

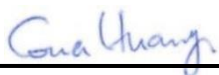
# RF EXPOSURE EVALUATION REPORT

FCC ID : GKRRMLV1  
Equipment : 5G LGA Module  
Brand Name : COMPAL  
Model Name : RML-N1v  
Applicant : Compal Electronics, Inc.  
No.581 & 581-1, Ruiguang Rd., Neihu District, Taipei, (114) Taiwan  
Manufacturer : Compal Electronics, Inc.  
No.581 & 581-1, Ruiguang Rd., Neihu District, Taipei, (114) Taiwan  
Standard : 47 CFR Part 2.1091

We, SPORTON INTERNATIONAL INC has been evaluated this product in accordance with 47 CFR Part2.1091 and it complies with applicable limit.

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 1190) and the FCC designation No. TW1190 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC evaluation.

The results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full



Approved by: Cona Huang / Deputy Manager



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## History of this test report

| Report No.  | Version | Description             | Issued Date   |
|-------------|---------|-------------------------|---------------|
| FA210421-02 | Rev. 01 | Initial issue of report | May 01, 2022  |
| FA210421-02 | Rev. 02 | Remove n48              | Jul. 13, 2022 |
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**1. Description of Equipment Under Test (EUT)**

| Product Feature & Specification         |                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EUT Type                                | 5G LGA Module                                                                                                                                                                                                                                                                                                                                       |
| Brand Name                              | COMPAL                                                                                                                                                                                                                                                                                                                                              |
| Model Name                              | RML-N1v                                                                                                                                                                                                                                                                                                                                             |
| FCC ID                                  | GKRRMLV1                                                                                                                                                                                                                                                                                                                                            |
| Wireless Technology and Frequency Range | LTE Band 2: 1850 MHz ~ 1910 MHz<br>LTE Band 5: 824 MHz ~ 849 MHz<br>LTE Band 12: 699 MHz ~ 716 MHz<br>LTE Band 13: 777 MHz ~ 787 MHz<br>LTE Band 48: 3550 MHz ~ 3700 MHz<br>LTE Band 66: 1710 MHz ~ 1780 MHz<br>5G NR n2 : 1850 MHz ~ 1910 MHz<br>5G NR n5 : 824 MHz ~ 849 MHz<br>5G NR n66 : 1710 MHz ~ 1780 MHz<br>5G NR n77: 3700 MHz ~ 3980 MHz |
| Mode                                    | LTE: QPSK, 16QAM, 64QAM, 256QAM<br>5G NR: DFT-s-OFDM/CP-OFDM, Pi/2 BPSK/QPSK/16QAM/64QAM/256QAM                                                                                                                                                                                                                                                     |
| EUT Stage                               | Identical Prototype                                                                                                                                                                                                                                                                                                                                 |

**Remark:** The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

**Reviewed by:** Jason Wang

**Report Producer:** Daisy Peng

**2. Maximum RF average output power among production units**

| Radio Tech | Band Number | Maximum Transmit Power Level (dBm) |
|------------|-------------|------------------------------------|
|            |             | Default                            |
| LTE        | B2          | 25.00                              |
| LTE        | B5          | 25.00                              |
| LTE        | B12         | 25.00                              |
| LTE        | B13         | 25.00                              |
| LTE        | B48         | 25.00                              |
| LTE        | B66         | 25.00                              |
| FR1        | n2          | 25.00                              |
| FR1        | n5          | 25.00                              |
| FR1        | n66         | 25.00                              |
| FR1        | n77         | 28.00                              |

### 3. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

| Frequency range (MHz)                                          | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|----------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposures</b>        |                               |                               |                                     |                          |
| 0.3-3.0                                                        | 614                           | 1.63                          | *(100)                              | 6                        |
| 3.0-30                                                         | 1842/f                        | 4.89/f                        | *(900/f <sup>2</sup> )              | 6                        |
| 30-300                                                         | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300-1500                                                       |                               |                               | f/300                               | 6                        |
| 1500-100,000                                                   |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34                                                       | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34-30                                                        | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |
| 30-300                                                         | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300-1500                                                       |                               |                               | f/1500                              | 30                       |
| 1500-100,000                                                   |                               |                               | 1.0                                 | 30                       |

