

TEST REPORT

EMI Test for FCC Certification of AR200 Model

APPLICANT
MOTREX

REPORT NO.
HCT-EM-2006-FC002

DATE OF ISSUE
June 10, 2020

Tested by
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TEST REPORT

EMI Test for
FCC Certification

REPORT NO.
HCT-EM-2006-FC002

DATE OF ISSUE
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FCC ID.
BP9-AR200NISN

Applicant MOTREX CO., LTD
25, Hwangsaeul-ro 258beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do,
Republic of Korea

Product Name DVRS
Model Name AR200

Date of Test May 29, 2020

Test Standard Used FCC CFR 47 PART 15 Subpart B Class B
ANSI C63.4-2014

Test Results Refer to the present document

Manufacturer MOTREX CO., LTD

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test results were applied only to the test methods required by the standard

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REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	June 10, 2020	Initial Release

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2014. (See Test Report if any modifications were made for compliance)

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

HCT certifies that no party to application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C 862

The above Test Report is not related to the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation), which signed the ILAC-MRA.

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1. GENERAL INFORMATION

1.1 Description of the EUT

FCC ID	BP9-AR200NISN
Model Name	AR200
Product Name	DVRS
Frequency Range	2 412 MHz to 2 462 MHz (WiFi 2.4 GHz)
Power Supply	12 V
Manufacturer	MOTREX CO., LTD

1.2 Tested System Details

All equipment descriptions used in the tested system (including inserted cards) are:

Device Type	Model Name	Serial Number	Manufacturer
EUT	AR200	-	MOTREX CO., LTD

1.3 Cable Description

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	DC IN	N	N/A	(P) 1.8

NOTE. The marked "(D)" means the data cable and "(P)" means the power cable.

1.4 Noise Suppression Parts on Cable (I/O Cable)

Product Name	Port	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
EUT	DC IN	N	N/A	N/A	N/A

1.5 Test Facility

Test site is located at 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, South Korea. Those measurement facilities are constructed in conformance with the requirements of ANSI C63.4-2014. The Normalized site attenuations (30 MHz to 1 GHz) and Site validation (1 GHz to 18 GHz) were performed in accordance with the standard in ANSI C63.4-2014

Measurement Facilities	Designation No.
Radiated Field strength measurement facility 3 m Semi Anechoic chamber	KR0032
Radiated Field strength measurement facility 10 m Semi Anechoic chamber #1	
Radiated Field strength measurement facility 10 m Semi Anechoic chamber #2	

1.6 Calibration of Measuring Instrument

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturers recommendations for utilizing calibration equipment, which is traceable to recognized national standards. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5:2017

1.7 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the 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. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty
Radiated Emissions (30 MHz to 1 GHz)	4.8 dB
Radiated Emissions (1 GHz to 18 GHz)	5.4 dB

2. DESCRIPTION OF TEST

2.1 Measurement of Conducted Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 7.3

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN).

If the EUT is connected to the PC through USB, the AC power-line adapter of the PC is directly connected to a line impedance stabilization network (LISN).

Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both conducted lines are measured in Quasi-Peak and Average mode, including the worst-case data points for each tested configuration.

c. The frequency range from 150 kHz to 30 MHz was searched.

Conducted Emission Limits

Frequency (MHz)	Resolution Bandwidth (kHz)	Class A		Class B	
		Quasi-Peak (dB μ V)	Average (dB μ V)	Quasi-Peak (dB μ V)	Average (dB μ V)
0.15 to 0.5	9	79	66	66 to 56*	56 to 46*
0.5 to 5	9	73	60	56	46
5 to 30	9	73	60	60	50

NOTE. Decreases with the logarithm of the frequency.

2.2 Measurement of Radiated Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 8.3

- a. The EUT was placed on the top of a turn table 0.8 meters above the ground at a semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from 1 m to 4 m 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 m to 4 m and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to Peak and Average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.
- g. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.
(1 GHz to 40 GHz)

