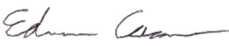
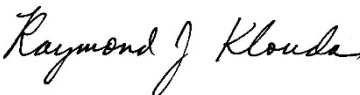




### Engineering Test Report No. 2402382-01

Report Date	October 17, 2024	
Manufacturer Name	Milwaukee Electric Tool Corporation	
Manufacturer Address	13135 West Lisbon Road Brookfield, WI 53005	
Product Name Model No.	Underground Cable Cutter Wireless Remote 22802875	
Date Received	October 2, 2024	
Test Dates	October 2, 2024 – October 3, 2024	
Specifications	FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 Innovation, Science, and Economic Development Canada, RSS-GEN Innovation, Science, and Economic Development Canada, RSS-247	
Test Facility	Elite Electronic Engineering, Inc. 1516 Centre Circle, Downers Grove, IL 60515	FCC Reg. Number: 269750 IC Reg. Number: 2987A CAB Identifier: US0107
Signature		
Tested by	Edwin Casas	
Signature		
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894	
PO Number	MF-1664378	

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Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 and Innovation, Science, and Economic Development Canada, RSS-247 test specifications. The data presented in this test report pertains to the EUT on the test dates specified. Any electrical or mechanical modifications made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification. This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

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## 1. Report Revision History

Revision	Date	Description
–	21 OCT 2024	Initial Release of Engineering Test Report No. 2402382-01

## 2. Introduction

### 2.1. Scope of Tests

This document presents the results of a series of RF emissions tests that were performed on the Milwaukee Electric Tool Corporation Underground Cable Cutter Wireless Remote (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was manufactured and submitted for testing by Milwaukee Electric Tool Corporation located in Brookfield, WI.

### 2.2. Purpose

The test series was performed to determine if the EUT meets the RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, §15.247 for a Digital Modulation intentional radiator operating within the 2400 – 2483.5MHz band.

The test series was also performed to determine if the EUT meets the RF emission requirements of the Innovation, Science, and Economic Development Canada Radio Standards Specification RSS-Gen and RSS-247 for a Digital Modulation intentional radiator operating within the 2400 – 2483.5MHz band. Testing was performed in accordance with ANSI C63.10-2013.

### 2.3. Identification of the EUT

The EUTs were identified as follows:

EUT Identification	
Product Description	Underground Cable Cutter Wireless Remote
Model/Part No.	22802875
Serial No.	7, 14, 15, 16
Size of EUT	7" x 5" x 1"
Software/Firmware Version	2023.8.8
Device Type	Digitally Modulated Transmission Device
Band of Operation	2400 – 2483.5MHz
Modulation Type	FSK
Antenna Type	Dipole
Conducted Output Power	12.7dBm
6dB Bandwidth	854 kHz
Occupied Bandwidth (99% CBW)	1.03MHz

## 3. Power Input

The EUTs are powered by 6VDC from AA batteries. For this testing, a DC power supply provided 6VDC to the EUTs.

## 4. Grounding

The EUT was not connected to ground.

## 5. Support Equipment

No support equipment was used during the tests.

## 6. Interconnect Leads

No interconnect leads were used during the tests.

## 7. Modifications Made to the EUT

No modifications were made to the EUT during the testing.

## 8. Modes of Operation

The EUT and all peripheral equipment were energized. The EUT was programmed to transmit in one of the following modes:

Mode	Mode Description
2402MHz Tx	Continuous transmission at 2402MHz, modulated. (S/N 14)
2440MHz Tx	Continuous transmission at 2440MHz, modulated. (S/N 15)
2480MHz Tx	Continuous transmission at 2480MHz, modulated. (S/N 16)
Rx Only	Receive only at 2440MHz, (S/N 7)

## 9. Test Specifications

The tests were performed to selected portions of, and in accordance with the test specifications.

- Federal Communications Commission "Code of Federal Regulations", Title 47, Chapter I, Subchapter A, Part 15, Subpart C
- ANSI C63.4-2014, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz"
- ANSI C63.10-2013, "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"
- Federal Communications Commission Office of Engineering and Technology Laboratory Division, Guidance For Compliance Measurements On Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 April 2, 2019 KDB 558074 D01v05r02
- RSS-Gen Issue 5, February 2020, Amendment 2, Innovation, Science, and Economic Development Canada, "General Requirements for Compliance of Radio Apparatus"
- RSS-247 Issue 2, February 2017, "Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices"

## 10. Test Plan

No test plan was provided. Instructions were provided by personnel from Milwaukee Electric Tool Corporation and used in conjunction with the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247, Innovation, Science, and Economic Development Canada, RSS-247, and ANSI C63.4-2014 specifications.

## 11. Deviation, Additions to, or Exclusions from Test Specifications

There were no deviations, additions to, or exclusions from the test specifications during this test series.

## 12. Laboratory Conditions

The ambient parameters of the laboratory during testing were as follows:

Ambient Parameters	Value
Temperature	21.1°C
Relative Humidity	47%
Atmospheric Pressure	997mb

### 13. Summary

The following EMC tests were performed and the results are shown below:

Test Description	Requirements	Test Method	S/N	Results
Receiver Radiated Emissions	ISED RSS-GEN	ANSI C63.4:2014	7	Conforms
6dB Bandwidth	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	14, 15, 16	Conforms
99% Bandwidth	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	14, 15, 16	Conforms
Output Power	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	14, 15, 16	Conforms
Power Spectral Density	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	14, 15, 16	Conforms
Low Band Edge	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	14	Conforms
EIRP	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	14, 15, 16	Conforms
Spurious Radiated Emissions	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	14, 15, 16	Conforms
High Band Edge	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	16	Conforms

### 14. Sample Calculations

For Powerline Conducted Emissions:

The resultant voltage level (VL) is a summation in decibels (dB) of the receiver meter reading (MTR) and the cable loss factor (CF).

$$\text{Formula 1: VL (dB}\mu\text{V)} = \text{MTR (dB}\mu\text{V)} + \text{CF (dB)}.$$

For Radiated Emissions:

The resultant field strength (FS) is a summation in decibels (dB) of the receiver meter reading (MTR), the antenna correction factor (AF), and the cable loss factor (CF). If an external preamplifier is used, the total is reduced by its gain (-PA). If a distance correction (DC) is required, it is added to the total.

$$\text{Formula 1: FS (dB}\mu\text{V/m)} = \text{MTR (dB}\mu\text{V)} + \text{AF (dB/m)} + \text{CF (dB)} + (-\text{PA (dB)}) + \text{DC (dB)}$$

To convert the Field Strength dB $\mu$ V/m term to  $\mu$ V/m, the dB $\mu$ V/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in  $\mu$ V/m terms.

$$\text{Formula 2: FS (}\mu\text{V/m)} = \text{AntiLog} [(\text{FS (dB}\mu\text{V/m)})/20]$$

### 15. Statement of Conformity

The Milwaukee Electric Tool Corporation Underground Cable Cutter Wireless Remote (Model No. 22802875) did fully conform to the selected requirements of FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 and Innovation, Science, and Economic Development Canada Radio Standards Specification RSS-Gen and RSS-247 for a Digital Modulation intentional radiator operating within the 2400 – 2483.5MHz band.

### 16. Certification

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained

under conditions which meet or exceed those specified in the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 and Innovation, Science, and Economic Development Canada, RSS-247 test specifications. The data presented in this test report pertains to the EUT as received by the customer on the test date specified. Any electrical or mechanical modifications made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.



## 17. Photographs of EUT







## 18. Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW10	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12-SFF	PL11685/1241	1GHZ-20GHZ	3/20/2024	3/20/2025
APW18	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-30-20G20R6G-3R0-10-12-SFF	PL34312/2148	18-26.5GHZ	2/23/2024	2/23/2025
GSFB	OSP120 BASE UNIT	ROHDE & SCHWARZ	OSP120	101071	---	3/30/2023	3/30/2025
GSFE	OSP120	ROHDE & SCHWARZ	OSP120	101288	.01-40GHZ	4/4/2023	4/4/2025
NHG1	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ	NOTE 1	
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-2000MHz	6/21/2024	6/21/2026
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	6/24/2024	6/24/2026
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	7/26/2024	7/26/2026
RBG4	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	103007	2HZ-44GHZ	3/16/2024	3/16/2025
SES0	24VDC POWER SUPPLY	P-TRANS	FS-32024-1M	001	18-27VDC	NOTE 1	
VBV2	COMMERCIAL RADIATED EMISSIONS.EXE	ELITE		---	---	N/A	
XPQ4	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000-O/O	1	4.8-20GHZ	9/14/2023	9/14/2025

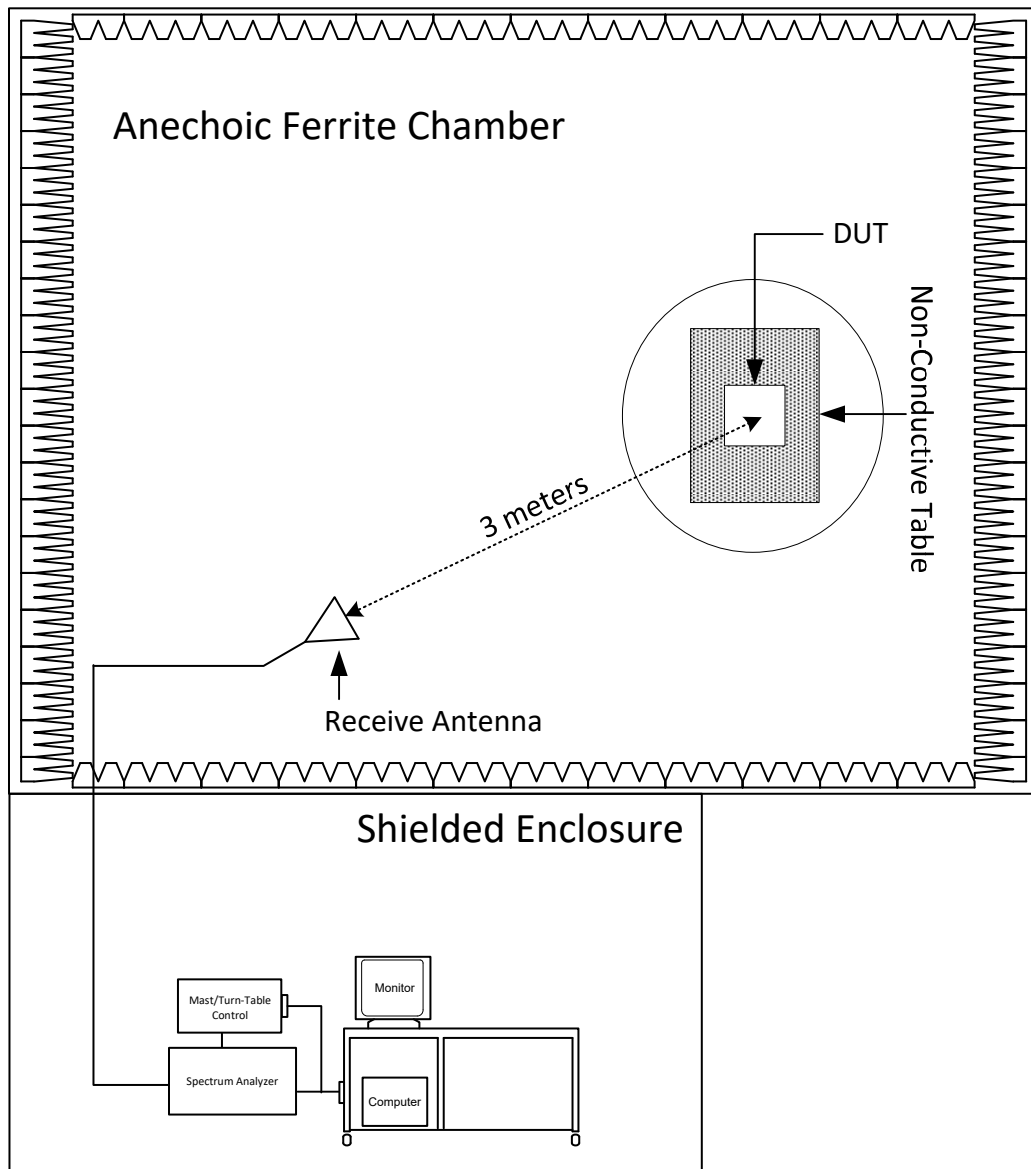
N/A: Not Applicable

I/O: Initial Only

CNR: Calibration Not Required

NOTE 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

## 19. Block Diagram of Test Setup



Radiated Measurements Test Setup

## 20. Receiver Radiated Emissions

EUT Information	
Manufacturer	Milwaukee Electric Tool Corporation
Product	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	7
Mode	Rx Only

Test Site Information	
Setup Format	Tabletop
Type of Test Site	Semi-Anechoic Chamber
Test Site Used	Room 29
Type of Antennas Used	Below 1GHz: Bilog (or equivalent) Above 1GHz: Double-ridged waveguide (or equivalent)
Highest Internal Frequency	2.4GHz
Highest Measurement Frequency	13GHz
Notes	The cables were manually maximized during the preliminary emissions sweeps. The cable arrangement which resulted in the worst-case emissions was utilized.

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

Requirements
The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the values in the following tables.

Radiated Emissions Limits (30MHz to 1GHz)		
Frequency of Emission (MHz)	Field Strength ( $\mu\text{V/m}$ )	Field Strength (dB $\mu\text{V/m}$ )
30 – 88	100	40
88 – 216	150	43.5
216 – 960	200	46
Above 960	500	54
Radiated Emissions Limits (Above 1GHz)		
Frequency of Emission (MHz)	Peak Limit (dB $\mu\text{V/m}$ )	Average Limit (dB $\mu\text{V/m}$ )
Above 1000	74	54

#### Procedure

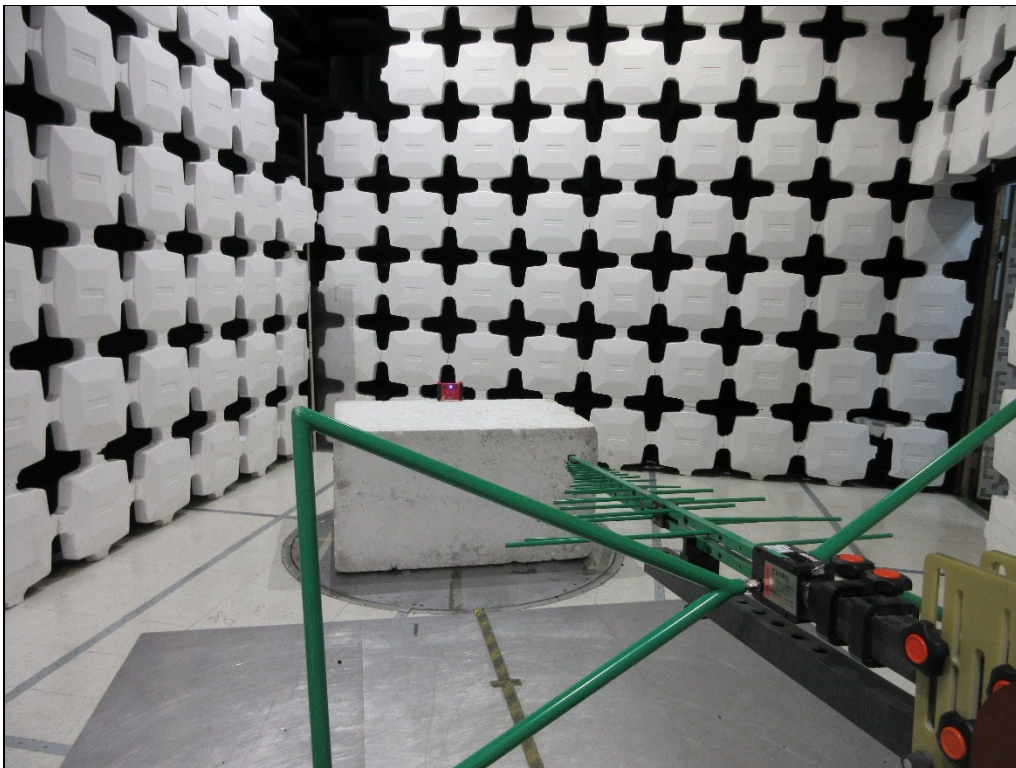
Since a quasi-peak detector and an average detector requires long integration times, it is not practical to automatically sweep through the quasi-peak and average levels. Therefore, radiated emissions from the EUT were first scanned using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured using the quasi-peak detector or average detector.

