

RF Exposure Report

Product Information

EUT	: Wattbike Performance Touchscreen
Model Number	: 80-000
Model Declaration	: /
Test Model	: 80-000
Power Supply	: DC 3.7V by battery
Hardware version	: BND-MT8163-MT116-BSF-V1.0
Software version	: V1.0
Chipset/Module 1	: MT6625L
Bluetooth Version	: V5.0+EDR
Channel Number	: 79 Channels for Bluetooth V5.0(DSS) : 40 Channels for Bluetooth V5.0(DTS)
Modulation Technology	: GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth V5.0(DSS) : GFSK for Bluetooth V5.0(DTS)
Data Rates	: Bluetooth V5.0(DSS): 1~3Mbps : Bluetooth V5.0(DTS): 1Mbps
WLAN	: Supported IEEE 802.11a/b/g/n IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz / 5180-5240MHz / 5745-5825MHz
WLAN FCC Operation Frequency	: IEEE 802.11n HT40:2422-2452MHz / 5190-5230MHz / 5755-5795MHz IEEE 802.11a: 5180-5240MHz / 5745-5825MHz
WLAN Channel Number	: 11 Channels for 2412-2462MHz(IEEE 802.11b/g/n HT20) 7 Channels for 2422-2452MHz(IEEE 802.11n HT40) 4 Channels for 5180-5240MHz (IEEE 802.11a/n HT20) 2 Channels for 5190-5230MHz (IEEE 802.11n HT40) 5 Channels for 5745-5825MHz(IEEE 802.11a/n HT20) 2 Channels for 5755-5795MHz(IEEE 802.11n HT40)
WLAN Modulation Technology	: IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) : IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) : IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Type And Gain	: Antenna 1 1.56 dBi(Max.), for TX/RX (Bluetooth), 1.56dBi(Max.), for TX/RX (WLAN 2.4G Band), 0.67 dBi(Max.), for TX/RX (WLAN 5.2G Band) 0.53 dBi(Max.), for TX/RX (WLAN 5.8G Band)
Chipset/Module 2	: nRF52840
Bluetooth Version	: V4.2 BLE
Frequency Range	: 2402-2480MHz
Channel Number	: 40 Channels
Modulation Technology	: GFSK

Data Rates : 1Mbps

Antenna Type And Gain : Antenna 2
: 0.5 dBi(Max.), for TX/RX (Bluetooth only support BLE mode),

Note: Antenna position refer to EUT Photos.

2. Evaluation Method and Limit

According to KDB447498 D01 General RF Exposure Guidance v06 Section 4.3.1 Standalone SAR test exclusion considerations: "Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions. The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander (see 5) of section 4.1). To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, typically in the SAR measurement or SAR analysis report, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for the SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops & tablets etc. "

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f} \text{ (GHz)}] \leq 3.0$ for 1-g SAR and ≤ 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 result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to f) in section 4.1 is applied to determine SAR test exclusion.

When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:

1) $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f \text{ (GHz)}} / x] \text{ W/kg}$, for test separation distances ≤ 50 mm;

where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

2) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is > 50 mm.

3. Antenna Information

This Product can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna Description	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Antenna 1	WiFi Antenna	Internal Antenna	2400 MHz – 2500 MHz	1.56 dBi
			5150 MHz – 5250 MHz	0.67 dBi
			5720 MHz – 5900 MHz	0.53 dBi
Antenna 2	BT Antenna	Internal Antenna	2400 MHz – 2500 MHz	1.56 dBi
	BT Antenna	Internal Antenna	2400 MHz – 2500 MHz	0.50 dBi

4. Conducted Power

Chipset: MT6625L

2.4G Band:

Bluetooth(BDR+EDR)

Test Mode	Channel	Frequency (MHz)	Measured Peak Output Power (dBm)
GFSK	00	2402	7.124
	39	2441	7.458
	78	2480	7.429
$\pi/4$ -DQPSK	00	2402	6.232
	39	2441	6.471
	78	2480	6.485
8-DPSK	00	2402	6.331
	39	2441	6.677
	78	2480	6.605

Bluetooth(BLE)

Test Mode	Channel	Frequency (MHz)	Measured Peak Output Power (dBm)
GFSK	00	2402	7.047
	19	2440	7.397
	39	2480	7.387

WiFi 2.4GHz Band

Test Mode	Channel	Frequency (MHz)	Measured Peak Output Power (dBm)
IEEE 802.11b	1	2412	15.379
	6	2437	14.995
	11	2462	15.227
IEEE 802.11g	1	2412	15.086
	6	2437	15.238
	11	2462	15.952
IEEE 802.11n HT20	1	2412	15.304
	6	2437	14.972
	11	2462	14.9
IEEE 802.11n HT40	3	2422	15.309
	6	2437	15.071
	9	2452	15.127

5G Band
UNII-1 Band

Test Mode	Channel	Frequency (MHz)	Measured Conducted Average Power (dBm)
IEEE 802.11a	36	5180	10.464
	40	5200	9.992
	48	5240	9.799
IEEE 802.11n HT20	36	5180	10.411
	40	5200	9.963
	48	5240	9.734
IEEE 802.11n HT40	38	5190	10.382
	46	5230	9.823

