# FCC Test Report

| | |
|---|---|
| Product Name | Delta 3D Printer |
| Model No | Atom 3.5 |
| FCC ID. | 2AWWXATOM3-5 |

| | |
|---|---|
| Applicant | LAYER ONE CO., LTD. |
| Address | No. 84, Sec. 2, Minsheng E. Rd., Zhongshan Dist., Taipei City 104, Taiwan (R.O.C.) |

| | |
|---|---|
| Date of Receipt | Jul. 08, 2020 |
| Issue Date | Jan. 27, 2021 |
| Report No. | 2070288R-E3032110113 |
| Report Version | V1.0 |

Testing Laboratory
3023

The test results relate only to the samples tested.
The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.
This report must not be used to claim product endorsement by TAF or any agency of the government.
The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.
Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

# Test Report

Issue Date: Jan. 27, 2021
Report No.: 2070288R-E3032110113

| | |
|---|---|
| Product Name | Delta 3D Printer |
| Applicant | LAYER ONE CO., LTD. |
| Address | No. 84, Sec. 2, Minsheng E. Rd., Zhongshan Dist., Taipei City 104, Taiwan (R.O.C.) |
| Manufacturer | LAYER ONE CO., LTD. |
| Model No. | Atom 3.5 |
| FCC ID. | 2AWWXATOM3-5 |
| EUT Rated Voltage | AC 100-240V, 50/60Hz |
| EUT Test Voltage | AC 120V / 60Hz |
| Trade Name | ATOM |
| Applicable Standard | FCC CFR Title 47 Part 15 Subpart C<br>ANSI C63.4: 2014, ANSI C63.10: 2013 |
| Test Result | Complied |

Documented By : Joanne Lin

( Senior Adm. Specialist / Joanne Lin )

Tested By : Ivan Chuang

( Senior Engineer / Ivan Chuang )

Approved By :

( Director / Vincent Lin )

# TABLE OF CONTENTS


| Description | | Page |
|---|---|---|
| **1.** | **GENERAL INFORMATION** | **5** |
| 1.1. | EUT Description | 5 |
| 1.2. | Tested System Details | 7 |
| 1.3. | Configuration of Tested System | 7 |
| 1.4. | EUT Exercise Software | 8 |
| 1.5. | Test Facility | 9 |
| 1.6. | List of Test Item and Equipment | 10 |
| 1.7. | Uncertainty | 11 |
| **2.** | **Conducted Emission** | **12** |
| 2.1. | Test Setup | 12 |
| 2.2. | Limits | 12 |
| 2.3. | Test Procedure | 12 |
| 2.4. | Test Result of Conducted Emission | 13 |
| **3.** | **Peak Power Output** | **17** |
| 3.1. | Test Setup | 17 |
| 3.2. | Limits | 17 |
| 3.3. | Test Procedure | 17 |
| 3.4. | Test Result of Peak Power Output | 18 |
| **4.** | **RF antenna conducted test** | **21** |
| 4.1. | Test Setup | 21 |
| 4.2. | Limits | 21 |
| 4.3. | Test Procedure | 21 |
| 4.4. | Test Result of RF antenna conducted test | 22 |
| **5.** | **Band Edge** | **25** |
| 5.1. | Test Setup | 25 |
| 5.2. | Limits | 25 |
| 5.3. | Test Procedure | 25 |
| 5.4. | Test Result of Band Edge | 26 |
| **6.** | **6dB Bandwidth** | **29** |
| 6.1. | Test Setup | 29 |
| 6.2. | Limits | 29 |
| 6.3. | Test Procedure | 29 |
| 6.4. | Test Result of 6dB Bandwidth | 30 |
| **7.** | **Power Density** | **36** |
| 7.1. | Test Setup | 36 |
| 7.2. | Limits | 36 |
| 7.3. | Test Procedure | 36 |
| 7.4. | Test Result of Power Density | 37 |
| **8.** | **EMI Reduction Method During Compliance Testing** | **43** |

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs

# Revision History

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| 2070288R-E3032110113 | V1.0 | Initial issue of report. | Jan. 27, 2021 |

# 1. GENERAL INFORMATION

## 1.1. EUT Description

| | |
|---|---|
| Product Name | Delta 3D Printer |
| Trade Name | ATOM |
| Model No. | Atom 3.5 |
| FCC ID. | 2AWWXATOM3-5 |
| Frequency Range | 802.11b/g/n-20: 2412-2462MHz |
| Number of Channels | 802.11b/g/n-20: 11CH |
| Data Speed | 802.11b: 1-11Mbps, 802.11g: 6-54Mbps, 802.11n: up to 72.2Mbps |
| Channel separation | 802.11b/g/n: 5 MHz |
| Type of Modulation | 802.11b: DSSS (DBPSK, DQPSK, CCK)<br>802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) |
| Antenna Type | Dipole Antenna |
| Antenna Gain | Refer to the table “Antenna List” |
| Channel Control | Auto |
| Power Adapter (1) | MFR: MW, M/N: GST220A24<br>Input: AC 100-240V, 50/60Hz, 4.0A<br>Output: 24V⎓9.2A, 221W MAX.<br>Cable Out: Non-shielded, 1m, with one ferrite core bonded. |
| Power Adapter (2) | MFR: EDACPOWER, M/N: EA13001N-240<br>Input: AC 100-240V~50-60Hz, 5-2.5A<br>Output: 24.0V⎓12.5A, 300.0W<br>Cable Out: Non-shielded, 1.2m, with one ferrite core bonded. |

**Antenna List**

| No. | Manufacturer | Part No. | Antenna Type | Peak Gain |
|---|---|---|---|---|
| 1 | Aosiya | GX001Z.100006.Z01 | Dipole Antenna | 2dBi for 2.4 GHz |

Note: The antenna of EUT is conforming to FCC 15.203.

802.11b/g/n-20MHz Center Frequency of Each Channel:

| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---|---|---|---|---|---|---|---|
| Channel 01: | 2412 MHz | Channel 02: | 2417 MHz | Channel 03: | 2422 MHz | Channel 04: | 2427 MHz |
| Channel 05: | 2432 MHz | Channel 06: | 2437 MHz | Channel 07: | 2442 MHz | Channel 08: | 2447 MHz |
| Channel 09: | 2452 MHz | Channel 10: | 2457 MHz | Channel 11: | 2462 MHz | | |

Note:

1. The EUT is an Delta 3D Printer with built-in Wi-Fi (802.11b/g/n) transceiver, this report for 2.4GHz Wi-Fi.
2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
3. Lowest and highest data rates are tested in each mode. Only worst case is shown in the report. (802.11b is 1Mbps、802.11g is 6Mbps、802.11n(20M-BW) is 7.2Mbps)
4. These tests are conducted on a sample for the purpose of demonstrating compliance of transmitter with Part 15 Subpart C Paragraph 15.247 of spread spectrum devices.
5. This is a partial report that only evaluated Conducted test item. The Radiated Spurious Emissions test item refer to TUV test report no.: NN20WV07(P15C-WiFi 2.4GHz) 001.

| | |
|---|---|
| Test Mode: | Mode 1: Transmit (802.11b 1Mbps) |
| | Mode 2: Transmit (802.11g 6Mbps) |
| | Mode 3: Transmit (802.11n-20 7.2Mbps) |

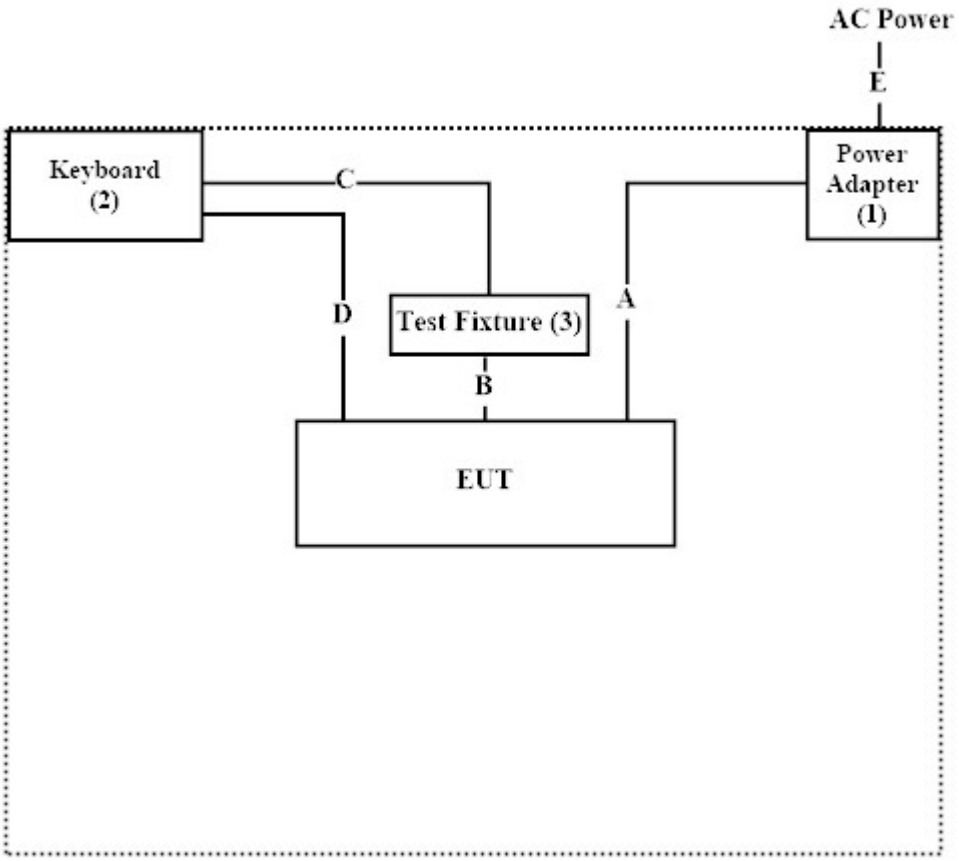
## 1.2. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

| Product | | Manufacturer | Model No. | Serial No. | Power Cord |
|---|---|---|---|---|---|
| 1 | Power Adapter (1) | MW | GST220A24 | N/A | N/A |
| | Power Adapter (2) | EDACPOWER | EA13001N-240 | N/A | N/A |
| 2 | Notebook PC | Lenvo | TP00067C | PF-0EW0C3 | N/A |
| 3 | Test Fixture | TWARM | USB-TTL | N/A | N/A |

| Signal Cable Type | | Signal cable Description |
|---|---|---|
| A | Power Cable (1) | Non-shielded, 1m, with one ferrite core bonded. |
| | Power Cable (2) | Non-shielded, 1.2m, with one ferrite core bonded. |
| B | Signal Cable | Non-shielded, 0.3m |
| C | USB Cable | Shielded, 1m |
| D | USB Cable | Shielded, 2m |
| E | Power Cable | Non-shielded, 1.8m |

## 1.3. Configuration of Tested System



## 1.4. EUT Exercise Software

1. Setup the EUT as shown in Section 1.3.
2. Execute software “EspRFtest Tool V2.5” on the Notebook PC.
3. Configure the test mode, the test channel, and the data rate.
4. Press “OK” to start the continuous Transmit.
5. Verify that the EUT works properly.

## 1.5. Test Facility

Ambient conditions in the laboratory:

| Performed Item | Items | Required | Actual |
|---|---|---|---|
| Conducted Emission | Temperature (°C) | 10~40 °C | 22.9 °C |
| | Humidity (%RH) | 10~90 % | 54.5 % |
| Conductive | Temperature (°C) | 10~40 °C | 22 °C |
| | Humidity (%RH) | 10~90 % | 55 % |

**USA : FCC Registration Number: TW0023**

**Canada : IC Registration Number: 25880**

Site Description : Accredited by TAF
Accredited Number: 3023

Test Laboratory : DEKRA Testing and Certification Co., Ltd
Address : No.159, Sec. 2, Wenhua 1st Rd., Linkou Dist.,
New Taipei City 24457, Taiwan, R.O.C.
Phone number : 886-2-2602-7968
Fax number : 866-2-2602-3286
Email address : info.tw@dekra.com
Website : http://www.dekra.com.tw

## 1.6. List of Test Item and Equipment

**For Conduction measurements /ASR1**

| | Equipment | Manufacturer | Model No. | Serial No. | Cali. Data | Due. Data |
|---|---|---|---|---|---|---|
| X | EMI Test Receiver | R&S | ESR7 | 101601 | 2020.05.28 | 2021.05.27 |
| X | Two-Line V-Network | R&S | ENV216 | 101306 | 2020.03.25 | 2021.03.24 |
| X | Two-Line V-Network | R&S | ENV216 | 101307 | 2020.04.17 | 2021.04.16 |
| X | Coaxial Cable | DEKRA | RG400_BNC | RF001 | 2020.05.24 | 2021.05.23 |

Note:
1. All equipments are calibrated every one year.
2. The test instruments marked with “X” are used to measure the final test results.
3. Test Software version : DEKRA Testing System V2.0

**For Conducted measurements /ASR2**

| | Equipment | Manufacturer | Model No. | Serial No. | Cali. Data | Due. Data |
|---|---|---|---|---|---|---|
| X | Spectrum Analyzer | R&S | FSV30 | 103465 | 2020.03.02 | 2021.03.01 |
| X | Power Meter | Anritsu | ML2496A | 1548002 | 2020.02.10 | 2021.02.09 |
| X | Power Sensor | Anritsu | MA2411B | 1531022 | 2020.02.10 | 2021.02.09 |
| X | Power Sensor | Anritsu | MA2411B | 1531023 | 2020.02.10 | 2021.02.09 |

Note:
1. All equipments are calibrated every one year.
2. The test instruments marked with “X” are used to measure the final test results.
3. Test Software version : DEKRA Conduction Test System V9.0.5

## 1.7. Uncertainty

Uncertainties have been calculated according to the DEKRA internal document, and is described in each test chapter of this report.

