GIL Technology

LIBRA 5816
Quick Start

Dec 2008

Contents

Important Information

Safety considerations

This document must be reviewed for familiarization with the product, instructions, and safety symbols before operation.
Verify that local safety regulations are adhered to during installation with regard to grounding and lightning protection.
Verify that the correct AC power source is available for the Power Inserter.
Disconnect the product from operating power before cleaning.

Warning symbols used in this book

WARNING: Injury or death may result from failure to heed a WARNING.
Do not proceed beyond a WARNING until the indicated conditions are fully understood and met.

! CAUTION: Damage to equipment may result from failure to heed a caution.
Do not proceed beyond a ! CAUTION until the indicated conditions are understood and met.
Important: Indicates critical information to be aware of which may affect the completion of a task or successful operation of equipment.

WARNING
All antennas must be installed by a knowledgeable and professional installer.

! CAUTION
An antenna must be connected to the BS, SS or LSS units before powering up the equipment. Powering up equipment without an antenna connected can permanently damage the unit or the RF transmission cable

Professional installation instruction

1. Installation personal
   This product is designed for specific application and needs to be installed by a qualified personal who has RF and related rule knowledge. The general user shall not attempt to install or change the setting.

2. Installation location
   The product shall be installed at a location where the radiating antenna can be kept 50 cm from nearby person in normal operation condition to meet regulatory RF exposure requirement.

3. Effective power output
   According to US Rule, CFR 47 part 15 Section 15.247 “Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz”, the authorized maximum peak conducted output power at antenna terminal is 0.319154 watt, 0.511682 watt, respectively for BS and SS, per the measurement procedure as described in the rule part. Please refer to the related rules for detail.

4. Installation procedure
   Please refer to user’s manual for the detail.

5. Warning
   Please carefully select the installation position and make sure that the final output power does not exceed the limit set force in US Rule CFR 47 part 15 section 15.247. The violation of the rule could lead to serious federal penalty.

Notices

Copyright notice

While every effort has been made to ensure that the information contained in this guide is correct, GIL Technology does not warrant the information is free of errors or omissions.

Information contained in this guide is subject to change without notice.

Regulatory notice

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

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

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

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

IMPORTANT NOTE:
Radiation Exposure Statement:
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance **50** cm between the radiator & your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination. The firmware setting is not accessible by the end user.

Industry Canada statement

This device complies with RSS-210 of the Industry Canada Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

IMPORTANT NOTE:
Radiation Exposure Statement:
This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance **50** cm between the radiator & your body.

This device has been designed to operate with an antenna having a maximum gain of **16.5** dBi. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms.

! Caution: This product is designed specific for point to point operation, the point to multi point operation is prohibited.

Other notices

Changes or modifications to the equipment not expressly approved by GIL Technology could void the user's authority to operate the equipment.

Appropriately shielded remote I/O serial cable with the metal connector shell and cable shield properly connected to chassis ground shall be used to reduce the radio frequency interference.

All antenna installation work shall be carried out by a knowledgeable and professional installer. The parts in some LIBRA 5816 versions are Imperial sizes – inches and fractions of an inch. *Do not* attempt to mix Imperial nuts, bolts and screws with similar metric hardware. This will strip the threads.

Warranty & Repair

Please contact the party from whom you purchased the product for warranty and repair information. GIL provides no direct warranty to end users of this product.

Customer support contacts

Users of GIL equipment who require technical assistance must contact their reseller or distributor.

Distributor technical support

Distributors may contact GIL's Technical Support on GIL's products.

When requesting support, please have the following information available

- configuration of the system, including models of GIL equipment, versions and serial numbers
- antenna type and cable lengths
- site information, including possible RF path problems, such as trees, buildings and other RF equipment in the area
- distance of the RF link
- configuration of unit.
- description of the problem

Contacting GIL Technical Support

By Telephone	Call: +886-2-8751-2366	Business hours: 9:00 a.m. to 6:00 p.m. (GMT +8)
By Email	Please send an email to: gilsupport@gil.com.tw	

GIL product information

To obtain information regarding GIL products, contact the GIL distributor in your region, or call +886-2-8751-2366 to speak with a GIL sales representative or visit our web site at http://www.gil.com.tw.

Publication history

Revision	Date	Description
Rev 1	Dec 2008	First public release of this manual.

Description

Overview

This information in this guide applies to the ***"LIBRA 5816"*** Series products, including the following.

Data Rate	**Channel Size**	**BWS Model**	**Frequency (TDD System)**
72Mbps /56Mbps(20MHz)	20 MHz / 15 MHz ; 10 MHz / 5 MHz	LIBRA 5816 BS	**TX&RX:**5725-5850
72Mbps /56Mbps(20MHz)	20 MHz / 15 MHz ; 10 MHz / 5 MHz	LIBRA 5816 SS	**TX&RX:**5725-5850
72Mbps /56Mbps(20MHz)	20 MHz / 15 MHz ; 10 MHz / 5 MHz	LIBRA 5816 LSS	**TX&RX:**5725-5850

This chapter presents an overview of the LIBRA 5816 Series product.

Hardware & Check list

There are 3 types of LIBRA 5816 radios:

- LIBRA 5816 Base Station (BS)

- LIBRA 5816 Subscriber Station (SS)

- LIBRA 5816 Long Range Subscriber Station (LSS)

Package Contents

LIBRA 5816 package contains:

1. LIBRA 5816 radio
2. Mounting main frame
3. Mounting nuts and bolts
4. Waterproof cap for PoE Cable
5. Ethernet cable (indoor type)
6. PoE Power adaptor and electrical wire

There might be items of optional order in the package. Please contact your distributor if any of the above basic items is missing.

- **LIBRA 5816 BS contents**

1. LIBRA 5816 BS

2. Mounting main frame

3.Mounting nuts and bolts

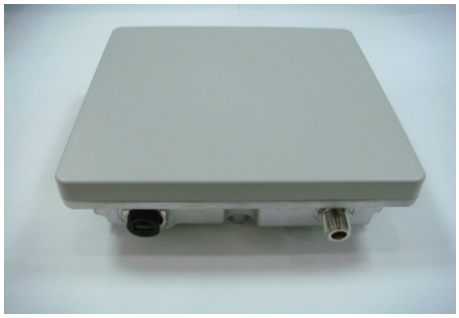
4. Waterproof cap for PoE Cable

5. Ethernet cable (indoor type)

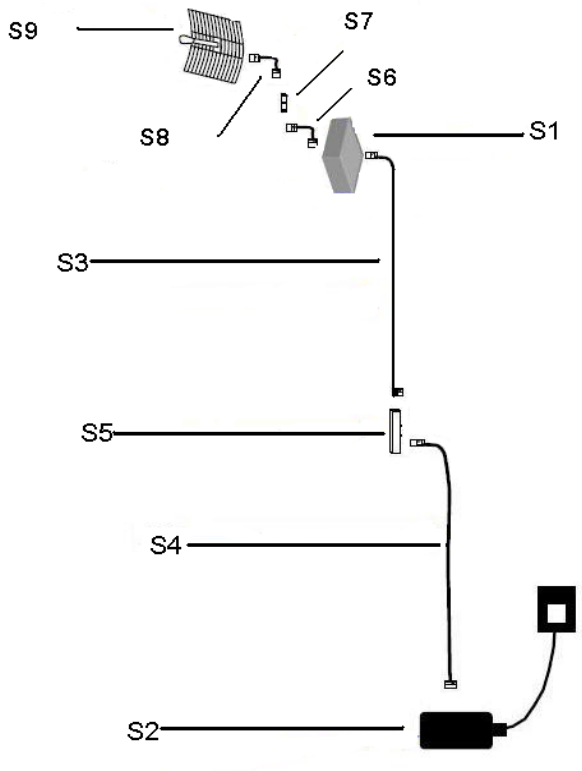
6. PoE Power adaptor and electrical wire-BS

- **LIBRA 5816 SS**

- **LIBRA 5816 LSS**

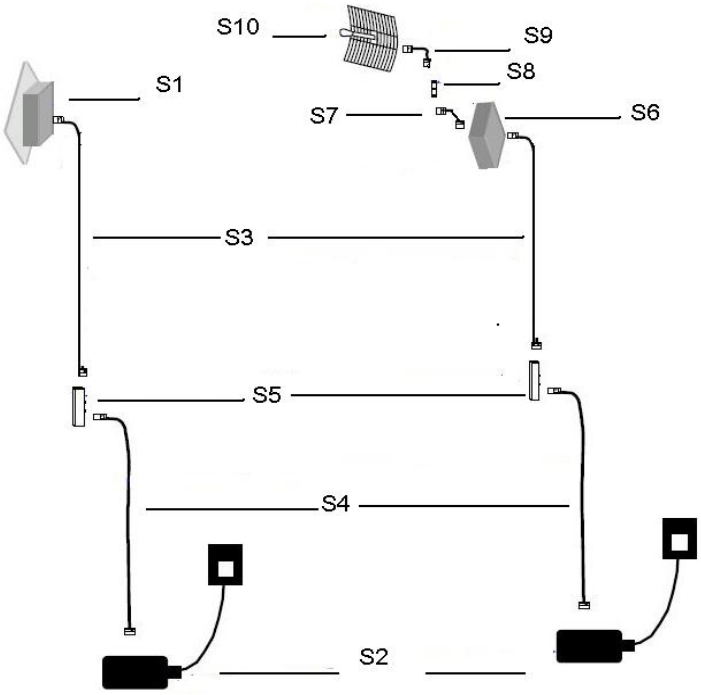


Configuration Diagram—LIBRA 5816 BS



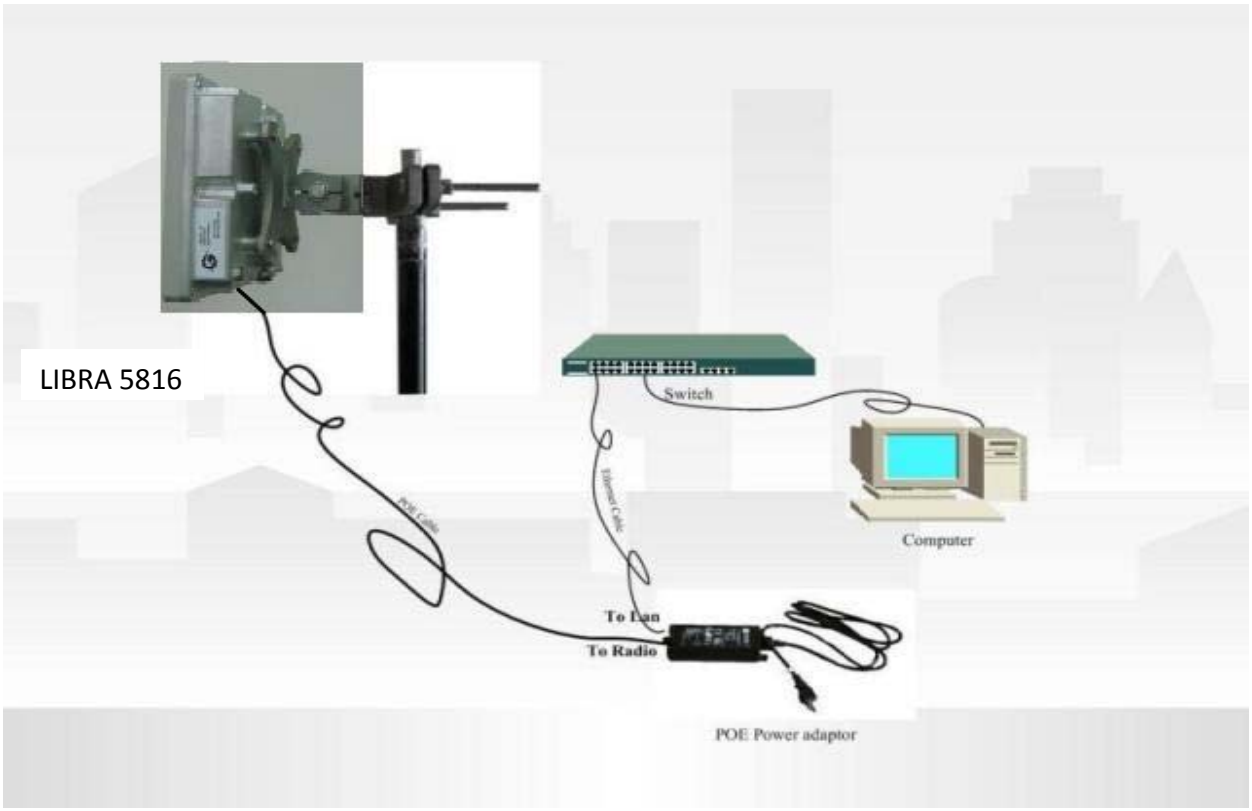
Item	Description	Part No.	Notes
S1	LIBRA 5816 – BS External	9900-0006	Unit also includes mounting kit & weatherproof cap, which are not shown here.
S2	Power Inserter	4000-0025	
S3	10m Outdoor Shielded CAT5 Power-over-Ethernet cable	6010-1414	
	30m Outdoor Shielded CAT5 Power-over-Ethernet cable	6010-1415	
	100m Outdoor Shielded CAT5 Power-over-Ethernet cable	6010-1416	
Item	**Description**	**Part No.**	**Notes**
S4	1.5m Indoor CAT5 Cable	6030-0018	Included in Standard Package
S5	Ethernet Surge Suppressor	1220-0042	Optional (Recommended)
S6	100cm (36inch), LMR400 Ultra-Flex, Patch, N(M)-N(M)	6010-0019	The given part number is an N type (Male) to N type (Male), assuming the Surge Suppressor has an N type (Female).
S7	Surge Suppressor @ 5.8GHz	1220-0025	Optional (Recommended)
S8	30cm (12inch), LMR400 Ultra-Flex, Patch, N(M)-N(M)	6010-0014	The given part number is an N type (Male) to N type (Male), assuming the surge suppressor and selected antenna has an N type (Female).
S9	5.8GHz 29dBi 8° Grid	1220-0601	Gil Technology certified Grid-Antenna with mounting Kit

Configuration Diagram—LIBRA 5816 SS & LSS



Item	Description	Part No.	Notes
S1	LIBRA 5816 – SS (Integrated with 18dBi antenna)	9900-0007	It includes an integrated antenna. Unit also includes mounting kit & weatherproof cap, which are not shown here.
S2	Power Inserter	4000-0025	
S3	10m Outdoor Shielded CAT5 Power-over-Ethernet cable	6010-1414	
	30m Outdoor Shielded CAT5 Power-over-Ethernet cable	6010-1415	
	100m Outdoor Shielded CAT5 Power-over-Ethernet cable	6010-1416	
S4	1.5m Indoor CAT5 Cable	6030-0018	Included in Standard Package
S5	Ethernet Surge Suppressor	1220-0042	Optional (Recommended)
S6	LIBRA 5816 - LSS (External antenna needed)	9900-0008	Unit also includes mounting kit & weatherproof cap, which are not shown here.
S7	100cm (36inch), LMR400 Ultra-Flex, Patch, N(M)-N(M)	6010-0019	The given part number is an N type (Male) to N type (Male), assuming the Surge Suppressor has an N type (Female).
S8	Surge Suppressor @ 5.8GHz	1220-0025	Optional (Recommended)
S9	30cm (12inch), LMR400 Ultra-Flex, Patch, N(M)-N(M)	6010-0014	The given part number is an N type (Male) to N type (Male), assuming the surge suppressor and selected antenna has an N type (Female).
S10	5.8GHz 29dBi 8° Grid	1220-0601	Gil Technology certified Grid-Antenna with mounting Kit

1. Basic Connection



Important:
LIBRA 5816 is powered by PoE (Power over Ethernet). There are LAN and WAN port available for connection, as shown in the picture.

Physical Description

This section describes the components of the LIBRA 5816 BS and SS/LSS

✍ LIBRA 5816 BS(Base Station)

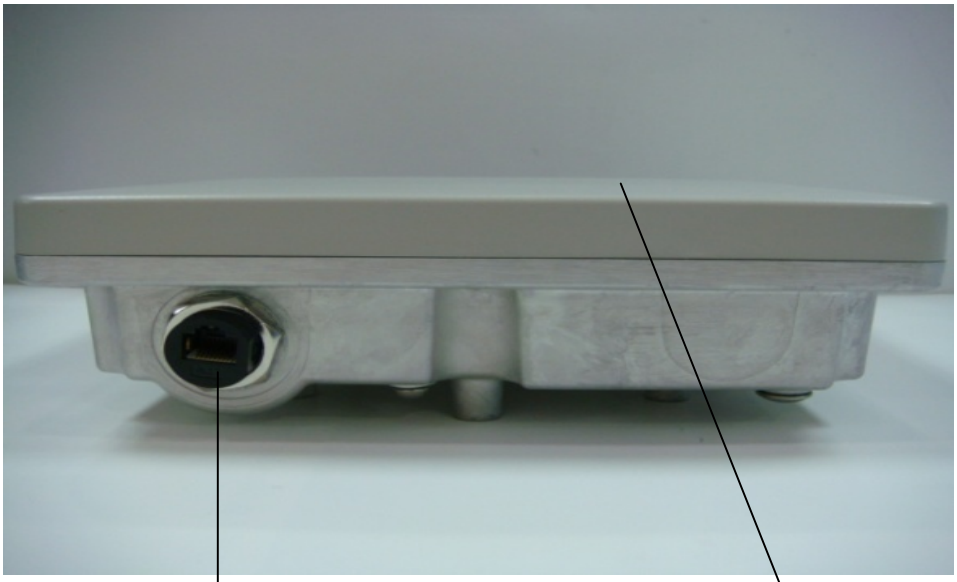
The LIBRA 5816 BS is an outdoor radio with IP67 enclosure providing PoE and data transmission through RJ45 connector. N type RF connector can be mounted with any outdoor 5.8GHz antenna. The back panel owns 8 holes to mount flexibly on the pole or tower(As shown in the picture below)

The back panel of LIBRA 5816

The physical dimensions of the LIBRA 5816 is 203mm(Height), 203mm(width)and 65mm(depth) or 8”,8”,2.5”) with the weight is 1.3kg(or 2.8lb)

LIBRA 5816 SS(Subscriber Station)

The LIBRA 5816 SS is an outdoor radio with IP67 enclosure providing PoE and data transmission through RJ45 connector. With the integrated 18dBi antenna that provides the convenience for rapid deployment. The back panel owns 8 holes to mount flexibly on the pole or tower.



The physical dimensions of the LIBRA 5816 is 203mm(Height), 203mm(width)and 65mm(depth) or 8”,8”,2.5”) with the weight is 1.35kg(or 2.9lb)

LIBRA 5816 LSS(Long Range Subscriber Station)

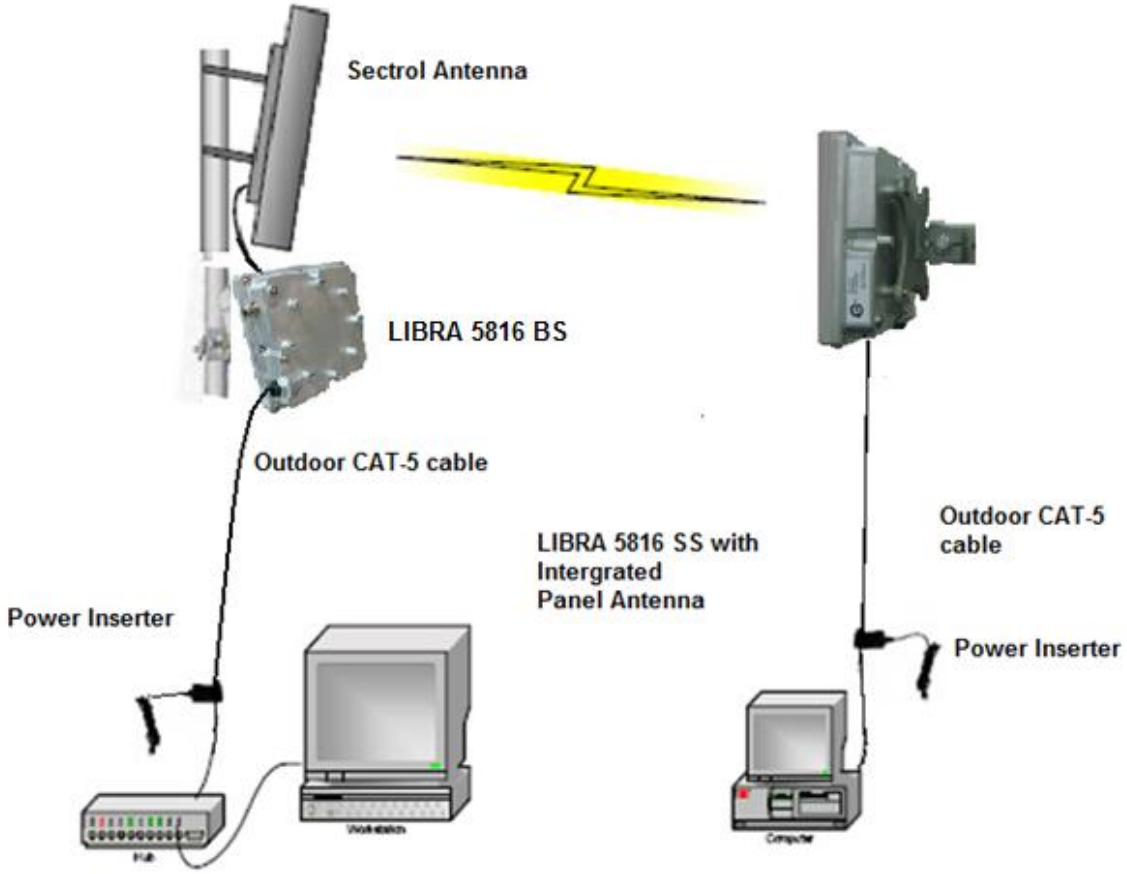
The LIBRA 5816 LSS is an outdoor radio with IP67 enclosure providing PoE and data transmission through RJ45 connector. N type RF connector can be mounted with any outdoor
5.8GHz antenna. The back panel owns 8 holes to mount flexibly on the pole or tower.

