Transmitter Certification
Test Report

FCC ID: SDBTGB001LP/SDBTGB001HP

FCC Rule Part: CFR 47 Part 24 Subpart D, Part 90 Subpart I, Part 101 Subpart C

ACS Report Number: 05-0169-LP/05-0169-HP

Manufacturer: Advanced Metering Data Systems, LLC
Equipment Type: Base Station Transceiver
Model(s): TGB001LP
TGB001HP

Users Manual

TGB 900MHz
Users Manual & Operators Guide

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1. DESCRIPTION

1.1. Purpose

The purpose of this document is to provide necessary information for use by field personnel in the installation, operation, and troubleshooting of the 900MHz Cell Tower Gateway Basestation (TGB).

1.2. FCC Class B Statement

"NOTE: 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: Changes or modifications to this device not expressly approved by AMDS could void the user's authority to operate the equipment.

RF Exposure

In accordance with FCC requirements of human exposure to radiofrequency fields, the radiating element shall be installed such that a minimum separation distance of:

- For HP Models (i.e. FCC ID and IC ID's end in "HP") a distance of 2.5 meters.
- For LP Models (i.e. FCC ID and IC ID's end in "LP") a distance of 0.5 meters.

Note: These limits are for CFR 47 Part 90 and Par101 operation. CFR 47 Part 24 limits will be addressed at time of licensing according to Part 1.1307 of CFR 47. This information presented is correct for all three Rule Parts.

1.3. Industry Canada

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. 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.

Cet appareillage numérique de la classe B répond à toutes les exigences de l'interférence canadienne causant des règlements d'équipement. L'opération est sujette aux deux conditions suivantes: (1) ce dispositif peut ne pas causer l'interférence nocive, et (2) ce dispositif doit accepter n'importe quelle interférence reçue, y compris l'interférence qui peut causer l'opération peu désirée.

1.4. Specifications

1.4.1. Input Power

1.4.1.1. **Voltage:** 24VDC

1.4.1.2. **Input Current**

10A max (at low input voltage range)
Approximately 3A continuous

1.4.1.3. Alarms and Controls

Low-voltage alarm is asserted when output voltage drops below 22VDC.

Low-voltage disconnect is asserted when output voltage drops below 20VDC, re-connects when output voltage exceeds 22VDC.

1.4.2. Environmental

1.4.2.1. Operating temperature

-40˚C to +85˚C

1.4.2.2. Storage temperature

-40˚C to +85˚C

1.4.2.3. Humidity

0% to 95%, non-condensing

1.4.3 General Information

The TGB Transceiver is a high performance burst data radio system. The RF receiver is configured to receive 3 distinct modulation schemes on 3 adjacent frequencies in the 896 to 940 MHz frequency range.

The TGB RF Transmitter operates on a single configurable channel (12.5kHz, 13.6 KHz, or 25kHz authorized bandwidth depending on the channel and FCC Rule section governing it's operation) in the 935 to 960 MHz frequency range. The transmitter utilizes yet another type of modulation scheme, different from the three utilized by the receiver.

Transmitted and received data messages are short in nature, meaning that the radio is intended for burst telemetry type of applications. Larger packets may, however, be transmitted by sending successive packets.

The TGB operates as a multi-channel transceiver in a "cellular" type system.

The TGB assembles the received messages and forwards them to the TGB Controller (one per city) via local phone lines. The TGB Controller eliminates redundant messages (i.e., messages from endpoints that were received by more than one TGB) before forwarding them to the NOC via a high-speed connection (ISDN, T1, etc).

The TGB shall also notify the NOC of any alarm indications, such as tamper/intrusion, temperature alarms, or power failure.

The TGB is installed inside an equipment enclosure containing a 24 VDC power supply and battery charger (FCC Part 15 Class B Compliant), a cavity duplexer/combiner allowing for single antenna operation, and all necessary grounding and lightning protection hardware needed to protect the TGB under normal operation.

1.5. Block Diagram

1.5.1. Power System

!!! Danger !!!

