NVLAP Lab Code: 200087-0

Application For Grant of Certification

for

Model: A02556

for

Garmin International, Inc.

1200 East 151st Street
Olathe, KS 66062

Test Report Number 150625

Authorized Signatory: Scot D Rogers
Scot D. Rogers

NVLAP Lab Code: 200087-0

ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
Phone / Fax (913) 837-3214

Engineering Test Report For Grant of Certification Application for FCC 47 CFR PART 15B, Unintentional Radiator Certification

Electromagnetic Emissions Interference Test

FOR

Garmin International, Inc.

1200 East 151st Street
Olathe, KS 66062

Model: A02556

Test Date: June 25, 2015

Certifying Engineer: Scot D Rogers

Scot D. Rogers
Rogers Labs, Inc.
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Revisions

Revision 1 Issued July 15, 2015

Executive Summary

The following information is submitted for consideration in obtaining Grant of Certification for unintentional radiator per 47 CFR Paragraph 15B. This equipment is not subject to the transition provisions authorized under paragraph 15.37 of the 47 CFR. The Electromagnetic Emissions Interference (EMI) compatibility tests required for demonstration of compliance with the 47 CFR Parts 15B have been completed on the Model: A02556. Test procedures used are the established American National Standard for Methods of Measurement of Radio-Noise Emissions as described in the ANSI C63.4-2014 Document.

Name of Applicant: Garmin International, Inc.
1200 East 151st Street
Olathe, KS 66062

Model: A02556

FCC ID: IPH-02556

Opinion / Interpretation of Results

Tests Performed	Margin	Results
AC Line Conducted Emissions per EN 55022 Class B Standards	-5.9	Complies
Radiated Emissions per EN 55022 Class B Standards	-9.3	Complies

Equipment Tested

Equipment	Model / PN	S/N	FCC ID	IC:
EUT	A02556	45Z000036	IPH-02556	1792A-02556
EUT (#2)	A02556	79286B	IPH-02556	1792A-02556
AC Adapter	SCB0500600P	Not Available	N/A	N/A
AC Adapter	362-00072-00	Not Available	N/A	N/A
AC Adapter	362-00086-01	D42402246A1	N/A	N/A
AC Adapter	362-00087-00	Not Available	N/A	N/A
USB Cable	320-00911-00	N/A	N/A	N/A
Laptop Computer	studio XPS (PP35L)	921LBN1	N/A	N/A
USB Printer	Dell 0N5819	5D1SL61	N/A	N/A

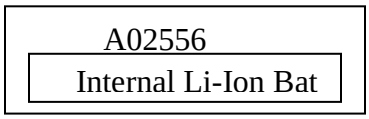
Test results in this report relate only to the items tested.

Equipment Function and Configuration

The EUT is a portable GPS enabled digital device. The device provides ability for tracking position and movement information and incorporates interface options as presented below in configuration diagrams. A completed system offers end user ability to utilize GPS information for display of location and navigational aid and wireless connectivity. The EUT also incorporates a low power transmitter with operation capability in the 2402-2480 MHz frequency band (47 CFR 15.249 and RSS-210). The design provides wireless communications in one of two modes providing wireless interface capabilities with compliant equipment. The product operates from internal rechargeable battery only. Recharge of internal battery is accomplished with the use of USB interface cradle, which may be connected to compliant AC adapter or standard USB interface port. The design utilizes internal fixed antenna system and offers no provision for antenna replacement or modification. Two samples were provided for testing, one representative of production design, and the other modified for testing purposes replacing integral antenna with RF connection port. Test samples were provided with test software enabling testing personnel ability to enable transmitter function on defined channels. The antenna modification offered testing facility ability to connect test equipment to the temporary antenna port for antenna port conducted emission testing. The EUT was arranged as described by the manufacturer emulating typical user configurations for testing purposes. The EUT offers no other interface connections than those in the configuration options as presented and described by the manufacturer. For testing purposes, the EUT received powered from freshly charged internal battery and configured to operate in available modes. As requested by the manufacturer and required by regulations, the equipment was tested for emissions compliance using the available configurations with the worst-case data presented. Test results in this report relate only to the products described in this report.

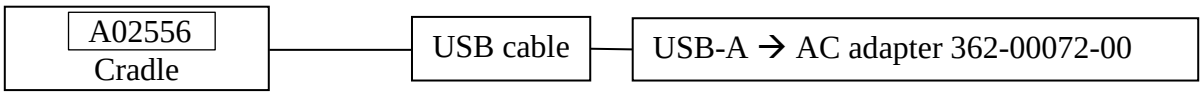
Equipment Configuration

1. A02556 operating off internal Li-Ion Battery

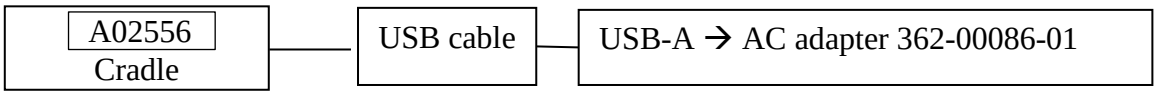


2. A02556 internal battery charged by PC through USB cable

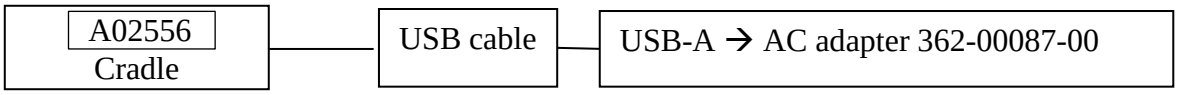
3. A02556 internal battery charged by AC adapter through USB cable



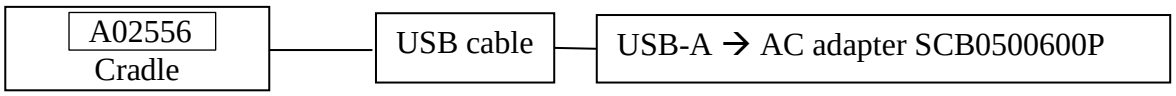
4. A02556 internal battery charged by AC adapter through USB cable



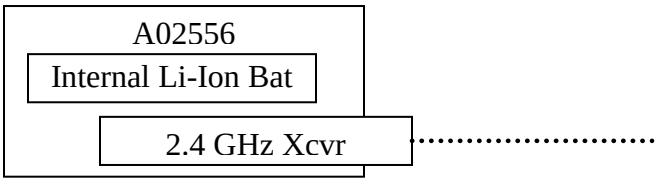
5. A02556 internal battery charged by AC adapter through USB cable



6. A02556 internal battery charged by AC adapter through USB cable



7. A02556 transmitting data through wireless 2.4 GHz communication (see test procedure document) and powered by internal battery



Application for Certification

(1) Manufacturer: Garmin International, Inc.
1200 East 151st Street
Olathe, KS 66062

(2) Identification: Model: A02556

FCC ID: IPH-02556

(3) Instruction Book:

Refer to Exhibit for Instruction Manual.

(4) Description of Circuit Functions:

Refer to Exhibit of Operational Description.

(5) Block Diagram with Frequencies:

Refer to Exhibit of Operational Description.

(6) Report of Measurements:

Report of measurements follows in this Report.

(7) Photographs: Construction, Component Placement, etc.:

Refer to Exhibit for photographs of equipment.

(8) List of Peripheral Equipment Necessary for operation. The equipment operates from DC power supplied from internal rechargeable battery as documented in this report. The battery may be charged with use of compliant AC adapter or USB port. The device provides information wirelessly to remotely located compliant equipment. The EUT offers no other connection ports than those presented in this filing.

(9) Transition Provisions of 47 CFR 15.37 are not requested.

(10) Not Applicable. The unit is not a scanning receiver.

(11) Not Applicable. The EUT does not operate in the 59 – 64 GHz frequency band.

(12) The equipment is not software defined and this section is not applicable.

Applicable Standards & Test Procedures

The EUT was tested for demonstration of compliance to the limits and methods of measurements per, 47 CFR part 15B. The following report is submitted in accordance with the Code of Federal Regulations 47, dated October 1, 2014, Class B Standards for unintentional radiator digital device. Test procedures used during testing were the established American National Standard for Methods of Measurement of Radio-Noise Emissions as described in the ANSI C63.4-2014 Document.

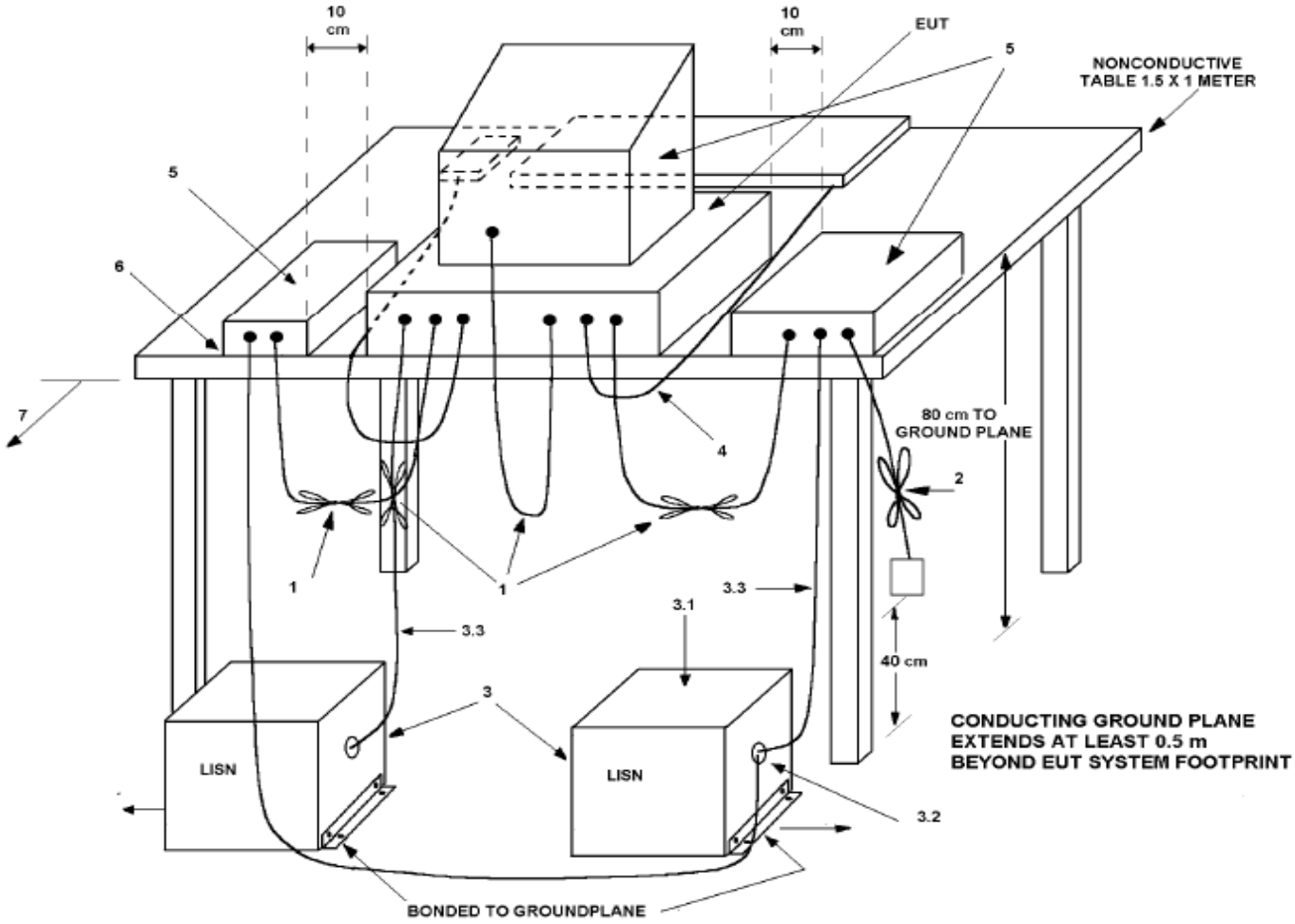
Test Procedures

AC Line Conducted Emission Test Procedure

Testing for the AC line-conducted emissions was performed as defined in ANSI C63.4-2014. The test setup, including the EUT was arranged in the test configurations as shown above. The test configuration was placed on a 1 x 1.5-meter wooden bench 0.8 meters high located in a screen room. The power lines of the system were isolated from the power source using a standard LISN with a 50-µHy choke. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor internal to the LISN. The LISN was positioned on the floor beneath the wooden bench supporting the EUT. The power lines and cables were draped over the back edge of the table. Refer to diagram one showing typical test arrangement and photographs in annex for EUT placement used during testing.

Radiated Emission Test Procedure

The EUT was placed on a rotating 1 x 1.5-meter wooden platform, elevated as required above the ground plane at a distance of 3 meters from the FSM antenna. Testing for the radiated emissions was performed as required by 47 CFR 15 and specified in ANSI C63.4-2014. EMI energy was maximized by equipment placement, raising and lowering the FSM antenna, changing the antenna polarization, and by rotating the turntable. Each emission was maximized before data was taken using a spectrum analyzer. Refer to photographs in the test setup exhibits for EUT placement during testing. Refer to diagrams two and three showing typical test arrangement and photographs in annex for EUT placement used during testing



1. Interconnecting cables that hang closer than 40 cm to the ground plane were folded back and forth in the center forming a bundle 30 cm to 40 cm long.
2. Input/output (I/O) cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
3. EUT connected to one LISN. Unused LISN measuring port connectors are terminated into 50 Ω loads. LISN is placed on top of and bonded to reference ground plane.

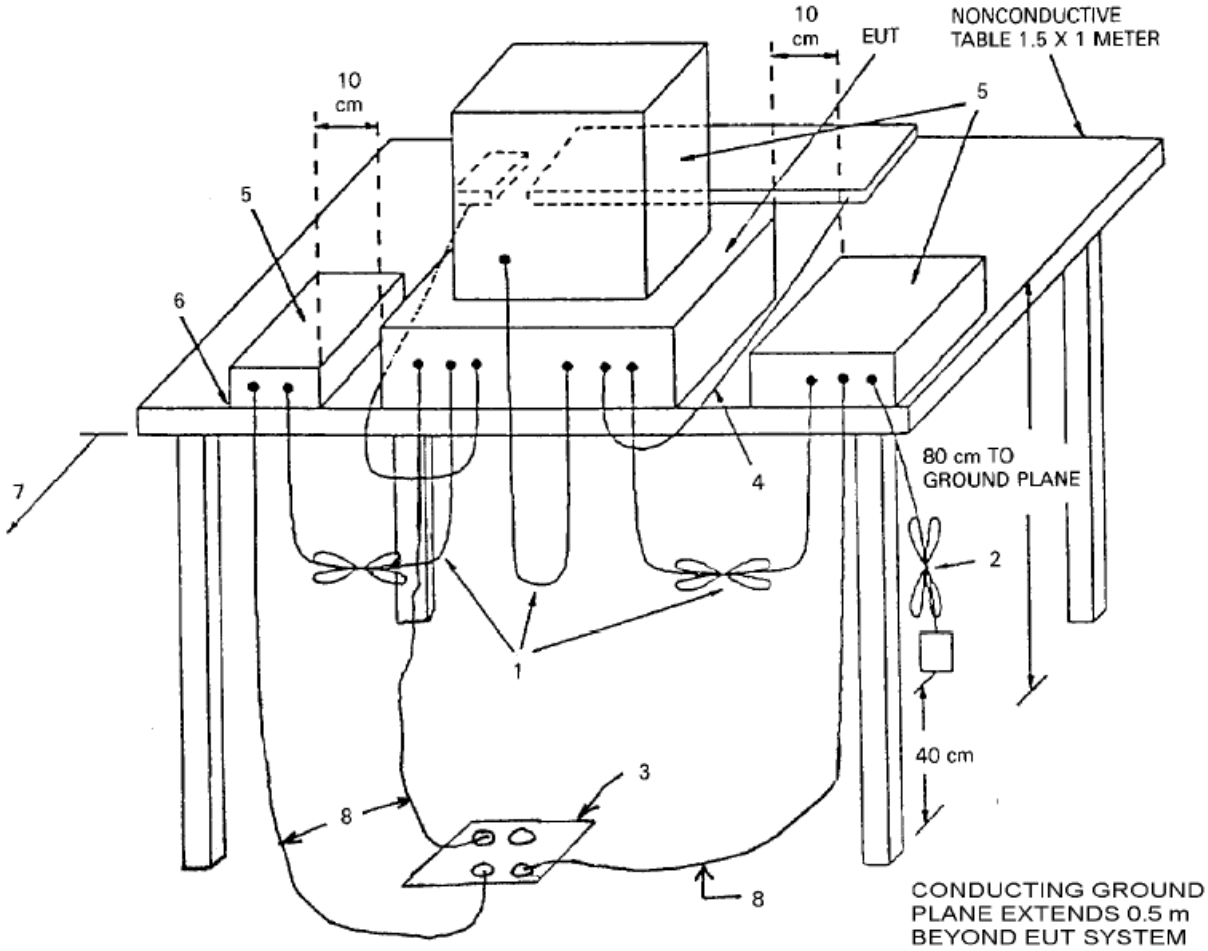
3.1 All other equipment powered from additional LISN(s).

