National Technical Systems Test Report for Electromagnetic Interference (EMI) Testing of the DS950

Prepared For
Pro V&V, Inc. | 6705 Odyssey Dr NW Ste C | Huntsville, AL 35806

Prepared By
National Technical Systems | 1736 Vista View Drive | Longmont, CO. 80504 | (303) 776-7249 |

Greg Gagne
Technical Writer

Michael Darling
EMI Department Manager

Revision History

Rev.	Description	Issue Date
0	ETR-PR120980	10/29/2020

Table of Contents

List of Tables

1.0 Introduction

This document presents the test procedures used and the results obtained during the performance of an Electromagnetic Interference test program. The test program was conducted to assess the ability of the specified Equipment Under Test (EUT) to successfully satisfy the requirements listed in Section 2.0.

2.0 References

The following references listed below form a part of this document to the extent specified herein.

- Pro V&V, Inc. Purchase Order(s) 2020-004, dated 07/01/2020
- National Technical Systems (NTS) Quote(s) OP0554725, dated 06/24/2020
- NTS Corporate Quality Policy Manual, Revision 9, dated 9/20/2018
- ISO/IEC 17025:2017(E) *General Requirements for the Competence of Testing and Calibration Laboratories,* dated 11/1/2017
- Test Specification: FCC Part 15

3.0 Product Selection and Description

Pro V&V, Inc. selected and provided the test sample(s) to be used as the Equipment Under Test. Details below:

Table 3.0-1: Product Identification - Equipment Under Test (EUT)

Item	Qty.	Name/Description	Part Number	Serial Number
1	1	DS950	DS950	DS9520070511

3.1 Security Classification

Non-classified

4.0 General Test Requirements

4.1 Test Equipment

NTS-provided equipment is calibrated according to ISO/IEC 17025:2017(E) and calibration is traceable to the National Institute of Standards and Technology (NIST). Calibration records are maintained on file at NTS.

4.2 Measurement Uncertainties

Measurement uncertainty data is available upon request.

4.3 Notice of Deviation

In accordance with NTS' quality procedures, when the EUT is observed to exceed or display susceptibility, a Notice of Deviation (NOD) document is generated by the technician performing the test. This NOD documents the requirement, how the EUT deviated from the requirement, and allows room for resolution of the deviation.

This document is reviewed and approved by the NTS Program Manager or Engineer and the NTS Quality Assurance Representative, and then forwarded to the customer contact. Once mitigated (or passed over), the steps taken to correct the deviation (or simply instruction from the customer to continue testing) are recorded in the NOD and a copy of the NOD is integrated into the body of the report, in the appropriate location.

5.0 Test Descriptions and Results

Table 5.0-1: Summary of Test Information & Results

Section	Test	Specification	Test Facility	Test Date	Part #	Serial #	Test Result*
5.1	Radiated Emissions, 30 MHz - 1 GHz	FCC Part 15	Longmont	09/09/2020 - 09/09/2020	DS950	DS9520070511	Complied
5.2	Conducted Emissions, 150 kHz - 30 MHz	FCC Part 15	Longmont	09/09/2020 - 09/09/2020	DS950	DS9520070511	Complied

*The decision rule used to state compliance is in accordance with the test specification used for testing. Unless otherwise noted, testing was performed in accordance with the latest published version of test specification at time of test.

5.1 Radiated Emissions, 30 MHz - 1 GHz

Radiated Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m1
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020
Temperature:	24˚C Humidity: 38%	Pressure:	846mb
Input Voltage:	120Vac/60Hz		
Configuration of Unit:	Normal Operating Mode		
Test Engineer:	Kevin Johnson		

B80803-11-RE.doc FR0100

Type	Frequency (MHz)	Level (dBuV)	Transducer (dB/m)	Gain / Loss (dB)	Final (dBuV/m)	Azm(deg)/Pol/Hgt(m)	Margin: FCC Class B QP (dB)
QP	200.003	43.2	17.3	-30.4	30.1	3/V-Pole/1.00	2.89
QP	235.019	35.7	15.6	-30.4	20.9	353/V-Pole/1.00	14.61
QP	328.719	31.8	18.3	-30.1	20.1	351/V-Pole/3.83	15.47
QP	334.888	28.0	18.2	-30.1	16.1	353/V-Pole/3.21	19.44
QP	347.531	29.3	18.4	-30.0	17.7	29/V-Pole/3.20	17.88
QP	434.141	24.8	20.9	-29.8	15.9	238/H-Pole/2.30	19.64
QP	496.425	24.7	22.1	-29.6	17.2	217/V-Pole/2.86	18.33
QP	585.997	25.9	22.8	-29.3	19.3	308/V-Pole/3.72	16.23

The highest emission measured was at **200.003 MHz,** which was **2.89 dB** below the limit.

