

Users Manual of WCH941M

1. Introduction

WCH941M is a Wi-Fi / Bluetooth Combo module compliant with IEEE802.11 a.b.g.n.ac.ax MAC/baseband/radio and Bluetooth v5.4 with BLE (BT Low Energy).

This module is for Samsung A/V products.

2. Main chipset information

Item	Vendor	Part Number
IEEE802.11 a.b.g.n.ac.ax	Media Tek	MT7921AUN

3. Operating Condition

Parameter	Min	Typ.	Max	Unit
Operating voltage	4.5	5	5.5	V
Operating temperature	-10	-	50	°C

4. Product Details

- Data Modulation

DSSS:CCK,BPSK,QPSK for 802.11b

OFDM:BPSK,QPSK,16QAM,64QAM,256QAM for 802.11a,g,n,ac,ax

FHSS:GFSK,OQPSK, 8DPSK, $\pi/4$ DPSK for Bluetooth

- Frequency Range

. 2.4GHz:2400-2483.5MHz

. 5GHz:5150-5850MHz

. 6GHz : 5925-7125MHz(KC, FCC, IC), 5945-6425MHz(CE, UKCA)

-Features

- IEEE 802.11 a/b/g/n/ac/ax compliant
- Support 20MHz, 40MHz, 80MHz band width in 2.4GHz, 5GHz, 6GHz band
- Dual-band 2T2R mode
- MT7921AUN data rate up to 800Mbps with USB3.0
- Support MU-MIMO RX
- Support MU-OFDM TX/RX
- Support DBDC (dual band dual concurrent)
- Support STBC, LDPC,
- Greenfield, mixed mode, legacy modes support
- IEEE 802.11 d/e/h/i/j/k/mc/r/v/w support
- Security support for WPA WPA2 personal, WPS2.0, WAPI
- QoS support of WPA WMM, WMM PS
- Integrated LNA, PA, and T/R switch
- Optional external LNA and PA support
- Bluetooth v5.4 with BLE (BT low energy)
- Supports BT/BLE dual mode
- Integrated BALUN and PA with 13dBm(class 1) transmit power
- RX sensitivity: GFSK -95dBm, DQPSK -94dBm, 8-DPSK -88dBm, BLE1Mbps -98dBm, BLE2Mbps -95dBm,
- Supports BT/Wi-Fi coexistence
- Supports 7 BT links and 16 BLE link
- Supports SCO and eSCO link with re-transmission
- Supports wide-band speech
- Supports mSBC and SBC including mono and stereo
- Supports Packet Loss Concealment (PLC) function for better voice quality
- Supports LE Isochronous channels
- Supports LC3 including mono and stereo
- Supports secure connection with AES128 and ECC256
- Channel quality driven data rate adaptation
- Channel assessment and WB RSSI for AFH
- Contains 2 BT controllers

5. Pin Definition

No.	Define	Description
1	IR_RX	IR Receiver
2	TSF_interrupt	WiFi_time_sync
3	GND	Ground
4	WIFI_USB_ON	WiFi_USB_suspend
5	WIFI_WOW	WiFi wake host
6	BTWIFI_NRESET	WiFi reset
7	BT_WAKE	BT wake host
8	GND	Ground
9	USB_D-	USB_D-
10	USB_D+	USB_D+
11	A5V_PW_WIFI	Supply voltage 5V
12	A5V_PW_WIFI	Supply voltage 5V
13	LED	Light emitting diode
14	I2C_SCL	I2C digital serial clock input
15	I2C_SDA	I2C digital serial data output
16	KEY1	Key
17	GND	Ground
18	MIC_on/off	Power on/off for MIC
19	DMIC_CLK	MIC I2C digital serial clock input
20	DMIC_DATA	MIC I2C digital serial data output
21	MIC_GND	MIC Ground
22	IR_OUT1	IR LED1
23	IR_OUT2	IR LED2
24	A3.3V_PW_Sensor	Supply voltage 3.3V

[Regulation statement]
US FCC statement

RF Software restrictions

1. Contention-Based Protocol, as demonstrated in the FCC test report, is permanently embedded in the module and is not host-dependent and can't be changed by anyone.
2. Operation of transmitters in the 5.25-5.35GHz, 5.47-5.725GHz, 5.85-5.895GHz, and 5.925-7.125GHz bands in this Modular device will only associate and connect with a low-power indoor access point or subordinate device and never directly connect to other client devices. This feature is included in its firmware and can't be changed by anyone.
3. Operation of transmitters in the 5.25-5.35GHz, 5.47-5.725GHz, 5.85-5.895GHz, and 5.925-7.125GHz bands in this Modular device will always initiate transmission under the control of a low-power indoor AP or subordinate except for brief transmissions before joining a network. These short messages will only occur if the client has detected an indoor AP or subordinate operating on a channel. These brief messages will have a timeout mechanism such that if it does not receive a response from an AP it will not continually repeat the request.
4. That transmissions will be lower or equal to the power advertised by the indoor low-power access point or subordinate and never above the maximum output power allowed by the FCC grant for equipment class 6XD.

