

NORTHWEST EMC

Payrange Inc.

BluKey Modem in BluKey Plus Host

FCC 15.207:2016

FCC 15.247:2016

Bluetooth Radio Module

Report # PAYR0005.1



NVLAP Lab Code: 200630-0

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.

CERTIFICATE OF TEST



Last Date of Test: June 02, 2016
Payrange Inc.
Model: BluKey Modem

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2016	ANSI C63.10:2013 KDB 558074
FCC 15.247:2016	

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	AC - Powerline Conducted Emissions	Yes	Pass	
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	
11.9.2.2.4	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:

Kyle Holgate, 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

Revision Number		Description	Date	Page Number
00		None		

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 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

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 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

Measurement Uncertainty

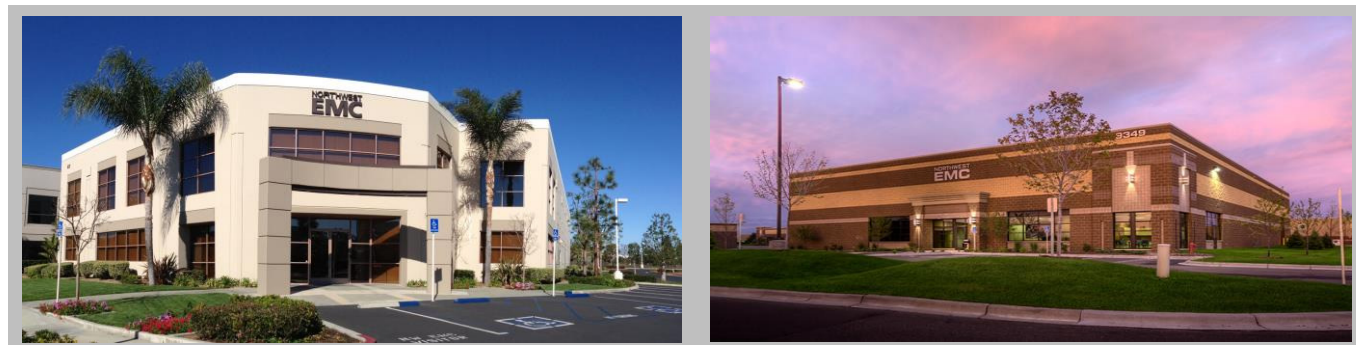
When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement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

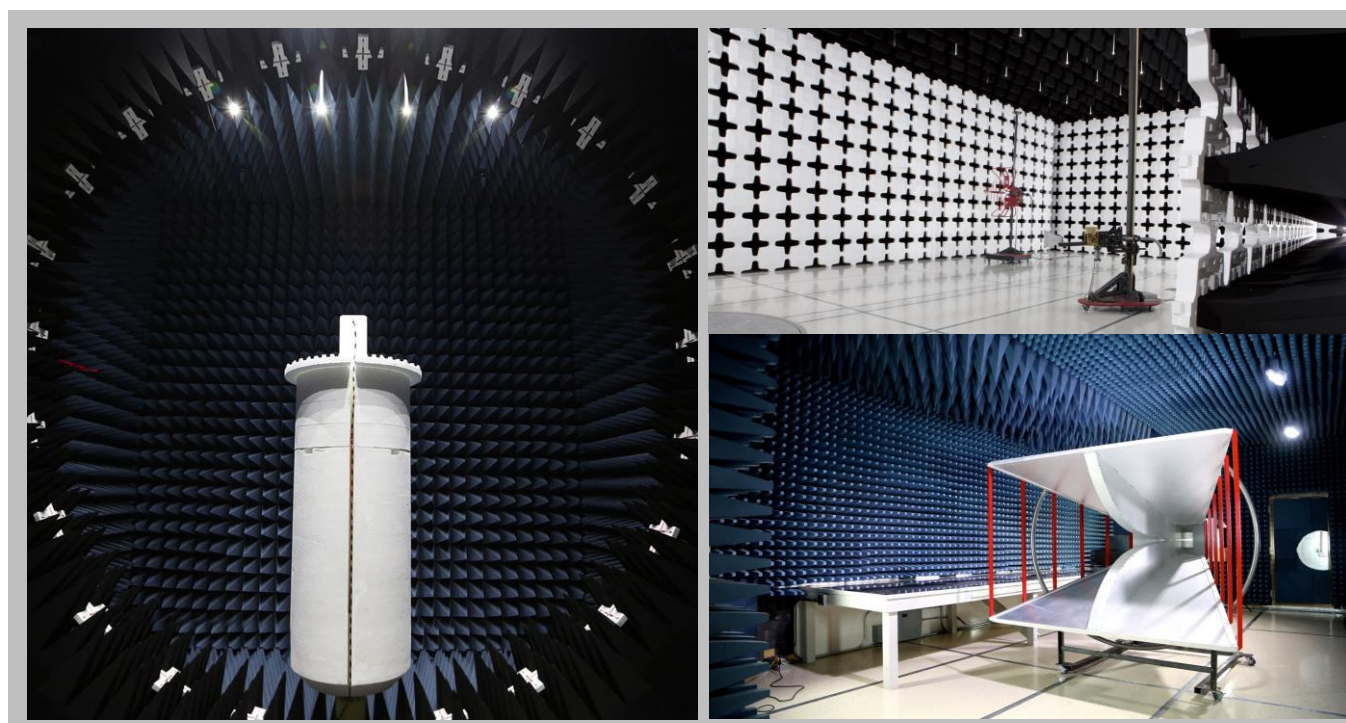
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

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



California Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Oregon Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th 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
Industry 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/RRR, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Payrange Inc.
Address:	919 SW Taylor St. Suite 500
City, State, Zip:	Portland, OR 97205
Test Requested By:	Mike Mitchell
Model:	BluKey Modem
First Date of Test:	June 01, 2016
Last Date of Test:	June 02, 2016
Receipt Date of Samples:	June 01, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

Wireless Payment Device using a Bluetooth low energy 4.1 module

The client, Mike Mitchell of Payrange, Inc. attests that the maximum possible source based duty cycle is 20.1%. This is based upon the following:

- The Bluetooth Low Energy protocol limits transmit to 6 packets of 376uS each in a 7.5mS interval. Therefore, the maximum duty cycle is 30%.
- For compatibility reasons, the radio SoC is programmed to further limit the duty cycle to 4 packets within a 7.5ms period. Therefore, the maximum duty cycle is actually 20.1%.

The source based duty cycle correction factor is: $20 \cdot \log(0.201) = -13.9 \text{ dB}$.

Testing Objective:

To demonstrate compliance of the Bluetooth radio to FCC 15.247 requirements for a limited modular approval.

CONFIGURATIONS

Configuration PAYR0005- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
BlueKey Modem	PayRange	None	020001

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Laptop (sony)	Sony	SVE141L11L	27556083300108
AC/DC Adapter (Sony)	Sony	VGP-AC19B48	1489078112727498
CTX MDB Emulator 1	SEM	A00887	S041478
Host Board	PayRange	None	20000011
Bk Module Programmer	PayRangeU	None	PDX1
AC/DC Adapter (CTX) 1	Wall Industries	CGSW-2402500	None

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
SPI Programming cable	No	0.3m	No	BK Module Programmer	Radio Module
CTX MDB I/O	No	0.5m	No	CTX 1	(Host MDB Port) PayRangeKey Plus
USB Cable	Yes	1.0m	No	Laptop	BK Module Programmer
AC Power Cable Sony	No	1.5m	No	AC/DC Adapter (Sony)	AC main
DC Power Cable Sony	Unknown	2.0m	No	AC/DC Adapter (Sony)	Laptop
AC Power Cable CTX 1	No	2.0m	No	AC/DC Adapter (CTX)	AC main
DC Power Cable CTX 1	Unknown	1.0m	No	AC/DC Adapter (CTX)	CTX 1

Configuration PAYR0005- 2

EUT					
Description	Manufacturer	Model/Part Number	Serial Number		
BlueKey Plus	PayRange	None	020001		
Peripherals in test setup boundary					
Description	Manufacturer	Model/Part Number	Serial Number		
Host Board	PayRange	None	20000011		
DC Power Supply	TOPWARD ELECTRIC INSTRUMENTS	TPS-2000	TPD		
Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power cable DC supply	No	2.0m	No	DC Power Supply	AC mains
DC Power Leads x2	No	2.0m	No	Power Supply	PayRangeBluKey Plus

CONFIGURATIONS

Configuration PAYR0005- 4

EUT					
Description	Manufacturer	Model/Part Number	Serial Number		
BlueKey Plus	PayRange	None	020001		
Peripherals in test setup boundary					
Description	Manufacturer	Model/Part Number	Serial Number		
Host Board	PayRange	None	20000011		
DC Power Supply	TOPWARD ELECTRIC INSTRUMENTS	TPS-2000	TPD		
Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power cable DC supply	No	2.0m	No	DC Power Supply	AC mains
DC Power Leads x2	No	2.0m	No	Power Supply	PayRangeBluKey Plus
BlueKey I/O Cables x3	No	4.1m	No	PayRange BluKey Plus	Unterminated

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	6/1/2016	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	6/1/2016	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	6/1/2016	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	6/1/2016	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	6/1/2016	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	6/1/2016	Spurious Conducted Emissions	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.
7	6/1/2016	AC – Powerline Conducted Emissions	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.
8	6/2/2016	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

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 (mo)
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	36
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Attenuator	S.M. Electronics	SA26B-20	AWT	NCR	0
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	2/13/2016	12

TEST DESCRIPTION

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. 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.

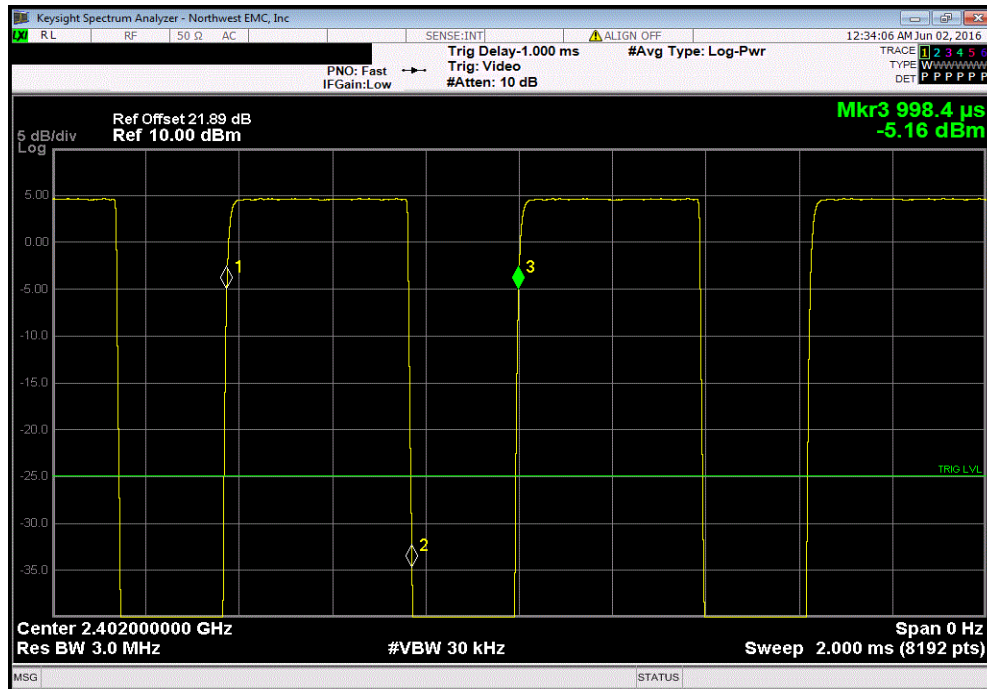
If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

**NORTHWEST
EMC**
XMIT 2015.01.14

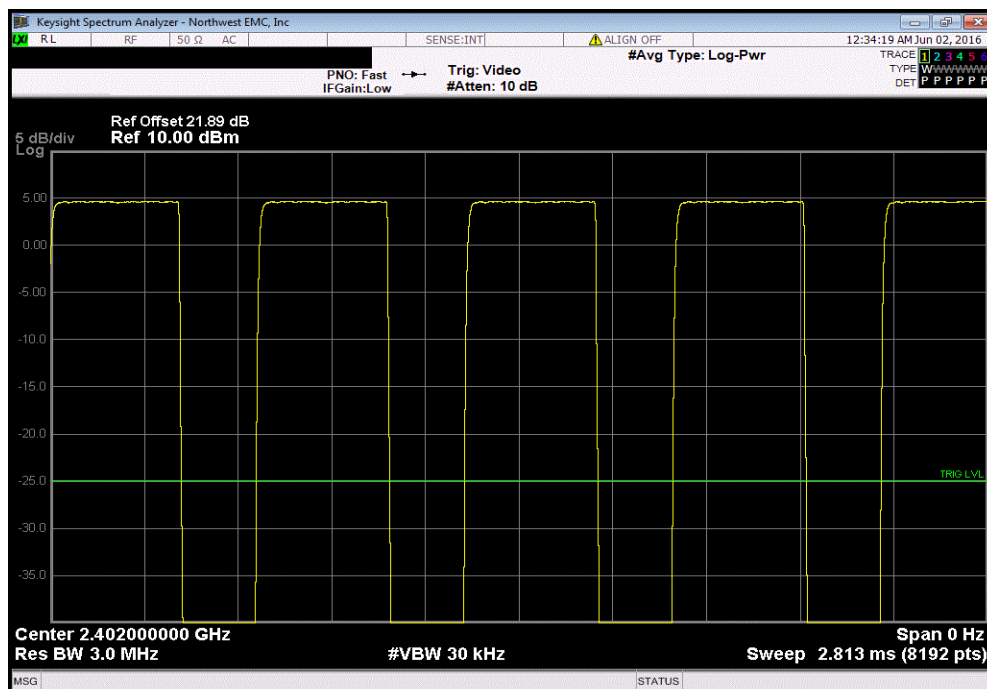
EUT: BluKey Modem			Work Order: PAYR0005				
Serial Number: 020001			Date: 06/01/16				
Customer: Payrange Inc.			Temperature: 22.9°C				
Attendees: Mike Mitchell			Humidity: 44%				
Project: None			Barometric Pres.: 1014.7				
Tested by: Brandon Hobbs		Power: 24VDC Nominal	Job Site: EV06				
TEST SPECIFICATIONS			Test Method				
FCC 15.247.2016			ANSI C63.10:2013				
COMMENTS							
The product was operating under normal operating conditions.							
DEVIATIONS FROM TEST STANDARD							
None							
Configuration #	1						
		Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
		396.8 us	625.1 us	1	63.5	N/A	N/A
		N/A	N/A	5	N/A	N/A	N/A
		397 us	625.1 us	1	63.5	N/A	N/A
		N/A	N/A	5	N/A	N/A	N/A
		397 us	624.8 us	1	63.5	N/A	N/A
		N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

