Nalloy, LLC

TEST REPORT FOR

Model: PFAY0H

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.207 & 15.247
(DTS 2400-2483.5 MHz)

Report No.: 102802-5

Date of issue: May 7, 2020

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 # 803.01

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Testing the Future
CKC LABORATORIES, INC.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Nalloy, LLC
2301 5th Avenue
Seattle, WA 98108

Representative: Naga Suryadevara
Customer Reference Number: 2D-03187704

REPORT PREPARED BY:

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Mariposa, CA 95338

Project Number: 102802

DATE OF EQUIPMENT RECEIPT: March 25, 2020
DATE(S) OF TESTING: March 25, 2020

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.
Canyon Park
22116 23rd Drive S.E., Suite A
Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.12

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Japan
Canyon Park, Bothell, WA	US0081	US1022	A-0136
Brea, CA	US0060	US1025	A-0136
Fremont, CA	US0082	US1023	A-0136
Mariposa, CA	US0103	US1024	A-0136

*CKC's list of NIST designated countries can be found at: https://standards.gov/cabs/designations.html

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS)

Test Procedure	Description	Modifications	Results
15.247(a)(2)	6dB Bandwidth	NA	Pass
15.247(b)(3)	Output Power	NA	Pass
15.247(e)	Power Spectral Density	NA	Pass
15.247(d)	RF Conducted Emissions & Band Edge	NA	Pass
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted 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 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
NA	Nalloy, LLC.	PFAY0H	9906679780

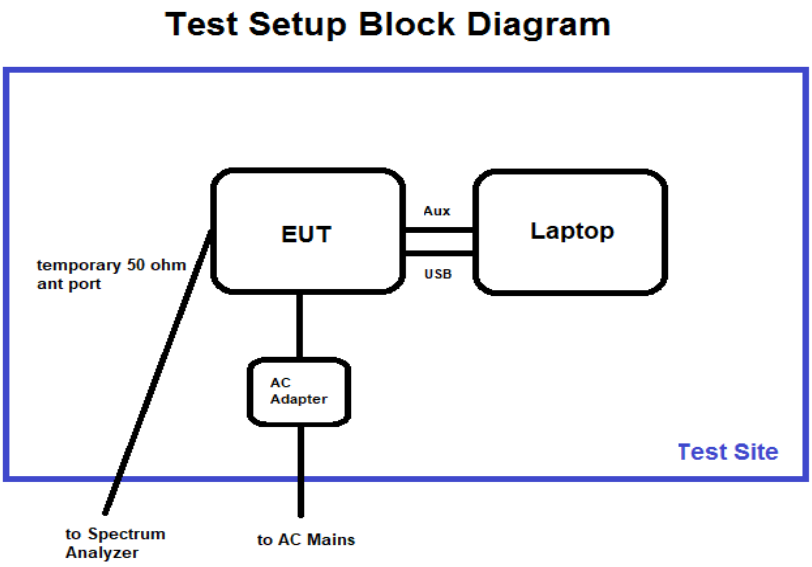
Support Equipment:

Device	Manufacturer	Model #	S/N
PC	Lenovo	81KT	YD07YGLG
PC PSU	Lenovo	ADL45WCC	NA
EUT PSU	Delta Electronics	MDS-030AAC15	24QW96P00CS

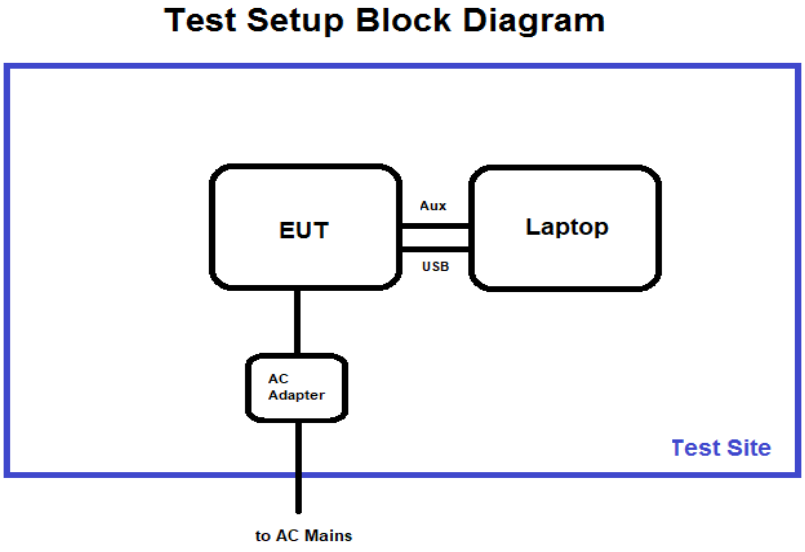
General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	BLE
Operating Frequency Range:	2402-2480 MHz
Modulation Type(s):	GFSK
Maximum Duty Cycle:	100% Modulation (tested worst-case)
Number of TX Chains:	1
Antenna Type(s) and Gain:	Linear polarized / 3.7 dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	120VAC
Firmware / Software used for Test:	ro.build.id=PKQ1.180819.001

Block Diagram (s)



Tx Cond Ant Port



Tx with Antenna

FCC Part 15 Subpart C

15.247(a)(2) 6dB Bandwidth

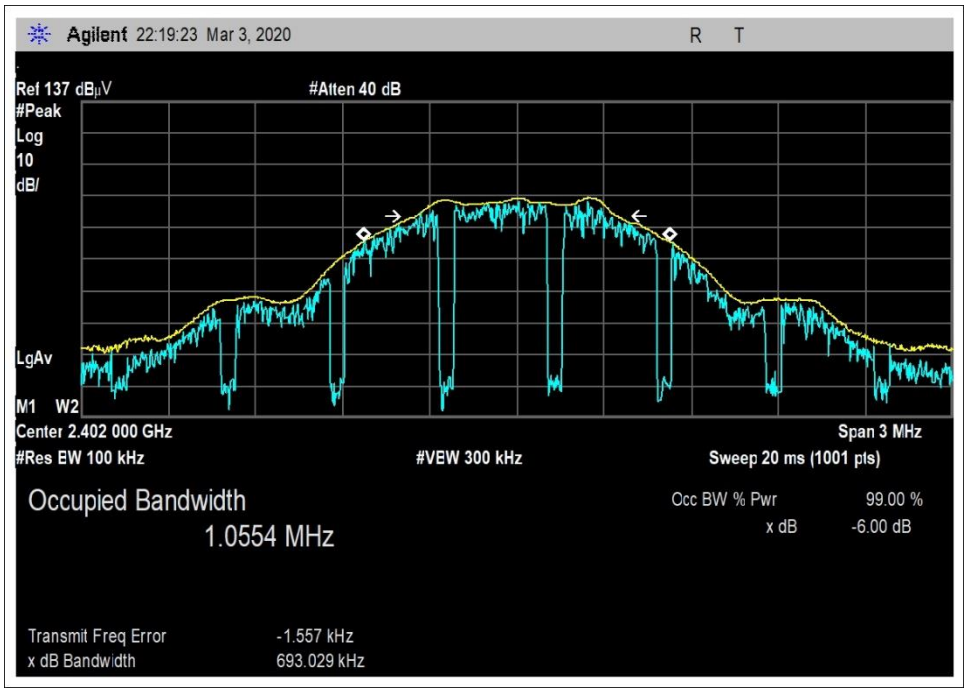
Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford
Test Method:	ANSI C63.10 (2013), KDB 558074 v05r02 April 2, 2019	Test Date(s):	3/25/2020
Configuration:	1		
Test Setup:	Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test Setup: EUT is transmitting through the antenna port connector and is attached to the spectrum analyzer.		

Environmental Conditions			
Temperature (ºC)	23	Relative Humidity (%):	28

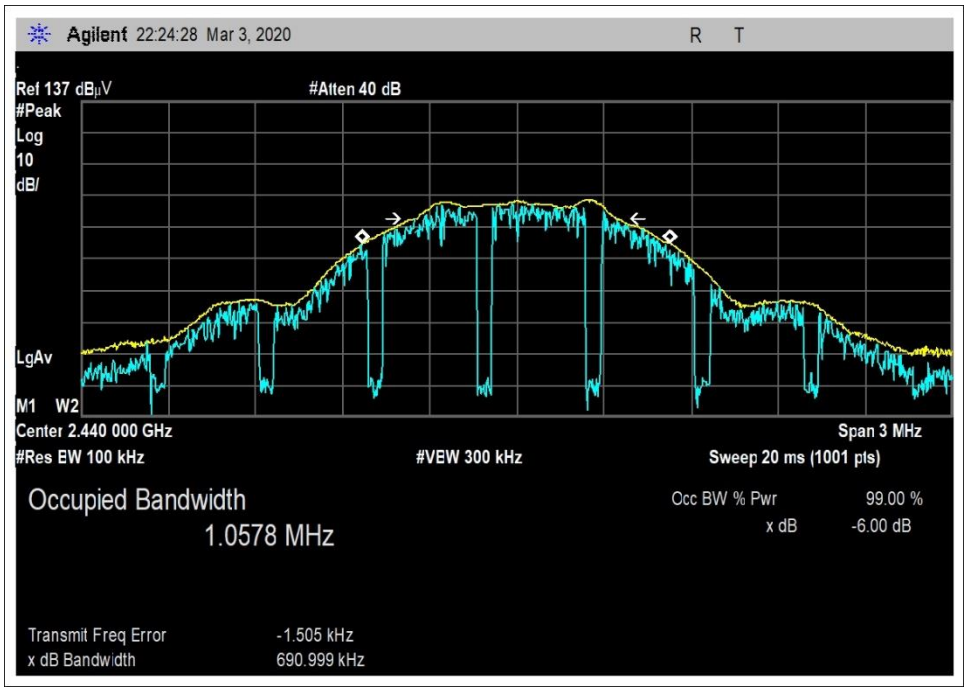
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/18/2019	11/18/2021

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2402	0	GFSK	693.0	≥500	Pass
2440	0	GFSK	691.0	≥500	Pass
2480	0	GFSK	690.7	≥500	Pass

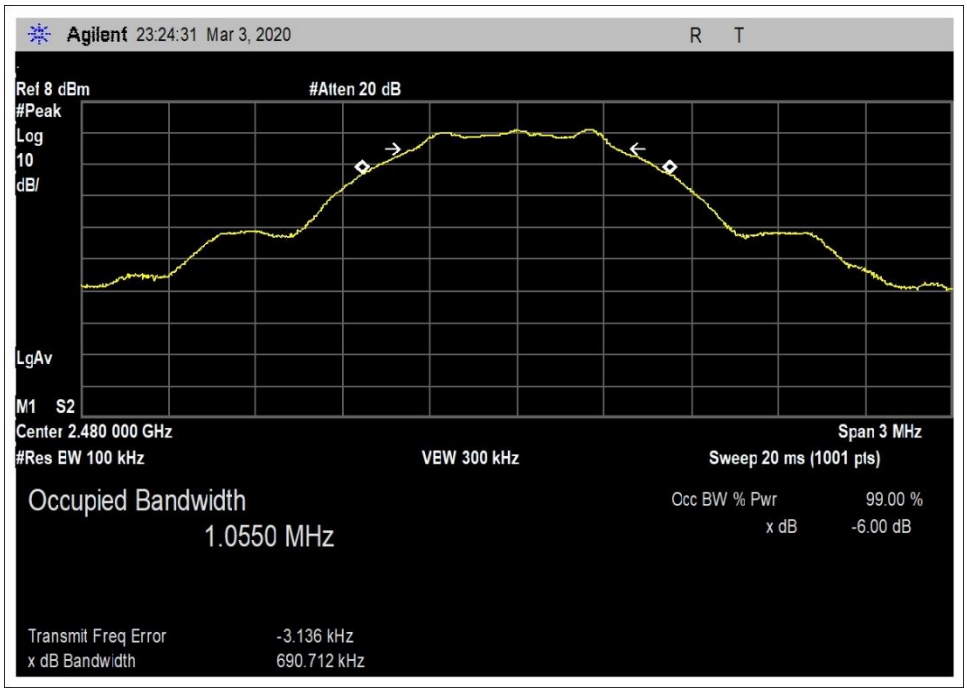
Plot(s)



2402 BLE



2440 BLE



2480 BLE

Test Setup Photo(s)

15.247(b)(3) Output Power

Test Setup / Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford
Test Method:	ANSI C63.10 (2013), KDB 558074 v05r02 April 2, 2019	Test Date(s):	3/25/2020
Configuration:	1		
Test Setup:	Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test Setup: EUT is transmitting through the antenna port connector and is attached to the spectrum analyzer.		

