



BUREAU
VERITAS

Test Report No.: W7L-P23030026EM02



Certificate # 3939.01

EMC TEST REPORT

| | |
|------------|--|
| Applicant: | Marquardt GmbH |
| Address: | Schloss-str.16,78604 Rietheim-Weilheim,Germany |

| | |
|---------------------------|--|
| Manufacturer or Supplier: | Marquardt GmbH |
| Address: | Schloss-str.16,78604 Rietheim-Weilheim,Germany |
| Product: | NFC reader |
| Brand Name: | Marquardt |
| Model Name: | GR2 |
| FCC ID: | IYZGR2 |
| Date of tests: | Apr. 14, 2023 ~ May. 10, 2023 |

The submitted sample of the above equipment has been tested for according to the requirements of the following standards:

FCC Part 15, Subpart B, Class A
 FCC Part 15, Subpart B, Class B
 ANSI C63.4:2014

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

| | |
|--|--|
| Prepared by Simon Wang Engineer / Mobile Department | Approved by Luke Lu Manager / Mobile Department |
| | |

Date: May. 10, 2023

Date: May. 10, 2023

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RELEASE CONTROL RECORD

| ISSUE NO. | REASON FOR CHANGE | DATE ISSUED |
|-------------------|-------------------|---------------|
| W7L-P23030026EM02 | Original release | May. 10, 2023 |



1 GENERAL INFORMATION

1.1 GENERAL DESCRIPTION OF EUT

| | | |
|---------------------|------------------------|----------|
| PRODUCT | NFC reader | |
| BRAND NAME | Marquardt | |
| MODEL NAME | GR2 | |
| NOMINAL VOLTAGE | DC12V | |
| MODULATION TYPE | NFC | ASK |
| OPERATING FREQUENCY | NFC | 13.56MHz |
| HW VERSION | 231502 | |
| SW VERSION | 230401 | |
| I/O PORTS | Refer to user's manual | |
| CABLE SUPPLIED | N/A | |

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.



1.2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC Part 15, Subpart B | | |
|---|---------------------------------------|-------------|
| Standard Section | Test Item | Result |
| FCC Part 15, Subpart B, Class B ANSI C63.4:2014 | Conducted Test | NA (Note 1) |
| | Radiated Emission Test (30MHz ~ 1GHz) | Compliance |
| | Radiated Emission Test (Above 1GHz) | NA (Note 2) |

Note:

1. Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.
2. The highest frequency generated or used in the device is 13.56MHz, so the test needn't to be executed.

2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

| MEASUREMENT | FREQUENCY | UNCERTAINTY |
|--------------------|--------------|-------------|
| Radiated emissions | 30MHz~1GHz | ±4.98dB |
| | 1GHz ~6GHz | ±4.70dB |
| | 6GHz ~18GHz | ±4.60dB |
| | 18GHz ~40GHz | ±4.12dB |



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2.1 DESCRIPTION OF TEST MODES

| Test Mode | Test Condition |
|-------------------------------|-------------------------|
| Radiated emission test | |
| 1 | NFC + DC 12V + DC Cable |

NOTE:

1. For radiated emission test, Pre-scan all mode, test mode 1 was the worst case and only this mode was presented in this report.



2.1 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

FOR ALL TESTS

| NO. | PRODUCT | BRAND | MODEL NO. | SERIAL NO. | FCC ID |
|-----|-----------|---------|-----------|------------|--------|
| 1 | DC Source | Agilent | U8002A | N/A | N/A |

| NO. | SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS |
|-----|---|
| 1 | AC Line: Unshielded, Undetachable, 2.0m |



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2 EMISSION TEST

2.1 RADIATED EMISSION MEASUREMENT

2.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

TEST STANDARD: FCC PART 15, SUBPART B (SECTION: 15.109)

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

| Radiated Emissions Limits at 3 meters (dB μ V/m) | | |
|--|-------------------------|---------------------|
| Frequencies (MHz) | FCC 15B, Class A | FCC 15B, Class B |
| 30-88 | 49 | 40 |
| 88-216 | 53.5 | 43.5 |
| 216-960 | 56 | 46 |
| 960-1000 | 59.5 | 54 |
| Above 1000 | Avg: 59.5 Peak: 79.5 | Avg: 54 Peak: 74 |

Frequency Range (For unintentional radiators)

| 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 |
| 1.705-108 | 1000 |
| 108-500 | 2000 |
| 500-1000 | 5000 |
| Above 1000 | 5 th harmonic of the highest frequency or 40GHz, whichever is lower |

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dB μ V/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
4. QP detector shall be applied if not specified.



