

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

TLN WRO Specification type Document

Formatted: Font: 26 pt, Bold, English (United Kingdom)

< Specification and Certification BB IP
Interconnect >

Formatted: Font: 20 pt, Italic, English (United Kingdom)



Formatted: Font: 16 pt, Bold, Underline, English (United States)

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Document Housekeeping

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

Document Category and type

CAT	TYPE	DOC ID	Comment
Broadband	SPEC	TLN_WRO_TA_B_S_PAAB	Specification type documents (-SPEC) are documents specifying logical / physical interfaces / protocols, etc., to which AO equipment/systems need to comply

Formatted Table

Document Status

EDITION	DATE	STATUS
1.0	09.10.2014	Final
2.0	29.12.2018	Final

Formatted Table

Legal Disclaimer

"This document constitutes an integral part of the Telenet Reference Offer for Basic TV / IDTV / BB and should be fully complied with by the Beneficiary at all times. Non compliance, incomplete or deviating application of this document by the Beneficiary, or his authorized agent, results in the suspension and ultimately termination of the Contract between Telenet and the Beneficiary.

At any time this document is susceptible to change by Telenet, Regulator's decision or by decision of a relevant judicial authority. Changes to this document will, depending on the circumstances for change, be appropriately notified to the Beneficiary and published on the Telenet website.

Telenet has appealed the CRC decisions of the VRM, BIPT and CSA of 29 June 2018 concerning the market analysis of the broadcasting and broadband market in Belgium and it consequently reserves all its rights in relation to this document." "This document constitutes an integral part of the Telenet Reference Offer for Basic TV / IDTV / BB and should be fully complied with by the Beneficiary at all times. Non compliance, incomplete or deviating application of this document by the Beneficiary, or his authorized agent, results in the suspension and ultimately termination of the Contract between Telenet and the Beneficiary.

At any time this document is susceptible to change by Telenet, Regulator's decision or by decision of a relevant judicial authority. Changes to this document will, depending on the circumstances for change, be appropriately notified to the Beneficiary and published on the Telenet website.

Telenet has appealed the CRC decisions of the VRM, BIPT and CSA of 1 July 2011 concerning the market analysis of the broadcasting market in Belgium and it consequently reserves all its rights in relation to this document."

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Table of Contents

1	Abstract.....	65
2	AO IP Interconnect Solution Functional Description	76
3	AO IP Interconnect Solution Functional Requirements	76
3.1	GENERAL ARCHITECTURE	76
3.2	REGIONAL INTERCONNECT ZONES	87
3.2.1	Regional Interconnect Zones General Requirements	87
3.2.2	Regional Interconnect Zones Geographical View.....	87
3.2.3	Regional Interconnect Zones List of Head-Ends	98
3.2.4	Regional Interconnect Zones Traffic Routing Rules	1140
3.3	AO INTERCONNECT LINKS.....	1140
3.3.1	AO Interconnect Links General Requirements	1140
3.3.2	AO Interconnect Links Physical Connections	1140
3.3.3	AO Interconnect Links Traffic Routing	1241
3.3.4	AO Interconnect Links Redundancy	1241
3.4	AO IP RANGE/ADDRESS SPACE	1241
3.4.1	AO IP Range/Address Space General Requirements	1241
3.4.2	AO IP Pool Management	1241
3.5	WHOLESALE BROADBAND NETWORK GATEWAY (WS-BNG)	1342
3.5.1	WS-BNG General Requirements	1342
3.5.2	WS-BNG Functions and Protocols.....	1342
3.5.3	WS-BNG Accounting.....	1342
3.6	AO DATA AND MANAGEMENT LINKS	1342
3.6.1	AO Data Link	1342
3.6.2	AO Management Link	1342
3.7	AO TRAFFIC MANAGEMENT	1342
3.7.1	AO Traffic Management General Description.....	1342
3.7.2	AO Traffic Management General Architecture	1443
3.8	RESTRICTIONS	1443
3.9	OPERATIONAL PROCEDURES	1543
4	Certification for interconnection between AO IP backbone network and the TLN network...	1645
4.1	INTRODUCTION	1645
4.2	TEST SCORE CARD.....	1645
1	Abstract.....	5
2	AO IP Interconnect Solution Functional Description	6
3	AO IP Interconnect Solution Functional Requirements	6
3.1	General Architecture	6
3.2	Regional Interconnect Zones	7
3.2.1	Regional Interconnect Zones General Requirements	7
3.2.2	Regional Interconnect Zones Geographical View	7
3.2.3	Regional Interconnect Zones List of Head-Ends	8
3.2.4	Regional Interconnect Zones Traffic Routing Rules	10
3.3	AO Interconnect Links	10
3.3.1	AO Interconnect Links General Requirements	10
3.3.2	AO Interconnect Links Physical Connections	10
3.3.3	AO Interconnect Links Traffic Routing	11
3.3.4	AO Interconnect Links Redundancy	11
3.4	AO IP Range/Address Space	11
3.4.1	AO IP Range/Address Space General Requirements	11
3.4.2	AO IP Pool Management	11
3.5	Wholesale Broadband Network Gateway (WS-BNG)	11
3.5.1	WS-BNG General Requirements	11
3.5.2	WS-BNG Functions and Protocols	12
3.5.3	WS-BNG Accounting	12
3.6	AO Data and Management Links	12
3.6.1	AO Data Link	12
3.6.2	AO Management Link	12
3.7	AO Traffic Management	12

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

3.7.1	AO Traffic Management General Description	12
3.7.2	AO Traffic Management General Architecture	13
3.8	Restrictions	13
3.9	Operational Procedures	13
4	Certification for interconnection between AO IP backbone network and the TLN network	15
4.1	Introduction	15
4.2	Test score card	15

Table of Figures

Figure 3-1: General Architecture	76
Figure 3-2: Regional Interconnect Zones	87
Figure 3-3: Physical Locations RPOI	98
Figure 3-4: List of Head-ends	98
Figure 3-5: Postal codes for Head-Ends	109
Figure 3-6: Postal codes for Head-Ends	109
Figure 3-7: Postal codes for Head-Ends	1140
Figure 3-8: Traffic Management Architecture	1443

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: 18 pt, Underline, English (United Kingdom), Kern at 14 pt

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

List of Appendixes

This document may refer to further detailed documents that are added in Appendixes to this document.