Environmental Conditions			
Temperature (ºC)	23	Relative Humidity (%):	28

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/18/2019	11/18/2021
01318	Multimeter	Fluke	Fluke 85	7/22/2019	7/22/2021
P07527	Variac	Simpson	na	11/21/2018	11/21/2020

Test Data Summary - Voltage Variations					
Frequency (MHz)	Modulation / Ant Port	$V_{Minimum}$ (dBm)	$V_{Nominal}$ (dBm)	$V_{Maximum}$ (dBm)	Max Deviation from $V_{Nominal}$ (dB)
2402	GFSK/0	-0.57	-0.57	-0.57	0
2440	GFSK/0	-1.21	-1.21	-1.21	0
2480	GFSK/0	-0.98	-0.98	-0.96	.02

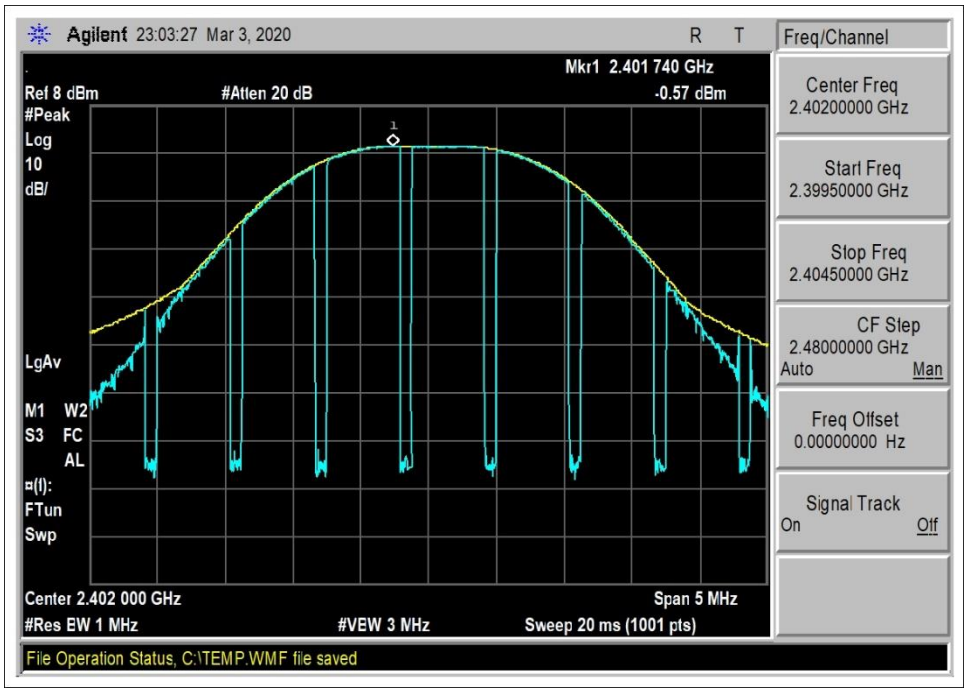
Test performed using operational mode with the highest output power, representing worst case.

Parameter Definitions:

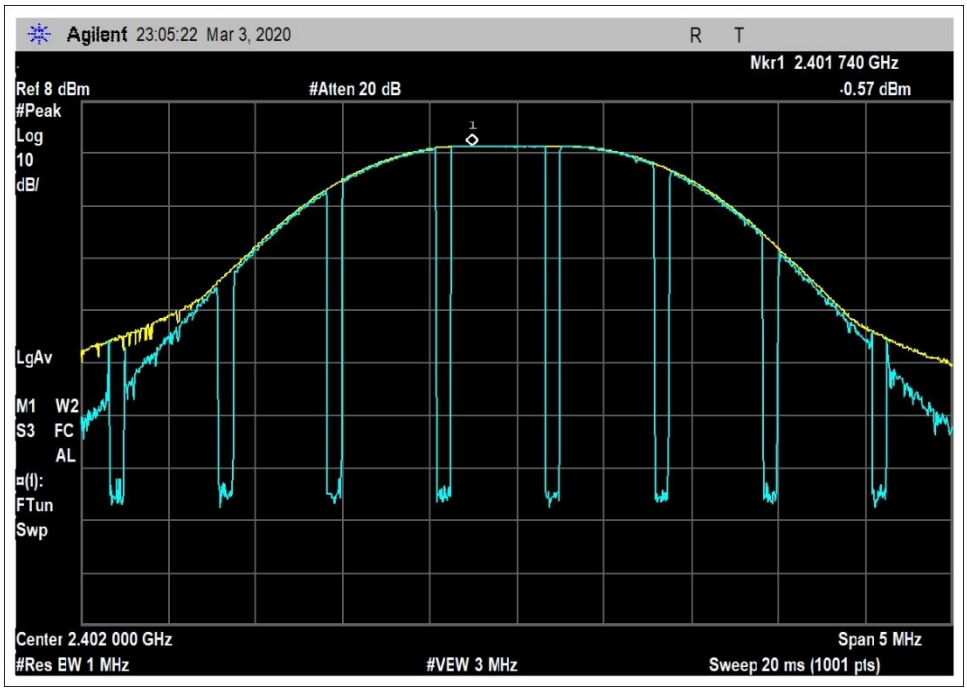
Measurements performed at input voltage Vnominal ± 15%.

