

Maximum Permissible Exposure Report

1. Product Information

FCC ID:	2AVTH-HTN4020MPC
Product name	HYUNDAI Mini PC
Test Model	HTN4020MPC
Model List No.	HTN4020MPC
Power Supply	DC 12V 2.0A Adapter parameters: Input: AC 100-240V 50/60Hz 0.8A Output: DC 12V 2.0A
Bluetooth Operation frequency	2402MHz-2480MHz
Bluetooth Version	Bluetooth 5.0
Channel Number	79 channels for Bluetooth 5.0 (BT Classics) 40 channels for Bluetooth 5.0 (BT LE)
Channel Spacing	1MHz for Bluetooth 5.0 (BT Classics) 2MHz for Bluetooth 5.0 (BT LE)
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8-DPSK for 5.0 (BT Classics) GFSK for Bluetooth 5.0 (BT LE)
WIFI(2.4G Band) Frequency Range	2412MHz-2462MHz
Channel Spacing	5MHz
Channel Number	11 channels for 20MHz bandwidth (2412~2462MHz) 7 channels for 40MHz bandwidth (2422~2452MHz)
Modulation Type	IEEE 802.11b: DSSS (CCK,DQPSK,DBPSK); IEEE 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
WIFI(5.2G Band) Frequency Range	5180MHz-5240MHz
Channel Number	4 channels for 20MHz bandwidth (5180-5240MHz) 2 channels for 40MHz bandwidth (5190~5230MHz) 1 channels for 80MHz bandwidth (5210MHz)
Modulation Type	IEEE 802.11a/n/ac: OFDM(64QAM, 16QAM, QPSK, BPSK)
WIFI(5.8G Band) Frequency Range	5745MHz-5825MHz
Channel Number	5 channels for 20MHz bandwidth (5745-5825MHz) 2 channels for 40MHz bandwidth (5755~5795MHz) 1 channels for 80MHz bandwidth (5775MHz)
Modulation Type	IEEE 802.11a/n/ac: OFDM(64QAM, 16QAM, QPSK, BPSK)
Antenna Type	ANT 1: Internal Antenna, used for Bluetooth TX/RX, WIFI TX/RX, 2.0 dBi(Max.) for Bluetooth and WIFI 2.4G, 2.0 dBi(Max.) for WIFI 5G Band ANT 2: Internal Antenna, used for WIFI TX/RX, 2.0 dBi(Max.) for WIFI 2.4G, 2.0 dBi(Max.) for WIFI 5G Band
Hardware version	IP3-GB3B
Software version	Windows10 20H2
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Equipment

2. 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 modelled 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.

3. Limit

3.1 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 1 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 2.1091](#): Radiofrequency radiation exposure evaluation: mobile devices

3.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	6
3.0 – 30	1842/f	4.89/f	(900/f ²)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	(180/f ²)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30
1500 – 100,000	/	/	1.0	30

F=frequency in MHz

*=Plane-wave equivalent power density

4. MPE 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. Antenna Information

HTN4020MPC can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
ANT 1	Internal Antenna	2402 MHz – 2480 MHz	2.0 dBi
ANT 1	Internal Antenna	5180 MHz – 5825 MHz	2.0 dBi
ANT 2	Internal Antenna	2412 MHz – 2462 MHz	2.0 dBi
ANT 2	Internal Antenna	5180 MHz – 5825 MHz	2.0 dBi

6. Conducted Power

BT

Mode	Channel	Frequency(MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	1.792
	39	2441	2.476
	78	2480	2.257
$\pi/4$ DQPSK	0	2402	2.685
	39	2441	3.118
	78	2480	2.855
8DPSK	0	2402	2.705
	39	2441	3.140
	78	2480	2.857
LE GFSK	0	2402	-0.930
	19	2440	-0.139
	39	2480	0.013

[2.4GWLAN Max Conducted Power]

Mode	Channel	Frequency(MHz)	Max Peak Conducted Power (dBm)	
			ANT1	ANT2
IEEE 802.11b	1	2412	17.10	17.43
	6	2437	17.17	16.93
	11	2462	17.23	16.60
IEEE 802.11g	1	2412	17.66	16.40
	6	2437	17.02	17.42
	11	2462	17.41	17.10
IEEE 802.11n HT20	1	2412	17.30	17.11
	6	2437	17.12	16.57
	11	2462	17.50	16.25
IEEE 802.11n HT40	3	2422	17.04	16.75
	6	2437	16.97	16.68
	9	2452	17.12	16.68

