

# IoT Gateway - Manual Cellular Settings

## Automatic Cellular Connections

The IoT Gateway integrates a multi-mode LPWA modules supporting LTE Cat M1 and Cat NB2. It complies with 3GPP Release 14 and enable cellular data-only communications for this gateway. The gateway defaults to automatic cellular connection settings. These settings have been tested to work with the following cellular providers: AT&T, Hologram, Telenor, Telstra, Sasktel, and Verizon.



LTE Cat M1 & Cat NB2

## Manual Settings and Options

With the combination of both Cellular and Ethernet interfaces, the IoT Gateway's Cellular settings can be customized to work with a cellular provider not automatically supported by either the gateway or the cellular module firmware. This guide illustrates these settings and how to enable that gateway to work on a previously unsupported network. By setting the "Carrier Preference" to "Manual" in either the iMonnit Server Gateway Settings View or the Local HTTP Settings View (see below), additional configuration options become available for customization.

**iMonnit Settings View**

**Settings**

General | Ethernet | **Cellular** | Commands | HTTP Interface

IMSI: XXXXXXXXXXXXX  
 ICCID: XXXXXXXXXXXXXXXXX  
 IMEI: XXXXXXXXXXXXX

Carrier Preference: **Manual** (dropdown)

Carrier APN:

SIM Authentication Type: **None** (dropdown)

	M Enabled	NB Enabled
Band 1	<input type="checkbox"/>	<input type="checkbox"/>
Band 2	<input type="checkbox"/>	<input type="checkbox"/>
Band 3	<input type="checkbox"/>	<input type="checkbox"/>
Band 4	<input type="checkbox"/>	<input type="checkbox"/>
Band 5	<input type="checkbox"/>	<input type="checkbox"/>
Band 8	<input type="checkbox"/>	<input type="checkbox"/>
Band 12	<input type="checkbox"/>	<input type="checkbox"/>
Band 13	<input type="checkbox"/>	<input type="checkbox"/>
Band 14	<input type="checkbox"/>	N/A
Band 18	<input type="checkbox"/>	<input type="checkbox"/>
Band 19	<input type="checkbox"/>	<input type="checkbox"/>
Band 20	<input type="checkbox"/>	<input type="checkbox"/>
Band 25	<input type="checkbox"/>	<input type="checkbox"/>
Band 26	<input type="checkbox"/>	<input type="checkbox"/>
Band 27	<input type="checkbox"/>	N/A
Band 28	<input type="checkbox"/>	<input type="checkbox"/>
Band 31	<input type="checkbox"/>	<input type="checkbox"/>
Band 66	<input type="checkbox"/>	<input type="checkbox"/>
Band 71	N/A	<input type="checkbox"/>
Band 72	<input type="checkbox"/>	<input type="checkbox"/>
Band 73	<input type="checkbox"/>	<input type="checkbox"/>
Band 85	<input type="checkbox"/>	<input type="checkbox"/>

Active Bands

**Local HTTP Settings View**

Status | **Settings** | Factory Reset | Reboot

General | Cellular Network Configuration

Ethernet Network:

Carrier Preferences: **Manual Configuration** (dropdown)

SIM APN:

Cellular Network:

SIM Authentication: **None** (dropdown)

Wireless Network:

Active LTE Bands

	M Enabled	NB Enabled
Band 1	<input type="checkbox"/>	<input type="checkbox"/>
Band 2	<input type="checkbox"/>	<input type="checkbox"/>
Band 3	<input type="checkbox"/>	<input type="checkbox"/>
Band 4	<input type="checkbox"/>	<input type="checkbox"/>
Band 5	<input type="checkbox"/>	<input type="checkbox"/>
Band 8	<input type="checkbox"/>	<input type="checkbox"/>
Band 12	<input type="checkbox"/>	<input type="checkbox"/>
Band 13	<input type="checkbox"/>	<input type="checkbox"/>
Band 14	<input type="checkbox"/>	<input type="checkbox"/>
Band 18	<input type="checkbox"/>	<input type="checkbox"/>
Band 19	<input type="checkbox"/>	<input type="checkbox"/>
Band 20	<input type="checkbox"/>	<input type="checkbox"/>
Band 25	<input type="checkbox"/>	<input type="checkbox"/>
Band 26	<input type="checkbox"/>	<input type="checkbox"/>
Band 27	<input type="checkbox"/>	<input type="checkbox"/>
Band 28	<input type="checkbox"/>	<input type="checkbox"/>
Band 31	<input type="checkbox"/>	<input type="checkbox"/>
Band 66	<input type="checkbox"/>	<input type="checkbox"/>
Band 71	<input type="checkbox"/>	<input type="checkbox"/>
Band 72	<input type="checkbox"/>	<input type="checkbox"/>
Band 73	<input type="checkbox"/>	<input type="checkbox"/>
Band 85	<input type="checkbox"/>	<input type="checkbox"/>