3.2 Multiple outlet strips can be used for multiple power cords of non-EUT equipment.

3.3 LISN is positioned at least 80 cm from nearest part of EUT chassis.

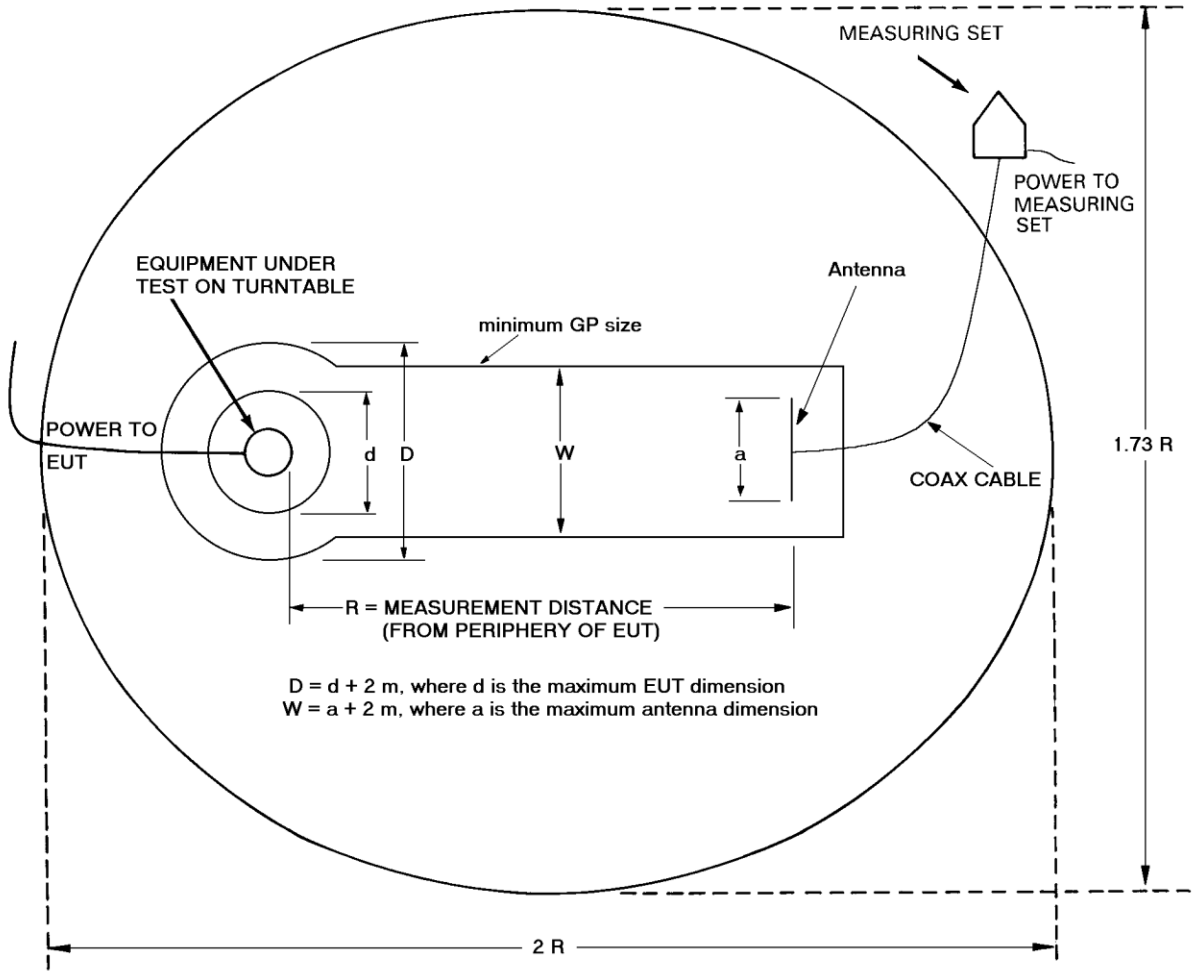
4. Cables of hand-operated devices, such as keyboards, mice, and so on, shall be placed as for normal use.
5. Non-EUT components of EUT system being tested.
6. Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.
7. Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane (see 5.2.2 for options).

Diagram 1 Test arrangement for Conducted emissions



1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center, forming a bundle 30 cm to 40 cm long.
2. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using the correct terminating impedance. The total length shall not exceed 1 m.
3. If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground plane with the receptacle flush with the ground plane.
4. Cables of hand-operated devices, such as keyboards, mice, and so on, shall be placed as for normal use.
5. Non-EUT components of EUT system being tested.
6. Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop (possibly center of table for transmitter equipment).
7. No vertical conducting plane used.
8. Power cords drape to the floor and are routed over to receptacle.

Diagram 2 Test arrangement for radiated emissions of tabletop equipment



AREA DIMENSIONS =	R = 3m	R = 10 m	R = 30 m
	6 m x 5.2 m	20 m x 17.3 m	60 m x 52 m

Diagram 3 Test arrangement for radiated emissions tested on Open Area Test Site (OATS)

Test Site Locations

Conducted EMI — The AC power line conducted emissions testing performed in a shielded screen room located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS

Radiated EMI — The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 W. 259th Terrace, Louisburg, KS

Site Registration — Refer to Annex for Site Registration Letters

NVLAP Accreditation — Lab code 200087-0

List of Test Equipment

A Rohde and Schwarz ESU40 and/or Hewlett Packard 8591EM was used as the measuring device for the emissions testing of frequencies below 1 GHz. A Rohde and Schwarz ESU40 and/or Hewlett Packard 8562A Spectrum Analyzer was used as the measuring device for testing the emissions at frequencies above 1 GHz. The analyzer settings used are described in the following table. Refer to the appendix for a complete list of test equipment.

AC Line Conducted Emissions (0.150 -30 MHz)		
RBW	AVG. BW	Detector Function
9 kHz	30 kHz	Peak / Quasi Peak
Emissions (30-1000 MHz)		
RBW	AVG. BW	Detector Function
120 kHz	300 kHz	Peak / Quasi Peak
Emissions (Above 1000 MHz)		
RBW	Video BW	Detector Function
100 kHz	100 kHz	Peak
1 MHz	1 MHz	Peak / Average

Equipment	Manufacturer	Model (SN)	Band	Cal Date	Due
☒ LISN	Comp. Design	FCC-LISN-2-MOD.CD (126)	.15-30MHz	10/14	10/15
☒ Cable	Time Microwave	750HF290-750 (L10M)	9kHz-40 GHz	10/14	10/15
☒ Cable	Belden	RG-58 (L1-CAT3-11509)	9kHz-30 MHz	10/14	10/15
☒ Cable	Belden	RG-58 (L2-CAT3-11509)	9kHz-30 MHz	10/14	10/15
☐ Antenna	ARA	BCD-235-B (169)	20-350MHz	10/14	10/15
☐ Antenna	EMCO	3147 (40582)	200-1000MHz	10/14	10/15
☒ Antenna	Com Power	AH-118 (10110)	1-18 GHz	10/14	10/16
☒ Antenna	Com Power	AH-840 (101046)	18-40 GHz	5/15	5/17
☒ Antenna	EMCO	6509 (9502-1374)	.001-30 MHz	10/14	10/15
☒ Antenna	Sunol	JB-6 (A100709)	30-1000 MHz	10/14	10/15
☒ Antenna	Standard	FXRY638A (621786)	10-18 GHz	5/15	5/17
☐ Antenna	EMCO	3143 (9607-1277)	20-1200 MHz	5/15	5/16
☐ Analyzer	HP	8591EM (3628A00871)	9kHz-1.8GHz	5/15	5/16
☐ Analyzer	HP	8562A (3051A05950)	9kHz-110GHz	5/15	5/16
☐ Analyzer	HP External Mixers	11571, 11970	25GHz-110GHz	5/15	5/16
☒ Analyzer	Rohde & Schwarz	ESU40 (100108)	20Hz-40GHz	5/15	5/16
☒ Amplifier	Com-Power	PA-010 (171003)	100Hz-30MHz	10/14	10/15
☒ Amplifier	Com-Power	CPPA-102 (01254)	1-1000 MHz	10/14	10/15
☒ Amplifier	Com-Power	PAM-118A (551014)	0.5-18 GHz	10/14	10/15

Units of Measurement

Conducted EMI: Data is in dBµV; dB referenced to one microvolt.

Radiated EMI: Data is in dBµV/m; dB referenced to one microvolt per meter.

Radiated Emissions Calculations:

Note: The limit is expressed for a measurement in dBµV/m when the measurement is taken at a distance of 3 or 10 meters. Data taken for this report was taken at distance of 3 meters. Sample calculation demonstrates corrected field strength reading for Open Area Test Site using the measurement reading and correcting for receive antenna factor, cable losses, and amplifier gains.

Field Strength (dBµV/m @ 3 m) = FSM (dBµV) + A.F. (dB) + cable loss - Amp Gain (dB)

Environmental Conditions

Ambient Temperature	24.0° C
Relative Humidity	45%
Atmospheric Pressure	1010.9 mb

Statement of Modifications and Deviations

No modifications to the EUT were required for the system to demonstrate compliance with the 47 CFR Part 15B Class B equipment emissions requirements. There were no modifications or deviations to the specifications.

Emission Measurements

AC Line Conducted EMI Procedure

The EUT was arranged in typical equipment configurations as offered by manufacturer. Testing was performed with the EUT placed on a 1 x 1.5-meter wooden bench 80 cm above the conducting ground plane, floor of a screen room. The bench was positioned 40 cm away from the wall of the screen room. The LISN was positioned on the floor of the screen room 80-cm from the rear of the EUT. Testing for the line-conducted emissions were the procedures of ANSI C63.4-2014. The AC adapter for the EUT was connected to the LISN for line-conducted emissions testing. A second LISN was positioned on the floor of the screen room 80-cm from the rear of the supporting equipment of the EUT. All power cords except the EUT were then powered from the second LISN. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor, internal to the LISN. Power line conducted emissions testing was carried out individually for each current carrying conductor of the EUT. The excess length of lead between the system and the LISN receptacle was folded back and forth to form a bundle not exceeding 40 cm in length. The screen room, conducting ground plane, analyzer, and LISN were bonded together to the protective earth ground. Preliminary testing was performed to identify the frequencies of each of the emissions, which demonstrated the highest amplitudes. The cables were repositioned to obtain maximum amplitude of measured EMI level. Once the worst-case configuration was identified, plots were made of the EMI from 0.15 MHz to 30 MHz then data was recorded with maximum conducted emissions levels. Refer to figures one through eight showing plots of the AC Line conducted emissions of the AC Adapter configurations while charging the EUT. Refer to figures nine and ten showing plots of the AC Line conducted emissions of the EUT-USB-CPU configuration.

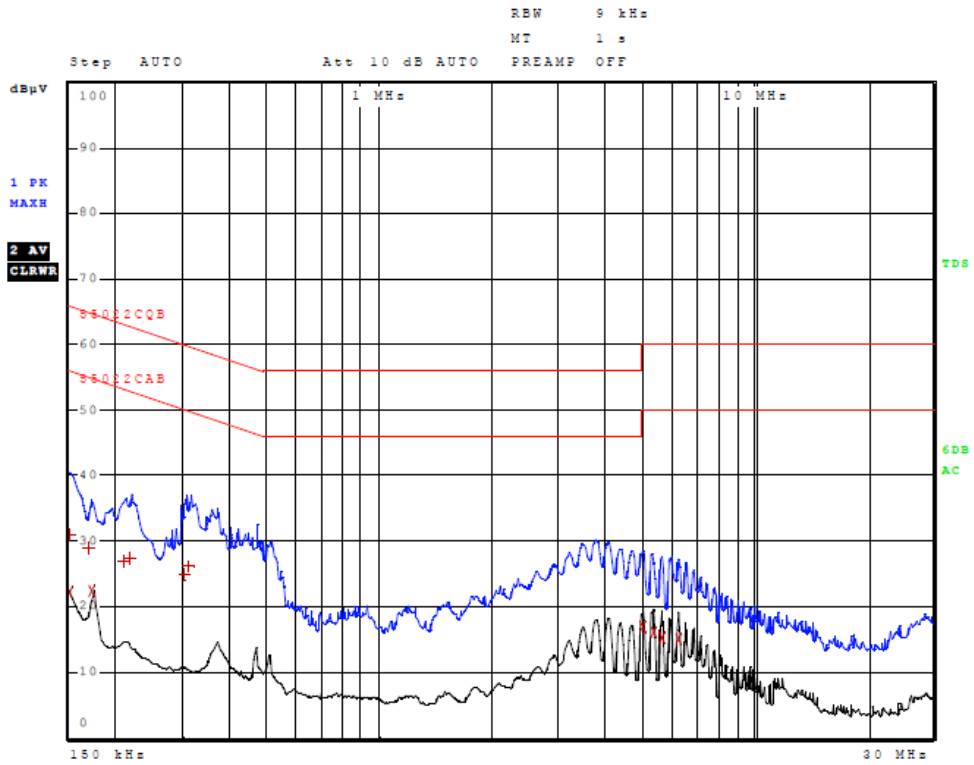


Figure 1 AC Line Conducted emissions of EUT line 1 (EUT AC Adapter, SCB0500600P)

