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.

5.X GHz Statement (FCC/IC)

This device has been designed to operate with the antennas listed in Antennas Appendix A and having a maximum gain of 17 dBi for 5.1 & 5.8GHz bands. Antennas not included in this list or having a gain greater than 17 dBi are strictly prohibited.

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.

Not withstand the above, operation in 5.XGHz Bands is subject to local and regional regulations which may include but may not be limited to:

- Sub-band to operate
- Allowed Tx Power
- Actual channel bandwidth
- Allowed EIRP

Frequency Stability

BreezeU100 & Comact1000 are based on OCXO oscillator with Max frequency stability of 200PPb, The OCXO is a 40 MHz device which feeds the RF component

The 40MHz OCXO is a standalone discrete part, while the other VCO's are incorporated in the RF component. The Oscillator and VCO's are used in conjunction with a phase lock circuit on the RF component in order to generate stable clocks and RF signals.

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

The BreezeCOMPACT 1000 and BreezeU100 require installation by a CPI (Certified Professional Installer)

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 tile 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 21, describes the BreezeCOMPACT system.
- **Chapter 2: Commissioning Steps,** page 46, describes how to commission the BreezeCOMPACT for provisioning.
- **Chapter 3: Operation and Administration Procedures,** page 52, describes how to configure the BreezeCOMPACT and perform various types of software upgrades.
- **Chapter 4: Events and Alarms,** page 130, describes how to handle events and alarms in the system.
- **Chapter 5: Licensing Mechanism,** page 138, describes how to handle events and alarms in the system.

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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 Isotopically 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
LTE-U	LTE in Un-Licensed Bands
MBR	Maximum Bit Rate
MCC	Mobile Country Code
MCS	Modulation and coding scheme

Table 0-1: Glossary

Acronym	Description
MDT	Mechanical Down-Tilt
MHz	Megahertz
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
MU-MIMO	Multi User MIMO
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
SFR	Soft Frequency Reuse
SGW	Serving GateWay
SINR	Signal to Interference plus Noise Ratio
SSF	Special SubFrame
SSH	Secure Shell
SW	Software
TA	Tracking Area

Table 0-1: Glossary

Acronym	Description
TAC	Tracking Area Code
TAI	Tracking Area Identity
TDD	Time-Division Duplex
TFTP	Trivial File Transfer Protocol
Tx	Transmitter
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:

- **LTE,** on page 22
- **Telrad LTE End-to-End Solution,** on page, 23
- **BreezeCOMPACT Family,** on page 24
- **BreezeCOMPACT Product Types per Frequency,** on page 28
- **BreezeCOMPACT Features,** on page 29
- **BreezeCOMPACT R7.2 Software Capabilities,** on page 38
- **BreezeCOMPACT Accessories and Specifications,** on page 41

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.

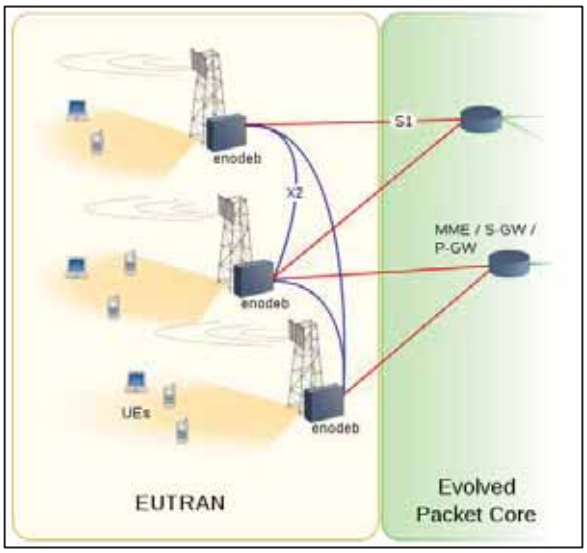


Figure 1: E-UTRAN Architecture

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.

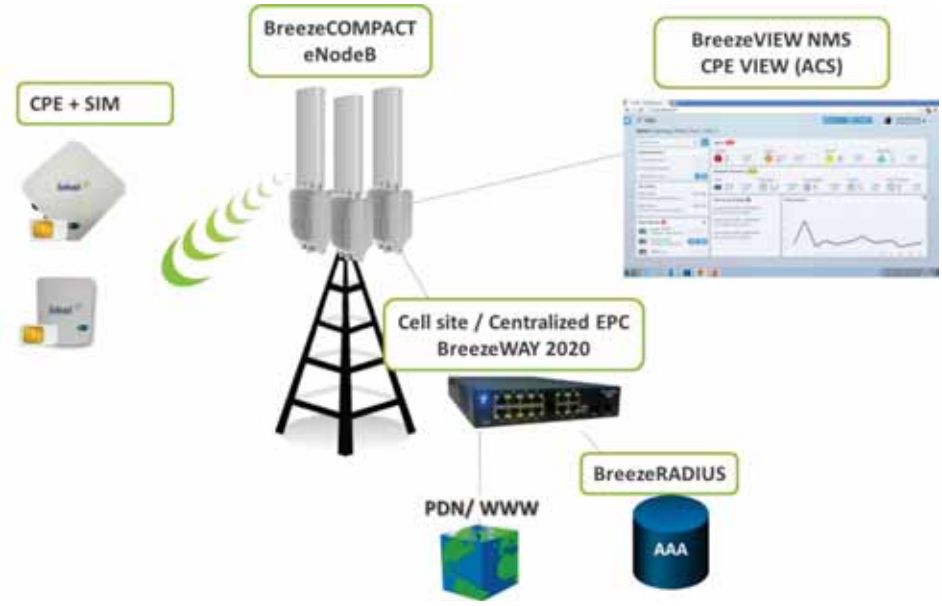


Figure 2: Telrad LTE End-to-End Solution Using BreezeWAY 2020

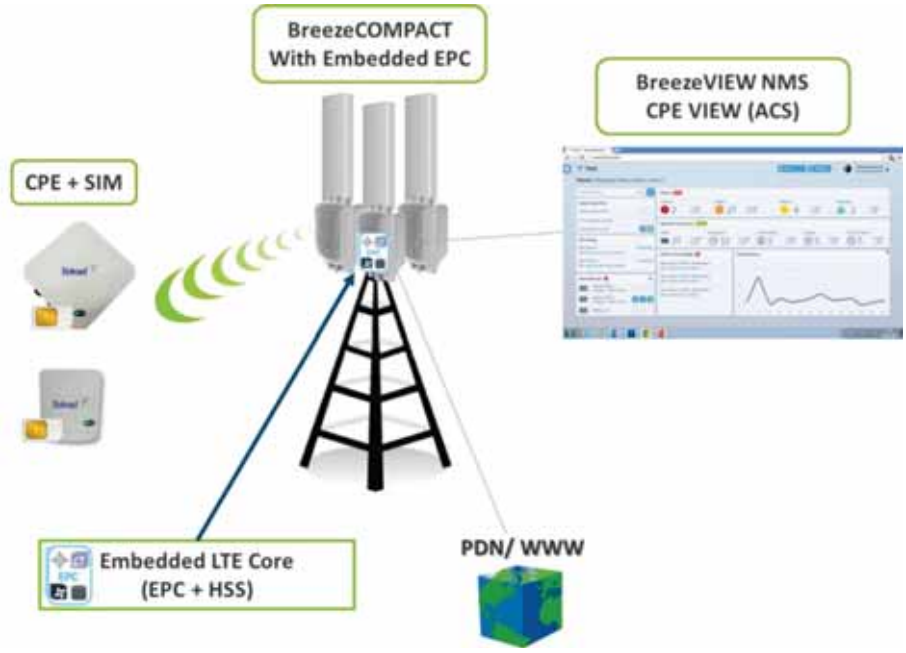


Figure 3: LTE End-to-End Solution Using Embedded EPC in BreezeCOMPACT1000

Table 2-2: Telrad Solution per Product Type

Product Type	Product
BS	BreezeCOMPACT 1000, 2000 and 3000
CPE	CPE7000 Outdoor/Indoor, CPE8102 Indoor, CPE8000/8100/8101, CPE9000, CPE12000 Outdoor or Third Party
EPC	BreezeWAY2020 EPC, BreezeWAY1010 Embedded EPC in BreezeCOMPACT1000/BU100 or Third Party (IOT required)
User Provisioning	Internal HSS (BreezeWAY2020) or BreezeRADIUS AAA (Aradial)
Network Management	BreezeVIEW (BS and EPC) UEs-VIEW (UE)
	CPEView TR-069(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 25
- **BreezeCOMPACT 2000,** page 25
- **BreezeCOMPACT 3000,** page 26
- **BreezeU100,** page 26

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/.

1.3.1 BreezeCOMPACT 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
- 5.XGHz Band up to 20 dBm per port (subject to local regulation)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 Outdoor CPEs and 4x4 diversity

Figure 4: BreezeCOMPACT 1000 – Small Cell, High Performance

1.3.2 BreezeCOMPACT 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: (Note: Compact2000 is not supported on R7.0 onwards)

- 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

1.3.4BreezeU100 (5.XGHz only)

The BreezeU100 provides high-performance outdoor coverage in licensed and un-licensed 5.XGHz Bands for multiple devices.

- 4 x 4, up to 20 dBm (100 mWatts) per port (subject to local regulations)
- 5.X GHz Band up to 20dBm per port (subject to local regulations)
- 4Tx x 4Rx and modem in a single, all-outdoor form factor
- TD-LTE-Advanced
- For Fixed, Mobility and Dense environments
- Embedded Antenna
- Embedded EPC1010
- Double capacity with dual-sector/carrier
- High power for areas with Non-Line-of-Sight
- Highest coverage and capacity using outdoor CPEs with 4x4 diversity

Figure 7: BreezeU100 – LTE-U

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	R7.2	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	R7.2	3.300–3.500 MHz	30	4x4
Compact1000e (with BreezeWAY1010)	735473	CMP.XT-BS-3.6-3.8	R7.2	3.600–3.800 MHz	30	4x4
Compact1000	735270	CMP.XT-BS-3.4-3.7	R7.2	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	R7.2	3.300–3.500 MHz	30	4x4
Compact1000	735273	CMP.XT-BS-3.6-3.8	R7.2	3.600–3.800 MHz	30	4x4
Compact2000	735271	CMP.HP-BS-3.5	R6.9	3.400–3.600 MHz	37	4x2
Compact3000	725270	CMP3000-B41-2496-2690MHz	R7.2	2.496–2.690 MHz	40	4x4
Compact3000	723270	CMP3000-B40-2300-2400MHz	R7.2	2.300–2.400 MHz	40	4x4
Compact3000	735370	CMP3000-B42-3400-3600MHz	R7.2	3.400-3.600 MHz	40	4x4
Compact3000	735373	CMP3000-3300-3400MHz	R7.2	3.300-3.400 MHz	40	4x4
Compact3000	735376	CMP3000-3475-3700MHz	R7.2	3.475-3.700 MHz	40	4x4
Compact1000e (with BreezeWAY1010)	750470-L	CMP.TX-BS-5.X	R7.2	5.150-5.900 MHz**	20	4x4
Compact1000e (with BreezeWAY1010)	750471-L	CMP.TX-BS-5.X	R7.2	4.900-5.350 MHz**	20	4x4
BreezeU100	755270-L	BreezeU100-5.x-Int.Ant	R7.2	5.150-5.900 MHz**	20	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

** Exact RF Band, Tx power and channel bandwidth is Subject to local/regional regulation

1.5 BreezeCOMPACT Features

1.5.1 BreezeCOMPACT Topologies

The BreezeCOMPACT platform supports 4Tx/4Rx Radio. The following topologies are supported as can be also configured via the BreezeView "Deployment" Menu:

- **Single Sector with Single Carrier,** page 29
  - **Single Carrier 2Tx2Rx**
  - **Single Carrier 2Tx4Rx**
  - **Single Carrier 4Tx4Rx**
  - **Single Carrier 4Tx4Rx with DL MU-MIMO**
- **Two Geographical Sectors:**
  - **Split Mode,** page 30
    - **Split Mode 2TX/2Rx F1F1**
    - **Split Mode 2TX/2Rx F1F2**
  - **Dual Carrier (Sector)**, page 31
- **Single Geographical Sector - Dual Carrier:**
  - **Dual Carrier,** page 31
  - **Dual Carrier Aggregation,** page 31

NOTE!	Activation of those various topologies, requires appliance of relevant software licenses

1.5.1.1 Single Sector

1.5.1.1.1.1 Single Sector 2x2 and 4x4

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 2Tx/2Rx, 4Tx/2Rx and 4Tx/4RX.

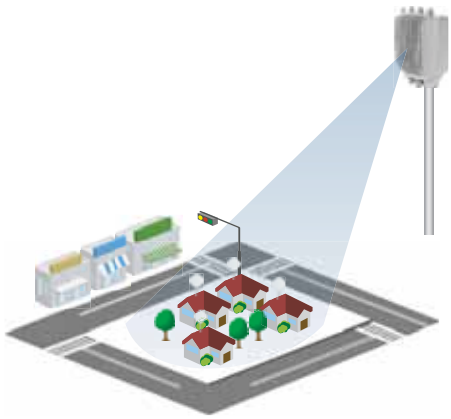


Figure 8: Single Sector Topology

1.5.1.1.1.2 Single Sector 4x4 with MU-MIMO

Downlink Multi-User MIMO (MU-MIMO) topology is supported for higher sector throughput with enhanced spectral efficiency optimized for fixed wireless. This mode of operation is supported in single sector with Compact's configuration to be used is 4Tx/4Rx.

Figure 9: MU-MIMO Operation

1.5.1.2 Two Geographical Sectors:

1.5.1.2.1 Split Mode 2x2

This topology covers two geographic sectors / areas, where the split mode is ideal for small areas with a low number of subscribers, each geographical sector can be configured in the same frequency F1F1 or different frequency F1F2.

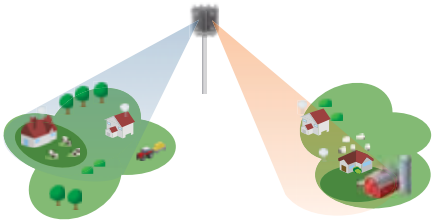


Figure 10: Split Mode 2x2 Topology

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, 20/10MHz) 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 Carrier (Sector) 2x2

The Dual Sector topology enables a double-capacity BreezeCOMPACT. In this mode, the BreezeCOMPACT behaves like two 2x2 eNodeB's (double capacity vs split mode). UEs on different geographical sectors see different eNodeB's 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 .**

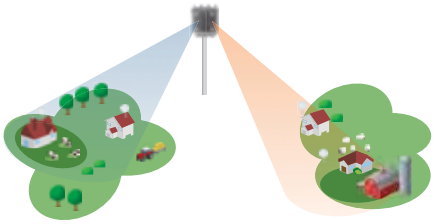


Figure 11: Dual Sector 2x2 Topology

1.5.1.3 Single Geographical Sector using Dual Carrier 2x2

The Dual Carrier topology enables a double-capacity BreezeCOMPACT. In this mode, the BreezeCOMPACT behaves like two 2x2 eNodeB's towards the same geographical sectors at two different frequencies (double capacity vs single carrier).

1.5.1.3.1 Dual Carrier 2x2

UEs on different carriers see different eNodeB's on different carriers. Each carrier can use any center frequency within the product's frequency range (but not the same frequency). 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.**

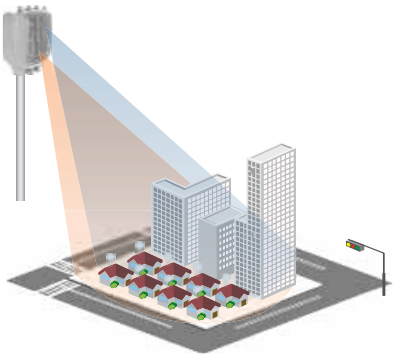


Figure 12: Dual Carrier 2x2 Topology towards the same geographical sector

1.5.1.3.2 Dual Carrier Aggregation (Downlink)

In a case of a Compact with a Dual Carrier configuration (two carries with two different frequencies 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 for the same CPE.

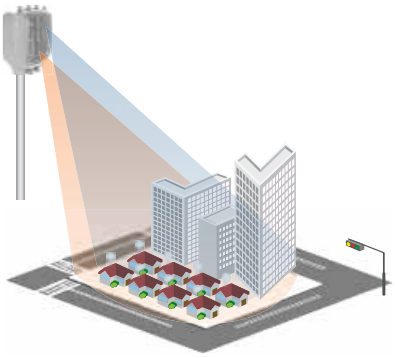


Figure 13: Dual Carrier Aggregation 2x2 Topology towards the same geographical sector

1.5.1.3.3 Load Balancing

In a case of a Compact with a Dual Carrier configuration or with Dual Carrier Aggregation configuration (two carries towards 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.

1.5.2BreezeCOMPACT 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 14) 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 14: TDD Configurations

Note: In Release R7.0, configurations 0, 1 and 2 are supported (Configuration 0 is demo mode)

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 15 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 15: Subframe Types

The Special subframe configuration defines the cell radius limitation, in addition to the throughput allocation for the DL and the UL. UE's 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, 7	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 16 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 16: 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:

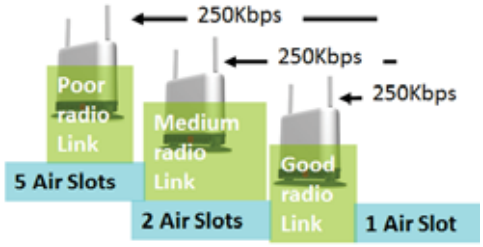


Figure 17: Equal Rate Scheduling

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:

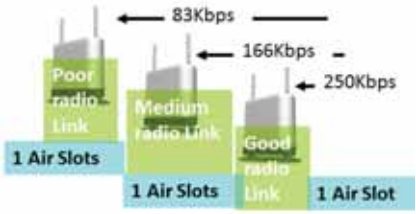


Figure 18: Equal Time Scheduling

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.

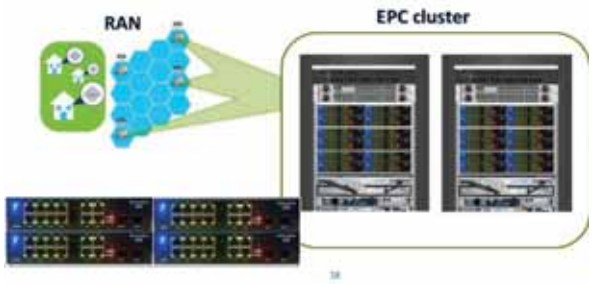


Figure 19: EPC Redundancy and Load Balancing

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.