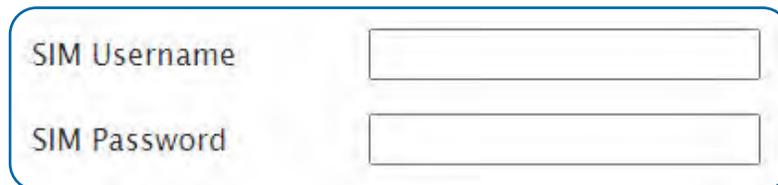
## Cellular Provider Information Request

**IMPORTANT:** To customize any of these settings, the following questions must be shared with the cellular provider:

- Is this SIM M2M, IoT, or CAT-M1/NB2 Enabled?
- What APN should be used with this SIM?
- Does this SIM support Authentication?
  - If so,
    - What is the Type: PAP or CHAP?
    - What is the Username?
    - What is the Password?
- What M1 Cellular Bands should I use at my location?
  - None or specify?
- What NB-IoT (NB2) Cellular Bands should I use at my location?
  - None or specify?

## Using Cellular Provider Information

- **Cellular Access Point Name (APN)** - Enables access to the cellular network and public or private Internet access. These APNs are unique to the cellular network or sub-network designated for the SIM. The following two options are supported:
  - Unspecified APN - If the field is left blank, the APN is requested from the tower on connection
  - Specified APN - If the field is not left blank, the cellular connection is pre-configured with this APN prior to requesting a tower connection and internet access
- **SIM Authentication Type** - To create authenticated connections, APNs may have a username/password setting and use a specific security protocol to send a username and password. The following options are supported:
  - **"None"** - No username or password required and no "Username" and "Password" are available
  - **"PAP" or "CHAP"** - Password Authentication Protocol (PAP) or Challenge Handshake Authentication Protocol (CHAP) is used to send the "Username" and "Password" and following fields become visible:



The image shows a rounded rectangular form with a blue border. It contains two input fields. The top field is labeled "SIM Username" and the bottom field is labeled "SIM Password". Both fields are currently empty.

- **Cellular Bands** - Different networks and locations will have different cellular bands available CAT-M1 (M-Enabled) and NB-IoT (NB-Enabled) connections:
  - When a checkbox is unmarked, the band will not be used
  - When a checkbox is marked, the band will be used

### Note:

- If either NB or M technologies are not used, disable the technology by not checking any bands
- If no bands are enabled, then page will prompt you to specify at least one band
- If many bands and technologies are selected, the gateway will take a long time scanning for a tower

## Confirm Connectivity

After saving the configurations, the gateway will reboot and attempt these settings. Successful cellular settings can be observed by:



If the bottom gateway indicator is green and stable, the cellular connection is active.



View "status.htm" and verify the cellular status is connected.

If the gateway is not connecting after saving and applying the information from the cellular provider, then additional, advanced troubleshooting steps need to be taken.

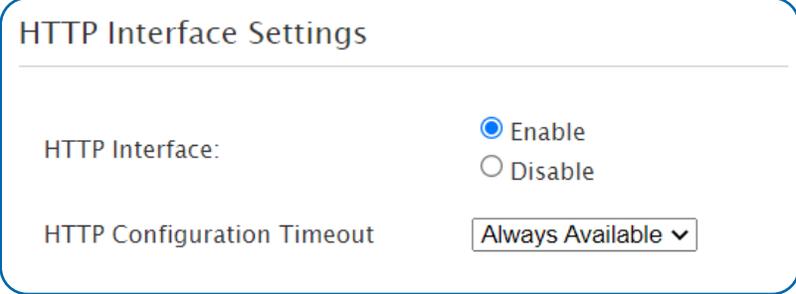


## Advanced Troubleshooting

### Setup for Troubleshooting

To setup the IoT gateway for Advanced Troubleshooting:

- The SIM card must be placed in the SIM card holder in side the Gateway
- The Ethernet interface must be connected
- The Connection Preferences must be either "Ethernet Preferred" or "Cellular Only"
- The HTTP interface must be "enabled" and "Always Available".



