



**ZINWAVE 2700  
DISTRIBUTED ANTENNA SYSTEM**

**INSTALLATION AND TECHNICAL MANUAL**



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**Part No:  
Document No:  
Issue: v6**

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## INTRODUCTION

This document describes the installation and technical specifications for the ZinWave 2700 Distributed Antenna System (DAS). The 2700 DAS comprises a Hub Unit (HU) and remote Antenna Units (AUs) with Small Form Pluggable (SFP) modules providing the RF to Optical interface. The simple view of the ZinWave 2700 DAS is that it enables downlink radio signals to be converted into RF modulated optical signals at the HU and then transmitted to remote AUs over any optical fibre medium (single mode or multimode) where the optical RF signal is converted back into pure radio signals for radiation from attached Antennae. Radio signals from client devices take an uplink path back through the AU, via fibre to the Hub. The system enables the Antennae to be situated remotely from the RF signal source by large distances that will vary depending on the choice of fibre type used, but at least 550m for 62.5um diameter fibre and at least 2000m for single mode fibre. Uniquely, the 2700 DAS has a broadband frequency response that will accept and transmit RF signals ranging from 370 MHz to 2.5 GHz enabling a range of cellular and data service formats to be propagated without down conversion or intervention at their carrier frequency. Services that can be carried over the 2700 system include TETRA, GSM, CDMA, TDMA, UMTS, iDEN, WLAN, Paging, DCS, EDGE, EVDO and DECT. In addition, the HU has a programmable combiner that simply enables the radio signal channels to be connected to one or multiple optical channels or combined with other services to multiple optical channels providing multi-service radio transmission to the AUs. Each channel comprises a full duplex uplink/downlink pair, and the HU has software configurable uplink/downlink gain and attenuation control. A band-specific AU, the 2776, is also available which provides higher power output for US Cellular and PCS services.

The HU is a 1U 19" rack mountable form factor which can accept up to four concurrent RF services via duplex SMA RF ports at the rear of the module and transmit on up to 8 optical channels via unique analog duplex Small Form Pluggable (SFP) optical modules plugged into sockets in the front panel of the module. Each RF channel is always connected to at least 2 optical channels. Accepted combination options include 1x2, 1x4, 1x8, 2x2, 2x4, 2x8, 3x2, 3x8, 4x2, 4x8 (each of x inputs to y outputs). Where x and y are both numbers greater than 2, this implies that the RF channels are being combined onto multiple optical channels. Visible warning LEDs are incorporated to show individual channel status and overall system status.

The SFP modules are built to fit the physical form of the international standard for digital modules, but specifically operate as analog parts. They are made pluggable so that the HU need only be populated with those optical channels required at any particular time, so providing a low cost but scaleable solution. The interface between the SFP and the customer fibre backbone is via custom ZinWave patchcords, with LC connectors at the HU end and any connector of customer equipment choice at the link end. The SFP modules incorporate SFP industry standard alarms and control features.

The 2760 AUs use an SFP as the fibre to RF transceiver whereas the 2776 AUs have integrated transceivers. Both AUs also incorporate software configurable uplink/downlink gain and attenuation control and radiate/receive RF signals via Antennae connected to SMA ports on the unit. Power for the AU is via an RJ45 connector which accepts industry standard Power over Ethernet (PoE) 48V DC supply.

The antennas are separate to the antenna unit as the specification of these will depend upon the service deployed using the system. A typical deployment is to use two patch antenna, one for the uplink and one for the downlink.

Software control of the HU is PC based from which both configuration of the System (via Command Line Interface (CLI)) and ongoing user control (via Simple Network Management Protocol (SNMP) over the internet) of the System can be achieved. The SNMP Management Interface Base (MIB) is constructed to allow control via any third party SNMP manager such as HP OpenView. Direct user control is simple and achieved through a Graphical User Interface (GUI) which is supplied disk with the system. The RS232 connector for the CLI is situated at the back of the HU while internet connectivity is via an RJ45 connector, also at the rear of the HU. Software control features include uplink/downlink gain and attenuation settings on both the HU and AU, RF path combiner control and digital diagnostics for the Optical Link.

## TRADEMARK



## **WARRANTY**

The ZinWave 2700 DAS is designed to operate in conditions conformant with Pollution Degree 2 as defined in IEC 60950 (the normal environmental class for offices).

The installation of sub-assemblies into the main units of the The ZinWave 2700 DAS shall only be undertaken if precautions required by IEC/TS 61340-5-1 have been taken. This covers:

- the installation of Zinwave 2780 SFP optical fibre transceiver modules into the ZinWave 2700 Hub;
- the replacement of the Zinwave 2781 SFP optical fibre transceiver modules in the ZinWave 2760 Antenna Unit.



## CONTENTS

### Table of Contents

Introduction .....	ii
<b>Trademark</b> .....	ii
Warranty .....	iii
Contents .....	iv
1 General Information .....	1
1.1 Purpose and scope of this document .....	1
1.2 Conventions, definitions and abbreviations .....	2
1.2.1 Conventions .....	2
1.2.2 Definitions .....	2
1.2.3 Abbreviations .....	2
1.3 External standards compliance .....	3
1.3.1 ZinWave 2700 DAS .....	3
1.3.2 ZinWave 2700 System Installation .....	3
1.4 Regulatory compliance .....	3
1.5 Other ZinWave publications .....	3
2 Overview of the ZinWave 2700 DAS .....	4
2.1 Introduction .....	4
2.2 The components .....	5
2.3 The technology .....	5
2.4 The system .....	5
2.5 Integrated management software .....	5
2.6 System specification .....	6
3 ZinWave 2700 DAS equipment .....	7
3.1 ZinWave 270X Hub .....	7
3.1.1 General description .....	7
3.1.2 Product description .....	7
3.1.3 Technical description .....	8
3.2 ZinWave 2760 Antenna Unit .....	9
3.2.1 General description .....	9
3.2.2 Product description .....	9
Warning and safety – The antenna unit must be installed at a distance of greater than 20cm away from the proximity of operators and intended operation. Technical description .....	9
Technical description .....	10
3.3 ZinWave 2776 Antenna Unit .....	10
3.3.1 General description .....	10
3.3.2 Product description .....	11
Warning and safety – The antenna unit must be installed at a distance of greater than 20cm away from the proximity of operators and intended operation .....	11
Technical description .....	11
3.4 Antenna .....	11
3.5 Multimode optical fibre terminations and cords .....	12
3.6 Singlemode optical fibre terminations and cords .....	13
3.7 Telecommunication Outlet (TO) connectivity .....	13
4 System 2700 design and planning .....	17
4.1 Infrastructure planning .....	17
4.1.1 ZinWave 2700 DAS infrastructures .....	17
4.1.2 ZinWave 2700 DAS integration within generic/structured cabling infrastructures .....	17
4.1.3 ZinWave 2700 DAS in stand-alone infrastructures .....	18
4.2 Distribution of overlay cabling .....	20
4.3 Selection of optical fibre cabling media .....	22
4.3.1 ZinWave 2700 DAS integration within generic/structured cabling infrastructures .....	22
4.3.2 ZinWave 2700 DAS in stand-alone infrastructures .....	25
4.3.3 Channel insertion loss considerations .....	26
4.4 Accommodation of ZinWave TO Closures .....	30



4.5	Accommodation of ZinWave Termination Panels .....	31
4.6	Accommodation of ZinWave Splice Panels .....	31
4.7	Remote Powering of ZinWave 2760 or 2776 Antenna Units.....	32
4.8	Transceiver Distribution .....	32
4.8.1	General .....	32
4.8.2	RF source mapping .....	32
4.8.3	Service-specific antenna service mapping.....	32
4.9	Gain Mapping.....	32
5	ZinWave 2700 DAS Installation .....	34
5.1	Cabling installation.....	34
5.1.1	General .....	34
5.1.2	Cables.....	34
5.1.3	Fitting of the ZinWave TO Closure.....	34
5.1.4	Cable termination.....	34
5.1.5	Cords .....	35
5.2	Inspection and testing of installed optical fibre cabling .....	35
6	Maintenance, troubleshooting and technical assistance .....	36
6.1	Maintenance .....	36
6.2	Troubleshooting .....	36
6.3	Technical assistance .....	36
	Bibliography .....	37
	International .....	37
	European .....	37
	CEN/CENELEC .....	37
	ETSI .....	38
	North America .....	38
	Japan .....	39



## Table of Figures

Figure 2-1: Elements of standards-based structured/generic cabling .....	4
Figure 3-1: ZinWave 2700 Hub Unit with 8 ZinWave 2780 modules .....	7
Figure 3-2: ZinWave 2760 Antenna Unit .....	9
Figure 3-3: ZinWave 2776 Antenna Unit .....	10
Figure 3-4: ZinWave 2700 DAS installation on multimode optical fibre .....	13
Figure 3-5: ZinWave 2760 Antenna Unit installation on multimode optical fibre .....	15
Figure 3-6: ZinWave 2760 Antenna Unit installation on singlemode optical fibre .....	16
Figure 4-1: ZinWave 2700 DAS within a generic/structured cabling system .....	18
Figure 4-2: ZinWave 2700 DAS as a stand-alone cabling system .....	19
Figure 4-3: ISO/IEC TR2 "Honeycomb" distribution array .....	20
Figure 4-4: ISO/IEC TR2 24704 "Equivalent" square array .....	21
Figure 4-5: Re-use of existing singlemode optical fibre backbone cabling at an FD/HC via patching .....	23
Figure 4-6: Re-use of existing singlemode optical fibre backbone cabling at an FD/HC via splicing within a panel .....	23
Figure 4-7: Re-use of existing multimode optical fibre backbone cabling at an FD/HC via patching .....	24
Figure 4-8: Re-use of existing multimode optical fibre backbone cabling at an FD/HC via splicing within a panel .....	25
Figure 4-9: Optical fibre channel .....	27
Figure 4-10: ZinWave 2700 DAS channels over multimode optical fibre .....	28
Figure 4-11: ZinWave 2700 DAS channels over internal singlemode optical fibre cabling .....	29
Figure 4-12: ZinWave 2700 DAS channels over internal and external singlemode optical fibre cabling .....	30
Figure 4-13: RF combiner options .....	33

## Table of Tables

Table 2-1 : Channel transmission performance .....	6
Table 2-2: Downlink RF parameters .....	6
Table 2-3: Uplink RF parameters .....	6
Table 3-1: ZinWave 2700 Hub Unit and associated product part numbers .....	7
Table 3-2: ZinWave 2700 Hub Unit physical parameters .....	8
Table 3-3: ZinWave 2780 optical fibre transceiver module physical parameters .....	8
Table 3-4: ZinWave 2760 Antenna Unit and associated product part numbers .....	9
Table 3-5: ZinWave 2760 Antenna Unit physical parameters .....	10
Table 3-6: ZinWave 2776 Antenna Unit and associated product part numbers .....	11
Table 3-7: ZinWave 2776 Antenna Unit physical parameters .....	11
Table 3-8: ZinWave optical fibre infrastructure cords and associated product part numbers .....	12
Table 3-9: ZinWave optical fibre infrastructure cables and housings and associated product part numbers .....	14
Table 4-1: Spaces served by TOs in square array of Figure 5-4 .....	20
Table 4-2: Quantity of TOs in areas served by each FD/HC .....	21
Table 4-3: Performance of cabled optical fibres in generic/structured cabling standards .....	26
Table 4-4: Typical channel insertion loss from connecting hardware .....	27
Table 4-5: Multimode optical fibre channel length for multiple connections and fusion splices .....	28
Table 4-6: Internal singlemode optical fibre channel length for multiple connections and fusion splices .....	29
Table 4-7: Internal/external singlemode optical fibre channel length for multiple connections and fusion splices .....	30



- 1    **1    GENERAL INFORMATION**
- 2    **1.1    Purpose and scope of this document**
- 3
- 4
- 5

6    **1.2    Conventions, definitions and abbreviations**

7    **1.2.1    Conventions**

8    **1.2.2    Definitions**

9    Channel      See Figure 4-9  
10   Downlink     From the ZinWave 2700 Hub Unit to the ZinWave 27xx Antenna Unit  
      Uplink       From the ZinWave 27xx Antenna Unit to the ZinWave 2700 Hub Unit

10   **1.2.3    Abbreviations**

2G	2 <sup>nd</sup> Generation
3G	3 <sup>rd</sup> Generation
AP	Access Point
AU	Antenna Unit
CDMA	Code division multiple access
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CISPR	Comite International Special des Perturbations Radioelectriques
CLI	Command line interface
DAS	Distributed antenna system
DCS	Digital Cellular System
EDGE	Enhanced Data rates for GSM Evolution
EMC	Electromagnetic Compatibility
EN	Euronorm (European Standard)
ETSI	European Telecommunications Standards Institute
EVDO	Evolution-Data Optimized
FCC	Federal Communications Commission
GSM	Global System for Mobile Communications
Hi-conn	High concentricity
HU	Hub Unit
iDEN	Integrated Digital Enhanced Network (Motorola)
IEC	International Electrotechnical Commission
MMF	Multimode optical fibre
R&TTE	Radio and Telecommunication Terminal Equipment
RF	Radio frequency
Rx (RX)	Receiver
SFP	Small Form Pluggable
SMF	Singlemode optical fibre
TDMA	Time division multiple access
TETRA	Terrestrial Trunked Radio
Tx (TX)	Transmitter
UL	Underwriters Laboratories Inc. 333 Pfingsten Road, Northbrook, IL 60062-2096 USA Phone: +1-847-272-8800, Fax: +1-847-272-8129
UMTS	Universal Mobile Telecommunications System
VSWR	Voltage Standing Wave Ratio
W-CDMA	Wideband - Code division multiple access
WLAN	Wireless Local Area Network



12    **1.3    External standards compliance**

13    **1.3.1    ZinWave 2700 DAS**

14    The ZinWave 2700 DAS products are compliant with Class A Emission limits of the following standards:

- 15    • CISPR22: Information technology equipment - Radio disturbance characteristics - Limits and methods of  
16    measurement;
- 17    • EN 55022: Information technology equipment - Radio disturbance characteristics - Limits and methods of  
18    measurement;
- 19    • FCC Part 15: Radio Frequency Devices

- 20       • Code of Federal Regulations: Title 47: Part 15: Radio Frequency Devices.

- 21       • Note: For WLAN services, only when the hub is connected to Cisco® Aironet ®1200 WLAN access  
22    points (Model AIR-AP1231-A-K9)

23    The ZinWave 2700 DAS products are compliant with the electrical safety requirements of the following standards:

- 24    • IEC 60950-1: Information technology equipment - Safety - Part 1: General requirements;
- 25    • EN 60950-1: Information technology equipment - Safety - Part 1: General requirements;

26    The ZinWave 2700 DAS products are compliant with the Class 1 requirements of the following standards:

- 27    • IEC 60825-1: Safety of laser products - Part 1: Equipment classification, requirements and user's guide.