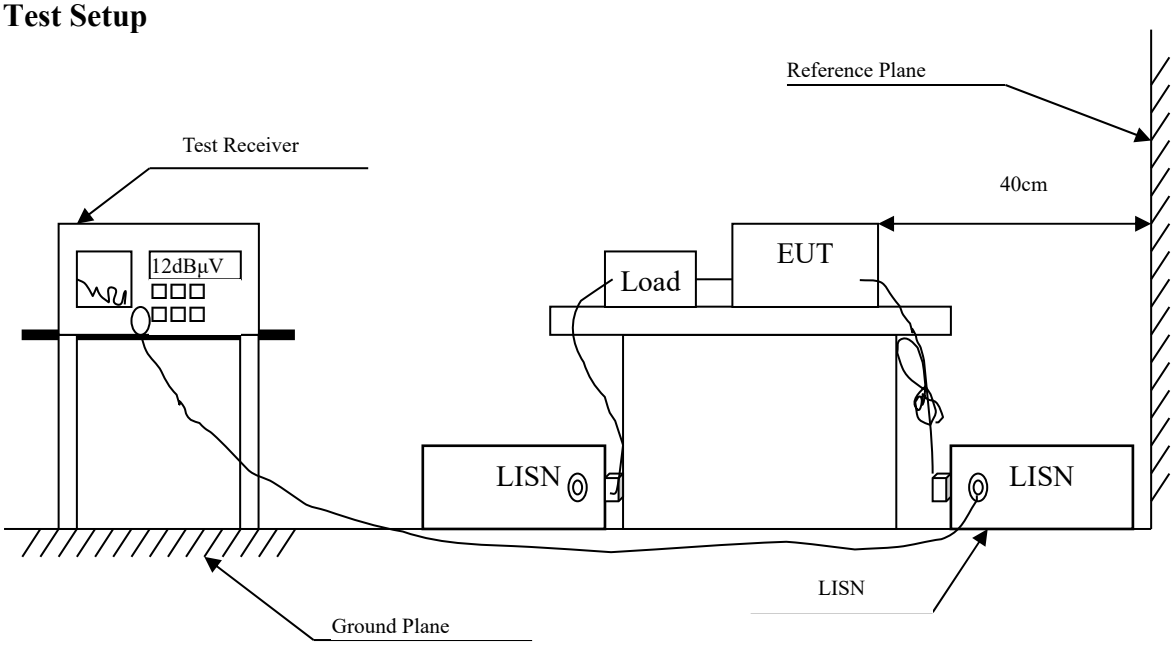
The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

| Test item | Uncertainty |
|---|---|
| Conducted Emission | ±3.42 dB |
| Peak Power Output | ±0.91 dB |
| RF antenna conducted test | ±2.53 dB |
| Band Edge | ±2.53 dB |
| 6dB Bandwidth | ±682.83 Hz |
| Power Density | ±2.53 dB |

## 2. Conducted Emission

### 2.1. Test Setup




### 2.2. Limits

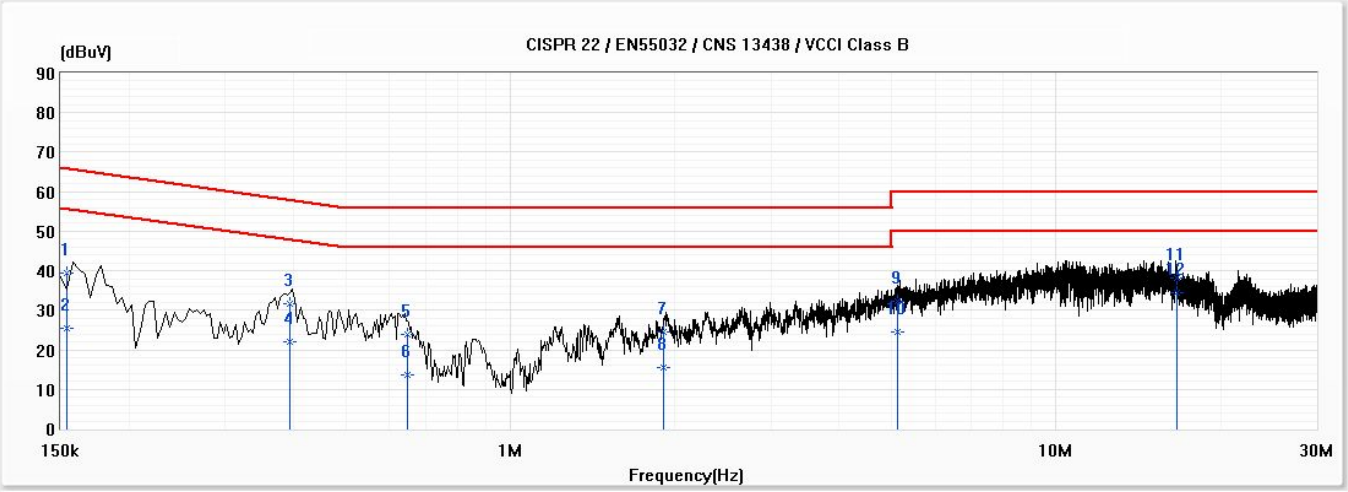
| FCC Part 15 Subpart C Paragraph 15.207 (dBμV) Limit | | |
|---|---|---|
| Frequency MHz | Limits | |
| | QP | AVG |
| 0.15 - 0.50 | 66-56 | 56-46 |
| 0.50-5.0 | 56 | 46 |
| 5.0 - 30 | 60 | 50 |

### 2.3. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)
Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.
Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

## 2.4. Test Result of Conducted Emission

Product : Delta 3D Printer
Test Item : Conducted Emission Test
Power Line : L 1
Test Mode : Mode 3: Transmit (802.11n-20 7.2Mbps) (2437MHz) (Power Adapter: GST220A24)
Test Date : 2020/10/30

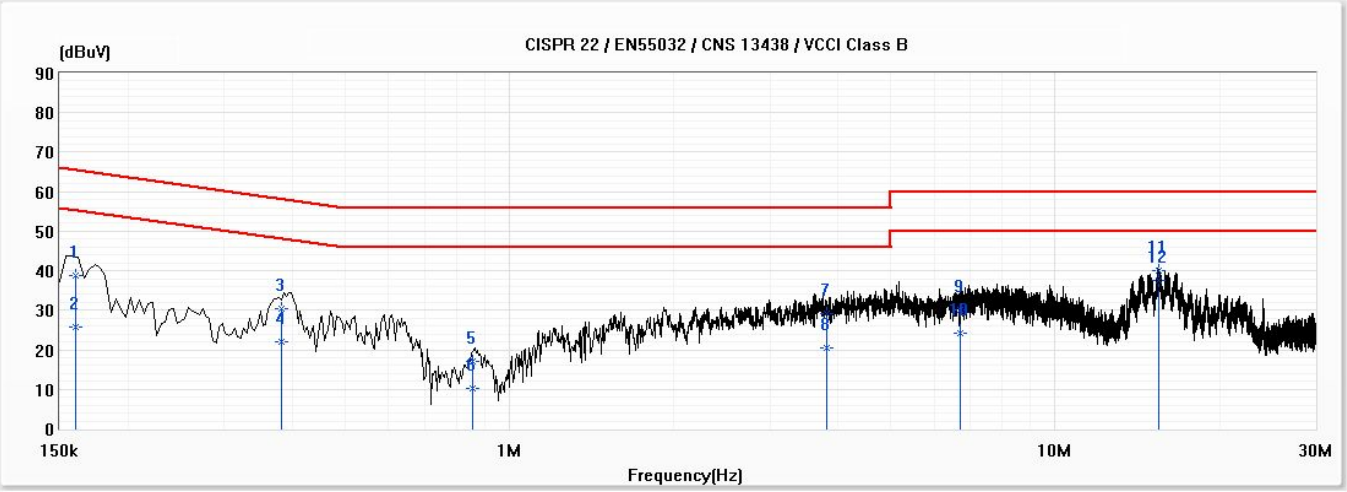



| No | Frequency (MHz) | Emission Level (dBµV) | Limit (dBµV) | Margin (dB) | Reading Level (dBµV) | Correct Factor (dB) | Detector Type |
|---|---|---|---|---|---|---|---|
| 1 | 0.154 | 39.44 | 65.77 | -26.33 | 29.78 | 9.66 | QP |
| 2 | 0.154 | 25.36 | 55.77 | -30.41 | 15.70 | 9.66 | AV |
| 3 | 0.395 | 31.73 | 57.96 | -26.23 | 22.07 | 9.66 | QP |
| 4 | 0.395 | 21.91 | 47.96 | -26.05 | 12.26 | 9.66 | AV |
| 5 | 0.646 | 23.95 | 56.00 | -32.05 | 14.28 | 9.67 | QP |
| 6 | 0.646 | 13.53 | 46.00 | -32.47 | 3.86 | 9.67 | AV |
| 7 | 1.912 | 24.57 | 56.00 | -31.43 | 14.86 | 9.72 | QP |
| 8 | 1.912 | 15.37 | 46.00 | -30.63 | 5.65 | 9.72 | AV |
| 9 | 5.126 | 32.25 | 60.00 | -27.75 | 22.45 | 9.80 | QP |
| 10 | 5.126 | 24.49 | 50.00 | -25.51 | 14.69 | 9.80 | AV |
| 11 | 16.640 | 38.24 | 60.00 | -21.76 | 28.29 | 9.95 | QP |
| *12 | 16.640 | 34.54 | 50.00 | -15.46 | 24.59 | 9.95 | AV |

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

| | | |
|---|---|---|
| Product | : | Delta 3D Printer |
| Test Item | : | Conducted Emission Test |
| Power Line | : | N |
| Test Mode | : | Mode 3: Transmit (802.11n-20 7.2Mbps) (2437MHz) (Power Adapter: GST220A24) |
| Test Date | : | 2020/10/30 |

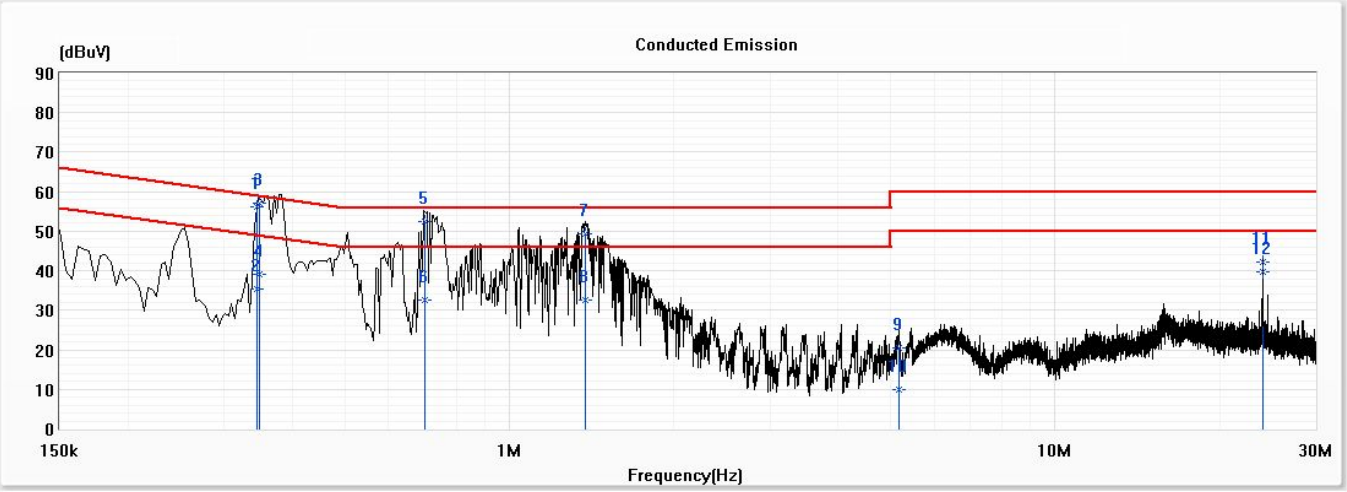



| No | Frequency (MHz) | Emission Level (dBµV) | Limit (dBµV) | Margin (dB) | Reading Level (dBµV) | Correct Factor (dB) | Detector Type |
|---|---|---|---|---|---|---|---|
| 1 | 0.161 | 38.77 | 65.43 | -26.66 | 29.10 | 9.67 | QP |
| 2 | 0.161 | 25.75 | 55.43 | -29.67 | 16.08 | 9.67 | AV |
| 3 | 0.382 | 30.56 | 58.24 | -27.67 | 20.89 | 9.67 | QP |
| 4 | 0.382 | 21.91 | 48.24 | -26.33 | 12.24 | 9.67 | AV |
| 5 | 0.856 | 16.96 | 56.00 | -39.04 | 7.28 | 9.68 | QP |
| 6 | 0.856 | 10.37 | 46.00 | -35.63 | 0.69 | 9.68 | AV |
| 7 | 3.821 | 29.05 | 56.00 | -26.95 | 19.28 | 9.78 | QP |
| 8 | 3.821 | 20.50 | 46.00 | -25.50 | 10.73 | 9.78 | AV |
| 9 | 6.702 | 29.95 | 60.00 | -30.05 | 20.11 | 9.85 | QP |
| 10 | 6.702 | 24.06 | 50.00 | -25.94 | 14.22 | 9.85 | AV |
| 11 | 15.480 | 40.01 | 60.00 | -19.99 | 30.01 | 10.00 | QP |
| *12 | 15.480 | 37.63 | 50.00 | -12.37 | 27.63 | 10.00 | AV |

