



Certification Test Report

FCC ID: SAK40020000

FCC Rule Part: 15.247

Report Number: 16-2053.W04.1B

Applicant: Walter Kidde Portable Equipment Inc.

Model(s): 40020000

Test Begin Date: October 13, 2016

Test End Date: January 27, 2017

Report Issue Date: January 24, 2018



FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, ANSI, or any agency of the Federal Government.

Prepared by:

A handwritten signature in blue ink, reading "Thierry Jean-Charles".

**Thierry Jean-Charles
Team Leader
TÜV SÜD America, Inc.**

Reviewed by:

A handwritten signature in blue ink, reading "Ryan McGann".

**Ryan McGann
Senior Engineer
TÜV SÜD America, Inc.**

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This report contains 18 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations for a permissive change.

The purpose of the permissive change is to document compliance of the FCC ID: SAK40020000 within a specific host device as well as a new antenna configuration. In that host device, the EUT is co-located with a 915 MHz ISM-band transceiver module (FCC ID: 2AB7YVPR9XYLN). There are no additional changes on the product.

1.2 Applicant Information

Walter Kidde Portable Equipment Inc.
1394 S. Third St.
Mebane, NC 27302

1.3 Product Description

The model 40020000 is an IEEE 802.11b/g/n wireless module operating in the 2.4 GHz ISM band. This test report documents the compliance of the device when integrated within the SBR101 wireless bridge which also contains a 915 MHz ISM wireless module (FCC ID: 2AB7YVPR9XYLN). The SBR101 device works as a bridge between SubGHz wireless network and Wi-Fi.

Technical Details

Mode of Operation:	WLAN IEEE 802.11b/g/n
Frequency Range:	802.11b/g/n 20 MHz: 2412 MHz - 2462 MHz 802.11n 40 MHz: 2422 MHz - 2452 MHz
Number of Channels:	11 for 802.11b, 802.11g and 802.11 n (20 MHz) 7 for 802.11n (40 MHz)
Channel Separation:	5 MHz
Modulations:	802.11b: DSSS 802.11b/n: OFDM
Antenna Type/Gain:	Flex PCB Antenna / 3 dBi
Input Power:	5 VDC (USB)

Model Number: 40020000

Test Sample Serial Number(s): 2182 (Host Device)

Test Sample Condition: The equipment was provided in good condition without any physical damage.

1.4 Test Methodology and Considerations

The purpose of the permissive change is to address a new antenna/host configuration. Therefore, the assessment was limited to radiated and power line conducted emissions only.

The EUT was evaluated for radiated emissions for all four modes of operation of the WLAN radio. The channels and data rates used for the evaluation correspond to the worst configuration documented in the original certification test reports. Preliminary evaluation was performed for the EUT in three orthogonal orientations. The EUT flat on the test table led to the highest emissions and the test results are documented in this report.

The EUT was also evaluated for compliance of radiated intermodulation products when transmitting simultaneously with the 900 MHz ISM transceiver module. All intermodulation products generated by the

co-transmission of the aforementioned co-located radios were found in compliance to the requirements of FCC Section 15.209.

The EUT was also investigated for unintentional emissions. The results are documented separately in a verification test report.

Test Software Power Setting: 13 dBm

Table 1.4-1: IEEE 802.11b/g/n Radio Test Configuration

Mode of Operation	Frequency (MHz)	Channel	Data Rate Setting
802.11b	2412	1	1 Mbps
	2437	6	
	2462	11	
802.11g	2412	1	6 Mbps
	2437	6	
	2462	11	
802.11n 20 MHz	2412	1	6.5 Mbps (MCS0)
	2437	6	
	2462	11	
802.11n 40 MHz	2422	3	13 Mbps (MCS0)
	2437	6	
	2452	9	

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

TÜV SÜD America, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
<http://www.tuv-sud-america.com>

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD AMERICA, INC. is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ANAB program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

