS channel count
1	16	32
2	20	32
3	32	32

Nominal minimum DS channel count for DOCSIS 3.1 services are given in the table below:

Table 2: Minimum DS 3.1 channel count

Network type	Nominal minimum DS channel count	Maximum DS channel count
1	0	0
2	> 1	2
3	> 1	2

5.1.2 Downstream RF performance

If not listed otherwise in this subclause the Downstream RF performance characteristics at the customer's coaxial pNTP in ANGA 100 001 subclause 5.1.2 apply.

The following tables define specific values different from in ANGA 100 001 subclause 5.1.2:

Table 3: Specific Downstream Performance characteristics for coaxial pNTP (type 1 networks)

Parameter	Nominal ratings and characteristics	Absolute maximum ratings and characteristics during normal operation
frequency deviation	≤ 20 kHz	N/A
ingress[1]	present	N/A
total input power	N/A	≤ 94 dB(µV)
signal tilt (full range)	N/A	≤ 16 dB
channel signal tilt	N/A	N/A
carrier level backoff between adjacent SC-QAM channels	≤ 6 dB	N/A
carrier level backoff between adjacent channels	≤ 10 dB	N/A
64 QAM signal level	50 to 67 dB(µV)	≤ 76 dB(µV)
64 QAM BER	$< 1 \times 10^{-6}$	$\leq 1 \times 10^{-4}$
64 QAM MER	≥ 27.1 dB	≥ 23 dB
256 QAM signal level	56 to 73 dB(µV)	≤ 76 dB(µV)
256 QAM BER	$< 1 \times 10^{-6}$	$\leq 1 \times 10^{-4}$
256 QAM MER	≥ 32.7 dB	≥ 29 dB

[1] see [2] in ANGA 100 001 v1.01

Table 4: Specific Downstream Performance characteristics for coaxial pNTP (type 2 networks)

Parameter	Nominal ratings and characteristics	Absolute maximum ratings and characteristics during normal operation
frequency deviation	≤ 20 kHz	N/A
ingress[1]	present	N/A
total input power	N/A	N/A
signal tilt (122/826 MHz)	N/A	≤ 10 dB
channel signal tilt	N/A	N/A
carrier level backoff between adjacent SC-QAM channels	≤ 6 dB	N/A
64 QAM signal level	50 to 67 dB(µV)	≤ 76 dB(µV)
64 QAM BER	$< 1 \times 10^{-6}$	$\leq 1 \times 10^{-4}$
64 QAM MER	≥ 27.1 dB	≥ 23 dB
256 QAM signal level	56 to 73 dB(µV)	≤ 76 dB(µV)
256 QAM BER	$< 1 \times 10^{-6}$	$\leq 1 \times 10^{-4}$
256 QAM MER	≥ 33.1 dB	≥ 29 dB
OFDM MER[2]	≥ 27 dB	≥ 24,5 dB (TBD)

[1] see [2] in ANGA 100 001 v1.01
[2] 256 QAM

Table 5: Specific Downstream Performance characteristics for coaxial pNTP (type 3 networks)

Parameter	Nominal ratings and characteristics	Absolute maximum ratings and characteristics during normal operation
frequency deviation	N/A	N/A
ingress[1]	present	N/A
total input power	< 93 dB(µV)	N/A
signal tilt (122/826 MHz)	≤ 12 dB	N/A
channel signal tilt	N/A	≤ 8 dB
group delay	≤ 100 ns	N/A
carrier level backoff between adjacent SC-QAM channels	N/A	N/A
64 QAM signal level	47 to 67 dB(µV)	N/A
64 QAM BER (pre FEC)	< 1×10^{-7} (typ. 1×10^{-8})	1×10^{-4}
64 QAM MER	≥ 26 dB (typ. 30 dB)	≥ 23 dB
256 QAM signal level	54 to 74 dB(µV)	N/A
256 QAM BER (pre FEC)	< 1×10^{-6} (typ. 1×10^{-7})	1×10^{-4}
256 QAM MER	≥ 32 dB	≥ 29 dB
OFDM MER[2]	See table [6] of [i.3] in ETSI ES 203 311-2	N/A

[1] see [2] in ANGA 100 001 v1.01
[2] In DOCSIS 3.1 OFDM technology, a modulation might be present at the pNTP that does not need to be de-modulated by the cable modem. A CMTS will address the cable modem with the most suitable modulation.

