



## Antenna Gain Test Report

### Applicant: Solid Tech LLC

Signature:

A handwritten signature in black ink, appearing to read "Tim Royer", written over a horizontal line.

Sr. EMC Engineer  
EMC-003838-NE



Name & Title:

Tim Royer, EMC Engineer

Date of Signature

5/13/2023

Signature:

A handwritten signature in black ink, appearing to read "Kristoffer Costa", written over a horizontal line.

Name & Title:

Kristoffer Costa, EMC Technician

Date of Signature

5/13/2023

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## 1. Customer Information

Applicant: Solid Tech LLC  
Address: 478 Fillmore Ave NE  
Palm Bay, Florida, 32907, United States

## 2. Location of Testing

### Test Laboratory

Timco Engineering Inc. is a subsidiary of Industrial Inspection & Analysis, Inc. ("IIA"). Testing was performed at IIA's permanent laboratory located at 13146 NW 86th Drive, Suite 400, Alachua, Florida 32615.

FCC test firm # 578780  
FCC Designation # US1070  
FCC site registration is under A2LA certificate # 0955.01  
ISED Canada test site registration # 2056A  
EU Notified Body # 1177  
For all designations see A2LA scope # 0955.01

### 3. Test Sample(s) (EUT/DUT)

The test sample was received: 5/9/2024

Dates of Testing: 5/10/2024 – 5/13/2024

#### Description of the EUT

A description as well as unambiguous identification of the EUT(s) tested. Where more than one sample is required for technical reasons (such as the use of connected units for the purpose of conducted output power testing where the product units will have integral antennas), each specific test shall identify which unit was tested.

| Identification    |                           |
|-------------------|---------------------------|
| FCC ID:           | 2BA2X-RCPS10              |
| Brief Description | Radio Control Transceiver |
| Model(s) #        | RCPS10<br>RCPS5<br>RCSW   |
| Firmware version  | N/A                       |
| Software version  | N/A                       |
| Serial Number     | N/A                       |

| Technical Characteristics    |                      |
|------------------------------|----------------------|
| Frequency Range              | 2400 MHz- 2483.5 MHz |
| RF O/P Power (Max.)          | 10.0 dBm             |
| Modulation                   | O-QPSK               |
| Bandwidth & Emission Class   | G7D (DSSS)           |
| Number of Channels           | 16                   |
| Duty Cycle                   | 20%                  |
| Antenna Connector            | Internal             |
| Voltage Rating (AC or Batt.) | 3.3 VDC              |

Note: Information such as antenna gain, firmware/software numbers are provided by manufacturer and cannot be validated by the test lab.

#### Operating conditions during Testing:

No modifications of the device under test (including firmware, specific software settings, and input/output signal levels to the EUT).

#### Peripherals used during Testing:

A Controller provided by the manufacturer was used to program the EUT.

### 4. Test methods & Applicable Regulatory Limits

#### Test methods/Standards/Guidance:

Test procedures and guidance for measuring transmitters are provided in ANSI C63.10-2013.

- 1) ANSI C63.10-2013
- 2) 353028 D01 Antennas Part 15 Transmitters v01r01

### 5. Applied Limits and Regulatory Limits:

- 3) FCC CFR 47 Part 15.203

## 6. FCC Notice:

All part 15 applications will need to show how the antenna gain was derived either from a manufacturer data sheet or a measurement. Where the gain of the antenna is inherently accounted for as a result of the measurement, such as field strength measurements on a part 15.249 or 15.231 device, so the gain does not necessarily need to be verified. However, enough information regarding the construction of the antenna shall be provided. Such information maybe photographs, length of wire antenna etc.

1. Part 15 applications with equipment classes **DSC, DXX, DCD, 8CC**, etc. which do not have an EIRP limit.  
We need at least the following antenna info: **Antenna photos/or drawings, including antenna dimensions.**
  - This info cannot be held short term confidential. If necessary, we will have to request the customer to provide a separate exhibit for that antenna photo/or drawing, if the internal photos are being held short term confidential. Alternatively, antenna info can be placed in the test report. That would make things easier to review and process.  
(We plan on providing guidance to customers in our newsletter to identify the antenna info vs. internal photo.).
  - Any antenna technical specifications, which are deemed confidential by customer/applicant should be removed from the antenna exhibit or test report.
  - However, antenna specifications such antenna gain, antenna patterns, etc. are not considered confidential information.
  - Antenna gain reports are **NOT** required for these equipment classes because the antenna gain is already accounted for in the field strength measurement of the fundamental emission. (see attached FCC minutes)
2. Part 15 applications with equipment classes **DTS, DSS, NII, 6ID**, etc. which use the antenna gain for compliance with EIRP limits:  
We need the manufacturer antenna data sheet or an antenna gain measurement report
  - The report must be a complete report, with a measurement procedure, test equipment, test setup, signatures, facility/test site descriptions, etc.
  - There is not requirement for the RF lab to be accredited.
  - The FCC has not specified or endorsed any measurement procedures. However, the FCC indicated at the TCBC conf call on June 14...
    - test labs should use good judgement when reviewing antenna datasheets with gain measured in free space because that the gain might change significantly when attached to the device... FCC wants test labs and manufacturers to be aware of it and take this into account. FCC does not necessarily need to see what was done, but needs to know whether gain has changed.
  - Confidential information about the antenna can be made confidential but photos/drawings, gain, antenna patterns, test setups are not considered confidential.