This device complies with Part 15 of the FCC's 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 undesirable operation.

To satisfy FCC exterior labeling requirements, the following text must be placed on the exterior of the end product.

Contains Transmitter module FCC ID: A3LWCH941M

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.
- The OEM integrator is responsible for ensuring the end-user has no manual instruction to remove or install module.
- The module is limited to installation in mobile or fixed applications.

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

-RF exposure considerations .

The module has been certified for integration into products only by OEM integrators under the following condition:

- The antenna(s) must be installed such that a minimum separation distance of at least 20cm is maintained between the radiator(antenna) and all persons at all times.
- The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi- transmitter product procedures.

The device operates strictly as a client in DFS channels (with passive scan). It does not support ad-hoc, Wi-Fi Direct Group Owner, Hotspot, or any other peer-to-peer modes that may initiate a network in DFS channels (UNII2-2A and UNII2- 2C band).

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 with CFR 47 FCC Part 15 C (15.247, DTS and DSS) and CFR 47 FCC Part 15 E (NII). It is applicable to the modular transmitter

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) will need a separate reassessment through a class II permissive change application or new certification.

Further operation restrictions on the host product include:

*Prohibited for control of or Communications with unmanned aircraft systems.

This radio transmitter FCC ID: A3LWCH941M has been approved by Federal Communications Commission to operate with the integrated Metal antenna and Chip antenna. Use of any other antenna is strictly prohibited without filing an application for a new system-specific FCC ID.

2.4 Limited module procedures.

The module complies with FCC Part 15.247 / Part 15.407 and applies for Single module approval.

Under ISSED Canada rules as the module is approved under RSS-248 Issue 3 it is a limited modular approval and a C4PC submission is required for each host model.

2.5 Trace antenna designs Not applicable.

The antenna is integrated into the module and cannot be modified. See section 2.3.

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. A separate SAR/Power Density evaluation is required to confirm compliance with relevant FCC portable RF exposure rules.

2.7 Antennas

Note 1: Use of other antenna types or the same type of antenna with higher gain than listed above must perform additional testing and appropriate permissive change approval.

Note 2: Additional testing/submission (C2PC) will be required if the device does not meet the antenna and RF exposure requirements.

Note 3: Contact Samsung for additional guidance, if choose to use different antenna types or higher/lower gain antennas in the end system.

IMPORTANT: The final host product must have an integral antenna that is not removable by

the end user.

BT, WIFI antenna gain table

BT

Antenna	Frequency(MHz)	Antenna Type	MAX Antenna Gain(dBi)
BT1	2400-2483.5	Chip Antenna	-2.18
BT2	2400-2483.5	Chip Antenna	-4.84

2.4G WiFi

Antenna	Frequency(MHz)	Antenna Type	MAX Antenna Gain(dBi)
ANT1	2400-2483.5	Chip Antenna	-1.42
ANT2	2400-2483.5	Chip Antenna	0.66

5G WiFi

Antenna	Frequency(MHz)	Antenna Type	MAX Antenna Gain(dBi)
ANT1	5150-5850	Chip Antenna	1.55
ANT2	5150-5850	Chip Antenna	0.54

6G WiFi

Antenna	Frequency(MHz)	Antenna Type	MAX Antenna Gain(dBi)
ANT1	5925(or)5945-6425	Chip Antenna	0.35
ANT1	6425-7125	Chip Antenna	-0.62
ANT2	5925(or)5945-6425	Chip Antenna	-2.09
ANT2	6425-7125	Chip Antenna	-1.15

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following: "Contains FCC ID: A3LWCH941M".

The grantee's FCC ID can be used only when all FCC compliance requirements are met.

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 transmitters need 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 with this portion of rule requirements if applicable. If all conditions above are met, further transmitter tests 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.

IMPORTANT NOTE: In the event that these conditions cannot 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 cannot 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.

2.11 Note EMI Considerations

The host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.

2.12 How to make changes

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

Canada IC statement

IC approval

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (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;
- (2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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

Attention: Toute change ou modifications non expressément approuvées par la partie responsable de la conformité pourraient annuler l'utilisateur's autorité de faire fonctionner cet équipement.

Please notice that if the ISED certification 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 IC: 649E-WCH941M" any similar wording that expresses the same meaning may be used.

L'appareil hôte doit porter une étiquette donnant le numéro de certification du module d'Industrie Canada, précédé des mots (Contient un module d'émission, du mot IC: 649E-WCH941M) ou d'une formulation similaire exprimant le même sens, comme suit

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.

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;

User should also be advised that high-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

Les utilisateurs doivent également être informés que les radars de haute puissance sont affectés aux bandes 5250 - 5350 MHz et 5650 - 5850 MHz en tant qu'utilisateurs principaux (c. - à - D. utilisateurs prioritaires) et que ces radars peuvent causer des interférences et / ou des dommages à l'équipement le - lan.

The device meets the exemption from the routine evaluation limits in section 6.6 of RSS 102 and compliance with RSS-102 RF exposure, users can obtain Canadian information on RF exposure and compliance.

