Philips Oral Healthcare, Inc.

TEST REPORT FOR

Rechargeable Power Toothbrush with BLE
Model: HX960U*
(*See Appendix A for Manufacturer Declaration)

Tested o The Following Standards:

FCC Part 15 Subpart C Section(s)

15.225
(13.110-14.010 MHz)

Report No.: 102125-1

Date of issue: January 10, 2019

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

Test Certificate # 803.05

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Philips Oral Healthcare, Inc.
22100 Bothell Everett Hwy
Bothell WA 98021

REPRESENTATIVE: Ethan Fabela
Customer Reference Number: US13 - 2100773905

REPORT PREPARED BY:

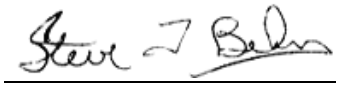
Terri Rayle
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 102125

DATE OF EQUIPMENT RECEIPT: December 19, 2018
DATE(S) OF TESTING: December 19-21, 2018

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
22116 23rd Drive S.E., Suite A
Canyon Park, Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.11

Site Registration & Accreditation Information

Location	NIST CB #	TAIWAN	CANADA	FCC	JAPAN
Canyon Park Bothell, WA	US0081	SL2-IN-E-1145R	3082C-1	US1022	A-0148

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C - 15.225

Test Procedure	Description	Modifications	Results
15.215(c)	Occupied Bandwidth	NA	Pass
15.225(a)-(c)	Field Strength of Fundamental	NA	Pass
15.225(e)	Frequency Stability	NA	Pass
15.225(d)	Field Strength of Spurious Emissions	NA	Pass

NA = Not Applicable

ISO/IEC 17025 Decision Rule
The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
Rechargeable Power Toothbrush with BLE	Philips Oral Healthcare, Inc.	HX960U	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
None			

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Modulation Type(s):	ASK
Maximum Duty Cycle:	100%
Antenna Type(s) and Gain:	Loop -92.8dBi estimated
Antenna Connection Type:	Integral
Nominal Input Voltage:	3.7V LI-ION Battery
Firmware / Software used for Test:	UPCI V1.3.0

FCC Part 15 Subpart C

15.215(c) Occupied Bandwidth (20dB BW)

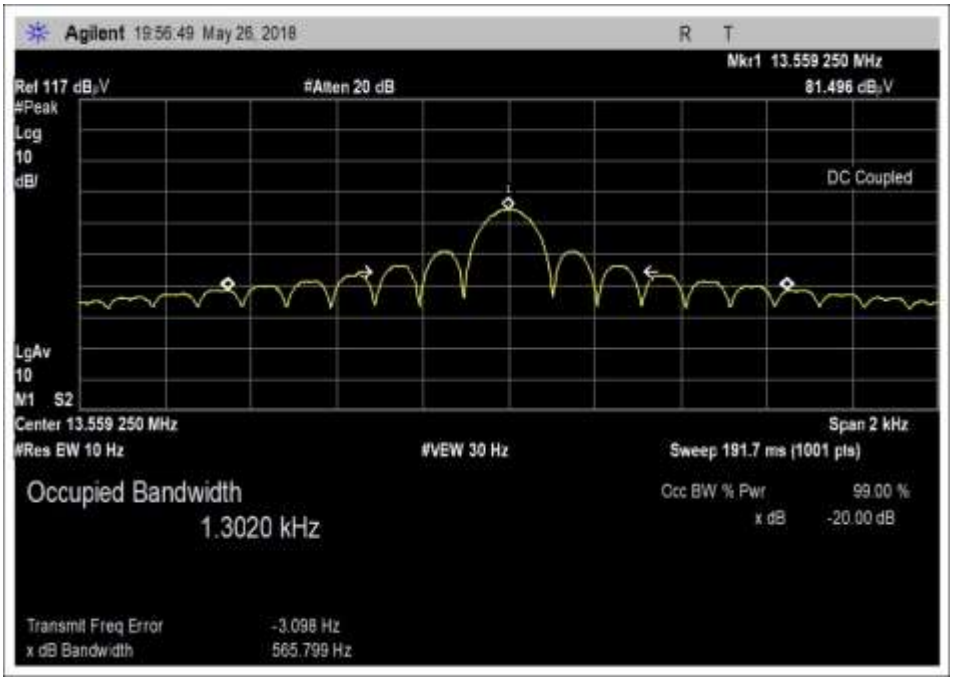
Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Harrison
Test Method:	ANSI C63.10 (2013)	Test Date(s):	12/21/2018
Configuration:	2		
Test Setup:	The EUT is placed next to a near field probe Freq: 13.56MHz Modulation: ASK Protocol: NFC BLE is Disabled. EUT is transmitting continuously at 13.56MHz. 15.31e EUT has a fresh battery installed.		

