38GHz

# HyperBridge Wi200-S

25GHz


20GHz

# Guide de l'usager

**Configuration de réseaux Radio Télécommunications pour la Video-Protection**

**NF EN 13306 X 60-319**

**The Last Mile White Book**

19GHz

Produced in Europe

ISO 9001 BUREAU VERITAS Certification

# Table des Matières

# 1 Généralités

Ce document décrit sommairement les domaines d'applications, les configurations, l'usage, les fonctionalités, le système de gestion etc, des **HyperBridge Wi200-S** series **Full Outdoor Unit** (FODU).

Ce document permet également de respecter la Norme NF EN 13306 X 60-319 relative à la maintenance Préventive, Palliative et Curative : *« Toutes les actions qui ont pour objectif de garder ou de remettre une chose en état de remplir la fonction qu'on exige d'elle. Ces actions regroupent toutes les actions techniques et toutes les actions d'administration, de direction et de supervision correspondantes* »

## 1.1 HyperBridge Wi200-S FODU ''Full OutDoor Unit''

**Dans la famille des produits HyperBridge, le Wi200-S** est une nouvelle generation de Faisceaux Hertziens full Duplex conçus afin de satisfaire la demande croissante de liaisons Numérique Data Video et audio via des réseaux micro-ondes de type SRD dans les bandes pour les ISM les Rlan et les SRD

Pour celà le premier interface de traffic pour l'HyperBridge Wi200-S est le Fast Ethernet.

HyperBridge Wi200-S permet un débit de 100 Mbits Full Duplex soit 200 Mbps utiles avec une latence inférieure a 100 µsec. L'excellence des performances de l'interface Radio et modem d' HyperBridge Wi200-S est en partie du à l'emploi de 32- niveaux de décision d'états et de schémas de modulation. Au delà de la **capacité effective de 200 Mbits** il est possible de configurer la radio dans un quelconque canal de 10 ou de 30 MHz dans un quelconque schéma de modulation **QPSK, 16QAM**, **32QAM**, permettant d'adapter le debit et la distance en fonction des besoins.

HYPERCABLE, JCDC à employé la plus moderne des solutions et des composants pour créer une radio à haute performances, Ultra compacte et de **très faible consommation** – <15W par radio.

HyperBridge Wi200-S est un composant parfait pour construire un réseau moderne et puissant, au service des "opérateurs alternatifs" des ministères, des communes et des gouvernements, pour assurer leurs besoins fixes et mobiles de transmission de données de voix et d'images de Vidéo-Protection.

## 1.2 HyperBridge Wi200-S, Spécifications essentielles

### 1.2.1 Spécifications générales

- Solution tout “outdoor” FODU
- Capacité: maximum **100 Mbps F/D utiles ( 200 Mbps)**
- Largeur de canal:**10 et 30 MHz**
- Modulations: **QPSK, 16QAM, 32QAM**
- Interfaces: **10/100Eth**
- Trafic: **Ethernet + 2E1**
- Gammes de Fréquences: **17GHz** et **24 GHz ( 61 Ghz fin 2012)**
- Radio Verte **<15W** de consommation 48VDC
- **ACM** avec **QoS** et 4 files de priorités
- **802.1Q VLAN** support

### 1.2.2 Spécifications Mecaniques

- FODU Compacte, **230x230x85mm**, **2.0 kg**

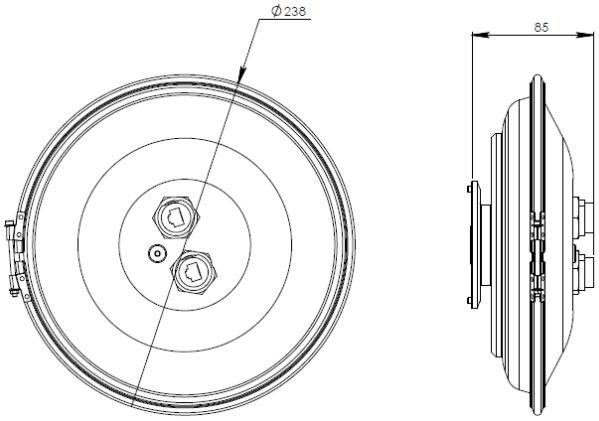



***Figure 1.1**: HyperBridge Wi200-S Full Outdoor Unit*

### 1.2.3 Interfaces/Management

- HyperBridge Wi200-S unit connexion et contrôle par **2 connecteurs** et une LED RSSI
- **Trafic usager et NMS transportés dans le câble Ethernet**
- Ethernet trafic supporte la **QoS** et **4 “priority queues”**, indispensable pour la fonction ACM
- **Le Trafic usager et NMS traffic** sont traités comme un flux data unique ou isolés par un marquage dans des **VLAN** tags differents.
- Web, Telnet et SNMP sont disponibles via l’interface IHM de **management.**

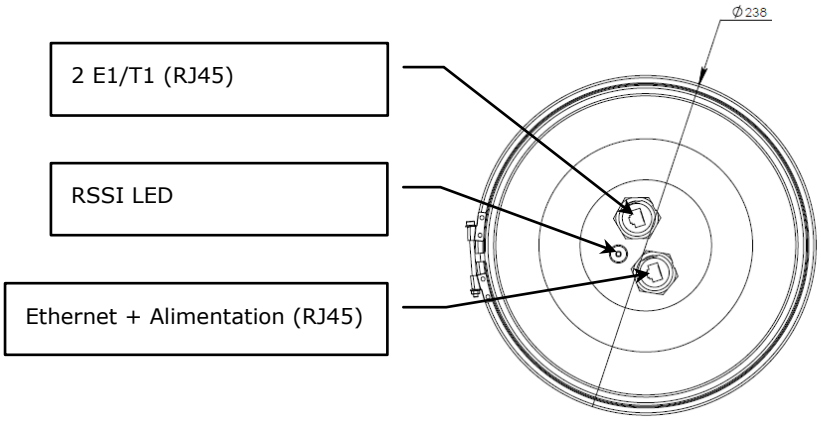



***Figure* 1.2**: *HyperBridge Wi200-S Full Outdoor Unit*

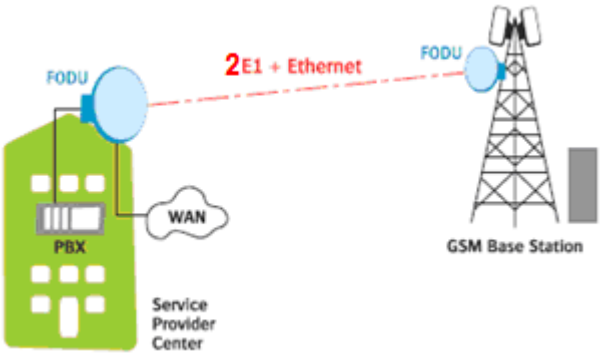
## 1.3 Paramètres Radio

- **HyperBridge** Wi200-S est un bon exemple des derniers perfectionnements dans les modem et le développement d'émetteur-récepteur, fournissant des paramètres radio excellents (le Gain du Système), en raison de l'utilisation des modulations QPSK et QAM tres efficaces malgré une consmmation d'énergie tres faible tant pour le TX que le RX.
- **RSL** Seuil à BER 10-6, 30MHz, 32QAM, 100Mbps :-77 dBm.
- **Le Gain de Système** compte tenu dela puissance Max Tx et la sensibilité du Rx est de 62 dBm.
- L'**ACM** (Codage Adaptatif de la Modulation), "hitless ACM" ouvre de nouvelles possibilités selon la stratégie de l'ingénieur du réseau Télécom.
- **La flexibilité très élevée** permet de configurer le système aux largeurs de bande de canal diverses, selon les schémas de modulation et les débits.

## 1.4 Applications Exemples

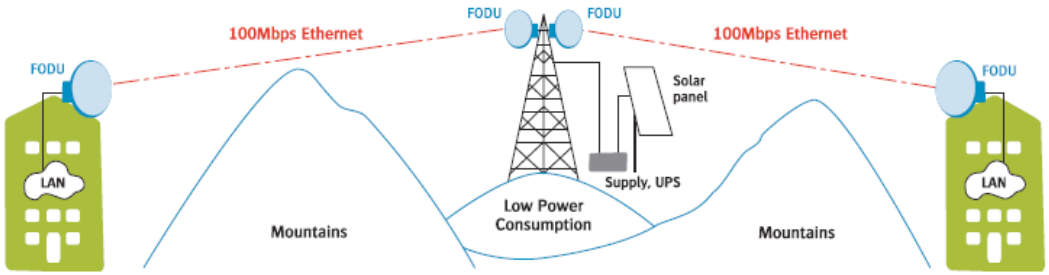
### 1.4.1 2E1 + Ethernet avec HyperBridge Wi200-SFODU

- HyperBridge Wi200-S se substitue aux réseaux de faible capacité E1 existants; tout en préservant les liaisons E1, l'on ajoute des capacités Ethernet supplémentaires très utiles pour l'expansion des services pour les réseaux GSM/3G/WiMax et LTE.
- Idéal pour la transition des réseaux TDM en Ethernet
- HyperBridge Wi200-S supporte le protocole SNMP pour le NMS.



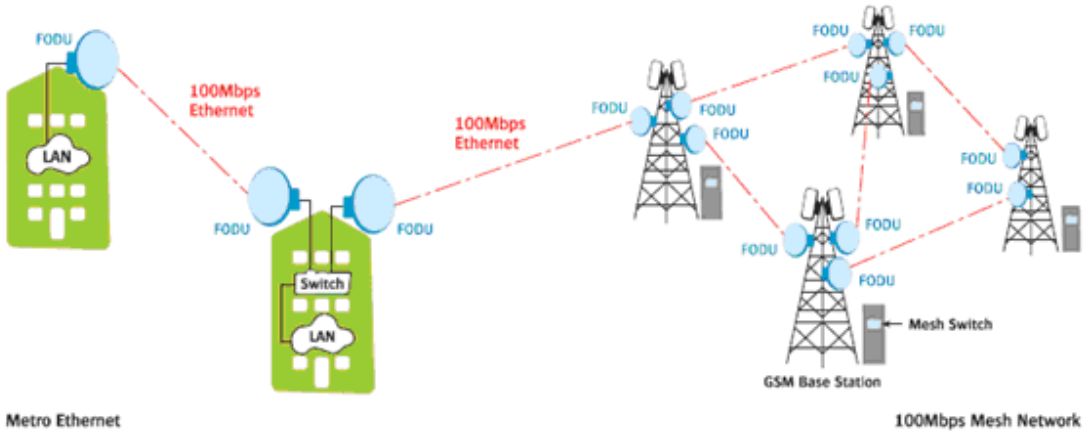
### 1.4.2 Relais actif de faible puissance avec HyperBridge Wi200-S FODU

- Extension du network vers des zones NLOS;
- Ideal pour franchir les montagnes et interconnecter des réseaux Ethernet;
- La tres faible consommation permet de créer des sites relais et d'utiliser des energies alternatives solaires et éoliennes, associées à des batteries Li-ion ayant plus de 15 ans de longévité.




### 1.4.3 Ethernet urbain et rural, réseaux maillés avec HyperBridge Wi200-S FODU

- Utilisable pour tous types de réseaux et de topologies 100Mbps Ethernet – star, ring, mesh;
- Solution "tout extérieur" avec alimentation en POE très efficient pour la connectivité de stations de base extérieures
- Accès Haut Débit des derniers Kilomètres et bien d'autres applications.



### 1.4.4 HyperBridge Wi200-S Topologie en anneau

- Le protocol STP permet à HyperBridge Wi200-S de fonctionner en mode anneau

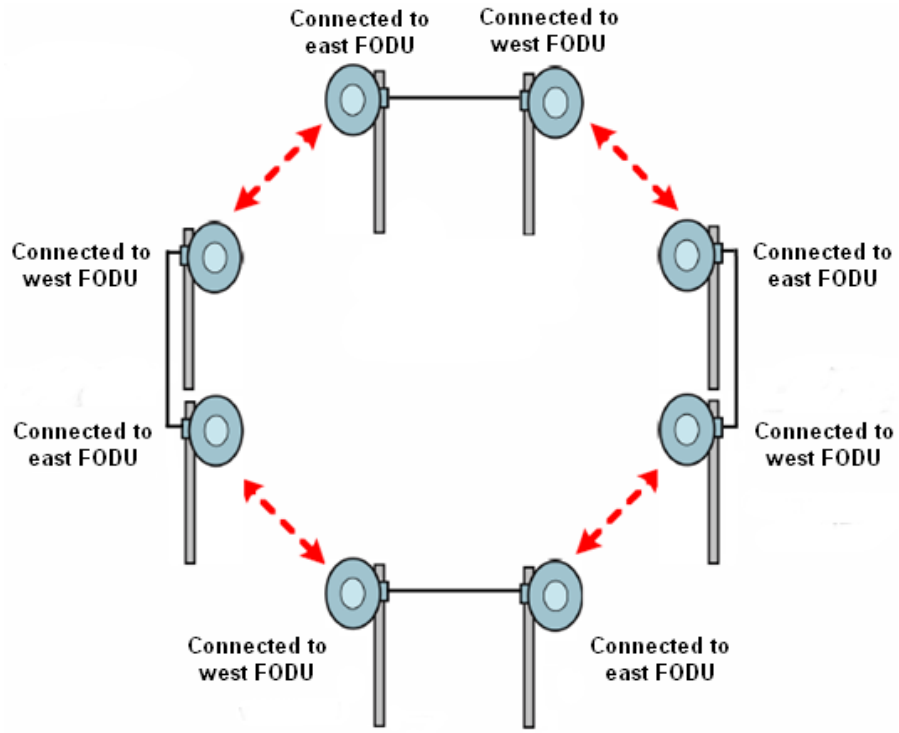



***Figure 1.3 HyperBridge Wi200-S implementation en topologie anneau.***


***Figure 1.3.1 HyperBridge Wi200-S implementation video & 3-4G offload en topologie anneau.***

## 1.5 Specifications Techniques Canaux et débits

### SPECIFICATIONS TECHNIQUES

| | | |
|---|---|---|
| **Gamme de Frequences** | 24GHz (24.05 – 24.25)<br>17GHz (17.1 – 17.3) | ERC 70/03E (100MHz offset) |
| | 24GHz (24.15 – 24.25) | UK Ofcom IR2030 (70MHz offset) |
| **Duplex (Tx, Rx) offset** | 70 / 100 MHz, cross-polarization | |
| **Largeur de canal** | 10 / 30 MHz | |
| **Modulation** | QPSK / 16QAM / 32QAM / 64QAM | |
| **Capacité** | 100 Mbps Eth / 2E1/T1 | |
| **Puissance maximale émise (PIRE)** | +20dBm (100mW) e.i.r.p.* | |
| **Configuration** | 1+0 | |
| **Trafic Interfaces** | 100Mbps FE (RJ-45) + 2xE1/T1 (RJ-45) | |
| **Tx Puissance, dBm** | -25 to -15 (24GHz) / -25 to -12 (17GHz) | |
| **RSL Seuil at BER $10^{-6}$** | -77dBm (30MHz, 32QAM, 100Mbps) | |
| **ACM (Adaptive Coding & Modulation)** | Hitless | |

### PORTS

| | |
|---|---|
| **Guide d'ondes Antenne** | Circulaire, 10.3mm / 13.8mm |
| **Ethernet avec alimentation via le câble Ethernet (POE)** | RJ-45 (data traffic, management port, power) |
| **Symétrique 2xE1/T1, et analogue RSSI** | 1xRJ-45 |

### SUPERVISION

| | |
|---|---|
| **Port de Management** | RJ-45 (in-band, avec option VLAN tag.) |
| **RSSI** | LED sur FODU, WEB management, analogue |
| **TCP/IP** | WEB, SNMP, Telnet – Monitoring local & distant via Telnet, WEB IHM, Hypercable NMS, SNMP Manager |
| **Loopbacks** | Oui, E1, modem, RF loopback |

### ETHERNET

| | |
|---|---|
| **Switch Type** | Managed Fast Ethernet Layer 2 |
| **Max frame size** | 1916 bytes |
| **MAC table** | 1K entries; automatic learning and aging |
| **Packet buffer** | 32KB; non-blocking store&forward |
| **Flow Control** | 802.3x |
| **VLAN support** | 802.1Q (maximum 15 concurrent traffic VLANs) |
| **QoS** | 64 level DiffServ (DSCP) ou 8 niveau 802.1P mapped en 4 prioritization queues avec VLAN support |
| **Spanning Tree Protocol** | 802.1D-2004 RSTP |

### MECHANICAL & TECHNICAL

| | |
|---|---|
| **Usage fixe** | Ref. ETSI EN 300 019-2-4, class 4.1E, exposé aux intempéries |
| **Gamme deTemperatures** | -33°C à +55°C |
| **Dimensions: HxWxD, mm / Poids, kg** | 230 x 230 x 85 / 2 |
| **Alimentation tension continue** | 48 V DC ±10% |
| **Consommation maximale** | <15W |

## PLAN DE CANALISATION Hypercable 24 / 17 GHz

| Nr. | Canal 10MHz | | Canal 30MHz | |
|---|---|---|---|---|
| | Tx, Rx (MHz) | Rx, Tx (MHz) | Tx, Rx (MHz) | Rx, Tx (MHz) |
| 1 | 24055/17105 | 24155/17205 | | |
| 2 | 24065/17115 | 24165/17215 | 24065/17115 | 24165/17215 |
| 3 | 24075/17125 | 24175/17225 | | |
| 4 | 24085/17135 | 24185/17235 | | |
| 5 | 24095/17145 | 24195/17245 | 24095/17145 | 24195/17245 |
| 6 | 24105/17155 | 24205/17255 | | |
| 7 | 24115/17165 | 24215/17265 | | |
| 8 | 24125 /17175 | 24225/17275 | 24125/17175 | 24225/17275 |
| 9 | 24135/17185 | 24235/17285 | | |
| 10 | 24145/17195 | 24245/17295 | | |

## PLAN de canalisation 24 GHz (UK Ofcom IR2030)

| Nr. | Canal 10MHz | | Canal 30MHz | |
|---|---|---|---|---|
| | Tx, Rx (MHz) | Rx, Tx (MHz) | Tx, Rx (MHz) | Rx, Tx (MHz) |
| 1 | 24155 | 24225 | | |
| 2 | 24165 | 24235 | 24165 | 24235 |
| 3 | 24175 | 24245 | | |

## DEBITS ET MODES ASSOCIES

| Modulation | 10MHz | 30MHz |
|---|---|---|
| QPSK** | 12Mbps Ethernet | 40Mbps Ethernet |
| | 8Mbps Ethernet+2E1 | 38Mbps Ethernet+2E1 |
| | 9Mbps Ethernet+2T1 | 39Mbps Ethernet+2T1 |
| 16QAM** | 25Mbps Ethernet | 81Mbps Ethernet |
| | 21Mbps Ethernet+2E1 | 80Mbps Ethernet+2E1 |
| | 21Mbps Ethernet+2T1 | 81Mbps Ethernet+2T1 |
| 32QAM | 31Mbps Ethernet | 100Mbps Ethernet |
| | 27Mbps Ethernet+2E1 | 100Mbps Ethernet+2E1 |
| | 28Mbps Ethernet+2T1 | 100Mbps Ethernet+2T1 |
| 64QAM | 41Mbps Ethernet | --- |
| | 37Mbps Ethernet+2E1 | --- |
| | 38Mbps Ethernet+2T1 | --- |

* Conforme au standard SRD (Short Range Device)

** Mode ACM seulement

## PLAN DE CANALISATION Hypercable 61.000 / 61.500 GHz

## 1.6 Type de câble requis

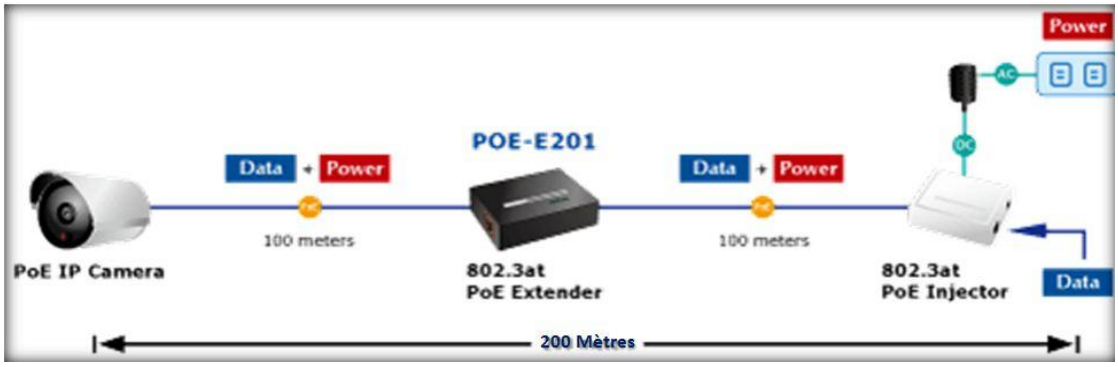
**10/100Base-T**

Un câble de catégorie Cat. 5e UTP, ou mieux, est requis pour la supervision VLAN et le trafic WAN, management of device and data traffic.

HyperBridge Wi200-S est alimenté par une alimentation DC 48 volts fournie avec un injecteur et parafoudre passif en mode POE (consommation maximale >15 W). La tension, de service est 48 V DC ± 10%, (52.8 volts) en mode POE via les deux paires inutilisées du cable Cat 5e . Il est possible également d'utiliser un switch POE en prévoyant toutefois un parafoudre en série dans le Cat 5e. Voir le ***Chapitre 9*** pour les details de câblage

La longueur du cable Cat. 5e ne doit pas exceder 100 metres, toutefois des extensions a 400 mètres sont possibles en utilisant une solution d'extension de la longueur du cable.

## 1.7 Solutions d'extension Gigabit CAT 5/5e/6




POE-E201 est un dispositif simple qui étend la portée, des données Gigabit Ethernet et de l'IEEE 802.3at/ 802.3af en puissance, au delà des 100m sur des câbles CAT.5/5e/6 UTP à 200m, 300m, 400m et 500m maximum. (La Documentation)

**Long Distance High Power PoE and Gigabit Data Extension Solution**

POE-E201 is a newly designed simple device which extends both the reach of Gigabit Ethernet Data and IEEE 802.3at / 802.3af Power over Ethernet over the standard 100m (328 ft.) CAT. 5/5e/6 UTP cable to 200m, 300m, 400m and maximum 500m.

## 1.8 HyperBridge Wi200-S étiquetage FODU

L'étiquetage se trouve sur le coté connectique de l'équipement.

L'étiquetage contient les informations suivantes (voir l'échantillon sur l'image ci-dessous):

- Le nom du modèle HyperBridge Wi200 suivi de la plage de fréquences:
- Wi200 –S C 24 pour la FODU 24 Ghz
- Wi200 –S C 17 pour la FODU 17 Ghz
- Le N° de produit P/N: (Z24FEE07H): qui contient l'information bande Haute H ou bande basse L dans laquelle HyperBridge Wi200-S FODU fonctionne.
- Le N° de série S/N: (325907 001 24); lequel identifie l' HyperBridge Wi200-S FODU.

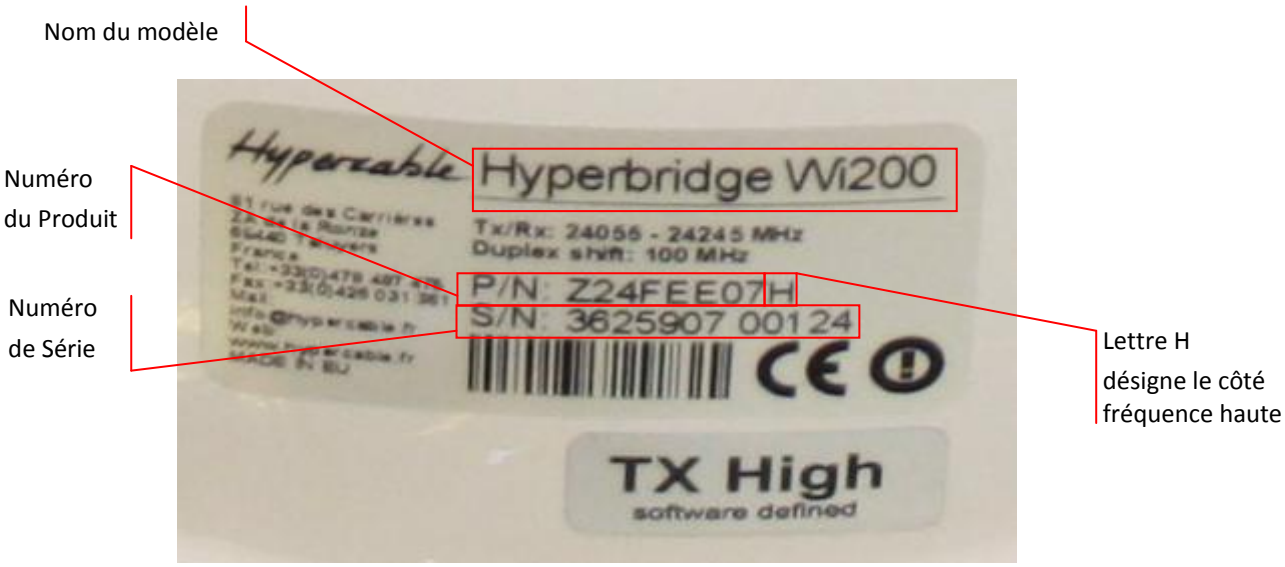



***Figure 1.5**. Etiquette du Wi200-S FODU Bande des 24 Ghz Fréquence Haute*

# 2 Configuration et Management

Trois voies sont utilisables pour régler et voir les paramètres de l'HyperBridge Wi200-S:

1. Avec Web terminal connecté au 10/100Base-T port de management
2. Avec Telnet terminal connecté au 10/100Base-T port de management
3. Avec le NMS ou SNMP terminal, connecté au 10/100Base-T port de management.

## 2.1 ''Reset'' de l'HyperBridge Wi200-S

Selon la méthode utilisée, l'utilisateur peut effectuer un ''reset'' de tout ou partie du terminal selon les indications de la table ci-dessous.

| | |
|---|---|
| Reset action par déconnexion de la source 48 VDC. | Redémarre le module Multiplexeur et le module de management. Redémarre tous les compteurs |
| Resetb via le bouton Restart CPU dans le Web IHM fenêtre 'Configuration → System configuration ou en utilisant la fonction command prompt command "**system reset**" | Redémarre la CPU de contrôle du management . Reset de tous les compteurs |
| Reset avec command prompt command "**system reset cold**" | Redémarre le modem et le CPU ''management controller''. Reset la totalité de tous les ''management counters''. |

## 2.2 Web interface

Cette section décrit les fonctionalités de l'interface WEB.

### 2.2.1 10/100Base-T Port

Le port de management 10/100Base-T est utilisé afin de raccorder l' HyperBridge Wi200-S t à un PC ou à un réseau Ethernet pour le management Web, SNMP et le Telnet.

**(!)** Le câble 10/100Base-T ne doit pas exceder 100 mètres sauf usage de la solution d'extension du câble Cat. 5e

### 2.2.2 Montage câblage du connecteur RJ 45 de l' HyperBridge Wi200-S

Ces instructions vous expliquent comment assembler correctement un connecteur étanche et disposer de la meilleure connexion possible avec la prise RJ45.

**(!)** Attention le design et les dimensions des RJ-45 sont variables. Les instructions ci-après ne sont valables que pour des connecteurs RJ 45 fournis par Hypercable.

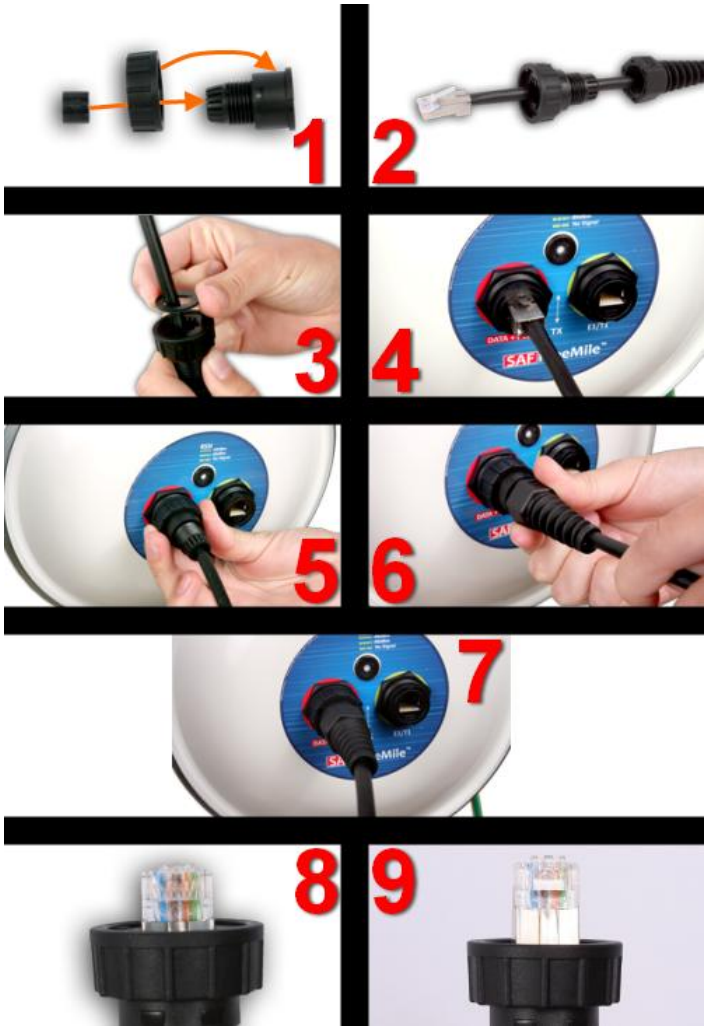



***Figure 1,6**. Assemblage du connecteur Ethernet étanche.*

Fig. 1.6(1). Mettez l'anneau en caoutchouc à l'intérieur du connecteur comme montré. Le verrouillage doit être placée sur la partie avant du connecteur.

Fig. 1.6 (2). Mettez les pièces du connecteur sur le cable

Fig. 1.6 (3). Collez la garniture d'étanchéité en caoutchouc sur le connecteur. .

Fig. 1.6 (4). Branchez le connecteur RJ45 à la douille d'Ethernet..

Fig. 1.6 (5). Fixez le connecteur à la douille avec la vis. Notez que la vis d'étanchéité du câble n'est toujours pas fixée à ce moment là.

Fig. 1.6 (6). Poussez le connecteur RJ45 dans la douille en poussant le câble et en même temps le joint et fixez le câble à l'aide de la vis d'étanchéité du câble.

Fig. 1.6 (7). Câble assemblé. Fixez le câble au mât aussi près que possible possible de la FODU. Ne le pliez pas ! Le rayon de recourbement nedoit pas être inférieur à 10cm.

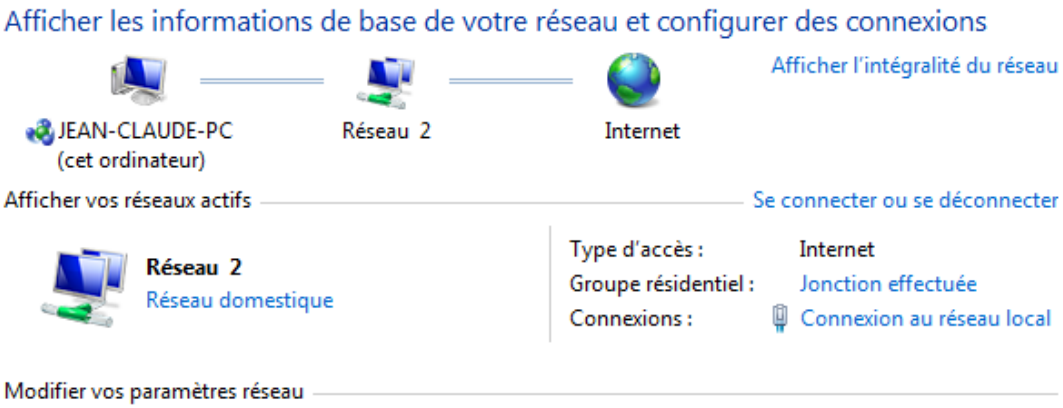
Fig. 1.6 (8). Exemple du positionnement correct du connecteur RJ45 rendant l'ensemble du connecteur étanche.

Fig. 1.6 (9). Exemple d'une position incorrecte du connecteur - alignement inexact. Notez, cellui ci sera engagé trop profond dans le socle connecteur.

