



*Testing Tomorrow's Technology*

## **Application for Certification**

**Per**

**Title 47 USC Part 2, Subpart J, Equipment Authorization Procedures,  
Paragraph 2.907, Certification and Part 15, Subpart C, Intentional Radiators,  
Paragraph 15.231, Periodic Operation in the band 40.66 MHz to 40.70 MHz  
and above 70 MHz**

**And**

**Innovation, Science, and Economic Development Canada  
Certification Per**

**ICRSS-Gen General Requirements for Radio Apparatus**

**And**

**RSS-210 License-Exempt Radio Apparatus: Category I Equipment**

**For the**

**Radio Systems Corporation**

**YT-100 (Assembly Number 300-3359)**

**Model: SDT54-16682**

**UST Project: 18-0186**

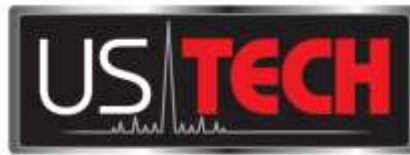
**Issue Date: August 23, 2018**

Number of Pages in this report: 17

**3505 Francis Circle Alpharetta, GA 30004**

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I certify that I am authorized to sign for the test facility and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US Tech (Agent Responsible For Test):

By: \_\_\_\_\_

Name: Alan Ghasiani

Title: President – Consulting Engineer

Date: August 23, 2018



TESTING  
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## MEASUREMENT/TECHNICAL REPORT

**COMPANY NAME:** Radio Systems Corporation  
**PRODUCT:** SDT54-16682  
**FCC ID:** KE3-3003359  
**IC:** 2721A-3003359  
**DATE:** September 6, 2018

This report concerns (check one): Original grant  X  
Class II change  \_\_\_\_\_

Equipment type: 433.92 MHz Transmitter Module

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes  No  X

If yes, defer until: \_\_\_\_\_  
date

N.A. agrees to notify the Commission by N.A.  
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech  
3505 Francis Circle  
Alpharetta, GA 30004

Phone Number: (770) 740-0717

Fax Number: (770) 740-1508

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## 1. General Information

This report is prepared as a means of presenting test data to be used by a Telecom Certification Body in determination of whether this product is permitted for unlicensed dissemination to the general public according to the Innovation, Science, and Economic Development Canada and FCC Rules and Regulations for RF Devices Intentional Radiators.

### 1.1 Product Description

The Equipment under Test (EUT) is the Radio Systems Corporation Yard Trainer 100 (YT-100) Model SDT54-16682 Transmitter. The EUT is a handheld transmitter used with a training collar that is designed to be lower cost entry point SportDog product. The design uses a 433.9MHz radio and can achieve distances of 100 meters

### 1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on July 13, 2018 in good operating condition.

### 1.3 Related Submittal(s)/Grant(s)

The EUT is subject to the following FCC Equipment Authorizations:

- a) Certification of the transmitter.
- b) Verification as a class B digital device.

## 2. Tests and Measurements

### 2.1 Configuration of Tested System

The Test sample was tested per *ANSI C63.10:2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices* to show compliance to CFR 47, Part 15.231.

All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was set to 3 times the resolution bandwidth or off throughout the evaluation process. There were no interconnecting cables to manipulate in an attempt to maximize emissions; however, the physical position of the EUT was varied through the three mutually exclusive orthogonal planes in an attempt to maximize the emissions. The worse case position is the position used for final measurements and is gathered in this test report. A block diagram of the tested system is shown in Figure 1.

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## 2.2 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and registered with the FCC, under site registration number 186022. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 9900A-1 and is also a NVLAP accredited test lab; lab code 200162-0.

## 2.3 Test Equipment

**Table 1. EUT and Peripherals**

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC/IC ID:	CABLES P/D
Handheld Transmitter/ Radio Systems Corporation (EUT)	SDT54-16682	Engineering Sample	Pending: FCC ID: KE3-3003359 IC: 2721A-3003359	N/A
Power Supply Adapter/ Dakacom	STC- A220501700 USBA-Z	N/A	None	1m U P

S= Shielded, U=Unshielded, P= Power line, D= Data line

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**Table 2. Test Instruments**

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	E4407B	AGILENT	US41442935	9/22/2018
SPECTRUM ANALYZER	8593E	HEWLETT PACKARD	3205A60124	10/28/2018
LOOP ANTENNA	6502	EMCO	9810-3246	1/22/2020 2 yr
BICONNICAL ANTENNA	3110B	EMCO	9307-1431	10/23/2019 2 yr
LOG PERIODIC ANTENNA	3146	EMCO	9305-3600	9/21/2018 2 yr.
HORN ANTENNA	3115	EMCO	9107-3723	9/22/2018 2 yr.
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	1937A02980	3/7/2019
PREAMP 1.0 GHz to 26.0 GHz	8449B	HEWLETT-PACKARD	3008A00480	12/01/2018
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.



