VDE Testing & Certification Institute

ADDENDUM TO TEST REPORT 95313-15

Toothbrush
Models: 3754 & 3764

Tested To The Following Standards:

FCC Part 15 Subpart C, Section 15.249

Report No.: 95313-15A

Date of issue: May 9, 2014

ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

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 EMC 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.

Testing the Future
CKC LABORATORIES, INC.

TABLE OF CONTENTS

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Braun GmbH
Frankfurterstraße 145
61476 Kronberg am Taunus
Germany

Representative: Martin Moesbauer – Braun GmbH
Ching-Yun Wang – VDE Testing & Certification Inst.

REPORT PREPARED BY:

Morgan Tramontin
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 95313

DATE OF EQUIPMENT RECEIPT: February 25, 2014
DATE(S) OF TESTING: February 25 – April 3, 2014

Revision History

Original: Testing of the Toothbrush, 3754 and 3764 to FCC Part 15.249.
Addendum A: To replace the Field Strength of Spurious Emissions data sheet because the previous datasheet did not include an antenna up to 26GHz. Removed the "Duty Cycle corrections factor that was applied based on a formula," statement in the test conditions of the Fundamental Field Strength section and added a new Duty Cycle statement.

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment 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.
5046 Sierra Pines Drive
Mariposa, CA 95338

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.00.14
Immunity	5.00.07

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Mariposa A	US0103	SL2-IN-E-1147R	3082A-2	90477	A-0136

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C

Test Procedure/Method	Description	Results
15.249(a)	Fundamental Field Strength	Pass
15.215(c)	Occupied Bandwidth	Pass
15.249(d)	Field Strength of Spurious Emissions & Band Edge	Pass

Conditions During Testing

This list is a summary of the conditions noted for or modifications made to the equipment during testing.

Summary of Conditions
Note: The two models are organized throughout the report structure as “3754” and “3764”. These two models each operate in two different modes: Bluetooth mode and Proprietary mode. All testing included in this report is tested in the Proprietary mode.

EQUIPMENT UNDER TEST (EUT)

EQUIPMENT UNDER TEST

Toothbrush
Manuf: Braun
Model: 3754
Serial: Test_SW

Toothbrush
Manuf: Braun
Model: 3764
Serial: Test_SW

PERIPHERAL DEVICES

The EUT was not tested with peripheral devices.

FCC PART 15 SUBPART C

This report contains EMC emissions test results under United States Federal Communications Commission (FCC) CFR 47 Section 15 Subpart C requirements for Intentional Radiators.

15.249(a) Fundamental Field Strength

Test Data

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Dr. • Mariposa, CA 95338 • (209) 966-5240

Customer: **VDE Testing and Certification Institute**
Specification: **15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**
Work Order #: **95313** Date: 2/28/2014
Test Type: **Maximized Emissions** Time: 11:27:07
Equipment: **Toothbrush** Sequence#: 2
Manufacturer: Braun Tested By: Eddie Mariscal
Model: 3754
S/N: Test_SW

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00327	Horn Antenna	3115	4/13/2012	4/13/2014
T2	AN03360	Cable	32022-2-29094-36TC	2/4/2013	2/4/2015
T3	AN03155	Preamp	83017A	6/26/2013	6/26/2015
T4	AN03355	Cable	32026-2-29094K-48TC	2/7/2013	2/7/2015
T5	AN03358	Cable	32022-2-29094K-36TC	2/7/2013	2/7/2015
T6	AN03359	Cable		2/4/2013	2/4/2015
T7	ANP05904	Cable	32022-2-29094K-144TC	2/15/2013	2/15/2015

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Toothbrush*	Braun	3754	Test_SW
Toothbrush	Braun	3764	Test_SW

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

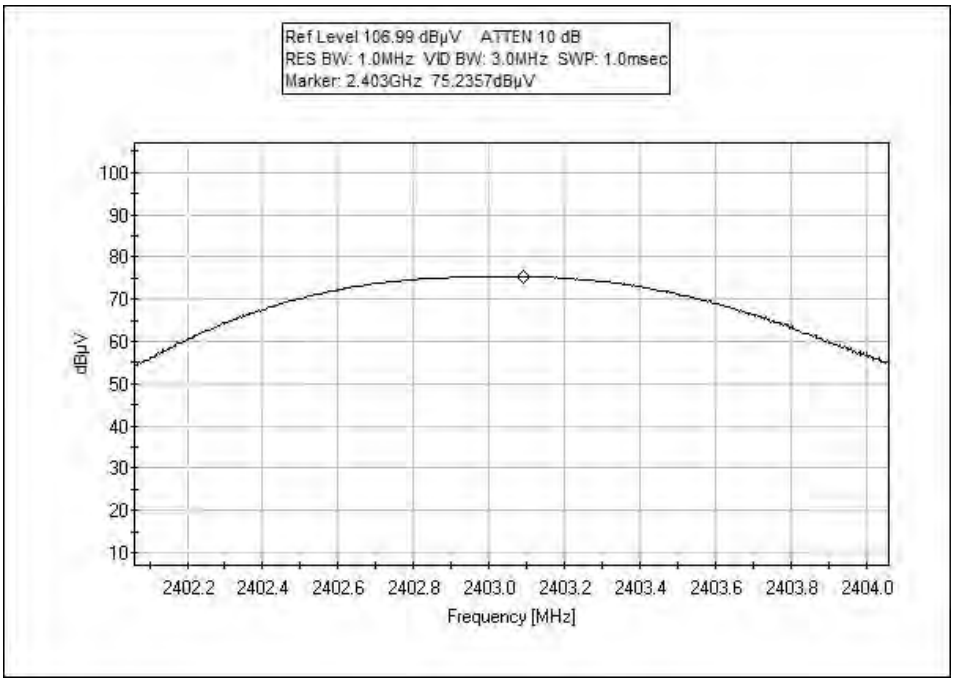
The EUT is placed atop Styrofoam support atop wooden nonconductive turntable of height 80cm. The EUT is in Proprietary mode with max duty cycle of 12.5%. EUT uses an integral antenna.
The EUT was investigated about three orthogonal axes. Reported data represents the worst case of all orientations.
Tested in accordance with 15.31(e). The EUT is battery operated, so testing was performed with freshly charged battery.
Duty Cycle correction factor -18.06dB was applied to the fundamental emission measurement (See Appendix A for Duty Cycle correction calculation).
Frequency range of Interest:
Fundamental
RBW = 1MHz; VBW > 1MHz;
Environmental Conditions:
Temperature: 18°C
Relative Humidity: 35%
Atmospheric Pressure: 97.8kPa

