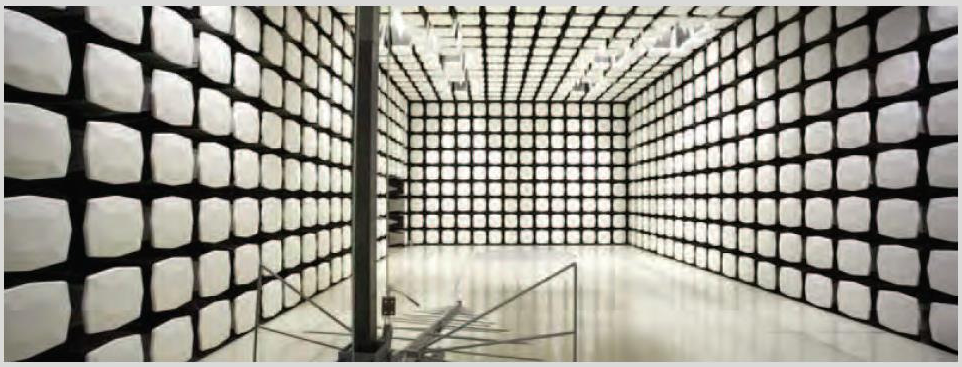
NORTHWEST EMC

Parker Hannifin Corporation

QX-008-427

FCC 15.207:2015
FCC 15.247:2015

Report # PQCD0003



NVLAP Lab Code: 200881-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

Last Date of Test: October 07, 2015
Parker Hannifin Corporation
Model: QX-008-427

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2015	ANSI C63.10:2013
FCC 15.247:2015	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
6.10.4	Band Edge Compliance	Yes	Pass	
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9	Output Power	Yes	Pass	
11.10	Power Spectral Density	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Tim O'Shea, 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
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

NORTHWEST EMC
REV 2015.2.19

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 Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

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

Korea

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

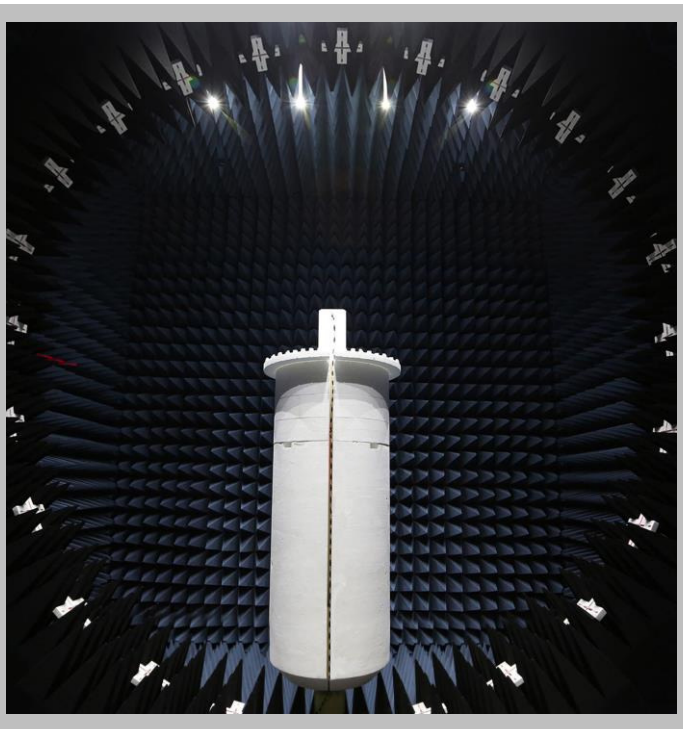
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

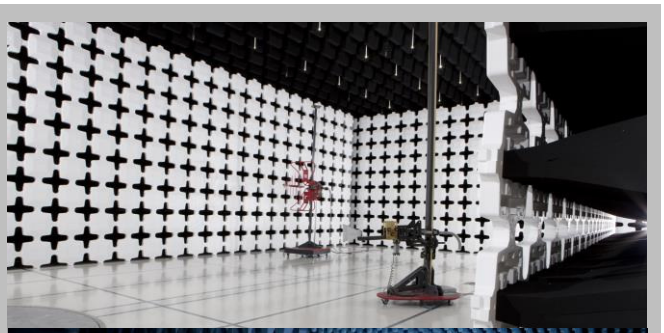
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

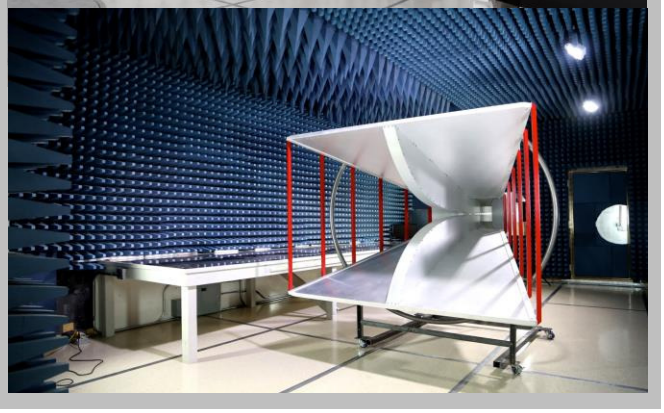
FACILITIES

NORTHWEST EMC
REV 2015.2.19

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 9801 (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/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157







PRODUCT DESCRIPTION

2014-12-10

Client and Equipment Under Test (EUT) Information

Company Name:	Parker Hannifin Corporation
Address:	8145 Lewis Road
City, State, Zip:	Minneapolis, 55427
Test Requested By:	Shawn Ellis
Model:	QX-008-427
First Date of Test:	September 09, 2015
Last Date of Test:	October 07, 2015
Receipt Date of Samples:	September 09, 2015
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Pressure sensor with a Bluetooth LE module.

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

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration PQCD0003- 1

Software/Firmware Running during test	
Description	**Version**
Test Firmware	QX-008-465 Rev B p4

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Radio Board Assembly	Parker Hannifin Corporation	QX-008-427	2715-025
Radio Board Assembly	Parker Hannifin Corporation	QX-008-427	2715-032
Radio Board Assembly	Parker Hannifin Corporation	QX-008-427	2715-074

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
3 V Lithium Battery	Panasonic	CR123A	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Coaxial Cable	Yes	7 cm	No	Pressure Sensor - Antenna Port	Direct Connect Testing SMA Cable

Configuration PQCD0003- 2

Software/Firmware Running during test	
Description	**Version**
Test Firmware	QX-008-465 Rev B p4

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Radio Board Assembly	Parker Hannifin Corporation	QX-008-427	2715-073

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
3.2 dBi Dipole	Sinbon	QX-008-55	None
3 V Lithium Battery	Panasonic	CR123A	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Coaxial Cable	Yes	7 cm	No	Pressure Sensor - Antenna Port	Direct Connect Testing SMA Cable

MODIFICATIONS

NORTHWEST EMC
2014-12-10

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	9/9/2015	Spurious Radiated 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.
2	9/16/2015	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.
3	10/7/2015	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.
4	10/7/2015	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.
5	10/7/2015	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.
6	10/7/2015	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.
7	10/7/2015	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.
8	10/7/2015	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.

CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

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. 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 50 Ω measuring port is terminated by a 50 Ω EMI meter or a 50 Ω resistive load. All 50 Ω measuring ports of the LISN are terminated by 50Ω.
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
Receiver	Rohde & Schwarz	ESR7	ARI	5/21/2015	5/21/2016
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	3/23/2015	3/23/2016
Attenuator	Fairview Microwave	SA01B-20	AQP	NCR	NCR
Filter - High Pass	TTE	H97-100K-50-720B	HGN	NCR	NCR
LISN	Solar Electronics	9117-5-TS-50-N	LIZ	9/30/2014	9/30/2016
LISN	Solar Electronics	9252-50-R-24-BNC	LIP	1/27/2015	1/27/2016
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Cable - Conducted Cable Assembly	Northwest EMC	None	MNC	NCR	NCR

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

PQCD0003-2

MODES INVESTIGATED

Continuous transmit. High Channel, 2480 MHz.
Continuous transmit. Low Channel, 2402 MHz.
Continuous transmit. Mid Channel, 2440 MHz.
EUT set to continuous receive.

CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

EUT:	QX-008-427	Work Order:	PQCD0003
Serial Number:	2715-000	Date:	10/07/2015
Customer:	Parker Hannifin Corporation	Temperature:	21.9°C
Attendees:	Shawn Ellis, Tim Skwiot	Relative Humidity:	33.5%
Customer Project:	None	Bar. Pressure:	989.9 mb
Tested By:	Jared Ison	Job Site:	MN03
Power:	Battery, 3 VDC	Configuration:	PQCD0003-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2013

TEST PARAMETERS

Run #:	1	Line:	Positive Lead	Add. Ext. Attenuation (dB):	0

COMMENTS

None

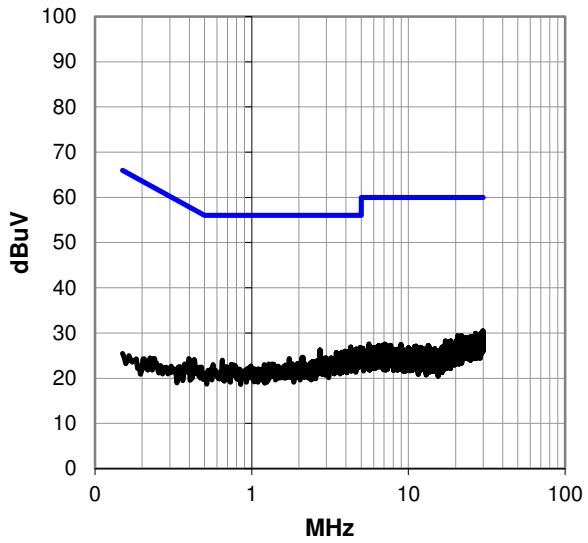
EUT OPERATING MODES

Continuous transmit. High Channel, 2480 MHz.

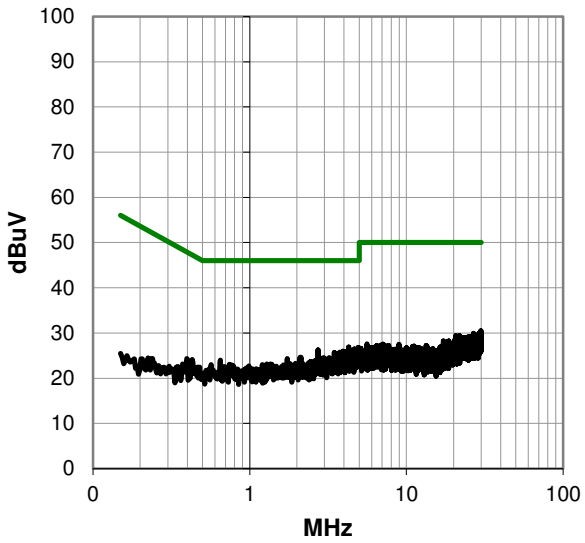
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



CONDUCTED EMISSIONS

NORTHWEST EMC

WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

RESULTS - Run #1

Peak Data - vs - Quasi Peak Limit

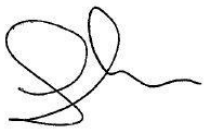
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
4.284	6.4	20.5	26.9	56.0	-29.1
4.940	6.3	20.5	26.8	56.0	-29.2
4.981	6.0	20.5	26.5	56.0	-29.5
29.858	8.0	22.5	30.5	60.0	-29.5
4.664	6.0	20.5	26.5	56.0	-29.5
2.728	5.9	20.3	26.2	56.0	-29.8
29.672	7.7	22.5	30.2	60.0	-29.8
29.642	7.7	22.5	30.2	60.0	-29.8
29.993	7.6	22.5	30.1	60.0	-29.9
4.511	5.6	20.5	26.1	56.0	-29.9
29.407	7.6	22.5	30.1	60.0	-29.9
4.739	5.5	20.5	26.0	56.0	-30.0
29.202	7.5	22.4	29.9	60.0	-30.1
26.892	7.7	22.2	29.9	60.0	-30.1
3.937	5.5	20.4	25.9	56.0	-30.1
29.601	7.4	22.5	29.9	60.0	-30.1
4.146	5.4	20.5	25.9	56.0	-30.1
3.750	5.4	20.4	25.8	56.0	-30.2
4.023	5.3	20.5	25.8	56.0	-30.2
4.347	5.2	20.5	25.7	56.0	-30.3
4.228	5.2	20.5	25.7	56.0	-30.3
3.470	5.3	20.3	25.6	56.0	-30.4
28.862	7.2	22.4	29.6	60.0	-30.4
4.597	5.1	20.5	25.6	56.0	-30.4
4.101	5.1	20.5	25.6	56.0	-30.4
27.679	7.2	22.3	29.5	60.0	-30.5

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
4.284	6.4	20.5	26.9	46.0	-19.1
4.940	6.3	20.5	26.8	46.0	-19.2
4.981	6.0	20.5	26.5	46.0	-19.5
29.858	8.0	22.5	30.5	50.0	-19.5
4.664	6.0	20.5	26.5	46.0	-19.5
2.728	5.9	20.3	26.2	46.0	-19.8
29.672	7.7	22.5	30.2	50.0	-19.8
29.642	7.7	22.5	30.2	50.0	-19.8
29.993	7.6	22.5	30.1	50.0	-19.9
4.511	5.6	20.5	26.1	46.0	-19.9
29.407	7.6	22.5	30.1	50.0	-19.9
4.739	5.5	20.5	26.0	46.0	-20.0
29.202	7.5	22.4	29.9	50.0	-20.1
26.892	7.7	22.2	29.9	50.0	-20.1
3.937	5.5	20.4	25.9	46.0	-20.1
29.601	7.4	22.5	29.9	50.0	-20.1
4.146	5.4	20.5	25.9	46.0	-20.1
3.750	5.4	20.4	25.8	46.0	-20.2
4.023	5.3	20.5	25.8	46.0	-20.2
4.347	5.2	20.5	25.7	46.0	-20.3
4.228	5.2	20.5	25.7	46.0	-20.3
3.470	5.3	20.3	25.6	46.0	-20.4
28.862	7.2	22.4	29.6	50.0	-20.4
4.597	5.1	20.5	25.6	46.0	-20.4
4.101	5.1	20.5	25.6	46.0	-20.4
27.679	7.2	22.3	29.5	50.0	-20.5

CONCLUSION

Pass



Tested By

CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

EUT:	QX-008-427	Work Order:	PQCD0003
Serial Number:	2715-000	Date:	10/07/2015
Customer:	Parker Hannifin Corporation	Temperature:	21.9°C
Attendees:	Shawn Ellis, Tim Skwiot	Relative Humidity:	33.5%
Customer Project:	None	Bar. Pressure:	989.9 mb
Tested By:	Jared Ison	Job Site:	MN03
Power:	Battery, 3 VDC	Configuration:	PQCD0003-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2013

TEST PARAMETERS

Run #:	2	Line:	Negative Lead	Add. Ext. Attenuation (dB):	0

COMMENTS

None

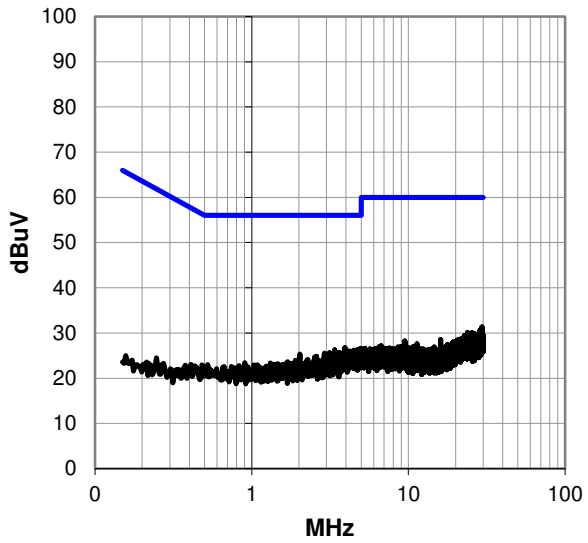
EUT OPERATING MODES

Continuous transmit. High Channel, 2480 MHz.

