



Report Number: R13158070-E2
Issue Date: 2020-03-20
Product: Toothbrush Charging Base
Model Number: 3783

Electromagnetic Compatibility Test Report

For

**Braun GMBH
T-QTA Frankfurter Strasses 145
Kronberg TS, D-61476
Germany**



NVLAP Lab code: 200246-0

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TEST REPORT DETAILS

Tests Performed By:	UL LLC 12 LABORATORY DR. RESEARCH TRIANGLE PARK, NC 27709, U.S.A.
Tests Performed For:	Braun GMBH T-QTA Frankfurter Strasses 145 Kronberg TS, D-61476 Germany
Issue Date:	2020-03-20
Model Number Tested:	3783
Sample Serial Number:	BW012969000010
Applicable Standards:	FCC 47 CFR PART 15 SUBPART B: 2020
Date Test Item Received:	2019-12-19
Testing Start Date:	2019-12-23
Date Testing Complete:	2020-01-03
Overall Results:	Compliant

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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REPORT REVISION HISTORY

Revision Date	Revision Version	Description	Revised By	Revision Reviewed By
	V1	Initial Issue		

1.0 SUMMARY

All tests were performed in accordance with ANSI C63.4:2014, ICES-003 ISSUE 6:2016.

1.1 Deviations from standard test methods

None

1.2 Device Modifications Necessary for Compliance

None

1.3 Applicable Standards

Standard
FCC 47 CFR PART 15 SUBPART B: 2020

1.4 Summary of Tests

This product is considered Class B

Requirement – Test	Result (Compliant / Non-Compliant)
CONDUCTED EMISSIONS	Compliant
RADIATED EMISSIONS	Compliant

Approved & Released For

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2.0 CALIBRATION AND UNCERTAINTY

2.1 Measuring Instrument Calibration

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

2.2 Sample Calculation

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$
$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Final Voltage (dBuV)} = \text{Measured Voltage (dBuV)} + \text{Cable Loss (dB)} + \text{Limiter Factor (dB)} + \text{LISN Insertion Loss.}$$

$$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$$

2.3 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance	3.07 dB
Worst Case Radiated Disturbance	5.17 dB

Uncertainty figures are valid to a confidence level of 95%.

3.0 GENERAL - Product Description

3.1 Equipment Description

The EUT is a wireless toothbrush charging base with a BT/BLE/2.4/5GHz WLAN radio and a WPT radio that operates from 30-47 kHz.

3.2 Equipment Marking Plate

None

3.3 Device Configuration During Test

3.3.1 Equipment Used During Test:

Use	Product Type	Manufacturer	Model	Comments
EUT	Charging Base	Braun	3783	None
AE	Toothbrush	Braun	3765	None
AE	Power Supply	Braun	3780	None

Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test)

3.3.2 Input/Output Ports:

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None
1	Mains	DC	N	N	None

*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical I/O= Signal Input or Output Port (Not Involved in Process Control) TP= Telecommunication Ports

3.3.3 EUT Internal Operating Frequencies:

Frequency (MHz)	Description
5825	Highest WLAN Tx frequency

3.3.4 Power Interface:

Mode # /Rated	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	100-240	-	-	50/60Hz	Single	None
1	120 Vac	-	-	60Hz	Single	None

3.3.5 Subassemblies

Description	Manufacturer	Model
None		

3.3.6 Manufacturer's Description of Model Differences

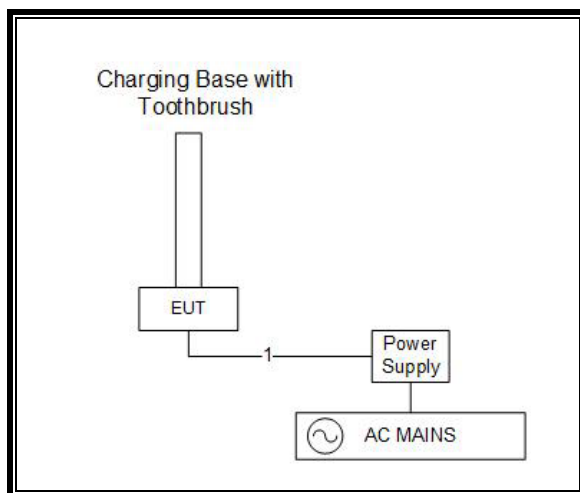
None

3.3.7 Software and Firmware

The test utility software used during testing was Type 3782 firmware version:V12, Type 3783 firmware version: V20.

3.4 Block Diagram:

The diagram below illustrates the configuration of the equipment above.



3.5 EUT Configurations

Configuration #	Description
1	Configured as table top equipment.

