NORTHWEST EMC

Uber Technologies Inc.

FF01

FCC 15.247:2016

Bluetooth Low Energy Radio Module

Report # SYNA0203.2 Rev 01

NVLAP TESTING

NVLAP Lab Code: 200629-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

Last Date of Test: November 29, 2016
Uber Technologies Inc.
Model: FF01

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2016	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Per FCC 15.207 this test is not required for a device intended for use only in a vehicle and which will not be connected to the AC mains.
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Rod Munro, Operations Manager

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. 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. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
01	Replaced SRE data to include measurements with USB port populated	11/29/16	38-40

ACCREDITATIONS AND AUTHORIZATIONS

REV 2016.7.25

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 17065 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

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

European Commission – Validated by the European Commission 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

MSIP / 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.

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/
http://gsi.nist.gov/global/docs/cabs/designations.html

MEASUREMENT UNCERTAINTY

TMU.2015.07.10

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 QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. 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 16-4-2 as applicable), and are available upon request.

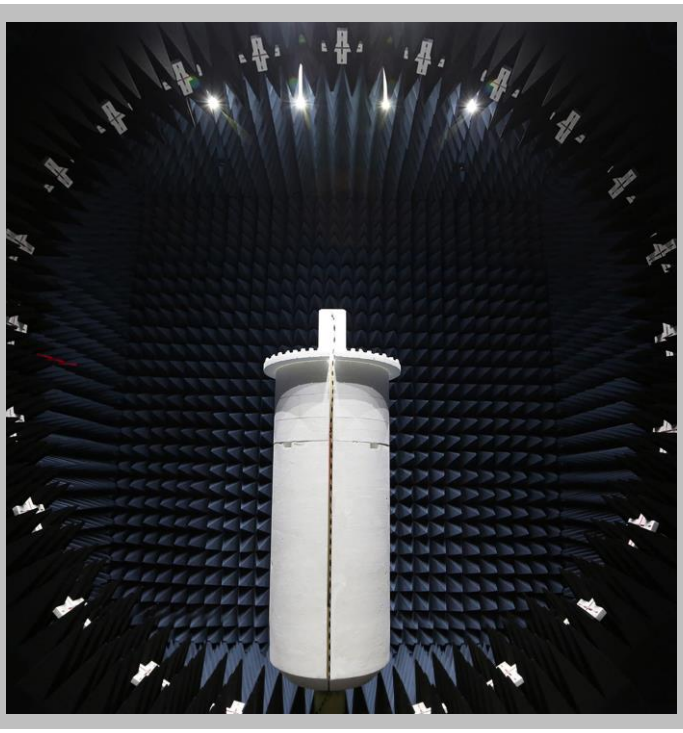
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

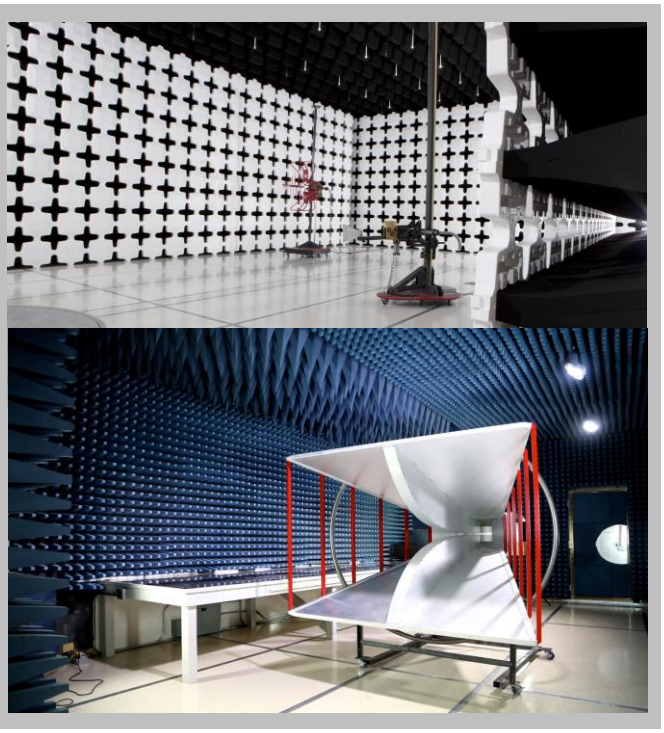
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

FACILITIES

NORTHWEST EMC
REV 2016.7.25

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157

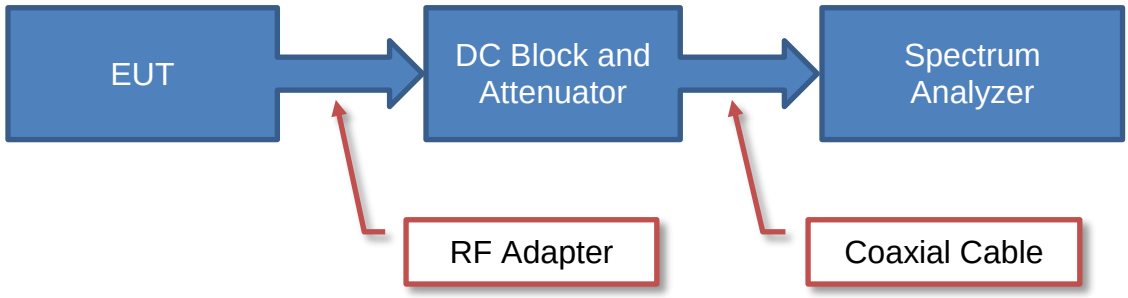




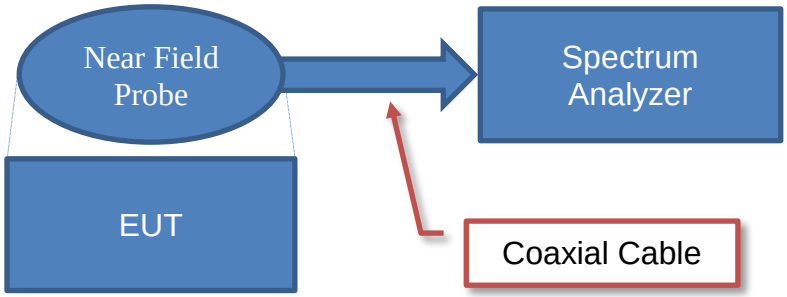
Test Setup Block Diagrams

NORTHWEST EMC
REV 2016.10.04

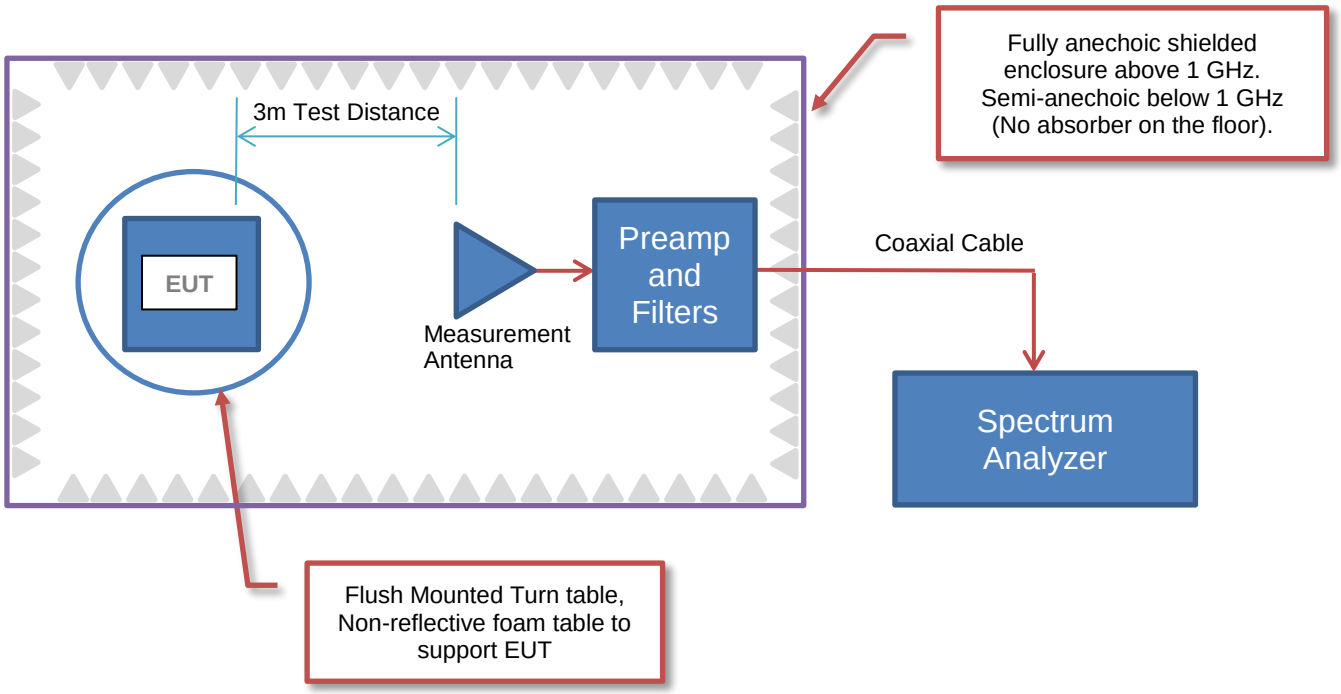
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

NORTHWEST EMC
2014-12-10

Client and Equipment Under Test (EUT) Information

Company Name:	Uber Technologies Inc.
Address:	1455 Market Street
City, State, Zip:	San Francisco, CA 94103
Test Requested By:	Nikhil Goel of Uber Technologies Inc. and Charles Manry of Synapse Product Development LLC
Model:	FF01
First Date of Test:	November 01, 2016
Last Date of Test:	November 01, 2016
Receipt Date of Samples:	November 29, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

Consumer electronics device that is mounted inside an automobile that displays a logo by using a set of color programmable Light Emitting Diodes (LED), backlighting semi-transparent light diffusing disk. The LED's are controlled via the commands from the User's smartphone running an application. The commands are sent to the device by using the device's Nordic (nFR51822) Bluetooth Low Energy radio (BLE) radio using a customer designed Inverted F Antenna (IFA) as an integrated trace on the PCB.

Normal operation is when the device is powered by its internal battery. It has a USB port that is solely used to charge this battery. No data is passed via the device's USB port as wiring to support that function is not present in the device. The operation and behavior of the device is identical when either powered by its internal battery, or when the device's internal battery is being recharged via the USB port. A 12VDC to USB charger and USB cable are provided with the unit. The provided USB charger accessory is a 12 V input automotive (cigarette lighter) manufactured by Bracketron Incorporated; Model number is BT2-920-3.

Testing Objective:

To demonstrate compliance of the Bluetooth radio to FCC 15.247 requirements.

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration SYNA0203- 3

Software/Firmware Running during test	
Description	**Version**
A2 Firmware	None

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
LED Display Unit	Uber Technologies Inc.	FF01	A2M12

Configuration SYNA0209- 5

Software/Firmware Running during test	
Description	**Version**
EV Firmware	None

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
LED Display Unit	Uber Technologies Inc.	FF01	J000045

MODIFICATIONS

NORTHWEST EMC
2014-12-10

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	11/1/2016	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	11/1/2016	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	11/1/2016	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	11/1/2016	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	11/1/2016	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	11/1/2016	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.
7	11/29/2016	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIA	4/6/2016	4/6/2018
Cable	Micro-Coax	UFD150A-1-0720-200200	NCS	6/7/2016	6/7/2017
Attenuator	Fairview Microwave	SA4014-20	TKV	3/4/2016	3/4/2017
Block - DC	Fairview Microwave	SD3379	AMU	5/6/2016	5/6/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	6/8/2016	6/8/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

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.

