



FCC RF Exposure Evaluation

1. Product Information

Product name	:	Bicycle light
Test Model	:	Recon plus TL300R
Ratings	:	Input: DC 5V Battery: 3.7V, 2600mAh
Hardware Version	:	A3
Software Version	:	V0.4
Bluetooth Frequency Range	:	2402MHz~2480MHz
Channel Number	:	40 channels for Bluetooth V5.0 (DTS)
Channel Spacing	:	2MHz for Bluetooth V5.0 (DTS)
Modulation Type	:	GFSK for Bluetooth V5.0 (DTS)
Bluetooth Version	:	V5.0
Antenna Description	:	PCB Antenna, -1.07dBi(Max.)
ANT+ Frequency Range	:	2457MHz
Channel Number	:	1 channels
Modulation Type	:	GFSK
Antenna Description	:	PCB Antenna, -1.07dBi(Max.)
24GHz radar Frequency Range	:	24.00–24.25GHz
Modulation Type	:	FMCW
Antenna	:	Microstrip Antenna Arrays
Antenna Gain	:	10dBi
Exposure category	:	General population/uncontrolled environment
EUT Type	:	Production Unit
Device Type	:	Mobile Device

2. Evaluation method and Limit

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modelled or measured field strengths or power density, is ≤ 1.0 . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.





3. Limit

3.1 Refer Evaluation Method

[ANSI C95.1-2019](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz

[FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

[FCC CFR 47 part1 1.1310](#): Radio frequency radiation exposure limits.

[FCC CFR 47 part2 2.1091](#): Radio frequency radiation exposure evaluation: mobile devices.

3.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	6
3.0 – 30	1842/f	4.89/f	(900/f ²)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Uncontrolled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	(180/f ²)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30
1500 – 100,000	/	/	1.0	30

F=frequency in MHz

*=Plane-wave equivalent power density

4. MPE Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S=PG/4\pi R^2$$

Where: S=power density

P=power input to antenna

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

R=distance to the center of radiation of the antenna



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Scan code to check authenticity



5. Antenna Information

EUT can only use antennas certificated as follows provided by manufacturer;

Internal/External Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
Internal	PCB Antenna	2400-2500MHz	-1.07dBi	Bluetooth Antenna
Internal	PCB Antenna	2400-2500MHz	-1.07dBi	ANT+ Antenna
Internal	Microstrip Antenna Arrays	24000-24250MHz	10dBi	24GHz radar Antenna





6. Conducted Power Results

[BT LE]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
BT LE	0	2402	0.36
	19	2440	0.76
	39	2480	0.92

ANT+ frequency range: 2457MHz

Device category: Mobile Device (Distance: 20cm)

Max. Field Strength: 92.73dBuV/m @3m

$EIRP = E - 104.8 + 20 \log D = 92.73 - 104.8 + 20 \log 3 = -2.53 \text{ dBm}$

Antenna Gain = -1.07dBi

Maximum Conducted Output Power: -1.46dBm

24GHz radar frequency range: 24150MHz

Device category: Mobile Device (Distance: 20cm)

Max. Field Strength: 122.962dBuV/m @1m

$EIRP = E - 104.8 + 20 \log D = 122.962 - 104.8 + 20 \log 1 = 18.16 \text{ dBm}$

Antenna Gain = 10dBi

Maximum Conducted Output Power: 8.16dBm

7. Manufacturing Tolerance

[BT LE]

BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	0	0	0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

[ANT+]

Channel	2457MHz
Target (dBm)	-1.5
Tolerance $\pm$ (dB)	1.0

[24GHz radar]

Channel	24150MHz
Target (dBm)	8.0
Tolerance $\pm$ (dB)	1.0





8. Evaluation Results

8.1 Standalone Evaluation

[BT LE]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
GFSK	1.0	1.2589	-1.07	0.7816	0.0002	1.0000

[ANT+]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
GFSK	-0.5	0.8913	-1.07	0.7816	0.0001	1.0000

[24GHz radar]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
FMCW	9.0	7.9433	10	10.0000	0.0158	1.0000

Remark:

1. Output power including tune-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.

8.2 Simultaneous Transmission for SAR Exclusion

The EUT equipped with one Bluetooth Antenna and one ANT+ Antenna. So, need consider simultaneous transmission;

According to KDB447498 for Transmitters used in portable exposure conditions for simultaneous transmission operations;

$\sum$ of MPE ratios ≤ 1.0

Simultaneous Transmission					
Bluetooth Antenna Max MPE ratios	ANT+ Antenna Max MPE ratios	24GHz radar Antenna Max MPE ratios	$\sum$ MPE ratios	Limit	Results
0.0002	0.0001	0.0158	0.0161	1.0	Pass

9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 v06.

-----THE END OF REPORT-----