## 7. Calculation Procedure

Conducted ERP and measured dBuV/m are converted and compared. The difference was compared to the stated antenna gain (dBi) to ensure that it doesn't exceed the manufacture stated.

## 8. Equations

$$E = \text{EIRP} - 20 \log d + 104.8 \quad (\text{ANSI C63.10-2013 sec 11.12.2.2})$$

where

E is the electric field strength in dBuV/m

EIRP is the equivalent isotropically radiated power in dBm

d is the specified measurement distance

$$\text{V/m to dB}\mu\text{V/m: dB}\mu\text{V/m} = 20 \log(\text{V/m}) + 120$$

$$\text{eirp} = p_t \times g_t = (E \times d)^2 / 30 \quad (\text{Poynting's theorem}) \quad (\text{KDB 412172 Determining ERP and EIRP DR01})$$

where:

$p_t$  = transmitter output power in watts,

$g_t$  = numeric gain of the transmitting antenna (unitless),

E = electric field strength in V/m,

d = measurement distance in meters (m).

Note that  $4\pi r^2$  is the surface area of a sphere and  $120\pi$  (377 ohms) is the impedance of free space.

## 9. List of Test Equipment

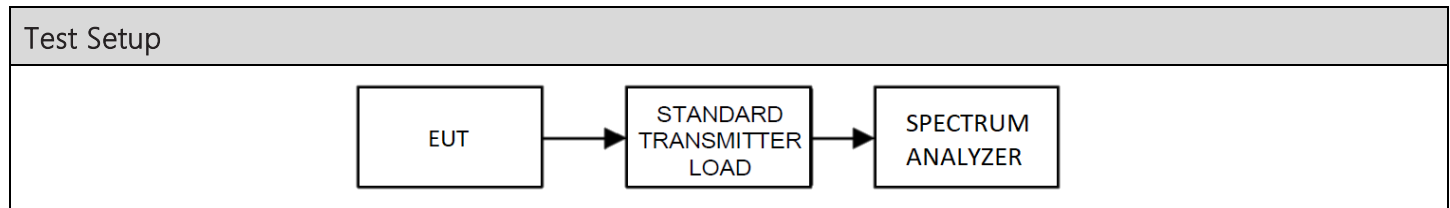
| Test Equipment     |                               |                 |             |          |             |            |
|--------------------|-------------------------------|-----------------|-------------|----------|-------------|------------|
| Type               | Device                        | Manufacturer    | Model       | SN#      | Current Cal | Cal Due    |
| Antenna            | Double-Ridged Horn/ETS Horn 1 | ETS-Lindgren    | 3117        | 00035923 | 5/31/23     | 5/30/2026  |
| CHAMBER            | CHAMBER                       | Panashield      | 3M          | N/A      | 12/29/23    | 12/18/2025 |
| Pre-amp            | Pre-amp                       | RF-LAMBDA       | RLNA00M45GA | NA       | 2/27/22     | 7/26/2025  |
| Receiver           | EMI Test Receiver R&S ESU 40  | Rohde & Schwarz | ESU 40      | 100320   | 5/27/21     | 5/26/2024  |
| Receiver           | EMI Test Receiver R&S ESW44   | Rohde & Schwarz | ESW44       | 103049   | 10/13/21    | 10/12/2024 |
| Function Generator | Function Generator            | Standford       | DS340       | 25200    | 2/22/24     | 2/21/2027  |

| Software       |                 |                          |               |
|----------------|-----------------|--------------------------|---------------|
| Software       | Author          | Version                  | Validation on |
| ESU Firmware   | Rohde & Schwarz | 4.43 SP3; BIOS v5.1-24-3 | 2018          |
| RSCcommander   | Rohde & Schwarz | 1.6.4                    | 2014          |
| ScopeExplorer  | LeCroy          | v2.25.0.0                | 2009          |
| Field Strength | Timco           | v4.10.7.0                | 2016          |



## 10. Conducted Output Power

Limits from FCC Part 15.247 (b) (1) – (4) as applicable, and test procedure from ANSI C63.10-2013 section 7.8 or 11.9 as applicable.