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 may have been used during some of the other tests in this report to only take the measurement during the burst duration.

DUTY CYCLE

NORTHWEST EMC

XMit 2016.05.06

EUT:	FF01			**Work Order:**	SYNA0203
Serial Number:	A2M12			**Date:**	11/01/16
Customer:	Uber Technologies Inc.			**Temperature:**	21.7 °C
Attendees:	Charles Manry			**Humidity:**	48.2% RH
Project:	Kitt-A2			**Barometric Pres.:**	1015 mbar
Tested by:	Matthew Barnes	**Power:**	Battery	**Job Site:**	NC02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

LED White Level 90%. All LED's on. 0dBm output power.

DEVIATIONS FROM TEST STANDARD

None

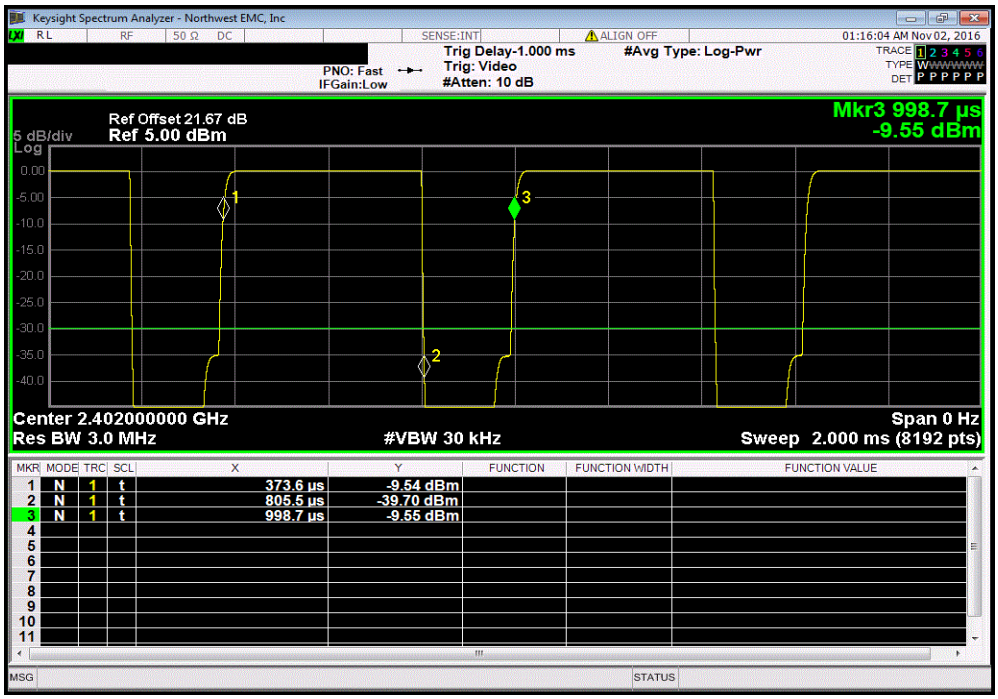
Configuration #	3	Signature	Matthew W Barnes

	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
BLE, Low Channel, 2402 MHz	431.9 us	625.1 us	1	69.1	N/A	N/A
BLE, Low Channel, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE, Mid Channel, 2442 MHz	432.2 us	625.1 us	1	69.1	N/A	N/A
BLE, Mid Channel, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE, High Channel, 2480 MHz	432.9 us	625.1 us	1	69.3	N/A	N/A
BLE, High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A

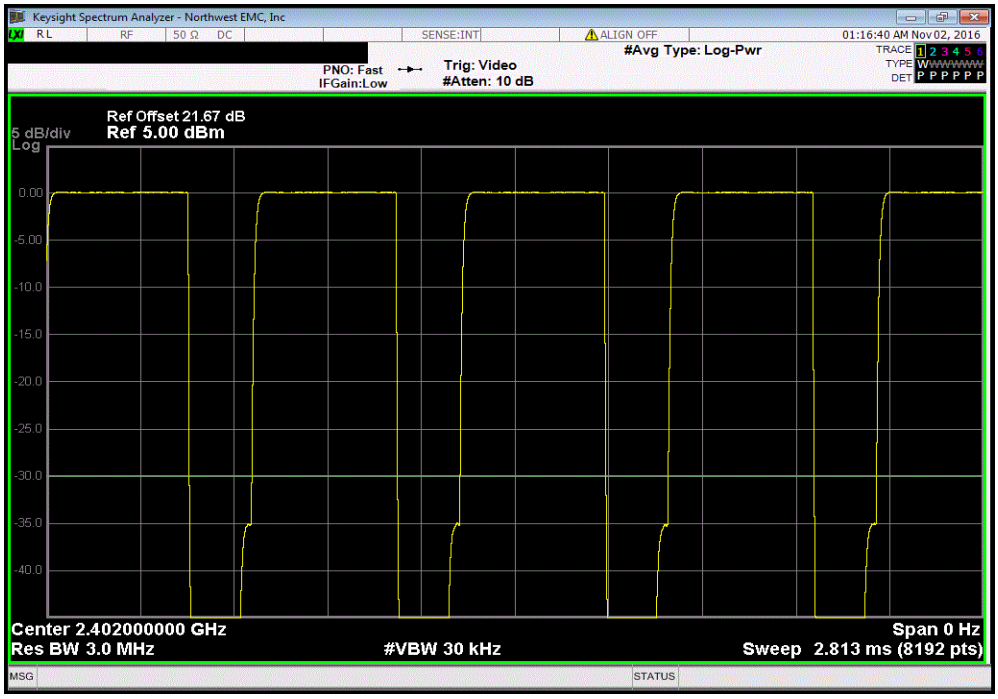
DUTY CYCLE

XMit 2016.05.06

BLE, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	431.9 us	625.1 us	1	69.1	N/A	N/A



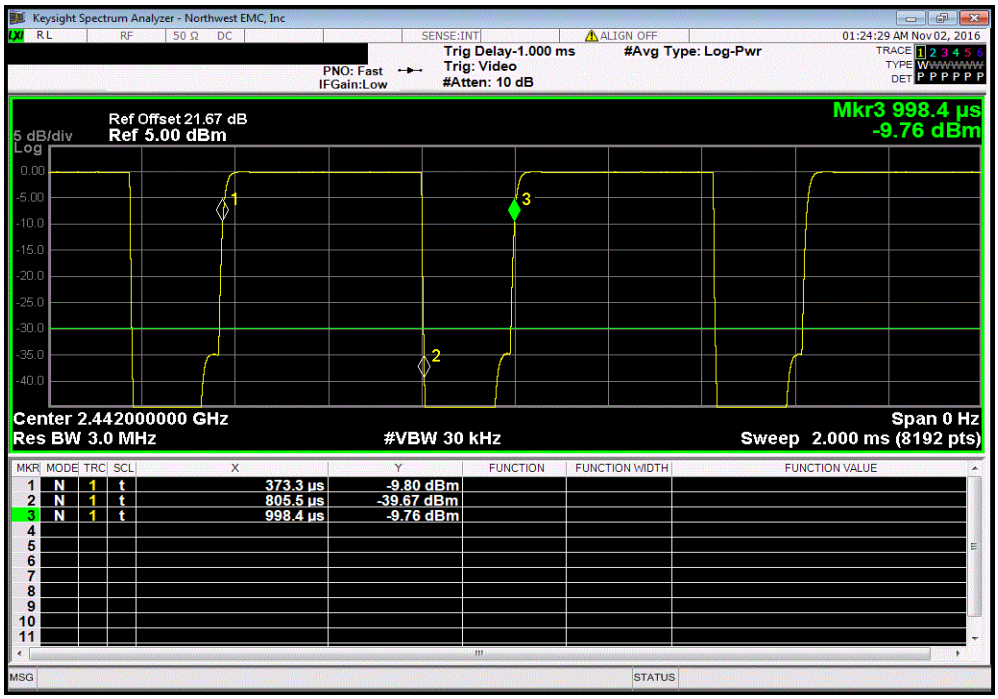
BLE, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



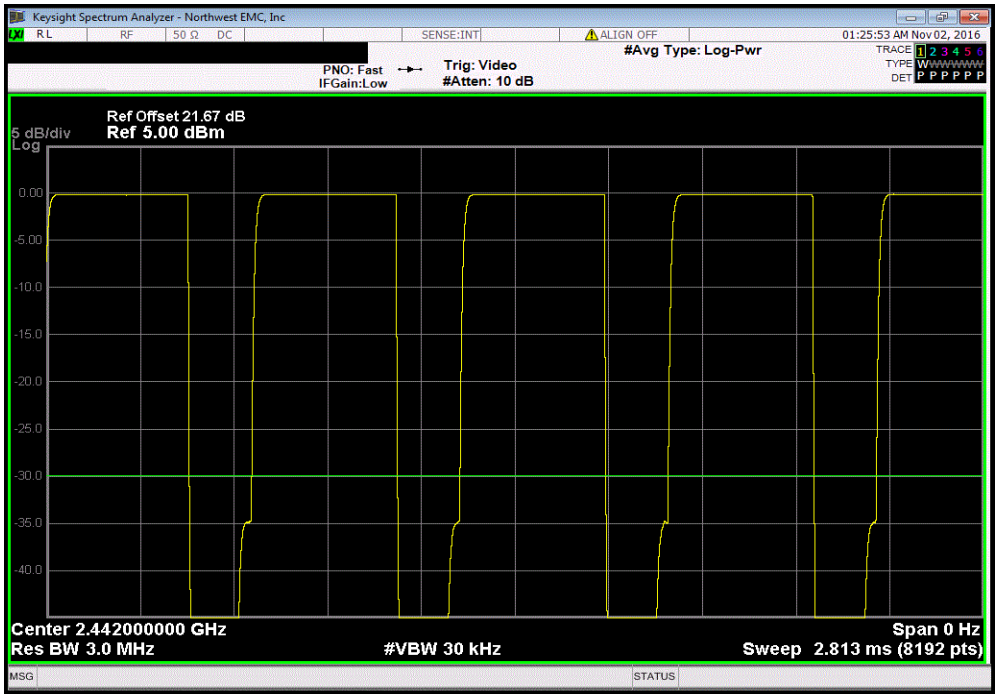
DUTY CYCLE

XMit 2016.05.06

BLE, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	432.2 us	625.1 us	1	69.1	N/A	N/A