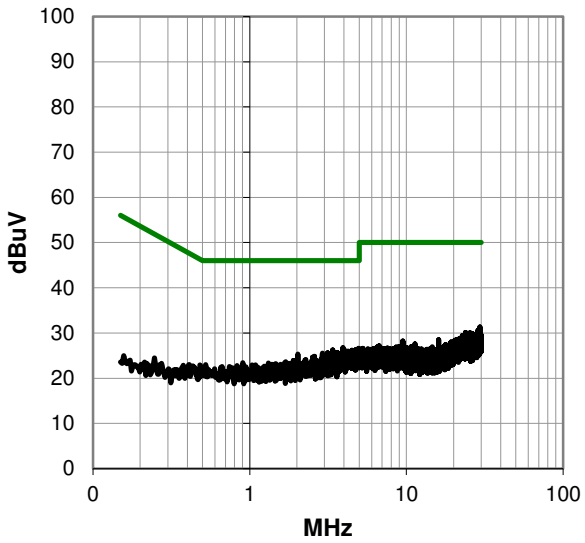
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

RESULTS - Run #2

Peak Data - vs - Quasi Peak Limit

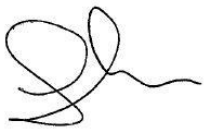
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
29.433	8.9	22.5	31.4	60.0	-28.6
3.937	6.3	20.4	26.7	56.0	-29.3
28.705	8.2	22.4	30.6	60.0	-29.4
4.952	6.1	20.5	26.6	56.0	-29.4
4.862	5.8	20.5	26.3	56.0	-29.7
4.746	5.8	20.5	26.3	56.0	-29.7
4.019	5.8	20.5	26.3	56.0	-29.7
3.388	5.9	20.3	26.2	56.0	-29.8
4.489	5.7	20.5	26.2	56.0	-29.8
29.273	7.7	22.5	30.2	60.0	-29.8
23.826	8.2	21.9	30.1	60.0	-29.9
25.463	8.0	22.1	30.1	60.0	-29.9
4.243	5.5	20.5	26.0	56.0	-30.0
29.037	7.5	22.4	29.9	60.0	-30.1
26.542	7.6	22.2	29.8	60.0	-30.2
4.060	5.3	20.5	25.8	56.0	-30.2
3.862	5.3	20.4	25.7	56.0	-30.3
29.832	7.2	22.5	29.7	60.0	-30.3
28.030	7.3	22.4	29.7	60.0	-30.3
3.620	5.3	20.4	25.7	56.0	-30.3
3.142	5.3	20.3	25.6	56.0	-30.4
28.452	7.2	22.4	29.6	60.0	-30.4
29.866	7.1	22.5	29.6	60.0	-30.4
28.064	7.2	22.4	29.6	60.0	-30.4
2.911	5.2	20.3	25.5	56.0	-30.5
3.817	5.1	20.4	25.5	56.0	-30.5

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
29.433	8.9	22.5	31.4	50.0	-18.6
3.937	6.3	20.4	26.7	46.0	-19.3
28.705	8.2	22.4	30.6	50.0	-19.4
4.952	6.1	20.5	26.6	46.0	-19.4
4.862	5.8	20.5	26.3	46.0	-19.7
4.746	5.8	20.5	26.3	46.0	-19.7
4.019	5.8	20.5	26.3	46.0	-19.7
3.388	5.9	20.3	26.2	46.0	-19.8
4.489	5.7	20.5	26.2	46.0	-19.8
29.273	7.7	22.5	30.2	50.0	-19.8
23.826	8.2	21.9	30.1	50.0	-19.9
25.463	8.0	22.1	30.1	50.0	-19.9
4.243	5.5	20.5	26.0	46.0	-20.0
29.037	7.5	22.4	29.9	50.0	-20.1
26.542	7.6	22.2	29.8	50.0	-20.2
4.060	5.3	20.5	25.8	46.0	-20.2
3.862	5.3	20.4	25.7	46.0	-20.3
29.832	7.2	22.5	29.7	50.0	-20.3
28.030	7.3	22.4	29.7	50.0	-20.3
3.620	5.3	20.4	25.7	46.0	-20.3
3.142	5.3	20.3	25.6	46.0	-20.4
28.452	7.2	22.4	29.6	50.0	-20.4
29.866	7.1	22.5	29.6	50.0	-20.4
28.064	7.2	22.4	29.6	50.0	-20.4
2.911	5.2	20.3	25.5	46.0	-20.5
3.817	5.1	20.4	25.5	46.0	-20.5

CONCLUSION

Pass



Tested By

CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

EUT:	QX-008-427	Work Order:	PQCD0003
Serial Number:	2715-000	Date:	10/07/2015
Customer:	Parker Hannifin Corporation	Temperature:	21.9°C
Attendees:	Shawn Ellis, Tim Skwiot	Relative Humidity:	33.5%
Customer Project:	None	Bar. Pressure:	989.9 mb
Tested By:	Jared Ison	Job Site:	MN03
Power:	Battery, 3 VDC	Configuration:	PQCD0003-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2013

TEST PARAMETERS

Run #:	3	Line:	Negative Lead	Add. Ext. Attenuation (dB):	0

COMMENTS

None

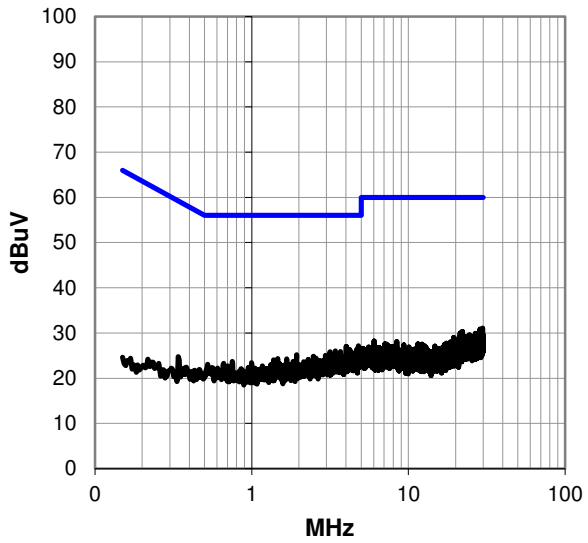
EUT OPERATING MODES

Continuous transmit. Low Channel, 2402 MHz.

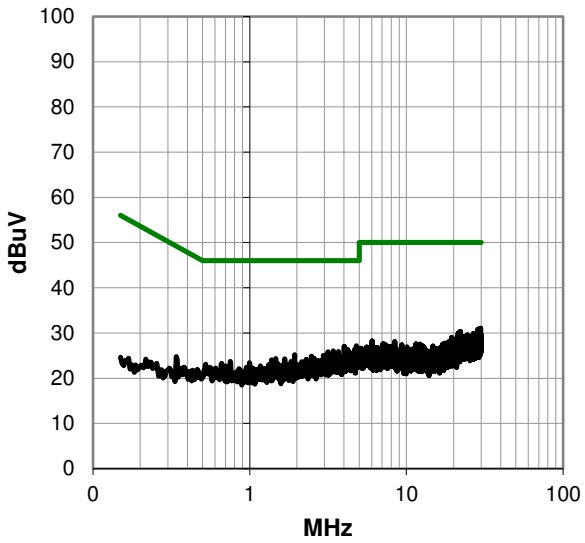
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

RESULTS - Run #3

Peak Data - vs - Quasi Peak Limit

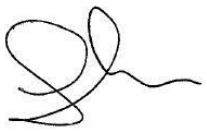
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
4.787	6.7	20.5	27.2	56.0	-28.8
29.713	8.6	22.5	31.1	60.0	-28.9
4.008	6.6	20.5	27.1	56.0	-28.9
28.657	8.4	22.4	30.8	60.0	-29.2
4.213	5.9	20.5	26.4	56.0	-29.6
22.147	8.6	21.8	30.4	60.0	-29.6
4.687	5.8	20.5	26.3	56.0	-29.7
22.128	8.5	21.8	30.3	60.0	-29.7
3.414	5.7	20.3	26.0	56.0	-30.0
21.371	8.3	21.7	30.0	60.0	-30.0
27.762	7.6	22.3	29.9	60.0	-30.1
26.792	7.7	22.2	29.9	60.0	-30.1
21.710	8.2	21.7	29.9	60.0	-30.1
4.989	5.4	20.5	25.9	56.0	-30.1
3.694	5.5	20.4	25.9	56.0	-30.1
27.150	7.6	22.3	29.9	60.0	-30.1
26.903	7.6	22.2	29.8	60.0	-30.2
3.168	5.5	20.3	25.8	56.0	-30.2
29.914	7.2	22.5	29.7	60.0	-30.3
4.090	5.2	20.5	25.7	56.0	-30.3
28.269	7.2	22.4	29.6	60.0	-30.4
29.597	7.1	22.5	29.6	60.0	-30.4
24.501	7.6	22.0	29.6	60.0	-30.4
28.791	7.1	22.4	29.5	60.0	-30.5
4.847	5.0	20.5	25.5	56.0	-30.5
4.605	5.0	20.5	25.5	56.0	-30.5

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
4.787	6.7	20.5	27.2	46.0	-18.8
29.713	8.6	22.5	31.1	50.0	-18.9
4.008	6.6	20.5	27.1	46.0	-18.9
28.657	8.4	22.4	30.8	50.0	-19.2
4.213	5.9	20.5	26.4	46.0	-19.6
22.147	8.6	21.8	30.4	50.0	-19.6
4.687	5.8	20.5	26.3	46.0	-19.7
22.128	8.5	21.8	30.3	50.0	-19.7
3.414	5.7	20.3	26.0	46.0	-20.0
21.371	8.3	21.7	30.0	50.0	-20.0
27.762	7.6	22.3	29.9	50.0	-20.1
26.792	7.7	22.2	29.9	50.0	-20.1
21.710	8.2	21.7	29.9	50.0	-20.1
4.989	5.4	20.5	25.9	46.0	-20.1
3.694	5.5	20.4	25.9	46.0	-20.1
27.150	7.6	22.3	29.9	50.0	-20.1
26.903	7.6	22.2	29.8	50.0	-20.2
3.168	5.5	20.3	25.8	46.0	-20.2
29.914	7.2	22.5	29.7	50.0	-20.3
4.090	5.2	20.5	25.7	46.0	-20.3
28.269	7.2	22.4	29.6	50.0	-20.4
29.597	7.1	22.5	29.6	50.0	-20.4
24.501	7.6	22.0	29.6	50.0	-20.4
28.791	7.1	22.4	29.5	50.0	-20.5
4.847	5.0	20.5	25.5	46.0	-20.5
4.605	5.0	20.5	25.5	46.0	-20.5

CONCLUSION

Pass



Tested By

CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

EUT:	QX-008-427	Work Order:	PQCD0003
Serial Number:	2715-000	Date:	10/07/2015
Customer:	Parker Hannifin Corporation	Temperature:	21.9°C
Attendees:	Shawn Ellis, Tim Skwiot	Relative Humidity:	33.5%
Customer Project:	None	Bar. Pressure:	989.9 mb
Tested By:	Jared Ison	Job Site:	MN03
Power:	Battery, 3 VDC	Configuration:	PQCD0003-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2013

TEST PARAMETERS

Run #:	4	Line:	Positive Lead	Add. Ext. Attenuation (dB):	0

COMMENTS

None

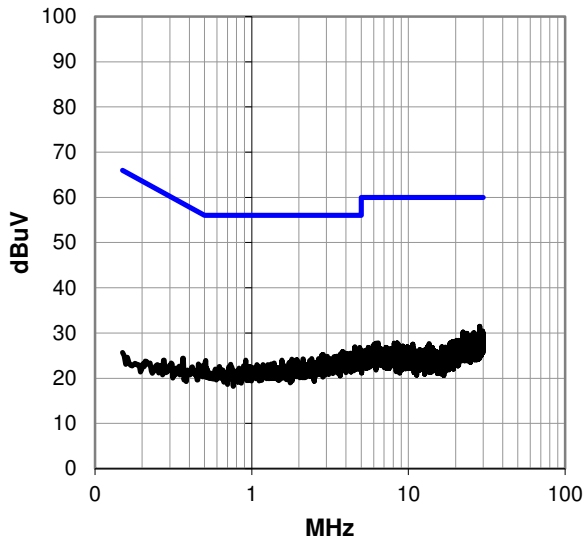
EUT OPERATING MODES

Continuous transmit. Low Channel, 2402 MHz.

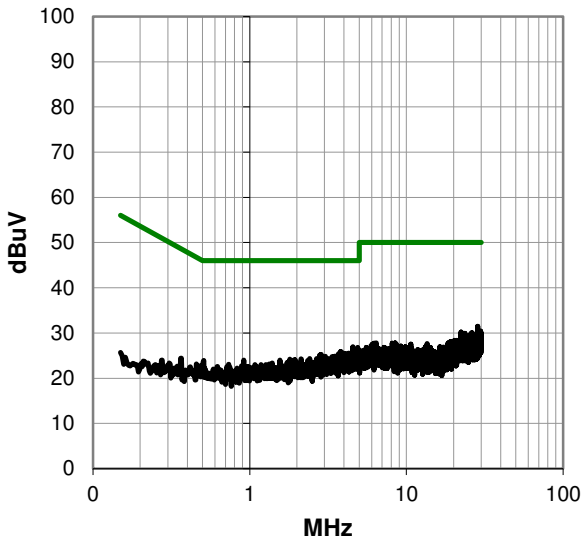
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

RESULTS - Run #4

Peak Data - vs - Quasi Peak Limit

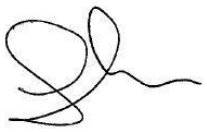
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
28.474	9.1	22.4	31.5	60.0	-28.5
4.549	6.5	20.5	27.0	56.0	-29.0
4.881	6.3	20.5	26.8	56.0	-29.2
4.534	6.2	20.5	26.7	56.0	-29.3
4.698	5.9	20.5	26.4	56.0	-29.6
29.799	7.9	22.5	30.4	60.0	-29.6
4.963	5.7	20.5	26.2	56.0	-29.8
22.303	8.4	21.8	30.2	60.0	-29.8
29.862	7.6	22.5	30.1	60.0	-29.9
28.265	7.7	22.4	30.1	60.0	-29.9
29.571	7.6	22.5	30.1	60.0	-29.9
26.217	7.9	22.2	30.1	60.0	-29.9
29.899	7.5	22.5	30.0	60.0	-30.0
26.105	7.8	22.2	30.0	60.0	-30.0
3.814	5.5	20.4	25.9	56.0	-30.1
4.933	5.4	20.5	25.9	56.0	-30.1
23.602	8.0	21.9	29.9	60.0	-30.1
29.993	7.2	22.5	29.7	60.0	-30.3
29.519	7.2	22.5	29.7	60.0	-30.3
26.064	7.5	22.1	29.6	60.0	-30.4
28.392	7.2	22.4	29.6	60.0	-30.4
4.295	5.1	20.5	25.6	56.0	-30.4
25.363	7.5	22.1	29.6	60.0	-30.4
3.940	5.1	20.4	25.5	56.0	-30.5
4.347	5.0	20.5	25.5	56.0	-30.5
4.056	5.0	20.5	25.5	56.0	-30.5

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
28.474	9.1	22.4	31.5	50.0	-18.5
4.549	6.5	20.5	27.0	46.0	-19.0
4.881	6.3	20.5	26.8	46.0	-19.2
4.534	6.2	20.5	26.7	46.0	-19.3
4.698	5.9	20.5	26.4	46.0	-19.6
29.799	7.9	22.5	30.4	50.0	-19.6
4.963	5.7	20.5	26.2	46.0	-19.8
22.303	8.4	21.8	30.2	50.0	-19.8
29.862	7.6	22.5	30.1	50.0	-19.9
28.265	7.7	22.4	30.1	50.0	-19.9
29.571	7.6	22.5	30.1	50.0	-19.9
26.217	7.9	22.2	30.1	50.0	-19.9
29.899	7.5	22.5	30.0	50.0	-20.0
26.105	7.8	22.2	30.0	50.0	-20.0
3.814	5.5	20.4	25.9	46.0	-20.1
4.933	5.4	20.5	25.9	46.0	-20.1
23.602	8.0	21.9	29.9	50.0	-20.1
29.993	7.2	22.5	29.7	50.0	-20.3
29.519	7.2	22.5	29.7	50.0	-20.3
26.064	7.5	22.1	29.6	50.0	-20.4
28.392	7.2	22.4	29.6	50.0	-20.4
4.295	5.1	20.5	25.6	46.0	-20.4
25.363	7.5	22.1	29.6	50.0	-20.4
3.940	5.1	20.4	25.5	46.0	-20.5
4.347	5.0	20.5	25.5	46.0	-20.5
4.056	5.0	20.5	25.5	46.0	-20.5

CONCLUSION

Pass



Tested By

CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

EUT:	QX-008-427	Work Order:	PQCD0003
Serial Number:	2715-000	Date:	10/07/2015
Customer:	Parker Hannifin Corporation	Temperature:	21.9°C
Attendees:	Shawn Ellis, Tim Skwiot	Relative Humidity:	33.5%
Customer Project:	None	Bar. Pressure:	989.9 mb
Tested By:	Jared Ison	Job Site:	MN03
Power:	Battery, 3 VDC	Configuration:	PQCD0003-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2013

TEST PARAMETERS

Run #:	5	Line:	Positive Lead	Add. Ext. Attenuation (dB):	0

COMMENTS

None

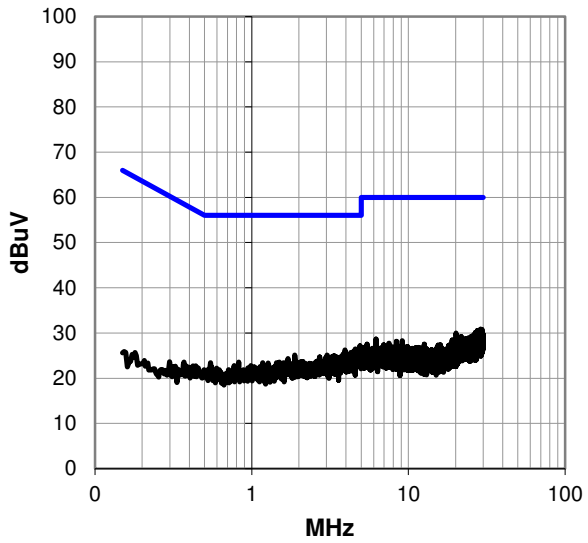
EUT OPERATING MODES

Continuous transmit. Mid Channel, 2440 MHz.

