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The BreezeNET family

An outdoor-ready long distance WLAN solution for harsh and adverse environments

Trieste, February 19, 2004

Alessandro Berta - ELMAT

AGENDA

- **Why outdoor-ready?**
- **Solution for 2.4 GHz, Wi-Fi compliant**
- **Solution for 5 GHz, proprietary OFDM air protocol**
- **Laboratory with BreezeNET DS.11**

Why Outdoor ready products?

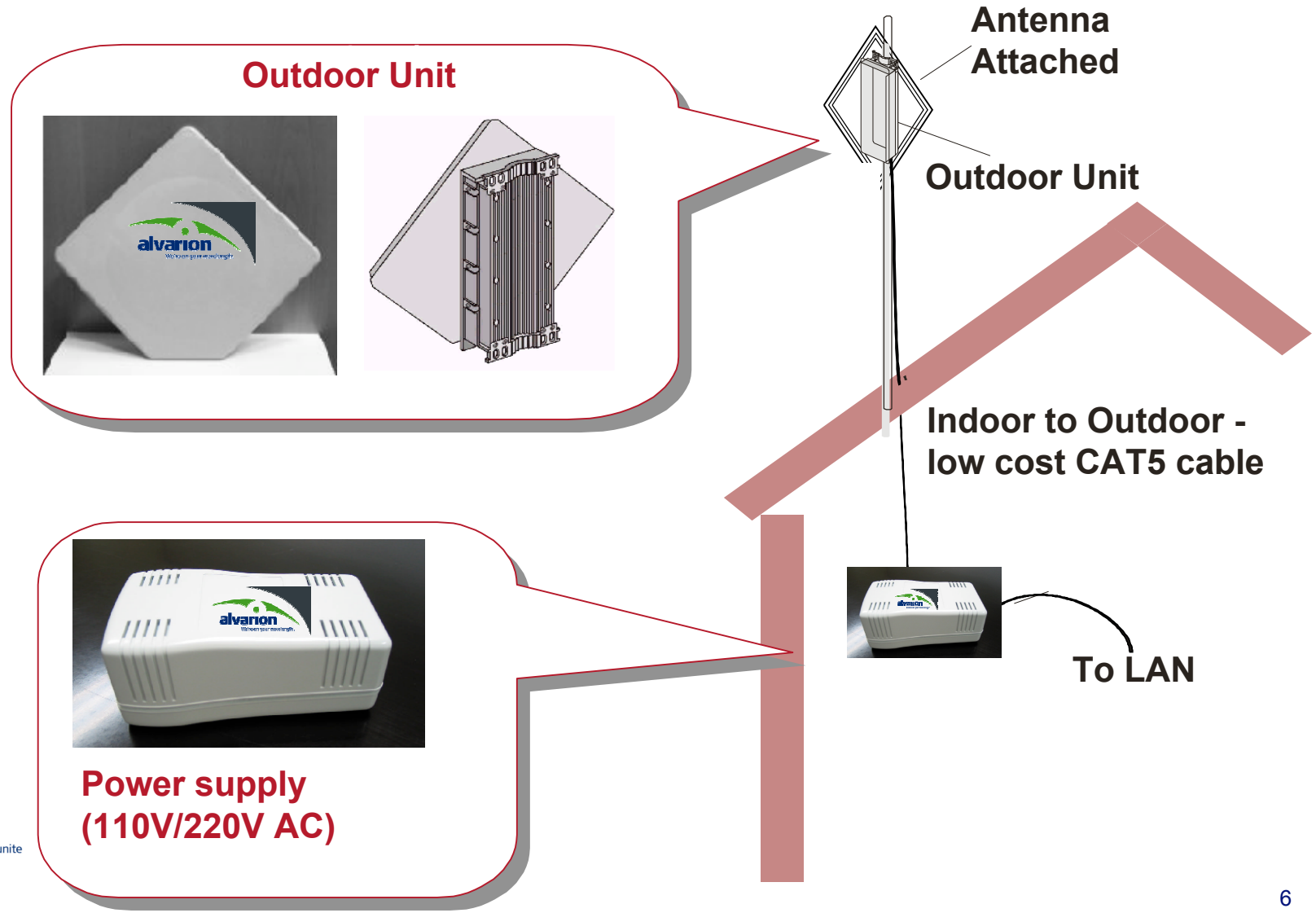
- BreezeNET is a family of wireless products for Point-to-Point and Point-to-MultiPoint networking, optimized for outdoor usage, in adverse environments and weather conditions.
- The enclosure used by all the BreezeNET models is dust-tight and water-proof. The degree of protection, rated with the IP scale, is IP 67.
- An automatic heating system extends the operating temperature range down to - 40 ° C.
- The efficient cooling provided by metal tongues (no fan and no forced ventilation) extends the operating temperature range up to + 55 ° C.
- Indoor-Outdoor architecture simplifies installation and maximize performances.
- The Outdoor Unit shape makes life easier when mounting it on a pole.
- Lightning protection is already included.

What does it mean IP 67?

- IP stands for Ingress Protection
- The rating's first digit e.g. IP54 relates to the ingress protection against dust
- The second digit e.g IP54 relates to the ingress protection against water
- IP 67 means:
  1. **No ingress of dust**
  2. **Ingress of water in a harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time**