28    The ZinWave 2700 DAS products are compliant with NEBS Level 3 requirements for electrical safety and  
29    electromagnetic performance defined in Telcordia SR-3580: NEBS Criteria Levels and are thereby fully compliant with  
30    the requirements of the following:

- 31    • Telcordia GR-63-CORE:NEBS Requirements: Physical Protection
- 32    • Telcordia GR-1089-CORE: Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network  
33    Telecommunications Equipment

38    **1.3.2    ZinWave 2700 System Installation**

39    The installation of electrical supplies in support of ZinWave 2700 DAS products shall be in accordance with national and  
40    local regulations.

41    Other aspects of the installation of ZinWave 2700 DAS products and interconnecting cabling shall be in accordance with  
42    the following standards:

43    Cabling installation

- 44    • EN 50174 series: Information technology – Cabling installation

45    Optical safety:

- 46    • IEC 60825-2: Safety of laser products - Part 2: Safety of optical fibre communication systems (OFCS).

50    **1.4    Regulatory compliance**

51    The ZinWave 2700 DAS products are compliant with, and are labelled as such according to, the following European  
52    Directives

- 53    • EMC: 89/336/EEC;
- 54    • EMC: 2004/108/EC;
- 55    • R&TTE: 1999/5/EC.

58    **1.5    Other ZinWave publications**

59    ZinWave 2700 DAS User Manual

## 60    2    OVERVIEW OF THE ZINWAVE 2700 DAS

### 61    2.1    Introduction

62    The ZinWave 2700 DAS is a simple 2-stage DAS, utilising either multimode optical fibre (MMF) or singlemode optical  
 63    fibre (SMF) to connect the two system units together.

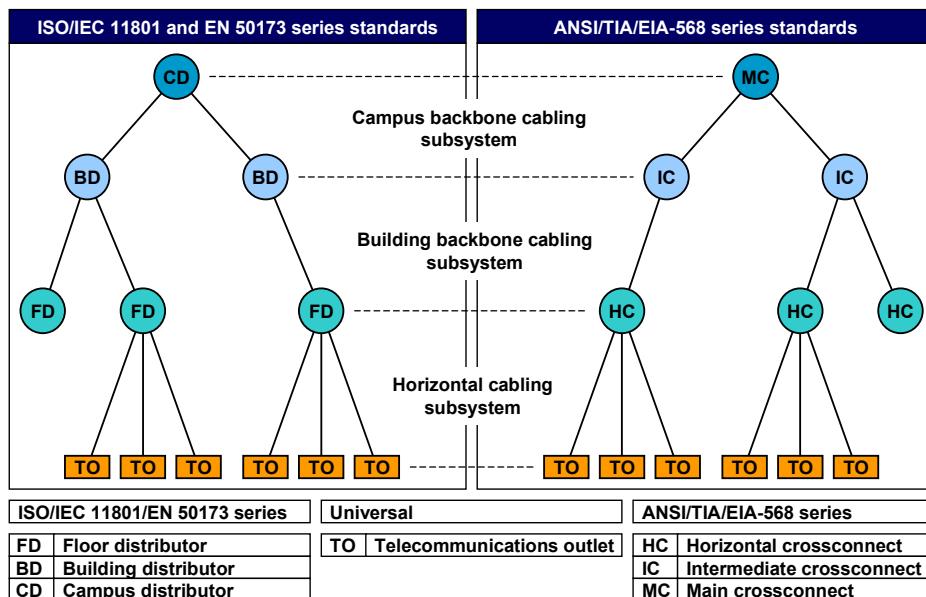
64    The ZinWave 2700 DAS unifies the distribution of multiple cellular and WLAN signals over a single cabling infrastructure  
 65    and supports current and future wireless technologies. Initial support is provided in the frequency range 370 -2500 MHz  
 66    which covers the following services: TETRA, GSM, CDMA, TDMA, UMTS, iDEN, WLAN (IEEE 802.11b/g), Paging, DCS,  
 67    EDGE, EVDO, DECT.

68    The programmable RF combiner within the ZinWave 2700 Hub Unit enables a wide variety of "RF to antenna" mappings  
 69    and provides the flexibility to move/add capacity as needed within the building without the need to change the deployed  
 70    antenna devices.

71    ZinWave's patented technology allows the multimode or singlemode optical fibres specified for structured (or generic)  
 72    cabling by the following standards to be used as the transmission system:

- 73    • North America: ANSI/TIA/EIA-568 series;
- 74    • European: EN 50173 series;
- 75    • international: ISO/IEC 11801.

76    NOTE:    Optimal performance of the ZinWave 2700 DAS may require the re-termination of the optical fibres within legacy  
 77    multimode optical fibre infrastructures installed using components meeting the above mentioned standards. This is  
 78    dealt with in detail in clause 4.



87    **Figure 2-1: Elements of standards-based structured/generic cabling**

88    By building on the existing infrastructures within the campus and building backbone cabling subsystems of professionally  
 89    designed cabling systems (see Figure 2-1) and by removing the need for network-specific overlay architectures, the  
 90    ZinWave 2700 DAS is simple to install and has low maintenance overheads.

91

92



93 The extended channel lengths over which the ZinWave 2700 DAS operates using these cabling systems (see 2.4)  
94 enables centralised location of all equipment within even the largest buildings. This in turn:  
95 • provides enhanced network security by allowing all vulnerable devices to be placed in one secure location;  
96 • reduces equipment and support costs;  
97 • provides the ability to remotely maintain and upgrade WLAN APs etc.

## 100 **2.2 The components**

101 The ZinWave 2700 DAS units are:

- 102 • **the ZinWave 2700 Hub Unit (HU):** which comprises a ZinWave 2700 Hub, a stackable 1U high 19" rack mount  
103 device, supporting four independent RF (370 - 2500 MHz) service inputs/outputs, together with up to eight ZinWave 2780  
104 Small Form Pluggable (SFP) optical fibre transceiver modules (see clause 3.1);. Each ZinWave 2780 SFP module  
105 supports a ZinWave 2760 antenna unit
- 106 • **the ZinWave 2760 Multi-service Antenna Unit (AU):** a small enclosure designed for unobtrusive installation with  
107 separate antennas in an office environment
- 108 • **the ZinWave 2776 Narrow-band Antenna Unit (AU):** a wall-mounted enclosure designed for installation with a  
109 separate antenna in an office environment.

## 110 **2.3 The technology**

111 ZinWave's patented technology renders conventional MMF a practical transmission medium for wideband, high  
112 frequency, radio frequency (RF) signals by extending the bandwidth of legacy, in-situ, cabling to permit the transmission  
113 of multiple RF signals, supporting different services, at original carrier frequency over long distances using low cost  
114 uncooled transceivers.

## 115 **2.4 The system**

116 The ZinWave transceivers within the hub and antenna units are "fibre agnostic" i.e. they can be used with either 50/125  
117 mm or 62.5/125  $\mu$ m MMF. ZinWave 2700 channels can be up to 550 metres long provided that the MMF cable has a  
118 modal bandwidth of at least 500MHz.km @ 1300 nm.

119 This length of channel is more than adequate to facilitate a high quality, broadband, in-building coverage extension  
120 system for multiple, simultaneous wireless feeds for 2G/3G Base stations, WLAN APs, TETRA etc

121 Without ZinWave's technology, such distances can only be achieved in most scenarios by expensive re-cabling of  
122 buildings using coaxial cables or single mode optical fibre, or by reverting to narrowband techniques which restrict the  
123 systems' capability.

124 The ZinWave DAS is ideally suited to applications where multiple cellular and/or WLAN services are required and can be  
125 easily configured for various deployment scenarios such as at campuses, large high-rise buildings and multi-tenanted  
126 units.

127 NOTE: In the US and Canada, only the use of the Cisco® Aironet 1200 WLAN access point (Model AIR-AP1231-A-K9) is  
128 approved for connection to the 2700 hub for providing WLAN services.

129 NOTE: Optimal performance of the ZinWave 2700 DAS may require the re-termination of the optical fibres within legacy  
130 multimode optical fibre infrastructures installed using components meeting the above mentioned standards. This is  
131 dealt with in detail in clause 4

132 NOTE: Channels lengths of up to 2000 metres can be delivered, using the same 2700 System components, over SMF cabling.

## 133 **2.5 Integrated management software**

134 Management of the ZinWave 2700 system is implemented by proprietary software which allows remote configuration via  
135 the World Wide Web, Telnet and/or SNMP. The management system allows Hub and Antenna Unit health monitoring  
136 and provides a flexible approach to both RF to Transceiver Distribution (see 4.8) and Gain Mapping (see 4.9).



149 **2.6 System specification**

150

**Table 2-1 : Channel transmission performance**

Parameter	Value			Unit	Comments
	Min.	Nom.	Max.		
Input impedance		50		Ohms	At HU service & AU uplink inputs
Output impedance		50		Ohms	At HU service & AU downlink outputs
Operating Temperature Range	0		+55	°C	Ambient, non-condensing
Channel length - MMF	1		550	m	50/125 µm, 62.5/125 µm <sup>1</sup>
Channel insertion loss - MMF	0		4	dB	@ 1300 nm
Channel length - SMF	1		2000	m	
Channel insertion loss - SMF	0		4	dB	@ 1310 nm
TX-RX Isolation <sup>2</sup>	30			dB	HU service input to service output (same service)
TX-RX Isolation <sup>2</sup>	70			dB	HU service input to any other service output
TX-TX Isolation <sup>2</sup>	70			dB	HU service input to any other service input
Antenna Isolation	35			dB	AU antenna output to AU antenna input

NOTE 1: Minimum modal bandwidth @ 1300 nm = 500MHz.km. Reduced channel lengths/insertion loss values may be supportable for lower modal bandwidth options following detailed analysis by ZinWave.

NOTE 2: At max HU RF input power, max AU RF output power, maximum uplink noise figure and for any RF combiner distribution

**Table 2-2: Downlink RF parameters**

Parameter	Value			Unit	Comments
	Min.	Nom.	Max.		
System Bandwidth					
2760 AU	370		2500	MHz	
2776 AU	869-894		1930-1990		
RF input power	-5	0	+10	dBm	At HU service input with 14dB peak-average-ratio
RF output power					
2760 AU			+ 6	dBm	Broadband rms composite power at AU antenna output
2776 AU			+18		
VSWR			1.5:1		
Return loss			14	dB	
Response variation	-5		+5	dB	Full bandwidth
Response variation	-1		+1	dB	Any 200kHz band
Response variation	-2		+2	dB	Any 100MHz band

**Table 2-3: Uplink RF parameters**

Parameter	Value			Unit	Comments
	Min.	Nom.	Max.		
System Bandwidth					
2760 AU	370		2500	MHz	
2776 AU	869-894		1930-1990		
RF input power			-15	dBm	Input gain adjustment for minimum coupling loss
Max RF output power	-20	-10		dBm	At HU service output for 1dB compression with maximum AU input power
Response variation	-5		+5	dB	Full bandwidth
Response variation	-2		+2	dB	Any 100MHz band
Response variation	-1		+1	dB	Any 5MHz band

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**154 3 ZINWAVE 2700 DAS EQUIPMENT****155 3.1 ZinWave 270X Hub****156 3.1.1 General description**

157 • 1U 19" rack mountable form factor (removable mounting bars allow desk mounting);  
158 • sophisticated software programmable RF combiner supporting:  
159     • concurrent RF services via four RF input/output ports (SMA);  
160     • frequency Range 370 - 2500 MHz (upgradeable for support up to 6GHz);  
161     • multi-service capability e.g. TETRA, GSM, CDMA, TDMA, UMTS, iDEN, WLAN, LMR, SMR, Paging,  
162       DCS, EDGE, EVDO;  
163     • wide variety of "RF to antenna" mappings (see 4.8);  
164     • delivered to remote ZinWave 2760 and/or 2776 Antenna Units via MMF or SMF cabling;  
165     • up to eight ZinWave 2780 Small Form Pluggable (SFP) optical fibre transceiver modules;  
166     • LED indicators above each optical port to show existence of transmitted/received optical signal as  
167       appropriate;  
168 • system management via:  
169     • SNMP v2 GUI network management;  
170     • Command Line Interface (CLI)-based network management via Telnet;  
171     • RJ-45 Ethernet and serial management interface;  
172     • health monitoring capabilities for Hub and Antenna Units.

**175  
176  
177 Figure 3-1: ZinWave 2700 Hub Unit with 8 ZinWave 2780 modules****178 3.1.2 Product description****180****181 Table 3-1: ZinWave 2700 Hub Unit and associated product part numbers**

Product Reference	Description	Information
2700	Hub	Hub (without optical modules fitted)
2780	2.5GHz SFP	SFP optical fibre transceiver modules
9301	Mains lead, 2m, UK	
9302	Mains lead, 2m, European	
9303	Mains lead, 2m, US	

**182**



183 **3.1.3 Technical description**

184

185

**Table 3-2: ZinWave 2700 Hub Unit physical parameters**

Parameter	Symbol	Value			Unit	Comments
		Min.	Nom.	Max.		
Height			44/1.8		mm/in	
Width			445/17.5		mm/in	
Depth			270/10.6		mm/in	
Weight			3.5		kg	
Mains power voltage		100		240	VAC	
Mains power frequency		50		60	Hz	
Mains power consumption				15	W	
Mains power interface			1		-	IEC Socket
RF interfaces			8		-	SMA connectors (separate Tx and Rx providing 4 RF I/O pairs)
Optical interfaces		-	-	8	-	Using ZinWave 2780 SFP modules
Control interfaces			1		-	IEC 60603-7 (RJ-45) 100BASE-T
Control interfaces			1		-	9-pin D connector (RS232 - CLI)
Temperature - operating		0		+55	°C	
Temperature - storage		-25		+55	°C	

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**Table 3-3: ZinWave 2780 optical fibre transceiver module physical parameters**

Parameter	Symbol	Value			Unit	Comments
		Min.	Nom.	Max.		
Weight					kg	
Optical interfaces		-	-	1	-	IEC 61754-20 (LC-Duplex)
Temperature - operating		0		+55	°C	
Temperature - storage		-25		+55	°C	

**189 3.2 ZinWave 2760 Antenna Unit****190 3.2.1 General description**

191 • Compact, unobtrusive and robust package (roof space, ceiling or wall mountable);  
192 • converts optical I/O from ZinWave 2700 Hub Units to electrical RF I/O;  
193 • upgradeable to support future wireless standards;  
194 • powered either via 48V external power supply (ZinWave 9370) or by “Power over Ethernet” using mid-span  
195 insertion panel in accordance with IEEE802.3af.  
196  
197



198

**199 Figure 3-2: ZinWave 2760 Antenna Unit**

200

201

**202 3.2.2 Product description**

203

**204 Table 3-4: ZinWave 2760 Antenna Unit and associated product part numbers**

Product Reference	Description	Information
2760	Antenna unit	Includes ZinWave 2781 2.5GHz SFP
9370	AU Power Supply Unit	100-240VAC, 50-60Hz (IEC mains socket) to 48 VDC (Lemo plug), included with AU as default
9301	Mains lead, 2m, UK	
9302	Mains lead, 2m, European	
9303	Mains lead, 2m, US	

205

206

207

Warning and safety – The antenna unit must be installed at a distance of greater than 20cm away from the proximity of operators and intended operation.