A reference to an appendix is in this document highlighted with grey background.

A. Appendix A, <APP_B_S_PAAB_A> contains:

1) Appendix A - <AO Network Interface>

The appendix (es) referred to in this section List of Appendixes, contain(s) detailed technical information which is only relevant when a Beneficiary enters in a concrete implementation project to become Beneficiary of the Telenet Reference Offer and/or Annex.

Formatted: Font: +Body (Calibri), 8 pt, English (United States)

List of References

This document may refer to external documents or information sources.

A reference to an external document or information source is in this document highlighted with grey background.

The list of referred external documents or information sources in this document:

Reference 1: TLN_WRO_TA_G_C_PAAA - General Certification Procedures

Reference 2: TLN_WRO_TA_T_T_PAAA - Co-location and physical interconnect

Restricted information

This document may contain sections that are not public information and that can be made available only to parties that have executed specific NDA's.

Information that is subject to NDA is marked in this document as follows:

NDA
NDA

The information in this text box is available only under NDA

Before conversion to PDF format for publication of the document, the information will be made unreadable by converting the background of the text box to black.

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

1 Abstract

This document provides the requirement specifications to which the physical and logical level backbone network interconnections must comply in order to provide an IP interconnect system between the AO and TLN IP networks carrying traffic in the data, control and OAM plane, supporting all services of the TLN WRO. It also specifies routing, geographical traffic aspects, redundancy and fail-over considerations.

Generic sections specifying certification procedures applicable to all AO CPE or network equipment that will be connected to the TLN network are described in General Certification Procedures Document TLN_WRO_TA_G_C_PAAA - General Certification Procedures.

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

2 AO IP Interconnect Solution Functional Description

- (1) This section describes the physical and logical backbone network interconnections on a functional level to which the solution must comply in order to provide an IP interconnect system between the AO and TLN IP networks carrying traffic in the data, control and OAM plane, supporting all services of the TLN WRO. It also specifies routing, geographical traffic aspects, redundancy and fail-over considerations.
- (2) Further it also discusses traffic management policies on the interconnect links as well as handling regional aspects of AO end-user IP address allocation techniques.

3 AO IP Interconnect Solution Functional Requirements

3.1 General Architecture

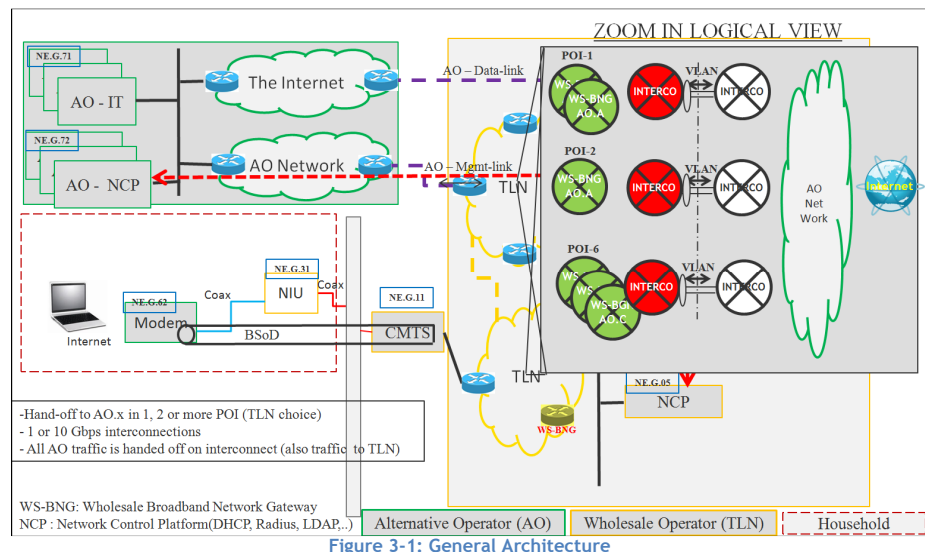


Figure 3-1: General Architecture

- (3) As shown in the figure above, AO CPE Traffic is transparently switched over the CMTS (BSoD L2VPN). From there the traffic is switched to a Wholesale Broadband Network Gateway (WS-BNG). The WS-BNG then routes traffic towards the correct AO interconnect link.

- (3)(4) -From the WS-BNG all BB traffic All traffic is forced over that AO interconnect link. Traffic originating from the AO domain, and with as destination an end-user of the AO, will need to be routed towards the correct WS-BNG over the corresponding interconnect link. From the WS-BNG the traffic will be sent towards the AO end-user.

- (4)(5) The "AO-Data link" is used to carry AO CPE's US/DS data and control plane traffic. The "AO-Mgmt-link", which will be realized as an IP-VPN or IPSec type connection is used to carry management type of traffic like CDR file transfers, configuration file uploads, etc. between AO and TLN.

3.2 Regional Interconnect Zones

(5)(6) There are 5 Regional Interconnect Zones (RIZ) which correspond to the location of the 5 TLN switching Offices (SO). Those RIZ are identified by a list of HE which together constitutes a RIZ. Each HE serves a number of communities ~~that are identified by postal zip codes~~.

3.2.1 Regional Interconnect Zones General Requirements

(6)(7) Telenet operates in 5 Regional Interconnect Zones (RIZ) and can provide services to the end users in each zone. An AO must have interconnection to at least one of the five RPOI's.

