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CERTIFICATION TEST REPORT

Manufacturer: Oraluent
156 Granada Avenue
Long Beach, California 90803 USA

Applicant: Same as Above

Product Name: Oraluent Phototherapy Toothbrush

Product Description: Powered phototherapy toothbrush with blue and red LEDs

**Operating Voltage/Freq.
of EUT During Testing:** Battery-Operated (3VDC)

Model: Model 1

FCC ID: 2AWIY001

Testing Commenced: 2021-04-29

Testing Ended: 2021-06-08

Summary of Test Results: In Compliance

The EUT complies with the EMC requirements when manufactured identically as the unit tested in this report, including any required modifications and/or manufacturer's statement. Any changes to the design or build of this unit subsequent to this testing may deem it non-compliant.

Standards:

- ❖ **FCC Part 15 Subpart C, Section 15.249**
- ❖ **FCC Part 15 Subpart C, Section 15.215(c) – Additional provisions to the general radiated emission limitations**
- ❖ **FCC15.207 - Conducted Limits**
- ❖ **FCC Part 15 Subpart A, Section 15.31(e) – Measurement Standards**



Order Number: F2P24980A

Applicant: Oraluent

Model: Model 1

Evaluation Conducted by:

Julius Chiller, EMC/Wireless Engineer

Michael Toth, Senior Engineer

Report Reviewed by:

Ken Littell, Vice President of EMC

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1 ADMINISTRATIVE INFORMATION

1.1 Measurement Location:

F2 Labs in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD.

1.2 Measurement Procedure:

All measurements were performed according to the 2013 version of ANSI C63.10 and recommended FCC procedure of measurement of DXT operating under Section 15.249. A list of the measurement equipment can be found in Section 6.

1.3 Uncertainty Budget:

The uncertainty in EMC measurements arises from several factors which affect the results, some associated with environmental conditions in the measurement room, the test equipment being used, and the measurement techniques adopted.

The measurement uncertainty budgets detailed below are calculated from the test and calibration data and are expressed with a 95% confidence factor using a coverage factor of $k=2$. The Uncertainty for a laboratory is referred to as U_{lab} . For Radiated and Conducted Emissions, the Expanded Uncertainty is compared to the U_{cispr} values to determine if a specific margin is required to deem compliance.

U_{lab}

Measurement Range	Combined Uncertainty	Expanded Uncertainty
Radiated Emissions <1 GHz @ 3m	2.54	5.07dB
Radiated Emissions <1 GHz @ 10m	2.55	5.09dB
Radiated Emissions 1 GHz to 2.7 GHz	1.81	3.62dB
Radiated Emissions 2.7 GHz to 18 GHz	1.55	3.10dB
AC Power Line Conducted Emissions, 150kHz to 30 MHz	1.38	2.76dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	1.66	3.32dB

U_{cispr}

Measurement Range	Expanded Uncertainty
Radiated Emissions <1 GHz @ 3m	5.2dB
Radiated Emissions <1 GHz @ 10m	5.2dB
Radiated Emissions 1 GHz to 2.7 GHz	Under Consideration
Radiated Emissions 2.7 GHz to 18 GHz	Under Consideration
AC Power Line Conducted Emissions, 150kHz to 30 MHz	3.6dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	4.0dB

If U_{lab} is less than or equal to U_{cispr} , then:

- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} in table 1, then:

- compliance is deemed to occur if no measured disturbance, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

Note: Only measurements listed in the tables above that relate to tests included in this Test Report are applicable.



Order Number: F2P24980A

Applicant: Oralucient
Model: Model 1

1.4 Document History:

Document Number	Description	Issue Date	Approved By
F2P24980A-01E	First Issue	2021-06-08	K. Littell

**2 SUMMARY OF TEST RESULTS**

Test Name	Standard(s)	Results
Occupied Bandwidth	CFR 47 Part 15.215(c)	Complies
Field Strength of Emissions	CFR 47 Part 15.249(a)(d)	Complies
Variation of the Input Power	CFR 47 Part 15.231(e)	N/A*
Conducted Emissions	CFR 47 Part 15.207(a)	Complies

**EUT is battery-powered only; does not plug into AC Mains network.*

Modifications Made to the Equipment
None

**3 TABLE OF MEASURED RESULTS**

Test	Low Channel 2402 MHz	Mid Channel 2444 MHz	High Channel 2480 MHz
Average Field Strength of Fundamental	69.1 dB μ V/m, 2.85 mV/m	66.4 dB μ V/m, 2.1 mV/m	66.8 dB μ V/m, 2.18 mV/m
Average Limit for Fundamental	50 millivolts/meter (93.97 dB μ V/m)	50 millivolts/meter (93.97 dB μ V/m)	50 millivolts/meter (93.97 dB μ V/m)
Peak Field Strength of Fundamental	69.5 dB μ V/m 2.9 mV/m	68.8 dB μ V/m 2.7 mV/m	68.5 dB μ V/m 2.66 mV/m
Peak Limit for Fundamental	113.97 dB μ V/m	113.97 dB μ V/m	113.97 dB μ V/m
-20dB Occupied Bandwidth	1.217 MHz	1.225 MHz	1.225 MHz



4 ENGINEERING STATEMENT

This report has been prepared on behalf of Oraluent to provide documentation for the testing described herein. This equipment has been tested and found to comply with part 15.249 of the FCC Rules using ANSI C63.10 2013 standard. The test results found in this test report relate only to the items tested.



5 EUT INFORMATION AND DATA

5.1 Equipment Under Test:

Product: **Oralucient Phototherapy Toothbrush**

Model: Model 1

Serial No.: None Specified

FCC ID: **2AWIY001**

5.2 Trade Name:

Oralucient

5.3 Power Supply:

Battery-Operated (3VDC)

5.4 Applicable Rules:

CFR 47, Part 15.249, subpart C

5.5 Equipment Category:

Radio Transmitter-DXT

5.6 Antenna:

Integral Chip Antenna, 2 dBi Gain

5.7 Accessories:

N/A

5.8 Test Item Condition:

The equipment to be tested was received in good condition.

5.9 Testing Algorithm:

EUT was set up in a test mode with a constant transmission from the radio and had the capability to select through the low/mid/high channels.