Water immersion test for IP 67 certification

Indoor – Outdoor Architecture



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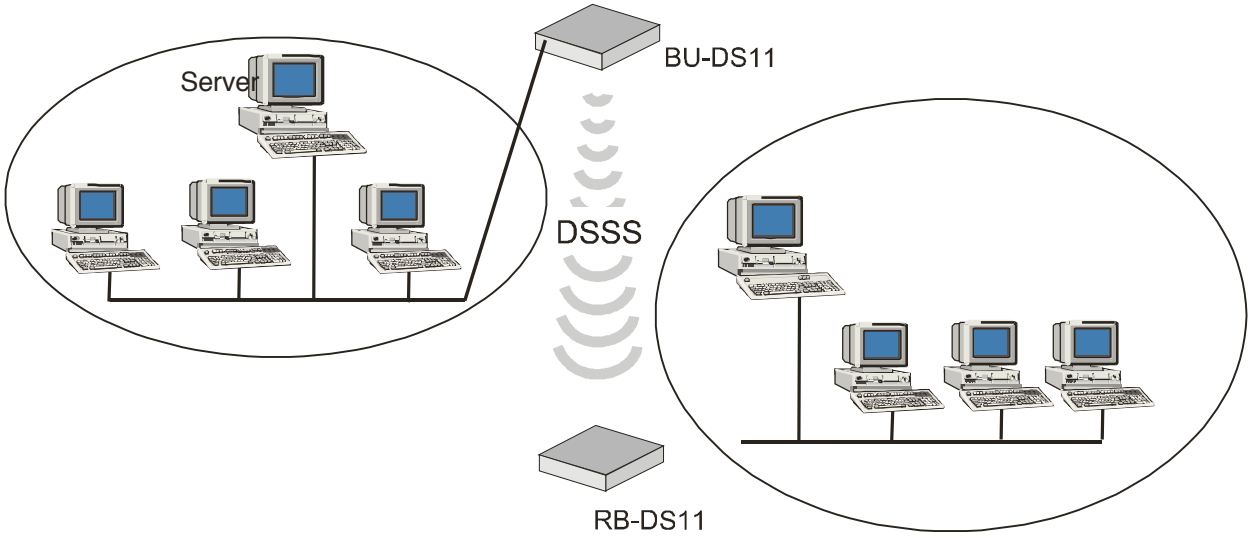
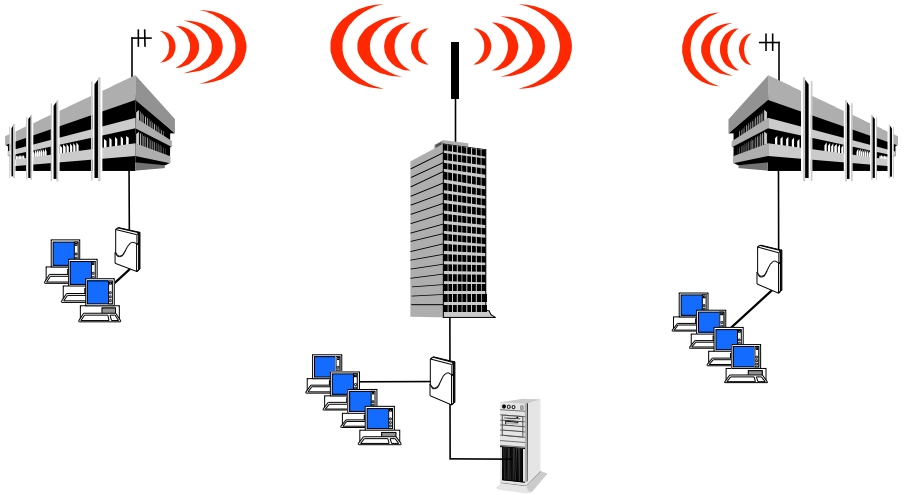
BreezeNET DS.11

The Wi-Fi compliant Solution in the 2.4 GHz

Architecture





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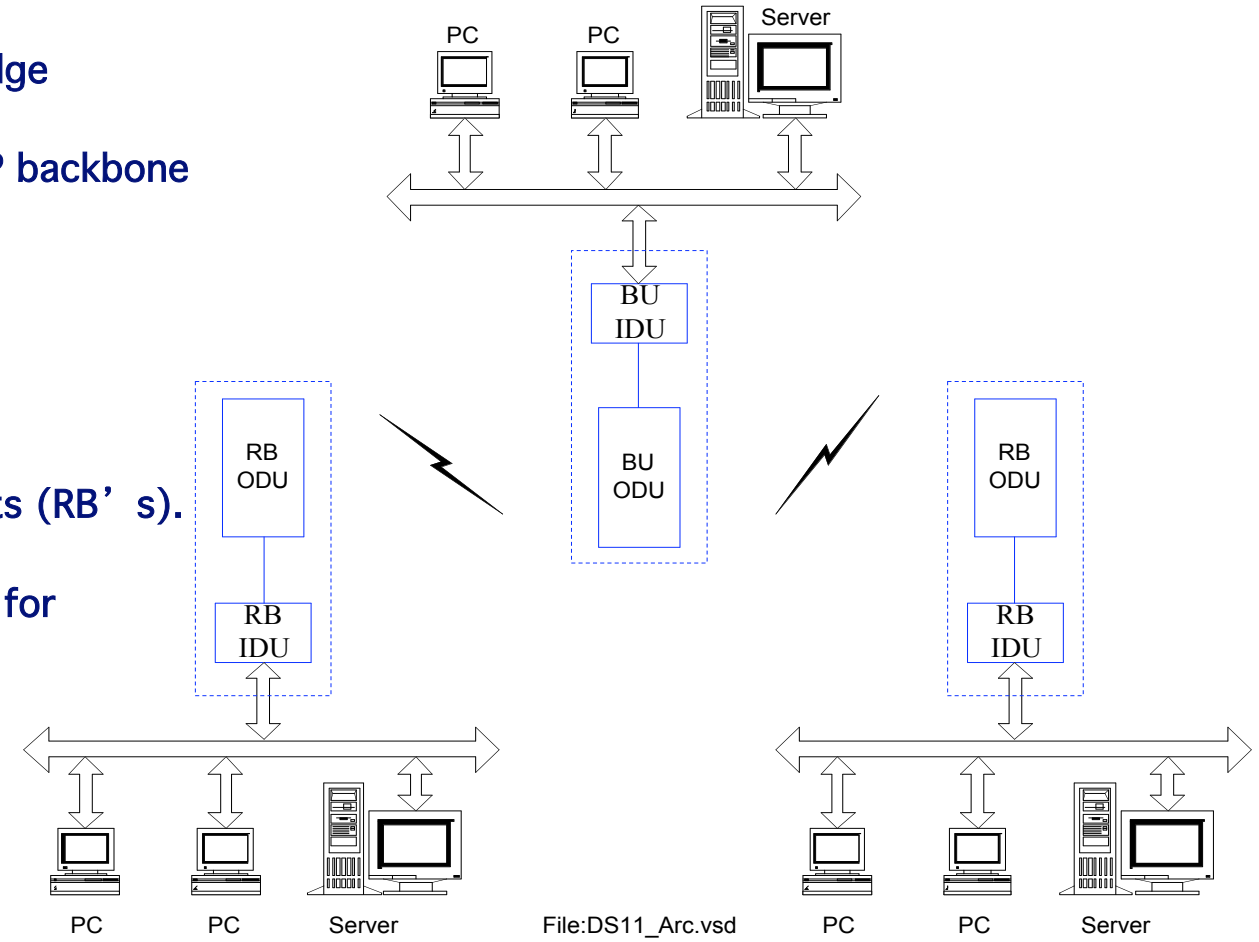
System environment

- Designed for outdoor usage
- Point to multi point wireless bridge
- Suits building to building and ISP backbone
- Connectivity applications.
- Up to 1024 PC's per LAN
- The BU will support up to 128 simultaneously associated clients (RB's).
- Integrated or external antennas for various type of applications.