The physical dimensions of the LIBRA 5816 is 203mm(Height), 203mm(width)and 65mm(depth) or 8”,8”,2.5”) with the weight is 1.3kg(or 2.8lb)

LIBRA 5816 Series System Features

- Operating in 5.8GHz ISM band - No licensing fee required in most countries WiMAX-compatible products
- Provides Non Line of Sight (NLOS) coverage, high spectral efficiency, adaptive modulations allowing robust RF network design and deployment
- Scalable design delivers a true broadband solution of up to 200 Mbps and serves up to 2,400 users per cell
- Rich built-in networking features provide cost-effective solution
- Efficient bandwidth allocation makes wireless networks highly scalable
- Fully antenna integrated design with optional external antenna connector in a IP67 weatherproof enclosure
- Provide greater spectral efficiency of 3.6Mbps/MHz than WiFi products 2.7Mbps/MHz

LIBRA 5816 System Components



Base Station (BS) Equipment

The BS controls communication within the wireless network and is the main access point to the Ethernet. The access point communicates with the SS's in the system to provide each SS with Access to the main network (ie Ethernet). The access point is typically located at a distance away from the SS that will provide adequate radio signal strength for the specified data rates.

The Base Station is responsible for any Subscriber Station (SS) data management functions. The LIBRA 5816 BS consists of three parts:

- BS radio unit,
- Ethernet Power Inserter with CAT-5 cable (bought separately) and weatherproofing kit(included), and
- the External Antenna and cable (both bought separately)

- **LIBRA 5816 BS**– The BS is the main piece of radio equipment. It is designed for outdoor installation but can also be installed indoors if needed. The BS is equipped with an N-type (F) RF connector so that the external antenna can be connected to it. Thus many different types of base stations can be deployed using sectoral, omni or other specialized antennas.

- **Ethernet Power Inserter**– This piece of equipment is a small box that connects between the SS and the P.C. This box also provides power for the BS equipment to run. A CAT-5 outdoor cable is

used to connect the Power inserter to the BS. The weatherproofing kit is used with standard RJ-45 connector to ensure reliable connection for outdoor systems.

✍ **Antenna and Cable**– In order to accommodate different frequency re-use plans and scalability of the base stations the BS is designed to be used with an external antenna. Antennas and cables are selected by the user based on the network requirements.

Subscriber Station (SS) Equipment

The Subscriber Station connects customers to the Base Station via a wireless link. The link enables customers to communicate with other users of the wireless network and the Ethernet. Subscriber Station has two parts:

1) SS radio unit and

2) Ethernet Power Inserter with CAT-5 cable (bought separately) and weatherproofing kit (included).

✍ **LIBRA 5816 SS**– The SS is the main piece of equipment that would *normally* be installed outdoors (indoor installation is permitted when feasible) The SS contains all of the necessary radio equipment to provide a high-speed wireless link. The SS also has an integral antenna such that no RF cables are required for a typical installation.

✍ **Ethernet Power Inserter**– This piece of equipment is a small box that connects between the SS and the P.C. This box also provides power for the SS equipment to run. A CAT-5 outdoor cable is used to connect the Power Inserter to the SS. The weatherproofing kit is used with standard RJ-45 connector to ensure reliable connection for outdoor systems. Wireless network activity focuses on the BS, which is both the main access point to the Ethernet (LAN or WAN) and the destination for SS-originated communications (SSs do not communicate directly with other SSs—they communicate only via the BS). SSs complete the customer-end of a wireless link.

Long Range Subscriber Station (LSS) Equipment

The Long Range Subscriber Station (LSS) also connects customers to the BS via a wireless link. The LSS enables the customer to reach longer ranges by allowing the connection to a higher gain external antenna. It can also be used for indoor installation of the units should severe weather conditions require it. The antenna is then mounted outdoors and connected via appropriate RF cables to the unit. One other alternative which customers may want to consider is to use lower gain

antennas with systems that are very close to the Base Station to mitigate some interference concerns without recourse to dynamic power control.

The LIBRA 5816 LSS consists of three parts:

1) LSS,

2) Ethernet Power Inserter with CAT-5 cable (bought separately) and weatherproofing kit (included), and

3) the External Antenna and cable (both bought separately).

- ✍ **LIBRA 5816 LSS**– The LSS is the main piece of equipment. It is designed for outdoor installation but can also be installed indoors if needed. The LSS is equipped with an N-type connector so that the external antenna can be connected to it. Thus the range of the system can be significantly increased by use of higher gain antennas. Also, in situations where very severe conditions may be encountered outdoors the LSS can be installed indoors with cabling to the antenna outside.
- ✍ **Ethernet Power Inserter**– This piece of equipment is a small box that connects between the LSS and the P.C. This box also provides power for the LSS equipment to run. A CAT-5 outdoor cable is used to connect the Power inserter to the LSS. The weatherproofing kit is used with standard RJ-45 connector to ensure reliable connection for outdoor systems.
- ✍ **Antenna and Cable**– In order to accommodate different range requirements for links, the LSS is designed to be used with an external antenna. Antennas and cables are selected by the user based on the network requirements.

About Point-to-Point (P-P) Systems

- **Base Station (BS) To Subscriber Station (SS)**
- **Base Station (BS) To Long Range Subscriber Station (LSS)**

For P-P systems LIBRA 5816 comes in three versions, Base Station (BS) 、Subscriber Station (SS)

and the Long Range Subscriber Station (LSS).P-P links are used when only two locations are connected, for example for backhaul purposes between Base Stations and the Network Operating Center for connection to the Internet backbone, or in situations where throughput requirements between two locations are such that the bandwidth can't be shared. It can provide two kinds to choose. (BS to SS or BS to LSS)

Base Station (BS) Equipment

The BS controls communication within the wireless network and is the main access point to the Ethernet. The access point communicates with the SS or LSS in the system to provide the SS or LSS with Access to the main network (ie Ethernet). The access point is typically located at a distance away from the SS or LSS that will provide adequate radio signal strength for the specified data rates.
The Access Point is responsible for the SS or LSS data management functions.
BS Equipment has three parts: 1) BS and 2) Ethernet Power Inserter with CAT-5 cable (bought separately) and weatherproofing kit (included), and 3) the External Antenna and cable (both bought separately).

- **LIBRA 5816 BS**– The BS is the main piece of equipment that is *normally* installed outdoors (indoor installation is permitted when the range and link budget allows it) The BS contains all of the necessary radio equipment to provide a high-speed wireless link.
- **Ethernet Power Inserter**– This piece of equipment is a small box that connects between the BS and the Ethernet network. This box also provides power for the BS equipment to run. A CAT-5 outdoor cable is used to connect the Power inserter to the BS. The weatherproofing kit is used with standard RJ-45 connector to ensure reliable connection for outdoor systems.
- **Antenna and Cable**– In order to accommodate different range requirements for P-P links, the BS is designed to be used with an external antenna. Antennas and cables are selected by the user based on the network requirements

Subscriber Station (SS) Equipment

The SS equipment is intended for very rapid installation of a P-P link and can be used for links of a long distance.
The LIBRA 5816 SS consists of two parts: 1) SS, 2) Ethernet Power Inserter with CAT-5 cable (bought separately) and weatherproofing kit (included).

- **LIBRA 5816 SS**–The SS is the main piece of equipment that would *normally* be installed outdoors (indoor installation is permitted when feasible) The SS contains all of the necessary radio equipment to provide a high-speed wireless link. The SS also has an integral antenna such that no RF cables are required for a typical installation.
- **Ethernet Power Inserter**– This piece of equipment is a small box that connects between the SS and the Ethernet network. This box also provides power for the SS equipment to run. A CAT-5 outdoor cable is used to connect the Power inserter to the SS. The weatherproofing kit is used with standard RJ-45 connector to ensure reliable connection for outdoor systems.

Long Range Subscriber Station (LSS) Equipment

The LSS equipment also connects customers to the BS via a wireless P-P link. The LSS enables the customer to reach longer ranges by allowing the connection to a higher gain external antenna. It can also be used for indoor installation of the unit should severe weather conditions require it. The antenna is then mounted outdoors and connected via appropriate RF cables to the unit. One other alternative which customers may want to consider is to use lower gain antennas with systems that

is very close to the Base Station to mitigate some interference concerns without recourse to dynamic power control.
The LSS Equipment has three parts: 1) LSS, 2) Ethernet Power Inserter with CAT-5 cable (bought separately) and weatherproofing kit (included), and 3) the External Antenna and cable (both bought separately).

- **LIBRA 5816 LSS**– The LSS is the main piece of equipment. It is designed for outdoor installation but can also be installed indoors if needed. The LSS is equipped with an N-type connector so that the external antenna can be connected to it. Thus the range of the P-P system can be significantly increased by use of higher gain antennas. Also, in situations where very severe conditions may be encountered outdoors the LSS can be installed indoors with cabling to the antenna outside.
- **Ethernet Power Inserter**– This piece of equipment is a small box that connects between the LSS and the Ethernet network. This box also provides power for the LSS equipment to run. A CAT-5 outdoor cable is used to connect the Power inserter to the LSS. The weatherproofing kit is used with standard RJ-45 connector to ensure reliable connection for outdoor systems.
- **Antenna and Cable**– In order to accommodate different range requirements for P-P links, the LSS is designed to be used with an external antenna. Antennas and cables are selected by the user based on the network requirements.

Specifications

Radio Specifications	LIBRA 5816 BS	LIBRA 5816 SS
Output Power (Antenna Port)	+20 dBm to 0 dBm, All Channels	+20 dBm to 0 dBm, All Channels
Frequency Range	5.15-5.35, 5.47 - 5.725, 5.725-5.850 GHz***	5.15-5.35, 5.47 - 5.725, 5.725-5.850 GHz
Technology	256 FFT OFDM	256 FFT OFDM
Coverage	NLOS	NLOS
Range	Up to 30 km	Up to 30KM
Cell Configuration	Up to 6	Up to 6
Throughput (Raw/Effective)	72Mbps /56Mbps(20MHz)	72Mbps /56Mbps(20MHz)
Modulation	BPSK,QPSK,16QAM, 64QAM	BPSK,QPSK,16QAM, 64QAM
Channel Size	20 MHz / 15 MHz / 10 MHz / 5 MHz	20 MHz / 15 MHz / 10 MHz / 5 MHz
Integrated Antenna	None	Yes (18dBi), Optional to external connection
RF Connector	N type	N type and Built-in antenna
Duplexing Format	TDD	TDD
Certification	FCC, CE, IC, SRRC, RoHS	FCC, CE, IC, SRRC, RoHS
Network Support		
Network Connection	10/100 Base T	10/100 Base T
VLAN (802.1q) Compliance	Yes	Yes
CIR/MBR	Yes	Yes
Bridge functionality	Yes	Yes
Network Filtering	MAC & IP	MAC & IP
QoS	802.16-2004	802.16-2004
T1/E1 Support	Optional	Optional
Wireless Networking		
Network Topologies	Point-to-MultiPoint, Point to Point	Point-to-Multipoint, Point to Point
Wireless Standard	802.16-2004	802.16-2004
Security		
X.509 Certification	YES	YES
Data Security Password	Manufacture Set	Manufacture Set
Configuration Security	Password Protected	Password Protected
Management		
Remote Management	SNMP, TELNET, WEB	SNMP, TELNET, WEB
Remote Management Access	Wireless & Wire	Wireless & Wire
Software Upgrade	Over the air/Local	Over the air/Local
Auto provisioning	Yes	Yes
Physical, Electrical and Environmental		
Power Consumption	Max 20 W	Max 20 W
Input Voltage	-48 V	-48 V
Dimensions	203 x 203 x 69 (mm) (8" x 8" x 2.7")	203 x 203 x 69 (mm) (8" x 8" x 2.7")
Weight	2.0 kg (4.4 lb)	2.0 kg (4.4 lb)
Operating Temperature	-40°C to 70°C	-40°C to 70°C
Relative Humidity	0-95%	0-95%
Enclosure	Fully weather proof (IP67)	Fully weather proof (IP67)

Note: QAM64 with TX power 17dbm has the optimum performance.

Getting Started

Introduction

The contents in this chapter are provided only for qualified professional installation technicians for reference.

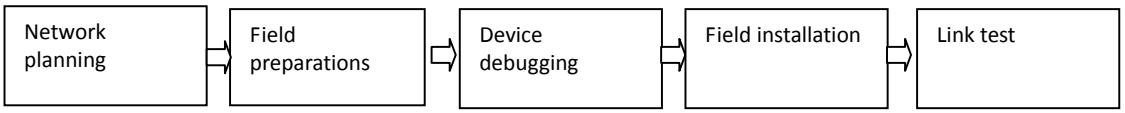
Warning

All antennas and devices must be installed by professional installation technicians who are familiar with such installation

Attention: It is recommended to always use a lightning arrester in the installation process.

Before the field installation of the device, the user shall work out network planning, make construction preparations and finish the device debugging work. The network planning is used to describe the whole system including the link budget, detailed list of required devices, LIBRA 5816 device, and installation positions of antennas, wiring route, device parameter settings and other network requirements. (GIL will provide network planning and field preparation support. Contact our sales agent or access *http://www.gil.com.tw* for further information about the service and charges). Doing network planning shall include the inspection of the installation field, checking the feasibility of the network planning and recording details. Installation technicians shall check final field preparations, conduct field installation and device settings as well as field-testing of every unit in accordance with the network planning document. Before device installation, a large amount of network planning and preparations shall be done. The more sufficient the preparations are, the less field installation problems there will be.

Installation process



Field Installation of the LIBRA 5816 Device

This section will discuss how to install, configure and test the LIBRA 5816 device in the field.

Pay attention to the following affairs before the field installation of the LIBRA device:

- All the devices shall be configured as per the instructions of ***Product Configuration***

- ✍ All the field preparations must be completed.
- ✍ Ensure all the required tools and equipment are prepared.

Field Preparations

Field preparations include inspection of the actual field environment and carry out field preparations to ensure proper installation of LIBRA devices. Though every field has its own specialty and uniqueness, the following preparations are necessary.

1. Acquire or work out a field installation plan. The planning shall include the installation position of the LIBRA device, which kind of LIBRA device to be selected as well as the parameters of the LIBRA device needed to be set.
2. Check cable connectivity before installation and the turning radius of the cable shall not exceed the recommended radius.
3. Ensure there is enough space to keep proper ventilation.
4. Ensure AC power and Ethernet access can be used.
5. Check the predetermined installation position of the LIBRA device to ensure:
   - ✍ The installation structure is reasonable.
   - ✍ There are no barriers in the LOS link and the Fresnel zone. Owing to the extraordinary non-LOS transmission property of OFDM, this requirement may not be as strict as that on other systems.
   - ✍ The installation position of the LIBRA device is reasonable.
6. Check the wiring route and cable inlet/outlet to ensure their usability.

Tools and Equipments

The following tools and equipment are a must:

1.Standard toolkit	7.Testing equipment, PDA with serial port cables and power supply
2.An electric drill and burr drills	8.LIBRA device
3.Waterproof material	9.LIBRA installation parts
4.Ladder	10.Cables: Category 5 cable for outdoor and AC power line
5.Compass or GPS satellite positioning devices	11.User acceptance form and installation records (optional)
6.Binoculars	

LIBRA 5816 Installation Procedure

✍ **Caution**

Before energizing the LIBRA device, first connect the device to RJ-45 interface of the power supply plug-in marked with "OUT", and then insert the AC power line with the plug-in into the AC power to energize the LIBRA device.

⚠ **Warning**

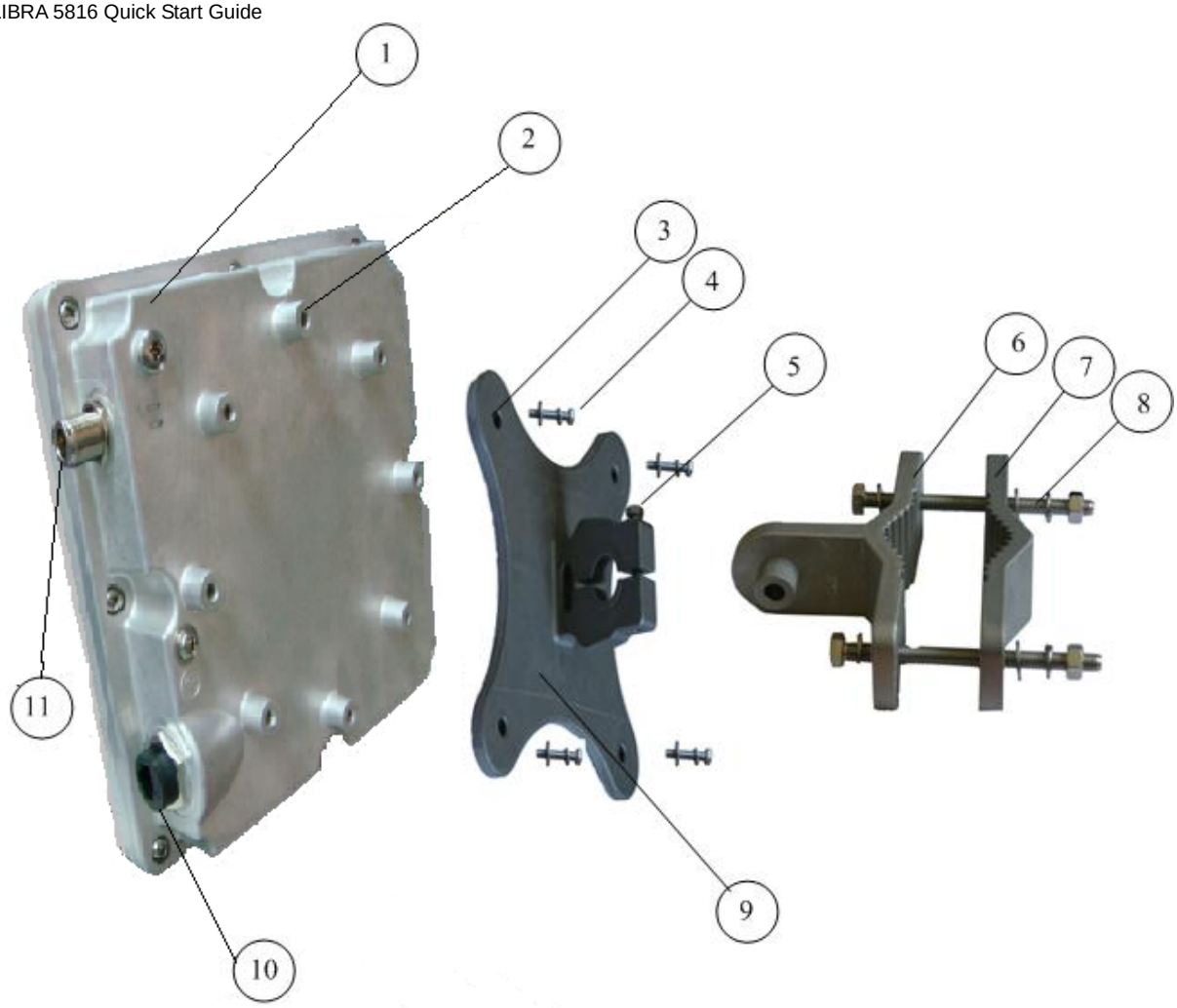
When connected to an Ethernet device, do not insert the RJ-45 interface for Ethernet cable to the interface of the power supply plug-in marked with "OUT" as the interface is used to energize the LIBRA device, which may damage the external Ethernet device.

When configuring **LIBRA 5816** device, you need to assembly parts, find the proper installation position, configure device parameters as well as detect the wireless link quality.

Mounting Instruction

LIBRA 5816 is designed to be mounted on pole. Below is assembly detail for mounting.

1. Enclosure	7. Mounting bracket clamp back
2. Trachea	8. Mounting clamp bolts
3. Bolt eye	9. Mounting Bracket Unit Anchor
4. Bolt	10. Water proof Ethernet socket
5. Bolt	11. RF connector
6. Mounting bracket clamp front	



Assembling LIBRA unit

1. Assemble the bracket clamp which has not be connected to the **LIBRA** unit to the mounting rod, as shown in Items **6, 7, 8** in the above drawing, adjust the screw to the extent that it can be screwed by hand so as to adjust the direction of the antenna.
2. Mount the rear panel bracket to the rear of the **LIBRA 5816** device with the screw marked Item **4** in the above drawing and fasten it. Assemble the required parts.

Attention: When mounting the clamp, be sure that the power/data interface of the LIBRA unit or N-type antenna interface is at the lower end of the LIBRA unit to connect Category 5 data cable for outdoor use, which will be waterproof.

3. For **BS** and **LSS** with separate antennas, connect the antenna directly to the device.
4. Adjust the antenna (integrated antenna or separate antenna) to make it point in the required direction.
5. For devices adopting the directional antenna, if it is necessary to adjust the angle of pitch, the antenna surface shall be turned towards directly to the corresponding unit as much as possible.
6. Slightly fasten the screw to enable the **LIBRA** unit to remain at the properly-adjusted position.

Connecting to LIBRA device

1. Use waterproof antenna cable without connector modification or transform on BS and SS.

2. Before screwing the cable connector, make sure the device is power-off.
3. After screwing cable connector on the device's (BS or LSS) tight, use silicon or heat shirk tubing to cover them is recommended.
4. All antenna accessories should be installed with device (BS or LSS) by an installer who has trained professional.
5. Insert one end of Category 5 cable for outdoor use into the waterproof installation assembly.
6. Connect the end of Category 5 cable inserting into the waterproof installation assembly to the power/Ethernet interface of **LIBRA** device, and then connect the waterproof installation assembly to the interface, screw and fasten the assembly.
7. Insert **RJ-45** interface at the other end of Category 5 cable into "**OUT**" socket of the power plug-in.
8. Connect "**IN"** socket of the power supply plug-in to **PC** or Ethernet with a network cable.
9. Connect one end of AC power line to the AC interface of the power supply plug-in and connect the other end to the AC power supply socket.

Attention: take necessary waterproof measures properly after completing all the above installation and cable connection work. Bind anti-aging tape and waterproof that required positions appropriately to protect devices from being damaged due to water ingression into cables or damping of interfaces.

Device configuration and link test

1. Connect the portable computer to **LIBRA** device. (See ***Product Configuration***).
2. If device parameters are not set beforehand, it is necessary to set key parameters such as center frequency of devices etc.
3. Test the link state of the device and observe **RSSI** value and **CINR** value indicated in the device menu.
4. If the link test results are satisfying, carry out the following **sixth** step directly.
   If such results are not satisfying, first need to adjust the antenna direction by making use of multipath transmission. If the adjustment effect is still unsatisfying, it is necessary to find another installation position with good sight distance until such results are satisfying.
5. If failures remain unsolved, refer to the troubleshooting guidance. See ***Troubleshooting Table***.
6. Keep adjusting the antenna position to achieve the optimum link test effects.
7. After acquiring the optimum link test effects, fasten the mounting parts firmly to fix the device.

Network connection test

Test computers at two ends of the link on their communication quality through the wireless link after completing the above operations.

