

TEST REPORT

of

FCC CFR 47 part 1, 1.1307(b), 1.1310

FCC ID: TQ8-TS390DHAN

Equipment Under Test : Premium Gen 2.0 I-BOX
Model Name : TS390DHAN
Applicant : Hyundai MOBIS Co., Ltd.
Manufacturer : Hyundai MOBIS Co., Ltd.
Date of Test(s) : 2014.10.14 ~ 2014.10.24
Date of Issue : 2014.11.20

In the configuration tested, the EUT complied with the standards specified above.

Tested By:


Jungmin Yang

Date:

2014.11.20

Approved By:


Hyunchoe You

Date:

2014.11.20

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

-Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 435-837

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Telephone : + 82 31 688 0901

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1.2. Details of applicant

Applicant : Hyundai MOBIS Co., Ltd.

Address : 203, Teheran-ro, Gangnam-gu, Seoul, 135-977, Korea

Contact Person : Choi, Seung-Hoon

Phone No. : + 82 31 260 0098

1.3. Description of EUT

Kind of Product	Premium Gen 2.0 I-BOX
Model Name	TS390DHAN
Power Supply	DC 14.4 V (Vehicle Battery)
Frequency Range	CDMA 850: 824.70 MHz ~ 848.31 MHz CDMA 1 900: 1 851.25 MHz ~ 1 908.75 MHz LTE Band 4 (5 MHz): 1 712.5 MHz ~ 1 752.5 MHz LTE Band 4 (10 MHz): 1 715.0 MHz ~ 1 750.0 MHz LTE Band 4 (15 MHz): 1 717.5 MHz ~ 1 747.5 MHz LTE Band 4 (20 MHz): 1 720.0 MHz ~ 1 745.0 MHz LTE Band 13 (5 MHz): 779.5 MHz ~ 784.5 MHz LTE Band 13 (10 MHz): 782 MHz WLAN (11b/g/n_HT20) : 2 412 MHz ~ 2 462 MHz
Antenna Gain	824.70 MHz ~ 848.31 MHz : 4.75 dB i 1 851.25 MHz ~ 1 908.75 MHz : 5.73 dB i 1 712.5 MHz ~ 1 752.5 MHz : 2.19 dB i 779.5 MHz ~ 784.5 MHz : 2.39 dB i 2 412 MHz ~ 2 462 MHz : 2.69 dB i

1.4. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL008179	2014.11.20	Initial

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2. RF Exposure Evaluation

2.1. Environmental evaluation and exposure limit according to FCC CFR 47 part 1, 1.1307(b), 1.1310

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time
(A) Limits for Occupational /Control Exposures				
300 – 1 500	--	--	F/300	6
1 500 – 100 000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
<u>300 – 1 500</u>	--	--	<u>F/1500</u>	<u>30</u>
<u>1 500 – 100 000</u>	--	--	<u>1</u>	<u>30</u>

2.1.1. Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

2.1.2. Test Result of RF Exposure Evaluation

Test Item : RF Exposure Evaluation Data

Test Mode : Normal Operation

2.1.3. Output Power into Antenna & RF Exposure Evaluation Distance

Mode: CDMA850 1xRTT

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	824.70	24.52	4.75	100	0.168 163	0.549 80
Middle	836.52	24.51	4.75	100	0.167 776	0.557 68
High	848.31	24.63	4.75	100	0.172 477	0.565 54

Mode: CDMA850 1xEV-DO

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	824.70	24.51	4.75	100	0.167 776	0.549 80
Middle	836.52	24.52	4.75	100	0.168 163	0.557 68
High	848.31	24.32	4.75	100	0.160 594	0.565 54

Mode: Maximum tune up tolerance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
-	824.70	25.50	4.75	100	0.210 732	0.549 80

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Mode: CDMA1 900 1xRTT

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	1 851.25	24.75	5.73	100	0.222 193	1
Middle	1 880.00	24.64	5.73	100	0.216 636	1
High	1 908.75	24.46	5.73	100	0.207 840	1

Mode: CDMA1900 1xEV-DO

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	1 851.25	24.80	5.73	100	0.224 766	1
Middle	1 880.00	24.68	5.73	100	0.218 640	1
High	1 908.75	24.46	5.73	100	0.207 840	1

Mode: Maximum tune up tolerance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
-	1 851.25	25.50	5.73	100	0.264 077	1

Note :

1. The power density Pd (5th column) at a distance of 20 cm calculated from the friis transmission formula is far below the limit .

