

RF TEST REPORT

Test item : Transmitter Assy - Smart Key
Model No. : MT FLIP 02
Order No. : DEMC1407-03026
Date of receipt : 2014-07-23
Test duration : 2014-08-05 ~ 2014-08-20
Date of issue : 2014-09-29
Use of report : FCC Original Grant

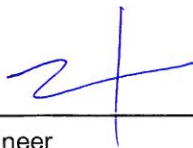
Applicant : MOTOTECH Co., Ltd..
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Test laboratory : DT&C Co., Ltd.
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Test specification : FCC Part 15 Subpart C
Test environment : See appended test report
Test result : Pass Fail

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 DT&C Co., Ltd.

Tested by:



Engineer
SeokHwan Hong

Reviewed by:



Technical Manager
HongHee Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1409-1242	Sep. 29, 2014	Initial issue

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1. Equipment information

1.1 Equipment description

FCC Equipment Class	Part 15 Low Power Transmitter
Equipment type	Transmitter Assy - Smart Key
Fundamental Frequency	433.92 MHz
Equipment model name	MT FLIP 02
Modulation	FSK
Equipment serial no.	Identical prototype
Power	DC 3 V(Battery)
Antenna type	Pattern Antenna

1.2 Ancillary equipment

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

2. Information about test items

2.1 Operating mode

Operating Mode 1	This device was tested with continuous TX mode for field strength of fundamental and spurious emissions measurements.
Operating Mode 2	Normal operating mode was used for 20 dB BW and less than 5 second requirements.

2.2 Tested frequency

Mode	Frequency(MHz)
Transmitting mode	433.92
-	-
-	-

2.3 Auxiliary equipment

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

2.4 Tested environment

Temperature	: 24 °C
Relative humidity content	: 48 ~ 52 % R.H.
Details of power supply	: DC 3 V(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			
15.205	Restricted bands of operation	Radiated	C
15.209	Radiated emission limits, general requirements		C
15.231(a)	Automatically deactivate		C
15.231(b)	Field strength of fundamental and spurious emissions		C
15.231(c)	20dB bandwidth		C
15.207	AC Power Line Conducted Emission	AC Line Conducted	NA ^{Note 2}
15.203	Antenna Requirements	-	C
<p>Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable</p> <p>Note 2: This device is used Battery for power supplying. Therefore this test item was not performed.</p>			

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

3.2 Transmitter requirements

3.2.1 20dB bandwidth

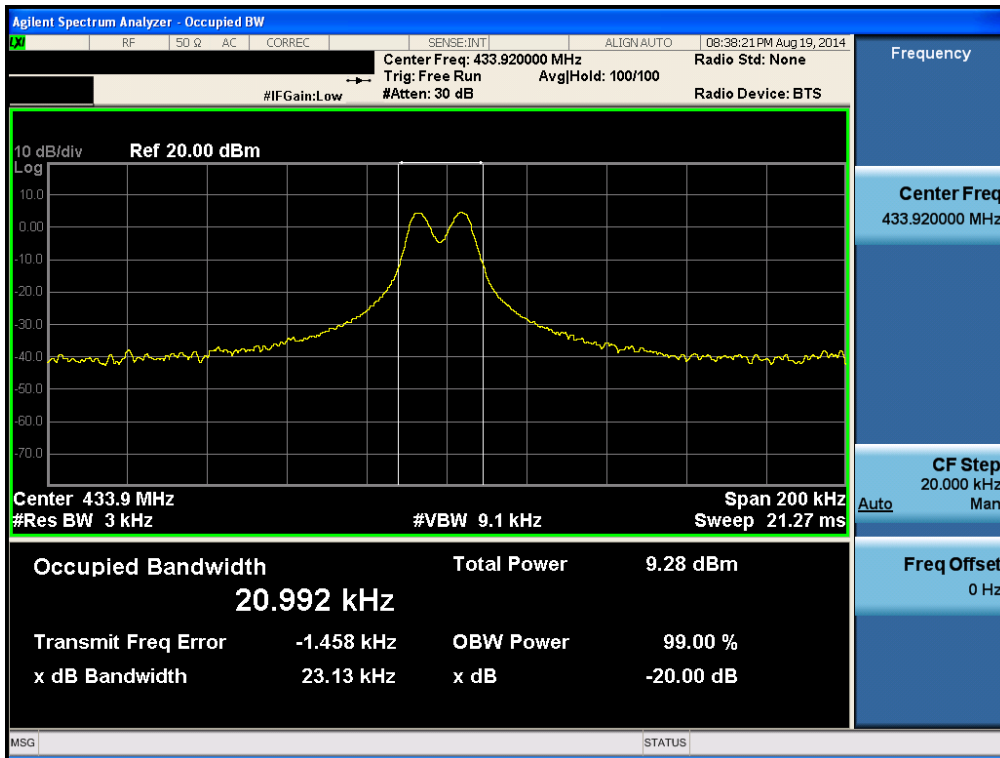
- Procedure:

The Transmitter output is connected to the spectrum analyzer.

