NORTHWEST EMC

Preco, Inc.

Wireless WorkSight PreView Sensor Model WWS7220

FCC 15.247:2015

Report # PRCO0074.1

NVLAP Lab Code: 200630-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

Last Date of Test: April 28, 2015
Preco, Inc.
Wireless WorkSight PreView Sensor Model WWS7220

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2015	ANSI C63.10:2009

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for vehicle mounted devices.
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
6.7	Band Edge Compliance	Yes	Pass	
6.7	Spurious Conducted Emissions	Yes	Pass	
6.9.1	Occupied Bandwidth	Yes	Pass	
6.10.2	Output Power	Yes	Pass	
6.11.2	Power Spectral Density	Yes	Pass	
7.5	Duty Cycle	Yes	N/A	Characterization of radio operation.

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.

REVISION HISTORY

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

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.2014.12.03

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.

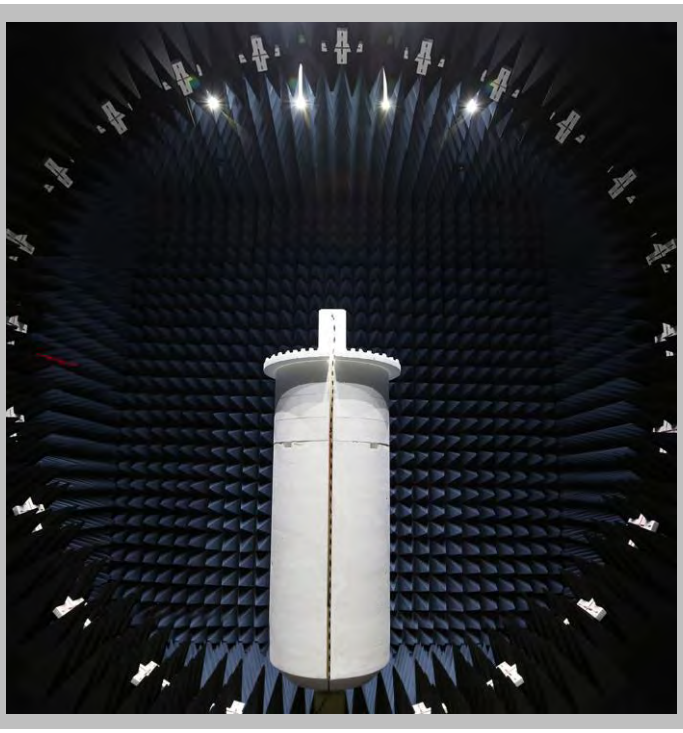
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

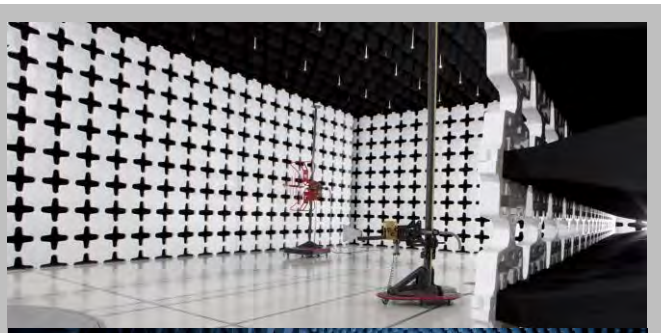
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.9 dB	-2.9 dB

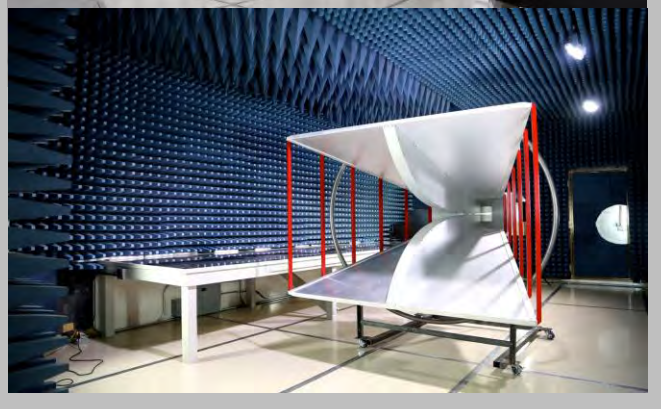
FACILITIES

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

NORTHWEST EMC
2014-12-10

Client and Equipment Under Test (EUT) Information

Company Name:	Preco, Inc.
Address:	10355 W Emerald St
City, State, Zip:	Boise, ID 83704-8241
Test Requested By:	John Fadgen
Model:	Wireless WorkSight PreView Sensor Model WWS7220
First Date of Test:	April 27, 2015
Last Date of Test:	April 28, 2015
Receipt Date of Samples:	April 27, 2015
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
'Sensor' unit utilizing a 5.8 GHz pulsed radio for sensing objects and a 2.4 GHz DTS radio for communicating with the LCD display.

Testing Objective:
To demonstrate compliance of the 2.4 GHz ISM radio to FCC 15.247 requirements.

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration PRCO0074- 1

Software/Firmware Running during test	
Description	**Version**
Firmware	1.9
Firmware	1.1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Sensor	Preco, Inc.	WWS7220	10997

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Display	Preco, Inc.	WD7102	3

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC and I/O Cable	No	1.6m	No	DC Power Supply	Display
DC and I/O Cable	No	1.8m	No	DC Power Supply	Cable Adapter
Cable adapter	No	.3m	No	Sensor	DC and I/O Cable

Configuration PRCO0074- 2

Software/Firmware Running during test	
Description	**Version**
Firmware	1.1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Sensor	Preco, Inc.	WWS7220	10997

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC and I/O Cable	No	1.8m	No	DC Power Supply	Cable Adapter
Cable adapter	No	.3m	No	Sensor	DC and I/O Cable

MODIFICATIONS

NORTHWEST EMC
2014-12-10

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	4/27/2015	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	4/28/2015	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.
3	4/28/2015	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.
4	4/28/2015	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.
5	4/28/2015	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.
6	4/28/2015	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

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

Continuous Tx, OQPSK

CHANNELS OF OPERATION

CH.11 2405MHz, Low Channel
CH.18 2440MHz, Mid Channel
CH.25 2480MHz, High Channel

POWER SETTINGS INVESTIGATED

12 VDC

CONFIGURATIONS INVESTIGATED

PRCO0074 - 2

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
Attenuator - 20dB, HF (1000MHz - 18000MHz)	Coaxicom	3910-20	AXZ	6/19/2014	12 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	4/16/2015	12 mo
Antenna, Horn	ETS	3160-08	AHV	NCR	0 mo
Cable	None	Standard Gain Horns Cable	EVF	4/20/2015	12 mo
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	4/20/2015	12 mo
Antenna, Horn	ETS	3160-07	AHU	NCR	0 mo
Cable	N/A	Double Ridge Horn Cables	EVB	4/16/2015	12 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	4/16/2015	12 mo
Antenna, Horn	ETS	3115	AIZ	1/27/2014	24 mo
High Pass Filter, 2.8 - 18 GHz	Micro-Tronics	HPM50111	HFO	3/31/2015	12 mo
Low Pass Filter, 0 - 1000 MHz	Micro-Tronics	LPM50004	LFD	6/18/2014	12 mo
Cable	N/A	Bilog Cables	EVA	2/10/2015	12 mo
Pre-Amplifier	Miteq	AM-1616-1000	AOL	2/10/2015	12 mo
Antenna, Biconilog	EMCO	3141	AXE	8/29/2014	24 mo
Signal Analyzer	Keysight	KT-N9010A	AFN	2/10/2015	12 mo

TEST DESCRIPTION

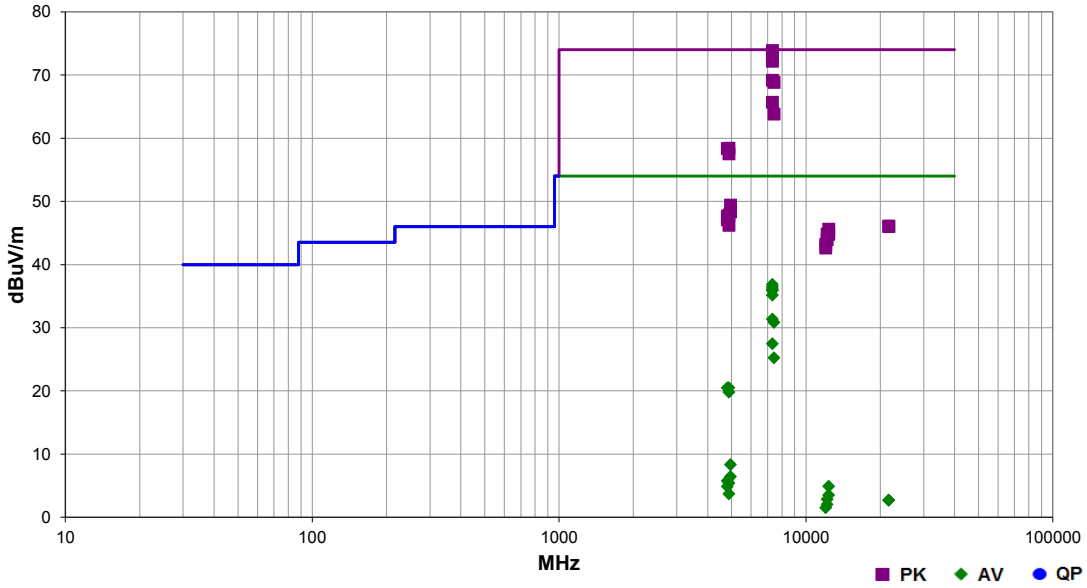
The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify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

SPURIOUS RADIATED EMISSIONS

Work Order:	PRCO0074	**Date:**	04/27/15		
Project:	None	**Temperature:**	22.4 °C		
Job Site:	EV01	**Humidity:**	42.6% RH		
Serial Number:	10345	**Barometric Pres.:**	1022 mbar	**Tested by:**	Brandon Hobbs
EUT:	Wireless WorkSight PreView Sensor Model WWS7220				
Configuration:	2				
Customer:	Preco, Inc.				
Attendees:	Jon Fix				
EUT Power:	12 VDC				
Operating Mode:	On Continuous				
Deviations:	None				
Comments:	Please reference the EUT orientation, frequency, power level and channel				