- "Type" refers to the type of measurement performed. The type of measurement made is based on the requirements of the particular standard:
  - PK = Peak Measurement: RBW is 120kHz, VBW is 3 MHz
  - QP = Quasi-Peak Measurement: RBW is 120kHz, VBW is 3 MHz, and QP Detection is ENABLED
  - AV = Video Average Measurement: RBW is 1 MHz, VBW is 10 Hz
- The "field strength" (FS) emissions level is attained by adding the received amplitude measured (RA), Antenna factor (AF), and cable factor (CF) minus the amplifier gain (AG). FS = RA + AF + CF – AG .Final measurements are made with the Azimuth, Polarity, Height, and EUT Cables positioned for maximum radiation. If applicable, cables positions are noted in the test log. (Sample Calculation: 49.6 dBuV + 11.4 dB/m – 28.8 dB (CF/AG) = 32.2 dBuV/m. **Important Note**: This is a sample calculation only for the purpose of demonstration, and does not reflect data in this report.)
- The "Azm/Pol/Hgt" indicates the turn-table *azimuth*, the antenna *polarity*, and the antenna *height* where the maximum emissions level was measured.
- The "Margin" is with reference to the emissions limit. A positive number indicates that the emission measurement is below the limit. A negative number indicates that the emission measurement exceeds the limit.
- The PRESCAN is a peak measurement and is performed with the RBW set to 120 kHz, VBW set to 3 MHz (30 MHz to 1 GHz), and the RBW set to 1 MHz, VBW set to 100 kHz (> 1 GHz)

Radiated Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m1
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-RE.doc FR0100

