

TEST REPORT

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 443-390, Korea
TEL: 82 70 5008 1021
FAX: 82 505 299 8311

Report No.: KCTL15-FR0051

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KCTL
<http://www.kctl.co.kr>

1. Applicant

Name: Hyundai Mobis Co., Ltd.
Address: 203, Teheran-ro, Gangnam-gu, Seoul, 135-977, Korea

2. Sample Description:

FCC ID: TQ8-ATBB0G2AN
Type of equipment: DIGITAL CAR AUDIO SYSTEM
Basic Model: ATBB0G2AN

3. Date of Test: September 16 ~ October 02, 2015

4. Test method used: FCC Part 22 Subpart H and Part 24 Subpart E

5. Test Results

Test Item: Refer to page 9
Result: Refer to page 10 ~ page 14
Measurement Uncertainty: Refer to page 9

This result shown in this report refer only to the sample(s) tested unless otherwise stated.

Affirmation	Tested by 	Technical Manager 
	Name: KIM, TAE YOUNG	Name: SON, MIN GI

2015. 10. 08

KCTL Inc. Testing Laboratory

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1. Client information

Applicant: Hyundai Mobis Co., Ltd.
Address: 203, Teheran-ro, Gangnam-gu, Seoul, 135-977, Korea
Telephone number: +82-31-260-2707
Facsimile number: +82-31-899-1788
Contact person: Seung-Hoon Choe / csh@mobis.co.kr

Manufacturer: Hyundai Mobis Co., Ltd.
Address: 69-23, Hansam-Ro, Ducksan-Myeon, Jinchun-Gun,
Chungcheongbuk-Do 365-843 Korea

2. Laboratory information

Address

KCTL Inc.

65 Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea

Telephone Number: 82-70-5008-1016 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: 231

