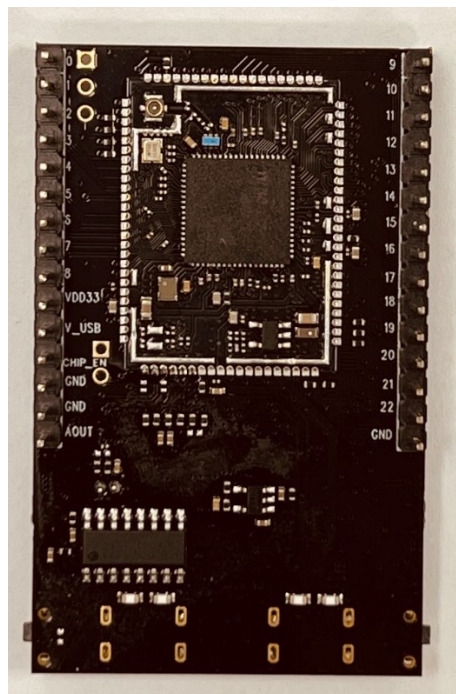


REALTEK

RTL8735BDM User Guide



Rev. 4
2024

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ESD Protection

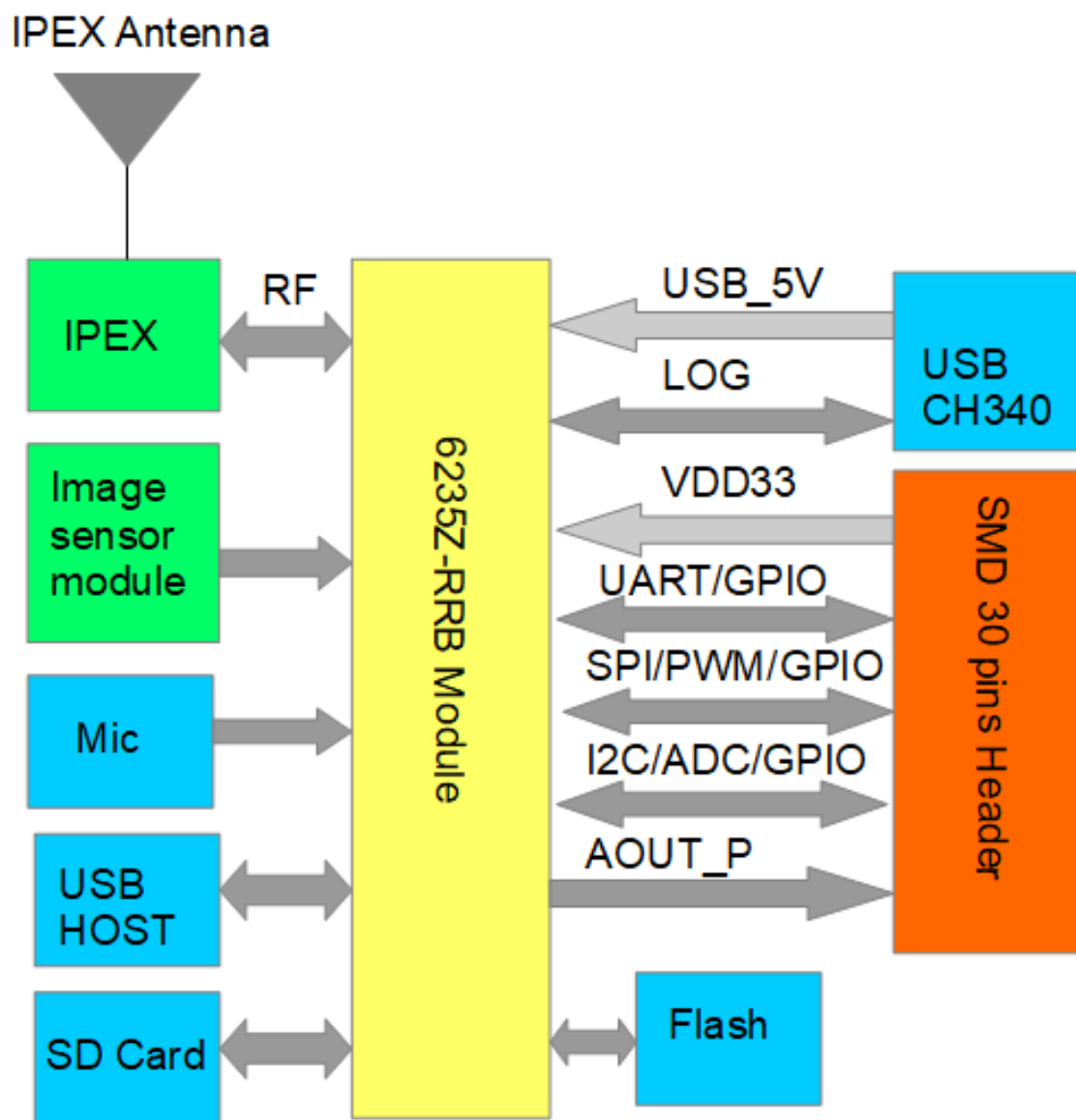
AMB82-MINI Development Board is electrostatic sensitive device, ESD protection measures should be taken when carrying.



1. Product Overview

AMB82-MINI is a development board designed for RTL8735BDM module. RTL8735BDM is a dual-frequency Wi-Fi + Bluetooth SoC module based on RTL8735BDM chip.

RTL8735BDM (also named AmebaPro-II) is a highly integrated low power 802.11 a/b/g/n Wireless LAN (WLAN) and Bluetooth camera SoC. It combines ARM v8M MCUs (500MHz and 2.23 DMIPS/MHz), WLAN MAC, a 1T1R capable WLAN baseband, Bluetooth MAC, RF, audio codec, ISP and H264/H265 encoder in a single chip. It provides useful high speed connectivity interfaces, such as USB 2.0 host, SD host interfaces. It also provides a bunch of configurable GPIOs which are configured as digital peripherals for different application and control usage.