**6 LIST OF MEASUREMENT INSTRUMENTATION**

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber	CL166-E	Albatross Projects	B83117-DF435-T261	US140023	2022-03-09
Temp/Hum. Recorder	CL119	Extech	RH520	H005869	2022-03-25
Spectrum Analyzer	CL138	Agilent Technologies	E4407B	US41192779	2021-09-16
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2021-10-06
Antenna, Bilog	CL211	Sunol Sciences, Inc.	JB1	A021017	2021-10-13
Low Loss Cable Set	--	Pasternack	PE3C0666-252 / PE3C066-50CM	None Spec.	2023-10-12
Horn Antenna	CL098	Emco	3115	9809-5580	2022-01-08
Horn Antenna 18-26.5 GHz	CL114	A.H. Systems, Inc.	SAS-572	237	2021-06-04
Pre-Amplifier	CL153	Keysight Tech.	83006A	MY39500791	2022-02-12
Active 18" Loop Antenna	CL163-Loop	A.H. Systems, Inc.	EHA-52B	100	2021-10-15
Pe-Amplifier	CL285	Com-Power	PAM-0207	322	2021-11-04
Software:	Tile Version 3.4.B.3		Software Verified: 2021-04-30; 2021-05-03		
Software:	EMC 32, Version 8.53.0		Software Verified: 2021-04-30; 2021-05-03		
Transient Limiter	0202	Hewlett Packard	11947A	3107A00729	2022-02-04
Spectrum Analyzer	CL147	Agilent	E7402A	MY45101241	2022-03-25
LISN	CL181	Com-Power	LI-125A	191226	2023-12-01
LISN	CL182	Com-Power	LI-125A	191225	2023-12-01



7 FCC PART 15.215(e), OCCUPIED BANDWIDTH

7.1 Requirements:

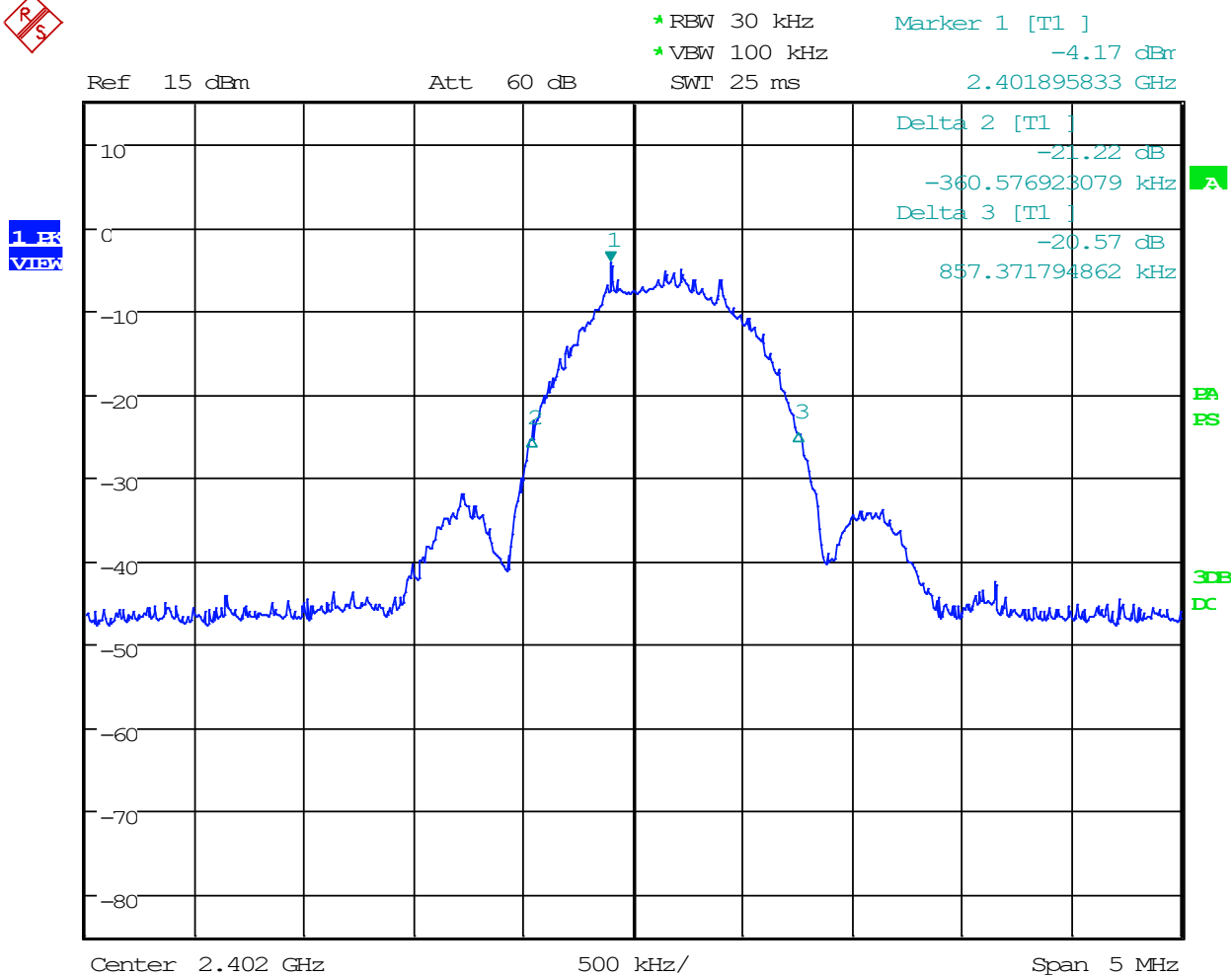
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the -20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

Bandwidth measurements were made at the low, mid and upper frequencies. The bandwidth was measured using the analyzer's marker function.



7.2 Occupied Bandwidth Test Data

Test Date(s):	2021-06-08	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	22.1°C
		Relative Humidity:	38%

