

TEST REPORT NUMBER – 408-18

**EN 55024:2010 + A1:2015 INFORMATION TECHNOLOGY EQUIPMENT—IMMUNITY
CHARACTERISTICS—LIMITS AND MEASUREMENTS**

**ETSI EN 301 489-1 V2.1.1 ELECTROMAGNETIC COMPATIBILITY (EMC) STANDARD FOR RADIO
EQUIPMENT AND SERVICES; PART 1: COMMON TECHNICAL REQUIREMENTS; HARMONISED
STANDARD COVERING THE ESSENTIAL REQUIREMENTS OF ARTICLE 3.1(B) OF DIRECTIVE
2014/53/EU AND THE ESSENTIAL REQUIREMENTS OF ARTICLE 6 OF DIRECTIVE 2014/30/EU
ETSI EN 301 489-17 V3.1.1 ELECTROMAGNETIC COMPATIBILITY (EMC) STANDARD FOR RADIO
EQUIPMENT AND SERVICES; PART 17: SPECIFIC CONDITIONS FOR BROADBAND DATA
TRANSMISSION SYSTEMS; HARMONISED STANDARD COVERING THE ESSENTIAL
REQUIREMENTS OF ARTICLE 3.1(B) OF DIRECTIVE 2014/53/EU**

**EN 301 489-33 V2.1.1 ELECTROMAGNETIC COMPATIBILITY AND RADIO SPECTRUM MATTERS
(ERM); ELECTROMAGNETIC COMPATIBILITY (EMC) STANDARD FOR RADIO EQUIPMENT AND
SERVICES; PART:33 SPECIFIC CONDITIONS FOR ULTRA-WIDEBAND (UWB) DEVICES**

IEC / EN 61000-4-2 ELECTRO STATIC DISCHARGE IMMUNITY

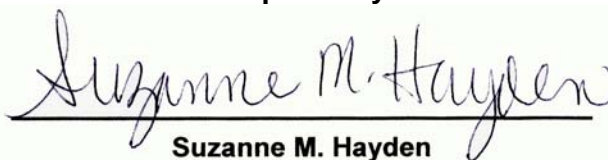
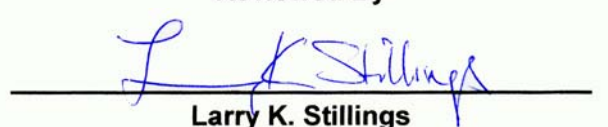
IEC / EN 61000-4-3 RADIATED RADIO FREQUENCY (RF) IMMUNITY

for

**DecaWave Ltd.
Adelaide Chambers, Peter Street
Dublin, Ireland D08 T6YA**

**For the
DWM1001C
on**

**Tested on
November 2 – November 29, 2018
Report issued December 7, 2018**

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1.0 OVERVIEW

1.1 PURPOSE OF TEST

This report has been compiled to document the Immunity (Susceptibility) test parameters, effects and results of the DWM1001C in comparison to the requirements for equipment as specified in the documents listed below. All results are based on a test of one sample, and represent other production units; only in as much as a sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required.

| | |
|------------------------------------|--|
| 2014/30/EU (29 March 2014) | Official Journal of the European Communities Council Directive on Electromagnetic Compatibility |
| 2014/53/EU (16 April 2014) | Official Journal of the European Communities Council Directive on Radio Equipment |
| EN 61000-6-1 (2007) | Electromagnetic Compatibility (EMC) Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments |
| EN 55024 (2010) CISPR 24 (2010) | Information technology equipment – Immunity characteristics - Limits and methods of measurement |
| EN 55024 (2015) | Electromagnetic Compatibility (EMC) Amendment A1 |
| EN 301 489-1 (2017-02) | Electromagnetic Compatibility and Radio Spectrum matters (ERM); Electromagnetic Compatibility (EMC) Standard for radio equipment and services; Part 1: Common Technical Requirements |
| EN 301 489-17 V3.1.1 (2017-02) | ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU |
| EN 301 489-33 (2017-02) | Electromagnetic Compatibility and Radio Spectrum matters (ERM); Electromagnetic Compatibility (EMC) Standard for radio equipment and services; Part 33: Specific conditions for Ultra-Wideband (UWB) devices |

