

User manual

Model Name: NNT-TG05

By

Emerson Digital Cold Chain, Inc.

Revision History

Revision	Date	Description
1.00	2022/09/14	Initial Release

INTRODUCTION:

This document provides a basic functional and operational description of Global PCBA- NNT-TG05. Operational instructions, capabilities and hardware features are elaborated. Block diagram and visual references are provided as a supplement.

PRODUCT OVERVIEW AND IMPACT SUMMARY:

NNT-TG05 is a PCBA that provides features such as location, temperature, vibration, and optic sensing. Aforementioned features are sampled at pre-designated configurable intervals, and then transmitted in real time to the customer user interface for observation by our end users. In the event that coverage is unavailable, this device stores information in logging memory which is subsequently transmitted when coverage is reacquired. 2G(GSM) and 4G (CATM/NBIOT) networks are in the process of being antiquated in various parts of the world. To adapt to such a changing environment, the latest generation of this Go product was designed to transmit data on CATM (LTE) and NBloT network with a 2G as a fallback.

REFERENCES:

Components incorporated in the design of the PCBA- NNT-TG05 product were analyzed for performance during Research and development. Approved technical documentation was obtained by respective manufacturers. Additional information provided was based on simulations, electrical circuit design, validation, and real time observations.

TECHNICAL SPECIFICATION:

Product: Global PCBA

Manufacturer: Emerson

Power Supply specifications

- Operational voltage range is between 3.4 and 3.8 VDC.
- Absolute Maximum voltage rating is 4.2 VDC.

Current Consumption:

- Maximum current draw is 250 mA.
- Typical current draw is 4.2 mA (mean), Base current \approx 1.6mA (sleep).

NOTE: Values provided for current consumption are worse case based on observations during Research and Development.

Operating conditions:

- Maximum operating temperature is 50 Degrees Celsius.
- Minimum operating temperature is -20 Degrees Celsius.

Communication Interface:

- I2C protocols.
- SPI.
- UART

OPERATIONAL INSTRUCTION:**Initialization:**

NNT-TG05 is initialized by pulling the tab from the main power switch. Upon initialization, a Blue LED serves as a “network status indicator”. A brief description of blue LED indicator is bulleted below.

- Constant Blue LED illumination: unit is attempting to acquire network.
- Blinking LED: Network acquisition successful.
- Blue LED disappears several seconds and blinks every 11 seconds after network acquisition is successful.

Tracking:

Information such as device location, temperature, illuminance, and vibration events are all available in real time on Oversight. If network is unavailable, the unit stores the aforementioned data which is subsequently transmitted when coverage is reacquired.

Tertiary Power Supplies

The NNT-TG05 does not provide a viable means of providing power for peripherals. Hence voltage regulators (LDO's) were introduced. Typical voltage regulator is rated at 1.8 VDC output and is capable of supplying up to 200 mA of current. Our design accommodates interrupts, so there is negligible current draw until the device awakes for pre-designated sampling or report intervals. A single 2.8V LDO provides bias for LED operation only.

Modem

Quectel BG96MA-128-SGN modem facilitates communication on CATM1, NBloT and 2G networks. A multi-tuned antenna also optimizes signal strength dBm (power ratio in Decibels) on all available networks. Increased memory enhances the logging capability for extended “out of coverage” scenarios. Figure 1 contains a block diagram that summarizes the design of this product.

Sensor Integration

NNT-TG05 contains peripherals that are used to provide invaluable information to the end user. Optic sensing, temperature, humidity, G force detection and location services are all provided to the end user by a customer User Interface. The optic sensor provides information regarding changes in illuminance, and also serves as a mean of security if utilized in a standard environment that is devoid of light. NIST traceable temperature and humidity also serves as a means of monitoring the ambient environment of the product, and the accelerometer provides vibration events when configured G (acceleration due to gravity) thresholds are exceeded. Sensor integration is configured to the BG96 by I2C protocols.

Debug Port

A micro-USB port provides dual functionality to this design. Firstly, it serves as a mean of charging the cells appended to the device. Secondly, it provides a AT debug interface to the modem. Observe figure 2 for the location of the micro-USB port and additional components on the main PCB. An additional debug interface is available by PCI connection.

Firmware:

Firmware architecture enables RAT (Radio Access Technology) handling with CATM1 as the primary mode of data transmission, NBloT as secondary and 2G as a fallback mode. However, RAT priorities are interchangeable. If the network is unavailable, the module is placed in AP Mode (Airplane Mode) for 3 hours, and subsequently re-attempts network connection after the elapsed AP Mode duration occurs.

