



VR Gen3.1 Module User Manual for Air-conditioner

Model Name : LVRF-001

- Be sure to read the safety precautions before use and installation, and use it correctly.
- This is to protect the safety of users and installers and prevent property damage.
- After reading the user manual, keep it in a place where the user can see it at any time.

1. Introduce

1.1 Summary

LVRF-001 is a module that supports Wi-Fi, BLE wireless communication, Air-conditioner voice recognition and artificial intelligence processing and is designed to operate independently. It supports multiple interfaces and has the advantage of being able to connect various external devices.

In addition, it has high performance based on CPU and has specialized functions for artificial intelligence, so it can be applied to home appliances that use artificial intelligence. It can operate as the Wi-Fi module allows you to connect with the voice recognition server.

1.2 Major Features and Specifications

1. ARM Dual Cortex-M4
2. WLAN: Real-M300, IEEE 802.11b/g/n 2.4Ghz
3. Hardware-based AES-128/192/256 encryption support
4. RTOS-based integrated SW development environment support
5. Supports Bluetooth LE 5.0
6. Refrigerator control through server-based natural language voice recognition
7. Input power: DC 12V or DC 5V (Harness cable length < 3M)
10. Mic. spec: 2Ch. Analog MEMS Mic.
11. Speaker: 1.5W / 4 Ω



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2. Electrical Characteristics

2.1 Absolute maximum ratings

Table 3-1 Absolute maximum ratings. Exceeding one of the absolute maximum ratings will result in poor performance or It can be caused damage.

Rating	Min.	Max.	Unit
Supply voltage	4.2	18	V
	2.7	6	V
Typical WIFI Output Power(Conduction)		17±3	dBm

2.2 Electro Static Discharge (ESD)

The LVR-001 can withstand ESD voltages up to 1000 V Human Body Model (HBM).According to JESD22-A114, JESD22-A115, it can withstand up to 450 V CDM (Charge Device Model).

2.3 Recommended Operation Condition

Table 3-2 Recommended operation condition

Rating	Min.	Typ.	Max.	Unit
*Supply Voltage V_{CC}	11.4	12	12.6	V
	4.74	5	5.25	V

2.4 Current Consumption

This is the data measuring power consumption in a scenario where the voice recognition module is in operation mode and the voice recognition function is used.

Condition : $T_{amb}=25^{\circ}C$, $V_{CC}=12V$

Table 3.4 Power consumption in Normal mode. *Output power value is based on WLAN module's antenna port Typ. output

Max Output Power*	Typ. Current	Comments
+17 dBm	290 mA	11 Mbps, In Case of voice recognition operation.
Max Output Power*	Typ. Power Consumption	Comments
+17 dBm	3,480 mW	11 Mbps, In Case of voice recognition operation.

Condition : $T_{amb}=25^{\circ}C$, $V_{CC}=5V$

Table 3.5 Power consumption in Normal mode. *Output power value is based on WLAN module's antenna port Typ. output

Max Output Power*	Typ. Current	Comments
+17 dBm	674 mA	11 Mbps, In Case of voice recognition operation.
Max Output Power*	Typ. Power Consumption	Comments
+17 dBm	3,370 mW	11 Mbps, In Case of voice recognition operation.

2.5 Antenna Characteristics(WLAN, Bluetooth Antenna)

Condition: antenna port radiation test of WLAN module VCC= 12 V, Temp= 0 to +70C, covered with shield-can.

Table 3-6 RF Characteristics

Frequency(MHz)	Efficiency (%)	Avg. Gain(dBi)	Peak Gain(dBi)
2400	66.79	-1.75	1.06
2442	70.83	-1.5	1.57
2485	50.17	-3.0	0.2