### 2.2.3 Configuration de la connexion Ethernet management

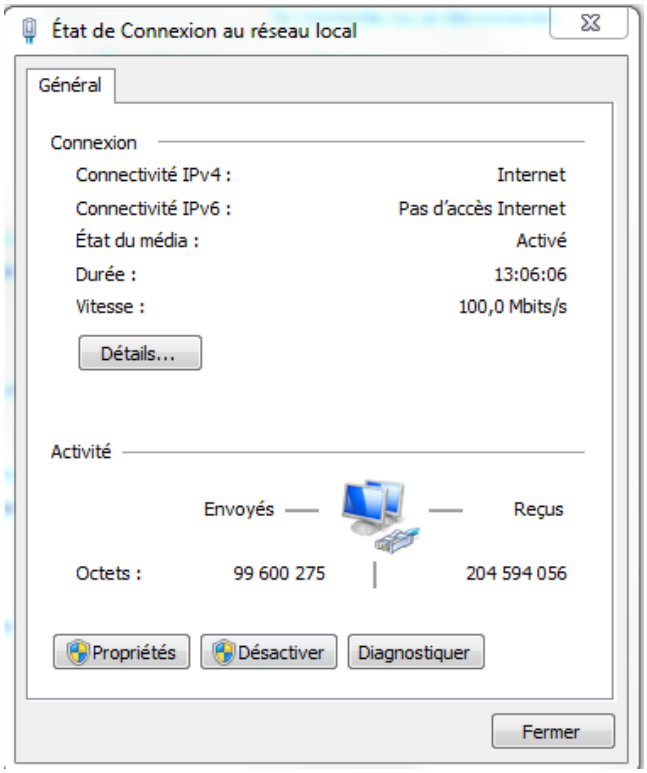
Avant que vous ne procédiez a la connexion avec l'IHM Web, vous devez exécuter la configuration de raccordement d'Ethernet en suivant ces étapes

1) Dans le système opérationnel de « MS Windows allez dans la page :

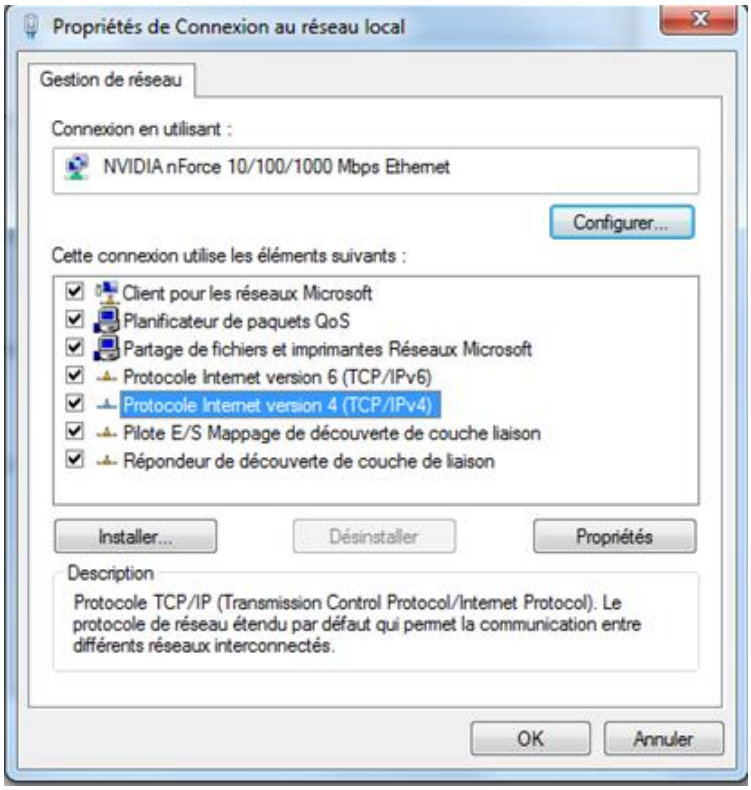




2) Choisissez et cliquez sur Connexions : Connexion au réseau local

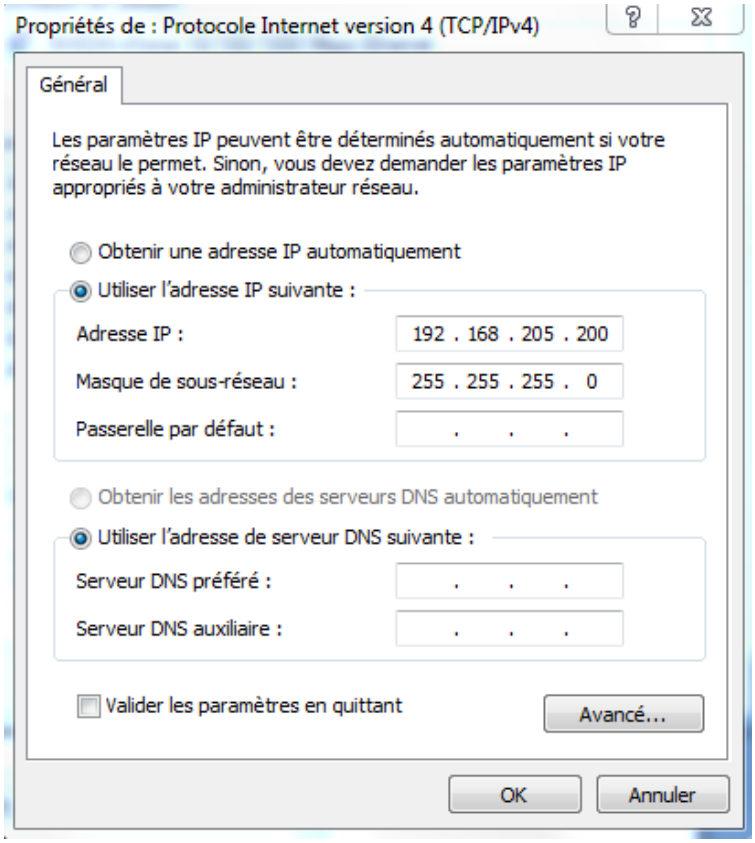
3) Cliquez sur : Propriétés



4) Dans la boite de dialogue cliquez sur Protocole Internet version 4 (TCP/IPv4)
Et cliquez ensuite sur Propriétés




La boite de dialogue suivante s'ouvre et vous configurez l'adresse IP et le masque de sous-réseau tels que indiqué dans les cases ci-dessous.




Maintenant vous êtes prêt a vous connecter en Web IHM ou a établir une connexion Telnet

**POE** ''Power over Ethernet'' injection 48 VDC

Tout type d'injecteur POE ou de switch respectant la norme 802.3af et 802.3at peut être utilisé. Toutefois Hypercable propose l'équipement ci-dessous, lequel inclus un parasurtenseur de protection des équipements et une alimentation 220 AC / 48 VDC. Voir également le ***Chapitre 9*** pour les informations détaillée sur les câblages.

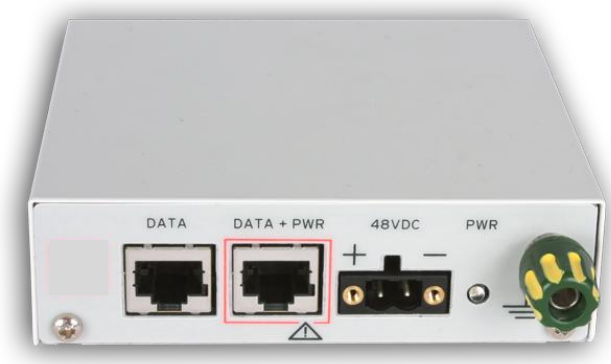



***Figure 2.2.*** *Injecteur POE et parasurtenseur*

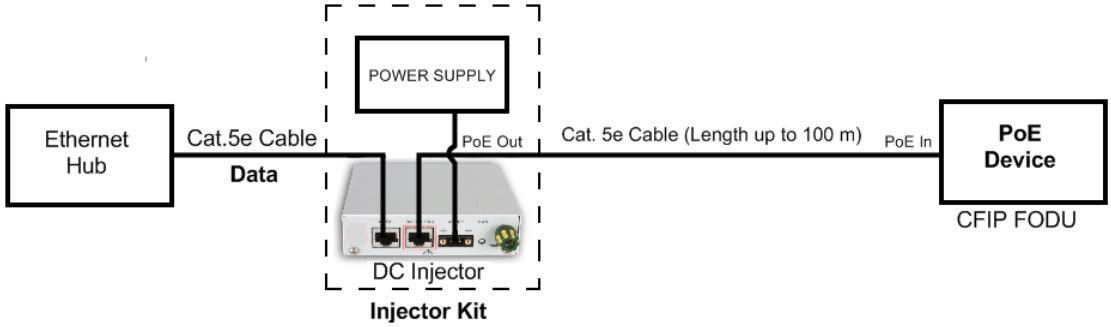



***Figure 2.3.*** *Schéma de l'application POE*

L'injecteur dispose d'embases RJ45 Blindées ainsi que d'un boitier métallique relié a la terre par un connecteur de forte section, tout ceci sécurisant les équipements et réduisant les interférences EMI ( CEM).

Dés que raccordé vous êtes prêt a vous connecter en Web IHM ou à établir une connexion Telnet

### 2.2.4 Connexion à l'interface Web

Il est recommandé d'utiliser ces navigateurs ou leur version la plus récente.

- IE v. 6.0
- Mozilla Firefox v. 2.0.0.11
- Safari v. 3.0
- Opera v. 9.50

Après avoir ouvert votre navigateur, entrez l'adresse de l'IHM de la FODU a visualiser.(**Figure 2.4**).

**(!)** Il est important de connaitre sur quelle extrémité FODU vous allez vous pour vous aider la configuration usine est la suivante :

Fréquence Basse L -> IP: 192.168.205.10

Fréquence Haute H -> IP: 192.168.205.11

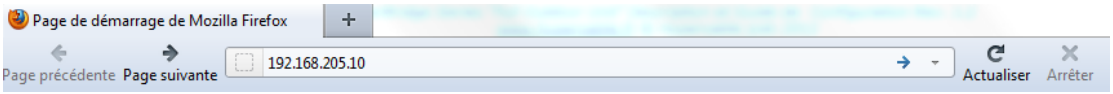



***Figure 2.4.*** *HyperBridge Wi200- S adresse IP coté fréquence basse L*

Si l'adresse IP est correcte et si vous disposez d'une version de navigateur valide vous lisez un texte vous confirmant un accès optimal.

Suite à cette confirmation vous êtes redirigé vers la page interface WEB. Dans le cas ou votre navigateur ne serait pas accepté, vous lisez un texte vous en informant, si c'est le cas vous pouvez malgré tout poursuivre en cliquant le bouton "Continue Anyway" pour être redirigé vers la page interface WEB.

Si tout est correct vous pouvez lire la page d'entrée de l'interface WEB. Si tout est correct vous pouvez lire la page d'entrée de l'interface WEB vous demandant le nom d'usager et le mot de passe :

**(!)** TLes mots d'usager et mot de passe par defaut pour l'acces a l'IHM WEB sont les suivants :

- username: *admin*
- password: *changeme*

Vous accédez ensuite à la page WEB principale. Dans l'espace affichant les paramètres de l'equipement Local et Distant, les paramètres non conformes ou posant problème seront surlignés en rouge.

**(!)** Si vous n'obtenez pas une page WEB correcte, effacez et supprimez les ''cookies'' de votre navigateur, nettoyez le cache et les historiques et redémarrez votre navigateur.

**(!)** Toutes les commandes effectuées depuis le WEB IHM sont interprétées comme des commandes CLI et exécutées a l'identique de commandes CLI. ( CLI = ''*Command Line Interface* '' Interface pour Lignes de Commandes)

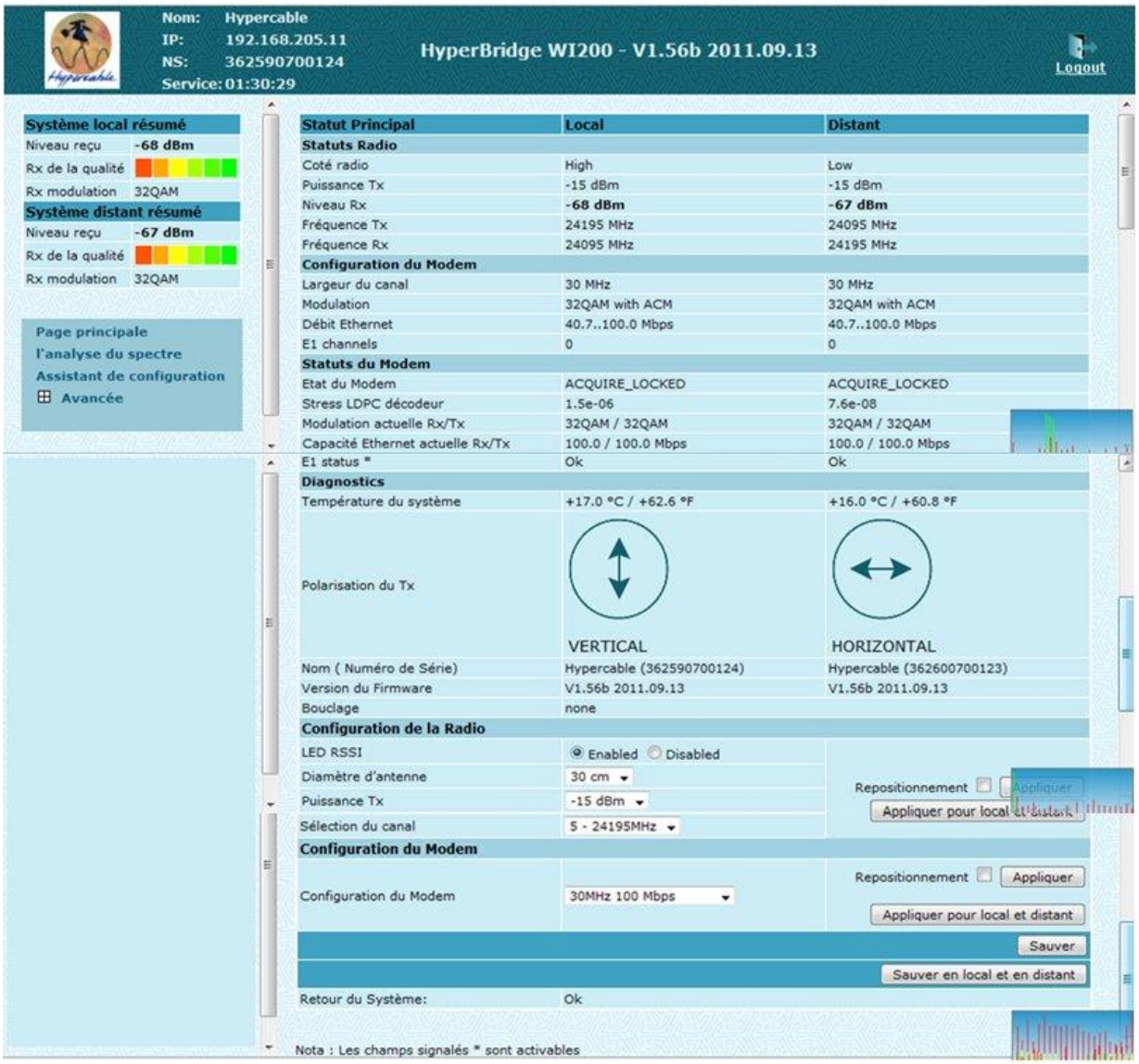



***Figure 2.5.*** *Web Interface - page principale d'une liaison configurée*

**(!)** Noter que l' HyperBridge Wi200-S utilise les deux plans de polarisation et fonctionne en Dual Orthomode, les FODU sont donc installées avec un décalage de 90°. Le repérage se fait a l'aide du repère en Double Flèche représenté entre la sortie des deux câbles. Le respect de cette polarisation se vérifie dans la page ''Statut Principal''.

### 2.2.5 Interface Description *Figures 2.6.et 2.5*

L'iinterface WEB est divisé en 4 volumes:

1. Le bandeau supérieur délivre des informations telles que le modèle,la version software, le nom du terminal, l'adresse IP, le N° de série et le temps deouis la mise en service.
2. Le Menu du panneau 2, si il est déroulé, montrera les accès aux autres pages.
3. L'état du sytème local et distant est résumé dans cet espace et reste visible même lors de la navigation dans d'autres pages du menu.
4. La page principale est affichée quand elle est sélectionnée dans le menu du panneau 2.

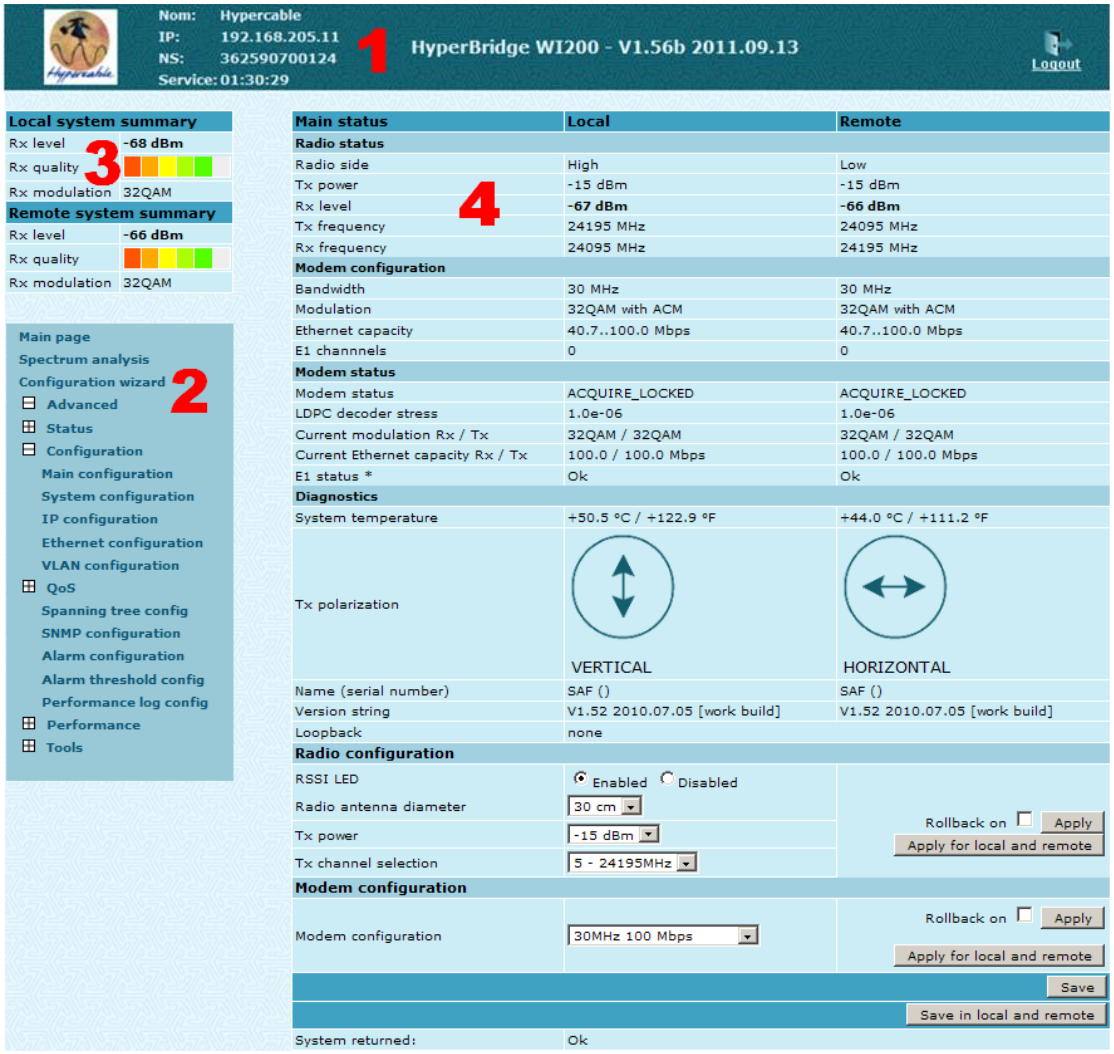



***Figure 2.6.*** *Web Interface description – Page principale d'une liaison configurée* .

( la comparer en se reportant à la page en Français ***Figure 2.5.*** )

Des affichages spéciaux sont également utilisés:

- Des Entrées surlignées en rouge indique que ces paramètres ne sont pas sonformes à un usage normal. Par exemple: valeurs en dehors de la plage permise de réglages; valeurs locales ne correspondant pas aux valeurs opposées et vice versa, absence de données N/D .
- Les entrées surlignées en jaune indiquent une alarme.
- 'N/D' à la place d'une valeur signifie 'No Data'. Pas de données.
- 'N/A' à la place d'une valeur signifie 'Not Available' Indisponible.

## 2.2.6 Execution des Commandes

Une page principale est présentée en ***Figure 2.7***. ( la comparer a la page en Français ***Figure 2.5.*** ) La page dans son ensemble est composée de plusieurs modules interactifs :

1. Le détail des configurations Radio et des performances Radio local et distant;
2. Le détail des configurations et des performances du Modem local et distant;
3. Nom des configurations;
4. Valeur actuelle des configurations;
5. Le bouton "Appliquer" execute le changement de configuration uniquement sur le coté local FODU. Valider la case repositionnement permet de refenir à l'ancienne configuration en cas de perte du lien par une fausse manoeuvre.
6. Le bouton "Appliquer pour local et Distant" execute le changement de configuration sur les deux extrémités FODU de la liaison Wi200-S
7. Le bouton "Sauver", sauve de façon permanente la configuration du coté Local

8. Le bouton “Sauver pour local et Distant” sauve la configuration sur les deux extrémités FODU de la liaison Wi200-S
9. Commentaires ( sur certaines pages)

“Appliquer pour local et Distant” est disponible dans la page principale durant la configuration de la liaison pour réaliser en simultané le site Local et le site Distant . La connexion doit être établie pour le management simultané des CPU des deux cotés du lien FH.

“*Repositionnement on*” est conçu pour maintenir la connectivité du lien HyperBridge Wi200-S par annulation des derniers changement erronés, afin de revenir a la précédente configuration fonctionelle.

Repositionnement n’est activé que si l’on a perdu la connexion avec le lien HyperBridge Wi200-S après l’ application d’un changement de configuration, le processus de retour aux précédents réglages fonctionnels prend environ 3 minutes.

Lors d’un nouveau paramétrage si les valeurs entrées ne sont pas valides ou ne concordent pas avec le coté opposé , la Ligne d’édition est surlignée en rouge.

Si “*Appliquer*” ou “*Appliquer pour local et distant’’ est cliqué*, et si une ou plusieurs lignes des boites d’édition sont surlignées en rouge, l’utilisateur peut lire un texte explicatif concernant l’erreur commise.

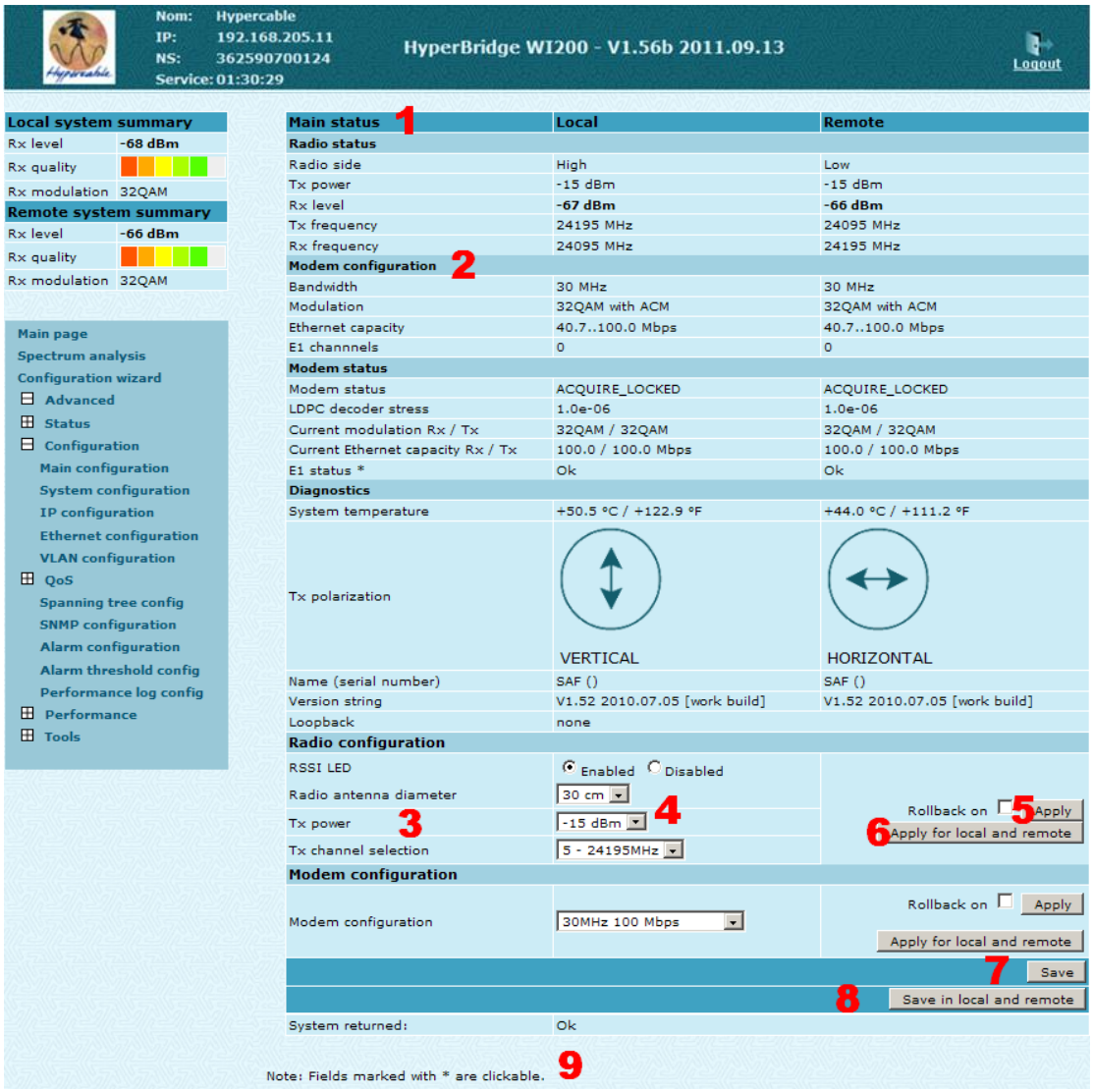



***Figure 2.7.*** *Web Interface - page principale avec N°s de repérage*

## 2.2.7 Configuration de la liaison avec l'IHM Web

#### 2.2.7.1.1 Rappel en Anglais du paragraphe **2.2.4**

In order to perform initial configuration you will need a laptop with LAN card, 2 Category 5e Ethernet cables and a Power over Ethernet injector.

- Your connected laptop should be in the same subnet with manageable HYPERCABLE HyperBridge, so you can "see" them; that is why, the laptop Ethernet port settings should be set as follows: (in 'Microsoft Windows' go to *Control panel* → *Network Connections* → *Local Area Connection* → *Properties* → *Internet Protocol (TCP/IP)* → *Properties*):
  - IP address 192.168.205.1;
  - Net mask 255.255.255.0;
  - everything else is blank.
- You must have PoE (Power over Ethernet) injector with the minimum of 20W power supply to connect the laptop to the HyperBridge Wi200-S FODU. Power over Ethernet injector can be purchased from Hypercable as optional accessory.
- To know IP address, side value should be read from the label. See Chapter 2.3 for details.
  - If Low Side -> IP: 192.168.205.10
  - If High Side -> IP: 192.168.205.11
- Connect to HyperBridge Wi200-S FODU by entering IP address in the browser address line - by default 192.168.205.10 for the low side and 192.168.205.11 for the high side.

**(!)** Default username for Web, Telnet and FTP access is admin and password is *changeme.*

It is recommended to use the following or later versions of web-browsers:

- IE v. 6.0
- Mozilla Firefox v. 2.0.0.11
- Safari v. 3.0
- Opera v. 9.50

Initial configuration in Web GUI should be done individually for each HyperBridge Wi200-S FODU.

## 2.2.8 Mode opératoire pour la configuration de la liaison avec l'IHM Web

Comme suite à l'étude de site du projet calculer le Bilan de liaison Prévisionnel :

**Bilan de liaison HyperBridge Wi200-S**

***Etape 1***

Apres avoir calculé le bilan de liaison prévisionnel, selon la distance et le Débit, choisir la taille d'antenne nécessaire (30 , 60 or 99 cm) dans la page principale à ''Configuration Radio'' Cliquer le bouton ''Appliquer" . Notez que le bouton "Appliquer pour local et distant" n'est pas actif tant que le lien n'est pas opérationnel.

***Etape 2***

Lancer ''Analyse de Spectre" "Spectrum analysis" tant que le second équipement n'est pas actif afin de verifier que le canal qui sera choisi est vierge de tout signal radio pouvant générer des interferences.

***Etape 3***

En se basant sur l'observation du spectre , choisir un canal libre de 10 MHz ou de 30 MHz et changer la configuration du modem, si requis, selon l'etude préalable des besoins et du Bilan de Liaison.

***Etape 4***

Activer l'émission en choisissant dans la page principale la puissanc e TX dans Configuration Radio et cliquez sur le bouton ''Appliquer''.

***Etape 5***

Les mêmes étapes de configuration doivent être appliqués au second HyperBridge Wi200-S.

Si tout est correct vous devez visualiser un écran en tous points semblable à celui de la Figure 2.5. (sans aucune indication d'alarmes).

Les paramèttres principaux se configurent également à l'aide du ''Configurateur Magique'' 'Configuration Wizard' présenté en **Figure 2.8.**

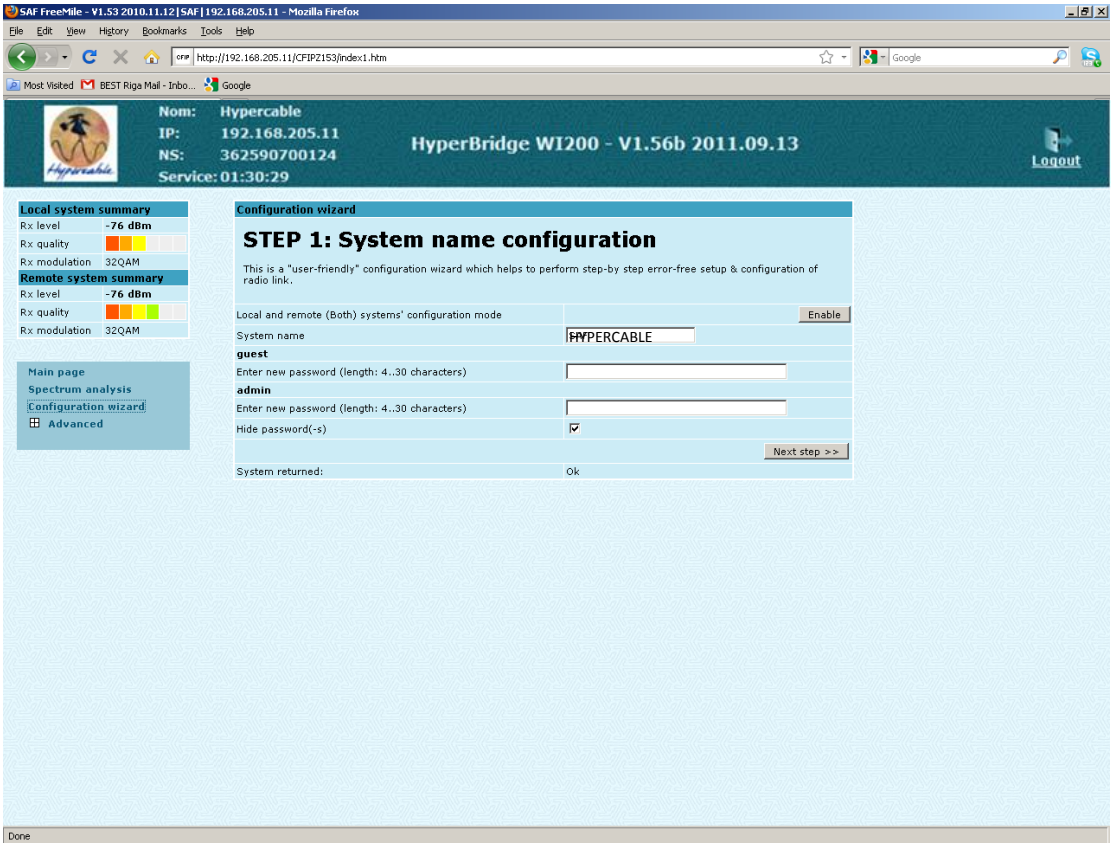



***Figure 2.8.*** *Démarrage de la configuration magique ''wizard''.*

Initialement Initially, vous pouvez spécifier le Nom du système , les mots de passe pour les comptes invités et administrateur ;

**(!)** Default password pour le compte "admin" est *changeme*.
Le compte "guest" est désactivé par défaut!

Si vous modifiez ces paramètres notez les soigneusement car ils seront ABSOLUMENT nécessaire pour accéder aux équipements par la suite..

**(!)** Il est recommandé de nommer chaque système selon sa localisation Géographique par exemple Pour un coté PREF>MONTESSUY et l'autre MONTESSUY >PREF

Par défaut le nom du système est 'HYPERCABLE'.

