FCC RF EXPOSURE REPORT

FCC ID: YBN-AIVIL42P0

Project No.	: 1807C078
Equipment	: Car Radio with navigation, BT and WLAN
Model	: AIVIL42P0
Applicant	: Bosch Car Multimedia GmbH
Address	: Robert-Bosch-Straße 200; 31139 Hildesheim, Germany
Exposure category	: General population/uncontrolled environment
EUT Type:	: Production Unit (Engineer Sample)
Device Type	: Mobile Device

B T L   I N C .

No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China.
TEL: +86-769-8318-3000   FAX: +86-769-8319-6000

1. Evaluation Method

Systems operating under the provisions of FCC 47 CFR 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.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

2. Limits for General Population/Uncontrolled Exposure

(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^2)	Averaging Time $\lvert E\rvert^2,\lvert H\rvert^2$ 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
1500-100,000			1.0	30

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

3. Refer Evaluation Method

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.
FCC KDB publication 447498 D01 General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.
FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.
FCC CFR 47 part2 2.1093: Radiofrequency radiation exposure evaluation: portable devices

4. Calculation Method

Predication of MPE limit at a given distance
Equation from page 18 of OET Bulletin 65, Edition 97-01
$S=PG/4\pi R^2$
Where:
S=power density
P=power input to antenna
G=power gain of the antenna in the direction of interest relative to an isotropic radiator
R=distance to the center of radiation of the antenna

5. Conducted Power Results

5.1 Test Setup

5.2 Test Equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Pulse Power Sensor	Agilent	U2021XA	MY53020007	Mar. 11, 2019
2	Measure Software	Keysight	V1.01.40	n/a	n/a

Remark: all calibration period of equipment list is one year.

5.3 Test Procedure

a.   The EUT was directly connected to the power meter and antenna output port as show in the block diagram Test Setup.

b.   Setup EUT work at duty cycle more than 98%;

c.   Read power sensor values in RMS detector;

5.4   Test Results and Manufacturing Tolerance

Communication Type	Frequency Band (MHz)	Maximum power declared by Manufacturer	
		Antenna 1	Antenna 2
GFSK	2402-2480	≤ -1.30	n/a
π/4dQPSK	2402-2480	≤ -4.35	n/a
8DPSK	2402-2480	≤ -3.81	n/a
IEEE 802.11b	2412-2462	n/a	≤ 11.20
IEEE 802.11g	2412-2462	n/a	≤ 7.82
IEEE 802.11n HT20	2412-2462	n/a	≤ 7.50
IEEE 802.11n HT40	2422-2452	n/a	≤ 6.10
IEEE 802.11a	5180-5825	n/a	≤ 8.53
IEEE 802.11n HT20	5180-5825	n/a	≤ 8.49
IEEE 802.11n HT40	5190-5795	n/a	≤ 7.44
IEEE 802.11ac VHT20	5180-5825	n/a	≤ 5.69
IEEE 802.11ac VHT40	5190-5795	n/a	≤ 4.00
IEEE 802.11ac VHT80	5210-5775	n/a	≤ 7.49

6. Antenna Information

Antenna	Manufacturer	Model Name	Antenna Type	Connector	Frequency Band (MHz)	Maximum Gain (dBi)
Antenna 1	N/A	N/A	Internal	N/A	2400-2500	4.13
Antenna 2	N/A	N/A	Internal	N/A	2400-2500	6.60
					5150-5250	8.10
					5250-5350	7.50
					5500-5700	5.10
					5745-5850	2.40

7. Evaluation Results

7.1   Standalone

Antenna 1

Communication Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	(dBm)	(mW)					
GFSK	-1.30	0.7413	4.13	2.5882	100%	0.0004	1.0000
π/4dQPSK	-4.35	0.3673	4.13	2.5882	100%	0.0002	1.0000
8DPSK	-3.81	0.4159	4.13	2.5882	100%	0.0002	1.0000

Antenna 2

Communication Type	Output power		Antenna Gain	Antenna Gain	Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	(dBm)	(mW)	(dBi)	(linear)			
IEEE 802.11a	8.53	7.1285	8.10	6.4565	100%	0.0092	1.0000
IEEE 802.11b	11.20	13.1826	6.60	4.5709	100%	0.0120	1.0000
IEEE 802.11g	7.82	6.0534	6.60	4.5709	100%	0.0055	1.0000
IEEE 802.11n HT20 (2412-2462 MHz)	7.50	5.6234	6.60	4.5709	100%	0.0051	1.0000
IEEE 802.11n HT20 (5180 -5825 MHz)	8.49	7.0632	8.10	6.4565	100%	0.0091	1.0000
IEEE 802.11n HT40 (2422-2452 MHz)	6.10	4.0738	6.60	4.5709	100%	0.0037	1.0000
IEEE 802.11n HT40 (5190-5795 MHz)	7.44	5.5463	8.10	6.4565	100%	0.0071	1.0000
IEEE 802.11ac VHT20 (5180 -5825 MHz)	5.69	3.7068	8.10	6.4565	100%	0.0048	1.0000
IEEE 802.11ac VHT40 (5190-5795 MHz)	4.00	2.5119	8.10	6.4565	100%	0.0032	1.0000
IEEE 802.11ac VHT80 (5210-5775 MHz)	7.49	5.6105	8.10	6.4565	100%	0.0072	1.0000

Remark:

1. *Maximum power including tune-up tolerance;*

2. *Used antenna gain is 8.10 dBi to calculate MPE as this maximum antenna gain from 5180 – 5825 MHz;*

3. *MPE use distance is 20 cm from manufacturer declaration of user manual.*

7.2   Simultaneous Transmission for MPE Exclusion

The sample support one BT and one WLAN modular, BT and WLAN share difference antenna, need consider simultaneous transmission;

Maximum MPE Ratios for dual-mode WLAN simultaneous transmission

Maximum MPE Ratio $_{BT}$	Maximum MPE Ratio $_{WLAN}$	∑ MPE ratios	Limit	Results
0.0004	0.0120	<0.1	1.0	PASS

Remark:

1. *Maximum power including tune-up tolerance;*

2. *Used antenna gain is 8.10 dBi to calculate MPE as this maximum antenna gain from 5180 – 5825 MHz;*

3. *MPE use distance is 20 cm from manufacturer declaration of user manual.*

8. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and MPE limits per KDB 447498 v06.