

RF TEST REPORT

Test item : Unit Ass'y - Smart Key
Model No. : MT SKM 01
Order No. : 1202-00241
Date of receipt : 2012-02-10
Test duration : 2012-03-14 ~ 2012-03-20
Date of issue : 2012-03-20
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.
683-3, Yubang-Dong, Cheoin-Gu, Yongin-Si, Kyunggi-Do, 449-080, Korea

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:


Witnessed by:

Reviewed by:



Engineer
S.K. Ryu

N/A



Technical Director
Harvey Sung

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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 01
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	133.33 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	: 32 ~ 35 % 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
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

3.2 Transmitter requirements

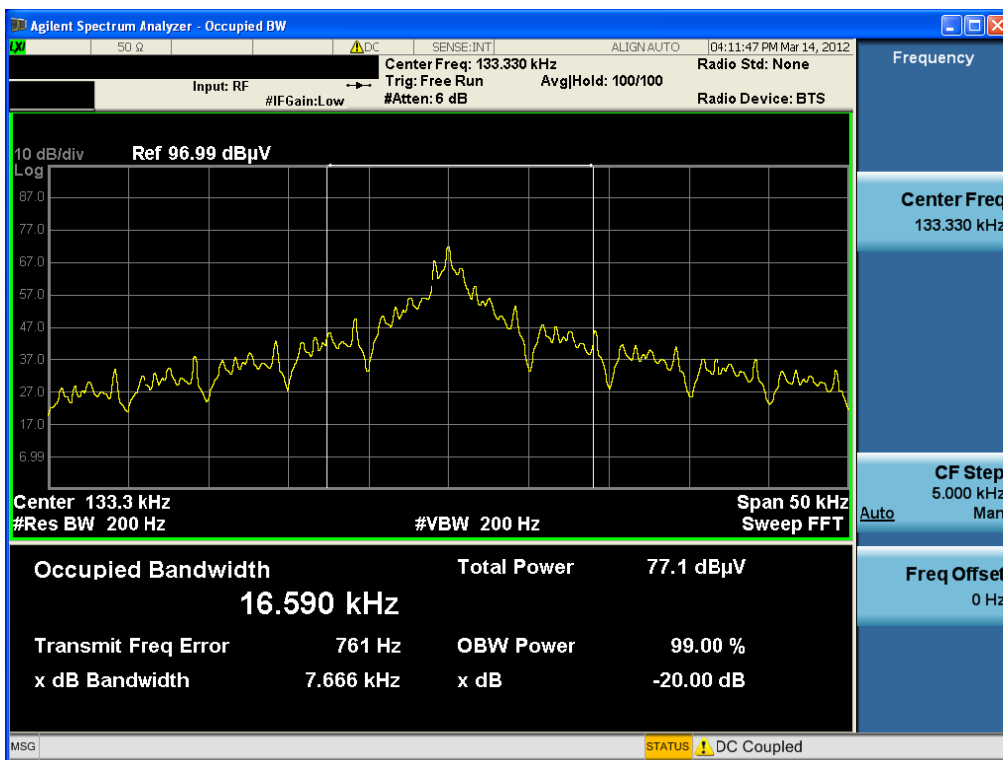
3.2.1 20dB Bandwidth Measurement

- 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)
133.33	7.666



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	0.13333	PK	N/A	97.38	-12.00	80.00	5.38	25.11	19.73
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	0.934	PK	N/A	75.00	-12.60	40.00	22.40	28.20	5.80
S	26.135	PK	N/A	76.30	-15.00	40.00	21.30	29.54	8.24
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	37.772	QP	Hor	42.84	-7.00	0.00	35.84	40.00	4.16
S	48.650	QP	Ver	48.00	-13.00	0.00	35.00	40.00	5.00
S	129.480	QP	Hor	42.50	-9.70	0.00	32.80	43.50	10.70
S	207.210	QP	Hor	48.93	-12.00	0.00	36.93	43.50	6.57
S	368.870	QP	Hor	47.53	-6.30	0.00	41.23	46.00	4.77