Parameter	Value
$V_{Nominal}$:	120
$V_{Minimum}$:	102
$V_{Maximum}$:	138

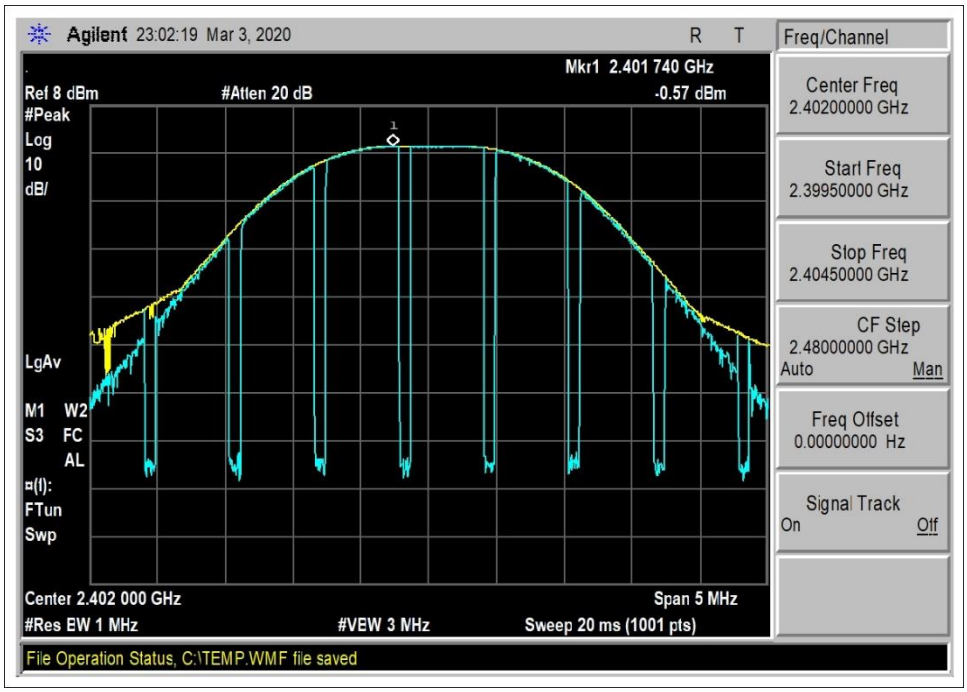
Plots



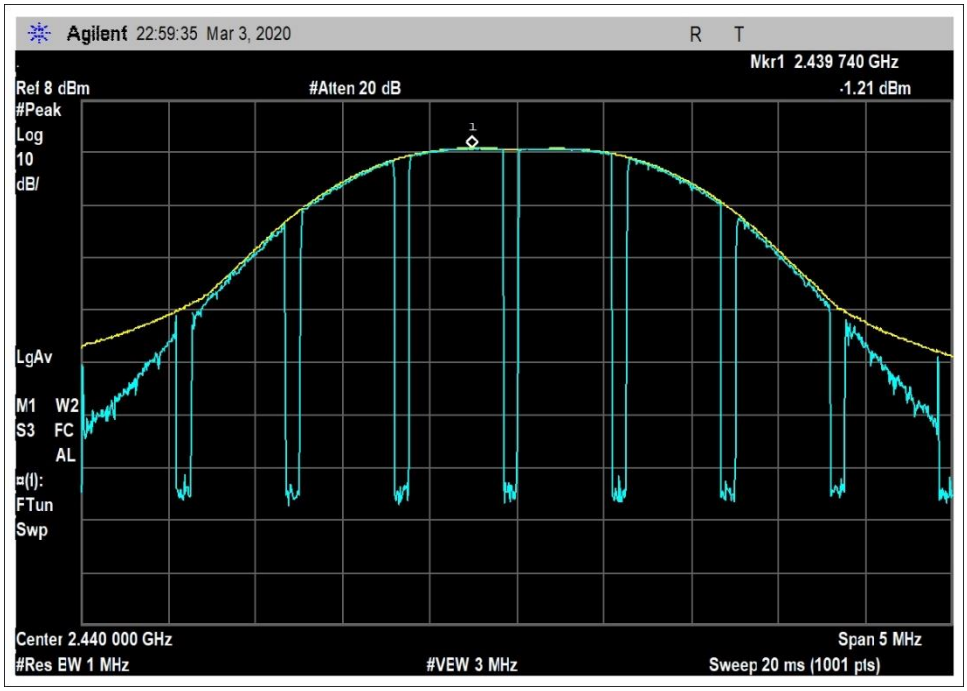
2402 BLE Vnom



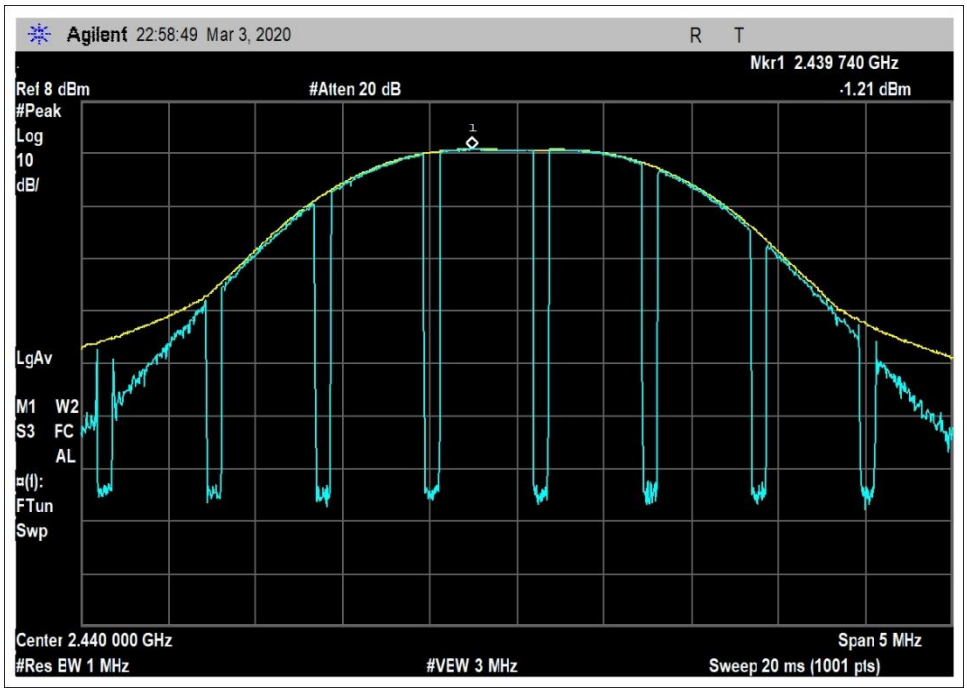
2402 BLE Vmin



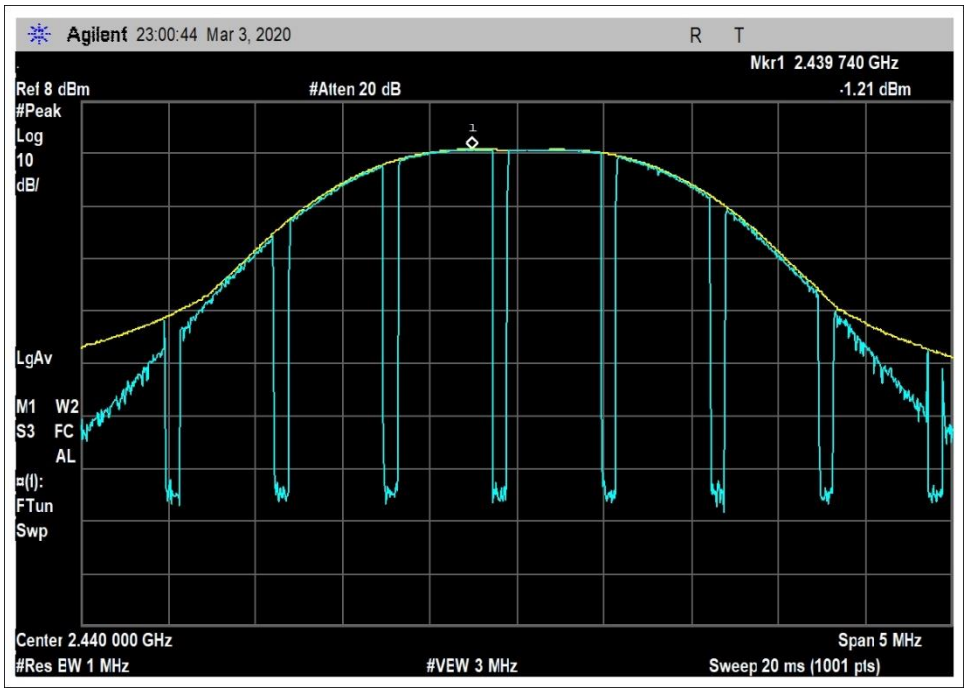
2402 BLE Vmax



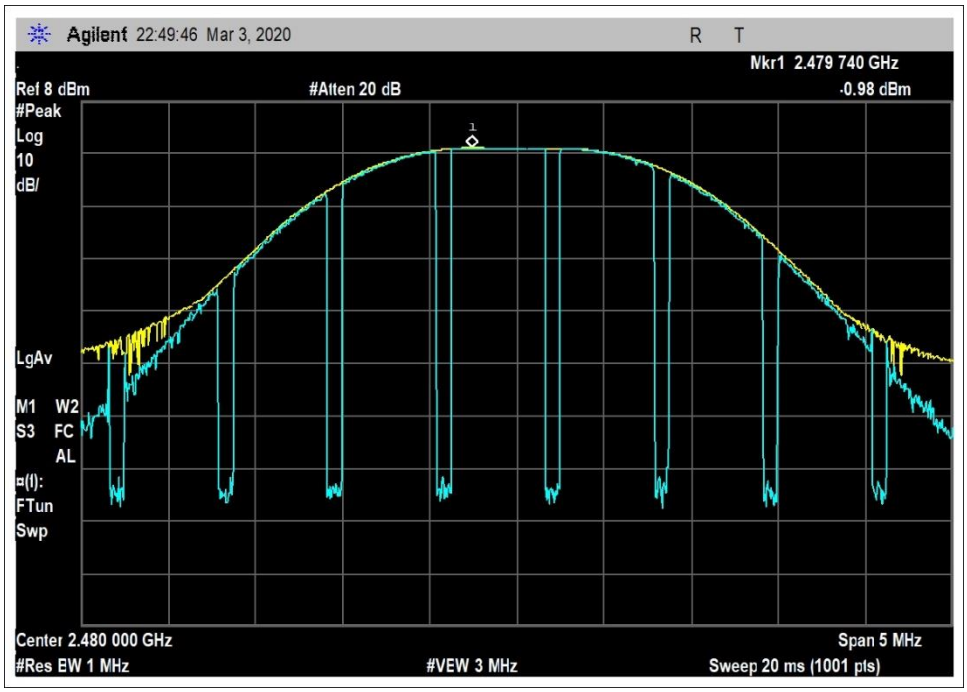
2440 BLE Vnom



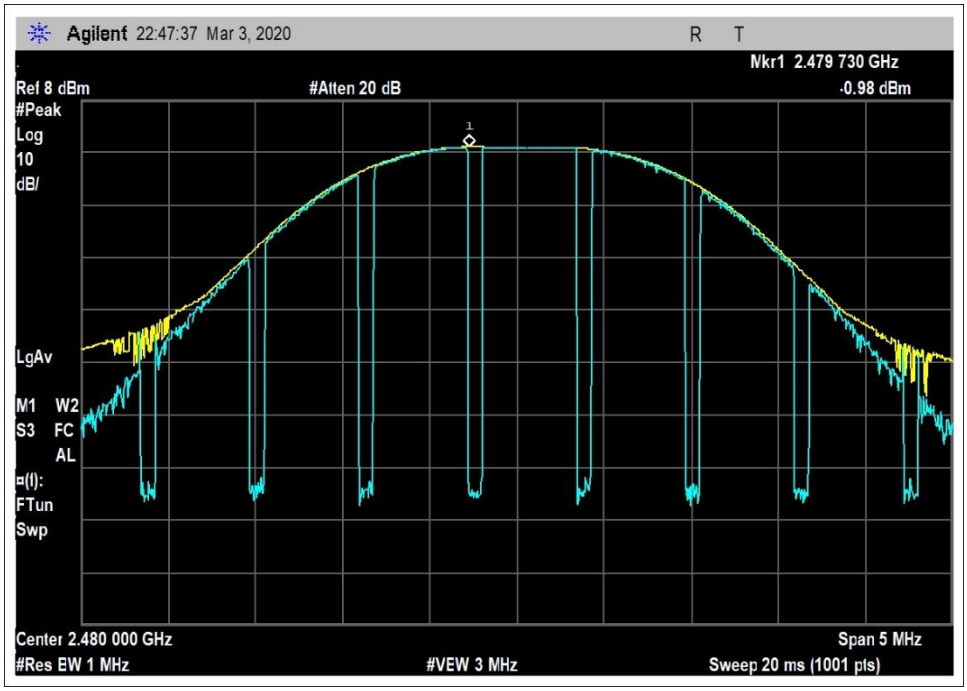
2440 BLE Vmin



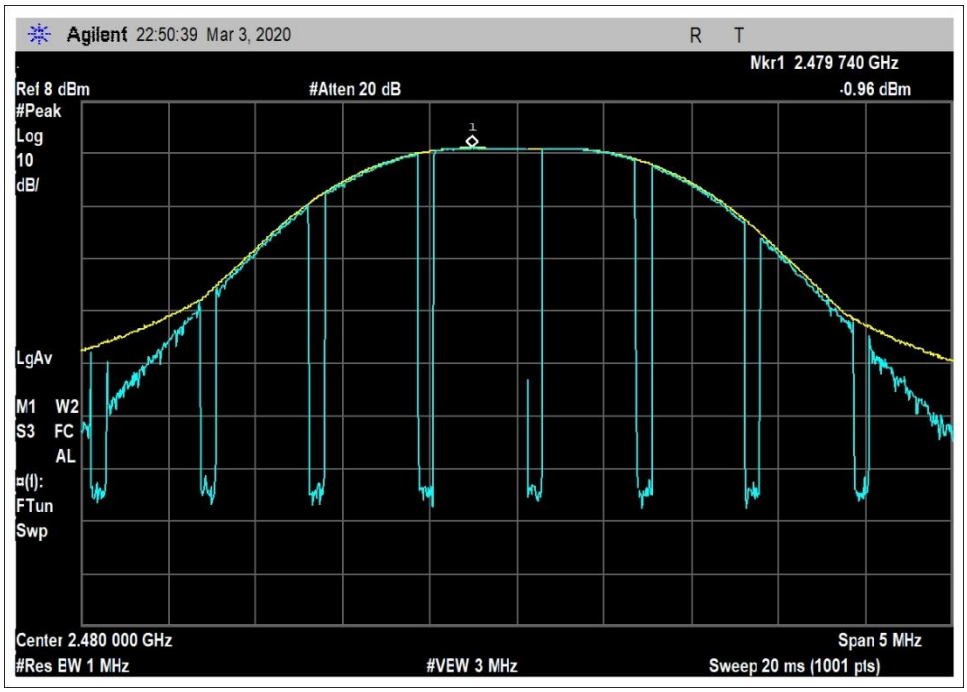
2440 BLE Vmax



2480 BLE Vnom



2480 BLE Vmin



2480 BLE Vmax

Test Setup Photo(s)

15.247(e) Power Spectral Density

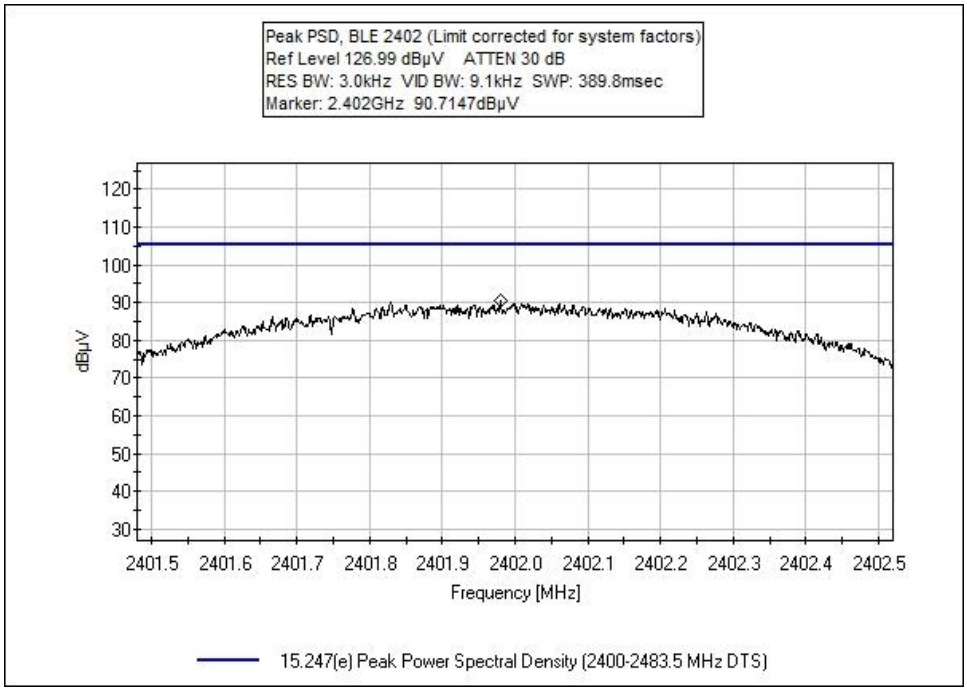
Test Setup / Conditions / Data			
Test Location:	Bothell Lab C3	Test Engineer:	M. Harrison
Test Method:	ANSI C63.10 (2013), KDB 558074 v05r02 April 2, 2019	Test Date(s):	3/25/2020
Configuration:	1		
Test Setup:	Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test Setup: EUT is transmitting through the antenna port connector and is attached to the spectrum analyzer.		

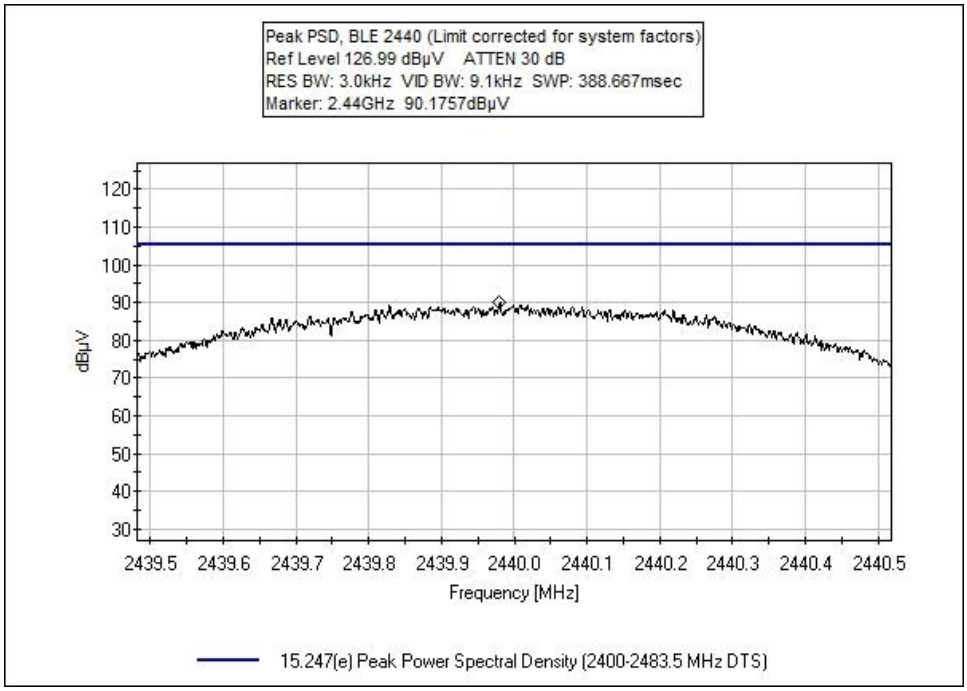
Environmental Conditions			
Temperature (ºC)	23	Relative Humidity (%):	28

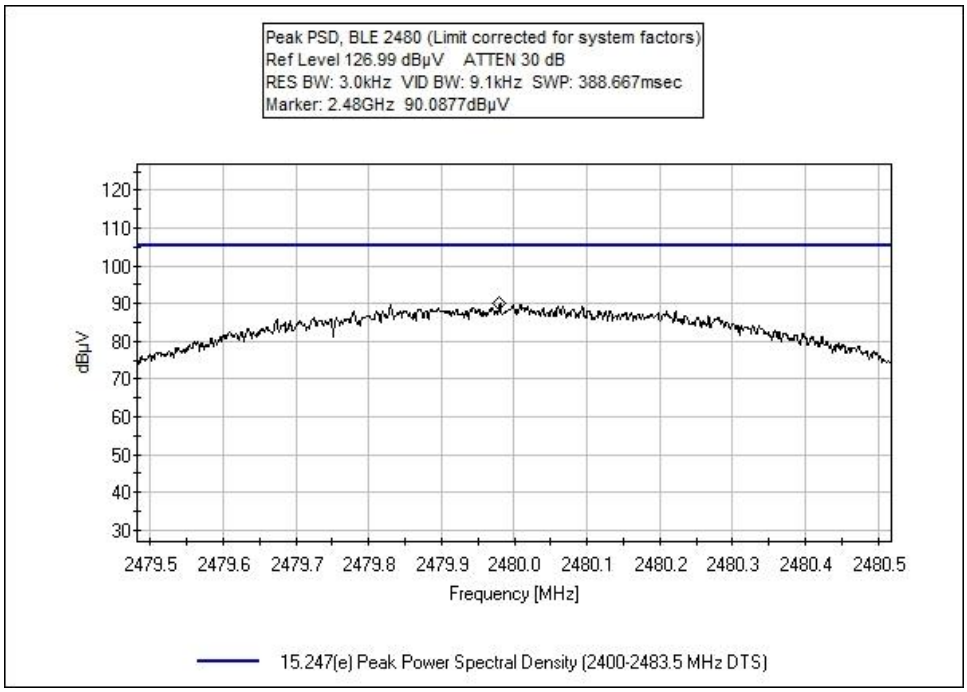
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/18/2019	11/18/2021

