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# DN201SC user guide (DRAFT FCC/ISED compliant)

BW-008828-SD

Issue 8

Proprietary and Confidential

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# 1. Overview

The DN201SC product delivers high bandwidth connectivity in two primary scenarios using mmWave technology in the 57-71 GHz radio band. The two scenarios are:

- For rail or transport use between a vehicle and static units when combined with the vehicle unit TN201SC. In this scenario the DN201SC is part of the static infrastructure.
- For fixed wireless systems where the DN201SC is used at both ends of the radio link.

*Table 1. Product types and part numbers*

Product	Manufacturer	Type
DN201SC	Blu Wireless Technology Limited	Trackside dual radio unit

## 1.1 Mast-mounted unit: DN201SC



*Figure 1. DN201SC mast-mounted unit*

## 2. Product Safety



Read all safety material in this document before installation or use.



This symbol means that there is a safety caution or warning. You must comply with any text associated with this symbol to maintain product safety.



This symbol identifies safety information relating to the unit getting hot and the conditions which may cause this.

These products are radio products and must only be used in the geographical region identified in the sales type description. Use outside of the defined region is not permitted and could violate national spectrum usage regulations. These products are only for outdoor use.

These products must not be used for any safety critical applications. Examples of such usage are: safety critical communication; emergency communication or response systems; being used to generate train position information for any rail operational purpose.



**CAUTION:** Only use DC power supplies or power sources meeting the technical requirements for voltage and power defined in the specification section of this document. Power supplies shall be suitably rated and certified in line with the installation environment.



**CAUTION:** Always install with an accessible switch or alternative accessible disconnect device to remove power from the unit. No disconnect devices are available at the product which are normally inaccessible after installation. Ensure that the switch or disconnect device is appropriately labelled.

Do not install or use the product in locations where other equipment heat sources will increase the ambient or case temperature beyond specified limits. Do not use when ambient or mounting point temperatures are below -25 or above 55 degrees Celsius.



**WARNING:** This device may become hot if covered. Should the unit be covered or otherwise become excessively hot whilst being installed or tested, turn the unit off and leave for one hour before touching.

Do not restrict airflow around or cover the unit. This may cause units to overheat and reduce performance.



**WARNING:** This product emits RF radiation as part of its normal operation. Do not install or use where, when powered on, any member of the public may be within 60 cm of the unit. Temporary use by service personnel at distances above 30 cm during installation is permitted.

If the product, attached cabling or mounting bracket is damaged, vandalised, misaligned or the unit is not operational, switch the unit off immediately by removing the power cable or switching off the power to the PSU and report to the appropriate installation, maintenance, or network operations centre.

Installation, uninstallation, and maintenance should only be performed by appropriately trained and qualified personnel for the environment in which the product is being installed. Product-specific training is available from Blu Wireless.



**WARNING:** During installation of units at height where units are not otherwise safely secured, always use a safety leash connected to a safety eye on the unit and another sturdy location to prevent units falling and causing injury or damage. See BW-003988-TD (DN201SC Installation Guide) for further advice.

Always use all mechanical fixings when mounting units to their mounting or mounting to train or trackside infrastructure.



**CAUTION:** Do not remove any cover, cover screw or connector from the body of the equipment unless requested or permitted by the manufacturer. There are no user serviceable parts inside and opening the unit will invalidate the warranty and may compromise product safety and performance.



**CAUTION:** Do not modify the product in any way unless requested or permitted by the manufacturer. This may compromise product safety and performance.

When cleaning any unit only use cold or warm water below 40 degrees Celsius with either no or only mild soap additives. Abrasives, solvents, harsh or corrosive cleaning materials or high-pressure water jets shall not be used.

All weather protecting seals for connectors (where provided with the product) must always be in place when installed, except for the brief period during installation.

Do not paint or allow any installation or other materials to coat or cover any surface of the unit. This is particularly important for the radio windows. This may adversely affect radio and/or thermal performance.

The GPS on this product is only for use within the product to assist with maximising system performance. It is not to be used for other operational or safety critical activities.