1. Contact the network operation centre (**NOC)**.
2. **Ping** the corresponding **NOC** from the **SS** end.
3. **Ping** the corresponding **SS** from the **NOC** end. The **SS** may be “seen” in the network in a successful ping test.
4. Connect the Ethernet port of **SS** to the LAN of the user end or to the user’s **PC.**
5. **Ping** the corresponding **NOC** from the LAN of the user end or from the user’s **PC**.
6. Transmit some large test file from the **NOC** port to the corresponding **PC** or other **IP** devices at the corresponding LAN with FTP.
7. Test the file transmission rate from two ends.

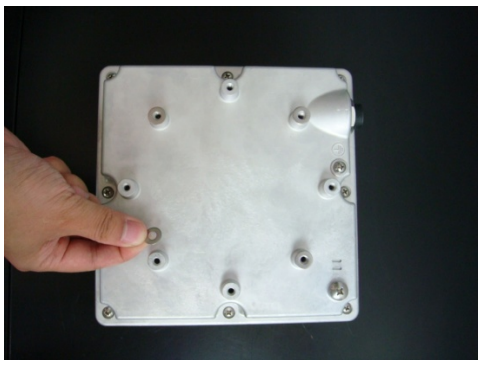
Safety precautions regarding installation

Complete the installation through the following works.

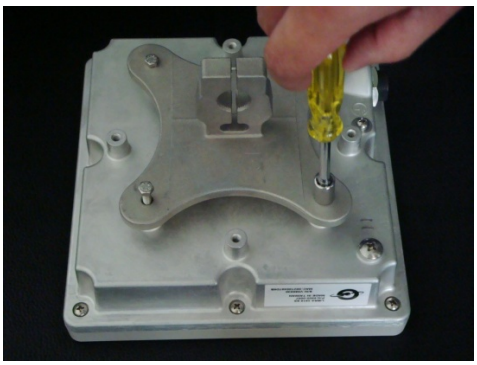
1. Protect interfaces of all cables and waterproof outdoor cables.
2. Sort out all the packing boxes, cables and other materials.
3. Record the installation information listed below as per the requirements of the network service provider (NSP):
   - ✍ Link distance
   - ✍ Installation site position (GPS coordinates)
   - ✍ LIBRA device parameter setting
   - ✍ Statistics of link quality
   - ✍ Antenna cable configuration
   - ✍ LIBRA device model, serial number, MAC address, IP address and IP net mask code.
   - ✍ Password of LIBRA device
   - ✍ Antenna azimuth (angle).
4. Demonstrate the device operation to the user to prove the installation work is completed and further demonstrate good communication effect, data upload and download via the installed wireless link.

The user signs his (her) name on the acceptance report to confirm the link quality.

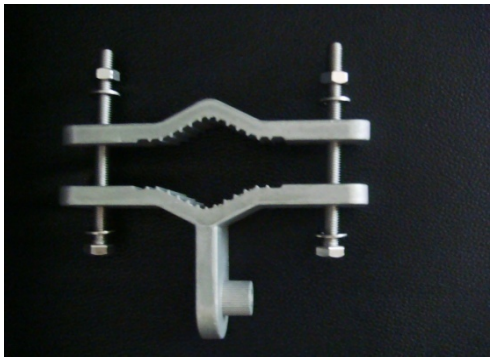
- **Mounting procedures step by step**



1



2



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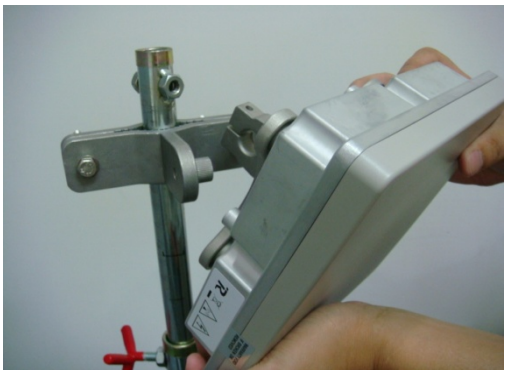

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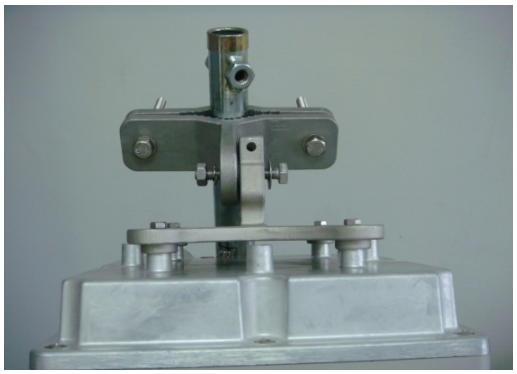

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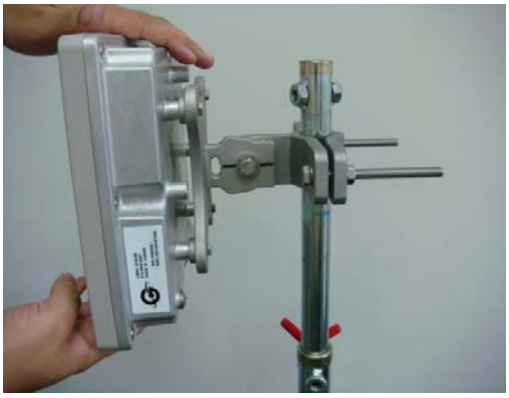
7



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10

LIBRA 5816 Quick Start Guide

Initial Configuration

Once you have installed and set up the physical equipment for both the LIBRA 5816 base station and subscriber station, you will need to configure both units so that they can connect to each other.

You do not need to configure your equipment to begin service at this time.
Your main focus at this stage is to make certain that all network hardware is working properly.

We recommend that you first set up your LIBRA 5816 base station, and then set up your subscriber station.

For the initial PTP or PTM installation, the following points are for the quick installation basic knowledge:

1. Connection Confirmation
2. LIBRA 5816 Web Login Access
3. Basic WiMAX Configuration/Link Status Check
4. BS/SS Key Configuration

4.1 IP configuration
4.2 RF Configuration

NOTE:

A. LIBRA 5816 is based on “plug & play;” connection between BS and SS is established by matching radio frequency, bandwidth and modulation.
Default configuration of these numbers:

   a. BS IP address: 10.1.1.254, SS IP address: 10.1.1.1
   b. Frequency: 5800000 KHz
   c. Bandwidth: 10 MHz

   Following the default configuration is recommended. If user wants to modify the above configurations, please see the section 4.BS/SS Key Configuration on page 42.

B. While testing for BS and SS, uninstalling or suspending any Anti-Virus software as well as the Firewall of PC/laptop is recommended.

C. While reading Quick Start Guide, please be aware of the following word types represented as:

   a. Emphasis: *Italic font with underline*:
   b. DOS Command: *Italic font of text*
   c. Web UI Command: ***Italic and bold font of text***
   d. Windows Command: ***“Italic, bold font of text with quotation marks”***
   e. Characters: “text with quotation marks”

1. Connection Confirmation

A. Antenna

LIBRA 5816 BS and N type SS need to be mounted on external antenna for working under normal status. *Please remember that mounting antenna on BS and N type SS before the power-on*.

B. Power-On Status

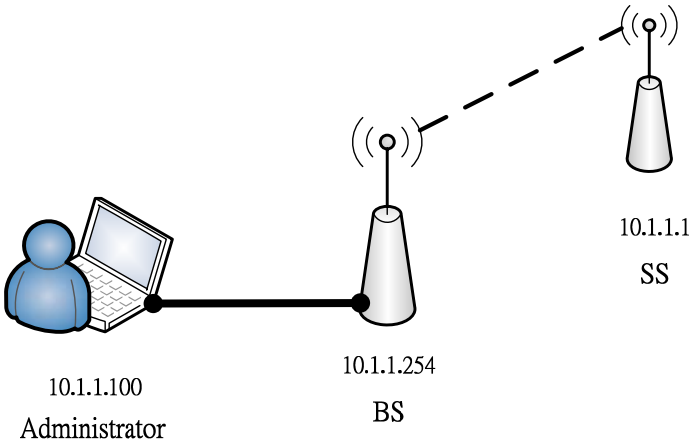
The initial configuration of LIBRA 5816 BS and SS from manufacture has reliable settled for normal connection. They can auto-communicate each other after power-on.

C. IP configuration

C.1 PTP Network System:

Default IP address configuration, 10.1.1.254 to BS and 10.1.1.1 to SS, respectively. To configure the PC's or Laptop's IP which is not in conflict with BS and SS. As the example they are set as:

IP address: 10.1.1.100
Netmask: 255.255.255.0



Then click ***"Start", "Run"***, and then type ***"cmd"*** for running DOS mode. Enter *ping* to confirm the connection:

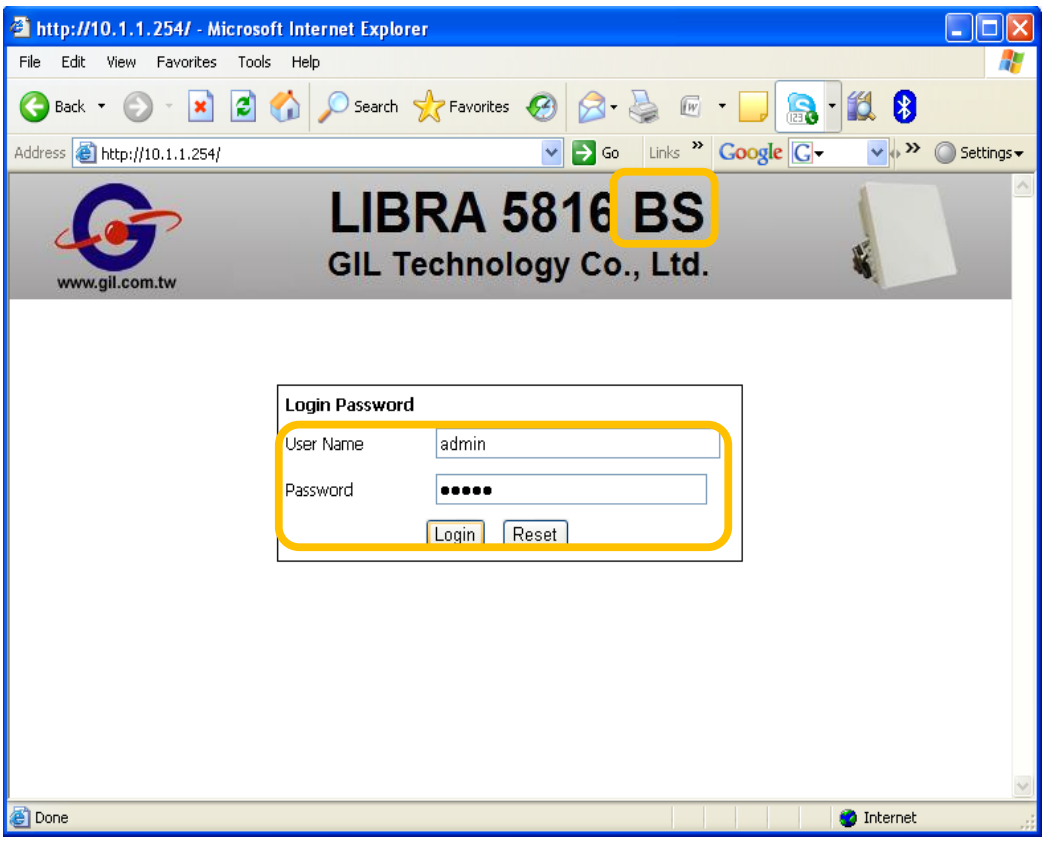
\>ping 10.1.1.254
\>ping 10.1.1.1

2. LIBRA 5816 Web Login Access

Default IP address is 10.1.1.254 to BS and 10.1.1.1 to SS, and default username and password are both "admin".

For login access, please follow those steps as below in order:

1. Open Web browser IE.
2. Enter correct IP address of BS or SS.
3. Enter "admin" in the blank of User Name and Password.
4. Click ***Login*** to access Web Control User Interface.



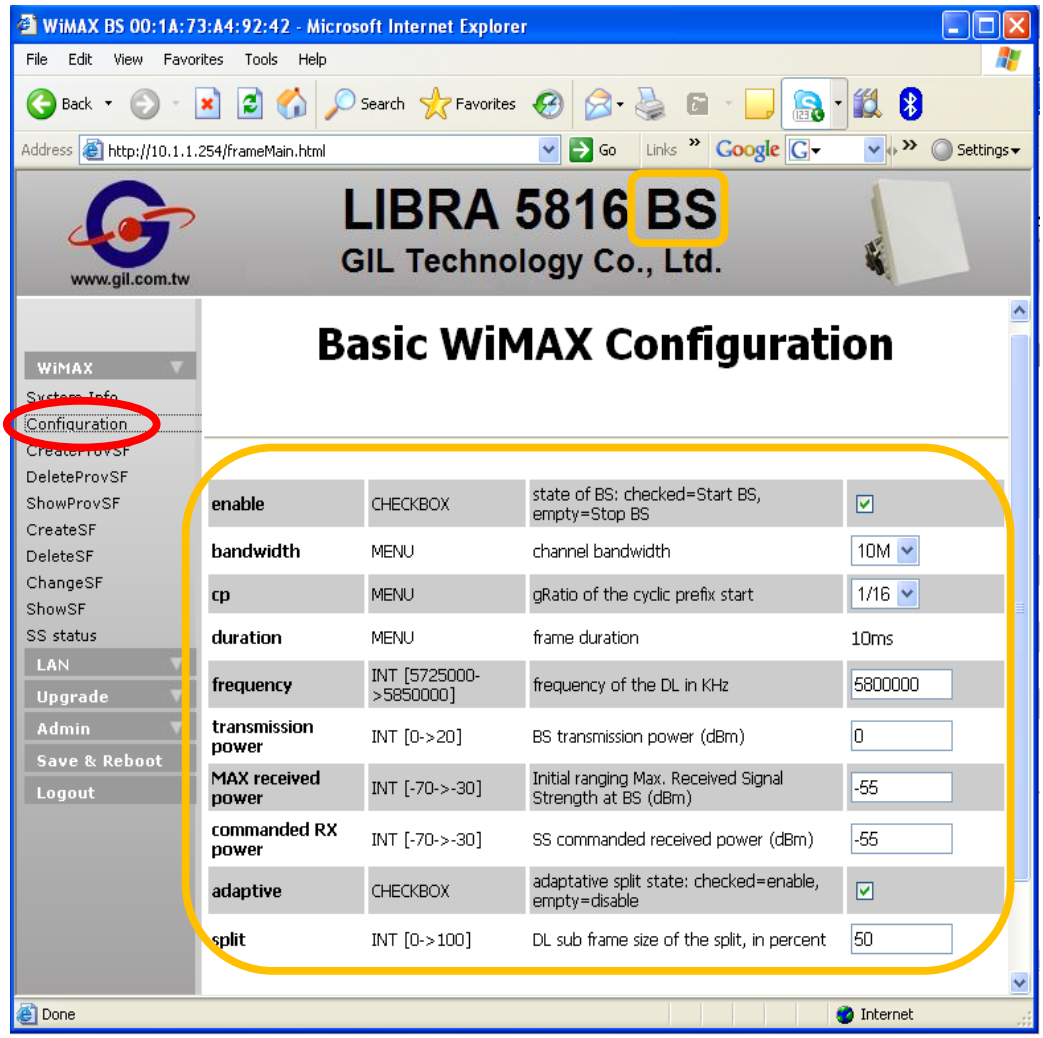
3. Basic WiMAX Configuration/Link Status Check

This section is for the check of default configuration and link status. *Without necessity, please do not modify those below configuration.*

A. Base Station

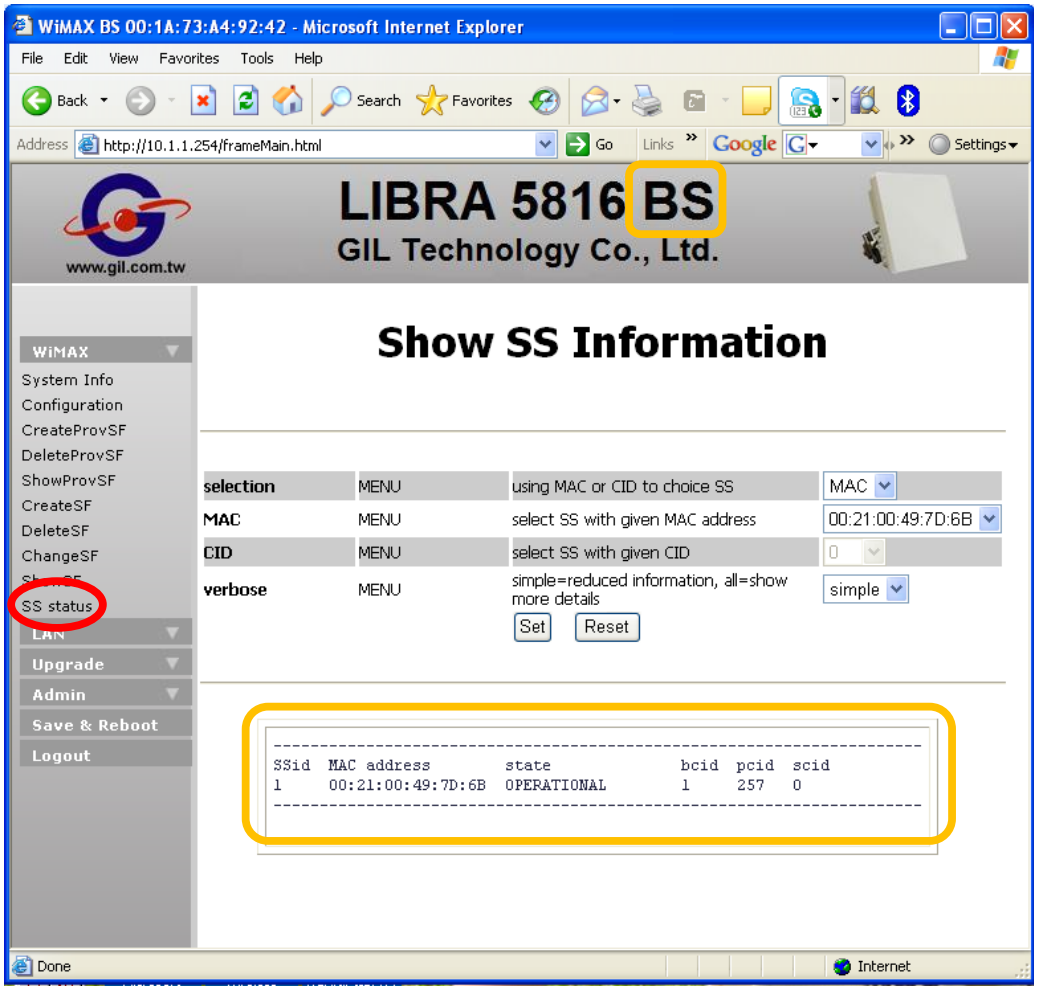
A.1 Configuration Check:

1. Open Web browser to access 10.1.1.254 for Web UI of BS
2. Click ***WiMAX/Configuration*** on the left side of the page and then the WiMAX RF configurations of the factory default are shown as the screen:



A.2 Link Status Check:

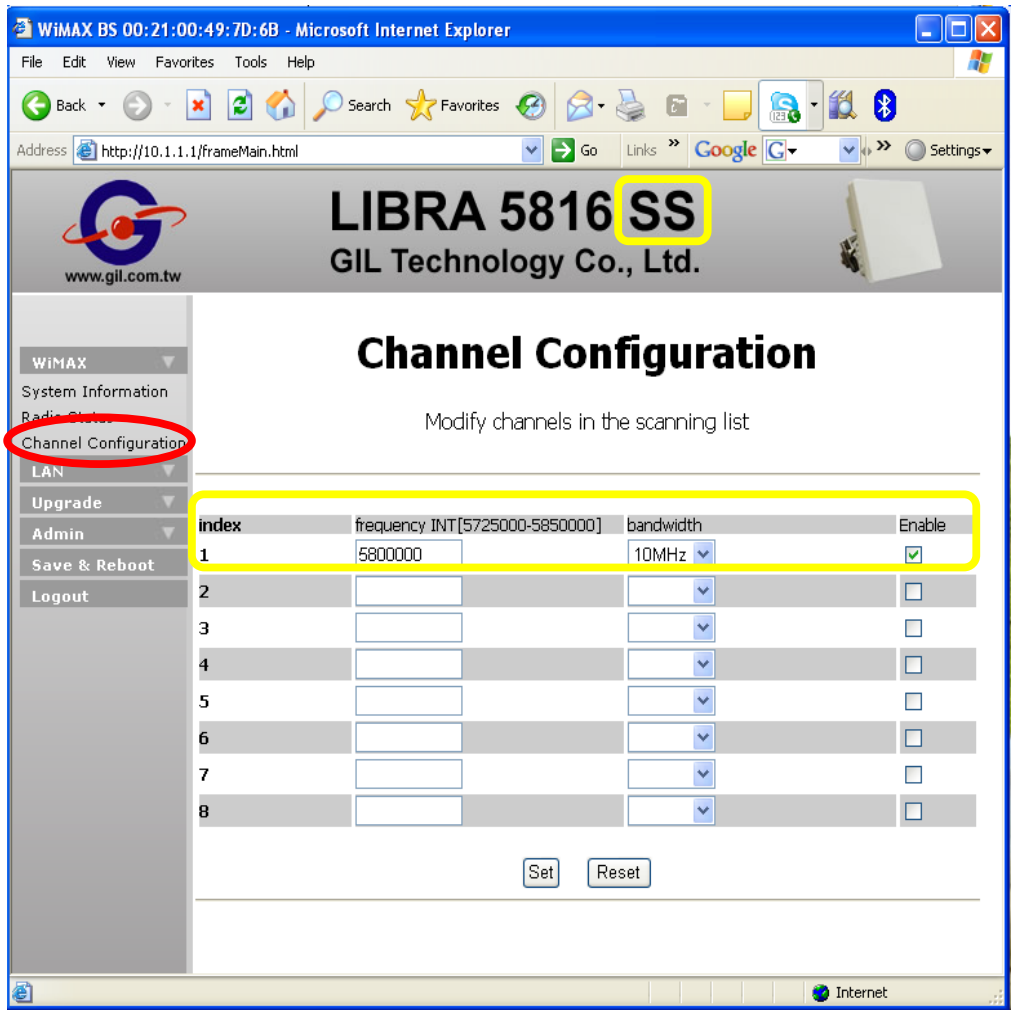
1. Click ***WiMAX/SS status*** on the left side of the page.
2. Click ***Set***, the link status is shown as below with ***verbose*** set as “simple”. The screen shows the ssid, MAC address, etc of SS which connects with BS.



