



TEST REPORT

KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr		Report No.: KR19-SRF0143-A Page (1) of (13)	
1. Client ◦ Name : HOIMYUNG ICT Corporation ◦ Address : 1203, 8th Daeryungtechnotown, 96, Gamasan-ro, Geumcheon-gu, Seoul, Republic of Korea ◦ Date of Receipt : 2019-06-03			
2. Use of Report : -			
3. Name of Product and Model : Telematics mangement Terminal / DTM-02L			
4. Manufacturer and Country of Origin : HOIMYUNG ICT Corporation / Korea			
5. FCC ID : 2ARPKDTM-02L			
6. IC Certification : 24504-DTM02L			
7. Date of Test : 2019-06-25 to 2019-08-13			
8. Test Standards : 47 CFR Part 1.1310 RSS-102 Issue 5 Mar. 2015			
9. Test Results : Refer to the test result in the test report			
Affirmation	Tested by 		Technical Manager
	Name : Heesu Ahn (Signature)		Name : Jaehyong Lee (Signature)
2019-09-25			
KCTL Inc.			
As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.			

Report revision history

Date	Revision	Page No
2019-09-18	Initial report	-
2019-09-25	Updated measurement equipment	13

This report shall not be reproduced except in full, without the written approval of KCTL Inc. This document may be altered or revised by KCTL Inc. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by KCTL Inc. will constitute fraud and shall nullify the document. This test report is a General report that does not use the KOLAS accreditation mark and is not related to KOLAS accreditation.

KCTL

CONTENTS

1. General information4

2. Device information4

 2.1. Frequency/channel operations.....5

3. Measurement uncertainty7

4. RF Exposure.....8

 4.1. Test results.....11

5. Measurement Equipment.....13



1. General information

Client : HOIMYUNG ICT Corporation
Address : 1203, 8th Daeryungtechnotown, 96, Gamasan-ro, Geumcheon-gu, Seoul, Republic of Korea
Manufacturer : HOIMYUNG ICT Corporation
Address : 1203, 8th Daeryungtechnotown, 96, Gamasan-ro, Geumcheon-gu, Seoul, Republic of 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-3327, G-198, C-3706, T-1849
Industry Canada Registration No. : 8035A
KOLAS No.: KT231

2. Device information

Equipment under test : Telematics mangement Terminal
Model : DTM-02L
Frequency range : 2 402 MHz ~ 2 480 MHz (Bluetooth Low Energy)
699.7 MHz ~ 715.3 MHz (LTE Band 12)
824.7 MHz ~ 848.3 MHz (LTE Band 5)
1 710.7 MHz ~ 1 754.3 MHz (LTE Band 4)
1 850.7 MHz ~ 1 909.3 MHz (LTE Band 2)
2 502.5 MHz ~ 2 567.5 MHz (LTE Band 7)
826.4 MHz ~ 846.6 MHz (WCDMA Band V)
1 852.4 MHz ~ 1 907.6 MHz (WCDMA Band II)
Modulation technique : GFSK (Bluetooth Low Energy)
QPSK, 16-QAM (LTE, WCDMA)
Number of channels : Bluetooth(BLE)_40 ch
Power source : DC 12 V, DC 24 V
Antenna specification : Chip Antenna (Bluetooth Low Energy, LTE, WCDMA)
Antenna gain : 3.50 dBi (Bluetooth Low Energy)
1.97 dBi (LTE Band 12)
1.94 dBi (LTE Band 5, WCDMA Band V)
3.03 dBi (LTE Band 4)
2.98 dBi (LTE Band 2, WCDMA Band II)
1.46 dBi (LTE Band 7)
Software version : Ver1.0.1
Hardware version : LTGHTTMS_LTE_R1.0
Operation temperature : -30 °C ~ 70 °C

2.1. Frequency/channel operations

This device contains the following capabilities:

Bluetooth(BDR/EDR/BLE), LTE Band 12, LTE Band 5, LTE Band 4, LTE Band 2, LTE Band 7
WCDMA 850, WCDMA 1900