PSD Test Data Summary - RF Conducted Measurement				
Measurement Method: PKPSD				
Frequency (MHz)	Modulation	Measured (dBm/3kHz)	Limit (dBm/3kHz)	Results
2402	GFSK	90.7	≤115	Pass
2440	GFSK	90.2	≤115	Pass
2480	GFSK	90.1	≤115	Pass

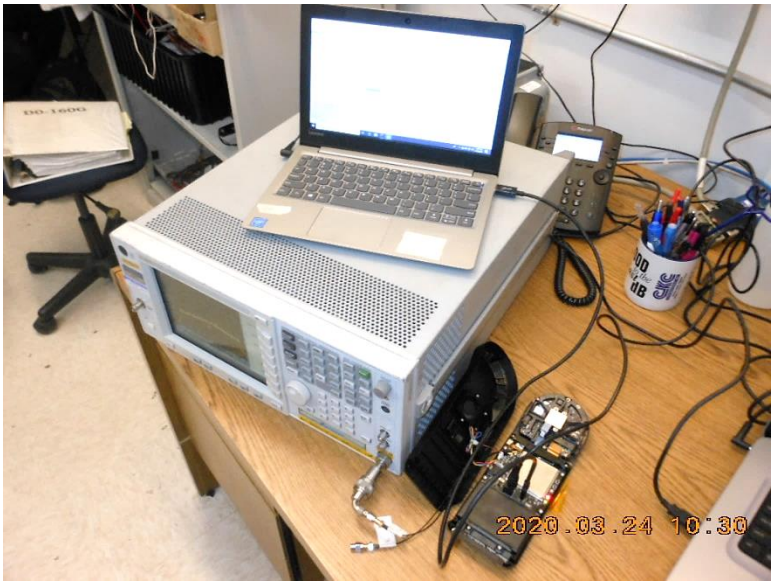
Plots


Peak PSD, BLE 2402 (Limit corrected for system factors)
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 389.8msec
Marker: 2.402GHz 90.7147dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
2401.5 2401.6 2401.7 2401.8 2401.9 2402.0 2402.1 2402.2 2402.3 2402.4 2402.5
Frequency [MHz]
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)


Peak PSD, BLE 2440 (Limit corrected for system factors)
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 388.667msec
Marker: 2.44GHz 90.1757dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
2439.5 2439.6 2439.7 2439.8 2439.9 2440.0 2440.1 2440.2 2440.3 2440.4 2440.5
Frequency [MHz]
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)



Test Setup Photo(s)



15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Nalloy, LLC.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**102802**	Date:	3/25/2020
Test Type:	**Conducted Emissions**	Time:	2:40:27 PM
Tested By:	Matthew Harrison	Sequence#:	38
Software:	EMITest 5.03.12		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 22° C
Humidity: 28%
Pressure: 101.3 kPa

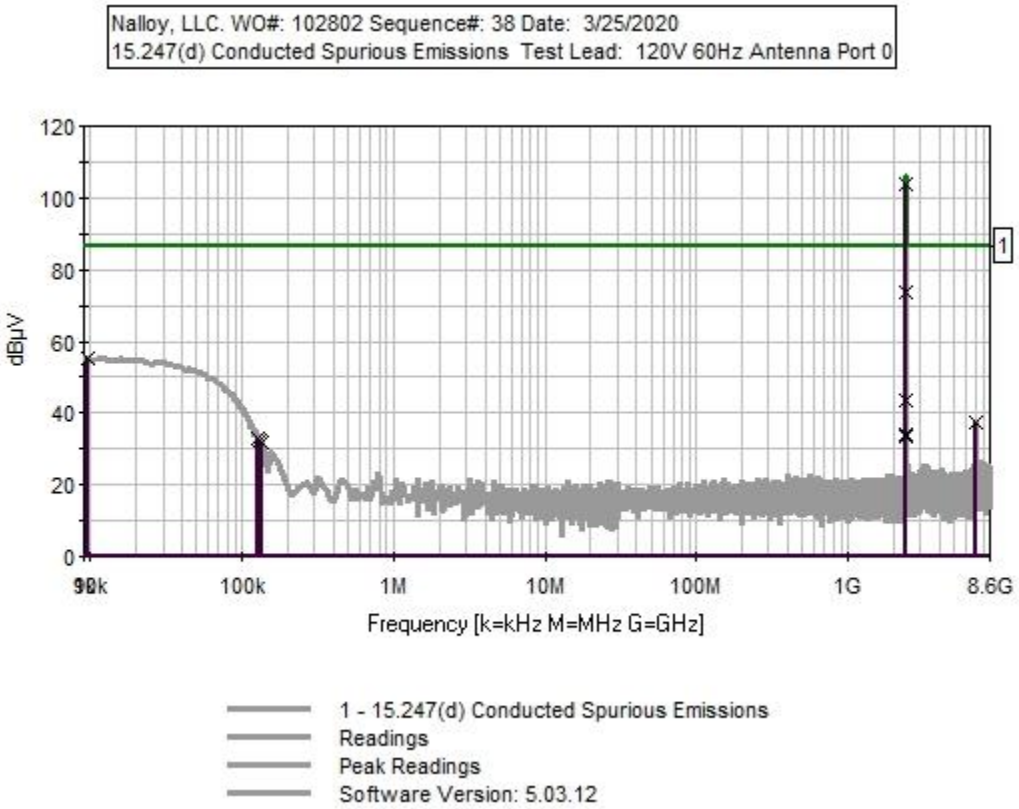
Frequency Range: 9kHz-25GHz
Frequency tested: 2402
Firmware power setting: Default
EUT Firmware:
Protocol /MCS/Modulation: BLE, 1Mbps

Antenna type: Linear Polarized
Antenna Gain: 3.7 dBi.

Duty Cycle: 100% Modulated

Test Method: ANSI C63.10: 2013 KDB 5508074 v05r02 4/2/2019
Test Mode: Transmitting
Test Setup: EUT is setup for conducted measurements.
Setup: EUT is connected to a Laptop via USB and Audio cable.

Low, Mid, and High channels along with all data rates investigated, worst-case provided.


Nalloy, LLC. WO#: 102802 Sequence#: 38 Date: 3/25/2020
15.247(d) Conducted Spurious Emissions Test Lead: 120V 60Hz Antenna Port 0
120
100
80
60
40
20
0
dBµV
1
100k
1M
10M
100M
1G
8.6G
Frequency [k=kHz M=MHz G=GHz]
1 - 15.247(d) Conducted Spurious Emissions
Readings
Peak Readings
Software Version: 5.03.12

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021

Measurement Data: Reading listed by margin. Test Lead: Antenna Port 0

#	Freq MHz	Rdng dBµV	dB	dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	2401.969M	104.0					+0.0	104.0	106.3	-2.3	Anten
2	9.705k	55.1					+0.0	55.1	86.3	-31.2	Anten
3	2402.871M	73.4					+0.0	73.4	106.3	-32.9	Anten
4	9608.970M	48.3					+0.0	48.3	86.3	-38.0	Anten
5	9606.968M	45.2					+0.0	45.2	86.3	-41.1	Anten
6	2399.467M	43.7					+0.0	43.7	86.3	-42.6	Anten
7	9607.468M	43.0					+0.0	43.0	86.3	-43.3	Anten
8	9607.969M	41.7					+0.0	41.7	86.3	-44.6	Anten
9	6960.023M	37.5					+0.0	37.5	86.3	-48.8	Anten
10	2398.266M	34.3					+0.0	34.3	86.3	-52.0	Anten
11	2398.766M	33.4					+0.0	33.4	86.3	-52.9	Anten
12	126.453k	33.1					+0.0	33.1	86.3	-53.2	Anten
13	131.811k	32.1					+0.0	32.1	86.3	-54.2	Anten
14	135.900k	31.9					+0.0	31.9	86.3	-54.4	Anten
15	133.221k	31.7					+0.0	31.7	86.3	-54.6	Anten

Test Location:	CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Nalloy, LLC.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**102802**	Date:	3/25/2020
Test Type:	**Conducted Emissions**	Time:	2:46:38 PM
Tested By:	Matthew Harrison	Sequence#:	39
Software:	EMITest 5.03.12		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 22° C
Humidity: 28%
Pressure: 101.3 kPa

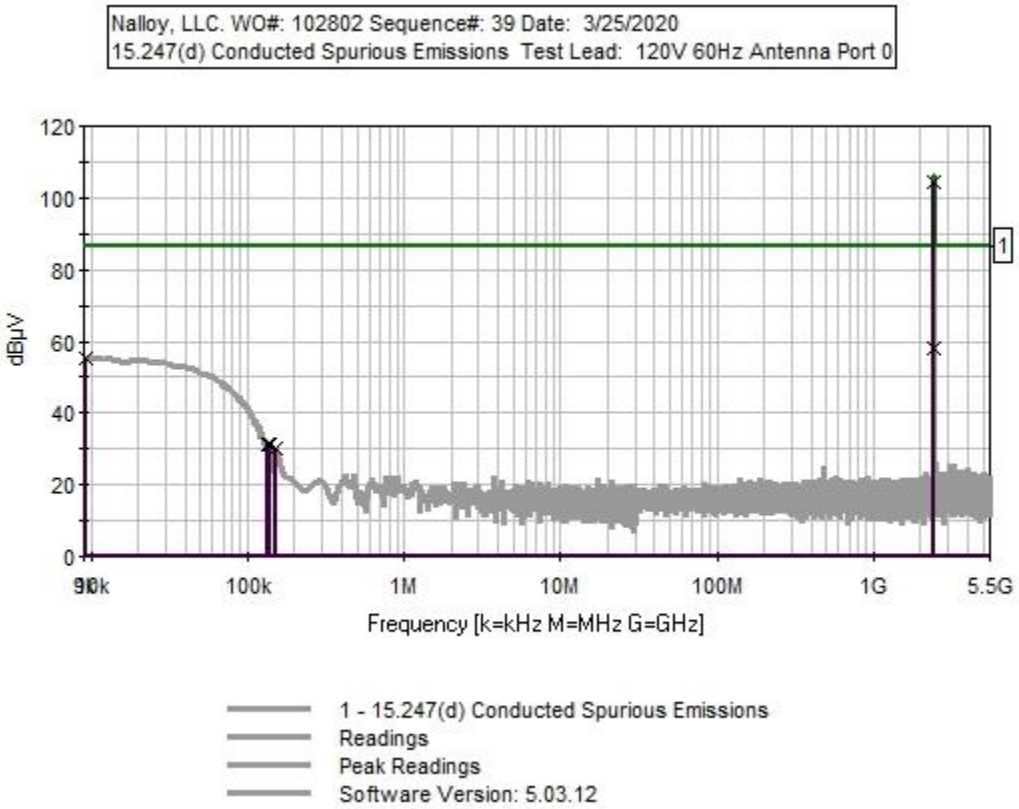
Frequency Range: 9kHz-25GHz
Frequency tested: 2440
Firmware power setting: Default
EUT Firmware:
Protocol /MCS/Modulation: BLE, 1Mbps

Antenna type: Linear Polarized
Antenna Gain: 3.7 dBi.

Duty Cycle: 100% Modulated

Test Method: ANSI C63.10: 2013 KDB 5508074 v05r02 4/2/2019
Test Mode: Transmitting
Test Setup: EUT is setup for conducted measurements.
Setup: EUT is connected to a Laptop via USB and Audio cable.

Low, Mid, and High channels along with all data rates investigated, worst-case provided.


