Washington Laboratories, Ltd.

FCC & ISED CANADA CERTIFICATION TEST REPORT

for the

433 MHz Device

FCC ID: YJ7DCV585

IC ID: 9082A-DCV585

REPORT# 15584-01 REV 2

Prepared for:

Stanley Black & Decker, Inc.

701 E. Joppa Road - TW116

Towson, MD 21286

Prepared By:

Washington Laboratories, Ltd.

7560 Lindbergh Drive

Gaithersburg, Maryland 20879

Testing Certificate AT-1448

FCC & ISED Canada Certification Test Report

for the

Stanley Black & Decker, Inc.

433 MHz Device

FCC ID: YJ7DCV585

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JUNE 26, 2018
Re-issued September 6, 2018

WLL REPORT# 15584-01 REV 2

Prepared by:

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EMC Engineer

Reviewed by:

Steven D. Koster
President

ABSTRACT

This report has been prepared on behalf of Stanley Black & Decker, Inc. to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 15.231 of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210 of Innovation, Science and Economic Development Canada. This Certification Test Report documents the test configuration and test results for the Stanley Black & Decker, Inc. 433 MHz Device.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The ISED Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively.

Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Certificate AT-1448 as an independent FCC test laboratory.

The Stanley Black & Decker, Inc. 433 MHz Device complies with the limits for an Intentional Radiator device under FCC Part 15.231 and RSS-210 of Innovation, Science and Economic Development Canada (ISED).

Revision History	Description of Change	Date
Rev 0	Initial Release	JUNE 26, 2018
Rev 1	Edited per ACB Comments	August 22, 2018
Rev 2	Edited per ACB Comments	September 6, 2018

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1 INTRODUCTION

1.1 COMPLIANCE STATEMENT

The Stanley Black & Decker, Inc. 433 MHz Device complies with the limits for an Intentional Radiator device under FCC Part 15.231 and ISED Canada RSS-210.

TX Test Summary (Low Power Transmitter)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.231 (e)	RSS-210	Transmission Length	Pass
15.231 (b)	RSS-210	Field Strength Limits	Pass
15.231 (c)	RSS-210	20dB Bandwidth	Pass
RX/Digital Test Summary (Low Power Transmitter)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.209	RSS-Gen [7.2.3.2]	General Field Strength Limits (Restricted Bands & RE Limits)	Pass

1.2 TEST SCOPE

Tests for radiated emissions were performed. All measurements were performed in accordance ANSI C63.10-2013. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Stanley Black & Decker, Inc.
Address	701 E. Joppa Road - TW116
	Towson, MD 21286
Purchase Order Number:	M833818
Quotation Number:	70686

1.4 Test Dates

Testing was performed on the following date(s): 5/29/2018 – 6/26/2018

1.5 Test and Support Personnel

Washington Laboratories, LTD	Nikolas Allen
Customer Representative	Anthony Romano

1.6 ABBREVIATIONS

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	Amperes
b/s	**b**its per **s**econd
BW	**B**and**W**idth
CE	**C**onducted **E**mission
cm	**C**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**d**eci**B**el
dc	**d**irect **c**urrent
EMI	**E**lectro**m**agnetic **I**nterference
EUT	**E**quipment **U**nder **T**est
FM	**F**requency **M**odulation
G	**g**iga – prefix for 10^9 multiplier
Hz	**H**ertz
IF	**I**ntermediate **F**requency
k	**k**ilo – prefix for 10^3 multiplier
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
M	**M**ega – prefix for 10^6 multiplier
m	**M**eter
µ	**m**icro – prefix for 10^{-6} multiplier
NB	**N**arrow**b**and
QP	**Q**uasi-**P**eak
RE	**R**adiated **E**missions
RF	**R**adio **F**requency
rms	**r**oot-**m**ean-**s**quare
SN	**S**erial **N**umber
S/A	**S**pectrum **A**nalyzer
V	**V**olt