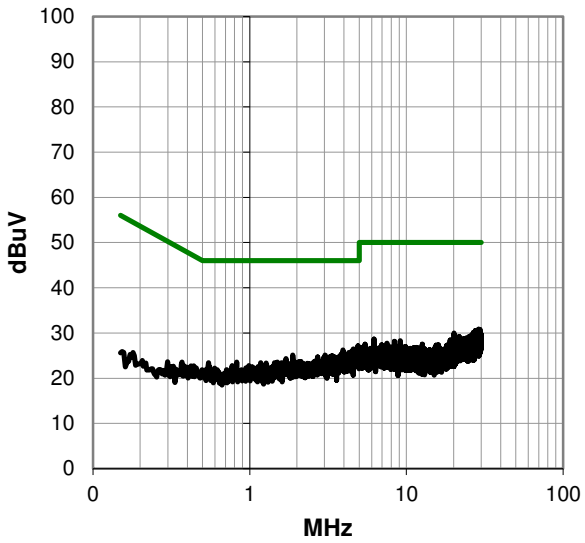
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

RESULTS - Run #5

Peak Data - vs - Quasi Peak Limit

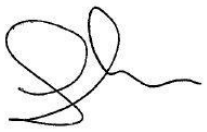
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
4.907	6.7	20.5	27.2	56.0	-28.8
28.911	8.4	22.4	30.8	60.0	-29.2
29.437	8.3	22.5	30.8	60.0	-29.2
27.638	8.2	22.3	30.5	60.0	-29.5
4.590	6.0	20.5	26.5	56.0	-29.5
4.638	5.8	20.5	26.3	56.0	-29.7
3.944	5.8	20.4	26.2	56.0	-29.8
26.795	7.9	22.2	30.1	60.0	-29.9
4.761	5.6	20.5	26.1	56.0	-29.9
29.590	7.6	22.5	30.1	60.0	-29.9
29.373	7.6	22.5	30.1	60.0	-29.9
4.813	5.5	20.5	26.0	56.0	-30.0
29.627	7.5	22.5	30.0	60.0	-30.0
20.188	8.4	21.6	30.0	60.0	-30.0
29.108	7.5	22.4	29.9	60.0	-30.1
4.440	5.4	20.5	25.9	56.0	-30.1
29.907	7.3	22.5	29.8	60.0	-30.2
28.571	7.3	22.4	29.7	60.0	-30.3
29.713	7.2	22.5	29.7	60.0	-30.3
4.276	5.2	20.5	25.7	56.0	-30.3
28.094	7.3	22.4	29.7	60.0	-30.3
26.224	7.5	22.2	29.7	60.0	-30.3
28.858	7.2	22.4	29.6	60.0	-30.4
4.534	5.1	20.5	25.6	56.0	-30.4
29.310	7.0	22.5	29.5	60.0	-30.5
29.250	7.0	22.4	29.4	60.0	-30.6

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
4.907	6.7	20.5	27.2	46.0	-18.8
28.911	8.4	22.4	30.8	50.0	-19.2
29.437	8.3	22.5	30.8	50.0	-19.2
27.638	8.2	22.3	30.5	50.0	-19.5
4.590	6.0	20.5	26.5	46.0	-19.5
4.638	5.8	20.5	26.3	46.0	-19.7
3.944	5.8	20.4	26.2	46.0	-19.8
26.795	7.9	22.2	30.1	50.0	-19.9
4.761	5.6	20.5	26.1	46.0	-19.9
29.590	7.6	22.5	30.1	50.0	-19.9
29.373	7.6	22.5	30.1	50.0	-19.9
4.813	5.5	20.5	26.0	46.0	-20.0
29.627	7.5	22.5	30.0	50.0	-20.0
20.188	8.4	21.6	30.0	50.0	-20.0
29.108	7.5	22.4	29.9	50.0	-20.1
4.440	5.4	20.5	25.9	46.0	-20.1
29.907	7.3	22.5	29.8	50.0	-20.2
28.571	7.3	22.4	29.7	50.0	-20.3
29.713	7.2	22.5	29.7	50.0	-20.3
4.276	5.2	20.5	25.7	46.0	-20.3
28.094	7.3	22.4	29.7	50.0	-20.3
26.224	7.5	22.2	29.7	50.0	-20.3
28.858	7.2	22.4	29.6	50.0	-20.4
4.534	5.1	20.5	25.6	46.0	-20.4
29.310	7.0	22.5	29.5	50.0	-20.5
29.250	7.0	22.4	29.4	50.0	-20.6

CONCLUSION

Pass



Tested By

CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

EUT:	QX-008-427	Work Order:	PQCD0003
Serial Number:	2715-000	Date:	10/07/2015
Customer:	Parker Hannifin Corporation	Temperature:	21.9°C
Attendees:	Shawn Ellis, Tim Skwiot	Relative Humidity:	33.5%
Customer Project:	None	Bar. Pressure:	989.9 mb
Tested By:	Jared Ison	Job Site:	MN03
Power:	Battery, 3 VDC	Configuration:	PQCD0003-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2013

TEST PARAMETERS

Run #:	6	Line:	Negative Lead	Add. Ext. Attenuation (dB):	0

COMMENTS

None

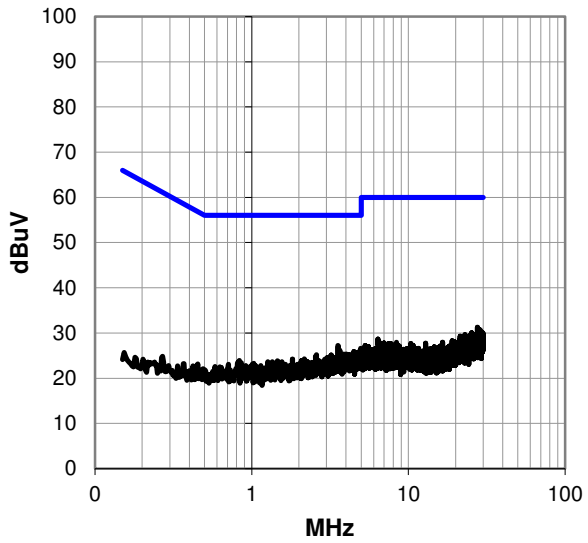
EUT OPERATING MODES

Continuous transmit. Mid Channel, 2440 MHz.

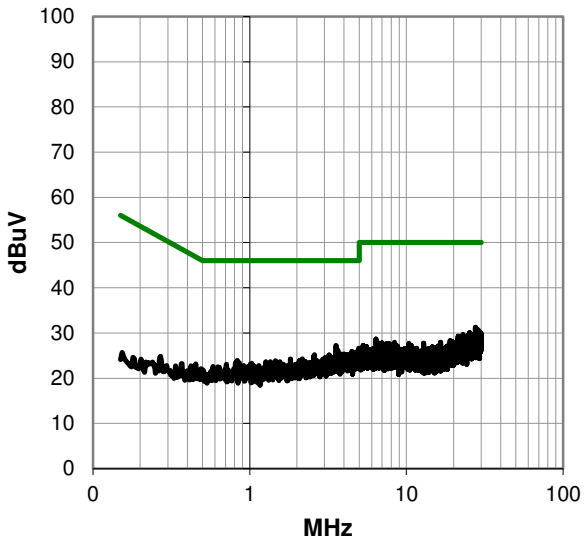
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

RESULTS - Run #6

Peak Data - vs - Quasi Peak Limit

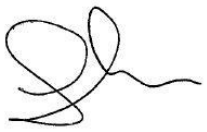
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
3.556	6.9	20.4	27.3	56.0	-28.7
27.661	8.9	22.3	31.2	60.0	-28.8
28.657	8.3	22.4	30.7	60.0	-29.3
4.952	6.1	20.5	26.6	56.0	-29.4
28.843	7.9	22.4	30.3	60.0	-29.7
3.646	5.8	20.4	26.2	56.0	-29.8
29.705	7.6	22.5	30.1	60.0	-29.9
25.366	8.0	22.1	30.1	60.0	-29.9
4.966	5.5	20.5	26.0	56.0	-30.0
29.881	7.5	22.5	30.0	60.0	-30.0
4.489	5.4	20.5	25.9	56.0	-30.1
29.425	7.4	22.5	29.9	60.0	-30.1
27.097	7.5	22.3	29.8	60.0	-30.2
4.593	5.2	20.5	25.7	56.0	-30.3
29.328	7.2	22.5	29.7	60.0	-30.3
27.004	7.4	22.3	29.7	60.0	-30.3
23.012	7.8	21.8	29.6	60.0	-30.4
29.108	7.2	22.4	29.6	60.0	-30.4
29.075	7.2	22.4	29.6	60.0	-30.4
28.967	7.1	22.4	29.5	60.0	-30.5
29.866	7.0	22.5	29.5	60.0	-30.5
28.366	7.1	22.4	29.5	60.0	-30.5
4.731	4.9	20.5	25.4	56.0	-30.6
24.699	7.4	22.0	29.4	60.0	-30.6
4.381	4.9	20.5	25.4	56.0	-30.6
29.590	6.9	22.5	29.4	60.0	-30.6

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
3.556	6.9	20.4	27.3	46.0	-18.7
27.661	8.9	22.3	31.2	50.0	-18.8
28.657	8.3	22.4	30.7	50.0	-19.3
4.952	6.1	20.5	26.6	46.0	-19.4
28.843	7.9	22.4	30.3	50.0	-19.7
3.646	5.8	20.4	26.2	46.0	-19.8
29.705	7.6	22.5	30.1	50.0	-19.9
25.366	8.0	22.1	30.1	50.0	-19.9
4.966	5.5	20.5	26.0	46.0	-20.0
29.881	7.5	22.5	30.0	50.0	-20.0
4.489	5.4	20.5	25.9	46.0	-20.1
29.425	7.4	22.5	29.9	50.0	-20.1
27.097	7.5	22.3	29.8	50.0	-20.2
4.593	5.2	20.5	25.7	46.0	-20.3
29.328	7.2	22.5	29.7	50.0	-20.3
27.004	7.4	22.3	29.7	50.0	-20.3
23.012	7.8	21.8	29.6	50.0	-20.4
29.108	7.2	22.4	29.6	50.0	-20.4
29.075	7.2	22.4	29.6	50.0	-20.4
28.967	7.1	22.4	29.5	50.0	-20.5
29.866	7.0	22.5	29.5	50.0	-20.5
28.366	7.1	22.4	29.5	50.0	-20.5
4.731	4.9	20.5	25.4	46.0	-20.6
24.699	7.4	22.0	29.4	50.0	-20.6
4.381	4.9	20.5	25.4	46.0	-20.6
29.590	6.9	22.5	29.4	50.0	-20.6

CONCLUSION

Pass



Tested By

CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

EUT:	QX-008-427	Work Order:	PQCD0003
Serial Number:	2715-000	Date:	10/07/2015
Customer:	Parker Hannifin Corporation	Temperature:	21.9°C
Attendees:	Shawn Ellis, Tim Skwiot	Relative Humidity:	33.5%
Customer Project:	None	Bar. Pressure:	989.9 mb
Tested By:	Jared Ison	Job Site:	MN03
Power:	Battery, 3 VDC	Configuration:	PQCD0003-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2013

TEST PARAMETERS

Run #:	7	Line:	Negative Lead	Add. Ext. Attenuation (dB):	0

COMMENTS

None

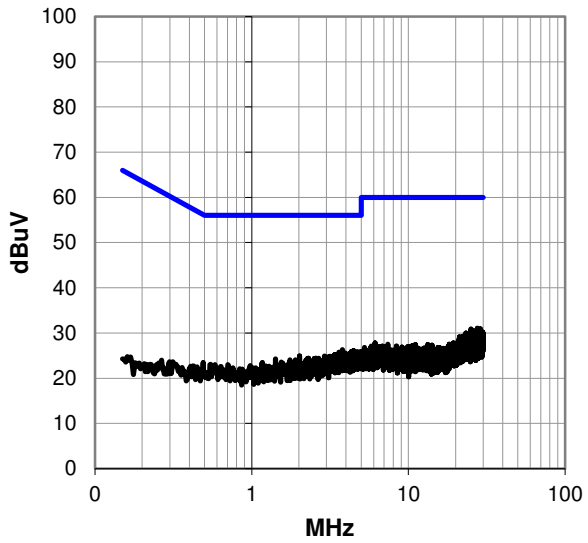
EUT OPERATING MODES

EUT set to continuous receive.

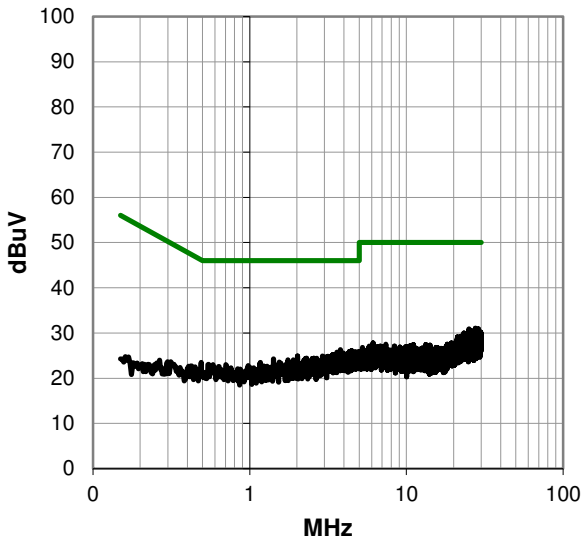
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

RESULTS - Run #7

Peak Data - vs - Quasi Peak Limit

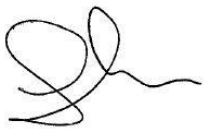
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
27.556	8.7	22.3	31.0	60.0	-29.0
25.068	8.9	22.0	30.9	60.0	-29.1
28.829	8.5	22.4	30.9	60.0	-29.1
25.896	8.4	22.1	30.5	60.0	-29.5
3.799	5.9	20.4	26.3	56.0	-29.7
28.441	7.9	22.4	30.3	60.0	-29.7
29.534	7.8	22.5	30.3	60.0	-29.7
25.124	8.2	22.0	30.2	60.0	-29.8
28.735	7.8	22.4	30.2	60.0	-29.8
29.702	7.7	22.5	30.2	60.0	-29.8
29.097	7.7	22.4	30.1	60.0	-29.9
29.899	7.6	22.5	30.1	60.0	-29.9
4.478	5.6	20.5	26.1	56.0	-29.9
23.296	8.1	21.9	30.0	60.0	-30.0
4.716	5.4	20.5	25.9	56.0	-30.1
4.332	5.4	20.5	25.9	56.0	-30.1
4.884	5.3	20.5	25.8	56.0	-30.2
27.314	7.5	22.3	29.8	60.0	-30.2
24.568	7.8	22.0	29.8	60.0	-30.2
3.608	5.4	20.4	25.8	56.0	-30.2
29.261	7.3	22.4	29.7	60.0	-30.3
27.948	7.3	22.4	29.7	60.0	-30.3
24.146	7.7	21.9	29.6	60.0	-30.4
25.960	7.5	22.1	29.6	60.0	-30.4
28.944	7.2	22.4	29.6	60.0	-30.4
25.210	7.5	22.0	29.5	60.0	-30.5

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
27.556	8.7	22.3	31.0	50.0	-19.0
25.068	8.9	22.0	30.9	50.0	-19.1
28.829	8.5	22.4	30.9	50.0	-19.1
25.896	8.4	22.1	30.5	50.0	-19.5
3.799	5.9	20.4	26.3	46.0	-19.7
28.441	7.9	22.4	30.3	50.0	-19.7
29.534	7.8	22.5	30.3	50.0	-19.7
25.124	8.2	22.0	30.2	50.0	-19.8
28.735	7.8	22.4	30.2	50.0	-19.8
29.702	7.7	22.5	30.2	50.0	-19.8
29.097	7.7	22.4	30.1	50.0	-19.9
29.899	7.6	22.5	30.1	50.0	-19.9
4.478	5.6	20.5	26.1	46.0	-19.9
23.296	8.1	21.9	30.0	50.0	-20.0
4.716	5.4	20.5	25.9	46.0	-20.1
4.332	5.4	20.5	25.9	46.0	-20.1
4.884	5.3	20.5	25.8	46.0	-20.2
27.314	7.5	22.3	29.8	50.0	-20.2
24.568	7.8	22.0	29.8	50.0	-20.2
3.608	5.4	20.4	25.8	46.0	-20.2
29.261	7.3	22.4	29.7	50.0	-20.3
27.948	7.3	22.4	29.7	50.0	-20.3
24.146	7.7	21.9	29.6	50.0	-20.4
25.960	7.5	22.1	29.6	50.0	-20.4
28.944	7.2	22.4	29.6	50.0	-20.4
25.210	7.5	22.0	29.5	50.0	-20.5

CONCLUSION

Pass



Tested By

CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

EUT:	QX-008-427	Work Order:	PQCD0003
Serial Number:	2715-000	Date:	10/07/2015
Customer:	Parker Hannifin Corporation	Temperature:	21.9°C
Attendees:	Shawn Ellis, Tim Skwiot	Relative Humidity:	33.5%
Customer Project:	None	Bar. Pressure:	989.9 mb
Tested By:	Jared Ison	Job Site:	MN03
Power:	Battery, 3 VDC	Configuration:	PQCD0003-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2013

TEST PARAMETERS

Run #:	8	Line:	Positive Lead	Add. Ext. Attenuation (dB):	0

COMMENTS

None

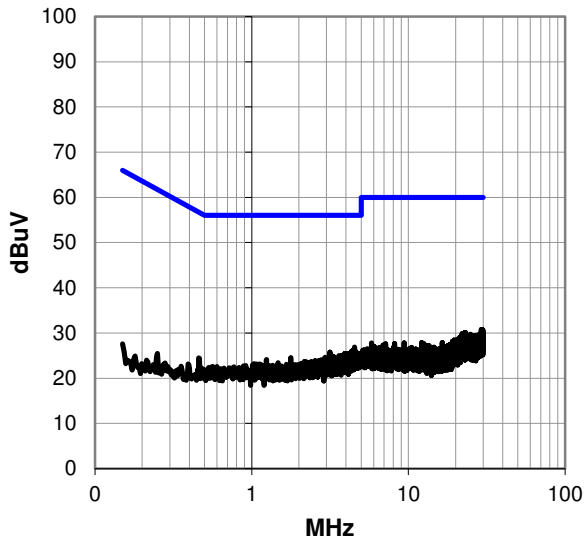
EUT OPERATING MODES

EUT set to continuous receive.

