GENESIS™ DAS
Installation and Maintenance

Version 0.0 Feb. 2019

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For Central & Latin America Region: CALA.support@solid.co.kr

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Revision History

Revision	Issue Date	Section	Changes

Contents

List of Illustrations

Glossary of Terms

Acronyms and abbreviation used in this manual are shown in the table below.

Abbreviation	Description
UPOI	Universal Point of Interface
UPIU	UPOI Point of Interface Unit
DAU	Distribution & Aggregation Unit
DRFU	DAU RF Unit
DDTU	DAU Digital Transceiver Unit
DPSU	DAU Power Supply Unit
DFAN	DAU FAN
DCU	DeCode Unit
HOU	Hub Optic Unit
HODTU	HOU Digital Transceiver Unit
HOPSU	HOU Power Supply Unit
HOFAN	HOU FAN
EPSU	Expansion Power Supply Unit
LRN	Low power Radio Node
RBU	RN Base Unit
LPMU	LRN Power Amplifier & Multiplexer Unit

1. Safety & Certification Notice

“Only qualified personnel are allowed to handle this unit. Read carefully and understand all the warning labels attached in this user manual”

Any personnel involved in installation, operation or service of the SOLiD repeaters must understand and comply the following:

- Understand all general and regional installation and safety regulations relating to work on high voltage installations, as well as regulations covering correct use of tools and personal protective equipment.
- The power supply unit in repeaters contains dangerous voltage level, which can cause electric shock. Switch the mains off prior to any work in such a repeater. Any local regulations are to be followed when servicing repeaters.
- The repeater cover should be (door) securely fastened in open position, e.g. by tying it up, at outdoor work in order to prevent door from slamming due to wind causing bodily harm or damage.
- Use this unit only for the purpose specified by the manufacturer. Do not carry out any modifications or fit any spare parts which are not sold or recommended by the manufacturer. This could cause fires, electric shock or other injuries.
- Any repeater, including this repeater, will generate radio signals and thereby give rise to electromagnetic fields that may be hazardous to the health of any person who is extensively exposed to the signals at the immediate proximity of the repeater and the repeater antennas.
- Due to power dissipation, repeater may reach a very high temperature. Do not operate this unit on or close to flammable materials.
- Do not use any solvents, chemicals, or cleaning solutions containing alcohol, ammonia, or abrasives.
- For pluggable equipment, the socket-outlet shall be installed near the equipment and shall be easily accessible.
- This power of this system shall be supplied through wiring installed in a normal building. If powered directly from the mains distribution system, it shall be used additional protection, such as overvoltage protection device.
- Round terminals located on the rear of a 1.0mm2 (16AWG) or more wires using permanently connected to earth.

WARNING

This is a class A product. In domestic environment, this product may cause radio interference in which cause the user may be required to take adequate measures.

Home/ personal use are prohibited.

 **Rotating fan Blade**

Can cause serious injury or pain. Keep hands clear. Turn off and lock-out unit before servicing.

CAUTION

 Do Not Open Except at Approved Field Force Protective Work Station.

2. System Overview

2.1 Purpose

GENESIS™ is a coverage system for indoor and outdoor services delivering voice and data in high quality and for seamlessly.

As a distributed antenna system, it provides analog and digital phone systems that are served in multiple bands. The system covers general public institutions and private facilities.

- Small building
- Shopping Malls
- Hotels
- Campus areas
- Airports
- Subways
- Multi-use stadiums, convention centers, etc.

The system helps to improve indoor/outdoor radio environments in poor condition and makes better RSSI and Ec/Io. By providing communication services at every corner of buildings, the system enables users to make a call at any site.

The GENESIS™ system supports communication standards and public interface protocols in worldwide use.

- Frequencies: 700MHz, 800MHz, 1900MHz, 2100MHz, 2300MHz, 2500MHz, etc.
- Technologies: GSM, EDGE, CDMA2000, 1XEVDO, WCDMA, LTE, APCO 25, etc.

GENESIS™ is in modular structure per frequency band. To provide desired frequency in target venue, all you need to do is to insert a corresponding frequency module into each unit. As it delivers multiple signals with one optical cable, the system, in one-body type, does not require additional facilities whenever new frequency is added.

The head-end unit must always be connected to the Base Station using a direct cabled connection. This system has not been approved for use with a wireless connection via server antenna to the base station.

The system is featured with the followings:

- Universal One Digital transport DAS platform
- Cover small to large venues with Low power remotes
- Common Head-End for various remote types
- Low power remotes to transport signals over an optical fiber

SOLiD GENESIS™ is a robust, flexible, expandable, and customizable cellular coverage solution for multiple operators and technologies as universal platform. It also supports enterprise, outdoor and indoor coverage applications.

- **Excellent Architecture & Performance**
  - Advanced platform of mix and match topology - any RN connection
  - Near-far mitigation functions - digital filtering and fast ALC function
  - Low power consumption - high linearization technology
- **Flexible & Scalable Deployment**
  - Support any band combination - simply plug-in as your network grows
  - Modular plug-in and play structure - easy management and expandable
- **High Capacity & Evolution**
  - Sector switching (cell split/combine) - software controlled based on user pre-defined profiles
  - Smooth LTE migration ready for all bands - technology refarming
- **Easy Management**
  - Embedded DMS, server DMS and cloud EMS
  - High-quality user experience(visibility, intuitive troubleshooting, auto commissioning, and reports)
  - Single EMS for managing LRN
  - Automatic node discovery
  - Easy-set
  - Flexible power splitting

2.2 System Overview

2.2.1 System Components and Network Topology

GENESIS™ product series are that one common head-end delivers a more flexible network configuration.

