**AT4 wireless, S.A.**
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*www.at4wireless.com* · C.I.F. A29 507 456

ENSAYOS Nº 51/LE147

Informe de ensayo nº:
Test report No:

NIE: 46165REM.003

# Test Report

## FCC Rules and Regulations 47 CFR Chapter I Part 15 Subpart B (10-01-14 Edition) & ANSI C63.4-2009: American National standard for methods of measurements of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9kHz to 40GHz.

| | |
|---|---|
| **Identification of item tested.....:** | POLAR M450<br>CYCLING COMPUTER |
| **Trade .....:** | Polar |
| **Model and /or type reference .....:** | 1F |
| **Versión final del HW .....:**<br>Final HW version | 00755840.01 |
| **Versión final del SW .....:**<br>Final SW version | 0.12.8 |
| **FCC ID .....:** | INW1F |
| **IC .....:** | 6248A-1F |
| **Features.....:** | Bluetooth Low Energy, GPS |
| **Manufacturer.....:** | POLAR ELECTRO OY<br>Professorintie 5, 90440 Kempele. Finland. |
| **Test method requested, standard.....:** | FCC Rules and Regulations 47 CFR Chapter I Part 15 Subpart B (10-01-14 Edition) & ANSI C63.4-2009 |
| **Summary.....:** | IN COMPLIANCE |
| **Approved by (name / position & signature).....:** | Rafael López Martín<br>LAB EMC Manager<br>Firmado digitalmente por Rafael López Martín<br>Fecha: 2015.06.03 15:56:05 +02'00' |
| **Date of issue.....:** | 2015-05-25 |
| **Report template No.....:** | FDT08_16 |

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# Competences and guarantees

AT4 wireless is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance program for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.



# General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

# Uncertainty

Uncertainty (factor k=2) was calculated according to the AT4 wireless internal document PODT000.

# Usage of samples

Samples under test have been selected by: the Client.

Sample S/01 is composed of the next elements:

| Control Nº | Description | Model | Serial number | Reception date |
|---|---|---|---|---|
| 46165/001 | POLAR M450<br>Cycling Computer | M450, model 1F | F5151F0500286 | 2015-05-06 |

# Test sample description

The samples consist of a POLAR M450 cycling computer.

# Identification of the client

POLAR ELECTRO OY
Professorintie 5, 90440. Kempele. Finland.

# Testing period

The performed test started on 2015-05-04 and finished on 2015-05-07.
The tests have been performed at AT4 wireless.

# Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

| | |
|---|---|
| **Temperature** | Min. = 15 ºC<br>Max. = 35 ºC |
| **Relative humidity** | Min. = 20 %<br>Max. = 80 % |
| **Shielding effectiveness** | > 100 dB |
| **Electric insulation** | > 10 kΩ |
| **Reference resistance to earth** | < 1 Ω |

In the semianechoic chamber, the following limits were not exceeded during the test.

| | |
|---|---|
| **Temperature** | Min. = 15 ºC<br>Max. = 30 ºC |
| **Relative humidity** | Min. = 45 %<br>Max. = 60 % |
| **Air pressure** | Min. = 860 mbar<br>Max. = 1060 mbar |
| **Shielding effectiveness** | > 100 dB |
| **Electric insulation** | > 10 kΩ |
| **Reference resistance to earth** | < 1 Ω |
| **Normal site attenuation (NSA)** | < ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz) |
| **Site VSWR** | < ±6 dB at 3m distance between item under test and receiver antenna, (1 GHz to 18 GHz) |
| **Field homogeneity** | More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 18 GHz). |

In the chamber for conducted measurements, the following limits were not exceeded during the test:

| | |
|---|---|
| **Temperature** | Min. = 15 ºC<br>Max. = 30 ºC |
| **Relative humidity** | Min. = 45 %<br>Max. = 60 % |
| **Air pressure** | Min. = 860 mbar<br>Max. = 1060 mbar |
| **Shielding effectiveness** | > 100 dB |
| **Electric insulation** | > 10 kΩ |
| **Reference resistance to earth** | < 1 Ω |

# Remarks and comments

The test has been performed by the technical personnel: Mario Alberto Ureña.

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 150 kHz to 30 MHz is I = ± 3,60 dB for quasi-peak measurements, I = ± 3,48 dB for peak measurements (k = 2).

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 30 MHz to 1 GHz is I = ± 4,57 dB for quasi-peak measurements, I = ± 4,48 dB for peak measurements (k = 2) and from 1 to 12,75 GHz is I = ± 3,43 dB for average and peak measurements.

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 12,75 GHz to 26 GHz is I = ± 4,09 dB for average and peak measurements.

# Testing verdicts (Legend)

| | |
|---|---|
| **Not applicable ..... :** | N/A |
| **Pass ..... :** | P |
| **Fail ..... :** | F |
| **Not measured ..... :** | N/M |

| List of equipment used during the test | | | | | |
|---|---|---|---|---|---|
| **CONTROL NUMBER** | **DESCRIPTION** | **MANUFACTURER** | **MODEL** | **LAST CALIBRATION** | **NEXT CALIBRATION** |
| 4523 | EMI Receptor | ROHDE & SCHWARZ | ESU 26 | 2013-08-27 | 2015-08-27 |
| 1935 | EMI Receptor | ROHDE & SCHWARZ | ESPI 3 | 2013-12-11 | 2015-12-11 |
| 2932 | Bilog Hybrid Antenna | SUNOL | JB6 | 2014-05-11 | 2017-05-11 |
| 4656 | Horn Antenna | SCHWARZBECK | BBHA 9170 | 2014-03-28 | 2017-03-28 |
| 1658 | RF Amplifier | SCHAFFNER | CPA9231A | 2013-06-11 | 2015-06-11 |
| 1975 | RF Amplifier | MITEQ | JS4 | 2014-05-22 | 2016-05-22 |
| 3783 | RF Amplifier | BONN ELEKTRONIK | BLMA 0118-3A | 2013-04-23 | 2015-05-19 |
| 0258 | Transient Limiter | HP | 119471A | 2014-10-02 | 2016-10-02 |
| 1650 | Artificial Network | SCHWARZBECK | NNLK - 8121 | 2013-06-25 | 2015-06-25 |