2 EQUIPMENT UNDER TEST

2.1 EUT IDENTIFICATION & DESCRIPTION

Table 1: Device Summary

Item	DeWalt Flexvolt Dust Extractor
Manufacturer:	Stanley Black & Decker, Inc.
FCC ID:	YJ7DCV585
ISED ID:	9082A-DCV585
Model:	433 MHz Device
Serial Number of Unit Tested	2018 17-47
FCC Rule Parts:	§15.231
ISED Rule Parts:	RSS-210
Frequency Range:	433 MHz
Maximum Output Power:	3548.2 uV/m
Modulation:	Pulse
Occupied Bandwidth (20dB):	122.8 kHz
Occupied Bandwidth (99%):	179 KHz
FCC Emission Designator:	179KP0N
ISED Emissions Designators:	179KP0N
Keying:	Automatic, Manual
Type of Information:	Pulse
Number of Channels:	1
Power Output Level	Fixed
Antenna Connector	Internal
Antenna Type	PCB
Interface Cables:	None
Maximum Data Rate	NA
Power Source & Voltage:	3.3V Li Button Cell

The Stanley Black & Decker, Inc. 433 MHz Device is a Key fob wireless remote to turn on/off a DC-powered dust extractor for jobsite use.

2.2 TEST CONFIGURATION

The 433 MHz Device was configured in a stand-alone configuration.

2.3 TESTING ALGORITHM

The 433 MHz Device was tested was tested ina continuous tramsmit operation. The signal generated by the device is a singular pulse that toggles the paired device on or off. For testing purposes, a CW signal was available.

2.4 TEST LOCATION

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The ISED Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Testing Certificate AT-1448 as an independent FCC test laboratory.

2.5 MEASUREMENTS

2.5.1 References

ANSI C63.2 (Jan-2016) Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 (Jan 2014) American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

ANSI C63.10 (Jun 2013) American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

2.6 MEASUREMENT UNCERTAINTY

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 (R2002) with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

Equation 1: Standard Uncertainty

$$u_c = \pm\sqrt{\frac{a^2}{div_a{}^2} + \frac{b^2}{div_b{}^2} + \frac{c^2}{div_c{}^2} + ...}$$

Where u_c = standard uncertainty

a, b, c,.. = individual uncertainty elements

$Div_{a, b, c}$ = the individual uncertainty element divisor based on the probability distribution

Divisor = 1.732 for rectangular distribution

Divisor = 2 for normal distribution

Divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

Where U = expanded uncertainty

k = coverage factor

$k \leq 2$ for 95% coverage (ANSI/NCSL Z540-2 Annex G)

u_c = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 2 below.

Table 2: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty
Conducted Emissions	CISPR11, CISPR22, , CISPR32, CISPR14, FCC Part 15	±2.63 dB
Radiated Emissions	CISPR11, CISPR22, , CISPR32, CISPR14, FCC Part 15	±4.55 dB

3 TEST EQUIPMENT

Table 3 shows a list of the test equipment used for measurements along with the calibration information.

Table 3: Test Equipment List

Test Name:	**Transmission Cessation**	**Test Date:**	**6/22/2018**
823	AGILENT - N9010A	EXA SPECTRUM ANALYZER	4/21/2019
Test Name:	**Radiated Emissions**	**Test Date:**	**6/22/2018**
Asset #	Manufacturer/Model	Description	Cal. Due
558	HP - 8447D	AMPLIFIER	2/9/2019
522	HP - 8449B	PRE-AMPLIFIER 1-26.5GHZ	2/12/2019
823	AGILENT - N9010A	EXA SPECTRUM ANALYZER	4/21/2019
826	MEGAPHASE - TM40-K1K5-36	RF CABLE - 2.9MM-2.9MM 36	08/15/2018
382	SUNOL SCIENCES CORPORATION - JB1	ANTENNA BICONLOG	3/21/2020
4	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	12/14/2018
Test Name:	**Occupied Bandwidth**	**Test Date:**	**6/22/2018**
823	AGILENT - N9010A	EXA SPECTRUM ANALYZER	4/21/2019