Some variants of these products employ a class 1 laser for fibre optic network connections. Such lasers are considered safe under any normal use case, however, please use care when interacting with these products when the fibre connection is exposed.

The customer is responsible for conducting suitable system trials prior to extended roll-out of any system containing these products. Whilst all relevant EMC standards are assessed for these products, customers are responsible for satisfying themselves that radio frequencies used do not interfere with other safety systems.



**CAUTION:** Where within the UK and the EU and when connecting to the M12 10G ethernet port always use CAT 7 ethernet cable or better to maintain EMC performance. Such cables should not exceed 30m in length.



**CAUTION:** Where used in the US and Canada and when connecting to the M12 10G ethernet port always use CAT 6A ethernet cable or better to maintain EMC performance. Such cables should not exceed 30m in length.



**CAUTION:** Do not update or change the software on this device except with changes, configuration and via methods approved of in writing by Blu Wireless. Uncontrolled changes may compromise product compliance and could cause unnecessary interference with other devices and systems and could void the user's authority to operate the equipment

## 3. Product components and accessories

*Table 2. Product components*

Product	Included	Optional (defined at time of order)
DN201SC	Radio mast-mounted unit - dual radio with an M12 10G wired ethernet port. Fibre network port.	Alternative network ports are available as an option and are included with some sales types. Mast attachment fixture (suitable for use with metal band/jubilee type clamps).

## 4. Regulatory

### 4.1 Radio regulatory information

**Table 3. DN201SC RF characteristics: All regions**

RF Characteristic	Min	Nominal	Max	Comment
Operating Frequency Range	57 GHz	-	71 GHz	May be subject to national restrictions on use.
Transmitter RF Power	-	-	40 dBm	Complies with EN 302 567 and CEPT 70-03 Regulations.


#### 4.1.1 Radio product change statement

Blu Wireless does not permit or authorize any changes or modifications to the product, including changes to software, which may affect radio behaviour except where explicitly supported by the product configuration tooling and documentation provided by Blu Wireless.

### 4.2 United Kingdom and Europe

The Blu Wireless DN201SC radio equipment is designed to operate in the unlicensed 57 to 71 GHz frequency allocation and is compliant with relevant market legislation and requirements.

The following graphic identifies the countries and regions where there maybe restrictions on operating the equipment. The national regulations in each country of operation should be reviewed prior to installing/operating the equipment to ensure the equipment will be in compliance with national spectrum regulations.

					
BE	BG	CZ	DK	DE	EE
IE	EL	ES	FR	HR	IT
CY	LV	LT	LU	HU	MT
NL	AT	PL	PT	RO	SI
SK	FI	SE	UK(NI)	NO	IS
LI	CH	TR			

#### 4.2.1 United Kingdom

The Blu Wireless DN201SC radio equipment complies with the Radio Regulations 2017 and EN 302 567. Operation in the United Kingdom is subject to the requirements of OFCOM Interface Requirement 2030 and the UK Implementing Decision 2019 No. 1345.

This equipment operates under Interface/Notification Number: IR2030/7/4 2018/316/UK and is subject to geographic restriction when using frequencies in the 59–63.9GHz band. See UK IR2030 for further details.

[UK Interface Requirement 2030](#)

[https://www.ofcom.org.uk/\\_\\_data/assets/pdf\\_file/0028/84970/ir-2030.pdf](https://www.ofcom.org.uk/__data/assets/pdf_file/0028/84970/ir-2030.pdf)

[UK Implementing Decision 2019 No. 1345](#)

<https://www.legislation.gov.uk/eudn/2019/1345>

#### 4.2.2 Europe

The Blu Wireless DN201SC radio equipment complies with the Radio Equipment Directive 2014/53/EU and EN 302 567, operation in European Member, EFTA and candidate states is subject to the national interface requirements of the Member state and EC Decision 2019/1345 including any national or regional restrictions.