# **Appendix A –** Test result

## CONTENT

# DESCRIPTION OF THE OPERATION MODES

The operation modes used by the samples to which the present report refers, are shown in the following table:

| OPERATION MODE | DESCRIPTION |
|---|---|
| OM#01 | EUT ON. Charging batteries. Powered by USB. Bluetooth Idle (No paired with devices). Receiving GPS signal. |
| OM#02 | EUT ON. Charging batteries. Powered by USB. Bluetooth in transmission mode (Paired with H6 device). Receiving GPS signal. |

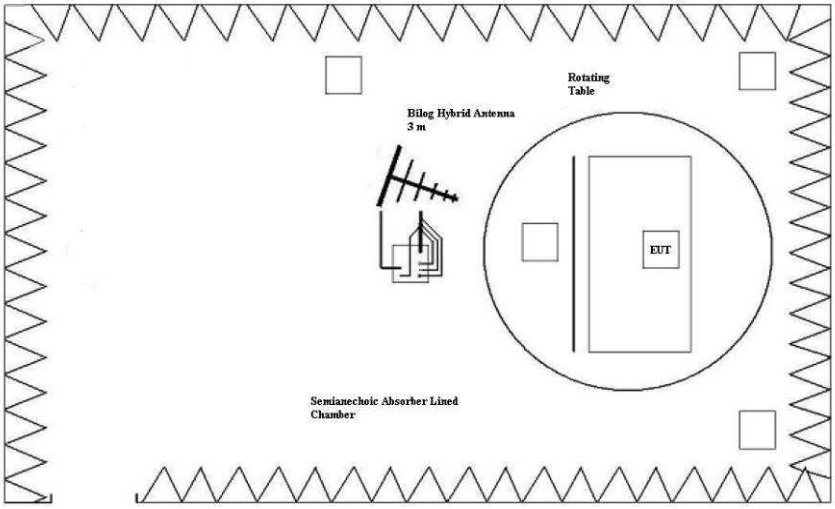
## RADIATED EMISSION. ELECTROMAGNETIC FIELD MEASURE.

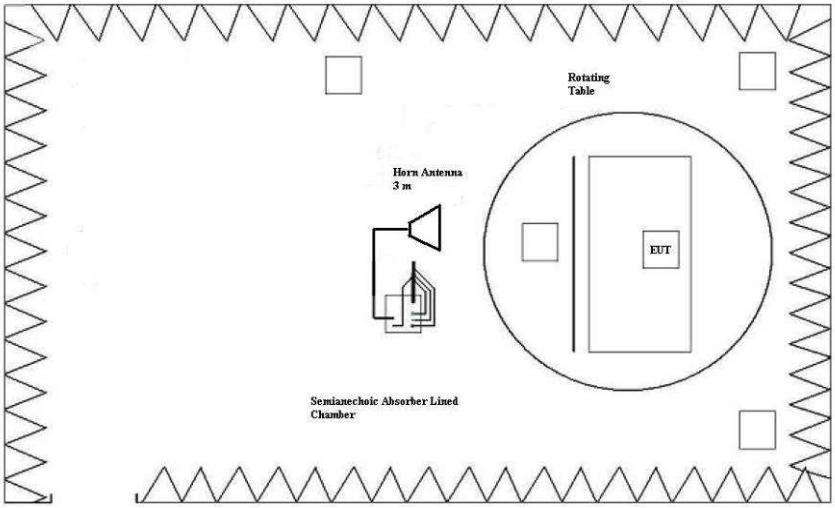
| | | |
|---|---|---|
| **LIMITS:** | Product standard: | FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-14 Edition) & ANSI C63.4-2009 |
| | Test standard: | FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-14 Edition) & ANSI C63.4-2009 |

**LIMITS OF INTERFERENCE CLASS B:**

The applied limit for radiated emissions, 3 m distance, according with the requirements of FCC Rules and Regulations 47 CFR Part 15.109, Subpart B (10-01-14 Edition) & ANSI C63.4-2009 in the frequency range 30 MHz to 26 GHz, for Class B equipment, which is a transmitter in a band over 500 MHz, was:

| Frequency range (MHz) | QP Limit for 3 m (µV/m) | QP Limit for 3 m (dBµV/m) |
|---|---|---|
| 30 to 88 | 100 | 40 |
| 88 to 216 | 150 | 43,52 |
| 216 to 960 | 200 | 46,02 |
| Above 960 | 500 | 53,98 |
| Above 1000 | Limit for 3m AVG | Limit for 3m PK |
| | 53.98 dBµV/m | 73.98 dBµV/m |