208 **Technical description**

209

210

**Table 3-5: ZinWave 2760 Antenna Unit physical parameters**

Parameter	Symbol	Value			Unit	Comments
		Min.	Nom.	Max.		
Height			215/8.5		mm/in	
Width			130/5.1		mm/in	
Depth			45/1.8		mm/in	
Weight			0.75		kg	
Power supply voltage		40		48	V	
Power supply frequency		DC			-	
Power consumption				3	W	
Power supply interface AC/DC		1			-	LEMO
Power supply interface (IEEE 802.3af)		1			-	IEC 60603-7 (RJ-45)
RF interfaces		2			-	SMA
Optical interfaces		1			-	IEC 61754-20 (LC-Duplex)
Temperature - operating		0		+45	°C	
Temperature – storage		-25		+55	°C	

211

212 **3.3 ZinWave 2776 Antenna Unit**213 **3.3.1 General description**

214 • Robust package (roof space or wall mountable);  
215 • converts optical I/O from ZinWave 2700 Hub Units to electrical RF I/O;  
216 • US Cellular band-specific but service independant;  
217 • powered by “Power over Ethernet” using mid-span insertion panel in accordance with IEEE802.3af.

218

219

**Figure 3-3: ZinWave 2776 Antenna Unit**

220

221

222

223



224 3.3.2 Product description

225

226 Table 3-6: ZinWave 2776 Antenna Unit and associated product part numbers

Product Reference	Description	Information
2776	Antenna unit	

227

228 Warning and safety – The antenna unit must be installed at a distance of greater than 20cm away from the  
229 proximity of operators and intended operation.

230

231 Technical description

232

233 Table 3-7: ZinWave 2776 Antenna Unit physical parameters

Parameter	Symbol	Value			Unit	Comments
		Min.	Nom.	Max.		
Height			120/4.75		mm/in	
Width			370/14.5		mm/in	
Depth			260/10.25		mm/in	Not including connectors
Weight			5.3		kg	
Power supply voltage		40		48	V	
Power supply frequency			DC		-	
Power consumption				15	W	
Power supply interface (IEEE 802.3af)			1		-	IEC 60603-7 (RJ-45)
RF interfaces			1		-	N (female)
Optical interfaces			1		-	IEC 60874-14 (SC-Duplex)
Temperature - operating		0		+45	°C	
Temperature - storage		-25		+55	°C	

234

235

236 3.4 Antenna

237 • The ZinWave DAS system can use a variety of Antennae connected to the Antenna Unit via Coax Cable. The  
238 choice of Antenna will depend on the service requirement within the operational bandwidth of the system. We  
239 recommend the use of a broadband patch antenna with specifications listed below:

240

241 • Gain (Max): 8dBi  
242 • Azimuth beamwidth: > 90° in all bands  
243 • Elevation beamwidth: Not less than 45° in any band  
244 • Front-to-back ratio >10dB  
245 • Pattern squint: Less than 10° in both planes in any band  
246 • Polarization: Linear or circular (to be stated)

247

248 For example an antenna that meets this requirement is the Huber and Suhner 824-2500MHz Planar Antenna SWA  
249 0824/55/8/0/V.

250

251 **Warning and Safety.** The antennas must be installed at a distance of greater than 20cm away from the proximity of  
252 operators and intended operation. A maximum antenna gain of 8dBi should be used.

253      ZinWave 2700 DAS infrastructure components

254  
255      **3.5      Multimode optical fibre terminations and cords**

256      The implementation of the ZinWave 2700 DAS using multimode optical fibre involves the control of launch conditions at  
257      all cabling interfaces within the transmission channel.

258  
259      NOTE:      High modal bandwidth 50/125  $\mu\text{m}$  multimode optical fibres including OM3 products specified in ISO/IEC 11801 and EN  
260      50173-1 and the laser optimised products specified in ANSI/TIA/EIA-B.3 do not generally require such controls but are  
261      not differentiated in this document.

262  
263      Where multimode optical fibres are to be used within ZinWave 2700 DAS channels they shall be terminated by the fusion  
264      splicing of ZinWave high concentricity (hi-conn) pigtailed as listed in Table 3-8.

265  
266      WARNING:      Only fusion splice techniques shall be used to joint the installed optical fibres to the ZinWave hi-conn pigtailed.  
267      Mechanical splices shall not be used

268  
269      The bulkhead adaptors (also known as couplers) into which the connectors of the pigtailed are fixed shall be those used  
270      for singlemode optical fibre connections. These are not listed as ZinWave products since they will be selected to suit the  
271      panels into which they are fitted.

272  
273      Crossconnections or patches (a patch is a crossconnection with identical connectors at each end) between multimode  
274      optical fibre panels containing the terminations as described above shall be made via high concentricity (hi-conn) patch  
275      cords as listed in Table 3-8.

276  
277      Where ZinWave 2700 DAS Hub and Antenna Units are connected to multimode optical fibre interfaces it is necessary to  
278      use ZinWave 2700 equipment cords listed in Table 3-8. These duplex cords feature an offset launch in the "launch" leg  
279      and must be connected in the correct orientation.

280  
281      WARNING:      ZinWave equipment cords are marked to indicate which is the launch "leg" and which end shall be connected to the  
282      equipment. Incorrect connections can affect the performance of the DAS and in some cases led to complete system  
283      failure.

284  
285      A schematic showing the implementation approach described above is shown in Figure 3-4.

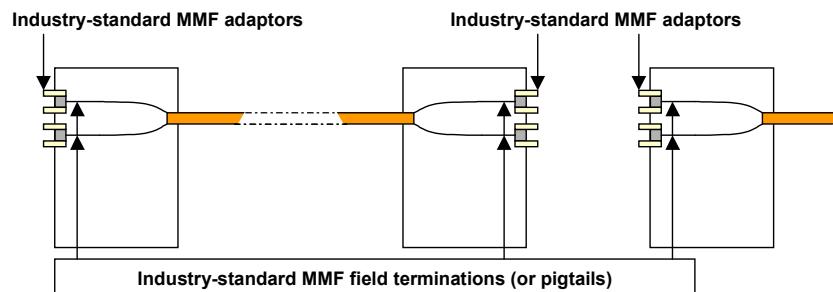
286  
287

288      **Table 3-8: ZinWave optical fibre infrastructure cords and associated product part numbers**

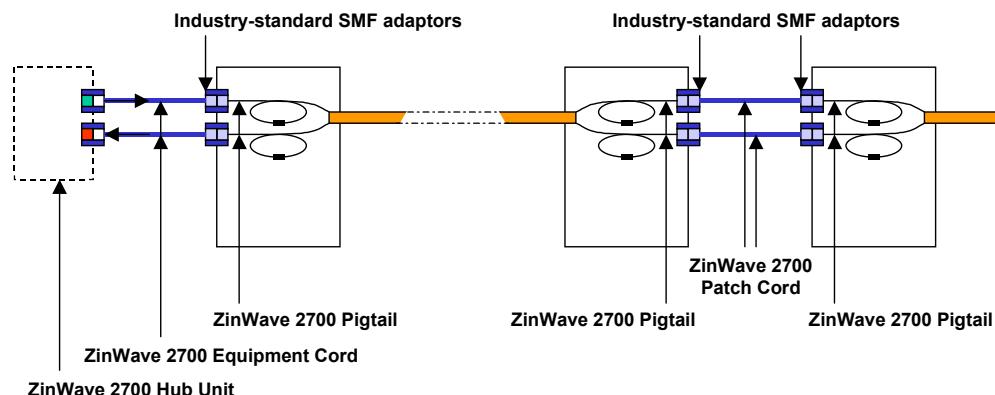
Product Reference	Description	Information
5XX22-ZZ	50/125 $\mu\text{m}$ MMF equipment cord (duplex)	Tight jacket optical fibre meeting ZinWave 2700 offset launch requirements, terminated at one end with LC-Duplex connector
6XX22-ZZ	62.5/125 $\mu\text{m}$ MMF equipment cord (duplex)	Tight jacket optical fibre meeting ZinWave 2700 offset launch requirements with LC-Duplex connector
50191-YY or 50192-YY	50/125 $\mu\text{m}$ MMF hi-con pigtail (simplex or duplex)	900 $\mu\text{m}$ secondary buffered optical fibre 1 m long meeting ZinWave 2700 hi-con requirements
60191-YY or 60192-YY	62.5/125 $\mu\text{m}$ MMF hi-con pigtail (simplex or duplex)	900 $\mu\text{m}$ secondary buffered optical fibre 1 m long meeting ZinWave 2700 hi-con requirements
5XX31YY-ZZ or YY-5XX32-YY-ZZ	50/125 $\mu\text{m}$ MMF hi-con patch cord (simplex or duplex)	Tight jacket optical fibre meeting ZinWave 2700 hi-con requirements
6XX31-YY-ZZ or YY-6XX32-YY-ZZ	62.5/125 $\mu\text{m}$ MMF hi-con patch cord (simplex or duplex)	Tight jacket optical fibre meeting ZinWave 2700 hi-con requirements

XX defines length in metres  
YY defines connector at end A  
ZZ defines connector at end B

**CONVENTIONAL MULTIMODE OPTICAL FIBRE INSTALLATION**



**AMENDED MULTIMODE OPTICAL FIBRE INSTALLATION FOR ZINWAVE 2700 DAS**



289  
290

291

Figure 3-4: ZinWave 2700 DAS installation on multimode optical fibre

292

293

294

### 3.6 Singlemode optical fibre terminations and cords

295

There are no ZinWave-specific requirements for the installation of the 2700 DAS using singlemode optical fibre. Industry standard equipment cords and patch cords may be used.

296

297

298

299

### 3.7 Telecommunication Outlet (TO) connectivity

300

Each ZinWave 2760 or 2776 Antenna Unit is connected to a Telecommunications Outlet (TO) which terminates the wireless application overlay cabling.

301

302

303

In order to simplify the installation of the TO and the cabling to the TO, the ZinWave components listed in Table 3-9 should be used.

304

305

306

The TO Closure is designed to allow the connection of optical fibre cabling and, where required, remote power via "Power over Ethernet" to one or two ZinWave 2760 or 2776 Antenna Units.

307

308

309

Each TO Closure should be located in a position to allow a simple connection to the ZinWave 2760 or 2776 Antenna Unit using the appropriate equipment cord of Table 3-8 (for attachment to multimode optical fibre cabling) or a industry-standard singlemode optical fibre cord i.e. not required to be a ZinWave product (for attachment to singlemode optical fibre cabling).

310

311

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316

The TO Closure has glanded ports for two LC-Duplex connectors and two shrouded IEC 60603-7 sockets. The required number of optical ports shall be fitted with industry-standard singlemode optical fibre adaptors following the installation of the TO Closure.



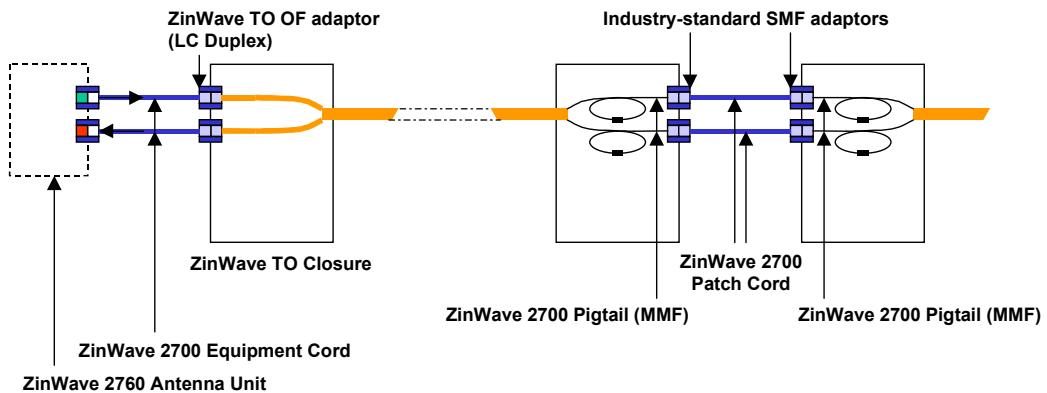
317  
318 The optical fibre TO cables listed in Table 3-9 are installed within the TO Closure without the need for termination or  
319 jointing at the TO. The remote ends of both multimode and singlemode TO cables are terminated by the fusion splicing  
320 of the appropriate pigtails.  
321  
322 A schematic showing the implementation approaches in shown in Figure 3-5 and Figure 3-6 for multimode and  
323 singlemode optical fibre respectively.  
324  
325 The provision of remote power to the ZinWave 2760 or 2776 Antenna Units is achieved by the termination of an industry-  
326 standard Category 5e/Category 5:2002 balanced cables using the IEC 60603-7 socket in the TO Closure.  
327  
328

329 **Table 3-9: ZinWave optical fibre infrastructure cables and housings and associated product part numbers**

Product Reference	Description	Information
XXXX-XX	TO Closure	2 No. LC-Duplex connector ports and 2 No. PoE presentation Incoming glands for 2 No. balanced cables and 2 No. OF cables
XXXX-XX	SMF Adaptor	LC-Duplex
10322-H	30 m TO cable, 2 No. SMF OF	Terminated at one end with LC-Duplex connector
50322-H	30 m TO cable, 2 No. 50/125 µm OF	Terminated at one end with LC-Duplex connector meeting ZinWave 2700 hi-con requirements
60322-H	50 m TO cable, 2 No. 62.5/125 µm OF	Terminated at one end with LC-Duplex connector meeting ZinWave 2700 hi-con requirements
10522-H	50 m TO cable, 2 No. SMF OF	Terminated at one end with LC-Duplex connector
50522-H	50 m TO cable, 2 No. 50/125 µm OF	Terminated at one end with LC-Duplex connector meeting ZinWave 2700 hi-con requirements
60522-H	50 m TO cable, 2 No. 62.5/125 µm OF	Terminated at one end with LC-Duplex connector meeting ZinWave 2700 hi-con requirements
11022-H	100 m TO cable, 2 No. SMF OF	Terminated at one end with LC-Duplex connector
51022-H	100 m TO cable, 2 No. 50/125 µm OF	Terminated at one end with LC-Duplex connector meeting ZinWave 2700 hi-con requirements
61022-H	100 m TO cable, 2 No. 62.5/125 µm OF	Terminated at one end with LC-Duplex connector meeting ZinWave 2700 hi-con requirements

