

## Starkey Laboratories, Inc. 24HALOXF13 FCC 15.247:2013

Report #: STAK0027



Report Prepared By Northwest EMC Inc.

NORTHWEST EMC - (888) 364-2378 - www.nwemc.com

California – Minnesota – Oregon – New York – Washington



## **CERTIFICATE OF TEST**

#### Last Date of Test: January 14, 2013 Starkey Laboratories, Inc. Model: 24HALOXF13

Emissions							
Test Description	Specification	Test Method	Pass/Fail				
Duty Cycle	FCC 15.247:2013	ANSI C63.10:2009	Pass				
Occupied Bandwidth	FCC 15.247:2013	ANSI C63.10:2009	Pass				
Output Power	FCC 15.247:2013	ANSI C63.10:2009	Pass				
Band Edge Compliance	FCC 15.247:2013	ANSI C63.10:2009	Pass				
Spurious Conducted Emissions	FCC 15.247:2013	ANSI C63.10:2009	Pass				
Power Spectral Density	FCC 15.247:2013	ANSI C63.10:2009	Pass				
Spurious Radiated Emissions	FCC 15.247:2013	ANSI C63.10:2009	Pass				

#### **Deviations From Test Standards**

None

Approved By:

Tim O'Shea, Operations Manager



NVLAP Lab Code: 200881-0

#### **Test Facility**

The measurement facility used to collect the data is located at:

Northwest EMC, Inc. 9349 W Broadway Ave., Brooklyn Park, MN 55445

Phone: (763) 425-2281

Fax: (763) 424-3469

This site has been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada (Site filing #2834E-1).

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.

Product compliance is the responsibility of the client, therefore the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test.



## **REVISION HISTORY**

Revision Number	Description	Date	Page Number	
00	None			

### **Barometric Pressure**

The recorded barometric pressure has been normalized to sea level.



# ACCREDITATIONS AND AUTHORIZATIONS

#### **United States**

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

**A2LA** - Accredited by A2LA to ISO / IEC Guide 65 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

#### Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

#### **European Union**

**European Commission** – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

#### Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

#### Korea

KCC / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

#### Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

#### Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

#### Singapore

**IDA** – Recognized by IDA as a CAB for the acceptance of test data.

#### Hong Kong

OFTA - Recognized by OFTA as a CAB for the acceptance of test data.

#### Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

#### Russia

**GOST** – Accredited by Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC to perform EMC and Hygienic testing for Information Technology products to GOST standards.

## SCOPE

For details on the Scopes of our Accreditations, please visit: http://www.nwemc.com/accreditations/



## **MEASUREMENT UNCERTAINTY**

#### **Measurement Uncertainty**

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-1 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.12	-0.01
Amplitude Accuracy (dB)	0.49	-0.49
Conducted Power (dB)	0.41	-0.41
Radiated Power via Substitution (dB)	0.69	-0.68
Temperature (degrees C)	0.81	-0.81
Humidity (% RH)	2.89	-2.89
Field Strength (dB)	4.00	-4.00
AC Powerline Conducted Emissions (dB)	2.70	-2.70



LOCATIONS



Oregon Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	<b>California</b> Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	New York Labs WA01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	Minnesota Labs MN01-08 9349 W Broadway Ave. Brooklyn Park, MN 55445 (763) 425-2281	Washington Labs NC01-05,SU02,SU07 19201 120 <sup>th</sup> Ave. NE Bothell, WA 98011 (425) 984-6600				
VCCI								
A-0108	A-0029		A-0109	A-0110				
	Industry Canada							
2834D-1, 2834D-2	2834B-1, 2834B-2, 2834B-3		2834E-1	2834C-1				









## **PRODUCT DESCRIPTION**

#### **Client and Equipment Under Test (EUT) Information**

Company Name:	Starkey Laboratories, Inc.
Address:	6600 Washington Ave. SO.
City, State, Zip:	Eden Prairie, MN 55344
Test Requested By:	Ken Meyer
Model:	24HALOXF13
First Date of Test:	January 14, 2013
Last Date of Test:	January 14, 2013
Receipt Date of Samples:	January 14, 2013
Equipment Design Stage:	Pre-Production
Equipment Condition:	No Damage

#### Information Provided by the Party Requesting the Test

**Functional Description of the EUT (Equipment Under Test):** Hearing aid containing Bluetooth LE radio module with 1 internal antenna.

#### **Testing Objective:**

To demonstrate compliance to FCC 15.247 requirements.



## Configuration STAK0027-1

EUT						
Description	Manufacturer	Model/Part Number	Serial Number			
Hearing Aid	Starkey Laboratories, Inc.	24HALOXF13	12826579			

### Configuration STAK0027-2

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Hearing Aid	Starkey Laboratories, Inc.	24HALOXF13	12826583



# **MODIFICATIONS**

## **Equipment Modifications**

Item	Date	Test	Modification	Note	Disposition of EUT
		Band Edge	Tested as	No EMI suppression	EUT remained at
1	1/14/2013	Compliance	delivered to	devices were added or	Northwest EMC
		Compliance	Test Station.	modified during this test.	following the test.
		Output	Tested as	No EMI suppression	EUT remained at
2	1/14/2013	Power	delivered to	devices were added or	Northwest EMC
		FOWEI	Test Station.	modified during this test.	following the test.
		Occupied	Tested as	No EMI suppression	EUT remained at
3	1/14/2013	Bandwidth	delivered to	devices were added or	Northwest EMC
		Danuwiutin	Test Station.	modified during this test.	following the test.
		Power	Tested as	No EMI suppression	EUT remained at
4	1/14/2013	Spectral	delivered to	devices were added or	Northwest EMC
		Density	Test Station.	modified during this test.	following the test.
		Spurious	Tested as	No EMI suppression	EUT remained at
5	1/14/2013	Conducted	delivered to	devices were added or	Northwest EMC
		Emissions	Test Station.	modified during this test.	following the test.
			Tested as	No EMI suppression	EUT remained at
6	1/14/2013	Duty Cycle	delivered to	devices were added or	Northwest EMC
			Test Station.	modified during this test.	following the test.
		Spurious	Tested as	No EMI suppression	Scheduled testing
7	1/14/2013	Radiated	delivered to	devices were added or	was completed.
		Emissions	Test Station.	modified during this test.	was completed.



Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator - 20db, 'SMA'	SM Electronics	SA26B-20	RFW	4/19/2012	12
40 GHz DC block	Fairview Microwave	SD3379	AMI	10/5/2012	12
Signal Generator MXG	Agilent	N5183A	TIK	6/7/2012	36
Spectrum Analyzer	Agilent	E4440A	AAX	5/15/2012	24

#### **TEST DESCRIPTION**

The Duty Cycle (x) were measured for each of the EUT operating modes. The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

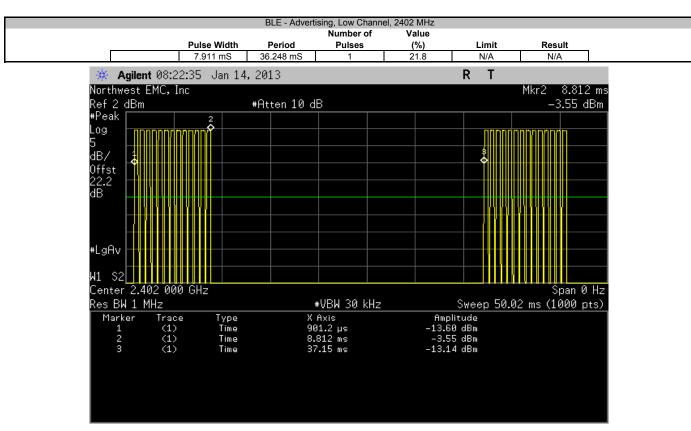
If the transmit duty cycle < 98 percent, burst gating was used during some of the other tests in this report to only measure during the burst duration.

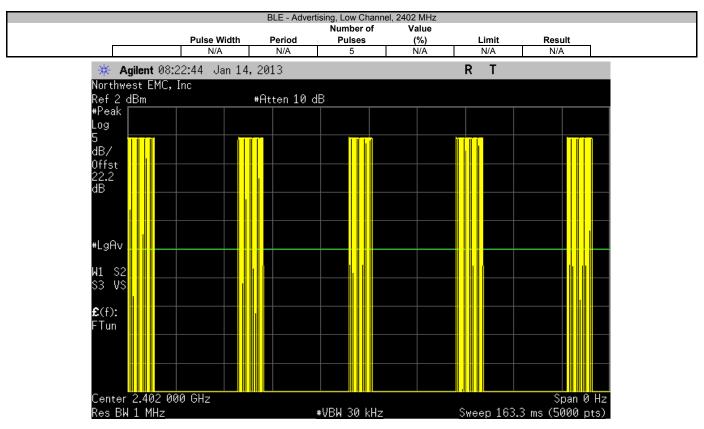


EU	T: 24HALOXF13						Work Order:	STAK0027	
Serial Numbe		·						01/14/13	
	er: Starkey Laboratories, Inc.						Temperature:	23.4°C	
	s: Larry McNabb						Humidity:		
	ct: None						Barometric Pres.:		
	v: Trevor Buls		Powe	r: Battery			Job Site:	MN08	
EST SPECIFICA	TIONS			Test Method					
FCC 15.247:2013				ANSI C63.10:2009					
COMMENTS									
lone									
Une									
	OM TEST STANDARD								
	JWI TEST STANDARD								
None									
				0 0.					
Configuration #	1	<b>.</b>	Trevo	7 Duls	-				
		Signature	27000	C					
						Number of	Value		
				Pulse Width	Period	Pulses	(%)	Limit	Result
BLE - Advertising									
BLE - Advertising	Low Channel, 2402 MHz			7.911 mS	36.248 mS	1	21.8	N/A	N/A
BLE - Advertising	Low Channel, 2402 MHz Low Channel, 2402 MHz			7.911 mS N/A	36.248 mS N/A	1 5	21.8 N/A	N/A N/A	N/A N/A
BLE - Advertising						1 5 1			

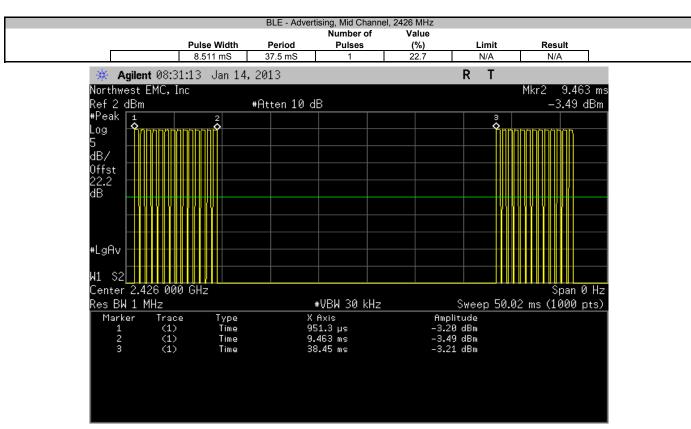
	Wild Chariner, 2420 Winz	0.0111113	37.31113		22.1	IN/A	IN/A
	Mid Channel, 2426 MHz	N/A	N/A	5	N/A	N/A	N/A
	High Channel, 2480 MHz	8.561 mS	37.5 mS	1	22.8	N/A	N/A
	High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE - Data							
	Low Channel, 2404 MHz	9.163 mS	37.5 mS	1	24.4	N/A	N/A
	Low Channel, 2404 MHz	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel, 2442 MHz	7.91 mS	36.248 mS	1	21.8	N/A	N/A
	Mid Channel, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
	High Channel, 2478 MHz	7.909 mS	36.248 mS	1	21.8	N/A	N/A
	High Channel, 2478 MHz	N/A	N/A	5	N/A	N/A	N/A
	-						