FCC Test Firm Registration #: 475089
Innovation, Science and Economic Development Canada Lab Code: 4175A

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is driven by pneumatic motor, which can support a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1060 Multi-device controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

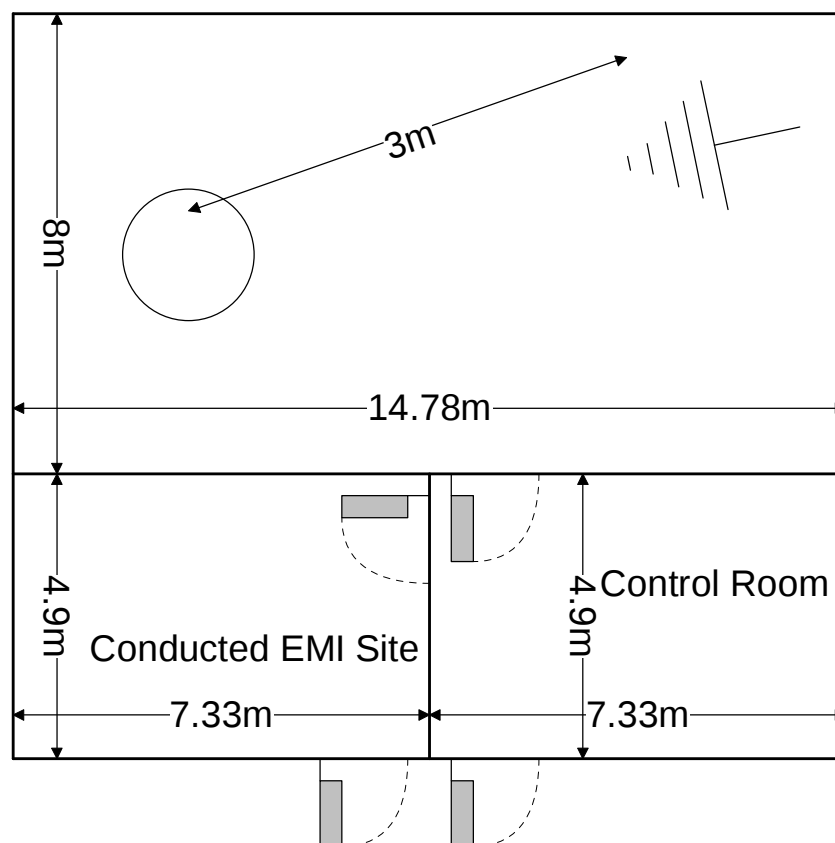


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m³. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50 Ω /50 μ H and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

A diagram of the room is shown below in figure 2.3.2-1:

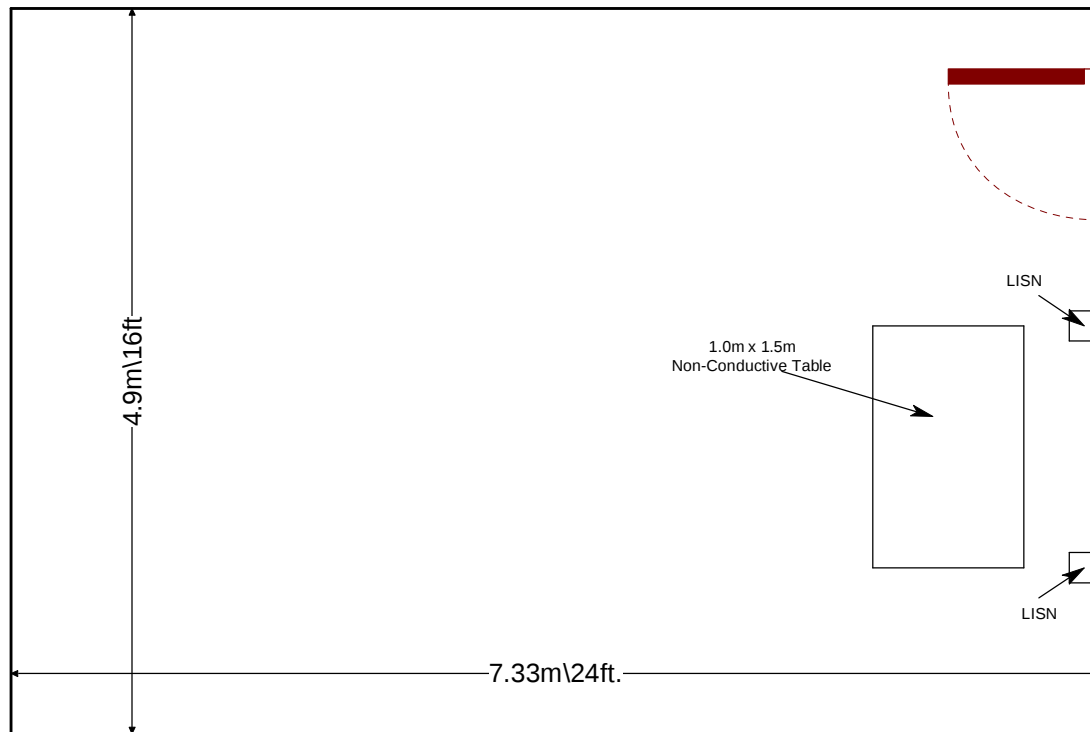


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2017.
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2017

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
78	EMCO	6502	Antennas	9104-2608	5/11/2016	5/11/2018
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/26/2014	12/26/2016
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/9/2016	12/9/2018
653	Suhner	SF-102A	Cables	0944/2A	9/6/2016	9/6/2017
2002	EMCO	3108	Antennas	2147	11/19/2015	11/19/2017
2004	EMCO	3146	Antennas	1385	11/19/2015	11/19/2017
2006	EMCO	3115	Antennas	2573	4/14/2015	4/14/2017
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	11/18/2015	11/18/2016
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	11/2/2016	11/2/2017
2022	EMCO	LISN3825/2R	LISN	1095	9/14/2015	9/14/2017
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	11/11/2015	11/11/2016
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	10/31/2016	10/31/2017
2070	Mini Circuits	VHF-8400+	Filter	2070	11/17/2015	11/17/2016
2070	Mini Circuits	VHF-8400+	Filter	2070	11/1/2016	11/1/2017
2072	Mini Circuits	VHF-3100+	Filter	30737	11/17/2015	11/17/2016
2072	Mini Circuits	VHF-3100+	Filter	30737	10/31/2016	10/31/2017
2082	Teledyne Storm Products	90-010-048	Cables	2082	4/21/2016	4/21/2017
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	11/16/2015	11/16/2016
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	11/2/2016	11/2/2017
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/9/2015	12/9/2016
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/2/2016	12/2/2017
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2121	ACS Boca	Radiated Cable Set	Cable Set	2121	8/1/2016	8/1/2017
3004	Teseq	CFL 9206A	Attenuators	34720	9/14/2016	9/14/2017

Notes:

- NCR=No Calibration Required
- The assets calibration information is provided to cover the entire test period.

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment Description

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Walter Kidde Portable Equipment Inc.	40020000	N/A
2	Host Device	Walter Kidde Portable Equipment Inc.	SBR101	2182
3	Wireless Module	Viper Design, LLC	VPR9XYLND	N/A
4	5VDC Power Supply	Phihong	PSA10F-050Q	N/A

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	USB	1 m	No	EUT to Power Supply
B	Extension Cord	2.7 m	No	Power Supply to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