3.6 EUT Operation Modes

Mode #	Description
1	Operating as intended. Toothbrush charging on base, radios not transmitting.

3.7 Rational for EUT Configurations

Configuration #	Description
1	The selected EUT configuration was chosen to maximize emissions. EUT intended to operate in only one orientation. Therefore, all testing performed with the EUT in its intended orientation.

4.0 APPLICABLE EMISSIONS LIMITS AND TEST RESULTS

4.1 Test Conditions and Results - MAINS TERMINAL - CONDUCTED EMISSIONS

Test Description	Measurements were made on a ground plane. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.	
Test Standards	ANSI C63.4-2014 ICES-003 ISSUE 6:2016	
Test Engineer	11993/46722	
Test Date	2019-12-23	
Laboratory Parameters	Required prior to the test	During the test
Ambient Temperature	10 to 40 °C	22.7 °C
Humidity	10 % to 90 %	47.9 %
	Frequency range on each side of line	Measurement Point
Fully configured sample scanned over the following frequency range	150kHz to 30MHz	Mains
Limits - Class B		
Frequency (MHz)	Limit (dBµV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50
Supplementary information: None		

Conducted Emissions EUT Configuration Settings

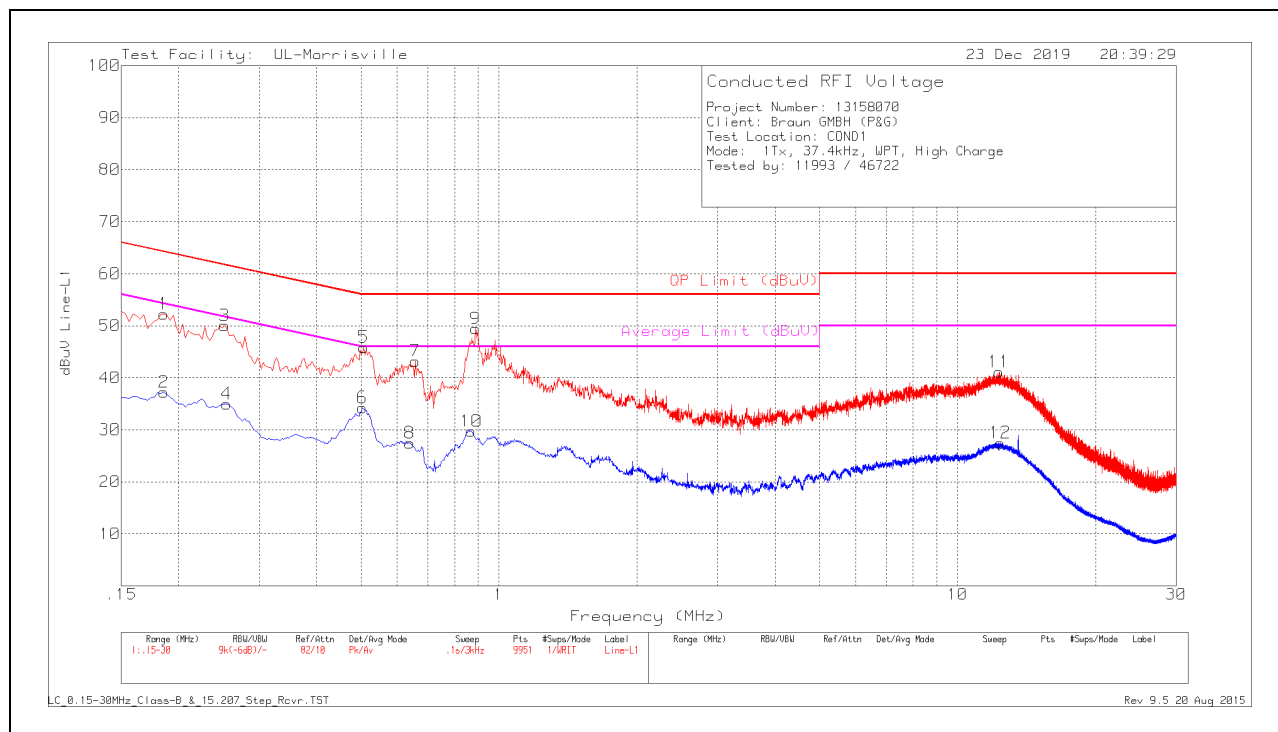
Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Conducted Emissions Test Equipment

Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2019-05-29	2020-05-29
s/n 181562858	Environmental Meter	Fisher Scientific	14-650-118	2018-09-04	2020-09-04
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2019-08-19	2020-08-19
75141 (PRE0101521)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2019-08-20	2020-08-20
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2019-05-29	2020-05-29
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
MM0165	Multi-meter	Agilent	U1232A	2019-08-23	2020-08-23
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2019-07-10	2020-07-10