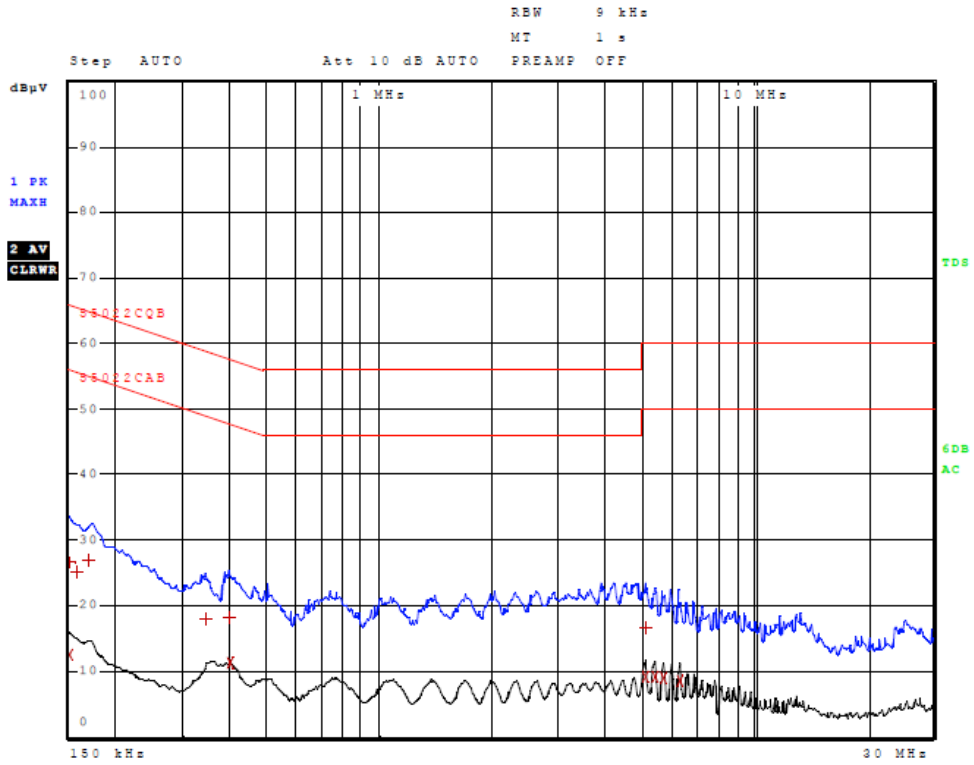


Figure 2 AC Line Conducted emissions of EUT line 2 (EUT AC Adapter, SCB0500600P)

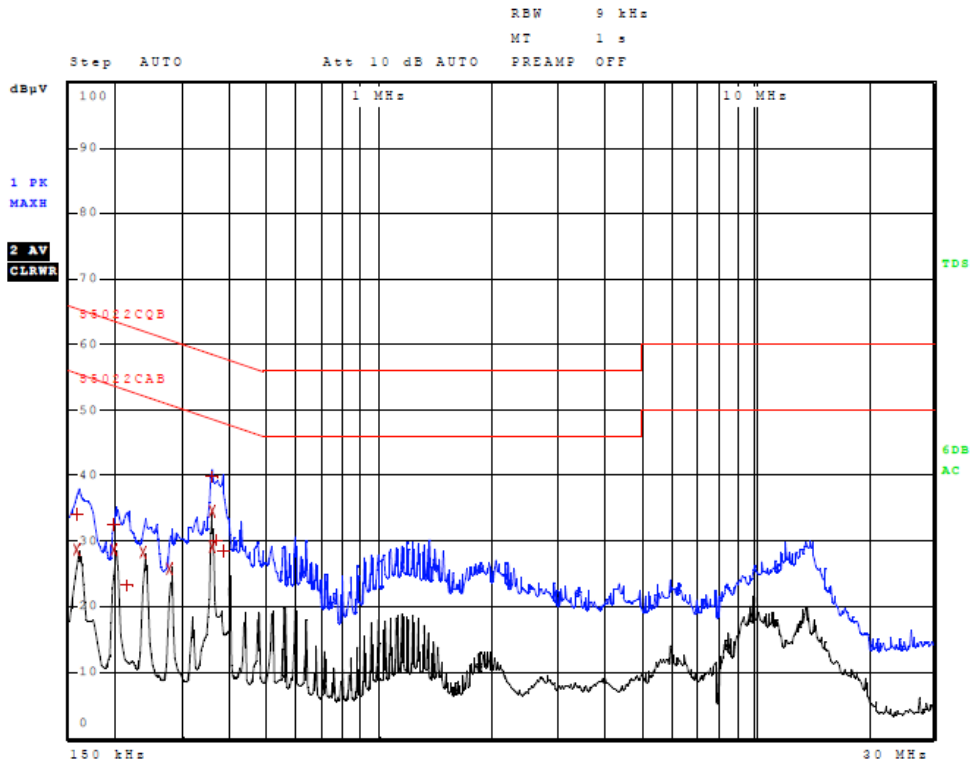


Figure 3 AC Line Conducted emissions of EUT line 1 (EUT AC Adapter, 362-00072-00)

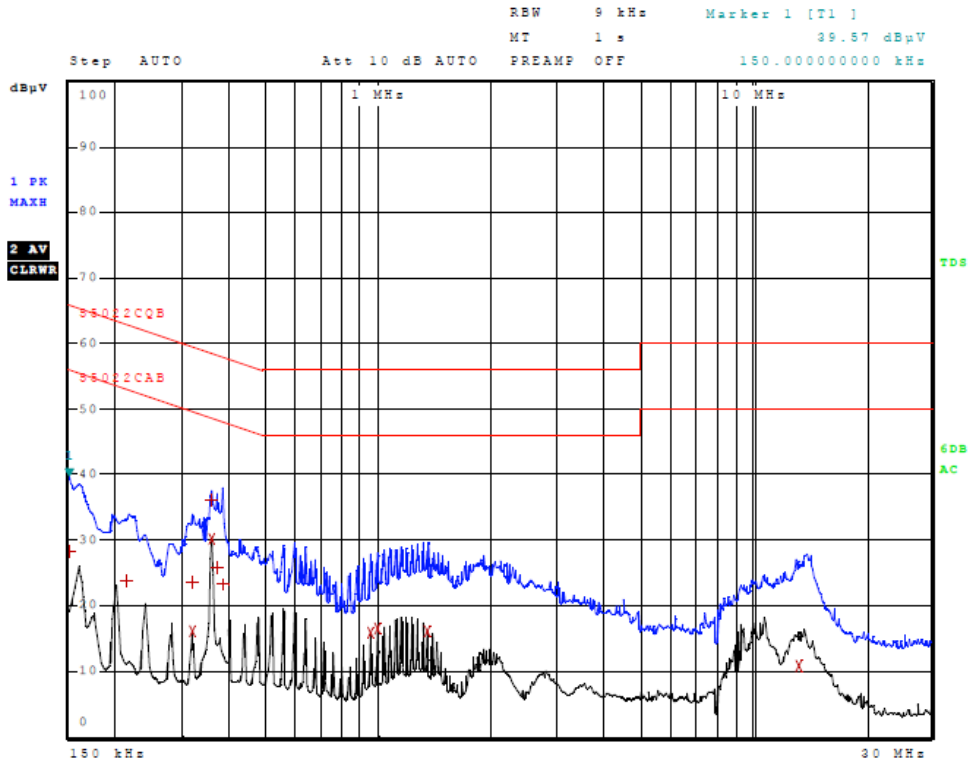


Figure 4 AC Line Conducted emissions of EUT line 2 (EUT AC Adapter, 362-00072-00)

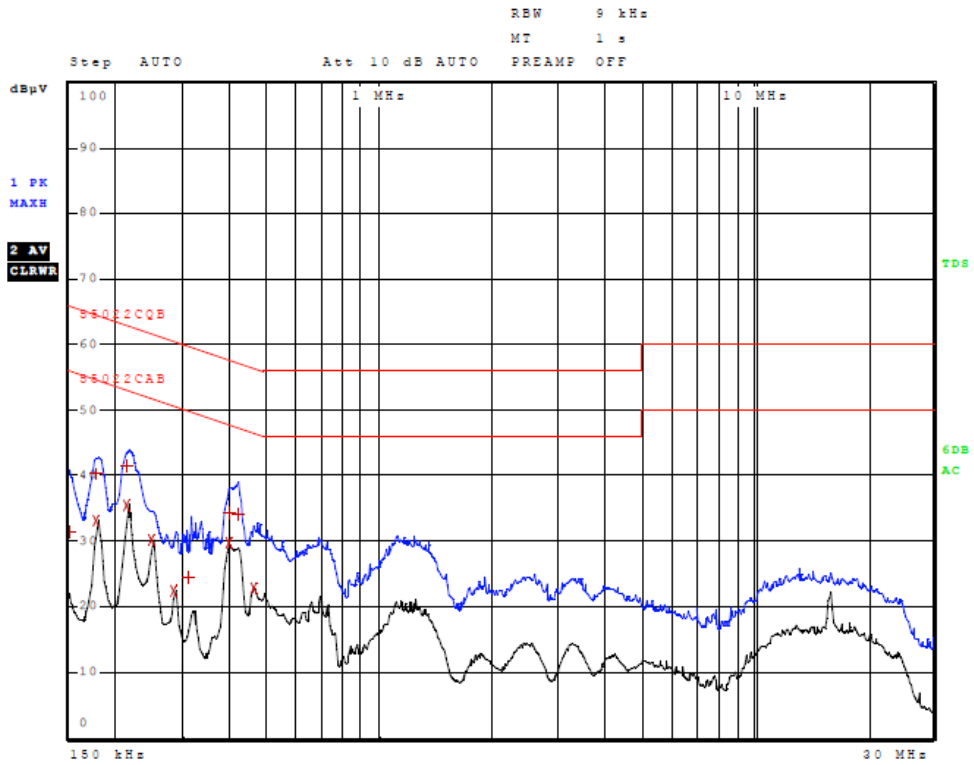


Figure 5 AC Line Conducted emissions of EUT line 1 (EUT AC Adapter, 362-00086-01)

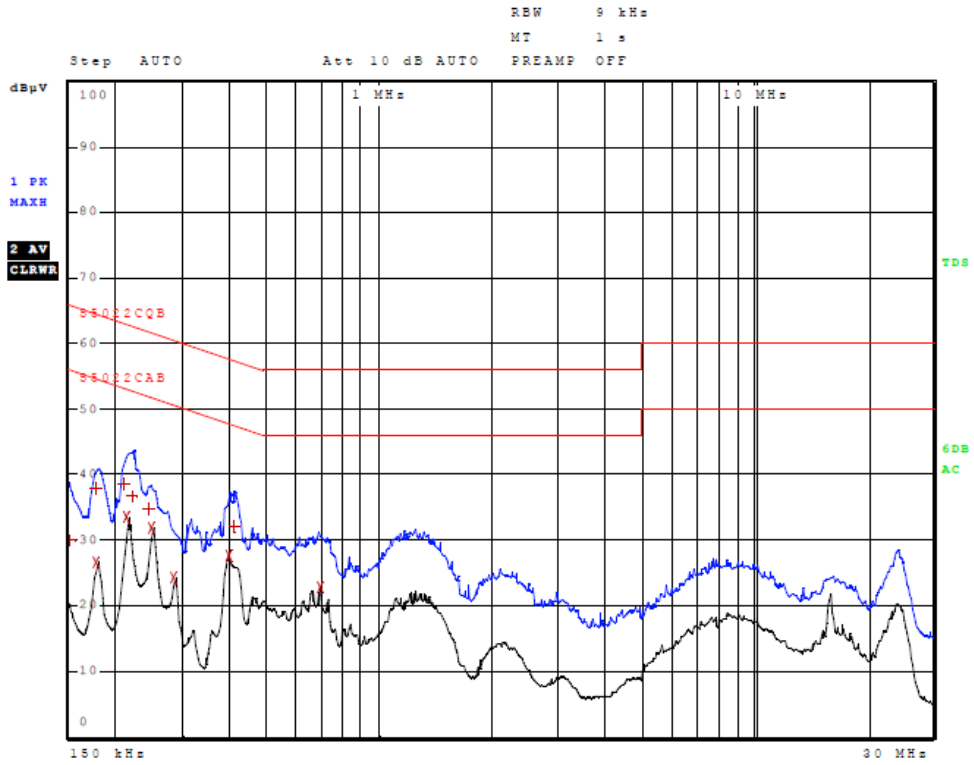


Figure 6 AC Line Conducted emissions of EUT line 2 (EUT AC Adapter, 362-00086-01)

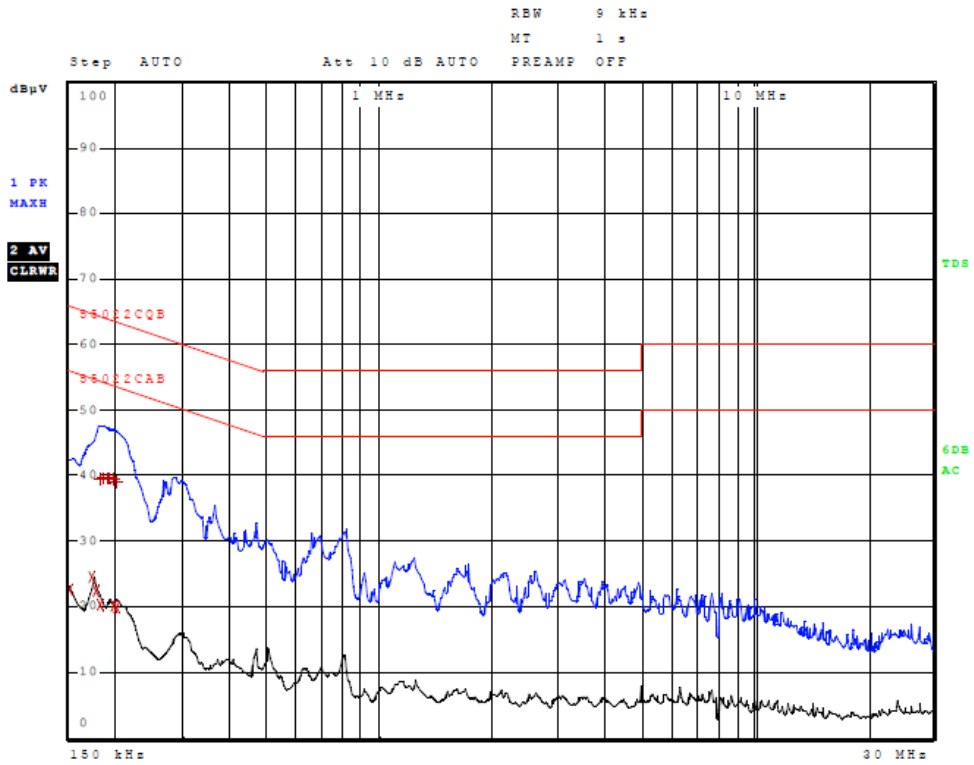


Figure 7 AC Line Conducted emissions of EUT line 1 (EUT AC Adapter, 362-00087-00)