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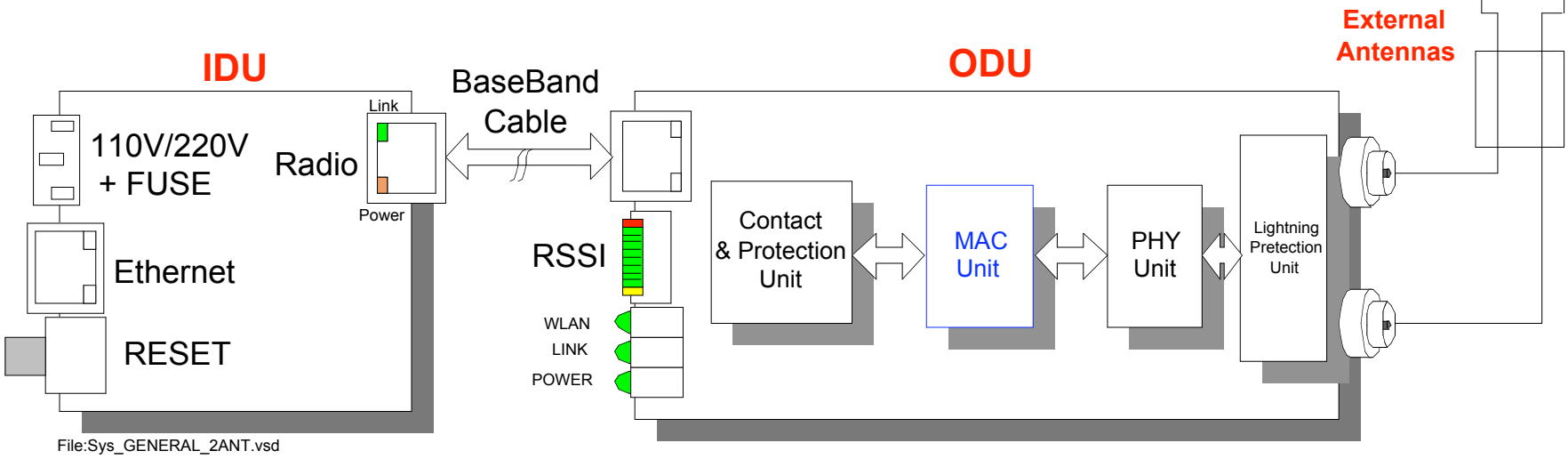
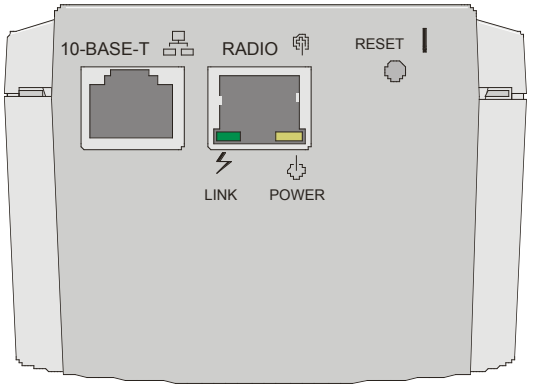
System architecture diagram

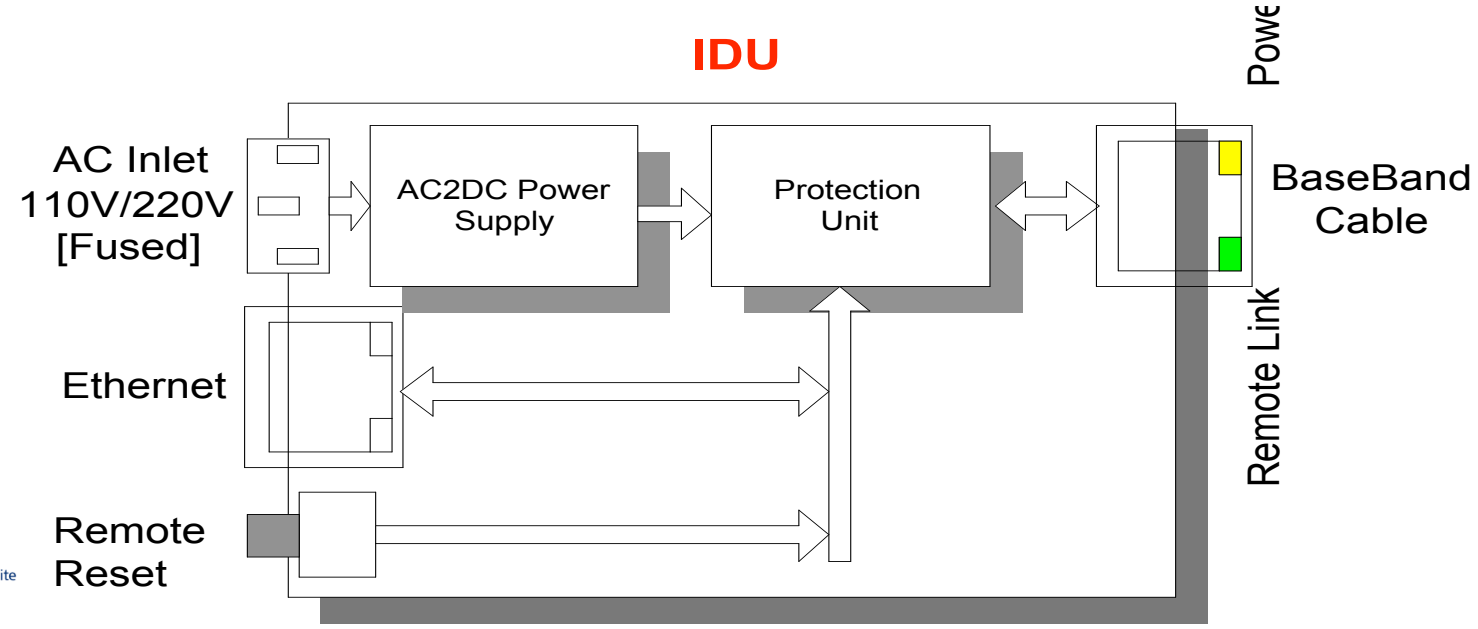


- The System is combined from IDU (indoor unit) and ODU (outdoor unit)
- The Base-Band Cable connects the IDU to the ODU (Maximum Length 90m, Supplied: 20m
- IDU Remote Reset (set factory default)
- IDU Ethernet link and Power O.K Indication

IDU block diagram

- AC to DC Power Supply Unit
  - AC: 110 or 220V, Internal AC Selector
  - DC: 500mA @ 48V Fused
- reset button:
  - While pressed during startup - resets the device to factory default.
  - While pressed during operation _ resets the device

