# Nova-233 G2 (mBS1105) Outdoor LTE TDD Base Station

# Installation Guide

04

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### About This Document

This document is a guidance of Nova-233 genrtation2 (G2) hardware installation for installation personnel, including the preparation of installation tools and supporting materials, the demands for installation environment, installation procedure, cable connection and power on.

Accomplish the installation of the device according to this guide, the installation personnel can avoid potential damage to the device during the installation procedure, which makes sure the subsequent good running of the device.

This document suits for the models of mBS11xx series base station.

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### **Disposal of Electronic and Electrical Waste**



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

### **Revision Record**

Date	Version	Description
20 Nov, 2017	01	Initial Released.
16 Jan, 2018	02	Optimize descriptions and fix some bugs.
4 Apr, 2018	03	Fix bugs.
31 Mar, 2018	04	Change the installation bracket.

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# **1. Product Overview**

### 1.1 Introduction

Baicells Nova-233 G2 is high performance outdoor micro base station based on LTE TDD technology, which is developed by Baicells. The Nova-233 G2 supports wired backhaul connections to backbone networks, and provides LTE access to user terminals, implemented voice and data service transmissions.

The Nova-233 G2 makes use of the current transmission resources to reduce the operator's investment, implement the low-cost construction of LTE networks and enhance indoor coverage, thereby providing high-speed broadband access for users in assembly occupations.

The Nova-233 G2 can be widely used by telecom operators, broadband operators, enterprises, and so on.

### 1.2 Features

- Adopt the integration design of baseband and RF.
- Based on 3GPP international standard LTE-TDD technology; provide high speed data service; support peak rate of DL: 110Mbit/s, UL: 14Mbit/s with 20MHz spectrum.
- Support flexible uplink and downlink time slot ratio: 1(2:2), 2(1:3), and high speed data transmission.
- Support 10MHz/20MHz operation bandwidth.
- <sup>a</sup> Support copper (RJ-45) and optical port backhaul, flexible to deploy.
- Security services to provide timely protection against potential security risks and illegal intrusion.
- Support simple and convenient local and remote web management.
- Integration as required, easy to installation and deployment, accurate coverage and improved network capacity.
- Support network management functions, which includes the management, monitoring and maintenance.

# 1.3 Appearance

The Nova-233 G2 base station appearance is shown in Figure 1-1.

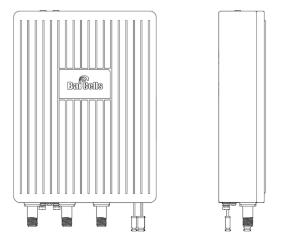
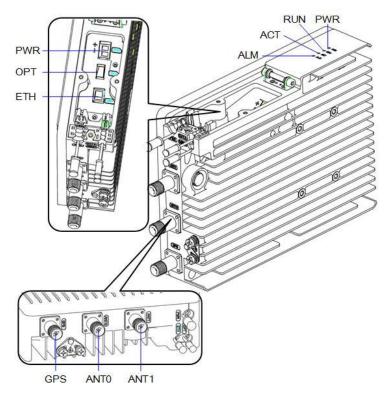


Figure 1-1 Nova-233 G2 Appearance

The Nova-233 G2 interfaces and indicators are shown in Figure 1-2.

Figure 1-2 Nova-233 G2 Interfaces and Indicators



The Nova-233 G2 interfaces are described in Table 1-1.

Interface Name	Description
PWR	Power interface: +48V (+42V~+60V) DC
GPS	External GPS antenna, N-female connector.
ANT0	External antenna 0, N-female connector.
OPT	Optical interface, connect to external transmission network,
	used for data backhaul.
ETH	RJ-45 interface, used for debug or data backhaul.
ANT1	External antenna 1, N-female connector.

Table 1-1 Nova-233	G2 Interface Descrip	tion
	OZ INCHAGE DESCHP	lion

The Nova-233 G2 interface indicators are described in Table 1-2.