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2.1.2 TEST INSTRUMENTS

Frequency range below 1GHz

| Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|--------------------------|--------------|------------|-----------------------------|------------|------------|
| 3m Semi-anechoic Chamber | ETS-LINDGREN | 9m*6m*6m | Euroshieldpn-CT0001143-1216 | May. 19,20 | May. 18,23 |
| Bilog Antenna | ETS-LINDGREN | 3143B | 00161965 | Mar. 05,23 | Mar. 04,24 |
| MXE EMI Receiver | KEYSIGHT | N9038A-544 | MY54450026 | Feb. 17,23 | Feb. 16,24 |
| Signal Pre-Amplifier | EMSI | EMC 9135 | 980249 | May.12,22 | May.11,23 |
| E3 Test Software | E3 | V 9.160323 | N/A | N/A | N/A |

NOTE: 1. The test was performed in 3m chamber.

2. The FCC Site Registration No. is 525120; The Designation No. is CN1171.



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2.1.3 TEST PROCEDURE

<Frequency Range below 1GHz>

The basic test procedure was in accordance with ANSI C63.4:2014 (section 12).

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from 1 meter to 4 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 rotatable 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 1GHz.

NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
4. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain(dB) (if the raw value contains the amplifier).
5. Margin value = Emission level – Limit value.



<Frequency Range above 1GHz>

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter fully-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna 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. The bore sight should be used during the test above 1GHz.
- 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. 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

NOTE:

- . The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- . The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth of test receiver/spectrum analyzer is 1Hz for Average detection (AV) at frequency above 1GHz.
- . For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
- . Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
- . Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
- . Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain(dB) (if the raw value contains the amplifier)
- . Margin value = Emission level – Limit value.

2.1.4 DEVIATION FROM TEST STANDARD

No deviation.