The EUT and all peripheral equipment were placed on an 80cm high non-conductive stand. The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The frequency range from 30MHz to 1GHz was investigated using a peak detector function with the bilog antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The frequency range from 1GHz to 13GHz was investigated using a peak detector function with the double ridged waveguide antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The maximum levels for each antenna polarization were plotted.

Final radiated emissions were performed on all significant broadband and narrowband emissions found in the exploratory sweeps using the following methods:

- 1) Measurements from 30MHz to 1GHz were made using a quasi-peak detector and a broadband bilog antenna. Measurements above 1GHz were made using an average detector and a broadband double ridged waveguide antenna.
- 2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken:
  - a) The EUT was rotated so that all sides were exposed to the receiving antenna.
  - b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
  - c) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
  - d) For hand-held or body-worn devices, the EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.



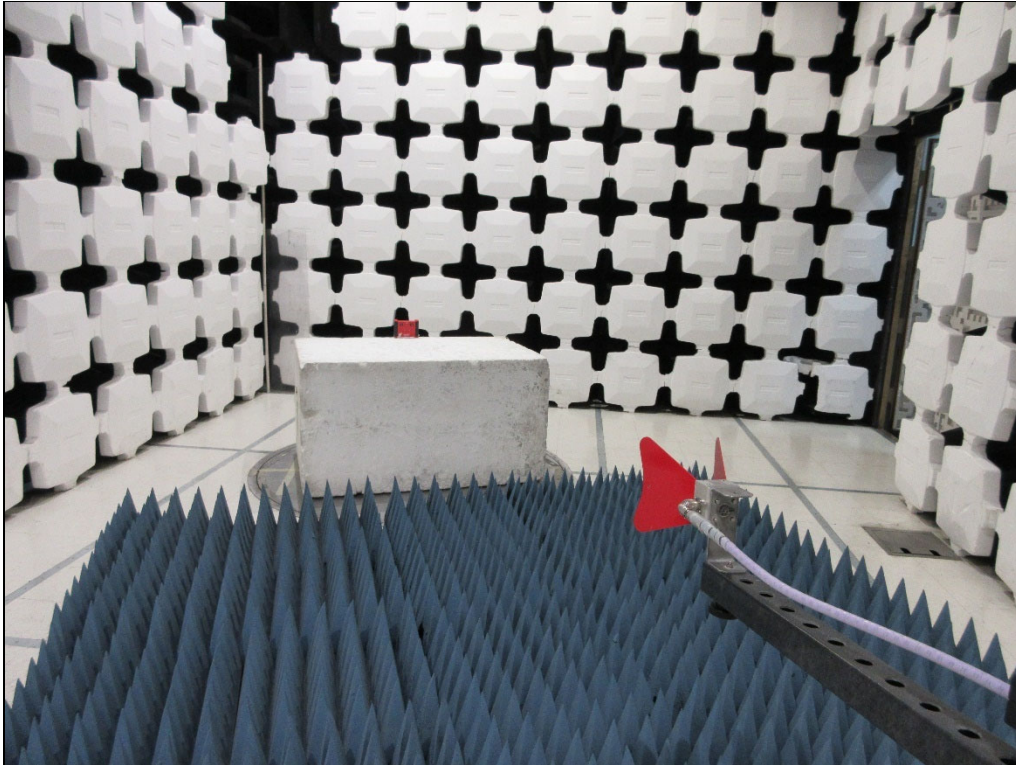


Test Setup for Radiated Emissions: 30MHz to 1GHz, Horizontal Polarization

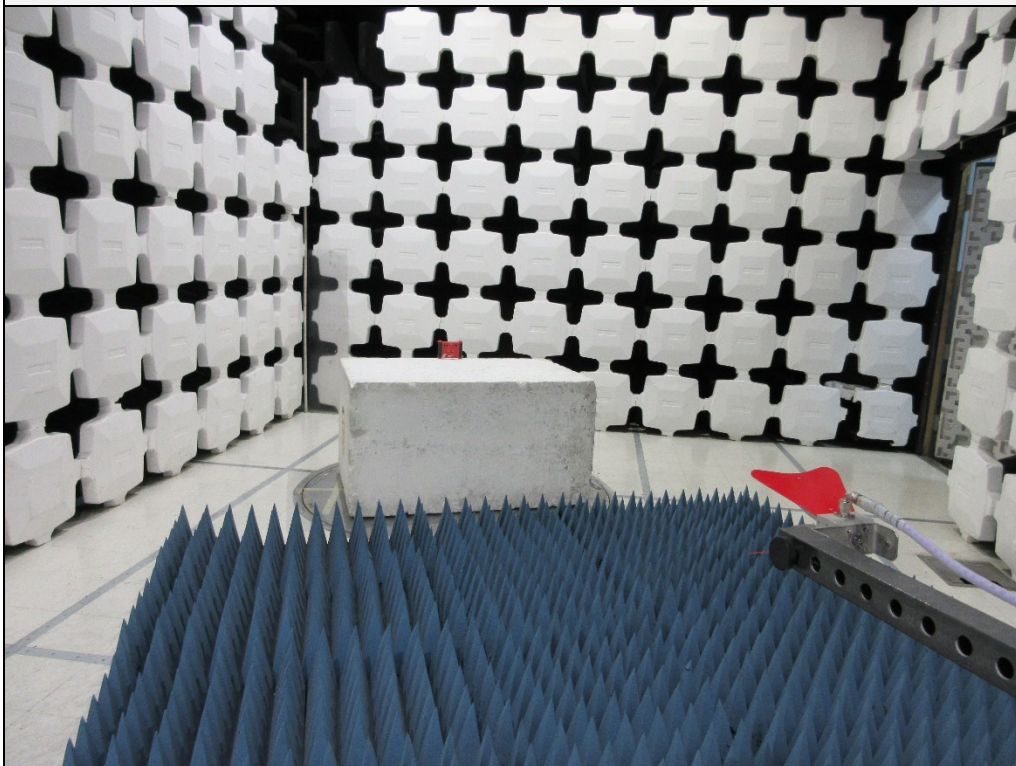


Test Setup for Radiated Emissions: 30MHz to 1GHz, Vertical Polarization





Test Setup for Radiated Emissions: Above 1GHz, Horizontal Polarization



Test Setup for Radiated Emissions: Above 1GHz, Vertical Polarization



## FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 04/17/2024

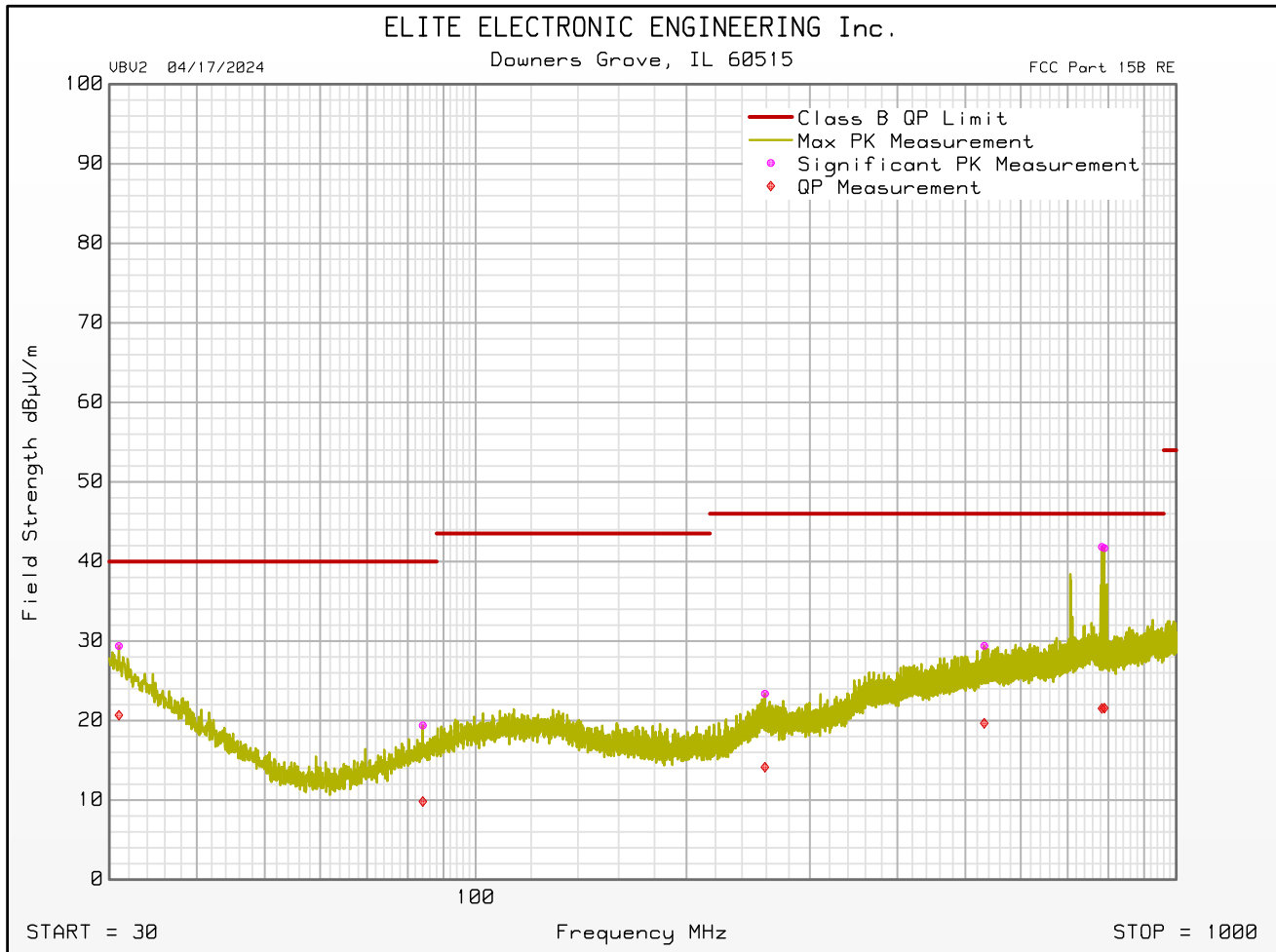
Manufacturer : Milwaukee Tool  
Model : Remote Controller  
Serial Number : 7  
DUT Mode : Receive Only  
Turntable Step Angle (°): 45  
Scan Type : Stepped Scan  
Test RBW : 120 kHz  
Prelim Dwell Time (s) : 0.0001  
Notes :  
Test Engineer : E. Casas  
Test Date : Oct 02, 2024 02:42:22 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBμV/m	QP Total dBμV/m	QP Limit dBμV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
30.960	4.1	-4.6	24.9	0.0	0.3	0.0	29.4	20.7	40.0	-19.3	Horizontal	200	315	
84.060	2.8	-6.7	16.0	0.0	0.6	0.0	19.4	9.8	40.0	-30.2	Horizontal	340	90	
102.280	2.5	-6.3	18.5	0.0	0.6	0.0	21.6	12.8	43.5	-30.7	Vertical	340	45	
258.780	2.8	-6.5	19.6	0.0	1.0	0.0	23.4	14.1	46.0	-31.9	Horizontal	340	0	
532.020	3.6	-6.1	24.4	0.0	1.4	0.0	29.4	19.7	46.0	-26.3	Horizontal	120	135	
783.300	13.8	-6.5	26.4	0.0	1.7	0.0	41.8	21.5	46.0	-24.5	Horizontal	120	315	
789.480	13.7	-6.4	26.3	0.0	1.7	0.0	41.7	21.6	46.0	-24.4	Horizontal	120	180	
836.400	15.2	-6.2	26.4	0.0	1.7	0.0	43.4	21.9	46.0	-24.1	Vertical	200	180	

## FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 04/17/2024

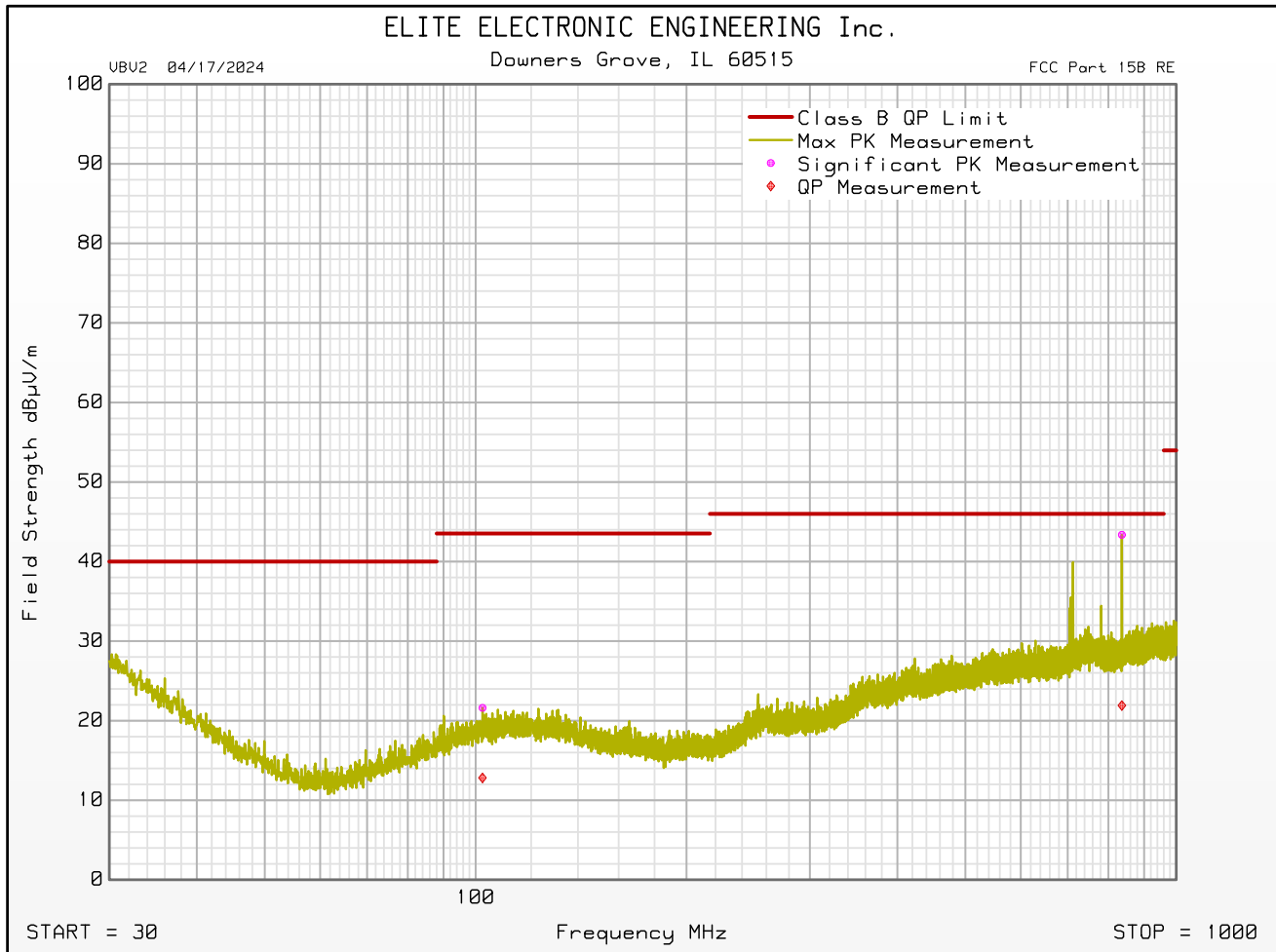
Manufacturer : Milwaukee Tool  
 Model : Remote Controller  
 Serial Number : 7  
 DUT Mode : Receive Only  
 Turntable Step Angle (°): 45  
 Antenna Polarization : Horizontal  
 Scan Type : Stepped Scan  
 Test RBW : 120 kHz  
 Prelim Dwell Time (s) : 0.0001  
 Notes :  
 Test Engineer : E. Casas  
 Test Date : Oct 02, 2024 02:42:22 PM



## FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 04/17/2024

Manufacturer : Milwaukee Tool  
 Model : Remote Controller  
 Serial Number : 7  
 DUT Mode : Receive Only  
 Turntable Step Angle (°): 45  
 Antenna Polarization : Vertical  
 Scan Type : Stepped Scan  
 Test RBW : 120 kHz  
 Prelim Dwell Time (s) : 0.0001  
 Notes :  
 Test Engineer : E. Casas  
 Test Date : Oct 02, 2024 02:42:22 PM



## FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 04/17/2024

Manufacturer : Milwaukee Tool  
 Model : Remote Controller  
 Serial Number : 7  
 DUT Mode : Receive Only  
 Turntable Step Angle (°): 45  
 Scan Type : Stepped Scan  
 Test RBW : 1 MHz  
 Prelim Dwell Time (s) : 0.0001  
 Notes :  
 Test Engineer : E. Casas  
 Test Date : Oct 02, 2024 02:01:36 PM

Freq MHz	Peak Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBuV/m	Peak Limit dBuV/m	Peak Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Peak Level
1281.000	50.6	29.3	-41.3	2.1	0.0	40.6	74.0	-33.4	Horizontal	200	180	
2146.000	49.2	32.9	-41.2	2.8	0.0	43.7	74.0	-30.3	Vertical	200	135	
2440.500	55.1	32.6	-41.0	3.0	0.0	49.7	74.0	-24.3	Vertical	200	90	
5186.500	54.1	35.3	-40.8	4.3	0.0	53.0	74.0	-21.0	Horizontal	120	45	
8448.000	47.7	36.3	-40.9	5.6	0.0	48.8	74.0	-25.2	Horizontal	200	90	
12072.500	47.7	39.2	-40.3	6.8	0.0	53.4	74.0	-20.5	Horizontal	120	225	

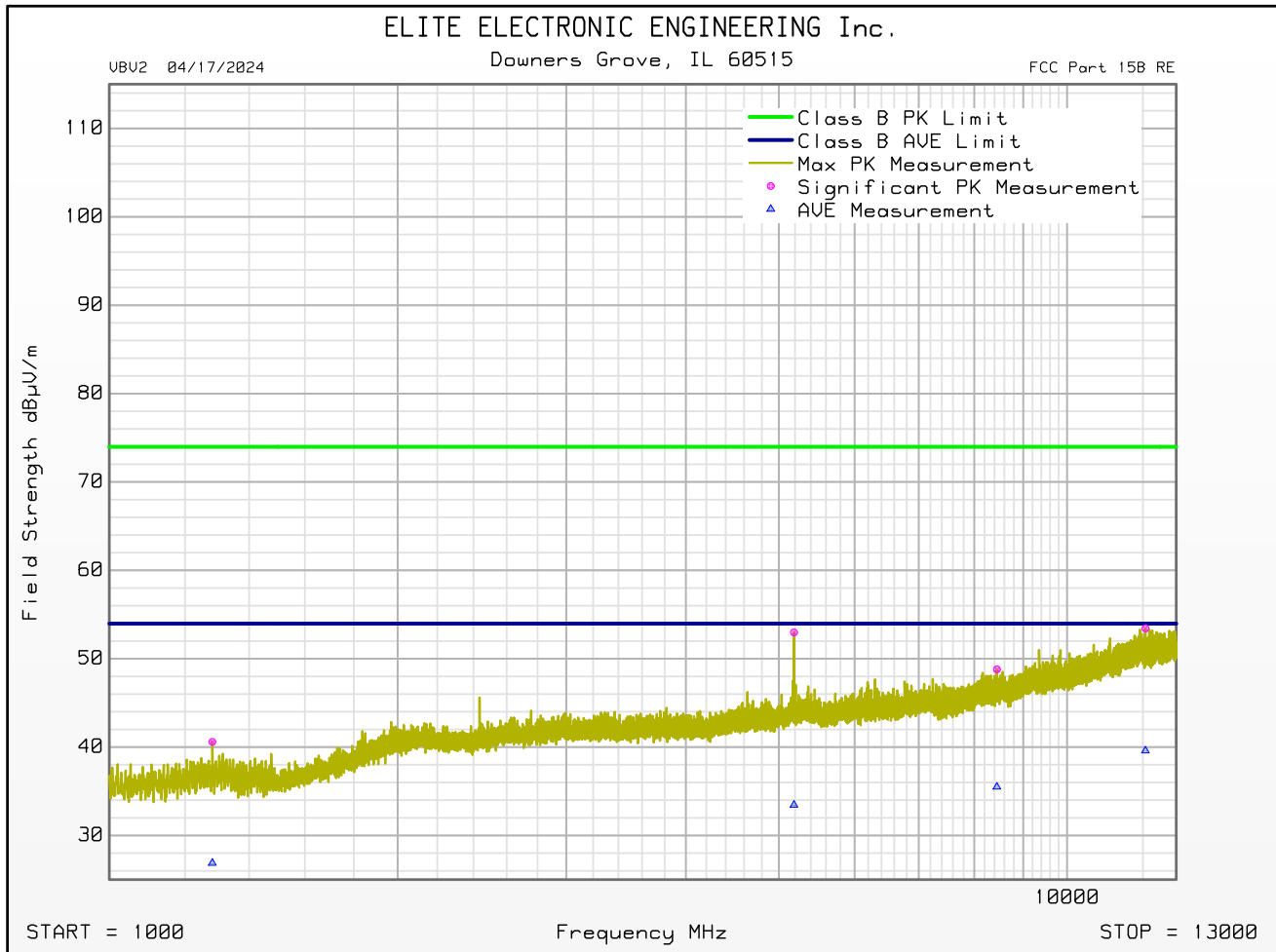
Freq MHz	Average Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Average Total dBuV/m	Average Limit dBuV/m	Average Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Average Level
1281.000	36.8	29.3	-41.3	2.1	0.0	26.9	54.0	-27.1	Horizontal	200	180	
2146.000	35.2	32.9	-41.2	2.8	0.0	29.7	54.0	-24.3	Vertical	200	135	
2440.500	36.0	32.6	-41.0	3.0	0.0	30.6	54.0	-23.4	Vertical	200	90	
5186.500	34.6	35.3	-40.8	4.3	0.0	33.5	54.0	-20.5	Horizontal	120	45	
8448.000	34.4	36.3	-40.9	5.6	0.0	35.5	54.0	-18.5	Horizontal	200	90	
12072.500	33.9	39.2	-40.3	6.8	0.0	39.6	54.0	-14.4	Horizontal	120	225	



## FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 04/17/2024

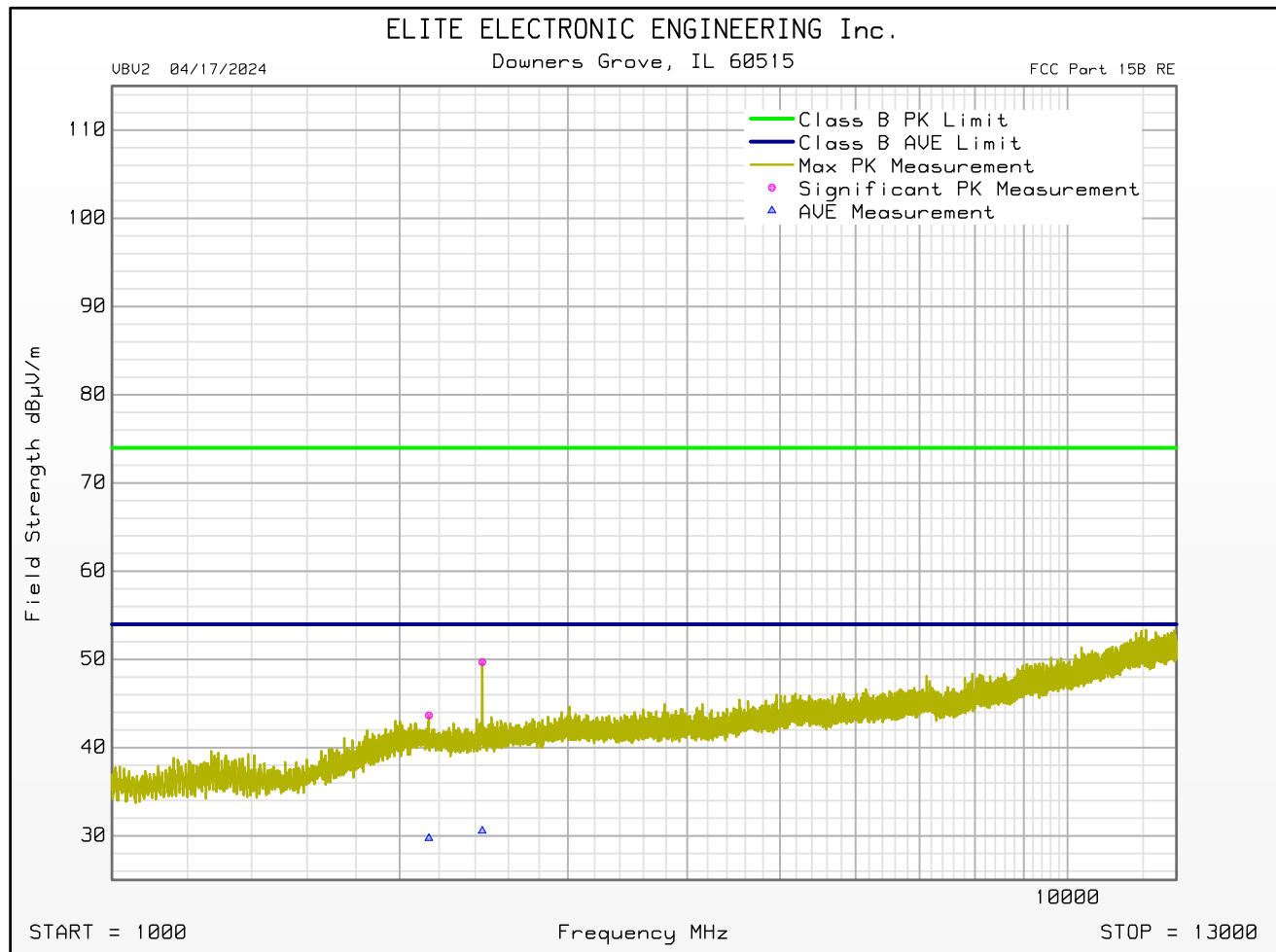
Manufacturer : Milwaukee Tool  
 Model : Remote Controller  
 Serial Number : 7  
 DUT Mode : Receive Only  
 Turntable Step Angle (°): 45  
 Antenna Polarization : Horizontal  
 Scan Type : Stepped Scan  
 Test RBW : 1 MHz  
 Prelim Dwell Time (s) : 0.0001  
 Notes :  
 Test Engineer : E. Casas  
 Test Date : Oct 02, 2024 02:01:36 PM



## FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 04/17/2024

Manufacturer : Milwaukee Tool  
 Model : Remote Controller  
 Serial Number : 7  
 DUT Mode : Receive Only  
 Turntable Step Angle (°): 45  
 Antenna Polarization : Vertical  
 Scan Type : Stepped Scan  
 Test RBW : 1 MHz  
 Prelim Dwell Time (s) : 0.0001  
 Notes :  
 Test Engineer : E. Casas  
 Test Date : Oct 02, 2024 02:01:36 PM



## 21. Antenna Port Conducted Emissions Tests

Test Information	
Manufacturer	Milwaukee Electric Tool Corporation
Product	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	14, 15, 16
Mode	2402MHz Tx, 2440MHz Tx, 2480MHz Tx

Test Setup Details	
Setup Format	Tabletop
Type of Test Site	EMC Bench
Note	None

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Occupied Channel Bandwidth	$\pm 224\text{kHz}$
Power Spectral Density	$\pm 0.372\text{Hz}$
RF Output Power, Conducted	$\pm 0.349\text{ dB}$
Unwanted Emissions, Conducted	$\pm 1.39\text{ dB}$
All Emissions Radiated Below 1GHz	$\pm 2.629\text{ dB}$
All Emissions Radiated Above 1GHz	$\pm 2.710\text{ dB}$
Temperature	$\pm 0.165^{\circ}\text{C}$
Humidity	$\pm 1.7\%\text{ RH}$
DC and Low Frequency Voltages	$\pm 0.115\text{ Volts}$
Time	$\pm 0.05\%$

Requirements
<p><u>6dB Bandwidth (DTS Bandwidth):</u></p> <p>Per FCC 15.247, Section (a)(2), and ISSED RSS-247, Section 5.2(a), the minimum 6dB bandwidth shall be at least 500kHz for all systems using digital modulation techniques.</p>
<p><u>99% Bandwidth:</u></p> <p>RSS-Gen requires the measurement of the 99% bandwidth (Occupied Bandwidth).</p> <p>If measuring the maximum conducted (average) output power for FCC 15.247, the 99% bandwidth is used as the reference for power integration.</p>
<p><u>Peak Conducted Output Power:</u></p> <p>Per FCC 15.247, Section (b)(3) and ISSED RSS-247, Section 5.4(d), for systems using digital modulation, the maximum peak conducted output power shall not exceed 1 watt.</p>
<p><u>Peak Power Spectral Density:</u></p> <p>Per FCC 15.247, Section (e), and ISSED RSS-247, Section 5.2(b), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. If peak conducted output power was measured, the same method must be used to measure the power spectral density.</p>
<p><u>Low Band Edge:</u></p> <p>Per FCC 15.247, Section (d) and ISSED RSS-247, Section 5.5, in any 100 kHz bandwidth outside the frequency band in which the 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 a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limits specified in FCC 15.209, Section (a) and ISSED RSS-Gen is not required.</p>

### Procedures

#### 6dB Bandwidth (DTS Bandwidth):

C63.10-2013 Section 11.8 Option 1:

- a) The following settings were employed on the EMI Test Receiver:
  1. Center Frequency = Transmit Frequency of the EUT
  2. Frequency Span = 2 x Occupied Channel Bandwidth
  3. RBW = 100kHz
  4. VBW = 3 x RBW
  5. Detector Mode = Max Peak
  6. Trace Mode = Max Hold
- b) Allow the trace to stabilize.
- c) Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
- d) Determine the 6dB down amplitude.
- e) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope trace, such that each marker is at or slightly below the 6dB down amplitude determined in step d). If a marker is below this 6dB down amplitude value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers.

#### 99% Bandwidth:

C63.10-2013 section 6.9.3:

- a) The following settings were employed on the EMI Test Receiver:
  1. Center Frequency = Transmit Frequency of the EUT
  2. Frequency Span = Between 1.5 and 5 times the OBW
  3. RBW = Between 1% to 5% of the OBW
  4. VBW = Approximately 3 x RBW
  5. Detector Mode = Max Peak
  6. Trace Mode = Max Hold
- b) Allow the trace to stabilize.
- c) Use the 99% power bandwidth function of the EMI receiver.

#### Peak Conducted Output Power:

C63.10-2013 section 11.9.1.1:

- a) The following settings were employed on the EMI Test Receiver:
  1. Center Frequency = Transmit Frequency of the EUT
  2. RBW =  $\geq$  DTS Bandwidth
  3. VBW =  $\geq$  3 x RBW
  4. Span =  $\geq$  3 x RBW
  5. Sweep Time = Auto couple
  6. Detector Mode = Max Peak
  7. Trace Mode = Max Hold
- b) Allow the trace to stabilize.
- c) Use the peak marker function to determine the peak amplitude level.

Peak Power Spectral Density:

C63.10-20013 section 11.10.2:

- a) The following settings were employed on the EMI Test Receiver:
- |                       |  |
|-----------------------|--|
| 1. Center Frequency = | Transmit Frequency of the EUT                    |
| 2. Frequency Span =   | At least 1.5 times the OBW                       |
| 3. RBW =              | $3\text{kHz} \leq \text{RBW} \leq 100\text{kHz}$ |
| 4. VBW =              | $\geq 3 \times \text{RBW}$                       |
| 5. Detector Mode =    | Max Peak   |
| 6. Sweep Time =       | Auto Couple                                      |
| 7. Trace Mode =       | Max Hold   |
- b) Allow the trace to stabilize.
- c) Use the peak marker function to determine the maximum amplitude level within the RBW.
- d) If measured value exceeds requirement, then reduce RBW (but no less than 3kHz) and repeat.

Low Band Edge:

C63.10-2013 section 11.11:

- a) Reference Level Measurement
- |                      |                            |
|----------------------|----------------------------|
| 1. Start Frequency = | 2400MHz                    |
| 2. Stop Frequency =  | 2483.5MHz                  |
| 3. RBW =             | 100kHz                     |
| 4. VBW =             | $\geq 3 \times \text{RBW}$ |
| 5. Detector Mode =   | Max Peak                   |
| 6. Trace Mode =      | Max Hold                   |
| 7. Sweep Time =      | Auto                       |
- b) Allow the trace to stabilize and use the peak marker function to determine the maximum level.
- c) Emission Level Measurement
- |                      |                            |
|----------------------|----------------------------|
| 1. Start Frequency = | <u>2310MHz</u>             |
| 2. Stop Frequency =  | 2400MHz                    |
| 3. RBW =             | 100kHz                     |
| 4. VBW =             | $\geq 3 \times \text{RBW}$ |
| 5. Detector Mode =   | Max Peak                   |
| 6. Trace Mode =      | Max Hold                   |
| 7. Sweep Time =      | Auto                       |
- d) Allow the trace to stabilize and use the peak marker function to determine the maximum level.
- e) The two sweeps were combined and plotted.
- f) Ensure that the amplitude of all unwanted emissions are attenuated by at least 20dB.