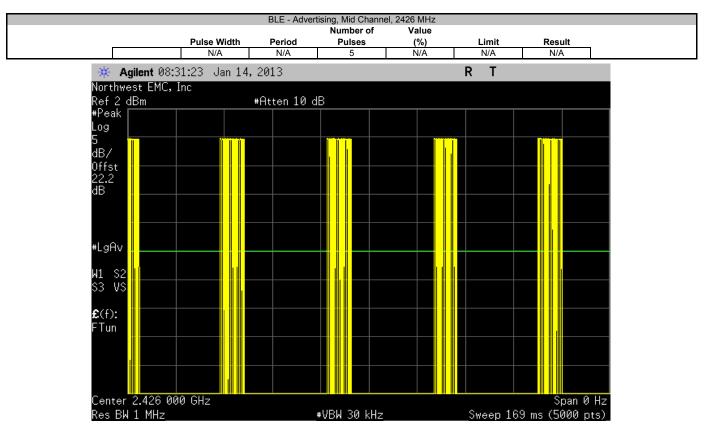






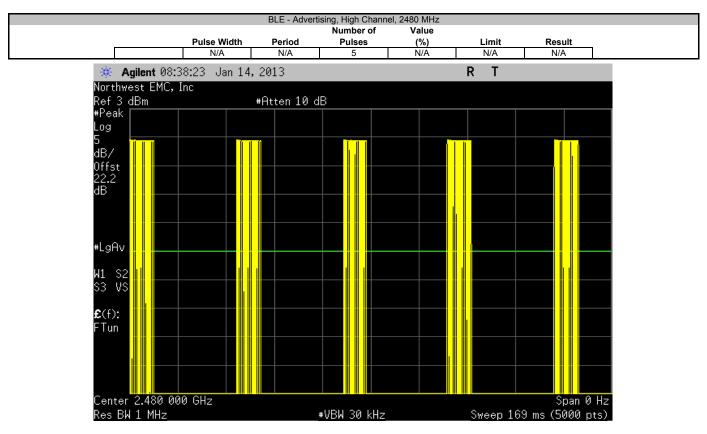




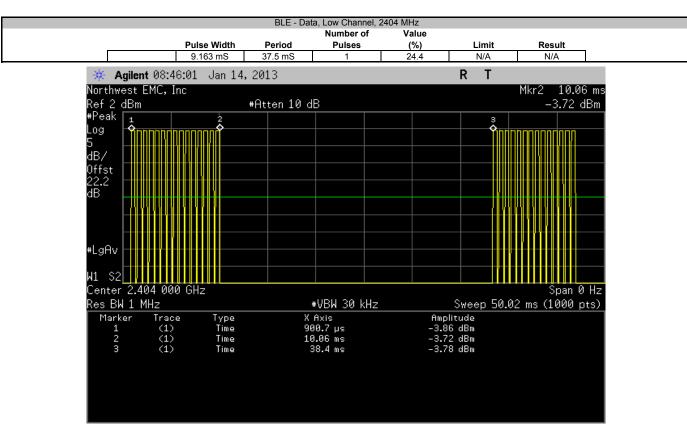


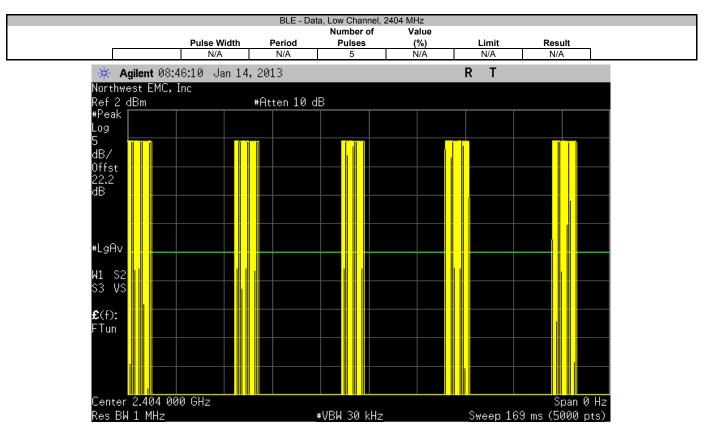




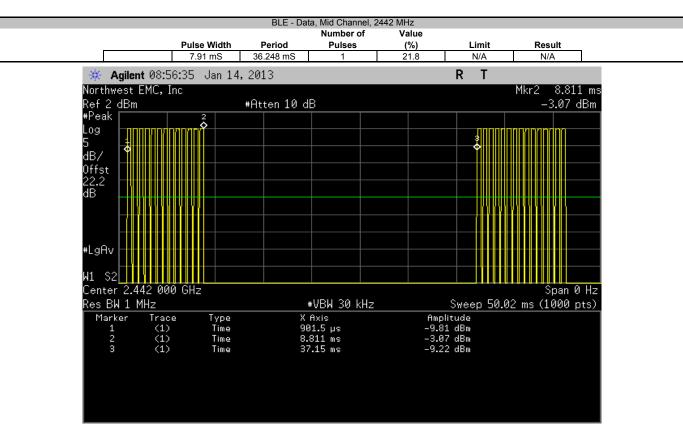


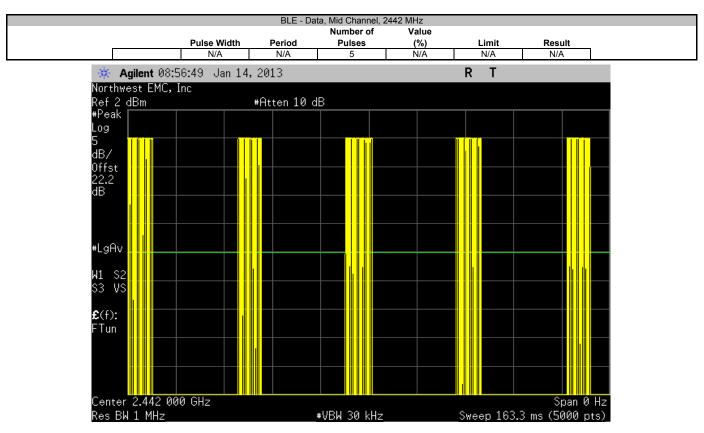






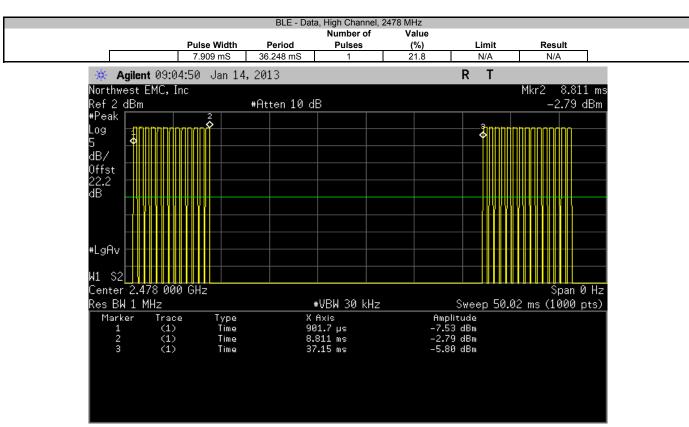


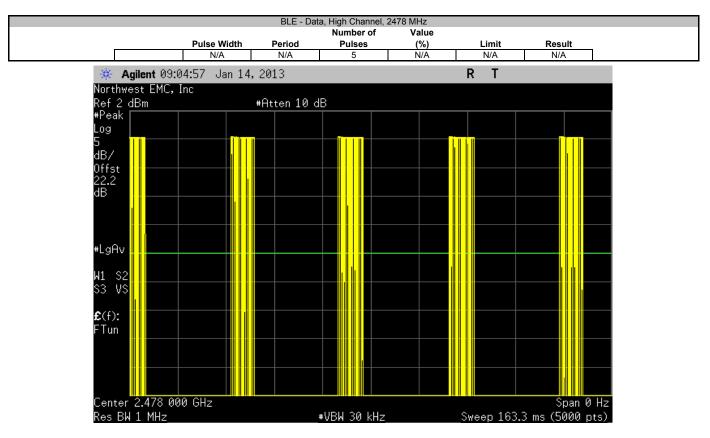














Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator - 20db, 'SMA'	SM Electronics	SA26B-20	RFW	4/19/2012	12
40 GHz DC block	Fairview Microwave	SD3379	AMI	10/5/2012	12
Signal Generator MXG	Agilent	N5183A	TIK	6/7/2012	36
Spectrum Analyzer	Agilent	E4440A	AAX	5/15/2012	24

#### **TEST DESCRIPTION**

The 6dB occupied bandwidth was measured. The 26 dB (99.9%) emission bandwidth (EBW) was also measured at the same time.

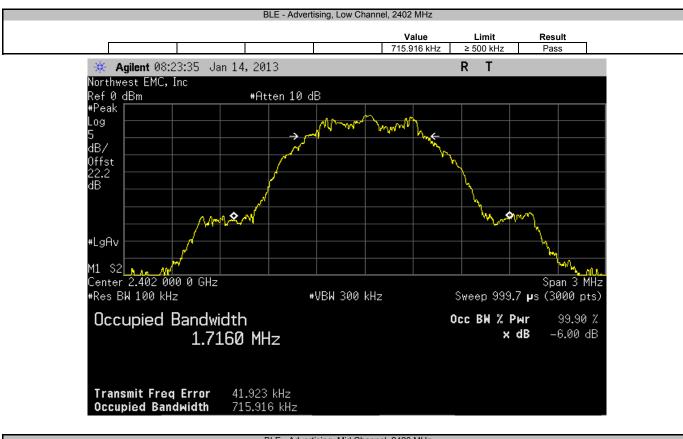
The EUT was set to low, medium and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the data rate(s) listed in the datasheet.

