



RML-N1 LGA Module User Manual



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1 Overview

The RML-N1 devices are WWAN LGA module in size 45x45mm. The LGA module and device software combination deliver multiband, multimode WWAN connectivity in a single hardware configuration. RML-N1 supports NR FR1(sub6) n2/ n5/ n12/ n25/ n30/ n41/ n66/ n71/ n77, LTE Band 2/ 4/ 5/ 12/ 25/ 26/ 30/ 41/ 48/ 66/ 71, LTE Band 29/46 is for downlink only. The RML-N1 devices also have an internal GPS receiver that can operate standalone or in simultaneous operation with its WWAN radios.

The RML-N1 device uses Mediatek chipset components. It implements the 5G NR standard for sub-6 GHz bands. The MT6190 device is a highly-integrated multimode, multiband RF CMOS transceiver IC that interfaces with the MT6890 device through IQ interface, it is the integrated single-chip RFIC that supports 5G NR sub-6 together with legacy 3G to 4G LTE.

RML-N1 and supported features for the NR FR1, Duplex mode: FDD(Frequency Division Duplex) and TDD((Time Division Duplex)). MIMO(Multi-input Multi-output) capability: up to 4x4 DL MIMO; CA(Carrier Aggregation) capability: DLCA: inter-band, intra-band contiguous and intra-band non-contiguous DLCA; ULCA: inter-band and intra-band contiguous ULCA. Modulation: UL: 256QAM; DL: 256QAM. Waveform: UL: CP-OFDM and DFT-S-OFDM; DL: CP-OFDM.

As for LTE, RML-N1 supports both FDD and TDD mode, MIMO capability: up to 4x4 DL MIMO, and 2x2 UL MIMO for n41. CA capability: DLCA: inter-band, intra-band contiguous and intra-band non-contiguous DLCA; ULCA: inter-band and intra-band contiguous ULCA. Modulation: UL: 256QAM; DL: 256QAM



1.1 Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular terminal or mobile incorporating with RML LGA module. Manufacturers of the cellular terminal should send the following safety information to users and operating personnel, and incorporate these guidelines into all manuals supplied with the product. If not so, Compal assumes no liability for customers' failure to comply with these precautions.



Full attention must be given to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.



Switch off the cellular terminal or mobile before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If the device offers an Airplane Mode, then it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on boarding the aircraft.



Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.



Cellular terminals or mobiles operating over radio signals and cellular network cannot be guaranteed to connect in all possible conditions (for example, with unpaid bills or with an invalid (U)SIM card). When emergent help is needed in such conditions, please remember using emergency call. In order to make or receive a call, the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength.



The cellular terminal or mobile contains a transmitter and receiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV set, radio, computer or other electric equipment.



In locations with potentially explosive atmospheres, obey all posted signs to turn off wireless devices such as your phone or other cellular terminals. Areas with potentially explosive atmospheres include fuelling areas, below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles such as grain, dust or metal powders, etc.