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Delta 3D Printer
Test Item : Conducted Emission Test
Power Line : L 1
Test Mode : Mode 3: Transmit (802.11n-20 7.2Mbps) (2437MHz) (Power Adapter: EA13001N-240)
Test Date : 2021/01/11

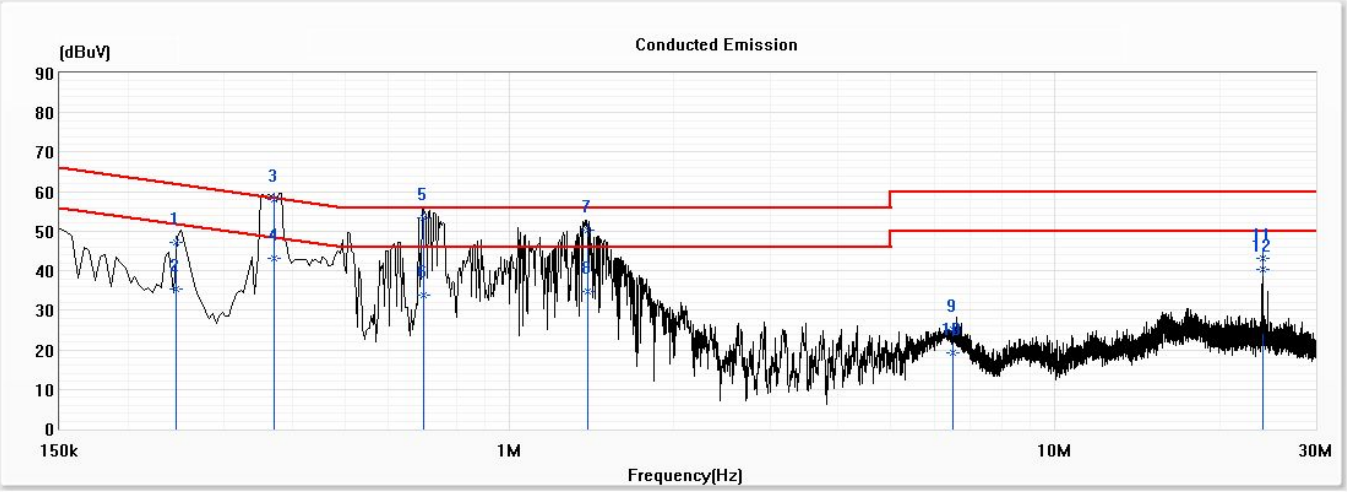



| No | Frequency (MHz) | Emission Level (dBµV) | Limit (dBµV) | Margin (dB) | Reading Level (dBµV) | Correct Factor (dB) | Detector Type |
|---|---|---|---|---|---|---|---|
| 1 | 0.345 | 56.04 | 59.09 | -3.05 | 46.39 | 9.66 | QP |
| 2 | 0.345 | 35.44 | 49.09 | -13.65 | 25.79 | 9.66 | AV |
| *3 | 0.348 | 57.12 | 59.00 | -1.88 | 47.47 | 9.66 | QP |
| 4 | 0.348 | 39.06 | 49.00 | -9.95 | 29.40 | 9.66 | AV |
| 5 | 0.699 | 52.50 | 56.00 | -3.50 | 42.83 | 9.67 | QP |
| 6 | 0.699 | 32.53 | 46.00 | -13.47 | 22.86 | 9.67 | AV |
| 7 | 1.379 | 49.49 | 56.00 | -6.51 | 39.79 | 9.70 | QP |
| 8 | 1.379 | 32.50 | 46.00 | -13.50 | 22.80 | 9.70 | AV |
| 9 | 5.181 | 20.34 | 60.00 | -39.66 | 10.53 | 9.80 | QP |
| 10 | 5.181 | 10.07 | 50.00 | -39.93 | 0.27 | 9.80 | AV |
| 11 | 24.000 | 42.24 | 60.00 | -17.76 | 32.28 | 9.96 | QP |
| 12 | 24.000 | 39.58 | 50.00 | -10.42 | 29.61 | 9.96 | AV |

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Delta 3D Printer
Test Item : Conducted Emission Test
Power Line : N
Test Mode : Mode 3: Transmit (802.11n-20 7.2Mbps) (2437MHz) (Power Adapter: EA13001N-240)
Test Date : 2021/01/11




| No | Frequency (MHz) | Emission Level (dBµV) | Limit (dBµV) | Margin (dB) | Reading Level (dBµV) | Correct Factor (dB) | Detector Type |
|---|---|---|---|---|---|---|---|
| 1 | 0.246 | 47.10 | 61.90 | -14.80 | 37.43 | 9.67 | QP |
| 2 | 0.246 | 35.35 | 51.90 | -16.55 | 25.68 | 9.67 | AV |
| *3 | 0.370 | 57.99 | 58.50 | -0.50 | 48.32 | 9.67 | QP |
| 4 | 0.370 | 43.06 | 48.50 | -5.43 | 33.40 | 9.67 | AV |
| 5 | 0.696 | 53.27 | 56.00 | -2.73 | 43.59 | 9.68 | QP |
| 6 | 0.696 | 33.68 | 46.00 | -12.32 | 24.00 | 9.68 | AV |
| 7 | 1.389 | 50.34 | 56.00 | -5.66 | 40.63 | 9.70 | QP |
| 8 | 1.389 | 34.80 | 46.00 | -11.20 | 25.09 | 9.70 | AV |
| 9 | 6.508 | 25.12 | 60.00 | -34.88 | 15.28 | 9.85 | QP |
| 10 | 6.508 | 19.26 | 50.00 | -30.74 | 9.42 | 9.85 | AV |
| 11 | 24.000 | 43.16 | 60.00 | -16.84 | 33.09 | 10.07 | QP |
| 12 | 24.000 | 40.33 | 50.00 | -9.67 | 30.26 | 10.07 | AV |

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

# 3. Peak Power Output

## 3.1. Test Setup

## 3.2. Limits

The maximum peak power shall be less 1 Watt.

## 3.3. Test Procedure

The EUT was tested according to C63.10:2013 for compliance to FCC 47CFR 15.247 requirements. The maximum peak conducted output power using C63.10:2013 Section 11.9.1.3 PKPM1 Peak power meter method. The maximum average conducted output power using C63.10:2013 Section 11.9.2.3 Measurement using a power meter (PM). (Measurement using a gated RF average-reading power meter).

## 3.4. Test Result of Peak Power Output

Product : Delta 3D Printer
Test Item : Peak Power Output Data
Test Mode : Mode 1: Transmit (802.11b 1Mbps)
Test Date : 2020/10/30

| Channel No | Frequency (MHz) | Average Power For different Data Rate (Mbps) | | | | Peak Power | Required Limit | Result |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 5.5 | 11 | 1 | | |
| | | Measurement Level (dBm) | | | | | | |
| 01 | 2412 | 11.12 | -- | -- | -- | 14.59 | <30dBm | Pass |
| 06 | 2437 | 11.66 | 11.62 | 11.57 | 11.51 | 15.13 | <30dBm | Pass |
| 11 | 2462 | 9.3 | -- | -- | -- | 12.7 | <30dBm | Pass |

Product : Delta 3D Printer
Test Item : Peak Power Output Data
Test Mode : Mode 2: Transmit (802.11g 6Mbps)
Test Date : 2020/10/30

| Channel No | Frequency (MHz) | Average Power For different Data Rate (Mbps) | | | | | | | | Peak Power | Required Limit | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 6 | 9 | 12 | 18 | 24 | 36 | 48 | 54 | 6 | | |
| | | Measurement Level (dBm) | | | | | | | | | | |
| 01 | 2412 | 14.43 | -- | -- | -- | -- | -- | -- | -- | 21.57 | <30dBm | Pass |
| 06 | 2437 | 14.56 | 14.52 | 14.47 | 14.41 | 14.36 | 14.30 | 14.26 | 14.20 | 21.34 | <30dBm | Pass |
| 11 | 2462 | 14.3 | -- | -- | -- | -- | -- | -- | -- | 21.04 | <30dBm | Pass |

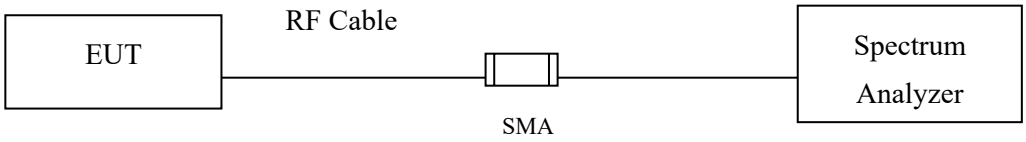
Product : Delta 3D Printer
Test Item : Peak Power Output Data
Test Mode : Mode 3: Transmit (802.11n-20 7.2Mbps)
Test Date : 2020/10/30

| Channel No | Frequency (MHz) | Average Power For different Data Rate (Mbps) | | | | | | | | Peak Power | Required Limit | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7.2 | 14.4 | 21.7 | 28.9 | 43.3 | 57.8 | 65 | 72.2 | 7.2 | | |
| | | Measurement Level (dBm) | | | | | | | | | | |
| 01 | 2412 | 14.15 | -- | -- | -- | -- | -- | -- | -- | 21.51 | <30dBm | Pass |
| 06 | 2437 | 14.34 | 14.30 | 14.26 | 14.19 | 14.13 | 14.06 | 14.03 | 13.98 | 21.41 | <30dBm | Pass |
| 11 | 2462 | 13.79 | -- | -- | -- | -- | -- | -- | -- | 20.91 | <30dBm | Pass |

# 4. RF antenna conducted test

## 4.1. Test Setup

**RF antenna Conducted Measurement:**




## 4.2. Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

## 4.3. Test Procedure

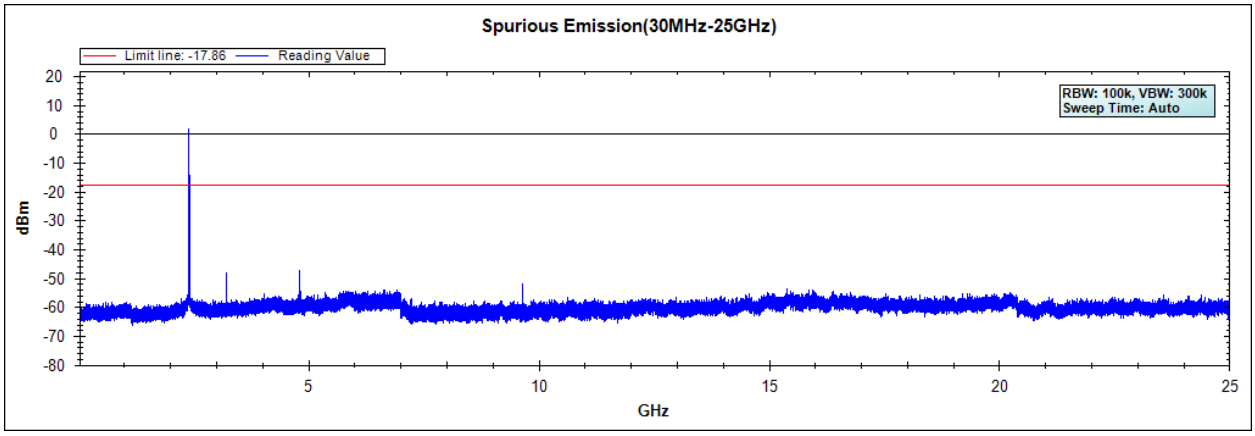
The EUT was tested according to C63.10:2013 Section 11.11 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Set VBW> RBW, scan up through 10th harmonic.

