






# TEST REPORT

<b>KCTL Inc.</b> 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 <a href="http://www.kctl.co.kr">www.kctl.co.kr</a>	Report No.: <b>KR20-SRF0046-A</b> Page (1) of (13)	
<p><b>1. Client</b></p> <ul style="list-style-type: none"> <li>◦ Name : HYUNDAI MOBIS CO., LTD.</li> <li>◦ Address : 203, Teheran-ro, Gangnam-gu, Seoul, 06141, Korea</li> <li>◦ Date of Receipt : 2019-09-20</li> </ul> <p><b>2. Use of Report</b> : Certification</p> <p><b>3. Name of Product and Model</b> : WIDE AVN / ATC31HYAN</p> <p><b>4. Manufacturer and Country of Origin</b> : Hyundai Mobis Co., Ltd. / Korea</p> <p><b>5. FCC ID</b> : TQ8-ATC31HYAN</p> <p><b>6. Date of Test</b> : 2019-10-01 to 2019-10-31</p> <p><b>7. Test Standards</b> : 47 CFR Part 1.1310</p> <p><b>8. Test Results</b> : Refer to the test result in the test report</p>		
Affirmation	Tested by  Name : Euijung Kim (Signature)	Technical Manager  Name : Heesu Ahn (Signature)
2020-02-21		
<h2>KCTL Inc.</h2>		
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**Report revision history**

Date	Revision	Page No
2020-02-09	Initial report	-
2020-02-21	Updated	3,5,12

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*Note. The report No. KR20-SRF0046 is superseded by the report No. KR20-SRF0046-A.*



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## 1. General information

Client : HYUNDAI MOBIS CO., LTD.  
Address : 203, Teheran-ro, Gangnam-gu, Seoul, 06141, Korea  
Manufacturer : Hyundai Mobis Co., Ltd  
Address : 95, Sayang 2-Gil, Munbaek-Myeon, Jincheon-Gun, Chungcheongbuk-Do  
27862 Korea  
Laboratory : KCTL Inc.  
Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea  
Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132  
VCCI Registration No. : R-20080, G-20078, C-20059, T-20056  
Industry Canada Registration No. : 8035A  
KOLAS No.: KT231

## 2. Device information

Equipment under test : WIDE AVN  
Model : ATC31HYAN  
Derivative model : ATC31HCAN, ATC34HCAN  
Frequency range : 2 402 MHz ~ 2 480 MHz (Bluetooth(BDR/EDR))  
2 412 MHz ~ 2 462 MHz (802.11b/g/n\_HT20)  
UNII-1: 5 180 MHz ~ 5 240 MHz (802.11a/n\_HT20/ac\_VHT20)  
UNII-1: 5 190 MHz ~ 5 230 MHz (802.11n\_HT40/ac\_VHT40)  
UNII-1: 5 210 MHz (802.11ac\_VHT80)  
UNII-2A: 5 260 MHz ~ 5 320 MHz (802.11a/n\_HT20/ac\_VHT20)  
UNII-2A: 5 270 MHz ~ 5 310 MHz (802.11n\_HT40/ac\_VHT40)  
UNII-2A: 5 290 MHz (802.11ac\_VHT80)  
UNII-2C: 5 500 MHz ~ 5 720 MHz (802.11a/n\_HT20/ac\_VHT20)  
UNII-2C: 5 510 MHz ~ 5 710 MHz (802.11n\_HT40/ac\_VHT40)  
UNII-2C: 5 530 MHz ~ 5 690 MHz (802.11ac\_VHT80)  
UNII-3: 5 745 MHz ~ 5 825 MHz (802.11a/n\_HT20/ac\_VHT20)  
UNII-3: 5 755 MHz ~ 5 795 MHz (802.11n\_HT40/ac\_VHT40)  
UNII-3: 5 775 MHz (802.11ac\_VHT80)  
Modulation technique : Bluetooth(BDR/EDR)\_GFSK,  $\pi/4$ DQPSK, 8DPSK  
WIFI(802.11a/b/g/n20/n40/ac20/ac40/ac80)\_DSSS, OFDM  
Number of channels : Bluetooth(BDR/EDR)\_79ch  
2.4GHz WIFI (802.11b/g/n\_HT20)\_11ch  
UNII-1: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)  
UNII-2A: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)  
UNII-2C: 9 ch (20 MHz), 5 ch (40 MHz), 2 ch (80 MHz)  
UNII-3: 5 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)  
Power source : DC 14.4 V

