

MPE Report

Applicant : Lightspeed International Co
Product Type : 5G gateway 500G
Trade Name : LIGHTSPEED
Model Number : 5G-500G
Applicable Standard : 47 CFR § 2.1091
Received Date : Jun. 11, 2021
Test Period : Jul. 21 ~ Jul. 22, 2021
Issue Date : Nov. 15, 2021

Issued by

Approved By :

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Taiwan Accreditation Foundation accreditation number: 1330
Test Firm MRA designation number: TW0010

Note:

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Revision History

| Rev. | Issued Date | Revisions | Revised By |
|------|---------------|---------------|------------|
| 00 | Nov. 15, 2021 | Initial Issue | Nicole Chu |
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1. Reference Applicable Standard

| Standard | Description | Version |
|---------------------|--|---------|
| IEEE C95.1 | American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300 KHz to 100 GHz, New York. | 1992 |
| 47 CFR Part §2.1091 | Radiofrequency radiation exposure evaluation: mobile devices. | - |
| 47 CFR Part §1.1310 | Radiofrequency radiation exposure limits. | - |

2. Description of Equipment under Test (EUT)

| | | | | | |
|---------------------|---|------------------|----------------|-----------------------|------|
| Applicant | Lightspeed International Co No.20, Lane 526 Niupu East Road HsinChu, Taiwan, ROC 30091 | | | | |
| Manufacturer | Lightspeed International Co No.20, Lane 526 Niupu East Road HsinChu, Taiwan, ROC 30091 | | | | |
| Product Type | 5G gateway 500G | | | | |
| Trade Name | LIGHTSPEED | | | | |
| Model Number | 5G-500G | | | | |
| FCC ID | NGJ-5G-500G | | | | |
| IMEI No. | 355979860033311 | | | | |
| Frequency Range | Operate Band | | | Frequency Range (MHz) | |
| | LTE Band 5 | | | 824 - 849 | |
| | 5 G NR n5 | | | 824 - 849 | |
| | IEEE 802.11b/g/n 2.4 GHz 20 MHz | | | 2412 - 2462 | |
| | IEEE 802.11n 2.4 GHz 40 MHz | | | 2422 - 2452 | |
| | IEEE 802.11a | | | 5180 - 5240 | |
| | IEEE 802.11n 5 GHz / 802.11ac 20 MHz | | | 5180 - 5240 | |
| | IEEE 802.11n 5 GHz / 802.11ac 40 MHz | | | 5190 - 5230 | |
| | IEEE 802.11ac 80 MHz | | | 5210 | |
| | Bluetooth LE | | | 2402 - 2480 | |
| Antenna Information | | Model | Type | Max. Gain (dBi) | |
| | ANT-0 | AN0750-74S05BSM | Linear Antenna | LTE Band 5 | 1.78 |
| | ANT-0 | AN0750-74S05BSM | Linear Antenna | 5 G NR n5 | 1.78 |
| | ANT-0 | AN2400-67A10BGX | Linear Antenna | Bluetooth/Zigbee | 3.07 |
| | ANT-0 | AN2450D-67A51BX | Linear Antenna | 2.4 GHz | 4.92 |
| | ANT-1/2/3 | AN2450D-67A52BGX | Linear Antenna | 2.4 GHz | 4.92 |
| | ANT-0 | AN2450D-67A51BX | Linear Antenna | 5 GHz | 3.67 |
| ANT-1/2/3 | AN2450D-67A52BGX | Linear Antenna | 5 GHz | 3.67 | |
| Antenna Delivery | IEEE 802.11b/g/n 2.4 GHz 20 MHz / 40 MHz: 4TX / 4RX (CDD) IEEE 802.11a/ac/ax 20 MHz / 40 MHz / 80 MHz: 4TX / 4RX (CDD) | | | | |
| RF Evaluation | 0.168 mW/cm ² | | | | |
| Operate Temp. Range | 0 ~ +40°C | | | | |

The above equipment was tested by A Test Lab Techno Corp. For compliance with the requirements set forth in 47 CFR § 2.1091 / 47 CFR § 1.1310. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

3. *Human Exposure Assessment*

Due to the design and installation of this product, it is not possible to conduct SAR evaluation. This is because client either manufactures or supplies the antenna(s) that will be used in the installation of this product. Therefore, this product will be evaluated as a mobile device per 47 CFR § 1.1310 titled “Radiofrequency radiation exposure limits”, generally referred to as MPE limits.