## Minimum Emission Bandwidth 6 dB (2402 MHz; 14.000 dBm; 5 MHz)

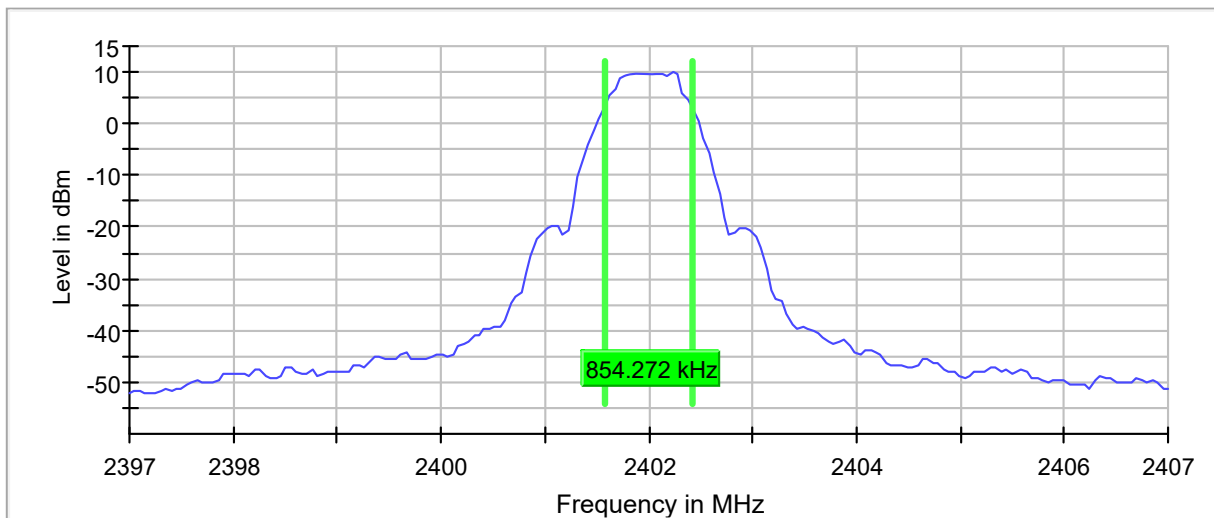
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

### 6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	0.854272	0.500000	---	2401.572864	2402.427136

DUT Frequency (MHz)	Max Level (dBm)	Result
2402.000000	10.1	PASS

6 dB Bandwidth



## Minimum Emission Bandwidth 6 dB (2440 MHz; 14.000 dBm; 5 MHz)

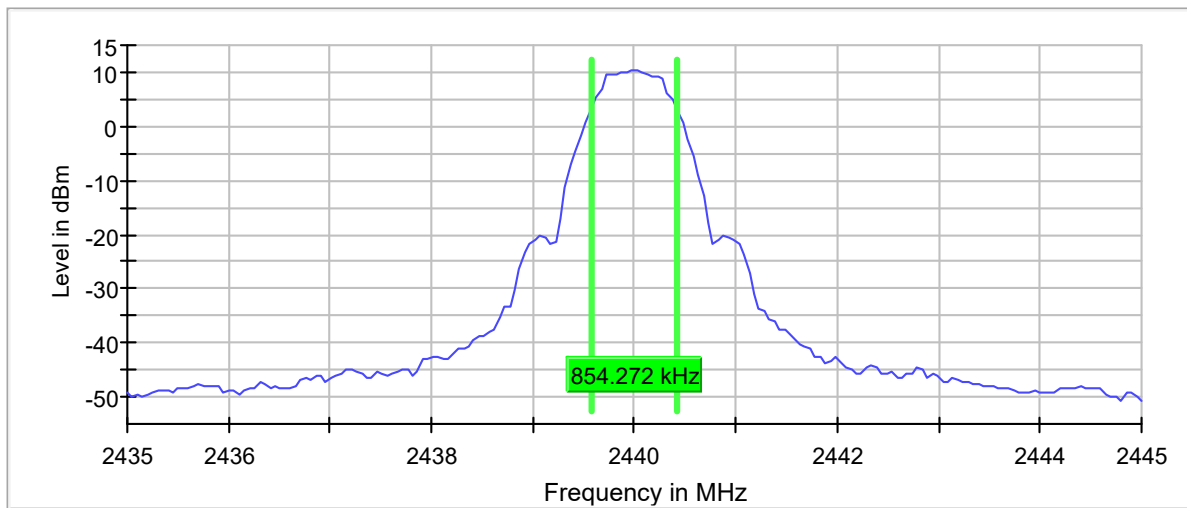
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

### 6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2440.000000	0.854272	0.500000	---	2439.572864	2440.427136

DUT Frequency (MHz)	Max Level (dBm)	Result
2440.000000	10.2	PASS

6 dB Bandwidth



## Minimum Emission Bandwidth 6 dB (2480 MHz; 14.000 dBm; 5 MHz)

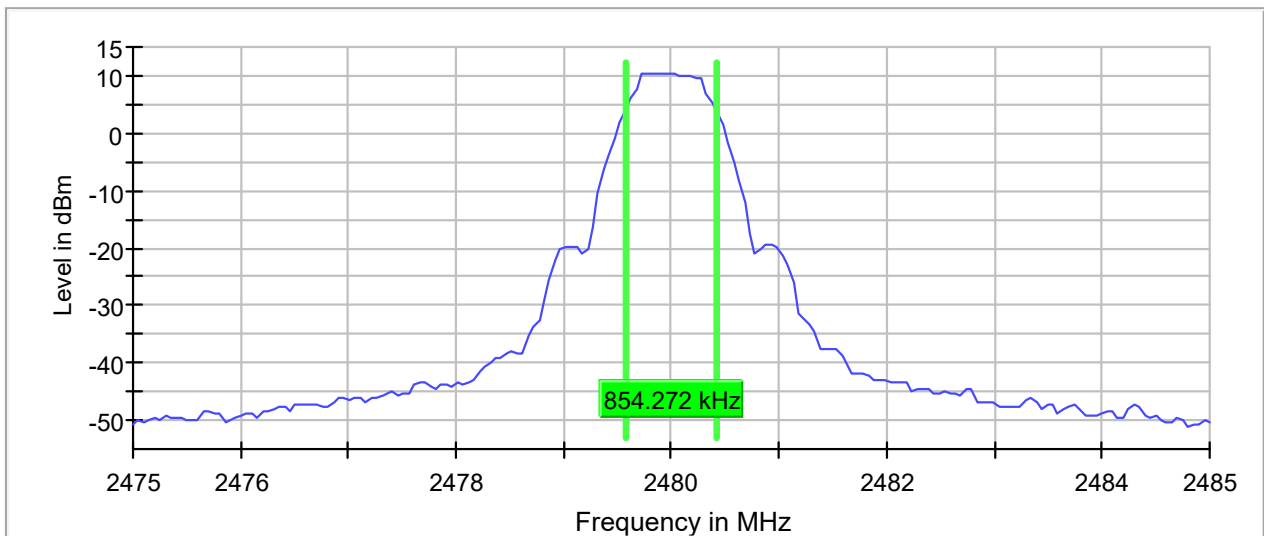
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

### 6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	0.854272	0.500000	---	2479.572864	2480.427136

DUT Frequency (MHz)	Max Level (dBm)	Result
2480.000000	10.4	PASS

6 dB Bandwidth

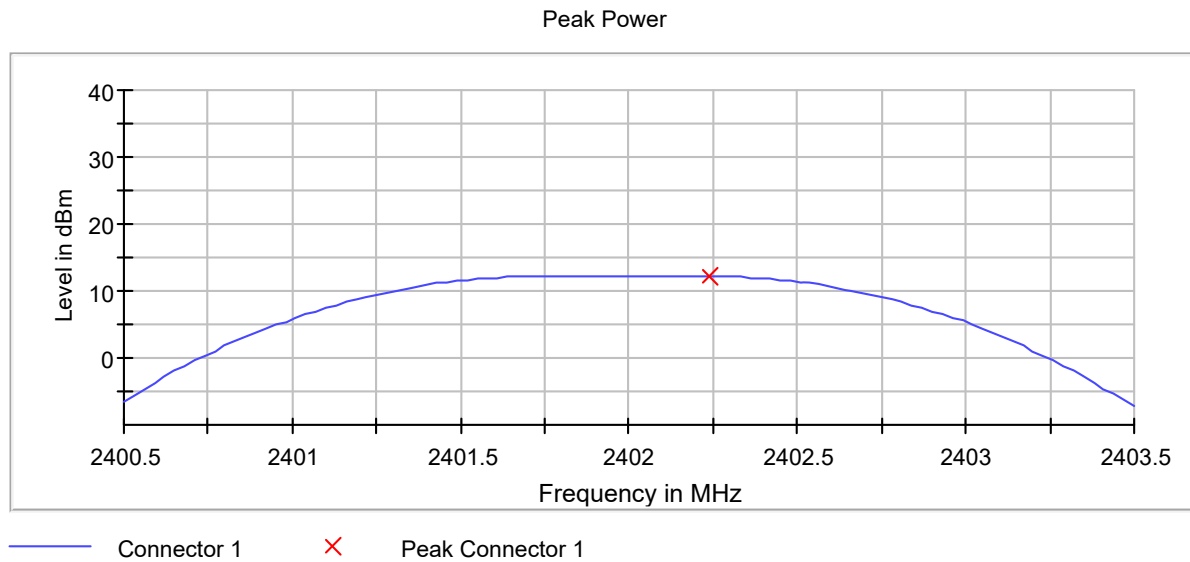


## Peak output power (Sweep) (2402 MHz; 14.000 dBm; 5 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.9.1.1

### Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	12.2	30.0	PASS

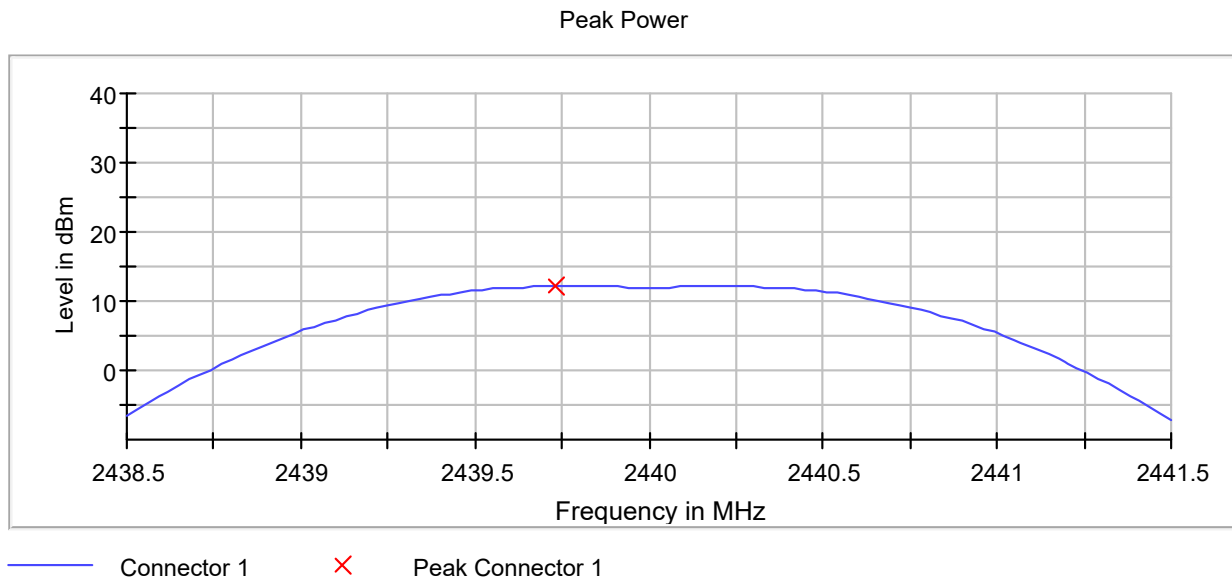


## Peak output power (Sweep) (2440 MHz; 14.000 dBm; 5 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.9.1.1

### Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2440.000000	12.1	30.0	PASS



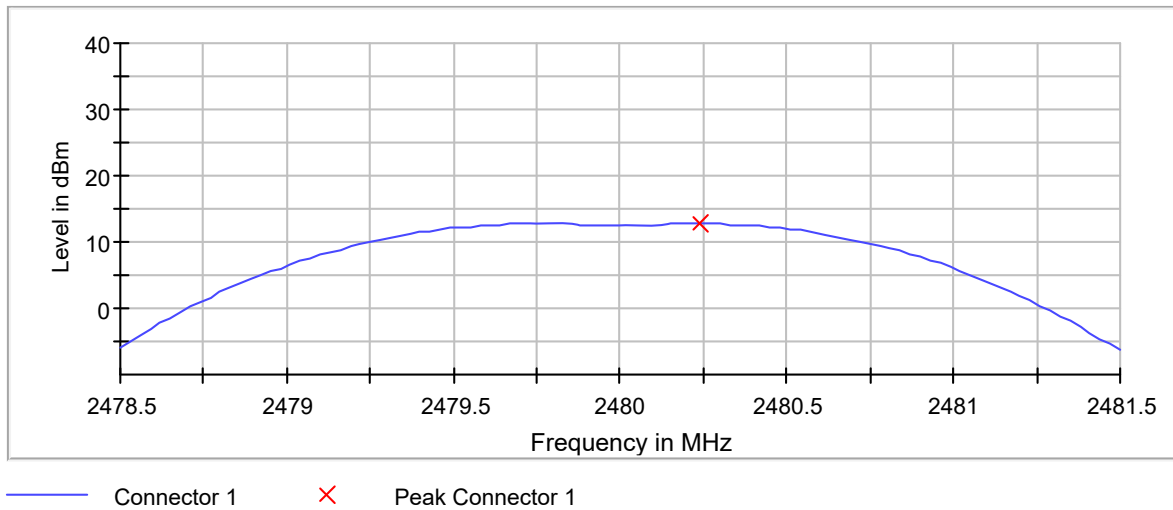
## Peak output power (Sweep) (2480 MHz; 14.000 dBm; 5 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.9.1.1

### Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2480.000000	12.7	30.0	PASS

Peak Power





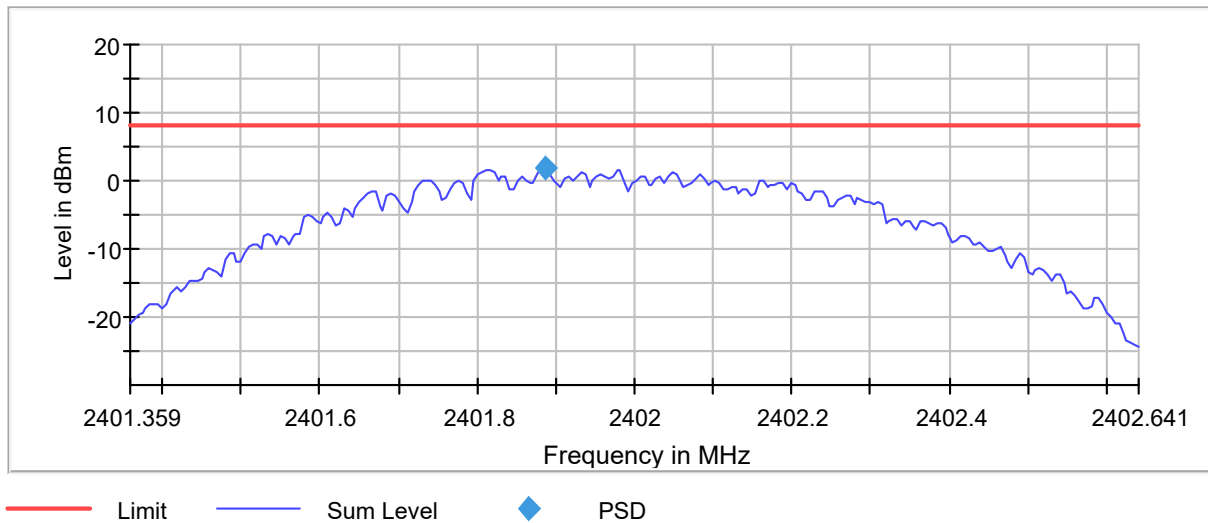
## Peak Power Spectral Density (2402 MHz; 14.000 dBm; 5 MHz)