Conducted Emissions Graph – Line 1

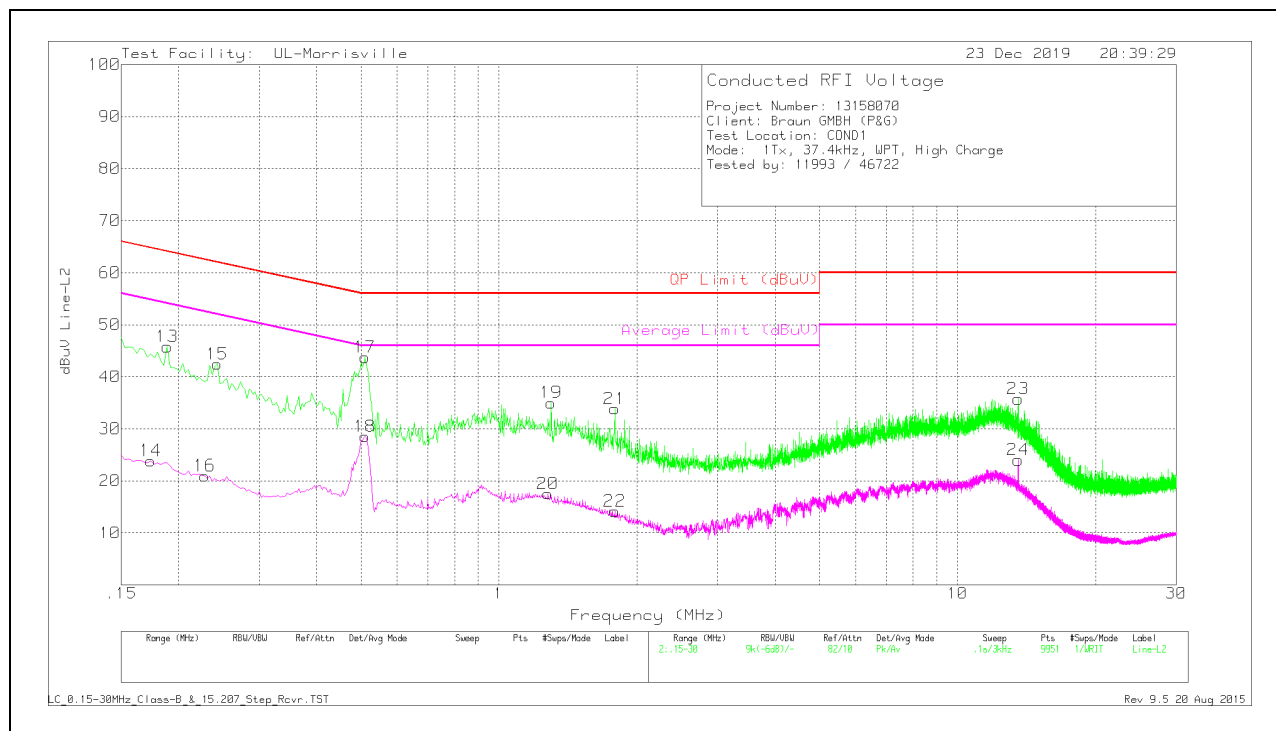


Conducted Emissions Data Points – Line 1

Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.186	42.05	Pk	.2	10	52.25	64.21	-11.96	-	-
2	.186	27.02	Av	.2	10	37.22	-	-	54.21	-16.99
3	.252	39.93	Pk	.1	10	50.03	61.69	-11.66	-	-
4	.255	24.87	Av	.1	10	34.97	-	-	51.59	-16.62
5	.507	35.75	Pk	.1	10	45.85	56	-10.15	-	-
6	.504	24.13	Av	.1	10	34.23	-	-	46	-11.77
7	.657	33.11	Pk	.1	10	43.21	56	-12.79	-	-
8	.639	17.35	Av	.1	10	27.45	-	-	46	-18.55
9	.888	39.42	Pk	0	10	49.42	56	-6.58	-	-
10	.87	19.74	Av	0	10	29.74	-	-	46	-16.26
11	12.309	30.61	Pk	.1	10.4	41.11	60	-18.89	-	-
12	12.393	16.98	Av	.1	10.4	27.48	-	-	50	-22.52