Test Specifications	**Test Method**
FCC 15.247:2015	ANSI C63.10:2009

Run #	14	**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 (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7320.783	58.7	15.2	1.7	137.0	0.0	0.0	Horz	PK	0.0	73.9	74.0	-0.1	Ch.18, 2440 MHz, Pwr19, EUT Horz
7318.042	58.1	15.2	2.2	249.0	0.0	0.0	Horz	PK	0.0	73.3	74.0	-0.7	Ch.18, 2440 MHz, Pwr19, EUT Vert
7318.008	57.9	15.2	1.8	139.0	0.0	0.0	Vert	PK	0.0	73.1	74.0	-0.9	Ch.18, 2440 MHz, Pwr19, EUT Horz
7317.975	57.8	15.2	1.0	53.0	0.0	0.0	Vert	PK	0.0	73.0	74.0	-1.0	Ch.18, 2440 MHz, Pwr19, EUT On Side
7318.358	57.6	15.2	1.0	360.0	0.0	0.0	Horz	PK	0.0	72.8	74.0	-1.2	Ch.18, 2440 MHz, Pwr19, EUT On Side
7318.192	57.0	15.2	1.0	348.0	0.0	0.0	Vert	PK	0.0	72.2	74.0	-1.8	Ch.18, 2440 MHz, Pwr19, EUT Vert
7318.333	54.0	15.2	1.8	136.0	0.0	0.0	Horz	PK	0.0	69.2	74.0	-4.8	Ch.18, 2440 MHz, Pwr17, EUT Horz
7423.275	53.4	15.4	1.9	133.0	0.0	0.0	Horz	PK	0.0	68.8	74.0	-5.2	Ch.25, 2475 MHz, Pwr17, EUT Horz
7321.275	50.5	15.2	1.0	46.0	0.0	0.0	Vert	PK	0.0	65.7	74.0	-8.3	Ch.18, 2440 MHz, Pwr17, EUT On Side
7423.275	48.4	15.4	1.2	49.0	0.0	0.0	Vert	PK	0.0	63.8	74.0	-10.2	Ch. 25, 2475 MHz, Pwr17, EUT On Side
4878.958	51.0	7.4	1.0	37.0	0.0	0.0	Horz	PK	0.0	58.4	74.0	-15.6	Ch.18, 2440 MHz, Pwr19, EUT Horz
4809.225	51.0	7.4	1.1	215.0	0.0	0.0	Vert	PK	0.0	58.4	74.0	-15.6	Ch.11, 2405 MHz, Pwr19, EUT On Side
4878.733	50.1	7.4	1.4	212.0	0.0	0.0	Vert	PK	0.0	57.5	74.0	-16.5	Ch.18, 2440 MHz, Pwr19, EUT On Side
7318.342	53.4	15.2	1.7	137.0	-31.7	0.0	Horz	AV	0.0	36.9	54.0	-17.1	Ch.18, 2440 MHz, Pwr19, EUT Horz
7318.450	53.0	15.2	2.2	249.0	-31.7	0.0	Horz	AV	0.0	36.5	54.0	-17.5	Ch.18, 2440 MHz, Pwr19, EUT Vert
7318.283	52.6	15.2	1.0	53.0	-31.7	0.0	Vert	AV	0.0	36.1	54.0	-17.9	Ch.18, 2440 MHz, Pwr19, EUT On Side
7318.275	52.6	15.2	1.8	139.0	-31.7	0.0	Vert	AV	0.0	36.1	54.0	-17.9	Ch.18, 2440 MHz, Pwr19, EUT Horz
7318.325	52.4	15.2	1.0	360.0	-31.7	0.0	Horz	AV	0.0	35.9	54.0	-18.1	Ch.18, 2440 MHz, Pwr19, EUT On Side
7318.325	51.7	15.2	1.0	348.0	-31.7	0.0	Vert	AV	0.0	35.2	54.0	-18.8	Ch.18, 2440 MHz, Pwr19, EUT Vert
7318.350	47.9	15.2	1.8	136.0	-31.7	0.0	Horz	AV	0.0	31.4	54.0	-22.6	Ch.18, 2440 MHz, Pwr17, EUT Horz
7423.350	47.1	15.4	1.9	133.0	-31.7	0.0	Horz	AV	0.0	30.8	54.0	-23.2	Ch.25, 2475 MHz, Pwr17, EUT Horz
4948.925	41.9	7.5	1.8	34.0	0.0	0.0	Horz	PK	0.0	49.4	74.0	-24.6	Ch. 25, 2475 MHz, Pwr17, EUT Horz
4949.075	40.8	7.5	1.2	212.0	0.0	0.0	Vert	PK	0.0	48.3	74.0	-25.7	Ch. 25, 2475 MHz, Pwr17, EUT On Side
4881.150	40.4	7.4	1.0	212.0	0.0	0.0	Vert	PK	0.0	47.8	74.0	-26.2	Ch.18, 2440 MHz, Pwr17, EUT On Side
4808.975	40.3	7.4	1.0	204.0	0.0	0.0	Horz	PK	0.0	47.7	74.0	-26.3	Ch.11, 2405 MHz, Pwr17, EUT Horz
7321.275	44.0	15.2	1.0	46.0	-31.7	0.0	Vert	AV	0.0	27.5	54.0	-26.5	Ch.18, 2440 MHz, Pwr17, EUT On Side
4809.225	39.7	7.4	2.0	205.0	0.0	0.0	Vert	PK	0.0	47.1	74.0	-26.9	Ch.11, 2405 MHz, Pwr17, EUT On Side
4877.592	38.8	7.4	1.0	48.0	0.0	0.0	Horz	PK	0.0	46.2	74.0	-27.8	Ch.18, 2440 MHz, Pwr17, EUT Horz
21649.430	46.1	0.0	1.2	267.0	0.0	0.0	Horz	PK	0.0	46.1	74.0	-27.9	Ch. 11, 2405 MHz, Pwr17, EUT Horz
21650.690	46.0	0.0	1.2	66.0	0.0	0.0	Vert	PK	0.0	46.0	74.0	-28.0	Ch. 11, 2405 MHz, Pwr17, EUT On Side

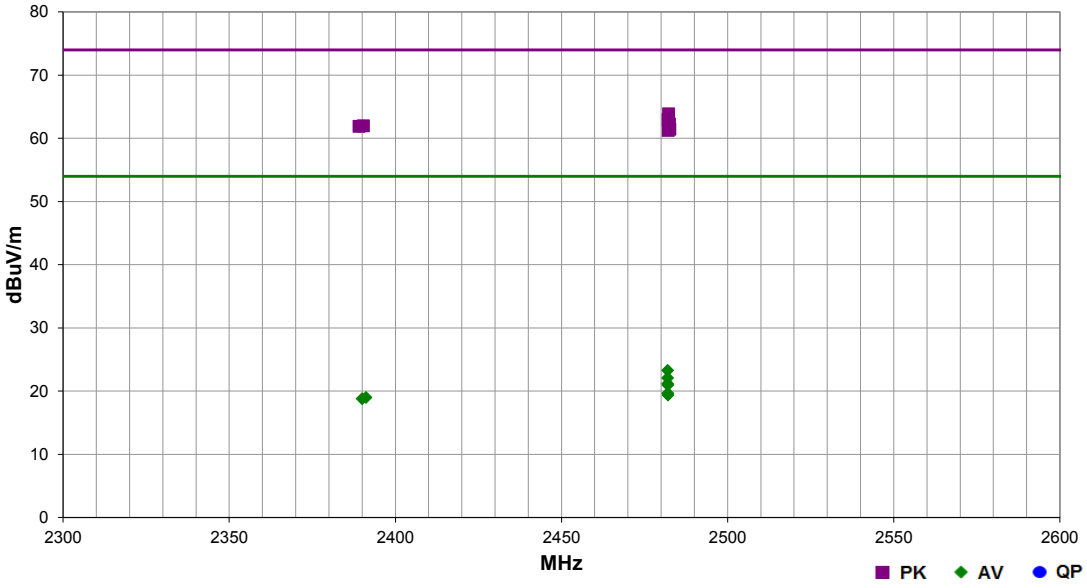
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
12377.170	43.8	1.8	1.5	20.0	0.0	0.0	Horz	PK	0.0	45.6	74.0	-28.4	Ch. 25, 2475 MHz, Pwr17, EUT Horz
7423.392	41.5	15.4	1.2	49.0	-31.7	0.0	Vert	AV	0.0	25.2	54.0	-28.8	Ch. 25, 2475 MHz, Pwr17, EUT On Side
12201.760	43.7	1.1	1.0	153.0	0.0	0.0	Vert	PK	0.0	44.8	74.0	-29.2	Ch. 18, 2440 MHz, Pwr17, EUT On Side
12376.800	43.0	1.8	1.0	159.0	0.0	0.0	Vert	PK	0.0	44.8	74.0	-29.2	Ch. 25, 2475 MHz, Pwr17, EUT On Side
12202.380	42.8	1.1	1.5	20.0	0.0	0.0	Horz	PK	0.0	43.9	74.0	-30.1	Ch. 18, 2440 MHz, Pwr17, EUT Horz
12027.030	43.0	0.2	1.0	48.0	0.0	0.0	Vert	PK	0.0	43.2	74.0	-30.8	Ch.11, 2405 MHz, Pwr17, EUT On Side
12027.400	42.4	0.2	1.0	200.0	0.0	0.0	Horz	PK	0.0	42.6	74.0	-31.4	Ch.11, 2405 MHz, Pwr17, EUT Horz
4878.883	44.8	7.4	1.0	37.0	-31.7	0.0	Horz	AV	0.0	20.5	54.0	-33.5	Ch.18, 2440 MHz, Pwr19, EUT Horz
4808.983	44.8	7.4	1.1	215.0	-31.7	0.0	Vert	AV	0.0	20.5	54.0	-33.5	Ch.11, 2405 MHz, Pwr19, EUT On Side
4878.883	44.1	7.4	1.4	212.0	-31.7	0.0	Vert	AV	0.0	19.8	54.0	-34.2	Ch.18, 2440 MHz, Pwr19, EUT On Side
4948.842	32.5	7.5	1.8	34.0	-31.7	0.0	Horz	AV	0.0	8.3	54.0	-45.7	Ch. 25, 2475 MHz, Pwr17, EUT Horz
4950.833	30.6	7.5	1.2	212.0	-31.7	0.0	Vert	AV	0.0	6.4	54.0	-47.6	Ch. 25, 2475 MHz, Pwr17, EUT On Side
4808.908	30.1	7.4	1.0	204.0	-31.7	0.0	Horz	AV	0.0	5.8	54.0	-48.2	Ch.11, 2405 MHz, Pwr17, EUT Horz
4878.808	29.7	7.4	1.0	212.0	-31.7	0.0	Vert	AV	0.0	5.4	54.0	-48.6	Ch.18, 2440 MHz, Pwr17, EUT On Side
12377.110	34.8	1.8	1.5	20.0	-31.7	0.0	Horz	AV	0.0	4.9	54.0	-49.1	Ch. 25, 2475 MHz, Pwr17, EUT Horz
4808.950	29.2	7.4	2.0	205.0	-31.7	0.0	Vert	AV	0.0	4.9	54.0	-49.1	Ch.11, 2405 MHz, Pwr17, EUT On Side
4879.925	28.0	7.4	1.0	48.0	-31.7	0.0	Horz	AV	0.0	3.7	54.0	-50.3	Ch.18, 2440 MHz, Pwr17, EUT Horz
12377.180	33.4	1.8	1.0	159.0	-31.7	0.0	Vert	AV	0.0	3.5	54.0	-50.5	Ch. 25, 2475 MHz, Pwr17, EUT On Side
12202.090	33.4	1.1	1.0	153.0	-31.7	0.0	Vert	AV	0.0	2.8	54.0	-51.2	Ch. 18, 2440 MHz, Pwr17, EUT On Side
21648.550	34.4	0.0	1.2	267.0	-31.7	0.0	Horz	AV	0.0	2.7	54.0	-51.3	Ch. 11, 2405 MHz, Pwr17, EUT Horz
21648.260	34.4	0.0	1.2	66.0	-31.7	0.0	Vert	AV	0.0	2.7	54.0	-51.3	Ch. 11, 2405 MHz, Pwr17, EUT On Side
12202.230	32.6	1.1	1.5	20.0	-31.7	0.0	Horz	AV	0.0	2.0	54.0	-52.0	Ch. 18, 2440 MHz, Pwr17, EUT Horz
12027.280	33.0	0.2	1.0	48.0	-31.7	0.0	Vert	AV	0.0	1.5	54.0	-52.5	Ch.11, 2405 MHz, Pwr17, EUT On Side
12027.210	30.9	0.2	1.0	200.0	-31.7	0.0	Horz	AV	0.0	-0.6	54.0	-54.6	Ch.11, 2405 MHz, Pwr17, EUT Horz