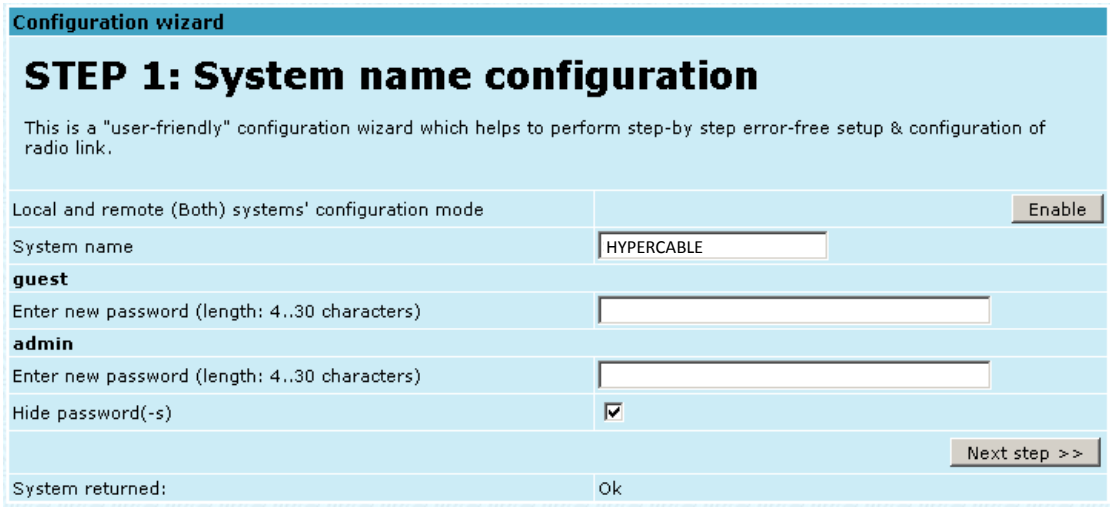



***Figure 2.9.*** *étape1. Définir le nom du système ainsi que les mots de passe.*

Presser ensuite le bouton 'Next step, qui vous amène a la page suivante ou vous allez configurer les adresses IP nécessaires à votre liaison ( sont indiquées par défaut celles du réglage usine).

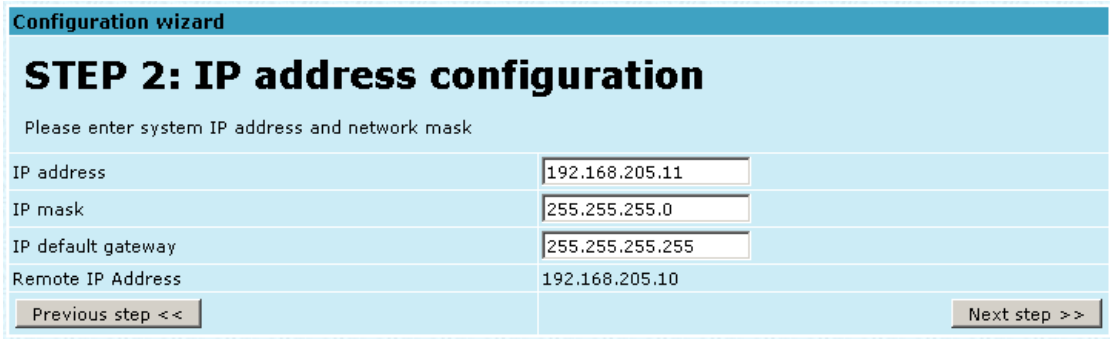



***Figure 2.10.*** *Etape 2. Definir IP address, mask, default gateway et adresse IP distante*

Presser 'Next Step' Le troisième écran du ''Wizard'' est dévolu aux réglages de la partie Radio et à ;,la configuration du Modem. Vous pouvez valider ou dévalider la LED RSSI selon le besoin et configurer le type d'antenne que vous utilisez pour ce lien. Cette étape spécifie également les paramètres radio – Tx power (depend de la taille d'antenne choisie afin de respecter automatiquement la PIRE légale) et Tx frequency est choisi et dépend du canal retenu en fonction de l'analyse de spectre et des réglements des Télécommunications locaux.

Il est aussi possible de spécifier la largeur de canal et le débit associé. Ces configurations déterminent la capacité Data du lien.

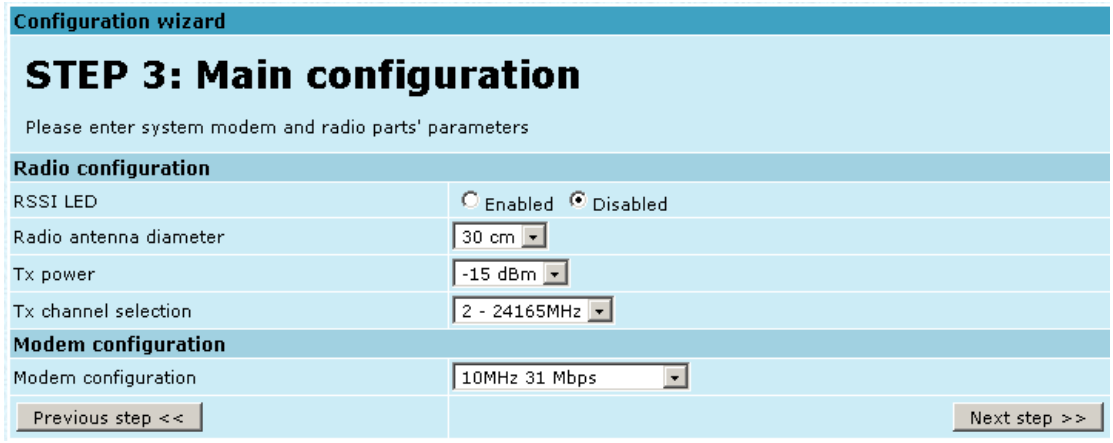



***Figure 2.11.*** *Etape 3. Definir la configuration de la radio et du modem.*

Noter que l'usage légal de la bande 24 Ghz limite la puissance équivalente isotrope rayonnée (PIRE) à 20 dBm. (100 milliwatts)

**(!)** Dans le tableau ci-dessous est exprimé l'interdépendance entre la puissance du TX et le gain de l'antenne afin de ne pas dépasser les +20 dBm PIRE dans la gamme 24 GHz.

| | Antenne Diamètre / gain | | |
|---|---|---|---|
| | 30 cm/35 dBi | 60 cm/40 dBi | 99 cm/45 dBi |
| Puissance TX allouée | **-…-15 dBm** | **-25…-20 dBm** | **-25 Bm** |

Un réglage TX erroné déclenche un message pop-up d'alerte visuelle.

**(!)** Dans le tableau ci-dessous est exprimé l'interdépendance entre la puissance du TX et le gain de l'antenne afin de ne pas dépasser les +20 dBm PIRE dans la gamme 17 GHz.

| | Antenne Diamètre / gain | | |
|---|---|---|---|
| | 30cm/32dBi | 60 cm/38.dBi | 99cm/41dBi |
| Puissance TX allouée | **-25…-12 dBm** | **-25…-18 dBm** | **-25…-21 dBm** |

Un réglage TX erroné déclenche un message pop-up d'alerte visuelle.

L'écran final de la configuration Magique ''Wizard'' récapitule les configurations programmées avant que de les appliquer. Les réglages optionnels (recommandés) sont les suivants :

- *Clear cfg file before the new settings will take place* – Pour remettre à zéro tout autres paramètres, non mentionnés ici, après exécution de la configuration
- *Set local machine time* – Utilise l'heure de votre PC local
- *Write this configuration into cfg file* – La configuration est automatiquement écrite dans le fichier ''configuration''.

LUMIERES

**Configuration wizard**

## STEP 4: Check parameters

Please verify the parameters set.

| | |
|---|---|
| **guest** | |
| Password | |
| **admin** | |
| Password | |
| System name | LUMIERES |
| IP address | 192.168.205.11 |
| IP mask | 255.255.255.0 |
| IP default gateway | 255.255.255.255 |
| RSSI LED | Disable |
| Radio antenna diameter | 30 cm |
| Tx power | -15 dBm |
| Tx channel | 2 - 24165MHz |
| Modem configuration | 10MHz 31 Mbps |
| Clear cfg file before the new settings will take place | ☐ |
| Set local machine time | ☐ |
| Write this configuration into cfg file | ☐ |
| Previous step << | Rollback on ☐ Apply |

***Figure 2.12.*** *Etape 4. Checking des réglages et éxécution de la configuration*

Pour vérifier ces réglages rendez vous dans Statuts de la page Principale afin de vérifier vos réglages si tout est conforme et sans alarme orange ou surlignages en Rouge c'est que tout est OK et que le lien est bien établi.

### 2.2.9 Upgrade du software firmware

**IMPORTANT :**

Cette opération peut être rendue nécessaire et préalable avant toute installation ou préparation de la liaison FH afin de disposer d'un firmware à jour et **surtout du même firmware** aux deux extrémités de la liaison. Sans cela les configurations telles que décrites, seront impossible à réaliser dans les modes Appliquer en Local et Distant et Sauver en Local et Distant.


1. *Choisir le Fichier ''Choose file''* – permet de sélectionner l'endroit ou se trouve le fichier permettant l'upgrade du firmware.

   **Par exemple :** (C:\Users\Jean-Claude\Desktop\cfipf155.elf.ezip,Ec) stocké dans le disque dur de votre PC de configuration.

   Le dossier Software upgrade doit avoir l'extension : ***.elf.ezip,Ec**

## 2.3 Ligne de Commande

**AVERTISSEMENT :**

*HyperBridge Wi200-S peut être géré en ligne de commande, toutefois nous recommandons l'usage du mode WEB IHM en Français pour les utilisateurs non avertis. De plus les lignes de commande étant en Anglais, la partie du Guide Utilisateur traitant des lignes de Commande et du mode TELNET sera en langue Anglaise se reporter à la page N° 31 Chapitre 4 de ce manuel.*

HyperBridge peut être managé et configuré en utilisant des lignes de commande. Ce processus est obtenu en entrant les commandes dans CLI , disponible dans : *Advanced – Tools – Command Line* dans l'IHM WEB.

L'interface ligne de commandes offre le plus large acces a toutes les configurations, son usage recommandé aux usagers avertis est déconseillé aux usagers inexpérimentés pour lesquels l'interface IHM WEB est en règle générale largement suffisant.. Les commandes disponibles pour le management sont dispoibles dans les fenêtres détaillées de l'IHM aussi bien que dans les tables des commandes additionnelles

**(!)** Notes syntactiques pour des messages de commandes pour des sollicitations de commande

- Les commandes sont en caractères **gras**.
- L'action de chaque commande sera affichée si la commande est dactylographiée avec « ? » à la fin du mot ou entré apres un quelconque signe reconnaissable , par exemple**, radio ?**

Le système de gestion est automatiquement remis en marche en cas de blocage. Ceci est exécuté par le temporisateur de surveillance. La remise en marche du système de gestion n'affecte pas (interrompre) le trafic d'E1/Ethernet.

Principales sections de l'IHM

## 2.4 Page principale

La page la plus importante de l'IHM est la Page Principale. Cette page principale affiche tous les paramètres esentiels du système, en cas de défaut ils se teintent en rouge.

Les sections de configuration vous permettent de modifier les paramètres majeurs et de cinfigurer la liaison FH . Pour plus de détails veuillez vous reporter au chapitre 2.2.7 configuration de la liaison avec l'IHM Web

Pour aider a la compréhension de la Page principale suivez les explications concernant chacun des champs repérés par un N° de 1 à 34. Reportez vous a l'IHM en Français en début de ce manuel.


1. Affiche le nom du système Hypercable son adresse IP son N° de série et depuis combien de temps il à été redémarré. Si lheure de redémarrage est affichée en rouge cela signifie que la connexion IP management est perdue.
2. Affiche la version du firmware en service.
3. Bouton de ''sortie'' met fin a la gestion WEB en cours et ramène a la page ''login''
4. Affiche un raccourci des informations utiles confirmant le fonctionement Local et Distant :


- Le Niveau Reçu (ou RSL) doit être tres voisin de celui calculé avant installation et pointage.
- Rx qualité bar utilise des couleurs (rouge, orange, jaune, vert) indiquant en temps réel la qualité du signal
- RX Modulation indique quelle modulation est en service.Lamême modulation doit être configurée pour les deux extrémités.

5. Menu déroulant des différentes sections de l'IHM
6. *Coté Radio* – indique quel coté est la fréquece Haute et lequel est la fréquence basse
7. *Puissance Tx*– affiche la puissance transmise en dBm;
8. *Niveau Rx*– affiche le niveau reçu en temps réel il ne doit pas différer de façon significative avec le niveau theorique calculé ( maximum +- 3 dB d'écart)
9. *Fréquence Tx*– affiche la fréquence émise
10. *Fréquence Rx* – affiche la fréquence reçue
11. *Largeur du canal* – affiche la largeur de canal utilisé en MHz;
12. *Modulation* – affiche le mode de modulation qui a été sélectionné;
13. *Débit Ethernet* – affiche la capacité Ethernet sélectionnée;
14. *E1 channels* – affiche le nombre de canaux E1 sélectionnés, **ATTENTION** le nombre de E1 sélectionnés doit être le même de chaque côté.
15. *Etat du Modem* – indique si le modem est acquis et verrouillé 'ACQUIRE_IN_PROGRESS' apparait au démarrage, quand le modem est en recherche de la configuration (ACM), mais en fonctionnelment normal la mention 'ACQUIRE_LOCKED' est affichée. Tout autre indication indiquerait un défaut.
16. *StressLDPC decodeur*– indique la charge du décodeur LDPC (low-den**sity** parity-check code). Le **LDPC** est contrôlé par le nombre d'erreurs corrigées à l'entrée du Decodeur LDPC (voir ***Figure 3.1***).


***Figure 3.1 Décodeur*** *LDPC fonctionnement*

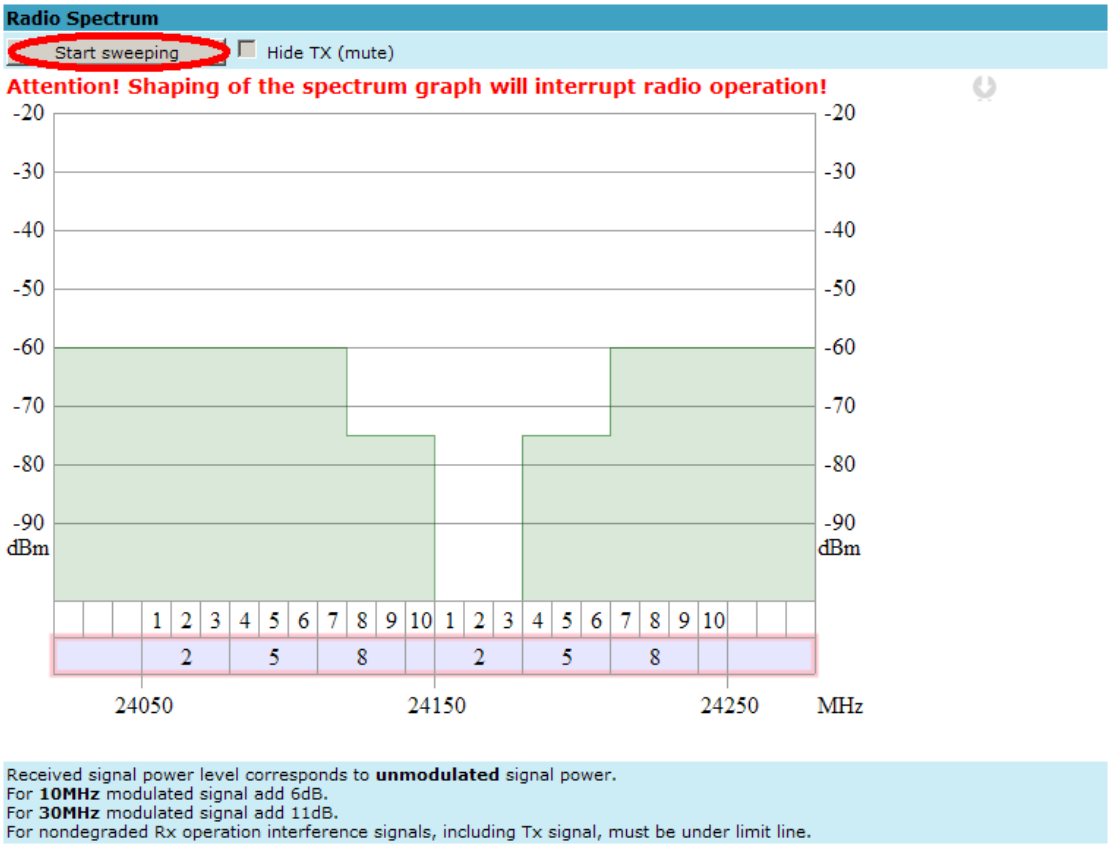
*Tant que la contrainte du LDPC se maintien sous les seuils préconisés, la quantité d'erreurs (le BER lui même) en sortie du LDPC se maintien à zero erreurs.*

17. M*odulation actuelle Rx / Tx* – indique le type de modulation en fonctionnement;
18. *Capacité Ethernet actuelle Rx / Tx* – Indique le débit réel simultané obtenu dans chaque direction
19. *E1 status* – Indique si les cannaux E1 sont connectés ou pas et indique les états LOS et AIS. Pour voir ces états, cliquer sur le texte doté de la mention *;
20. *Temperature du système* – indique la température interne en ° Celsius;
21. *Polarization du TX* – un accelerometre indique la position de la partie TX de chaque coté de la liaison.
22. *Nom (Numéro de Série)* – Indique le nom du lien Radio et son N° de série;
23. *Version du Firmware* – Indique la version firmware en service qui doit être la même de chaque côté dela liaison.
24. *Bouclage* – indique si un bouclage est en service ( Loop);
25. *LED RSSI* – active ou désactive la LED RSSI d'aide au pointage;
26. *Diamètre d'Antenne* – vous permet de choisir le modèle d'antenne en service;

27. *Tx power* – Permet de choisir la puissance TX appropriée;
28. *Sélection du canal* – permet de choisir parmi 3 canaux a 30 MHz ou parmi 10 canaux a 10 MHz Pour vérifier la disponibilité, activez“Spectrum analysis”;
29. *Configuration du Modem* – Permet de choisir la capacité Ethernet et le nombre de canaux E1. Par defaut un canal a 30 MHz et un debit de 100 Mbps sont sélectionnés;
30. Presser le bouton „Sauver” sauvegarde en local les changements appliqués;
31. Presser le bouton „Sauver en Local et Distant” sauvegarde dans le distant et dans le local les modifications faites en local
32. *Retour du Système* – en cas d’erreur ou de mauvaise entrée de données de configuration, un message adapté est affiché dans cet espace; en absence d’erreurs la ligne affiche ‘’OK’’
33. Presser le bouton „Appliquer” change les modifications en local;
34. Presser le bouton „Appliquer pour local et distant ” change les modifications en local et distant

## 2.5 Analyse de Spectre

Avec l’aide de l’analyseur de Spectre vous pouvez déceler la présence d’autres FH et ou d’interférences dans la bande et choisir un canal en conséquence.



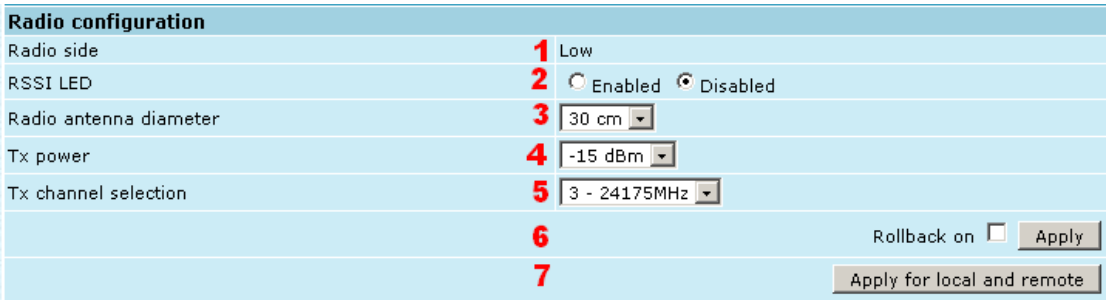
# 3 Configuration détaillée en mode WEB IHM graphique

La section configuration de l'IHM vous permet d'apater la liaison à vos impératifs spécifiques. (voir également les pages suivantes à partir de la page N° 31)

## 3.1 Configuration principale

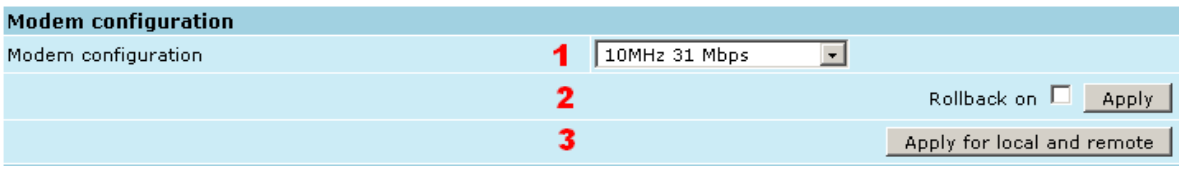
La fenêtre de configuration principale permet la configuration des paramètres vitaux du système incluant ceux de la configuration magique ''Wizard''. Ci-dessous une brève explication des espaces a configurer pour votre customization.

### 3.1.1 Configuration radio




1. *Radio side* – affiche si vous etes connecté a la Radio High ou a la Radio Low (command line – ***radio side***);
2. *RSSI LED* – active ou inhibe les indications RSSI LED;
3. *Radio antenna diameter* – pour selectionner le diametre de l'antenne utilisée .
4. *Tx power* – pour affecter la puissance TX requise;
5. *Tx channel selection* – permet de choisir parmi 3 canaux a 30 MHz ou parmi 10 canaux a 10 MHz Pour vérifier la disponibilité, activez"Spectrum analysis";
6. *En pressant* "Apply" les changements dans cette section sont appliqués seulement au coté Local de l' HyperBridge FODU. Si "Rollback on" est coché la configuration revient a la précédente au cas ou une mauvaise nouvelle configuration serait appliquée.( le retour prend 3 minutes)
7. En pressant "*Apply for local and remote*" les modifications sont appliquées aux deux extrémités des HyperBridge FODUs.

### 3.1.2 Configuration du Modem




1. *Modem configuration* – Permet de choisir la largeur de canal appropriée, la capacité Ethernet et le nombre de canaux E1. Par defaut un canal de 30MHz de largeur et un débit de 100Mbps capacity sont selectionnés;
2. Presser "Apply" modifie les réglages aportés dans le coté local d'HyperBridge si "Rollback on" est activé, la configuration est annulée au cas ou une mauvaise configuration aurait été entrée et la précédente revient au bout de 3 minutes.
3. En pressant "*Apply for local and remote*" les modifications sont appliquées aux deux extrémités des HyperBridge FODUs.

# 4 Dossier en Anglais des configurations système avancées

**NOTA :**

Les sections suivantes reprennent en Anglais la description détaillée des technologies utilisées dans les FODU Hyperbridge, ainsi que les aspects upgrade des firmwares , configurations complémentaires et configurations de réseaux avancé ainsi que les protocoles de test et de maintenance. Les configurations réseau avancées et les commandes en Ligne utilisant la langue Anglaise, ces sections non nécessaires à l'installation, la mise en service et la maintenance des systemes ne sont pas disponibles en Français.

**The following pages complie NF EN 13306 X 60-319**

« *All actions which have the objective of retaining or restoring an item in or to a state in which it can perform its required function. The actions include the combination of all technical and corresponding administrative, managerial, and supervision actions* »

**(!)** Note that for HyperBridge FODU 32QAM with ACM (Adaptive Coding and Modulation) feature is permanently enabled.

**Adaptive Coding and Modulation (ACM)** technology allows operators to achieve high-capacity data transmission over microwave links and improve the link utilization. This reduces both operational and capital expenditures for maintaining high-capacity links. ACM can maintain the highest link spectral efficiency possible at any given time in any link condition.

In traditional voice-dominated wireless backhaul transmission networks, service availability levels of 99.995% are the norm.

However, newer services such as Internet browsing, video streaming and video conferencing can operate at more relaxed availability levels. With use of QoS prioritizing ACM can allocate the required availability based on the priority. As a result, high-priority services such as voice enjoy 99.995% availability, while low-priority services like video streaming are allocated lower priorities.

Use of QoS prioritizing defines which services should be transmitted under any link condition and which services should be adapted whenever the link condition is degraded and the link payload is decreased.

For example, when bad weather has decreased the channel capacity of a link, ACM maintains high-priority services – such as E1 channels – with full bandwidth capacity while adapting the bandwidth capacity of low- and mid-priority services such as Internet browsing (see ***Figure 4.2***).

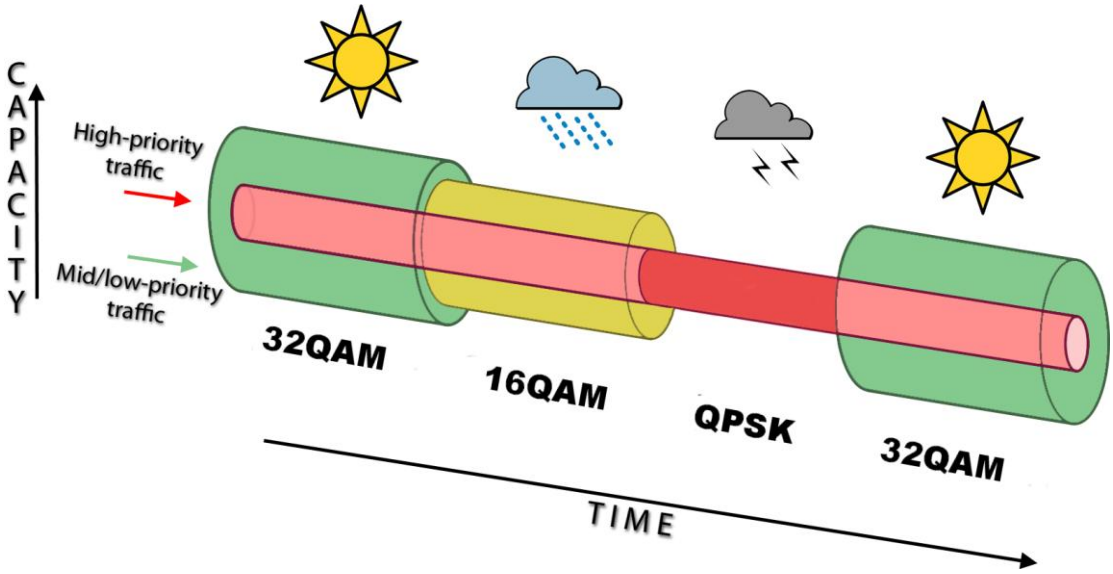



***Figure 4.2.*** *ACM bandwidth capacity adaptation*

Traffic can be mapped into different priorities, which define the level of service for each application. ***Figure 4.***3 illustrates how different services – such as rich voice and video – are mapped into different classes of availability (CoA) such as 99.995% or 99.985%.

**(!)** Figure 4.3. represents intermediate modulations. Full range of modulations available is 32QAM, 16QAM, QPSK.

The implementation of multiple priorities increases the available capacity up to 10 times that of standard links. When conditions are clear, the wireless link operates at maximum capacity and provides all services with the full data rate. When link conditions are poor – during harsh rain, for example – predefined high-availability services such as voice are not affected. However, the capacity of low-priority services is adapted dynamically to the changing link conditions. This is done by provisioning bandwidth according to the link conditions and traffic priority.

An ACM profile defines the link parameters (modulation) for a given range of the Radial MSE. The Radial MSE range of each profile defines the threshold for switching from one ACM profile to another. Each ACM profile has a different spectral efficiency, derived from its modulation.

The receiver continuously monitors the link condition based on Radial MSE value.

Once the estimators at the receiver side show that the link performance is not suitable for the current ACM profile, an ACM switching process will be initiated. In case of degradation in the link performance, the new ACM profile will include lower modulation, decreasing the link bitrate. The ACM switching rate is measured in dB/s and is a key feature of ACM systems.

In general, the higher the switching rate, the better the system's immunity to rapid Radial MSE changes. When the switching is being executed, the payload rate is being modified to fit the aggregated data rate to the new available link data rate.

Alternatively, ACM can also be used to increase the link distance, resulting in added link spectral efficiency. The same concept is implemented as previously, with the margins that were kept for 99.995-percent bandwidth availability now used to increase the link distance. Whenever the link conditions are degraded, the system will switch to an ACM profile with lower spectral efficiency to enable maintaining the link.

The following real-world example illustrates the benefits of ACM. Consider a HYPERBRIDGE link operating at 24 GHz with 30 MHz channel spacing and 45 dBi (120 cm) antenna gain. The link is operating in a moderate rain region similar to central Europe with a distance of 15 kilometers.

The system operation is set to a minimal payload of two E1 connections plus 34 Mbps Ethernet for 99.995% availability.

Implementation of ACM technology, the system was able to operate most of the time at 104 Mbps, depending on the link conditions. The system automatically monitors the link conditions and changes the capacity without interrupting the data transmission (hitless changes), as shown in ***Figure 4.3***.

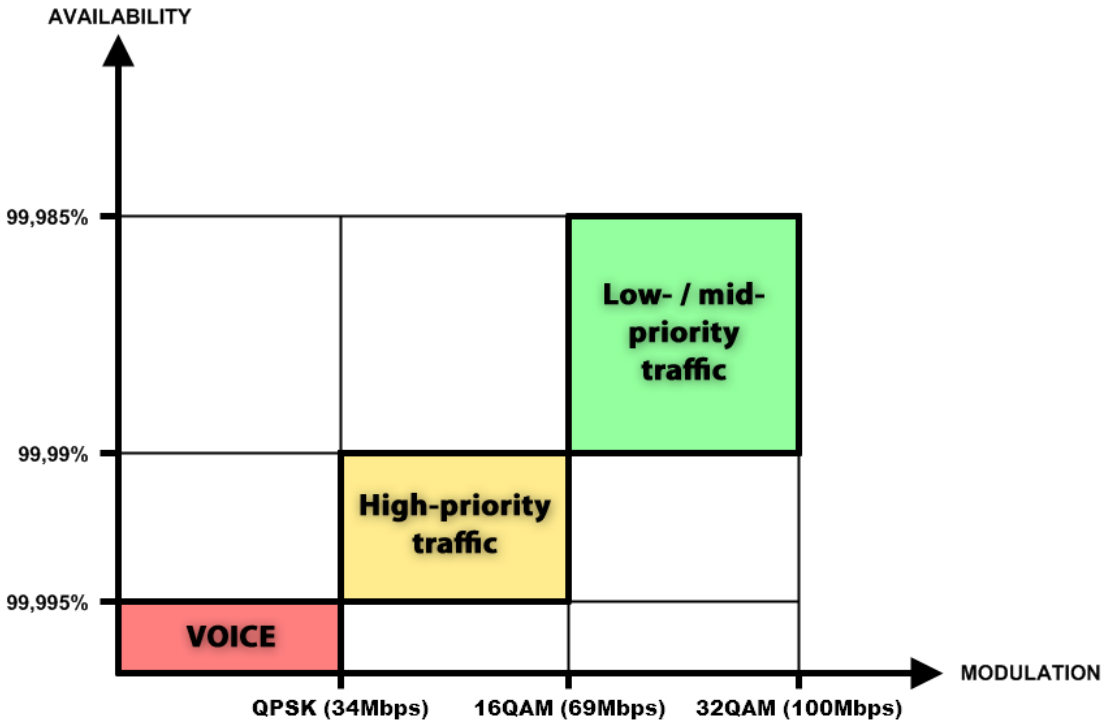



***Figure 4.3.*** *Link availability and classes of services*

In comparison similar system using 32QAM and providing similar capacity would provide only 99,981% of availability. Besides, lack of ACM would not provide higher availability. You would have to decrease the distance, decrease modulation or increase antenna sizes to achieve 99,995% availability for the given link.

This example demonstrates how the new technology, based on an ACM mechanism, can play a key role in the development of cost-effective next-generation wireless access networks, by taking advantage of traffic evolution from synchronous TDM traffic to packet IP-based traffic.

The **Weak FEC** option allows increasing overall capacity of the link in terms of deteriorating RSL sensitivity threshold. Note, that using 32APSK with total capacity of 100Mbps, HYPERBRIDGE automatically uses **Strong FEC** mode with better sensitivity, but incrementally enabling E1 channels, HYPERBRIDGE adapts it's forward error correction, till the maximum 104Mbps capacity (100Mbps Ethernet + 2E1) is enabled and HYPERBRIDGE operates in **Weak FEC** mode. For more details refer to table in ***Chapter 1.6***.

### 4.1.1 Loopback configuration

Loopback tests are accessible using local or remote management methods.

For Safety purposes all loopbacks (local and remote) can be set on a fixed time interval only. If no time interval is specified, the default value is 60 seconds (1 minute).