Pk - Peak detector
Av - Average detection

Conducted Emissions Graph – Line 2



Conducted Emissions Data Points – Line 2

Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
13	.189	35.58	Pk	.2	10	45.78	64.08	-18.3	-	-
14	.174	13.63	Av	.2	10	23.83	-	-	54.77	-30.94
15	.243	32.31	Pk	.1	10	42.41	61.99	-19.58	-	-
16	.228	10.86	Av	.1	10	20.96	-	-	52.52	-31.56
17	.51	33.73	Pk	0	10	43.73	56	-12.27	-	-
18	.51	18.51	Av	0	10	28.51	-	-	46	-17.49
19	1.299	24.89	Pk	0	10.1	34.99	56	-21.01	-	-
20	1.278	7.52	Av	0	10	17.52	-	-	46	-28.48
21	1.788	23.74	Pk	0	10.1	33.84	56	-22.16	-	-
22	1.788	4.05	Av	0	10.1	14.15	-	-	46	-31.85
23	13.563	25.24	Pk	.1	10.4	35.74	60	-24.26	-	-
24	13.56	13.52	Av	.1	10.4	24.02	-	-	50	-25.98

Pk - Peak detector
Av - Average detection

4.2 Test Conditions and Results - RADIATED EMISSIONS

Test Description	Measurements were made in a 3-meter/10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter/10-meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.	
Test Standards	ANSI C63.4-2014	
Test Engineer	11993	
Laboratory Parameters	Required prior to the test	During the test
Ambient Temperature	10 to 40 °C	24.6 °C
Humidity	10 % to 90 %	46.3 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30MHz – 30 GHz	3 meter measurement distance
Limits - Class B		
Frequency (MHz)	Limit (dBµV/m)	
30-88	40	NA
88-216	43.5	NA
216-960	46	NA
Above 960	54	NA
	Peak	Average
Above 1 GHz	74	54
Supplementary information: None		