Universal Point of Interface (UPOI): Attenuate high power signal from RAN and transport into DAU

Distribution & Aggregation Unit (DAU): Interface with analog RANs. Convert RF to digital and digital into RF signals, and distributes digital signals to HOU via optical fiber

Decode Unit (DCU): Interface with DAU via UTP cable (CAT5). Decode signals input to DAU, and Decode information is used for system 'Auto Setup'

Hub Optic Unit (HOU): Interface with LRN via optical cable. Support the daisy chain of HOU to reduce the number of optical fiber cables

Expansion Power Supply Unit (EPSU): Interface with HOU via D-SUB cable. Supply DC 57V to LRN. Up to 24 LRNs can be powered via power cable (supported AWG 14 to 24)

Low Power Radio Node (LRN): Receive signal and power via optical cable and power cable (supported AWG 14 to 24) from HOU

The following shows GENESIS™ network topology.

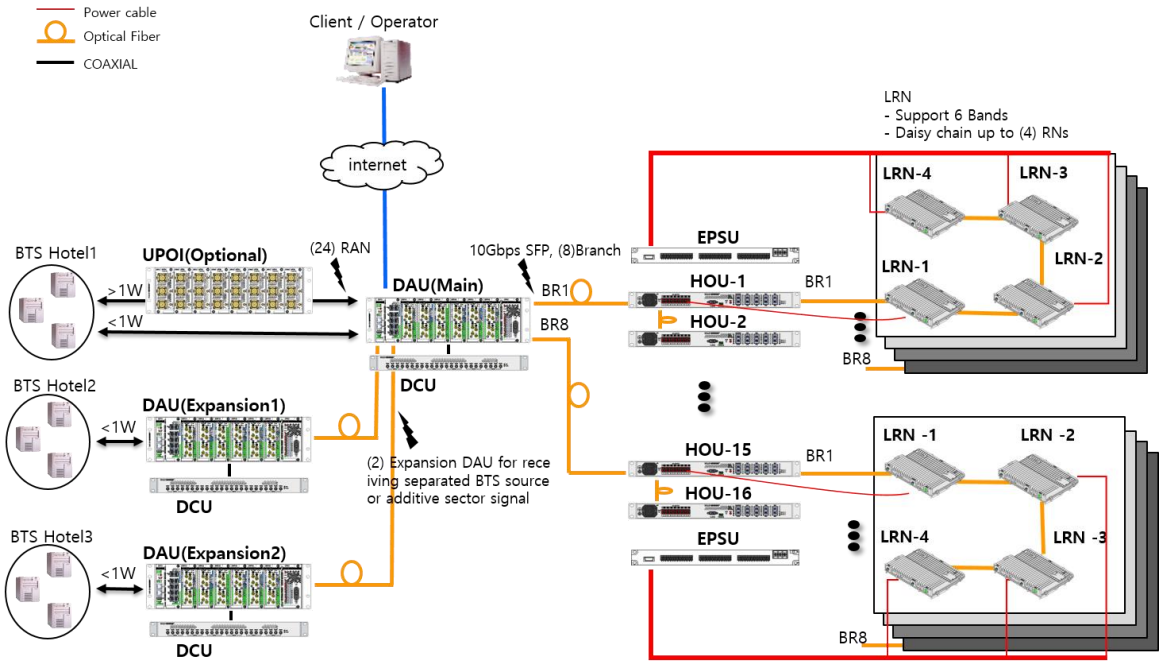


Figure 2.1 GENESIS™ Network Topology

2.2.2 System Capacities

- UPOI can support up to eight (8) interface module slots and each slot supports three (3) input ports.
- DAU can have up to six (6) RF interface module slots and each slot supports four (4) input ports.
- DAU can support up to two (2) Expansion DAUs.
- Adding two (2) Expansion DAUs to the main DAU, a system can support up to seventy-two (72) cell interfaces.
- Main DAU can drive up to sixteen (16) HOUs
- HOU can drive up to eight (8) LRNs via optical cables.
- LRN can support up to six (6) RF band modules.

3. System Specifications

3.1 General Specifications

Item	Specification						Remark
Frequency Band	700FB	8085	1900	AWS13	2300W	2500TDD	
Instantaneous Bandwidth	39MHz	32MHz	65MHz	70MHz	10MHz	190MHz	
Technology	LTE	GSM, UMTS, LTE, CDMA	GSM, UMTS, LTE, CDMA	UMTS, LTE	LTE	LTE	
Transmission Capacity	10Gbps						
Transmission Distance	<10km@Optic, <100m@Power Cable(AWG 14 to 24)						
VSWR	< 1.5 : 1@DAU, <1.8 : 1@LRN Uplink						
Frequency Error	±0.01ppm						
System Delay	< 8usec, 1.0usec raise whenever node is added in daisy chain						

3.2 Ports and Environment Specifications

Item	UPOI	DAU	DCU	HOU	EPSU	LRN
Input Connector	4.3-10_F(24)	QMA_F(24): DL/UL QMA_F(24): UL MCX_F(24)_Mon	QMA(24): DAU	Optic(1): DAU	-	Optic(1): HOU
Output Connector	QMA_F(24)	Optic(2): E-DAU Optic(8): HOU	RJ45(1): DAU	Optic(1): HOU Optic(8): LRN	-	NEX-10(1): External ANT
Input Voltage	+12V from DAU	90 ~ 264VAC or -42 ~ - 56VDC	90 ~ 264VAC	90 ~ 264VAC	90 ~ 264VAC	DC 57V from HOU
IP Rating	IP20	IP20	IP20	IP20	IP20	IP20 or IP66 (OPTION)
Cooling	FAN Forced	FAN Forced	Natural	FAN Forced	FAN Forced	Natural

Operating Temp.	-5 ~ +45°C	-5 ~ +45°C	-5 ~ +45°C	-5 ~ +45°C	-5 ~ +45°C	-25 ~ +45°C
Size(WxHxD), mm	19” x 3U x 475	19” x 3U x 475	19” x 1U x 420	19” x 1U x 371.4	19” x 1U x 374	390 x 300 x 74 (8.7ℓ)
Normal Noise, dBA	64	61	NA	60	65	NA
Watt, w	25	370	36	55+800(LRN)	800 X 3	75
Weight, kg	31	17.5	4.36	4.15	10.1	7.5