SPURIOUS RADIATED EMISSIONS

Work Order:	PRCO0074	**Date:**	04/27/15		
Project:	None	**Temperature:**	22.6 °C		
Job Site:	EV01	**Humidity:**	46.9% RH		
Serial Number:	10345	**Barometric Pres.:**	1018.5 mbar	**Tested by:**	Brandon Hobbs
EUT:	Wireless WorkSight PreView Sensor Model WWS7220				
Configuration:	2				
Customer:	Preco, Inc.				
Attendees:	Jon Fix				
EUT Power:	12 VDC				
Operating Mode:	On Continuous				
Deviations:	None				
Comments:	Please reference the EUT orientation, frequency, power level and channel				

Test Specifications	**Test Method**
FCC 15.247:2015	ANSI C63.10:2009

B	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
2482.217	46.9	-3.0	1.0	137.0	0.0	20.0	Vert	PK	0.0	63.9	74.0	-10.1	Ch. 25, 2475 MHz, Pwr17, EUT Vert
2482.083	46.0	-3.0	1.0	167.0	0.0	20.0	Horz	PK	0.0	63.0	74.0	-11.0	Ch. 25, 2475 MHz, Pwr17, EUT On Side
2482.500	45.3	-3.0	1.0	13.0	0.0	20.0	Horz	PK	0.0	62.3	74.0	-11.7	Ch. 25, 2475 MHz, Pwr17, EUT Horz
2482.317	45.2	-3.0	2.6	281.0	0.0	20.0	Vert	PK	0.0	62.2	74.0	-11.8	Ch. 25, 2475 MHz, Pwr17, EUT On Side
2390.358	45.3	-3.3	1.0	224.0	0.0	20.0	Horz	PK	0.0	62.0	74.0	-12.0	Ch. 11, 2405 MHz, Pwr17, EUT Vert
2389.080	45.2	-3.3	1.0	150.0	0.0	20.0	Vert	PK	0.0	61.9	74.0	-12.1	Ch. 11, 2405 MHz, Pwr17, EUT On Side
2482.592	44.5	-3.0	1.0	244.0	0.0	20.0	Horz	PK	0.0	61.5	74.0	-12.5	Ch. 25, 2475 MHz, Pwr17, EUT Vert
2482.133	44.3	-3.0	1.0	337.0	0.0	20.0	Vert	PK	0.0	61.3	74.0	-12.7	Ch. 25, 2475 MHz, Pwr17, EUT Horz
2482.000	38.0	-3.0	1.0	137.0	-31.7	20.0	Vert	AV	0.0	23.3	54.0	-30.7	Ch. 25, 2475 MHz, Pwr17, EUT Vert
2482.000	36.8	-3.0	1.0	167.0	-31.7	20.0	Horz	AV	0.0	22.1	54.0	-31.9	Ch. 25, 2475 MHz, Pwr17, EUT On Side
2482.000	35.9	-3.0	2.6	281.0	-31.7	20.0	Vert	AV	0.0	21.2	54.0	-32.8	Ch. 25, 2475 MHz, Pwr17, EUT On Side
2482.033	35.7	-3.0	1.0	13.0	-31.7	20.0	Horz	AV	0.0	21.0	54.0	-33.0	Ch. 25, 2475 MHz, Pwr17, EUT Horz
2482.025	34.4	-3.0	1.0	337.0	-31.7	20.0	Vert	AV	0.0	19.7	54.0	-34.3	Ch. 25, 2475 MHz, Pwr17, EUT Horz
2482.075	34.1	-3.0	1.0	244.0	-31.7	20.0	Horz	AV	0.0	19.4	54.0	-34.6	Ch. 25, 2475 MHz, Pwr17, EUT Vert
2391.175	34.0	-3.3	1.0	224.0	-31.7	20.0	Horz	AV	0.0	19.0	54.0	-35.0	Ch. 11, 2405 MHz, Pwr17, EUT On Side
2389.990	33.8	-3.3	1.0	150.0	-31.7	20.0	Vert	AV	0.0	18.8	54.0	-35.2	Ch. 11, 2405 MHz, Pwr17, EUT Vert

BAND EDGE COMPLIANCE

NORTHWEST EMC

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 (mo)
Signal Generator	Keysight	N5182B	TFX	4/16/2015	36
Attenuator	S.M. Electronics	SA26B-20	AWU	NCR	0
DC Block, 40 GHz	Fairview Microwave	SD3379	AMK	12/11/2014	12
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Power Meter	Gigatronics	8651A	SPM	9/17/2014	12
Power Sensor	Gigatronics	80701A	SPL	5/28/2014	12
Spectrum Analyzer	Agilent	E4446A	AAQ	3/10/2015	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:	Wireless WorkSight PreView Sensor Model WWS7220			**Work Order:**	PRCO0074
Serial Number:	10997			**Date:**	04/28/15
Customer:	Preco, Inc.			**Temperature:**	22.3°C
Attendees:	Jon Fix			**Humidity:**	41%
Project:	None			**Barometric Pres.:**	1024 mbar
Tested by:	Brandon Hobbs	**Power:**	12 VDC	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2009

COMMENTS

The EUT was running at 100% duty cycle.