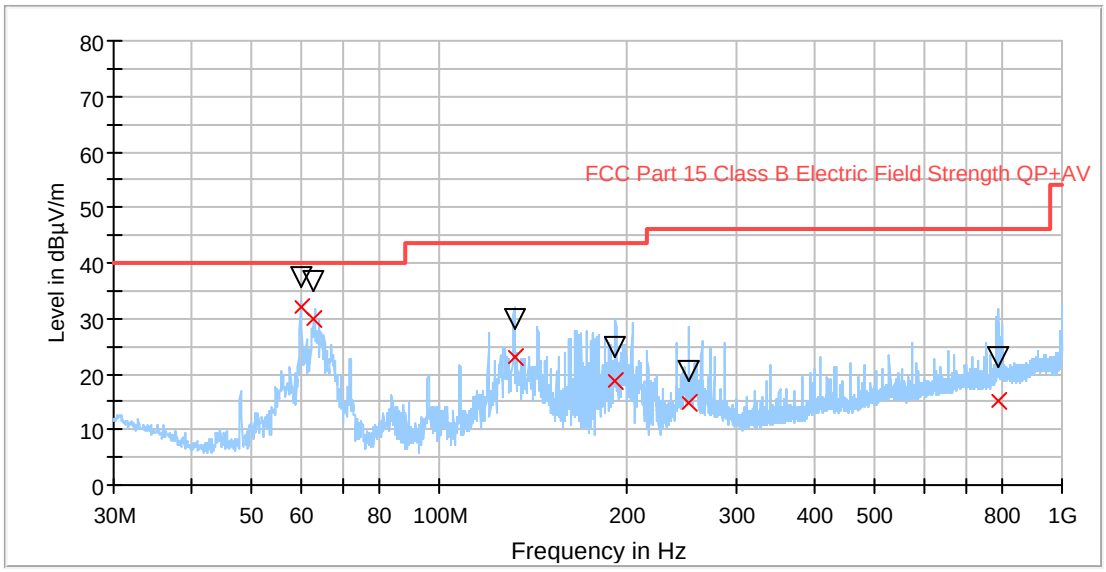
| | |
|---|---|
| **TESTED SAMPLES:** | S/01 |
| **TESTED OPERATION MODES:** | OM#01 |
| **TEST RESULTS :** | CRmmnn: CR, Condición de Radiación; mm: Sample number; nn: Operation mode; rr: Measured range; PP: Antenna polarization. |

| CRmmnnrrpp | Description | Result |
|---|---|---|
| CR0101 | Range: 30MHz o 1GHz. | P |
| CR0101_RA1_PH | Range: 1GHz o 18GHz. Horizontal polarization. | P |
| CR0101_RA1_PV | Range: 1GHz o 18GHz. Vertical polarization. | P |
| CR0101_RA2_PH | Range: 18GHz o 26GHz. Horizontal polarization. | P |
| CR0101_RA2_PV | Range: 18GHz o 26GHz. Vertical polarization. | P |

**Radiated Emission: CR0101**

| | |
|---|---|
| Project: | 46165REM.002 |
| Company: | POLAR ELECTRO OY |
| Sample: | S/01 |
| Operation mode: | OM#01 |
| Description: | EUT ON. Charging batteries. Powered by USB. Bluetooth Idle (No paired with devices). Receiving GPS signal. |

