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BreezeCOMPACT LTE

System Manual

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Radio Frequency Interference Statement

The Base Transceiver Station (BTS) equipment has been tested and found to comply with the limits for a class A digital device, pursuant to ETSI EN 301 489-1 rules and Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in commercial, business and industrial environments. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense.

FCC and Industry Canada Radiation Hazard Warning

To comply with Industry Canada exposure requirements, and FCC RF exposure requirements in Section 1.1307 and 2.1091 of the FCC Rules, the antenna used for this transmitter must be fixed-mounted on outdoor permanent structures with a separation distance of at least 425 cm from all persons.

Pour se conformer aux exigences d'exposition d'Industrie Canada, et aux exigences FCC dans les sections 1,1307 et 2,1091 de la réglementation FCC, l'antenne utilisée pour cet émetteur doit être montée d'une manière fixe sur des structures permanentes de plein air avec une distance de séparation d'au moins 425 cm de toutes personnes.

Industry Canada Statement

Users can obtain Canadian information on RF exposure and compliance from the Canadian Representative:

Nick Dewar
Nick.Dewar@Telrad.com

Canadian Radio Standards Specifications (RSS) Compliance Statement

This device has been designed to operate with the antennas listed in "Antennas" on page 28, and having a maximum gain of 18 dBi. Antennas not included in this list or having a gain greater than 18 dBi are strictly prohibited for High-density areas of use with this device. Low-density areas can use a higher-gain Antenna.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the Equivalent Isotropically Radiated Power (EIRP) is not more than that permitted for successful communication.

R&TTE Compliance Statement

This equipment complies with the appropriate essential requirements of Article 3 of the R&TTE Directive 1999/5/EC.

Safety Considerations – General

For the following safety considerations, "Instrument" means the BreezeCOMPACT units' components and their cables.

Grounding

The BTS chassis is required to be bonded to protective grounding using the bonding stud or screw provided with each unit.

Safety Considerations – DC-powered Equipment

	CAUTION	ATTENTION
	Risk of electric shock and energy hazard.	Risque de décharge électrique et d'electrocution.
	Restricted Access Area: The DC-powered equipment should only be installed in a Restricted Access Area.	**Zone d'Accès Limité:** L'alimentation en courant continue doit être installée dans une zone a accès limité
	Installation Codes: The equipment must be installed according to the latest edition of the country's national electrical codes. For North America, equipment must be installed in accordance with the US National Electrical Code and the Canadian Electrical Code.	**Normes d'installation:** les équipements doivent être installes d'après les dernières normes en vigueur. Pour l'Amérique du nord les équipements doivent être installés d'après les normes électriques nationales US et les normes électriques Canadiennes.
	Overcurrent Protection: A readily accessible Listed branch circuit overcurrent protective device, rated 10A, must be incorporated in the building wiring.	**Protection de surintensité:** Une protection de surintensité de 10A doit être installée sur le circuit d'alimentation.
	CAUTION: This equipment is designed to permit connection between the earthed conductor of the DC supply circuit and the grounding conductor at the equipment. See installation instructions.	**ATTENTION:** Cet équipement est prévu pour permettre une mise a la terre entre le courant continu et le reste de l'installation. Voir les instructions d'installation.
	■ The equipment must be connected directly to the DC Supply System grounding electrode conductor. ■ All equipment in the immediate vicinity must be grounded in the same way, and not be grounded elsewhere. ■ The DC supply system is to be local, meaning within the same premises as the equipment. ■ There shall be no disconnect device between the grounded circuit conductor of the DC source (return) and the point of connection of the grounding electrode conductor.	■ L'appareil doit être connecté a la terre de l'allimentation en courant continu. ■ Tout appareil dans la proximité immédiate doit être connecté a la terre de la même manière et pas autrement. ■ L'alimentation du système en courant continu doit être local et remplir les mêmes conditions que le matériel. ■ Le circuit de terre doit être ininterrompu entre la source et les différents appareils.

Caution

To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

Pour éviter tout choque électrique ne pas intervenir sur les circuits électriques si vous n'êtes pas qualifié pour.

Line Voltage

Before connecting this instrument to the power line, make sure that the voltage of the power source matches the requirements of the instrument.

Laser

	**CLASS 1 LASER PRODUCT** The system can be equipped with Class 1 laser products, which comply with IEC 60825-1, IEC 60825-2 and a UL recognized laser or CDRH CFR Title 21, part 1040. The system does not emit hazardous light, and the beam is totally enclosed during normal operation, as long as the equipment is operated in accordance with the applicable safety instructions.	**APPAREIL A` LASER DE CLASSE 1** Classe du Laser Le système peut être équipe d'un laser de classe 1 selon la norme IEC 60825-1, IEC 60825-2 et reconnu comme UL laser ou CDRH CFR titre 21, partie 1040. Le système n'émet pas de lumière apparente et le rayon est entièrement protégé pendant l'utilisation normal du système par l'utilisateur tant que les appareils sont utilisés en suivant les instructions de sécurité.

Laser Safety Statutory Warning

All personnel involved in equipment installation, operation and maintenance must be aware that laser radiation is invisible. Therefore, although protective devices generally prevent direct exposure to the beam, personnel must strictly observe the applicable safety precautions, and in particular, must avoid staring into optical connectors, either directly or using optical instruments.

Remember that observing safety precautions is not a matter of personal choice; ignoring safety puts all people within the line-of-sight in danger.

Précautions de sécurité réglementaire pour laser

Tout personnel impliqué dans l'installation, le fonctionnement et la maintenance de l'installation doivent savoir que les radiations laser sont invisibles. Donc, bien que généralement les protections évitent tout contact direct avec les rayons émis, le personnel doit observer strictement les précautions de sécurité et en particulier, les connecteurs optiques, aussi bien directement ou avec des instruments d'optique.

Souvenez vous que remplir les précautions de sécurité n'est en aucun cas un choix personnel; ignorer les règles de sécurité mets toutes les personnes en présence en danger.

Radio

The instrument transmits radio energy during normal operation. To avoid possible harmful exposure to this energy, do not stand or work for extended periods of time in front of its antenna. The long-term characteristics or the possible physiological effects of radio frequency electromagnetic fields have not yet been fully investigated.

Outdoor Units and Antennas Installation and Grounding

Ensure that outdoor units, antennas and supporting structures are properly installed to eliminate any physical hazard to either people or property. Make sure that the installation of the outdoor unit, antenna and cables is performed in accordance with all relevant national and local building and safety codes. Even where grounding is not mandatory according to applicable regulation and national codes, it is highly recommended to ensure that the outdoor unit and the antenna mast are grounded and suitable lightning protection devices are used so as to provide protection against voltage surges and static charges. In any event, Telrad Networks is not liable for any injury, damage or regulation violations associated with or caused by installation, grounding or lightning protection.

USA CBRS Band Category B device

The BreezeCOMPACT 1000 requires installation by a CPI (Certified Professional Installer) as defined in Section 96.39 and 96.45 of FCC part 96 requirements. The Compact is Classified as a Category B CBSD which requires the following info be recorded and uploaded as part of the CPI process per section 96.45

All CBSDs:	**Category B Devices:**
• Geographic location • Antenna height AGL (m) • CBSD class (Category A or B) • Requested authorization status (PAL or GAA)[9] • FCC ID • Call sign (PALs only) • User contact info • Air interference technology • Serial # • Sensing capability (if supported)	• Limited to Outdoor operation • Antenna gain • Antenna Beam-width • Antenna Azimuth • Antenna Down tilt angle

The BreezeCompact 1000 (Category B CBSD) must report to a SAS to register and obtain spectrum grants per FCC part 96. Local administration should be executed through the domain proxy and all freq, bandwidth and power adjustments must be handled in coordination with the SAS and grant process. Once band 48 CBRS license has been added to the system the CBSD will require a grant from the SAS to automatically modify TX on/off, Frequency, bandwidth and power. Location info will be reported to the SAS by means of GPS synchronization.

Transmitter Antenna

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

This radio transmitter IC:899A-COMPACT3X has been approved by Industry Canada to operate with the antenna types listed in Section 1.4.7 below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio IC:899A-COMPACT3X a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans la Section 1.4.7 ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Disposal of Electronic and Electrical Waste

	**Disposal of Electronic and Electrical Waste**
	Pursuant to the WEEE EU Directive, electronic and electrical waste must not be disposed of with unsorted waste. Please contact your local recycling authority for disposal of this product.

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About This Manual

This manual describes the BreezeCOMPACT solution, and details how to install, operate and manage the BTS equipment.

This manual is intended for technicians responsible for installing, setting and operating the BreezeCOMPACT BTS equipment, and for system administrators responsible for managing the system.

In Release 6.8, BreezeCOMPACT1000 introduce new hardware including BreezeWAY1010 EPC (embedded EPC), for the additional EPC configuration please refer to BreezeWAY EPC user manual.

This manual contains the following chapters:

- **Chapter 1: System Description,** page **Error! Bookmark not defined.**, describes the BreezeCOMPACT system.
- **Chapter 2: Commissioning Steps,** page 38, describes how to commission the BreezeCOMPACT for provisioning.
- **Chapter 3: Operation and Administration Procedures,** page 43, describes how to configure the BreezeCOMPACT and perform various types of software upgrades.
- **Chapter 4: Events and Alarms,** page 122, describes how to handle events and alarms in the system.
- **Chapter 5: Licensing Mechanism,** page 130, describes how to handle events and alarms in the system.
- **Appendix A: Antenna Specifications,** page **Error! Bookmark not defined.**, provides specifications for the various antennas supported by BreezeCOMPACT.

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Table 0-1: Glossary

Acronym	Description
3GPP	3rd Generation Partnership Project
AAA	Authentication, Authorization and Accounting
BB	Baseband
BS	Base Station
BTS	Base Transceiver Station
CA	Carrier Aggregation
CAPEX	Capital Expenditure
CLI	Command Line Interface
CPE	Customer Premises Equipment
CQI	Channel Quality Indication
DSCP	Differentiated Services Code Point
DL	Downlink
EARFCN	EUTRA Absolute Radio Frequency Channel Number
ECGI	E-UTRAN Cell Global Identifier
EDT	Electrical Down-Tilt
EIRP	Equivalent Isotropically Radiated Power
eNB	eNodeB
EPC	Evolved Packet Core
EPROM	Erasable Programmable Read-Only Memory
E-UTRAN	Evolved UMTS Terrestrial Radio Access Network
FDD	Frequency Division Duplexing
GBR	Guaranteed Bit Rate
GHz	Gigahertz
GPS	Global Positioning System
HARQ	Hybrid Automatic Repeat Request
HPA	High Power Amplifier
HSS	Home Subscriber Server
IDU	Indoor unit
IEEE	Institute of Electrical and Electronics Engineers
IF	Interface
IP	Internet Protocol
iPCRF	Internal Policy and Charging Rules Function
IPv4	Internet Protocol Version 4
iHSS	Internal Home Subscriber Server
km	Kilometers
LC	Lucent Connector fiber optics
LSB	Least Significant Bit
LTE	Long Term Evolution
MBR	Maximum Bit Rate
MCC	Mobile Country Code
MCS	Modulation and coding scheme
MDT	Mechanical Down-Tilt
MHz	Megahertz

Acronym	Description
MIMO	Multiple Input and Multiple Output
MME	Mobility Management Entity
MNC	Mobile Network Code
MO	Managed Object
MSB	Most Significant Bit
MTU	Maximum Transmission Unit
NMS	Network Management System
Non-GBR	Non-Guaranteed Bit Rate
ODU	Outdoor Unit
OFDM	Orthogonal Frequency Division Multiplexing
OPEX	Operating Expenditure
PA	Power Amplifier
PCI	Physical Cell ID
PER	Packet Error Rate
PGW	Packet Gateway
PHY	Physical Layer
PLL	Phase-Locked Loop
PLMN ID	Public Land Mobile Network Identifier
PN	Part Number
QAM	Quadrature Amplitude Modulation
QCI	QoS Class Identifier
QoS	Quality of Service
QPSK	Quadrature Phase Shift Keying
RACH	Random Access Channel
RB	Resource Block
RH	Radio Head
RNC	Radio Network Controller
RNP	Radio Network Planning
RRC	Radio Resource Control
RRM	Radio Resource Management
Rx	Receiver
SFP	Small Form-Factor Pluggable
SGW	Serving GateWay
SINR	Signal to Interference plus Noise Ratio
SSF	Special SubFrame
SSH	Secure Shell
SW	Software
TA	Tracking Area
TAC	Tracking Area Code
TAI	Tracking Area Identity
TDD	Time-Division Duplex
TFTP	Trivial File Transfer Protocol
Tx	Transmitter

Acronym	Description
UE	User Equipment
UE-AMBR	UE Aggregate Maximum Bit Rate
UL	Uplink
VLAN	Virtual Local Area Network
VSWR	Voltage Standing Wave Ratio
WiMAX	Worldwide Interoperability for Microwave Access

Chapter 1: System Description

In This Chapter:

1.1 LTE

1.1.1Introduction to LTE

Long-Term Evolution (LTE), commonly marketed as 4G LTE, is a wireless communication standard for high-speed data for mobile phones and data terminals. The standard, which was developed by the 3rd Generation Partnership Project (3GPP), is specified in its Release 8 document series, with enhancements described in later releases.

The key benefits of LTE include:

- Responds to user demand for higher data rates (peak rates) and quality of service (QoS) that supports up to 20MHz channels in release 8 with Carrier Aggregation (CA) capabilities supported beginning with release 10 (for example, 20+20 MHz providing a capacity of 40 MHz).
- Addresses continued demand for cost reduction (CAPEX and OPEX).
- Supports both Frequency Division Duplexing (FDD) and Time-Devision Duplex (TDD).
- IP-based network architecture provides a simpler all-IP architecture that lowers operating costs.

1.1.2E-UTRAN Architecture

The LTE radio access network E-UTRAN architecture has been improved from a legacy cellular radio access (such as 3G) UTRAN network. eNodeB functions in E-UTRAN include not only legacy base station (NodeB) functions, but also the radio interface and Radio Network Controllers (RNCs), which include Radio Resource Management (RRM) functions.

Because both WiMAX and E-UTRAN architecture implement a similar approach, it is easier to migrate WiMAX networks to LTE. For example, Telrad's BreezeCOMPACT and Dual Mode CPE solution enables software upgrades from WiMAX to LTE. For more details about WiMAX migration options, contact Telrad.

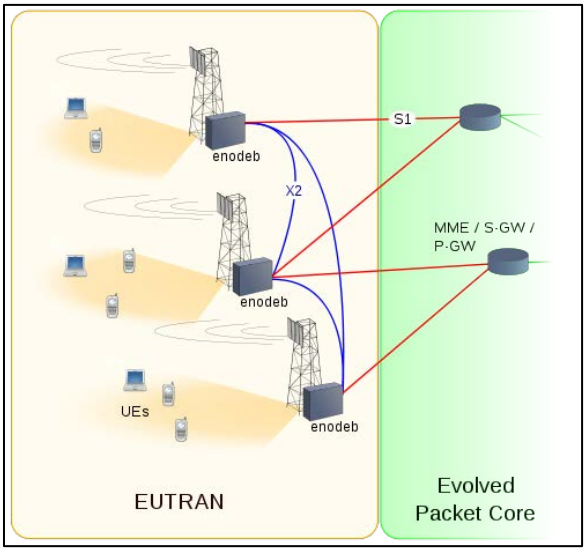


Figure 1: E-UTRAN Architecture

1.2 Telrad LTE End-to-End Solution

Telrad delivers a comprehensive LTE solution that includes BreezeCOMPACT eNB, BreezeWAY EPC, BreezeRADIUS AAA, CPE Indoor and Outdoor (User Equipment [UE]) and the BreezeVIEW management system.

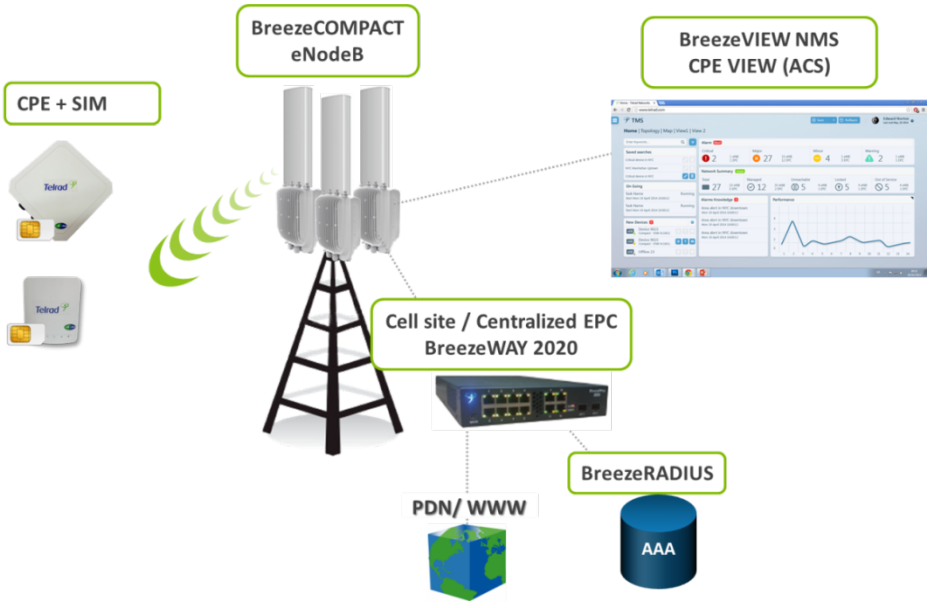


Figure 2: Telrad LTE End-to-End Solution Using BreezeWAY 2020

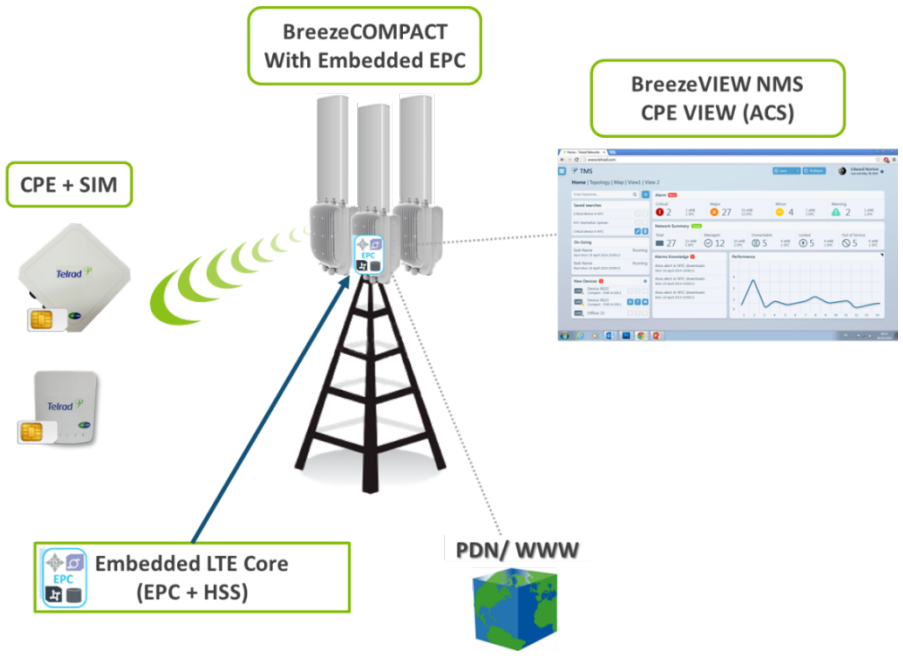


Figure 3: LTE End-to-End Solution Using Embedded EPC in BreezeCOMPACT1000

Table 2-2: Telrad Solution per Product Type

Product Type	Product
BS	BreezeCOMPACT 1000, 2000 and 3000
CPE	CPE7000 Outdoor/Indoor, CPE8000, CPE9000 Outdoor or Third Party
EPC	BreezeWAY2020 EPC, BreezeWAY1010 Embedded EPC in BreezeCOMPACT1000 or Third Party (IOT required)
User Provisioning	Internal HSS (BreezeWAY2020) or BreezeRADIUS AAA (Aradial)
Network Management	BreezeVIEW (BS and EPC) UEs-VIEW (UE)
	StarACS (UE/CPE)
Performance Monitoring	BreezeVIEW

1.3 BreezeCOMPACT Family

Telrad's BreezeCOMPACT family of products includes the following BreezeCOMPACT base station models:

- **BreezeCOMPACT 1000,** page 23
- **BreezeCOMPACT 2000,** page 23
- **BreezeCOMPACT 3000,** page 24

The highlights of these products are described in the sections that follow. For more information, please visit the BreezeCOMPACT section of the Telrad website at http://www.telrad.com/products/.

1.3.1BreezeCOMPACT 1000 – Small Cell, High Performance, Superior No-Line-of-Sight

The BreezeCOMPACT 1000 is Telrad's flagship solution that delivers high performance, enabling superior connectivity in a small package:

- Bands 42, 43 & 48; 3.3–3.5 GHz, 3.4–3.7 GHz, 3.6–3.8 GHz; 30 dBm per port
- BreezeWAY1010 embedded EPC
- WiMAX/TD-LTE-Advanced, software-upgradable
- Double capacity with dual-sector/carrier
- 4Tx x 4Rx and modem in a single, all-outdoor form factor
- Ultimate alternative to small cells in dense urban areas
- Highest capacity using Indoor and Outdoor CPEs and 4x4 diversity

Figure 4: BreezeCOMPACT 1000 – Small Cell, High Performance

1.3.2BreezeCOMPACT 2000 – Coverage and Capacity

The BreezeCOMPACT 2000 offers pervasive coverage, enabling triple-play connectivity in areas with no line of sight, in an all-outdoor single form factor:

- Band 42; 3.5 GHz; 37 dBm per port
- WiMAX/TD-LTE-Advanced, software-upgradable
- Ideal for urban environments with a mix of CPEs
- High power for areas with Non-Line-of-Sight
- All-in-one, outdoor Radio 4Rx x 2Tx and Modem
- High coverage and capacity for indoor CPEs

Figure 5: BreezeCOMPACT 2000 – Coverage and Capacity

1.3.3BreezeCOMPACT 3000 – Unmatched Performance

The BreezeCOMPACT 3000 provides high-performance indoor coverage for multiple devices, such as USB dongles, hotspot units and a wide selection of mobile devices:

- 4 x 4, 40 dBm (10 Watts) per port
- 3.3–3.4GHz Band 42; 3.4–3.6GHz, 3.475–3.7 GHz
- 2.3–2.4GHz Band 40; 2.5.–2.7GHz Band 41
- 4Tx x 4Rx and modem in a single, all-outdoor form factor
- WiMAX/TD-LTE-Advanced, software-upgradable
- For Fixed, High-mobility and Dense environments
- Double capacity with dual-sector/carrier
- High power for areas with Non-Line-of-Sight
- Highest coverage and capacity using indoor and outdoor CPEs with 4x4 diversity

Figure 6: BreezeCOMPACT 3000 – Unmatched Performance

1.4 BreezeCOMPACT Product Types per Frequency

Table 2-3 specifies the BreezeCOMPACT models and their supported frequencies.