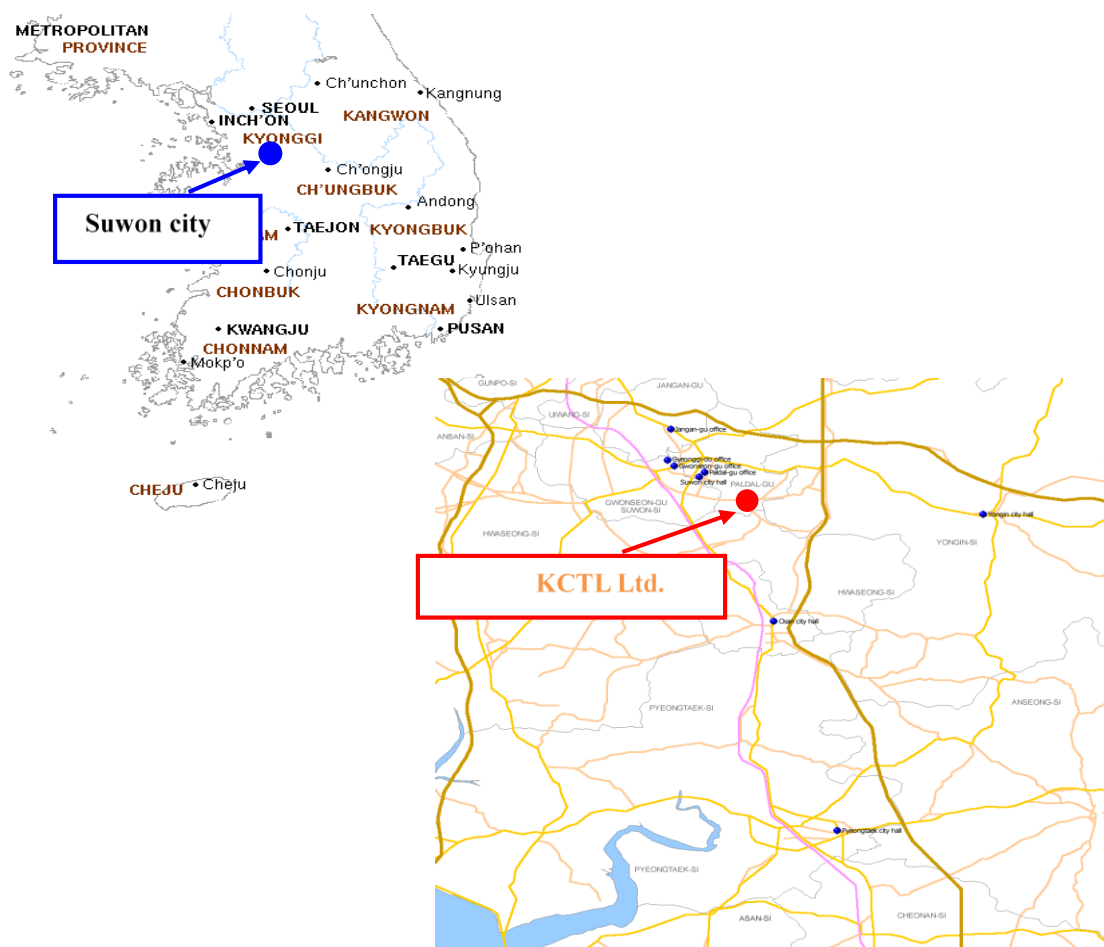
FCC Site Designation No: KR0040

FCC Site Registration No: 687132

VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849

IC Site Registration No.:8035A-2

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant	Hyundai Mobis Co., Ltd.
Address of Applicant	203, Teheran-ro, Gangnam-gu, Seoul, 135-977, Korea
Manufacturer	Hyundai Mobis Co., Ltd.
Address of Manufacturer	69-23, Hansam-Ro, Ducksan-Myeon, Jinchun-Gun, Chungcheongbuk-Do 365-843 Korea
Type of equipment	DIGITAL CAR AUDIO SYSTEM
Basic Model	ATBB0G2AN
Serial number	N/A

3.2 General description

Frequency Range	2 402 MHz ~ 2 480 MHz (Bluetooth) 2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20) 5 180 MHz ~ 5 240 MHz (802.11a/n/ac_HT20/VHT20) 5 190 MHz ~ 5 230 MHz (802.11n/ac_HT40/VHT40) 5 210 MHz (802.11ac_VHT80) 5 260 MHz ~ 5 320 MHz (802.11a/n/ac_HT20/VHT20) 5 270 MHz ~ 5 310 MHz (802.11n/ac_HT40/VHT40) 5 290 MHz (802.11ac_VHT80) 5 500 MHz ~ 5 700 MHz (802.11a/n/ac_HT20/VHT20) 5 510 MHz ~ 5 670 MHz (802.11n/ac_HT40/VHT40) 5 530 MHz (802.11ac_VHT80) 5 745 MHz ~ 5 825 MHz (802.11a/n/ac_HT20/VHT20) 5 755 MHz ~ 5 795 MHz (802.11n/ac_HT40/VHT40) 5 775 MHz (802.11ac_VHT80) 824.70 MHz ~ 848.31 MHz (CDMA800) 1 851.25 MHz ~ 1 908.75 MHz (CDMA1 900) 779.5 MHz ~ 784.5 MHz (LTE Band 13) 1 710.7 MHz ~ 1 754.3 MHz (LTE Band 4)
Type of Modulation	GFSK, $\pi/4$ DQPSK, 8DPSK : Bluetooth, DSSS, OFDM : WIFI 2.4 G, OFDM : WIFI 5 G 1xRTT (CDMA800, CDMA1 900) QPSK, 16QAM (LTE Band 13, LTE Band 4)
Number of Channels	2.0 GHz: 79 ch (Bluetooth) 11 ch (802.11b/g/n_HT20) 5.0 GHz: 5 150 MHz Band: 4 ch (802.11a/n/ac_HT20/VHT20) 2 ch (802.11n/ac_HT40/VHT40) 1 ch (802.11ac_VHT80) 5 250 MHz Band: 4 ch (802.11a/n/ac_HT20/VHT20) 2 ch (802.11n/ac_HT40/VHT40) 1 ch (802.11ac_VHT80) 5 470 MHz Band: 11 ch (11a/n/ac_HT20/VHT20) 5 ch (802.11n/ac_HT40/VHT40) 1 ch (802.11ac_VHT80) 5 725 MHz Band: 4 ch (802.11a/n/ac_HT20/VHT20) 2 ch (802.11n/ac_HT40/VHT40) 1 ch (802.11ac_VHT80)
Type of Antenna	Chip Antenna
Antenna Gain	2 GHz: 2.29 dBi (Bluetooth), 4.11 dBi (WiFi) 5 GHz: 5 150 MHz Band: 2.89 dBi, 5 250 MHz Band: 2.89 dBi 5 470 MHz Band: 2.51 dBi, 5 725 MHz Band: 5.78 dBi 6.0 dBi (CDMA800) 6.0 dBi (CDMA1 900) 6.0 dBi (LTE Band 13) 6.0 dBi (LTE Band 4)

Transmit Power	23.78 dBm
Power supply	DC 14.4 V
H/W Version	1.0
S/W Version	1.0
Test S/W version	Refer to the test report #3562408EMC02 and 3843586EMC02 (Model Name: CASAN, FCC ID: LHJ-CASAN)
RF Power setting	Refer to the test report #3562408EMC02 and 3843586EMC02 (Model Name: CASAN, FCC ID: LHJ-CASAN)

Note : The above EUT information was declared by the manufacturer.

