

FCC 47 CFR MPE REPORT

BYD Auto Industry Company Limited

In-vehicle Multimedia Host

Model Number: MTCV03

FCC ID: SD4-MTCV03

Applicant:	BYD Auto Industry Company Limited
Address:	No.3001, 3007, Hengping Road, Pingshan, Shenzhen, P.R.China
Prepared By:	EST Technology Co., Ltd.
	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China
Tel: 86-769-83081888-808	

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Maximum Permissible Exposure

1. Applicable Standards

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

1.1. Limits for Maximum Permissible Exposure (MPE)

(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 ²)	Averaging Times E ² , H ² 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
1500-10000			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 ²)	Averaging Times E ² , H 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
1500-10000			1.0	30

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

1.2. MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric Field (V/m)

P = Peak RF output Power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

2. Conducted Power Result

Mode	Frequency (MHz)	Antenna	Peak output power (dBm)	Peak output power (mW)
GFSK	2402	ant 1	9.02	7.980
	2441	ant 1	9.14	8.204
	2480	ant 1	8.99	7.925
$\pi/4$ -DQPSK	2402	ant 1	8.8	7.586
	2441	ant 1	8.86	7.691
	2480	ant 1	8.74	7.482
8-DPSK	2402	ant 1	9.05	8.035
	2441	ant 1	9.02	7.980
	2480	ant 1	8.87	7.709
BLE 1M	2402	ant 1	8.95	7.852
	2440	ant 1	9.05	8.035
	2480	ant 1	8.84	7.656
BLE 2M	2402	ant 1	9.09	8.110
	2440	ant 1	9.11	8.147
	2480	ant 1	8.87	7.709
IEEE 802.11b	2412	ant 1	17.99	62.951
		ant 2	16.87	48.641
	2437	ant 1	17.36	54.450
		ant 2	16.16	41.305
	2462	ant 1	17.68	58.614
		ant 2	16.2	41.687
IEEE 802.11g	2412	ant 1	18.1	64.565
		ant 2	16.89	48.865
	2437	ant 1	18.64	73.114
		ant 2	17.59	57.412
	2462	ant 1	17.67	58.479
		ant 2	16.66	46.345
IEEE 802.11n HT20	2412	ant 1	18.16	65.464
		ant 2	16.9	48.978
	2437	ant 1	17.57	57.148
		ant 2	16.7	46.774
	2462	ant 1	17.61	57.677
		ant 2	16.71	46.881

IEEE 802.11ax HE20	2412	ant 1	18.4	69.183
		ant 2	17.15	51.880
	2437	ant 1	17.89	61.518
		ant 2	16.95	49.545
	2462	ant 1	17.9	61.660
		ant 2	17.05	50.699
IEEE 802.11a	5180	ant 1	15.21	33.189
		ant 2	16.82	48.084
	5200	ant 1	15.28	33.729
		ant 2	16.85	48.417
	5240	ant 1	15.27	33.651
		ant 2	17.76	59.704
	5260	ant 1	14.86	30.620
		ant 2	17.32	53.951
	5300	ant 1	15.53	35.727
		ant 2	16.17	41.400
	5320	ant 1	15.24	33.420
		ant 2	15.97	39.537
	5500	ant 1	15.25	33.497
		ant 2	15.88	38.726
	5580	ant 1	15.6	36.308
		ant 2	16.09	40.644
	5700	ant 1	15.66	36.813
		ant 2	14.92	31.046
	5745	ant 1	15.2	33.113
		ant 2	14.19	26.242
	5785	ant 1	14.44	27.797
		ant 2	13.81	24.044
	5825	ant 1	13.92	24.660
		ant 2	13.18	20.797
IEEE 802.11n20	5180	ant 1	13.34	21.577
		ant 2	14.92	31.046
	5200	ant 1	13.06	20.230
		ant 2	15.11	32.434
	5240	ant 1	13.11	20.464
		ant 2	15.08	32.211
	5260	ant 1	14.39	27.479
		ant 2	15.82	38.194