3.3 Downlink Specifications

Item	Specification		Remark
Ripple	< 4dB		Peak to peak
Input level	UPOI	+47 ~ +30dBm Max.+50dBm/No-destructive	
	DAU	+30 ~ 0dBm Max.+33dBm/No-destructive	
Output power	LRN	20dBm(>1GHz), 15dBm(<1GHz), 17dBm(2300W Band)	Per band
System Gain	LRN	-10 ~ 20dB(>1GHz), -15 ~ 15dB(<1GHz), -13 ~ 17dB(2300W Band)	
Gain Control	0 ~ 50dB		DAU
Output Control	0 ~ 25dB		RN
Out of Band Gain	3GPP TS 25 106 Section 8 and 3GPP TS 36 106		
Unwanted Emission			
Spurious Emission	Category B		
ACLR	LTE	> 35dB @ Fc±5MHz	
	UMTS	> 35dB @ Fc±5MHz	
EVM	LTE	< 3.5%	256QAM
	UMTS	< 12.5%	
	CDMA	< 0.912(Rho)	
	GSM	< 5°(phase error), < 20°peak(RMS)	

3.4 Uplink Specifications

Item	Specification		Remark
Ripple	< 4dB		Peak to peak
Input Level	Nominal -40dBm Max. -38dBm @ No- destructive by ALC function		RN per band
Output Power	Duplexed port	-15dBm/total	DAU
	Simplex port	-35dBm/total	
System Gain	Duplexed port	30dB	RN to DAU
	Simplex port	10dB	
Gain Control	0 ~ 50dB		DAU
EVM	LTE	< 8%	64QAM
	UMTS	< 12.5%	
Noise Figure	< 14dB		

4. System Configuration and Functions

4.1 Low power Radio Node (LRN)

The LRN is active modular and multi-band upgradeable antenna unit. It supports four (2) sub-modules which are replaceable in a SOLiD certified facilities by SOLiD certified personnel. The mix of service bands can be achieved, for example, six (6) different bands are available. The composite RF power per band is 15dBm(below 1GHz), 20dBm(upper 1GHz) and 17dBm(2300W Band).

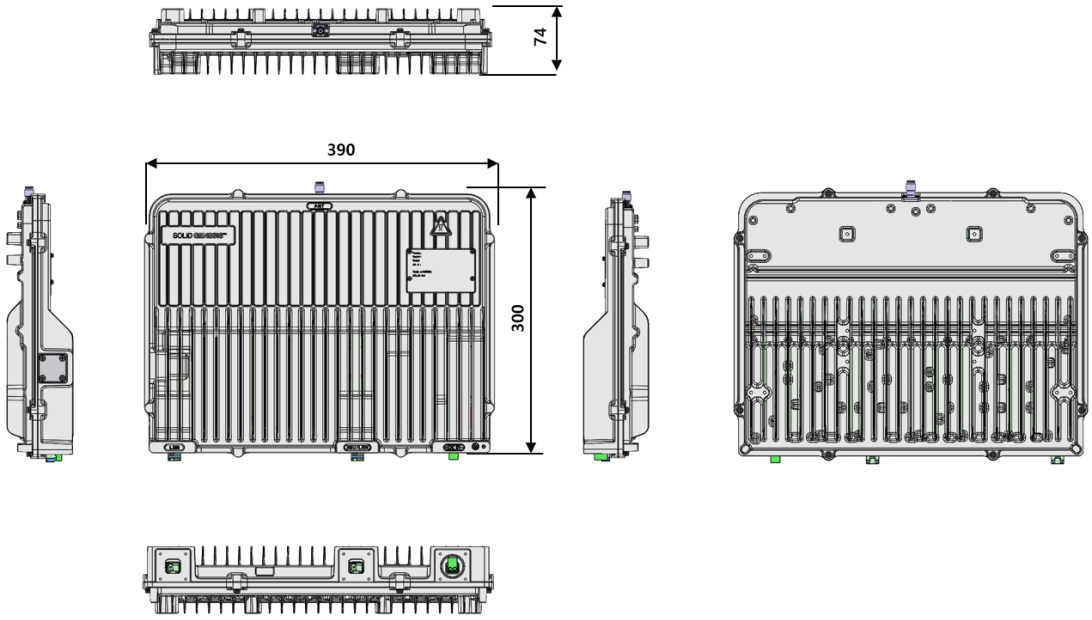


Figure 4.1 LRN Front, Side and Rear Views

4.1.1 LRN Specifications

Item	Specification	Remark
Size, mm	390 x 300 x 74	
Weight, kg	7.5	Full Load
Power Consumption, W	75	
Operating Temperature, °C	-25 ~ 45	
Operating Humidity, %	5 ~ 90	
Rating IP	IP 20 or IP66(OPTION)	

4.1.2 LRN Functions and Description

The LRN provides highly flexible combinations of service bands and sectors. Typical configurations of LRNs are six (6) band SISO.

MAIN KEY FEATURES

- Supports 6 bands
- 15dBm(below 1GHz), 17dBm(2300W Band), 20dBm(upper 1GHz) output power per band
- 10Gbps over an optical cable
- External antenna ports available
- IP20 rated and optional IP66 supported
- Wall or ceiling mounting options
- 256 QAM supported