Full Spectrum




Peak Preview
FCC Part 15 Class B Electric Field Strength QP+AV
QuasiPeak
MaxPeak

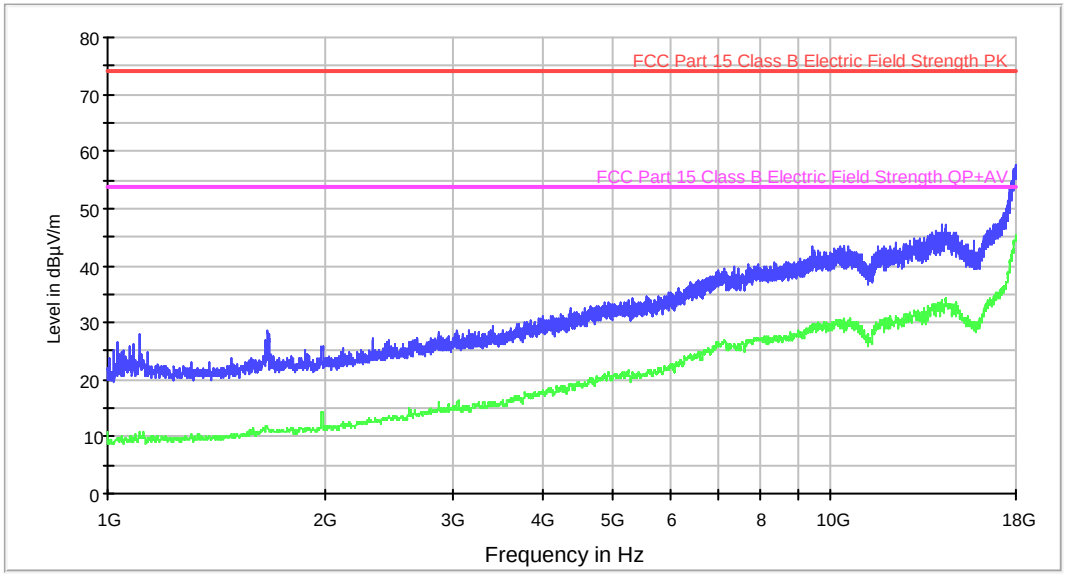
# Final_Result

| Frequency (MHz) | QuasiPeak (dBµV/m) | MaxPeak (dBµV/m) | Height (cm) | Pol | Azimuth (deg) |
|---|---|---|---|---|---|
| 59.889610 | --- | 37.54 | 364.0 | H | 219.0 |
| 59.889610 | 32.09 | --- | 364.0 | H | 219.0 |
| 62.957143 | --- | 36.93 | 337.0 | H | 222.0 |
| 62.957143 | 29.88 | --- | 337.0 | H | 222.0 |
| 132.315584 | 22.97 | --- | 238.0 | H | 259.0 |
| 132.315584 | --- | 29.89 | 238.0 | H | 259.0 |
| 191.935065 | --- | 24.71 | 124.0 | H | 243.0 |
| 191.935065 | 18.60 | --- | 124.0 | H | 243.0 |
| 251.720779 | --- | 20.60 | 131.0 | H | 184.0 |
| 251.720779 | 14.81 | --- | 131.0 | H | 184.0 |
| 789.214286 | 15.16 | --- | 112.0 | V | 55.0 |
| 789.214286 | --- | 23.06 | 112.0 | V | 55.0 |

**Radiated Emission: CR0101RA1_PH**

| | |
|---|---|
| Project: | 46165REM.002 |
| Company: | POLAR |
| Sample: | S/01 |
| Operation mode: | OM#01 |
| Description: | EUT ON. Charging batteries. Powered by USB. Bluetooth Idle (No paired with devices). Receiving GPS signal. |

## ER EMI FCC 15 Class B AMP_4659 (1-18GHz)




Peak Scan
FCC Part 15 Class B Electric Field Strength PK
Average Scan
FCC Part 15 Class B Electric Field Strength QP+AV

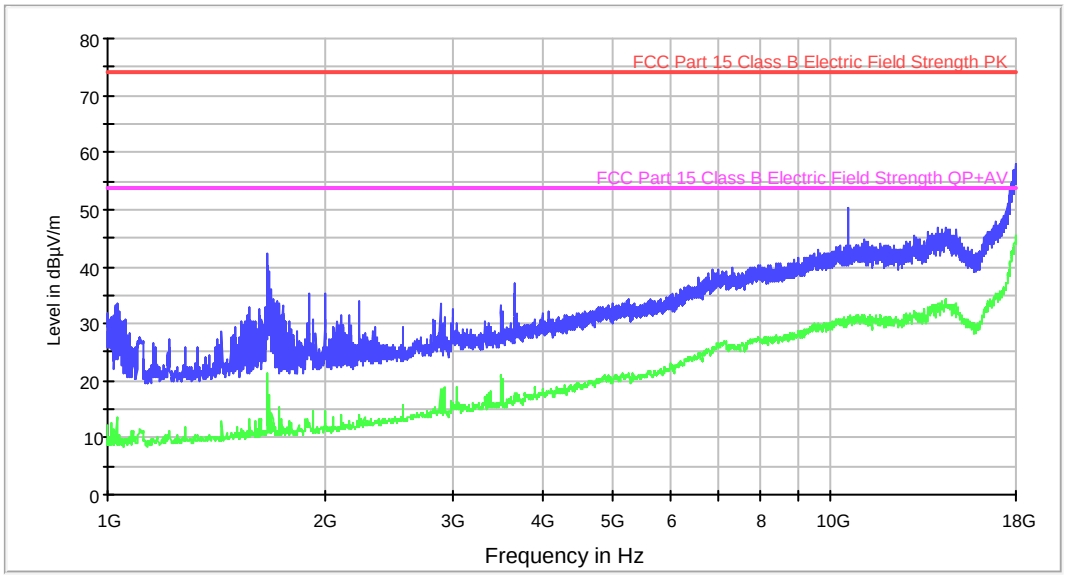
## Subrange Maxima

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV/m) | Average-ClearWrite (dBµV/m) | Polarization |
|---|---|---|---|
| 1107.000000 | 27.8 | 10.7 | H |
| 1667.000000 | 28.5 | 11.5 | H |
| 2326.000000 | 27.1 | 12.6 | H |
| 3049.000000 | 28.7 | 16.1 | H |
| 4227.000000 | 31.4 | 18.6 | H |
| 5557.000000 | 34.4 | 21.0 | H |
| 7362.000000 | 39.7 | 25.8 | H |
| 9403.000000 | 43.2 | 28.8 | H |
| 13271.000000 | 44.7 | 30.7 | H |
| 17978.000000 | 57.8 | 45.2 | H |

**Radiated Emission: CR0101RA1_PV**

| | |
|---|---|
| Project: | 46165REM.002 |
| Company: | POLAR |
| Sample: | S/01 |
| Operation mode: | OM#01 |
| Description: | EUT ON. Charging batteries. Powered by USB. Bluetooth Idle (No paired with devices). Receiving GPS signal. |

# ER EMI FCC 15 Class B AMP_4659 (1-18GHz)




Peak Scan
FCC Part 15 Class B Electric Field Strength PK
Average Scan
FCC Part 15 Class B Electric Field Strength QP+AV