## 2.4 EUT Antenna Description (FCC Sec. 15.203, RSS-Gen 6.7)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The Radio Systems Corporation, Model SDT54-16682 incorporates the antennas detailed in Table 3.

**Table 3. Antenna Description**

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	TYPE OF CONNECTOR
None	Radio Systems Corporation	monopole	N/A	Permanently attached and soldered

## 2.5 Modifications to Equipment

No modifications were needed to bring the EUT into compliance with the FCC Part or IC RSS requirements.

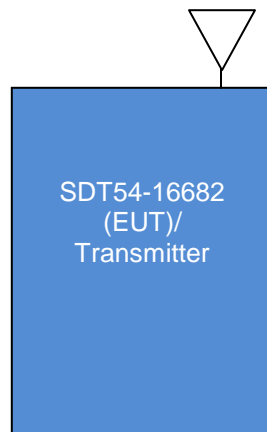
## 2.6 Test Procedure

The EUT was configured as shown in the following block diagram(s) and photograph(s). The sample was tested per ANSI C63.10:2013. Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 9 kHz and 120 kHz depending on the frequency range of testing, 150 kHz-30 MHz or 30 MHz to 1000 MHz, respectively. All measurements are peak unless stated otherwise. The video filter on the spectrum analyzer was OFF throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. The EUT was rotated 360 degrees with the turntable to maximize emissions. The physical position of the EUT was varied through the three mutually exclusive orthogonal planes in an attempt to maximize the emissions. The final setup description is found in the test section of this report.

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**Figure 1. Block Diagram of Test Configuration**

## 2.7 Compliance to CFR 15.231(a), RSS-210, A.1.1(a) Transmitter Activation/Deactivation

According to CFR 15.231(a) The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

*(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.*

The transmitter is not a manually operated transmitter.

*(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.*

The transmitter is classified as an automatically activated transmitter and the transmitter does comply with transmissions ceasing after 5 seconds. See Figure 2 below.

