intertek
Total Quality. Assured.

Walter Kidde Portable Equipment
TEST REPORT

SCOPE OF WORK
FCC 15.247 TESTING – SDX-135Z-433 AND HDX-135Z-433

REPORT NUMBER
103485229LAX-002

ISSUE DATE
April 24, 2018

PAGES
30

DOCUMENT CONTROL NUMBER
Non-Specific Radio Report Shell Rev. December 2017
© 2017 INTERTEK

EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 103485229LAX-002
Project Number: G103485229

Report Issue Date: April 24, 2018

Model(s) Tested: SDX-135Z-433, HDX-135Z-433

Standards: **FCC CFR47 Part 15 Subpart C, April 2018**
Intentional Radiator
§15.247, Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

ISED RSS-247 Issue 2, February 2017
Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

ISED RSS-Gen Issue 4, Amendment 1, March 15, 2018
General Requirements for Compliance of Radio Apparatus

Tested by:
Intertek
25791 Commercentre Drive
Lake Forest, CA 92630
USA

Client:
Walter Kidde Portable Equipment Inc.
1016 Corporate Park Drive
Mebane, NC 27302
USA

Report prepared by

Grace Lin
EMC Staff Engineer

Report reviewed by

Norman Shpilsher
Sr. Staff Engineer

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

Table of Contents

Walter Kidde Portable Equipment 1
1 Introduction and Conclusion 4
2 Test Summary 4
3 Client Information 5
4 Description of Equipment Under Test and Variant Models 5
5 System Setup and Method 7
6 6 dB Bandwidth and 99% Bandwidth 8
7 Maximum Peak Conducted Output Power at Antenna Terminals 12
8 Maximum Power Spectral Density 15
9 Conducted Spurious Emissions 18
10 Radiated Spurious Emissions 22
11 AC Mains Conducted Emissions 27
12 Revision History 30

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	-
4	Description of Equipment Under Test and Variant Models	-
5	System Setup and Method	-
6	6 dB Bandwidth and 99% Bandwidth (FCC §15.247(a)(2), ISED RSS-247 §5.2a; ISED RSS-Gen §6.6)	Compliant
7	Maximum Peak Conducted Output Power at Antenna Terminals (FCC §15.247(b)(3), ISED RSS-247 §5.4d)	Compliant
8	Maximum Power Spectral Density (FCC §15.247(e), ISED RSS-247 §5.2b)	Compliant
9	Conducted Spurious Emissions (FCC §15.247(d), ISED RSS-247 §5.5)	Compliant
10	Radiated Spurious Emissions (FCC §15.247(d), §15.209, §15.205, ISED RSS-247 §5.5, ISED RSS-Gen §8.9)	Compliant
11	AC Mains Conducted Emissions (FCC §15.207, ISED RSS-Gen §8.8)	Not Applicable*
12	Revision History	-

*: The EUT is battery powered

3 Client Information

This EUT was tested at the request of:

Client: Walter Kidde Portable Equipment Inc.
1016 Corporate Park Drive
Mebane, NC 27302
USA

Contact: Narval Danvers
Telephone: 719-533-2366
Email: narval.danvers@kiddeus.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Walter Kidde Portable Equipment Inc.
1016 Corporate Park Drive
Mebane, NC 27302
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Wireless Interconnected Smoke/Heat/Freeze Sensor	Walter Kidde Portable Equipment	SDX-135Z-433	412 (Conducted), 443 (Radiated)
Wireless Interconnected Heat/Freeze Sensor	Walter Kidde Portable Equipment	HDX-135Z-433	25 (Radiated)

Receive Date:	04/17/2018	Test Started	04/17/2018
Received Condition:	Good	Test Ended	04/23/2018
Type:	Production		

Description of Equipment Under Test (provided by client)

The equipment under test are SDX-135Z-433 and HDX-135Z-433. SDX-135Z-433 and HDX-135Z-433 use the same transmitter module operating at 433.92 MHz and 918.2 MHz. This test report covers for the 918.2 MHz transmitter.

HDX-135Z-433 is a depopulated version of SDX-135Z-433.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
3 Vdc	-	-	-

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Test Mode – Continuously Transmitting normal modulated signal

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	Under test mode, the EUT was programmed to transmit continuously (FSK modulation) during testing.

