

Product Specification

Product Name	Bluetooth module
Product Model.	CE-BTSP5
Customer Name	Cear, Inc.
Cutomer P/N	
Hardware Version	CE-BTSP5-MAIN-PCB REV-01Aa
Firmware Version	CE-BTSP5 Firmware
DocumentVersion	V1.0

Approved By	Prepared By	Checked by	Approved By	Date
customer				

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➤ Revision history

Version	Date	Reviser	Overview of the revised content
V0.1	2026-03-11	LiuGuang qing	Draft version

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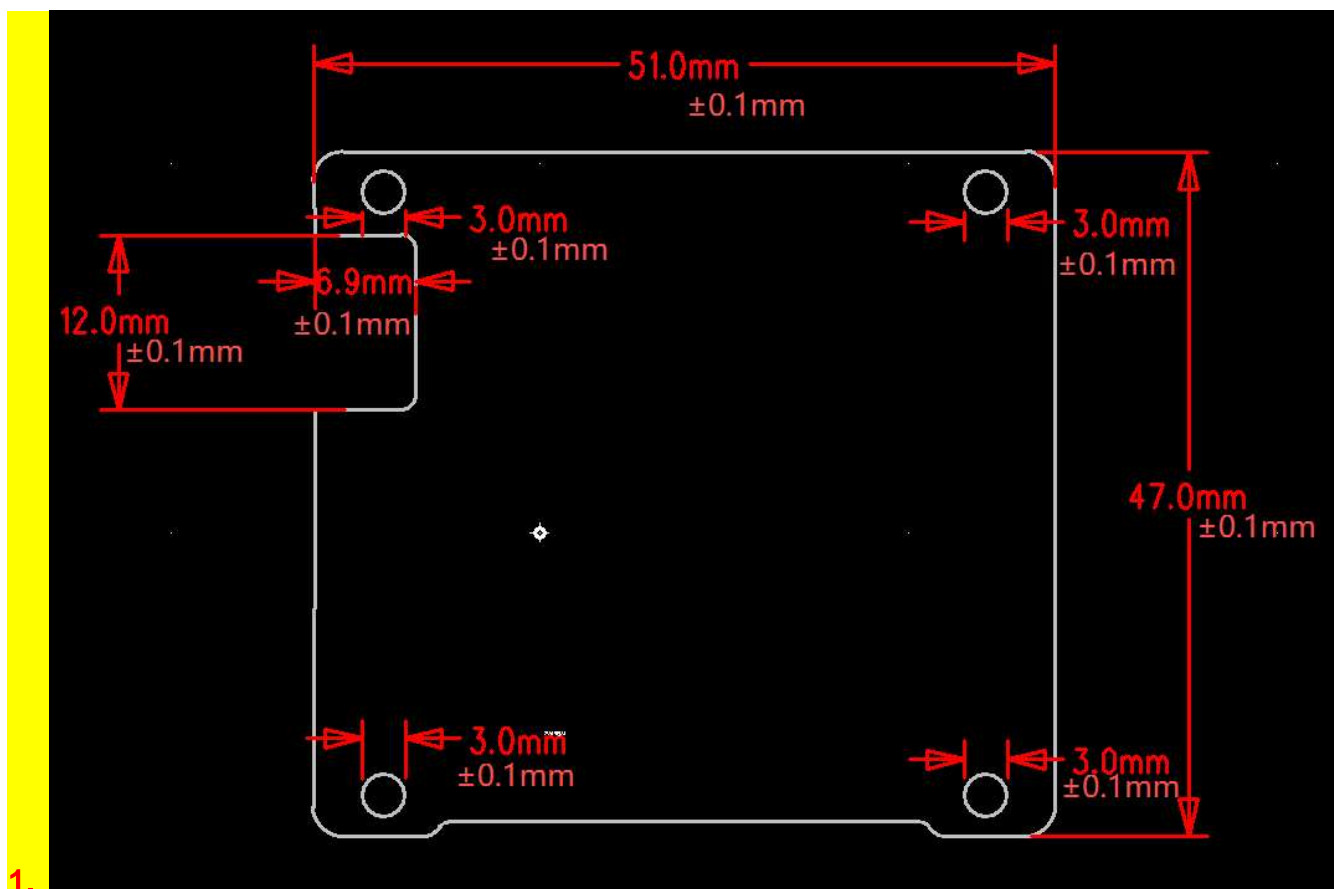
➤ Preface