Table 2-3: BreezeCOMPACT Models

Platform	Part No.	Telrad Part Number (PN)	Supported SW Release	Frequencies	Tx Power per Port (dBm)	Rx/Tx Config.
Compact1000e (with BreezeWAY1010)	735470	CMP.XT-BS-3.4-3.7	R7.0	3,400–3,700 MHz: ■ Band 42: 3,400–3,600. ■ Band 43: 3,600–3,700. ■ Band 43: 3,700–3,800 is not supported. ■ Band 48: 3,550-3700 *	30	4x4
Compact1000e (with BreezeWAY1010)	735472	CMP.XT-BS-3.3-3.5	R7.0	3,300–3,500 MHz	30	4x4
Compact1000e (with BreezeWAY1010)	735473	CMP.XT-BS-3.6-3.8	R7.0	3,600–3,800 MHz	30	4x4

* Requires CBRS License key. Once enabled all freq, bandwidth, TX power require a spectrum grant through BreezeView Domain proxy which will coordinate with a SAS. Only 10 and 20MHz channels are supported on CBRS version. Note only 2x2, Dual carrier, Dual Sector and 4RX 2TX are supported under part 96 using Rel 7.0. 4TX modes are planned for rel 7.2

Platform	Part No.	Telrad Part Number (PN)	Supported SW Release	Frequencies	Tx Power per Port (dBm)	Rx/Tx Config.
Compact1000	735270	CMP.XT-BS-3.4-3.7	R7.0	3,400–3,700 MHz: ■ Band 42: 3,400–3,600. ■ Band 43: 3,600–3,700. ■ Band 43: 3,700–3,800 is not supported. ■ Band 48: 3,550-3700 *	30	4x4
Compact1000	735272	CMP.XT-BS-3.3-3.5	R7.0	3,300–3,500 MHz	30	4x4
Compact1000	735273	CMP.XT-BS-3.6-3.8	R7.0	3,600–3,800 MHz	30	4x4
Compact2000	735271	CMP.HP-BS-3.5	R7.0	3,400–3,600 MHz	37	4x2
Compact3000	725270	CMP3000-B41-2496-2690MHz	R7.0	2,496–2,690 MHz	40	4x4
Compact3000	723270	CMP3000-B40-2300-2400MHz	R7.0	2,300–2,400 MHz	40	4x4
Compact3000	735370	CMP3000-B42-3400-3600MHz	R7.0	3,400-3,600 MHz	40	4x4
Compact3000	735373	CMP3000-3300-3400MHz	R7.0	3,300-3,400 MHz	40	4x4
Compact3000	735376	CMP3000-3475-3700MHz	R7.0	3,475-3,700 MHz	40	4x4

1.5 BreezeCOMPACT Features

1.5.1BreezeCOMPACT Topologies

The BreezeCOMPACT platform supports 4Tx/4Rx Radio. The following topologies are supported:

- **Single** Sector, page 26
- **Split Mode / Dual** Sector 2x2, page 26
- **Dual Carrier 2x2**, page 25

* Requires CBRS License key. Once enabled all freq, bandwidth, TX power require a spectrum grant through BreezeView Domain proxy which will coordinate with a SAS. Only 10 and 20MHz channels are supported on CBRS version

1.5.1.1 Single Sector

The Single Sector topology covers one geographic area. It can achieve up to 50% improved coverage/capacity on both the downlink (DL) and the uplink (UL) (vs 2x2) due to better diversity and power to the UE. Single Sector supports 2Rx/2Tx, 4Rx/2Tx and 4Rx/4TX.

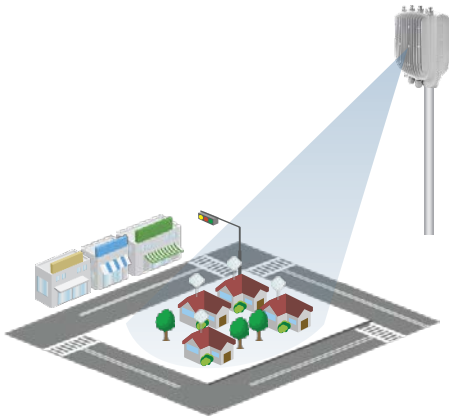


Figure 7: Single Sector 4x4 Topology

1.5.1.2 Split Mode / Dual Sector 2x2

This topology covers two geographic sector / areas, where the split mode is ideal for small areas with a low number of subscribers , where the Dual Sector license enables higher capacity and supported users for adding capacity for existing deployment and coverage holes.

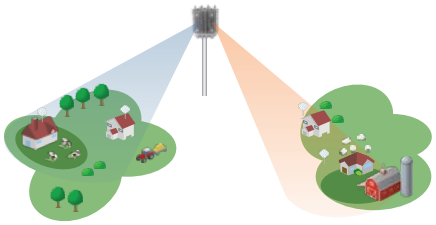


Figure 8: Split Mode / Dual Sector 2x2 Topology

1.5.1.2.1 Split Mode 2x2

The Single Carrier Using Split Mode topology enables deployment on a single BreezeCOMPACT unit to cover two geographic areas. In this mode, single carrier bandwidth (for example, 20/10 MHz) is used. The capacity of the single carrier is shared over both the geographic areas.

There are two options for Split mode:

- Split Mode default mode - using the same frequency for the two 2x2 sectors where the two antennas are back to back
- Split Mode f1f2 - Using different frequency for each 2x2 sector

The capacity of single carrier (5, 10, 14, 15, 20 MHz) is shared between the two sectors in both cases.

NOTE!	Handover is not supported in Split mode.

1.5.1.2.2 Dual Sector 2x2

The Dual Sector topology enables a double-capacity BreezeCOMPACT. In this mode, the BreezeCOMPACT behaves like two 2x2 eNodeBs (double capacity vs split mode). UEs on different sectors see different eNodeBs on different carriers. Each carrier can use any center frequency within the product's frequency range. For example, the BreezeCOMPACT 1000 supports 3.4–3.7 GHz. The operator can configure one carrier for 3.405 GHz and another for 3.695 GHz. This capability enables two 5MHz carriers or two 10 Hz carriers. **This feature is available for 5+5, 10+10, 14+14, 15+15, 20+20 MHz .**

1.5.1.3 Dual Carrier 2x2

The Dual Carrier topology enables a double-capacity BreezeCOMPACT. In this mode, the BreezeCOMPACT behaves like two 2x2 eNodeBs towards the same geographical sectors at two different frequencies (double capacity vs single carrier). UEs on different carriers see different eNodeBs on different carriers. Each carrier can use any center frequency within the product's frequency range. For example, the BreezeCOMPACT 1000 supports 3.4–3.7 GHz. The operator can configure one carrier for 3.405 GHz and another for 3.695 GHz. This capability enables two 5MHz carriers or two 10 Hz carriers. **This feature is available for 5+5, 10+10, 14+14, 15+15, 20+20 MHz .**

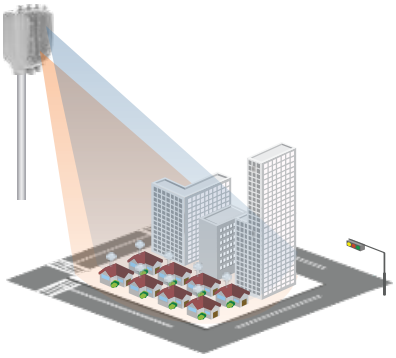


Figure 9: Dual Carrier 2x2 Topology towards the same geographical sector

1.5.1.3.1.1 Load Balancing

In a case of a Compact with a Dual Carrier configuration (two carries within the same geographical sector) the Load Balancing capability enables balance users per each carrier to eliminate un balanced user count per a specific carrier. This feature is enabled by the BreezeView towards the CPE.

1.5.1.3.1.2 Carrier Aggregation (Downlink)

In a case of a Compact with a Dual Carrier configuration (two carries within the same geographical sector) the Carrier Aggregation capability is supported with selective CPE's. The Carrier Aggregation enables optimizing Sector performance with increased throughput per user by aggregating two radio channels in the Downlink.

1.5.2BreezeCOMPACT TDD Configuration

1.5.2.1 LTE TDD Configuration

LTE supports various TDD configurations, which define the ratio between the DL and the UL. The LTE frame comprises 10 subframes, each of which is one millisecond long. The special subframes (marked in yellow in Figure 9) function as transition frames between the DL and the UL.

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

Figure 10: TDD Configurations

Note: In Release R7.0, configurations 0, 1, 2 and 7 are supported.

1.5.2.2 LTE TDD Special Subframe Configuration

The Special subframe contains the DL (DwPTS), Gap and UL (UpPTS) parts. A longer Gap supports a longer range. Figure 10 describes the special subframe types.

Special configuration	DL symbols	Gap symbols	UL symbols	OFDM symbol												
				0	1	2	3	4	5	6	7	8	9	10	11	12	13
0	3	10	1	D	D	D	G	G	G	G	G	G	G	G	G	G	U
1	9	4	1	D	D	D	D	D	D	D	D	D	G	G	G	G	U
2	10	3	1	D	D	D	D	D	D	D	D	D	D	G	G	G	U
3	11	2	1	D	D	D	D	D	D	D	D	D	D	D	G	G	U
4	12	1	1	D	D	D	D	D	D	D	D	D	D	D	D	G	U
5	3	9	2	D	D	D	G	G	G	G	G	G	G	G	G	U	U
6	9	3	2	D	D	D	D	D	D	D	D	D	G	G	G	U	U
7	10	2	2	D	D	D	D	D	D	D	D	D	D	G	G	U	U
8	11	1	2	D	D	D	D	D	D	D	D	D	D	D	G	U	U

Figure 11: Subframe Types

The Special subframe configuration defines the cell radius limitation, in addition to the throughput allocation for the DL and the UL. UEs located further than the cell radius are not registered to the eNodeB.

Cell radius limitations may reduce inter-cell configuration issues and enable the UE to register the correct eNodeB.

The table below describes the Special subframe configuration for each range.

Table 2-4: Cell Radius and Special Subframes

Cell Radius (Km)	SpecialSubframeCfg	Maximum Supported Range
R <= 10	0 to 3	10 km
R <= 20	0 to 2	20 km
R <= 30	0 to 1	30 km
R <= 39	0	39 km
R <= 60	0	60 km

1.5.3BreezeCOMPACT QoS

3GPP defines the following levels of quality of service (QoS):

- **QCI 1–4:** Guaranteed Bit Rate (GBR) service
- **QCI 5–9:** Non-Guaranteed Bit Rate (Non-GBR)

Figure 11 describes each QCI type and provides an application example for each type.

QCI	Resource Type	Priority	Packet Delay Budget	Packet Error Loss	Example Services
1	GBR	2	100 ms	10^ -2	Conversational Voice
2		4	150 ms	10^ -3	Conversational Video (Live Streaming)
3		3	50 ms	10^ -3	Real Time Gaming
4		5	300 ms	10 ^-6	Non-Conversational Video (Buffered Streaming)
5	Non-GBR	1	100 ms	10 ^-6	IMS Signalling
6		6	300 ms	10 ^-6	Video (Buffered Streaming),TCP-based (e.g., www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)
7		7	100 ms	10 ^ -3	Voice,Video (Live Streaming), Interactive Gaming
8		8	300 ms	10 ^ -3	Video (Buffered Streaming), TCP-based (e.g., www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)
9		9	300 ms	10 ^ -3	

Figure 12: QCI Types

GBR provides a guaranteed bit rate and is associated with parameters such as GBR and MBR, as follows:

- **GBR:** The minimum guaranteed bit rate. Specified independently for the UL and DL.
- **MBR:** The maximum guaranteed bit rate. Specified independently for the UL and DL.

The Non-GBR bearer does not provide a guaranteed bit rate and has the parameter UE-AMBR, as follows:

- **UE-AMBR:** The UE aggregate maximum bit rate is the maximum allowed total non-GBR throughput among all APNs to a specific UE.

QoS provisioning per UE can be either iHSS (in EPC and BreezeVIEW) or AAA.

1.5.4BreezeCOMPACT Equal Time/Equal Rate Scheduler

The system enables two scheduling schemes to support fairness between different UEs. It takes into account scenarios in which the system is overloaded and has limited air resources. The BreezeCOMPACT scheduler supports the following scheduling schemes: Equal Time and Equal Rate.

In order to ensure GBR committed rates in QCI 1-4, Equal rate scheduling is assigned always to the GBR portion.

For the un-committed (MBR / AMBR), operator can configure the eNB for Equal time or Equal rate.

1.5.5Equal Rate Scheduling

The Equal Rate scheduler attempts to deliver the same bit rate to all UEs provisioned that have the same GBR/MBR/AMBR. When UEs have different radio link conditions, the low modulation CPEs consume more air resource than the good modulation CPEs, in order to reach bit-rate fairness, as shown below:

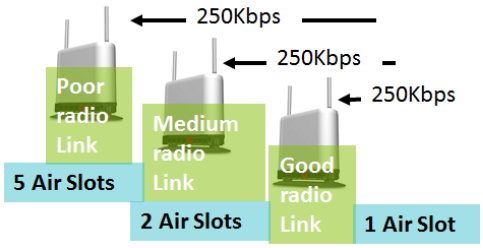


Figure 13: Equal Rate Scheduling

The Equal Rate scheme delivers rates that are proportional to the provisioning of GBR/MBR/AMBR.

In Release 6.8, a new protection mechanism for Equal Rate was introduced to limit the consumption of air resources by CPEs in poor radio conditions.

1.5.5.1 Equal Time Scheduling

The Equal Time scheduler attempts to deliver the same air resources to all UEs provisioned that have the same MBR. When UEs have different radio link conditions, lower-modulation CPEs get a lower bit rate than good-modulation CPEs, as shown below:

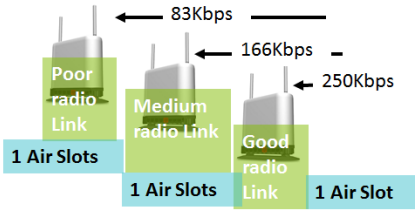


Figure 14: Equal Time Scheduling

The Equal Time scheme delivers rates that are proportional to the provisioning of MBR/AMBR.

1.5.5.2 Scheduling Schemes and QCI Mapping

The BreezeCOMPACT scheduler behavior for GBR/Non-GBR QCIs works as follows:

- Guaranteed bit rate service (QCI 1–4):
  - **GBR (Committed):** Schedule D with Equal Rate

- **MBR Minus GBR (Uncommitted Portion):** Scheduled either using Equal Time/Equal Rate (based on user provisioning)
- Non-guaranteed bit rate (QCI 5–9):
- **UE-AMBR:** Scheduled either with Equal Time/Equal Rate (based on user provisioning)

1.5.6Multiple PLMN IDs

The PLMN ID is built by concatenating the Mobile Country Code (MCC) and the Mobile Network Code (MNC). It provides the unique network identity. The same PLMN ID value must be configured in both the EPC and the eNB. The BreezeCOMPACT can support multiple PLMN IDs working with different MMEs/EPCs for multi-service networks and RAN sharing scenarios.

The eNodeB (BreezeCOMPACT) is configured with the list of MME IP addresses. When the UE is initially attached, the eNodeB selects the relevant MME/EPC based on the PLMN ID.

For more details about this capability, contact Telrad.

1.5.7EPC Redundancy and Load Balancing (Cluster)

The BreezeCOMPACT supports redundancy and load balancing between different BreezeWAY2020 entities in an EPC cluster. The cluster organizes the EPC entities in order to scale up the capacity and redundancy.

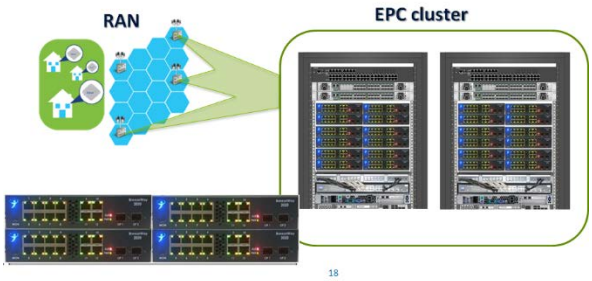


Figure 15: EPC Redundancy and Load Balancing

BreezeCOMPACT configuration enables multiple IP addresses to be configured for MMEs/EPCs (as described for multiple PLMN IDs in Sections 1.5.5, Multiple PLMN IDs

When EPCs/MMEs are configured with the same PLMN ID, BreezeCOMPACT can select the best EPC for load-balancing purposes.

Telrad BreezeCOMPACT eNB supports proportional-fair load-balancing mechanism for UE sessions distribution between EPC (MME) entities it is associated with (S1 Flex topology). The Load-balancing mechanism is applied during a new UE Attach procedure. eNB may be provisioned with multiple EPCs (MMEs) in a load-balancing/ failover mode. BreezeCOMPACT supports two pools of MMEs (EPCs) for load balancing

– Primary and Secondary.

EPC "balancing" is used within the pool – either Primary or Secondary. If no resources or no available MME entities event occurs in the Primary pool, eNB will switch to the Secondary pool. When resources of the Primary pool recover, eNB will switch back to use it (for a new-coming UEs)

Note: In R6.9 BreezeCOMPACT with eEPC (BreezeWAY1010), can be configured to enable local embedded EPC entity which can be set as one of EPC entities (either primary or secondary)

1.5.8Spectrum analyzer

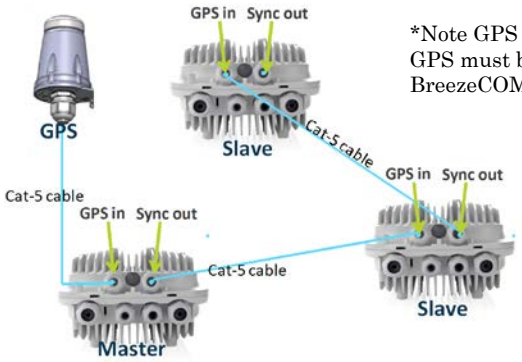
The spectrum analyzer functionality was developed to help field engineers to define the best (less interfere) channel for BreezeCOMPACT during the installation and commissioning. This function is critical in unlicensed bands, such as in 3.65 GHz – 3.7 GHz in the US and Canada, where other transmitting devices may interfere with the BreezeCOMPACT. In addition, it allows operator in licensed band to identify existence of interference from other sources which may not be allowed to use the spectrum.

1.5.9GPS

GPS is used to synchronize the air link frames of Intra-site-located and Inter-site-located BTSs, in order to ensure that the air frame starts at the same time in all base stations (BSs), and that all BSs switch from transmit (DL) to receive (UL) at the same time. This synchronization is necessary for preventing Intra-site and Inter-site interference and BS saturation (assuming that all BSs operate with the same frame size and with the same DL/UL ratio).

The all-outdoor GPS receiver is a pole-mountable GPS receiver and antenna in a single environmentally protected enclosure that is powered from the unit.

GPS Chaining is supported where the chaining enables the use of a single GPS receiver for several collocated units (up to 4 BreezeCOMPACT units). The figure below describes the GPS chaining connectivity.



*Note GPS chaining disabled on CBRS Version. Also GPS must be installed within 3 meters of BreezeCOMPACT by a CPI

Figure 16: GPS Chaining

NOTE!	In case of GPS chaining, the chained units depends on proper operation of the feeding units (Master or Slaves). Therefore for better redundancy general recommendation would be to use single GPS per BreezeCOMPACT

1.6 BreezeCOMPACT R7.0 Software Capabilities

The following describes the BreezeCOMPACT R7.0 capabilities (the list includes existing and new features):

- **LTE 3GPP Capabilities:**
  - **3GPP Release:** Release 9 with Release 12 capabilities for selected UE's
  - **Distance:** Up to 60 kilometers (km) **(new in R7.0)Transmit Modes (TM):** TM1, TM2, TM3 & TM4 (relevant for 4x4 single sector configuration)
- **Carrier Aggregation with selected CPE's (new in R7.0)**
  5+5MHz,10+10MHz,14+14MHz, 15+15MHz and 20+20MHz (with CPE9000)
  BreezeCOMPACT hardware Capabilities:
  - **Number of Rx/Tx:** 4x4, 2x2, 4x2
  - **BreezeCOMPACT Topology:**
    - Single Sector
    - Split Mode 2x2 (Dual Sector with Single Carrier) – Single frequency or two different frequencies for each sector
    - Dual Sector Mode (5+5MHz,10+10MHz,14+14MHz, 15+15MHz and 20+20MHz) 2x2 - Single frequency or two different frequencies for each sector **(New in R6.9)**
    - Dual Sector Mode (5+5MHz,10+10MHz,14+14MHz/15+15MHz and 20+20MHz) 2x2 - Single frequency or two different frequencies for each sector
    - Dual Carrier Mode (5+5MHz,10+10MHz,14+14MHz/15+15MHz and 20+20MHz) 2x2 - Two different frequencies for each Carrier on the same geogrpahical sector
    - Load Balancing of CPE's between two Carriers within the same Geographical Sector (via BreezeView) **(new in R7.0)**
  - **BreezeCOMPACT SDR Capabilities:** WiMAX, LTE and LTE-Advanced
  - **GPS:** Single BreezeCOMPACT or multiple on-site (chained)
  - **GPS:** Supporting Holdover time up to 2 hours
  - **GPS:** Enabling/Disabling Tx Power shutdown (Operator Parameter), when holdover time is expired
  - **Data Port redudnacy :** capability to switch from DAT1 to DAT2 in case of link down (requires cell site switch support) –
  - **BreezeCOMPACT embedded EPC –** BW1010 (on supported hardware models)
    - Supporting Local (eEPC) and Remote EPC
    - Two IP addresses for BreezeCOMPACT – LTE interface and eEPC
- **Radio Capabilities:**
  - UL and DL rate adaptation
  - UE power control
  - X2 Handover Support – A3 triggers (supported) and A5 Triggers
  - Equal Time/Equal Rate scheduling
  - Equal rate scheduling protection for low modulation CPEs (Weak UEs protection)
  - UL QAM64 supported (On supported CPE models)
  - Spectrum analyzer – full band scan
  - Spectrum analyzer (NI - Noise indication) – MAX NI during the last 5 min measurements interval **(New in R6.9)**
  - UE KPIs using CPE VIEW
  - TDD configuration 0 - for enhanced Uplink **(new in R7.0)**

- **Services/ QOS:**
  - Default bearers (GBR or Non-GBR QCIs)
  - Dedicated bearers (GBR or Non-GBR QCIs)
    - Supporting PBR – QoS between multiple GBR bearers
  - All QoS parameters support: QCI 1–9; GBR/MBR, AMBR with full rate policy
  - Logical Channel Groups for Uplink (
  - Multiple PLMN-IDs support

- **Networking:**
  - S1 interface is 802.1q tagged - VLANs for LTE infrastructure and Management.
  - DSCP and 802.1p policy-based marking at the infrastructure level for Control Plane (LTE infrastructure VLAN), Management (Management VLAN) and User traffic (as per LTE bearer QCI)
  - eNodeB Ethernet statistics
- **Management**
  - Rollback management
  - CLI User Authentication
  - NTP – BreezeVIEW address is added
  - Software Licensing
  - Load Balancing of CPE's between two carriers within the same geographical sectors **(new in R7.0)**

1.7 BreezeCOMPACT Accessories and Specifications

1.7.1Antennas

In the system architecture, the antenna is represented as an independent element. This provides the operator with the flexibility to select between different antenna types with various capabilities, such as supported frequencies, gain, beam width and sizing.

For more information about supported antennas, refer to Appendix A, Antenna Specifications.

1.7.2SFP (Fiber)

BreezeCOMPACT supports 1GB fiber on the DAT1 port.