-20dB, Low Channel

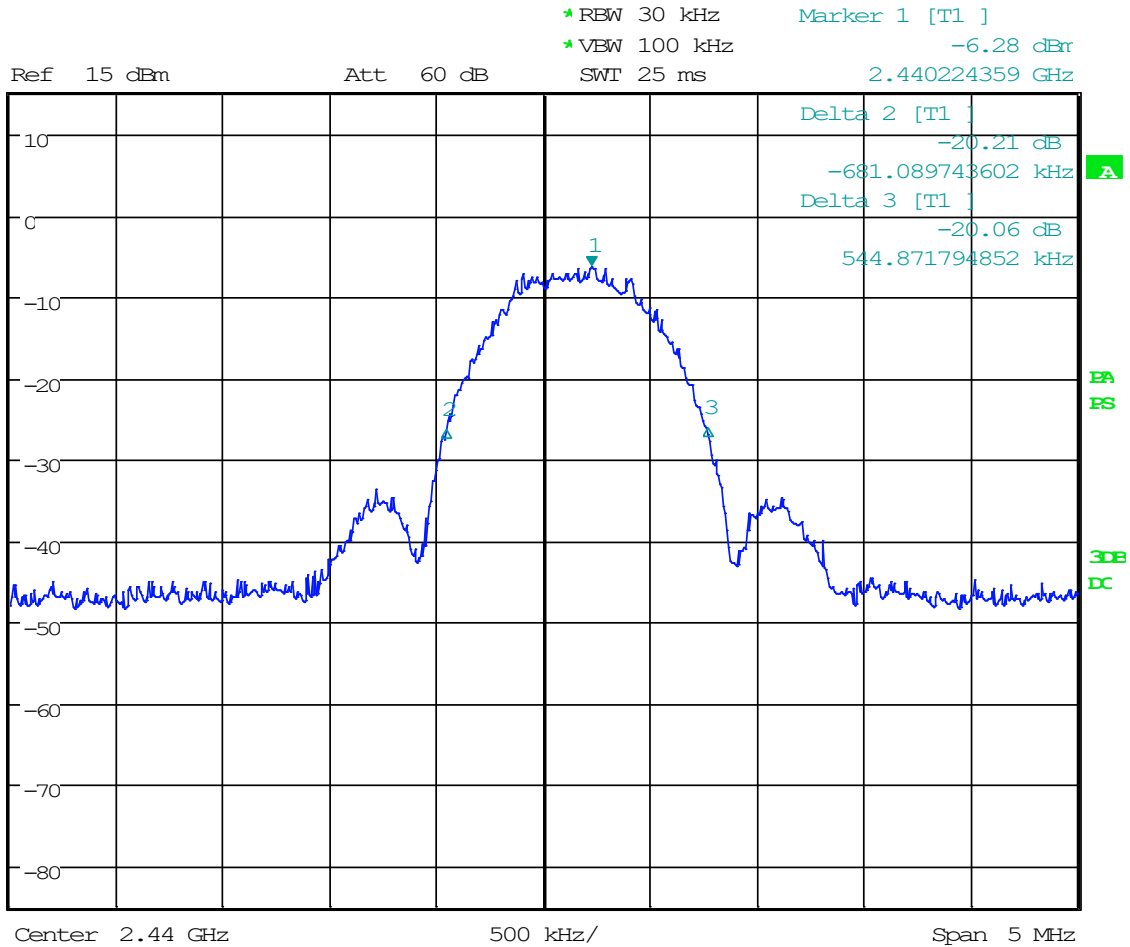
Date: 8.JUN.2021 15:30:01



-20dB, Mid Channel



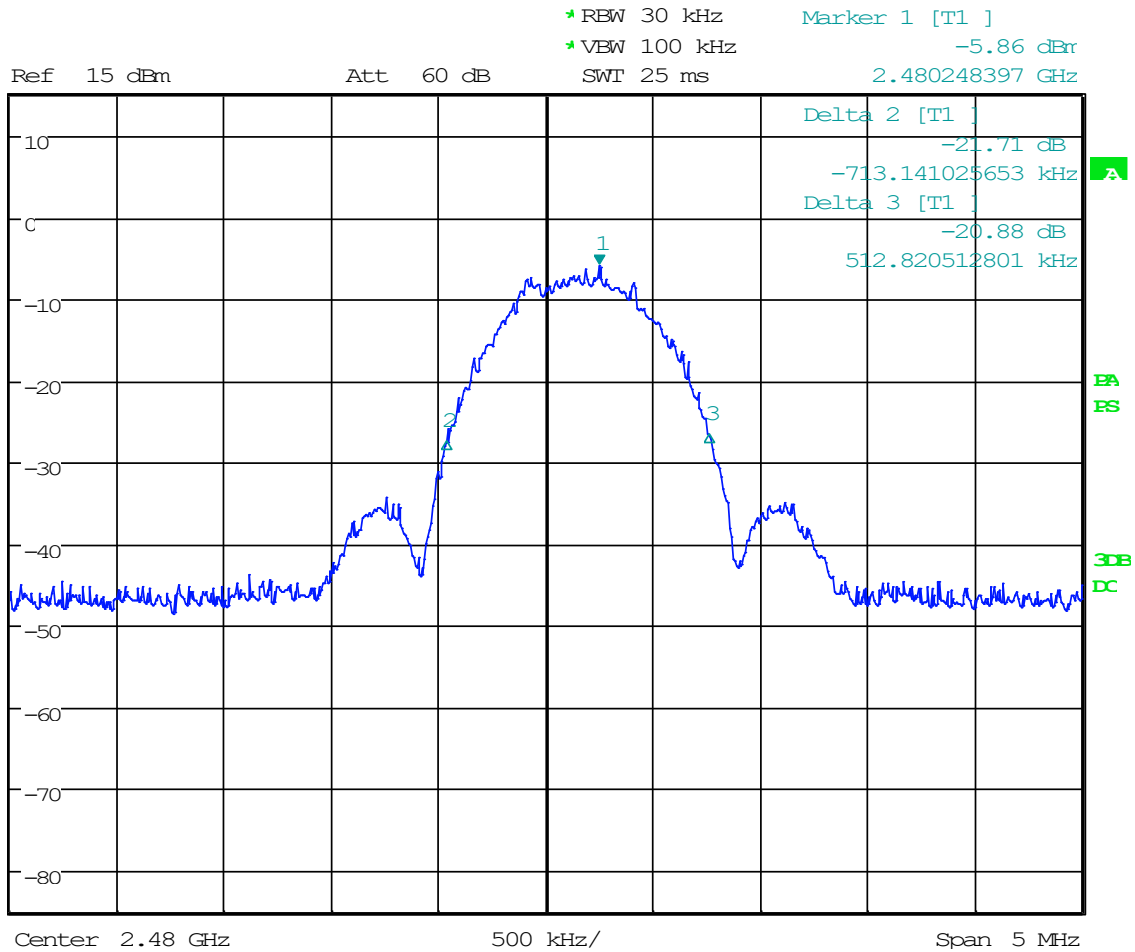
1. Bk
V1BW



Date: 8.JUN.2021 15:31:15



-20dB, High Channel



**8 FIELD STRENGTH OF EMISSIONS FROM INTENTIONAL RADIATORS**

- (a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

- (d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

NOTE: During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions.