20dB Bandwidth: The RBW is set to 3 kHz. The VBW is set to 9.1 kHz. The sweep time is coupled. Bandwidth is determined at the points 20 dB down from the modulated carrier.

- Measurement Data: Comply

Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)
433.92	23.130	1084.8



- Limit: § 15.209(c)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

3.2.2 Field strength of fundamental and spurious emissions

- Procedure:

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-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: Refer to next page

- Limit:

§ 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	608 ~ 614	3345.8 ~ 3358		
		960 ~ 1240	3600 ~ 4400		

§ 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 of Fundamental Frequency [uV/m]	Measurement Distance [m]
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

§ 15.231(b), In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Frequency [MHz]	Field Strength of Fundamental Frequency [uV/m]	Field Strength of Spurious Emissions [uV/m]
40.66 ~ 40.70	2,250	225
70 ~ 130	1,250	125
130 ~ 174	1,250 to 3,750	125 to 375
174 ~ 260	3,750	375
260 ~ 470	3,750 to 12,500	375 to 1,250
Above 470	12,500	1,250

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

- Measurement Data: Comply**Field strength of fundamental**

Measurement Distance : 3 m

EUT Position	Frequency [MHz]	Detector Mode	ANT Pol	Reading [dBuV]	T.F [dB/m]	Averaging correction fator [dB]	Field Strength [dBuV/m]	Averaging Limit [dBuV/m]	Margin [dB]
X	433.920	PK	Hor	84.30	-4.90	-	79.40	80.80	1.40
X	433.920	PK	Ver	74.60	-4.90	-	69.70	80.80	11.10
Y	433.920	PK	Hor	79.70	-4.90	-	74.80	80.80	6.00
Y	433.920	PK	Ver	69.90	-4.90	-	65.00	80.80	15.80
Z	433.920	PK	Hor	82.20	-4.90	-	77.30	80.80	3.50
Z	433.920	PK	Ver	72.10	-4.90	-	67.20	80.80	13.60

Note 1 : EUT was in continuous transmission mode and peak field strength meets AV limit.

Therefore averaging correction factor using the duty cycle is not required.

Note 2. 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

Field strength of spurious emissions

Measurement Distance : 3 m

EUT Position	Frequency [MHz]	Detector Mode	ANT Pol	Reading [dBuV]	T.F [dB/m]	Averaging correction fator [dB]	Field Strength [dBuV/m]	Averaging Limit [dBuV/m]	Margin [dB]
X	868.024	PK	Hor	42.00	2.00	-	44.00	60.80	16.80
X	1735.625	PK	Hor	54.40	-9.50	-	44.90	60.80	15.90
X	2169.375	PK	Hor	56.20	-7.70	-	48.50	60.80	12.30
X	2603.125	PK	Hor	64.20	-5.20	-	59.00	60.80	1.80
X	3037.500	PK	Hor	60.80	-4.00	-	56.80	60.80	4.00
X	3471.250	PK	Ver	62.10	-3.00	-	59.10	60.80	1.70
X	3905.625	PK	Hor	57.10	-1.00	-	56.10	60.80	4.70
X	4339.375	PK	Hor	52.50	0.00	-	52.50	60.80	8.30
X	4773.125	PK	Hor	50.00	1.10	-	51.10	60.80	9.70

Note 1. EUT was in continuous transmission mode and peak field strength meets AV limit.

Note 2. No other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 3. Sample calculation

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

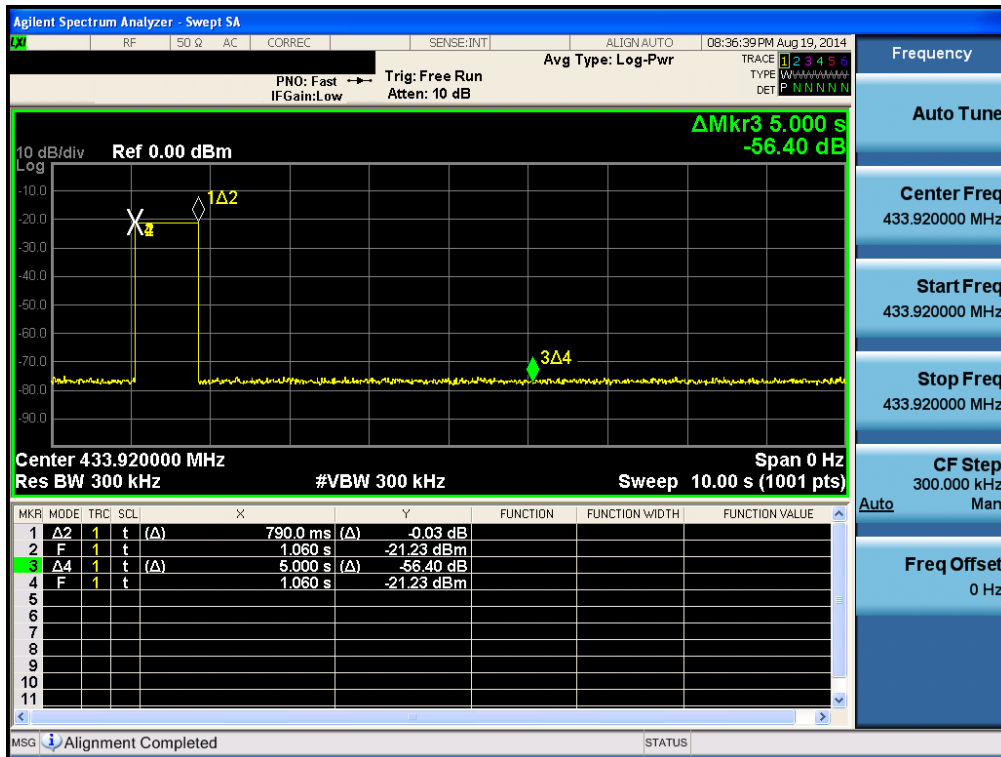
$$/ \quad \text{Field Strength} = \text{Reading} + T.F + DF$$