See [EC Decision 2019/1345](#)

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019D1345>

##### 4.2.2.1 EU representation

As a UK manufacturer Blu Wireless Technology Limited have nominated an EU representative to meet representation requirements defined in EU regulations. The Representative's details will be identified on the product label where a sales type is suitable for use on the EU.

#### 4.3 USA

This product has been assessed with respect to FCC requirements, specifically 47 CFR 15 and certified.

Note that not all sales-types have been approved with respect to FCC requirements. Sales-types approved for use in the USA are:

- DN201SC-G (see sections 6.2 and 6.2.3 for details of the specification for this sales type)

Other sales-types may be in the process of being approved. Please discuss any such requirements with Blu Wireless.

##### 4.3.1 FCC compliance statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the



instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

#### **4.3.1.1 Safe use of radios**

**WARNING:** This product emits RF radiation in normal use. Do not install or use where, when powered on, any member of the public may be within 60 cm of the unit. Temporary use is permitted at distances above 30 cm during installation or maintenance operations.

#### **4.3.1.2 Usage restrictions in line regulatory requirements in aviation**

Regulatory restrictions defined in 47 CFR 15.255 (b)

(2) Operation on aircraft is permitted under the following conditions:

- (1) When the aircraft is on the ground.
- (2) While airborne, only in closed exclusive on-board communication networks within the aircraft, with the following exceptions:
  - (i) Equipment shall not be used in wireless avionics intra-communication (WAIC) applications where external structural sensors or external cameras are mounted on the outside of the aircraft structure.

#### **4.3.2 Product changes**

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment

#### **4.3.3 FDA laser notice 50 compliance**

Some sales-types of this product contain fibre optic components including class 1 laser components. These variants of the DN201SC are all expected to be in compliance with FDA laser notice 50 requirements, however formal approval has not been achieved. As such devices shall only be used for test and evaluation purposes and either kept secure or exported from the US at the end of such test or evaluation activity. Units shall not be deployed to the market.

### **4.4 Canada - English**

This product complies with Innovation, Science and Economic Development Canada (ISED) requirements RSS-Gen, RSS-210 and RSS-102. Not all sales-types have been approved for use in Canada. The sales type currently approved for use in Canada is

- DN201SC-G with reference IC 28284-DN201SCG. See section 6.2.3 for details of the network connectivity specification for this sales type,

Other sales-types may be in the process of being approved. Please discuss any such requirements with Blu Wireless

#### 4.4.1 ISED compliance statements

This device contains licence-exempt transmitters and receivers that comply with ISED's licence-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device

##### 4.4.1.1 Safe use of radios

WARNING: This product emits RF radiation in normal use. Do not install or use where, when powered on, any member of the public may be within 60 cm of the unit. Temporary use is permitted at distances above 30 cm during installation or maintenance operations

##### 4.4.1.2 Aviation usage

In line with regulatory restrictions defined in RSS-210 Annex J:

- Devices used on aircraft are permitted under the following conditions:
  - devices are used when the aircraft is on the ground

## 4.5 Canada - Français

Ce produit est conforme aux exigences d'Innovation, Sciences et Développement économique Canada (ISDE) CNR-Gen, CNR-210 et CNR-102. Tous les types de vente n'ont pas été approuvés pour utilisation au Canada. Les types de vente suivants ont été approuvés pour une utilisation au Canada

- DN201SC-G : IC 28284-DN201SCG

### 4.5.1 ISED déclarations de conformité

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) L'appareil ne doit pas produire de brouillage;
- (2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

#### 4.5.1.1 Utilisation sécuritaire des radios

AVERTISSEMENT : Ce produit émet un rayonnement RF lors d'une utilisation normale. Ne pas installer ou utiliser là où, lorsqu'il est sous tension, un membre du public peut se trouver à moins de 60 cm de l'appareil. L'utilisation temporaire est autorisée à des distances supérieures à 30 cm pendant les opérations d'installation ou de maintenance

#### 4.5.1.2 Utilisation aéronautique

Conformément aux restrictions réglementaires définies dans CNR-210 Annexe J.