Radio/Receiver Characteristics	
Frequency Band(s)	918.2 MHz
Modulation Type(s)	FSK
Maximum Output Power	7.87 dBm (6.12 mW)
Test Channels	918.2 MHz
Occupied Bandwidth	559.4 kHz (6 dB), 849.2 kHz (99%)
Frequency Hopper: Number of Hopping Channels	Not Applicable
Frequency Hopper: Channel Dwell Time	Not Applicable
Frequency Hopper: Max interval between two instances of use of the same channel	Not Applicable
MIMO Information (# of Transmit and Receive antenna ports)	Not Applicable
Equipment Type	Standalone
Antenna Type and Gain	Permanent Attached Wire Antenna, Antenna Gain < 6dBi

Variant Models:

The following variant models were not tested as part of this evaluation but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None.

5 System Setup and Method

Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
-	None	-	-	-	-

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None	-	-	-

5.1 Method:

Configuration as required by ANSI C63.10-2013.

5.2 Test Setup Block Diagram:

6 6 dB Bandwidth and 99% Bandwidth

6.1 Requirement(s)

The minimum 6 dB bandwidth shall be at least 500 kHz.

6.2 Method

A. The procedure described in the FCC Publication *558074 D01 DTS Meas Guidance v04*, April 5, 2017 was used to determine the 6 dB bandwidth. Section *8.1 Option 1* was used.

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 x RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

B. The following procedure was used for measuring 99% power bandwidth.

a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level.
d) Step a) through step c) might require iteration to adjust within the specified range.
e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
f) Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

TEST SITE:

The test is performed in the 3 meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. IC test site registration number is 2042T.

6.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	R&S	ESW44	101636	07/14/2017	07/14/2018
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

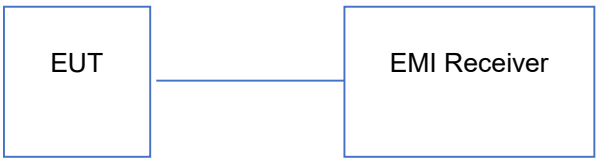
Software Utilized:

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

6.4 Results:

The sample tested was found to Comply.

