FCC PART 15, SUBPART C

TEST AND MEASUREMENT REPORT

For

Cisco Systems, Inc.

125 West Tasman Drive,

San Jose, CA 95134, USA

FCC ID: LDK-IR529UWP

Report Type:	**Product Type:**
CIIPC	915 MHz WPAN Range Extender

Prepared By:	Frank Wang RF Engineer
Report Number:	R1609051-529UWP
Report Date:	2016-11-28
Reviewed By:	Todd Moy RF Engineer

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162
Fax: (408) 732-9164

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1609051-529UWP	Original Report	2016-11-28

1 General Description

1.1 General Statements

Bay area Compliance Laboratory Corp. [BACL] hereby makes the following Statements:

- The Unit(s) described in this Test Report were received at BACL's facilities on 8 September 2016 and was in working condition upon arrival. Testing was performed on the Unit(s) described in this Test Report during the period 18 September through 3 October 2016.
- The Test Results reported herein apply only to the Unit(s) actually tested, and to substantially identical Units.
- This Test Report must not be used to claim product endorsement by A2LA, or any agency of the U.S. Government, or by any other foreign government.
- This Test Report is the property of BACL, and shall not be reproduced, except in full, without prior written approval of BACL.

1.2 Objective

This test and measurement report was prepared on behalf of *Cisco System, Inc,* and their product Model number: *IR529UWP-915D/K9, IR529UBWP-915S/K9, and IR529UBWP-915D/K9 or FCC ID: LDK-IR529UWP* in accordance with Part 2, Subpart J, and Part 15, Subparts C of the Federal Communication Commission's rules.

The objective is to determine compliance with FCC Part 15.247 rules for AC Line Conducted Emissions, Output Power, Antenna Requirements, 20 dB Bandwidth, Hopping Channel Separation, Number of Hopping Frequencies Used, Dwell Time, 100 kHz Bandwidth of Band Edges Measurement, and Conducted and Radiated Spurious Emissions.

1.3 Agent of responsible Party

None

1.4 Responsible Party

Company Name:	Cisco Systems, Inc.
Contact:	Adama Walb
Street Address:	125 West Tasman
City/State/Zip:	San Jose, CA 95134
Country:	USA
E-mail:	awalb@cisco.com
Web:	www.cisco.com

1.5 Mechanical Description of EUT

Model: **IR529UWP-915D/K9**

The EUT measures approximately 9.4(W) x 14.5(D) x 19.3(H) cm. (3.7 in x 5.7 in x 7.6 in) and weighs approximately 2.95kg (6.5lbs).
The test data gathered are from typical production sample, S/N: JMX1829X015 assigned by Cisco, Inc.

Model: **IR529UBWP-915S/K9**

The EUT measures approximately 18.36(W) x 26.34(D) x 12.32(H) cm. (7.23 in x 10.37 in x 4.85 in) and weighs approximately 3.8kg (8.4lbs).
The test data gathered are from typical production sample, S/N: JMX1830X02Y assigned by Cisco, Inc.

Model: **IR529UBWP-915D/K9**

The EUT measures approximately 18.36(W) x 26.34(D) x 12.32(H) cm. (7.23 in x 10.37 in x 4.85 in) and weighs approximately 3.6kg (7.94lbs).

The test data gathered are from typical production sample, S/N: JMX1828X00N assigned by Cisco, Inc.

1.6 Product Description for Equipment Under Test (EUT)

The EUTs are WPAN Industrial Routers operate at 902-928 MHz.

1.7 Related Submittal(s)/Grant(s)

NA

1.8 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.9 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2:2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.10 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.11 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3297.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.03)*** to certify

- For the USA (Federal Communications Commission):
    1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
    2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
    3- All Telephone Terminal Equipment within FCC Scope C.
    4-
- For the Canada (Industry Canada):
    1 All Scope 1-Licence-Exempt Radio Frequency Devices;
    2 All Scope 2-Licensed Personal Mobile Radio Services;
    3 All Scope 3-Licensed General Mobile & Fixed Radio Services;
    4 All Scope 4-Licensed Maritime & Aviation Radio Services;
    5 All Scope 5-Licensed Fixed Microwave Radio Services
    6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.

- For Singapore (Info-Communications Development Authority (IDA)):
  1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2

- For the Hong Kong Special Administrative Region:
  1 All Radio Equipment, per KHCA 10XX-series Specifications;
  2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.