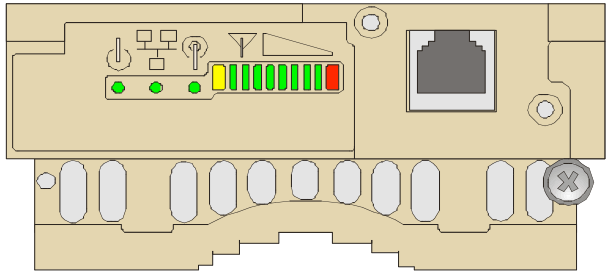


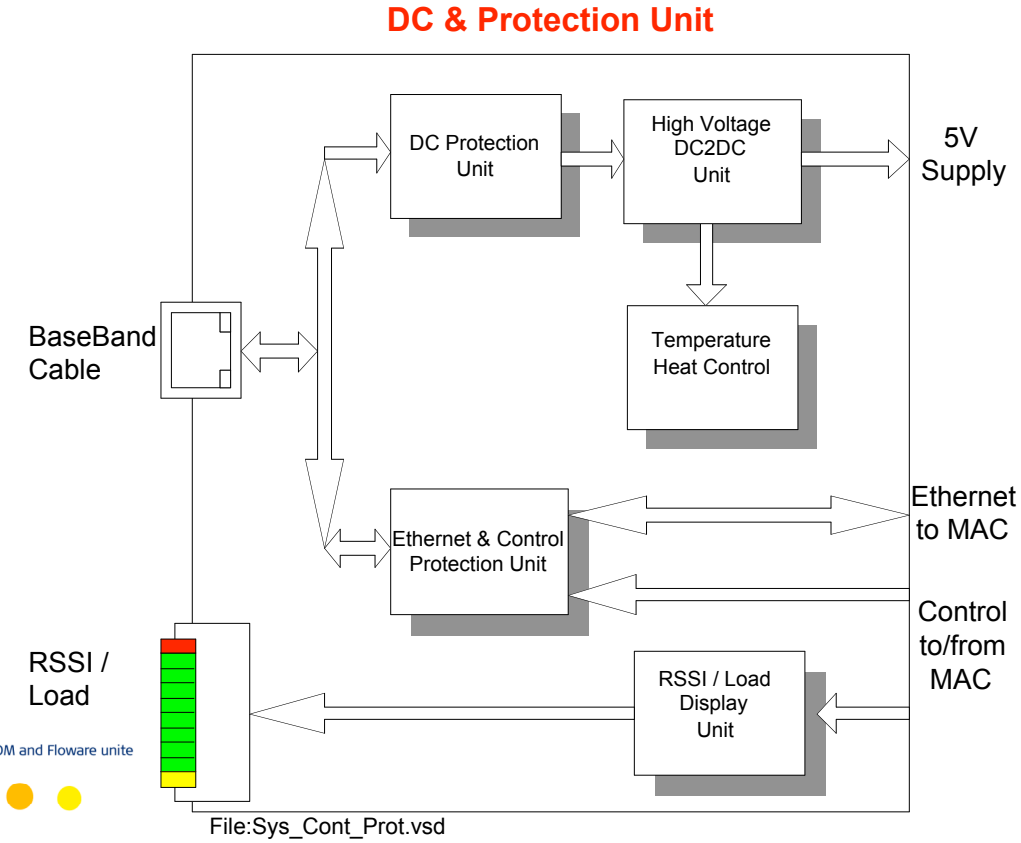


File:Sys_InDoor.vsd

ODU block diagram

- IP67 Degree of protection (water immersion).
- Temperature Heat Control (-40° C +55° C Support).
- High Voltage DC to DC Power Supply Unit (Switcher)
  - High Voltage DC Input : 24 _ 60V (48V nominal)





System Components

Integrated Outdoor unit

Universal Indoor Unit

Detached Outdoor unit (needs separated antenna)

Universal Indoor Unit

IDU-ODU cable description (Base cable)

- CATEGORY 5 outdor or data cable double jacket 4x2x24# FTP UL listed
- Temp. operating range: -40 to +70C
- UV resistance: ASTM G 53 (2016 Hours Exp.)
- Overall diameter (inner jacket): 6.1 mm max
- Overall diameter (outer jacket): 7.9 mm nom, 8.3 mm max
- Max. length: 100m (Supplied: 20m with 2.4GHz and 30m with 5.8GHz)

- Manufacturer item: 5E-DB-4PFTP-R, Manufacture: LTK
- Manufacturer item: CAB120-011, Manufacture: NEO-STAR

Lightning protection & interfaces

- The lightning protectors are located in two section:
  - ODU External Antennas Interface:
    Up to 4KV (8/20_S Pulse)
  - IDU-ODU Interface
    According to ETSI EN61000-4-5 Class 3

Interfaces

RF (antenna) connector in the outdoor unit	**N-Type jack, lightning protected**
Baseband (indoor to outdoor unit)	**Outdoor units: Shielded RJ-45 with special water proof sealed cap**
	Indoor units: Shielded RJ-45
Ethernet	**Indoor units: 10BaseT,(RJ-45) with 2 embedded LEDs**

Radio

- Multi-Rate support.
  - Support 802.11 standard rates: 11, 5.5, 2 and 1 Mbps.
  - Automatically switch to the best-fit (lower or higher) rate depending on the link condition

- Multiple radio output power support
  - Supporting variety of antenna Types
  - Supporting variety of regulatory Domains (US-FCC,ETSI,etc)

- 11 Mbps long links support
  - 10 km, (6 Miles) in 2.4 ETSI Regulatory Domain
  - 25 km, (15 Miles) in 2.4 GHz - FCC Regulatory Domain

Radio specifications for DS.11 - 2.4 GHz

- RF range: 2.400-2.4835GHz (center channels 1-14) compliant with: IEEE 802.11b HR
- RF channel step size: 5MHz
- Selectable channels:

FCC	1-11
ETSI	1-13
Japan TELEC	1-14
France	10-13

- Adjustable output power level : -4, -2, 4, 6, 12, 14, 20, 24 dBm (depend on reg domain)

- Integrated Antenna (BR-DS.11/BU-DS.11): Flat Panel 16 dBi, 20° Vertical /Horizontal HPBW

	Data Rate	Sensitivity	Modulation
Sensitivity (BER 1E10^{-6})	11 Mbps	-85 dBm	256 CCK
	5.5 Mbps	-88 dBm	16 CCK
	2 Mbps	-90 dBm	DQPSK
	1 Mbps	-93 dBm	DBPSK

Radio specifications-regulatory domains

Output power level steps: -4, -2, 4, 6, 12, 14, 20, 24 dBm

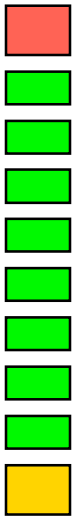
Regulatory domain	Min CH	Max CH	Default Channel	Maximum allowed output power by DS.11(dBm)	Default Output Power (dBm)	Maximum allowed EIRP output power by domain (dBm)
ETSI	1	13	7	14	4	20
FCC	1	11	6	24	24	48 PtP
Japan	1	14	7	14	6	24
Spain	10	11	10	14	4	20
France	10	13	11	14	4	20
Canada	1	11	6	24	24	36
Israel	8	8	8	14	4	20

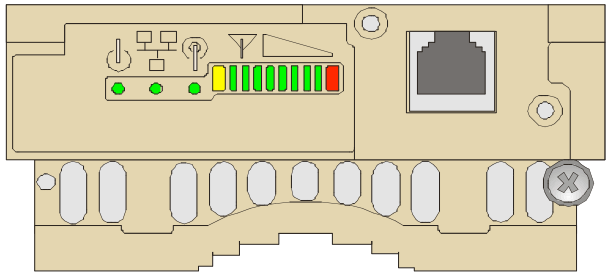
NOTE:

Configuration is preset in the factory and

CAN NOT be changed through software afterwards !!!