3.3 Test frequency Test mode

The transmitter has a maximum average output power as follows:

* 1xRTT

-Cellular Band-

Frequency (MHz)	Service Option (SO)	Channel
824.70	RC1 55 (Loopback)	1 013
836.52		384
848.31		777

-PCS Band-

Frequency (MHz)	Service Option (SO)	Channel
1 851.25	RC1 55 (Loopback)	25
1 880.00		600
1 908.75		1 175

CDMA (800 / 1 900)

We found out the test mode with the highest power level after we investigated average output power of all the modulations and (or) data rates for each mode. So we chose below test mode as a representative of worst case.

- CDMA (800) 1xRTT : RC1 / 55 (Loopback)
- CDMA (1 900) 1xRTT : RC1 / 55 (Loopback)

3.4 Test Voltage

Mode	Voltage
Norminal voltage	DC 14.4 V

4. Summary of test results

4.1 Standards & results

FCC Part 22 Subpart H and Part 24 Subpart E			
FCC Rule Reference	Parameter	Report Section	Test Result
§2.1046, §22.913(a) §24.232(c)	RF Radiated Output Power	5.1	C
§2.1053, §22.917(a) §24.238(a)	Spurious Radiated Emission	5.2	C
§2.1046	Conducted Output Power	5.3	N/A ₁₎
§2.1049	26 dB Bandwidth	5.4	N/A ₁₎
§24.232(d)	Peak-Average Ratio	5.5	N/A ₁₎
§2.1051, §22.917(a) §24.238(a)	Spurious Emission at Antenna Terminal	5.6	N/A ₁₎
§2.1055, §22.355 §24.235	Frequency Stability	5.7	N/A ₁₎
§22.917(a), §24.238(a)	Band Edge	5.8	N/A ₁₎
§15.207(a)	Conducted Emission	-	N/A ₂₎
Note: C = complies NC = Not complies NT = Not tested NA = Not Applicable N/A₁₎ : Refer to the RF test report # 3562408EMC02 & 3843586EMC02 (FCC ID : LHJ-CASAN / Continental Automotive Systems, Inc.) N/A₂₎ : The test is not applicable since the EUT is not the device that is designed to be connected to the public utility(AC) power line(This EUT is automotive device)			

4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = KU_c (K = 2)$	
Conducted RF power	± 1.30 dB	
Conducted Spurious Emissions	± 1.52 dB	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+ 4.94 dB, - 5.06 dB
		+ 4.93 dB, - 5.05 dB
	300 MHz ~ 1 000 MHz:	+ 4.97 dB, - 5.08 dB
		+ 4.84 dB, - 4.96 dB
	1 GHz ~ 25 GHz:	+ 6.03 dB, - 6.05 dB
Conducted Emissions	9 kHz ~ 150 kHz:	± 3.75 dB
	150 kHz ~ 30 MHz:	± 3.36 dB

5. Test results

5.1 RF Radiated Output Power

5.1.1 Measurement Procedure

1. On a test site, the EUT shall be placed at 80cm height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. During the measurement of the EUT, the resolution bandwidth was to 3 MHz and the video bandwidth was set to 3 MHz.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
7. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. The EUT was replaced by half-wave dipole (824 ~ 849 MHz) or horn antenna (1 850 ~ 1 910 MHz) connected to a signal generator.
11. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
12. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
13. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
14. The input level to the substitution antenna shall be recorded as power level in dB m, corrected for any change of input attenuator setting of the measuring receiver.
15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

5.1.2 Limit

FCC §22.913(a), The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.FCC §24.232(c) Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

5.1.3 Test Result

CDMA 800 1xRTT mode

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
824.70	H	15.30	33.88	7 000
824.70	V	14.80	30.20	7 000
836.52	H	15.30	33.88	7 000
836.52	V	15.00	31.62	7 000
848.31	H	15.50	35.48	7 000
848.31	V	15.20	33.11	7 000

CDMA 1 900 1xRTT mode

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
1 851.25	H	18.60	72.44	2 000
1 851.25	V	20.50	112.20	2 000
1 880.00	H	22.10	162.18	2 000
1 880.00	V	21.50	141.25	2 000
1 908.75	H	21.00	125.89	2 000
1 908.75	V	24.10	257.04	2 000

5.2 Spurious radiated emission

5.2.1 Measurement Procedure

1. On a test site, the EUT shall be placed at 80 cm height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. During the measurement of the EUT, the resolution bandwidth was to 3 MHz and the video bandwidth was set to 3 MHz.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
7. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. The EUT was replaced by half-wave dipole (824 ~ 849 MHz) or horn antenna (1 850 ~ 1 910 MHz) connected to a signal generator.
11. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
12. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
13. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
14. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

5.2.2 Limit

§ 22.917(a) and §24.238 (a) Out of band emissions. The power of any emission outside of the Authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least $43+10\log(P)$ dB.