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

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

3.2.3 Automatically deactivate

- Measurement Data:

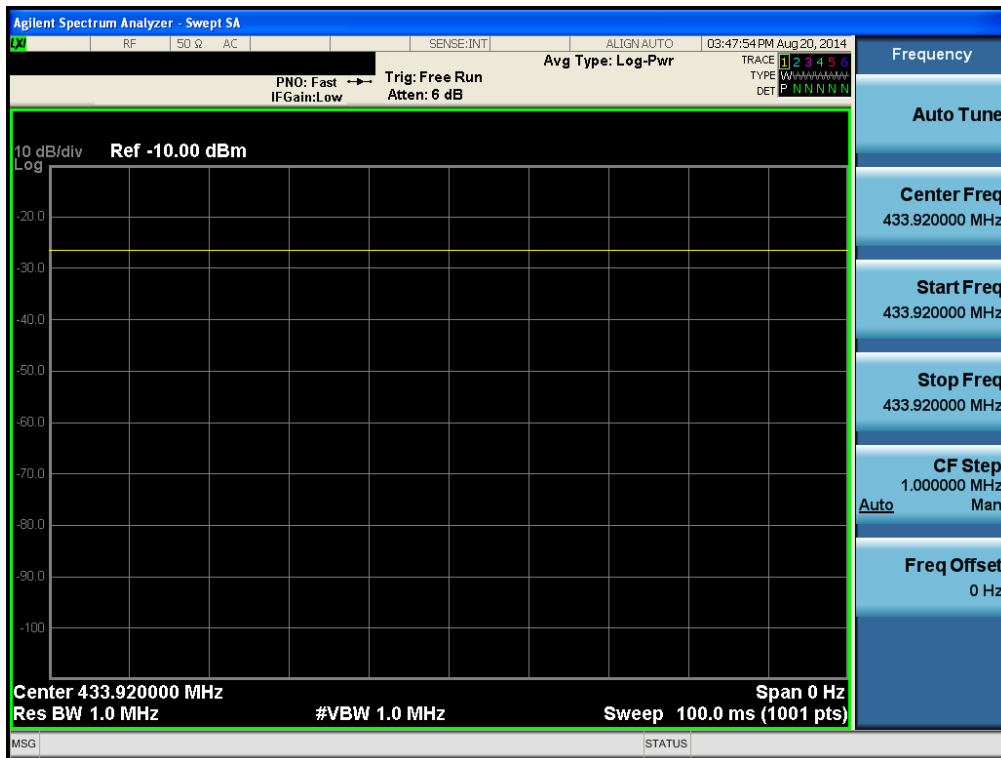


- Limit: § 15.231(a)

- (a) The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:
- (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
 - (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
 - (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.
 - (4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition
 - (5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

3.2.4 Duty Cycle Correction Factor

- Measurement Data:



$T_{on+off} = 100 \text{ ms}$
 $T_{on} = 100 \text{ ms}$

Duty Cycle Correction Factor = $20\log(T_{on} / T_{off}) = 20\log(1) = 0$

- Limit:

No dedicated Limit specified in the Rules.

3.2.5 AC power line conducted emission

- 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: **NA**

Note: This device is used Battery for power supplying.

Therefore this test item was not performed.

- Limit:

According to §15.207(a) 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 uH/50 ohm line impedance stabilization network(LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

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

3.2.6 Antenna requirement

- Procedure:

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

- Measurement Data: Comply

This device uses a pattern antenna. Please refer to internal photo.

- Limit: § 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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.

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
MXA Signal Analyzer	Agilent	N9020A	13/11/05	14/11/05	MY48011075
Thermo Hygrometer	BODYCOM	BJ5478	14/05/13	15/05/13	120612-2
HORN ANT	Schwarzbeck	BBHA9120A	14/04/14	16/04/14	322
LOOP Antenna	Schwarzbeck	FMZB1513	14/04/14	16/04/14	1513-128
BILOG ANTENNA	SCHAFFNER	CBL6112B	12/11/06	14/11/06	2737
Amplifier (22dB)	H.P	8447E	14/01/08	15/01/08	2945A02865
Amplifier (30dB)	Agilent	8449B	14/02/27	15/02/27	3008A01590
EMI TEST RECEIVER	R&S	ESU	14/01/08	15/01/08	100014