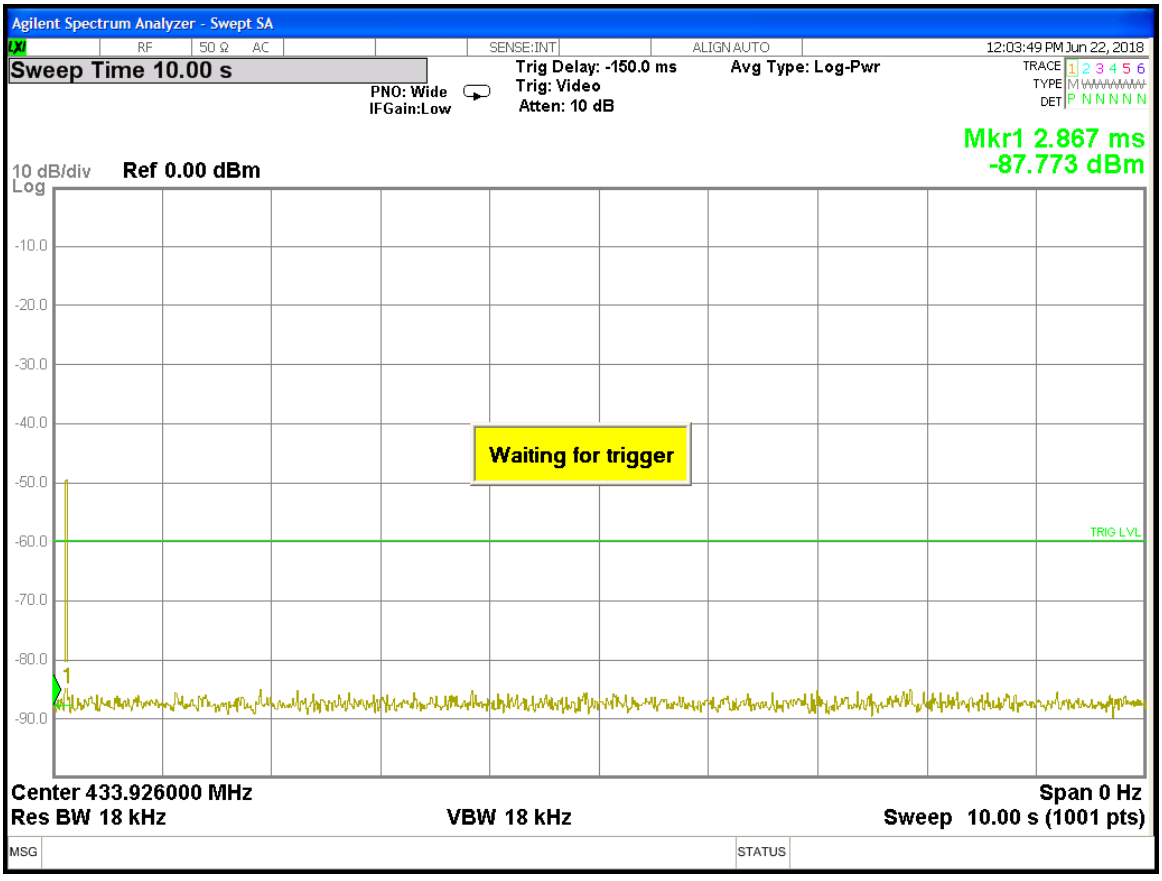
4 TEST RESULTS

4.1 TRANSMISSION CESSATION FROM TIME OF RELEASE (FCC PART §15.231(A), RSS210 A.1.4(E))

FCC Part 15.231 states that a periodic intentional radiator shall cease transmission within a five second period from release of automatic or manual keying of operation.

Testing was done to verify that the 433 MHz Device stopped transmitting within the required time period. A 10 second sweep was made, during which the control toggle was activated and released, and the time to transmission end was measured Figure 1 shows the indicated time period from un-keying the device until cessation of transmission. The EUT complies with the requirements for this section.

Figure 1: Time Period: Release to Termination of Transmission



4.2 Radiated Spurious Emissions: (FCC Part §15.231, RSS210 A.1.4(d))

4.2.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2014. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured. Measurements were made on all three orthogonals with the worst-case measurements being displayed below.