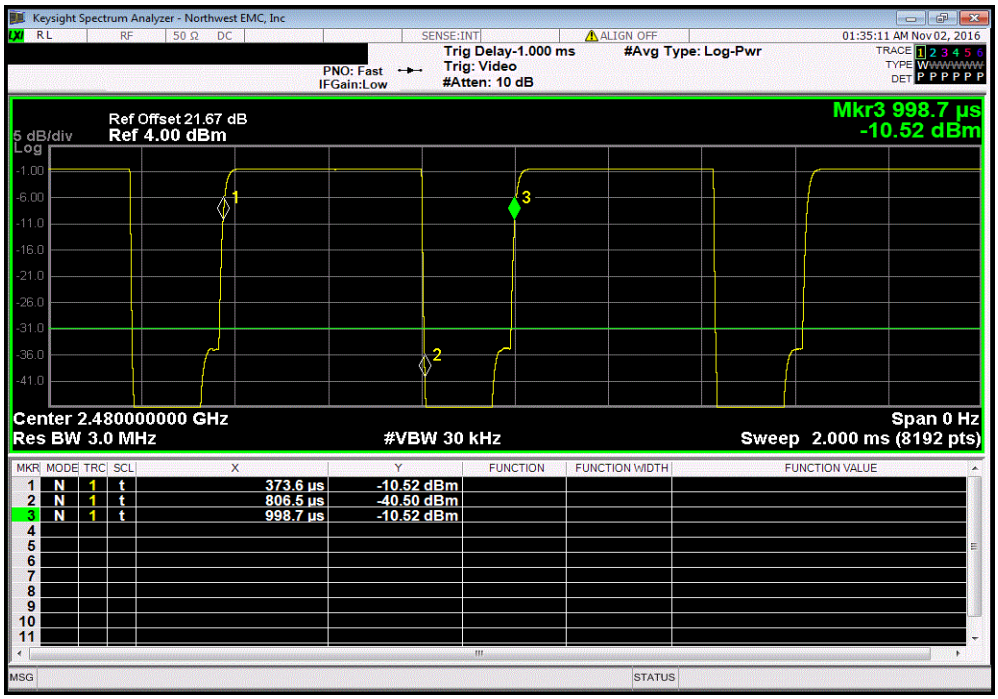
BLE, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



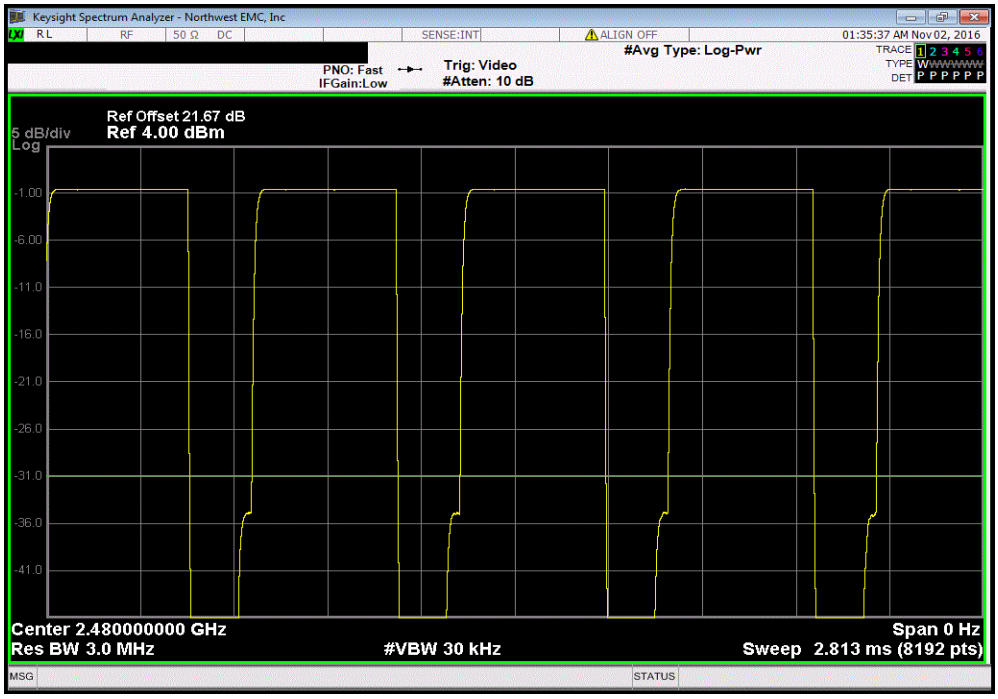
DUTY CYCLE

XMit 2016.05.06

BLE, High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	432.9 us	625.1 us	1	69.3	N/A	N/A



BLE, High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



OCCUPIED BANDWIDTH

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIA	4/6/2016	4/6/2018
Cable	Micro-Coax	UFD150A-1-0720-200200	NCS	6/7/2016	6/7/2017
Attenuator	Fairview Microwave	SA4014-20	TKV	3/4/2016	3/4/2017
Block - DC	Fairview Microwave	SD3379	AMU	5/6/2016	5/6/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	6/8/2016	6/8/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was set to the channels and modes listed in the datasheet.

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% occupied bandwidth was also measured at the same time which can be needed during Output Power depending on the applicable method.

OCCUPIED BANDWIDTH

NORTHWEST EMC

XMit 2016.05.06

EUT:	FF01			**Work Order:**	SYNA0203
Serial Number:	A2M12			**Date:**	11/01/16
Customer:	Uber Technologies Inc.			**Temperature:**	21.7 °C
Attendees:	Charles Manry			**Humidity:**	48.2% RH
Project:	Kitt-A2			**Barometric Pres.:**	1014 mbar
Tested by:	Matthew Barnes	**Power:**	Battery	**Job Site:**	NC02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

LED White Level 90%. All LED's on. 0dBm output power.

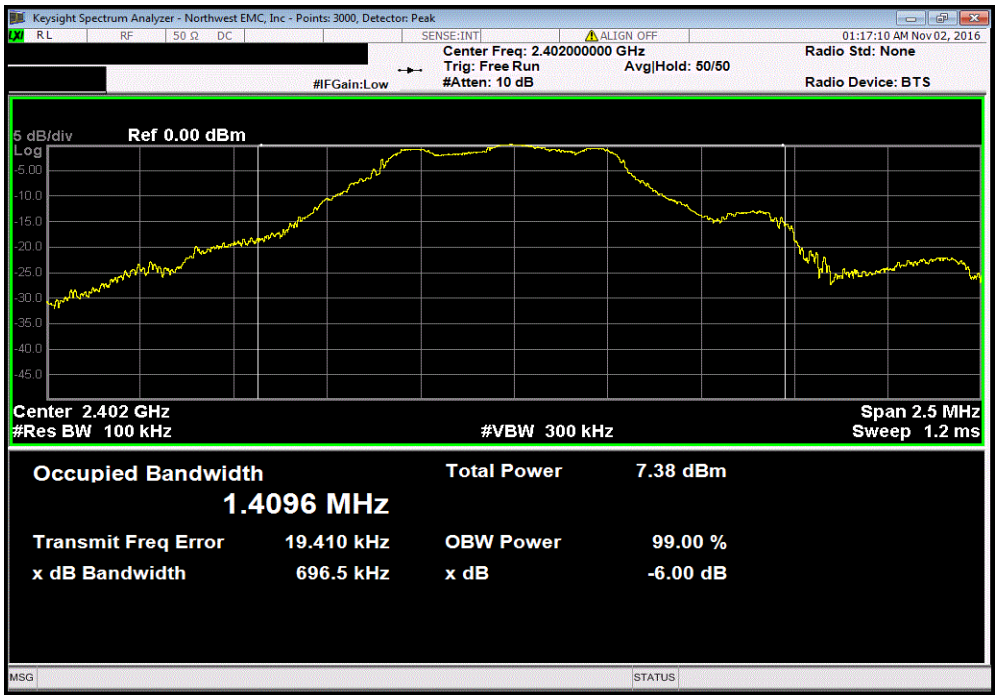
DEVIATIONS FROM TEST STANDARD

None

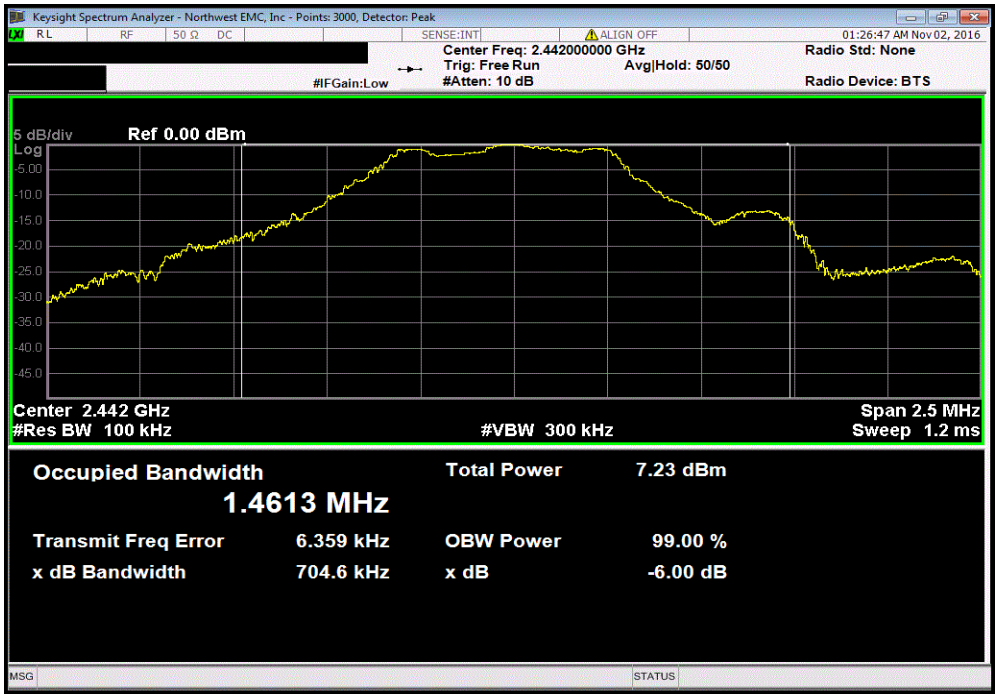
Configuration #	3	Signature

	Value	Limit (≥)	Result
BLE, Low Channel, 2402 MHz	696.494 kHz	500 kHz	Pass
BLE, Mid Channel, 2442 MHz	704.599 kHz	500 kHz	Pass
BLE, High Channel, 2480 MHz	706.074 kHz	500 kHz	Pass

BLE, Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				696.494 kHz	500 kHz	Pass



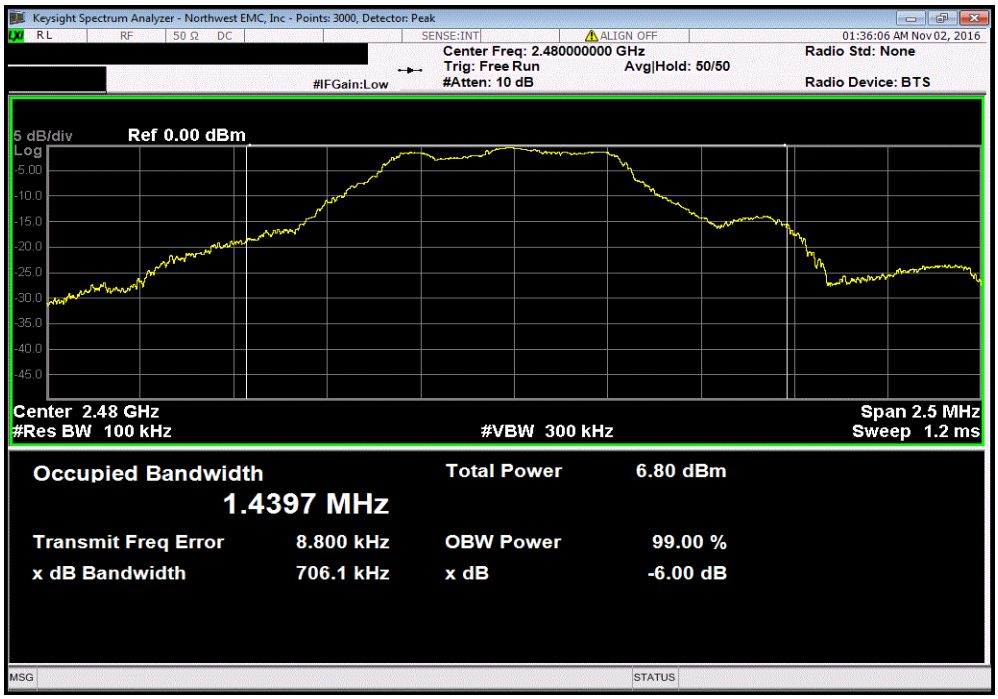
BLE, Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				704.599 kHz	500 kHz	Pass



OCCUPIED BANDWIDTH

XMit 2016.05.06

BLE, High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				706.074 kHz	500 kHz	Pass



OUTPUT POWER

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIA	4/6/2016	4/6/2018
Cable	Micro-Coax	UFD150A-1-0720-200200	NCS	6/7/2016	6/7/2017
Attenuator	Fairview Microwave	SA4014-20	TKV	3/4/2016	3/4/2017
Block - DC	Fairview Microwave	SD3379	AMU	5/6/2016	5/6/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	6/8/2016	6/8/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) and the transmission pulse duration (T) were measured. Both are required to determine the method of measuring Maximum Conducted Output Power. The transmission pulse duration (T) was measured using a zero span on the spectrum analyzer to see the pulses in the time domain.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio..