Table 4 in ANGA 100 001 is augmented by the table below.

Table 6: Micro reflections at the coaxial pNTP for type 1 and type 2 networks

time	nominal value
≤ 35 ns	-12 dBc
35 ns to 0.3 µs	-12 to -42 dBc
0.3 µs to 0.5 µs	-42 dBc

For micro reflections in type 3 networks, see ANGA 100 001, Table 4.

5.2 Upstream RF characteristics

5.2.1 Upstream Frequency Range

If not listed otherwise in this subclause the upstream frequency range at the customer's coaxial pNTP in ANGA 100 001, subclause 5.2.1 applies. The usable Frequency Range is 15 MHz to 65 MHz. The upstream spectrum used for DOCSIS operation is divided into 3.2 MHz and 6.4 MHz wide channels and OFDMA channels in the frequency range from 15 MHz to 65 MHz.

Nominal minimum US channel count for DOCSIS 3.0 services are given in the table below:

Table 7: Minimum DS 3.0 channel count

Network type	Nominal minimum DS channel count	Maximum DS channel count
1	4	4
2	4	5
3	4	5

Nominal minimum US channel count for DOCSIS 3.1 services are given in the table below:

Table 8: Minimum DS 3.1 channel count

Network type	Nominal minimum DS channel count	Maximum DS channel count
1	0	0
2	≥ 1	2
3	≥ 1	2

5.2.2 Upstream RF Performance

If not listed otherwise in this subclause the Upstream RF Performance characteristics at the customers coaxial pNTP in ANGA 100 001, subclause 5.2.2 MUST be supported. The reference channel bandwidth is 3.2 MHz. Nominal values are valid for 99.5 % of the time.

Table 9: Network Upstream Characteristics at the pNTP for type 1 and type 2 networks

Parameter	Nominal ratings and characteristics at installation time	Absolute maximum ratings and characteristics
single upstream level range	98.1 to 110 dB(µV)	≤ 114 dB(µV)
OFDM level range	N/A	≤ 125 dB(µV)
C/(N+IM)	≥ 64.5 dB	≥ 62.5 dB
MER[1]	≥ 32 dB	≥ 30 dB
AD	≤ 1.1 dB_{PP}	≤ 2.0 dB_{PP}
PD	≤ 1.1 $°_{PP}$	≤ 2.4 $°_{PP}$
[1] for 16 QAM		

Table 10: Network Upstream Characteristics at the pNTP for type 3 networks

Parameter	Nominal ratings and characteristics at installation time	Absolute maximum ratings and characteristics
upstream level range	Max total average output power of 125 dB(µV)[1]	114 dB dB(µV)
C/(N+I)[3]	N/A	≥ 71 dB[2]
BER[3]	N/A	≤ 10^{-9}
PER3[3]	N/A	≤ 10^{-8}
amplitude ripple	0.5 dB/MHz·	N/A
group delay ripple	200 ns/MHz·	N/A
carrier hum modulation	≤ -23 dBc	N/A
[1] Due to the used OFDMA modulation a range cannot be defined, only a total maximum output power [2] OPERATOR specific [3] 16 QAM in 3.2 MHz channel		

Table 11: Spurious Emissions in a 5.12 MHz upstream channel for type 1 and type 2 networks

Parameter	During Burst transmission	Between Bursts
Inband	-43 dBc	-72 dBc

For type 3 networks, the spurious emissions MUST meet table 11 of [i.3] in ETSI ES 203 311-2.

6 DOCSIS 3.x Physical Interface Requirements

The Network RF interface requirements at the customers coaxial pNTP in ANGA 100 001 and ANGA 100 002, clause 6 applies (see also subclause 4.4).

7 DOCSIS 3.x Upper Layer Requirements

7.1 MAC and Upper Layer

The MULPI interface requirements at the customer's pNTP in ANGA 100 001 and ANGA 100 002, clause 7 applies, except:

Where the NVT-ASCII character set is referenced in the CableLabs' DHCP Options Registry, ASCII graphics characters (hexadecimal 20 through 7E) MUST be used. For DOCSIS 3.1, RMVI Sub-Options MUST be present[1].