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1.1 OVERVIEW

1.1 PURPOSE OF TEST (continued)

| | |
|---|---|
| EN 61000-4-2 (2009) IEC 61000-4-2 (2008) | Electromagnetic Compatibility (EMC) Part 4: Testing and measurement techniques - Section 2 Electrostatic Discharge Immunity Test |
| EN 61000-4-3 (2006) IEC 61000-4-3 (2006) | Electromagnetic Compatibility (EMC) Part 4: Testing and measurement techniques - Section 3: Radiated, Radio-Frequency Immunity Test |
| EN 61000-4-3 (2008) IEC 61000-4-3 (2007) | Electromagnetic Compatibility (EMC) Amendment A1 |
| EN 61000-4-3 (2010) IEC 61000-4-3 (2010) | Electromagnetic Compatibility (EMC) Amendment A2 |

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Product Details

Manufacturer: DecaWave, Inc.
Model Numbers: DWM1001C
Serial Number: 18230049E4
Description: The DWM1001C RTLS Module is a full-function real-time location system (or RTLS) subsystem in a compact factor
Power Sources: 230 VAC, 50 Hz via 2.8 – 3.6 VDC

Product Configuration

Cables

| Cable Type | Length | Shield | From | To |
|------------|--------|--------|------|-------------|
| USB | 2M | Yes | EUT | USB Charger |

Support Equipment

| Manufacturer | Model/Part # / Options | Serial Number | Description/Function |
|--------------|------------------------|---------------|--------------------------|
| Phihong | PSA 05F-050Q | n/a | USB Charger |
| Dell | Inspiron E1505 | 5573349937 | Laptop for Configuration |

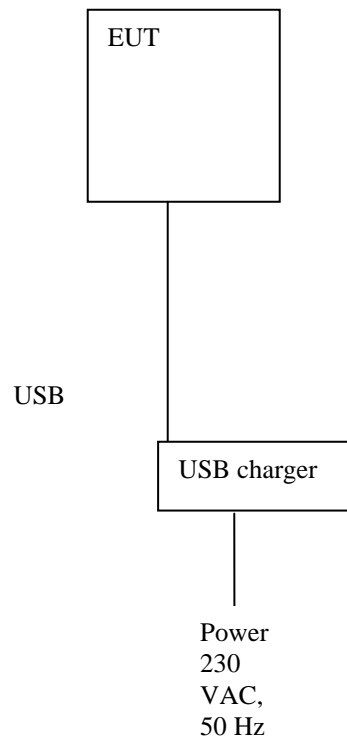
Operation

The EUT was configured to operate on battery power and via a daughter board that provided USB power. Two units were configured, one as a “tag” and one as an “anchor”. The two devices were configured to provide distance information to the remotely located unit that was attached to a laptop computer.

Modifications performed on product at test facility: None

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1.3 BLOCK DIAGRAM



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2.0 EN 61000-4-2 ELECTROSTATIC DISCHARGE TEST DESCRIPTION

2.1 TEST SETUP

The EUT setup was placed in the ESD test laboratory in accordance with EN 55024, EN 301 489-1, EN 301 489-17, EN 301 489-33 and the IEC standards, with the following climatic conditions:

Temperature: 18.5 degrees C

Relative Humidity: 37%

The EUT was connected as diagrammed in Section 1.3 of this report.

A horizontal coupling plane (HCP) was placed on a non-conductive table, 0,8 meters above the ground plane and connected to the ground plane through two series 470-kohm resistors. The EUT was placed on the table with an insulating support between the EUT and the HCP. The ESD simulator was charged and allowed to discharge through the HCP See section 9 for photographs of typical setups.

A vertical coupling plane (VCP) measuring 0,5m by 0,5m was fixed 0,1m from the vertical surfaces of the equipment, parallel to them and connected to the ground plane through two series 470 kohm resistors. The ESD simulator was charged and allowed to discharge to the VCP. This test was repeated until all vertical surface areas of the EUT were exposed to the VCP.