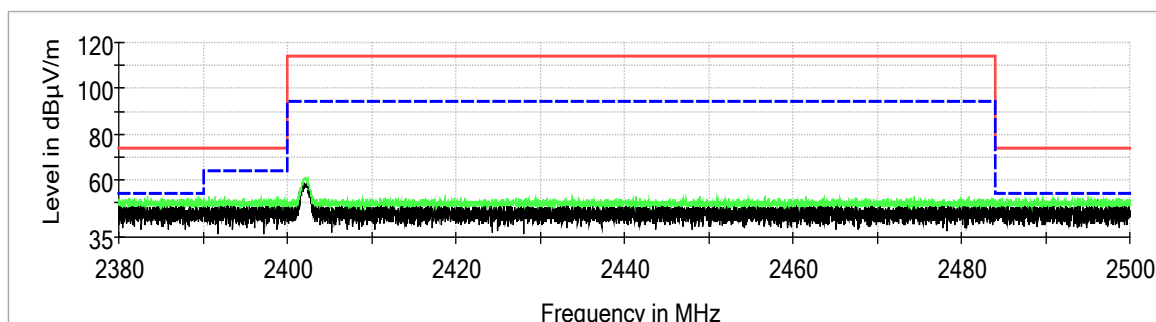


8.1 Test Data - Field Strength of Emissions from Intentional Radiators

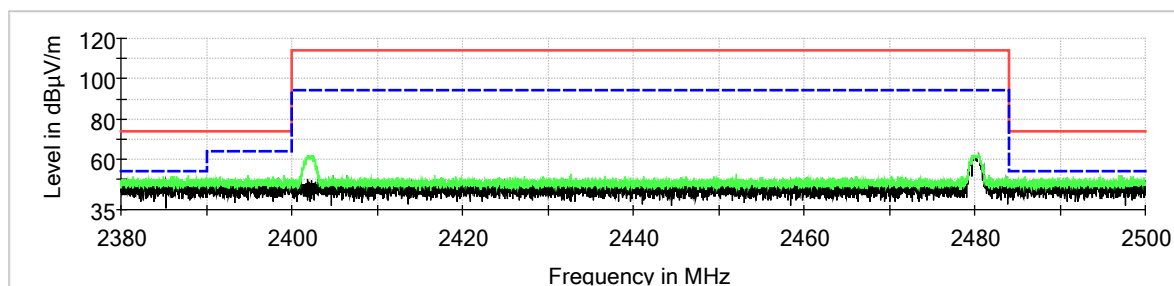
Test Date(s):	2021-05-03	Test Engineer(s):	M. Toth
Standards:	CFR 47 Part 15.249(a)	Air Temperature:	21.1°C
		Relative Humidity:	41%

Note: Scans and limit line on this page are for reference only.

Low Band Edge: Horizontal



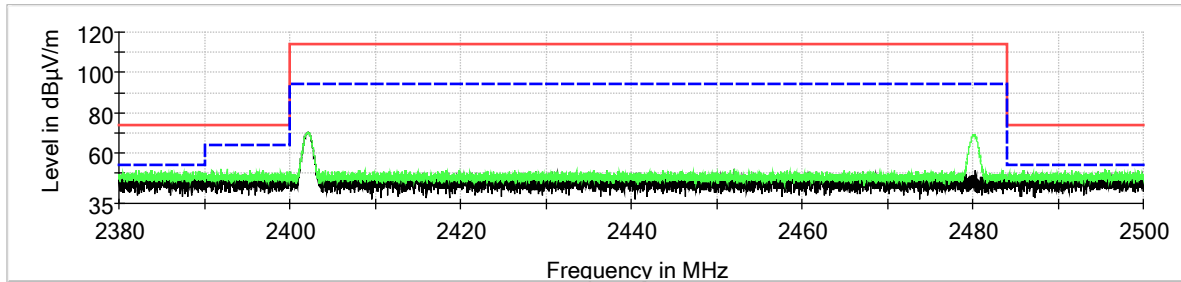
High Band Edge: Horizontal



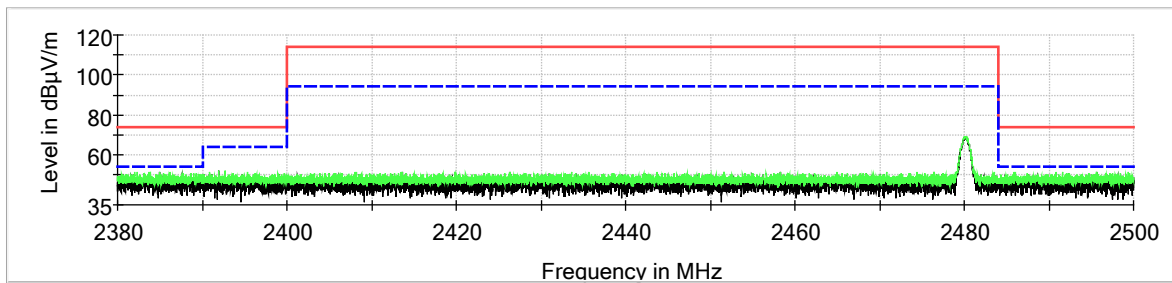


Note: Scans and limit line on this page are for reference only.

Low Band Edge: Vertical



High Band Edge: Vertical





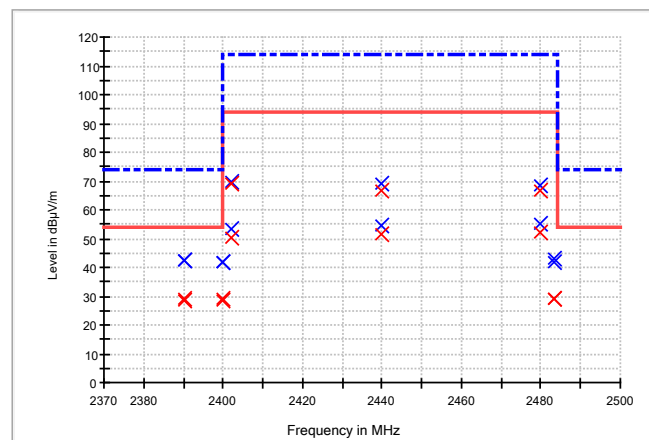
Band Edge and Field Strength of the Fundamentals

MaxPeak

Frequency (MHz)	Antenna Polarization	Bandwidth (kHz)	Antenna Height (cm)	Azimuth (deg)	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2483.50	V	1000.00	100.00	0.00	37.0	5.8	42.80	74.0	-31.2
2480.00	V	1000.00	100.00	0.00	62.8	5.7	68.50	114.0	-45.5
2402.00	V	1000.00	100.00	0.00	63.7	5.8	69.50	114.0	-44.5
2400.00	V	1000.00	100.00	0.00	36.0	5.8	41.80	74.0	-32.2
2390.00	V	1000.00	100.00	0.00	36.8	5.9	42.70	74.0	-31.3
2440.00	V	1000.00	100.00	0.00	63.1	5.7	68.80	114.0	-45.2
2402.00	H	1000.00	151.00	0.00	47.7	5.8	53.50	114.0	-60.5
2390.00	H	1000.00	150.00	0.00	36.5	5.9	42.40	74.0	-31.6
2400.00	H	1000.00	150.00	0.00	36.0	5.8	41.80	74.0	-32.2
2440.00	H	1000.00	229.00	0.00	48.6	5.7	54.30	114.0	-59.7
2480.00	H	1000.00	280.00	0.00	49.2	5.7	54.90	114.0	-59.1
2483.50	H	1000.00	280.00	0.00	36.2	5.8	42.00	74.0	-32.0