### Output Power Test Results

| Test Results, Mode 1  |                    |
|-----------------------|--------------------|
| Tuned Frequency (MHz) | Power Output (dBm) |
| 2405                  | -1.56              |
| 2440                  | -1.99              |
| 2475                  | -2.45              |

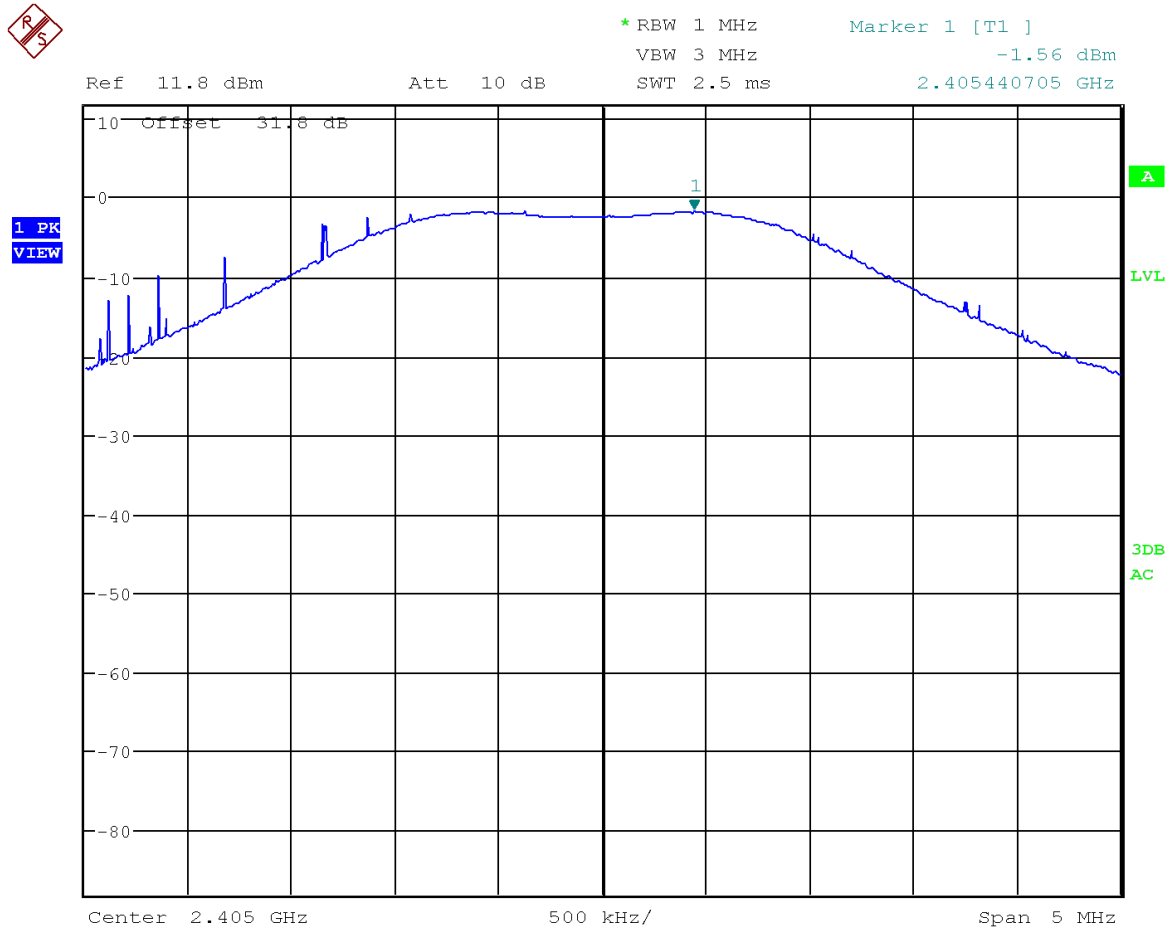
- MAXIMUM Conducted Output Power = -1.56 dBm

Point-to-Point - N/A. The EUT is not a PtP device.

MIMO - N/A. The EUT is not a MIMO device.