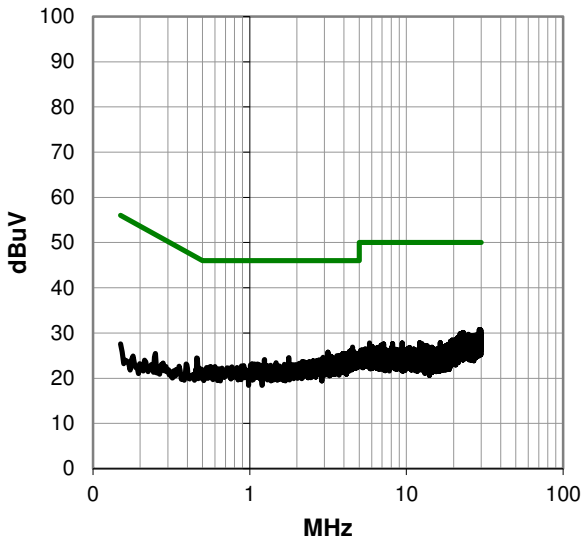
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.09.03
PSA-ESCI 2015.07.01, EmiR5 2015.08.28

RESULTS - Run #8

Peak Data - vs - Quasi Peak Limit

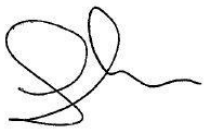
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
4.526	6.4	20.5	26.9	56.0	-29.1
29.575	8.3	22.5	30.8	60.0	-29.2
29.142	8.3	22.4	30.7	60.0	-29.3
29.892	8.1	22.5	30.6	60.0	-29.4
23.035	8.3	21.8	30.1	60.0	-29.9
4.425	5.6	20.5	26.1	56.0	-29.9
29.500	7.6	22.5	30.1	60.0	-29.9
22.893	8.2	21.8	30.0	60.0	-30.0
4.455	5.5	20.5	26.0	56.0	-30.0
4.351	5.5	20.5	26.0	56.0	-30.0
29.556	7.5	22.5	30.0	60.0	-30.0
29.302	7.5	22.5	30.0	60.0	-30.0
4.627	5.4	20.5	25.9	56.0	-30.1
22.012	8.1	21.8	29.9	60.0	-30.1
29.317	7.4	22.5	29.9	60.0	-30.1
28.467	7.4	22.4	29.8	60.0	-30.2
3.157	5.4	20.3	25.7	56.0	-30.3
28.717	7.3	22.4	29.7	60.0	-30.3
24.840	7.7	22.0	29.7	60.0	-30.3
28.821	7.2	22.4	29.6	60.0	-30.4
29.425	7.1	22.5	29.6	60.0	-30.4
28.579	7.1	22.4	29.5	60.0	-30.5
29.993	7.0	22.5	29.5	60.0	-30.5
4.168	5.0	20.5	25.5	56.0	-30.5
27.165	7.2	22.3	29.5	60.0	-30.5
4.075	5.0	20.5	25.5	56.0	-30.5

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
4.526	6.4	20.5	26.9	46.0	-19.1
29.575	8.3	22.5	30.8	50.0	-19.2
29.142	8.3	22.4	30.7	50.0	-19.3
29.892	8.1	22.5	30.6	50.0	-19.4
23.035	8.3	21.8	30.1	50.0	-19.9
4.425	5.6	20.5	26.1	46.0	-19.9
29.500	7.6	22.5	30.1	50.0	-19.9
22.893	8.2	21.8	30.0	50.0	-20.0
4.455	5.5	20.5	26.0	46.0	-20.0
4.351	5.5	20.5	26.0	46.0	-20.0
29.556	7.5	22.5	30.0	50.0	-20.0
29.302	7.5	22.5	30.0	50.0	-20.0
4.627	5.4	20.5	25.9	46.0	-20.1
22.012	8.1	21.8	29.9	50.0	-20.1
29.317	7.4	22.5	29.9	50.0	-20.1
28.467	7.4	22.4	29.8	50.0	-20.2
3.157	5.4	20.3	25.7	46.0	-20.3
28.717	7.3	22.4	29.7	50.0	-20.3
24.840	7.7	22.0	29.7	50.0	-20.3
28.821	7.2	22.4	29.6	50.0	-20.4
29.425	7.1	22.5	29.6	50.0	-20.4
28.579	7.1	22.4	29.5	50.0	-20.5
29.993	7.0	22.5	29.5	50.0	-20.5
4.168	5.0	20.5	25.5	46.0	-20.5
27.165	7.2	22.3	29.5	50.0	-20.5
4.075	5.0	20.5	25.5	46.0	-20.5

CONCLUSION

Pass



Tested By

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

Bluetooth Low Energy: Low Channel, 2402 MHz
Bluetooth Low Energy: Middle Channel, 2440 MHz
Bluetooth Low Energy: High Channel, 2480 MHz

POWER SETTINGS INVESTIGATED

Battery, 3 VDC

CONFIGURATIONS INVESTIGATED

PQCD0001 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 MHz

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
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	10/3/2014	12 mo
Cable	Northwest EMC	18-26GHz Standard Gain Horn Cable	MNP	10/3/2014	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	3/2/2015	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	5/5/2015	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	3/2/2015	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	3/2/2015	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	5/5/2015	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJA	6/3/2014	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	PAD	3/2/2015	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	3/30/2015	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	12/17/2013	24 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2015	12 mo

MEASUREMENT BANDWIDTHS

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

TEST DESCRIPTION

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

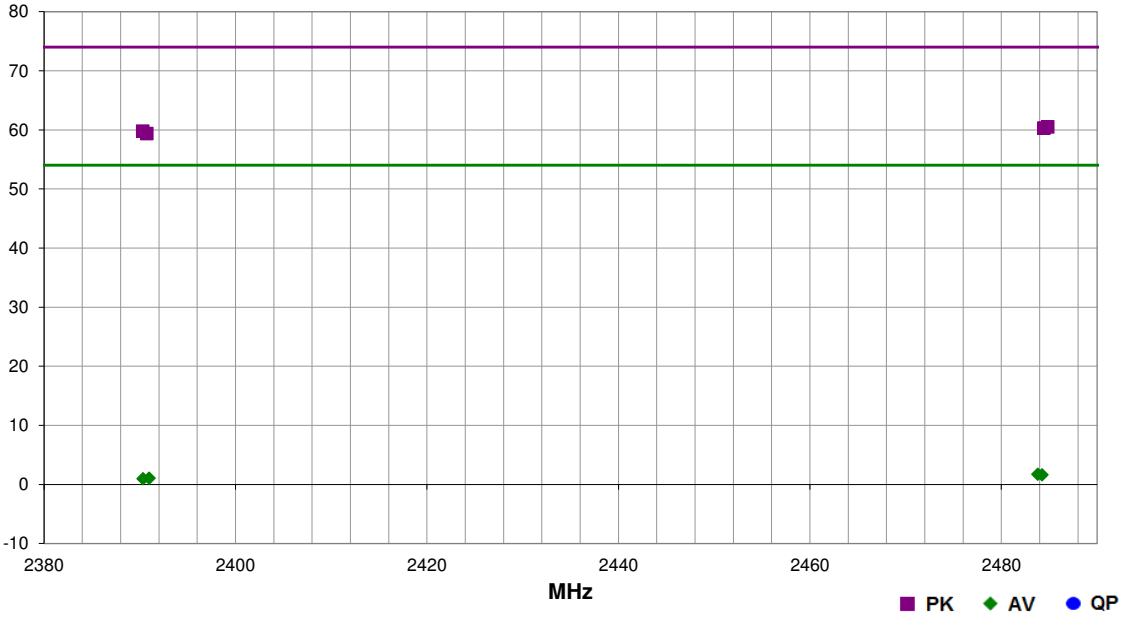
Duty cycle correction factor:
EUT was configured to the worst case duty cycle under normal operating conditions for the measurement of “Duty Cycle Correction Factor”.
Per ANSI C63.10-2013 the DCCF was determined using equation: (dB) = 20 Log (.433/100ms).

SPURIOUS RADIATED EMISSIONS

Work Order:	PQCD0001	**Date:**	09/09/15		
Project:	None	**Temperature:**	22.9 °C		
Job Site:	MN05	**Humidity:**	52.5% RH		
Serial Number:	See Configuration	**Barometric Pres.:**	985.9 mbar	**Tested by:**	Jared Ison
EUT:	QX-008-427				
Configuration:	1				
Customer:	Parker Hannifin Corporation				
Attendees:	Tim Skwiot, Shawn Ellis				
EUT Power:	Battery, 3 VDC				
Operating Mode:	Bluetooth Low Energy, Continuous Transmit.				
Deviations:	None				
Comments:	Reference data comments for EUT channel and orientation. Due to antenna symmetry, only two orthogonal axis were investigated. Output power set to +8 dBm. Using Antenna with gain of 3.2 dBi. Due to the fixed low duty cycle of the advertising channels and hopping nature of the data channels a duty cycle correction factor was applied to the average data. The worst case DCCF from both modes was applied to the data.				

Test Specifications	**Test Method**
FCC 15.247:2015	ANSI C63.10:2013

Run #	17	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



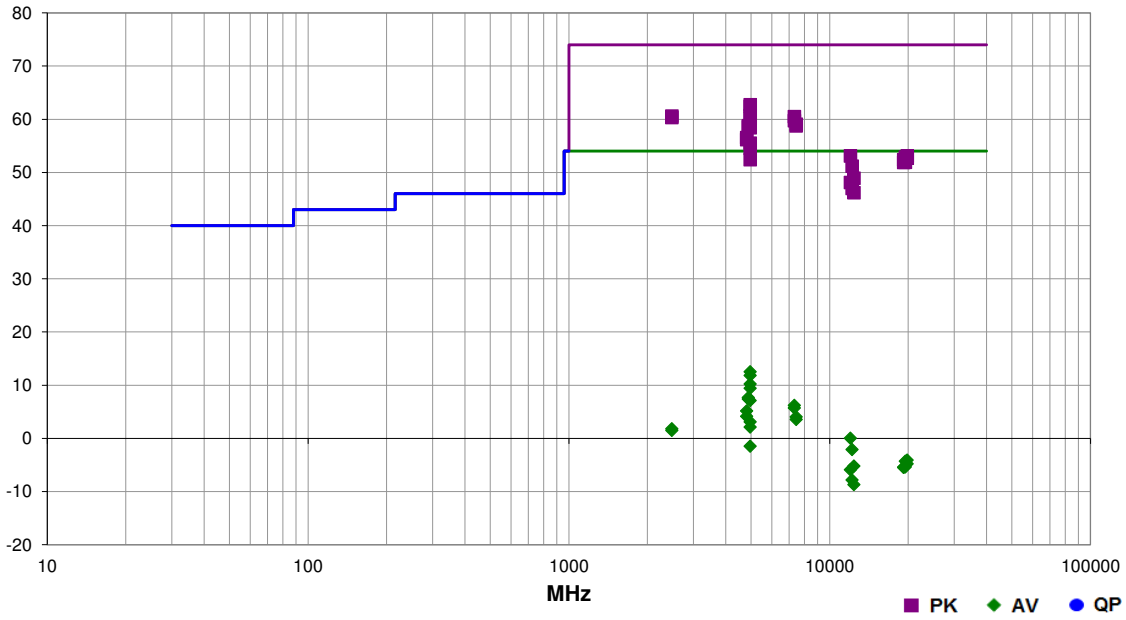
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2484.837	42.4	-1.9	1.0	51.1	0.0	20.0	Horz	PK	0.0	60.5	74.0	-13.5	High Ch. 2480 MHz, EUT Horz
2484.440	42.2	-1.9	1.0	87.1	0.0	20.0	Vert	PK	0.0	60.3	74.0	-13.7	High Ch. 2480 MHz, EUT Horz
2390.313	42.0	-2.2	1.0	57.0	0.0	20.0	Vert	PK	0.0	59.8	74.0	-14.2	Low Ch. 2402 MHz, EUT Vert
2390.733	41.6	-2.2	1.0	346.0	0.0	20.0	Horz	PK	0.0	59.4	74.0	-14.6	Low Ch. 2402 MHz, EUT Horz
2483.800	30.9	-1.9	1.0	51.1	-47.3	20.0	Horz	AV	0.0	1.7	54.0	-52.3	High Ch. 2480 MHz, EUT Horz
2484.260	30.8	-1.9	1.0	87.1	-47.3	20.0	Vert	AV	0.0	1.6	54.0	-52.4	High Ch. 2480 MHz, EUT Horz
2390.983	30.6	-2.2	1.0	346.0	-47.3	20.0	Horz	AV	0.0	1.1	54.0	-52.9	Low Ch. 2402 MHz, EUT Horz
2390.337	30.5	-2.2	1.0	57.0	-47.3	20.0	Vert	AV	0.0	1.0	54.0	-53.0	Low Ch. 2402 MHz, EUT Vert

SPURIOUS RADIATED EMISSIONS

Work Order:	PQCD0001	**Date:**	09/09/15		
Project:	None	**Temperature:**	22.9 °C		
Job Site:	MN05	**Humidity:**	52.5% RH		
Serial Number:	See Configuration	**Barometric Pres.:**	985.9 mbar	**Tested by:**	Jared Ison
EUT:	QX-008-427				
Configuration:	1				
Customer:	Parker Hannifin Corporation				
Attendees:	Tim Skwiot, Shawn Ellis				
EUT Power:	Battery, 3 VDC				
Operating Mode:	Bluetooth Low Energy, Continuous Transmit.				
Deviations:	None				
Comments:	Reference data comments for EUT channel and orientation. Due to antenna symmetry, only two orthogonal axis were investigated. Output power set to +8 dBm. Using Antenna with gain of 3.2 dBi. Due to the fixed low duty cycle of the advertising channels and hopping nature of the data channels a duty cycle correction factor was applied to the average data. The worst case DCCF from both modes was applied to the data.				