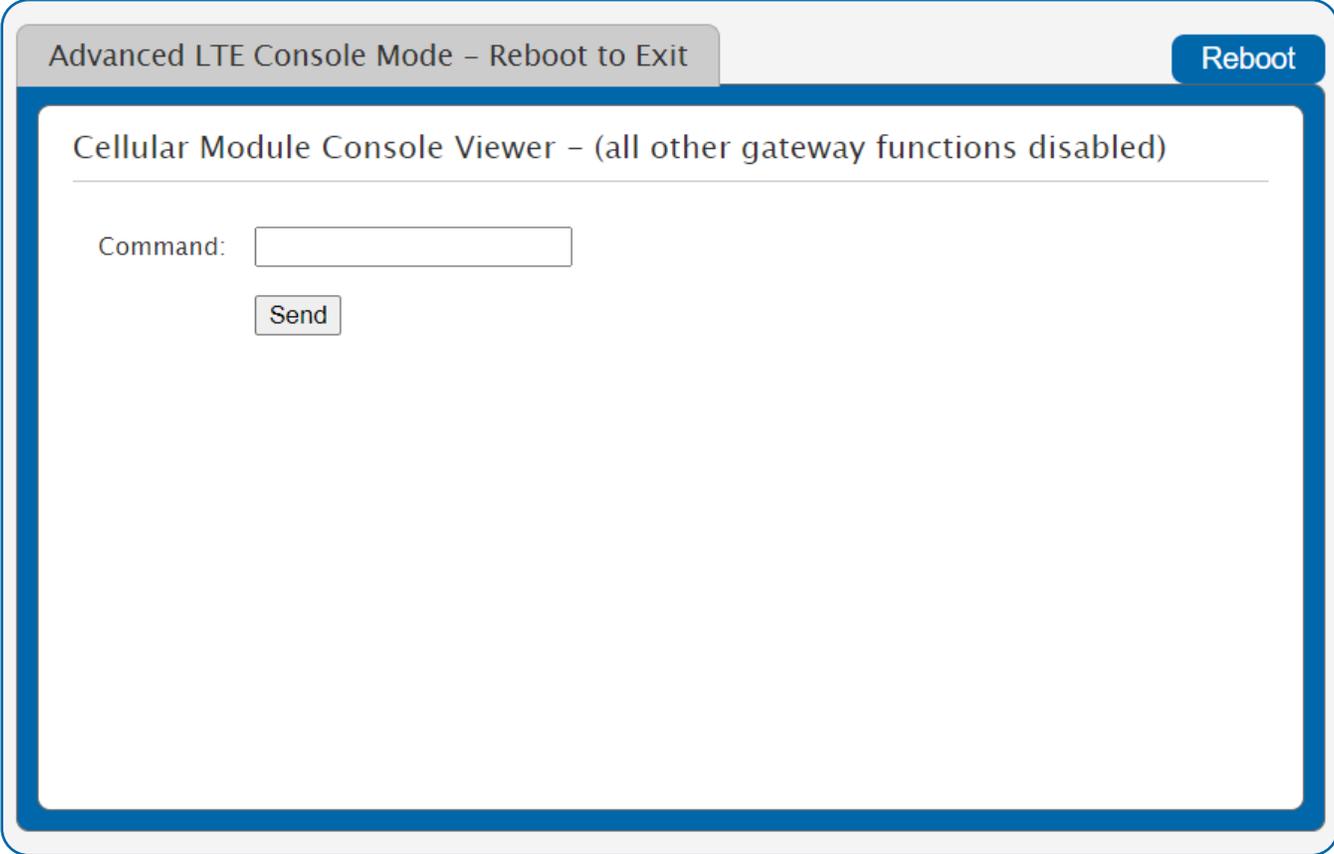
The screenshot shows a web interface titled "HTTP Interface Settings". It contains two main sections: "HTTP Interface:" with radio buttons for "Enable" (selected) and "Disable"; and "HTTP Configuration Timeout" with a dropdown menu set to "Always Available".