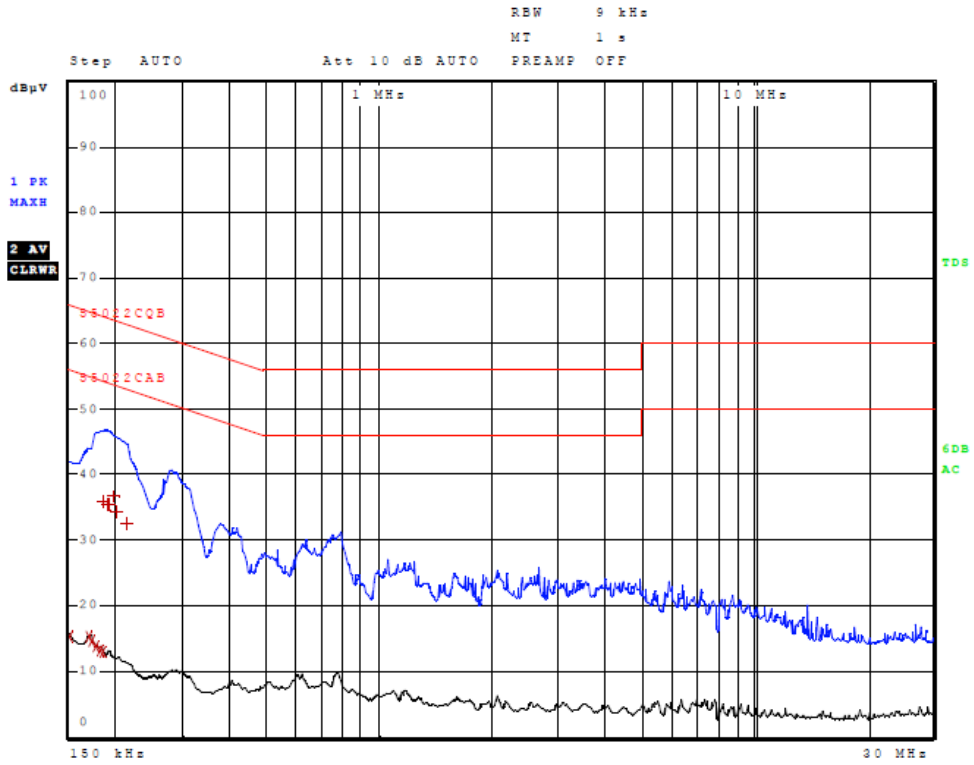


Figure 8 AC Line Conducted emissions of EUT line 2 (EUT AC Adapter, 362-00087-00)

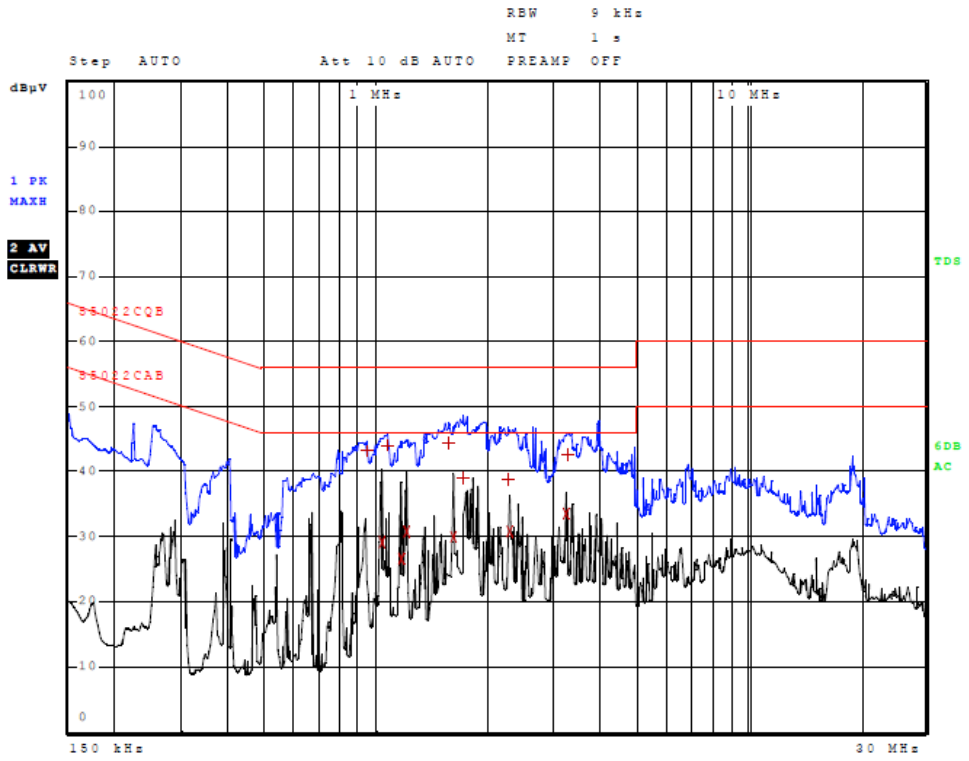


Figure 9 AC Line Conducted emissions of EUT line 1 (EUT-USB-CPU)

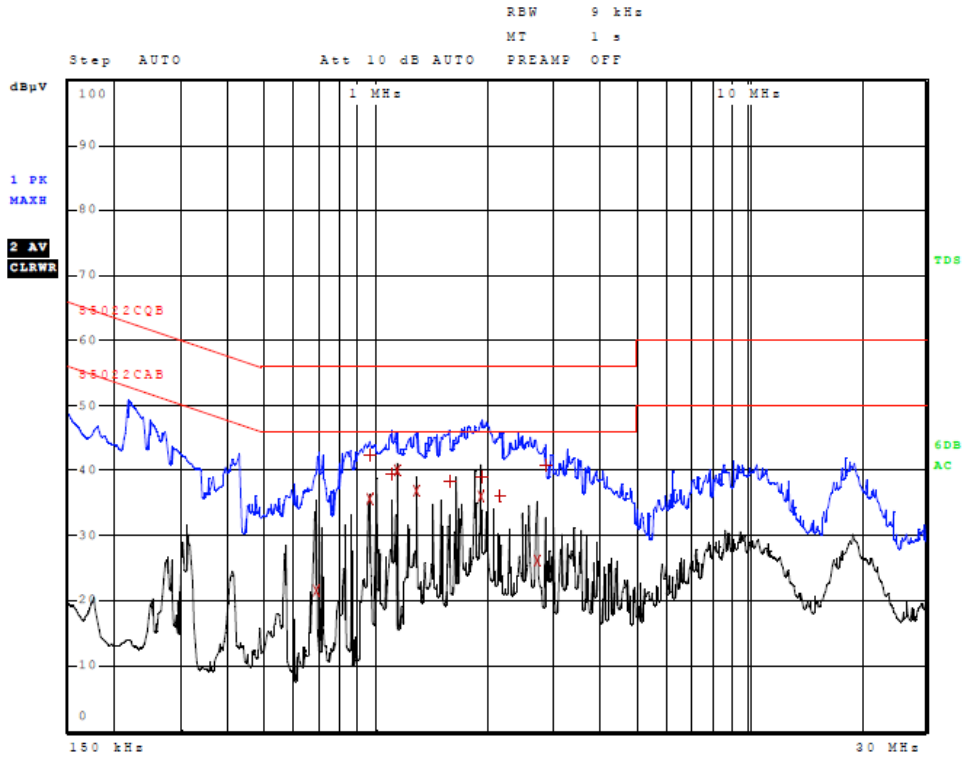


Figure 10 AC Line Conducted emissions of EUT line 2 (EUT-USB-CPU)

Radiated EMI Procedure

Test procedures of ANSI C63.4-2014 were used during radiated emissions testing. For testing purposes, the EUT was arranged as presented in the configuration diagram above and operated through all modes emulating typical operation. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions measurements were performed to identify the frequencies, which produced the highest emissions. Plots were made of the frequency spectrum for the preliminary testing. The EUT and cable locations were noted and reconfigured at the open area test site. The radiated emissions were then re-maximized at the OATS location before final radiated emissions measurements were performed. Final data was taken with the EUT located at the OATS at distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 9 kHz to 25,000 MHz was searched for radiated emissions. Measured emission levels were maximized by EUT placement on the table, changing cable location, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna position between horizontal and vertical polarization. Antennas used were Loop, Biconical, Broadband Biconilog, Log Periodic, and Double Ridge or Pyramidal Horns and mixers above 1 GHz. Emissions plots were taken for reference only. Radiated emissions measurements were performed on the OATS. Refer to figures eleven through fourteen showing plots of the EUT – AC adapter (SCB0500600P) configuration worst-case radiated emissions spectrum taken in the screen room. Refer to figures fifteen through eighteen showing plots of the EUT – AC adapter (362-00072-00) configuration worst-case radiated emissions spectrum taken in the screen room. Refer to figures nineteen through twenty-two showing plots of the EUT – AC adapter (362-00086-01) configuration worst-case radiated emissions spectrum taken in the screen room. Refer to figures twenty-three through twenty-six showing plots of the EUT – AC adapter (362-00087-00) configuration worst-case radiated emissions spectrum taken in the screen room. Refer to figures twenty-seven through thirty showing plots of the EUT-USB-CPU configuration worst-case radiated emissions spectrum taken in the screen room.

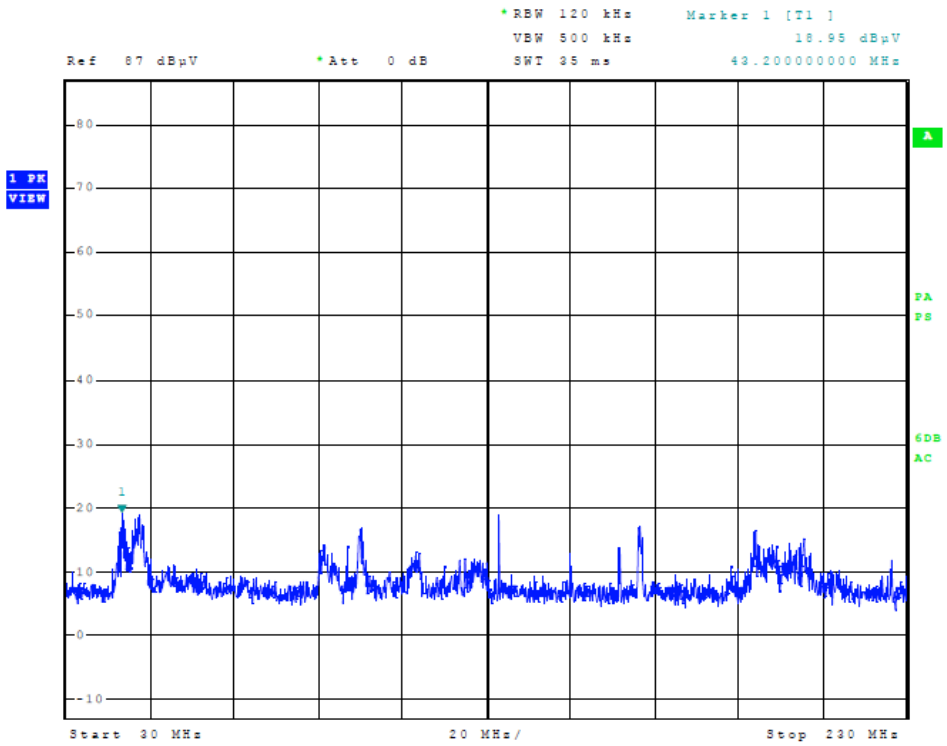


Figure 11 Radiated Emissions Plot (EUT AC Adapter, SCB0500600P)

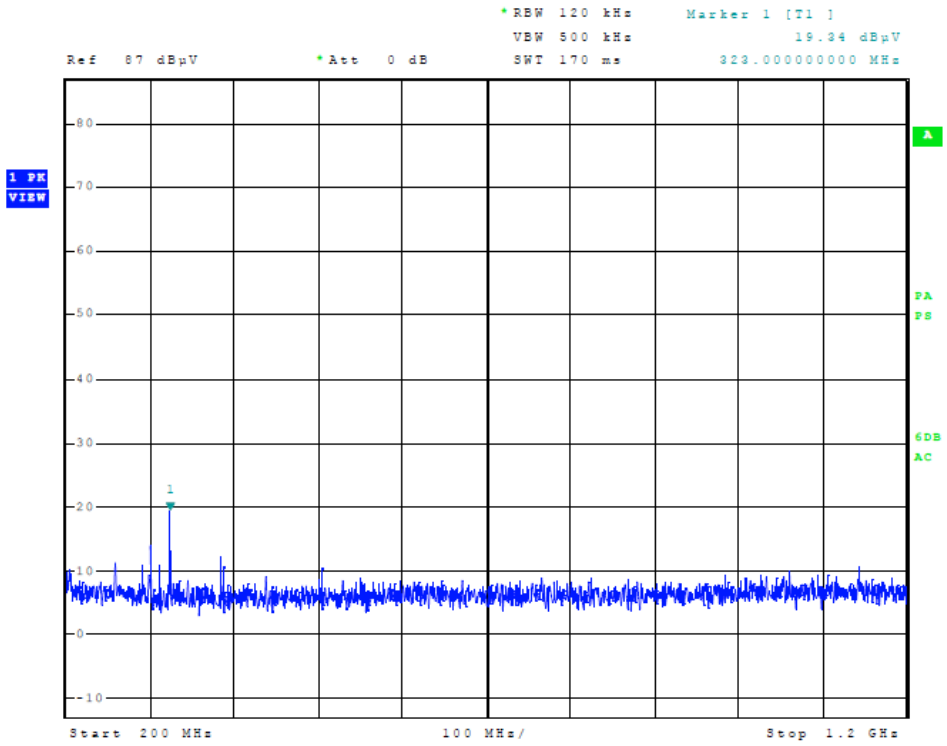


Figure 12 Radiated Emissions Plot (EUT AC Adapter, SCB0500600P)

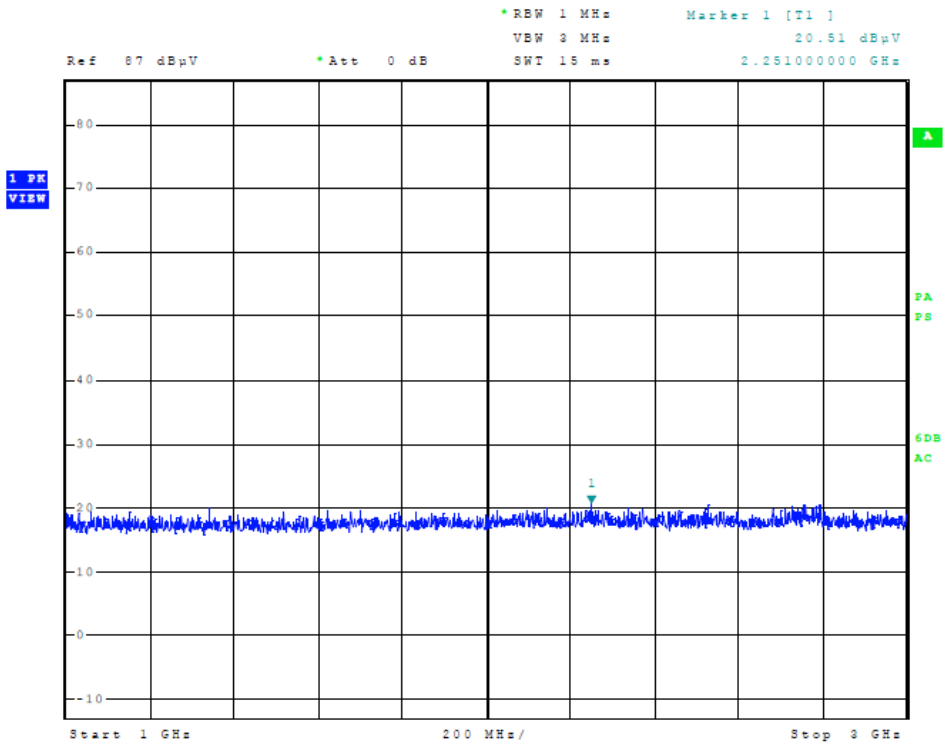


Figure 13 Radiated Emissions Plot (EUT AC Adapter, SCB0500600P)

