Maximum Permissible Exposure Evaluation

FCC ID: 2BOQQ-VANGUARD1

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) Radiation as specified in §1.1307(b).

EUT Specification

Product Name:	Vanguard
Trade Mark:	Vanguard
Model/Type Reference:	Vanguard
Listed Model(s):	/
Model Differences:	/
Frequency Band (Operating)	BLE: 2402MHz ~ 2480MHz LTE Cat-M1 / LTE Cat-NB1 Band 2: UL: 1850.7MHz~1909.3MHz, DL: 1930.7MHz~1989.3MHz LTE Cat-M1 / LTE Cat-NB1 Band 4: UL: 1710.7MHz~1754.3MHz, DL: 2110.7MHz~2154.3MHz LTE Cat-M1 / LTE Cat-NB1 Band 5: UL: 824.7MHz~848.3MHz, DL: 869.7MHz~893.3MHz LTE Cat-M1 / LTE Cat-NB1 Band 12: UL: 699.7MHz~715.3MHz, DL: 729.7MHz~745.3MHz LTE Cat-M1 / LTE Cat-NB1 Band 13: UL: 779.5MHz~784.5MHz, DL: 748.5MHz~751.0MHz LTE Cat-M1 Band 14: UL: 788MHz~798MHz, DL: 748.5MHz~751.0MHz LTE Cat-M1 / LTE Cat-NB1 Band 17: UL: 706.5MHz~713.5MHz, DL: 758MHz~768MHz LTE Cat-M1 / LTE Cat-NB1 Band 25: UL: 1850.7MHz~1914.3MHz, DL: 1930.7MHz~1994.3MHz LTE Cat-M1 / LTE Cat-NB1 Band 26 (814~824MHz): UL: 814MHz~824MHz, DL: 859MHz~869MHz LTE Cat-M1 / LTE Cat-NB1 Band 26 (824~849MHz): UL: 824MHz~849MHz, DL: 869MHz~894MHz LTE Cat-M1 / LTE Cat-NB1 Band 66: UL: 1710.7MHz~1779.3MHz, DL: 2110.7MHz~2179.3MHz
Device Category	☐Portable (<5mm separation) ☒Mobile (>20cm separation)

	☐Fixed (>20cm separation) ☐Others ___
Exposure Classification	☐Occupational/Controlled exposure (S=5mW/cm^2) ☒General Population/Uncontrolled exposure (S=1mW/cm^2)
Antenna Diversity	☒Single antenna ☐Multiple antennas ☐Tx diversity ☐Rx diversity ☐Tx/Rx diversity
Antenna Gain (Max)	BLE: 1.5dBi Band 2/4/25/66: 4.4dBi Band 5/12/13/14/17/26: 2.6dBi
Evaluation Applied	☒MPE Evaluation ☐SAR Evaluation

Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
(A) Limits for Occupational/Controlled Exposure				
300-1500	--	--	F/300	<6
1500-100000	--	--	5	<6
(B) Limits for General Population/Uncontrolled Exposure				
300-1500	--	--	F/1500	<30
1500-100000	--	--	1	<30

Calculation Method

Friis transmission formula: $Pd=(P_{out}*G)/(4*Pi*R^2)$
Where:
Pd= Power density in mW/cm^2
P_{out}= output power to antenna in mW
G= gain of antenna in linear scale
Pi= 3.1416
R= distance between observation point and center of the radiator in cm

Pd limit of MPE is 1mW/cm^2. If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

Measurement Result

Mode	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)
BLE	2440	1.5	6.53	0.00126	1
LTE Cat-M1 / LTE Cat-NB1 Band 2	1850	4.4	24	0.05	1
LTE Cat-M1 / LTE Cat-NB1 Band 4	1710	4.4	24	0.05	1
LTE Cat-M1 / LTE Cat-NB1 Band 5	824	2.6	24	0.05	0.549
LTE Cat-M1 / LTE Cat-NB1 Band 12	699	2.6	24	0.05	0.466
LTE Cat-M1 / LTE Cat-NB1 Band 13	777	2.6	24	0.05	0.518
LTE Cat-M1 Band 14	788	2.6	24	0.05	0.525
LTE Cat-M1 / LTE Cat-NB1 Band 17	704	2.6	24	0.05	0.469
LTE Cat-M1 / LTE Cat-NB1 Band 25	1850	4.4	24	0.05	1
LTE Cat-M1 / LTE Cat-NB1 Band 26	814	2.6	24	0.05	0.543
LTE Cat-M1 / LTE Cat-NB1 Band 66	1710	4.4	24	0.05	1

The LTE and BLE can transmit simultaneously.

LTE Power density at 20cm (mW/cm^2)	BLE Power density at 20cm (mW/cm^2)	Total Power density at 20cm (mW/cm^2)	Power density Limit (mW/cm^2)
0.05	0.00126	0.05126	1

Note:
1. Calculate in the worst-case mode.
2. Max. Tune Up Power is declared by manufacturer, and used to calculate.
3. For a more detailed features description, please refer to the RF Test Report.

**********THE END**********