

# 1. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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## 1.1 General Information

### Client Information

Applicant: LM Technologies Ltd.  
Address of applicant: Unit 19, Spectrum House, 32-34, Gordon House Road, London, NW5 1LP, United Kingdom

Manufacturer: LM Technologies Ltd.  
Address of manufacturer: Unit 19, Spectrum House, 32-34, Gordon House Road, London, NW5 1LP, United Kingdom

### General Description of EUT:

Product Name: LM813 WiFi and BT Dual Mode Combi Module  
Trade Name: LM Technologies  
Model No.: LM813  
FCC ID: VVXLM813  
Rated Voltage: DC 3.3/5V

### Technical Characteristics of EUT:

#### Wi-Fi 5G

Support Standards: 802.11a, 802.11n(HT20) , 802.11n-HT40, 802.11ac-VH80  
Frequency Range: 5150-5250MHz, 5725-5850MHz  
RF Output Power: 12.86dBm (Conducted)  
Type of Modulation: QPSK, 16QAM, 64QAM  
Data Rate: 6-54Mbps, up to 433.3Mbps  
Type of Antenna: SMA-reverse Antenna  
Antenna Gain: 0.5dBi

#### Wi-Fi 2.4G

Support Standards: 802.11b, 802.11g, 802.11n  
Frequency Range: 2412-2462MHz for 802.11b/g/n-HT20  
2422-2452MHz for 802.11n-HT40  
RF Output Power: 13.80dBm (Conducted)  
Type of Modulation: CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM  
Data Rate: 1-11Mbps, 6-54Mbps, up to 150Mbps  
Quantity of Channels: 11 for 802.11b/g/n-HT20  
7 for 802.11n-HT40  
Channel Separation: 5MHz  
Type of Antenna: SMA-reverse Antenna  
Antenna Gain: 0.5dBi

#### Bluetooth

Bluetooth Version: V4.0 (BR/EDR mode)

Frequency Range: 2402-2480MHz  
 RF Output Power: 6.865dBm (Conducted)  
 Data Rate: 1Mbps, 2Mbps, 3Mbps  
 Modulation: GFSK, Pi/4 QDPSK, 8DPSK  
 Quantity of Channels: 79/40  
 Channel Separation: 1/2MHz  
 Type of Antenna: SMA-reverse Antenna  
 Antenna Gain: 0.5dBi

## 1.2 Standard Applicable

According to § 1.1307(b)(1) and KDB 447498 D01 General RF Exposure Guidance v06, 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.

### (a) Limits for Occupational / Controlled Exposure

| Frequency range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Times   E   <sup>2</sup> ,   H   <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|---|--|
| 0.3-3.0               | 614                               | 1.63                              | (100)*                                  | 6  |
| 3.0-30                | 1842/f                            | 4.89/f                            | (900/f)*                                | 6  |
| 30-300                | 61.4                              | 0.163                             | 1.0                                     | 6  |
| 300-1500              | /                                 | /                                 | F/300                                   | 6  |
| 1500-100000           | /                                 | /                                 | 5                                       | 6  |

### (b) 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 <sup>2</sup> ) | Averaging Times   E   <sup>2</sup> ,   H   <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|---|--|
| 0.3-1.34              | 614                               | 1.63                              | (100)*                                  | 30   |
| 1.34-30               | 824/f                             | 2.19/f                            | (180/f)*                                | 30   |
| 30-300                | 27.5                              | 0.073                             | 0.2                                     | 30   |
| 300-1500              | /                                 | /                                 | F/1500                                  | 30   |
| 1500-100000           | /                                 | /                                 | 1                                       | 30   |

Note: f = frequency in MHz; \* = Plane-wave equivalent power density

## 1.3 MPE Calculation Method

$$S = (30 * P * G) / (377 * R^2)$$

S = power density (in appropriate units, e.g., mw/cm<sup>2</sup>)

P = power input to the antenna (in appropriate units, e.g., mw)

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

the power gain factor is normally numeric gain.

R = distance to the center of radiation of the antenna (in appropriate units, e.g., cm)

## 1.4 MPE Calculation Result

Wi-Fi 5G

Maximum Tune-Up output power: 13 (dBm)

Maximum peak output power at antenna input terminal: 19.95 (mW)

Prediction distance: >20(cm)

Prediction frequency: 5825 (MHz)

Antenna gain: 0.5 (dBi)

Directional gain (numeric gain): 1.12

The worst case is power density at prediction frequency at 20cm: 0.004(mw/cm<sup>2</sup>)

MPE limit for general population exposure at prediction frequency: 1 (mw/cm<sup>2</sup>)

Wi-Fi 2.4G

Maximum Tune-Up output power: 14 (dBm)

Maximum peak output power at antenna input terminal: 25.12 (mW)

Prediction distance: >20(cm)

Prediction frequency: 2462 (MHz)

Antenna gain: 0.5 (dBi)

Directional gain (numeric gain): 1.12

The worst case is power density at prediction frequency at 20cm: 0.006(mw/cm<sup>2</sup>)

MPE limit for general population exposure at prediction frequency: 1 (mw/cm<sup>2</sup>)

BT

Maximum Tune-Up output power: 7 (dBm)

Maximum peak output power at antenna input terminal: 5.01 (mW)

Prediction distance: >20(cm)

Prediction frequency: 2462 (MHz)

Antenna gain: 0.5 (dBi)

Directional gain (numeric gain): 1.12

The worst case is power density at prediction frequency at 20cm: 0.001(mw/cm<sup>2</sup>)

MPE limit for general population exposure at prediction frequency: 1 (mw/cm<sup>2</sup>)

**Not support WiFi and BT transmit simultaneously.**

Result: Pass