6.5 Setup Diagram:

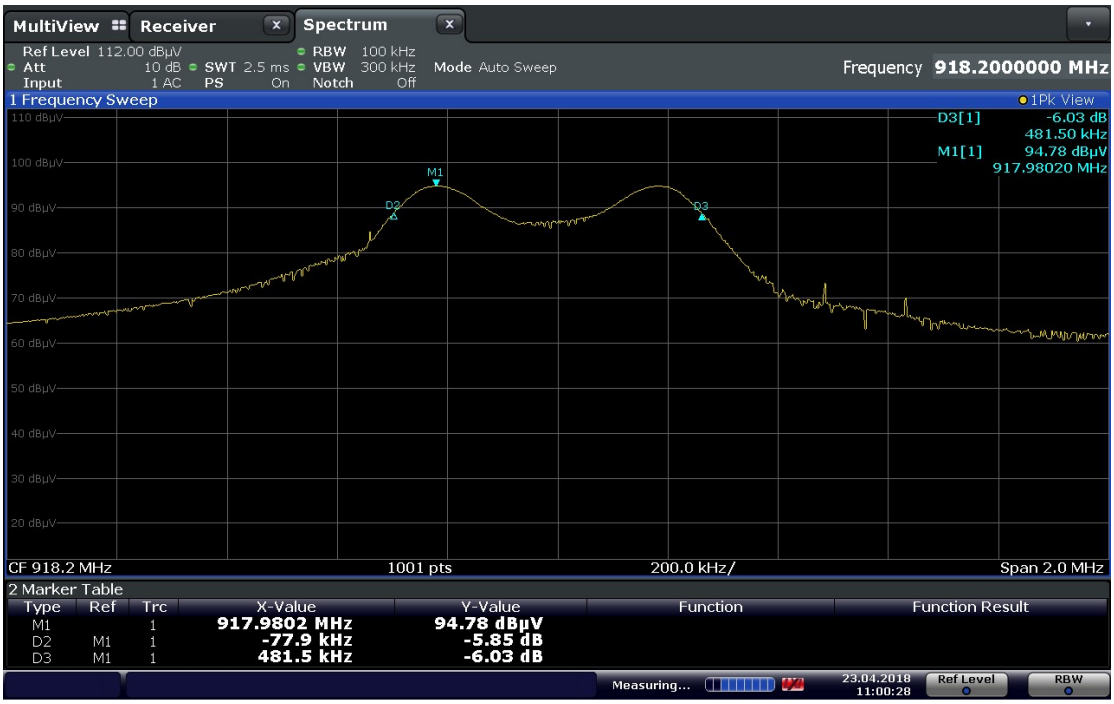


6.6 Plots/Data:

Frequency (MHz)	6 dB Bandwidth (kHz)	99% Bandwidth (kHz)
918.2	559.4	849.2

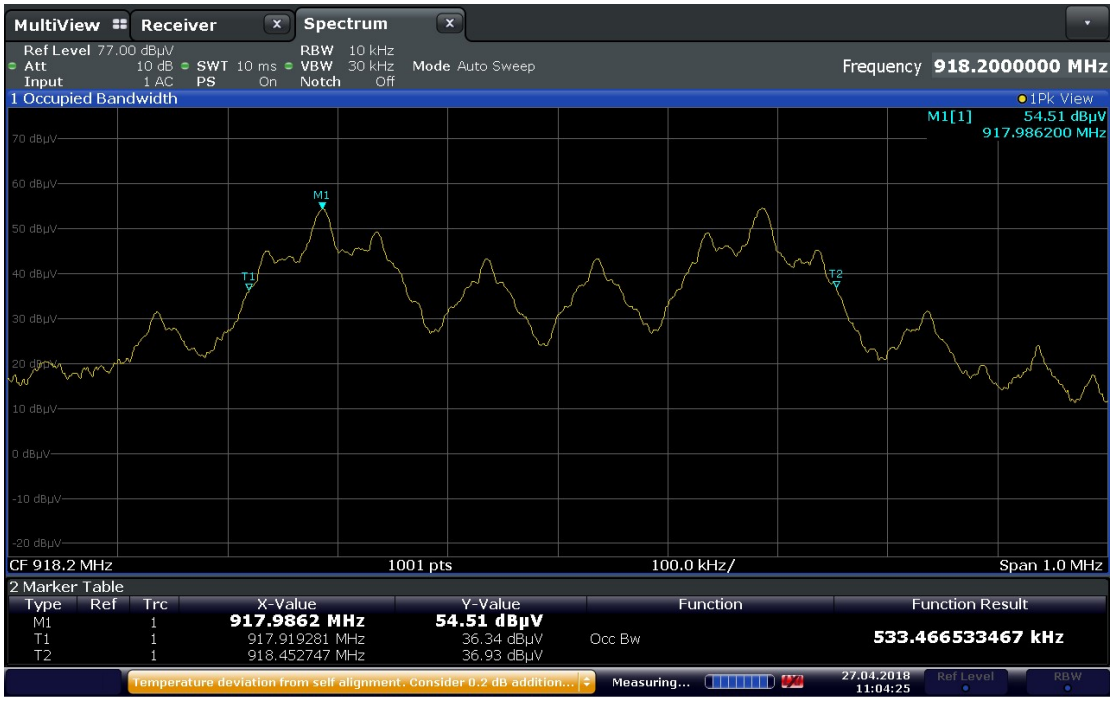
Note: The RF level in the plots is relative and is not the indication of RF output power.

6 dB Bandwidth:



11:00:28 23.04.2018

99% Bandwidth:



11:04:25 27.04.2018

Test Personnel:	Grace Lin	Test Date:	04/23/2018, 04/27/2018
Product Standard:	FCC §15.247, ISED RSS-247	Limit Applied:	FCC §15.247, ISED RSS-247
Input Voltage:	3 Vdc Battery (x2)	Ambient Temperature:	22.1 ºC
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	37.9 %
		Atmospheric Pressure:	990 mbars

Deviations, Additions, or Exclusions: None

7 Maximum Peak Conducted Output Power at Antenna Terminals

7.1 Requirement(s)

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt or 30 dBm. For antennas with gains greater than 6 dBi, transmitter output level must be decreased appropriately, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

7.2 Method

The procedure described in FCC Publication *558074 D01 DTS Meas Guidance v04*, April 5, 2017 was used. Specifically, Section *9.1.1 RBW ≥ DTS bandwidth* was utilized as the spectrum analyzer's resolution bandwidth was greater than the DTS bandwidth.

a) Set the RBW ≥ DTS Bandwidth
b) Set the VBW ≥ 3 x RBW
c) Set the span ≥ 3 x RBW
d) Sweep time = Auto couple
e) Detector = Peak
f) Trace mode = Max Hold
g) Allow trace to fully stabilize
h) Use peak marker function to determine the peak amplitude level.

TEST SITE:

The test is performed in the 3 meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. IC test site registration number is 2042T.