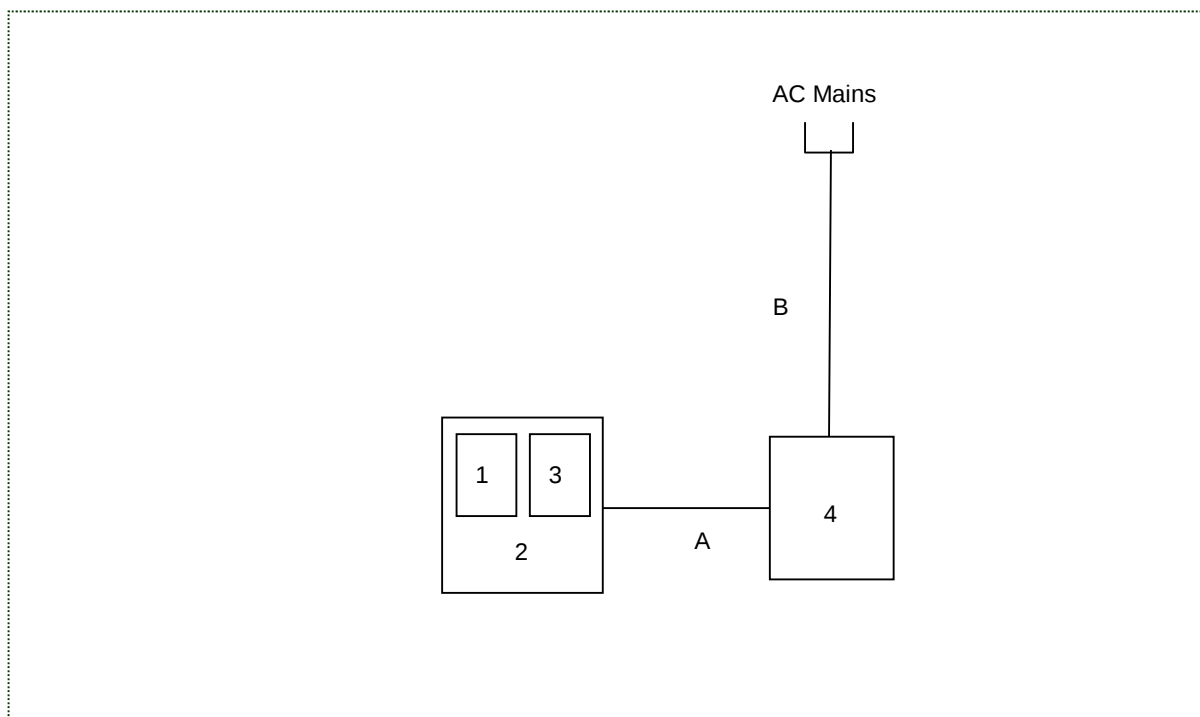


Figure 6-1: EUT and Support Equipment Description

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The EUT uses a 3 dBi Flex PCB antenna with a u.FI. connector. The antenna meets the requirements of FCC Section 15.203.

7.2 Band-Edge and Spurious Emissions

7.2.1 Radiated Spurious Emissions into Restricted Frequency Bands – FCC: Sections 15.205, 15.209; ISED Canada: RSS-Gen 8.9, 8.10

7.2.1.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 26 GHz, 10 times the highest fundamental frequency. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in Section 15.209.

For measurements below 30 MHz, the receive antenna height was set to 1m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using VBW of 30 Hz.

7.2.1.2 Measurement Results

Performed by: Jean Tezil, Jean Rene

Radiated band-edge and spurious emissions found in the restricted frequency bands of 9 kHz to 26 GHz are reported in the tables below.

Table 7.2.1.2-1: Radiated Spurious Emissions Tabulated Data - 802.11b

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 2412 MHz										
Noise Floor										
Middle Channel 2437 MHz										
Noise Floor										
High Channel 2462 MHz										
2483.5	56.21	42.71	V	-4.89	51.32	37.82	74.0	54.0	22.7	16.2

Notes:

All emissions above 2.484 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.2.1.2-2: Radiated Spurious Emissions Tabulated Data – 802.11g

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 2412 MHz										
2390	57.44	43.81	H	-5.35	52.09	38.46	74.0	54.0	21.9	15.5
Middle Channel 2437 MHz										
Noise Floor										
High Channel 2462 MHz										
2483.5	55.63	42.94	V	-4.89	50.74	38.05	74.0	54.0	23.3	16.0