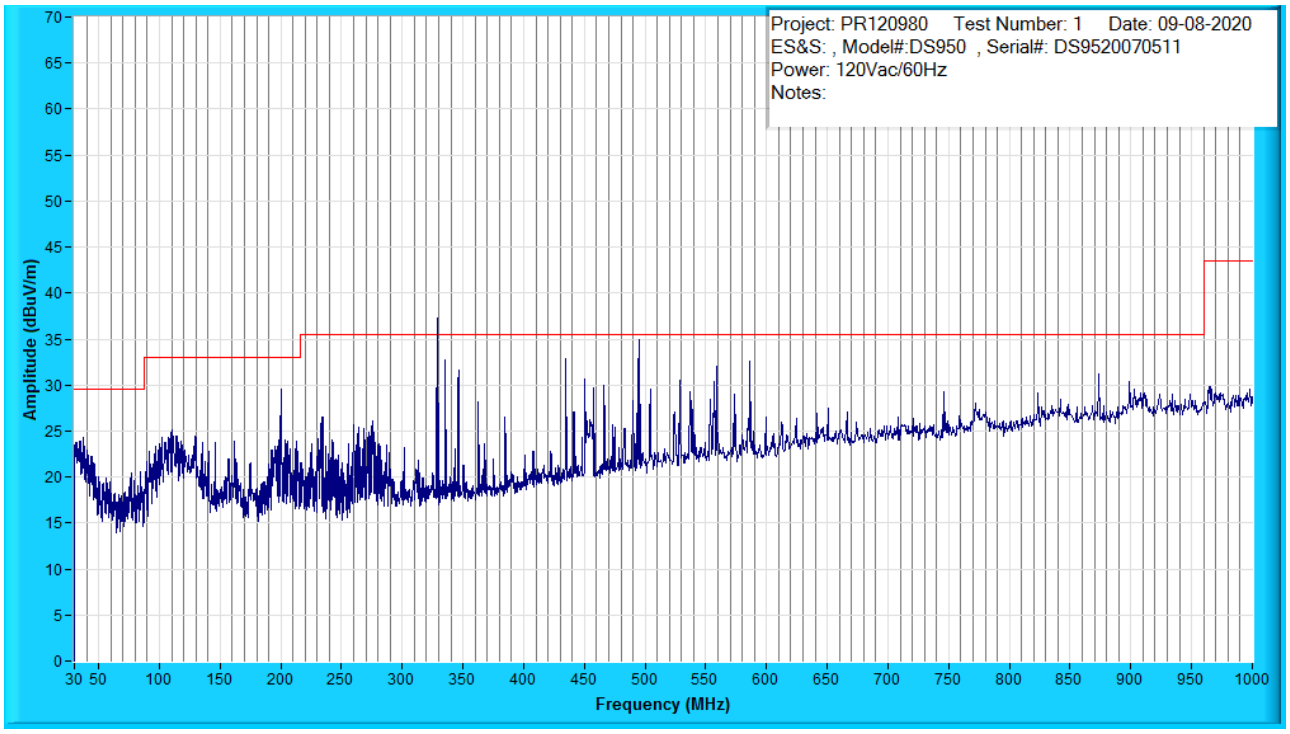

Figure A1: Radiated Emissions Prescan, 30MHz to 1000MHz, Peak Measurements at 10m Distance

Radiated Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m1
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-RE.doc FR0100

Figure A2: Radiated Emissions Test Setup – Front Side

Radiated Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m1
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-RE.doc FR0100

Figure A3: Radiated Emissions Test Setup – Right Side

Radiated Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m1
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-RE.doc FR0100

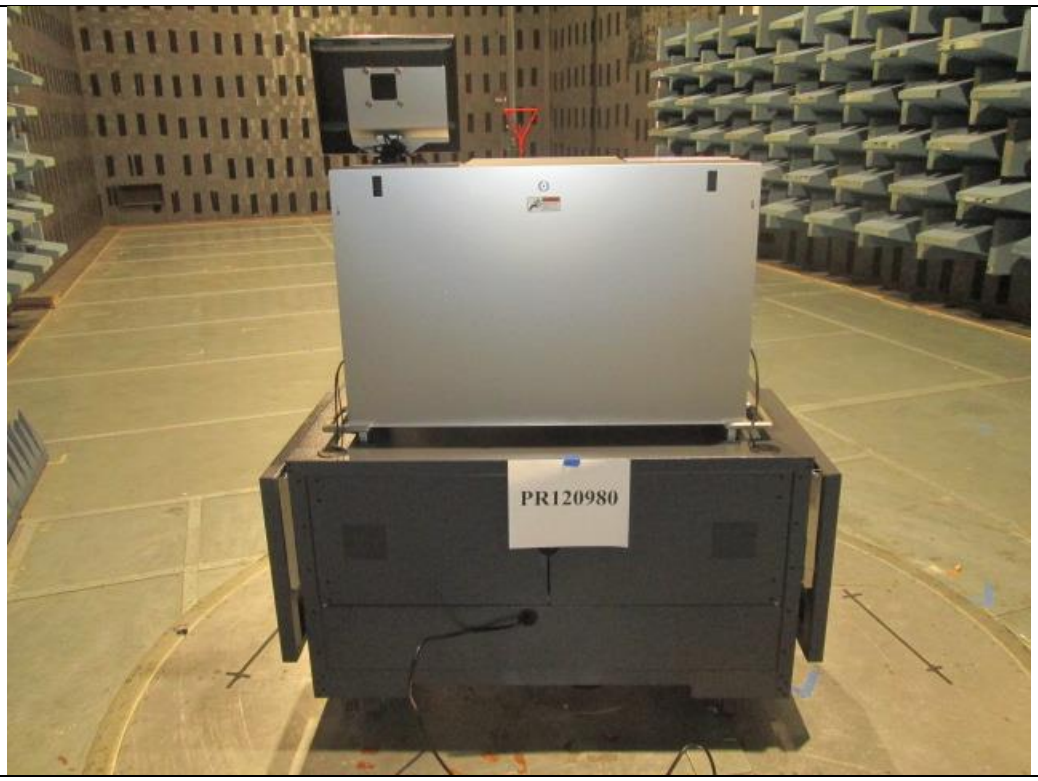

Figure A4: Radiated Emissions Test Setup – Back Side

Radiated Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m1
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-RE.doc FR0100