Test Specifications	**Test Method**
FCC 15.247:2015	ANSI C63.10:2013

Run #	18	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 1.25(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4960.490	55.9	6.8	1.0	31.0	0.0	0.0	Horz	PK	0.0	62.7	74.0	-11.3	High Ch. 2480 MHz, EUT Horz
4960.350	55.6	6.8	1.0	26.1	0.0	0.0	Horz	PK	0.0	62.4	74.0	-11.6	High Ch. 2480 MHz, EUT Hor
4960.540	53.9	6.8	1.0	249.0	0.0	0.0	Vert	PK	0.0	60.7	74.0	-13.3	High Ch. 2480 MHz, EUT Vert
2485.293	42.5	-1.9	1.0	47.1	0.0	20.0	Horz	PK	0.0	60.6	74.0	-13.4	High Ch. 2480 MHz, EUT Vert
7319.085	46.3	14.2	1.2	210.1	0.0	0.0	Horz	PK	0.0	60.5	74.0	-13.5	Mid Ch. 2440 MHz, EUT Horz
2485.057	42.2	-1.9	2.5	200.0	0.0	20.0	Vert	PK	0.0	60.3	74.0	-13.7	High Ch. 2480 MHz, EUT Vert
4960.440	53.3	6.8	1.0	194.0	0.0	0.0	Vert	PK	0.0	60.1	74.0	-13.9	High Ch. 2480 MHz, EUT Vert
7320.625	45.5	14.2	1.0	12.1	0.0	0.0	Vert	PK	0.0	59.7	74.0	-14.3	Mid Ch. 2440 MHz, EUT Vert
7440.585	44.4	14.6	2.3	38.0	0.0	0.0	Vert	PK	0.0	59.0	74.0	-15.0	High Ch. 2480 MHz, EUT Vert
4880.330	52.3	6.5	1.0	7.0	0.0	0.0	Horz	PK	0.0	58.8	74.0	-15.2	Mid Ch. 2440 MHz, EUT Horz
7439.175	44.1	14.6	2.3	12.1	0.0	0.0	Horz	PK	0.0	58.7	74.0	-15.3	High Ch. 2480 MHz, EUT Hor
4880.430	52.1	6.5	1.0	257.0	0.0	0.0	Vert	PK	0.0	58.6	74.0	-15.4	Mid Ch. 2440 MHz, EUT Vert
4959.465	51.6	6.8	1.0	315.0	0.0	0.0	Vert	PK	0.0	58.4	74.0	-15.6	High Ch. 2480 MHz, EUT Horz
4803.700	50.2	6.4	1.0	346.0	0.0	0.0	Horz	PK	0.0	56.6	74.0	-17.4	Low Ch. 2402 MHz, EUT Horz
4803.490	49.8	6.4	1.0	88.1	0.0	0.0	Vert	PK	0.0	56.2	74.0	-17.8	Low Ch. 2402 MHz, EUT Vert
4959.635	48.7	6.8	3.9	29.1	0.0	0.0	Horz	PK	0.0	55.5	74.0	-18.5	High Ch. 2480 MHz, EUT Vert
4960.255	47.7	6.8	1.0	26.1	0.0	0.0	Horz	PK	0.0	54.5	74.0	-19.5	High Ch. 2480 MHz, EUT Horz
19841.610	41.1	12.0	1.8	78.0	0.0	0.0	Vert	PK	0.0	53.1	74.0	-20.9	High Ch. 2480 MHz, EUT Vert
12008.580	56.9	-3.8	1.7	80.1	0.0	0.0	Horz	PK	0.0	53.1	74.0	-20.9	Low Ch. 2402 MHz, EUT Horz
19521.520	41.2	11.7	1.6	292.0	0.0	0.0	Horz	PK	0.0	52.9	74.0	-21.1	Mid Ch. 2440 MHz, EUT Horz
19838.100	40.7	12.0	1.6	292.0	0.0	0.0	Horz	PK	0.0	52.7	74.0	-21.3	High Ch. 2480 MHz, EUT Horz
4959.490	45.6	6.8	1.0	311.9	0.0	0.0	Vert	PK	0.0	52.4	74.0	-21.6	High Ch. 2480 MHz, EUT Vert
19214.290	41.1	11.3	1.8	218.0	0.0	0.0	Vert	PK	0.0	52.4	74.0	-21.6	Low Ch. 2402 MHz, EUT Vert
19521.320	40.2	11.7	1.8	252.0	0.0	0.0	Vert	PK	0.0	51.9	74.0	-22.1	Mid Ch. 2440 MHz, EUT Vert

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
19216.900	40.6	11.3	1.7	114.0	0.0	0.0	Horz	PK	0.0	51.9	74.0	-22.1	Low Ch. 2402 MHz, EUT Horz
12201.140	54.3	-3.1	1.3	264.9	0.0	0.0	Horz	PK	0.0	51.2	74.0	-22.8	Mid Ch. 2440 MHz, EUT Horz
12398.760	51.6	-2.7	1.8	328.0	0.0	0.0	Horz	PK	0.0	48.9	74.0	-25.1	High Ch. 2480 MHz, EUT Hor
12008.620	51.9	-3.8	1.0	264.9	0.0	0.0	Vert	PK	0.0	48.1	74.0	-25.9	Low Ch. 2402 MHz, EUT Vert
12201.080	50.1	-3.1	1.0	94.1	0.0	0.0	Vert	PK	0.0	47.0	74.0	-27.0	Mid Ch. 2440 MHz, EUT Vert
12398.860	48.9	-2.7	1.7	289.0	0.0	0.0	Vert	PK	0.0	46.2	74.0	-27.8	High Ch. 2480 MHz, EUT Vert
4959.925	53.0	6.8	1.0	31.0	-47.3	0.0	Horz	AV	0.0	12.5	54.0	-41.5	High Ch. 2480 MHz, EUT Horz
4959.960	52.3	6.8	1.0	26.1	-47.3	0.0	Horz	AV	0.0	11.8	54.0	-42.2	High Ch. 2480 MHz, EUT Hor
4959.965	50.7	6.8	1.0	249.0	-47.3	0.0	Vert	AV	0.0	10.2	54.0	-43.8	High Ch. 2480 MHz, EUT Vert
4959.935	49.9	6.8	1.0	194.0	-47.3	0.0	Vert	AV	0.0	9.4	54.0	-44.6	High Ch. 2480 MHz, EUT Vert
4879.890	48.5	6.5	1.0	7.0	-47.3	0.0	Horz	AV	0.0	7.7	54.0	-46.3	Mid Ch. 2440 MHz, EUT Horz
4879.950	48.2	6.5	1.0	257.0	-47.3	0.0	Vert	AV	0.0	7.4	54.0	-46.6	Mid Ch. 2440 MHz, EUT Vert
4959.920	47.6	6.8	1.0	315.0	-47.3	0.0	Vert	AV	0.0	7.1	54.0	-46.9	High Ch. 2480 MHz, EUT Horz
7319.390	39.3	14.2	1.2	210.1	-47.3	0.0	Horz	AV	0.0	6.2	54.0	-47.8	Mid Ch. 2440 MHz, EUT Horz
7319.385	38.8	14.2	1.0	12.1	-47.3	0.0	Vert	AV	0.0	5.7	54.0	-48.3	Mid Ch. 2440 MHz, EUT Vert
4803.900	46.1	6.4	1.0	346.0	-47.3	0.0	Horz	AV	0.0	5.2	54.0	-48.8	Low Ch. 2402 MHz, EUT Horz
4803.895	45.1	6.4	1.0	88.1	-47.3	0.0	Vert	AV	0.0	4.2	54.0	-49.8	Low Ch. 2402 MHz, EUT Vert
7440.375	36.7	14.6	2.3	38.0	-47.3	0.0	Vert	AV	0.0	4.0	54.0	-50.0	High Ch. 2480 MHz, EUT Vert
7440.295	36.2	14.6	2.3	12.1	-47.3	0.0	Horz	AV	0.0	3.5	54.0	-50.5	High Ch. 2480 MHz, EUT Hor
4959.955	43.6	6.8	3.9	29.1	-47.3	0.0	Horz	AV	0.0	3.1	54.0	-50.9	High Ch. 2480 MHz, EUT Vert
4960.010	42.6	6.8	1.0	26.1	-47.3	0.0	Horz	AV	0.0	2.1	54.0	-51.9	High Ch. 2480 MHz, EUT Horz
2483.687	31.0	-1.9	2.5	200.0	-47.3	20.0	Vert	AV	0.0	1.8	54.0	-52.2	High Ch. 2480 MHz, EUT Vert
2484.630	30.7	-1.9	1.0	47.1	-47.3	20.0	Horz	AV	0.0	1.5	54.0	-52.5	High Ch. 2480 MHz, EUT Vert
12010.950	51.1	-3.8	1.7	80.1	-47.3	0.0	Horz	AV	0.0	0.0	54.0	-54.0	Low Ch. 2402 MHz, EUT Horz
4960.030	39.0	6.8	1.0	311.9	-47.3	0.0	Vert	AV	0.0	-1.5	54.0	-55.5	High Ch. 2480 MHz, EUT Vert
12198.790	48.3	-3.1	1.3	264.9	-47.3	0.0	Horz	AV	0.0	-2.1	54.0	-56.1	Mid Ch. 2440 MHz, EUT Horz
19841.900	31.2	12.0	1.8	78.0	-47.3	0.0	Vert	AV	0.0	-4.1	54.0	-58.1	High Ch. 2480 MHz, EUT Vert
19521.570	31.3	11.7	1.6	292.0	-47.3	0.0	Horz	AV	0.0	-4.3	54.0	-58.3	Mid Ch. 2440 MHz, EUT Horz
19838.150	30.5	12.0	1.6	292.0	-47.3	0.0	Horz	AV	0.0	-4.8	54.0	-58.8	High Ch. 2480 MHz, EUT Horz
12399.000	44.8	-2.7	1.8	328.0	-47.3	0.0	Horz	AV	0.0	-5.2	54.0	-59.2	High Ch. 2480 MHz, EUT Hor
19521.520	30.2	11.7	1.8	252.0	-47.3	0.0	Vert	AV	0.0	-5.4	54.0	-59.4	Mid Ch. 2440 MHz, EUT Vert
19214.500	30.6	11.3	1.7	114.0	-47.3	0.0	Horz	AV	0.0	-5.4	54.0	-59.4	Low Ch. 2402 MHz, EUT Horz
19214.250	30.6	11.3	1.8	218.0	-47.3	0.0	Vert	AV	0.0	-5.4	54.0	-59.4	Low Ch. 2402 MHz, EUT Vert
12008.740	45.2	-3.8	1.0	264.9	-47.3	0.0	Vert	AV	0.0	-5.9	54.0	-59.9	Low Ch. 2402 MHz, EUT Vert
12200.890	42.6	-3.1	1.0	94.1	-47.3	0.0	Vert	AV	0.0	-7.8	54.0	-61.8	Mid Ch. 2440 MHz, EUT Vert
12398.930	41.3	-2.7	1.7	289.0	-47.3	0.0	Vert	AV	0.0	-8.7	54.0	-62.7	High Ch. 2480 MHz, EUT Vert

BAND EDGE COMPLIANCE

XMit 2015.01.14

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 (mos)
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	4/20/2015	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(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 2015.01.14

EUT:	QX-008-427			**Work Order:**	PQCD0003
Serial Number:	See Configuration			**Date:**	10/07/15
Customer:	Parker Hannifin Corporation			**Temperature:**	23°C
Attendees:	Shawn Ellis, Tim Skwiot			**Humidity:**	36%
Project:	None			**Barometric Pres.:**	993.8
Tested by:	Jared Ison	**Power:**		**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

EUT set to single channel continuous transmit using test firmware. EUT output power set to 8 dBm.

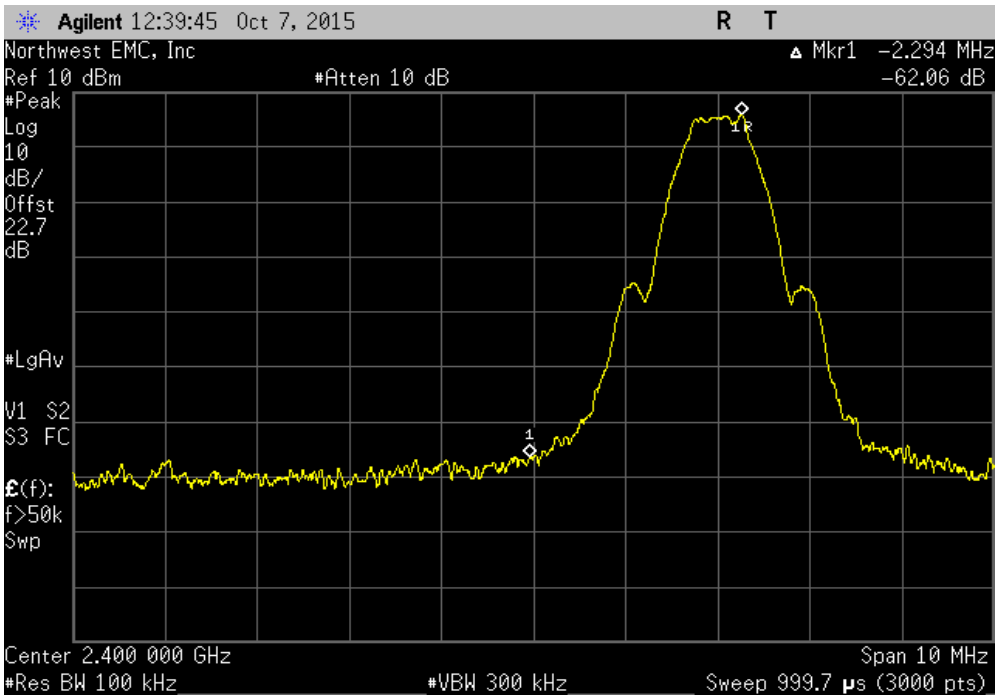
DEVIATIONS FROM TEST STANDARD

None

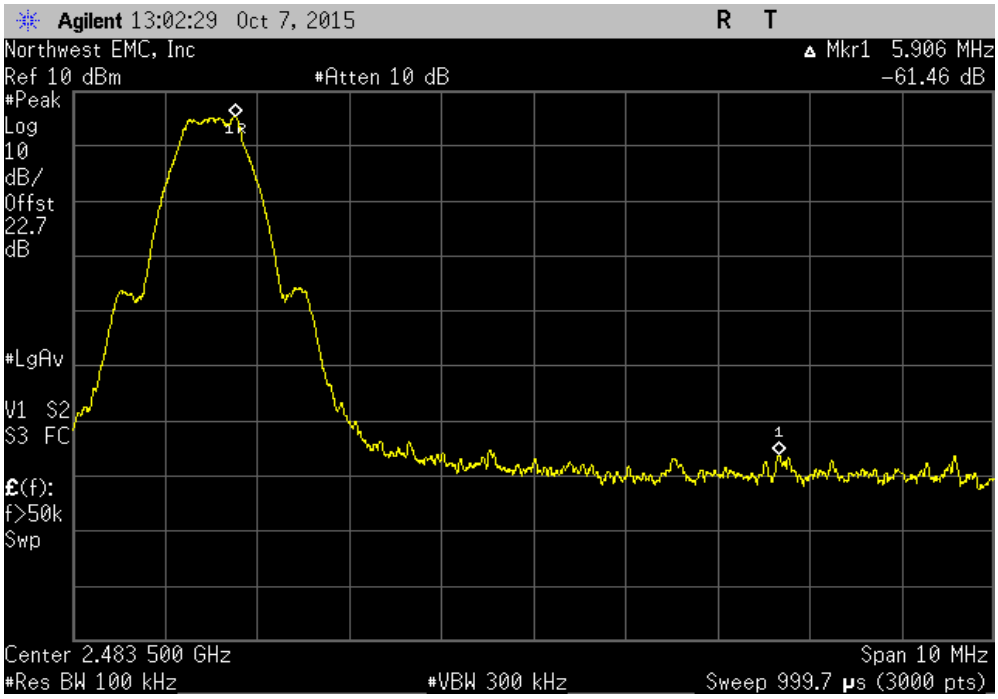
Configuration #	1	Signature

	Value (dBc)	Limit ≤ (dBc)	Result
Bluetooth Low Energy			
Low Channel, 2402 MHz	-62.06	-20	Pass
High Channel, 2480 MHz	-61.46	-20	Pass

Bluetooth Low Energy, Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-62.06	-20	Pass



Bluetooth Low Energy, High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-61.46	-20	Pass



DUTY CYCLE

XMit 2015.01.14

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 (mos)
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	3/2/2015	12
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	5/5/2015	12
Antenna - Double Ridge	ETS Lindgren	3115	AJA	6/3/2014	24
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2015	12

TEST DESCRIPTION

EUT was configured to the worst case duty cycle under normal operating conditions for the measurement of “Duty Cycle Correction Factor”.

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 measured radiated in the RF chamber.

DUTY CYCLE

NORTHWEST EMC

XMit 2015.01.14

EUT:	QX-008-427			**Work Order:**	PQCD0001
Serial Number:	See Configuration			**Date:**	09/16/15
Customer:	Parker Hannifin Corporation			**Temperature:**	23°C
Attendees:	Tim Skwiot, Shawn Ellis			**Humidity:**	67%
Project:	None			**Barometric Pres.:**	983
Tested by:	Jared Ison	**Power:**	Battery, 3 VDC	**Job Site:**	MN05

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

Output power set to +8 dBm. Using Antenna with gain of 3.2 dBi. EUT was set to normal operating conditions.