	5300	ant 1	14.42	27.669
		ant 2	15.19	33.037
	5320	ant 1	14.05	25.410
		ant 2	15.23	33.343
	5500	ant 1	15.58	36.141
		ant 2	16.11	40.832
	5580	ant 1	15.33	34.119
		ant 2	15.76	37.670
	5700	ant 1	15.5	35.481
		ant 2	14.76	29.923
	5745	ant 1	15.06	32.063
		ant 2	14.31	26.977
	5785	ant 1	14.11	25.763
		ant 2	13.59	22.856
	5825	ant 1	14.06	25.468
		ant 2	13.32	21.478
IEEE 802.11ac VHT20	5180	ant 1	14.09	25.645
		ant 2	15.59	36.224
	5200	ant 1	13.87	24.378
		ant 2	15.9	38.905
	5240	ant 1	13.91	24.604
		ant 2	15.98	39.628
	5260	ant 1	12.92	19.588
		ant 2	14.95	31.261
	5300	ant 1	12.98	19.861
		ant 2	14.22	26.424
	5320	ant 1	13.72	23.550
		ant 2	15.39	34.594
	5500	ant 1	14.14	25.942
		ant 2	15.19	33.037
	5580	ant 1	14.34	27.164
		ant 2	15.06	32.063
	5700	ant 1	14.04	25.351
		ant 2	13.65	23.174
	5745	ant 1	15.01	31.696
		ant 2	14.4	27.542
	5785	ant 1	14.12	25.823
		ant 2	13.3	21.380

	5825	ant 1	14.31	26.977
		ant 2	13.27	21.232
IEEE 802.11ax HE20	5180	ant 1	14.4	27.542
		ant 2	15.89	38.815
	5200	ant 1	14.13	25.882
		ant 2	16.02	39.994
	5240	ant 1	14.26	26.669
		ant 2	16.4	43.652
	5260	ant 1	14.07	25.527
		ant 2	16.03	40.087
	5300	ant 1	14.72	29.648
		ant 2	15.22	33.266
	5320	ant 1	14.51	28.249
		ant 2	15.33	34.119
	5500	ant 1	14.5	28.184
		ant 2	14.95	31.261
	5580	ant 1	14.37	27.353
		ant 2	15.39	34.594
	5700	ant 1	15.43	34.914
		ant 2	15	31.623
	5745	ant 1	15.12	32.509
		ant 2	14.32	27.040
IEEE 802.11n HT40	5785	ant 1	14.27	26.730
		ant 2	13.7	23.442
	5825	ant 1	14.12	25.823
		ant 2	13.5	22.387
	5190	ant 1	13.7	23.442
		ant 2	15.34	34.198
	5230	ant 1	14.69	29.444
		ant 2	15.71	37.239
	5270	ant 1	13.23	21.038
		ant 2	14.9	30.903
	5310	ant 1	13.12	20.512
		ant 2	13.93	24.717
	5510	ant 1	13.6	22.909
		ant 2	14.49	28.119
	5550	ant 1	14.72	29.648
		ant 2	15.8	38.019

	5670	ant 1	15.77	37.757
		ant 2	15.88	38.726
	5755	ant 1	15.13	32.584
		ant 2	14.6	28.840
	5795	ant 1	14.49	28.119
		ant 2	13.49	22.336
IEEE 802.11ac VHT40	5190	ant 1	13.6	22.909
		ant 2	15.19	33.037
	5230	ant 1	13.44	22.080
		ant 2	15.59	36.224
	5270	ant 1	13.45	22.131
		ant 2	14.74	29.785
	5310	ant 1	13.22	20.989
		ant 2	14.45	27.861
	5510	ant 1	13.95	24.831
		ant 2	15.05	31.989
	5590	ant 1	14.74	29.785
		ant 2	15.99	39.719
	5670	ant 1	15.18	32.961
		ant 2	14.89	30.832
	5755	ant 1	14.3	26.915
		ant 2	13.94	24.774
	5795	ant 1	14.95	31.261
		ant 2	13.9	24.547
IEEE 802.11ax HE40	5190	ant 1	13.54	22.594
		ant 2	15.32	34.041
	5230	ant 1	13.58	22.803
		ant 2	15.5	35.481
	5270	ant 1	13.23	21.038
		ant 2	14.96	31.333
	5310	ant 1	13.5	22.387
		ant 2	14.71	29.580
	5510	ant 1	13.87	24.378
		ant 2	14.83	30.409
	5590	ant 1	13.8	23.988
		ant 2	15.63	36.559
	5670	ant 1	15.03	31.842
		ant 2	14.79	30.130

