

BLE Module Product Manual



Product Name: BLE Sensor Module

Manufacturer Model No: BT840E

FCC ID: 2BGG6BT840F

Manufactured by:

Petropower, LLC

3003 E 37th St N #100

Wichita, KS 67219 USA

Intended Use and Approval Type

This radio module is approved for OEM integration only and is not intended for direct sale to, or installation by, end users.

This module has been approved by the Federal Communications Commission under a Single Modular Approval configuration in accordance with 47 CFR §15.212 and is subject to the conditions identified in this manual.

This module is not distributed to third-party OEM integrators, resellers, or end customers for independent installation or integration. This module is for the sole and exclusive use within PetroPower host products and is not offered for sale or distribution as a standalone product.

Installation, configuration, and integration of this module must be performed by PetroPower or personnel authorized by PetroPower. The module must not be made accessible to end users. End users must not modify or service the antenna connection or RF control interfaces.

Modular Approval Conditions and Controls

The conditions associated with this modular approval and the controls used to maintain compliance are identified below.

Conditions of Use

The module is subject to the following conditions:

1. The module is approved only for installation within PetroPower host products.
2. The module is approved only for use with the antenna types and maximum gains identified in this manual.
3. The antenna system must maintain a minimum separation distance of 20 cm from all persons.
4. A minimum separation distance of 2 feet shall be maintained between this antenna and any other antenna.
5. The module is not approved for portable use.
6. The module has not been evaluated for simultaneous transmission unless otherwise stated.

Compliance Controls

PetroPower maintains compliance with the above conditions through the following controls:

- For host configurations using the MD24-12 or OC24006H Type-N antennas, the external antenna connection uses permanently bonded, 50-ohm Type-N male to reverse-polarity Type-N female adapters at the control-panel and approved-antenna endpoints. The adapters are connected by a 50-ohm reverse-polarity Type-N male-to-male coaxial cable. The adapters are permanently bonded using J-B Weld Original Cold-Weld Steel Reinforced Epoxy and allowed to cure for at least 24 hours. The completed antenna system does not expose an accessible standard Type-N connection.
- Antenna selection is restricted to the specific antenna models and maximum gain values listed in this manual. Substitution of alternative antennas is not permitted without prior review and approval by PetroPower Compliance and may require additional FCC authorization.
- The bonded adapters, antenna, and RF cable are not user-serviceable. End users must not remove, bypass, modify, substitute, extend, or replace these components. Service or replacement shall be performed only by PetroPower or personnel authorized by PetroPower.
- Any proposed changes affecting RF characteristics — including new antenna types, higher gain antennas, alternate cable assemblies, additional host platforms, or new operational modes — must be submitted to PetroPower Compliance for evaluation prior to implementation and may require additional FCC authorization.

These administrative and physical controls ensure continued compliance with 47 CFR §§15.203, 15.204, and 15.212 and the conditions of this modular approval.

FCC Regulatory Compliance

Applicable FCC Rules and Standards

This radio module has been tested and certified for compliance with the following Federal Communications Commission (FCC) rules and associated standards:

- 47 CFR Part 15, Subpart C
 - §15.247 — Digital Transmission System (Bluetooth Low Energy)
 - §15.209 — Radiated emissions limits
- ANSI C63.10
- FCC Knowledge Database (KDB) 558074
- Modular approval requirements evaluated under 47 CFR §15.212

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.

Class A Digital Device Statement

Note: 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.

WARNING:

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

Contact Information

Phone: (316) 361-0222

Email: info@petropower.com

Web: www.petropower.com

OEM / Host Integrator Instructions

Intended Integrator and Use Restrictions

- This module is intended for OEM integrator use only and is not marketed or sold to the general public.
- The module is only to be used in commercial / industrial applications, including oil well and heavy-industrial environments.
- Integration and configuration of this module shall be performed by PetroPower or personnel authorized by PetroPower.
- End users shall not be provided access to the module or RF control interfaces and shall not be permitted to modify or service the antenna connection assembly.
- Any requests for changes or modifications to this module, including but not limited to antenna changes or additional host integrations, must be reviewed and approved by the grantee, PetroPower, on a case-by-case basis, and may require additional FCC authorization prior to implementation.