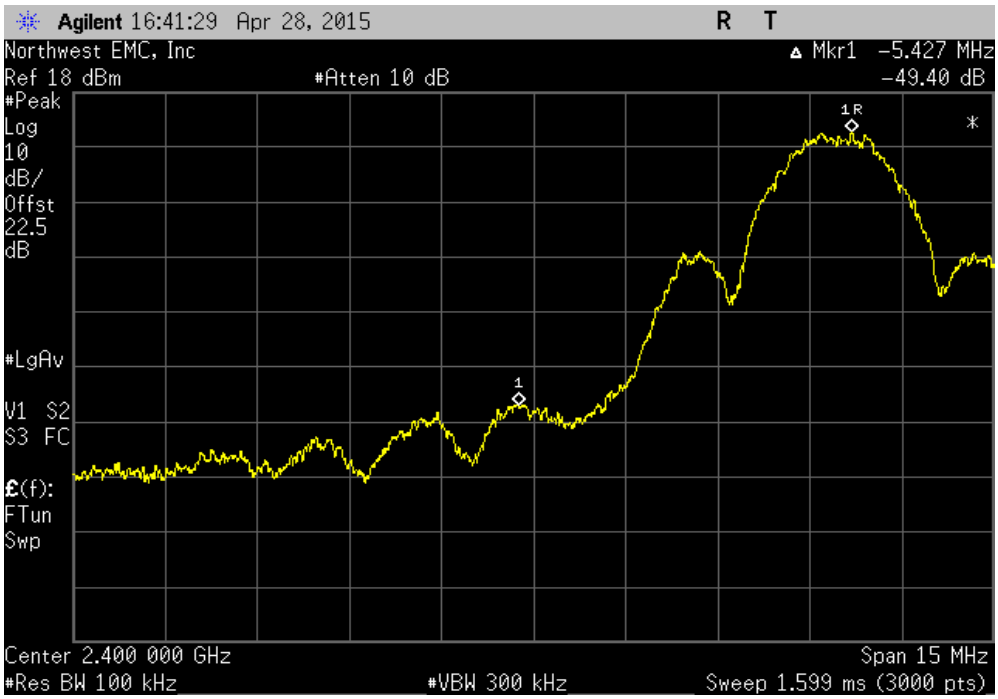
DEVIATIONS FROM TEST STANDARD

None

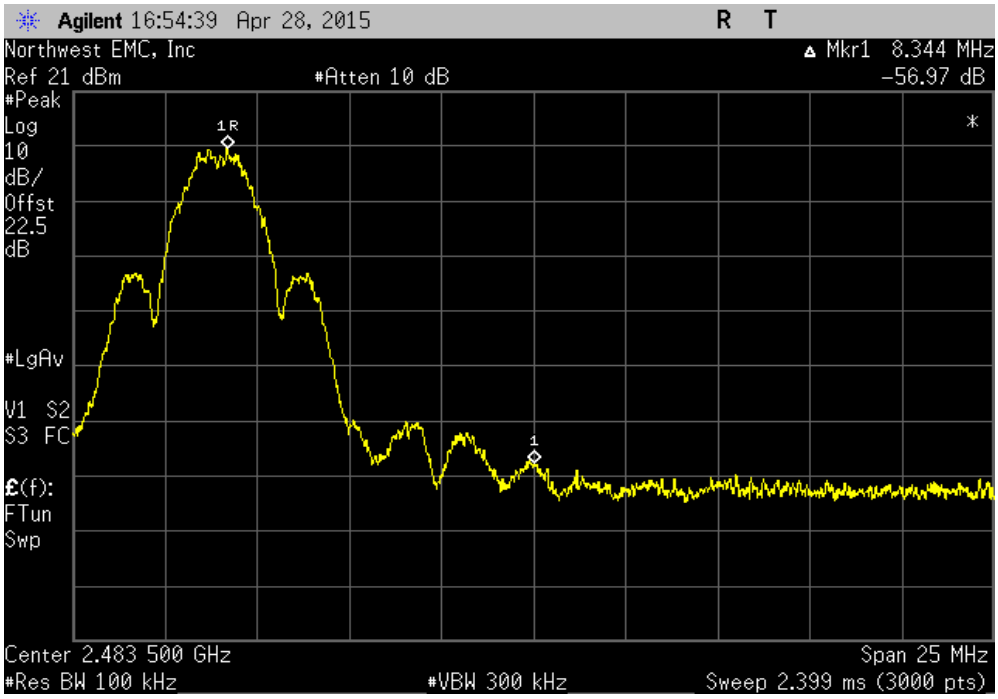
Configuration #	1	Signature

	Value (dBc)	Limit ≤ (dBc)	Result
OQPSK			
Low Channel 11, 2405 MHz	-49.4	-20	Pass
High Channel 25, 2475 MHz	-56.97	-20	Pass

OQPSK, Low Channel 11, 2405 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-49.4	-20	Pass



OQPSK, High Channel 25, 2475 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-56.97	-20	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 (mo)
Signal Generator	Keysight	N5182B	TFX	4/16/2015	36
Attenuator	S.M. Electronics	SA26B-20	AWU	NCR	0
DC Block, 40 GHz	Fairview Microwave	SD3379	AMK	12/11/2014	12
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Power Meter	Gigatronics	8651A	SPM	9/17/2014	12
Power Sensor	Gigatronics	80701A	SPL	5/28/2014	12
Spectrum Analyzer	Agilent	E4446A	AAQ	3/10/2015	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:	Wireless WorkSight PreView Sensor Model WWS7220			**Work Order:**	PRCO0074
Serial Number:	10997			**Date:**	04/28/15
Customer:	Preco, Inc.			**Temperature:**	22.3°C
Attendees:	Jon Fix			**Humidity:**	41%
Project:	None			**Barometric Pres.:**	1024 mbar
Tested by:	Brandon Hobbs	**Power:**	12 VDC	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2009

COMMENTS

The EUT was running at 100% duty cycle.

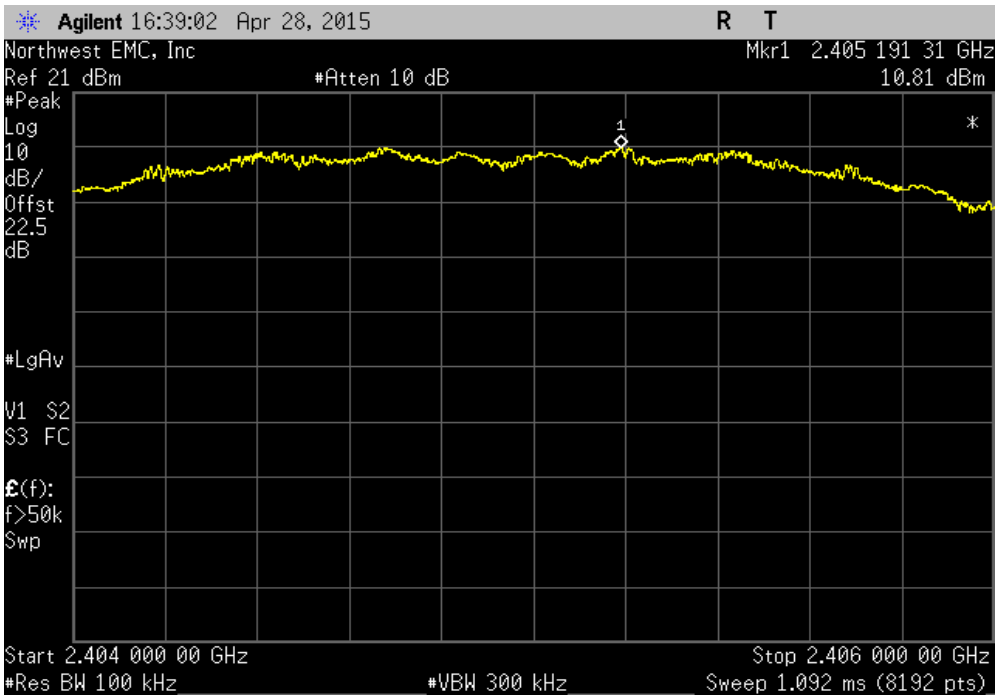
DEVIATIONS FROM TEST STANDARD

None

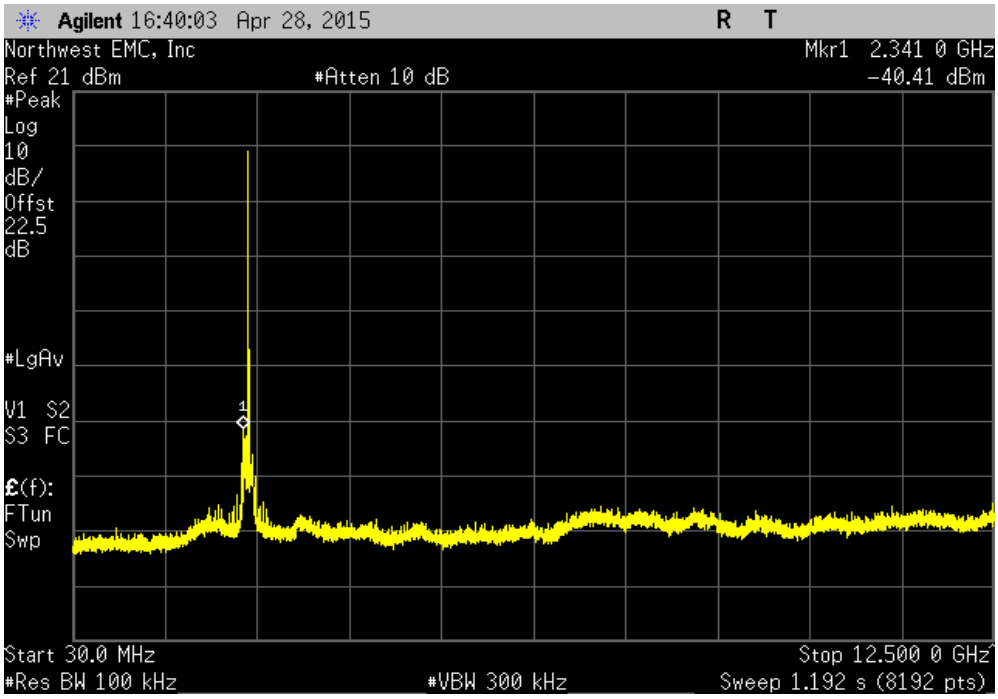
Configuration #	1	Signature

		Frequency Range	Value (dBc)	Limit ≤ (dBc)	Result
OQPSK					
	Low Channel 11, 2405 MHz	Fundamental	N/A	N/A	N/A
	Low Channel 11, 2405 MHz	30 MHz - 12.5 GHz	-51.22	-20	Pass
	Low Channel 11, 2405 MHz	12.5 GHz - 25 GHz	-58	-20	Pass
	Mid Channel 18, 2440 MHz	Fundamental	N/A	N/A	N/A
	Mid Channel 18, 2440 MHz	30 MHz - 12.5 GHz	-57.83	-20	Pass
	Mid Channel 18, 2440 MHz	12.5 GHz - 25 GHz	-57.73	-20	Pass
	High Channel 25, 2475 MHz	Fundamental	N/A	N/A	N/A
	High Channel 25, 2475 MHz	30 MHz - 12.5 GHz	-53.92	-20	Pass
	High Channel 25, 2475 MHz	12.5 GHz - 25 GHz	-56.98	-20	Pass

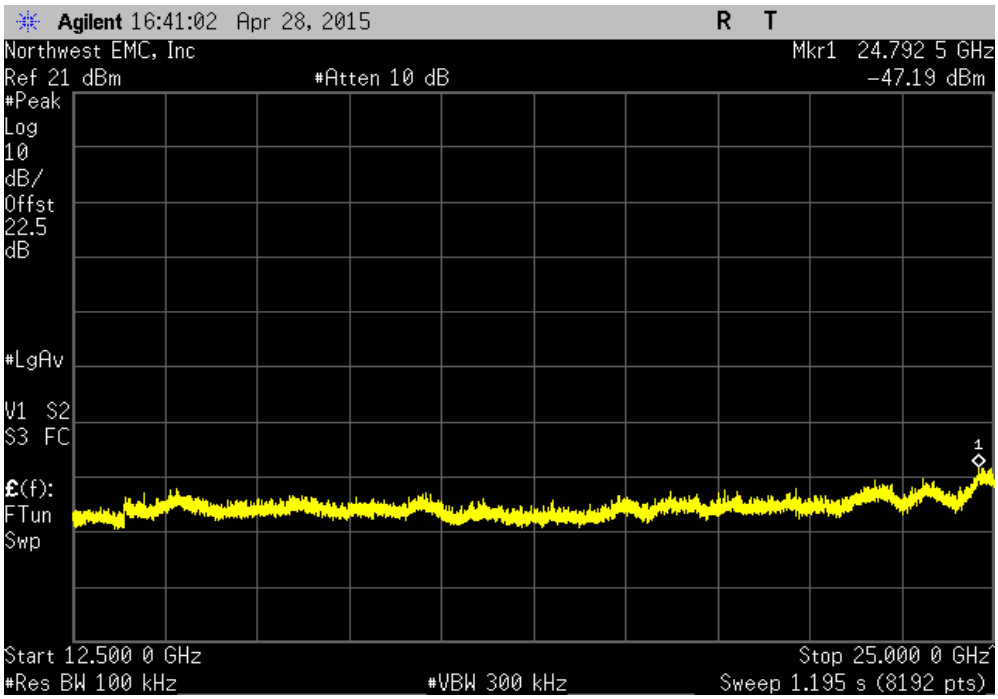
OQPSK, Low Channel 11, 2405 MHz						
	Frequency Range			Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



