

Test Report

Electromagnetic Compatibility (EMC)

HELEM2111000438-5



TESTS ACCORDING TO FCC PART 15 B AND ISED CANADA REQUIREMENTS

| | |
|-----------------------|---|
| Equipment Under Test: | Temperature probe with SRD |
| Model: | Tango XN 1m |
| Manufacturer: | Quanturi Oy Lars Sonckin kaari 10 FI-02600 Espoo FINLAND |
| Customer: | Quanturi Oy Lars Sonckin kaari 10 FI-02600 Espoo FINLAND |
| FCC Rule Part: | FCC CFR 47 Part 15 Subpart B, Class B |
| IC Rule Part: | ICES-003 Issue 7, Class B |

Date: 14 February 2022

Issued by:

A handwritten signature in blue ink, appearing to read "R. Repo".

Rauno Repo
Senior EMC Specialist

Date: 14 February 2022

Checked by:

A handwritten signature in blue ink, appearing to read "Henri Mäki".

Henri Mäki
Testing Engineer

TABLE OF CONTENTS

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| TABLE OF CONTENTS | 2 |
| GENERAL REMARKS | 3 |
| Disclaimer | 3 |
| RELEASE HISTORY | 4 |
| PRODUCT DESCRIPTION | 5 |
| Equipment Under Test (EUT) | 5 |
| General description | 5 |
| Samples and modifications..... | 5 |
| Ports and cables | 5 |
| Peripherals | 5 |
| TEST CONDITION..... | 6 |
| EUT Test Conditions During EMC-Testing..... | 6 |
| Operation modes | 6 |
| Emission Measurement Uncertainty | 6 |
| SUMMARY OF TESTING | 7 |
| EMISSION TESTS..... | 8 |
| Radiated Emissions In The Frequency Range 9 kHz – 10 GHz..... | 8 |
| TEST EQUIPMENT | 15 |

GENERAL REMARKS

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

RELEASE HISTORY

| Version | Changes | Issued |
|---------|-----------------|------------------|
| 1.0 | Initial release | 14 February 2022 |

PRODUCT DESCRIPTION

Equipment Under Test (EUT)

| EUT information | |
|-----------------------------|--|
| General Product Description | Temperature probe with SRD |
| Trademark | Quanturi |
| Model | Tango XN 1m |
| Type | - |
| Serial number | - |
| Power input port type | Internal lithium battery |
| Rated voltage | 3.6 V |
| Rated current | - |
| Rated frequency | - |
| Rated power | - |
| EUT Highest operation freq. | SRD radio 927 MHz |
| Hardware Version (if any) | - |
| Software Version (if any) | - |
| Mechanical size of the EUT | Height: 130 mm Width: 38 mm Length: 1355 mm |
| Parallel models | Tango XN 2m, Tango XN 2m, Tango M 2m, Tango M 3m, Tango M 4m |
| Radio module or chip | ON Semiconductor AX8052F143-D |

The EUT was tested as a tabletop unit.

General description

The Tango M probes are for measuring temperatures at every meter inside stored goods such as grains, loose hay, woodchips, or other fermentable materials. The Tango XN probes are extra robust probes specifically designed for highly corrosive environments, such as those found in the composting industry.

The probe transmits a packet once per hour. If the Base Station and/or repeater are in the receiving range they will proceed the message and reply to the probe.

Samples and modifications

| No. | Name | Description |
|-----|----------|---------------|
| 1 | Sample 1 | Normal sample |

Ports and cables

None.

Peripherals

None.

TEST CONDITION

EUT Test Conditions During EMC-Testing

Configuration of the EUT was made to correspond to the actual assembling conditions as far as possible. The EUT was set to receiver mode.



Figure 1: Test setup block diagram

Operation modes

During the tests the EUT was in the following operation modes:

| Mode | Description |
|------|----------------|
| 1 | EUT in RX mode |

Table 1: Test RX frequencies

| Channel | Frequency (MHz) |
|---------|-----------------|
| Low | 903 |
| Mid | 915 |
| High | 927 |

Emission Measurement Uncertainty

The uncertainties comply with CISPR 16-4-2 ed.2 requirements ($U_{lab} < U_{cispr}$).