Frequency & output power

WLAN : 2412~2472 MHz 802.11b/g/n (bandwidth 20MHz) : 10mW/MHz

BT LE(1Mbps) : 2402~2480 MHz : 3.0 mW

3. Interface

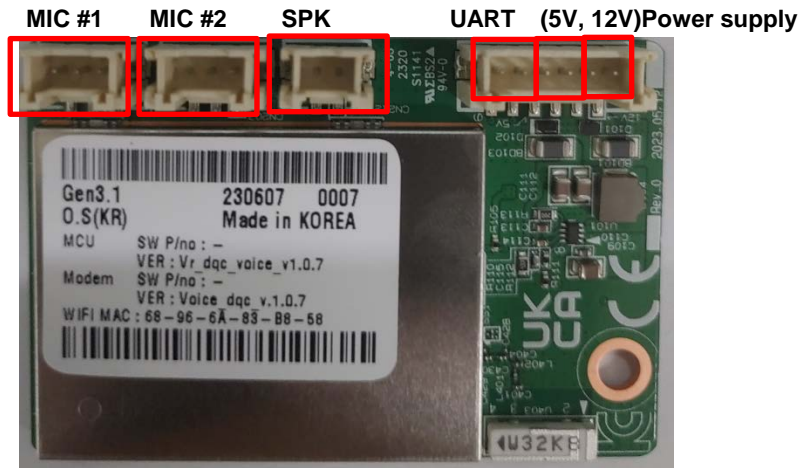
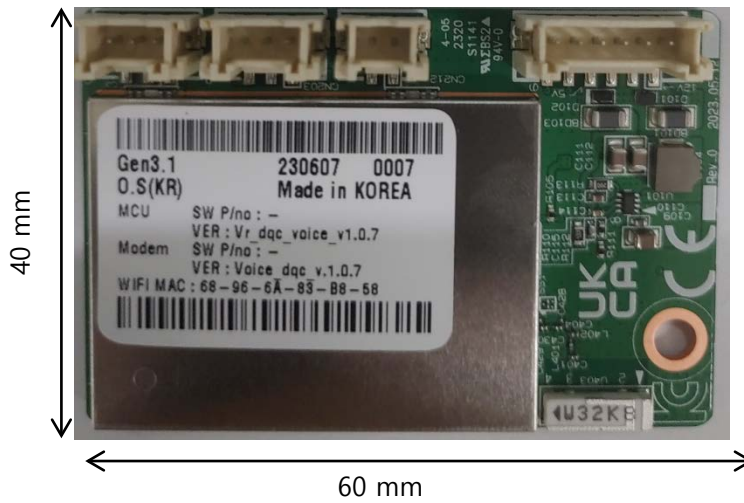


Figure 4-1 LVRF-001(Voice recognition Module) Connector option for connection of external Interface

	Connector type	Description
CN201	6 pin 2.00 mm pin header	UART(2PIN), Power Supply(2PIN_5V, 2PIN_12V)
CN203	3 pin 2.00 mm pin header	MIC input(#1)
CN204	3 pin 2.00 mm pin header	MIC input(#2)
CN212	2 pin 2.00 mm pin header	SPK

4. Package Characteristics

4.1 Mechanical Characteristics of LVRF-001 PCB



Regulatory Statement (FCC)

• Part 15.19 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.

• Part 15.105 Statement (Class 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.

• Part 15.21 Statement

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

• Responsible Party Information (Supplier's Declaration of Conformity)

LG Electronics USA
1000 Sylvan Avenue Englewood Cliffs
New Jersey, United States, 07632

Regulatory Statement (FCC)

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)

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 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.

Regulatory Statement (FCC)

- **Antennas list**

This module is certified with the following integrated antenna.

-Type: chip type

-Max. peak Antenna gain

BT, WIFI Ant: 1.57 dBi (2402 - 2480 MHz)(2412 - 2462 MHz)

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: BERL VRF001

- Contains IC: 2703N-LVRF001

- **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.

Regulatory Statement (ISED)

RSS-GEN, Sec. 7.1.3–(licence-exempt radio apparatus)

This device complies with Industry Canada licence-exempt RSS standard(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.

Le présent appareil est conforme aux CNR d'Industrie 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 radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RF Exposure

The antenna (or antennas) must be installed so as to maintain at all times a distance minimum of at least 20 cm between the radiation source (antenna) and any individual. This device may not be installed or used in conjunction with any other antenna or transmitter.

l'exposition aux RF

L'antenne (ou les antennes) doit être installée de façon à maintenir à tout instant une distance minimum de au moins 20 cm entre la source de radiation (l'antenne) et toute personne physique.

Étiquetage du produit final (IC)

Le module MB3021 est étiqueté avec sa propre identification FCC et son propre numéro de certification IC. Si l'identification FCC et le numéro de certification IC ne sont pas visibles lorsque le module est installé à l'intérieur d'un autre dispositif, la partie externe du dispositif dans lequel le module est installé devra également présenter une étiquette faisant référence au module inclus. Dans ce cas, le produit final devra être étiqueté sur une zone visible avec les informations suivantes :

Contient module émetteur identification FCC ID: BEJ-LVRF001

Contient module émetteur IC : 2703N-LVRF001