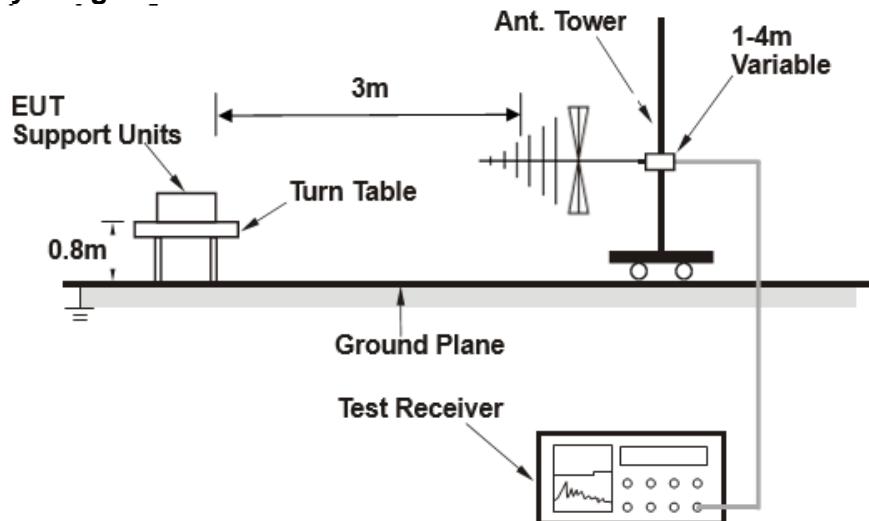


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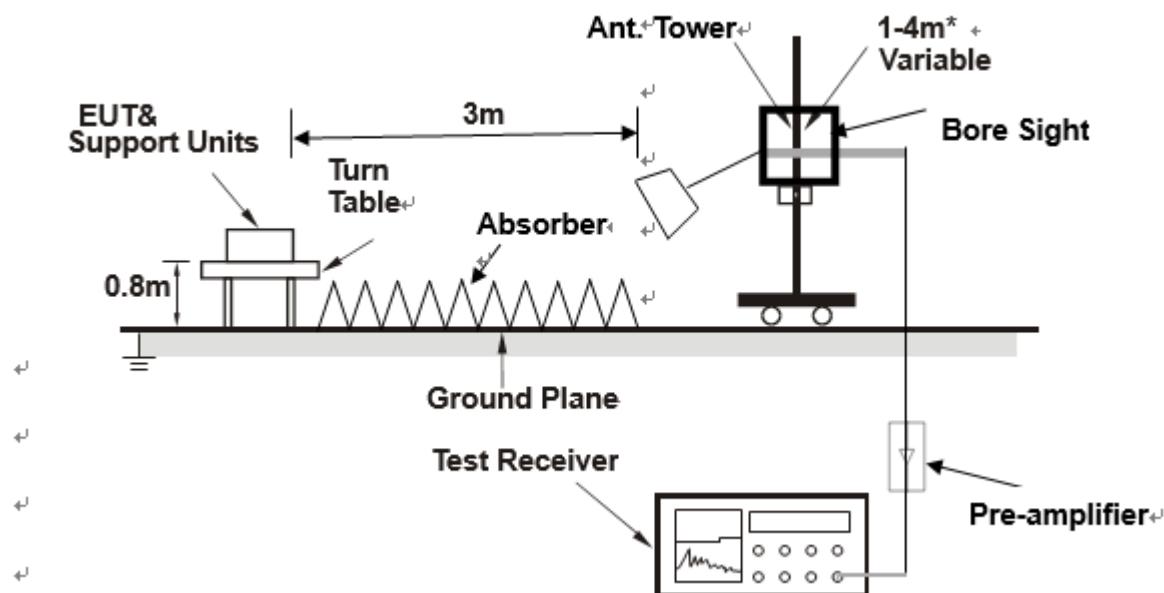
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2.1.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



Note: Above 1G is a directional antenna

depends on the EUT height and the antenna 3dB bandwidth both, refer to section 7.3 of CISPR 16-2-3.

2.1.6 EUT OPERATING CONDITIONS

Same as item 2.1.6.



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2.1.7 TEST RESULTS

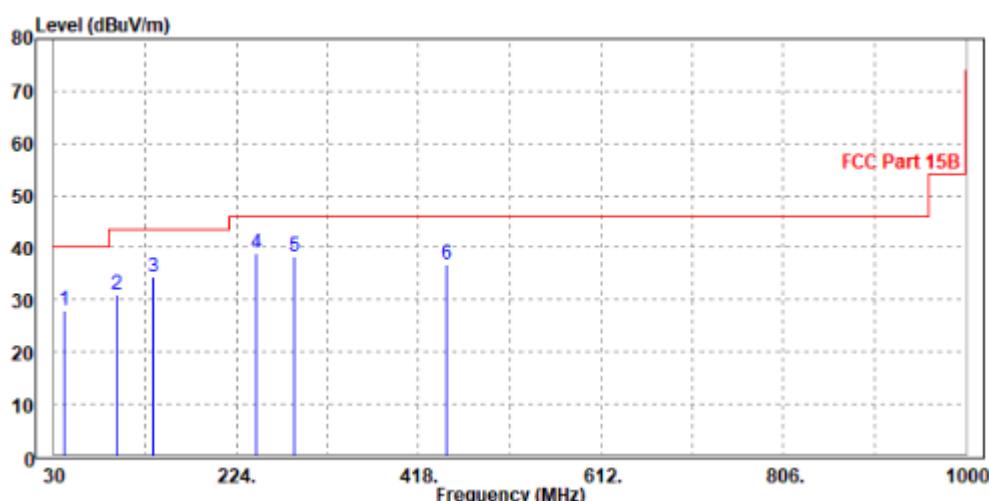
| | | | |
|--------------------------|------------------|--|---------------------|
| TEST VOLTAGE | DC12V | FREQUENCY RANGE | 30-1000 MHz |
| ENVIRONMENTAL CONDITIONS | 23deg. C, 70 %RH | DETECTOR FUNCTION & RESOLUTION BANDWIDTH | Quasi-Peak, 120 kHz |
| TESTED BY | Jace Hu | | |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

