User Manual

[2.1 General]

Devices equipped with this module are used only in On-Vehicle devices.

This user manual describes the integration procedure per Sec. 2.2 to 2.12 of KDB 996369 D03.

[2.2 List of applicable FCC rules]

This device complies with below part of the FCC Rules.

Part 22 Subpart H
Part 24 Subpart E
Part 27
Part 90

[2.3 Summarize the specific operational use conditions]

Not Applicable

[2.4 Limited module procedures]

This is Limited modular approval as this module is limited to installation by the grantee into our host systems.

[2.5 Trace antenna designs]

See page 4 and later for details.

[2.6 RF exposure considerations]

This module may transmit simultaneously with other collocated radio transmitters within a host device, provided the following conditions are met:
· Each collocated radio transmitter has been certified by FCC/ISED for mobile application.
· At least 20 cm separation distance between the antennas of the collocated transmitters and the user's body must be maintained at all times.
· The radiated power of a collocated transmitter must not exceed the EIRP limit stipulated in the table below.

Device	Technology	Frequency (MHz)	EIRP Limit (dBm)
Collocated transmitters[a]	WLAN	2400–2500	25
		5150–5850	27
	WiMAX	2300–2400	25
		2500–2700	25
		3300–3800	25
	BT	2400–2500	15

a. Valid collocated transmitter combinations: WLAN+BT; WiMAX+BT. (WLAN+WiMAX+BT is not permitted.)

The following statements must be described on the user manual of the host device of this module;

【For FCC】

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

【For ISED】

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the ISED radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôl é et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'ISDE. Cet équipement doit être installé et utilisé en gardant une distance de 20 cm ou plus entre le radiateur et le corps humain.

[2.7 Antennas]

Provided the conducted power and antenna gain do not exceed the limits in the table below for each given frequency band and operating mode.

	Operating Mode	TX Freq Range (MHz)		Max Time-Avg Cond Power (dBm)	Antenna Gain Limits(dBi)		EIRP Limits (dBm)
					Standalone	Collocated	
RC7611	LTE Band 2	1850	1910	24	6	6	30
	LTE Band 4	1710	1755	24	6	6	30
	LTE Band 5	824	849	24	6	4	30
	LTE Band 12	699	716	24	6	4	30
	LTE Band 13	777	787	24	6	4	30
	LTE Band 14	788	798	24	6	4	30
	LTE Band 25	1850	1915	24	6	6	30
	LTE Band 26	814	849	24	6	4	30
	LTE Band 66	1710	1780	24	6	4	30
	LTE Band 71	663	698	24	6	3	30

[2.8 Label and compliance information]

【For FCC】

Following information must be indicated on the host device of this module.

Contains Transmitter Module FCC ID: Y9O-RC76B

or

Contains FCC ID: Y9O-RC76B

【For ISED】

Following information must be indicated on the host device of this module.
Contains IC : 9518A-RC76B

The following statements must be described on the user manual of the host device of this module.

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.

[2.9 Information on test modes and additional testing requirements]

Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

[2.10 Additional testing, Part 15 Subpart B disclaimer]

Not Applicable

[2.11 Note EMI Considerations]

We recommend to use "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.
The host manufacturer is responsible for ensuring compliance with the applicable FCC rules for the transmitters operating individually and simultaneously. This includes compliance for the summation of all emissions from all outputs occupying the same or overlapping frequency ranges, as defined by the applicable rules.

[2.12 How to make changes]

Only the grantee is permitted to make permissive changes. Please contact us at https://www.transtron.com/en/company/branch.html.

[2.5 Trace antenna designs]

Routing Constraints and Recommendations

This section describes general routing constraints and recommendations for this module.

1) General Rules and Recommendations

Clock and other high-frequency digital signals (e.g. serial buses) should be routed as far as possible from the module's analog signals.

If the application design makes it possible, all analog signals should be separated from digital signals by a ground trace on the PCB.

2) PCB Layout Recommendations

Ground pads should be re-flowed on to the host PCB with < 30% voiding to allow effective heat dissipation.

3) Power Supply

When designing the power supply, make sure that VBAT_BB/VBAT_RF meet the requirements listed in this module Product Technical Specification.
Careful attention should be paid to the following:

- Power supply quality—PFM, or PSM systems should be avoided; Low ripple, linear regulation or PWM converters are preferred for low noise.
- Capacity to deliver high current peaks in a short time (for pulsed radio emission)
- VBAT_BB/VBAT_RF must support peak currents with an acceptable voltage drop that guarantees the minimum required VBAT_BB/VBAT_RF value.
- VBAT_BB/VBAT_RF signal pads must never exceed the maximum required VBAT_BB/VBAT_RF value, otherwise the module's power amplifier and GPS chipset may be severely damaged.
- A weakly-designed (not robust) power supply could affect EMC performance, the emission spectrum, and the phase error and frequency error.

