REVISION AND UPDATES

REV	ECN NO.	DESCRIPTION	DATE	BY
00	N/A	1. First Release (EVT)	2022/03/10	Vincent Tung
01	N/A	1. Update Block Diagram in item 3.1. 2. Update PID and product string info in item 5.2. 3. Update Regulatory requirement & Selling countries in item 9. 4. Update Package specification in item 12. 5. Update module layout guidelines in item 11.	2022/04/13 2022/05/19 2022/05/19 2022/05/19 2022/05/19	Vincent Tung Thum Keng How Leon Lee Qincao.Li Vincent Tung
02	N/A	1. Updata Figure 3.4-1 Dimensions and board assembly. 2. Updata Figure 3.5-1 Module footprint for assembly on a carrier board. 3. Update item 6.1 Shielded case drawing. 4. Update item 6.3 PCBA Dimensions drawing. 5. Update item 9 Certificate test plan. 6. Add item 11.2 Package Moisture Sensitivity Level. 7. DVT1 Version release.	2022/07/06	Vincent Tung
03	N/A	1. Change Bluetooth version 5.2 to 5.3 in item 2.6. 2. Updata Figure 3.4-1 Dimensions and board assembly. 3. Updata Figure 3.5-1 Module footprint for assembly on a carrier board. 4. Update item 6.3 PCBA Dimensions drawing. 5. Updata Figure 10.5-1 Top View (Unit : mm)Recommended solder pad layout. 6. DVT2 Version release.	2022/09/27	Vincent Tung

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Customer's Product Specification
Customer: A27
PRODUCT NAME: ULL Module
MODEL NO: Ralphie
PART NO:
REV.: 00

FCC

15.19

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.

15.105(b)

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.

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15.21

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment."

FCC RF Radiation Exposure Statement:

1. This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

2. This equipment 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.

IC

"This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). 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.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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 radioelectrique subi, meme si le brouillage est susceptible d'en compromettre le fonctionnement."

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"Caution: Exposure to Radio Frequency Radiation

1. To comply with the Canadian RF exposure compliance requirements, this device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter."

2. To comply with RSS 102 RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.

"Attention: exposition au rayonnement radiofréquence

1. Pour se conformer aux exigences de conformité RF canadienne l'exposition, cet appareil et son antenne ne doivent pas être co-localisés ou fonctionnant en conjonction avec une autre antenne ou transmetteur."

2. Pour se conformer aux exigences de conformité CNR 102 RF exposition, une distance de séparation d'au moins 20 cm doit être maintenue entre l'antenne de cet appareil et toutes les personnes

Required End Product Labeling

Any device incorporating this module must include an external, visible, permanent marking or label which states:
“Contains FCC ID: B94TNM101D” and “Contains IC :466X-TNM101D”

Obligation d'étiquetage du produit final:

Tout dispositif intégrant ce module doit comporter un externe, visible, marquage permanent ou une étiquette qui dit: "Contient IC : 466X-TNM101D”

Additional testing, Part 15 Subpart B disclaimer

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.

The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

FCC

This module has been tested and found to comply with the following requirements for Modular Approval.
Part 15.247 - Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

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Test Modes

This device uses various test mode programs for test set up which operate separate from production firmware. Host integrators should contact the grantee for assistance with test modes needed for module/host compliance test requirements.

Antennas

This radio transmitter has been approved by the FCC and ISED to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Antennes

Cet émetteur radio a été approuvé par la FCC et ISED pour fonctionner avec les types d'antennes répertoriés ci-dessous avec le gain maximal autorisé indiqué. Les types d'antennes non inclus dans cette liste, ayant un gain supérieur au gain maximum indiqué pour ce type, sont strictement interdits pour une utilisation avec cet appareil.

Radio	Antenna Type	Freq. (MHz)	Max. Peak Antenna Gain (dBi)
Bluetooth	**PIFA**	2402-2480	**3.41**
Bluetooth	**PIFA**	2402-2480	**2.73**
Bluetooth	**PIFA**	2402-2480	**-0.65**
Bluetooth	**PIFA**	2402-2480	**2.43**
Bluetooth	**PIFA**	2402-2480	**0.97**

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 shown in User manual.

In the end product, the antenna(s) used with this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operation in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures. User and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying the RF exposure compliance.