3.2.2 Regional Interconnect Zones Geographical View

(7)(8) An approximate Geographical coverage is view for the 5 TLN RIZ can be seen in below figure.

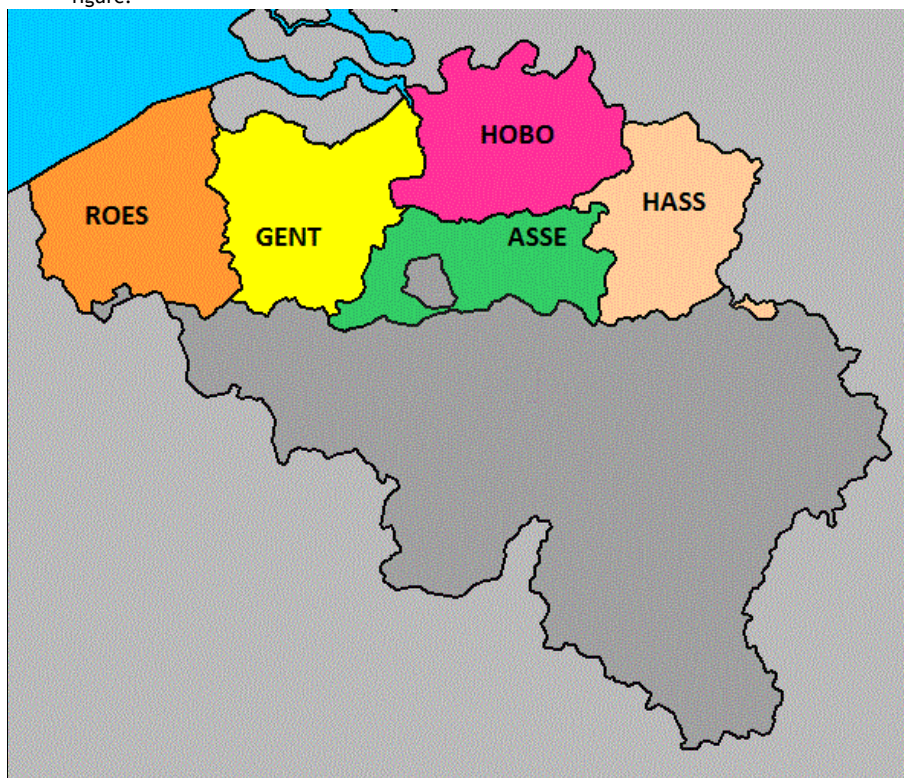


Figure 3-2: Regional Interconnect Zones

(9) Also the physical Locations for 5 the RPOI can be seen in below figure.

(10) The addresses of the RPPOI's are respectively:

- Hoboken: Boombekelaan 14, 2660 Hoboken
- Asse: Brusselsesteenweg 464, 1730 Asse
- Gent: Bomastraat 11, 9000 Gent
- Hasselt: Gouverneur Verwilghensingel 32, 3500 Hasselt

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font color: Accent 1

Formatted: Font color: Accent 1

Formatted: Highlight

Formatted: Font: 10 pt, Font color: Auto, English (United States)

Formatted: Highlight

Formatted: Bulleted + Level: 1 + Aligned at: 1,9 cm + Indent at: 2,54 cm

Formatted: Font: 10 pt, Font color: Auto, English (United States)

Formatted: Highlight

Formatted: Font: 10 pt, Font color: Auto, English (United States)

Formatted: Highlight

Formatted: Font: English (United States)

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

- [Roeselare: Hof ter Weze 10, 8800 Roeselare](#)

(8)



Figure 3-3: Physical Locations RPOI

3.2.3 Regional Interconnect Zones List of Head-Ends

(9)(11) The lists of Head-Ends for each of the five Regional Interconnect Zones (ASSE, GENT, HASS, HOB0 and ROES) are as shown below.

Postcode	Name	Site Type	SO	Postcode	Name	Site Type	SO	Postcode	Name	Site Type	SO	Postcode	Name	Site Type	SO
1730	ASSE	HE	ASSE	9000	GENT	HE	GENT	3350	WOMMERSOM	HE	HASS	8900	IEPER	HE	ROES
1650	BEERSEL	HE	ASSE	9080	LOCHRISTI	HE	GENT	2340	BEERSE	HE	HOB0	8680	KOEKELARE	HE	ROES
1785	BRUSSEGEEM	HE	ASSE	9100	SINT-NIKLAAS	HE	GENT	2440	GEEL	HE	HOB0	8500	KORTRIJK	HE	ROES
1000	BRUSSEL	HE	ASSE	9620	ZOTTEGEM	HE	GENT	2270	HERENTHOUT	HE	HOB0	9090	MELLE	HE	ROES
3080	DUISBURG	HE	ASSE	3200	AARSCHOT	HE	HASS	2660	HOBOKEN	HE	HOB0	8930	MENEN	HE	ROES
1540	HERFELINGEN	HE	ASSE	3380	BERINGEN	HE	HASS	2540	HOVE	HE	HOB0	8430	MIDDELKERKE	HE	ROES
1750	LENNIK	HE	ASSE	3740	BILZEN	HE	HASS	2800	MECHELEN	HE	HOB0	9700	OUDENAARDE	HE	ROES
3000	LEUVEN	HE	ASSE	3600	GENK	HE	HASS	2900	SCHOTEN	HE	HOB0	8800	ROESELARE	HE	ROES
1820	PERK	HE	ASSE	3500	HASSELT	HE	HASS	2940	STABROEK	HE	HOB0	8460	ROKSEM	HE	ROES
6470	RANCE	HE	ASSE	3680	MAASEIK	HE	HASS	2300	TURNHOUT	HE	HOB0	8880	SINT-ELOOIS-WINKEL	HE	ROES
1030	SCHAARBEK	HE	ASSE	3000	OVERPELT	HE	HASS	2980	ZOERSEL	HE	HOB0	8630	VEURNE	HE	ROES
3000	UPC-LEUVEN	HE	ASSE	3390	SINT-JORIS-WINGE	HE	HASS	8000	BRUGGE	HE	ROES	8790	WAREGEM	HE	ROES
9200	DENDERMONDE	HE	GENT	3800	SINT-TRUIDEN	HE	HASS	9900	EEKLO	HE	ROES				