The following minimum requirements are applicable

- For type 1 and type 2 networks at least 8 upstream service flows MUST be supported, 4 of which can be UGS-only.

7.2 Security Layer

- Compliance with CM-SP-SECv3.0-I15-130808 with the exception of the requirements defined in EuroDOCSIS BPI+ requirements MUST be accomplished.
- Certificate requirements are defined in EuroDOCSIS BPI+; requirements specified in this document take precedence over requirements in CM-SP-SECv3.0 or ETSI ES 203 311-6.
- For DOCSIS 3.1 services, ANGA 100 002, clause 8 applies.

7.3 OSS Layer

Compliance with CM-SP-OSSIv3.0MUST be accomplished. For DOCSIS 3.1 services, ANGA 100 002 clause 7 applies.

Note: SNMP MAY be used.

7.4 Registration and Provisioning

During registration cable modems will receive a generic configuration file with maximum sustained traffic rates for raw internet access in bit/s (gross IP service data rate) considering SI decimal prefixes. All network provided channels MUST be supported to achieve the maximum configurable traffic rate per network segment.

Settings included will be:

- eRouter initialization Mode, see TLV 202; all possible values MUST be supported
- US packet class + DS packet class with corresponding US Service Flows and DS Service Flows for separation of voice based traffic and best effort traffic
- SNMP access communities

For type 3 networks, see VOICE regarding dynamic service flows and MTA initialization.

Note: For minimum and maximum channel counts see subclauses 5.1.1 and 5.2.1.

[1] contact Volker of CL-RMVI-WP for more information.

7.5 Console Access

Requirements in Chapter 9 of CM-SP-OSSIv3.0 MUST be implemented.

Annex A Example pRMCD for type A pNTP

pRMCD with IEC 61169-24 screw type F connectors SHOULD NOT be used and MAY be accompanied by a plastic torque handle to achieve the nominal tightening torque at type A pNTP for technically correct installation (see ANGA 100 001, subclause 4.3).

The screening effectiveness requirements for pRMCD in the VF KD network depend on the capabilities of the demodulator within the cable modem and the physical parameters like return loss and the length of the pRMCD itself.

Calculated example values for the minimum required screening effectiveness of pRMCD within the VF KD network are given in the table below for an external disturbance field strength of 120 dB(µV/m) (EN 55035).

Table 12: Calculated screening effectiveness of pRMCD

Frequency [MHz]	Value [dB]
30 to 80	75
698 (MER_{CM}=27 @64 QAM)	74
546 (MER_{CM}=32 @256 QAM)	76

Annex B Mechanical Interface description (informative)

The requirements for the mechanical coaxial connector with socket centre contact and the connection requirements at a customer's pNTP in ANGA 100 001, subclause 4.3 for a type A pNTP, IEC 61169-2 for type B pNTP and WN 744-747 for type D pNTP apply.

Annex C Firmware updates (informative)

In type 1,2 and type 3 networks CVC information is not included in the bootfile. DOCSIS compliant Secure Software Download being referenced in [i.1] of ETSI ES 203 311-3; Chapter 12.1, [i.1] of ETSI ES 203 311-4; Chapter 8.2.3 and [i1] of ETSI ES 203 311-6; Chapter 14 will not be triggered.

Recommendation:
It is recommended, that the general idea of validation of the trusted source for the software-image will still be in place for locally triggered software updates.
This may be achieved by only providing manufacturer CVC certified software-images and adapt the process of validation described in [i1] of ETSI ES 203 311-6; Chapter 14 or CL-SP-sRouter to a local process.

Annex D Higher Level Protocol Data (informative)

Higher level protocols that require logical instances make use of the residential gateway routing capability of the cable modem. This clause describes the interpretation of the data that may flow between the physical interface beyond the cable modem and associated systems within the Vodafone core network.

Note: Performance characteristics such as timing and the data flow at the customer facing interface of the cable modem are out of scope of this interface specification (see BNetzA 01).