*(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.*

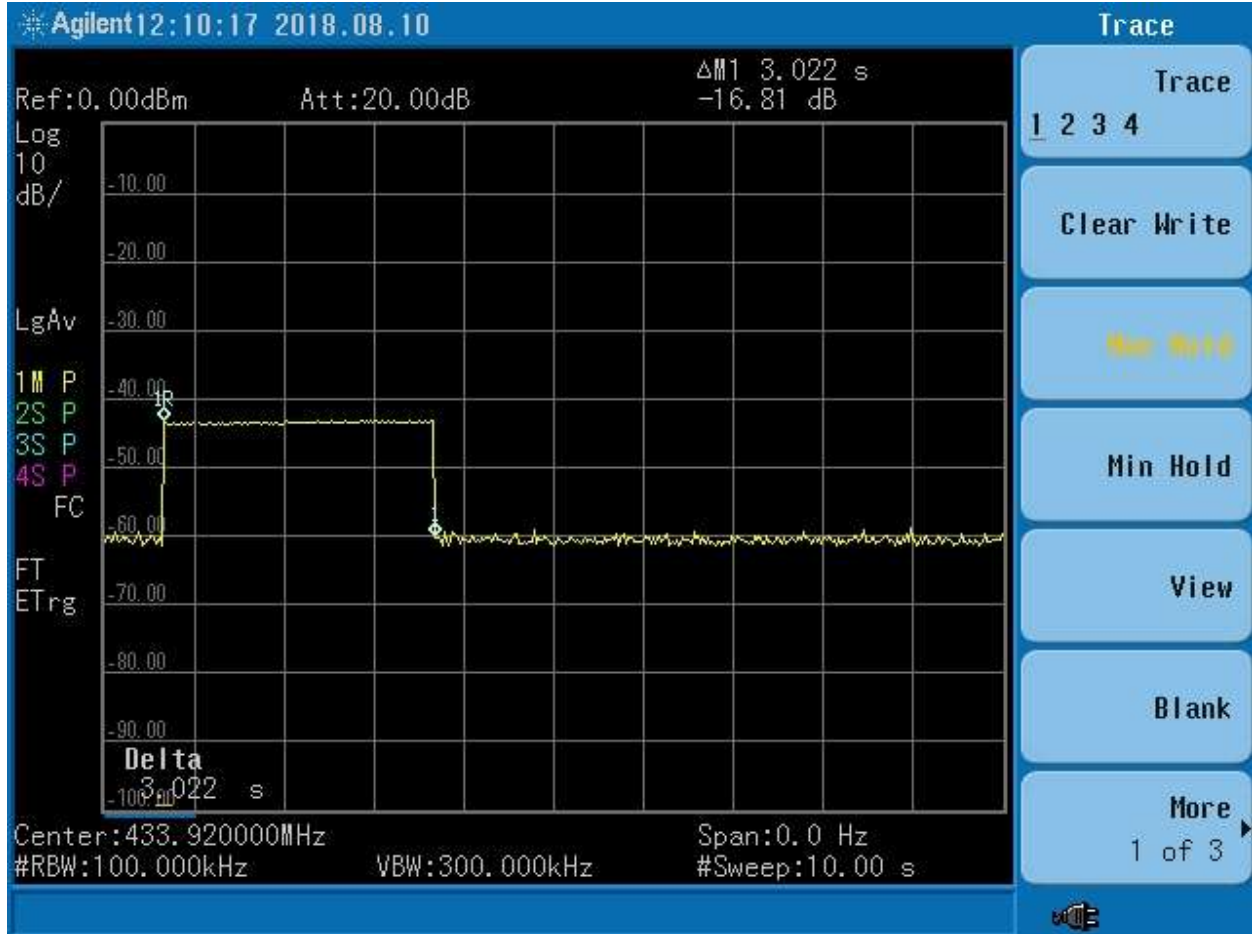
This does not apply; the transmitter does not have periodic transmissions at predetermined intervals, and does not have polling or supervision transmissions to determine system integrity. Transmissions from the Clear Connect transmitter in this product are always initiated by a user initiated event, such as a button press on a product in the system or a user interaction in a smart-phone app to adjust the position of the light dimmer or window shade.

*(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.*

This does not apply; the transmitter is not employed for radio control purposes during emergencies.

*(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.*

This does not apply; the transmitter is not used for security systems.



\*Note: The EUT deactivates within 5 seconds.

**Figure 2. Deactivation per 15.231(a)(1), RSS-210, A.1.1(a)**

## **2.8 Field Strength of Fundamental (47 CFR 15.231(b), RSS-210, A.1.2(b))**

The results of the measurements for peak fundamental emissions are given in Table 4. The EUT emissions measurement was started by setting up the Antenna in the vertical orientation at a distance of 3 meters from the EUT and at a height of 1.0 meters above the ground. The EUT's major axis was set normal to the direction of the measuring antenna.

The Spectrum Analyzer (SA) displays were set to: Channel A free-running, Channel B to Max-Hold. Choose a frequency or frequency range and scan it at a coupled rate. When a signal is detected, raise and lower the antenna to maximize the signal.

When the signal has been maximized, the antenna height is fixed the turn-table is rotated through 360 degrees to further maximize the signal.

When all signals have been maximized for antenna height and direction, the EUT case is carefully maneuvered in each of the three mutually exclusive orthogonal planes while observing the same Max-hold/free-running SA display indication. When the EUT position is found that further maximizes the signal, record the antenna height, rotation orientation, EUT orthogonal position and signal strength on the data sheet for that particular frequency.

Next, the measurement antenna is re-oriented to a Horizontal polarization at 1 meter height and the process described above is repeated. All signals within 6 dB of the limit are recorded.

Finally, the collected data is input into the calculation spread sheet. The spread sheet is designed to calculate for the true value that is collected. The spread sheet takes into account the SA reading, the antenna correction factor, cable losses and duty cycle factors. See the data tables herein.