1.1. Characteristic

MCU Features

- Real-M500 (TM9) clock frequency up to 500MHz
- I-Cache 32KB/D-Cache 32KB
- eXecute In Place (XIP) on NOR flash
- Internal Memory
- Supports 768KB ROM
- Supports 512KB RAM
- Supports external flash interface
- Supports MCM embedded 64MB/128MB DDR2 Memory

ISP Features

- Advanced temporal and spatial noise reduction(3DNR)
- Support major brands of DOL-HDR or Staggered-HDR sensors
- Support MIPI CSI-2 data lane
- Support Auto Banding, Auto Exposure, Auto White Balance
- Black level compensation and dead pixel cancellation
- Lens shading compensation
- Advanced contrast adjustment and sharpness enhancement
- Programmable color matrix and gamma table
- Digital WDR
- Image enhancement(brightness, contrast, saturation, hue and sharpness)
- ISP tuning tool

Graphic Processing

- Digital resolution scaling down
- Multiple stream outputs and various formats: NV12, RGB888
- Each stream has individual OSD overlay
- Support motion detection and private mask

Video Encoding

- Max 5-megapixel resolution for H.264/H.265 encoding
- H.264 Baseline/Main/High profiles, levels 4.1
- H.265 Main and Main Still profiles, levels 4
- JPEG/MJPEG Baseline and Max 5-megapixel resolution for JPEG encoding
- Multiple streams real-time H.265/H.264/JPEG encoding
- H265 2M@30fps + H265 1M@30fps
- CBR/VBR rate control

Audio

- Built-in Audio Codec
- 1 way Audio analog output for earphone
- 1 way Audio analog input on board

WIFI Features

- 802.11 a/b/g/n compatible 1x1, 2.4GHz/5GHz
- 802.11e QoS Enhancement (WMM)
- Wi-Fi WEP, WPA, WPA2, WPA3, WPS. Open, shared key, and pair-wise key authentication

services

- Supports low power Tx/Rx for short-range application
- Frame aggregation for increased MAC efficiency (A-MSDU, A-MPDU)
- Low latency immediate High-Throughput Block Acknowledgement (HT-BA)

Bluetooth Features

- Bluetooth Low Energy (BLE) 5.1
- Supports LE secure connections
- Supports LE scatternet
- Supports 1 Master/1 Slave
- Crypto engine: MD5, SHA-1, SHA2-224, SHA2-256, HMAC, AES
- ECDSA, ED25519
- RSA

SD Card Features

- Support SD version 3.0
- Support card capacity up to 2TB
- Support 3.3V and 1.8V operating voltage

Peripheral Interfaces

- Support UART、I2C、SPI interface for external device
- Support PWM interface with configurable duration and duty cycle from 0 ~ 100%
- Support ADC channel with 12-bit mode
- Maximum 59 programmable GPIOs

2. Main Parameters

Model	AMB82-MINI
Suitable modules	RTL8735BDM
Package	DIP-30(2.54 spacing standard row pin)
Size	60*37.4mm
WIFI Antenna	External 4th IPEX antenna
Spectrum Range	2400-2483.5MHz or 5180-5825MHz
WIFI	Supports 802.11 a/b/g/n
Bluetooth	BLE 5.1
Operation temperature	-20℃ ~ 85℃ , from main chip point of view
Storage environment	-40℃ ~ 105℃ , < 90%RH
Power supply	Supply voltage 5V current greater than 1000mA
Interfaces	UART/GPIO/ADC/PWM/IIC/SPI/ MIPI
Audio	Built-in Analog Microphone
Video	MS-SA816988B01-R Image Sensor Module
SD Card	Support SD version 3.0
USB	One is RTL8735BDM USB 2.0 host, the other is debug log
Flash	SPI NOR Flash 16MB

2.1. Power supply selection

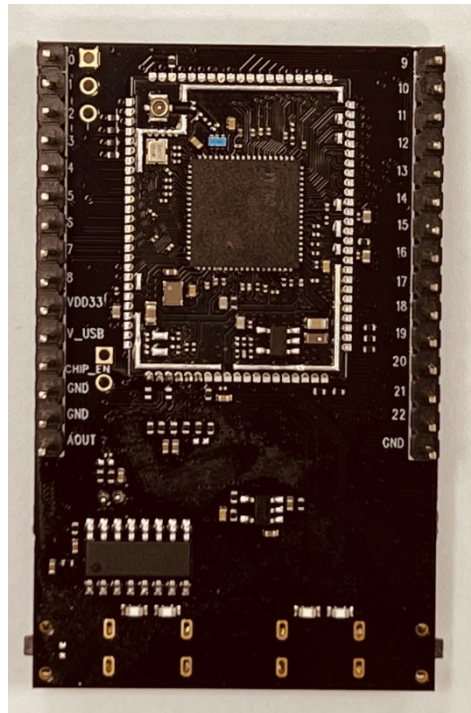
You can choose one of the following methods to supply power for AMB82-MINI:

- Micro USB interface power adapter, recommend the rated current $\geq 1A$
- External 5V power supply on V_USB and GND pin.