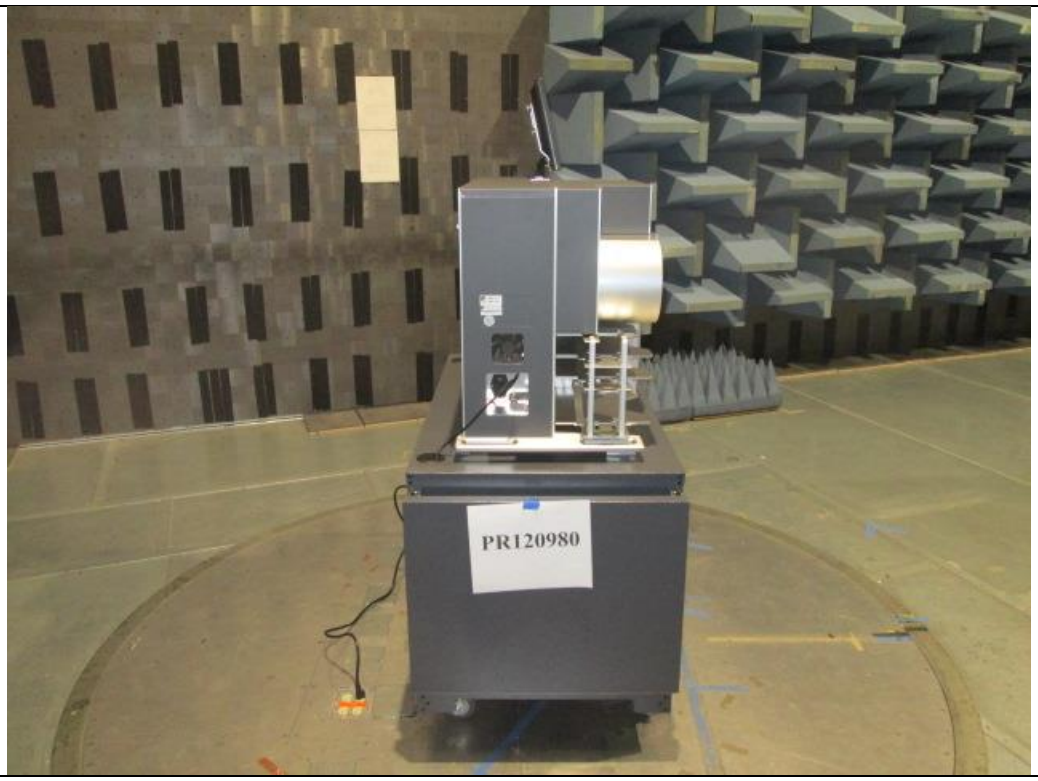

Figure A5: Radiated Emissions Test Setup – Left Side

Radiated Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980B80803
Customer Representative:	Michael Walker	Test Area:	10m1
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-RE.doc FR0100

Test Equipment List

ID Number	Manufacturer	Model #	Serial #	Description	Cal Date	Cal Due
1041	Fluke	83-3	70130434	Multimeter/Frequency Meter	06/29/2020	06/29/2021
1219	Mini-Circuits	ZKL-2	062905	Preamp, 10 - 2000 MHz, 30 dB	05/20/2020	05/20/2021
1223	Hewlett Packard	85650A	3303A01859	Quasi-Peak Adaptor	04/01/2020	04/01/2021
1232	Sunol Sciences	JB1	A071605-2	Bilog Antenna, 30 MHz to 2.0 GHz	09/25/2019	09/25/2021
1233	Sunol Sciences	SC104V	110305-1	Positioning Controller	NA	NA
1234	CIR Enterprises	10m Chamber	001	10m Chamber with 2.5m turntable	05/28/2019	05/28/2021
1335	Hewlett Packard	85662A	2542A10937	Spectrum Analyzer Display	04/01/2020	04/01/2021
1336	Hewlett Packard	8566B	2532A02062	Spectrum Analyzer RF Section	04/01/2020	04/01/2021
1338	Hewlett Packard	85685A	3506A01551	RF Preselector	04/01/2020	04/01/2021
1591	EMCI	CEAS	V4.1.1	Commercial Emissions Automation Software - 10 M#1	NA	NA
1901	EXTECH	445703	0617	Hygrometer-Thermometer (WC059899)	06/29/2020	06/29/2021

