

RF Exposure Evaluation For FCC ID: ST2-ITD73XXRH

Refer user manual this device is a Temperature & Humidity Sensor, and this device was designed used in Mobile devices that the minimum distance between human's body is **20 cm**. 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 that 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

Bluetooth			
Mode	BLE		
	Low	Middle	High
EIRP (dBm)	-1.67	-2.00	-2.53

Note: This report listed the worst case EIRP value, please refer to RF test report for more details.

2.4G WIFI		
Mode	802.11b	802.11g
EIRP (dBm)	17.15	22.95

Note: This report listed the worst case EIRP value, please refer to RF test report for more details.

RFID		
Frequency (MHz)	Field Strength @3m (dBuV/m)	EIRP (dBm)
904.00	92.02	-3.21
915.00	90.84	-4.39
922.00	89.39	-5.84
926.00	89.33	-5.90

Note 1: This report listed the worst case value, please refer to RF test Report No. BL-SZ2180917-601, section A.4 Radiated Emission.

Note 2: The value of maximum peak output power is according to the method described in ANSI C63.10 clause 11.12.2.2 General procedure for conducted measurements in restricted bands:

- a) Measure the conducted output power (in dBm) using the detector specified (see guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
- b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see guidance on determining the applicable antenna gain)
- c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies \leq 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies $>$ 1000 MHz).
- d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).

e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:

$$E = \sqrt{EIRP - 20 \log D + 104.8}$$

where:

E = electric field strength in dB μ V/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

Note 3: Pout EIRP (dBm) = Field Strength of Fundamental (dBuV/m) -95.23 (dB)

Tune-up power

Mode	Range (dBm)
Bluetooth	(-2.00) – (-1.50)
2.4G WIFI	16.00 – 23.50
RFID	(-6.00) – (-3.00)

Test result

Evolution mode	Maximum EIRP/ERP (dBm)	Antenna Gain (typical) (dBi)	Total Power (mw)	Distance (cm)	Limit of Power Density (mW/cm ²)	Power Density (mW/cm ²)	Verdict
Bluetooth	-1.50	0	0.708	20	1.00	0.0001	Pass
2.4G WIFI	23.50	3.3	100	20	1.00	0.0445	Pass
RFID	-3.00	2.3	0.501	20	0.62	0.0001	Pass

Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ (Power Density / Limit) of WIFI 2.4GHz + Bluetooth + RFID	Verdict
Bluetooth	2402MHz ~ 2480MHz	0.0001	0.0448	Pass
2.4G WIFI	2412MHz ~ 2472MHz	0.0445		Pass
RFID	902MHz ~ 928MHz	0.0002		Pass

Note:

1. The Temperature & Humidity Sensor work frequency range used is 2400 MHz ~ 2483.5 and 902 MHz ~ 928 MHz the result close to the limit by the above formula so, we select worst case power to calculate the exclusion power threshold.
2. More power list please refer to RF test report.

Conclusion:

RF exposure Evaluation Results: **Compliance**