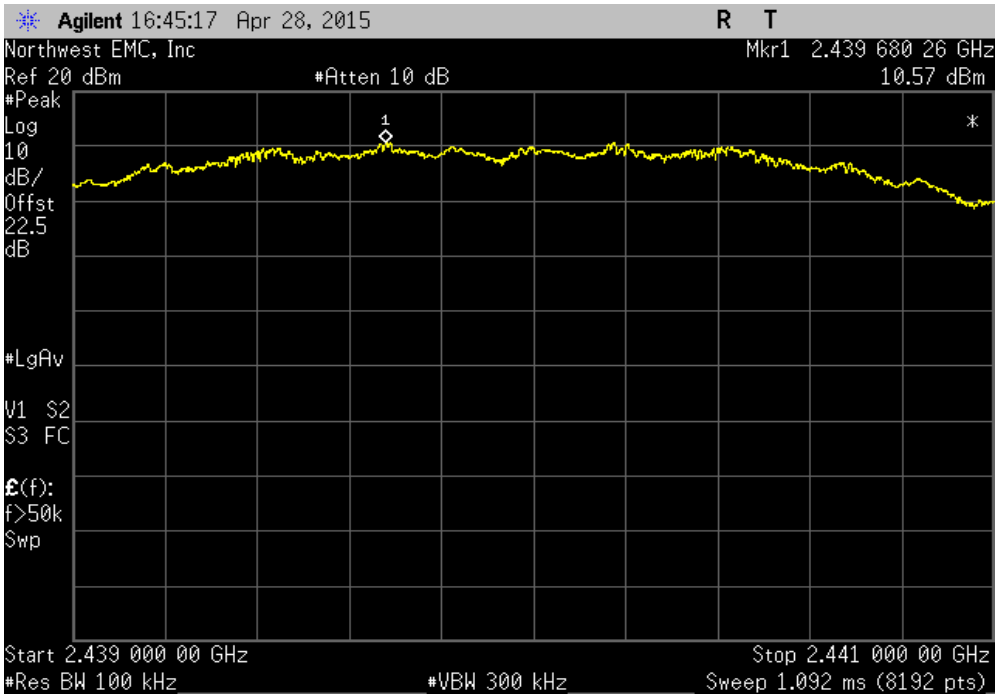
OQPSK, Low Channel 11, 2405 MHz					
Frequency Range		Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz		-51.22	-20	Pass	



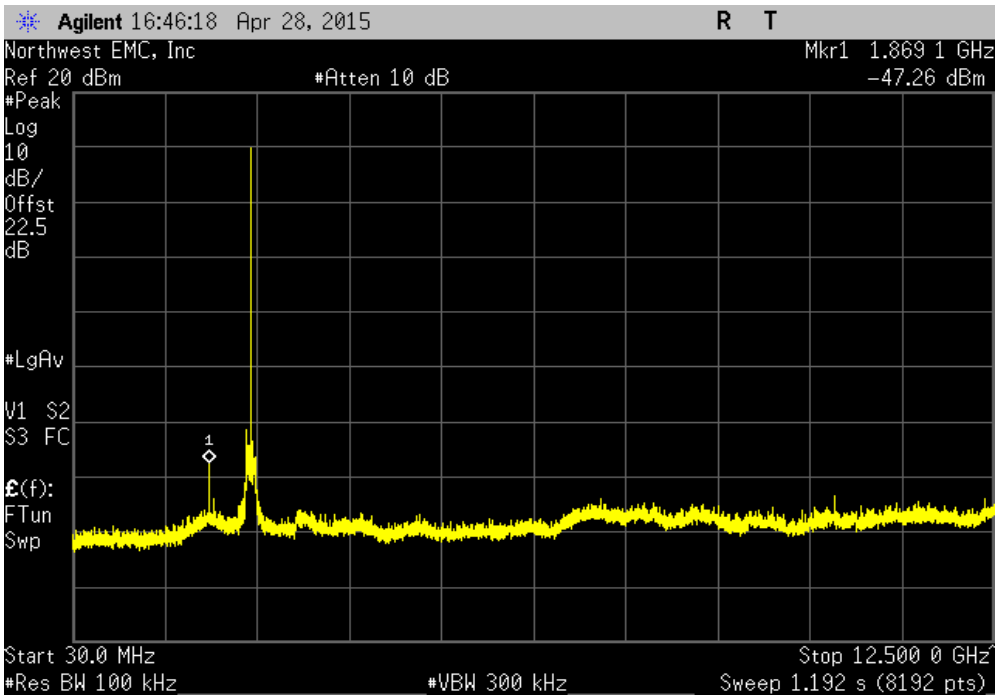
OQPSK, Low Channel 11, 2405 MHz				
Frequency Range		Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-58	-20	Pass



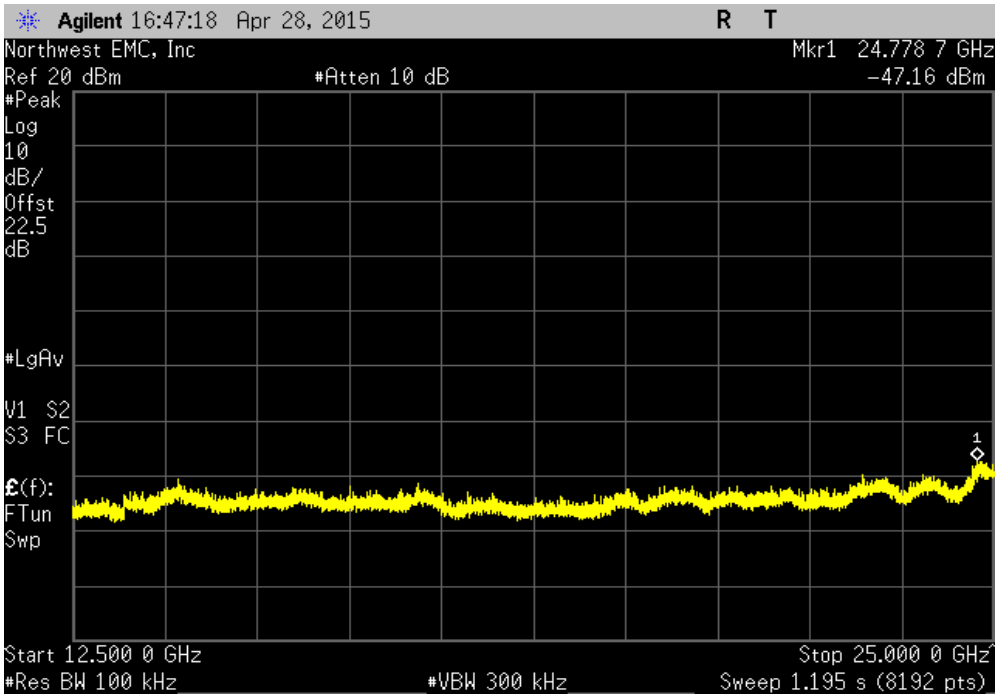
OQPSK, Mid Channel 18, 2440 MHz						
	Frequency Range			Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



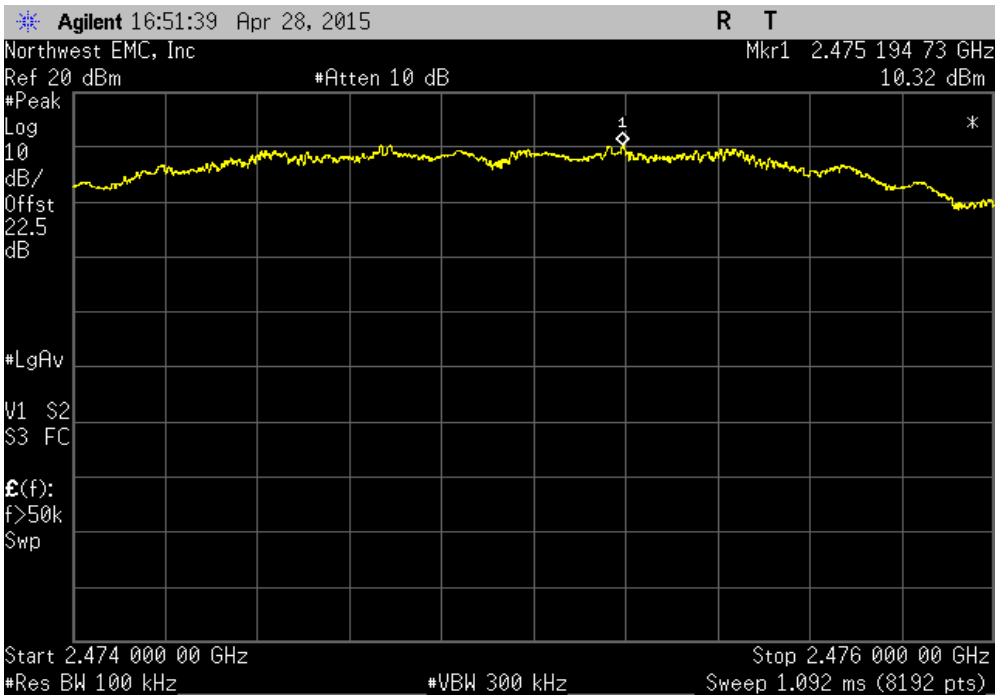
OQPSK, Mid Channel 18, 2440 MHz				
Frequency Range		Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-57.83	-20	Pass



