FCC Part 15 Subpart C §15.231

Test Report

Equipment Under Test	**Remote Keyless Entry Transmitter**
Model Name	**MBEC3TX2004**
Variant Model Name	**-**
FCC ID	**NYOMBEC3TX2004**
IC Number	**-**
Applicant	**MOBASE ELECTRONICS CO., LTD.**
Manufacturer	**MOBASE ELECTRONICS CO., LTD.**
Date of Test(s)	**2019. 12. 18 ~ 2020. 01. 09**
Date of Issue	**2020. 01. 13**

In the configuration tested, the EUT complied with the standards specified above.

Issue to	Issue by
MOBASE ELECTRONICS CO., LTD. 100, Saneop-ro 156beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do, Korea Tel.: +82-31-8091-2611 Fax: +82-31-8090-2609	**MOVON CORPORATION** 498-2, Geumeo-ro, Pogok-eup, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17030 Tel.: +82-31-338-8837 Fax: +82-31-338-8847

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Revision history

Revision	Date of issue	Description	Revised by
--	2020.01.13	Initial	-

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1. Applicant Information

1.1. Details of applicant

Applicant	:	MOBASE ELECTRONICS CO., LTD.
Address	:	100, Saneop-ro 156beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do, Korea
Contact Person	:	Hee Tack Ryu
Telephone	:	+82-31-8091-2611
Fax	:	+82-31-8090-2609

1.2. Manufacturer Information

Manufacturer	:	MOBASE ELECTRONICS CO., LTD.
Address	:	100, Saneop-ro 156beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do, Korea

2. Laboratory Information

Company name	:	MOVON CORPORATION
Test site number	:	FCC (KR0151)
Address	:	498-2, Geumeo-ro, Pogok-eup, Cheoin-gu, Yongin-si, Gyeonggi-do, South Korea
Web site	:	http://www.movonlab.co.kr
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3. Summary of test results

The EUT has been tested according to the following specifications:

FCC Rule	IC Rule	Description	Result
§15.203	-	Antenna requirement	C
§15.209(a) §15.231(b)	RSS-210, Issue9, Table A1	Field Strength of Fundamental, Radiated spurious emissions	C
§15.231(c)	RSS-210, Issue 9, A1.3 RSS-GEN Issue 5, 6.7	Bandwidth measurement	C
§15.231(a)	RSS-210, Issue 9, A1, 1(a)	Transmission time	C
§15.207(a)	Rss-Gen, 8.8	AC Conducted power line test	N/A[Note1]

※ Abbreviation

C Complied
N/A Not applicable
F Fail

※ Note

Note 1 : This test is not applicable because the EUT uses battery and it's not to be connected to the Public utility(AC) power line

※ The sample was tested according to the following specification:

FCC Parts 15.209, 15.231; ANSI C63.10:2013
RSS-210 Issue 9, RSS-Gen Issue 5

Approval Signatories

Test and Report Completed by :	Report Approval by :
박성호	진홍섭
David park Test Engineer MOVON CORPORATION	Issac Jin Technical Manager MOVON CORPORATION

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4. EUT Description

Kind of product	Remote Keyless Entry Transmitter
Model Name	MBEC3TX2004
Variant Model Name	-
FCC ID	NYOMBEC3TX2004
IC Number	-
Power supply	DC 3.0 V
Frequency range	433.92 MHz (TX)
Modulation technique	FSK
Number of channels	1 ch
Antenna gain / Type	-22.00 dBi (Max.) / PCB Antenna
Test Site Registration Number	FCC (KR0151)

4.1. Declarations by the manufacturer

None

4.2. Details of modification

None

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5. Measurement equipment

Equipment	Manufacturer	Model	Serial number	Calibration Interval	Calibration date	Calibration due.
Test Receiver	R&S	ESVS30	829673/015	1 year	2019-12-05	2020-12-05
Signal Generator	R&S	SMB100A	178128	1 year	2019-12-06	2020-12-06
Vector Signal Generator	R&S	SMBV100A	257379	1 year	2019-05-27	2020-05-27
Spectrum Analyzer	R&S	FSV-40	100832	1 year	2019-05-27	2020-05-27
Horn Antenna	R&S	HF906	100236	2 year	2019-04-09	2021-04-09
Bi-Log Ant.	S/B	VULB 9161SE	4159	2 year	2018-06-11	2020-06-11
Loop Antenna	ETS LINDGREN	6502	00118166	2 year	2018-10-30	2020-10-30
Power Amplifier	TESTEK	TK-PA18H	170013-L	1 year	2019-05-27	2020-05-27
Controller	INNCO	CO2000	CO2000/064/6961003/L	N/A	N/A	N/A
Antenna Master	INNCO	MA4000	MA4000/038/6961003/L	N/A	N/A	N/A
Controller	INNCO	CO3000	CO3000/812/34240914/L	N/A	N/A	N/A
Antenna Master	INNCO	MA4640-XP-ET	None	N/A	N/A	N/A

