

1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant:	Firia Inc
Address of applicant:	1038 Research Blvd. Ste 240, Madison, AL, 35758
Manufacturer:	Firia Inc
Address of manufacturer:	1038 Research Blvd. Ste 240, Madison, AL, 35758

General Description of EUT:

Product Name:	Firia Waypoint WP-1
Trade Name:	/
Model No.:	WP1
Adding Model(s):	/
Rated Voltage:	DC12V
Power Adapter:	/
FCC ID:	2BUSG-WP1
Equipment Type:	Mobile device

Technical Characteristics of EUT:

Bluetooth

Bluetooth Version:	V6.0 (LE mode)
Frequency Range:	2402-2480MHz
RF Output Power:	Antenna 1: 1Mbps: 9.68dBm (Conducted)
	2Mbps: 9.75dBm (Conducted)
	Antenna 2: 1Mbps: 9.43dBm (Conducted)
	2Mbps: 9.47dBm (Conducted)
Data Rate:	1Mbps, 2Mbps
Modulation:	GFSK
Quantity of Channels:	40
Channel Separation:	2MHz
Type of Antenna:	Antenna 1: External antenna
	Antenna 2: PCB antenna
Antenna Gain:	Antenna 1: 5.3dBi
	Antenna 2: -9.32dBi

SRD 2.4G

Frequency Range:	2405-2475MHz
RF Output Power:	Antenna 1: 10.02dBm (Conducted)
	Antenna 2: 9.44dBm (Conducted)
Modulation:	OQPSK
Quantity of Channels:	15
Channel Separation:	5MHz

Type of Antenna:	Antenna 1:External antenna Antenna 2:PCB antenna
Antenna Gain:	Antenna 1:5.3dBi Antenna 2:-9.32dBi

SRD 900MHz

Frequency Range:	902.2-927.8MHz
RF Output Power:	9.19dBm (Conducted)
Modulation:	FSK
Quantity of Channels:	129
Channel Separation:	200kHz
Type of Antenna:	External antenna
Antenna Gain:	1.7dBi

1.2 RF Exposure Exemption

According to §1.1307(b)(3) and KDB 447498 D04 Interim General RF Exposure Guidance v01, system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

Option A: FCC Rule Part 1.1307 (b)(3)(i)(A):The available maximum time-averaged power is no more than 1mW, regardless of separation distance.

Option B: FCC Rule Part 1.1307 (b)(3)(i)(B): 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. P_{th} is given by:

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

Where

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

and

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

d = the separation distance (cm);

Option C: FCC Rule Part 1.1307 (b)(3)(i)(C): 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. R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters.

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	$19.2R^2$

For Multiple RF sources: FCC Rule Part 1.1307(b)(3)(ii):

- (A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required).
- (B) In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

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

1.3 Calculated Result

Radio Access Technology	Prediction Frequency (MHz)	Output Power (dBm)	Antenna Gain (dBi)	Duty Cycle (%)	Tune-Up Time-Averaged Power (dBm)	ERP (dBm)
Bluetooth -Antenna 1	2402	9.75	5.3	100	10.00	13.15
Bluetooth -Antenna 2	2402	9.47	-9.32	100	10.00	-1.47
SRD 2.4G -Antenna 1	2405	10.02	5.3	100	11.00	14.15
SRD 2.4G -Antenna 2	2405	9.44	-9.32	100	10.00	-1.47
SRD 900MHz	902.2	9.19	1.17	100	10.00	9.02

Frequency	Option	Min. Distance	Max. Power		Exposure Limit	Ratio	Result
(MHz)		(cm)	(dBm)	(mW)	(mW)		Pass/Fail
2402	C	20.00	13.15	20.65	768.00	0.03	Pass
2402	C	20.00	-1.47	0.71	768.00	0.01	Pass
2405	C	20.00	14.15	26.00	768.00	0.03	Pass
2405	C	20.00	-1.47	0.71	768.00	0.01	Pass
902.2	C	20.00	9.02	7.98	461.93	0.02	Pass

*Note: 1. Time-Averaged Power=Output Power * Duty Cycle; ERP= Time-Averaged Power+ Antenna gain-2.15dB*

2. Option A, B and C refers as clause 1.2.

3. For option B, Max (time-averaged power, effective radiated power (ERP)) converts to Max. Power. For option C, ERP converts to Max. Power;

4. For option B, P_{th} (mW) converts to Exposure Limit (mW); For option C, ERP (W) converts to Exposure Limit (mW).

5. Ratio= Tune-Up ERP (mW)/ Exposure Limit (mW)

Mode for Simultaneous Multi-band Transmission:

Radio Access Technology	Ratio 1	Ratio 2	Simultaneous Ratio	Limit	Result
Antenna 1 + SRD 900MHZ	0.03	0.02	0.05	1	Pass
Antenna 2 + SRD 900MHZ	0.01	0.02	0.03	1	Pass

Note: 2.4G Antenna 1 and 2.4G Antenna 2 can't transmit at the same time.

Result: Pass