Radiated Emission Limits

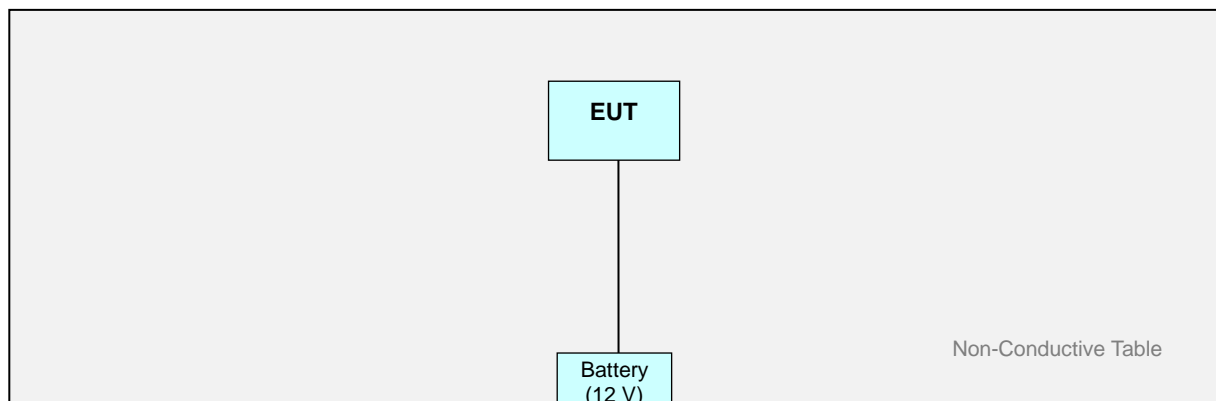
Frequency (MHz)	Class A			Class B		
	Antenna Distance (m)	Field Strength ($\mu\text{V}/\text{m}$)	Quasi-Peak ($\text{dB}\mu\text{V}/\text{m}$)	Antenna Distance (m)	Field Strength ($\mu\text{V}/\text{m}$)	Quasi-Peak ($\text{dB}\mu\text{V}/\text{m}$)
30 to 88	10	90	39.0	3	100	40.0
88 to 216	10	150	43.5	3	150	43.5
216 to 960	10	210	46.4	3	200	46.0
Above 960	10	300	49.5	3	500	54.0
Frequency (MHz)	Antenna Distance (m)	Class A		Class B		
		Peak ($\text{dB}\mu\text{V}/\text{m}$)	Average ($\text{dB}\mu\text{V}/\text{m}$)	Peak ($\text{dB}\mu\text{V}/\text{m}$)	Average ($\text{dB}\mu\text{V}/\text{m}$)	
Above 1 000	3	80	60	74	54	

2.2.1 Frequency Range of Radiated Measurements

An unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a Radiated Emission limit is specified, up to the frequency shown in the following table

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 to 108	1 000
108 to 500	2 000
500 to 1 000	5 000
Above 1 000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

2.3 Configuration of Tested System



3. PRELIMINARY TEST

3.1 Conducted Emission (Not Applicable)

It was tested the following operating mode, after connecting all peripheral devices.

Operating Mode: Not applicable

This product is used for automobiles, and is a product that operates on the battery of a vehicle

3.2 Radiated Emission

It was tested the following operating mode, after connecting all peripheral devices.

Operating Mode:

Camera Recording + WiFi 2.4 GHz Idle mode

This product was tested in the Camera Recording and WiFi 2.4 GHz Idle mode in a state for supplying a direct current power source.

4. CONDUCTED EMISSION AND RADIATED EMISSION TEST SUMMARY

4.1 Conducted Emission (Not Applicable)

4.1.1 Measuring instruments

	Type	Manufacturer	Model Name	Serial Number	Calibration Cycle	Calibration Date
<input type="checkbox"/>	EMI Test Receiver	Rohde & Schwarz	ESCI	100584	1 year	06.18.2019
<input type="checkbox"/>	LISN	Rohde & Schwarz	ENV216	102245	1 year	09.11.2019
<input type="checkbox"/>	LISN	Rohde & Schwarz	ENV216	100073	1 year	04.27.2020
<input type="checkbox"/>	Software	Rohde & Schwarz	EMC32	-	-	-

4.1.2 Operating Condition

The test results of conducted emission at mains ports provide the following information:

Test Standard Used	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Frequency Range	150 kHz to 30 MHz
Detector	Quasi-Peak, CISPR-Average
Bandwidth	9 kHz (6 dB)
Kind of Test Site	EMI Shielded Room
Temperature	- °C
Relative Humidity	- %
Test Date	-

Calculation Formula:

1. Conductor L1 = Hot, Conductor N = Neutral
2. Corr. = LISN Factor + Cable Loss
3. QuasiPeak or CAverage= Receiver Reading + Corr.
4. Margin = Limit – QuasiPeak or CAverage

4.2 Radiated Emission Below 1 GHz

4.2.1 Measuring instruments

Type	Manufacturer	Model Name	Serial Number	Calibration Cycle	Calibration Date
<input checked="" type="checkbox"/> EMI Test Receiver	Rohde & Schwarz	ESU40	100524	1 year	05.12.2020
<input checked="" type="checkbox"/> TRILOG antenna	Schwarzbeck	VULB9168	255	2 year	03.26.2019
<input checked="" type="checkbox"/> Antenna master	INNCO SYSTEM	MA4640-XP-ET	-	-	-
<input checked="" type="checkbox"/> Antenna master controller	INNCO SYSTEM	CO3000	CO3000/870/ 35990515/L	-	-
<input checked="" type="checkbox"/> Turn table	INNCO SYSTEM	1060-2M	-	-	-
<input checked="" type="checkbox"/> Turn table controller	INNCO SYSTEM	CO2000	CO2000/095/ 7590304/L	-	-
<input checked="" type="checkbox"/> Software	Rohde & Schwarz	EMC32	-	-	-

4.2.2 Operating Condition

The test results of radiated emission provide the following information:

Used Test Standard	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Frequency Range	30 MHz to 1 000 MHz
Detector	Quasi-Peak
Bandwidth	120 kHz (6 dB)
Kind of Test Site	3 m semi anechoic chamber
Temperature	22.5 °C
Relative Humidity	47.2 %
Test Date	May 29, 2020

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4.2.3 Measuring Data

Radiated Emission (30 MHz to 1 GHz)

Frequency (MHz)	Quasi Peak (dB μ V/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
95.026200	33.0	117.8	V	168.0	14.7	7.0	43.5
185.433800	28.0	99.8	V	332.0	17.9	15.5	43.5
288.886000	36.0	174.9	H	280.0	20.1	10.0	46.0
299.986600	30.7	125.0	H	76.0	20.5	15.3	46.0
416.525400	34.0	99.8	H	319.0	23.2	12.0	46.0
445.049200	38.6	99.8	V	325.0	23.9	7.4	46.0

- Calculation Formula:

1. POL. H = Horizontal, POL. V = Vertical
2. QuasiPeak = Reading (Receiver Reading) + Corr.
3. Corr. (Correction Factor) = Antenna Factor + Cable Loss
4. Margin = Limit - QuasiPeak

4.3 Radiated Emission Above 1 GHz

4.3.1 Measuring instruments

Type	Manufacturer	Model Name	Serial Number	Calibration Cycle	Calibration Date
<input checked="" type="checkbox"/> EMI test receiver	Rohde & Schwarz	ESU40	100524	1 year	05.12.2020
<input checked="" type="checkbox"/> Antenna master	INNCO Systems	MA4640-XP-ET	-	N/A	-
<input checked="" type="checkbox"/> Antenna master controller	INNCO Systems	CO3000	CO3000/870/ 35990515/L	N/A	-
<input checked="" type="checkbox"/> Turn table	INNCO Systems	1060-2M	-	N/A	-
<input checked="" type="checkbox"/> Turn table controller	INNCO Systems	CO2000	CO2000/095/ 7590304/L	N/A	-
<input checked="" type="checkbox"/> Low Noise amplifier	TESTEK	TK-PA18H	170034-L	1 year	03.03.2020
<input type="checkbox"/> Power Amplifier	TESTEK	TK-PA1840H	170030-L	1 year	02.13.2020
<input checked="" type="checkbox"/> Horn antenna	Schwarzbeck	BBHA 9120D	01836	1 year	07.19.2019
<input type="checkbox"/> Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170786	1 year	12.03.2019
<input checked="" type="checkbox"/> Software	Rohde & Schwarz	EMC32	-	-	-

4.3.2 Operating Condition

The test results of radiated emission provide the following information:

Used Test Standard	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Detector	Peak mode: Peak (RBW: 1 MHz, VBW: 3 MHz) CISPR-Average mode: Peak (RBW: 1 MHz, VBW: 10 Hz)
Highest Frequency	2 462 MHz
Tested Frequency Range	1 GHz to 18 GHz
Kind of Test Site	3 m semi anechoic chamber
Temperature	22.5 °C
Relative Humidity	47.2 %
Test Date	May 29, 2020

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4.3.3 Measuring Data

Radiated Emission (1 GHz to 18 GHz)

Frequency (MHz)	Peak (dB μ V/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
1343.915000	38.4	292.4	V	132.0	-28.4	35.6	74.0
1799.880000	38.8	321.5	V	351.0	-27.1	35.2	74.0
2100.215000	37.2	298.6	V	350.0	-26.1	36.8	74.0
2400.070000	43.2	99.9	H	0.0	-24.6	30.8	74.0
3000.025000	39.2	140.8	V	112.0	-22.7	34.8	74.0
3560.990000	39.4	249.4	V	232.0	-21.8	34.6	74.0

Frequency (MHz)	CAverage (dB μ V/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
1343.915000	32.5	292.4	V	132.0	-28.4	21.5	54.0
1799.880000	33.5	321.5	V	351.0	-27.1	20.5	54.0
2100.215000	32.2	298.6	V	350.0	-26.1	21.8	54.0
2400.070000	35.4	99.9	H	0.0	-24.6	18.6	54.0
3000.025000	31.1	140.8	V	112.0	-22.7	22.9	54.0
3560.990000	35.6	249.4	V	232.0	-21.8	18.4	54.0

- Calculation Formula:

1. POL. H = Horizontal, POL. V = Vertical
2. Peak or CAverage = Reading (Receiver Reading) + Corr.
3. Corr. (Correction Factor) = Antenna Factor+ Cable Loss –Amplifier Gain
4. Margin = Limit - Peak or CAverage

5. CONCLUSION

The data collected shows that the **Product Name: DVRS, Model Name: AR200** complies with §15.107 and §15.109 of the FCC rules.

6. APPENDIX A. TEST SETUP PHOTO

Please refer to Appendix. A and test setup photo file no. as follows;

File No.	Date of Issue	Description
HCT-EM-2006-FC002-P	June 10, 2020	Initial Release

End of report