5.2 Conducted Emissions, 150 kHz - 30 MHz

Conducted Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m1
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020
Temperature:	24˚C Humidity: 38%	Pressure:	846mb
Input Voltage:	120Vac/60Hz		
Configuration of Unit:	Normal Operating Mode		
Test Engineer:	Kevin Johnson		

B80803-11-CE.doc FR0100

Type	Frequency (MHz)	Level (dBuV)	Transducer (dB)	Gain / Loss (dB)	Final (dBuV)	Test Point	Margin: FCC Class B AV (dB)	Margin: FCC Class B QP (dB)
AV	0.302	12.6	0.0	16.1	28.7	Line 1	22.94	-
QP	0.302	16.6	0.0	16.1	32.7	Line 1	-	28.99
AV	0.452	5.8	0.0	16.1	21.9	Line 1	25.48	-
QP	0.452	12.7	0.0	16.1	28.8	Line 1	-	28.57
AV	0.583	4.2	0.0	16.1	20.3	Line 1	25.72	-
QP	0.583	11.8	0.0	16.1	28.0	Line 1	-	28.04
AV	0.715	3.7	0.0	16.1	19.8	Line 1	26.15	-
QP	0.715	9.7	0.0	16.1	25.8	Line 1	-	30.16
AV	2.082	2.5	0.0	16.2	18.7	Line 1	27.27	-
QP	2.082	7.8	0.0	16.2	24.0	Line 1	-	31.99
AV	2.398	2.5	0.1	16.2	18.7	Line 1	27.30	-
QP	2.398	8.2	0.1	16.2	24.4	Line 1	-	31.60
AV	0.352	10.8	0.0	16.1	26.9	Neutral	23.35	-
QP	0.352	16.3	0.0	16.1	32.4	Neutral	-	27.83
AV	0.486	7.6	0.0	16.1	23.7	Neutral	22.67	-
QP	0.486	12.5	0.0	16.1	28.6	Neutral	-	27.78
AV	0.563	5.0	0.0	16.1	21.2	Neutral	24.82	-
QP	0.563	11.7	0.0	16.1	27.8	Neutral	-	28.20
AV	1.969	4.3	0.0	16.2	20.5	Neutral	25.47	-
QP	1.969	7.4	0.0	16.2	23.7	Neutral	-	32.34
AV	2.398	2.2	0.1	16.2	18.5	Neutral	27.50	-
QP	2.398	8.1	0.1	16.2	24.3	Neutral	-	31.70
AV	8.414	1.9	0.3	16.1	18.3	Neutral	31.70	-
QP	8.414	7.7	0.3	16.1	24.0	Neutral	-	35.98

The highest emission measured was at **0.486 MHz,** which was **22.67 dB** below the limit.

- "Type" refers to the type of measurement performed. The type of measurement made is based on the requirements of the particular standard:
  - PK = Peak Measurement: RBW is 9 kHz, VBW is 3 MHz
  - QP = Quasi-Peak Measurement: RBW is 9 kHz, VBW is 3 MHz, and QP Detection is ENABLED
  - AV = Video Average Measurement: RBW is 9 kHz, VBW is 10 Hz
- The "field strength" (FS) emissions level is attained by adding the received amplitude measured (RA), Antenna factor (AF), and cable factor (CF) minus the amplifier gain (AG). FS = RA + AF + CF – AG .Final measurements are made with the Azimuth, Polarity, Height, and EUT Cables positioned for maximum radiation. If applicable, cables positions are noted in the test log. (Sample Calculation: 49.6 dBuV + 11.4 dB/m – 28.8 dB (CF/AG) = 32.2 dBuV/m. **Important Note**: This is a sample calculation only for the purpose of demonstration, and does not reflect data in this report.)
- The "TestPoint" indicates which AC or DC input power line or which I/O cable the measurement was made on.
- The "Margin" is with reference to the emissions limit. A positive number indicates that the emission measurement is below the limit. A negative number indicates that the emission measurement exceeds the limit.
- The PRESCAN is a peak measurement and is performed with the RBW set to 9 kHz, and the VBW set to 3 MHz