Summary of Testing

SUMMARY OF TESTING

| Test Specification | Description of Test | Result |
|--|------------------------------|-------------------------|
| FCC CFR 47 15/B §15.107, ICES-003 3.2.1 | Conducted emissions, Class B | N/A¹⁾ |
| FCC CFR 47 15/B §15.109, ICES 003 3.2.2 | Radiated Emissions, Class B | PASS |

¹⁾ Internal battery-operated device

Decision rule used for the emission tests are defined in standard CISPR 16-4-2 / EN 55016-4-2 clause 4.2

Test Facility

| | |
|--|---|
| Testing Laboratory / address: FCC designation number: FI0002 ISED CAB identifier: T004 | SGS Fimko Ltd Takomotie 8 FI-00380, HELSINKI FINLAND |
| Test Site: | <input type="checkbox"/> K10LAB, ISED Canada registration number: 8708A-1 <input checked="" type="checkbox"/> K5LAB, ISED Canada registration number: 8708A-2 <input type="checkbox"/> T10LAB |

Radiated Emissions In The Frequency Range 9 kHz – 10 GHz

EMISSION TESTS

Radiated Emissions In The Frequency Range 9 kHz – 10 GHz

| | | |
|---------------------------------|----------------------------|-----------------------------------|
| Standard: | ANSI C63.4 (2014) | |
| Tested by: | PKA, RRE | |
| Date: | 24 – 25 November 2021 | |
| Humidity: | 30 – 60 % | |
| Temperature: | 22 ± 3 °C | |
| Barometric pressure: | 860 – 1 060 mbar | |
| Measurement uncertainty: | ± 4.9 dB (30 – 200 MHz) | Level of confidence 95 % (k = 2). |
| | ± 4.1 dB (200 – 1 000 MHz) | |
| | ± 4.3 dB (1 – 18 GHz) | |

FCC Rule: 15.109(a)

ICES-003: 3.2.2

Test plan

The radiated emission measurements were done within a semi anechoic screened chamber. Additional floor absorbers were used on the floor between the EUT and receiving antenna in radiated emission test above 1 GHz. The EUT was placed on a table 0.8 m above the reflecting ground plane. The measurement distance was 3 meters. The worst interferences were determined during measurements by rotating the turntable and adjusting the antenna height. The measurements were done in horizontal and vertical antenna polarizations.

The EUT was working as described in the section “EUT Test Conditions”.

X, Y, Z axes orientations were determined, the worst-case orientation (X) was measured.

Radiated measurement settings

Preliminary testing:

| | |
|-----------------------|-------------------------|
| Turntable movement: | 30 ° step |
| Turntable position: | 0 ° to 330° |
| Antenna movement: | 1.5 m step |
| Antenna height: | 1.0 m to 4.0 m |
| Antenna polarization: | Vertical and horizontal |

Final testing:

| | |
|-----------------------|-------------------------|
| Turntable movement: | Continuous |
| Turntable position: | ± 15 ° |
| Antenna movement: | Continuous |
| Antenna height: | ± 0.75 m |
| Antenna polarization: | Vertical and horizontal |