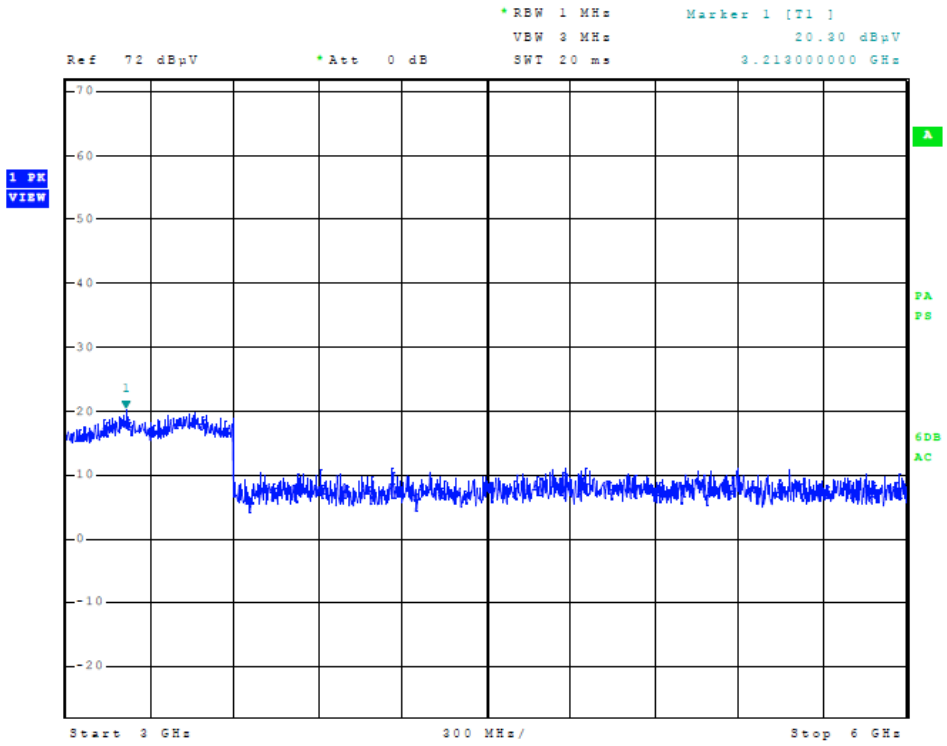


Figure 14 Radiated Emissions Plot (EUT AC Adapter, SCB0500600P)

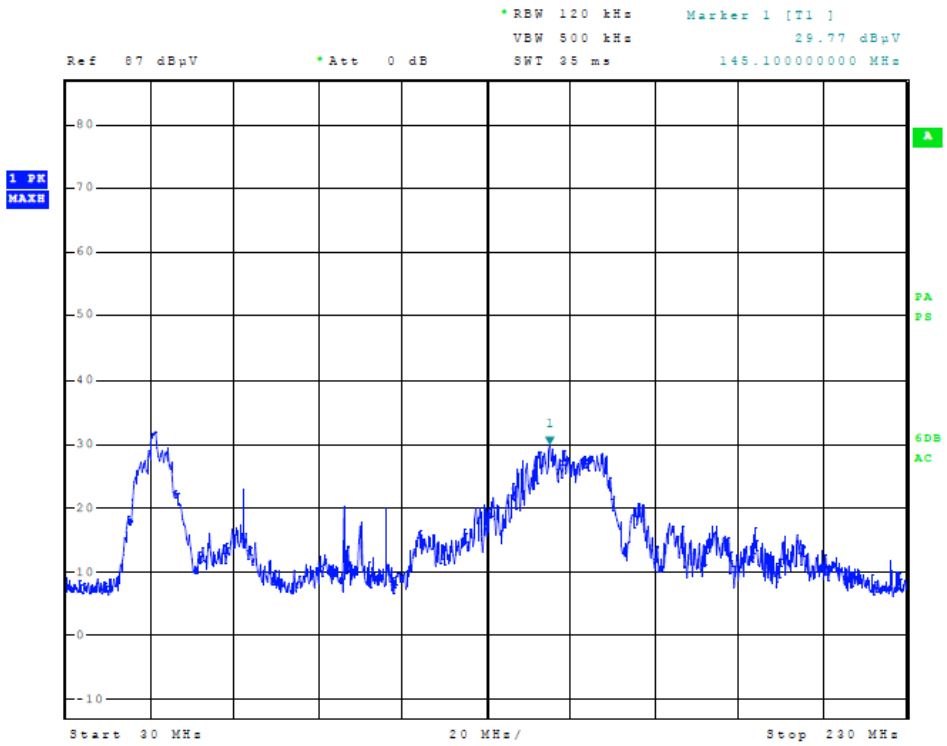


Figure 15 Radiated Emissions Plot (EUT AC Adapter, 362-00072-00)

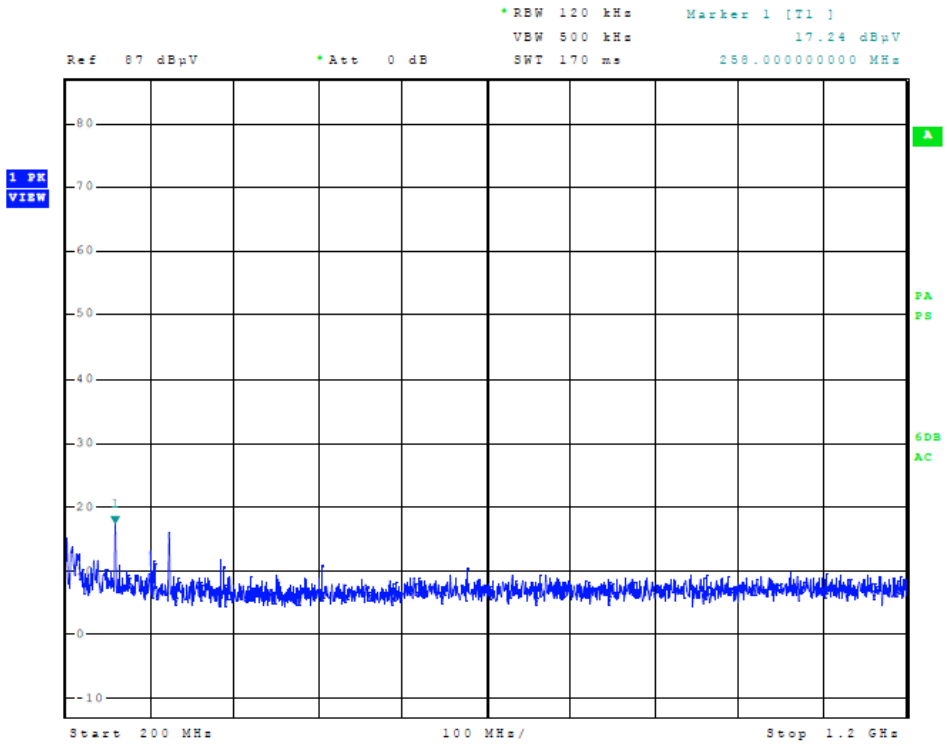


Figure 16 Radiated Emissions Plot (EUT AC Adapter, 362-00072-00)

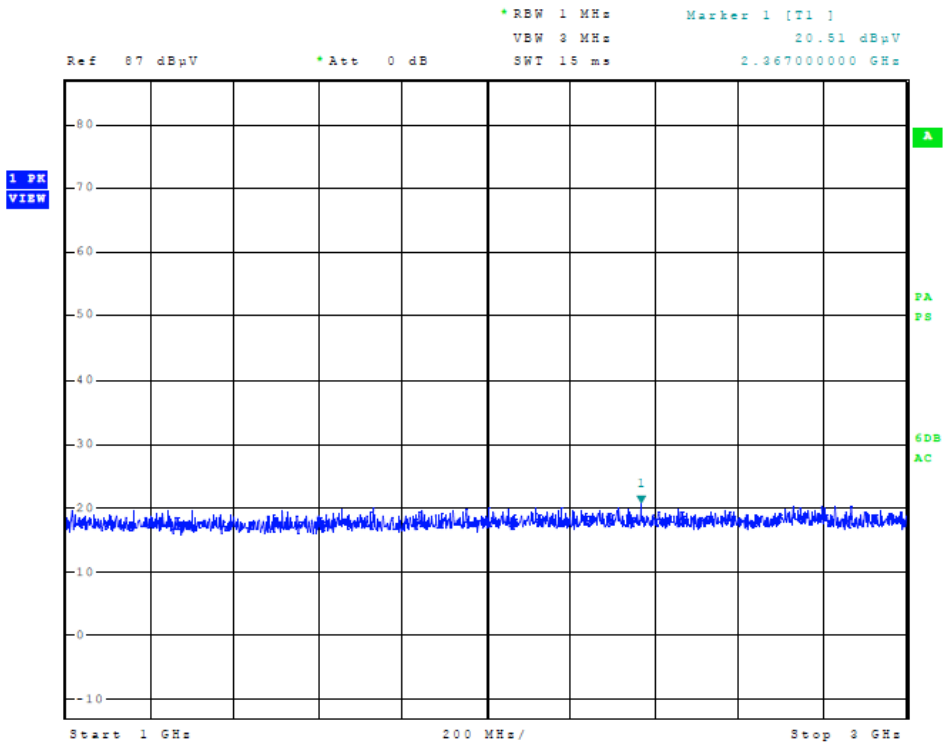


Figure 17 Radiated Emissions Plot (EUT AC Adapter, 362-00072-00)

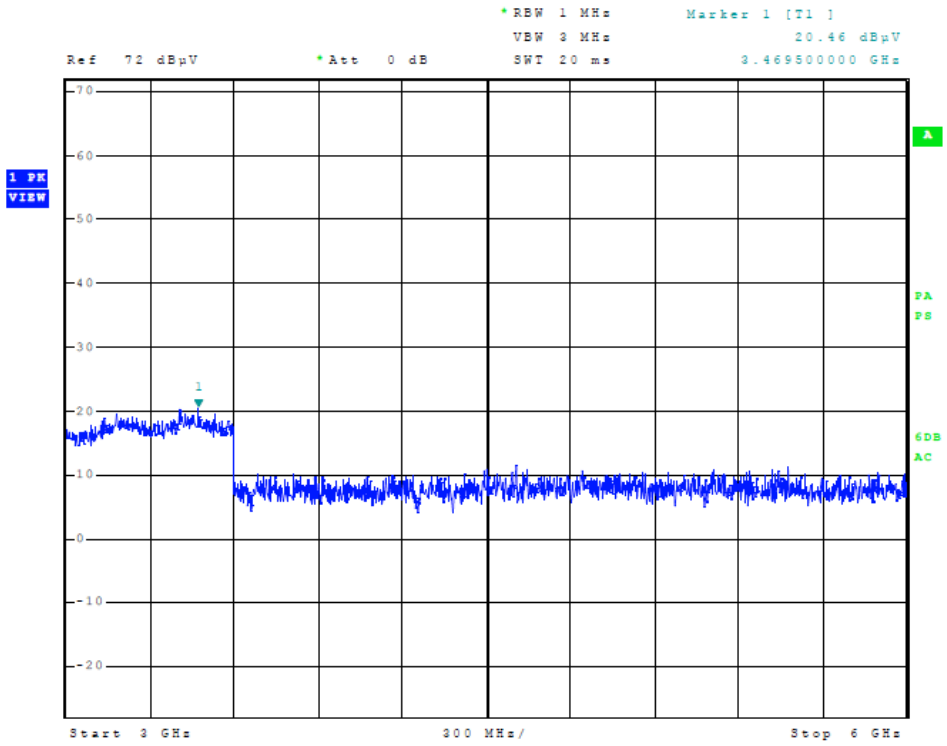


Figure 18 Radiated Emissions Plot (EUT AC Adapter, 362-00072-00)

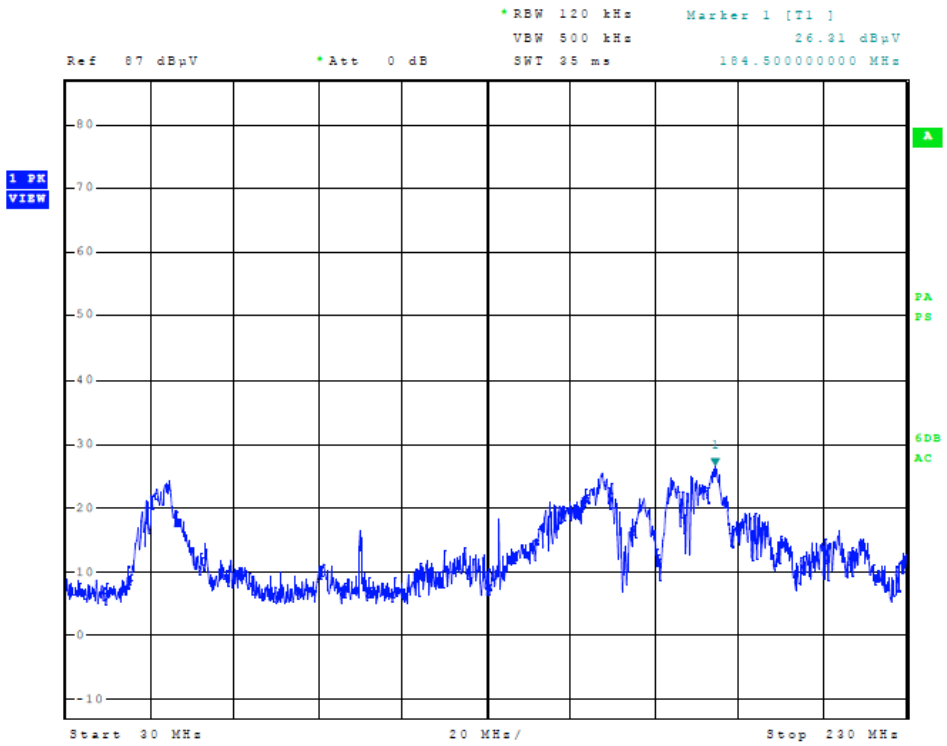


Figure 19 Radiated Emissions Plot (EUT AC Adapter, 362-00086-01)

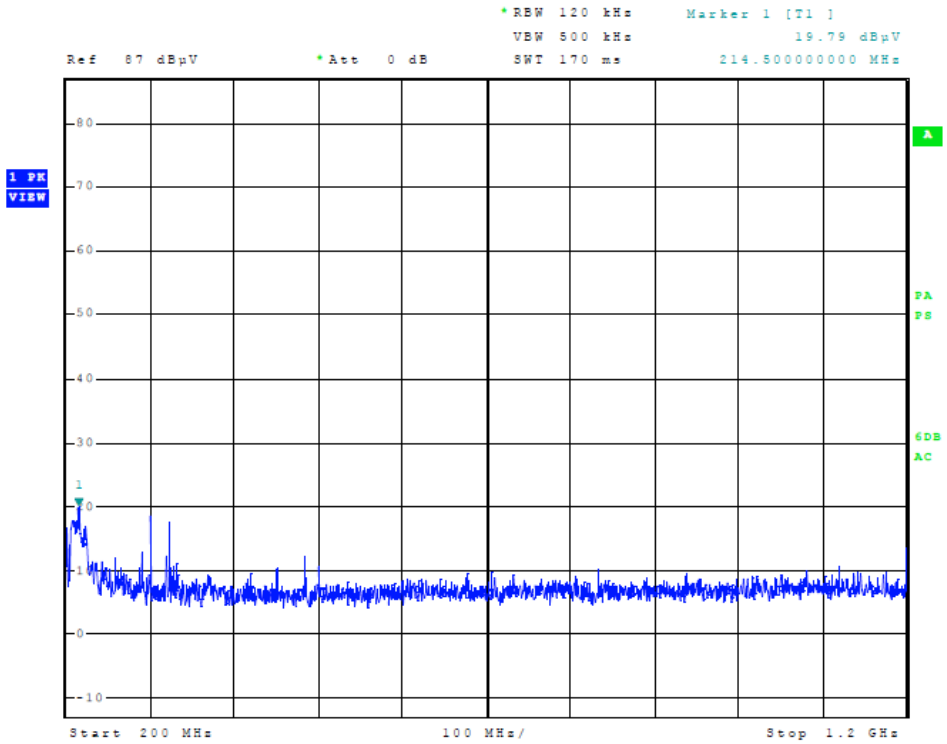


Figure 20 Radiated Emissions Plot (EUT AC Adapter, 362-00086-01)

