1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant:	GUANGZHOU SHANGKE INFORMATION TECHNOLOGY CO., LTD
Address of applicant:	Room 1205-1212, R&F To-Win Building, No.30 Huaxia Road, Tianhe District, Guangzhou, Guangdong Province,China
Manufacturer:	GUANGZHOU SHANGKE INFORMATION TECHNOLOGY CO., LTD
Address of manufacturer:	Room 1205-1212, R&F To-Win Building, No.30 Huaxia Road, Tianhe District, Guangzhou, Guangdong Province,China

General Description of EUT:

Product Name:	PC Motherboard
Trade Name:	/
Model No.:	MS-Challenger B760ITX D5 WIFI
Adding Model(s):	MS-iCraft Z890 VERTEX, MS-iCraft Z890 ARCTIC, MS-iCraft Z890 PACIFIC, MS-Terminator Z890-A WIFI, MS-Terminator Z890M GKD5 WIFI, MS-Terminator Z890M GKD5 ICE, MS-iCraft Z890ITX WIFI, MS-ESPORT Z890M WIFI, MS-Challenger Z890M WIFI, MS-iCraft B860M CROSS, MS-Terminator B860M WIFI, MS-Terminator B860M WIFI6E, MS-Terminator B860M GKD5 WIFI, MS-Terminator B860M GKD5 ICE, MS-ESPORT B860M Sniper WIFI, MS-ESPORT B860M Gank WIFI, MS-ESPORT B860M ACE WIFI, MS-Challenger H810ITX WIFI, MS-Challenger B860BKB WIFI, MS-Terminator B860YTX WIFI, MS-Terminator B860ITX WIFI, MS-ESPORT H810M Gank WIFI, MS-Challenger H810ITX WIFI, MS-Terminator B850M WIFI, MS-Terminator B850ITX WIFI, MS-Challenger B850M WIFI ICE, MS-iCraft Z790 WiFi V2, MS-iCraft Z790ITX WIFI, MS-Terminator Z790-A WIFI6, MS-Terminator Z790M D5 ICE, MS-iCraft B760M CROSS, MS-Terminator B760M D5 WIFI6E, MS-Terminator H770YTX D5 WIFI, MS-Terminator B760M GKD5 ICE, MS-Terminator B760M D5 WIFI, MS-Terminator B760M D4 ICE, MS-Terminator B760M D4 WIFI6E, MS-Terminator B760M D4 WIFI, MS-Terminator B760ITX D4 WIFI V2, MS-Challenger B760M D5 WIFI, MS-B760M GAMING WIFI ACE, MS-B760M GAMING WIFI GANK, MS-Challenger H610ITX 2LAN, MS-H610M 666 WiFi6 D5, MS-H610M 666 WiFi6 ARGB, MS-H610M 666 WiFi6, MS-eSport B650M WIFI6 ICE, MS-eSport B650ITX WIFI ICE, MS-Terminator B650M WIFI6, MS-Challenger B650M WIFI ICE, MS-Challenger B650M WIFI, MS-Challenger A520M-K WIFI, MS-MoDT 12450H ITX WIFI F, MS-MoDT 12650H ITX WIFI F, MS-MoDT 13420H ITX WIFI F, MS-MoDT 13620H ITX WIFI F, ADV-MoDT 12450H ITX WIFI F, ADV-MoDT 12500H ITX WIFI F,

	ADV-MoDT 12600H ITX WIFI F, ADV-MoDT 12650H ITX WIFI F, ADV-MODT 12700H ITX WIFI F, ADV-MoDT 12800H ITX WIFI F, ADV-MoDT 12900H ITX WIFI F, ADV-MoDT 12900HK ITX WIFI F, ADV-MoDT 13420H ITX WIFI F, ADV-MoDT 13500H ITX WIFI F, ADV-MoDT 13600H ITX WIFI F, ADV-MoDT 13620H ITX WIFI F, ADV-MoDT 13700H ITX WIFI F, ADV-MoDT 13800H ITX WIFI F, ADV-MoDT 13900H ITX WIFI F, ADV-MoDT 13900HK ITX WIFI F, ADV-MoDT 13420H ITX D5 F, ADV-MoDT 13500H ITX D5 F, ADV-MoDT 13600H ITX D5 F, ADV-MoDT 13620H ITX D5 F, ADV-MoDT 13700H ITX D5 F, ADV-MoDT 13800H ITX D5 F, ADV-MoDT 13900H ITX D5 F, ADV-MoDT 13900HK ITX D5 F, MS-MoDT ADL-P ITX WIFI F, ADV-MoDT ADL-P ITX WIFI F, ADV-MoDT RPL-P ITX D5, ADV-MoDT RPL-HX MATX D4, ADV-MoDT MTL-H ITX LPD5
Rated Voltage:	DC12V
Battery Capacity:	/
Power Adapter:	/
FCC ID:	2ACGT-MSMB
Equipment Type:	Mobile device