The emissions were measured using the following resolution bandwidths:

Table 4: Spectrum Analyzer Settings

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	10 Hz (Avg.), 1MHz (Peak)

Peak Measurements below 1GHz were made with the spectrum analyzer with a Video bandwidth greater than 100kHz. Correction factors were then applied and then the result was compared to the limit.

Average measurements above 1GHz were made mathematically using duty cycle correction. A single pulse was measured during a 100 ms period to have an on time of 10.89 ms. Using Equation 3 a correction factor of -19.26 was obtained.

Equation 3: Duty Cycle Correction

$$\delta(dB) = 20 * \log(\frac{t_{on}}{100ms})$$

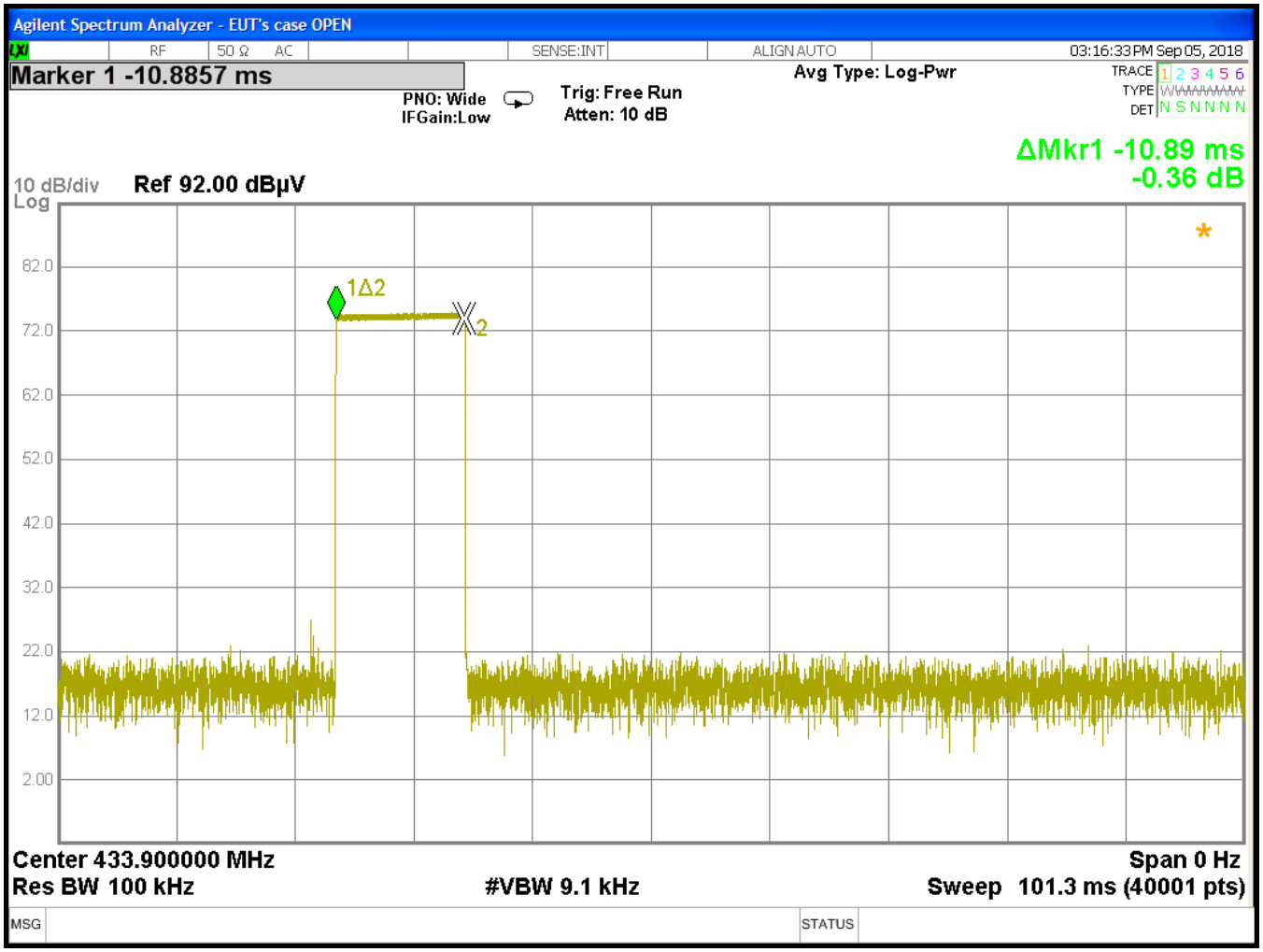


Figure 2: Single Pulse over 100 ms

Table 5: Radiated Emission Test Data

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Duty Cycle Correction (dB)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
433.92	V	0.00	0.00	66.98	0	-8.3	861.0	10946.8	-22.1	Fundamental
61.25	V	270.00	3.04	51.95	0	-17.9	50.2	100.0	-6.0	
76.28	V	270.00	1.27	44.59	0	-17.2	23.5	100.0	-12.6	
157.91	V	270.00	3.48	37.85	0	-12.6	18.3	150.0	-18.3	
168.23	V	270.00	2.22	35.64	0	-13.0	13.5	150.0	-20.9	
219.30	V	0.00	1.17	49.61	0	-14.0	60.3	200.0	-10.4	
345.00	V	0.00	2.22	33.60	0	-10.4	14.5	200.0	-22.8	
1301.74	V	270.00	1.50	64.10	0	-9.1	564.1	5000.0	-19.0	Peak
1301.74	V	270.00	1.50	64.10	-19.26	-9.1	61.4	500.0	-18.2	Ave
1735.65	V	270.00	3.18	54.27	0	-7.6	214.6	5000.0	-27.3	Peak
1735.65	V	270.00	3.18	54.27	-19.26	-7.6	23.4	500.0	-26.6	Ave