Nalloy, LLC. WO#: 102802 Sequence#: 39 Date: 3/25/2020
15.247(d) Conducted Spurious Emissions Test Lead: 120V 60Hz Antenna Port 0
120
100
80
60
40
20
0
dBµV
1
90k
100k
1M
10M
100M
1G
5.5G
Frequency [k=kHz M=MHz G=GHz]
1 - 15.247(d) Conducted Spurious Emissions
Readings
Peak Readings
Software Version: 5.03.12

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021

Measurement Data: Reading listed by margin. Test Lead: Antenna Port 0

#	Freq MHz	Rdng dBµV	dB	dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	2439.807M	104.4					+0.0	104.4	106.3	-1.9	Anten
2	9.282k	55.3					+0.0	55.3	86.3	-31.0	Anten
3	9759.020M	41.5					+0.0	41.5	86.3	-44.8	Anten
4	9760.921M	41.4					+0.0	41.4	86.3	-44.9	Anten
5	2438.706M	58.2					+0.0	58.2	106.3	-48.1	Anten
6	6960.023M	36.9					+0.0	36.9	86.3	-49.4	Anten
7	136.041k	31.5					+0.0	31.5	86.3	-54.8	Anten
8	133.221k	31.4					+0.0	31.4	86.3	-54.9	Anten
9	137.310k	31.2					+0.0	31.2	86.3	-55.1	Anten
10	24277.720 M	30.9					+0.0	30.9	86.3	-55.4	Anten
11	24642.290 M	30.7					+0.0	30.7	86.3	-55.6	Anten
12	24821.670 M	30.3					+0.0	30.3	86.3	-56.0	Anten
13	24692.840 M	30.2					+0.0	30.2	86.3	-56.1	Anten
14	24702.850 M	30.1					+0.0	30.1	86.3	-56.2	Anten
15	150.000k	29.9					+0.0	29.9	86.3	-56.4	Anten

Test Location:	CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Nalloy, LLC.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**102802**	Date:	3/25/2020
Test Type:	**Conducted Emissions**	Time:	2:53:50 PM
Tested By:	Matthew Harrison	Sequence#:	40
Software:	EMITest 5.03.12		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 22° C
Humidity: 28%
Pressure: 101.3 kPa

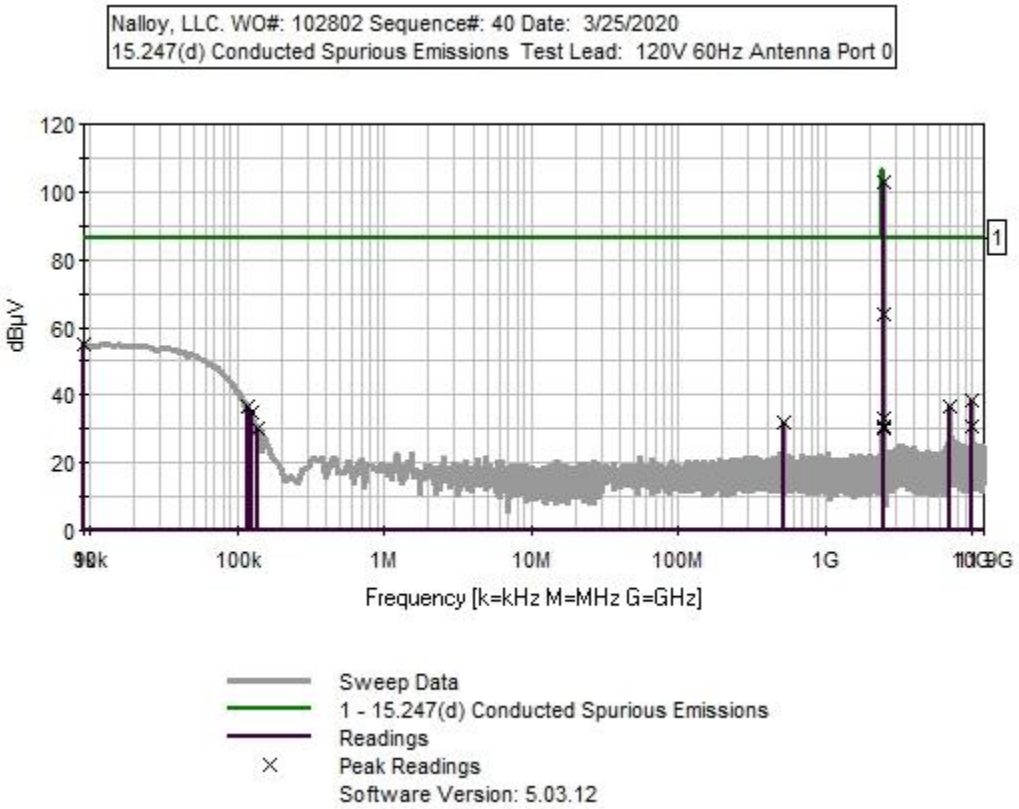
Frequency Range: 9kHz-25GHz
Frequency tested: 2440
Firmware power setting: Default
EUT Firmware:
Protocol /MCS/Modulation: BLE, 1Mbps

Antenna type: Linear Polarized
Antenna Gain: 3.7 dBi.

Duty Cycle: 100% Modulated

Test Method: ANSI C63.10: 2013 KDB 5508074 v05r02 4/2/2019
Test Mode: Transmitting
Test Setup: EUT is setup for conducted measurements.
Setup: EUT is connected to a Laptop via USB and Audio cable.

Low, Mid, and High channels along with all data rates investigated, worst-case provided.


Nalloy, LLC. WO#: 102802 Sequence#: 40 Date: 3/25/2020
15.247(d) Conducted Spurious Emissions Test Lead: 120V 60Hz Antenna Port 0
120
100
80
60
40
20
0
dBµV
1
100k
1M
10M
100M
1G
Frequency [k=kHz M=MHz G=GHz]
Sweep Data
1 - 15.247(d) Conducted Spurious Emissions
Readings
Peak Readings
Software Version: 5.03.12

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021

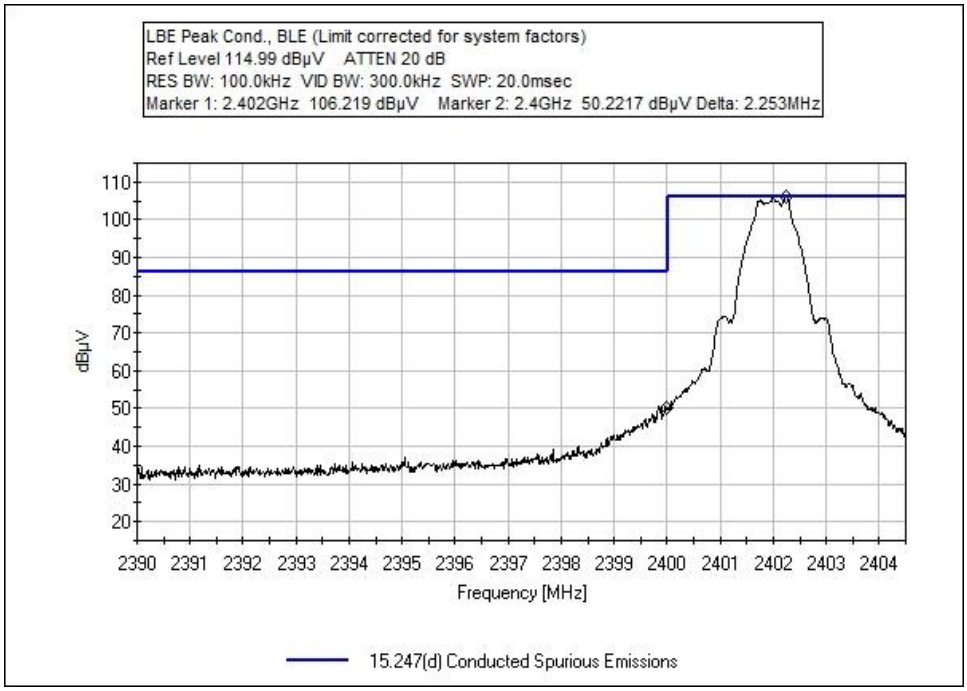
Measurement Data: Reading listed by margin. Test Lead: Antenna Port 0

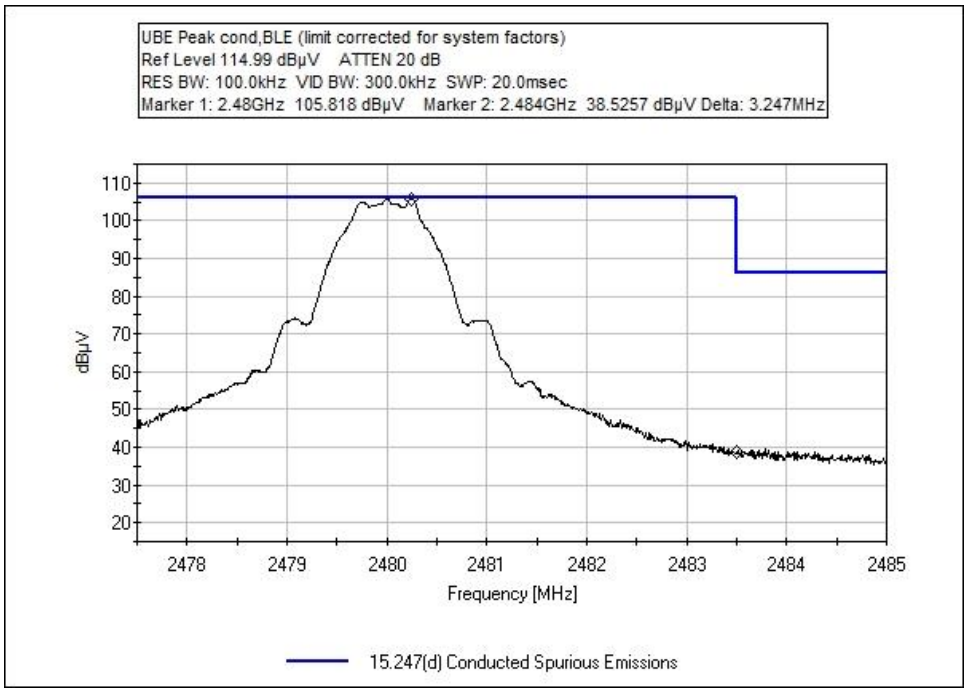
#	Freq MHz	Rdng dBµV	dB	dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	2479.948M	102.8					+0.0	102.8	106.3	-3.5	Anten
2	9.000k	54.9					+0.0	54.9	86.3	-31.4	Anten
3	2481.149M	63.7					+0.0	63.7	106.3	-42.6	Anten
4	9921.081M	38.5					+0.0	38.5	86.3	-47.8	Anten
5	6960.023M	36.9					+0.0	36.9	86.3	-49.4	Anten
6	117.429k	36.8					+0.0	36.8	86.3	-49.5	Anten
7	123.774k	35.0					+0.0	35.0	86.3	-51.3	Anten
8	2483.651M	33.1					+0.0	33.1	86.3	-53.2	Anten
9	519.589M	32.2					+0.0	32.2	86.3	-54.1	Anten
10	2484.752M	31.0					+0.0	31.0	86.3	-55.3	Anten
11	24811.790 M	31.0					+0.0	31.0	86.3	-55.3	Anten
12	9919.680M	30.5					+0.0	30.5	86.3	-55.8	Anten
13	2483.951M	30.4					+0.0	30.4	86.3	-55.9	Anten
14	136.887k	30.3					+0.0	30.3	86.3	-56.0	Anten
15	2485.653M	30.0					+0.0	30.0	86.3	-56.3	Anten

Band Edge

Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB.				
Frequency (MHz)	**Modulation**	**Measured (dBµV)**	**Limit (dBµV)**	**Results**
2400.0	GFSK	50.2	<86.28	Pass
2483.5	GFSK	38.5	<86.28	Pass

Band Edge Plots





Test Setup Photo(s)

15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Nalloy, LLC.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**102802**	Date:	3/25/2020
Test Type:	**Maximized Emissions**	Time:	11:21:20
Tested By:	Matthew Harrison	Sequence#:	33
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 20-23° C
Humidity: 28-45%
Pressure: 100.8-101.8 kPa

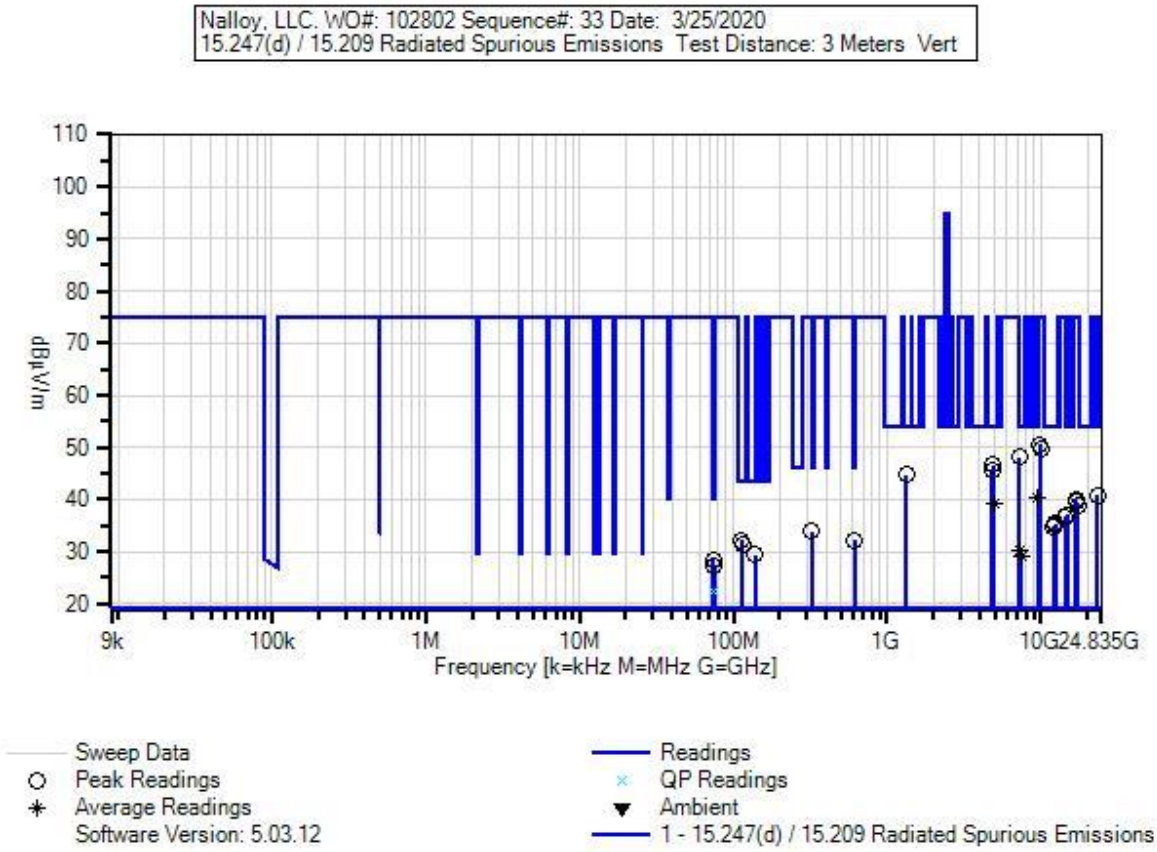
Frequency Range: 9kHz-25GHz
Frequency tested: 2402, 2440, 2480
Firmware power setting: Default
EUT Firmware:
Protocol /MCS/Modulation: BLE, 1Mbps

Antenna type: Linear Polarized
Antenna Gain: 3.7 dBi.