BLE/GFSK Low Channel, 2402 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
396.8 us	625.1 us	1	63.5	N/A	N/A	

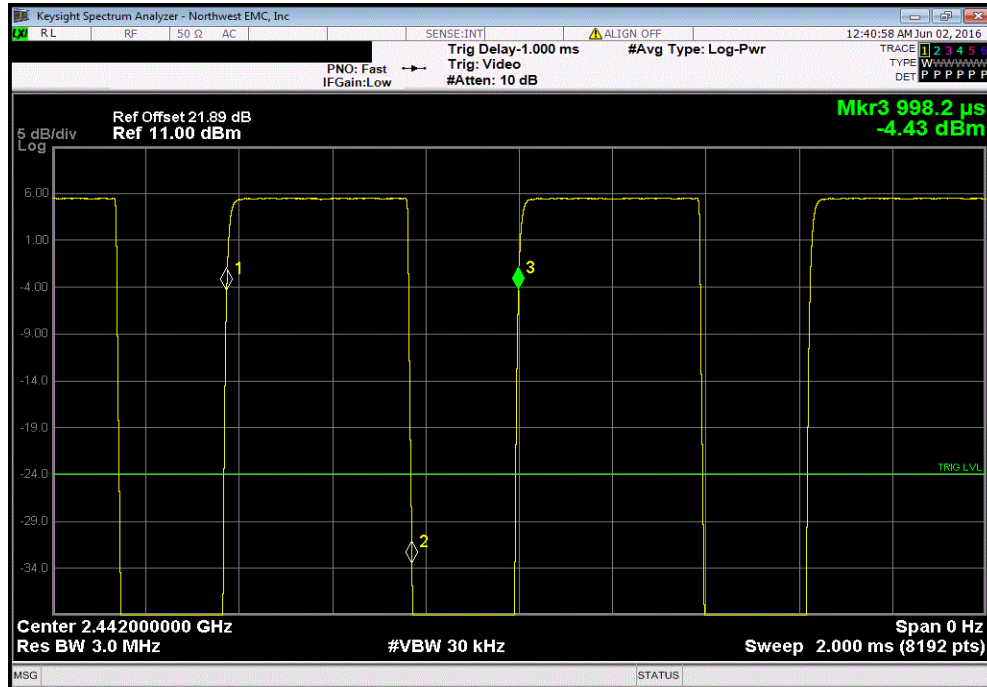


BLE/GFSK Low Channel, 2402 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

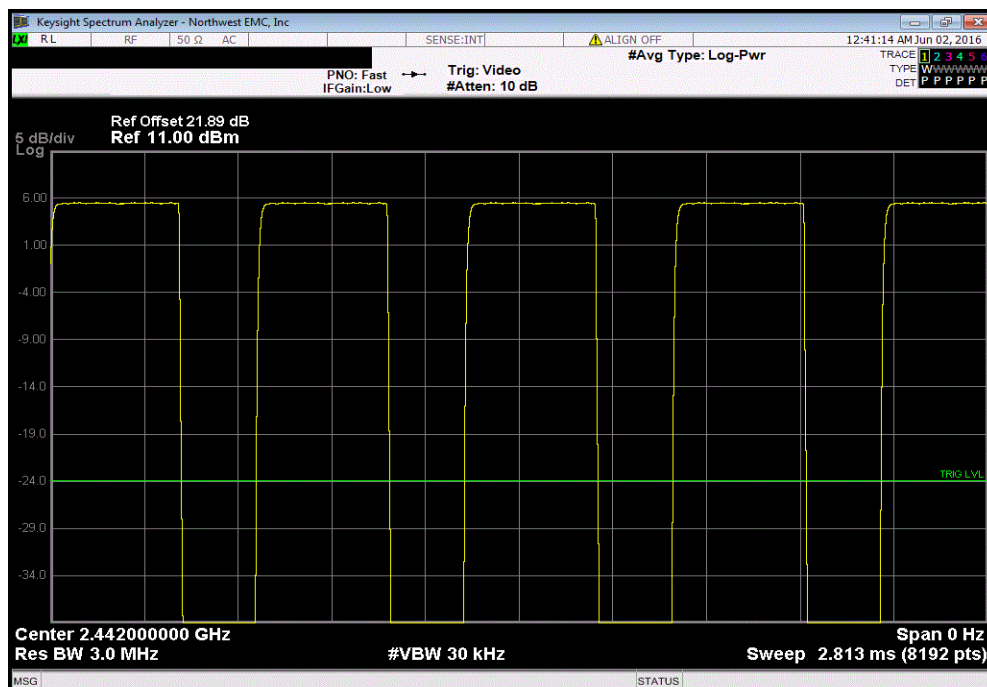


DUTY CYCLE

BLE/GFSK Mid Channel, 2442 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
397 us	625.1 us	1	63.5	N/A	N/A	

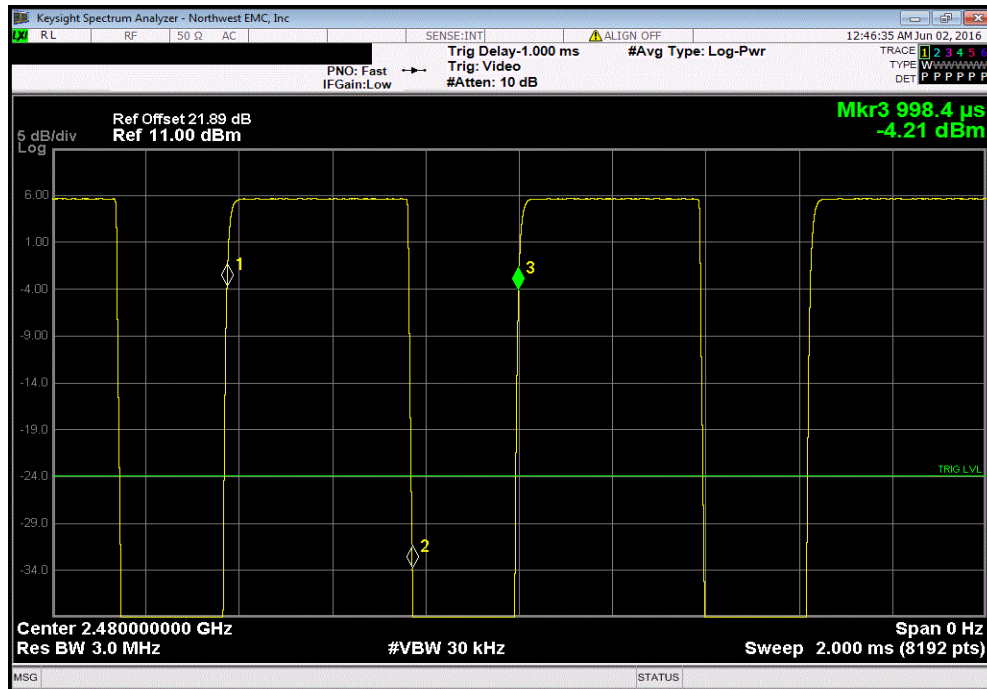


BLE/GFSK Mid Channel, 2442 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

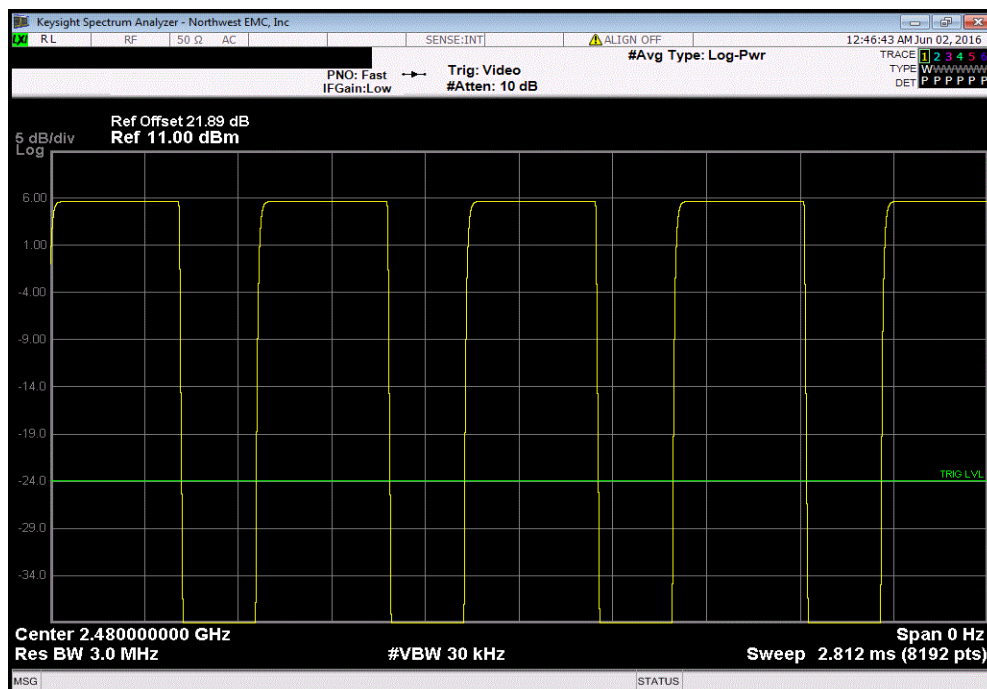


DUTY CYCLE

BLE/GFSK High Channel, 2480 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
397 us	624.8 us	1	63.5	N/A	N/A	



BLE/GFSK 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

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 (mo)
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	36
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	AWT	NCR	0
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	2/13/2016	12

TEST DESCRIPTION

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.

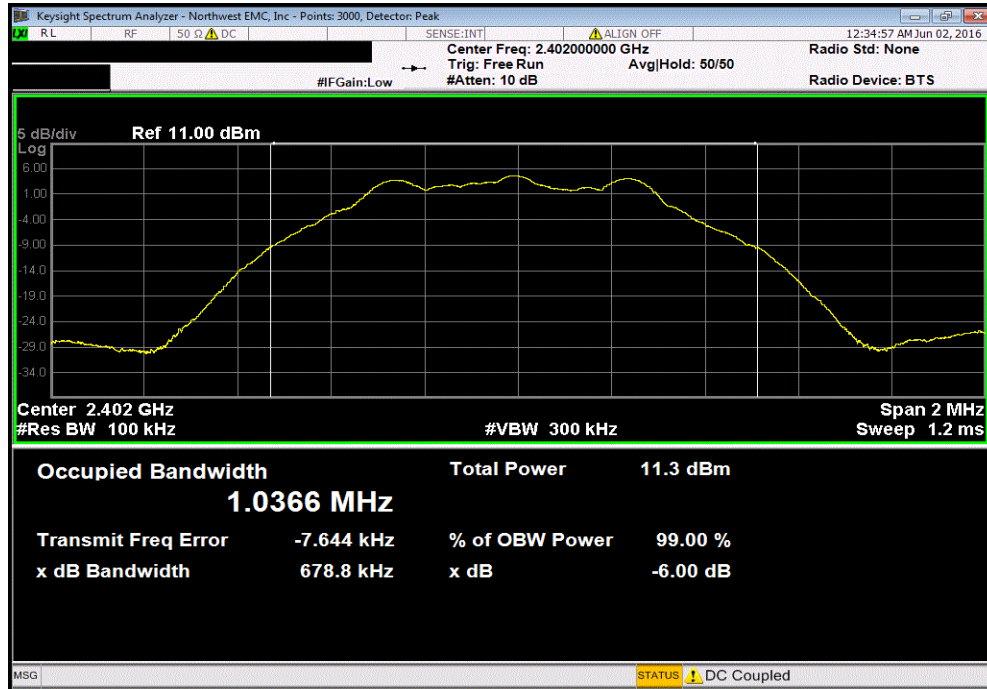
The EUT was set to the channels and modes listed in the datasheet. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer.

OCCUPIED BANDWIDTH

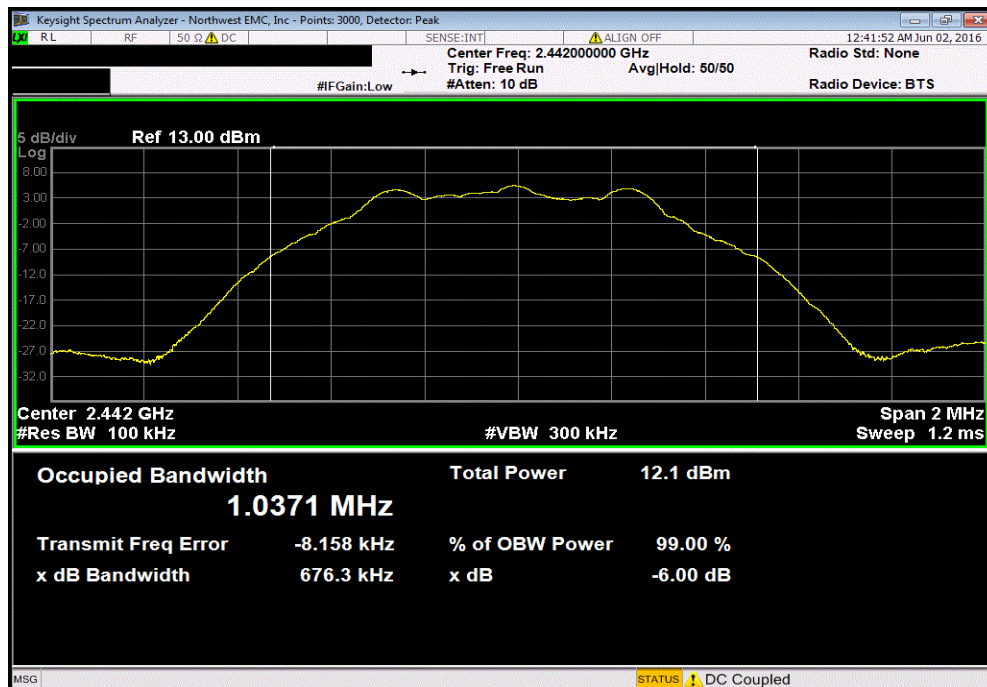
EUT: BluKey Modem		Work Order: PAYR0005	
Serial Number: 020001		Date: 06/01/16	
Customer: Payrange Inc.		Temperature: 22.9°C	
Attendees: Mike Mitchell		Humidity: 44%	
Project: None		Barometric Pres.: 1014.7	
Tested by: Brandon Hobbs		Power: 24VDC Nominal	
		Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2016		ANSI C63.10:2013	
COMMENTS			
The product was operating under normal operating conditions.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value	Limit (±) Result
BLE/GFSK Low Channel, 2402 MHz		678.824 kHz	500 kHz Pass
BLE/GFSK Mid Channel, 2442 MHz		676.336 kHz	500 kHz Pass
BLE/GFSK High Channel, 2480 MHz		677.004 kHz	500 kHz Pass

