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ENGINEERING TEST REPORT #: 316130 LSR JOB #: C-2580

Compliance Testing of:

IntelliCenter Wireless Control Panel (WCP)

Test Date(s):

11/21/2016-11/23/2016	12/15/2016	12/21/2016	1/7/2017
11/30/2016-12/2/2016	12/19/2016	1/6/2017	1/10/2017-1/12/2017
1/17/2017	1/19/2017		

Prepared For:

Pentair
Attn: Ed Feten
10951 West Los Angeles Ave
Moorpark, CA 93021

This Test Report is issued under the Authority of:

John Johnston, EMC Engineer

Signature: 

Date: 1/31/17

Reviewed by:

Adam Alger, Quality Systems Engineer

Signature:  Date: 2-5-17

Project Engineer:

John Johnston, EMC Engineer I

Signature:  Date: 1/31/17

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LS Research, LLC in Review

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:



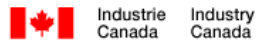
A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01



Federal Communications Commission (FCC) – USA

Listing of two 3 Meter Semi-Anechoic Chambers based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756



Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-GEN – Issue 4
File Number: IC 3088A-2
On file, 3 Meter Semi-Anechoic Chamber based on RSS-GEN – Issue 4
File Number: IC 3088A-3

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Summary of Test Report

Between November 21, 2016 and January 19, 2017 the WCP, provided by Pentair, was tested and MEETS the following requirements:

FCC and IC Paragraph	Test Requirements	Compliance (Yes/No)
FCC: 15.247 (a)(2) IC: RSS-247 sect. 5.2 (1) IC: RSS-Gen sect. 6.6	Minimum 6 dB Bandwidth / Occupied Bandwidth	Yes
FCC: 15.247 (b)(3) IC: RSS-247 sect. 5.4 (4)	Maximum Output Power	Yes
FCC: 15.247 (e) IC: RSS-247 sect. 5.2 (2)	Power Spectral Density of a Digitally Modulated System	Yes
FCC: 15.247(d) IC: RSS-247 sect. 5.5	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
FCC: 15.209 & 15.205 IC: RSS-Gen sect 6.13	Transmitter Radiated Emissions	Yes
FCC: 2.1055 (d) IC: RSS Gen sect. 6.11	Frequency Stability	Yes
FCC : 15.207 IC : RSS Gen sect. 8.8	AC Power Line Conducted Emissions	Yes

Test Facilities

All testing was performed at:

LS Research, LLC
W66 N220 Commerce Court
Cedarburg, Wisconsin, 53012 USA

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to the requirements of ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.

LS Research, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted.

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1.0 Client Information

Manufacturer Name:	Pentair
Address:	10951 West Los Angeles Avenue, Moorpark, CA 93021
Contact Person:	Ed Feten

1.1 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	IntelliCenter Wireless Control Panel (WCP)
Model Number:	ICHNDHLD
Serial Numbers:	1 and 2

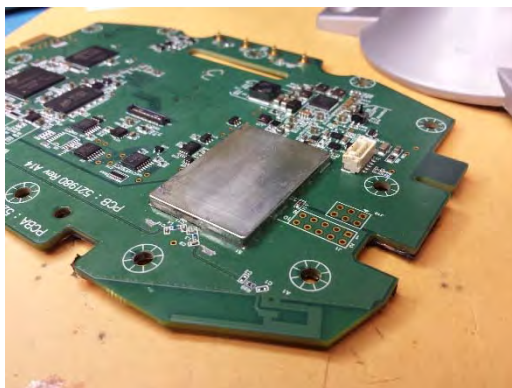
1.2 Product Information

The IntelliCenter WCP (wireless control panel) is a 2.4 GHz wireless remote that allows swimming pool owners to control their Pentair IntelliCenter Pool Automation system wirelessly. The IntelliCenter WCP is powered by a rechargeable battery and is supplied with a charging cradle.

The WCP includes an 802.15.4 Atmel ATmega256RFR2 module configured to operate in the 2.4 GHz ISM band. The WCP can transmit via one of two antennas. As used herein, antenna 1 refers to the main antenna and exhibits a gain of 2.79 dBi. Similarly, antenna 2 refers to the diversity antenna and exhibits a gain of 1.49 dBi. The WCP is supplied power via an internal 3.7 V nominal battery. Moreover, the WCP can be mounted to a charging station which is powered via a 12 V DVE switching adapter.

1.3 Modifications Incorporated In the EUT for Compliance Purposes

A Pentair Next Generation Wireless RF shield has been added to the WCP and encloses the Atmel ATmega256RFR2 module circuitry as shown in the image below:



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Additionally, it should be noted that the WCP is configured to transmit on channels 11 (2405 MHz) through channel 25 (2475 MHz). To be compliant with the aforementioned FCC and IC requirements, the WCP is prohibited from transmitting on channel 26. Additionally, it should be noted that when operating on channels 12 (2410 MHz) through 23 (2465 MHz), the WCP operates at a maximum power level compliant with the aforementioned FCC/IC requirements. The WCP is intended to operate at reduced power levels on channels 11, 24, and 25.

1.4 Deviations & Exclusions from Test Specifications

None noted at time of test.

1.5 Additional Information

The WCP, referred to herein as the *Equipment Under Test*, or *EUT*, operates nominally when supplied 3.7 V nominal from an internal battery. The *EUT* was tested as a handheld unit. The *EUT* was programmable via a display GUI onboard the WCP. The *EUT* was capable of being configured to operate in receive or transmit mode on each of the two antennas. Additionally, the output power setting and channel could be selected via the display GUI.

It should be noted that serial number 1 is representative of the unit tested for conducted measurements (i.e., included the SMA connector). On the contrary, serial number 2 is representative of the unit tested during radiated and conducted emission testing.

The charging station includes a USB port which enables data transfer from the WCP to a peripheral device, such as a USB stick.

Test operational modes (transmit, receive, channel selection, etc.) were instantiated by pressing a combination of icons on the display GUI.

1.6 Conditions of Test

Environmental:

Temperature: 20-25° C
Relative Humidity: 30-60%
Atmospheric Pressure: 86-106 kPa

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1.7 Test Equipment

All test equipment is calibrated by a calibration laboratory accredited by A2LA to the requirements of ISO 17025. For a complete list of test equipment and calibration dates, see Appendix A. Unless otherwise noted, resolution bandwidth of measuring instrument used during testing for given frequency range, see below.

Frequency Range	Resolution Bandwidth
9 kHz – 150 kHz	200 Hz
150 kHz – 30 MHz	9 kHz
30 MHz – 1000 MHz	120 kHz
Above 1000 MHz	1 MHz

1.8 EUT Technical Specifications

802.15.4 Atmel ATmega256RFR2:

EUT Frequency Range (in MHz)	2405-2475 MHz
EIRP (in W)	
Antenna 1 Maximum	0.216
Antenna 1 Minimum	0.00738
Antenna 2 Maximum	0.109
Antenna 2 Minimum	0.00499
Occupied Bandwidth (-6 dB) (MHz)	2.403
Type of Modulation	DSSS
Emission Designator	2M40FXD
Frequency Tolerance %, Hz, ppm	Better than 100 ppm
Antenna Information	
Detachable/non-detachable	Non-detachable
Type	Trace
EUT will be operated under FCC Rule Part(s)	15.247
EUT will be operated under RSS Rule Part(s)	247
Modular Filing?	No

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2.0 Conformance Summary

When tested between 11/21/2017 and 1/19/2017, it was determined that the EUT, WCP, as provided by Pentair, was compliant with the requirements of FCC Title 47, CFR Part 15.247, 15.209, 15.207, Industry Canada RSS-247, Issue 1 (2015), and RSS-Gen Issue 4 (2014) using the methods of ANSI C63.10 2013.

Any modifications made to the EUT after the specified test date(s) will invalidate the data herein.

If some measurements are seen to be within the uncertainty value, as listed in Appendix C, there is a possibility that this unit may not meet the required limit specification if subsequently tested.

Prepared For: Pentair	EUT: WCP
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3.0 – RF Conducted Measurements

Manufacturer	Pentair
Test Location	LS Research, LLC
Rule Part	FCC Part 15.247 / RSS-247
General Measurement Procedure	ANSI C63.10-2013
General Description of Measurement	A direct measurement of the transmitted signal was performed at the antenna port of the EUT via a cable connection to a spectrum analyzer. A 10 dB attenuator was placed in series with the cable to protect the spectrum analyzer. The attenuator was added on the analyzer as gain offset settings thereby allowing direct measurements. The gain offset settings were also manipulated to account for loss via the SMA pigtails connected to antenna1 and antenna 2. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source.

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3.1 – RF Conducted – Fundamental Bandwidth

Manufacturer	Pentair
Date	1/16/2017
Operator	Coty Hammerer
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC Part 15.247 (a)(2) / RSS-247 sect. 5.2 (1)
Specific Measurement Procedure	ANSI C63.10 2013 Section 11.8 and 6.9.3 RSS-GEN Section 6.6
Additional Description of Measurement	Peak detector used
Additional Notes	1. Continuous modulated transmit used for this test.

Table

Tx Frequency (MHz)	Antenna	6 dB Bandwidth (MHz)	6 dB Bandwidth Minimum Limit (MHz)	99% OBW (MHz)
2405	1	1.535	0.500	2.302
2410	1	1.564	0.500	2.326
2440	1	1.581	0.500	2.348
2465	1	1.596	0.500	2.403
2470	1	1.580	0.500	2.378
2475	1	1.588	0.500	2.390
2405	2	1.514	0.500	2.309
2410	2	1.578	0.500	2.327
2440	2	1.551	0.500	2.339
2465	2	1.595	0.500	2.385
2470	2	1.570	0.500	2.391
2475	2	1.587	0.500	2.389

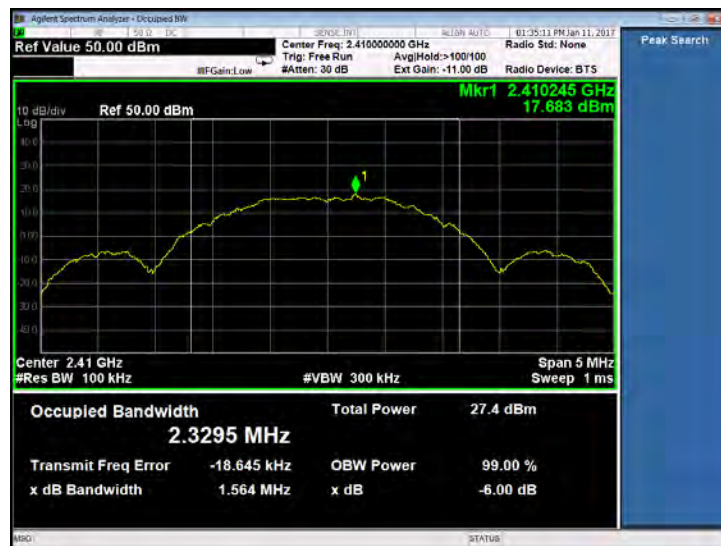
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Plots

Antenna 1



2405 MHz – DTS (-6dB) BW



2410 MHz – DTS (-6dB) BW

Prepared For: Pentair	EUT: WCP
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LSR: C-2580	Model: ICHNDHLD



2440 MHz - DTS (-6dB) BW



2465 MHz - DTS (-6dB) BW

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



2470 MHz - DTS (-6dB) BW



2475 MHz - DTS (-6dB) BW

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

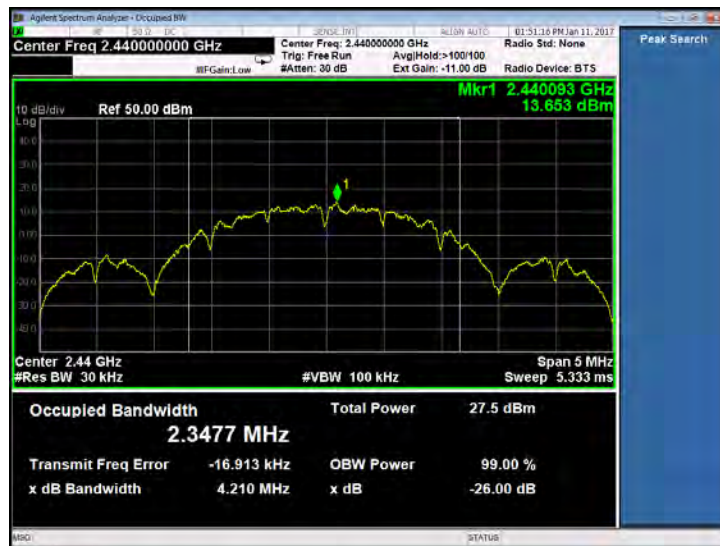


2405 MHz – 99% BW



2410 MHz – 99% BW

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



2440 MHz - 99% BW



2465 MHz - 99% BW

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



2470 MHz - 99% BW



2475 MHz - 99% BW

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 2



2405 MHz – DTS (-6 dB) BW



2410 MHz – DTS (-6 dB) BW

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



2440 MHz - DTS (-6 dB) BW



2465 MHz - DTS (-6 dB) BW

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



2470 MHz - DTS (-6 dB) BW

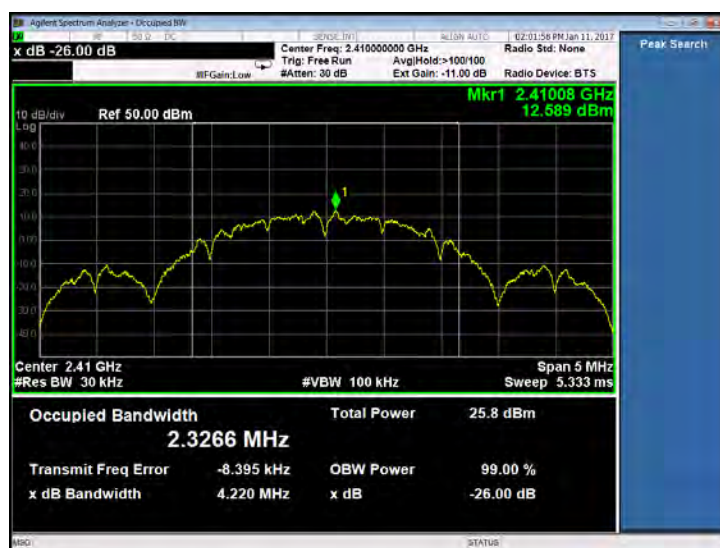


2475 MHz - DTS (-6 dB) BW

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



2405 MHz – 99% BW



2410 MHz – 99% BW

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



2440 MHz - 99% BW



2465 MHz - 99% BW

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



2470 MHz – 99% BW



2475 MHz – 99% BW

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

3.2 – RF Conducted – Fundamental Power and Spectral Density

Manufacturer	Pentair
Date	1/11/2017 and 1/16/2017
Operator	Coty Hammerer
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.247(b)(3)/ FCC 15.247(e) / RSS-247 Section 5.4(3)/ RSS-247 Section 5.2(2)
Specific Measurement Procedure	ANSI C63.10 Section 11.9.1.1 and 11.10.2
Additional Description of Measurement	Peak Output Power and Peak PSD methods utilized for measurement 10 kHz resolution bandwidth used for Peak Power Spectral Density measurement
Additional Notes	1. Continuous transmit modulated used for this test. Sample Calculation: Margin (dB) = Limit – Measured Level 2. PSD measurements taken in 3 kHz RBW

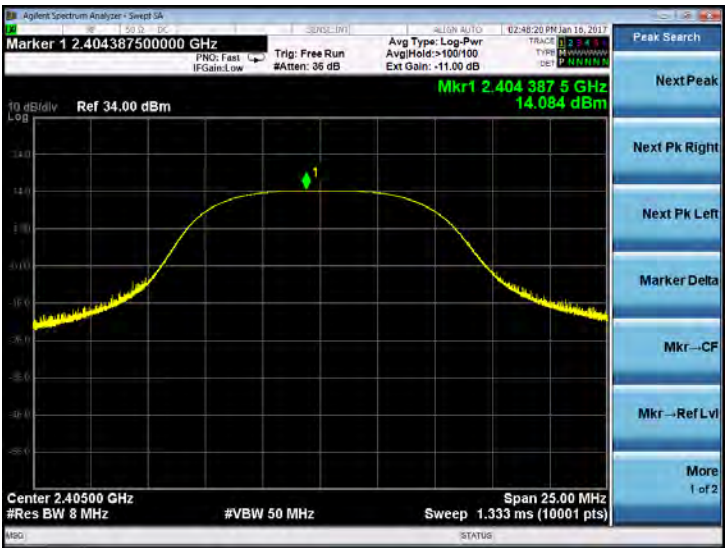
Table

Tx Frequency (MHz)	Antenna	Max Peak Conducted Output Power (dBm)	Power Limit (dBm)	Power Margin (dB)	Peak PSD in 3 kHz RBW (dBm)	PSD Limit in 3kHz Band Limit (dBm)	PSD Margin (dBm)
2405	1	14.084	30	15.916	-1.776	8	9.776
2410	1	20.551	30	9.449	4.154	8	3.846
2440	1	20.505	30	9.495	4.120	8	3.880
2465	1	19.701	30	10.299	3.539	8	4.461
2470	1	11.688	30	18.312	-4.520	8	12.520
2475	1	5.889	30	24.111	-11.046	8	19.046
2405	2	15.123	30	14.877	-1.371	8	9.371
2410	2	18.868	30	11.132	2.200	8	5.800
2440	2	18.631	30	11.369	2.994	8	5.006
2465	2	17.999	30	12.001	1.171	8	6.829
2470	2	10.972	30	19.028	-4.870	8	12.870
2475	2	5.493	30	24.507	-10.446	8	18.446

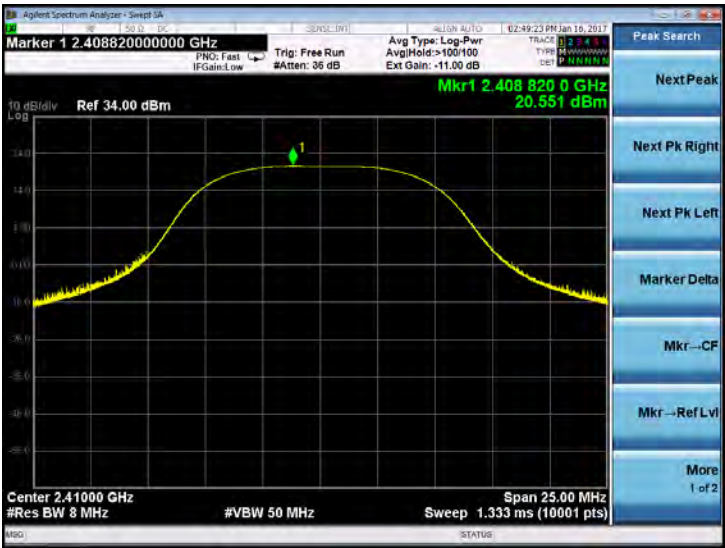
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
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Plots