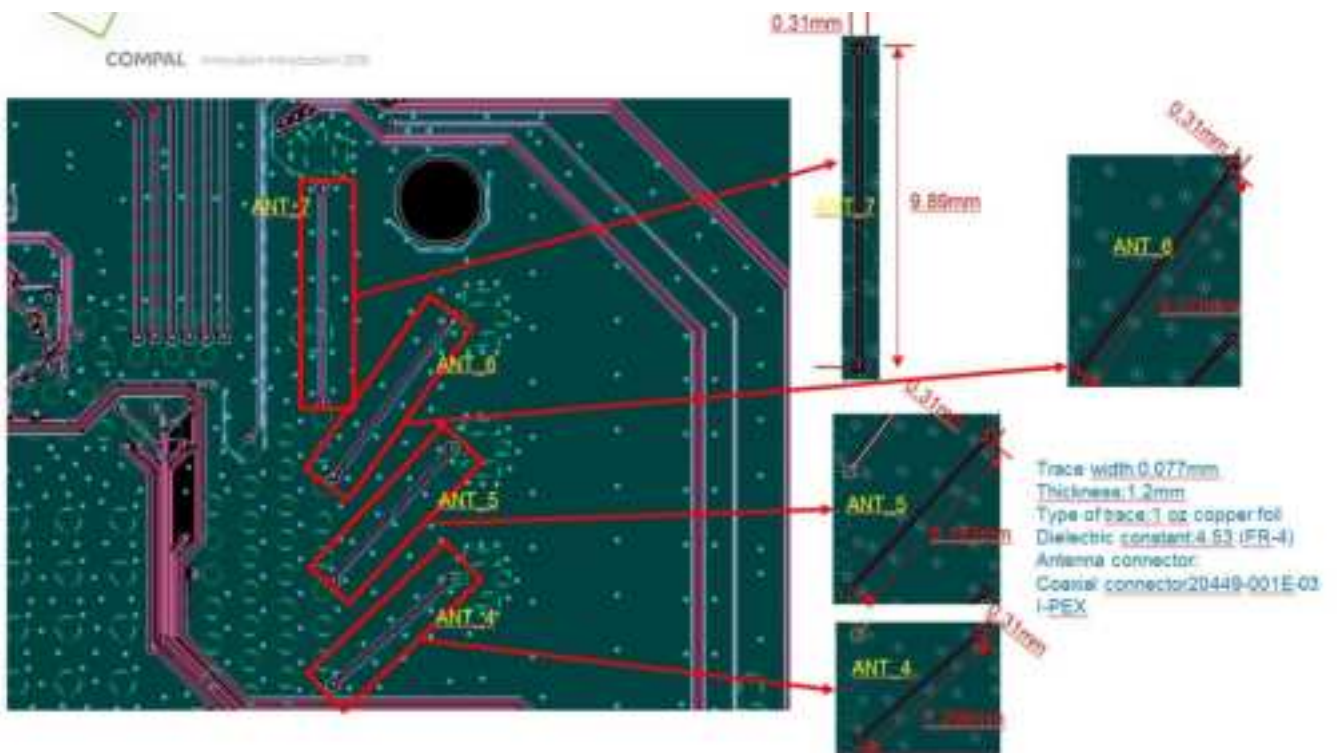
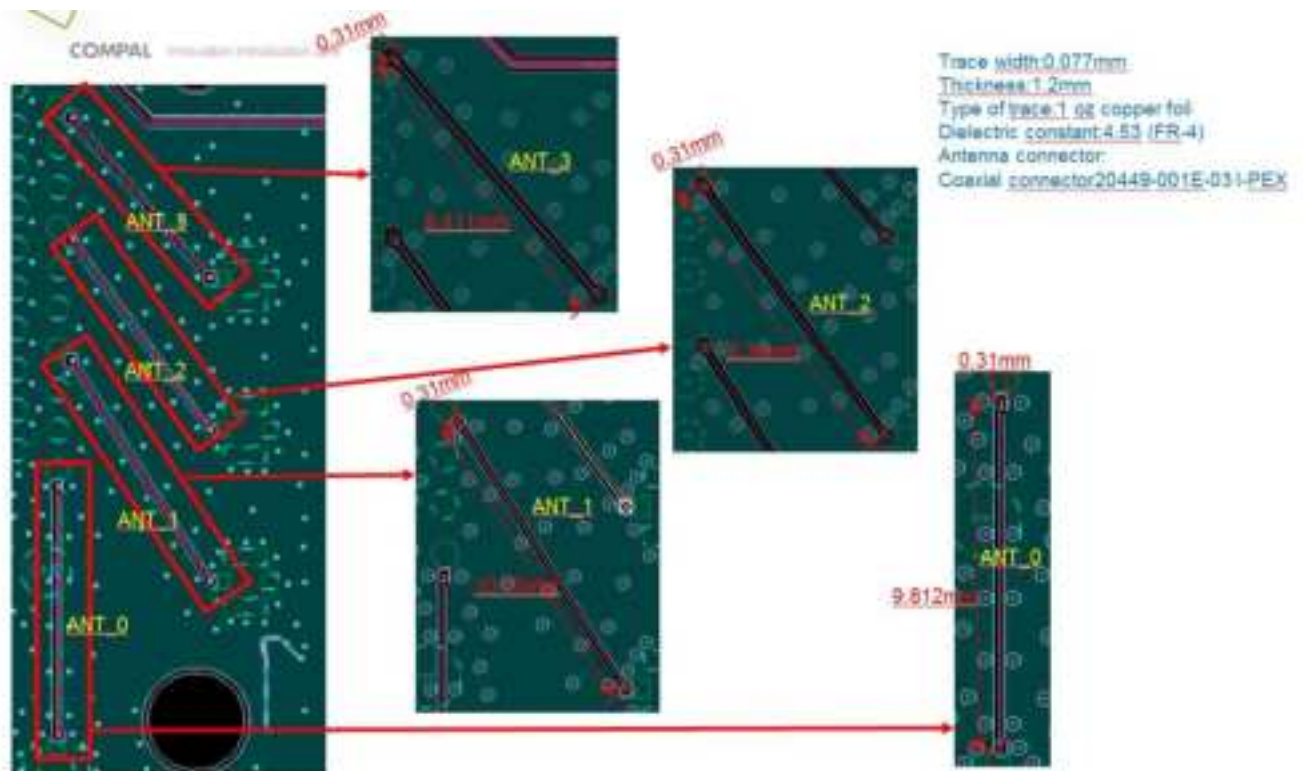