Le dispositif rencontre l'exemption des limites courantes d'évaluation dans la section 6.6 de RSS 102 et la conformité à l'exposition de RSS-102 RF, utilisateurs peut obtenir l'information canadienne sur l'exposition et la conformité de RF.

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

This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Cet émetteur ne doit pas être Co-placé ou ne fonctionnant en même temps qu'aucune autre antenne ou émetteur. Cet équipement devrait être installé et actionné avec une distance minimum de 20 centimètres entre le radiateur et votre corps.

IMPORTANT: The final host product must have an integral antenna that is not removable by the end user.

Low-power indoor access points and indoor subordinate devices shall bear statements acknowledging both of the following restrictions in the user manual and, where feasible, in a conspicuous location on the device:

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

Devices shall not be used on oil platforms.

Devices shall not be used on aircraft, except for the low-power indoor access points, indoor subordinate devices, low-power client devices, and very low-power devices operating in the 5925-6425 MHz band, that may be used on large aircraft as defined in the Canadian Aviation Regulations, while flying above 3,048 metres (10,000 feet).

Devices shall not be used on automobiles.

Devices shall not be used on trains.

Devices shall not be used on maritime vessels.

Operation shall be limited to indoor use only.

Operation on oil platforms, automobiles, trains, maritime vessels and aircraft shall be prohibited except for on large aircraft flying above 3,048 m (10,000 ft).

L'équipement ne doit pas être utilisé pour le contrôle ou la communication des systèmes d'aéronefs sans pilote.

Les points d'accès intérieurs de faible puissance et les accessoires intérieurs doivent indiquer les restrictions suivantes dans le manuel de l'utilisateur et, si possible, à un endroit bien en vue de l'appareil:

Les dispositifs ne doivent pas être utilisés pour contrôler ou communiquer avec des systèmes d'aéronefs sans pilote.

Les dispositifs ne doivent pas être utilisés sur des plateformes pétrolières.

Les appareils ne doivent pas être utilisés sur les aéronefs, à l'exception des points d'accès intérieurs à faible puissance, des appareils intérieurs subordonnés, des appareils clients à faible puissance et des appareils à très faible puissance fonctionnant dans la bande 5925-6425 MHz, qui peuvent être utilisés sur les grands aéronefs tels que définis dans le Règlement de l'aviation canadien, au-dessus de 3 048 mètres (10 000 pieds).

l'appareil ne doit pas être utilisé dans la voiture.

l'équipement ne doit pas être utilisé à bord du train.

l'équipement ne doit pas être utilisé à bord des navires en mer.

Le fonctionnement doit être limité à une utilisation intérieure seulement.

Europe CE approval statement CE, UKCA approval

This device is restricted to indoor use when operating in the 5150-5350MHz frequency range to reduce the potential for harmful interference to co-channel mobile satellite systems in all EU/EFTA member states, Turkey and the UK.

This device complies with Low power indoor (LPI) when operating in the frequency band 5945-6425 MHz for WAS/RLAN use, restricted to indoor use, and no fixed outdoor WAS/RLAN use.

Frequency Range and Maximum Output Power (EIRP)

- 2400 MHz to 2483.5 MHz Below 20 dBm for WI-FI / BT
- 5150 MHz to 5250 MHz: Below 23 dBm for WI-FI
- 5250 MHz to 5350 MHz: Below 20 dBm for WI-FI
- 5470 MHz to 5725 MHz: Below 20 dBm for WI-FI
- 5725MHz to 5850 MHz: Below 14 dBm for WI-FI
- 5945 MHz to 6425 MHz: Below 23 dBm for WI-FI

Restricted countries:

	AT	BE	BG	CH	CY	CZ	DK	DE	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)			

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Hereby, Samsung declares that this radio equipment is in compliance with Directive 2014/53/EU and the relevant UK statutory requirements. The full text of the declaration of conformity is available at the following internet address: www.samsung.com

This equipment may be operated in all EU countries and in the UK.

Manufacturer Name: SAMSUNG ELECTRONICS CO., LTD.

Address: 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA

EU Importer Name: Samsung

Address: PO Box 12987, Dublin. IE

UKCA Importer Name: Samsung

Address: Yateley, GU46 6GG. UK

Note:

1. This module cannot be installed in a weatherized enclosure and cannot operate from a battery but only power sources.
2. The host device must be connected to a power source as it has no battery.
3. Tests such as host level EMC testing, safety testing, and potential RF tests such as RX blocking, radiated spurious emissions, etc. should be considered based on the installation and proximity to other circuits which may reduce receiver performance or couple/retransmit radiated signals.

The domestic KC manual stipulates:

This module is only permitted for use in devices that are installed and operated by connecting to a power source inside a building, or in devices that communicate with such equipment. Its use in moving objects such as automobiles, aircraft, railways, ships, drones, etc., is prohibited.

(Note: "KC" refers to Korea Certification, a mandatory safety and quality mark for products sold in South Korea.)