Telrad supplies the following accessories (must be ordered separately):

- Pluggable multi-mode SFP (PN 300728) or single mode SFP (PN 300758)
- LC connector
- Adhesive tube shrink
- Sealing gland

1.7.3Modem and Radio

Table 2-5: General Modem and Radio Specifications

Item	Description
BreezeCOMPACT Family: List of products supported by frequency band, maximum Tx power and port configuration	**BreezeCOMPACT 1000:** ■ 3,300–3,500 MHz, 30 dBm per port, 4 Rx by 4 Tx ■ 3,400–3,700 MHz, 30 dBm per port, 4 Rx by 4 Tx ■ 3,600–3,800 MHz, 30 dBm per port , 4 Rx by 4 Tx **BreezeCOMPACT 2000:** ■ 3,400–3,600 MHz, 37 dBm per port, 4 Rx by 2 Tx (Tx RF ports 1, 2) **BreezeCOMPACT 3000:** ■ 2,496–2,696 MHz, 40 dBm per port, 4 Rx by 4 Tx ■ 2,300–2,400 MHz, 40 dBm per port, 4 Rx by 4 Tx ■ 3,300–3,400 MHz, 40 dBm per port, 4 Rx by 4 Tx ■ 3,400–3,600 MHz, 40 dBm per port, 4 Rx by 4 Tx ■ 3,475–3,700 MHz, 40 dBm per port, 4 Rx by 4 Tx
Central Frequency Resolution	WiMAX: 0.125 MHz LTE: 0.1 MHz
Operation Mode	TDD
Channel Bandwidth *	■ 5, 10, 14, 15, 20 MHz – Single Carrier ■ 5+5MHz, 10+10MHz, 14+14MHz, 15+15MHz, 20+20MHz – Dual Sector/Carrier
Tx Power Control Range	10 dB, in 1dB steps
Tx Power Accuracy	+/- 1 dB
Modulation	QPSK, QAM16, QAM64 (MCS0-MCS28)
Access Method	OFDMA Downlink SC-FDMA Uplink

1.7.4Data Communication (Ethernet Interfaces)

Table 2-6: Data Communication (Ethernet Interfaces)

Item	Description
Standards Compliance	IEEE 802.3 CSMA/CD
DAT 1 (optional, if an SFP is installed)	1000Mbps Base-X optical fiber interface, Half/Full Duplex with Auto-Negotiation
DAT 2	100/1000 Mbps Base-T twisted-pair electrical interface, Half/Full Duplex with Auto-Negotiation
DAT 3	BreezeCOMPACT1000/3000 10/100 Mbps Base-T twisted-pair electrical interface, Half/Full Duplex with Auto-Negotiation BreezeCOMPACT with embedded EPC 10/100/1000 Mbps Base-T twisted-pair electrical interface, Half/Full Duplex with Auto-Negotiation

1.7.5GPS Receiver Specifications

Table 2-7: BMAX-4M-GPS and BreezeGPS Receiver, Mechanical and Electrical Specifications

* Note only 10 and 20MHz channels supported when Compact is licensed for CBRS. All spectrum allocation and grant to transmit will be issued by an approved SAS to BreezeView Domain Proxy

Item	Description
Dimensions	8.8 x 10.4 x 16 cm
Weight	0.38 kilograms (Kg)
Power Source	12 VDC from the BTS
Power Consumption	2W maximum
Connector	RJ-45

1.7.6Configuration and Management

Table 2-8: Configuration and Management

Item	Description
Management (Out-of-Band, In-Band)	BreezeVIEW CLI
Device Management protocol	NETCONF
Software Upgrade	TFTP/BreezeVIEW

1.7.7Standards Compliance, General

Table 2-9: Standards Compliance, General

Type	Standard
EMC	■ ETSI EN 301 489-1/4 ■ FCC Part 15
Safety	■ EN60950-1 (CE) ■ UL 60950-1 (US/C)
Environmental	ETS 300 019: ■ Part 2-1 T 1.2 and part 2-2 T 2.3 for indoor and outdoor ■ Part 2-3 T 3.2 for indoor ■ Part 2-4 T 4.1E for outdoor
Radio	■ ETSI EN 302 326 ■ FCC Part 90 ■ IC RSS-192 ■ IC RSS-197 ■ FCC Part 27 ■ FCC Part 96 (CBSD Compact1000 3,550-3,700MHz)

1.7.8Environmental

Table 2-10: Environmental Specifications

Type	Details
Operating Temperature	-40°C to 55°C
Operating Humidity	5%–95%, weather protected

1.7.9Mechanical and Electrical

1.7.9.1 BreezeCOMPACT 1000

Table 2-11: Mechanical and Electrical Specifications, BreezeCOMPACT 1000 Units

Item	Description
Dimensions	242.7 x 343 x 166.9 mm
Weight	8.2 Kg
Power Input	-40 to -60 VDC
Power Consumption	100W Average (at 70% Tx/Rx duty cycle) 142W peak (Power supply requirement)
Tx Ports/Rx Ports	Ports 1–4 (Tx), Ports 1–4 (Rx)

1.7.9.2 BreezeCOMPACT 2000

Table 2-12: Mechanical and Electrical Specifications, BreezeCOMPACT 2000 Units

Item	Description
Dimensions	280 x 510 x 220 mm
Weight	19.5 Kg
Power Input	-40 to -60 VDC
Power Consumption	186W Average (at 70% Tx/Rx duty cycle) 225W peak (Power supply requirement)
Tx Ports/Rx Ports	Ports 1, 2 (Tx), Ports 1–4 (Rx)

1.7.9.3 BreezeCOMPACT 3000

Table 2-13: Mechanical and Electrical Specifications, BreezeCOMPACT 3000 Units

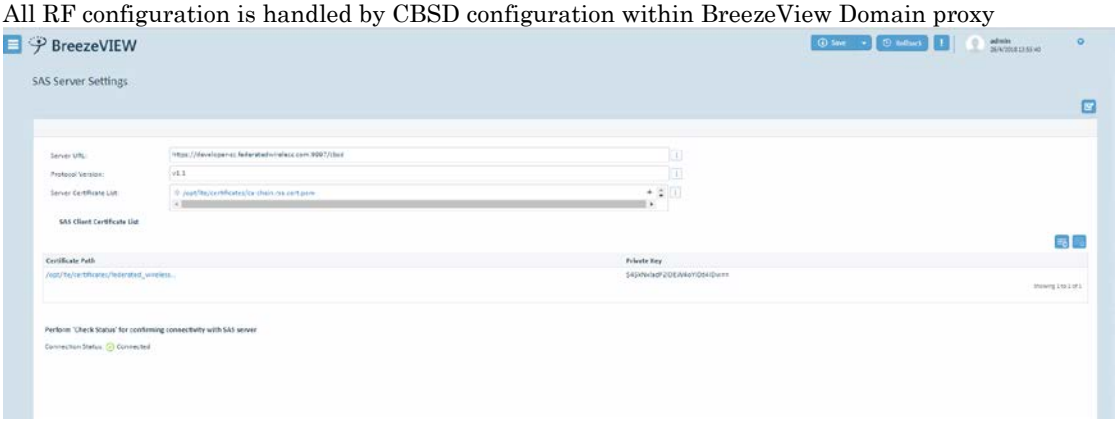
Item	Description
Dimensions	260 x 400 x 330 mm
Weight	19 Kg
Power Input	-40 to -60 VDC
Power Consumption	230W Average (at 70% Tx/Rx duty cycle) 300W peak (Power supply requirement)
Tx Ports/Rx Ports	Ports 1–4 (Tx), Ports 1–4 (Rx)

Chapter 2: Commissioning Steps

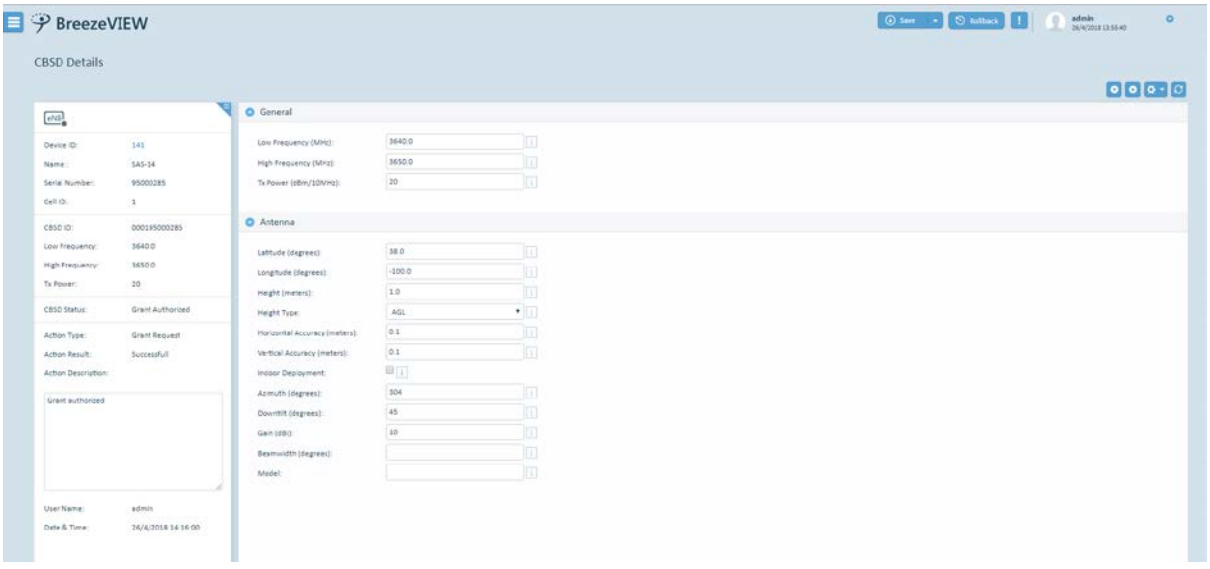
In This Chapter:

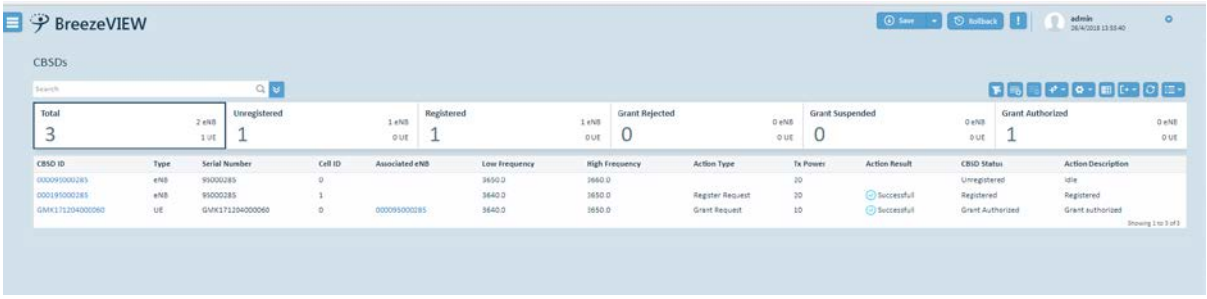
2.1 BreezeCOMPACT Commissioning

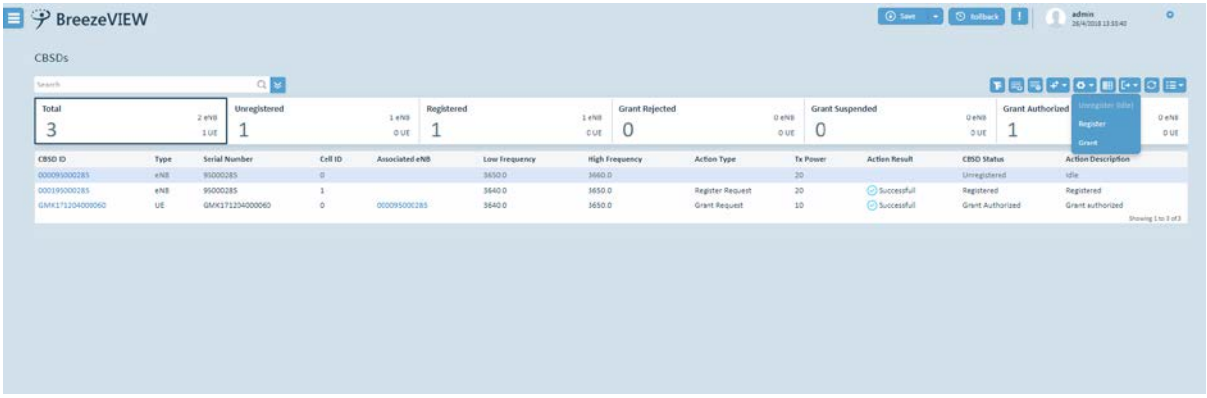
NOTE: Before commissioning BreezeCOMPACT please refer to CBRS band warning on page 7.
All RF configuration is handled by CBSD configuration within BreezeView Domain proxy



SAS Communication is required as are necessary parameters detailed on page 7. All parameters below must be populated for the Category B CBSD. Telrad standard 65 degree antenna is 17.5dBi. This 17.5 dBi will be computed as part of MAX EIRP. MAX EIRP will be granted by the SAS based. Assuming no coexistence requirements or incumbent protection this EIRP would be 47dBm/10MHz. Based on 2x2 MiMO the Compact could use up to 30dBm per port i.e. 30dBm (MiMO per port cross polarized) + antenna gain 17.5dBi - .5dB cable loss = 47dBm EIRP. When using 4x4 (TM4) The max TX power would be 27dBm to account for MiMO Array Gain.







2.1.1Purpose

This procedure describes the steps required to initially commission the BreezeCOMPACT 1000, 2000 and 3000, in order to enable its connection for provisioning.

NOTE!	BreezeWAY1010 embedded EPC configuration is covered in BreezeWAY user manual

2.1.2BreezeCOMPACT Commissioning Procedure

2.1.2.1 Initial Out-of-the-Box Connection

The following procedure assumes that the BreezeCOMPACT LTE software is already loaded (already upgraded from WiMAX or shipped with the LTE software) and has been set to the factory defaults.

➢ **To connect the BreezeCOMPACT:**

1. Connect the cable from the PC to the DATA3 Local Management port.
2. On the PC, define the IP address as **192.168.1.100**.
3. Connect the BreezeCOMPACT unit to the power supply and wait until the unit boots up.
4. Use any Telnet client software on the PC, such as putty.exe, to access the eNodeB using the IP address **192.168.1.1**.
5. After a prompt is displayed, perform the following:
   - Log in using **admin**.
   - Use the password LteAdmin!.

- At the **BreezeCompact>** prompt, type **configure**. The **BreezeCompact%** prompt displays.

It is recommended that you change the password. To change the password, see the *BreezeVIEW User Manual* for more details.

2.1.2.2 eNodeB initial general and external management parameters

This section describes how to define the management parameters for the CLI and the BreezeVIEW connectivity. To define CLI with BreezeVIEW - general and external

Management connection parameters:

1 Perform the procedure described in Section 2.1.2.1, Initial Out-of-the-Box Connection.

2 Perform eNodeB Timing and GPS configuration as described in Section 4.2.2.11

3 Perform basic device commissioning procedure

- Set Device ID

  At the **BreezeCompact%** prompt, set parameters by entering the following commands: set device general device-id < unsignedInt, 1 .. 999999 >

- For embedded eNB (BreezeCompact 1000e) use the following command to enable/disable EPC

  set device general enable-embedded-EPC <Disable or Enable>.

- External management IP parameters

  At the **BreezeCompact%** prompt, set parameters by entering the following commands:

  set networking external-management ip-address <The external management IP address >

  set networking external-management subnet-mask <The external management subnet mask >

  set networking external-management next-hop-gateway <The external management default gateway>

  set networking external-management vlan-id <VLAN of the external management >

  This value can be a vlan number or NoVLAN in case that this external management port is not tagged with VLAN.

  set networking external-management use-bearer-ip-address <true or false >

  The default value is false. Set the value to true in case that the s1 bearer address and the external management will have the same IP address

- L1 & L2 Port configuration (default Auto negotiate)

  At the **BreezeCompact%** prompt, set parameters by entering the following commands:

  set networking physical-ports-list <Port number 1-3> **duplex-mode** <fullDuplex or HalfDuplex>

  This command sets a port Duplex (half or full)

  set networking physical-ports-list <Port number 1-3> **negotiation** <Auto or manual>

  This command sets a port negotiation to manual or Automatic mode.

  set networking physical-ports-list <Port number 1-3> **speed** <100 ,1000> This command sets the port speed to 100 or 1000 .

  Important remark : For port 1: speed may be 1 Gb only For port 2: speed may be 100Mb or 1Gb only For port 3: speed may be 100Mb only in BreezeCOMPACT1000 & 3000, in case of embbeded EPC 1000Mb can be set.

- Configure NMS BreezeVIEW IP address to permit auto discovery of the device.

  set device management nms-ip <The NMS IP address>

- Configure the TFTP server IP address (used for software version upgrade) – TFTP server IP address (optional)

  set device management tftp-ip-address <TFTP Server IP address>

4 Perform license loading according to the procedure described in the Chapter 6, Licensing Mechanism.

5 Perform commit procedure as explained in 4.1

6 Reboot is required for changes to take effect

BreezeCompact> request reboot reboot

The reboot will disrupt all services provided by device. Are You sure? [no,yes] yes

➢ To install the BreezeCOMPACT hardware on a pole:

1 Follow the hardware installation instructions provided in the quick installation guides for the various BreezeCOMPACT devices.

2 Connect DATA1 or/and DATA2 to the network.

3 Install the GPS and connect the GPS cable.

After the eNodeB is up, it is discovered automatically by BreezeVIEW.

You can configure the eNodeB using:

7 BreezeVIEW configuration methods (such as Manual and Template). For more details, see Section 3.4.6, Configuring Via BreezeVIEW.

8 A direct SSH connection to an external management IP address in order to use the management CLI. For more details, see Chapter 3, Operation and Administration Procedures.

5. Please verify if the equipment installed properly. The PWR (Power) and GPS LEDs status should be GREEN.

Chapter 3: Operation and Administration Procedures

In This Chapter:

The Spectrum Analysis Collection feature enables you to determine the noise characteristics per eNB frequency range and channel.

Collection performed online and not affecting eNB services. Measurements are collected at five-minute intervals.

The data is collected within a range of eNB frequencies and on all active Rx ports (up to 4 ports), the spectrum analyzer is aligned with the system configured TDD split, and the listening period is in the uplink period.

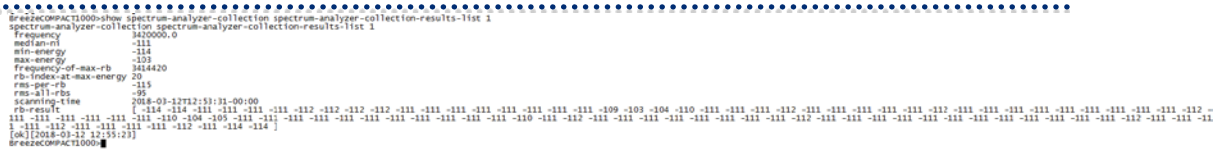
3.1.1.1Spectrum Analyzer Collection scanning results

To display results for all active ports:

BreezeCOMPACT1000>show spectrum-analyzer-collection spectrum-analyzer-collection-results-list

To display results for specific port:

BreezeCOMPACT1000>show spectrum-analyzer-collection spectrum-analyzer-collection-results-list 1



BreezeCOMPACT1000>show spectrum-analyzer-collection spectrum-analyzer-collection-results-list

Possible completions:

1 - The Scanned Antenna Port Number

2 - The Scanned Antenna Port Number

3 - The Scanned Antenna Port Number

4 - The Scanned Antenna Port Number

Possible match completions:

frequency - Frequency(MHz)

frequency-of-max-rb - Frequency of RB at Max NI (kHz)

max-energy - Max NI per dBm/RB

median-ni - Median NI per dBm/RB

min-energy - Min NI per dBm/RB

rb-index-at-max-energy - RB Index at Max NI

rb-result - The Scanned Antenna Port Number

rms-all-rbs - RMS BW per dBm

rms-per-rb - RMS NI per dBm/RB

scanning-time - ScanningTime

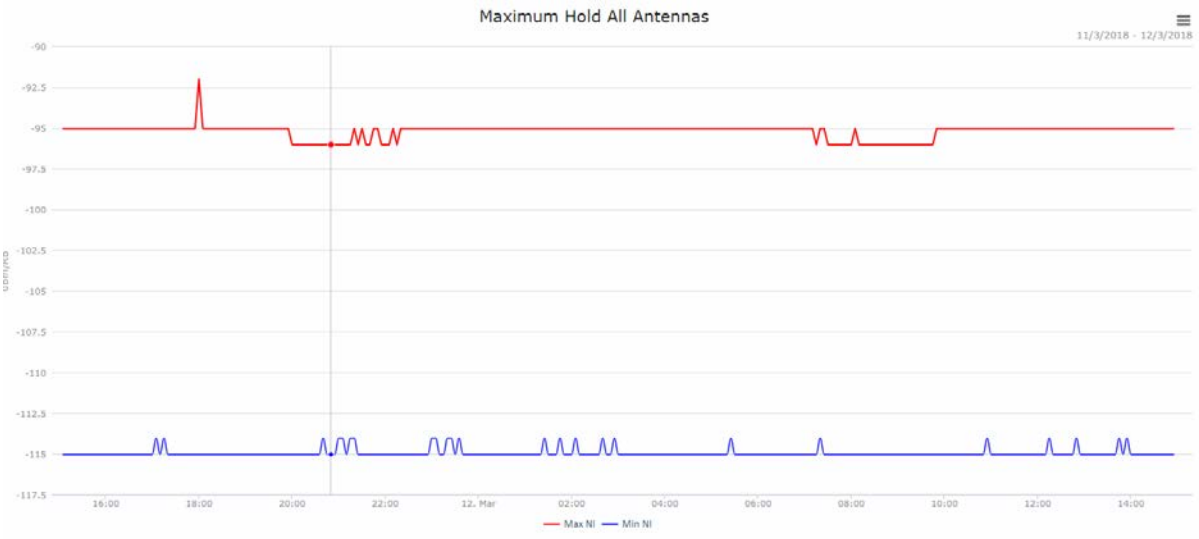


Figure 89: BREEZEVIEW -ENB Spectrum Analyzer Collection All Antennas

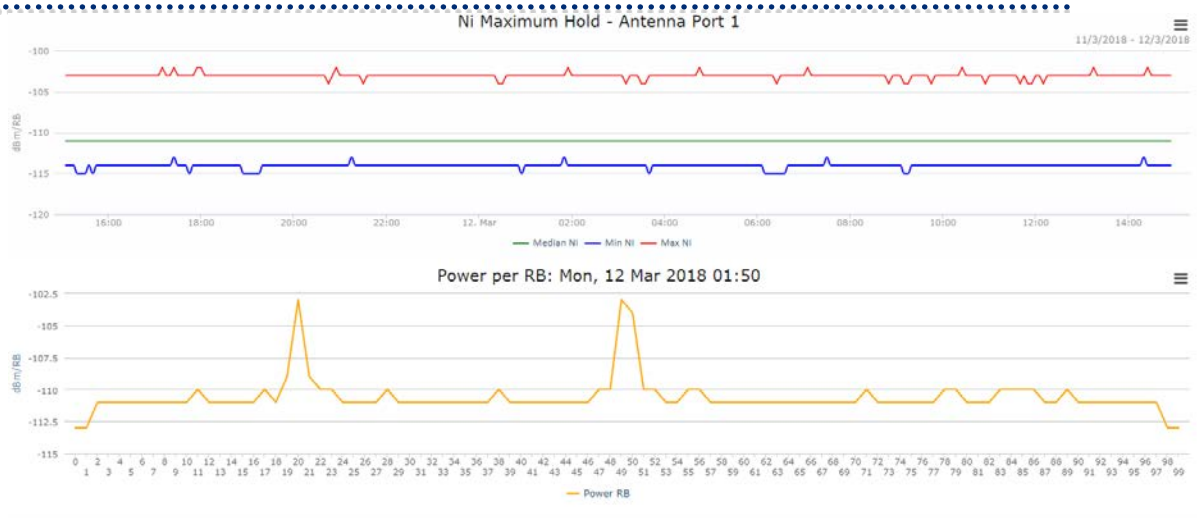


Figure 90: BREEZEVIEW -ENB Spectrum Analyzer Collection 1 Antenna

3.1.2 Spectrum Analyzer Range Frequency Scanning

The Spectrum Analysis feature enables you to determine the noise characteristics per channel per frequency range. When the Spectrum Analyzer feature is activated, the unit enters a passive scanning mode for a period of time during which information is gathered. The scanned channels are the channels comprising a selected subset.