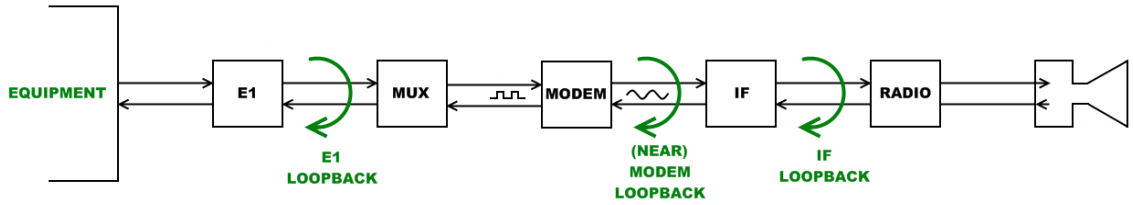



***Figure 4.2.*** *Loopback modes*

- **E1** loopback mode loops signal back to local end in bounds of E1 interface. E1 loopback mode must be set on the particular channel you are wishing to test. If no E1 channels are selected, E1 loopback mode is not available;
- **NEAR** loopback mode loops signal back to local end after the modem;
- **IF** loopback mode loops signal back to local end by linking intermediate frequencies.

| **Loopback configuration** | | |
|---|---|---|
| Loopback name | 1 | none |
| Loopback time duration | 2 | sec |
| Tx mute | 3 | off sec |
| | 4 | Rollback on Apply |
| | 5 | Save |
| | 6 | Save in local and remote |
| System returned: | 7 | Ok |

1. *Loopback name* – allows choosing loopback mode
2. *Loopback time duration* - loopback activity time in seconds (command line – ***loopback***) *{status | none | if | modem | e1{1|2|3|4}} [<time>]*).
3. *Tx mute* – allows turning transmitter power off for specified time. It may be effective when diagnosing on interference existence – when transmitter power of one side is off, you should not experience significant RSL on the other side (command line - ***radio txmute*** *[on|off]*);
4. By pressing “Apply” changes made to corresponding section apply only for the local side of HYPERCABLE HyperBridge. If “Rollback on” is selected, configuration will be reverted in case erroneous configuration changes are applied.
5. Pressing „Save” button saves in local unit all changes applied;
6. Pressing „Save in local and remote” button saves in both local and remote units all changes applied;

7. *System returned* - in case of error or incorrectly entered parameter value, or other problems in the whole page – info message will be displayed here. Otherwise it says "Ok".

| ***Additional radio and modem configuration commands in command line interface*** | |
|---|---|
| ***Command*** | ***Description*** |
| **modem status** | Shows all the modem parameters. |
| **modem configuration** show | Displays current configuration file. |
| **modem configuration** *<file>* | Uses separate configuration file. |
| **modem configuration** embedded | Switches back to the embedded configuration last used. |
| **modem factory** | Resets modem settings to factory defaults. |
| **modem ipremote** [on \| off] | Allows enabling manual remote IP specifying. By default remote IP is being obtained automatically. |
| **radio factory** *[max]* | Resets radio settings to factory defaults. By default Tx power will be turned off. 'max' option will switch Tx power to the maximum value after restart. |

| ***Additional loopback commands in command line interface*** | |
|---|---|
| ***Command*** | ***Description*** |
| **Loopback status** | Displays status of loopback mode. |
| **Loopback** *{status \| none \| if \| modem \| e1{1\|2\|3\|4}} [<time>]* | Sets the specified loopback mode. |

### 4.1.2 Radio frequency loopback

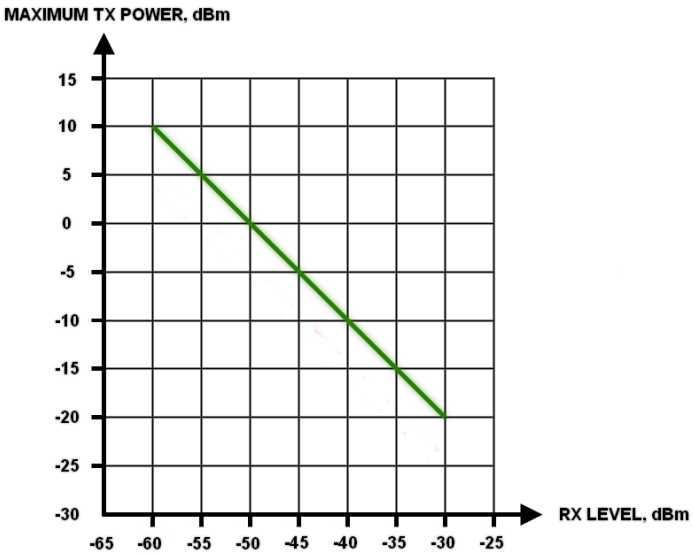
In order to check performance of HYPERCABLE HyperBridge, radio frequency loopback should be used:

a. In "Tools→Command line" enter command "radio txpower -10" in order to set transmit output power to -10 dBm;

b. In "Tools→Command line" enter command "loopback rf <time_in_second>", where" <time_in_seconds> should be substituted by sufficient time of loopback operation;

c. Observe Rx level during radio frequency loopback operation ("Status → Main status" → Rx level" or "System summary")

d. Chart below allows to determine maximum Tx power for HyperBridge FODU at which self-interference does not occur and overall performance would be as expected:



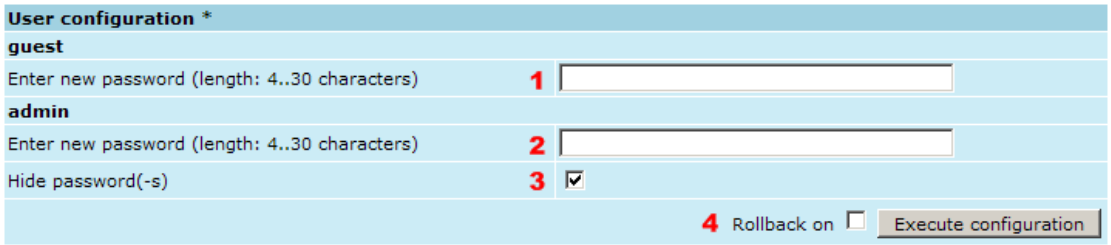

For example, if radio frequency loopback indicated Rx level = -40dBm, Tx power shouldn't be set above -10dBm

## 4.2 System configuration

The system configuration window provides the configuration of web access interface; allows changing system name, web data refresh time and system time.

Explanation of customization fields:

### 4.2.1 User configuration




1. **guest** – *Enter new password (length: 4..30 characters)* – allows entering preferable 'guest' account password and enabling the account. By default guest account is disabled. Maximal length of the password cannot exceed 30 symbols. Guest account has only monitoring privileges, only the Main status page is available for guest account.
2. **admin** – *Enter new password (length: 4..30 characters)* – allows entering preferable 'admin' account password. Maximal length of the user name cannot exceed 30 symbols. By default password for 'admin' account is '*changeme*'. Admin account has full control of the HYPERBRIDGE configuration process.
3. **Hide password(-s)** – Hides typed in password. This option unchecked will display typed in password in plaintext.
4. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE HyperBridge. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

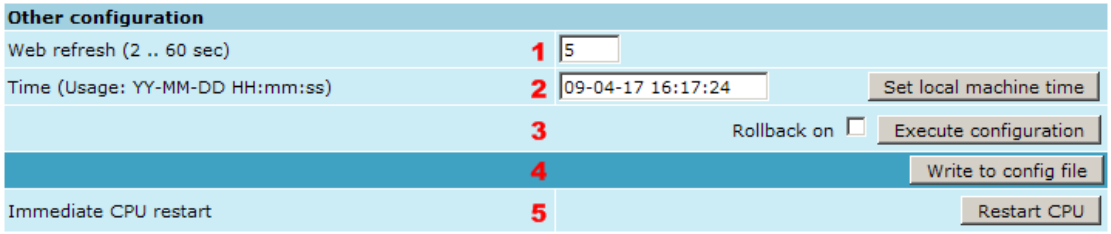
More detailed status controls are available in command prompt, which include:

| ***Additional user management commands in command line interface*** | |
|---|---|
| ***Command*** | ***Description*** |
| **access login** *<name> <password>* | Logs on as a user specified by <name> and <password>. |
| **access logout** | Logs current user out. |
| **access set** *<guest\|admin> <password> [plaintext]* | Allows specifying a new password for a specific account (admin or guest). '*plaintext*' option will save the password in plaintext in configuration script without encrypting it (by default saved passwords in configuration file are encrypted). |
| **access show** | Shows user name and password of a user currently logged on. |
| **access list** | Shows the list of usernames and passwords the current account is able to manage (if logged on as admin, 'guest' and 'admin' account passwords will be seen). |

### 4.2.2 Name configuration


1. *FODU name (Max length: 17 characters)* – allows entering preferable system name. It is recommended to name the system after its geographic location. Maximum length of the user name cannot exceed 17 symbols. Default name is 'HYPERCABLE' (command line – ***system name*** *<name>*);
2. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE HyperBridge. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

### 4.2.3 Other configuration




1. *Web refresh (2 .. 600 sec)* – allows specifying time interval of Web data refreshing. The default value is 5 seconds. You can choose between 2 and 600 seconds (10 minutes) (command line – ***web refresh*** *<web refresh time>*);
2. *Time (Usage: YY-MM-DD HH:mm:ss)* – allows changing system date and time manually by entering date and time in specific syntax. "*Set local machine time*" button forces system to use the time set on your PC or laptop, from which you are connected to the Web interface (command line – ***system time*** *[yyyy-mm-dd hh:mm:ss]*);
3. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE HyperBridge. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.
4. *Write to config file* - saves to configuration file all the changes made (command line – ***cfg write***);

5. Restarts HYPERBRIDGE FODU you are connected to. ((command line – ***system reset***);

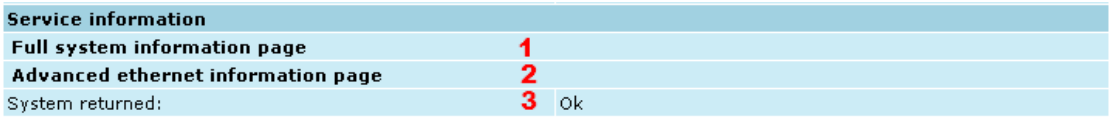
**(!)** Note that after restarting the HYPERBRIDGE will use only those settings, which are written to the configuration script. Other settings will be restored to previously saved or reset to default values (if configuration was never saved).

| ***Additional system commands in command line interface*** | |
|---|---|
| ***Command*** | ***Description*** |
| **System status** | Displays the name of the device and its uptime. |
| **System inventory** [ show ] | Displays the HYPERBRIDGE FODU product code, serial number and additional information. |
| **System aliases** [ list \| all \| basic \| off \| add \| remove \| clear ] | **list** – shows the alias list and whether the aliases are going to be used. The user can choose whether to see all the aliases (adding the argument "all"), built-in aliases ("built-in"), or optional aliases ("optional") , or user aliases ("user");<br>**all** – all the aliases will be used;<br>**basic** – only basic (built-in, hidden and user) aliases will be used;<br>**off** – no aliases will be used;<br>**add** – if two arguments are given, creates an alias of the second argument, named as the first argument. If one argument given, alias command tries and loads the aliases from a file specified by the argument;<br>**remove** – removes the alias specified by the argument;<br>**clear** – removes all the user aliases. |
| **System commands** [ show \| help ] | **show** – displays all available commands;<br>**help** – displays available help messages for all commands. |
| **System reset** [cold] | Restarts CPU of the management controller. Resets all management counters.<br>**cold** – Restarts modem as well. |
| **Ver** | Displays hardware and software version of FODU, as well as built date. |

### 4.2.4 Upgrade software


2. *Choose file* – allows choosing location of software upgrade file (e.g. HyperBridgef142.elf.ezip,Ec) stored on your hard disk. Software upgrade file must have *.elf.ezip,Ec extension;

### 4.2.5 Service Information



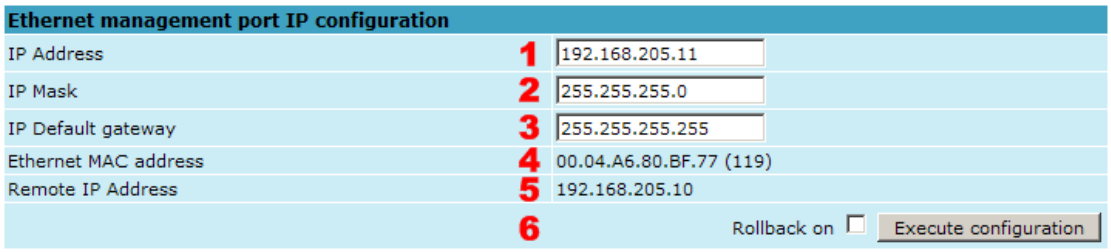

1. *Full system information page* – provides full system information summary in a separate browser tab;
2. *Advanced ethernet information page* – provides advanced Ethernet information in a separate browser tab;
3. *System returned* – in case of error or incorrectly entered parameter value, or other problems on the whole page – info message will be displayed here.. Otherwise it says “Ok”.

## 4.3 IP configuration window

The IP configuration window provides configuration of the Ethernet management port addressing, IP services and routes. Settings listed here are essential for building a network or other specific traffic purposes.

Explanation of customization fields:

### 4.3.1 Ethernet management port IP configuration




1. *IP Address* – allows specifying IP address of HYPERBRIDGE FODU you are currently logged in. Default IP address is 192.168.205.10 or 192.168.205.11 – depending on which side the specific HYPERBRIDGE FODU is – low side has 192.168.205.10 IP address and high side – 192.168.205.11 (command line – ***net ip addr*** <*addr*>);

   **(!)** Note that HyperBridge Wi200-SIP addresses need to be in the same subnet.

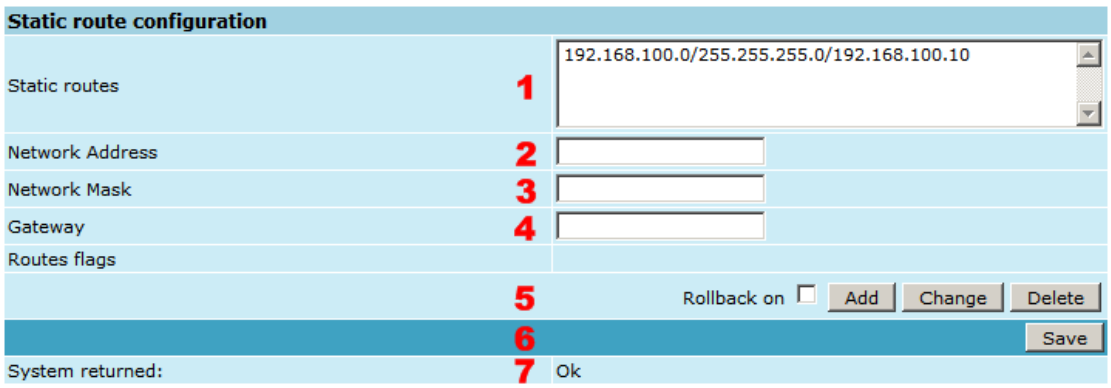
2. *IP Mask* – allows specifying IP mask of HYPERBRIDGE FODU you are currently logged in. Default IP mask is 255.255.255.0, and it should not be changed unless you are owning network with huge amount of hops (command line – ***net ip mask*** <*mask*>);
3. *IP Default gateway* – allows specifying gateway of HYPERBRIDGE FODU you are currently logged in. Default gateway is 255.255.255.255 which means that there is no gateway specified (command line – ***net ip gw*** <*gw*>);
4. *Ethernet MAC address* – shows the MAC address of HYPERBRIDGE FODU you are currently logged in (command line – ***net mac***);
5. *Remote IP Address* – shows IP address of remote (far-end) HYPERBRIDGE FODU to ensure communication between link sides (command line – ***net ip remaddr*** <*remaddr*>);
6. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE HyperBridge. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

### 4.3.2 IP services


1. *FTP service* – starts FTP service for file access and software update of your HYPERBRIDGE FODU. By default FTP service is not running (command line – ***net start ftp***);
2. *TFTP service* – starts TFTP service for file transfer between both HYPERBRIDGE FODU link sides. By default TFTP service is not running (command line – ***net start tftp***).

### 4.3.3 Static route configuration

**(!)** Do not make any changes to default route; otherwise, management connection to HyperBridge Wi200-S will be lost.




1. *Static routes* – shows the list of existing static routes, as well as allows you to choose specific route you are willing to change or delete. By default there is one route which depends on earlier entered IP settings (command line – ***net route***);
2. *Network address* – allows specifying network address for the route changing/adding (command line – ***net route add|delete*** *<dest addr> [MASK <mask>] <gateway>*);
3. *Network mask* - allows specifying network mask for changing/adding the route (command line – ***net route add|delete*** *<dest addr> [MASK <mask>] <gateway>*);
4. *Gateway* - allows specifying gateway for the route changing/adding (command line – ***net route add|delete*** *<dest addr> [MASK <mask>] <gateway>*);
5. After entering addresses or selecting a specific route, buttons “Add”, “Change” and “Delete” allow you to modify HYPERBRIDGE FODU routes. If “Rollback on” is selected, configuration will be reverted in case of erroneous configuration changes applied.
6. *Write to config file* - saves to configuration file all the changes made (command line – ***cfg write***);
7. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says “Ok”.

| *Additional network configuration commands in command line interface* | |
|---|---|
| ***Command*** | ***Description*** |
| **Net ping** *<ip>* | This command is for troubleshooting purposes to verify the service channel connectivity, - it sends a special packet to the specified address and then waits for a reply. |
| **Net telnet** *<host> [<port>]* | Opens Telnet session with the FODU, *host* – IP address of the FODU management Ethernet port. |
| **Net tftp** *<host> {get\|put} <source> [<destination>]* | Uploads or downloads (put/get) file (<source>) to or from the host FODU (<host>). |
| **Web trace** *{show\|on\|off}* | Web trace allows you to see commands being executed through Web interface when you're using serial or telnet connection. *Show* – shows web trace status (on or off), *on* – turns web trace on, *off* – turns web trace off. |
| **Web timeout** <time in minutes> | Allows setting the time, after which the Web GUI presumes no connectivity state. By default the value is set to 15 minutes. |

Below is the explanation of the procedure of network IP configuration in case of network IP Class area change.

For the purpose of illustration, we use B class IP network address 10.0.10.11 for the remote side HYPERBRIDGE and 10.0.10.10 for the local side HYPERBRIDGE, while the IP address of our management PC LAN adapter is 10.0.0.1.

The steps of the configuration procedure are as follows:

1) Enter the remote side (far-end) Web GUI first (in the following case it is 192.168.205.10) and go to **"IP configuration"**. The configuration in this particular example will look in the following way:

| **Ethernet management port IP configuration** | |
|---|---|
| IP Address | 10.0.10.10 |
| IP Mask | 255.255.0.0 |
| IP Default gateway | 255.255.255.255 |
| Ethernet MAC address | 00.04.A6.80.B2.08 (8) |
| Remote IP Address | 192.168.205.11 |
| | Rollback on ☐ Execute configuration |

**(!)** "Rollback on" should not be selected!

Press "Execute configuration".

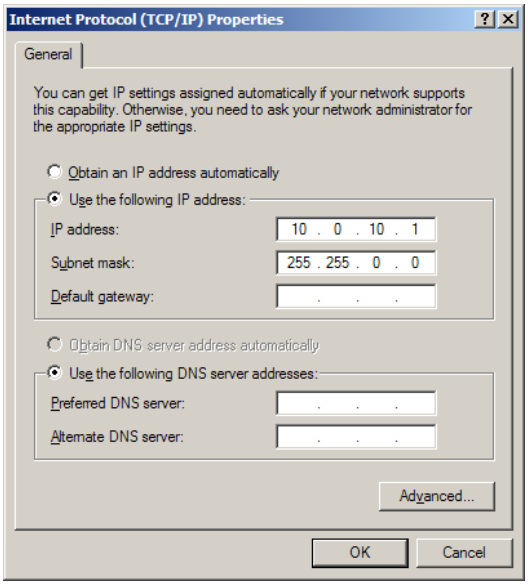
2) Enter the local side (close-end) Web GUI and go to **"IP configuration"**. The configuration will look in the following way:

| **Ethernet management port IP configuration** | |
|---|---|
| IP Address | 10.0.10.11 |
| IP Mask | 255.255.0.0 |
| IP Default gateway | 255.255.255.255 |
| Ethernet MAC address | 00.04.A6.80.B2.07 (7) |
| Remote IP Address | 10.0.10.10 |
| | Rollback on ☐ Execute configuration |

**(!)** "Rollback on" should not be selected!

Press "Execute configuration".

3) In "MS Windows" go to "Control panel → Network Connections". In LAN "Properties" find "Internet Protocol TCP/IP" and click on its "Properties" (detailed description is in ***Chapter 2.2.3***. Configuration of LAN Ethernet port must be as follows:




4) Go to the remote side Web GUI, choose "Tools → Configuration file" and press "Cfg write".

5) Repeat step 4) for the local side Web GUI.

## 4.4 Ethernet configuration

The Ethernet configuration window provides the configuration of the Ethernet LAN, WAN and management ports as well as shows the current status of all three ports (command line – ***ethernet stat***).

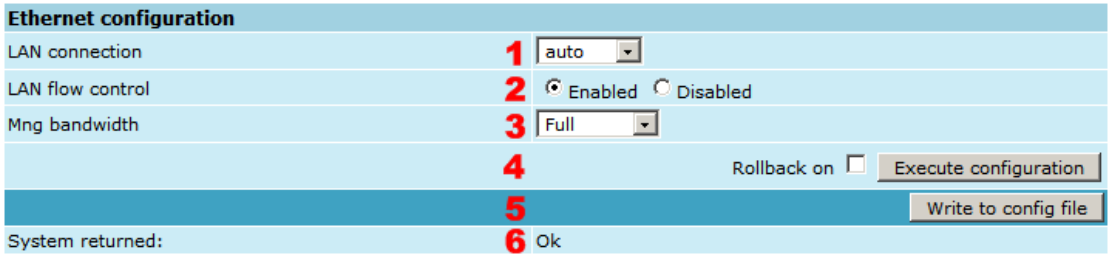
Explanation of customization fields:

### 4.4.1 Ethernet status

| **Ethernet status** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | Port 1 (LAN) | | Port 2 (WAN) | | Port 3 (Mng) | | |
| Link | 2 | On | | On | | | | |
| Speed | 3 | 100 Mb | | 100 Mb | | 100 Mb | | |
| Duplex | 4 | Full | | Full | | Full | | |
| Flow control | 5 | Rx | Tx | Rx | Tx | Rx | Tx | |
| | | On | On | On | On | Off | Off | |
| Rx | 6 | | | | | Enabled | | |
| Tx | 7 | | | | | Enabled | | |
| Bandwidth limit | 8 | | | | | Full | | |

1. Represents all three ports of the HYPERBRIDGE FODU switch – Local Area Network (LAN) port, Wide Area Network (WAN) port and Management (Mng) port;
2. *Link* – shows operation status of each port;
3. *Speed* – shows operation speed of each port;
4. *Duplex* – shows if port is operating in full or half duplex mode;
5. *Flow control* – shows if 'flow control' is enabled or disabled for each port;
6. *Rx* – shows if regress activity is allowed on *Mng* port;
7. *Tx* – shows if egress activity is allowed on *Mng* port;
8. *Bandwidth limit* – shows if Mng port is using bandwidth limiting. If not - 'Full' is being shown.

### 4.4.2 Ethernet configuration




1. *LAN connection* – allows choosing LAN speed and duplex. You are able to choose between 10 Mbps Half Duplex (10hdx), 10 Mbps Full Duplex (10fdx), 100 Mbps Half Duplex (100hdx), 100 Mbps Full Duplex (100fdx) and auto mode. By default 'auto' mode is on (command line – ***ethernet set lan connection*** *[auto|10hdx|10fdx|100hdx|100fdx]*);
2. *LAN flow control* – allows enabling or disabling LAN flow control (command line – ***ethernet set lan flowcntrl*** *enable|disable*);
3. *Mng bandwidth* – allows limiting bandwidth for the Management port. Possible choices are 128 Kbps, 256 Kbps, 512 Kbps, 1 Mbps, 2 Mbps, 4 Mbps and Full (command line – ***ethernet set mng bandwidth*** *[128 | 256 | 512Kbps | 1 | 2 | 4Mbps | Full]*);
4. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE HyperBridge. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.
5. Pressing "Execute configuration" applies changes made to the corresponding section;
6. *Write to config file* - saves to configuration file all the changes made (command line – ***cfg write***);
7. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

## 4.5 VLAN configuration

The VLAN configuration window provides configuration of port-based Ethernet Virtual Local Area Networks (VLANs), allowing using up to 16 different VLAN IDs. It is possible to assign 3 different modes to your VLANs – Trunk (LAN port is interconnected with WAN port and Management port is not accessible – useful for configuring customer VLANs), Management (all ports are interconnected) and Access (all VLAN tagged packets are being untagged at LAN egress port and tagged at LAN ingress port).

**(!)** Note, that Trunk and Access type VLANs cannot be configured together.

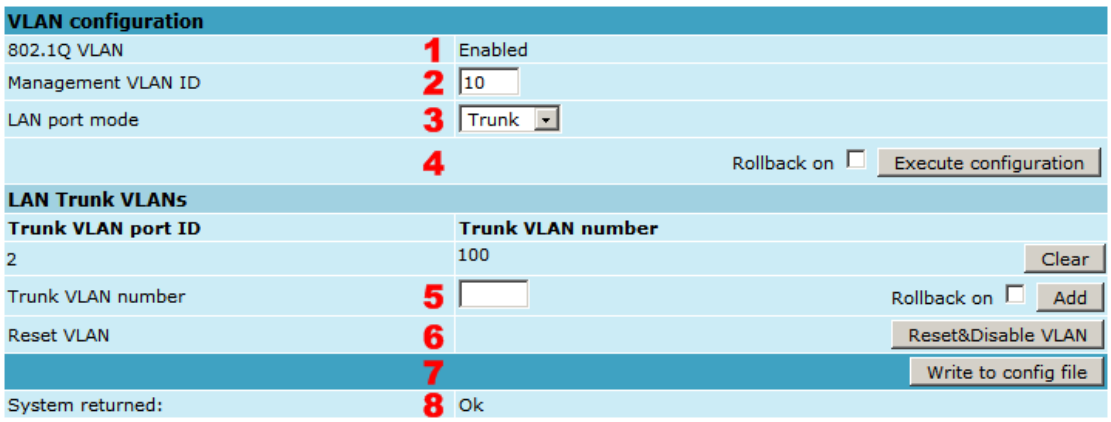



***Figure 4.3.*** *VLAN configuration*

1. *802.1Q VLAN* – shows if support of 802.1Q VLAN is enabled (command line – ***ethernet vlan***);
2. *Management VLAN ID* – allows specifying Management VLAN ID. When already configured, shows current Management VLAN ID (command line – ***ethernet vlan*** *<VLAN ID>* ***management***);
3. *LAN port mode* – specifies LAN port operation mode for user traffic VLANs – with tagging/untagging packets (Access) or passing through already tagged packets (Trunk) (command line – ***ethernet vlan*** *<VLAN ID>* [Trunk | Access]);
4. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE HyperBridge. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.
5. *Trunk VLAN number* – allows to specify and add Trunk VLAN ID. If "Rollback on" is selected, configuration will be reverted in case of erroneous configuration changes applied (command line – ***ethernet vlan*** *<VLAN ID>* [Trunk | Access]);
6. *Reset&Disable VLAN* – resets the whole VLAN configuration and disables 802.1Q VLAN (command line – ***ethernet vlan reset***);
7. *Write to config file* - saves to configuration file all the changes made (command line – ***cfg write***);
8. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

Before configuring VLANs, please ensure the configuration intended to be set is correct.

### 4.5.1 Ethernet switch port status and settings

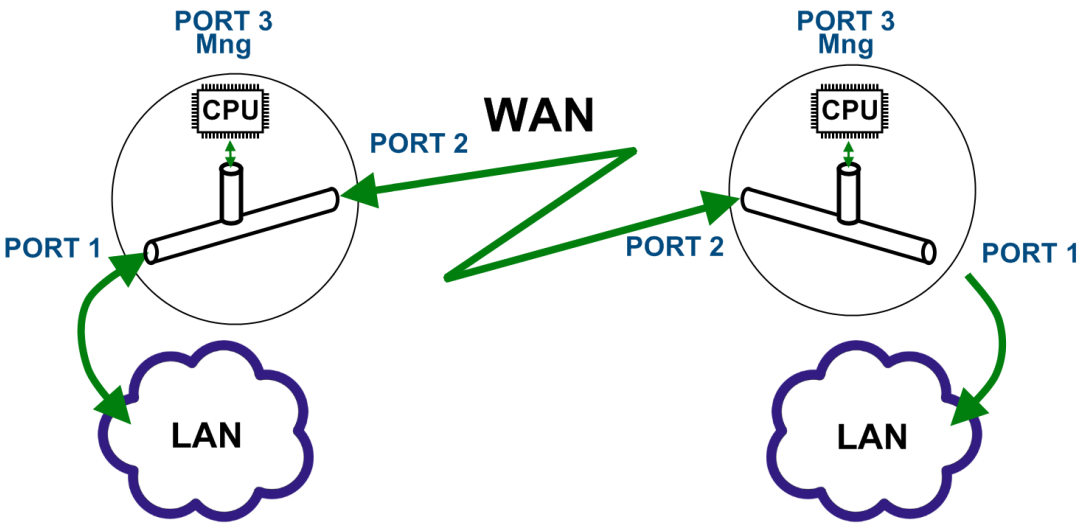



***Figure 4.4.***

Switch port 1 (LAN) is connected to LAN interface.

Switch port 2 (WAN) is connected to WAN interface, modem and radio part.

Switch port 3 (Mng) is connected to LAN Management CPU.

### 4.5.2 Ethernet switch block (functional) diagram

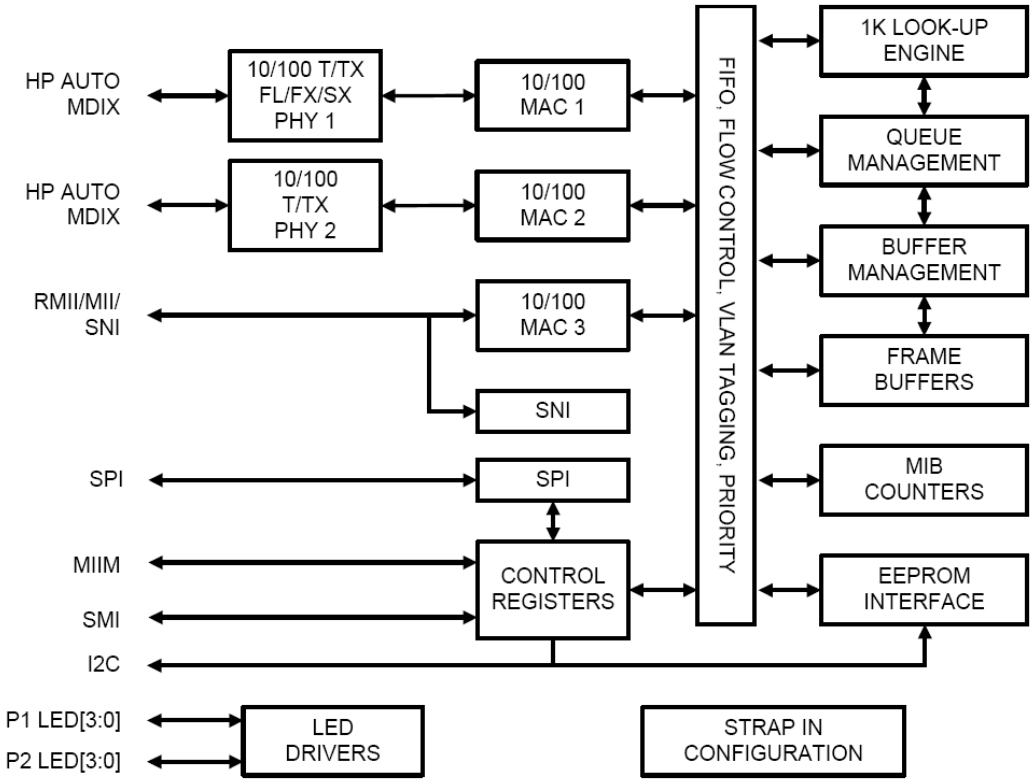



***Figure 4.5.*** *Ethernet switch block diagram*

### 4.5.3 Ethernet switch VLAN status and settings

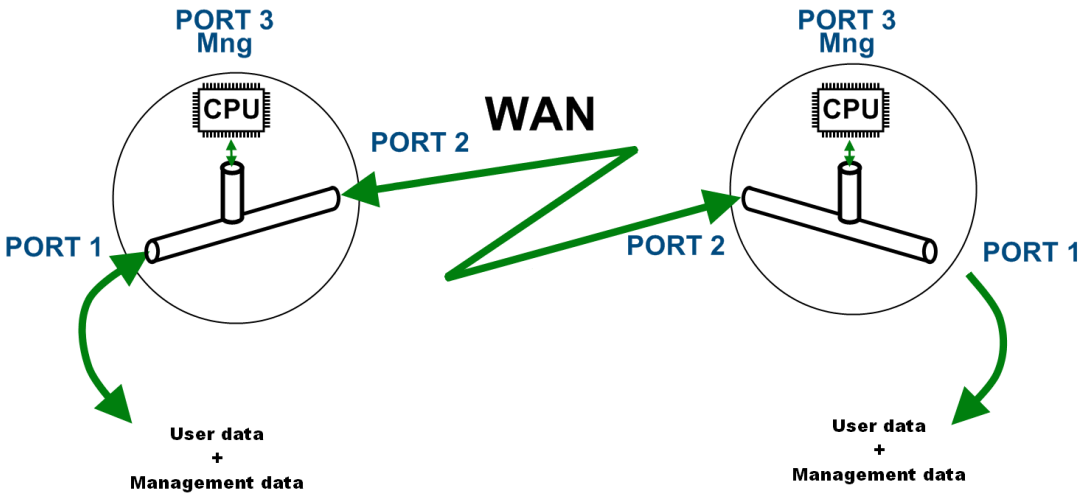



***Figure 4.6.*** *System without VLANs*

When VLANs are not used (***Figure 4.6***), user data and management data are not separated either logically, or physically.

When using VLANs (***Figure 4.7***), it is necessary to use external switches (Switch 3 and Switch 4). These switches add/remove VLAN tags per port basis. Thus, management data and user data have different VLAN tags and are logically separated.

