FCC CFR47 PART 25

CERTIFICATION TEST REPORT

FOR

Multi Path Blue Force Tracker

MODEL NUMBER : mBFT17

FCC ID: 2AL3AHDJC-1701

REPORT NUMBER: 4787927807-E3V1

ISSUE DATE: JUN 02, 2017

Prepared for
HYUNDAI J-COMM. CO., LTD.
27, Sagimakgol-ro 105beon-gil, Jungwon-gu, Seongnam-Si,
GYEONGGI-DO, 13201, KOREA

Prepared by
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ACCREDITED
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	06/02/17	Initial issue	Junwhan Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: HYUNDAI J-COMM. CO., LTD.

EUT DESCRIPTION: Multi Path Blue Force Tracker

MODEL NUMBER: mBFT17

SERIAL NUMBER: 0001, 0002 (RADIATED);
0001 (CONDUCTED)

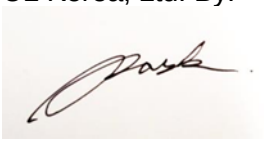
DATE TESTED: MAR 28, 2017 – JUN 02, 2017

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 25	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:



SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 25
2. FCC CFR 47 Part 2
3. ANSI TIA-603-D
4. KDB 971168 D01 Power Meas License Digital Systems v02r02

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro
☐ Chamber 1
☒ Chamber 2

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at http://www.iasonline.org/PDF/TL/TL-637.pdf.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

EIRP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

ERP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna)

(Path loss = Signal generator output – PSA reading with substitution antenna)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.32 dB
Radiated Disturbance, Below 1GHz	4.14 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

Uncertainty figures are valid to a confidence level of 95%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Multi Path Blue Force Tracker.
This test report addresses the Satellite communication operational mode.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum radiated EIRP output powers as follows:

Part 25		
Frequency Range	Radiated	
[MHz]	Avg [dBm]	Avg [mW]
1616~1626	36.36	4325.14

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a external antenna for the [List the bands supported] with a maximum peak gain as follow:

Frequency (MHz)	Peak Gain (dBi)
1616-1626 MHz	2

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5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SHENZHEN LIANYUNDA ELECTRONIC CO., LTD	LYD0505000	N.A	N/A

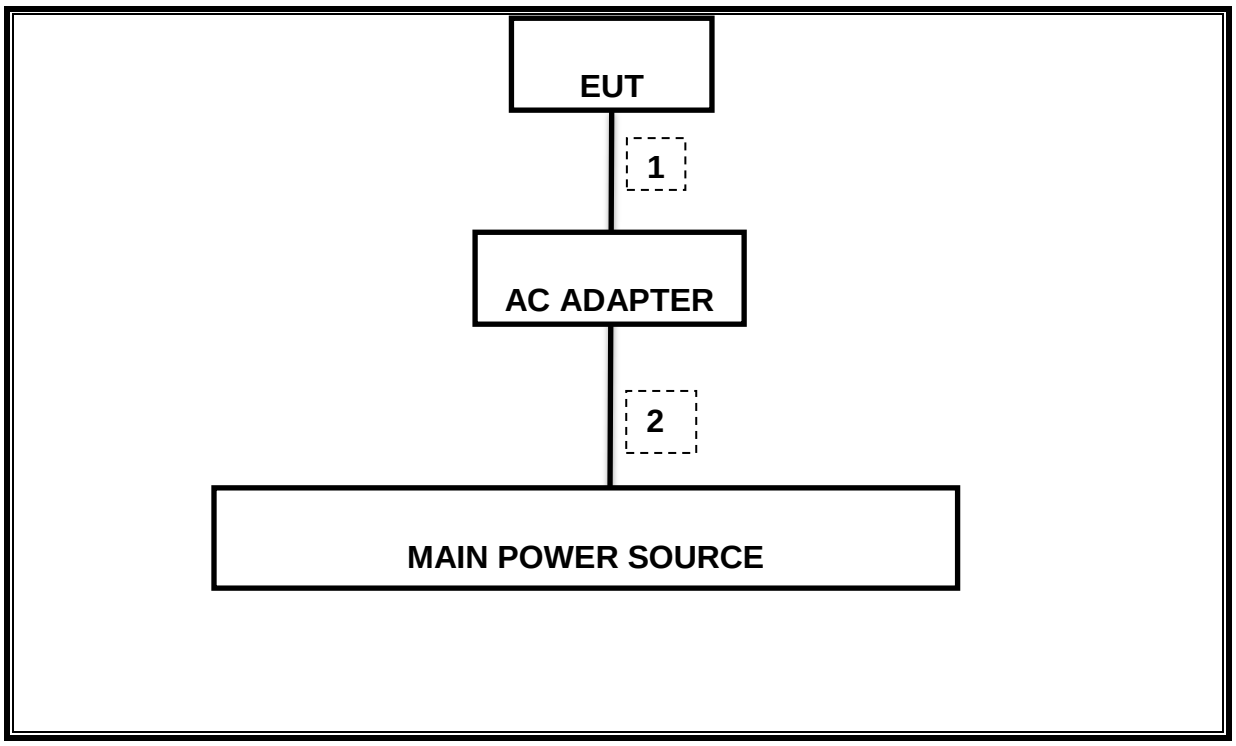
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	2-PIN	Shielded	1 m	N/A
2	AC Power	2	AC	Shielded	1.1 m	N/A