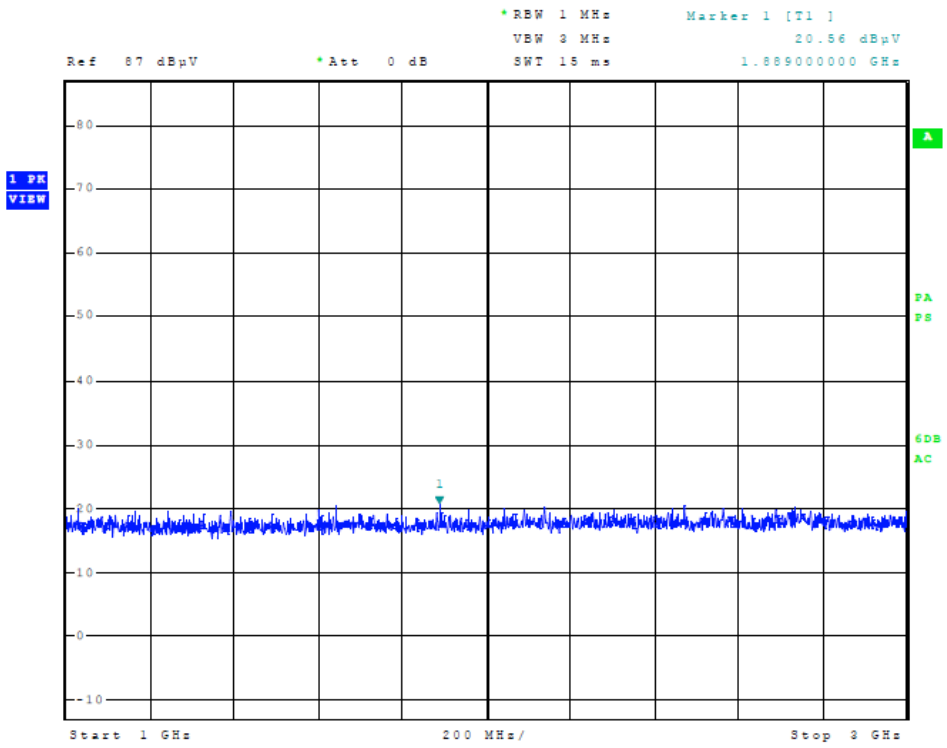


Figure 21 Radiated Emissions Plot (EUT AC Adapter, 362-00086-01)

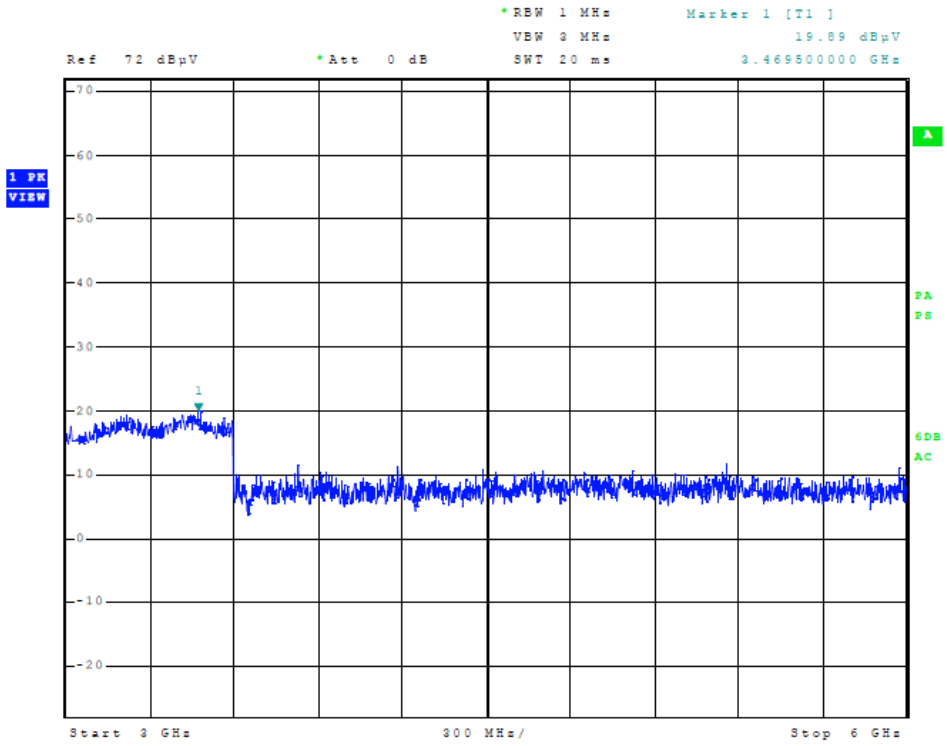


Figure 22 Radiated Emissions Plot (EUT AC Adapter, 362-00086-01)

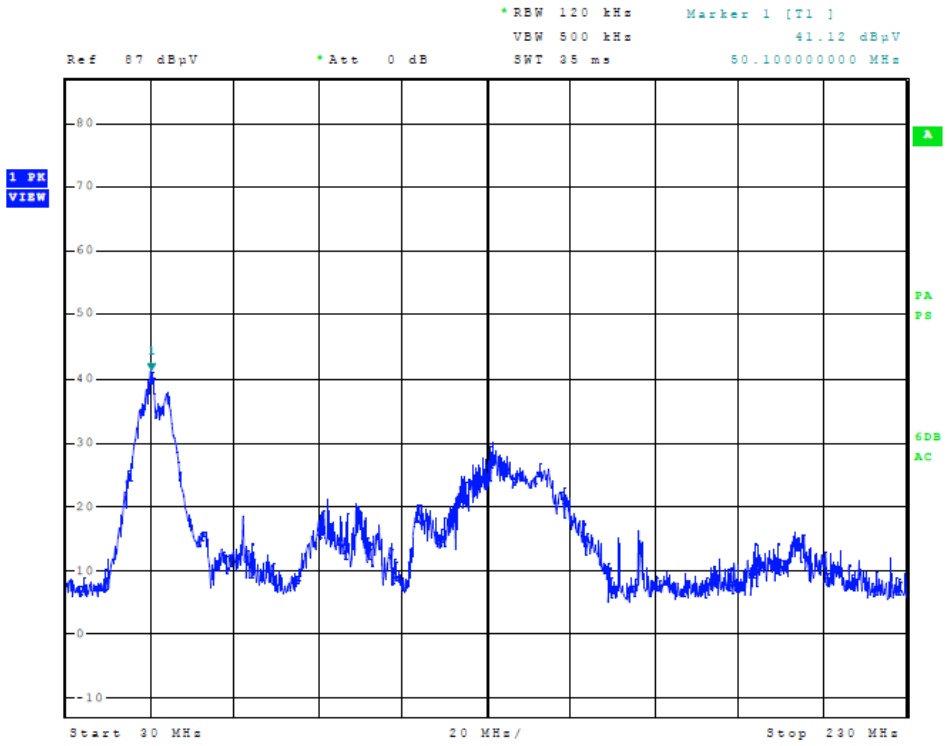


Figure 23 Radiated Emissions Plot (EUT AC Adapter, 362-00087-00)

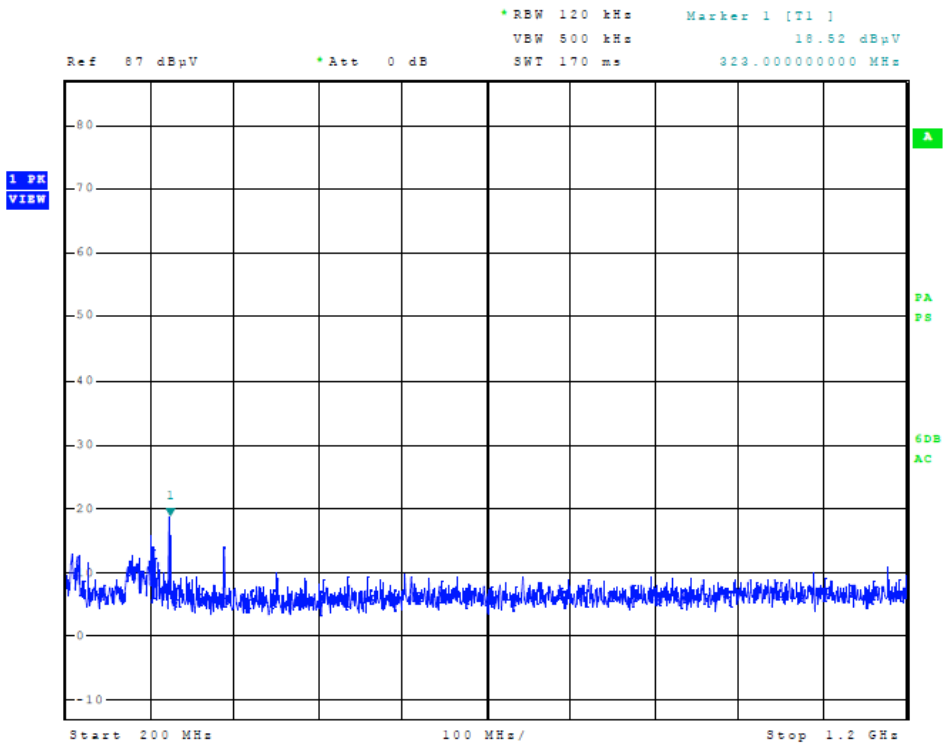


Figure 24 Radiated Emissions Plot (EUT AC Adapter, 362-00087-00)

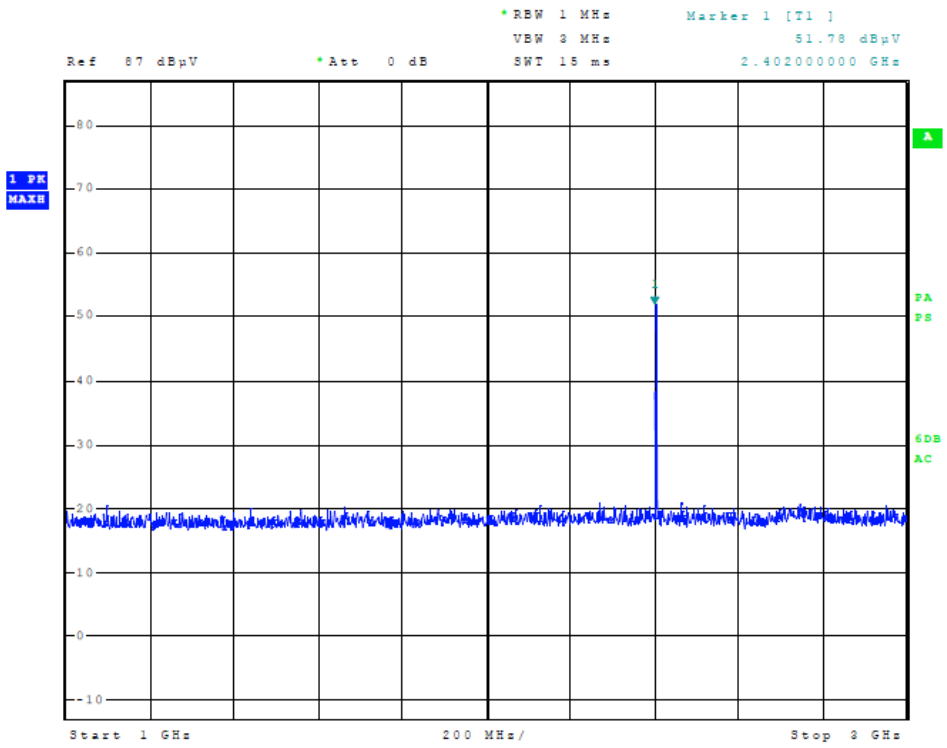


Figure 25 Radiated Emissions Plot (EUT AC Adapter, 362-00087-00)

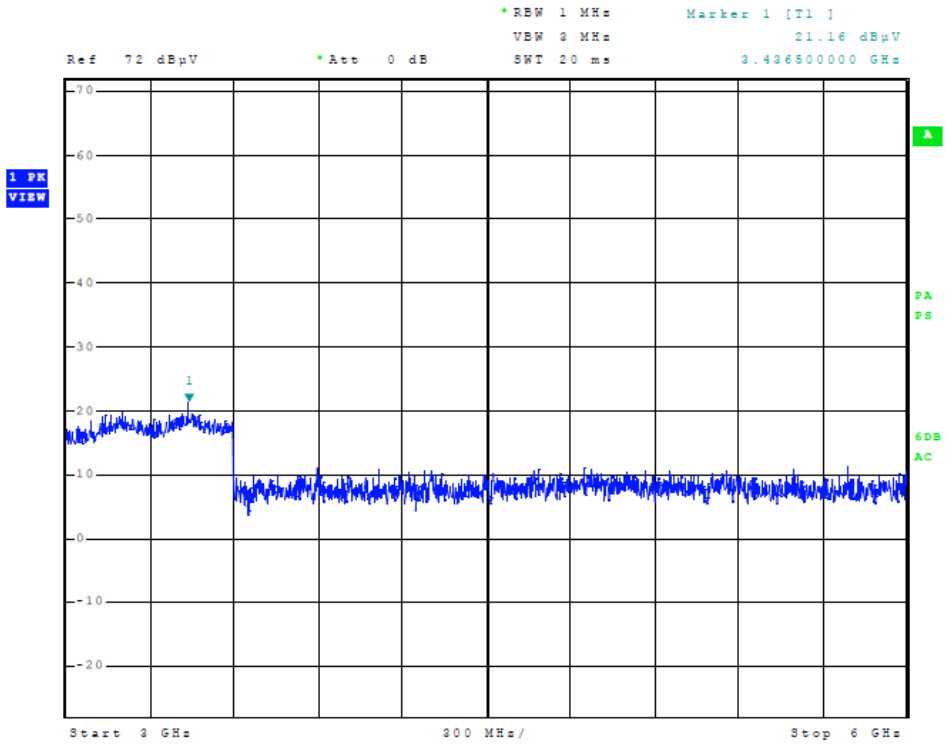


Figure 26 Radiated Emissions Plot (EUT AC Adapter, 362-00087-00)