Hazardous AC voltages capable of producing severe electrical shock are present at various locations in the TGB. Exercise caution when working inside the enclosure, to assure that contact is not made with and electrical termination.

!!! Warning !!!

The batteries are a source of energy and can be hazardous if shorted. Exercise caution.

1.5.1.1. AC Power – Indoor

AC Power is supplied to the rectifier through a rack mounted power strip with integral ON/OFF switch and surge protection.

1.5.1.2. AC Power – Outdoor

AC Power enters the outdoor enclosure through the bottom of the cabinet. The rectifier plugs into the surge protected, GFI outlet located in the bottom of the cabinet.

1.5.1.3. DC Power

An FCC, Part 15, Class B compliant rectifier (battery charger) converts commercial power (120/220VAC) to 24VDC power to the equipment chassis, heat exchanger, fans, intrusion alarm, and batteries. In the event of commercial power failure, the rectifier provides uninterrupted DC power by switching over to battery backup.

1.5.1.4. Fuses and Breakers

The TGB contains one 10A circuit breaker/disconnect to protect/control power to the electronics chassis.

1.5.1.5. Grounding

The ground bus bar MUST be connected to the site's HALO ground using an insulated conductor of sufficient size. All transient voltage protectors (antenna, commercial power, TELCO lines) are grounded to this bus bar. Failure to properly ground the TGB equipment presents a risk to not only the TGB electronics, but other customers' equipment at the site as well.
A qualified electrician must perform this connection. Consult a local electrician, or site engineer, for size requirements.

1.5.2. Wiring

The TGB equipment enclosure wiring is supplied in another document and is beyond the scope of this manual. All TGB connections to the wiring and interconnect of the TGB equipment enclosure are provided below to assist the operator in installing the TGB inside the equipment enclosure.

1.5.3. Alarms

1.5.3.1. Intrusion

The enclosure the TGB is mounted in is equipped with pin switches on both the front and rear doors that activate and intrusion alarm when a door is opened. A feature of the outdoor enclosures intrusion switch is the ability to "pull out" the switch to cancel the alarm. The switch has a 30-minute mechanical delay, after which the intrusion alarm will again be asserted.

1.5.3.2. Temperature

The TGB is equipped with high (120F) and low (41F) temperature sensors. The TGB notifies the TGB controller of the type of alarm.

1.5.3.3. Power System

The rectifier has several alarm outputs to signal different types of faults associated with the power system.
Low Voltage Alarm – Asserted upon loss of AC Commercial Power.
Rectifier Failure – Asserted when DC output voltage is out-of-range.
Load Fuse Failure – Asserted when one of the load fuses (Fan, Heat Exchanger, Intrusion Alarm) opens.
Battery Failure – Asserted when output voltage drops below threshold, Low voltage disconnect is activated, or Bypass switch is in Bypass position.

1.5.4. RF Subsystem

1.5.4.1. Spark Gap

The antenna bulkhead connector is a Gas Discharge Tube Surge Arrestor designed to shunt lightening induced transients to ground; thereby protecting the TGB electronics from damage. The arrestor contains a replaceable gas tube element that should be inspected regularly are replaced as necessary.

1.5.4.2. Cavity Filter / Duplexer

The cavity filter is a frequency selective device designed to protect the RF front end from overloading by out-of-band signals. The cavity filter assembly is tuned and assembled as a unit by qualified AMDS personnel. No cables or connectors should be changed or replaced,

nor should any adjustments be made to the tuning screws of the Cavity Filter / Duplexer by the operator.

1.5.4.3. RF Cabling

The RF cabling and connectors inside the TGB enclosure are selected due to their low-loss characteristics. No cables or connectors should be changed or replaced by the operator.

1.5.5. Breakout Panel Assembly

The purpose of the Breakout Panel is to function as an interface between the Fusion Processor and the "external world". It provides a termination point, and more importantly Transient Voltage Suppression, of signals coming into the Fusion Processor. TVS devices protect all Alarm Inputs, Modem Lines, and Ethernet Lines.