AVG

Frequency (MHz)	Antenna Polarization	Bandwidth (kHz)	Antenna Height (cm)	Azimuth (deg)	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2483.50	V	1000.00	100.00	0.00	23.2	5.8	29.00	54.0	-25.0
2480.00	V	1000.00	100.00	0.00	61.1	5.7	66.80	94.0	-27.2
2402.00	V	1000.00	100.00	0.00	63.3	5.8	69.10	94.0	-24.9
2400.00	V	1000.00	100.00	0.00	23.1	5.8	28.90	54.0	-25.1
2390.00	V	1000.00	100.00	0.00	22.9	5.9	28.80	54.0	-25.2
2440.00	V	1000.00	100.00	0.00	60.7	5.7	66.40	94.0	-27.6
2402.00	H	1000.00	151.00	0.00	44.4	5.8	50.20	94.0	-43.8
2390.00	H	1000.00	150.00	0.00	22.7	5.9	28.60	54.0	-25.4
2400.00	H	1000.00	150.00	0.00	22.8	5.8	28.60	54.0	-25.4
2440.00	H	1000.00	229.00	0.00	45.9	5.7	51.60	94.0	-42.4
2480.00	H	1000.00	280.00	0.00	46.7	5.7	52.40	94.0	-41.6
2483.50	H	1000.00	280.00	0.00	23.0	5.8	28.80	54.0	-25.2





8.2 Test Data – Spurious Emissions

Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some frequencies, no emissions from the EUT were measurable over the ambient noise floor. The readings did not change with EUT on and EUT off.

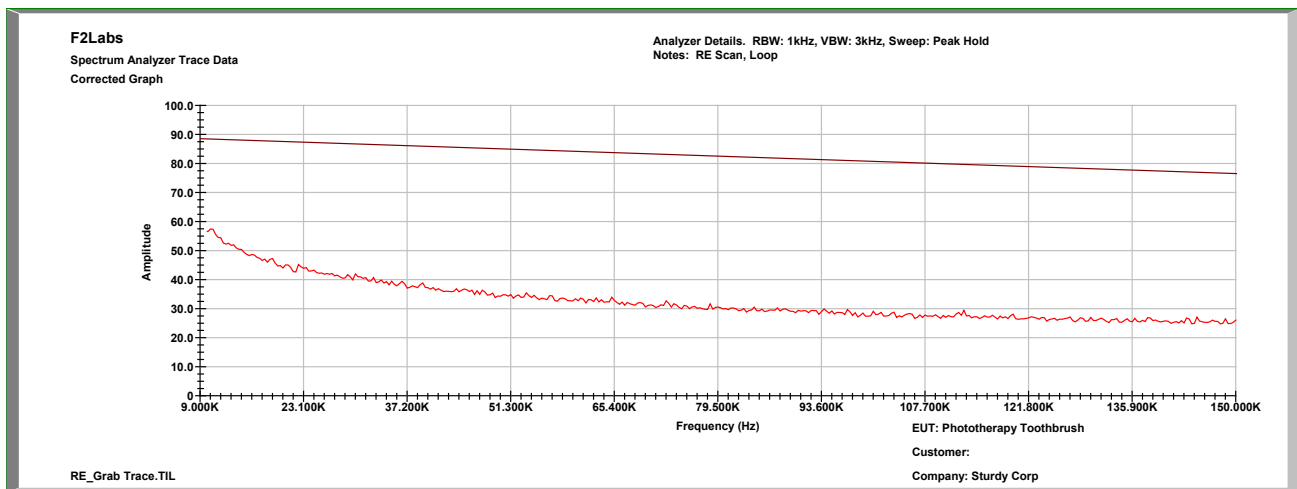
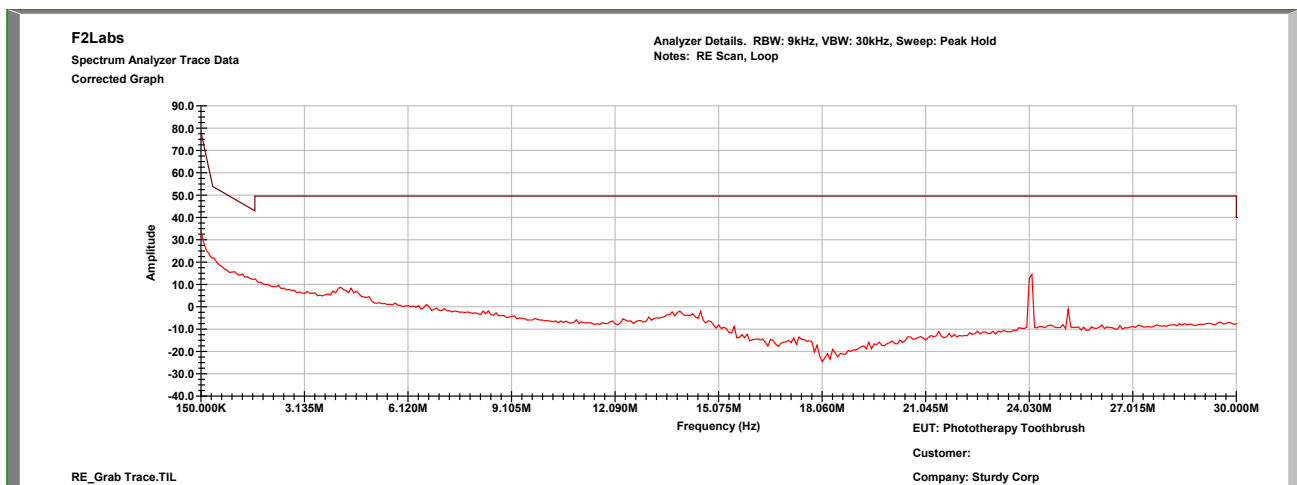
At least 6 of the highest frequencies were measured per ANSI 63.4 in a 3-meter anechoic chamber. Frequencies below 1 GHz were measured using a quasi-peak detector. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. Some of the frequencies did not change with the EUT on or off. At those frequencies, the test distance was shortened to 1 meter and still no emissions from the EUT were visible or over the ambient or limit. Frequencies were scanned from 9kHz to 26 GHz and the highest emissions are listed below.

In the following plots, the black line indicates ambient noise, and the red line indicates the measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables below.

Note: Low Channel was determined to be worst-case after a scan of all three channels was performed. The following plots are from the Low Channel, but measurements were taken from all three channels.



