

Maximum Permission Exposure Caculation

On Behalf of

Graupner CO.,Ltd.

202Dong 8th F,18, Bucheon-ro 198beon-gil, Wonmi-gu, Bucheon-si,
Gyeonggi-do, South Korea

Product Name:	2.4GHz receiver
Model/Type No.:	Falcon 12, Falcon 12 plus
FCC ID:	SNL-16007900
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	Graupner CO.,Ltd.
Address of Applicant:	202Dong 8th F,18, Bucheon-ro 198beon-gil, Wonmi-gu, Bucheon-si, Gyeonggi-do, South Korea
Manufacturer 1:	SJ Technology(Shenzhen)Co.,Ltd
Address of manufacturer:	F6, 1 Bldg, A Area, Yintianxifa Industrial Area, Xixiang Town, Baoan District Shenzhen, Guangdong Province, China

General Description of E.U.T

Items	Description
EUT Description:	2.4GHz receiver
Model No.:	Falcon 12, Falcon 12 plus
Test Model:	Falcon 12
Trade Name:	HoTT
Frequency Band:	2404.056~2474.025MHz
Mini Channel Spacing:	1.014MHz
Number of Channels:	70
Type of Modulation:	MSK and FHSS
Antenna Gain	1.5dBi
Antenna Type:	$\lambda/4$ MONOPOLE ANTENNA
Rated Voltage:	DC 3~6V 30mA

Remark: * The test data gathered are from the production sample provided by the manufacturer.
 * The difference is the presence / absence of sensor operation according to the provided firmware.

1.2 Objective

The objective of the following report is used to demonstrate that EUT operated in a manner that ensures the public is not exposed to radio frequency energy levels in excess of the relative provisions of FCC 47CFR Part 1.1310

1.3 General Description of Test

Items	Description
EUT Frequency band	<input checked="" type="checkbox"/> FHSS: 2.400GHz ~ 2.483GHz <input type="checkbox"/> WLAN: 2.400GHz ~ 2.483GHz <input type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5825GHz <input type="checkbox"/> Others: _____
Device category	<input type="checkbox"/> Portable (<20cm separation) <input type="checkbox"/> Mobile (>20cm separation) <input checked="" type="checkbox"/> Others <u>Stationary type</u> (>20cm separation)
Exposure classification	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm ²) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm ²) <input type="checkbox"/> Others: _____
Antenna diversity	<input checked="" type="checkbox"/> Single antenna <input type="checkbox"/> Multiple antennas: <ul style="list-style-type: none"> <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input type="checkbox"/> Tx/Rx diversity
Max. output power	14.05dBm (0.025W)
Antenna gain (Max)	1.5dBi (Numeric gain:1.41)
Evaluation applied	<input checked="" type="checkbox"/> MPE Evaluation <input type="checkbox"/> SAR Evaluation

Note:

- The maximum output power is 14.05dBm at 2404.056MHz (with 1.44 numeric antenna gain.)
- For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20 cm, even if the calculations indicate that the MPE distance would be lesser.

Modulation Type	Channel No.	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
FHSS	Low	2404.056	14.05	30	Pass
FHSS	Middle	2438.533	13.22	30	Pass
FHSS	High	2474.025	12.52	30	Pass

1.4 Human Exposure Assessment Results

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3–3.0	614	1.63	* 100	6
3.0–30	1842/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
(B) Limits for General Population/Uncontrolled Exposure				
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
300–1,500 .....	.....	.....	f/1500	30
1,500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

Calculation

$$\text{Given } E = \frac{\sqrt{30 \times P \times G}}{d} \quad \& \quad S = \frac{E^2}{3770}$$

Where E = Field Strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \text{Equation 1}$$

Where d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW / cm²

EUT parameter (data from the separate report)	
Given $E = \frac{\sqrt{30 \times P \times G}}{d} \quad \& \quad S = \frac{E^2}{3770}$	Where G: numerical gain of transmitting antenna; TP: Transmitted power in watt; d: distance from the transmitting antenna in meter
Max average output power in Watt (TP)	14.05dBm (0.0254W=25.4mW)
Antenna gain (G)	1.5dBi (Numeric gain:1.41)
Exposure classification	S=1mW/cm ²
Minimum distance in meter (d) (from transmitting structure to the human body)	20cm (0.2m)
Yields $S = \frac{30 \times P \times G}{3770 d^2}, \quad P=25.4\text{mW}, G=1.41, d=20\text{cm}$ $S=0.007\text{mW/cm}^2$ Or $d = \sqrt{\frac{30 \times P \times G}{3770 S}}, \quad S=1 \text{ mW/cm}^2, P=25.4\text{mW}, G=1.41$ $d=1.7\text{cm}$	
Conclusion: S=0.007mW/cm ² is significant lower than the FCC 47CFR Part 1.1310 Limit 1mW/cm ² or except the distance when human body proximity to the antenna is less than 1.7 cm then will reach the General Population Exposure Power Density Limit. (For mobile or fixed location transmitters, the maximum power density is 1.0 mW / cm ² even if the calculation indicates that the power density would be larger.)	