1. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1 General Information

Client Information	
Applicant:	Thesis Ltd.
Address of applicant:	Retkoz utca 67. fsz. 2., Budapest, Hungary 1112
Applicant:	Thesis Ltd.
Address of applicant:	Retkoz utca 67. fsz. 2., Budapest, Hungary 1112
General Description of EUT:	
Product Name:	Nucleus
Trade Name	/
Model No.:	Nucleus8
Adding Model(s):	/
Rated Voltage:	USB Port:DC5V
	Battery:DC3.7V
Capacity:	1100mAh
FCC ID:	2A28A-NUCLEUS
Equipment Type:	Mobile

Technical Characteristics of EUT:				
Bluetooth:				
Bluetooth Version:	V5.1 (BLE mode)			
Frequency Range:	2402-2480MHz			
RF Output Power:	0.124dBm (Conducted)			
Data Rate:	1Mbps, 2Mbps			
Modulation:	GFSK			
Quantity of Channels:	40			
Channel Separation:	2MHz			
Type of Antenna:	PCB Antenna			
Antenna Gain:	0dBi			

1.2 Standard Applicable

According to § 1.1307(b)(1) and KDB 447498 D01 General RF Exposure Guidance v06, 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.

(a) 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 Times $ E ^2$, $ H ^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	F/300	6
1500-100000	/	/	5	6

(b) 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 Times $ 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)*	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-100000	/	/	1	30

Note: f = frequency in MHz: * = Plane-wave equivalents power density

1.3 MPE Calculation Method

 $S = (30*P*G) / (377*R^2)$

- S = power density (in appropriate units, e.g., mw/cm²)
- P = power input to the antenna (in appropriate units, e.g., mw)
- G = power gain of the antenna in the direction of interest relative to an isotropic radiator,

the power gain factor is normally numeric gain.

R = distance to the center of radiation of the antenna (in appropriate units, e.g., cm)

1.4 MPE Calculation Result

Maximum Tune-Up output power: 1.0(dBm)

Maximum peak output power at antenna input terminal: <u>1.26 (mW)</u>

Prediction distance: >20(cm)

Prediction frequency: 2480 (MHz)

Antenna gain: 0(dBi)

Directional gain (numeric gain): 1.00

The worst case is power density at prediction frequency at 20cm: $0.0003 \text{ (mw/cm}^2)$ MPE limit for general population exposure at prediction frequency: $1 \text{ (mw/cm}^2)$ For Wi-Fi & Bluetooth Internet of Things Module (FCC ID: 2AC7Z-ESPWROOM32D): Wi-Fi:

The worst case is power density at prediction frequency at 20cm: 0.0295 (mw/cm²)

Bluetooth:

The worst case is power density at prediction frequency at 20cm: 0.0013 (mw/cm²)

Mode for Simultaneous Multi-band Transmission Bluetooth + Wi-Fi+ Bluetooth The worst case is power density at prediction frequency at 20cm: <u>0.0003/1 +0.0295/1+ 0.0013/1=0.0311</u><1

Result: Pass