Antenna 1

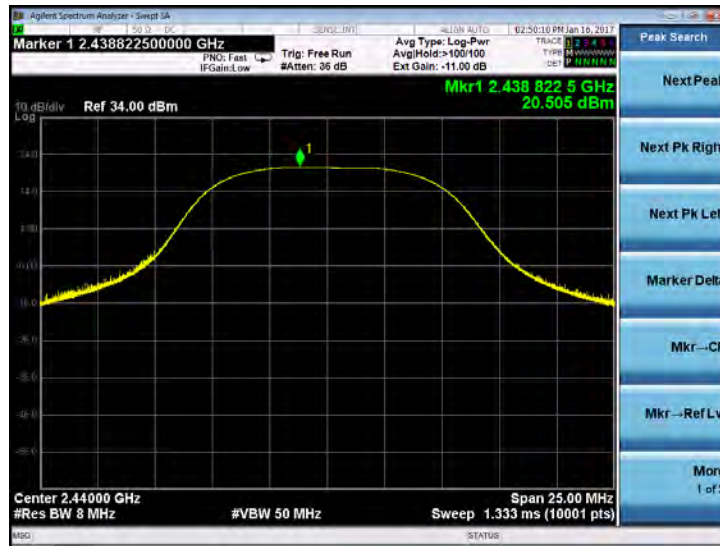


2405 MHz – Peak Output Power

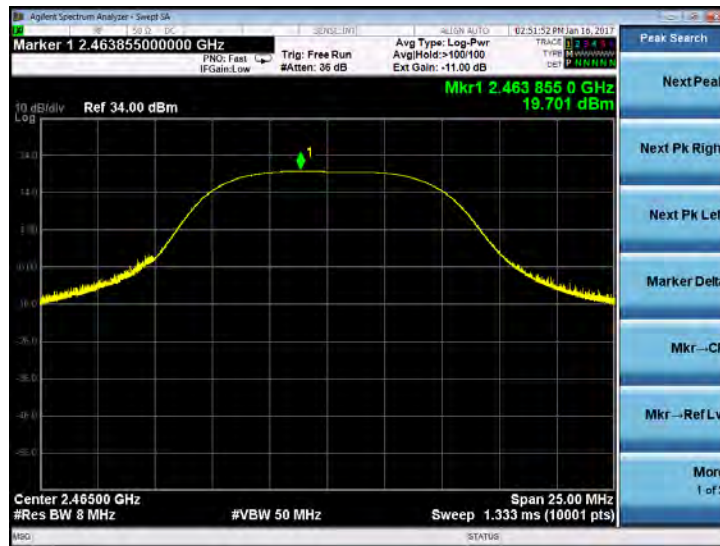


2410 MHz – Peak Output Power

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

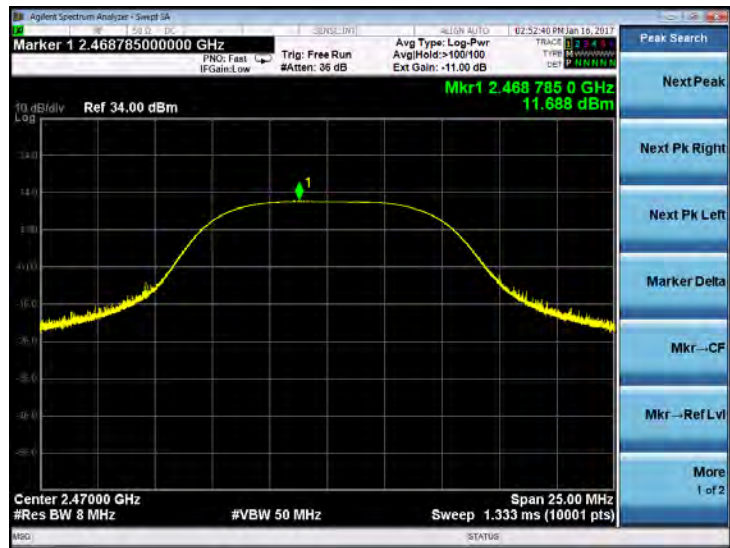


2440 MHz – Peak Output Power

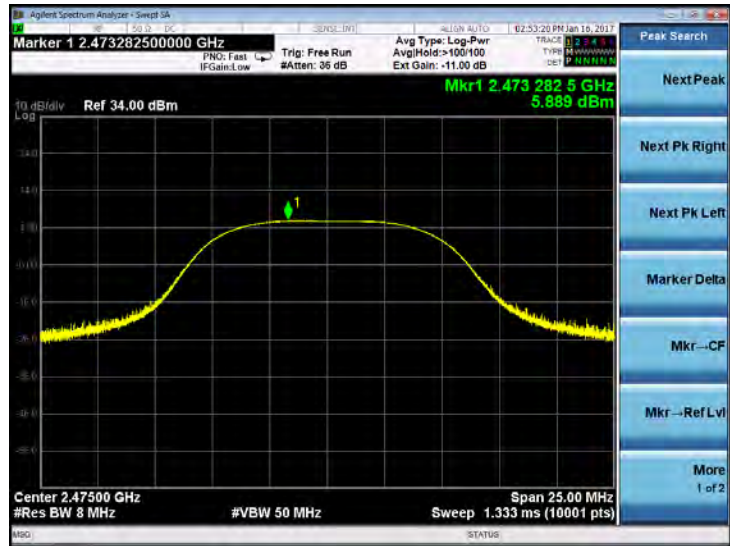


2465 MHz – Peak Output Power

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



2470 MHz – Peak Output Power



2475 MHz – Peak Output Power

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



2405 MHz – Peak PSD



2410 MHz – Peak PSD

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



2440 MHz – Peak PSD



2465 MHz – Peak PSD

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



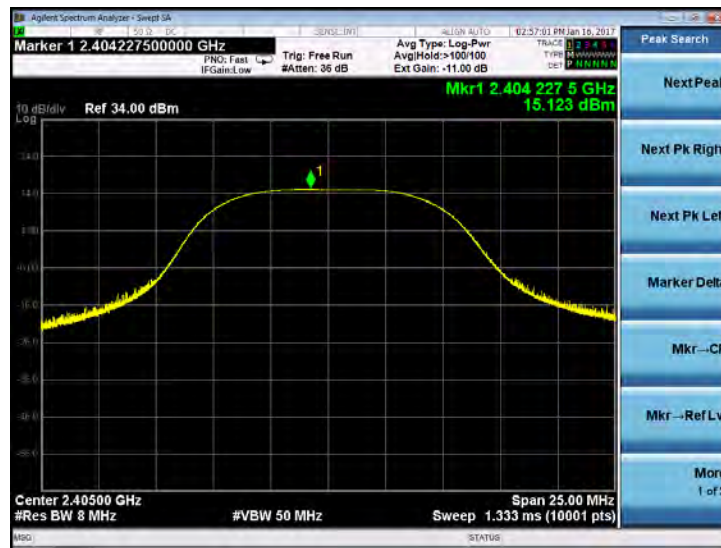
2470 MHz – Peak PSD



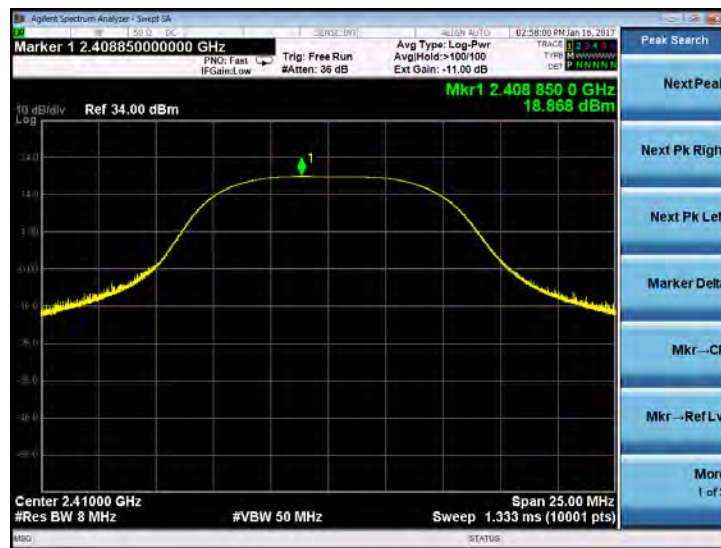
2475 MHz – Peak PSD

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 2

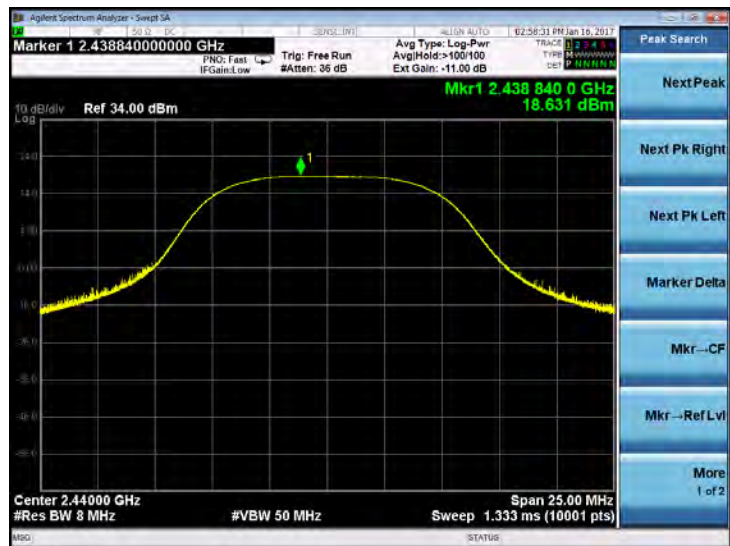


2405 MHz – Peak Output Power



2410 MHz – Peak Output Power

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

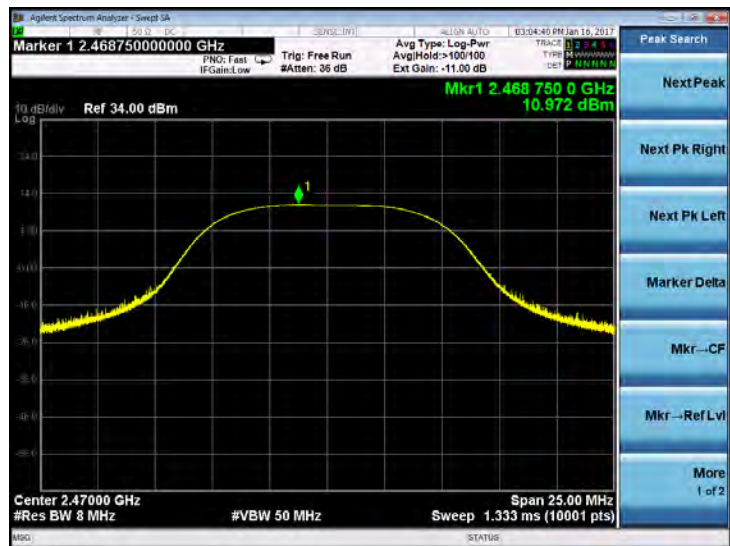


2440 MHz – Peak Output Power

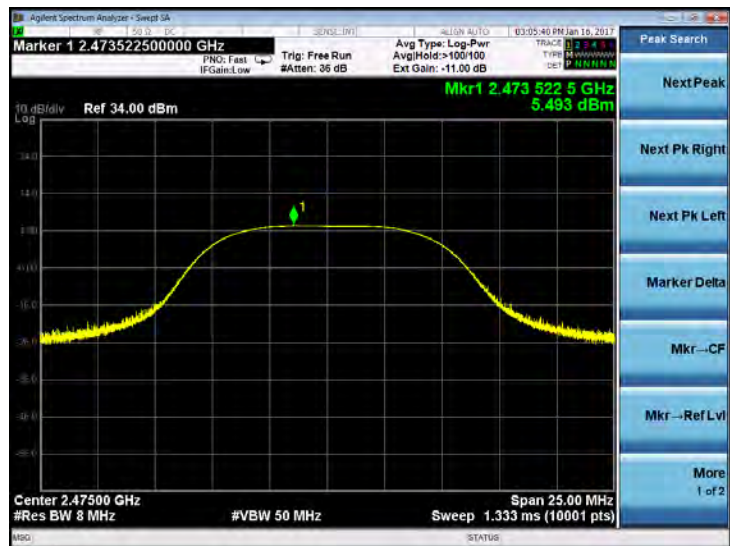


2465 MHz – Peak Output Power

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

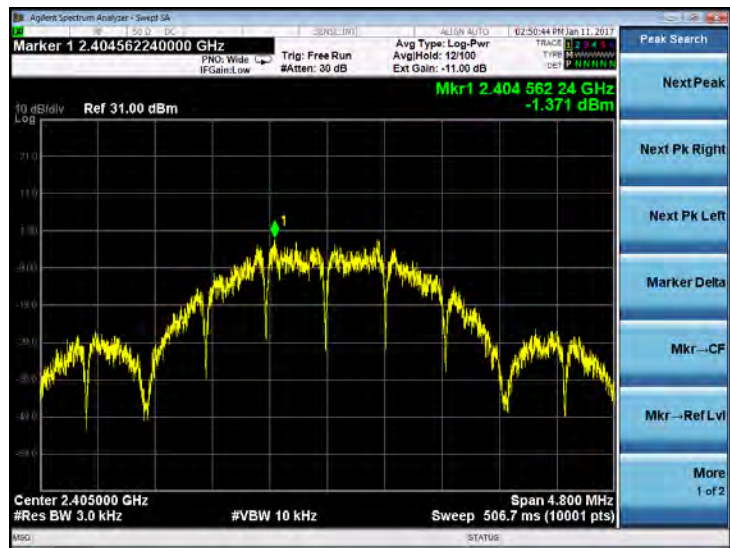


2470 MHz – Peak Output Power

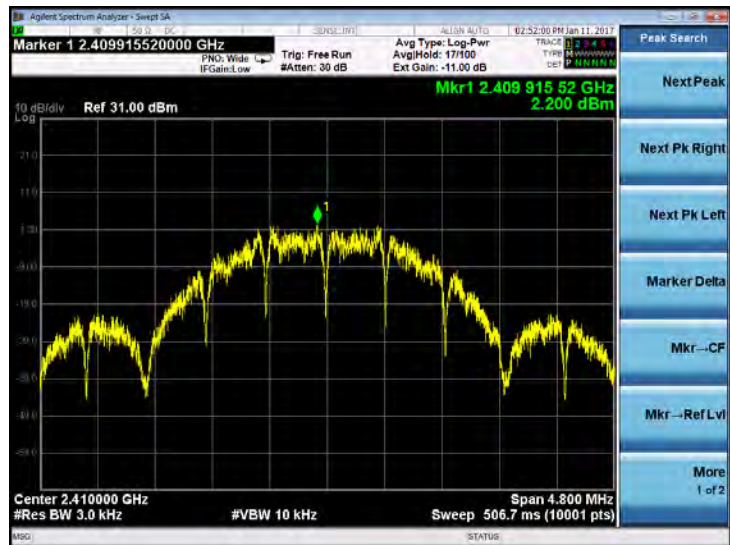


2475 MHz – Peak Output Power

Prepared For: Pentair	EUT: WCP
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2405 MHz – Peak PSD



2410 MHz – Peak PSD

Prepared For: Pentair	EUT: WCP
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2440 MHz – Peak PSD



2465 MHz – Peak PSD

Prepared For: Pentair	EUT: WCP
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2470 MHz – Peak PSD



2475 MHz – Peak PSD

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Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

3.3 – RF Conducted – Spurious Emissions/ Band Edges

Manufacturer	Pentair
Date	1/17/2017
Operator	Shane Dock
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.247 (d) / RSS-247 sect. 5.5
Specific Measurement Procedure	ANSI C63.10 Section 11.11
Additional Description of Measurement	Peak output power measured in any 100 kHz band outside the authorized frequency band shall be attenuated by at least 20 dBc.
Additional Notes	1. Continuous modulated transmission used for this test. 2. Reference Level Plots were taken at the transmitted frequency and used to determine the 20 dBc limit line. No emissions detected were within 15 dB of the reference level and, as such, are below the 20 dBc limit line.

Tx Frequency (MHz)	Antenna	Reference Level (dBm)	Limit (dBm)
2405	1	10.518	-9.482
2410	1	17.207	-2.793
2440	1	16.923	-3.077
2465	1	15.519	-4.481
2470	1	7.208	-12.792
2475	1	1.997	-18.003
2405	2	11.174	-8.826
2410	2	15.396	-4.604
2440	2	14.366	-5.634
2465	2	14.230	-5.770
2470	2	6.797	-13.203
2475	2	1.039	-18.961

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Reference Level Plots

Antenna 1

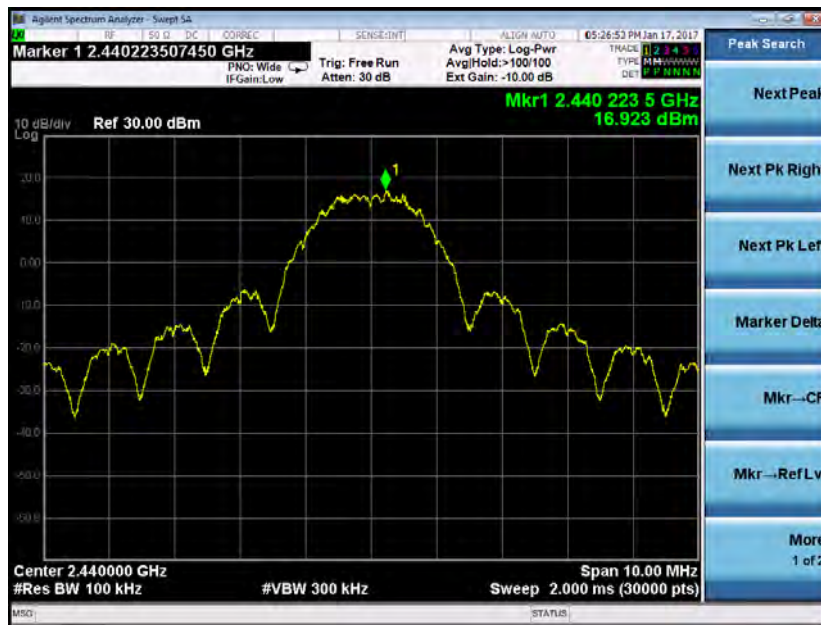


2405 MHz



2410 MHz

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2440 MHz



2465 MHz

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2470 MHz



2475 MHz

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Antenna 2



2405 MHz



2410 MHz

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2440 MHz



2465 MHz

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2470 MHz

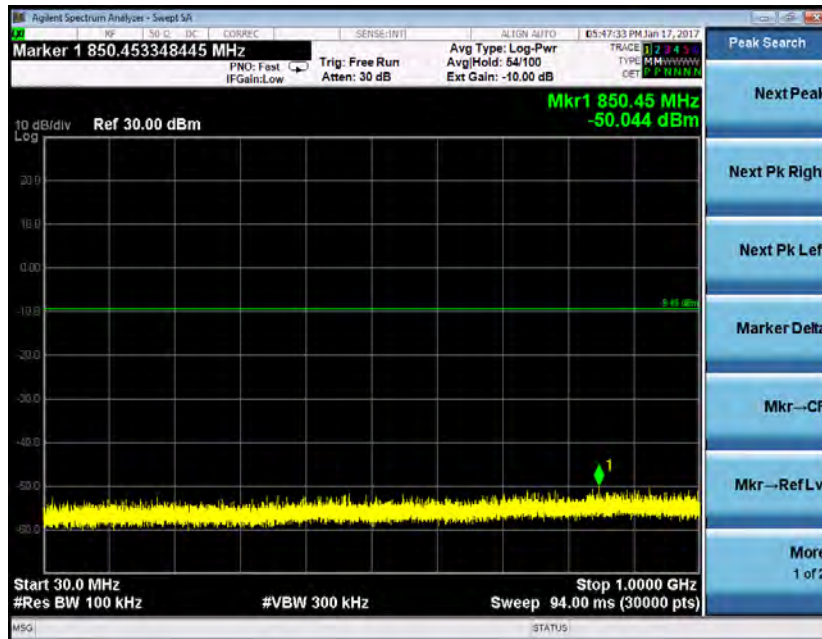


2475 MHz

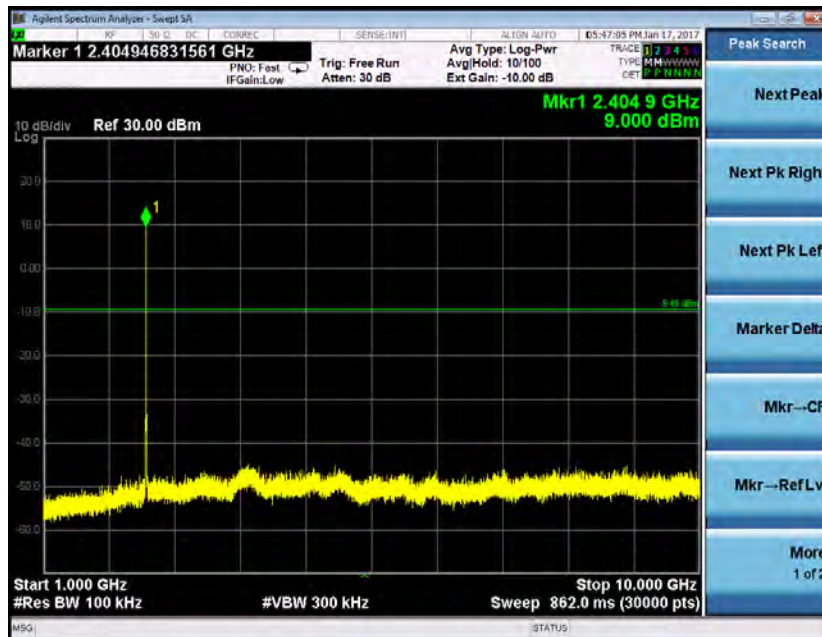
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 1

2405 MHz

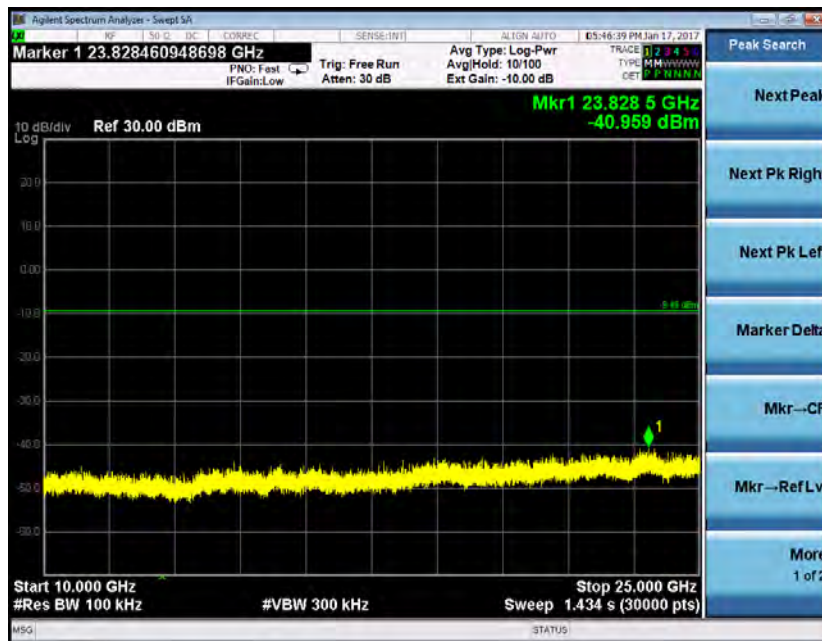


30-1000 MHz



1000-10000 MHz

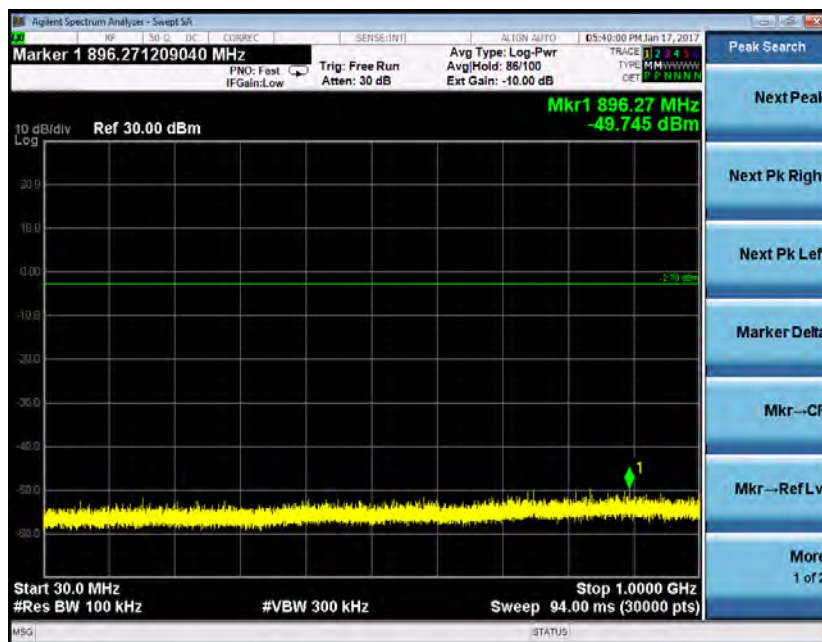
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



10000-25000 MHz

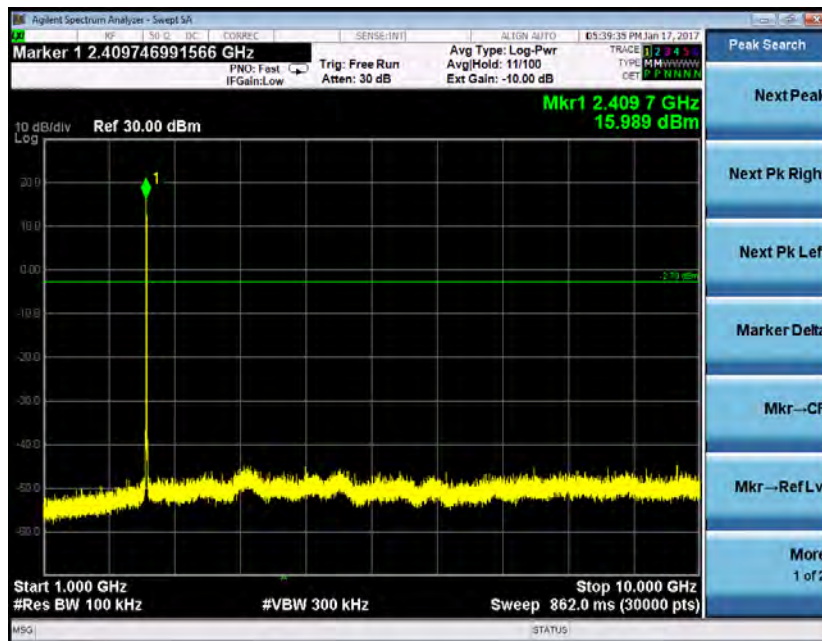
Antenna 1

2410 MHz

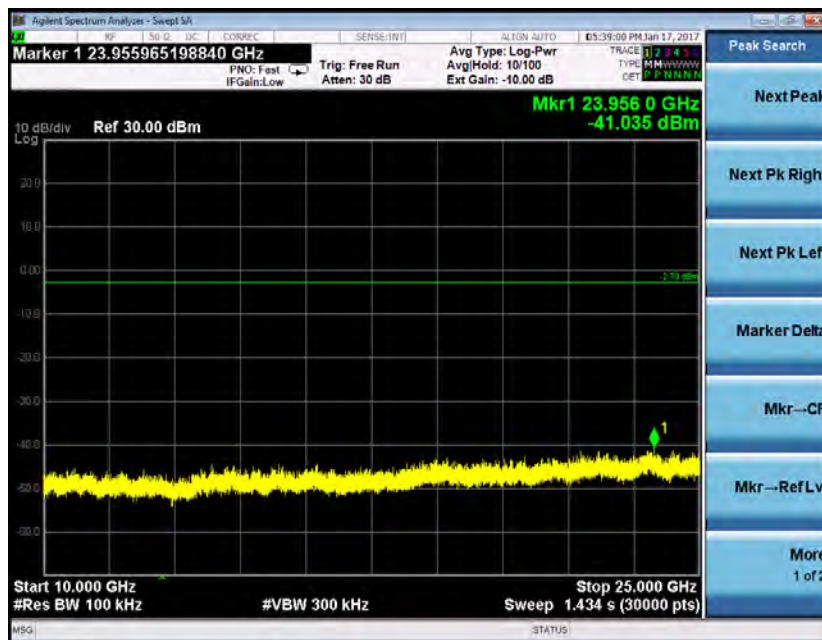


30-1000 MHz

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



1000-10000 MHz

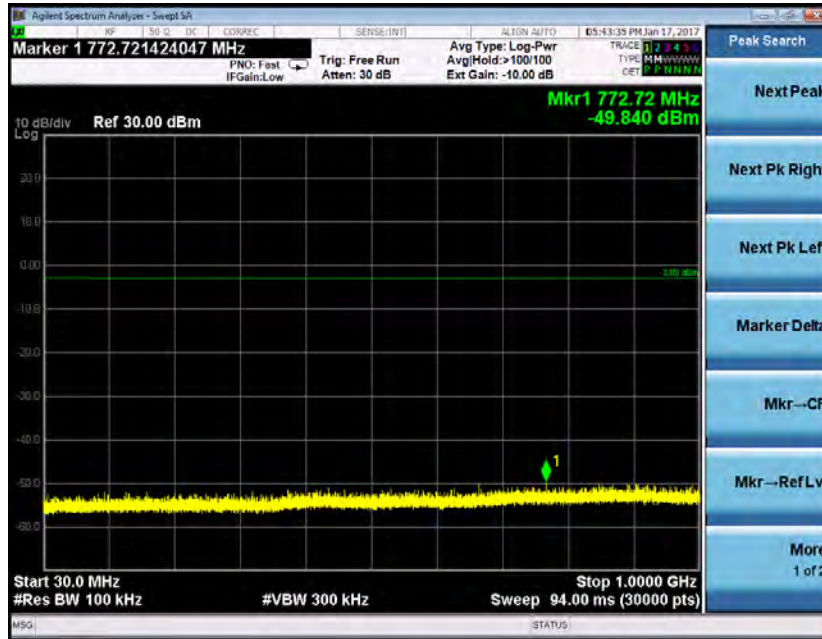


10000-25000 MHz

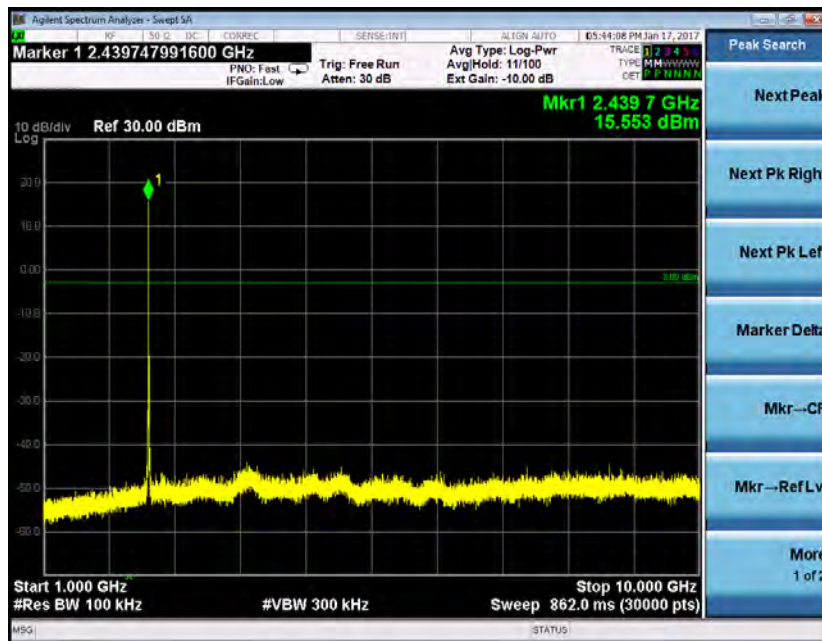
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 1