Duty Cycle: 100% Modulated

Test Method: ANSI C63.10: 2013 KDB 5508074 v05r02 4/2/2019
Test Mode: Transmitting
Test Setup: EUT is setup 0.8m high on a Styrofoam table <1GH and 1.5m high on a Styrofoam table >1GHz.
Setup: EUT is connected to a Laptop via USB and Audio cable.

Low, Mid, and High channels along with all data rates investigated, worst-case provided.


Nalloy, LLC. WO#: 102802 Sequence#: 33 Date: 3/25/2020
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert
110
100
90
80
70
60
50
40
30
20
dBµV/m
9k
100k
1M
10M
100M
1G
10G24.835G
Frequency [k=kHz M=MHz G=GHz]
Sweep Data
Peak Readings
Average Readings
Software Version: 5.03.12
Readings
QP Readings
Ambient
1 - 15.247(d) / 15.209 Radiated Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T2	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T3	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T4	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T5	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T6	ANP07504	Cable	CLU40-KMKM-02.00F	1/17/2019	1/17/2021
	AN03116	High Pass Filter	11SH10-00313	1/22/2019	1/22/2021
T7	AN02742	Active Horn Antenna	AMFW-5F-18002650-20-10P	10/16/2018	10/16/2020
T8	AN02763-69	Waveguide	Multiple	4/23/2018	4/23/2020
T9	ANP06678	Cable	32026-29801-29801-144	2/20/2020	2/20/2022
T10	ANP07211	Cable	32026-29801-29801-18	8/7/2019	8/7/2021
T11	ANP07212	Cable	32026-29801-29801-18	8/7/2019	8/7/2021
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T12	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020
T13	AN02307	Preamp	8447D	1/10/2020	1/10/2022
T14	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021
T15	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T16	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T17	ANP05360	Cable	RG214	2/3/2020	2/3/2022
T18	AN02741	Active Horn Antenna	AMFW-5F-12001800-20-10P	4/26/2019	4/26/2021

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

#	Freq	Rdng	T1 T5 T9 T13 T17	T2 T6 T10 T14 T18	T3 T7 T11 T15	T4 T8 T12 T16	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4880.390M	42.0	+0.0 +0.0 +3.9 +0.0 +0.0	+0.0 +0.0 +0.3 +0.0 +0.0	+0.0 +0.0 +0.5 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	46.7	54.0 Mid	-7.3	Vert 121
2	4803.695M	41.2	+32.4 -33.6 +0.0 +0.0 +0.0	+4.1 +0.6 +0.0 +0.0 +0.0	+0.9 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	45.6	54.0 Low	-8.4	Horiz

3	1332.400M	52.9	+25.2 -35.8 +0.0 +0.0 +0.0	+1.9 +0.1 +0.0 +0.0 +0.0	+0.4 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	44.7	54.0	-9.3	Vert 135
4	1332.400M	52.9	+25.2 -35.8 +0.0 +0.0 +0.0	+1.9 +0.1 +0.0 +0.0 +0.0	+0.4 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	44.7	54.0	-9.3	Vert 135
5	113.366M	44.9	+0.0 +0.0 +0.0 -27.7 +0.6	+0.0 +0.0 +0.0 +8.0 +0.0	+0.1 +0.0 +0.0 +5.8	+0.0 +0.0 +0.0 +0.5	+0.0	32.2	43.5	-11.3	Vert 130
6	73.922M	42.4	+0.0 +0.0 +0.0 -27.8 +0.5	+0.0 +0.0 +0.0 +7.1 +0.0	+0.1 +0.0 +0.0 +5.8	+0.0 +0.0 +0.0 +0.4	+0.0	28.5	40.0	-11.5	Vert 130
7	113.966M	44.0	+0.0 +0.0 +0.0 -27.7 +0.6	+0.0 +0.0 +0.0 +8.0 +0.0	+0.1 +0.0 +0.0 +5.8	+0.0 +0.0 +0.0 +0.5	+0.0	31.3	43.5	-12.2	Vert 130
8	323.816M	38.6	+0.0 +0.0 +0.0 -27.1 +1.1	+0.0 +0.0 +0.0 +14.3 +0.0	+0.2 +0.0 +0.0 +5.8	+0.0 +0.0 +0.0 +0.9	+0.0	33.8	46.0	-12.2	Horiz 130
9	75.187M	41.3	+0.0 +0.0 +0.0 -27.8 +0.5	+0.0 +0.0 +0.0 +7.0 +0.0	+0.1 +0.0 +0.0 +5.8	+0.0 +0.0 +0.0 +0.4	+0.0	27.3	40.0	-12.7	Horiz 130
10	612.584M	30.4	+0.0 +0.0 +0.0 -28.2 +1.6	+0.0 +0.0 +0.0 +21.1 +0.0	+0.3 +0.0 +0.0 +5.8	+0.0 +0.0 +0.0 +1.2	+0.0	32.2	46.0	-13.8	Horiz 130
11	137.510M	41.5	+0.0 +0.0 +0.0 -27.6 +0.7	+0.0 +0.0 +0.0 +8.4 +0.0	+0.1 +0.0 +0.0 +5.8	+0.0 +0.0 +0.0 +0.5	+0.0	29.4	43.5	-14.1	Vert 130
12	4960.435M Ave	34.4	+0.0 +0.0 +4.0 +0.0 +0.0	+0.0 +0.0 +0.3 +0.0 +0.0	+0.0 +0.0 +0.5 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	39.2	54.0 High	-14.8	Horiz 155

^	4960.435M	42.7	+32.6 -33.6 +0.0 +0.0 +0.0	+4.2 +0.4 +0.0 +0.0 +0.0	+0.9 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	47.2	54.0 High	-6.8	Horiz 132
14	75.120M QP	36.5	+0.0 +0.0 +0.0 -27.8 +0.5	+0.0 +0.0 +0.0 +7.0 +0.0	+0.1 +0.0 +0.0 +5.8	+0.0 +0.0 +0.0 +0.4	+0.0	22.5	40.0	-17.5	Vert 117
^	75.120M	41.3	+0.0 +0.0 +0.0 -27.8 +0.5	+0.0 +0.0 +0.0 +7.0 +0.0	+0.1 +0.0 +0.0 +5.8	+0.0 +0.0 +0.0 +0.4	+0.0	27.3	40.0	-12.7	Vert 130
16	12399.950 M	39.8	+0.0 +0.0 +0.0 +0.0 +0.0	+7.0 +0.0 +0.0 +0.0 -13.0	+1.5 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	35.3	54.0 High	-18.7	Horiz
17	12200.000 M	39.5	+0.0 +0.0 +0.0 +0.0 +0.0	+6.9 +0.0 +0.0 +0.0 -12.8	+1.4 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	35.0	54.0 Mid	-19.0	Vert
18	12010.000 M	39.7	+0.0 +0.0 +0.0 +0.0 +0.0	+6.8 +0.0 +0.0 +0.0 -13.0	+1.4 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	34.9	54.0 Low	-19.1	Vert
19	7320.000M Ave	24.1	+0.0 +0.0 +4.9 +0.0 +0.0	+0.0 +0.0 +0.5 +0.0 +0.0	+0.0 +0.0 +0.7 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	30.2	54.0 Mid	-23.8	Horiz 141
^	7320.000M	38.9	+36.8 -34.6 +0.0 +0.0 +0.0	+5.4 +0.4 +0.0 +0.0 +0.0	+1.3 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	48.2	54.0 Mid	-5.8	Horiz
21	9760.000M	39.0	+37.5 -33.9 +0.0 +0.0 +0.0	+6.3 +0.4 +0.0 +0.0 +0.0	+1.3 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	50.6	74.9 Mid	-24.3	Vert
22	7439.885M Ave	22.7	+0.0 +0.0 +5.1 +0.0 +0.0	+0.0 +0.0 +0.5 +0.0 +0.0	+0.0 +0.0 +0.7 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	29.0	54.0 High	-25.0	Vert 155

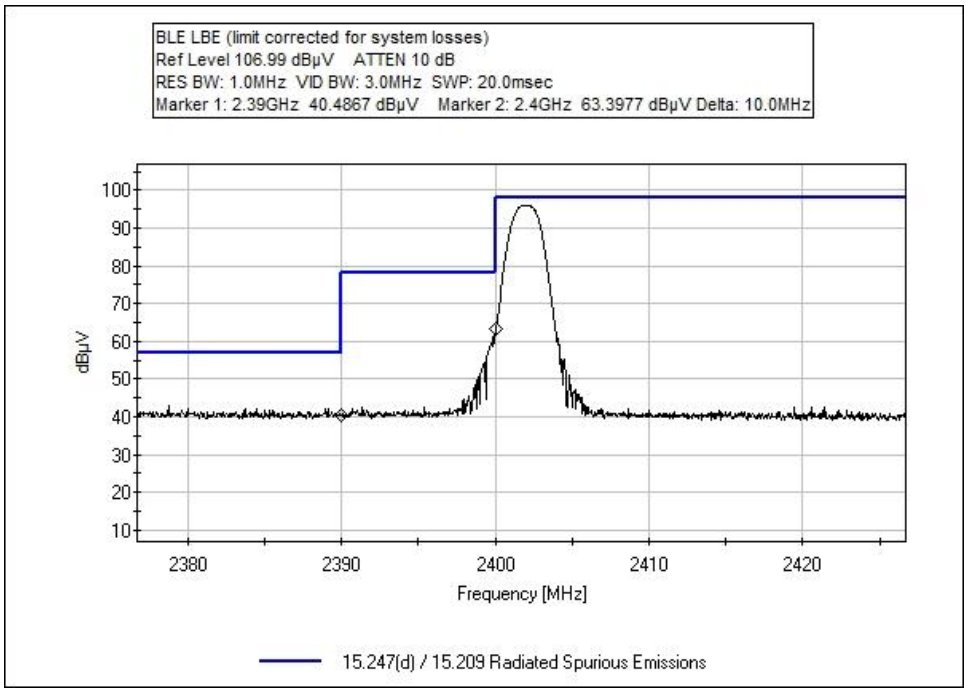
^	7439.885M	37.3	+37.1 -34.7 +0.0 +0.0 +0.0	+5.5 +0.3 +0.0 +0.0 +0.0	+1.6 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	47.1	54.0 High	-6.9	Vert 153
24	9920.065M	37.9	+37.5 -33.9 +0.0 +0.0 +0.0	+6.3 +0.5 +0.0 +0.0 +0.0	+1.3 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	49.6	74.9 High	-25.3	Vert 153
25	7206.000M	39.2	+36.5 -34.5 +0.0 +0.0 +0.0	+5.3 +0.5 +0.0 +0.0 +0.0	+1.1 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	48.1	74.9 Low	-26.8	Horiz
26	23250.000 M	42.6	+0.0 +0.0 +9.6 +0.0 +0.0	+0.0 +0.0 +0.9 +0.0 +0.0	+0.0 -15.2 +1.2 +0.0	+0.0 +1.8 +0.0 +0.0	+0.0	40.9	74.9	-34.0	Vert 132
27	9608.760M Ave	33.4	+0.0 +0.0 +5.7 +0.0 +0.0	+0.0 +0.0 +0.6 +0.0 +0.0	+0.0 +0.0 +0.8 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	40.5	74.9 Low	-34.4	Horiz 177
^	9608.760M	40.8	+0.0 +0.0 +5.7 +0.0 +0.0	+0.0 +0.0 +0.6 +0.0 +0.0	+0.0 +0.0 +0.8 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	47.9	74.9 Low	-27.0	Horiz
29	16814.000 M	40.4	+0.0 +0.0 +0.0 +0.0 +0.0	+9.0 +0.0 +0.0 +0.0 -11.2	+1.8 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	40.0	74.9 Low	-34.9	Vert
30	17080.000 M	40.1	+0.0 +0.0 +0.0 +0.0 +0.0	+9.0 +0.0 +0.0 +0.0 -11.6	+2.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	39.5	74.9 Mid	-35.4	Horiz
31	17359.950 M	39.6	+0.0 +0.0 +0.0 +0.0 +0.0	+8.6 +0.0 +0.0 +0.0 -11.3	+1.8 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	38.7	74.9 High	-36.2	Vert
32	14879.950 M	41.3	+0.0 +0.0 +0.0 +0.0 +0.0	+8.5 +0.0 +0.0 +0.0 -14.4	+1.7 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	37.1	74.9 High	-37.8	Vert