Test Date(s):	2021-05-03	Test Engineer(s):	M. Toth
Standards:	CFR 47 Part 15.249(d) / Part 15.209	Air Temperature:	20.6°C
		Relative Humidity:	39%

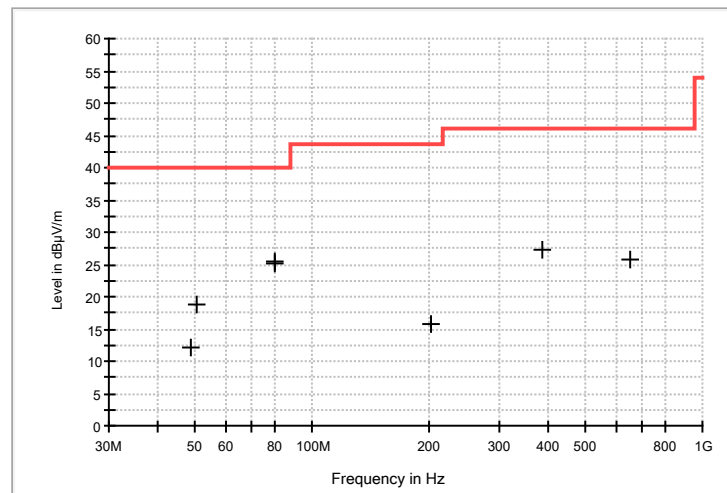
Characterization Scan, 9 kHz to 150 kHz – Low Channel (worst case)**Characterization Scan, 150 kHz to 30 MHz – Low Channel (worst case)**



Operating Mode: 30 MHz to 1000 MHz

Note: Chart below includes data from all three channels.

Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Azimuth (degrees)	Reading (dB μ V)	Correcton Factors (dB)	Emission (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
48.530000	V	100.00	14.00	25.7	-13.7	12.00	40.0	-28.0
50.442308	H	299.00	126.00	33.1	-14.3	18.80	40.0	-21.2
80.000000	H	299.00	0.00	39.9	-14.8	25.10	40.0	-14.9
80.000000	V	100.00	179.00	40.2	-14.8	25.40	40.0	-14.6
200.492308	H	299.00	206.00	24.4	-8.6	15.80	43.5	-27.7
386.450000	V	100.00	272.00	32.4	-5.1	27.30	46.0	-18.7
650.201923	V	100.00	86.00	24.6	1.1	25.70	46.0	-20.3





9 CONDUCTED EMISSIONS

9.1 Requirements

In accordance with FCC CFR 47 Part 15.207(a), "Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

9.2 Procedure

The EUT was placed on a 1.0 x 1.5 meter non-conductive table, 0.8 meter above a horizontal ground plane and 0.4 meter from a vertical ground plane. Power was provided to the EUT through a LISN bonded to a 3 x 2 meter ground plane. The LISN and peripherals were supplied power through a filtered AC power source. The output of the LISN was connected to the input of the receiver via a transient limiter, and emissions in the range 150 kHz to 30 MHz were measured. The measurements were recorded using the quasi-peak and average detectors as directed by the standard, and the resolution bandwidth during testing was 9 kHz. The raw measurements were corrected to allow for attenuation from the LISN, transient limiter and cables.

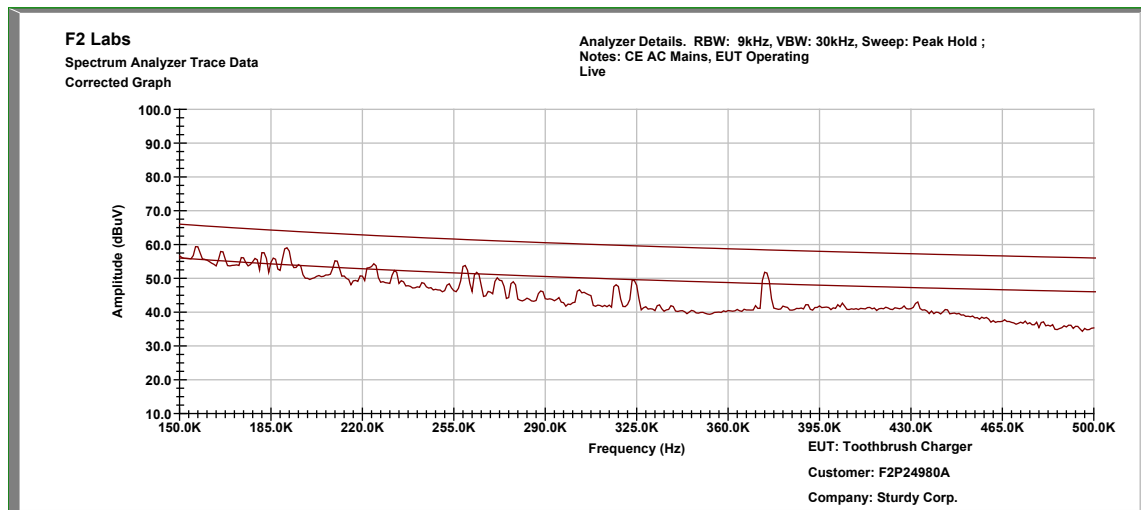


9.3 Conducted Emissions Test Data

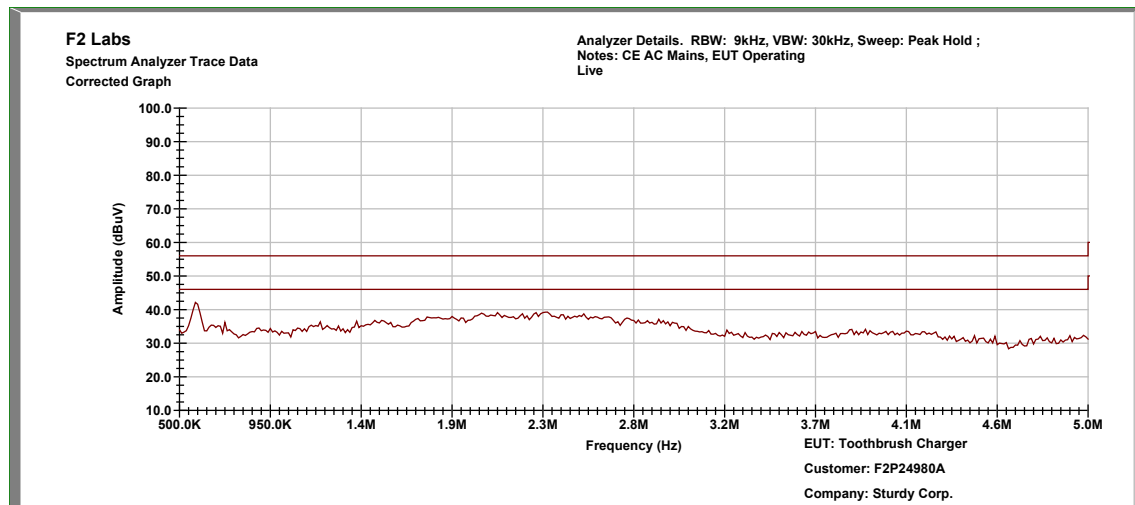
Test Date(s):	2021-04-30	Test Engineer:	M. Toth
Rule:	15.207	Air Temperature:	19.6° C
Test Results:	Complies	Relative Humidity:	51%

Note: The data below represents worst case results of all three channels.