Figure 20: GPS Chaining

NOTE!	In case of GPS chaining, the chained units depend 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 R7.2 Software Capabilities

The following describes the BreezeCOMPACT R7.2 capabilities (the list includes existing and new features): (For the most updated feature set please refer to the Release Notes)

- **LTE 3GPP Capabilities:**
  - **3GPP Release:** Release 9 with Release 12 capabilities for selected UE's
  - **Distance:** Up to 60 kilometers (km)
  - **Transmit Modes (TM):** TM1, TM2, TM3 & TM4, TM8 (relevant for 4x4 single sector configuration)
- **BreezeCOMPACT hardware Capabilities:**
  - **Number of Tx/Rx:** 4x4, 2x2, 2x4
  - **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
    - 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
    - Downlink Dual Carrier Aggregation with selected CPE's (5+5MHz,10+10MHz,14+14MHz, 15+15MHz and 20+20MHz) 2x2 - Two different frequencies for each Carrier on the same geogrpahical sector towards the CPE (with CPE9000, CPE12000)
    - Load Balancing of CPE's between two Carriers within the same Geographical Sector (via BreezeView)
    - Downlink Multi-User MIMO (MU-MIMO) **(new in R7.2)** Higher sector throughput with enhanced spectral efficiency optimized for fixed wireless. (Compact's configuration to be used is 4Tx/4Rx)
  - **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)
- **CAT12 Downlink 256QAM (with Selected CAT12 CPE'12000's) (new in R7.2)**
  Higher Downlink throughput (per sector and per CPE)
- **Soft Frequency Reuse (SFR) (new in R7.2)**
  In case of Reuse 1 deployments where nearby cells operate in the same frequency.
- Spectrum analyzer – full band scan
- Spectrum analyzer (NI - Noise indication) – MAX NI during the last 5 min measurements interval
- UE KPIs using CPE VIEW
- TDD configuration 0 - for enhanced Uplink as a demo mode
- SSF#7 (for up to 10Km radius)
- Frequency Selective Scheduling **(new in R7.2)**
- Uplink Interference Protection for 5GHz bands **(new in R7.2)**

- **CBRS Band 48 Support:**
  - Compact1000
  - CPE9000, CPE8100 (EUD Support (please contact CS for latest SW versions):
    - Maximum Tx power limit
    - Channel Change
    - Downlink RSSI measurement via TR-069
- **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
  - 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
  - Federated CBRS SAS Support Rel. 1.5 (please contact CS for latest SW versions)

- Floating UE Licensing (for EPC and CPEView)
- BreezeView feature Licensing per Comapct

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.

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 ■ 5,150–5,900 MHz, 20 dBm per port, 4 Rx by 4 Tx 4,900–5,350 MHz, 20 dBm per port, 4 Rx by 4 Tx**BreezeCOMPACT 2000: (N/A in Release 7.0 Onwards)** ■ 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 **BreezeU100:** ■ 5,150–5,900 MHz, 20 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), QAM256 (MCS_-MCS__)

Item	Description
Access Method	OFDMA Downlink SC-FDMA Uplink

* 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

** Note only 10, 15 and 20MHz channels supported when Compact 5GHz Mode subject to local regulations

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

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	■ EN60950-1/22 (CE) ■ IEC/EN 62368-1 UL 60950-1/22 (US/C) ■ UL 62368-1
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 ■ IC RSS-247 (Compact1000, BU100: 5.150-5.250MHz & 5.725-5.825MHz) ■ FCC Part 27 ■ FCC Part 96 (CBSD Compact1000 3,550-3,700MHz) ■ FCC 47CFR, Part 15, Subpart E: (Compact1000, BU100: 5.150-5.250MHz & 5.725-5.825MHz)

Colored certifications are under process for 5.XGHz Products (Compact1000 & BU100).

Certification is subject to relevant frequency band and Product Type

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 (Not supported on R7.0 onwards)

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)

1.7.9.4BreezeU100

Table 2-14: Mechanical and Electrical Specifications, BreezeU100 Unit

Item	Description
Dimensions	423 x 159 x 357 mm
Weight	12 Kg
Power Input	-40 to -60 VDC
Power Consumption	100W Average (at 70% Tx/Rx duty cycle) 142W peak (Power supply requirement)

Chapter 2: Commissioning Steps

In This Chapter:

- **BreezeCOMPACT Commissioning,** on page 46

2.1 BreezeCOMPACT Commissioning

2.1.1Preface

2.1.1.1For Un-License Markets:

NOTE!	Before commissioning BreezeCOMPACT or BreezeU100 at 5.XGHz Bands please refer to 5GHz band warning on page 7. All RF configurations are subject to local/regional regulations by Operator

2.1.1.2For CBRS Markets:

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.

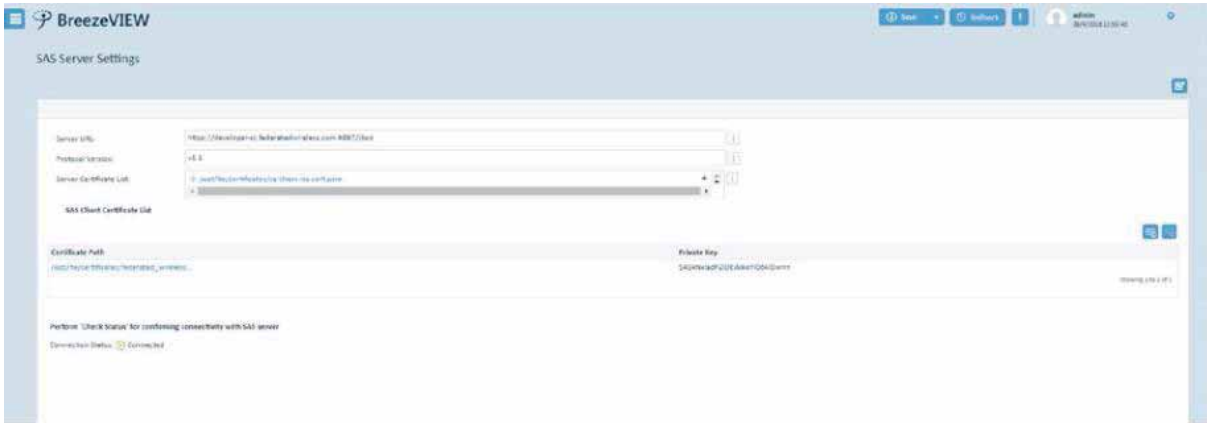


Figure 21: SAS Server Setting Screen

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.

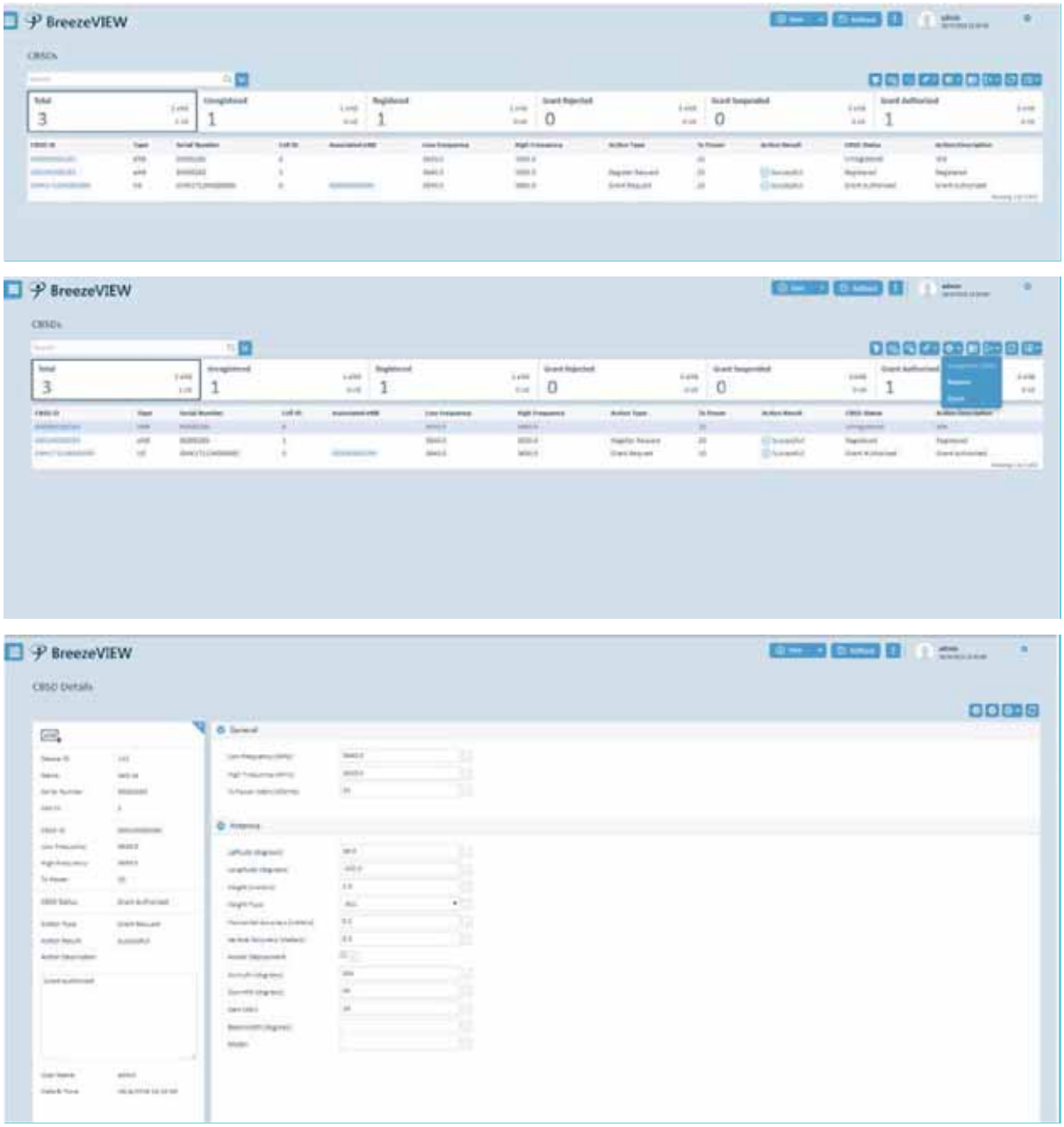


Figure 22: CBSD Screens

2.1.2Purpose

This procedure describes the steps required to initially commission the BreezeCOMPACT 1000, 2000 and 3000 and BreezeU100, in order to enable its connection for provisioning.

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

2.1.3BreezeCOMPACT Commissioning Procedure

2.1.3.1 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.

2.1.3.2 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 2.1.3.1, 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 in3.1

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 3.3.6, 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:

- **BreezeCOMPACT Full Configuration via** CLI, on page 54
- **Software Upgrade Via** CLI, on page 91
- **Software Upgrade Via BreezeVIEW,** on page 94
- **Resetting BreezeCOMPACT to Its Factory Default,** on page 101
- **Provisioning BreezeCOMPACT Using a Template,** on page 103
- **Locking and Unlocking a Device,** on page 107
- **Spectrum Analyzer Collection,** on page 110
- **Performance Monitoring,** on page 118

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

3.1 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.

3.2 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.

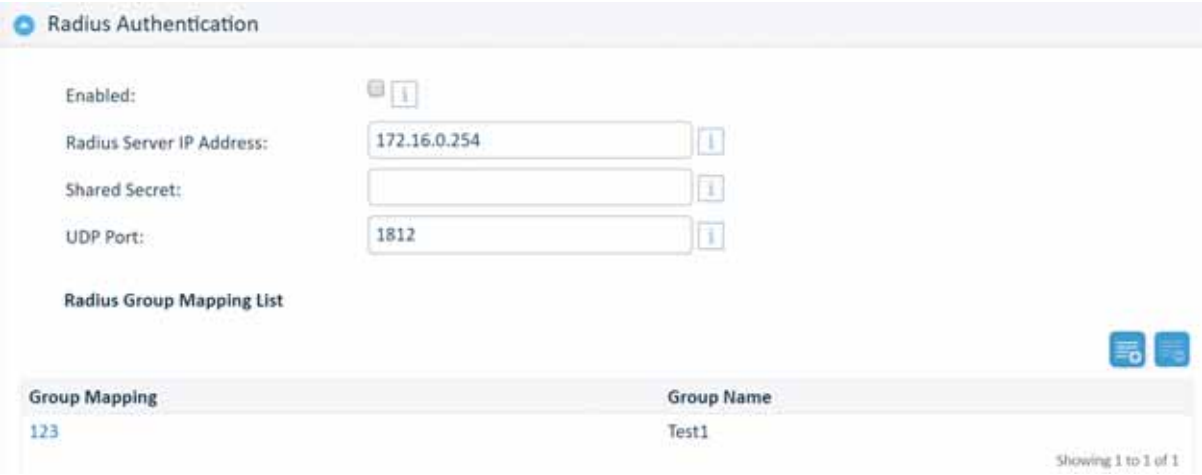


Figure 23: CLI User – Radius Authentication

3.3 BreezeCOMPACT Full Configuration via CLI

3.3.1Purpose

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

3.3.2Full 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.

3.3.2.1 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>

3.3.2.2 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 1-60 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;

}

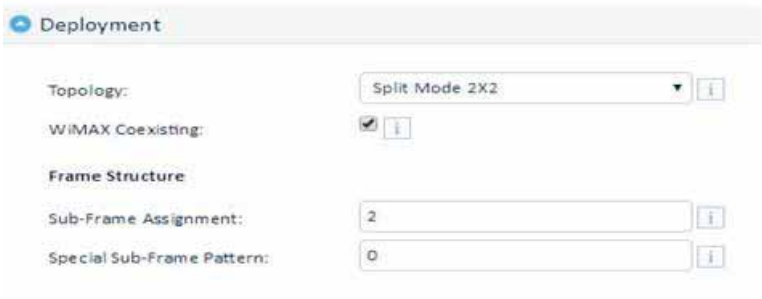


Figure 24: Deployment Tab in BreezeVIEW

3.3.2.3 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:

3.3.2.3.1 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 3.1

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 :

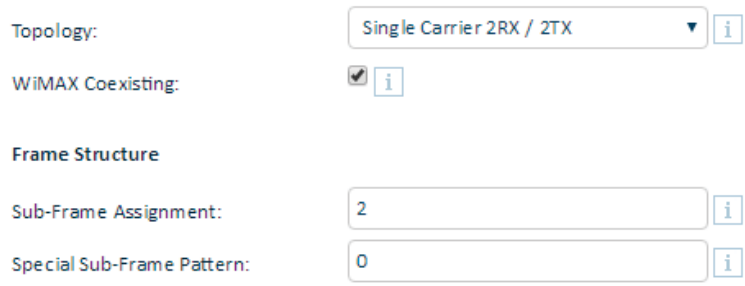


Figure 25: BREEZEVIEW -ENB deployment tab when setting deployment topology as Default topology

When looking on the BreezeVIEW ENB Advanced RAN tab:

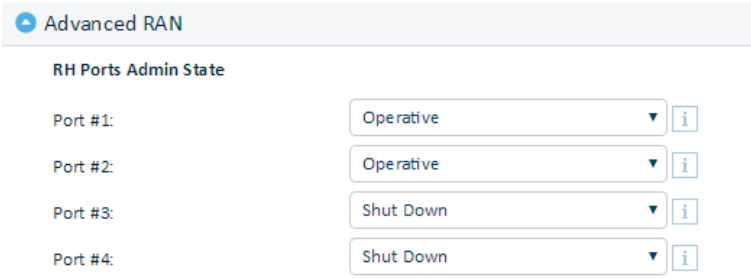


Figure 26: BREEZEVIEW -ENB Advanced RAN tab when setting deployment topology as Default

3.3.2.3.2 Single Carrier 2Tx/4Rx

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

In order to change the deployment mode to single carrier 2Tx/4Rx 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 27: BREEZEVIEW -ENB Antenna's status in single carrier 4Rx/2Tx

When looking on Breeze view on the ENB deployment tab:

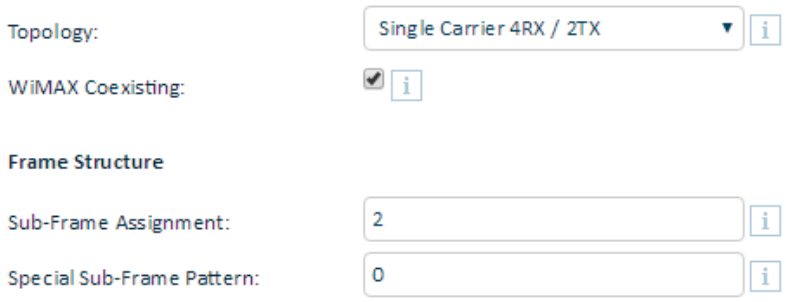


Figure 28: BREEZEVIEW -ENB deployment tab in single carrier 4Rx/2Tx

3.3.2.3.3 Single Carrier 4X4

In order to change the topology to Single carrier 4x4 , On BreezeCOMPACT 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 29: BREEZEVIEW -ENB Antenna's status in single carrier 4Rx/4Tx

When looking on Breeze view on the ENB deployment tab:

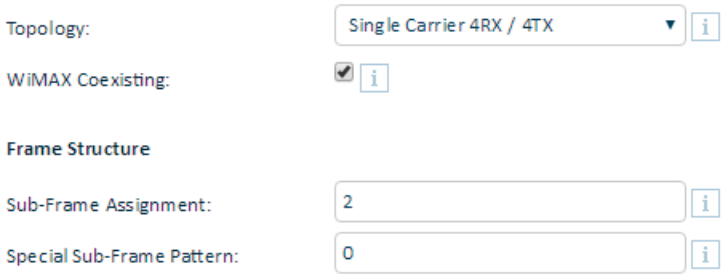


Figure 30: BREEZEVIEW -ENB deployment tab in single carrier 4Rx/4Tx

3.3.2.3.4 Single Carrier 4X4 with DL MU-MIMO

In order to change the topology to Single carrier 4x4 with DL MU-MIMO, On BreezeCOMPACT CLI from BreezeCompact% prompt perform the following commands :

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

```
On BreezeCOMPACT1000>show ran
ran general min-freq 3400
ran general max-freq 3700
ran general max-tx 30
ran general port-config 4x4

PORT  OPERATIONAL  ADMIN
NUM   STATUS       STATE
1     InService    InService
2     InService    InService
3     InService    InService
4     InService    InService

BreezeCOMPACT1000%show ran
rh-ports-admin-state {
   port1-admin-state Operative;
   port2-admin-state Operative;
   port3-admin-state Operative;
   port4-admin-state Operative;
}
[ok]
```

On BreezeVIEW :

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

Figure 31: BREEZEVIEW -ENB Antenna's status in single carrier 4Rx/4Tx DL MU-MIMO

When looking on Breeze view on the ENB deployment tab:

Figure 32: BREEZEVIEW -ENB deployment tab in single carrier 4Rx/4Tx DL MU-MIMO

3.3.2.3.5 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 33: BREEZEVIEW -ENB Antenna's status in SplitMode2x2

When looking on Breeze view on the ENB deployment tab:

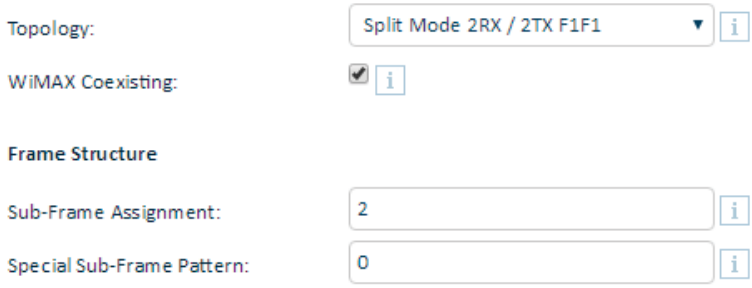


Figure 34: BREEZEVIEW -ENB deployment tab when in SplitMode2x2

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

3.3.2.3.6 SplitModef1f2:

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

On BreezeCOMPACT 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 3.1

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 cell0 general

result is:

central-frequency 3510.0;

central-frequency-f2 3540.0;

phy-cell-id 0;

- **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:

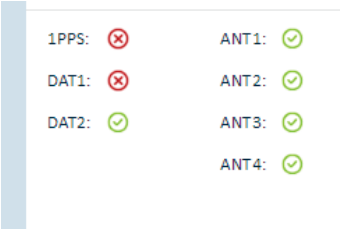


Figure 35: BREEZEVIEW -ENB Antenna's status in SplitModef1f2

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

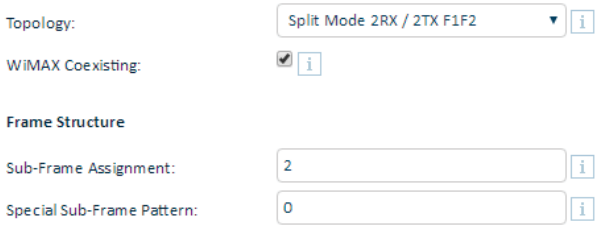


Figure 36: BREEZEVIEW -ENB deployment tab when in SplitModef1f2

On BREEZEVIEW->devices->ENB ->cell0 tab:

Figure 37: BREEZEVIEW -ENB CELL0 deployment tab when in SplitModef1f2

As can be seen in Figure 27: BREEZEVIEW -ENB CELL0 deployment tab when in SplitModef1f2 it is important to set F2 frequency when working on splitModef1f2

3.3.2.3.7 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 BreezeCOMPACT 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 3.1

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 cell0 general

result is:

cell-identity 0;

central-frequency 3510.0;

phy-cell-id 0;

When running show cell1 general

result is:

cell-identity 0;

central-frequency 3510.0;

phy-cell-id 0;

- 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:

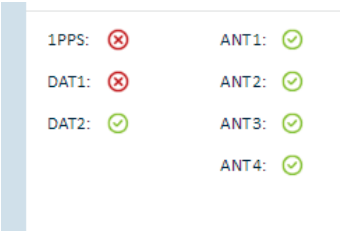


Figure 38: BREEZEVIEW -ENB Antenna's status in DualCarrier

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

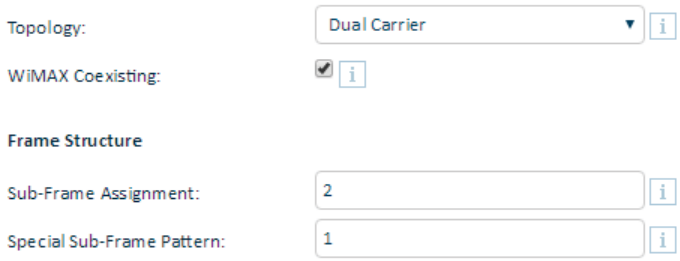


Figure 39: BREEZEVIEW -ENB deployment tab when in DualCarrier

On BREEZEVIEW->devices->ENB ->cell0 tab:

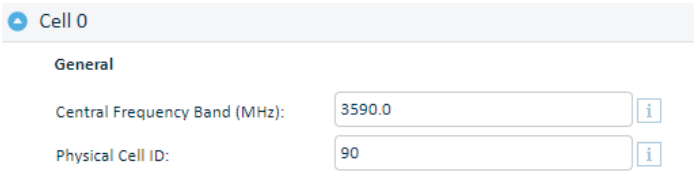


Figure 40: BREEZEVIEW -ENB CELL0 deployment tab when in DualCarrier

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

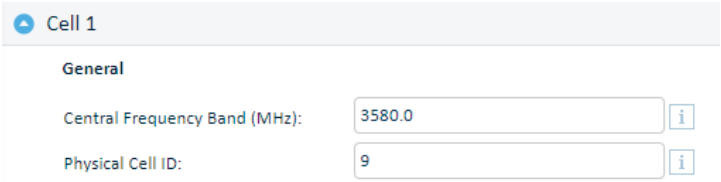


Figure 41: BREEZEVIEW -ENB CELL1 deployment tab when in DualCarrier

3.3.2.3.8 Dual Carrier Aggregation:

The Dual Carrier Aggregation topology enables in addition to a double-capacity BreezeCOMPACT, an up to double downlink capacity on selected CPE. In this mode, the BreezeCOMPACT behaves like two 2x2 eNodeBs (up to double downlink capacity vs split mode) and enables selected CPE's to aggregate downlink traffic from both carriers.

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

- set deployment topology DualCarrierAggregation
- set cell0 general central-frequency <Frequency 0 in MHZ>
- set cell1 general central-frequency <Frequency 1 in MHZ>
- set cell0 general phy-cell-id [physical cell ID 0]
- set cell1 general phy-cell-id [physical cell ID 1]
- Perform commit procedure as per 3.1

When running: show deployment topology

Result is: topology DualCarrierAggregation

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 cell0 general

result is:

cell-identity 0;

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:

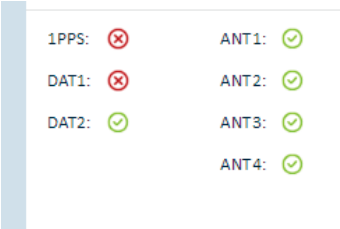


Figure 42: BREEZEVIEW -ENB Antenna's status in DualCarrierAggregation

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

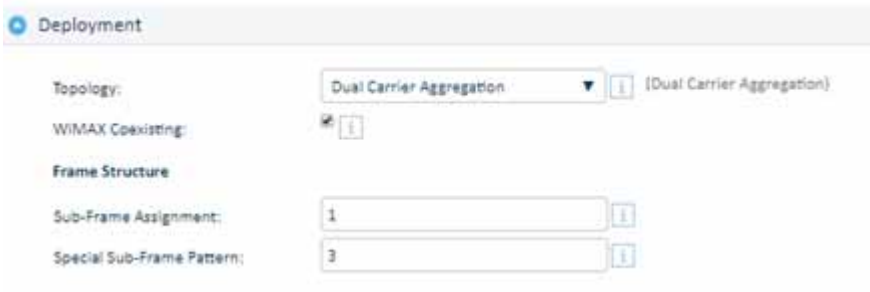


Figure 43: BREEZEVIEW -ENB deployment tab when in DualCarrierAggregation

On BREEZEVIEW->devices->ENB ->cell0 tab:

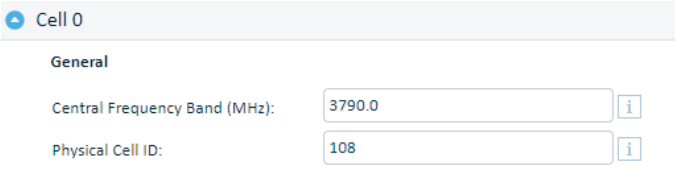


Figure 44: BREEZEVIEW -ENB CELL0 deployment tab when in DualCarrierAggregation

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

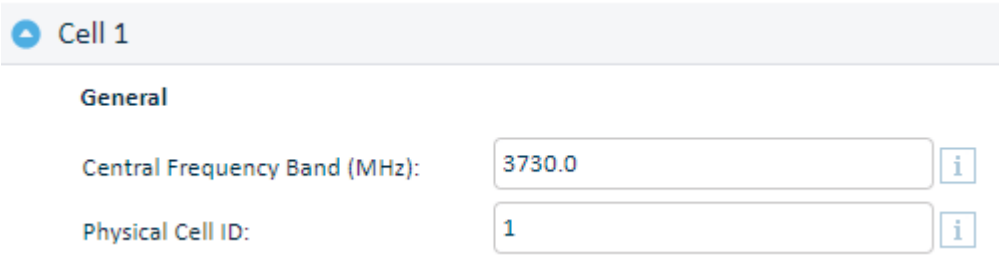


Figure 45: BREEZEVIEW -ENB CELL1 deployment tab when in DualCarrierAggregation

3.3.2.4 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;

3.3.2.5 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;

3.3.2.5.1 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;

3.3.2.5.2 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

3.3.2.6 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;

3.3.2.7 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.

3.3.2.8Modifying 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 46: Physical ports configuration in BREEZEVIEW

3.3.2.9 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;

3.3.2.10 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, 7
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;

35 **Set cell SFR configuration:**

This is the prameter for using Soft Frequncy Reuse (SFR) in case of Reuse 1 deployments where nearby cells operate in the same freuqcy.

3.3.2.11 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:

36 **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**.

37 **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

38 **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.

39 **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.

40 **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 :

41 **show timing**

As a result the output should look like that :

```
time-zone-params TZP {
    area        Custom;
    city        GMT+0300;
```

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

Defines whether to stop transmitting after Hold Over Timeout.

```
}
```

3.3.2.12 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)

3.3.2.13 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.

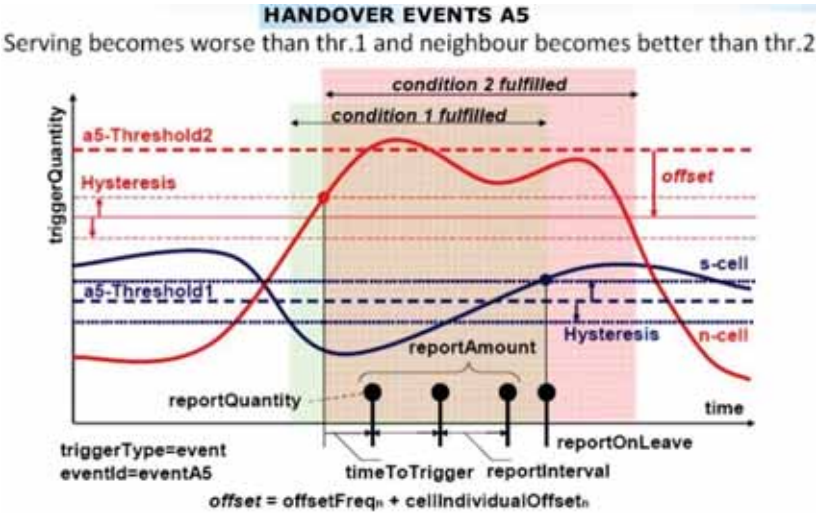


Figure 47: Handover A5 Events

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. (A3-OFFSET parameter units is 0.5db)

In other words, when ΔRSRP > A3 offset,

where ΔRSRP = RSRPneigh – RSRPserv.

Figure below shows an example of the A3 reporting event.

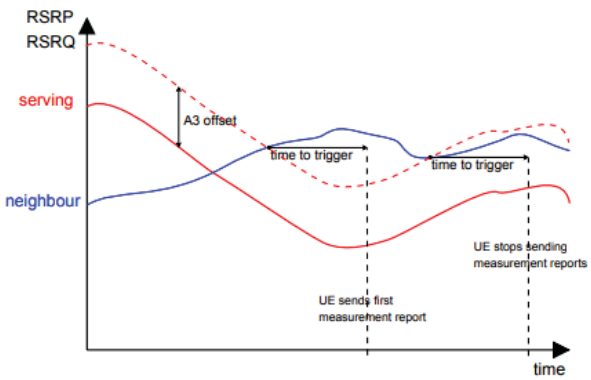


Figure 48: Handover A3 Events

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.

3.3.2.14 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;
}
```

3.3.3 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)

3.3.4 Enhanced 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>

3.3.5 Configuration of backup & restore to external TFTP

3.3.5.1 Create 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

3.3.5.2 Download 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

3.3.6Configuring 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 49: Device Information

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

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

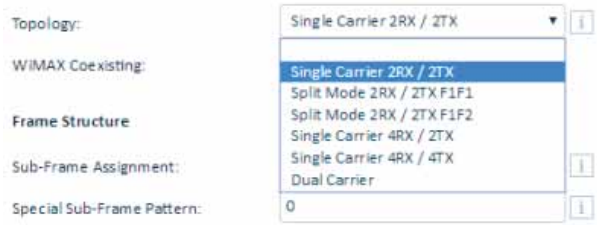


Figure 50: Device Capability

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

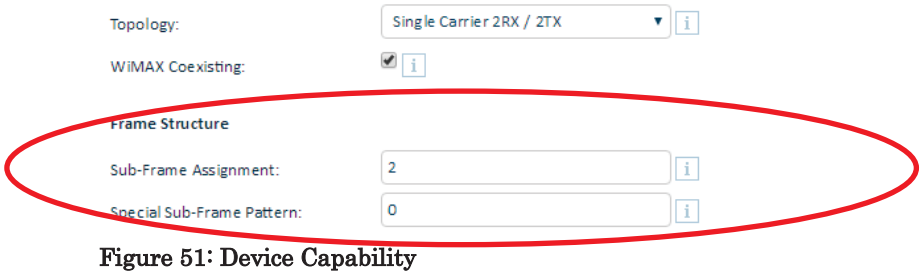


Figure 51: Device Capability

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

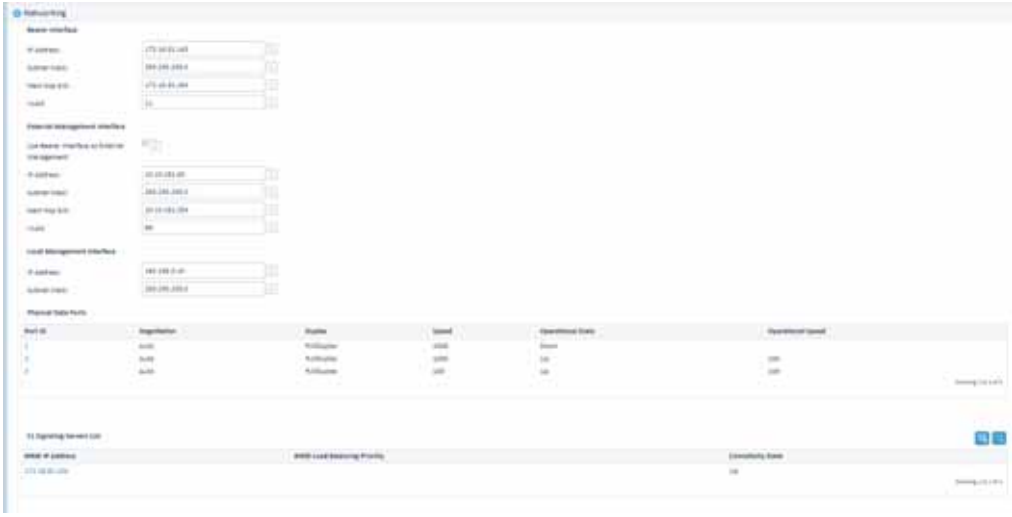


Figure 52: Device Networking Information

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

Figure 53: External Management Interface – 1

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

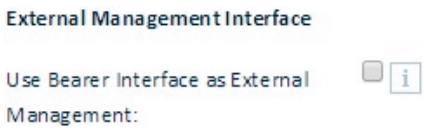


Figure 54: External Management Interface – 2

8 Define the cell configuration by:

43 Adding the PLMNID to the PLMN Identity List.

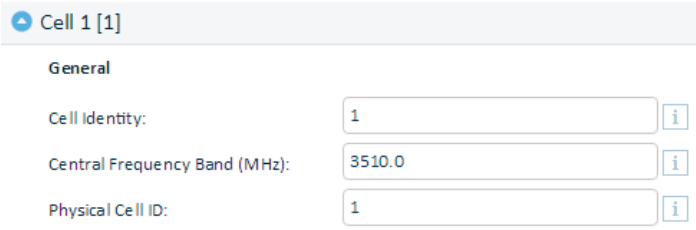
44 Setting the RAN Common parameters,

45 Setting the RAN RF parameters.

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

Figure 55: 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.

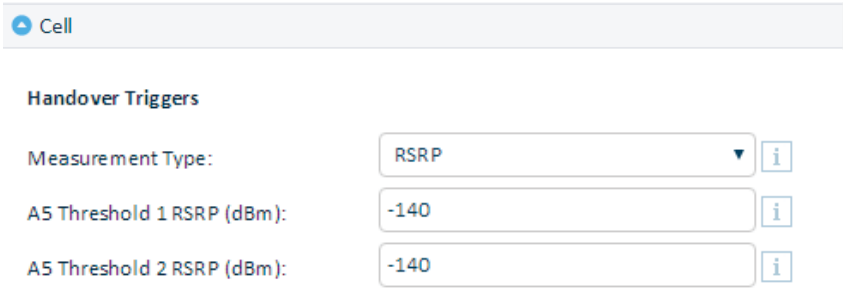


Figure 56: Handover Configuration –A5

50 Choose A3 triggers in the cell.

51 Defining A2 threshould and A3 offset

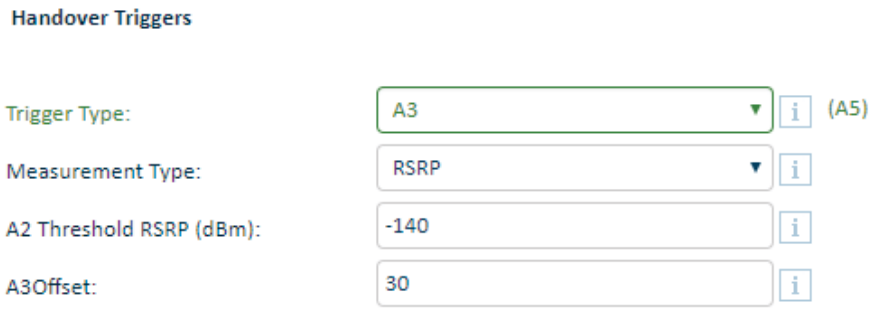


Figure 57: Handover Configuration –A3

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 58: 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.

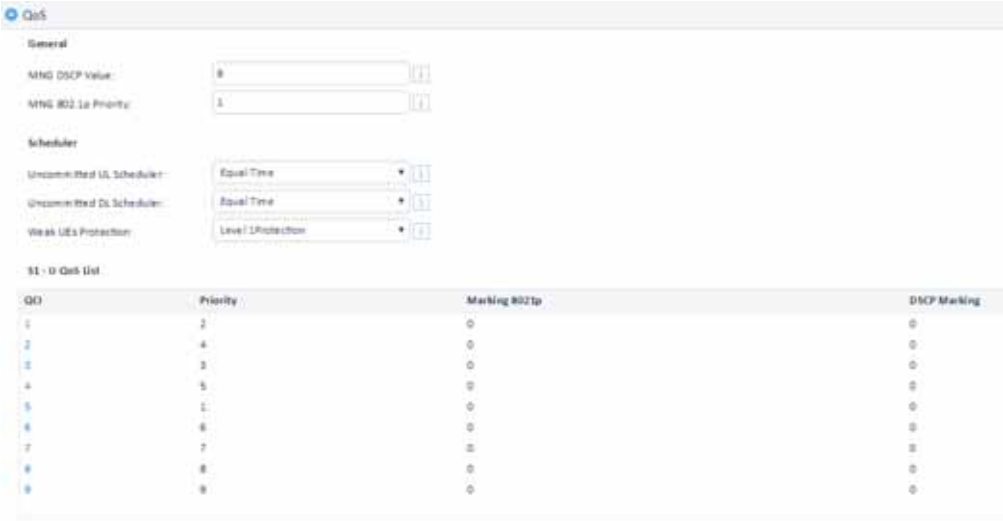


Figure 59: QoS Configuration – 1

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.

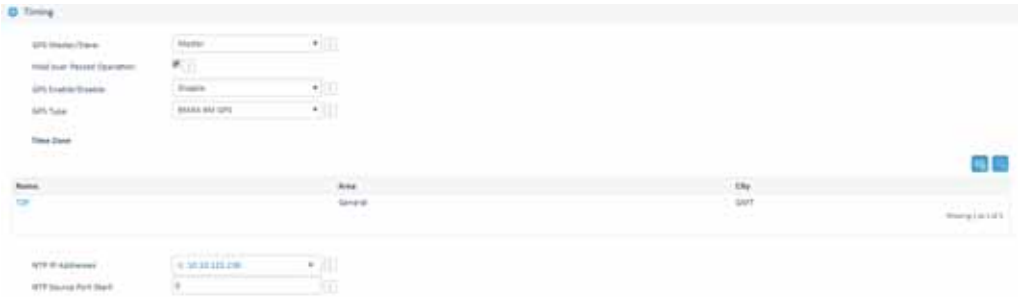


Figure 60: Timing Configuration

13 Click the

button.

The following window displays:

Figure61: Confirm Save

14 Click **OK** to confirm.

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

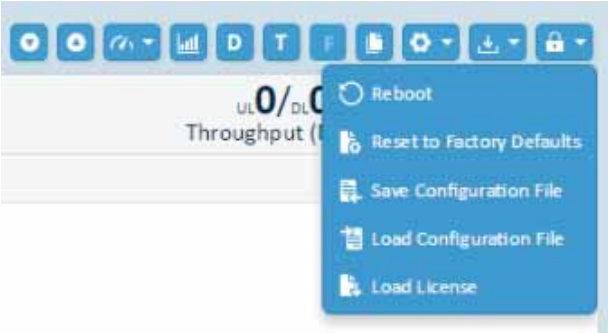


Figure 62: Actions Menu – Reset to Factory Defaults

The following window displays:

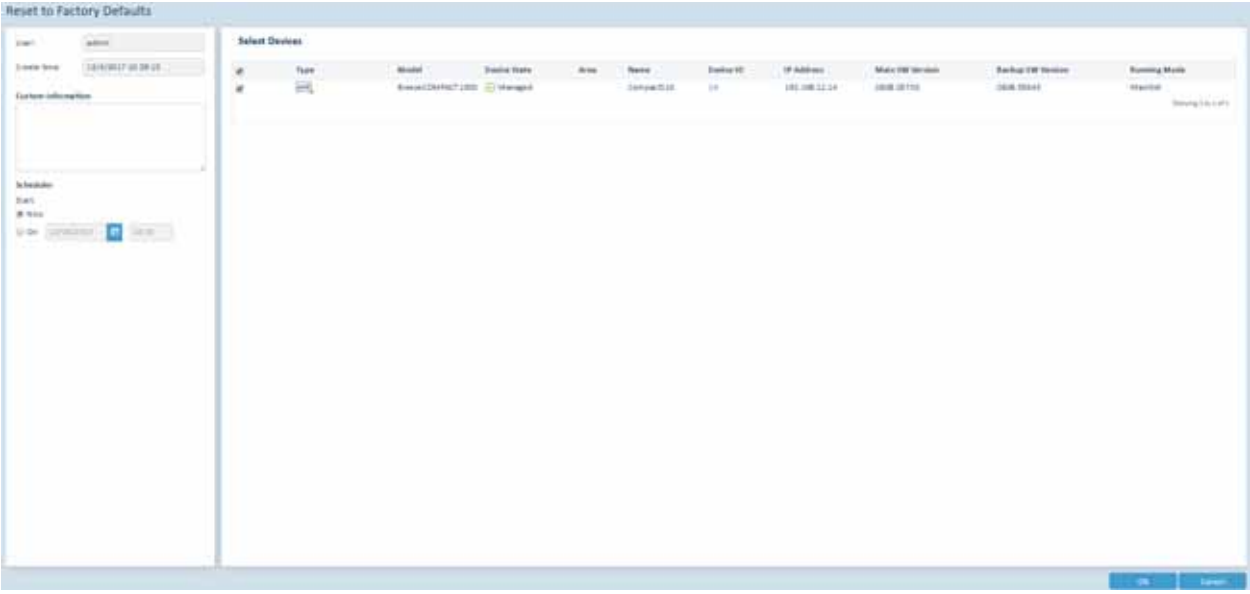


Figure 63: Reset Device

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.

3.4 Software Upgrade Via SSH

3.4.1Purpose

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

3.4.2Procedure

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

- **Preparing the TFTP Server,** page 92
- **Configuring the TFTP Server,** page 92
- **Copying the BreezeCOMPACT Software to the TFTP** Server, page 92
- **Loading a New Software Version to the Backup** Bank, page 92
- **Resetting the BreezeCOMPACT from the Backup Bank,** page 93
-
-
- **Setting the BreezeCOMPACT Version in the Backup Bank as the Main** Software Version, page 93

3.4.2.1Preparing 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.

3.4.2.2Configuring 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.

3.4.2.3 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**).

3.4.2.4 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
```