Radiated Emissions EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

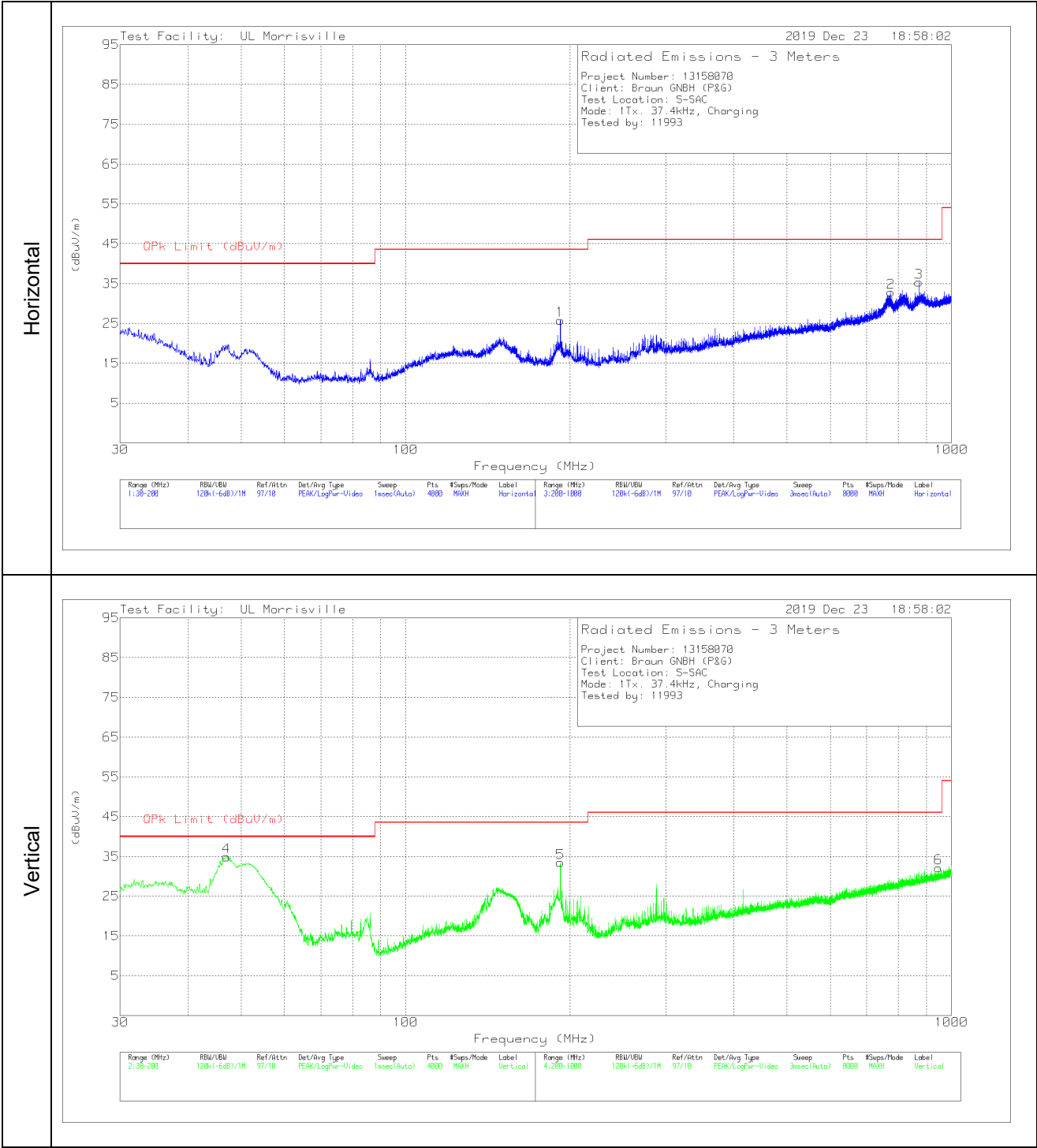
Radiated Emissions Test Equipment

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
30-1000 MHz					
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-07-16	2020-07-16
1-18 GHz					
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2019-04-22	2020-04-22
18-40 GHz					
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2019-11-07	2020-11-07
AT0077	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2019-11-07	2020-11-07
Gain-Loss Chains					
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2019-05-02	2020-05-02
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2019-05-02	2020-05-02
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2019-03-13	2020-03-13
S62/AMP017/ CBL269426-001 (Effective 09/20/2019)	Gain-loss string: 18-40GHz	Huber+Suhner Miteq MegaPhase	SUCOFLEX 102EA TTA1840-35-HG NC12-K1K1-216	2019-03-21	2020-03-21