SO	Name	SiteType	SO	Name	SiteType	SO	Name	SiteType	SO	Name	SiteType
ASSE	Beersel	HE	GENT	St Niklaas	HE	HOB0	Beerse	HE	ROES	Ieper	HE
ASSE	Brussegem	HE	GENT	Zottegem	HE	HOB0	Geel	HE	ROES	Koekelare	HE
ASSE	Duisburg	HE	HASS	Aarschot	HE	HOB0	Herenthout	HE	ROES	Kortrijk	HE
ASSE	Herfelingen	HE	HASS	Beringen	HE	HOB0	Hoboken	HE	ROES	Melle	HE
ASSE	Lennik	HE	HASS	Bilzen	HE	HOB0	Hove	HE	ROES	Menen	HE
ASSE	Leuven	HE	HASS	Genk	HE	HOB0	Mechelen	HE	ROES	Middelkerke	HE
ASSE	Perk	HE	HASS	Hasselt	HE	HOB0	Schoten	HE	ROES	Oudenaarde	HE
ASSE	Schaarbeek	HE	HASS	Maaseik	HE	HOB0	Stabroek	HE	ROES	Roeselare	HE
GENT	Aalst	HE	HASS	Overpelt	HE	HOB0	Turnhout	HE	ROES	Roksem	HE
GENT	Dendermonde	HE	HASS	St Joris Winge	HE	HOB0	Zoersel	HE	ROES	St Eloo	HE
GENT	Gent	HE	HASS	St Truiden	HE	ROES	Brugge	HE	ROES	Veurne	HE
GENT	Lochristi	HE	HASS	Wommersom	HE	ROES	EEKLO	HE	ROES	Waregem	HE

Figure 3-4: List of Head-ends

Formatted Table**Formatted:** Font: Bold, English (United Kingdom)**Formatted:** Font: Bold, English (United Kingdom)**Formatted:** Font: 10 pt, Font color: Auto**Formatted:** Font: 10 pt**Formatted:** Indent: Left: 1,27 cm, No bullets or numbering**Formatted:** Font color: Accent 1**Formatted:** Font color: Accent 1**Formatted:** Font color: Accent 1**Formatted:** Font color: Accent 1**Formatted:** Font: (Default) Arial, Bold, English (United Kingdom)**Formatted:** Do not check spelling or grammar**Formatted:** Do not check spelling or grammar**Formatted:** Font: (Default) Arial, Bold, English (United Kingdom)

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

(40)(12) Postal zip codes of communities belonging to the service area for each Head-End are shown below.

HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC
Aalst	1730	Aarschot	3202	Beringen	2430	Bilzen	3740	Brussegem	1730	Duisburg	1560	Eeklo	9910	Geel	2470
Aalst	1790	Aarschot	3270	Beringen	2431	Bilzen	3742	Brussegem	1731	Duisburg	1930	Eeklo	9920	Geel	2480
Aalst	9280	Aarschot	3271	Beringen	3510	Bilzen	3746	Brussegem	1745	Duisburg	1932	Eeklo	9921	Geel	2490
Aalst	9300	Aarschot	3272	Beringen	3530	Bilzen	3770	Brussegem	1785	Duisburg	1933	Eeklo	9930	Geel	2491
Aalst	9308	Beerse	2340	Beringen	3540	Brugge	8000	Brussegem	1850	Duisburg	1950	Eeklo	9931	Geel	2800
Aalst	9310	Beerse	2350	Beringen	3545	Brugge	8020	Brussegem	1851	Duisburg	1970	Eeklo	9932	Genk	3530
Aalst	9320	Beersel	1500	Beringen	3550	Brugge	8200	Brussegem	1852	Duisburg	2800	Eeklo	9940	Genk	3600
Aalst	9340	Beersel	1501	Beringen	3560	Brugge	8210	Brussegem	1853	Duisburg	3040	Eeklo	9950	Genk	3665
Aalst	9400	Beersel	1502	Beringen	3580	Brugge	8211	Brussegem	1860	Duisburg	3060	Eeklo	9960	Genk	3668
Aalst	9401	Beersel	1600	Beringen	3581	Brugge	8300	Brussegem	1861	Duisburg	3061	Eeklo	9961	Genk	3960
Aalst	9402	Beersel	1601	Beringen	3582	Brugge	8301	Dendermonde	1745	Duisburg	3070	Eeklo	9968	Genk	9000
Aalst	9403	Beersel	1602	Beringen	3583	Brugge	8310	Dendermonde	1785	Duisburg	3071	Eeklo	9970	Genk	9030
Aalst	9404	Beersel	1620	Beringen	3945	Brugge	8340	Dendermonde	1840	Duisburg	3078	Eeklo	9971	Genk	9031
Aalst	9406	Beersel	1630	Beringen	3970	Brugge	8370	Dendermonde	1861	Duisburg	3080	Eeklo	9980	Genk	9032
Aalst	9420	Beersel	1640	Beringen	3971	Brugge	8377	Dendermonde	2830	Duisburg	3090	Eeklo	9981	Genk	9040
Aalst	9450	Beersel	1650	Beringen	3980	Brugge	8380	Dendermonde	2870	Eeklo	8340	Eeklo	9982	Genk	9041
Aalst	9451	Beersel	1651	Bilzen	3590	Brugge	8400	Dendermonde	2880	Eeklo	9000	Eeklo	9988	Genk	9042
Aalst	9470	Beersel	1652	Bilzen	3620	Brugge	8420	Dendermonde	2890	Eeklo	9042	Eeklo	9990	Genk	9050
Aalst	9472	Beersel	1653	Bilzen	3621	Brugge	8421	Dendermonde	9200	Eeklo	9060	Eeklo	9991	Genk	9051
Aalst	9473	Beersel	1654	Bilzen	3690	Brugge	8450	Dendermonde	9220	Eeklo	9800	Eeklo	9992	Genk	9052
Aarschot	2230	Beersel	1730	Bilzen	3700	Brugge	8730	Dendermonde	9250	Eeklo	9850	Geel	2260	Genk	9060
Aarschot	2800	Beersel	1740	Bilzen	3717	Brugge	9990	Dendermonde	9255	Eeklo	9880	Geel	2400	Genk	9080
Aarschot	3200	Beersel	1741	Bilzen	3730	Brussegem	1082	Dendermonde	9280	Eeklo	9881	Geel	2440	Genk	9090
Aarschot	3201	Beersel	1742	Bilzen	3732	Brussegem	1702	Dendermonde	9310	Eeklo	9900	Geel	2450	Genk	9820