View of "lan.htm"

On "lte.htm", the following link can be selected to access the LTE Module Console Viewer "lcon.htm".

[Click here to run advanced LTE Module console...](#)

The LTE Module Console Viewer is the page where advanced cellular troubleshooting steps are executed. The page permits commands to be sent directly to the cellular module and for responses to be displayed.



The screenshot shows a web browser window titled "Advanced LTE Console Mode - Reboot to Exit" with a "Reboot" button in the top right. The main content area is titled "Cellular Module Console Viewer - (all other gateway functions disabled)". It features a "Command:" label next to an empty text input field, and a "Send" button below it.

View of "lcon.htm"



## Steps for Troubleshooting

The following table outlines the commands and expected responses for each step of troubleshooting. If the result does not match the expected, record the result and share Monnit Technical Support (support@monnit.com). This information is also helpful in identifying the required settings to add automatic cellular provider support to future gateway firmwares. Record the command and results you get and share these with Monnit Technical Support (support@monnit.com)

STEP	COMMAND	EXPECTED RESULT																								
1	+CPIN?	<b>+CPIN: READY</b> Result: the SIM is correctly installed and correctly inserted.																								
2	+GSN	XXXXXXXXXXXXXXXXXX Result: The IMEI of the module is reported																								
3	+CIMI	XXXXXXXXXXXXXXXXXX Result: The IMSI of the SIM is reported																								
4	+QCCID	<b>+QCCID: xxxxxxxxxxxxxxxxxxxxxx</b> Result: The ICCID of the SIM is reported																								
5	+QPRTPARA=3	<b>OK</b> Result: The Module will learn BAND and APN settings from the SIM card																								
6	+CFUN=1,1	<b>OK</b> Result: Reboot the Module and apply settings learned from +QPRTPARA command. <b>Note: The next command should be ran between 5 and 15 seconds after this one.</b>																								
7	E0;+COPS=2;+CEREG=2	<b>OK</b> Result: Halt module, remove command echoes, enable tower identification																								
8	+QCFG="band"	<p><b>+QCFG: "band",0x0,0x80a,0x80a</b> Result: This shows that Bands 2, 4, and 12 are recognized by the SIM by default. <b>Note: This is an AT&amp;T Example. Other Bands can be decoded from the data below.</b></p> <table border="1"> <tbody> <tr> <td><b>B1</b> 0x1</td> <td><b>B2</b> 0x2</td> <td><b>B3</b> 0x4</td> <td><b>B4</b> 0x8</td> </tr> <tr> <td><b>B5</b> 0x10</td> <td><b>B6</b> 0x80</td> <td><b>B12</b> 0x800</td> <td><b>B13</b> 0x1000</td> </tr> <tr> <td><b>B14</b> 0x2000</td> <td><b>B18</b> 0x20000</td> <td><b>B19</b> 0x40000</td> <td><b>B20</b> 0x80000</td> </tr> <tr> <td><b>B25</b> 0x1000000</td> <td><b>B26</b> 0x2000000</td> <td><b>B27</b> 0x4000000</td> <td><b>B28</b> 0x8000000</td> </tr> <tr> <td><b>B31</b> 0x40000000</td> <td><b>B66</b> 0x200000000000000000</td> <td><b>B71</b> 0x400000000000000000</td> <td><b>B72</b> 0x800000000000000000</td> </tr> <tr> <td><b>B73</b> 0x1000000000000000000</td> <td><b>B85</b> 0x10000000000000000000</td> <td><b>All Bands (M)</b> 0x4001820000000000F0E389F</td> <td><b>All Bands (NB)</b> 0x4001C2000000004E0E189F</td> </tr> </tbody> </table> <p>If the results need to change, the command format is as follows:  <b>+QCFG="band",0x0,&lt;M BAND MASK&gt;,&lt;NB BAND MASK&gt;</b>  <b>Example for setting Band 5 and 13: +QCFG="band",0x0,0x1010,0x1010</b></p>	<b>B1</b> 0x1	<b>B2</b> 0x2	<b>B3</b> 0x4	<b>B4</b> 0x8	<b>B5</b> 0x10	<b>B6</b> 0x80	<b>B12</b> 0x800	<b>B13</b> 0x1000	<b>B14</b> 0x2000	<b>B18</b> 0x20000	<b>B19</b> 0x40000	<b>B20</b> 0x80000	<b>B25</b> 0x1000000	<b>B26</b> 0x2000000	<b>B27</b> 0x4000000	<b>B28</b> 0x8000000	<b>B31</b> 0x40000000	<b>B66</b> 0x200000000000000000	<b>B71</b> 0x400000000000000000	<b>B72</b> 0x800000000000000000	<b>B73</b> 0x1000000000000000000	<b>B85</b> 0x10000000000000000000	<b>All Bands (M)</b> 0x4001820000000000F0E389F	<b>All Bands (NB)</b> 0x4001C2000000004E0E189F
<b>B1</b> 0x1	<b>B2</b> 0x2	<b>B3</b> 0x4	<b>B4</b> 0x8																							
<b>B5</b> 0x10	<b>B6</b> 0x80	<b>B12</b> 0x800	<b>B13</b> 0x1000																							
<b>B14</b> 0x2000	<b>B18</b> 0x20000	<b>B19</b> 0x40000	<b>B20</b> 0x80000																							
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9	+QCFG="iotopmode",0 or +QCFG="iotopmode",1 or +QCFG="iotopmode",2	<b>OK</b> Result: Set Technology to: 0 = M1 only (auto-default) , 1 = NB only, 2 = Both M1/NB2 Note: Choose which command and send one only.																								