Signal	I/O	Function/Comments
POTS1 POTS2	Bi-directional	POTS Modem Connections
Diagnostic Port	Bi-directional	DB9 Female connector wired as a DCE
Inputs 1-7	Inputs	Contact Closure Alarm Inputs.
Ethernet	Bi-directional	10/100Base T Ethernet Port

2. Installation

2.1. Ventilation

The outdoor enclosure is completely sealed from the outside environment (NEMA 4). A heat exchanger is used to cool internal electronics.
The indoor enclosure is designed to circulate ambient air for cooling. Fans inside the enclosure are designed to circulate air across the electronics and power supply.

2.2. Electrical Connections

2.2.1. Grounding

Ensure that all connections to the Ground bus bar are secure. The bus bar must also be connected to the site's Halo Ground using the 8AWG Green/Yellow cable provided with the TGB System.

2.2.2. Power/Battery

!!! Warning !!!

Do not make any connections with power applied to the system. The batteries are a source of energy and can be hazardous if shorted. Exercise caution.

Prior to connecting batteries, disconnect the battery cable from the right hand side of the rectifier cabinet. Install batteries and connect jumpers to battery terminals. Before reconnecting battery cable to right hand side of rectifier cabinet, measure open circuit voltage between pins 1 & 2. The voltage should be above 24VDC. If the voltage is below 22VDC, **do not** proceed with connection—batteries must first be charged before installation.

2.2.3. Antenna

The antenna connection is a Type-N female located on the top of the indoor cabinet (bottom of the outdoor cabinet). The connector is a bulkhead mounted surge arrestor rated at 90V.

The antennas (and their installations, including separation distances) utilized by the TGB must follow the following FCC guidelines:

For Part 24:

The antenna(s) used for this transmitter (receiver) must be fixed-mounted on outdoor permanent structures. RF exposure compliance is addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of §1.1307(b)(3).

For Part 90 and Part 101 Operation:

The antenna(s) used for this transmitter must be fixed-mounted on outdoor permanent structures with a separation distance of 2.5 meters for the HP model and 0.5 meters for the LP model (Note: Model numbers are ascertained by either front panel labeling or by noting the IC or FCC ID label placed on the rear panel of the TGB) from all persons during normal operation. The peak conducted output power at each antenna terminal must not exceed 1.24 Watts for the LP model and 32.21 Watts for the HP Model. The peak radiated output power (EIRP) must not exceed 16.14 Watts for the LP model and 418.8 Watts for the HP model.

Antenna Co-Location At Multiple-Transmitter Sites:

According to § 1.1307(b)(3), the FCC requires the following (excerpted from CFR 47):

(3) In general, when the guidelines specified in § 1.1310 are exceeded in an accessible area due to the emissions from multiple fixed transmitters, actions necessary to bring the area into compliance are the shared responsibility of all licensees whose transmitters produce, at the area in question, power density levels that exceed 5% of the power density exposure limit applicable to their particular transmitter or field strength levels that, when squared, exceed 5% of the square of the electric or magnetic field strength limit applicable to their particular transmitter. Owners of transmitter sites are expected to allow applicants and licensees to take reasonable steps to comply with the requirements contained in § 1.1307(b) and, where feasible, should encourage co-location of transmitters and common solutions for controlling access to areas where the RF exposure limits contained in § 1.1310 might be exceeded.

2.3. Data Link

The TGB supports several different communications backbones—a single/dual modem (56K) connection or a 10/100BaseT Ethernet connection. The modems and Ethernet connections are made through the modular connectors on the breakout panel.

2.4. Initial Startup

Prior to applying power, ensure that all fuses are in place, the antenna is connected, the 24 VDC supply is connected to the TGB, and the data line (POTS or Ethernet) is connected.

After approximately 30 seconds, the Fusion Processor will complete its boot up procedure, and the TGB will connect to the TGB Controller.

After approximately 1 minute, the TGB boot-up sequence should be completed. All LED's indicating a green color on the front panel informs the operator that the TGB is operating correctly and has passed all self tests.

IF ANY RED LIGHTS ARE DISPLAYED ON THE TGB FRONT PANEL, POWER DOWN THE UNIT AND CALL THE OPERATIONS CENTER FOR FURTHER INSTRUCTIONS.

