

TEST REPORT



DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1901-0027

2. Customer

• Name : MOTOTECH Co., Ltd.

• Address : #68-26, Mannyeon-ro, Jeongnam-myeon, Hwasong-si, Gyeonggi-do, South Korea

3. Use of Report : FCC Original Grant

4. Product Name / Model Name : Unit Assy - Smart Key / MT SKM 10

FCC ID : DEO-MT-SKM10

5. Test Method Used : ANSI C63.10 - 2013

Test Specification : FCC Part 15 Subpart C

6. Date of Test : 2019.01.18 ~ 2019.01.24

7. Testing Environment : See appended test report.

8. Test Result : Refer to the attached test result.

Affirmation	Tested by	Reviewed by
	Name : Myunghoon Lee  (Signature)	Name : Geunki Son  (Signature)

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.

2019 . 01 . 29 .

DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1901-0027	Jan. 29, 2019	Initial issue

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1. General Information

1.1 Testing Laboratory

DT&C Co., Ltd.		
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The test site complies with the requirements of § 2.948 according to ANSI C63.4-2014.		
- FCC MRA Accredited Test Firm No. : KR0034		
www.dtnet.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

1.2 Testing Environment

Ambient Condition	
▪ Temperature	22 °C ~ 25 °C
▪ Relative Humidity	43 % ~ 46 %

1.3 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.

Test items	Measurement uncertainty
AC conducted emission	2.4 dB (The confidence level is about 95 %, $k = 2$)
Radiated spurious emission (1 GHz Below)	5.1 dB (The confidence level is about 95 %, $k = 2$)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, $k = 2$)

1.4 Details of Applicant

Applicant : MOTOTECH Co., Ltd.
Address : #68-26, Mannyeon-ro, Jeongnam-myeon, Hwasong-si, Gyeonggi-do, South Korea
Contact person : SungMuk Won

1.5 Description of EUT

FCC Equipment Class	Part 15 Low Power Transmitter Below 1705 kHz (DCD)
Equipment type	Unit Assy - Smart Key
Equipment model name	MT SKM 10
Equipment add model name	NA
Equipment serial no.	Identical prototype
Frequency	125 kHz
Power Supply	DC 12 V
Antenna type	LF Antenna - 6EA Coil Antenna - 1EA

2. Information about test items

2.1 Test mode

This device has been tested with the below test modes and antenna transmitting configurations:

Test Mode	Coil Ant	LF Ant					
	SSB	INNER-F	INNER-C	INNER-R	FRT-LH	FRT-RH	BUMPER
TM1	-	O	O	O	-	-	-
TM2	-	-	-	-	O	O	O
TM3	O	-	-	-	-	-	-

2.2 Support equipment

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

Note: The above equipment was supported by manufacturer.

2.3 EMI Suppression Device(s)/Modifications

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

3. Antenna requirements

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

The antenna is attached using the unique connectors.

Therefore this E.U.T Complies with the requirement of §15.203

4. Test Report

4.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status Note 1
2.1049	20 dB Bandwidth	N/A	Radiated	C
15.209	Radiated Emission	FCC 15.209 limits		C
15.207	AC Conducted Emissions	FCC 15.207 limits	AC Line Conducted	NA ^{note3}
15.203	Antenna Requirements	FCC 15.203	-	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS.

Note 3: This device is installed in a car. Therefore the power source is a battery of car.

4.2 Transmitter requirements

4.2.1 20 dB Bandwidth

- Procedure:

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

And spectrum analyzer setting use following test procedure of **ANCSI C63.10-2013 – Section 6.9.2.**

1. Center frequency = EUT channel center frequency
2. Span = 2 ~ 5 times the OBW
3. RBW = 1 % ~ 5 % OBW
4. VBW $\geq 3 \times$ RBW
5. Detector = Peak
6. Trace = Max hold
7. The trace was allowed to stabilize
8. Determine the reference value = Set the spectrum analyzer marker to the highest level of the displayed trace
9. Using the marker-delta function of the instrument, determine the “-xx dB down amplitude” using [(reference value) - xx].
10. Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