Antenna specification : WIFI/Bluetooth(BDR/EDR)\_Pattern Antenna  
 Antenna gain : 2.4GHz WIFI (802.11b/g/n\_HT20) : -0.70 dBi  
 Bluetooth(BDR/EDR) : 0.29 dBi  
 UNII-1 :3.51 dBi, UNII-2A : 3.12 dBi  
 UNII-2C : 2.28 dBi, UNII-3 : -0.84 dBi  
 Software version : MQ4.USA.0000.V028.001.190821  
 Hardware version : MQ4.USA.STD\_AVN\_G5\_WIDE.004.001  
 Test device serial No. : N/A  
 Operation temperature : -20 °C ~ 70 °C

**2.1. Information about derivative model**

The difference between basic model and derivative models is:

The derivative models have a different product identification number.

ATC31HCAN (96560 P4710), ATC34HCAN (96560 P4910)

**2.2. Frequency/channel operations**

This device contains the following capabilities:

WIFI(2.4 GHz band 802.11b/g/n(HT20), 5 GHz band 802.11a/n(HT20/HT40)/ac(VHT/20/40/80)),  
 Bluetooth(BDR/EDR)

Ch.	Frequency (MHz)
00	2 402
.	.
39	2 441
.	.
78	2 480

Table 2.2.1. Bluetooth(BDR/EDR) mode

Ch.	Frequency (MHz)
01	2 412
.	.
06	2 437
.	.
11	2 462

Table 2.2.2. 802.11b/g/n HT20 mode

**UNII-1**

Ch.	Frequency (MHz)
36	5 180
40	5 200
48	5 240

**UNII-2A**

Ch.	Frequency (MHz)
52	5 260
56	5 280
64	5 320

**UNII-2C**

Ch.	Frequency (MHz)
100	5 500
116	5 580
144	5 720

**UNII-3**

Ch.	Frequency (MHz)
149	5 745
157	5 785
165	5 825

Table 2.2.3. 802.11a/n/ac\_HT20/VHT20 mode

**UNII-1**

Ch.	Frequency (MHz)
38	5 190
46	5 230

**UNII-2A**

Ch.	Frequency (MHz)
54	5 270
62	5 310

**UNII-2C**

Ch.	Frequency (MHz)
102	5 510
110	5 550
142	5 710

**UNII-3**

Ch.	Frequency (MHz)
151	5 755
159	5 795

Table 2.2.4. 802.11n/ac\_HT40/VHT40 mode

**UNII-1**

Ch.	Frequency (MHz)
42	5 210

**UNII-2A**

Ch.	Frequency (MHz)
58	5 290

**UNII-2C**

Ch.	Frequency (MHz)
106	5 530
138	5 690

**UNII-3**

Ch.	Frequency (MHz)
155	5 775

Table 2.2.5. 802.11ac\_VHT80 mode

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### 3. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of  $k=2$  to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty ( $\pm$ )
Conducted RF power	1.76 dB



## 4. RF Exposure

### Regulation

This document is prepared to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC rules and Regulations.

The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310, is listed in Table 1-1. According to FCC §1.1310: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b).