Conducted Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m2
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-CE.doc FR0100

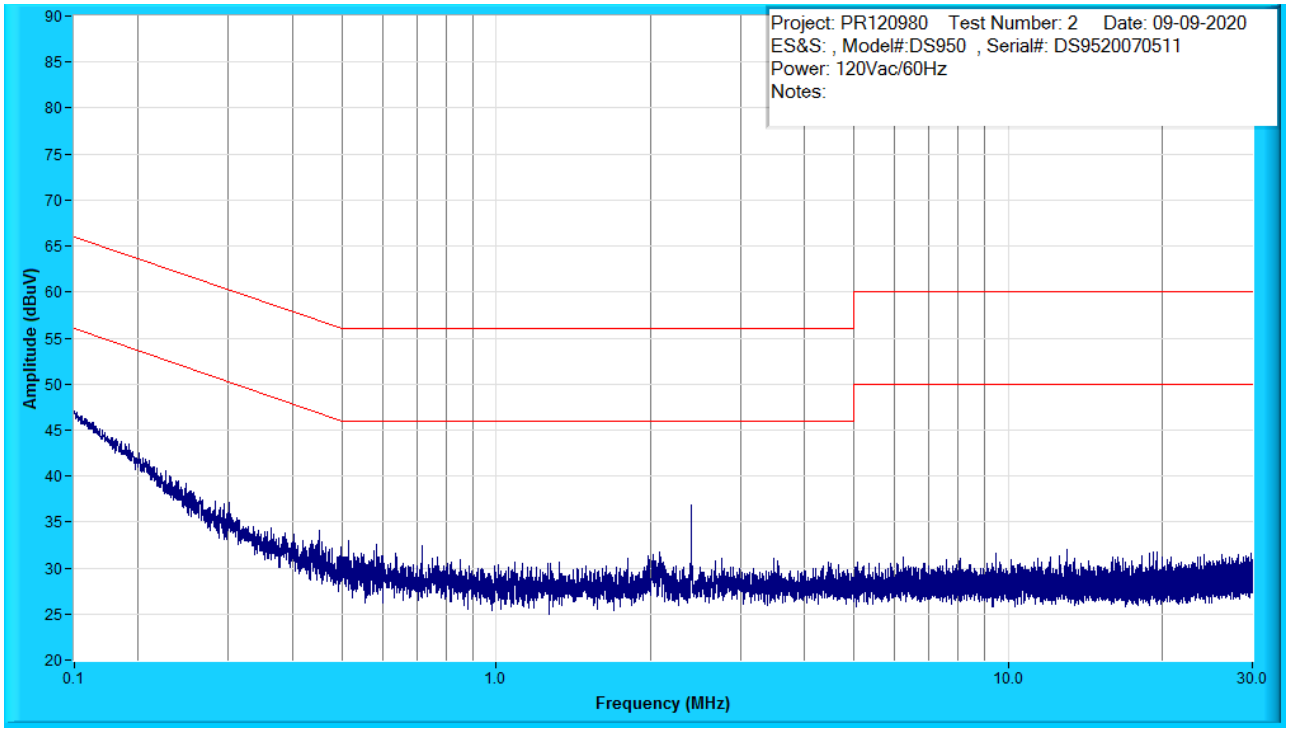

Figure B1: Conducted Emissions Prescan, Line 1, 0.150MHz to 30MHz, Peak Measurements

Conducted Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m2
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-CE.doc FR0100