Test according to FCC title 47 part 15 §15.247(a),(e), KDB 558074 D01 DTS Meas Guidance v05r02 F and ANSI C63.10-2013

### Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2401.886935	1.973	8.0	PASS

Peak Power Spectral Density

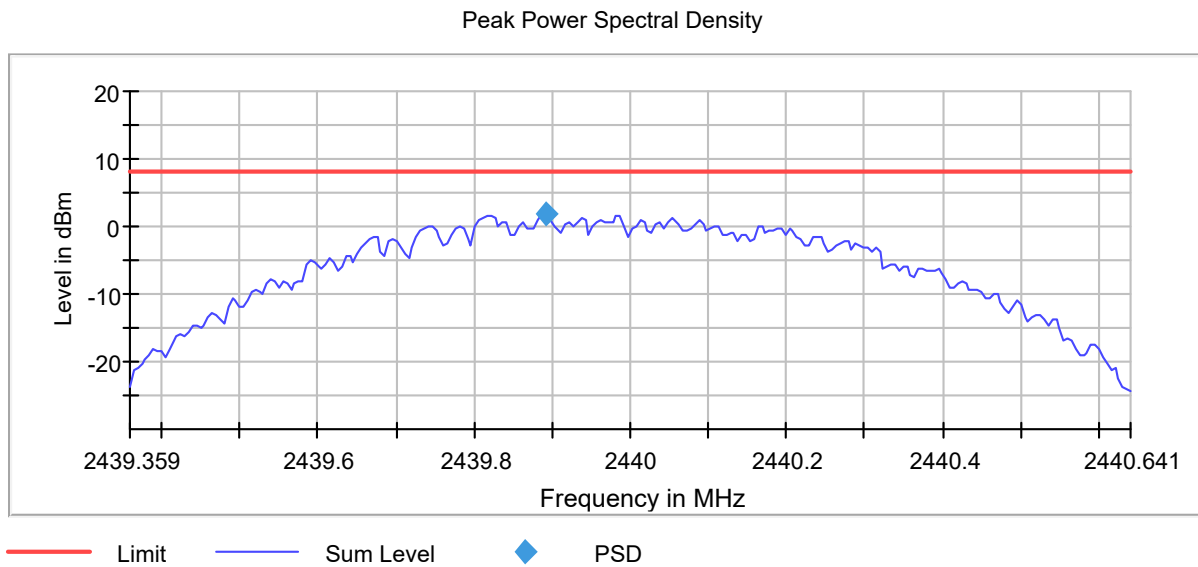


## Peak Power Spectral Density (2440 MHz; 14.000 dBm; 5 MHz)

Test according to FCC title 47 part 15 §15.247(a),(e), KDB 558074 D01 DTS Meas Guidance v05r02 F and ANSI C63.10-2013

### Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2440.000000	2439.891960	1.968	8.0	PASS



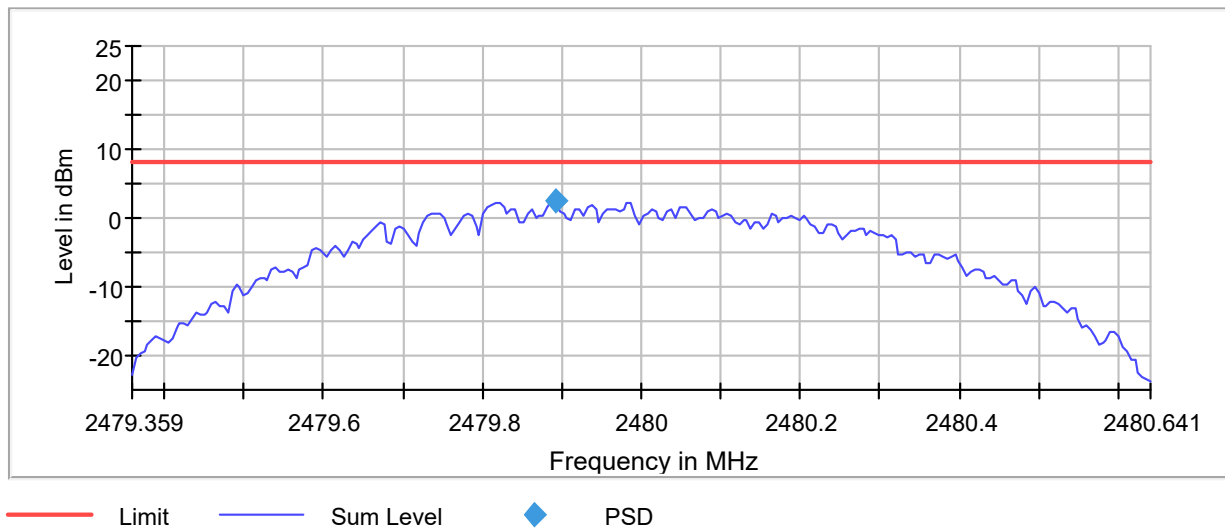
## Peak Power Spectral Density (2480 MHz; 14.000 dBm; 5 MHz)

Test according to FCC title 47 part 15 §15.247(a),(e), KDB 558074 D01 DTS Meas Guidance v05r02 F and ANSI C63.10-2013

### Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2480.000000	2479.891960	2.493	8.0	PASS

Peak Power Spectral Density



## Occupied Channel Bandwidth 99% (2402 MHz; 14.000 dBm; 5 MHz)

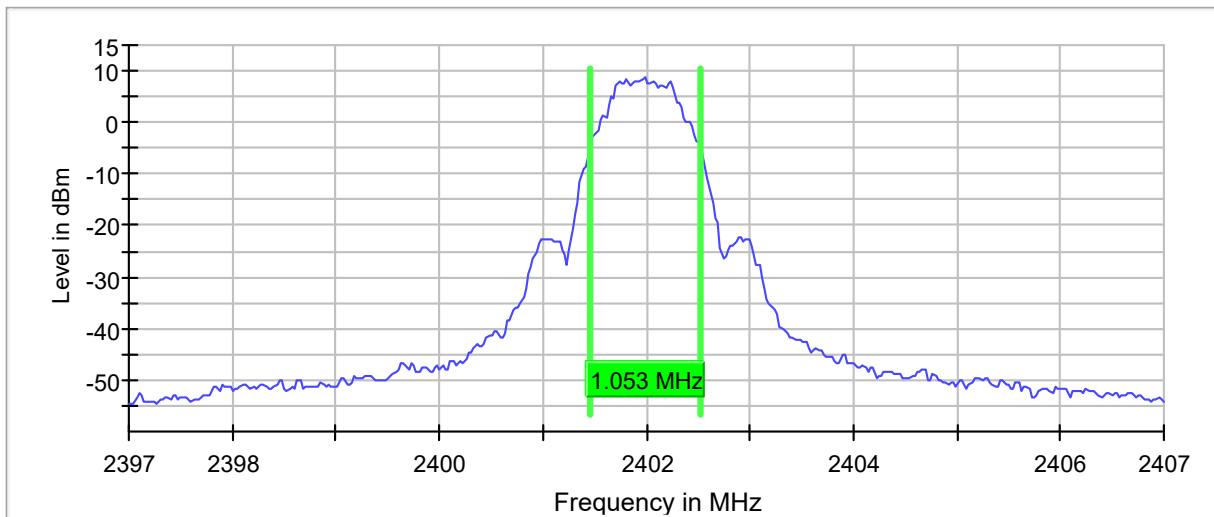
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

### 99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	1.052631	---	---	2401.461153	2402.513784

DUT Frequency (MHz)	Result
2402.000000	PASS

99 % Bandwidth



## Occupied Channel Bandwidth 99% (2440 MHz; 14.000 dBm; 5 MHz)

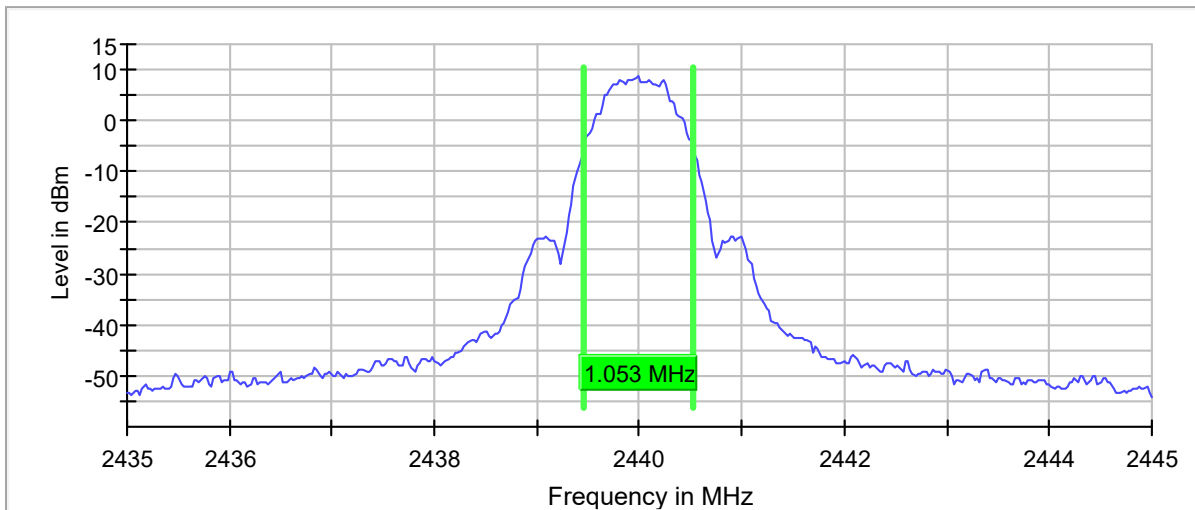
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

### 99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2440.000000	1.052631	---	---	2439.461153	2440.513784

DUT Frequency (MHz)	Result
2440.000000	PASS

99 % Bandwidth



## Occupied Channel Bandwidth 99% (2480 MHz; 14.000 dBm; 5 MHz)

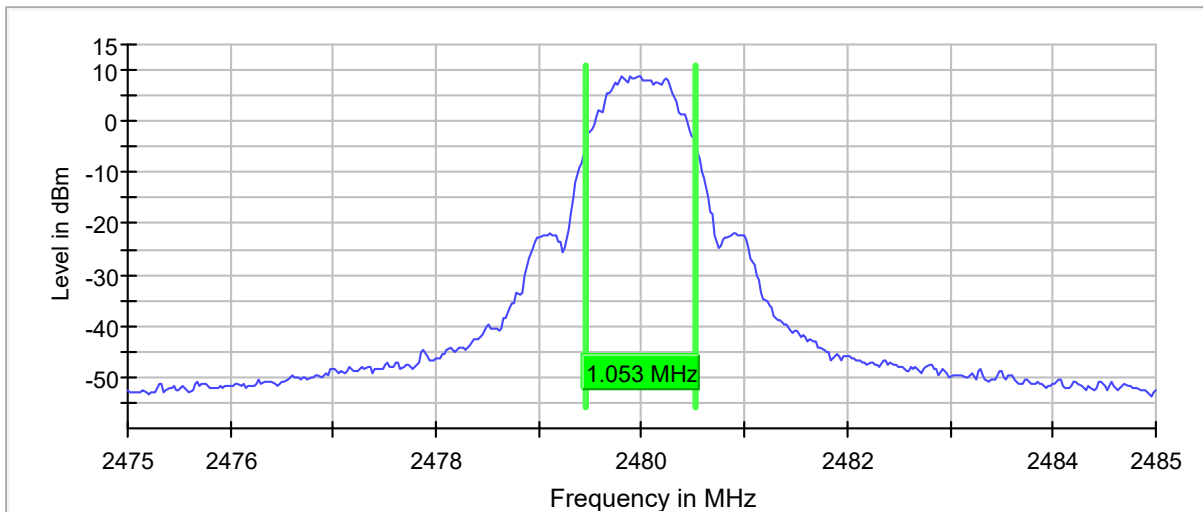
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.8.1

### 99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	1.052631	---	---	2479.461153	2480.513784

DUT Frequency (MHz)	Result
2480.000000	PASS

99 % Bandwidth



## Band Edge low (2402 MHz; 14.000 dBm; 5 MHz)

Test according to FCC title 47 part 15 §15.247(d), KDB 558074 D01 DTS Meas Guidance v05r02 8.7 and ANSI C63.10-2013

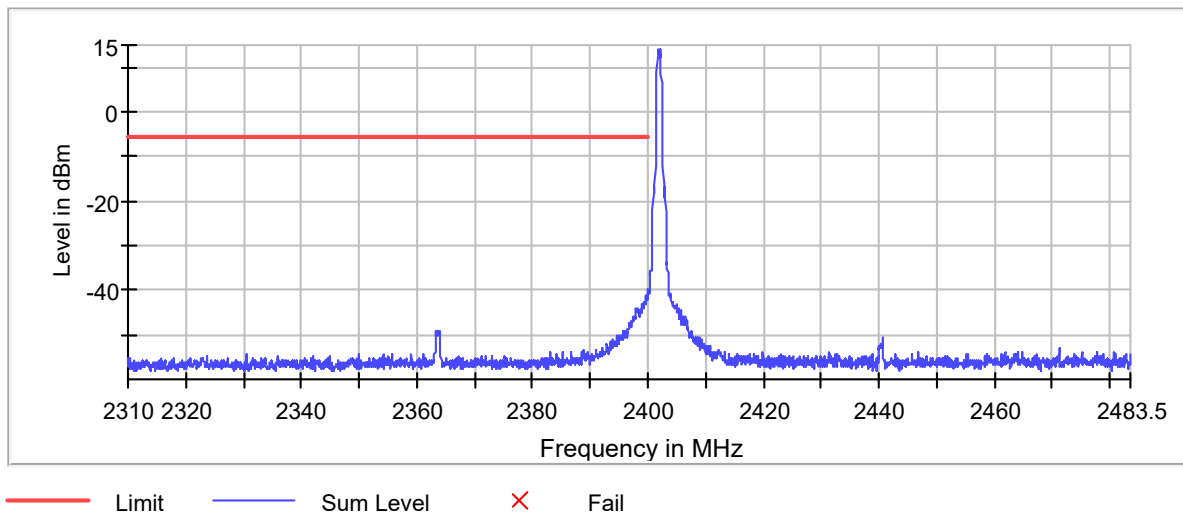
### Result

DUT Frequency (MHz)	Result
2402.000000	PASS

### Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.949972	-41.0	35.2	-5.8	PASS
2399.699833	-41.3	35.4	-5.8	PASS
2399.649805	-41.3	35.5	-5.8	PASS
2399.599778	-41.5	35.7	-5.8	PASS
2399.899944	-41.5	35.7	-5.8	PASS
2399.749861	-41.8	36.0	-5.8	PASS
2399.849917	-42.2	36.4	-5.8	PASS
2399.799889	-42.3	36.4	-5.8	PASS
2399.549750	-42.3	36.5	-5.8	PASS
2399.449694	-42.5	36.7	-5.8	PASS
2399.399666	-42.8	37.0	-5.8	PASS
2399.199555	-42.9	37.1	-5.8	PASS
2399.349639	-43.0	37.2	-5.8	PASS
2399.499722	-43.2	37.4	-5.8	PASS
2399.049472	-43.2	37.4	-5.8	PASS

Band Edge





## 22. Radiated Emissions Tests

EUT Information	
Manufacturer	Milwaukee Electric Tool Corporation
Product	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	14, 15, 16
Mode	2402MHz Tx

Test Setup Details	
Setup Format	Tabletop
Type of Test Site	Semi-Anechoic Chamber
Test Site Used	Room #29 & #21
Type of Antennas Used	Below 1GHz: Bilog (or equivalent) 1 – 18GHz: Double-Ridged Waveguide (or equivalent) Above 18GHz: Horn (or equivalent)
Notes	N/A