Notes:

All emissions above 2.484 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.2.1.2-3: Radiated Spurious Emissions Tabulated Data – 802.11n 20 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 2412 MHz										
2390	57.80	43.81	H	-5.35	52.45	38.46	74.0	54.0	21.6	15.5
Middle Channel 2437 MHz										
Noise Floor										
High Channel 2462 MHz										
2483.5	55.41	42.86	V	-4.89	50.52	37.97	74.0	54.0	23.5	16.0

Notes:

All emissions above 2.484 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.2.1.2-4: Radiated Spurious Emissions Tabulated Data – 802.11n 40 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 2422 MHz										
2390	56.82	43.51	H	-5.35	51.47	38.16	74.0	54.0	22.5	15.8
Middle Channel 2437 MHz										
Noise Floor										
High Channel 2452 MHz										
2483.5	56.05	42.84	V	-4.89	51.16	37.95	74.0	54.0	22.8	16.1

Notes:

All emissions above 2.484 GHz were attenuated below the limits and the noise floor of the measurement equipment.

7.2.1.3 Sample Calculation:

$$R_C = R_U + CF_T$$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: $56.21 + (-4.89) = 51.32 \text{ dB}\mu\text{V/m}$

Margin: $74 \text{ dB}\mu\text{V/m} - 51.32 \text{ dB}\mu\text{V/m} = 22.7 \text{ dB}$

Example Calculation: Average

Corrected Level: $42.71 + (-4.89) = 37.82 \text{ dB}\mu\text{V/m}$

Margin: $54 \text{ dB}\mu\text{V/m} - 37.82 \text{ dB}\mu\text{V/m} = 16.2 \text{ dB}$

7.3 Power Line Conducted Emissions – FCC: Section 15.207; ISED Canada: RSS-Gen 8.8

7.3.1 Measurement Procedure

ANSI C63.10 section 6.2 was the guiding document for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss

Margin = Applicable Limit - Corrected Reading

7.3.2 Measurement Results

Performed by: Thierry Jean-Charles

Results are shown below.