RB-DS ODU LED's

Name	Description		Functionality
RSSI Bar on RB-DS units	**Displays the Received RF Signal Strength at the antenna port of the ODU**		Bar0 (red) -91dBm Bar1 (green) -87dBm Bar2 (green) -83dBm Bar3 (green) -80dBm Bar4 (green) -77dBm Bar5 (green) -74dBm Bar6 (green) -71dBm Bar7 (green) -66dBm Bar8 (green) -61dBm Bar9 (yellow) -55dBm



MAC

- IEEE 802.11b MAC implementation.
- Enhanced bridging functionality.
  - 802.3 (Ethernet) based networks, using the 802.11b (Wireless) protocol
  - Standard frame translation.
- Compatibility with all layer 3 protocols:
  - IP, IPX, MS-NetBEUI, and AppleTalk protocols.
- 802.1q (VLAN) capable.
  - long (VLAN tagged) frames will be transparently translated as regular 802.3 (Ethernet) frames.

Long / Short Preamble Support - (BU Only)

Two different preamble types are defined: the mandatory supported Long Preamble, which interoperates with the 1Mbps and 2 Mbps specifications as described in IEEE 802.11 standard, and a
Short Preamble, as described in IEEE 802.11b standard.

The Short Preamble may be used to minimize overhead and thus increase the data throughput - Increase throughput in "Short Preamble" by 30%.

The BU supports (configurable parameter) long and short preamble frame format.
The Short Preamble is supported only by the IEEE 802.11b standard (High-Rate), and not by the
original IEEE 802.11 standard. That means that stations using Short Preamble cannot communicate
with stations that support only the IEEE 802.11 standard. By default, the BU is set to use the long
preamble (for backward compatibility).

Short Preamble may be enabled only if all units support the IEEE 802.11b standard and can be configured to support Short Preamble.

This parameter is available only in BU; the RB will identify the preamble type used by the BU and will
use it as well.

MAC Address Association Control - (BU Only)

The Access Control List table is used to authorize / deny access to certain stations.

It is possible to add a specific RB MAC address into the Add/Delete MAC Address ACL.

The format should be XX-XX-XX-XX-XX-XX. The status of the entry is defined by checking the Allowed check box.

Configuration utility -> "Security" button -> ACL Table -> Check the Add check box to add the entry, and click the apply button.

The broadcast address FF-FF-FF-FF-FF-FF serves as a default entry to define the status of addresses that are not defined in the list.

If the table is empty, access is denied to all addresses.

Max number of entries _128.

802.11 WEP - 128-bit encryption key

The product supports the standard 802.11 WEP (40 bit encryption key) in both authentication and data encryption.

In addition, an enhanced proprietary security system utilizing a 128-bit encryption key is incorporated, to provide superior privacy.

The implementation was done by HW to avoid any performance degradation.

Wired Equivalent Privacy (WEP) is an encryption algorithm that protects authorized Wireless LAN users against eavesdropping and is implemented in BreezeNET DS.11 units. It supports key length of either 64 bits or 128 bits,including a 24 bit Initialization Vector.

WEP keys _ Defines the encryption keys used. Define each key by clicking the appropriate WEP Key row and entering 10 (for 64 bits keys) or 26 (for 128 bits keys) hexadecimal characters for each of the four keys. After clicking Apply, the WEP Key values are displayed as zeros for security reasons.

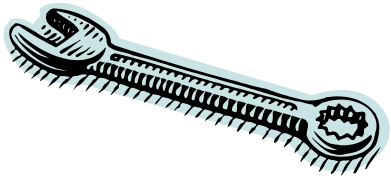
Proprietary Scrambling of data

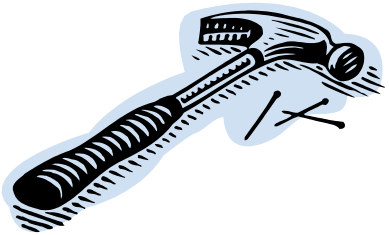
The scrambling mechanism is another security measure that can be enabled or disabled independently of the WEP mechanism.

It may also be used for simple to implement security without the administrative effort associated with distributing and managing keys.

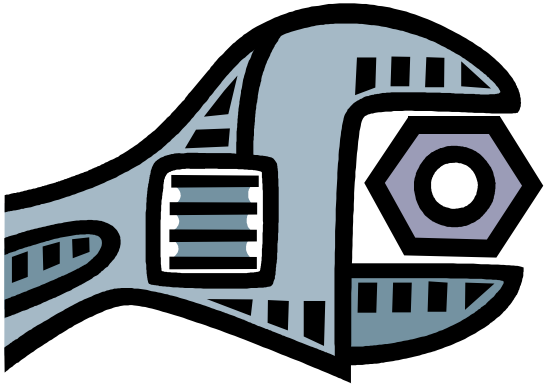
It is a differentiating element, disabling association of stations that do not have this feature.

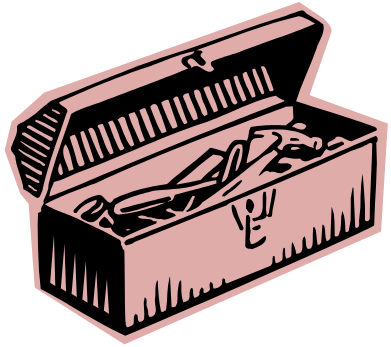
The default is Disable.