Radiated Emissions In The Frequency Range 9 kHz – 10 GHz

Measured Quasi-Peak Values In The Frequency Range 9 kHz - 30 MHz

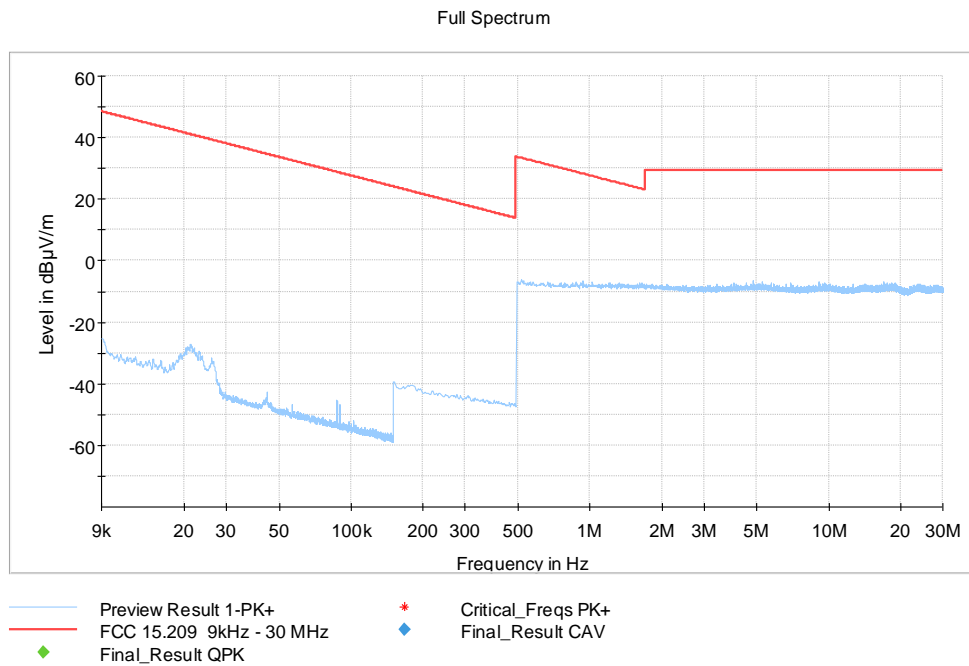


Figure 2: Measured results with peak-detector (Low)

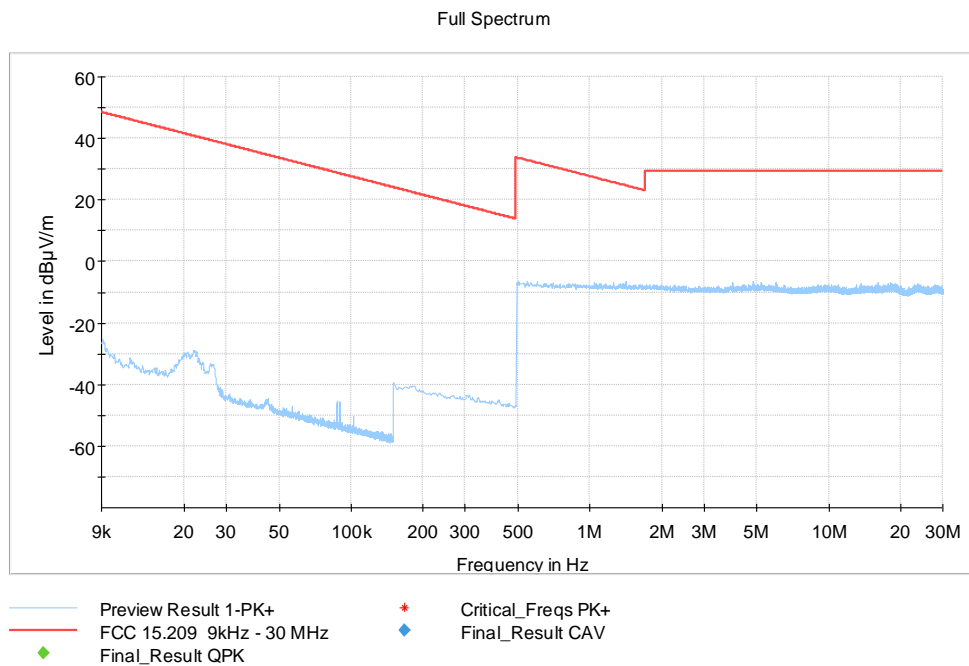


Figure 3: Measured results with peak-detector (Mid)