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NCC

根據 NCC LP0002 低功率射頻器材技術規範_章節 3.8.2：

取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻器材之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前述合法通信，指依電信管理法規定作業之無線電通信。

低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

此模組於取得認證後將依規定於模組本體標示審驗合格標籤，並要求平台廠商於平台上標示

或相似含意的標示

JP

FCC ID of this device is FCC ID:B94TNM101D

ISED Model and certificate number of this device is TPN-M101D and IC:466X-TNM101D

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1 GENERAL PRODUCT SPECIFICATION FOR DEVICE

1.1 Product part number list – Merry

ITEM	MODEL NO.	PART NO.	SHIP PLACE	TYPE
1	MX-121-001-01	89M121001001		

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2 FEATURES

2.1 Host processor subsystem

- ARM® Cortex®-M4 (CM4) with Floating Point Unit (FPU) application processor
- Supports Memory Protection Unit (MPU)
- Supports Nested Vectored Interrupt Controller (NVIC) with 41 interrupt sources each with up to 16 levels of priority.
- Support Serial Wire Debug (SWD, 2 pins) and JTAG (5 pins) debug interface.
- Support breakpoints, watchpoints, stepping, vector catching, data matching. Complete debug
  features.
- Maximum speed: 208MHz 192kB memory with zero wait state. It can be programmed as L1 cache or Tightly Couple Memory (TCM).
- Configurable L1 cache size: 32kB, 16kB, 8kB or 0kB
- eXecute In Place (XIP) on flash memory
  DSP processor

2.2 DSP processor subsystem

- Cadence® HiFi Mini®Audio Engine DSP coprocessor with HiFi EP® extension
- 7-stage pipeline
- Maximum speed: 416MHz
- Support Memory Management Unit (MMU) for memory protection with translation
- 32 maskable interrupts with 4 priority levels and a NMI (non-maskable Interrupt)
- 16kB instruction cache and 16kB data cache with high hit rate and zero wait state
- 192kB instruction RAM with zero wait state
- 512kB data RAM with zero wait state and two memory banks to increase co-access performance.

2.3 Memory summary

- On-die memories (SRAMs) with up to 192kB at CPU clock speed with zero wait state.
- Low latency 400kB system RAM (SYSRAM) with maximum speed 208MHz
- System in Package (SiP) 32Mb low-power flash memory with 0.1μA deep-down current (typical condition) and maximum speed 104MHz

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2.4 Platform

- Dynamic Frequency Scaling (DFS)
- 30 DMA channels
- RTC timer
- Nine general purpose timers (GPT s)
- Watchdog timer (WDT)
- Crypto engine for AES/SHA1/SHA224/SHA256
- True random number generator
- Ambient temperature from -40°C to 85°C

2.5 Peripheral

- One USB2.0 device
- One MSDC (eMMC4.41 / SDIO v2.0) up to 48MHz
- Three I2C interfaces up to 3.4Mhz
- Three UART interfaces up to 3Mbps
- SPI master interfaces up to 52MHz
- ESC external sram control interface up to 52MHz
- One SPI slave interface up to 52MHz
- PWM channels
- 12-bit AUXADC channels

2.6 Connectivity (Bluetooth) features overview

- ULL Module offers a highly integrated Bluetooth radio and baseband processor.
- ULL Module is fully compliant with Bluetooth version 5.3. It is upgradable to later versions, including BR/EDR and Bluetooth LE1M/2M and offers enhanced data rates of up to 3Mbps.

2.6.1 Bluetooth RF

- Fully compliant with Bluetooth core specification 5.3.
- Low-IF architecture with high degree of linearity and high order channel filter.
- Integrated T/R switch and balun.
- Hardware AGC dynamically adjusts the receiver performance in changing environments.

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2.6.2 Bluetooth baseband

- Bluetooth specification V5.3 + dual mode + isochronous channel
- Up to four simultaneous active ACL links.
- Up to four simultaneous active Bluetooth LE links.
- Support for single SCO or eSCO link with CVSD/mSBC coding.
- Support for BLE1M/2M
- Up to simultaneous active ICO/ICL links (ICO+ICL links=4)
- AFH and PTA collaborative support for WLAN/Bluetooth coexistence.
- Supports PCM interface and built-in programmable transcoders for linear voice with re-transmission.
- Built-in hardware modem engine for access code correlation, header error correction, forward
  error correction, CRC, whitening and encryption.
- Channel quality driven data rate adaptation.
- Channel assessment for AFH.