Environmental Conditions			
Temperature (ºC)	20-23	Relative Humidity (%):	30-36

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02872	Spectrum Analyzer	Agilent	E4440A	11/3/2017	11/3/2019

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
13.56	Integral	ASK	0.565	None	NA

Plot



Test Setup Photo

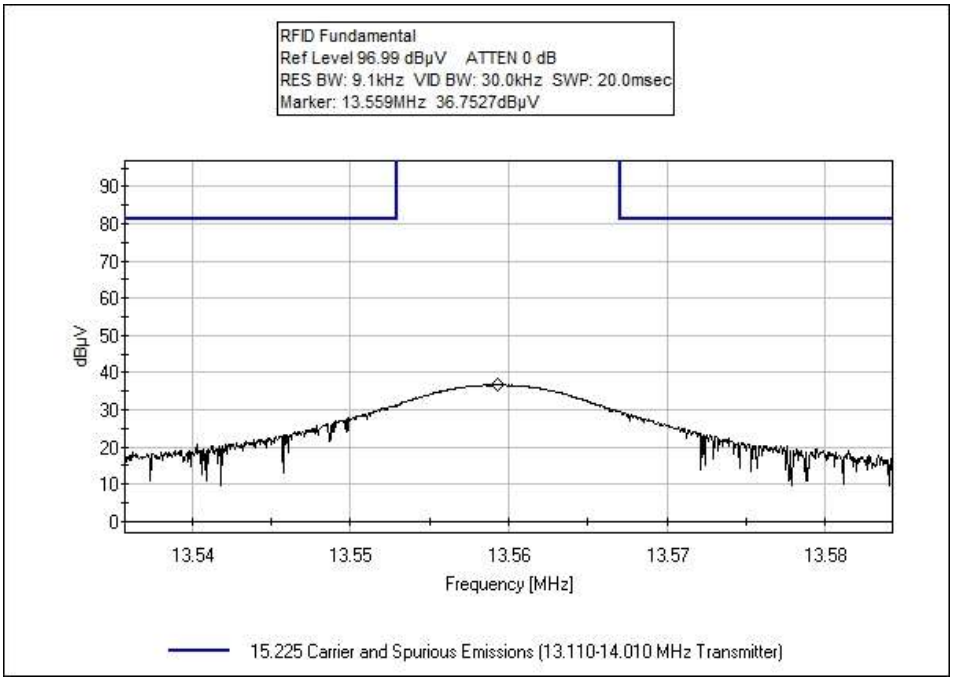
15.225(a)-(c) Field Strength of Fundamental

Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using a fresh battery.