CE Regulations

Caution

The technical documentation relevant to the above equipment will be held at Emerson.

Please make sure the temperature for the device will be from -20°C to 50°C.

The manufacturer specified the maximum ambient temperature for use in charging mode of 40 °C and for use in the non-charge mode of 45 °C.

The minimum distance between the user and/or any bystander and the radiating structure of the transmitter is 20cm.

This radio equipment operates with the following frequency bands and maximum radio-frequency power:

Features	Description
Frequency Band	GSM/GPRS: 900/1800 LTE B1/3/8/20/28
Max. TX power	31 dBm for GSM/GPRS 900 30 dBmfor GSM/GPRS 1800 24dBm for LTE B1/3/8/20/28

List of the Followed Test Standards for Assessment of RED Requirement

Hereby, Emerson Digital Cold Chain, Inc. declares that the radio equipment NNT-TG05 is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address:

https://europa.eu/youreurope/business/product-requirements/compliance/technical-documentation-conformity/index_en.htm

NNT-TG05 complies with the essential requirements of Article 3 of the RED 2014/53/EU Directive, if used for its intended use and that the following standards have been applied:

1. Health (Article 3.1(a) of the RE Directive)

Applied Standard(s):

- EN 62311:2020
- EN 50665:2017

2. Safety (Article 3.1(a) of the RE Directive)

Applied Standard(s):

- EN 62368-1:2020/A11:2020

3. Electromagnetic compatibility (Article 3.1 (b) of the RE Directive)

Applied Standard(s):

- ETSI EN 301 489-1 V2.3.3
- ETSI EN 301 489-52 V1.2.1

4. Radiofrequency spectrum usage (Article 3.2 of the RE Directive)

Applied Standard(s):

- ETSI EN 301 511 V12.5.1
- ETSI EN 301 908-13 V13.1.1
- ETSI EN 301 908-1 V15.1.1

The technical documentation relevant to the above equipment will be held at Emerson.

FCC Regulations:

According to the definition of mobile and fixed device is described in Part 2.1091(b), this device is a

mobile device.

And the following conditions must be met:

1. This Modular Approval is limited to OEM installation for mobile and fixed applications only.

The antenna installation and operating configurations of this transmitter, including any applicable source-based time-averaging duty factor, antenna gain and cable loss must satisfy MPE categorical Exclusion Requirements of 2.1091.

2. The EUT is a mobile device; maintain at least a 20 cm separation between the EUT and the user's body and must not transmit simultaneously with any other antenna or transmitter.

3. A label with the following statements must be attached to the host end product: This device contains FCC ID: AMH101019.

4. To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, maximum antenna gain (including cable loss) must not exceed:

☐ LTE B1/B2/B3/B4/B5/B8/B12/B13/B20/B26/B28 <4dBi

☐ GSM 850/900/1800/1900 <4dBi

5. This module must not transmit simultaneously with any other antenna or transmitter

6. The host end product must include a user manual that clearly defines operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

For portable devices, in addition to the conditions 3 through 6 described above, a separate approval is required to satisfy the SAR requirements of FCC Part 2.1093.

If the device is used for other equipment that separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.

For this device, OEM integrators must be provided with labeling instructions of finished products. Please refer to KDB784748 D01 v07, section 8. Page 6/7 last two paragraphs:

A certified modular has the option to use a permanently affixed label, or an electronic label. For a permanently affixed label, the module must be labeled with an FCC ID - Section 2.926 (see 2.2 Certification (labeling requirements) above). The OEM manual must provide clear instructions explaining to the OEM the labeling requirements, options and OEM user manual instructions that are required (see next paragraph).

For a host using a certified modular with a standard fixed label, if (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straight forward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module FCC ID: AMH101019" or "Contains FCC ID: AMH101019" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID.

The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device. The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be

expected to have the capability to access information in that form.

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.

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

To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements.

ISED Notice

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."

Radiation Exposure Statement

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

**This device is intended only for OEM integrators under the following conditions:
(For module device use)**

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

- 1) L'antenne doit être installée de telle sorte qu'une distance de 20 cm est respectée entre l'antenne et les utilisateurs, et
- 2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 2 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or colocation with another transmitter), then the Canada authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains IC: 10124A-101019".

Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte qu'une distance de 20cm peut être maintenue entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 10124A-101019 ".

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

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