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

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

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

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

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
<input checked="" type="checkbox"/>	Spectrum Analyzer	Agilent	E4440A	11/09/30	12/09/30	MY45304199
<input type="checkbox"/>	Spectrum Analyzer	Rohde Schwarz	FSQ26	12/01/09	13/01/09	200445
<input type="checkbox"/>	Spectrum analyzer	Agilent	E4404B	12/03/05	13/03/05	US41061134
<input type="checkbox"/>	Spectrum Analyzer(RE)	H.P	8563E	11/10/04	12/10/04	3551A04634
<input type="checkbox"/>	MXA Signal Analyzer	Agilent Technologies, Inc	N9020A	12/01/09	13/01/09	MY49100833
<input type="checkbox"/>	Power Meter	H.P	EPM-442A	11/07/01	12/07/01	GB37170413
<input type="checkbox"/>	Power Sensor	H.P	8481A	11/07/01	12/07/01	3318A96332
<input type="checkbox"/>	Wideband Power Sensor	Rohde Schwarz	NRP-Z81	11/06/04	12/06/04	1137.9009.02-101001
<input type="checkbox"/>	Virtual Power Meter(S/W)	Rohde Schwarz	R&S Power Viewer Plus	-	-	V 4.1.0
<input type="checkbox"/>	Power Divider	Agilent	11636B	11/09/30	12/09/30	56471
<input type="checkbox"/>	4-Way Power Divider	ET Industries	D-0526-4	11/12/01	12/12/01	210195001
<input type="checkbox"/>	Power Splitter	Anritsu	K241B	11/09/30	12/09/30	020611
<input type="checkbox"/>	Power Splitter	Anritsu	K241B	11/07/01	12/07/01	017060
<input type="checkbox"/>	Frequency Counter	H.P	5342A	11/07/01	12/07/01	2119A04450
<input type="checkbox"/>	TEMP & HUMIDITY Chamber	JISCO	KR-100/J-RHC2	11/09/30	12/09/30	30604493/021031
<input type="checkbox"/>	Digital Multimeter	H.P	34401A	12/03/05	13/03/05	3146A13475, US36122178
<input type="checkbox"/>	Multifunction Synthesizer	HP	8904A	11/10/06	12/10/06	3633A08404
<input type="checkbox"/>	Signal Generator	Rohde Schwarz	SMR20	12/03/05	13/03/05	101251
<input type="checkbox"/>	Signal Generator	H.P	ESG-3000A	11/07/01	12/07/01	US37230529
<input type="checkbox"/>	Vector Signal Generator	Rohde Schwarz	SMJ100A	12/01/09	13/01/09	100148
<input type="checkbox"/>	Vector Signal Generator	Rohde Schwarz	SMBV100A	12/01/09	13/01/09	255571
<input type="checkbox"/>	Audio Analyzer	H.P	8903B	11/07/02	12/07/02	3011A09448
<input type="checkbox"/>	Modulation Analyzer	H.P	8901B	11/07/01	12/07/01	3028A03029
<input type="checkbox"/>	Bluetooth Tester	TESCOM	TC-3000B	11/07/01	12/07/01	3000B000268
<input type="checkbox"/>	Thermo hygrometer	BODYCOM	BJ5478	12/01/13	13/01/13	090205-3
<input type="checkbox"/>	Thermo hygrometer	BODYCOM	BJ5478	12/01/13	13/01/13	090205-2
<input type="checkbox"/>	Thermo hygrometer	BODYCOM	BJ5478	12/01/13	13/01/13	090205-4
<input type="checkbox"/>	AC Power supply	DAEKWANG	5KVA	12/03/05	13/03/05	20060321-1
<input type="checkbox"/>	DC Power Supply	HP	6622A	12/03/05	13/03/05	3448A03760
<input type="checkbox"/>	DC Power Supply	HP	6633A	12/03/05	13/03/05	3524A06634
<input type="checkbox"/>	DC Power Supply	Protek	PWS-3010D	11/09/30	12/09/30	4072702
<input type="checkbox"/>	DC Power Supply	SM techno	SDP30-5D	11/05/20	12/05/20	305DKA013
<input type="checkbox"/>	BAND Reject Filter	Microwave Circuits	N0308372	11/09/30	12/09/30	3125-01DC0352
<input type="checkbox"/>	BAND Reject Filter	Wainwright	WRCG1750	11/09/30	12/09/30	2
<input type="checkbox"/>	High-Pass Filter	ANRITSU	MP526D	11/09/30	12/09/30	M27756

	Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
<input type="checkbox"/>	High-pass filter	Wainwright	WHNX2.1	11/09/30	12/09/30	1
<input type="checkbox"/>	High-pass filter	Wainwright	WHNX3.0	11/09/30	12/09/30	9
<input type="checkbox"/>	High-pass filter	Wainwright	WHNX5.0	11/09/19	12/09/19	8
<input type="checkbox"/>	High-Pass Filter	Wainwright	WHKX8.5	11/09/19	12/09/19	1
<input type="checkbox"/>	High-Pass Filter	Wainwright	WHKX1.0	11/09/30	12/09/30	9
<input type="checkbox"/>	Tunable Notch Filter	Wainwright	WRCT800.0 /960.0-0.2/40-8SSK	N/A	N/A	32
<input type="checkbox"/>	Tunable Notch Filter	Wainwright	WRCD1700.0 /2000.0-0.2/40- 10SSK	N/A	N/A	53
<input type="checkbox"/>	Tunable Notch Filter	Wainwright	WRCT1900.0/ 2200.0-5/40-10SSK	N/A	N/A	30
<input type="checkbox"/>	HORN ANT	ETS	3115	11/09/06	12/09/06	21097
<input type="checkbox"/>	HORN ANT	ETS	3115	11/03/22	12/03/22	6419
<input type="checkbox"/>	HORN ANT	A.H.Systems	SAS-574	11/03/25	13/03/25	154
<input type="checkbox"/>	HORN ANT	A.H.Systems	SAS-574	11/03/25	13/03/25	155
<input type="checkbox"/>	HORN ANT	SCHWARZBECK	BBHA9120A	10/04/13	12/04/13	322
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	VHA9103	11/11/22	12/11/22	2116
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	VHA9103	11/11/22	12/11/22	2117
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	UHA9105	11/11/22	12/11/22	2261
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	UHA9105	11/11/22	12/11/22	2262
<input checked="" type="checkbox"/>	LOOP Antenna	ETS	6502	10/10/29	12/10/29	3471
<input type="checkbox"/>	Coaxial Fixed Attenuators	Agilent	8491B	11/07/02	12/07/02	MY39260700
<input type="checkbox"/>	Attenuator (3dB)	WEINSCHHEL	56-3	11/09/30	12/09/30	Y2342
<input type="checkbox"/>	Attenuator (3dB)	WEINSCHHEL	56-3	11/09/30	12/09/30	Y2370
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	23-10-34	11/09/30	12/09/30	BP4386
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	23-10-34	12/01/09	13/01/09	BP4387
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	86-10-11	11/09/30	12/09/30	446
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	86-10-11	11/09/30	12/09/30	408
<input type="checkbox"/>	Attenuator (20dB)	WEINSCHHEL	86-20-11	11/09/30	12/09/30	432
<input type="checkbox"/>	Attenuator (30dB)	JFW	50FH-030-300	12/03/05	13/03/05	060320-1
<input type="checkbox"/>	Attenuator (40dB)	WEINSCHHEL	57-40-33	11/09/30	12/09/30	NN837
<input type="checkbox"/>	Termination	H.P	HP-909D	11/07/02	12/07/02	02750
<input type="checkbox"/>	Termination	H.P	HP-909D	11/07/02	12/07/02	02702
<input type="checkbox"/>	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0088CAN	11/07/01	12/07/01	788
<input type="checkbox"/>	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0185CAN	11/07/01	12/07/01	790
<input type="checkbox"/>	Amplifier (30dB)	Agilent	8449B	12/03/05	13/03/05	3008A01590
<input type="checkbox"/>	Amplifier (30dB)	H.P	8449B	12/03/05	13/03/05	3008A00370
<input type="checkbox"/>	Amplifier	EMPOWER	BBS3Q7ELU	11/09/30	12/09/30	1020
<input type="checkbox"/>	RF Power Amplifier	OPHIRRF	5069F	11/07/01	12/07/01	1006
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	R&S	ESU	12/01/09	13/01/09	100014

	Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
<input checked="" type="checkbox"/>	BILOG ANTENNA	SCHAFFNER	CBL6112B	10/07/14	12/07/14	2737
<input checked="" type="checkbox"/>	Amplifier (22dB)	H.P	8447E	12/01/09	13/01/09	2945A02865
<input type="checkbox"/>	EMI TEST RECEIVER	R&S	ESCI	12/03/05	13/03/05	100364
<input type="checkbox"/>	BICONICAL ANT.	Schwarzbeck	VHA 9103	10/11/29	12/11/29	91032789
<input type="checkbox"/>	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	10/11/29	12/11/29	1098
<input type="checkbox"/>	BICONICAL ANT.	Schwarzbeck	VHA 9103	10/12/21	12/12/21	91031946
<input type="checkbox"/>	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	10/07/07	12/07/07	0590
<input type="checkbox"/>	Low Noise Pre Amplifier	TSJ	MLA-100K01-B01-2	12/03/05	13/03/05	1252741
<input type="checkbox"/>	Low Noise Pre Amplifier	TSJ	MLA-00108-B02-36	12/01/09	13/01/09	1518831
<input type="checkbox"/>	Amplifier (25dB)	Agilent	8447D	12/03/05	13/03/05	2944A10700
<input type="checkbox"/>	Amplifier (25dB)	Agilent	8447D	11/07/01	12/07/01	2648A04922
<input type="checkbox"/>	Spectrum Analyzer(CE)	H.P	8591E	12/03/05	13/03/05	3649A05889
<input type="checkbox"/>	LISN	Kyoritsu	KNW-407	12/01/09	13/01/09	8-317-8
<input type="checkbox"/>	LISN	Kyoritsu	KNW-242	11/07/02	12/07/02	8-654-15
<input type="checkbox"/>	CVCF	NF Electronic	4420	11/09/15	12/19/15	304935/4420023
<input type="checkbox"/>	50 ohm Terminator	HME	CT-01	12/01/09	13/01/09	N/A
<input type="checkbox"/>	RFI/FIELD Intensity Meter	Kyoritsu	KNM-2402	11/07/02	12/07/02	4N-170-3
<input type="checkbox"/>	EMI Test Receiver	R&S	ECSI	12/03/05	13/03/05	100364
<input type="checkbox"/>	LISN	R&S	ESH2-Z5	11/09/30	12/09/30	8287391006
<input type="checkbox"/>	CVCF	NF Electronic	4420	12/03/05	13/03/05	304935/337980
<input type="checkbox"/>	RFI/FIELD Intensity Meter	ES4152	424059	11/09/30	12/09/30	424059
<input type="checkbox"/>	Wideband Radio Communication Tester	R&S	CMW500	11/09/30	12/09/30	100989