Upon activating the spectrum analysis, the unit automatically shuts down the RF transmit ports and keep eNB receive ports for capturing the data. During the information-gathering period, the UEs will not be serviced by the eNB. At the end of the period, the user should configure the system for normal operation.

The data is collected within a range of frequencies and on all active Rx ports (up to 4 ports), the spectrum analyzer is aligned with the system configured TDD split, and the listening period is in the uplink period.

3.1.2.1Spectrum Analyzer State

Perform the command “show spectrum-analyzer state”

BreezeCompact> show spectrum-analyzer state

spectrum-analyzer state spectrum-analyzer-state Disable

spectrum-analyzer state spectrum-analyzer-state-cell2 Disable

spectrum-analyzer state scanning-state Disable

spectrum-analyzer state scanning-state-cell2 Disable

Disable (normal operation), Enable (spectrum analyzer mode)

state scanning-state options:

Disable (spectrum analyzer is not in active scanning), Enable (spectrum analyzer is in active scanning)

3.1.2.2Spectrum analyzer configuration

The default spectrum analyzers settings can be used, the frequency scanning range will be defined as the whole band supported by the BreezeCompact hardware, however in order to minimize the scanning time it is recommend to perform scanning on the desired spectrum.

Use “show” command to display the Spectrum Analyzer scanning parameters. For example:

BreezeCompact% show spectrum-analyzer scanning

start-frequency 3400000;

stop-frequency 3700000;

frequency-step 1000;

interval 1000;

repetitions 0;

Configurable parameters:

- start-frequency – Scanning start frequency (in kHz) stop-frequency – Scanning stop frequency (in kHz)
- frequency-step – Scanning step/resolution frequency (in kHz), minimum step of 0kHz step, default 1000kHz
- interval – defines the time to between each frequency steps, higher interval time will enable more measurements but increase the overall scanning duration, minimum internal 10msec, default 1 second.
- repetitions – in cases where operator would like to perform several scans for a period of time, it can define the repetition number. For example repetition value 1, the spectrum analyzer will scan the frequency range two rounds. In default case (0), only one round of spectrum scan will be reported.

Use “set” command for configuration of the above parameters:

BreezeCompact% set spectrum-analyzer scanning <Parameter> <Value> Perform commit command:

BreezeCompact% commit

Use command “show spectrum-analyzer scanning” to verify definitions

BreezeCompact% show spectrum-analyzer scanning

start-frequency 3480000;

stop-frequency 3530000;

frequency-step 1000;

interval 200;

repetitions 0;

Quit from the configuration level to CLI level BreezeCompact% quit

3.1.2.3Enable / Disable spectrum analyzer

- **To enable spectrum analyzer:**
  - BreezeCompact> request spectrum-analyzer-actions enable-spectrum-analyzer

This action will enable the spectrum analyzer, the Tx ports will stop transmit. Are You sure? [no,yes] yes

Spectrum analyzer will become enabled after several seconds. To verify state:

BreezeCompact> show spectrum-analyzer state spectrum-analyzer state (Enable/Disable)

3.1.2.4Start scanning

BreezeCompact> request spectrum-analyzer-actions start-scanning This action will start the scanning operation. Are You sure? [no,yes] yes [ok][2016-05-03 10:41:18]

BreezeCompact> show spectrum-analyzer state scanning-state

spectrum-analyzer state scanning-state Enable

3.1.2.5Wait for scanning finished

The spectrum analyzer state will be Enabled as long as the scanning is performed, scanning-state will be changed to Disable once scanning is finished. In order to monitor the state:

BreezeCompact> show spectrum-analyzer state scanning-state

spectrum-analyzer state scanning-state Disable

3.1.2.6See the scanning results

To display results for all active ports:

BreezeCompact> show spectrum-analyzer scanning-results-list

- **To display results for specific port number:**
  - BreezeCompact> show spectrum-analyzer spectrum-scanning-results-list antenna-port <Port Number>
- **To show the full table (without need for pressing enter):**
  - BreezeCompact> show spectrum-analyzer spectrum-scanning-results-list | nomore

Example for results operating Spectrum analyzer with interference on central frequency of 3655000kHz and 10MHz Bandwidth:

BreezeCompact> show spectrum-analyzer spectrum-scanning-results-list antenna-port 2

ANTENNA PORT	FREQUENCY	MEDIAN NI	MIN ENERGY	MAX ENERGY	FREQUENCY OF MAX RB	RB INDEX AT MAX ENERGY	RMS PER RB	RMS ALL RBS	SCANNING TIME	KEY RB RESULT	RB RESULT
2	3490000.0	-115	-116	-100	3489820	12	-111	-98	2017-04-27T10:13:54-00:00	1	0
										2	0
										3	-116
										4	-116
										5	-116
										6	-116
										7	-115
										8	-114
										9	-114
										10	-113
										11	-110
										12	-100
										13	-106
										14	-113
										15	-111
										16	-111
										17	-113
										18	-115
										19	-116
										20	-116
										21	-116
										22	-116
										23	0
										24	0
										25	0
										26	0
										27	0
										28	0
										29	0
										30	0
										31	0
										32	0
										33	0
										34	0
										35	0
										36	0
										37	0
										38	0
										39	0
										40	0
										41	0
										42	0
										43	0

Each frequency scanned (one row) is comprised of multiple Resource Blocks (RBs) within the bandwidth used. In most cases Median/Min/Max NI measurement will give good indication for interference.

Explanation about the table fields:

Table 3-2: SA results table

Measurement	Description	Units
ANTENNA PORT	BreezeCOMPACT port number	1,2,3,4
FREQUENCY	RF Central frequency	kHz
MEDIAN NI	Median NI	dBm
MIN ENERGY	Minimum NI	dBm
MAX ENERGY	Maximum NI	dBm
FREQUENCY OF MAX RB	Frequency of Maximum NI	kHz
RB INDEX AT MAX ENERGY	Telrad internal use	1 … 96
RMS PER RB	RMS normalize for 1RB	dBm
RMS ALL RBS	RMS of the BW	dBm
SCANNING Time	Time of the latest result of the measurements at specific RF frequency	
KEY RB RESULTS	Numbers in order according to the number of the RBs (Recourse Blocks)	1 …. 100
RB RESULT	Energy per RB	dBm

Figure 91: BREEZEVIEW -ENB Spectrum Analyzer Range Frequency Scanning page

3.1.2.7Disable spectrum analyzer

BreezeCompact> request spectrum-analyzer-actions disable-spectrum-analyzer

This action will disable the spectrum analyzer the system will be back to normal mode. Are You sure? [no,yes] yes

See that spectrum analyzer is disabled:

BreezeCompact> show spectrum-analyzer state spectrum-analyzer state

spectrum-analyzer-state spectrum-analyzer state Disable

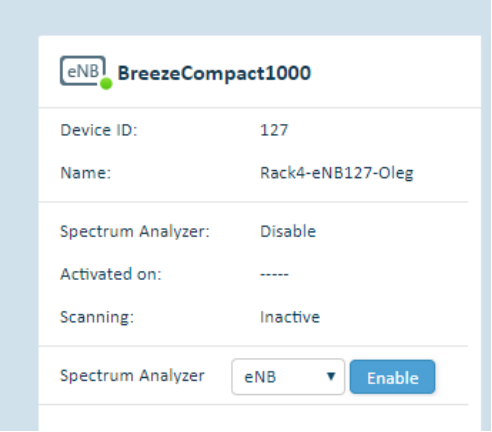
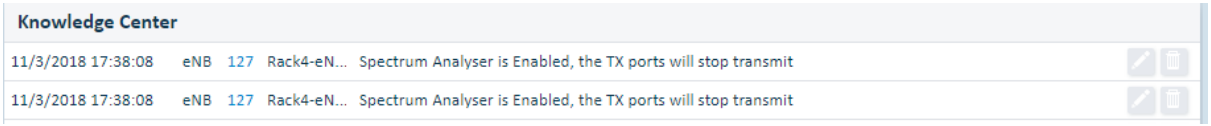


Figure 92: BREEZEVIEW – Spectrum Analyzer Disable

3.1.2.7.1 Spectrum analyzer events in BreezeVIEW

When spectrum analyzer is enabled, TX power shutdown event is raised in Home page Knoweledge Center.



System event is raised for spectrum analyzer disable or enabled.

Type	Model	Device	Name	Managed Object	Event Time	Event Type	Additional Info
eNB	BreezeCompact1000	127	Rack4-eNB127-Oleg	eNB	11/3/2018 17:48:41	Spectrum Analyser is disabled	Spectrum Analyser is Disabled the TX ports will start transmitting
eNB	BreezeCompact1000	127	Rack4-eNB127-Oleg	eNB	11/3/2018 17:38:08	Spectrum Analyser is enabled	Spectrum Analyser is Enabled, the TX ports will stop transmit

- Performance Monitoring, on page 103

The following section will cover the relevant CLI commands in two ways:

3.2 Configuration commit procedure

The following procedure explains how to implement updates in CLI configuration.

After performing such updates follow the following steps at the BreezeCompact% prompt

1 **Commit**

2 A message "commit update" should show up in case that the validation check for the last changes past successfully.

quit (it is not mandatory to exit from configuration mode to continue)

3 Once configuration changes are complete and committed. It is required to perform a reset to activate the changes, at the BreezeCompact> prompt, type the following:

request reboot reboot

4 When the following message displays, type yes to confirm:

The reboot will disrupt all services provided by device. Are You sure? [no,yes]

The eNB as a result will reset then the eNB should come up with the updates implemented configuration.

3.3 CLI User – Radius Authentication

NOTE!	To implement this feature please contact a Telrad Support

Release 6.9 enables a new feature – authentication and authorization of the management user session using RADIUS. If configured, when a new SSH management session is being established to BreezeCOMPACT entity, BreezeCOMPACT management client will trigger RADIUS session authentication and authorization with the provisioned AAA server.

As per authorization parameters, 2 types of access rights are supported: read-write access or read-only access. BreezeCOMPACT entity generates an audit log for any change performed by the management user, capturing modification Date and Time, User name and the committed change.

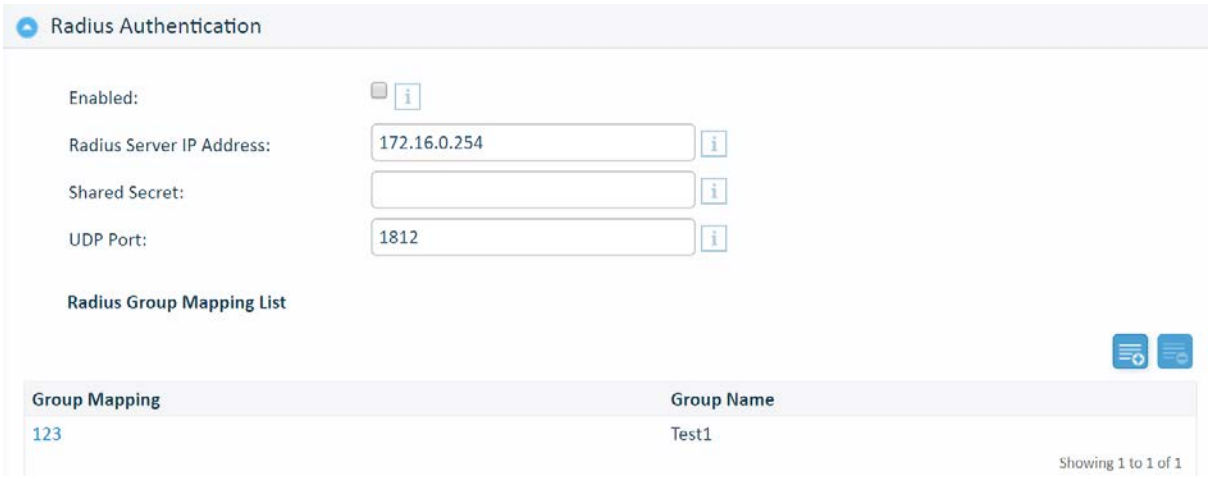


Figure 17: CLI User – Radius Authentication

3.4 BreezeCOMPACT Full Configuration via CLI

3.4.1Purpose

This procedure describes how to configure the BreezeCOMPACT for full functionality.

3.4.2Full Configuration via CLI Procedure

The following procedures must only be performed after the commissioning procedure described in Chapter 3, Commissioning has been completed. The following procedures must be performed in the same order as described below.

3.4.2.1 Configuring Device Settings

- Device general settings

  At the **BreezeCompact%** prompt, set parameters by entering the following commands:

  set device general device-id <The unique device ID>

  set device general address <Address location of the device>

  set device general area <Operator Area location of the device>

  set device general contact <The name of the contact person>

  set device general name <The name of the device and device site>

- Device management settings (DNS IP Address)

  set device management primary-dns-ip-address <Primary DNS IP address>

  set device management secondary-dns-ip-address <Secondary DNS IP address>

3.4.2.2 Configuring LTE TDD Configuration

In order to configure LTE TDD and special subframe configuration the following cli commands should be performed from BreezeCompact% prompt:

- set cell ran-common cell-radius <cell radius number in km>

The value for the cell radius should be between 1-39 km

- **set deployment frame-structure subframe-Cfg <Sub frame configuration number >**

The value for the sub frame configuration should be between 0-2 (These are the supported values). Please see further explanation regarding the possible sub frames in 1.5.2.1

- **set deployment frame-structure special-subframe-Cfg <special sub frame configuration number >**

The value for the special sub frame configuration should be within 0-3 (These are the supported values). Please see further explanation regarding the possible special sub frame configurations in 1.5.2.2

- **set deployment wimax-coexisting <true or false>**

It is recommended to set this value as true .This value is important to be set to true in order to be avoided from mutual interference when WiMAX is running and additional LTE deployments.

In order to show the Implanted configuration, run the following command from BreezeCompact% prompt:

- **show deployment**

As a result you will see the following output as an example:

topology SplitMode2X2; wimax-coexisting true; enable-dcs false;

frame-structure { subframe-Cfg 2;

special-subframe-Cfg 0;

}

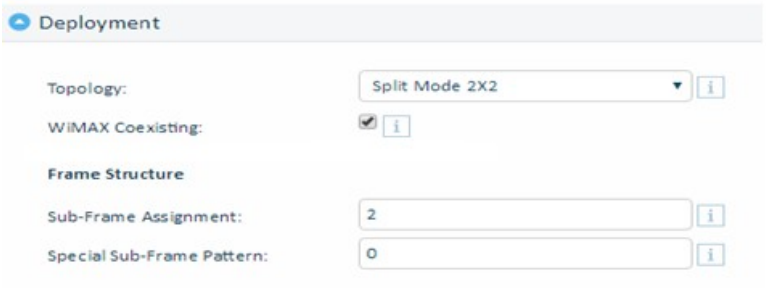


Figure 18: Deployment Tab in BreezeVIEW

3.4.2.3 Configuring deployment for an Antenna Topology

In this release, the supported modes are Single Sector and Dual Carrier/Split Mode 2x2 . For more details, see Section 1.5.1, BreezeCOMPACT Topologies.

- At the BreezeCompact% prompt, set the cell deployment topology of the antenna:

3.4.2.3.1 Default topology - single carrier 2Rx/2Tx

This is the default deployment topology. In case that it's required to set the deployment topology to default topology the following steps should be considered:

The following command should be running from CLI from BreezeCompact% prompt:

- **set deployment topology DefaultTopology**
- Perform commit procedure as in 4.1

When running:

- **show deployment topology**

Result is:

topology DefaultTopology;

When running:

- **show ran rh-ports-admin-state**

result is:

port1-admin-state Operative; port2-admin-state Operative; port3-admin-state ShutDown; port4-admin-state ShutDown;

When running From BreezeCompact> prompt :

- **show status ran port**

result is: PortsList 1 {

operational-status InService; admin-state InService;

}

PortsList 2 {

operational-status InService; admin-state InService;

}

PortsList 3 {

operational-status OutOfService; admin-state InShutdown;

}

PortsList 4 {

operational-status OutOfService; admin-state InShutdown;

}

The above means that 2 antennas (1,2) are operative and antennas 3,4 are not. Default topology control in BreezeView :

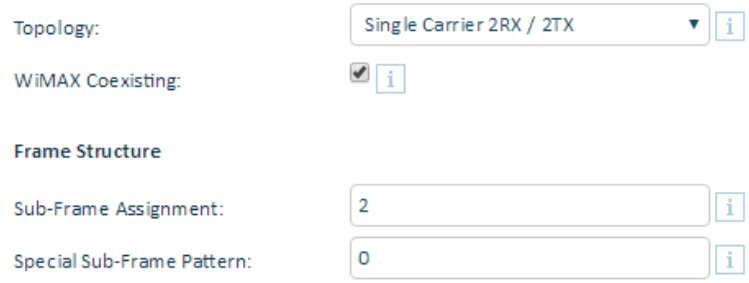


Figure 19: BREEZEVIEW -ENB deployment tab when setting deployment topology as Default topology

When looking on the Breezeview ENB Advanced RAN tab:

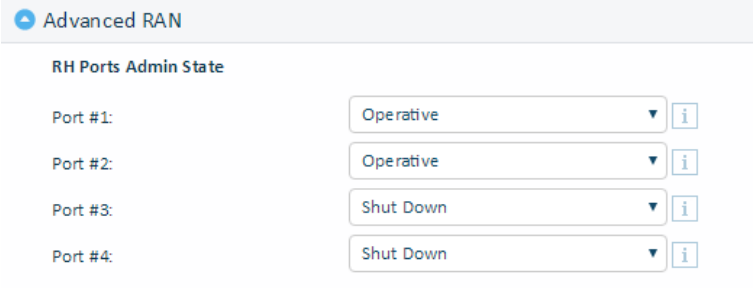


Figure 20: BREEZEVIEW -ENB Advanced RAN tab when setting deployment topology as Default

3.4.2.3.2 Single Carrier 4Rx/2Tx

In this mode 2 antennas in transmit mode and 4 antennas in receive.

In order to change the deployment mode to single carrier 4Rx/2Tx perform the following CLI command from ENB from BreezeCompact% prompt:

- **set deployment topology SingleCarrier2X4**
- **commit**

when running:

- **show deployment topology**

result is :

topology SingleCarrier2X4;

When running:

- **show ran rh-ports-admin-state**

result is:

port1-admin-state Operative; port2-admin-state Operative; port3-admin-state RxOnly; port4-admin-state RxOnly;

When running from BreezeCompact> prompt :

- **show status ran port**

result is: PortsList 1 {

operational-status InService; admin-state InService;

}

PortsList 2 {

operational-status InService; admin-state InService;

}

PortsList 3 {

operational-status InService; admin-state RxOnly;

}

PortsList 4 {

operational-status InService; admin-state RxOnly;

}

On Breezeview :

When clicking on the BREEZEVIEW home->devices->ENB ->device details :

Figure 21: BREEZEVIEW -ENB Antenna's status in single carrier 4Rx/2Tx

When looking on Breeze view on the ENB deployment tab:

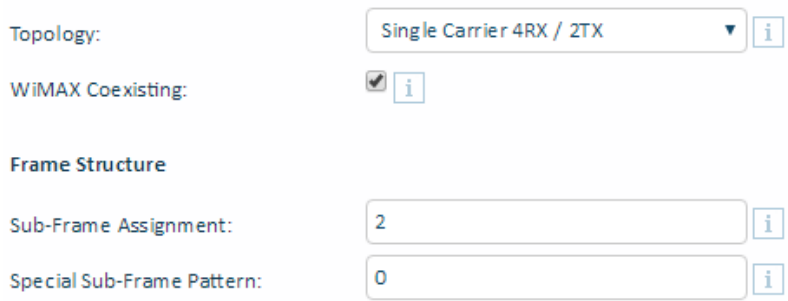


Figure 22: BREEZEVIEW -ENB deployment tab in single carrier 4Rx/2Tx

3.4.2.3.3 Single Carrier 4X4

In order to change the topology to Single carrier 4x4 , On Breezcompact CLI from BreezeCompact% prompt perform the following commands :

- set deployment topology SingleCarrier4X4TM4
- Perform commit procedure as per 3.1

When running from % prompt: "show deployment topology" topology SingleCarrier4X4TM4;

When running from % prompt : " show ran rh-ports-admin-state" port1-admin-state Operative;

port2-admin-state Operative; port3-admin-state Operative; port4-admin-state Operative;

When running from > prompt : "show status ran port" you should see the following :

PortsList 1 {

operational-status InService; admin-state InService;

}

PortsList 2 {

operational-status InService; admin-state InService;

}

PortsList 3 {

operational-status InService; admin-state InService;

}

PortsList 4 {

operational-status InService; admin-state InService;

}

On Breezeview :

When clicking on the BREEZEVIEW home->devices->ENB ->device details :

Figure 23: BREEZEVIEW -ENB Antenna's status in single carrier 4Rx/4Tx

When looking on Breeze view on the ENB deployment tab:

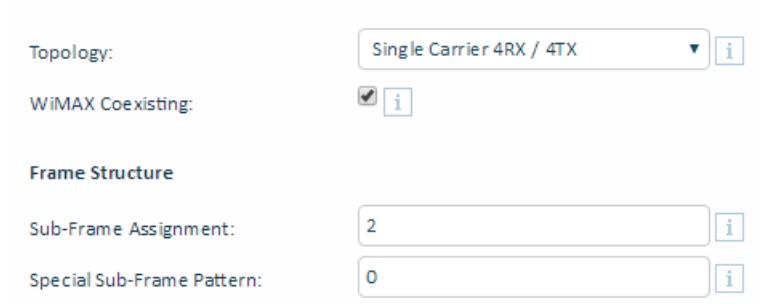


Figure 24: BREEZEVIEW -ENB deployment tab in single carrier 4Rx/4Tx

3.4.2.3.4 SplitMode2X2 :

The Split Mode 2x2 normal mode will use the same frequency for both sectors.