De Facto EIRP Limit: The EUT meets the de facto EIRP limit of +36 dBm.

OUTPUT POWER

NORTHWEST EMC

XMit 2016.05.06

EUT:	FF01			**Work Order:**	SYNA0203
Serial Number:	A2M12			**Date:**	11/01/16
Customer:	Uber Technologies Inc.			**Temperature:**	21.8 °C
Attendees:	Charles Manry			**Humidity:**	48% RH
Project:	Kitt-A2			**Barometric Pres.:**	1015 mbar
Tested by:	Matthew Barnes	**Power:**	Battery	**Job Site:**	NC02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

LED White Level 90%. All LED's on. 0dBm output power.

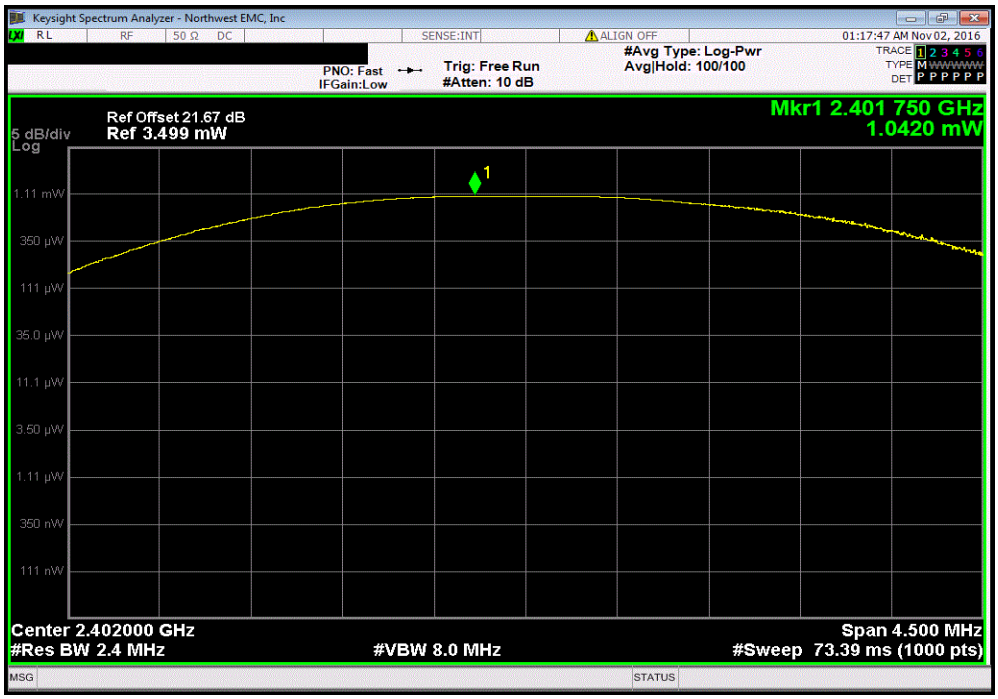
DEVIATIONS FROM TEST STANDARD

None

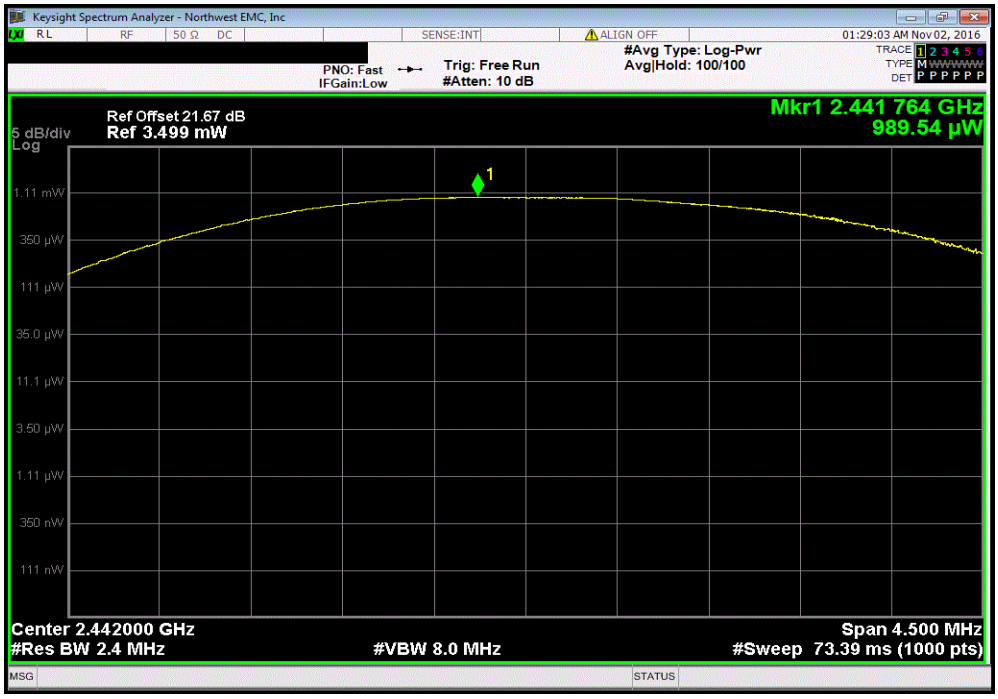
Configuration #	3	Signature	Matthew W Barnes

	Value	Limit (<)	Result
BLE, Low Channel, 2402 MHz	1.042 mW	1 W	Pass
BLE, Mid Channel, 2442 MHz	989.54 uW	1 W	Pass
BLE, High Channel, 2480 MHz	894.4 uW	1 W	Pass

BLE, Low Channel, 2402 MHz						
				Value	Limit (<)	Result
				1.042 mW	1 W	Pass



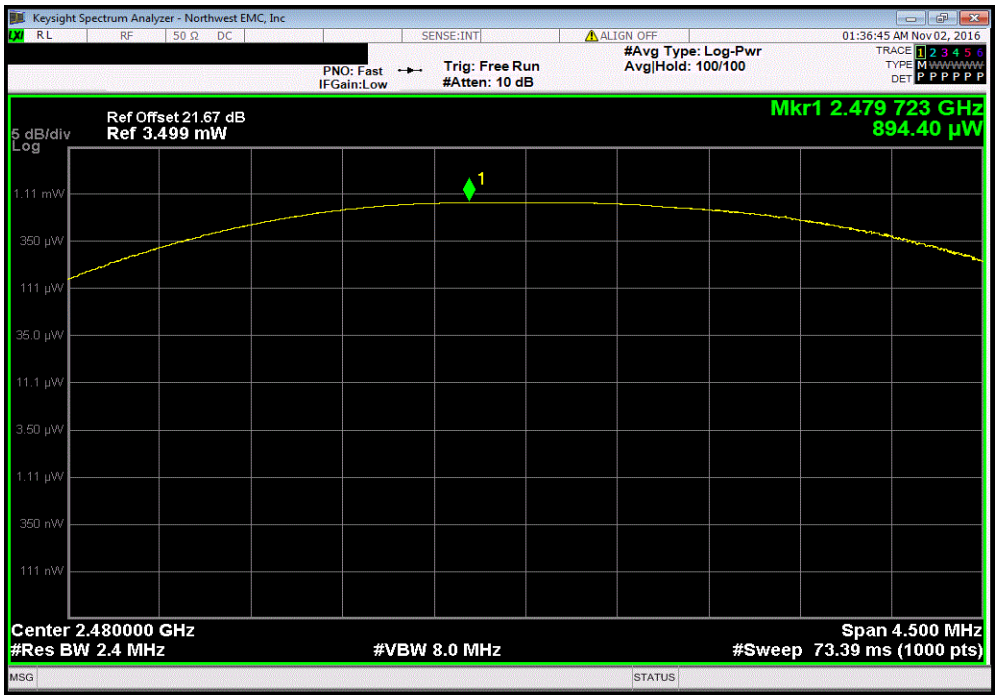
BLE, Mid Channel, 2442 MHz						
				Value	Limit (<)	Result
				989.54 uW	1 W	Pass



OUTPUT POWER

XMit 2016.05.06

BLE, High Channel, 2480 MHz						
				Value	Limit (<)	Result
				894.4 uW	1 W	Pass



POWER SPECTRAL DENSITY

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIA	4/6/2016	4/6/2018
Cable	Micro-Coax	UFD150A-1-0720-200200	NCS	6/7/2016	6/7/2017
Attenuator	Fairview Microwave	SA4014-20	TKV	3/4/2016	3/4/2017
Block - DC	Fairview Microwave	SD3379	AMU	5/6/2016	5/6/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	6/8/2016	6/8/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY

NORTHWEST EMC

XMit 2016.05.06

EUT:	FF01			**Work Order:**	SYNA0203
Serial Number:	A2M12			**Date:**	11/01/16
Customer:	Uber Technologies Inc.			**Temperature:**	21.8 °C
Attendees:	Charles Manry			**Humidity:**	47.9% RH
Project:	Kitt-A2			**Barometric Pres.:**	1015 mbar
Tested by:	Matthew Barnes	**Power:**	Battery	**Job Site:**	NC02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

LED White Level 90%. All LED's on. 0dBm output power.