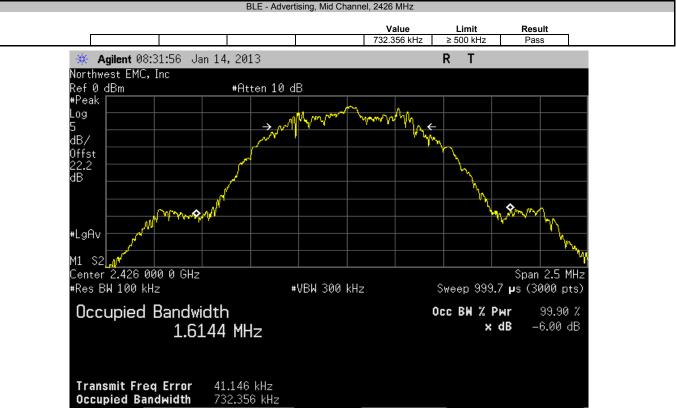


## Occupied Bandwidth

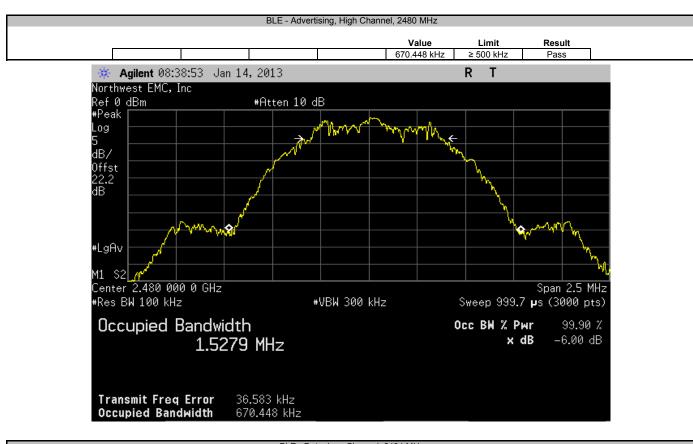
EUT	24HALOXF13		Work Order:	STAK0007	
Serial Number				01/14/13	
	: Starkey Laboratories, Inc.		Temperature:		
	:: Larry McNabb		Humidity:		
	: None		Barometric Pres.:		
	Trevor Buls	Power: Battery	Job Site:	MNU8	
TEST SPECIFICAT	lions	Test Method			
FCC 15.247:2013		ANSI C63.10:2009			
COMMENTS					
None					
DEVIATIONS FRO	M TEST STANDARD				
None					
Configuration #	1 Signature	Trevor Buls			
			Value	Limit	Result
BLE - Advertising					
	Low Channel, 2402 MHz		715.916 kHz	≥ 500 kHz	Pass
	Mid Channel, 2426 MHz		732.356 kHz	≥ 500 kHz	Pass
	High Channel, 2480 MHz		670.448 kHz	≥ 500 kHz	Pass
BLE - Data					
	Low Channel, 2404 MHz		717.977 kHz	≥ 500 kHz	Pass
			000 100 111		_
	Mid Channel, 2442 MHz		688.496 kHz	≥ 500 kHz	Pass







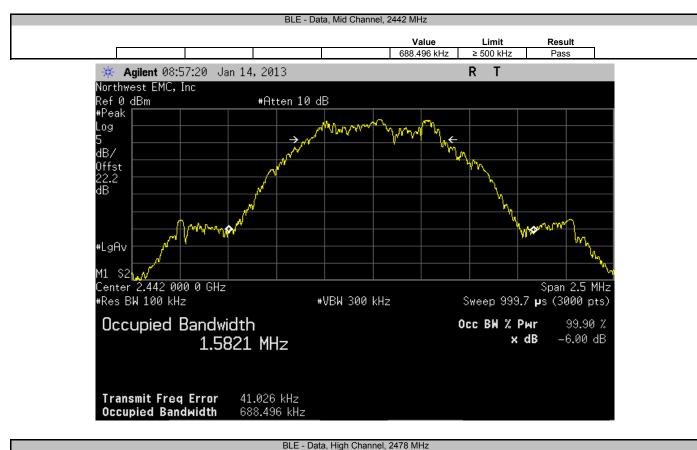
















Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator - 20db, 'SMA'	SM Electronics	SA26B-20	RFW	4/19/2012	12
40 GHz DC block	Fairview Microwave	SD3379	AMI	10/5/2012	12
Signal Generator MXG	Agilent	N5183A	TIK	6/7/2012	36
Spectrum Analyzer	Agilent	E4440A	AAX	5/15/2012	24

#### **TEST DESCRIPTION**

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

Method Option 1 found in KDB 558074 DTS D01 Measurement Section 8.1.1 was used because the RBW on the analyzer was greater than the Emission Bandwidth of the radio.

De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36 dBm.



XMit 2012.09.20
PsaTx 2013.01.10

	24HALOXF13				Work Order:		
Serial Number:						01/14/13	
	Starkey Laboratories, Inc				Temperature:		
	Larry McNabb				Humidity:		
Project:					Barometric Pres.:		
	Trevor Buls		Power:	Battery	Job Site:	MN08	
TEST SPECIFICAT	IONS			Test Method			
FCC 15.247:2013				ANSI C63.10:2009			
COMMENTS							
None							
DEVIATIONS FROM	M TEST STANDARD						
None							
			1	00			
Configuration #	1		Trevor	13 11 2			
		Signature	start c				
					Value	Limit	Result
BLE - Advertising							
	Low Channel, 2402 MHz				507.224 uW	< 1 W	Pass
	Mid Channel, 2426 MHz				528.08 uW	< 1 W	Pass
	High Channel, 2480 MHz				621.727 uW	< 1 W	Pass
BLE - Data							
	Low Channel, 2404 MHz				506.524 uW	< 1 W	Pass
	Mid Channel, 2442 MHz				565.067 uW	< 1 W	Pass
	High Channel, 2478 MHz				612.632 uW	< 1 W	Pass



Center 2.426 000 GHz

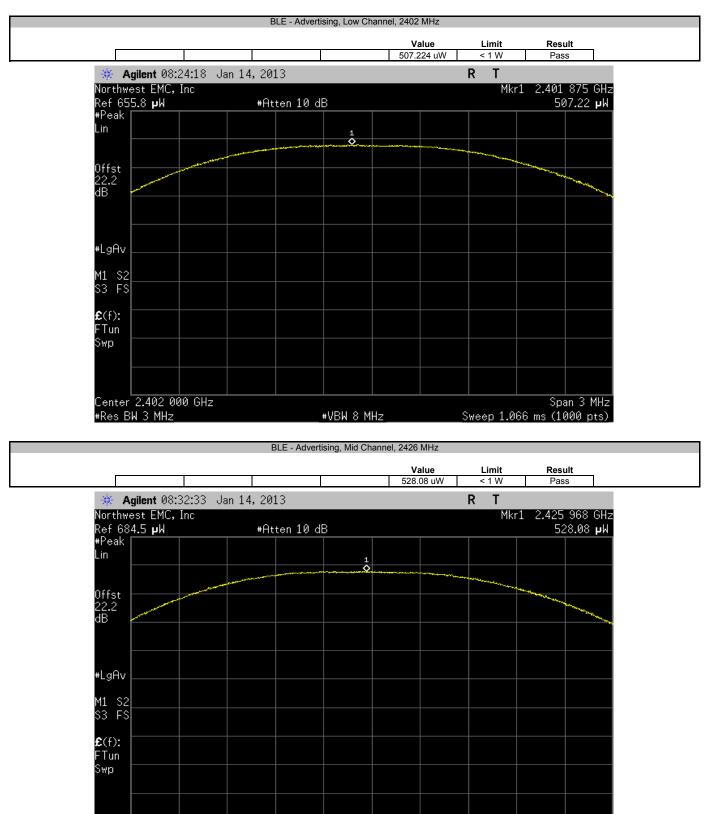
#Res BW 3 MHz

#### **Output Power**



Span 3 MHz

Sweep 1.066 ms (1000 pts)



₩VBW 8 MHz



Offst 22.2 dB

#LgAv

M1 S2 S3 FS

€(f): FTun Swp

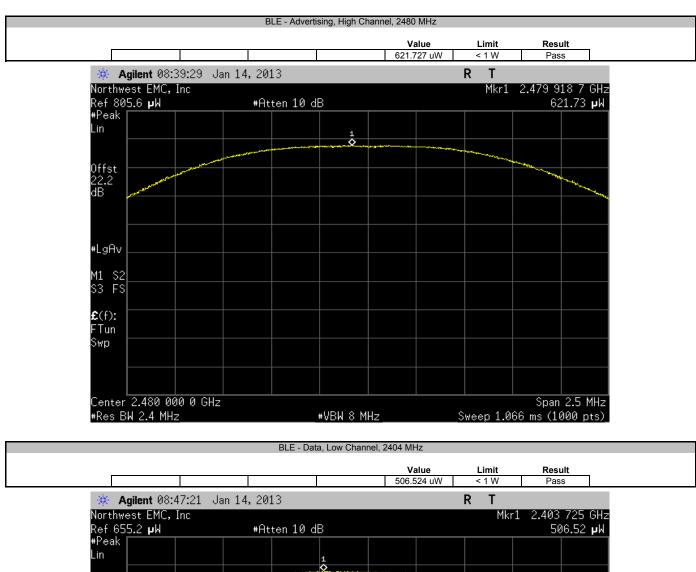
Center 2.404 000 GHz

#Res BW 3 MHz

#### **Output Power**

Span 3 MHz

Sweep 1.066 ms (1000 pts)



#VBW 8 MHz



€(f): FTun Swp

Center 2.478 000 0 GHz

#Res BW 2.4 MHz

#### **Output Power**



Span 2.5 MHz

Sweep 1.066 ms (1000 pts)

BLE - Data, Mid Channel, 2442 MHz Limit Value Result 565.067 uW < 1 W Pass Agilent 08:57:56 Jan 14, 2013 R Т 瘚 Mkr1 2.441 906 2 GHz Northwest EMC, Inc 565.07 µW Ref 733.8 **µW** #Peak #Atten 10 dB Lin 1 Offst 22.2 dB #LgAv M1 S2 S3 FS £(f): FTun Swp Center 2.442 000 0 GHz Span 2.5 MHz #Res BW 2.4 MHz #VBW 8 MHz Sweep 1.066 ms (1000 pts)\_ BLE - Data, High Channel, 2478 MHz Limit Result Value 612.632 uW < 1 W Pass 🔆 Agilent 09:06:08 Jan 14, 2013 R Т Northwest EMC, Inc Mkr1 2.477 828 6 GHz Ref 794.9 µW #Peak #Atten 10 dB 612.63 µW Lin 1 Offst 22.2 dB #LgAv M1 S2 S3 FS

₩VBW 8 MHz

# ENC

## **Band Edge Compliance**

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator - 20db, 'SMA'	SM Electronics	SA26B-20	RFW	4/19/2012	12
40 GHz DC block	Fairview Microwave	SD3379	AMI	10/5/2012	12
Signal Generator MXG	Agilent	N5183A	TIK	6/7/2012	36
Spectrum Analyzer	Agilent	E4440A	AAX	5/15/2012	24

#### **TEST DESCRIPTION**

The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the data rate(s) listed in the datasheet.

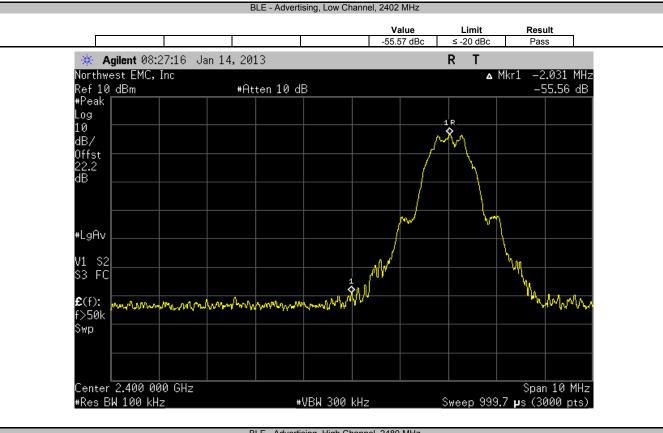
The spectrum was scanned below the lower band edge and above the higher band edge.