In order to change the deployment mode to SplitMode2x2 perform the following CLI command from ENB from BreezeCompact% prompt :

- set deployment topology SplitMode2X2
- Perform commit procedure on 3.1

when running:

- **show deployment topology**

result is:

topology SplitMode2X2;

When running :

- **show ran rh-ports-admin-state**

result is:

port1-admin-state Operative; port2-admin-state Operative; port3-admin-state Operative; port4-admin-state Operative;

When running from BreezeCompact> prompt :

- **show status ran port**

result is:

PortsList 1 {

operational-status InService; admin-state InService;

}

PortsList 2 {

operational-status InService; admin-state InService;

}

PortsList 3 {

operational-status InService; admin-state InService;

}

PortsList 4 {

operational-status InService; admin-state InService;

}

On Breezeview :

When clicking on the BREEZEVIEW home->devices->ENB ->device details :

Figure 25: BREEZEVIEW -ENB Antenna's status in SplitMode2x2

When looking on Breeze view on the ENB deployment tab:

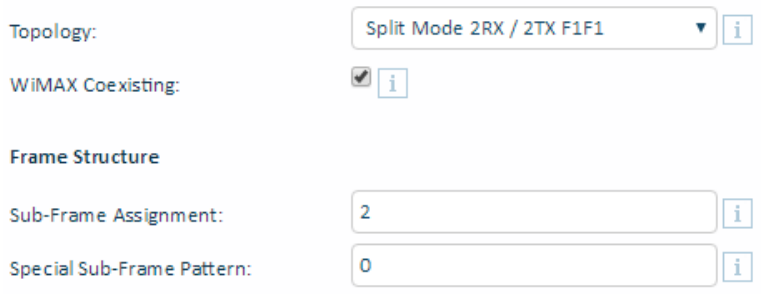


Figure 26: BREEZEVIEW -ENB deployment tab when in SplitMode2x2

On SplitMode2x2 all 4 antena's are fully operational. All Antenna's will work with the same frequency.

3.4.2.3.5 SplitModef1f2:

Split mode f1f2 enabling each 2x2 sector (port 1,2 and port 3,4) to define different center frequencies.

On Breezcompact CLI from BreezeCompact% prompt perform the following in order to set:

- **set deployment topology SplitModef1f2**
- **set cell**1 general **central-frequency <Frequency 1 in MHZ>**
- **set cell**1 general **central-frequency-f2 < Frequency 2 in MHZ>**
- Perform commit procedure as per 4.1

When running: show deployment topology

Result is: topology SplitModef1f2;

When running: show ran rh-ports-admin-state

Result is: port1-admin-state Operative; port2-admin-state Operative; port3-admin-state Operative; port4-admin-state Operative;

When running: show cell ran-rf

result is:

bandwidth 5MHz;

tx-power 30;

When running: show cell1 general

result is:

central-frequency 3510.0;

central-frequency-f2 3540.0;

phy-cell-id 1;

- **show status ran port**

result is :

PortsList 1 {

operational-status InService; admin-state InService;

}

PortsList 2 {

operational-status InService; admin-state InService;

}

PortsList 3 {

operational-status InService; admin-state InService;

}

PortsList 4 {

operational-status InService; admin-state InService;

}

On BREEZEVIEW when looking in Home->devices->ENB ->Device details:

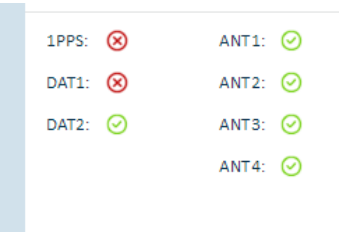


Figure 27: BREEZEVIEW -ENB Antenna's status in SplitModef1f2

When looking on BREEZEVIEW->Home->devices-> ENB deployment tab :

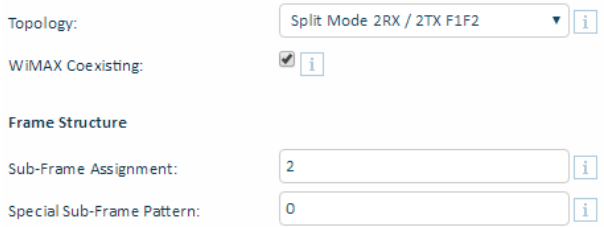


Figure 28: BREEZEVIEW -ENB deployment tab when in SplitModef1f2

On BREEZEVIEW->devices->ENB ->cell1 tab:

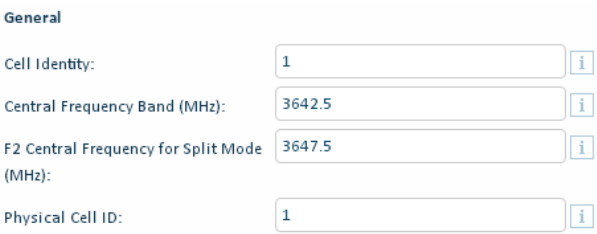


Figure 29: BREEZEVIEW -ENB CELL1 deployment tab when in SplitModef1f2

As can be seen in Figure 27: BREEZEVIEW -ENB CELL1 deployment tab when in SplitModef1f2 it is important to set F2 frequency when working on splitModef1f2

3.4.2.3.6 Dual Sector/Carrier:

The Dual Carrier topology enables a double-capacity BreezeCOMPACT. In this mode, the BreezeCOMPACT behaves like two 2x2 eNodeBs (double capacity vs split mode).

On Breezcompact CLI from BreezeCompact% prompt perform the following in order to set:

- set deployment topology DualCarrier
- set cell1 general central-frequency <Frequency 1 in MHZ>
- set cell1 general central-frequency-f2 < Frequency 2 in MHZ>
- Perform commit procedure as per 4.1

When running: show deployment topology

Result is: topology DualCarrier;

When running: show ran rh-ports-admin-state

Result is: port1-admin-state Operative; port2-admin-state Operative; port3-admin-state Operative; port4-admin-state Operative;

When running: show cell ran-rf

result is:

bandwidth 5MHz;

tx-power 30;

When running show cell1 general

result is:

cell-identity 1;

central-frequency 3510.0;

phy-cell-id 1;

When running show cell1 general

result is:

cell-identity 1;

central-frequency 3510.0;

phy-cell-id 1;

- show status ran port

result is :

PortsList 1 {

operational-status InService; admin-state InService;

}

PortsList 2 {

operational-status InService; admin-state InService;

}

PortsList 3 {

operational-status InService; admin-state InService;

}

PortsList 4 {

operational-status InService; admin-state InService;

}

On BREEZEVIEW when looking in Home->devices->ENB ->Device details:

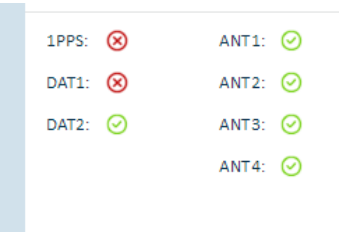


Figure 30: BREEZEVIEW -ENB Antenna's status in DualCarrier

When looking on BREEZEVIEW->Home->devices-> ENB deployment tab :

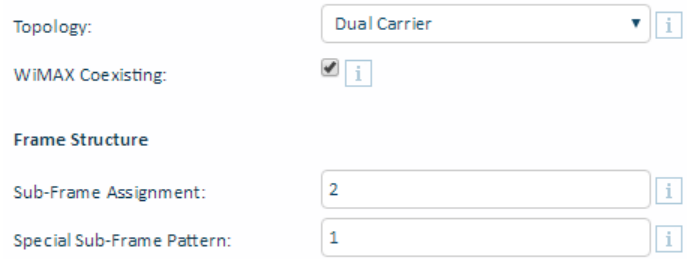


Figure 31: BREEZEVIEW -ENB deployment tab when in DualCarrier

On BREEZEVIEW->devices->ENB ->cell1 tab:

Figure 32: BREEZEVIEW -ENB CELL1 deployment tab when in DualCarrier

On BREEZEVIEW->devices->ENB ->cell2 tab:

Figure 33: BREEZEVIEW -ENB CELL2 deployment tab when in DualCarrier

3.4.2.4 Configuring the Bearer Network

The Bearer network is used to enable an LTE S1 connection between the eNodeB and the MME. It supports the S1-C, S1-U and X2 protocols over an SCTP connection.

The Bearer connection is defined on the same port as the management port, with a different VLAN separation.

➢ To configure the bearer network:

- At the **BreezeCompact%** prompt, set the bearer network parameters by entering the following commands:

9 set networking lte-infrastructure enb-ip-address < eNB infrastructure IP address>

10 set networking lte-infrastructure subnet-mask <Subnet mask>

11 set networking lte-infrastructure next-hop-gateway <DGW IP>

12 set networking lte-infrastructure vlan-id <VLAD ID or NoVLAN>

13 For eEPC with EPC mode Enable,

set networking lte-infrastructure eepc-ip-address < IP address of the embedded EPC>

➢ To show the current configuration run the following command:

- show networking lte-infrastructure:

enb-ip-address 192.168.11.14;

subnet-mask 255.255.255.0;

next-hop-gateway 192.168.11.254;

vlan-id 11;

3.4.2.5 Configuring S1 Signaling

The S1 signaling IP list is used to connect to up to six EPC (MME) IP addresses, in order to enable a redundant, load-balancing configuration. Using this configuration for multiple MME IP addresses enables either load balancing or multiple PLMID capabilities. For more details, see Section 1.5.6, Multiple PLMN IDs

and Section 1.5.7, EPC Redundancy and Load Balancing (Cluster).

➢ To configure an S1 signaling connection to the EPC BreezeWay2020:

- At the **BreezeCompact%** prompt, enter the following command:

14 set networking s1-signaling link-server-list <MME IP address>

- **In order to delete an existing configured s1 signaling connection to the EPC BreezeWay2020:**
  - At the BreezeCompact% prompt, enter the following command:

15 delete networking s1-signaling link-server-list <Default MME IP address>

- **To show the current configuration:**
  - At the Breezecompact% prompt , enter the following command:

16 show networking s1-signaling-servers-list As a result you will see the following output:

s1-signaling-servers-list 172.16.81.144;

- **In order to configure TAC per ENB run the command below:**
  - At the BreezeCompact% prompt, enter the following command:

set cell tracking-area tac <Track area code number >

- **In order to show the TAC configured in the ENB run the command below from the BreezeCompact% prompt**
  - show cell tracking-area

As a result you should get the output as per the example below : tac 1;

3.4.2.5.1 PLMN-ID setting

The BreezeCOMPACT support multiple PLMN-IDs to enable multi-service modes, each PLMN-ID can be supported by the EPCs in the network. Once PLMN-IDs are set the eNodeB publish over the air to all UEs the available PLMN-IDs, according to the UE logic it decides which PLMN ID will be selected. In case UE does not select the PLMN-ID, the default PLMN-ID is used by the eNodeB.

In order to Set PLMN IDs:

- set cell tracking-area **plmn-identity-list 011111 is-primary true**

is-primary settings :

true – The PLM-ID is the default PLMN-ID false – non default PLMN-ID

- **In order to show the PLMN ID configured in the ENB run the command below from the BreezeCompact% prompt**
  - Show cell tracking-area plmn-identity-list

As a result you should get the output as per the example below : plmn-identity-list 00101;

3.4.2.5.2 Load Balancing & Redundancy setting

The Load-balancing mechanism is applied during a new UE Attach procedure. eNB may be provisioned with multiple EPCs (MMEs) in a load-balancing/ failover mode.

BreezeCOMPACT supports two pools of MMEs (EPCs) for load balancing – Primary and Secondary.

EPC load balancing is used within the pool – either Primary or Secondary. If no resources or no available MME entities event occurs in the Primary pool, eNB will switch to the Secondary pool. When resources of the Primary pool recover, eNB will switch back to use it (for a new-coming UEs)

Note, that BreezeCOMPACT supports multiple PLMNIDs concept for EUTRAN sharing and multi-service networks convergence. In this case, BreezeCOMPACT will sort out all the MMEs (EPCs) per PLMNID – effectively, this will result in Primary/ Secondary EPC pools per each of the configured PLMNIDs (MME provides its PLMNID to eNB during S1 Setup).

eNB balancing the UE sessions between MMEs during UE Attach. The eNB balancing algorithm takes into account EPC relative capacity and actual eNB load for the particular EPC. "EPC relative capacity" is the number configured in EPC and provided to eNB during S1 setup. It is proportional to EPC licensed capacity. "Actual capacity"- is the local eNB counter that represents the number of active UE sessions on the particular EPC.

In the case of a restart on one of the EPC entities, after that EPC recovers, eNBs will force all the sessions to it until the load between all the entities is proportionally aligned.

In the case eNB switched to work with the Secondary MME pool, the UE sessions forwarded to "secondary" MME entities will stay there until UE disconnection. After the recovery of the primary, in a new UE Attach, eNB will perform the new balancing decision, forwarding the new coming UEs to one of the Primary MME entities. There is a manual operational command on eNB that enables an operator to force disconnection of UE sessions on Secondary MME entities to move to the primary.

Following the settings. This should be running from BreezeCompact% prompt:

- set networking s1-signaling-servers-list 172.16.81.144 mme-load-balancing-priority Primary
- set networking s1-signaling-servers-list 172.26.20.70 mme-load-balancing-priority Secondary

NOTE!	For load balancing - configure MMEs within the same group (Primary or Secondary) For Fail over – configure at least two MMEs (one in primary group and one in secondary group)

Show MME settings:

BreezeCompact% show networking s1-signaling-servers-list

s1-signaling-servers-list 172.16.81.144 {mme-load-balancing-priority Primary;

}

s1-signaling-servers-list 172.26.20.70 { mme-load-balancing-priority Secondary;

}

Note, in case the primary fail consequently all the UEs which associate with the primary MME automatically will registers with the secondary MME. When the primary MME will come up the UEs that are connected to the secondary MME will not move back to the primary MME unless the operator will initiate the following command:

BreezeCompact% prompt:

request eNB-actions switch-over-to-primary-mme-pool

3.4.2.6 Use Bearer Interface as External Management Mode

If a single interface is used for both bearer traffic and management, you must select the **Bearer Interface as External Management Mode** option. In this mode, only the bearer VLAN is used and external management parameters are ignored.

NOTE!	Do not use this mode when using the BreezeWay2020, as the Management and Bearer must be defined on different VLANs.

To enable this mode, enter the following command at the **BreezeCompact%** prompt:

- set networking external-management use-bearer-ip-address true

To disable this mode (the default mode), enter the following command at the **BreezeCompact%** prompt:

- set networking external-management use-bearer-ip-address false

To show the current configuration:

- At the Breezecompact% prompt , enter the following command:

17 show networking external-management use-bearer-ip-address As a result you will see the following output:

use-bearer-ip-address false;

3.4.2.7 Data Port redundancy

To make BreezeCOMPACT1000/3000 DAT1 and DAT2 redundancy the DAT1 (fiber) and DAT2 (copper) links must be active in the same time.

Only one port will be active a time (preferred is DAT1) and in time connection (link) failed, the eNB will be switch its connectivity to DAT2.

Note: In R6.9, BreezeCOMPACT with embedded EPC hardware (1000e) does not support dynamic data port redundancy. For further information, please contact Telrad CS.

3.4.2.8Modifying Physical Data Port Parameters

Modifying physical data port parameters is optional.

NOTE!	A 1GB interface can use either the DAT1 (Fiber) or DAT2 (Copper) interface.

To modify physical data port parameters:

Use following command level in BreezeCompact% prompt:

- set networking physical-ports-list <Port number 1-3> duplex-mode <fullDuplex or HalfDuplex>

This command sets a port Duplex (half or full)

- set networking physical-ports-list <Port number 1-3> negotiation <Auto or manual> This command sets a port negotiation to manual or Automatic mode.
- set networking physical-ports-list <Port number 1-3> speed <100 ,1000> This command sets the port speed to 100 or 1000 .

Important remark : For port 1: speed may be 1 Gb only For port 2: speed may be 100Mb or 1Gb only For port 3: speed may be 100Mb only in BreezeCOMPACT1000 & 3000, in case of embbeded EPC 1000Mb can be set.

To show the current port configuration:

- Use following command level in BreezeCompact% prompt:
- show networking physical-ports-list The result should look like that :

```
physical-ports-list 1 { negotiation Auto;
duplex-mode FullDuplex; speed     1000;
}
physical-ports-list 2 { negotiation Auto;
duplex-mode FullDuplex; speed     1000;
}
physical-ports-list 3 { negotiation Auto;
duplex-mode FullDuplex; speed     100;
}
```

To show the current configuration from BREEZEVIEW open from BREEZEVIEW->home->devices->ENB->networking tab and see the Physical data ports table as in the bottom part of this tab :

Physical Data Ports

Port ID	Negotiation	Duplex	Speed	Operational State	Operational Speed
1	Auto	FullDuplex	1000	Down	
2	Auto	FullDuplex	1000	Up	100
3	Auto	FullDuplex	100	Up	100

Showing 1 to 3 of 3

Figure 34: Physical ports configuration in BREEZEVIEW

3.4.2.9 Modifying Local Management Connectivity Parameters

Local management refers to IP connectivity from a PC that connects directly to the eNodeB local network port (DAT3) using a *same subnet IP* without a VLAN. This connection enables *on-the-bench* provisioning as part of the commissioning process or during other debugging.

Modifying local management connectivity parameters is optional.

➢ **To modify local management connectivity parameters:**

- Use following command level from BreezeCompact% prompt

18 set networking local-management ip-address <IP address of the local Management interface>

19 set networking local-management subnet-mask <Local management subnet mask of the IP interface>

➢ **To show the current configuration:**

- Use following command level from BreezeCompact% prompt

20 show networking local-management As a result the following will show up :

ip-address 192.168.0.10;

subnet-mask 255.255.255.0;

3.4.2.10 Configuring the Cell (RAN)

➢ **To configure a cell:**

- At the **BreezeCompact%** prompt, configure cell parameters by entering the following commands:

21 **set cell tracking-area tac <Tracking Area ID>**

The Tracking Area (TA) is a logical concept that involves an area in which the user can move around without having to update the MME. The network allocates a list to the user that contains one or more TAs. In certain operation modes, the UE can move around freely in all of the TAs on the list, without updating the MME.

Each eNodeB broadcasts a special tracking area code (TAC) to indicate to which TA the eNodeB belongs. This TAC is unique within a PLMN. Because the PLMN is a unique number allocated to each system operator and because the TAC is unique within a PLMN, if you combine these two numbers, you have a globally unique number. This number (PLMN + TAC) is called the Tracking Area Identity (TAI).

This parameter must match the TAC on the EPC. When using BreezeWay2020, use TAC=1 as the default.

22 **set cell tracking-area plmn-identity-list <Customer PLMN ID>**

The same PLMN ID value must be configured in both the EPC and the eNB. The eNB BreezeCOMPACT can support multiple PLMN IDs working with different EPCs (in multi-service networks, RAN sharing scenarios and so on).

It is possible to use different PLMN IDs for a SIM card (Home PLMN ID) and for the network (PLMN ID configured in an eNB/EPC and broadcast over the air). In this case, the UE is in *Roaming* mode for the network.

ECGI Setting:

The following parameters enable the operator to define a unique ECGI:

- An eNB is a base station, which can have multiple cells (sector/carriers), each with its own cell ID.
- The BreezeCOMPACT BS type is a Macro BS (Macro eNB). A Macro eNB can include multiple cells.
- The global identity of the cell (ECGI) is 28 bits, where 20 MSBs refer to the Macro eNB identity and the last eight bits (LSBs) refer to the *local* cell ID inside the eNB.

In order for the MME to distinguish between two eNBs, the 20 MSBs for the two eNBs should be different. If an eNB has multiple cells/sectors, the 20 MSBs must be the same for these cells/sectors, and the eight LSBs should be different. To ensure that this is the case, each BreezeCOMPACT has two configurable parameters: the eNB identifier (20 bits) and the local cell identifier (eight bits). Together, they define a unique ECGI.

The ECGI ID contains 28 bits, and consists of the **Macro eNB ID** and **local cell ID**. The ECGI ID displays on the UE. The ECGI ID is determined, as follows: eNB-identity * 256 + cell-identity.

If the operator does not have multi-sector/multi-carrier functionality, the operator can leave the local cell ID's default value (for example, 1), and configure only the eNB ID as a unique value.

23 **set cell ran-common enb-identity <eNB Identity>**
This parameter must be unique on the network. It specifies the Global eNB ID for the Macro eNB ID (20 bits).

24 **set cell1 general cell-identity <Cell ID>**
This is the Local Cell ID for the Macro eNodeB ID. The default can be 1.

25 **set cell ran-common cell-radius <Cell Radius in KM>**
This parameter defines the maximum cell radius, in kilometers. The eNodeB determines the cell radius according to the received RACH code. RACH codes exceeding the **cell-radius** parameter are rejected and the UE cannot attach. This value must not exceed the maximum allowed distance for the Special Subframe (SSF) configuration.

26 **set cell ran-common eNB-name<ENB name>**

In this parameter there is a possibility to define a name to this ENB that will be populated in the S1-MME interface.

Note: the name should not contain space.

In order to show the configuration done run the following command from BreezeCompact% prompt in ENB :

27 **show cell ran-common**

As a result you should see an output similar to as follows:

enb-identity 1;

enb-name "eNB";

cell-radius 39;

In general, the special sub frame (SSF) configuration determines the gap required between the DL path and the UL path. It is primarily used to supported different cell

radiuses, UL sounding and special RACH capabilities. Table 3-1 describes the relationship between the SSF setting, as set in QoS >scheduler>special-subframe-Cfg.

When the **SpecialSubframeCfg** parameter is configured, verify that the configured value matches the Cell Radius value, as described in Table 3-1.

Table 3-1: SSF Settings

Cell Radius (Km)	SpecialSubframeCfg
1 =< R <= 10	0 to 3
11 =< R <= 20	0 to 2
21 =< R <= 30	0 to 1
31 =< R <= 39	0
39 =< R <= 60	0

28 **set cell ran-rf bandwidth < Bandwidth allocated for the cell in MHZ >**

Here the value of the bandwith of the cell should be set in MHZ units. Possible values are 5,10,15,20 .

29 **set cell1 general central-frequency** <Central frequency, in MHz>

The supported resolution is XXXX.XXX MHz.

This parameter sets the central frequency of the LTE bandwidth. You must set the central frequency within the limits specified by the Device Frequency and Bandwidth that are currently set. For example: set cell ran-rf central-frequency

3510.123

30 **set cell1 general phy-cell-id <Physical Cell ID>**

The Physical Cell ID sets the physical (PHY) layer Cell ID. This PHY-layer Cell ID determines the Cell ID Group and Cell ID Sector. There are 168 possible Cell ID groups and three possible Cell ID sectors. Therefore, there are 3 * 168 = 504 possible PHY-layer cell IDs.

The PHY Cell ID can be calculated using the following formula:

PHY-layer Cell ID = 3 * (Cell ID Group) + Cell ID Sector

The selected PHY Cell ID should be part of the radio network planning (RNP) and should be planned carefully.

31 **set cell ran-rf tx-power <TX Power; Maximum allowed TX power to MAX-10Dbm>**

This parameter sets the power that the eNodeB can transmit. The maximum power is determined during eNodeB power up and is recognized by the type of radio head inside the BreezeCOMPACT. The permitted power range is between 1dBm and the maximum power allowed for the radio head type.

32 **set cell1 general central-frequency-f2 <f2 frequency in MHZ>**

This is required to be configured in case that the deployment topology is set to SplitModef1f2

Rotem – Please confirm the above change is correct (Confirm)

In order to show the configuration related to this ran-rf run the following command from BreezeCompact% prompt in ENB :

33 **show cell ran-rf**

As a result the out should look like below :

bandwidth 5MHz;

tx-power 20;

34 show cell1 general

As a result the out should look like below :

cell-identity 1;

central-frequency 3510.0;

phy-cell-id 1;

3.4.2.11 Configuring eNodeB Timing and GPS

➢ To configure eNodeB Timing and GPS:

- More information about GPS capabilities are described in section 1.5.7 GPS
- At the **BreezeCompact%** prompt, configure the GPS by entering the following commands:

35 **set timing chain-mode** <Master or Slave>

NOTE!	If the GPS is connected directly to the eNodeB, define the chain mode as **MASTER**. If it is chained to another eNodeB, define the chain mode as **SLAVE**.