B. Subscriber Station

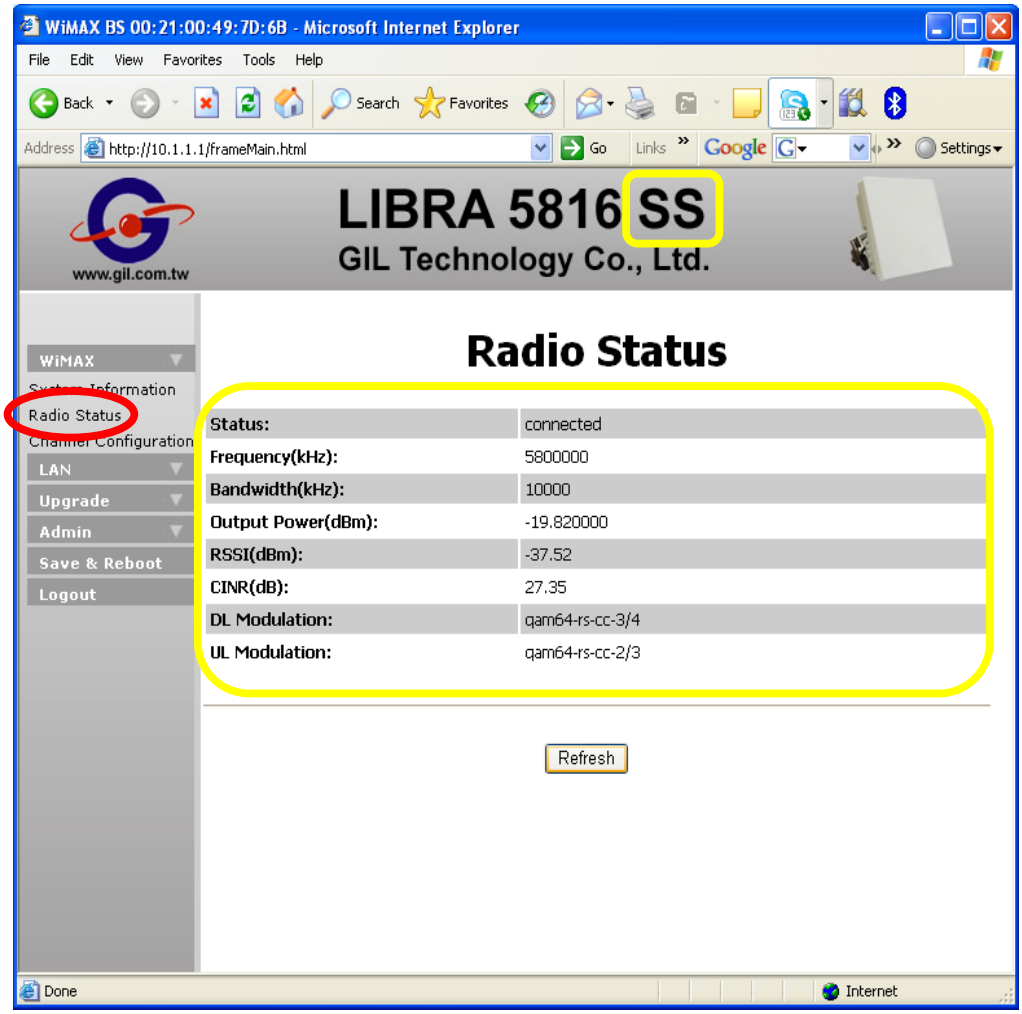
B.1 Configuration Check:

1. Open Web browser to access 10.1.1.1 for Web UI of SS
2. For checking default configuration of SS, please click ***WiMAX/Channel Configuration***.



B.2 Link Status Check:

Click ***WiMAX/Radio*** Status, and then screen shows RF link status of SS.

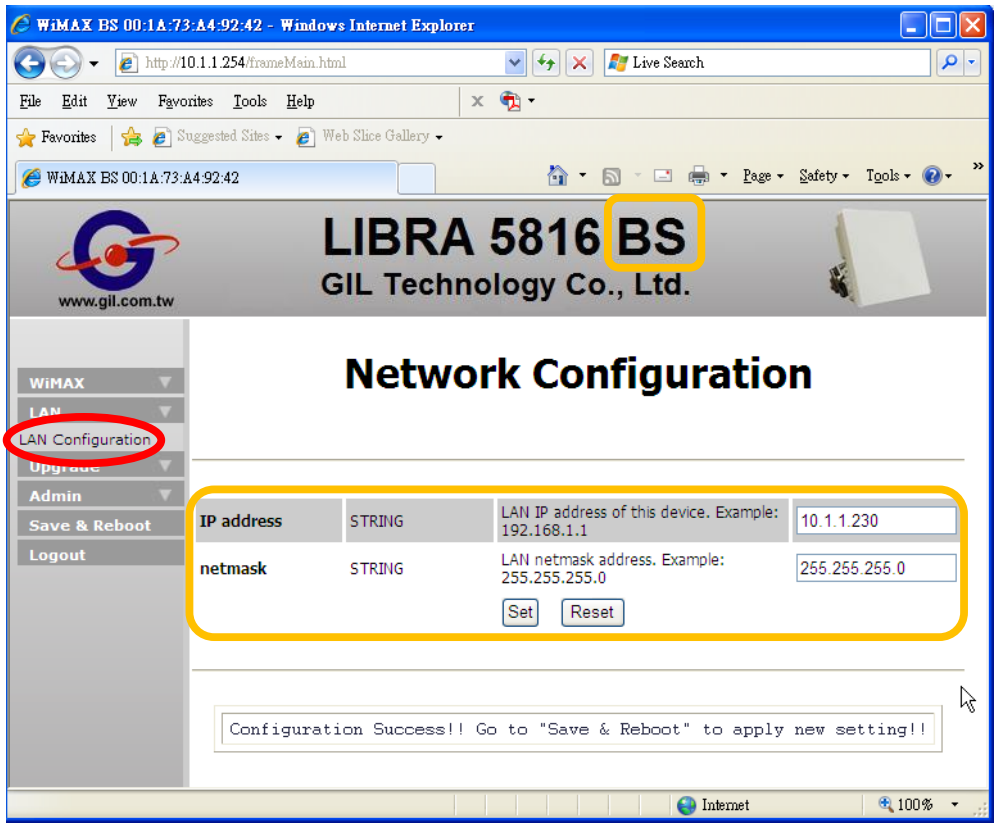


4. BS/SS Key Configuration

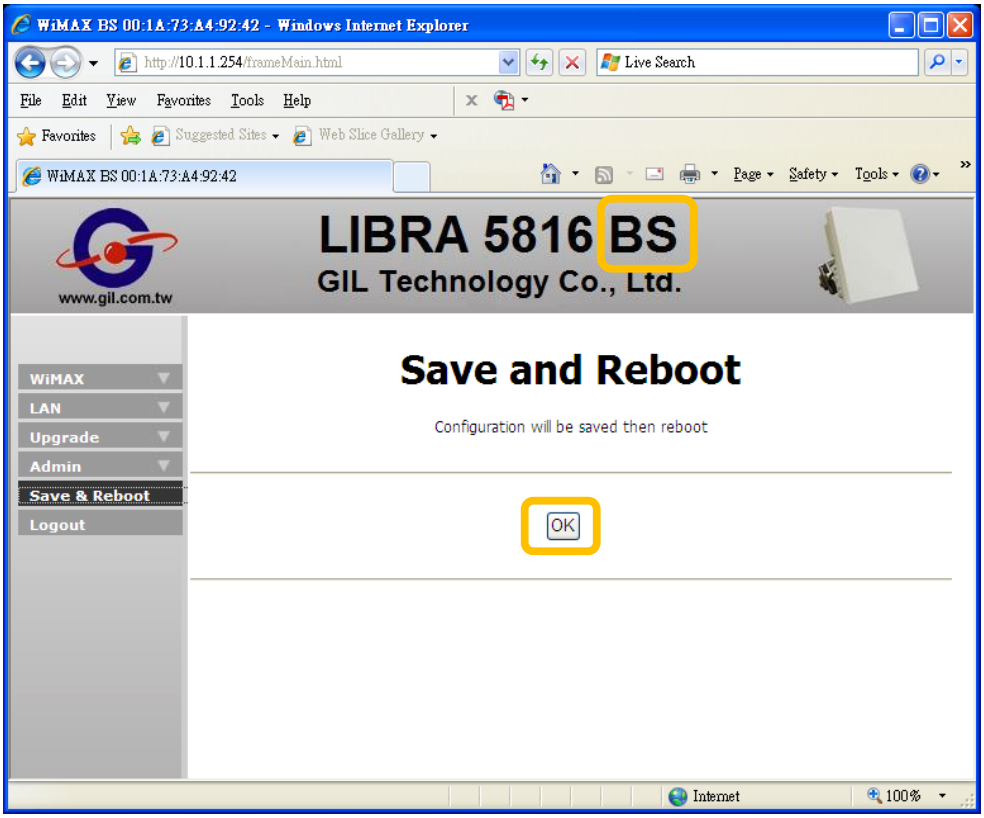
4.1 IP Configuration

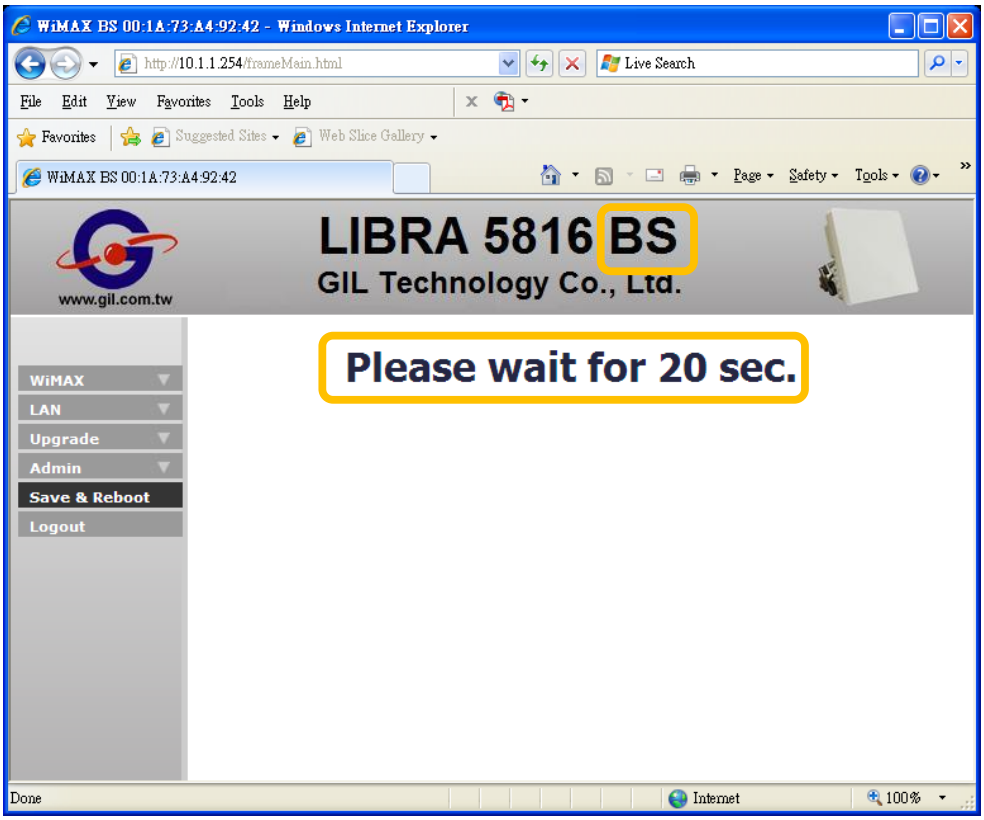
A. Base Station

1. Open Web browser to access 10.1.1.254 for Web UI of BS.
2. Click ***LAN/ LAN Configuration*** on the left side of the Web.
3. For example, entering new IP address 10.1.1.230 in blank.
4. Click ***Set*** and then follow the guide message to click ***Save & Reboot***

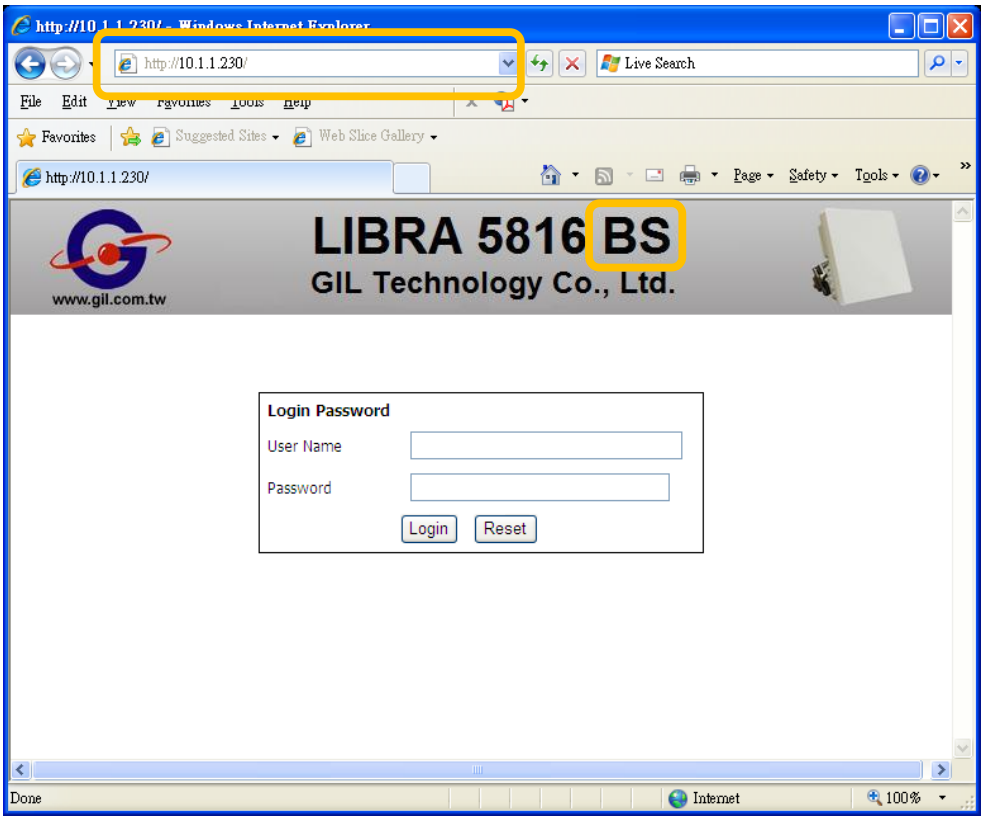


5. Click ***OK***, and then wait for 20 seconds.



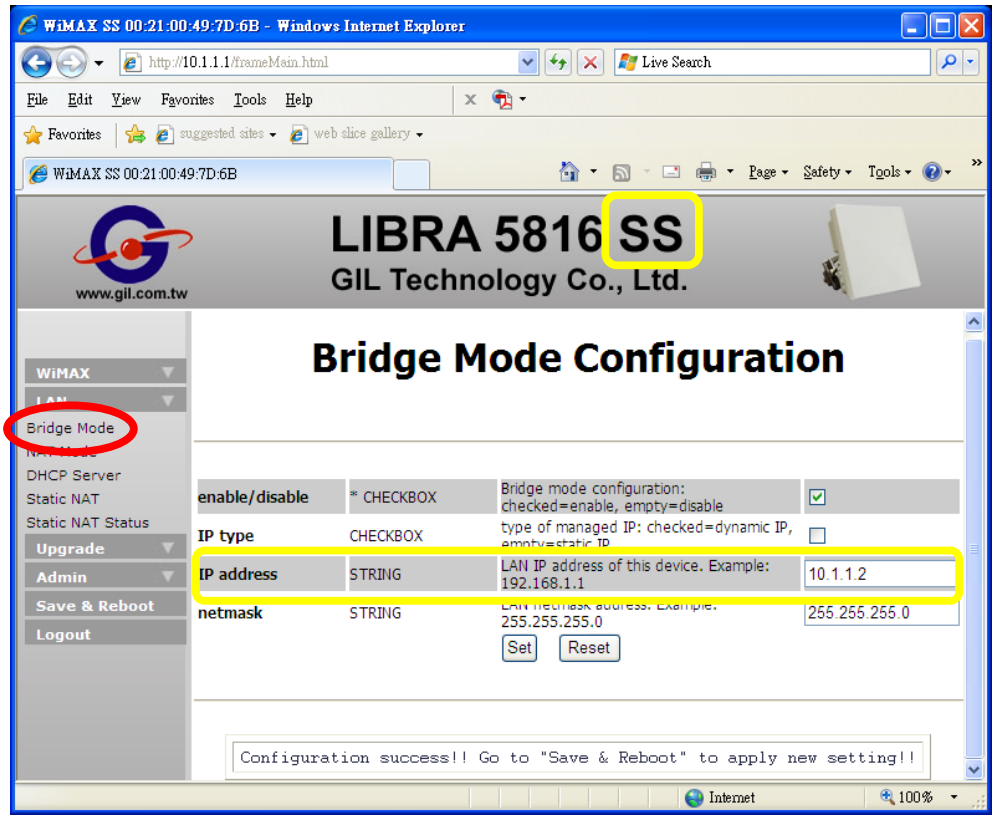


6. To enter new IP address in blank of browser for BS login access.

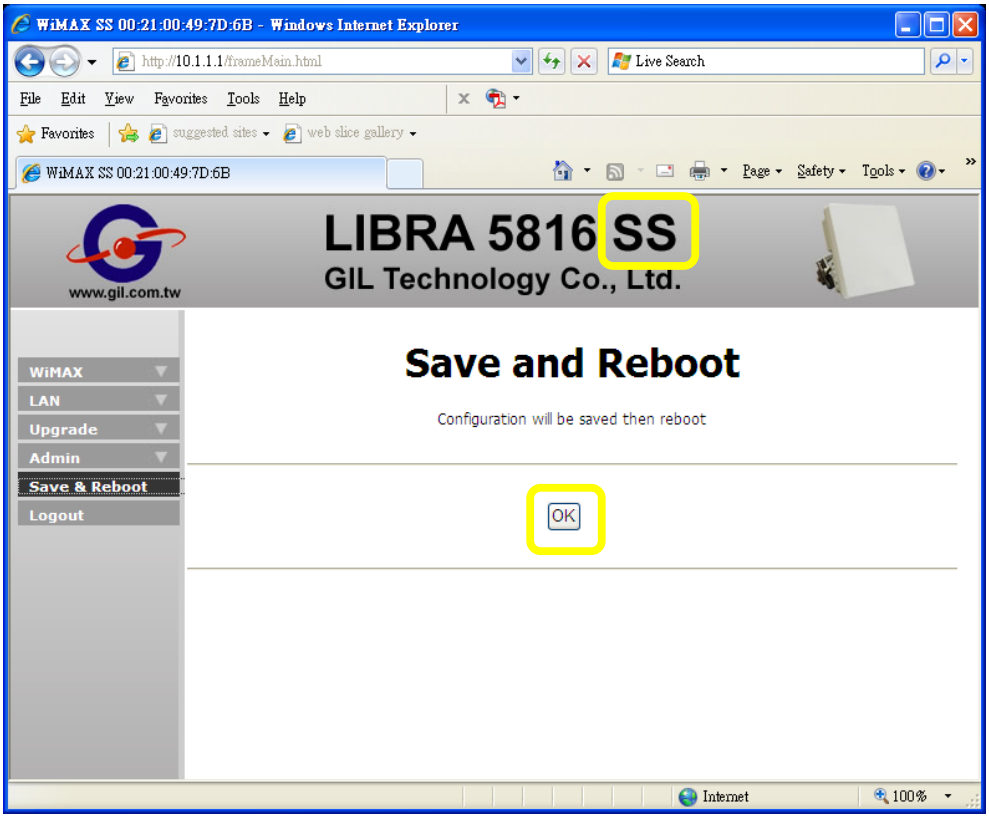


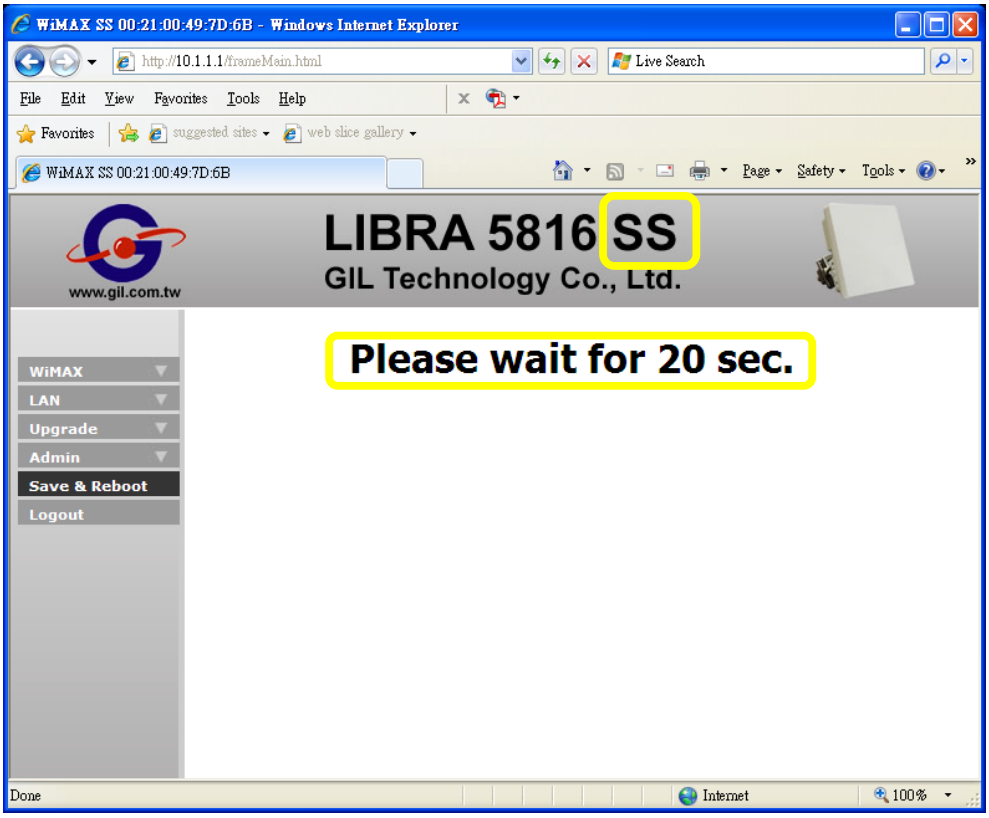
B. Subscriber Station

1. Open Web browser to access 10.1.1.1 for Web UI of BS.
2. Click ***LAN/ Bridge Mode*** on the left side of the Web.
3. For example, entering new IP address 10.1.1.2 in blank,
4. Click ***Set***, and then follow the guide message to click ***Save & Reboot***.