Identity	Color	Status	Description
	Steady On	Power On	
PWR	Green	OFF	No Power Supply
		Fast flash: 0.125s on,0.125s off	The board is loading.
RUN Green	Green	Slow flash: 1s on,1s off	The board is normal.
		OFF	No power input or board fault
	Croon	Steady On	The transmitting channel works normally
ACT	Green	OFF	The transmitting channel works abnormally
ALM	Red	Steady On	Hardware alarm, e.g. VSWR alarm
	Red	OFF	No alarm

Table 1-2 Nova-233 G2 Interface Indicators

# 1.4 Technical Specification

## **1.4.1 Hardware Specification**

Item	Description
LTE Mode	LTE TDD
LTE Band	band48 (3550 MHz ~ 3700 MHz)
Channel Bandwidth	10/20 MHz
MAX Output Power	30dBm/Ant

Item	Description
Receive Sensitivity	-100 dBm
Synchronization	GPS, 1588 V2
Backhaul	1 Optical (SFP) and 1 RJ-45 Ethernet interface (1 GE)
MIMO	DL 2 x 2
Dimension	227mm (H) x 305mm (W) x 74mm (D)
Installation Type	Pole, wall
	External 18.5dBi directional antenna
	Vertical beamwidth: 35°
Antenna	Horizontal beamwidth:65°
	Downtilt angle: 8.5°
	Height: 30m
Overall Power	< 45 W
Power	48V DC, AC adaptor (multi-national standards)
Weight	About 4.4 kg

**Note**: The test method of receiving sensitivity is proposed by the 3GPP TS 36.104, which is based on 5MHz bandwidth, FRC A1-3 in Annex A.1 (QPSK, R=1/3, 25RB) standard.

# **1.4.2 Software Specification**

ltem	Description	
LTE Standard	LTE TDD 3GPP Release 9	
	• 20 MHz:	
	SA1: DL 80 Mbps, UL 28 Mbps	
Maximum Throughput	SA2: DL 110 Mbps, UL 14 Mbps	
	• 10MHz:	
	SA1: DL 40 Mbps, UL 14 Mbps	
	SA2: DL 55 Mbps, UL 7 Mbps	
Business Capacity	96 concurrent users	
Modulation Mode	UL: QPSK, 16QAM, 64QAM	
	DL: QPSK, 16QAM, 64QAM	
Voice Solution	CSFB, VoLTE, eSRVCC	
Traffic Offload	LIPA (Local IP Access)	
Trainc Onioau	SIPTO (Selected IP Traffic Offload)	
	Automatic setup	
SON	ANR (Automatic Neighbor Relation)	
	PCI confliction detection	
Spectrum Scanning	Supported	
UL Interference	Supported	
Detection	Supported	
RAN Sharing	Supported	
Network Management	TR069	

ltem	Description			
Interface				
MTBF	≥ 150000 hours			
MTTR	≤ 1 hour			
	Support remote/local maintenance, based on SSH protocol			
	Support remote maintenance			
	Support online status management			
	Support performance statistics			
	Support failure management			
	Support configuration management			
Maintenance	Support local or remote software upgrading and loading			
	Support log			
	Support connectivity diagnosis			
	Support automatic start and configuration			
	Support alarm reporting			
	Support KPI Recording			
	Support user information tracing			
	Support signaling trace			

# **1.4.3 Environment Specification**

Item	Description
Operating Temperature	-40°C to 55°C
Storage Temperature	-45°C to 70°C
Humidity	5% to 95%
Atmospheric Pressure	70kPa to 106kPa
Ingress Protection Rating	IP66
Power interface Lightning Protection	Differential mode: ±10 KA Common mode: ±20 KA

### **1.4.4 FCC Compliance**

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.

Any Changes or modifications not expressly approved by the party responsible for

compliance could void the user's authority to operate the equipment.

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 or more 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.

### Warning:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 70cm between the radiator & your body.

# **2.Installation Preparation**

## 2.1 Support Materials

Prepare the following support materials accordingly, as given in Table 2-1.

Item	Description	
Power cable	< AWG16 e.g. AWG14	
	Shorter than 100m	
Power plug	The power plug connecting to the electricity supply.	
Antenna RF cable	50 ohm feeder	
Optical fiber	Single mode optical fiber	
Ethernet cable	Outdoor CAT6	
	Shorter than 100m	
Antenna	Omnidirectional, or directional antenna	
Ground cable	16mm <sup>2</sup> yellow-green wire	

Table 2-1 Support Materials

# 2.2 Installation Tools

The following tools are needed during the installation.