[5.2GWLAN Max Conducted Power]

Mode	Channel	Frequency(MHz)	Max Average Conducted Power(dBm)	
			ANT1	ANT2
IEEE 802.11a	36	5180	14.30	13.26
	40	5200	14.43	13.07
	48	5240	14.35	13.06
IEEE 802.11n HT20	36	5180	14.47	13.63
	40	5200	14.67	13.38
	48	5240	14.17	13.38
IEEE 802.11n HT40	38	5190	13.31	12.23
	46	5230	13.89	12.45
IEEE 802.11ac HT20	36	5180	13.45	13.63
	40	5200	13.69	12.44
	48	5240	13.39	12.08
IEEE 802.11ac HT40	38	5190	14.01	13.27
	46	5230	13.74	13.31
IEEE 802.11ac HT80	42	5210	12.40	13.53

[5.8GWLAN Max Conducted Power]

Mode	Channel	Frequency(MHz)	Max Average Conducted Power(dBm)	
			ANT1	ANT2
IEEE 802.11a	149	5745	14.09	12.36
	157	5785	13.73	13.11
	165	5825	13.87	13.48
IEEE 802.11n HT20	149	5745	13.78	13.51
	157	5785	14.63	13.68
	165	5825	13.08	13.67
IEEE 802.11n HT40	151	5755	14.06	12.58
	159	5795	14.52	12.59
IEEE 802.11ac HT20	149	5745	13.45	13.63
	157	5785	13.69	12.44
	165	5825	13.39	12.08
IEEE 802.11ac HT40	151	5755	14.01	13.27
	159	5795	13.74	13.31
IEEE 802.11ac HT80	155	5775	14.3	13.4

7. Manufacturing Tolerance

BT

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	2.0	2.0	2.0
Tolerance \pm (dB)	1.0	1.0	1.0
$\pi/4$ -DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	3.0	3.0	3.0
Tolerance \pm (dB)	1.0	1.0	1.0
8DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	3.0	3.0	3.0
Tolerance \pm (dB)	1.0	1.0	1.0
GFSK – BT LE(Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	0	0	0
Tolerance \pm (dB)	1.0	1.0	1.0

ANT1:

WIFI(2.4G Band)

IEEE 802.11b (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	17.0	17.0	17.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	17.0	17.0	17.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	17.0	17.0	17.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	17.0	17.0	17.0
Tolerance \pm (dB)	1.0	1.0	1.0

WIFI 5GWLAN (5.2G Band)

IEEE 802.11a (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	14.0	14.0	14.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	14.0	14.0	14.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 38	---	Channel 46
Target (dBm)	14.0	---	14.0
Tolerance \pm (dB)	1.0	---	1.0
IEEE 802.11ac HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	14.0	14.0	14.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11ac HT40 (Average)			
Channel	Channel 38	---	Channel 46
Target (dBm)	14.0	---	14.0
Tolerance \pm (dB)	1.0	---	1.0
IEEE 802.11ac HT80 (Average)			
Channel	---	Channel 42	---
Target (dBm)	---	13.0	---
Tolerance \pm (dB)	---	1.0	---

WIFI 5GWLAN (5.8G Band)

IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	14.0	14.0	14.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	14.0	14.0	14.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 151	---	Channel 159
Target (dBm)	14.0	---	14.0
Tolerance \pm (dB)	1.0	---	1.0
IEEE 802.11ac HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	14.0	14.0	14.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11ac HT40 (Average)			
Channel	Channel 151	---	Channel 159
Target (dBm)	14.0	---	14.0
Tolerance \pm (dB)	1.0	---	1.0
IEEE 802.11ac HT80 (Average)			
Channel	---	Channel 155	---
Target (dBm)	---	14.0	---
Tolerance \pm (dB)	---	1.0	---

ANT2:

WIFI(2.4G Band)

IEEE 802.11b (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	17.0	17.0	17.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	17.0	17.0	17.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	17.0	17.0	17.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	17.0	17.0	17.0
Tolerance \pm (dB)	1.0	1.0	1.0

WIFI 5GWLAN (5.2G Band)

IEEE 802.11a (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	13.0	13.0	13.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	13.0	13.0	13.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 38	---	Channel 46
Target (dBm)	13.0	---	13.0
Tolerance \pm (dB)	1.0	---	1.0
IEEE 802.11ac HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	13.0	13.0	13.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11ac HT40 (Average)			
Channel	Channel 38	---	Channel 46
Target (dBm)	13.0	---	13.0
Tolerance \pm (dB)	1.0	---	1.0
IEEE 802.11ac HT80 (Average)			
Channel	---	Channel 42	---
Target (dBm)	---	13.0	---
Tolerance \pm (dB)	---	1.0	---