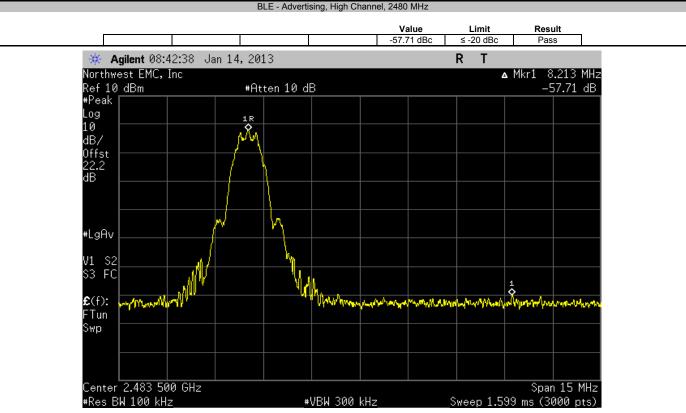




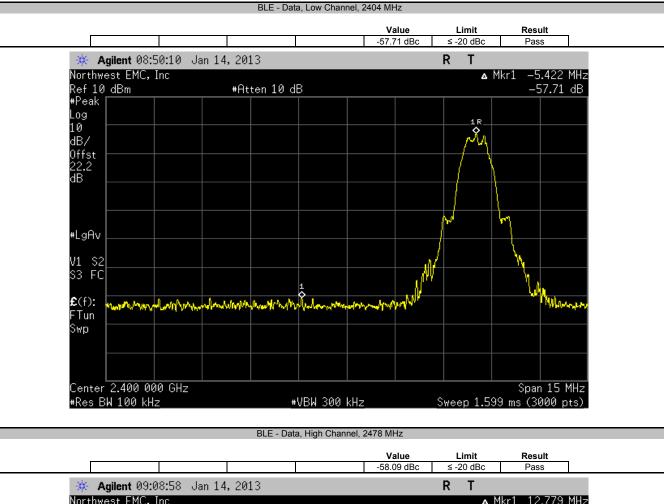
	24HALOXF13				Work Order		
Serial Number						01/14/13	
	Starkey Laboratories, Inc				Temperature		
	: Larry McNabb				Humidity		
Project					Barometric Pres.		
Tested by	Trevor Buls		Power:	Battery	Job Site	MN08	
TEST SPECIFICAT	IONS			Test Method			
FCC 15.247:2013				ANSI C63.10:2009			
COMMENTS							
None							
DEVIATIONS FROM	M TEST STANDARD						
None							
			/	2 0			
Configuration #	1	-	1 ~	BUND			
-		Signature <	Trevor	i mus			
					Value	Limit	Result
BLE - Advertising							
	Low Channel, 2402 MHz				-55.57 dBc	≤ -20 dBc	Pass
	High Channel, 2480 MHz				-57.71 dBc	≤ -20 dBc	Pass
BLE - Data	5 7 7 7						
	Low Channel, 2404 MHz				-57.71 dBc	≤ -20 dBc	Pass
	High Channel, 2478 MHz				-58.09 dBc	≤ -20 dBc	Pass
					00.00 000	= 10 000	. 465

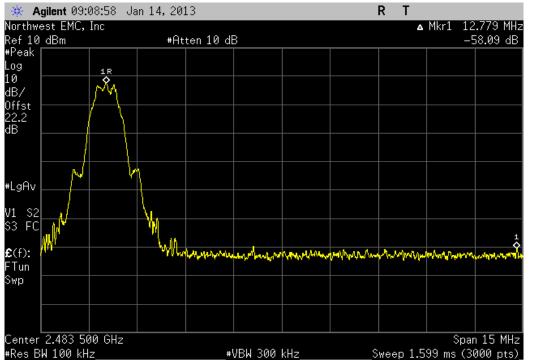














## Spurious Conducted Emissions

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator - 20db, 'SMA'	SM Electronics	SA26B-20	RFW	4/19/2012	12
40 GHz DC block	Fairview Microwave	SD3379	AMI	10/5/2012	12
Signal Generator MXG	Agilent	N5183A	TIK	6/7/2012	36
Spectrum Analyzer	Agilent	E4440A	AAX	5/15/2012	24

#### **TEST DESCRIPTION**

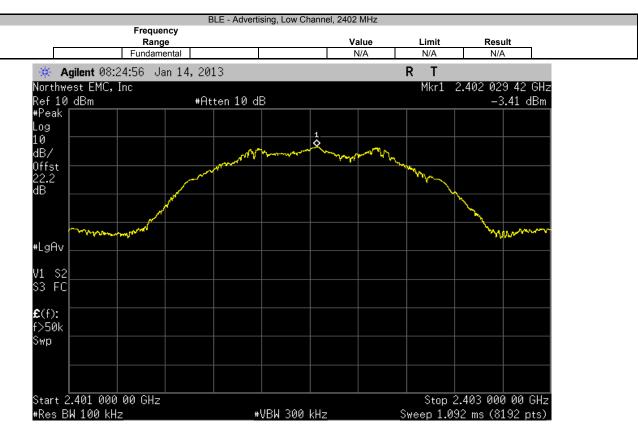
The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.



## Spurious Conducted Emissions

	NC	Spuri	ous Conducted Emissions			XMit 2012.09.20 PsaTx 2013.01.10
EUT: 2	24HALOXF13			Work Order:	STAK0027	
Serial Number: 1	12826579			Date:	01/14/13	
	Starkey Laboratories, Inc.			Temperature:		
	Larry McNabb			Humidity:		
Project: N				Barometric Pres.:		
Tested by: 1			Power: Battery	Job Site:	MN08	
TEST SPECIFICATIO	JNS		Test Method			
FCC 15.247:2013			ANSI C63.10:2009			
COMMENTS None						
DEVIATIONS FROM	TEST STANDARD					
None						
None Configuration #	1	Signature	Trevor Buls			
	1	Signature	Frequency	Valuo	Limit	Rosult
Configuration #	1	Signature		Value	Limit	Result
Configuration #	1 _ow Channel, 2402 MHz	Signature	Frequency	Value	Limit N/A	Result N/A
Configuration #	· .	Signature	Frequency Range			
Configuration # BLE - Advertising	Low Channel, 2402 MHz	Signature	Frequency Range Fundamental	N/A	N/A ≤ -20 dBc ≤ -20 dBc	N/A
Configuration # BLE - Advertising L	ow Channel, 2402 MHz Low Channel, 2402 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental	N/A -33.74 dBc -48.6 dBc N/A	N/A ≤ -20 dBc ≤ -20 dBc N/A	N/A Pass
Configuration # BLE - Advertising L L N N	Low Channel, 2402 MHz Low Channel, 2402 MHz Low Channel, 2402 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 26 GHz Fundamental 30 MHz - 12.5 GHz	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc	N/A ≤ -20 dBc ≤ -20 dBc N/A ≤ -20 dBc	N/A Pass Pass N/A Pass
Configuration #	ow Channel, 2402 MHz Low Channel, 2402 MHz Jow Channel, 2402 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc	N/A ≤ -20 dBc ≤ -20 dBc N/A ≤ -20 dBc ≤ -20 dBc ≤ -20 dBc	N/A Pass Pass N/A Pass Pass
Configuration # BLE - Advertising L L N N N	Low Channel, 2402 MHz Low Channel, 2402 MHz Jow Channel, 2402 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Ligh Channel, 2480 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc N/A	N/A ≤ -20 dBc ≤ -20 dBc N/A ≤ -20 dBc ≤ -20 dBc N/A	N/A Pass Pass N/A Pass Pass N/A
Configuration # BLE - Advertising L L N N N H	Low Channel, 2402 MHz Low Channel, 2402 MHz Low Channel, 2402 MHz Vild Channel, 2426 MHz Vild Channel, 2426 MHz High Channel, 2480 MHz High Channel, 2480 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc N/A -37.98 dBc	N/A ≤ -20 dBc ≤ -20 dBc N/A ≤ -20 dBc N/A ≤ -20 dBc N/A ≤ -20 dBc	N/A Pass Pass N/A Pass N/A Pass
Configuration #	Low Channel, 2402 MHz Low Channel, 2402 MHz Jow Channel, 2402 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Ligh Channel, 2480 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc N/A	N/A ≤ -20 dBc ≤ -20 dBc N/A ≤ -20 dBc ≤ -20 dBc N/A	N/A Pass Pass N/A Pass Pass N/A
Configuration # BLE - Advertising L L L N N BLE - Data	Low Channel, 2402 MHz Low Channel, 2402 MHz Jow Channel, 2402 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz High Channel, 2480 MHz High Channel, 2480 MHz High Channel, 2480 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc N/A -37.98 dBc -49.53 dBc	N/A < -20 dBc < -20 dBc N/A < -20 dBc < -20 dBc N/A < -20 dBc < -20 dBc < -20 dBc	N/A Pass Pass N/A Pass N/A Pass Pass Pass
Configuration # BLE - Advertising L L L L L B L E BLE - Data	Low Channel, 2402 MHz Low Channel, 2402 MHz Low Channel, 2402 MHz Viid Channel, 2426 MHz Viid Channel, 2426 MHz Viid Channel, 2426 MHz High Channel, 2480 MHz High Channel, 2480 MHz Low Channel, 2404 MHz Low Channel, 2404 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc N/A -37.98 dBc -49.53 dBc N/A	N/A < -20 dBc < -20 dBc N/A < -20 dBc < -20 dBc N/A < -20 dBc < -20 dBc	N/A Pass Pass N/A Pass N/A Pass Pass N/A
Configuration # BLE - Advertising L BLE - Advertising BLE - Data L L L L L L L L L L L L L L L L L L	ow Channel, 2402 MHz ow Channel, 2402 MHz ow Channel, 2402 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Vid Channel, 2480 MHz High Channel, 2480 MHz Ligh Channel, 2480 MHz ow Channel, 2404 MHz ow Channel, 2404 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc N/A -37.98 dBc -49.53 dBc	N/A < -20 dBc < -20 dBc N/A < -20 dBc < -20 dBc N/A < -20 dBc < -20 dBc < -20 dBc	N/A Pass Pass N/A Pass N/A Pass Pass Pass
Configuration #	Low Channel, 2402 MHz Low Channel, 2402 MHz Low Channel, 2402 MHz Low Channel, 2426 MHz Mid Channel, 2426 MHz Mid Channel, 2426 MHz Mid Channel, 2426 MHz High Channel, 2480 MHz High Channel, 2480 MHz Low Channel, 2404 MHz Low Channel, 2404 MHz Low Channel, 2404 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz Fundamental 30 MHz - 12.5 GHz	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc N/A -37.98 dBc -49.53 dBc N/A -33.91 dBc	N/A ≤ -20 dBc < -20 dBc N/A ≤ -20 dBc N/A ≤ -20 dBc N/A ≤ -20 dBc N/A ≤ -20 dBc	N/A Pass Pass N/A Pass Pass Pass N/A Pass Pass
Configuration #	ow Channel, 2402 MHz ow Channel, 2402 MHz ow Channel, 2402 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Vid Channel, 2480 MHz High Channel, 2480 MHz Ligh Channel, 2480 MHz ow Channel, 2404 MHz ow Channel, 2404 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz Fundamental 30 MHz - 12.5 GHz	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc N/A -37.98 dBc -49.53 dBc N/A -33.91 dBc -49.53 dBc	N/A ≤ -20 dBc ≤ -20 dBc N/A ≤ -20 dBc ≤ -20 dBc ≤ -20 dBc ≤ -20 dBc N/A ≤ -20 dBc ≤ -20 dBc	N/A Pass Pass N/A Pass N/A Pass Pass Pass Pass
Configuration #	Low Channel, 2402 MHz Low Channel, 2402 MHz Low Channel, 2402 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Vid Channel, 2480 MHz Vigh Channel, 2480 MHz Vigh Channel, 2404 MHz Low Channel, 2404 MHz Low Channel, 2404 MHz Low Channel, 2404 MHz Vid Channel, 2404 MHz Vid Channel, 2404 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz Fundamental 30 MHz - 12.5 GHz Fundamental	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc N/A -37.98 dBc -49.53 dBc N/A -33.91 dBc -48.37 dBc N/A	N/A < 20 dBc < 20 dBc N/A < 20 dBc < 20 dBc < 20 dBc < 20 dBc < 20 dBc < 20 dBc < 20 dBc	N/A Pass Pass Pass Pass N/A Pass Pass N/A Pass N/A
Configuration # BLE - Advertising L L L BLE - Data L L N N N H H H H H H H H H H H H H H H	ow Channel, 2402 MHz ow Channel, 2402 MHz ow Channel, 2402 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Vid Channel, 2480 MHz High Channel, 2480 MHz Low Channel, 2404 MHz ow Channel, 2404 MHz ow Channel, 2404 MHz Vid Channel, 2404 MHz Vid Channel, 2404 MHz Vid Channel, 2404 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz Euroamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz 12.5 GHz - 25 GHz 12.5 GHz - 25 GHz 12.5 GHz - 12.5 GHz 12.5 GHz - 12.5 GHz	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc N/A -37.98 dBc -49.53 dBc N/A -33.91 dBc -48.37 dBc N/A -33.01 dBc N/A -36.07 dBc	N/A ≤ -20 dBc < -20 dBc N/A ≤ -20 dBc N/A ≤ -20 dBc S -20 dBc N/A ≤ -20 dBc S -20 dBc N/A ≤ -20 dBc N/A ≤ -20 dBc	N/A Pass Pass Pass Pass N/A Pass Pass Pass N/A Pass N/A Pass N/A Pass
Configuration #	Low Channel, 2402 MHz Low Channel, 2402 MHz Low Channel, 2402 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Vid Channel, 2426 MHz Vid Channel, 2480 MHz Low Channel, 2404 MHz Low Channel, 2404 MHz Low Channel, 2404 MHz Vid Channel, 2442 MHz Vid Channel, 2442 MHz Vid Channel, 2442 MHz Vid Channel, 2442 MHz	Signature	Frequency Range           Fundamental           30 MHz - 12.5 GHz           12.5 GHz - 25 GHz           Fundamental           30 MHz - 12.5 GHz           12.5 GHz - 25 GHz           Fundamental           30 MHz - 12.5 GHz           12.5 GHz - 25 GHz           Fundamental           30 MHz - 12.5 GHz           12.5 GHz - 25 GHz           Fundamental           30 MHz - 12.5 GHz           12.5 GHz - 25 GHz           Fundamental           30 MHz - 12.5 GHz           12.5 GHz - 25 GHz           Fundamental           30 MHz - 12.5 GHz           12.5 GHz - 25 GHz           Fundamental           30 MHz - 12.5 GHz           12.5 GHz - 25 GHz           Fundamental           30 MHz - 12.5 GHz           12.5 GHz - 25 GHz           12.5 GHz - 25 GHz	N/A -33.74 dBc -48.6 dBc N/A -35.16 dBc -49.34 dBc N/A -37.98 dBc -49.53 dBc N/A -33.91 dBc -49.53 dBc N/A -33.91 dBc -48.37 dBc N/A -36.07 dBc -48.89 dBc	N/A < -20 dBc < -20 dBc N/A < -20 dBc r N/A Solution	N/A Pass Pass N/A Pass Pass N/A Pass Pass N/A Pass N/A Pass Pass N/A Pass Pass