() cm ~ cm ()				- Int
Level bar	Marking pen	Knife	Vise	Wrench
Percussion drill and some drill heads	hammer	Cross screw driver	Cable vice	Tape measure
	A 100	A		
5mm L-shape allen wrench	T7 screwdriver head	Ladder		

## 2.3 Installation Environment

### 2.3.1 Locational Requirements

Environments with high-temperatures, harmful gases, unstable voltages, volatile vibrations, loud noises, flames, explosives, and electromagnetic interference (large radar stations, transmitting stations, transformer substations) are not suitable for the operation of Nova-233 G2, and thus should be avoided.

Places prone to have impounded water, soaking, leakage, or condensation, should also be avoided.

Factors like climate, hydrology, geology, earthquake, electric power, and transportation should be taken into consideration in the construction process so that a proper location can be chosen to meet the communication engineering environmental requirements, as well as the technical requirements of network planning and communication equipment.

### 2.3.2 Environmental Requirements

Table 2-2 gives the base station's environmental requirements with regards to temperature, humidity, and voltage.

ltem	Range	Typical value
Temperature	-40°C to 55°C	25°C
Relative humidity (no condensation)	0% to 100%	5% to 95%
Safety voltage	42V to 58V	48V

Table 2-2 Environmental Requirements

### 2.3.3 Space Requirements

After the base station has installed, the enough space must be provided for operation and maintenance. And for heat dissipation and normal running of the base station, the space must be planed before installation, as shown in Figure 2-1.

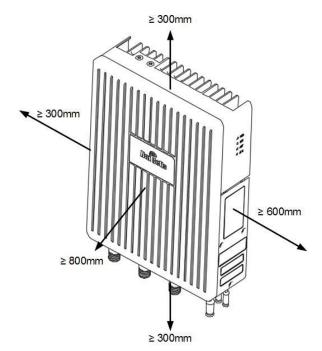


Figure 2-1 Installation Space Requirement

### 2.4 Personnel Requirements

The installation personnel must master the basic safe operation knowledge, through the training, and having the corresponding qualifications.

### 2.5 Against Lightening and Grounding Protection

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It is unlikely to happen but since the LTE base station is very sophisticated equipment so we would recommend you to test it on the ground to make sure everything is functioning before install on the tower.

The operator must prepare external against lightning protector to protect the GPS, external antenna and RJ-45 port.

Grounding Notes:

- The ground wire adopts yellow-green wire that is no smaller than 16 mm<sup>2</sup>.
- Grounding principle: as near as possible.
- The base station connects to the reliable outdoor grounding point (earth) through one ground screw.
- The connection of the grounding points and the ground bar need to be tight and

reliable. Rustproofing the terminals is required. This can be done with rust preventing paint, anti-oxidation coatings, grease, and so on.

## 2.6 Weatherproof Protection

The Nova-233 G2 adopts cold shrink tube for weatherproof protection. Before installing the cold shrink tube, clean up the interface first. The weatherproof protection steps are as follows:

- 1. Insert cable into cold shrink tube.
- 2. Tighten the connector.
- 3. Push the cold shrink tube to the top joint and pull out the strip.
- 4. Check whether the cold shrink tube tight connect with the connection.









# 3. Base Station Installation

## 3.1 Unpacking

Before opening the box, make sure the package is in good condition, undamaged and not wet. During the unpacking, avoid potential damaging impacts from hits or excessive force.

Once unpacked, check whether the quantity are consistent with the packing list.

### 3.2 Installation Procedure

The installation procedure of Nova-233 G2 is given in Figure 3-1.