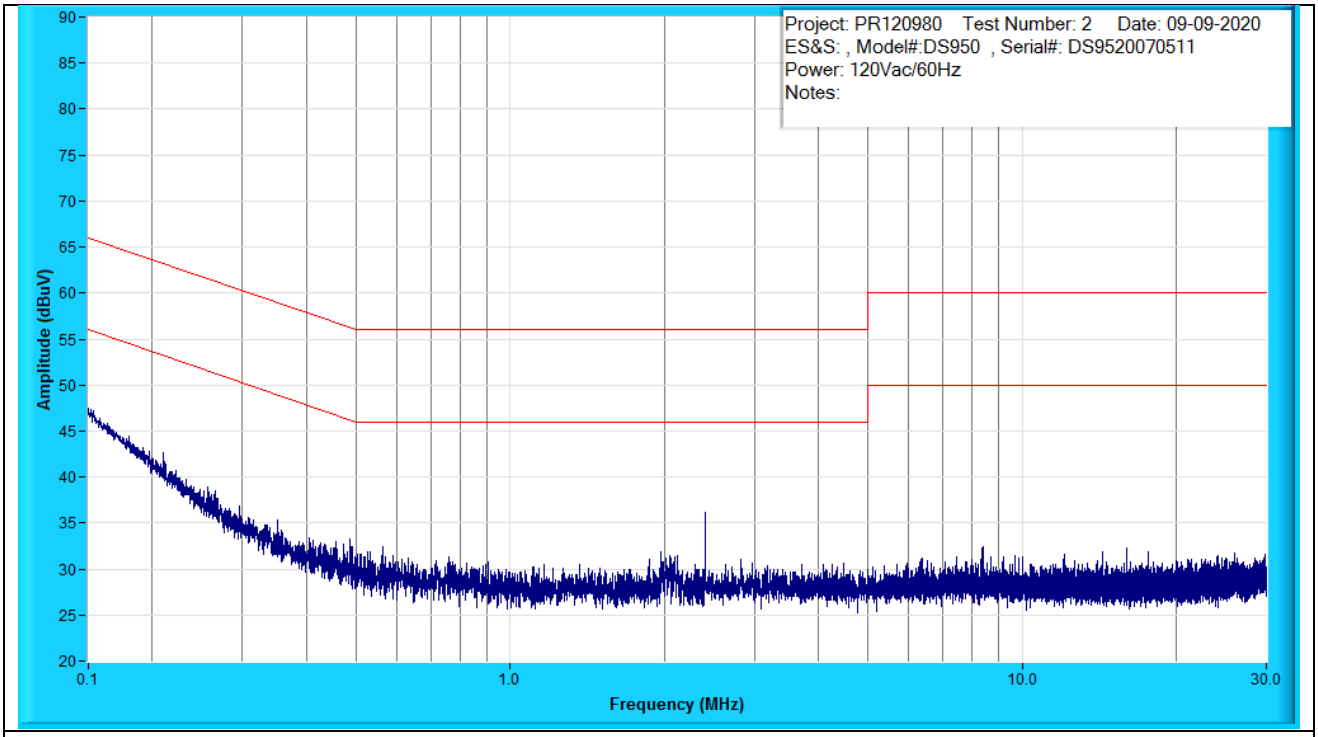

Figure B2: Conducted Emissions Prescan, Neutral, 0.150MHz to 30MHz, Peak Measurements

Conducted Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m2
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-CE.doc FR0100

Figure B3: Conducted Emissions Prescan

Conducted Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m2
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-CE.doc FR0100