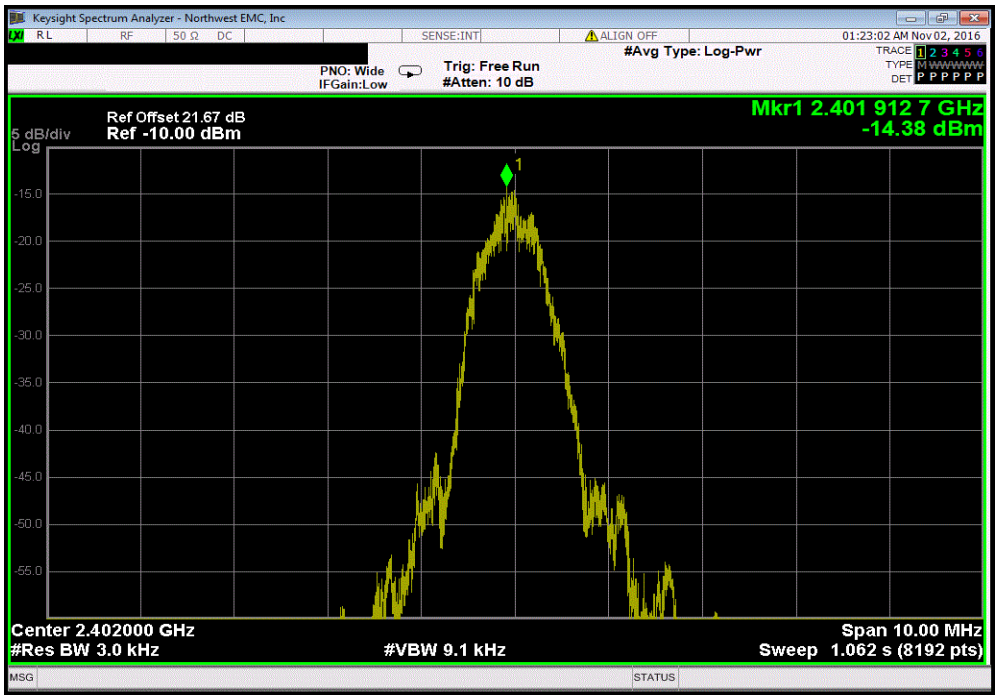
DEVIATIONS FROM TEST STANDARD

None

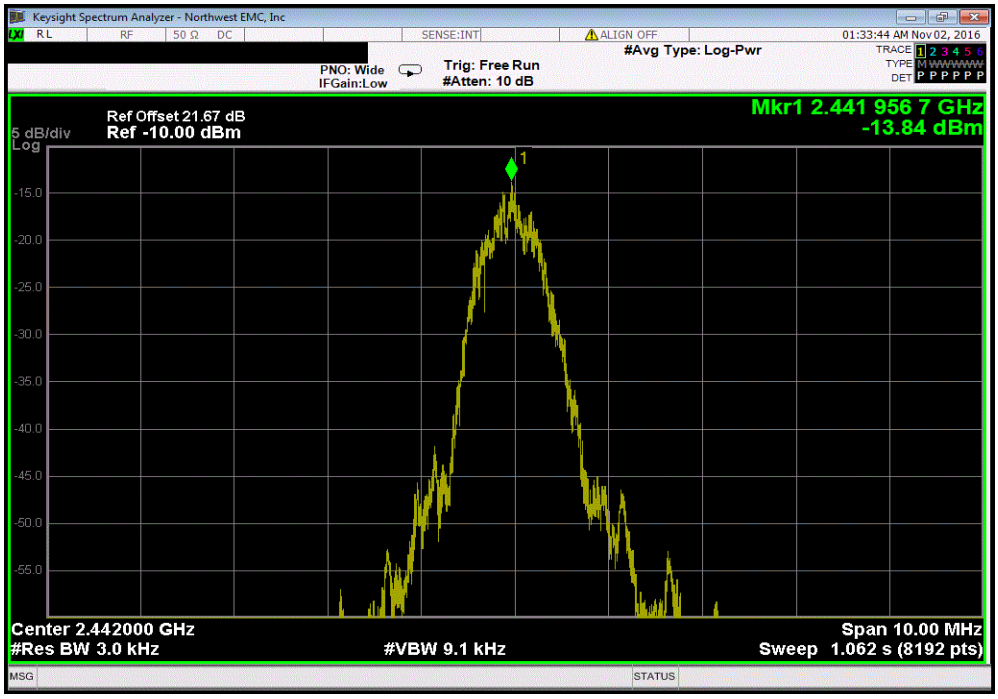
Configuration #	3	Signature

	Value dBm/3kHz	Limit < dBm/3kHz	Results
BLE, Low Channel, 2402 MHz	-14.375	8	Pass
BLE, Mid Channel, 2442 MHz	-13.837	8	Pass
BLE, High Channel, 2480 MHz	-13.53	8	Pass

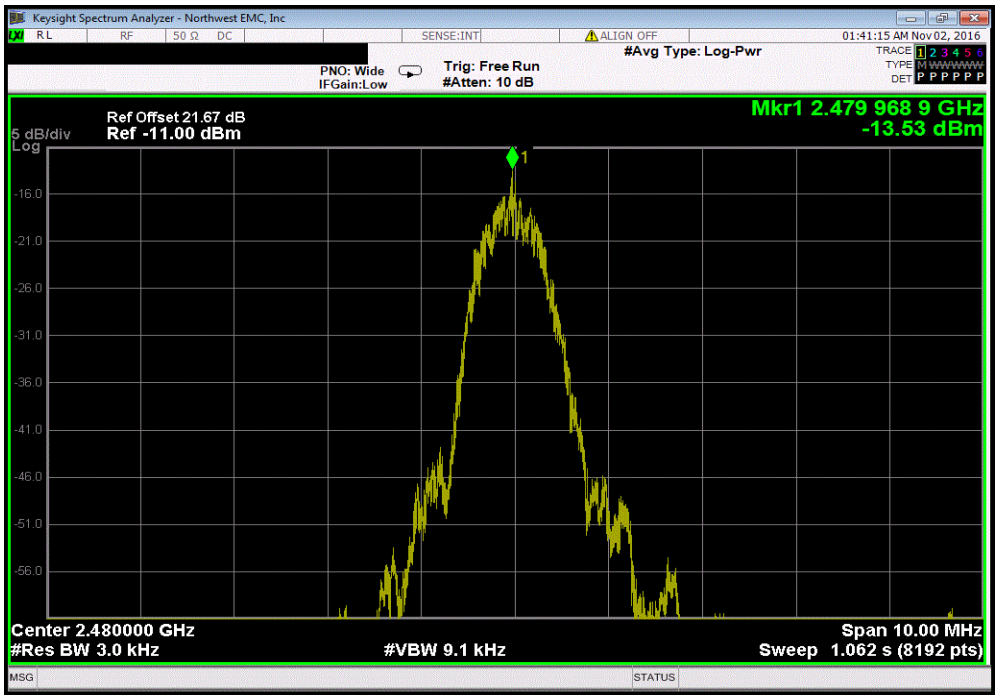
BLE, Low Channel, 2402 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-14.375	8	Pass



BLE, Mid Channel, 2442 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-13.837	8	Pass



BLE, High Channel, 2480 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-13.53	8	Pass



BAND EDGE COMPLIANCE

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIA	4/6/2016	4/6/2018
Cable	Micro-Coax	UFD150A-1-0720-200200	NCS	6/7/2016	6/7/2017
Attenuator	Fairview Microwave	SA4014-20	TKV	3/4/2016	3/4/2017
Block - DC	Fairview Microwave	SD3379	AMU	5/6/2016	5/6/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	6/8/2016	6/8/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. 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 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.

BAND EDGE COMPLIANCE

NORTHWEST EMC

XMit 2016.05.06

EUT:	FF01			**Work Order:**	SYNA0203
Serial Number:	A2M12			**Date:**	11/01/16
Customer:	Uber Technologies Inc.			**Temperature:**	21.6 °C
Attendees:	Charles Manry			**Humidity:**	48.3% RH
Project:	Kitt-A2			**Barometric Pres.:**	1014 mbar
Tested by:	Matthew Barnes	**Power:**	Battery	**Job Site:**	NC02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

LED White Level 90%. All LED's on. 0dBm output power.

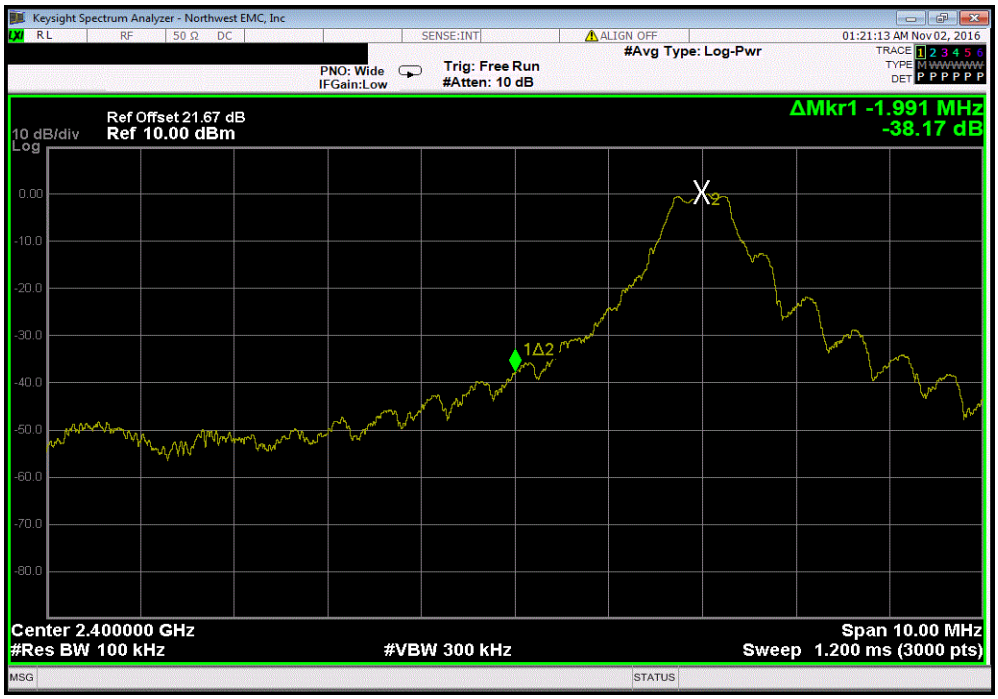
DEVIATIONS FROM TEST STANDARD

None

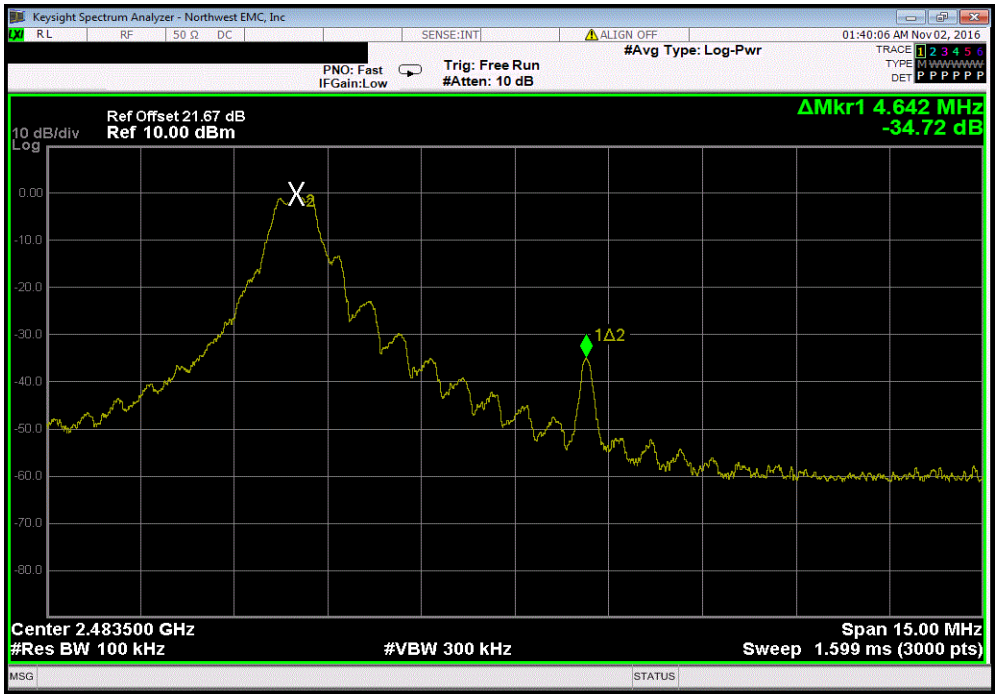
Configuration #	3	Signature

	Value (dBc)	Limit ≤ (dBc)	Result
BLE, Low Channel, 2402 MHz	-38.17	-20	Pass
BLE, High Channel, 2480 MHz	-34.72	-20	Pass

BLE, Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-38.17	-20	Pass



BLE, High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-34.72	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIA	4/6/2016	4/6/2018
Cable	Micro-Coax	UFD150A-1-0720-200200	NCS	6/7/2016	6/7/2017
Attenuator	Fairview Microwave	SA4014-20	TKV	3/4/2016	3/4/2017
Block - DC	Fairview Microwave	SD3379	AMU	5/6/2016	5/6/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	6/8/2016	6/8/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. 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

NORTHWEST EMC

XMit 2016.05.06

EUT:	FF01			**Work Order:**	SYNA0203
Serial Number:	A2M12			**Date:**	11/01/16
Customer:	Uber Technologies Inc.			**Temperature:**	21.8 °C
Attendees:	Charles Manry			**Humidity:**	47.9% RH
Project:	Kitt-A2			**Barometric Pres.:**	1015 mbar
Tested by:	Matthew Barnes	**Power:**	Battery	**Job Site:**	NC02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

LED White Level 90%. All LED's on. 0dBm output power.