2440 MHz

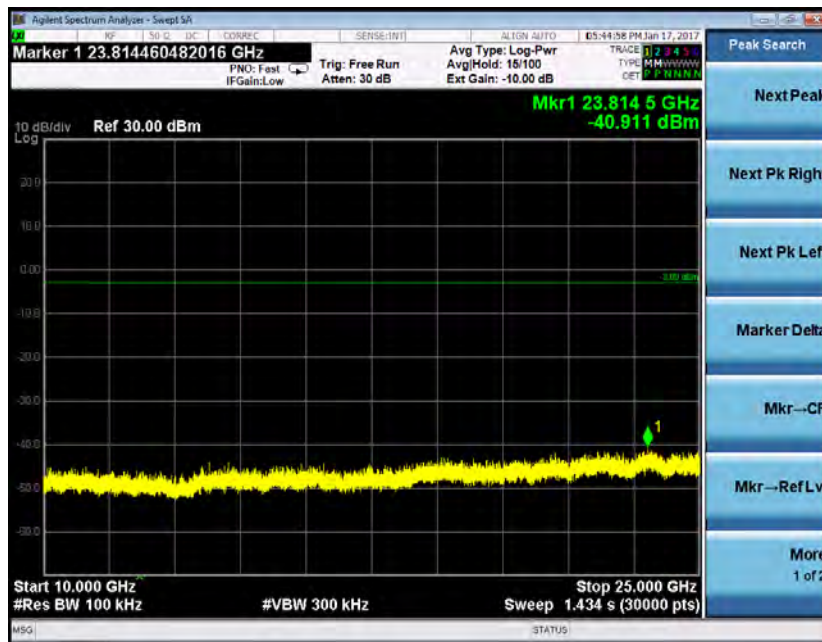


30-1000 MHz



1000-10000 MHz

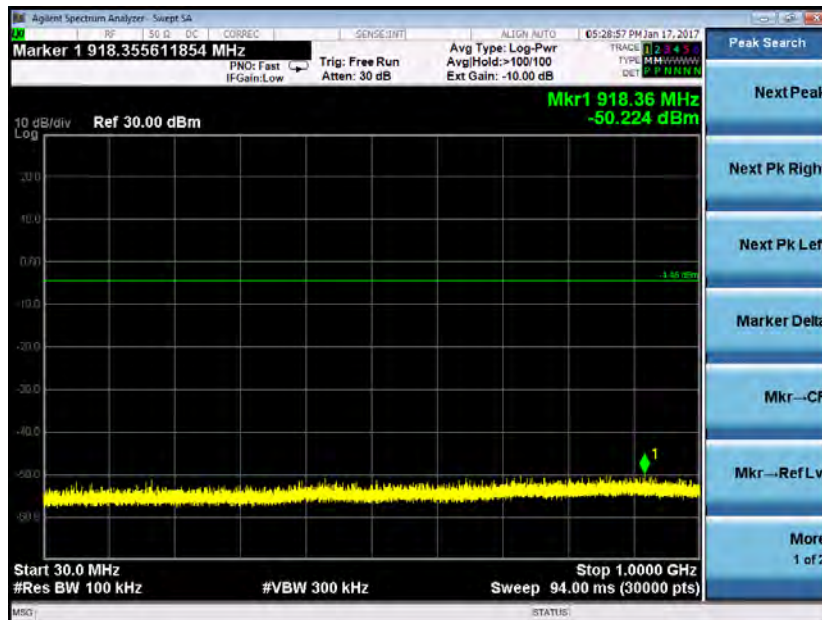
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



10000-25000 MHz

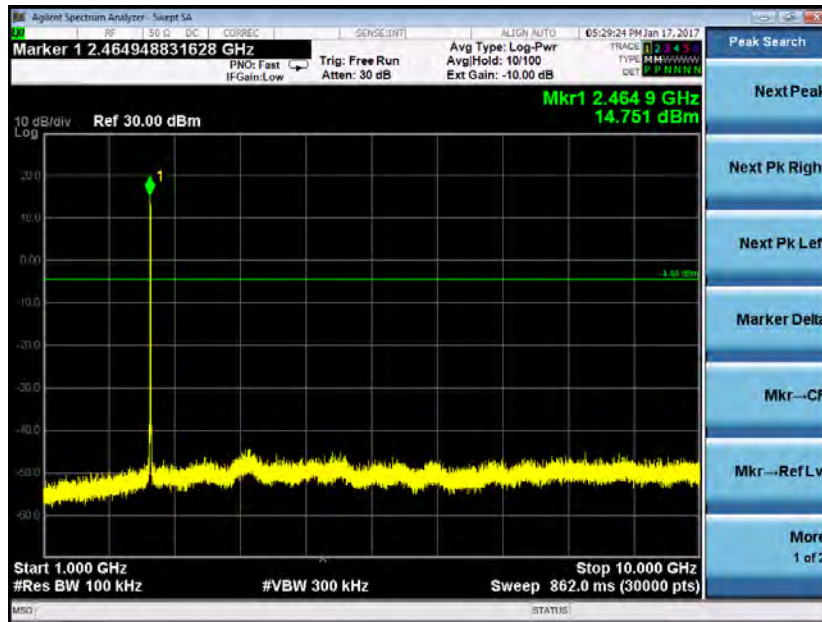
Antenna 1

2465 MHz

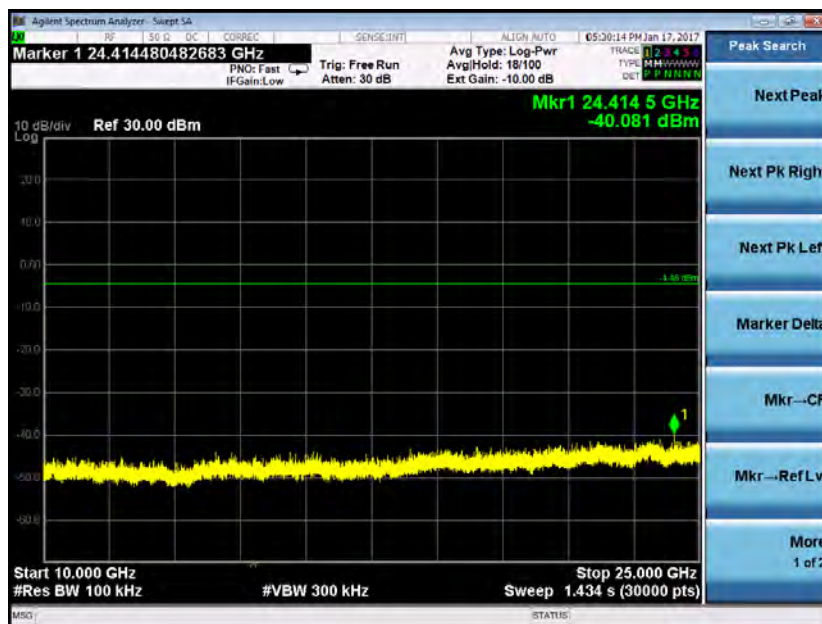


30-1000 MHz

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



1000-10000 MHz

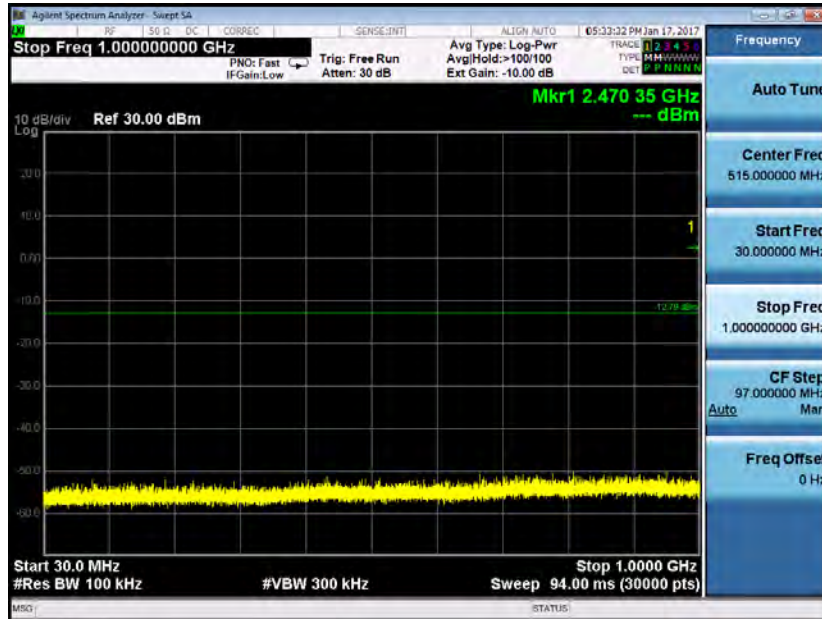


10000-25000 MHz

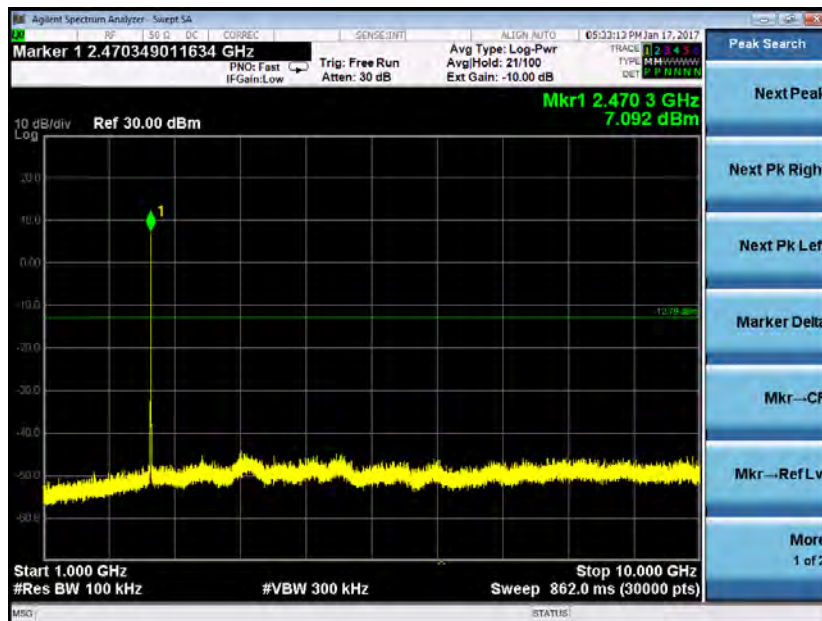
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 1

2470 MHz

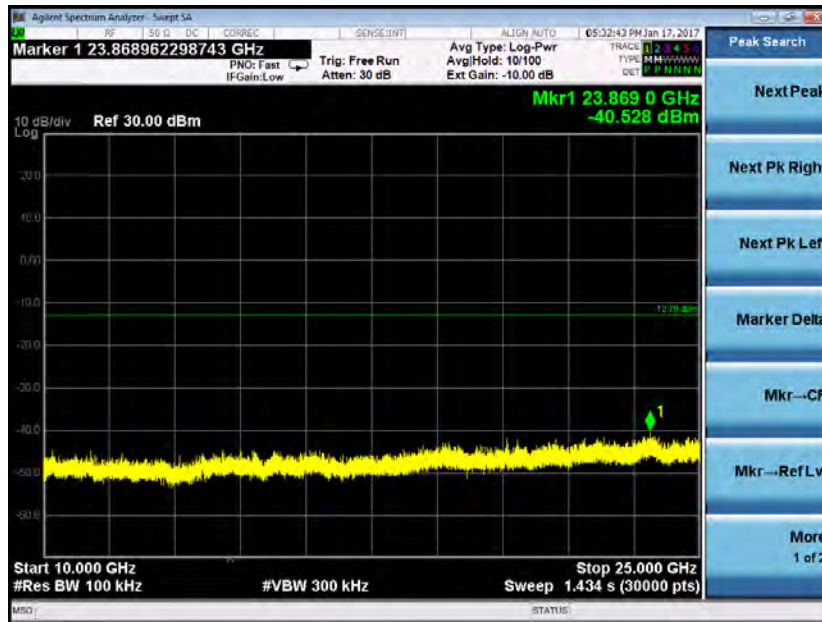


30-1000 MHz



1000-10000 MHz

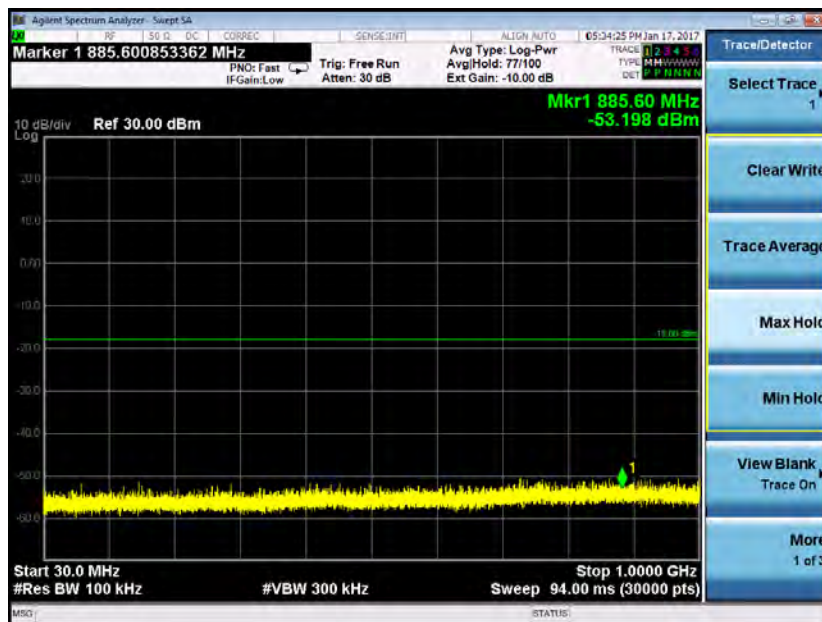
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



10000-25000 MHz

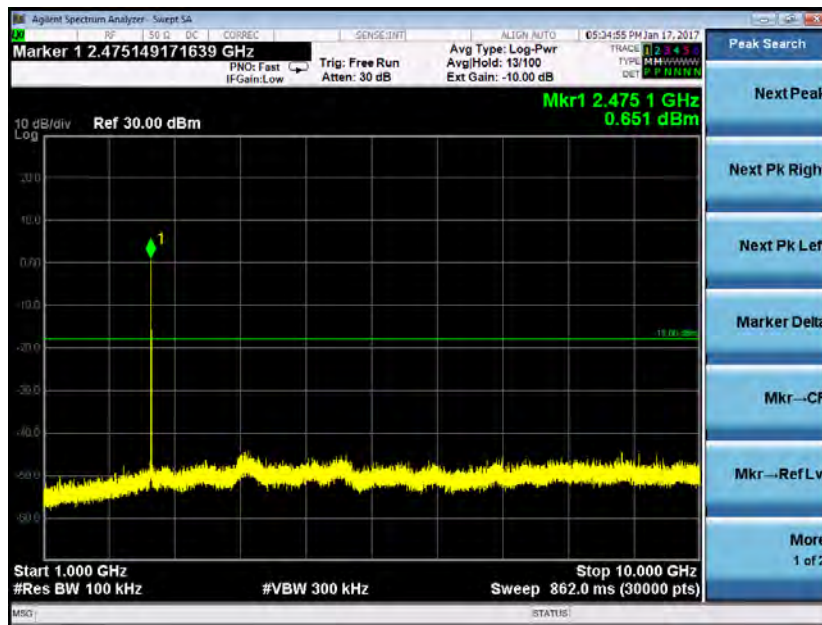
Antenna 1

2475 MHz

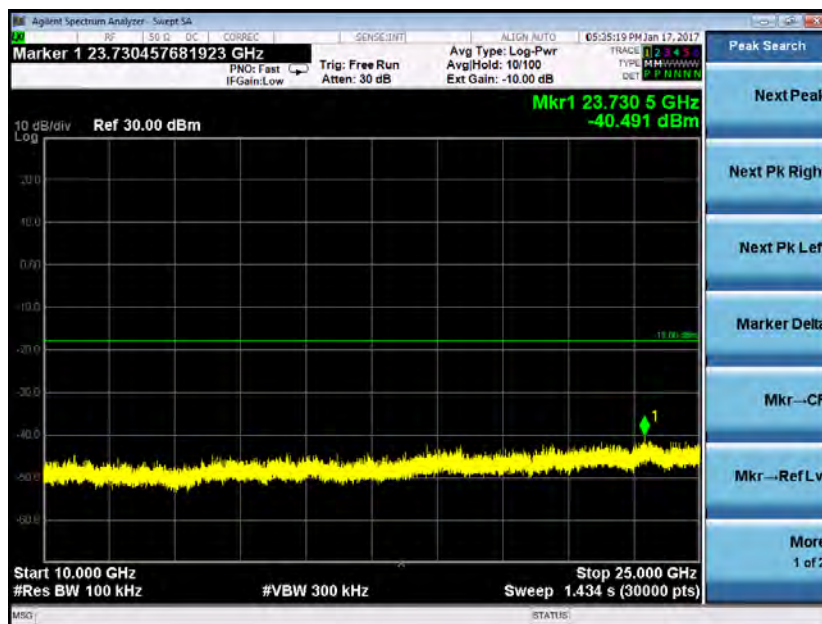


30-1000 MHz

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



1000-10000 MHz

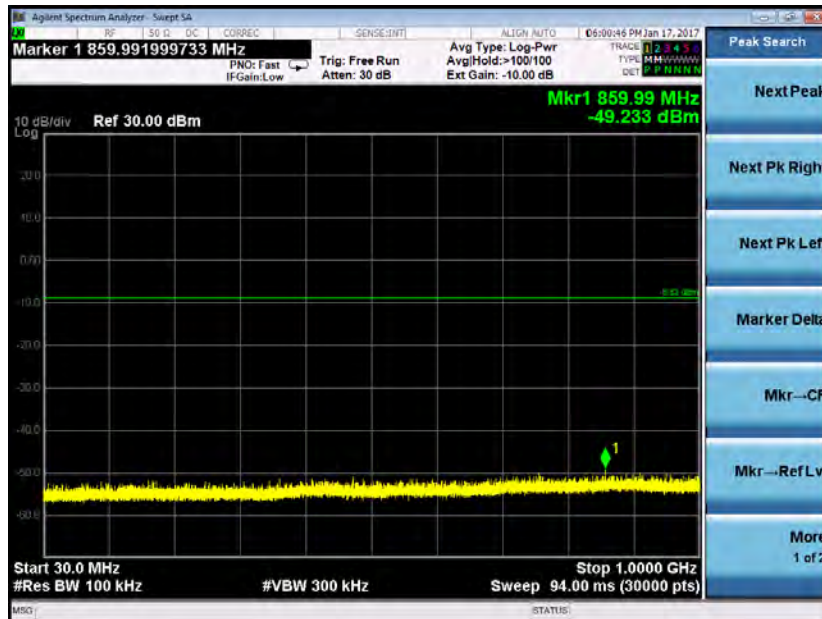


10000-25000 MHz

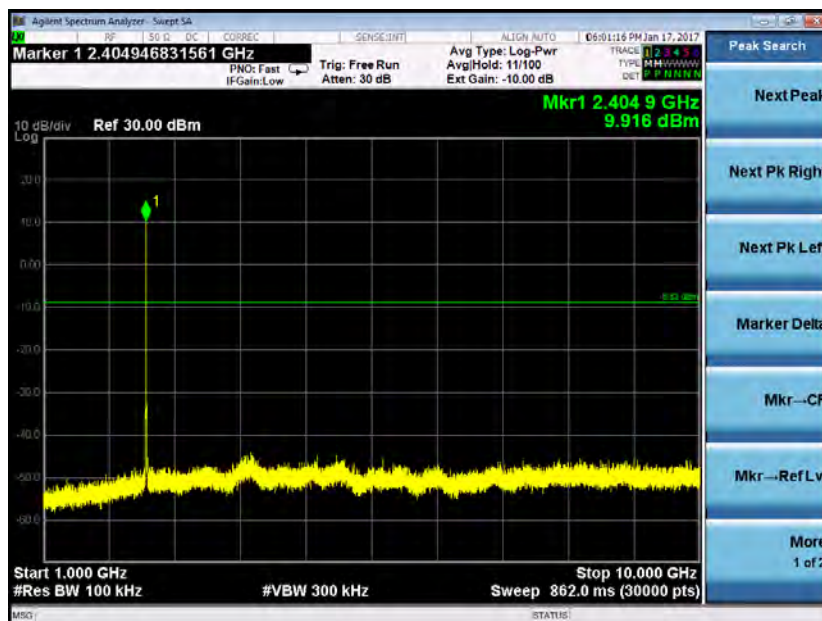
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 2