The ESD events were applied to such points and surfaces of the EUT that are normally accessible to the operator for normal operation or maintenance. Contact discharge is the preferred test method. Air discharges are used where contact discharge cannot be applied.

NOTES:

1. See Sections 2.4 for ESD test locations.

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| | | | |
|---|--|-----------------|---|
| 61000-4-2 | TEST: Electrostatic discharges (IEC 61000-4-2: - use latest edition) | | Verdict |
| <u>Method:</u> The test is intended to demonstrate the immunity of equipment subjected to static electricity discharges from operators directly and to adjacent objects. The table top equipment under test is placed on a wooden table, 0.8 m high, standing on the ground reference plane. A horizontal coupling plane (HCP), 1.6 x 0.8 m, is placed on the table. The EUT and the cables are isolated from the coupling plane by an insulating support 0.5 mm thick. The vertical coupling plane (VCP) of dimensions 0.5 m x 0.5 m is placed parallel to, and positioned at a distance of 0.1 m from, the EUT. | | | Pass |
| Laboratory Parameters: | Required prior to the test | During the test | |
| Ambient Temperature | 15 to 35 °C | 18.5°C | |
| Relative Humidity | 30 to 60 % | 37% | |
| Equipment mode | Power interface mode | | |
| | EUT configurations mode | | |
| | Operation mode | | |
| Test Levels | | | |
| Discharge type | Discharge Level (kV) | | Number of discharges per location (each polarity) |
| | Positive | Negative | |
| Air – Direct | 2, 4, 8 | 2, 4, 8 | 10 |
| Contact – Direct | 2, 4 | 2, 4 | 10 |
| Contact – Indirect | 2, 4 | 2, 4 | 10 |
| Discharge location | See photo documentation of the test set-up All external locations accessible by hand, Horizontal plate (HCP) Vertical coupling plate (VCP) | | |

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2.2 TEST RESULTS

The DWM1001C meets the requirements set forth in EN 301 489-1, EN 301 489-17, EN 301 489-33. Detailed test results are found in the following table(s).

2.3 TEST DATA:

The test results are based upon 10 discharges at both polarities at each test point

Contact Discharge Data:

| PERFORMANCE CATEGORY | | | | | | | | |
|----------------------|---------|-----|---------|-----|---------|---|---------|---|
| | Level 1 | | Level 2 | | Level 3 | | Level 4 | |
| VOLTAGE=> | 2K V | | 4K V | | 6K V | | 8K V | |
| Position Key | + | - | + | - | + | - | + | - |
| 1 | N/A | N/A | N/A | N/A | | | | |

Indirect Discharge

| PERFORMANCE CATEGORY | | | | | | | | |
|----------------------------|---------|---|---------|---|---------|---|---------|---|
| | Level 1 | | Level 2 | | Level 3 | | Level 4 | |
| VOLTAGE=> | 2K V | | 4K V | | 6K V | | 8K V | |
| Coupling Plane Orientation | + | - | + | - | + | - | + | - |
| Horizontal (table top) | A | A | A | A | | | | |
| Vertical (Front) | A | A | A | A | | | | |
| Vertical (Left) | A | A | A | A | | | | |
| Vertical (Rear) | A | A | A | A | | | | |
| Vertical (Right) | A | A | A | A | | | | |

Air Discharge Data

| PERFORMANCE CATEGORY | | | | | | | | |
|----------------------|---------|-----|---------|-----|---------|---|---------|---|
| | Level 1 | | Level 2 | | Level 3 | | Level 4 | |
| VOLTAGE=> | 2K V | | 4K V | | 8K V | | 15K V | |
| Position Key | + | - | + | - | + | - | + | - |
| A1 | N/A | N/A | N/A | N/A | | | | |
| A2 | | | | | | | | |
| A3 | | | | | | | | |

PERFORMANCE CATEGORY EXPLANATION

Category A - Normal Performance within specified limits.

Monitored traffic between device and support equipment. EUT continued to communicate with support equipment.

Category B - Normal Performance or manufacturer-defined loss of function within specified limits.

Category C - Temporary loss of function that is self-recoverable or requires operator intervention.