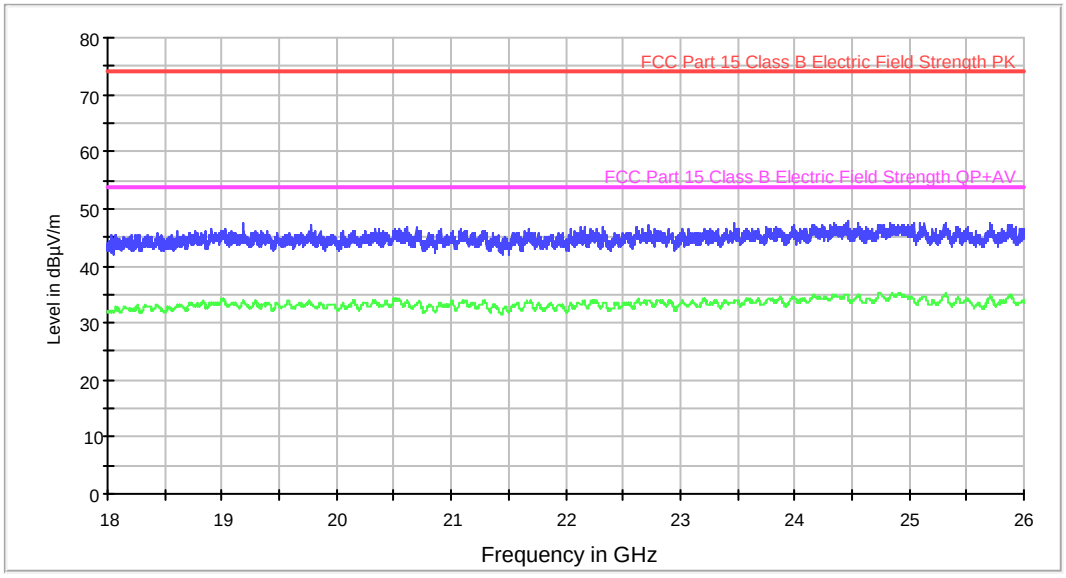
# Subrange Maxima

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV/m) | Average-ClearWrite (dBµV/m) | Polarization |
|---|---|---|---|
| 1031.000000 | 33.5 | 9.9 | V |
| 1659.000000 | 42.4 | 15.5 | V |
| 1903.000000 | 35.2 | 12.6 | V |
| 2880.000000 | 33.4 | 18.4 | V |
| 3664.000000 | 37.0 | 17.7 | V |
| 5247.000000 | 34.2 | 21.3 | V |
| 7313.000000 | 39.8 | 25.9 | V |
| 9572.000000 | 43.1 | 30.1 | V |
| 10531.000000 | 50.3 | 31.0 | V |
| 17992.000000 | 57.9 | 45.2 | V |

**Radiated Emission: CR0101RA2_PH**

| | |
|---|---|
| Project: | 46165REM.002 |
| Company: | POLAR |
| Sample: | S/01 |
| Operation mode: | OM#01 |
| Description: | EUT ON. Charging batteries. Powered by USB. Bluetooth Idle (No paired with devices). Receiving GPS signal. |

# ER EMI FCC 15 Class B AMP_4729 (18-26GHz)



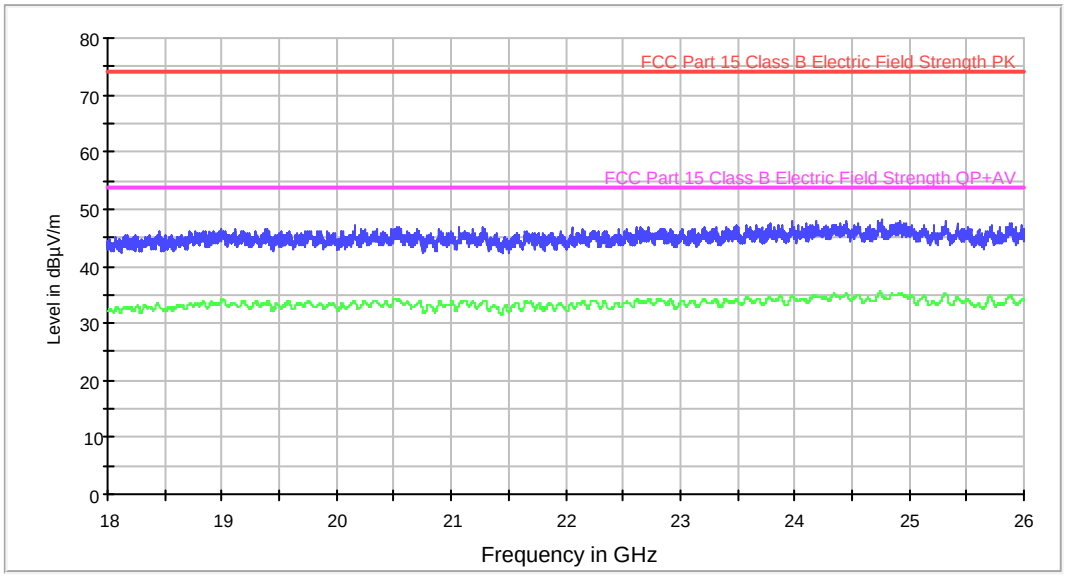

# Subrange Maxima

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV/m) | Average-ClearWrite (dBµV/m) | Polarization |
|---|---|---|---|
| 18617.000000 | 46.0 | 32.9 | H |
| 19182.000000 | 47.6 | 33.6 | H |
| 19782.000000 | 47.1 | 33.4 | H |
| 20622.000000 | 46.8 | 33.7 | H |
| 21089.000000 | 46.6 | 33.5 | H |
| 22158.000000 | 46.9 | 33.7 | H |
| 22726.000000 | 47.2 | 34.0 | H |
| 23476.000000 | 47.6 | 33.8 | H |
| 24459.000000 | 47.9 | 34.8 | H |
| 25322.000000 | 47.6 | 35.0 | H |