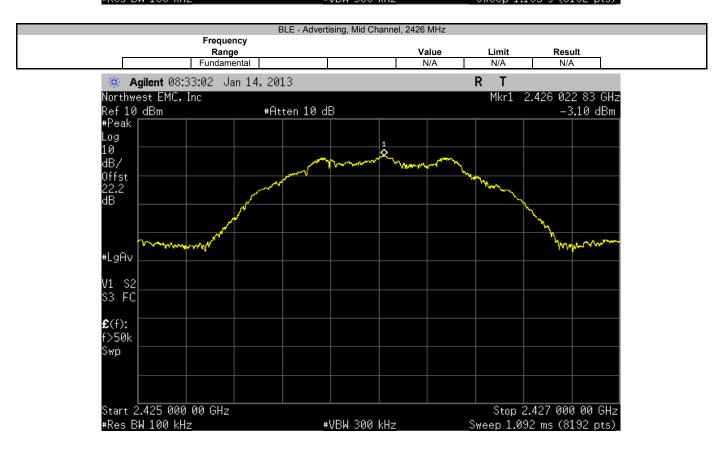




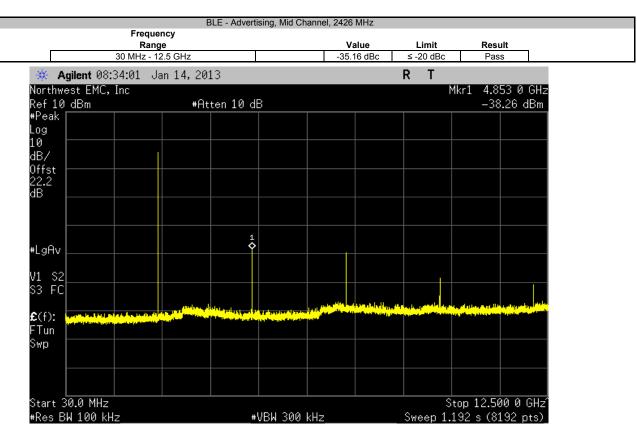
	BLE - Advert	ising, Low Channel, 2402	2 MHz	
	Frequency Range	v	alue Limit	Result
3	0 MHz - 12.5 GHz		74 dBc ≤ -20 dBc	Pass
	5:56 Jan 14, 2013		RT	
Northwest EMC, In				Mkr1 7.206 6 GHz
Ref 10 dBm #Peak	#Atten 10 d	IR I		-37.16 dBm
Log				
10				
dB/				
0ffst 22.2				
dB				
#LgAv		¥		
U1 02				
V1 S2 S3 FC				
				a standa baata pin kanata birta da a tanata
€(f): <mark>auththrauth</mark> FTun		a state of the second		
Swp				
Start 30.0 MHz #Res BW 100 kHz	#	ŧVBW 300 kHz		δtop 12.500 0 GHz .192 s (8192 pts)_



		BLE - Ad	dvertising, Low Ch	annel, 2402	MHz			_
		uency		.,		1.1	<b>D</b>	
Г		i <b>nge</b> z - 25 GHz			alue 6 dBc	Limit ≤ -20 dBc	Result Pass	
				-+0.	0 UDC		1 833	
*	Agilent 08:26:55	Jan 14, 2013				RT		
	west EMC, Inc					Mk		
Ref :	10 dBm	#Atten 1	0 dB				-52.0	2 dBm
#Pea	K							
Log 10								
dB/								
Öffsi	.							
Offsi 22.2 dB								
dB								
#LgA	v							
V1 :	52 1							
\$3 F	- 0							
	and the second se		a la segura de la s					
<b>£</b> (f):								
FTun								
Swp								
	: 12.500 0 GHz						op 25.000	
Pac	B⊍ 100 kH≂		#VR⊍ З00 U	/H-7		Swaan 11	95 c (819)	2 ntel

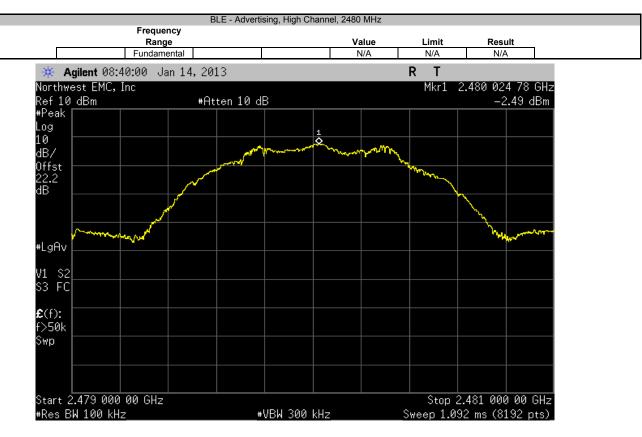






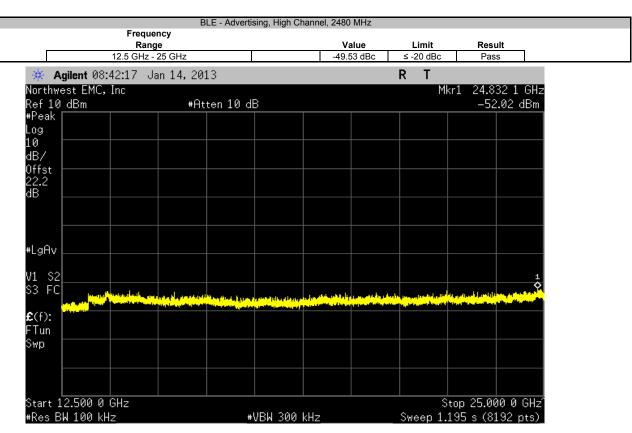
BLE - Advertising, Mid Channel, 2426 MHz											
	Frequency Range 12.5 GHz - 25 GHz						alue 34 dBc	Limit ≤ -20 dBc	Res Pas		
*	Agilent 08:	35:02 Jar	14,20	13				RT			
Nor	thwest EMC,									'68 0 GHz	
Ref #Pe	10 dBm		#At	ten 10 d	B				-52	2 <b>.44</b> dBm	
+re Log											
10											
dB/	<u></u>										
0ffs 22.2	2										
dB											
#Lg	iAv										
U1	\$2									1	
V1 S3	FC	the state of the second st							an Hall Courses		
	la parte de la compañía de la c									and the state of the	
£(f F⊺u											
Swp											
Star	rt 12.500 0	<u>сц</u> 2							+on 25.0	 00 0 GHz	
	rt 12.300 0 s BW 100 kH			#	VBW 300	kHz				00 0 0 0HZ 192 pts)_	