OCCUPIED BANDWIDTH

BLE/GFSK Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				678.824 kHz	500 kHz	Pass

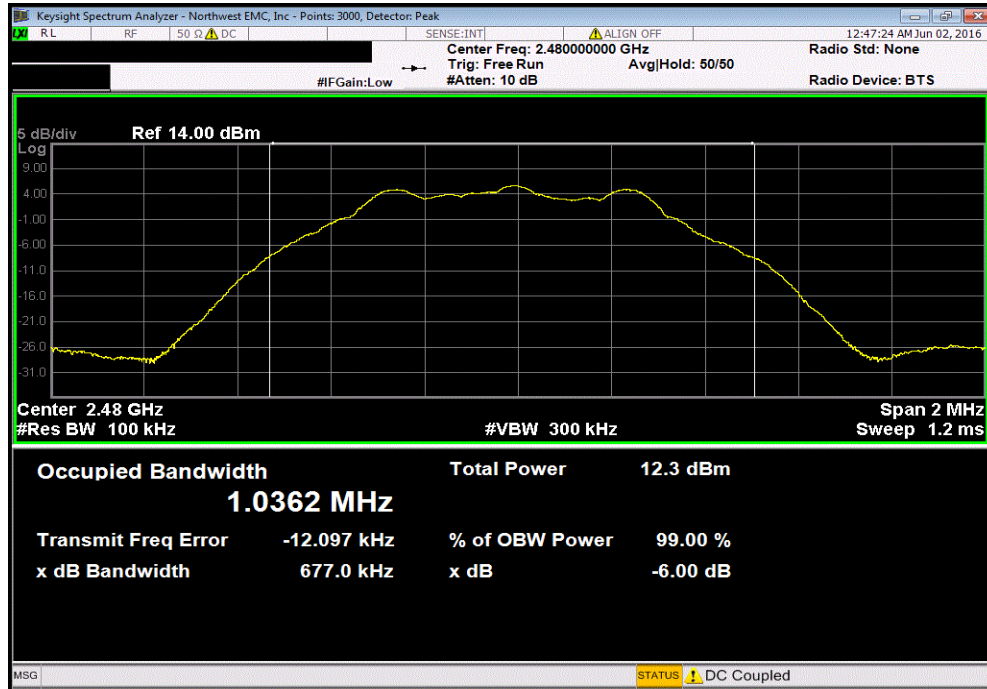


BLE/GFSK Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				676.336 kHz	500 kHz	Pass



OCCUPIED BANDWIDTH

BLE/GFSK High Channel, 2480 MHz						
Value				Limit	Result	
677.004 kHz				500 kHz	Pass	



OUTPUT POWER

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 (mo)
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	36
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Attenuator	S.M. Electronics	SA26B-20	AWT	NCR	0
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	2/13/2016	12

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.

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 11.9.2.2.4 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio..

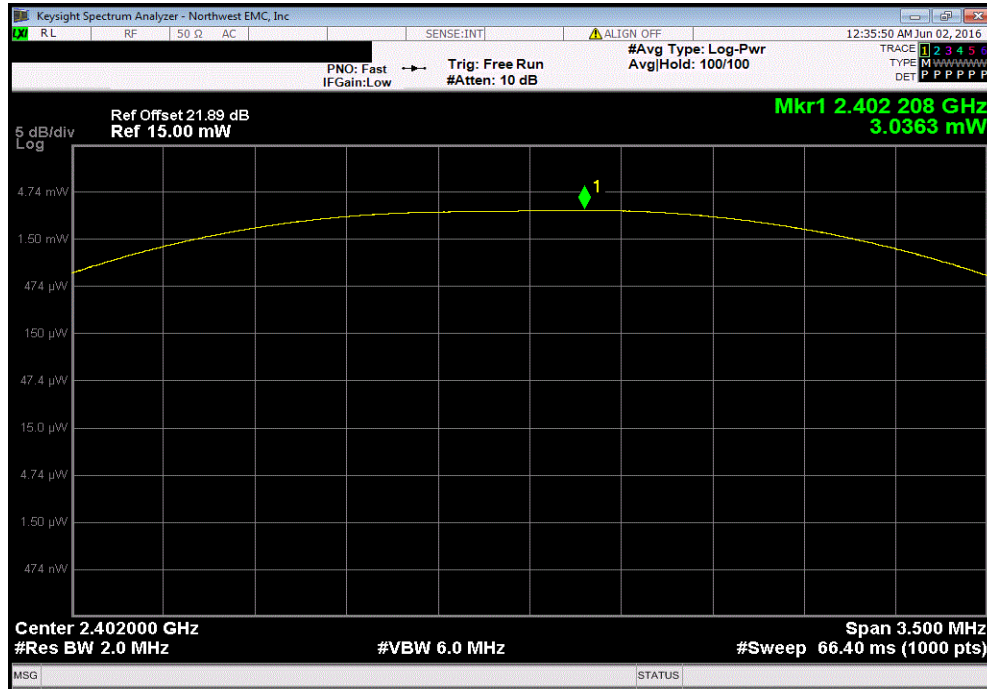
De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36 dBm.

OUTPUT POWER

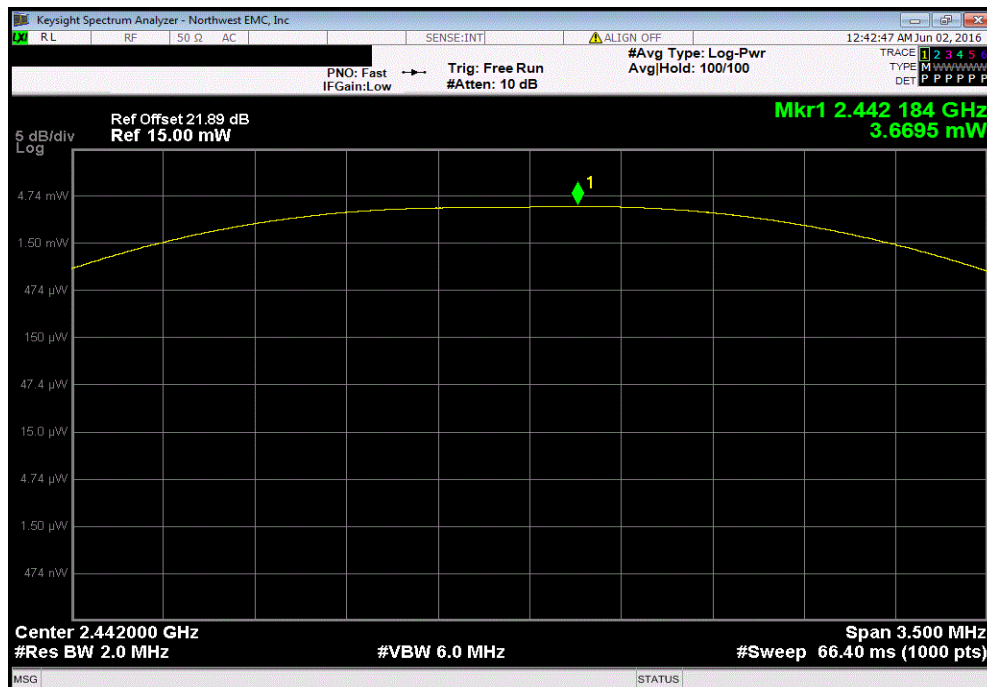
EUT: BluKey Modem		Work Order: PAYR0005	
Serial Number: 020001		Date: 06/01/16	
Customer: Payrange Inc.		Temperature: 22.9°C	
Attendees: Mike Mitchell		Humidity: 44%	
Project: None		Barometric Pres.: 1014.7	
Tested by: Brandon Hobbs	Power: 24VDC Nominal	Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2016		ANSI C63.10:2013	
COMMENTS			
The product was operating under normal operating conditions.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value	Limit (<)
BLE/GFSK Low Channel, 2402 MHz		3.036 mW	1 W
BLE/GFSK Mid Channel, 2442 MHz		3.67 mW	1 W
BLE/GFSK High Channel, 2480 MHz		3.806 mW	1 W
			Result
			Pass
			Pass
			Pass

OUTPUT POWER

BLE/GFSK Low Channel, 2402 MHz						
				Value	Limit	Result
				3.036 mW	1 W	Pass

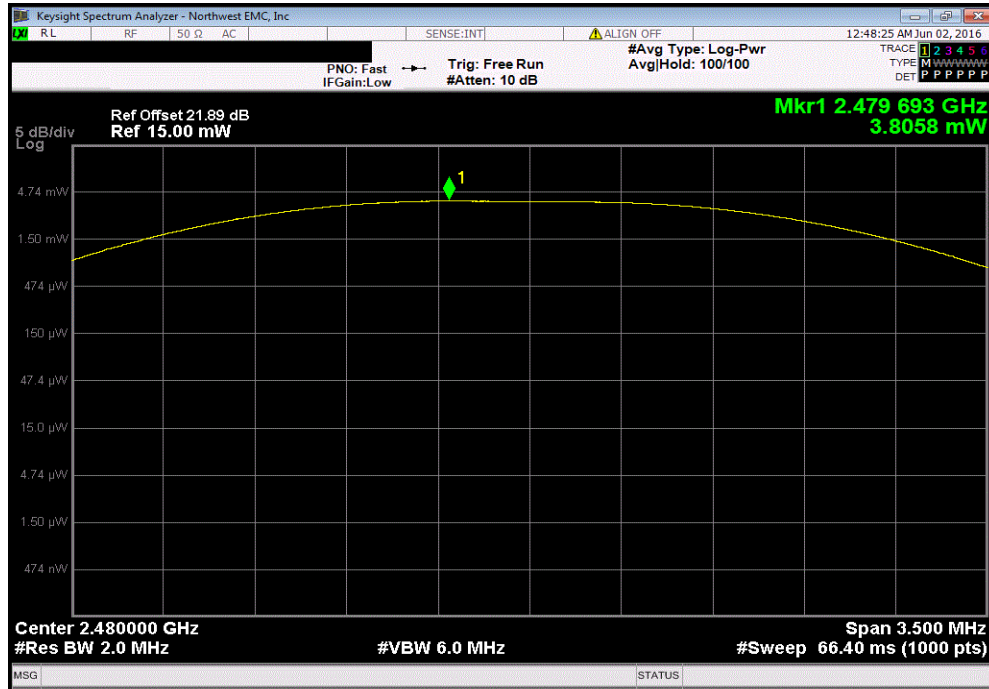


BLE/GFSK Mid Channel, 2442 MHz						
				Value	Limit	Result
				3.67 mW	1 W	Pass



OUTPUT POWER

BLE/GFSK High Channel, 2480 MHz						
				Value	Limit	Result
				3.806 mW	1 W	Pass



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 (mo)
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	36
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Attenuator	S.M. Electronics	SA26B-20	AWT	NCR	0
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	2/13/2016	12

TEST DESCRIPTION

The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

A direct connection was made between the RF output of the EUT and a spectrum analyzer. External 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.

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

POWER SPECTRAL DENSITY

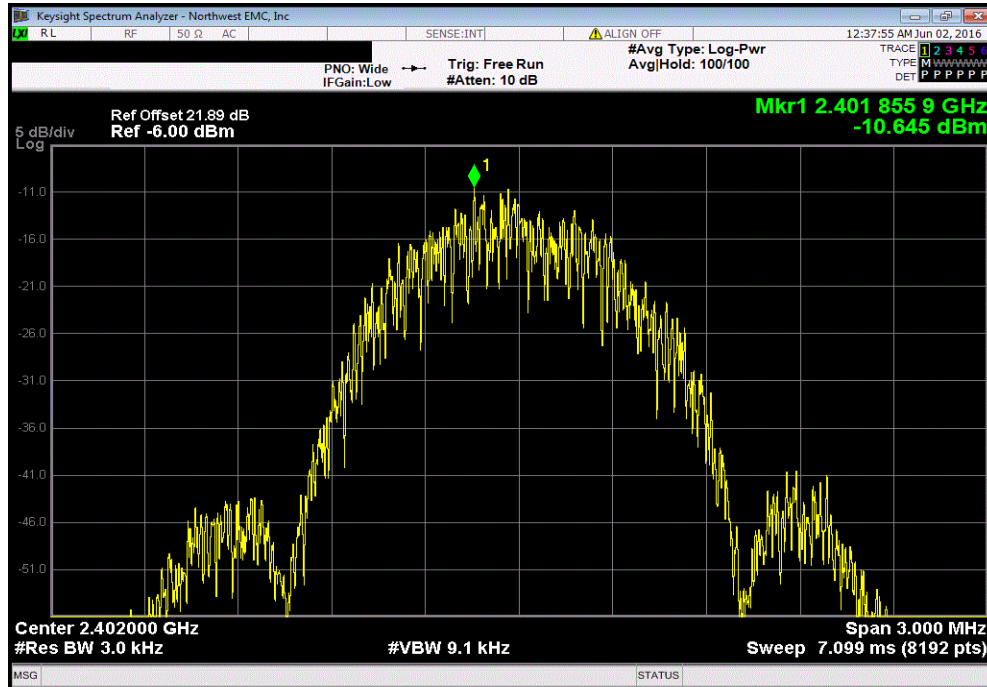


XMtr 2015.01.14

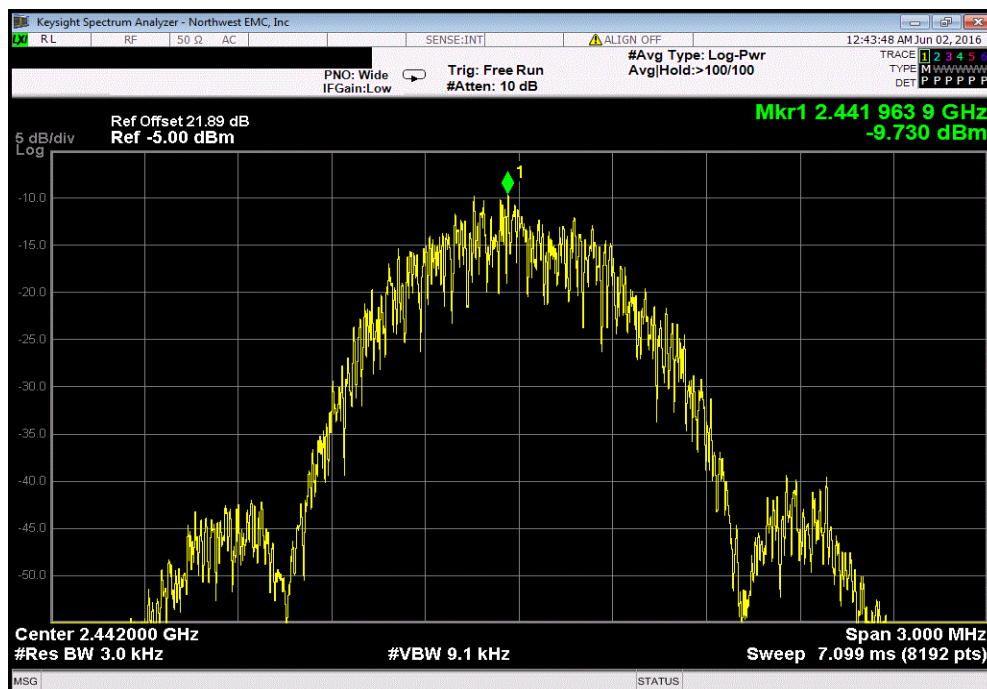
EUT: BluKey Modem		Work Order: PAYR0005	
Serial Number: 020001		Date: 06/01/16	
Customer: Payrange Inc.		Temperature: 22.9°C	
Attendees: Mike Mitchell		Humidity: 44%	
Project: None		Barometric Pres.: 1014.7	
Tested by: Brandon Hobbs	Power: 24VDC Nominal	Job Site: EV06	
TEST SPECIFICATIONS			
FCC 15.247:2016		Test Method: ANSI C63.10:2013	
COMMENTS			
The product was operating under normal operating conditions.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value dBm/3kHz	Limit < dBm/3kHz
BLE/GFSK Low Channel, 2402 MHz		-10.645	8
BLE/GFSK Mid Channel, 2442 MHz		-9.73	8
BLE/GFSK High Channel, 2480 MHz		-9.438	8
			Results
			Pass
			Pass
			Pass