Test Data Summary – Radiated Field Strength Measurement					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Measured (dBuV/m @ 30m)**	**Limit (dBuV/m @ 30m)**	**Results**
13.56	ASK	Integral Loop	6.9	≤84	Pass

Plot



Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC		
Customer:	**Philips Oral Healthcare, Inc.**		
Specification:	**15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter)**		
Work Order #:	**102029**	Date:	12/19/2018
Test Type:	**Maximized Emissions**	Time:	10:04:09
Tested By:	Matthew Harrison	Sequence#:	16
Software:	EMITest 5.03.11		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

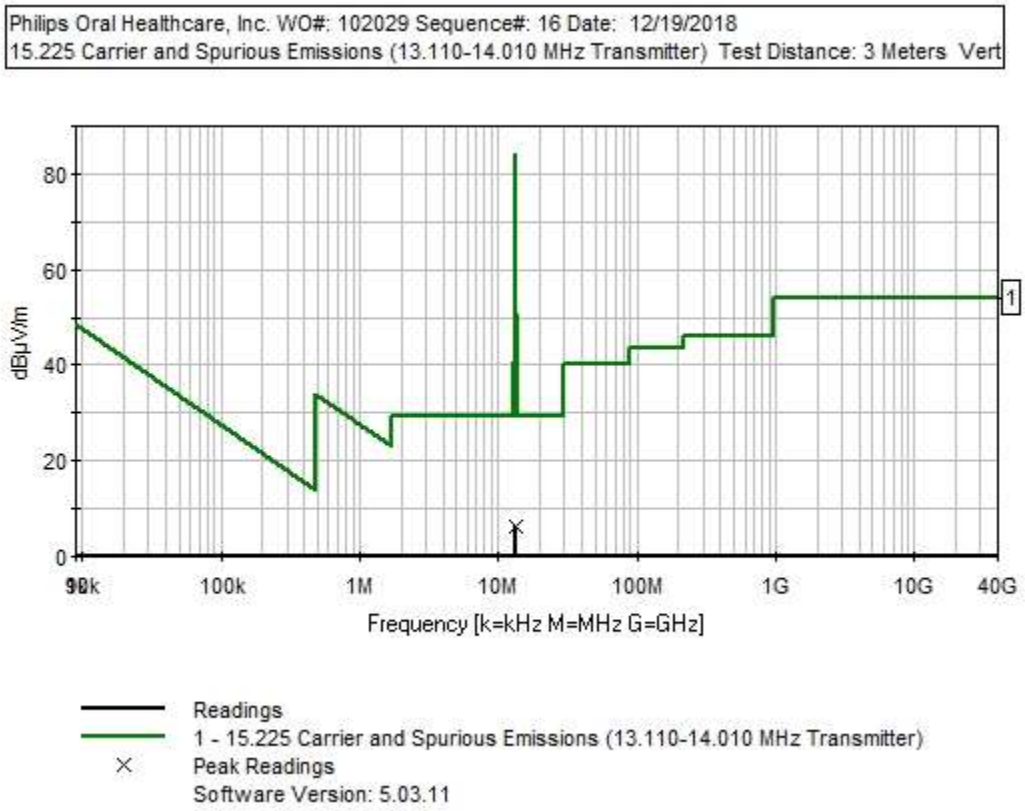
Transmit Frequency: 13.56 MHz
Firmware power setting: Max Power
Software: UPCI V1.3.0
Protocol /MCS/Modulation: ASK

Antenna type: Loop
Antenna Gain: -92.8dBi estimated

Duty Cycle: Continuously Transmitting (100%)

Test Mode: Continuously transmitting on one channel
Test Setup: EUT is transmitting through integral antenna. EUT X, Y, Z axis investigated, horizontal and vertical antenna polarities (above 30MHz) + 3 orthogonal polarities (below 30MHz), only worst case reported.
Modifications Added: None

Test Location: Bothell Lab C3
Test Method: ANSI C63.10 (2013)
Temperature (ºC): 20-23
Relative Humidity (%): 30-36



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T2	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019
T3	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	13.559M	36.8	+0.2	+0.0	+9.1		-40.0	6.1	84.0	-77.9	Para
							270		Y Axis		100

Test Setup Photos

Below 1GHz

X Axis

Y Axis

Z Axis

15.225(e) Frequency Stability

Test Setup/Conditions			
Test Location:	Brea Lab Bench	Test Engineer:	M. Harrison
Test Method:	ANSI C63.10 (2013)	Test Date(s):	12/20/2018
Configuration:	2		
Test Setup:	The EUT was placed in the temperature chamber in a test fixture where measurements were made. Freq: 13.56MHz Modulation: ASK Protocol: NFC BLE is Disabled. EUT is transmitting continuously at 13.56MHz. 15.31e A DC source set to the nominal voltage of the battery was used.		

