

RF Exposure Evaluation For FCC ID: M82-DLTV72

Refer user manual this device is a Computer, and this device was designed used in Mobile devices that the minimum distance between human's body is **20cm**. Based on the 47CFR 2.1091, this device belongs to Mobile device. The definition of the category as following:

Mobile Derives:

CFR Title 47 §2.1091(b)

(b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

FCC KDB 447498 D01 General RF Exposure Guidance v06 Limit

Devices operating in standalone mobile exposure conditions may contain a single transmitter or multiple transmitters that do not transmit simultaneously. A minimum test separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits. The distance must be fully supported by the operating and installation configurations of the transmitter and its antenna(s), according to the source-based time-averaged maximum power requirements of § 2.1091(d)(2). In cases where cable losses or other attenuations are applied to determine compliance, the most conservative operating configurations and exposure conditions must be evaluated. The minimum test separation distance required for a device to comply with mobile exposure conditions must be clearly identified in the installation and operating instructions, for all installation and exposure conditions, to enable users and installers to comply with RF exposure requirements. For mobile devices that have the potential to operate in portable device exposure conditions, similar to the configurations described in § 2.1091(d)(4), a KDB inquiry is required to determine the SAR test requirements for demonstrating compliance.

When the categorical exclusion provision of § 2.1091(c) applies, the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance. The source-based time-averaged maximum radiated power, according to the maximum antenna gain, must be applied to calculate the field strength and power density required to establish the minimum test separation distance. When the estimated test separation distance becomes overly conservative and does not support compliance, MPE measurement or computational modeling may be used to determine the required minimum separation distance.

According to FCC Part 1.1307, systems operating under the provisions of this section shall be operated in a manner the ensures that the public is not exposed to radio frequency energy level in excess of the commission's guidelines.

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)
0.3-1.34	614	1.63	(100)*
1.34-30	824/f	2.19/f	(180/f ²)*
30-300	27.5	0.073	0.2
300-1500			f/1500
1500-100,000			1.0

MPE calculation formula

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = power density

P = output power (mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Separation distance between radiator and human body (cm)

Test Data

WCDMA Band2			
Mode	Low Channel	Middle Channel	High Channel
EIRP (dBm)	20.53	21.44	21.50
WCDMA Band5			
Mode	Low Channel	Middle Channel	High Channel
ERP (dBm)	21.10	22.00	21.87
Note: This report listed the worst case ERP power value, please refer to RF report BL-EC18C0175-501.			

LTE Band2	
Bandwidth (MHz)	3
UL Channel	Low Channel
UL Modulation	16-QAM
EIRP (dBm)	22.34
LTE Band4	
Bandwidth (MHz)	15
UL Channel	Low Channel
UL Modulation	16-QAM
EIRP (dBm)	23.65
LTE Band12	
Bandwidth (MHz)	5
UL Channel	High Channel
UL Modulation	QPSK
ERP (dBm)	21.88
Note: This report listed the worst case ERP/EIRP power value, please refer to RF report BL-EC18C0175-501.	

Bluetooth			
Mode	GFSK	8-DPSK	BLE
Average Power (dBm)	11.61	10.66	2.75
Note: This report listed the worst case peak power value, please refer to module FCC report: RF140808E04S-2 (FCC ID: RYK-261ACNBT) (issued by Bureau Veritas Consumer Products Sciences (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory on Sep. 18, 2017) Section 4.7 Maximum Output Power Measurement & RF140808E04S-4 (issued by Bureau Veritas Consumer Products Sciences (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory on Sep. 18, 2017) Section 4.4 Conducted Output Power Measurement.			

2.4G WIFI				
Mode	802.11 b	802.11 g	802.11 VHT20	802.11 VHT40
	Total Power	Total Power	Total Power	Total Power
Average Power (dBm)	21.67	21.08	21.03	17.52
Note: This report listed the worst case peak power value, please refer to module FCC report: RF140808E04S (FCC ID: RYK-261ACNBT) (issued by Bureau Veritas Consumer Products Sciences (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory on Sep. 18, 2017) Section 4.4 Conducted Output Power Measurement.				

5G WIFI				
Band 1~2 (5180-5240,5260-5320)				
Mode	802.11 a	802.11 ac (VHT20)	802.11 ac (VHT40)	802.11 ac (VHT80)
	Total Power	Total Power	Total Power	Total Power
Average Power (dBm)	18.87	18.03	16.75	12.57
Band 3 (5500-5580&5660-5720)				
Mode	802.11 a	802.11 ac (VHT20)	802.11 ac (VHT40)	802.11 ac (VHT80)
	Total Power	Total Power	Total Power	Total Power
Average Power (dBm)	18.22	17.19	16.75	16.42
Band 4 (5745-5825)				
Mode	802.11 a	802.11 ac (VHT20)	802.11 ac (VHT40)	802.11 ac (VHT80)
	Total Power	Total Power	Total Power	Total Power
Average Power (dBm)	18.17	17.35	16.11	13.59
Note: This report listed the worst case peak power value, please refer to module FCC report: RF140808E04S-1 (FCC ID: RYK-261ACNBT) (issued by Bureau Veritas Consumer Products Sciences (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory on Sep. 18, 2017) Section 4.3 Transmit Power Measurement.				