## Conducted Output Power, Spectrum Plots

### 10.1.1 Conducted Output Power, 2405 MHz

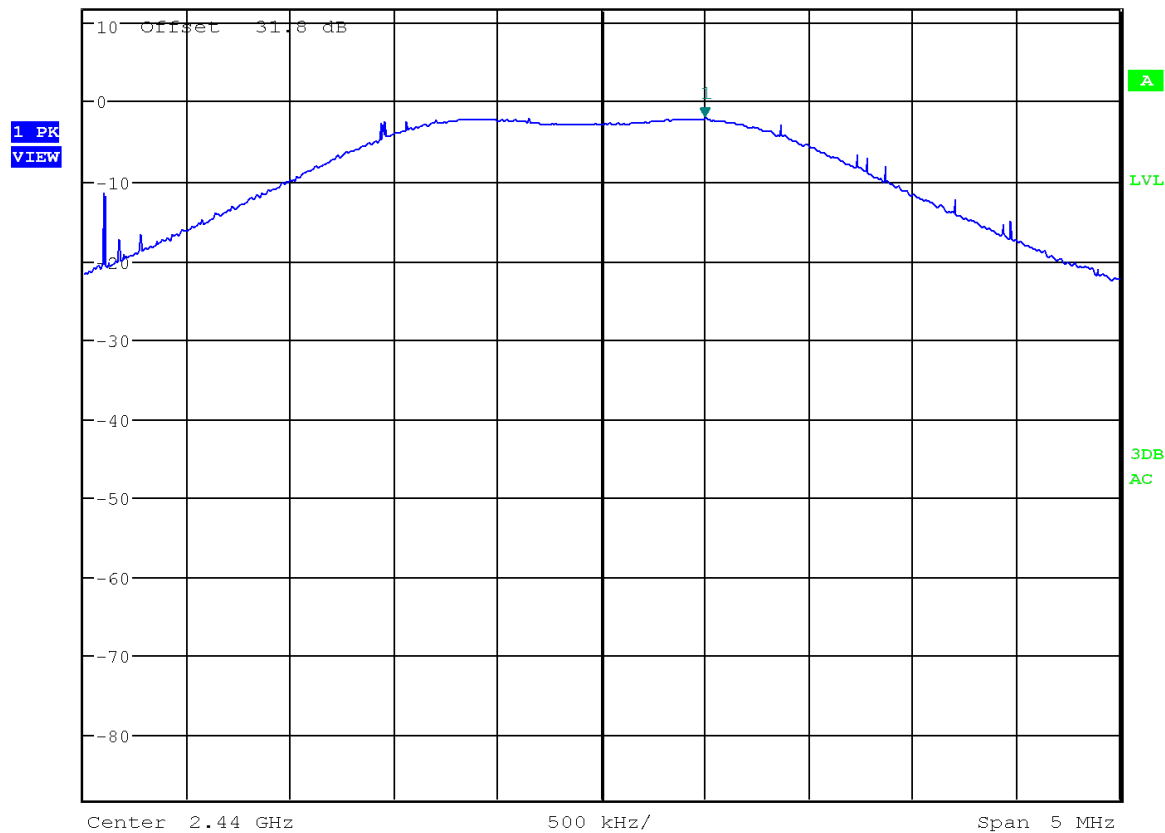


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## 10.1.2 Conducted Output Power, 2440 MHz