2405 MHz

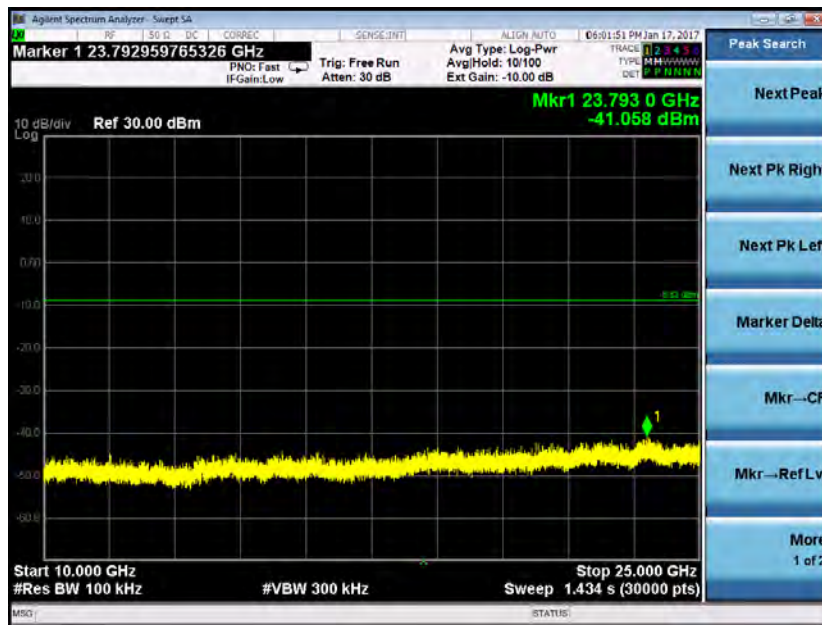


30-1000 MHz



1000-10000 MHz

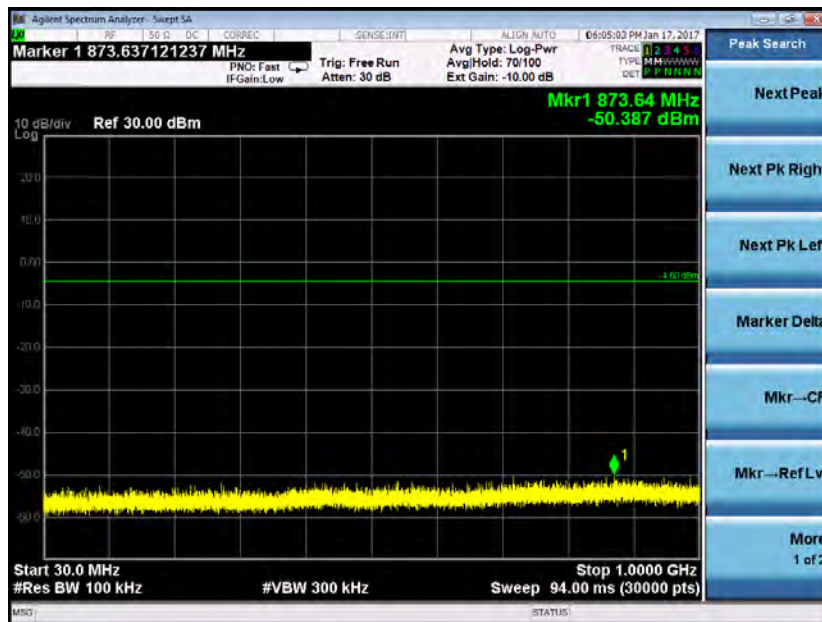
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



10000-25000 MHz

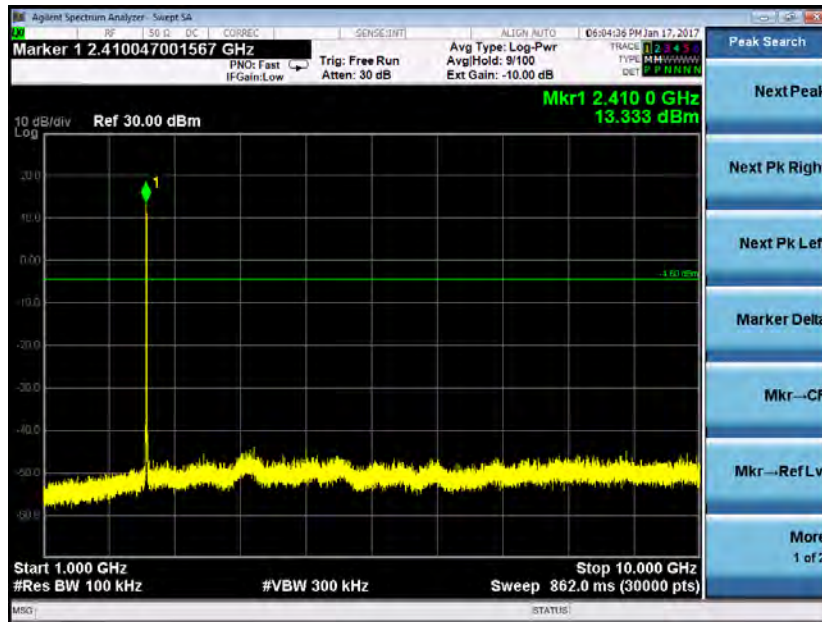
Antenna 2

2410 MHz

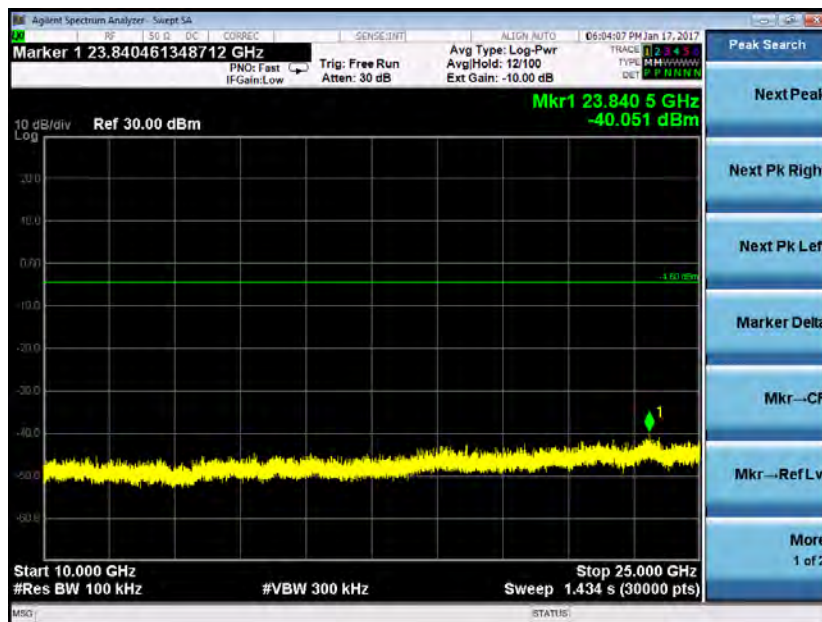


30-1000 MHz

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



1000-10000 MHz

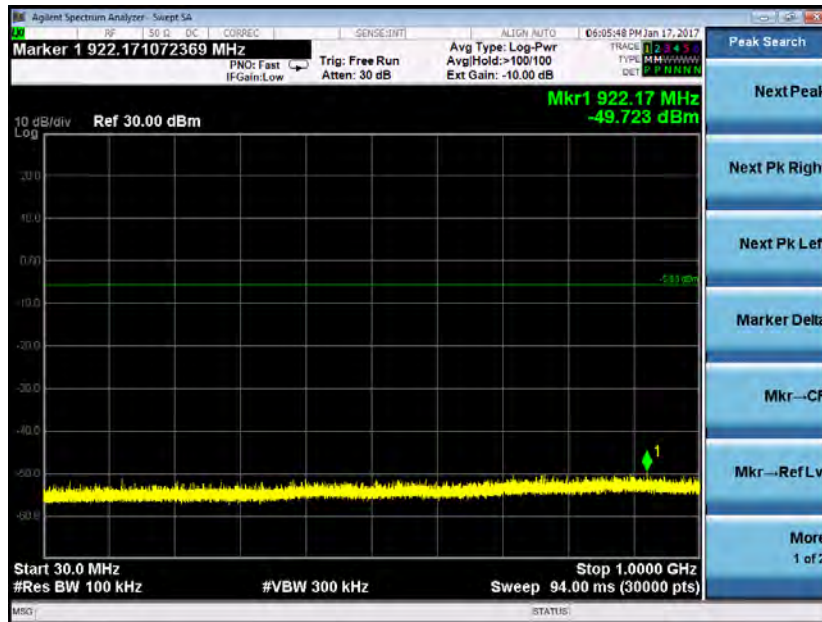


10000-25000 MHz

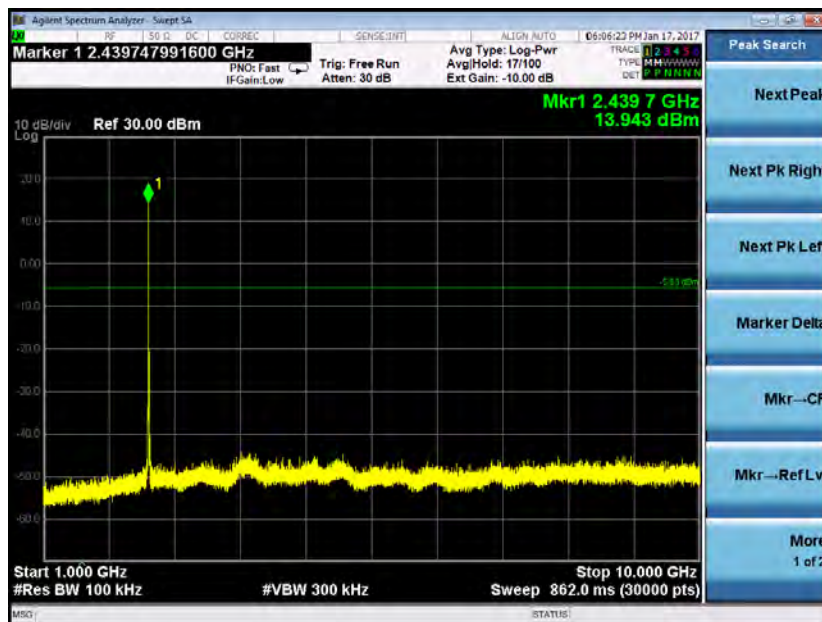
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 2

2440 MHz

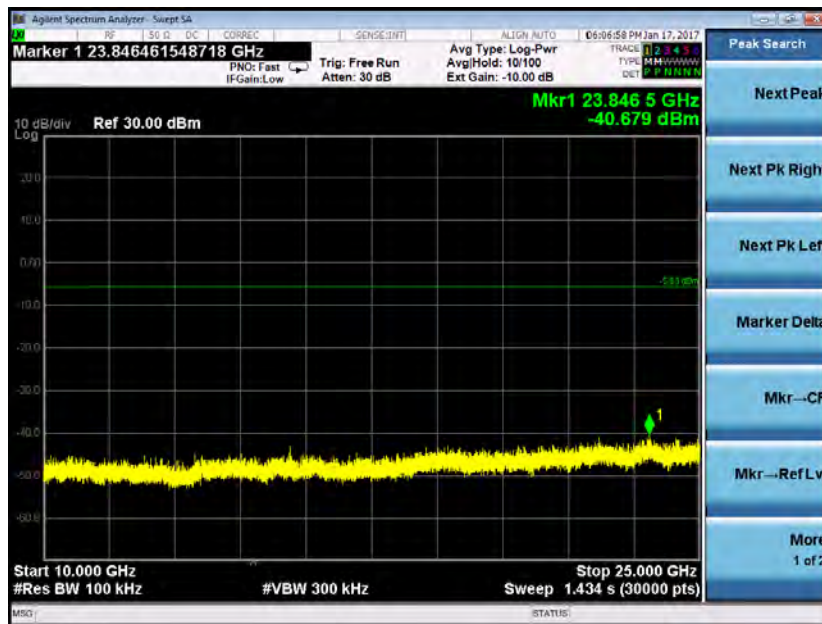


30-1000 MHz



1000-10000 MHz

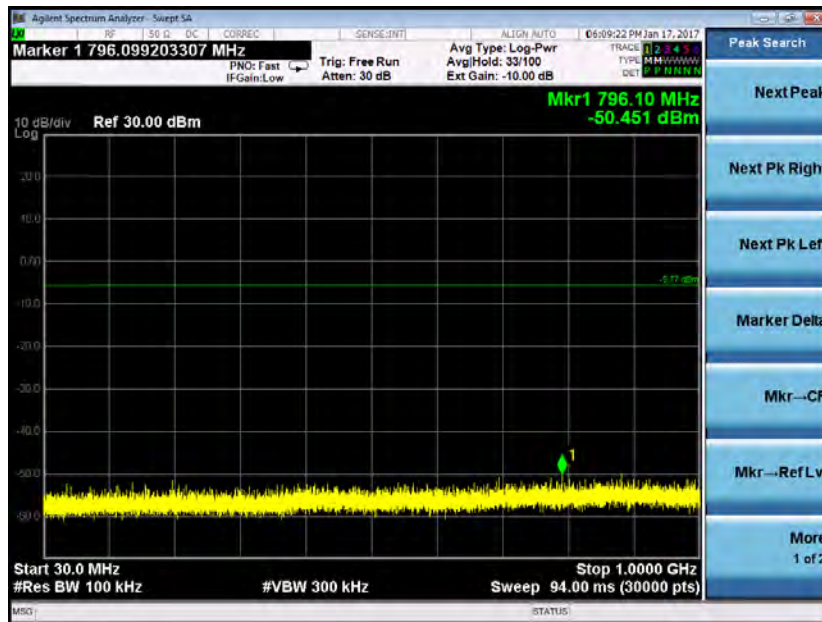
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



10000-25000 MHz

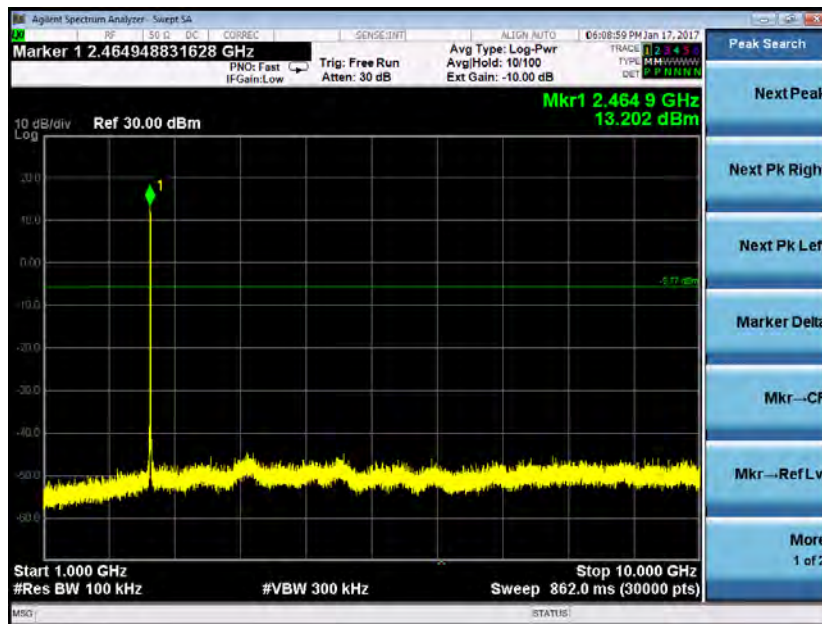
Antenna 2

2465 MHz

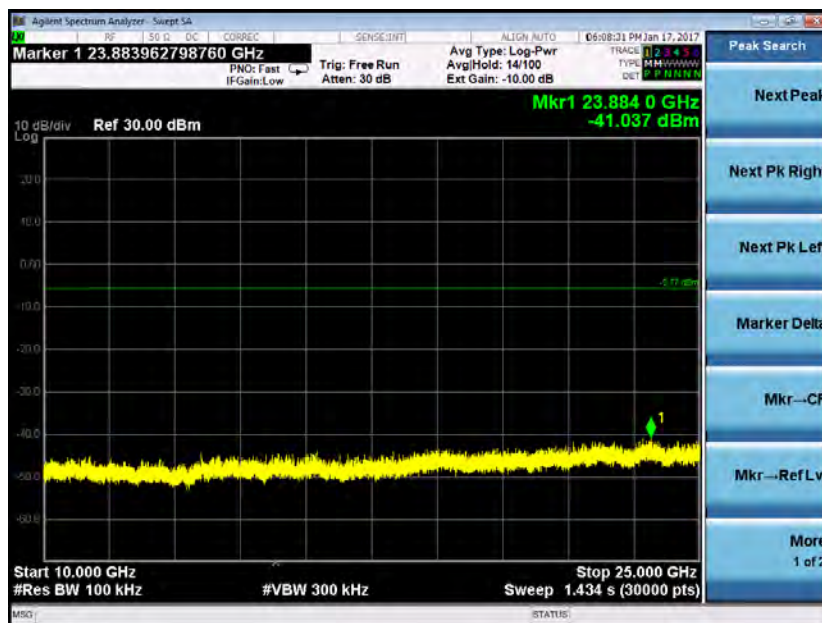


30-1000 MHz

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



1000-10000 MHz

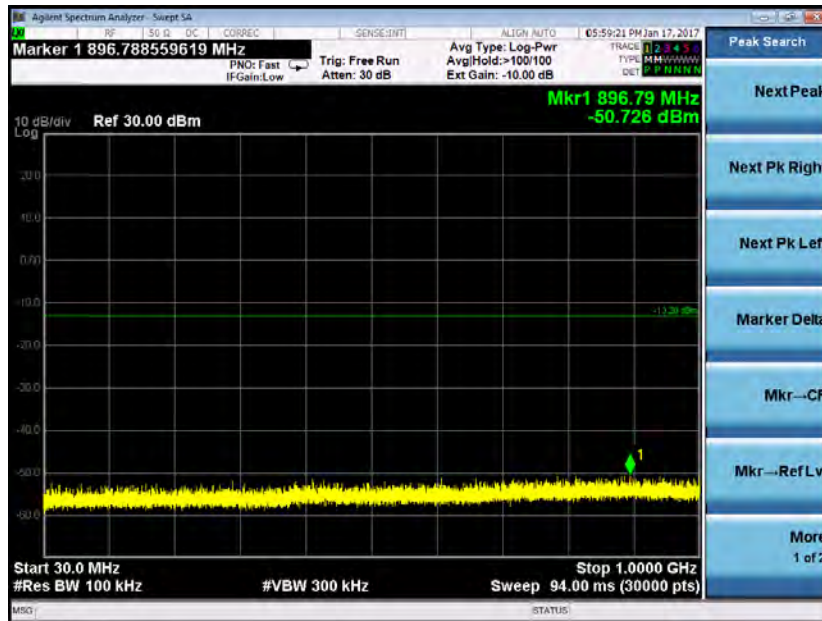


10000-25000 MHz

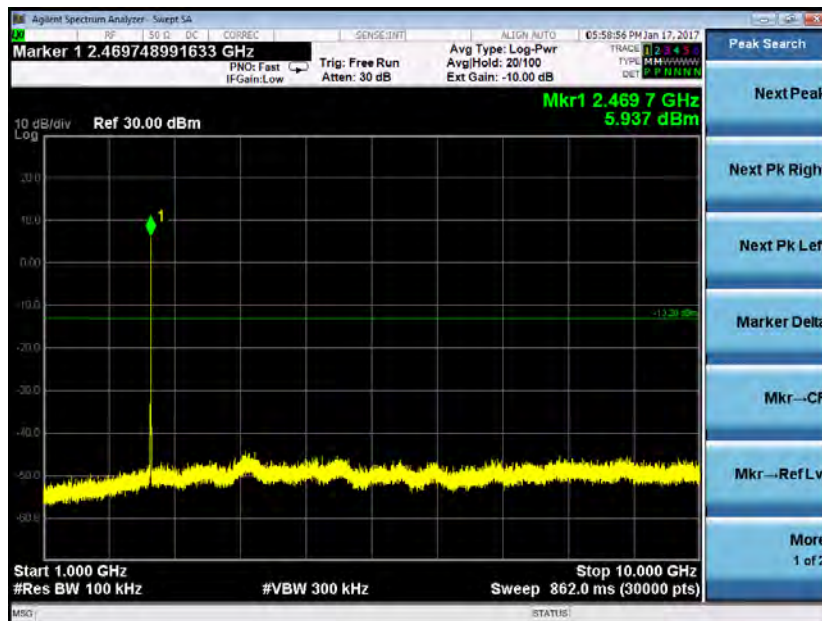
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 2

2470 MHz



30-1000 MHz



1000-10000 MHz

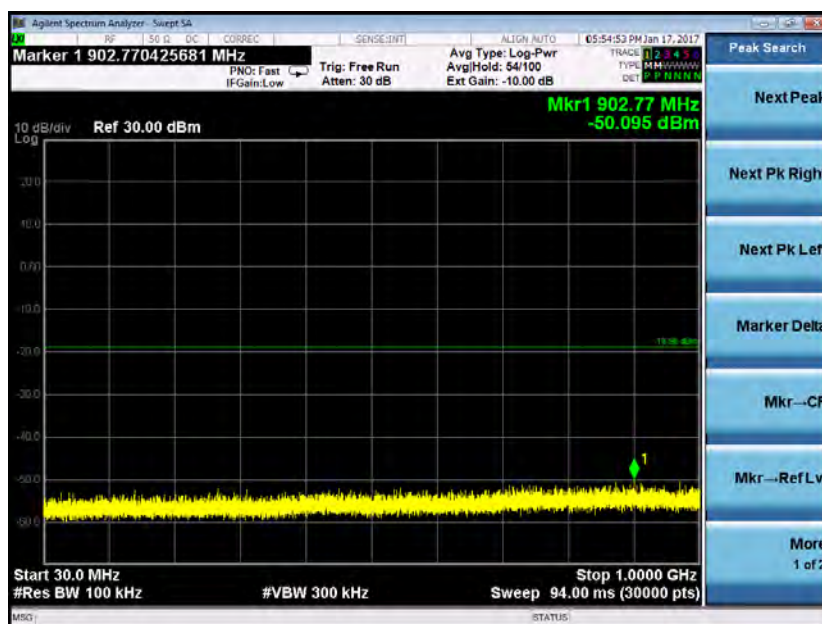
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