- **The purpose of this manual is to provide relevant technical documents for the design, manufacturing and other processes of the CE-BTSP5-MAIN-PCB.**

➤ Product characteristics specification overview

1. Bluetooth Version: Bluetooth 5.4 Dual-mode (Classic+LE Audio)
Operating Frequency Band: 2.402-2.480 GHz ISM Band
Transmit Power: +9 dBm (Typical)
2. Supported Profiles:
Classic Bluetooth (BR/EDR): A2DP, AVRCP, HFP, HSP, PBAP, SPP; Bluetooth Low Energy (BLE): GATT, ATT
3. Audio Decoding Modes: SBC, AAC, aptX, aptX HD (24bit/48kHz), aptX Adaptive, aptX Lossless, LDAC.
4. The product complies with RoHS2.0 and REACH-SVHC, and meets Halogen-Free (HF) requirements;
The product has passed RF testing by Bluetooth SIG, as well as certification testing for FCC (USA), Telec (Japan), CE (EU) and UKCA (UK).

➤ Product outline dimensions



➤ User Interaction

① Multi-function button	② Volume Up button	③ Volume Down button		
Pairing Mode 1	①	Press and hold (1 sec) while power ON	Bluetooth pairing standby	Red & Blue flashing
Play / Pause		Click during Bluetooth connection	Play / Pause music	—
Call		Click during Bluetooth connection	Start / End call	—
Mono Mode Setting		Triple-click during Bluetooth connection	Start mono mode setting	Yellow → White → Green
Positioning Setting	①+②	Double-click during Bluetooth connection	Enter main unit 3D command input	Yellow → White → Green
Mode Switch		Press while power ON	Start positioning setting mode	Yellow → White → Green
Pairing Mode 2	①+③	Press and hold (2 sec) while power ON	Enter main unit 3D command input	White flashing every 0.5 seconds
Reset Positioning Setting	①	Click 5 times while power ON	Switch modes (Standard → Music → Movie → Mono → Standard)	Cyan & Blue flashing
			CearLINK (Auracast™) pairing standby	—
			Reset CearLINK positioning setting	—

➤ Design specification parameter

1. Supports Classic Audio, LE Audio and Auracast, adopting Class-D Amp
2. Audio Output Power: 2 x 15W, supporting Hi-Res (up to 40kHz)
3. The product is powered by a 2-cell Li-ion battery (2S1P, 7.4V)
4. Signal-Noise Ratio at Rated Output Power ≥ 85 dB

FCC Statement

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.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: 2BUGSCE-BTSP5" Or "Contains FCC ID: 2BUGSCE-BTSP5 "

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. 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.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

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

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with Limited Single modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C : 15.247 and 15.209 requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 requirement, then the host can be sold legally.

Limited module procedures:

This module is limited to Cear, Inc. use ONLY.

The module has no RF shielding and will be installed in Bluetooth speaker.

Installation Notes:

- 1) CE-BTSP5 Module Power supply range is DC 7.4V, when you use CE-BTSP5 Module design product, the power supply cannot exceed this range.
- 2) Make sure the module pins correctly installed.
- 3) Make sure that the module does not allow users to replace or demolition
- 4) Any modifications to the module model CE-BTSP5 may invalidate regulatory approvals or may necessitate notifications to the relevant regulatory authorities.
- 5) Any changes which may require the Class I or Class II permissive changes for the FCC.
- 6) The Class II permissive changes is required for each specific host installation
- 7) Test plan for Class II permissive changes (C2PC)