Figure 3-5: Postal codes for Head-Ends

Formatted: Font color: Accent 1

Formatted: Font color: Accent 1

HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC
Herenthout	2200	Hervelingen	1760	Hove	2500	Ieper	8908	Kortrijk	8511	Lennik	1770	Lochristi	9180	Mechelen	2570
Herenthout	2220	Hoboken	2000	Hove	2520	Ieper	8920	Kortrijk	8520	Leuven	3000	Lochristi	9185	Mechelen	2580
Herenthout	2221	Hoboken	2018	Hove	2530	Ieper	8950	Kortrijk	8540	Leuven	3001	Lochristi	9230	Mechelen	2650
Herenthout	2222	Hoboken	2020	Hove	2531	Ieper	8951	Kortrijk	8550	Leuven	3010	Lochristi	9240	Mechelen	2800
Herenthout	2223	Hoboken	2030	Hove	2540	Ieper	8952	Kortrijk	8551	Leuven	3012	Lochristi	9260	Mechelen	2801
Herenthout	2230	Hoboken	2040	Hove	2547	Ieper	8953	Kortrijk	8552	Leuven	3018	Lochristi	9270	Mechelen	2811
Herenthout	2235	Hoboken	2050	Hove	2550	Ieper	8954	Kortrijk	8553	Leuven	3020	Lochristi	9290	Mechelen	2812
Herenthout	2250	Hoboken	2060	Hove	2560	Ieper	8956	Kortrijk	8554	Leuven	3078	Maaseik	3630	Mechelen	2820
Herenthout	2260	Hoboken	2550	Hove	2570	Ieper	8957	Kortrijk	8572	Leuven	3110	Maaseik	3631	Mechelen	2830
Herenthout	2270	Hoboken	2600	Hove	2600	Ieper	8958	Kortrijk	8580	Leuven	3111	Maaseik	3640	Mechelen	2860
Herenthout	2275	Hoboken	2620	Hove	2610	Ieper	8970	Kortrijk	8581	Leuven	3118	Maaseik	3650	Mechelen	2861
Herenthout	2460	Hoboken	2627	Hove	2630	Ieper	8972	Kortrijk	8582	Leuven	3150	Maaseik	3660	Mechelen	3020
Herenthout	2580	Hoboken	2640	Hove	2640	Ieper	8978	Kortrijk	8583	Leuven	3300	Maaseik	3670	Mechelen	3120
Herenthout	2590	Hoboken	2660	Hove	2650	Ieper	8980	Kortrijk	8587	Leuven	3320	Maaseik	3680	Mechelen	3140
Herenthout	3120	Hoboken	2830	Hove	2840	Koekelare	8470	Lennik	1602	Leuven	3321	Maaseik	3960	Mechelen	3150
Herenthout	3140	Hoboken	2840	Hove	2850	Koekelare	8600	Lennik	1700	Leuven	3360	Mechelen	1840	Mechelen	3190
Hervelingen	1540	Hoboken	2845	Hove	9100	Koekelare	8610	Lennik	1701	Leuven	3370	Mechelen	1850	Mechelen	3191
Hervelingen	1541	Hoboken	2850	Ieper	8640	Koekelare	8680	Lennik	1702	Lochristi	9040	Mechelen	1880	Melle	9032
Hervelingen	1570	Hove	2018	Ieper	8647	Koekelare	8810	Lennik	1703	Lochristi	9041	Mechelen	1910	Melle	9050
Hervelingen	1670	Hove	2150	Ieper	8650	Koekelare	8820	Lennik	1730	Lochristi	9042	Mechelen	1980	Melle	9070
Hervelingen	1671	Hove	2160	Ieper	8900	Koekelare	8830	Lennik	1740	Lochristi	9060	Mechelen	1981	Melle	9090
Hervelingen	1673	Hove	2170	Ieper	8902	Kortrijk	8500	Lennik	1750	Lochristi	9070	Mechelen	1982	Melle	9230
Hervelingen	1674	Hove	2280	Ieper	8904	Kortrijk	8501	Lennik	1760	Lochristi	9080	Mechelen	2223	Melle	9260
Hervelingen	1755	Hove	2288	Ieper	8906	Kortrijk	8510	Lennik	1761	Lochristi	9160	Mechelen	2500	Melle	9340

