

RF TEST REPORT

Test item : Unit Ass'y - Smart Key
Model No. : MT SKM 03
Order No. : DEMC1305-01475
Date of receipt : 2013-05-03
Test duration : 2013-05-22 ~ 2013-06-04
Date of issue : 2013-06-07
Use of report : FCC Original Grant

Applicant : MOTOTECH Co., Ltd..
#451-8, Gwiraе-ri, Jeongnam-myeon, Hwasong-si, Gyeonggi-do, 445-961,
Korea

Test laboratory : Digital EMC Co., Ltd.
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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 DIGITAL EMC CO., LTD.

Tested by:



Engineer
JaeJin Lee

Witnessed by:

N/A

Reviewed by:



Deputy General Manager
HongHee Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1306-0571	Jun. 07, 2013	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 Ass'y - Smart Key
Equipment model name	MT SKM 03
Equipment add model name	N/A
Equipment serial no.	Identical prototype
Power	DC 12 V(Car Battery)
Antenna type	Fixed type(Low frequency Antenna)

1.2 Ancillary equipment

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

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	133.30 KHz	133.30 KHz

2.3 Auxiliary equipment

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

2.4 Tested environment

Temperature	: 21 ~ 24 °C
Relative humidity content	: 39 ~ 47 % 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. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Test Condition	Status Note 1
I. Test Items			
2.1049	20 dB Bandwidth	Radiated	C
15.209	Radiated Emission		C
15.207	AC Conducted Emissions	AC Line Conducted	NA
<p>Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable</p>			

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

3.2 Transmitter requirements

3.2.1 20dB Bandwidth Measurement

- Procedure:

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

- Measurement Data: Comply

Tested Frequency(kHz)	Test Results(kHz)
133.30	7.677



3.2.2 Radiated Emissions

- Limit: FCC Part 15.209(a):

Frequency [MHz]	Field Strength [$\mu\text{V}/\text{m}$]	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

- Procedure: ANCI C63.4

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. 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.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. 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 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	0.13300	PK	Hor	78.80	17.90	80.00	16.70	25.13	8.43
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]	Margin [dB]
S	29.733	QP	Hor	46.60	21.50	40.00	28.10	29.54	1.44
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	145.869	QP	Hor	49.20	-10.60	0.00	38.60	43.50	4.90
S	183.870	QP	Hor	49.50	-11.00	0.00	38.50	43.50	5.00
S	230.670	QP	Hor	46.60	-8.60	0.00	38.00	46.00	8.00

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. No other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 5. Sample calculation

$$T.F = AF + CL - AG$$

$$/ \quad \text{Field Strength} = \text{Reading} + T.F + DF$$

$$\text{Margin} = \text{Limit} - \text{Field Strength}$$

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

3.2.3 AC Line Conducted Emissions

- Minimum Standard: FCC Part 15.207

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:

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: N/A (This device is powered by Car battery)

APPENDIX I

TEST EQUIPMENT FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Multimeter	HP	34401A	13/02/27	14/02/27	3146A13475
Thermo Hygrometer	BODYCOM	BJ5478	13/01/14	14/01/14	090205-4
Vector Signal Generator	Rohde Schwarz	SMJ100A	13/01/08	14/01/08	100148
MXA Signal Analyzer	Agilent Technologies	N9020A	13/01/08	14/01/08	MY49100833
LOOP Antenna	Schwarzbeck	FMZB1513	12/09/24	13/09/24	1513-128
DC Power Supply	SM techno	SDP30-5D	13/02/14	14/02/14	305DLJ204
BILOG ANTENNA	SCHAFFNER	CBL6112B	12/11/16	14/11/16	2737
Amplifier (22dB)	H.P	8447E	13/01/08	14/01/08	2945A02865
EMI TEST RECEIVER	R&S	ESU	13/01/08	14/01/08	100014