TEST SETUP

The EUT is a stand-alone unit during the tests.
Test software exercised the EUT to enable BLE mode.

SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121D DB4	00164753	07-28-17
Antenna, Horn, 40 GHz	ETS	3116C	00166155	11-30-17
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	12-15-17
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	10-14-18
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	11-24-17
Antenna, Horn, 18 GHz	ETS	3115	00167211	10-14-18
Antenna, Horn, 18 GHz	ETS	3117	00168724	06-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168717	06-17-17
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-17-17
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-16-17
Preamplifier	ETS	3115-PA	00167475	08-17-17
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-16-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-17-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	03-09-18
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-16-17
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	08-17-17
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	08-17-17
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	08-17-17
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	08-17-17
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	08-17-17
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	08-17-17
Attenuator	PASTERNACK	PE7087-10	A007	08-17-17
Attenuator	PASTERNACK	PE7087-10	A006	08-17-17
Attenuator	PASTERNACK	PE7087-10	A009	08-16-17

7. REFERENCE MEASUREMENT RESULTS

7.1. OUTPUT POWER

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss(3* 10dB attenuator) was entered as an offset in the power meter to allow for direct reading of power. Duty cycle correction factor is already added to the average output power results.

Results

Channel	Frequency	Meas Power
	[MHz]	[dBm]
Low	1616.020803	30.17
Mid	1621.020803	31.34
High	1625.979167	31.09
Worst		31.34

8. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result	Note
2.1049	Occupied Band width	N/A	Conducted	N/P	See module test report
25.202(f)	Emission Limit	See module test report		N/P	See module test report
25.216	Limits on Emissions from Mobile Earth stations for protection of aeronautical Radionavigation-Satellite Service	See module test report		N/P	See module test report
2.1047(d)	Modulation charateristics	N/A		N/P	See module test report
25.202(d) 2.1055	Frequency Stability	10 ppm		N/P	See module test report
25.204(a)	Equivalent Isotropic Radiated Power	40dBW(70dBm)	Radiated	Pass	36.36 dBm
25.202(f)	Emission Limit	See the section 8.2		Pass	-26.5 dBm

- N/P : Not performed

- **NOTE**

All conducted test didn't performed because conducted output power of this device is in the module's conducted power tolerance range(30.7dBm ~ 32.7dBm). Also module was installed on this device as same condition with original approval condition.