In 47 CFR § 2.1091, paragraph (b) defines a mobile device as “a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 cm is normally maintained between the transmitter’s radiating structure(s) and the body of the user or nearby persons. ” This product is intended to be installed into a vehicle such that the unit is physically secured at one location. In the installation guide supplied with the product,

Client has made the following statement: “IMPORTANT: To meet the FCC’s RF Exposure Guidelines, the antenna should be installed so there is at least 20 cm of separation between the body of the user and nearby persons and the antenna”. Based on the installation of the transceiver and the antenna, the transmitters radiating structure is more than 20 cm from the user. Thus, this product is a “mobile device” as defined in section § 2.1091 paragraph (b).

| Exposure evaluation |
|---|
| $S_{eirp} = \frac{EIRP}{4\pi d^2} = \frac{PG}{4\pi d^2} (W / m^2)$ |
| <p>Where</p> <p>S: is the input power (W);</p> <p>G: is the antenna gain;</p> <p>d : is the distance between antennas and evaluation point (m).</p> |

4. Power Density Limit – RF Exposure Evaluation

Thv In 47 CFR § 1.1310, use of the device as based upon the user's awareness and ability to exercise control over human exposure. The two categories defined are Occupational / Controlled Exposure and General Population / Uncontrolled. These two categories are defined as follow:

| Limits for General Population / Uncontrolled Exposure | | | | |
|---|-----------------------------------|-----------------------------------|---|---|
| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm ²) | Averaging Time E ² , H ² or S (minutes) |
| 0.3-1.34 | 614 | 1.63 | (100)* | 30 |
| 1.34-30 | 824 / f | 2.19 / f | (180 / f ²)* | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | - | - | F / 1,500 | 30 |
| 1,500-100,000 | - | - | 1.0 | 30 |
| Limits for Occupational / Controlled Exposure | | | | |
| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm ²) | Averaging Time E ² , H ² or S (minutes) |
| 0.3-3.0 | 614 | 1.63 | (100)* | 6 |
| 3.0-30 | 1,842 / f | 4.89 / f | (900 / f ²)* | 6 |
| 30-300 | 61.4 | 0.163 | 1.0 | 6 |
| 300-1,500 | - | - | F / 300 | 6 |
| 1,500-100,000 | - | - | 5 | 6 |

4.1 Conducted Power

| Band | Date Rate or Sub-test | CH | Frequency (MHz) | Average Conducted power | | | | |
|--------------|-----------------------|----|-----------------|-------------------------|-------|-------|-------|---------|
| | | | | ANT-0 | ANT-1 | ANT-2 | ANT-3 | All ANT |
| | | | | dBm | dBm | dBm | dBm | dBm |
| 802.11b | 1M | 1 | 2412 | 14.15 | 14.31 | 14.00 | 14.03 | 20.14 |
| | | 6 | 2437 | 14.08 | 14.51 | 14.05 | 14.16 | 20.22 |
| | | 11 | 2462 | 14.16 | 14.45 | 14.33 | 14.39 | 20.35 |
| 802.11g | 6M | 1 | 2412 | 14.28 | 14.31 | 14.15 | 14.09 | 20.23 |
| | | 6 | 2437 | 14.11 | 14.63 | 14.05 | 14.07 | 20.24 |
| | | 11 | 2462 | 14.63 | 14.52 | 14.45 | 14.20 | 20.47 |
| 802.11n_HT20 | 26M | 1 | 2412 | 13.44 | 13.42 | 13.04 | 12.81 | 19.21 |
| | | 6 | 2437 | 14.35 | 14.97 | 14.44 | 14.16 | 20.51 |
| | | 11 | 2462 | 12.35 | 12.82 | 12.65 | 12.37 | 18.57 |
| 802.11n_HT40 | 54M | 3 | 2422 | 12.30 | 12.47 | 12.02 | 11.85 | 18.19 |
| | | 6 | 2437 | 14.07 | 14.02 | 14.09 | 14.05 | 20.08 |
| | | 9 | 2452 | 11.32 | 11.47 | 11.22 | 11.08 | 17.30 |