LTE Band 12

Ch.	Frequency (MHz)
23017	699.7
23095	707.5
23173	715.3

Table 2.1.1. 1.4M BW

Ch.	Frequency (MHz)
23025	700.5
23095	707.5
23165	714.5

Table 2.1.2. 3M BW

Ch.	Frequency (MHz)
23035	701.5
23095	707.5
23155	713.5

Table 2.1.3. 5M BW

Ch.	Frequency (MHz)
23060	704.0
23095	707.5
23130	711.0

Table 2.1.4. 10M BW

LTE Band 5

Ch.	Frequency (MHz)
20407	824.7
20525	836.5
20643	848.3

Table 2.1.5. 1.4M BW

Ch.	Frequency (MHz)
20415	825.5
20525	836.5
20635	847.5

Table 2.1.6. 3M BW

Ch.	Frequency (MHz)
20425	826.5
20525	836.5
20625	846.5

Table 2.1.7. 5M BW

Ch.	Frequency (MHz)
20450	829.0
20525	836.5
20600	844.0

Table 2.1.8. 10M BW

LTE Band 4

Ch.	Frequency (MHz)
19957	1 710.7
20175	1 732.5
20393	1 754.3

Table 2.1.9. 1.4M BW

Ch.	Frequency (MHz)
19965	1 711.5
20175	1 732.5
20385	1 753.5

Table 2.1.10. 3M BW

Ch.	Frequency (MHz)
19975	1 712.5
20175	1 732.5
20375	1 752.5

Table 2.1.11. 5M BW

Ch.	Frequency (MHz)
20000	1 715.0
20175	1 732.5
20350	1 750.0

Table 2.1.12. 10M BW

Ch.	Frequency (MHz)
20025	1 717.5
20175	1 732.5
20325	1 747.5

Table 2.1.13. 15M BW

Ch.	Frequency (MHz)
20050	1 720.0
20175	1 732.5
20300	1 745.0

Table 2.1.14. 20M BW

LTE Band 2

Ch.	Frequency (MHz)
18607	1 850.7
18900	1 880.0
19193	1 909.3

Table 2.1.15. 1.4M BW

Ch.	Frequency (MHz)
18615	1 851.5
18900	1 880.0
19185	1 908.5

Table 2.1.16. 3M BW

Ch.	Frequency (MHz)
18625	1 852.5
18900	1 880.0
19175	1 907.5

Table 2.1.17. 5M BW

Ch.	Frequency (MHz)
18650	1 855.0
18900	1 880.0
19150	1 905.0

Table 2.1.18. 10M BW

Ch.	Frequency (MHz)
18675	1 857.5
18900	1 880.0
19125	1 902.5

Table 2.1.19. 15M BW

Ch.	Frequency (MHz)
18700	1 860.0
18900	1 880.0
19100	1 900.0

Table 2.1.20. 20M BW

LTE Band 7

Ch.	Frequency (MHz)
20775	2 502.5
21100	2 535.0
21425	2 567.5

Table 2.1.21. 5M BW

Ch.	Frequency (MHz)
20800	2 505.0
21100	2 535.0
21400	2 565.0

Table 2.1.22. 10M BW

Ch.	Frequency (MHz)
20825	2 507.5
21100	2 535.0
21375	2 562.5

Table 2.1.23. 15M BW

Ch.	Frequency (MHz)
20850	2 510.0
21100	2 535.0
21350	2 560.0

Table 2.1.24. 20M BW

WCDMA 850**WCDMA 1900**

Ch.	Frequency (MHz)
4132	826.4
4182	836.4
4233	846.6

Table 2.1.25. RMC

Ch.	Frequency (MHz)
9262	1 852.4
9400	1 880.0
9538	1 907.6

Table 2.1.26. RMC

Ch.	Frequency (MHz)
00	2 402
.	.
19	2 440
.	.
39	2 480

Table 2.1.27. Bluetooth Low Energy

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_{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

KCTL

4. RF Exposure

FCC

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 ²]	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 ²	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 ²	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

IC

RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

According to RSS-102 Issue 5, Paragraph "4. Exposure Limits", Industry of Canada has adopted the RF field strength limits established in Health Canada's RF exposure guideline, Safety code 6:

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
<u>300-6000</u>	<u>3.142 $f^{0.3417}$</u>	<u>0.008335 $f^{0.3417}$</u>	<u>0.02619 $f^{0.6834}$</u>	<u>6</u>
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10 ⁻⁴ $f^{0.5}$	6.67 x 10 ⁻⁵ f	616000/ $f^{1.2}$
Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

Exemption Limits for Routine Evaluation – RF Exposure Evaluation

According to RSS-102 Issue 5 section 2.5.2, RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- Below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1W (adjusted for tune-up tolerance);
- At or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- At or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- At or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance.)

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

KCTL

4.1. Test results

FCC

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^2]

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]

IC

RF Exposure evaluation

At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834} \text{ W}$ (adjusted for tune-up tolerance), where f is in MHz;

RF Exposure Compliance Issue

The information should be included in the user's manual:

This appliance and its antenna must not be co-located or operation is conjunction with any other antenna or transmitter. A minimum separation distance of 20 cm must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

Calculation Result of RF exposure (FCC)

Maximum tune-up tolerance

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 ²]	Limit [mW/cm ²]
BLE / 1 Mbps	2 402	5.00	3.16	3.50	2.24	0.001 4	1.000 0
WCDMA 850	826.40	25.00	316.23	2.29	1.69	0.106 6	0.550 9
WCDMA 1900	1 852.40	25.00	316.23	1.59	1.44	0.090 7	1.000 0
LTE 12	699.70	25.00	316.23	3.26	2.12	0.133 3	0.466 5
LTE 5	824.70	25.00	316.23	2.29	1.69	0.106 6	0.549 8
LTE 4	1 710.70	25.00	316.23	2.00	1.58	0.099 7	1.000 0
LTE 2	1 850.70	25.00	316.23	1.59	1.44	0.090 7	1.000 0
LTE 7	2 502.50	25.00	316.23	3.00	2.00	0.125 5	1.000 0

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/cm².

Calculation Results of RF exposure (IC)

Maximum tune-up tolerance

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Ant Gain [dBi]	E.I.R.P		Limit [W]
				[dBm]	[W]	
BLE / 1 Mbps	2 402	5.00	3.50	8.50	0.007 1	2.680 0
WCDMA 850	826.40	25.00	2.29	25.14	0.326 6	1.290 9
WCDMA 1900	1 852.40	25.00	1.59	26.59	0.456 0	2.241 0
LTE 12	699.70	25.00	3.26	26.11	0.408 3	1.152 1
LTE 5	824.70	25.00	2.29	25.14	0.326 6	1.289 0
LTE 4	1 710.70	25.00	2.00	27.00	0.501 2	2.122 4
LTE 2	1 850.70	25.00	1.59	26.59	0.456 0	2.239 6
LTE 7	2 502.50	25.00	3.00	28.00	0.631 0	2.752 5

5. Measurement Equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Wideband Power Sensor	R&S	NRP-Z81	102398	19.01.25	20.01.25
ATTENUATOR	R&S	DNF Dämpfungsglied 10 dB in N-50 Ohm	31212	19.05.13	20.05.13

End of test report

KCTL