Radiated Emissions In The Frequency Range 9 kHz – 10 GHz

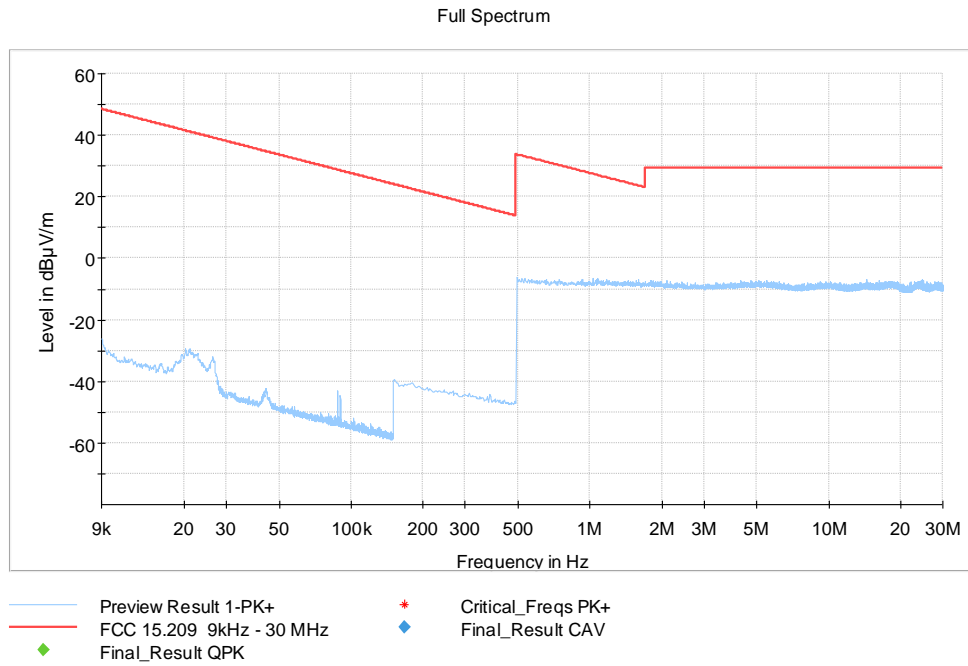


Figure 4: Measured results with peak-detector (High)

No peaks near the limits; no final measurements were performed.

Radiated Emissions In The Frequency Range 9 kHz – 10 GHz

Measured Quasi-Peak Values In The Frequency Range 30 MHz - 1000 MHz

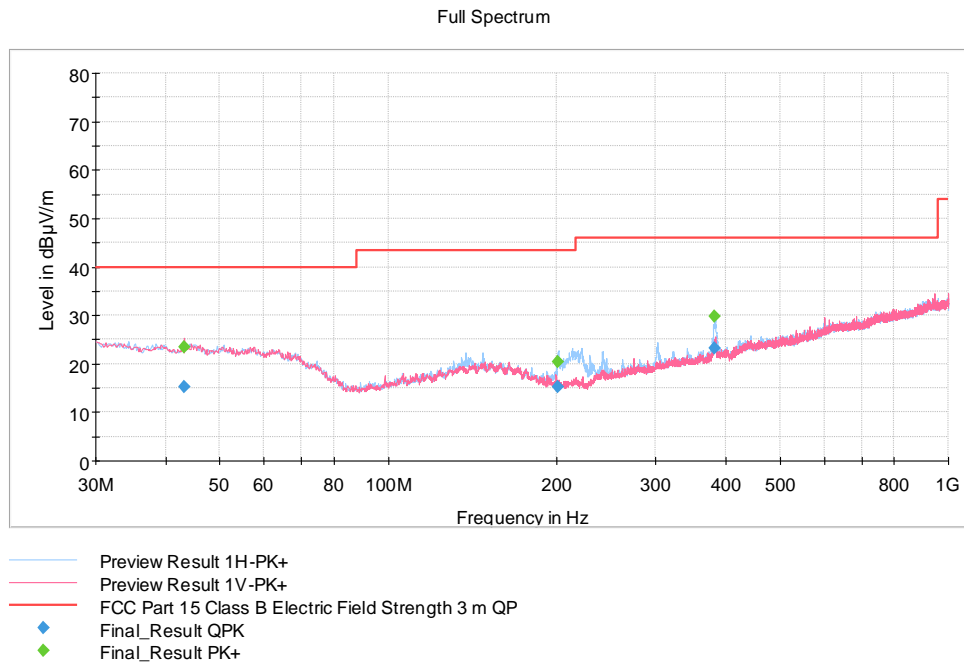


Figure 5: Measured results with peak-detector (Low)

