



Manual of WCF930M

1. Introduction

WCF930M is a highly integrated module which features a low power 2x2 11a/n/ac/ax/be dual band Wi-Fi subsystem、Bluetooth v5.2 subsystem and 60GHz Radar, offering feature-rich wireless connectivity at high standards, and delivering reliable, cost-effective throughput from an extended distance.

The main chips used are Media Tek's MT7925AUN 、 Realtek's RTL8762EJF and Infineon's BGT60LTR11AIP. This module is for Samsung TV and AV products.

2. Main Chipset Information

Item	Vendor	Part Number
IEEE802.11 a.n.ac.ax.be mac/baseband/radio	MediaTek	MT7925AUN
Bluetooth 5.2	Realtek	RTL8762EJF
60 GHz Doppler radar sensor with AIP	Infineon	BGT60LTR11AIP



3. Operational Description

WCF930M is the 802.11a/n/ac/ax/be +Bluetooth 5.2+60GHz Radar WIFI+IR Module that acts as a communication controller for users of a wireless device to connect to SMART TV

3.1 Features

- Technology and package

- 11.5x8.7 SQFN 102 pins package
- 5X5 QFN 40 pins package
- 6.7 × 3.3 PG-UF2BGA 42pins package

- Power management and clock source

- Integrate high efficiency power management unit with single 3.3V power supply input
- Support 40MHz crystal clock with low power operation in idle mode

- Platform

- 32-bit RISC MCU for Wi-Fi/Bluetooth protocols and Wi-Fi offload
- Embedded SRAM/ROM
- UART interface with hardware flow control
- Programmable and multiplexed GPIO pins
- MT7925AUN - USB device fully compliant with USB v2.0 specification
- MT7925AUN - USB device fully compliant with USB v3.0 specification

- WLAN

- IEEE 802.11 a/n/ac/ax/be compliant
- Support 20/40/80 MHz bandwidth in 5 GHz
- Support 20/40/80/160 MHz bandwidth in 6 GHz
- Support MU-MIMO RX
- Support STBC, LDPC,
- Greenfield mode, mixed mode, and legacy mode support
- IEEE 802.11 d/e/h/i/k/mc/r/v/w support
- Security support for WFA WPA/WPA2/WPA3 personal/enterprise, WPS2.0, FIPS
- QoS support of WFA WMM and WMM PS
- Integrated LNA, PA, and T/R switch

- Bluetooth

- Bluetooth 5.2 Low Energy (LE)

- Miscellaneous

- Integrate eFuse (Electronic Fuse) to store device-specific information and RF calibration data
- Advanced FDD/TDD mode Wi-Fi/Bluetooth coexistence scheme

- 60GHz

- 60GHz Radar IC with one transmitter and one receiver unit



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- Antennas in Package (AiP) Radar IC
 - Integrated controller for full autonomous mode
 - Integrated motion detectors and direction of movement detectors
 - CW and pulsed-CW mode of operation
 - D-MIC
 - 38.4MHz X-Tal

3.2 Functional Description

- 32-bit RISC MCU subsystem

The 32-bit RISC MCU subsystem is built upon a multi-layer AHB (Advanced High-Performance Bus) fabric infrastructure. The MCU has local instruction memory and data memory, with 1T access capability.

- Host interface subsystem

WCF930M supports a USB device port that is fully compliant with the USB v3.0 specification (USB Specification, Revision v3.0). It supports high-speed and full-speed modes, suspend/resume signaling, as well as remote wake-up signaling.

WCF930M offers Bluetooth SIG (Special Interest Group) standard HCI (Host Controller Interface) over USB. It contains the following endpoints:

- A Control Endpoint (Endpoint 0x00) for HCI commands.
- An Interrupt Endpoint (Endpoint 0x01) for HCI events.
- A Bulk IN Endpoint (Endpoint 0x02) for receiving ACL data.
- A Bulk OUT Endpoint (Endpoint 0x02) for transmitting ACL data.
- An Isochronous IN Endpoint (Endpoint 0x03) for receiving SCO voice.
- An Isochronous OUT Endpoint (Endpoint 0x03) for transmitting SCO voice.
- And an Interrupt IN Endpoint (Endpoint 0x0F) for Bluetooth watchdog timeout indication.

For Wi-Fi function over USB, it contains the following endpoints:

- 6 Bulk OUT Endpoints (Endpoint 0x04 to 0x09) for data transmission with flexible queue management.
- 2 Bulk IN Endpoints (Endpoint 0x04 to 0x05) for data receiving.
- An Interrupt IN Endpoint (Endpoint 0x06) for Wi-Fi watchdog timeout indication.