Annex D.1 MTA Initialization

Vodafone will not provide MTA-bootfiles and provisioning of any MTA as described in the Packetcable specification. Also MAX-CPE will always be value of 1 to allow one client to receive Public IP-address.

To indicate to the cable modem non-support of MTA, DHCP Server will always include DHCP Option 122 Sub-Option 1 with value “0.0.0.0” as described in Packetcable specification.

If the CM DHCP option code 122 suboption 1 contains a DHCP server of value of 0.0.0.0, then the MTA must not attempt to provision and must remain dormant.

Annex D.2 IP-addresses for devices behind the cable modem

IP-capable devices/interfaces behind the cable modem may be assigned with IP configuration in the following possible scenarios:

1. IPv4-only configuration (deprecated) – each allowed device/interface will receive a native IPv4 address and other corresponding configuration to use for inbound/outbound IPv4-based traffic.
2. Dual-Stack (deprecated) – each allowed device/interface will receive a native IPv4 address and a global IPv6 address as well as a delegated prefix in the range of /56 to /64 to use for inbound/outbound IPv4- and IPv6-based traffic respectively.
3. Dual-Stack Lite – each allowed device/interface will receive a global IPv6 address as well as a delegated prefix in the range of /56 to /64 to use for inbound/outbound IPv6-based traffic. Also, DS-Lite configuration will be assigned to the device/interface for IPv4-based traffic.
4. RIPv2 configuration (under consideration) – each allowed device/interface will request one IPv4 address and other corresponding configuration to use for inbound/outbound IPv4-based traffic.

Annex D.2.1 DHCPv4

The following information must be requested by the DHCP client and will then be provided by DHCP server:

- IP-address
- DNS-server
- Subnet mask
- Gateway address (router)

Annex D.2.2 DHCPv6

The following information must be requested by the DHCP client and thus will be provided by DHCPv6

- IPv6-address
- DNS-server
- DS-Lite option (if requested see section 8.3 below)
- Delegated prefix

To avoid a configuration conflict, the configuration of the devices/interfaces behind the cable modem must be done via respective DHCP and other procedures such as static configuration must not be used.

Annex D.2.3 DS-Lite

Dual-Stack Lite is implemented according to RFC 6333.

The FQDN of the AFTR device is provided to the client-router according to RFC 6334.

Annex D.2.4 Prefix delegation

IPv6 Prefix delegation according to RFC3633 must be supported.

Annex D.2.5 RIPv2

For type 3 networks, Routing Information Protocol Version 2 may be implemented according to RFC 2453 and extends the Routing Information Protocol as defined in RFC 1058. It requires RIP Version 2 MIB extensions according to RFC 1389 and security implementation according to RFC 1389.

Annex E Example cable modem Downstream frequency range (informative)

A successful implementation of subclause 5.1.1 requires RCP CLAB-8M-016 (16 downstream channels, extended up to 1 GHz) or CLAB-8M-024 (24 DS channels, extended to 1 GHz). For speeds exceeding 400 Mbit/s, OFDM must be used.

Note: A 16 DS-channel CM may bond to 8 channels if no 16 channel bonding group is available.

Annex F Security Recommendations (informative)

Security relevant exclusion requirements can be found in BSI 01 “Testkonzept für Breitbandrouter” (e.g. table 33). Vodafone Kabel Deutschland accepts security measures according to CL-SP-sRouter-I02-170111, subclause 13.3 through 13.5.

History

Document history		
V1.0	21.07.2016	Ready for publishing
V1.01	22.07.2016	Version to be published
V1.02	02.08.2016	Editorial changes
V1.03	26.04.2018	Major changes: AC/DC and RF performance characteristics, clause 9 and subclauses 4.2, 4.4, 7.1
V1.04	13.12.2018	Additional requirements for DS 3.1 and CMCI Interface (clause 4). New security recommendations in Annex C.
V2.00	19.11.2020	Merger of UM TS 411a and VF Vodafone Kabel Deutschland pNTP Interface Specification Version 1.4. Remove support for devices behind the cable modem (clause 8, type C interface). Support for additional pNTP connectors by new Annex for the mechanical interface. New Annex inserted for higher level data. Added informal RIPv2 protocol and MTA initialization. Renaming of document.