Peak results (green tags) are only for informative purposes

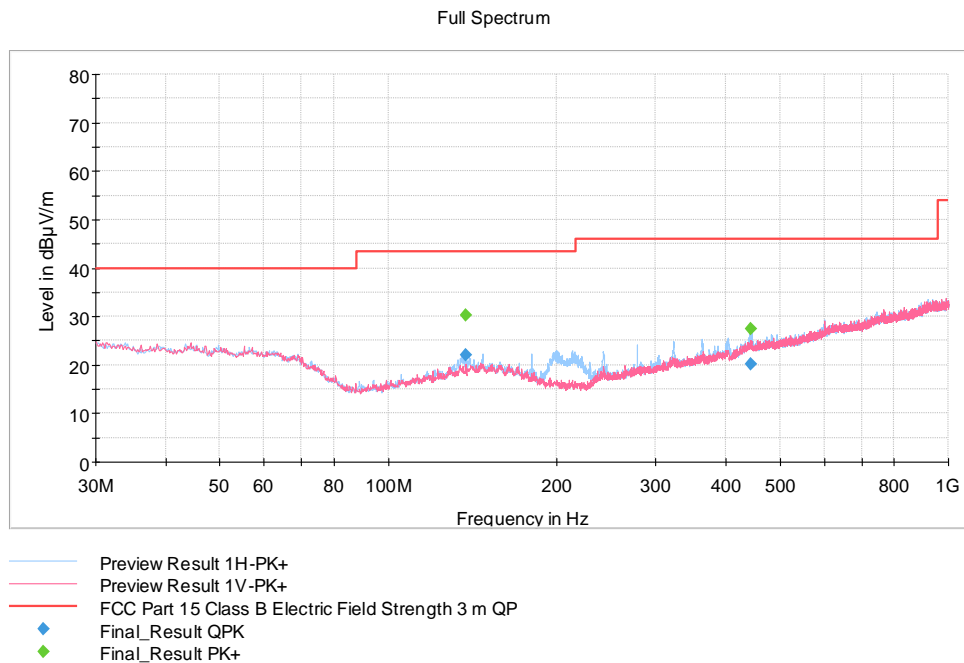


Figure 6: Measured results with peak-detector (Mid)