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2.4 TEST POINT DIAGRAM: Front



Note: EUT is a module and therefore ESD was only performed to the horizontal and vertical coupling planes.

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2.5 TEST EQUIPMENT

| <u>Equipment</u> | <u>Serial #</u> | <u>Calibration Due</u> |
|---|----------------------|------------------------|
| KeyTek ESD Simulator Mini Zap & TPC 2A | 6280 & 6281 | 6/12/2019 |
| KeyTek ESD Simulator Mini Zap & TPC 2A (Green Tape on Body of Minizap) | 9605335 & 9605275 | 7/26/2019 |
| Control Company Digital Barometer | ID236 | 4/3/2020 |
| Extech Instruments SD700 | Q590483 | 4/23/2019 |

All equipment used for testing has been calibrated according to the methods and procedures defined by the National Institute of Standards and Technology (NIST).

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2.6 ELECTROSTATIC DISCHARGE PHOTOGRAPHS:



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3.0 EN 61000-4-3 RADIATED RADIO-FREQUENCY TEST DESCRIPTION

3.1 TEST SETUP

The EUT setup was placed in a calibrated uniform field in the ferrite tile chamber. The field was calibrated using the test methodology in the IEC standard. The following climatic conditions existed:

Temperature: 22.7 degrees C

Relative Humidity: 33.7%

The EUT was connected as diagrammed in Section 1.3 of this report. All testing and verification for EUT operation was monitored. The customer was present during testing.

The transmitting antenna is placed 3 meters from the Uniform Field Area (UFA) from 80 to 1000 MHz, and 2 meters from the UFA from 1.0 to 6.0 GHz.

3.2 TEST RESULTS

The DWM1001C meets the requirements set forth in EN 61000-4-3.

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| | | | | | | |
|---|---|---|--|--|-----------------|----------------|
| 61000-4-3 | | TEST: RF electromagnetic fields (IEC 61000-4-3: - use latest edition) | | | Verdict | |
| <u>Method:</u> The test allows estimating of the radiated immunity of electrical and electronic equipment to electromagnetic disturbances coming from intended radio-frequency (RF) transmitters in the frequency range 80 MHz to 1000 MHz. The interference is applied on the enclosure of the equipment by using transmitting antennas. | | | | | Pass | |
| Laboratory Parameters: | | | Required prior to the test | | During the test | |
| Ambient Temperature | | | 15 to 35 °C | | 22.7°C | |
| Relative Humidity | | | 30 to 60 % | | 33.7% | |
| Equipment mode | | | Power interface mode | | | |
| | | | EUT configurations mode | | | |
| | | | Operation mode | | | |
| Test specifications | | | | | | |
| Calibration Requirements | | | Uniform field area (UFA) | 1.5 m x 1.5 m, 16 points with a minimum UFA size 0.5 m x 0.5 m | | |
| | | | | 75 % of calibration points within specifications if UFA is larger than 0.5 m x 0.5 m. 100 % (all 4 points) in the specifications for 0.5 x 0.5 m UFA | | |
| Frequency bandwidth | | | 80 to 1000 MHz | | | 1.0 to 6.0 GHz |
| Level | <input checked="" type="checkbox"/> | Equipment | 3 V/m | | | 3 V/m |
| | | | Amplitude modulation | 80 % / 1 kHz sine wave | | |
| | | | | | | |
| Frequency step | | | 1% or less of fundamental test frequency | | | |
| Dwell time | <input checked="" type="checkbox"/> 1 kHz Modulation | | 3 seconds | | | |