COMPONENT DESCRIPTION

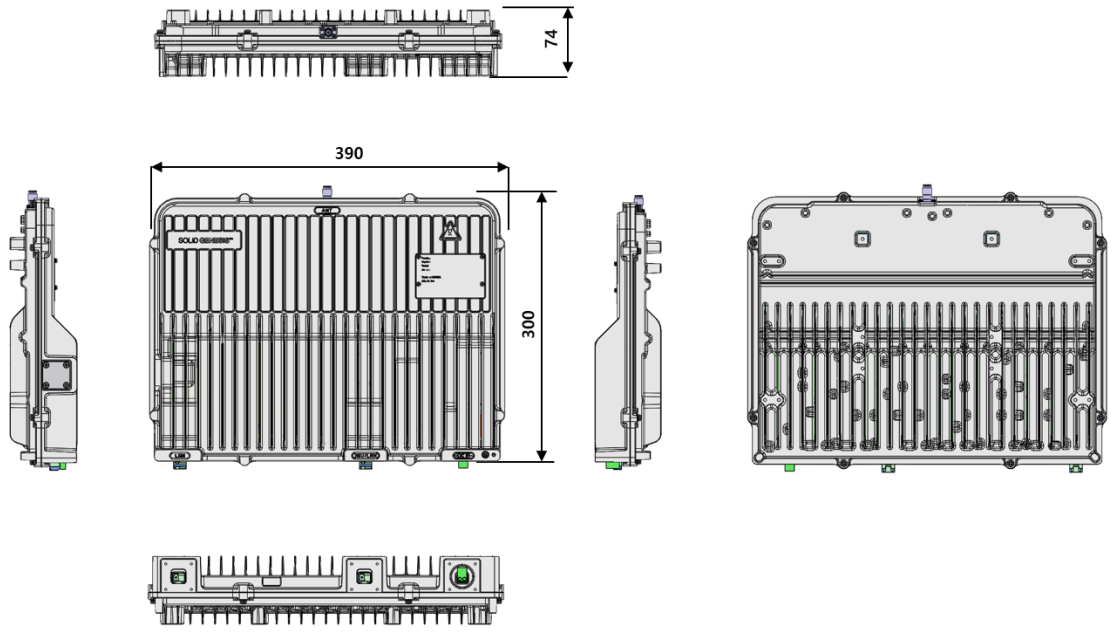
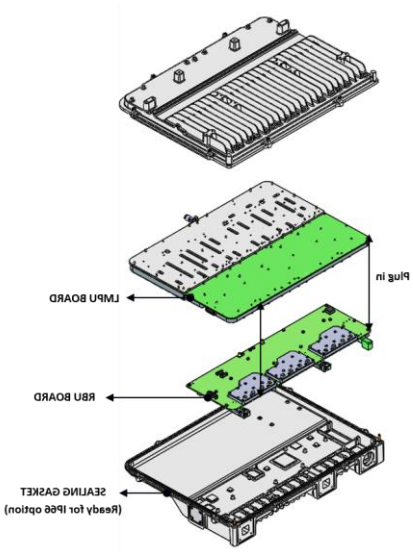


Figure 4.2 LRN Appearance

LRN includes all components in the enclosure below. The following table shows LRN components, functions and quantities.

Part	Unit	Description	Qty
	RBU	• Support (1) SFP port for interfacing with HOU via optical cable • Support 6 bands • Convert digital signal into downlink RF signal • Convert uplink RF signal into digital with digital filtering technology • Control and monitoring system status	1ea
	LPMU	• Amplify downlink RF signal and then filter the signal • Filter and amplify uplink RF signal • Support external antenna port	1ea

LPMU SPECIFICATION

The LPMU amplifies downlink RF signal and then filters the signal, and for uplink, it filters and amplifies uplink signals in sequential order. The following table shows LPMU specification.

LRFU Types	Uplink		Downlink	
	Range	BW	Range	BW
LPMU_700_8085_1900_2100_2300_2500	699 – 716	17	729 – 768	39
	776 – 798	21		
	817 – 849	32	862 – 894	32
	1850 – 1915	65	1930 – 1995	65
	1710 – 1780	70	2110 – 2180	70
	2305 – 2315	10	2350 – 2360	10
	2497.4 – 2687.4	190	2497.4 – 2687.4	190

The following table shows the LPMU specification.

Item	Specification	Remark
DL Output Power	+20dBm composite power per band	
UL Input Power	Max. -40dBm w/o ALC function Max. -38dBm w ALC function	
Nominal Impedance	50ohm	
VSWR	1.8:1	
Type of External Antenna Port	SMA_F	
System Ripple	±2dB	
UL ALC Control Range/step	0 ~ 20dB/0.1dB	

4.1.3 LRN Front and Rear Panel

4.1.3.1 Front Panel

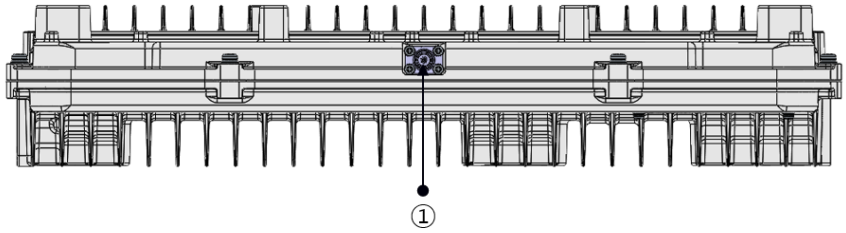


Figure 4.3 LRN Front Panel View

No	Item	Description
①	ANT	External antenna interface port

4.1.3.2 Rear Panel

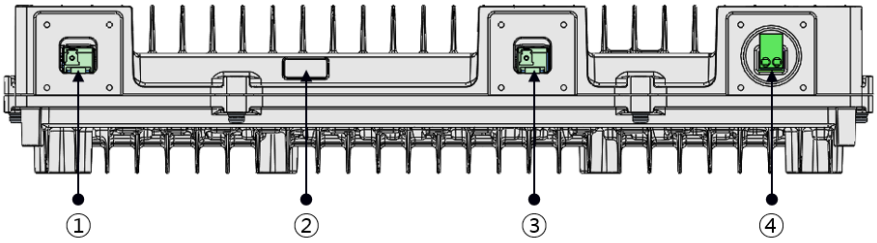


Figure 4.4 LRN Rear Panel View

No	Item	Description	
①	HOU(SFP+)	Port to transmit / receive data connected to Cascade LRN	
②	LED	Red	LRN is abnormal
		Blue	LRN is normal
		Off	Power is not activated
③	HOU(SFP+)	Port connected to the HOU to transmit / receive data	
④	DC IN	Port receiving DC 57V from HOU or EPSU	

4.1.4 LRN Installation

The following table shows the required accessories and tools for installing LRN.