- Les dispositifs utilisés dans des aéronefs sont permis selon les conditions suivantes :
  - Les dispositifs sont utilisés lorsque l'aéronef est au sol.

## 5. Usage

### 5.1 Example – a rail deployment

These products are intended to support high bandwidth passenger internet connectivity and link the on-train network to the trackside network. The radio deployment guide BW-000976 uses this scenario as it's prime reference use case.

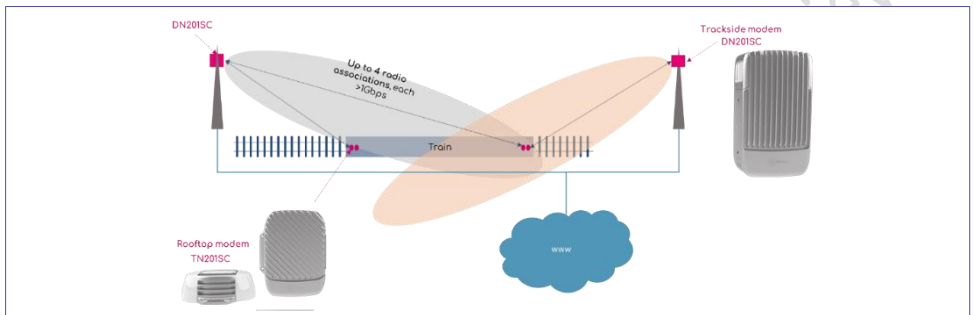


Figure 2. Radio connections for a typical installation

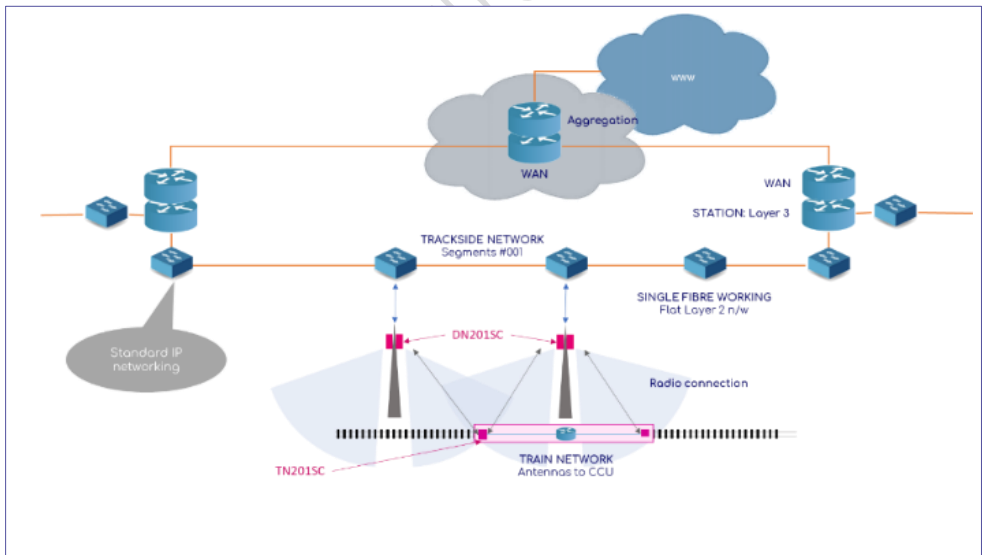


Figure 3. Typical trackside network

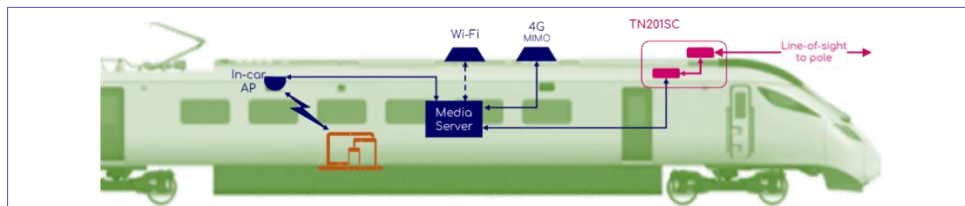


Figure 4. Typical on-train usage

## 5.2 Other usage scenarios

BWT support a variety of application scenarios including but not limited to fixed wireless, backhaul, front-haul and mobility scenarios. Please discuss any such requirements with Blu Wireless. Application guides for other use cases can be made available as needed. Note that some use cases may have regional regulatory limitations.