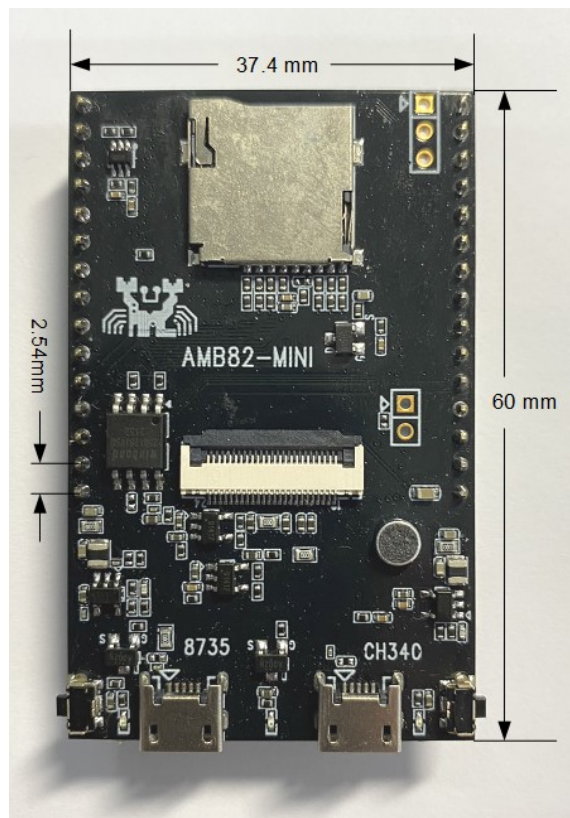
2.2. Electrical characteristics

Parameter	Symbol	Min	Typ.	Max	Units
5V Supply voltage	V_USB	4.75	5	5.25	V
Digital I/O voltage	-	3.135	3.3	3.465	V
Input-High Voltage	V _{IH}	2.0	-	-	
Input-Low Voltage	V _{IL}	-	-	0.8	V

3. Appearance size



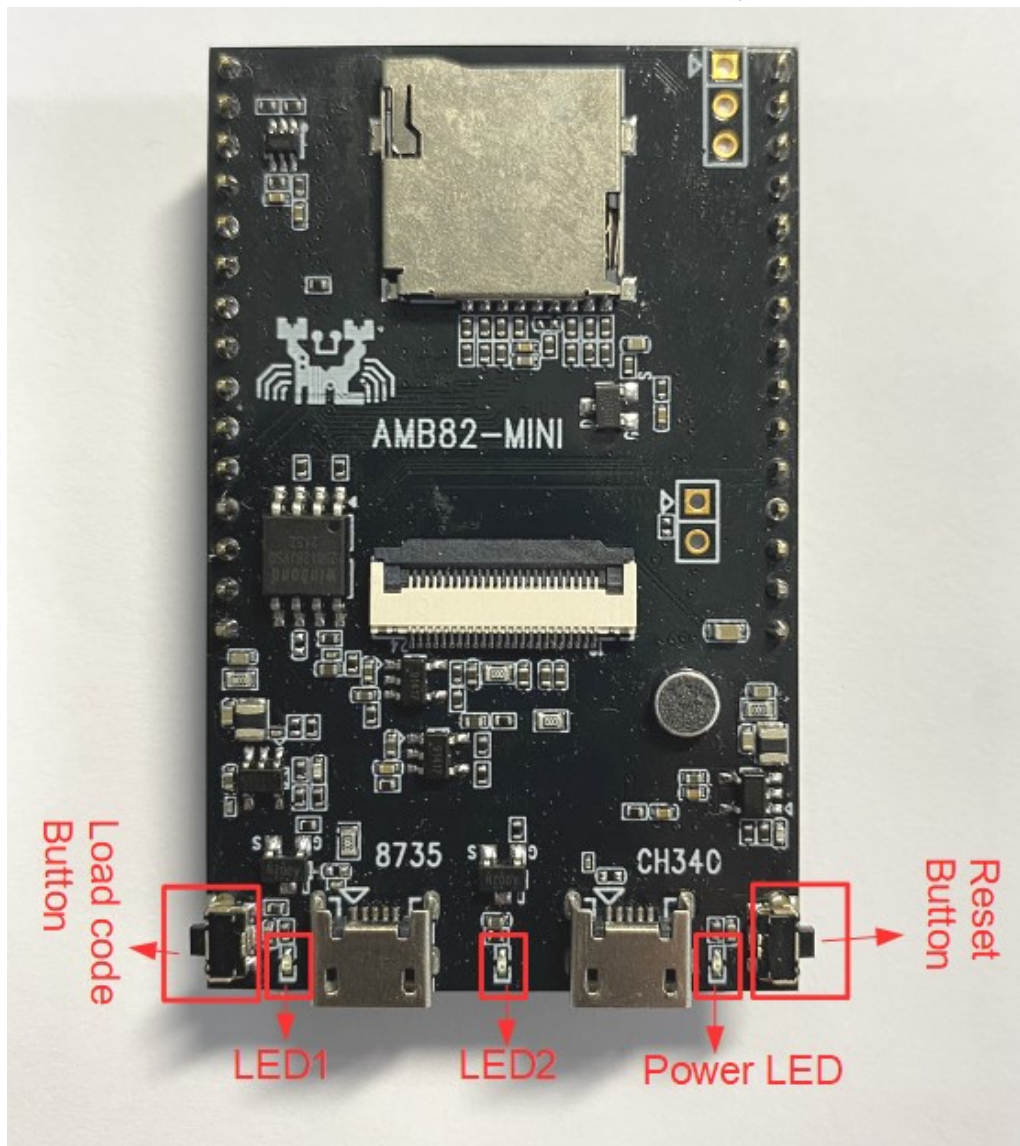
Back Side



Front Side, Board Size

4. Led indicator and button description

There are three LED indicators and two buttons on AMB82-MINI, as shown in following figure:



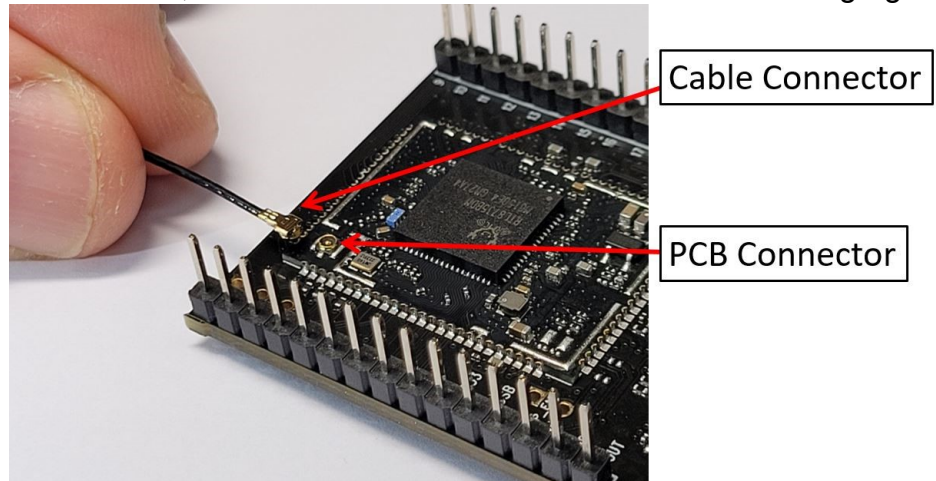
Led indicator and button	LED status or button function	Remarks
Power LED	5V power indicator	When 5V power is supplied, the LED is on.
LED1	Blue LED by user defined	Controlled by PF9
LED2	Green LED by user defined	Controlled by PE6
Reset Button	Reset system	/
Load code Button	Set system to load code mode	Press Button into load code mode.

5. Assembly

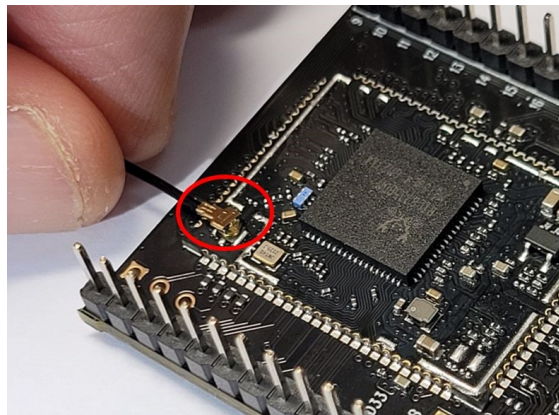
There are two accessories for AMB82-MINI, one is IPEX RF antenna and the other is image sensor module.

5.1. How to assemble IPEX RF antenna

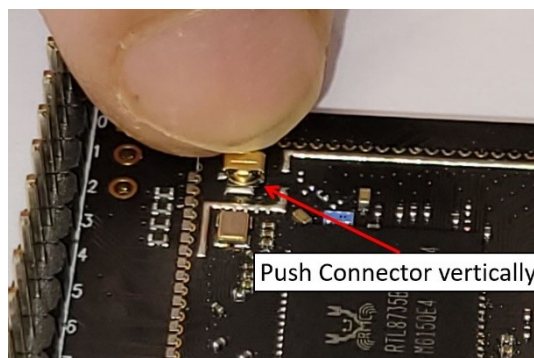
Step 1 : Keep AMB82-MINI at back side, hold the cable connector as shown in following figure:



Step 2 : Combine cable connector with PCB connector, please check they are set firmly.