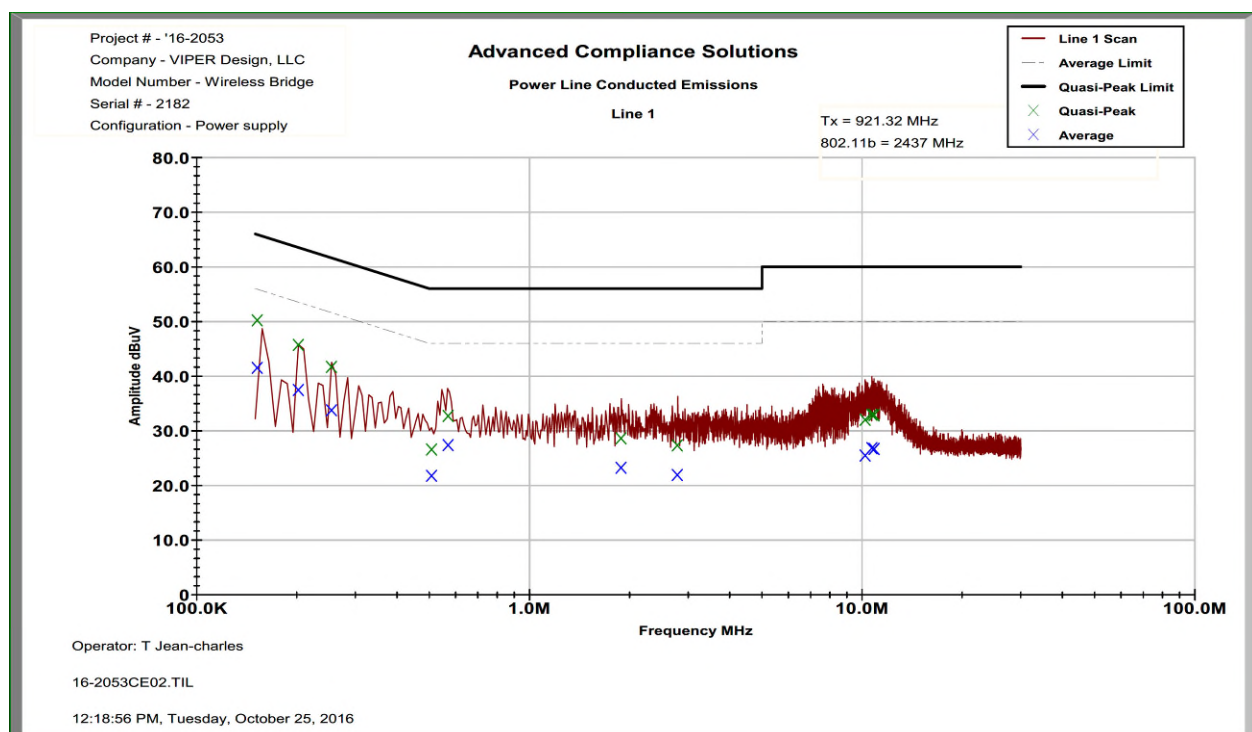


Figure 7.3.2-1: Conducted Emissions Results – Line 1

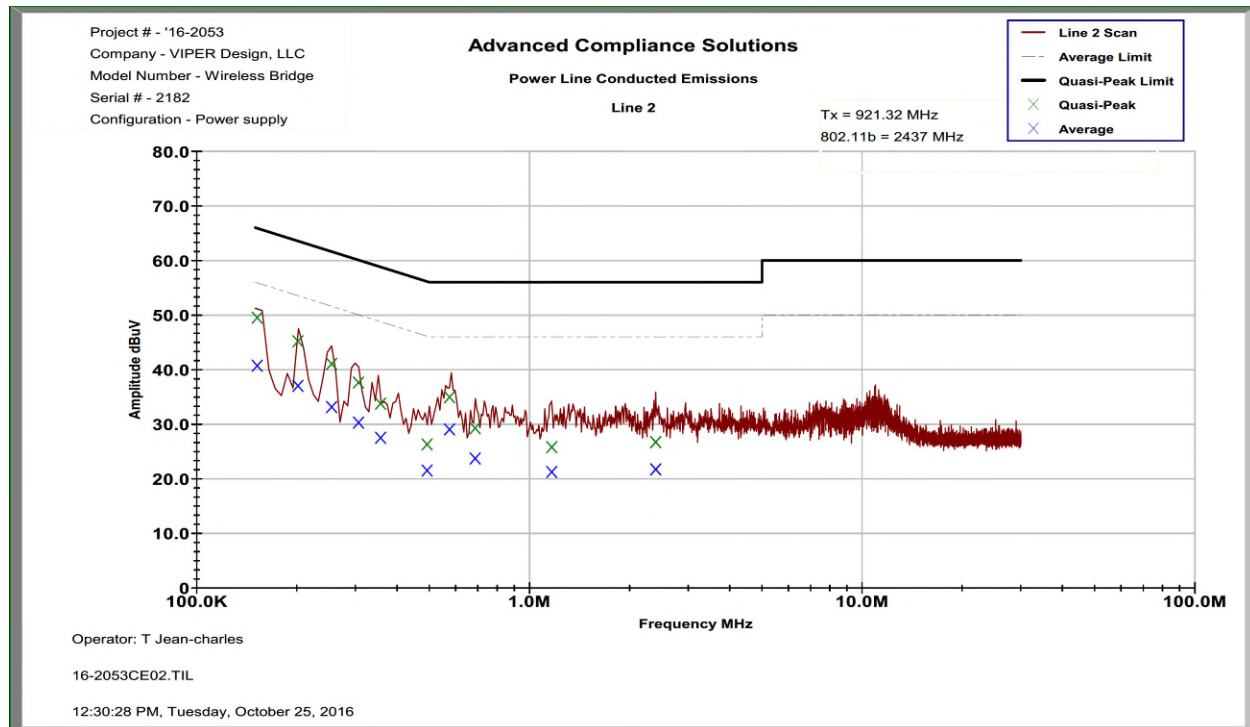


Figure 7.3.2-2: Conducted Emissions Results – Line 2

Table 7.3.2-1: Conducted EMI Results

☒ Line 1 ☒ Line 2 ☐ Line 3 ☐ Line 4 ☐ To Ground ☒ Floating ☐ Telecom Port ☒ dBµV ☐ dBµA Plot Number: <u>16-2053CE02</u> Power Supply Description: <u>5</u> <u>VDC Power Supply</u>									
Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi- Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.151981	39.96	31.255	10.25	50.21	41.50	65.89	55.89	15.7	14.4
0.202187	35.481	27.239	10.24	45.72	37.48	63.52	53.52	17.8	16.0
0.254175	31.461	23.512	10.23	41.69	33.74	61.62	51.62	19.9	17.9
0.507899	16.374	11.527	10.23	26.60	21.75	56.00	46.00	29.4	24.2
0.569699	22.473	17.141	10.23	32.71	27.37	56.00	46.00	23.3	18.6
1.88541	18.256	12.905	10.28	28.54	23.19	56.00	46.00	27.5	22.8
2.78328	16.926	11.514	10.36	27.29	21.88	56.00	46.00	28.7	24.1
10.212	21.235	14.69	10.78	32.01	25.47	60.00	50.00	28.0	24.5
10.6967	22.146	16.032	10.79	32.94	26.82	60.00	50.00	27.1	23.2
10.8537	22.084	15.854	10.80	32.88	26.65	60.00	50.00	27.1	23.3
Line 2									
0.152054	39.254	30.474	10.26	49.51	40.73	65.89	55.89	16.4	15.2
0.201738	34.957	26.799	10.24	45.20	37.04	63.54	53.54	18.3	16.5