Please refer to the original approval FCC Part 25 test report.
(FCC ID : Q639603N, Document 75926443 Report05 Issue 2)

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9. RADIATED TEST RESULTS

9.1. RADIATED POWER (EIRP)

RULE PART(S)

FCC: §2.1046, §25.204(a)

LIMITS

25.204 - (a) In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (c) of this section:

+ 40 dBW in any 4 kHz band for $\theta \leq 0°$

+ 40 + 3θ dBW in any 4 kHz band for $0° < \theta \leq 5°$

where θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

TEST PROCEDURE

ANSI / TIA / EIA 603D Clause 2.2.17; ESU40 setting reference to 971168 D01 v02r02

For peak power measurement with a ESU40:

a) Set the RBW ≥ OBW; b) Set VBW ≥ 3 × RBW; c) Set span ≥ 2 x RBW; d) Sweep time = auto couple; e) Detector = peak; f) Ensure that the number of measurement points ≥ span/RBW; g) Trace mode = max hold;

For average power measurement with a ESU40:

a) Set span to at least 1.5 times the OBW; b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz; c) Set VBW ≥ 3 x RBW; d) Set number of points in sweep ≥ 2 × span / RBW; e) Sweep time = auto-couple; f) Detector = RMS (power averaging); g) Use free run trigger If burst duty cycle ≥ 98; h) Use trigger to capture bursts If burst duty cycle < 98; i) Trace average at least 100 traces in power averaging (*i.e.*, RMS) mode. j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function.

TEST RESULTS

9.1.1. ERP/EIRP Results

Satellite

Mode	Channel	f [MHz]	ERP / EIRP	
			[dBm]	[mW]
Satellite	1	1616.0208033	32.43	1749.85
	121	1621.0208033	34.58	2870.78
	240	1625.979167	36.36	4325.14

9.1.2. ERP/EIRP DATA

Satellite

Satellite

High Frequency Substitution Measurement
UL Korea, Ltd. Suwon Laboratory Chamber 2

Company: Hyundai J.comm
Project #: 4787927807
Date: 04-18-17
Test Engineer: Chan Park
Configuration: EUT ONLY, Y Position
Mode: SATELLITE

Test Equipment:
Receiving: 3117[00168724] and Chamber 1 SMA Cables
Substitution: 3115[00161451] Substitution, 3m SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
1616.02	24.77	V	1.54	9.20	32.43	70.0	-37.6	
1616.02	24.77	H	1.54	9.20	32.43	70.0	-37.6	
Mid Ch								
1621.02	24.50	V	1.55	9.31	32.26	70.0	-37.7	
1621.02	26.82	H	1.55	9.31	34.58	70.0	-35.4	
High Ch								
1625.98	24.81	V	1.56	9.38	32.63	70.0	-37.4	
1625.98	28.54	H	1.56	9.38	36.36	70.0	-33.6	

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9.2. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §25.202(f)

LIMIT

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the occupied bandwidth;
2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the occupied bandwidth;
3) 43 + 10 Log p (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the occupied bandwidth.

TEST PROCEDURE

ANSI / TIA / EIA 603D Clause 2.2.12; ESU40 setting reference to 971168 D01 v02r02

For peak power measurement with a ESU40:

a) Set the RBW = 100 KHz for emission below 1GHz and 1MHz for emissions above 1GHz

b) Set VBW ≥ 3 × RBW;

c) Set span ≥ 1.5 times the OBW;

d) Sweep time = auto couple;

e) Detector = peak ;

f) Ensure that the number of measurement points ≥ span/RBW;

g) Trace mode = max hold;

RESULTS

9.2.1. SPURIOUS RADIATION PLOTS

Satellite

Satellite

UL Korea, Ltd Suwon Laboratory
Above 1GHz High Frequency Substitution Measurement

Company: Hyundai J.comm
Project #: 4787927807
Date: 04-19-17
Test Engineer: Chan Park
Configuration: EUT / AC Adapter / Y Position
Mode: SATELLITE