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

Requirements
<p><u>Peak EIRP:</u></p> <p>Per FCC 15.247, Section (b)(3) and ISSED RSS-247, Section 5.4(d), for systems using digital modulation, the maximum peak conducted output power shall not exceed 1 watt.</p> <p>Per FCC 15.247, Section (b)(4), and ISSED RSS-247, Section 5.4(d), the conducted output power limit is based on the use of antennas with directional gains that do not exceed 6dBi. If transmitting antennas of directional gain greater than 6dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values, by the amount in dB that the directional gain of the antenna exceeds 6dBi.</p>
<p><u>Radiated Emissions in Non-Restricted Bands:</u></p> <p>Per FCC 15.247, Section (d), and ISSED RSS-247, Section 5.5, in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated emissions measurement. Attenuation below the general limits specified in §15.209(a) is not required.</p> <p><u>Radiated Emissions in Restricted Bands:</u></p> <p>Per 15.247, Section (d), radiated emissions which fall in the restricted bands, as defined in FCC 15.205, Section (a), must comply with the radiated emission limits specified in FCC 15.209, Section (a).</p> <p>Per ISSED RSS-247, Section 3.3, radiated emissions which fall in the restricted bands, as defined in ISSED RSS-Gen, Section 8.10, must comply with the radiated emission limits specified in RSS-Gen, Section 8.9.</p>
<p><u>High Band Edge:</u></p> <p>Per 15.247, Section (d), radiated emissions which fall in the restricted band beginning at 2483.5MHz, as defined in FCC 15.205, Section (a), must comply with the radiated emission limits specified in FCC 15.209, Section (a).</p> <p>Per ISSED RSS-247, Section 3.3, radiated emissions which fall in the restricted band beginning at 2483.5MHz, as defined in ISSED RSS-Gen, Section 8.10, must comply with the radiated emission limits specified in RSS-Gen, Section 8.9.</p>

### Procedures

#### Peak EIRP:

C63.10 Annex G and Section 11.9.1.1:

The EUT was placed on a 1.5 meter high non-conductive stand and set to transmit. A double ridged waveguide antenna was placed at a test distance of 3 meters from the EUT.

a) The following settings were employed on the EMI Test Receiver:

- |                                |  |
|--------------------------------|--|
| 1) Center Frequency =          | Transmit frequency of EUT                  |
| 2) Span =                      | $\geq 3 \times \text{RBW}$                 |
| 3) RBW =                       | $\geq \text{DTS Bandwidth}$                |
| 4) VBW =                       | $\geq 3 \times \text{RBW}$                 |
| 5) Number of points in sweep = | $\geq (2 \times \text{span} / \text{RBW})$ |
| 6) Sweep time =                | Auto                                       |
| 7) Detector =                  | Peak                                       |
| 8) Trace =                     | Max hold                                   |

b) Allow trace to stabilize and use peak marker function to determine the peak amplitude level.

c) The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a double ridged waveguide antenna was then set in place of the EUT and connected to a calibrated signal generator. The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was then corrected to compensate for cable loss and antenna gain.

#### Radiated Emissions in Non-Restricted Bands:

C63.10-2013 Section 11.11

Radiated measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 25GHz was investigated using a peak detector function.

The final radiated emission tests were then manually performed over the frequency range of 30MHz to 25GHz.

- 1) The field strength of the fundamental was measured using a double ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a 1.5 meter high non-conductive stand and set to transmit. A peak detector with a resolution bandwidth of 100kHz was used on the spectrum analyzer.
- 2) The field strengths of all of the harmonics not in the restricted band were then measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a 1.5 meter high non-conductive stand and set to transmit. A peak detector with a resolution bandwidth of 100kHz was used on the spectrum analyzer.
- 3) To ensure that maximum or worst case emission levels at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:
  - a) The EUT was rotated so that all of its sides were exposed to the receiving antenna.

- b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
  - c) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
  - d) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer, the measuring antenna was not raised or lowered to ensure maximized readings. Instead, the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.
- 4) All harmonics not in the restricted bands must be at least 20dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.

#### Radiated Emissions in Restricted Bands:

##### C63.10-2013 Section 11.12

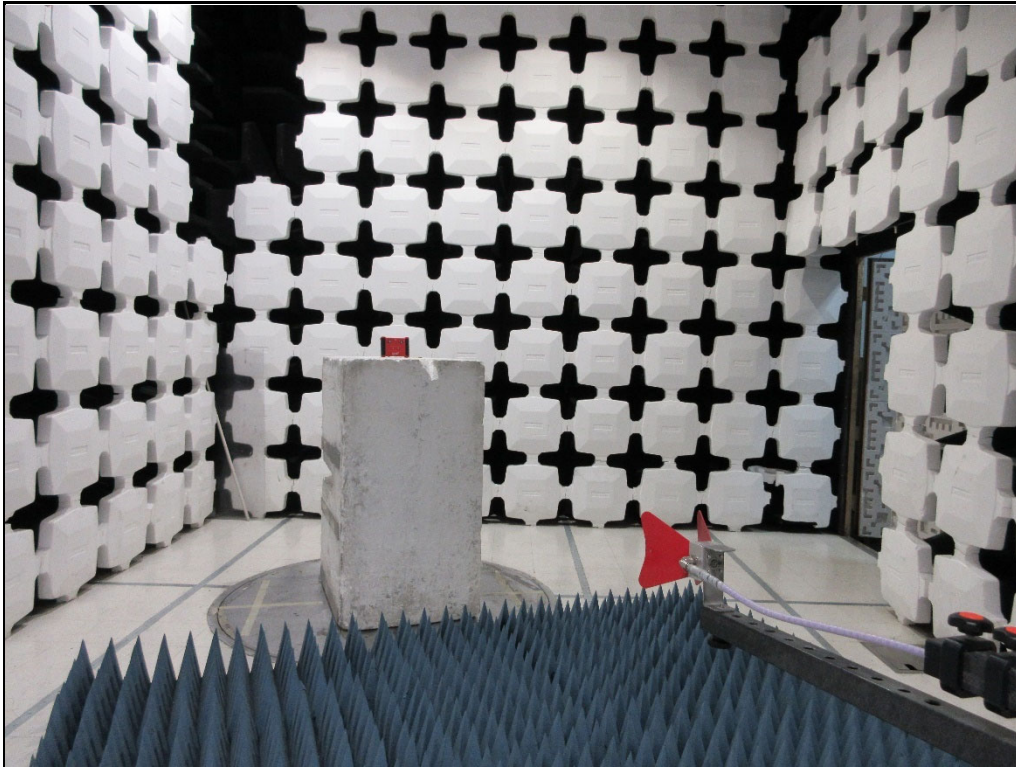
- 1) The field strengths of all emissions below 1 GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on an 80 cm high non-conductive stand and set to transmit. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
- 2) The field strengths of all emissions above 1 GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a 1.5 meter high non-conductive stand and set to transmit. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.
- 3) To ensure that maximum or worst case emission levels were measured, the following steps were taken when taking all measurements:
  - a) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
  - b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
  - c) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
  - d) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer, the measuring antenna was not raised or lowered to ensure maximized readings. Instead, the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.
- 4) For all radiated emissions measurements below 1GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If, however, the peak readings exceed the limits listed in 15.209(a), then the emissions are remeasured using a quasi-peak detector.
- 5) For all radiated emissions measurements above 1GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1GHz must be no greater than 20dB above the limits specified in 15.209(a).
- 6) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken.

#### High Band Edge:

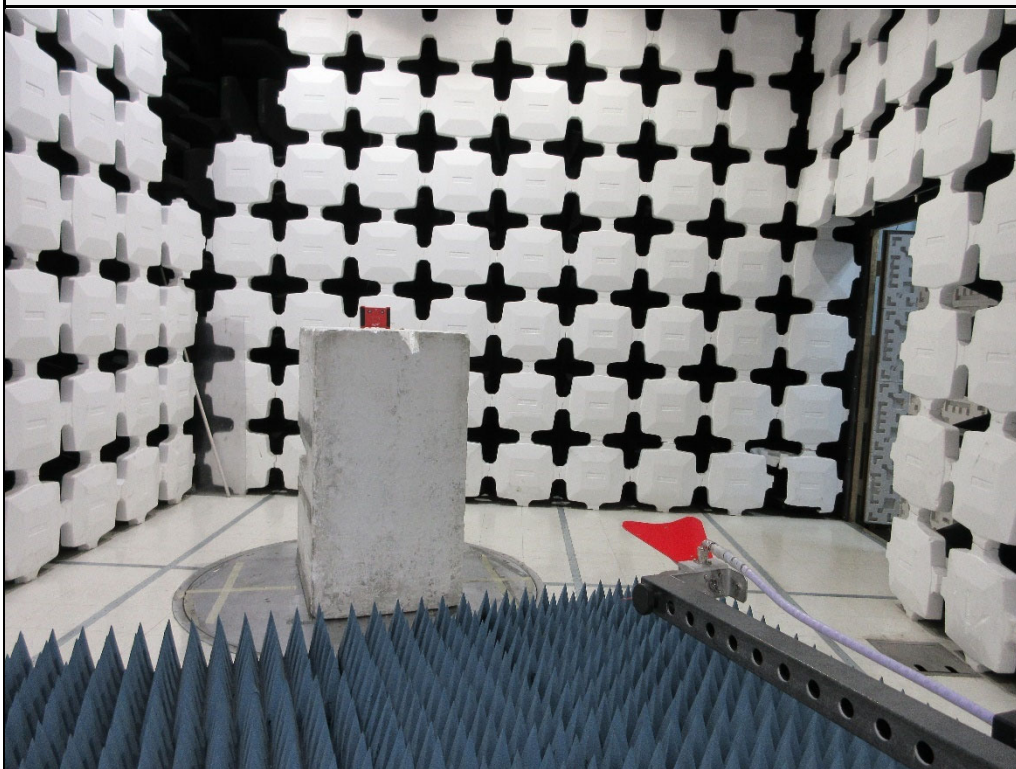
##### C63.10-2013 section 6.10.5:

- 1) The EUT was set to transmit continuously at the channel closest to the high band-edge.
- 2) The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a 1.5 meter high non-conductive stand and set to transmit. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.
- 3) To ensure that maximum or worst case emission levels were measured, the following steps were taken when taking all measurements:
  - a) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
  - b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
  - c) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
- 4) The peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.209(a).
- 5) Next, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken.



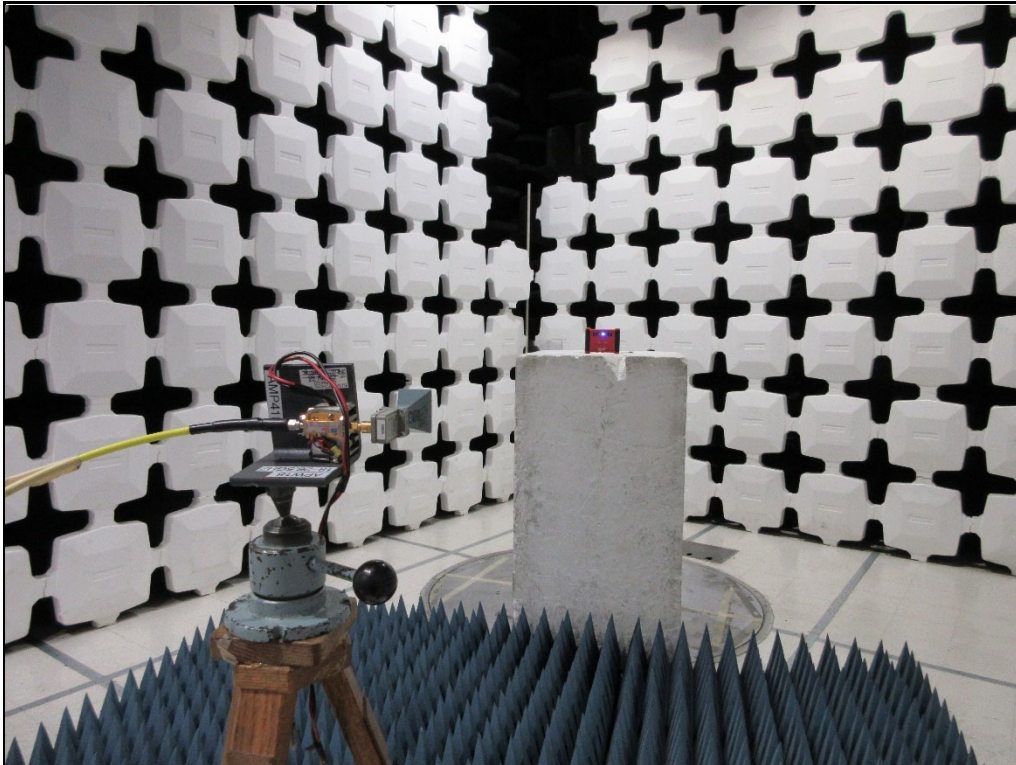


Test Setup for Spurious Radiated Emissions, 1 – 18GHz – Antenna Polarization  
Horizontal

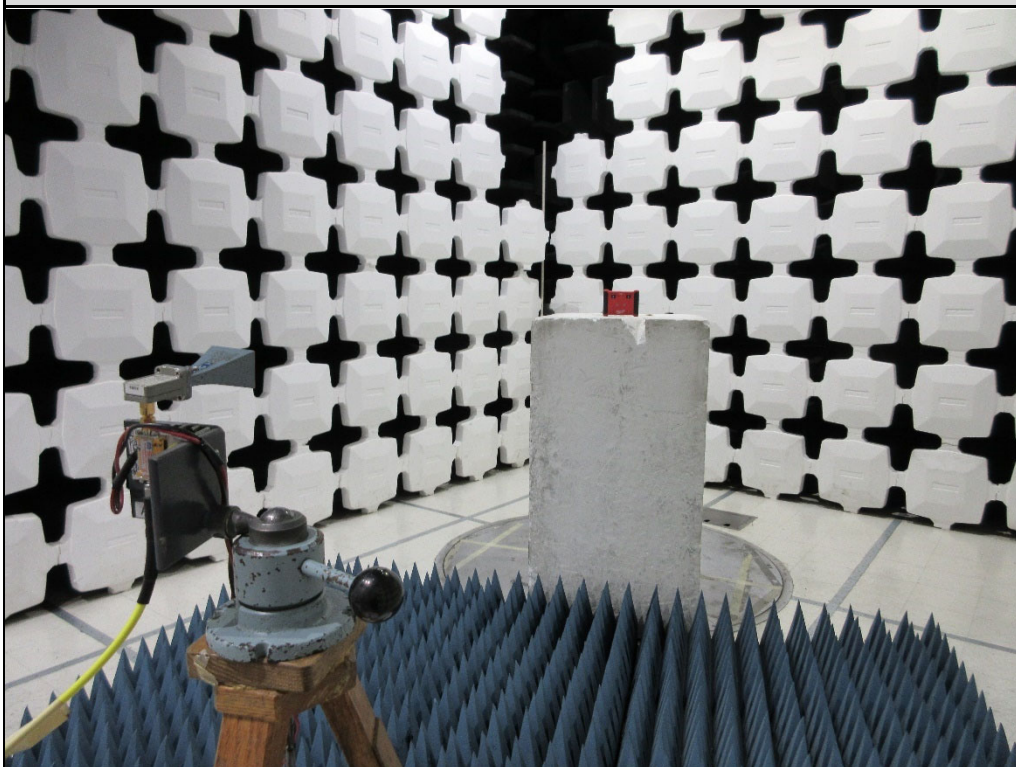


Test Setup for Spurious Radiated Emissions, 1 – 18GHz – Antenna Polarization  
Vertical





Test Setup for Spurious Radiated Emissions, Above 18GHz – Antenna Polarization Horizontal



Test Setup for Spurious Radiated Emissions, Above 18GHz – Antenna Polarization Vertical



Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	14, 15, 16
Mode	2402MHz Tx, 2440MHz Tx, 2480MHz Tx
Result	Max EIRP = 32.4mW (15.1dBm)
Notes	Matching performed on all horizontal polarization measurements. Matching estimate using room factors was used for all vertical polarization measurements.