POWER SPECTRAL DENSITY

BLE/GFSK Low Channel, 2402 MHz						
				Value	Limit	Results
				dBm/3kHz	< dBm/3kHz	
				-10.645	8	Pass

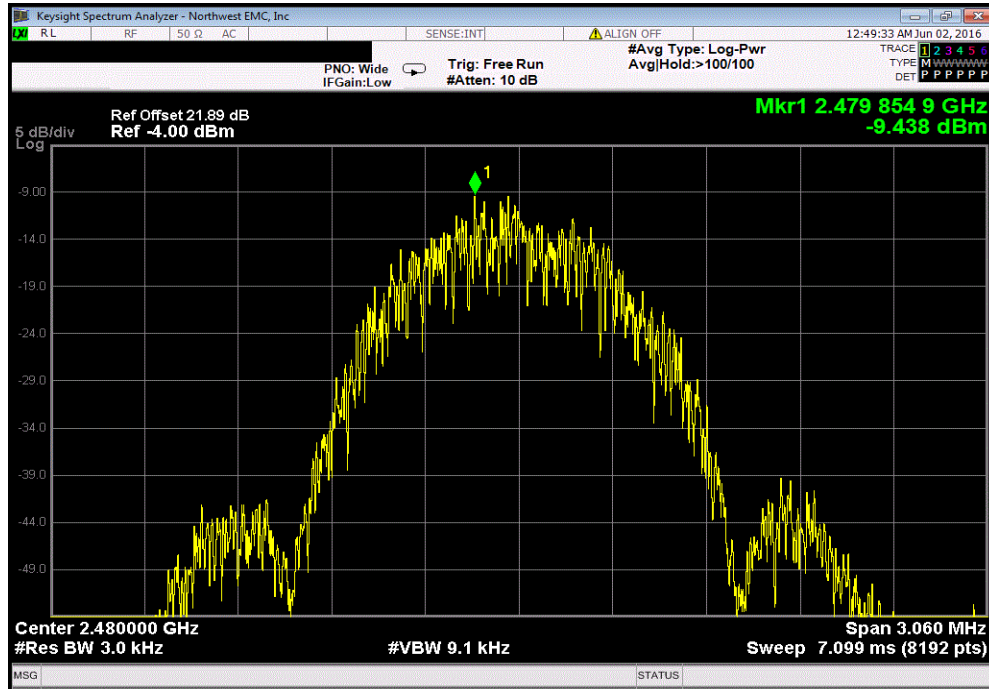


BLE/GFSK Mid Channel, 2442 MHz						
				Value	Limit	Results
				dBm/3kHz	< dBm/3kHz	
				-9.73	8	Pass



POWER SPECTRAL DENSITY

BLE/GFSK High Channel, 2480 MHz						
				Value	Limit	Results
				dBm/3kHz	< dBm/3kHz	
				-9.438	8	Pass



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 (mo)
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	36
Attenuator	S.M. Electronics	SA26B-20	AWT	10/27/2015	36
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	2/13/2016	12

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 listed in the datasheet.

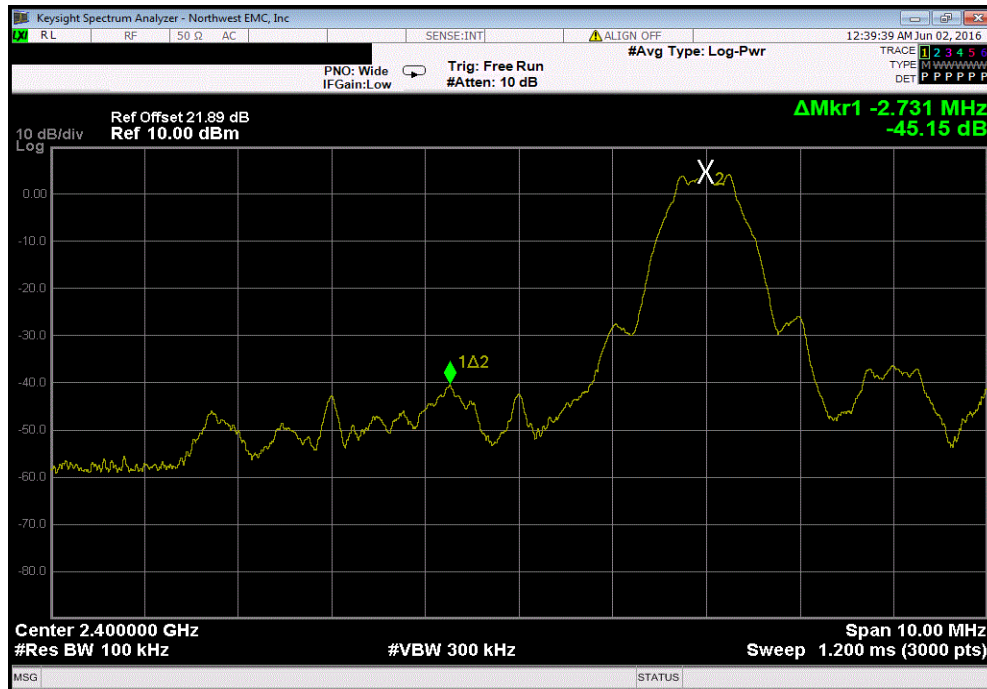
The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE

EUT: BluKey Modem		Work Order: PAYR0005	
Serial Number: 020001		Date: 06/01/16	
Customer: Payrange Inc.		Temperature: 22.9°C	
Attendees: Mike Mitchell		Humidity: 44%	
Project: None		Barometric Pres.: 1014.7	
Tested by: Brandon Hobbs	Power: 24VDC Nominal	Job Site: EV06	
TEST SPECIFICATIONS			
FCC 15.247:2016		Test Method	
		ANSI C63.10:2013	
COMMENTS			
The product was operating under normal operating conditions.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value (dBc)	Limit ≤ (dBc) Result
BLE/GFSK Low Channel, 2402 MHz		-45.15	-20 Pass
BLE/GFSK High Channel, 2480 MHz		-52.32	-20 Pass

BAND EDGE COMPLIANCE

BLE/GFSK Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-45.15	-20	Pass



BLE/GFSK High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-52.32	-20	Pass



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 (mo)
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	36
Cable	ESM Cable Corp.	TT	EV1	NCR	0
Block - DC	Fairview Microwave	SD3379	AMQ	6/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	AWT	NCR	0
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	2/13/2016	12

TEST DESCRIPTION

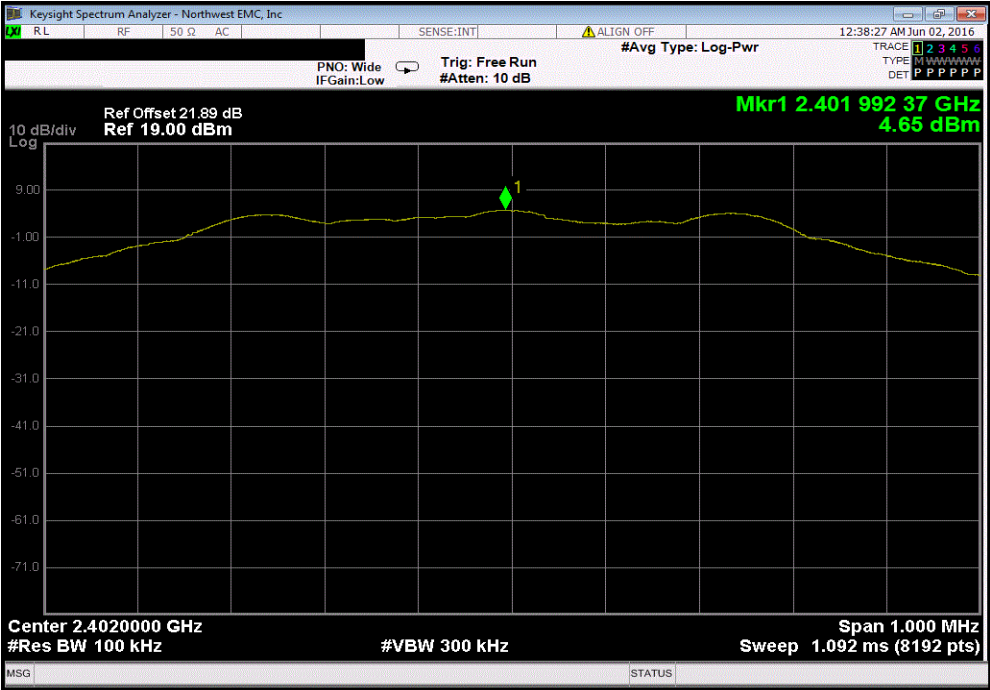
The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the data rate(s) listed in the datasheet. For each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

SPURIOUS CONDUCTED EMISSIONS

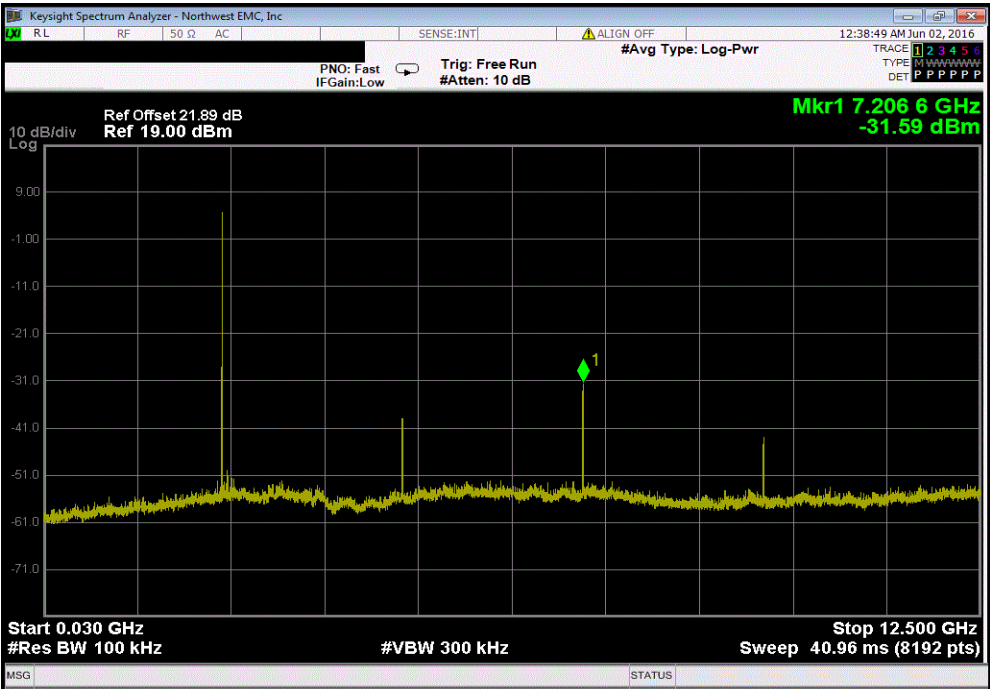
EUT: BluKey Modem		Work Order: PAYR0005	
Serial Number: 020001		Date: 06/01/16	
Customer: Payrange Inc.		Temperature: 22.9°C	
Attendees: Mike Mitchell		Humidity: 44%	
Project: None		Barometric Pres.: 1014.7	
Tested by: Brandon Hobbs		Power: 24VDC Nominal	
		Job Site: EV06	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2016		ANSI C63.10:2013	
COMMENTS			
The product was operating under normal operating conditions.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Frequency Range	Max Value (dBc)
			Limit ≤ (dBc)
			Result
BLE/GFSK Low Channel, 2402 MHz		Fundamental	N/A
BLE/GFSK Low Channel, 2402 MHz		30 MHz - 12.5 GHz	-36.25
BLE/GFSK Low Channel, 2402 MHz		12.5 GHz - 25 GHz	-43.15
BLE/GFSK Mid Channel, 2442 MHz		Fundamental	N/A
BLE/GFSK Mid Channel, 2442 MHz		30 MHz - 12.5 GHz	-33.9
BLE/GFSK Mid Channel, 2442 MHz		12.5 GHz - 25 GHz	-43.21
BLE/GFSK High Channel, 2480 MHz		Fundamental	N/A
BLE/GFSK High Channel, 2480 MHz		30 MHz - 12.5 GHz	-32.92
BLE/GFSK High Channel, 2480 MHz		12.5 GHz - 25 GHz	-43.83
			Pass