Chamber	Pre-amplifer	Filter	Limit
Chamber 2	AFS42	Filter 1	Part 25

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1616.02MHz									
3.2320	2.7	V	3.0	39.4	1.0	-35.6	-13.0	-22.6	
4.8480	9.6	V	3.0	39.8	1.0	-29.2	-13.0	-16.2	
6.4640	1.3	V	3.0	39.9	1.0	-37.6	-13.0	-24.6	
8.0801	2.3	V	3.0	39.1	1.0	-35.8	-13.0	-22.8	
9.6961	0.5	V	3.0	38.7	1.0	-37.1	-13.0	-24.1	
11.3121	-0.4	V	3.0	38.7	1.0	-38.1	-13.0	-25.1	
12.9282	0.0	V	3.0	40.0	1.0	-39.0	-13.0	-26.0	
14.5442	-2.0	V	3.0	41.0	1.0	-42.1	-13.0	-29.1	
3.2320	2.7	H	3.0	39.4	1.0	-35.7	-13.0	-22.7	
4.8480	12.3	H	3.0	39.8	1.0	-26.5	-13.0	-13.5	
6.4640	3.3	H	3.0	39.9	1.0	-35.6	-13.0	-22.6	
8.0801	4.7	H	3.0	39.1	1.0	-33.4	-13.0	-20.4	
9.6961	3.6	H	3.0	38.7	1.0	-34.1	-13.0	-21.1	
11.3121	-0.6	H	3.0	38.7	1.0	-38.3	-13.0	-25.3	
12.9282	1.7	H	3.0	40.0	1.0	-37.3	-13.0	-24.3	
14.5442	-0.3	H	3.0	41.0	1.0	-40.3	-13.0	-27.3	
Mid Ch, 1621.02MHz									
3.2420	1.7	V	3.0	39.4	1.0	-36.7	-13.0	-23.7	
4.8630	8.2	V	3.0	39.8	1.0	-30.6	-13.0	-17.6	
6.4840	8.2	V	3.0	39.9	1.0	-30.6	-13.0	-17.6	
8.1051	8.1	V	3.0	39.1	1.0	-30.0	-13.0	-17.0	
9.7261	-0.8	V	3.0	38.6	1.0	-38.4	-13.0	-25.4	
11.3471	2.4	V	3.0	38.7	1.0	-35.3	-13.0	-22.3	
12.9682	-3.3	V	3.0	40.0	1.0	-42.3	-13.0	-29.3	
14.5892	-2.0	V	3.0	41.0	1.0	-42.1	-12.0	-30.1	
3.2420	1.8	H	3.0	39.4	1.0	-36.6	-13.0	-23.6	
4.8630	11.7	H	3.0	39.8	1.0	-27.1	-13.0	-14.1	
6.4840	9.7	H	3.0	39.9	1.0	-29.1	-13.0	-16.1	
8.1051	6.9	H	3.0	39.1	1.0	-31.2	-13.0	-18.2	
9.7261	0.8	H	3.0	38.6	1.0	-36.8	-13.0	-23.8	
11.3471	2.4	H	3.0	38.7	1.0	-35.4	-13.0	-22.4	
12.9682	-2.9	H	3.0	40.0	1.0	-41.9	-13.0	-28.9	
14.5892	-1.0	H	3.0	41.0	1.0	-41.0	-13.0	-28.0	
High Ch, 1625.98MHz									
3.2519	0.2	V	3.0	39.4	1.0	-38.2	-13.0	-25.2	
4.8779	6.4	V	3.0	39.8	1.0	-32.4	-13.0	-19.4	
6.5039	9.5	V	3.0	39.8	1.0	-29.4	-13.0	-16.4	
8.1299	6.4	V	3.0	39.1	1.0	-31.7	-13.0	-18.7	
9.7559	2.3	V	3.0	38.6	1.0	-35.4	-13.0	-22.4	
11.3819	-4.4	V	3.0	38.8	1.0	-42.2	-13.0	-29.2	
13.0078	-2.4	V	3.0	40.0	1.0	-41.4	-13.0	-28.4	
14.6338	-2.1	V	3.0	41.1	1.0	-42.2	-12.0	-30.2	
3.2519	0.5	H	3.0	39.4	1.0	-37.9	-13.0	-24.9	
4.8779	8.0	H	3.0	39.8	1.0	-30.8	-13.0	-17.8	
6.5039	8.2	H	3.0	39.8	1.0	-30.6	-13.0	-17.6	
8.1299	5.2	H	3.0	39.1	1.0	-33.0	-13.0	-20.0	
9.7559	0.9	H	3.0	38.6	1.0	-36.7	-13.0	-23.7	
11.3819	-2.2	H	3.0	38.8	1.0	-40.0	-13.0	-27.0	
13.0078	-1.6	H	3.0	40.0	1.0	-40.6	-13.0	-27.6	
14.6338	-1.7	H	3.0	41.1	1.0	-41.8	-13.0	-28.8	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.