Figure 3-6: Postal codes for Head-Ends

Formatted: Font color: Accent 1

Formatted: Font color: Accent 1

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC	HE	AP_PC
Oudenaarde	9690	Perk	1831	Schoten	2060	Sint-Joris-Winge	3128	Sint-Niklaas	9170	Turnhout	2321	Waregem	8700
Oudenaarde	9700	Perk	1850	Schoten	2100	Sint-Joris-Winge	3130	Sint-Niklaas	9190	Turnhout	2322	Waregem	8710
Oudenaarde	9750	Perk	1910	Schoten	2110	Sint-Joris-Winge	3200	Sint-Niklaas	9250	Turnhout	2323	Waregem	8720
Oudenaarde	9770	Roeselare	8480	Schoten	2140	Sint-Joris-Winge	3210	Sint-Truiden	3540	Turnhout	2328	Waregem	8740
Oudenaarde	9771	Roeselare	8740	Schoten	2520	Sint-Joris-Winge	3211	Sint-Truiden	3700	Turnhout	2330	Waregem	8755
Oudenaarde	9772	Roeselare	8750	Schoten	2600	Sint-Joris-Winge	3212	Sint-Truiden	3720	Turnhout	2360	Waregem	8760
Oudenaarde	9790	Roeselare	8755	Schoten	2900	Sint-Joris-Winge	3220	Sint-Truiden	3800	Turnhout	2370	Waregem	8770
Oudenaarde	9800	Roeselare	8800	Schoten	2910	Sint-Joris-Winge	3221	Sint-Truiden	3803	Turnhout	2380	Waregem	8780
Oudenaarde	9810	Roeselare	8810	Schoten	2930	Sint-Joris-Winge	3290	Sint-Truiden	3806	Turnhout	2381	Waregem	8790
Oudenaarde	9870	Roeselare	8840	Schoten	2950	Sint-Joris-Winge	3293	Sint-Truiden	3830	Turnhout	2382	Waregem	8791
Oudenaarde	9890	Roeselare	8850	Schoten	2960	Sint-Joris-Winge	3294	Sint-Truiden	3832	Turnhout	2387	Waregem	8792
Overpelt	3900	Roeselare	8851	Schoten	2970	Sint-Joris-Winge	3390	Sint-Truiden	3840	Turnhout	2470	Waregem	8793
Overpelt	3910	Roeselare	8870	Schoten	9111	Sint-Joris-Winge	3391	Sint-Truiden	3850	Turnhout	2990	Waregem	8850
Overpelt	3920	Roeselare	8890	Sint-Eloois-Winkel	8500	Sint-Joris-Winge	3460	Sint-Truiden	3870	Veurne	8630	Waregem	9790
Overpelt	3930	Roksem	8400	Sint-Eloois-Winkel	8530	Sint-Joris-Winge	3461	Sint-Truiden	3890	Veurne	8647	Waregem	9800
Overpelt	3940	Roksem	8420	Sint-Eloois-Winkel	8531	Sint-Joris-Winge	3560	Sint-Truiden	3891	Veurne	8660	Waregem	9870
Overpelt	3950	Roksem	8460	Sint-Eloois-Winkel	8560	Sint-Niklaas	2070	Stabroek	2180	Veurne	8670	Wommersom	3350
Overpelt	3990	Roksem	8470	Sint-Eloois-Winkel	8880	Sint-Niklaas	9100	Stabroek	2920	Veurne	8690	Wommersom	3380
Perk	1702	Roksem	8490	Sint-Eloois-Winkel	8880	Sint-Niklaas	9111	Stabroek	2940	Veurne	8691	Wommersom	3381
Perk	1785	Roksem	8680	Sint-Joris-Winge	3050	Sint-Niklaas	9112	Stabroek	2950	Waregem	8540	Wommersom	3384
Perk	1800	Schoten	2000	Sint-Joris-Winge	3051	Sint-Niklaas	9120	Stabroek	2990	Waregem	8570	Wommersom	3400
Perk	1818	Schoten	2018	Sint-Joris-Winge	3052	Sint-Niklaas	9130	Turnhout	2300	Waregem	8572	Wommersom	3401
Perk	1820	Schoten	2030	Sint-Joris-Winge	3053	Sint-Niklaas	9140	Turnhout	2310	Waregem	8573	Wommersom	3404
Perk	1830	Schoten	2040	Sint-Joris-Winge	3054	Sint-Niklaas	9150	Turnhout	2320	Waregem	8581	Wommersom	3440

Figure 3-7: Postal codes for Head-Ends

3.2.4 Regional Interconnect Zones Traffic Routing Rules

AO modems (or STB's) will be unable to get service, if they are moved in another location than where they were initially installed. In case of a move for AO end-user Modem (or STB), the CM (or STB) needs to be re-registered in the TLN NCP for the new specific region.

3.3 AO Interconnect Links

3.3.1 AO Interconnect Links General Requirements

~~(11)~~(13) Telenet delivers all aggregated BB traffic of AO end-users towards AO via TLN to AO interconnect link, distributed over 5 RPOI's based on geographic origin of traffic.

~~(12)~~(14) Details over the interface are documented in [Appendix A - <AO Network Interface>](#).

3.3.2 AO Interconnect Links Physical Connections

~~(15)~~ AO to TLN interconnectivity is established in minimum 1 of the 5 regional POI's (AO-RPOI) which are physically based in the Telenet switching office locations (Asse, Hoboken, Gent, Roeselare, Hasselt), where the WS-BNG will be located. Telenet offers single or multiple 1Gbps ~~or~~, 10 Gbps ~~or~~ 100 Gbps link connections. If the link between AO and TLN is a combination of multiple physical links, LAG support is required with LACP.

~~(13)~~
~~(14)~~(16) The first RPOI the AO needs to connect to the RPOI in one of the regions to be selected by Telenet.