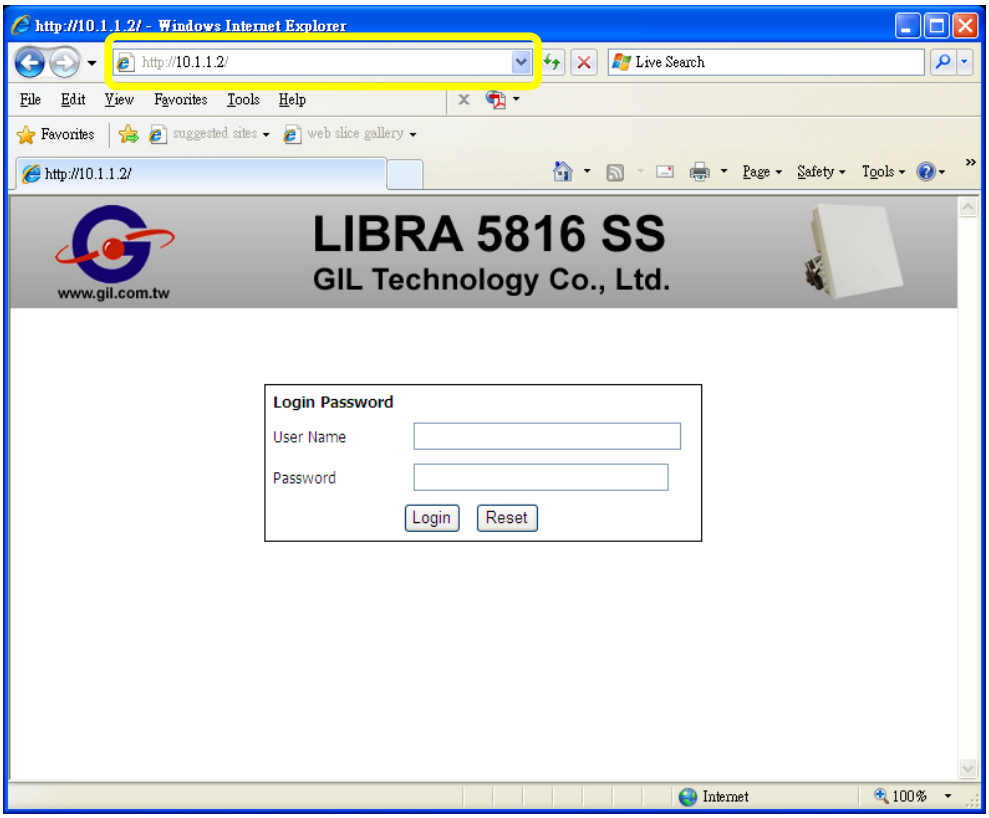


5. Click ***OK***, and then wait for 20 seconds.





6. To enter new IP address in blank of browser for SS login access.



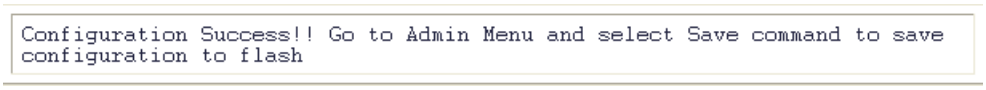
4.2 RF Configuration

A. Example: Modify Bandwidth and Radio Frequency.

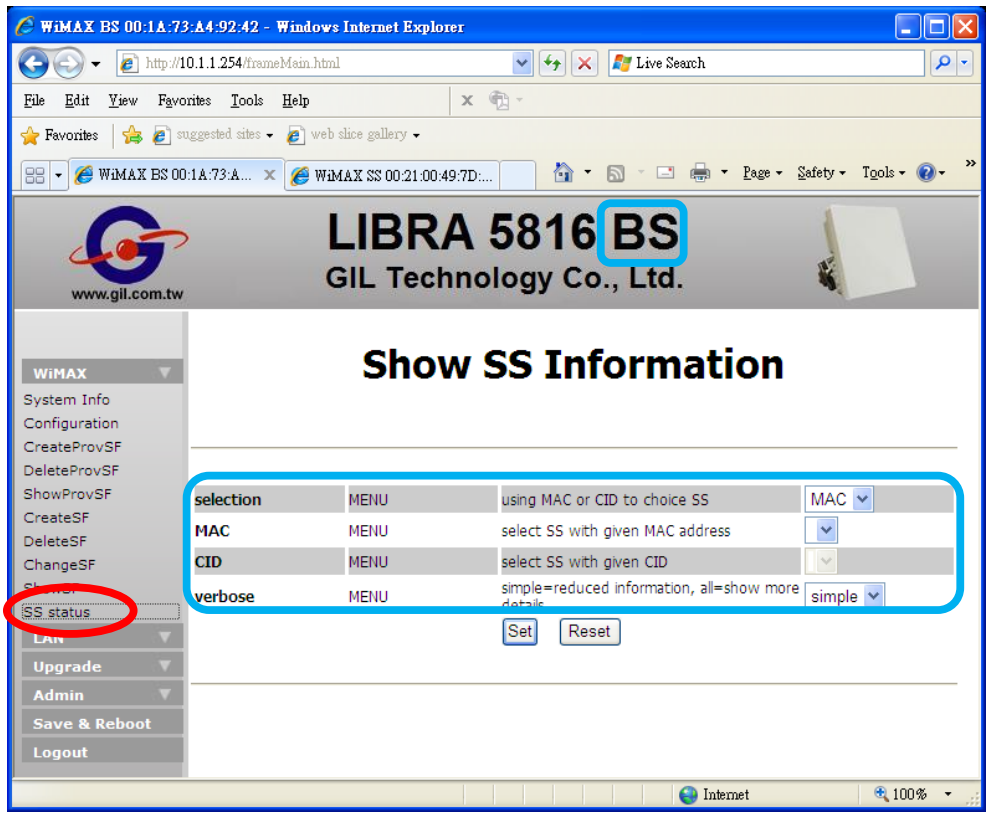
Base Station

1. Open Web browser to access 10.1.1.254 for Web UI of BS.
2. Click ***WiMAX/Configurations*** on the left side of the Web.
3. Make bandwidth as 15MHz, frequency as 5850000KHz.
4. Click ***Set***.

5. After click ***Set***, please follow the guide message to save.

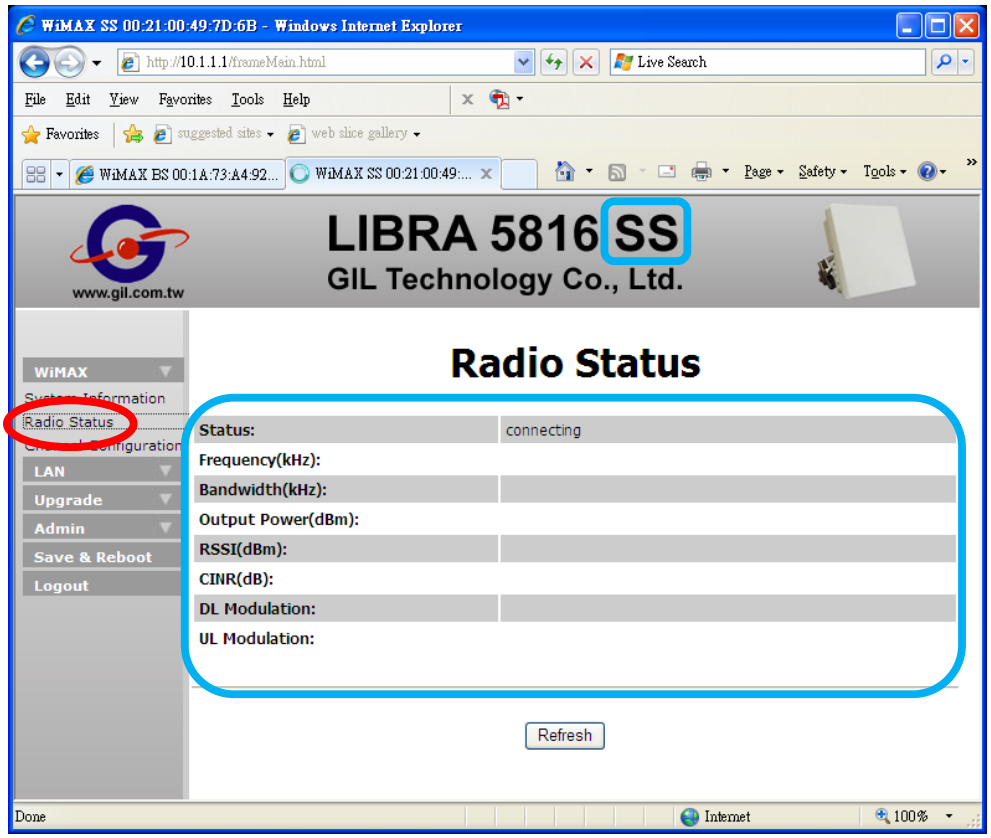


6. Click ***SS status***, because of RF specifications of BS has been changed, thus there has no SS is connecting with BS now.

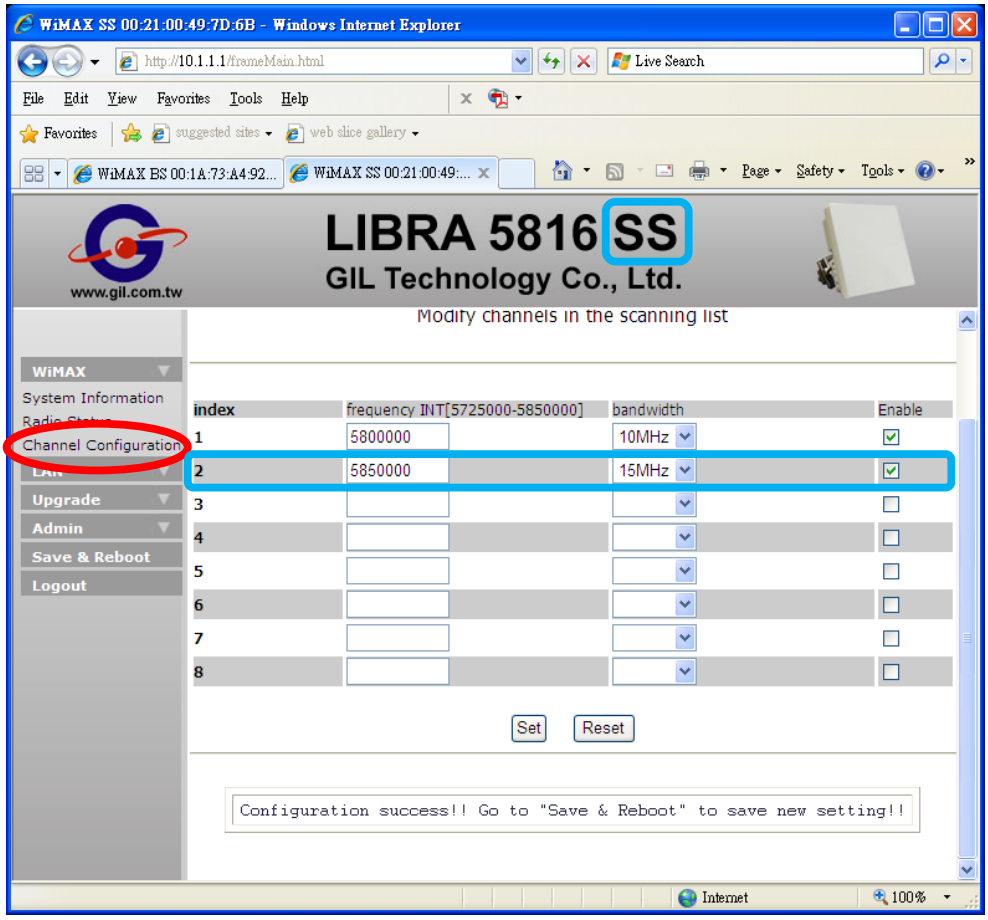


Subscriber Station

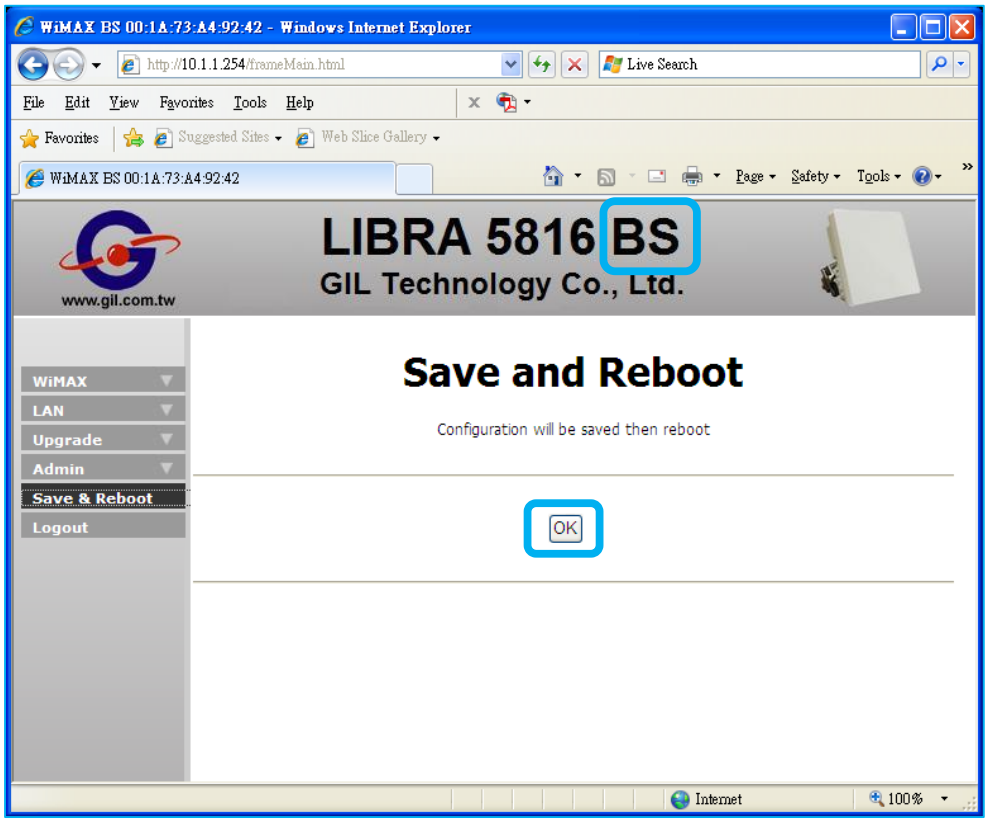
7. Open Web browser to access 10.1.1.1 for Web UI of SS.
8. Click ***WiMAX/Radio Status*** on the left side of the Web. There has no RF information of SS before the connection established.

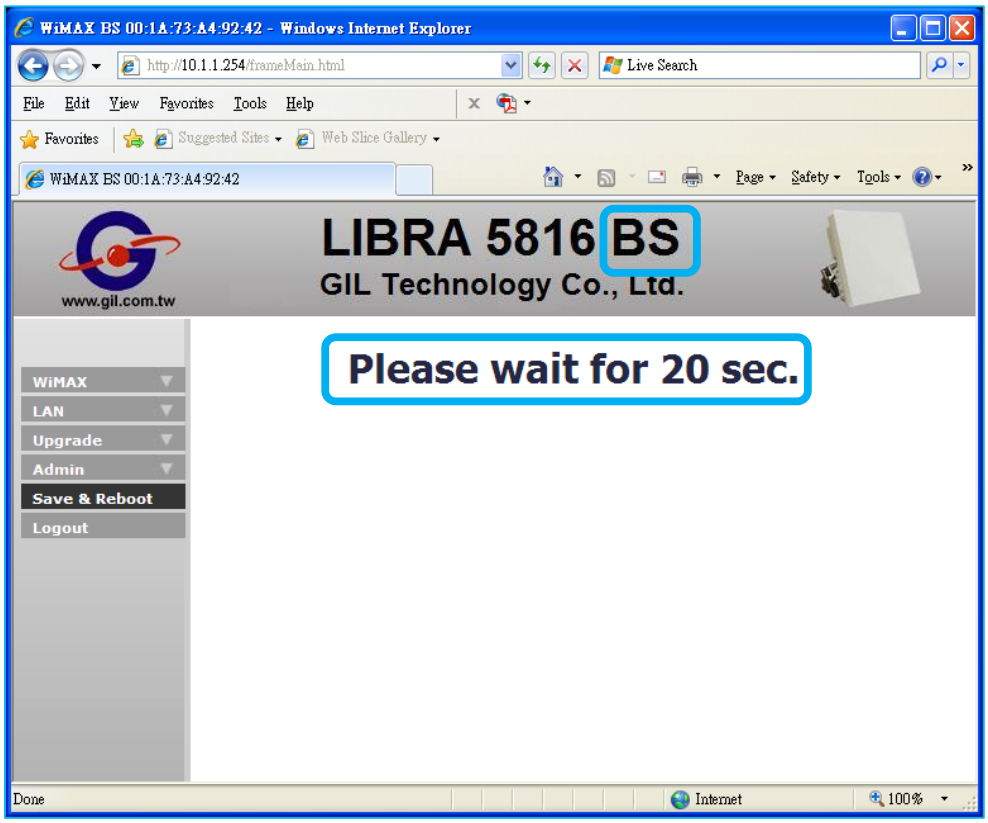


9. Click ***WiMAX/Channel Configuration***.
10. Adding index 2. of scan list, frequency as 5850000KHz and bandwidth as 15MHz for mapping RF specifications of BS. And then mark the check box for enable SS to scan this channel.
11. Click ***Set***, and then follow the guide message to click ***Save & Reboot***.

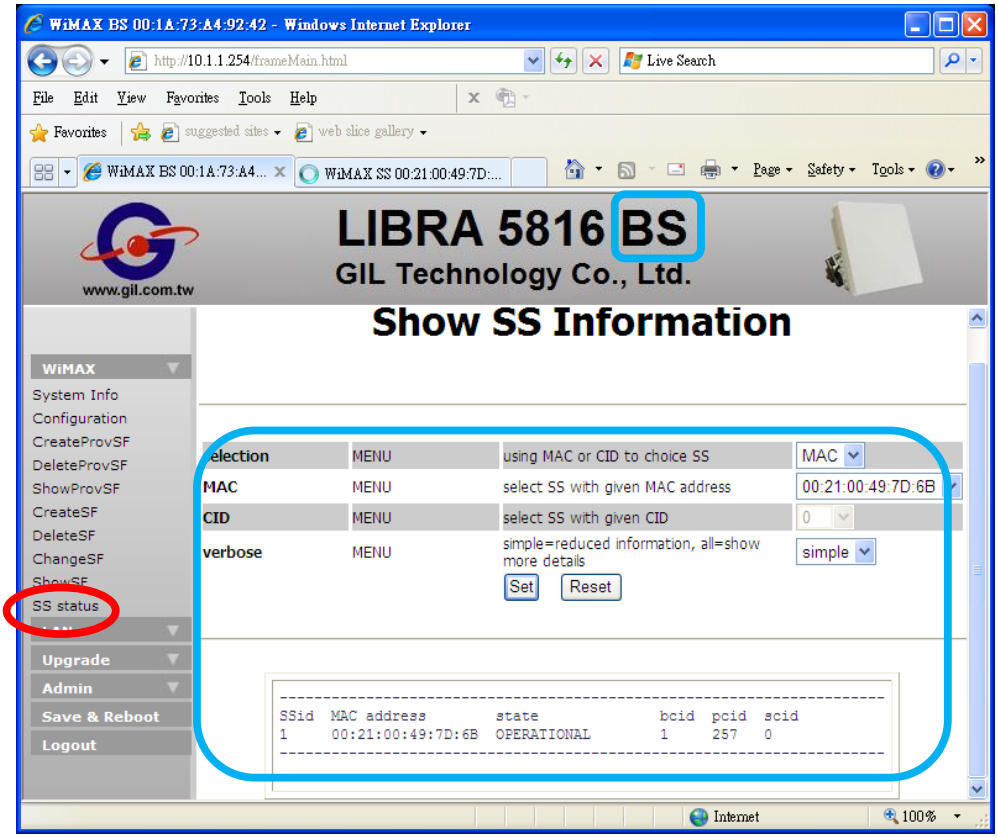


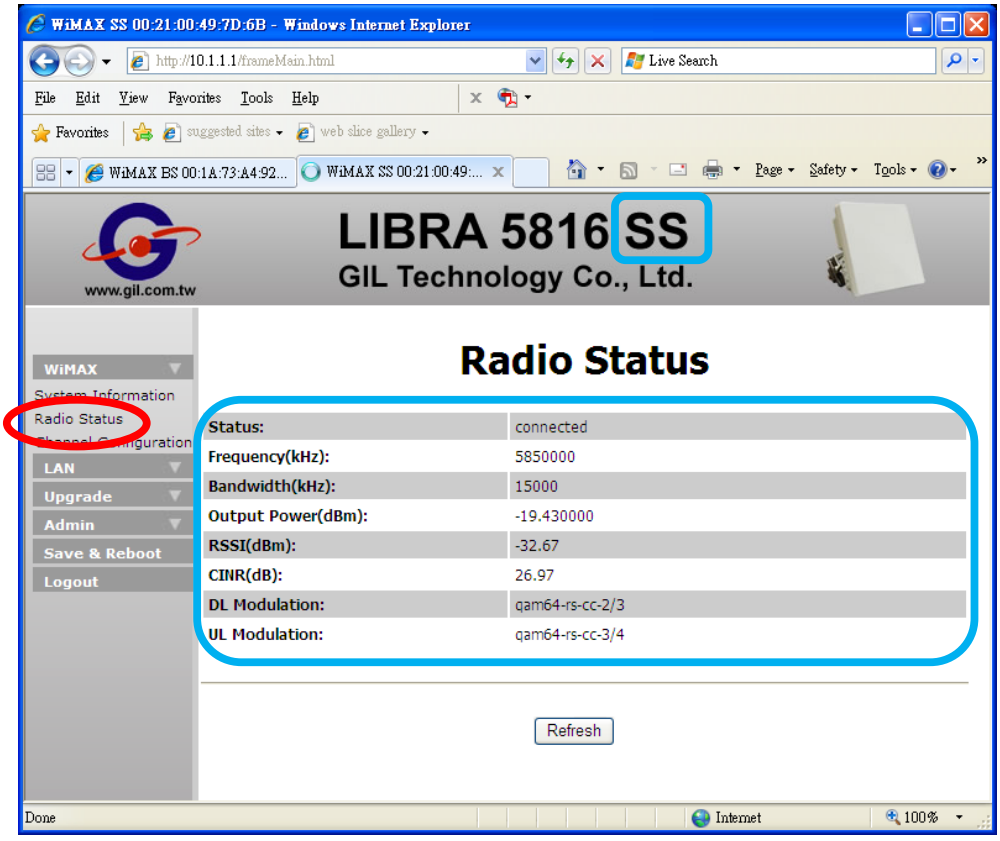
12. Click ***OK*** and then wait for 20 seconds.