Installation Items	Required Accessories	Qty	Included	Tool	Remark
LRN Enclosure	M6 Anchor Set	4	X	#2 screw driver(+)	
Ext. Antenna Connection	RF cables [SMA type]	4	X	Spanner(8mm)	1ea/LRFU
RJ-45 Connection	CAT 6A patch cord	1	X		

LRN Ceiling and Wall Mounting

It requires at least 200mm clearance when installing LRN on the ceiling or wall for heat dissipation and cable access as shown below. The clearance might be increased depending on the flexibility of cable.

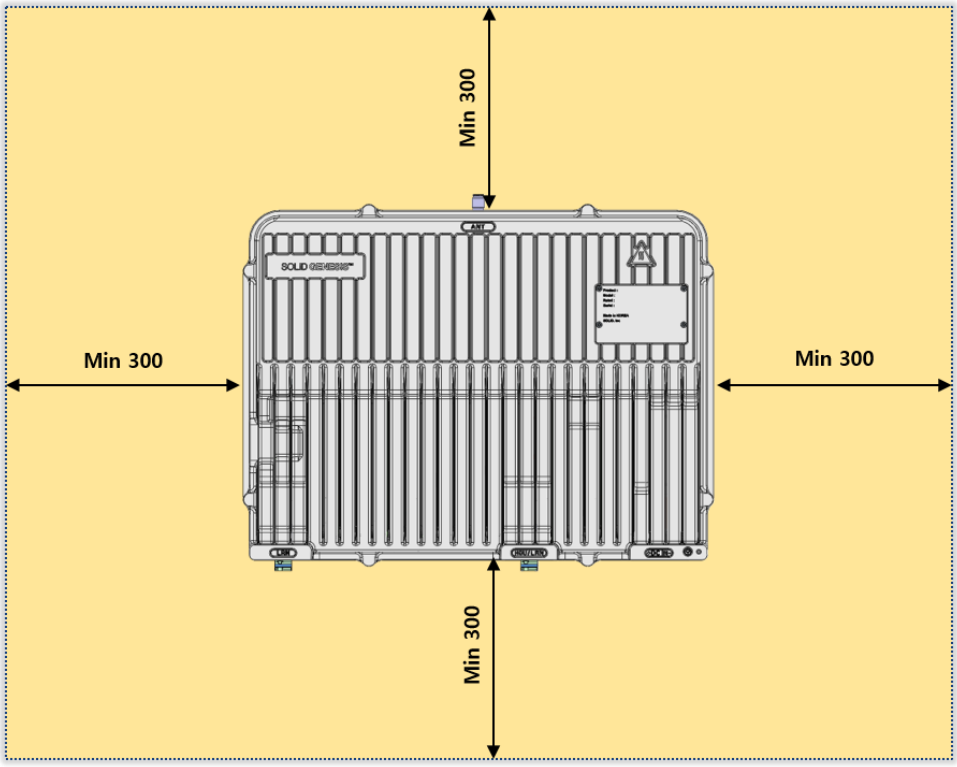
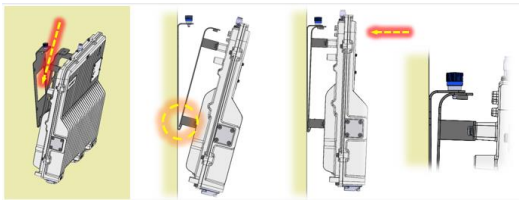
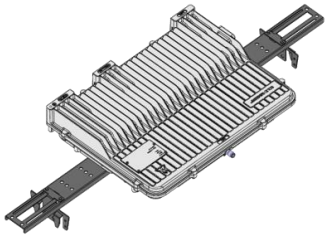
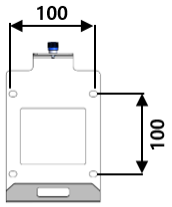
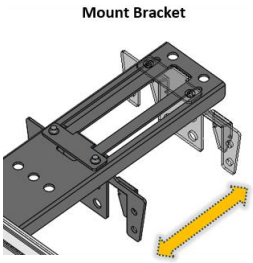


Figure 4.5 LRN Installation Clearance

There are two LRN installation mount brackets as shown below.

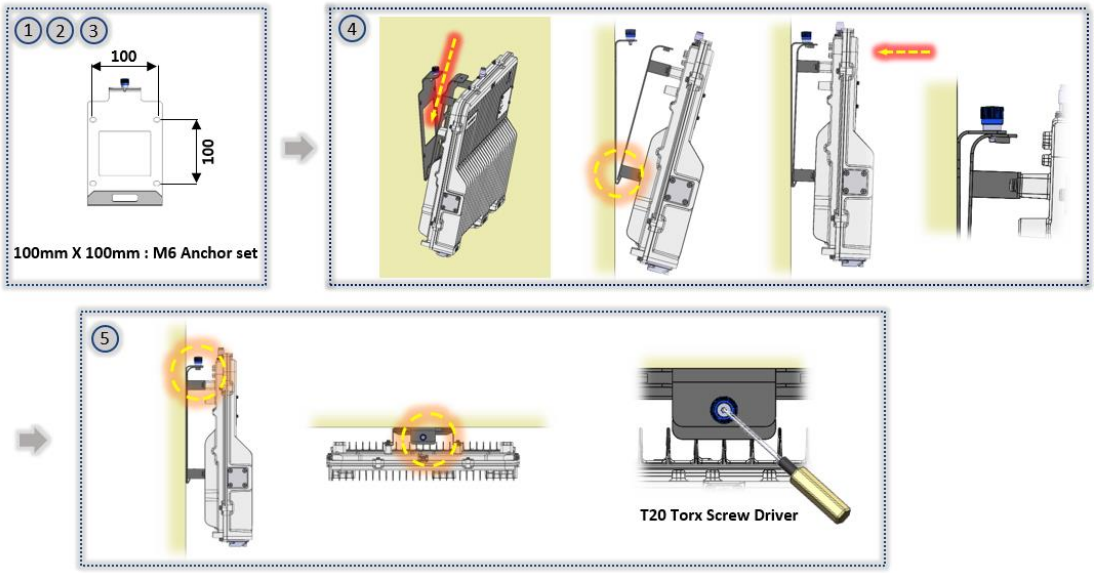
	Quick-lock Mounting Bracket	Ceiling Mounting Bracket

Outlook		
Mounting bracket kit	 100mm X 100mm : M6 Anchor set	

The following procedures are to install each mounting bracket.