※Remark
Support equipment

Description	Manufacturer	Model	Serial number
-	-	-	-

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6. Antenna requirement

6.1. Regulation

According to §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 of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

6.2. Test results

Complied

The PCB Antenna is an integral antenna, and no antenna other than that furnished by the responsible party shall be used with the device

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7. Field strength of Fundamental

7.1. Regulation

According to § 15.109(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: 83

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30 - 88	100**	3
88 – 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (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., Sections 15.231 and 15.241.

According to §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:

Fundamental Frequency (MHz)	Field strength of Fundamental (μV/m)	Field Strength of spurious emissions (μV/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

** linear interpolations

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, μV /m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, μV /m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

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7.2. Test procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

a. 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.
b. During performing radiated emission below 1 ㎓, 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 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
c. 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.
d. 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.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10 ㎧ 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 ㎧ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
g. It tested x,y and z – 3 axis each, mentioned only worst case data at this report. by measuring peak result and applying DCCF.

7.3. Test results

Complied

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
433.92	Peak	H	81.80	100.83	19.03
433.92	Average	H	72.70	80.83	8.13

※Remark

1. Average Limit = 80.83 dBuV/m
2. Peak Limit = 80.83 dBuV/m + 20 dB = 100.83 dBuV/m
   If the average limit is specified for the EUT, the peak limit is 20 dB above the average limit as specified in FCC 15.35 (b)
3. Result = Reading + Ant. factor - Amp + CL (Cable loss)

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8. Radiated spurious emissions

8.1. Regulation

According to § 15.109(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: 83

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30 - 88	100**	3
88 – 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (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., Sections 15.231 and 15.241.

According to §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:

Fundamental Frequency (MHz)	Field strength of Fundamental (μV/m)	Field Strength of spurious emissions (μV/m)
40.66-40.70	2,250	225
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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

** linear interpolations

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8.2. Test procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

a. 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.
b. During performing radiated emission below 1 ㎓, 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 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
c. 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.
d. 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.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10 ㏈ 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 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
g. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

Note
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 ㎓.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒ and the video bandwidth is 1/T for Average detection (AV) at frequency above 1 ㎓. (where T = pulse width)

8.3. Test results

Complied (Measurement data : refer to the next page)

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8.3.1. Radiated spurious emission (9 kHz to 30 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
No other emissions were detected at a level greater than 20dB below limit.					

8.3.2. Radiated spurious emission (30 MHz to 1 000 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
867.84	QP	H	39.90	46.00	6.1

8.3.3. Radiated spurious emission (Above 1 000 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*4 338.70	Peak	H	48.95	74.00	25.05
*4 338.70	Average	H	36.17	54.00	17.83
*4 774.20	Peak	V	54.93	74.00	19.07
*4 774.20	Average	H	40.76	54.00	13.24

※Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Result = Reading + Ant. factor - Amp + CL (Cable loss)
4. 15.31 Measurement standards.
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.
5. * is Restricted band.
6. Average measurement did not take place because the peak data did not exceed average limit

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9. Bandwidth measurement

9.1. Regulation

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

9.2. Test procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=2 ㎑, VBW=5 ㎑ and Span= 200 ㎑.
3. The bandwidth of fundamental frequency was measured and recorded.

9.3. Test results

Complied (Test plot : refer to the next page)

Frequency(㎒)	20 ㏈ bandwidth(㎑)	Limit(㎑)	99% bandwidth(㎑)
433.92	44.86	1 084.80	45.73

