1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant:	invoxia
Address of applicant:	8 ESPLANADE DE LA MANUFACTURE, 92130 Issy-Les-Moulineaux France
Manufacturer:	INVOXIA SAS
Address of manufacturer:	8 ESPLANADE DE LA MANUFACTURE, 92130 ISSY LES MOULINEAUX

General Description of EUT:

Product Name:	LWT4
Trade Name	/
Model No.:	LWT4
Adding Model(s):	/
Rated Voltage:	Charging Port:DC5V Battery:DC3.8V
Battery Capacity	520mAh*2
FCC ID:	ZVS-LWT4
Equipment Type:	Mobile device

Technical Characteristics of EUT:

Bluetooth

Bluetooth Version:	V4.2 (BLE mode)
Frequency Range:	2402-2480MHz
RF Output Power:	1.22dBm (Conducted)
Data Rate:	1Mbps
Modulation:	GFSK
Quantity of Channels:	40
Channel Separation:	2MHz
Type of Antenna:	PCB Antenna
Antenna Gain:	2.2dBi

Wi-Fi

Support Standards:	802.11b
Frequency Range:	2412-2462MHz for 802.11b
RF Output Power:	17.53dBm (Conducted)
Type of Modulation:	CCK, DQPSK, DBPSK
Quantity of Channels:	11 for 802.11b
Channel Separation:	5MHz
Type of Antenna:	PCB Antenna
Antenna Gain:	2.1dBi

1.2 RF Exposure Exemption

According to §1.1307(b)(3) and 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:

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

Where

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

and

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

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	2402	1.22	2.2	100	2.00	2.05
Wi-Fi	2412	17.53	2.1	100	18.00	17.95
LTE	699	--	1.7	--	25.0	24.55

Frequency (MHz)	Option	Min. Distance (cm)	Max. Power (dBm)	Max. Power (mW)	Exposure Limit (mW)	Ratio	Result Pass/Fail
2402	B	20	2.05	1.60	3060.00	0.01	Pass
2412	B	20	18.00	63.10	3060.000	0.02	Pass
699	B	20	25.00	316.23	1425.96	0.22	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).

6. The LTE data refer the original report (FCC ID: 2AAGMGM02SA).

Mode for Simultaneous Multi-band Transmission:

Radio Access Technology	Ratio 1	Ratio 2	Simultaneous Ratio	Limit	Result Pass/Fail
Bluetooth + LTE	0.01	0.22	0.23	1	Pass
Wi-Fi + LTE	0.02	0.22	0.24	1	Pass

Result: Pass