Ext Attn: 0 dB

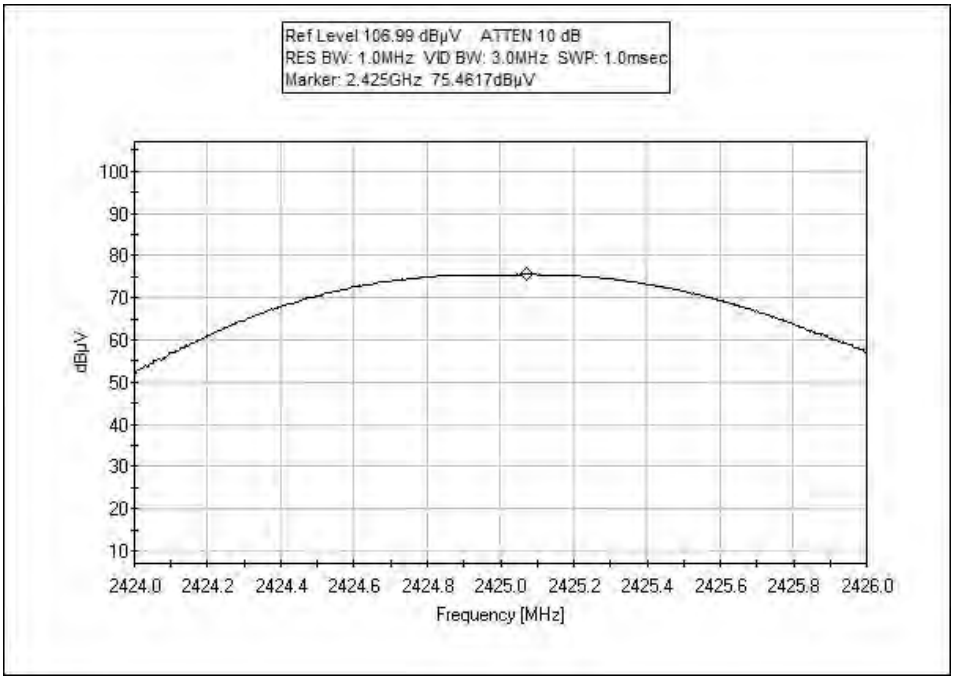
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3 T7	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2403.000M	80.5	+28.4 +0.5	+0.7 +0.6	-32.9 +2.2	+0.5	+0.0	80.5	94.0 Model 3764-Duty Cycle correction factor of -18.06 applied	-13.5	Horiz
2	2425.030M	79.7	+28.5 +0.5	+0.7 +0.6	-32.9 +2.2	+0.5	+0.0	79.8	94.0 Model 3764-Duty Cycle correction factor of -18.06 applied	-14.2	Horiz
3	2451.887M	78.7	+28.6 +0.6	+0.7 +0.6	-32.9 +2.2	+0.5	+0.0	79.0	94.0 Model 3764-Duty Cycle correction factor of -18.06 applied	-15.0	Horiz
4	2425.070M	75.5	+28.5 +0.5	+0.7 +0.6	-32.9 +2.2	+0.5	+0.0	75.6	94.0 Model 3754-Duty Cycle correction factor of -18.06 applied	-18.4	Horiz
5	2451.903M	75.1	+28.6 +0.6	+0.7 +0.6	-32.9 +2.2	+0.5	+0.0	75.4	94.0 Model 3754-Duty Cycle correction factor of -18.06 applied	-18.6	Horiz
6	2403.073M	75.2	+28.4 +0.5	+0.7 +0.6	-32.9 +2.2	+0.5	+0.0	75.2	94.0 Model 3754-Duty Cycle correction factor of -18.06 applied	-18.8	Horiz

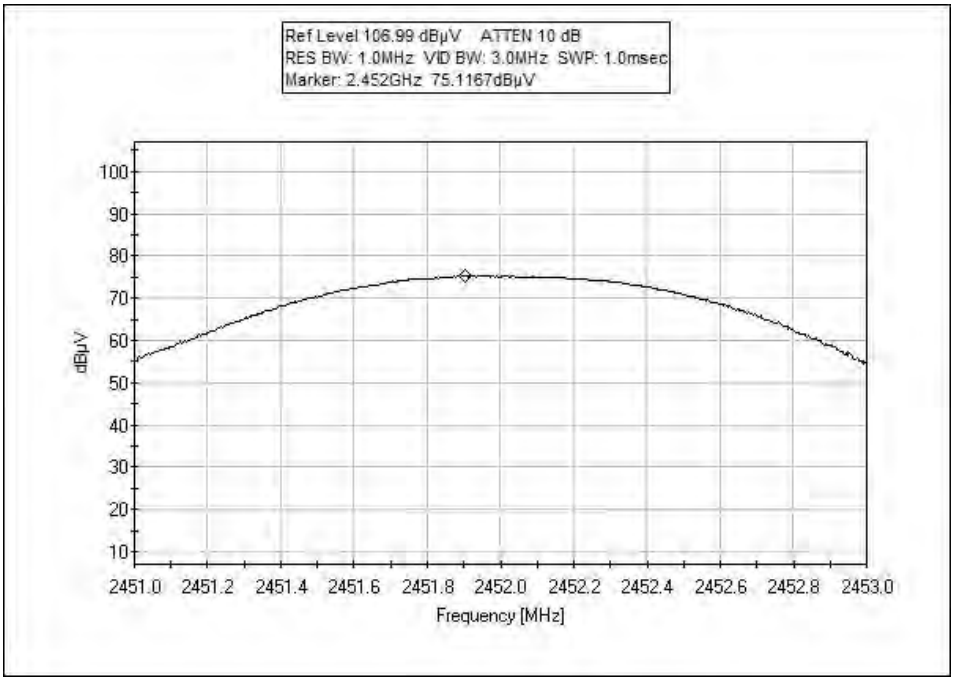
Test Plot(s)