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna

## 4. Radio Frequency Radiation Exposure Evaluation

### 4.1. Standalone Power Density Calculation

| Band         | Antenna Gain (dBi) | Maximum Power (dBm) | Maximum EIRP (dBm) | Maximum EIRP (W) | Average EIRP (mW) | Power Density at 20cm (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) | Power Density / Limit |
|--------------|--------------------|---------------------|--------------------|------------------|-------------------|---------------------------------------------|-----------------------------|-----------------------|
| LTE Band 2   | 7.50               | 25.00               | 32.5               | 1.78             | 1778.28           | 0.354                                       | 1.000                       | 0.354                 |
| LTE Band 5   | 5.00               | 25.00               | 30.0               | 1.00             | 1000.00           | 0.199                                       | 0.549                       | 0.362                 |
| LTE Band 12  | 5.50               | 25.00               | 30.5               | 1.12             | 1122.02           | 0.223                                       | 0.466                       | 0.479                 |
| LTE Band 13  | 5.50               | 25.00               | 30.5               | 1.12             | 1122.02           | 0.223                                       | 0.518                       | 0.431                 |
| LTE Band 48  | -2.00              | 25.00               | 23.0               | 0.20             | 199.53            | 0.040                                       | 1.000                       | 0.040                 |
| LTE Band 66  | 4.50               | 25.00               | 29.5               | 0.89             | 891.25            | 0.177                                       | 1.000                       | 0.177                 |
| FR1 Band n2  | 7.50               | 25.00               | 32.5               | 1.78             | 1778.28           | 0.354                                       | 1.000                       | 0.354                 |
| FR1 Band n5  | 5.00               | 25.00               | 30.0               | 1.00             | 1000.00           | 0.199                                       | 0.549                       | 0.362                 |
| FR1 Band n66 | 4.50               | 25.00               | 29.5               | 0.89             | 891.25            | 0.177                                       | 1.000                       | 0.177                 |
| FR1 Band n77 | 2.00               | 28.00               | 30.0               | 1.00             | 1000.00           | 0.199                                       | 1.000                       | 0.199                 |

#### <EN-DC Simtaneous Transmission analysis>

| EN-DC                        |                                | $\Sigma$ (Power Density / Limit)<br>of<br>LTE + 5G NR |
|------------------------------|--------------------------------|-------------------------------------------------------|
| LTE<br>Power Density / Limit | 5G NR<br>Power Density / Limit |                                                       |
| 0.479                        | 0.362                          | 0.841                                                 |

#### General Note:

- The device support 5G FR1 NSA mode, consider colocation analysis to selected worst case LTE and 5G NR power density / limit to summation to show compliance
- $\Sigma$  (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for LTE + 5G NR.
- Considering the collocation with the four transmitters of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 2 collocated transmitters is compliant

## 4.2. EN-DC active and transmit with WLAN/BT

**Note:**

1. This MPE analysis is applicable to any collocated transmitters with transmit power for WLAN is less than or equal to 21dBm and for Bluetooth is less than or equal to 15dBm.
2. A maximum antenna gain of 5 dBi for WLAN/BT has been assumed for all collocated antennas.