10000-25000 MHz

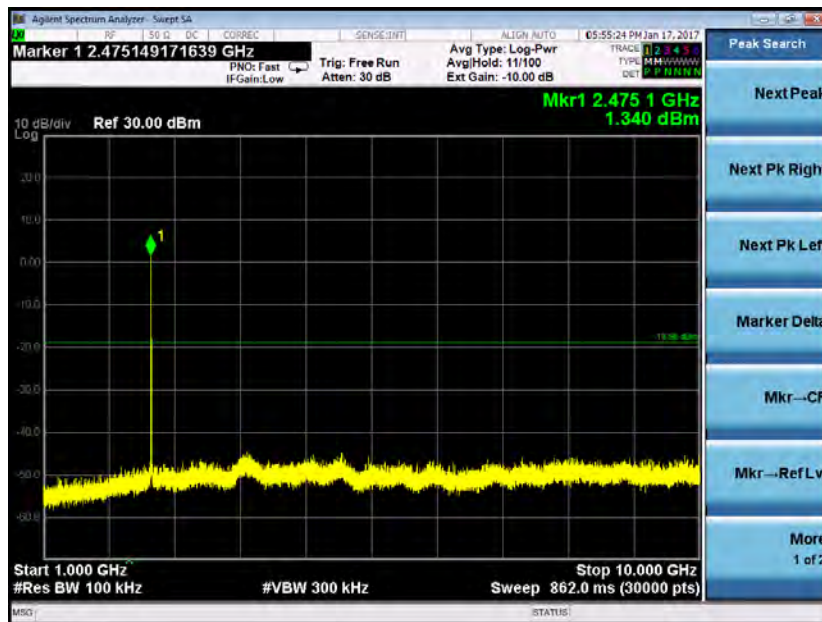
Antenna 2

2475 MHz

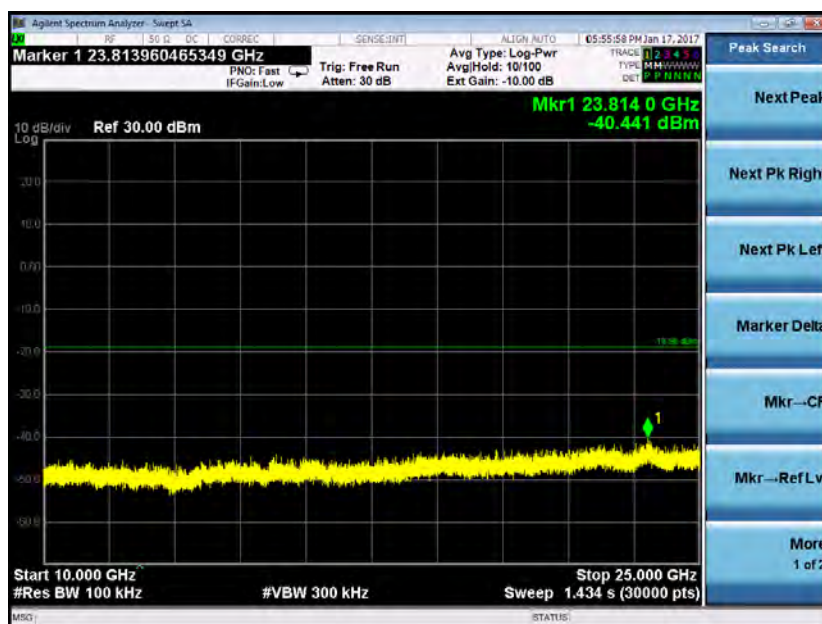


30-1000 MHz

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



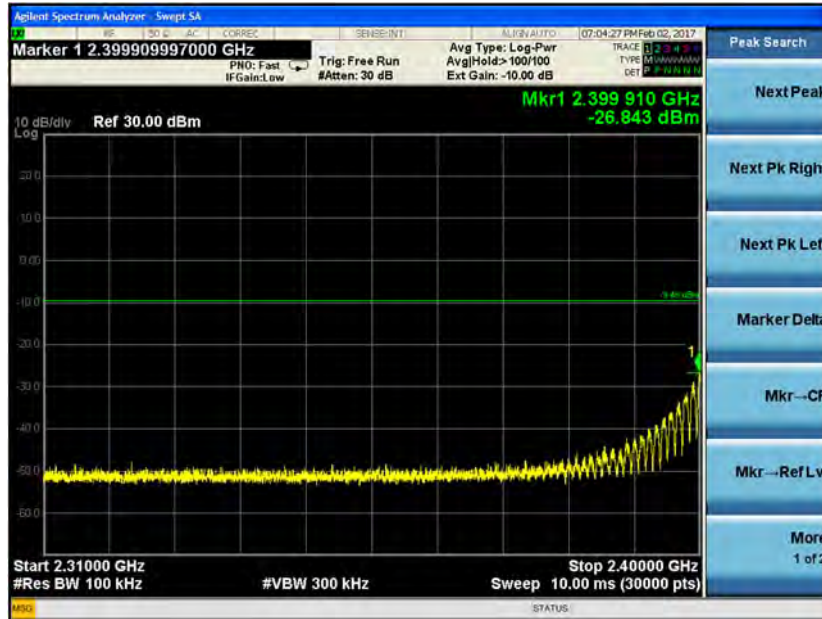
1000-10000 MHz



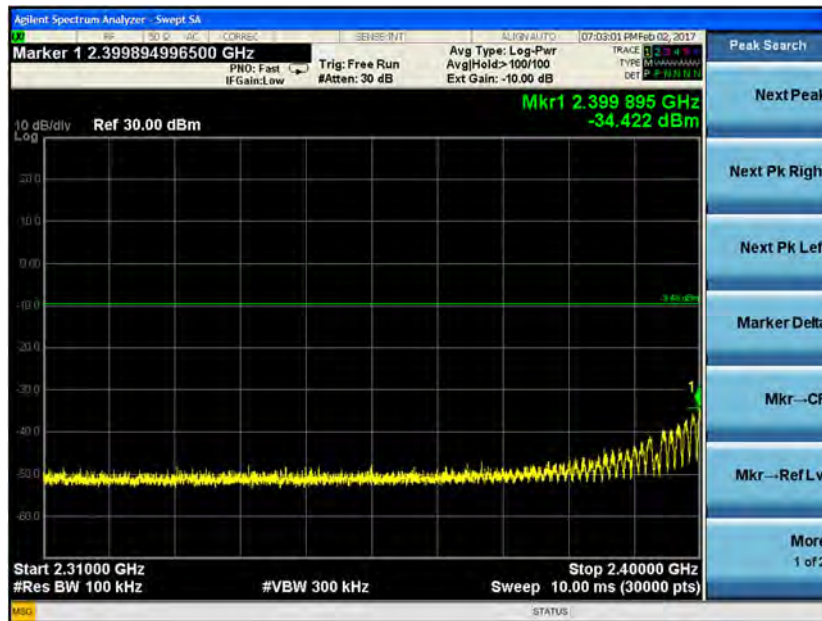
10000-25000 MHz

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 1
2405 MHz
Lower Band Edge

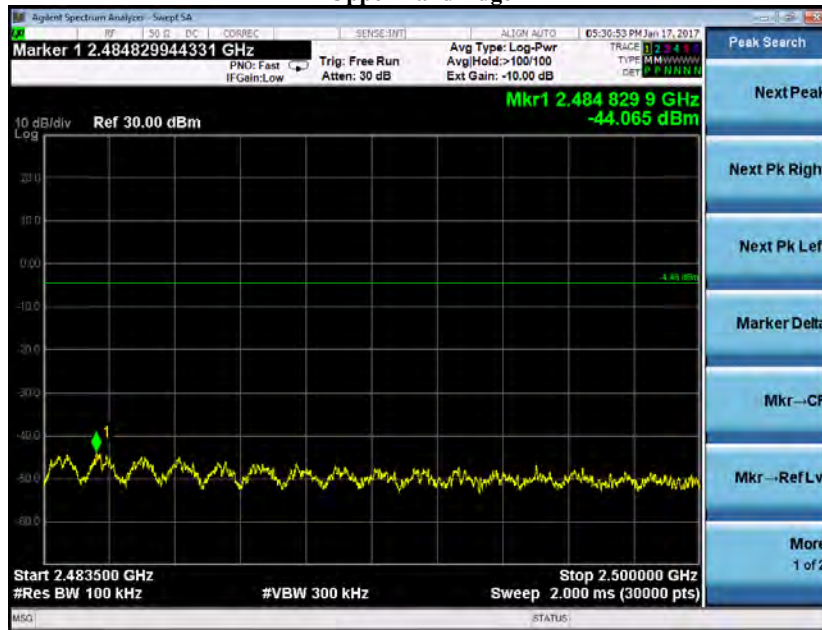


Antenna 1
2410 MHz
Lower Band Edge

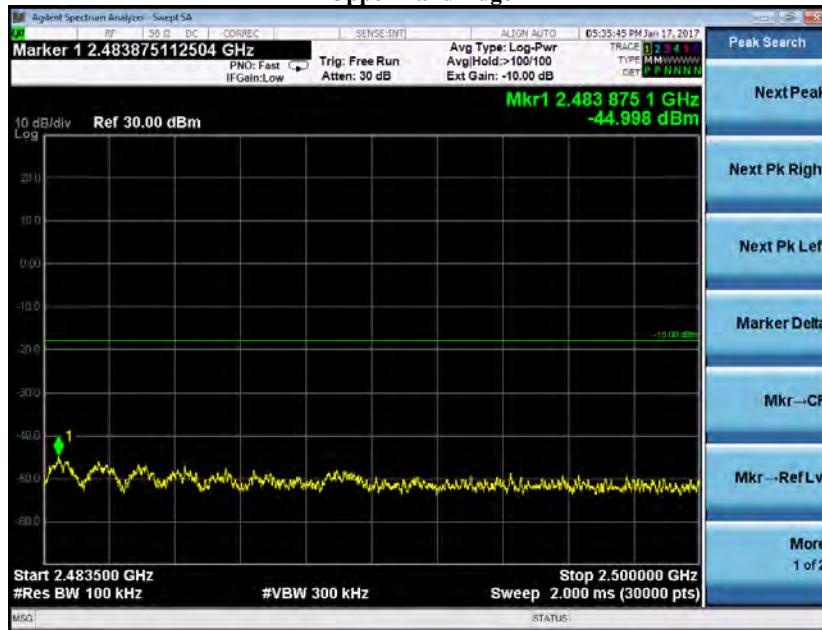


Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

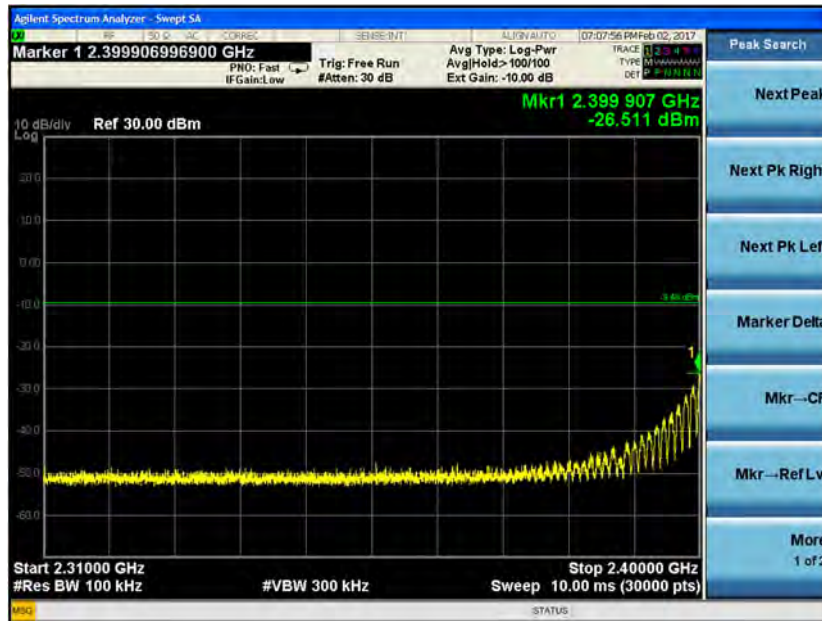
Antenna 1
2465 MHz
Upper Band Edge



**Antenna 1
2475 MHz
Upper Band Edge**

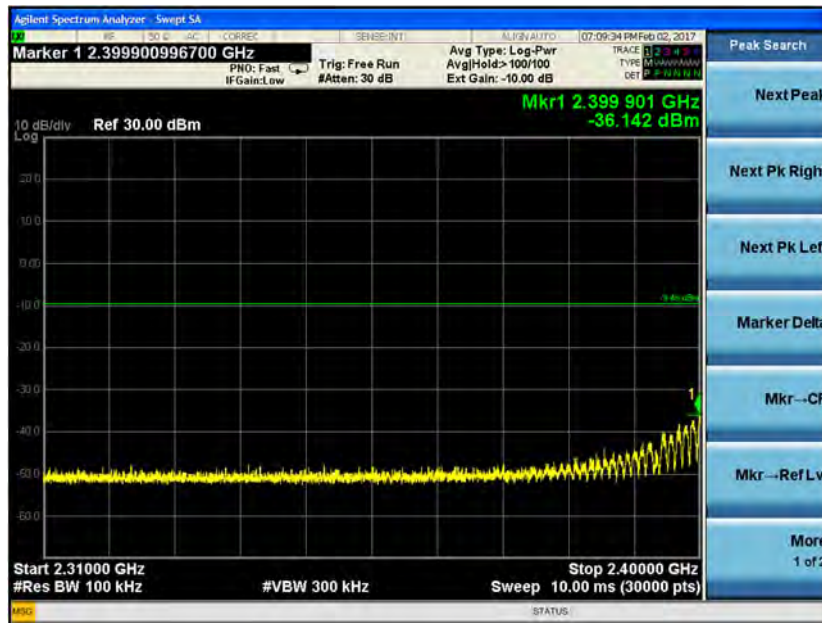


**Antenna 2
2405 MHz
Lower Band Edge**

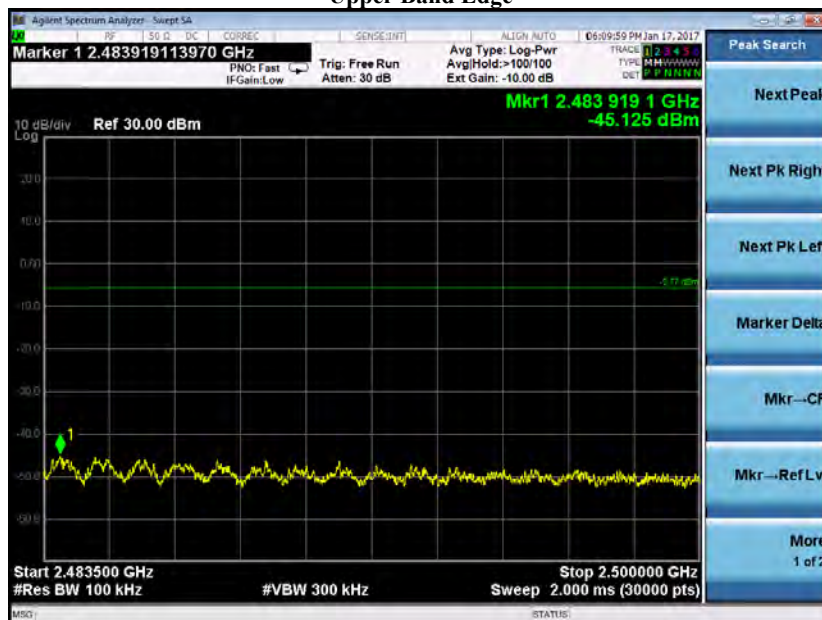


Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 2
2410 MHz
Lower Band Edge

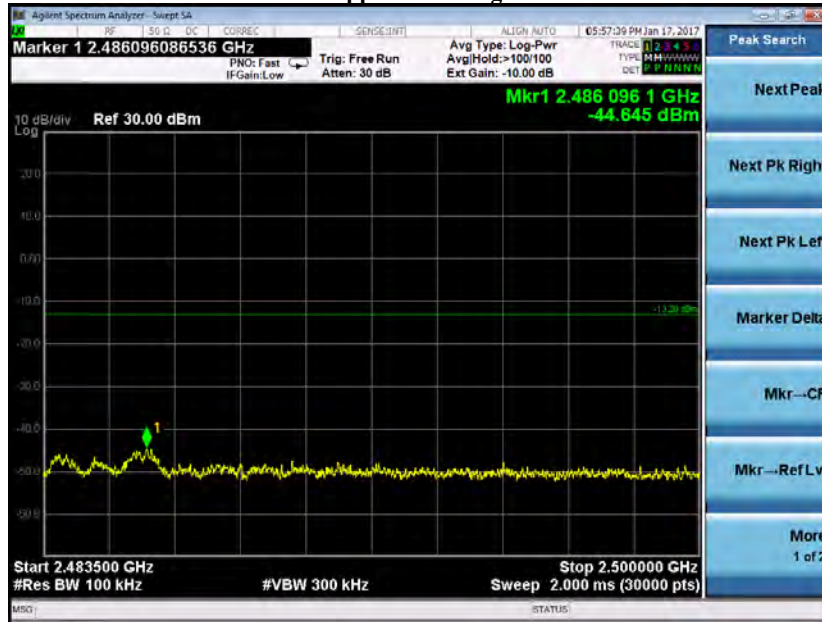


Antenna 2
2465 MHz
Upper Band Edge

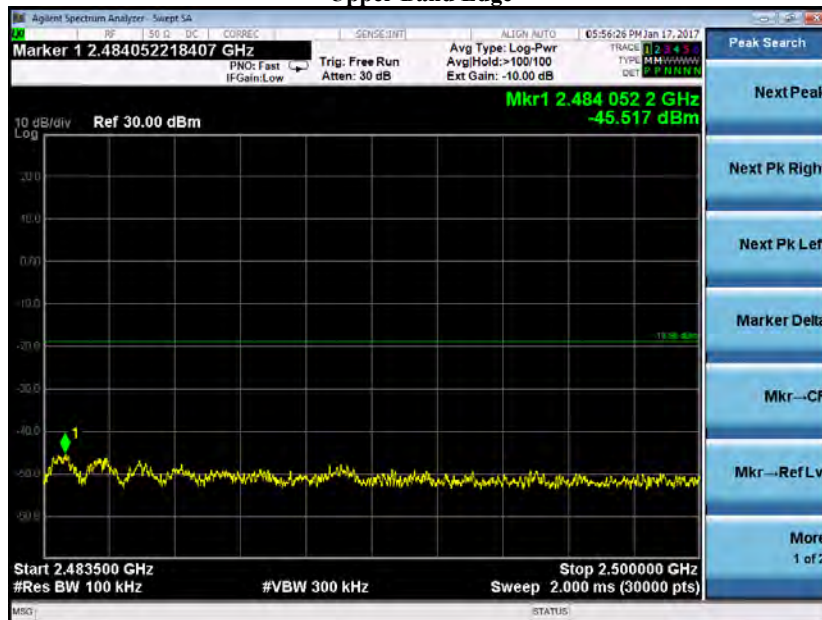


Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 2
2470 MHz
Upper Band Edge



Antenna 2
2475 MHz
Upper Band Edge



Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

3.4 – RF Conducted – Frequency Stability

Manufacturer	John Johnston
Date	1/19/2017
Operator	Kim Bay
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.247 and 2.1055 / RSS-247
Specific Measurement Procedure	ANSI C63.10 Section 6.8 ANSI C63.10 Section 5.13(b)
Additional Description of Measurement	RF Conducted Measurement
Additional Notes	1. Continuous unmodulated transmission used for this test. 2. EUT Battery Ratings – Nominal: 3.7 V; Minimum: 3.3 V¹ 3. Per the manufacturer's specification, the EUT is not operable at - 15% of the nominal supply voltage. Thus, the EUT was tested at the minimum allowable voltage per the manufacturer's specifications.

The sample calculation below illustrates how the delta was calculated.

$$\text{Delta (Hz)} = |\text{Frequency (Hz)} - \text{Measured Frequency (Hz)}|$$

Tables

Antenna 1 Frequency Stability f = 2405 MHz			
Supply Voltage (VDC)	Frequency (Hz) ²	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2404487333	2404486850	483

¹ It should be noted that the unit would not remain on when provided 3.3 V as declared by the manufacturer. Instead, the voltage was reduced to the lowest value possible and is provided in the accompanying tables.

² This is the frequency measured when the EUT is supplied the nominal 3.7 V

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 1 Frequency Stability f = 2410 MHz			
Supply Voltage (VDC)	Frequency (Hz)	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2409486322	2409486084	238

Antenna 1 Frequency Stability f = 2440 MHz			
Supply Voltage (VDC)	Frequency (Hz)	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2439485825	2439485530	295

Antenna 1 Frequency Stability f = 2465 MHz			
Supply Voltage (VDC)	Frequency (Hz)	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2464485446	2464485365	81

Antenna 1 Frequency Stability f = 2470 MHz			
Supply Voltage (VDC)	Frequency (Hz)	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2469485728	24964858832	104

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 1 Frequency Stability f = 2475 MHz			
Supply Voltage (VDC)	Frequency (Hz)	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2474245985	2474485998	240013

Antenna 2 Frequency Stability f = 2405 MHz			
Supply Voltage (VDC)	Frequency (Hz)	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2404487318	2404486426	892

Antenna 2 Frequency Stability f = 2410 MHz			
Supply Voltage (VDC)	Frequency (Hz)	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2409486061	2409485957	104

Antenna 2 Frequency Stability f = 2440 MHz			
Supply Voltage (VDC)	Frequency (Hz)	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2439485757	2439485479	278

Antenna 2 Frequency Stability f = 2465 MHz			
Supply Voltage (VDC)	Frequency (Hz)	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2464485671	2464485355	316

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Antenna 2 Frequency Stability f = 2470 MHz			
Supply Voltage (VDC)	Frequency (Hz)	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2469486088	2469486059	29

Antenna 2 Frequency Stability f = 2475 MHz			
Supply Voltage (VDC)	Frequency (Hz)	Deviation	
		Measured Frequency (Hz)	Delta (Hz)
3.52	2474486056	2474486950	894

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

4.0 – Radiated Emissions

Rule Part(s)	FCC: 15.247 / 15.205 / 15.209 IC: RSS-247 / RSS-Gen			
Measurement Procedure	ANSI C63.10 2013			
Test Location	LS Research, LLC - FCC Listed 3 meter Semi-Anechoic Chamber			
Test Distance	3 meters			
EUT Placement	Transmitter Mode: Below 1 GHz: 80 cm height Above 1 GHz: 150 cm height			
Frequency Range of Measurement	Biconical: 30-200 MHz	Log Periodic Dipole Array: 200-1000 MHz	Double-Ridged Waveguide Horn: 1-18 GHz	Small Horn: 18-25 GHz
Measurement Detectors	30-1000MHz RBW: 120 kHz VBW: ≥ 300 kHz		1 – 25 GHz: RBW : 1MHz VBW: 3 MHz (Transmitter Peak Measurements); 10 Hz (Transmitter Average Measurements)	
Measurement Description	The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer before the measurements are performed. Data is gathered and reported as corrected values. The EUT is placed on a non-conductive pedestal centered on a turn-table in the test location with the antenna at a 3 meter separation distance from the EUT. Maximum radiated RF emissions are determined by rotation of azimuth and scanning the sense antenna between 1 and 4 meters in height using both horizontal and vertical antenna polarities. Maximized levels are manually noted at degree values of azimuth and at sense antenna height. The EUT was measured in 3 orthogonal orientations and while mounted to the charging station			

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Example Calculations	Reported Measurement data = Raw receiver measurement + Antenna Correction Factor + Cable factor (dB) - amplification factor (when applicable) + Additional factor(s) (when applicable)
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FCC Part 15.209 / IC RSS-GEN sect 8.9 limits:

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)	Detector Type
30-88	100	40.0	Quasi-Peak
88-216	150	43.5	Quasi-Peak
216-960	200	46.0	Quasi-Peak
Above 960	500	54.0	Quasi-Peak
Above 1 GHz	-	54.0	Average
Above 1 GHz	-	74.0	Peak

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

4.1 – Transmitter Band-Edge Restricted Band

Manufacturer	Pentair	
Date	11/21/2016	
Operator	John Johnston	
Temp. / R.H.	20 - 25° C / 30-60% R.H.	
Rule Part	FCC 15.247/ 15.205 / 15.209	
Measurement Procedure	ANSI C63.10 - 2013 Section 6.10.5	
Test Distance	3 meters	
EUT Placement	Antenna situated 150 cm above floor in each of three orientations and while mounted to charging station	
Detectors	Peak: RBW = 1 MHz VBW $\geq$ 3 MHz	Average: RBW = 1 MHz VBW : 3 MHz (peak); 10 Hz (average)
Additional Notes	1) Tested in continuous transmit modulated mode with EUT rotated in three orientations. 2) EUT maximized in azimuth and antenna height with maximum results reported. Additionally, the peak fundamental transmission power was determined by orienting the EUT in 3 orthogonal orientation and by mounting the unit in the charging station. 3) Video bandwidth greater than $[1/(\text{minimum transmitter on time})]$. Since duty cycle is 100%, a 10 Hz video bandwidth was used for average measurements.	