Table 1 – Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength [V/m]	Magnetic Field Strength [A/m]	Power Density [mW/cm <sup>2</sup> ]	Averaging Time [minute]
(A) Limits for Occupational / Controlled Exposure				
0.3 ~ 3.0	614	1.63	*100	6
3.0 ~ 30	1842/f	4.89/f	*900/f <sup>2</sup>	6
30 ~ 300	61.4	0.163	1.0	6
300 ~ 1 500	/	/	f/300	6
1 500 ~ 15 000	/	/	5	6
(B) Limits for General Population / Uncontrolled Exposure				
0.3 ~ 1.34	614	1.63	*100	30
1.34 ~ 30	824/f	2.19/f	*180/f <sup>2</sup>	30
30 ~ 300	27.5	0.073	0.2	30
300 ~ 1 500	/	/	f/1 500	30
1 500 ~ 15 000	/	/	1.0	30

*f*=frequency in MHz, \* = plane-wave equivalent power density

Per the guidance of KDB 680106, the E-field and H-field limits shown in the table above are extended down to 100 kHz



## 4.1. Test results

### MPE (Maximum Permissible Exposure) Prediction

Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2 \quad (\Rightarrow R = \sqrt{PG/4\pi S})$$

S = power density [mW/cm<sup>2</sup>]

P = Power input to antenna [mW]

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 [cm]

### Calculation Result of RF exposure

Maximum tune-up tolerance

#### - 2.4GHz

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm <sup>2</sup> ]	Limit [mW/cm <sup>2</sup> ]
GFSK	2 441	3.50	2.24	0.29	1.07	0.000 48	1.000 00
802.11g	2 412	9.50	8.91	-0.70	0.85	0.001 51	1.000 00

#### - UNII-1

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm <sup>2</sup> ]	Limit [mW/cm <sup>2</sup> ]
802.11a	5 180	10.00	10.00	3.51	2.24	0.004 46	1.000 00
802.11an(HT20)	5 240	10.00	10.00	3.51	2.24	0.004 46	1.000 00
802.11an(HT40)	5 230	6.00	3.98	3.51	2.24	0.001 78	1.000 00
802.11ac(VHT20)	5 240	10.00	10.00	3.51	2.24	0.004 46	1.000 00
802.11ac(VHT40)	5 190	6.00	3.98	3.51	2.24	0.001 78	1.000 00
802.11ac(VHT80)	5 210	7.00	5.01	3.51	2.24	0.002 24	1.000 00

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**- UNII-2A**

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm <sup>2</sup> ]	Limit [mW/cm <sup>2</sup> ]
802.11a	5 320	11.00	12.59	3.12	2.05	0.005 14	1.000 00
802.11an(HT20)	5 320	11.00	12.59	3.12	2.05	0.005 14	1.000 00
802.11an(HT40)	5 310	11.00	12.59	3.12	2.05	0.005 14	1.000 00
802.11ac(VHT20)	5 280	11.00	12.59	3.12	2.05	0.005 14	1.000 00
802.11ac(VHT40)	5 270	11.00	12.59	3.12	2.05	0.005 14	1.000 00
802.11ac(VHT80)	5 290	11.00	12.59	3.12	2.05	0.005 14	1.000 00

**- UNII-2C**

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm <sup>2</sup> ]	Limit [mW/cm <sup>2</sup> ]
802.11a	5 580	11.00	12.59	2.28	1.69	0.004 23	1.000 00
802.11an(HT20)	5 580	11.00	12.59	2.28	1.69	0.004 23	1.000 00
802.11an(HT40)	5 510	11.00	12.59	2.28	1.69	0.004 23	1.000 00
802.11ac(VHT20)	5 580	11.00	12.59	2.28	1.69	0.004 23	1.000 00
802.11ac(VHT40)	5 550	11.00	12.59	2.28	1.69	0.004 23	1.000 00
802.11ac(VHT80)	5 690	11.00	12.59	2.28	1.69	0.004 23	1.000 00