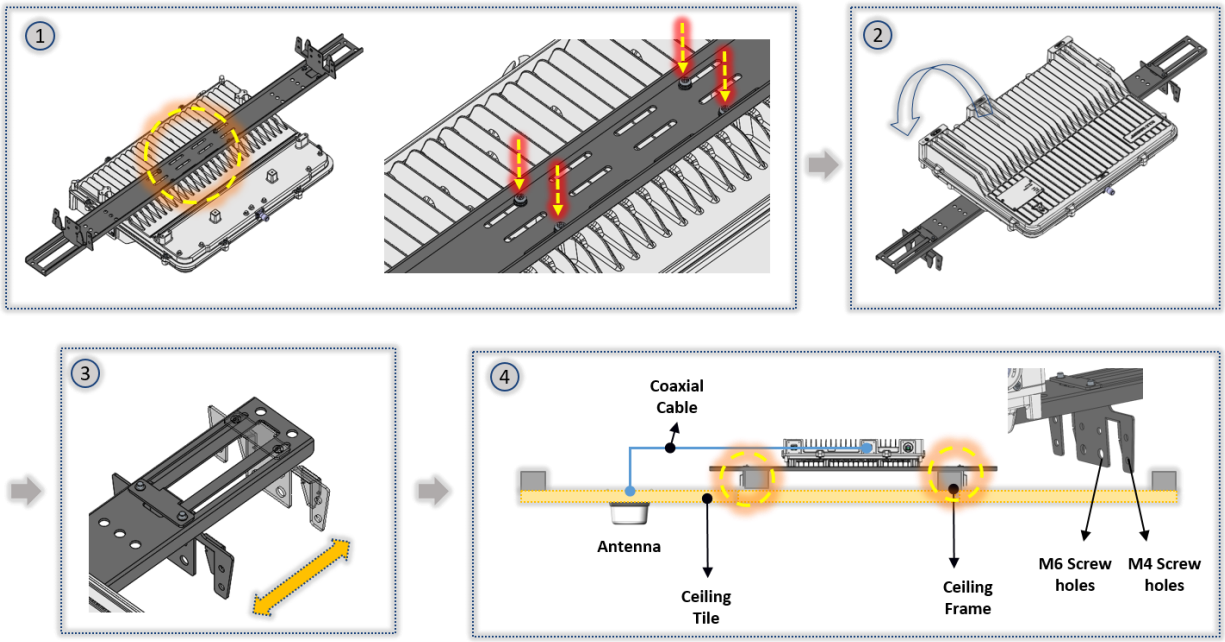
A. Quick-Lock Mounting Bracket

1. Mark the position of the drilling holes on the wall or ceiling to match the holes of the wall bracket.
2. Drill 4(four) holes at the marked position.
3. Secure the wall bracket to the wall or ceiling using the 4(four) M6 anchor sets.
4. Slide the LRN into the wall bracket and lift it up to be caught on the bracket.
5. Screw the captive screw on the wall bracket using T20-Torx-screwdriver to secure the LRN tightly.
   (*The mounting bracket set has the special structure to prevent the LRN from falling. Please consider it when you need to remove the LRN from the wall bracket.)



B. Ceiling Mounting Bracket

1. Combine LRN and ceiling mount with 4(four) M4 screws.
2. Position the LRN in the direction shown below.
3. Adjust the ceiling mount to the ceiling frame interval you want to install.
4. Tighten the ceiling frame with M4 and M6 screws in the screw hole of the ceiling mount.



LRN Power Cabling

The LRN can use DC power supply from HOU. Power cables DC are not provided because different length of cables depends on field situation and different types of jack in each country.

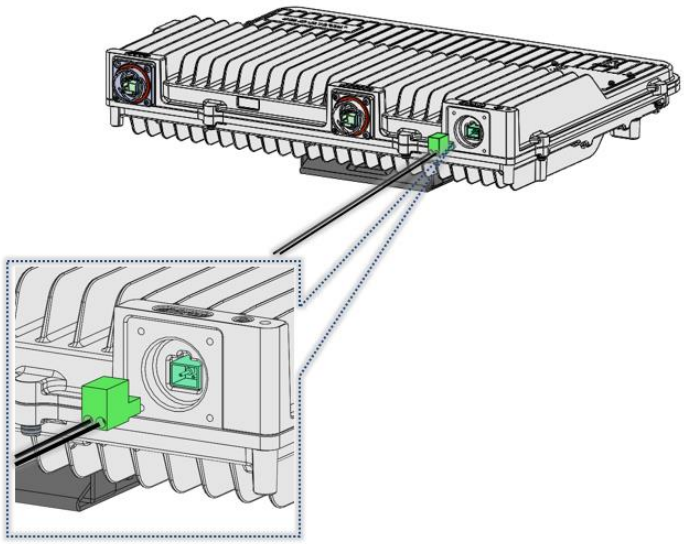


Figure 4.6 LRN Power Cabling

The recommended power cables (AWG 14 to 24) is dependent on each country. User can seek easily in the market.