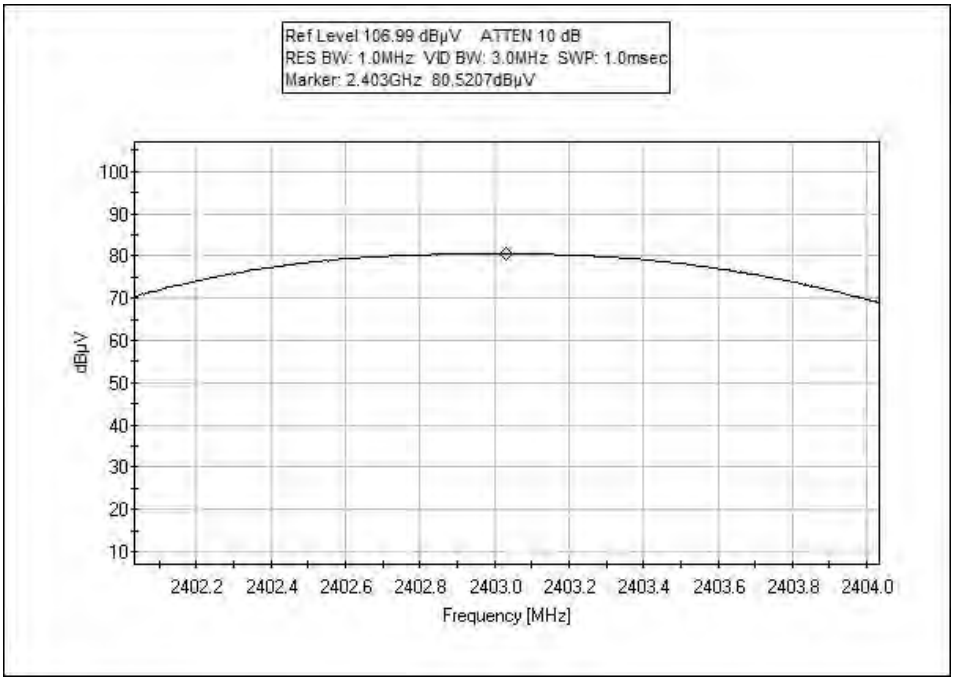
Low Frequency, 3754



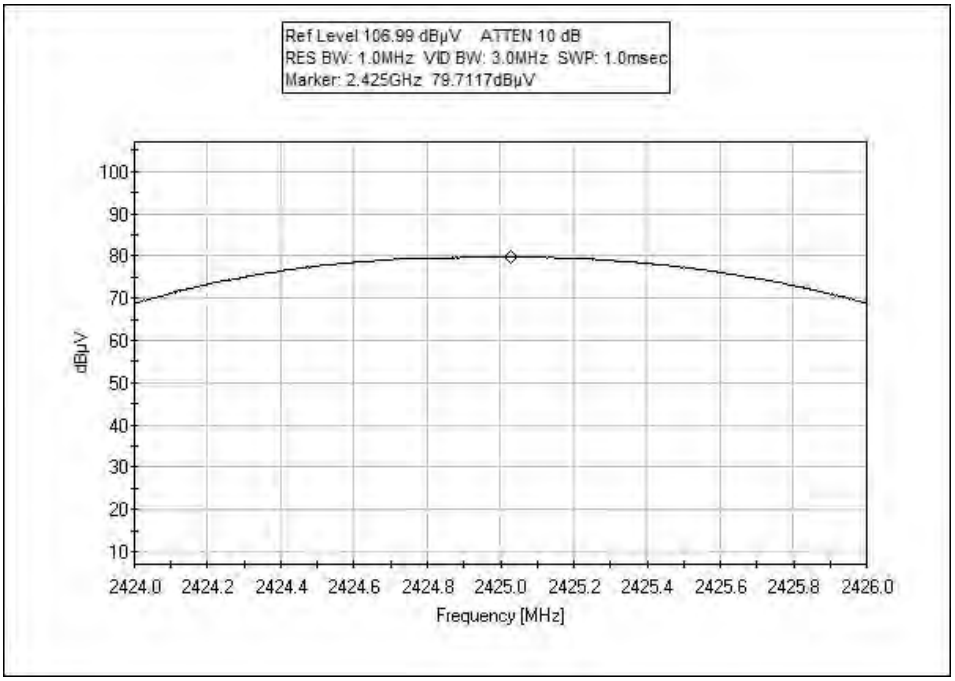
Middle Frequency, 3754



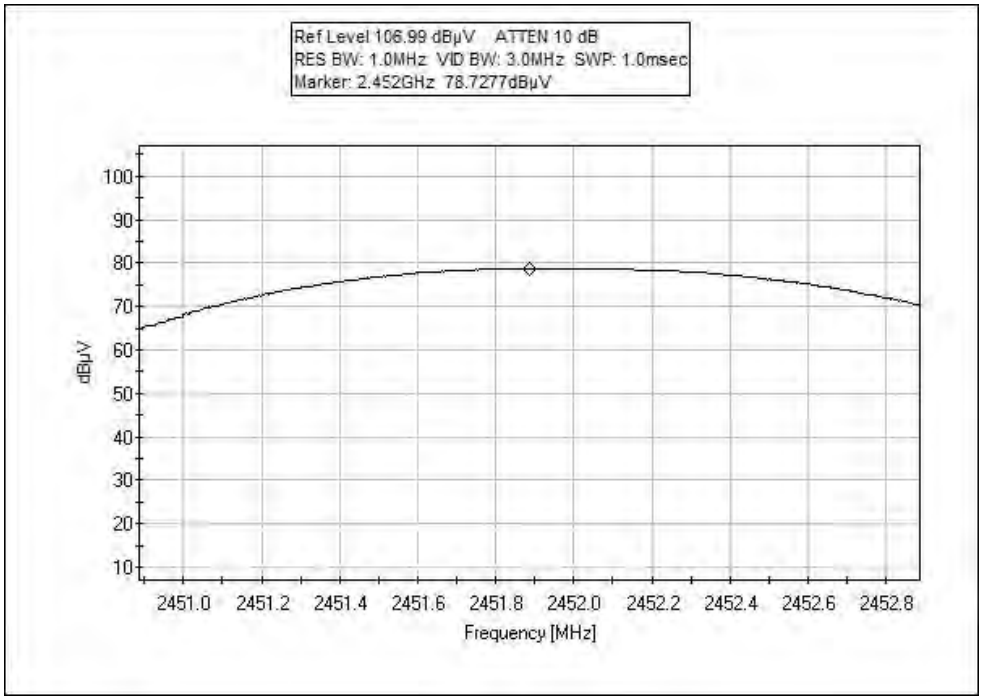
High Frequency, 3754



Low Frequency, 3764



Middle Frequency, 3764



High Frequency, 3764

Test Setup Photo(s)

X - Axis, 3754

Y - Axis, 3754

Z - Axis

High Frequency, 3754

X - Axis, 3764

Y- Axis, 3764

Z - Axis, 3764

High Frequency, 3764

15.215(c) Occupied Bandwidth

Test Conditions / Setup

Engineer Name: Eddie Mariscal

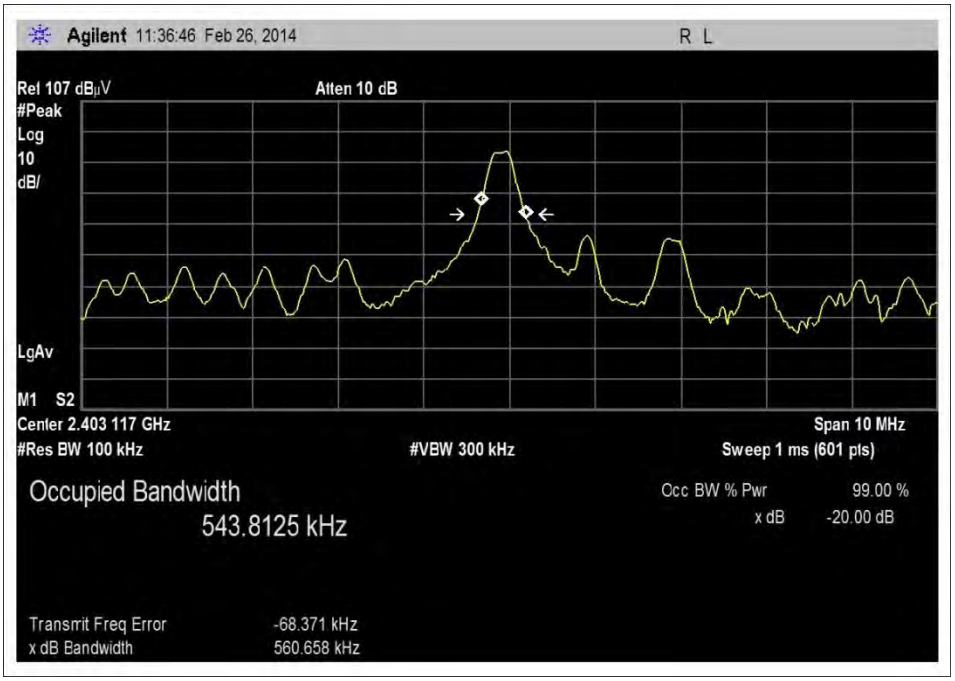
Test Conditions:
Temp: 18°C
Humidity: 35%
Pressure: 97.8kPa
Freq: 2402-2480MHz