7.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	R&S	ESW44	101636	07/14/2017	07/14/2018
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

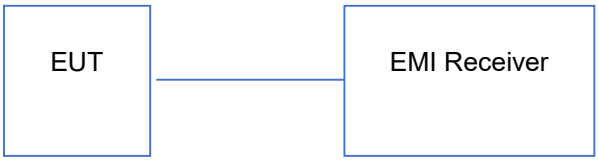
Software Utilized:

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

7.4 Results:

The sample tested was found to Comply.

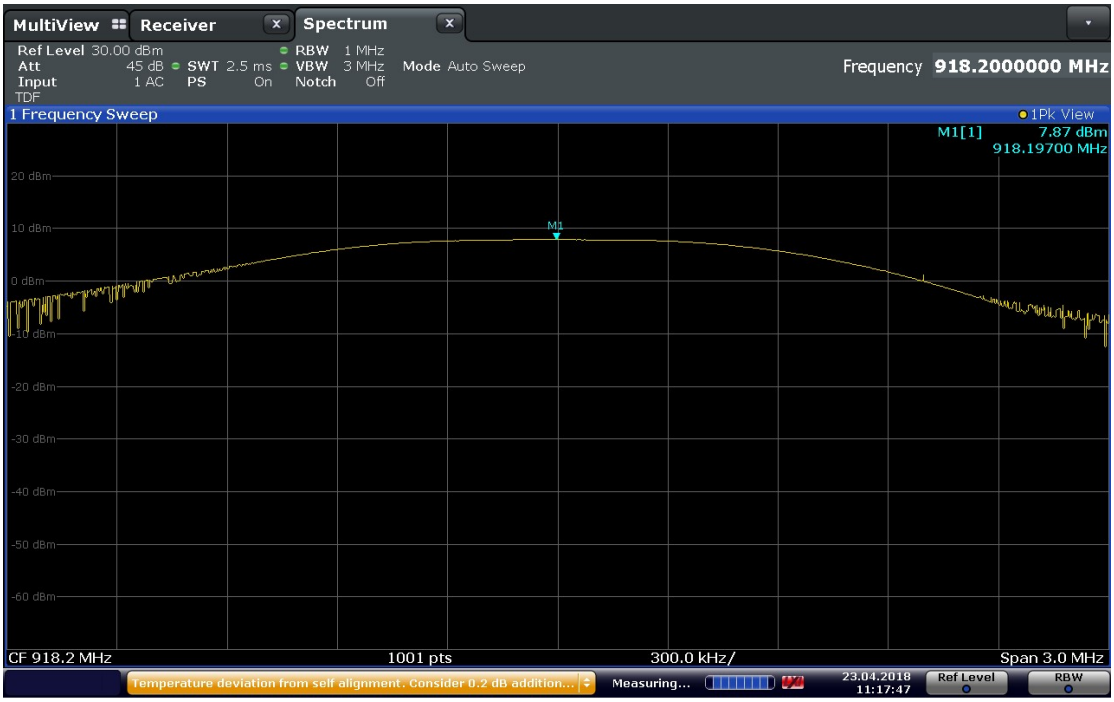
7.5 Setup Diagram:



7.6 Plots/Data:

Frequency (MHz)	Peak Conducted Output Power	
	dBm	mW
918.2	7.87	6.12

Note: The insertion loss was compensated for in the receiver



11:17:48 23.04.2018

Test Personnel:	Grace Lin	Test Date:	04/23/2018
Product Standard:	FCC §15.247, ISED RSS-247	Limit Applied:	FCC §15.247, ISED RSS-247
Input Voltage:	3 Vdc Battery (x2)	Ambient Temperature:	22.1 ºC
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	37.9 %
		Atmospheric Pressure:	990 mbars

Deviations, Additions, or Exclusions: None

8 Maximum Power Spectral Density

8.1 Requirement(s)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna should not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.2 Method

The procedure described in FCC Publication *558074 D01 DTS Meas Guidance v04*, April 5, 2017, specifically Section *10.2 Method PKPSD (peak PSD)* was utilized.

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the *DTS bandwidth*.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST SITE:

The test is performed in the 3 meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. IC test site registration number is 2042T.

8.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	R&S	ESW44	101636	07/14/2017	07/14/2018
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

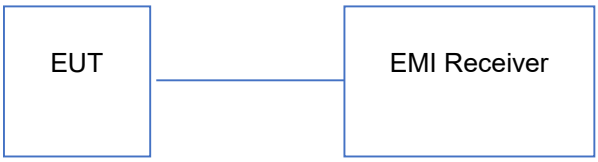
Software Utilized:

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

8.4 Results:

The sample tested was found to Comply.