LRN Optical Fiber Cabling

LRN has total two SFP ports, one SFP ports is for HOU and the other SFP ports is for daisy chain LRN. The following shows SFP port and name

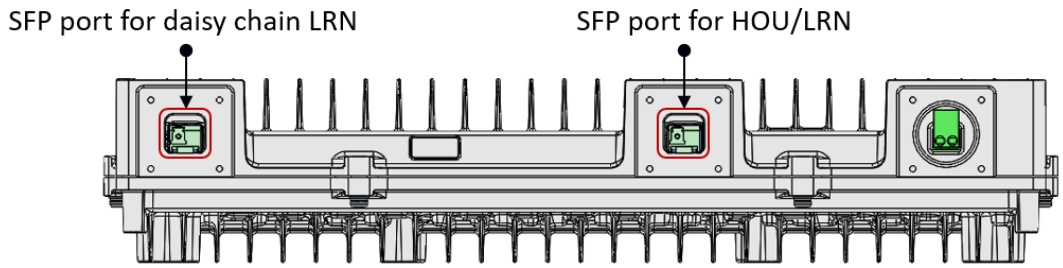


Figure 4.7 LRN SFP Ports

The following table shows SFP type each SFP ports on the LRN based on mode (LRN or Daisy chain LRN).

No	Mode	Port Name	400m
1	LRN	HOU/LRN	 SFP-10G-SR
			Black handle
		LRN	 SFP-10G-SR
			Black handle
2	Daisy chain LRN	HOU/LRN	 SFP-10G-SR
			Black handle
		LRN	 SFP-10G-SR
			Black handle

Complete the following tasks before inserting the SFP module:

- Inspect and clean the fiber tips, coupler, and connectors.
- Prepare and clean an external attenuator, if needed

When handling fiber cables, take the following precautions to prevent damage to the cable:

- Do not stretch the fiber.
- Make sure the bend radius of the fiber is not less than 2inches(5.08cm)

User can add or remove SFP modules in LRN without powering off the system. To insert an SFP module:

- Holding the SFP module by its sides, insert the SFP module into the port on the LRN
- Slide the SFP module into the port until you hear it click. If the SFP module has a handle, push up on the handle to secure the SFP module.

To remove an SFP Module:

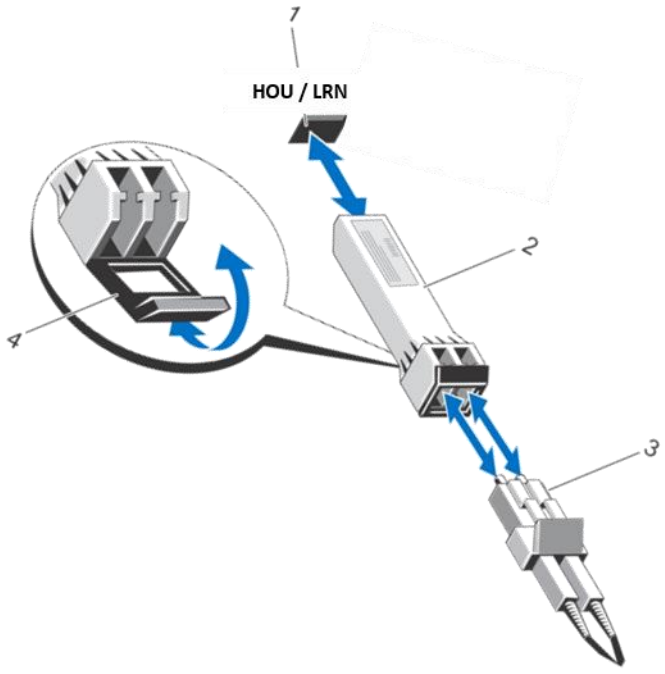
- Disconnect the optical cable from the SFP module.
- Unlatch the SFP module
- Pull the SFP module out of the port on the LRN

WARNING!

Optical SFPs contain Class 1 lasers. Invisible laser radiation can occur when laser connections are unplugged. Do not stare into the beam. This device is compliant with FCC 21 CFR 1040.10 and EN60825-1 :2007.

Use of unauthorized antennas, cables, and/or coupling devices not conforming with ERP/EIRP and/or indoor-only restrictions is prohibited.

LRN's SFP cage direction is horizontal type. So user install SFP module horizontally to optical port like below.



1. SFP optical port
2. SFP transceiver
3. Fiber optic cable
4. SFP handle

User should use optical fiber cable based on SFP type (only duplexer).

The following shows optical fiber based on SFP type

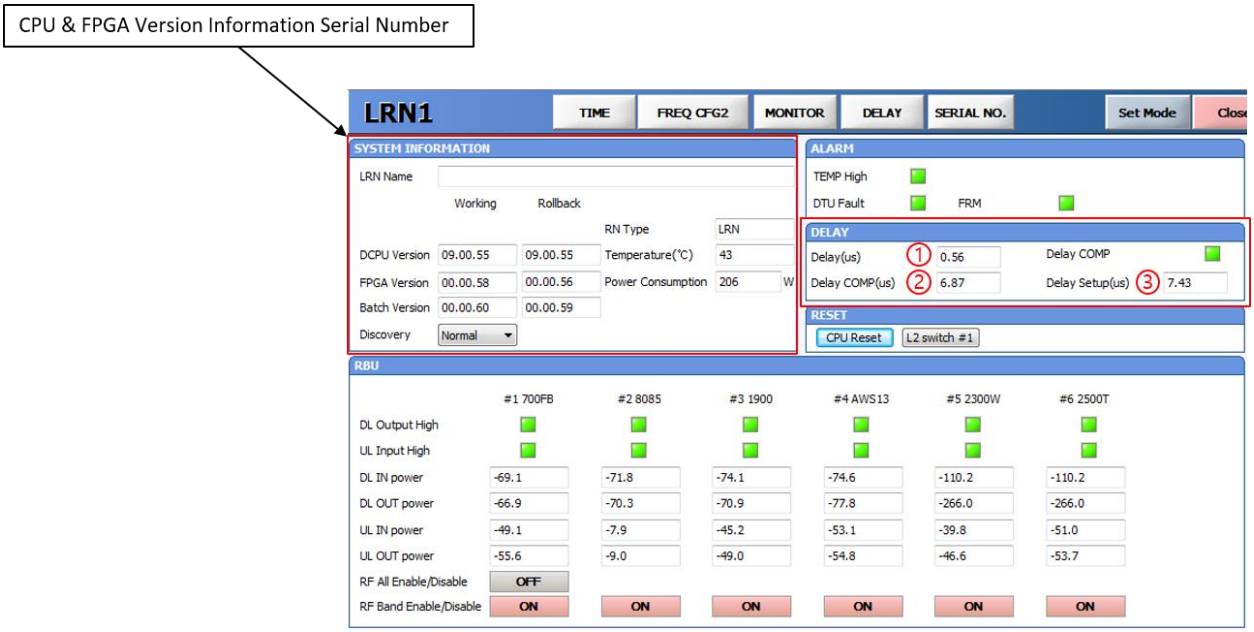
No	SFP Types	Optical fiber	Connector/Ferrule type	Remark
1	 SFP-10G-SR	 2 optical fiber	LC/UPC	

5. System Operation

5.1 LRN Parameters

LRN consists of digital board and RF module. Based on components, all parameters are displayed.