# 6. Technical Specifications

## 6.1 Radio

Two products form radio links for use in either of the following scenarios:

- between a vehicle such as a train and static infrastructure (TN201SC in conjunction with a DN201SC) or
- between nodes as part of a backhaul fixed wireless system where two DN201SC units communicate.
- between vehicles where vehicles each have one or more TN201SC nodes installed.

**Note:** Point to multi-point use is not excluded from these usage scenarios but may be subject to further licencing and system design.

- Customers are responsible for defining and maintaining system performance in the context of radio planning, particularly with respect to maintaining line of sight between communicating units, managing range verses performance characteristics of their system and in understanding environmental specifics of their system. Information on radio performance to assist this decision making can be found in the radio deployment guide (BW-000976).
- The maximum unit spacing and performance achieved will depend on several factors, including:
  - Specified weather limits including rain intensity and environmental temperatures.
  - Data throughput minima (average and absolute minima).
  - Robustness of connection required.
  - Network redundancy considerations, if available.
  - In multi-unit vehicle installations, the separation of the TN units on an individual vehicle on a single vehicle network.
  - The dynamics of the system, if any.

### 6.1.1 In all cases

Line of sight must be maintained at all times between the two antennas – there must be no radio obstructions. Note the radio beam cannot be considered a zero-width beam; a radio guide identifying line of sight constraints is available from Blu Wireless.

*Table 4. Radio performance and characteristics*

Radio link characteristics	Min	Nominal	Max	Comment
Radio frequencies	57 GHz		71 GHz	Note use of the full frequency range is subject to national regulations permitting their use.
Transmit EIRP			40 dBm	Conformant to the following standards/regulations: <ul style="list-style-type: none"> <li>• EN302567</li> <li>• FCC Part 15.255</li> <li>• CEPT 07 03</li> <li>• ISED RSS-Gen &amp; RSS-210</li> </ul>
Azimuth beam steering range vs reference	-45°		45°	The product will steer the beam and perform to specification in this range. A slight loss of range may be seen at high steering angle (+ve or -ve) greater than 25°
Vertical beam offset from horizontal	-5°		+5°	Specified reception characteristics will be met within this range

## 6.2 General specification

The following specifications may apply to any or all the component parts as defined in the header for each table. For most elements the mounting brackets, adapters and hardware are **not** included.

### 6.2.1 Physical characteristics

*Table 5. DN201SC trackside unit physical characteristics*

Physical Characteristics DN201SC unit	Min	Nom	Max	Comment
Height		296 mm		
Length		170 mm		
Width		83 mm		
Weight		4.1 kg		Excludes any mounting brackets or hardware.
Ambient operating temperature range	-25°C		40°C	
Mounting plate operating temperature	-25°C		55°C	
Mounting height – above ground		4.5 m		All installation heights will be site specific. All installations are expected to be mast or pole fitments. Other configuration should be discussed with Blu Wireless prior to installation commencing.
Mounting height – antenna centre above associated TN201SC when used in a mobility scenario		0.4 m		Details of Installation height should be aligned with BW-000976-SD Radio Deployment Guide (available from Blu Wireless) to achieve maximum performance.
IP Rating		IP66		