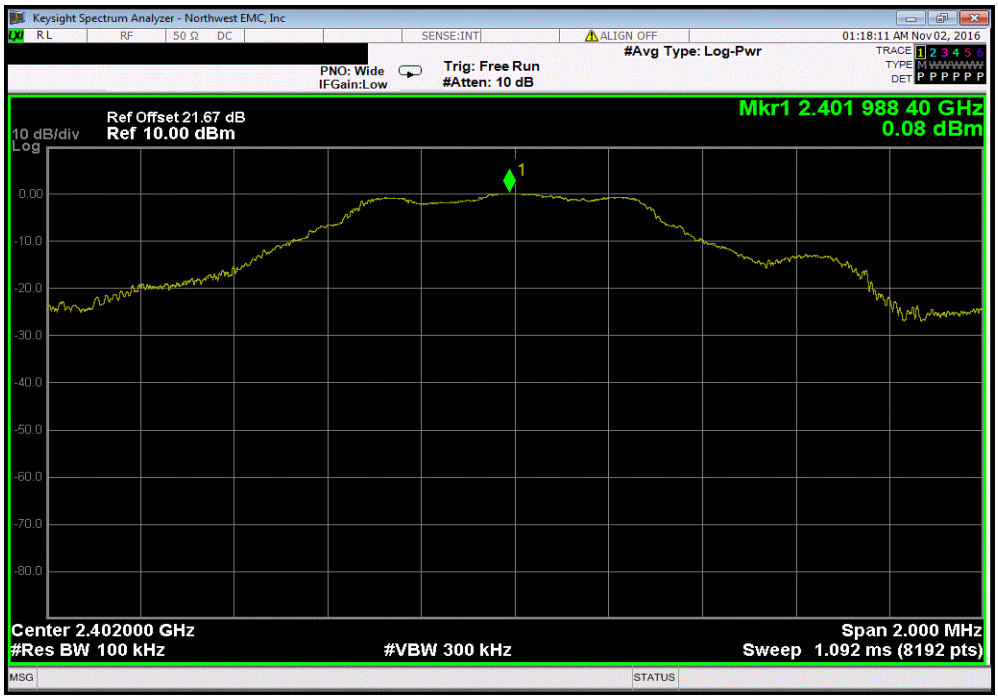
DEVIATIONS FROM TEST STANDARD

None

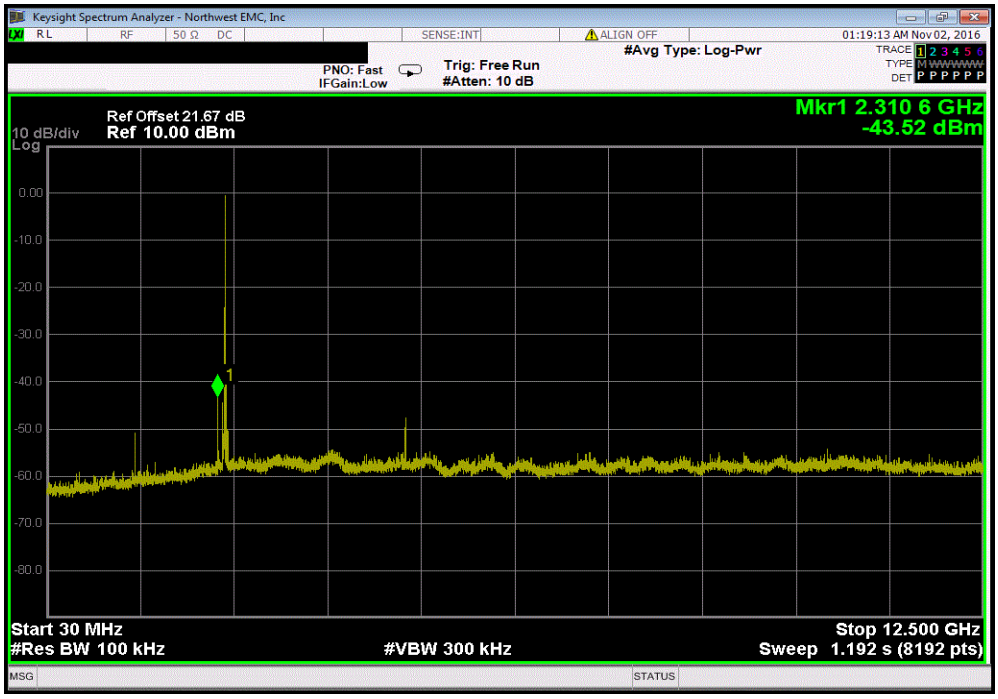
Configuration #	3	Signature

	Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
BLE, Low Channel, 2402 MHz	Fundamental	N/A	N/A	N/A
BLE, Low Channel, 2402 MHz	30 MHz - 12.5 GHz	-43.6	-20	Pass
BLE, Low Channel, 2402 MHz	12.5 GHz - 25 GHz	-51.41	-20	Pass
BLE, Mid Channel, 2442 MHz	Fundamental	N/A	N/A	N/A
BLE, Mid Channel, 2442 MHz	30 MHz - 12.5 GHz	-41.06	-20	Pass
BLE, Mid Channel, 2442 MHz	12.5 GHz - 25 GHz	-51.52	-20	Pass
BLE, High Channel, 2480 MHz	Fundamental	N/A	N/A	N/A
BLE, High Channel, 2480 MHz	30 MHz - 12.5 GHz	-44.14	-20	Pass
BLE, High Channel, 2480 MHz	12.5 GHz - 25 GHz	-51.15	-20	Pass

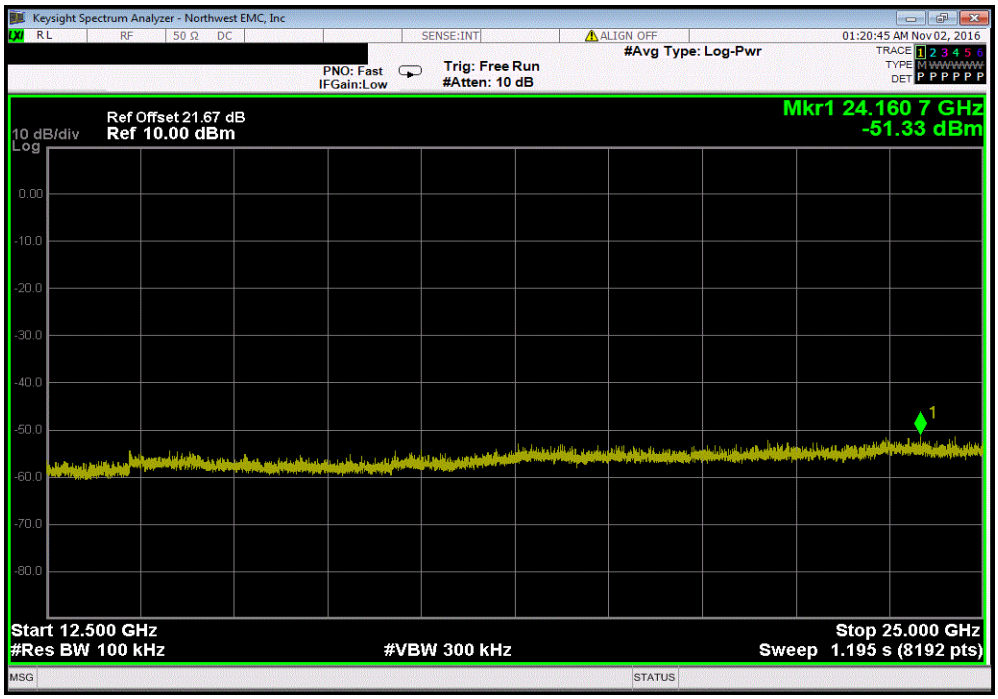
BLE, Low Channel, 2402 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



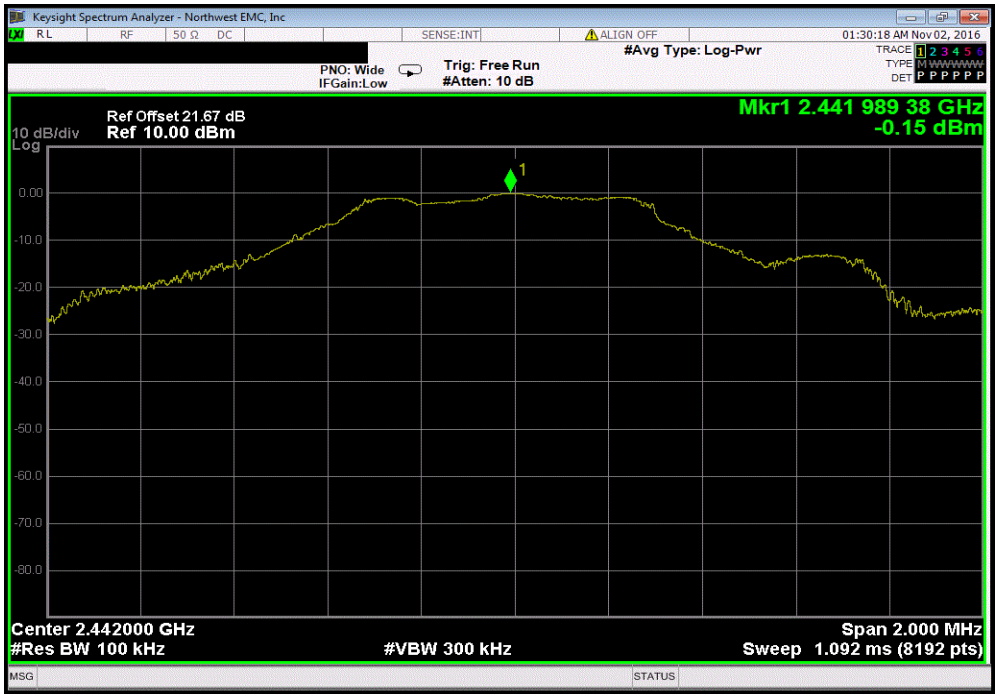
BLE, Low Channel, 2402 MHz					
Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz			-43.6	-20	Pass