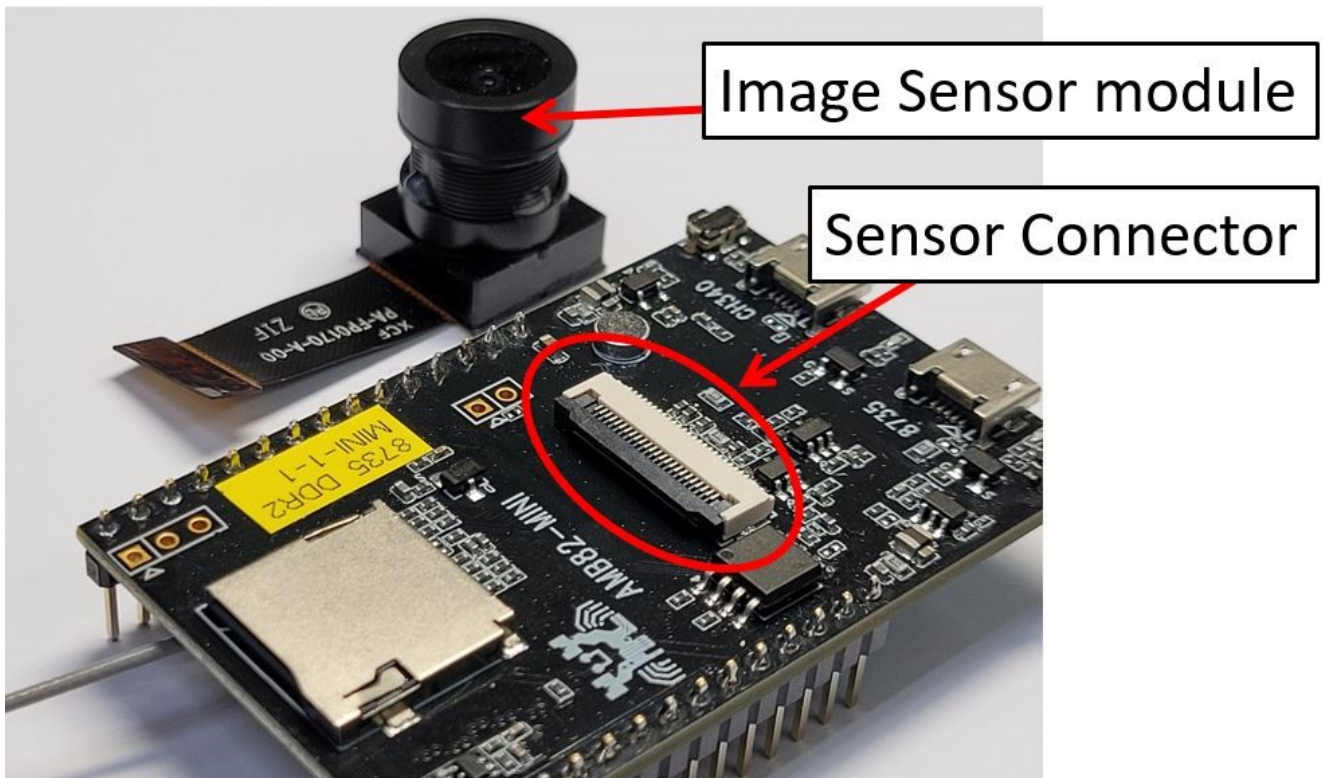


Step 3 : Push cable connector at center location vertically. The connectors mating action is completed when click sound could be heard.