2169.55	V	0.00	1.00	51.12	0	-3.4	242.9	5000.0	-26.3	Peak
2169.55	V	0.00	1.00	51.12	-19.26	-3.4	26.5	500.0	-25.5	Ave
433.92	H	0.00	0.00	79.28	0	-8.3	3548.2	10946.8	-9.8	Fundamental
66.37	H	180.00	0.00	39.94	0	-17.4	13.4	100.0	-17.5	
133.28	H	180.00	3.04	53.63	0	-11.0	135.4	150.0	-0.9	
133.28	H	180.00	3.04	48.35	0	-11.0	73.8	150.0	-6.2	
238.42	H	270.00	2.02	32.59	0	-13.1	9.4	200.0	-26.6	
257.45	H	0.00	1.26	33.60	0	-13.2	10.5	200.0	-25.6	
296.80	H	270.00	2.95	35.81	0	-11.6	16.3	200.0	-21.8	
332.88	H	270.00	2.76	35.28	0	-10.7	17.0	200.0	-21.4	
1301.91	H	180.00	1.00	65.26	0	-9.1	644.8	5000.0	-17.8	Peak
1301.91	H	180.00	1.00	65.26	-19.26	-9.1	70.2	500.0	-17.1	Ave
1735.64	H	270.00	1.00	57.03	0	-7.6	294.8	5000.0	-24.6	Peak
1735.64	H	270.00	1.00	57.03	-19.26	-7.6	32.1	500.0	-23.8	Ave
2169.57	H	180.00	3.00	51.56	0	-3.4	255.6	5000.0	-25.8	Peak
2169.57	H	180.00	3.00	51.56	-19.26	-3.4	27.8	500.0	-25.1	Ave

Measurements shown were the worst case for all device orientation.

4.3 Occupied Bandwidth (FCC Part §2.231(c) and RSS210 A.1.3):

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

The limit specified for momentary operating devices with center frequency between 70 MHz and 900 MHz is .25% of the center frequency. Bandwidth is determined at the 20 dB down point from the carrier and the 99% power bandwidth.

Table 6: Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Video Bandwidth
15 kHz	150 kHz

At full modulation, the occupied bandwidth was measured as shown:

Figure 3 provides a summary of the Occupied Bandwidth Results.