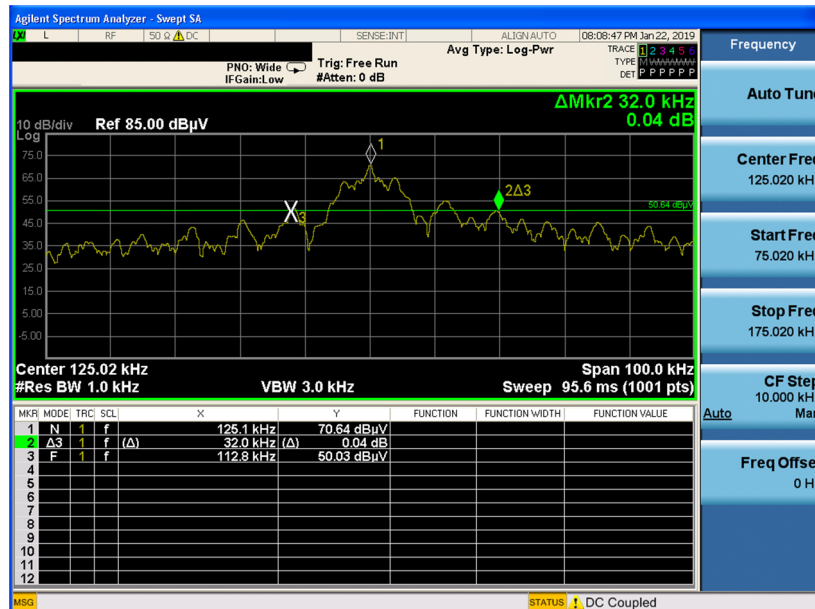
- Measurement Data: **Comply**

Test mode	Tested Frequency(kHz)	20dB Bandwidth(kHz)
TM 1	125	25.0
TM 2	125	32.0
TM 3	125	32.6

-TM 1



-TM 2



-TM 3



- Minimum Standard: NA

4.2.2 Radiated Emissions

- Limit: FCC Part 15.209

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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 - 88 MHz, 174 - 216 MHz or 470 - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

- Procedure:

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.
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: **NA**

- Measurement Data:

Measurement Distance : 3 Meters

Tested Mode	Freq. [MHz]	Detector	Worst case ANT pol (Note 2)	Reading [dBuV]	T.F [dB/m]	Distance Factor	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
TM 1	*0.126	PK	P	86.10	18.80	80	24.90	25.60	0.70
	*0.126	AV	P	52.10	18.80	80	-9.10	25.60	34.70
	0.499	PK	P	42.90	18.70	40	21.60	33.64	12.04
	0.626	PK	P	47.40	18.70	40	26.10	31.67	5.57
	0.624	QP	P	17.10	18.70	40	-4.20	31.70	35.90
	0.875	PK	P	40.40	18.70	40	19.10	28.76	9.66
	1.001	PK	P	30.60	18.70	40	9.30	27.60	18.30
	1.375	PK	P	33.30	18.70	40	12.00	24.84	12.84
	1.624	PK	P	29.80	18.80	40	8.60	23.39	14.79
	31.000	QP	V	42.80	-10.20	N/A	32.60	40.00	7.40
	35.000	QP	V	42.00	-10.00	N/A	32.00	40.00	8.00
	43.500	QP	V	42.60	-9.10	N/A	33.50	40.00	6.50
	58.250	QP	V	37.50	-9.80	N/A	27.70	40.00	12.30
	90.500	QP	V	46.00	-13.50	N/A	32.50	43.50	11.00
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-

Note 1. "*" = Fundamental frequency

Note 2. Loop antenna orientation (30 MHz Below)

"P"= Parallel, "V"= perpendicular, "G"= ground-parallel

Bilog antenna polarization (30 MHz above)

"H"= Horizontal, "V"= Vertical

Note 3. No other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 4. Sample calculation

Margin = Limit – Field Strength

Field Strength = Reading + T.F – Distance factor

T.F = AF + CL – AG

Distance factor = $20\log(\text{Measurement distance} / \text{The measured distance})^2$

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

- Measurement Data:

Measurement Distance : 3 Meters

Tested Mode	Freq. [MHz]	Detector	Worst case ANT pol (Note 2)	Reading [dBuV]	T.F [dB/m]	Distance Factor	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
TM 2	*0.126	PK	P	75.50	18.80	80	14.30	25.60	11.30
	0.250	PK	P	65.80	18.70	80	4.50	19.65	15.15
	0.501	PK	P	52.00	18.70	40	30.70	33.61	2.91
	0.501	QP	P	19.90	18.70	40	-1.40	33.61	35.01
	0.626	PK	P	37.80	18.70	40	16.50	31.67	15.17
	0.999	PK	P	38.60	18.70	40	17.30	27.61	10.31
	1.247	PK	P	34.50	18.70	40	13.20	25.69	12.49
	1.500	PK	P	28.80	18.80	40	7.60	24.08	16.48
	31.000	QP	V	35.50	-10.20	N/A	25.30	40.00	14.70
	72.000	QP	V	42.90	-11.80	N/A	31.10	40.00	8.90
	81.000	QP	H	43.90	-13.70	N/A	30.20	40.00	9.80
	91.000	QP	H	48.40	-13.40	N/A	35.00	43.50	8.50
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-

Note 1. "*" = Fundamental frequency

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Distance factor = $20\log(\text{Measurement distance} / \text{The measured distance})^2$

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

- Measurement Data:

Measurement Distance : 3 Meters

Tested Mode	Freq. [MHz]	Detector	Worst case ANT pol (Note 2)	Reading [dBuV]	T.F [dB/m]	Distance Factor	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
TM 3	*0.126	PK	P	75.40	18.80	80	14.20	25.60	11.40
	*0.126	AV	P	38.50	18.80	80	-22.70	25.60	48.30
	0.250	PK	P	65.60	18.70	80	4.30	19.65	15.35
	0.501	PK	P	50.80	18.70	40	29.50	33.61	4.11
	0.499	QP	P	19.60	18.70	40	-1.70	33.64	35.34
	0.624	PK	P	38.10	18.70	40	16.80	31.70	14.90
	0.875	PK	P	31.60	18.70	40	10.30	28.76	18.46
	1.001	PK	P	39.10	18.70	40	17.80	27.60	9.80
	1.251	PK	P	34.90	18.70	40	13.60	25.66	12.06
	1.502	PK	P	25.50	18.80	40	4.30	24.07	19.77
	30.500	QP	V	39.80	-10.20	N/A	29.60	40.00	10.40
	72.500	QP	V	41.40	-11.90	N/A	29.50	40.00	10.50
	91.000	QP	V	47.50	-13.40	N/A	34.10	43.50	9.40
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-

Note 1. "*" = Fundamental frequency

Note 2. Loop antenna orientation (30 MHz Below)

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Margin = Limit – Field Strength

Field Strength = Reading + T.F – Distance factor

T.F = AF + CL – AG

Distance factor = $20\log(\text{Measurement distance} / \text{The measured distance})^2$

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

4.2.3 AC Line Conducted Emissions

- Test Requirements and limit

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration:

See test photographs for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

Measurement Data: **NA**

APPENDIX I

TEST EQUIPMENT FOR TESTS

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	18/12/19	19/12/19	MY48011700
EMI TEST RECEIVER	Rohde Schwarz	ESCI7	18/03/13	19/03/13	100364
Multimeter	FLUKE	17B	18/12/18	19/12/18	26030065WS
Thermohygrometer	BODYCOM	BJ5478	18/07/09	19/07/09	NA
Thermohygrometer	BODYCOM	BJ5478	18/12/27	19/12/27	120612-1
Signal Generator	Rohde Schwarz	SMBV100A	18/12/19	19/12/19	255571
DC Power Supply	SM techno	SDP30-5D	18/12/18	19/12/18	305DLJ204
Loop Antenna	Schwarzbeck	FMZB1513	18/01/30	20/01/30	1513-128
Biglog Antenna	Schwarzbeck	VULB 9160	18/07/13	20/07/13	3359
PreAmplifier	H.P	8447D	18/12/18	19/12/18	2944A07774
Cable	HUBER+SUHNER	SUCOFLEX 106	18/06/25	19/06/25	G-01
Cable	HUBER+SUHNER	SUCOFLEX 104	18/06/25	19/06/25	G-02
Cable	HUBER+SUHNER	SUCOFLEX 104	18/06/25	19/06/25	G-03
Cable	DT&C	CABLE	18/06/25	19/06/25	RF-20

Note 1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

Note 2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.