13. Repeat the step 6 and 7 to check link status and RF information between SS and BS.





LIBRA 5816 Quality of Service Configuration Guide

QoS Configuration Demo

Abbreviation:

BE	Best Effort
BS	Base Station
DL	Downlink
nrtPS	non real time Polling Service
rtPS	real time Polling Service
SF	Service Flow
SFC	Service Flow Configuration
SS	Subscriber Station
UGS	Unsolicited Grant Service
UL	Uplink

Method:

1. Static SFC –
   a. SFCs are storable in BS.
   b. They are not real-time executed. SS should be restarted or repowered-on after SFs are set.
   c. UL and DL SFs should be coexistent.

   Related command: **CreatProvSF, DeleteProvSF, ShowProvSF**

2. Dynamic SFC –
   a. SFCs will be cleared after BS rebooted or repowered on.
   b. It is real time executable, the SFCs work immediately.
   c. There has default “Best Effort” of DL.

   Related command: ***CreatSF, DeleteSF, ChangeSF, ShowSF***

Before SFC Configuration

All items of those related command have their own definition as below:

MAC Media Access Control address of the SS

BCID Basic Communication Identifier

SFID SF Identifier

direction DL or UL of the SF

maxrate Maximum data rate of the SF

minrate Minimum data rate of the SF

maxlatency Maximum latency of the SF

priority Traffic priority of the SF

scheduling QoS type selection

grant interval The grant period between SS and BS (UGS mode only)

polling interval The polling period between SS and BS(rtPS and nrtPS)

－**classifier1~4** (Syntax definition and format instance)

any Defines this classifier that matched all packets. *Format:* any

priority Priority of this classifier, integer range is [0..255]. The highest priority is 255, default values is 128. *Format:* priority:55

ethsa Ethernet source address. *Format:* ethsa:00:11:22:33:44:55

ethda Ethernet destination address. *Format:* ethda:00:1A:2B:3C:4D:5E

ipsaIP source address. *Format:* ipsa:192.168.10.68

ipda IP destination address. *Format:* ipda:192.168.10.33

spr Source port range. *Format:* spr:1230 – 1240

dpr destination port range. *Format:* dpr:1510 – 1520

dscprm Different Service Code Point range and mask. *Format:* dscprm:13:57:63

ipproto Protocol transported by IP datagram. *Format:* ipproto:17

ipv6fl Matches the lower 16 bits of IpV6 flow label(00001-FFFFF). *Format:* FFFFF

vlan-id VLAN id 1~4094. *Format:* vlan-id:2024

Note: Please be aware of the following word types represented as,

f. Emphasis: *Italic font with underline*:
g. DOS Command: *Italic font of text*
h. Web UI Command: ***Italic and bold font of text***
i. Windows Command: ***"Italic, bold font of text with quotation marks"***
j. Characters: "text with quotation marks"

DEMO-1: Ping Time Configuration (UGS Mode)

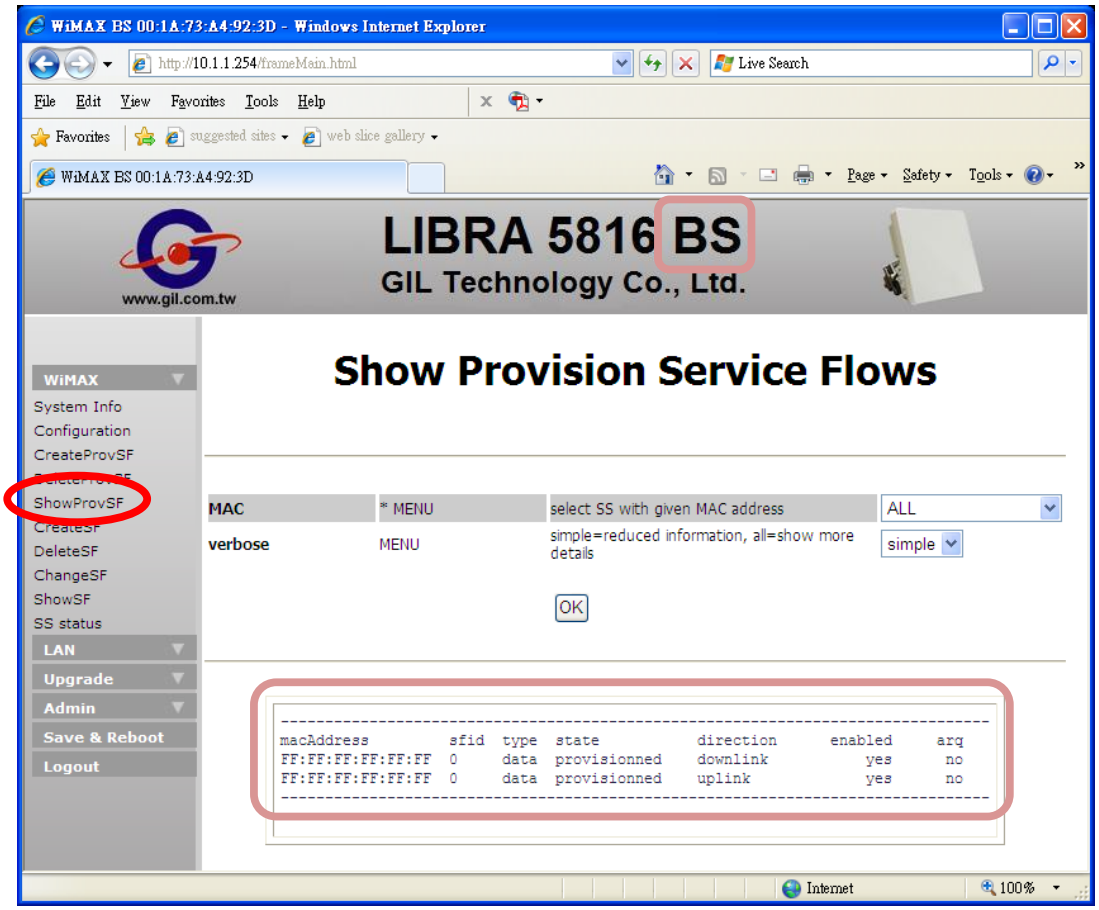
Goal:

To modify the ping time shorter between BS and SS.

1- Static SFC

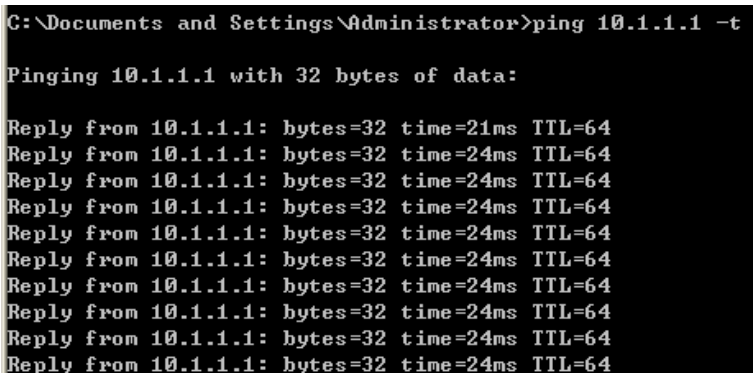
A. ***ShowProvSF:***

1. Before provisioned SFC, click ***Ok*** to display default SFs information.



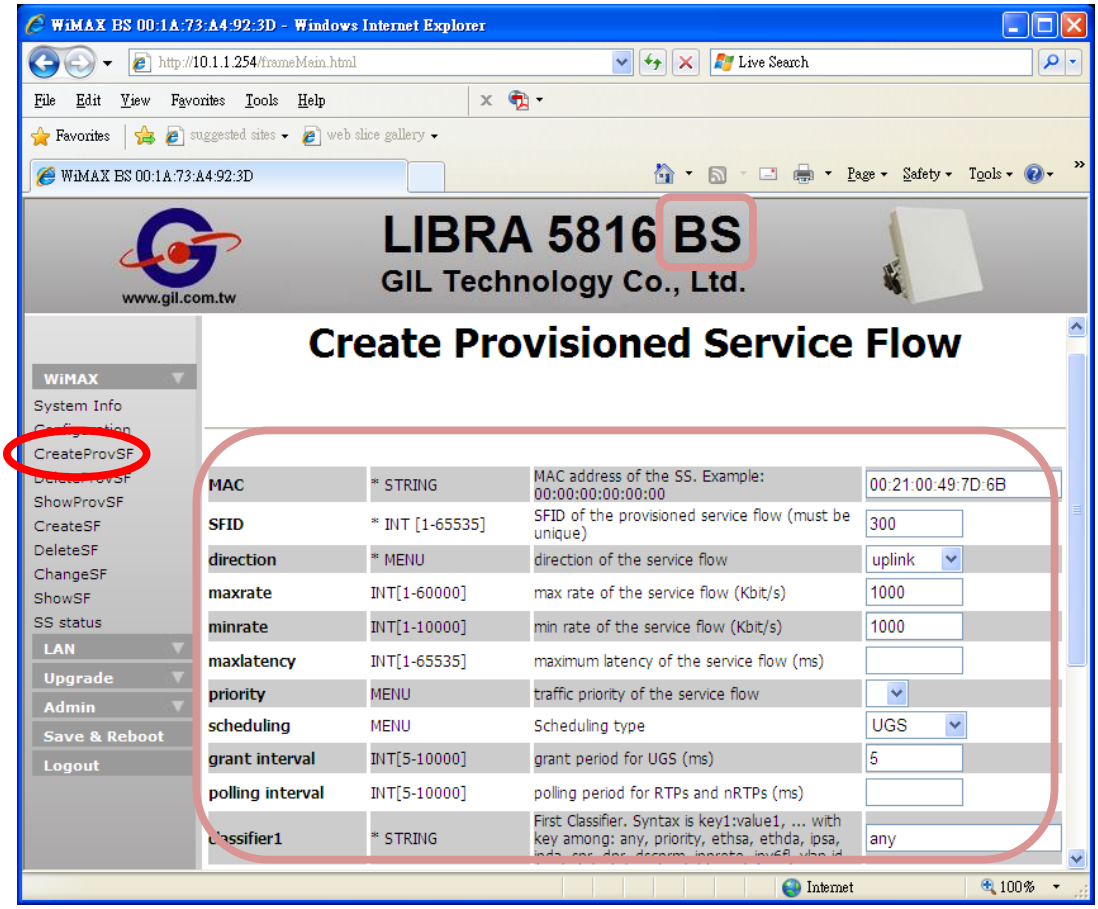
2. Then click ***"Start", "Run"***, and then type ***"cmd"*** for running DOS mode. Enter *ping* to check default ping time:

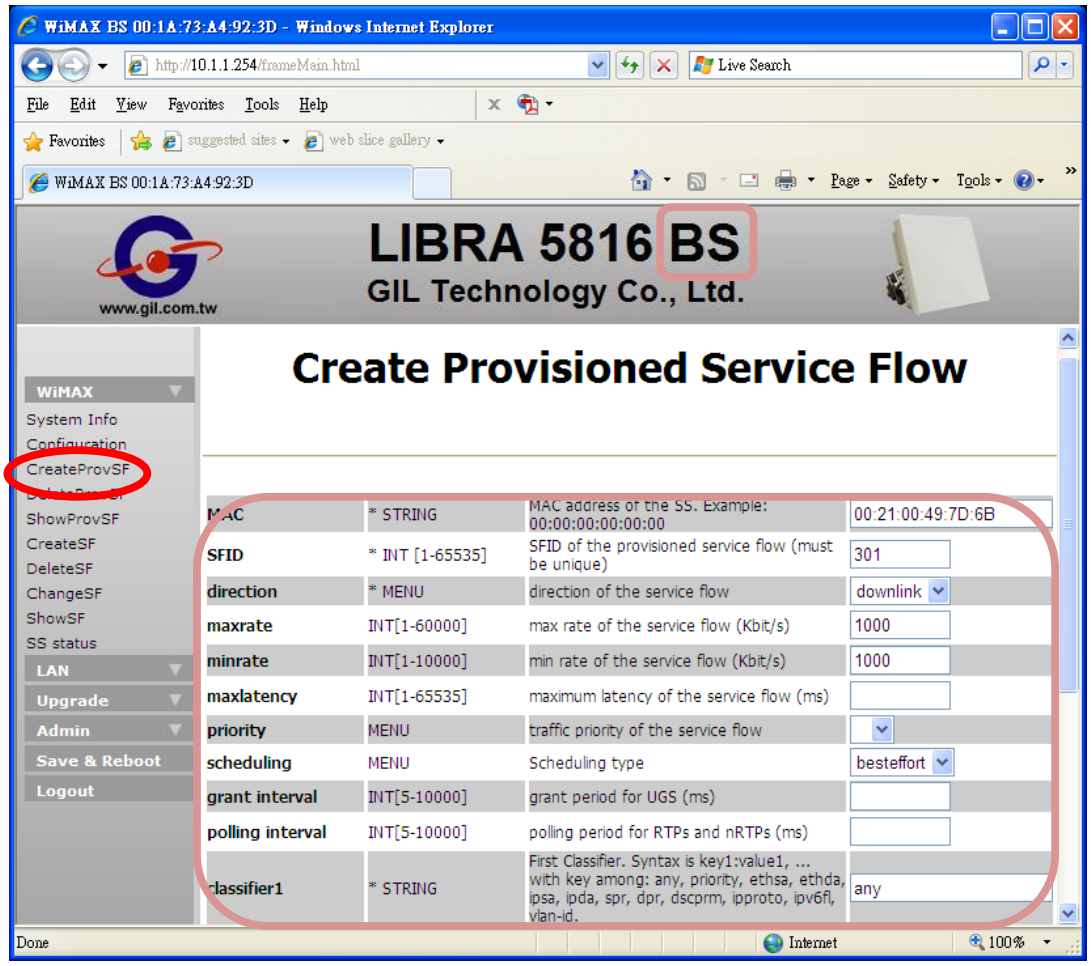
   \>*ping 10.1.1.1 –t*



B. ***CreatProvSF:***

1. Use SS MAC address as index, please refer to the below screen for creating provisioned SFCs (Uplink and Downlink).





2. After click ***Set*** in BS.

```
Configuration Success!! Press Save button to save settings to flash
```

3. And then click ***Save*** in BS.

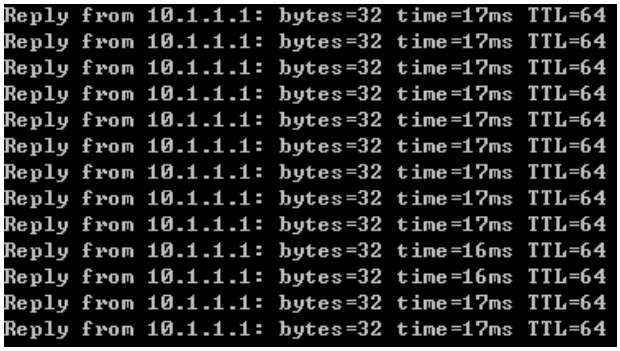
```
Save Provisional Service Flow settings Success!!
```

4. SS must be rebooted or repowered-on so that the SFs are work.

5. Repeat step A. ***ShowProvSF*** to display provisioned information.

```
-------------------------------------------------------------------------------
macAddress         sfid  type  state          direction      enabled     arq
FF:FF:FF:FF:FF:FF  0     data  provisionned   downlink           yes      no
FF:FF:FF:FF:FF:FF  0     data  provisionned   uplink             yes      no
00:21:00:49:7D:6B  300   data  provisionned   uplink             yes      no
00:21:00:49:7D:6B  301   data  provisionned   downlink           yes      no
-------------------------------------------------------------------------------
```

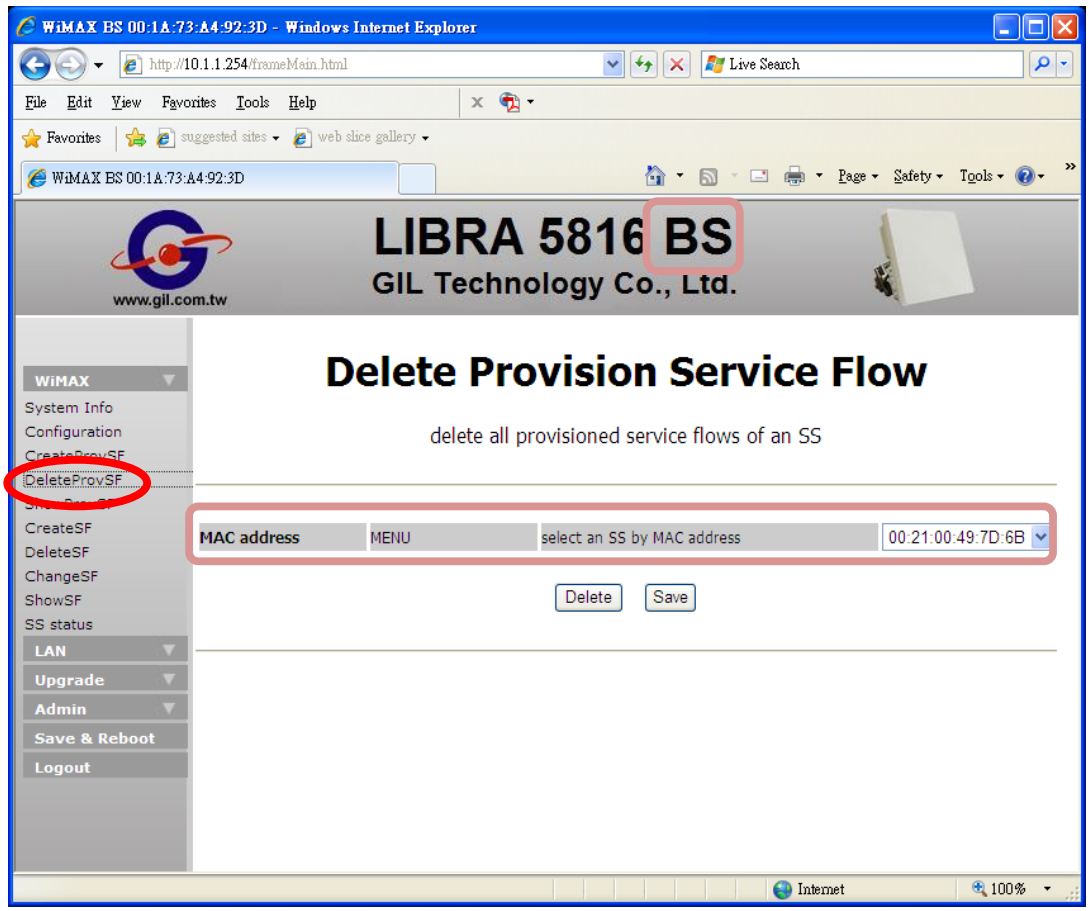
6. And then check the ping time.



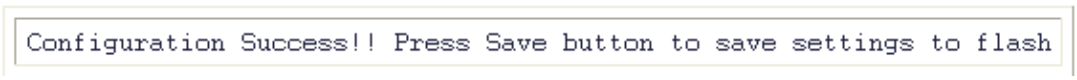
The range of ping time between BS and SS is dependent on many conditions, such as antenna selection, environment factors and another RF devices external influence, etc.