Table 7: Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Given Channel: 433.5MHz, 99%	179.06 kHz	1084.86 kHz	Pass
Given Channel: 433.5MHz, 20 dB	122.8 kHz	1084.86 kHz	Pass

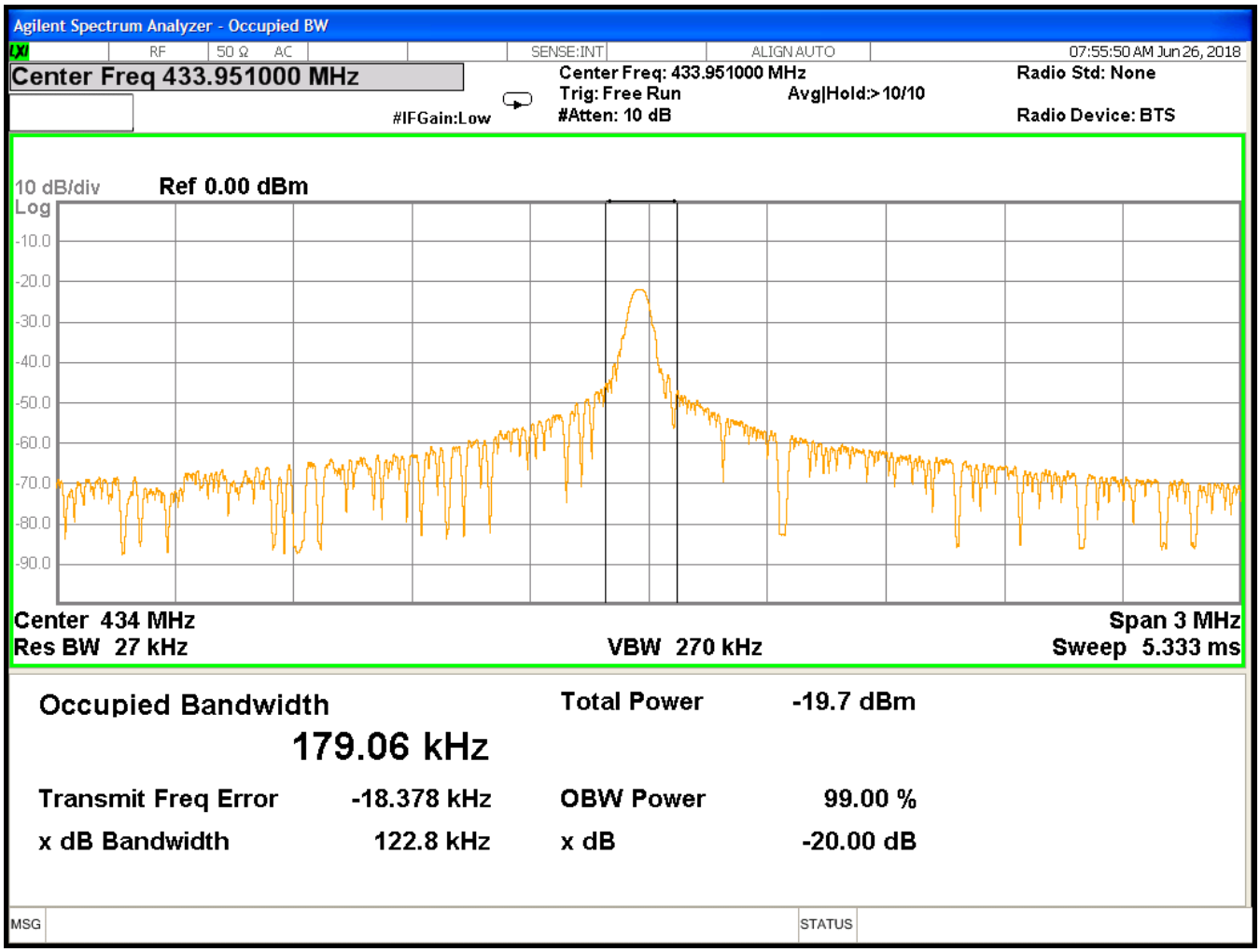


Figure 3: Occupied Bandwidth