The EUT's use a non-removable antenna, thus the data will be gathered through radiated measurements. The EUT is located on top of a Styrofoam support, 80cm above the reference ground plane. The EUT is operating in Proprietary mode during testing. Three orthogonal axes were investigated. The data presented represents the worst case orientation. The EUT battery is fully charged per FCC 15.31(e).

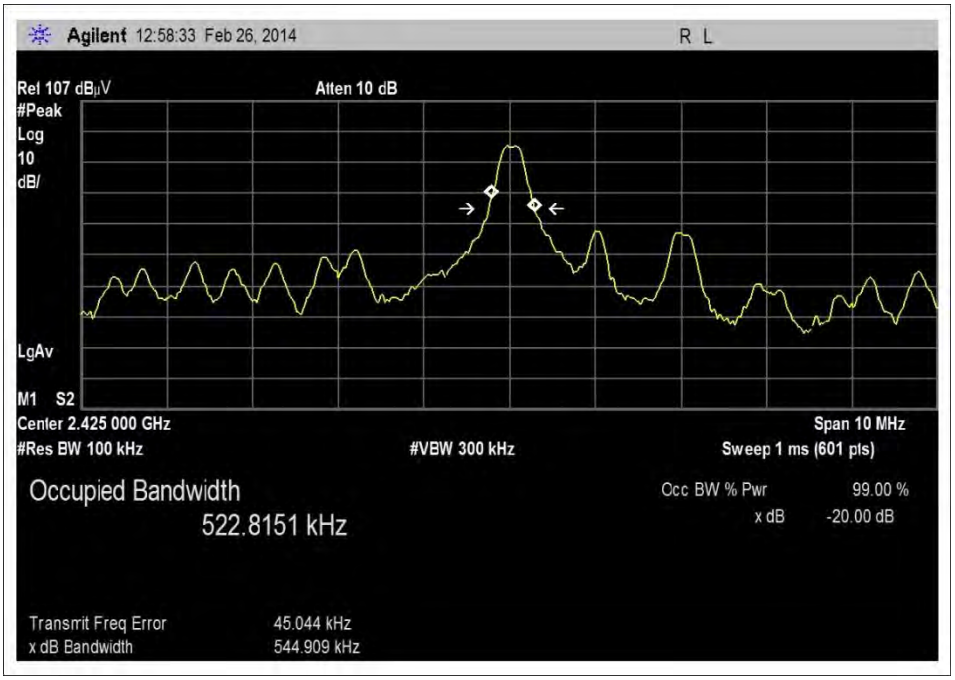
Test Equipment

Asset #	Description	Model	Manufacturer	Cal Date	Cal Due
00327	Horn Antenna	3115	EMCO	4/13/2012	4/13/2014
03360	Cable	32022-2-29094-36TC	Astrolab	2/4/2013	2/4/2015
03155	Preamp	83017A	HP	6/26/2013	6/26/2015
03355	Cable	32026-2-29094K-48TC	Astrolab	2/7/2013	2/7/2015
03358	Cable	32022-2-29094K-36TC	Astrolab	2/7/2013	2/7/2015
03359	Cable	32022-2-29094-36TC	Astrolab	2/4/2013	2/4/2015
P05904	Cable	32022-2-29094K-144TC	Astrolab	2/15/2013	2/15/2015