Peak results (green tags) are only for informative purposes

Radiated Emissions In The Frequency Range 9 kHz – 10 GHz

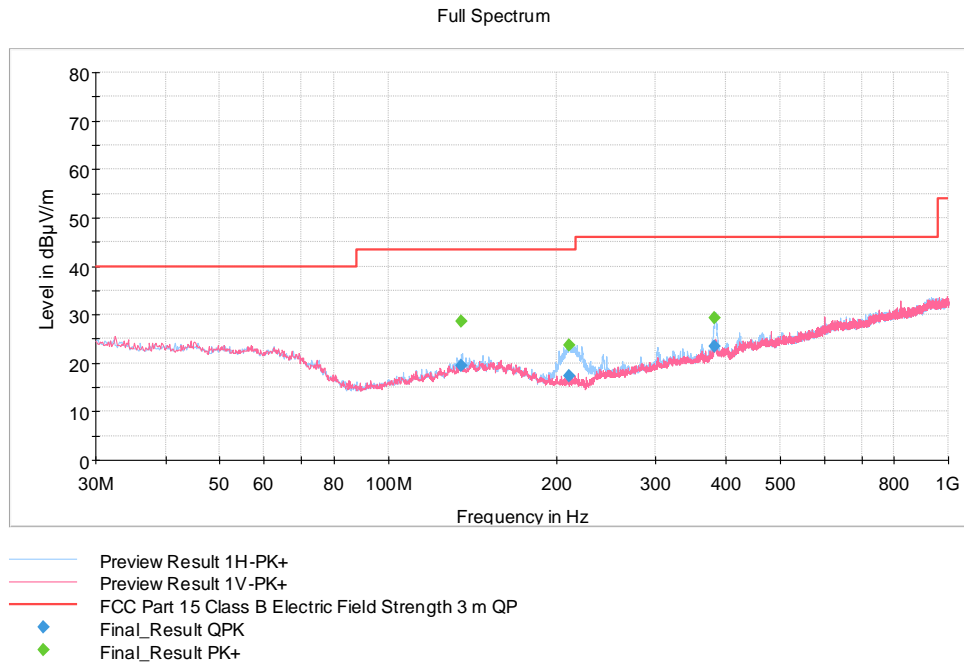


Figure 7: Measured results with peak-detector (High)

Peak results (green tags) are only for informative purposes

Table 2: Final measurement results

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Note |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|------|
| 43.115000 | 15.34 | 40.00 | 24.66 | 15x1000 | 120.000 | 354.0 | V | 219.0 | 17.5 | Low |
| 200.625000 | 15.34 | 43.50 | 28.16 | 15x1000 | 120.000 | 301.0 | H | 320.0 | 15.3 | Low |
| 382.575000 | 23.22 | 46.00 | 22.78 | 15x1000 | 120.000 | 105.0 | H | 303.0 | 21.7 | Low |
| 137.425000 | 22.04 | 43.50 | 21.46 | 15x1000 | 120.000 | 248.0 | H | 345.0 | 17.7 | Mid |
| 444.275000 | 20.27 | 46.00 | 25.73 | 15x1000 | 120.000 | 100.0 | H | 306.0 | 23.5 | Mid |
| 210.395000 | 17.37 | 43.50 | 26.13 | 15x1000 | 120.000 | 126.0 | H | 354.0 | 15.3 | High |
| 382.735000 | 23.38 | 46.00 | 22.62 | 15x1000 | 120.000 | 112.0 | H | 246.0 | 21.7 | High |

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + cables). QuasiPeak values are measured values corrected with the correction factor.

Radiated Emissions In The Frequency Range 9 kHz – 10 GHz

Measured Peak and Average Values In The Frequency Range 1 GHz - 10 GHz

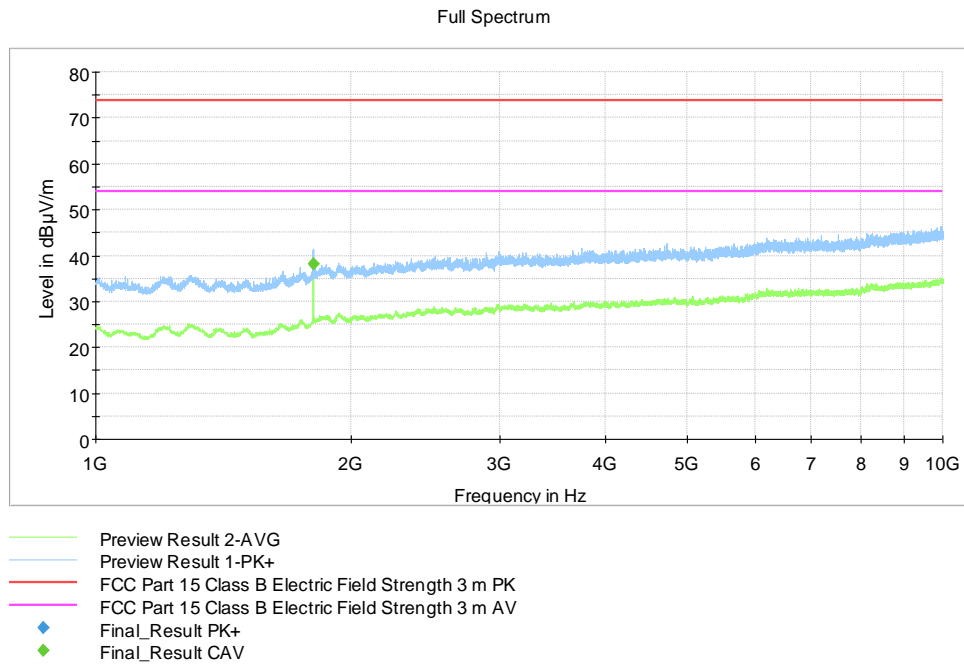


Figure 8: Measured result with peak and average detector (Low)