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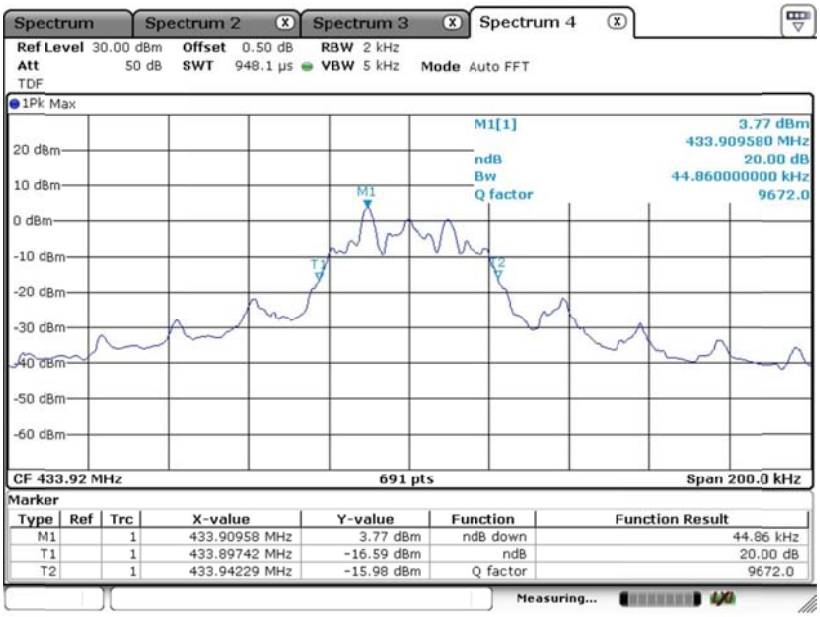
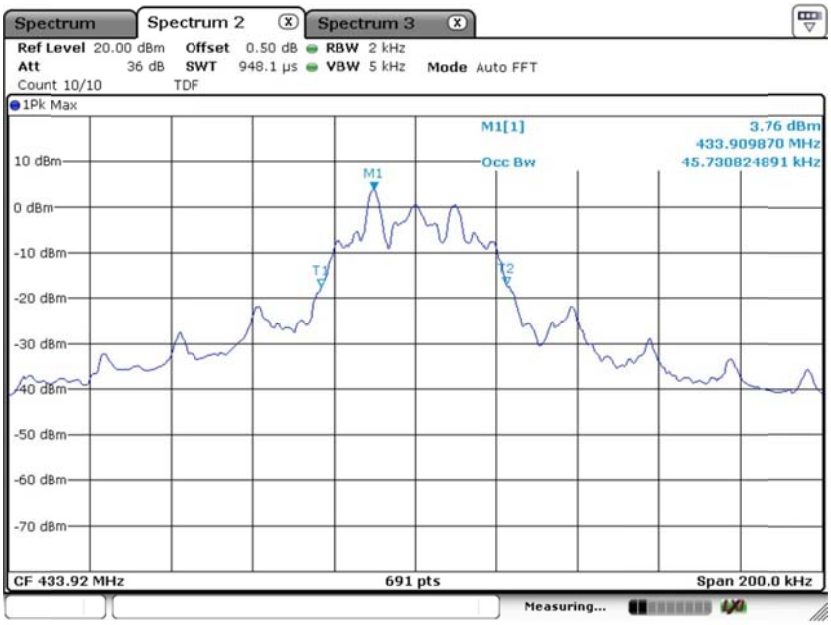
9.4. Test plot

9.4.1. 20 dB Bandwidth



9.4.2. 99% Bandwidth



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10. Transmission time

10.1. Regulation

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

10.2. Test procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

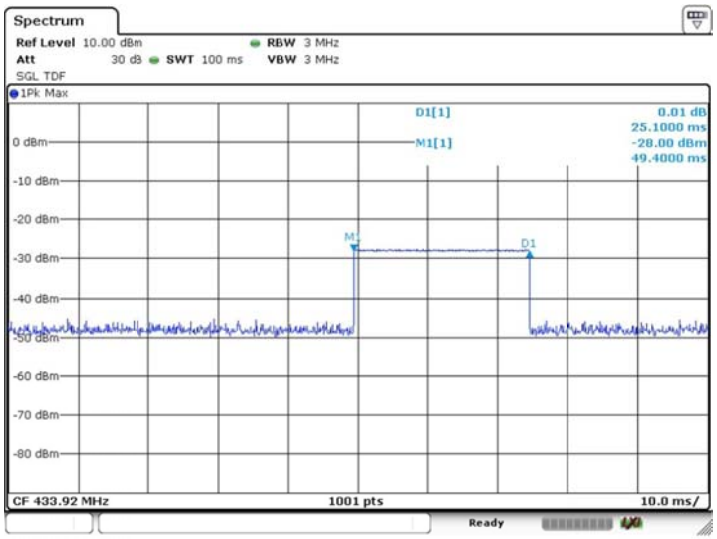
1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=100 ㎑, VBW=300 ㎑, Span=0 ㎐.
3. The bandwidth of fundamental frequency was measured and recorded.

10.3. Test results

Complied

Frequency(㎒)	Transmission time(㎳)	Limit(㎳)
433.92	25.10	5 000.00

10.4. Test plot



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