36 **set timing gps-type** <GPS Type>
The permitted types are Origin or Trimble. The value depends on the GPS hardware.

- Trimble GPS PNs : 700250/700258 BMAX-4M-GPS
- Origin GPS PN : 700275 BreezeGPS

37 **set timing ntp-ip-address** <Dedicated NTP Server IP address for time setting in case GPS is not functioning>

When the eNodeB starts, it looks for GPS in order to obtain the PPS and time. When it fails to retrieve or work with the GPS, it gets the time from the NTP server. The NTP server list is an internal list and includes all known public NTP servers. The operator can define a specific NTP IP address to be used by using the **ntp-ip-address** parameter. The NTP time is used for logs and event time marking for maintenance and debugging purposes.

38 **set timing time-zone-params TZP area <Customer area> city <Customer City>**
The time-zone offset modifies the time received by the GPS or NTP, in order to be aligned with the local time.

39 **set timing gps-enable-disable** <Enable/Disable>

It is possible to disable the need of GPS before enabling the RF chain.

In order to show the current GPS related configuration run the following command from the BreezeCompact% prompt :

40 **show timing**

As a result the output should look like that :

time-zone-params TZP {

area Custom;

city GMT+0300;

41 **set timing hold-over-passed-operation <true or false>**

Defines whether to stop transmitting after Hold Over Timeout.

}

3.4.2.12 Configuring Quality of Service Parameters

In this section, you define the QoS for the external management VLAN, including the control plane (DATA Bearer infrastructure) VLAN and the User DATA QoS parameters per QCI. These commands should be running from BreezeCompact% prompt:

- set qos general s1-mme-dscp-value< s1 Bearer DSCP marking > Value should be between 0-63
- set qos general mng-dscp-value<management QoS DSCP markup> Value should be between 0-63 .
- set qos general mng-802.1p <Management QoS 802.1p Priority on management> Values should be between 0-7 .7 is the highest priority and 0 is the lowest .
- set qos general s1-mme-802.1p < S1 - MME 802.1p Priority > Values should be between 0-7.

In order to show the current general QOS related configuration run the following command from the BreezeCompact% prompt:

- show qos general

As a result the output should look like that :

mng-dscp-value 8;

mng-802.1p 1;

s1-mme-dscp-value 48;

s1-mme-802.1p 6;

Below are CLI commands from ENB BreezeCompact% regarding the classified 9 possible level :

- set qos s1-u-qos-list <QCI 1-9> 8021p-marking <802.1 marking value for this QCI> . Marking of possible vlan tag between 0-7 for s1-u packets on 802.1 layer belongs to a specific QCI level.
- set qos s1-u-qos-list <QCI 1-9> dscp-marking <dscp marking value for this QCI> .

Marking of possible levels between 0-64 for s1-u packets on dscp layer belongs to a specific QCI level.

- set qos s1-u-qos-list <QCI 1-9> priority <Priority given> .

Marking of possible levels between 1-9. By this command it is possible to change the priority associated with this QCI for s1 traffic .

The following describes how to adapt QCI settings:

NOTE!	Telrad recommends to keep the QCI priority default settings, as changing them may affect system QoS behavior. Contact Telrad Support for assistance if you need to update the QCI table.

In order to show the current QOS s1-u-qis-list in the ENB perform the following command from CLI BreezeCompact% prompt:

show qos s1-u-qos-list

As a result the output should look like that :

```
s1-u-qos-list 1 {
priority        2;
dscp-marking 0;
}
s1-u-qos-list 2 {
priority        4;
dscp-marking 0;
}
s1-u-qos-list 3 {
priority        3;
dscp-marking 0;
}
s1-u-qos-list 4 {
priority        5;
dscp-marking 0;
}
s1-u-qos-list 5 {
priority        1;
dscp-marking 0;
}
s1-u-qos-list 6 {
priority        6;
dscp-marking 0;
}
```

s1-u-qos-list 7 {

priority 7;

dscp-marking 0;

}

s1-u-qos-list 8 {

priority 8;

dscp-marking 0;

}

s1-u-qos-list 9 {

priority 9;

dscp-marking 0;

}

Configuring uncommitted scheduler type:

- set qos scheduler dl-uncommit-scheduler <EqualRate or EqualTime>

By this command it is possible to set what will be the fairness mechanism for user data traffic to the UE's for data coming on the downlink direction.

- set qos scheduler ul-uncommit-scheduler <EqualRate or EqualTime>

By this command it is possible to set what will be the fairness mechanism for user data traffic to the UE's for data coming on the uplink direction.

Note that Equal Rate is applied automaticaly for the commited portion (GBR), where the uncommit type configured in this command is related to MBR/AMBR which is the uncommited service.

Configuring weak UE scheduling protection level:

- In general, when working with Equal Rate or Equal Time (with mutliple QCIs), weak UEs (low MCS) may consumes most of the sector air resources. As a result, the sector throughput degrades dramatically. In order to limit the canalization of
- resources by these weak UEs, three configurable levels for DL and UL defines if the UE is considered weak or not – NoProtection, Level1Protection and Level2Protection.
- set qos scheduler weak-ue-protection < Level1Protection or Level2Protection or NoProtection >
- UE is considered as weak UE when it equal or below the defined MCS (Modulation):

	Downlink MCS	Uplink MCS
No protection	n/a	n/a
Level 1 protection	3	6
Level 2 protection	9	10

This option defines the level of protection of the system utilization resources . The threshold of each level are configurable on the vendor level.

In order to show the current QOS scheduler related parameters in the ENB perform the following command from CLI BreezeCompact% prompt:

- show qos scheduler

As a result the output should look like that :

ul-uncommit-scheduler EqualTime;

dl-uncommit-scheduler EqualTime;

weak-ue-protection Level1Protection;

Configuration:

- set qos scheduler weak-ue-protection

Possible completions: Level1Protection, Level2Protection, NoProtection

- set qos scheduler weak-ue-protection Level1Protection dl-uncommit-scheduler (EqualRate/EqualTime)
- set qos scheduler weak-ue-protection Level1Protection ul- uncommit-scheduler (EqualRate/EqualTime)

3.4.2.13 Configuring Handovers

The BreezeCOMPACT supports handovers (HOs) with an A5 and A3 trigger that supports the LTE X2 protocol.

An A5 HO event triggers when UE RF conditions to the serving BS RF become worse than the provisioned value (Threshold 1) and the Neighbor BS becomes better than the provisioned value (Threshold 2).

Figure describes A5 HO events. The service BS's Serving (S-cell) is shown in blue and the Neighbor cell (n-cell) is shown in red.

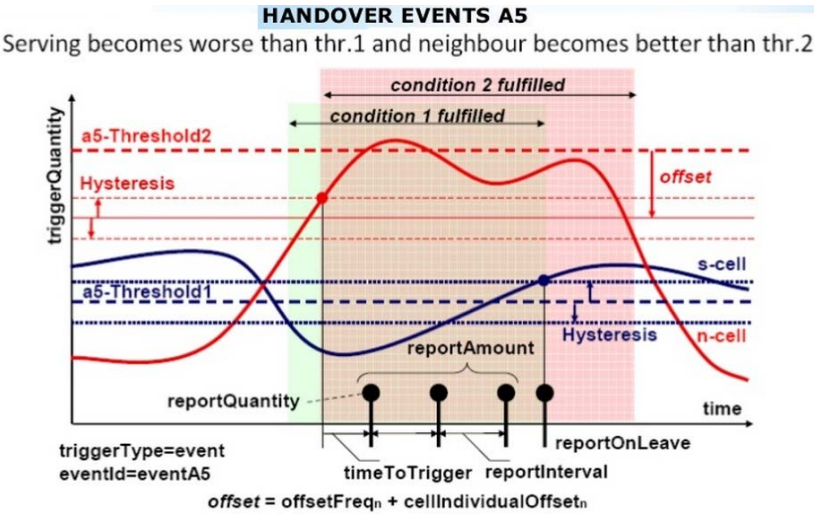


Figure 35: Handover A5 Events

TheA5 trigger is triggered on the RSRP levels.

Each neighbor cell is identified by its frequency (EARFCN), eNB ID, physical cell ID and X2 IP address (the Bearer IP address of the eNB in the BreezeCOMPACT).

To set the HO triggers, you define the measurement type and thresholds for the A5 triggers using the following commands:

- set cell handover-triggers measurement-type <RSRP or RSRQ>

Sets the way how the measurement will be prformed (based on RSRP or RSRQ)

- set cell handover-triggers a5-threshold1-rsrp <Defines the RSRP level for threshold 1>

Specifies the Threshold 1 value used in an E-UTRA measurement-report triggering condition for the A5 (dBm) RSRP event.

- set cell handover-triggers a5-threshold1-rsrq<Defines the RSRQ level for threshold 1>

Specifies the Threshold 1 value used in an E-UTRA measurement-report triggering condition for the A5 (dB) RSRQ event.

- set cell handover-triggers a5-threshold2-rsrp <Defines the RSRP level for threshold 2>

Specifies the Threshold 2 value used in an E-UTRA measurement-report triggering condition for the A5 (dBm) RSRP event.

In order to show the current handover trigers related parameters in the ENB perform the following command from CLI BreezeCompact% prompt:

- show cell handover-triggers

As a result the output should look like that :

measurement-type RSRP; a5-threshold1-rsrp -140;

a5-threshold2-rsrp -140;

a5-threshold1-rsrq -20;

a5-threshold2-rsrq -20;

An A3 HO event basic form the UE sends an A3 measurement report when a non-serving cell RSRP becomes better than the serving cell RSRP by a margin defined by an A3 offset parameter.

In other words, when ΔRSRP > A3 offset,

where ΔRSRP = RSRPneigh − RSRPserv.

Figure below shows an example of the A3 reporting event.

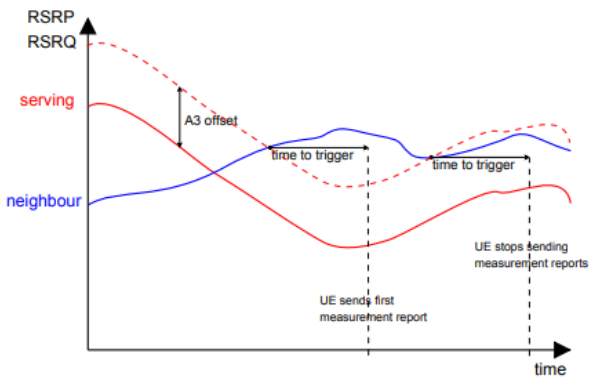


Figure 36: Handover A3 Events

To change the handover event to A3 use the following command:

- set cell handover-triggers trigger-type A3
- To set the HO triggers, define A3 offset value using the following commands:set cell handover-triggers a3-offset <offset value>

In order to show the current handover trigers related parameters in the ENB perform the following command from CLI BreezeCompact%: prompt:

- show cell handover-triggers

As a result the output should look like that :

trigger-type A3;

a2-threshold-rsrp -140;

a3-offset 6;

To set the neighbors that participate in the X2 HO process, you must define the neighbor list. The operator should define parallel definitions in the neighbor cell:

- set cell1 neighbor-list-cell <Cell ID> <eNodeB ID> black-listed <true or false>

Indicates whether or not this neighbor cell is allowed as a handover target for UEs (true – enabled false-not enabled).

- set cell1 neighbor-list-cell <Cell ID> <eNodeB ID> cio < offset>

Specifies the individual cell offset that applies to a specific neighboring cell. This value is in dB with an offset of 15, which means that the configuration of the parameter with a value of 15 is equal to 0dB.

- set cell1 neighbor-list-cell <Cell ID> <eNodeB ID> eutra-carrier-arfcn <ARFCN> Specifies the ARFCN of the neighbor carrier frequency.
- set cell1 neighbor-list-cell <Cell ID> <eNodeB ID> neighbor-ip-address <X2 of Neighbor IP Address>

Sets the neighbor X2 IP for signaling.

- set cell1 neighbor-list-cell <Cell ID> <eNodeB ID> phy-cell-id <physical-cell-id> Specifies the neighbor physical cell ID.
- set cell1 neighbor-list-cell <Cell ID> <eNodeB ID> qoffset <qoffset>

Specifies the cell-specific offset that applies to a specific neighboring cell. This value is in dB with an offset of 15, which means that the configuration of the parameter with a value of 15 is equal to 0dB.

- set cell1 neighbor-list-cell <Cell ID> <eNodeB ID> rx-tx-power <RS Tx power in DB>

Specifies the downlink reference-signal transmit power.

3.4.2.14 Applying Parameter Changes

Apply and activate the configuration by performing commit procedure in 3.1

- **4 In order to show the current cell neighbor list related parameters in the ENB perform the following command from CLI BreezeCompact% prompt :**

  - show cell neighbor-list-cell

As a result the output should look like that :

```
neighbor-list-cell 1 1 {
eutra-carrier-arfcn 42590;
phy-cell-id 1;
qoffset 1;
cio 1;
rx-tx-power 15; black-listed false;
neighbor-ip-address 172.16.1.23;
}
neighbor-list-cell 1 2 {
eutra-carrier-arfcn 42591;
phy-cell-id 2;
qoffset 14;
cio 0;
rx-tx-power 22; black-listed false;
neighbor-ip-address 172.16.2.5;
}
```

3.4.3 Stop/Start all RH ports transmitting from BreezeVIEW CLI

- Open BreezeVIEW CLI and perform the following command to stop transmission for the cell :

request devices device <device ID> live-status cell-actions-transmission stop-transmission cell-identity <Cell ID>

- To start transmission of all 4 ports perform the following command

request devices device <device ID> live-status cell-actions-transmission start-transmission cell-identity <Cell ID>

Command help:

start-transmission - Start Transmission of a selected Cell

stop-transmission - Stop Transmission of a selected Cell

Cell ID – perform operation on the specific cell ID (carrier)

3.4.4Enhanced log collection

Enhanced log Collection located at tmp and in case of reset /mnt/flashes/ backup (only in case of eNB reset)

To upload log files to TFTP server use the following command:

request usage upload-logs-files destination-ip-address <IP address> destination-path <destination path>

3.4.5Configuration of backup & restore to external TFTP

3.4.5.1Create and Save (backup) the configuration file on TFTP server.

- To create configuration file:

request config-file create-config-file

This action will create a configuration file,

which later can be uploaded to an external TFTP server.

Are You sure? [no,yes] **yes**

Status Success

- Check in system events that create-config-file-completed by command:

show notification stream alarm

- Upload configuration file to external TFTP server by command:

request config-file upload-config-file destination-ip-address <IP address> destination-path <destination path>

- Check in system events that upload-config-file-completed by command:

show notification stream alarm

3.4.5.2Download and Restore (restore) the configuration file from TFTP server.

- To upload configuration file:

request config-file upload-config-file destination-ip-address <IP Address> destination-path <destination path>

This action will upload device configuration file to an external tFTP server.

Are You sure? [no,yes] **yes**

- Check in system events that upload-config-file-completed by command:

show notification stream alarm

- Restore configuration file

request config-file restore-config-file

This action will load (restore)the configuration file from the disk and replace the database.

Are You sure? [no,yes] **yes**

- Check in system events that restore-config-file-completed by command:

show notification stream alarm

- Reboot eNB to apply changes

request reboot reboot

3.4.6Configuring Via BreezeVIEW

The following describes how to perform a full configuration via BreezeVIEW.

➢ To configure via BreezeVIEW:

1 Access BreezeVIEW as **admin**.

2 In the device list, select the number of the device to be edited.

3 Define the device's general information, as shown below.

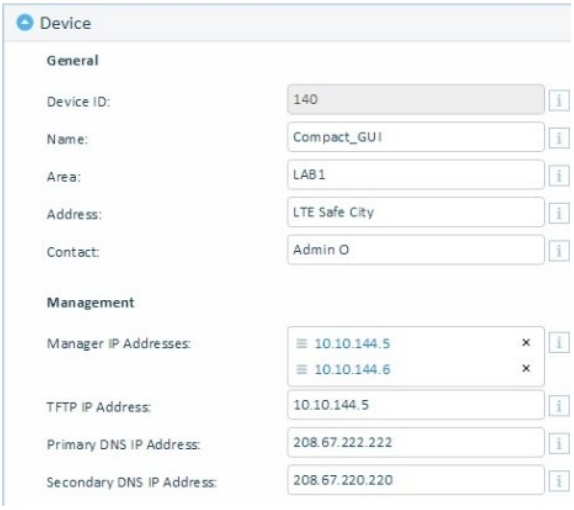


Figure 37: Device Information

4 Define the device's management information, as shown in above.

5 Define the device's antenna topology information, as shown below.

Figure 38: Device Capability

Also you can define here the Frame structure sub frame assignment as well as the special sub frame pattern.

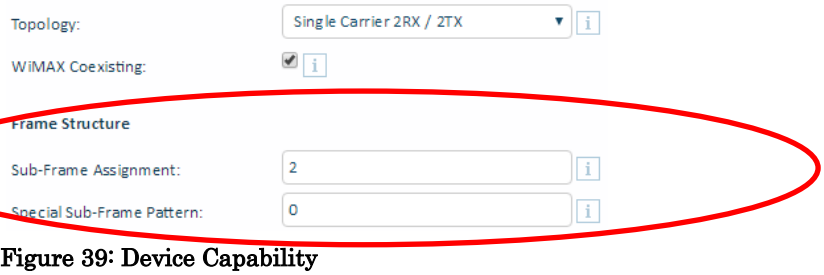


Figure 39: Device Capability

6 Define the device's networking information, as shown in Figure .

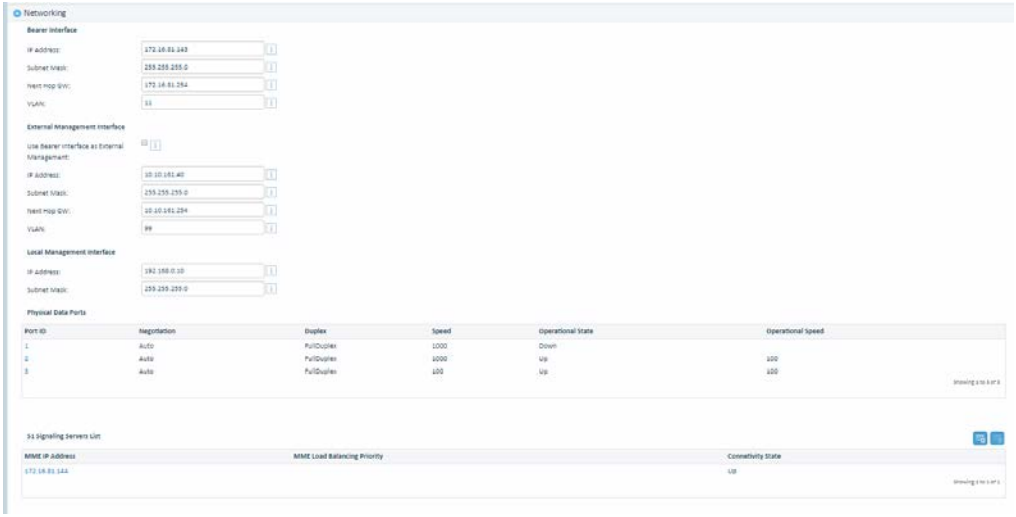


Figure 40: Device Networking Information

7 If the system is operating in Unified mode, check the **Use Bearer Interface as External Management** checkbox.

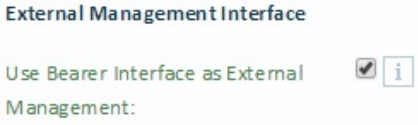


Figure 41: External Management Interface – 1

If the system is operating in Inband mode, uncheck the **Use Bearer Interface as External Management** checkbox:

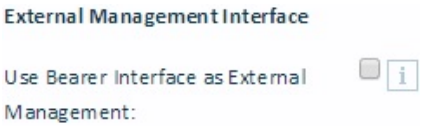


Figure 42: External Management Interface – 2

8 Define the cell configuration by:

43 Adding the PLMNID to the PLMN Identity List.

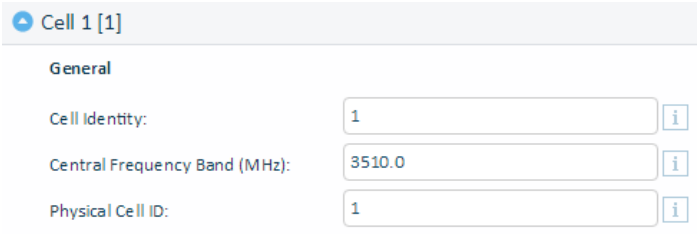
44 Setting the RAN Common parameters,

45 Setting the RAN RF parameters.

46 Setting the cell's **TAC** value.

Figure 43: Cell Configuration

Part of the parameters such as: Cell ID, Central Frequency and Physical Cell ID are now under Cell1 (please refer to the picture below)



9 Define HOs using the BreezeVIEW GUI by:

47 Defining the handover A5 triggers in the cell.

48 Defining the **Trigger Quantity** as **RSRP**.

49 Defining the A5 thresholds for Trigger 1 and Trigger 2.

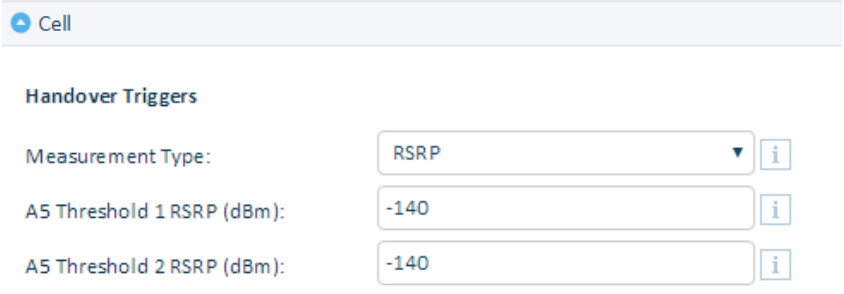


Figure 44: Handover Configuration –A5

50 Choose A3 triggers in the cell.

51 Defining A2 threshould and A3 offset

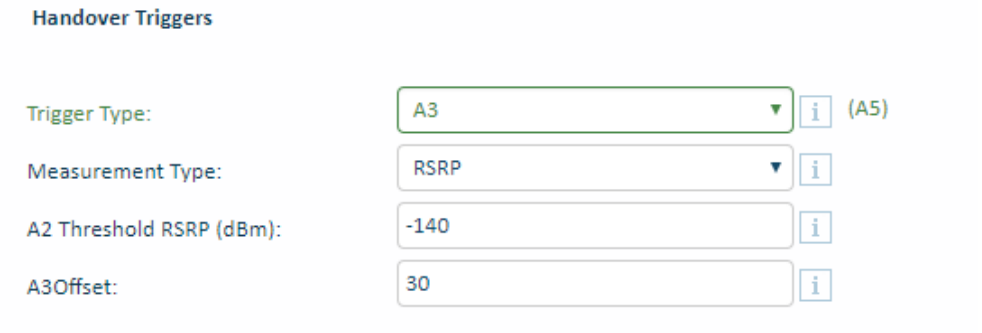


Figure 45: Handover Configuration –A3

10 Define the Neighbor Cells List by:

52 Defining the neighbor list sectors.

53 Defining the neighbor eNB ID.

54 Defining the neighbor EARFCN (central frequency).

55 Defining the neighbor physical cell ID (PCI).

56 Defining neighbor offsets.

57 Defining the neighbor reference signal maximum power.

58 Defining the neighbor X2 IP (is the same as the Neighbor Bearer IP address for BreezeCOMPACT).

Figure 46: Neighbor Cells List Configuration

11 Define QoS parameters by:

59 Configuring Scheduler parameters.

60 Defining Networking QoS.

61 Defining the QCI index's QoS parameter.

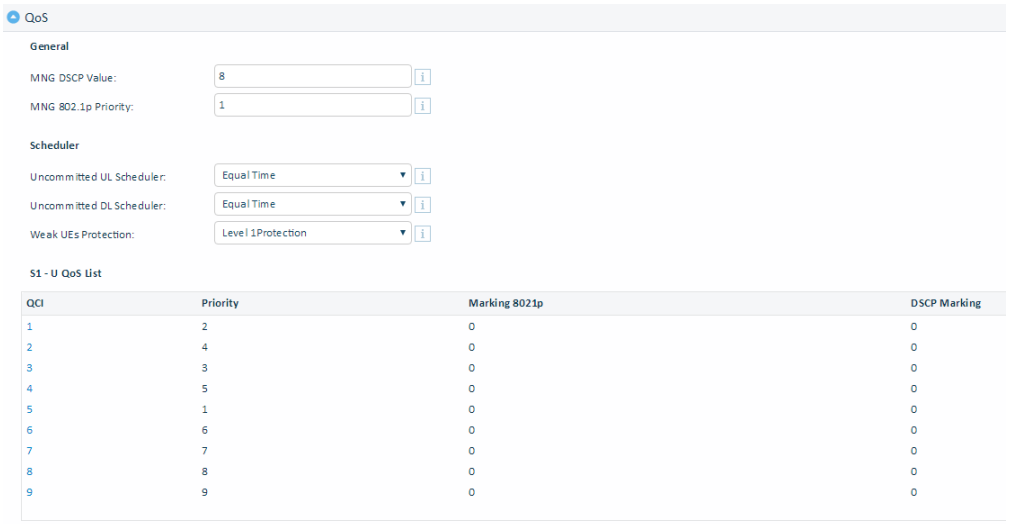


Figure 47: QoS Configuration – 1

12 Define timing parameters by:

62 Setting the GPS configuration. If the BreezeCOMPACT is a GPS Slave, set the GPS Master/Slave field to Slave

63 Setting of the GPS Type :

a. Trimble GPS PNs : 700250/700258 BMAX-4M-GPS

b. Origin GPS PN : 700275 BreezeGPS

64 . Setting the NTP IP Address. It is possible to set more than 1 IP address as NTPThesystem will use the NTP as a backup only to the GPS.