Authorized Installation and Service Personnel

Installation and service personnel shall be PetroPower personnel or personnel authorized by PetroPower who are instructed on approved antenna selection, RF exposure separation requirements, antenna-to-antenna spacing, the permanent antenna-connector configuration, and the installation conditions identified in this manual. Only such authorized personnel may install, replace, or service the antenna interface, approved antennas, bonded adapters, or RF cable assemblies.

Control of RF Parameters and Firmware

- The module's RF power, bandwidth, and transmission behavior are controlled by compiled firmware installed by PetroPower staff.
- No interfaces are provided to third parties to modify operating parameters.
- Firmware updates are managed exclusively by PetroPower through credential-controlled update mechanisms, including over-the-air updates.
- This control ensures the module operates only within the parameters of the FCC grant.

Antenna Type and Installation Requirements

Approved Antenna Types

This module is approved for use only with the antenna types and maximum gain values identified in Appendix B of this manual.

Substitution of antenna types, modification of antenna characteristics, or use of antennas exceeding the approved maximum gain values is not permitted without prior review and approval by PetroPower Engineering – Compliance and may require additional FCC authorization.

Regulatory Installation Requirements

The following regulatory conditions shall be met:

- The antenna system must maintain a minimum separation distance of 20 cm from all persons.
- A minimum separation distance of 2 feet shall be maintained between this antenna and any other antenna.
- For host configurations using the Type-N antennas, the control-panel endpoint and approved-antenna endpoint shall each be fitted with a 50-ohm Type-N male to reverse-polarity Type-N female adapter permanently bonded using J-B Weld Original Cold-Weld Steel Reinforced Epoxy.
- The epoxy shall be applied to the external threads of each Type-N female endpoint before final assembly. The adapters shall be mechanically secured and the epoxy allowed to cure for a minimum of 24 hours before the antenna system is placed into service.
- The two permanently bonded reverse-polarity Type-N female endpoints shall be connected only by a 50-ohm reverse-polarity Type-N male-to-male coaxial cable. The completed antenna system shall not expose an accessible standard Type-N connection.
- The bonded adapters, antenna, and RF cable are not user-serviceable and must not be removed, bypassed, modified, or substituted. Service or replacement shall be performed only by PetroPower or personnel authorized by PetroPower. Removal of a bonded adapter requires destructive cutting and replacement of the affected connection assembly.

These requirements ensure continued compliance with the RF exposure evaluation and the conditions of this modular approval.

The antenna installation instructions in this manual are intended only for PetroPower personnel or personnel authorized by PetroPower. No antenna, bonded-adapter, or RF-cable installation, replacement, or service instructions are provided to end users.

Recommended Installation Practices (Non-Regulatory Guidance)

Recommended installation practices for typical deployments include:

- Outdoor fixed-location installation
- Mounting to a permanently affixed structure (e.g., metal pole or equivalent structural support)

- Installation height appropriate for the intended coverage area
- Avoiding obstructions that may degrade RF performance

These recommended practices are provided for typical operational deployments and do not alter the regulatory installation requirements stated above.

Host Manufacturer Responsibilities and FCC Labeling Requirements

Host manufacturers are responsible for ensuring that the finished host product incorporating this module complies with all applicable FCC requirements prior to marketing.

The finished host product may be subject to FCC Part 15 Subpart B (unintentional radiator) evaluation and must be properly authorized, as required, before distribution.

Compliance of the final host device with applicable FCC rules remains the responsibility of the host product manufacturer.

Exterior Labeling Requirements

The module shall retain its own FCC Identifier.

If the FCC ID is not visible after installation, the finished host product shall display a permanent external label stating:

Contains FCC ID: 2BGG6BT840F

This label shall be affixed using durable, non-removable means (e.g., engraving, indelible ink, or equivalent) and shall not be placed on a removable part.

If the FCC ID is not visible after installation, placement inside a user-accessible compartment is permitted provided the compartment can be accessed without the use of special tools, in accordance with FCC KDB 784748 D01.

Host User Manual Requirements

The finished host product user manual shall include the following FCC statements in a prominent and predominant location. These statements shall be reproduced verbatim:

1. FCC Part 15 Compliance Statement (47 CFR §15.19(a)(3)):

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.

2. FCC Caution Statement (47 CFR §15.21):

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

3. RF Exposure Statement (Mobile Conditions Only):

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment shall be installed and operated with a minimum separation distance of 20 cm between the radiator and all persons.

4. Digital Device Statement (47 CFR §15.105)

If the finished host product is marketed for commercial or industrial use (Class A), the following statement shall be included:

Note: 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.