DEVIATIONS FROM TEST STANDARD

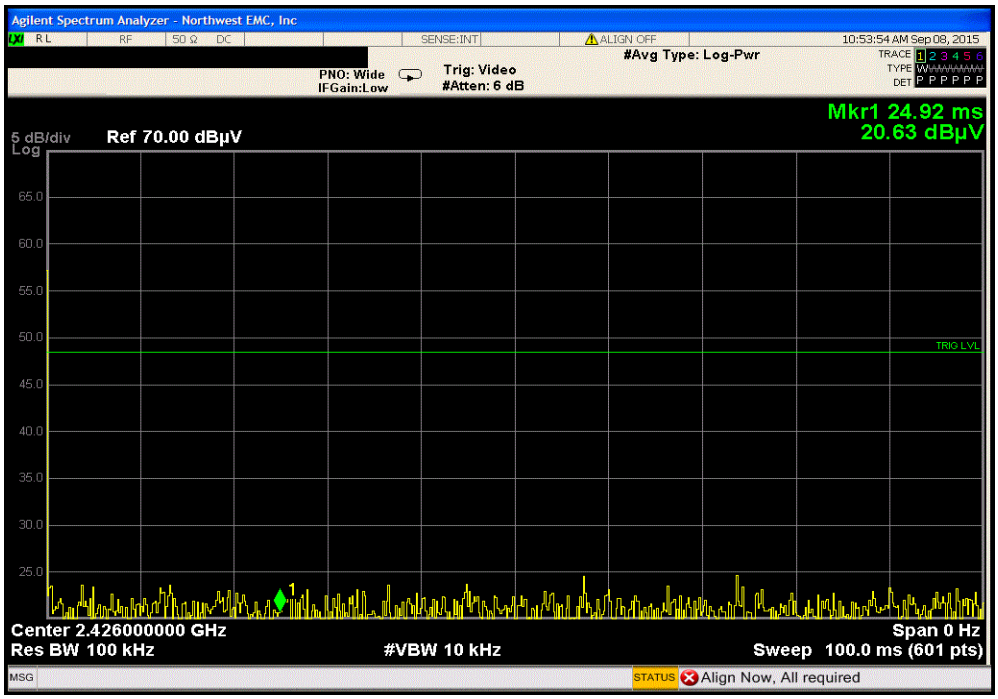
None

Configuration #	1	Signature

	Value	Limit	Result
Bluetooth Low Engery			
Mid. Ch. 2426 MHz			
100 ms Period	See Graph	N/A	N/A
500 ms Period	See Graph	N/A	N/A
Pulse Width	433.3 us	N/A	N/A

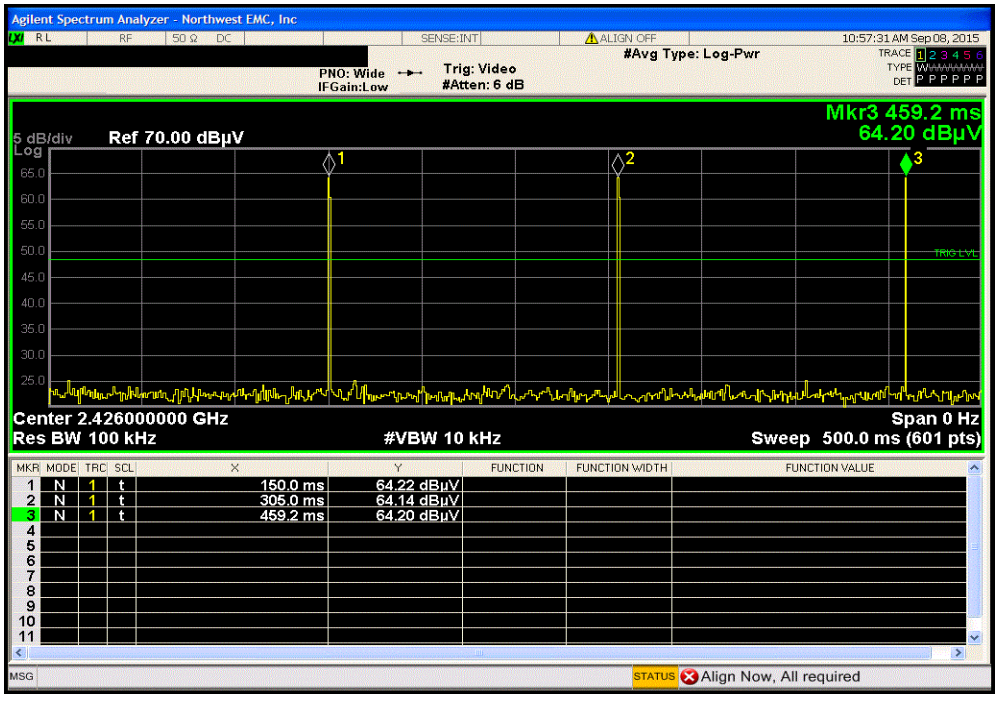
Bluetooth Low Engery, Mid. Ch. 2426 MHz, 100 ms Period

				Value	Limit	Result
				See Graph	N/A	N/A



Bluetooth Low Engery, Mid. Ch. 2426 MHz, 500 ms Period

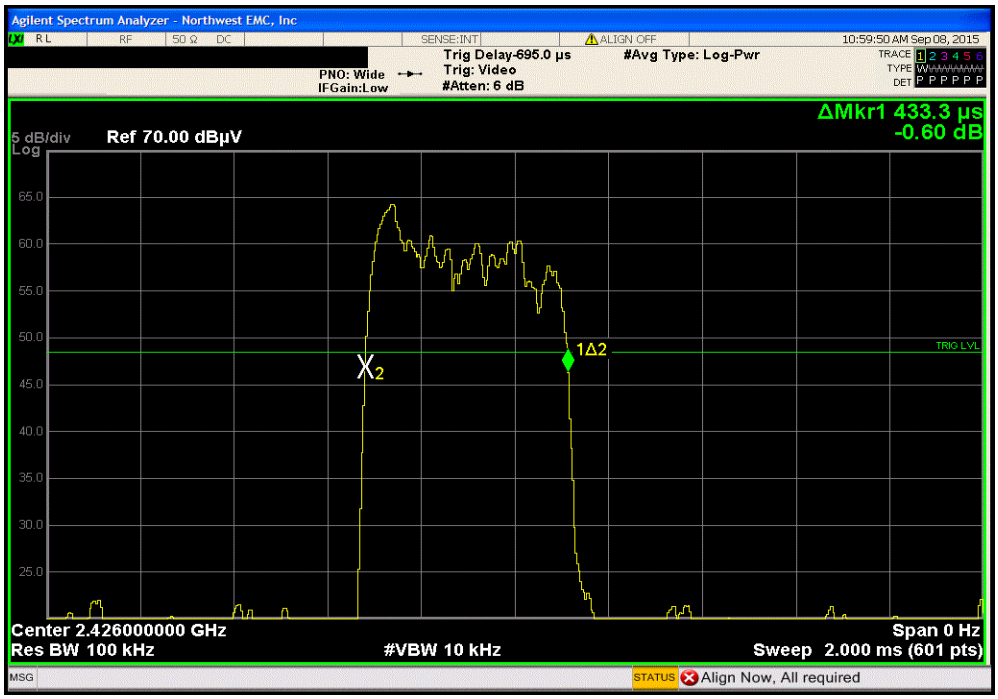
				Value	Limit	Result
				See Graph	N/A	N/A



DUTY CYCLE

XMit 2015.01.14

Bluetooth Low Engery, Mid. Ch. 2426 MHz, Pulse Width						
				Value	Limit	Result
				433.3 us	N/A	N/A



OCCUPIED BANDWIDTH

XMit 2015.01.14

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 (mos)
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	4/20/2015	12

TEST DESCRIPTION

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.9% (approximate 26 dB) emission bandwidth (EBW) 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

NORTHWEST EMC

XMit 2015.01.14

EUT:	QX-008-427			**Work Order:**	PQCD0003
Serial Number:	See Configuration			**Date:**	10/07/15
Customer:	Parker Hannifin Corporation			**Temperature:**	23°C
Attendees:	Shawn Ellis, Tim Skwiot			**Humidity:**	36%
Project:	None			**Barometric Pres.:**	993.8
Tested by:	Jared Ison	**Power:**	Battery, 3 VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

EUT set to single channel continuous transmit using test firmware. EUT output power set to 8 dBm.

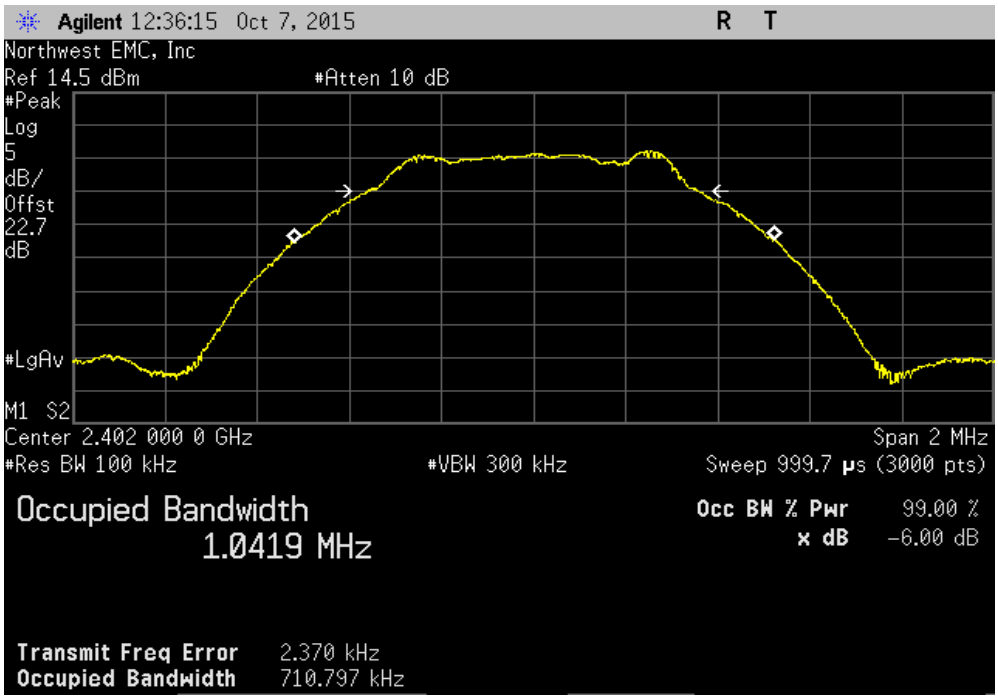
DEVIATIONS FROM TEST STANDARD

None

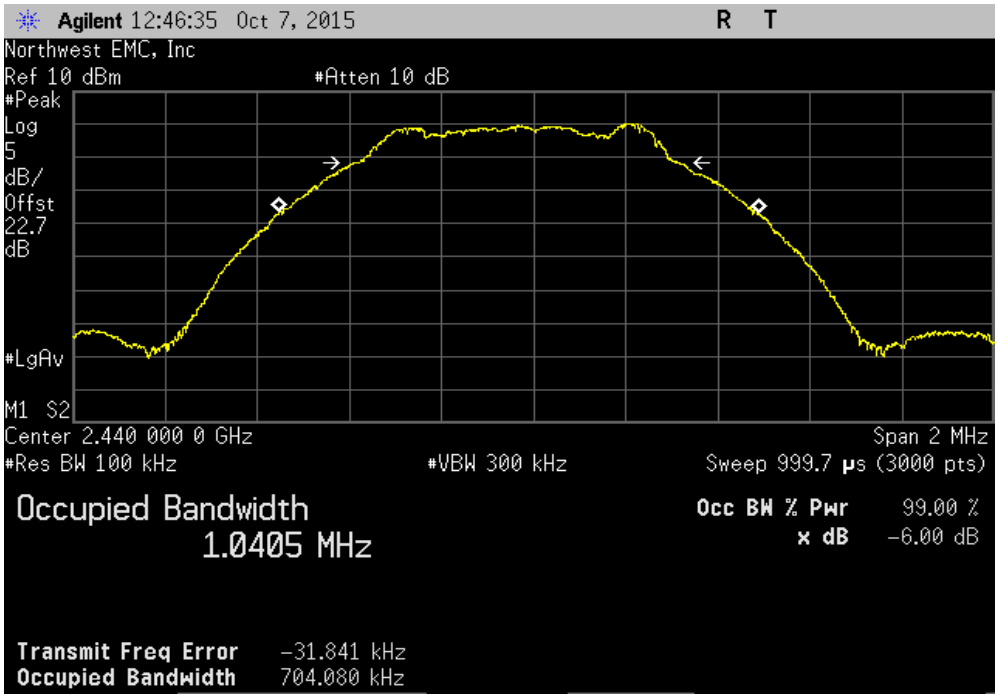
Configuration #	1	Signature

	Value	Limit (≥)	Result
Bluetooth Low Energy			
Low Channel, 2402 MHz	710.797 kHz	500 kHz	Pass
Mid Channel, 2440 MHz	704.08 kHz	500 kHz	Pass
High Channel, 2480 MHz	709.317 kHz	500 kHz	Pass

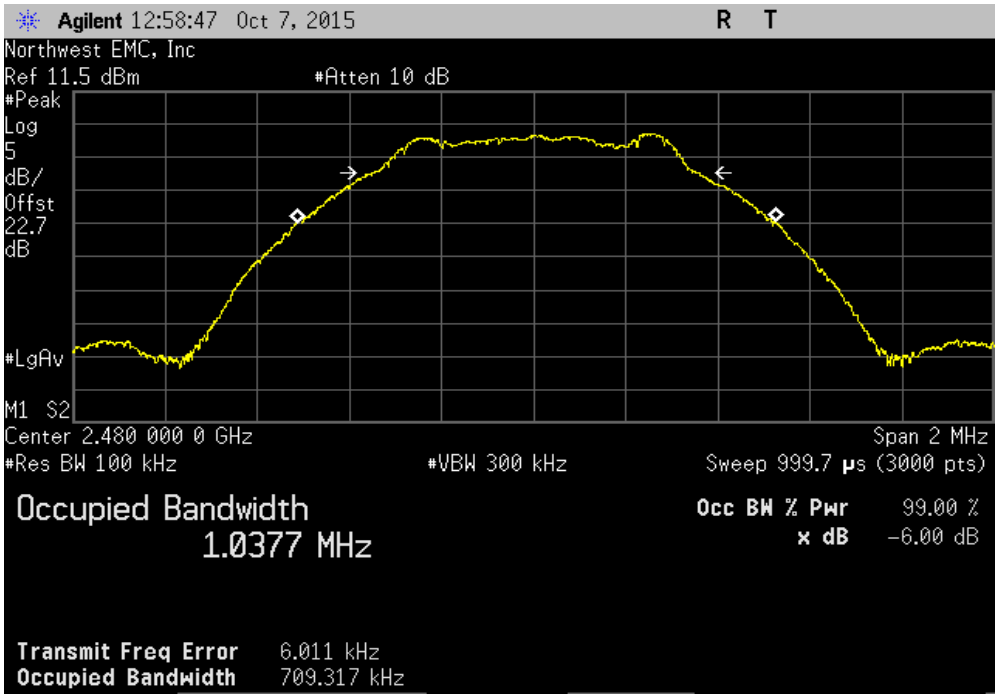
Bluetooth Low Energy, Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				710.797 kHz	500 kHz	Pass



Bluetooth Low Energy, Mid Channel, 2440 MHz						
				Value	Limit (≥)	Result
				704.08 kHz	500 kHz	Pass



Bluetooth Low Energy, High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				709.317 kHz	500 kHz	Pass



OUTPUT POWER

XMit 2015.01.14

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 (mos)
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	4/20/2015	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 11.10.2 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

NORTHWEST EMC

XMit 2015.01.14

EUT:	QX-008-427			**Work Order:**	PQCD0003
Serial Number:	See Configuration			**Date:**	10/07/15
Customer:	Parker Hannifin Corporation			**Temperature:**	23°C
Attendees:	Shawn Ellis, Tim Skwiot			**Humidity:**	36%
Project:	None			**Barometric Pres.:**	993.8
Tested by:	Jared Ison	**Power:**	Battery, 3 VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

EUT set to single channel continuous transmit using test firmware. EUT output power set to 8 dBm.