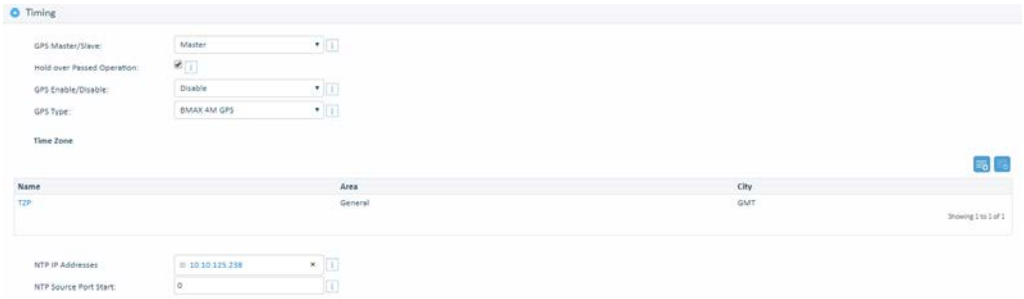


Figure 48: Timing Configuration

13 Click the 

button.

The following window displays:

Figure49: Confirm Save

14 Click **OK** to confirm.

15 In the **Actions** menu, reset the device by selecting **Reset** to Factory Defaults.

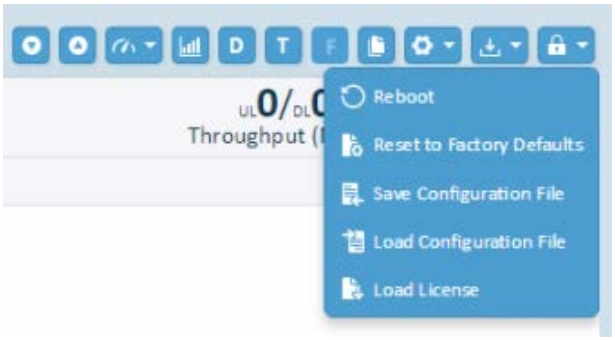


Figure 50: Actions Menu – Reset to Factory Defaults

The following window displays:

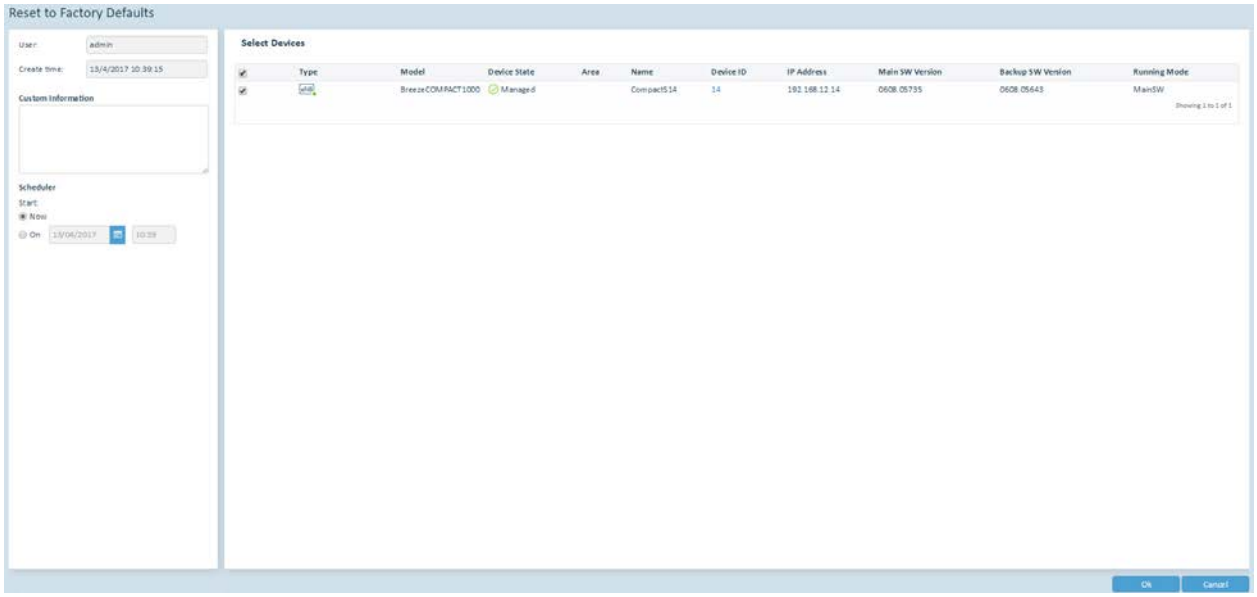


Figure 51: Reset Device

16 It provides the opportunity to make a reset "Now" or "Schedule" it on some day and hour.

17. Click Ok to reset the device and complete the configuration.

3.5 Software Upgrade Via SSH

3.5.1Purpose

This procedure describes how to upgrade LTE software using CLI commands.

3.5.2Procedure

Upgrading LTE software via SSH involves performing the following steps using the CLI:

3.5.2.1Preparing the TFTP Server

➢ **To prepare the TFTP server:**

- Set the TFTP server on BreezeVIEW. Refer to the *TFTP Server Installation and Configuration* section in the *BreezeVIEW Installation Manual* for details.

3.5.2.2Configuring the TFTP Server

➢ **To set the TFTP server in the CLI:**

1 At the **BreezeCompact%** prompt, enter the following command:

65 set device management tftp-ip-address <TFTP IP Address- Breeze View IP>

2 Perform the commit procedure as per 3.1.

3.5.2.3 Copying the BreezeCOMPACT Software to the TFTP Server

➢ **To copy the BreezeCOMPACT software to the TFTP server:**

1 Copy the new BreezeCOMPACT software version to the **TFTP** directory.

2 When using BreezeVIEW as the TFTP server, copy the new BreezeCOMPACT version using an SFTP program (such as FileZilla) to the eNodeB software version directory (**/opt/lte/Data/FirmwareSW/ENB**).

3.5.2.4 Loading a New Software Version to the Backup Bank

➢ **To load a new software version to the backup bank (shadow):**

1 At the **BreezeCompact>** prompt, type **request software-upgrade load-to-backup file-name "compact version** (including extension)**"**.

For example, COMPACT0608B.05643

The following displays:

This action will download the software image from the TFTP server. Are You sure? [no,yes]

2 Type **yes**.

3 Wait until the new version appears in the back-up-sw version, as shown below:

BreezeCOMPACT1000>show device
device general product-type COMPACT
device general product-subtype ENB
device general compact-model-type BreezeCompact1000
device inventory hw-ver 002-001-00
device inventory serial-number 95009785
device inventory main-sw-ver 0609.07358
device inventory backup-sw-ver 0609.07395
device inventory running-sw MainSW
device inventory boot-ver 0608.03.00045
device inventory up-time 2018-02-19T14:19:54+00:00
device inventory temperature 40

3.5.2.5Resetting the BreezeCOMPACT from the Backup Bank

The following procedure describes how to reset the eNodeB from the backup bank in order to load the eNodeB software version from a backup.

➢ To reset the eNodeB from the backup bank:

1 At the **BreezeCompact>** prompt, type **request software-upgrade reset-from-backup**. The following message displays:

The reset will disrupt all services provided by the device. The device will come up with the backup version. Are You sure? [no,yes]

2 Type **yes**.

3 After the eNodeB is up, type **show status device** at the **BreezeCompact>** prompt:

The line highlighted in yellow below shows the current software version.

BreezeCOMPACT1000>show device
device general product-type COMPACT
device general product-subtype ENB
device general compact-model-type BreezeCompact1000
device inventory hw-ver 002-001-00
device inventory serial-number 95009785
device inventory main-sw-ver 0609.07395
device inventory backup-sw-ver 0609.07358
device inventory running-sw ShadowSW
device inventory boot-ver 0608.03.00045
device inventory up-time 2018-02-19T14:19:54+00:00
device inventory temperature 40

3.5.2.6Setting the BreezeCOMPACT Version in the Backup Bank as the Main Software Version

The following procedure describes how to set the BreezeCOMPACT backup software version as the Main software version.

➢ **To set the backup version as the main software version:**

1 At the **BreezeCompact>** prompt, type the following:

BreezeCompact> request software-upgrade set-backup-as-main

The following message displays:

This action will set the backup software image as Main. Are You sure? [no,yes]

2 Type **yes**.

3 Check the status by typing the following:

BreezeCOMPACT1000>show device
device general product-type COMPACT
device general product-subtype ENB
device general compact-model-type BreezeCompact1000
device inventory hw-ver 002-001-00
device inventory serial-number 95009785
device inventory main-sw-ver 0609.07395
device inventory backup-sw-ver 0609.07358
device inventory running-sw MainSW
device inventory boot-ver 0608.03.00045
device inventory up-time 2018-02-19T14:19:54+00:00
device inventory temperature 40

3.6 Software Upgrade Via BreezeVIEW

3.6.1Purpose

This procedure describes how to upgrade LTE BreezeCOMPACT software using BreezeVIEW.

3.6.2Procedure

Upgrading LTE software via BreezeVIEW involves performing the following steps:

- **Configuring TFTP as the BreezeVIEW IP** Address, page 88
- **Copying the BreezeCOMPACT Software to the TFTP** Server, page 88
- **Uploading the Software to a** Backup, page 88
- **Running the Software from a Backup** Version, page 90
- **Setting the Backup as the Main** Version, page 92

3.6.2.1 Configuring TFTP as the BreezeVIEW IP Address

The TFTP configuration should be installed on BreezeVIEW in order to enable it to act as the TFTP server. For details describing how to configure BreezeVIEW as the TFTP server, refer to the *TFTP Server Installation and Configuration* section in the *BreezeVIEW Installation Manual.*

Configure the TFTP IP address in BREEZEVIEW->home->devices->ENB->General tab with the TFTP IP address.

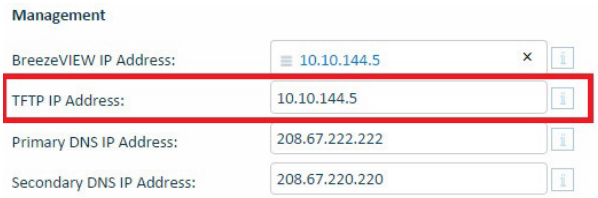


Figure 52: TFTP Server IP Address

3.6.2.2 Copying the BreezeCOMPACT Software to the TFTP Server

➢ **To copy the BreezeCOMPACT software version to the TFTP server:**

1 Copy the new BreezeCOMPACT software version to the **TFTP** directory.

2 In case that using BreezeVIEW as the TFTP server, copy the new BreezeCOMPACT version using an SFTP program (such as FileZilla) to the eNodeB software version directory (**/opt/lte/Data/FirmwareSW/ENB**).

3.6.2.3 Uploading the Software to a Backup

➢ **To upload software to a backup:**

1 In the **SW Upgrade** dropdown menu of the *Device* window or the *Device Details* window, select **Load SW File To Backup**.

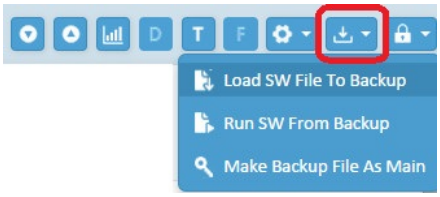


Figure 53: Actions Menu – Load SW File To Backup

The *Load SW File to Backup* window opens.

Confirm that the device is selected in the device list.

2 Select the correct software version file in the **Select Backup SW File** list.

3 Click **OK**. The following displays:

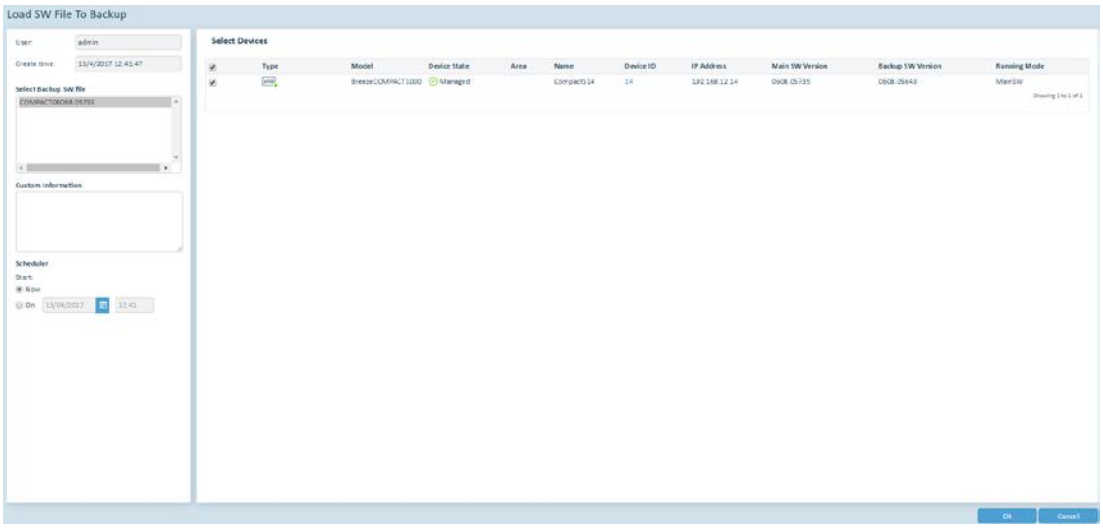


Figure 54: Load SW File to Backup Main Window

4 The following window displays:

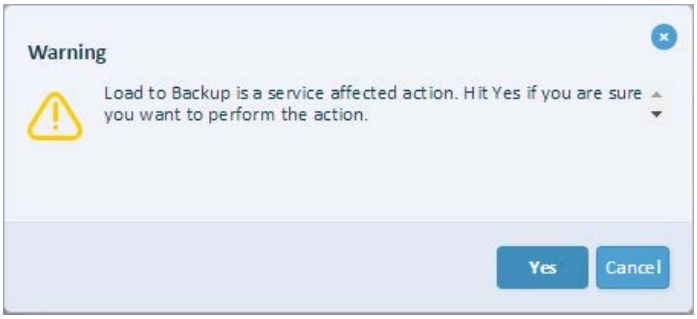


Figure 55: Warning – Load to Backup

5 Click **Yes**. The *Ongoing* window displays. The last action shows **In Process** in the **Status** column, as shown below:

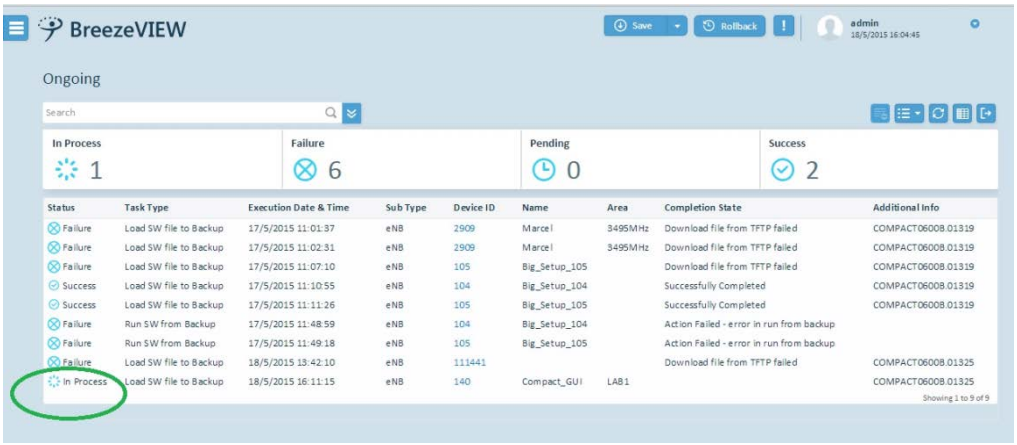


Figure 56: Ongoing Task – Load to Backup SW Version

6 Wait until the ongoing task displays **Success** in the **Status** column, as shown below:

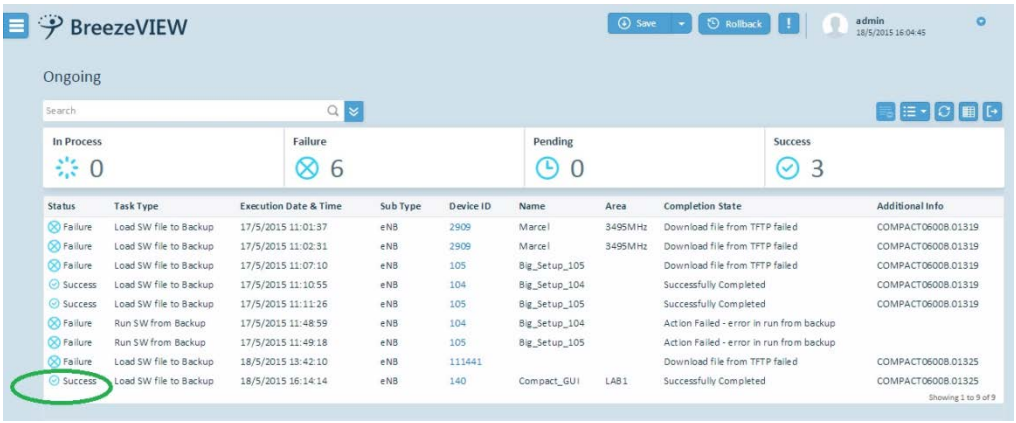


Figure 57: Ongoing Task – Successful

The new version displays in the *Device Details* window, as shown below:

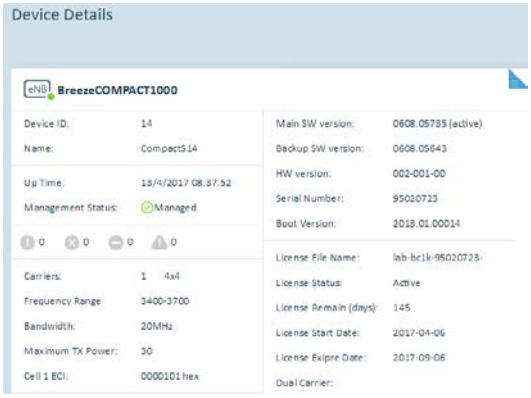


Figure 58: Device Details Window – Backup SW Version

3.6.2.4 Running the Software from a Backup Version

➢ To run LTE software from a backup:

1 In the **SW Upgrade** menu, select **Run SW From Backup**.

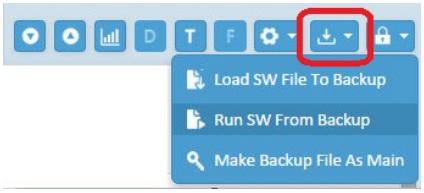


Figure 59: SW Upgrade Menu – Run SW From Backup

2 Select the device in the Select Devices area in the *Run SW From Backup* window.

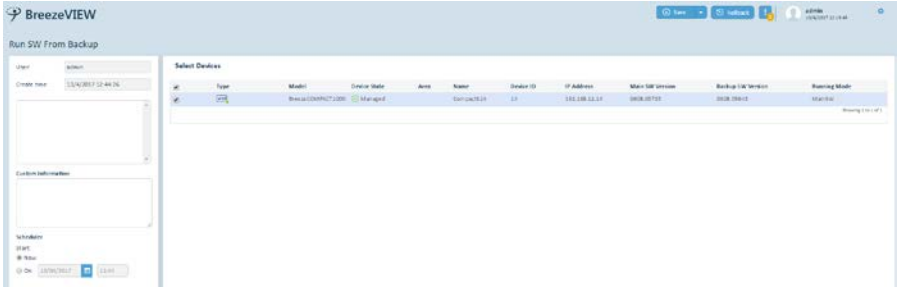


Figure 60: Run SW from Backup Window

3 Click **OK**. The following window displays:

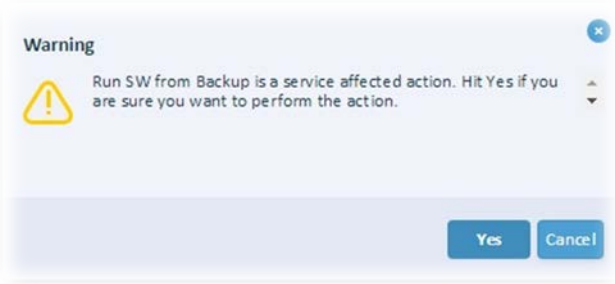


Figure 61: Warning – Run SW from Backup

4 Click **Yes**.

The eNodeB resets. The *Ongoing* window redisplays showing the Run SW from Backup task with the **In Process** status in the **Status** column, as shown below:

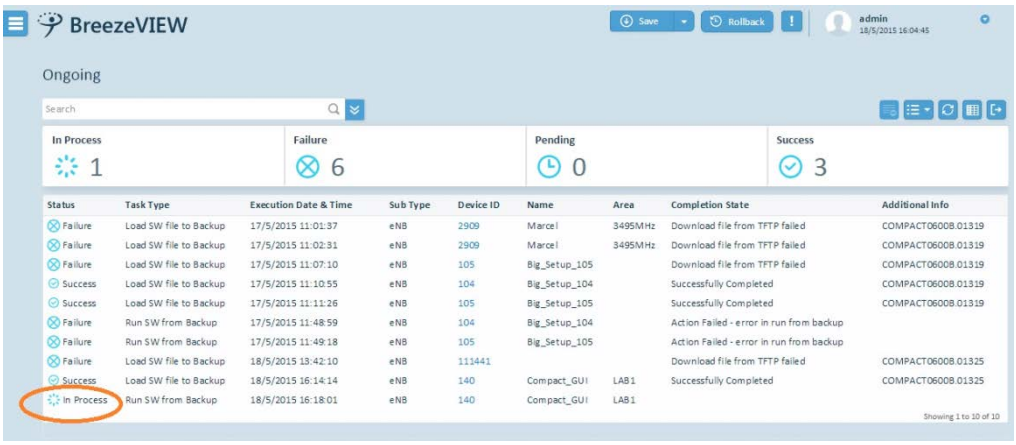


Figure 62: Ongoing Task – Run SW from Backup – In Process

5 After the connection resumes, check the status and verify that the running version is from the backup bank. Wait until the **In Process** status changes to **Success** in the **Status** column, as shown below:

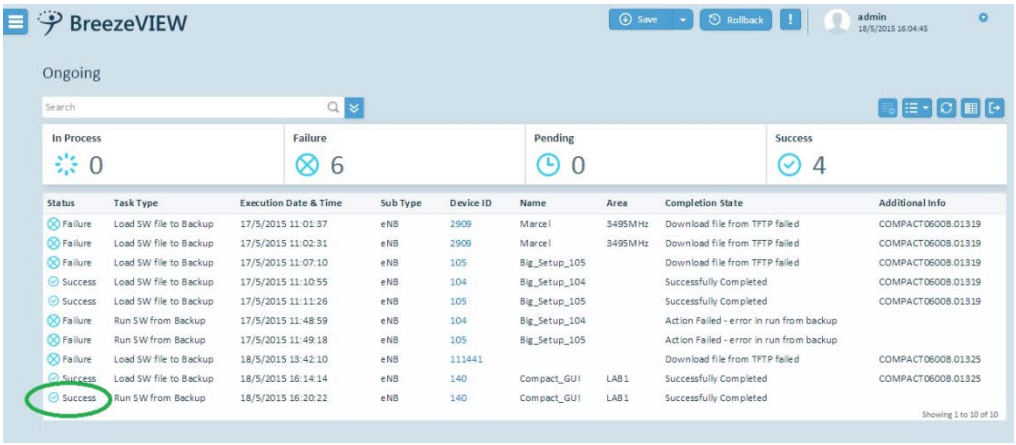


Figure 63: Ongoing Task – Run SW from Backup – Success

6 Verify that the backup software version is the active version in the device information.

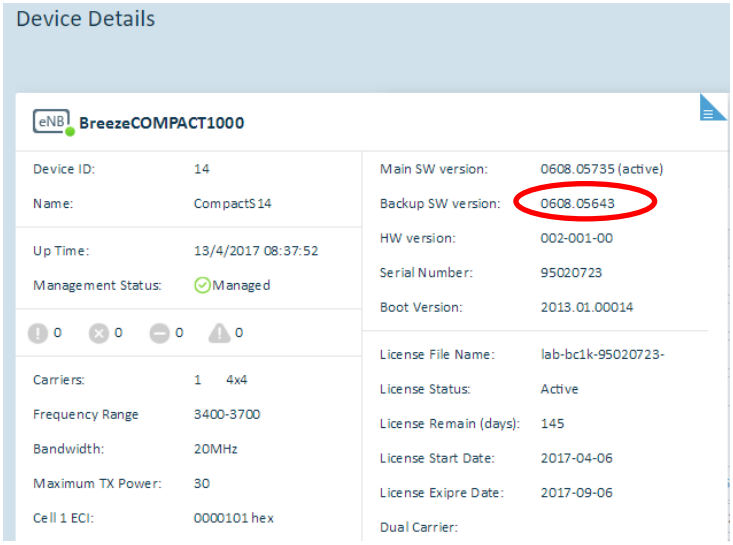


Figure 64: Device Details Window – Backup Software Version is Active

3.6.2.5 Setting the Backup as the Main Version

➢ To set the backup LTE software version as the main version:

1 In the **SW Upgrade** menu, select **Make Backup File As Main**.

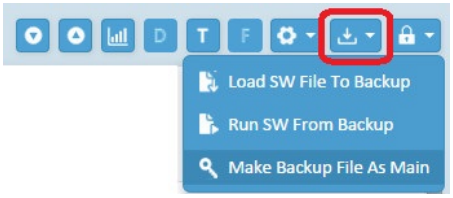


Figure 65: SW Upgrade Menu – Make Backup File As Main

2 In the *Make Backup Software As Main* window, check that the device is selected in the Select Devices area and then click **OK**.

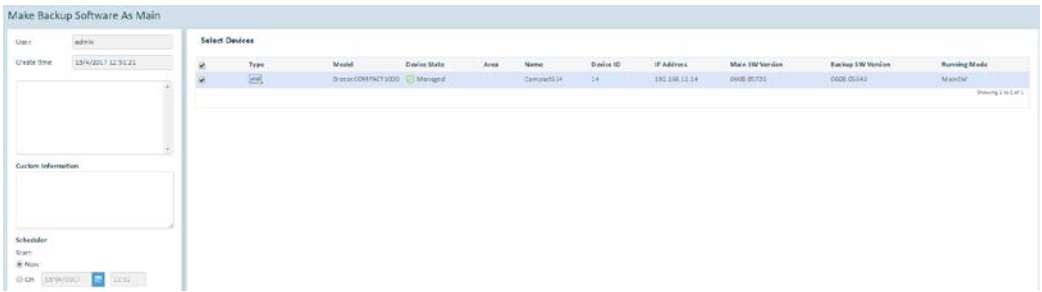


Figure 66: Make Backup Software As Main Window

3 In the *Warning* window that displays, click **Yes**.

Figure 67: Warning – Make Backup SW as Main

The *Ongoing* window displays.

4 Verify that Make Backup File as Main task shows **Success** in the **Status** column, as shown below:

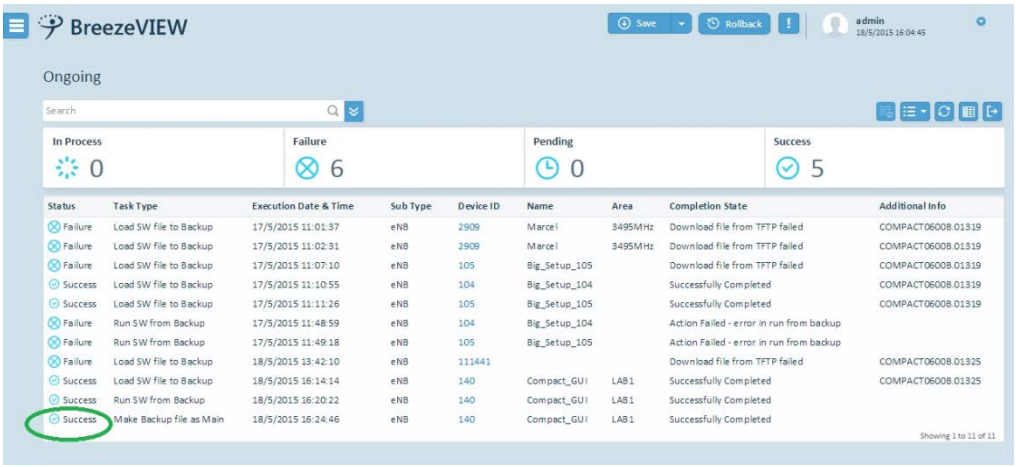


Figure 68: Warning – Make Backup SW as Main – Success

5 In the *Device Details* window, verify that the main software version is active and that the new version and backup software version are the previous software version, as shown below:

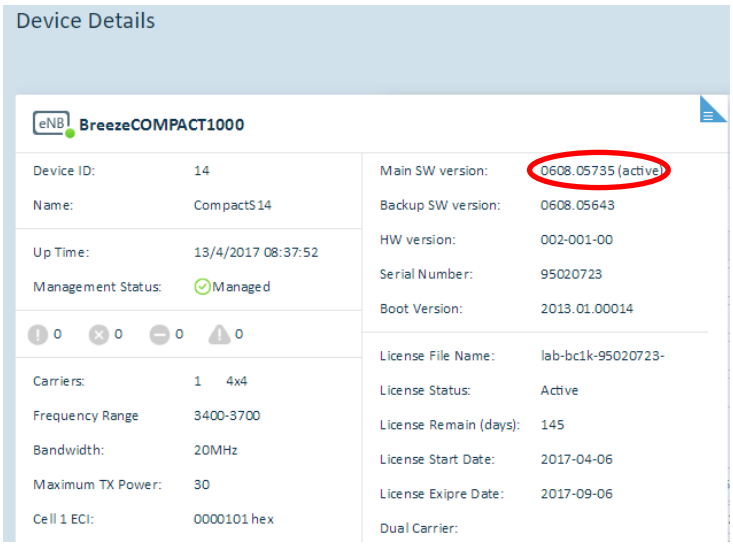


Figure 69: Main SW Version Activated

3.6.2.5.1 Software Upgrades and System Events

The events associated with the upgrade procedure can be viewed in the *System Events* window.

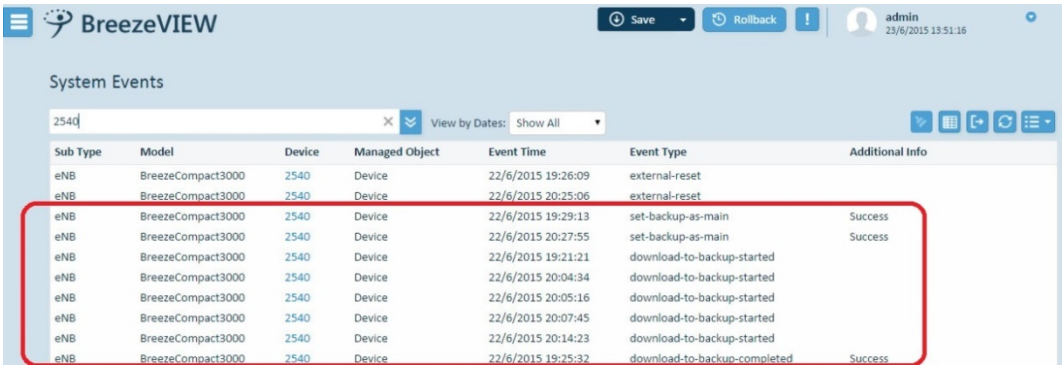


Figure 70: System Events Window

The Load SW to Backup operation ends with the following two events:

- Download-To-Backup-Started
- Download-to-Backup-Completed

The Reset from Backup operation shows one event: External-Reset.

The Set Backup as Main operation shows one event: Set-Backup-as-Main.

3.7 Resetting BreezeCOMPACT to Its Factory Defaults

3.7.1 Purpose

This procedure describes how to reset the BreezeCOMPACT configuration to the factory default configuration. The factory default configuration sets all parameters to their vendor factory defaults, except External Management parameters, the BreezeVIEW IP address and the Device ID.

3.7.2 Procedure

The BreezeCOMPACT automatically resets after performing the procedure below.

➢ **To reset the BreezeCOMPACT configuration to its factory default configuration:**

1 Select the Reset to **Factory Defaults** option using one of the following methods:

66 In the **Reset** action menu in the *Devices* window, select the **Set Factory Defaults** option.

67 In the *Device Details* window, select a device and then select the **Set Factory Defaults**

option.

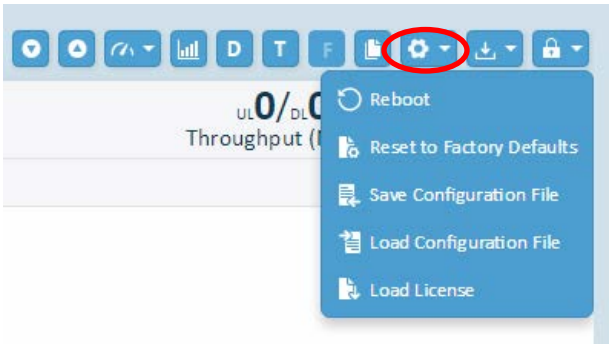
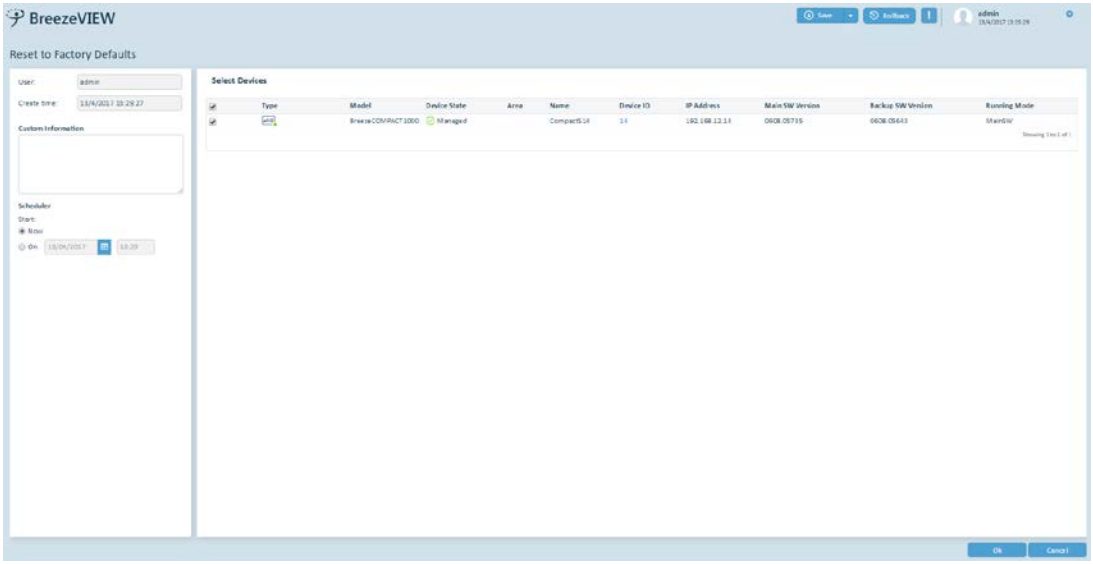


Figure 71: Set Factory Defaults

Press OK on the following window:



The following window displays.

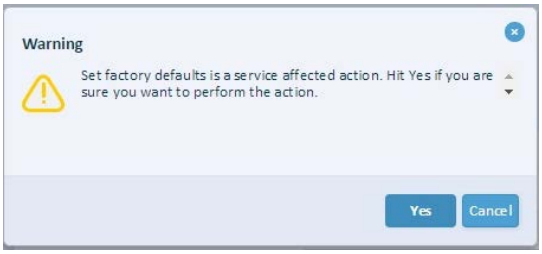


Figure 72: Warning – Set Factory Defaults

2 Click **Yes**.

The device is set to its factory defaults and begins a reset process. Its **Management Status** shows **Unreachable** while the device is resetting.

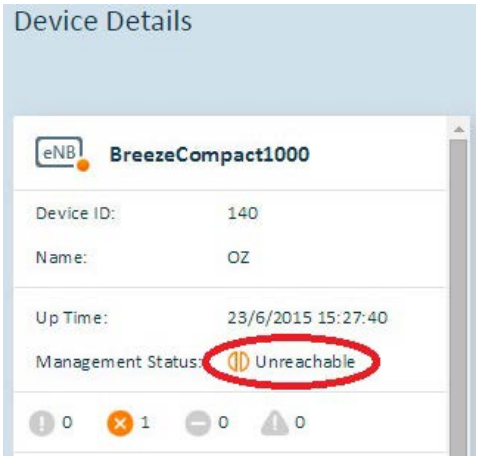


Figure 73: Management Status – Unreachable

3 Verify that the **Management Status** shows **Managed** once the reset completes.

3.8 Provisioning BreezeCOMPACT Using a Template

3.8.1 Purpose

This procedure describes how to provision BreezeCOMPACT using a predefined template.

3.8.2 Procedure

Provisioning BreezeCOMPACT using a template involves the following general steps:

- Defining a new template name using the BreezeVIEW **New Template** option
- Auto-discovery of a new BreezeCOMPACT device after its commissioning
- Applying a template to the new BreezeCOMPACT device using the **Assign Template** option
- Completing manual provisioning on BreezeCOMPACT
- Resetting the BreezeCOMPACT to activate the provisioning changes

➢ To provision BreezeCOMPACT using a template:

1 Select a Profiles from the **Main** menu.

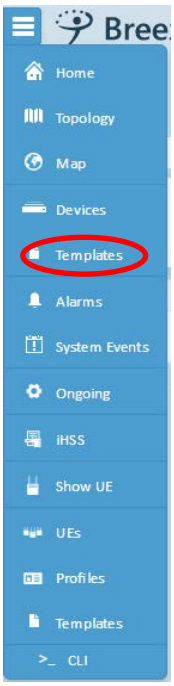


Figure 74: Selecting a Template

2 Click the **New** Template button to create a new profile.

Figure 75: New Template

3 Specify the template name in the **Name** field and click the Save button.

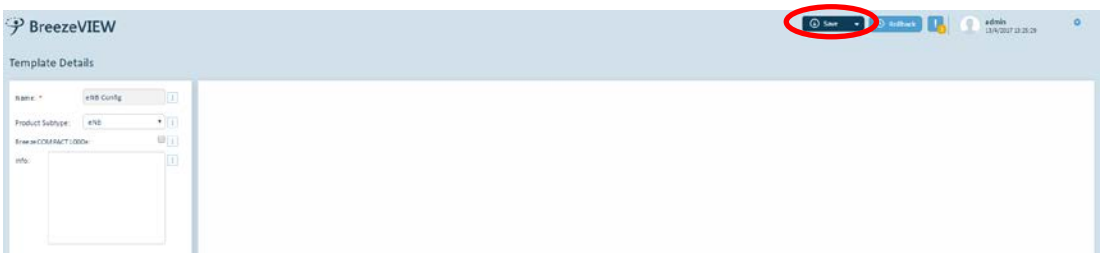


Figure 76: Template Details Window – 1

4. The new template is added to the templates list in the Templates window.

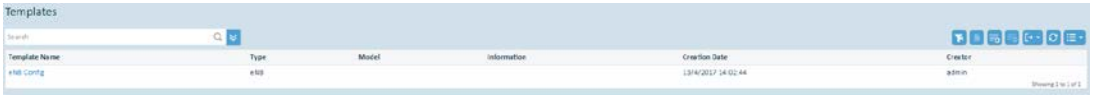


Figure 77: Templates Window

4 Specify the ENB device parameters in *Template Details* window.

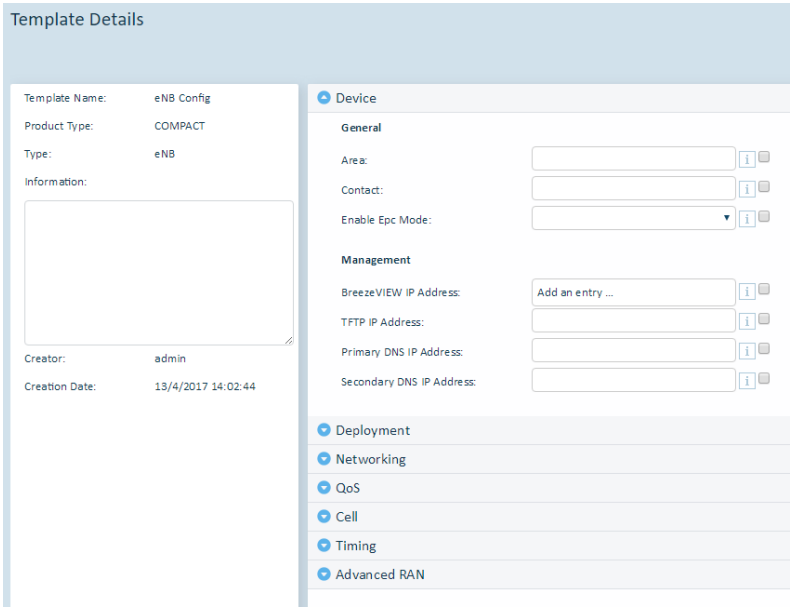


Figure 78: Template Details Window – 2

5 To assign the template to the device, click the **Apply from template** button. The location of this button varies, depending on the window from which you make your selection, as follows:

68 From the *Device Details* window:

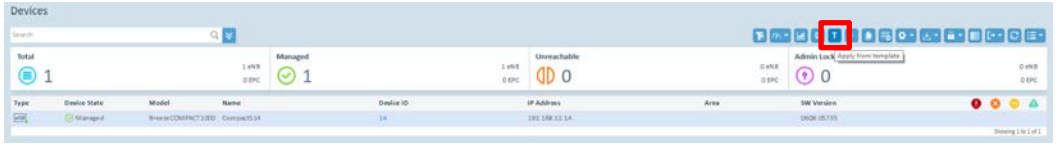


Figure 79: Apply From Template – Device Details Window

Important remark : The "apply from template" button will be enabled only if at least 1 module is chosen .

69 From the New Devices area in the *Home* page:

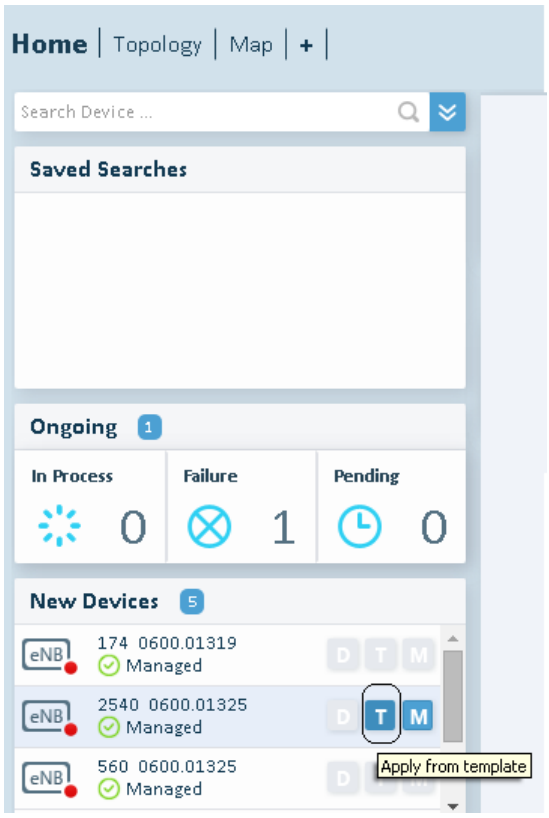


Figure 80: Apply From Template – New Devices Area of Home Page

The *Apply a Template* window displays:

Figure 81: Apply a Template Window

7 Select the relevant template and click **OK**.

8 Click the **Save** button.

9 Manually provision the BreezeCOMPACT device.

10 Click the **Save** button.

11 Reset the device to activate the configuration changes, as described in Section 3.11.1, Locking and Unlocking a Device.