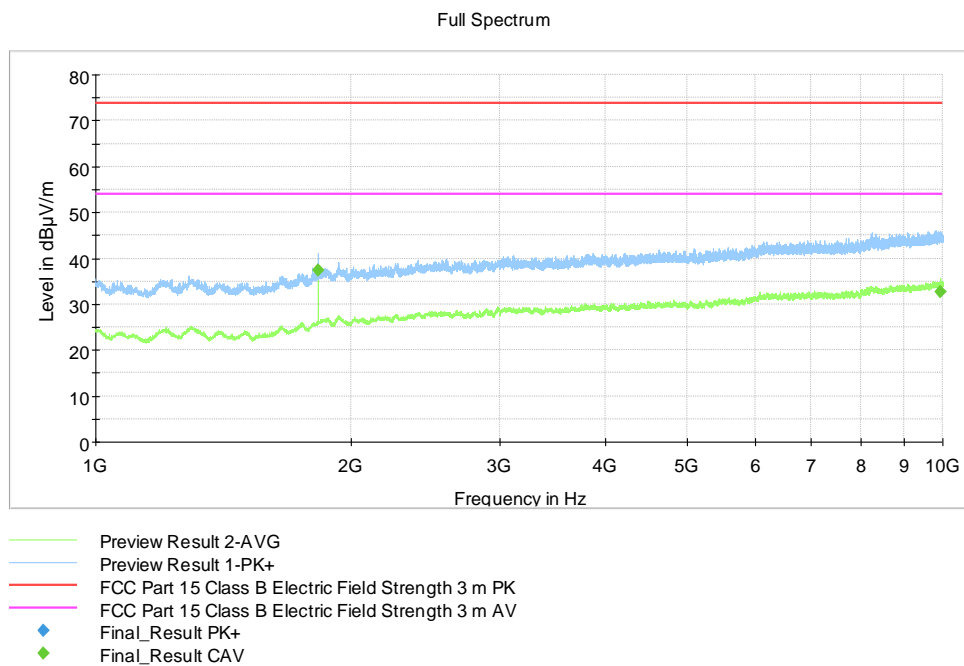


Figure 9: Measured result with peak and average detector (Mid)