Freq (MHz)	Ant Pol	Wide BW Meter Reading (dBμV)	Matched Sig Gen Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2402.00	H	77.6	11.9	5.3	3.4	13.8	36.0	-22.2
	V	72.0	7.6	5.3	3.4	9.5	36.0	-26.5
2440.00	H	78.5	12.5	5.2	2.6	15.1	36.0	-20.9
	V	72.5	8.2	5.2	3.5	9.9	36.0	-26.1
2480.00	H	78.3	13.4	5.2	3.5	15.0	36.0	-21.0
	V	71.3	6.9	5.2	3.5	8.6	36.0	-27.4

Peak Total (dBμV/m) = Matched Sig. Gen. Reading (dBμV) + Equivalent Antenna Gain (dB) – Cable Loss (dB)

Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	14
Test	Peak Measurements in the Restricted Bands
Mode	2402MHz Tx
Frequency Tested	2402MHz
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dBμV/m)	Peak Total at 3m (μV/m)	Peak Limit at 3m (μV/m)	Margin (dB)
4804.00	H	51.0		3.7	35.9	-39.3	51.3	367.8	5000.0	-22.7
	V	50.9		3.7	35.9	-39.3	51.2	364.0	5000.0	-22.8
12010.00	H	49.5	*	6.1	41.1	-39.2	57.5	753.1	5000.0	-16.4
	V	49.9	*	6.1	41.1	-39.2	57.9	787.7	5000.0	-16.1
19216.00	H	39.0	*	2.0	40.4	-27.6	53.7	483.8	5000.0	-20.3
	V	38.1	*	2.0	40.4	-27.6	52.8	437.2	5000.0	-21.2

Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	14
Test	Average Measurements in the Restricted Bands
Mode	2402MHz Tx
Frequency Tested	2402MHz
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle Factor (dB)	Average Total at 3m (dBμV/m)	Average Total at 3m (μV/m)	Average Limit at 3m (μV/m)	Margin (dB)
4804.00	H	41.55		3.7	35.9	-39.3	0.0	41.8	123.6	500.0	-12.1
	V	43.04		3.7	35.9	-39.3	0.0	43.3	146.8	500.0	-10.6
12010.00	H	38.63	*	6.1	41.1	-39.2	0.0	46.6	214.7	500.0	-7.3
	V	38.74	*	6.1	41.1	-39.2	0.0	46.7	217.4	500.0	-7.2
19216.00	H	27.94	*	2.0	40.4	-27.6	0.0	42.7	135.7	500.0	-11.3
	V	27.56	*	2.0	40.4	-27.6	0.0	42.3	129.9	500.0	-11.7

Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	14
Test	Peak Measurements in the Non-Restricted Bands
Mode	2402MHz Tx
Frequency Tested	2402MHz
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dBμV/m)	Peak Total at 3m (μV/m)	Peak Limit at 3m (μV/m)	Margin (dB)
2402.00	H	76.59		3.4	32.6	0.0	112.6	426303.6	NA	NA
	V	70.18		3.4	32.6	0.0	106.2	203807.0	NA	NA
7206.00	H	38.77	*	4.6	37.7	-39.4	41.7	122.1	42630.4	-50.9
	V	39.25	*	4.6	37.7	-39.4	42.2	129.0	42630.4	-50.4
9608.00	H	38.10	*	5.2	39.2	-39.3	43.2	144.4	42630.4	-49.4
	V	39.27	*	5.2	39.2	-39.3	44.4	165.2	42630.4	-48.2
14412.00	H	38.19	*	6.6	41.6	-38.3	48.1	254.8	42630.4	-44.5
	V	38.10	*	6.6	41.6	-38.3	48.0	252.2	42630.4	-44.6
16814.00	H	36.54	*	7.2	44.3	-37.5	50.5	336.5	42630.4	-42.1
	V	37.56	*	7.2	44.3	-37.5	51.6	378.5	42630.4	-41.0
21618.00	H	26.43	*	2.1	40.6	-25.3	43.9	156.0	42630.4	-48.7
	V	26.84	*	2.1	40.6	-25.3	44.3	163.5	42630.4	-48.3
24020.00	H	27.18	*	2.3	40.6	-25.2	44.9	175.0	42630.4	-47.7
	V	27.48	*	2.3	40.6	-25.2	45.2	181.1	42630.4	-47.4
2400.00	H	14.58	*	3.4	32.6	0.0	50.6	337.8	42630.4	-42.0
	V	15.74	*	3.4	32.6	0.0	51.7	386.1	42630.4	-40.9

Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	15
Test	Peak Measurements in the Restricted Bands
Mode	2440MHz Tx
Frequency Tested	2440MHz
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dBμV/m)	Peak Total at 3m (μV/m)	Peak Limit at 3m (μV/m)	Margin (dB)
4880.00	H	50.7		3.7	35.8	-39.3	50.9	349.1	5000.0	-23.1
	V	50.7		3.7	35.8	-39.3	50.8	347.9	5000.0	-23.2
7320.00	H	49.5	*	4.7	37.7	-39.4	52.5	420.2	5000.0	-21.5
	V	49.5	*	4.7	37.7	-39.4	52.5	419.7	5000.0	-21.5
12200.00	H	49.9	*	6.1	41.1	-39.1	58.0	791.0	5000.0	-16.0
	V	49.2	*	6.1	41.1	-39.1	57.3	735.7	5000.0	-16.6
19520.00	H	36.2	*	2.1	40.4	-27.6	51.0	355.0	5000.0	-23.0
	V	37.7	*	2.1	40.4	-27.6	52.5	420.9	5000.0	-21.5

Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	15
Test	Average Measurements in the Restricted Bands
Mode	2440MHz Tx
Frequency Tested	2440MHz
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle Factor (dB)	Average Total at 3m (dBμV/m)	Average Total at 3m (μV/m)	Average Limit at 3m (μV/m)	Margin (dB)
4880.00	H	40.68		3.7	35.8	-39.3	0.0	40.8	110.3	500.0	-13.1
	V	40.34		3.7	35.8	-39.3	0.0	40.5	106.0	500.0	-13.5
7320.00	H	37.75	*	4.7	37.7	-39.4	0.0	40.7	108.5	500.0	-13.3
	V	37.58	*	4.7	37.7	-39.4	0.0	40.5	106.4	500.0	-13.4
12200.00	H	38.09	*	6.1	41.1	-39.1	0.0	46.2	203.8	500.0	-7.8
	V	37.97	*	6.1	41.1	-39.1	0.0	46.1	201.0	500.0	-7.9
19520.00	H	26.43	*	2.1	40.4	-27.6	0.0	41.2	115.3	500.0	-12.7
	V	26.90	*	2.1	40.4	-27.6	0.0	41.7	121.7	500.0	-12.3

Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	15
Test	Peak Measurements in the Non-Restricted Bands
Mode	2440MHz Tx
Frequency Tested	2440MHz
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dBμV/m)	Peak Total at 3m (μV/m)	Peak Limit at 3m (μV/m)	Margin (dB)
2440.00	H	77.40		2.6	32.7	0.0	112.8	435354.4	NA	NA
	V	72.46		2.6	32.7	0.0	107.8	246514.7	NA	NA
9760.00	H	38.39	*	5.2	39.3	-39.3	43.6	152.0	43535.4	-49.1
	V	37.93	*	5.2	39.3	-39.3	43.2	144.2	43535.4	-49.6
14640.00	H	38.06	*	6.7	41.9	-38.2	48.4	263.7	43535.4	-44.4
	V	37.92	*	6.7	41.9	-38.2	48.3	259.5	43535.4	-44.5
17080.00	H	37.11	*	7.3	44.5	-37.6	51.3	368.9	43535.4	-41.4
	V	37.08	*	7.3	44.5	-37.6	51.3	367.6	43535.4	-41.5
21960.00	H	25.72	*	2.1	40.6	-25.3	43.2	143.8	43535.4	-49.6
	V	26.87	*	2.1	40.6	-25.3	44.3	164.1	43535.4	-48.5
24400.00	H	24.94	*	2.1	40.6	-25.2	42.5	133.1	43535.4	-50.3
	V	24.33	*	2.1	40.6	-25.2	41.9	124.0	43535.4	-50.9



Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	16
Test	Peak Measurements in the Restricted Bands
Mode	2480MHz Tx
Frequency Tested	2480MHz
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dBμV/m)	Peak Total at 3m (μV/m)	Peak Limit at 3m (μV/m)	Margin (dB)
4960.00	H	48.3	*	3.7	36.1	-39.3	48.8	274.0	5000.0	-25.2
	V	49.8	*	3.7	36.1	-39.3	50.3	326.4	5000.0	-23.7
7440.00	H	47.4	*	4.7	37.7	-39.4	50.4	329.9	5000.0	-23.6
	V	46.7	*	4.7	37.7	-39.4	49.6	302.7	5000.0	-24.4
12400.00	H	47.2	*	6.1	41.2	-39.0	55.4	590.1	5000.0	-18.6
	V	47.1	*	6.1	41.2	-39.0	55.3	584.0	5000.0	-18.7
19840.00	H	35.6	*	1.9	40.4	-27.6	50.4	329.5	5000.0	-23.6
	V	35.6	*	1.9	40.4	-27.6	50.3	328.3	5000.0	-23.7
22320.00	H	35.6	*	1.9	40.6	-25.3	52.9	440.7	5000.0	-21.1
	V	35.8	*	1.9	40.6	-25.3	53.1	450.5	5000.0	-20.9

Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	16
Test	Average Measurements in the Restricted Bands
Mode	2480MHz Tx
Frequency Tested	2480MHz
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle Factor (dB)	Average Total at 3m (dBμV/m)	Average Total at 3m (μV/m)	Average Limit at 3m (μV/m)	Margin (dB)
4960.00	H	40.36	*	3.7	36.1	-39.3	0.0	40.9	110.3	500.0	-13.1
	V	41.97	*	3.7	36.1	-39.3	0.0	42.5	132.8	500.0	-11.5
7440.00	H	39.81	*	4.7	37.7	-39.4	0.0	42.8	137.7	500.0	-11.2
	V	38.92	*	4.7	37.7	-39.4	0.0	41.9	124.3	500.0	-12.1
12400.00	H	39.28	*	6.1	41.2	-39.0	0.0	47.5	237.9	500.0	-6.5
	V	39.58	*	6.1	41.2	-39.0	0.0	47.8	246.3	500.0	-6.2
19840.00	H	26.27	*	1.9	40.4	-27.6	0.0	41.0	112.0	500.0	-13.0
	V	26.38	*	1.9	40.4	-27.6	0.0	41.1	113.5	500.0	-12.9
22320.00	H	25.70	*	1.9	40.6	-25.3	0.0	42.9	140.3	500.0	-11.0
	V	25.61	*	1.9	40.6	-25.3	0.0	42.9	138.9	500.0	-11.1

Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	16
Test	Peak Measurements in the Non-Restricted Bands
Mode	2480MHz Tx
Frequency Tested	2480MHz
Notes	None

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dBμV/m)	Peak Total at 3m (μV/m)	Peak Limit at 3m (μV/m)	Margin (dB)
2480.00	H	77.42	0.00	3.5	32.9	0.0	113.9	492718.3	NA	NA
	V	71.74	0.00	3.5	32.9	0.0	108.2	256211.6	NA	NA
9920.00	H	37.20	*	5.3	39.4	-39.2	42.7	136.2	49271.8	-51.2
	V	37.20	*	5.3	39.4	-39.2	42.7	136.2	49271.8	-51.2
14880.00	H	35.78	*	6.8	42.3	-38.2	46.7	216.3	49271.8	-47.2
	V	35.78	*	6.8	42.3	-38.2	46.7	216.3	49271.8	-47.2
17360.00	H	35.49	*	7.4	44.0	-37.7	49.1	285.9	49271.8	-44.7
	V	36.53	*	7.4	44.0	-37.7	50.2	322.3	49271.8	-43.7
24800.00	H	36.78	*	2.3	40.6	-25.2	54.5	533.0	49271.8	-39.3
	V	24.08	*	2.3	40.6	-25.2	41.8	123.5	49271.8	-52.0

Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	16
Test	High Band-Edge – Peak Readings
Mode	2480MHz Tx
Frequency Tested	2480MHz
Notes	None

Freq. (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBμV/m at 3m	Peak Total μV/m at 3 m	Peak Limit μV/m at 3 m	Margin (dB)
2483.50	H	24.0		2.7	33.0	0.0	59.6	952.6	5000.0	-14.4
2483.50	V	22.0		2.7	33.0	0.0	57.6	756.6	5000.0	-16.4

Test Details	
Manufacturer	Milwaukee Electric Tool Corporation
EUT	Underground Cable Cutter Wireless Remote
Model No.	22802875
Serial No.	16
Test	High Band-Edge – Average Readings
Mode	2480MHz Tx
Frequency Tested	2480MHz
Notes	None

Freq. (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBμV/m at 3m	Average Total μV/m at 3 m	Average Limit μV/m at 3 m	Margin (dB)
2483.50	H	16.55		2.7	33.0	0.0	0.0	52.2	406.3	500.0	-1.8
2483.50	V	13.37		2.7	33.0	0.0	0.0	49.0	281.8	500.0	-5.0

## 23. Scope of Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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## ELECTRICAL

Valid To: June 30, 2025

Certificate Number: 1786.01

In recognition of the successful completion of the A2LA Accreditation Program evaluation process, accreditation is granted to this laboratory to perform the following automotive electromagnetic compatibility and other electrical tests:

**Test Technology:****Test Method(s)<sup>1</sup>:**

***Transient Immunity***  
(Max Voltage 60V/Max current 100A)

ISO 7637-2 (including emissions); ISO 7637-3;  
ISO 16750-2:2012, Sections 4.6.3 and 4.6.4;  
CS-11979, Section 6.4; CS.00054, Section 5.9;  
EMC-CS-2009.1 (CI220); FMC1278 (CI220, CI221, CI222);  
GMW 3097, Section 3.5; SAE J1113-11; SAE J1113-12;  
ECE Regulation 10.06 Annex 10

***Electrostatic Discharge (ESD)***  
(Up to +/-25kV)

ISO 10605 (2001, 2008);  
CS-11979 Section 7.0; CS.00054, Section 5.10;  
EMC-CS-2009.1 (CI 280); FMC1278 (CI280); SAE J1113-13;  
GMW 3097 Section 3.6

***Conducted Emissions***

CISPR 25 (2002, 2008), Sections 6.2 and 6.3;  
CISPR 25 (2016), Sections 6.3 and 6.4;  
CS-11979, Section 5.1; CS.00054, Sections 5.6.1 and 5.6.2;  
GMW 3097, Section 3.3.2;  
EMC-CS-2009.1 (CE 420); FMC1278 (CE420, CE421,  
CE 430, CE440)

(A2LA Cert. No. 1786.01) 08/15/2023



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**Test Technology:**
**Test Method(s)<sup>1</sup>:**

***Radiated Emissions Anechoic***  
(Up to 6GHz)

CISPR 25 (2002, 2008), Section 6.4;  
CISPR 25 (2016), Section 6.5;  
CS-11979, Section 5.3; CS.00054, Section 5.6.3;  
GMW 3097, Section 3.3.1;  
EMC-CS-2009.1 (RE 310); FMC1278 (RE310, RE320);

***Vehicle Radiated Emissions***

CISPR 12; CISPR 36; ICES-002;  
ECE Regulation 10.06 Annex 5

***Bulk Current Injection (BCI)***  
(1 to 400MHz 500mA)

ISO 11452-4; CS-11979, Section 6.1; CS.00054, Section 5.8.1;  
GMW 3097, Section 3.4.1; SAE J1113-4;  
EMC-CS-2009.1 (RI112); FMC1278 (RI112);  
ECE Regulation 10.06 Annex 9

***Radiated Immunity Anechoic***  
(Up to 6GHz and 200V/m)  
(Including Radar Pulse 600V/m)

ISO 11452-2;  
CS-11979, Section 6.2; CS.00054, Section 5.8.2;  
GMW 3097, Section 3.4.2;  
EMC-CS-2009.1 (RI114); FMC1278 (RI114); SAE J1113-21;  
ECE Regulation 10.06 Annex 9

***Radiated Immunity Magnetic Field***

ISO 11452-8; FMC 1278 (RI140)

***Radiated Immunity Reverb***  
(360MHz to 6GHz and 100V/m)

ISO/IEC 61000-4-21; GMW 3097, Section 3.4.3;  
EMC-CS-2009.1 (RI114); FMC1278 (RI114);  
ISO 11452-11

***Radiated Immunity***  
(Portable Transmitters)  
(Up to 6GHz and 20W)

ISO 11452-9;  
EMC-CS-2009.1 (RI115); FMC1278 (RI115);  
GMW 3097, Sec 3.4.4

***Vehicle Radiated Immunity (ALSE)***

ISO 11451-2; ECE Regulation 10.06 Annex 6

***Vehicle Product Specific EMC Standards***

EN 14982; EN ISO 13309; ISO 13766; EN 50498;  
EC Regulation No. 2015/208; EN 55012

