RML-N1v LGA Module User Manual

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Notice

The document is subject to update from time to time owing to the product version upgrade or other reasons.

Unless otherwise specified, the document only serves as the user guide. All the statements, information and suggestions contained in the document do not constitute any explicit or implicit guarantee.

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1 Overview

The RML-N1v 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-N1v supports NR FR1(sub6) n2/ n5/ n66/ n77, LTE Band 2/ 5/ 12/ 13/48/ 66. The RML-N1v devices also have an internal GPS receiver that can operate standalone or in simultaneous operation with its WWAN radios.

The RML-N1v 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-N1v 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-N1v supports both FDD and TDD mode, MIMO capability: up to 4x4 DL MIMO, and 2x2 UL MIMO. 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.

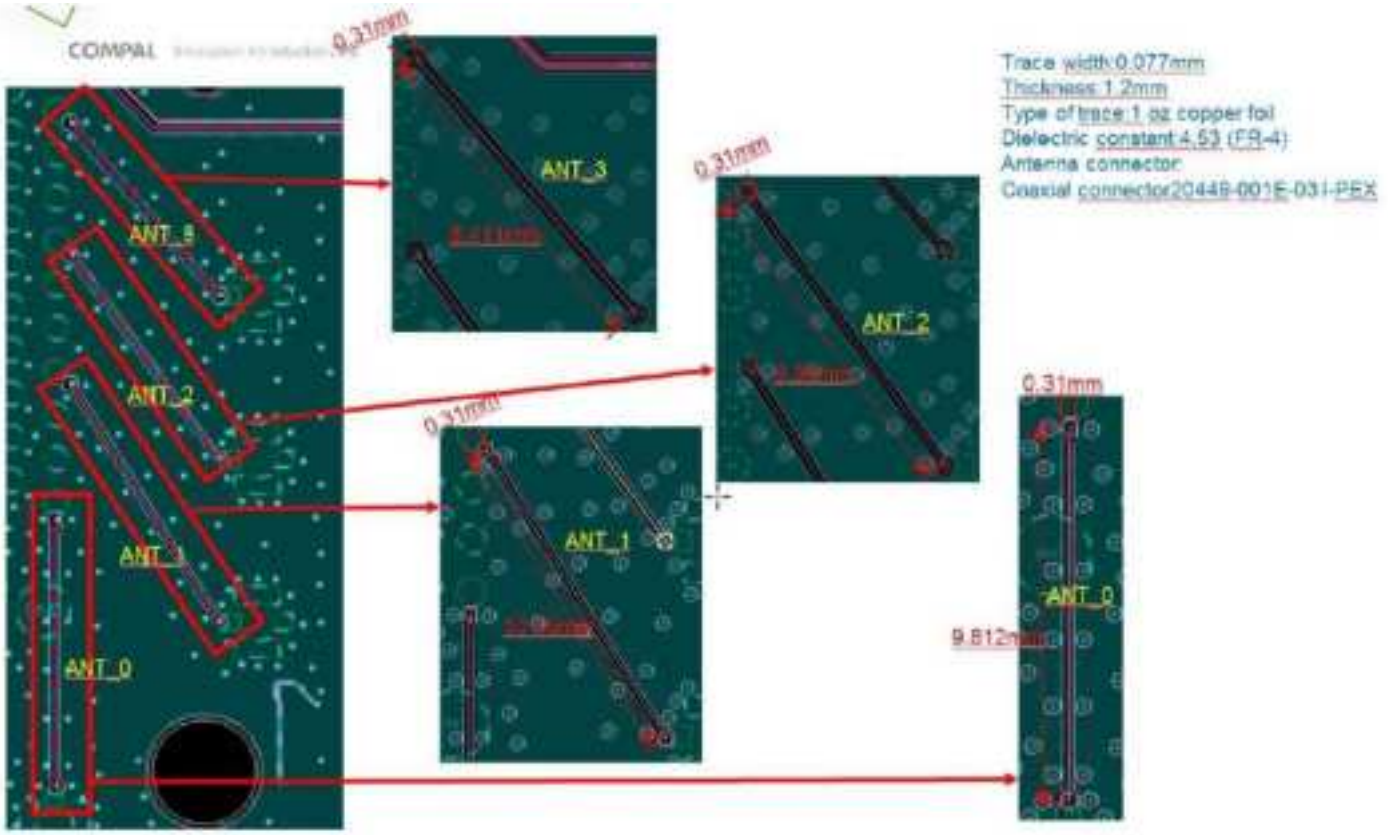
The cellular terminal or mobile contains a transmitter and receiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV set, radio, computer or other electric equipment.