**Radiated Emission: CR0101RA2_PV**

| | |
|---|---|
| Project: | 46165REM.002 |
| Company: | POLAR |
| Sample: | S/01 |
| Operation mode: | OM#01 |
| Description: | EUT ON. Charging batteries. Powered by USB. Bluetooth Idle (No paired with devices). Receiving GPS signal. |

## ER EMI FCC 15 Class B AMP_4729 (18-26GHz)




Peak Scan
FCC Part 15 Class B Electric Field Strength PK
Average Scan
FCC Part 15 Class B Electric Field Strength QP+AV

## Subrange Maxima

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV/m) | Average-ClearWrite (dBµV/m) | Polarization |
|---|---|---|---|
| 18455.000000 | 46.0 | 33.0 | V |
| 19119.000000 | 46.5 | 33.3 | V |
| 19384.000000 | 46.6 | 33.2 | V |
| 20155.000000 | 47.2 | 33.9 | V |
| 21284.000000 | 46.9 | 33.9 | V |
| 22053.000000 | 46.7 | 33.4 | V |
| 22614.000000 | 46.9 | 33.9 | V |
| 23982.000000 | 47.7 | 34.8 | V |
| 24754.000000 | 48.3 | 35.3 | V |
| 25322.000000 | 47.7 | 35.1 | V |

## CONTINUOUS CONDUCTED EMISSION ON POWER LEADS

| | | |
|---|---|---|
| **LIMITS:** | Product standard : | FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-14 Edition) & ANSI C63.4-2009 |
| | Test standard : | FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-14 Edition) & ANSI C63.4-2009 |

**CLASS B**

The applied limit for continuous conducted emissions in power leads, according with the requirements of FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-14 Edition) & ANSI C63.4-2009, in the frequency range 0,15 to 30 MHz, for Class B equipment was:

| **Frequency range (MHz)** | **Limit (dBµV)** | |
|---|---|---|
| | **Quasi-peak** | **Average** |
| 0,15 to 0,5 | 66-56 | 56-46 |
| 0,5 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

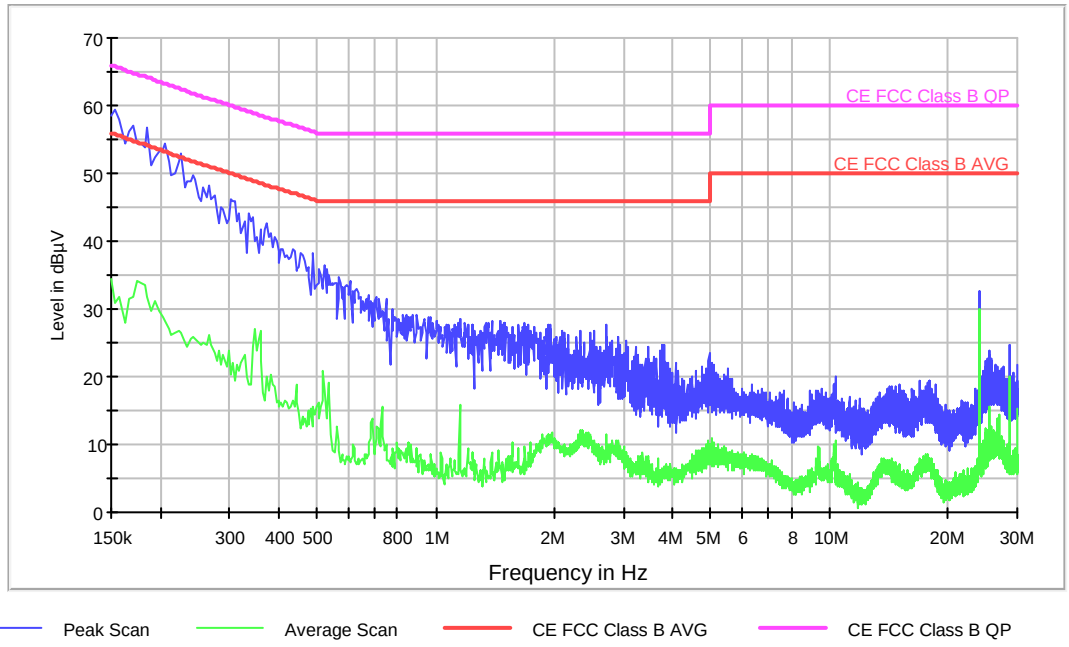
| | |
|---|---|
| **TESTED SAMPLES:** | S/01 |
| **TESTED OPERATION MODES:** | OM#01 & 02 |
| **TEST RESULTS :** | CCmmnnhh: CC, Conducted Condition; mm: Sample number; nn: Operation mode; hh: wire |

| **CCmmnnhh** | **Description** | **Result** |
|---|---|---|
| CC01010N | Neutral wire noise | P |
| CC0101L1 | Phase wire noise | P |
| CC01020N | Neutral wire noise | P |
| CC0102L1 | Phase wire noise | P |

| **Continuous Conducted Emission : CC01010N** | **Detector : Peak / Average / Cuasi-peak** |
|---|---|

Project: 46165REM.002
Company: POLAR
Sample: S/01
Operation mode: OM#01
Description: EUT ON. Charging batteries. Powered by USB. Bluetooth Idle (No paired with devices). Receiving GPS signal. Neutral wire noise.