| Band            | Antenna Gain (dBi) | Maximum Power (dBm) | Maximum EIRP (dBm) | Maximum EIRP (W) | Average EIRP (mW) | Power Density at 20cm (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) | Power Density / Limit |
|-----------------|--------------------|---------------------|--------------------|------------------|-------------------|---------------------------------------------|-----------------------------|-----------------------|
| LTE Band 2      | 7.5                | 25.00               | 32.5               | 1.78             | 1778.28           | 0.354                                       | 1.000                       | 0.354                 |
| LTE Band 5      | 5.0                | 25.00               | 30.0               | 1.00             | 1000.00           | 0.199                                       | 0.549                       | 0.362                 |
| LTE Band 12     | 5.0                | 25.00               | 30.0               | 1.00             | 1000.00           | 0.199                                       | 0.466                       | 0.427                 |
| LTE Band 13     | 5.5                | 25.00               | 30.5               | 1.12             | 1122.02           | 0.223                                       | 0.518                       | 0.431                 |
| LTE Band 48     | -2.0               | 25.00               | 23.0               | 0.20             | 199.53            | 0.040                                       | 1.000                       | 0.040                 |
| LTE Band 66     | 4.5                | 25.00               | 29.5               | 0.89             | 891.25            | 0.177                                       | 1.000                       | 0.177                 |
| FR1 Band n2     | 7.5                | 25.00               | 32.5               | 1.78             | 1778.28           | 0.354                                       | 1.000                       | 0.354                 |
| FR1 Band n5     | 5.0                | 25.00               | 30.0               | 1.00             | 1000.00           | 0.199                                       | 0.549                       | 0.362                 |
| FR1 Band n66    | 4.5                | 25.00               | 29.5               | 0.89             | 891.25            | 0.177                                       | 1.000                       | 0.177                 |
| FR1 Band n77    | 2.0                | 28.00               | 30.0               | 1.00             | 1000.00           | 0.199                                       | 1.000                       | 0.199                 |
| WLAN2.4GHz Band | 5.0                | 21.0                | 26.0               | 0.40             | 398.11            | 0.079                                       | 1.000                       | 0.079                 |
| WLAN5GHz Band   | 5.0                | 21.0                | 26.0               | 0.40             | 398.11            | 0.079                                       | 1.000                       | 0.079                 |
| Bluetooth       | 5.0                | 15.0                | 20.0               | 0.10             | 100.00            | 0.020                                       | 1.000                       | 0.020                 |

| EN-DC                        |                                | WLAN<br>Power Density / Limit | Bluetooth<br>Power Density / Limit | $\Sigma$ (Power Density / Limit)<br>of<br>LTE +5G NR+WLAN+Bluetooth |
|------------------------------|--------------------------------|-------------------------------|------------------------------------|---------------------------------------------------------------------|
| LTE<br>Power Density / Limit | 5G NR<br>Power Density / Limit |                               |                                    |                                                                     |
| 0.431                        | 0.362                          | 0.079                         | 0.020                              | 0.892                                                               |

**Note:**

4.  $\Sigma$  (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for LTE + NR + WLAN + Bluetooth.
5. Considering the WWAN module collocation with the WLAN and Bluetooth transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 4 collocated transmitters is compliant

**Conclusion:**

Based on FCC 47 CFR §1.1307, the analysis concludes that this product when transmitting in standalone within a host device, is compliant with the FCC RF exposure requirements in mobile exposure condition, provided the conducted power and antenna gain do not exceed the limits for each given frequency band per wireless technology as follow table:

| Device  | Technology | Band    | Maximum Conducted Power (dBm) | Stanalone Maximum Antenna Gain (dBi) | Collocated Maximum Antenna Gain (dBi) |
|---------|------------|---------|-------------------------------|--------------------------------------|---------------------------------------|
| RML-N1v | LTE        | Band 2  | 25.00                         | 7.5                                  | 7.5                                   |
|         |            | Band 5  | 25.00                         | 5.0                                  | 5.0                                   |
|         |            | Band 12 | 25.00                         | 5.5                                  | 5.0                                   |
|         |            | Band 13 | 25.00                         | 5.5                                  | 5.5                                   |
|         |            | Band 48 | 25.00                         | -2                                   | -2                                    |
|         |            | Band 66 | 25.00                         | 4.5                                  | 4.5                                   |
|         | FR1        | n2      | 25.00                         | 7.5                                  | 7.5                                   |
|         |            | n5      | 25.00                         | 5.0                                  | 5.0                                   |
|         |            | n66     | 25.00                         | 4.5                                  | 4.5                                   |
|         |            | n77     | 28.00                         | 2.0                                  | 2.0                                   |