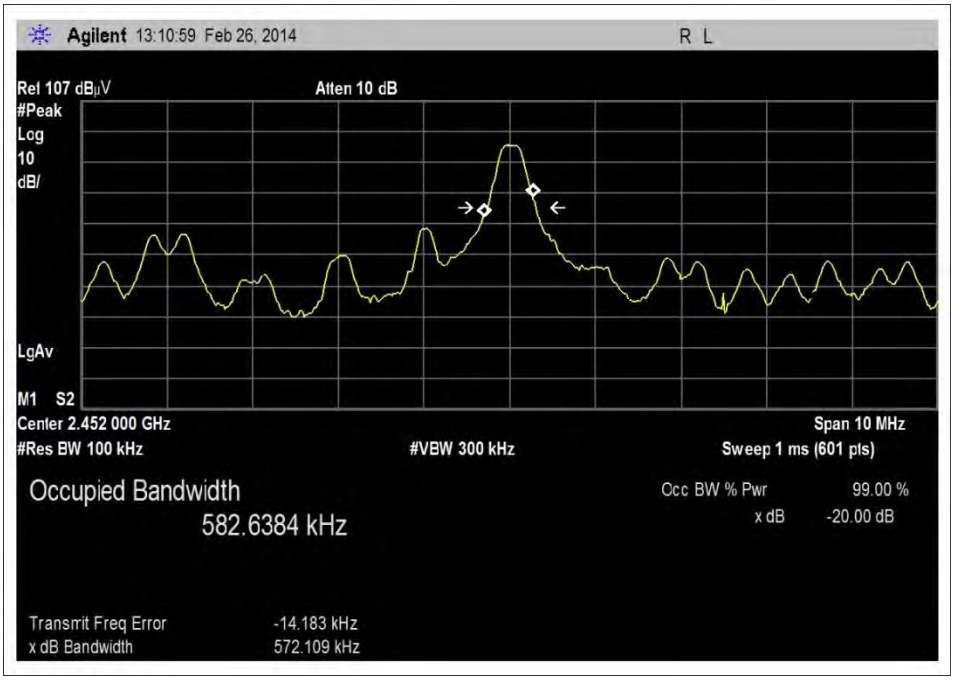
Test Data



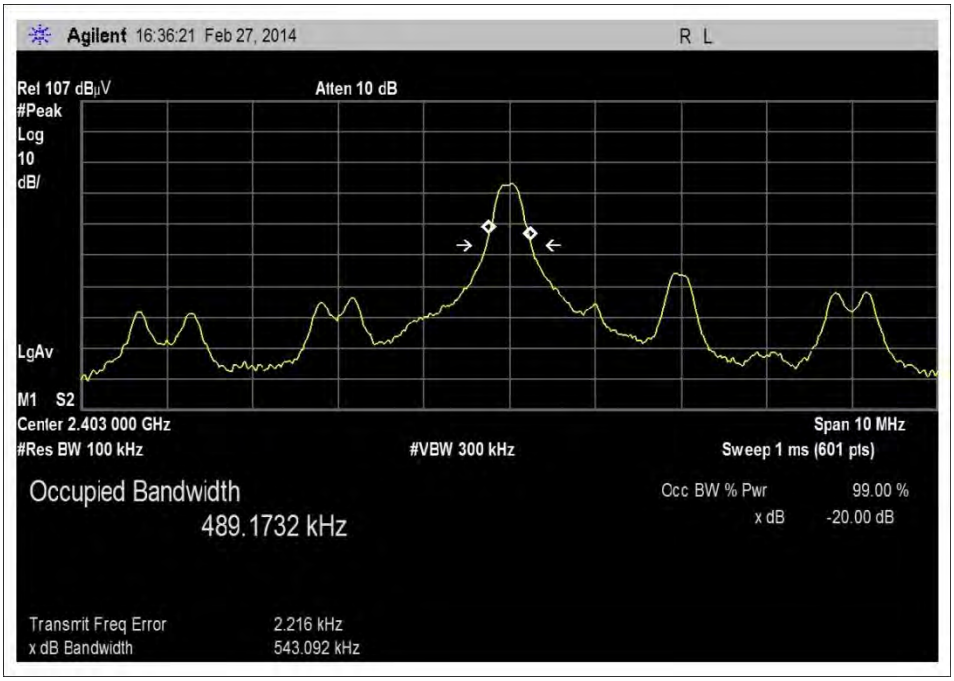
Low Frequency, 3754



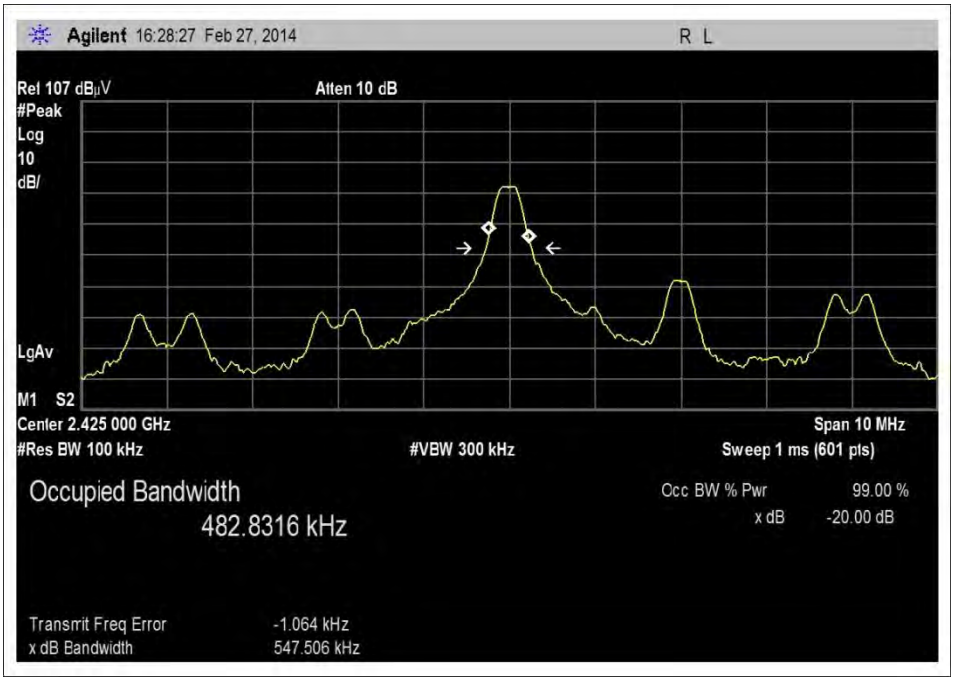
Middle Frequency, 3754



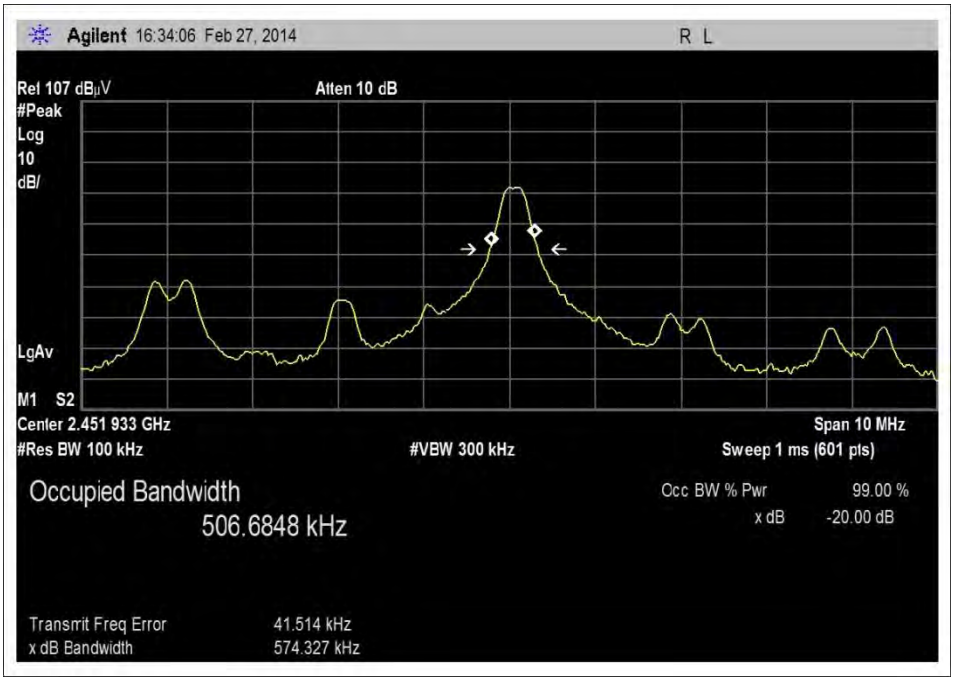
High Frequency, 3754



Low Frequency, 3764



Middle Frequency, 3764



High Frequency, 3764

Test Setup Photo(s)

High Frequency, 3754

High Frequency, 3764

15.249(d) Field Strength of Spurious Emissions and Band Edge

Test Data

Test Location: CKC Laboratories, Inc. • 5046 Sierra Pines Dr. • Mariposa, CA 95338 • (209) 966-5240

Customer: **VDE Testing and Certification Institute**
Specification: **15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**
Work Order #: **95313** Date: 3/28/2014
Test Type: **Maximized Emissions** Time: 16:32:23
Equipment: **Toothbrush** Sequence#: 2
Manufacturer: Braun Tested By: Eddie Mariscal
Model: 3754
S/N: Test_SW