C. ***DeleteProvSF:***

1. Use SS MAC address as index.



2. Click ***Delete***.

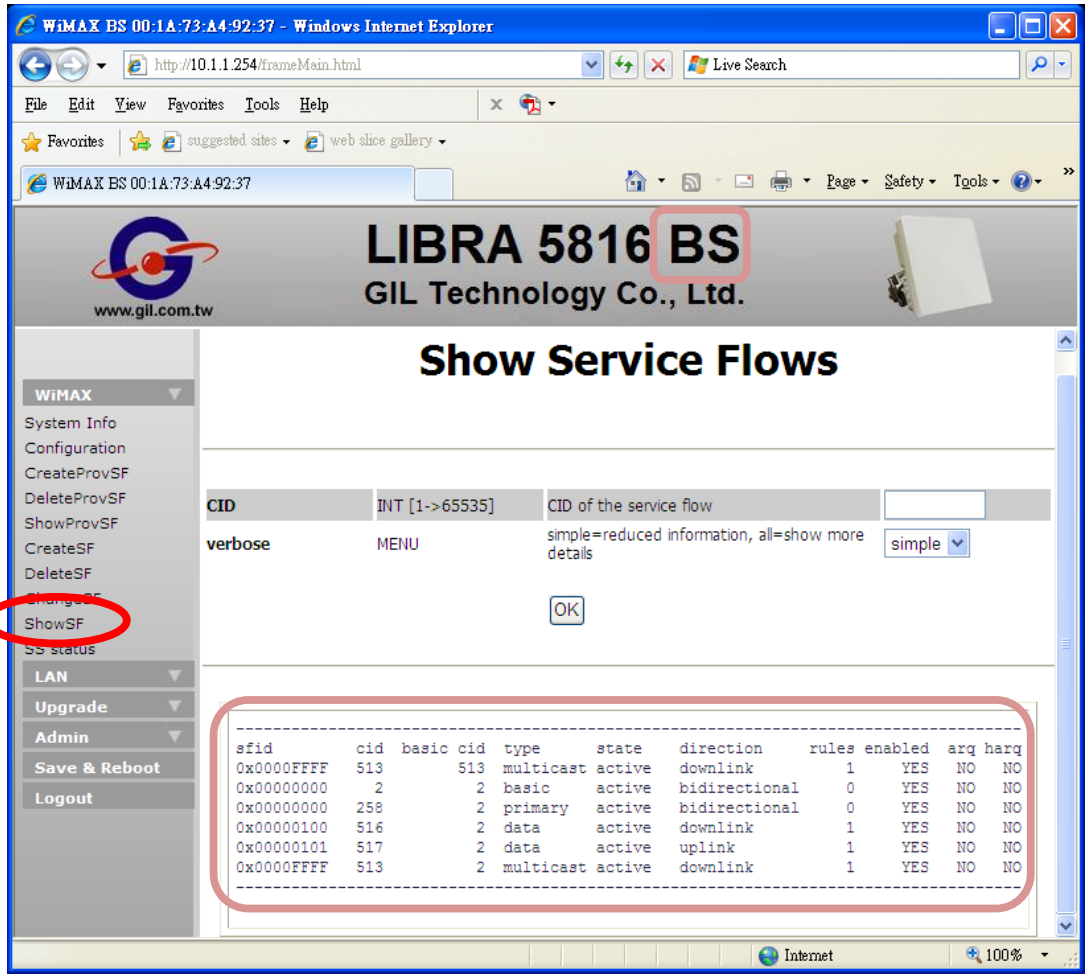


3. Clikc ***Save***, *and all SFCs mapped this SS of BS will be removed*.

2- Dynamic SFC

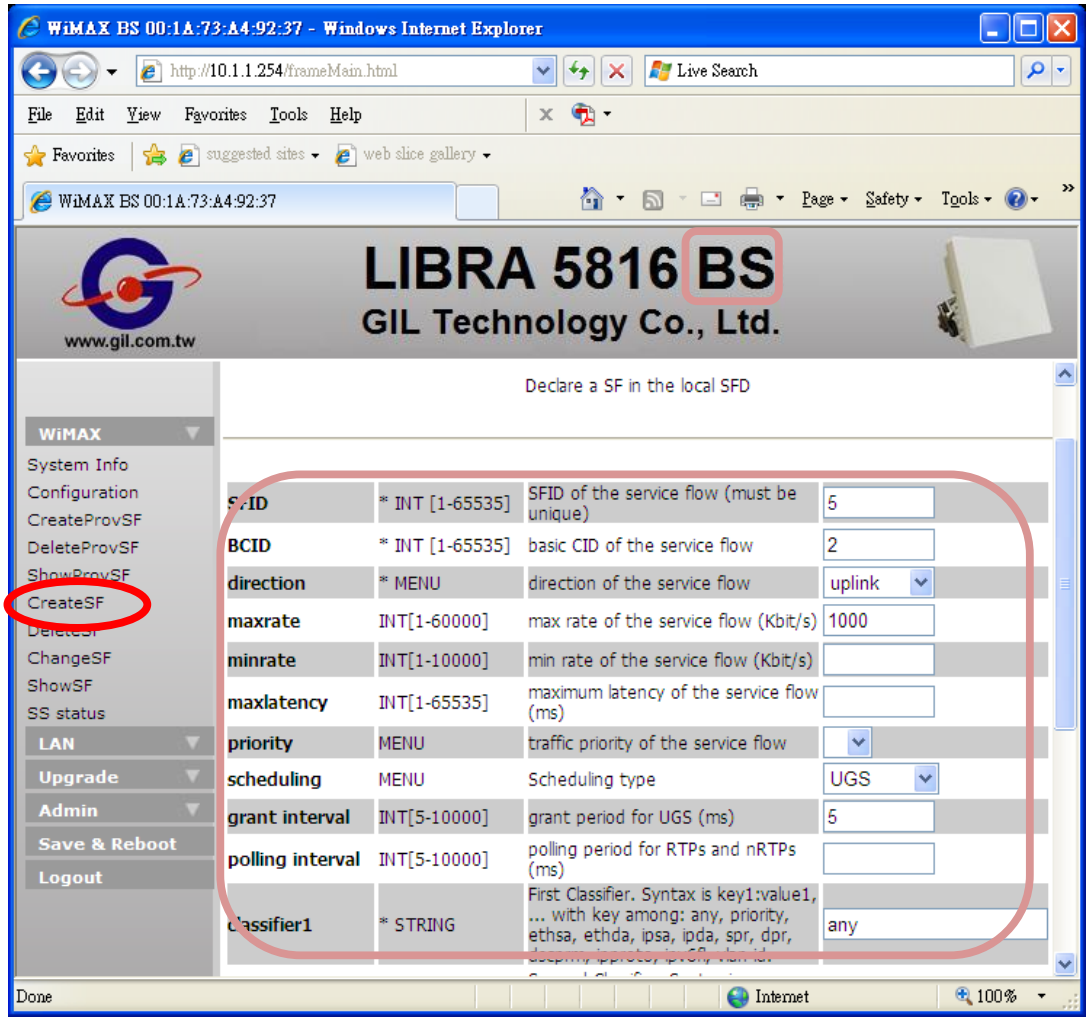
A. ***ShowSF:***

Click ***Ok*** to display default SFs information.



B. ***CreateSF:***

1. As example, specifications of SFID, BCID, direction, maxrate, scheduling, grant interval and classifier1 are configured as below:



2. Click ***Set***, SFID 5 of BCID 2 is created.

```
Create SFID 5 BCID 2 Success!!
```

3. Please review A. ***ShowSF*** for checking the new SF.

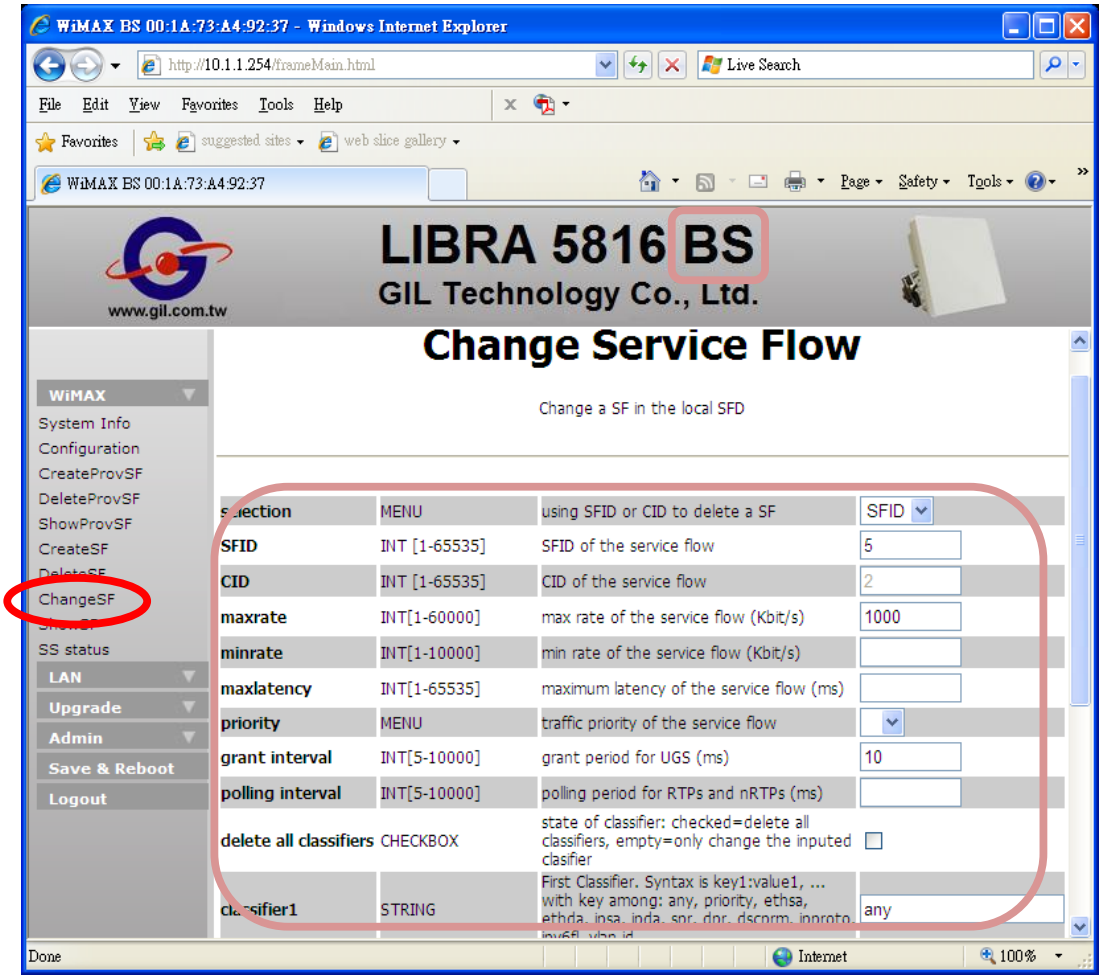
```
-------------------------------------------------------------------------------
sfid        cid  basic cid  type      state    direction      rules enabled  arq harq
0x0000FFFF  513        513  multicast active   downlink           1     YES   NO   NO
0x00000000    2          2  basic     active   bidirectional      0     YES   NO   NO
0x00000000  258          2  primary   active   bidirectional      0     YES   NO   NO
0x00000100  516          2  data      active   downlink           1     YES   NO   NO
0x00000101  517          2  data      active   uplink             1     YES   NO   NO
0x0000FFFF  513          2  multicast active   downlink           1     YES   NO   NO
0x00000005  522          2  data      active   uplink             1     YES   NO   NO
-------------------------------------------------------------------------------
```

4. Click ***"Start"***, ***"Run"***, and then type ***"cmd"*** for running DOS mode. Enter *ping*, the reply time should be improved between BS and SS.

   The range of ping time between BS and SS is dependent on many conditions, such as antenna selection, environment factors and another RF devices external influence, etc.

C. ***ChangeSF:***

1. Select SFID or CID as index, and enter its number and new value.

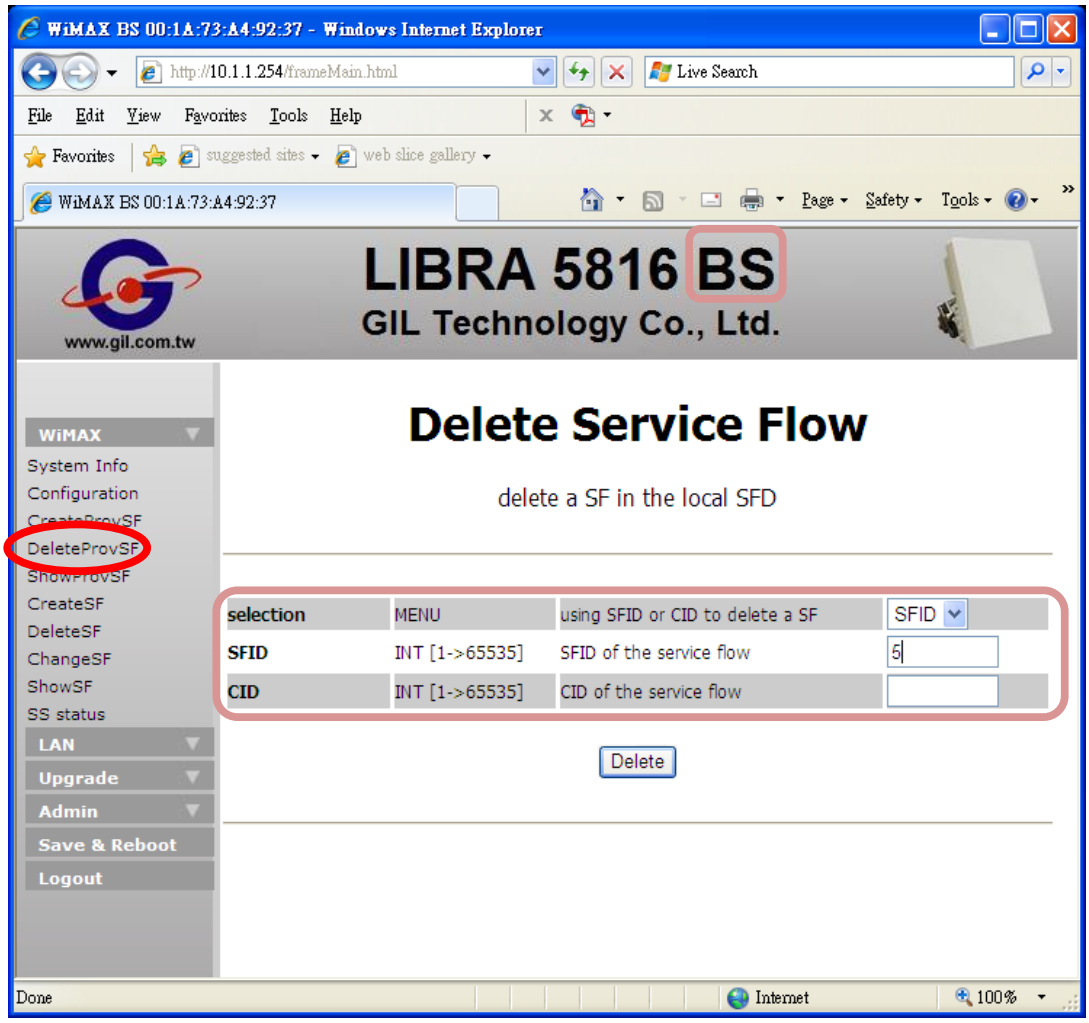


2. Click ***Set***, SF specification is changed.

3. Repeat section B.4 to verify the alteration of reply time.

D. ***DeleteSF:***

1. Select SFID or CID as index, and then enter its number.(Example: SFID 5)



2. After click Delete, SFID 5 is deleted.

```
Delete SFID 5 Success!!
```

3. Please review A. ***ShowSF*** for checking the SF list.

```
-------------------------------------------------------------------------------
sfid        cid  basic cid  type      state    direction     rules enabled  arq harq
0x0000FFFF  513        513  multicast active   downlink          1     YES   NO   NO
0x00000000    2          2  basic     active   bidirectional     0     YES   NO   NO
0x00000000  258          2  primary   active   bidirectional     0     YES   NO   NO
0x00000100  516          2  data      active   downlink          1     YES   NO   NO
0x00000101  517          2  data      active   uplink            1     YES   NO   NO
0x0000FFFF  513          2  multicast active   downlink          1     YES   NO   NO
-------------------------------------------------------------------------------
```

DEMO-2: Throughput Limitation Configuration (Best-Effort Mode)

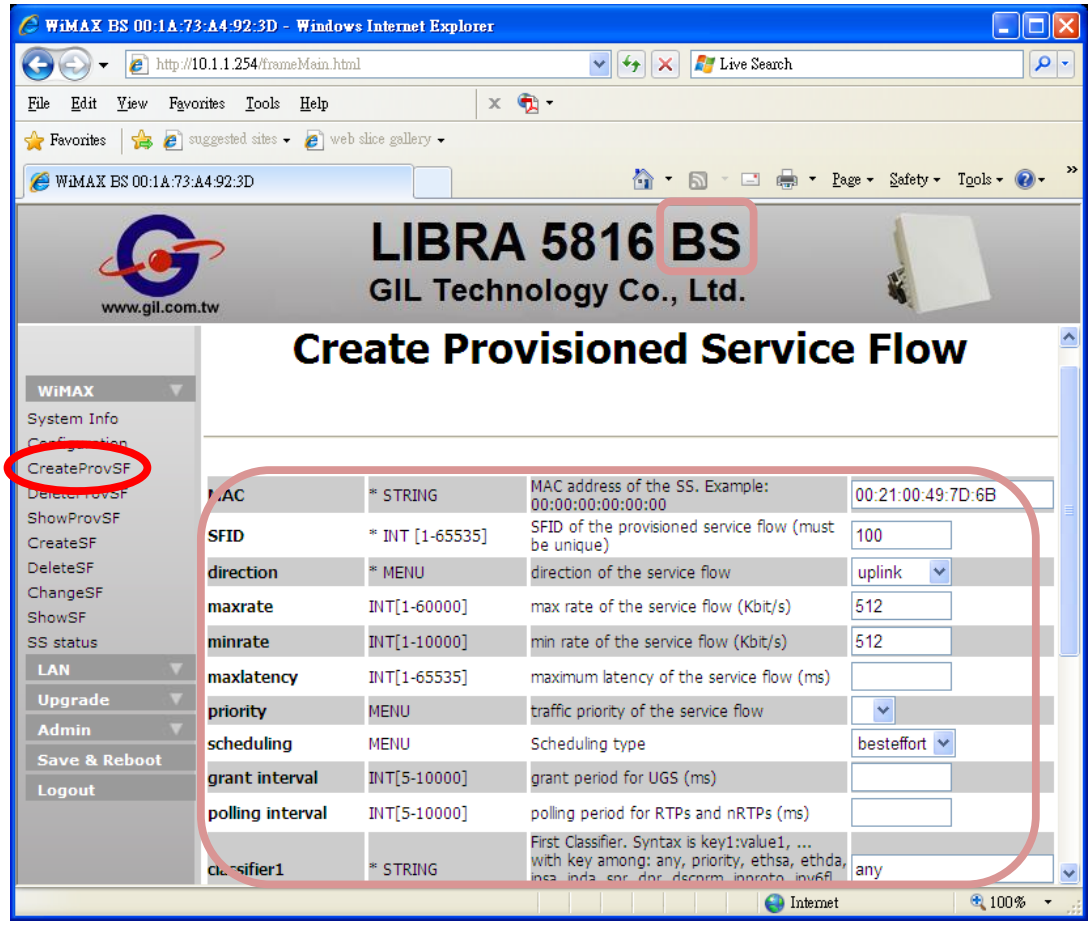
Goal:

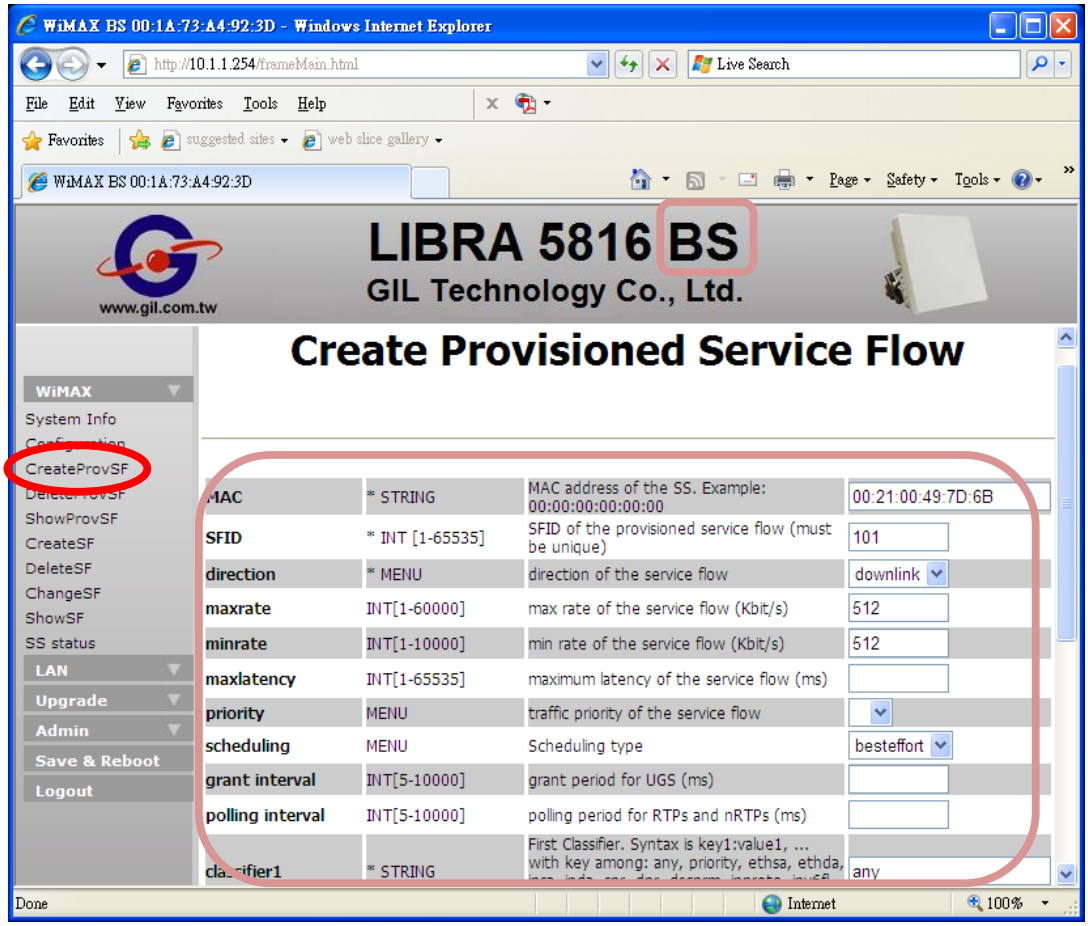
To limit the data rates transmission of DL and UL between BS and SS.

1- Static SFC

CreateProvSF:

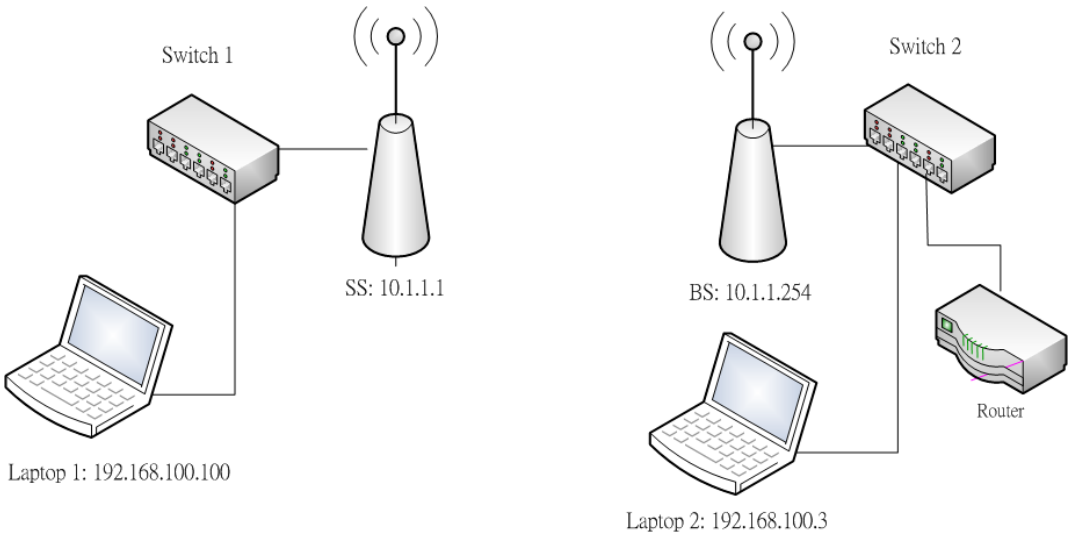
1. Use SS MAC address as index, please refer to the below screen for creating provisioned SFCs (Uplink and Downlink).