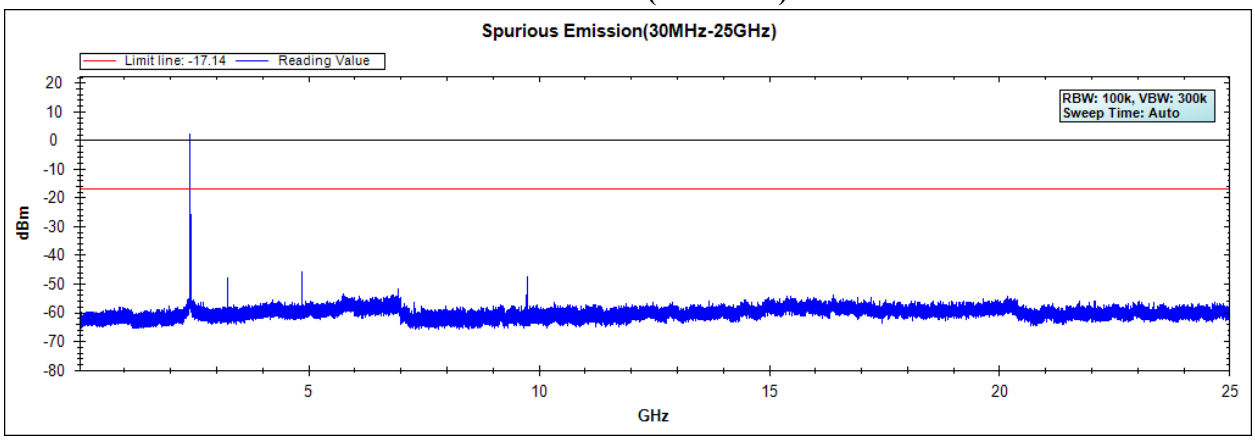
## 4.4. Test Result of RF antenna conducted test

| | | |
|---|---|---|
| Product | : | Delta 3D Printer |
| Test Item | : | RF antenna conducted test |
| Test Mode | : | Mode 1: Transmit (802.11b 1Mbps) |
| Test Date | : | 2020/10/30 |

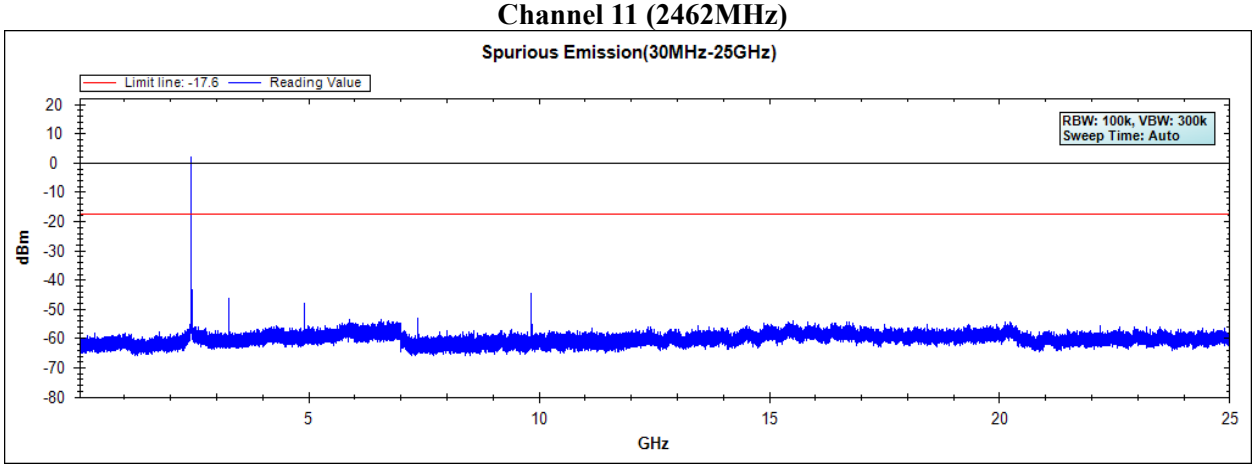
**Channel 01 (2412MHz)**




**Channel 06 (2437MHz)**



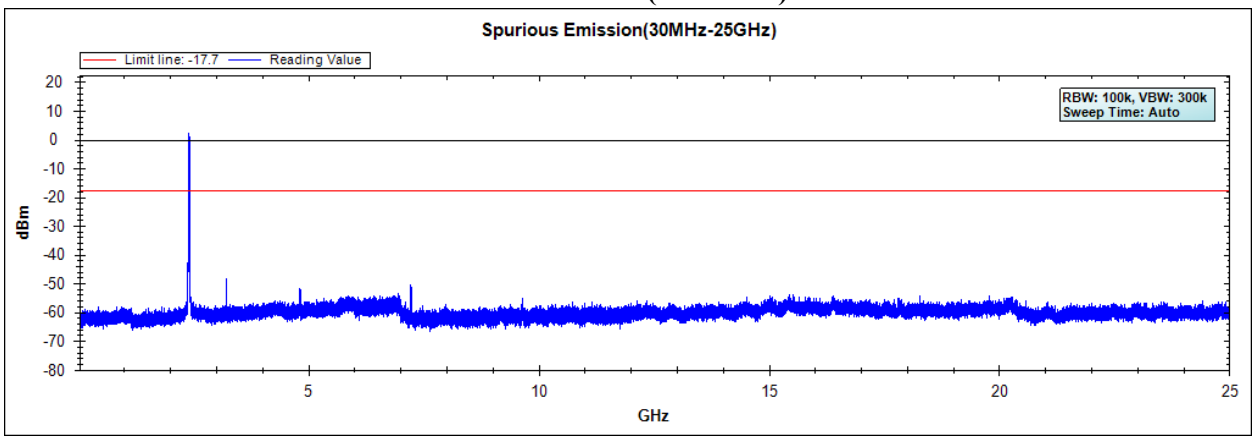

**Channel 11 (2462MHz)**



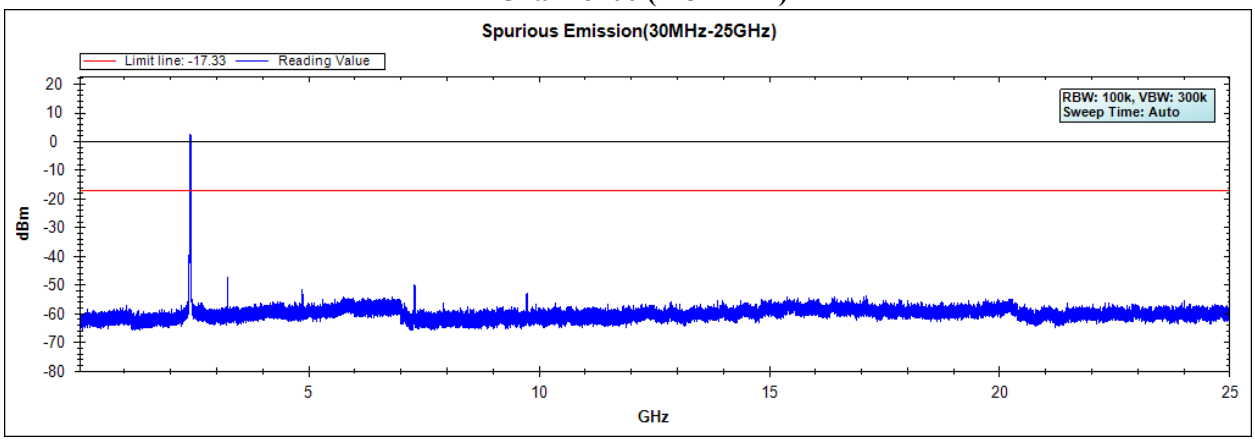

Note: The above test pattern is synthesized by multiple of the frequency range.

| | | |
|---|---|---|
| Product | : | Delta 3D Printer |
| Test Item | : | RF Antenna Conducted Spurious |
| Test Mode | : | Mode 2: Transmit (802.11g 6Mbps) |
| Test Date | : | 2020/10/30 |

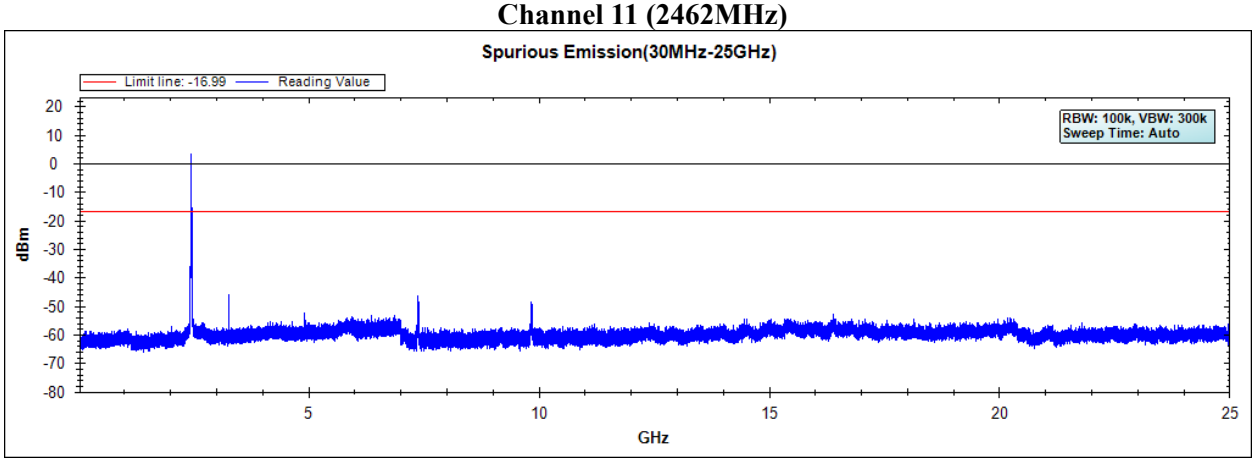
**Channel 01 (2412MHz)**




**Channel 06 (2437MHz)**



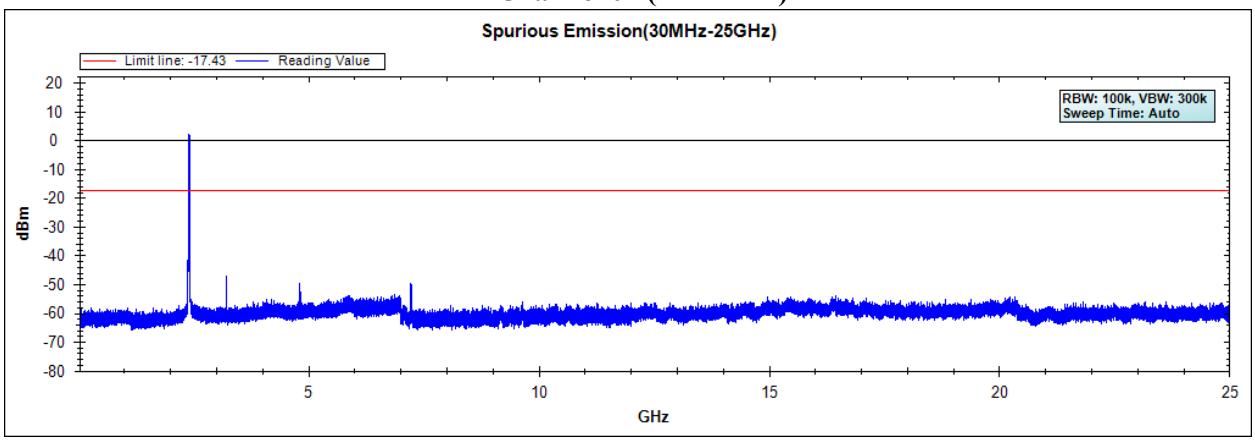

**Channel 11 (2462MHz)**



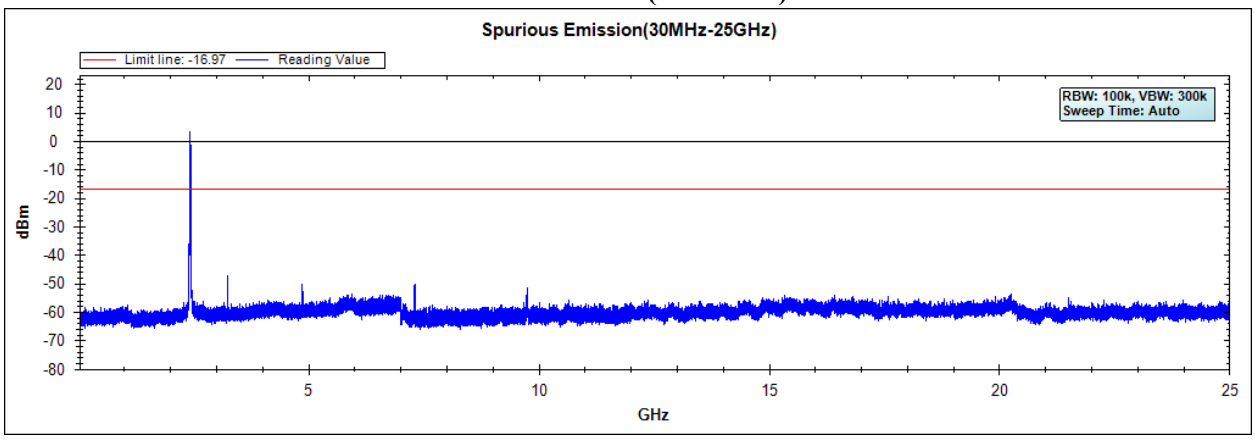

Note: The above test pattern is synthesized by multiple of the frequency range.

| | | |
|---|---|---|
| Product | : | Delta 3D Printer |
| Test Item | : | RF Antenna Conducted Spurious |
| Test Mode | : | Mode 3: Transmit (802.11n-20 7.2Mbps) |
| Test Date | : | 2020/10/30 |

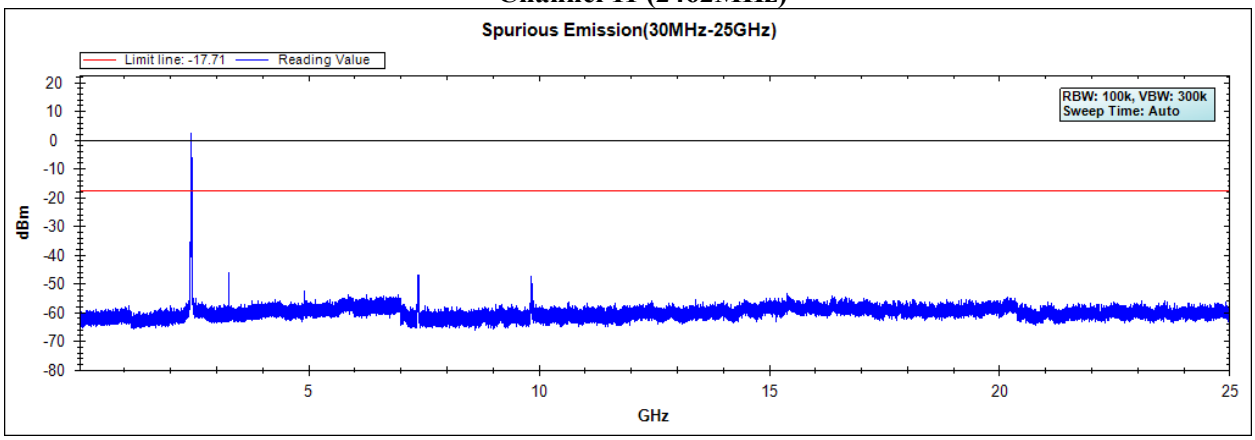
**Channel 01 (2412MHz)**




**Channel 06 (2437MHz)**




**Channel 11 (2462MHz)**

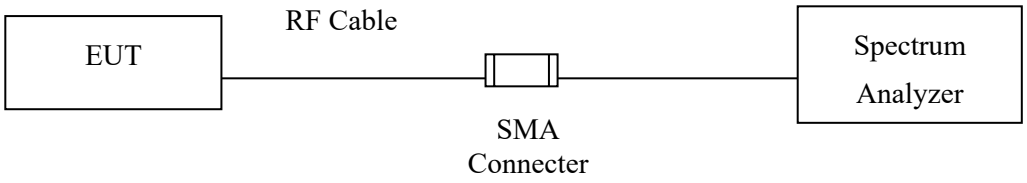



Note: The above test pattern is synthesized by multiple of the frequency range.