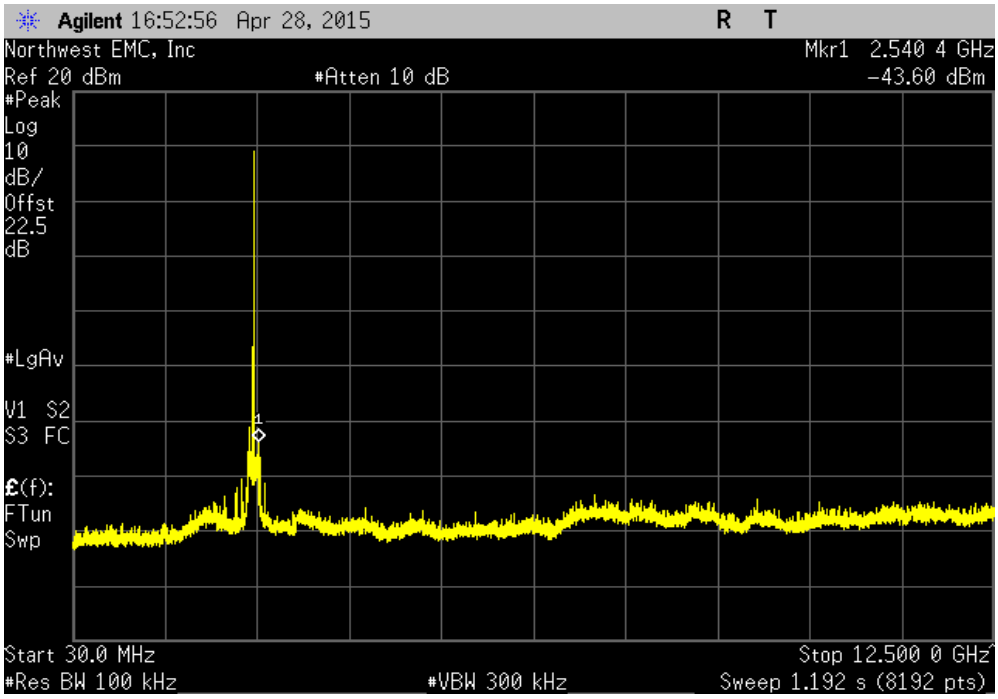
OQPSK, Mid Channel 18, 2440 MHz				
Frequency Range		Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-57.73	-20	Pass



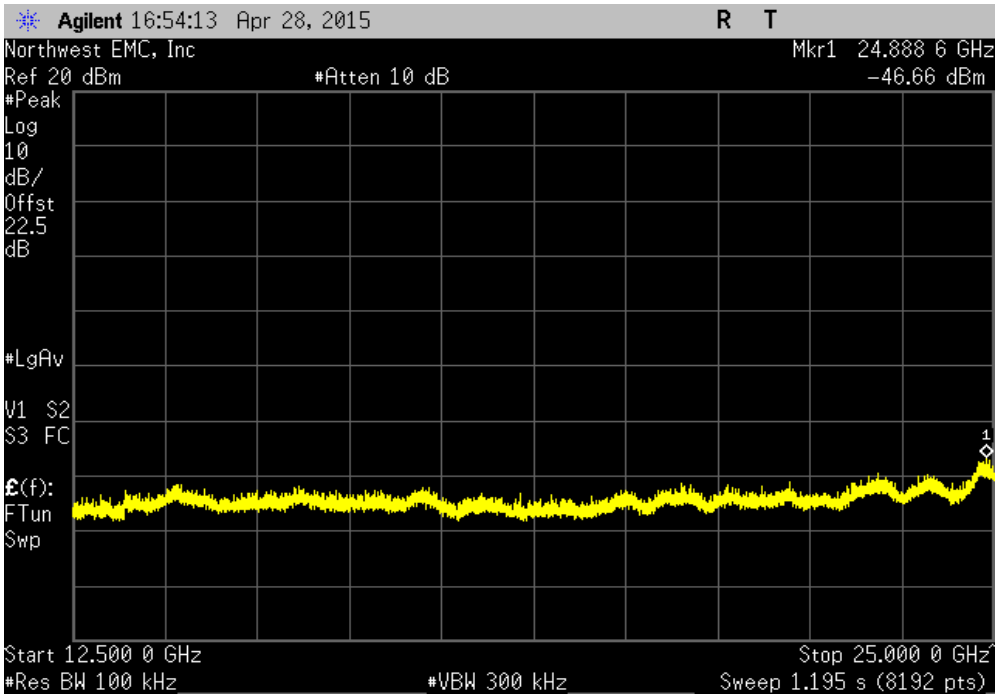
OQPSK, High Channel 25, 2475 MHz						
	Frequency Range			Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



OQPSK, High Channel 25, 2475 MHz					
Frequency Range			Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz			-53.92	-20	Pass



OQPSK, High Channel 25, 2475 MHz				
Frequency Range		Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-56.98	-20	Pass



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 (mo)
Signal Generator	Keysight	N5182B	TFX	4/16/2015	36
Attenuator	S.M. Electronics	SA26B-20	AWU	NCR	0
DC Block, 40 GHz	Fairview Microwave	SD3379	AMK	12/11/2014	12
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Power Meter	Gigatronics	8651A	SPM	9/17/2014	12
Power Sensor	Gigatronics	80701A	SPL	5/28/2014	12
Spectrum Analyzer	Agilent	E4446A	AAQ	3/10/2015	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:	Wireless WorkSight PreView Sensor Model WWS7220			**Work Order:**	PRCO0074
Serial Number:	10997			**Date:**	04/28/15
Customer:	Preco, Inc.			**Temperature:**	22.3°C
Attendees:	Jon Fix			**Humidity:**	41%
Project:	None			**Barometric Pres.:**	1024 mbar
Tested by:	Brandon Hobbs	**Power:**	12 VDC	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2009

COMMENTS

The EUT was running at 100% duty cycle.

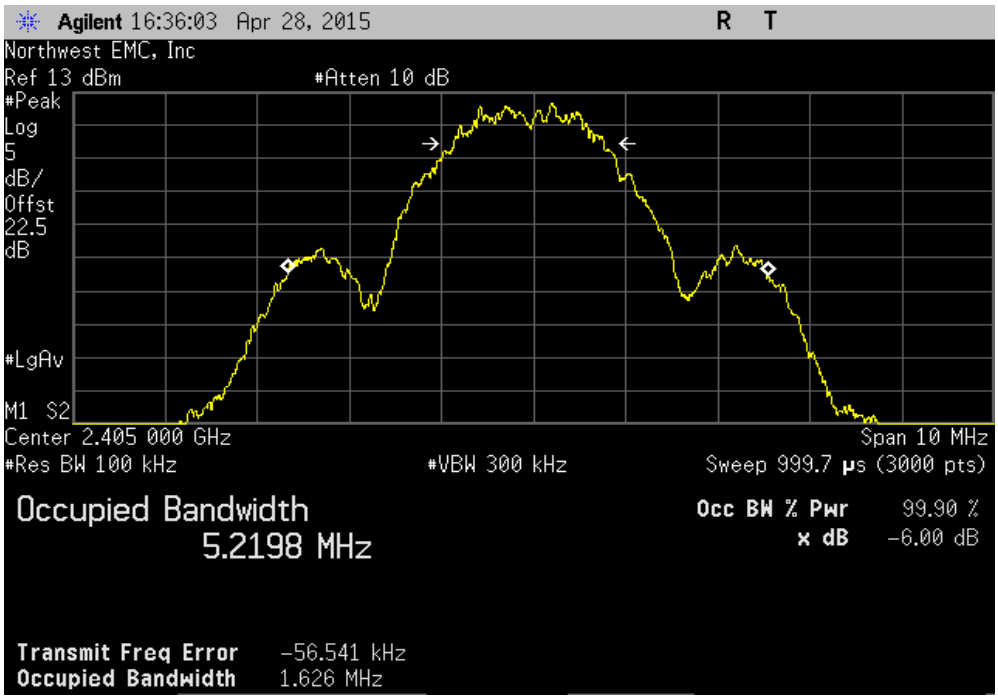
DEVIATIONS FROM TEST STANDARD

None

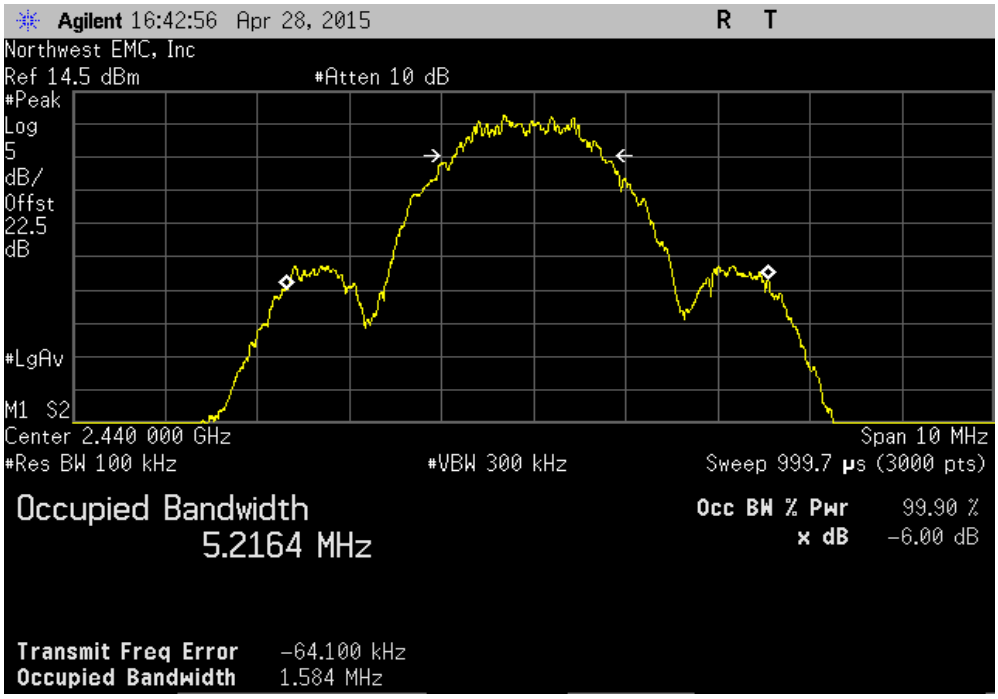
Configuration #	1	Signature

	Value	Limit (>)	Result
OQPSK			
Low Channel 11, 2405 MHz	1.626 MHz	500 kHz	Pass
Mid Channel 18, 2440 MHz	1.584 MHz	500 kHz	Pass
High Channel 25, 2475 MHz	1.59 MHz	500 kHz	Pass