3.4.2.5 Resetting 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
```

3.4.2.6 Setting 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
```

3.5 Software Upgrade Via BreezeVIEW

3.5.1 Purpose

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

3.5.2 Procedure

Upgrading LTE software via BreezeVIEW involves performing the following steps:

- **Configuring TFTP as the BreezeVIEW IP** Address, page 95
- **Copying the BreezeCOMPACT Software to the TFTP** Server, page 95
- **Uploading the Software to a** Backup, page 95
- **Running the Software from a Backup** Version, page 97
- **Setting the Backup as the Main** Version, page 99

3.5.2.1 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.

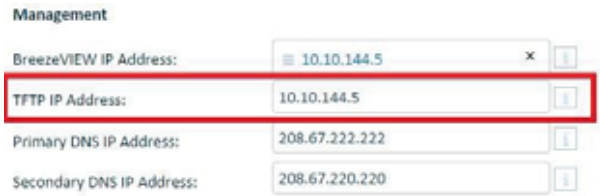


Figure 64: TFTP Server IP Address

3.5.2.2 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**).

3.5.2.3 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**.

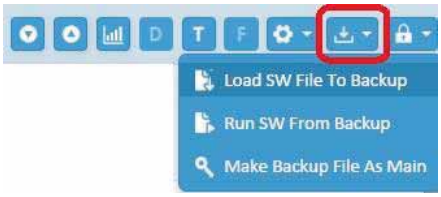


Figure 65: Actions Menu – Load SW File To Backup

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:

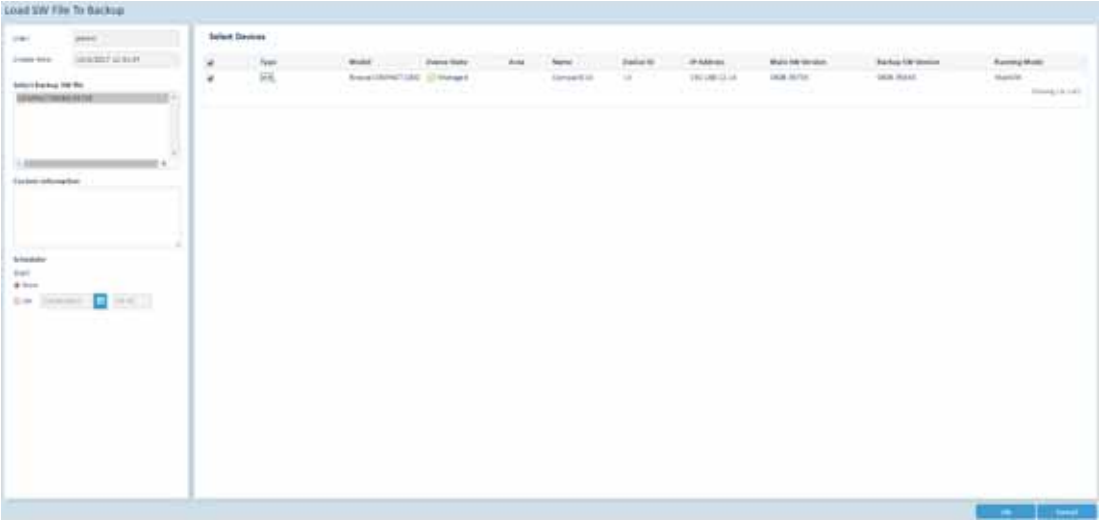


Figure 66: Load SW File to Backup Main Window

4 The following window displays:

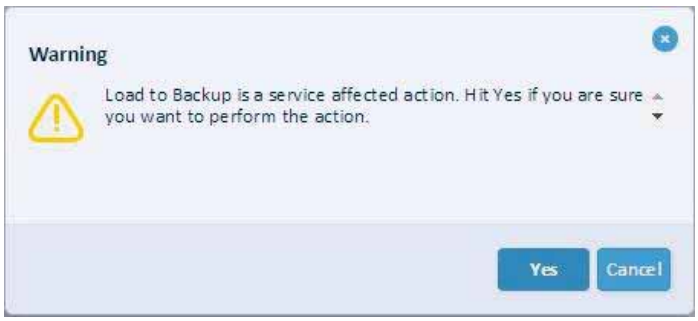


Figure 67: Warning – Load to Backup

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

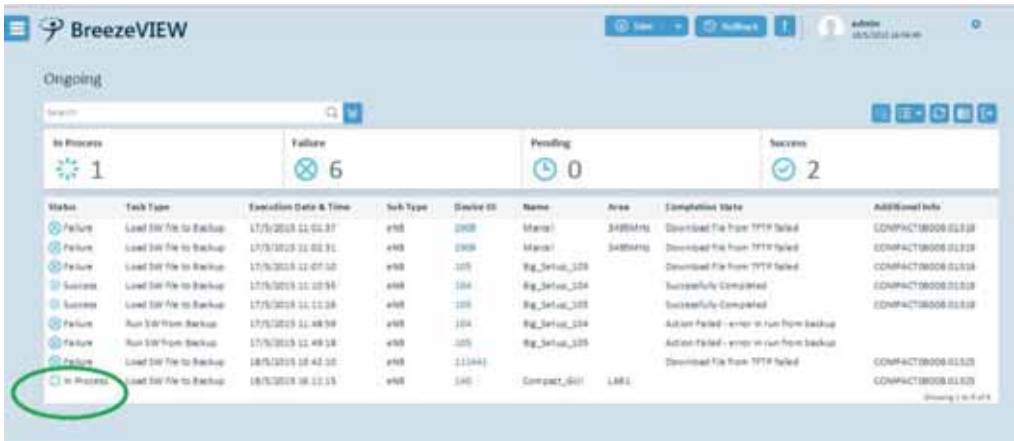


Figure 68: Ongoing Task – Load to Backup SW Version

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

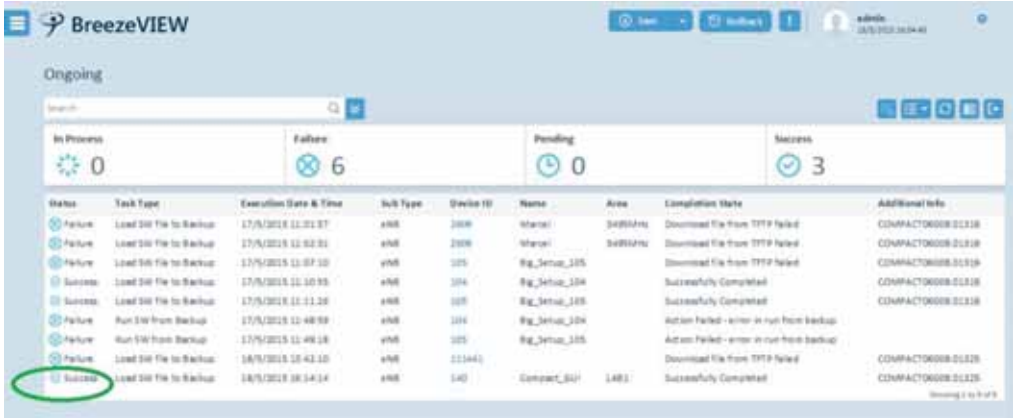


Figure 69: Ongoing Task – Successful

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

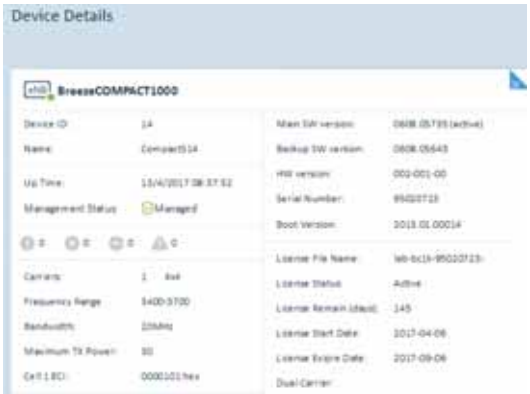


Figure 70: Device Details Window – Backup SW Version

3.5.2.4 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 71: SW Upgrade Menu – Run SW From Backup

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

Figure 72: Run SW from Backup Window

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

Figure 73: 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:

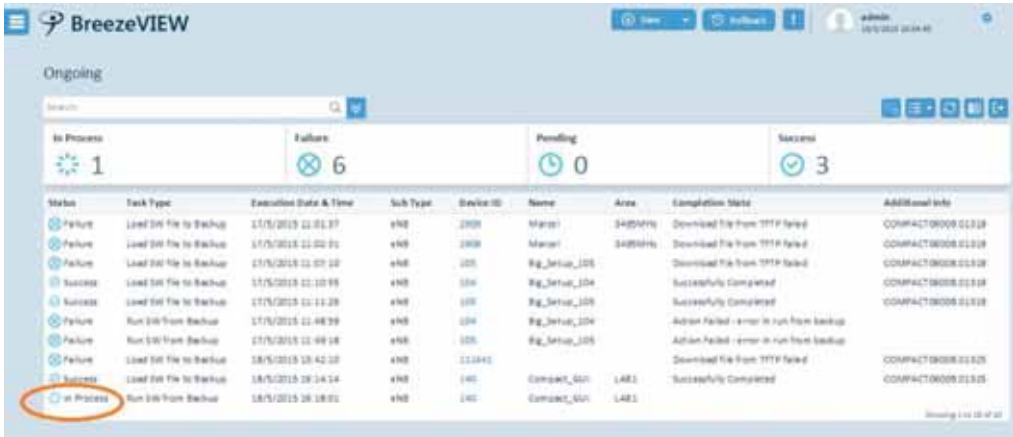


Figure 74: Ongoing Task – Run SW from Backup – In Process

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:

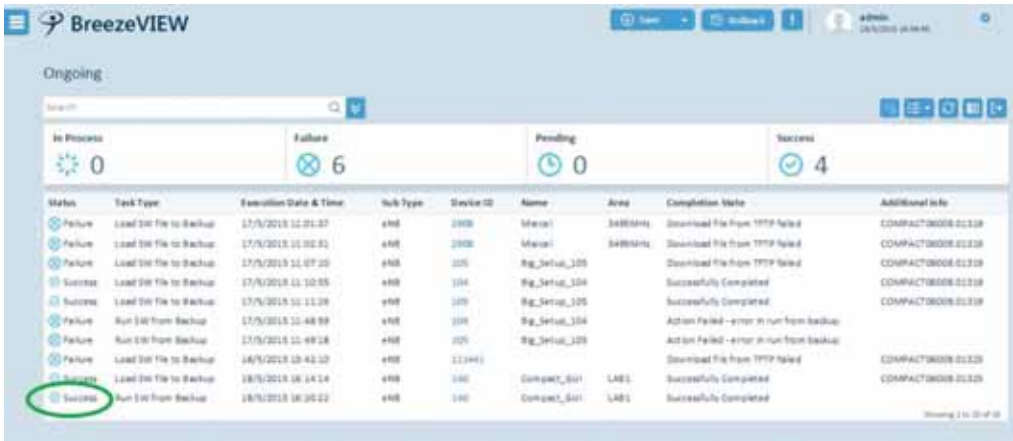


Figure 75: Ongoing Task – Run SW from Backup – Success

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

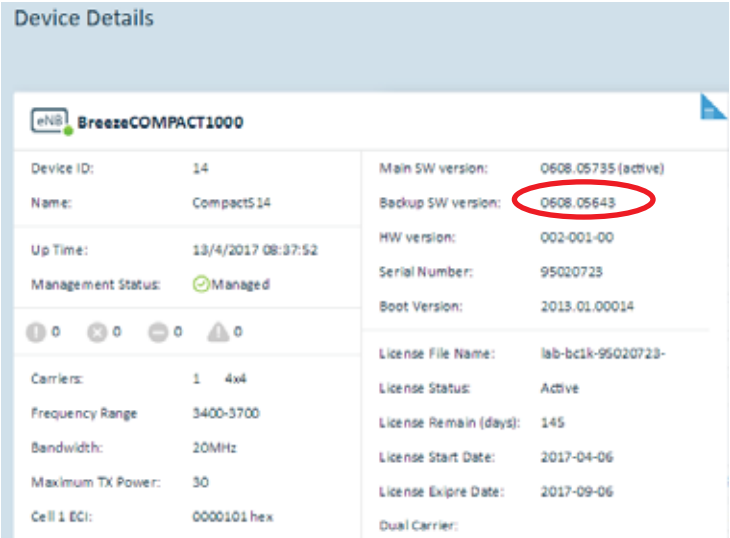


Figure 76: Device Details Window – Backup Software Version is Active

3.5.2.5 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**.

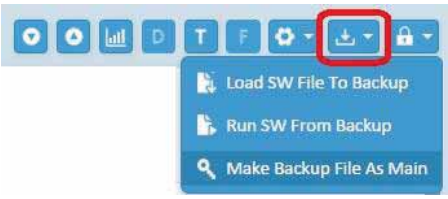


Figure 77: SW Upgrade Menu – Make Backup File As Main

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 78: Make Backup Software As Main Window

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

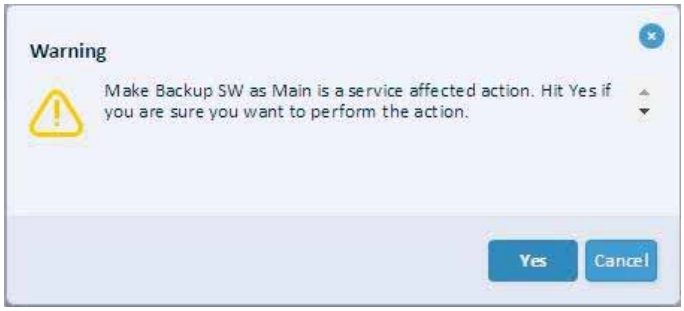


Figure 79: Warning – Make Backup SW as Main

The *Ongoing* window displays.