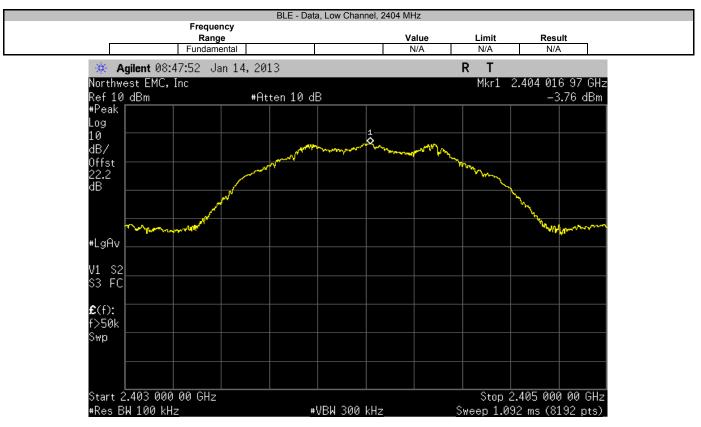




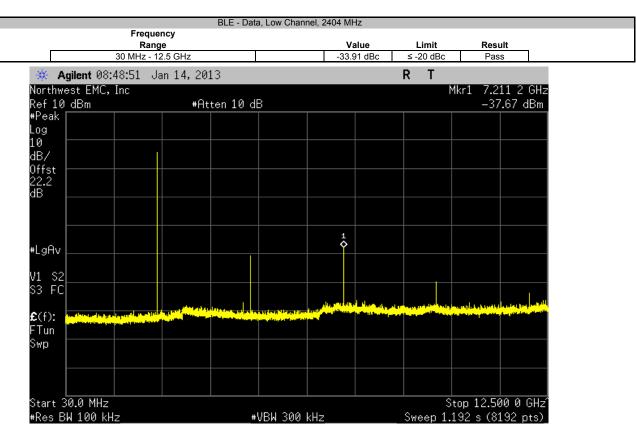
			BLE - Advert	ising, High Cł	nannel, 2480	) MHz				
		Frequency Range 30 MHz - 12.5 GHz				alue 98 dBc	Limit ≤ -20 dBc	Res		
Sie	Agilant 08.	41:10 Jan 14,			-57.		R T	a	33	
	thwest EMC,		2015					1kr1 4.9	961 1 GHz	
Ref	10 dBm		#Atten 10 d	IB					0.47 dBm	
#Pe										
Log 10	·									
dB≁	/									
0ff: 22.	st									
22., dB	۷ 🗋									
#Lg	കം			1						
				°						
V1 S3	<u>\$2</u>									
\$3										
£(f	): A set of the set of	where the last state of								
FTu										
Swp	)									
	rt 30.0 MHz								00 0 GHzî	
#Re	s BW 100 kH	Iz	+	ŧVBW 300	kHz		Sweep 1.	192 s (8	192 pts)_	





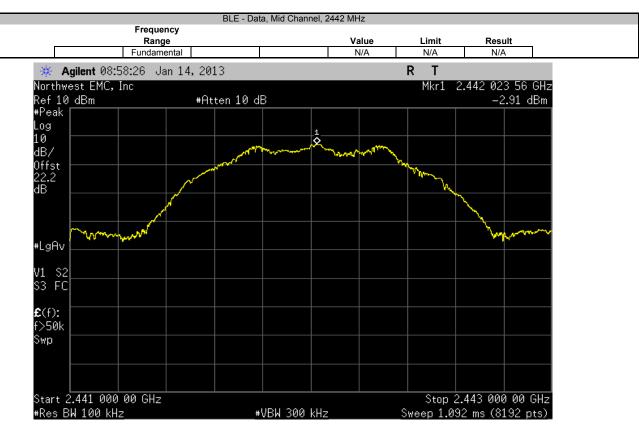






		_		BLE - Data	a, Low Chani	nel, 2404 MH	lz				
		Frequen Range	•				alue	Limit	Resi		
		12.5 GHz - 2				-48.3	37 dBc	≤ -20 dBc <b>R T</b>	Pas	S	
	Agilent 08:		n 14, 201	13							
Ref	thwest EMC, 10 dBm	Inc	#At	Atten 10 dB				M			
#Pe: Log	ak									2.13 dBm	
10	,										
dB/ 0ffs 22.2	st										
22.2 dB	2										
#Lgi	Av										
V1 \$3	S2 1										
\$3	FC	History black	anda, kund det ut				in and that				
£(f)	): [ <sup></sup>										
FTu Swp											
Star	rt 12.500 0	GHz						S	top 25.00	00 0 GHz	
#Re	s BW 100 kH	z		#	VBW 300	kHz		Sweep 1.	195 s (8:	192 pts)_	

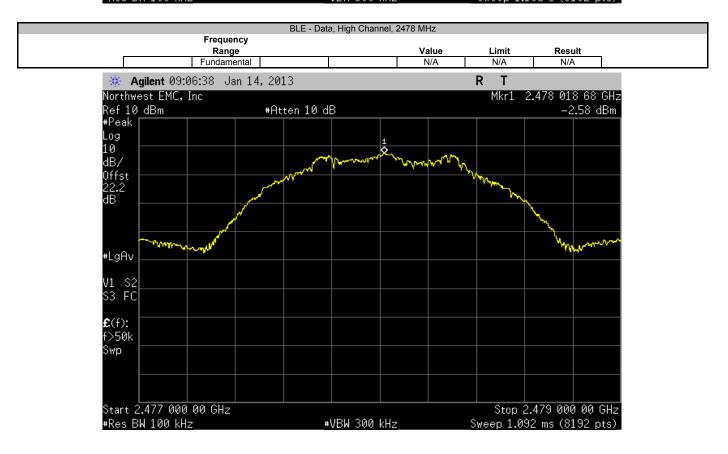




		ata, Mid Channel	, 2442 MHz		
I	Frequency Range		Value	Limit	Result
30 N	IHz - 12.5 GHz		-36.07 dBc	≤ -20 dBc	Pass
🔆 💥 Agilent 08:59:2	25 Jan 14, 2013			RT	
Northwest EMC, Inc				Mkr:	
Ref 10 dBm	#Atten 10	dB			-38.98 dBm
#Peak Log					
10		_			
dB/					
Offst					
0ffst 22.2 dB					
#LgAv		1			
#L9HV		Ť			
V1 S2 S3 FC					
S3 FC					
£(f):	and the state of the	a des le signe en statistic	وبالالمالية فأفتوني	and the later of the	is a start of the start of the start of the start
FTun	A STATUTE AND A STATUTE AN				
Swp					
Start 30.0 MHz #Res BW 100 kHz_		≢VBW 300 kH	7		12.500 0 GHzî s (8192 pts)



				BLE - Dat	ta, Mid Chani	nel, 2442 MI	Ηz			
		Frequen					_		_	
г	40	Range					alue	Limit	Res	
	12	2.5 GHz - 2	5 GHZ			-48.	89 dBc	≤ -20 dBc	Pa	SS
莱	Agilent 09:00	):25 Jai	n 14, 201	13				RT		
	west EMC, In	IC						M	kr1 24.9	974 1 GH
Ref 1	.0_dBm		#At	ten 10 d	В				-5	1.80 dBi
#Peal	<									
Log 10										
dB/										
uD/ Affet										
Offst 22.2 dB										
dB										
#LgA	v									
71 S \$3 F	2									
<b>პ</b> ⊦	C	then wheeler	a ha dha gu ga an da bh	All and the second second second	and the later party	and a set of the set of the	Internetical	الإرابية بيباليرية	البرجة الجملة	
<b>£</b> (f):			installing of the second s	and the latter of the latter o	al and the second s					
FTun										
Swp										
Start	12.500 0 G							S	top 25.0	00 0 GH
	RW 100 kHz			#	VRW 300	447		Sween 1		





		BLE - D	ata, High Chann	el, 2478 Mi	Ηz			
		uency		V.	alue	Limit	De	sult
ĺ		<b>nge</b> 12.5 GHz			4 dBc	≤ -20 dBc		iss
*	Agilent 09:07:39					RT		
	hwest EMC, Inc	0an 14, 2010					Mkr1 4.9	955 0 GHz
	10 dBm	#Atten 10	dB					2.98 dBm
#Pea	ik 🔽 🗌							
Log								
10 dB/								
ab/ Affs	+							
Offs 22.2 dB								
dB								
#Lgf	iv l		1					
-3.			\$					
V1	\$2							
\$3	FC							
<b>£</b> (f)	· · · · · · · · · · · · · · · · · · ·	a design of the second s			eriek kon			
FTu								
Swp								
	t 30.0 MHz							500 0 GHz
Res	; BW 100 kHz		#VBW 300 k	HZ		Sweep 1.	192 S ()	3192 pts)

		_	BLE - I	Data, High Char	nnel, 2478 M	Hz					
		Frequency Range 12.5 GHz - 25 G	iHz			alue 36 dBc	Limit ≤ -20 dBc	Resu Pas			
- size	Agilent 09:0		4,2013		RT						
Nort	thwest EMC,				Mkr1 13.685 8 GHz						
Ref	10 dBm		#Atten 10	l dB				-51	.94 dBm		
#Pe Log											
10											
dB/	/										
0ffs 22.2	st 2										
dB											
#Lgi	Av										
U1	\$2 1										
V1 S3	FC							المراجعة المالية	. Alternation		
	and a state of the second										
£(f) F⊺u											
Swp											
\$+0	rt 12.500 0	CU-7						+on 25 00	)0 0 GHzî		
	<u>s BW 100 kH</u>			_#VBW 300	kHz		Sweep 1.				

# ENC

# **Power Spectral Density**

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator - 20db, 'SMA'	SM Electronics	SA26B-20	RFW	4/19/2012	12
40 GHz DC block	Fairview Microwave	SD3379	AMI	10/5/2012	12
Signal Generator MXG	Agilent	N5183A	TIK	6/7/2012	36
Spectrum Analyzer	Agilent	E4440A	AAX	5/15/2012	24

#### **TEST DESCRIPTION**

The maximum power spectral density measurements were measured with the EUT set to the required transmit frequencies in each band. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the lowest, middle, and maximum data rate for each modulation type available.