0.254524	30.835	22.928	10.24	41.07	33.16	61.61	51.61	20.5	18.4
0.3063	27.401	20.062	10.24	37.64	30.30	60.07	50.07	22.4	19.8
0.357238	23.549	17.261	10.23	33.78	27.49	58.79	48.79	25.0	21.3
0.49265	16.09	11.291	10.25	26.34	21.54	56.12	46.12	29.8	24.6
0.575374	24.745	18.803	10.24	34.99	29.05	56.00	46.00	21.0	17.0
0.6871	19.047	13.477	10.25	29.30	23.73	56.00	46.00	26.7	22.3
1.167	15.474	10.897	10.33	25.80	21.23	56.00	46.00	30.2	24.8
2.39501	16.273	11.304	10.41	26.68	21.71	56.00	46.00	29.3	24.3

8 MEASUREMENT UNCERTAINTIES

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) $k = 1.96$ which provide confidence levels of 95%.

Parameter	U_{lab}
Occupied Channel Bandwidth	$\pm 0.009 \%$
RF Conducted Output Power	$\pm 0.349 \text{ dB}$
Power Spectral Density	$\pm 0.372 \text{ dB}$
Antenna Port Conducted Emissions	$\pm 1.264 \text{ dB}$
Radiated Emissions $\leq 1\text{GHz}$	$\pm 3.93 \text{ dB}$
Radiated Emissions $> 1\text{GHz}$	$\pm 5.814 \text{ dB}$
Temperature	$\pm 0.860 \text{ }^{\circ}\text{C}$
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	$\pm 2.93 \text{ dB}$

9 CONCLUSION

In the opinion of TÜV SÜD America, Inc. the model 40020000, manufactured by Walter Kidde Portable Equipment Inc., meet the requirements of FCC Part 15.247 for the tests documented herein.

END REPORT