BreezeNET DS Outdoor Configuration

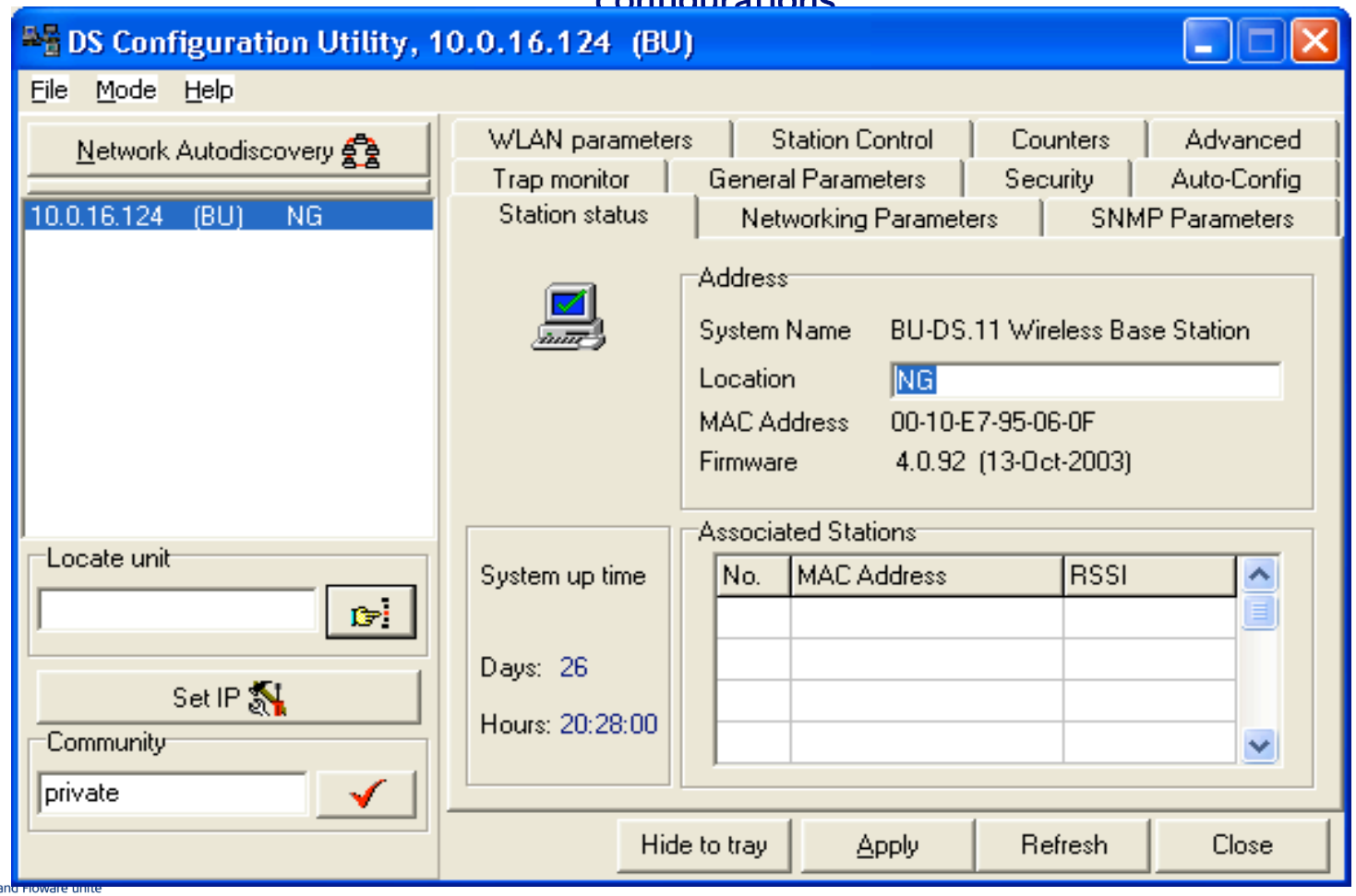




BreezeNET DS.11 Configuration Utility Specifications

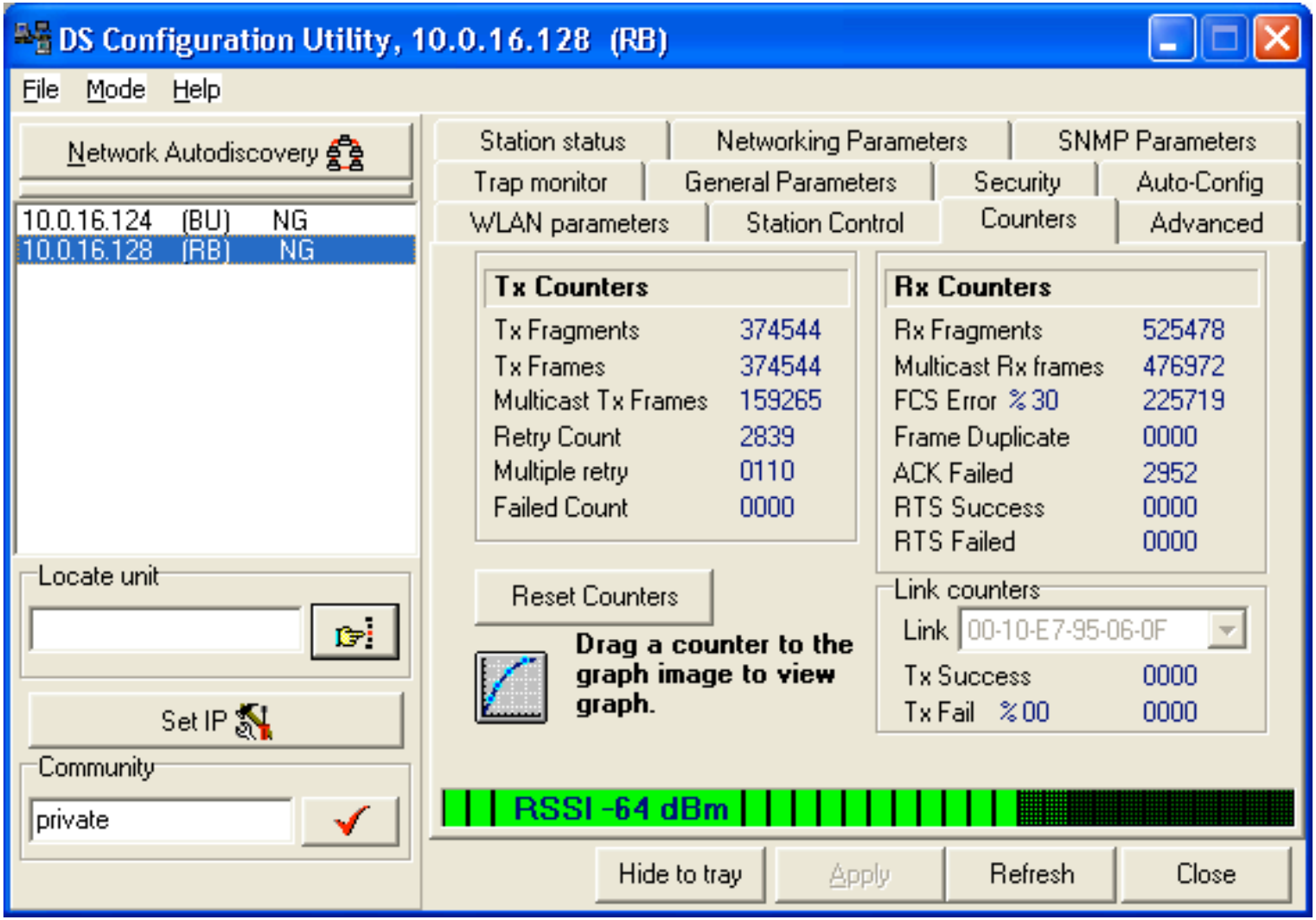
Released Version 4.0.19
Backward compatible with:
AP/SA/WBS/WBC-DS.11

SNMP based
Windows 9x/NT/2000
GUI
Easy to configure devices - Multiple configurations