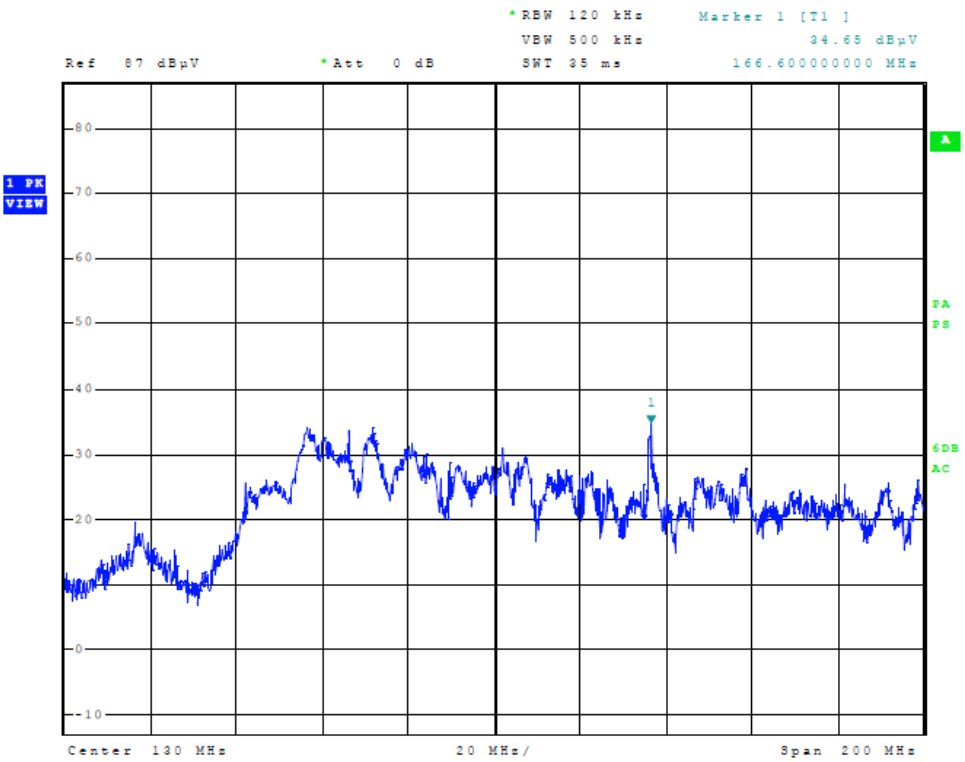


Figure 27 Radiated Emissions Plot (EUT-USB-CPU)

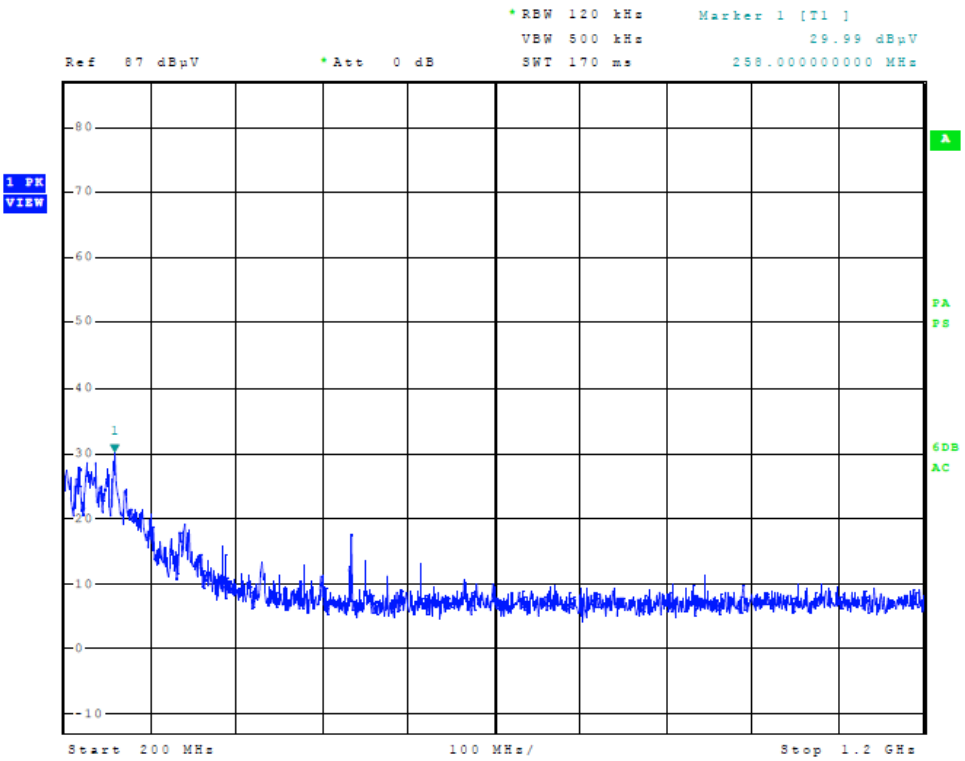


Figure 28 Radiated Emissions Plot (EUT-USB-CPU)

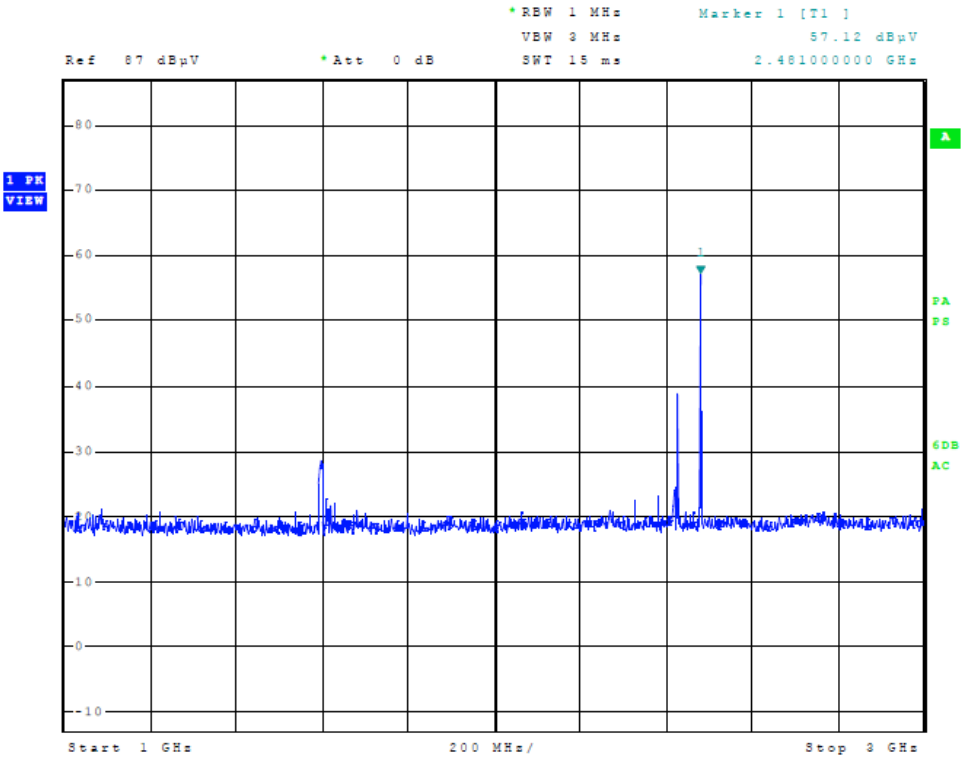


Figure 29 Radiated Emissions Plot (EUT-USB-CPU)

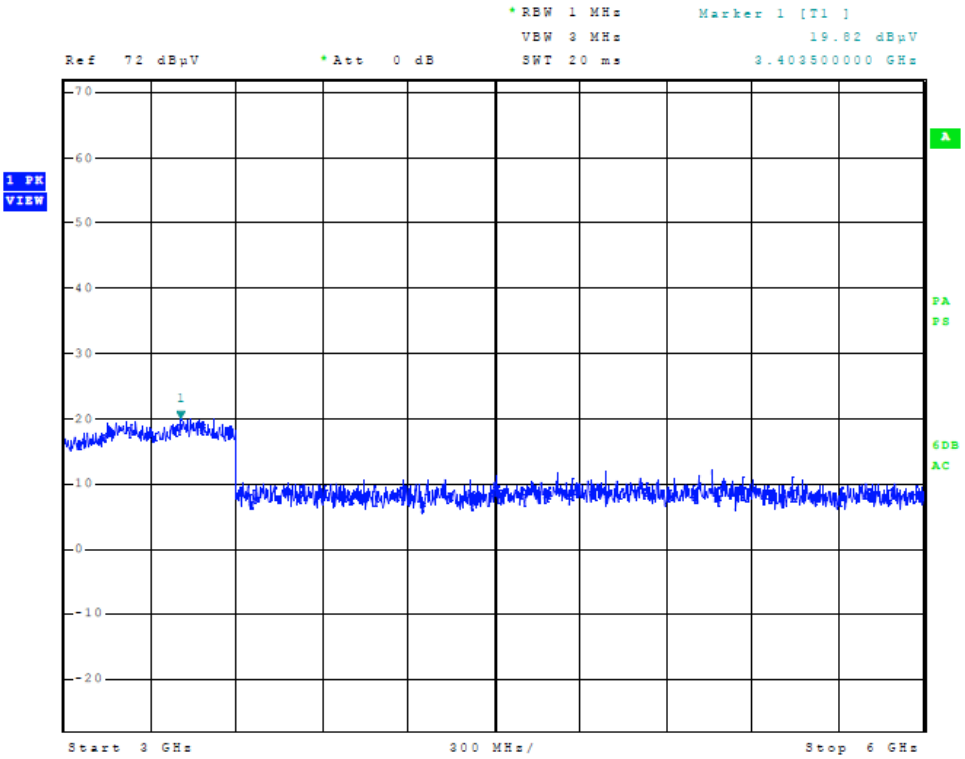


Figure 30 Radiated Emissions Plot (EUT-USB-CPU)

Emissions Test Data

Table 1 AC Line Conducted Emissions Data L1 (EUT-AC Adapter, SCB00500600P)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	150.000000000 kHz	22.22	Average	-33.78
1	150.000000000 kHz	30.98	Quasi Peak	-35.02
1	170.000000000 kHz	28.95	Quasi Peak	-36.01
2	174.000000000 kHz	22.40	Average	-32.37
1	210.000000000 kHz	26.97	Quasi Peak	-36.23
1	218.000000000 kHz	27.43	Quasi Peak	-35.46
1	306.000000000 kHz	24.80	Quasi Peak	-35.27
1	314.000000000 kHz	26.10	Quasi Peak	-33.77
2	5.044000000 MHz	16.86	Average	-33.14
2	5.396000000 MHz	16.03	Average	-33.97
2	5.668000000 MHz	15.30	Average	-34.70
2	6.288000000 MHz	14.93	Average	-35.07

Other emissions present had amplitudes at least 20 dB below the limit.

Table 2 AC Line Conducted Emissions Data L2 (EUT-AC Adapter, SCB00500600P)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	150.000000000 kHz	12.45	Average	-43.55
1	150.000000000 kHz	26.52	Quasi Peak	-39.48
1	158.000000000 kHz	25.19	Quasi Peak	-40.38
1	170.000000000 kHz	27.00	Quasi Peak	-37.96
1	342.000000000 kHz	17.88	Quasi Peak	-41.27
1	394.000000000 kHz	18.24	Quasi Peak	-39.74
2	398.000000000 kHz	11.30	Average	-36.60
1	5.108000000 MHz	16.67	Quasi Peak	-43.33
2	5.120000000 MHz	9.13	Average	-40.87
2	5.420000000 MHz	9.24	Average	-40.76
2	5.704000000 MHz	8.88	Average	-41.12
2	6.324000000 MHz	8.59	Average	-41.41

Other emissions present had amplitudes at least 20 dB below the limit.

Table 3 AC Line Conducted Emissions Data L1 (EUT-AC Adapter, 362-00072-00)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	158.000000000 kHz	34.07	Quasi Peak	-31.50
2	158.000000000 kHz	28.63	Average	-26.93
2	198.000000000 kHz	28.76	Average	-24.94
1	198.000000000 kHz	32.53	Quasi Peak	-31.16
1	214.000000000 kHz	23.31	Quasi Peak	-39.74
2	238.000000000 kHz	28.21	Average	-23.95
2	278.000000000 kHz	25.81	Average	-25.07
2	358.000000000 kHz	34.59	Average	-14.19
1	358.000000000 kHz	39.74	Quasi Peak	-19.03
2	362.000000000 kHz	29.14	Average	-19.54
1	366.000000000 kHz	30.20	Quasi Peak	-28.39
1	382.000000000 kHz	28.40	Quasi Peak	-29.84

Other emissions present had amplitudes at least 20 dB below the limit.

Table 4 AC Line Conducted Emissions Data L2 (EUT-AC Adapter, 362-00072-00)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	28.17	Quasi Peak	-37.83
1	214.000000000 kHz	23.95	Quasi Peak	-39.10
2	318.000000000 kHz	16.00	Average	-33.76
1	318.000000000 kHz	23.68	Quasi Peak	-36.08
2	358.000000000 kHz	30.06	Average	-18.72
1	358.000000000 kHz	35.96	Quasi Peak	-22.81
1	370.000000000 kHz	25.81	Quasi Peak	-32.69
1	382.000000000 kHz	23.26	Quasi Peak	-34.97
2	954.000000000 kHz	15.85	Average	-30.15
2	994.000000000 kHz	16.41	Average	-29.59
2	1.350000000 MHz	16.05	Average	-29.95
2	13.244000000 MHz	10.81	Average	-39.19

Other emissions present had amplitudes at least 20 dB below the limit.

Table 5 AC Line Conducted Emissions Data L1 (EUT-AC Adapter, 362-00086-01)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	31.33	Quasi Peak	-34.67
2	178.000000000 kHz	33.12	Average	-21.46
1	178.000000000 kHz	40.25	Quasi Peak	-24.33
2	214.000000000 kHz	35.47	Average	-17.58
1	214.000000000 kHz	41.39	Quasi Peak	-21.66
2	250.000000000 kHz	30.09	Average	-21.67
2	286.000000000 kHz	22.37	Average	-28.27
1	314.000000000 kHz	24.38	Quasi Peak	-35.48
2	394.000000000 kHz	29.64	Average	-18.34
1	394.000000000 kHz	34.32	Quasi Peak	-23.66
1	418.000000000 kHz	34.15	Quasi Peak	-23.34
2	462.000000000 kHz	22.74	Average	-23.91

Other emissions present had amplitudes at least 20 dB below the limit.

Table 6 AC Line Conducted Emissions Data L2 (EUT-AC Adapter, 362-00086-01)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	29.96	Quasi Peak	-36.04
1	178.000000000 kHz	37.89	Quasi Peak	-26.69
2	178.000000000 kHz	26.67	Average	-27.91
1	210.000000000 kHz	38.46	Quasi Peak	-24.75
2	214.000000000 kHz	33.57	Average	-19.48
1	222.000000000 kHz	36.70	Quasi Peak	-26.04
1	246.000000000 kHz	34.84	Quasi Peak	-27.05
2	250.000000000 kHz	31.80	Average	-19.96
2	286.000000000 kHz	24.17	Average	-26.47
2	394.000000000 kHz	27.69	Average	-20.29
1	410.000000000 kHz	32.04	Quasi Peak	-25.61
2	694.000000000 kHz	22.71	Average	-23.29

Other emissions present had amplitudes at least 20 dB below the limit.