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3.3 TEST DATA:

| SIDE OF EUT | POLARITY (H / V) | FREQUENCY (MHz) | V/M | 1kHz 80% AM | PERFORMANCE CATEGORY |
|-------------|---------------------|--------------------|-----|----------------|-------------------------|
| FRONT | V | 80 - 1000 | 3 | YES | A |
| FRONT | H | 80 - 1000 | 3 | YES | A |
| LEFT | V | 80 - 1000 | 3 | YES | A |
| LEFT | H | 80 - 1000 | 3 | YES | A |
| RIGHT | V | 80 - 1000 | 3 | YES | A |
| RIGHT | H | 80 - 1000 | 3 | YES | A |
| BACK | V | 80 - 1000 | 3 | YES | A |
| BACK | H | 80 - 1000 | 3 | YES | A |
| SIDE OF EUT | POLARITY (H / V) | FREQUENCY (GHz) | V/M | 1kHz 80% AM | PERFORMANCE CATEGORY |
| FRONT | V | 1.0 – 6.0 | 3 | YES | A |
| FRONT | H | 1.0 – 6.0 | 3 | YES | A |
| LEFT | V | 1.0 – 6.0 | 3 | YES | A |
| LEFT | H | 1.0 – 6.0 | 3 | YES | A |
| RIGHT | V | 1.0 – 6.0 | 3 | YES | A |
| RIGHT | H | 1.0 – 6.0 | 3 | YES | A |
| BACK | V | 1.0 – 6.0 | 3 | YES | A |
| BACK | H | 1.0 – 6.0 | 3 | YES | A |

PERFORMANCE CATEGORY EXPLANATION

Category A - Normal Performance within specified limits.

Monitored traffic between device and support equipment. EUT continued to communicate with support equipment.

Category B - Normal Performance or manufacturer-defined loss of function within specified limits.

Category C - Temporary loss of function that is self-recoverable or requires operator intervention.

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3.4 TEST EQUIPMENT

| <u>Characterized/Verified Equipment</u> | <u>Serial #</u> | <u>Calibration Due</u> |
|---|-----------------|-------------------------------|
| Chase CBL6121A BiConilog Antenna | 1015 | 10/19/2019 |
| ETS Lindgren Horn Antenna Model 3119 | 00224545 | 10/30/2019 |
| Teseq CBA-1G-300B 80-1000 MHz Amplifier | W2337-0818 | Use with Calibrated Equipment |
| IFI S61-100 1-6 GHz Amplifier | W2338-0918 | Use with Calibrated Equipment |
| IFI EFS-5 E-Field Sensor | 1192-244 | Verified |
| Narda E-Field Probe 8760 | 09022 | Verified |
| Teseq CBA 3G-025 Amplifier | T44110 | Use with Calibrated Equipment |
| Teseq CBA 6G-030 Amplifier | 4525 | Use with Calibrated Equipment |
| IFI EFS-5 E-Field Sensor | 493-275 | Calibration not required |
| Narda 8760 / IFI 0301-S Field Probe | 9022 | Calibration not required |

| <u>Calibrated Equipment</u> | <u>Serial #</u> | <u>Calibration Due</u> |
|--|-------------------|------------------------|
| Hewlett Packard 8648C Signal Generator | 3642U01557 | 9/10/2020 |
| Rohde & Schwarz SMT06 Signal Generator | 100362 | 9/11/2020 |
| IFI EFS-5 E-Field Sensor | 991-185 | 11/2/2018 |
| Narda 8760 | 10028 | 11/2/2018 |
| W&G EMR-200 with Type 8 Field Probe | BN/2244/21 060019 | 10/15/2019 |
| W&G EMR-200 with Type 9 Field Probe | 0051 w/ 0037 | 11/18/2018 |

* Signal Generator, Amplifiers and Antennas are characterized as part of the Uniform Field Calibration

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3.5 RADIATED LOW RADIO FREQUENCY PHOTOGRAPHS: Front



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3.6 RADIATED HIGH RADIO FREQUENCY PHOTOGRAPHS: Front



Name/Customer: _____ **Issue Date:** _____

We value our customers' opinions. Please let us know what we can do to make your testing experience more beneficial and efficient. Feel free to let us know if your expectations have been met.

Thank you in advance for taking the time to share your thoughts with us.

Please email to sales@complianceworldwide.com

You may answer with: (E) Exceeded Expectation, (S) Satisfactory, (N) Needs Improvement, (P) Poor

| | |
|--|--|
| Technical Knowledge of Staff as it pertains to your product test: | |
| Test Facility | |
| Product Test/Test Report Turnaround | |
| Quality of Test Report | |
| Overall experience/Customer Service | |
| Customer comment or issue: | |