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		Ant_0	Ant_1	Ant_2	Ant_3	Ant_4	Ant_5	Ant_6	Ant_7
LB	600-960MHz	Tx/PRx	DRx		Tx/PRx[2,3]	DRx[2,3]			
MB	1710-2200MHz		DRx	Tx/DRx2	PRx2	Tx/PRx			
HB	2300-2700MHz								
n41	2496-2690MHz								
n77/n78	3300-4200MHz			DRx2		PRx2	Tx/PRx	Tx[4]/DRx	
LAA	5150-5850MHz								
GPS L1	1575-1610MHz								Rx
GPS L5	1176MHz								Rx

Note.1 for B2/B66 CA
Note.2 B13 (when ENDC B13_n5)
Note.3 B5/12/13 4x4 DL MIMO
Note.4 n77 UL 2x2 MIMO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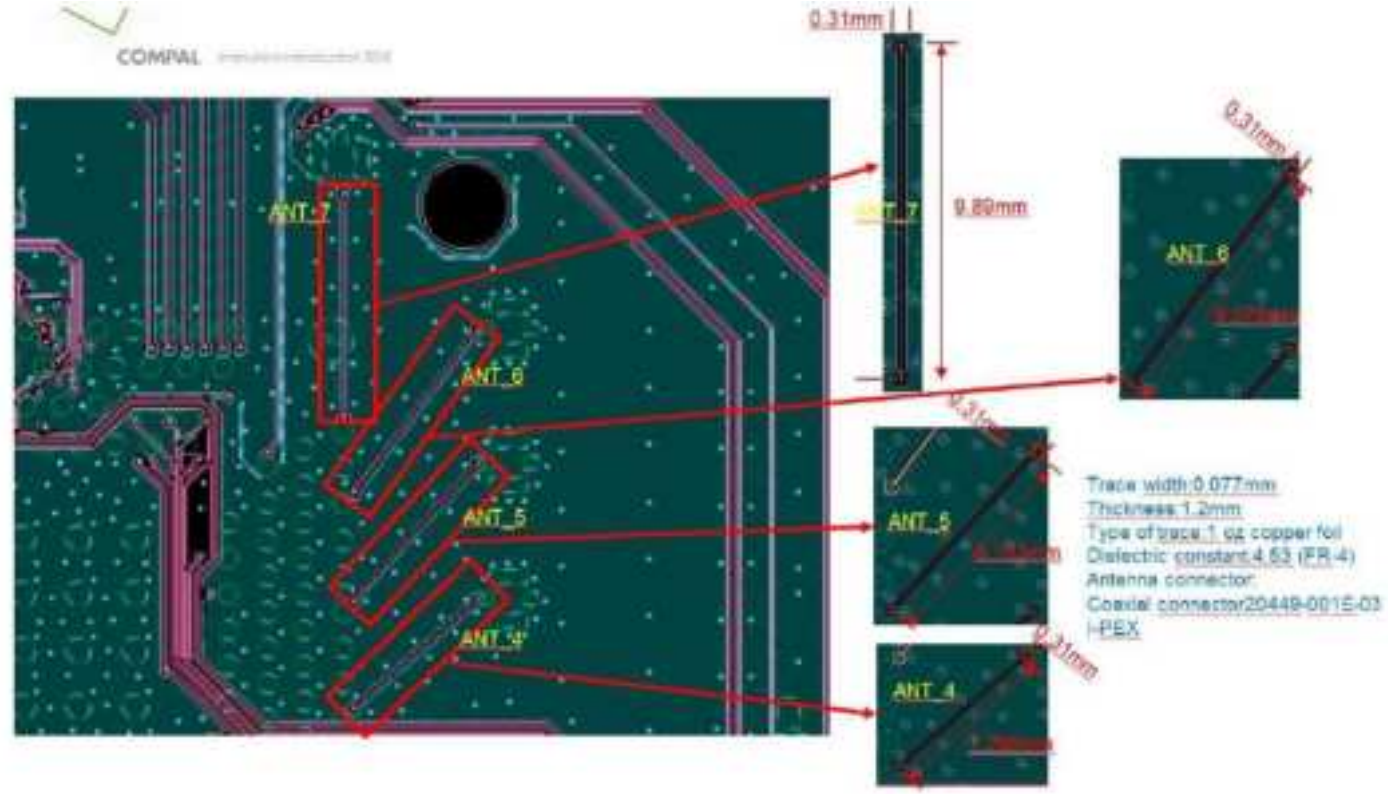
0.31mm
ANT_3
ANT_4
ANT_2
ANT_1
ANT_0
0.31mm
ANT_2
0.31mm
ANT_1
0.31mm
ANT_0
9.812mm
Trace width:0.077mm
Thickness:1.2mm
Type of trace:1 oz copper foil
Dielectric constant:4.53 (FR-4)
Antenna connector
Coaxial connector20449-001E-031-PEX


COMPAL
0.31mm
ANT_7
9.89mm
0.31mm
ANT_6
ANT_7
ANT_6
ANT_5
ANT_4
ANT_5
0.31mm
ANT_4
Trace width:0.077mm
Thickness:1.2mm
Type of trace:1 oz copper foil
Dielectric constant:4.53 (FR-4)
Antenna connector
Coaxial connector20449-001E-03
I-PEX

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 a 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-N1v

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 5 / NR n5	824 ~ 849	5.0	5.0
LTE Band 12	699 ~ 716	5.5	5.0
LTE Band 13	746 ~ 787	5.5	5.5
LTE Band 48	3550 ~ 3700	-2	-2
LTE Band 66 / NR n66	1710 ~ 1780	4.5	4.5
NR n77	3300 ~ 4200	2.0	2.0

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: GKRRMLV1"