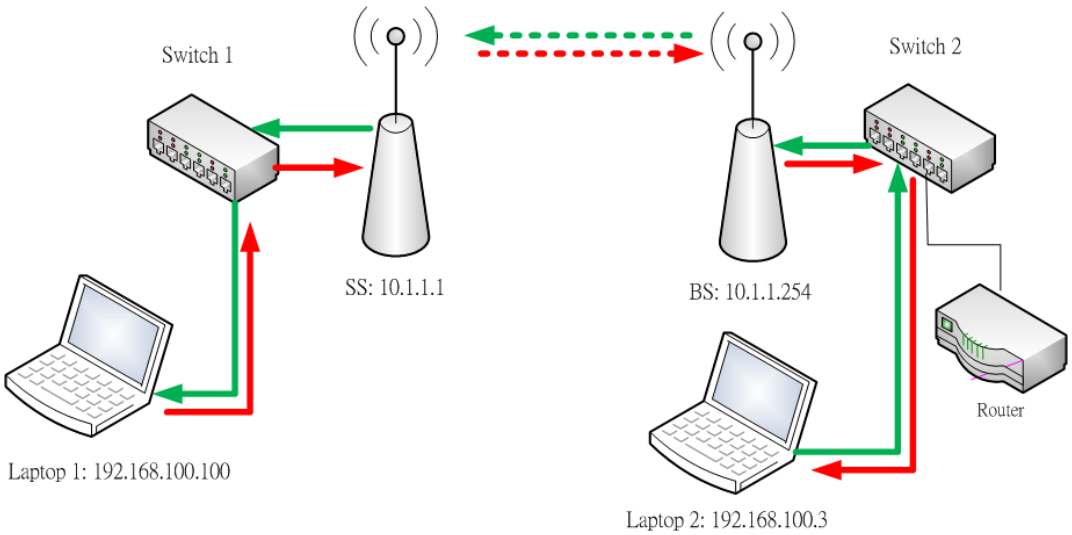

WiMAX BS 00:1A:73:A4:92:3D - Windows Internet Explorer
http://10.1.1.254/frameMain.html
Live Search
File Edit View Favorites Tools Help
Favorites
WiMAX BS 00:1A:73:A4:92:3D
Page Safety Tools
www.gil.com.tw
LIBRA 5816 BS
GIL Technology Co., Ltd.
Create Provisioned Service Flow
WiMAX
System Info
CreateProvSF
ShowProvSF
CreateSF
DeleteSF
ChangeSF
ShowSF
SS status
LAN
Upgrade
Admin
Save & Reboot
Logout
MAC * STRING MAC address of the SS. Example: 00:00:00:00:00:00 00:21:00:49:7D:6B
SFID * INT [1-65535] SFID of the provisioned service flow (must be unique) 101
direction * MENU direction of the service flow downlink
maxrate INT[1-60000] max rate of the service flow (Kbit/s) 512
minrate INT[1-10000] min rate of the service flow (Kbit/s) 512
maxlatency INT[1-65535] maximum latency of the service flow (ms)
priority MENU traffic priority of the service flow
scheduling MENU Scheduling type besteffort
grant interval INT[5-10000] grant period for UGS (ms)
polling interval INT[5-10000] polling period for RTPs and nRTPs (ms)
* STRING First Classifier. Syntax is key1:value1, ... with key among: any, priority, ethsa, ethda, any
Done
Internet
100%

2. FTP software can verify the throughput per second simply. FileZilla Server and Client are free and popular. They are available from the website: http://filezilla-project.org

3. Laptop1is installed on FileZilla Client, and Laptop2 on FileZilla Server.



4. DL is a transmission from BS to SS (Green dotted line), and UL is contrary to DL (Red dotted line). Therefore, laptop1 downloads from laptop2 is DL throughput (Green line), and laptop1 uploads from laptop2 is UL throughput (Red line).

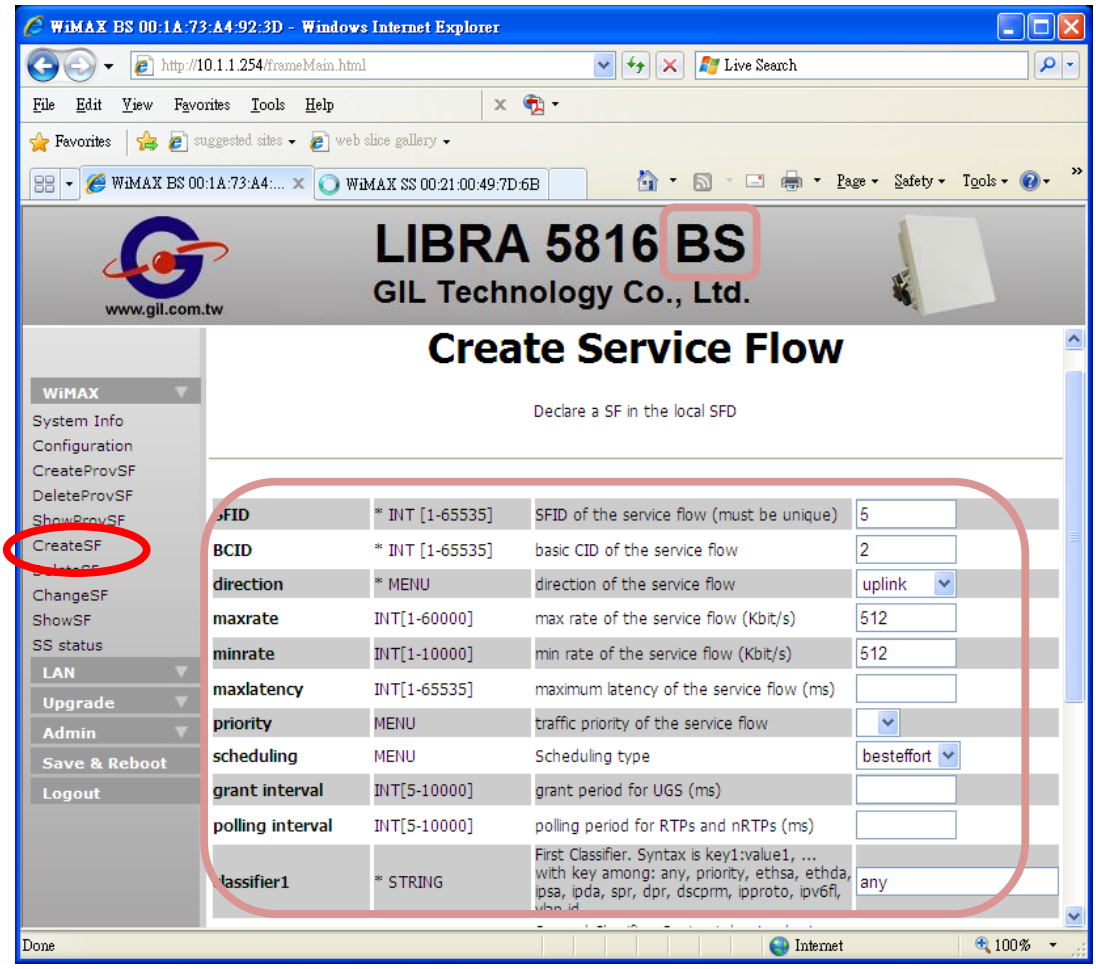


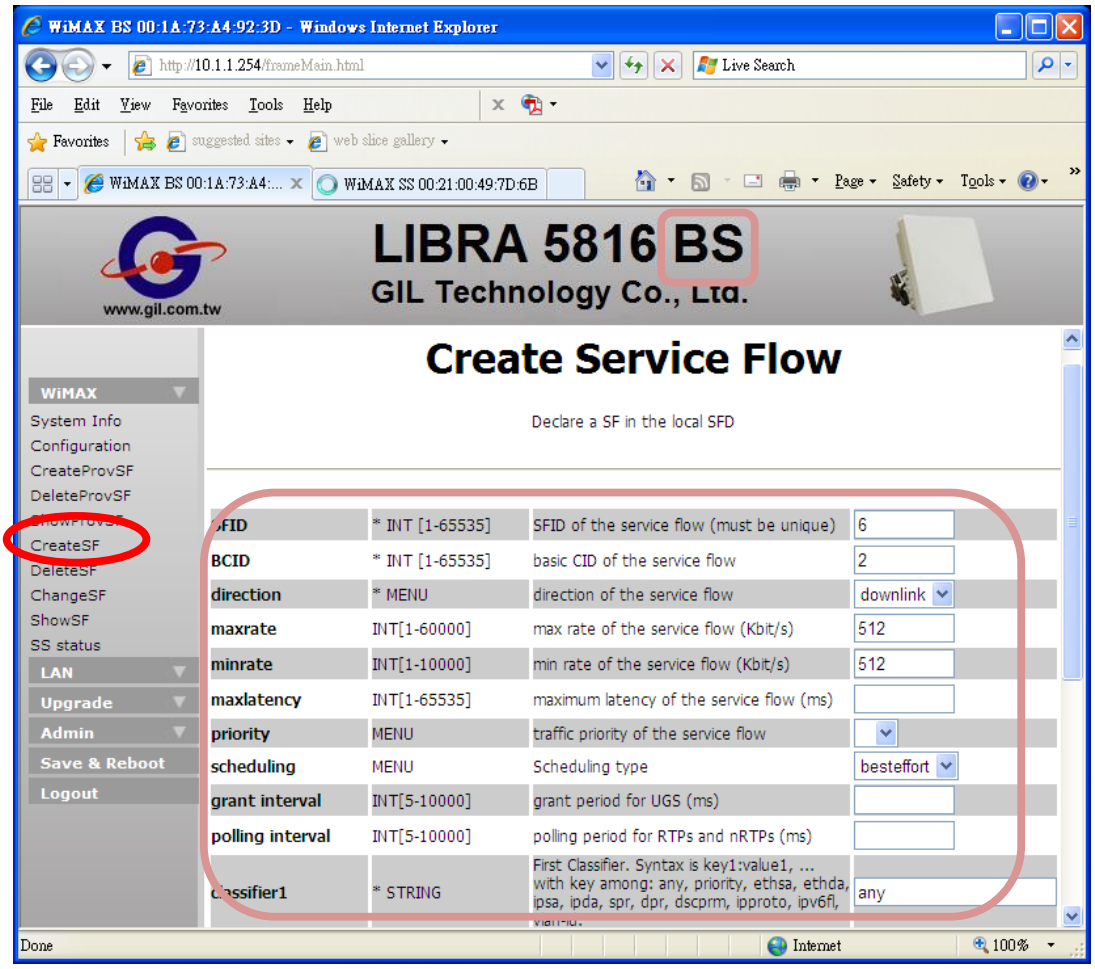
Throughput of DL and UL between BS and SS should be approximately limited to 512Kbps.
The file size unit of FileZilla is B (Byte), thus it is eight times the size of the b (bit).

2- Dynamic SFC

CreateSF:

1. Please refer to the below screen for creating SFCs (Uplink and Downlink)





2. Please review the static SFC steps, the same FTP software with the same network structure.

   Throughput of DL and UL between BS and SS should be approximately limited to 512Kbps.
   The file size unit of FileZilla is B (Byte), thus it is eight times the size of the b (bit).

Troubleshooting

General principles

Proper management and maintenance can prevent the occurrence of many problems and discover and handle problems as early as possible before problems become serious. The following methods are recommended for regular maintenance.

- ✍ Establish regular maintenance log rules.
- ✍ Keep detailed records of failure points, symptoms, occurrence time and treatment methods.
- ✍ Follow up failure treatment results.
- ✍ Conduct planned link tests on a regular basis.
- ✍ Check the installation tower, antenna, **ODU**, cables and adapters on a regular basis, especially after a bad weather.
- ✍ Test the system performance on a regular basis, as environment changes, normal wear and cracks of the device may have an adverse impact on the system performance.
- ✍ Keep the integrity of system design when adding or changing a system. When adding a new unit into the system, revise the network plan again to prevent problems. For example, installing an extra antenna at the same place improperly will lead to self-interference of the system.
- ✍ Save the records of all changes, especially relevant files of the adding unit, software and hardware change, configuration and setting changes, as configuration error often leads to other problems. Compare current record files with the original record files to analyze and address failures.

Considerations on Regular Maintenance and Failure Treatment

1. **Network Integrity:** ensuring the integrity of the network is vital to the network performance and reliability. If the network design is changed, the network operation will be affected. Fully acquaint yourself with recent change of the network.
2. **RF Link Quality:** data communication depends firstly on good RF link. If you set up and maintain high-quality RF link, you can ensure these links to bear high-speed data flow. If the quality of the RF link deteriorates, as a consequence, the quality of data communications will deteriorate too.
3. **Transmission Module:** the module consists of three parts, namely, **ODU** generating signals; antenna feed line including the cable, connector and oscillatory interference suppressor, antenna. The faulty device may be found out through tests and replacements.
   - ✍ To identify the state of the **ODU** unit, you may check the operating condition of the device on a regular basis and observe its changes in **RSSI** value and **Cinr** value;
   - ✍ To identify the state of the antenna feed line, you may use the integrated testing equipment to test the properties of cables, connector and lightning arrester and replace parts when necessary.
   - ✍ To identify the state of the antenna, you may use the integrated testing equipment to test the antenna and replace the antenna when necessary.
4. **Proper Unit Configuration:** the unit shall be properly configured as per the requirements of the network plan. A configuration error may lead to communication failure or poor communication performance. Adding a new unit in the system or making other changes to the system may need to change the configuration.

Troubleshooting table

Symptoms	Possible cause	Corresponding measures
Bit error rate is too high	Signal intensity is too low	Adjust or replace the antenna or the cable. Ensure there is no barrier in the **LOS** link of two antennas.
	Signal intensity is too high	Adjust the antenna azimuth. Increase the distance between units to enhance attenuation. Reduce transmission power (**Tx**).
	Interference	Change the centre frequency Increase the RF frequency Change the antenna polarization mode Increase the separation or change the antenna position Increase the antenna separation at the same place
	RF device damaged (**Tx/Rx**)	Conduct the **bench** test of RF devices Replace RF devices
	Antenna damaged	Check whether the antenna is damaged. Clean the antenna Replace the antenna
	Cable damaged	Check whether the cable is damaged Clean the cable Replace the antenna
	Connector damaged	Check whether the connector is damaged Replace the cable/connector
	Temperature	Detect whether the environment temperature is too high or too low Adjust the temperature properly
RSSI value or **CINR** value is too low	Transmission distance is too far	Replace high gain antenna Increase the transmission power Reduce the modulation mode
	RF device is damaged	Conduct the **bench** test of RF devices Replace RF devices
	Antenna damaged	Check whether the antenna is damaged. Clean the antenna Replace the antenna
	Antenna not aligned	Align the antenna again
	Cable damaged	Check the cable/connector Clean the cable Replace the cable/connector
	RF parameter configuration error	Conduct a **bench** test over the RF parameter settings Configure the RF parameters again
	No-clean fresnel zone	Increase the antenna height Change the antenna position Remove the barrier
	Power supply problems	Replace different AC power Test AC output power supply Test power supply output of device

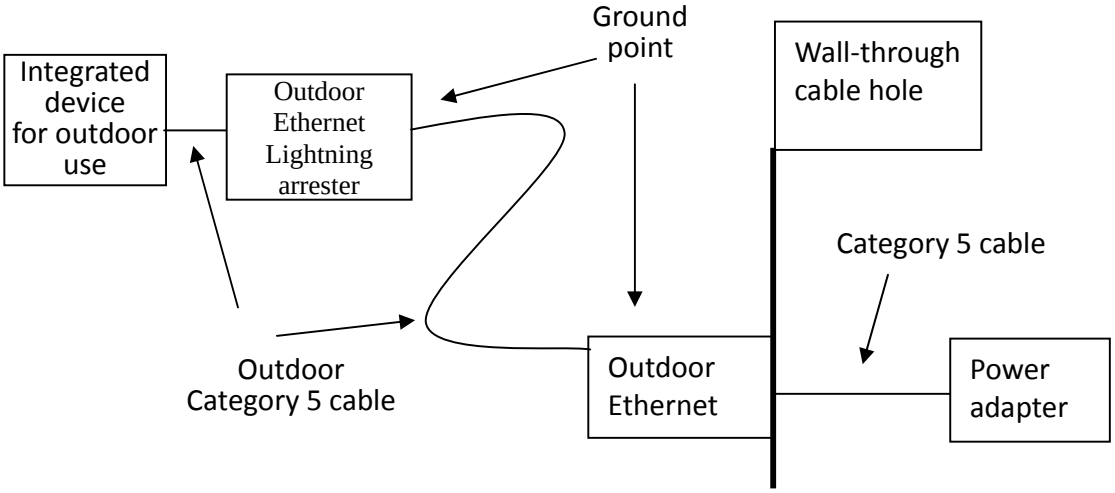
Symptoms	Possible failures	Corresponding measures
Packet loss rate is high	Signal intensity decreases	Check the **LOS** link of antennas Check whether there are barriers in the RF path. Check the interference Align the antenna again Replace the antenna
	Interference	Change the centre frequency Increase the transmission power Change the antenna polarization mode Increase the separation or change the antenna position
	Multipath interference	Adjust antenna again Chang antenna position
	Temperature	Detect whether the environment temperature is too high or too low Adjust the temperature properly
Communication failure between units	Configuration problems	Check the following configurations: ● Whether Centre frequencies are consistent. ● Whether **IP** address and netmask code configuration are correct
	Antenna or cable damaged	Check whether antenna or cable is damaged Clean the cable and antenna Replace the antenna or cable
Poor link quality	Distance	Check distance configuration of the largest remote station
	NLOS	Check **LOS** between antennas.
	Signal is absorbed	Check barriers of **LOS** such as trees
	Centre frequency	Adjust the centre frequency and keep away from the wireless interference from other equipment
New configurations can not effect	Software update error	Use **FTP** to load software mapping or replace **EPROM**
Can not access main configuration menu	Password error	Contact **Gil** as the unit needs to be set again.
The device does not work	Device failure	Test the device and record the failure results.
	Software damaged.	Update software
Power LED does not light up	1 · The power supply is dead 2 · POE Power failure 3 · Device failure	1 · Check whether the utility power is normal or whether to use **UPS** for power supply. 2 · Replace **POE** power 3 · Replace the faulty device

Symptoms	Possible failures	Corresponding measures
When pinging large packet, the packet will be expanded. When pinging small packet, it is normal	1. The link is obstructed seriously. 2. Wireless signal is under interference or obstruction	1. Change the installation position to ensure there is good LOS between the base station and the user station 2. Find out and shutoff the interference source; tune the antenna direction to avoid the interference source or reduce its impact; change the installation point position to keep away from the interference source; adopt the physical insulation to avoid the interference.
Packet loss is serious	1 · The link is obstructed seriously. 2 · Wireless signal is under interference or obstruction 3 · Too large user traffic exceeds the bearing capacity of the bandwidth of the device 4 · Under hacker attack.	1 · Change the installation position to ensure there is good LOS between the base station and the user station. 2 · Find out and shutoff the interference source; tune the antenna direction to avoid the interference source or reduce its impact; change the installation point position to keep away from the interference source; adopt the physical insulation to avoid the interference. 3 · Optimize the network and increase its bandwidth. 4 · Check the sector of the hacker to identify the position of the subscriber station the hacker is located and shut off the device of this subscriber station immediately, and then negotiate with relevant entities.
No signal within the normal coverage range	1 · Serious obstruction 2 · Device failure 3 · SS version and BS version is not consistent. 4 · Frequency configuration not correct.	1 · Change the installation position to ensure there is good LOS between the base station and the user station. 2 · Replace the device 3 · Update the software version 4 · Check the menu of the device to make sure BS frequency and SS frequency are consistent.

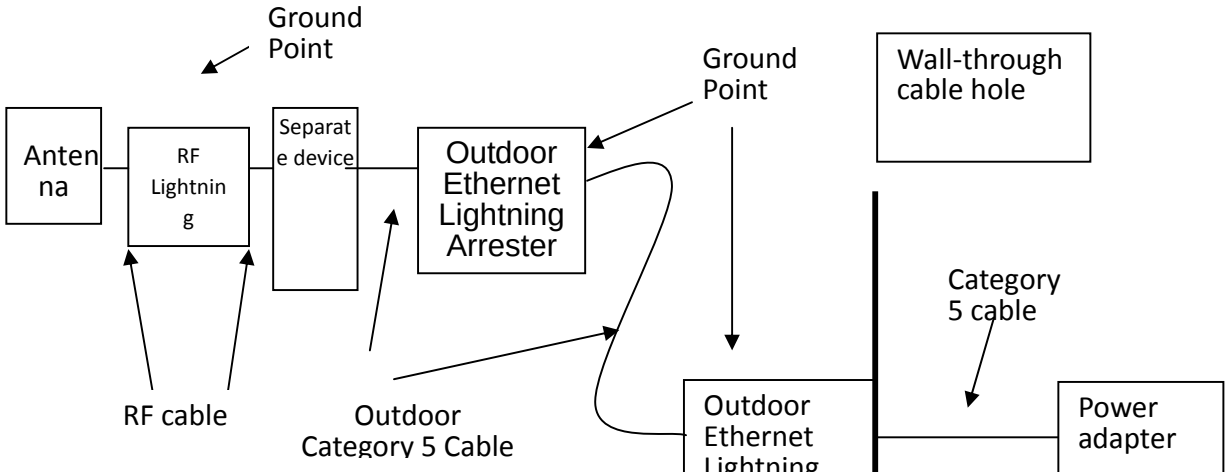
Appendix A:
Specifications for lightning protection of GIL Technology

In view of the specific characteristics in wireless device field installation and as per the requirements of actual conditions, Gil Technology Company Limited hereby formulates this technical specification of lightning protection of LIBRA5816 wireless device. **In case the user fails to adopt this specification, our company will not be liable for any wireless device damage or wireless link interruption arising out of lightning strike to the device.**

- ✍ Ensure that a properly grounded lightning rod has been installed on the iron tower or the holding pole;
- ✍ Install an Ethernet lightning arrester outdoors at the position within 1.5m to the incoming inlet or install an arrester in the indoor computer room to protect the indoor devices in the room.
- ✍ For integrated devices for outdoor use, install an outdoor Ethernet lightning arrester outdoors at the position within 1.5m to the outdoor devices to protect wireless bridge equipment;



- ✍ For devices with separate antennas, install a RF feeder lightning arrester on the RF cable to protect the high frequency circuit of the device; in the meantime, install a lightning arrester on the outdoor Ethernet cable within 1.5m to outdoor devices;



- ✍ Ensure lightning arresters are properly ground