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

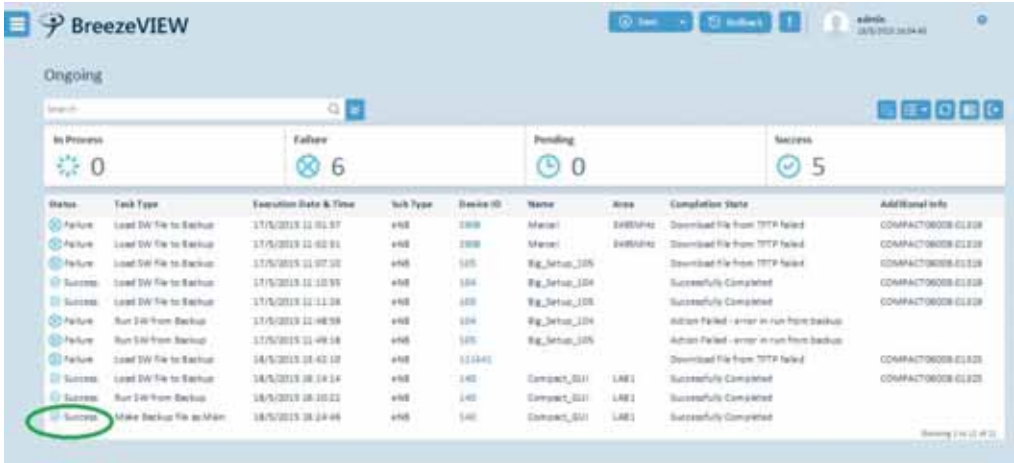


Figure 80: Warning – Make Backup SW as Main – Success

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:

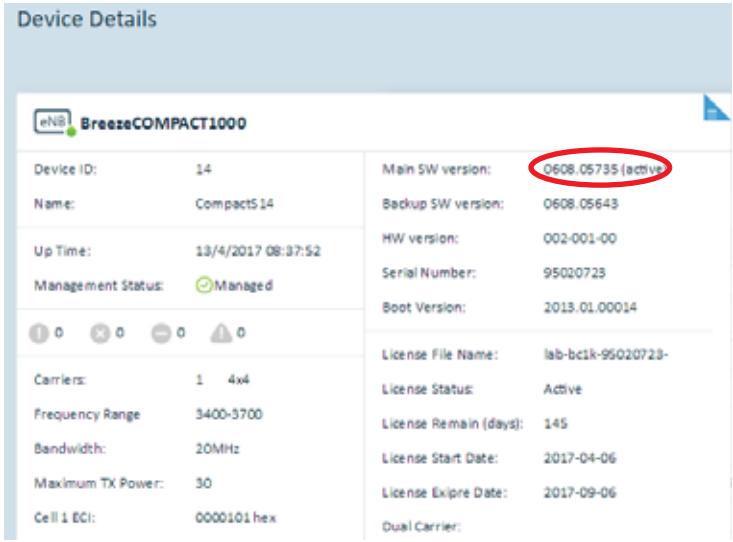


Figure 81: Main SW Version Activated

3.5.2.5.1 Software Upgrades and System Events

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

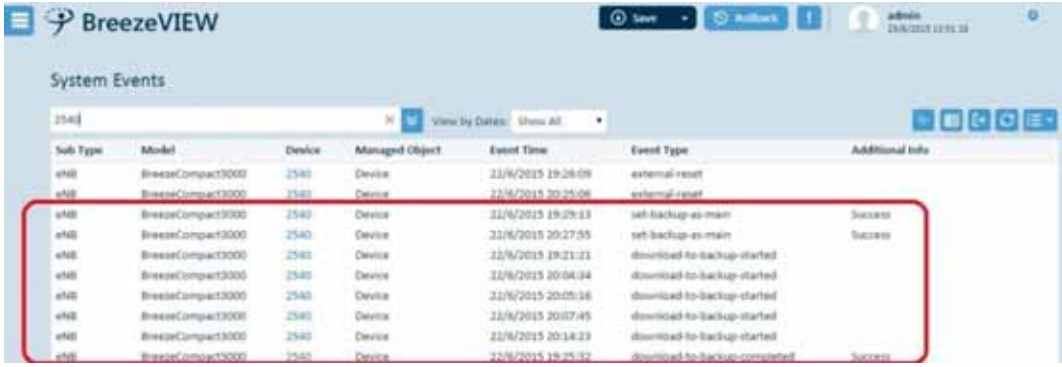


Figure 82: System Events Window

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.

3.6 Resetting BreezeCOMPACT to Its Factory Defaults

3.6.1 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.

3.6.2 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.

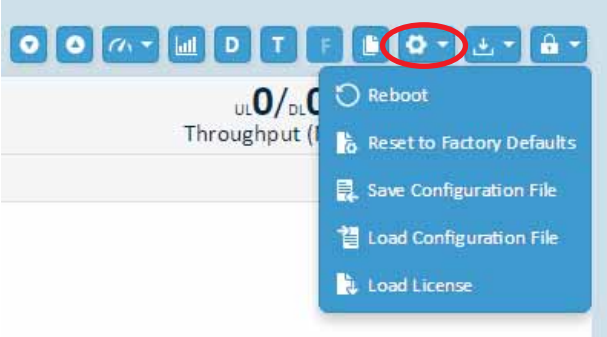
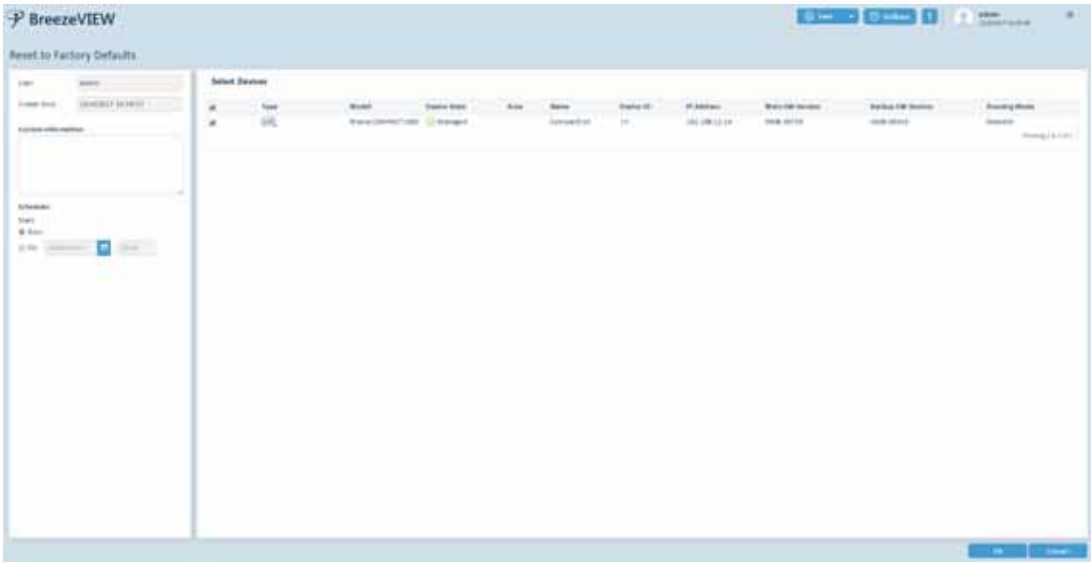


Figure 83: Set Factory Defaults

Press OK on the following window:



The following window displays.

Figure 84: 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.

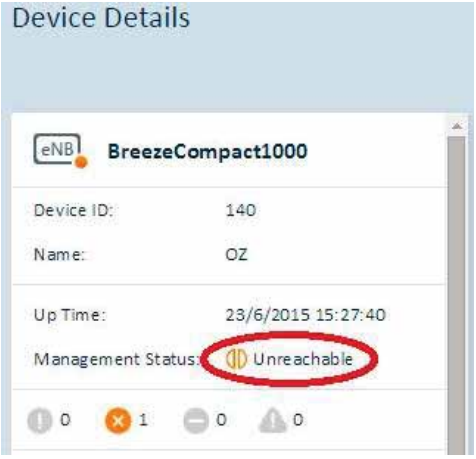


Figure 85: Management Status – Unreachable

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

3.7 Provisioning BreezeCOMPACT Using a Template

3.7.1 Purpose

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

3.7.2 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.

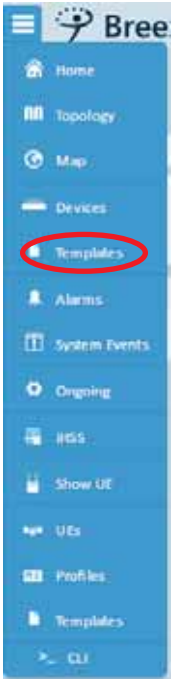


Figure 86: Selecting a Template

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

Figure 87: New Template

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

Figure 88: Template Details Window – 1

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

Figure 89: Templates Window

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

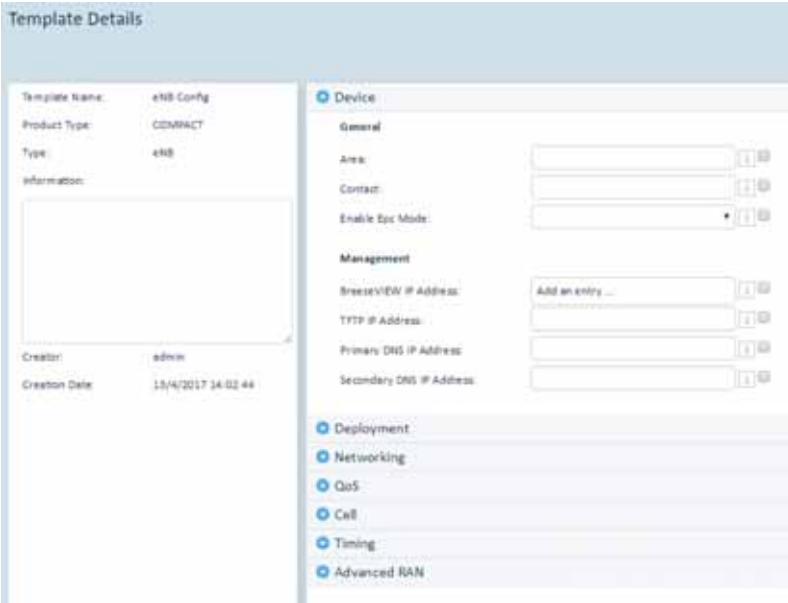


Figure 90: Template Details Window – 2

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 91: 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:

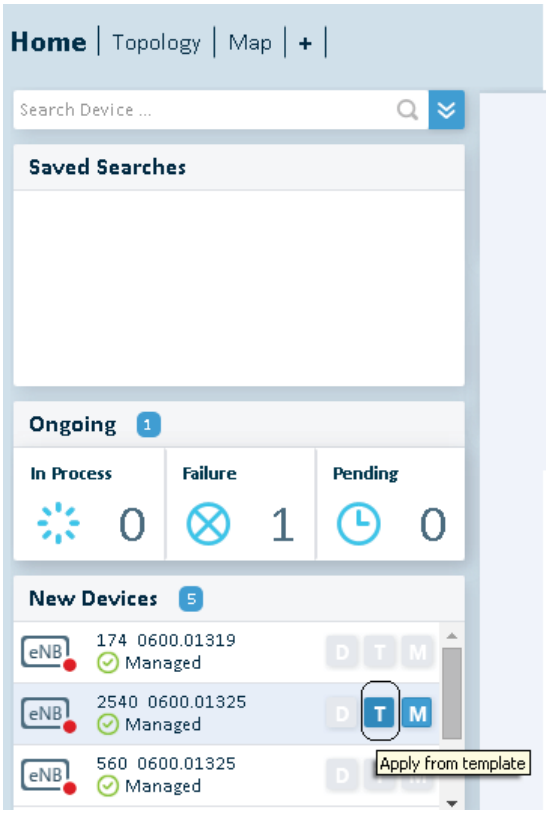


Figure 92: Apply From Template – New Devices Area of Home Page

The *Apply a Template* window displays:

Figure 93: 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 3.10.1, Locking and Unlocking a Device.

3.8 Locking and Unlocking a Device

3.8.1Purpose

This procedure describes how to lock and unlock a device.

3.8.2Procedure

The following are described in this section:

- **Locking a** Device, page 107
- **Unlocking and Synchronizing a** Device, page 108

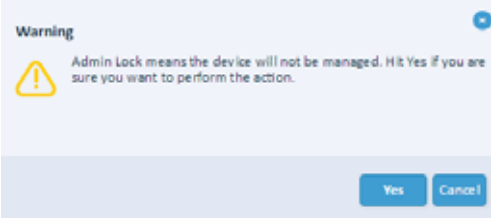
3.8.2.1 Locking a Device

➢ **To lock a device:**

1 Select a device in the *Devices* window.

2 Click the **Admin Actions** icon and select **Lock**.

Figure 94: Locking a Device

NOTE!	Alternatively, you can select a device in the *Device Details* window. The following will show up : 

3 Click the Yes button in order to apply locking .

After locking the device, the device is in the Admin Locked state. At this point, the device is no longer synchronized with BreezeVIEW and any changes made to the device on BreezeVIEW are not synchronized to the device.

Any changes made via are not synchronized with BreezeVIEW.

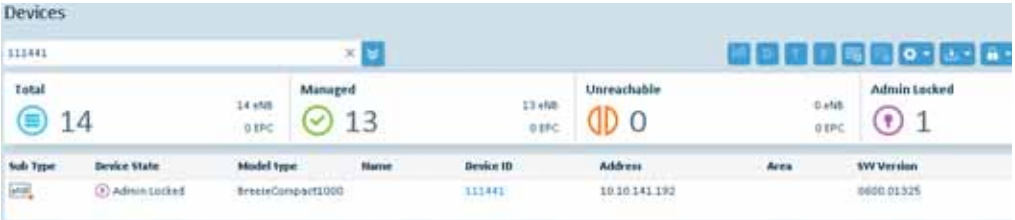


Figure 95: Locked Device

3.8.2.2 Unlocking and Synchronizing a Device

➢ **To unlock and synchronize a device:**

1 Select a locked device in the *Devices* window.

2 Click the **Admin Actions** icon and select **Unlock & Sync From Device**.

Figure 96: Unlock & Sync From Device

NOTE!		Alternatively, you can select a device in the *Device Details* window. As a result the following screen will show up : **Figure 84: Unlock & Sync From Device reset warning message on BREEZEVIEW**

3 Click the Yes button in order to apply the unlocking.

4 After unlocking the device, the device is in the **Managed** state. The device's parameters are shown in the GUI.

3.9 Rebooting BreezeCOMPACT from BreezeVIEW

3.9.1 Purpose

This procedure describes how to perform a BreezeCOMPACT Manual Reset operation from BreezeVIEW. Use this procedure to implement configuration changes or to resolve issues, when necessary.

3.9.2Procedure

➢ To perform a manual reset:

1 In the *Device Details* window or the *Devices* window, click the Device action button and then select **Reboot**.

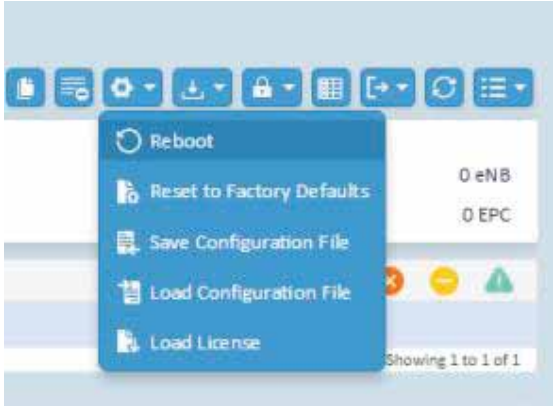
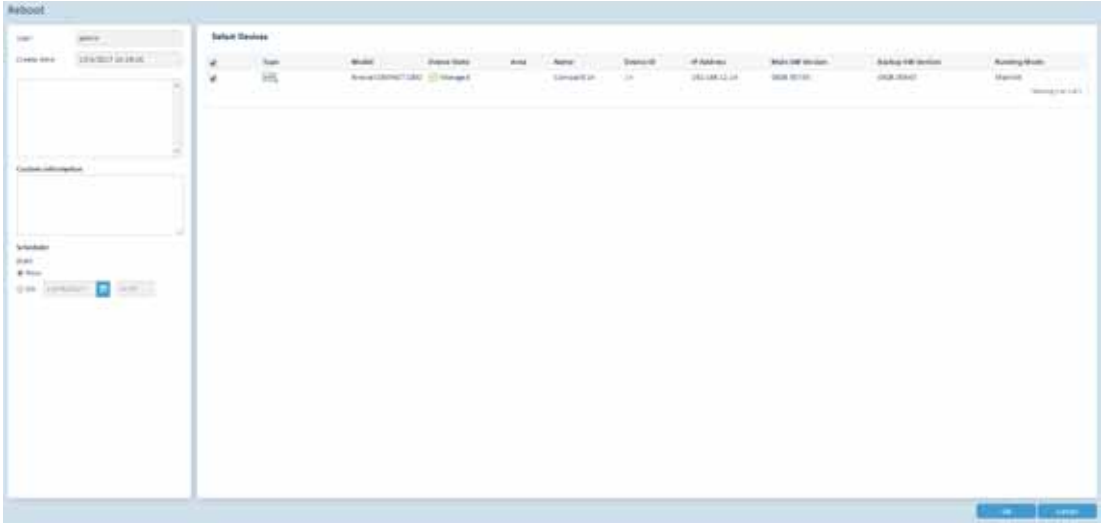


Figure 97: Reboot

Press OK on the following window



The following window displays:

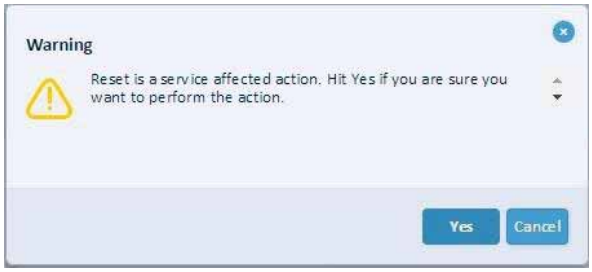


Figure 98: Warning – Reset

2 Click **Yes**.

The device begins the reset process and its **Management Status** changes to **Unreachable**, as shown below:

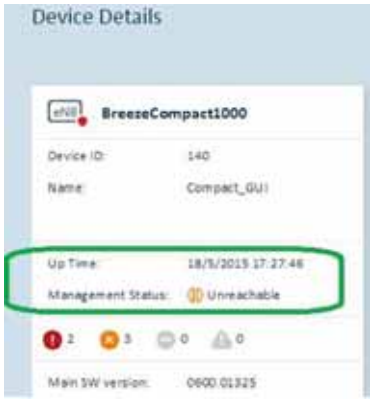


Figure 99: Device Details – Unreachable Management Status

After the device resets, its **Management Status** changes to **Managed** and its **Up Time** is updated.

Figure 100: Device Details – Managed Management Status

The reset event is listed in the *System Events* window, as shown below:

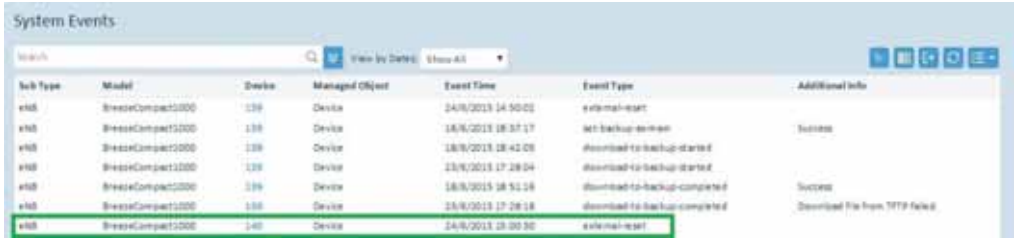


Figure 101: System Events Window – Reset

3.10 Spectrum Analyzer

3.10.1 Spectrum Analyzer Collection

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.