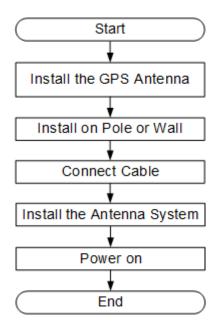


Figure 3-1 Installation Procedure of Nova-233 G2

### 3.3 Install GPS Antenna

Installation requirements on the GPS antenna:

- No major blocking from buildings in the vicinity. Keep the rooftop buildings a distance away from the GPS. Make sure the space atop within 90 degrees (at least 45 degrees) is not blocked by any buildings.
- · Avoid installing the GPS in the vicinity of any other transmitting and receiving

devices. Avoid interference from other transmitting antennas to the GPS antennas.

• Should be installed within 45 degrees to the lightning rod.

The GPS has been assembled before packing, the only installation step is to fix the GPS mounting bracket on the base station using the M4 x 14 screws.



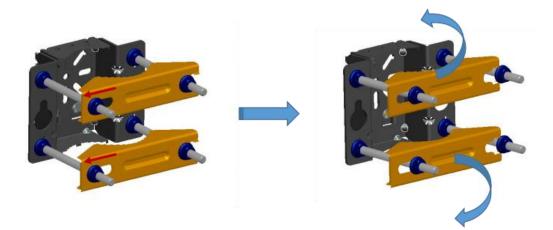
### 3.4 Install on Pole

Required diameter of the pole: 40mm ~ 100mm.

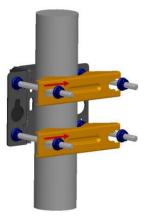
Suggest the installation height higher than 120cm, and the installation space requirements meet the requirements in "2.3.3 Space Requirements".

The mount bracket has been assembled before packing.

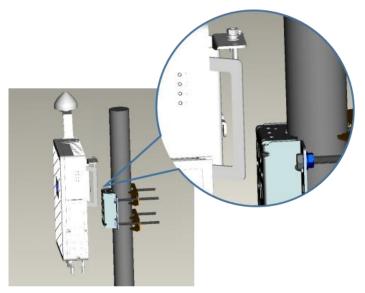
1. Unscrew the four screws of the assembled bracket and slide the two omegas to the left as the following figure, and then turn the two omegas up or down.



2. Make sure the base station's installation height, fit the thread rod of the assembled bracket to the pole, and then turn the two omegas to proper position as the following figure, and slide the two omegas to the right, and then fasten the four screws.



3. As the following figure, hung the two pins on the base station bracket to the installation bracket, push the base station until the hook block to the base station bracket.



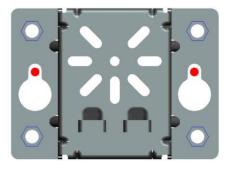
4. Tighten two screws on the top of the bracket using cross screwdriver to complete the installation.



## 3.5 Install on Wall

The wall must bear four times of the base station's weight.

- 1. Take apart the assembled installation bracket kit to get the installation bracket.
- 2. Fit the bracket on the wall, and mark the drilling locations.



### Caution:

The arrow of the installation bracket must be upward.

- 3. Drill two 10mm diameter and 70mm depth holes in the wall on the marked locations, and insert the expansion pipes.
- 4. Check the up/down direction of the installation rack, and then fix base station to the wall with M8 x 80 expansion bolts.
- 5. Refer to the installation steps on pole, fix base station on wall.

### 3.6 Connect Cable

### 3.6.1 Requirement for Cable Laying

### **General requirements:**

- Bending radius requirement of feeder cable: 7/8" > 250mm, 4/5" > 380mm.
- Bending radius requirement of jumper cable: 1/4" > 35mm, 1/2" (super soft) > 50mm, 1/2" (ordinary)>127mm.
- Bending radius requirement of power cable and grounding cable: > tripled of the diameter of cable.
- The minimum bend radius of the optical fiber is the 20 times of the diameter of optical fiber.
- Binding the cables according the type of the cable, the intertwining and crossing is forbidden.

• The label should be paste after the cable laying.

### **Optical fiber laying requirement:**

- The circling and twisting is forbidden during the laying.
- The binding on the turning is forbidden.
- The pulling and weigh down the optical fiber is forbidden.
- The redundant optical fiber must enwind the dedicated device.

### Grounding laying requirement:

- The grounding cable must connect to the grounding point.
- The grounding cable must be separate with the signal cables, remaining a certain distance to avoid the interruption of signal.