Receiver & Software					
SA0025	Spectrum Analyzer	Agilent	N9030A	2019-02-28	2020-02-28
SA0027 (18-40GHz RSE)	Spectrum Analyzer	Agilent	N9030A	2019-05-15	2020-05-15
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
Additional Equipment used					
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA

RADIATED EMISSIONS 30 TO 1000 MHz

Radiated Emissions Graph



Radiated Emissions Data Points

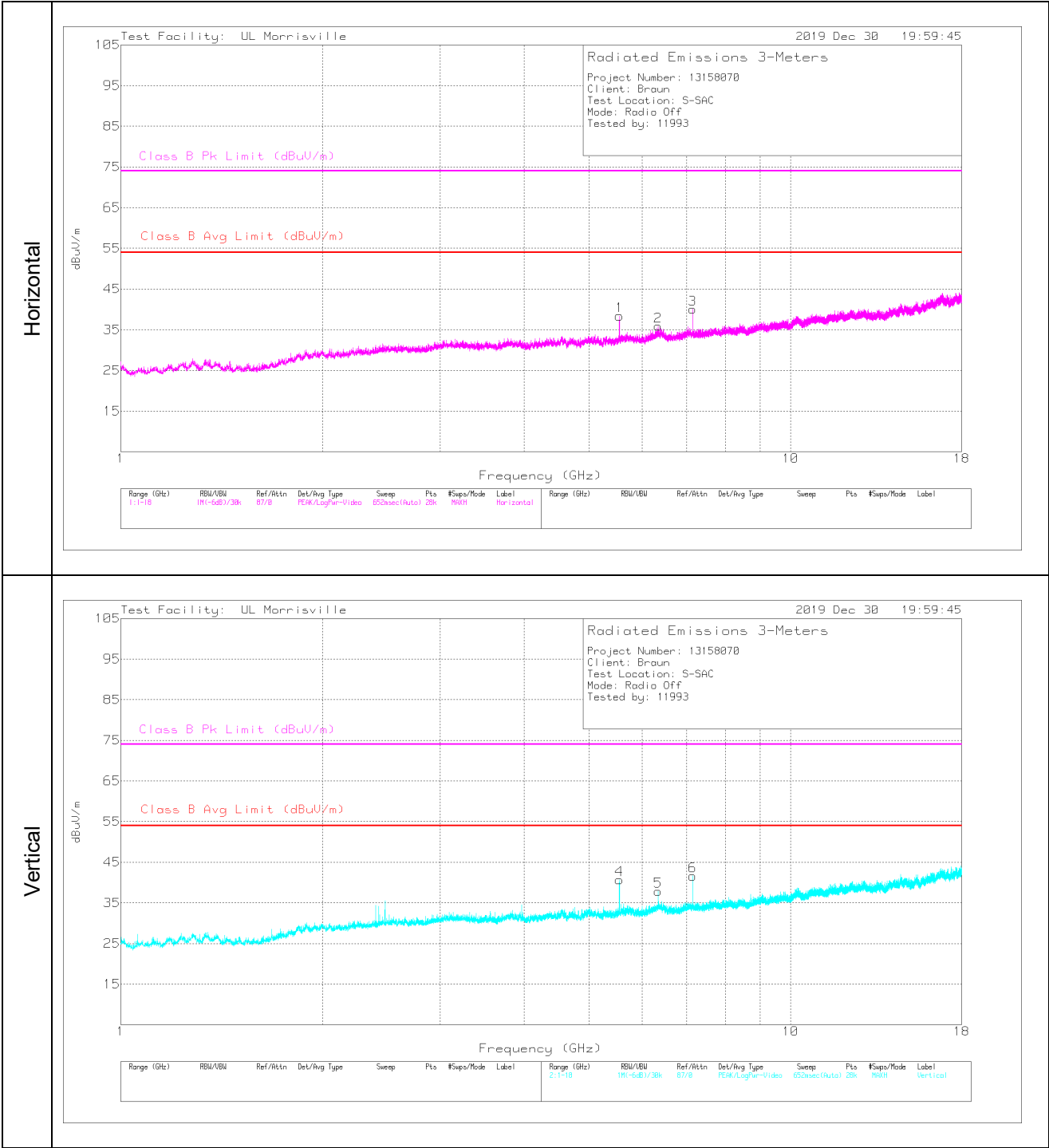
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Cbl/Amp	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	47.0901	47.11	Qp	15.2	-31.5	30.81	40	-9.19	220	103	V
1	192.1795	38.29	Pk	17.7	-30.2	25.79	43.52	-17.73	0-360	99	H
5	192.222	45.95	Pk	17.7	-30.2	33.45	43.52	-10.07	0-360	101	V
2	774.8747	33.74	Pk	27.1	-28	32.84	46.02	-13.18	0-360	101	H
3	872.0874	34.82	Pk	28	-27.5	35.32	46.02	-10.7	0-360	101	H
6	947.6972	29.72	Pk	28.9	-26.5	32.12	46.02	-13.9	0-360	101	V