4) Antenna

We strongly recommends working with an antenna manufacturer either to develop an antenna adapted to the application, or to adapt an existing solution to the application.
For information on routing constraints for the RF circuit, see RF Circuit below.

5) PCB Specifications for the Application Board

Sensitive signals (such as audio, UIM, and clocks) should be protected by ground planes/fills. Routing sensitive signals close to noisy signals could result in noise being coupled.

6) Recommended PCB Land Pattern

Refer to AirPrime RC Series Customer Process Guidelines, available at http://source.sierrawireless.com.

7) Routing Constraints

Power Supply

If the following design recommendations are not followed, phase error (peak) and power loss could occur.

• Since the maximum peak current can reach 2.5 A, Sierra Wireless strongly recommends having a large width for the layout of the power supply signal (to avoid voltage loss between the external power supply and VBAT_BB/VBAT_RF).

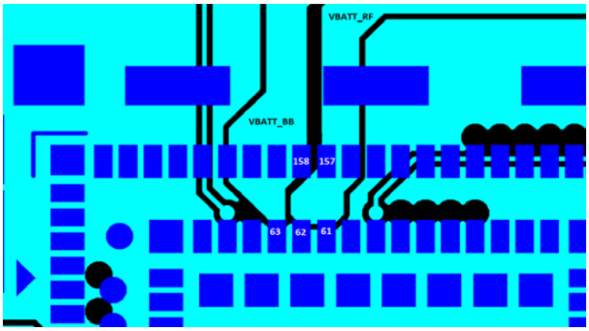

Figure 1: Power Supply Routing Example

Note: For optimal decoupling, place the capacitors on the underside of the board, directly under the pins.

• Filtering capacitors (100 nF to 1500 µF) are recommended near the module's power supply.

• Attention should be paid to the ground trace or the ground plane on the application board for the power supply that supplies the module. The ground trace or ground plane, as well as the VBAT trace, must be able to support current peaks.

• If the ground trace between the module and the power supply is a copper plane, make sure it is a solid plane.

• Design routing to make sure total line impedance does not exceed 10 mΩ @ 217 Hz.

Ground Plane Connection

this module requires a solid, central ground plane (with solder mask defined pads) located directly under the module. This will:

• Ensure high current signal returns

• Provide heat dissipation under higher operating temperatures

The ground plane should be connected (with vias) to the reference ground layer of the application board.

UIM Interface

• The length of the tracks between this module and the UIM socket should be as short as possible. Maximum recommended length is 10cm.

• ESD protection is mandatory on the UIM lines unless there is no physical access to the UIM.

• The decoupling capacitor(s) should be placed as close as possible to the UIM card connector for the UIM1_VCC signal.

RF Circuit

The RF signal must be routed on the application board using tracks with a 50Ω characteristic impedance.

The characteristic impedance depends on the dielectric, the track width and the ground plane spacing.

It is recommended to use stripline design if the RF path is fairly long (more than 3 cm), since microstrip design is not shielded. Consequently, the RF (transmit) signal may interfere with neighboring electronic circuits. In the same way, the neighboring electronics (micro-controllers, etc.) may interfere with the RF (receive) signal and degrade the reception performance.

USB Interface

When the USB interface is externally accessible, ESD protection is required on the USB_VBUS, USB_D+, and USB_D- signals.

8) Thermal Considerations

When transmitting, this module can generate significant amounts of heat (due to the internal Power Amplifier) that must be dissipated in the host device for safety and performance reasons.

The amount of thermal dissipation required depends on the following factors:

• Supply voltage—Maximum power dissipation for these modules can be up to 3 W at voltage supply limits.

• Usage—Typical power dissipation values depend on the location within the host, amount of data transferred, etc.

To enhance heat dissipation:

• Maximize airflow over / around the module

• Locate the module away from other components that generate heat

• Ensure the module is connected to a solid ground plane

9) EMC and ESD Recommendations

EMC tests must be performed on the application as soon as possible to detect any potential problems.

When designing, special attention should be paid to:

• Possible spurious emissions radiated by the application to the RF receiver in the receiver band

• ESD protection—Typically, ESD protection is mandatory for externally accessible signals, including:

· VBAT_RF/VBAT_BB

· UIM (if accessible from outside)

· Serial link

· USB

· Antennas

• Length of the UIM interface lines (preferably <10 cm)

• Length of the HSIC interface lines (<10 cm, as required by the HSIC specification)

• EMC protection on audio input/output (filters against 900 MHz emissions)

• Ground plane: Sierra Wireless recommends a common ground plane for analog/digital/RF grounds

Note: this module does not include any protection against over-voltage.

10) Mechanical Integration

Attention should be paid to:

• Antenna cable integration (bending, length, position, etc)

• Pads of this module to be soldered to the ground plane

• Ensuring proper board layout

• Providing sufficient space around the module for heat dissipation