~~(15)~~(17) Initially, there might be a single WS-BNG (possibly redundant) that will be used for all five regions. There will be a logical separation per region on the WS-BNG, ~~but not on the interconnect link to the AO and the interconnect link.~~ However, if the WS-BNG's were to be decentralized and a single physical interconnect were to be used, a logical separation on that interconnect would be made.

There will be a restriction for the aggregated bandwidth of logical RPOI links. If the bandwidth for an interconnect exceed 10Gbps, Telenet reserves the right to request the AO to interconnect to additional RPOI's. ~~The order in which the RPOI's need to be added will be defined by Telenet taking into account the characteristics of the AO traffic~~

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font color: Accent 1

Formatted: Font color: Accent 1

Formatted: Indent: Left: 1,26 cm, No bullets or numbering

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

resulting from the AO end-users. The purpose of adding RPOI's should be to have the traffic spread out evenly throughout the Telenet network bearing in mind that offload of the AO traffic should be done as close to the source as possible.

(16)

(17)(18) The different possibilities to realize the AO must order "standard lines" from the TLN carrier division portfolio in order to realize the required physical link for the interconnect link to pick up its traffic in minimum one of the 5 RPOI. Refer to is described in the document TLN_WRO_TA_T_PAAA Co-location and physical interconnect.

Formatted: List Paragraph

3.3.3 AO Interconnect Links Traffic Routing

(18)(19) AO BB Traffic will be routed towards the AO backbone through TLN to AO interconnect link. All traffic is forced over the AO interconnect link. A router redundancy protocol of dynamic routing protocol must be used for redundant interconnect links.

(19)(20) Even if the destination of traffic is in the TLN network, the traffic will always be routed to the AO network primarily and it will be the responsibility of the AO network to route it back to destination which is in TLN network in this case.

3.3.4 AO Interconnect Links Redundancy

(20)(21) Telenet offers link redundancy, based on redundant interface cards for AO interconnections to ensure that networks continue to function in the presence of single points of link failure.

3.4 AO IP Range/Address Space

3.4.1 AO IP Range/Address Space General Requirements

(21)(22) Telenet does not offer IP address ranges for AO end-users. The AO has to provide sufficient IP address ranges for each of 5 RPOIs. TLN needs to be informed about IP address ranges for each specific region. Telenet will request the required ranges the AO has to provide. The ranges need to contain sufficient IP addresses and be communicated upfront by the AO to Telenet and subject to appropriate change management as described in the relevant procedures in the TLN WRO.

(22)(23) For each update the AO has to provide minimum a /22 per required subnet for IPv4 ranges, and minimum a /64 per CPE subnet and a /40 for prefix delegation subnets for IPv6 ranges. There can only be a maximum of 4 updates per year. Each update can contain new subnets for multiple regions. The AO needs to request the implementation of new subnets at least 2 weeks in advance.

(*) Sufficient means the number of IP addresses per region that are needed to cover the AO end-users growth for minimal the next 6 months in order to limit the impact on the Telenet network and changes can be initiated in time.

3.4.2 AO IP Pool Management

(23)(24) TLN participates in IP pool management and IP address assignment services for AO end-users. The effective dynamic IP address assignment to individual AO end-users customers is the responsibility of the AO NCP. The AO uses its own IP address range for each of the 5 RPOIs and Telenet configures these ranges in the appropriate NE on a per RPOI basis. Multiple ranges are required per RPOI. The AO needs to assign "dynamic" IP addresses to its individual end-user devices that are selected via a dynamic algorithm (e.g. round robin) from the AO IP ranges configured for a particular RPOI. The address "lease-time" needs to be of limited duration (maximum 24H). In addition the "lease-time" should not be lower than 2 hours to avoid excessive network overhead. The AO dynamic IP address selection algorithm should in

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

at least 95% of the cases, select a different address for two consecutive leases of the same modem.

3.5 Wholesale Broadband Network Gateway (WS-BNG)

3.5.1 WS-BNG General Requirements

~~(24)~~(25) The Gateway (WS-BNG) terminates AO end-user traffic which is sent over the TLN access network using L2VPN BSoD technology. ~~BSoD~~.

~~(25)~~(26) The L2VPN The BSoD configuration VLAN for an AO modem is implemented via the modem configuration file.

3.5.2 WS-BNG Functions and Protocols

~~(26)~~(27) The Gateway (WS-BNG) functions as a transit router. It receives IP data packets from the AO end-user devices and routes them to the AO network and vice versa.

3.5.3 WS-BNG Accounting

~~(27)~~(28) Telenet provides CDR type info about traffic usage of AO end-users for billing purpose. Implementing specific volume limits for individual end-users is the responsibility of AO.

3.6 AO Data and Management Links

3.6.1 AO Data Link

~~(28)~~(29) The "AO Data Link" Interface between AO and TLN is used to carry all the traffic originated from / destined to AO end-users.

3.6.2 AO Management Link

~~(29)~~(30) This interface is used for management purposes applications between AO and TLN. Since the link carries sensitive traffic, it is secured by using IP-VPN or IPsec type connections.

3.7 AO Traffic Management

3.7.1 AO Traffic Management General Description

~~(30)~~(31) In order to guarantee a fair use of the available bandwidth in the network among all end-users Telenet performs traffic management to ensure that also in peak load situations end-users will have a good broadband service experience.