# 5. Band Edge

## 5.1. Test Setup

**RF Conducted Measurement**




## 5.2. Limits

According to FCC Section 15.247(d). In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

## 5.3. Test Procedure

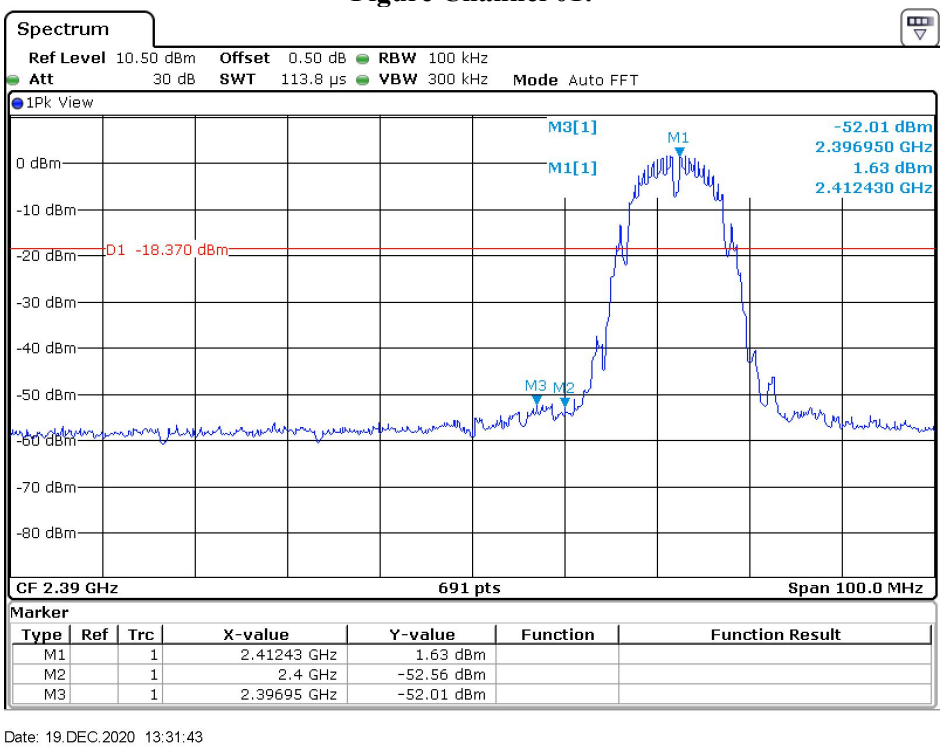
The EUT was tested according to C63.10:2013 Section 11.11 for compliance to FCC 47CFR 15.247 requirements.
Set RBW = 100 kHz, Set VBW> RBW.

## 5.4. Test Result of Band Edge

Product : Delta 3D Printer
Test Item : Band Edge Data
Test Mode : Mode 1: Transmit (802.11b 1Mbps)
Test Date : 2020/12/19

| Measurement Level<br>Δ (dB) | Result |
|---|---|
| > 20 | PASS |

**Figure Channel 01:**

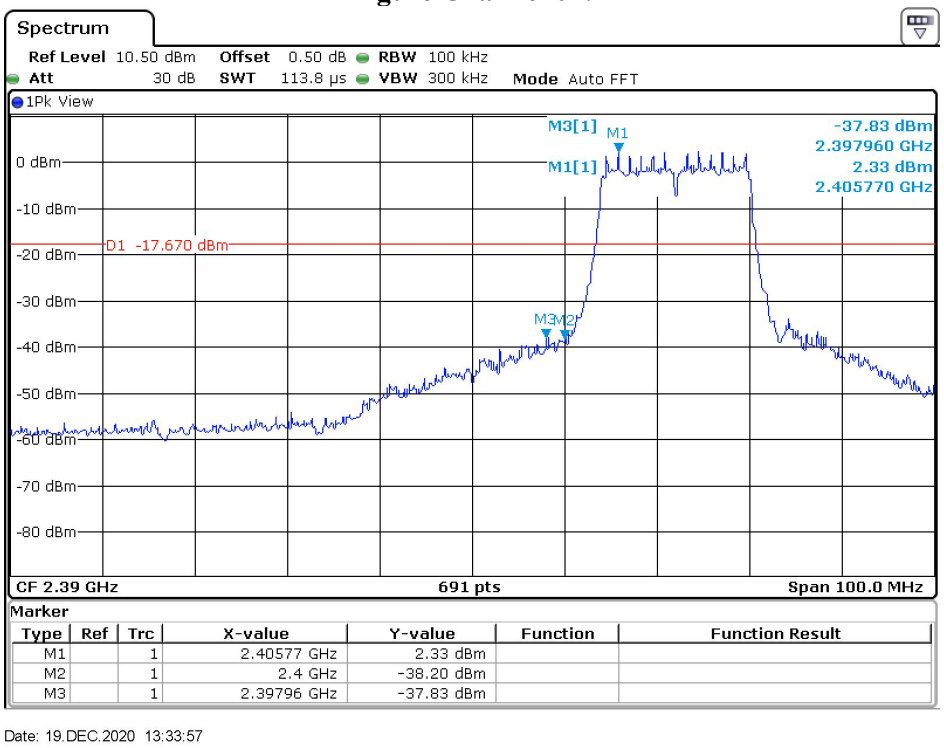



Date: 19.DEC.2020 13:31:43

Product : Delta 3D Printer
Test Item : Band Edge Data
Test Mode : Mode 2: Transmit (802.11g 6Mbps)
Test Date : 2020/12/19

| Measurement Level<br>Δ (dB) | Result |
|---|---|
| > 20 | PASS |

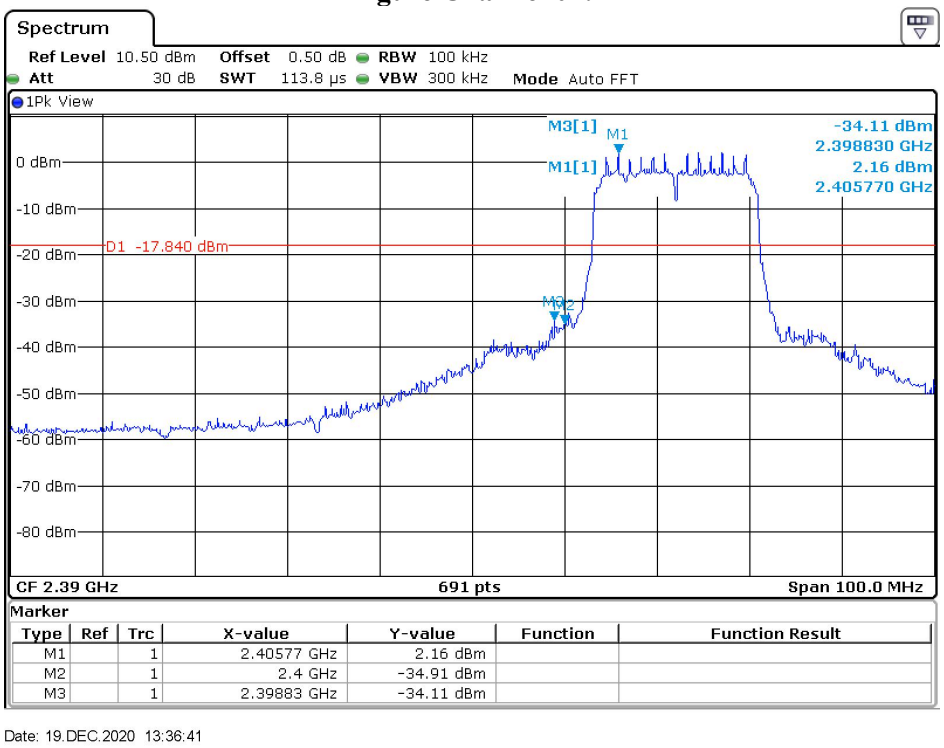
**Figure Channel 01:**



Product : Delta 3D Printer
Test Item : Band Edge Data
Test Mode : Mode 3: Transmit (802.11n-20 7.2Mbps)
Test Date : 2020/12/19

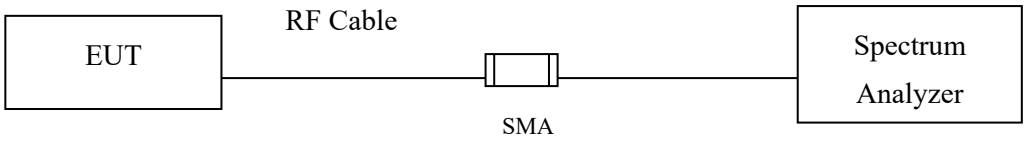
| Measurement Level<br>Δ (dB) | Result |
|---|---|
| > 20 | PASS |

**Figure Channel 01:**



# 6. 6dB Bandwidth

## 6.1. Test Setup




## 6.2. Limits

The minimum bandwidth shall be at least 500 kHz.

## 6.3. Test Procedure

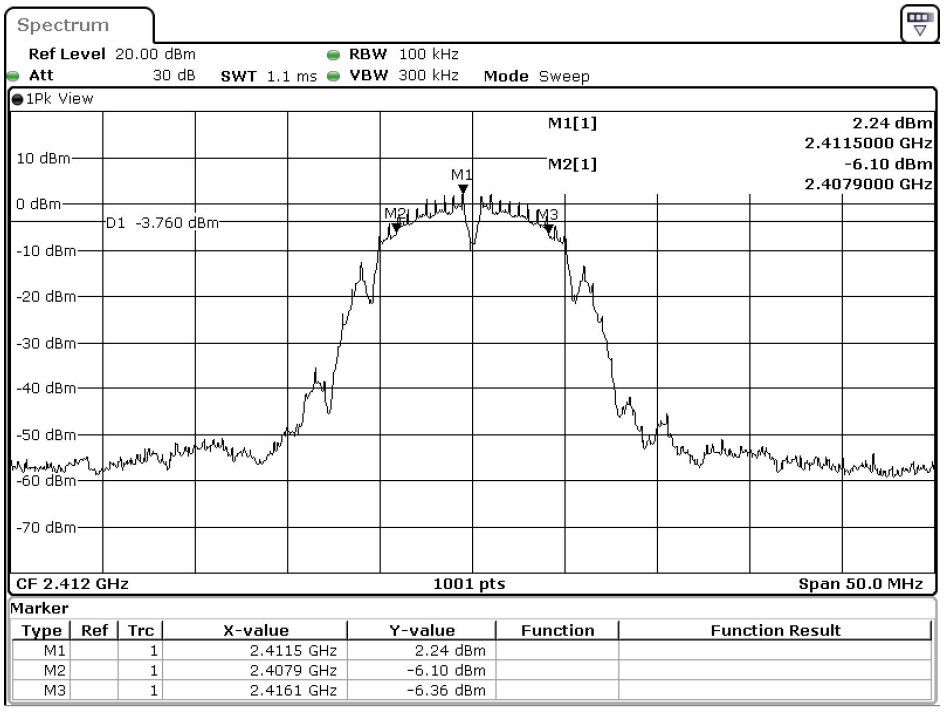
The EUT was setup according to ANSI C63.4, 2014; tested according to ANSI C63.10 Section 11.8 for compliance to FCC 47CFR 15.247 requirements.