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN00327	Horn Antenna	3115	4/13/2012	4/13/2014
	AN03360	Cable	32022-2-29094-36TC	2/4/2013	2/4/2015
	AN03155	Preamp	83017A	6/26/2013	6/26/2015
	AN03355	Cable	32026-2-29094K-48TC	2/7/2013	2/7/2015
	AN03358	Cable	32022-2-29094K-36TC	2/7/2013	2/7/2015
	AN03359	Cable		2/4/2013	2/4/2015
	ANP05904	Cable	32022-2-29094K-144TC	2/15/2013	2/15/2015
	AN01991	Biconilog Antenna	CBL6111C	3/7/2014	3/7/2016
	AN00062	Preamp	8447D	6/6/2012	6/6/2014
T1	ANP06230	Cable	CXTA04A-50	8/16/2012	8/16/2014
T2	AN00226	Loop Antenna	6502	3/28/2012	3/28/2014
T3	AN02660	Spectrum Analyzer	E4446A	8/23/2012	8/23/2014
	AN02046	Horn Antenna-ANSI C63,5 (2006) 3m (dB)	MWH-1826/B	2/4/2013	2/4/2015

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Toothbrush*	Braun	3754	Test_SW
Toothbrush	Braun	3764	Test_SW

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT is placed atop Styrofoam support atop wooden nonconductive turntable of height 80cm. EUT is in Proprietary mode with a duty cycle of 12.5%. EUT uses an integral antenna.

EUT was investigated about three orthogonal axes. Reported data represents the worst case of all orientations.

Tested in accordance with 15.31(e). EUT is battery operated, so testing was performed with freshly charged battery.

Frequency range of Interest:
.009-25000MHz

RBW = 1MHz; VBW > 1MHz;

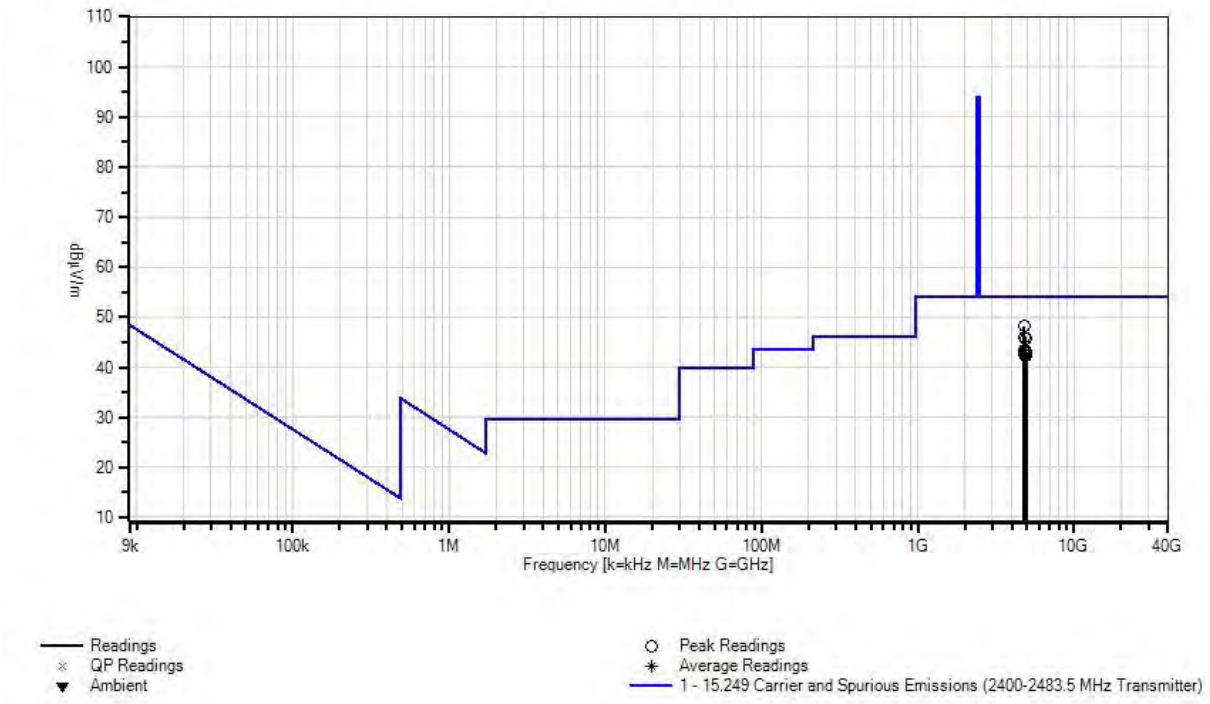
Environmental Conditions:
Temperature: 18°C
Relative Humidity: 35%
Atmospheric Pressure: 97.8kPa

Ext Attn: 0 dB

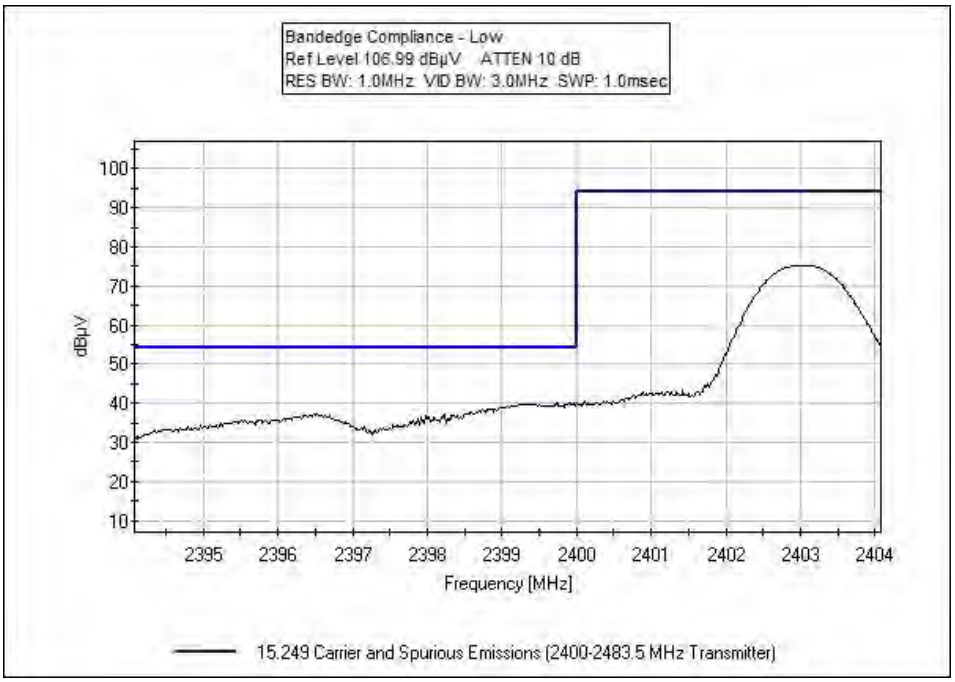
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	4808.000M	42.6	+0.0	+0.0	+0.0		+0.0	48.2	54.0 Model 3764 Transmit low	-5.8	Vert
2	4849.990M	40.3	+0.0	+0.0	+0.0		+0.0	46.0	54.0 Model 3764 Transmit mid	-8.0	Vert
3	4901.985M	40.0	+0.0	+0.0	+0.0		+0.0	45.7	54.0 Model 3764 Transmit high	-8.3	Vert
4	4805.700M	37.9	+0.0	+0.0	+0.0		+0.0	43.5	54.0 Model 3754 Transmit low	-10.5	Vert
5	4808.000M	37.5	+0.0	+0.0	+0.0		+0.0	43.1	54.0 Model 3764 Transmit low	-10.9	Horiz
6	4956.700M	37.4	+0.0	+0.0	+0.0		+0.0	43.0	54.0 Model 3754 Transmit high	-11.0	Vert
7	4901.985M	37.2	+0.0	+0.0	+0.0		+0.0	42.9	54.0 Model 3764 Transmit high	-11.1	Horiz
8	4850.000M	37.0	+0.0	+0.0	+0.0		+0.0	42.7	54.0 Model 3764 Transmit mid	-11.3	Horiz
9	4890.000M	36.7	+0.0	+0.0	+0.0		+0.0	42.4	54.0 Model 3754 Transmit mid	-11.6	Vert