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331  
332  
333  
334  
335

**MULTIMODE OPTICAL FIBRE INSTALLATION FOR ZINWAVE 2760 ANTENNA UNIT - PATCHED ONWARD CONNECTION**



**MULTIMODE OPTICAL FIBRE INSTALLATION FOR ZINWAVE 2760 ANTENNA UNIT - JOINTED ONWARD CONNECTION**

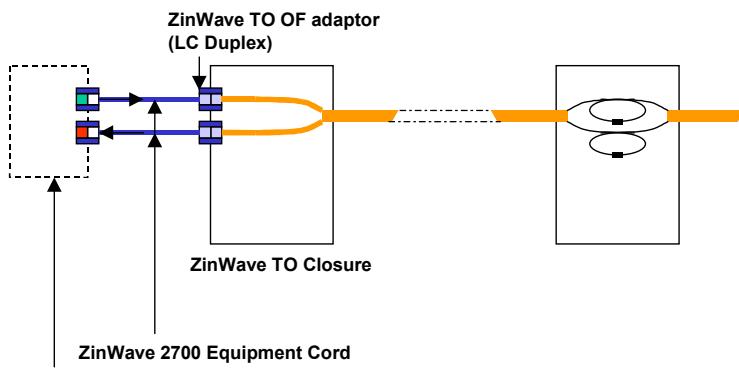


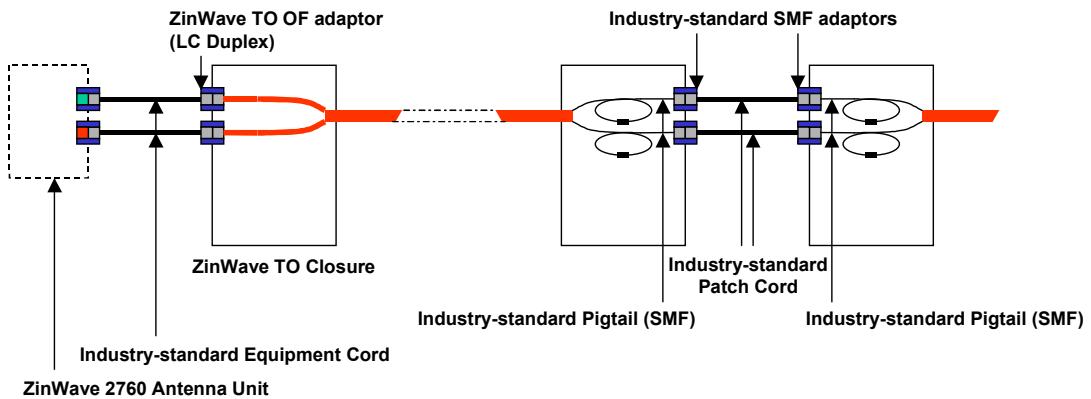
Figure 3-5: ZinWave 2760 Antenna Unit installation on multimode optical fibre

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337

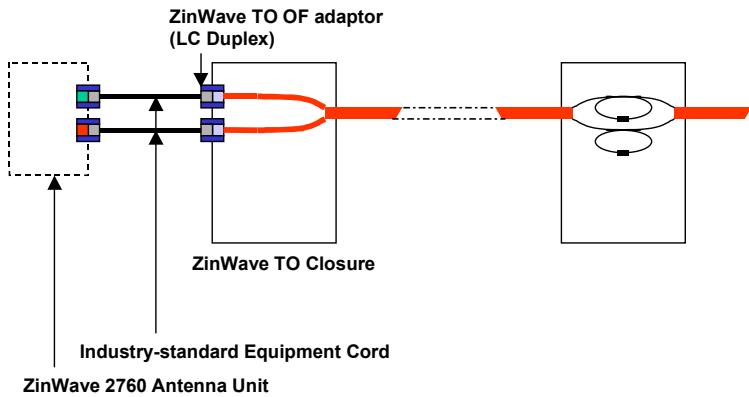
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341

**SINGLEMODE OPTICAL FIBRE INSTALLATION FOR ZINWAVE 2760 ANTENNA UNIT - PATCHED ONWARD CONNECTION**



**SINGLEMODE OPTICAL FIBRE INSTALLATION FOR ZINWAVE 2760 ANTENNA UNIT - JOINTED ONWARD CONNECTION**



342  
343

344

Figure 3-6: ZinWave 2760 Antenna Unit installation on singlemode optical fibre



345 **4 SYSTEM 2700 DESIGN AND PLANNING**

346 **4.1 Infrastructure planning**

347 **4.1.1 ZinWave 2700 DAS infrastructures**

348 One of the key advantages of the ZinWave 2700 DAS is the way in which it can use and be integrated with  
349 generic/structured cabling systems designed in accordance with the following standards:

- North America: ANSI/TIA/EIA-568 series;
- European: EN 50173 series;
- international: ISO/IEC 11801.

353 The design and planning considerations for a ZinWave 2700 DAS in such circumstances is described in clause 4.1.2.

354 It is also possible to use the ZinWave 2700 DAS in situation where premises are not served by generic/structured cabling  
355 systems. The design and planning considerations for a ZinWave 2700 DAS in such circumstances is described in clause  
356 4.1.3.

357 **4.1.2 ZinWave 2700 DAS integration within generic/structured cabling infrastructures**

361 ISO/IEC TR2 24704 specifies the cabling overlay for wireless access points in association with generic (i.e. structured)  
362 cabling in accordance with either ANSI/TIA/EIA-568 series standards, the EN 50173 series standards or ISO/IEC 11801.

364 ISO/IEC TR2 24704 specifies that the length between the connection of the generic wireless application overlay cabling  
365 at the FD/HC and the TO shall not exceed 90 metres. The ZinWave 2700 DAS recognises this restriction but can, where  
366 necessary, operate over extended lengths provided that the total length and the channel insertion loss of the cabling  
367 channel from the ZinWave 2700 Hub Unit to each ZinWave 2760 or 2776 Antenna Unit does not exceed the values  
368 shown in Table 2-1. Nevertheless, it is recommended that length between the connection of the generic wireless  
369 application overlay cabling at the FD/HC and the TOs should not exceed 90 metres.

370 NOTE: The provision of remote powering of the ZinWave 2760 or 2776 Antenna Unit using "Power over Ethernet" should not be  
371 implemented if the resulting channel length between the mid-span power insertion panel at the FD/HC and the ZinWave  
372 2760 or 2776 Antenna Unit exceeds 100 metres.

374 In cases where the ZinWave 2700 DAS is to use and be integrated with generic/structured cabling systems the design  
375 and planning sequence is as follows:

- determine the distribution and number of TOs to be installed in the generic wireless application overlay cabling (see  
4.2);
- determine the number of optical fibres to be used in the backbone cabling subsystem;
- determine the optical fibre media to be used:
  - whether the ZinWave 2700 DAS is to be implemented by incorporating the customers existing optical  
fibre infrastructure or by installing additional generic/structured cabling to support the ZinWave 2700 DAS (see  
4.3.1);
  - taking into account the predicted channel lengths and channel insertion loss values (see 4.3.3);
- determine the connection mechanism between the generic wireless application overlay cabling and the building  
backbone cabling subsystem at the FD/HC (see Figure 4-1 and 4.3);
- determine the space requirements for the ZinWave 2700 DAS infrastructure at each FD/HC ((see 4.4 ,4.6 and 4.7);
- determine the space requirements for the ZinWave 2700 DAS infrastructure at each BD/IC (see Figure 4-1, 4.4 and  
4.6);
- where the ZinWave 2700 DAS is to be extended to a separate CD/MC it will also be necessary to:
  - determine the space requirements for the ZinWave 2700 DAS infrastructure at each CD/MC ((see 4.4  
and 4.6);
  - determine the connection mechanism between the building backbone cabling subsystem and the  
campus backbone cabling subsystem at the BD/IC (see Figure 4-1 and 4.3).

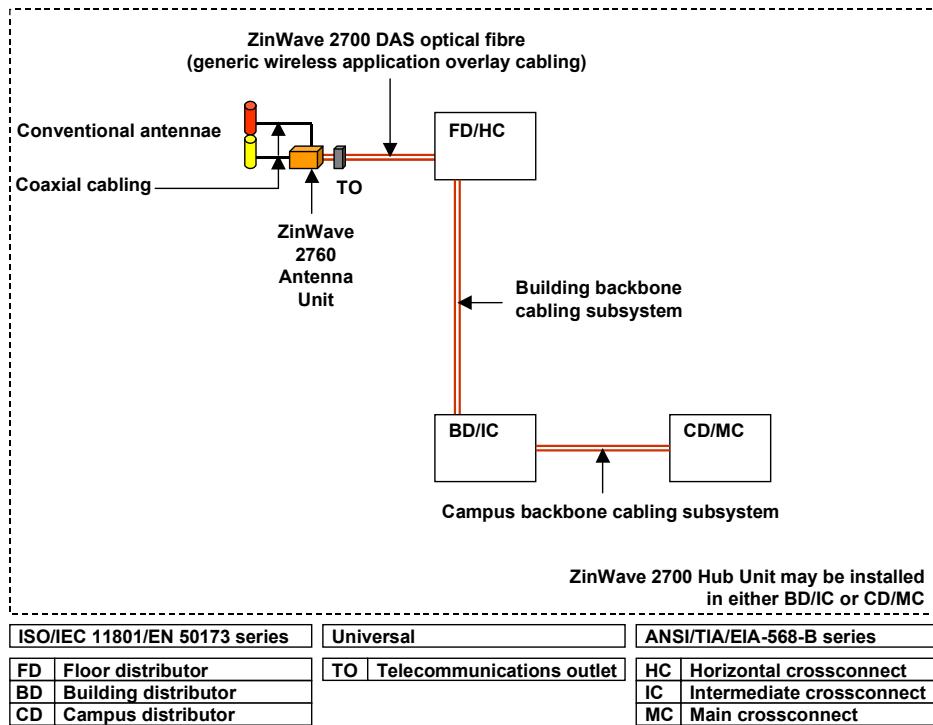


Figure 4-1: ZinWave 2700 DAS within a generic/structured cabling system

398

399

400

401

402

#### 4.1.3 ZinWave 2700 DAS in stand-alone infrastructures

403 ISO/IEC TR2 24704 specifies the cabling overlay for wireless access points in association with generic (i.e. structured) 404 cabling in accordance with either ANSI/TIA/EIA-568 series standards, the EN 50173 series standards or ISO/IEC 11801. 405 However, the principles underlying its requirements and recommendations are equally applicable to stand-alone cabling 406 (perhaps in situations where there is no generic/structured cabling system or the premises do not contain viable locations 407 for distributors/crossconnects).

408

For distribution in a single building:

- 410 • the FD/HCs of Figure 4-1 are replaced by ZinWave Local Splice Panels as shown in Figure 4-2;
  - 411 • ZinWave Splice Panels can be installed in any convenient location, are completely passive and require 412 no mains power supplies;
  - 413 • ZinWave Building Termination Panels are located in association with the ZinWave 2700 Hub Units as shown in the 414 upper diagram in Figure 4-2.

415

For campus distribution

- 416 • the FD/HCs of Figure 4-1 are replaced by ZinWave Local Splice Panels as shown in Figure 4-2;
  - 417 • ZinWave Local Splice Panel can be installed in any convenient location, is completely passive and 418 requires no mains power supplies;
  - 419 • the BD/ICs of Figure 4-1 are replaced by ZinWave Building Splice Panels as shown in the lower diagram in Figure 420 4-2;
    - 421 • ZinWave Building Splice Panels can be installed in any convenient location at the entrance to the 422 buildings, are completely passive and require no mains power supplies;
    - 423 • ZinWave Campus Termination Panels are located in association with the ZinWave 2700 Hub Units.

424

425 In the absence of remote power (due to the passive nature of the ZinWave Local Splice Panel), the ZinWave 2760 426 Antenna Units will generally be powered using the default 48V DC power supply.

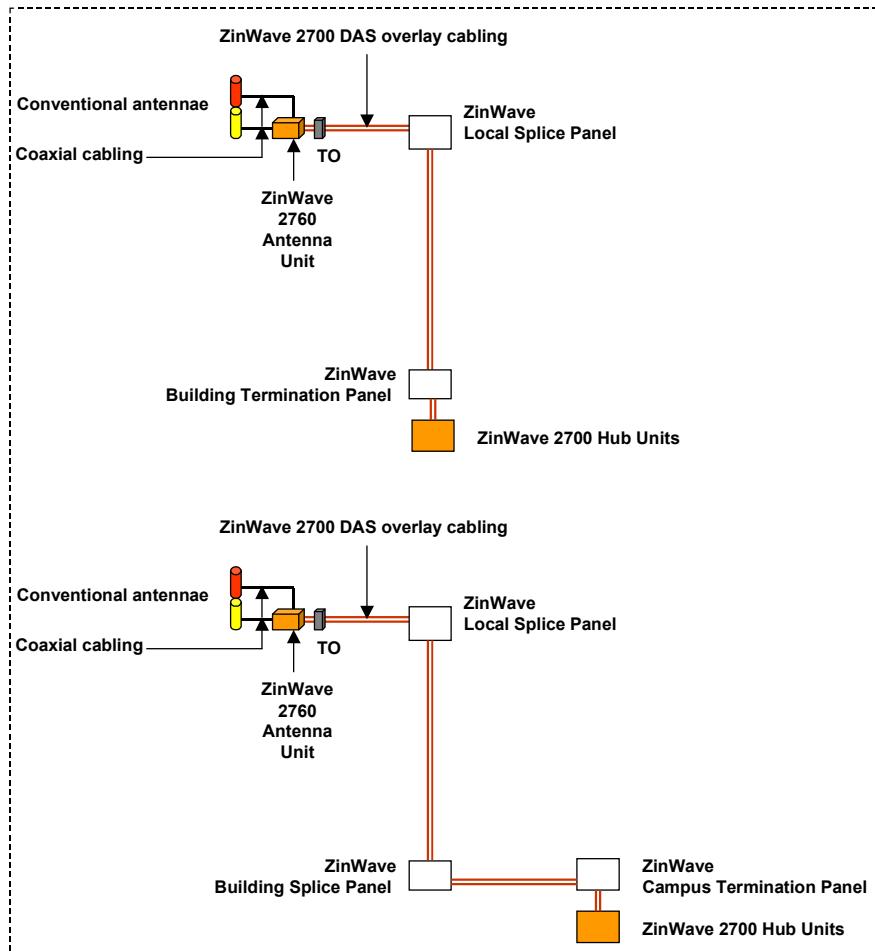
427

428

429 ISO/IEC TR2 24704 specifies that the length between the connection at the FD/HC and the TO shall not exceed 90  
430 metres. The ZinWave 2700 DAS recognises this restriction but can, where necessary, operate over extended lengths  
431 provided that the total length and the channel insertion loss of the cabling channel from the ZinWave 2700 Hub Unit to  
432 each ZinWave 2760 or 2776 Antenna Unit does not exceed the values shown in Table 2-1. Nevertheless, to enable  
433 integration of the ZinWave 2700 DAS cabling within future generic/structured cabling it is recommended that length  
434 between the ZinWave Local Splice Panel and the TOs should not exceed 90 metres.  
435

436 The design and planning sequence is as follows:

- 437 • determine the distribution and number of TOs to be installed in the ZinWave overlay cabling (see 4.2);
- 438 • determine the number of optical fibres to be used between each Local Splice Panel and the corresponding ZinWave  
439 Building Splice or Termination Panel;
- 440 • for campus distribution, determine the number of optical fibres to be used between each Building Splice Panel and  
441 the corresponding ZinWave Campus Termination Panel;
- 442 • determine the optical fibre media to be used:
  - 443 • whether the ZinWave 2700 DAS is to be implemented by incorporating the customers existing optical  
444 fibre infrastructure or by installing additional generic/structured cabling to support the ZinWave 2700 DAS (see  
445 4.3.2);
  - 446 • taking into account the predicted channel lengths and channel insertion loss values (see 4.3.3);
- 447 • determine the space requirements for the ZinWave 2700 DAS infrastructure at the primary and secondary points of  
448 distribution in association with the ZinWave 2700 Hub Units (see 4.4 and 4.6).