| Freq | Level | Read | Limit | Over | Remark | Pol/Phase |
|------|---------|-------|--------|--------------|--------|-------------|
| | | Level | Line | Limit Factor | | |
| MHz | dBuV/m | dBuV | dBuV/m | dB | dB/m | |
| 1 | 40.670 | 28.05 | 52.14 | 40.00 | -11.95 | -24.09 Peak |
| 2 | 95.960 | 31.17 | 57.67 | 43.50 | -12.33 | -26.50 Peak |
| 3 | 135.730 | 34.28 | 61.41 | 43.50 | -9.22 | -27.13 Peak |
| 4 PP | 244.370 | 38.84 | 61.05 | 46.00 | -7.16 | -22.21 Peak |
| 5 | 285.110 | 38.40 | 59.92 | 46.00 | -7.60 | -21.52 Peak |
| 6 | 447.100 | 36.87 | 55.15 | 46.00 | -9.13 | -18.28 Peak |

REMARKS:

1. Emission level(dBuV/m)=Read Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)- Amplifier Gain
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.





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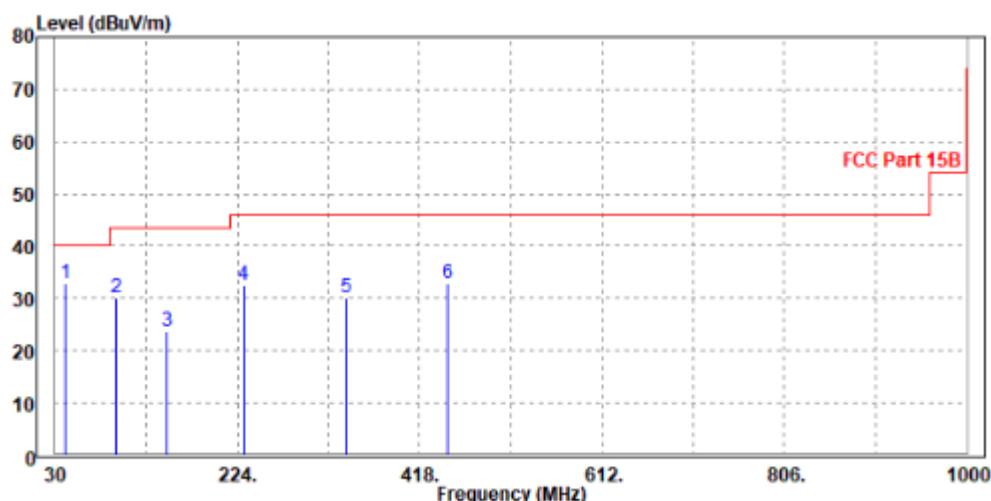
| | | | |
|--------------------------|------------------|--|----------------------|
| TEST VOLTAGE | DC12V | FREQUENCY RANGE | 30-1000 MHz |
| ENVIRONMENTAL CONDITIONS | 23deg. C, 70% RH | DETECTOR FUNCTION & RESOLUTION BANDWIDTH | Quasi-Peak , 120 kHz |
| TESTED BY | Jace Hu | | |

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

| Freq | Level | Read | Limit | Over | Factor | Remark | Pol/Phase |
|------|---------|-------|--------|-------|--------|-------------|-----------|
| | | Level | Line | Limit | | | |
| MHz | dBuV/m | dBuV | dBuV/m | dB | dB/m | | |
| 1 PP | 40.670 | 33.00 | 57.73 | 40.00 | -7.00 | -24.73 Peak | Vertical |
| 2 | 94.990 | 30.06 | 57.57 | 43.50 | -13.44 | -27.51 Peak | Vertical |
| 3 | 149.310 | 23.82 | 49.33 | 43.50 | -19.68 | -25.51 Peak | Vertical |
| 4 | 230.790 | 32.46 | 55.76 | 46.00 | -13.54 | -23.30 Peak | Vertical |
| 5 | 339.430 | 30.01 | 50.45 | 46.00 | -15.99 | -20.44 Peak | Vertical |
| 6 | 447.100 | 32.72 | 51.18 | 46.00 | -13.28 | -18.46 Peak | Vertical |

REMARKS:

1. Emission level(dBuV/m)=Read Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) -Amplifier Gain
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.





3 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications were made to the EUT by the lab during the test.

---END---