## 6.4. Test Result of 6dB Bandwidth

Product : Delta 3D Printer
Test Item : 6dB Bandwidth Data
Test Mode : Mode 1: Transmit (802.11b 1Mbps)

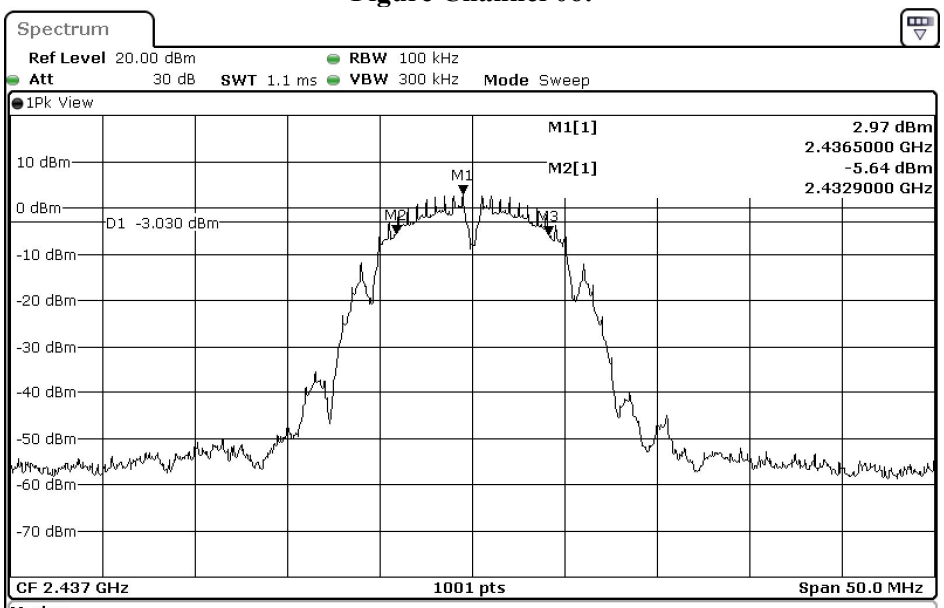
| Channel No. | Frequency (MHz) | Measurement Level (kHz) | Required Limit (kHz) | Result |
|---|---|---|---|---|
| 01 | 2412 | 8200 | >500 | Pass |
| 06 | 2437 | 8200 | >500 | Pass |
| 11 | 2462 | 8200 | >500 | Pass |

**Figure Channel 01:**




Date: 30.OCT.2020 03:41:04

## Figure Channel 06:

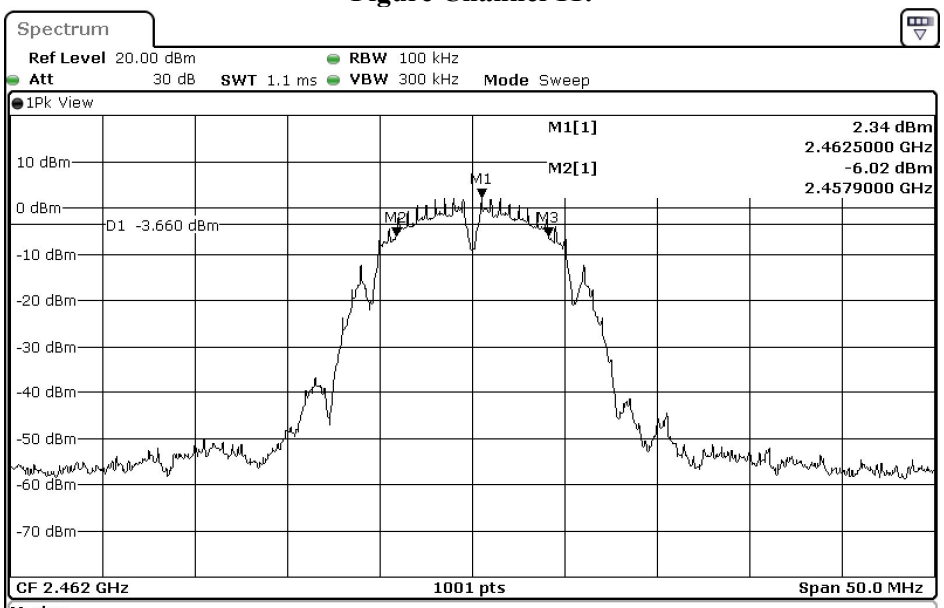



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.4365 GHz | 2.97 dBm | | |
| M2 | | 1 | 2.4329 GHz | -5.64 dBm | | |
| M3 | | 1 | 2.4411 GHz | -5.75 dBm | | |

Date: 30.OCT.2020 03:45:01

## Figure Channel 11:




Marker

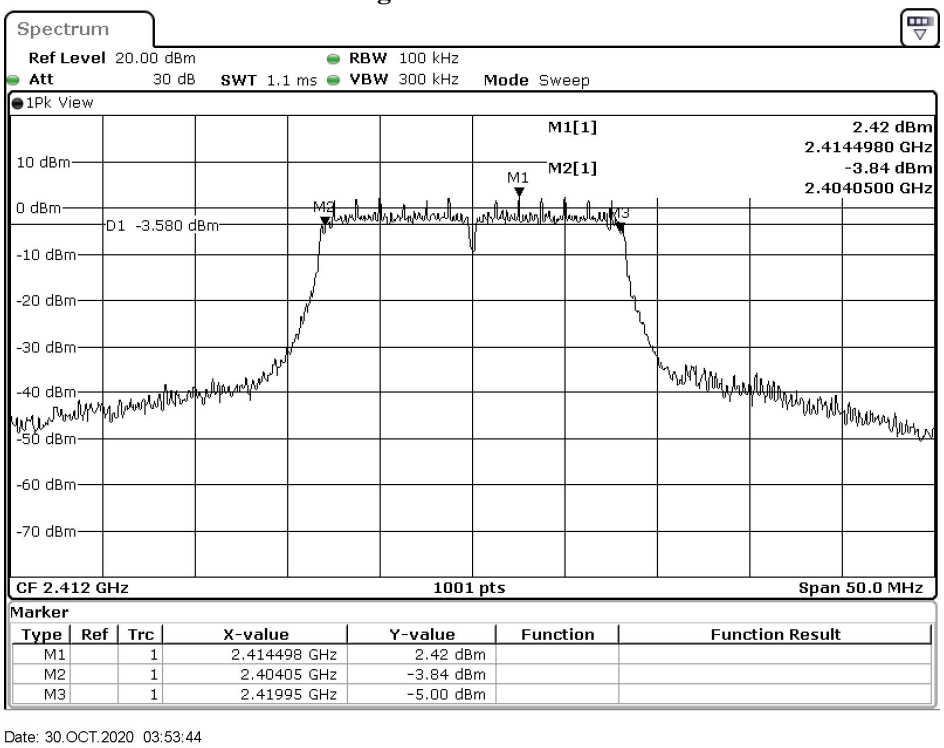
| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.4625 GHz | 2.34 dBm | | |
| M2 | | 1 | 2.4579 GHz | -6.02 dBm | | |
| M3 | | 1 | 2.4661 GHz | -5.97 dBm | | |

Date: 30.OCT.2020 03:49:44

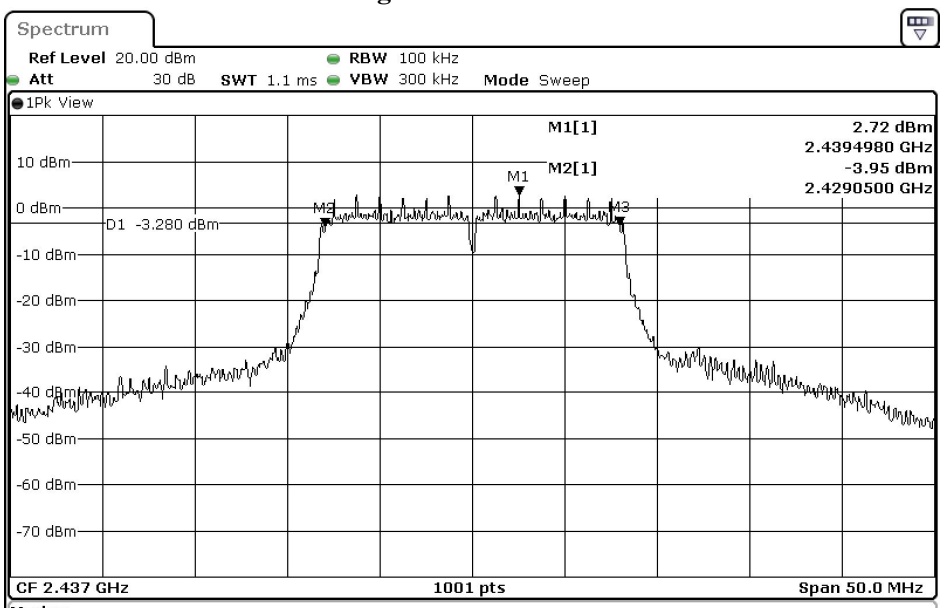
Product : Delta 3D Printer
Test Item : 6dB Bandwidth Data
Test Mode : Mode 2: Transmit (802.11g 6Mbps)

| Channel No. | Frequency (MHz) | Measurement Level (kHz) | Required Limit (kHz) | Result |
|---|---|---|---|---|
| 01 | 2412 | 15900 | >500 | Pass |
| 06 | 2437 | 15900 | >500 | Pass |
| 11 | 2462 | 15950 | >500 | Pass |

**Figure Channel 01:**



## Figure Channel 06:

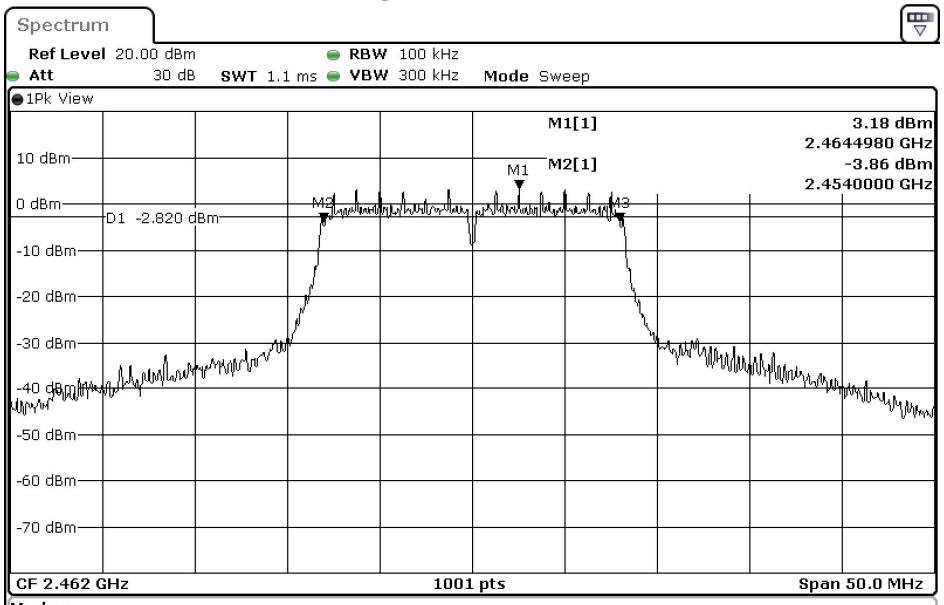



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.439498 GHz | 2.72 dBm | | |
| M2 | | 1 | 2.42905 GHz | -3.95 dBm | | |
| M3 | | 1 | 2.44495 GHz | -3.78 dBm | | |

Date: 30.OCT.2020 03:57:38

## Figure Channel 11:




Marker

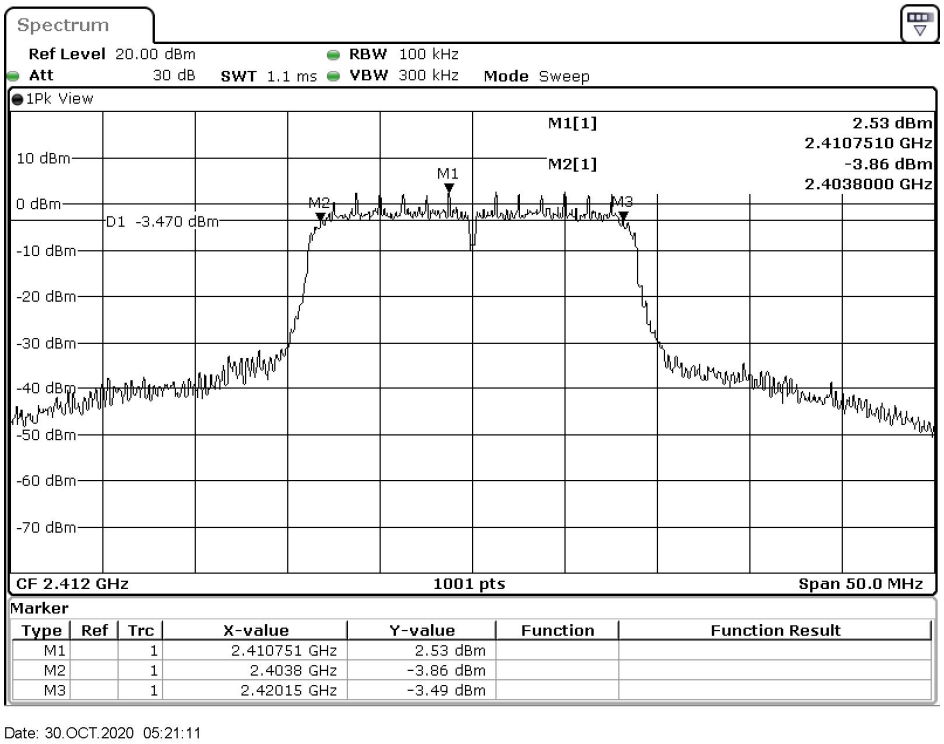
| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.464498 GHz | 3.18 dBm | | |
| M2 | | 1 | 2.454 GHz | -3.86 dBm | | |
| M3 | | 1 | 2.46995 GHz | -3.73 dBm | | |