Pk – Peak Detector

Qp - Quasi-Peak detector

RADIATED EMISSIONS 1000 TO 18,000 MHz – FCC

Radiated Emissions Graph



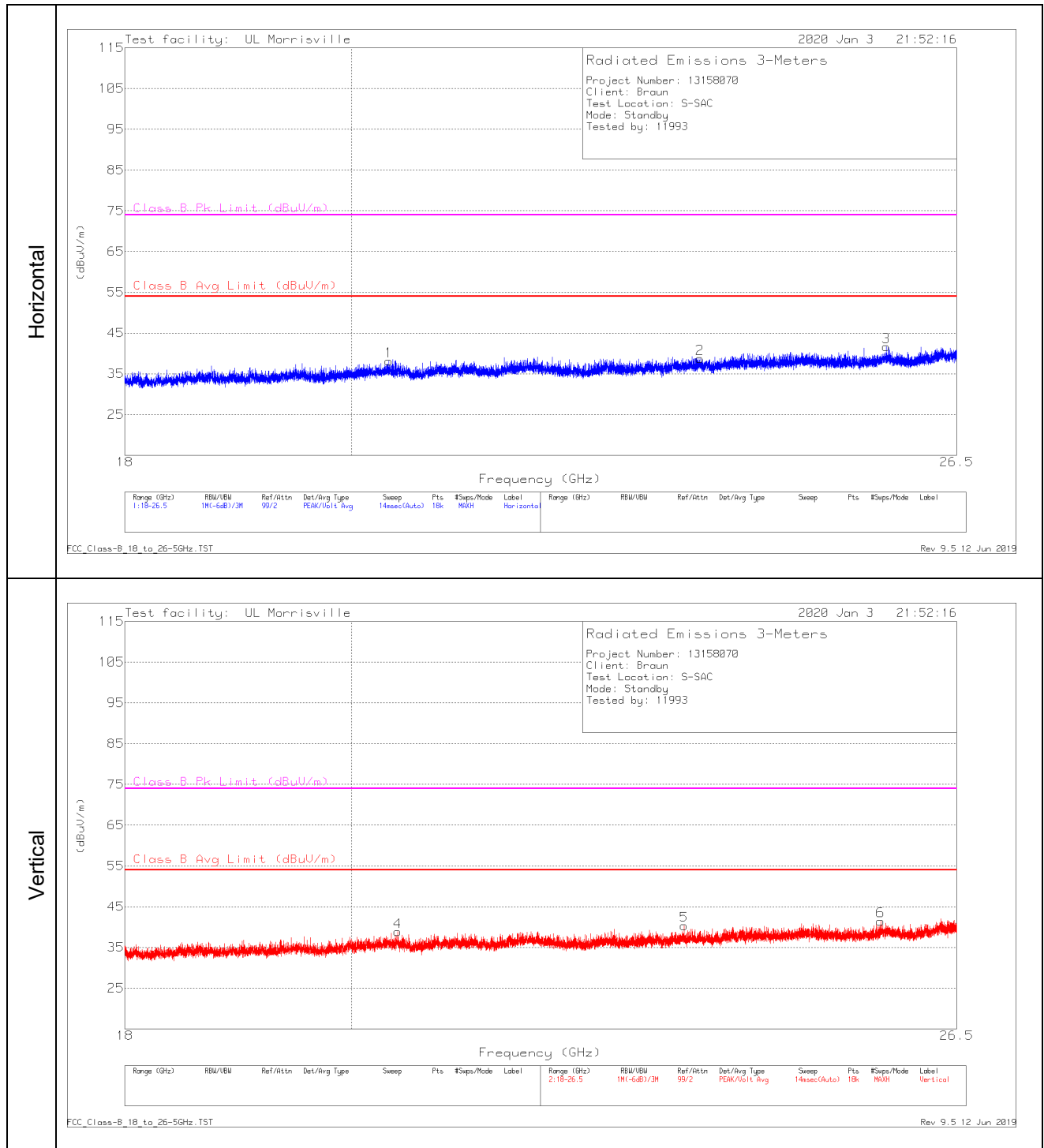
Radiated Emissions Data Points

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading dBuV/m	Class B Avg Limit (dBuV/m)	Margin (dB)	Class B Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.55097	41.5	Pk	34.5	-30.8	45.2	-	-	74	-28.8	107	388	H
	5.55097	38.27	Av	34.5	-30.8	41.97	54	-12.03	-	-	107	388	H
4	5.55105	40.81	Pk	34.5	-30.8	44.51	-	-	74	-29.49	246	101	V
	5.55105	37.2	Av	34.5	-30.8	40.9	54	-13.1	-	-	246	101	V
5	6.34399	38.8	Pk	35.5	-29.5	44.8	-	-	74	-29.2	206	361	V
	6.34399	33.98	Av	35.5	-29.5	39.98	54	-14.02	-	-	206	361	V
2	6.34405	38.39	Pk	35.5	-29.5	44.39	-	-	74	-29.61	88	295	H
	6.344	30.13	Av	35.5	-29.5	36.13	54	-17.87	-	-	88	295	H
6	7.13699	41.55	Pk	35.7	-28.8	48.45	-	-	74	-25.55	24	266	V
	7.13699	38.1	Av	35.7	-28.8	45	54	-9	-	-	24	266	V
3	7.1373	40.36	Pk	35.7	-28.8	47.26	-	-	74	-26.74	152	357	H
	7.1373	33.99	Av	35.7	-28.8	40.89	54	-13.11	-	-	152	357	H