10	+QICSGP=...	<p>OK</p> <p>Result: Set the APN, Username, and Password, and Authentication Type  +QICSGP=1,&lt;context_types&gt;,[<b>"APN"</b>],[<b>"username"</b>],[<b>"password"</b>],[&lt;authentication&gt;]]  &lt;context_type&gt; is 1 for "IP" and 3 for "IPV4V6"  &lt;authentication&gt; is 0 None, 1 PAP, and 2 CHAP</p> <p>Empty APN, no Authentication example: <b>+QICSGP=1,3,""</b>  set APN, no authentication example: : <b>+QICSGP=1,3,"my.apn.com"</b>  Full Example with CHAP: <b>+QICSGP=1,3,"carrier.apn","myuser","mypass",2</b></p>
11	+CFUN=1;+COPS=0	<p>OK</p> <p>Result: The cellular module now is active.</p>
12	+CEREG?	<p>+CEREG: 2,0 -- 0 is Off, run step 11  +CEREG: 2,2 -- 2 is Scanning for Tower  +CEREG: 2,1,"990D","6E20B0F",8 -- 1 is "home" network, tower information and technology  +CEREG: 2,5,"990D","6E20B0F",8 -- 5 is "roaming" network, tower information and technology  +CEREG: 2,3 -- 3 is registration denied  +CEREG: 2,4 -- 4 is unknown state</p> <p>Result: Check for Tower Connection. Keep running this command until Result is 1 or 5  Note: Success on this step means that steps 8-10 were input correctly.</p>
13	+COPS?	<p>+COPS: 0,0,"AT&amp;T",8</p> <p>Result: Reports the carrier the gateway attached too.</p>
14	+CSQ	<p>+CSQ: 28,99</p> <p>Result: First number reports the signal strength (&gt;4 is acceptable signal).</p>
15	+CGATT?	<p>+CGATT: 1</p> <p>Result: Data session active if value is 1. Failed to Open a data session if 0</p>
16	+CGCONTRDP	<p>+CGCONTRDP: 1,5,"m2m005230.attz",10.139.237.252,,100.122.11.10,100.121.11.10</p> <p>Result: Show the current APN and IP settings in use.</p>
17	+QIOPEN=...	<p>OK</p> <p>+QIOPEN: 1,0</p> <p>Send: <b>+QIOPEN=1,1,"UDP","sensorgateway.com",3000</b> (Test DNS and server) or  <b>+QIOPEN=1,1,"UDP","68.169.16.253",3000</b> (Test server only)  Result: UDP socket opened successfully</p>
18	+QISENDEX=...	<p>SEND OK</p> <p>+QIURC: "recv",1 (if network is fast enough, this message is received indicating there was a response from the server, this message may not be received)</p> <p>Send : <b>+QISENDEX=1,"4757503D393237333930"</b>  Result: Data sent to server</p>
19	+QIRD=1,2	<p>+QIRD: 2  CB or OK (Data from Server)  OK</p> <p>Result: Two bytes received from server successfully</p>
20	+QICLOSE=1	<p>OK</p> <p>Result: The socket is closed</p>