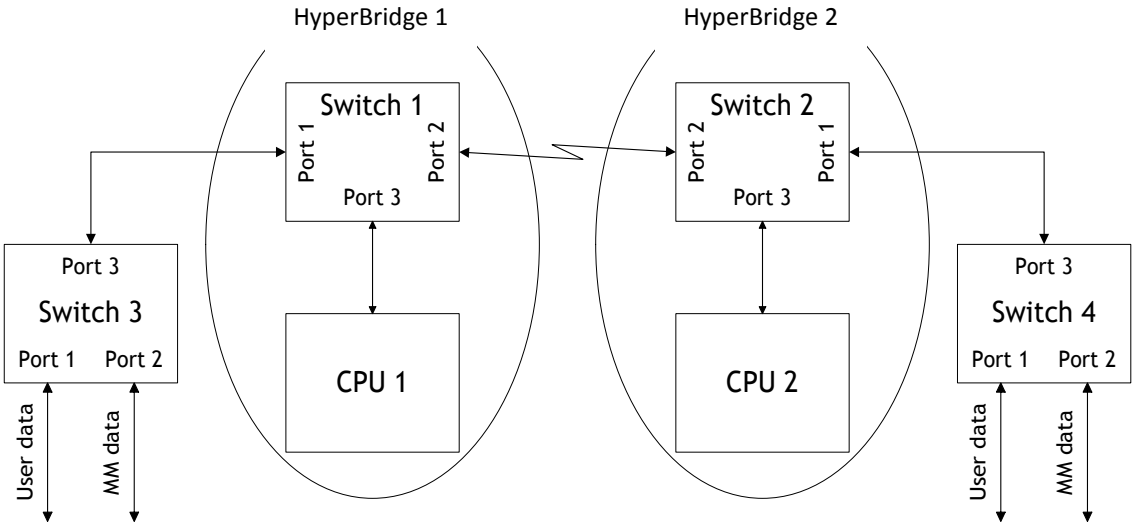



***Figure 4.7.*** *System with VLANs*

System with two separate VLANs – A and B***. Figure 4.8.*** represents ports membership to VLANs.

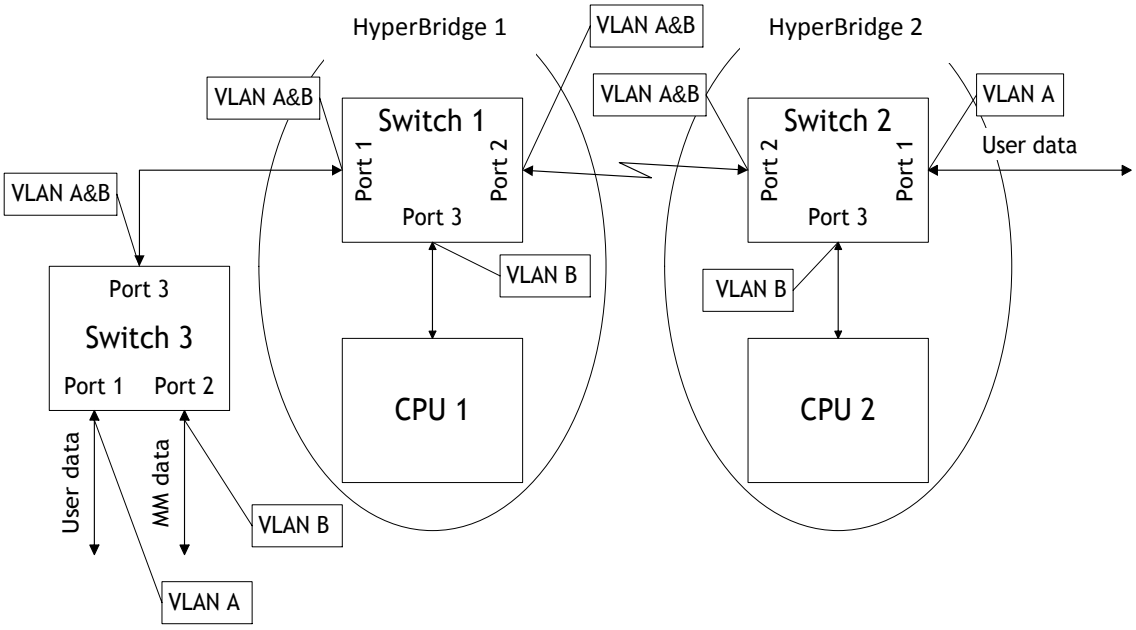



***Figure 4.8.*** *VLANs and ports membership*

Port 1 and port 2 of Switch 1 and Switch 2 are sending data according to VLAN ID and destination address, and adding VLAN tags for packets outgoing from port 3. Additionally, VLAN tag is removed at port 3 of Switch 1 and Switch 2.

VLAN A is the Trunk type VLAN with port 1 & 2 membership.

VLAN B is the Management type VLAN with port 1 & 2 & 3 membership.

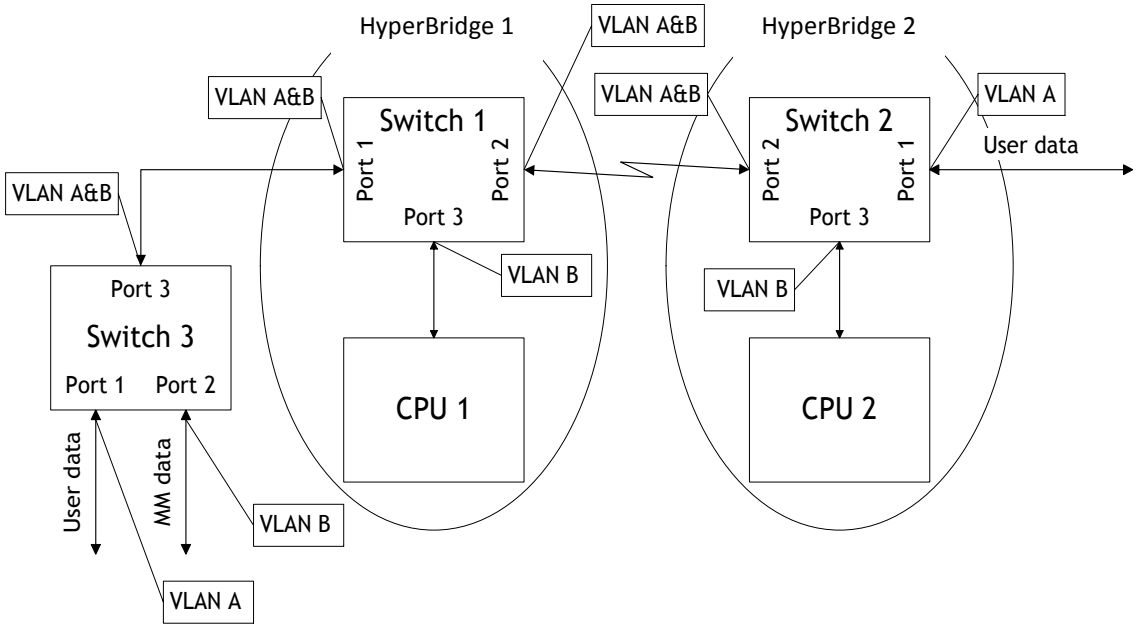



***Figure 4.9.*** *Configuration with management access from one side of the link*

**For Switch 1:**

VLAN A is the Trunk type VLAN with ports 1 & 2 membership

VLAN B is the Management type VLAN with ports 1 & 2 & 3 membership when removing VLAN tags while packet is being sent to port and inserting tag while packet is transmitting to ports 2 & 1.

**For Switch 2:**

VLAN A is the Access type VLAN with ports 1 & 2 membership with removing and inserting VLAN tags while packet is being transmitted to ports 1 and 2, respectively.

VLAN B is the Management type VLAN with ports 2 & 3 membership with removing and inserting VLAN tags while packet is being transmitted to ports 3 and 2, respectively.

**Limitations and rules on using VLAN:**

- Supports up to 16 full range VLAN IDs. If hardware VLAN table is full, software responds with the error message: "*Error: VLAN table is full.*"
- Only one VLAN with unique IDs is allowed. When adding a different VLAN with the same IDs, the old VLAN is deleted (also the other types of VLANs).
- Simultaneous use of Access and Trunk type VLANs is not allowed.
- Use the "*Access*" VLAN type only for remote FODU, because after setting the "*Access*" VLAN type, access to the management CPU from LAN port is **blocked**!
- In order to pass untagged packets through the link, "**Ethernet vlan 0 traffic**" should be added

**Steps required for VLAN configuration:**

1) Configure switches for VLAN tag encapsulation on both ends of the link;

2) Set preferable VLAN configuration in "VLAN configuration" of remote link side HYPERBRIDGE FODU Web management;

> **(!)** Attention! VLAN tagging already must be configured on the switch and known to you; otherwise, incorrect VLAN configuration may disable access to management port.

3) Set preferable VLAN configuration in "VLAN configuration" of local link side HYPERBRIDGE FODU Web management.

Examples of VLAN usage:

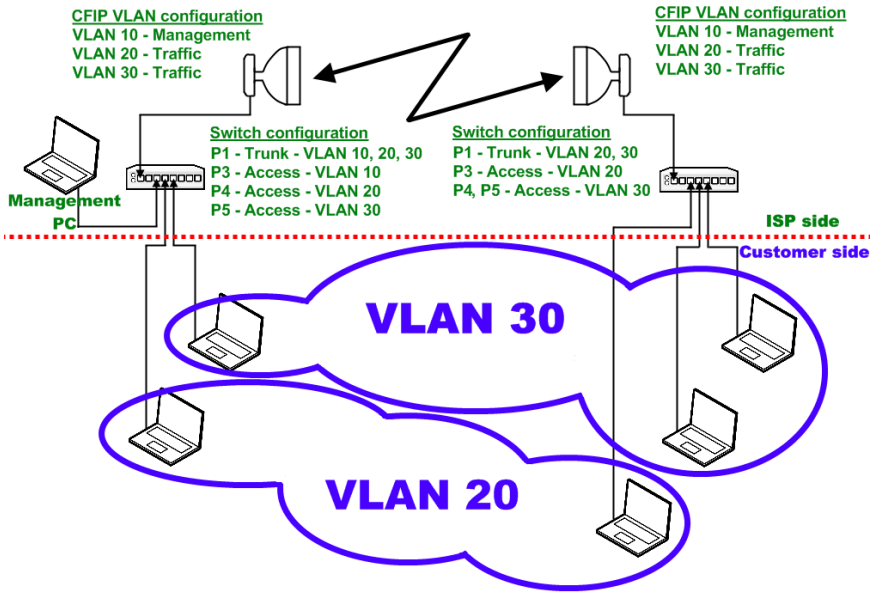



***Figure 4.10.*** *VLAN configuration with VLAN tag encapsulation on the ISP side*

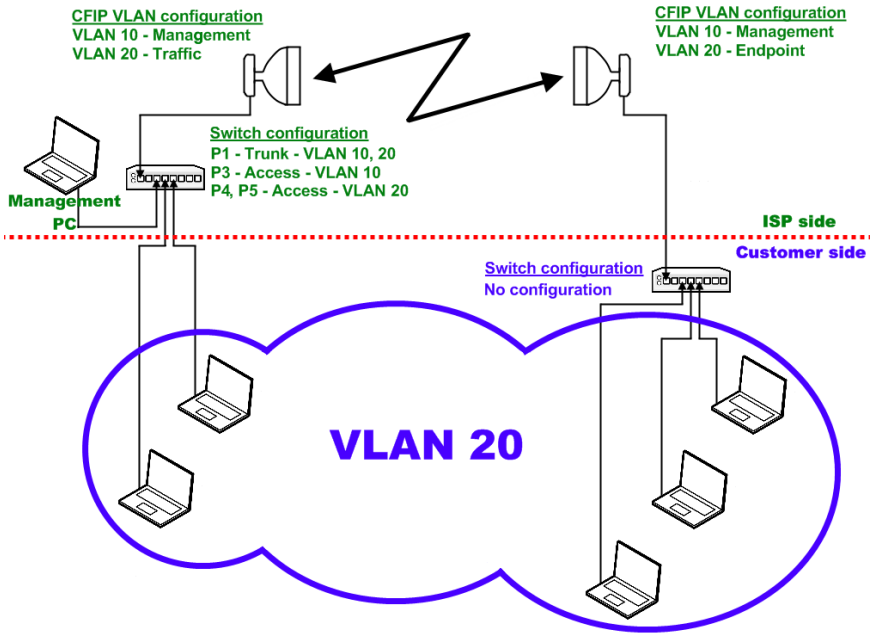



***Figure 4.11.*** *VLAN configuration with 'Access' VLAN*

## 4.6 QoS

HYPERBRIDGE FODU priority queuing uses fixed queuing mode, in which highest priority buffer (q4) will pass packets as long as its buffer is full.

By default weighted priority queuing mode is enabled.

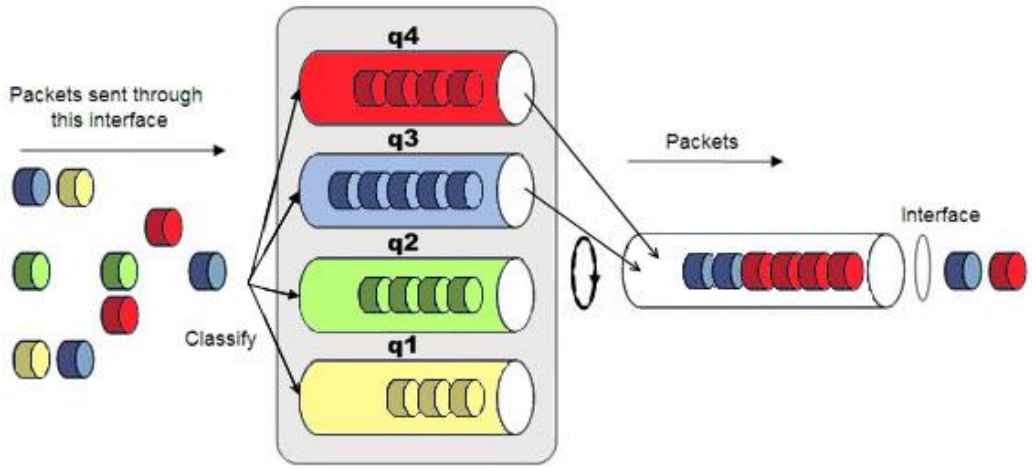



***Figure 4.13.*** *Fixed priority queuing mode*

### 4.6.1 QoS 802.1p configuration

QoS 802.1p provides configuration of QoS 802.1p priority mapping. You are able to map 8 different traffic 802.1p values (0 – 7) into 4 priority queues (1 – 4).

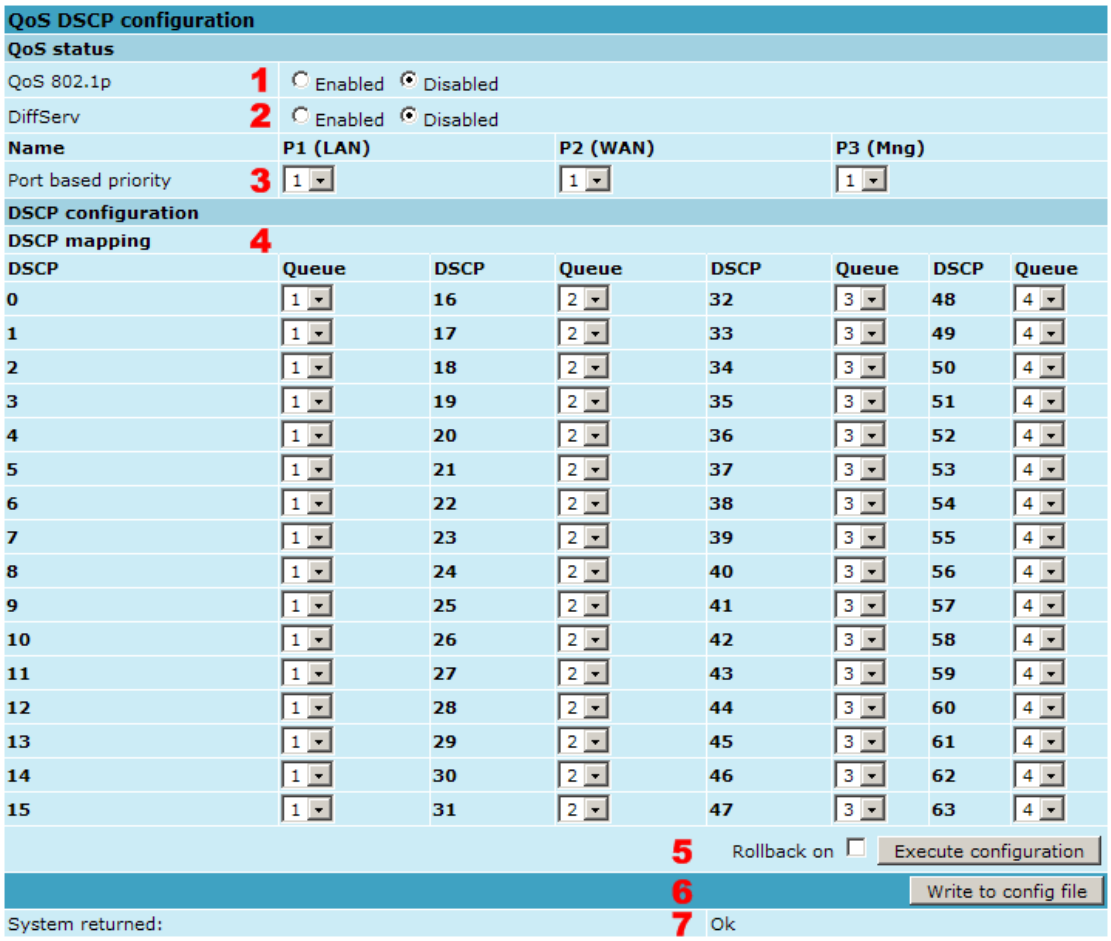
| **QoS 802.1p configuration** | | | |
|---|---|---|---|
| **QoS Status** | | | |
| QoS 802.1p | 1 ○ Enabled ◉ Disabled | | |
| DiffServ | 2 ○ Enabled ◉ Disabled | | |
| **Name** | **P1 (LAN)** | **P2 (WAN)** | **P3 (Mng)** |
| Port based priority | 3 1 | 1 | 1 |
| **QoS 802.1p configuration** | | | |
| **QoS 802.1p priority mapping** | 4 | | |
| **802.1p value** | | **Queue value** | |
| 0 | | 1 | |
| 1 | | 1 | |
| 2 | | 2 | |
| 3 | | 2 | |
| 4 | | 3 | |
| 5 | | 3 | |
| 6 | | 4 | |
| 7 | | 4 | |
| | 5 | Rollback on ☐ | Execute configuration |
| | 6 | | Write to config file |
| System returned: | 7 | Ok | |

1. *QoS 802.1p* – enables or disables 802.1p priorities for all three ports – LAN, WAN and Mng (command line – ***ethernet QoS 802.1p*** *{[enable | disable <Port>] | [map]}*);
2. *DiffServ* – enables or disables DiffServ (DSCP) priorities for all three ports – LAN, WAN and Mng (command line – ***ethernet QoS DSCP*** *[enable | disable <port>] | map)*;
3. *Port based priority* – allows passing packets from ports (LAN, WAN or Mng) directly to a specific priority queue. By default port based priority queuing passes packets from all ports to lowest (1) priority queue (command line – ***ethernet QoS port*** *<port> <priority>);*
4. *QoS 802.1p priority mapping* – allows assigning queue values to specific 802.1p values.

5. By pressing “Execute configuration” changes made to the corresponding section apply only for the local side HYPERCABLE HyperBridge. If “Rollback on” is selected, configuration will be reverted in case erroneous configuration changes are applied.
6. *Write to config file* - saves to configuration file all the changes made (command line – ***cfg write***);
7. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says “Ok”.

### 4.6.2 DSCP configuration

QoS DSCP provides mapping of different traffic DSCP classes to priority queues.



**QoS DSCP configuration**

**QoS status**

| | | |
|---|---|---|
| QoS 802.1p | 1 | ○ Enabled ◉ Disabled |
| DiffServ | 2 | ○ Enabled ◉ Disabled |

| Name | P1 (LAN) | P2 (WAN) | P3 (Mng) |
|---|---|---|---|
| Port based priority | 3 | 1 | 1 |

**DSCP configuration**

**DSCP mapping** 4

| DSCP | Queue | DSCP | Queue | DSCP | Queue | DSCP | Queue |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 16 | 2 | 32 | 3 | 48 | 4 |
| 1 | 1 | 17 | 2 | 33 | 3 | 49 | 4 |
| 2 | 1 | 18 | 2 | 34 | 3 | 50 | 4 |
| 3 | 1 | 19 | 2 | 35 | 3 | 51 | 4 |
| 4 | 1 | 20 | 2 | 36 | 3 | 52 | 4 |
| 5 | 1 | 21 | 2 | 37 | 3 | 53 | 4 |
| 6 | 1 | 22 | 2 | 38 | 3 | 54 | 4 |
| 7 | 1 | 23 | 2 | 39 | 3 | 55 | 4 |
| 8 | 1 | 24 | 2 | 40 | 3 | 56 | 4 |
| 9 | 1 | 25 | 2 | 41 | 3 | 57 | 4 |
| 10 | 1 | 26 | 2 | 42 | 3 | 58 | 4 |
| 11 | 1 | 27 | 2 | 43 | 3 | 59 | 4 |
| 12 | 1 | 28 | 2 | 44 | 3 | 60 | 4 |
| 13 | 1 | 29 | 2 | 45 | 3 | 61 | 4 |
| 14 | 1 | 30 | 2 | 46 | 3 | 62 | 4 |
| 15 | 1 | 31 | 2 | 47 | 3 | 63 | 4 |

5 Rollback on ☐ Execute configuration

6 Write to config file

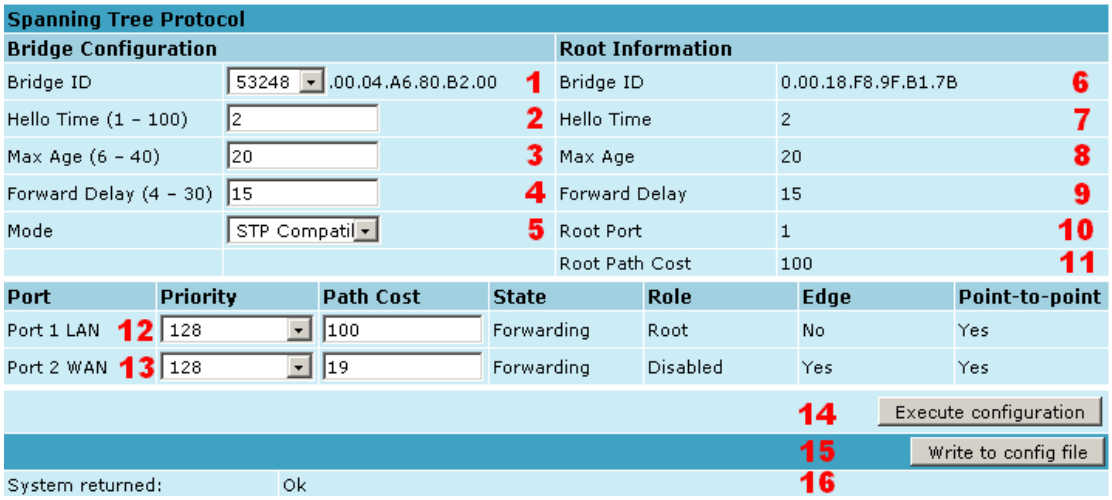
System returned: 7 Ok

1. *QoS 802.1p* – enables or disables 802.1p priorities for all three ports – LAN, WAN and Mng (command line – ***ethernet QoS 802.1p*** *{[enable | disable <Port>] | [map]}*);
2. *DiffServ* – enables or disables DiffServ (DSCP) priorities for all three ports – LAN, WAN and Mng (command line – ***ethernet QoS DSCP*** *[enable | disable <port>] | map)*;
3. *Port based priority* – allows passing packets from ports (LAN, WAN or Mng) directly to a specific priority queue. By default port based priority queuing passes packets from all ports to lowest (1) priority queue (command line – ***ethernet QoS port*** *<port> <priority>);*
4. *DSCP mapping* – allows assigning queues for different DSCP classes. You may have up to 64 different traffic DSCP classes;
5. Pressing "Execute configuration" applies changes made to the corresponding section only for the local side HyperBridge Wi200-SFODU. If "Rollback on" is selected, configuration will be reverted in case of erroneous configuration changes applied;
6. *Write to config file* - saves to configuration file all the changes made (command line – ***cfg write***);
7. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

## 4.7 Spanning Tree Configuration

Implementation of 802.1D-2004 RSTP (Rapid Spanning Tree Protocol) is backwards compatible with STP, as well as having additional capability for automatic WAN port Path Cost calculation and non-standard mode for faster network convergence.

### 4.7.1 Spanning Tree Configuration




*Bridge configuration* - Values 2-4 take effect only if a given Bridge is Root:

1. *Bridge ID* – value from (0..61440)*;* this parameter and MAC address determine whether a given Bridge is Root Bridge. Advantage is given to the combination of *Priority* and *Address*, which is numerically smaller;
2. *Hello Time (1..100)* – time gap, between which the BPDU packets are being sent;
3. *Max Age (6..40)* – this parameter determines time period, during which the received BPDU packets' information is stored for a separate port;
4. *Forward Delay (4..30)* – time period that determines time a separate port stays in *Listening* and *Learning* conditions;
5. *Mode* – allows enabling or disabling STP support. In "Disabled" mode the switch passes through BPDU (Bridge Protocol Data Unit) packets. In STP Compatibility mode the Spanning tree is compatible with STP devices and in RSTP mode the tree is compatible with RSTP devices

*Root information* – displays the data only when STP/RSTP is enabled:

.

6. *Bridge ID* – displays the Bridge ID of current Root bridge;
7. *Hello Time* – displays the current hello time;
8. *Max Age* – displays the current max age;
9. *Forward Delay* – displays the current forward delay;
10. *Root Port* – currently elected root port is being shown;
11. *Root Path Cost* – displays the path cost from current bridge to root bridge;
12. *Port 1 LAN* – STP parameters of LAN port;
13. *Port 2 WAN* – STP parameters of WAN port:

- *Priority (0..240)* – Port Priority. Combination of Priority, Port number and Path Cost determines whether the port will be selected as Root port or will be blocked on the occasion of loop, etc;
- *Path cost (1..200000000)* – this parameter setting depends on the capacity of a separate port;

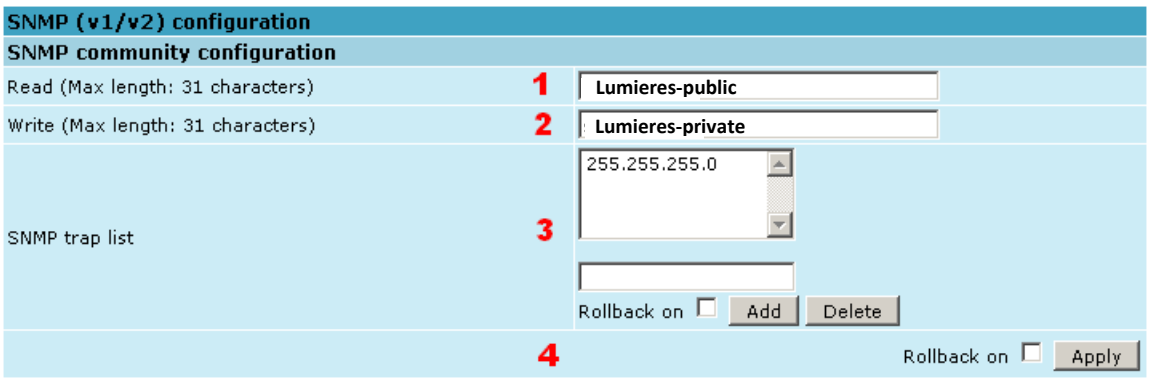
- *State* – port condition. Can be one of the following: *Disabled*, *Blocking*, *Listening*, *Learning*, *Forwarding* or *Broken*;
- *Role* – role of the particular port. Can be one of the following: *Root, Designated, Disabled;*
- *Edge* – specifies whether this particular port is Edge port or not;
- *Point-to-point* – specifies whether there is point-to-point connection from particular port or not;

14. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HyperBridge. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.
15. *Write to config file* - saves to configuration file all the changes made (command line – ***cfg write***);
16. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

## 4.8 SNMP configuration

The SNMP configuration window provides the configuration of SNMP communities, host and trap addresses. HYPERCABLE NMS system will work only when SNMP is properly configured.

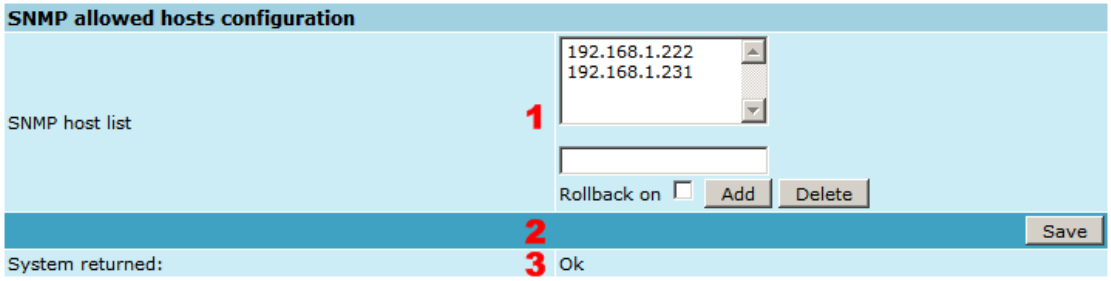
Explanation of customization fields:




### 4.8.1 SNMP community configuration

1. *Read* - Specifies the SNMP community name of the agent to enable parameters to be read (not configured). By default read community name is not specified (command line – ***snmp community read*** *<communityname>*);
2. *Write* – Specifies the community name of the agent to enable parameters to be written (configured). By default community name for writing parameters is not specified (command line – ***snmp community write*** *<communityname>*);
3. *SNMP trap list* – shows the list of entered IP addresses of SNMP trap receivers; possible to add or delete IP addresses in the list of HyperBridge Wi200-S SNMP trap receivers. HyperBridge Wi200-Smanagement controller (agent) sends SNMP traps to the Trap Manager through IP address specified here. The SNMP Trap Manager is a PC with installed SNMP trap management software. (command line – ***snmp trap*** *<ipaddr>*);
4. Pressing "Execute configuration" applies changes made to the corresponding section only for the local side HyperBridge Wi200-SFODU. If "Rollback on" is selected, configuration will be reverted in case of erroneous configuration changes applied.

### 4.8.2 SNMP allowed hosts configuration




1. *SNMP host list* – shows the list of available SNMP hosts; adds or deletes the host IP address to the HyperBridge Wi200-SSNMP host table. If the SNMP host connected to the HyperBridge Wi200-Sis not added to the HyperBridge Wi200-SSNMP host table, the HyperBridge Wi200-Swill not respond to the SNMP requests from that host. If "Rollback on" is selected, configuration will be reverted in case of erroneous configuration changes applied. (command line – ***snmp host*** *{add | delete}* <*ipaddr*>);
2. *Write to config file* - saves to configuration file all the changes made (command line – ***cfg write***);
3. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

# 5 Performance and alarm management

## 5.1 Alarm management

### 5.1.1 Alarms and events structure

All alarms and events are placed in indexed table. Low level raw alarms and events are placed in the first table. Raw alarms and events are merged in groups, which are placed in the second indexed group table. Raw alarm table and group table are related one to many, or one to one if each alarm has a separate group (see ***Figure 5.1***.). Group is in *SET* state if one or more group members are in *SET* state. If there is no info about any group member alarm or event state, then there is no info about group state too.

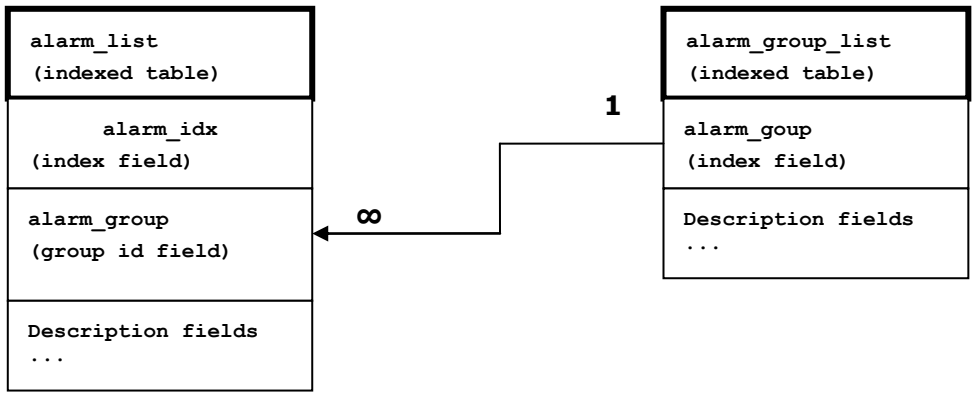



***Figure 5.1.*** *Alarm and group table relation*

### 5.1.2 Alarms-events and groups tables

Most groups write log when group state changes (Set/Reset), but some groups are only rising.