## 6.2.2 Interface details and pinout

*Table 6. DN201SC interface details*

DN201SC Interfaces	Detail
Power	<p>M12 A connector</p> <p>VIN+: Pin 1 &amp; 4</p> <p>VIN-: Pin 2 &amp; 3</p> <p>For EMC reasons the power cable used should be shielded and the shield connected to a suitable grounding point, unless other arrangements are made for earthing described here.</p>
Ground	<p>Grounding points are available on the unit should local installation requirements demand that the unit enclosure be earthed. It is <b>not</b> required to ground the unit for product safety reasons using this connection however the case of unit shall be earthed for EMC reason by some means. Two threaded holes are available allowing multiple connections if needed.</p>
Network wired port	<p>M12X coded, 10G ethernet (10G/5G/2.5G/1000BASE-T)</p> <p>Pin 1: DA+</p> <p>Pin 2: DA-</p> <p>Pin 3: DB+</p> <p>Pin 4: DB-</p> <p>Pin 5: DD+</p> <p>Pin 6: DD-</p> <p>Pin 7: DC-</p> <p>Pin 8: DC+</p> <p>To maintain EMC performance CAT6A ethernet cable or better shall be used if a wired connection is used for anything other than installation and unit test purposes.</p>
Network fibre port	<p>Fibre connection options may vary between different sales types.</p> <p><b>DN201SC-G</b> and <b>DN201SC-J</b> sales types : These products utilise a single LC bulkhead connector where bidirectional fibre is used. The 1270 nm TX/1330 nm RX wavelengths are used and are intended for longer ranges (see section 6.2.3)</p> <p><b>DN201SC-L</b> utilises dual LC connectors and 850nm wavelength (see section 6.2.3 for details)</p> <p>Other sales types may be available. Contact Blu Wireless for details.</p>
Radio	<p>Dual 57-71 GHz mmWave radio</p> <p>Radios facing 180 degrees apart</p>



### 6.2.3 Fibre technical specification

Sales type	Fibre	Connector type	Nominal range	Tx Power		RX sensitivity	Rx Overload	Recommended fibre type
				Nom (dbm)	Max (dbm)	Max (dbm)	Min (dbm)	
DN201SC - G	Bidirectional 10G 1270nm Tx, 1330nm Rx	Single LC	10km	-3.5	-1	-13.9	0.5	SMF-28 Dia: 9/125/250um
DN201SC-J	Bidirectional 10G 1270nm Tx, 1330nm Rx	Single LC	20km	-1.5	3	-13.9	0.5	SMF-28 Dia: 9/125/250um
DN201SC-L	Dual port 850nm	LC-LC	Varies – fibre dependent 300m OM3	-4	-1	-10.6	0.5	MMF dia:50 or 62.5um OM1,2,3,4

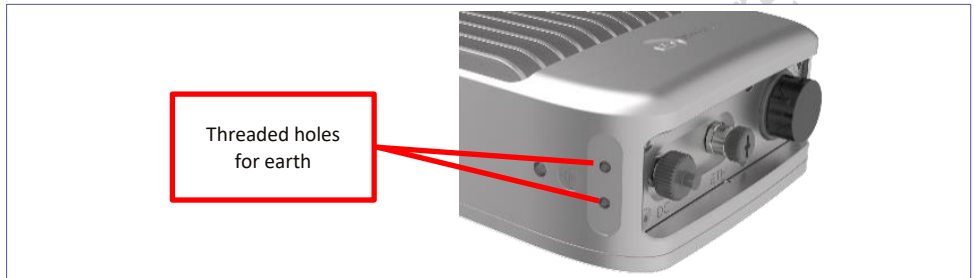
## 6.3 Electrical protection, earthing and isolation



**CAUTION:** These products require the case to be earthed for Electromagnetic compatibility reasons. This may be achieved via the earth terminals on the case or the power cord shield if fully connected.

The casing of units need not be earthed for electrical safety purposes, but the product supports this, should local regulations require it. Note that the power cable shall be screened, and the screen shall be suitably grounded. This is for EMC reasons.

Should the DN201SC units require an earth this may be achieved by use of either or both threaded case points shown in Figure 5. Note that if using a DC power cable with a screen which is connected at both ends, or an SFP which has its shield connected to an external earth, an alternative earth path may also exist, and installers should ensure that any such arrangement complies with their applicable regulations on earthing.



*Figure 5. DN201SC earthing points*

### 6.3.1 Isolation

The DC power input on the DN201SC unit is isolated from the case and internal electronics via an internal isolated power supply.