Table 7 AC Line Conducted Emissions Data L1 (EUT-AC Adapter, 362-00087-00)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	150.000000000 kHz	22.57	Average	-33.43
2	174.000000000 kHz	24.57	Average	-30.20
2	178.000000000 kHz	22.33	Average	-32.24
1	182.000000000 kHz	39.48	Quasi Peak	-24.91
2	182.000000000 kHz	20.27	Average	-34.12
1	186.000000000 kHz	39.57	Quasi Peak	-24.64
1	190.000000000 kHz	39.67	Quasi Peak	-24.36
1	194.000000000 kHz	39.67	Quasi Peak	-24.19
2	198.000000000 kHz	20.06	Average	-33.64
1	198.000000000 kHz	39.36	Quasi Peak	-24.34
2	202.000000000 kHz	19.79	Average	-33.74
1	202.000000000 kHz	38.95	Quasi Peak	-24.58

Other emissions present had amplitudes at least 20 dB below the limit.

Table 8 AC Line Conducted Emissions Data L2 (EUT-AC Adapter, 362-00087-00)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	150.000000000 kHz	15.19	Average	-40.81
2	170.000000000 kHz	15.27	Average	-39.69
2	174.000000000 kHz	14.66	Average	-40.11
2	178.000000000 kHz	13.70	Average	-40.88
2	182.000000000 kHz	13.10	Average	-41.30
2	186.000000000 kHz	12.86	Average	-41.35
1	186.000000000 kHz	35.72	Quasi Peak	-28.49
1	190.000000000 kHz	35.41	Quasi Peak	-28.62
1	194.000000000 kHz	35.44	Quasi Peak	-28.42
1	198.000000000 kHz	36.72	Quasi Peak	-26.97
1	202.000000000 kHz	34.37	Quasi Peak	-29.16
1	214.000000000 kHz	32.42	Quasi Peak	-30.63

Other emissions present had amplitudes at least 20 dB below the limit.

Table 9 AC Line Conducted Emissions Data L1 (EUT-USB-CPU)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	942.000000000 kHz	43.18	Quasi Peak	-12.82
2	1.034000000 MHz	29.13	Average	-16.87
1	1.074000000 MHz	43.92	Quasi Peak	-12.08
2	1.162000000 MHz	26.64	Average	-19.36
2	1.206000000 MHz	30.72	Average	-15.28
1	1.562000000 MHz	44.51	Quasi Peak	-11.49
2	1.606000000 MHz	30.00	Average	-16.00
1	1.714000000 MHz	38.87	Quasi Peak	-17.13
1	2.274000000 MHz	38.79	Quasi Peak	-17.21
2	2.282000000 MHz	30.74	Average	-15.26
2	3.238000000 MHz	33.52	Average	-12.48
1	3.254000000 MHz	42.57	Quasi Peak	-13.43

Other emissions present had amplitudes at least 20 dB below the limit.

Table 10 AC Line Conducted Emissions Data L2 (EUT-USB-CPU)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	690.000000000 kHz	21.57	Average	-24.43
1	958.000000000 kHz	42.43	Quasi Peak	-13.57
2	958.000000000 kHz	35.55	Average	-10.45
1	1.102000000 MHz	39.36	Quasi Peak	-16.64
2	1.138000000 MHz	40.09	Average	-5.91
2	1.282000000 MHz	36.84	Average	-9.16
1	1.574000000 MHz	38.34	Quasi Peak	-17.66
2	1.914000000 MHz	35.99	Average	-10.01
1	1.930000000 MHz	38.94	Quasi Peak	-17.06
1	2.150000000 MHz	35.95	Quasi Peak	-20.05
2	2.718000000 MHz	26.21	Average	-19.79
1	2.850000000 MHz	40.94	Quasi Peak	-15.06

Other emissions present had amplitudes at least 20 dB below the limit.

Table 11 Radiated Emissions (EUT AC Adapter, SCB0500600P)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
43.2	25.1	20.3	N/A	31.1	26.8	N/A	40.0
47.5	22.6	16.5	N/A	27.0	20.9	N/A	40.0
132.9	31.1	26.6	N/A	21.6	14.3	N/A	43.5
166.5	18.5	13.8	N/A	20.3	14.7	N/A	43.5
193.3	19.3	14.8	N/A	13.2	7.7	N/A	43.5
323.1	14.8	9.2	N/A	16.9	11.3	N/A	46.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency range below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 12 Radiated Emissions (EUT AC Adapter, 362-00072-00)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
50.6	28.7	22.9	N/A	26.1	19.8	N/A	40.0
51.2	23.1	18.9	N/A	30.9	19.8	N/A	40.0
51.9	24.8	19.7	N/A	32.9	20.8	N/A	40.0
54.0	23.4	19.6	N/A	30.5	23.3	N/A	40.0
145.1	26.3	20.0	N/A	24.5	17.7	N/A	43.5
145.6	26.2	20.2	N/A	22.7	16.9	N/A	43.5

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency range below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 13 Radiated Emissions (EUT AC Adapter, 362-00086-01)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
157.6	24.4	18.8	N/A	18.8	14.1	N/A	43.0
173.9	23.2	17.2	N/A	19.1	12.8	N/A	43.0
178.8	24.4	19.6	N/A	18.7	12.1	N/A	43.0
183.8	23.8	17.7	N/A	16.3	10.6	N/A	43.0
184.2	23.2	18.5	N/A	16.3	10.2	N/A	43.0
184.5	23.2	18.7	N/A	17.1	10.9	N/A	43.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency range below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 14 Radiated Emissions (EUT AC Adapter, 362-00087-00)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
49.2	24.2	17.1	N/A	26.4	20.5	N/A	40.0
49.5	24.1	17.3	N/A	27.2	20.6	N/A	40.0
50.1	23.2	17.5	N/A	25.9	19.5	N/A	40.0
50.7	24.6	17.3	N/A	26.9	19.7	N/A	40.0
53.7	21.7	16.2	N/A	27.0	19.6	N/A	40.0
54.3	22.5	17.1	N/A	27.9	20.5	N/A	40.0
131.6	31.1	26.0	N/A	20.7	15.1	N/A	43.5
323.1	18.8	10.8	N/A	16.2	11.3	N/A	46.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency range below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 15 Radiated Emissions (EUT-USB-CPU)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)
86.4	27.9	19.3	N/A	33.2	30.7	N/A	40.0
87.0	28.9	20.1	N/A	33.5	30.2	N/A	40.0
96.0	32.3	27.8	N/A	35.3	27.7	N/A	43.5
101.8	30.0	24.1	N/A	30.3	24.1	N/A	43.5
110.7	29.9	25.7	N/A	31.4	27.8	N/A	43.5
132.0	31.8	26.2	N/A	25.4	20.9	N/A	43.5
144.2	30.7	26.6	N/A	30.1	25.2	N/A	43.5
159.7	34.9	19.8	N/A	43.1	22.4	N/A	43.5
166.5	28.5	21.1	N/A	25.1	20.1	N/A	43.5
258.0	30.7	26.0	N/A	26.9	22.9	N/A	46.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency range below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Summary Of Results

AC Line Conducted Emissions Results

The EUT demonstrated compliance with the AC Line Conducted Emissions requirements of 47 CFR Part 15B and other applicable Class B emissions requirements. The EUT AC Adapter worst-case configuration demonstrated a minimum margin of -14.10 dB below the 47 CFR 15B Class B limit. The EUT-USB-CPU worst-case configuration demonstrated a minimum margin of -5.9 dB below the 47 CFR 15B Class B limit. Other emissions were present with amplitudes at least 20 dB below the limit and worst-case amplitudes recorded.

Radiated Emissions Results

The EUT demonstrated compliance with the radiated emissions requirements of 47 CFR Part 15B Class B emissions requirements. The EUT AC Adapter (SCB0500600P) configuration demonstrated a minimum margin of -13.2 dB below the 47 CFR Part 15B Class B limit. The EUT AC Adapter (362-00072-00) configuration demonstrated a minimum margin of -16.7 dB below the 47 CFR Part 15B Class B limit. The EUT AC Adapter (362-00086-01) configuration demonstrated a minimum margin of -23.4 dB below the 47 CFR Part 15B Class B limit. The EUT AC Adapter (362-00087-00) configuration demonstrated a minimum margin of -17.5 dB below the 47 CFR Part 15B Class B limit. The EUT-USB-CPU configuration demonstrated a minimum margin of -9.3 dB below the 47 CFR Part 15B and CISPR Class B limit. Other emissions were present with amplitudes at least 20 dB below the limit and worst-case amplitudes recorded.

Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Rogers Labs Test Equipment List
- Annex C Rogers Qualifications
- Annex D FCC Site Registration Letter
- Annex E Industry Canada Site Registration Letter
- Annex F Photographs of Radiated Emissions Test Setup
- Annex G Photographs of Radiated Emissions Test Setup
- Annex H Photographs of Equipment Under Test

Annex A Measurement Uncertainty Calculations

Measurement uncertainty calculations were made for the laboratory. Result of measurement uncertainty calculations are recorded below for AC line conducted and radiated emission measurements.

Measurement Uncertainty	$U_{(E)}$	$U_{(lab)}$
3 Meter Horizontal 30-200 MHz Measurements	2.08	4.16
3 Meter Vertical 30-200 MHz Measurements	2.16	4.33
3 Meter Vertical Measurements 200-1000 MHz	2.99	5.97
10 Meter Horizontal Measurements 30-200 MHz	2.07	4.15
10 Meter Vertical Measurements 30-200 MHz	2.06	4.13
10 Meter Horizontal Measurements 200-1000 MHz	2.32	4.64
10 Meter Vertical Measurements 200-1000 MHz	2.33	4.66
3 Meter Measurements 1-6 GHz	2.57	5.14
3 Meter Measurements 6-18 GHz	2.58	5.16
AC Line Conducted	1.72	3.43

Annex B Rogers Labs Test Equipment List

List of Test Equipment	Calibration Date	Due
Spectrum Analyzer: Rohde & Schwarz ESU40	5/15	5/16
Spectrum Analyzer: HP 8562A, HP Adapters: 11518, 11519, and 11520 Mixers: 11517A, 11970A, 11970K, 11970U, 11970V, 11970W	5/15	5/16
Spectrum Analyzer: HP 8591EM	5/15	5/16
Antenna: EMCO Biconilog Model: 3143	5/15	5/16
Antenna: Sunol Biconilog Model: JB6	10/14	10/15
Antenna: EMCO Log Periodic Model: 3147	10/14	10/15
Antenna: Com Power Model: AH-118	10/14	10/16
Antenna: Com Power Model: AH-840	5/15	5/17
Antenna: Antenna Research Biconical Model: BCD 235	10/14	10/15
Antenna: EMCO 6509	10/14	10/15
LISN: Compliance Design Model: FCC-LISN-2.Mod.cd, 50 μHy/50 ohm/0.1 μf	10/14	10/15
R.F. Preamp CPPA-102	10/14	10/15
Attenuator: HP Model: HP11509A	10/14	10/15
Attenuator: Mini Circuits Model: CAT-3	10/14	10/15
Attenuator: Mini Circuits Model: CAT-3	10/14	10/15
Cable: Belden RG-58 (L1)	10/14	10/15
Cable: Belden RG-58 (L2)	10/14	10/15
Cable: Belden 8268 (L3)	10/14	10/15
Cable: Time Microwave: 4M-750HF290-750	10/14	10/15
Cable: Time Microwave: 10M-750HF290-750	10/14	10/15
Frequency Counter: Leader LDC825	2/15	2/16
Oscilloscope Scope: Tektronix 2230	2/15	2/16
Wattmeter: Bird 43 with Load Bird 8085	2/15	2/16
Power Supplies: Sorensen SRL 20-25, SRL 40-25, DCR 150, DCR 140	2/15	2/16
R.F. Generators: HP 606A, HP 8614A, HP 8640B	2/15	2/16
R.F. Power Amp 65W Model: 470-A-1010	2/15	2/16
R.F. Power Amp 50W M185- 10-501	2/15	2/16
R.F. Power Amp A.R. Model: 10W 1010M7	2/15	2/16
R.F. Power Amp EIN Model: A301	2/15	2/16
LISN: Compliance Eng. Model 240/20	2/15	2/16
LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08	2/15	2/16
Antenna: EMCO Dipole Set 3121C	2/15	2/16
Antenna: C.D. B-101	2/15	2/16
Antenna: Solar 9229-1 & 9230-1	2/15	2/16
Audio Oscillator: H.P. 201CD	2/15	2/16
ELGAR Model: 1751	2/15	2/16
ELGAR Model: TG 704A-3D	2/15	2/16
ESD Test Set 2010i	2/15	2/16
Fast Transient Burst Generator Model: EFT/B-101	2/15	2/16
Field Intensity Meter: EFM-018	2/15	2/16
KEYTEK Ecat Surge Generator	2/15	2/16

Annex C Rogers Qualifications

Scot D. Rogers, Engineer

Rogers Labs, Inc.

Mr. Rogers has approximately 17 years experience in the field of electronics. Work experience includes six years working in the automated controls industry and remaining years working with the design, development and testing of radio communications and electronic equipment.

Positions Held:

Systems Engineer:	A/C Controls Mfg. Co., Inc.	6 Years
Electrical Engineer:	Rogers Consulting Labs, Inc.	5 Years
Electrical Engineer:	Rogers Labs, Inc.	Current

Educational Background:

1) Bachelor of Science Degree in Electrical Engineering from Kansas State University

2) Bachelor of Science Degree in Business Administration Kansas State University

3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

NVLAP Lab Code: 200087-0

Annex D FCC Test Site Registration Letter

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

April 16, 2015

Registration Number: 90910

Rogers Labs, Inc.
4405 West 259th Terrace
Louisburg, KS 66053

Attention: Scot Rogers,

Re: Measurement facility located at Louisburg
3 & 10 meter site
Date of Renewal: April 16, 2015

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Industry Analyst

NVLAP Lab Code: 200087-0

Annex E Industry Canada Test Site Registration Letter

Industry Canada Industrie Canada

June 08, 2015

OUR FILE: 46405-3041
Authorization No: 010277847-001

Rogers Labs Inc.
4405 West 259th Terrace
Louisburg, KS
USA
66053

Attention: Mr. Scot D. Rogers

Dear Sir:

The Bureau has received your application for the renewal of 3m OATS. Be advised that the information received was satisfactory to Industry Canada. The following number(s) is now associated to the site(s) for which registration / renewal was sought **(Site# 3041A-1).** Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please keep for your records the following information;

- The company address code associated to the site(s) located at the above address is: **3041A**

Furthermore, to obtain or renew a unique site number, the applicant shall demonstrate that the site has been accredited to ANSI C63.4-2009 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2009 or later shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 metre OATS or 3 metre chamber). If the test facility is not accredited to ANSI C63.4-2009 or later, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Bureau will evaluate the filing to determine if recognition shall be granted.

The frequency for re-validation of the test site and the information that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site re-validation shall occur on an interval not to **exceed three years**. There is no fee or form associated with an OATS filing. OATS submissions are encouraged to be submitted electronically to the Bureau using the following URL; http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/en/h_tt00052e.html.

If you have any questions, you may contact the Bureau by e-mail at certification.bureau@ic.gc.ca Please reference our file and submission number above for all correspondence.

Yours sincerely,

Bill Payn
For: Wireless Laboratory Manager
Certification and Engineering Bureau
3701 Carling Ave., Building 94
P.O. Box 11490, Station AH@
Ottawa, Ontario K2H 8S2
Email: certification.bureau@ic.gc.ca