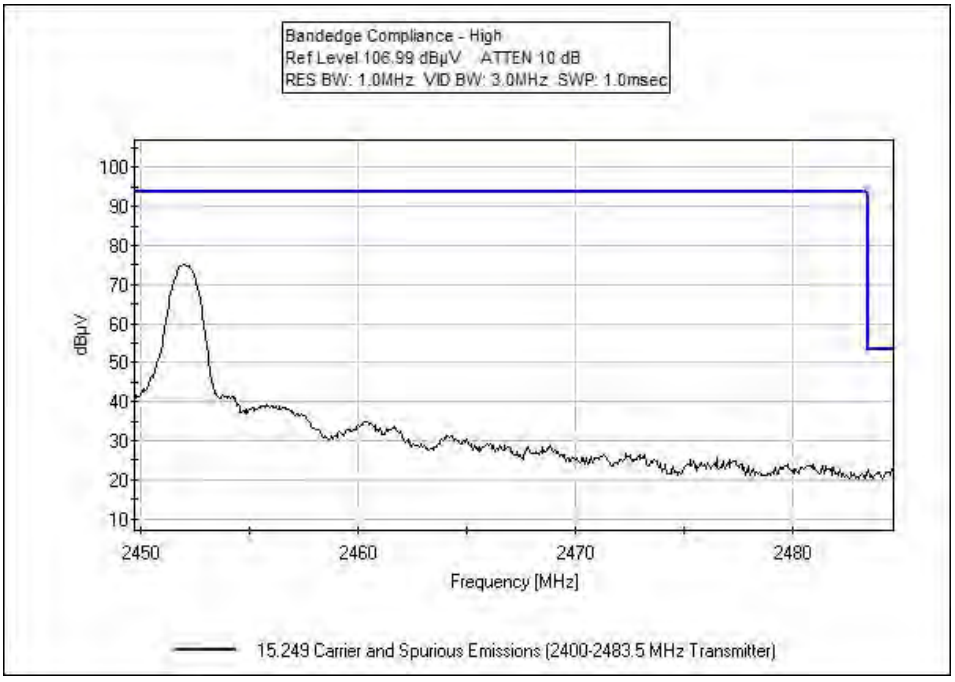
CKC Laboratories, Inc. Date: 3/28/2014 Time: 16:32:23 VDE Testing and Certification Institute WO#: 95313
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters Sequence#: 2 Ext
ATTN: 0 dB



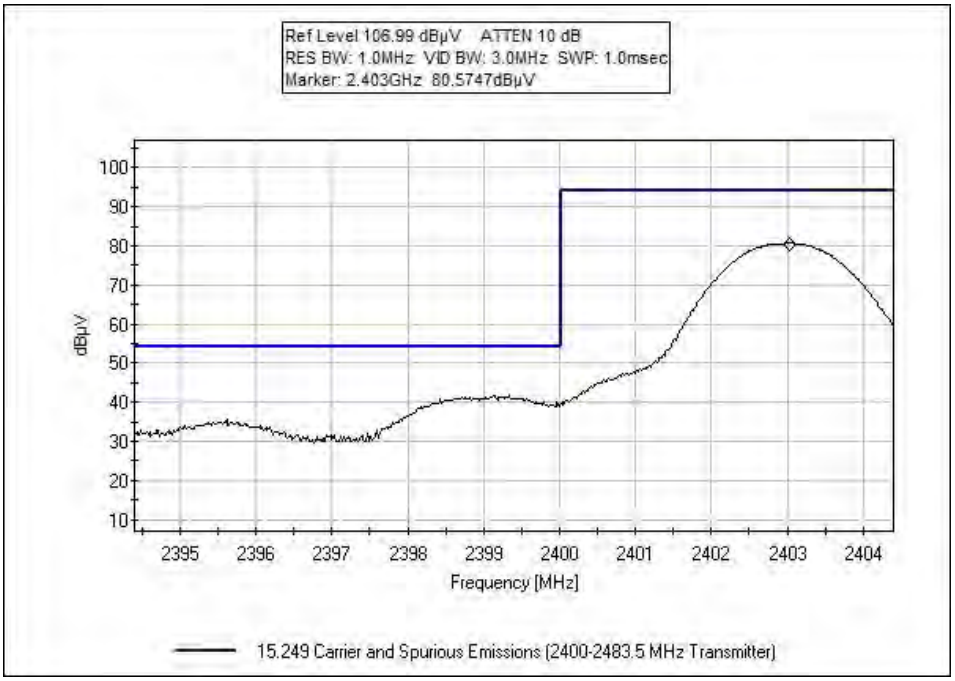
Band Edge Plot(s)