3.10.1.1 Spectrum 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

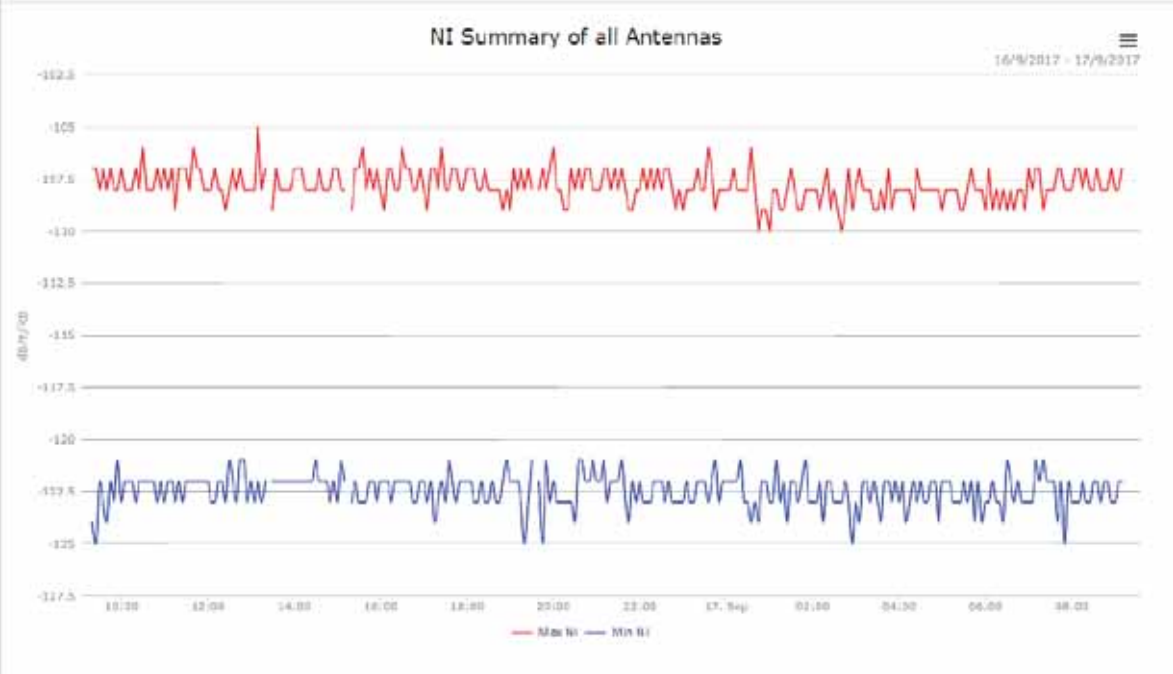


Figure 102: BREEZEVIEW -ENB Spectrum Analyzer Collection All Antennas

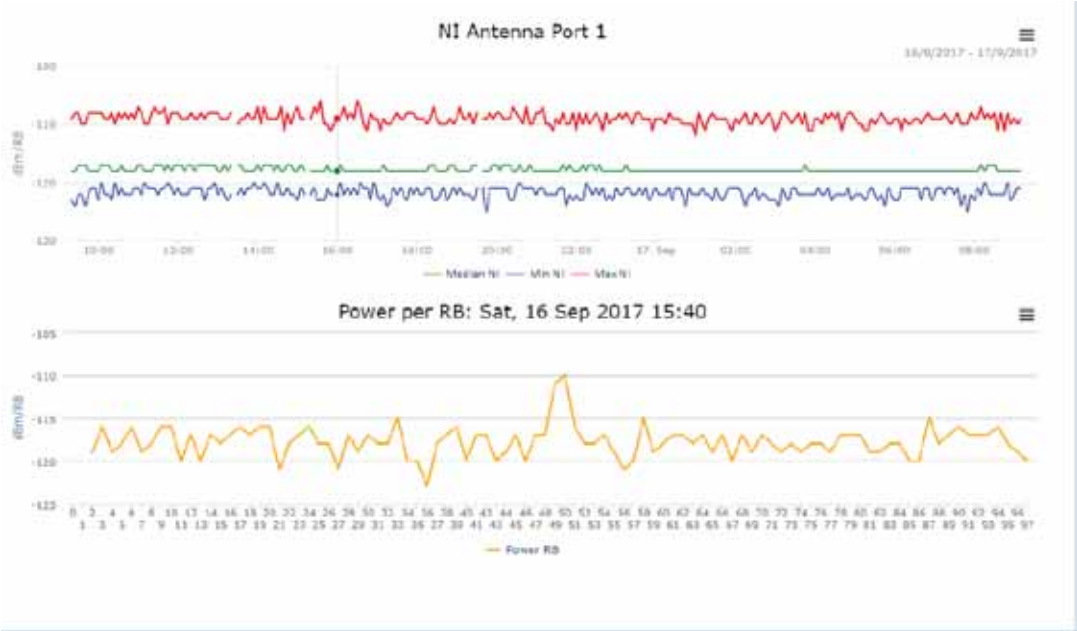


Figure 103: BREEZEVIEW -ENB Spectrum Analyzer Collection 1 Antenna

3.10.2 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.

3.10.2.1 Spectrum 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)

3.10.2.2 Spectrum 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

3.10.2.3 Enable / 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)

3.10.2.4 Start 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

3.10.2.5 Wait 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

3.10.2.6 See 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 104: BREEZEVIEW -ENB Spectrum Analyzer Range Frequency Scanning page

3.10.2.7 Disable 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:

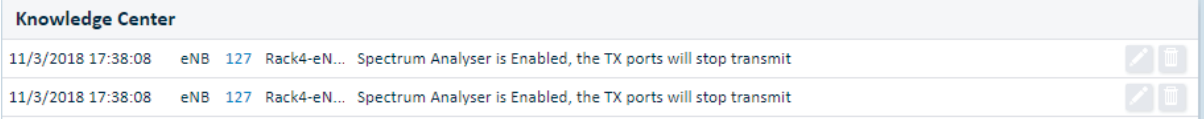
BreezeCompact> show spectrum-analyzer state spectrum-analyzer state

spectrum-analyzer-state spectrum-analyzer state Disable

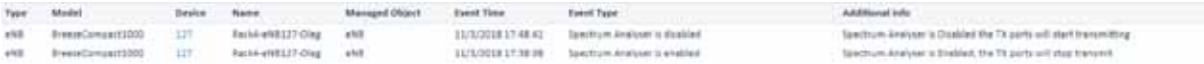
Figure 105: BREEZEVIEW – Spectrum Analyzer Disable

3.10.2.7.1 Spectrum analyzer events in BreezeVIEW

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



System event is raised for spectrum analyzer disable or enabled.



3.11 Performance Monitoring

3.11.1 Purpose

This procedure describes how to access and to use the Device Performance View in order to collect and view Key Performance Indicators (KPIs).

3.11.2 Procedure

For performance monitoring, measurements are collected at five-minute intervals.

The following are described in this section:

- **Accessing** KPIs, page 118
- **Using the Device Performance Graphical** Display, page 120
- **Exporting KPIs to** Excel, page 124
- **Selecting the Performance Display** Time, page 124
- **Printing and Saving** Charts, page 125

3.11.2.1 Accessing KPIs

➢ **To access KPIs:**

- To access KPIs, click the **Performance** button. The location of this button varies, depending on the window from which you make your selection, as follows:

70 From the *Device Details* window: Click the **Performance** button.

Figure 106: Accessing the KPI – Device Details Window

71 From the *Devices* window: Highlight a device and click the **Performance** button.

Figure 107: Accessing the KPI – Devices Window

Clicking the **Performance** button opens the Device Performance View. The opening window of the Device Performance View displays performance data for the eNodeB in a graph.

Each KPI graph displayed in the view's main window uses a fixed time span of 24 hours back from the current time.

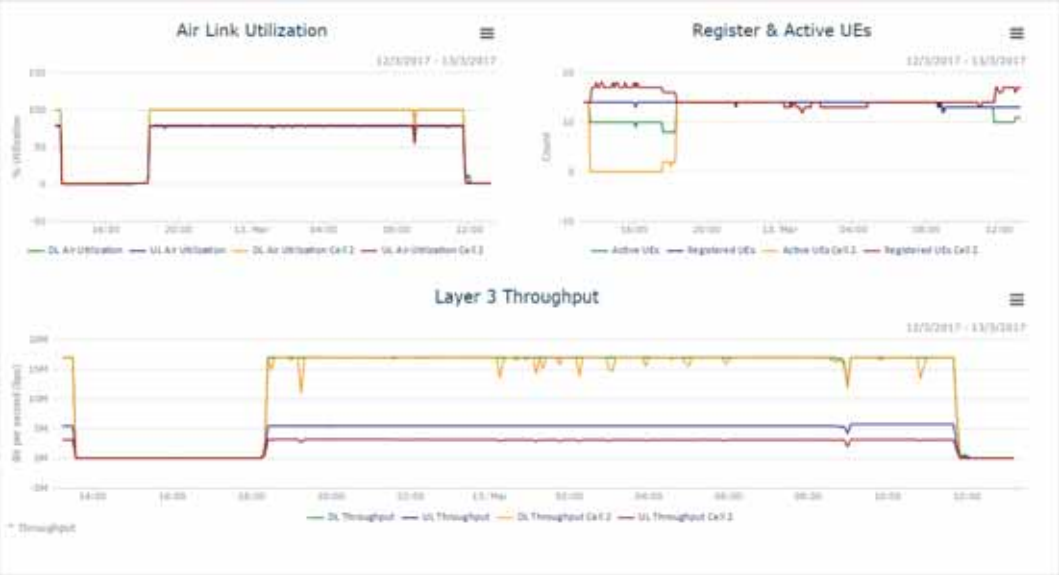


Figure 108: eNodeB Device Performance View

The top bar in the Device Performance View displays numeric values for basic KPIs, as shown below:

Figure 109: Basic KPIs

To exit the Device Performance View and return to the Single Device Configuration View, click the wrench button at the top right of the main display area.

3.11.2.2 Using the Device Performance Graphical Display

To access a specific KPI graph in the Device Performance View, click the dropdown menu to the right of the **Dashboard** button and then select the required KPI in the list.

Figure 110: Device Performance View Toolbar

The following KPI graphs are available:

- **Air Link Utilization,** page 121
- **Registered and Active UEs,** page 121
- **Layer 3 Throughput,** page 122

Each KPI graph contains the following elements:

- The KPI name as the graph header
- The displayed units and unit values on the Y axis
- The time indication on the X axis
- A legend located below the graph

Figure 111: Legend

Clicking an item in the legend removes that KPI from the graph. Clicking that item again returns it to the graph.

In all KPI graphs, you can position the cursor over a point on the line in the graph and then click the left mouse button to see the value of the parameters for that specific point in time.

3.11.2.2.1 Air Link Utilization Graph

Figure 112 shows the Air Link Utilization KPI graph.

Figure 112: Air Link Utilization Graph

3.11.2.2.2 Registered and Active UEs Graph

Figure 113 shows the Registered and Active UEs KPI graph.

Figure 113: Registered and Active UEs Graph

3.11.2.2.3 Layer 3 Throughput Graph

Figure 113 shows the Layer 3 Throughput graph.

Figure 114: Layer 3 Throughput Graph

3.11.2.2.4 Changing the Time Zoom

You can zoom in and zoom out on the X axis timeframe, as needed.

➢ To zoom in on the X axis:

- Position the cursor on the point in the graph in which you are interested. Click the left mouse button and then drag the mouse without releasing the button to the left or right, to zoom in or out, respectively. Then, release the mouse button.

Figure 115: Changing the Time Zoom – Before Releasing the Mouse Button

Figure 116: Graph View Zoom – After Releasing the Mouse Button

You can click the **Reset Zoom** button to return to the general graph view.

3.11.2.3 Exporting KPIs to Excel

KPIs can be exported to an Excel file, as needed.

➢ **To export KPIs to Excel:**

1 Click the **Export** button in the view toolbar to open the following window:

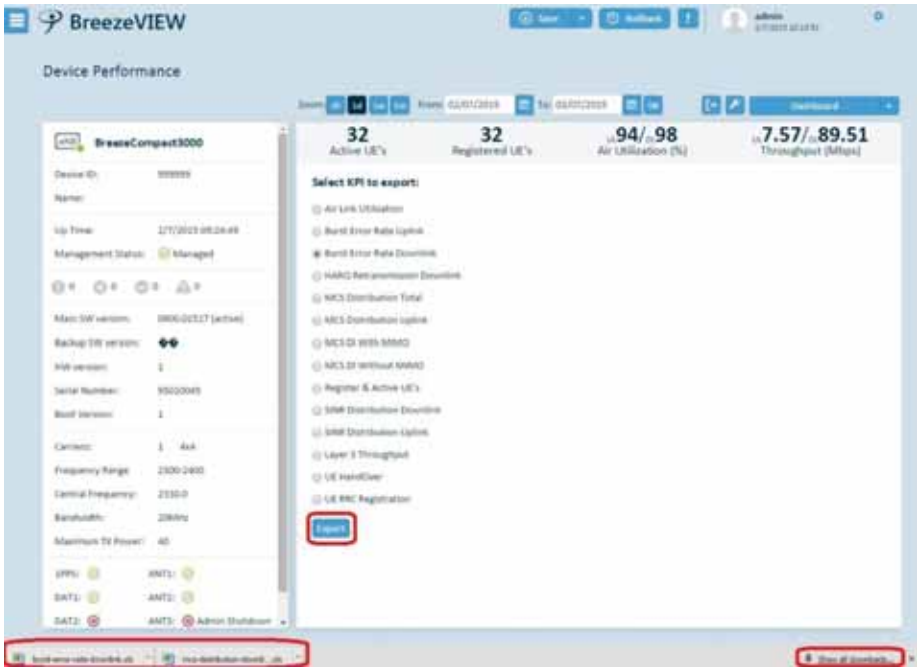


Figure117: Export Window

2 Select the radio buttons for the KPIs you want to export.

3 Specify the time frame, as described in Section 3.11.2.4, Selecting the Performance Display Time.

4 Click **Export**.

3.11.2.4 Selecting the Performance Display Time

You can specify the time span for the view using the following buttons in the view toolbar:

Figure 118: Time Span Selection

- 2h: Displays two hours back from the current time
- 1d: Displays one day from back from the current time
- 1w: Displays one week back from the current time
- 1m: Displays one month back from the current time

When specifying the time frame for the graph, use the **From/To** dates to specify the dates for the graph, in whole days.

Figure 119: From/To Dates

3.11.2.5 Printing and Saving Charts

The **Chart** button, which is located at the top right of each graph, enables you to perform the following operations:

Figure 120: Chart Button

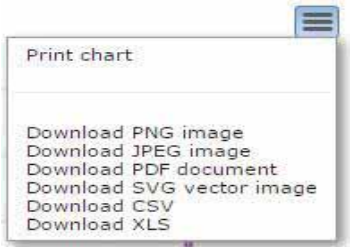


Figure 121: Chart Context Menu

- Download the graph as a PNG image
- Download the graph as a JPEG image
- Download the graph as a PDF document
- Download the graph as an SVG vector image
- Download the graph to a CSV file
- Download the graph to an XLS file

3.11.3 Performance KPIs Description

The performance KPIs are displayed and exported in BreezeVIEW. The KPIs are collected within the sampling period (every five minutes) and stored in the BreezeVIEW database.

Table 3-3: Performance KPIs

#	KPI Report	Unit	Description	Calculation	Guidelines
1	Air Link Utilization	Percent (%)	Air link utilization enables the actual consumption of the air resource during the sampling period to be analyzed. The calculation is based on the actual consumption of the air frame resource blocks (RBs) as a percentage of the number of RBs available for data transport. The utilization is presented separately for the DL and the UL.	100 * (Used RBs) / (Potential RBs per channel BW)	This important KPIs to track the system load over time especially in peak hours.
2	Registered and Active UEs	Count	This report presents the following information: ■ **Number of Registered UEs:** All UEs that are registered to the eNodeB (RRC connected) ■ **Number of Active UEs:** UEs that are currently using and occupying sector resources (meaning those that have DL and/or UL data packets)	Count Active and Idle UEs	This report presents a snapshot of the number of registered and active UEs within the sampling period. It can be used for over-subscription validation.
3	Layer 3 Throughput	Bps	Average eNodeB traffic over the collection period for both DL and UL (IP layer, excluding LTE MAC overheads)	Number of bits / (sampling period)	
4	Packet Error Rate (PER) Downlink	Percent (%)	Each transport block carrying one or more packets has a retransmission (HARQ) mechanism, After the maximum number of retransmissions is exceeded, the packet is considered as a packet with errors.	Number of DL packet errors / total number of bursts within the sampling period	Can be used to explore (TCP) throughput degradation issues (if the PER ratio is high).

#	KPI Report	Unit	Description	Calculation	Guidelines
5	Packet Error Rate (PER) Uplink	Percent (%)	Each transport block carrying one or more packets has a retransmission (HARQ) mechanism, After the maximum number of retransmissions is exceeded, the packet is considered as a packet with errors.	Number of UL packet errors / total number of bursts within the sampling period	Can be used to explore (TCP) throughput degradation issues (if the PER ratio is high).
6	MCS Distribution Downlink – With MIMO	bps	This report presents the actual transferred bits per DL MCS for MIMO within the sampling period.	Bits / second per DL MCS (Modulation)	BreezeCOMPACT Rate Adaptation selects the MCS (modulation) to be used in the DL and UL. The throughput is maximized according to various considerations, such as the channel condition of the UEs. The report may help to understand issues related to low-modulation CPEs, in order to improve deployment spectral efficiency.
7	MCS Distribution Downlink – Without MIMO	bps	This report presents the actual transferred bits per DL MCS without MIMO within the sampling period.	Bits / second per DL MCS (Modulation)	The report may help to understand issues related to low-modulation CPEs, in order to improve deployment spectral efficiency.
8	MCS Distribution Downlink – Total	bps	This report presents the actual transferred bits per DL MCS within the sampling period.	Bits / second per DL MCS (Modulation)	The report may help to understand issues related to low-modulation CPEs, in order to improve deployment spectral efficiency.
9	MCS Distribution Uplink	bps	This report presents the actual transferred bits per UL MCS within the sampling period.	Bits / second per DL MCS (Modulation)	The report may help to understand issues related to low-modulation CPEs, in order to improve deployment spectral efficiency.

#	KPI Report	Unit	Description	Calculation	Guidelines
10	SINR Distribution Downlink	Ratio	Downlink Signal-to-Interference-plus-Noise ratio (SINR) distribution is based on a Channel Quality Indication (CQI) report by the UE to the eNodeB. UE measurements are made on the DL. The higher the CQI value (from 0 to 15) reported by the UE, the higher the modulation scheme (from QPSK to 64QAM) and the higher the coding rate used by the eNodeB to achieve better efficiency.	Ratio of CQI index consumption within the sampling period	
11	SINR Distribution Uplink	Ratio	UL SINR is measured by the eNodeB, based on the UL. The report presents the ratio of SINR distribution on the UL, from -10dB to 40dB, in 1dB steps.	Ratio of UL SINR per dB	
12	HARQ Retransmis-sion Downlink	Ratio	A Hybrid Automatic Repeat Request (HARQ) is used for error corrections on the PHY level, enabling short retransmission periods and improved performance. Depending on the QCI configuration of the HARQ retransmission, after a number of HARQ retransmissions, the burst is considered as an error to the upper layers. The DL HARQ retransmission is reported from *Zero* retransmissions to *Above Four* retransmissions.	Ratio per number of retransmis-sions	
13	UE RRC Registration Procedure	Count	A UE registration procedure is done every time the UE attempts to connect to the system. This report measures the number of successful and failed registrations.	Count of total (successful and failed) registration attempts	The report may enable the operator to identify network-level issues with failed registrations, which should be very low.
14	UE Handover	Count	A UE handover is the process of the UE moving from one eNodeB to another. This report counts the UE handovers within the sampling period.	Count UE Handover successful and failed attempts	The report may enable the operator to identify network-level handover activity, in order to assist with network optimization.