UNII-3 Band

Test Mode	Channel	Frequency (MHz)	Measured Conducted Average Power (dBm)
IEEE 802.11a	149	5745	7.942
	157	5785	8.624
	165	5825	8.873
IEEE 802.11n HT20	149	5745	8.153
	157	5785	8.607
	165	5825	8.986
IEEE 802.11n HT40	151	5755	8.424
	159	5795	8.955

Chipset: nRF52840

Bluetooth(BLE)

Test Mode	Channel	Frequency (MHz)	Measured Peak Output Power (dBm)
GFSK	00	2402	-4.910
	39	2441	-2.857
	78	2480	-4.827

5. Manufacturing Tolerance

Chipset: MT6625L

Bluetooth(BDR+EDR)

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	7.0	7.0	7.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
$\pi/4$ -DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	6.0	6.0	6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
8-DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	6.0	6.0	6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

Bluetooth(BLE)

GFSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	6.5	6.5	6.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0

WiFi 2.4GHz Band

IEEE 802.11b (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14.5	14.5	14.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15.0	15.0	15.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14.5	14.5	14.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	14.5	14.5	14.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0

UNII-1 Band

IEEE 802.11a (Maximum)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	9.5	9.5	9.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Maximum)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	9.5	9.5	9.5
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Maximum)			
Channel	Channel 38	Channel 46	--
Target (dBm)	9.5	9.5	--
Tolerance $\pm$ (dB)	1.0	1.0	--

UNII-3 Band

IEEE 802.11a (Maximum)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	8.0	8.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Maximum)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	8.0	8.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Maximum)			
Channel	Channel 151	Channel 159	--
Target (dBm)	8.0	8.0	--
Tolerance $\pm$ (dB)	1.0	1.0	--

Chipset: nRF52840

Bluetooth(BLE)

GFSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	-5.0	-3.5	-5.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

6. Evaluation Results

Chipset: MT6625L

Bluetooth(BDR+EDR)

Modulation Type	Output power		f (GHz)	separation distance (mm)	Calculation Value	SAR Test Exclusion Threshold	SAR Test Exclusion
	dBm	mW					
GFSK	8.0	6.310	2.45	25	0.395	3.000	Yes
$\pi/4$ -DQPSK	7.0	5.012	2.45	25	0.314	3.000	Yes
8-DPSK	7.0	5.012	2.45	25	0.314	3.000	Yes

Bluetooth(BLE)

Modulation Type	Output power		f (GHz)	separation distance (mm)	Calculation Value	SAR Test Exclusion Threshold	SAR Test Exclusion
	dBm	mW					
GFSK	7.5	5.623	2.45	25	0.352	3	Yes

WiFi 2.4GHz Band

Modulation Type	Output power		f (GHz)	separation distance (mm)	Calculation Value	SAR Test Exclusion Threshold	SAR Test Exclusion
	dBm	mW					
IEEE 802.11b	15.5	35.481	2.45	25	2.221	3	Yes
IEEE 802.11g	16.0	39.811	2.45	25	2.493	3	Yes
IEEE 802.11n HT20	15.5	35.481	2.45	25	2.221	3	Yes
IEEE 802.11n HT40	15.5	35.481	2.45	25	2.221	3	Yes

UNII-1 Band

Modulation Type	Output power		f (GHz)	separation distance (mm)	Calculation Value	SAR Test Exclusion Threshold	SAR Test Exclusion
	dBm	mW					
IEEE 802.11a	10.5	11.220	5.20	25	1.023	3	Yes
IEEE 802.11n HT20	10.5	11.220	5.20	25	1.023	3	Yes
IEEE 802.11n HT40	10.5	11.220	5.20	25	1.023	3	Yes

UNII-3 Band

Modulation Type	Output power		f (GHz)	separation distance (mm)	Calculation Value	SAR Test Exclusion Threshold	SAR Test Exclusion
	dBm	mW					
IEEE 802.11a	9.0	7.943	5.85	25	0.768	3	Yes
IEEE 802.11n HT20	9.0	7.943	5.85	25	0.114	3	Yes
IEEE 802.11n HT40	9.0	7.943	5.85	25	0.114	3	Yes

Chipset: nRF52840

Bluetooth(BLE)

Modulation Type	Output power		f (GHz)	separation distance (mm)	Calculation Value	SAR Test Exclusion Threshold	SAR Test Exclusion
	dBm	mW					
GFSK	-2.5	0.562	2.45	25	0.035	3	Yes

Remark:

1. Output power including tune-up tolerance;
2. When the minimum test separation distance is < 25 mm, a distance of 25 mm according to f) in section 4.1 is applied to determine SAR test exclusion.

7. Simultaneous Transmission for SAR Exclusion

The sample support two modules, they supports difference antenna, need consider simultaneous transmission;

Σ of (the highest measured or estimated SAR_{BT}+SAR_{2.4Gwifi}+SAR_{5Gwifi})/1.6 =
(0.0532+0.3357+0.1447)/1.6 = 0.3 < 1.0;

8. 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..

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