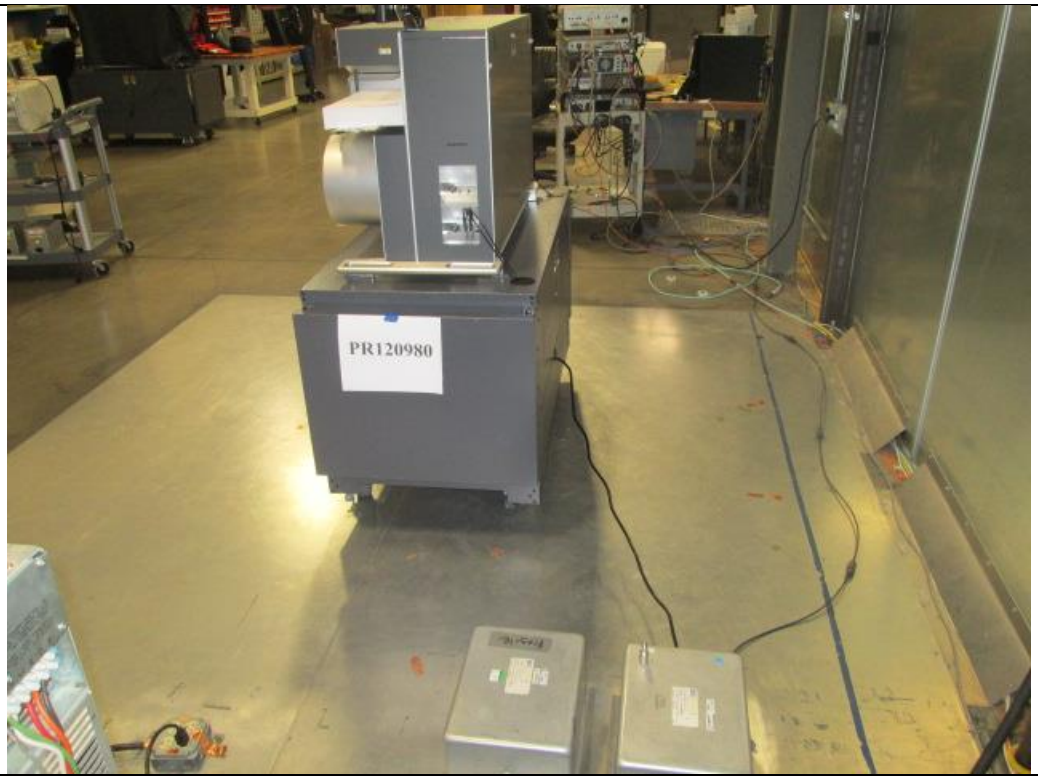

Figure B4: Conducted Emissions Prescan

Conducted Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m2
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-CE.doc FR0100

Figure B5: Conducted Emissions Prescan

Conducted Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980/B80803
Customer Representative:	Michael Walker	Test Area:	10m2
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-CE.doc FR0100

Figure B6: Conducted Emissions Prescan

Conducted Emissions, FCC Part 15

Manufacturer:	ES&S	Project Number:	PR120980B80803
Customer Representative:	Michael Walker	Test Area:	10m2
Model:	DS950	S/N:	DS9520070511
Standard Referenced:	FCC Part 15	Date:	September 9, 2020

B80803-11-CE.doc FR0100

Test Equipment List

ID Number	Manufacturer	Model #	Serial #	Description	Cal Date	Cal Due
1041	Fluke	83-3	70130434	Multimeter/Frequency Meter	06/29/2020	06/29/2021
1200	Agilent Technology	11947A	3107A03807	Transient Limiter, 9 kHz to 200 MHz	04/24/2020	04/24/2021
1223	Hewlett Packard	85650A	3303A01859	Quasi-Peak Adaptor	04/01/2020	04/01/2021
1233	Sunol Sciences	SC104V	110305-1	Positioning Controller	NA	NA
1234	CIR Enterprises	10m Chamber	001	10m Chamber with 2.5m turntable	05/28/2019	05/28/2021
1336	Hewlett Packard	8566B	2532A02062	Spectrum Analyzer RF Section	04/01/2020	04/01/2021
1338	Hewlett Packard	85685A	3506A01551	RF Preselector	04/01/2020	04/01/2021
1556	EMCI	EMCI, 2 Phase LISN	10	150 kHz to 30 MHz, 277 Vac/400 Vdc, 50/60 Hz, 16 A	04/23/2020	04/23/2021
1591	EMCI	CEAS	V4.1.1	Commercial Emissions Automation Software - 10 M#1	NA	NA
1901	EXTECH	445703	0617	Hygrometer-Thermometer (WC059899)	06/29/2020	06/29/2021

6.0 Test Log

EMI Test Log

Manufacturer:	Pro V&V (ES&S)	Project Number:	PR120980/B80803
Model:	DS950	S/N:	DS9520070511
Customer Representative:	Michael Walker		
Standard Referenced:	FCC Pat 15		

FR0105

10m Emissions

Test	Test Code	Date	Event	OT	Time (hrs)	Result	Initials
RE		September 9, 2020 0930-1100	Test#1: 30MHz – 1GHz, 8 rads, 4 heights, 3 second dwell, ref level = 80dBu, 10-meter distance 120Vac/60Hz		1.5	Pass	KJ
CE		1100-1200	Test#2:150kHz – 30MHz 120Vac/60Hz NOTE: CE comb generator not functioning, no CE pretest available		1.0	Pass	KJ

End of Report