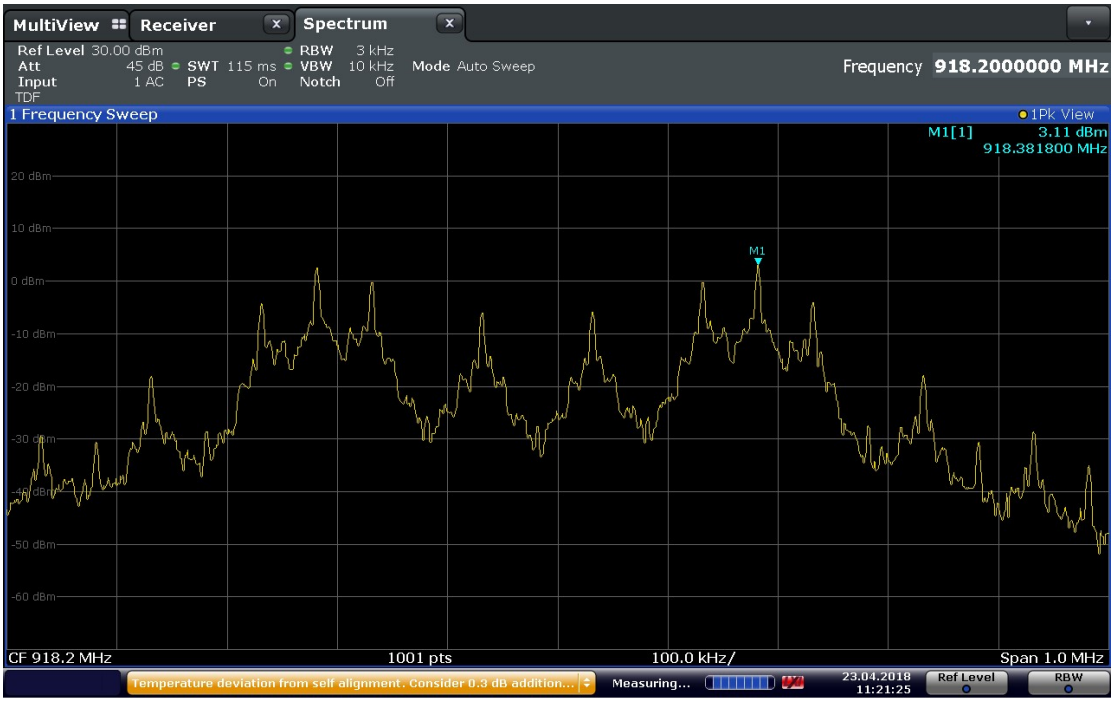
8.5 Setup Diagram:



8.6 Plots/Data:

Frequency (MHz)	Maximum Power Spectral Density (dBm)
918.2	3.11

Note: The insertion loss was compensated for in the receiver



11:21:26 23.04.2018

Test Personnel:	Grace Lin	Test Date:	04/23/2018
Product Standard:	FCC §15.247, ISED RSS-247	Limit Applied:	FCC §15.247, ISED RSS-247
Input Voltage:	3 Vdc Battery (x2)	Ambient Temperature:	22.1 ºC
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	37.9 %
		Atmospheric Pressure:	990 mbars

Deviations, Additions, or Exclusions: None

9 Conducted Spurious Emissions

9.1 Requirement(s)

In any 100 kHz bandwidth outside the frequency band, the radio frequency power 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of the RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), shall comply with the radiated emission limits specified in § 15.209(a)

9.2 Method

The procedure described in FCC Publication *558074 D01 DTS Meas Guidance v04*, April 5, 2017, specifically Section *11.0 Emissions in non-restricted frequency bands* was utilized.

A spectrum analyzer was connected to the antenna port of the transmitter.

a) Set the RBW = 100 kHz.
b) Set the VBW ≥ 3 x RBW.
c) Detector = peak.
d) Sweep time = auto couple.
e) Trace mode = max hold.
f) Allow trace to fully stabilize.
g) Use the peak marker function to determine the maximum amplitude level.

The unwanted emissions were measured from 30 MHz to 10 GHz. Plots below are corrected for cable loss and then compared to the limits. The RF level in the plots is relative and is not the indication of RF output power.

TEST SITE:

The test is performed in the 3 meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. IC test site registration number is 2042T.