Example Calculations:

Radiated Emissions Limits:

Average Limit @ 3 meter (dB μ V/m) – Average Reading (dB μ V/m) = Margin

Peak Limit @ 3 meter (dB μ V/m) – Peak Reading (dB μ V/m) = Margin

Video Bandwidth:

$1/\infty$ s = 0 Hz = 10 Hz default

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Band Edge Data

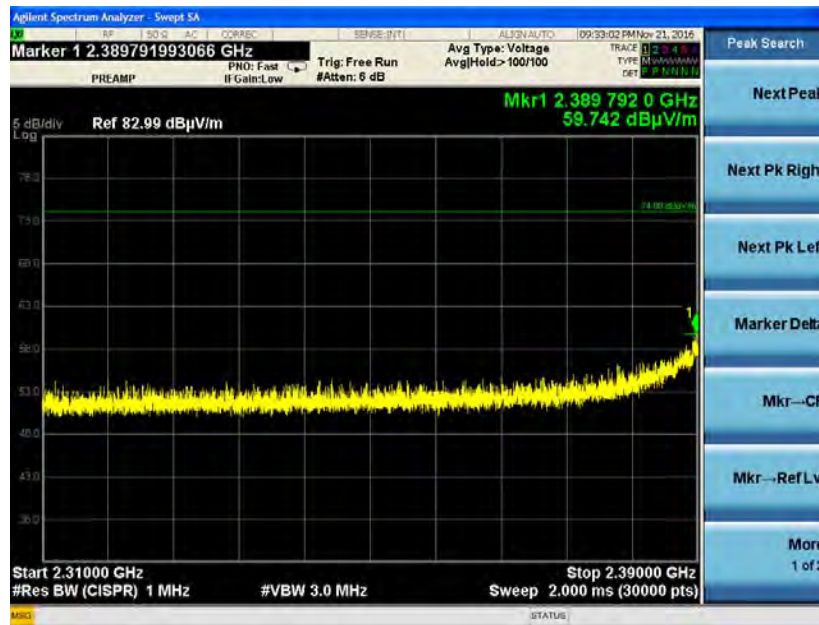
Tx Frequency (MHz)	Antenna	Emission Frequency (MHz)	Peak Meas (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Meas (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)
2405	1	2390	59.742	74.000	14.258	50.340	54.000	3.660
2410	1	2389	61.550	74.000	12.450	51.631	54.000	2.369
2465	2	2484	65.954	74.000	8.046	50.592	54.000	3.408
2470	2	2486	61.108	74.000	12.892	53.183	54.000	0.817
2475	2	2484	60.248	74.000	13.752	50.344	54.000	3.656
2405	2	2390	60.913	74.000	13.087	53.691	54.000	0.309
2410	2	2390	65.068	74.000	8.932	48.597	54.000	5.403
2465	1	2484	62.204	74.000	11.796	52.829	54.000	1.171
2470	1	2486	59.778	74.000	14.222	51.405	54.000	2.595
2475	1	2484	61.323	74.000	12.677	50.839	54.000	3.161

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Plots

Antenna 1

2405 MHz – Lower Band Edge – Peak Measurement



Antenna 1

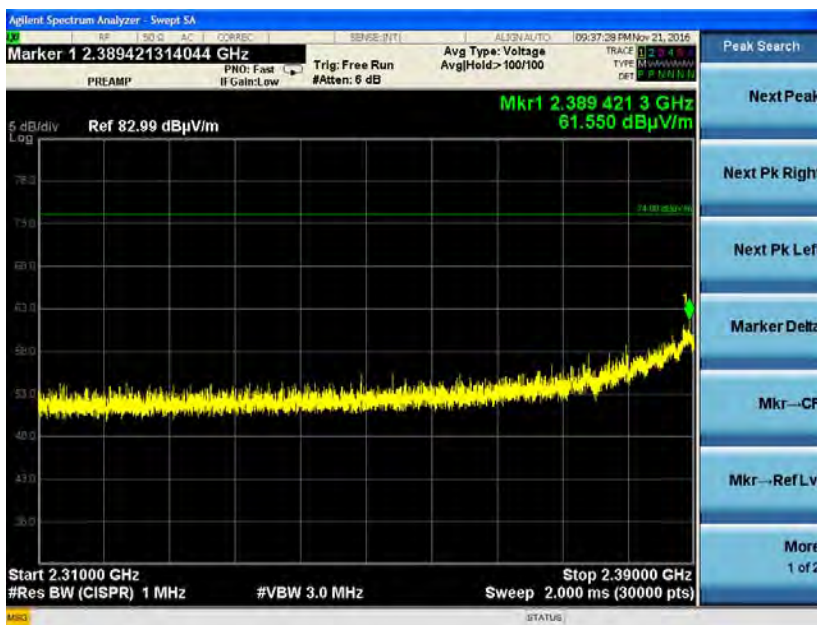
2405 MHz – Lower Band Edge – Average Measurement

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



Antenna 1

2410 MHz – Lower Band Edge – Peak Measurement



Antenna 1

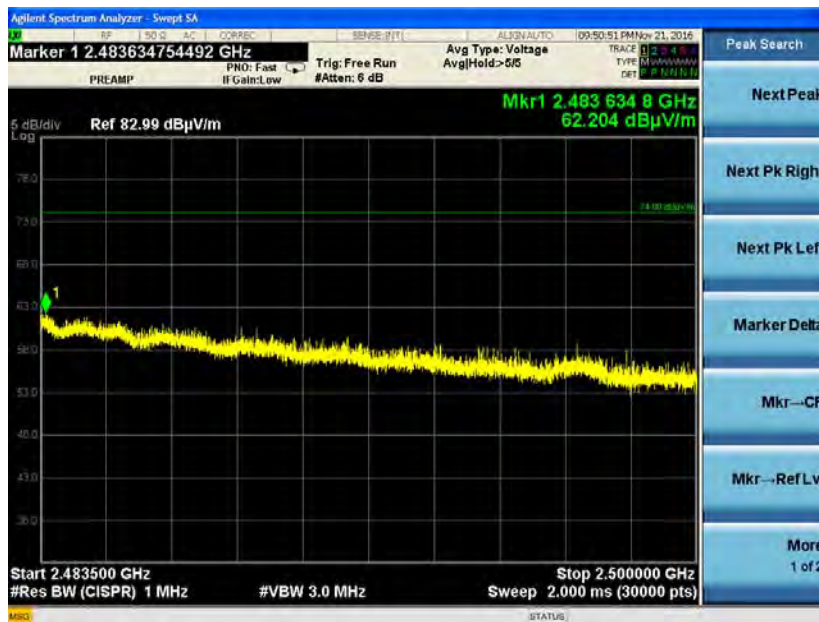
2410 MHz – Lower Band Edge – Average Measurement

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



Antenna 1

2465 MHz – Upper Band Edge – Peak Measurement



Antenna 1

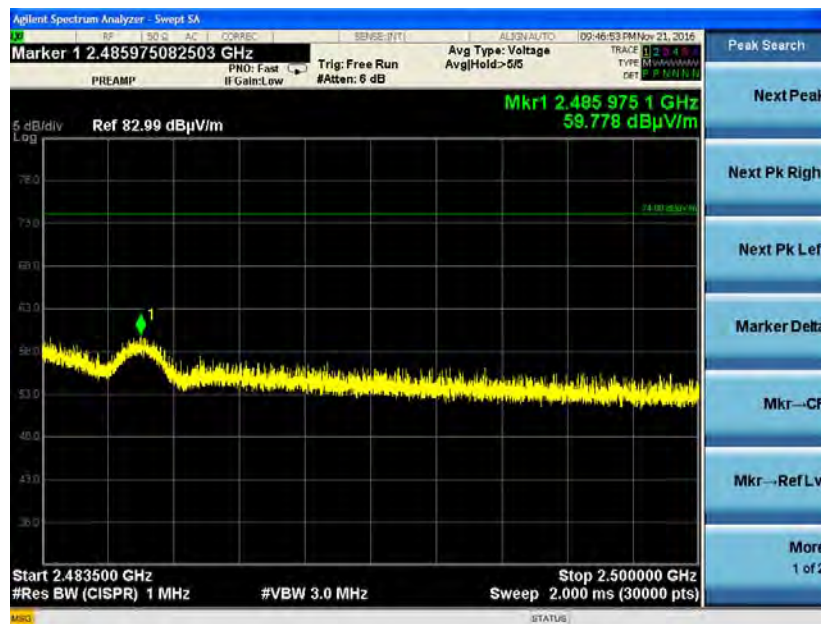
2465 MHz – Upper Band Edge – Average Measurement

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



Antenna 1

2470 MHz – Upper Band Edge – Peak Measurement



Antenna 1

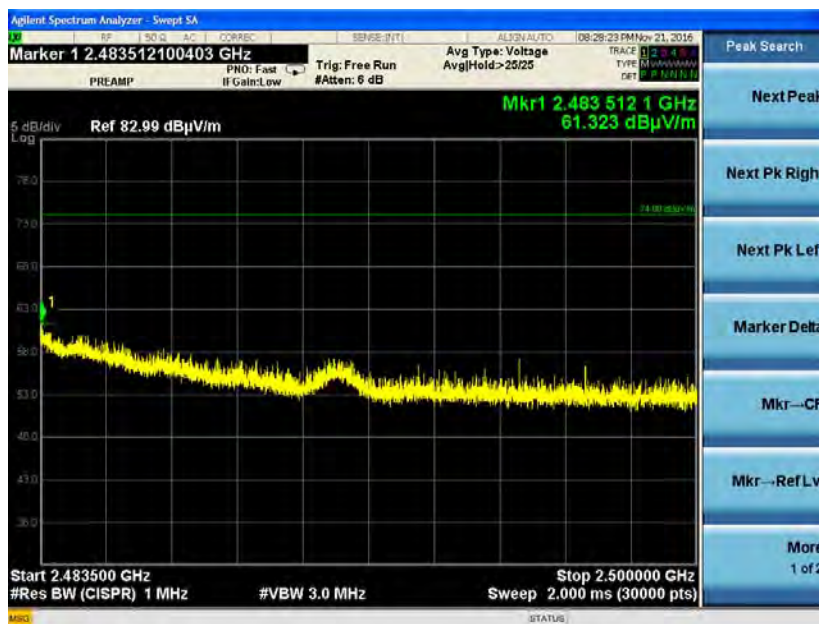
2470 MHz – Upper Band Edge – Average Measurement

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



Antenna 1

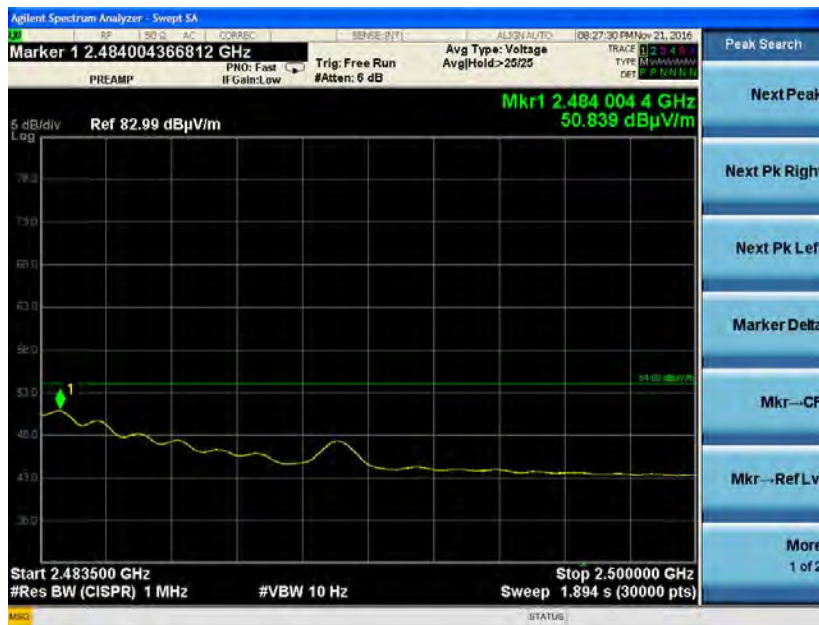
2475 MHz – Upper Band Edge – Peak Measurement



Antenna 1

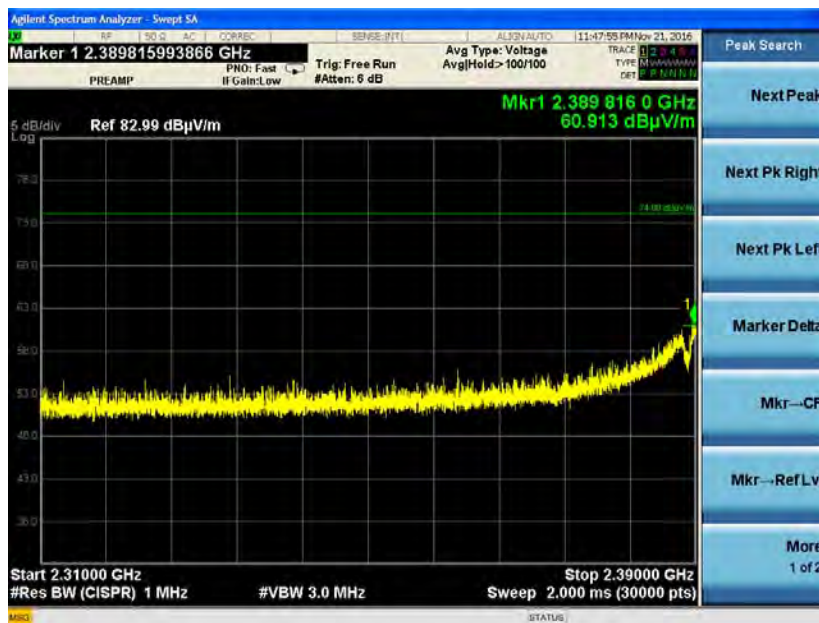
2475 MHz – Upper Band Edge – Average Measurement

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



Antenna 2

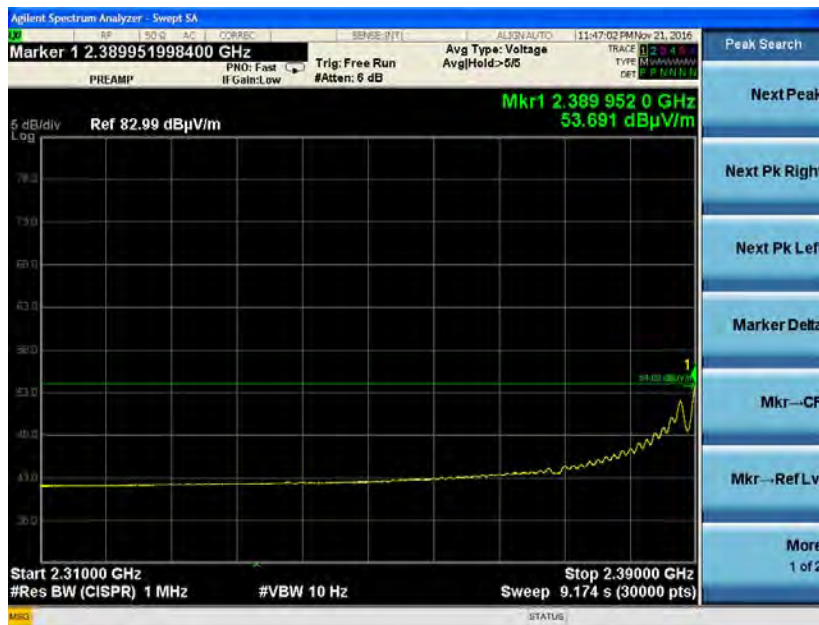
2405 MHz – Lower Band Edge – Peak Measurement



Antenna 2

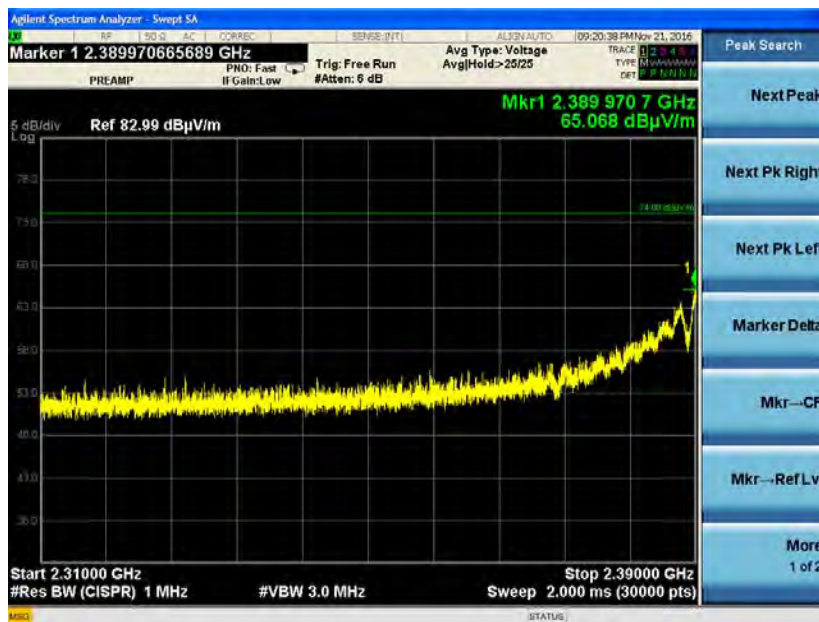
2405 MHz – Lower Band Edge – Average Measurement

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



Antenna 2

2410 MHz – Lower Band Edge – Peak Measurement



Antenna 2

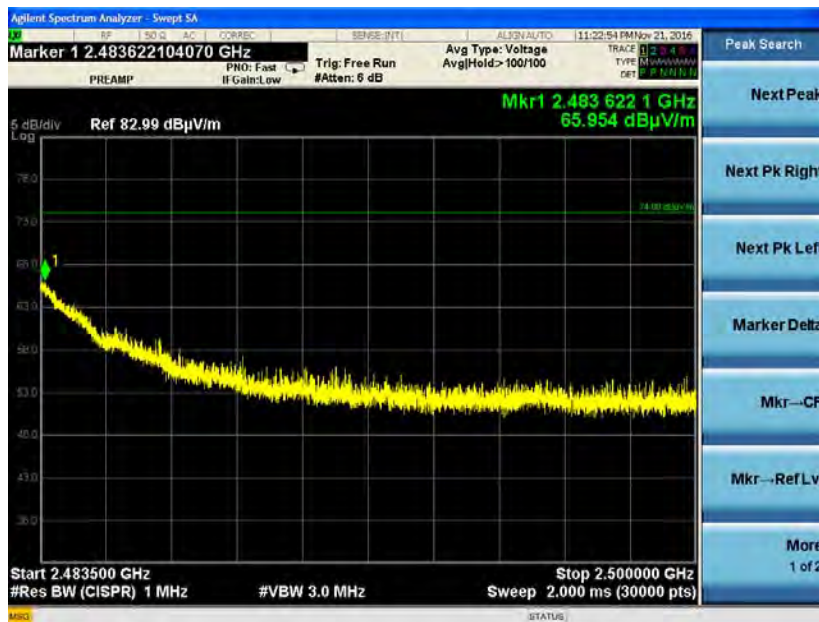
2410 MHz – Lower Band Edge – Average Measurement

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



Antenna 2

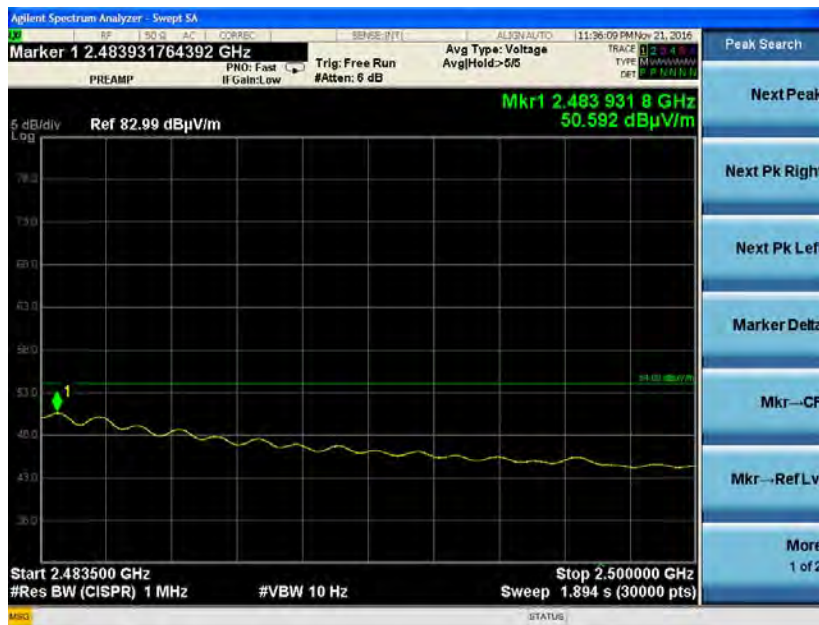
2465 MHz – Upper Band Edge – Peak Measurement



Antenna 2

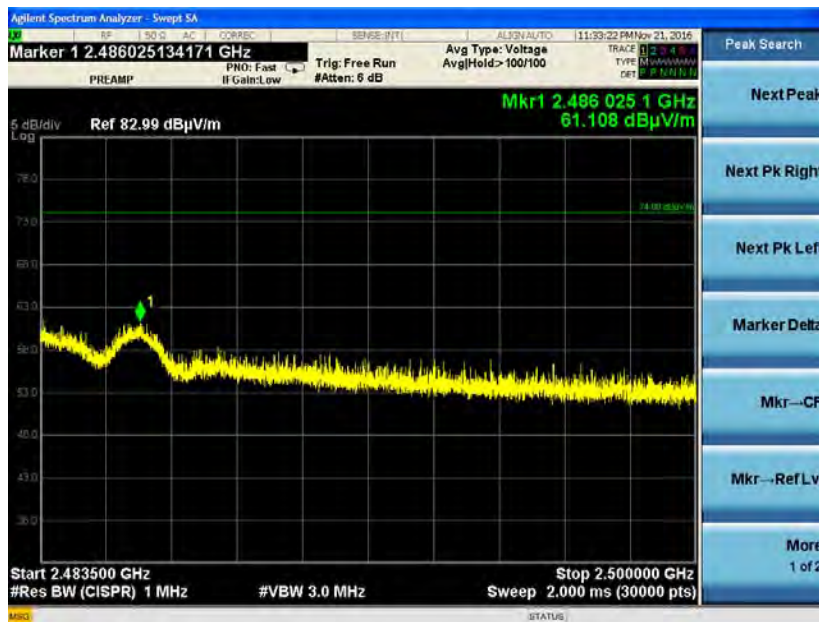
2465 MHz – Upper Band Edge – Average Measurement

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



Antenna 2

2470 MHz – Upper Band Edge – Peak Measurement



Antenna 2

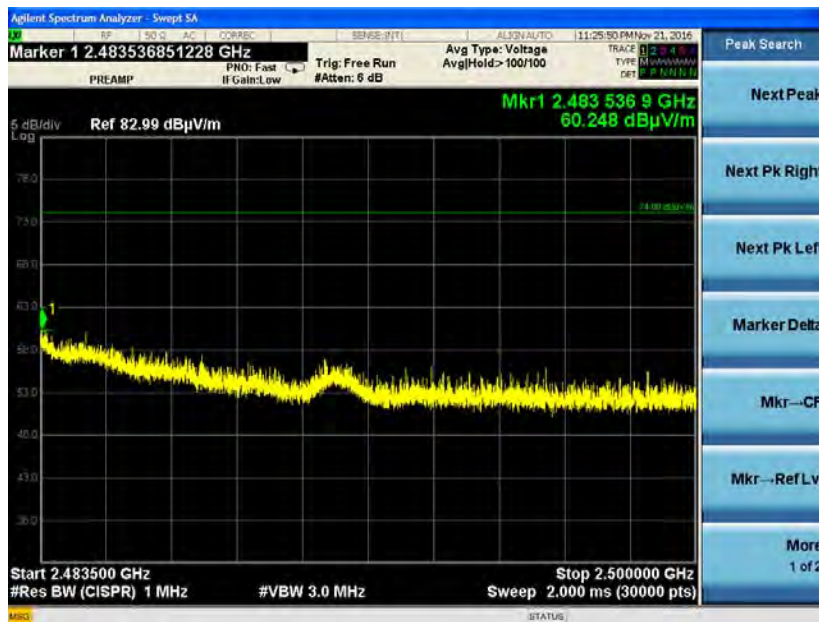
2470 MHz – Upper Band Edge – Average Measurement

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



Antenna 2

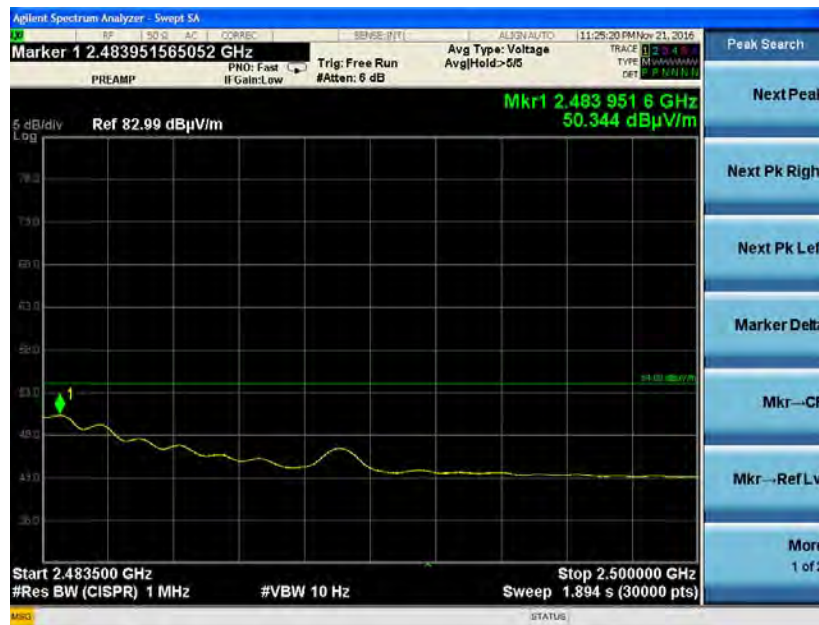
2475 MHz – Upper Band Edge – Peak Measurement



Antenna 2

2475 MHz – Upper Band Edge – Average Measurement

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD



4.2 – Transmitter Radiated Spurious Emissions in Restricted Bands

Manufacturer	Pentair		
Date	11/22/2016, 11/23/2016, 11/30/2016-12/2/2016, 12/15/2016, 12/19/2016, 12/21/2016, 1/6/2017, 1/7/2017, 1/10/2017, 1/19/2017		
Operator	John Johnston, Kim Bay, and Coty Hammerer		
Temp. / R.H.	20 - 25° C / 30-60% R.H.		
Rule Part	15.247/ 15.205 / 15.209		
Measurement Procedure	ANSI C63.10 - 2013 Sections 6.3, 6.5, and 6.6		
Test Distance	3 meters		
EUT Placement	Above 1 GHz: EUT placed 150 cm above ground plane Below 1 GHz: EUT placed 80 cm above ground plan		
Detectors Above 1 GHz	Quasi-Peak: RBW: 120 kHz VBW: ≥ 300 kHz	Peak: RBW = 1 MHz VBW ≥ 3 MHz	Average: RBW = 1 MHz VBW = 10 Hz
Additional Notes	1) Tested in continuous transmit modulated mode on three channels in three orientations and with unit mounted to charging station 2) EUT maximized in azimuth and antenna height with maximum results reported. 3) Video bandwidth greater than $[1/(\text{minimum transmitter on time})]$. Since duty cycle is 100%, a 10 Hz video bandwidth was used for average measurements.		