RF Exposure Requirements

- This module has been evaluated for compliance with FCC RF exposure requirements under 47 CFR §1.1310.
 - The module is approved for use in mobile exposure conditions only.
 - A minimum separation distance of 20 cm must be maintained between the module antenna and all persons during normal operation.
 - The module must not be installed or operated in a configuration that results in RF exposure conditions inconsistent with the evaluated mobile exposure requirements.
 - Portable or body-worn use configurations are not permitted.
 - Compliance with RF exposure requirements is dependent upon maintaining the specified installation conditions.
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Antenna and Transmission Restrictions

- This module is approved for use only with the antennas listed in the Approved BLE Antennas for Installation section of this manual (See Appendix B).
- Antenna substitution, modification, or use of unapproved antenna types is not permitted.
- The maximum antenna gain shall not exceed the values specified for each approved antenna type.
- The antenna must be installed in a fixed location, and the permanently bonded antenna connection assembly must not be user-serviceable.
- Any changes to antenna type, gain, or installation configuration require prior review by PetroPower Engineering - Compliance and may require additional FCC authorization.

Simultaneous Transmission and Co-Location

This module has not been evaluated for simultaneous transmission with other radio transmitters.

If the host product incorporates additional transmitters or permits co-location, the host manufacturer is responsible for ensuring continued compliance with applicable FCC requirements. Additional FCC evaluation may be required if simultaneous transmission or co-location conditions exist.

Integration of this module into host products shall follow the guidance provided in FCC KDB 996369 D04 (Module Integration Guide). For simultaneous transmission conditions, evaluation shall be consistent with FCC KDB 996369 D02 guidance.

Test Mode and RF Control Access

RF test modes and associated compliance firmware are controlled exclusively by PetroPower Engineering and are not accessible to end users or host integrators.

Production firmware does not expose RF test functionality through external interfaces. Test modes may only be enabled using secured PetroPower engineering tools under authorized conditions.

Compliance test firmware, associated procedures, and validation instructions are maintained under PetroPower Engineering configuration control as controlled internal documentation. These materials are not distributed as part of this manual and are made available only to PetroPower personnel or personnel authorized by PetroPower for compliance validation purposes.

Requests regarding compliance test firmware, RF test procedures, or certification-related validation shall be directed to:

PetroPower Engineering – Compliance

compliance@petropower.com

The firmware revision and test configuration used for certification are documented within PetroPower's internal engineering records and configuration management system to ensure traceability for future compliance evaluations.

Process for Certification-Affecting Changes

Any proposed changes that may affect FCC certification — including but not limited to:

- Addition of new host platforms
- Use of new antenna types

- Increase in antenna gain
- Modification of RF cable assemblies
- New operational modes
- Firmware changes affecting RF parameters

— must be submitted to PetroPower Engineering – Compliance for review prior to implementation.

PetroPower Engineering – Compliance will evaluate the proposed change to determine whether additional FCC authorization (e.g., Class II permissive change or new equipment authorization) is required.

No certification-impacting changes shall be implemented without written approval from PetroPower Engineering – Compliance.

APPENDIX A

Product Details (Non-Regulatory)

Product Summary:

BluNor BT840E is a Bluetooth module consisting of: Nordic nRF52840 QIAA with Cortex M4F MCU, available 1MB flash, 256KB RAM, embedded 2.4GHz BLE multi-protocol transceiver, and a u.FL connector for an external antenna. Product size is: 14x16x1.9mm.

- Uses an nRF52840 QIAA with Cortex M4F MCU
- 1MB flash, 256 KB RAM
- Supports NFC
- An u.FL connector for external antenna
 - Certified with Fanstel ANT060 antenna
 - Certified with Molex 146153-0050 antenna
 - Certified with TE Connectivity OC24006H-FNF antenna
 - Certified with TE Connectivity MD24-12 antenna
- Maximum TX power is +14.6 dBm with ANT060 antenna
- Maximum TX power is +8 dBm with 146153-0050 antenna
- Maximum TX power is +8 dBm with OC24006H-FNF antenna
- Maximum TX power is +8 dBm with MD24-12 antenna
- Size: 14x16x1.9mm

Explicit Exclusion:

- This module does NOT rely on location information to operate.
- This module does NOT use WIFI or manage channels from a master device.
- This module does NOT use mobile country code or mobile network codes for its operation.