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Mode: LTE Band 4 (5 MHz - QPSK)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	1 712.5	23.85	2.19	100	0.079 934	1
Middle	1 732.5	23.88	2.19	100	0.080 488	1
High	1 752.5	23.56	2.19	100	0.074 770	1

Mode: LTE Band 4 (5 MHz - 16QAM)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	1 712.5	23.02	2.19	100	0.066 028	1
Middle	1 732.5	23.19	2.19	100	0.068 664	1
High	1 752.5	22.19	2.19	100	0.054 542	1

Mode: LTE Band 4 (10 MHz - QPSK)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	1 715.0	23.70	2.19	100	0.077 220	1
Middle	1 732.5	24.14	2.19	100	0.085 454	1
High	1 750.0	24.13	2.19	100	0.085 257	1

Mode: LTE Band 4 (10 MHz - 16QAM)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	1 715.0	22.28	2.19	100	0.055 684	1
Middle	1 732.5	23.28	2.19	100	0.070 102	1
High	1 750.0	22.79	2.19	100	0.062 622	1

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Mode: LTE Band 4 (15 MHz - QPSK)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	1 717.5	23.86	2.19	100	0.080 118	1
Middle	1 732.5	24.12	2.19	100	0.085 061	1
High	1 747.5	24.05	2.19	100	0.083 701	1

Mode: LTE Band 4 (15 MHz - 16QAM)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	1 717.5	23.15	2.19	100	0.068 035	1
Middle	1 732.5	23.16	2.19	100	0.068 191	1
High	1 747.5	22.65	2.19	100	0.060 636	1

Mode: LTE Band 4 (20 MHz - QPSK)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	1 720.0	23.73	2.19	100	0.077 755	1
Middle	1 732.5	24.11	2.19	100	0.084 865	1
High	1 745.0	24.29	2.19	100	0.088 457	1

Mode: LTE Band 4 (20 MHz - 16QAM)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	1 720.0	22.90	2.19	100	0.064 229	1
Middle	1 732.5	23.21	2.19	100	0.068 981	1
High	1 745.0	23.39	2.19	100	0.071 900	1

Mode: Maximum tune up tolerance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
-	1 745.0	25.70	2.19	100	0.122 386	1

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Mode: LTE Band 13 (5 MHz - QPSK)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	779.5	24.01	2.39	100	0.086 842	0.519 67
High	784.5	24.29	2.39	100	0.092 625	0.523 00

Mode: LTE Band 13 (5 MHz - 16QAM)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Low	779.5	22.67	2.39	100	0.063 787	0.519 67
High	784.5	23.37	2.39	100	0.074 943	0.523 00

Mode: LTE Band 13 (10 MHz - QPSK)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Middle	782.0	24.19	2.39	100	0.090 517	0.521 33

Mode: LTE Band 13 (10 MHz - 16QAM)

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
Middle	782.0	23.34	2.39	100	0.074 427	0.521 33

Mode: Maximum tune up tolerance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	LIMITS (mW/cm ²)
-	779.5	25.70	2.39	100	0.128 153	0.519 67

Note :

1. The power density Pd (5th column) at a distance of 20 cm calculated from the friis transmission formula is far below the limit .

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WLAN

Mode: 11b

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
Low	2 412	14.26	2.69	100	0.009 857	1
Middle	2 437	14.86	2.69	100	0.011 317	1
High	2 462	14.85	2.69	100	0.011 291	1

Mode: Maximum tune up tolerance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
-	2 437	18.00	2.69	100	0.023 320	1

Mode: 11g

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
Low	2 412	10.29	2.69	98	0.003 872	1
Middle	2 437	10.41	2.69	98	0.003 981	1
High	2 462	10.70	2.69	98	0.004 256	1

Mode: Maximum tune up tolerance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
-	2 462	14.00	2.69	98	0.009 098	1

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Mode: 11n_HT20

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
Low	2 412	10.13	2.69	98	0.003 732	1
Middle	2 437	10.37	2.69	98	0.003 944	1
High	2 462	10.56	2.69	98	0.004 121	1

Mode: Maximum tune up tolerance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Duty Cycle (%)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
-	2 462	14.00	2.69	98	0.009 098	1

Note :

1. The power density Pd (5th column) at a distance of 20 cm calculated from the friis transmission formula is far below the limit of 1 mW/cm².

Simultaneous transmission MPE test exclusion

CDMA850: the ratio is 0.210 732 / 0.549 80

LTE band4: the ratio is 0.128 153 / 0.519 67

WLAN 802.11b: the ratio is 0.023 320 / 1

Confirm the sum result of individual MPEs ratio is ≤ 1.0 ;

$$(0.210\ 732 / 0.549\ 80) + (0.128\ 153 / 0.519\ 67) + (0.023\ 320 / 1) = 0.653\ 213 \leq 1.0$$

So this device meets the KDB447498 D01 v05r02 section 7.2 requirement of "Simultaneous transmission MPE test exclusion".

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