WIFI 5G WLAN (5.8G Band)

IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	13.0	13.0	13.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	13.0	13.0	13.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 151	---	Channel 159
Target (dBm)	13.0	---	13.0
Tolerance \pm (dB)	1.0	---	1.0
IEEE 802.11ac HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	13.0	13.0	13.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11ac HT40 (Average)			
Channel	Channel 151	---	Channel 159
Target (dBm)	13.0	---	13.0
Tolerance \pm (dB)	1.0	---	1.0
IEEE 802.11ac HT80 (Average)			
Channel	---	Channel 155	---
Target (dBm)	---	13.0	---
Tolerance \pm (dB)	---	1.0	---

8. Measurement Results

8.1 Standalone MPE Evaluation

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r=20\text{cm}$, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

ANT1:

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
GFSK	3.0	2.00	2.0	1.58	100%	0.0006	1.0000
$\pi/4$ DQPSK	4.0	2.51	2.0	1.58	100%	0.0008	1.0000
8DPSK	4.0	2.51	2.0	1.58	100%	0.0008	1.0000
BT LE	1.0	1.26	2.0	1.58	100%	0.0004	1.0000
IEEE 802.11b	18.00	63.10	2.0	1.58	100%	0.0198	1.0000
IEEE 802.11g	18.00	63.10	2.0	1.58	100%	0.0198	1.0000
IEEE 802.11n HT20	18.00	63.10	2.0	1.58	100%	0.0198	1.0000
IEEE 802.11n HT40	18.00	63.10	2.0	1.58	100%	0.0198	1.0000
IEEE 802.11a (5.2G)	15.00	31.62	2.0	1.58	100%	0.0099	1.0000
IEEE 802.11n20 (5.2G)	15.00	31.62	2.0	1.58	100%	0.0099	1.0000
IEEE 802.11n40 (5.2G)	15.00	31.62	2.0	1.58	100%	0.0099	1.0000
IEEE 802.11ac20 (5.2G)	15.00	31.62	2.0	1.58	100%	0.0099	1.0000
IEEE 802.11ac40 (5.2G)	15.00	31.62	2.0	1.58	100%	0.0099	1.0000
IEEE 802.11ac80 (5.2G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11a (5.8G)	15.00	31.62	2.0	1.58	100%	0.0099	1.0000
IEEE 802.11n20 (5.8G)	15.00	31.62	2.0	1.58	100%	0.0099	1.0000
IEEE 802.11n40 (5.8G)	15.00	31.62	2.0	1.58	100%	0.0099	1.0000
IEEE 802.11ac20 (5.8G)	15.00	31.62	2.0	1.58	100%	0.0099	1.0000
IEEE 802.11ac40 (5.8G)	15.00	31.62	2.0	1.58	100%	0.0099	1.0000
IEEE 802.11ac80 (5.8G)	15.00	31.62	2.0	1.58	100%	0.0099	1.0000

ANT2:

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11b	18.00	63.10	2.0	1.58	100%	0.0198	1.0000
IEEE 802.11g	18.00	63.10	2.0	1.58	100%	0.0198	1.0000
IEEE 802.11n HT20	18.00	63.10	2.0	1.58	100%	0.0198	1.0000
IEEE 802.11n HT40	18.00	63.10	2.0	1.58	100%	0.0198	1.0000
IEEE 802.11a (5.2G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11n20 (5.2G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11n40 (5.2G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11ac20 (5.2G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11ac40 (5.2G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11ac80 (5.2G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11a (5.8G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11n20 (5.8G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11n40 (5.8G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11ac20 (5.8G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11ac40 (5.8G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000
IEEE 802.11ac80 (5.8G)	14.00	25.12	2.0	1.58	100%	0.0079	1.0000

Remark:

1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer.

8.2 Simultaneous Transmission MPE

The sample support one Bluetooth/WLAN modular with two same antenna and not support MIMO technology, need consider simultaneous transmission;

The EUT operating at 2.4GWIFI has the highest emission measured value,

$MPE_{ANT1} = 0.0198$; $MPE_{ANT2} = 0.0198$;

$\sum MPE = \sum$ of (the highest measured or estimated $MPE_{ANT1} + MPE_{ANT2}$) = $(0.0198 + 0.0198) = 0.0396 < 1.0$;

9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

-----THE END OF REPORT-----