Chapter 4: Events and Alarms

In This Chapter:

- **Alarm Introduction,** on page 130
- **Alarm Severities,** on page 130
- **Handling Alarms and Events Using the CLI,** on page 131
- **Handling Alarms and Events Using BreezeVIEW,** on page 132
- **BreezeCOMPACT – System Events,** on page 133
- **BreezeCOMPACT – Alarms,** on page 133

4.1 Alarm Introduction

The system supports the following event and alarm notification categories. The numbers in parentheses indicate the alarm type:

- **alarmNotification (1):** An Alarm Notification is a persistent indication of a fault. An alarm is said to be:

Set (or raised) when a fault is first detected and is administratively enabled.

Cleared when a fault is first noticed to have ceased or is administratively disabled.

- **systemEventNotification (2):** A System Event Notification indicates an event that is of interest to the operator of the management system, but is not indicating any failure of the system or part of it. As such, system events only carry information. They are not assigned with a severity, and are not cleared by any mechanism.
- **configurationChangeNotification (3):** A Configuration Change Notification indicates an event related to a configuration change. In general, configuration change notifications are issued by the device as a result of any configuration change performed on any managed object. This can be done by either the element management system or by any other management entity (for example, the CLI). The configuration change notification data also includes the nature of the change (Create/Delete/Modify). In some cases, more than one notification type may be issued due to a single event. For example, creating a new managed object that is not yet installed generates a configuration change notification and an alarm notification.

4.2 Alarm Severities

The Event Severity Value (eventSeverityValue) indicates how the managed object (MO) has been affected by the alarming event. It represents the severity of the alarm, as perceived by the MO.

The Object Severity Value (objectSeverityValue) indicates the overall perceived severity level of the MO at the moment the alarm message was issued.

The severity levels defined in the system are in accordance with ITU-T Rec X.733, and are as follows. The numbers in parentheses indicate the severity level:

- **Cleared (1):** The Cleared severity level indicates the clearing of one or more previously reported alarms. This alarm clears all alarms for this MO that have the same alarm type, probable cause and specific problems (if given).
- **Indeterminate (2):** The Indeterminate severity level indicates that the severity level cannot be determined.
- **Critical (3):** The Critical severity level indicates that a service-affecting condition has occurred and an immediate corrective action is required. Such a severity may be reported, for example, when an MO becomes totally out of service and its capability must be restored.
- **Major (4):** The Major severity level indicates that a service-affecting condition has developed and an urgent corrective action is required. Such a severity may be reported, for example, when there is a severe degradation in the capability of the MO and its full capability must be restored.
- **Minor (5):** The Minor severity level indicates the existence of a non-service-affecting fault condition and that corrective action should be taken in order to prevent a more serious (for example, service affecting) fault. Such a severity may be reported, for example, when the detected alarm condition is not currently degrading the capacity of the MO.
- **Warning (6):** The Warning severity level indicates the detection of a potential or impending service-affecting fault, before any significant effects have been felt. Action should be taken to further diagnose (if necessary) and correct the problem in order to prevent it from becoming a more serious service-affecting fault.

4.3 Handling Alarms and Events Using the CLI

Each system event record includes the event time, severity, event name and event short description.

➢ To view alarms and events:

- Run the following command:

show notification stream alarms.

➢ To monitor alarms/events:

- Run the following command:

show notification stream alarms last <positiveInteger>

➢ To view alarms/events that occurred during a certain time period:

- Run the following command:

show notification stream alarms from <date> to <date>

4.4 Handling Alarms and Events Using BreezeVIEW

➢ **To handle alarms and events using BreezeVIEW:**

1 To view alarms:

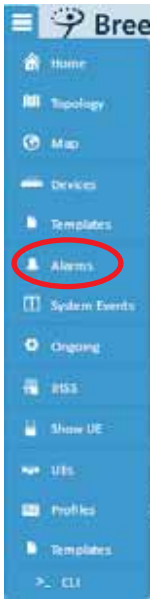
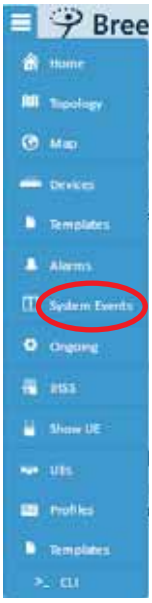


Figure 122: BreezeVIEW – Alarms

2 To view events:



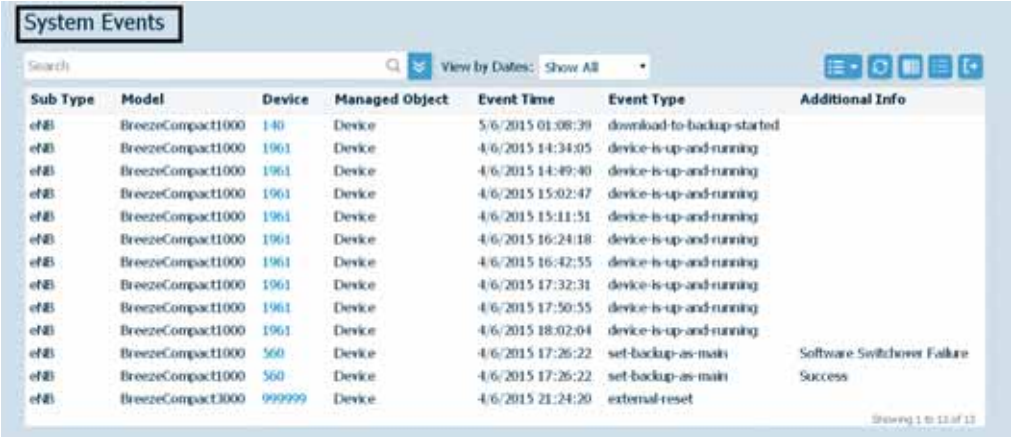


Figure 123: BreezeVIEW – System Events

4.5 BreezeCOMPACT – System Events

Table 4-1 describes the system events supported in the current release.

Table 4-1: BreezeCOMPACT System Events

No.	Event Name	Description	Guideline
1	External Reset performed	the user commit a device reset	
2	Internal reset performed	the device committed a reset	
3	SW upgrade - Load SW file to backup started	SW upgrade process is started	
4	SW upgrade - Load SW file to backup completed	SW upgrade process is completed	
5	Make backup file as primary performed	Set backup SW as main performed	

No.	Event Name	Description	Guideline
6	Device is Up and Running	The device is Up and available	The event is raised when the device is up and running after being initialized. This event must be the first one issued after initialization completes.
7	Upload Device Configuration File started	Upload Device Configuration File is started	
8	Upload Device Configuration File completed	Upload Device Configuration File is completed	
10	Download Device Configuration File started	Download Device Configuration File is started	
11	Download Device Configuration File completed	Download Device Configuration File is completed	
12	Upload Device Logs Files started	Upload Device Logs Files is started	
13	Upload Device Logs Files completed	Upload Device Logs Files is completed	
14	Spectrum Analyzer Enabled	The spectrum analyzer is enabled, the Tx ports will stop transmit	The system events triggers together with Critical alarms TX shut-down
15	Spectrum Analyzer Disabled	The spectrum analyzer is disabled the Tx ports will start transmitting	

4.6 BreezeCOMPACT – Alarms

Table 4-2 describes the alarms supported in the current release.

Table 4-2: BreezeCOMPACT Alarms

Alarm Name	Severity	Alarm Description	Problem Cause/Guideline
Device High Temperature	Critical	The device temperature is too high.	
SW Upgrade, Run from Backup Failure	Minor	A failure occurred while booting up using the backup image residing in the device flash.	
SW Upgrade, Set as Main Failure	Minor	A failure occurred while trying to set the backup image as the main image.	
Device Connection Lost	Minor	BreezeVIEW lost connection with the device.	The event is detected and initiated by BreezeVIEW upon detecting a link failure with a unit.
Data Port is down	Critical	Connectivity with Data port has been lost.	should be raised only on connection change, from connected to lost connection

Alarm Name	Severity	Alarm Description	Problem Cause/Guideline
RH Hardware Failure	Critical	The RH detected an internal hardware problem. The alarm is issued on a specific hardware port.	For radio hardware failures, the system raises an alarm specifying the cause and automatically restarts. If the issue appears again, contact Telrad support for further assistance. You will need to provide the complete alarm information. For alarms related to the environment, do the following: Temperature: Ensure that the unit is working in accordance with the product's permitted temperature. VSWR: Ensure proper installation, cabling, and connections. In addition, ensure that there are no obstacles or obstructions affecting the antenna.
GPS Communication Failure	Major	Communication failure with the GPS receiver.	Recheck the GPS cable connectivity. Ensure that the CAT5 cable is properly installed.
GPS Lock Not Achieved	Major	Failed to *lock*. No traffic is provided when *not locked*.	
External 1 PPS Input Failure	Major	The device lost its 1PPS signal input.	When BreezeCOMPACT gets GPS synchronization from another BreezeCOMPACT unit (for example, GPS chaining), the signal may be lost. Verify proper cable installation and make sure that the master unit is working properly with GPS.
TX Clock Holdover Timer Expired	Critical	Clock holdover for Tx shut-down timer expired. The unit stopped transmitting.	The unit alerts first for a *Clock Holdover Entered* event after timer expiration (several hours), and then stops transmitting. Ensure that GPS is properly installed.
Clock Holdover Timer Expired	Major	Clock Holdover Timer Expired, Failure of the internal source	

Alarm Name	Severity	Alarm Description	Problem Cause/Guideline
Clock Holdover Entered	Major	The unit entered Clock Holdover mode because it is not receiving the 1PPS signal.	PS may have difficulties of receiving satellites. Try to improve the GPS installation and make sure that it is properly installed with a clear sky and no obstacles. Note: The system is fully functional for several hours when entering Holdover mode. After GPS reception is improved, the system clears the alarm.
Synthesizer Error	Critical	Synthesizer internal hardware problem was detected. The unit stopped transmitting.	Contact Telrad support for further assistance.
Tx Power Shut Down	Critical	Tx power shut down.	A Tx power shutdown may result due to multiple reasons, such as a Radio Head failure or a user-initiated shutdown. In case Spectrum Analyzer is enabled, Tx shutdown will be performed automatically. Contact Telrad support for further assistance.
Authenticator Communication Timer Expired	Major	Authenticator communication timer expired.	
Excess Number of MSs (UEs)	Minor	The number of UEs in an active operation state served by the cell exceeded the threshold.	
High UL Median Noise	Minor	The UL median noise level represents the median value of the noise floor histogram. If the measured UL median noise level exceeds the value calculated as the target noise, a noise alarm is generated.	Interference may result in high UL noise. Proper analysis of the deployment is needed, in case this alarm is triggered inconsistently.
DCS Channel Busy	Major	Measured noise level is exceeded the threshold (DCS), the channel declared as 'busy'	For BreezeCOMPACT deployed in the US/Canada in 3.65GHz unlicensed band, DCS is required. This alarm indicate channel busy which requires the operator to move to different frequency. Clear alarm condition: when the NI is 3 dB below the "Channel Busy NI Level" Threshold value, the channel declared as cleared

Alarm Name	Severity	Alarm Description	Problem Cause/Guideline
SCTP link failure	Critical	Alarm raised when SCTP communication link fails and cleared when SCTP connection is restored	

Chapter 5: Licensing Mechanism

In This Chapter:

- **Licensing introduction,** on page 117
- **Licensing Prerequisites,** on page 117
- **BreezeVIEW Licensing Related Operations,** on page 118
- **CLI License Operations,** on page 123

5.1 Licensing introduction

As of Release 6.8 all Telrad LTE equipment, including BreezeCOMPACT, must be loaded with license file (Certificate) in order to be operational.
Per each shipped or already deployed specific hardware unit (Unique Serial Number) a dedicated license will be required which will enable all the purchased features.
The license Certificate files will be supplied by Telrad
An HW without loaded certificate will not be operational but will remain manageable (locally and remotely) for configuration and license certificate loading via the following means:

- BreezeVIEW – From the BreezeVIEW to all the network elements in a single operation
- CLI – Directly to a single HW

The license certificate includes the following data:

- Certificate expiration date
- Licensed features that have been purchased

5.2 Licensing Prerequisites

Before upgrading BreezeCompact to Release 6.9 the following prerequisites should be verified:

* Timing - Each BreezeCOMPACT must include a working GPS module and configured with a reachable and valid NTP server IP
* TFTP server – every HW should be configured with BreezeVIEW IP as TFTP IP address (or if working without BreezeVIEW – the correct TFTP IP address in which the license certificates are placed)
* License Certificates – Customer needs to receive from Telrad license certificates for the devices that are being upgraded.

5.3 BreezeVIEW License related Functionality

License nearing expiration alerts – escalating alerts seen in BreezeVIEW Alarms view as expiration date approaches

5.3.1 License Distribution to HW

Transfer the license certificates to the BreezeVIEW machine and place them in the following directory - /opt/lte/Data/license

In BreezeVIEW R6.9 open devices view and highlight the R6.9 devices still not uploaded with license

Press 'Device Action' button on top right of the devices list and choose 'Load License' (bottom) option

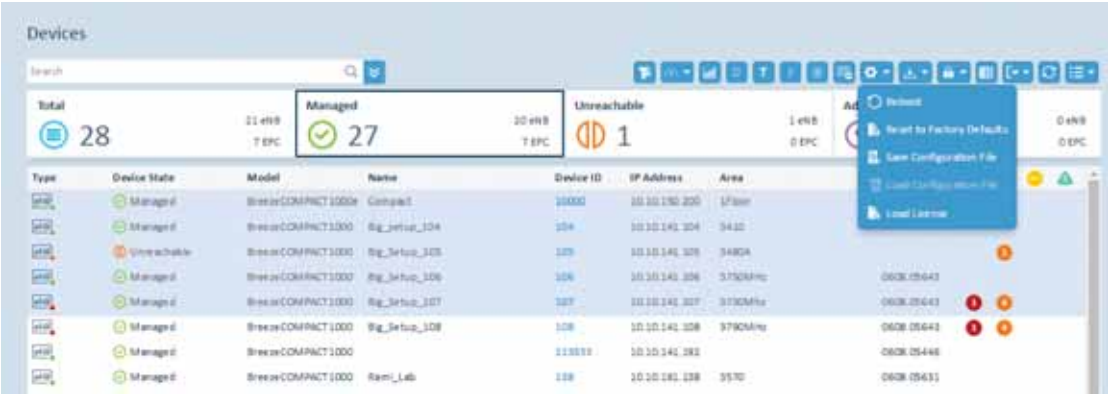


Figure 124: Devices view with highlighted devices to be licensed

In the opened 'Load License File' form verify the correct devices are present and click 'ok'

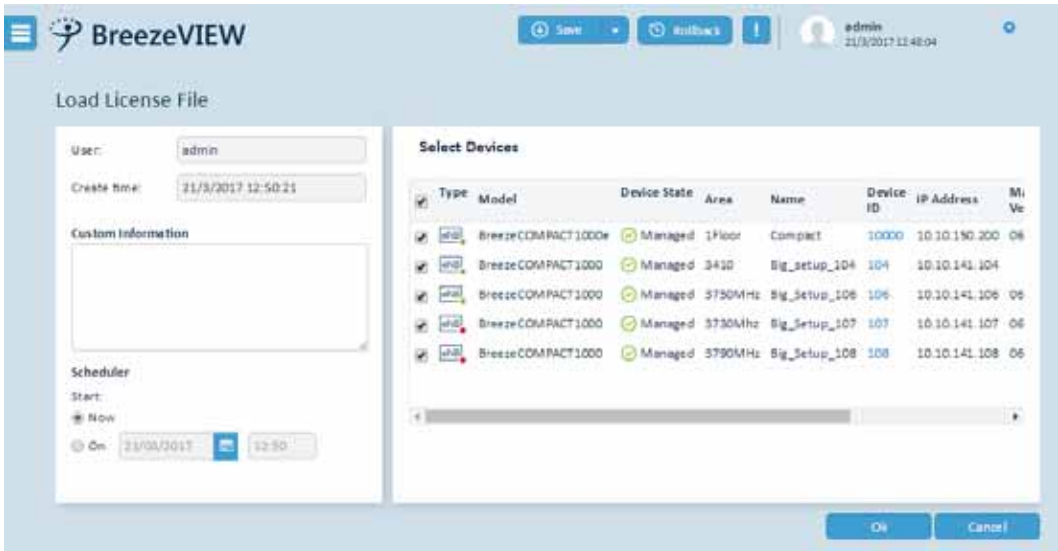


Figure 125: Load License File form

Reply 'yes' to the opened warning notification

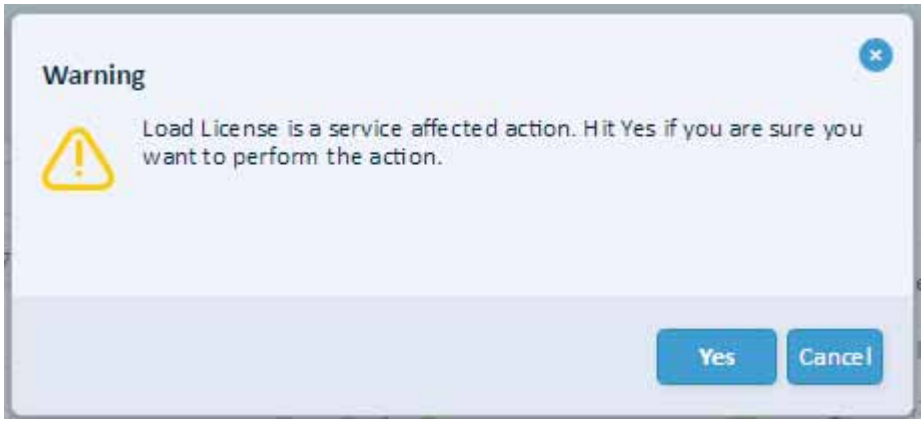


Figure 126: License loading warning frame

The 'Ongoing' view will open, verify operations for all chosen devices have completed successfully (unlike what is seen in the enclosed screenshot)

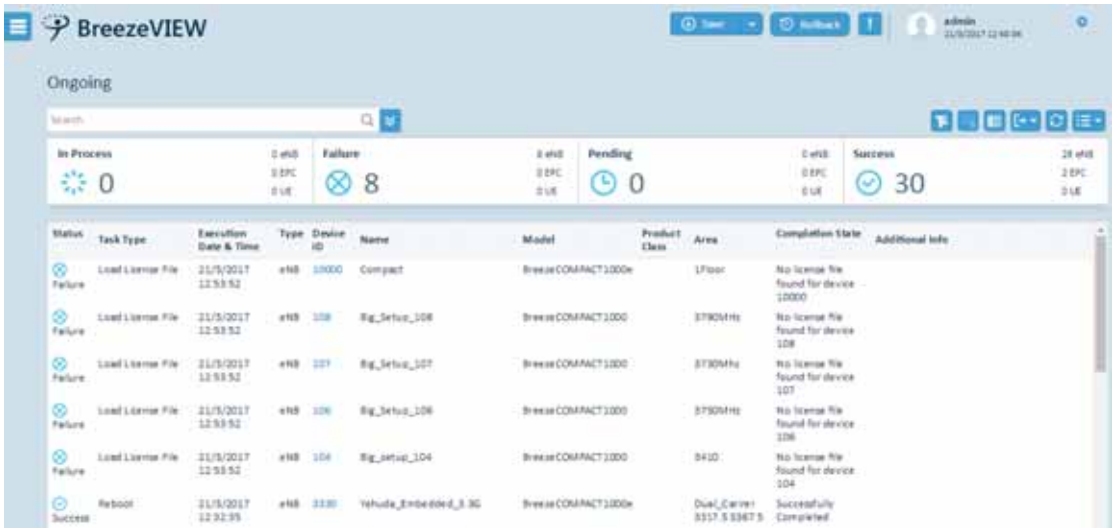


Figure 127: Ongoing task view (in this example - with failed license loading operations)