Counters and Site Survey - RB

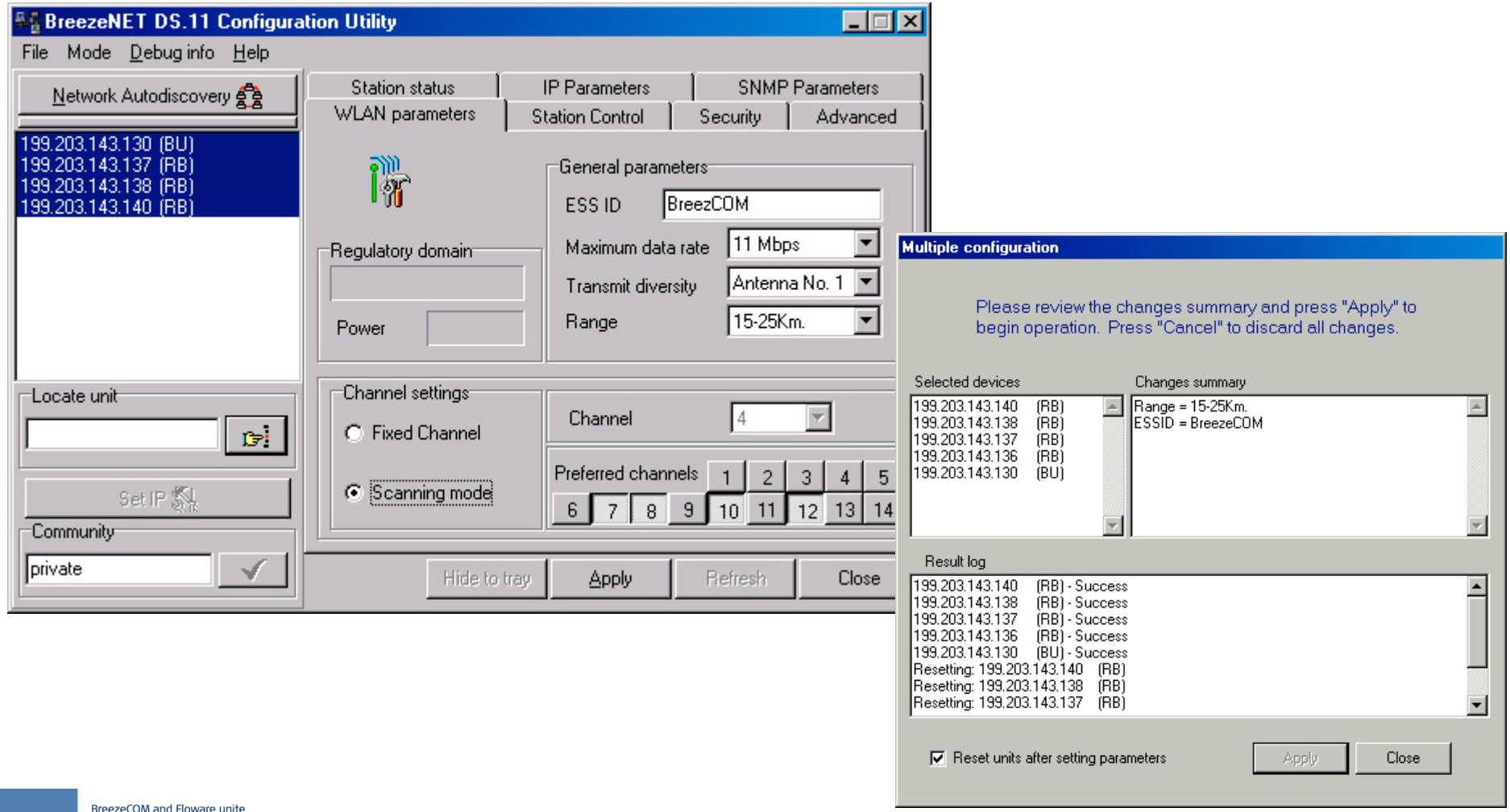
Graphic RSSI (dBm) bar for easy and fast link setup and control
A range of counters for troubleshooting and diagnostics



Multiple Units Parameters Settings

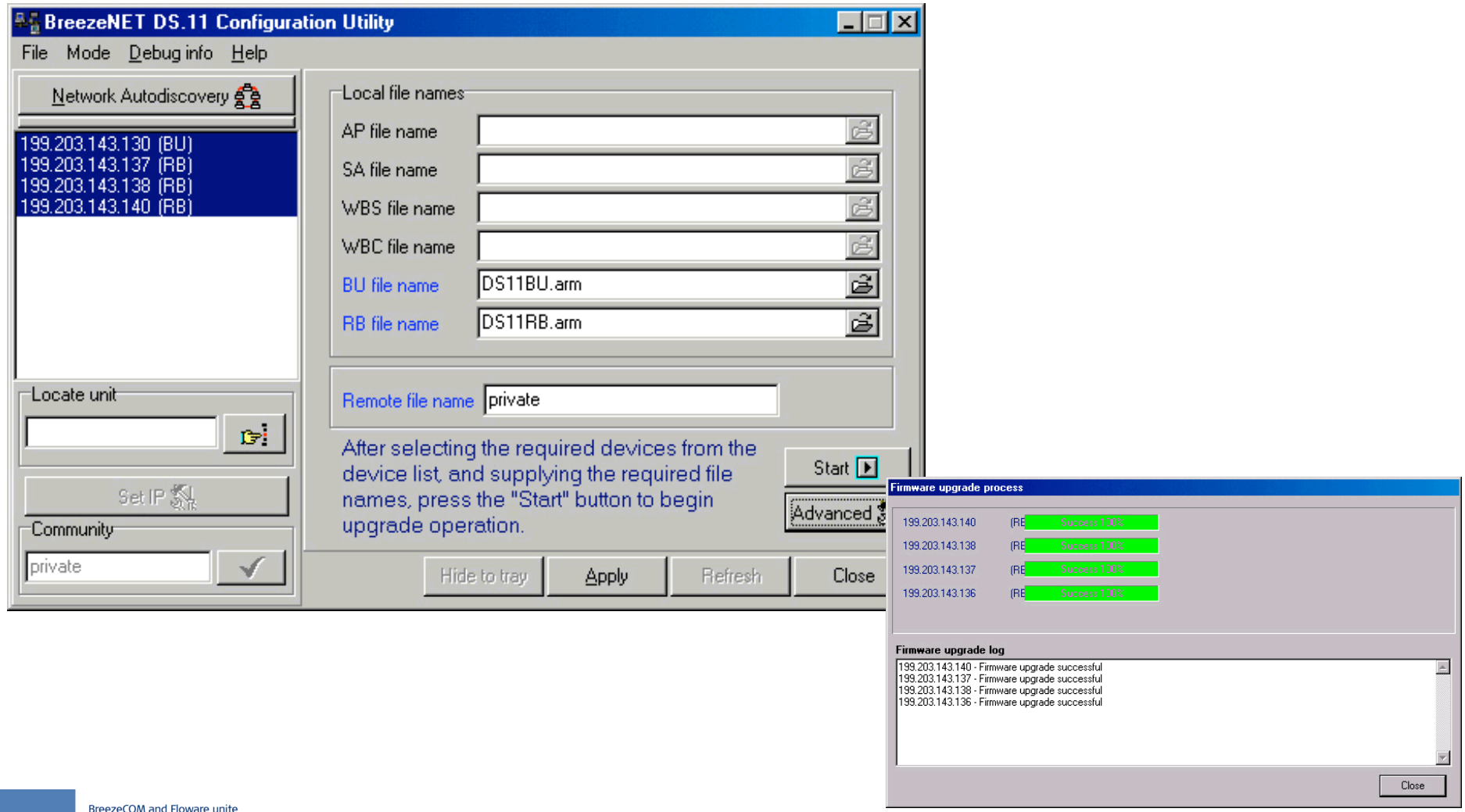
Quick and easy multiple units parameters settings