9.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	R&S	ESW44	101636	07/14/2017	07/14/2018
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

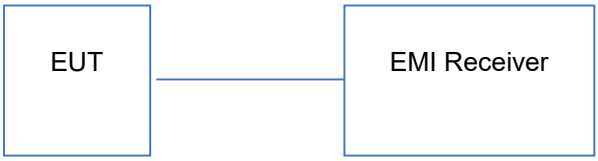
Software Utilized:

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

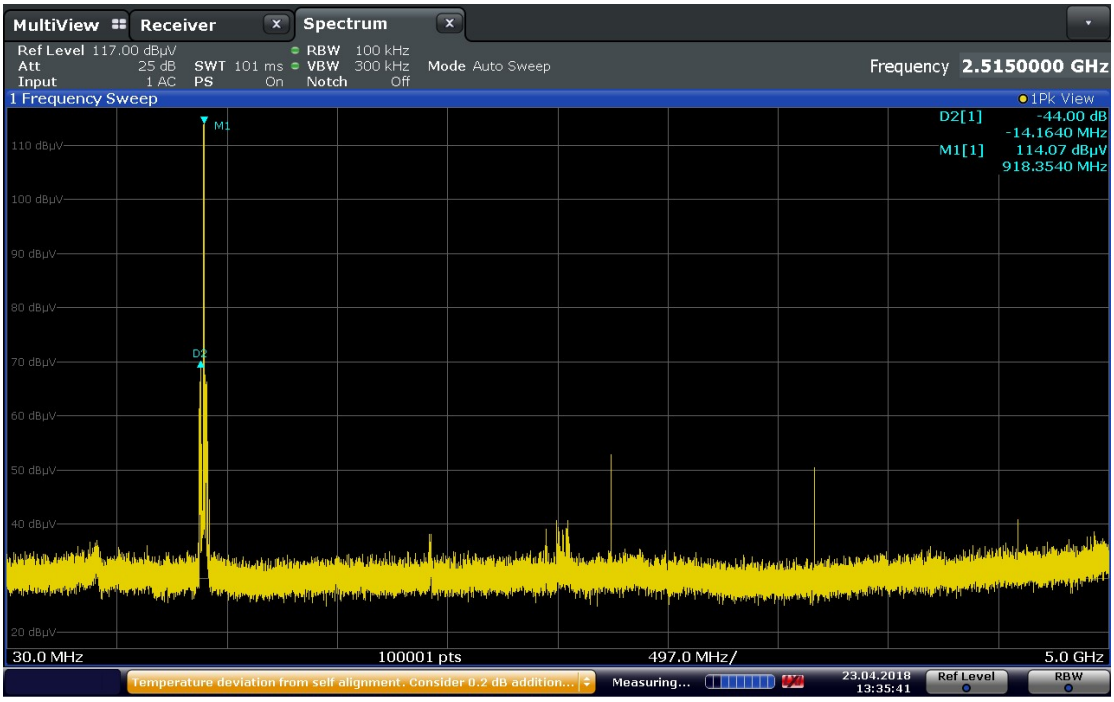
9.4 Results:

The sample tested was found to Comply.

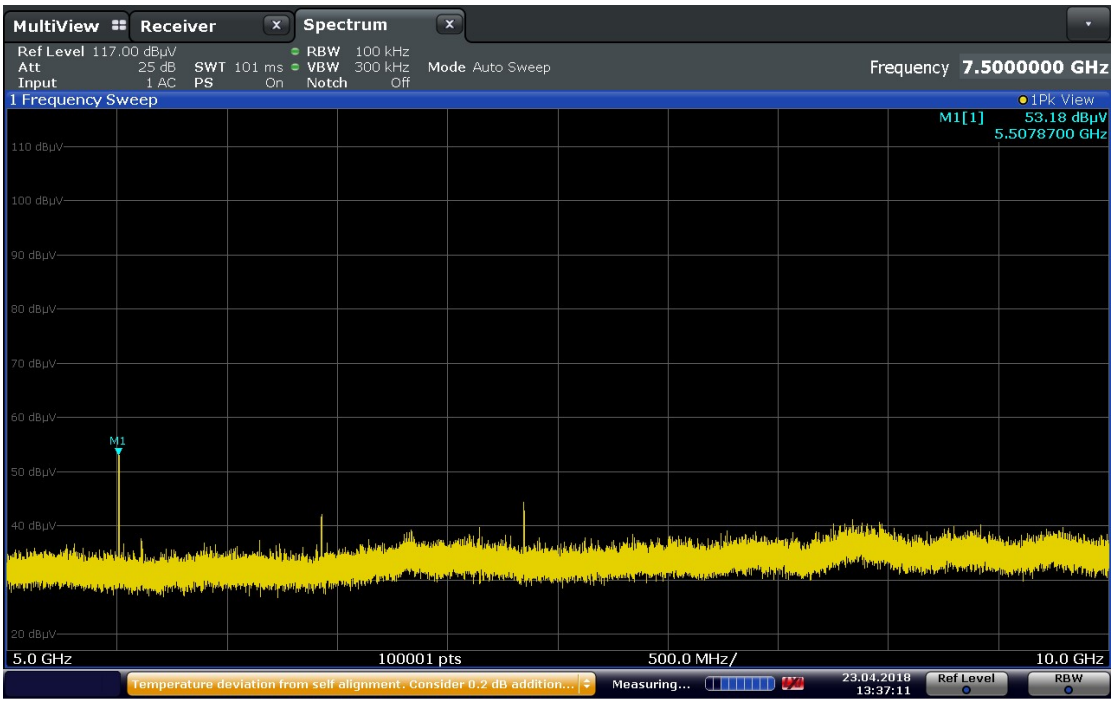
9.5 Setup Diagram:



9.6 Plots/Data:



13:35:42 23.04.2018



13:37:11 23.04.2018

Test Personnel:	Grace Lin	Test Date:	04/23/2018
Product Standard:	FCC §15.247, ISED RSS-247	Limit Applied:	FCC §15.247, ISED RSS-247
Input Voltage:	3 Vdc Battery (x2)	Ambient Temperature:	22.1 ºC
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	37.9 %
		Atmospheric Pressure:	990 mbars

Deviations, Additions, or Exclusions: None

10 Radiated Spurious Emissions

10.1 Requirement(s)

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), shall comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

In any 100 kHz bandwidth outside the frequency band, the radio frequency power 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of the RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

10.2 Method

EUT was configured to transmit continuously. Radiated emission measurements were performed from 30 MHz to 10 GHz according to the procedure described in ANSI C64.10. Spectrum analyzer resolution bandwidth is 120 kHz for frequencies 30 MHz to 1000 MHz. Above 1 GHz, both Peak and Average measurements were performed. The peak level of radiated emissions was measured with a resolution bandwidth (RBW) of 1 MHz, a video bandwidth (VBW) of 3 MHz, and a peak detector. The average level of radiated emissions was measured with a resolution bandwidth (RBW) of 1 MHz, a video bandwidth (VBW) of 3 MHz, and a RMS detector with trace averaging.

The EUT is placed on a plastic turntable that is 80 cm in height for frequencies 30 MHz to 1000 MHz, 1.5 meters for frequency above 1000 MHz. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at 3 meters for frequencies below 18 GHz and 1 meter for frequencies above 18 GHz.

EUT was tested at three orientations: upward, downward, and sideward. Data included is representative of the worst-case configuration (the configuration which resulted in the highest emission levels). Plots below are corrected for distance, cables, preamp, filters and antenna factors then compared to the limits.

TEST SITE:

The test is performed in the 3 meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. IC test site registration number is 2042T.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 3m	30-1000 MHz	4.3	6.3 dB
Radiated Emissions, 3m	1-18 GHz	5.5	5.2 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

10.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
637	3m Semi-anechoic Chamber	Panashield	3 meter	25 331-D-Z	December 2015	December 2018
1669	EMI Test Receiver	R&S	ESW44	101636	07/14/2017	07/14/2018
1140	EMI Test Receiver	R&S	ESCI7	100825	02/28/2018	02/28/2019
1147	Bilog Antenna	TESEQ Gmbh	CBL 6112D	32852	11/16/2017	11/16/2018
692	Horn Antenna	ETS-Lindgren	3115	00031626	07/25/2017	07/25/2018
1576	Pre-amp	R&S	TS-PR1	102068	06/20/2017	06/20/2018
1556	Pre-amp	R&S	TS-PR18	102144	07/29/2017	07/29/2018
1517	Cable	R&S	TSPR-B7	101528	07/13/2017	07/13/2018
1518	Cable	R&S	TSPR-B7	101529	07/13/2017	07/13/2018
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