OQPSK, Low Channel 11, 2405 MHz						
				Value	Limit (>)	Result
				1.626 MHz	500 kHz	Pass



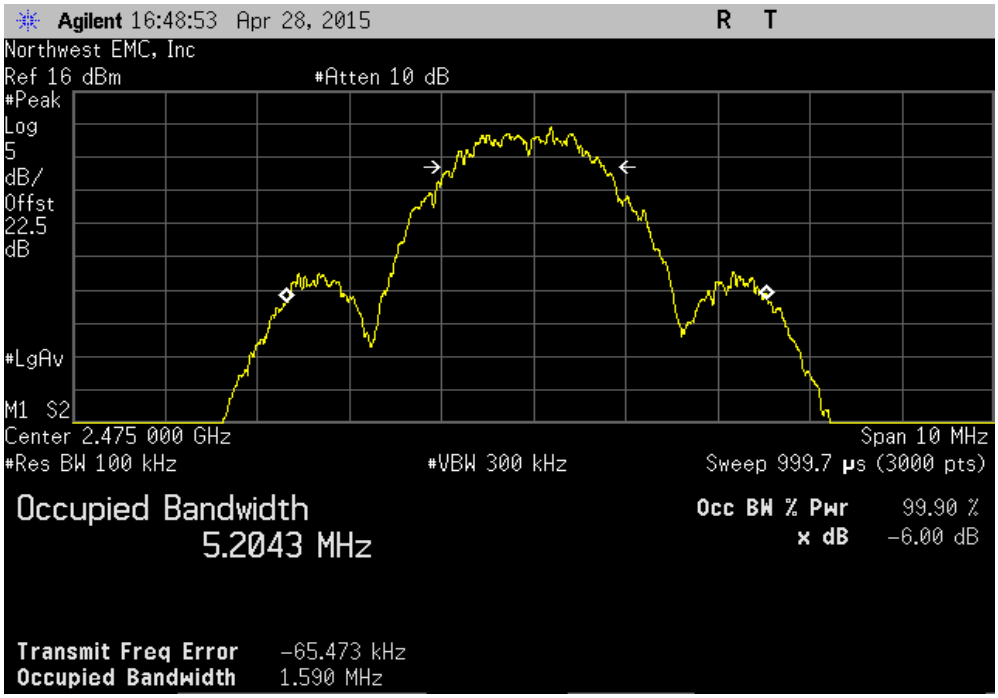
OQPSK, Mid Channel 18, 2440 MHz						
				Value	Limit (>)	Result
				1.584 MHz	500 kHz	Pass



OCCUPIED BANDWIDTH

XMit 2015.01.14

OQPSK, High Channel 25, 2475 MHz						
				Value	Limit (>)	Result
				1.59 MHz	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 (mo)
Signal Generator	Keysight	N5182B	TFX	4/16/2015	36
DC Block, 40 GHz	Fairview Microwave	SD3379	AMK	12/11/2014	12
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Attenuator	S.M. Electronics	SA26B-20	AWU	NCR	0
Power Meter	Gigatronics	8651A	SPM	9/17/2014	12
Power Sensor	Gigatronics	80701A	SPL	5/28/2014	12
Spectrum Analyzer	Agilent	E4446A	AAQ	3/10/2015	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 KDB 558074 DTS D01 Measurement Section 9.1.1 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:	**Wireless WorkSight PreView Sensor Model WWS7220**			**Work Order:**	**PRCO0074**
Serial Number:	**10997**			**Date:**	**04/28/15**
Customer:	**Preco, Inc.**			**Temperature:**	**22.3°C**
Attendees:	**Jon Fix**			**Humidity:**	**41%**
Project:	**None**			**Barometric Pres.:**	**1024 mbar**
Tested by:	**Brandon Hobbs**	**Power:**	**12 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2015	ANSI C63.10:2009

COMMENTS

The EUT was running at 100% duty cycle.

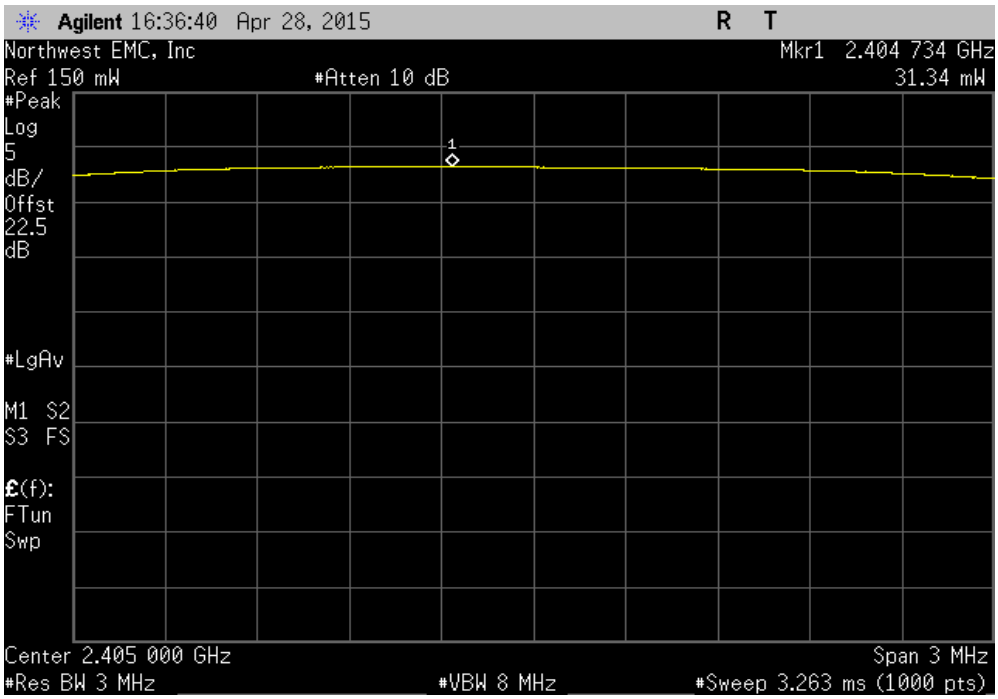
DEVIATIONS FROM TEST STANDARD

None

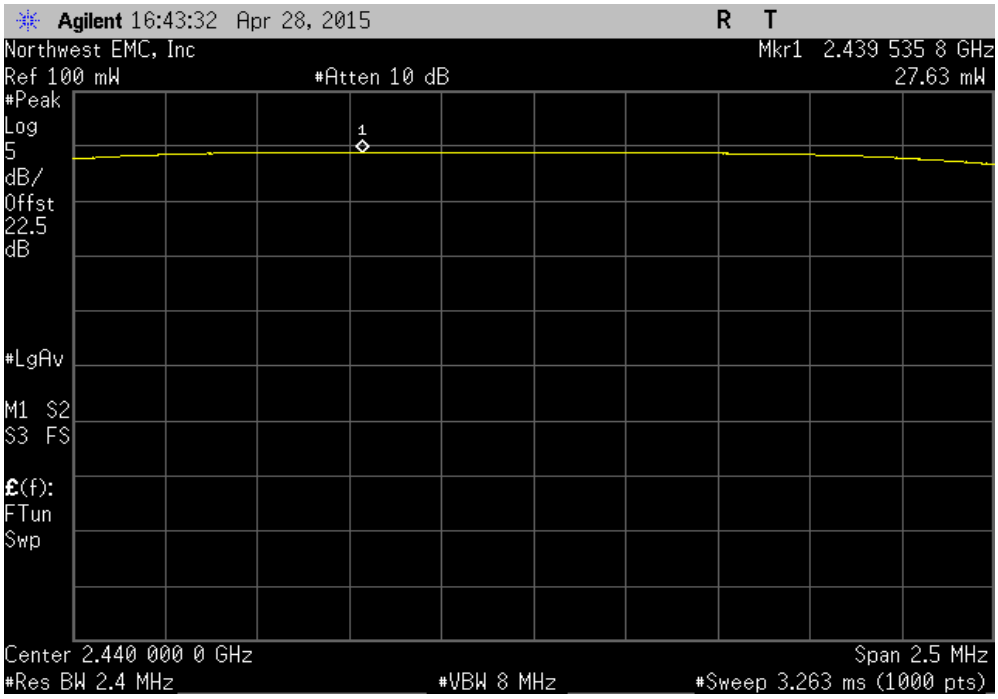
Configuration #	**1**	*Signature*

	Value	**Limit (<)**	**Result**
OQPSK			
Low Channel 11, 2405 MHz	31.34 mW	1 W	Pass
Mid Channel 18, 2440 MHz	27.631 mW	1 W	Pass
High Channel 25, 2475 MHz	25.71 mW	1 W	Pass

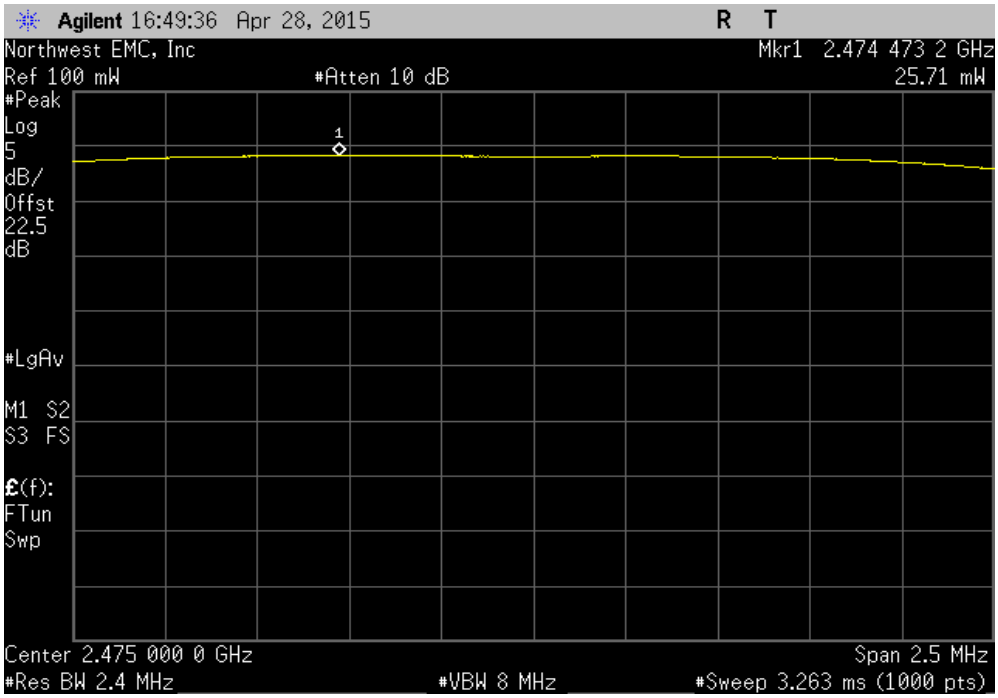
OQPSK, Low Channel 11, 2405 MHz						
				Value	Limit (<)	Result
				31.34 mW	1 W	Pass



