RF Exposure

Standard Applicable:

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in the manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Portable device with its physical nature to be used nearby, the distance between radiating structure and human is less than 20cm.

As per KDB 447498 D01 $4.3.1.1, The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances $\leq$ 50 mm, and <= 5m (not to exceed) are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·
[$\sqrt{f}$(GHz)] $\leq$ 3.0 for 1-g SAR and $\leq$ 7.5 for 10-g extremity SAR, where

f (GHz) is the RF channel transmit frequency in GHz
Power and distance are rounded to the nearest mW and mm before calculation

The operational distance is 10mm with the verification of KDB inquiry, tracking number with 803558, that KDB941225 D07 can be referred and used to evaluate the most proper way how RF exposure concern shall be met.

Measurement Result:
  IEEE 802.11b/g/n_20MHz
  802.11b

Cable loss = 0		Average Power Output (dBm)				
CH	**Frequency (MHz)**	**Data Rate**				**Power (mW)**
		1	**2**	**5.5**	**11**	
1	**2412**	9.51	9.56	9.57	9.54	**9.06**
6	**2437**	9.78	9.79	**9.82**	9.78	**9.59**
11	**2462**	9.25	9.27	9.69	9.66	**9.31**

802.11g

Cable loss = 0		Average Power Output(dBm)								Power (mW)
CH	**Frequency (MHz)**	**Data Rate**								Power (mW)
		6	**9**	**12**	**18**	**24**	**36**	**48**	**54**	
1	**2412**	9.56	9.41	9.38	9.44	9.37	9.33	9.35	9.47	**9.03**
6	**2437**	**9.86**	9.80	9.79	9.83	9.75	9.68	9.73	9.67	**9.68**
11	**2462**	9.66	9.63	9.62	9.64	9.60	9.51	9.57	9.52	**9.25**

802.11n_20M

Cable loss = 0		Average Power Output(dBm)								Power (mW)
CH	**Frequency (MHz)**	**Data Rate**								**Power (mW)**
		MCS0	**MCS1**	**MCS2**	**MCS3**	**MCS4**	**MCS5**	**MCS6**	**MCS7**	
1	**2412**	9.42	9.47	9.43	9.41	9.39	9.41	9.40	9.39	**8.85**
6	**2437**	9.85	**9.87**	9.79	9.81	9.80	9.79	9.75	9.77	**9.71**
11	**2462**	9.65	9.66	9.64	9.65	9.64	9.62	9.63	9.61	**9.25**

Bluetooth:

BR mode (GFSK):

Frequency (MHz)	Output Power (dBm)	Duty Cycle	Output Power (mW)
2402.00	0.81	0.77	0.92788
2441.00	0.91	0.77	0.94949
2480.00	0.71	0.77	0.90676

EDR mode (π /4DQPSK):

Frequency (MHz)	Output Power (dBm)	Duty Cycle	Output Power (mW)
2402.00	3.45	0.77	1.70408
2441.00	3.67	0.77	1.79263
2480.00	3.40	0.77	1.68458

EDR mode (8DPSK):

Frequency (MHz)	Output Power (dBm)	Duty Cycle	Output Power (mW)
2402.00	3.96	0.77	1.91642
2441.00	4.16	0.77	2.00674
2480.00	3.89	0.77	1.88578

Step 1: (<=5mm)

This is a portable device and the Max peak output power is (9.68mW) lower than the threshold given and derived as formula given above, where

Test with 1gram SAR with 10mm separation

Limit of threshold:

Limit on 10 gram	Limit on 1 gram
7.5	3.0

Tolerance = 2.5dB, please refer to operational description for further detail

Wifi 802.11b/g/n_20MHz:

Mode	Frequency	Power (avg in dBm)	Power + Tolerance	Power (avg mw)	Distance (mm)	Threshold (<10mm)
802.11b	2437	9.82	12.32	17.06082389	10	2.66334707
802.11g	2437	9.86	12.36	17.21868575	10	2.687990717
802.11n	2437	9.87	12.37	17.25837892	10	2.694187176

Bluetooth:

Mode	Frequency	Power (avg in dBm)	Power (avg mw)	Distance (mm)	Threshold (<10mm)
GFSK	2441	0.7007	1.175086941	10	0.183592058
π/4DQPSK	2441	2.8259	1.916858257	10	0.299484182
8DPSK	2441	3.2032	2.090836148	10	0.326665966

Test with 10gram SAR with 0mm separation, taken 5mm as the most conservative test distance

Wifi 802.11b/g/n_20MHz:

Mode	Frequency	Power (avg in dBm)	Power + Tolerance	Power (avg mw)	Distance (mm)	Threshold (<5mm)
802.11b	2437	9.82	12.32	17.06082389	5	5.326694141
802.11g	2437	9.86	12.36	17.21868575	5	5.375981435
802.11n	2437	9.87	12.37	17.25837892	5	5.388374352

Bluetooth:

Mode	Frequency	Power (avg in dBm)	Power (avg mw)	Distance (mm)	Threshold (<5mm)
GFSK	2441	0.7007	1.175086941	5	0.367184116
π/4DQPSK	2441	2.8259	1.916858257	5	0.598968365
8DPSK	2441	3.2032	2.090836148	5	0.653331932

Conclusion:

As the result of calculation result indicates, the RF exposure generating from given transmitter (transmitter employed digital modulation) can be excluded from SAR measurement, (<3.0 and <7.0, respectively), and therefore is deemed compliant with RF exposure as per KDB 447498 D01, FCC.

Standard Applicable:

As per RSS-102, any transmitter shall be compliant with applicable RF exposure prior to being market. In $2.5.2, while the operative frequency range is *"above 2.2 GHz and up to 3 GHz inclusively, and with output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 20 mW for general public use and 100 mW for controlled use"*

Measurement Result:

Mode	Power	Power + Tolerance	Gain	Radiated Power or Conducted Power (mW)
802.11b	9.59	12.09	-3	9.099132726
802.11g	9.68	12.18	-3	9.289663868
802.11n	9.71	12.21	-3	9.354056741
Bluetooth	1.79	1.79	-2.1	1.510080154

9.10 mW < 20mW

Therefore, RF exposure generating from Bluetooth transmitter can be excluded based on RSS-102