3. Operation

3.1. General

The TGB is designed to operate with minimal user intervention—even in the event of commercial AC power interruption.

Specialized software may be used (available ONLY to authorized AMDS technical personnel pursuant to the requirements of CFR 47 Part 90.203) to configure the control parameters of the TGB at the installation site for setup and troubleshooting.

For all installation purposes other than those expressly listed above, performed by authorized AMDS personnel, you, the operator, only have the ability, and are authorized to:

- Connect power to the unit.
- Attach the interconnect cabling to the unit (i.e. RF cables, POTS interconnect).
- Turn on and off the unit's power.
- Connect a diagnostic cable to the unit to allow for monitoring of system status.
- Run a monitoring and control program on an IBM PC compatible computer that allows you to monitor several TGB status indicators and to power up and down the unit.
- Visually ascertain certain system operational parameters by viewing the LED indicators on the front panel of the TGB.
- Work with AMDS authorized personnel to ascertain if the TGB is operating properly.

Pursuant to FCC regulations, you the operator are NOT allowed to perform the following tasks by ***any*** means. Operators that do not adhere to these important guidelines will face disciplinary action and may be prosecuted under the laws of the United States Of America or Canada:

- You may not program new transmitter or receiver frequencies (these are programmed by authorized AMDS personnel either at the site or at the AMDS service depot using specialized software or via an internet connection using a secure data link).
- You may not program ***any*** on-air related characteristics of the TGB.

NOTE: The items listed immediately above may not be invoked in any way due to any control on the front panel of the TGB pursuant to CFR 47 Part 90.203 of

the FCC Rules. Highly controlled and specialized software, protected using password login is utilized (either through a specialized diagnostic port or via a secure internet link to the TGB) by ONLY AMDS authorized personnel, to program any of the on-air operational parameters of the TGB.

3.2. Starting and Stopping

Prior to powering down the TGB Electronics, the Halt command should be issued to the Fusion Processor via the internet link or by qualified AMDS service personnel. After the Fusion Processor has completed shutdown, the TGB Electronics can then be powered-down by switching the Chassis breaker/disconnect to the OFF position. To start the TGB Electronics simply switch the Chassis breaker/disconnect to the ON position.

If a qualified AMDS service professional is not present to execute the Halt command to the Fusion Processor, the unit may be powered off (and then on if desired) by the operator with no detriment to the system or it's operation. If this scenario is performed by the operator it is the operator's responsibility to inform the AMDS network operations center of this condition so that AMDS personnel can perform the appropriate housekeeping for the TGB via the secure internet link.

3.3. Indicators

Indicator	Location	Description
INPUT OK	Power Supply	GRN – Input voltage within normal operating limits
FAULT	Power Supply	RED – Output Voltage Fault
POWER	Fusion Processor	GRN – Fusion Processor Power OK
		OFF – Fusion Processor Power Fail
IN1 thru IN7	Fusion Processor	RED – Alarm Input Active
		OFF – Alarm Input not Active
TRIP	CPC	Flash RED – Trip Detected
MSG	CPC	Flash AMBER – Valid Message Received
OK	CPC	GRN – CPC Power OK
		OFF – CPC Power Fail
RESET	A/D	RED – System RESET Asserted
		OFF – System OK
POWER	A/D	GRN – A/D Power OK
		OFF – A/D Power Fail
OTR	A/D	Flash AMBER – Input Over-range
POWER	Receiver	GRN – Receiver Power OK
		OFF – Receiver Power Fail
LOCK	Receiver	AMBER – Synthesizer Locked
		RED – Synthesizer Unlocked
AC POWER OK	Rectifier	GRN – AC Power OK
		OFF – AC Power Fail
RECTIFIER FAILURE	Rectifier	RED – DC Output Voltage Out of Range
		OFF – Normal Operation
LOAD FUSE FAILURE	Rectifier	RED – Load Fuse Failed
		OFF – Normal Operation
BATTERY FAILURE	Rectifier	RED – Output Voltage Low, or Low Voltage Disconnect Activated, or Switch in BYPASS
		OFF – Normal Operation

Shaded areas indicate Normal Operation.