***Alarms events and event groups:***

| Alarm ID | Group ID | Alarm-Event name | Description |
|---|---|---|---|
| 1 | 1 | ==> System Start | Software started [Only rising] |
| 2 | 2 | Invalid device license | License is not valid |
| 3 | 3 | License expired | License validity has expired |
| 4 | 4 | License will soon expire | License validity will soon expire |
| 5 | 5 | Log was Cleared | Entered when 'Log Clear' command was called [Only rising] |
| 6 | 6 | Log ERROR | Log data structure missing |
| 7 | 7 | Log TEST | Log test was made |
| 8 | 8 | Counters was Cleared | System performance counters were cleared [Only rising] |
| 9 | 9 | Config was Written | Configuration was written [Only rising] |
| 10 | 10 | System CPU restart ==> | Entered when system restart was called [Only rising] |
| 11 | 11 | No data from system temperature sensor | No data from temperature sensor connected |
| 12 | 12 | System temperature fault | Temperature is out of defined range |
| 13 | 13 | No data from main PSU ADC | No data from the main PSU ADC |

| | | | |
|---|---|---|---|
| 14 | 14 | Main supply voltage failure | Main supply voltage is out of defined range |
| 15 | 15 | Main supply current failure | Main supply current is out of defined range |
| 16 | 16 | Main supply power failure | Main supply power is out of defined range |
| 17 | 17 | No data from power supply ADC | No data from ADC |
| 18 | 18 | 1,2V failure | Power supply voltage out of defined range |
| 19 | 18 | 1,5V failure | Power supply voltage out of defined range |
| 20 | 18 | 3,3V failure | Power supply voltage out of defined range |
| 21 | 18 | 5,0V failure | Power supply voltage out of defined range |
| 22 | 18 | Permanent 7,5V failure | Power supply voltage out of defined range |
| 23 | 18 | Switchable 7,5V failure | Power supply voltage out of defined range |
| 24 | 18 | 12,0V failure | Power supply voltage out of defined range |
| 25 | 18 | -5,0V failure | Power supply voltage out of defined range |
| 26 | 19 | No data from RADIO | No data from radio (for future compatibility) |
| 27 | 20 | Rx level alarm | Rx alarm level is out of defined range |
| 28 | 21 | Tx PLL error alarm | Tx PLL failure |
| 29 | 22 | Rx PLL error alarm | Rx PLL failure |
| 30 | 23 | No data from MODEM | No data from MODEM connected via UART interface |
| 31 | 24 | Acquire status alarm | Modem acquire failure status |
| 32 | 25 | Last acquire error status | Modem last acquire failure status |
| 33 | 26 | Radial MSE | Radial MSE is out of defined range |
| 34 | 27 | LDPC decoder stress | LDPC decoder stress is out of defined range |
| 35 | 28 | ACM profile was changed | ACM profile was changed |
| 36 | 29 | RX carrier offset | Error in Rx carrier offset |
| 37 | 30 | No data from modem temperature sensor | No data from modem temperature sensor |
| 38 | 31 | Modem temperature fault | Modem temperature is out of defined range |
| 39 | 32 | ATPC Tx power correction was changed | ATPC Tx power correction was changed |
| 40 | 33 | Rollback initiate system CPU restart ==> | System restart was called by rollback [Only rising] |
| 41 | 34 | System CPU reset was WDT initiated ==> | System restart was called by watchdog [Only rising] |
| 42 | 35 | PM log flash write error | Error while writing pm log to flash |
| 43 | 36 | Command from interface | Message about command execution from particular interface |
| 44 | 37 | Message | Informative message |
| 45 | 38 | T1 interface | T1 interface failure |
| 46 | 39 | Ethernet interface | No connection to Ethernet LAN port |

### 5.1.3 Alarm status window

'Status → Alarm status' in navigation bar shows you all the current alarms.

Date and time represents the time the alarm appeared, so you can easily evaluate for how long the alarm has been active. 'Alarm gr.' is the number of alarm group in which the specific alarm is grouped. Complete list of alarm individual IDs and group IDs can be seen in the table above or using the command '**alarm list**' in the command prompt.

To configure representation of alarms, refer to ***Chapter 5.2.5***.

**Alarm status**

| Alarm gr. | Date | Time | Alarm |
|---|---|---|---|
| 30 | 2008-11-22 | 12:39:36 | E1 interface |
| 31 | 2008-11-22 | 12:39:36 | Ethernet interface |

***Figure 5.2**. Alarm status window*

### 5.1.4 Alarm log

To view alarms history, go to 'Performance → Alarm log'.

Alarm log shows 21 latest alarm entries per page and about 2000 latest alarm entries in total.

Alarm entries are mostly distributed in two groups – 'Set' when alarm appears and 'Reset' when alarm disappears.

To view earlier log entries, please enter the number of log entry and press 'Previous 21' or 'Next 21' to view 21 entries before or after entered entry number.

Note that the alarm ID (for example, '032' in the ***Figure 5.3.***) here is an individual ID, not a group ID.

You also have fast access to alarm filtering, where it is possible to choose which alarm ID you are willing to search among all log entries. To configure detailed and permanent alarm representation, refer to the next chapter.

**Alarm log**

0001: 2009-05-05 17:12:35 - 005 - Log was Cleared - Set
0002: 2009-05-05 17:12:49 - 041 - Command from interface - TASK> modem modulation 16APSK wide ACM
0003: 2009-05-05 17:12:52 - 031 - Acquire status alarm - [ACQUIRE_IN_PROGRESS]-> Set
0004: 2009-05-05 17:12:52 - 032 - Last acquire error status - [ACQUIRE_ERR_FREQ_SWEEP]-> Set
0005: 2009-05-05 17:12:52 - 033 - Radial MSE - [2.7]-> Set
0006: 2009-05-05 17:12:54 - 027 - Rx level alarm - [-91]-> Set
0007: 2009-05-05 17:12:54 - 027 - Rx level alarm - [-39]-> Reset
0008: 2009-05-05 17:12:54 - 031 - Acquire status alarm - [ACQUIRE_LOCKED]-> Reset
0009: 2009-05-05 17:12:54 - 032 - Last acquire error status - [ACQUIRE_SUCCESS]-> Reset
0010: 2009-05-05 17:12:54 - 033 - Radial MSE - [-26.2]-> Reset
0011: 2009-05-05 17:12:55 - 035 - ACM profile was changed - [16APSK]
0012: 2009-05-05 17:13:04 - 041 - Command from interface - WEB> log show
0013: 2009-05-05 17:13:23 - 041 - Command from interface - WEB> cfg rollback on
0014: 2009-05-05 17:13:23 - 041 - Command from interface - WEB> cfg rollback exe
0015: 2009-05-05 17:13:25 - 041 - Command from interface - WEB> cfg rollback accept
0016: 2009-05-05 17:13:44 - 041 - Command from interface - WEB> cfg show
0017: 2009-05-05 17:13:45 - 041 - Command from interface - WEB> cfg write
0018: 2009-05-05 17:13:45 - 009 - Config was Written - Set
0019: 2009-05-05 17:13:47 - 041 - Command from interface - WEB> cfg show
0020: 2009-05-05 17:14:06 - 041 - Command from interface - WEB> log show
End

|< | Previous 21 | 20 | Next 21 | >| | Filter: none

> Alarm-event log file <

Clear alarm log

***Figure 5.3**. Alarm log window*

### 5.1.5 Alarm and alarm threshold configuration

The alarm configuration screen allows you to configure alarm representation. You have a choice to see specific alarm groups globally in alarm status (**Global**), in alarm log (**Log**) or in NMS system (**SNMP**). By default all alarms are enabled.

| Alarm & log configuration | Global | Log | SNMP |
|---|---|---|---|
| [1] ==> System Start | ☑ | ☑ | ☑ |
| [2] Invalid device license | ☑ | ☑ | ☑ |
| [3] License expired | ☑ | ☑ | ☑ |
| [4] License will soon expire | ☑ | ☑ | ☑ |
| [5] Log was Cleared | ☑ | ☑ | ☑ |
| [6] Log ERROR | ☑ | ☑ | ☑ |
| [7] Log TEST | ☑ | ☑ | ☑ |
| [8] Counters was Cleared | ☑ | ☑ | ☑ |
| [9] Config was Written | ☑ | ☑ | ☑ |
| [10] System CPU restart ==> | ☑ | ☑ | ☑ |
| [11] No data from system temperature sensor | ☑ | ☑ | ☑ |
| [12] System temperature fault | ☑ | ☑ | ☑ |
| [13] No data from main PSU ADC | ☑ | ☑ | ☑ |
| [14] Main supply voltage failure | ☑ | ☑ | ☑ |
| [15] Main supply current failure | ☑ | ☑ | ☑ |
| [16] Main supply power failure | ☑ | ☑ | ☑ |
| [17] No data from power supply ADC | ☑ | ☑ | ☑ |
| [18] Power supply voltage failure | ☑ | ☑ | ☑ |
| [19] No data from RADIO | ☑ | ☑ | ☑ |
| [20] Rx level alarm | ☑ | ☑ | ☑ |
| [21] Tx PLL error alarm | ☑ | ☑ | ☑ |
| [22] Rx PLL error alarm | ☑ | ☑ | ☑ |
| [23] No data from MODEM | ☑ | ☑ | ☑ |
| [24] Acquire status alarm | ☑ | ☑ | ☑ |
| [25] Last acquire error status | ☑ | ☑ | ☑ |
| [26] Radial MSE | ☑ | ☑ | ☑ |
| [27] LDPC decoder stress | ☑ | ☑ | ☑ |
| [28] ACM profile was changed | ☑ | ☑ | ☑ |
| [29] RX carrier offset | ☑ | ☑ | ☑ |
| [30] No data from modem temperature sensor | ☑ | ☑ | ☑ |
| [31] Modem temperature fault | ☑ | ☑ | ☑ |
| [32] ATPC Tx power correction was changed | ☑ | ☑ | ☑ |
| [33] Rollback initiate system CPU restart ==> | ☑ | ☑ | ☑ |
| [34] System CPU reset was WDT initiated ==> | ☑ | ☑ | ☑ |
| [35] PM log flash write error | ☑ | ☑ | ☑ |
| [36] Event of command execution starting | ☑ | ☑ | ☑ |
| [37] Message of event | ☑ | ☑ | ☑ |
| [38] E1 interface | ☑ | ☑ | ☑ |
| [39] Ethernet interface | ☑ | ☑ | ☑ |
| | | | Execute configuration |
| | | | Write to config file |
| System returned: | Ok | | |

***Figure 5.4**. Alarm configuration window*

Alarm threshold configuration screen allows you to define specific threshold levels to bound alarms to desirable values, so that you are able to adapt alarm system to your individual needs.

Alarms in bold font represent group alarms and alarms in normal font – individual alarms.

**Alarm threshold configuration**

| Alarm ID | Alarm name | Low value | High value | Delta value | Alarm value |
|---|---|---|---|---|---|
| 4 | License will soon expire | 1296000 s | | | Value = 80352000 s |
| 12 | System temperature fault | -33.0 C | 85.0 C | 1.0 C | Value = 42.0 C |
| 14 | Main supply voltage failure | 36.00 V | 57.00 V | 1.00 V | Value = 46.92 V |
| 15 | Main supply current failure | 0.000 A | 0.700 A | 0.010 A | Value = 0.432 A |
| 16 | Main supply power failure | 0.00 W | 25.00 W | 0.50 W | Value = 20.29 W |
| 18 | 1,2V failure | 1.15 V | 1.32 V | 0.03 V | Value = 1.27 V |
| 19 | 1,5V failure | 1.43 V | 1.57 V | 0.03 V | Value = 1.49 V |
| 20 | 3,3V failure | 3.15 V | 3.60 V | 0.03 V | Value = 3.40 V |
| 21 | 5,0V failure | 4.50 V | 5.50 V | 0.03 V | Value = 5.06 V |
| 22 | Permanent 7,5V failure | 6.75 V | 8.25 V | 0.05 V | Value = 7.67 V |
| 23 | Switchable 7,5V failure | 6.75 V | 8.25 V | 0.05 V | Value = 7.64 V |
| 24 | 12,0V failure | 10.80 V | 13.20 V | 0.05 V | Value = 11.95 V |
| 25 | -5,0V failure | -5.50 V | -4.50 V | 0.03 V | Value = -5.04 V |
| 27 | Rx level alarm | -68 dBm | -30 dBm | 1 dBm | Def: ☑ Value = -47 dBm |
| 33 | Radial MSE | | -29.0 dB | 1.0 dB | Def: ☑ Value = -32.6 dB |
| 34 | LDPC decoder stress | | 1.0e-04 | | Def: ☑ Value = 3.3e-05 |
| 36 | RX carrier offset | -700 kHz | 700 kHz | 10 kHz | Value = 11 kHz |
| 38 | Modem temperature fault | -33.0 C | 95.0 C | 1.0 C | Value = 51.5 C |

Execute configuration

Write to config file

System returned: Ok

***Figure 5.5**. Alarm threshold configuration window*

### 5.1.6 Alarm management commands

To manage alarms in command prompt, the commands are as follows:

| ***Alarm management commands*** | |
|---|---|
| ***Command*** | ***Description*** |
| **Log show** [*<start line>*] | The management controller maintains event log, - events include configuration changes, management controller restarts, and local site alarm changes.<br>The "**log show**" or "**log**" commands display the latest 20 log entries, the log entries are numbered, - entry with the largest number is the latest event. The "log show" command can be followed up with an entry number to display the latest 20 entries beginning from the entry specified by the number, e.g., "*log show 100*" will display entries 100…120. |
| **Log filter** *<alarm ID> [<num>]* | Filters event list by specific alarm ID. <num> works similarly to 'log show' command. |
| **Log file** *<file name>* | Makes event log file with specified filename. |
| **Alarm stat** | Lists alarm groups currently set. |
| **Alarm list** | Displays the list of all alarms, their group IDs and alarm IDs. |
| **Alarm groups** | Displays the list of all alarms and their group IDs. |

| *Alarm management commands* | |
|---|---|
| ***Command*** | ***Description*** |
| **Alarm cfg** *<group ID> [<global> <led> <aux> <log> <snmp>]* | Allows defining detailed alarm representation settings. [*<global> <led> <aux> <log> <snmp>*] must be defined in a row of '1's or '0's of 5 values for specified group ID with *<group ID>*. '1' means the values are 'on' and '0' – 'off'. |
| **Alarm threshold** *{stat} \| {<Alarm ID> lo\|hi\|delta <value>}* | Sets threshold values outside which alarm status will be shown. |

## 5.2 Performance management

The main aim of the *performance management* is to register mostly critical device performance event values in predefined time intervals.

### 5.2.1 Performance management data collection

The performance parameters are collected within time intervals of 1 min., 15 min. and 1 hour. List reserved space for every time interval is 1440 records (see ***Figure 5.6***.).

Second-by-second the input performance event values are stored by updating previous second values. The register is called *current register*. The *current register* contains the performance values collected second-by-second from the reset instant to the present second.

At the end of period the contents of current registers are transferred to the history registers (records), with a time-date stamp to identify the period, after which the current register must be reset.

Some current register values are passed to the threshold crossing control unit for triggering threshold crossing notification.

Optionally, the same values are output to the Message Communication Function (MCF) to be forwarded to the managing system.

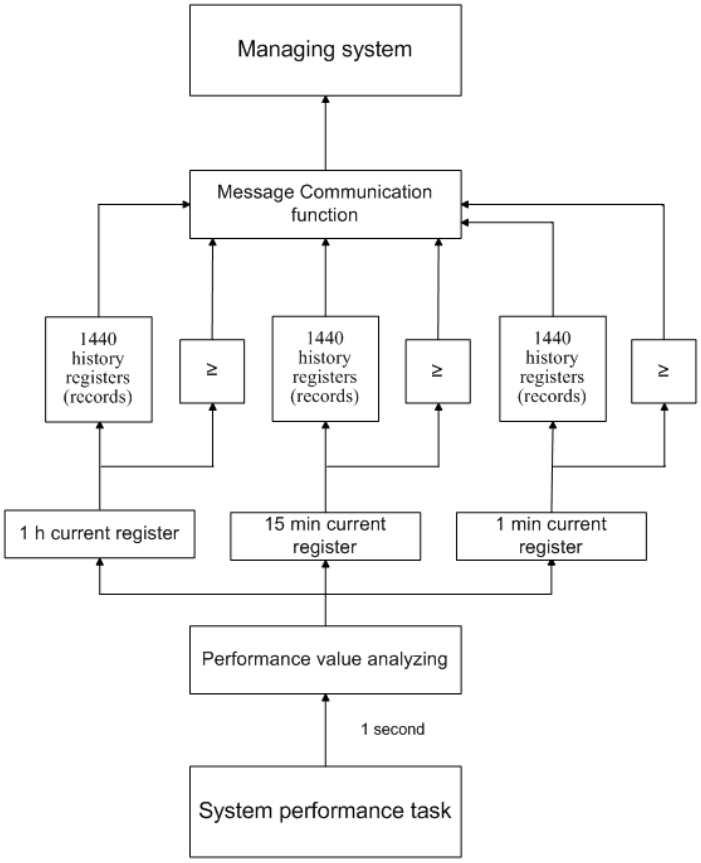



***Figure 5.6.*** *Functional architecture for data collection, history and thresholding treatment*

### 5.2.2 Performance values

### 5.2.3 Threshold seconds (TS)

The TS is defined as one second period during which the detected value is outside of predefined thresholds. The current value of the counter associated with TS should be readable by the managing system on request. In case a threshold associated to a TS counter is changed, the current value of the counter should be reset to zero.

### 5.2.4 Tide Mark (TM)

The TM is a mechanism that records the maximum and the minimum value reached during measurement period. The tide mark values are automatically reset to the current value assumed at the beginning of each measurement period. The TM is therefore composed of two values: the minimum and the maximum value. Comparison between the current value and the minimum and maximum values is performed on a second basis.

### 5.2.5 Performance management in Web GUI

The main performance management tool in the HyperBridge Wi200-SFODU is Web interface, allowing user to review performance measurements in a very convenient and visualized way.

Going to 'Performance → Performance log' in navigation panel on the left side of the Web GUI window will lead you to the log parameters' selection screen, where you will be able to choose between 6 different parameters to display in summarizing performance log or pick 'ALL' to display all 6 parameters in conjoint log which is shown in ***Figure 5.7.***

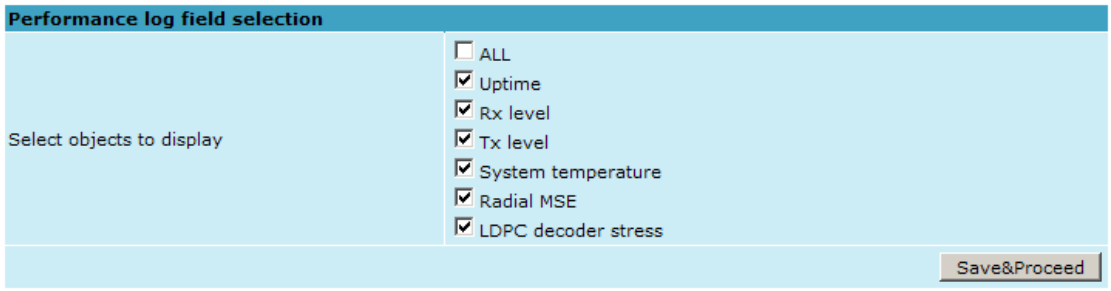



***Figure 5.7*** *Selecting performance log parameters*

**Performance log**

| Nr | Date | Time | Radio | | | | | | System | | | | Modem | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Rx level | | | Tx level | | | Uptime | System temp, C | | | Radial MSE | | | LDPC decoder stress | | |
| | | | Min | Max | TS | Min | Max | TS | Val | Min | Max | TS | Min | Max | TS | Min | Max | TS |
| 1419 | 09-05-05 | 16:54 | -42 | -42 | 0 | 17 | 17 | 0 | 8164 | 48.0 | 48.0 | 0 | -30.0 | -29.6 | 0 | 0.0e+00 | 9.2e-07 | 0 |
| 1420 | 09-05-05 | 16:55 | -42 | -42 | 0 | 17 | 17 | 0 | 8224 | 48.0 | 48.0 | 0 | -30.1 | -29.6 | 0 | 0.0e+00 | 1.2e-06 | 0 |
| 1421 | 09-05-05 | 16:56 | -42 | -42 | 0 | 17 | 17 | 0 | 8284 | 48.0 | 48.0 | 0 | -30.0 | -29.5 | 0 | 0.0e+00 | 9.2e-07 | 0 |
| 1422 | 09-05-05 | 16:57 | -42 | -42 | 0 | 17 | 17 | 0 | 8344 | 48.0 | 48.0 | 0 | -30.0 | -29.6 | 0 | 0.0e+00 | 1.2e-06 | 0 |
| 1423 | 09-05-05 | 16:58 | -42 | -42 | 0 | 17 | 17 | 0 | 8404 | 48.0 | 48.0 | 0 | -30.0 | -29.5 | 0 | 0.0e+00 | 1.0e-06 | 0 |
| 1424 | 09-05-05 | 16:59 | -42 | -42 | 0 | 17 | 17 | 0 | 8464 | 48.0 | 48.0 | 0 | -30.2 | -29.5 | 0 | 0.0e+00 | 1.9e-06 | 0 |
| 1425 | 09-05-05 | 17:00 | -42 | -42 | 0 | 17 | 17 | 0 | 8524 | 48.0 | 48.0 | 0 | -30.0 | -29.6 | 0 | 0.0e+00 | 1.4e-06 | 0 |
| 1426 | 09-05-05 | 17:01 | -42 | -42 | 0 | 17 | 17 | 0 | 8584 | 48.0 | 48.0 | 0 | -30.1 | -29.6 | 0 | 0.0e+00 | 1.3e-06 | 0 |
| 1427 | 09-05-05 | 17:02 | -42 | -42 | 0 | 17 | 17 | 0 | 8644 | 48.0 | 48.0 | 0 | -30.0 | -29.5 | 0 | 0.0e+00 | 2.5e-06 | 0 |
| 1428 | 09-05-05 | 17:03 | -42 | -42 | 0 | 17 | 17 | 0 | 8704 | 48.0 | 48.0 | 0 | -30.1 | -29.6 | 0 | 0.0e+00 | 1.1e-06 | 0 |
| 1429 | 09-05-05 | 17:04 | -42 | -42 | 0 | 17 | 17 | 0 | 8764 | 48.0 | 48.0 | 0 | -30.0 | -29.6 | 0 | 0.0e+00 | 9.4e-07 | 0 |
| 1430 | 09-05-05 | 17:05 | -42 | -42 | 0 | 17 | 17 | 0 | 8824 | 48.0 | 48.0 | 0 | -30.0 | -29.6 | 0 | 0.0e+00 | 1.4e-06 | 0 |
| 1431 | 09-05-05 | 17:06 | -42 | -42 | 0 | 17 | 17 | 0 | 8884 | 48.0 | 48.0 | 0 | -30.0 | -29.6 | 0 | 0.0e+00 | 1.7e-06 | 0 |
| 1432 | 09-05-05 | 17:07 | -42 | -42 | 0 | 17 | 17 | 0 | 8944 | 48.0 | 48.0 | 0 | -30.0 | -29.6 | 0 | 0.0e+00 | 2.3e-06 | 0 |
| 1433 | 09-05-05 | 17:08 | -42 | -42 | 0 | 17 | 17 | 0 | 9004 | 48.0 | 48.0 | 0 | -30.1 | -29.6 | 0 | 0.0e+00 | 1.4e-06 | 0 |
| 1434 | 09-05-05 | 17:09 | -42 | -42 | 0 | 17 | 17 | 0 | 9064 | 48.0 | 48.0 | 0 | -30.1 | -29.6 | 0 | 0.0e+00 | 1.4e-06 | 0 |
| 1435 | 09-05-05 | 17:10 | -42 | -42 | 0 | 17 | 17 | 0 | 9124 | 48.0 | 48.0 | 0 | -30.0 | -29.6 | 0 | 0.0e+00 | 2.3e-06 | 0 |
| 1436 | 09-05-05 | 17:11 | -42 | -42 | 0 | 17 | 17 | 0 | 9184 | 48.0 | 48.0 | 0 | -30.0 | -29.6 | 0 | 0.0e+00 | 1.4e-06 | 0 |
| 1437 | 09-05-05 | 17:12 | -42 | -42 | 0 | 17 | 17 | 0 | 9249 | 48.0 | 48.0 | 0 | -30.0 | -29.6 | 0 | 0.0e+00 | 1.0e-06 | 0 |
| 1438 | 09-05-05 | 17:13 | -42 | -37 | 0 | 16 | 17 | 0 | 9311 | 48.0 | 48.0 | 0 | -30.3 | 2.7 | 3 | 0.0e+00 | SyncLos | 3 |
| 1439 | 09-05-05 | 17:14 | -41 | -41 | 0 | 16 | 16 | 0 | 9371 | 48.0 | 48.0 | 0 | -30.5 | -29.8 | 0 | 0.0e+00 | 0.0e+00 | 0 |
| 1440 | 09-05-05 | 17:15 | -41 | -41 | 0 | 16 | 16 | 0 | 9431 | 48.0 | 48.0 | 0 | -30.4 | -29.6 | 0 | 0.0e+00 | 0.0e+00 | 0 |

Select time interval 1 Min Start date Start time End date End time Show

|< Previous Next >|

Clear performance log

***Figure 5.8*** *Performance log window*

Time interval can be chosen between 1 min, 15 min or 1 hr. You can also define the start time and the start date. When start values are defined, it is also possible to define the end time and the end date.

TS (threshold seconds) show the amount of seconds in a chosen period (1min, 15min or 1h) when the parameter has been out of bounds set by performance thresholds in 'Configuration → Performance log configuration'.

To define thresholds from where TS (threshold seconds) will be counted, you must go to 'Configuration → Performance log configuration' and enter preferable threshold values. Refer to sections **5.2.1.** and **5.2.2.** for further details on threshold seconds.

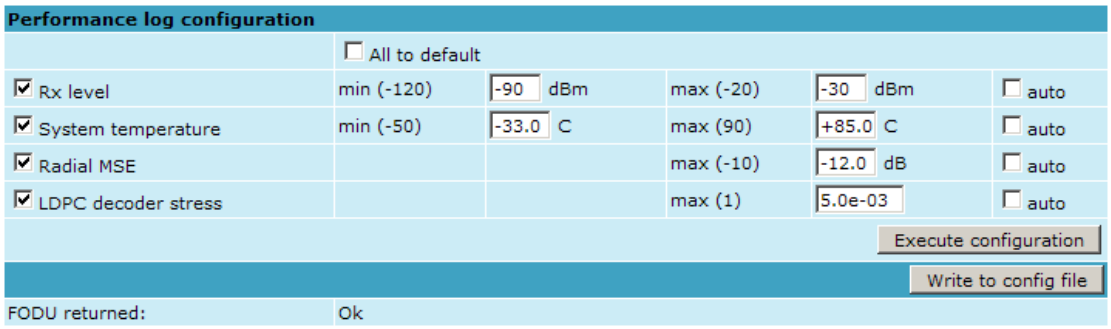



***Figure 5.9*** *Performance log configuration window*

The main advantage in terms of demonstration means is obtained from 'Performance graphs', which are found in 'Performance → Performance graph' section.

You are able to choose between 5 parameters – Rx level; Tx level; System temperature; Radial MSE and LDPC stress – and to view their graphs. It is possible to choose between 8 scales – from 12 last minutes to the maximum of 6 last days to be displayed in the graph. It is also possible to choose time period to be displayed, defining date and time till which the graph will be shown.

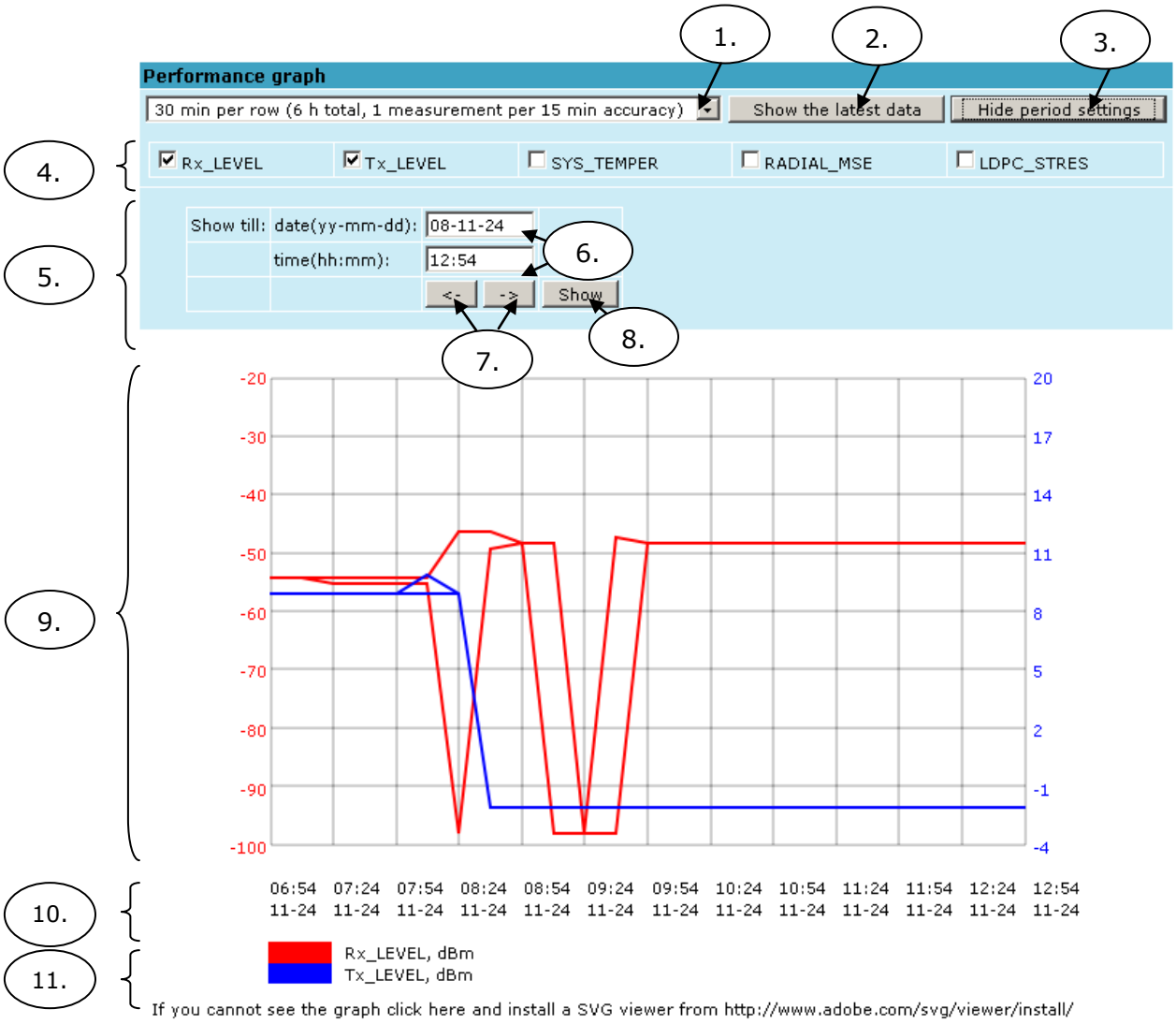



***Figure 5.10*** *Performance graph showing system temperature and Rx level in period of last 6 hours*

1. Time scale selector. User can select the scale and accuracy (1 / 15 / 60 minutes). The lower accuracy, the longer period will be available for data (mechanism of the performance management system)

2. Updates the performance graph; the latest data is shown
3. Shows / hides period settings (point 5)
4. Performance data selector. .Only two performance parameters can be selected at a time
5. Period settings. Allows the user to specify time period for the graph
6. Date and time fields. The date format is “yy-mm-dd”, the time format is “hh:mm”
7. Sets date and time fields (point 6) one screen back / forth
8. Shows / updates the performance graph using the period settings (point 5)
9. Performance graph. Displays two performance parameters. Each parameter is shown with the minimum and maximum curves, which are in the same color. The curves in red have the scale on the left, while the curves in blue have the scale on the right
10. Time scale. Shows the time scale chosen from the time scale selector (point 1) for the performance data available. If no data is available for the according moment, “__:__” is shown
11. Legend for the curves of the performance graph. Contains the color, the name and the unit of measurement, if available.

In case no performance data has been recorded, or the period specified has no data, “No data” is shown (instead of points 9, 10, 11).

### 5.2.6 Constellation diagram

A constellation diagram is a representation of a signal modulated by the digital modulation schemes 32QAM, 16QAM or QPSK. It displays the signal as a two-dimensional scatter diagram in the complex plane at symbol sampling instants. Measured constellation diagram can be used to recognize the type of interference and distortion in a signal.