**2.9 Limits for Operation in the Band above 70 MHz (CFR15.231 (b), RSS-210, A.1.2(b))**

This limit versus frequency table is as follows (test distance = 3.0 meters):

Fundamental Frequency (MHz)	Limit Fundamental (Average) uV/m	Limit Harmonics and other spurious (Average) uV/m
260 to 470	3750 to 12500 <sup>*1</sup>	375 to 1250 <sup>*2</sup>
* Linear Interpolations		

Note: formula 1:  $limit_1 = E = 41.667F - 7083.5$

2:  $limit_2 = E = 4.1667F - 708.35$

E= Electric field strength

F= fundamental frequency in MHz

The frequency spectrum above the fundamental to its 10<sup>th</sup> harmonic was examined and measured for signals falling into the restricted bands of 15.205. If average emissions measurements are employed, the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions were applied. Spurious and harmonics signals meet the requirements of the above table or the requirements of 15.209, whichever requirement permits higher field strength.

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**Table 4. Intentional Radiated Emissions Peak Measurements**

Tested By:	Test: Part 15C, Para 15.231			Client: Radio Systems Corporation.			
<b>JF</b>	Project: 18-0186			Model: SDT54-16682			
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	PK Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detection Method
433.91	80.56	17.95	98.51	100.5	3m./VERT	2.0	<b>PK</b>
867.82	60.59	-0.95	59.64	80.5	3m./VERT	20.9	<b>PK</b>
1301.78	46.69	-5.31	41.38	80.5	3.0m./VERT	39.1	<b>PK</b>
<b>No other emissions found less than 20 dB from the applicable limit.</b>							

1. (\*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10<sup>th</sup> harmonic
3. (-) Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).

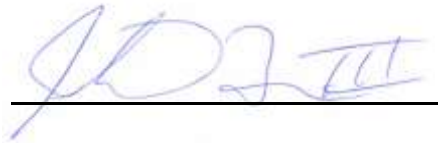
Sample Calculation at 433.91:

Magnitude of Measured Frequency	80.56	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	17.95	dB/m
Corrected Result	98.51	dBuV/m

Test Date: May 24, 2018

Tested By

Signature:



Name: John Freeman

US Tech Test Report:  
 FCC ID:  
 IC:  
 Test Report Number:  
 Issue Date:  
 Customer:  
 Model:

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**Table 5. Intentional Radiated Emissions Average Measurements**

Tested By:	Test: Part 15B, Para 15.231			Client: Radio Systems Corporation.			
<b>JF</b>	Project: 18-0186			Model: SDT54-16682			
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detection Method
433.91	55.23	17.95	73.18	80.5	3m./VERT	7.3	<b>AVG</b>
867.82	39.47	-0.95	38.52	60.5	3m./VERT	22.0	<b>AVG</b>
1301.78	33.50	-5.31	28.19	60.5	3.0m./VERT	32.3	<b>AVG</b>
<b>No other emissions found less than 20 dB from the applicable limit.</b>							

1. (\*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10<sup>th</sup> harmonic
3. (-) Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).

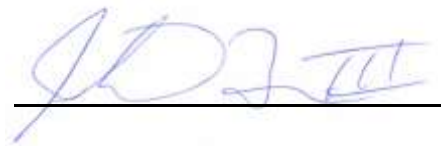
Sample Calculation at 433.91:

Magnitude of Measured Frequency	55.23	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	17.95	dB/m
Corrected Result	73.18	dBuV/m

Test Date: May 24, 2018

Tested By

Signature: \_\_\_\_\_



Name: John Freeman



US Tech Test Report:  
 FCC ID:  
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**2.10 Radiated Spurious Emissions other than Fundamental and Harmonics  
 (CFR 15.209, 15.231, RSS-Gen 8.8, 8.9)**

The EUT was placed in a state representative of how the device will function under normal operation. The radiated spurious emissions were measured over the frequency range of 9 KHz to 30MHz and 30 MHz to the 10<sup>th</sup> harmonic of the fundamental frequency of the intentional transmitter. The test results are shown below.

**Table 6. Spurious Radiated Emissions, 9 kHz - 30 MHz**

9 kHz to 30 MHz, 15.209 limits							
Test: Radiated Emissions				Client: Radio Systems Corporation.			
Project: 18-0186				Model: SDT54-16682			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	QP Limits (dBuV/m)	Antenna Distance/Polarization	Margin (dB)	Detector PK, or AVG
<b>Loop X position</b>							
0.04	56.37	13.00	69.37	115.0	m./meters.	45.6	<b>PK</b>
0.50	34.87	11.54	46.41	93.7	m./meters.	47.3	<b>PK</b>
1.71	25.33	11.77	37.10	83.0	m./meters.	45.9	<b>PK</b>
<b>Loop Y position</b>							
0.04	55.23	13.00	68.23	115.3	m./meters.	47.1	<b>PK</b>
0.54	35.31	11.82	47.13	93.0	m./meters.	45.9	<b>PK</b>
1.71	24.42	11.77	36.19	83.0	m./meters.	46.8	<b>PK</b>
<b>Loop Z position</b>							
0.04	54.99	13.00	67.99	115.3	m./meters.	47.3	<b>PK</b>
0.50	34.34	11.54	45.88	93.7	m./meters.	47.8	<b>PK</b>
1.71	23.90	11.77	35.67	83.0	m./meters.	47.3	<b>PK</b>