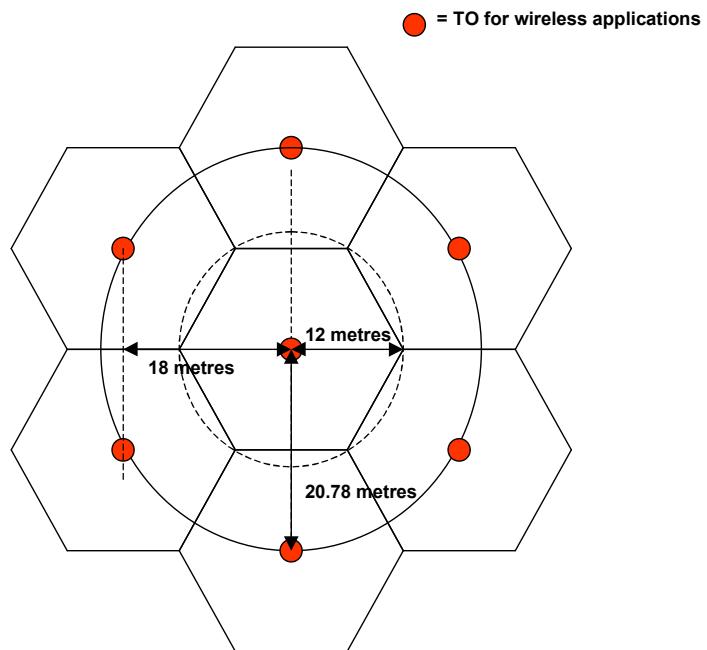


451  
452 **Figure 4-2: ZinWave 2700 DAS as a stand-alone cabling system**

453 **4.2 Distribution of overlay cabling**

454 ISO/IEC TR2 24704 specifies the cabling overlay for wireless access points in association with generic (i.e. structured)  
 455 cabling in accordance with either ANSI/TIA/EIA-568 series standards, the EN 50173 series standards or ISO/IEC 11801.  
 456 The same distribution of 2760 or 2776 Antenna Units connection points applies to if the cabling is installed specifically to  
 457 serve the ZinWave 2700 DAS using stand-alone cabling.

458  
 459 ISO/IEC TR2 24704 recommends a “honeycomb” distribution grid as shown in Figure 4-3 which features the best overall  
 460 coverage (450 m<sup>2</sup> per TO).  
 461  
 462



463  
 464 **Figure 4-3: ISO/IEC TR2 “Honeycomb” distribution array**

465  
 466 However, certain areas and layouts may be better suited with a square array as shown in Figure 4-4 which, although  
 467 using more TOs (282 m<sup>2</sup> per TO), is more easily analysed in terms of building designs. Table 4-1 shows the spatial  
 468 coverage of the square array of Figure 5-4.  
 469  
 470

471 **Table 4-1: Spaces served by TOs in square array of Figure 5-4**

		Space served ( m x m )					
		TOs in horizontal matrix					
		1	2	3	4	5	6
TOs in vertical matrix	1	16.8 x 16.8	33.6 x 16.8	50.3 x 16.8	67.1 x 16.8	83.9 x 16.8	>100 x 16.8
	2	16.8 x 33.6	33.6 x 33.6	50.3 x 33.6	67.1 x 33.6	83.9 x 33.6	>100 x 33.6
	3	16.8 x 50.3	33.6 x 50.3	50.3 x 50.3	67.1 x 50.3	83.9 x 50.3	>100 x 50.3
	4	16.8 x 67.1	33.6 x 67.1	50.3 x 67.1	67.1 x 67.1	83.9 x 67.1	>100 x 67.1
	5	16.8 x 83.9	33.6 x 83.9	50.3 x 83.9	67.1 x 83.9	83.9 x 83.9	>100 x 83.9
	6	16.8 x >100	33.6 x >100	50.3 x >100	67.1 x >100	83.9 x >100	-

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 473  
 474

475

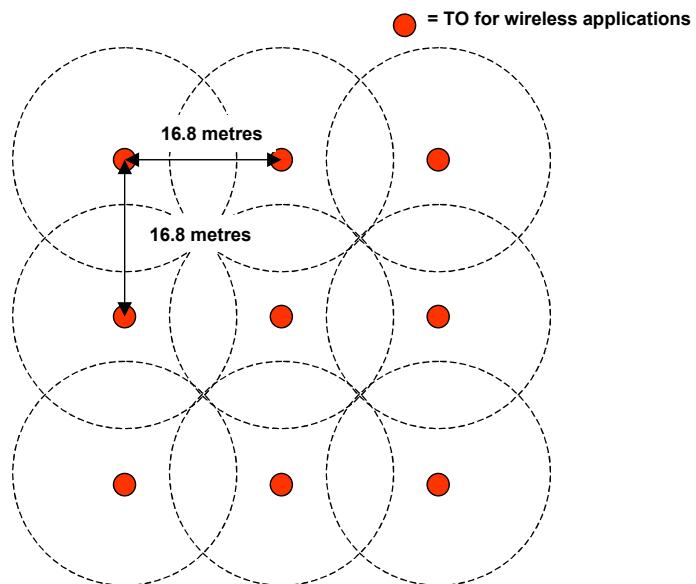


Figure 4-4: ISO/IEC TR2 24704 "Equivalent" square array

476

477

478

479

480 ZinWave recommends that cabling to the wireless application TOs is installed to support 2760 or 2776 Antenna Units  
481 using the guidelines of this clause for both generic/structured and stand-alone cabling (where references to the FD/HC  
482 should be taken as the ZinWave Local Splice Panel).

483

484 The total number of TOs shall be based upon a combination of the total floor area served by each FD/HC and the shape  
485 of that floor area. The maximum number TOs required to service the areas and dimensions served by an FD/HC is  
486 shown in Table 4-2.

487

488

489

Table 4-2: Quantity of TOs in areas served by each FD/HC

Floor area (m <sup>2</sup> )	Floor dimensions (m)	No. of TO (max)	Floor area (m <sup>2</sup> /ft <sup>2</sup> )	Floor dimensions (m)	No. of TO (max)
500	10 x 50	3 (square)	2000	20 x 100	11 (honeycomb)
	15 x 33	2 (square)		25 x 80	9 (honeycomb)
	20 x 25	3 (honeycomb)		30 x 67	8 (honeycomb)
1000	10 x 100	6 (square)		35 x 51.4	9 (honeycomb)
	15 x 67	4 (square)		40 x 50	9 (square)
	20 x 50	5 (honeycomb)		45 x 44.4	9 (square)
	25 x 40	5 (honeycomb)		25 x 100	11 (honeycomb)
	30 x 33	4 (honeycomb)		30 x 83.3	9 (honeycomb)
1500	15 x 100	6 (square)		35 x 71.2	12 (honeycomb)
	20 x 75	8 (honeycomb)		40 x 62.5	12 (square)
	25 x 60	7 (honeycomb)		45 x 44.4	9 (square)
	30 x 50	6 (square)		50 x 50	9 (square)
	35 x 43	8 (honeycomb)			

490

491



492 Table 4-2 indicates that for an area of 2500 m<sup>2</sup> then the maximum number of TOs is 12 No. for an elongated space and 9  
493 No. for a "square" space. By reference to building drawings and appropriately careful placement of TOs, the actual  
494 number of TOs will be less than that specified in Table 4-2.  
495

496 It should be noted that the number of TOs does not mandate the number of ZinWave 2760 or 2776 Antenna Units or the  
497 usage of those Antenna Units (see 4.8). However, the number of TOs does define the number of optical fibres to be  
498 provided from the FD/HC, and where a direct correspondence is applied, the number of optical fibres required in the  
499 backbone cabling subsystem which services the FD/HC.  
500

501 **4.3 Selection of optical fibre cabling media**

502 **4.3.1 ZinWave 2700 DAS integration within generic/structured cabling infrastructures**

503 **4.3.1.1 General**

504 The number of TOs to be served by each FD/HC defines the number of optical fibres required in the building backbone  
505 cabling at each FD/HC.  
506

507 As building backbone cabling already exists it has to be determined if the existing optical fibre cables serving the FD/HCs  
508 have adequate numbers of unused (or reassignable) optical fibres. If not then additional backbone cables are required.  
509

510 Clause 4.3.1.2 discusses the re-use of existing singlemode optical fibre backbone cabling.  
511

512 Clause 4.3.1.3 discusses the re-use of existing multimode optical fibre backbone cabling.  
513

514 Clause 4.3.1.4 discusses installation of additional backbone cabling.  
515

516 The selection of the optical fibre media to be used and how they are to be connected should also take into account the  
517 considerations of channel length and channel insertion loss outlined in clause 4.3.3.  
518

519 **4.3.1.2 Re-use of existing singlemode backbone cabling**  
520

521 It is not uncommon for premises to have backbone cabling to comprise both multimode and singlemode optical fibres  
522 either as separate or composite cables. If there are insufficient multimode optical fibres available, it may be that the  
523 singlemode optical fibres are unused. In such cases, as the ZinWave 2700 DAS is "fibre-agnostic", it is reasonable to use  
524 the singlemode backbone cabling and to implement the generic wireless application overlay cabling in singlemode  
525 cabling also. This has the benefit that no ZinWave proprietary pigtails, launch cords and patchcords are required  
526 anywhere within the ZinWave channel.  
527

528 If there are adequate numbers of unused (or reassignable) singlemode optical fibres in the building backbone cabling  
529 then their use for the ZinWave 2700 DAS will require either:  
530

- a crossconnection using an industry-standard singlemode "patch cord" between the existing backbone panel and the  
531 ZinWave Termination Panel in the FD/HC as shown in Figure 4-5;
- or, where there are enough optical fibres in an existing singlemode optical fibre backbone cable to allow the allocation of  
533 a complete cable to the ZinWave 2700 DAS;
- the replacement of the backbone cabling panel and the ZinWave Termination Panel with a ZinWave Splice panel as  
535 shown in Figure 4-6.

536 The latter enables a lower channel insertion loss (see 4.3.3) and more secure distribution of the services provided over  
537 the ZinWave 2700 DAS. It is also the preferred approach if additional backbone cabling is to be installed (see 4.3.1.4).  
538

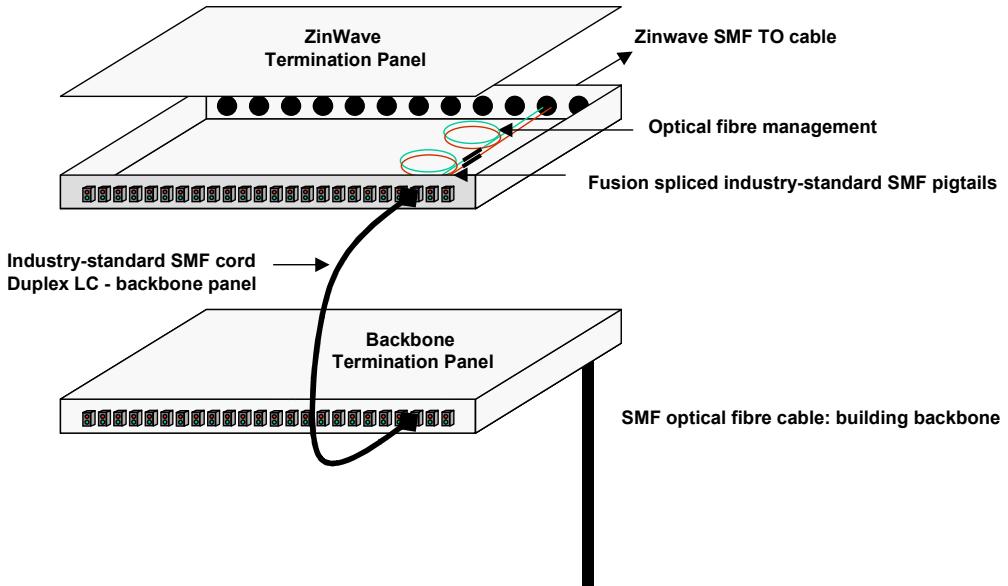
539 **WARNING:** Customers may be unwilling to allow partial re-work to be undertaken on a backbone cabling panel if other services are  
540 already operating through the optical fibre contained within it.  
541

542 **WARNING:** Installers may be unwilling to accept responsibility for the modifications made to existing cable plant. The opening of  
543 backbone panels may:

- a) be difficult due to poor cable dressing practice in the cabinets that puts both the re-work and other cabling at risk;
- b) determine that inadequate lengths of optical fibre exist in the panels to allow fusion splicing of the ZinWave hi-conn  
545 pigtails;
- c) determine that the management practices for the optical fibre within the panels puts other optical fibres at risk.  
547

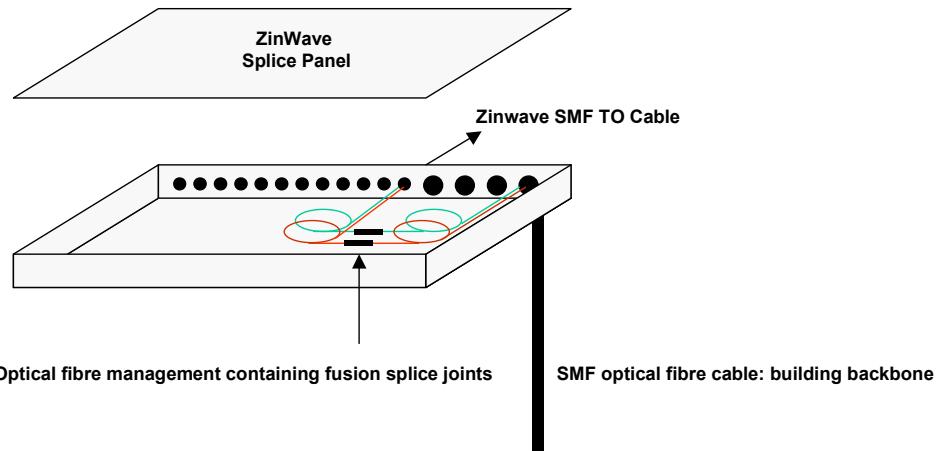
549 Where there is no singlemode content within the backbone cabling, the choice lies between the re-use of existing  
550 multimode optical fibre cabling (see 4.3.1.2) and the installation of additional multimode or singlemode backbone cables  
551 (see 4.3.1.4).