Per the procedure outlined in FCC KDB 558074 D01 DTS Measurement Section 5.3.1, the spectrum analyzer was used as follows:

≻RBW = 100 kHz

≻VBW = 300 kHz

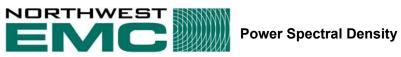
>Detector = Peak (to match method used for power measurement)

≻Trace = Max hold

The observed power level is then scaled to an equivalent value in 3 kHz by adding a Bandwidth Correction Factor (BWCF) where:

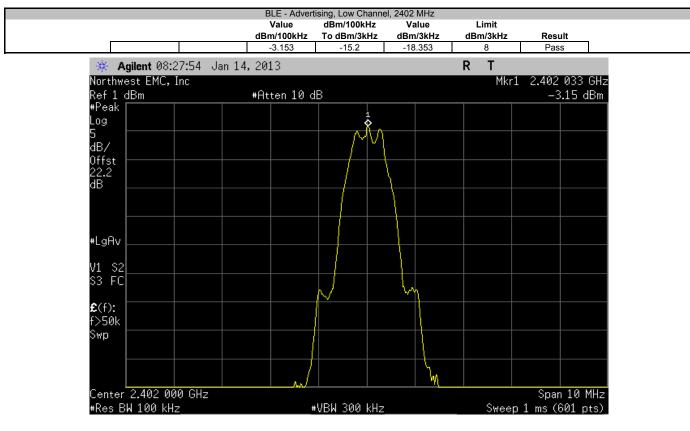
BWCF = 10\*LOG (3 kHz / 100 kHz) = -15.2 dB

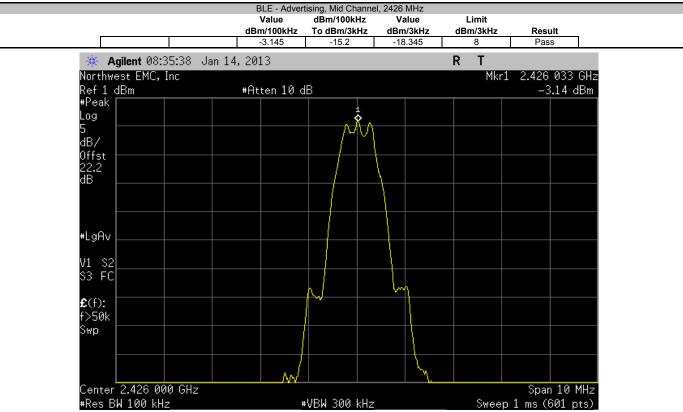




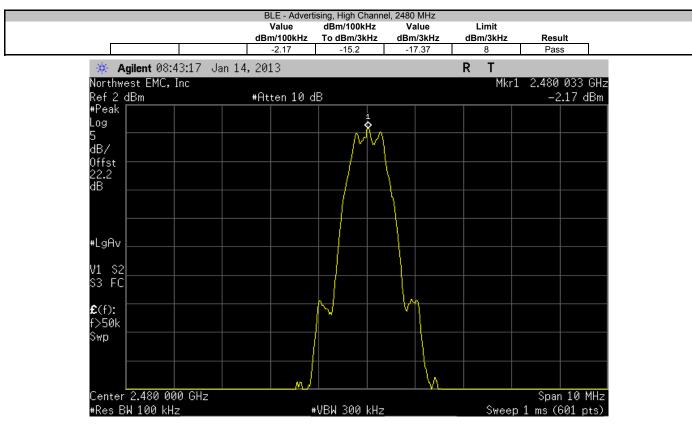
	T: 24HALOXF13								Work Order:	STAK0027	
Serial Number	r: 12826579								Date:	01/14/13	
Custome	r: Starkey Laboratories, Inc.								Temperature:	23.4°C	
Attendees	s: Larry McNabb								Humidity:	12%	
Projec	t: None								Barometric Pres.:	1030	
Tested by	y: Trevor Buls				Power:	Battery			Job Site:	MN08	
EST SPECIFICA	TIONS					Test Method					
CC 15.247:2013					A	ANSI C63.10:2009					
COMMENTS											
lone											
DEVIATIONS FRO	OM TEST STANDARD										
DEVIATIONS FRC	DM TEST STANDARD										
	DM TEST STANDARD		Signature	In	evor	Buls					
lone	DM TEST STANDARD		Signature	Jru	evor	Buls	Value dBm/100kHz	dBm/100kHz To dBm/3kHz	Value dBm/3kHz	Limit dBm/3kHz	Result
lone	DM TEST STANDARD		Signature	Jru	evor	Buls					Result
lone Configuration #	DM TEST STANDARD		Signature	Jru	evor	Buls					Result Pass
lone	1		Signature	Jru	evor	Buls	dBm/100kHz	To dBm/3kHz	dBm/3kHz	dBm/3kHz	
one onfiguration #	1 Low Channel, 2402 MHz Mid Channel, 2426 MHz		Signature	Jru	evor	Buls	dBm/100kHz -3.153	To dBm/3kHz -15.2	dBm/3kHz -18.353	dBm/3kHz 8	Pass
tone	1 Low Channel, 2402 MHz	_	Signature	Tru	evor	Buls	dBm/100kHz -3.153 -3.145	To dBm/3kHz -15.2 -15.2	dBm/3kHz -18.353 -18.345	<b>dBm/3kHz</b> 8 8	Pass Pass
tone	1 Low Channel, 2402 MHz Mid Channel, 2426 MHz		Signature	Jru	evor	Buls	dBm/100kHz -3.153 -3.145	To dBm/3kHz -15.2 -15.2	dBm/3kHz -18.353 -18.345	<b>dBm/3kHz</b> 8 8	Pass Pass
lone	1 Low Channel, 2402 MHz Mid Channel, 2426 MHz High Channel, 2480 MHz		Signature	Jru	evor	Buls	dBm/100kHz -3.153 -3.145 -2.17	To dBm/3kHz -15.2 -15.2 -15.2	dBm/3kHz -18.353 -18.345 -17.37	<b>dBm/3kHz</b> 8 8 8 8	Pass Pass Pass

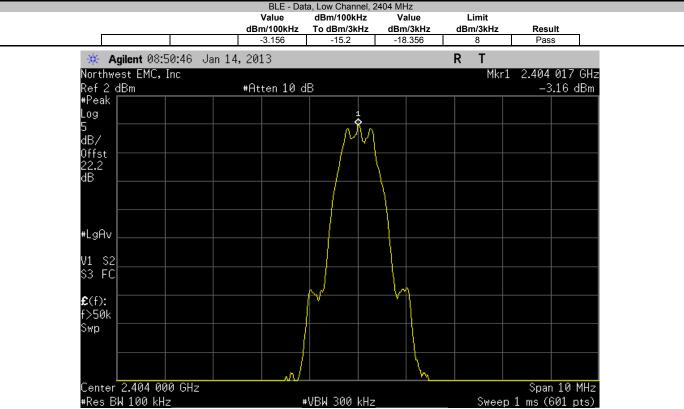




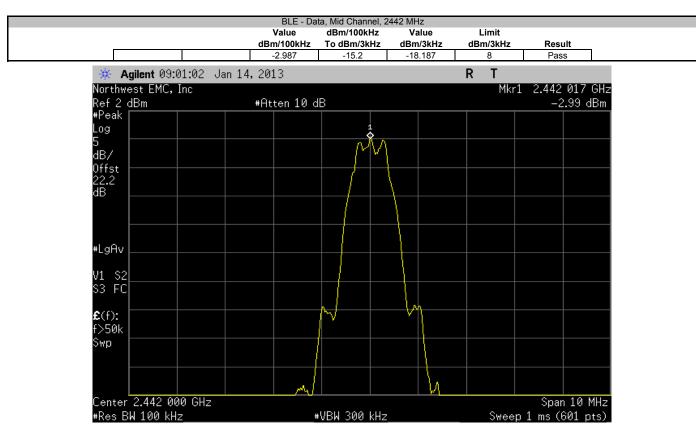


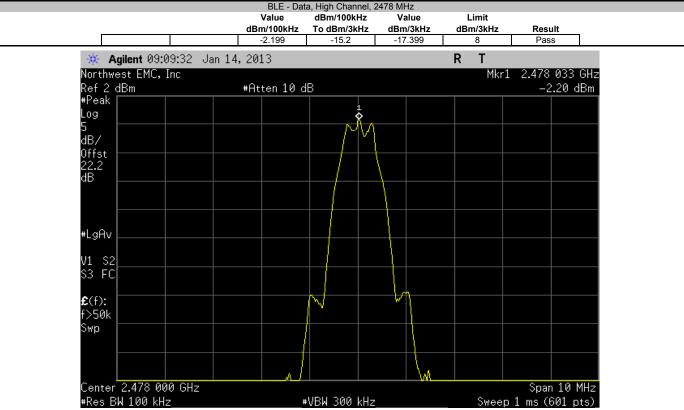














# **Spurious Radiated Emissions**

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

#### MODES OF OPERATION

Transmitting BLE, Low, Mid, High, Chan: Data: 2402, 2426, 2480 MHz, Advertising: 2404, 2442, 2478 MHz (See Comments)

### POWER SETTINGS INVESTIGATED

Battery

#### **CONFIGURATIONS INVESTIGATED**

STAK0027 - 2

#### FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	25 GHz

#### SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Interval
High Pass Filter	Micro-Tronics	HPM50111	HGQ	6/1/2012	24 mo
Low Pass Filter	Micro-Tronics	LPM50004	HGK	5/31/2012	24 mo
Attenuator, 20 dB, 'SMA'	SM Electronics	SA6-20	REO	5/31/2012	12 mo
		18-26GHz Standard Gain			
MN05 Cables	N/A	Horn Cable	MNP	10/5/2012	12 mo
Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	10/5/2012	12 mo
Antenna, Horn	ETS	3160-09	AHG	NCR	0 mo
MN05 Cables	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	5/30/2012	12 mo
Antenna, Horn	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Antenna, Horn	ETS	3160-07	AXP	NCR	0 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	5/30/2012	12 mo
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	5/30/2012	12 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	5/30/2012	12 mo
		Double Ridge Guide Horn			
MN05 Cables	ESM Cable Corp.	Cables	MNI	5/30/2012	12 mo
Antenna, Horn (DRG)	ETS Lindgren	3115	AIP	6/29/2011	24 mo
Pre-Amplifier	Miteq	AM-1616-1000	PAD	8/28/2012	12 mo
MN05 Cables	ESM Cable Corp.	M Cable Corp. Bilog Cables		5/31/2012	12 mo
Antenna, Bilog	Teseq	CBL 6141B	AYD	12/17/2012	12 mo
Spectrum Analyzer	Agilent	E4446A	AAT	6/28/2012	24 mo

### **MEASUREMENT BANDWIDTHS**

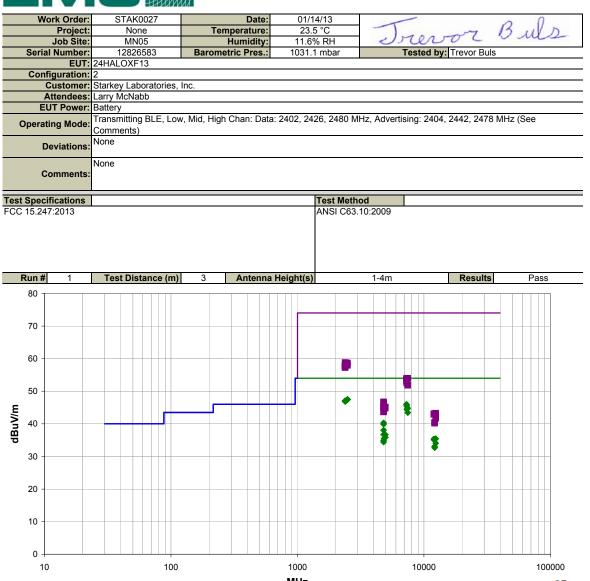
Frequency Range	Peak Data	Quasi-Peak Data	Average Data
(MHz)	(kHz)	(kHz)	(kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

#### **TEST DESCRIPTION**

The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization. A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.