5.3.2 License Status View per Single HW

To check/verify General license status of an LTE device enter the configuration screen of this device and expand the left read-only pane by pressing the triangle on the left pane right upper corner

NOTE: this view does not detail the license content per device

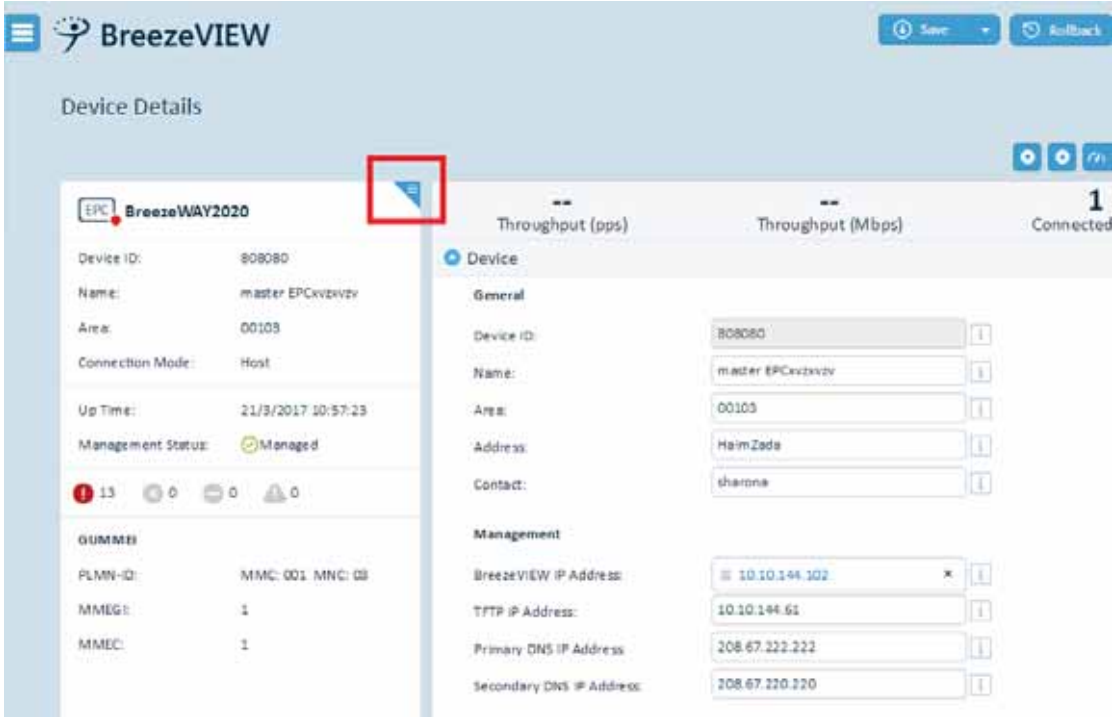


Figure 128: closed left pane without license info

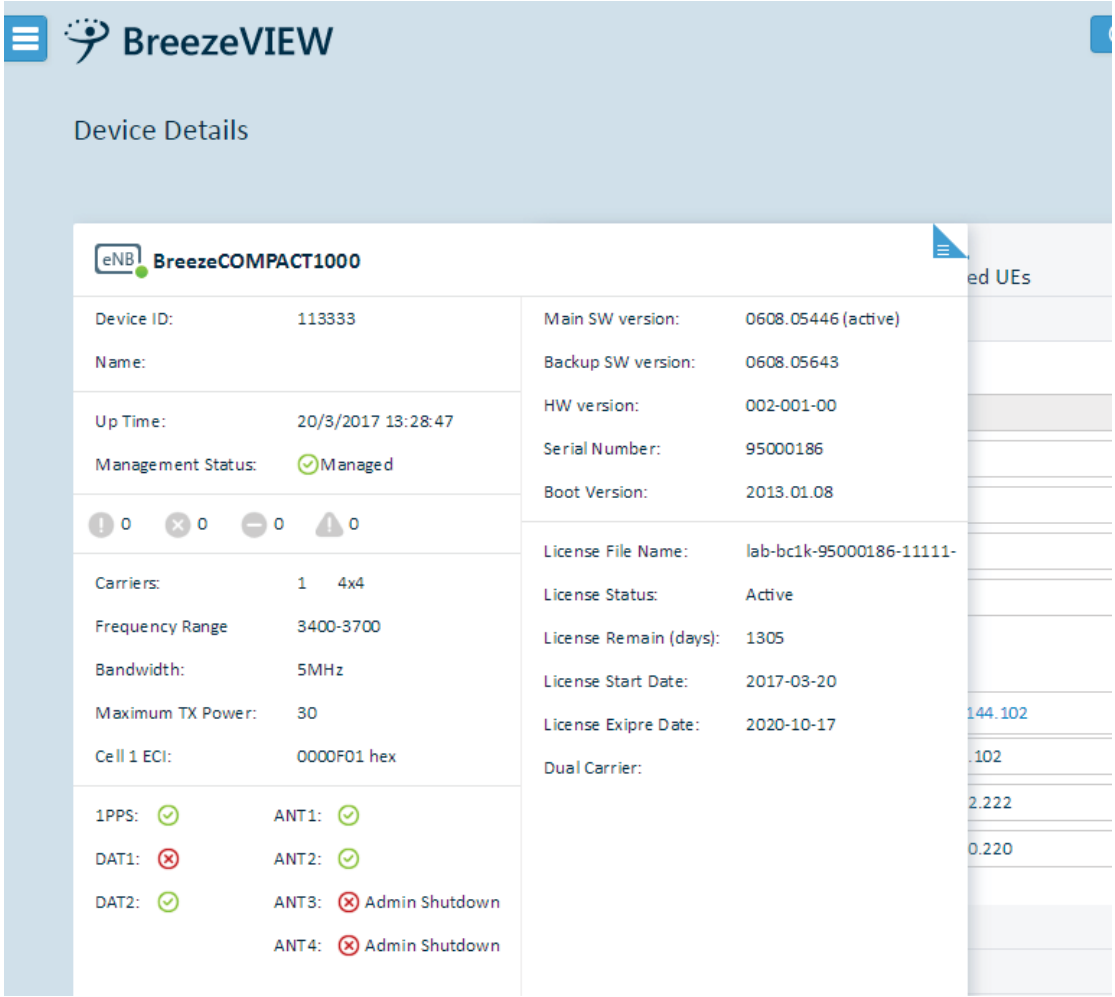


Figure 129: expanded left pane with license info

5.3.3 License inventory Display per network

To view/export the detailed license status of all devices in the network use the 'Device Licensing' option in the 'Network View' area

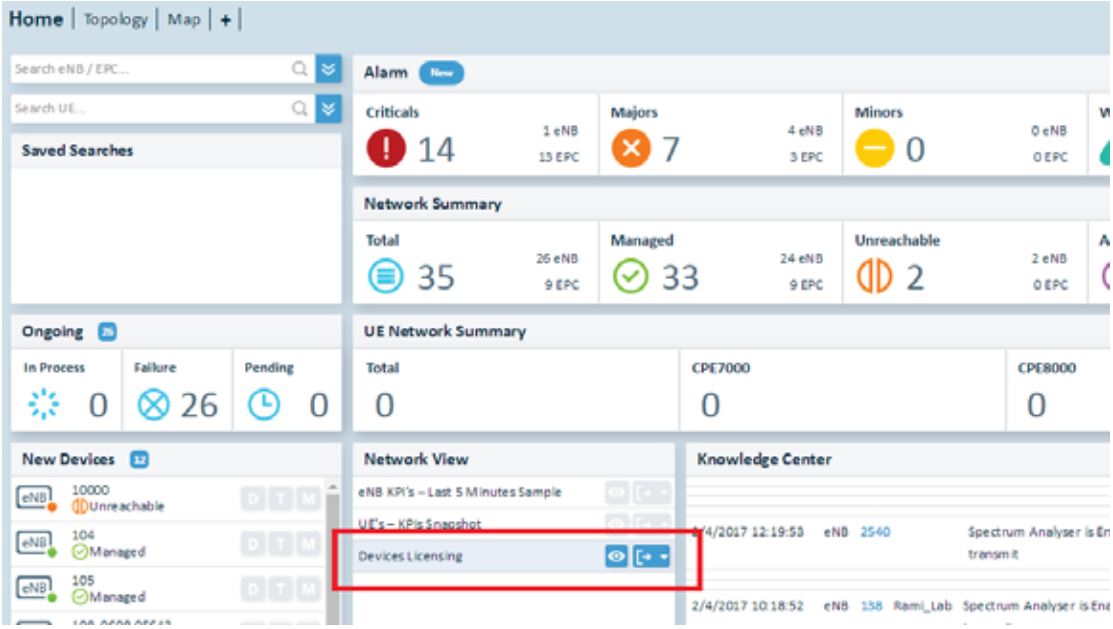


Figure 130: Device licensing controls

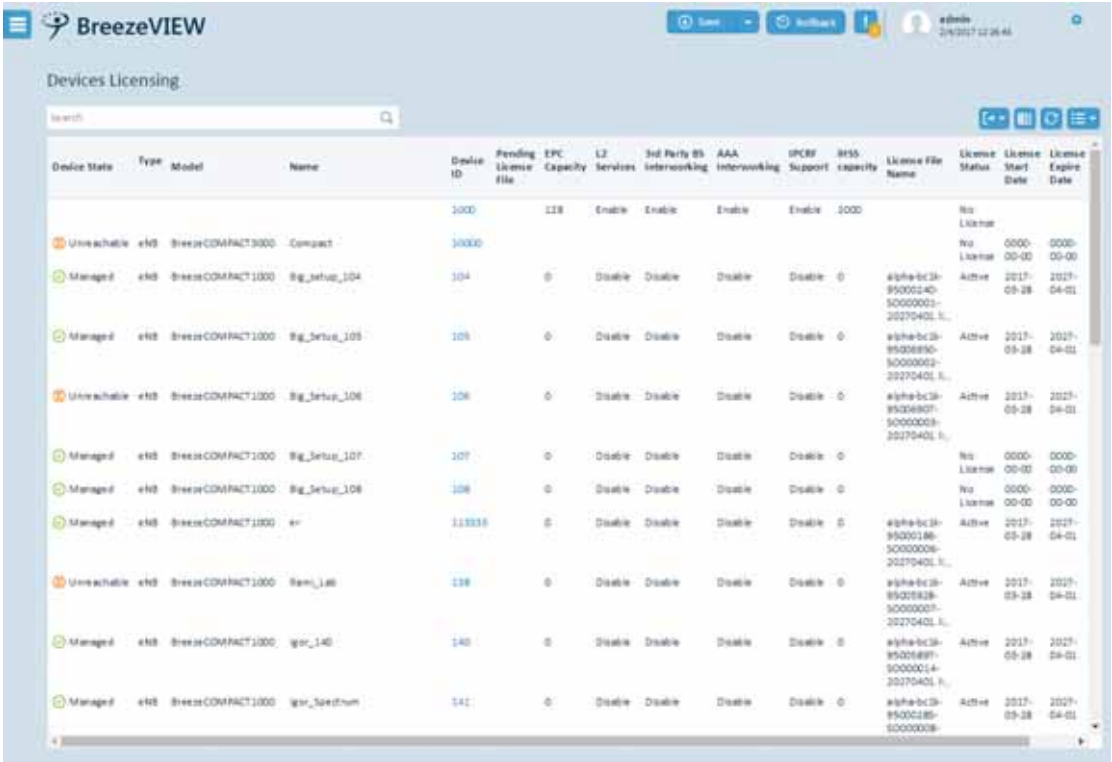


Figure 131: Device Licensing view

5.3.4 License Related Alarms

In BreezeVIEW open Alarms view, enter 'license' as search word.

The display will include devices with expired license or license nearing expiration (needs renewing).

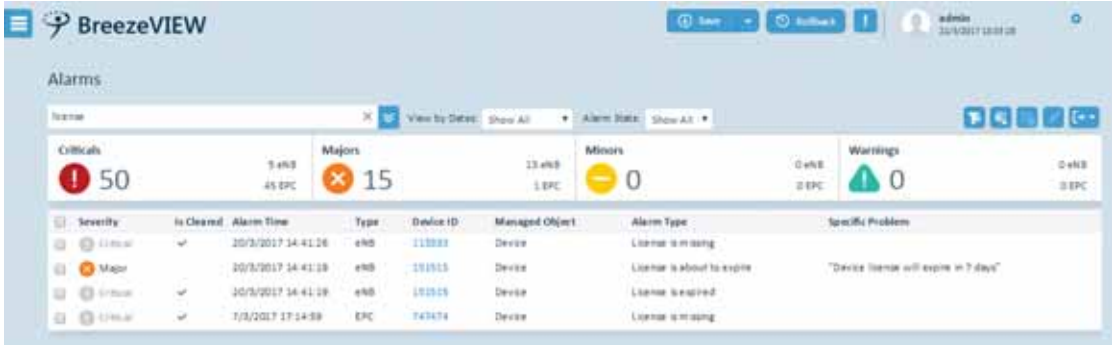


Figure 132: Alarms view with 'license' as search criterion

5.4 CLI License Operations

This item will detail the way to perform license related actions for single device from devices' CLI as secondary option in case BreezeVIEW is not available.

Reminder – BreezeVIEW is prime and should be preferred for license functionality.

5.4.1 TFTP server verification/configuration

Make available a TFTP server, create a directory named 'license' in its home directory and in this directory place the license certificates.
In all the upgraded devices about to be licensed verify TFTP server IP is pointed at the TFTP server machine in the following way:
Log into the device using SSH as root user
type 'cli' and then 'enter' to switch to CLI interface
type 'conf' and then 'enter' to switch to configuration mode
type ' show device management tftp-ip-address' to view current IP configured
if needed configure new IP by running command 'set device management tftp-ip-address <ip>'

5.4.2 Showing license status of an LTE device

Log into the device using SSH as root user
Type 'cli' to switch to CLI interface

The command to run is 'show license'

Command reply for a device with no license loaded

```
BreezeCompact> show license
license general operational-license-file ""
license general pending-license-file ""
license general status   NoLicense
license features start-date 0000-00-00
license features expiry-date 0000-00-00
license features topology single-carrier-2x2 Enable
license features topology single-carrier-2x4 Enable
license features topology single-carrier-4x4 Enable
license features topology split-mode-2x2-f1 Enable
license features topology split-mode-2x2-f1f2 Enable
license features topology dual-carrier Enable
[ok][2017-03-29 12:02:11]
BreezeCompact>
```

Command reply for a licensed device:

```
BreezeCompact> show license
license general operational-license-file telrad-bc1k-95006907-SO000001-20190909.lic
license general pending-license-file ""
license general status   Active
license features start-date 2017-03-21
license features expiry-date 2019-09-09
license features topology single-carrier-2x2 Enable
license features topology single-carrier-2x4 Disable
license features topology single-carrier-4x4 Disable
license features topology split-mode-2x2-f1 Disable
license features topology split-mode-2x2-f1f2 Disable
license features topology dual-carrier Disable
[ok][2017-03-26 08:26:51]
BreezeCompact>
```

5.4.3 Loading LTE license via CLI

The operation is comprised of two stages – downloading the license certificate to the device and activating it

The machine from which the license certificate is to be downloaded needs to have a tftp server installed and working on it

Downloading the license file

Log into the device using SSH as root user

Type 'cli' to switch to CLI interface

Type the following command (in the following example the license certificate name is new_customer-bc1k-321654-testso-20201017.lic

Option 1 – specifying TFTP server IP to download from

```
BreezeCompact> request license-file download-license-file source-ip-address 1.1.1.1 source-path-file-name license/new_customer-bc1k-321654-testso-20201017.lic
This action will download a license file from external tFTP server into device. Are You sure? [no,yes] yes
Status Success
[ok][2017-03-26 09:50:59]
BreezeCompact>
```

Option 2 – without specifying TFTP server IP (in this case the device will download from the IP configured in it as TFTP server)

```
BreezeCompact> request license-file download-license-file source-path-file-name license/new_customer-bc1k-321654-testso-20201017.lic
This action will download a license file from external tFTP server into device. Are You sure? [no,yes] yes
Status Success
[ok][2017-03-26 09:54:02]
BreezeCompact>
```

NOTE – each of these options assumes the license certificate is placed directory 'license' which itself is placed in the home directory of the tftp server. If it is placed in a different place, the path from the tftp server home directory to the license certificate location should be added to the license certificate name.

Verifying successful license certificate download - run the following command

```
BreezeWay2020> show notification stream alarms last 1
```

to view the outcome of the license download operation

Activating downloaded license file

```
BreezeCompact> request license-file activate-license-file
This action activates device license. Are You sure? [no,yes] yes
Status MissingPathFileName
Reason License file not exist
[ok][2017-03-26 08:35:13]
BreezeCompact>
```

To verify license active and valid run the following command –

```
show license
```

Appendix A: 5GHz Antennas

A.1 5.x GHz Antennas

Compact1000 using External Antenna (Antenna P/N 300743)

QaudPort, 65 degree, +/-45^0 Polarisation, Fixed Tilt

RF Specifications

Frequency Range	MHz	4900 - 5950MHz
Gain	dBi	16.0 ± 0.5 dBi
Return Loss (VSWR)		1.5:1(typ) / 2:1 (max)
Polarisation		+/-45° Double Dual Slant
Horizontal 3dB BW	Degree	65°
Vertical 3dB BW	Degree	7°
Port-to-Port Isolation	dB	20 dB (typ)
Front to Back Ratio	dB	-25 dB (typ)
Side-Lobe Level Elevation	dB	-12 dB (typ)
Cross polarization	dB	-15 dB (typ)
Input Power	W	6W (max)
Input Impedance	Ω	50Ω

Mechanical Specifications

Connector Type		4 x N Type Female
Dimensions (LxWxD)	mm	371 x 371 x 40 mm
Weight	kg	2 Kg
Radome		Plastic
Base Plate		Aluminium with chemical conversion coating
Mounting Kit		Included
Rated Wind Velocity	km/h	200 km/h (125mph)
Lightening Protection		DC Grounded
Temperature	ºC	-45ºC to +70ºC

BreezeU100 Internal Antenna Specifications

RF Specifications

Frequency range	4.9-5.9 GHz
GAIN, typ.	17 dBi
VSWR, max.	1.7 : 1
Polarization	2 x Dual Slant ±45°
3dB Beam-Width, H-Plane, typ.	65º
3dB Beam-Width, E-Plane, typ.	7º
Side Lobes, typ	-12 dB
Cross Polarization, min.	-15 dB
Port to Port Isolation, min.	-20 dB
Front to Back Ratio, min.	-25 dB
Lightning Protection	DC Grounded

Telrad
We're on your wavelength.