SPURIOUS CONDUCTED EMISSIONS

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

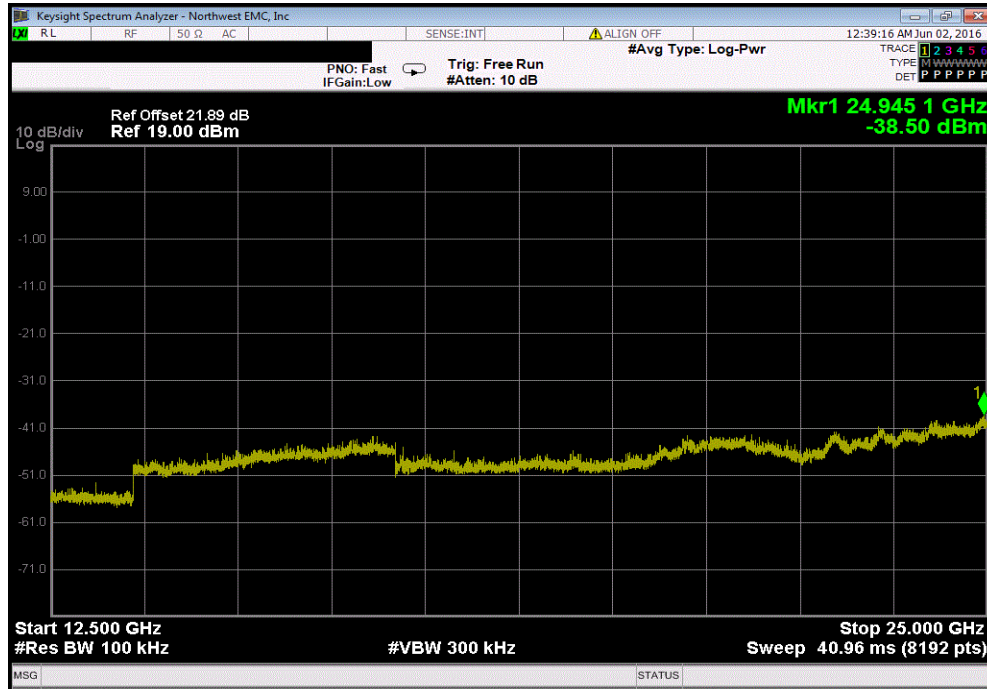


BLE/GFSK Low Channel, 2402 MHz						
Frequency Range		Max Value (dBc)		Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz		-36.25		-20	Pass	

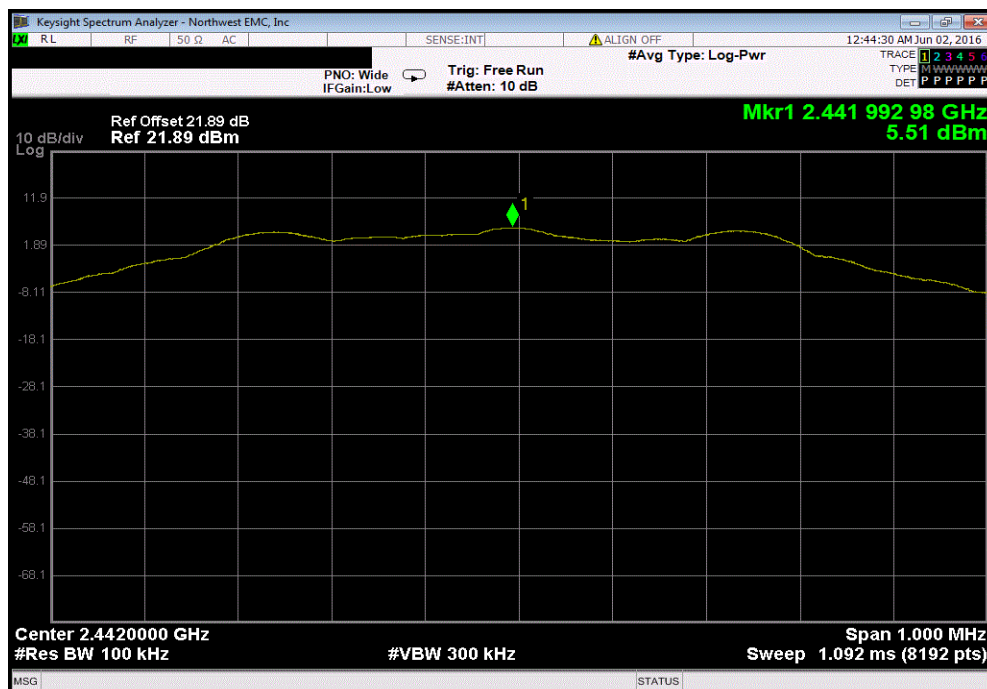


SPURIOUS CONDUCTED EMISSIONS

BLE/GFSK Low Channel, 2402 MHz				
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	-43.15	-20	Pass	

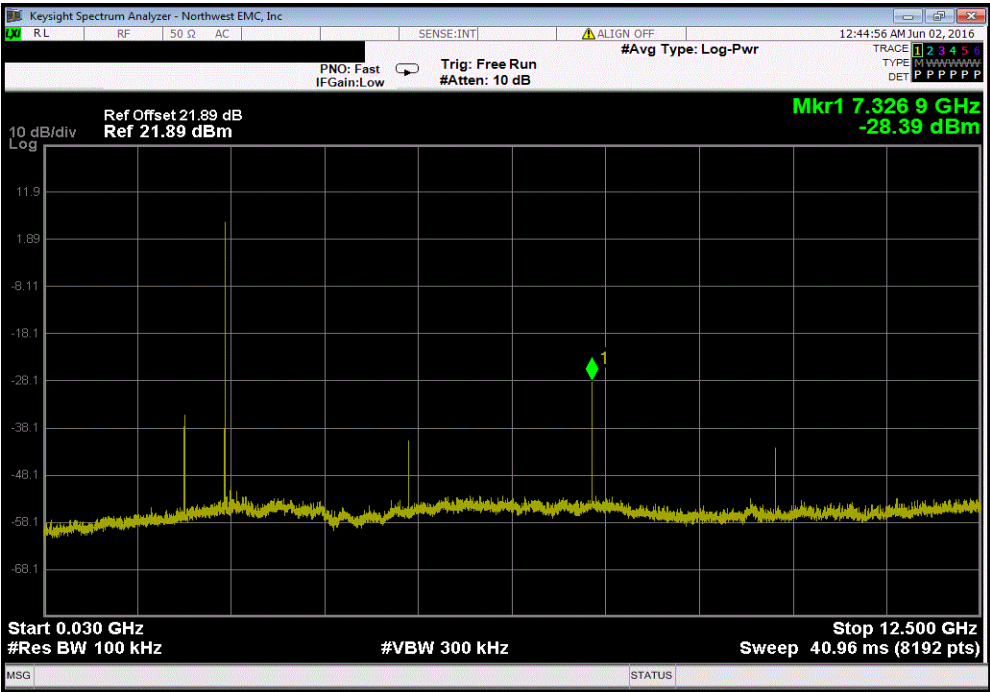


BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	N/A	N/A	N/A	

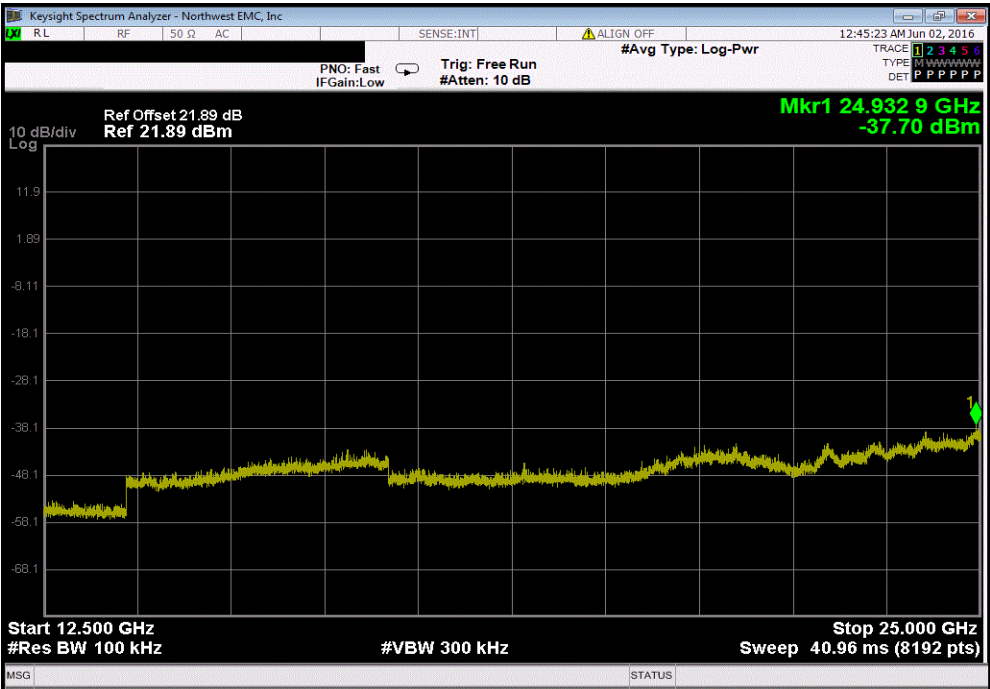


SPURIOUS CONDUCTED EMISSIONS

BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	-33.9	-20	Pass	

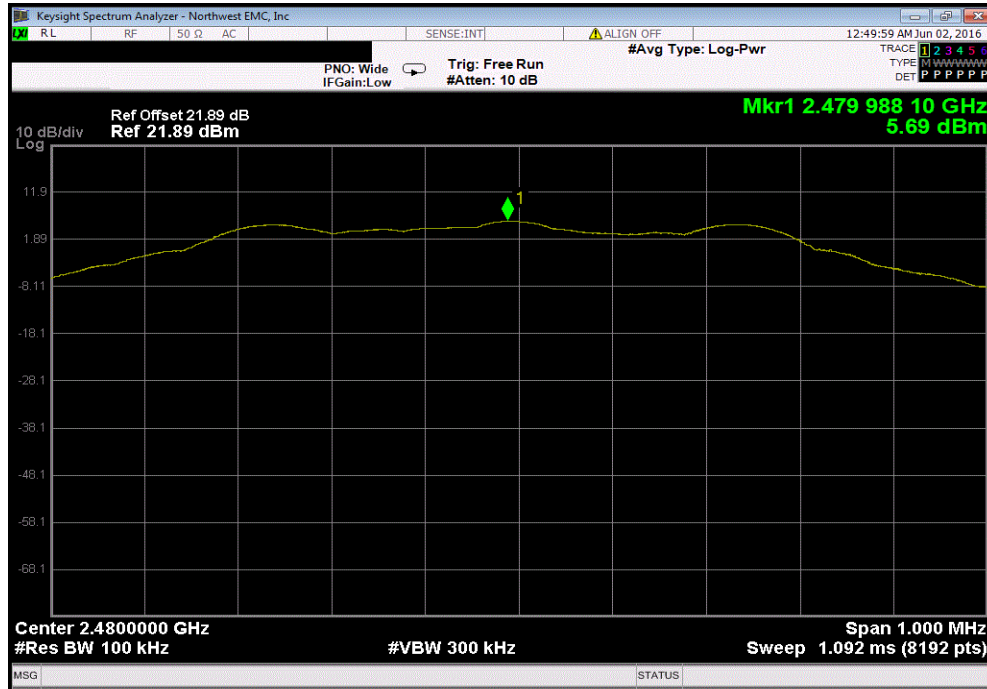


BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	-43.21	-20	Pass	

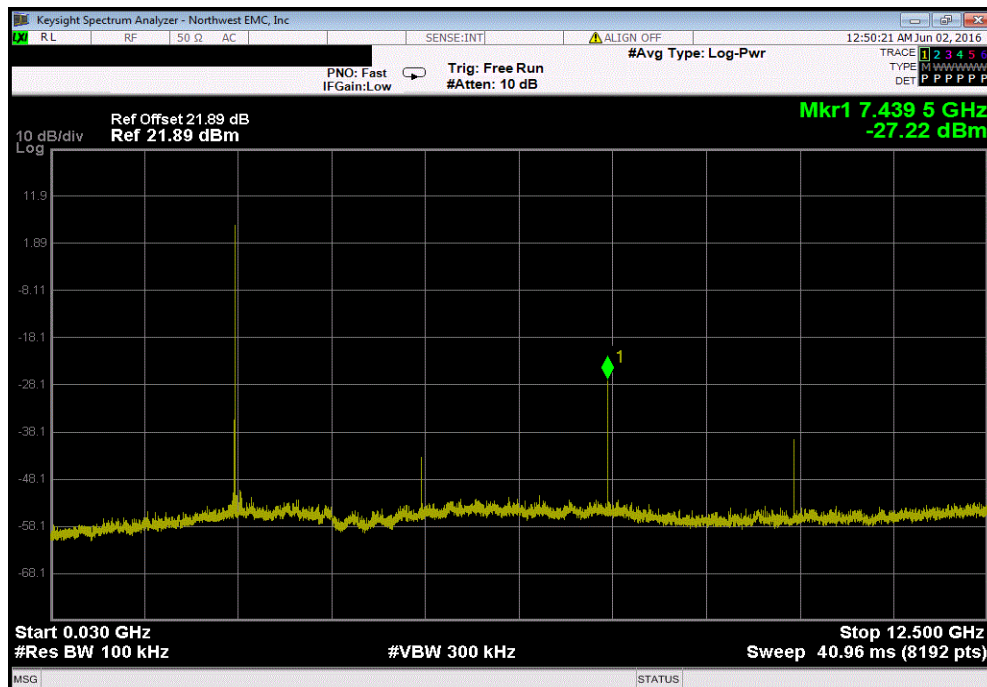


SPURIOUS CONDUCTED EMISSIONS

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

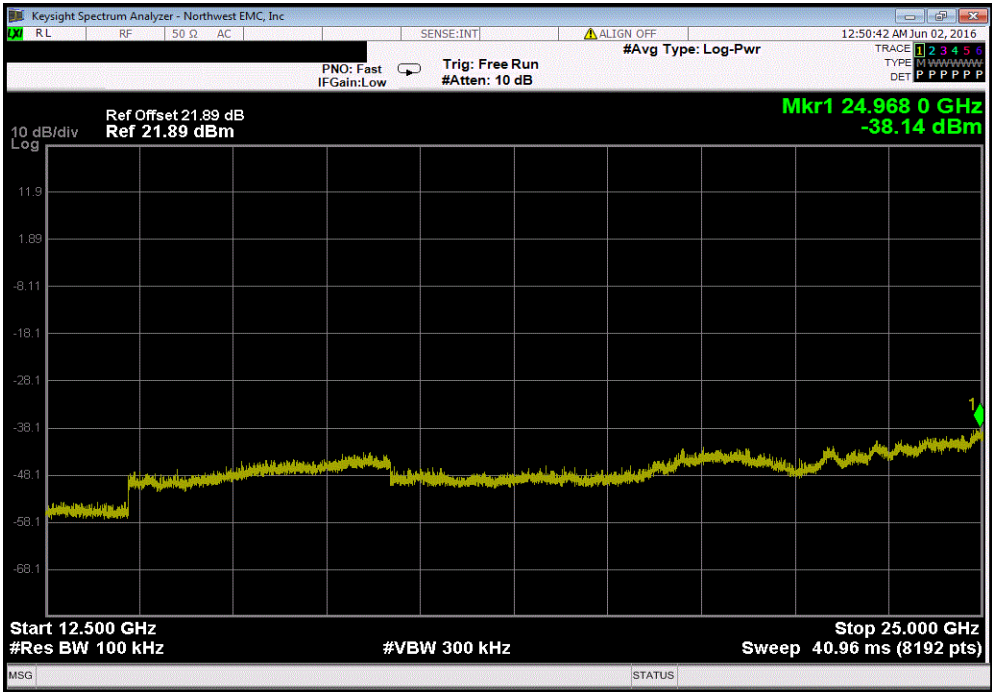


BLE/GFSK High Channel, 2480 MHz						
Frequency Range		Max Value (dBc)		Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz		-32.92		-20	Pass	