Turn-up power

Mode		ERP/EIRP Tune up Limit (dBm)	
WWAN	WCDMA Band2	22.00	
	WCDMA Band5	22.50	
	LTE Band2	22.50	
	LTE Band4	24.00	
	LTE Band12	22.00	
Mode		Average Power Tune up Limit (dBm)	
WLAN 2.4G	802.11 b	23.00	
	802.11 g	22.50	
	802.11 VHT20	22.50	
	802.11 VHT40	19.00	
Bluetooth	GFSK	11.63	
	8-DPSK	10.70	
	BLE	2.90	
WLAN 5G	Band 1~2 (5180-5240,5 260-5320)	802.11a	20.00
		802.11 ac (VHT20)	19.00
		802.11 ac (VHT40)	18.00
		802.11 ac (VHT80)	15.00
	Band 3 (5500-5580& 5660-5720)	802.11a	20.25
		802.11 ac (VHT20)	19.82
		802.11 ac (VHT40)	20.42
		802.11 ac (VHT80)	19.79
	Band 4 (5745-5825)	802.11a	20.00
		802.11 ac (VHT20)	19.00
		802.11 ac (VHT40)	18.00
		802.11 ac (VHT80)	15.50

Antenna Information

Antenna	WWAN	WLAN	Bluetooth
Internal Antenna 0	Support	Support	Support
Internal Antenna 1	N/A	Support	Support
External Antenna	Support	Support	Support

Note :

1. This product support two WWAN antennas, one is external antenna and another one is internal antenna.
2. This product support three WLAN or Bluetooth antennas, one is external antenna and two is internal antenna.
3. This product support three Bluetooth antennas, but only one antenna can used at same time.
4. Used highest antenna gain to calculate power density values.

Assessment result

Evolution mode	Maximum ERP/EIRP power (dBm)	Total Power (mw)	Distance (cm)	Limit of Power Density (mW/cm ²)	Power Density (mW/cm ²)	Power Density/Limit	Verdict
WCDMA Band2	22.00	158.49	20	1	0.032	0.032	Pass
WCDMA Band5	22.50	177.83	20	0.557	0.035	0.064	Pass
LTE Band2	22.50	177.83	20	1	0.035	0.035	Pass
LTE Band4	24.00	251.19	20	1	0.050	0.050	Pass
LTE Band12	22.00	158.49	20	0.477	0.032	0.066	Pass

Evolution mode			Maximum Average Power (dBm)	Antenna Gain (typical) (dBi)	Total Power (mw)	Distance (cm)	Limit of Power Density (mW/cm²)	Power Density (mW/cm²)	Power Density/ Limit	Verdict
WLAN 2.4G	802.11 b		23.00	6.51	893.31	20	1	0.178	0.178	Pass
Bluetooth	GFSK		11.63	3.50	32.58	20	1	0.006	0.006	Pass
WLAN 5G	Band 1~2 (5180-5240, 5260-5320)	802.11a	20.00	5.91	389.94	20	1	0.078	0.078	Pass
	Band 3 (5500-5580& 5660-5720)	802.11 ac (VHT40)	20.42	5.91	429.54	20	1	0.085	0.085	Pass
	Band 4 (5745-5825)	802.11a	20.00	5.91	389.94	20	1	0.078	0.078	Pass

Note:

- 1.WLAN 2.4G : Directional Gain = 3.50dBi + 10log(2) = 6.51dBi
- 2.WLAN 5G : Directional Gain = 2.90dBi + 10log(2) = 5.91dBi

Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ (Power Density / Limit) of WWAN +WIFI 2.4GHz	Verdict
WWAN (LTE Band12)	699 MHz ~ 716 MHz	0.066	0.244	Pass
WLAN 2.4G	2400MHz ~ 2483.5MHz	0.178		Pass
Evolution mode	Frequency(MHz)	Power Density/Limit	Σ (Power Density / Limit) of WWAN + Bluetooth	Verdict
WWAN (LTE Band12)	699 MHz ~ 716 MHz	0.066	0.072	Pass
Bluetooth	2400MHz ~ 2483.5MHz	0.006		Pass
Evolution mode	Frequency(MHz)	Power Density/Limit	Σ (Power Density / Limit) of WWAN + Bluetooth	Verdict
WWAN (LTE Band12)	699 MHz ~ 716 MHz	0.066	0.151	Pass
WLAN 5G	5500 MHz ~ 5580 MHz & 5660 MHz ~ 5720 MHz	0.085		Pass

Note:

1. Σ (Power Density / Limit): This is a summation of [(power density for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WLAN or Bluetooth + WWAN.
2. Both of the WLAN/BT and WWAN can transmit simultaneously, the formula of calculated the MPE is

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$
CPD = Calculation power density
LPD = Limit of power density
3. The worst-case situation is 0.244, which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

Conclusion:

RF exposure Evaluation Results: **Compliance**