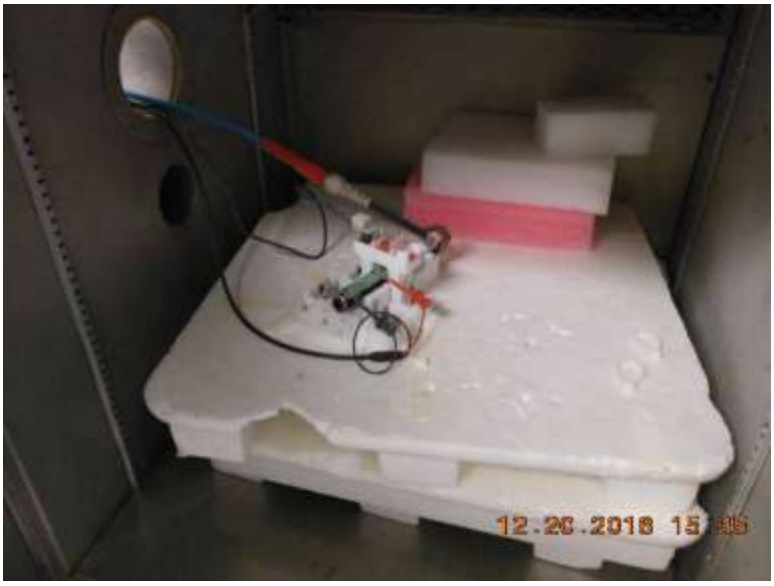
Environmental Conditions			
Temperature (ºC)	20	Relative Humidity (%):	27

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02757	Temperature Chamber	Bemco	F100/350-8	1/2/2017	1/2/2019
02673	Spectrum Analyzer	Agilent	E4446A	2/3/2017	2/3/2019
P07228	Attenuator	Pasternack	PE7004-20	11/30/2017	11/30/2019
P07527	Variac	Simpson	NA	11/21/2018	11/21/2020
P06008	Cable	Andrew	Heliax	4/10/2018	4/10/2020
03029	Thermometer, Digital Infrared	Fluke	566	1/12/2017	1/12/2019
P07514	Power Supply	Wanptek	KPS305D	10/30/2018	10/30/2020

Test Data Summary					
Temperature (ºC)	**Voltage**	**Frequency (MHz)**	**Deviation (%)**	**Limit (%)**	**Results**
-20	$V_{Nominal}$	13.55920	0.00590	±0.01	Pass
-10	$V_{Nominal}$	13.55926	0.00546	±0.01	
0	$V_{Nominal}$	13.55927	0.00538	±0.01	
10	$V_{Nominal}$	13.55927	0.00538	±0.01	
20	$V_{Nominal}$	13.55925	0.00553	±0.01	
30	$V_{Nominal}$	13.55923	0.00568	±0.01	
40	$V_{Nominal}$	13.55922	0.00575	±0.01	
50	$V_{Nominal}$	13.55921	0.00583	±0.01	
Nominal Frequency:		13.560000			

This equipment is battery powered. Power output tests were performed using a fresh battery.

Test Setup Photos



Inside Temperature Chamber

Outside Temperature Chamber

15.225(d) Radiated Emissions & Band Edge

Test Setup / Conditions/ Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC		
Customer:	**Philips Oral Healthcare, Inc.**		
Specification:	**15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter)**		
Work Order #:	**102029**	Date:	12/21/2018
Test Type:	**Maximized Emissions**	Time:	08:31:23
Tested By:	Steven Pittsford / Matt Harrison	Sequence#:	10
Software:	EMITest 5.03.11		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Frequency Range: 9kHz-1GHz
Transmit Frequency: 13.56 MHz
Firmware power setting: Max Power
Software: UPCI V1.3.0
Protocol /MCS/Modulation: ASK