OQPSK, Mid Channel 18, 2440 MHz						
				Value	Limit (<)	Result
				27.631 mW	1 W	Pass



OQPSK, High Channel 25, 2475 MHz						
				Value	Limit (<)	Result
				25.71 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 (mo)
Signal Generator	Keysight	N5182B	TFX	4/16/2015	36
Attenuator	S.M. Electronics	SA26B-20	AWU	NCR	0
DC Block, 40 GHz	Fairview Microwave	SD3379	AMK	12/11/2014	12
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Power Sensor	Gigatronics	80701A	SPL	5/28/2014	12
Power Meter	Gigatronics	8651A	SPM	9/17/2014	12
Spectrum Analyzer	Agilent	E4446A	AAQ	3/10/2015	12

TEST DESCRIPTION

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

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

- RBW = 100 kHz
- VBW = 300 kHz
- Detector = Peak (to match method used for power measurement)
- Trace = Max hold

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

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

POWER SPECTRAL DENSITY

NORTHWEST EMC

XMit 2015.01.14

EUT:	Wireless WorkSight PreView Sensor Model WWS7220			**Work Order:**	PRCO0074
Serial Number:	10997			**Date:**	04/28/15
Customer:	Preco, Inc.			**Temperature:**	22.3°C
Attendees:	Jon Fix			**Humidity:**	41%
Project:	None			**Barometric Pres.:**	1024 mbar
Tested by:	Brandon Hobbs	**Power:**	12 VDC	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2009

COMMENTS

The EUT was running at 100% duty cycle.

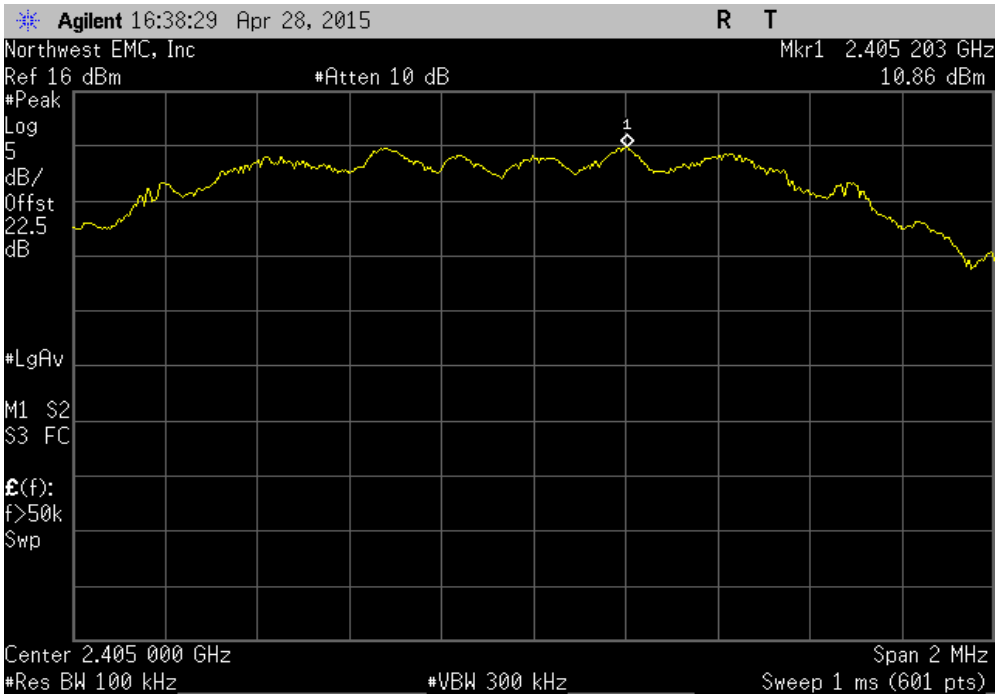
DEVIATIONS FROM TEST STANDARD

None

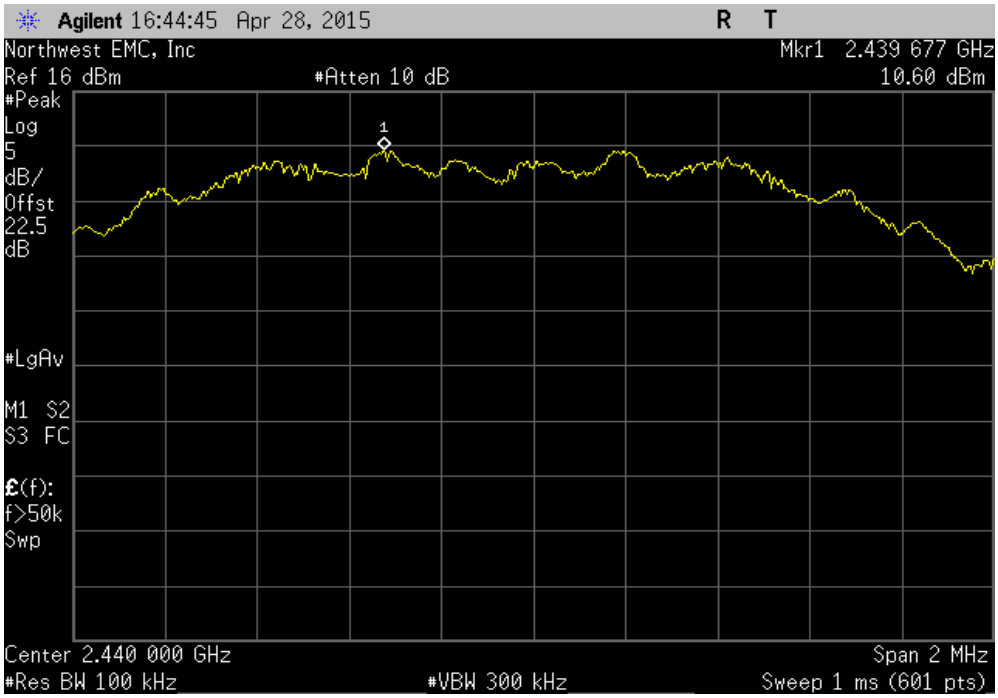
Configuration #	1	Signature

	Value dBm/100kHz	dBm/100kHz To dBm/3kHz	Value dBm/3kHz	Limit dBm/3kHz	Results
OQPSK					
Low Channel 11, 2405 MHz	10.859	-15.2	-4.341	8	Pass
Mid Channel 18, 2440 MHz	10.598	-15.2	-4.602	8	Pass
High Channel 25, 2475 MHz	10.402	-15.2	-4.798	8	Pass

OQPSK, Low Channel 11, 2405 MHz						
		Value dBm/100kHz	dBm/100kHz To dBm/3kHz	Value dBm/3kHz	Limit dBm/3kHz	Results
		10.859	-15.2	-4.341	8	Pass



OQPSK, Mid Channel 18, 2440 MHz						
		Value dBm/100kHz	dBm/100kHz To dBm/3kHz	Value dBm/3kHz	Limit dBm/3kHz	Results
		10.598	-15.2	-4.602	8	Pass



POWER SPECTRAL DENSITY

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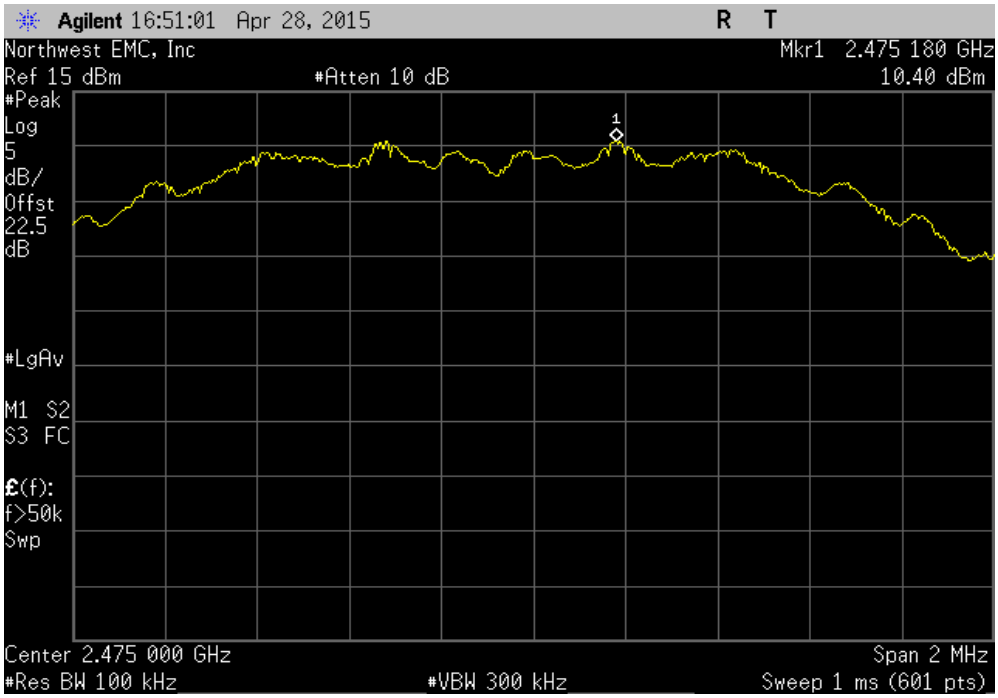
OQPSK, High Channel 25, 2475 MHz						
		Value dBm/100kHz	dBm/100kHz To dBm/3kHz	Value dBm/3kHz	Limit dBm/3kHz	Results
		10.402	-15.2	-4.798	8	Pass



DUTY CYCLE

NORTHWEST EMC

XMit 2015.01.14

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.

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 test software provided for operation in a fixed, single channel mode allows the EUT to operate continuously at 100% Duty Cycle.