SPURIOUS CONDUCTED EMISSIONS

BLE/GFSK High Channel, 2480 MHz				
Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	-43.83	-20	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

Low Ch. 2402 MHz GFSK BTL

Mid Ch. 2442 MHz GFSK BTL

High Ch. 2480 MHz GFSK BTL

POWER SETTINGS INVESTIGATED

24VDC via 110VAC/60Hz

CONFIGURATIONS INVESTIGATED

PAYR0005 - 4

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26 MHz
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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 (mo)
Cable	ESM Cable Corp.	KMKM-72	EVY	11/4/2015	12
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	11/4/2015	12
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	0
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	3/11/2016	12
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	0
Cable	None	Standard Gain Horns Cable	EVF	3/11/2016	12
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	3/11/2016	12
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	0
Filter - High Pass	Micro-Tronics	HPM50111	HFO	3/22/2016	12
Attenuator	Coaxicom	3910-20	AXZ	5/18/2016	12
Cable	N/A	Double Ridge Horn Cables	EVB	3/11/2016	12
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	3/11/2016	12
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	5/18/2016	12
Antenna - Double Ridge	EMCO	3115	AHC	6/13/2014	24
Cable	N/A	Bilog Cables	EVA	3/11/2016	12
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	3/11/2016	12
Antenna - Biconilog	EMCO	3141	AXE	8/29/2014	24
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	4/22/2016	12

TEST DESCRIPTION

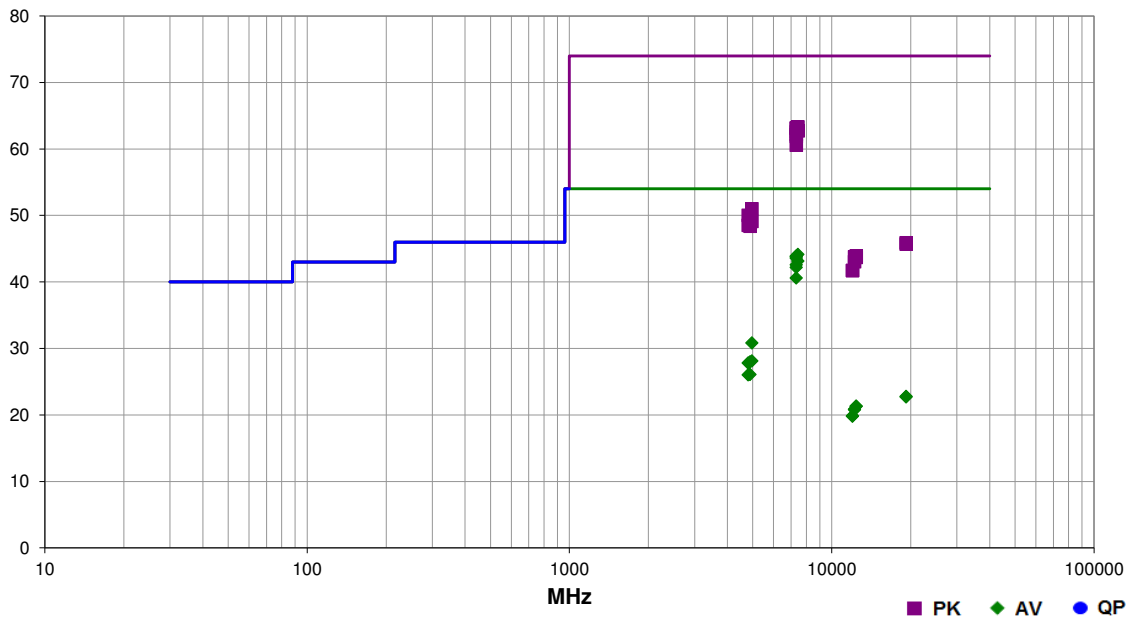
The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify 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.

The source based duty cycle correction factor is: $20 \cdot \log(0.201) = -13.9$ dB. Please see Product Description for details.

Work Order:	PAYR0005	Date:	06/02/16	
Project:	None	Temperature:	22.9 °C	
Job Site:	EV01	Humidity:	45.8% RH	
Serial Number:	020001	Barometric Pres.:	1022 mbar	
EUT:	BluKey Plus			
Configuration:	4			
Customer:	Payrange Inc.			
Attendees:	Mike Mitchell			
EUT Power:	24VDC via 110VAC/60Hz			
Operating Mode:	On, GFSK			
Deviations:	None			
Comments:	Please reference the data comments for EUT orientation, channel and frequency. A correction was added to the average measurements per ANSI C63.10:2013 to compensate for test software operation less than 100%. A duty cycle correction was added to the average measurements per ANSI C63.10:2013 section 7.5 for pulsed emissions.			

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

Run #	15	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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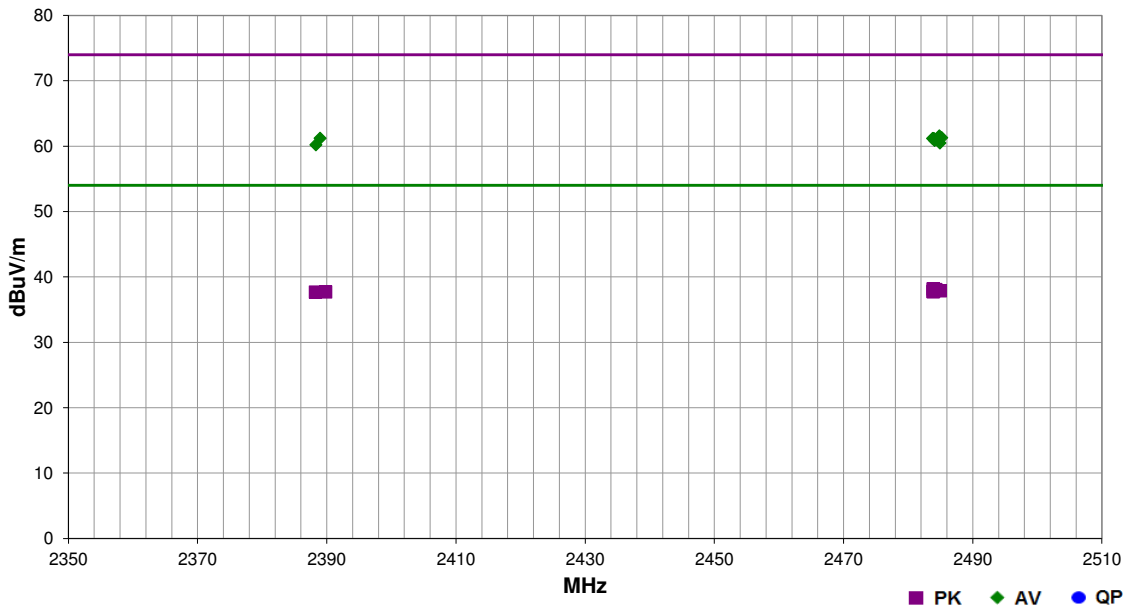


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Correction Factor for RMS (dB)	Duty Cycle Correction Factor (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7439.385	38.3	17.7	1.0	135.0	2.0	-13.9	Horz	AV	0.0	44.1	54.0	-9.9	High Ch.2448MHz, EUT Vertical
7326.375	38.8	17.0	2.6	145.0	2.0	-13.9	Horz	AV	0.0	43.9	54.0	-10.1	Mid Ch.2442MHz, EUT Horz
7326.490	38.7	17.0	3.1	64.0	2.0	-13.9	Horz	AV	0.0	43.8	54.0	-10.2	Mid Ch.2442MHz, EUT Vertical
7326.435	38.5	17.0	2.1	102.0	2.0	-13.9	Horz	AV	0.0	43.6	54.0	-10.4	Mid Ch.2442MHz, EUT On Side
7439.425	37.3	17.7	1.0	127.0	2.0	-13.9	Vert	AV	0.0	43.1	54.0	-10.9	High Ch.2448MHz, EUT On Side
7326.510	37.5	17.0	1.0	78.0	2.0	-13.9	Vert	AV	0.0	42.6	54.0	-11.4	Mid Ch.2442MHz, EUT Horz
7326.445	37.1	17.0	1.0	138.0	2.0	-13.9	Vert	AV	0.0	42.2	54.0	-11.8	Mid Ch.2442MHz, EUT On Side
7439.115	45.6	17.7	1.0	135.0	0.0	0.0	Horz	PK	0.0	63.3	74.0	-10.7	High Ch.2448MHz, EUT Vertical
7326.610	46.2	17.0	3.1	64.0	0.0	0.0	Horz	PK	0.0	63.2	74.0	-10.8	Mid Ch.2442MHz, EUT Vertical
7326.850	46.1	17.0	2.6	145.0	0.0	0.0	Horz	PK	0.0	63.1	74.0	-10.9	Mid Ch.2442MHz, EUT Horz
7439.830	45.0	17.7	1.0	127.0	0.0	0.0	Vert	PK	0.0	62.7	74.0	-11.3	High Ch.2448MHz, EUT On Side
7326.760	45.6	17.0	2.1	102.0	0.0	0.0	Horz	PK	0.0	62.6	74.0	-11.4	Mid Ch.2442MHz, EUT On Side
7326.375	35.5	17.0	1.0	39.0	2.0	-13.9	Vert	AV	0.0	40.6	54.0	-13.4	Mid Ch.2442MHz, EUT Vertical
7326.295	45.2	17.0	1.0	78.0	0.0	0.0	Vert	PK	0.0	62.2	74.0	-11.8	Mid Ch.2442MHz, EUT Horz
7326.835	44.9	17.0	1.0	138.0	0.0	0.0	Vert	PK	0.0	61.9	74.0	-12.1	Mid Ch.2442MHz, EUT On Side
7325.265	43.6	17.0	1.0	39.0	0.0	0.0	Vert	PK	0.0	60.6	74.0	-13.4	Mid Ch.2442MHz, EUT Vertical
4959.795	33.1	9.6	2.1	64.0	2.0	-13.9	Horz	AV	0.0	30.8	54.0	-23.2	High Ch.2448MHz, EUT Vertical
4959.110	41.4	9.6	2.1	64.0	0.0	0.0	Horz	PK	0.0	51.0	74.0	-23.0	High Ch.2448MHz, EUT Vertical
4959.860	30.4	9.6	1.1	121.0	2.0	-13.9	Vert	AV	0.0	28.1	54.0	-25.9	High Ch.2448MHz, EUT On Side
4803.635	40.8	9.2	2.1	66.0	0.0	0.0	Horz	PK	0.0	50.0	74.0	-24.0	Low Ch.2402MHz, EUT Vertical
4884.020	30.4	9.5	2.2	52.0	2.0	-13.9	Horz	AV	0.0	28.0	54.0	-26.0	Mid Ch.2442MHz, EUT Vertical
4803.950	30.5	9.2	2.1	66.0	2.0	-13.9	Horz	AV	0.0	27.8	54.0	-26.2	Low Ch.2402MHz, EUT Vertical
4884.005	40.3	9.5	2.2	52.0	0.0	0.0	Horz	PK	0.0	49.8	74.0	-24.2	Mid Ch.2442MHz, EUT Vertical
4958.895	39.5	9.6	1.1	121.0	0.0	0.0	Vert	PK	0.0	49.1	74.0	-24.9	High Ch.2448MHz, EUT On Side
4804.010	39.3	9.2	1.0	72.0	0.0	0.0	Vert	PK	0.0	48.5	74.0	-25.5	Low Ch.2402MHz, EUT On Side

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Correction Factor for RMS (dB)	Duty Cycle Correction Factor (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4883.845	38.9	9.5	1.0	121.0	0.0	0.0	Vert	PK	0.0	48.4	74.0	-25.6	Mid Ch.2442MHz, EUT On Side
4883.885	28.5	9.5	1.0	121.0	2.0	-13.9	Vert	AV	0.0	26.1	54.0	-27.9	Mid Ch.2442MHz, EUT On Side
4803.845	28.7	9.2	1.0	72.0	2.0	-13.9	Vert	AV	0.0	26.0	54.0	-28.0	Low Ch.2402MHz, EUT On Side
19216.290	45.2	0.7	1.6	52.0	0.0	0.0	Vert	PK	0.0	45.9	74.0	-28.1	Low Ch.2402MHz, EUT On Side
19216.270	45.0	0.7	1.6	148.0	0.0	0.0	Horz	PK	0.0	45.7	74.0	-28.3	Low Ch.2402MHz, EUT Vertical
19214.670	34.0	0.7	1.6	148.0	2.0	-13.9	Horz	AV	0.0	22.8	54.0	-31.2	Low Ch.2402MHz, EUT Vertical
19215.830	33.9	0.7	1.6	52.0	2.0	-13.9	Vert	AV	0.0	22.7	54.0	-31.3	Low Ch.2402MHz, EUT On Side
12399.100	38.9	5.0	1.8	134.0	0.0	0.0	Vert	PK	0.0	43.9	74.0	-30.1	High Ch.2480MHz, EUT On Side
12208.820	39.3	4.5	2.4	57.0	0.0	0.0	Vert	PK	0.0	43.8	74.0	-30.2	Mid Ch.2442MHz, EUT On Side
12398.690	38.7	5.0	1.0	115.0	0.0	0.0	Horz	PK	0.0	43.7	74.0	-30.3	High Ch.2480MHz, EUT Vertical
12398.670	28.2	5.0	1.0	115.0	2.0	-13.9	Horz	AV	0.0	21.3	54.0	-32.7	High Ch.2480MHz, EUT Vertical
12398.720	28.2	5.0	1.8	134.0	2.0	-13.9	Vert	AV	0.0	21.3	54.0	-32.7	High Ch.2480MHz, EUT On Side
12208.600	38.6	4.5	1.1	105.0	0.0	0.0	Horz	PK	0.0	43.1	74.0	-30.9	Mid Ch.2442MHz, EUT Vertical
12208.770	28.3	4.5	2.4	57.0	2.0	-13.9	Vert	AV	0.0	20.9	54.0	-33.1	Mid Ch.2442MHz, EUT On Side
12208.680	28.2	4.5	1.1	105.0	2.0	-13.9	Horz	AV	0.0	20.8	54.0	-33.2	Mid Ch.2442MHz, EUT Vertical
12008.730	28.4	3.3	3.7	0.0	2.0	-13.9	Vert	AV	0.0	19.8	54.0	-34.2	Low Ch.2402MHz, EUT On Side
12008.680	28.4	3.3	1.0	101.0	2.0	-13.9	Horz	AV	0.0	19.8	54.0	-34.2	Low Ch.2402MHz, EUT Vertical
12009.330	38.4	3.3	3.7	0.0	0.0	0.0	Vert	PK	0.0	41.7	74.0	-32.3	Low Ch.2402MHz, EUT On Side
12008.680	38.4	3.3	1.0	101.0	0.0	0.0	Horz	PK	0.0	41.7	74.0	-32.3	Low Ch.2402MHz, EUT Vertical