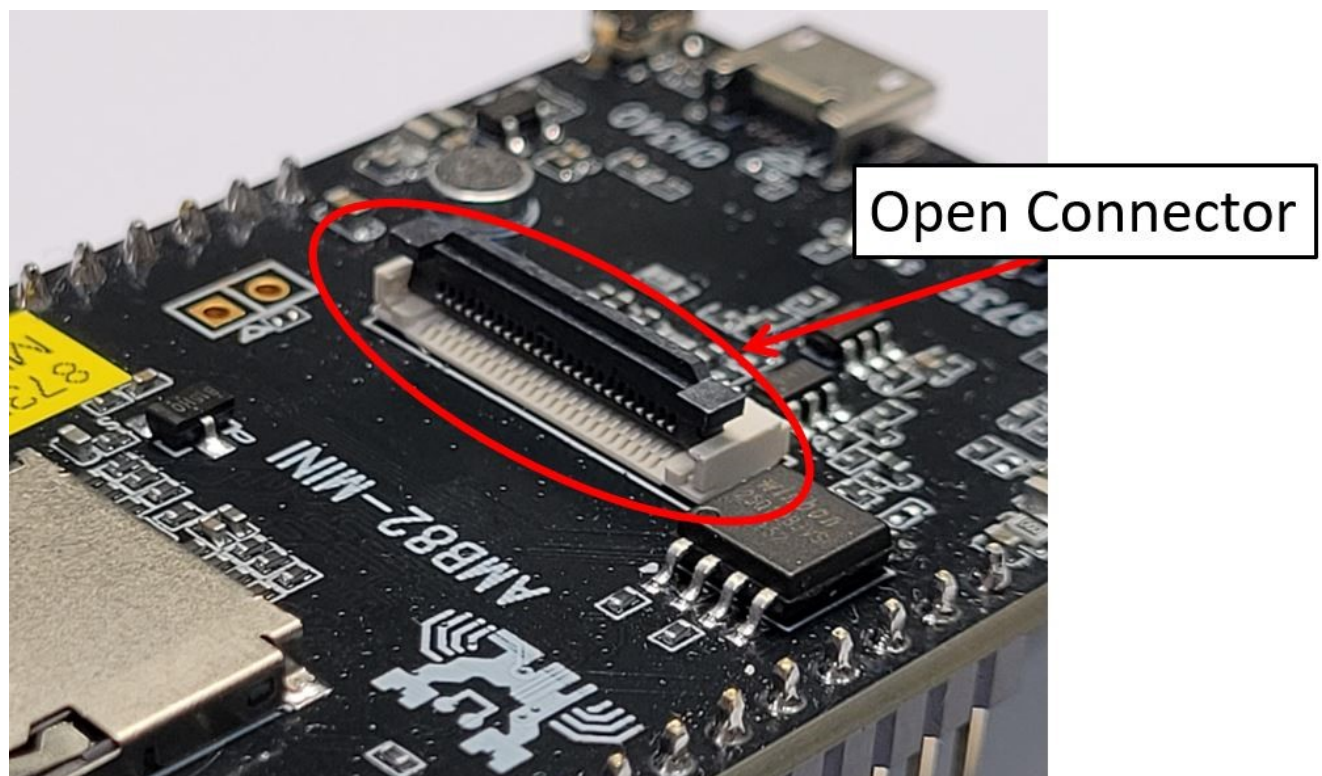


5.2. How to assemble image sensor module

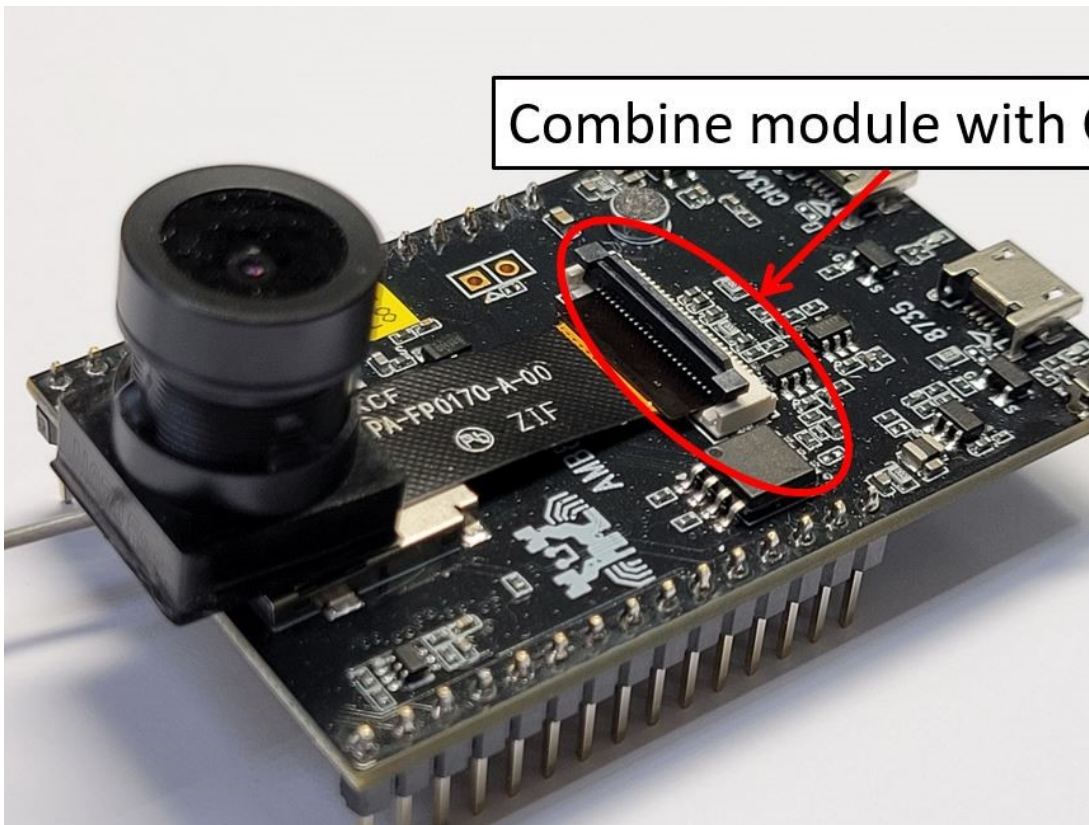
Step 1 : Keep AMB82-MINI at top side,



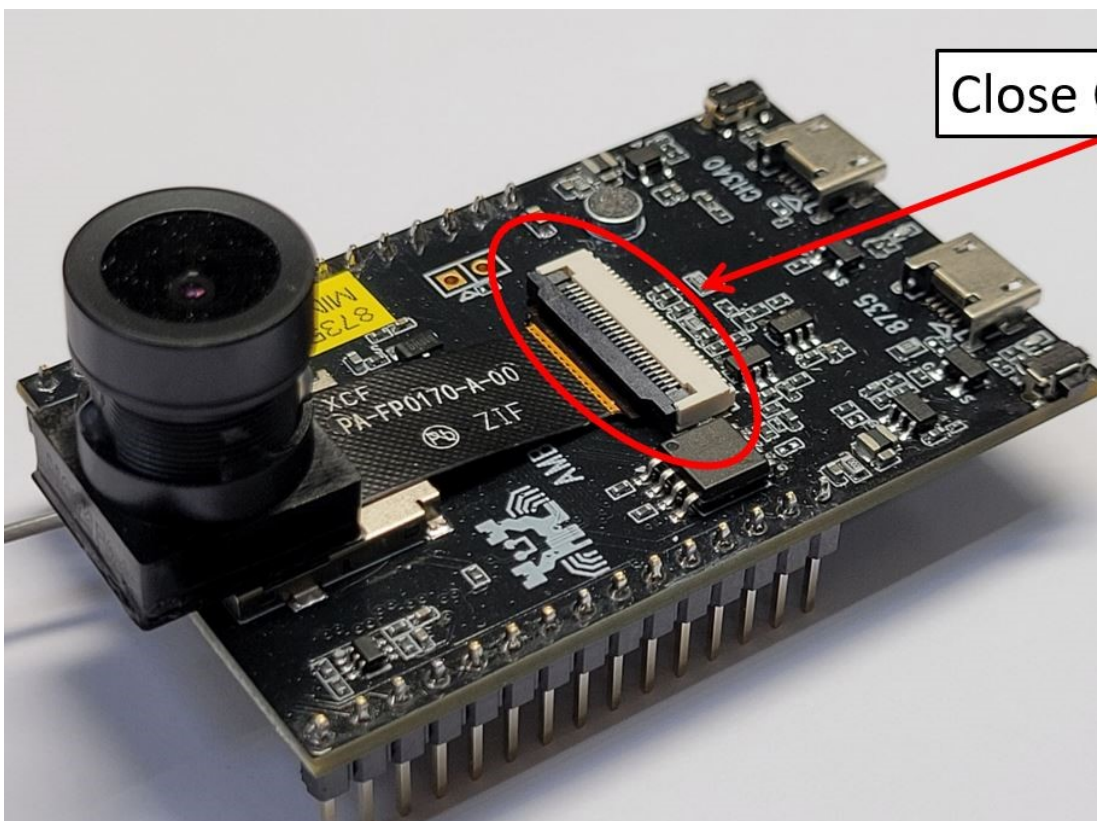
Step 2 : Open sensor connector carefully.



Step 3 : Combine Image sensor module with sensor connector, please check they are set firmly.