2.6.3 Power management unit (PMU) features overview

- Input range: 4.5V ~ 5.5V
- Low quiescent buck converters and LDOs.
- Ultra-low quiescent current with regulators.
- Over-current and thermal overload protection
- Under voltage lockout protection
- Adjustable Over-Voltage Protection Switches
- Watchdog reset
- Flexibility hardware PMU reset function
- Power-on reset and start-up timer

2.7 Compact size with

- (L) 14 x (W) 12 x (H) 2.1 mm.

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3 FIRMWARE SPECIFICATION

3.1 Feature/Description

- Support low latency mode when connected with the well-matched earbuds
- Support firmware update via USB connection
- Enter low power mode when USB host in standby mode
- PC control synchronization (audio/media control)
- Support HID interface with the PC client application

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3.2 USB Interface

USB Descriptors

Items	Fields
VID	0x03F0
PID	0x099C
Manufacturer String	HP, Inc
Product Name	HyperX Wireless Audio

USB Specifications

Items	Description
USB Device Type	USB Audio Class 1.0
USB Test Requirement	USB Chapter 9
Playback Device Type	Speaker
Playback Channels	Stereo
Playback Bitrate	16-bit
Playback Sampling Frequency	48000 Hz
Recording Device Type	Microphone
Recording Channels	Mono
Recording Bitrate	16-bit
Recording Sampling Frequency	16000Hz
Minimum Vendor Pages	3 pages ▪ Usage: 0x0001 ▪ Usage Page: 0x01C0 ○ App specific commands ○ Uses Set/Get Feature Reports ▪ Usage Page: 0x170F ○ App specific notifications ○ Uses Read ▪ Usage page: 0xFFC0 ○ Factory specific commands ○ Uses Write/Read

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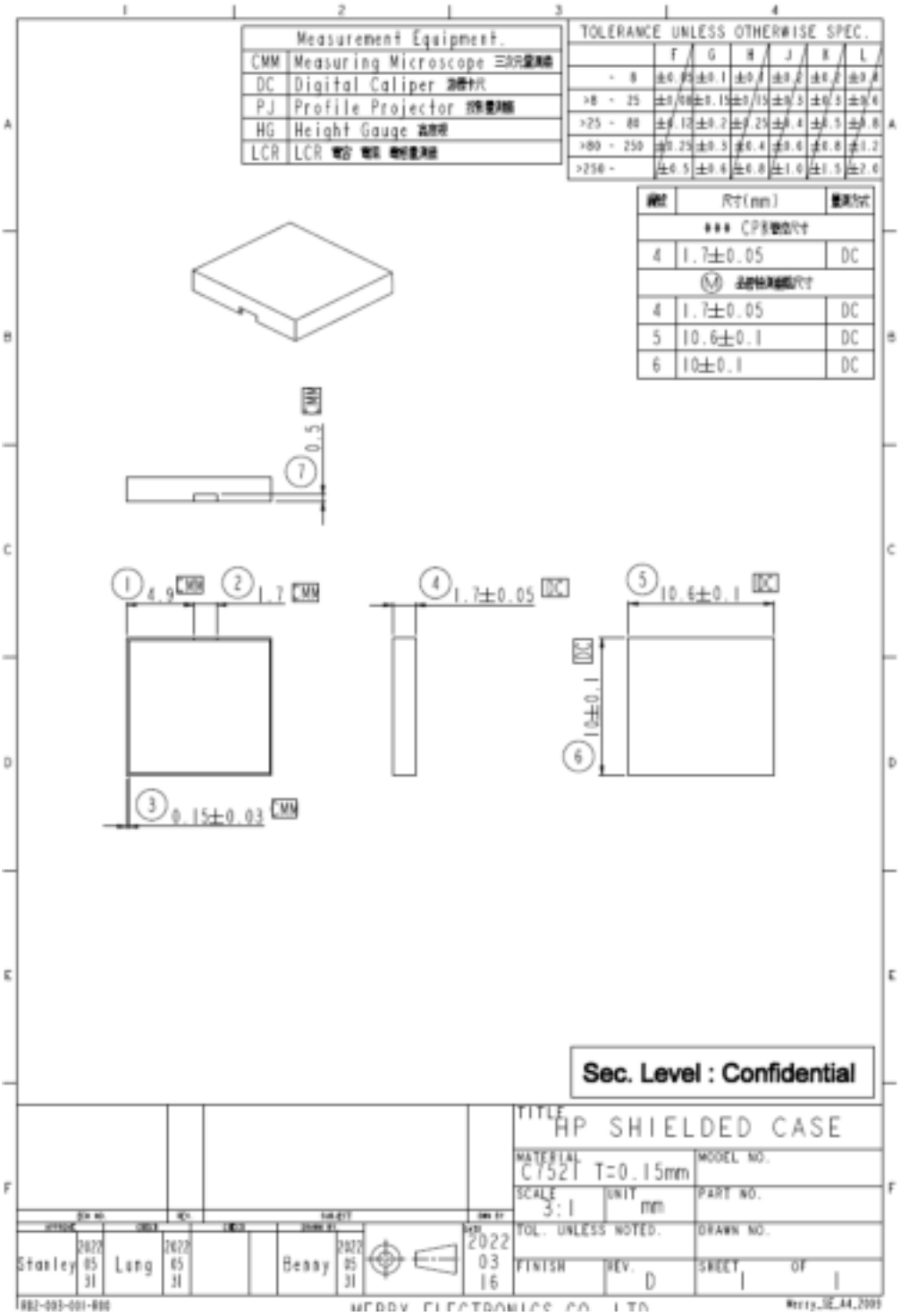
4 MECHANICAL