Date: 30.OCT.2020 05:16:58

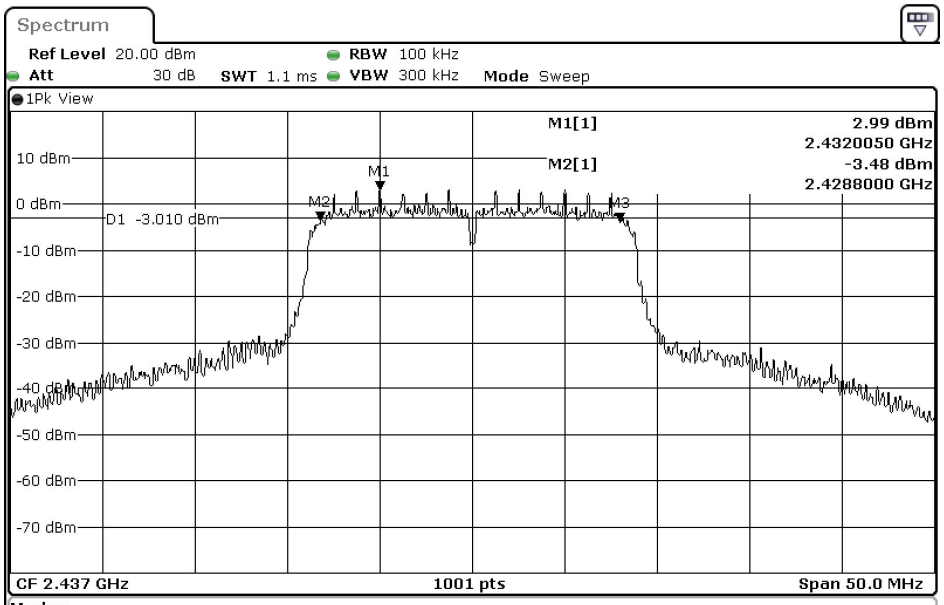
Product : Delta 3D Printer
Test Item : 6dB Bandwidth Data
Test Mode : Mode 3: Transmit (802.11n-20 7.2Mbps)

| Channel No. | Frequency (MHz) | Measurement Level (kHz) | Required Limit (kHz) | Result |
|---|---|---|---|---|
| 01 | 2412 | 16350 | >500 | Pass |
| 06 | 2437 | 16150 | >500 | Pass |
| 11 | 2462 | 16350 | >500 | Pass |

**Figure Channel 01:**



## Figure Channel 06:

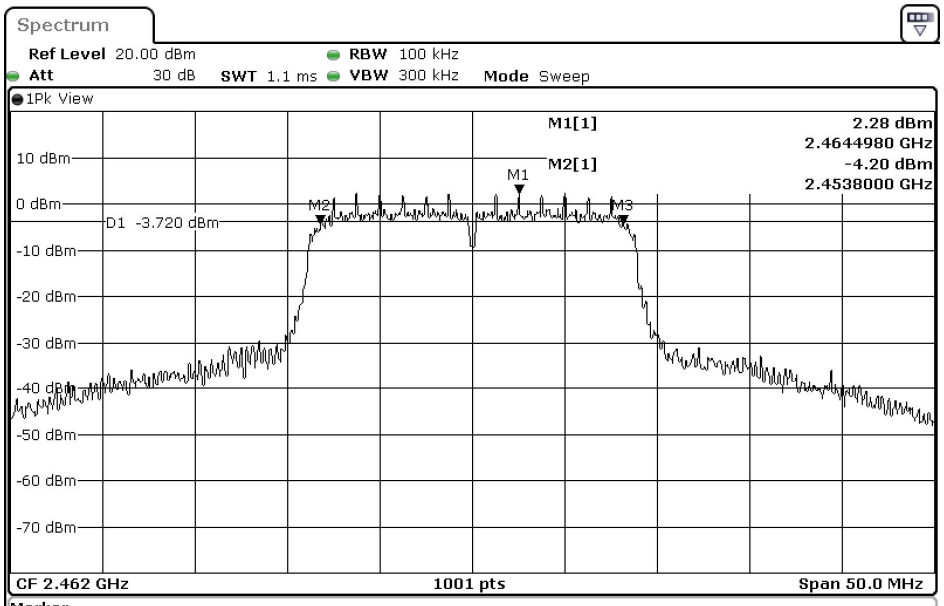



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.432005 GHz | 2.99 dBm | | |
| M2 | | 1 | 2.4288 GHz | -3.48 dBm | | |
| M3 | | 1 | 2.44495 GHz | -3.89 dBm | | |

Date: 30.OCT.2020 05:25:25

## Figure Channel 11:



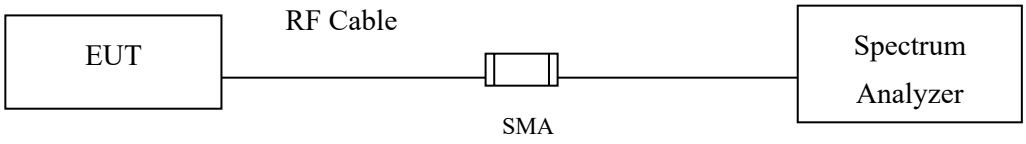

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.464498 GHz | 2.28 dBm | | |
| M2 | | 1 | 2.4538 GHz | -4.20 dBm | | |
| M3 | | 1 | 2.47015 GHz | -4.26 dBm | | |

Date: 30.OCT.2020 05:29:20

# 7. Power Density

## 7.1. Test Setup




## 7.2. Limits

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

## 7.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013; tested according to DTS test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements.
The maximum power spectral density using C63.10 Section 11.10.2 Method PKPSD (peak PSD)

## 7.4. Test Result of Power Density

Product : Delta 3D Printer
Test Item : Power Density Data
Test Mode : Mode 1: Transmit (802.11b 1Mbps)

| Channel No. | Frequency (MHz) | Measure Level (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|
| 01 | 2412 | 2.14 | ≦8dBm | Pass |
| 06 | 2437 | 2.86 | ≦8dBm | Pass |
| 11 | 2462 | 2.40 | ≦8dBm | Pass |

**Figure Channel 01:**

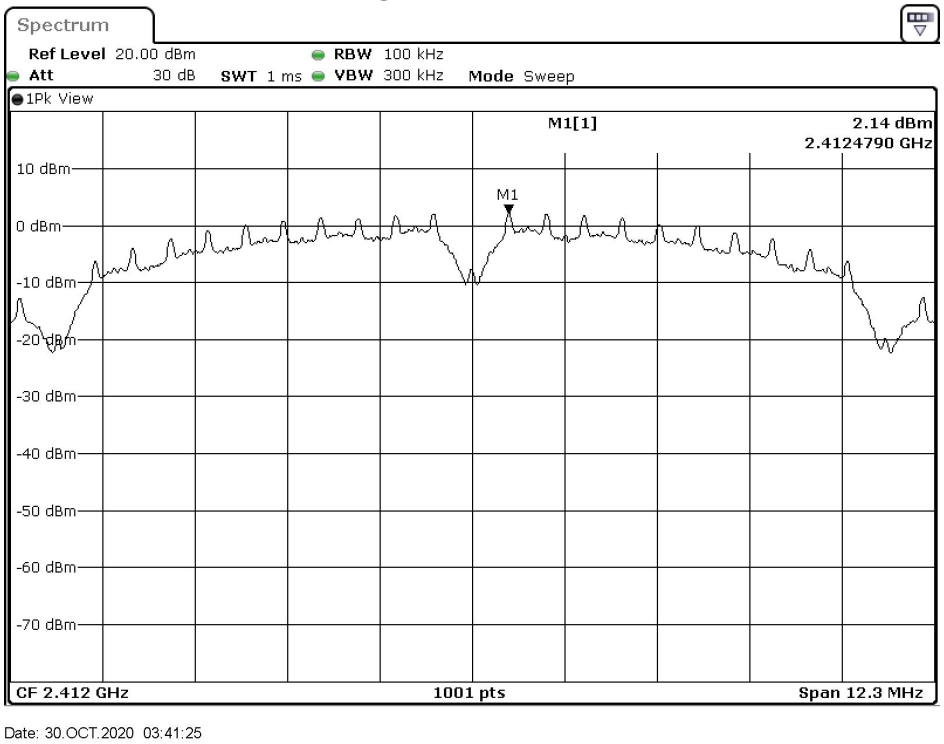
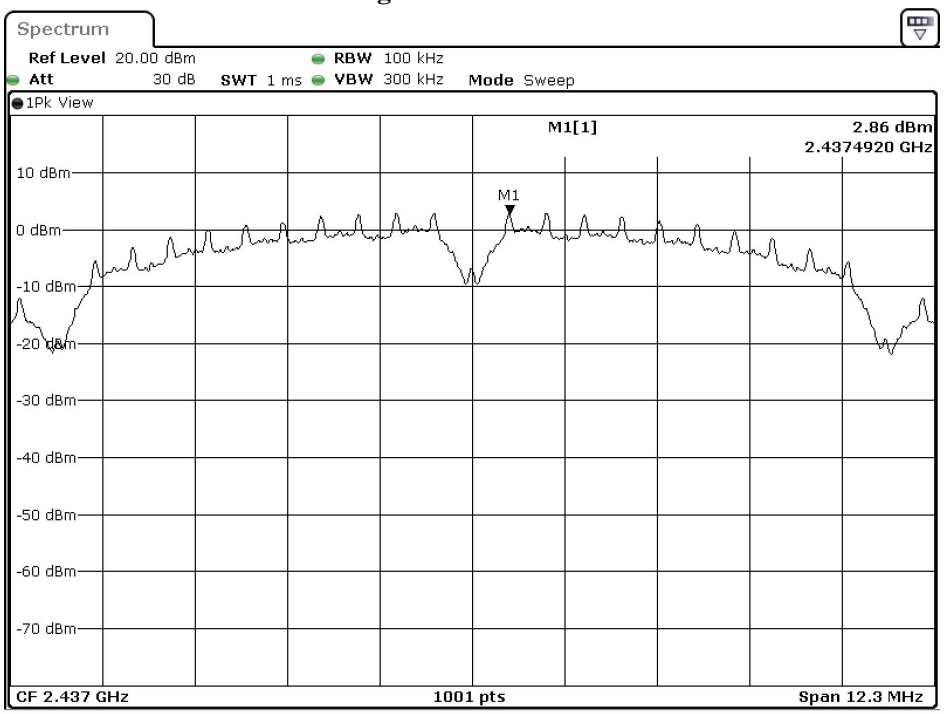
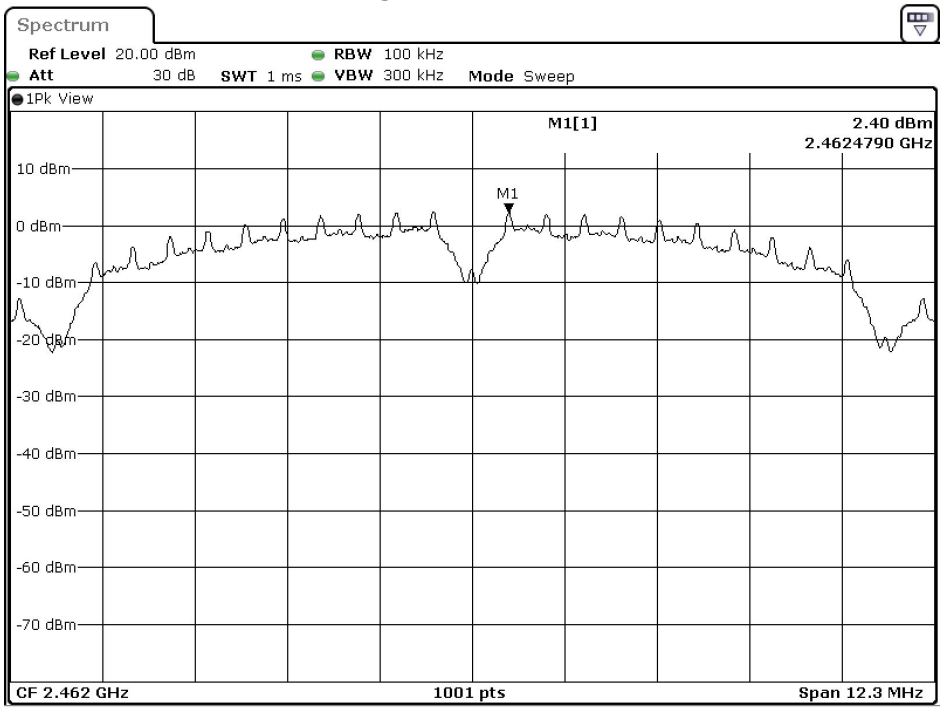