### 3.6.2 Connect GPS Antenna

- 1. Insert GPS jumper into cold shrink tube.
- 2. Connect one end of the GPS jumper to the GPS antenna.
- 3. Push the cold shrink tube to the top joint and pull out the strip.
- 4. Connect the other end of the GPS jumper to **GPS** interface of the base station, which also need weatherproof protection.

### 3.6.3 Connect RF Cable

- 1. Open the dust cap of **ANT0** and **ANT1** interface.
- 2. Insert RF cables into cold shrink tube.
- 3. Connect one end of the two RF cables to **ANT0** and **ANT1** interface of the base station and tighten them with wrench.
- 4. Push the cold shrink tube to the top joint and pull out the strip.
- 5. Connect the other end of the RF cables to the external antenna, which also need weatherproof protection.

### 3.6.4 Connect Optical Fiber

- 1. Unscrew three screws on the cover of wiring cavity using M4 cross screwdriver and open the wiring cavity.
- 2. Connect the optical fiber to **OPT** interface in the wiring cavity.

3. Lay optical fibers along the wire groove, and stretch out the wiring cavity from **OPT** hole.

The redundant fiber should wind neatly.

### 3.6.5 Connect Ethernet Cable

- 1. Connect the Ethernet cable to ETH interface in the wiring cavity.
- 2. Lay Ethernet cable along the wire groove, and stretch out the wiring cavity from **ETH** hole.

### **3.6.6 Connect Power Connector**

Because it is not sure that the distance between the installation site and the power supply device, the two ends of power adapter are bare terminal end. The operators need to make power cable according to the actual conditions on installation site, and assemble power plug and power terminal on two ends of power adapter.

Strip 12mm insulating layer with wire stripper, which is used for connection to connector. It is recommended that the power cord length is kept below 100m (330 feet).

The connection steps of power cable is as follows.

1. Assemble power plug.

The power plug will be installed on the end of input direction. Refer to the identification on power plug, connect live wire, neutral wire, and ground wire to corresponding terminals separately, and tighten screws.

2. Assemble power terminal.

The power terminal will be installed on the end of output direction. Refer to the following figure to connect live wire and neutral wire.



- 3. Connect the power cable to **PWR** interface in the wiring cavity.
- 4. The power cable lays along the lint slot, and stretch out the wiring cavity from **PWR** hole.
- 5. The input of the power adaptor connects to the outlet.
  - If the outlet is indoors, place the power adaptor indoors.

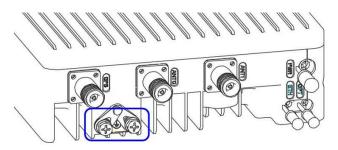
- If the outlet is outdoors, place the power adaptor in a water proof box.
- 6. After the cable connection is complete in the wiring cavity, tighten the screws on the cover to close the wiring cavity using M4 cross screwdriver.

## 3.6.7 Connect Ground Cable

Make the grounding cable according the actual situation of the installation site.

The Nova-233 G2 provides two grounding screws, which is located on the bottom of the base station, as shown in Figure 3-2.

Figure 3-2 Location of Grounding Screws



- 1. Unscrew one grounding screw, connect one end of the grounding cable to the grounding screw, and fasten it again.
- 2. The other end of the ground cable needs to connect to a good grounding point.

### 3.7 Install Antenna Feeder System

There are two kinds of outdoor antennas, omnidirectional outdoor antennas and directional outdoor antennas, whose installation will be introduced in the following, respectively.

## 3.7.1 Install Omnidirectional Antennas

One should pay attention to the followings while installing the omnidirectional outdoor antenna:

- The diameter of the pole for omnidirectional outdoor antennas is required to be 35mm ~ 50mm. A typical case is to use the 50mm-diameter round-steel-made pole (with details depending on the specific antenna type).
- Make sure that the top of pole and the clamp beneath the antenna are at the same level, after installing the omnidirectional outdoor antenna on the pole.
- Make sure that the antenna is high enough to meet the coverage requirement, and

that the antenna top falls within the 45 degrees safety angle towards the lightening rod, as shown in Figure 3-3. In principle, no lightening rod can be welded to pole (no metal object is allowed within 1m of the horizontal direction of the omnidirectional antennas), when installing the omnidirectional antennas. Instead, an independent lightening rod should be settled between the two poles, where the lightening rod must be high enough to keep all antennas under its protection cover.