4.1 Shielded case drawing



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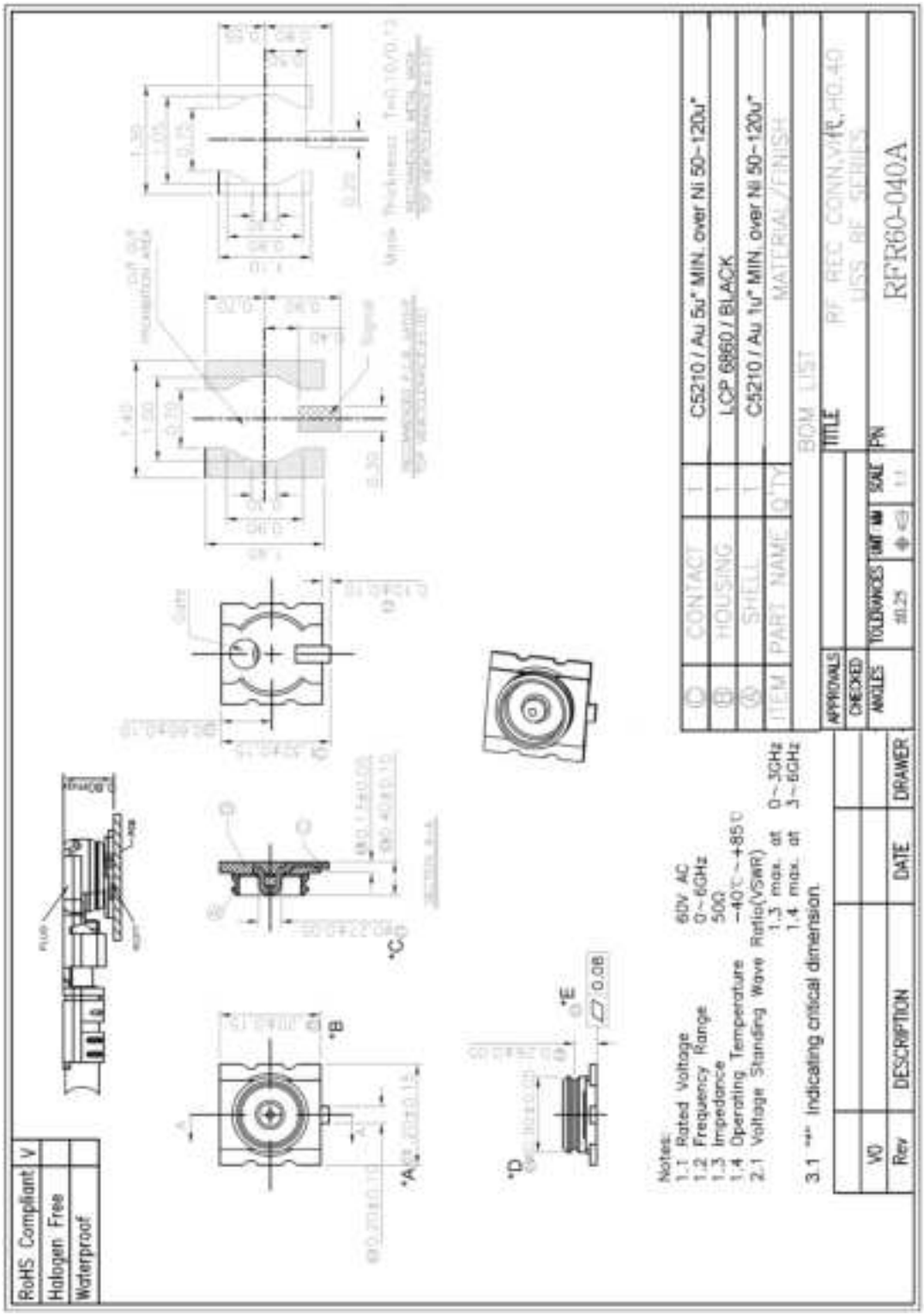
4.2 Antenna connector detail