For the purpose of analyzing the received signal quality, some types of corruption are evident in the constellation diagram. For example:

1) Gaussian noise is displayed as fuzzy constellation points:

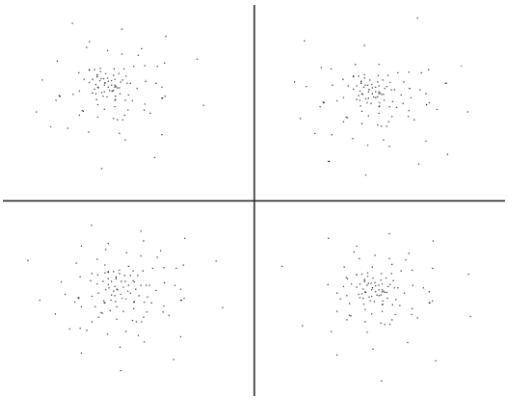


***Figure 5.11.*** *Gaussian noise (QPSK)*

2) Non-coherent single frequency interference is displayed as circular constellation points:

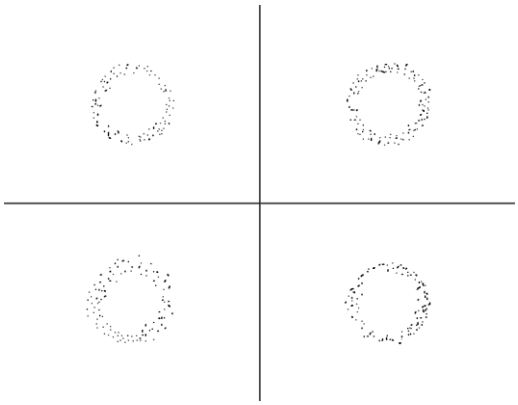


***Figure 5.12.*** *Non-coherent single frequency interference (QPSK)*

3) Phase noise is displayed as rotationally spreading constellation points:

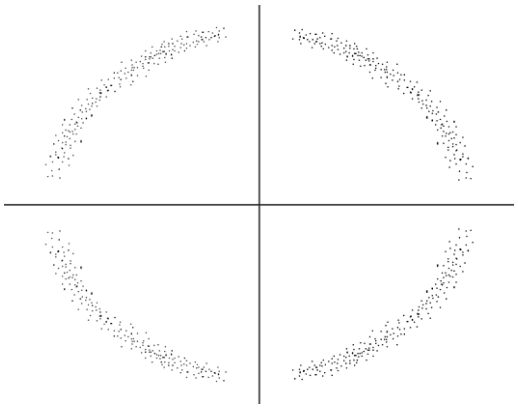


***Figure 5.13.*** *Phase noise (QPSK)*

4) Amplitude compression causes the corner points to move towards the centre:

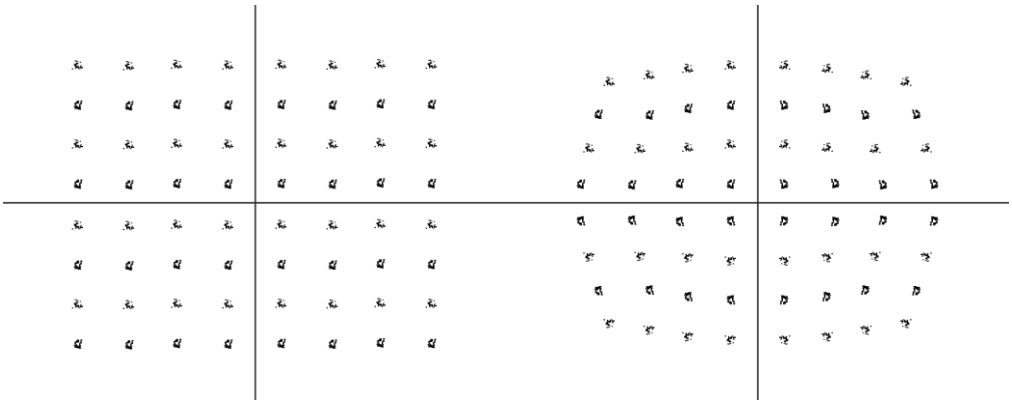


***Figure 5.14.*** *Amplitude compression (64QAM)*

Examples of HyperBridge Wi200-S constellation diagrams under normal conditions are shown below:

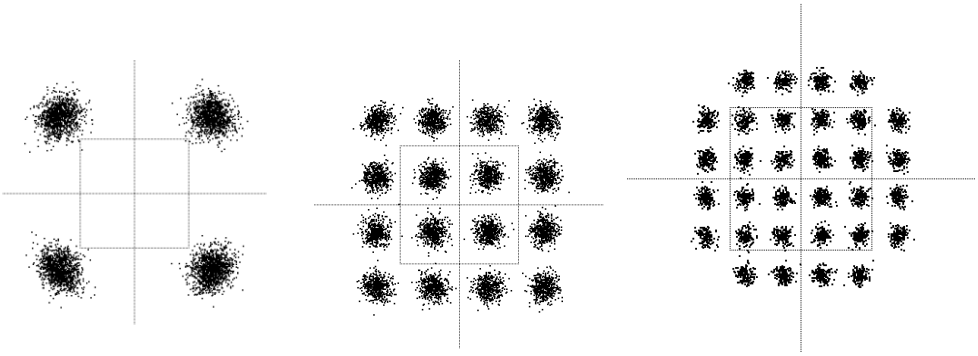
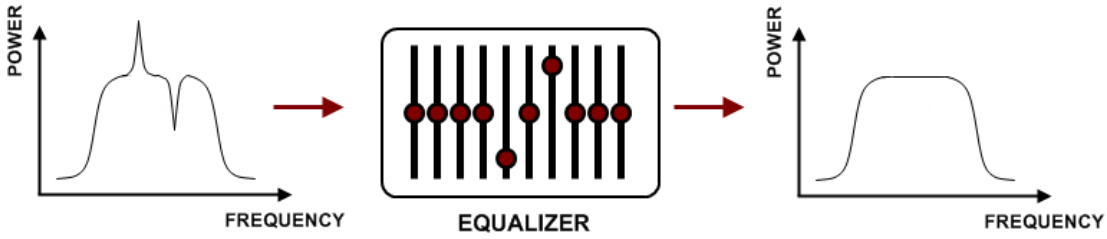


***Figure 5.15.*** *Constellation diagrams – QPSK, 16QAM, 32QAM*

### 5.2.7 Adaptive Equalizer

HyperBridge Wi200-S FODU features adaptive equalizer, which is a filter that automatically adapts to time-varying properties of a communication channel with selective fading, having a target to compensate the inequalities in frequency response, mitigating the effects of multipath propagation. In wireless telecommunications, using QAM modulation this filter equalizes not only a separate quadrature channel, but provides a cancellation of cross-interference between them.

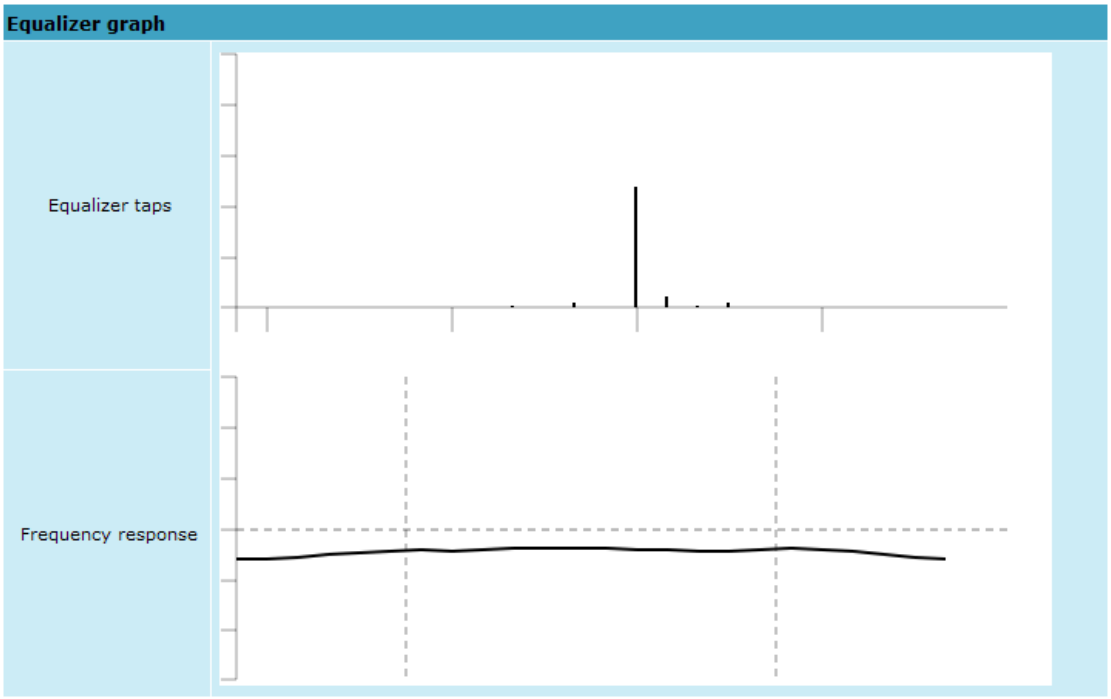
In current HyperBridge Wi200-S device an adaptive equalizer is realized as complex-arithmetic 24-taps digital FIR (Finite Impulse Response) filter. In other words, equalizer is a selective frequency amplifier and attenuator, a device, which application to IF (Intermediate Frequency) bandlimited signal is schematically shown in the picture below:



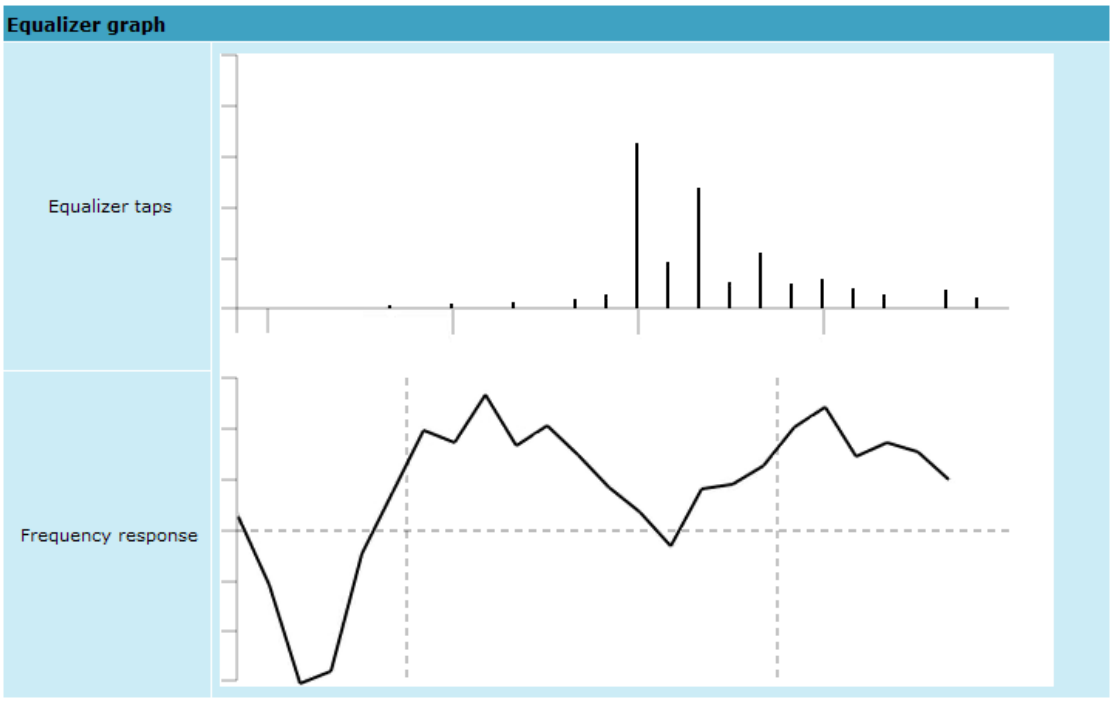

#### Equalizer graph

Equalizer graph window shows adaptive equalizer taps' coefficients, which at a set time moment minimize multipath fading effect in channel.

Example of equalizer taps' coefficients and its frequency response in case of a normal operation is shown below:




During normal operation frequency response curve is smooth and the only equalizer tap towers are in the centre of equalizer taps graph, otherwise frequency response curve will appear jagged and many equalizer taps will become visible. The latter case most probably will indicate to multipath issue, which must be inspected with use of precise and accurate path profiling. An example of multipath caused equalization is shown on the picture below. Taps mainly on the right side designate a weaker reflected signal in comparison with the main signal.




### 5.2.8 Performance management commands

It is also possible to view performance log in command prompt.

The list of available commands is the following:

| *Additional performance management commands in Telnet/serial interface* | |
|---|---|
| ***Command*** | ***Description*** |
| **pm log** *<interval> {<last rec count>\|{<start date>\|<start time>\|<end date>\|<end time>}}* | Lists performance management log with selected *<interval>* of 1min, 15min or 1hr. Allows choosing the number of last records to be shown *(<last rec count>)* or to define start and end time and date. Note that end time and date values must be entered after entering start time or date respectively. |
| **pm select** *{Up_TIME . Rx_LEVEL . Tx_LEVEL . SYS_TEMPER . RADIAL_MSE . LDPC_STRES.} \| {ALL\|NOT}* | Allows selecting the system parameters to be monitored and shown in the performance management log. |
| **pm logclear** | Clears performance log. |
| **pm threshold** stat \| auto \| *{{\|Rx_LEVEL \| Tx_LEVEL \| SYS_TEMPER \| RADIAL_MSE \| LDPC_STRES} {min\|max <value>}\|auto }* | Sets threshold levels for parameters outside which TS (Threshold Seconds) are counted and shown in the performance log. |

## 5.3 Ethernet modem statistics

Ethernet modem statistics window shows the full Ethernet and framing statistics of HyperBridge Wi200-Smodem since unit start or statistics reset. All statistics are also accessible using command prompt command ***ethernet statistics all***.

Explanation of fields:

**Ethernet modem statistics**

Statistics for 1 day 22:40:03 **1**

Modem state Ok **2**

**3** Clear statistics

| Name | | Rx | Name | | Tx |
|---|---|---|---|---|---|
| Truncated frames | 4 | 0 | Vlan tags | 26 | 0 |
| Log events | 5 | 0 | Backpres. events | 27 | 0 |
| Vlan tags detected | 6 | 0 | Pause frames | 28 | 0 |
| Unsup. opcodes | 7 | 0 | Control frames | 29 | 0 |
| Pause frames | 8 | 0 | Wire byte counter | 30 | 3357985167 |
| Control frames | 9 | 0 | Underruns | 31 | 0 |
| Dribble nibbles | 10 | 0 | Giants | 32 | 0 |
| Broadcasts | 11 | 11036 | Late collisions | 33 | 0 |
| Multicasts | 12 | 11054 | Max collisions | 34 | 0 |
| Dones | 13 | 21245712 | Excessive defers | 35 | 0 |
| Jumbo frames | 14 | 0 | Non-exc. defers | 36 | 0 |
| Length check errors | 15 | 0 | Broadcasts | 37 | 21383 |
| CRC errors | 16 | 0 | Multicasts | 38 | 21437 |
| Code errors | 17 | 0 | Dones | 39 | 21282030 |
| False carrier errors | 18 | 0 | Length check errors | 40 | 0 |
| Rx Dv event | 19 | 0 | CRC errors | 41 | 0 |
| Prev. pkt dropped | 20 | 0 | Collisions | 42 | 0 |
| Byte counter | 21 | 3364556166 | Byte counter | 43 | 3357985167 |
| **Name** | | **GFP** | **Name** | | **QoS** |
| FCS errors | 22 | 0 | Rx Q1 frames | 44 | 21245712 |
| CHEC errors | 23 | 0 | Rx Q1 dropped | 45 | 0 |
| Dropped frames | 24 | 0 | Rx Q2 frames | 46 | 0 |
| Delineation errors | 25 | 0 | Rx Q2 dropped | 47 | 0 |
| | | | Tx frames | 48 | 21282031 |
| | | | Tx dropped | 49 | 0 |

1. Shows time period during which statistics have been gathered;
2. *Modem state* – shows if the modem is operating correctly;
3. *Clear statistics* – resets all statistics counters (not available for “guest” account);
4. *Truncated frames* – number of truncated received frames;
5. *Long events* – frames having byte count greater than MAXIMUM FRAME SIZE parameter (1518, 1536 or 1916 bytes);
6. *Vlan tags detected* – VLAN tagged frames;
7. *Unsup. opcodes* – frames recognized as control frames but contained an Unknown Opcode;

8. *Pause frames* – frames received are control frames with valid PAUSE opcodes;
9. *Control frames* – frames received as control frames;
10. *Dribble nibbles* – indicates that following the end of the packet additional 1 to 7 bits are received. A single nibble, named the dribble nibble, is formed but not sent to the system;
11. *Broadcasts* – packets, which destination address contained broadcast address;
12. *Multicasts* – packets, which destination address contained multicast address;
13. *Dones* – reception of packets successfully completed;
14. *Jumbo frames* – frame Type/Length field larger than 1518 (Type Field) bytes;
15. *Length check errors* – frame length field in the packet does not match the actual data byte length and is not a Type Field;
16. *CRC errors* – frame CRC do not match the internally generated CRC;
17. *Code errors* – one or more nibbles are signalled as errors during reception of the packet;
18. *False carrier errors* – indicates that following the last received statistics vector, a false carrier was detected, noted and reported with next received statistics. The false carrier is not associated with this packet. False carrier is activated on the receiving channel that does not result in a packet receive attempt being made;
19. *Rx Dv event* – indicates that the last receiving event seen is too short to be a valid packet;
20. *Prev. pkt dropped* – indicates that since the last RSV, a packet is dropped (i.e. interframe gap too small);
21. *Byte counter* – total number of bytes received on the wire, not counting collided bytes;
22. *FCS errors* – number of generic framing procedure (GFP) frames with CRC errors received by the de-encapsulation block;
23. *CHEC errors* – number of generic framing procedure (GFP) frames with CHEC errors received by the de-encapsulation block;
24. *Dropped frames* – number of generic framing procedure (GFP) frames that were dropped in the de-encapsulation block;
25. *Delineation errors* – number of 'lost of synchronization' events;
26. *Vlan tags* – number of VLAN tagged packets, 32-bit counter;
27. *Backpres. events* – carrier-sense-method backpressure was previously applied;
28. *Pause frames* – frames transmitted are control frames with a valid PAUSE opcodes;
29. *Control frames* – frames transmitted are control frames;
30. *Wire byte counter* – total number of bytes transmitted on the wire, including all bytes from collided attempts;
31. *Underruns* – underruns occur during frame transmission;
32. *Giants* – frames having byte count greater than the MAXIMUM FRAME SIZE parameter (1516, 1536 or 1916 bytes);
33. *Late collisions* – Collisions occurred beyond the collision window (512 bit times);
34. *Max collisions* – packets aborted after number of collisions exceeded the RETRANSMISSION MAXIMUM parameter;
35. *Excessive defers* – packets deferred in excess of 6,071 nibble times in 100 Mbps mode, or 24,287 bit-times in 10 Mbps mode;
36. *Non-exc. defers* – packets deferred for at least one attempt, but less than an excessive defer;
37. *Broadcasts* – packets, which destination address contained broadcast address;
38. *Multicasts* – packets, which destination address contained multicast address;
39. *Dones* – transmission of packets successfully completed;
40. *Length check errors* – frame length field in the packet does not match the actual data byte length and is not a Type Field;
41. *CRC errors* – frame CRC do not match the internally generated CRC;

42. *Collisions* – number of collisions the current packet incurred during transmission attempts. Note: bits 19 through 16 are the collision count on any successfully transmitted packet and as such will not show the possible maximum count of 16 collisions;
43. *Byte counter* – total count of bytes transmitted on the wire not including collided bytes;
44. *Rx Q1 frames* – number of frames received on Q1;
45. *Rx Q1 dropped* – number of frames dropped on Q1;
46. *Rx Q2 frames* – number of frames received on Q2;
47. *Rx Q2 dropped* – number of frames dropped on Q2;
48. *Tx frames* – number of frames passed through TX FIFO;
49. *Tx dropped* – number of frames dropped in TX FIFO.

## 5.4 Ethernet switch statistics

Ethernet switch statistics window shows the full Ethernet statistics of HyperBridge Wi200-Sswitch since unit start or statistics reset. All statistics are also accessible using command prompt command ***ethernet mib all***.

Explanation of fields:

**Ethernet switch statistics**

Data collecting time 67 seconds **1**

**2** Clear statistics

| Value | | LAN | WAN | Mng |
|---|---|---|---|---|
| RxLoPriorityByte | 3 | 37017 | 0 | 66149 |
| RxHiPriorityByte | 4 | 0 | 0 | 0 |
| RxUndersizePkt | 5 | 0 | 0 | 0 |
| RxFragments | 6 | 0 | 0 | 0 |
| RxOversize | 7 | 0 | 0 | 0 |
| RxJabbers | 8 | 0 | 0 | 0 |
| RxSymbolError | 9 | 0 | 0 | 0 |
| RxCRCerror | 10 | 0 | 0 | 0 |
| RxAlignmentError | 11 | 0 | 0 | 0 |
| RxControl8808Pkts | 12 | 0 | 0 | 0 |
| RxPausePkts | 13 | 0 | 0 | 0 |
| RxBroadcast | 14 | 15 | 0 | 0 |
| RxMulticast | 15 | 1 | 0 | 0 |
| RxUnicast | 16 | 155 | 0 | 133 |
| Rx64Octets | 17 | 126 | 0 | 7 |
| Rx65to127Octets | 18 | 1 | 0 | 0 |
| Rx128to255Octets | 19 | 2 | 0 | 57 |
| Rx256to511Octets | 20 | 0 | 0 | 27 |
| Rx512to1023Octets | 21 | 43 | 0 | 7 |
| Rx1024to1522Octets | 22 | 0 | 0 | 35 |
| TxLoPriorityByte | 23 | 66149 | 1294 | 37611 |
| TxHiPriorityByte | 24 | 0 | 0 | 0 |
| TxLateCollision | 25 | 0 | 0 | 0 |
| TxPausePkts | 26 | 0 | 0 | 0 |
| TxBroadcastPkts | 27 | 0 | 15 | 15 |
| TxMulticastPkts | 28 | 0 | 1 | 0 |
| TxUnicastPkts | 29 | 133 | 0 | 158 |
| TxDeferred | 30 | 0 | 0 | 0 |
| TxTotalCollision | 31 | 0 | 0 | 0 |
| TxExcessiveCollision | 32 | 0 | 0 | 0 |
| TxSingleCollision | 33 | 0 | 0 | 0 |
| TxMultipleCollision | 34 | 0 | 0 | 0 |

1. Shows the time during which statistics have been gathered;
2. *Clear statistics* – resets all statistics counters (not available for “guest” account);
3. RxLoPriorityByte - Rx lo-priority (default) octet count including bad packets;
4. RxHiPriorityByte - Rx hi-priority octet count including bad packets;
5. RxUndersizePkt - Rx undersize packets w/ good CRC;
6. RxFragments - Rx fragment packets w/ bad CRC, symbol errors or alignment errors;
7. RxOversize - Rx oversize packets w/ good CRC (max: 1536 or 1522 bytes);
8. RxJabbers - Rx packets longer than 1522 bytes w/ either CRC errors, alignment errors, or symbol errors (depends on max packet size setting);

9. RxSymbolError - Rx packets w/ invalid data symbol and legal packet size.;
10. RxCRCerror - Rx packets within (64,1522) bytes w/ an integral number of bytes and a bad CRC (upper limit depends on max packet size setting);
11. RxAlignmentError - Rx packets within (64,1522) bytes w/ a non-integral number of bytes and a bad CRC (upper limit depends on max packet size setting);
12. RxControl8808Pkts - Number of MAC control frames received by a port with 88-08h in EtherType field;
13. RxPausePkts - Number of PAUSE frames received by a port. PAUSE frame is qualified with EtherType (88-08h), DA, control opcode (00-01), data length (64B min), and a valid CRC;
14. RxBroadcast - Rx good broadcast packets (not including error broadcast packets or valid multicast packets);
15. RxMulticast – Rx good multicast packets (not including MAC control frames, error multicast packets or valid broadcast packets);
16. RxUnicast - Rx good unicast packets;
17. Rx64Octets – Total Rx packets (bad packets included) that were 64 octets in length;
18. Rx65to127Octets – Total Rx packets (bad packets included) that are between 65 and 127 octets in length;
19. Rx128to255Octets - Total Rx packets (bad packets included) that are between 128 and 255 octets in length;
20. Rx256to511Octets - Total Rx packets (bad packets included) that are between 256 and 511 octets in length;
21. Rx512to1023Octets - Total Rx packets (bad packets included) that are between 512 and 1023 octets in length;
22. Rx1024to1522Octets - Total Rx packets (bad packets included) that are between 1024 and 1522 octets in length (upper limit depends on max packet size setting);
23. TxLoPriorityByte - Tx lo-priority good octet count, including PAUSE packets;
24. TxHiPriorityByte - Tx hi-priority good octet count, including PAUSE packets;
25. TxLateCollision – The number of times a collision is detected later than 512 bit-times into the Tx of a packet;
26. TxPausePkts - Number of PAUSE frames transmitted by a port;
27. TxBroadcastPkts - Tx good broadcast packets (not including error broadcast or valid multicast packets);
28. TxMulticastPkts - Tx good multicast packets (not including error multicast packets or valid broadcast packets);
29. TxUnicastPkts – Tx good unicast packets;
30. TxDeferred - Tx packets by a port for which the 1st Tx attempt is delayed due to the busy medium;
31. TxTotalCollision – Tx total collision, half duplex only;
32. TxExcessiveCollision – A count of frames for which Tx fails due to excessive collisions;
33. TxSingleCollision - Successfully Tx frames on a port for which Tx is inhibited by exactly one collision;
34. TxMultipleCollision – Successfully Tx frames on a port for which Tx is inhibited by more than one collision.

# 6 Miscellaneous Controls in Web Graphic User Interface

These controls are located in the Navigation Panel under the “Tools” item.

## 6.1 Configuration File

This section describes operation with HyperBridge Wi200-Sconfiguration script.

The management module has RAM and EEPROM chips onboard. When HyperBridge Wi200-Sis booted up, bootstrap is loaded from the EEPROM into RAM. The bootstrap contains the parameters that were previously stored in EEPROM using **write** and/or **cfg write** commands. These parameters are stored in EEPROM in the form of script and when booting up, the script parameters are loaded into RAM. These parameters can be freely changed in run-time, - changing the data in RAM. If the HyperBridge Wi200-Sis shut down without saving the current configuration (script) in EEPROM, the original configuration will be restored from EEPROM on the next boot-up.

Example of script can be observed on the screenshot below.

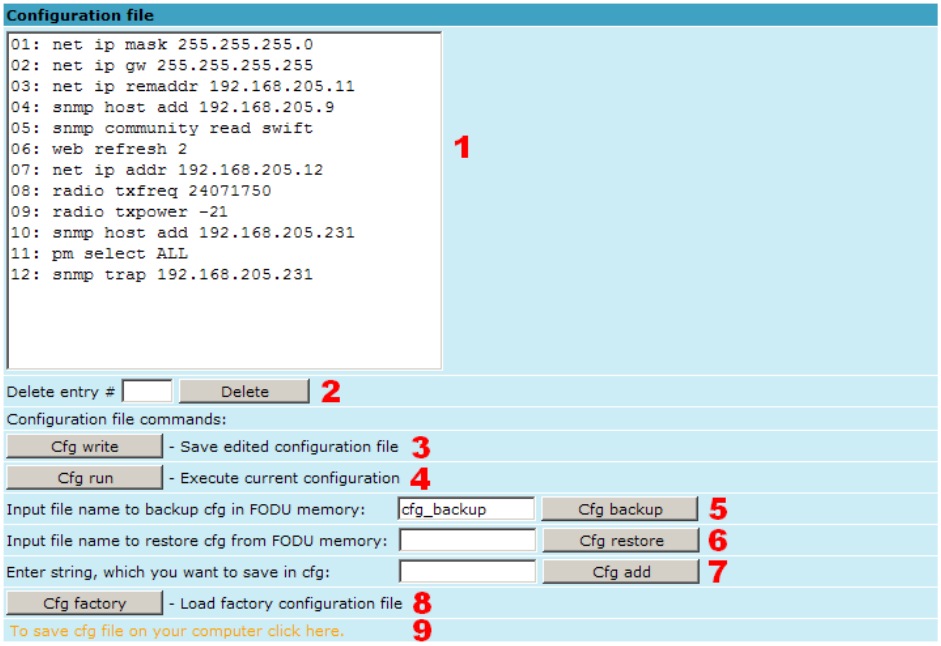
The script can be edited:

- string can be added by simply entering required string (see Nr. 7 on the screenshot below) or by executing command in CLI or in the appropriate Web GUI section (the script will be supplemented with the new string or the instant string entry will be updated);
- string can be deleted by entering appropriate line number (see Nr. 2 on the screenshot below) or by using “**cfg delete** <string#>” in CLI.

The changes can be saved in EEPROM by pressing “Cfg write” button (see Nr. 3 on the screenshot below) or by entering “**cfg write**” command in CLI.

> **(!)** Note! The parameters that are not specified in the configuration script will have their default values when the HyperBridge Wi200-Sis restarted.

Explanation of customization fields:




1. Window shows contents of configuration script. Commands contained in this configuration script are executed at every system start-up (command line – ***cfg show***);
2. *Delete entry #* – allows deleting a specific line of configuration script. You must type the number represented in configuration script to proceed with deleting and press 'Delete' button (command line – ***cfg delete*** *<line>*);

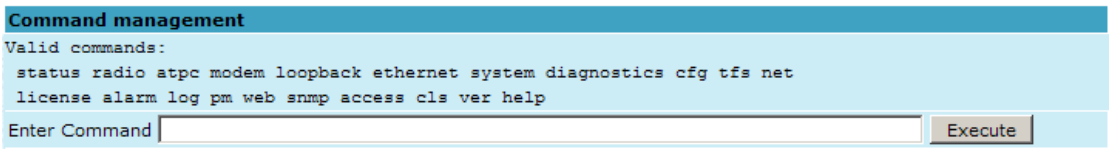
3. *Save edited configuration file* – to confirm the changes made, you must write configuration script into EEPROM, otherwise changes will not be saved (command line – ***cfg write***);
4. *Execute current configuration* – executes commands present in configuration script (command line – ***cfg run***);
5. *Input file name to backup cfg in FODU memory* – allows choosing file name under which current configuration script will be saved in the HyperBridge Wi200-Sflash memory (command line – ***cfg backup*** <*file*>);
6. *Input file name to restore cfg from FODU memory* – allows loading configuration script from previously saved backup file (command line – ***cfg restore*** <*file*>). To view the contents of flash memory, go to 'Tools --> Command line' and type in 'tfs ls';
7. *Enter string, which you want to save in cfg* – allows you to enter desirable command, which will be added to the configuration script as the last line (command line – ***cfg add*** <*cmdline*>);
8. *Load factory configuration file* – Resets the configuration by loading in EEPROM the script with default settings. This command performs the following actions (in the following order):
    1. clears the current script from EEPROM,
    2. creates and stores in EEPROM the new script with the following settings:
        - net ip addr 192.168.205.10 or 192.168.205.11 (as marked on the label)
        - net ip remaddr 192.168.205.11 or 192.168.205.10
        - net ip mask 255.255.255.0
        - net ip gw – 255.255.255.255 (default gateway - none)
        - SNMP trap 255.255.255.255 (none)
    3. restarts the management controller.

    (command line – ***cfg factory***);
9. *To save cfg file on your computer click here* – allows downloading configuration script and saving it on your hard drive.

| ***Additional commands for script editing in command interface*** | |
|---|---|
| ***Command*** | ***Description*** |
| **Cfg load** | Loads the configuration script from EEPROM into RAM. |
| **Cfg clear** | Clears the script stored in RAM. |
| **Cfg insert** <*line*> <*cmdline*> | Inserts typed command line with specified line number into configuration script stored in RAM. |
| **Cfg cmd** <*file with commands*> | Restarts CPU of management controller and loads configuration script from the specified file. |
| **Cfg group** | Groups commands in configuration script. |

## 6.2 Command Line

In the command line you are able to execute all the commands to manage the HyperBridge Wi200-Swhich are available through command interface. This dialog box interprets commands as Telnet commands and sends them to the device. The initial screen shows you the available commands. To view help on a command, type in "<command> **?**", where <command> stands for the specific command.




| *Additional command prompt commands* | |
|---|---|
| ***Command*** | ***Description*** |
| **Cls** | Clears the screen. |
| **Help** *<command>* | Provides help messages for commands. |

## 6.3 File System

The software used by the HyperBridge Wi200-Smanagement controller is organized in files, which are stored on Flash disk.

**Firmware and boot configuration files**

The following files are required for the HyperBridge Wi200-Sto start:

- 'boot.ini' file, - device boot configuration file. This file is a text file and contains the name of the firmware file which must be executed on start-up. The file name can be freely changed, but its default name is 'boot.ini'; hereinafter, it is assumed that this file has default filename. The most important factor concerning this file is that it must be uploaded with 'B' and 'e' attribute flags (flags are case sensitive!), only then it will be treated as executive script.

  Attribute flags for 'boot.ini' file:
  **B** – query run at boot; **e** – executive script
  For information how to upload files in the Flash disk, please refer to ***Chapter 7***.
- Firmware file, - this file is the main firmware executable for the appropriate HyperBridge Wi200-Smodel. The file name can be freely changed, but its default name will contain the version and HyperBridge Wi200-Smodel, e.g., 'cfipz000.elf.ezip'. The most important factor concerning this file is that it must be uploaded with 'E' and 'c' attribute flags, otherwise this file will not be used as the firmware.

  Attribute flags for firmware file:

  **E** – executable binary; **c** - compressed

Notes:

- The files are uploaded from PC to Flash disk using TFTP/FTP (via Ethernet management port) For more information about file upload please refer to ***Chapter 7***; configuration backup files are created by HyperBridge Wi200-Smanagement system.
- The flash disk may store other files as well, for example - previous firmware versions, configuration backup files, - up to 7.7 Mb (about 8 firmware files).
- The attribute flags for files are case sensitive.
- The file names can be changed, but it is very important that the file has the necessary attribute flags; otherwise, the file will not be used either as firmware, or as 'boot.ini' type file.
- There are no file extensions in the file system; either file, when edited, is treated as ASCII text file.
- When uploading the file, if the Flash disk stores the file with the same filename as for the file being uploaded, it will be overwritten with the new file.