Example Calculation:

Quasi-Peak Limit @ 3 meter (dBμV/m) – Peak Reading (dBμV/m) = Margin

Average Limit @ 3 meter (dBμV/m) – Average Reading (dBμV/m) = Margin

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Peak Limit @ 3 meter (dB μ V/m) – Peak Reading (dB μ V/m) = Margin

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Tables

Below 1 GHz – Antenna 1

Emission Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi-Peak Radiated (dBuV/m)	Quasi-Peak Limit (dBuV/m)	Margin (dB)	Antenna Polarity	Orientation	Notes
196.0	1.00	0	25.440	43.500	18.070	H	F	Noise Floor
182.0	1.00	0	24.320	43.500	19.180	V	H	Noise Floor
326.2	2.21	160	27.700	46.000	18.300	V	H	None
326.4	1.00	155	29.090	46.000	16.910	H	V	None
242.2	1.00	200	27.720	46.000	18.280	H	Docked	None
242.2	1.00	130	26.420	46.000	19.580	V	Docked	None

Note: *H – Horizontal orientation; V - Vertical orientation; F – Flat orientation; Docked – EUT mounted to charging station*

Below 1 GHz – Antenna 2

Emission Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi-Peak Radiated (dBuV/m)	Quasi-Peak Limit (dBuV/m)	Margin (dB)	Antenna Polarity	Orientation	Notes
175.0	1.00	0	24.730	43.500	18.770	V	F	Noise Floor
194.0	1.00	0	25.010	43.500	18.490	H	H	Noise Floor
326.8	1.00	0	28.520	46.000	17.480	H	F	None
326	1.45	206	28.400	46.000	17.600	H	F	None
242.2	1.00	104	24.170	46.000	21.830	H	H	None
326.7	1.00	164	29.800	46.000	16.200	H	V	None

Note: *H – Horizontal orientation; V - Vertical orientation; F – Flat orientation; Docked – EUT mounted to charging station*

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

1-4 GHz – Antenna 1 and Antenna 2³

Emission Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Radiated (dBuV/m)	Avg Radiated (dBuV/m)	Avg Radiated Limit (dBuV/m)	Avg Margin (dB)	Antenna Polarity	Orientation
1200	1.12	232	48.199	46.713	54.000	7.290	H	Docked
2000	2.21	232	38.265	29.915	54.000	24.090	H	Docked
2000	1.26	219	43.429	35.071	54.000	18.930	V	Docked
1200	2.45	192	36.108	23.648	54.000	30.350	V	Docked
1200	1.15	182	43.426	32.300	54.000	21.700	H	H
1200	1.00	200	44.677	33.833	54.000	20.170	V	V

Note: *H – Horizontal orientation; V - Vertical orientation; F – Flat orientation; Docked – EUT mounted to charging station*

³ Radiated emissions in this range still appeared in the traces when the transmitter functionality was turned off

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Above 4 GHz – Antenna 1

Tx Freq (MHz)	Emission Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Radiated (dBuV/m)	Avg Radiated (dBuV/m)	Avg Radiated Limit (dBuV/m)	Avg Margin (dB)	Antenna Polarity	Orientation
2410	19280	3.82	329	53.581	45.851	54.000	8.149	H	V
2410	19280	2.63	146	56.745	49.790	54.000	4.210	V	V
2410	19280	1.00	209	54.644	46.884	54.000	7.116	H	H
2410	19280	1.00	0	51.686	43.227	54.000	10.773	V	H
2410	19280	1.00	222	50.019	41.404	54.000	12.596	H	F
2410	19280	1.00	0	53.520	45.927	54.000	8.073	V	F
2440	19520	1.72	81	53.568	44.142	54.000	9.858	H	V
2440	7320	3.74	156	52.580	44.460	54.000	9.540	V	V
2440	19520	1.15	130	52.345	42.324	54.000	11.676	V	V
2440	19520	1.00	210	54.216	45.098	54.000	8.902	H	H
2440	19520	1.00	144	51.367	41.496	54.000	12.504	V	H
2440	19520	1.00	222	51.843	40.131	54.000	13.869	H	F
2440	4880	1.75	160	50.090	41.580	54.000	12.420	V	F
2440	7320	1.00	131	55.270	47.460	54.000	6.540	V	F
2440	19520	1.00	0	54.092	44.485	54.000	9.515	V	F
2465	19720	3.76	43	51.521	41.976	54.000	12.024	H	V
2465	19720	2.97	222	50.575	41.802	54.000	12.198	V	V
2465	19720	1.00	208	51.734	43.091	54.000	10.909	H	H
2465	19720	1.37	1.35	50.250	40.193	54.000	13.807	V	H
2465	19720	1.00	350	51.812	42.528	54.000	11.472	V	F

Note: H – Horizontal orientation; V - Vertical orientation; F – Flat orientation; Docked – EUT mounted to charging station

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Above 4 GHz – Antenna 2

Tx Freq (MHz)	Emission Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Radiated (dBuV/m)	Avg Radiated (dBuV/m)	Avg Radiated Limit (dBuV/m)	Avg Margin (dB)	Antenna Polarity	Orientation
2410	4820	2.24	128	50.210	42.190	54	11.810	H	V
2410	12050	1.00	0	46.250	37.080	54	16.920	H	V
2410	19280	1.11	157	50.626	42.556	54	11.444	H	V
2410	4820	1.2	120	47.970	38.670	54	15.330	V	V
2410	12050	1.00	13.25	51.670	40.340	54	13.660	V	V
2410	19280	2.62	146	54.879	47.665	54	6.335	V	V
2410	4820	1.44	103	50.700	43.100	54	10.900	H	H
2410	19280	1.00	209	53.256	46.528	54	7.472	H	H
2410	4820	2.77	310	50.070	41.540	54	12.460	V	H
2410	12050	1.05	129	47.760	36.230	54	17.770	V	H
2410	19280	1.00	135	52.096	44.589	54	9.411	V	H
2410	4820	1.00	253	49.620	40.500	54	13.500	H	F
2410	19280	1.00	222	48.529	40.386	54	13.614	H	F
2410	4820	1.00	156	48.070	44.220	54	9.780	V	F
2410	19280	1.00	0	52.536	44.798	54	9.202	V	F
2440	4880	2.59	120	48.250	39.750	54	14.250	H	V
2440	7320	1.8	262	60.300	53.060	54	0.940	H	V
2440	12200	1.00	87	48.790	37.980	54	16.020	H	V
2440	19520	1.17	127	55.495	46.147	54	7.853	H	V
2440	7320	1.19	267	55.370	47.870	54	6.130	V	V
2440	12200	1.00	0	48.390	36.010	54	17.990	V	V
2440	19520	2.53	144	58.301	50.312	54	3.688	V	V
2440	7320	2.93	217	60.830	53.610	54	0.390	H	H
2440	19520	1.00	209	57.242	49.230	54	4.770	H	H
2440	7320	2.31	207	60.410	53.020	54	0.980	V	H
2440	4880	1.00	296	48.270	39.270	54	14.730	H	F
2440	7320	1.00	245	54.960	46.310	54	7.690	H	F
2440	19520	1.00	222	52.766	42.885	54	11.115	H	F
2440	4880	1.00	260	50.300	41.570	54	12.430	V	F
2440	7320	1.00	130	56.693	49.531	54	4.469	V	F
2440	12200	1.00	44	43.840	38.920	54	15.080	V	F
2440	19520	1.00	348	57.138	49.052	54	4.948	V	F
2465	7395	1.43	79	58.980	51.710	54	2.290	H	V

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

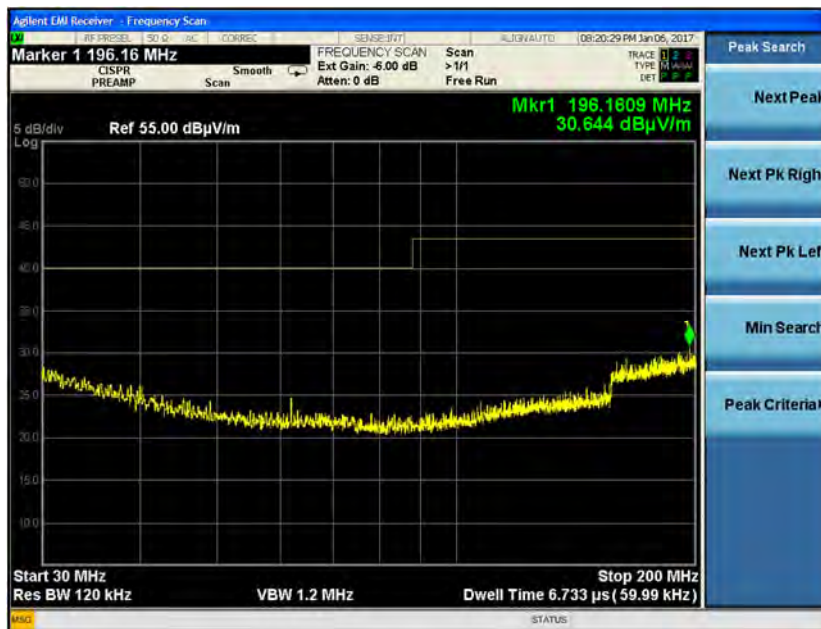
Tx Freq (MHz)	Emission Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Radiated (dBuV/m)	Avg Radiated (dBuV/m)	Avg Radiated Limit (dBuV/m)	Avg Margin (dB)	Antenna Polarity	Orientation
2465	19720	3.78	44	51.938	42.815	54	11.185	H	V
2465	7395	2.00	176	57.810	50.410	54	3.590	V	V
2465	19720	2.99	221	51.963	43.567	54	10.433	V	V
2465	7395	1.67	260	60.130	52.880	54	1.120	H	H
2465	19720	1.00	209	51.841	43.623	54	10.377	H	H
2465	7395	1.00	303	58.000	50.470	54	3.530	V	H
2465	19720	1.00	142	49.848	40.757	54	13.243	V	H
2465	4930	1.00	294	48.410	39.340	54	14.660	H	F
2465	7395	1.00	244	51.500	42.550	54	11.450	H	F
2465	4930	1.00	30	49.830	41.470	54	12.530	V	F
2465	7395	1.00	126	53.650	45.080	54	8.920	V	F
2465	19720	1.00	341	53.186	44.271	54	9.729	V	F

Note: H – Horizontal orientation; V - Vertical orientation; F – Flat orientation; Docked – EUT mounted to charging station

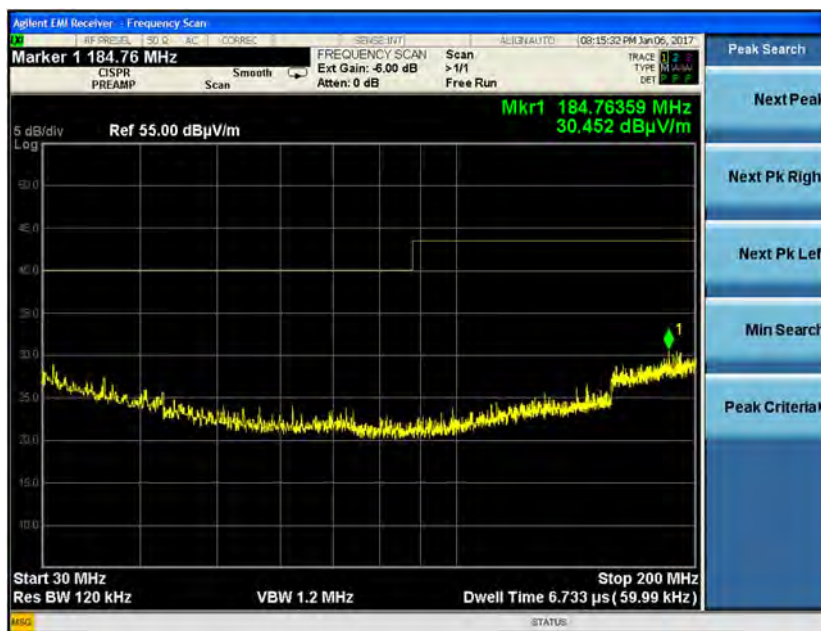
Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Plots

30 MHz – 200 MHz⁴, Horizontal Polarity



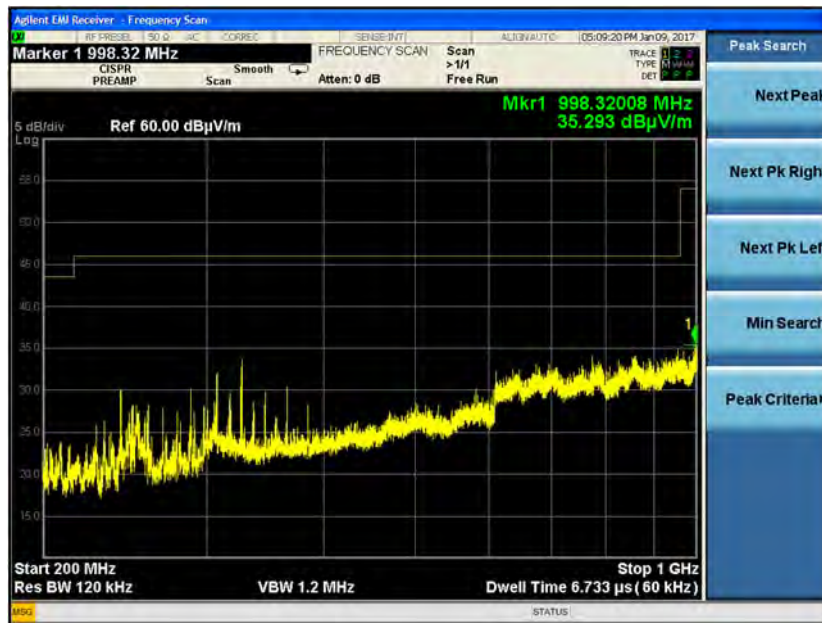
30 MHz – 200 MHz, Vertical Polarity



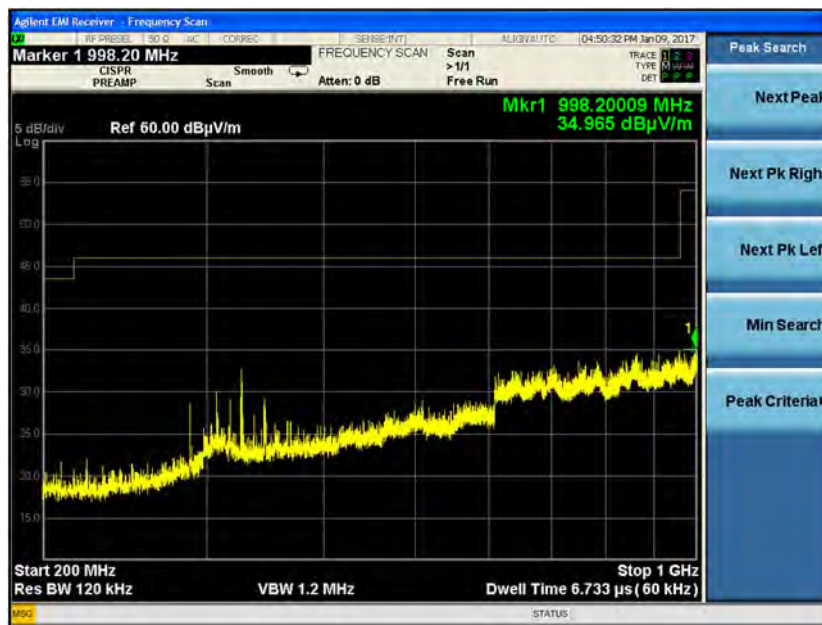
⁴ The traces in this frequency range are representative of emissions when transmitting via antenna 1 and antenna 2 across all channels

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

200 MHz to 1000 MHz⁵, Horizontal Polarity



200 MHz to 1000 MHz, Vertical Polarity



⁵ The traces in this frequency range are representative of emissions when transmitting via antenna 1 and antenna 2 across all channels

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

1-2.31 GHz, Horizontal Polarity⁶



1-2.31 GHz, Vertical Polarity



⁶ The traces in this frequency range are representative of emissions when transmitting via antenna 1 and antenna 2 across all channels

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

2.5-4 GHz, Horizontal Polarity, 2465 MHz



2.5-4 GHz, Vertical Polarity, 2465 MHz



Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

4-18 GHz⁷, Vertical Polarity, 2410 MHz, Antenna 1, Reduced VBW



4-18 GHz, Horizontal Polarity, 2410 MHz, Antenna 1, Reduced VBW



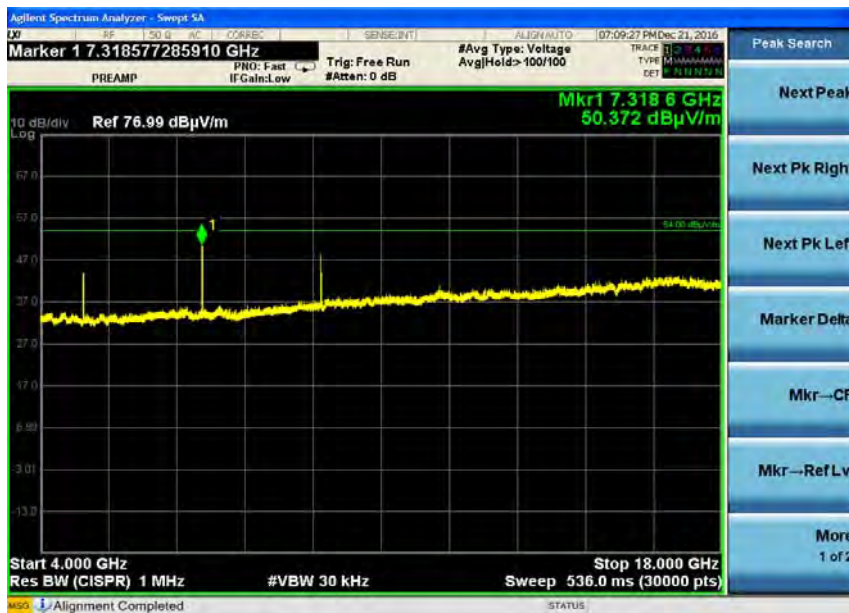
⁷ The traces in this frequency range are representative of the worst case for each antenna, channel and orientation combination