3.4. Low Voltage Alarm and Disconnect

Upon Commercial AC Power Failure, the TGB will immediately notify the network via the AC POWER Alarm; at which time the system will begin operating on battery backup. After duration determined by capacity of batteries, charge state, temperature, and current draw, the output voltage of the batteries will decrease.

The system provides for local visual (BATTERY FAILURE) and remote indication the system output voltage has fallen below a preset level. This level is set at the factory at 24V. The alarm clears automatically when the system output voltage increases above this level.
The Low Voltage Alarm is the final indication that the TGB system is about to shut down. Once asserted the TGB will shutdown in approximately 8 hours unless commercial AC power is restored..

4. Maintenance

4.1. General

The TGB is designed to require minimal maintenance. Care should be taken to observe the appropriate precautions when working inside the TGB enclosure.

!!! The circuit cards used in this equipment contain static sensitive devices. Observe precautions for handling ESD sensitive items. A, ESD wrist strap is located inside the front door of the TGB enclosure.

4.2. Preventative or Routine Maintenance

4.2.1. Surge arrestor

The antenna surge arrestor is of the gas discharge tube type. A gas tube element may not always show outward signs of failure or degradation, therefore routine maintenance and inspection is recommended. The gas tube element can be replaced by simply removing the nut and replacing the element. If the number of thunderstorms in an area is high, gas tubes should be inspected more frequently. Gas tube degradation is dependant on the number of strikes as well as the intensity of the strikes. As obvious as it may seem, gas tube elements should never be inspected, or replaced, when a thunderstorm is approaching or occurring.

4.2.2. Airflow

Without adequate airflow, TGB performance may degrade due to increased temperature. At least once per year, the TGB enclosures should be checked for proper airflow. This includes verifying operation of all fans and ensuring that any air filters are free of dust and dirt.

4.3. Circuit Card Installation/Replacement

No operator or user serviceable equipment is provided in the TGB with the exception of battery replacement and other housekeeping items.

IF ANY HARDWARE OR SOFTWARE FAILURE IS REPORTED OR DETECTED SERVICING IS TO BE PERFORMED BY QUALIFIED AMDS TECHNICAL SERVICE PERSONNEL ONLY!!

4.4. Battery Replacement

!!! Warning !!!

The batteries are a source of energy and can be hazardous if shorted. Exercise caution.

The batteries are rated for a 5-yr life at 25˚C and 27.5VDC float voltage. Extended periods of operation above 25˚C will reduce battery life (rule of thumb: 50% life reduction per every 10˚C increase. After this time it is appropriate to have a change-out program. In the event of frequent deep discharges it is possible that the batteries may require earlier replacement.

Prior to disconnecting batteries, disconnect the battery cable from the right hand side of the rectifier cabinet. Remove jumpers from the battery terminals and remove old batteries. Install new batteries and reconnect jumpers. Before reconnecting battery cable to right hand side of rectifier cabinet, measure open circuit voltage between pins 1 & 2. The voltage should be above 22VDC. If the voltage is below 22VDC, **do not** proceed with connection—batteries must first be charged before installation.

4.5. Battery Recharging

!!! Warning !!!

The batteries are a source of energy and can be hazardous if shorted. Exercise caution.

The shelf life of the batteries is 6 months from the date of charge. If the battery has been stored for more than 6 months, it should be recharged prior to installation.

5. Ordering Information and Parts List

5.1. Spares Kit

Description	Manufacturer	Part Number
Antenna Surge Arrestor	Andrews	APG-BNFNF-090
Gas Tube	Andrews	GASTUBE-090
Generator Plug	Hubbell	2713
1 1/3A GMT Fuse	Bussmann	GMT - 1 1/3 A
	Littlefuse	HB481001.33
2A GMT Fuse	Bussmann	GMT - 2 A
	Littlefuse	HB481002
5A GMT Fuse	Bussmann	GMT - 5 A
	Littlefuse	H481005