Acknowledgment from every individual unit for successful of unsuccessful parameter setting



Multiple Units Firmware Upgrade

One button click multiple units firmware upgrade
Remote bridges are the first to be upgraded, to ensure continuity during the upgrade process
Provides progress indicator bar in addition to acknowledgments from every individual unit



Features & Benefits Summary (1)

Feature	Benefits
Indoor outdoor architecture	➢ Maximizes the link distance significantly further than conventional equipment ➢ Allows up to 90 m distance between the outdoor and the indoor unit with a simple to install inexpensive UTP cable ➢ Allows the use of integrated outdoor antenna ➢ Saves the expense of costly high quality RF cable
Very high sensitivity: –85 dBm @ 11 Mbit/s	➢ Maximizes the link distance significantly further than any conventional equipment in outdoor environment
Dynamic output power range (-4 dBm to + 24 dBm)	➢ Maximizes the link distance significantly in ETSI by using the –4 dBm output power combined 24 dBi antenna (Up to 10 km) ➢ Maximizes the link distance in all other regulatory domains by using + 24 dBm output power combined with 24 dBi antenna (Up to 25 km / 16 miles) ➢ **Note**: 50 km link with a clear line of site has been tested and approved in full throughput
Easy to use, comprehensive configuration and management utility	➢ Simplifies the installation (saves time and cost) ➢ Reduces the cost of ownership

Features & Benefits Summary (2)

Feature	Benefits
Extensive LED diagnostics	➢ Simplifies the installation (saves time and cost) ➢ Enables very quick diagnostics of the unit status
10 LED RSSI bar	➢ Very easy antenna alignment that saves a lot of installation time
Multiple units configuration	➢ Significantly simplifies the installation by configuring multiple ➢ units with one click of the button (saves time and cost) ➢ Reduces the cost of ownership
Multiple units remote upgrade	➢ Significantly simplifies the upgrade procedure by using one button click multiple units upgrade (saves cost and time) ➢ Reduces the cost of ownership
Encryption	➢ RC4 40 and 128 bit key WEP encryption prevents eavesdropping and hacking. Proprietary additional data scrambling
Specially optimized for point to multi point outdoor environment	➢ Ensures fairness and maximum performance in point to multipoint hidden stations configuration (Avoid “capture” and “near far” problems)

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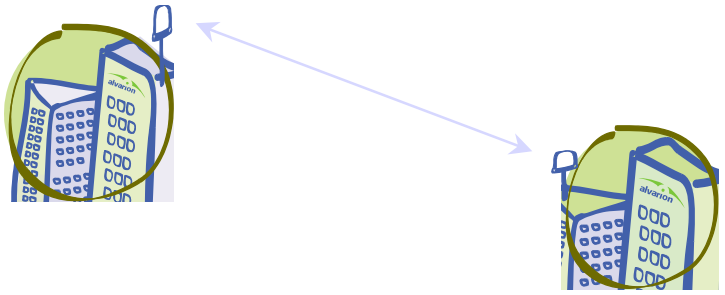
BreezeNET B

The Optimal PTP Solution in the 5.8GHz

A family of PTP solutions

Product	Frequency
BreezeNET DS 11	2.4GHz
BreezeNET B14	5.8GHz
BreezeNET B28	5.8GHz
LinkBLASTER LB	5.8GHz



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What is the BreezeNET B?

A **PTP** wireless bridge solution in the **5GHz** band

Part of the **BreezeNET family**

Two variants:

- **BreezeNET B14**: a 14 Mbps product
- **BreezeNET B28**: a 28Mbps product

Types of BreezeNET B

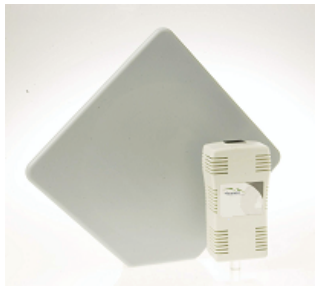
Integrated and Detached

BreezeNET B14

BreezeNET B14D

BreezeNET B28

BreezeNET B28D



21 dBi
Integrated

Antennas

21 dBi (diamond) integrated antenna

23 dBi, 9°, detached flat, 1'x1'

28 dBi, 4.5°, detached, flat, 2'x2'

28 dBi

23 dBi

Detached

BreezeNET B - Specification

Frequency: 5.725 – 5.850GHz

OFDM, TDD, ATPC

NLOS capability

Multi rate adaptive modulation: BPSK, QPSK, 16QAM and 64QAM

Channel bandwidth: 20MHz

Throughput: B14=14Mbps and B28=28Mbps

Advanced Bridging, VLAN and DHCP client

Security: AES, WEP 128, IP Filtering

Management: BreezeCONFIG and Telnet

SW upgrade using FTP and TFTP

Indications: 10 LED BAR display for RSSI

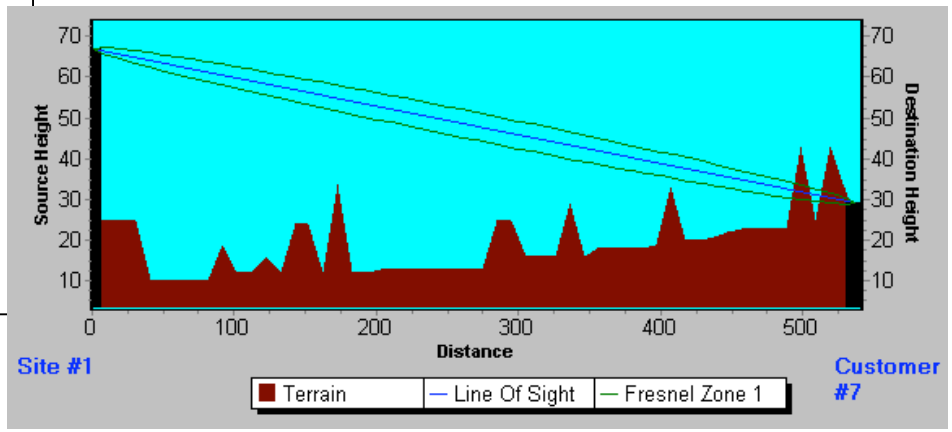
Cabling: CAT-5 Indoor/Outdoor cable

NLOS Capability

- OFDM is designed to cope with multipath conditions and enables operation in Non Line-Of-Sight environments
- The site was located 2.5 KM from the base station, with high trees completely blocking LOS.
- Link was successfully established with performance of 10.5Mbps FTP traffic and very good video quality

NLOS Capability

- SU was positioned in 3 heights, all with completely blocked LOS.
- The link was successfully established, yielding 5 Mbps of FTP performances



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Thank You