APPENDIX B

Installation and Engineering Reference (Non-Regulatory)

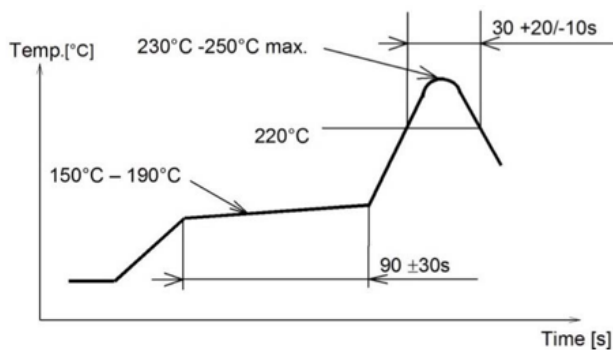
Cautions, Design Notes, and Installation Notes:

Failure to follow the guidelines set forth in this document may result in degrading of the product's functions and damage to the product.

This module is only to be used in products manufactured by PetroPower, LLC for industrial or commercial applications. Products using the Type-N antennas listed below shall use the permanently bonded reverse-polarity antenna connection configuration described in these instructions. Direct connection to an accessible standard Type-N interface is not permitted.

Installation Instructions:

1. Attach the module to the board via reflow soldering:
 - a. Reflow soldering is possible twice based on the time-temperature profile in this datasheet. Set up the temperature at the soldering portion of this product according to the below reflow profile:



- b. Position the products so that their heat will not burn into printed circuit boards or affect the other components that are susceptible to heat.
 - c. Locate these products so that their temperatures will not increase due to the effects of heat generated by neighboring components.
 - d. This product should not be mechanically stressed or vibrated when reflowed.
 - e. Pressing on parts of the metal cover or fastening objects to the metal will cause damage to the unit.

External Type-N Antenna Connection Instructions:

1. Attach the U.FL end of the U.FL-to-Type-N female bulkhead cable to the module.
2. Secure the Type-N female bulkhead endpoint in the host enclosure.

3. Apply J-B Weld Original Cold-Weld Steel Reinforced Epoxy to the external threads of the Type-N female bulkhead endpoint. Thread a 50-ohm Type-N male to reverse-polarity Type-N female adapter onto the endpoint and mechanically secure it. Allow the epoxy to cure for a minimum of 24 hours.
4. Apply J-B Weld Original Cold-Weld Steel Reinforced Epoxy to the external threads of the approved antenna's Type-N female connector. Thread a second 50-ohm Type-N male to reverse-polarity Type-N female adapter onto the antenna and mechanically secure it. Allow the epoxy to cure for a minimum of 24 hours.
5. Connect a 50-ohm reverse-polarity Type-N male-to-male coaxial cable between the two permanently bonded reverse-polarity Type-N female adapters.
6. Do not remove, bypass, modify, or substitute either permanently bonded adapter. Removal requires destructive cutting and replacement of the affected connection assembly.
7. Placement of the BLE antenna should be limited to:
 - a. Outdoor installation only
 - b. Not higher than 30 feet
 - c. Ensure there is at least a 2 foot gap between the BLE antenna and any other nearby antennas
 - d. Attached to a permanently affixed mounting structure (e.g., metal pole)
 - e. BLE antenna is typically 7'-8' off the ground, but can be adjusted for optimal line of sight to sensor locations.
 - f. Antenna should be attached using its supplied mounting bracket to a permanent location.

Approved BLE Antennas for Installation:

Only antenna types listed below and evaluated under this certification may be used. The specific antenna type used depends on the host configuration.

Fanstel Base Model	Antenna	Antenna Type	Antenna Gain	Impedance
BT840	L-PCB ANT	PCB	-3.52dBi	50ohm
BT840F	F-PCB ANT	PCB	0.34dBi	50ohm
BT840H	MHF4	Dipole	6dBi	50ohm
BT840E	u.FL	Dipole	6dBi	50ohm
BT840E	MD24-12 (Type N)	Mini Directional	11dBi	50ohm
BT840E	OC24006H (Type N)	Omni Antenna	6dBi	50ohm

Type-N antenna connection requirement: The MD24-12 and OC24006H antennas have standard Type-N female connectors. Each antenna shall be used only with the permanently bonded 50-ohm Type-N male to reverse-polarity Type-N female adapter and reverse-polarity cable configuration specified above. Use of either standard Type-N female endpoint without the permanently bonded adapter is prohibited.