

RF TEST REPORT

Test item : Unit Assy - Smart Key
Model No. : MT SKM 05
Order No. : DEMC1407-03033
Date of receipt : 2014-07-23
Test duration : 2014-11-02 ~ 2014-11-07
Date of issue : 2014-11-13
Use of report : FCC Original Grant

Applicant : MOTOTECH Co., Ltd.
#68-26, Mannyeon-ro, Jeongnam-myeon, Hwaseong-si, Gyeonggi-do, Korea

Test laboratory : DT&C Co., Ltd.
42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935

Test specification : FCC Part 15 Subpart C
Test environment : See appended test report
Test result : ☒ Pass ☐ Fail

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

Tested by:



Engineer
KwiCheol Yeom

Reviewed by:



Technical Manager
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Test Report Version

Test Report No.	Date	Description
DRTFCC1411-1441	Nov. 13, 2014	Initial issue

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1. Equipment information

1.1 Equipment description

FCC Equipment Class	Part 15 Low Power Transmitter Below 1705 kHz (DCD)
Equipment type	Unit Assy - Smart Key
Equipment model name	MT SKM 05
Equipment add model name	N/A
Equipment serial no.	Identical prototype
Frequency	133.33kHz
Power	DC 12 V(Car Battery)
Antenna type	Fixed type(Low frequency Antenna)

1.2 Support equipments

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Note: The above equipment was supported by manufacturer.

2. Information about test items

2.1 Operating mode

Operating Mode	Continuous transmitting mode
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2.2 Tested frequency

Item	TX	RX
Frequency	133.33 kHz	133.33 kHz

2.3 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-

2.4 Tested environment

Temperature	:	22 ~ 24 °C
Relative humidity content	:	39 ~ 53 % R.H.
Details of power supply	:	DC 12 V(Car Battery)

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. FACILITIES AND ACCREDITATIONS

3.1 FACILITIES

The semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935. The site is constructed in conformance with the requirements.

- Semi anechoic chamber registration Number: 165783

3.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of antennas: loop, tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

4. Test Report

4.1 Summary of tests

FCC Part Section(s)	RSS Section(s)	Parameter	Limit	Test Condition	Status Note 1
Test Items					
2.1049	N/A	20 dB Bandwidth	N/A	Radiated	C
15.209	RSS-Gen [7.2.5]	Radiated Emission	FCC 15.209 limits		C
15.207	RSS-Gen [7.2.4]	AC Conducted Emissions	FCC 15.207 limits	AC Line Conducted	NA
Note 1: C =Comply NC =Not Comply NT =Not Tested NA =Not Applicable					

The sample was tested according to the following specification:
ANSI C-63.4 2009

4.2 Transmitter requirements

4.2.1 20dB Bandwidth

- Procedure:

The 20 dB bandwidth is measured with a spectrum analyzer connected via a receiving antenna placed near the EUT while the EUT is operating.

Tested Frequency(kHz)	Test Results(kHz)
133.330	4.601



4.2.2 Radiated Emissions

- Limit: FCC Part 15.209(a) & RSS-GEN, section 7.2.5

Frequency [MHz]	Field Strength [uV/m]	Measurement Distance [Meters]
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

- Procedure: ANSI C63.4 2009

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. In order to find out the highest emission, the relative positions of this EUT was rotated through three orthogonal axes.
5. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
6. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

- Measurement Data: **Comply** (refer to the next page)

- Measurement Data:Measurement Distance : **3 Meters**

Fundamental or Spurious	Frequency [MHz]	Detector Mode	ANT Pol	Reading [dBuV]	T.F [dB/m]	Distance factor	Field Strength [dBuV/m]@300m	Average Limit [dBuV/m] *Note3	Margin [dB]
F	0.133	PK	H	53.60	19.10	80	-7.30	25.13	32.43
-	-	-	-	-	-	-	-	-	-
Fundamental or Spurious	Frequency [MHz]	Detector Mode	ANT Pol	Reading [dBuV]	T.F [dB/m]	Distance factor	Field Strength [dBuV/m]@30m	QP Limit [dBuV/m] *Note4	Margin [dB]
S	0.664	PK	H	34.50	19.00	40	13.50	31.16	17.66
S	1.862	PK	H	20.50	19.10	40	-0.40	29.54	29.94
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
Fundamental or Spurious	Frequency [MHz]	Detector Mode	ANT Pol	Reading [dBuV]	T.F [dB/m]	Distance factor	Field Strength [dBuV/m]@3m	QP Limit [dBuV/m]	Margin [dB]
S	38.117	QP	V	56.10	-17.40	0	38.70	40.00	1.30
S	161.329	QP	H	48.00	-15.90	0	32.10	43.50	11.40
S	432.002	QP	H	29.90	-12.00	0	17.90	46.00	28.10
S	994.183	QP	V	19.40	-2.90	0	16.50	54.00	37.50
-	-	-	-	-	-	-	-	-	-

Note 1. Distance Factor(DF)For 300m: $40 \cdot \log(300/3) = 80\text{dB}$ For 30m: $40 \cdot \log(30/3) = 40\text{dB}$ **Note 2.** " F " = Fundamental

" S " = Spurious

" * " = Noise Floor

Note 3. PK result meets the average limit. So average measurement was omitted.**Note 4.** PK result meets the QP limit. So QP measurement was omitted.**Note 5.** No other spurious and harmonic emissions were reported greater than listed emissions above table.**Note 6.** Sample calculation

T.F = AF + CL – AG

/ Field Strength = Reading + T.F + DF

Margin = Limit – Field Strength

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

4.2.3 AC Line Conducted Emissions

- Minimum Standard: FCC Part 15.207 & RSS-GEN Issue 3, section 7.2.4

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

- Procedure: ANSI C63.4 2009

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

- Measurement Data: NA

Note: The supplying power of this device is DC 12V from a Car Battery.

APPENDIX I

TEST EQUIPMENT FOR TESTS

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Multimeter	HP	34401A	14/02/27	15/02/27	3146A13475
Thermo Hygrometer	BODYCOM	BJ5478	14/05/13	15/05/13	120612-2
Vector Signal Generator	Rohde Schwarz	SMJ100A	14/01/07	15/01/07	100148
MXA Signal Analyzer	Agilent Technologies	N9020A	14/10/21	15/10/21	MY48011075
LOOP Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
DC Power Supply	SM techno	SDP30-5D	14/02/10	15/02/10	305DLJ204
BILOG ANTENNA	SCHWARZBECK	VULB 9160	14/04/04	16/04/04	3357
Low Noise Pre Amplifier	tsj	MLA-010K01-B01-27	14/04/09	15/04/09	1844538
EMI TEST RECEIVER	R&S	ESU 8	14/10/21	15/10/21	100348