**Figure Channel 06:**




Date: 30.OCT.2020 03:45:23

**Figure Channel 11:**

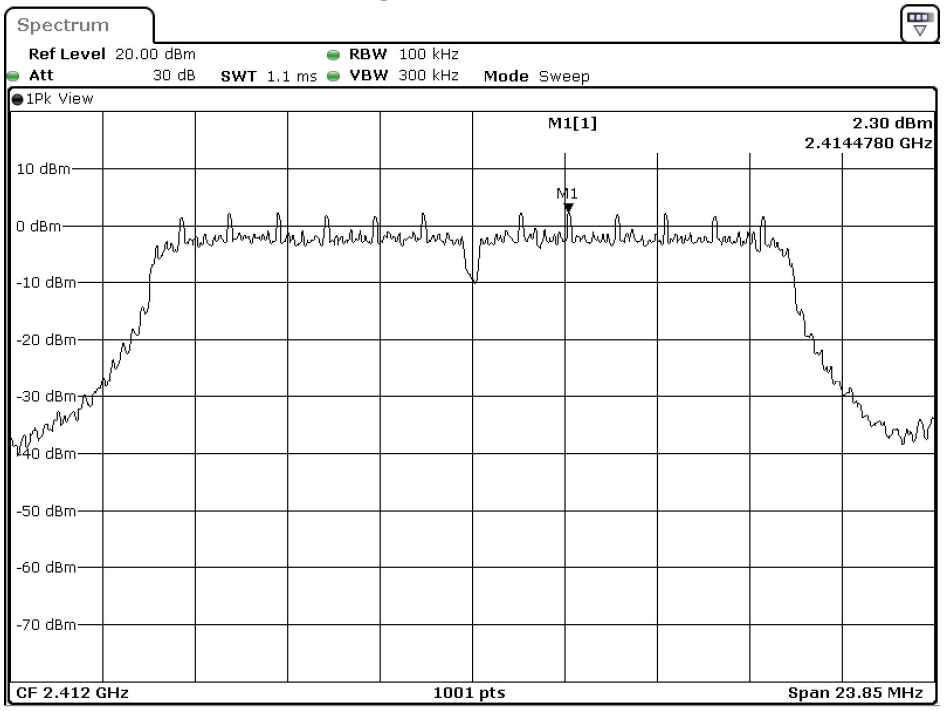



Date: 30.OCT.2020 03:50:05

Product : Delta 3D Printer
Test Item : Power Density Data
Test Mode : Mode 2: Transmit (802.11g 6Mbps)

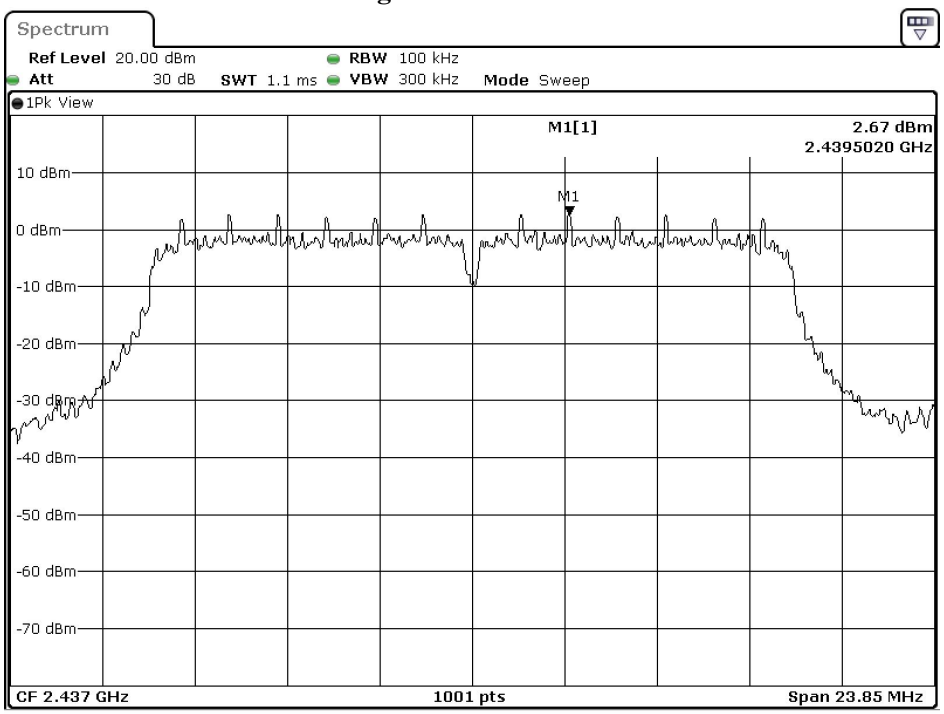
| Channel No. | Frequency (MHz) | Measure Level (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|
| 01 | 2412 | 2.30 | ≦8dBm | Pass |
| 06 | 2437 | 2.67 | ≦8dBm | Pass |
| 11 | 2462 | 3.01 | ≦8dBm | Pass |

**Figure Channel 01:**



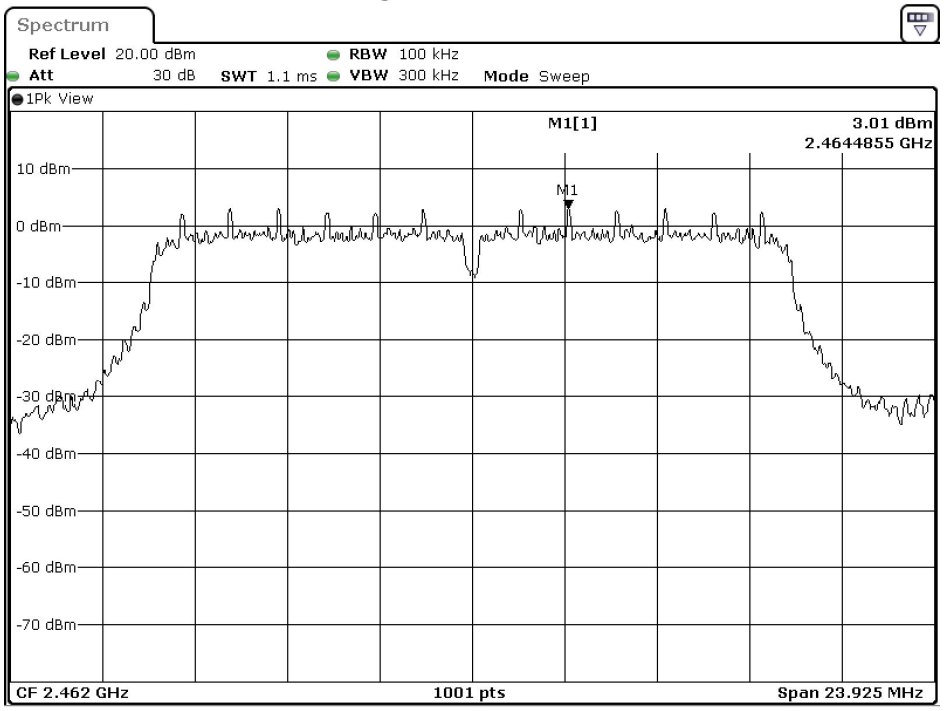

Date: 30.OCT.2020 03:54:05

**Figure Channel 06:**




Date: 30.OCT.2020 03:57:59

**Figure Channel 11:**




Date: 30.OCT.2020 05:17:20

Product : Delta 3D Printer
Test Item : Power Density Data
Test Mode : Mode 3: Transmit (802.11n-20 7.2Mbps)

| Channel No. | Frequency (MHz) | Measure Level (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|
| 01 | 2412 | 2.57 | ≦8dBm | Pass |
| 06 | 2437 | 3.03 | ≦8dBm | Pass |
| 11 | 2462 | 2.29 | ≦8dBm | Pass |

**Figure Channel 01:**

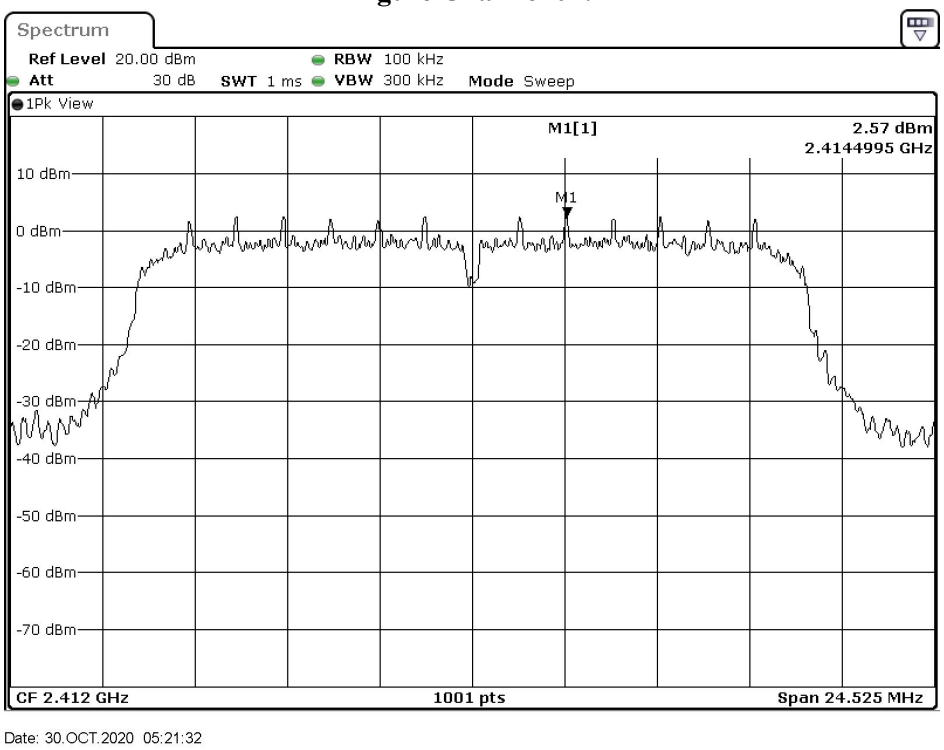
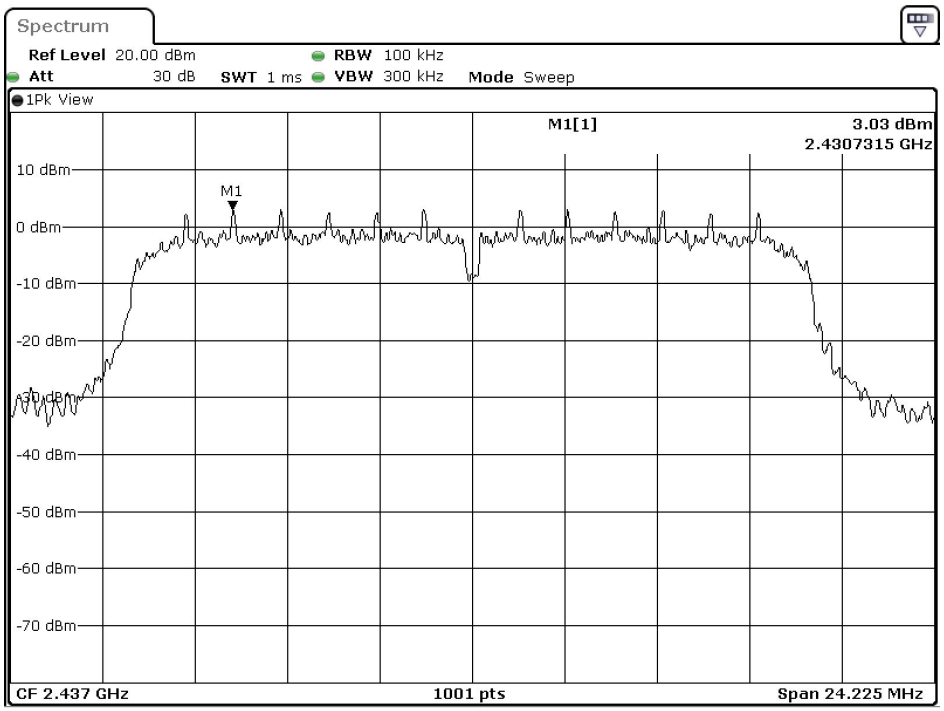
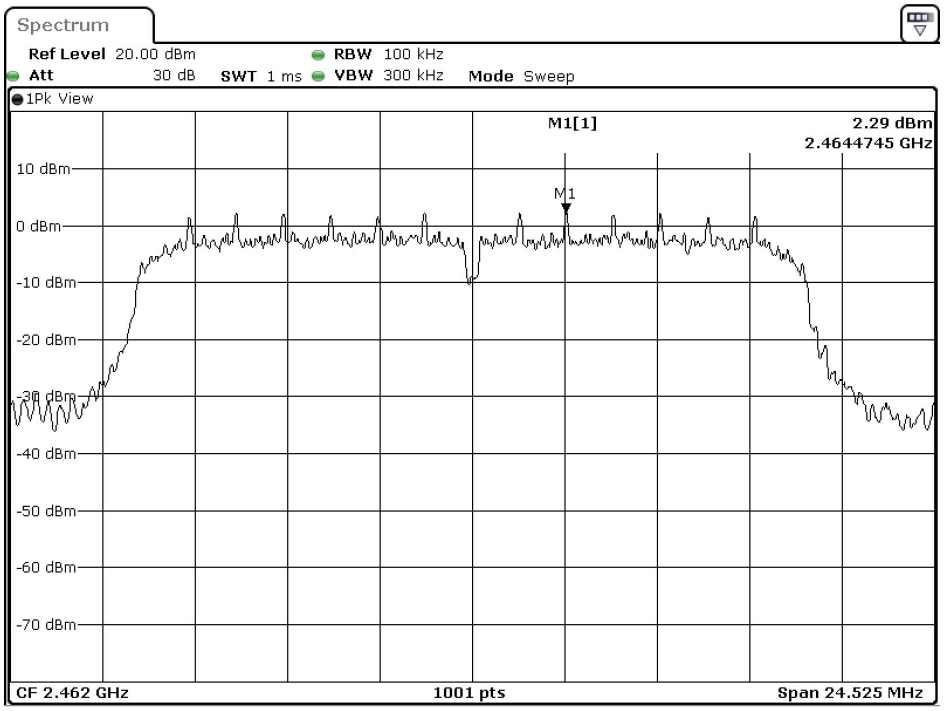


**Figure Channel 06:**




Date: 30.OCT.2020 05:25:47

**Figure Channel 11:**




Date: 30.OCT.2020 05:29:41

## 8. EMI Reduction Method During Compliance Testing

No modification was made during testing.