## EC FCC Class B ESPI CC



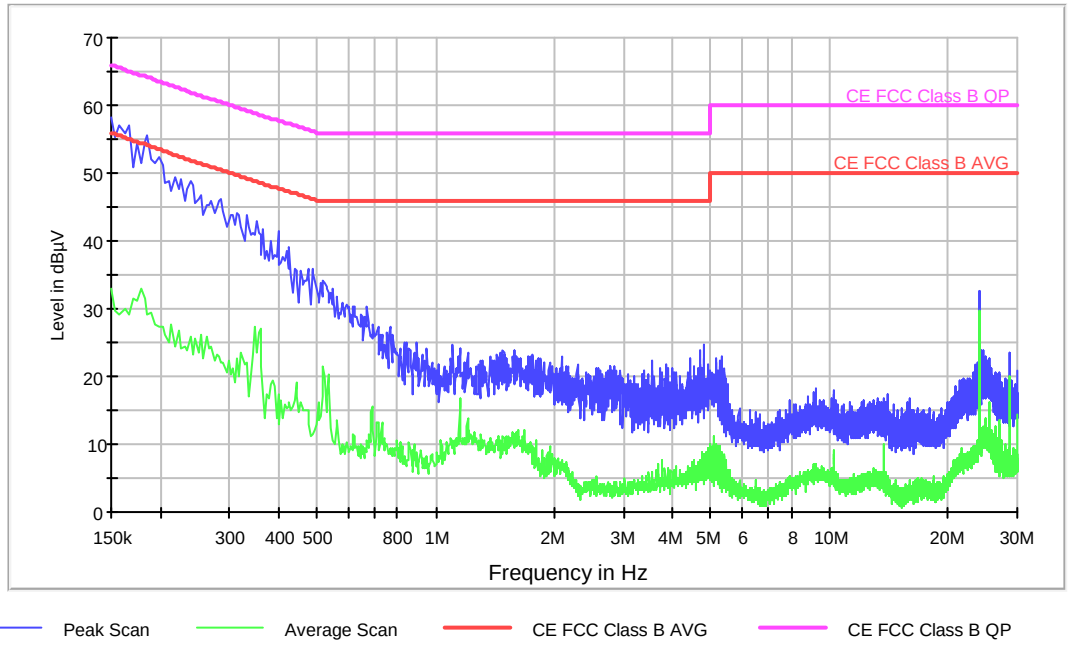

## Subrange Maxima

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV) | Average-ClearWrite (dBµV) |
|---|---|---|
| 0.154000 | 59.4 | 30.8 |
| 0.266000 | 48.1 | 26.1 |
| 0.434000 | 39.0 | 16.6 |
| 0.750000 | 31.4 | 9.9 |
| 1.462000 | 28.2 | 6.4 |
| 2.722000 | 27.6 | 11.4 |
| 3.810000 | 24.7 | 6.3 |
| 10.338000 | 20.1 | 9.6 |
| 16.958000 | 19.3 | 6.7 |
| 24.002000 | 32.7 | 29.9 |

| **Continuous Conducted Emission : CC0101L1** | **Detector : Peak / Average / Cuasi-peak** |
|---|---|

Project: 46165REM.002
Company: POLAR
Sample: S/01
Operation mode: OM#01
Description: EUT ON. Charging batteries. Powered by USB. Bluetooth Idle (No paired with devices). Receiving GPS signal. Phase wire noise.