Conducted Test – Live: 0.15 MHz to 0.5 MHz

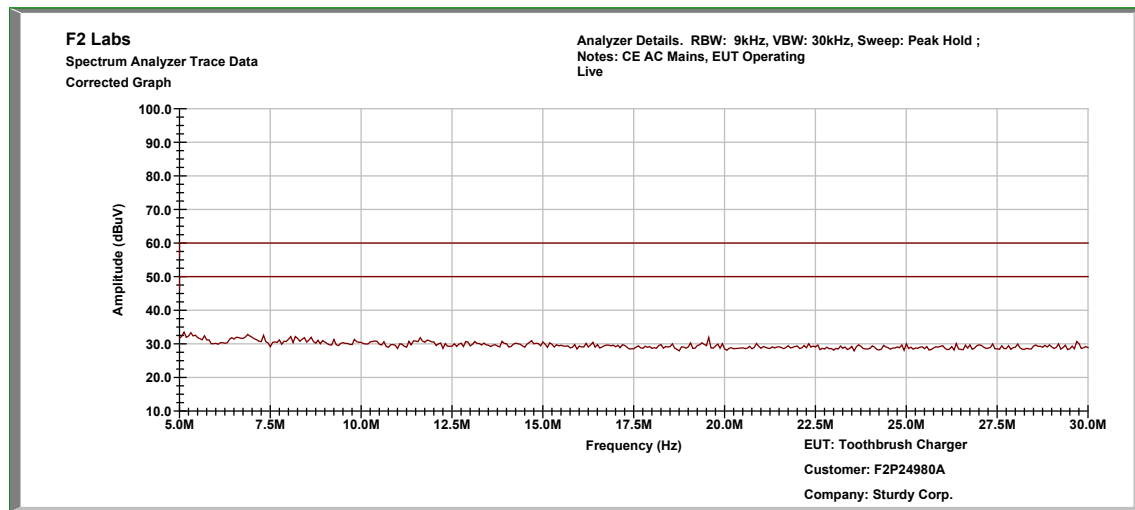


Conducted Test – Live: 0.5 MHz to 5.0 MHz





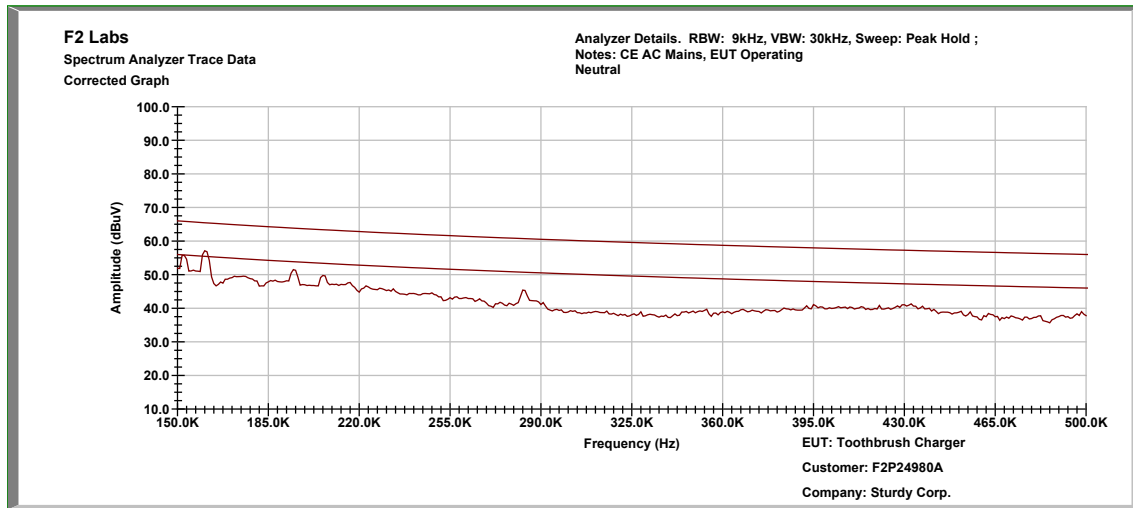
Conducted Test – Live: 5.0 MHz to 30.0 MHz



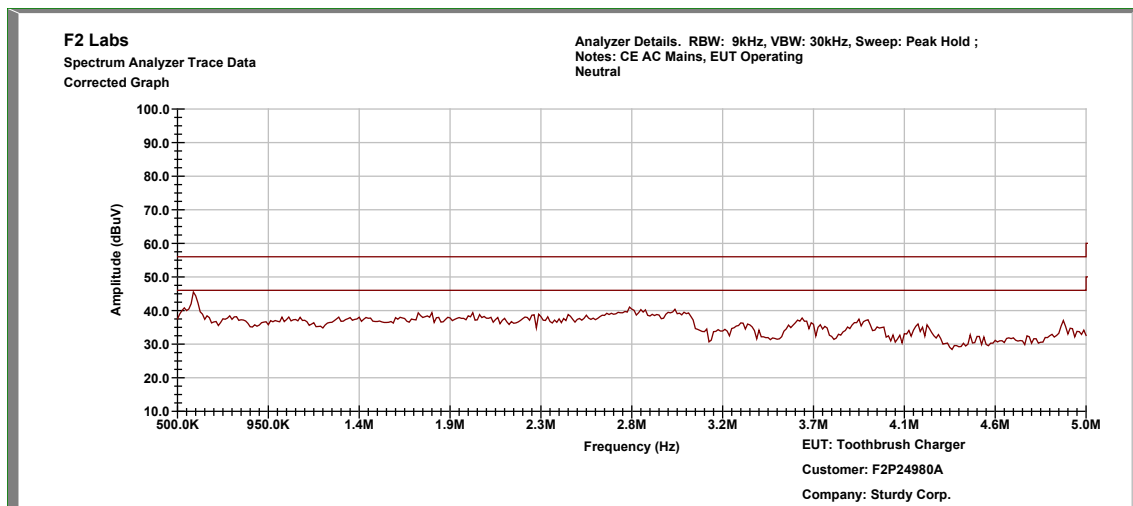
Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBμV)	Adjustment (dB)	Results (dBμV)	Limit (dBμV)	Margin (dB)
1	Live	0.157	Quasi-Peak	40.76	11.08	51.84	65.62	-13.8
			Average	24.23	11.08	35.31	55.62	-20.3
2	Live	0.166625	Quasi-Peak	39.24	11.00	50.24	65.21	-15.0
			Average	21.77	11.00	32.77	55.21	-22.4
3	Live	0.191125	Quasi-Peak	34.21	10.80	45.01	63.99	-19.0
			Average	16.93	10.80	27.73	53.99	-26.3
4	Live	0.37400	Quasi-Peak	24.52	10.31	34.83	58.41	-23.6
			Average	11.36	10.31	21.67	48.41	-26.7
5	Live	0.57825	Quasi-Peak	27.96	10.22	38.18	56.00	-17.8
			Average	19.96	10.22	30.18	46.00	-15.8