	5755	ant 1	14.37	27.353
		ant 2	14.03	25.293
	5795	ant 1	13.59	22.856
		ant 2	12.72	18.707
IEEE 802.11ac VHT80	5210	ant 1	11.15	13.032
		ant 2	13.22	20.989
	5290	ant 1	11.21	13.213
		ant 2	12.77	18.923
	5530	ant 1	12.31	17.022
		ant 2	13.2	20.893
	5610	ant 1	11.5	14.125
		ant 2	11.87	15.382
	5775	ant 1	12.88	19.409
		ant 2	12.28	16.904
IEEE 802.11ax HE80	5210	ant 1	11.38	13.740
		ant 2	13.59	22.856
	5290	ant 1	11.39	13.772
		ant 2	12.9	19.498
	5530	ant 1	12.19	16.558
		ant 2	13.06	20.230
	5610	ant 1	11.44	13.932
		ant 2	11.88	15.417
	5775	ant 1	12.7	18.621
		ant 2	12.22	16.672
GSM/GPRS/EGPRS	850	33.4		2187.762
GSM/GPRS/EGPRS	1900	29.54		899.498
WCDMA	Band 2	23.05		201.837
	Band 4	23.4		218.776
	Band 5	23.26		211.836
LTE	Band 2	23.01		199.986
	Band 4	23.11		204.644
	Band 5	22.9		194.984
	Band 7	22.75		188.365
	Band 12	22.89		194.536
	Band 13	23.02		200.447
	Band 26	23.13		205.589
	Band 41	23.56		226.986

3. Calculated Result and Limit

SISO

The Worst Mode	Ant.	Peak output power (dBm)	Target power (dBm)	MAX Target power (dBm)	Antenna gain		Power Density (S) (mW /cm²)	Limited of Power Density (S) (mW /cm²)	Test Result
					(dBi)	(Linear)			
2.4G Band									
GFSK	ant 1	9.14	9±1	10	-1.86	0.652	0.0013	1	Complies
π/4-DQPSK	ant 1	8.86	8 ±1	9	-1.86	0.652	0.0010	1	Complies
8-DPSK	ant 1	9.05	9±1	10	-1.86	0.652	0.0013	1	Complies
BLE	ant 1	9.11	9 ±1	10	-1.86	0.652	0.0013	1	Complies
IEEE 802.11b	ant 1	17.99	17 ±1	18	-1.86	0.652	0.0082	1	Complies
	ant 2	16.87	16 ±1	17	-1.34	0.735	0.0073	1	Complies
IEEE 802.11g	ant 1	18.64	18 ±1	19	-1.86	0.652	0.0103	1	Complies
	ant 2	17.59	17 ±1	18	-1.34	0.735	0.0092	1	Complies
IEEE 802.11n HT20	ant 1	18.16	18 ±1	19	-1.86	0.652	0.0103	1	Complies
	ant 2	16.9	16±1	17	-1.34	0.735	0.0073	1	Complies
IEEE802.11ax HE20	ant 1	18.4	18 ±1	19	-1.86	0.652	0.0103	1	Complies
	ant 2	17.15	17 ±1	18	-1.34	0.735	0.0092	1	Complies
5G Band									
IEEE 802.11a	ant 1	15.66	15 ±1	16	-2.07	0.6209	0.0049	1	Complies
	ant 2	17.76	17 ±1	18	-1.31	0.7396	0.0093	1	Complies
IEEE 802.11n HT20	ant 1	15.58	15 ±1	16	-2.07	0.6209	0.0049	1	Complies
	ant 2	16.11	16 ±1	17	-1.31	0.7396	0.0074	1	Complies
IEEE802.11ac VHT20	ant 1	15.01	15 ±1	16	-2.07	0.6209	0.0049	1	Complies
	ant 2	15.98	15 ±1	16	-1.31	0.7396	0.0059	1	Complies
IEEE802.11ax HE20	ant 1	15.43	15 ±1	16	-2.07	0.6209	0.0049	1	Complies
	ant 2	16.4	16 ±1	17	-1.31	0.7396	0.0074	1	Complies
IEEE 802.11n HT40	ant 1	15.77	15 ±1	16	-2.07	0.6209	0.0049	1	Complies
	ant 2	15.88	15 ±1	16	-1.31	0.7396	0.0059	1	Complies