1. Conducted Emission AC Power Port (FCC Part 15.207)

Test mode 1: BLE 1M GFSK-2402MHz

Test mode 2: BLE 1M GFSK-2440MHz

Test mode 3: BLE 1M GFSK-2480MHz

Test mode 4: BLE 2M GFSK-2402MHz

Test mode 5: BLE 2M GFSK-2440MHz

Test mode 6: BLE 2M GFSK-2480MHz

Test mode 7: BT 1M GFSK-2402MHz

Test mode 8: BT 1M GFSK-2441MHz

Test mode 9: BT 1M GFSK-2480MHz

Test mode 10: BT 2M $\pi/4$ -DQPSK -2402MHz

Test mode 11: BT 2M $\pi/4$ -DQPSK -2441MHz

Test mode 12: BT 2M $\pi/4$ -DQPSK -2480MHz

Test mode 10: BT 3M 8DPSK -2402MHz

Test mode 11: BT 3M 8DPSK -2441MHz

Test mode 12: BT 3M 8DPSK -2480MHz

2. Antenna Port Conducted Output Power (FCC Part 15.247(b))

Test mode 1: BLE 1M GFSK-2402MHz

Test mode 2: BLE 1M GFSK-2440MHz

Test mode 3: BLE 1M GFSK-2480MHz

Test mode 4: BLE 2M GFSK-2402MHz

Test mode 5: BLE 2M GFSK-2440MHz

Test mode 6: BLE 2M GFSK-2480MHz

Test mode 7: BT 1M GFSK-2402MHz

Test mode 8: BT 1M GFSK-2441MHz

Test mode 9: BT 1M GFSK-2480MHz

Test mode 10: BT 2M $\pi/4$ -DQPSK -2402MHz

Test mode 11: BT 2M $\pi/4$ -DQPSK -2441MHz

Test mode 12: BT 2M $\pi/4$ -DQPSK -2480MHz

Test mode 10: BT 3M 8DPSK -2402MHz

Test mode 11: BT 3M 8DPSK -2441MHz

Test mode 12: BT 3M 8DPSK -2480MHz

Note: Test that the BLE conducted power range must be 8 - 9dBm, If a new installed host that Conducted Power exceeding 10dBm, a new grantee must be required

Test that the BT conducted power range must be 9.7-13.54dBm, If a new installed host that Conducted Power exceeding 14dBm, a new grantee must be required

3. Radiated Emission (FCC Part 15.205, FCC Part 15.209 and FCC Part 15.247(d))

Test mode 1: BLE 1M GFSK-2402MHz

Test mode 2: BLE 1M GFSK-2440MHz

Test mode 3: BLE 1M GFSK-2480MHz

Test mode 4: BLE 2M GFSK-2402MHz

Test mode 5: BLE 2M GFSK-2440MHz

Test mode 6: BLE 2M GFSK-2480MHz

Test mode 7: BT 1M GFSK-2402MHz

Test mode 8: BT 1M GFSK-2441MHz

Test mode 9: BT 1M GFSK-2480MHz

Test mode 10: BT 2M $\pi/4$ -DQPSK -2402MHz

Test mode 11: BT 2M $\pi/4$ -DQPSK -2441MHz

Test mode 12: BT 2M $\pi/4$ -DQPSK -2480MHz

Test mode 10: BT 3M 8DPSK -2402MHz

Test mode 11: BT 3M 8DPSK -2441MHz

Test mode 12: BT 3M 8DPSK -2480MHz

Note: These tests be based on C63.10 and FCC Part 15.247 as guidance, according to the operating frequency High, mid and low channel test.

Requirement per KDB996369 D03

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.³

Explanation: This module meets the requirements of FCC part 15.247.

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users,

then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT has a Chip Antenna, and the antenna use a permanently attached antenna which is not replaceable.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval. This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is a Limited Single Modular

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: Not applicable, the module use ceramic antenna.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: 2BUGSCE-BTSP5

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT has a chip Antenna, and the antenna use a permanently attached antenna which is unique.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: “Contains FCC ID: 2BUGSCE-BTSP5

2.9 Information on test modes and additional testing requirements⁵

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

Explanation: Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.