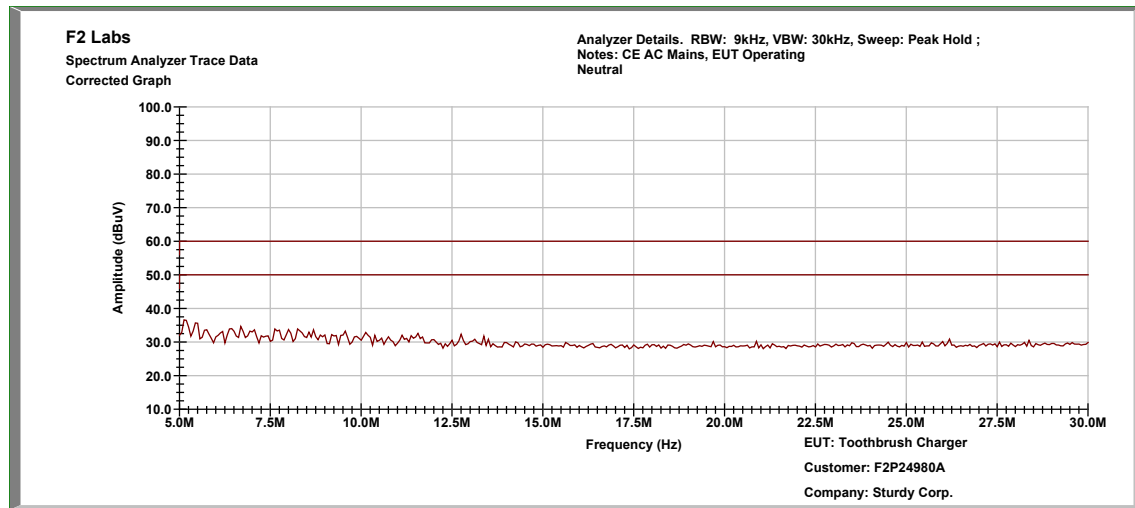


Conducted Test – Neutral: 0.15 MHz to 0.5 MHz



Conducted Test – Neutral: 0.5 MHz to 5.0 MHz



**Conducted Test – Neutral: 5.0 MHz to 30.0 MHz**

Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBμV)	Adjustment (dB)	Results (dBμV)	Limit (dBμV)	Margin (dB)
1	Neutral	0.152625	Quasi-Peak	37.80	11.11	48.91	65.86	-17.0
			Average	20.30	11.11	31.41	55.86	-24.5
2	Neutral	0.161375	Quasi-Peak	37.53	11.04	48.57	65.44	-16.9
			Average	20.53	11.04	31.57	55.44	-23.9
3	Neutral	0.57875	Quasi-Peak	29.54	10.23	39.77	56.00	-16.2
			Average	17.84	10.23	28.07	46.00	-17.9



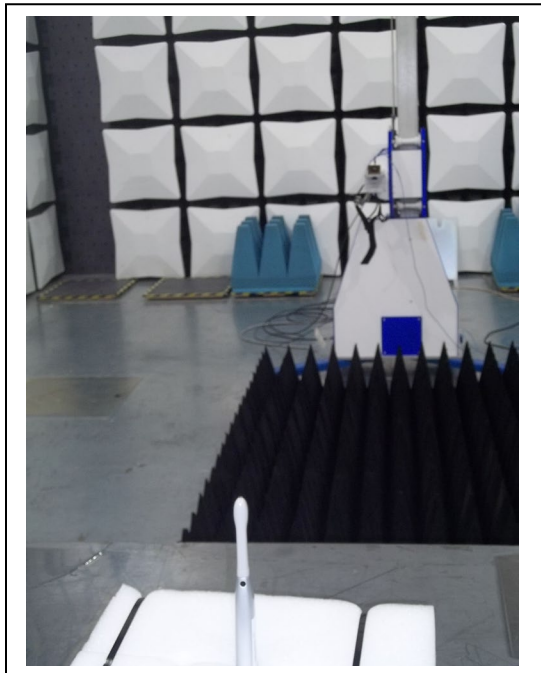
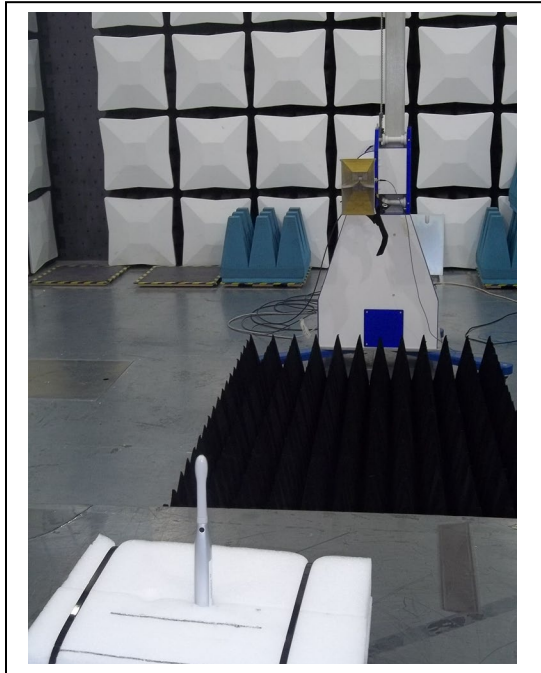
10 PHOTOGRAPHS - TEST SETUPS

Spurious Emissions

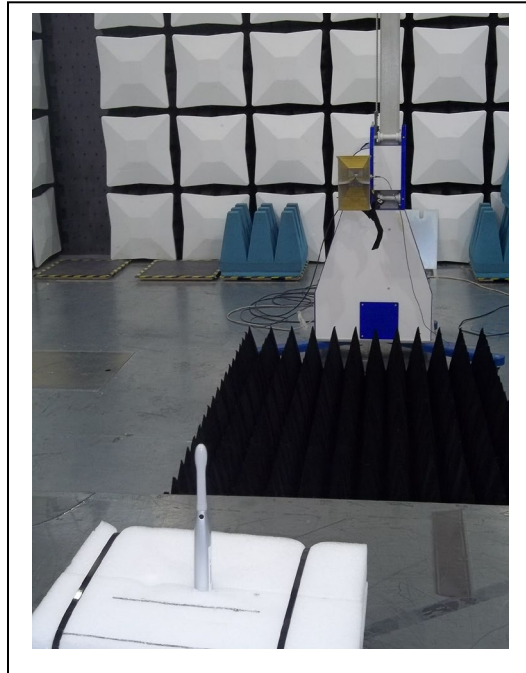




Spurious Emissions, cont'd



Field Strength of Emissions, Occupied Bandwidth





Conducted Emissions