Work Order:	PAYR0005	Date:	06/02/16		
Project:	None	Temperature:	22.9 °C		
Job Site:	EV01	Humidity:	45.8% RH		
Serial Number:	020001	Barometric Pres.:	1022 mbar	Tested by:	Brandon Hobbs
EUT:	BluKey Plus				
Configuration:	4				
Customer:	Payrange Inc.				
Attendees:	Mike Mitchell				
EUT Power:	24VDC via 110VAC/60Hz				
Operating Mode:	On, GFSK				
Deviations:	None				
Comments:	Please reference the data comments for EUT orientation, channel and frequency. A correction was added to the average measurements per ANSI C63.10:2013 to compensate for test software operation less than 100%. A duty cycle correction was added to the average measurements per ANSI C63.10:2013 section 7.5 for pulsed emissions.				
Test Specifications	FCC 15.247:2016			Test Method	ANSI C63.10:2013

Run #	19	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Correction Factor for RMS (dB)	Duty Cycle Correction Factor (dB)	Polarity/Transducer Type	Detector	External Attenuation (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2484.850	42.0	-0.4	2.2	102.0	0.0	0.0	Horz	PK	20.0	61.6	74.0	-12.4	High Ch.2480MHz, EUT On Side
2485.207	41.7	-0.4	1.0	206.0	0.0	0.0	Vert	PK	20.0	61.3	74.0	-12.7	High Ch.2480MHz, EUT Horz
2388.967	42.0	-0.8	1.0	246.0	0.0	0.0	Horz	PK	20.0	61.2	74.0	-12.8	Low Ch.2402MHz, EUT Vertical
2483.983	41.6	-0.4	1.0	168.0	0.0	0.0	Vert	PK	20.0	61.2	74.0	-12.8	High Ch.2480MHz, EUT On Side
2483.807	41.6	-0.4	1.0	337.0	0.0	0.0	Horz	PK	20.0	61.2	74.0	-12.8	High Ch.2480MHz, EUT Vertical
2484.117	41.3	-0.4	1.0	293.0	0.0	0.0	Vert	PK	20.0	60.9	74.0	-13.1	High Ch.2480MHz, EUT Vertical
2484.917	40.9	-0.4	1.0	310.0	0.0	0.0	Horz	PK	20.0	60.5	74.0	-13.5	High Ch.2480MHz, EUT Horz
2388.323	41.0	-0.8	1.0	7.0	0.0	0.0	Vert	PK	20.0	60.2	74.0	-13.8	Low Ch.2402MHz, EUT Vertical
2483.853	30.5	-0.4	1.0	337.0	2.0	-13.9	Horz	AV	20.0	38.2	54.0	-15.8	High Ch.2480MHz, EUT Vertical
2484.273	30.4	-0.4	1.0	293.0	2.0	-13.9	Vert	AV	20.0	38.1	54.0	-15.9	High Ch.2480MHz, EUT Vertical
2484.977	30.2	-0.4	1.0	310.0	2.0	-13.9	Horz	AV	20.0	37.9	54.0	-16.1	High Ch.2480MHz, EUT Horz
2483.923	30.1	-0.4	1.0	206.0	2.0	-13.9	Vert	AV	20.0	37.8	54.0	-16.2	High Ch.2480MHz, EUT Horz
2483.890	30.1	-0.4	1.0	168.0	2.0	-13.9	Vert	AV	20.0	37.8	54.0	-16.2	High Ch.2480MHz, EUT On Side
2483.840	30.1	-0.4	2.2	102.0	2.0	-13.9	Horz	AV	20.0	37.8	54.0	-16.2	High Ch.2480MHz, EUT On Side
2389.817	30.4	-0.8	1.0	246.0	2.0	-13.9	Horz	AV	20.0	37.7	54.0	-16.3	Low Ch.2402MHz, EUT Vertical
2388.237	30.4	-0.8	1.0	7.0	2.0	-13.9	Vert	AV	20.0	37.7	54.0	-16.3	Low Ch.2402MHz, EUT Vertical

AC - POWERLINE CONDUCTED EMISSIONS

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Cable - Conducted Cable Assembly	Northwest EMC	EVG, HHD, RKA	EVGA	5/10/2016	5/10/2017
Receiver	Rohde & Schwarz	ESCI	ARH	3/21/2016	3/21/2017
LISN	Solar Electronics	9252-50-R-24-BNC	LIP	1/27/2015	1/27/2017

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	+ XX	- XX

CONFIGURATIONS INVESTIGATED

PAYR0005-2

MODES INVESTIGATED

On Tx, Continuous 2402 MHz GFSK BTLE
On Tx, Continuous 2480 MHz GFSK BTLE

AC - POWERLINE CONDUCTED EMISSIONS

EUT:	BluKey Plus	Work Order:	PAYR0005
Serial Number:	020001	Date:	06/01/2016
Customer:	Payrange Inc.	Temperature:	23°C
Attendees:	Mike Mitchell	Relative Humidity:	43.4%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Brandon Hobbs	Job Site:	EV07
Power:	24VDC via 110VAC/60Hz	Configuration:	PAYR0005-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	3	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

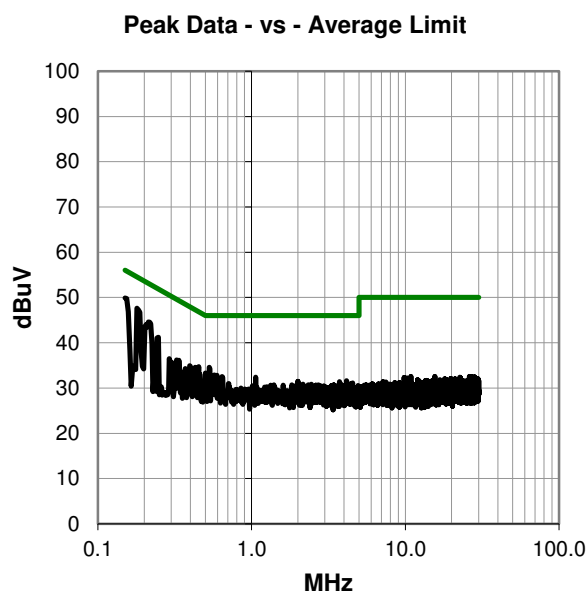
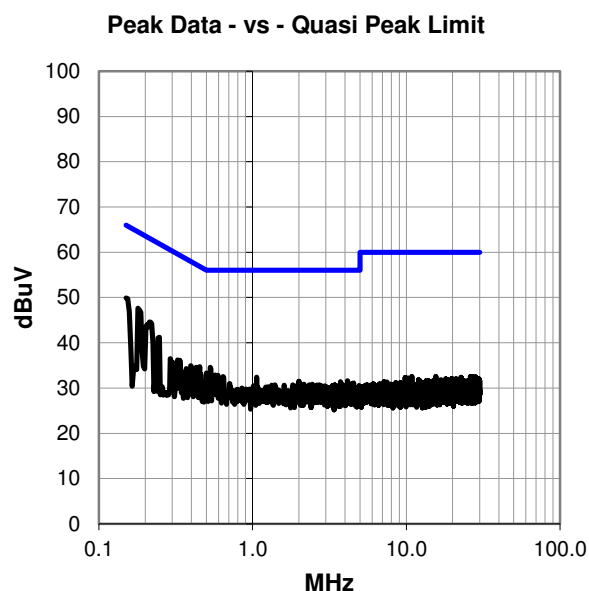
None

EUT OPERATING MODES

On Tx, Continuous 2402 MHz GFSK BTLE

DEVIATIONS FROM TEST STANDARD

None



AC - POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #3

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.150	30.0	19.9	49.9	66.0	-16.1
0.180	27.8	19.8	47.6	64.5	-16.9
0.213	24.8	19.8	44.6	63.1	-18.5
0.247	21.4	19.8	41.2	61.9	-20.7
0.531	14.9	19.7	34.6	56.0	-21.4
0.452	15.0	19.7	34.7	56.8	-22.1
0.430	14.9	19.7	34.6	57.3	-22.7
0.501	13.6	19.7	33.3	56.0	-22.7
0.396	15.2	19.7	34.9	57.9	-23.0
0.572	13.2	19.7	32.9	56.0	-23.1
0.337	16.4	19.7	36.1	59.3	-23.2
0.594	13.1	19.7	32.8	56.0	-23.2
0.325	16.5	19.7	36.2	59.6	-23.4
0.642	12.8	19.7	32.5	56.0	-23.5
1.064	12.6	19.8	32.4	56.0	-23.6
0.292	16.8	19.7	36.5	60.5	-24.0
0.370	14.6	19.7	34.3	58.5	-24.2
4.157	11.7	19.9	31.6	56.0	-24.4
2.000	11.7	19.8	31.5	56.0	-24.5
3.739	11.5	19.9	31.4	56.0	-24.6
4.534	11.2	19.9	31.1	56.0	-24.9
0.706	11.3	19.7	31.0	56.0	-25.0
4.179	11.1	19.9	31.0	56.0	-25.0
4.444	11.1	19.9	31.0	56.0	-25.0
2.153	11.0	19.8	30.8	56.0	-25.2
2.444	11.0	19.8	30.8	56.0	-25.2

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.150	30.0	19.9	49.9	56.0	-6.1
0.180	27.8	19.8	47.6	54.5	-6.9
0.213	24.8	19.8	44.6	53.1	-8.5
0.247	21.4	19.8	41.2	51.9	-10.7
0.531	14.9	19.7	34.6	46.0	-11.4
0.452	15.0	19.7	34.7	46.8	-12.1
0.430	14.9	19.7	34.6	47.3	-12.7
0.501	13.6	19.7	33.3	46.0	-12.7
0.396	15.2	19.7	34.9	47.9	-13.0
0.572	13.2	19.7	32.9	46.0	-13.1
0.337	16.4	19.7	36.1	49.3	-13.2
0.594	13.1	19.7	32.8	46.0	-13.2
0.325	16.5	19.7	36.2	49.6	-13.4
0.642	12.8	19.7	32.5	46.0	-13.5
1.064	12.6	19.8	32.4	46.0	-13.6
0.292	16.8	19.7	36.5	50.5	-14.0
0.370	14.6	19.7	34.3	48.5	-14.2
4.157	11.7	19.9	31.6	46.0	-14.4
2.000	11.7	19.8	31.5	46.0	-14.5
3.739	11.5	19.9	31.4	46.0	-14.6
4.534	11.2	19.9	31.1	46.0	-14.9
0.706	11.3	19.7	31.0	46.0	-15.0
4.179	11.1	19.9	31.0	46.0	-15.0
4.444	11.1	19.9	31.0	46.0	-15.0
2.153	11.0	19.8	30.8	46.0	-15.2
2.444	11.0	19.8	30.8	46.0	-15.2

CONCLUSION

Pass



Tested By

AC - POWERLINE CONDUCTED EMISSIONS

EUT:	BluKey Plus	Work Order:	PAYR0005
Serial Number:	020001	Date:	06/01/2016
Customer:	Payrange Inc.	Temperature:	23°C
Attendees:	Mike	Relative Humidity:	43.4%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Brandon Hobbs	Job Site:	EV07
Power:	24VDC via 110VAC/60Hz	Configuration:	PAYR0005-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	4	Line:	Neutral	Add. Ext. Attenuation (dB):	0
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COMMENTS

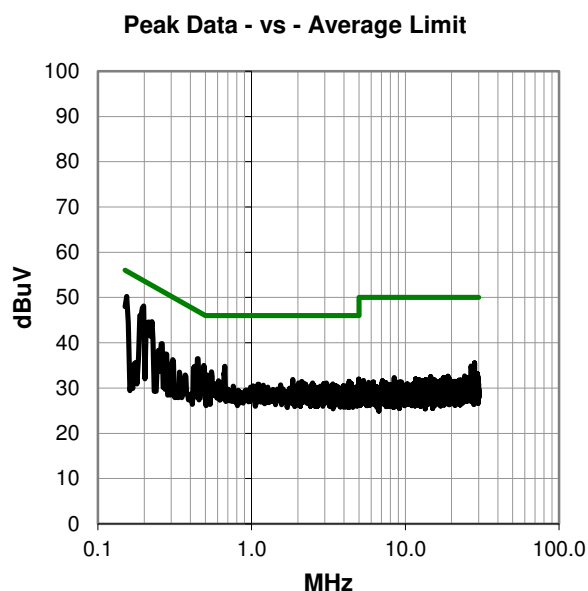
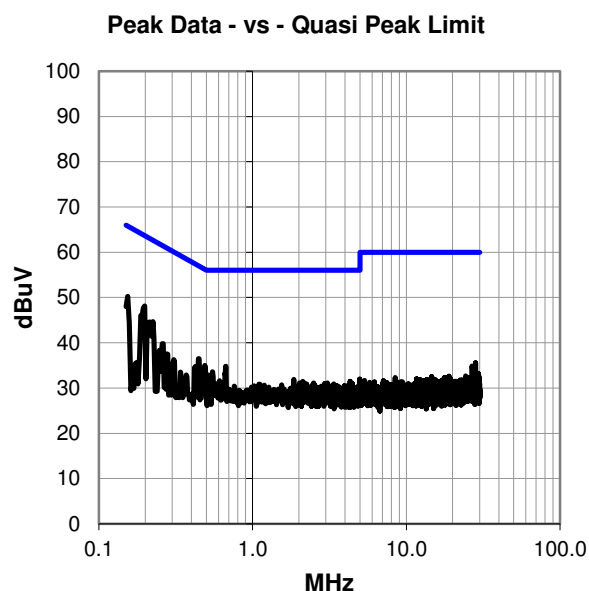
None

EUT OPERATING MODES

On Tx, Continuous 2402 MHz GFSK BTLE

DEVIATIONS FROM TEST STANDARD

None



AC - POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #4

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.154	30.4	19.9	50.3	65.8	-15.5
0.199	28.3	19.8	48.1	63.7	-15.6
0.225	24.9	19.8	44.7	62.6	-17.9
0.213	24.8	19.8	44.6	63.1	-18.5
0.445	16.8	19.7	36.5	57.0	-20.5
0.490	15.3	19.7	35.0	56.2	-21.2
0.669	15.1	19.7	34.8	56.0	-21.2
0.258	20.0	19.8	39.8	61.5	-21.7
0.549	13.9	19.7	33.6	56.0	-22.4
0.426	15.1	19.7	34.8	57.3	-22.5
0.516	13.2	19.7	32.9	56.0	-23.1
0.277	17.8	19.8	37.6	60.9	-23.3
0.247	18.5	19.8	38.3	61.9	-23.6
0.307	16.6	19.7	36.3	60.1	-23.8
4.974	12.0	20.0	32.0	56.0	-24.0
1.851	12.1	19.8	31.9	56.0	-24.1
0.609	11.9	19.7	31.6	56.0	-24.4
28.243	14.4	21.2	35.6	60.0	-24.4
2.124	11.7	19.8	31.5	56.0	-24.5
4.314	11.6	19.9	31.5	56.0	-24.5
0.639	11.5	19.7	31.2	56.0	-24.8
2.019	11.3	19.8	31.1	56.0	-24.9
2.176	11.3	19.8	31.1	56.0	-24.9
2.497	11.3	19.8	31.1	56.0	-24.9
3.071	11.2	19.9	31.1	56.0	-24.9
4.455	11.1	19.9	31.0	56.0	-25.0