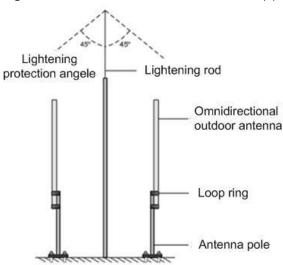
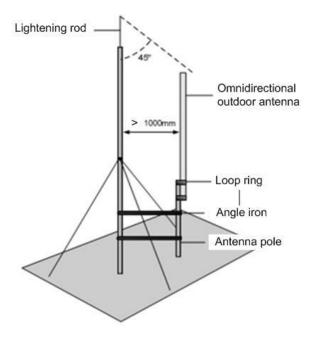


Figure 3-3 Omnidirectional Antenna Installation (1)

In case is impossible to install an independent lightning rod due to environmental limitations, the installation method shown in Figure 3-4 can be used. Be aware that the pole supporting the lightening rod should be kept at least 1m away from the omnidirectional outdoor antennas.





### 3.7.2 Install Directional Antennas

1. First, assemble the antennas, as shown in Figure 3-5.

Figure 3-5 Assembling Procedure of Directional Antennas



2. To install it on the iron tower, use a pulley to transport the antenna assembled to the platform on the iron tower, as shown in Figure 3-6. Following the safety rules when working at these heights.

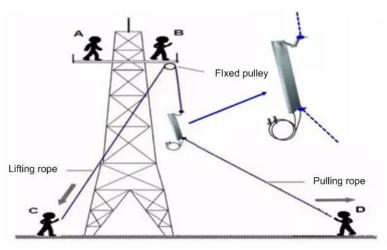
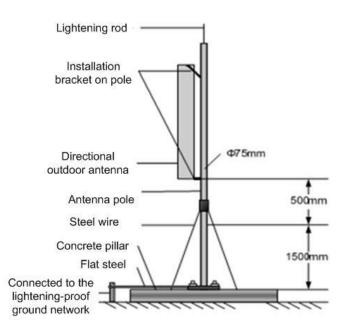


Figure 3-6 Transportation the Antennas in the Height

3. Fix the pole vertically to the ground or concrete pillars on the rooftop using expansion screws, and fasten it with steel wires. Then, mount the directional outdoor antenna onto the pole using the installation rack, as shown in Figure 3-7.

Figure 3-7 Directional Antenna Installation



- 4. When the base station has been installed in a proper position, connect all the cables and wires.
- 5. Run tests, then seal and weatherproof all the connections after the testing has successfully completed. Refer to 2.6 Weatherproof Protection.

# 4. Power On

Power on the Nova-233 G2, and the indicators will light up, as shown in Figure 4-1.

Figure 4-1 LED Indicators		
O PWR		
ORUN		
O ACT		
o alm		
l		

The explanation of the indicator signal is given in Table 4-1.

Туре	Color	Status	Meaning
	Croop	ON	Have power input
PVK	PWR Green	OFF	No power input
RUN Greer		Fast blink: 0.125s on, 0.125s off	Single board loading
	Green	Slow blink: 1s on, 1s OFF	Single board running well
		OFF	No power input, or single board failure
ALM Red	Red	ON	Hardware warning status, e.g., cable connection failure warning
		OFF	No warning
ACT Gr	Orean	ON	Active cell
	Green	OFF	Inactive cell

Table 4-1 Nova-233 G2 Indicator Description

#### Caution:

This device complies with Part 15 of the FCC rules and Industry Canada license-exempt RSS standard(s). 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.

The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or change to this equipment. Such modifications or change could void the user's authority to operate the equipment.

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 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.

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 or more 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.

The device has been evaluated to meet general RF exposure requirement.

To maintain compliance with FCC's RF exposure guidelines, this equipment should be installed and operated with a minimum distance of 70cm between the radiator and your body.