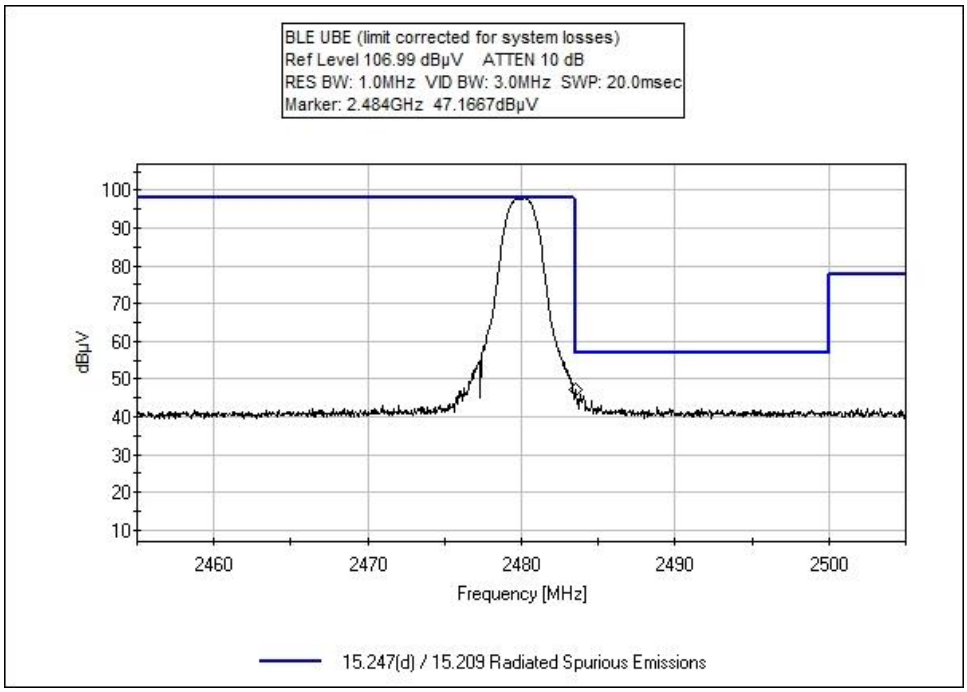
33	14640.000 M	41.9	+0.0 +0.0 +0.0 +0.0 +0.0	+8.2 +0.0 +0.0 +0.0 -14.7	+1.5 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	36.9	74.9 Mid	-38.0	Vert
34	14412.000 M	42.0	+0.0 +0.0 +0.0 +0.0 +0.0	+8.0 +0.0 +0.0 +0.0 -14.7	+1.4 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	36.7	74.9 Low	-38.2	Vert
35	31.278k	46.6	+0.0 +0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +10.9 +0.0	-40.0	17.5	74.9	-57.4	Para, 117
36	180.000k	47.1	+0.0 +0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +9.7 +0.0	-40.0	16.8	74.9	-58.1	Para, 117
37	28.478M	19.8	+0.0 +0.0 +0.0 +0.0 +0.0	+0.3 +0.0 +0.0 +0.0 +0.0	+0.1 +0.0 +0.0 +0.0	+0.0 +0.0 +6.0 +0.0	-20.0	6.2	74.9	-68.7	Para, 117

Band Edge

Band Edge Summary					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	GFSK	Linear Polarized	37.4	<54	Pass
2400.0	GFSK	Linear Polarized	60.3	<74.9	Pass
2483.5	GFSK	Linear Polarized	44.2	<54	Pass

Band Edge Plots




BLE UBE (limit corrected for system losses)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 2.484GHz 47.1667dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
2460
2470
2480
2490
2500
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Nalloy, LLC.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**102802**	Date:	3/25/2020
Test Type:	**Maximized Emissions**	Time:	08:05:40
Tested By:	Steven Pittsford	Sequence#:	34
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 22° C
Humidity: 28%
Pressure: 101.3 kPa

Frequency Range: 2.377-2.505GHz
Frequency tested: 2402, 2480
Firmware power setting: Default
EUT Firmware:
Protocol /MCS/Modulation: BLE, 1Mbps

Antenna type: Linear Polarized
Antenna Gain: 3.7 dBi.

Duty Cycle: 100% Modulated

Test Method: ANSI C63.10: 2013 KDB 5508074 v05r02 4/2/2019
Test Mode: Transmitting
Test Setup: EUT is setup 1.5m high on a Styrofoam table.
Setup: EUT is connected to a Laptop via USB and Audio cable.

Low, Mid, and High channels along with all data rates investigated, worst-case provided.

Test Equipment:

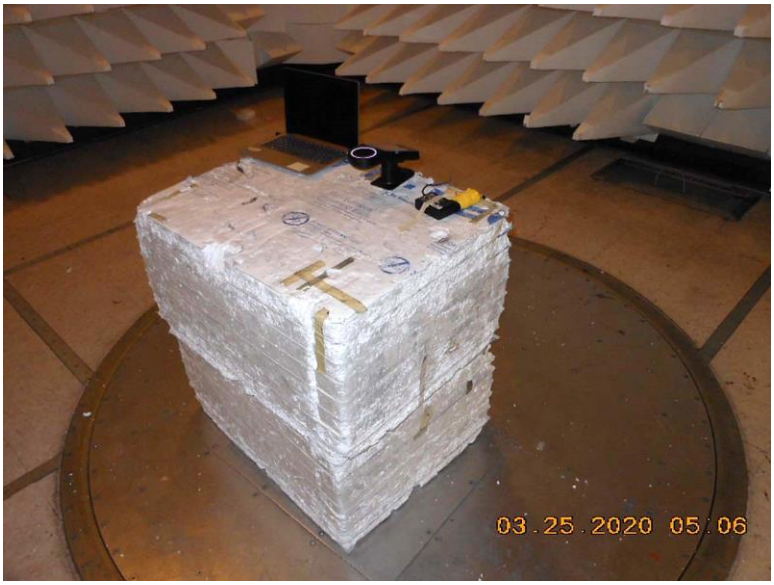
ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T2	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T3	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T4	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/17/2019	1/17/2021

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

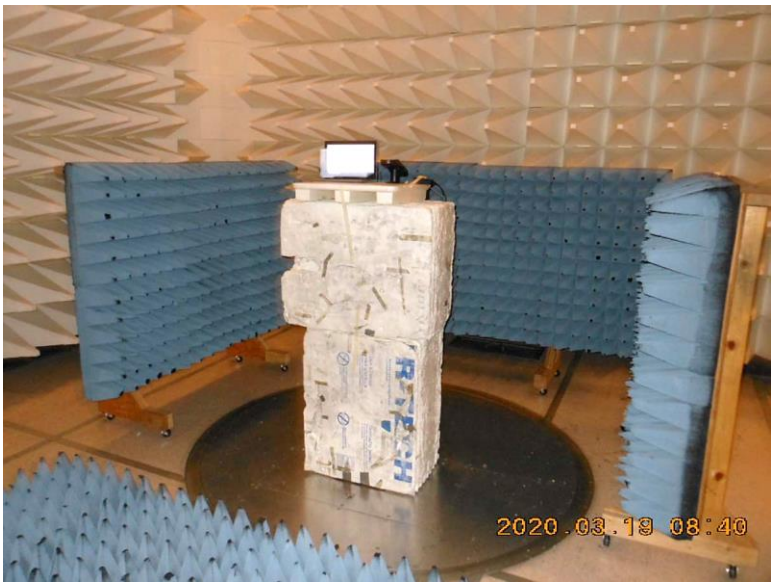
#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2483.500M	47.2	+27.6 +0.3	+2.7	+0.6	-34.2	+0.0	44.2	54.0	-9.8	Vert 144
2	2400.000M	63.4	+27.7 +0.3	+2.6	+0.6	-34.3	+0.0	60.3	74.9	-14.6	Vert 201
3	2390.000M	40.5	+27.7 +0.3	+2.6	+0.6	-34.3	+0.0	37.4	54.0	-16.6	Vert 201

Test Setup Photo(s)

Below 1GHz



Below 1GHz



Above 1GHz

Above 1GHz

15.207 AC Conducted Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Nalloy, LLC.**		
Specification:	**15.207 AC Mains - Average**		
Work Order #:	**102802**	Date:	3/25/2020
Test Type:	**Conducted Emissions**	Time:	15:39:55
Tested By:	Matthew Harrison	Sequence#:	41
Software:	EMITest 5.03.12		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 22° C
Humidity: 28%
Pressure: 101.3 kPa

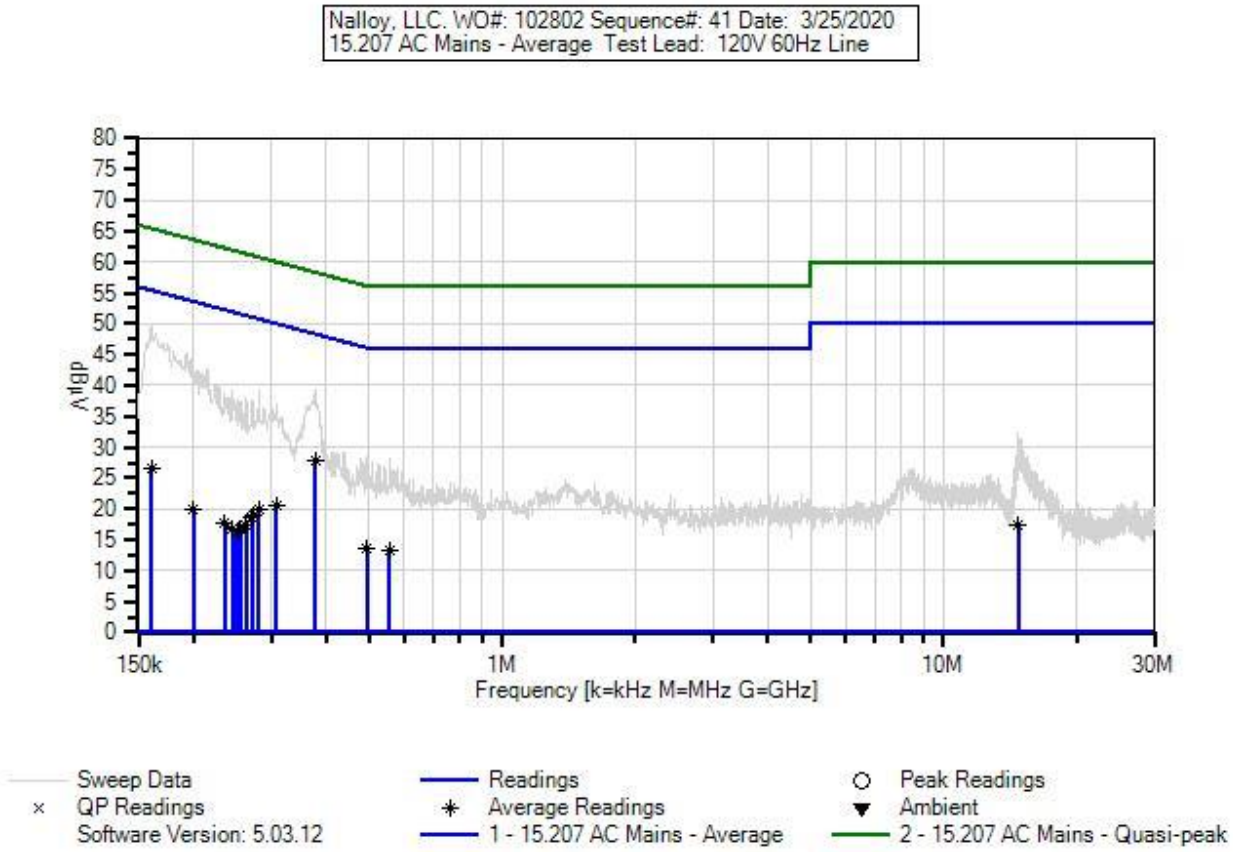
Frequency Range: 150kHz-30MHz
Frequency tested: 2440
Firmware power setting: Default
EUT Firmware:
Protocol /MCS/Modulation: BLE, 1Mbps

Antenna type: Linear Polarized
Antenna Gain: 3.7 dBi.

Duty Cycle: 100% Modulated

Test Method: ANSI C63.10: 2013
Test Mode: Transmitting
Test Setup: EUT is setup for conducted measurements.
Setup: EUT is connected to a Laptop via USB and Audio cable.