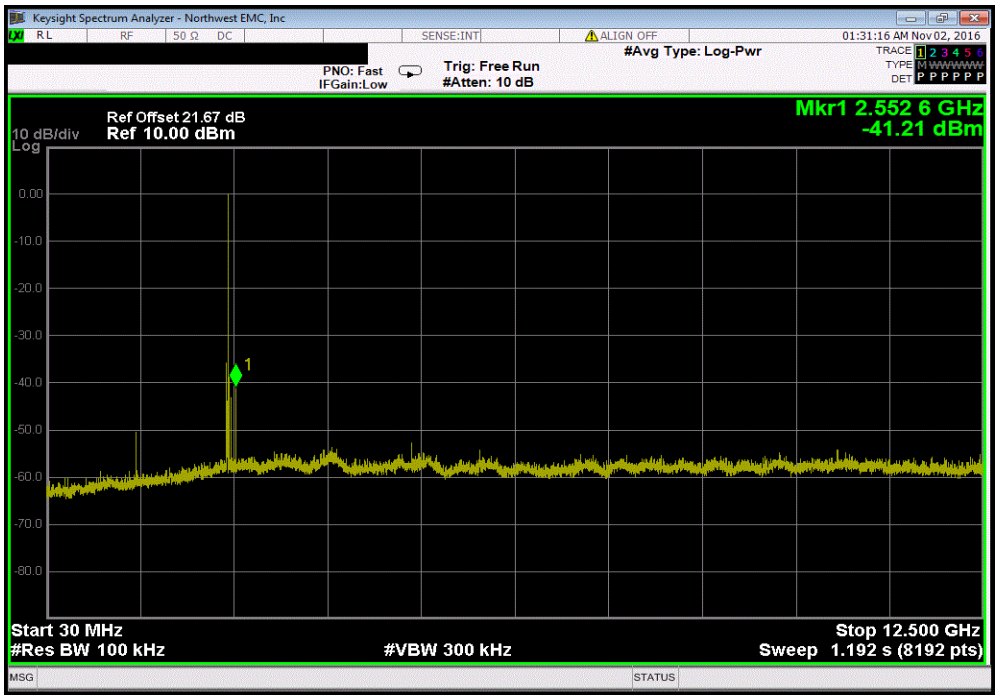
BLE, Low Channel, 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-51.41	-20	Pass



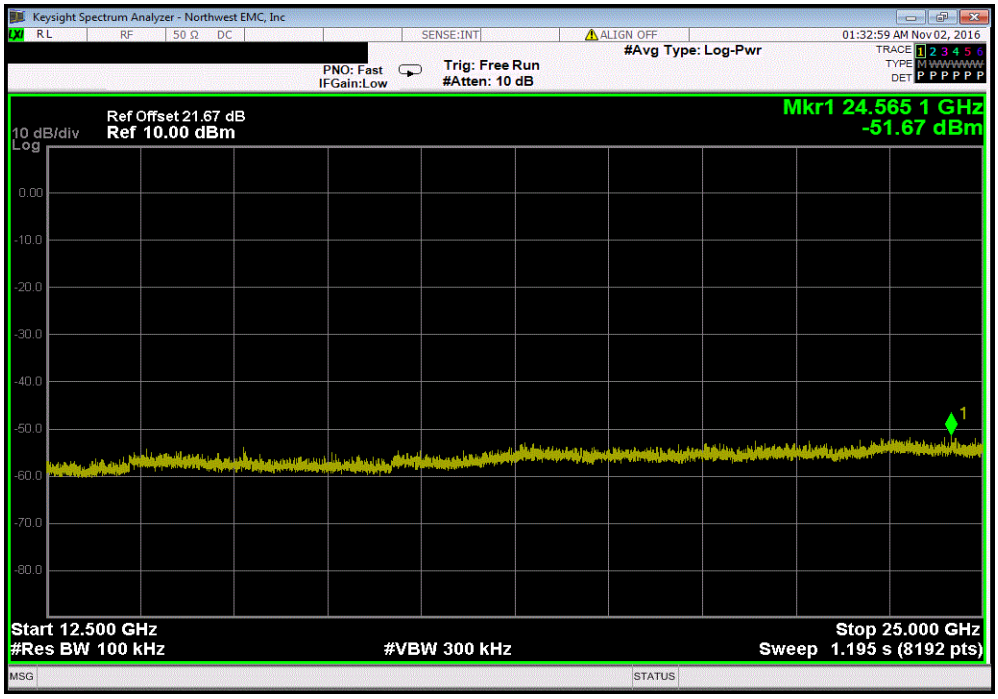
BLE, Mid Channel, 2442 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



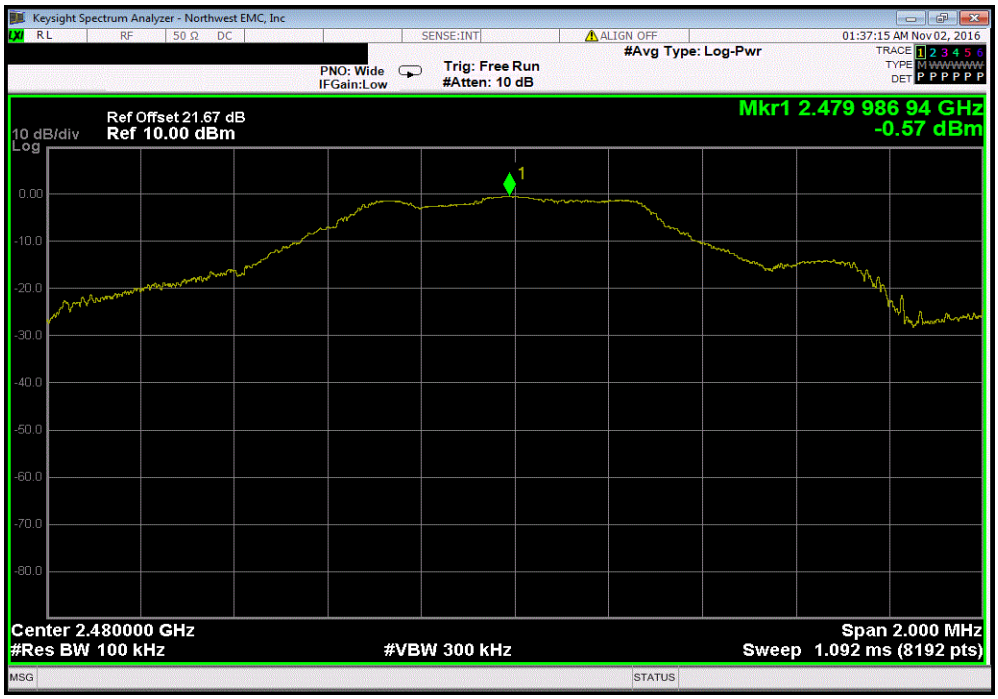
BLE, Mid Channel, 2442 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-41.06	-20	Pass



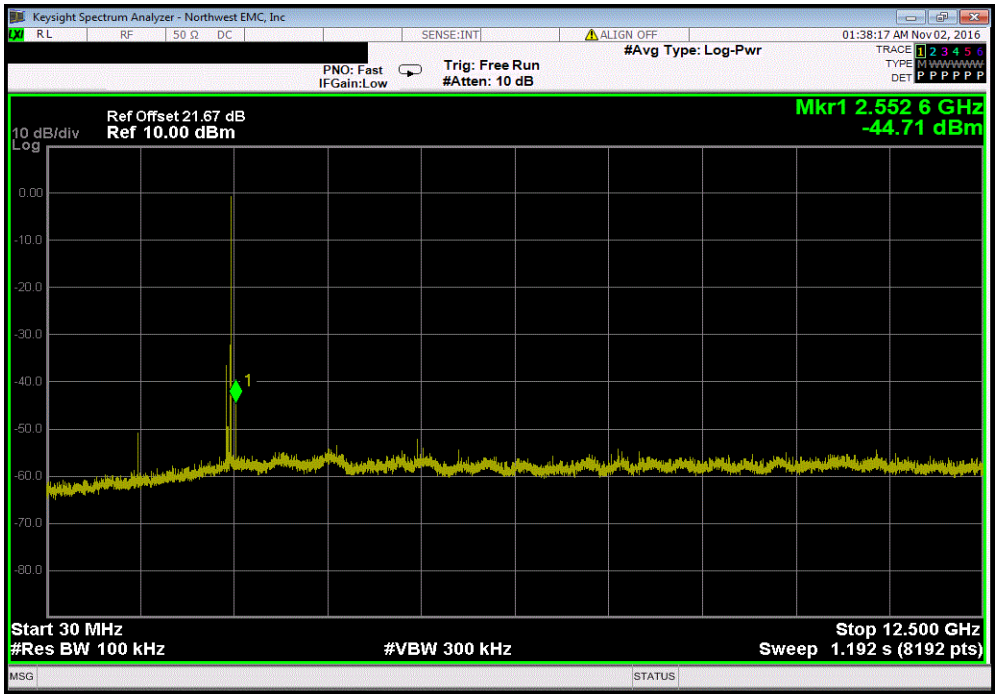
BLE, Mid Channel, 2442 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-51.52	-20	Pass



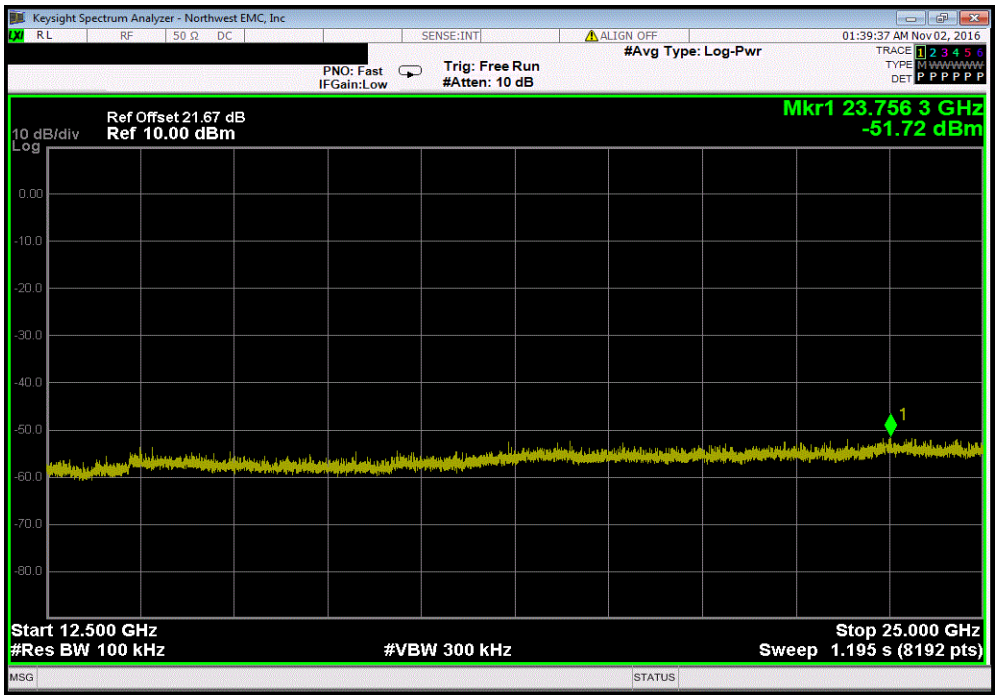
BLE, High Channel, 2480 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



BLE, High Channel, 2480 MHz					
Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz			-44.14	-20	Pass



BLE, High Channel, 2480 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-51.15	-20	Pass



SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2016.07.22

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.