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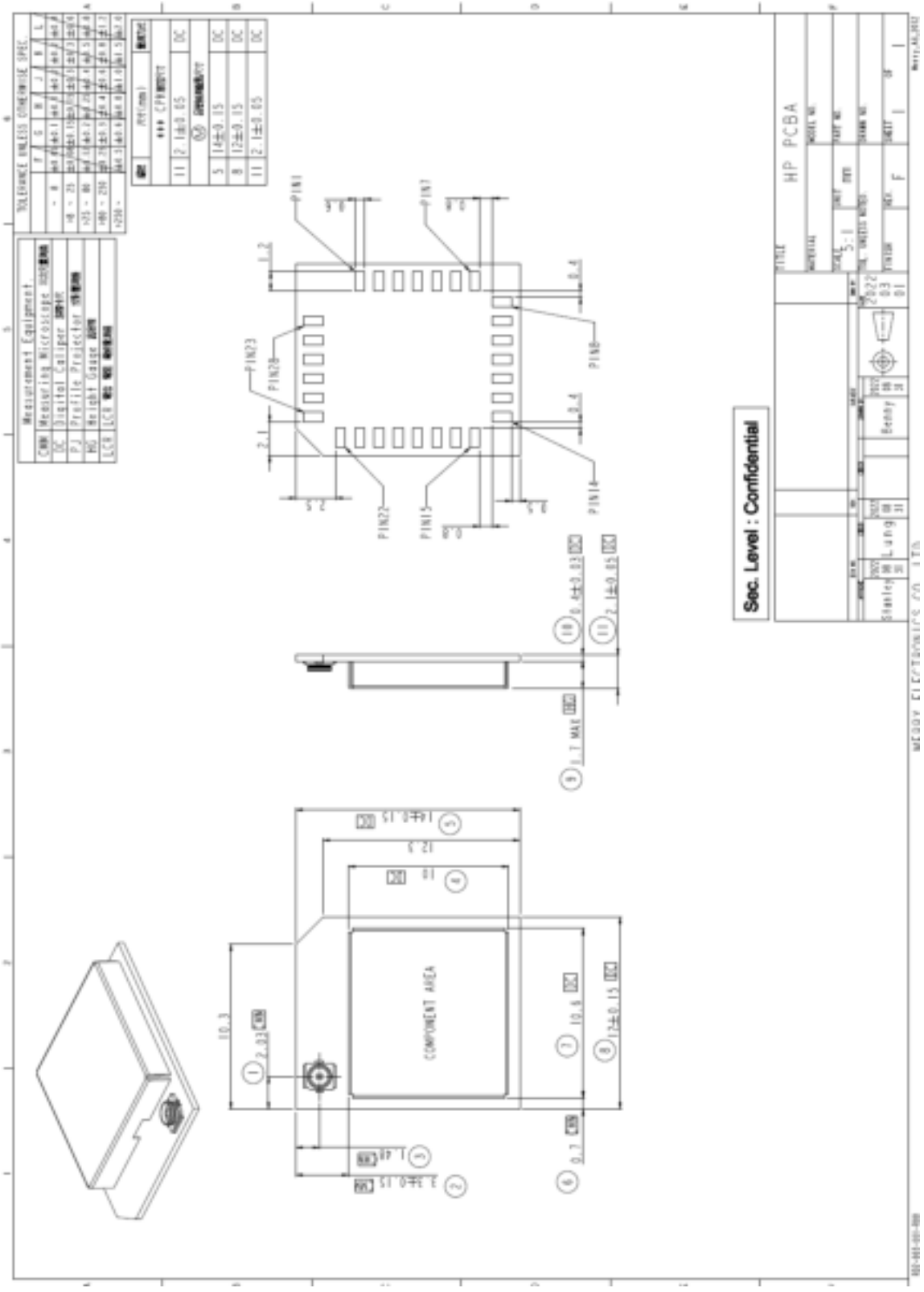
4.3 PCBA Dimensions drawing