Low, Mid, and High channels along with all data rates investigated, worst-case provided.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T1	ANP06219	Attenuator	768-10	4/13/2018	4/13/2020
T2	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T3	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T4	AN01311	50uH LISN-Line1 (L)	3816/2	2/24/2020	2/24/2022
	AN01311	50uH LISN-Line2 (N)	3816/2	2/24/2020	2/24/2022
T5	AN02611	High Pass Filter	HE9615-150K-50-720B	1/10/2020	1/10/2022

Measurement Data: Reading listed by margin. Test Lead: Line

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	377.615k Ave	19.0	+9.1 +0.2	+0.0	+0.0	-0.6	+0.0	27.7	48.3	-20.6	Line
^	377.615k	30.6	+9.1 +0.2	+0.0	+0.0	-0.6	+0.0	39.3	48.3	-9.0	Line
3	160.908k Ave	18.7	+9.1 +0.6	+0.0	+0.0	-1.7	+0.0	26.7	55.4	-28.7	Line
^	160.908k	41.9	+9.1 +0.6	+0.0	+0.0	-1.7	+0.0	49.9	55.4	-5.5	Line
5	308.531k Ave	12.0	+9.1 +0.1	+0.0	+0.0	-0.7	+0.0	20.5	50.0	-29.5	Line
^	308.530k	28.5	+9.1 +0.1	+0.0	+0.0	-0.7	+0.0	37.0	50.0	-13.0	Line
7	280.897k Ave	11.4	+9.1 +0.1	+0.0	+0.0	-0.8	+0.0	19.8	50.8	-31.0	Line
^	280.897k	30.9	+9.1 +0.1	+0.0	+0.0	-0.8	+0.0	39.3	50.8	-11.5	Line
9	272.898k Ave	10.5	+9.1 +0.1	+0.0	+0.0	-0.8	+0.0	18.9	51.0	-32.1	Line
10	495.423k Ave	4.7	+9.1 +0.2	+0.0	+0.0	-0.4	+0.0	13.6	46.1	-32.5	Line
^	495.422k	19.8	+9.1 +0.2	+0.0	+0.0	-0.4	+0.0	28.7	46.1	-17.4	Line
12	270.716k Ave	10.1	+9.1 +0.1	+0.0	+0.0	-0.8	+0.0	18.5	51.1	-32.6	Line
^	270.716k	29.2	+9.1 +0.1	+0.0	+0.0	-0.8	+0.0	37.6	51.1	-13.5	Line
^	272.897k	28.8	+9.1 +0.1	+0.0	+0.0	-0.8	+0.0	37.2	51.0	-13.8	Line
15	14.752M Ave	8.4	+9.1 +0.2	+0.2	+0.1	-0.6	+0.0	17.4	50.0	-32.6	Line
^	14.752M	23.3	+9.1 +0.2	+0.2	+0.1	-0.6	+0.0	32.3	50.0	-17.7	Line
17	556.508k Ave	4.4	+9.1 +0.3	+0.0	+0.0	-0.4	+0.0	13.4	46.0	-32.6	Line
^	556.508k	19.2	+9.1 +0.3	+0.0	+0.0	-0.4	+0.0	28.2	46.0	-17.8	Line
19	200.177k Ave	11.8	+9.1 +0.2	+0.0	+0.0	-1.2	+0.0	19.9	53.6	-33.7	Line
^	200.177k	35.4	+9.1 +0.2	+0.0	+0.0	-1.2	+0.0	43.5	53.6	-10.1	Line
21	263.444k Ave	8.9	+9.1 +0.2	+0.0	+0.0	-0.8	+0.0	17.4	51.3	-33.9	Line
^	263.444k	29.6	+9.1 +0.2	+0.0	+0.0	-0.8	+0.0	38.1	51.3	-13.2	Line

23	235.083k Ave	9.3	+9.1 +0.2	+0.0	+0.0	-1.0	+0.0	17.6	52.3	-34.7	Line
^	235.083k	30.5	+9.1 +0.2	+0.0	+0.0	-1.0	+0.0	38.8	52.3	-13.5	Line
25	255.445k Ave	8.4	+9.1 +0.2	+0.0	+0.0	-0.9	+0.0	16.8	51.6	-34.8	Line
26	245.264k Ave	8.5	+9.1 +0.2	+0.0	+0.0	-0.9	+0.0	16.9	51.9	-35.0	Line
^	245.263k	31.1	+9.1 +0.2	+0.0	+0.0	-0.9	+0.0	39.5	51.9	-12.4	Line
28	251.082k Ave	8.2	+9.1 +0.2	+0.0	+0.0	-0.9	+0.0	16.6	51.7	-35.1	Line
^	251.081k	29.4	+9.1 +0.2	+0.0	+0.0	-0.9	+0.0	37.8	51.7	-13.9	Line
^	255.444k	28.9	+9.1 +0.2	+0.0	+0.0	-0.9	+0.0	37.3	51.6	-14.3	Line

Test Location:	CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Nalloy, LLC.**		
Specification:	**15.207 AC Mains - Average**		
Work Order #:	**102802**	Date:	3/25/2020
Test Type:	**Conducted Emissions**	Time:	15:33:21
Tested By:	Matthew Harrison	Sequence#:	42
Software:	EMITest 5.03.12		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 22° C
Humidity: 28%
Pressure: 101.3 kPa

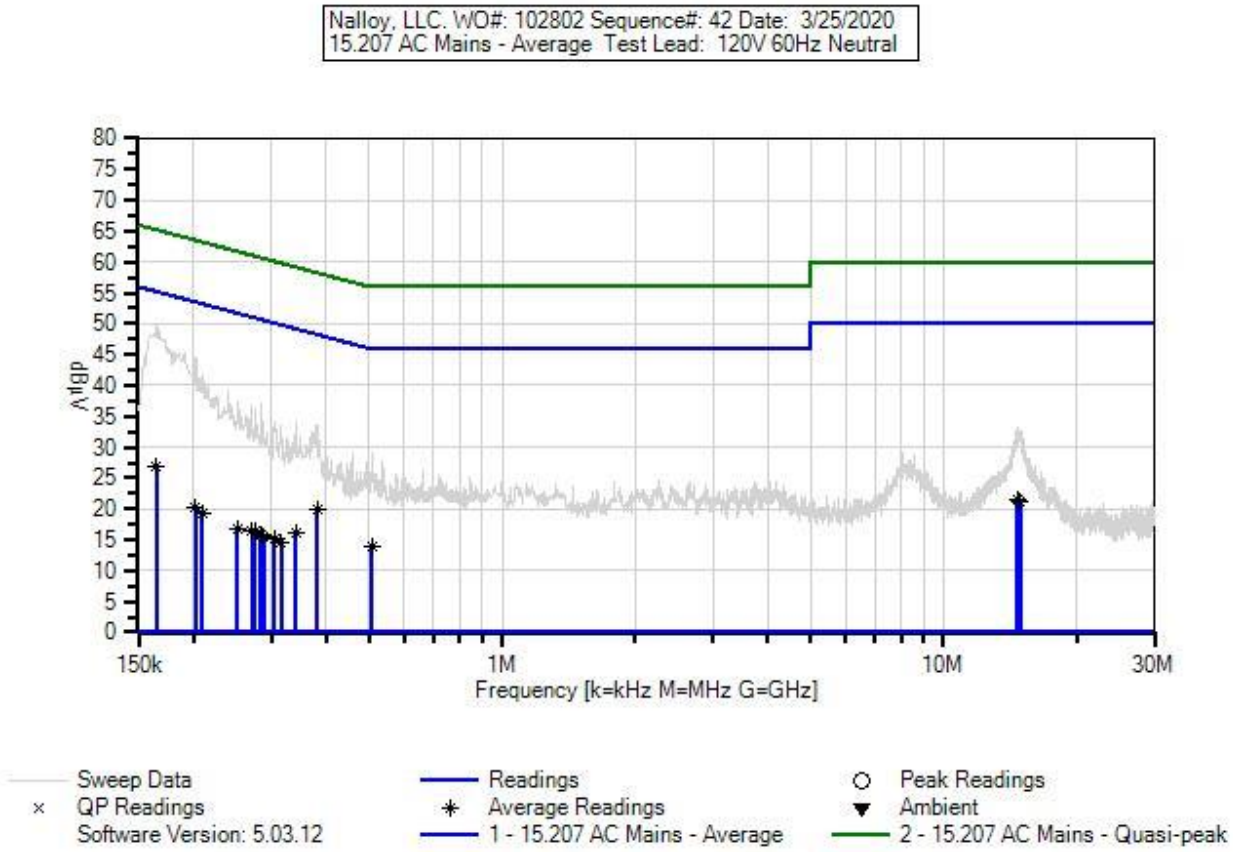
Frequency Range: 150kHz-30MHz
Frequency tested: 2440
Firmware power setting: Default
EUT Firmware:
Protocol /MCS/Modulation: BLE, 1Mbps

Antenna type: Linear Polarized
Antenna Gain: 3.7 dBi.

Duty Cycle: 100% Modulated

Test Method: ANSI C63.10: 2013
Test Mode: Transmitting
Test Setup: EUT is setup for conducted measurements.
Setup: EUT is connected to a Laptop via USB and Audio cable.

Low, Mid, and High channels along with all data rates investigated, worst-case provided.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T1	ANP06219	Attenuator	768-10	4/13/2018	4/13/2020
T2	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T3	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
	AN01311	50uH LISN-Line1 (L)	3816/2	2/24/2020	2/24/2022
T4	AN01311	50uH LISN-Line2 (N)	3816/2	2/24/2020	2/24/2022
T5	AN02611	High Pass Filter	HE9615-150K-50-720B	1/10/2020	1/10/2022

Measurement Data: Reading listed by margin. Test Lead: Neutral

#	Freq MHz	Rdng dBµV	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	164.544k Ave	18.9	+9.1 +0.5	+0.0	+0.0	-1.6	+0.0	26.9	55.2	-28.3	Neutr
^	164.544k	41.6	+9.1 +0.5	+0.0	+0.0	-1.6	+0.0	49.6	55.2	-5.6	Neutr
3	380.524k Ave	11.1	+9.1 +0.2	+0.0	+0.0	-0.5	+0.0	19.9	48.3	-28.4	Neutr
^	380.524k	24.9	+9.1 +0.2	+0.0	+0.0	-0.5	+0.0	33.7	48.3	-14.6	Neutr
5	14.697M Ave	12.5	+9.1 +0.2	+0.2	+0.1	-0.6	+0.0	21.5	50.0	-28.5	Neutr
^	14.697M	24.1	+9.1 +0.2	+0.2	+0.1	-0.6	+0.0	33.1	50.0	-16.9	Neutr
7	14.923M Ave	12.3	+9.1 +0.2	+0.2	+0.1	-0.6	+0.0	21.3	50.0	-28.7	Neutr
^	14.923M	23.8	+9.1 +0.2	+0.2	+0.1	-0.6	+0.0	32.8	50.0	-17.2	Neutr
9	507.785k Ave	5.0	+9.1 +0.2	+0.0	+0.0	-0.4	+0.0	13.9	46.0	-32.1	Neutr
^	507.785k	20.3	+9.1 +0.2	+0.0	+0.0	-0.4	+0.0	29.2	46.0	-16.8	Neutr
11	341.255k Ave	7.5	+9.1 +0.1	+0.0	+0.0	-0.6	+0.0	16.1	49.2	-33.1	Neutr
^	341.255k	25.4	+9.1 +0.1	+0.0	+0.0	-0.6	+0.0	34.0	49.2	-15.2	Neutr
13	202.359k Ave	12.0	+9.1 +0.2	+0.0	+0.0	-1.2	+0.0	20.1	53.5	-33.4	Neutr
^	202.358k	36.7	+9.1 +0.2	+0.0	+0.0	-1.2	+0.0	44.8	53.5	-8.7	Neutr
15	209.631k Ave	11.1	+9.1 +0.2	+0.0	+0.0	-1.1	+0.0	19.3	53.2	-33.9	Neutr
^	209.630k	33.6	+9.1 +0.2	+0.0	+0.0	-1.1	+0.0	41.8	53.2	-11.4	Neutr
17	275.807k Ave	8.1	+9.1 +0.1	+0.0	+0.0	-0.8	+0.0	16.5	50.9	-34.4	Neutr
^	275.806k	27.7	+9.1 +0.1	+0.0	+0.0	-0.8	+0.0	36.1	50.9	-14.8	Neutr
19	270.716k Ave	8.1	+9.1 +0.1	+0.0	+0.0	-0.8	+0.0	16.5	51.1	-34.6	Neutr
^	270.716k	28.2	+9.1 +0.1	+0.0	+0.0	-0.8	+0.0	36.6	51.1	-14.5	Neutr

21	283.806k	7.5	+9.1	+0.0	+0.0	-0.8	+0.0	15.9	50.7	-34.8	Neutr
	Ave		+0.1								
22	305.622k	6.7	+9.1	+0.0	+0.0	-0.7	+0.0	15.2	50.1	-34.9	Neutr
	Ave		+0.1								
^	305.622k	25.8	+9.1	+0.0	+0.0	-0.7	+0.0	34.3	50.1	-15.8	Neutr
			+0.1								
24	251.809k	8.4	+9.1	+0.0	+0.0	-0.9	+0.0	16.8	51.7	-34.9	Neutr
	Ave		+0.2								
^	251.808k	29.0	+9.1	+0.0	+0.0	-0.9	+0.0	37.4	51.7	-14.3	Neutr
			+0.2								
26	288.169k	7.1	+9.1	+0.0	+0.0	-0.7	+0.0	15.6	50.6	-35.0	Neutr
	Ave		+0.1								
^	283.805k	28.7	+9.1	+0.0	+0.0	-0.8	+0.0	37.1	50.7	-13.6	Neutr
			+0.1								
^	288.169k	25.7	+9.1	+0.0	+0.0	-0.7	+0.0	34.2	50.6	-16.4	Neutr
			+0.1								
29	315.803k	6.2	+9.1	+0.0	+0.0	-0.7	+0.0	14.7	49.8	-35.1	Neutr
	Ave		+0.1								
^	315.802k	25.0	+9.1	+0.0	+0.0	-0.7	+0.0	33.5	49.8	-16.3	Neutr
			+0.1								

Test Setup Photo(s)

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.