RF Exposure Evaluation For FCC ID: XYO-W01

Refer user manual this device is a LTE WIFI Router, and this device was designed in a fixed location 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 $\geqslant$ 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/cm²)
0.3-1.34	614	1.63	(100)*
1.34-30	824/f	2.19/f	(180/f2)*
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)	23.574	**23.780**	23.725
WCDMA Band4			
Mode	Low Channel	Middle Channel	High Channel
EIRP (dBm)	24.391	24.085	**24.676**
WCDMA Band5			
Mode	Low Channel	Middle Channel	High Channel
ERP (dBm)	**22.708**	22.432	22.428
Note: This report listed the worst case ERP/EIRP power value, please refer to RF report BL-EC2010026-501.			

LTE Band2	
Bandwidth (MHz)	10
UL Channel	Middle Channel
UL Modulation	QPSK
EIRP (dBm)	24.942
LTE Band4	
Bandwidth (MHz)	15
UL Channel	High Channel
UL Modulation	QPSK
EIRP (dBm)	24.784
LTE Band5	
Bandwidth (MHz)	10
UL Channel	High Channel
UL Modulation	QPSK
ERP (dBm)	23.257
LTE Band12	
Bandwidth (MHz)	5
UL Channel	Middle Channel
UL Modulation	QPSK
ERP (dBm)	19.246
LTE Band13	
Bandwidth (MHz)	5
UL Channel	Low Channel
UL Modulation	QPSK
ERP (dBm)	22.763
LTE Band14	
Bandwidth (MHz)	5
UL Channel	High Channel
UL Modulation	QPSK
ERP (dBm)	23.101

LTE Band66	
Bandwidth (MHz)	10
UL Channel	Middle Channel
UL Modulation	QPSK
EIRP (dBm)	25.948
LTE Band71	
Bandwidth (MHz)	5
UL Channel	High Channel
UL Modulation	QPSK
ERP (dBm)	21.346
Note: This report listed the worst case ERP/EIRP power value, please refer to RF report BL-EC2010026-501.	

2.4G WIFI			
Mode	802.11 b	802.11 g	802.11 VHT20
Average Power (dBm)	10.41	**10.74**	10.30
Note: This report listed the worst case AV power value, please refer to module FCC report: BL-EC2010026-601.			

5G WIFI						
Band 1(5180-5240 MHz)						
Mode	802.11 a	802.11 n (HT20)	802.11 n (HT40)	802.11 ac (VHT20)	802.11 ac (VHT40)	802.11 ac (VHT80)
Average Power (dBm)	**12.37**	11.92	11.93	11.94	11.92	11.02
Band 4 (5745-5825)						
Mode	802.11 a	802.11 n (HT20)	802.11 n (HT40)	802.11 ac (VHT20)	802.11 ac (VHT40)	802.11 ac (VHT80)
Average Power (dBm)	**11.36**	10.82	9.97	10.84	9.88	9.76
Note: This report listed the worst case AV power value, please refer to module FCC report: BL-EC2010026-602.						

Turn-up power

Mode		ERP/EIRP Tune up Limit (dBm)
WWAN	WCDMA Band2	25.00
	WCDMA Band4	26.00
	WCDMA Band5	24.00
	LTE Band2	26.00
	LTE Band4	26.00
	LTE Band5	25.00
	LTE Band12	21.00
	LTE Band13	24.00
	LTE Band14	25.00
	LTE Band66	27.00
	LTE Band71	23.00
Mode		Average Power Tune up Limit (dBm)
WLAN 2.4G	802.11 b	**12.00**
	802.11 g	12.00
	802.11 VHT20	12.00
WLAN 5G	Band 1 (5180-5240)	802.11a	**14.00**
		802.11 n (HT20)	13.00
		802.11 n (HT40)	13.00
		802.11 ac (VHT20)	13.00
		802.11 ac (VHT40)	13.00
		802.11 ac (VHT80)	12.00
	Band 4 (5745-5825)	802.11a	**13.00**
		802.11 n (HT20)	12.00
		802.11 n (HT40)	12.00
		802.11 ac (VHT20)	12.00
		802.11 ac (VHT40)	12.00
		802.11 ac (VHT80)	11.00

Assessment result

Evolution mode	Maximum ERP/EIRP power (dBm)	Total Power (mw)	Distance (cm)	Limit of Power Density (mW/cm²)	Power Density (mW/cm²)	Power Density/Limit	Verdict
WCDMA Band2	25.00	316.23	20	1	0.063	0.063	Pass
WCDMA Band4	26.00	398.11	20	1	0.079	0.079	Pass
WCDMA Band5	24.00	251.19	20	0.551	0.050	0.091	Pass
LTE Band2	26.00	398.11	20	1	0.079	0.079	Pass
LTE Band4	26.00	398.11	20	1	0.079	0.079	Pass
LTE Band5	25.00	316.23	20	0.550	0.063	0.114	Pass
LTE Band12	21.00	125.89	20	0.466	0.025	0.054	Pass
LTE Band13	24.00	251.19	20	0.520	0.050	0.096	Pass
LTE Band14	25.00	316.23	20	0.525	0.063	**0.120**	Pass
LTE Band66	27.00	501.19	20	1	0.100	0.100	Pass
LTE Band71	23.00	199.53	20	0.444	0.040	0.089	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		12.00	3.30	33.88	20	1	0.007	0.007	Pass
WLAN 5G	Band 1 (5180-5240)	802.11a	14.00	2.70	46.77	20	1	0.009	**0.009**	Pass
	Band 4 (5745-5825)	802.11a	13.00	3.40	37.15	20	1	0.007	0.007	Pass

Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ (Power Density / Limit) of WWAN +WIFI 2.4GHz	Verdict
WWAN (LTE Band14)	788 MHz ~ 798 MHz	0.120	**0.127**	Pass
WLAN 2.4G	2400MHz ~ 2483.5MHz	0.007		Pass
Evolution mode	Frequency(MHz)	Power Density/Limit	Σ (Power Density / Limit) of WWAN + Bluetooth	Verdict
WWAN (LTE Band71)	788 MHz ~ 798 MHz	0.120	0.129	Pass
WLAN 5G	5180 MHz ~ 5240 MHz	0.009		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 + WWAN.
2. Both of the WLAN and WWAN can transmit simultaneously, the formula of calculated the MPE is
   CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1
   CPD = Calculation power density
   LPD = Limit of power density
3. The worst-case situation is 0.129, which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

Conclusion:

RF exposure Evaluation Results: **Compliance**