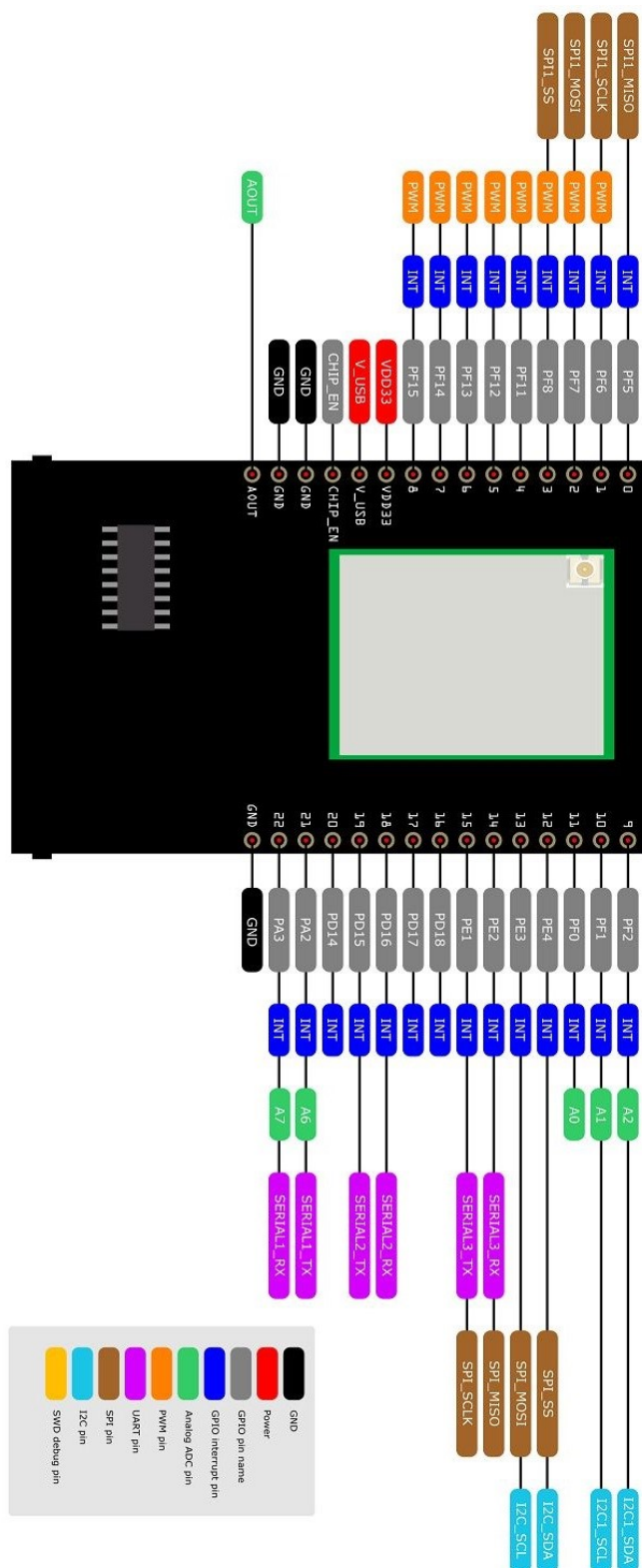


Step 4 : Close the connector carefully and make sure that the lens of sensor module is clear.

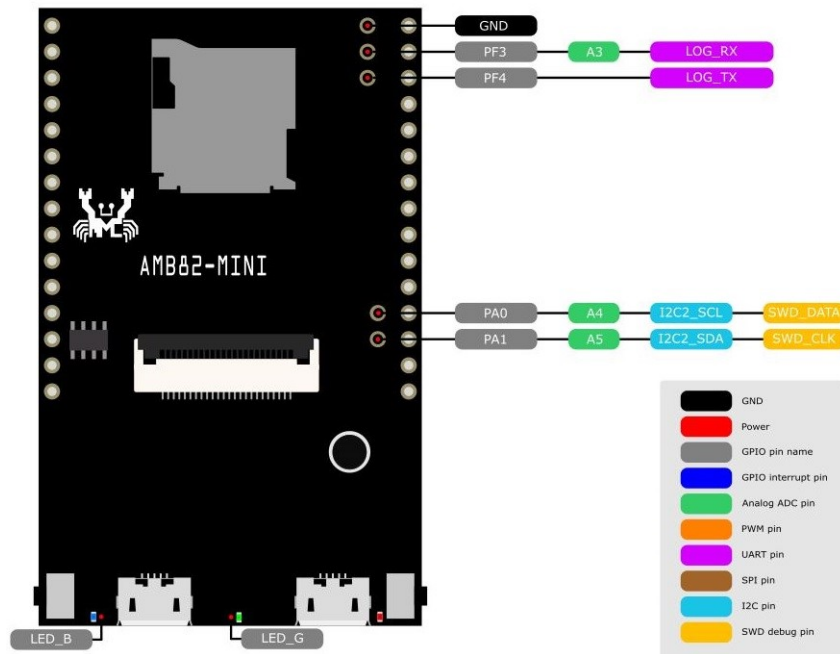


6. Pin definition

AMB82-MINI has 30 pin and 5 test point for user, as shown in the diagram of pins.



Back Side



Front Side

GPIO pin	GPIO INT	ADC	PWM	UART	SPI	I2C	Other
PF5	✓				SPI1_MISO		
PF6	✓		✓		SPI1_SCLK		
PF7	✓		✓		SPI1_MOSI		
PF8	✓		✓		SPI1_SS		
PF11	✓		✓				
PF12	✓		✓				
PF13	✓		✓				
PF14	✓		✓				
PF15	✓		✓				
PF2	✓	A2				I2C1_SDA	
PF1	✓	A1				I2C1_SCL	
PF0	✓	A0					
PE4	✓				SPI_SS	I2C_SDA	
PE3	✓				SPI_MOSI	I2C_SCL	
PE2	✓			SERIAL3_RX	SPI_MISO		
PE1	✓			SERIAL3_TX	SPI_SCLK		
PD18	✓						
PD17	✓						



PD16	✓			SERIAL2_RX			
PD15	✓			SERIAL2_TX			
PD14	✓						
PA2	✓	A6		SERIAL1_TX			
PA3	✓	A7		SERIAL1_RX			
PF9	✓		✓				LEB_B (blue)
PE6	✓						LED_G (green)
PF4	✓			LOG_TX			
PF3	✓			LOG_RX			
PA1	✓	A5				I2C2_SDA	SWD_CLK
PA0	✓	A4				I2C2_SCL	SWD_DATA
PF10	✓						
AOUT							Audio Output for earphones

Warning

Federal Communication Commission Interference 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.