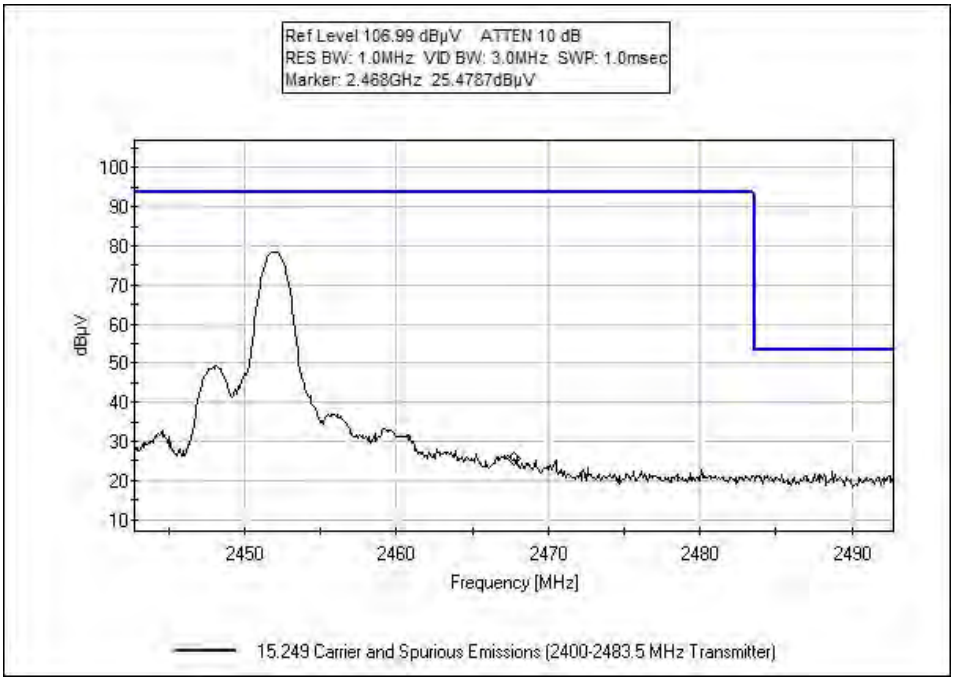
Low Frequency, 3754



High Frequency, 3754



Low Frequency, 3764



High Frequency, 3764

Test Setup Photo(s)

Low Frequency, 3754

Middle Frequency, 3754

High Frequency, 3754 - View 1

High Frequency, 3754 - View 2

Low Frequency, 3764

Middle Frequency, 3764

High Frequency, 3764 - View 1

High Frequency, 3764 - View 2

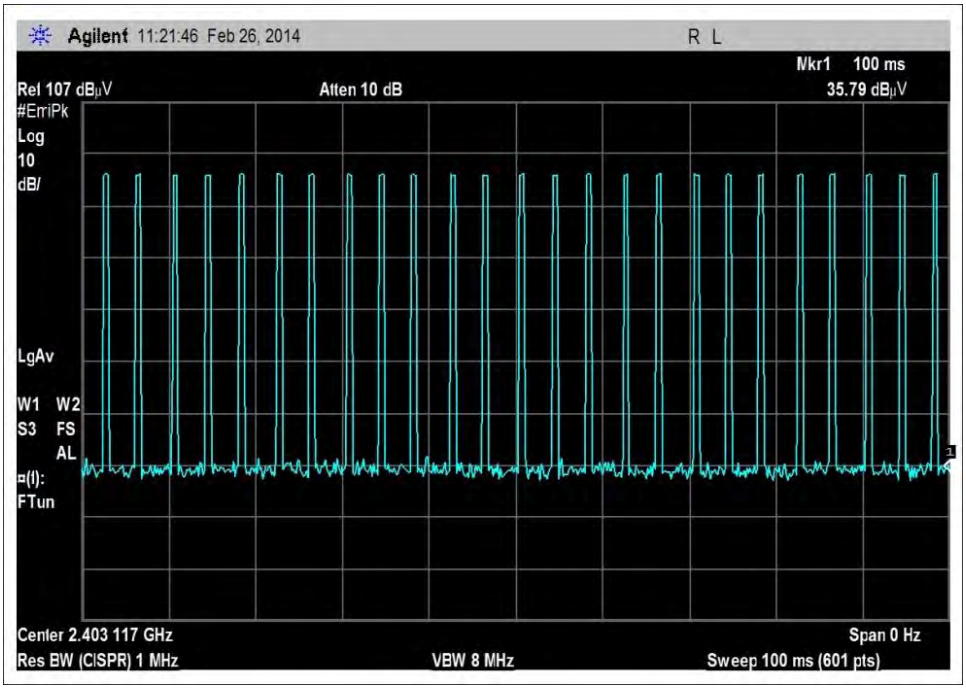
APPENDIX A
DUTY CYCLE

Duty Cycle Correction Factor Calculation

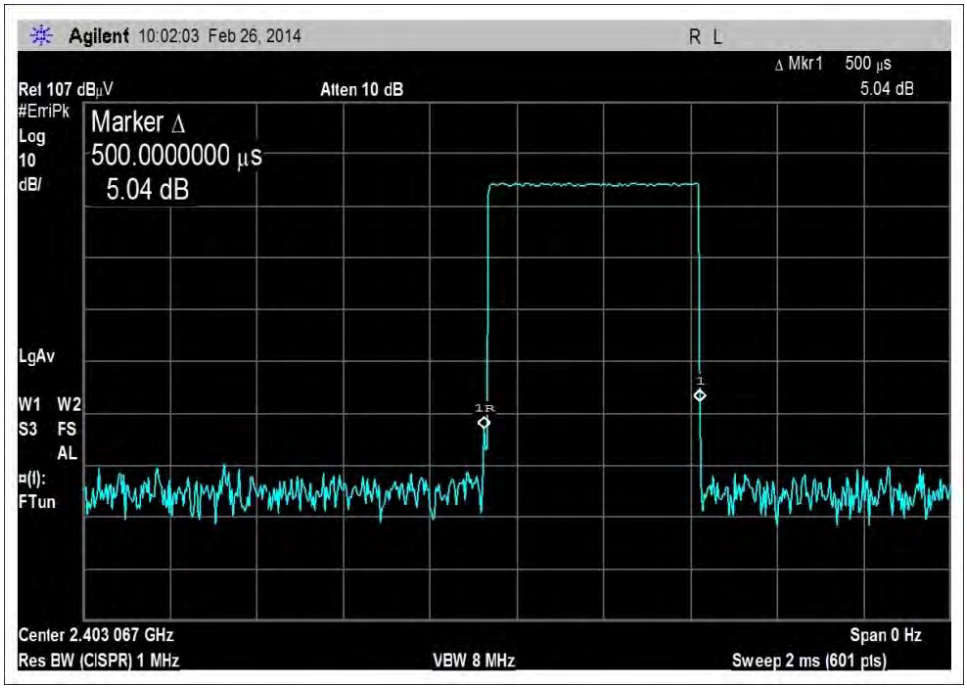
A Duty Cycle correction factor was applied based on the following formula:

(On time per pulse) * (number of pulses in 100ms period) = 500us * 25pulses = 12.5ms
(On time in 100ms sweep) / 100ms = (12.5ms) / 100ms = 0.125
Duty cycle correction factor = 20*log (0.125) = -18.06dB
-18.06dB was applied to each fundamental emission measurement.

Test Data



Number of pulses in 100ms period = 25



On time of one pulse = 500us

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

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

The reported measurement uncertainties are calculated based on the worst case of all laboratory environments from CKC Laboratories, Inc. test sites. Only those parameters which require estimation of measurement uncertainty are reported. The reported worst case measurement uncertainty is less than the maximum values derived in CISPR 16-4-2. Reported uncertainties 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.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB)
+	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 carrot ("^") 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.