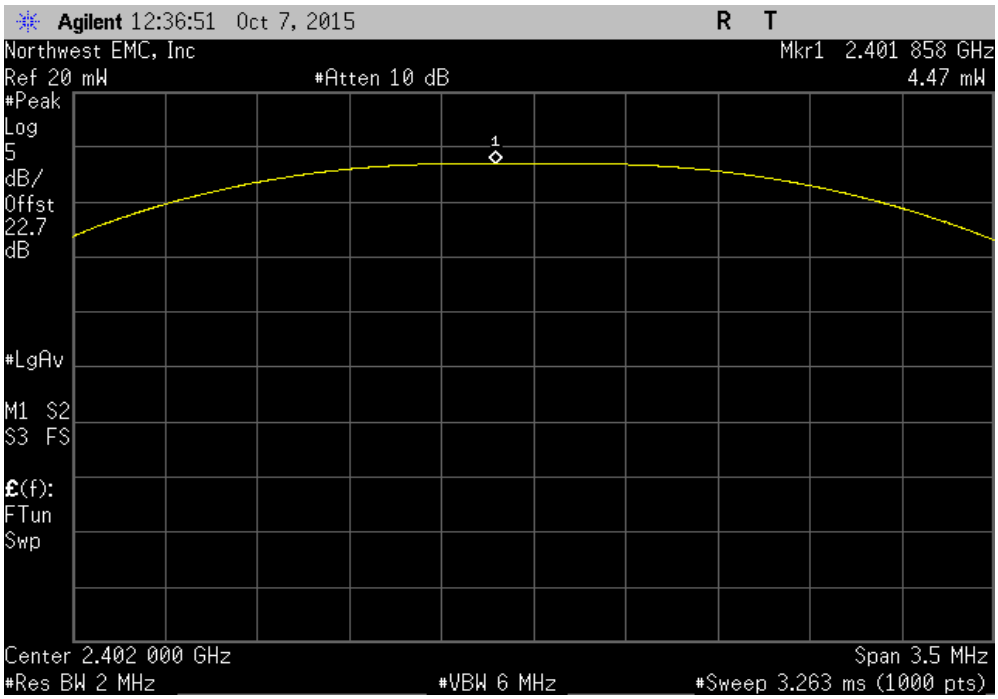
DEVIATIONS FROM TEST STANDARD

None

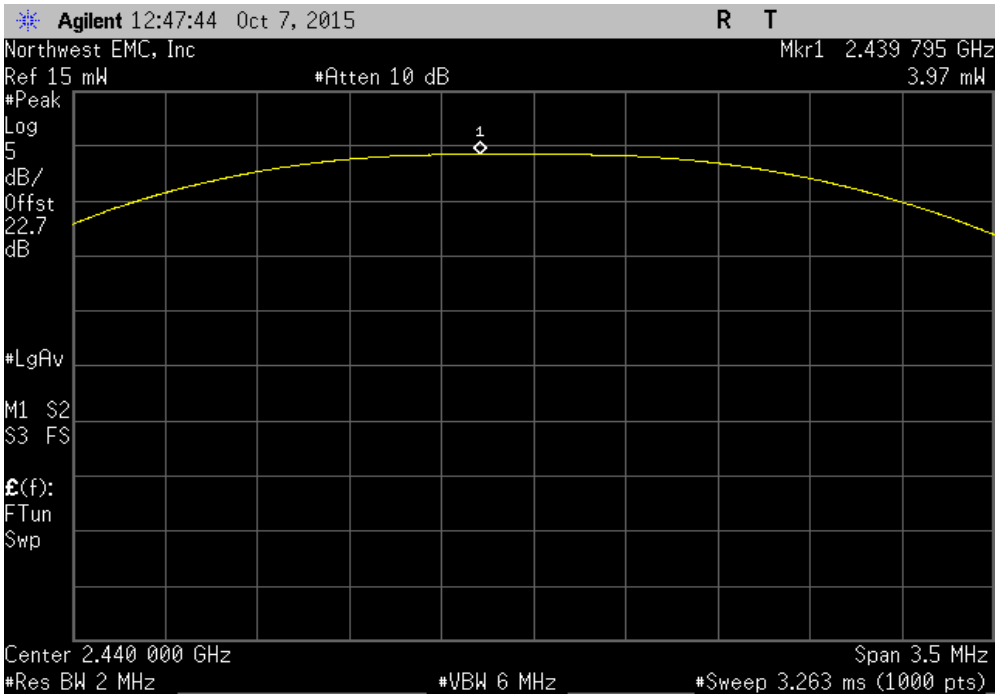
Configuration #	1	*Signature*

	Value	Limit (<)	Result
Bluetooth Low Energy			
Low Channel, 2402 MHz	4.471 mW	1 W	Pass
Mid Channel, 2440 MHz	3.971 mW	1 W	Pass
High Channel, 2480 MHz	3.964 mW	1 W	Pass

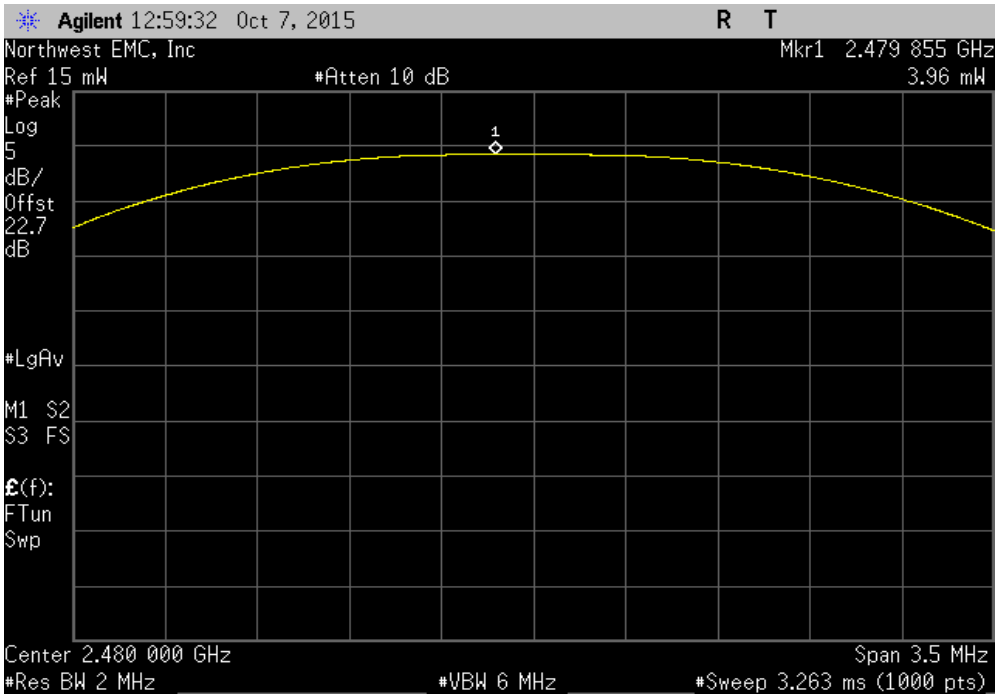
Bluetooth Low Energy, Low Channel, 2402 MHz						
				Value	Limit (<)	Result
				4.471 mW	1 W	Pass



Bluetooth Low Energy, Mid Channel, 2440 MHz						
				Value	Limit (<)	Result
				3.971 mW	1 W	Pass



Bluetooth Low Energy, High Channel, 2480 MHz						
				Value	Limit (<)	Result
				3.964 mW	1 W	Pass



POWER SPECTRAL DENSITY

XMit 2015.01.14

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 (mos)
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	4/20/2015	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 C63.10:2013 Section 11.10.2, the peak power spectral density was measured.

POWER SPECTRAL DENSITY

NORTHWEST EMC

XMit 2015.01.14

EUT:	QX-008-427			**Work Order:**	PQCD0003
Serial Number:	See Configuration			**Date:**	10/07/15
Customer:	Parker Hannifin Corporation			**Temperature:**	23°C
Attendees:	Shawn Ellis, Tim Skwiot			**Humidity:**	36%
Project:	None			**Barometric Pres.:**	993.8
Tested by:	Jared Ison	**Power:**	Battery, 3 VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

EUT set to single channel continuous transmit using test firmware. EUT output power set to 8 dBm.

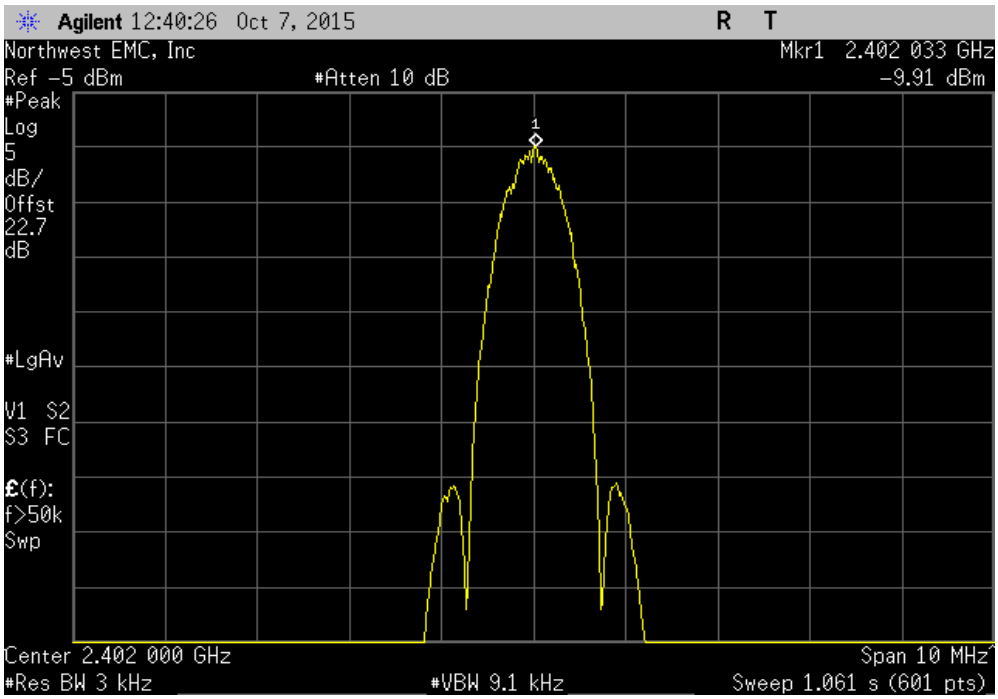
DEVIATIONS FROM TEST STANDARD

None

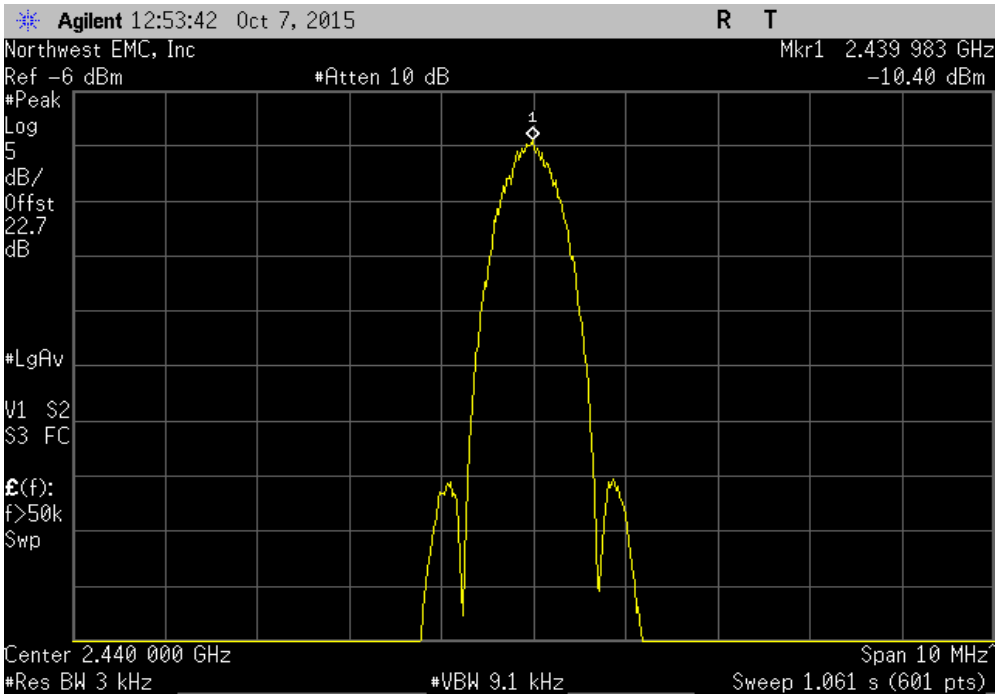
Configuration #	1	Signature

	Value dBm/3kHz	Limit < dBm/3kHz	Results
Bluetooth Low Energy			
Low Channel, 2402 MHz	-9.907	8	Pass
Mid Channel, 2440 MHz	-10.401	8	Pass
High Channel, 2480 MHz	-10.401	8	Pass

Bluetooth Low Energy, Low Channel, 2402 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-9.907	8	Pass



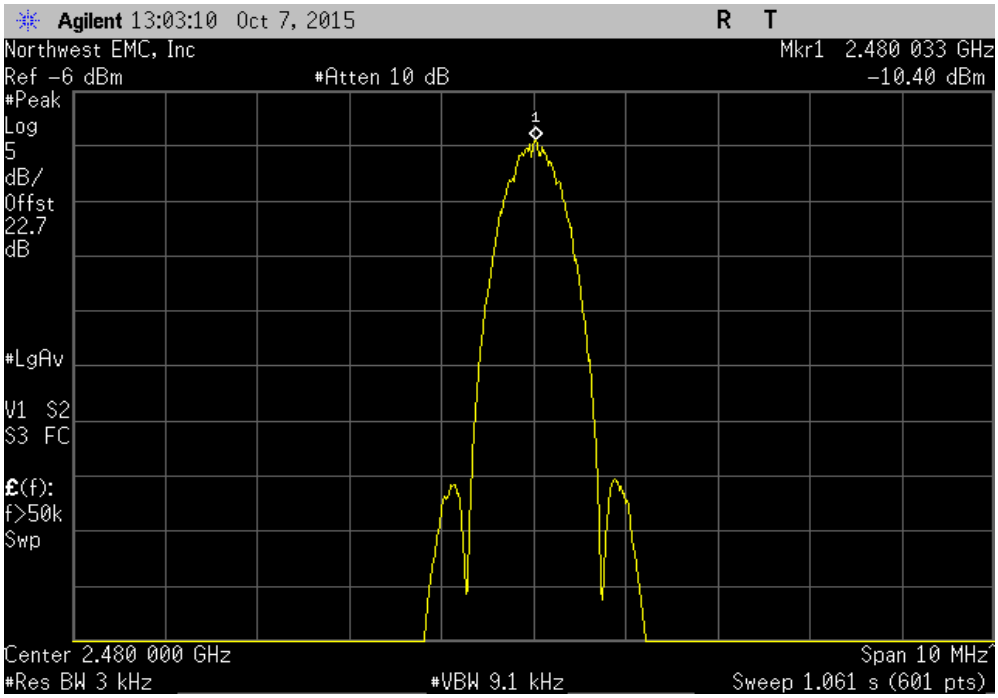
Bluetooth Low Energy, Mid Channel, 2440 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-10.401	8	Pass



POWER SPECTRAL DENSITY

XMit 2015.01.14

Bluetooth Low Energy, High Channel, 2480 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-10.401	8	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2015.01.14

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 (mos)
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	4/20/2015	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

NORTHWEST EMC

XMit 2015.01.14

EUT:	QX-008-427			**Work Order:**	PQCD0003
Serial Number:	See Configuration			**Date:**	10/07/15
Customer:	Parker Hannifin Corporation			**Temperature:**	23°C
Attendees:	Shawn Ellis, Tim Skwiot			**Humidity:**	36%
Project:	None			**Barometric Pres.:**	993.8
Tested by:	Jared Ison	**Power:**	Battery, 3 VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

EUT set to single channel continuous transmit using test firmware. EUT output power set to 8 dBm.