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Figure 4-5: Re-use of existing singlemode optical fibre backbone cabling at an FD/HC via patching



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Figure 4-6: Re-use of existing singlemode optical fibre backbone cabling at an FD/HC via splicing within a panel

560  
561

#### 4.3.1.3 Re-use of existing multimode backbone cabling

562 If there are adequate numbers of unused (or reassignable) multimode optical fibres in the building backbone cabling then  
563 their use for the ZinWave 2700 DAS will require, as shown in Figure 4-7:

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568

- a crossconnection using the appropriate ZinWave hi-conn “patch cord” between the and the ZinWave Termination Panel in the FD/HC;
- the re-termination (at both ends) of the available optical fibres in the existing backbone panel using appropriate hi-conn pigtaills of Table 3-8;
- the replacement of the backbone panel adaptors (at both ends) with their singlemode equivalents.

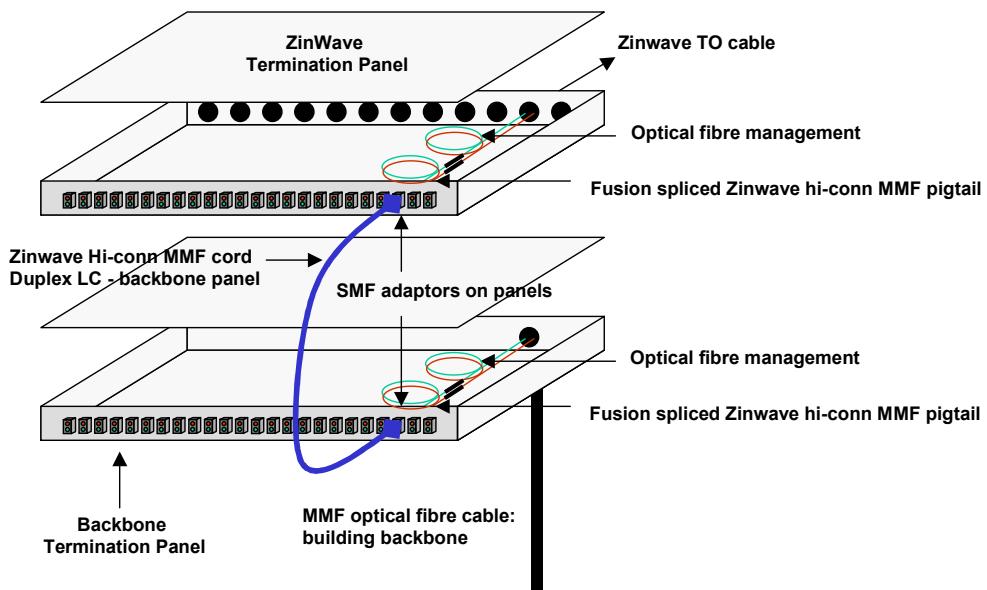
569 Where there are enough optical fibres in an existing multimode optical fibre backbone cable to allow the allocation of a  
570 complete cable to the ZinWave 2700 DAS then the backbone panel at the FD/HC may be replaced with a ZinWave  
571 Splice Panel as shown in Figure 4-8. The latter enables a lower channel insertion loss (see 4.3.3) and more secure  
572 distribution of the services provided over the ZinWave 2700 DAS. It is also the preferred approach if additional backbone  
573 cabling is to be installed (see 4.3.1.4).  
574

575 However, unless another ZinWave Splice Panel is used at the BD/IC (as part of a campus distribution system) the optical  
576 fibre cable at the BD/IC will require:  
577 • the re-termination of the optical fibres using appropriate hi-conn pigtails of Table 3-8;  
578 • the replacement of the backbone panel adaptors with their singlemode equivalents.  
579

580 **WARNING:** Customers may be unwilling to allow partial re-work to be undertaken on a backbone cabling panel if other services are  
581 already operating though the optical fibre contained within it.  
582

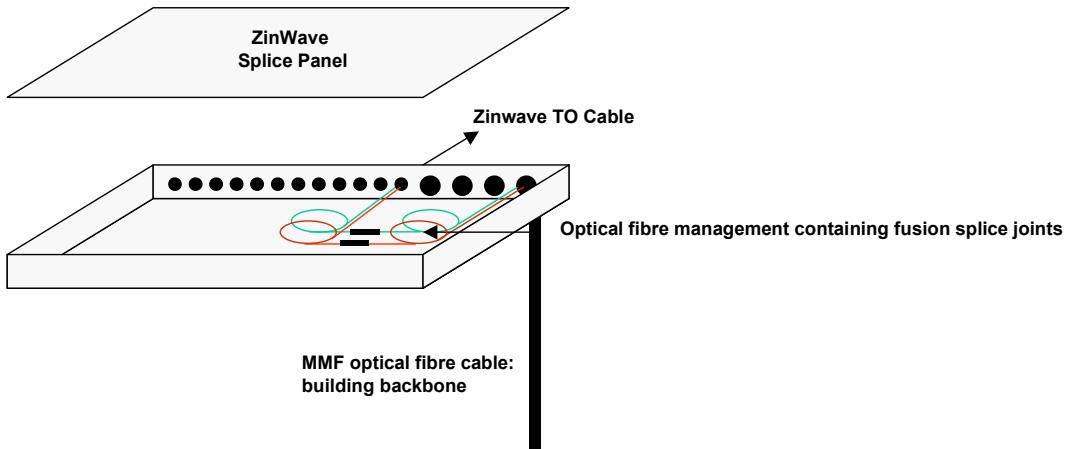
583 **WARNING:** Installers may be unwilling to accept responsibility for the modifications made to existing cable plant. The opening of  
584 backbone panels may:  
585 a) be difficult due to poor cable dressing practice in the cabinets that puts both the re-work and other cabling at risk;  
586 b) determine that inadequate lengths of optical fibre exist in the panels to allow fusion splicing of the ZinWave hi-conn  
587 pigtails;  
588 c) determine that the management practices for the optical fibre within the panels puts other optical fibres at risk.  
589

590 Where existing backbone cables are to be used for the distribution of the ZinWave 2700 DAS, the optical fibre in the  
591 ZinWave TO cables (see Table 3-9), launch cords, hi-conn pigtails and patchcords (see Table 3-8), shall be selected to  
592 match those of the backbone cable.  
593  
594



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596

597 **Figure 4-7: Re-use of existing multimode optical fibre backbone cabling at an FD/HC via patching**  
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599

600 **Figure 4-8: Re-use of existing multimode optical fibre backbone cabling at an FD/HC via splicing within a panel**

601

#### 602 **4.3.1.4 Installation of new backbone cabling**

603 The installation of additional backbone cabling, integrated within the generic/structured cabling but intended for the  
604 distribution of the ZinWave 2700 DAS has certain advantages by:

- 605 • overcoming the reluctance on behalf of customers and/or installers to interfere with existing cable infrastructures;
- 606 • maintaining the existing backbone capacity;
- 607 • enabling lower channel insertion loss (see 4.3.3) and more secure distribution of the services provided over the  
608 ZinWave 2700 DAS by using ZinWave Splice Panels (as shown in Figure 4-6 and Figure 4-8) in as many locations as  
609 possible.

610

611 The installation of additional generic/structured backbone cabling provides considerable freedom in the selection of the  
612 type of optical fibre to be used. The full range of all-silica optical fibres specified in the generic/structured cabling  
613 standards including the ANSI/TIA/EIA-568 series standards, the EN 50173 series standards and ISO/IEC 11801 may be  
614 considered.

615

616 The specifications of the cabled optical fibres in these standards are shown in Table 4-3. The shaded areas show  
617 parameters that are not relevant for the ZinWave 2700 DAS but do influence selection for other applications.

618

619 As the ZinWave 2700 DAS is "fibre-agnostic", any selection of media may be made on a number of criteria including  
620 requirement to match existing cabling media, cabling installation cost, future requirements etc.

621

622 The selection of the optical fibre media to be used and how they are to be connected should also take into account the  
623 considerations of channel length and channel insertion loss outlined in clause 4.3.3.

624

625 However, the final selection made has to be applied to all the cabling in the ZinWave 2700 DAS infrastructure.

626

#### 627 **4.3.2 ZinWave 2700 DAS in stand-alone infrastructures**

628

##### **4.3.2.1 Media selection**

629 The number of TOs to be served by each ZinWave Local Splice Panel defines the number of optical fibres required to  
630 feed that Local Distribution Panel from the ZinWave Building Termination or Splice Panel.

631

632 The installation of a stand-alone ZinWave DAS infrastructure provides considerable freedom in the selection of the type  
633 of optical fibre to be used. The full range of all-silica optical fibres specified in the generic/structured cabling standards  
634 including the ANSI/TIA/EIA-568 series standards, EN 50173-1 and ISO/IEC 11801 may be considered.

635

636 The specifications of the cabled optical fibres in these standards are shown in Table 4-3.

637

638 As the ZinWave 2700 DAS is “fibre-agnostic”, any selection of media may be made on a number of criteria including  
 639 cabling installation cost, future requirements etc. The selection of the optical fibre media to be used and how they are to  
 640 be connected should also take into account the considerations of channel length and channel insertion loss outlined in  
 641 clause 4.3.3.

642 However, the final selection made has to be applied to all the cabling in the ZinWave 2700 DAS infrastructure.

643 The installation of stand-alone cabling is typically implemented by fusion splicing the cabling at Local Splice Panels (and  
 644 Building Splice Panels where campus distribution is involved). This enables lower channel insertion loss (see 4.3.3) and  
 645 more secure distribution of the services provided over the ZinWave 2700 DAS.

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650 **Table 4-3: Performance of cabled optical fibres in generic/structured cabling standards**

Optical fibre	Applicable standard	Designation with the applicable standard	Attenuation coefficient	Modal bandwidth
<b>SMF</b>	ANSI/TIA/EIA-568-B series	Internal plant	1.0 dB/km @ 1310 nm	N.A.
			1.0 dB/km @ 1550 nm	
		External plant	0.5 dB/km @ 1310 nm	
			0.5 dB/km @ 1550 nm	
	EN 50173-1	OS1	1.0 dB/km @ 1310 nm	
			1.0 dB/km @ 1550 nm	
		OS2	0.4 dB/km @ 1310 nm	
			0.4 dB/km @ 1550 nm	
	ISO/IEC 11801	OS1	1.0 dB/km @ 1310 nm	
			1.0 dB/km @ 1550 nm	
		OS2 <sup>1</sup>	0.4 dB/km @ 1310 nm	
			0.4 dB/km @ 1550 nm	
<b>50/125</b>	ANSI/TIA/EIA-568-B series	Basic	3.5 dB/km @ 850 nm	500 MHz.km @ 850 nm
		Laser optimised	3.5 dB/km @ 850 nm	1500 <sup>2</sup> MHz.km @ 850 nm
		Basic or laser optimised	1.5 dB/km @ 1300 nm	500 MHz.km @ 1300 nm
	EN 50173-1/ISO/IEC 11801	OM1	3.5 dB/km @ 850 nm	200 MHz.km @ 850 nm
		OM2	3.5 dB/km @ 850 nm	500 MHz.km @ 850 nm
		OM3	3.5 dB/km @ 850 nm	1500 <sup>2</sup> MHz.km @ 850 nm
		OM1, OM2 or OM3	1.5 dB/km @ 1300 nm	500 MHz.km @ 1300 nm
<b>62.5/125</b>	ANSI/TIA/EIA-568-B series		3.5 dB/km @ 850 nm	500 MHz.km @ 850 nm
			1.5 dB/km @ 1300 nm	500 MHz.km @ 1300 nm
	EN 50173-1/ISO/IEC 11801	OM1	3.5 dB/km @ 850 nm	200 MHz.km @ 850 nm
		OM2	3.5 dB/km @ 850 nm	500 MHz.km @ 850 nm
		OM1 or OM2	1.5 dB/km @ 1300 nm	500 MHz.km @ 1300 nm

651 NOTE 1: By reference to ISO/IEC 24702

652 NOTE 2: 2000 MHz.km for restricted launch

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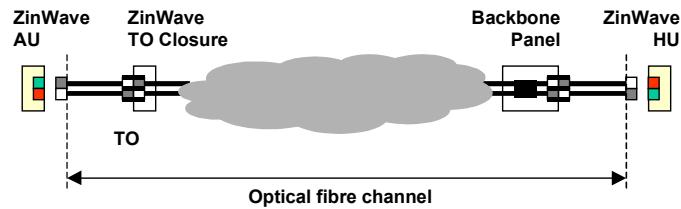
### 4.3.3 Channel insertion loss considerations

#### 4.3.3.1 General

655 In this clause the figures show the ZinWave 2700 DAS implemented within generic/structured cabling infrastructures.  
 656 However, the analysis provided also applies to stand-alone ZinWave infrastructures where the FD/HCs are replaced by  
 657 ZinWave Local Splice Panels etc.

658  
 659 An optical fibre channel is specified and tested (see clause 5) between the two reference points shown in Figure 4-9.  
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663

**Figure 4-9: Optical fibre channel**

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666 A ZinWave 2700 DAS optical fibre channel will comprise lengths of cable and a number of connections and fusion  
667 spliced joints.