## 6.4 Power connections

### 6.4.1 DN201SC power supply

*Table 7. DN201SC power supply parameters*

DN201SC power supply parameter	Units	Min	Nom	Max	Detail
Input voltage (long term)	Volts	20.0	36	48.0	Where used with a nominal 36 Volt power source the product is compliant with EN50155 excursions
Input voltage (< 3 seconds per excursion)	Volts	18.4		50.4	
Power consumption - average	Watts		42	55	
Operational short term power consumption (< 3 second)	Watts			70	
Permitted power supply ripple with respect to average input voltage	Pk-pk variation			5%	

## 6.5 Example connector panel layouts for options

### 6.5.1 DN sales type A

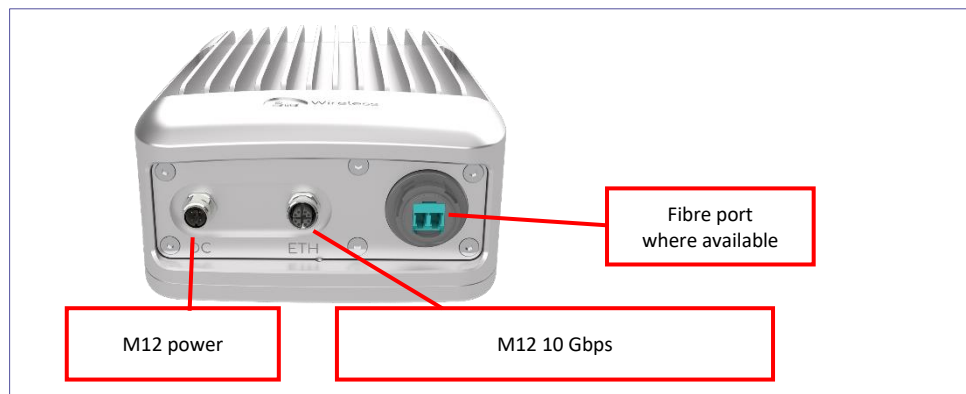


Figure 6. DN sales type A

## 6.6 Installation

Installation is described in Blu Wireless document BW-003988-GD.

## 7. Returns, end of life and recycling

Under all circumstances, contractual arrangements take precedence over this document with respect to returned units.

### 7.1 End of life



These products should not be disposed of in normal waste.

Individual units at the end of their life may be recycled by sending to RECYCLING, Blu Wireless Technology Ltd, One Castlepark, Tower Hill, Bristol, UK. This address cannot accept multiple product shipments.

For larger scale shipments or decommissioning please contact Blu Wireless Ltd for shipping details.

By shipping units to Blu Wireless for recycling we can ensure that the best product recycling options are used. Contact Blu Wireless at One Castlepark, Tower Hill, Bristol, UK for an RMA number prior to shipment for recycling at which time the shipping location will also be advised.

### 7.2 Returns

Should any units require to be returned to Blu Wireless for any other reason than recycling, please contact Blu Wireless at One Castlepark, Tower Hill, Bristol, UK for an RMA number prior to shipment at which time the shipping location will also be advised. Unsolicited returns will be treated as end-of-life with no further responsibilities accepted by Blu Wireless Technology Ltd.

## Terms and Acronyms

Term / Acronym	Definition
AOC	Active Optical Cable
CE	Conformité Européenne
DC	Direct Current
ETSI	European Telecommunications Standards Institute
EU	European Union
GPS	Global Positioning System
mmWave	Radio frequency communication using the 57-71 GHz unlicensed radio band.
NPU	Network Processing Unit
OLE	Overhead Line Equipment
PCIe	Peripheral Component Interface - Express
PHY	Physical Layer
REACH	Registration, Evaluation, Authorization and Restriction of Chemicals
RED	Radio Equipment Directive
RMA	Return Merchandise Authorization
ROHS	Restriction on Hazardous Substances
SFP	Small Form factor Pluggable
UK	United Kingdom
USB	Universal Serial Bus

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