LRN PARAMETERS

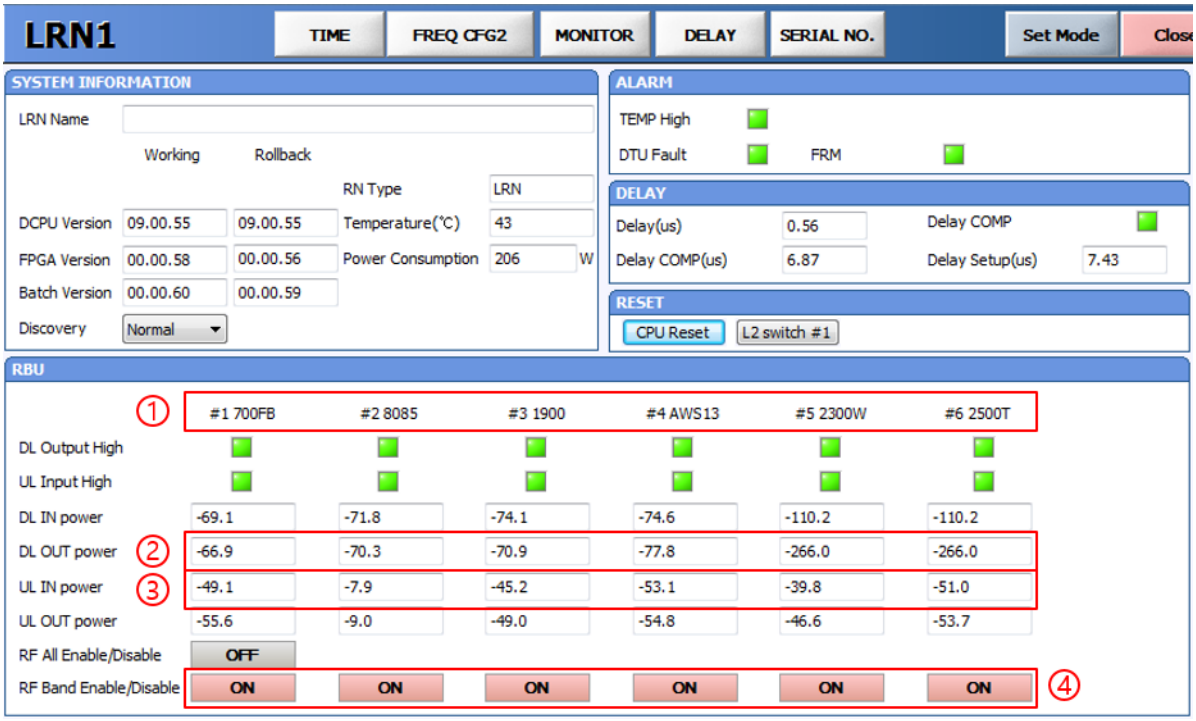


LRN Digital board receives optical data from HOU over optical cable. And then convert into RF signal.

System information shows a lot of CPU firmware version, temperature, serial number, and so on.

① Actual delay value between HOU and LRN
② Delay value to be compensated as target delay
③ Target delay

LPMU is installed at the LRN. Its LPMU can be hot pluggable. Whenever LPMU installed, LRN system detect that LPMU type and can set up the parameters of LPMUs.



① Band information
② DL Output power
③ DL/UL Amp on/off
④ UL Input power

6. FCC/IC User Warning

FCC Part 15.105 statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Part 15.21 statement

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

RF Exposure Statement

The product complies with the FCC Fixed RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual.

RSS-GEN, Sec. 7.1.2 – (transmitters)

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

Conformément à la réglementation d’Industrie Canada, le présent émetteur radio peut fonctionneravec une antenne d’un type et d’un gain maximal (ou inférieur) approuvé pour l’émetteur par Industrie Canada.

Dans le but de réduire les risques de brouillage radioélectrique à l’intention desautres utilisateurs, il faut choisir le type d’antenne et son gain de sorte que la puissance isotroperayonnée quivalente (p.i.r.e.) ne dépassepas l’intensité nécessaire à l’établissement d’une communication satisfaisante.

RSS-GEN, Sec. 7.1.2 – (detachable antennas)

This radio transmitter (identify the device by certification number, or model number if Category II)has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégorie I) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste,ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

RF Radiation Exposure

This equipment complies with RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of **20** cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. RF exposure will be addressed at time of installation and the use of higher gain antennas require larger separation distances. (Max. antenna gain : DL 5 dBi)

RSS-102 RF Exposure

L'antenne (ou les antennes) doit être installée de façon à maintenir à tout instant une distance minimum de au moins **20** cm entre la source de radiation (l'antenne) et toute personne physique. Cet appareil ne doit pas être installé ou utilisé en conjonction avec une autre antenne ou émetteur.
(Max. antenna gain : DL 5 dBi)

FCC Booster warning

Part 90 and Part 20 Signal Boosters. THIS IS A 90.219 CLASS B DEVICE
WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Part 90 Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.

IC Booster warning

WARNING: This is NOT a CONSUMER device. It is designed for installation by an installer approved by an ISED licensee. You MUST have an ISED LICENCE or the express consent of an ISED licensee to operate this device.