| Band | Frequency (MHz) | Average Conducted power (dBm) |
|--------------|-----------------|-------------------------------|
| Bluetooth LE | 2402 | 6.29 |
| | 2440 | 7.01 |
| | 2480 | 6.85 |
| Zigbee | 2405 | 8.87 |
| | 2440 | 8.85 |
| | 2480 | 8.83 |

| Band | Date Rate or Sub-test | CH | Frequency (MHz) | | Average Conducted power | | | | | |
|-----------------|-----------------------|----|-----------------|-----|-------------------------|-------------------------|-------|-------|---------|---------|
| | | | | | ANT-0 | ANT-1 | ANT-2 | ANT-3 | All ANT | |
| | | | | | dBm | dBm | dBm | dBm | dBm | |
| 802.11a | 6M | 36 | 5180 | | 15.08 | 15.24 | 15.54 | 14.89 | 21.21 | |
| | | 40 | 5200 | | 14.95 | 15.15 | 15.48 | 15.05 | 21.18 | |
| | | 44 | 5220 | | 14.90 | 15.10 | 15.40 | 15.00 | 21.12 | |
| | | 48 | 5240 | | 14.89 | 15.04 | 14.93 | 15.02 | 20.99 | |
| 802.11n_5G_HT20 | 26M | 36 | 5180 | | 14.68 | 14.93 | 15.18 | 14.83 | 20.93 | |
| | | 40 | 5200 | | 14.84 | 15.02 | 15.29 | 14.75 | 21.00 | |
| | | 44 | 5220 | | 14.80 | 15.00 | 15.18 | 14.70 | 20.94 | |
| | | 48 | 5240 | | 14.65 | 15.09 | 15.08 | 14.86 | 20.94 | |
| 802.11n_5G_HT40 | 54M | 38 | 5190 | | 13.78 | 13.92 | 14.01 | 13.62 | 19.86 | |
| | | 46 | 5230 | | 14.82 | 14.99 | 15.14 | 15.15 | 21.05 | |
| 802.11ac_VHT20 | 26M | 36 | 5180 | | 14.79 | 15.01 | 15.59 | 14.94 | 21.11 | |
| | | 40 | 5200 | | 14.92 | 15.10 | 15.39 | 14.85 | 21.09 | |
| | | 44 | 5220 | | 14.82 | 15.07 | 15.25 | 14.82 | 21.01 | |
| | | 48 | 5240 | | 14.78 | 15.14 | 15.19 | 15.00 | 21.05 | |
| 802.11ac_VHT40 | 54M | 38 | 5190 | | 13.85 | 14.05 | 14.12 | 13.74 | 19.96 | |
| | | 46 | 5230 | | 14.90 | 15.11 | 15.28 | 15.28 | 21.17 | |
| 802.11ac_VHT80 | 117.2M | 42 | 5210 | | 14.91 | 15.00 | 15.14 | 15.04 | 21.04 | |
| Band | Date Rate or Sub-test | CH | Frequency (MHz) | RU | RU Number | Average Conducted power | | | | |
| | | | | | | ANT-0 | ANT-1 | ANT-2 | ANT-3 | All ANT |
| | | | | | | dBm | dBm | dBm | dBm | dBm |
| 802.11ax_HE20 | MCS 0 | 36 | 5180 | 242 | 1 | 15.24 | 15.21 | 15.57 | 15.24 | 21.34 |
| | | 40 | 5200 | 242 | 1 | 15.39 | 15.24 | 15.52 | 15.15 | 21.35 |
| | | 44 | 5220 | 242 | 1 | 15.36 | 15.15 | 15.49 | 15.12 | 21.30 |
| | | 48 | 5240 | 242 | 1 | 15.42 | 15.21 | 15.37 | 15.25 | 21.33 |
| 802.11ax_HE40 | MCS 0 | 38 | 5190 | 484 | 1 | 14.07 | 13.87 | 14.27 | 13.83 | 20.03 |
| | | 46 | 5230 | 484 | 1 | 15.28 | 15.29 | 15.36 | 15.55 | 21.39 |
| 802.11ax_HE80 | MCS 0 | 42 | 5210 | 968 | 1 | 15.14 | 15.31 | 15.33 | 15.25 | 21.28 |