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.154	30.4	19.9	50.3	55.8	-5.5
0.199	28.3	19.8	48.1	53.7	-5.6
0.225	24.9	19.8	44.7	52.6	-7.9
0.213	24.8	19.8	44.6	53.1	-8.5
0.445	16.8	19.7	36.5	47.0	-10.5
0.490	15.3	19.7	35.0	46.2	-11.2
0.669	15.1	19.7	34.8	46.0	-11.2
0.258	20.0	19.8	39.8	51.5	-11.7
0.549	13.9	19.7	33.6	46.0	-12.4
0.426	15.1	19.7	34.8	47.3	-12.5
0.516	13.2	19.7	32.9	46.0	-13.1
0.277	17.8	19.8	37.6	50.9	-13.3
0.247	18.5	19.8	38.3	51.9	-13.6
0.307	16.6	19.7	36.3	50.1	-13.8
4.974	12.0	20.0	32.0	46.0	-14.0
1.851	12.1	19.8	31.9	46.0	-14.1
0.609	11.9	19.7	31.6	46.0	-14.4
28.243	14.4	21.2	35.6	50.0	-14.4
2.124	11.7	19.8	31.5	46.0	-14.5
4.314	11.6	19.9	31.5	46.0	-14.5
0.639	11.5	19.7	31.2	46.0	-14.8
2.019	11.3	19.8	31.1	46.0	-14.9
2.176	11.3	19.8	31.1	46.0	-14.9
2.497	11.3	19.8	31.1	46.0	-14.9
3.071	11.2	19.9	31.1	46.0	-14.9
4.455	11.1	19.9	31.0	46.0	-15.0

CONCLUSION

Pass



Tested By

AC - POWERLINE CONDUCTED EMISSIONS

EUT:	BluKey Plus	Work Order:	PAYR0005
Serial Number:	020001	Date:	06/01/2016
Customer:	Payrange Inc.	Temperature:	23°C
Attendees:	Mike	Relative Humidity:	43.4%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Brandon Hobbs	Job Site:	EV07
Power:	24VDC via 110VAC/60Hz	Configuration:	PAYR0005-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	5	Line:	Neutral	Add. Ext. Attenuation (dB):	0
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COMMENTS

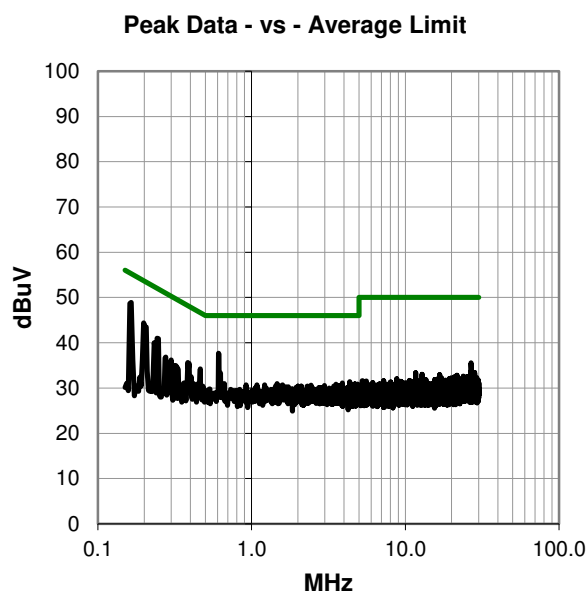
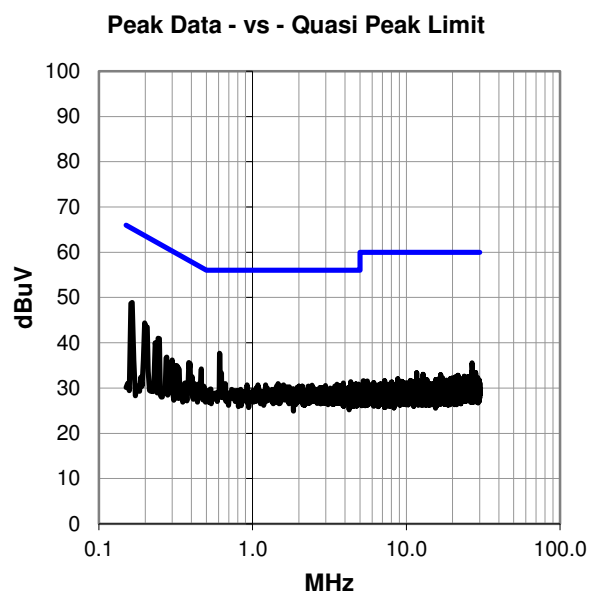
None

EUT OPERATING MODES

On Tx, Continuous 2480 MHz GFSK BTLE

DEVIATIONS FROM TEST STANDARD

None



AC - POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #5

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.165	29.1	19.8	48.9	65.2	-16.3
0.609	18.0	19.7	37.7	56.0	-18.3
0.199	24.6	19.8	44.4	63.7	-19.3
0.243	21.2	19.8	41.0	62.0	-21.0
0.232	20.2	19.8	40.0	62.4	-22.4
0.463	14.5	19.7	34.2	56.6	-22.4
0.385	15.9	19.7	35.6	58.2	-22.6
0.628	13.6	19.7	33.3	56.0	-22.7
0.277	17.1	19.8	36.9	60.9	-24.0
0.299	16.5	19.7	36.2	60.3	-24.1
26.833	14.5	21.1	35.6	60.0	-24.4
4.343	11.5	19.9	31.4	56.0	-24.6
0.318	15.3	19.7	35.0	59.8	-24.8
3.888	11.2	19.9	31.1	56.0	-24.9
0.329	14.8	19.7	34.5	59.5	-25.0
0.665	11.3	19.7	31.0	56.0	-25.0
1.467	11.2	19.8	31.0	56.0	-25.0
4.698	11.0	19.9	30.9	56.0	-25.1
4.884	10.9	19.9	30.8	56.0	-25.2
3.549	10.9	19.9	30.8	56.0	-25.2
0.404	12.8	19.7	32.5	57.8	-25.3
0.922	11.0	19.7	30.7	56.0	-25.3
1.083	10.9	19.8	30.7	56.0	-25.3
1.213	10.9	19.8	30.7	56.0	-25.3
1.590	10.9	19.8	30.7	56.0	-25.3
4.452	10.8	19.9	30.7	56.0	-25.3

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.165	29.1	19.8	48.9	55.2	-6.3
0.609	18.0	19.7	37.7	46.0	-8.3
0.199	24.6	19.8	44.4	53.7	-9.3
0.243	21.2	19.8	41.0	52.0	-11.0
0.232	20.2	19.8	40.0	52.4	-12.4
0.463	14.5	19.7	34.2	46.6	-12.4
0.385	15.9	19.7	35.6	48.2	-12.6
0.628	13.6	19.7	33.3	46.0	-12.7
0.277	17.1	19.8	36.9	50.9	-14.0
0.299	16.5	19.7	36.2	50.3	-14.1
26.833	14.5	21.1	35.6	50.0	-14.4
4.343	11.5	19.9	31.4	46.0	-14.6
0.318	15.3	19.7	35.0	49.8	-14.8
3.888	11.2	19.9	31.1	46.0	-14.9
0.329	14.8	19.7	34.5	49.5	-15.0
0.665	11.3	19.7	31.0	46.0	-15.0
1.467	11.2	19.8	31.0	46.0	-15.0
4.698	11.0	19.9	30.9	46.0	-15.1
4.884	10.9	19.9	30.8	46.0	-15.2
3.549	10.9	19.9	30.8	46.0	-15.2
0.404	12.8	19.7	32.5	47.8	-15.3
0.922	11.0	19.7	30.7	46.0	-15.3
1.083	10.9	19.8	30.7	46.0	-15.3
1.213	10.9	19.8	30.7	46.0	-15.3
1.590	10.9	19.8	30.7	46.0	-15.3
4.452	10.8	19.9	30.7	46.0	-15.3

CONCLUSION

Pass



Tested By

AC - POWERLINE CONDUCTED EMISSIONS

EUT:	BluKey Plus	Work Order:	PAYR0005
Serial Number:	020001	Date:	06/01/2016
Customer:	Payrange Inc.	Temperature:	23°C
Attendees:	Mike	Relative Humidity:	43.4%
Customer Project:	None	Bar. Pressure:	1017 mb
Tested By:	Brandon Hobbs	Job Site:	EV07
Power:	24VDC via 110VAC/60Hz	Configuration:	PAYR0005-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	7	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

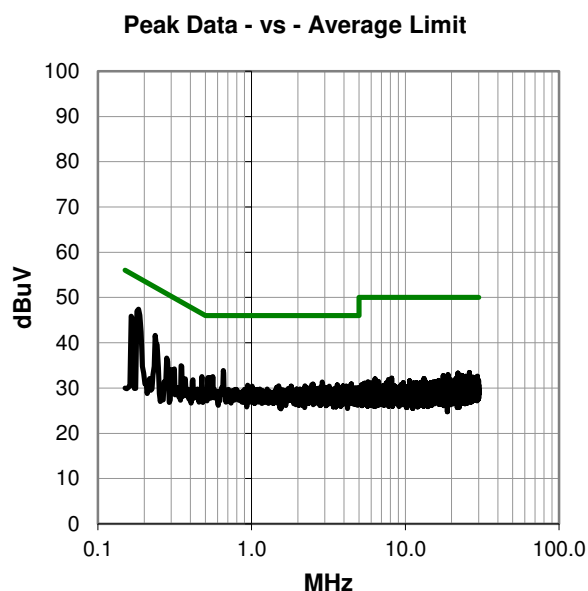
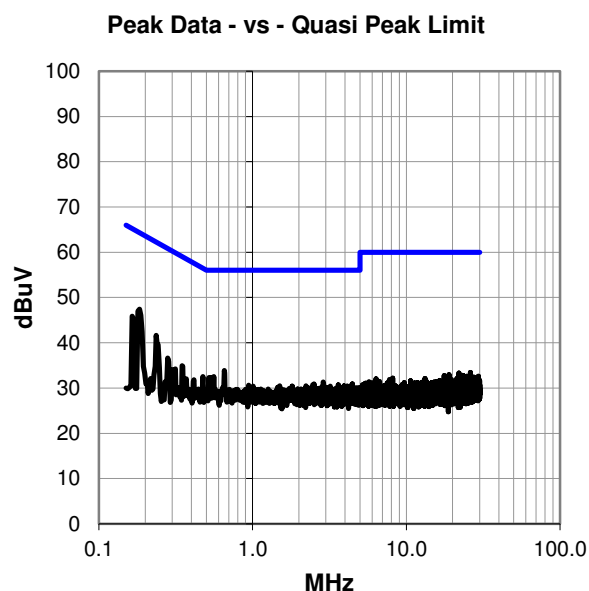
None

EUT OPERATING MODES

On Tx, Continuous 2480 MHz GFSK BTLE

DEVIATIONS FROM TEST STANDARD

None



AC - POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #7

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.184	27.6	19.8	47.4	64.3	-16.9
0.165	26.1	19.8	45.9	65.2	-19.3
0.236	21.8	19.8	41.6	62.2	-20.6
0.654	14.2	19.7	33.9	56.0	-22.1
0.560	12.8	19.7	32.5	56.0	-23.5
0.519	12.6	19.7	32.3	56.0	-23.7
0.538	12.6	19.7	32.3	56.0	-23.7
0.475	12.8	19.7	32.5	56.4	-23.9
0.348	15.2	19.7	34.9	59.0	-24.1
0.281	16.9	19.7	36.6	60.8	-24.2
2.885	11.5	19.8	31.3	56.0	-24.7
2.504	11.1	19.8	30.9	56.0	-25.1
4.463	11.0	19.9	30.9	56.0	-25.1
2.463	10.9	19.8	30.7	56.0	-25.3
2.523	10.9	19.8	30.7	56.0	-25.3
3.612	10.8	19.9	30.7	56.0	-25.3
0.945	10.9	19.8	30.7	56.0	-25.3
4.384	10.7	19.9	30.6	56.0	-25.4
1.501	10.7	19.8	30.5	56.0	-25.5
2.228	10.7	19.8	30.5	56.0	-25.5
3.937	10.6	19.9	30.5	56.0	-25.5
1.008	10.6	19.8	30.4	56.0	-25.6
1.810	10.6	19.8	30.4	56.0	-25.6
3.202	10.5	19.9	30.4	56.0	-25.6
4.123	10.5	19.9	30.4	56.0	-25.6
0.314	14.5	19.7	34.2	59.9	-25.7

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.184	27.6	19.8	47.4	54.3	-6.9
0.165	26.1	19.8	45.9	55.2	-9.3
0.236	21.8	19.8	41.6	52.2	-10.6
0.654	14.2	19.7	33.9	46.0	-12.1
0.560	12.8	19.7	32.5	46.0	-13.5
0.519	12.6	19.7	32.3	46.0	-13.7
0.538	12.6	19.7	32.3	46.0	-13.7
0.475	12.8	19.7	32.5	46.4	-13.9
0.348	15.2	19.7	34.9	49.0	-14.1
0.281	16.9	19.7	36.6	50.8	-14.2
2.885	11.5	19.8	31.3	46.0	-14.7
2.504	11.1	19.8	30.9	46.0	-15.1
4.463	11.0	19.9	30.9	46.0	-15.1
2.463	10.9	19.8	30.7	46.0	-15.3
2.523	10.9	19.8	30.7	46.0	-15.3
3.612	10.8	19.9	30.7	46.0	-15.3
0.945	10.9	19.8	30.7	46.0	-15.3
4.384	10.7	19.9	30.6	46.0	-15.4
1.501	10.7	19.8	30.5	46.0	-15.5
2.228	10.7	19.8	30.5	46.0	-15.5
3.937	10.6	19.9	30.5	46.0	-15.5
1.008	10.6	19.8	30.4	46.0	-15.6
1.810	10.6	19.8	30.4	46.0	-15.6
3.202	10.5	19.9	30.4	46.0	-15.6
4.123	10.5	19.9	30.4	46.0	-15.6
0.314	14.5	19.7	34.2	49.9	-15.7

CONCLUSION

Pass



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