Pk - Peak detector
Av - Average detection

RADIATED EMISSIONS 18,000 TO 26,000 MHz

Radiated Emissions Graph



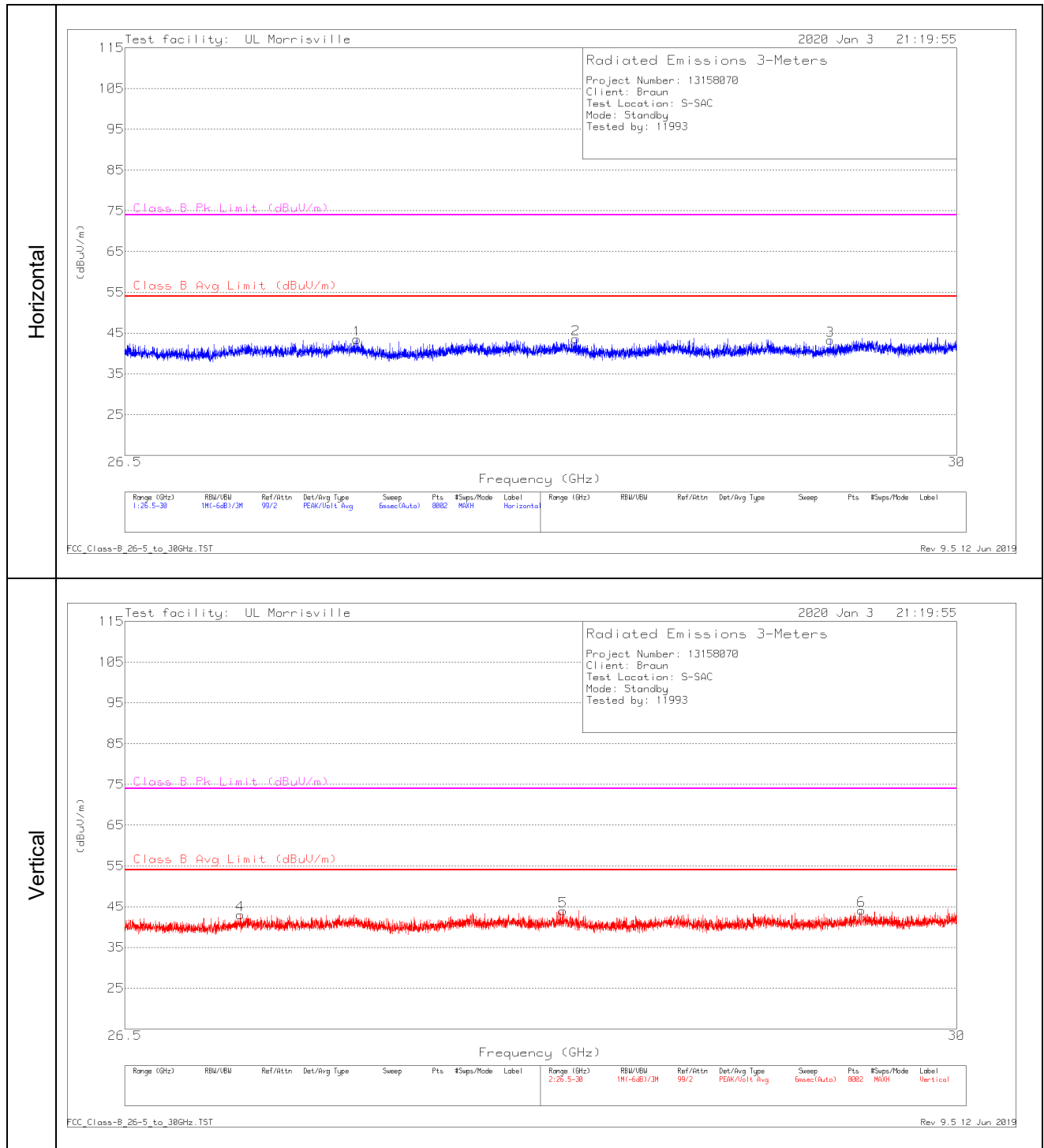
Radiated Emissions Data Points

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Class B Avg Limit (dBuV/m)	Margin (dB)	Class B Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	20.35038	39.57	Pk	33.1	-34.5	38.17	54	-15.83	74	-35.83	0-360	102	H
4	20.43397	40.13	Pk	33.2	-34.5	38.83	54	-15.17	74	-35.17	0-360	102	V
5	23.34774	39.97	Pk	34.1	-33.7	40.37	54	-13.63	74	-33.63	0-360	202	V
2	23.51775	38.35	Pk	34.1	-33.7	38.75	54	-15.25	74	-35.25	0-360	148	H
6	25.57864	40.07	Pk	34.5	-33.1	41.47	54	-12.53	74	-32.53	0-360	152	V
3	25.6457	40.27	Pk	34.5	-33.1	41.67	54	-12.33	74	-32.33	0-360	148	H

Pk - Peak detector

RADIATED EMISSIONS 26,000 TO 30,000 MHZ

Radiated Emissions Graph



Radiated Emissions Data Points

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0077 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Class B Avg Limit (dBuV/m)	Margin (dB)	Class B Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	26.96063	39.73	Pk	35.9	-32.6	43.03	54	-10.97	74	-30.97	0-360	252	V
1	27.43307	40.05	Pk	35.8	-32.4	43.45	54	-10.55	74	-30.55	0-360	198	H
5	28.28959	39.68	Pk	36.4	-32.1	43.98	54	-10.02	74	-30.02	0-360	102	V
2	28.34383	39.18	Pk	36.4	-32	43.58	54	-10.42	74	-30.42	0-360	100	H
3	29.43963	37.92	Pk	36.4	-31.1	43.22	54	-10.78	74	-30.78	0-360	198	H
6	29.57786	38.7	Pk	36.5	-31.1	44.1	54	-9.9	74	-29.9	0-360	202	V

Pk - Peak detector

Appendix A

Facilities, Accreditations and Authorizations

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, NC, 27709 USA and at 2800 Perimeter Park Drive, Suite B, Morrisville, NC, 27560, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

12 Laboratory Dr.	2800 Perimeter Park Dr.
Site Code: 2180C	
☐ Chamber A RTP	☐ North Chamber
☐ Chamber C RTP	☒ South Chamber

The above test sites and facilities are covered under FCC Test Firm Registration # 703469. Chambers above are covered under Industry Canada company address and respective code

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0

BSMI Laboratory Code is SL2-IN-E-1033 (US0067).

The UL LLC VCCI laboratory facility registration numbers are G-246 (Chamber A) and A-0046 (all others).

END OF TEST REPORT