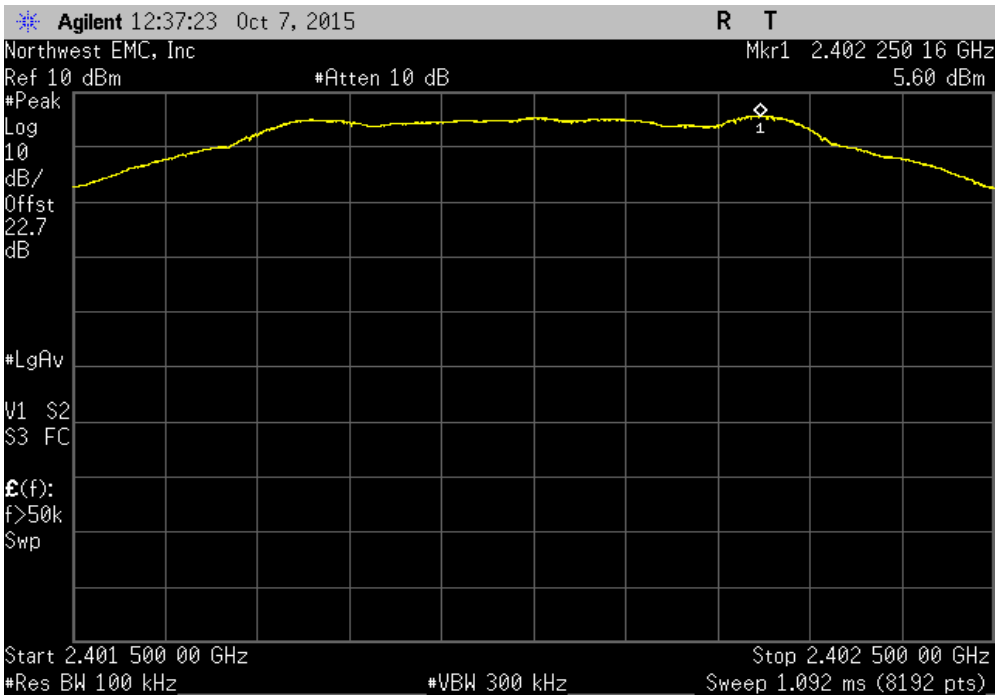
DEVIATIONS FROM TEST STANDARD

None

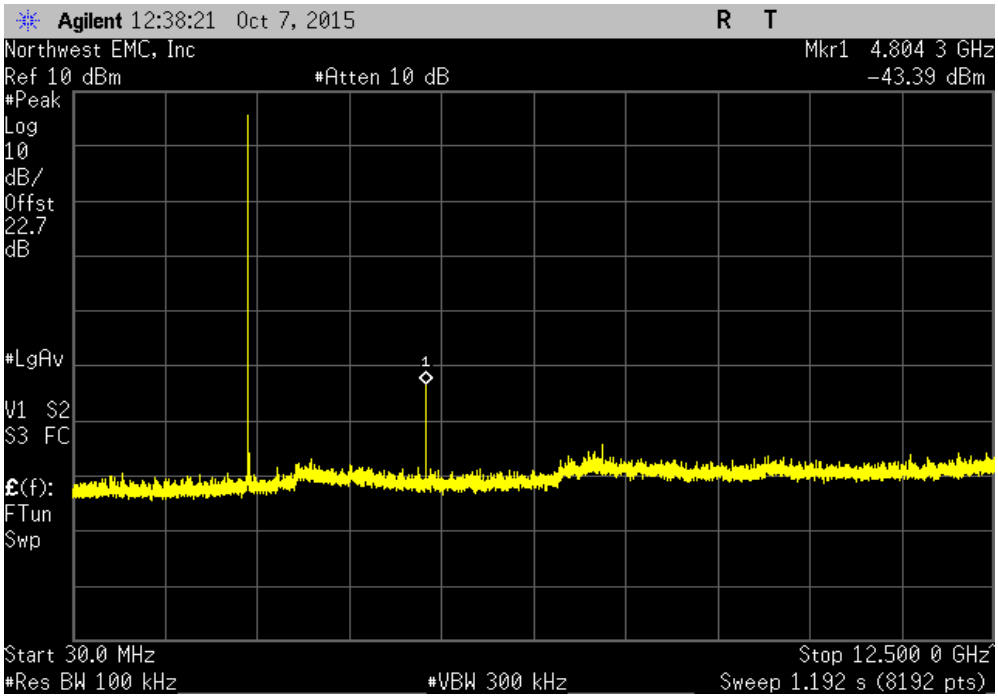
Configuration #	1	Signature

	Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
Bluetooth Low Energy				
Low Channel, 2402 MHz	Fundamental	N/A	N/A	N/A
Low Channel, 2402 MHz	30 MHz - 12.5 GHz	-48.99	-20	Pass
Low Channel, 2402 MHz	12.5 GHz - 25 GHz	-56.92	-20	Pass
Mid Channel, 2440 MHz	Fundamental	N/A	N/A	N/A
Mid Channel, 2440 MHz	30 MHz - 12.5 GHz	-46.53	-20	Pass
Mid Channel, 2440 MHz	12.5 GHz - 25 GHz	-52.12	-20	Pass
High Channel, 2480 MHz	Fundamental	N/A	N/A	N/A
High Channel, 2480 MHz	30 MHz - 12.5 GHz	-46.21	-20	Pass
High Channel, 2480 MHz	12.5 GHz - 25 GHz	-49.1	-20	Pass

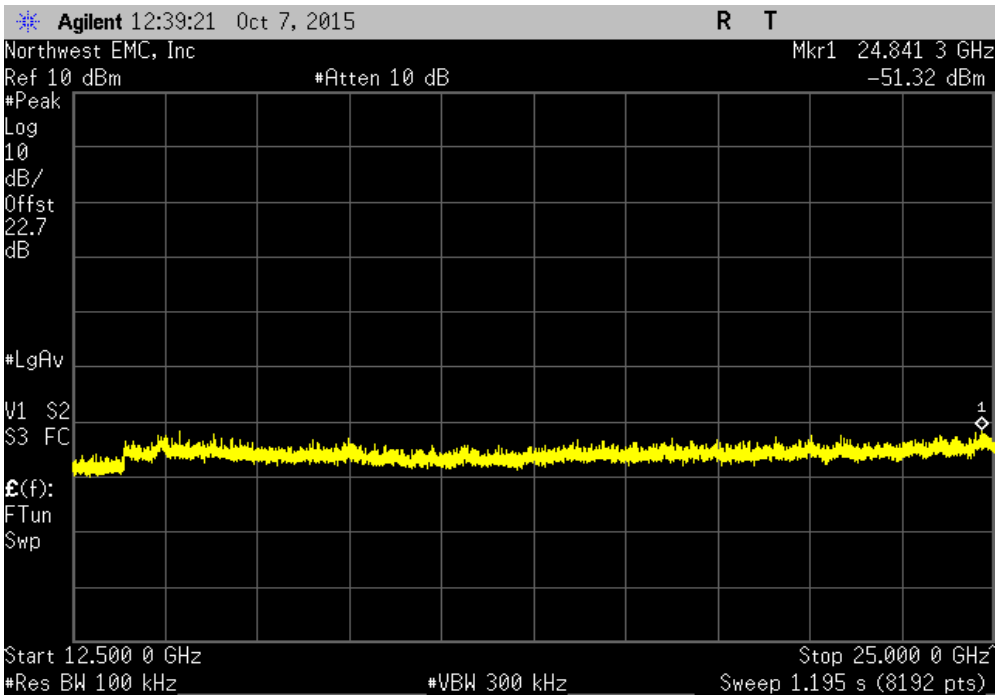
Bluetooth Low Energy, Low Channel, 2402 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



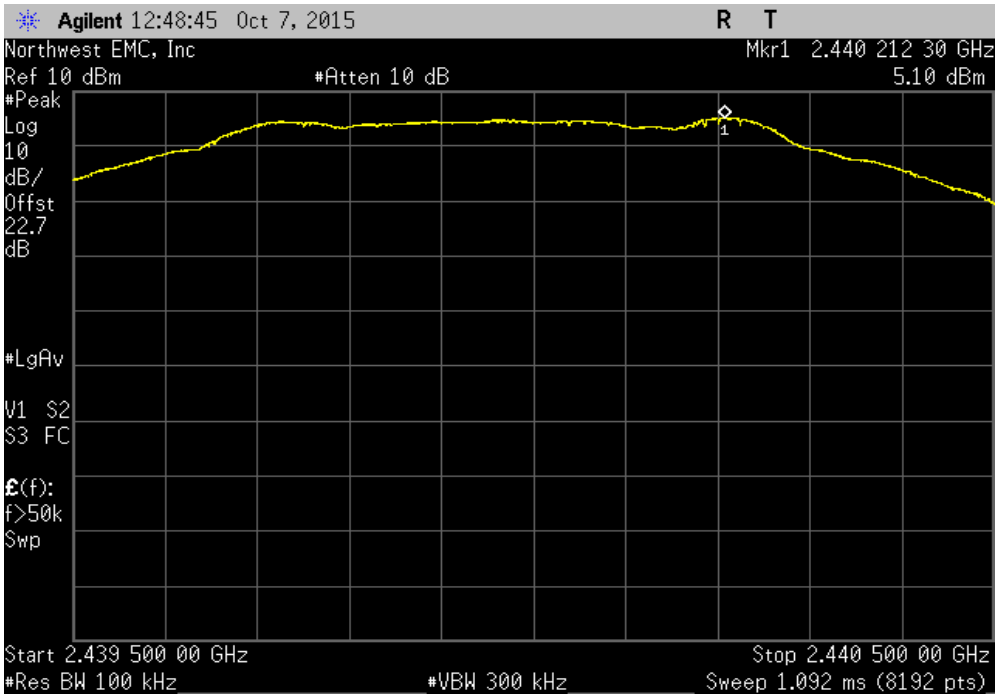
Bluetooth Low Energy, Low Channel, 2402 MHz					
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz		-48.99	-20	Pass	



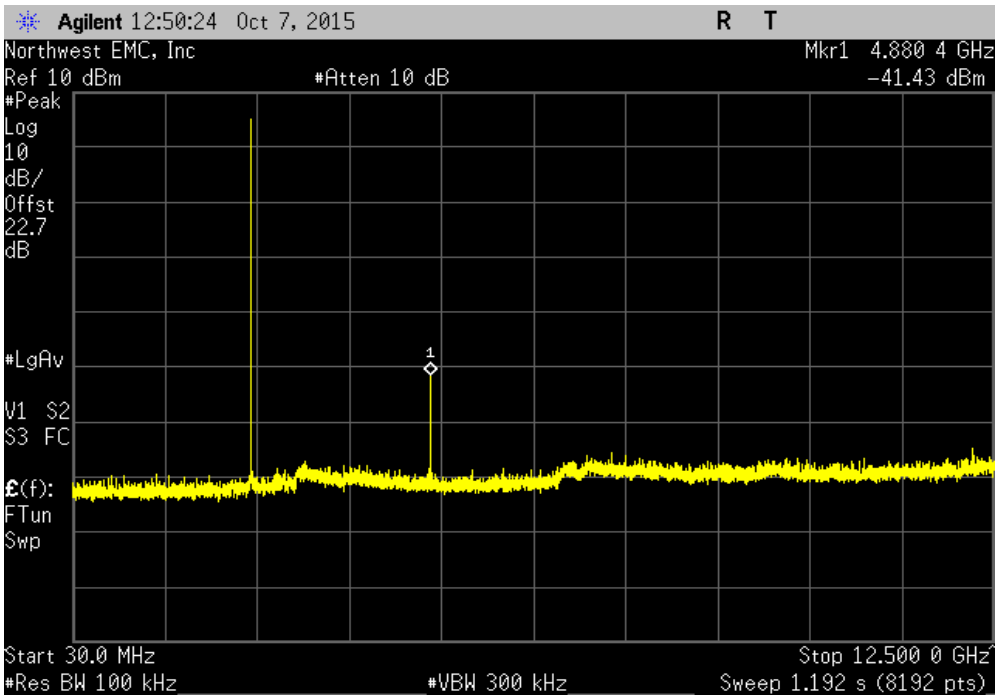
Bluetooth Low Energy, Low Channel, 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-56.92	-20	Pass



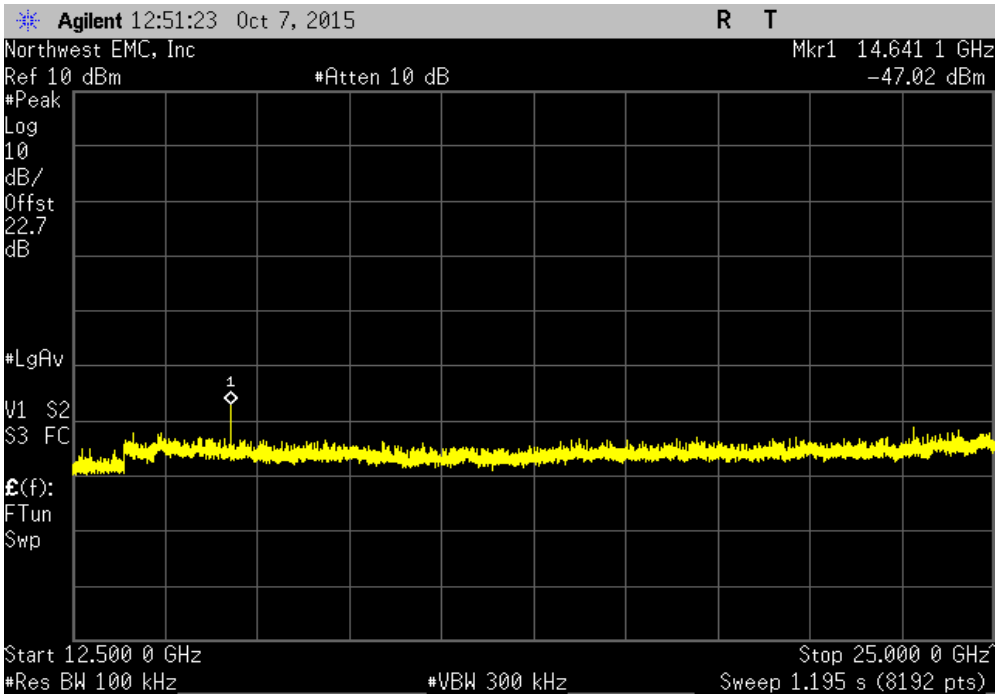
Bluetooth Low Energy, Mid Channel, 2440 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



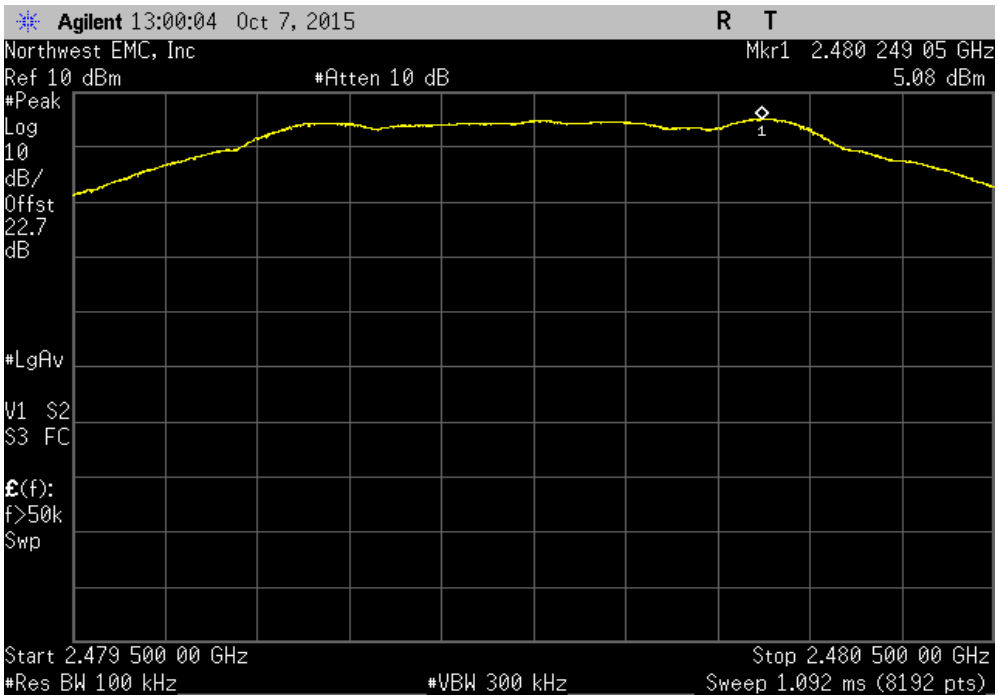
Bluetooth Low Energy, Mid Channel, 2440 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-46.53	-20	Pass



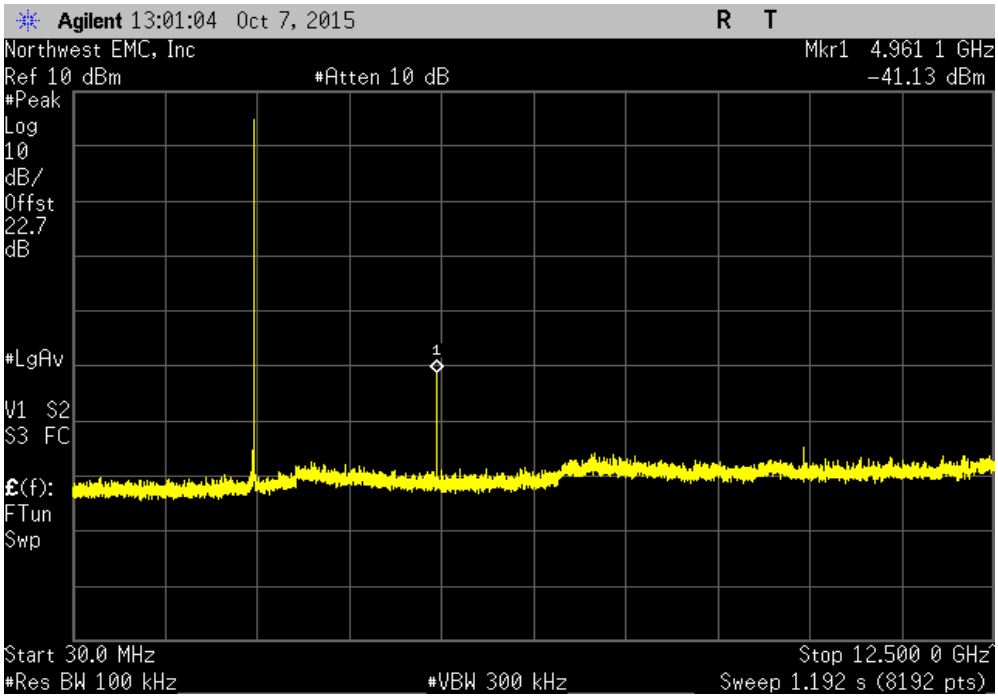
Bluetooth Low Energy, Mid Channel, 2440 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-52.12	-20	Pass



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



Bluetooth Low Energy, High Channel, 2480 MHz					
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz		-46.21	-20	Pass	



Bluetooth Low Energy, High Channel, 2480 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-49.1	-20	Pass