Technical Characteristics of EUT:

Bluetooth (BLE mode)

Bluetooth Version:	V5.2 (BLE mode)
Frequency Range:	2402-2480MHz
RF Output Power:	1Mbps: 5.30dBm (Conducted) 2Mbps: 5.32dBm (Conducted)
Data Rate:	1Mbps, 2Mbps
Modulation:	GFSK
Quantity of Channels:	40
Channel Separation:	2MHz
Type of Antenna:	External antenna
Antenna Gain:	3.32dBi

Bluetooth (BR/EDR mode)

Bluetooth Version:	V5.2 (BR/EDR mode)
Frequency Range:	2402-2480MHz
RF Output Power:	9.79dBm (Conducted)
Data Rate:	1Mbps, 2Mbps, 3Mbps
Modulation:	GFSK, π/4 DQPSK, 8DPSK
Quantity of Channels:	79
Channel Separation:	1MHz
Type of Antenna:	External antenna
Antenna Gain:	3.32dBi

Wi-Fi (2.4G)

Support Standards:	802.11b, 802.11g, 802.11n, 802.11ax
Frequency Range:	2412-2462MHz for 802.11b/g/n/ax(HT/HE20)

RF Output Power:	2422-2452MHz for 802.11n/ax(HT/HE40) Antenna 0: 16.36dBm (Conducted) Antenna 1: 16.28dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Quantity of Channels:	11 for 802.11b/g/n/ax(HT/HE20); 7 for 802.11n/ax(HT/HE40)
Channel Separation:	5MHz
Type of Antenna:	External antenna
Antenna Gain:	3.13dBi
Wi-Fi (5G)	
Support Standards:	802.11a, 802.11n-HT20, 802.11n-HT40, 802.11ac-VHT20/40/80, 802.11ax-HE20/40/80
Frequency Range:	5180-5240MHz
Max. RF Output Power:	Antenna 0: 16.09dBm (Conducted) Antenna 1: 16.08dBm (Conducted)
Type of Modulation:	QPSK, 16QAM, 64QAM, 256QAM, 1024QAM
Type of Antenna:	External antenna
Antenna Gain:	4.42dBi

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:

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

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 λ/2π, 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.

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

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	9.79	3.32	100	10.00	11.17
Wi-Fi (2.4G) Antenna 0	2412	16.36	3.13	100	17.00	17.98
Wi-Fi (2.4G) Antenna 1	2412	16.28	3.13	100	17.00	17.98
Wi-Fi (5G) Antenna 0	5180	16.09	4.42	100	17.00	19.27
Wi-Fi (5G) Antenna 1	5180	16.08	4.42	100	17.00	19.27

Frequency (MHz)	Option	Min. Distance (cm)	Max. Power (dBm)	Max. Power (mW)	Exposure Limit (mW)	Ratio	Result Pass/Fail
2402	C	20.00	11.17	13.09	768.00	0.02	Pass
2412	C	20.00	17.98	62.81	768.00	0.08	Pass
2412	C	20.00	17.98	62.81	768.00	0.08	Pass
5180	C	20.00	19.27	84.53	768.00	0.11	Pass
5180	C	20.00	19.27	84.53	768.00	0.11	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 Pass/Fail
Antenna 0+Antenna 1	0.11	0.11	0.22	1	Pass

Note: BT and Wi-Fi can't transmit at the same time.

Result: Pass