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

4-18 GHz, Vertical Polarity, 2440 MHz, Antenna 1, Reduced VBW



4-18 GHz, Horizontal Polarity, 2440 MHz, Antenna 1, Reduced VBW



Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

4-18 GHz, Vertical Polarity, 2465 MHz, Antenna 1, Reduced VBW

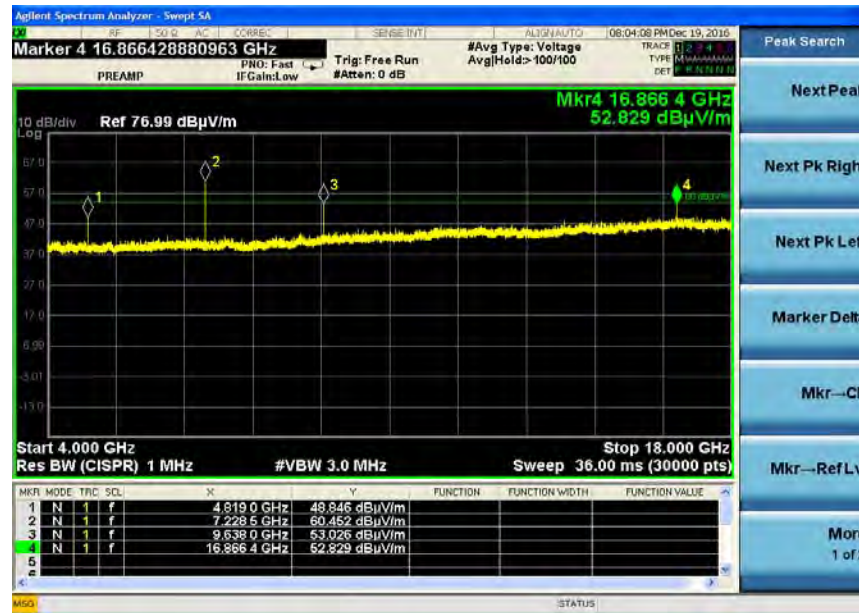


4-18 GHz, Horizontal Polarity, 2465 MHz, Antenna 1, Reduced VBW



Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

4-18 GHz, Horizontal Polarity, 2410 MHz, Antenna 2, Reduced VBW

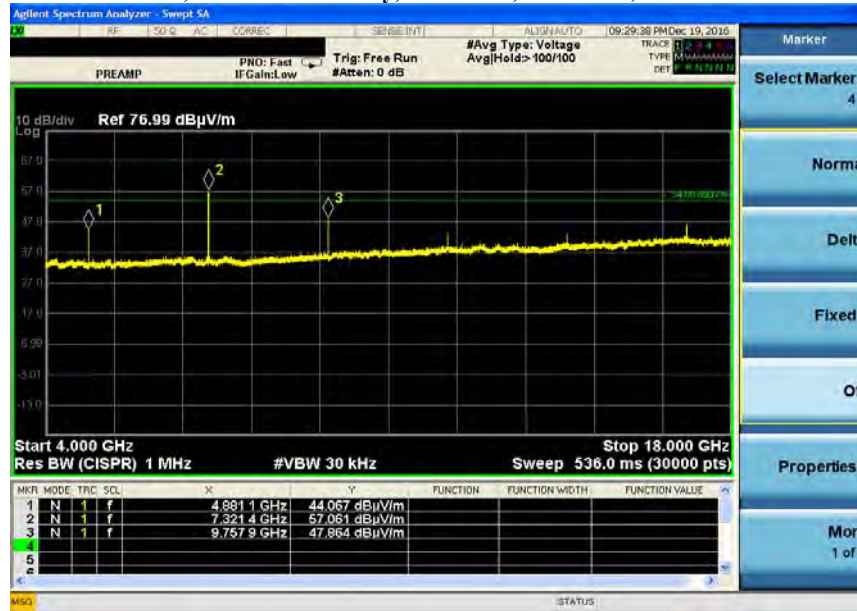


4-18 GHz, Vertical Polarity, 2410 MHz, Antenna 2, Reduced VBW



Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

4-18 GHz, Horizontal Polarity, 2440 MHz, Antenna 2, Reduced VBW



4-18 GHz, Vertical Polarity, 2440 MHz, Antenna 2, Reduced VBW



Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

4-18 GHz, Horizontal Polarity, 2465 MHz, Antenna 2, Reduced VBW

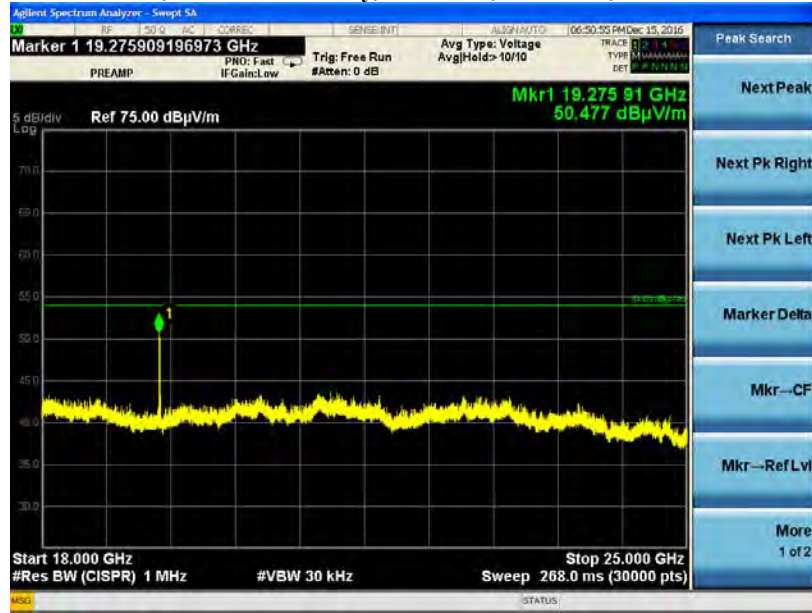


4-18 GHz, Vertical Polarity, 2465 MHz, Antenna 2, Reduced VBW

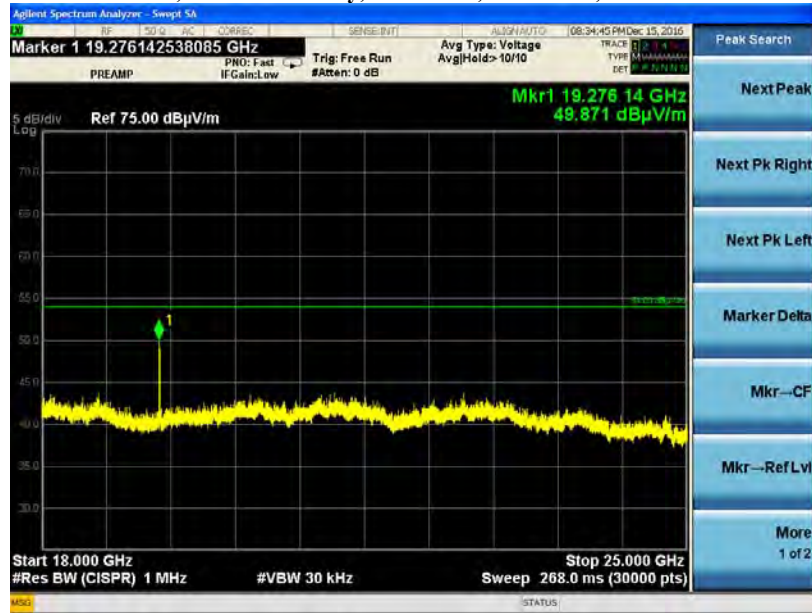


Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

18-25 GHz, Horizontal Polarity, 2410 MHz, Antenna 1, Reduced VBW

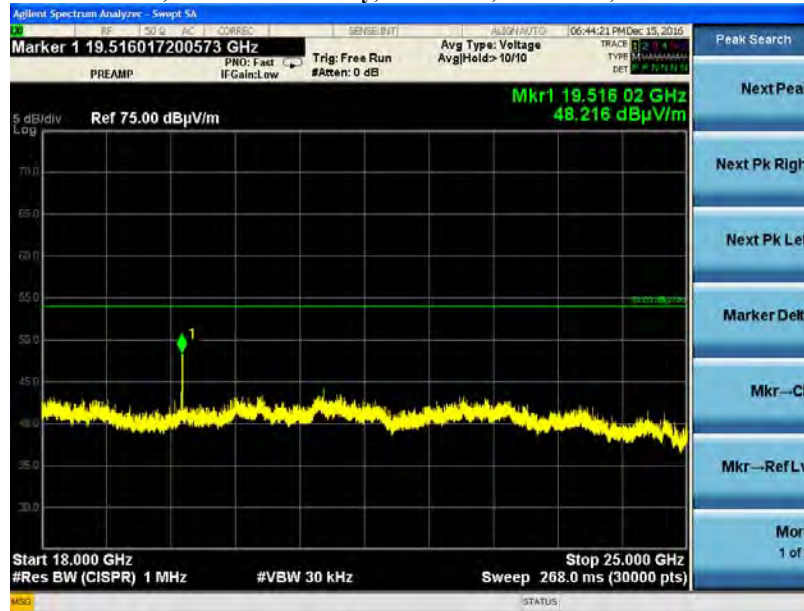


18-25 GHz, Vertical Polarity, 2410 MHz, Antenna 1, Reduced VBW

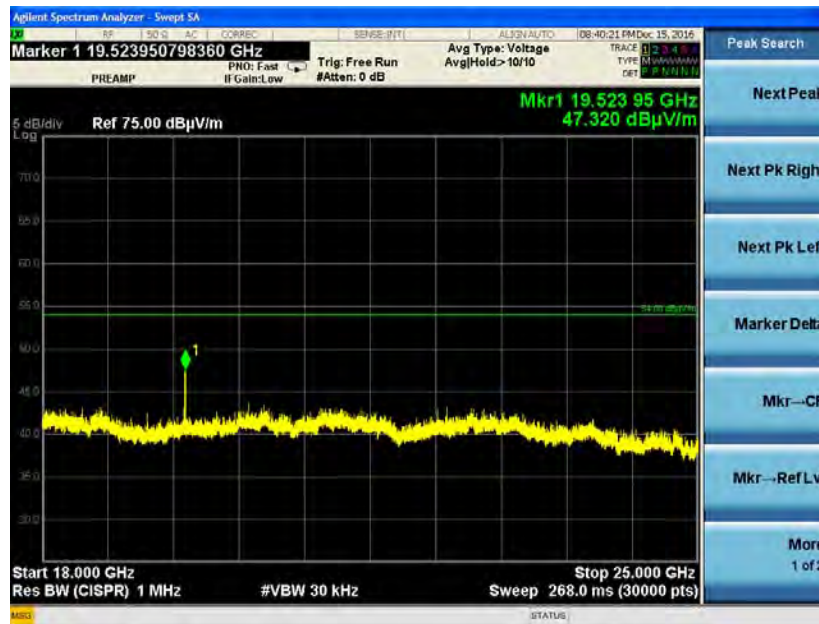


Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

18-25 GHz, Horizontal Polarity, 2440 MHz, Antenna 1, Reduced VBW

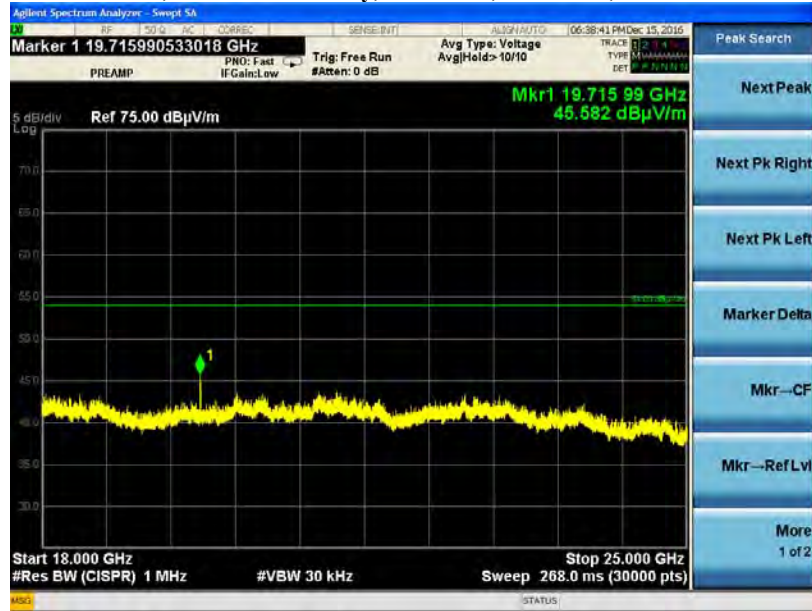


18-25 GHz, Vertical Polarity, 2440 MHz, Antenna 1, Reduced VBW



Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

18-25 GHz, Horizontal Polarity, 2465 MHz, Antenna 1, Reduced VBW

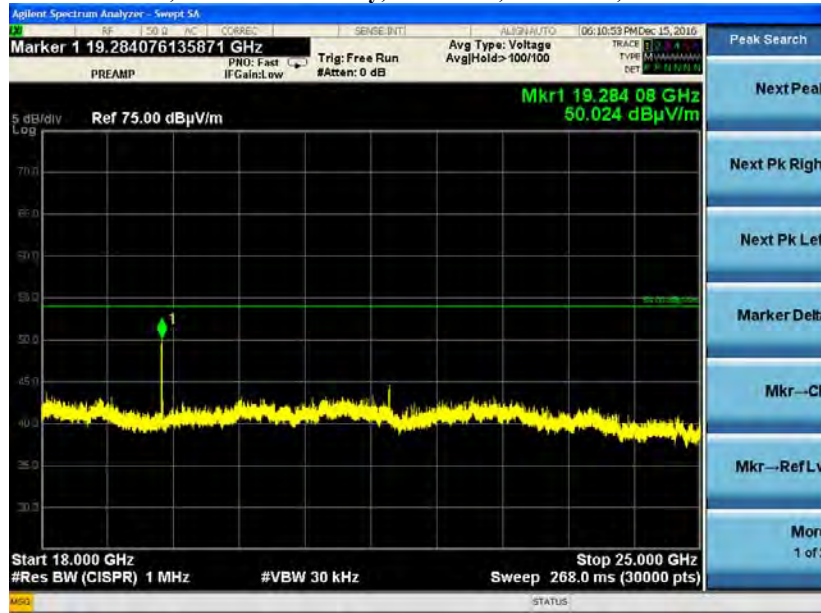


18-25 GHz, Vertical Polarity, 2465 MHz, Antenna 1, Reduced VBW

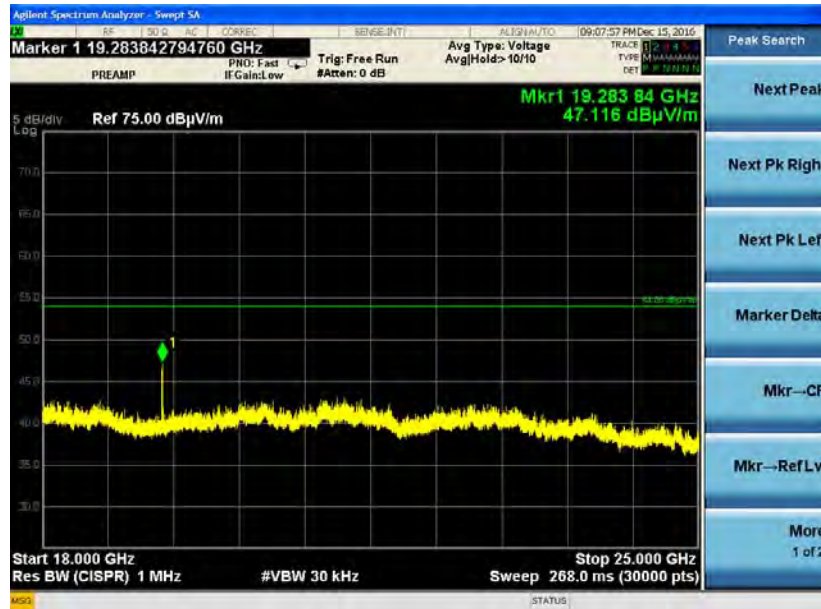


Prepared For: Pentair	EUT: WCP
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18-25 GHz, Horizontal Polarity, 2410 MHz, Antenna 2, Reduced VBW

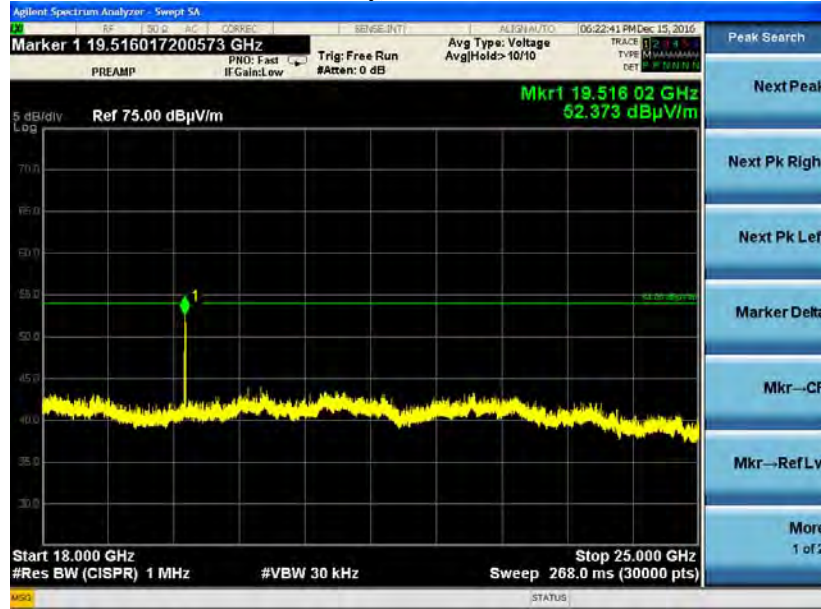


18-25 GHz, Vertical Polarity, 2410 MHz, Antenna 2, Reduced VBW

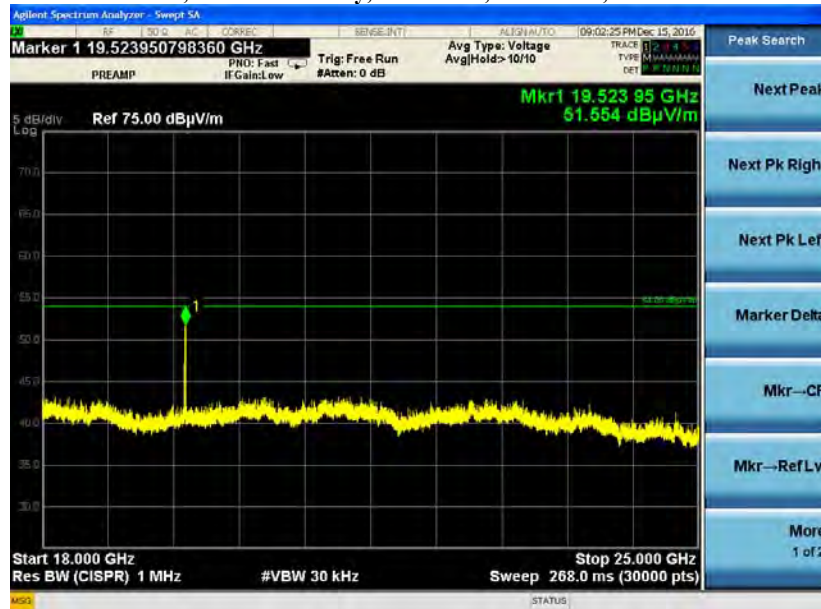


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18-25 GHz, Horizontal Polarity, 2440 MHz, Antenna 2, Reduced VBW

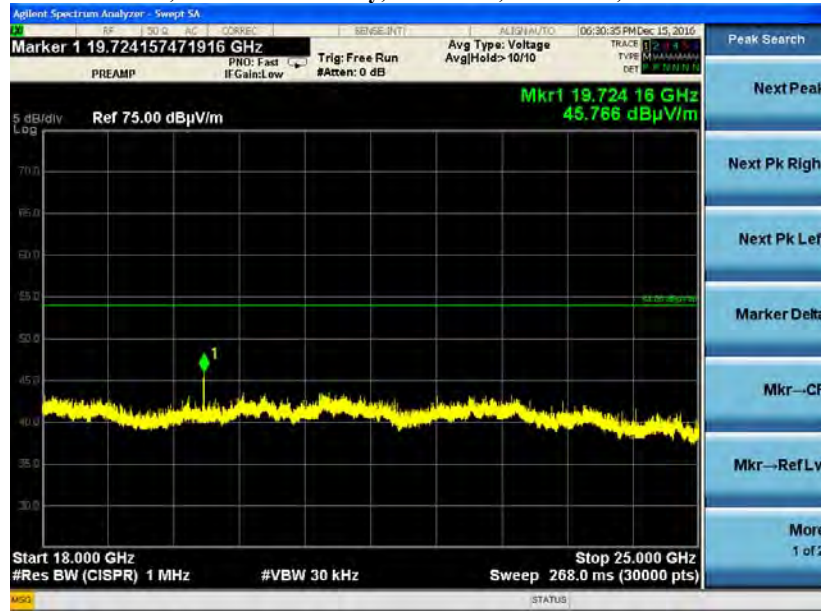


18-25 GHz, Vertical Polarity, 2440 MHz, Antenna 2, Reduced VBW

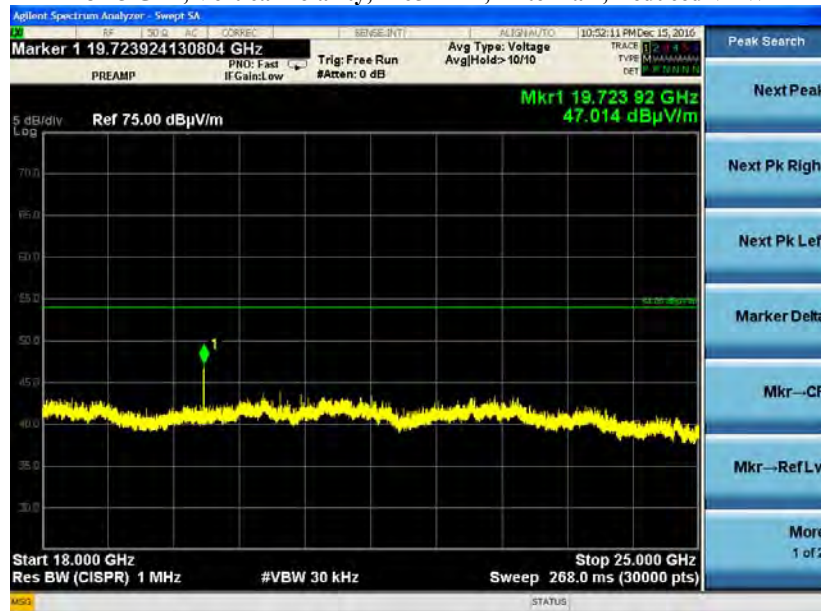


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18-25 GHz, Horizontal Polarity, 2465 MHz, Antenna 2, Reduced VBW



18-25 GHz, Vertical Polarity, 2465 MHz, Antenna 2, Reduced VBW



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5.0 – Conducted Emissions

Manufacturer	Pentair
Date	1/17/2017
Operator	John Johnston
Temp./R.H.	20 - 25° C / 30-60% R.H.
Rule Part(s)	FCC: 15.207 IC: RSS Gen sect. 8.8
Measurement Procedure	ANSI C63.10 2013
Test Location	Bench Testing
EUT Placement	80 cm height 40 cm from vertical ground plane
Frequency Range of Measurement	150 kHz to 30 MHz
Measurement Detectors	Quasi-Peak and Average Detectors
Measurement Description	The necessary measurement system correction factors are loaded onto the EMI receiver before the measurements are performed. Data is gathered and reported as corrected values. The EUT is placed on a non-conductive pedestal. Maximum conducted RF emissions are determined on Line 1 and Line 2. The EUT was mounted to the charging station. The charging station was in turn powered via the AC/DC adapter. The AC/DC adapter was plugged into the LISN.
Example Calculations	Reported Measurement data = Raw receiver measurement + Cable factor (dB) - amplification factor (when applicable) + Additional factor (when applicable)

Prepared For: Pentair	EUT: WCP
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Conducted Emission Limits

The 47 CFR Part 15 Section 207 and RSS-GEN section 8.8 AC line conducted emission limits are provided in the table below:

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

5.1 – Conducted Emissions Test Set-Up

Manufacturer	Pentair
Date	1/17/2017
Operator	John Johnston
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC 15.207 and RSS-GEN Section 8.8
Measurement Procedure	ANSI C63.10 (2013) Section 6.2
Additional Notes	1) Tested in continuous transmit modulated mode 2) The battery within the EUT was charging while the EUT was mounted to the charging station/dock.

Test Data

Line	Frequency (MHz)	Quasi-Peak Measurement (dBμV)	Quasi-Peak Limit (dBμV/m)	Margin (dB)	Average Measurement (dBμV)	Average Limit (dBμV)	Margin (dB)
1	0.160	53.4	65.5	12.1	40.1	55.5	15.4
1	0.431	48.8	57.2	8.4	38.3	47.2	8.9
1	0.422	48.6	57.4	8.8	38.4	47.4	9.0
1	0.440	47.9	57.1	9.2	36.8	47.1	10.3
2	0.165	53.4	65.2	11.8	35.3	55.2	19.9
2	0.442	44.0	57.0	13.0	33.0	47.0	14.0

Prepared For: Pentair	EUT: WCP
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Screen Captures⁸ *Transmit Mode*

Line 1



Line 2



⁸ Note: The screen captures provided depict the worst-case traces on each line across all transmission channels

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
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Appendix A – Test Equipment



Date: 17-Jan-2017 Type Test: Conducted AC Emissions Job #: C-2580
 Prepared By: Kim Bay Customer: Pentair Quote #: 316130

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	2/24/2016	2/23/2017	Active Calibration
2	EE 960162	LISN - 15A	COM-POWER	LI-215A	191963	8/15/2016	8/15/2017	Active Calibration

Project Engineer:

Quality Assurance:



Date: 17-Jan-2017 Type Test: Conducted Measurements Job #: C-2580
 Prepared By: Cory Hammerer Customer: Pentair Quote #: 316130

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	6/26/2015	6/25/2017	Active Calibration
2	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	2/24/2016	2/23/2017	Active Calibration

Project Engineer:

Quality Assurance:



Date: 22-Nov-2016 Type Test: Tx Radiated Emissions Job #: C-2580
 Prepared By: John Johnston Customer: Pentair Quote #: 316130

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	5/12/2016	5/12/2017	Active Calibration
2	AA 960158	Double Ridge Horn Antenna	ETS Lindgren	3117	109300	10/13/2016	10/13/2017	Active Calibration
3	EE 960159	0.8 - 21GHz LNA	Mini-Circuits	ZVA-213X-S+	40201429	10/13/2016	10/13/2017	Active Calibration
4	AA 960154	2.4GHz High Pass Filter	KWM	HPF-L-14186	7272-02	7/25/2016	7/25/2017	Active Calibration
5	AA 960171	Cable - low loss 6m	A.H. Systems, Inc.	SAC-26G-6	386	3/31/2016	3/31/2017	Active Verification
6	AA 960174	Small Horn Antenna 18-40 GHz	ETS-Lindgren	3116C-PA	00206880	4/23/2016	4/23/2017	Active Calibration
7	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	2/24/2016	2/23/2017	Active Calibration
8	AA 960005	Biconical Antenna	EMCO	93110B	9601-2280	7/14/2016	7/13/2017	Active Calibration
9	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	3/31/2016	3/31/2017	Active Calibration

Project Engineer:

Quality Assurance:

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Appendix B - Uncertainty Summary

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of $k = 2$.

<i>Measurement Type</i>	<i>Configuration</i>	<i>Uncertainty Values</i>
<i>Radiated Emissions</i>	<i>Biconical Antenna</i>	<i>5.0 dB</i>
<i>Radiated Emissions</i>	<i>Log Periodic Antenna</i>	<i>5.3 dB</i>
<i>Radiated Emissions</i>	<i>Horn Antenna</i>	<i>4.7 dB</i>
<i>AC Line Conducted Emissions</i>	<i>AMN</i>	<i>3.4 dB</i>
<i>Telecom Conducted Emissions</i>	<i>AAN</i>	<i>4.9 dB</i>
<i>Disturbance Power (Emissions)</i>	<i>Absorbing Clamp</i>	<i>4.1 dB</i>
<i>Radiated Immunity</i>	<i>3 Volts/Meter</i>	<i>2.2 dB</i>
<i>Conducted Immunity</i>	<i>CDN/EM/BCI</i>	<i>2.4/3.5/3.4 dB</i>
<i>EFT Burst / Surge</i>	<i>Peak pulse voltage</i>	<i>164 volts</i>
<i>ESD Immunity</i>	<i>15 kV level</i>	<i>1377 Volts</i>

Parameter	ETSI U.C.,+/-	U.C.,+/-
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (PM)	1.5 dB	1.2 dB
RF conducted emissions (SA)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

Prepared For: Pentair	EUT: WCP
Report: TR 316130	Serial Numbers: 1 and 2
LSR: C-2580	Model: ICHNDHLD

Appendix C - References

Publication	Year	Title
FCC CFR Parts 0-15	2016	Code of Federal Regulations – Telecommunications
ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
RSS-247 Issue 1	2015	Digital Transmission System (DTSS), Frequency Hopping System (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices
RSS-Gen Issue 4	2014	General Requirements and Information for the Certification of Radio Apparatus

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