CHANNEL OF OPERATION

Low Channel 0, 2402 MHz
Middle Channel 20, 2442 MHz
High Channel 39, 2480 MHz

POWER SETTINGS INVESTIGATED

Battery only and Charging mode via USB

CONFIGURATIONS INVESTIGATED

SYNA0209 - 5

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26.5 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
Cable	ESM Cable Corp.	KMKM-72	EVY	10/17/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	10/17/2016	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D00100800-32-13P	AVF	7/11/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	3/11/2016	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	0 mo
Attenuator	Coaxicom	3910-20	AXZ	5/18/2016	12 mo
Cable	N/A	Double Ridge Horn Cables	EVB	3/11/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	3/11/2016	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIZ	2/3/2016	24 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	5/18/2016	12 mo
Cable	N/A	Bilog Cables	EVA	3/11/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	3/11/2016	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AXR	6/30/2016	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	4/22/2016	12 mo

TEST DESCRIPTION

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made
The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

SPURIOUS RADIATED EMISSIONS

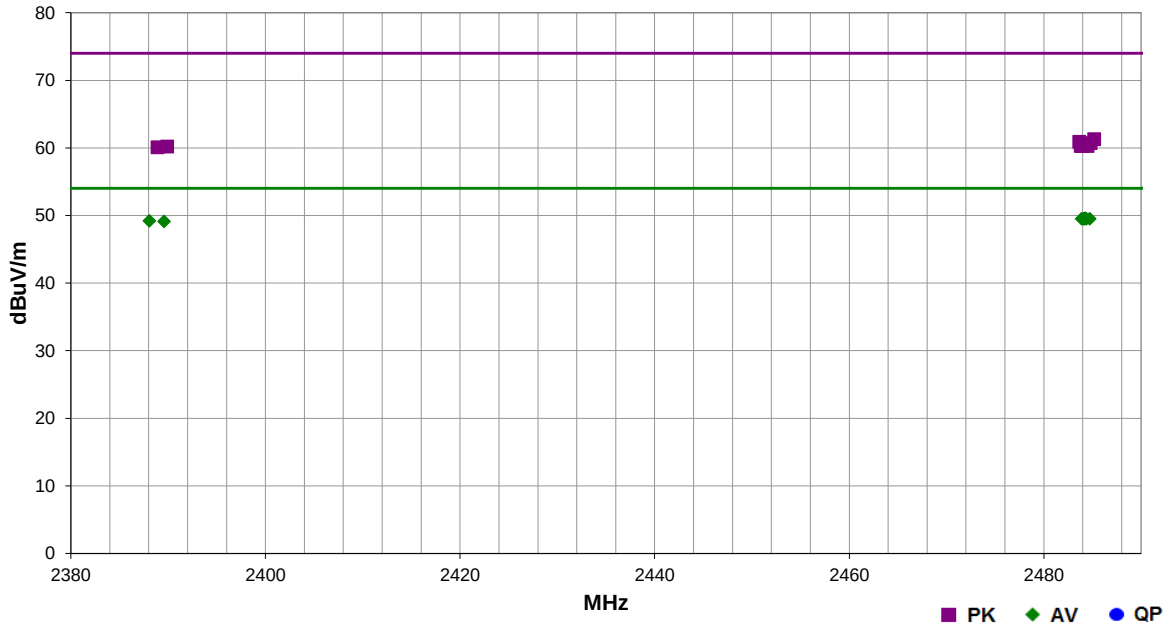
NORTHWEST EMC

PSA-ESCI 2016.07.22
EmiR5 2016.08.26

Work Order:	SYNA0209	**Date:**	11/29/16		
Project:	None	**Temperature:**	22.1 °C		
Job Site:	EV01	**Humidity:**	39.7% RH		
Serial Number:	J000045	**Barometric Pres.:**	1018 mbar	**Tested by:**	Jeff Alcoke and Rod Peloquin
EUT:	FF01				
Configuration:	5				
Customer:	Uber Technologies, Inc.				
Attendees:	Charles Manry				
EUT Power:	Battery				
Operating Mode:	Transmit, Logo on, white level 90.				
Deviations:	None				
Comments:	See comments for EUT orientation and transmit frequency and channel				

Test Specifications	**Test Method**
FCC 15.247:2016	ANSI C63.10:2013

Run #	25	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



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)
2484.247	30.7	-1.1	1.0	0.0	3.0	20.0	Horz	AV	0.0	49.6	54.0	-4.4
2484.107	30.6	-1.1	3.1	138.0	3.0	20.0	Horz	AV	0.0	49.5	54.0	-4.5
2484.197	30.6	-1.1	1.0	49.0	3.0	20.0	Vert	AV	0.0	49.5	54.0	-4.5
2484.733	30.6	-1.1	3.9	81.0	3.0	20.0	Vert	AV	0.0	49.5	54.0	-4.5
2484.377	30.6	-1.1	1.7	194.0	3.0	20.0	Horz	AV	0.0	49.5	54.0	-4.5
2483.887	30.6	-1.1	1.0	280.0	3.0	20.0	Vert	AV	0.0	49.5	54.0	-4.5
2388.067	30.8	-1.6	3.7	311.0	3.0	20.0	Vert	AV	0.0	49.2	54.0	-4.8
2389.593	30.7	-1.6	1.0	149.0	3.0	20.0	Horz	AV	0.0	49.1	54.0	-4.9
2485.177	42.4	-1.1	1.7	194.0	3.0	20.0	Horz	PK	0.0	61.3	74.0	-12.7
2483.647	42.0	-1.1	3.1	138.0	3.0	20.0	Horz	PK	0.0	60.9	74.0	-13.1
2484.793	41.8	-1.1	1.0	0.0	3.0	20.0	Horz	PK	0.0	60.7	74.0	-13.3
2483.797	41.4	-1.1	1.0	49.0	3.0	20.0	Vert	PK	0.0	60.3	74.0	-13.7
2484.490	41.4	-1.1	3.9	81.0	3.0	20.0	Vert	PK	0.0	60.3	74.0	-13.7
2483.990	41.4	-1.1	1.0	280.0	3.0	20.0	Vert	PK	0.0	60.3	74.0	-13.7
2389.900	41.8	-1.6	1.0	149.0	3.0	20.0	Horz	PK	0.0	60.2	74.0	-13.8
2388.907	41.7	-1.6	3.7	311.0	3.0	20.0	Vert	PK	0.0	60.1	74.0	-13.9

SPURIOUS RADIATED EMISSIONS

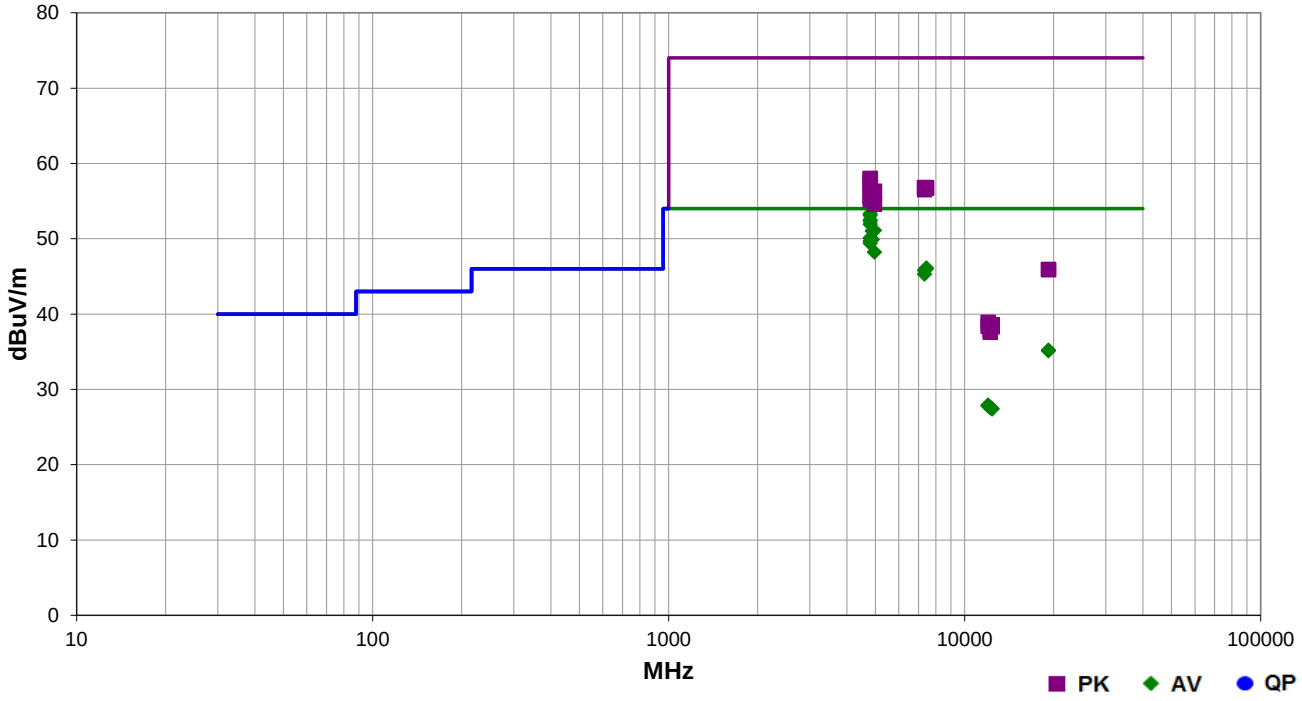
NORTHWEST EMC

PSA-ESCI 2016.07.22
EmiR5 2016.08.26

Work Order:	SYNA0209	**Date:**	11/29/16		
Project:	None	**Temperature:**	22.1 °C		
Job Site:	EV01	**Humidity:**	39.7% RH		
Serial Number:	J000045	**Barometric Pres.:**	1018 mbar	**Tested by:**	Jeff Alcoke and Rod Peloquin
EUT:	FF01				
Configuration:	5				
Customer:	Uber Technologies, Inc.				
Attendees:	Charles Manry				
EUT Power:	Battery				
Operating Mode:	Logo on, white level 90, Transmit				
Deviations:	None				
Comments:	See comments for Transmit channel, frequency and EUT orientation. Charging via USB investigated in worst case orientation.				

Test Specifications	**Test Method**
FCC 15.247:2016	ANSI C63.10:2013

Run #	30	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



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)
4803.980	44.3	9.0	3.5	302.0	3.0	0.0	Vert	AV	0.0	53.3	54.0	-0.7
4803.980	44.1	9.0	3.0	249.0	3.0	0.0	Horz	AV	0.0	53.1	54.0	-0.9
4803.890	43.5	9.0	2.6	344.0	3.0	0.0	Horz	AV	0.0	52.5	54.0	-1.5
4803.905	43.3	9.0	1.2	194.0	3.0	0.0	Horz	AV	0.0	52.3	54.0	-1.7
4803.960	42.9	9.0	2.4	105.0	3.0	0.0	Vert	AV	0.0	51.9	54.0	-2.1
4959.950	41.7	9.4	3.5	141.0	3.0	0.0	Vert	AV	0.0	51.1	54.0	-2.9
4883.925	41.8	9.2	3.6	314.0	3.0	0.0	Vert	AV	0.0	51.0	54.0	-3.0
4803.960	41.1	9.0	1.0	247.0	3.0	0.0	Vert	AV	0.0	50.1	54.0	-3.9
4883.970	40.7	9.2	3.1	53.0	3.0	0.0	Horz	AV	0.0	49.9	54.0	-4.1
4804.025	40.7	9.0	1.0	139.0	3.0	0.0	Vert	AV	0.0	49.7	54.0	-4.3