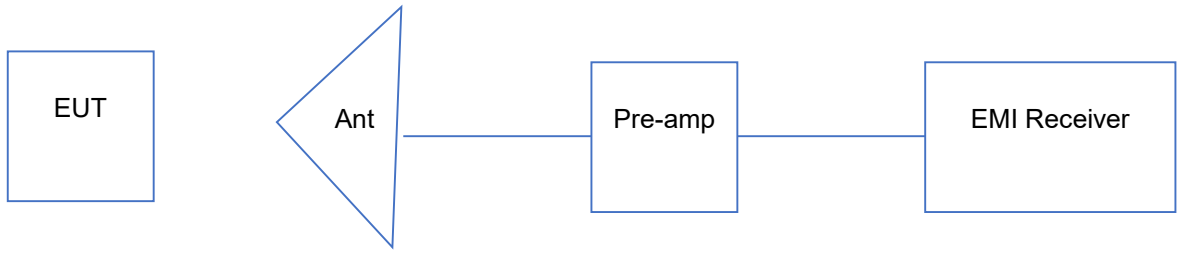
Software Utilized:

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

10.4 Results:

The sample tested was found to Comply.

10.5 Setup Diagram:



10.6 Plots/Data:

SDX-135Z-433:

Antenna Polarization	Frequency (MHz)	EUT Power Setting	Measured Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Turntable Degree	Antenna Height (cm)	Detector
H	1836.4	12	41.5	74.0	-32.5	24	259	PK
H	1836.4	12	36.2	54.0	-17.8	24	259	RMS
V	1836.4	12	45.2	74.0	-28.9	351	116	PK
V	1836.4	12	41.3	54.0	-12.7	351	116	RMS
V	2754.6	12	42.9	74.0	-31.1	14	150	PK
V	2754.6	12	34.3	54.0	-19.7	14	150	RMS
H	3673.1	12	50.7	74.0	-23.4	67	188	PK
H	3673.1	12	45.1	54.0	-8.9	67	188	RMS
V	5509.2	12	53.1	74.0	-21.0	307	100	PK
V	5509.2	12	45.6	54.0	-8.4	307	100	RMS
V	7345.6	12	49.1	74.0	-24.9	289	100	PK
V	7345.6	12	38.1	54.0	-15.9	289	100	RMS

Note: Radiated spurious emissions measurements were performed from 30 MHz to 10 GHz. There was no emission detected below 1 GHz.

HDX-135Z-433:

Antenna Polarization	Frequency (MHz)	EUT Power Setting	Measured Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Turntable Degree	Antenna Height (cm)	Detector
H	1836.4	12	45.7	74.0	-28.3	7	114	PK
H	1836.4	12	41.9	54.0	-12.1	7	114	RMS
V	2754.6	12	44.3	74.0	-29.7	357	156	PK
V	2754.6	12	36.4	54.0	-17.6	357	156	RMS
H	3673.1	12	47.5	74.0	-26.5	201	121	PK
H	3673.1	12	41.3	54.0	-12.7	201	121	RMS
H	5509.2	12	52.4	74.0	-21.6	9	178	PK
H	5509.2	12	46.3	54.0	-7.7	9	178	RMS
V	7345.6	12	49.6	74.0	-24.4	328	136	PK
V	7345.6	12	39.2	54.0	-14.8	328	136	RMS

Note: Radiated spurious emissions measurements were performed from 30 MHz to 10 GHz. There was no emission detected below 1 GHz.

Test Personnel:	Grace Lin	Test Date:	04/17/2018, 04/19/2018
Product Standard:	FCC §15.247, ISED RSS-247	Limit Applied:	FCC §15.209, RSS-Gen §8.9
Input Voltage:	3 Vdc Battery (x2)	Ambient Temperature:	26.2 ºC
Pretest Verification w/ BB Source:	Yes	Relative Humidity:	44.1 %
		Atmospheric Pressure:	990 mbars

Deviations, Additions, or Exclusions: None

11 AC Mains Conducted Emissions

11.1 Performance Criterion

Frequency Band MHz	ConductedLimit dB(μV)	
	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *
0.50-5.00	56	46
5.00-30.00	60	50

*Note: *Decreases linearly with the logarithm of the frequency*
At the transition frequency the lower limit applies.

11.2 Method

Tests are performed in accordance with ANSI C63.4.

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4.

TEST SITE:

The test is performed in the 3 meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. IC test site registration number is 2042T.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
AC Line Conducted Emissions	150 kHz - 30 MHz	2.1 dB	3.4dB

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculations

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN or ISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(49.1\ dB\mu V / 20)}$ = 285.1 μV/m

11.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
-	-	-	-	-	-	-

Software Utilized:

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

11.4 Results:

This test is not applicable as the equipment under test is battery powered.

12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	04/24/2018	103485229LAX-002	GL	NS	Initial Issue