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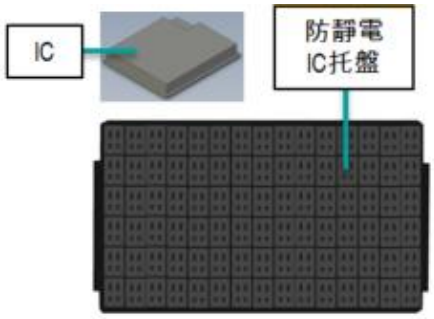
5 PACKAGE SPECIFICATION

5.1 PCBA 板 136PCS 裝入防靜電 IC 托盤內(圖示僅供參考）

136PCS PCBA put into anti-static IC tray (Picture for reference only)



5.2 5 層托盤合計裝入 680PCS 的 PCBA 板子

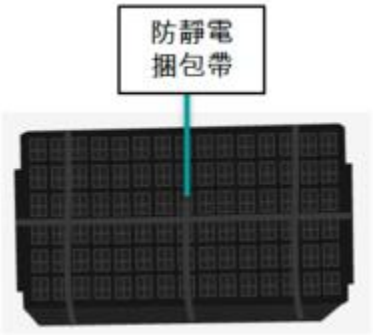
680PCS PCBA in total put into 5-layer tray.

5.3 頂部放入 1 張空托盤防護

Put an empty tray on top for protection

5.4 使用防靜電捆包帶，依如下圖示捆扎

Use anti-static strapping to bundle it as below picture showed.



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5.5 二包干燥劑&濕度卡。(依下圖示擺放)

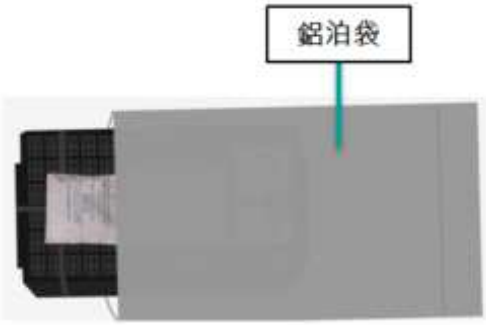
Prepare two bags of desiccant & one humidity card. (Place them as below picture showed.)

5.6 擺放完成品裝入鋁泊集袋內

Put final product into the aluminum container bag

5.7 依要求完成抽真空包裝

Complete vacuum packaging as required



5.8 鋁泊袋外依要求粘貼出貨標貼后裝入瓦楞盒（標貼圖示僅供參考）

Paste a shipping label on aluminum bag, then put it into the corrugated paper box. (Label info. TBD)

5.9 瓦楞盒外依要求粘貼出貨標貼（標貼示意圖僅供參考）

Shipping labels are pasted on the corrugated paper box. (Label info. TBD)

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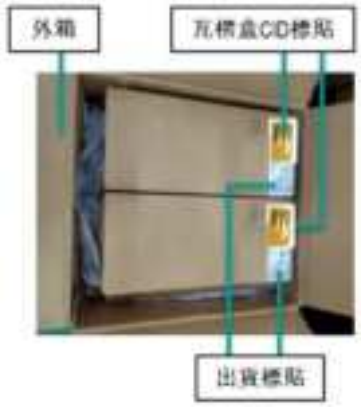
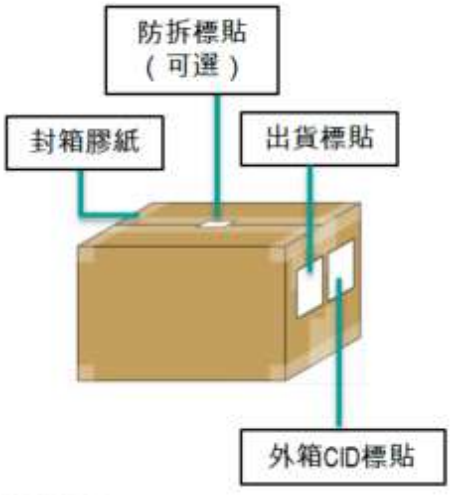
5.10 紙箱內并排放入 2PCS*2 層，合計 4PCS 瓦楞盒裝。

4PCS of corrugated paper box put into carton, 2PCS*2 layers placed side by side



5.11 紙箱外粘貼防拆標貼&外箱標貼（標貼內容圖示僅供參考）

Stick tamper sticker & carton label on the carton (label info. TBD)



(label info.)

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