IEEE 802.11ac VHT40	ant 1	15.18	15±1	16	-2.07	0.6209	0.0049	1	Complies
	ant 2	15.99	15 ±1	16	-1.31	0.7396	0.0059	1	Complies
IEEE802.11ax HE40	ant 1	15.03	15 ±1	16	-2.07	0.6209	0.0049	1	Complies
	ant 2	15.63	15 ±1	16	-1.31	0.7396	0.0059	1	Complies
IEEE 802.11ac VHT80	ant 1	12.88	12 ±1	13	-2.07	0.6209	0.0025	1	Complies
	ant 2	13.22	13 ±1	14	-1.31	0.7396	0.0037	1	Complies
IEEE802.11ax HE80	ant 1	12.7	12 ±1	13	-2.07	0.6209	0.0025	1	Complies
	ant 2	13.59	13±1	14	-1.31	0.7396	0.0037	1	Complies
GSM/GPRS/ EGPRS	850	33.4	33±1	34	-3.17	0.482	0.2408	0.57	Complies
GSM/GPRS/ EGPRS	1900	29.54	29 ±1	30	-1.9	0.646	0.1284	1	Complies
WCDMA	Band 2	23.05	23±1	24	-1.9	0.646	0.0323	1	Complies
	Band 4	23.4	23 ±1	24	-2.08	0.619	0.0310	1	Complies
	Band 5	23.26	23 ±1	24	-3.17	0.482	0.0241	0.55	Complies
LTE	Band 2	23.01	23 ±1	24	-1.9	0.646	0.0323	1	Complies
	Band 4	23.11	23 ±1	24	-2.08	0.619	0.0310	1	Complies
	Band 5	22.9	22 ±1	23	-3.17	0.482	0.0191	0.55	Complies
	Band 7	22.75	22 ±1	23	-1.96	0.637	0.0253	1	Complies
	Band 12	22.89	22±1	23	-2.5	0.562	0.0223	0.46	Complies
	Band 13	23.02	23 ±1	24	-4.03	0.395	0.0198	0.51	Complies
	Band 26	23.13	23 ±1	24	-3.17	0.482	0.0241	0.55	Complies
	Band 41	23.56	23 ±1	24	-1.84	0.655	0.0327	1	Complies

MIMO

Mode	Power Density (S) (mW /cm2) Antenna 0	Power Density (S) (mW /cm2) Antenna 1	Power Density (S) (mW /cm2) Total	Limited of Power Density (S) (mW /cm2)	Test Result
2.4G Band					
IEEE 802.11n HT20	0.0103	0.0073	0.0176	1	Complies
IEEE802.11ax HE20	0.0103	0.0092	0.0195	1	Complies
5G Band					
IEEE 802.11n HT20	0.0049	0.0074	0.0123	1	Complies
IEEE 802.11ac VHT20	0.0049	0.0059	0.0108	1	Complies
IEEE802.11ax HE20	0.0049	0.0074	0.0123	1	Complies
IEEE 802.11n HT40	0.0049	0.0059	0.0108	1	Complies
IEEE 802.11ac VHT40	0.0049	0.0059	0.0108	1	Complies
IEEE802.11ax HE40	0.0049	0.0059	0.0108	1	Complies
IEEE 802.11ac VHT80	0.0025	0.0037	0.0062	1	Complies
IEEE802.11ax HE80	0.0025	0.0037	0.0062	1	Complies

Simultaneous Transmission Mode (BT+BLE+GSM/GPRS/EGPRS+WCDMA+LTE)

Mode	Result	Limit	Simultaneous Transmissions Result	Simultaneous Transmissions Limit	Total Result
BT	0.0013	1	0.52	1	Complies
WIFI	0.0195	1			Complies
GSM/GPRS/EGPRS	0.2408	0.57			Complies
WCDMA	0.0323	1			Complies
LTE	0.0327	1			Complies

End of Test Report