Table 1: Antenna port mapping table---For US band LGA module

| Frequency | | LTE | NR | Ant_0 | Ant_1 | Ant_2 | Ant_3 | Ant_4 | Ant_5 | Ant_6 | Ant_7 |
|-----------|--------------|--------------------|------------|-----------------------|-------|--------|----------------------|--------|--------|-------|-------|
| LB | 600-960MHz | 5,12,26,29(RX), 71 | n5,n12,n71 | Tx/PRx | DRx | | Tx ² /PRx | DRx4 | | | |
| MB | 1710-2200MHz | 2,4,25,66 | n2,n25,n66 | Tx ¹ /DRx2 | DRx | | PRx2 | Tx/PRx | | | |
| HB | 2300-2700MHz | 30,41 | n30,n41 | Tx ¹ /DRx2 | DRx | Tx/PRx | PRx2 | | | | |
| n41 | 2496-2690MHz | 41 | n41 | Tx ² /PRx | Rx | Tx/PRx | Rx | | | | |
| n77 | 3300-4200MHz | 48 | n77 | | | DRx | | PRx2 | Tx/PRx | DRx2 | |
| LAA | 5150-5850MHz | 46 | | PRx2 | DRx2 | | | | PRx | DRx | |
| GPS L1 | 1575-1610MHz | | | | | | | | | | Rx |
| GPS L5 | 1176MHz | | | | | | | | | | Rx |

Note.1 for B2/B4/B25/B66 CA

Note.2 n41 UL MIMO/LMHB+n41 EN-DC





Trace design

The trace from module transmitter to antenna connector on the EVB must be maintained identical as the above specification with i-pex connector. Only trace designs approved by the module original grantee or through permissive change can be used by an host manufacturer. Any changes are deemed as antenna type change and should be reviewed to ensure compliance with the FCC regulation rules.

Verification must be conducted and the results shall not exceed below ranges to ensure identical antenna design is applied to subsequent integration and end product production.

Test procedures of Verification

1. Set Transmission in the supported modulation mode, band and Channel.
2. Verify RF tuned-up power through conducted measurement with appropriate cable loss. The KDB guidance 971168 D01 can be followed to obtain the measurement results.
3. Verify the RF output power results obtained if it's accordance with the datasheet and test reports.



2 FCC Notice

Model: RML-N1

Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).

Antenna Installation

- (1) The antenna must be installed such that 20 cm is maintained between the antenna and users,
- (2) The transmitter module may not be co-located with any other transmitter or antenna.
- (3) To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile exposure condition must not exceed:

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.



Antenna (Maximum allowable gain)

| Modulation | Frequency (MHz) | Max. Allowable Antenna Gain (dBi) | Max. Collocated Antenna Gain (dBi) |
|------------------------|-----------------|-----------------------------------|------------------------------------|
| LTE Band 2 / NR n2 | 1850 ~ 1910 | 7.5 | 7.5 |
| LTE Band 4 | 1710 ~ 1755 | 4.5 | 4.5 |
| LTE Band 5 / NR n5 | 824 ~ 849 | 8.4 | 7.0 |
| LTE Band 12 / NR n12 | 699 ~ 716 | 8.6 | 7.0 |
| LTE Band 25 / NR n25 | 1850 ~ 1915 | 7.5 | 7.5 |
| LTE Band 26 | 824 ~ 849 | 8.4 | 7.0 |
| LTE Band 30 / NR n30 | 2305 ~ 2315 | -1.1 | -1.1 |
| LTE Band 41 / NR n41 | 2496 ~ 2690 | 5.0 | 5.0 |
| NR n41 MIMO Total gain | 2496 ~ 2690 | 5.0 | 5.0 |
| LTE Band 48 | 3550 ~ 3700 | -2.0 | -2.0 |
| LTE Band 66 / NR n66 | 1710 ~ 1780 | 4.5 | 4.5 |
| LTE Band 71 / NR n71 | 663 ~ 698 | 8.4 | 7.0 |
| NR n77 | 3300 ~ 4200 | 1.5 | 1.5 |



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.

Module Warning statements

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.

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

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.

RF Exposure

This device has been tested and meets applicable limits for Radio Frequency (RF) exposure.

The antenna(s) used for this transmitter should be installed and operated with minimum distance 20 cm between the radiator & your body.

Label requirements

Any device incorporating this module must include an external, visible, permanent marking or label which states:

"Contains FCC ID: GKRRMLN1"