5.2.3 Test Result

CDMA 800 BC0 1xRTT mode

Low Channel (824.70 MHz)

Limit = $43+10\log(P)$ dB = 28.3 dBc

(P = 15.3 dBm = 0.034 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
64.80	V	15.3	-49.7	65.0	-13.0	36.7
1648.13	H	15.3	-43.6	58.9	-13.0	30.6
2472.63	V	15.3	-49.6	64.9	-13.0	36.6

Middle Channel (836.52 MHz)

Limit = $43+10\log(P)$ dB = 28.3 dBc

(P = 15.3 dBm = 0.034 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
147.73	V	15.3	-50.6	65.9	-13.0	37.6
1671.50	H	15.3	-38.5	53.8	-13.0	25.5
2508.75	V	15.3	-51.9	67.2	-13.0	38.9

High Channel (848.31 MHz)

Limit = $43+10\log(P)$ dB = 28.5 dBc

(P = 15.5 dBm = 0.035 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
193.32	V	15.5	-50.1	65.6	-13.0	37.1
1697.00	H	15.5	-53.2	68.7	-13.0	40.2

*Result = Operation Frequency Power level – Spurious level

*Margin=Limit – Spurious Level

CDMA 1 900 BC1 1xRTT mode

Low Channel (1 851.25 MHz)

Limit = $43+10\log(P)$ dB = 33.5 dBc

(P = 20.5 dBm = 0.112 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
1930.75	V	20.50	-18.0	38.5	-13.0	5.0
3701.25	H	20.50	-20.0	40.5	-13.0	7.0
5553.75	H	20.50	-39.0	59.5	-13.0	26.0
7406.25	V	20.50	-36.0	56.5	-13.0	23.0
9256.87	V	20.50	-40.0	60.5	-13.0	27.0

Middle Channel (1 880.00 MHz)

Limit = $43+10\log(P)$ dB = 35.1 dBc

(P = 22.1 dBm = 0.162 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
1960.25	V	22.10	-18.1	40.2	-13.0	5.1
3759.38	H	22.10	-18.2	40.3	-13.0	5.2
5640.00	V	22.10	-39.2	61.3	-13.0	26.2
7520.63	V	22.10	-36.7	58.8	-13.0	23.7
9401.25	H	22.10	-41.2	63.3	-13.0	28.2

High Channel (1 908.75 MHz)

Limit = $43+10\log(P)$ dB = 37.1 dBc

(P = 24.1 dBm = 0.257 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
1988.50	V	24.10	-17.8	41.9	-13.0	4.8
3815.63	V	24.10	-18.6	42.7	-13.0	5.6
5726.25	V	24.10	-41.0	65.1	-13.0	28.0
7635.00	V	24.10	-37.9	62.0	-13.0	24.9
9543.75	V	24.10	-38.0	62.1	-13.0	25.0

*Result = Operation Frequency Power level – Spurious level

*Margin=Limit – Spurious Level

6. Test equipment used for test

	Description	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	Spectrum Analyzer	R&S	FSV40	100988	16.01.26
■	Wideband Power Sensor	R&S	NRP-Z81	102398	15.11.27
■	DC Power Supply	AGILENT	E3632A	MY40004399	16.01.06
■	Loop Antenna	R&S	HFH2-Z2	861971/003	17.03.03
■	Bi-Log Antenna	SCHWARZBECK	VULB9163	552	16.06.14
■	Horn Antenna	SCHWARZBECK	3117	155787	16.02.05
■	Horn Antenna	ETS.lindgren	3116	86632	15.10.20
■	Amplifier	SONOMA INSTRUMENT	310	293004	15.09.25
■	Emi Test Receiver	R&S	ESCI	101078	16.02.16
■	Broadband Preamplifier	SCHWARZBECK	BBV9721	2	16.05.09
■	Preamplifier	AGILENT	8449B	3008A02343	16.09.02
■	Attenuator	HP	8494A	2631A09825	15.10.14
■	Attenuator	HP	8496A	3308A16640	15.10.14
■	Antenna Mast	Innco Systems	MA4000-EP	-	-
■	Turn Table	Innco Systems	DT2000	-	-
■	Highpass Filter	Wainwright Instruments GmbH	WHKX3.0 /18G-12SS	44	16.02.02
■	Bluetooth Tester	TESCOM	TC-3000A	3000A310047	16.04.06
■	SPIRAL ANTENNA	COBHAM	PSA-75301R/170	406827-0001	-
■	WIDEBANDRADIO COMMUNICATION TESTER	R & S	CMW500	102572	16.10.01
■	Highpass Filter	Wainwright Instruments GmbH	WHKX1.0 /1.5S-10SS	14	16.02.02