***Electrical Loads***

ISO 16750-2

***Stripline***

ISO 11452-5

***Transverse Electromagnetic (TEM) Cell***

ISO 11452-3



Test Technology:
Test Method(s)¹:
**Emissions**

Radiated and Conducted  
(3m Semi-anechoic chamber,  
up to 40 GHz)

47 CFR, FCC Part 15 B (using ANSI C63.4:2014);  
47 CFR, FCC Part 18 (using FCC MP-5:1986);  
ICES-001; ICES-003; ICES-005;  
IEC/CISPR 11, Ed. 4.1 (2004-06); AS/NZS CISPR 11 (2004);  
IEC/CISPR 11 Ed 5 (2009-05) + A1 (2010);  
KN 11 (2008-5) with RRL Notice No. 2008-3 (May 20, 2008);  
CISPR 11; EN 55011; KS C 9811; CNS 13803 (1997, 2003);  
CISPR 14-1; EN 55014-1; AS/NZS CISPR 14.1;  
CISPR 16-2-1 (2008); CISPR 16-2-1; KS C 9814-1; KN 14-1;  
IEC/CISPR 22 (1997);  
EN 55022 (1998) + A1(2000);  
EN 55022 (1998) + A1(2000) + A2(2003); EN 55022 (2006);  
IEC/CISPR 22 (2008-09); AS/NZS CISPR 22 (2004);  
AS/NZS CISPR 22, 3rd Edition (2006); KN 22 (up to 6 GHz);  
CNS 13438 (up to 6 GHz); VCCI V-3 (up to 6 GHz);  
CISPR 32; EN 55032; KS C 9832; KN 32;  
ECE Regulation 10.06 Annex 7 (Broadband);  
ECE Regulation 10.06 Annex 8 (Narrowband);  
ECE Regulation 10.06 Annex 14 (Conducted)

Cellular Radiated Spurious Emissions

ETSI TS 151 010-1 GSM; 3GPP TS 51.010-1, Sec 12;  
ETSI TS 134 124 UMTS; 3GPP TS 34.124;  
ETSI TS 136 124 LTE; E-UTRA; 3GPP TS 36.124

Current Harmonics

IEC 61000-3-2; IEC 61000-3-12;  
EN 61000-3-2; KN 61000-3-2;  
KS C 9610-3-2; ECE Regulation 10.06 Annex 11

Flicker and Fluctuations

IEC 61000-3-3; IEC 61000-3-11;  
EN 61000-3-3; KN 61000-3-3;  
KS C 9610-3-3; ECE Regulation 10.06 Annex 12

**Immunity**

Electrostatic Discharge

IEC 61000-4-2, Ed. 1.2 (2001);  
IEC 61000-4-2 (1995) + A1(1998) + A2(2000);  
EN 61000-4-2 (1995); EN 61000-4-2 (2009-05);  
KN 61000-4-2 (2008-5);  
RRL Notice No. 2008-4 (May 20, 2008);  
IEC 61000-4-2; EN 61000-4-2; KN 61000-4-2;  
KS C 9610-4-2; IEEE C37.90.3 2001

Radiated Immunity

IEC 61000-4-3 (1995) + A1(1998) + A2(2000);  
IEC 61000-4-3, Ed. 3.0 (2006-02);  
IEC 61000-4-3, Ed. 3.2 (2010);  
KN 61000-4-3 (2008-5);  
RRL Notice No. 2008-4 (May 20, 2008);  
IEC 61000-4-3; EN 61000-4-3; KN 61000-4-3;  
KS C 9610-4-3; IEEE C37.90.2 2004

Test Technology:
Test Method(s)<sup>1</sup>:
**Immunity (cont'd)**

Electrical Fast Transient/Burst

IEC 61000-4-4, Ed. 2.0 (2004-07);  
IEC 61000-4-4, Ed. 2.1 (2011);  
IEC 61000-4-4 (1995) + A1(2000) + A2(2001);  
KN 61000-4-4 (2008-5);  
RRL Notice No. 2008-5 (May 20, 2008);  
IEC 61000-4-4; EN 61000-4-4; KN 61000-4-4;  
KS C 9610-4-4; ECE Regulation 10.06 Annex 15

Surge

IEC 61000-4-5 (1995) + A1(2000);  
IEC 61000-4-5, Ed 1.1 (2005-11);  
EN 61000-4-5 (1995) + A1(2001);  
KN 61000-4-5 (2008-5);  
RRL Notice No. 2008-4 (May 20, 2008);  
IEC 61000-4-5; EN 61000-4-5; KN 61000-4-5;  
KS C 9610-4-5;  
IEEE C37.90.1 2012; IEEE STD C62.41.2 2002;  
ECE Regulation 10.06 Annex 16

Conducted Immunity

IEC 61000-4-6 (1996) + A1(2000);  
IEC 61000-4-6, Ed 2.0 (2006-05);  
IEC 61000-4-6 Ed. 3.0 (2008);  
KN 61000-4-6 (2008-5);  
RRL Notice No. 2008-4 (May 20, 2008);  
EN 61000-4-6 (1996) + A1(2001); IEC 61000-4-6;  
EN 61000-4-6; KN 61000-4-6; KS C 9610-4-6

Power Frequency Magnetic Field  
Immunity (*Down to 3 A/m*)

IEC 61000-4-8 (1993) + A1(2000); IEC 61000-4-8 (2009);  
EN 61000-4-8 (1994) + A1(2000);  
KN 61000-4-8 (2008-5);  
RRL Notice No. 2008-4 (May 20, 2008);  
IEC 61000-4-8; EN 61000-4-8; KN 61000-4-8; KS C 9610-4-8

Voltage Dips, Short Interrupts, and Line  
Voltage Variations

IEC 61000-4-11, Ed. 2 (2004-03);  
KN 61000-4-11 (2008-5);  
RRL Notice No. 2008-4 (May 20, 2008);  
IEC 61000-4-11; EN 61000-4-11; KN 61000-4-11;  
KS C 9610-4-11

Ring Wave

IEC 61000-4-12, Ed. 2 (2006-09);  
EN 61000-4-12:2006;  
IEC 61000-4-12; EN 61000-4-12; KN 61000-4-12;  
IEEE STD C62.41.2 2002

**Test Technology:**

Generic and Product Specific EMC Standards

**Test Method(s)<sup>1</sup>:**

IEC/EN 61000-6-1; AS/NZS 61000-6-1; KN 61000-6-1;  
KS C 9610-6-1; IEC/EN 61000-6-2; AS/NZS 61000-6-2;  
KN 61000-6-2; KS C 9610-6-2; IEC/EN 61000-6-3;  
AS/NZS 61000-6-3; KN 61000-6-3; KS C 9610-6-3;  
IEC/EN 61000-6-4; AS/NZS 61000-6-4; KN 61000-6-4;  
KS C 9610-6-4; EN 50130-4; EN 61326-1; EN 50121-3-2;  
EN 12895; EN 50270; EN 50491-1; EN 50491-2; EN 50491-3;  
EN 55015; EN 60730-1; EN 60945; IEC 60533;  
EN 61326-2-6; EN 61800-3; IEC/CISPR 14-2; EN 55014-2;  
AS/NZS CISPR 14-2; KN 14-2; KS C 9814-2;  
IEC/CISPR 24; AS/NZS CISPR 24; EN 55024; KN 24;  
IEC/CISPR 35; AS/NZS CISPR 35; EN 55035; KN 35;  
KS C 9835; IEC 60601-1-2; JIS T0601-1-2

***TxRx EMC Requirements***

EN 301 489-1; EN 301 489-3; EN 301 489-9;  
EN 301 489-17; EN 301 489-19; EN 301 489-20

***European Radio Test Standards***

ETSI EN 300 086-1; ETSI EN 300 086-2;  
ETSI EN 300 113-1; ETSI EN 300 113-2;  
ETSI EN 300 220-1; ETSI EN 300 220-2;  
ETSI EN 300 220-3-1; ETSI EN 300 220-3-2;  
ETSI EN 300 330-1; ETSI EN 300 330-2;  
ETSI EN 300 440-1; ETSI EN 300 440-2;  
ETSI EN 300 422-1; ETSI EN 300 422-2;  
ETSI EN 300 328; ETSI EN 301 893;  
ETSI EN 301 511; ETSI EN 301 908-1;  
ETSI EN 908-2; ETSI EN 908-13;  
ETSI EN 303 413; ETSI EN 302 502;  
EN 303 340; EN 303 345-2; EN 303 345-3; EN 303 345-4

***Canadian Radio Tests***

RSS-102 measurement (RF Exposure Evaluation);  
RSS-102 measurement (Nerve Stimulation);  
SPR-002; RSS-111; RSS-112; RSS-117; RSS-119; RSS-123;  
RSS-125; RSS-127; RSS-130; RSS-131; RSS-132; RSS-133;  
RSS-134; RSS-135; RSS-137; RSS-139; RSS-140; RSS-141;  
RSS-142; RSS-170; RSS-181; RSS-182; RSS-191; RSS-192;  
RSS-194; RSS-195; RSS-196; RSS-197; RSS-199; RSS-210;  
RSS-211; RSS-213; RSS-215; RSS-216; RSS-220; RSS-222;  
RSS-236; RSS-238; RSS-243; RSS-244; RSS-247; RSS-248;  
RSS-251; RSS-252; RSS-287; RSS-288; RSS-310; RSS-GEN

***Mexico Radio Tests***

IFT-008-2015; NOM-208-SCFI-2016

***Japan Radio Tests***

Radio Law No. 131, Ordinance of MPT No. 37, 1981,  
MIC Notification No. 88:2004, Table No. 22-11;  
ARIB STD-T66, Regulation 18

***Taiwan Radio Tests***

LP-0002 (July 15, 2020)

**Test Technology:**
**Test Method(s)<sup>1</sup>:**

*Australia/New Zealand Radio Tests*

AS/NZS 4268; Radiocommunications (Short Range Devices) Standard (2014)

*Hong Kong Radio Tests*

HKCA 1039 Issue 6;  
HKCA 1042;  
HKCA 1033 Issue 7;  
HKCA 1061;  
HKCA 1008;  
HKCA 1043;  
HKCA 1057;  
HKCA 1073

*Korean Radio Test Standards*

KN 301 489-1; KN 301 489-3; KN 301 489-9;  
KN 301 489-17; KN 301 489-52; KS X 3124; KS X 3125;  
KS X 3130; KS X 3126; KS X 3129

*Vietnam Radio Test Standards*

QCVN 47:2015/BTTTT; QCVN 54:2020/BTTTT;  
QCVN 55:2011/BTTTT; QCVN 65:2013/BTTTT;  
QCVN 73:2013/BTTTT; QCVN 74:2020/BTTTT;  
QCVN 112:2017/BTTTT; QCVN 117:2020/BTTTT

*Vietnam EMC Test Standards*

QCVN 18:2014/BTTTT; QCVN 86:2019/BTTTT;  
QCVN 96:2015/BTTTT; QCVN 118:2018/BTTTT

*Unlicensed Radio Frequency Devices  
(3 Meter Semi-Anechoic Room)*

47 CFR FCC Part 15C, 15D, 15E, 15F, 15G, 15H  
(using ANSI C63.10:2013, ANSI C63.17:2013 and  
FCC KDB 905462 D02 (v02))

*Licensed Radio Service Equipment*

47 CFR FCC Parts 20, 22, 24, 25, 27, 30, 73, 74, 80, 87,  
90, 95, 96, 97, 101 (using ANSI/TIA-603-E,  
TIA-102.CAAA-E, ANSI C63.26:2015)

*OIA (Over the Air) Performance*

GSM, GPRS, EGPRS  
UMTS (W-CDMA)  
LTE including CAT M1  
A-GPS for UMTS/GSM  
LTS A-GPS, A-GLONASS,  
SIB8/SIB16  
Large Device/Laptop/Tablet Testing  
Integrated Device Testing  
WiFi 802.11 a/b/g/n/a

CTIA Test Plan for Wireless Device Over-the-Air  
Performance (Method for Measurement for Radiated Power  
and Receiver Performance) V3.8.2;  
CTIA Test Plan for RF Performance Evaluation of WiFi  
Mobile Converged Devices V2.1.0

**Test Technology:**
**Test Method(s)<sup>1</sup>:**
**Electrical Measurements and Simulation**
**AC Voltage / Current**

(1mV to 5kV) 60 Hz  
(0.1V to 250V) up to 500 MHz  
(1μA to 150A) 60 Hz

FAA AC 150/5345-10H;  
FAA AC 150/5345-43J;  
FAA AC 150/5345-44K;  
FAA AC 150/5345-46E;  
FAA AC 150/5345-47C;  
FAA EB 67D

**DC Voltage / Current**

(1mV to 15 kV) / (1μA to 10A)

**Power Factor / Efficiency / Crest Factor**  
(Power to 30kW)

**Resistance**

(1mΩ to 4000MΩ)

**Surge**

(Up to 10 kV / 5 kA) (Combination  
Wave and Ring Wave)

**On the following products and materials:**

Telecommunications Terminal Equipment (TTE), Radio Equipment, Network Equipment, Information Technology Equipment (ITE), Automotive Electronic Equipment, Automotive Hybrid Electronic Devices, Maritime Navigation and Radio Communication Equipment and Systems, Vehicles, Boats and Internal Combustion Engine Driven Devices, Automotive, Aviation, and General Lighting Products, Medical Electrical Equipment, Motors, Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment, Household Appliances, Electric Tools, Low-voltage Switchgear and Control gear, Programmable Controllers, Electrical Equipment for Measurement, Control and Laboratory Use, Base Materials, Power and Data Transmission Cables and Connectors

<sup>1</sup> When the date, edition, version, etc. is not identified in the scope of accreditation, laboratories may use the version that immediately precedes the current version for a period of one year from the date of publication of the standard measurement method, per part C., Section 1 of A2LA R101 - General Requirements - Accreditation of ISO-IEC 17025 Laboratories.

Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1<sup>2</sup>

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
<b><u>Unintentional Radiators</u></b>		
Part 15B	ANSI C63.4:2014	40000
<b><u>Industrial, Scientific, and Medical Equipment</u></b>		
Part 18	FCC MP-5 (February 1986)	40000
<b><u>Intentional Radiators</u></b>		
Part 15C	ANSI C63.10:2013	40000



Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1<sup>2</sup>

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
<u>Unlicensed Personal Communication Systems Devices</u>		
Part 15D	ANSI C63.17:2013	40000
<u>U-NII without DFS Intentional Radiators</u>		
Part 15E	ANSI C63.10:2013	40000
<u>U-NII with DFS Intentional Radiators</u>		
Part 15E	FCC KDB 905462 D02 (v02)	40000
<u>UWB Intentional Radiators</u>		
Part 15F	ANSI C63.10:2013	40000
<u>BPL Intentional Radiators</u>		
Part 15G	ANSI C63.10:2013	40000
<u>White Space Device Intentional Radiators</u>		
Part 15H	ANSI C63.10:2013	40000
<u>Commercial Mobile Services (FCC Licensed Radio Service Equipment)</u>		
Parts 22 (cellular), 24, 25 (below 3 GHz), and 27	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>General Mobile Radio Services (FCC Licensed Radio Service Equipment)</u>		
Parts 22 (non-cellular), 90 (below 3 GHz), 95, 97, and 101 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Citizens Broadband Radio Services (FCC Licensed Radio Service Equipment)</u>		
Part 96	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Maritime and Aviation Radio Services</u>		
Parts 80 and 87	ANSI/TIA-603-E; ANSI C63.26:2015	40000
<u>Microwave and Millimeter Bands Radio Services</u>		
Parts 25, 30, 74, 90 (above 3 GHz), 97 (above 3 GHz), and 101	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000

Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1<sup>2</sup>

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
<u>Broadcast Radio Services</u> Parts 73 and 74 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Signal Boosters</u> Part 20 (Wideband Consumer Signal Boosters, Provider-specific signal boosters, and Industrial Signal Boosters) Section 90.219	ANSI C63.26:2015	40000

<sup>2</sup> Accreditation does not imply acceptance to the FCC equipment authorization program. Please see the FCC website (<https://apps.fcc.gov/oetcf/eas/>) for a listing of FCC approved laboratories.



## Accredited Laboratory

A2LA has accredited

### ELITE ELECTRONIC ENGINEERING INC.

Downers Grove, IL

for technical competence in the field of

### Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



Presented this 15<sup>th</sup> day of August 2023.



Mr. Trace McInturff, Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 1786.01  
Valid to June 30, 2025

*For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.*