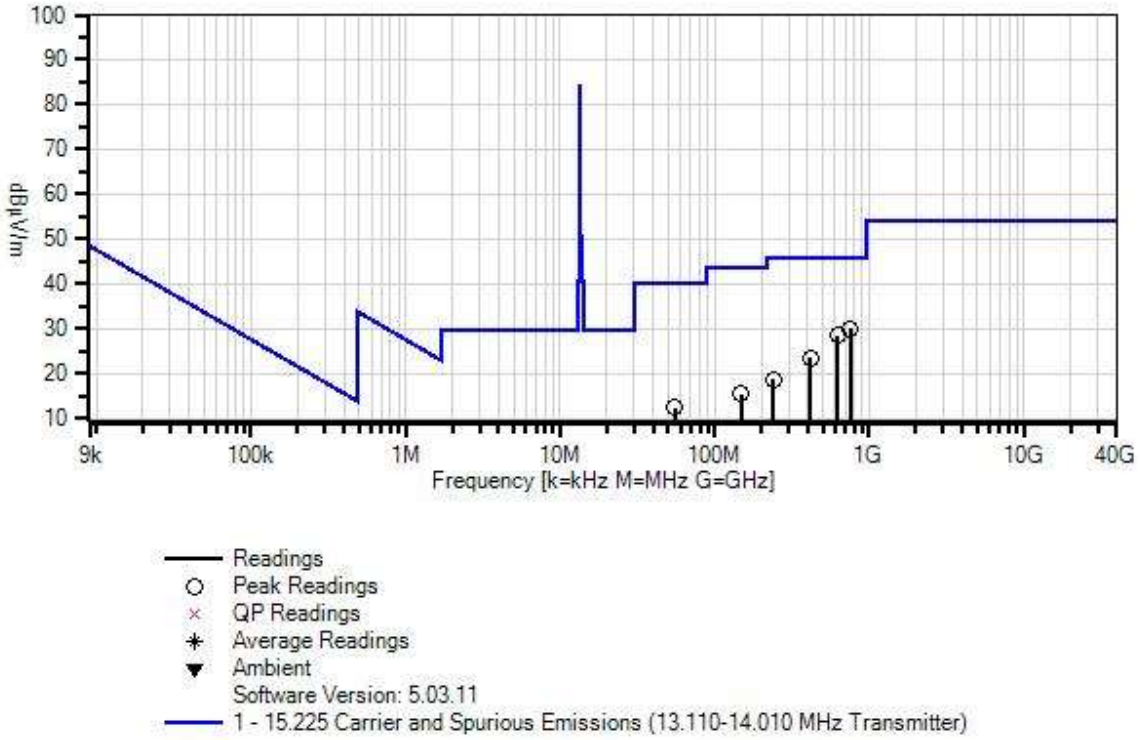
Antenna type: Loop
Antenna Gain: -92.8dBi estimated

Duty Cycle: Continuously Transmitting (100%)

Test Mode: Continuously transmitting on one channel
Test Setup: EUT is transmitting through integral antenna. EUT X, Y, Z axis investigated, horizontal and vertical antenna polarities (above 30MHz) + 3 orthogonal polarities (below 30MHz), only worst case reported.
Modifications Added: None

Test Location: Bothell Lab C3
Test Method: ANSI C63.10 (2013)
Temperature (ºC): 21
Relative Humidity (%): 32

Philips Oral Healthcare, Inc. WO#: 102029 Sequence#: 10 Date: 12/21/2018
15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter) Test Distance: 3 Meters Vert



Readings
Peak Readings
QP Readings
Average Readings
Ambient
Software Version: 5.03.11
1 - 15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T1	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019
	AN02763-69	Waveguide	Multiple	4/23/2018	4/23/2020
	AN03122	Cable	32026-2-29801-36	3/13/2018	3/13/2020
	ANP06678	Cable	32026-29801-29801-144	3/13/2018	3/13/2020
T2	AN02307	Preamp	8447D	1/15/2018	1/15/2020
T3	AN03628	Biconilog Antenna	3142E	6/7/2017	6/7/2019
T4	ANP06123	Attenuator	18N-6	5/5/2017	5/5/2019
T5	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T6	ANP05360	Cable	RG214	1/31/2018	1/31/2020
	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020