## **Spurious Radiated Emissions**



						MHz				PK	<ul> <li>AV</li> </ul>	QP	
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2487.925	31.2	-3.7	1.0	100.0	3.0	20.0	Vert	AV	0.0	47.5	54.0	-6.5	EUT Horizontal, BLE AV, High CH
2485.617	31.2	-3.8	2.4	232.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	EUT Vertical, BLE AV, High CH
2484.717	31.2	-3.8	3.2	320.0	3.0	20.0	Horz	AV	0.0	47.4	54.0	-6.6	EUT Vertical, BLE DATA, High CH
2484.708	31.2	-3.8	3.5	111.0	3.0	20.0	Vert	AV	0.0	47.4	54.0	-6.6	EUT Horizontal, BLE DATA, High CH
2386.225	31.1	-4.0	1.0	345.0	3.0	20.0	Horz	AV	0.0	47.1	54.0	-6.9	EUT Horizontal, BLE AV, Low CH
2386.717	31.1	-4.0	1.1	107.0	3.0	20.0	Horz	AV	0.0	47.1	54.0	-6.9	EUT Vertical, BLE AV, Low CH
2385.850	31.0	-4.0	1.0	215.0	3.0	20.0	Horz	AV	0.0	47.0	54.0	-7.0	EUT Vertical, BLE DATA, Low CH
2386.350	31.0	-4.0	1.0	36.0	3.0	20.0	Horz	AV	0.0	47.0	54.0	-7.0	EUT on Side, BLE AV, Low CH
2386.450	31.0	-4.0	1.0	127.0	3.0	20.0	Vert	AV	0.0	47.0	54.0	-7.0	EUT Horizontal, BLE DATA, Low CH
2387.117	31.0	-4.0	1.4	84.0	3.0	20.0	Vert	AV	0.0	47.0	54.0	-7.0	EUT on Side, BLE AV, Low CH
2385.417	30.9	-4.0	1.0	94.0	3.0	20.0	Vert	AV	0.0	46.9	54.0	-7.1	EUT Horizontal, BLE AV, Low CH
2387.775	30.9	-4.0	1.0	267.0	3.0	20.0	Vert	AV	0.0	46.9	54.0	-7.1	EUT Vertical, BLE AV, Low CH
7277.492	34.2	11.8	1.0	134.0	3.0	0.0	Vert	AV	0.0	46.0	54.0	-8.0	EUT Horizontal, BLE AV, Mid CH
7277.500	34.1	11.8	1.6	84.0	3.0	0.0	Horz	AV	0.0	45.9	54.0	-8.1	EUT Vertical, BLE AV, Mid CH
7325.383	33.4	12.1	1.0	312.0	3.0	0.0	Vert	AV	0.0	45.5	54.0	-8.5	EUT Horizontal, BLE DATA, Mid CH
7439.600	32.1	12.6	1.5	57.0	3.0	0.0	Horz	AV	0.0	44.7	54.0	-9.3	EUT Vertical, BLE AV, High CH
7325.542	32.4	12.1	1.8	113.0	3.0	0.0	Horz	AV	0.0	44.5	54.0	-9.5	EUT Vertical, BLE DATA, Mid CH
7439.625	30.8	12.6	1.0	323.0	3.0	0.0	Vert	AV	0.0	43.4	54.0	-10.6	EUT Horizontal, BLE AV, High CH
4804.050	36.3	4.0	1.0	90.0	3.0	0.0	Horz	AV	0.0	40.3	54.0	-13.7	EUT Vertical, BLE AV, Low CH
4803.992	35.9	4.0	1.0	313.0	3.0	0.0	Vert	AV	0.0	39.9	54.0	-14.1	EUT Horizontal, BLE AV, Low CH
2385.067	42.8	-4.0	1.0	267.0	3.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	EUT Vertical, BLE AV, Low CH
2487.000	42.4	-3.8	2.4	232.0	3.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	EUT Vertical, BLE AV, High CH
2483.633	42.3	-3.8	3.5	111.0	3.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT Horizontal, BLE DATA, High CH
2386.958	42.2	-4.0	1.0	215.0	3.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	EUT Vertical, BLE DATA, Low CH
2484.017	41.8	-3.8	1.0	100.0	3.0	20.0	Vert	PK	0.0	58.0	74.0	-16.0	EUT Horizontal, BLE AV, High CH
4804.017	34.0	4.0	1.0	316.0	3.0	0.0	Horz	AV	0.0	38.0	54.0	-16.0	EUT on Side, BLE AV, Low CH
2484.417	41.7	-3.8	3.2	320.0	3.0	20.0	Horz	PK	0.0	57.9	74.0	-16.1	EUT Vertical, BLE DATA, High CH

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2385.625	41.9	-4.0	1.4	84.0	3.0	20.0	Vert	PK	0.0	57.9	74.0	-16.1	EUT on Side, BLE AV, Low CH
2387.967	41.9	-4.0	1.0	127.0	3.0	20.0	Vert	PK	0.0	57.9	74.0	-16.1	EUT Horizontal, BLE DATA, Low CH
2387.358	41.8	-4.0	1.0	94.0	3.0	20.0	Vert	PK	0.0	57.8	74.0	-16.2	EUT Horizontal, BLE AV, Low CH
2385.033	41.5	-4.0	1.0	36.0	3.0	20.0	Horz	PK	0.0	57.5	74.0	-16.5	EUT on Side, BLE AV, Low CH
2385.317	41.3	-4.0	1.1	107.0	3.0	20.0	Horz	PK	0.0	57.3	74.0	-16.7	EUT Vertical, BLE AV, Low CH
2386.133	41.3	-4.0	1.0	345.0	3.0	20.0	Horz	PK	0.0	57.3	74.0	-16.7	EUT Horizontal, BLE AV, Low CH
4803.942	32.7	4.0	1.0	56.0	3.0	0.0	Horz	AV	0.0	36.7	54.0	-17.3	EUT Horizontal, BLE AV, Low CH
4960.042	32.1	4.6	1.0	113.0	3.0	0.0	Horz	AV	0.0	36.7	54.0	-17.3	EUT Vertical, BLE AV, High CH
4959.983	31.3	4.6	1.0	275.0	3.0	0.0	Vert	AV	0.0	35.9	54.0	-18.1	EUT Horizontal, BLE AV, High CH
4852.150	31.3	4.2	1.0	102.0	3.0	0.0	Horz	AV	0.0	35.5	54.0	-18.5	EUT Vertical, BLE AV, Mid CH
4852.108	31.3	4.2	1.0	261.0	3.0	0.0	Vert	AV	0.0	35.5	54.0	-18.5	EUT Horizontal, BLE AV, Mid CH
12399.140	41.1	-5.6	1.1	320.0	3.0	0.0	Horz	AV	0.0	35.5	54.0	-18.5	EUT Vertical, BLE AV, High CH
12008.940	42.0	-6.6	1.1	92.0	3.0	0.0	Horz	AV	0.0	35.4	54.0	-18.6	EUT Vertical, BLE AV, Low CH
12008.960	41.7	-6.6	1.2	280.0	3.0	0.0	Vert	AV	0.0	35.1	54.0	-18.9	EUT Horizontal, BLE AV, Low CH
4803.933	30.9	4.0	1.0	249.0	3.0	0.0	Vert	AV	0.0	34.9	54.0	-19.1	EUT Vertical, BLE AV, Low CH
4804.108	30.4	4.0	1.0	260.0	3.0	0.0	Vert	AV	0.0	34.4	54.0	-19.6	EUT on Side, BLE AV, Low CH
12399.020	39.7	-5.6	1.2	271.0	3.0	0.0	Vert	AV	0.0	34.1	54.0	-19.9	EUT Horizontal, BLE AV, High CH
7440.842	41.3	12.7	1.5	57.0	3.0	0.0	Horz	PK	0.0	54.0	74.0	-20.0	EUT Vertical, BLE AV, High CH
7278.958	42.1	11.8	1.6	84.0	3.0	0.0	Horz	PK	0.0	53.9	74.0	-20.1	EUT Vertical, BLE AV, Mid CH
7277.400	41.5	11.8	1.0	134.0	3.0	0.0	Vert	PK	0.0	53.3	74.0	-20.7	EUT Horizontal, BLE AV, Mid CH
12129.020	39.4	-6.3	1.2	336.0	3.0	0.0	Horz	AV	0.0	33.1	54.0	-20.9	EUT Horizontal, BLE AV, Mid CH
7325.833	40.7	12.1	1.0	312.0	3.0	0.0	Vert	PK	0.0	52.8	74.0	-21.2	EUT Horizontal, BLE DATA, Mid CH
12128.900	39.0	-6.3	1.2	276.0	3.0	0.0	Vert	AV	0.0	32.7	54.0	-21.3	EUT Vertical, BLE AV, Mid CH
7326.967	40.5	12.1	1.8	113.0	3.0	0.0	Horz	PK	0.0	52.6	74.0	-21.4	EUT Vertical, BLE DATA, Mid CH
7439.650	39.2	12.6	1.0	323.0	3.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	EUT Horizontal, BLE AV, High CH
4804.092	42.7	4.0	1.0	90.0	3.0	0.0	Horz	PK	0.0	46.7	74.0	-27.3	EUT Vertical, BLE AV, Low CH
4804.367	42.3	4.0	1.0	313.0	3.0	0.0	Vert	PK	0.0	46.3	74.0	-27.7	EUT Horizontal, BLE AV, Low CH
4960.400	40.6	4.6	1.0	113.0	3.0	0.0	Horz	PK	0.0	45.2	74.0	-28.8	EUT Vertical, BLE AV, High CH
4803.758	41.1	4.0	1.0	56.0	3.0	0.0	Horz	PK	0.0	45.1	74.0	-28.9	EUT Horizontal, BLE AV, Low CH
4803.550	41.1	4.0	1.0	316.0	3.0	0.0	Horz	PK	0.0	45.1	74.0	-28.9	EUT on Side, BLE AV, Low CH
4852.308	40.8	4.2	1.0	102.0	3.0	0.0	Horz	PK	0.0	45.0	74.0	-29.0	EUT Vertical, BLE AV, Mid CH
4960.617	40.3	4.6	1.0	275.0	3.0	0.0	Vert	PK	0.0	44.9	74.0	-29.1	EUT Horizontal, BLE AV, High CH
4851.875	40.5	4.2	1.0	261.0	3.0	0.0	Vert	PK	0.0	44.7	74.0	-29.3	EUT Horizontal, BLE AV, Mid CH
4806.042	40.0	4.0	1.0	249.0	3.0	0.0	Vert	PK	0.0	44.0	74.0	-30.0	EUT Vertical, BLE AV, Low CH
4803.500	39.6	4.0	1.0	260.0	3.0	0.0	Vert	PK	0.0	43.6	74.0	-30.4	EUT on Side, BLE AV, Low CH
12399.000	48.9	-5.6	1.1	320.0	3.0	0.0	Horz	PK	0.0	43.3	74.0	-30.7	EUT Vertical, BLE AV, High CH
12011.760	49.7	-6.6	1.1	92.0	3.0	0.0	Horz	PK	0.0	43.1	74.0	-30.9	EUT Vertical, BLE AV, Low CH
12011.800	49.5	-6.6	1.2	280.0	3.0	0.0	Vert	PK	0.0	42.9	74.0	-31.1	EUT Horizontal, BLE AV, Low CH
12399.220	47.3	-5.6	1.2	271.0	3.0	0.0	Vert	PK	0.0	41.7	74.0	-32.3	EUT Horizontal, BLE AV, High CH
12128.640	46.7	-6.3	1.2	276.0	3.0	0.0	Vert	PK	0.0	40.4	74.0	-33.6	EUT Vertical, BLE AV, Mid CH
12131.270	46.5	-6.3	1.2	336.0	3.0	0.0	Horz	PK	0.0	40.2	74.0	-33.8	EUT Horizontal, BLE AV, Mid CH