Data aggregation is used to enhance the throughput over the USB interface. Internal pull-up and pull-down resistors are integrated to indicate signaling speed capability. The USB descriptors including VID (Vendor ID) and PID (Product ID) can be customized. The configuration of the endpoints and the customized USB descriptors are predefined and stored in the eFuse or external flash. They are fetched and used by the USB firmware to provide the desired setting.

- Wi-Fi MAC

Wi-Fi MAC supports the following features:

- Support all data rates of 802.11a including 6, 9, 12, 18, 24, 36, 48, and 54 Mbps
- Support short GI and all data rates of 802.11n including MCS0 to MCS7
- Support 802.11ac MCS0 to MCS9
- Support 802.11ax MCS0 to MCS11
- Support 802.11be MCS0 to MCS13
- A-MPDU/A-MSDU RX (de-aggregation) and TX (aggregation) support
- TX rate adaptation



➤ Security

- 64-bit WEP (WEP-40) and 128-bit WEP (WEP-104) encryption with hardware TKIP and CKIP processing
- AES-CCMP hardware processing
- GCMP-256 hardware processing

- WLAN Baseband

Wi-Fi baseband supports the following features:

- 20/40/80/160 MHz channels mode
- HE MCS0 to 11, BW = 20, 40, 80, 160 MHz with Nss = 1 to 2
- EHT MCS0 to 13, BW = 20, 40, 80, 160 MHz with Nss = 1 to 2
- Short Guard Interval
- Space-time block code (STBC)
- Low Density Parity check (LDPC)
- Support digital pre-distortion to enhance PA performance
- Smoothing (channel estimation) extension to MIMO case
- Support 2x2 and two independent 1x1 operations
- 802.11v location
- Support up to 4096 QAM

- WLAN RF

RF supports the following features:

- Integrated 5 GHz/6 GHz PA and LNA, and T/R switch
- Integrated 5 GHz/6 GHz balun
- Support frequency band
 - 5 GHz: 5150 to 5250 and 5725 to 5850 MHz
 - 6 GHz: 5925 to 7125 MHz(except europe), 5925 to 6425 (europe)
- Configurable PA that provides different PA modes at different power levels for power consumption optimization

- Bluetooth subsystem feature set

RTL8762EJF Bluetooth supports the following features:

- Bluetooth 5.2
 - Itra-low power consumption with intelligent PMU
 - Supports 2Mbps LE
 - Integrated MCU to execute Bluetooth protocol stack
 - Supports multiple level Low Energy states
 - Supports LE L2CAP Connection Oriented Channel Support
 - Supports LE data length extension feature
 - Supports OTA (Over-the-Air) programming mechanism for firmware upgrade
 - Supports GAP, ATT/GATT, SMP, L2CAP
 - Supports AES128 and AES256 feature



4. Product Details

-Data Modulation

OFDM:BPSK,QPSK,16QAM,64QAM,256QAM,1024QAM,4096QAM for 802.11a,g,n,ac,ax,be

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

-Frequency Range

2.4GHz:2400-2483.5MHz (BT)

5GHz:5150-5250 and 5725-5850MHz

6GHz:5925-7125MHz(except EU),5925-6425MHz (EU)

60GHz : 61-61.5GHz (motion sensor)

-Output Power tolerance

Output power $\pm$ 2dBm

-Recommended Operating conditions

	Min	Typ.	Max	Unit
Operating voltage (BT,WiFi)	4.5	5	5.5	V
Operating voltage (60GHz)	2.97	3.3	3.63	V
Operating temperature(ambient)	-10	25	50	°C

■ AS Information

Company Name:

Fax:

Tel:

Add:

■ Certification Information

1) Name(Model name):

2) Certification ID:

3) Company Name:

4) Production date

5) Vendor:

The Motion Detection Sensor Module specified is a product that is installed in the application after being mounted on the frame in actual use.



<Regulatory notice to host manufacturer according to KDB 996369 D03 OEM Manual v01>

List of applicable FCC rules

This module has been granted modular approval as below listed FCC rule parts.

- FCC Rule parts 15C (15.247, 15.407, 15.255)

Summarize the specific operational use conditions

- The OEM integrator should use equivalent antennas which is the same type and equal or less gain than an antenna listed in 2.7 in this instruction manual.