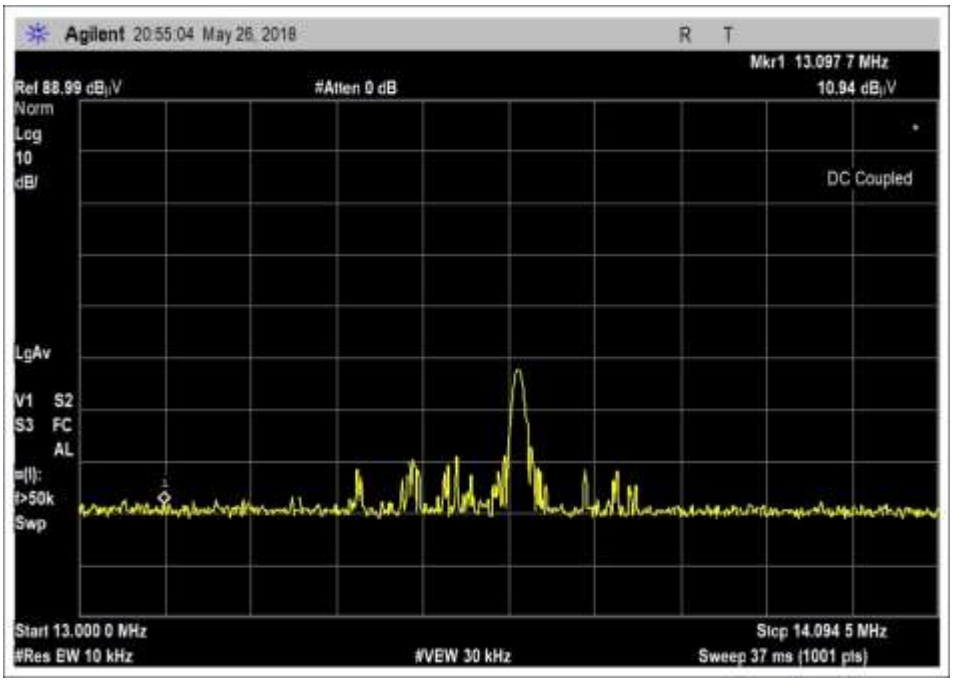
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