Radiated Emissions In The Frequency Range 9 kHz – 10 GHz

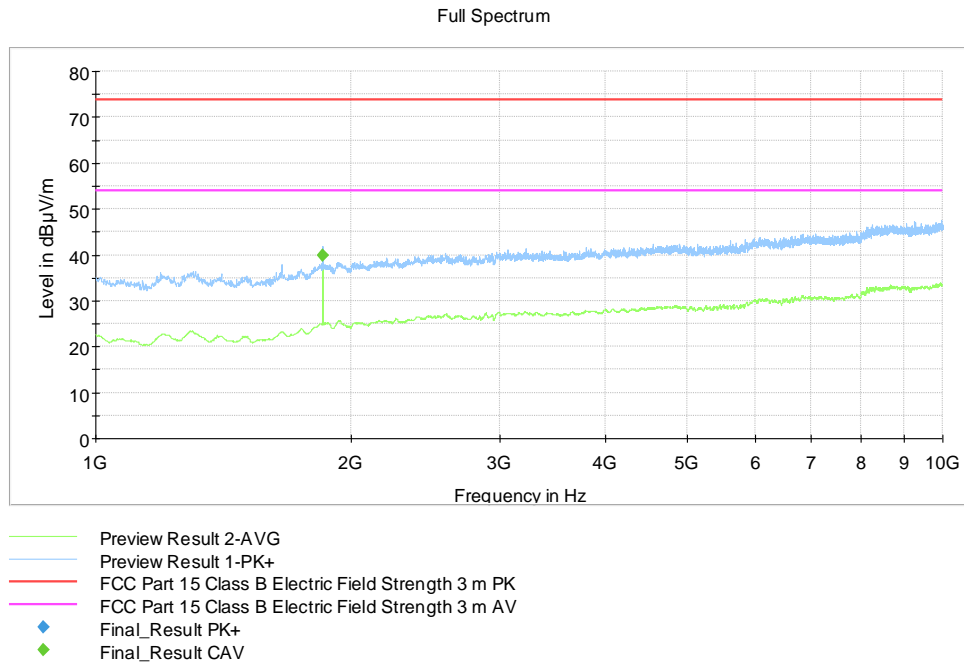


Figure 10: Measured result with peak and average detector (High)

Table 3: Final measurement results

| Frequency (MHz) | MaxPeak (dBμV/m) | Average (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Note |
|-----------------|------------------|------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|------|
| 1805.950000 | --- | 38.22 | 53.90 | 15.68 | 15x1000 | 1000.000 | 100.0 | H | 117.0 | 2.1 | Low |
| 1830.000000 | --- | 37.52 | 53.90 | 16.38 | 15x1000 | 1000.000 | 231.0 | H | 129.0 | 1.7 | Mid |
| 9950.500000 | --- | 32.64 | 53.90 | 21.26 | 15x1000 | 1000.000 | 115.0 | H | 182.0 | 14.4 | Mid |
| 1853.975000 | --- | 39.83 | 53.90 | 14.07 | 15x1000 | 1000.000 | 105.0 | H | 131.0 | 2.1 | High |

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + cables). MaxPeak and Average values are measured values corrected with the correction factor.

TEST EQUIPMENT

RF-Test Equipment

| Equipment | Manufacturer | Type | Inv or serial | Prev Calib | Next Calib |
|------------------------------|-----------------|--------------------|---------------|------------|------------|
| ATTENUATOR | HUBER&SUHNER | 6810.17.B (10dB) | inv:10390 | 2021-01-25 | 2023-01-25 |
| ANTENNA | A.H. SYSTEMS | SAS-200/518 | inv:7873 | NCR | NCR |
| SPECTRUM ANALYZER | AGILENT | E7405A, monitoring | inv:9746 | 2020-02-17 | 2022-02-17 |
| RF PREAMPLIFIER | CIAO | CA118-3123 | inv:10278 | 2021-10-05 | 2022-10-05 |
| TEMPERATURE/ HUMIDITY SENSOR | EDS | OW-ENV-TH, K5 SAC | inv:10517 | 2021-10-22 | 2022-10-22 |
| ANTENNA | EMCO | 3117, emi 1-18GHz | inv:7293 | 2020-03-11 | 2022-03-11 |
| TURNTABLE | MATURO | DS430 UPGRADED | inv:10182 | NCR | NCR |
| MAST & TURNTABLE CONTROLLER | MATURO | NCD | inv:10183 | NCR | NCR |
| ANTENNA MAST | MATURO | TAM 4.0E | inv:10181 | NCR | NCR |
| ATTENUATOR | PASTERNAK | PE 7004-4 (4dB) | inv:10126 | 2021-03-26 | 2022-03-26 |
| TEST SOFTWARE | ROHDE & SCHWARZ | EMC-32 | - | NCR | NCR |
| EMI TEST RECEIVER | ROHDE & SCHWARZ | ESW26 | inv:10679 | 2021-06-21 | 2022-06-21 |
| GPS REFERENCE | PENDELUM | GPS-88 | inv:8032 | NCR | NCR |
| ANTENNA | SCHWARZBECK | VULB 9168 | inv:8911 | 2020-11-04 | 2022-11-04 |

NCR = No calibration required

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