## EC FCC Class B ESPI CC



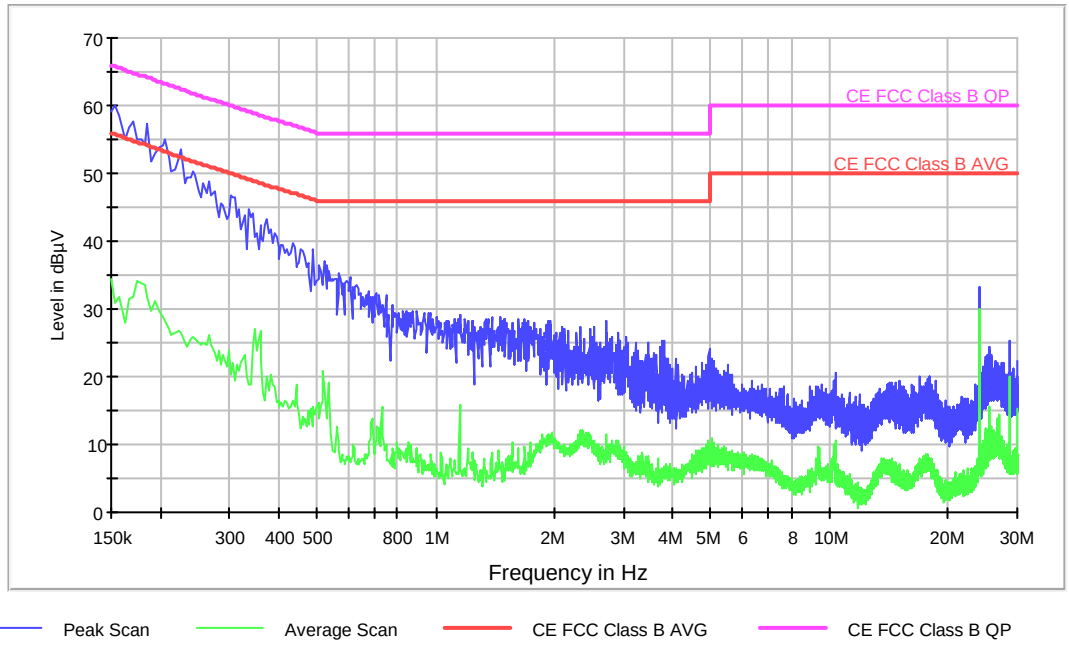

## Subrange Maxima

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV) | Average-ClearWrite (dBµV) |
|---|---|---|
| 0.150000 | 58.1 | 33.1 |
| 0.286000 | 46.3 | 22.2 |
| 0.486000 | 35.9 | 11.6 |
| 0.766000 | 27.3 | 9.4 |
| 1.486000 | 23.9 | 11.1 |
| 3.542000 | 22.3 | 4.4 |
| 4.782000 | 24.7 | 5.4 |
| 9.226000 | 18.3 | 6.4 |
| 14.082000 | 17.3 | 5.0 |
| 24.002000 | 32.7 | 29.6 |

| **Continuous Conducted Emission : CC01020N** | **Detector : Peak / Average / Cuasi-peak** |
|---|---|

Project: 46165REM.002
Company: POLAR
Sample: S/01
Operation mode: OM#02
Description: EUT ON. Charging batteries. Powered by USB. Bluetooth in transmission mode (Paired with H6 device). Receiving GPS signal. Neutral wire noise.

## EC FCC Class B ESPI CC



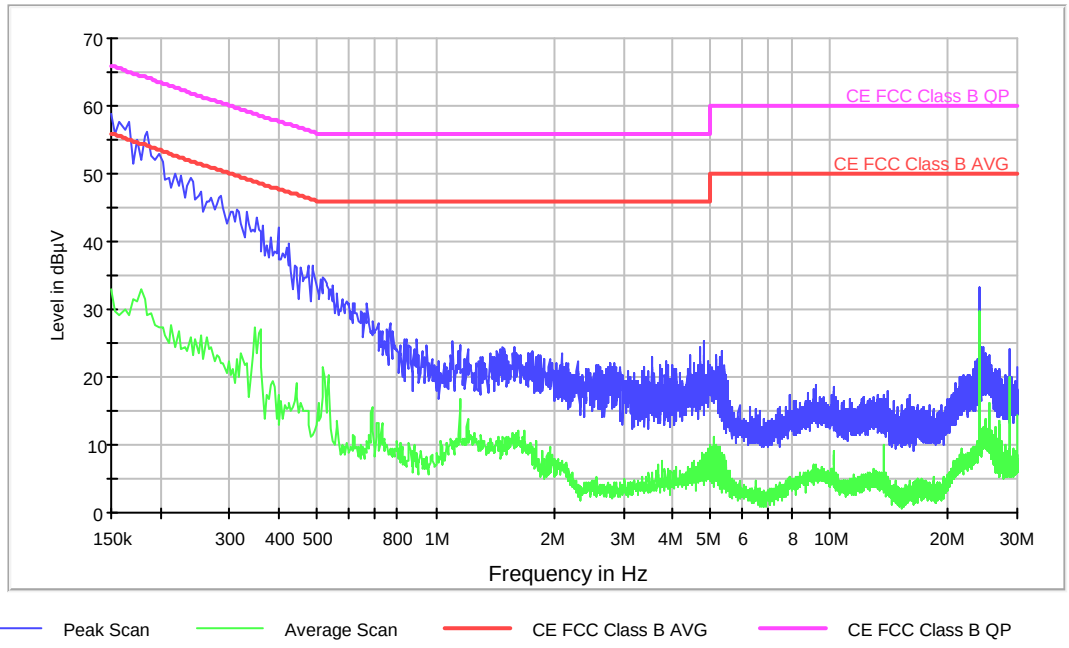

## Subrange Maxima

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV) | Average-ClearWrite (dBµV) |
|---|---|---|
| 0.154000 | 60.0 | 30.8 |
| 0.266000 | 48.7 | 26.1 |
| 0.434000 | 39.6 | 16.6 |
| 0.750000 | 32.0 | 9.9 |
| 1.462000 | 28.8 | 6.4 |
| 2.722000 | 28.2 | 11.4 |
| 3.810000 | 25.3 | 6.3 |
| 10.338000 | 20.7 | 9.6 |
| 16.958000 | 19.9 | 6.7 |
| 24.002000 | 33.3 | 29.9 |

| **Continuous Conducted Emission : CC0102L1** | **Detector : Peak / Average / Cuasi-peak** |
|---|---|

Project: 46165REM.002
Company: POLAR
Sample: S/01
Operation mode: OM#02
Description: EUT ON. Charging batteries. Powered by USB. Bluetooth in transmission mode (Paired with H6 device). Receiving GPS signal. Phase wire noise.

## EC FCC Class B ESPI CC




## Subrange Maxima

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV) | Average-ClearWrite (dBµV) |
|---|---|---|
| 0.150000 | 58.7 | 33.1 |
| 0.286000 | 46.9 | 22.2 |
| 0.486000 | 36.5 | 11.6 |
| 0.766000 | 27.9 | 9.4 |
| 1.486000 | 24.5 | 11.1 |
| 3.542000 | 22.9 | 4.4 |
| 4.782000 | 25.3 | 5.4 |
| 9.226000 | 18.9 | 6.4 |
| 14.082000 | 17.9 | 5.0 |
| 24.002000 | 33.3 | 29.6 |