668

669 For the purposes of this clause, the following assumptions are made:

- 670 • the attenuation coefficients of the multimode cabled optical fibres are those of Table 4-3 (a common value of  
671 1.5dB/km maximum at 1300 nm);
- 672 • the attenuation coefficient of the internal singlemode cabled optical fibres is 1.0dB/km maximum at 1310 nm;
- 673 • the attenuation coefficient of the external singlemode cabled optical fibres is 0.5 dB/km maximum at 1310 nm;

674

675 The combined insertion loss of multiple connections and fusion spliced joints are treated statistically as shown in Table  
676 4-4.

677

**Table 4-4: Typical channel insertion loss from connecting hardware**

Typical maximum channel insertion loss from connections and splices (dB)							
No. of splices in channel	Number of connections in channel						
	2	3	4	5	6	7	8
	3	1.74	2.11	2.50	2.80	3.06	3.31
	4	1.84	2.21	2.60	2.90	3.16	3.41
	5	1.94	2.31	2.70	3.00	3.26	3.51
	6	2.04	2.41	2.80	3.10	3.36	3.61
	7	2.14	2.51	2.90	3.20	3.46	3.71
							3.95

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NOTE: It should be noted that the statistical addition of connection and fusion splice losses assumes that all interfaces are in good condition, terminated/jointed in accordance with suppliers instructions and meet the following individual performance criteria:

- a) Connections: 100% < 0.75dB, 95% < 0.5 dB
- b) Fusion splices: 100% < 0.3dB, 95% < 0.15 dB

If the connections and fusion splices used in a given channel do not meet these criteria the channel insertion loss calculations of this clause will be inaccurate.

#### 4.3.3.2 Multimode channel length and channel insertion loss calculations

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The maximum channel lengths and channel insertion loss values shown in Table 2-1 are only applicable to optical fibre cables having modal bandwidth of 500 MHz.km @ 1300 nm minimum. These meet the minimum requirements of all multimode optical fibres in ANSI/TIA/EIA-568 series standards, EN 50173-1 and ISO/IEC 11801 as detailed in Table 4-3.

NOTE: Reduced channel lengths and channel insertion loss values may be supportable for lower modal bandwidth options following detailed analysis by ZinWave.

Figure 4-10 shows typical configurations for ZinWave 2700 DAS channels using multimode optical fibre cables to the specifications quoted in Table 4-3. Figure 4-10 shows that for channels containing up to four connections and four splices the maximum channel insertion is not exceeded at the maximum channel length (550 metres) as per Table 2-1.

701 If the number of connections and splices changes the typical supported channel lengths are shown in Table 4-5.  
 702  
 703

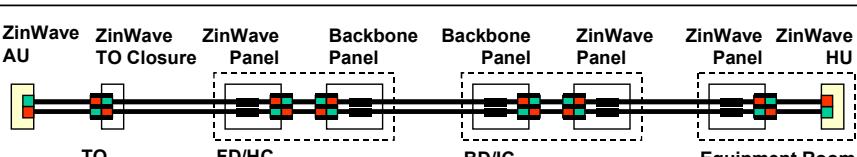
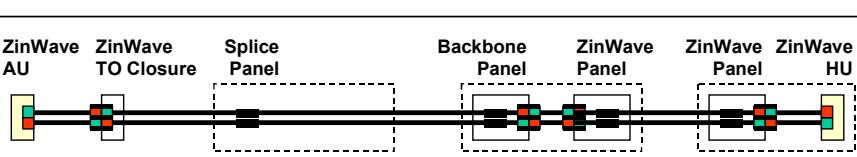
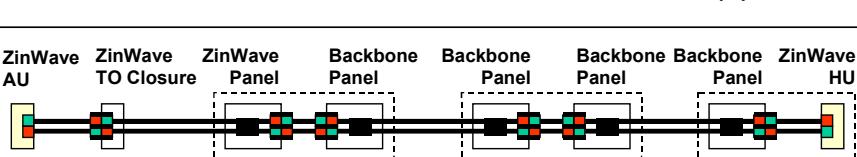
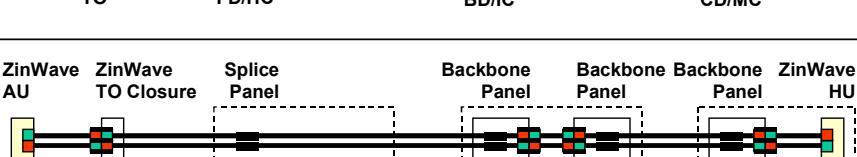
	<p>MMF @ 1.5 dB/km max.    493 m = 0.74 dB max.</p> <p>Statistical addition:    6 connections = 2.76 dB max    5 splices = 0.5 dB max</p> <p>Total = 4.00 dB</p>
	<p>MMF @ 1.5 dB/km max.    550 m = 0.83 dB max.</p> <p>Statistical addition:    4 connections = 2.20 dB max    4 splices = 0.4 dB max</p> <p>Total = 3.43 dB</p>
	<p>MMF @ 1.5 dB/km max.    493 m = 0.83 dB max.</p> <p>Statistical addition:    6 connections = 2.76 dB max    5 splices = 0.5 dB max</p> <p>Total = 4.00 dB</p>
	<p>MMF @ 1.5 dB/km max.    550 m = 0.83 dB max.</p> <p>Statistical addition:    4 connections = 2.20 dB max    4 splices = 0.4 dB max</p> <p>Total = 3.43 dB</p>

Figure 4-10: ZinWave 2700 DAS channels over multimode optical fibre

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Table 4-5: Multimode optical fibre channel length for multiple connections and fusion splices

No. of splices in channel	Typical channel length (metres)							
	Number of connections in channel							
	2	3	4	5	6	7	8	
3	3					460	300	
	4					393	233	
	5	550				493	327	167
	6					426	260	100
	7				533	360	193	33

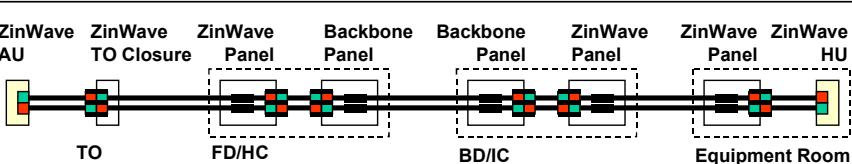
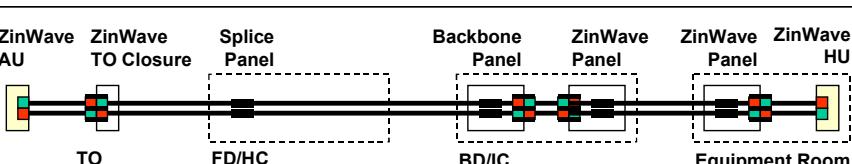
708  
 709  
 710 4.3.3.3 Singlemode optical fibre channel length and channel insertion loss calculations

711 Figure 4-11 shows typical configurations for ZinWave 2700 DAS channels using internal singlemode optical fibre cables  
 712 to the specifications quoted in Table 4-3. Figure 4-11 shows that for channels containing up to six connections and five

713 splices the maximum channel insertion is not exceeded at the channel lengths up to 830 metres. It is unlikely that an  
714 internal cabling channel would ever exceed this number of connections and splices.

715  
716 A reduction in the number of connections and splices would increase the maximum channel lengths to 2000 metres. It is  
717 also probable that a channel of such a length would, for reason of installation practice, begin to use external grade  
718 cables and the maximum channel length supported by the ZinWave 2700 DAS (2000 metres) would be reached before  
719 the maximum channel insertion loss of Table 2-1 is attained.

720  
721 If the number of connections and splices changes the typical supported channel lengths are shown in Table 4-6.  
722

	<b>SMF @ 1.0 dB/km max.</b> <b>740 m = 0.74 dB max.</b>  <b>Statistical addition:</b> <b>6 connections = 2.76 dB max</b> <b>5 splices = 0.5 dB max</b>  <b>Total = 4.00 dB</b>
	<b>SMF @ 1.0 dB/km max.</b> <b>1400 m = 1.40 dB max.</b>  <b>Statistical addition:</b> <b>4 connections = 2.20 dB max</b> <b>4 splices = 0.4 dB max</b>  <b>Total = 4.00 dB</b>

724  
725 **Figure 4-11: ZinWave 2700 DAS channels over internal singlemode optical fibre cabling**

726  
727 **Table 4-6: Internal singlemode optical fibre channel length for multiple connections and fusion splices**

No. of splices in channel	Typical channel length (metres)						
	Number of connections in channel						
	2	3	4	5	6	7	8
3	1890	1500	1200	940	690	450	
	2000	1790	1400	1100	840	590	350
		1690	1300	1000	740	490	250
		1590	1200	900	640	390	150
	1960	1490	1100	800	540	290	50

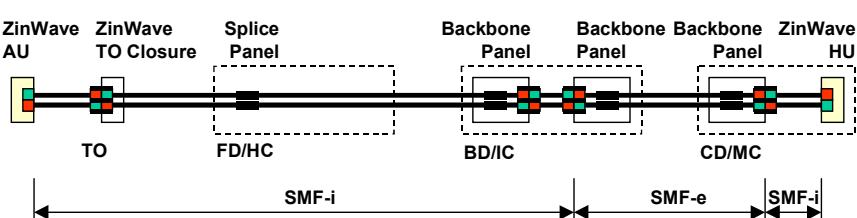
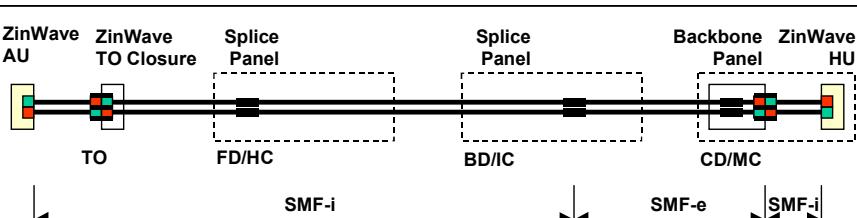
728  
729  
730 Figure 4-12 shows typical configurations for ZinWave 2700 DAS channels using combinations of internal and external  
731 singlemode optical fibre cables to the specifications quoted in Table 4-3. In Figure 4-12 it is assumed that the length of  
732 the channel inside a building is 400 metres. Figure 4-12 shows that for channels containing up to six connections and  
733 five splices the maximum channel insertion is not exceeded at the channel lengths up to 1280 metres.

734  
735 Once again the use of splice panels to reduce the number of connections and splices would increase the maximum  
736 channel lengths to the maximum channel length supported by the ZinWave 2700 DAS (2000 metres) before the  
737 maximum channel insertion loss of Table 2-1 is attained.

738

739 If the number of connections and splices changes or the lengths of internal and external cable are varied the typical  
 740 supported channel lengths are shown in Table 4-7.

741  
 742

	<p><b>SMF-i @ 1.0 dB/km max.</b>    400 m (int) = 0.40 dB max.  <b>SMF-e @ 0.5 dB/km max.</b>    1600 m (ext) = 0.80 dB max.</p> <p><b>Statistical addition:</b>    4 connections = 2.20 dB max    4 splices = 0.5 dB max</p> <p><b>Total = 3.90 dB</b></p>
	<p><b>SMF-i @ 1.0 dB/km max.</b>    400 m (int) = 0.40 dB max.  <b>SMF-e @ 0.5 dB/km max.</b>    1600 m (ext) = 0.80 dB max.</p> <p><b>Statistical addition:</b>    2 connections = 1.34 dB max    3 splices = 0.3 dB max</p> <p><b>Total = 2.84 dB</b></p>

743

744

Figure 4-12: ZinWave 2700 DAS channels over internal and external singlemode optical fibre cabling

745

746

Table 4-7: Internal/external singlemode optical fibre channel length for multiple connections and fusion splices

No. of splices in channel	Typical total channel length (metres)						
	Number of connections in channel						
	2	3	4	5	6	7	8
4000	3780	3000	2400	1880	1380	900	
	3580	2800	2200	1680	1180	700	
	3380	2600	2000	1480	980	500	
	3180	2400	1800	1280	780	300	
7	3920	2980	2200	1600	1080	580	100
8	3720	2780	2000	1200	880	380	-
9	3520	2580	1800	1200	680	180	-

**NOTE:**  
 The channel lengths shown above can be divided between internal and external cable in the ratio 1:2.  
 As an example a value of 2000 metres may be installed as 1500 metres of external cable and 250 metres of internal cable.  
 The total channel length shall not exceed 2000 metres.

747

748

#### 4.4 Accommodation of ZinWave TO Closures

750 Each ZinWave TO Closure provides the capacity for 2 No. ZinWave TO cables and 2 No. 4 pair balanced cables (for provision of remote power feeding to ZinWave 2760 or 2776 Antenna Units. If fully populated a ZinWave TO Closure



752 can support the connection of 2 No. ZinWave 2760 or 2776 Antenna Units. Alternatively, the TO Closure enables the  
753 installation of a dual-redundant connections to a single ZinWave 2760 or 2776 Antenna Unit.

754

#### 755 **4.5 Accommodation of ZinWave Termination Panels**

756 In generic/structured cabling infrastructures, ZinWave Termination Panels may be located at:

757 

- 758 • FD/HCs to provide:
  - 759 • the presentation of the generic wireless application overlay cabling to the TO;
  - 760 • the presentation of additional building backbone cabling (although ZinWave Splice Panels are  
761 recommended for security);
- 762 • BD/ICs to provide:
  - 763 • the presentation of additional building backbone cabling;
  - 764 • the presentation of the ZinWave presentation cabling from a remote equipment room;
  - 765 • the presentation of additional campus backbone cabling (although ZinWave Splice Panels are  
766 recommended for security);
- 767 • CD/MCs to provide:
  - 768 • the presentation of additional building backbone cabling;
  - 769 • the presentation of the ZinWave presentation cabling from a remote equipment room;
- 770 • remote equipment rooms to provide the presentation for connection to the ZinWave 2700 Hub Units.

771 In stand-alone infrastructures, ZinWave Termination Panels may be used as:

772 

- 773 • Building Termination Panels;
- 774 • Campus Termination Panels.

775 ZinWave Termination Panels are not ZinWave products since they have no ZinWave-specific features. However, they  
776 are recommended to contain the following features:

777 

- 778 • a 1U 19" unit (for cabinet/rack/frame fixing);
- 779 • front panel access to maximum of 24 No. LC-Duplex interfaces (this number of interfaces are not generally required  
780 to provide connections to ZinWave 2760 or 2776 Antenna Units at each TO - instead they provide, if necessary, spare  
optical fibres to each TO as a means of resilience);
- 781 • glanded rear entry points for 12 No. ZinWave TO cables (see Figure 4-5 and Figure 4-7);
- 782 • glanded rear entry points for up to two backbone optical fibre cables (depending upon the approach to resilience  
783 adopted by the customer).