**Configuration backup files**

Using '*cfg backup <filename>*' command, the user can create the backup file of the current HyperBridge Wi200-Sconfiguration. The configuration backup file is a text file and, when created, contains the current configuration script, - the same configuration script that are stored in EEPROM. Please refer to ***Chapter 7*** for more information on configuration script.

The configuration backup files are stored on Flash disk, where they can be edited or downloaded to PC. The backup configuration file can be applied in run-time, by consecutively entering '*cfg restore <filename>*' and '*cfg run*' commands. Note: the configuration restored from file is not stored in EEPROM and, therefore, will be lost when HyperBridge Wi200-Sis restarted. To save it in EEPROM use *'write'* command.

The user can create and store several configuration files to quickly revert to other HyperBridge Wi200-Ssite configurations.

**Working with files**

The following commands are intended to operate with files stored on the Flash disk on the management controller.

| | |
|---|---|
| tfs edit <file> | Edits the specified file. This command is applied for editing configuration backup files and boot configuration file (boot.ini). For example,<br>*edit boot.ini,Be*<br>– file 'boot.ini' will be opened for editing. 'Be' specifies that this file will be saved with attributes 'B' and 'e'. If boot.ini file is intended to be modified, it should always be opened specifying 'B' and 'e' flags as in the example above, this will ensure that file is saved with these attributes (flags).<br>To close the file and save changes press Ctrl+Z, to close the file without saving changes press Ctrl+Q.<br>The configuration backup files do not require specific attributes. |
| tfs ls | Displays the list of files stored on the Flash disk and the number of bytes, both free and used by these files.<br>'tfs dir' can also be used. |
| tfs cat <filename> | Displays the contents of the text file.<br>'tfs type' can also be used. |
| tfs del <filename> | Deletes the specified file from Flash disk.<br>'tfs rm' can also be used. |

## 6.4 Security Commands

**General tips**

Telnet server supports one user only, web server supports up to 32 users simultaneously. By default the username and password for Web server, FTP server and Telnet terminal is:

- Username (login): *admin*
- Password: *changeme*

The username and password can be changed in Web GUI "System configuration → User configuration"

'***access set*** *<username> <password> [plaintext]*' command.

Take note of upper case and lower case type: it should be taken into account for the password!

The passwords may contain spaces; if using space(s), the password should be entered in quotation marks.

For Telnet, FTP and Web GUI the password can be changed by simply entering the security command '***access set*** *<username> <password> [plaintext]*' while logged on and then saving the configuration in EEPROM by using '*write*' command.

To terminate Telnet session press Ctrl+D.

**(!)** "Guest" account is unable to change its access password.

**(!)** Specification of the password should always be followed by saving the configuration script (using "**cfg write**" command); otherwise, the password request will be ignored after the restart of HYPERCABLE HyperBridge.

# 7 HyperBridge Wi200-S FODU Discovery Protocol

Discovery Protocol is Layer 3 Network protocol. This feature allows gathering information from connected HyperBridge Wi200-S devices. The protocol discovers the IP address and software version of connected HyperBridge Wi200-S unit. Discovery protocol uses UDP packets sent on port 78.

## 7.1 HyperBridge Wi200-S FODU Discovery Procedure

In order to discover the IP address and software version of HyperBridge Wi200-S unit proceed with the following steps:

- Connect your PC to HyperBridge Wi200-S FODU through PoE injector
- Download Discovery Protocol (available from Hypercable.fr webpage )

- Open the cmd window on your PC (Go to "Start->Run.." and enter "cmd")
- Check for the IP address of your PC Ethernet adapter connected to HyperBridge Wi200-S unit by executing the command "ipconfig"
- Navigate to the folder containing previously downloaded and unzipped Discovery Protocol using "cd" command
- Now the necessary Discovery Protocol command can be executed (e.g. "dp sight <scan_addr>", where <scan_addr> should be substituted by Ethernet adapter IP address of your PC.)

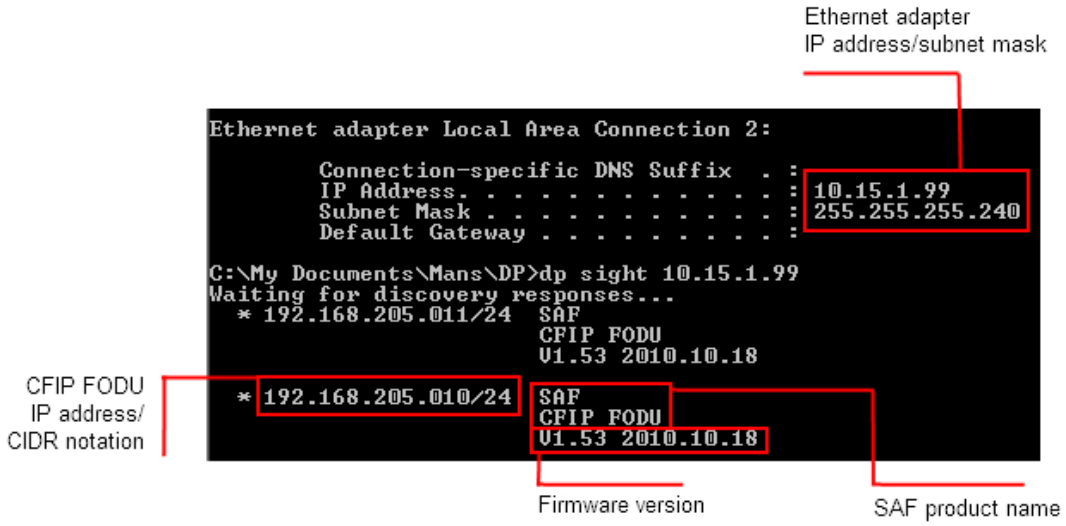
Discovery Protocol Commands:

| **Discovery protocol commands** | |
|---|---|
| **Command** | **Description** |
| dp sight <local_addr> | Allows to find out the IP address and firmware version of HyperBridge Wi200-S FODU without knowing the IP subnet. |
| dp scan <local_addr> <scan_addr> | This command gathers the information in the specified subnet. It sends discovery packets to the broadcast address <scan_addr> and returns the IP address and firmware version of HyperBridge Wi200-S unit. |
| dp remote <local_addr> <remote_addr> <scan_addr> | Allows to find out the IP address and firmware version of HyperBridge Wi200-S remote unit. This procedure allows bypassing routers as the response packets are unicast packets. |

## 7.2 Discovery Protocol Performance Examples

### 7.2.1 Discovery of IP Address and Firmware Version in Case The Subnet of HyperBridge Wi200-S FODU is Unknown

For this purpose the command “dp sight <local_addr>” should be executed in ‘cmd’. Instead of <local_addr> place the IP address of your PC Ethernet adapter that is connected to HyperBridge Wi200-S FODU. Refer to figure below for example.



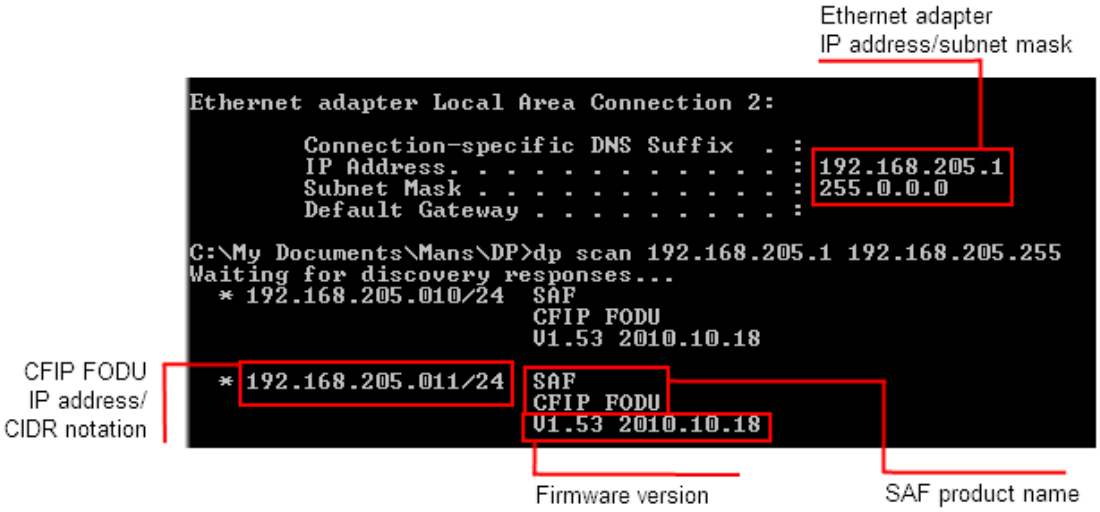

**(!)** Note that IP addresses of Ethernet adapter and HyperBridge Wi200-SFODUs may belong to different subnets. This command sends discovery messages on broadcast address 255.255.255.255 to all devices in network. All HyperBridge Wi200-Sdevices connected to this network are responding with its own IP address/CIDR notation and firmware version.

CIDR notation (routing prefix) is related to network mask that is also necessary in order to manage HyperBridge Wi200-Sunit. The IP address of your PC Ethernet adapter and HyperBridge Wi200-SFODU should be from the same subnet in order to manage the HyperBridge Wi200-S FODU. In the table below some examples are given for CIDR notation and subnet mask relation.

| CIDR notation | Network mask |
|---|---|
| /24 | 255.255.255.0 |
| /25 | 255.255.255.128 |
| /26 | 255.255.255.192 |
| /27 | 255.255.255.224 |
| /28 | 255.255.255.240 |
| /29 | 255.255.255.248 |
| /30 | 255.255.255.252 |

### 7.2.2 Discovery of IP Address and Firmware Version in Case The Subnet of HyperBridge Wi200-S Unit is Known

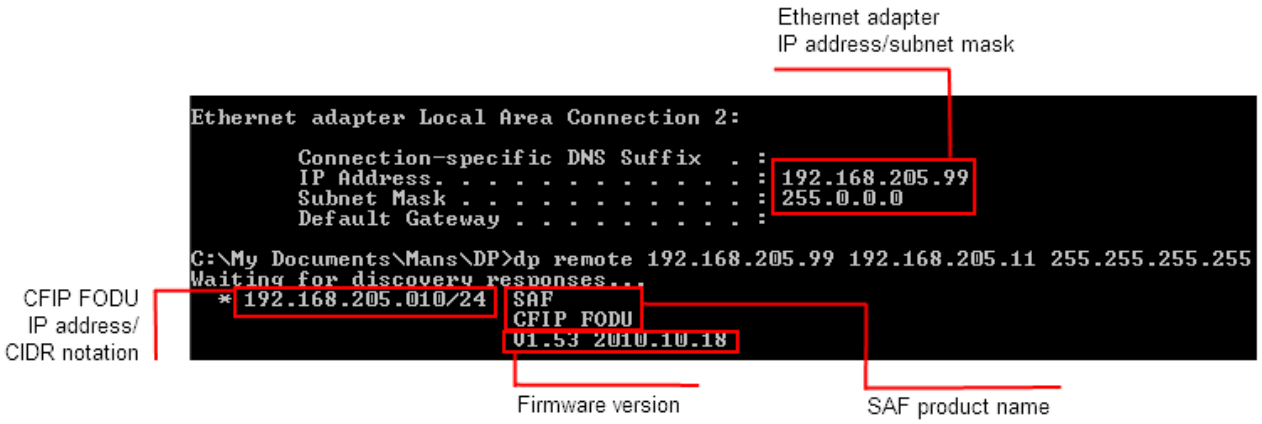
For this purpose the command “dp scan <local_addr> <scan_addr>” should be executed in ‘cmd’. Instead of <local_addr> place the IP address of your PC Ethernet adapter that is connected to HyperBridge Wi200-S FODU and instead of <scan_addr> place the broadcast address of specified subnet. Refer to figure below for example.




**(!)** Note that IP address of Ethernet adapter should belong to the same subnet as HyperBridge Wi200-SFODUs, i.e. the subnet of HyperBridge Wi200-Sunits should be known. The subnet mask of Ethernet adapter and HyperBridge Wi200-SFODUs may differ. This command sends discovery messages on specified broadcast address to all devices in the specified subnet. All HyperBridge Wi200-S devices from specified subnet are responding with its own IP address/CIDR notation and firmware version

### 7.2.3 Discovery of IP Address and Firmware Version of Remote HyperBridge Wi200-S FODU Connected to Router In Case one IP address of Remote Units is Known

For this purpose the command “dp remote <local_addr> <remote_addr> <scan_addr>” should be executed in ‘cmd’. Instead of <local_addr> place the IP address of your PC Ethernet adapter that is connected to router/HyperBridge Wi200-SFODU. Instead of <remote_addr> place the IP address of one of the remote HyperBridge Wi200-Sunits known to you. Instead of <scan_addr> place the broadcast address. Refer to figure below for example.




**(!)** Note that one IP address of remote HyperBridge Wi200-Sunits should be known. The remote host sends discovery packets to specified broadcast address and the responses are delivered to the local host. This allows to find out the IP address and firmware version of neighboring devices of a known remote device. The bypassing of a router is possible as the response packets are unicast.

# 8 Updating software

To simplify the software update process, HYPERCABLE Tehnika provides special update package, as a new version is available. This update pack is available as archive (e.g. zip), which includes firmware file (with *.elf.ezip extension), boot configuration file (with *.ini extension) and other files needed for update process. To receive update pack, please contact your HYPERCABLE Tehnika distributor.

The main method for software upgrade is Web GUI software upgrade, which automates the whole software upgrade process. To perform software upgrade from Web GUI, please go to "Configuration → System configuration" and in "Upgrade software" section press "Browse…" button and locate software upgrade file (e.g. HYPERCABLE HyperBridgel000.elf.ezip) on your hard disc (see Chapter 4.2.4 for detailed explanation of Web GUI upgrade).

| Upgrade software | | |
|---|---|---|
| Choose file: | Browse... | Upgrade |
| System returned: | Ok | |

Besides there are other various ways how the user can update the HyperBridge Wi200-Smanagement software by uploading the appropriate firmware file to the HyperBridge Wi200-Sflash disk and further editing boot configuration file if necessary. The file upload can be performed:

- via Ethernet management port using update package,
- via Ethernet management port using FTP, or

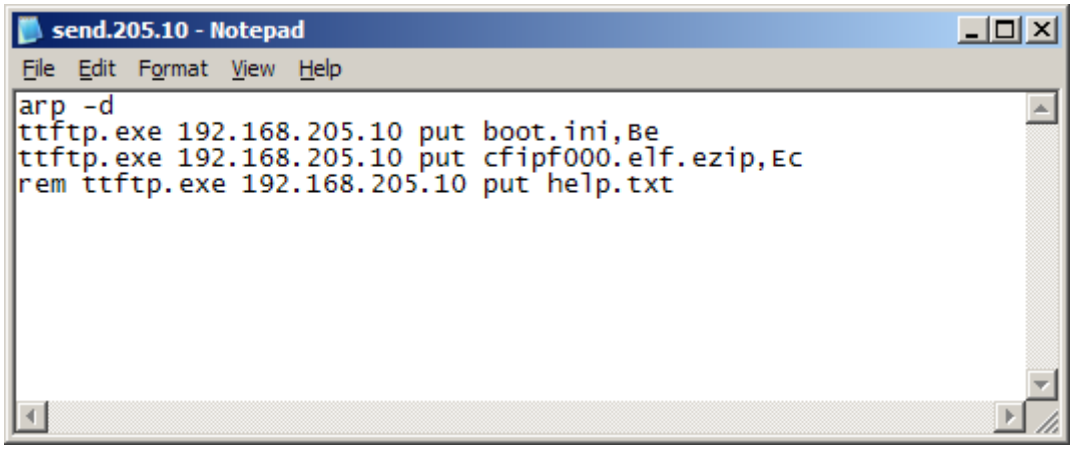
  via Ethernet management port using TFTP.

***Following chapters*** describe other methods how to update the software.

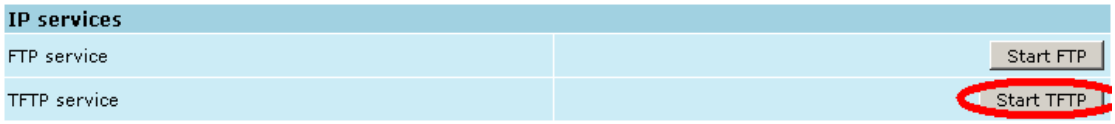
## 8.1 Update Software with Update Pack

To update HyperBridge Wi200-Ssoftware using the update pack, proceed as follows:

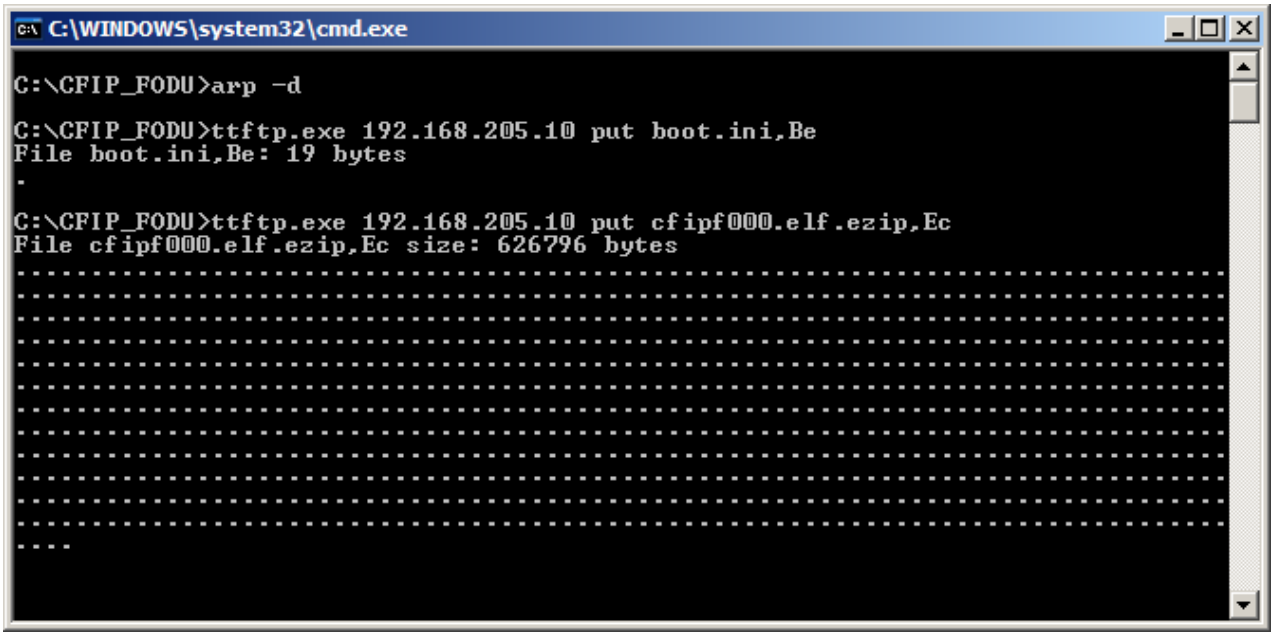
- uncompress the package;
- change the HyperBridge Wi200-SIP address to 192.168.205.10, *or* edit 'send.205.xx' files by replacing "192.168.205.10" with actual HyperBridge Wi200-SIP address;



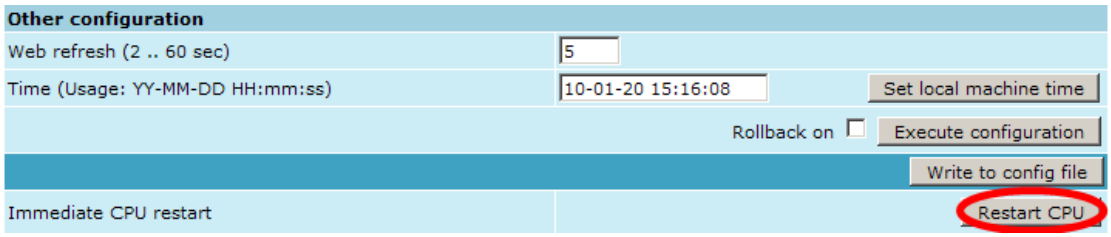

  - **arp –d** *ip_addr* [*if_addr*] deletes the host specified by ip_addr. If another host with a duplicate IP address exists on the network, the ARP cache may have had the MAC address for the other computer placed in it. **arp –d** is used to delete an entry that may be incorrect. By default no host is specified.
  - ***rem*** *ttftp.exe 192.168.205.10 put help.txt* prefix ignores command execution
  - *ttftp.exe 192.168.205.10 put HYPERCABLE HyperBridgel000.elf.ezip,Ec* uploads firmware file named 'HYPERCABLE HyperBridgel000.elf.ezip' with attribute flags 'E' and 'c' to host HyperBridge Wi200-Swith IP address 192.168.205.10.
- Start TFTP on both link sides in 'Configuration → IP configuration':




– run 'send.205.xx.cmd' to perform update, where „xx" represents last number of actual HyperBridge Wi200-SIP address. In case the memory is full, upload will halt and error message will be displayed. In this case user must first delete some files to free enough memory on the HyperBridge Wi200-SFlash disk. Update process screen is shown below:




– To activate new firmware, firstly restart the management CPU of the remote link side HyperBridge Wi200-Sand then the local side HyperBridge Wi200-S(traffic flow won't be interrupted) in 'Configuration → System configuration':




## 8.2 Uploading File via Ethernet Management Port (TFTP)

Assuming that the HyperBridge Wi200-SIP settings are properly configured, proceed as follows:

1. Connect the HyperBridge Wi200-Sto network or directly to PC;
2. Make sure TFTP is running on HyperBridge Wi200-S(by default, the TFTP is switched off); to run the TFTP on HYPERCABLE HyperBridge, connect to HyperBridge Wi200-Swith Telnet client and enter the following command: '*start tftp*';
3. Run the program that enables to use TFTP service, for example command interpreter (cmd.exe) if using Windows, see ***Figure 7.1***;
4. For example, to upload the firmware file 'HYPERCABLE HyperBridge000.elf.ezip' with attribute flags 'E' and 'c', enter command:

**tftp –i 192.168.205.11 put C:\files\cfipz000.elf.ezip cfipz001.elf.ezip,Ec**

where:

'-i' – key which specifies that file must be transferred in binary image transfer mode;

'192.168.205.11' – HyperBridge Wi200-SEthernet management port IP address (host);

'C:\files\cfipz000.elf.ezip' – firmware file (source);

'cfipz001.elf.ezip' – file name in the HyperBridge Wi200-Sflash memory (destination);

'Ec' – file attribute flags 'E' and 'c'; the attribute flags are separated from file name or source with comma (only comma and no space) and there are no commas or spaces between flags;

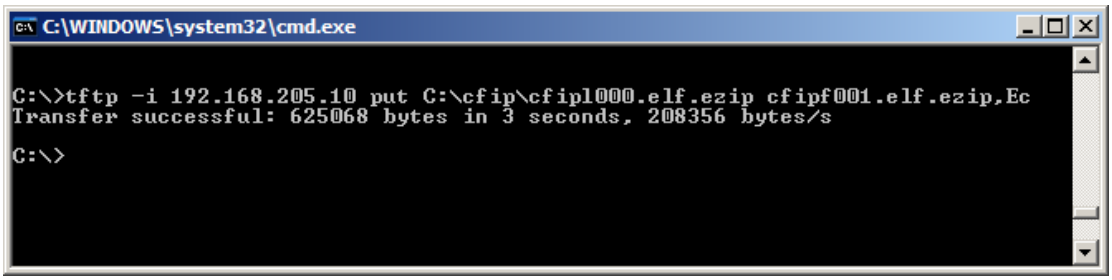



***Figure 7.1.***

5. If uploaded file is large (like firmware file), it is recommended to defragment Flash disk. Use '*tfs clean*' command from Telnet or ASCII terminal to perform defragmentation.

6. If the uploaded file is the firmware file which should be used by HYPERCABLE HyperBridge, it is necessary to edit 'boot.ini' file by deleting the entry with the old file name and to write file name of the new firmware file; the 'boot.ini' file must be saved with 'B' and 'e' flags (file attributes). For more information how to edit files, please refer to the chapter *Working with files* in ***Chapter 6.4***.

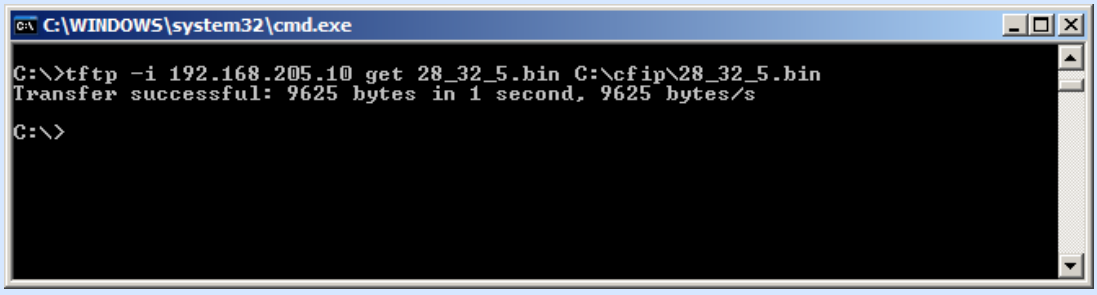
**(!)** To copy file from HYPERCABLE HyperBridge Flash disk to PC hard disk via TFTP, use the following command:

**tftp -i 192.168.205.11 get filename destination_filename**

where

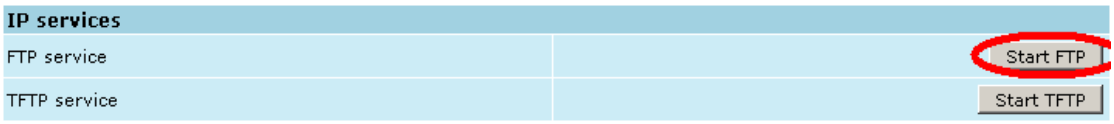
'192.168.205.11' – HYPERCABLE HyperBridge port IP address (host);

'filename' – file to be copied from HYPERCABLE HyperBridge to PC; 'destination_filename' – destination path where the file will be saved on PC hard disk.



## 8.3 Uploading File via Ethernet Management Port (FTP)

Before uploading file via FTP, make sure the HyperBridge Wi200-SFTP server is running. To start it, go to 'Configuration → IP configuration' in Web GUI and press 'Start FTP':




1. Open command window.
2. Start FTP client by entering "***ftp***" command ("*ftp>*" prompt will appear).
3. Connect to HyperBridge Wi200-SFTP server using command "***open*** *<HYPERCABLE HyperBridge_IP_address>*". Type in username and password when prompted (by default username is *admin* and password is *changeme*).
4. Enter the command "***type binary***" to make sure the binary transfer mode is selected.
5. Use command "***send*** *<local file> <remote file>, <flags>*" to upload files to HyperBridge Wi200-SFlash disk. For example:

*send c:\boot.ini boot.ini,Be*

Use flags 'E' and 'c' if the file is a firmware file; if the file is a boot configuration file (boot.ini), the flags must be 'B' and 'e' ('**Be**'); the flags for configuration backup files may not be specified.

Use command "***ls***" to list files on HyperBridge Wi200-Sflash disk.

Use command "***delete*** *<filename>*" to delete the file from the HyperBridge Wi200-SFlash disk.

6. Proceed with steps 5. and 6. in ***Chapter 7.1***.

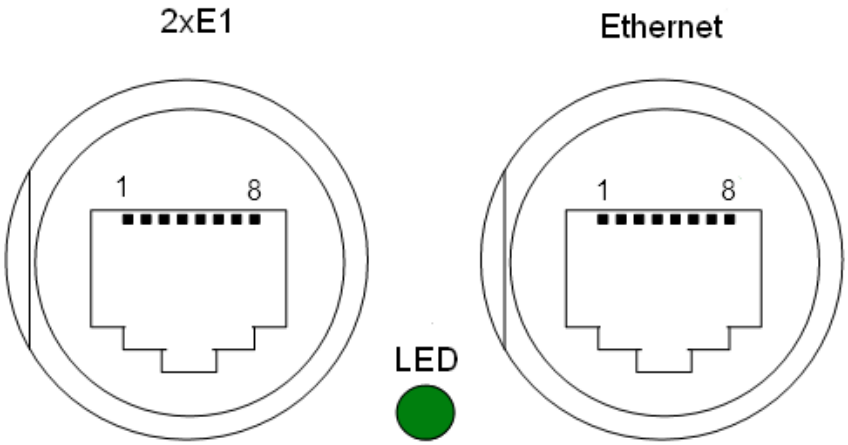
You can also use any preferable FTP client if you wish.

# 9 Pinouts

## 9.1 Sealed RJ45 sockets

One RJ45 socket of HyperBridge interface is for Ethernet data transfer and power supply, the second one is for 2xE1 data transfer and for RSSI.

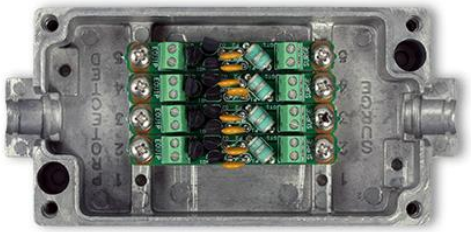
The pinouts of both sockets are shown in the figure below. The drawing is made according to position of RJ45 ports on HyperBridge interface.




| RJ45, 2xE1 | |
|---|---|
| 1 | RX2-, RSSI + |
| 2 | RX2+, RSSI + |
| 3 | RX1-, RSSI - |
| 4 | TX2- |
| 5 | TX2+ |
| 6 | RX1+, RSSI - |
| 7 | TX1- |
| 8 | TX1+ |

| RJ45, Ethernet | |
|---|---|
| 1, 2 | RX |
| 3, 6 | TX |
| 4, 5 | DC + |
| 7, 8 | DC - |

# 10 Available Accessories

| | |
|---|---|
|  |  |
| PoE injector & surge protector<br>P/N I0ATPI04 | Grounding cable<br>P/N Z0AK6001 |
|  |  |
| FODU RJ45 connector 8P shield solid<br>P/N FOACNR02 | O-ring - rubber gasket to be fitted between antenna and FODU<br>P/N CLAOR001 |
|  |  |
| Test kit for 24GHz (50dB attenuation)<br>P/N Z0S24TST01 | FODU RJ45 LTW cable connector case<br>P/N FOACNR03 |
|  | |
| Surge protector for 2xE1<br>P/N F0ALA001 | |

# 11 List of Abbreviations

**3G** – third generation
**AC** – Alternating Current
**ACI** – Adjacent-Channel Interference
**ACM** – Adaptive Coding and Modulation
**AGC** – Automatic Gain Control
**ASCII** - American Standard Code for Information Interchange
**ATPC** – Automatic Transmit Power Control
**BER** – Bit-Error Ratio
**CCI** – Co-Channel Interference
**CLI** – Command-Line Interface
**CPU** – Central Processing Unit
**CRC** – Cyclic Redundancy Check
**DC** – Direct Current
**DiffServ** – Differentiated Services
**DSCP** - Differentiated Services Code Point
**EEPROM** - Electrically Erasable Programmable Read-Only Memory
**EMI** – Electromagnetic Interference
**ETS** – European Telecommunication Standard
**ETSI** – European Telecommunications Standards Institute
**FIR** – Finite Impulse Response
**FO** – Fiber Optics
**FODU** – Full Outdoor Unit
**FTP** – File Transfer Protocol
**GFP** – Generic Framing Procedure
**GND** - Ground
**GSM** - Global System for Mobile communications
**GUI** – Graphical User Interface
**IEEE** - Institute of Electrical and Electronics Engineers
**IF** – Intermediate Frequency
**ISP** – Internet Service Provider
**ITU-T** – International Telecommunication Union – Telecommunication Standardization Sector
**LAN** – Local Area Network
**LDPC** – Low-Density Parity-Check Code
**LED** – Light-Emitting Diode
**LTE** – Long-Term Evolution
**MAC** – Media Access Control
**MSE** – Mean Square Error
**NMS** – Network Management System
**PC** – Personal Computer
**PDH** – Plesiochronous Digital Hierarchy
**PLL** – Phase-Locked Loop
**PoE** - Power over Ethernet
**QAM** - Quadrature amplitude modulation

**QoS** – Quality of Service
**QPSK** - Quadrature Phase-Shift Keying
**RAM** – Random Access Memory
**RSL** – Received Signal Level
**RSSI** – Received Signal Strength Indicator
**RSTP** – Rapid Spanning Tree Protocol
**Rx** – Receive
**SNMP** - Simple Network Management Protocol
**SNR** – Signal-to-Noise Ratio
**STP** – Spanning Tree Protocol
**TCP/IP** – Internet Protocol Suite (Transmission Control Protocol / Internet Protocol)
**TDM** – Time-Division Multiplexing
**TFTP** – Trivial File Transfer Protocol
**TM** – Tide Mark
**TP** – Twisted Pair
**TS** – Threshold Seconds
**Tx** – Transmission
**UART** – Universal Asynchronous Receiver/Transmitter
**USB** – Universal Serial Bus
**UTP** – Unshielded Twisted Pair
**VLAN** – Virtual Local Area Network
**WAN** – Wide Area Network