Sample Calculation at 0.010 MHz:

Magnitude of Measured Frequency	47.48	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	15.60	dB/m
Corrected Result	63.08	dBuV/m

Test Date: July 2, 2018

Tested By

Signature: 

Name: John Freeman

US Tech Test Report:  
 FCC ID:  
 IC:  
 Test Report Number:  
 Issue Date:  
 Customer:  
 Model:

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**Table 7. Spurious Radiated Emissions other than Fundamental & Harmonics**

<b>&gt;30 MHz 15.209 Limits</b>							
<b>Test: Radiated Emissions</b>				<b>Client: Radio Systems Corporation.</b>			
<b>Project: 18-0186</b>				<b>Model: SDT54-16682</b>			
<b>Frequency (MHz)</b>	<b>Test Data (dBuV)</b>	<b>AF+CA-AMP (dB/m)</b>	<b>Results (dBuV/m)</b>	<b>QP Limits (dBuV/m)</b>	<b>Antenna Distance/ Polarization</b>	<b>Margin (dB)</b>	<b>Detector PK, or AVG</b>
650.86	50.71	-4.02	46.69	60.5	3.0m./VERT	13.8	<b>PK</b>
1300.00	51.27	-6.13	45.14	60.5	3.0m./HORZ	15.4	<b>PK</b>
2960.00	46.99	1.38	48.37	60.5	3.0m./VERT	12.1	<b>PK</b>
4050.00	45.85	6.67	52.52	60.5	3.0m./VERT	8.0	<b>PK</b>
4260.00	44.64	6.46	51.10	60.5	3.0m./HORZ	9.4	<b>PK</b>
<b>All other emissions greater than 20 dB from the applicable limit.</b>							

Sample Calculation at 39.72 MHz:

Magnitude of Measured Frequency	31.37	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	-15.91	dB/m
Corrected Result	15.46	dBuV/m

Test Date: June 14, 2018

Tested By

Signature: 

Name: John Freeman

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## 2.11 Power Line Conducted Emissions (CFR 15.207, RSS-Gen 8.8, 8.9)

Power line conducted emissions were performed on the EUT while in charging mode. The EUT cannot be operated while charging.

150 KHz to 30 MHz with Class A Limits						
Frequency (MHz)	Test Data (dBuv)	LISN+CL-PA (dB)	Results (dBuV)	AVG Limits (dBuV)	Margin (dB)	Detector PK, QP, or AVG
<b>Phase</b>						
0.2964	40.50	0.21	40.71	50.3	9.6	<b>PK</b>
0.5930	38.54	0.14	38.68	46.0	7.3	<b>PK</b>
2.2130	36.30	0.17	36.47	46.0	9.5	<b>QP</b>
5.7250	28.76	0.26	29.02	50.0	21.0	<b>PK</b>
12.0500	25.93	0.49	26.42	50.0	23.6	<b>PK</b>
27.0100	24.61	0.80	25.41	50.0	24.6	<b>PK</b>
<b>Neutral</b>						
0.3436	42.24	0.32	42.56	49.1	6.6	<b>PK</b>
0.8658	35.97	0.29	36.26	46.0	9.7	<b>PK</b>
1.9800	37.47	0.32	37.79	46.0	8.2	<b>QP</b>
5.6250	29.22	0.40	29.62	50.0	20.4	<b>PK</b>
13.9500	26.62	0.76	27.38	50.0	22.6	<b>PK</b>
21.7000	24.36	0.77	25.13	50.0	24.9	<b>PK</b>

Sample Calculation at 0.2964 MHz:

Magnitude of Measured Frequency	40.50	dBuV
+ (LISN+CL-PA)	0.21	dB
Corrected Result	40.71	dBuV

Test Date: June 20, 2018

Tested By

Signature: 

Name: Robert Nevels

### 2.12 Bandwidth of Fundamental (CFR15.231(c), RSS-210, A.1.3)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined by those frequencies that are at least 20 dB down on either side of the center frequency of the pulse and as the 99% bandwidth.

$$\text{Bandwidth of Fundamental} = 0.0025 \times 433,920,000.00 = 1.0848 \text{ MHz}$$

The WORST CASE measured bandwidth is 159.295 kHz, well within the limit. See the figure below.