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 20 cm 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.
- Mobile use

As long as the three conditions above are met, further transmitter testing will not be required.

OEM integrators should provide the minimum separation distance to end users in their end-product manuals.

Antenna type

BT(LE) : Chip Antenna

WLAN : Metal antenna

60GHz : Patch type antenna in package

* Antenna gain and frequency are listed separately on the back.

Any new antenna type, higher gain than listed antenna should be met the requirements of FCC rule 15.203 and 2.1043 as permissive change procedure.

Label and compliance information

End Product Labeling

The module is labeled with its own FCC ID and IC Certification Number. If the FCC ID and IC Certification Number are 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. In that case, the final end product must be labeled in a visible area with the following:

“Contains FCC ID: A3LWCF930M

“Contains IC: 649E-WCF930M

Information on test modes and additional testing requirements

- OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, additional transmitter in the host, etc.).

Additional testing, Part 15 Subpart B disclaimer



- The final host product also requires Part 15 subpart B compliance testing with the modular transmitter installed to be properly authorized for operation as a Part 15 digital device.

FCC Instructions

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 5.15-5.25GHz, 5.725-5.850GHz and 5.925-7.125GHz bands in this Modular device will associate and connect with indoor clients. This feature is included in its firmware and can't be changed by anyone.

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: A3LWCF930M

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.

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 15.255, 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: A3LWCF930M 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 Not applicable for FCC, required for ISED Canada.

The module complies with FCC Part 15.247 / Part 15.407 and Part 15.255 applies for Single module approval.

Under ISED 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.

Antenna Type & Antenna Gain:

BT&BLE:

Frequency(MHz)	Antenna Type	MAX Antenna Gain(dBi)
2402-2480	Chip Antenna	-0.44 dBi

Note: The antennas are permanently attached and can't be replaced.

5G WIFI:

Frequency Band	Antenna 1 Gain (dBi)	Antenna 2 Gain (dBi)	Antenna Type
UNII 1	0.82	-0.52	Metal Antenna
UNII 3	0.72	-1.71	

Note: The antennas are permanently attached and can't be replaced.

6G WIFI:

Frequency Band	Antenna 1 Gain (dBi)	Antenna 2 Gain (dBi)	Antenna Type
UNII 5	0.04	-0.80	Metal Antenna
UNII 6	0.64	-1.96	
UNII 7	0.64	-0.20	
UNII 8	-0.92	-0.48	

Note: The antennas are permanently attached and can't be replaced.

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following: "Contains FCC ID: A3LWCF930M". 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.

2.13 Restrictions

The devices certified under this annex are not permitted to be used on satellites. Devices used on aircraft are permitted under the following conditions:

1. devices are only to be used when the aircraft is on the ground.
2. Devices used in-flight are subject to the following restrictions:
 - a) They shall be used within closed, exclusive on-board, communication networks within the aircraft.
 - b) They shall not be used in wireless avionics intra-communication (WAIC) applications where external structural sensors or external cameras are mounted on the outside of the aircraft structure.
 - c) They shall not be used on aircraft equipped with a body/fuselage that provides little or no RF attenuation except when installed on unmanned air vehicles (UAVs).
 - d) Devices operating in the 59.3-71.0 GHz band shall not be used except if they meet all of the following conditions:
 - they are FDS
 - they are installed within personal portable electronic devices
 - they comply with the relevant requirements in Emission limits for FDS.

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.



This module cannot be installed in a weatherized enclosure and cannot operate from a battery but only power sources.

The host device must be connected to a power source as it has no battery.

FCC regulations restrict the operation of this device to indoor use only. The operation of this device is prohibited on oil platforms, cars, trains, boats, and aircraft, except that operation of this device is permitted in large aircraft while flying above 10,000 feet.

Operation of transmitters in the 5.925-7.125 GHz band is prohibited for control of or communications with unmanned aircraft systems.

This module cannot be installed in a weatherized enclosure and cannot operate from a battery but only power sources.

The host device must be connected to a power source as it has no battery.

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

IC

Canada IC approval statement

Under ISSED Canada rules as the module is approved under RSS-248 Issue 3 it is a limited modular approval and every host device that uses the module needs to submit a C4PC before it is considered approved for use in Canada

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

Attention: Toute modification ou modifications non expressément approuvées par la partie responsable de la conformité pourraient annuler l'utilisation autorisée de l'équipement.

Please notice that if the ISSED 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-WCF930M" 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-WCF930M) 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;

The device meets the exemption from the routine evaluation limits in section 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 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.

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.

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.