784 The panels are not required to house more than 48 No. optical fibre fusion splices.

785 One panel is required to support the termination of:

786 

- 787 • up to 24 No. TOs
- 788 • up to 48 backbone or stand-alone infrastructure optical fibres.

789 As the ZinWave Termination Panels present interfaces to which cords are to be attached, space shall be allocated for the  
790 associated cable management fixtures to hold and prevent damage to those cords.

791

#### 792 **4.6 Accommodation of ZinWave Splice Panels**

793 In generic/structured cabling infrastructures, ZinWave Termination Panels may be located at:

794 

- 795 • FD/HCs to:
  - 796 • joint the generic wireless application overlay cabling to the building backbone cabling;
- 797 • BD/ICs to:
  - 798 • joint building backbone cabling to campus backbone cabling;
  - 799 • joint building backbone cabling to ZinWave presentation cabling from a remote equipment room;
- 800 • CD/MCs to joint campus backbone cabling to ZinWave presentation cabling from a remote equipment room.

801 In stand-alone infrastructures, ZinWave Termination Panels may be used as:

802 

- 803 • Local Splice Panels;
- 804 • Building Splice Panels.



807 ZinWave Termination Panels are not ZinWave products since they have no ZinWave-specific features. However, they  
808 are recommended to contain the following features:

- 809 • a 1U 19" unit (for cabinet/rack/frame fixing) or wall box (for free form fixing);
- 810 • glanded entry points for 12 No. ZinWave TO cables (see Figure 4-6 and Figure 4-8);
- 811 • glanded entry points for 4 No. "backbone-type" optical fibre cables.

812 One panel is required to support the jointing of 48 No. optical fibre fusion splices

813 There are no specific additional accommodation requirements for ZinWave Splice Panels.

814 The location of the ZinWave Splice Panels shall take into account the installation and operational environment.

## 815 **4.7 Remote Powering of ZinWave 2760 or 2776 Antenna Units**

816 Remote powering of the ZinWave 2760 or 2776 Antenna Units requires the installation at the FD/HC of:

- 817 • a balanced cabling panel at which to present the balanced cables providing the power to the TO Closures;
- 818 • an IEEE 802.3af compliant mid-span power panel.

819 These panels are not ZinWave products since they have no ZinWave-specific features.

820 As these panels present interfaces to which cords are to be attached, space shall be allocated for the associated cable  
821 management fixtures to hold and prevent damage to those cords.

## 822 **4.8 Transceiver Distribution**

### 823 **4.8.1 General**

824 Clauses 4.1 to 4.7 have concentrated on the cabling infrastructure to support a ZinWave 2700 DAS. This clause focuses  
825 on the topics required to optimise the functionality of the ZinWave 2700 DAS using the infrastructure.

### 826 **4.8.2 RF source mapping**

827 The RF combiner within the ZinWave 2700 basic hub operates with the installed ZinWave 2780 SFP optical fibre  
828 transceiver modules in specific combinations. The possible combinations are shown in Figure 4-13.

829 The requirement delivery of services within the premises may influence the way in the RF sources are connected to the  
830 ZinWave 2700 Hub Unit and the way in which the RF combiner is configured using the ZinWave management software.

831 Further information is provided in the ZinWave 2700 DAS User Manual.

### 832 **4.8.3 Service-specific antenna service mapping**

833 The TO matrix described in clause 4.2 is installed to minimise the need for, and cost of, future re-installation of cabling  
834 that may be required as wireless service demands change. However, the installed TO matrix does not define the matrix  
835 of ZinWave 2760 or 2776 Antenna Units.

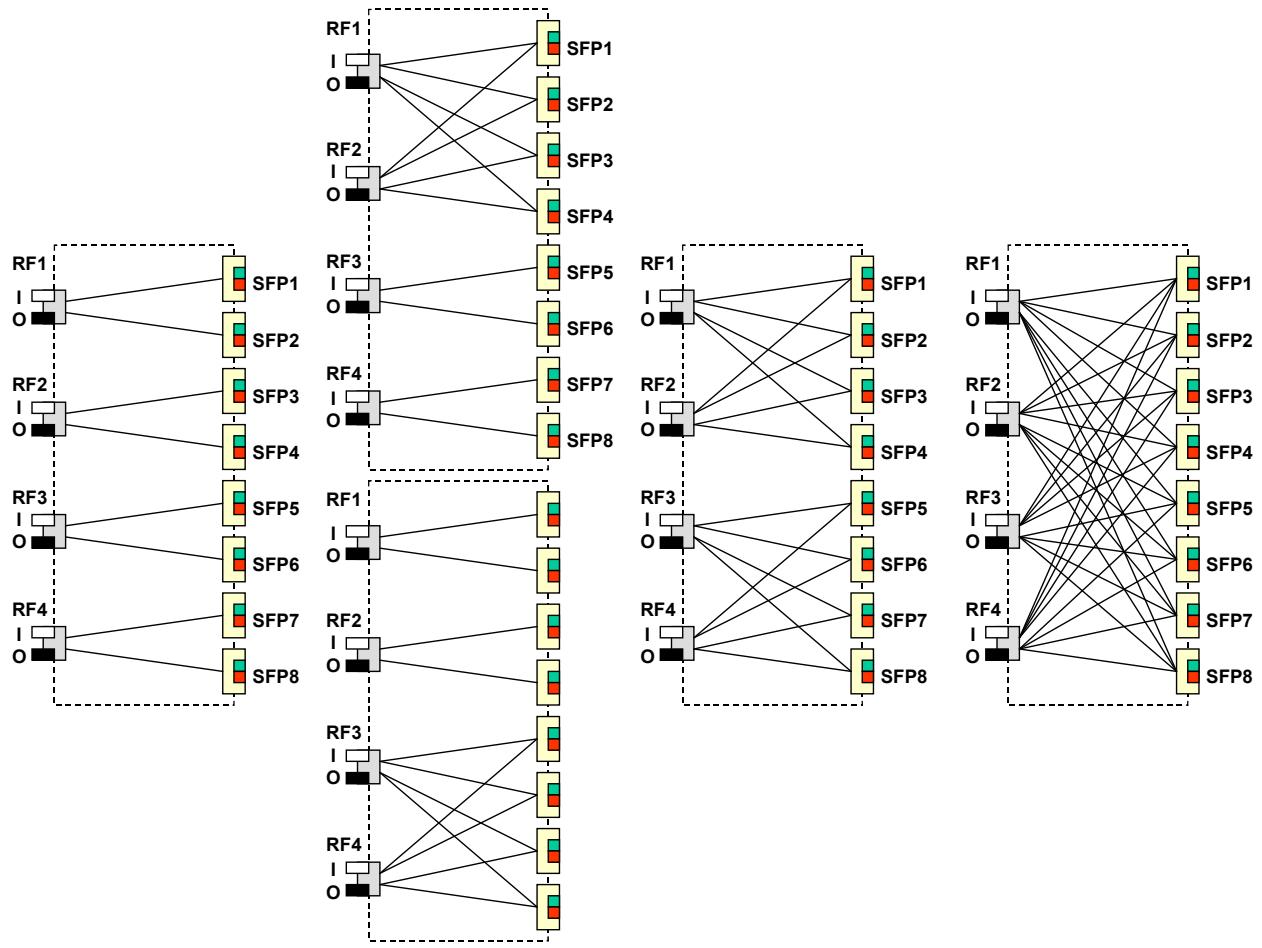
836 The number of ZinWave 2760 or 2776 Antenna Units installed at any given time is required to match the wireless  
837 application needs of the customer at that time. In addition the type and number of service-specific antennae attached to  
838 each ZinWave 2760 or 2776 Antenna Units will also depend on the demand for and operating range of those specific  
839 services.

840 Further information is provided in the ZinWave 2700 DAS User Manual.

## 841 **4.9 Gain Mapping**

842 Once the selection of the necessary RF source and service-specific antenna mapping has been addressed it is  
843 necessary to consider mapping the gain applied to each antenna system using the ZinWave management software to  
844 ensure that the correct RF channel budget is met.

845 Further information is provided in the ZinWave 2700 DAS User Manual.



861  
862

[1:2] x 4

[1:4] + [1:2] x 2

[2:4] x 2

[4:8]

**Figure 4-13: RF combiner options**

863  
864  
865  
866  
867



868 **5 ZINWAVE 2700 DAS INSTALLATION**

869 **5.1 Cabling installation**

870 **5.1.1 General**

871 The installation of optical fibre cabling shall be in accordance with the EN 50174 series of standards.

872

873 **5.1.2 Cables**

874 **5.1.2.1 ZinWave TO cables**

875 The ZinWave TO cables shall be selected from those of Table 3-9 in order to allow sufficient spare cable for subsequent  
876 dressing in cabinets/frames/racks and for the inclusion, where appropriate, of service loops at specific locations.

877

878 The pre-terminated end of the TO cables shall be protected during their installation and the end caps shall not be  
879 removed prior to, or during, the installation of the cables.

880

881 **5.1.2.2 Coaxial cables**

882 Coaxial cables are used to deliver/access the services supported by the ZinWave 2700 DAS:

- at the ZinWave 2760 or 2776 Antenna Unit
- at the ZinWave 2700 Hub

883

884

885 The interfaces on both the 2760 Antenna Unit and the ZinWave 2700 Hub are SMA-style. The interfaces on the 2776  
886 Antenna Unit is N-style.

887

888 At the ZinWave 2760 Antenna Unit, it is expected that the service-specific antennae will be connected via small diameter  
889 coaxial cables that are compatible to the SMA interface.

889

890

891 At the ZinWave 2776 Antenna Unit it is expected that that the service-specific antenna will be connected via a coaxial  
892 cable that is compatible to the N interface.

893

894

895 In the vicinity of the ZinWave 2700 Hub Unit, the RF sources may be presented on larger coaxial cables that are not  
896 physically compatible to the SMA interface of the Hub Unit. It is therefore required to install a separate interface panel, in  
897 association with the ZinWave 2700 Hub Unit, that provides a fixed conversion from the larger coaxial cables to cables  
898 that are physically compatible to the SMA interfaces on the ZinWave 2700 Hub Unit.

899

900 **5.1.2.3 Balanced cables for the provision of remote power to the ZinWave 2760 or 2776 Antenna Units**

901 The cables shall be in accordance with Category 5e of ANSI/TIA/EIA-568-B-2 or Category 5 of EN 50173-1 (equivalent  
902 to Category 5 specified in ISO/IEC 11801:2002)

903

904 **5.1.3 Fitting of the ZinWave TO Closure**

905 The ZinWave TO Closure should be fixed in its desired location after the termination of the balanced cable (see 5.1.2.3  
906 and 5.1.4.3) has been completed and the balanced cable glandled and dressed into position within the closure.

907

908 Once the ZinWave TO Closure has been fixed in position and the TO cable(s) installed:

- blanking plate(s) covering optical fibre port(s) may be removed and the SMF adaptor(s) installed;
- the TO cable(s) can be inserted into the SMF adaptor(s);
- the external caps of the SMF adaptor(s) shall remain in place.

912

913 **5.1.4 Cable termination**

914 **5.1.4.1 Multimode optical fibre cables**

915 The termination of all multimode optical fibres to be used by the ZinWave 2700 DAS shall be via the fusion splicing of  
916 ZinWave hi-conn pigtailed as detailed in Table 3-8. The adaptors shall be SMF variants of the relevant connector style.

917

918 WARNING: Only fusion splice techniques shall be used to joint the installed optical fibres to the ZinWave hi-conn pigtailed.  
919 Mechanical splices shall not be used



920  
921 NOTE: it may be possible to avoid the use of Zinwave hi-conn pigtails if the multimode optical fibre is of the laser optimised  
922 type specified in the ANSI/TIA/EIA-568-B series standards or of Category OM3 specified in EN 50173-1 and ISO/IEC  
923 11801. However, this decision should only be made following agreement with appropriate ZinWave personnel.  
924

925 **5.1.4.2 Singlemode optical fibre cables**

926 The termination of all singlemode optical fibres to be used by the ZinWave 2700 DAS shall be via the fusion splicing of  
927 industry-standard pigtails. The adaptors shall be SMF variants of the relevant connector style.  
928

929 **5.1.4.3 Balanced cables for the provision of remote power to the ZinWave 2760 or 2776 Antenna Units**

930 The pin-pair allocation of the cable at the TO Closure shall be that of the cables at the balanced cabling panel. This may  
931 be either T568A or T568B (defined in ANSI/TIA/EIA-568-B series standards) in accordance with the pin-pair allocation  
932 elsewhere in the premises.  
933

934 The connecting hardware at the balanced cabling panel at the FD/HC shall be in accordance with Category 5e of  
935 ANSI/TIA/EIA-568-B-2 or Category 5 of EN 50173-1 (equivalent to Category 5 specified in ISO/IEC 11801:2002).  
936

937 **5.1.5 Cords**

938 **5.1.5.1 Multimode optical fibre cords**

939 Where ZinWave 2700 DAS Hub and Antenna Units are connected to multimode optical fibre interfaces it is necessary to  
940 use ZinWave 2700 equipment cords listed in Table 3-8. These duplex cords feature an offset launch in the "launch" leg  
941 and must be connected in the correct orientation.  
942

943 The connection between multimode optical fibre interfaces for the ZinWave 2700 DAS shall be made via ZinWave hi-  
944 conn cords as detailed in Table 3-8.  
945

946 NOTE: it may be possible to avoid the use of Zinwave equipment cords and patch cords if the multimode optical fibre is of the  
947 laser optimised type specified in the ANSI/TIA/EIA-568-B series standards or of Category OM3 specified in EN 50173-1  
948 and ISO/IEC 11801. However, this decision should only be made following agreement with appropriate ZinWave  
949 personnel.  
950

951 **5.1.5.2 Singlemode optical fibre cords**

952 The connection of singlemode optical fibre interfaces for the ZinWave 2700 DAS shall be made via industry-standard  
953 cords.  
954

955 **5.1.5.3 Balanced cables for the provision of remote power to the ZinWave 2760 or 2776 Antenna Units**

956 The cords shall be in accordance with Category 5e of ANSI/TIA/EIA-568-B-2 or Category 5 of EN 50173-1 (equivalent to  
957 Category 5 specified in ISO/IEC 11801:2002).  
958

959 **5.2 Inspection and testing of installed optical fibre cabling**

960 ISO/IEC 14763-3 contains the full set of inspection and test methods for installed optical fibre cabling.  
961



964    **6           MAINTENANCE, TROUBLESHOOTING AND TECHNICAL ASSISTANCE**

965    **6.1       Maintenance**

966    **6.2       Troubleshooting**

967    **6.3       Technical assistance**

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**DISTRIBUTED ANTENNA SYSTEM**  
**INSTALLATION AND TECHNICAL MANUAL**

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