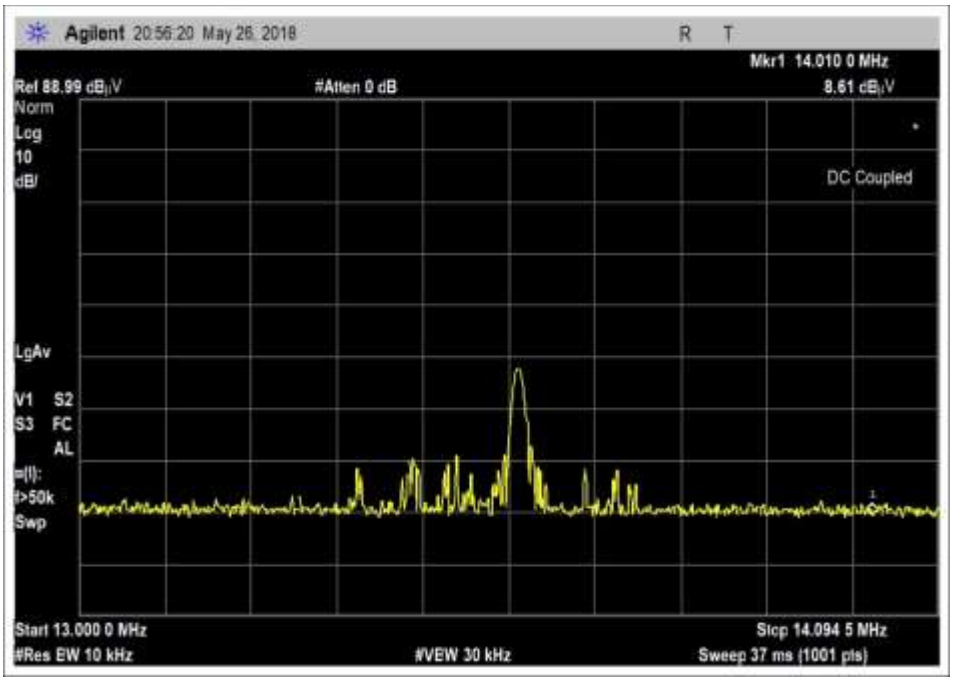
#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	754.600M	26.3	+0.3 +1.4	-27.9 +1.7	+22.4	+5.9	+0.0	30.1	46.0	-15.9	Vert 213
2	625.600M	25.9	+0.3 +1.3	-28.2 +1.5	+21.7	+5.9	+0.0	28.4	46.0	-17.6	Vert 213
3	415.100M	24.9	+0.2 +1.0	-27.7 +1.2	+17.9	+5.9	+0.0	23.4	46.0	-22.6	Vert 213
4	238.600M	25.8	+0.2 +0.8	-27.1 +0.9	+12.2	+5.9	+0.0	18.7	46.0	-27.3	Vert 213
5	55.200M	27.1	+0.1 +0.4	-27.9 +0.4	+6.5	+5.9	+0.0	12.5	40.0	-27.5	Vert 213
6	147.400M	26.9	+0.2 +0.6	-27.5 +0.7	+8.7	+5.9	+0.0	15.5	43.5	-28.0	Vert 213

Band Edge

Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @30m)**	**Limit (dBuV/m @30m)**	**Results**
13.110	ASK	Integral	-19.8	≤29.5	Pass
14.010	ASK	Integral	-22.1	≤29.5	Pass

Band Edge Plots





Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC
Customer: **Philips Oral Healthcare, Inc.**
Specification: **15.225 Carrier and Spurious Emissions (13.110-14.010 MHz Transmitter)**
Work Order #: **102029** Date: 12/21/2018
Test Type: **Maximized Emissions** Time: 12:08:52
Tested By: Matthew Harrison Sequence#: 21
Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Frequency Range: 13.11-14.01MHz
Transmit Frequency: 13.56 MHz
Firmware power setting: Max Power
Software: UPCI V1.3.0
Protocol /MCS/Modulation: ASK

Antenna type: Loop
Antenna Gain: -92.8dBi estimated

Duty Cycle: Continuously Transmitting (100%)

Test Mode: Continuously transmitting on one channel
Test Setup: EUT is transmitting through integral antenna. EUT X, Y, Z axis investigated, horizontal and vertical antenna polarities (above 30MHz) + 3 orthogonal polarities (below 30MHz), only worst case reported.
Modifications Added: None

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T2	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019
T3	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	13.098M	10.9	+0.2	+0.0	+9.1		-40.0 270	-19.8	29.5	-49.3	Vert 100
2	14.010M	8.6	+0.2	+0.0	+9.1		-40.0 270	-22.1	29.5	-51.6	Vert 100

Test Setup Photos

Below 1GHz

X Axis

Y Axis

Z Axis

Appendix A: Manufacturer Declaration

The following device and model has been tested by CKC Laboratories:
Rechargeable Power Toothbrush with BLE, HX960U

Since the time of testing, the manufacturer has chosen to use the following device and model name in its place:
Rechargeable Power Toothbrush with BLE and NFC 13.56, HX96

The manufacturer declares that the following additional models are identical electrically or any differences between them do not affect their EMC characteristics, and therefore meets the level of testing equivalent to the tested model.
HX960Y, HX961Y, HX962Y, with "Y" representing the color of the handle.

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2.
Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret (“^”) was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.