5. Test Result

| Antenna | Band | Frequency (MHz) | Limit (mW)/cm ² | Distance | Tune-up Power | ANT Gain | Numeric Gain | Duty Cycle | Power with Duty cycle | Power Density |
|-------------------|------------|-----------------|----------------------------|----------|---------------|----------|--------------|------------|-----------------------|----------------------|
| | | | | (cm) | (dBm) | | | | (mW) | (mW)/cm ² |
| | | | | [R] | [P] | | | | [P]x[G] | [S] |
| WWAN Antenna | LTE Band 5 | 824-849 | 0.566 | 20 | 24.00 | 1.78 | 1.51 | 1 | 379.29 | 0.075 |
| | n5 | 824-849 | 0.566 | 20 | 24.00 | 1.78 | 1.51 | 1 | 379.29 | 0.075 |
| Bluetooth Antenna | Bluetooth | 2402-2480 | 1.000 | 20 | 7.50 | 3.07 | 2.03 | 1 | 11.42 | 0.002 |
| Zibee Antenna | Zibee | 2405-2480 | 1.000 | 20 | 9.00 | 4.92 | 3.10 | 1 | 24.62 | 0.005 |
| Wi-Fi Antenna 0 | 2.4GHz | 2412-2462 | 1.000 | 20 | 15.00 | 4.92 | 3.10 | 1 | 98.03 | 0.020 |
| | 5GHz | 5150-5250 | 1.000 | 20 | 16.00 | 3.67 | 2.33 | 1 | 92.76 | 0.018 |
| Wi-Fi Antenna 1 | 2.4GHz | 2412-2462 | 1.000 | 20 | 15.00 | 4.92 | 3.10 | 1 | 98.03 | 0.020 |
| | 5GHz | 5150-5250 | 1.000 | 20 | 16.00 | 3.67 | 2.33 | 1 | 92.76 | 0.018 |
| Wi-Fi Antenna 2 | 2.4GHz | 2412-2462 | 1.000 | 20 | 15.00 | 4.92 | 3.10 | 1 | 98.03 | 0.020 |
| | 5GHz | 5725-5850 | 1.000 | 20 | 16.00 | 3.67 | 2.33 | 1 | 92.76 | 0.018 |
| Wi-Fi Antenna 3 | 2.4GHz | 2412-2462 | 1.000 | 20 | 15.00 | 4.92 | 3.10 | 1 | 98.03 | 0.020 |
| | 5GHz | 5150-5250 | 1.000 | 20 | 16.00 | 3.67 | 2.33 | 1 | 92.76 | 0.018 |

Note:

1. Mobile or fixed location transmitters, minimum separation distance is 20 cm, even if calculations indicate MPE distance is less.
2. We used the maximum power and gain to provide MPE results.
3. The Numeric Gain calculated by $10^{(\text{ant. Gain(dBi)} / 10)}$.
4. The MPE results are evaluated by lowest data rate for WLAN.

Simultaneous Transmitting :

Total MPE = 0.158 (mW)/cm² < 10 (mW)/cm²

---END---