Client:	Generac Power Systems Inc.
Product Name/Model:	Generac PWRcell 2 Gateway / APCBPGN2101
FCC ID:	VDEAPCBPGN2101
Reference	8036A-APCBPGN2101

FCC RF Exposure

Where the Device Under Test (DUT) can be shown to meet the requirements for an exemption pursuant to FCC 47 CFR §1.1307(b)(3), an evaluation is not required with respect to the limits on human exposure to RF emissions provided in FCC 47 CFR §1.1310.

1. Determination of Exemption

As per 47 CFR §1.1307(b)(3), for single RF sources (i.e., any single fixed RF source, mobile device, or portable device), a single RF source is exempt if:

A. **1-mW Test Exemption:** The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

B. **SAR-Based Exemption:** The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th}\ (mW) = \begin{cases} ERP(d/20\ cm)^{x} & d\ \leq 20\ cm \\ ERP_{20cm} & 20\ cm\ < d\ \leq 40\ cm \end{cases}$$

Where

$$x = -log_{10}\left(\frac{60}{ERP_{20cm}\sqrt{f}}\right)\ and\ f\ is\ in\ GHz$$

And

$$ERP_{20cm}\ (mW) = \begin{cases} 2040f & 0.3\ GHz \leq f < 1.5\ GHz \\ 3060 & 1.5\ GHz \leq f \leq 6\ GHz \end{cases}$$

d = the minimum separation distance (cm) in any direction from any part of the device antenna(s) or radiating structure(s) to the body of the device user.

C. **MPE-Based Exemption:** Using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 of § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency (MHz)	Threshold ERP (Watts)
0.3-1.34	1,920 R^2
1.34-30	3,450 R^2/f^2
30-300	3.83 R^2
300-1,500	0.0128 R^2f
1,500-100,000	19.2 R^2

2. RF Exposure Evaluation

The DUT is a mobile device designed to be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the RF source's radiating structure and the body of the user or nearby persons.

The EUT contains a 2400 – 2483.5 MHz DTS transmitters. ERP exemption threshold was calculated using the lowest operating frequency for each transmitter; the lower frequency resulted in a lower exemption limit.

2.1 DUT RF Output Power

Highest power (peak or average) for each operation band was used in the RF exposure evaluation.

Transmitter	Operation Band (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Max ERP (dBm)	Max ERP (W)	Minimum Separation Distance (cm)
WLAN	2412 - 2462	14.91	3.3	16.06	0.04	20

Note:

1. ERP (dBm) = conducted power (dBm) + Antenna Gain (dBi) – 2.15
2. ERP (W) = 10^((ERP(dBm) – 30)/10)

2.2 MPE-Based Exemption

The EUT contains a 2400 – 2483.5 MHz DTS transmitters. ERP exemption threshold was calculated using the lowest operating frequency for each transmitter; the lower frequency resulted in a lower exemption limit

Evaluation Frequency (MHz)	Minimum Required Separation Distance (λ/2π) (mm)	Threshold ERP (W)	DUT Maximum ERP (W)
2412.00	19.8	0.77	0.04

Note:
$\lambda/2\pi = (3x10^8 m/s) / (2 * 3.14 * f (Hz))$ in meters
Threshold ERP = $19.2 * 0.2^2 = 0.768$

The transmitter operates below its applicable Threshold ERP Limit; thus, the RF Exposure Exemption requirement is met.

According to 47 CFR §1.1307(b)(3)(i)(B), this device complies with the RF exposure test exemption.

2.3 Simultaneous Transmission Evaluation

The DUT contains a pre-certified LTE and NB IoT Module, FCC ID: XMR2021BG950AGL.

The module is evaluated for MPE based on 47 CFR §1.1310(e)(1). The antenna used has gain less than the maximum gain allowed for the LTE module.

The module's conducted power is 25.7 dBm (371.5352 mW) for both LTE and NB IoT protocols.

Power density for the LTE module is recalculated for the antenna used with the same separation distance of 20 cm. The table below are the Power Density of the module for the particular antenna used:

LTE/ NB IoT	Frequency (MHz)	LTE Antenna (dBi)	LTE Antenna Linear Gain	PG (mW)	Power Density (S) (mW/cm^2)	MPE Limit (mW/cm^2)	Ratio of S/MPE Limit
Band 2	1850 - 1910	4.0	2.512	933.254	0.371	1.0	0.371
Band 4	1710 - 1755	4.0	2.512	933.254	0.371	1.0	0.371
Band 5	824 - 849	3.4	2.188	812.831	0.323	0.566	0.571
Band 12	699 - 716	3.4	2.188	812.831	0.323	0.477	0.678

Band 13	777 - 787	3.4	2.188	812.831	0.323	0.525	0.616
Band 25	1850 - 1915	4.0	2.512	933.254	0.371	1.0	0.371
Band 26	814 - 849	3.4	2.188	812.831	0.323	0.566	0.571
Band 66	1710 - 1780	4.0	2.512	933.254	0.371	1.0	0.371

Band 12 has the highest power densities to exposure limit ratio, 0.678. This value is used for simultaneous transmission exemption calculation.

Per 47 CFR Section 1307(b)(3)(ii)(B), the DUT qualify for simultaneous exemption if the transmitters meet the following requirement:

$$\sum_{i=1}^{a} \frac{P_i}{P_{\text{th},i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{\text{th},j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

$$\frac{0.04W}{0.77\,W} + \frac{0.323}{0.477} = 0.73 < 1$$

The DUT qualifies for simultaneous transmission exemption.