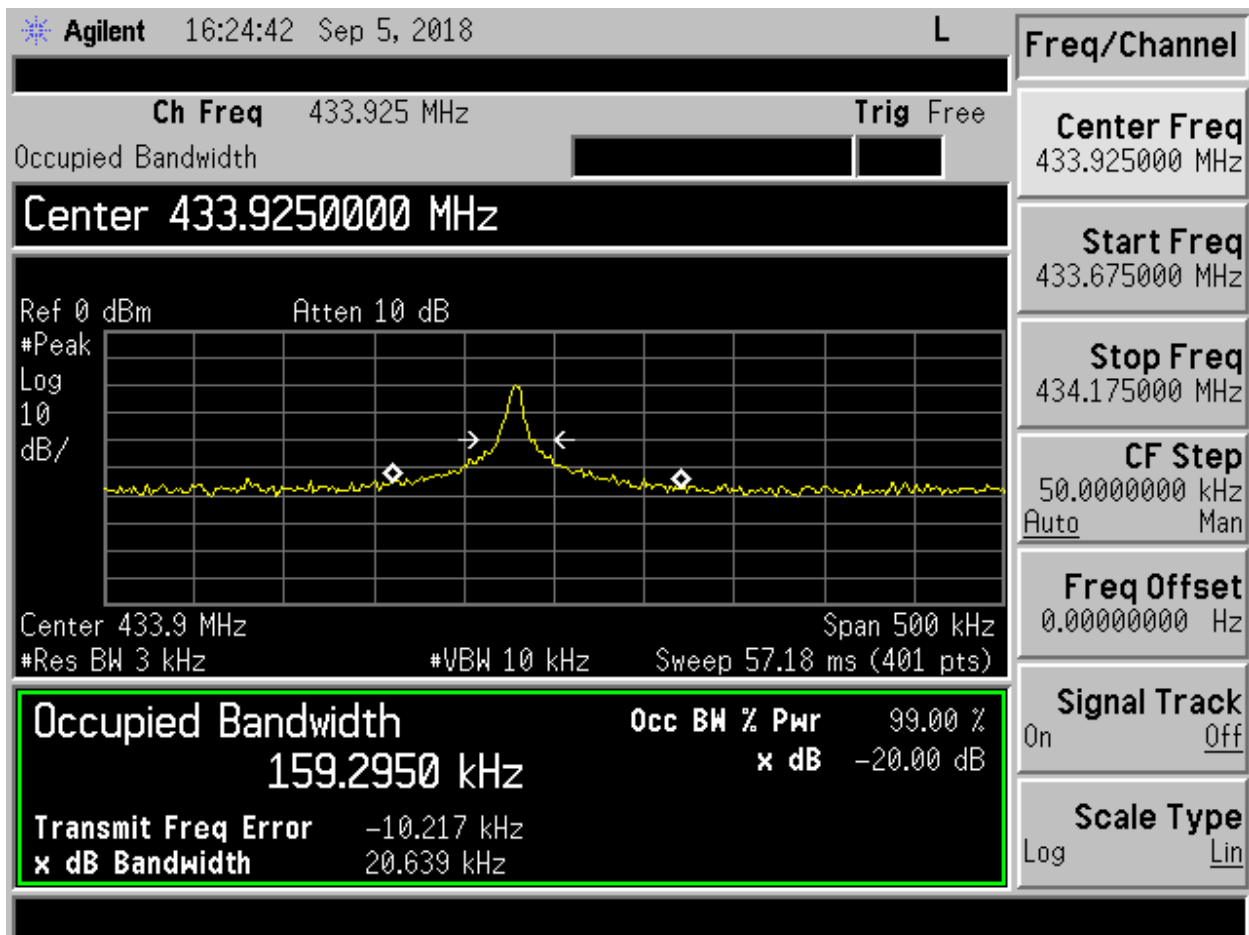


Figure 3. EUT Bandwidth Measurement (20 dB & 99%)