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

Formatted: English (United States)

Formatted: English (United States)

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

3.7.2 AO Traffic Management General Architecture

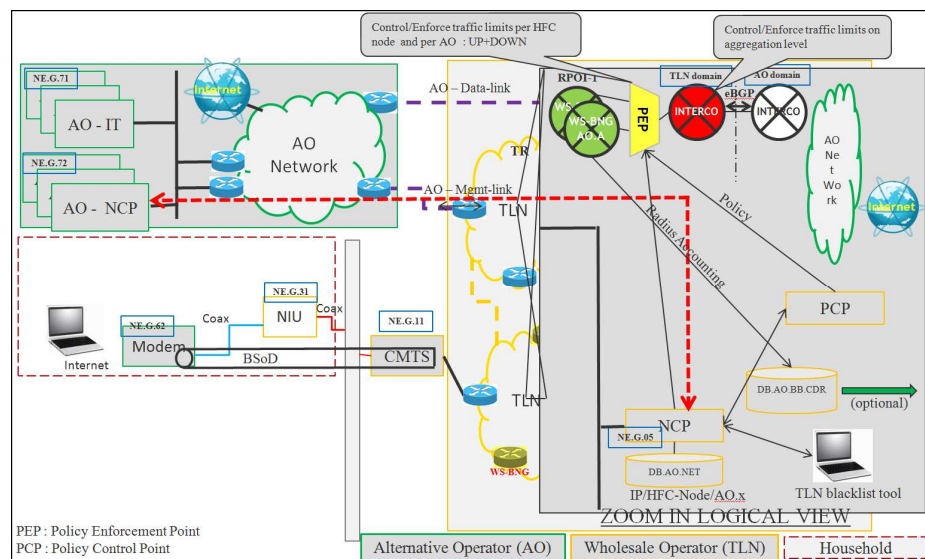


Figure 3-8: Traffic Management Architecture

(31)(32) Telenet will apply bandwidth management to both AO and TLN end-users and potential other users equally. ~~equally~~. Bandwidth limitations ~~are can be~~ applicable on ~~two~~ three levels: HFC node level, ~~and~~ aggregation level and optionally end-user level.

(33) HFC node level restrictions ~~are can be~~ implemented on the PEP. PEP is the logical entity or place in the TLN network that enforces policies for admission and bandwidth control. Practically it is implemented in different network elements. This type of traffic management is performed to avoid congestion and depends on the specific broadband product tier.

(34) Besides HFC node level traffic management, also aggregation level restrictions ~~are can be~~ applicable. For traffic related to AO end-users this aggregation level based traffic management will be performed on the interconnection links between the AO and TLN Networks.

(35) Optionally, Telenet can apply bandwidth restriction on individual end-users based on their specific broadband product tier.

3.8 Restrictions

(32)(36) The broadband interconnection service explicitly excluded below listed services that belong to the AO domain as the ROBB service offered by Telenet is restricted to the delivery / pick-up of the traffic from/ to the interconnect links at the RPOI:

- Value added services like (but not limited to): E-mail, Web space hosting, Virus scan, Personal firewalling, TLN Hot-spot access, TLN Home-spot access, Network based backup
- My Telenet type subscription management functionality
- Telemeter service

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font color: Accent 1

Formatted: Font color: Accent 1

Formatted: Left

Formatted: Left, Indent: Left: 1,27 cm, No bullets or numbering

Formatted: Justified, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0,63 cm + Indent at: 1,27 cm

Formatted: Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0,63 cm + Indent at: 1,27 cm

Formatted: Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0,63 cm + Indent at: 1,27 cm

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

- Re-direction towards landing page, offering volume block up-sell or choice for continue in narrowband services
- AO end-user e-mail notification services on network events (e.g. high usage, ...)

3.9 Operational Procedures

(33)(37) Telenet will execute from time to time operational changes on the IP interconnect infrastructure. An AO making use of the TLN WRO part should be prepared at all time to adapt its infrastructure, devices and systems, as well as its operational procedures to handle those changes. In addition it is strongly recommended by TLN that AO will take this into account in the design of its solution, so that impact of future changes will be limited. Below a non exhaustive list is given, showing some examples of operational changes that TLN has executed in the past and which will be repeated likely in the future:

- Creation of new RIZ, or re-organisation of existing ones
- Updates and changes to the routing protocols and routing policies
- Updated and changes to the IP address allocation and sub-netting requirements

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted Table

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

4 Certification for interconnection between AO IP backbone network and the TLN network

4.1 Introduction

(34)(38) The tests will cover all of the requirements specified by this document.

4.2 Test score card

CONFORMANCE TEST SCORE CARD					
Conformance Test Score Card Number	TLN-WRO-TA-TSC-%-P%%%				
Test Identification					
Test Execution Date					
Test Run Type	Full / Reduced(without OOS cases)				
Device / Equipment / Interface Name					
Device / Equipment / Interface Type / Class					
AO Device / Equipment / Interface Identification					
Software Version					
Tested by					
Overall Result Status	Pass / Fail				
Applicability	Select 1 or more: ROTV / ROBB / AIDTV				
CONFORMANCE TEST ITEM LIST					
Test Cases Summary	FORMAT	IN SCOPE	MAN	PASS/FAIL	REM
3. AO IP Interconnect Solution Functional Requirements	HO		"Y/N"	"P/F"	(*xy)
3.1. General Architecture			Y		
3.2. Regional Interconnect Zones			Y		
3.3 AO Interconnect Links			Y		
3.4 AO IP Range / Address Space			Y		
3.5 Wholesale Broadband Network Gateway (WS-BNG)			Y		
3.6 AO Data and Management Links			Y		
3.7 AO Traffic Management			Y		
3.8 Restrictions			Y		
3.9 Operational Procedures			Y		
Remarks					
(*xy) : "Remark explanation comes here"					

Formatted Table

Formatted: Font: (Default) Calibri, 11 pt, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, 11 pt, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, 11 pt, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, 11 pt, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, 11 pt, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, 11 pt, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, 11 pt, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, 11 pt, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, 11 pt, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, 11 pt, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, 11 pt, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Calibri, Italic, Font color: Black, English (United Kingdom)

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)

Formatted: Do not check spelling or grammar

Formatted: Do not check spelling or grammar

Formatted: Font: (Default) Arial, Bold, English (United Kingdom)