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 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device and its antenna(s) must not be co-located with any other transmitters except in accordance with FCC multi-transmitter product procedures. Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without C2P.

Operations in the 5.15-5.25GHz band are restricted to indoor usage only.

This device meets all the other requirements specified in Part 15E, Section 15.407 of the FCC Rules.

Radiation Exposure Statement:

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

This module is intended for OEM integrators only. Per FCC KDB 996369 D03 OEM Manual v01 guidance, the following conditions must be strictly followed when using this certified module:

KDB 996369 D03 OEM Manual v01 rule sections:

2.2 List of applicable FCC rules

This module has been tested for compliance to FCC Part 15.247, 15.407

2.3 Summarize the specific operational use conditions

The module is tested for standalone mobile RF exposure use condition. Any other usage conditions such as co-location with other transmitter(s) or being used in a portable condition will need a separate reassessment through a class II permissive change application or new certification.

2.4 Limited module procedures

Not applicable.

2.5 Trace antenna designs

Not applicable.

2.6 RF exposure considerations

This equipment complies with FCC mobile radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. If the module is installed in a portable host, a separate SAR evaluation is required to confirm compliance with relevant FCC portable RF exposure rules.

2.7 Antennas

The following antennas have been certified for use with this module; antennas of the same type with equal or lower gain may also be used with this module. The antenna must be installed such that 20 cm can be maintained between the antenna and users. Antenna type PIFA, 3.5dBi at 2.4GHz; 5.0dBi at 5GHz.

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following: “Contains **FCC ID: TX2-RTL8735BDM**”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

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 product user manual shall include all required regulatory information/warning as shown

in this manual.

2.9 Information on test modes and additional testing requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) or portable use will require a separate class II permissive change re-evaluation or new certification.

2.10 Additional testing, Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable.

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment.

As long as all 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.

2.11 Note EMI Considerations

Please follow the guidance provided for host manufacturers in KDB publications 996369 D02 and D04.

2.12 How to make changes

Only Grantees are permitted to make permissive changes. Please contact us should the host integrator expect the module to be used differently than as granted:

Company Name	Realtek Semiconductor Corp.
Company Address	No. 2, Innovation Road II, Hsinchu Science Park, Hsinchu 300, Taiwan
Contact Name	Judy Hsu
Tel No	886-3-578-0211 #13835
E-mail	judy_hsu@realtek.com

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC 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 FCC authorization.

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.

OEM/Host manufacturer responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment

Industry Canada statement:

This device complies with ISED's licence-exempt RSSs. 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.

Le présent appareil est conforme aux CNR d' ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Radiation Exposure Statement:

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with greater than 20cm 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 à plus de 20cm entre le radiateur 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 and operated with greater than 20cm 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 et exploitée avec plus de 20 cm 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 co-location 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 and operated with greater than 20cm between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains IC: **6317A-RTL8735BDM**".

Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un appareil où l'antenne peut être

installée et utilisée à plus de 20 cm entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: **6317A-RTL8735BDM** ".

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.

Caution :

(i) the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;

(ii) for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit;

(iii) for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits as appropriate;

(iv) where applicable, antenna type(s), antenna models(s), and worst-case tilt angle(s) necessary to remain compliant with the e.i.r.p. elevation mask requirement set forth in section 6.2.2.3 shall be clearly indicated.

Avertissement:

Le guide d'utilisation des dispositifs pour réseaux locaux doit inclure des instructions précises sur les restrictions susmentionnées, notamment :

(i) les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une

utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;

(ii) pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis pour les dispositifs utilisant les bandes de 5 250 à 5 350 MHz et de 5 470 à 5 725 MHz doit être conforme à la limite de la p.i.r.e.;

(iii) pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis (pour les dispositifs utilisant la bande de 5 725 à 5 850 MHz) doit être conforme à la limite de la p.i.r.e. spécifiée, selon le cas;

(iv) lorsqu'il y a lieu, les types d'antennes (s'il y en a plusieurs), les numéros de modèle de l'antenne et les pires angles d'inclinaison nécessaires pour rester conforme à l'exigence de la p.i.r.e. applicable au masque d'élévation, énoncée à la section 6.2.2.3, doivent être clairement indiqués

Devices shall not be used for control of or communications with unmanned aircraft systems.

Les dispositifs ne doivent pas être utilisés pour commander des systèmes d'aéronef sans pilote ni pour communiquer avec de tels systèmes.

This radio transmitter [IC: **6317A-RTL8735BDM**] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Le présent émetteur radio [IC: **6317A-RTL8735BDM**

] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

NCC Statement

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。

1. 使用此產品時應避免影響附近雷達系統之操作。

2. 高增益指向性天線只得應用於固定式點對點系統。
1. 本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。
2. 系統廠商應於平台上標示「本產品內含射頻模組：XXXyyyLPDzzzz-x」字樣。系統廠商外包裝需標示 NCC LOGO

CE /UK Statement

This device complies with Directive 2014/53/EU issued by the Commission of the European Community.

The device is restricted to indoor use only when operating in the 5150 to 5350 MHz



AT	BE	BG	CH	CY	CZ
DE	DK	EE	EL	ES	FI
FR	HR	HU	IE	IS	IT
LI	LT	LU	LV	MT	NL
NO	PL	PT	RO	SE	SI
SK	TR	UK(NI)			



UK