**- UNII-3**

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm <sup>2</sup> ]	Limit [mW/cm <sup>2</sup> ]
802.11a	5 785	11.00	12.59	-0.84	0.82	0.002 06	1.000 00
802.11an(HT20)	5 785	11.00	12.59	-0.84	0.82	0.002 06	1.000 00
802.11an(HT40)	5 795	11.00	12.59	-0.84	0.82	0.002 06	1.000 00
802.11ac(VHT20)	5 785	11.00	12.59	-0.84	0.82	0.002 06	1.000 00
802.11ac(VHT40)	5 755	11.00	12.59	-0.84	0.82	0.002 06	1.000 00
802.11ac(VHT80)	5 775	11.00	12.59	-0.84	0.82	0.002 06	1.000 00

**- Simultaneous Transmission**

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm <sup>2</sup> ]	Limit [mW/cm <sup>2</sup> ]
802.11g (2 412 MHz) + 802.11a / UNII-1 (5 320 MHz) + BT,GFSK (2 441 MHz)						0.007 13	1.000 00

**Note.**

- The power density  $P_d$  (5th column) at a distance of 20 cm calculated from the friis transmission Formula is far below the limit of 1 mW/cm<sup>2</sup>.
- Simultaneous transmission of RF Exposure test exclusion for worst case configuration.

2.4G WIFI: the ratio is 0.001 51 / 1

Bluetooth: the ratio is 0.000 48 / 1

5G WIFI: the ratio is 0.005 14 / 1

2.4G WIFI + Bluetooth + 5G WIFI Power density: (0.001 51 / 1 + 0.000 48 / 1 + 0.005 14 / 1)

**- CDMA**

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm <sup>2</sup> ]	Limit [mW/cm <sup>2</sup> ]
BC0	824.70	25.70	371.54	4.50	2.82	0.208 441	0.549 800
BC1	1 851.25	25.70	371.54	2.00	1.58	0.117 147	1.000 000

**- LTE**

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm <sup>2</sup> ]	Limit [mW/cm <sup>2</sup> ]
Band 2	1 850.70	25.70	371.54	2.00	1.58	0.117 147	1.000 000
Band 4	1 710.70	25.70	371.54	2.00	1.58	0.117 147	1.000 000
Band 5	824.70	25.70	371.54	4.50	2.82	0.208 441	0.549 800
Band 13	779.50	25.70	371.54	4.50	2.82	0.208 441	0.549 800

**- Simultaneous Transmission**

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Max Tune-up Power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power density at 20 cm [mW/cm <sup>2</sup> ]	Limit [mW/cm <sup>2</sup> ]
802.11g (2 412 MHz) + 802.11a / UNII-1 (5 320 MHz) + BT,GFSK (2 441 MHz) + LTE Band 5 (824.70 MHz)						0.386 114	1.000 000
802.11g (2 412 MHz) + 802.11a / UNII-1 (5 320 MHz) + BT,GFSK (2 441 MHz) + CDMA BC0 (824.70 MHz)						0.386 114	1.000 000

**Note.**

1. The power density  $P_d$  (5th column) at a distance of 20 cm calculated from the friis transmission Formula is far below the limit of 1 mW/cm<sup>2</sup>.
2. Simultaneous transmission of RF Exposure test exclusion for worst case configuration.

2.4G WIFI: the ratio is 0.001 51 / 1

Bluetooth: the ratio is 0.000 48 / 1

5G WIFI: the ratio is 0.005 14 / 1

CDMA BC0: the ratio is 0.208 441 / 0.55

LTE Band5: the ratio is 0.208 441 / 0.55

2.4G WIFI + Bluetooth + 5G WIFI + LTE Power density:

(0.001 51 / 1 + 0.000 48 / 1 + 0.005 14 / 1 + 0.208 441 / 0.55)

2.4G WIFI + Bluetooth + 5G WIFI + CDMA Power density:

(0.001 51 / 1 + 0.000 48 / 1 + 0.005 14 / 1 + 0.208 441 / 0.55)

## 5. Measurement Equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV40	100898	20.01.14
Wideband Power Sensor	R&S	NRP-Z81	102398	20.01.25
Attenuator	Weinschel ENGINEERING	21-10	0005	20.01.25
Attenuator	API Inmet	40AH2W-10	17	20.05.15

**End of test report**