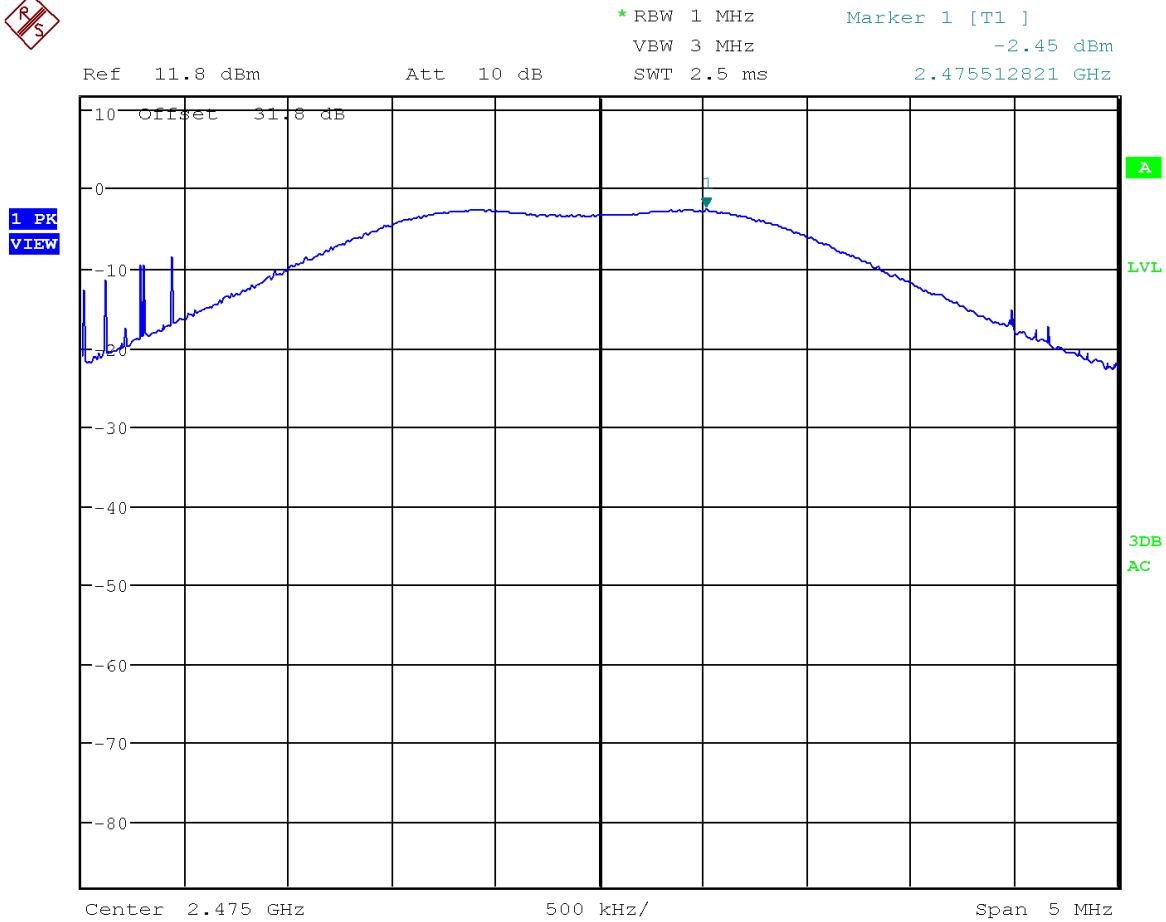


\* RBW 1 MHz      Marker 1 [T1 ]  
VBW 3 MHz      -1.99 dBm  
SWT 2.5 ms      2.440496795 GHz



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### 10.1.3 Conducted Output Power, 2475 MHz



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## 11. RF Exposure Results

### Antenna Gain Verification

| Tuned Frequency (MHz) | Conducted PO (dBm) | Field Strength (dBμV/m) | Stated Antenna Gain (dBi) |
|-----------------------|--------------------|-------------------------|---------------------------|
| 2440.00               | -1.56              | 75.90                   | 2.14                      |

| Fundamental Frequency (MHz) | Coax Loss (dB) | Antenna Correction Factor (dB) | Distance (m) | Field Strength (dBμV/m) | Radiated ERP (dBm) | ERP (W)        | Conducted ERP (dBm) | Conducted ERP (W) | Calculated Field Strength from Conducted power (dBμV/m) | Antenna Gain Calculated from field strength (dBi) | Antenna Gain Calculated from Power (dBi) |
|-----------------------------|----------------|--------------------------------|--------------|-------------------------|--------------------|----------------|---------------------|-------------------|---|---|--|
| 2440.00                     | 5.61           | 31.85                          | 3.00         | 75.90                   | -21.48             | 0.000007116679 | -1.56               | 0.000698232404    | 95.81   | -19.91  | -19.92                                   |

| Field Strength calculated from radiated EIRP (dBμV/m) | Field Strength from Conducted W (V/m) | Conversion (V/m) to (dBμV/m) | Conversion (dBμV/m) to (dBm) |
|---|---------------------------------------|------------------------------|------------------------------|
| 75.93034897   | 0.061721912                           | 95.80878745                  | 58.35                        |

Measured Gain is less than Stated Gain

RESULT: Pass

## 12. ANNEX-B – Test Setup Photographs

Test setup photographs are located in a separate supplementary ANNEX-B document.

## 13. History of Test Report Changes

| Test Report #                    | Revision # | Description      | Date of Issue |
|----------------------------------|------------|------------------|---------------|
| TR_13564-24_Antenna Gain Report_ | 1          | Initial release  | 5/13/2024     |
|                                  | 2          | Added section 10 | 6/24/2024     |
|                                  |            |                  |               |

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END OF TEST REPORT

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