- For Japan:
  1 MIC Telecommunication Business Law (Terminal Equipment):
  - All Scope A1 - Terminal Equipment for the Purpose of Calls;
  - All Scope A2 - Other Terminal Equipment
  2 Radio Law (Radio Equipment):
  - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
  - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
  - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes & Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D- ***A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:***

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Innovation, Science, and Economic Development Canada - ISEDC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
    - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
    - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
    - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC
      US -EU EMC & Telecom MRA CAB
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
    - ENERGY STAR Recognized Test Laboratory – US EPA
    - Telecommunications Certification Body (TCB) – US FCC;
- Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the average and peak power across all data rates, bandwidths, and modulations.

2.2 EUT Exercise Software

Tera Term was used to connect to the EUT and commands lines was used to control the EUT.

2.3 Special Equipment

There were no special accessories which were required, included, or intended for use with the EUT during these tests.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model	Serial Number
DELL	Laptop	Latitude E6530	-

2.6 Internal Configuration

Model: IR529UBWP-915S/K9

Manufacturer	Description	Model
Cisco	Advanced Range Extender Interface Board	73-16448-02 01
Cisco	Battery	74-10147-02
Cisco	Main Board	73-15680-02 10
Cisco	Power Board	TB1723

Model: IR529UWP-915D/K9

Manufacturer	Description	Model
Cisco	Advanced Range Extender Interface Board	73-16447-02 10
Cisco	Main Board	73-15680-02 10
Cisco	Power Board	TB1723

Model: IR529UBWP-915D/K9

Manufacturer	Description	Model
Cisco	Advanced Range Extender Interface Board	73-16447-02 10
Cisco	Battery	74-10147-02
Cisco	Main Board	73-15680-02 10
Cisco	Power Board	341-0430-01 A0

2.7 External I/O Cabling List and Details

Cable Description	Length (m)	To	From
USB Cable	<1M	Laptop	EUT
RF Cable	<1M	EUT	PSA

2.8 Power Supply List and Details

Manufacturer	Description	Model	Part Number
Cisco	DC adapter	COM8910ARA	DTM170902A7

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
§15.247(i) & §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirements	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, & §15.247(d)	Spurious Radiated Emissions	Compliant
§15.247(a)(1)	20 dB Channel Bandwidth	Compliant
§15.247(b)(2)	Maximum Peak Output Power	Compliant
§15.247(d)	Band Edge	Compliant
§15.247(a)(1)	Hopping Channel Separation	Compliant
§15.247(a)(1)(i)	Dwell Time	Compliant
§15.247(a)(1)(i)	Number of Hopping Channels	Compliant

4 FCC §2.1091 & §15.247 (i) – RF Exposure

4.1 Applicable Standard

According to FCC §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

4.3 MPE Results

Model: IR529UWP-915D/K9

Maximum peak output power at antenna input terminal (dBm):	25.49*
Maximum peak output power at antenna input terminal (mW):	354.00
Prediction distance (cm):	20
Prediction frequency (MHz):	902.5
Maximum Antenna Gain, typical (dBi):	9
Maximum Antenna Gain (numeric):	7.94
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.559
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.602

Model: IR529UBWP-915S/K9

Maximum peak output power at antenna input terminal (dBm):	29.79
Maximum peak output power at antenna input terminal (mW):	952.80
Prediction distance (cm):	20
Prediction frequency (MHz):	927.5
Maximum Antenna Gain, typical (dBi):	5
Maximum Antenna Gain (numeric):	3.162
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.599
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.618

Model: IR529UBWP-915D/K9

Maximum peak output power at antenna input terminal (dBm):	25.49*
Maximum peak output power at antenna input terminal (mW):	354.00
Prediction distance (cm):	20
Prediction frequency (MHz):	902.5
Maximum Antenna Gain, typical (dBi):	9
Maximum Antenna Gain (numeric):	7.94
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.559
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.602

*the measured conducted power is 26.49 dBm but connection cable with 1 dB insertion loss will be applied in installation. Thus, 25.49 dBm conducted output power was applied in RF Exposure calculation.

The devices are compliant with the requirement MPE limit for uncontrolled exposure.

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to FCC §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2 Antenna List

Antenna Type/Pattern	Antenna Gain (dBi)	Applied Mode
Yagi (or other directional) antenna, Pole-mounted, N-connector, connected via coaxial cable	9	IR529UBWP-915D/K9 IR529UWP-915D/K9
Directional multi-beam steerable dipole antenna array, Chassis-mounted, Integrated directly onto the chassis without any external coaxial connections	5	IR529UBWP-915S/K9

The EUT used an external antenna with unique coupling; therefore it complies with the antenna requirement.

6 FCC §15.207– AC Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	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.*

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.10-2013 measurement procedure. The specification used was FCC §15.207 limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V/60 Hz AC power.

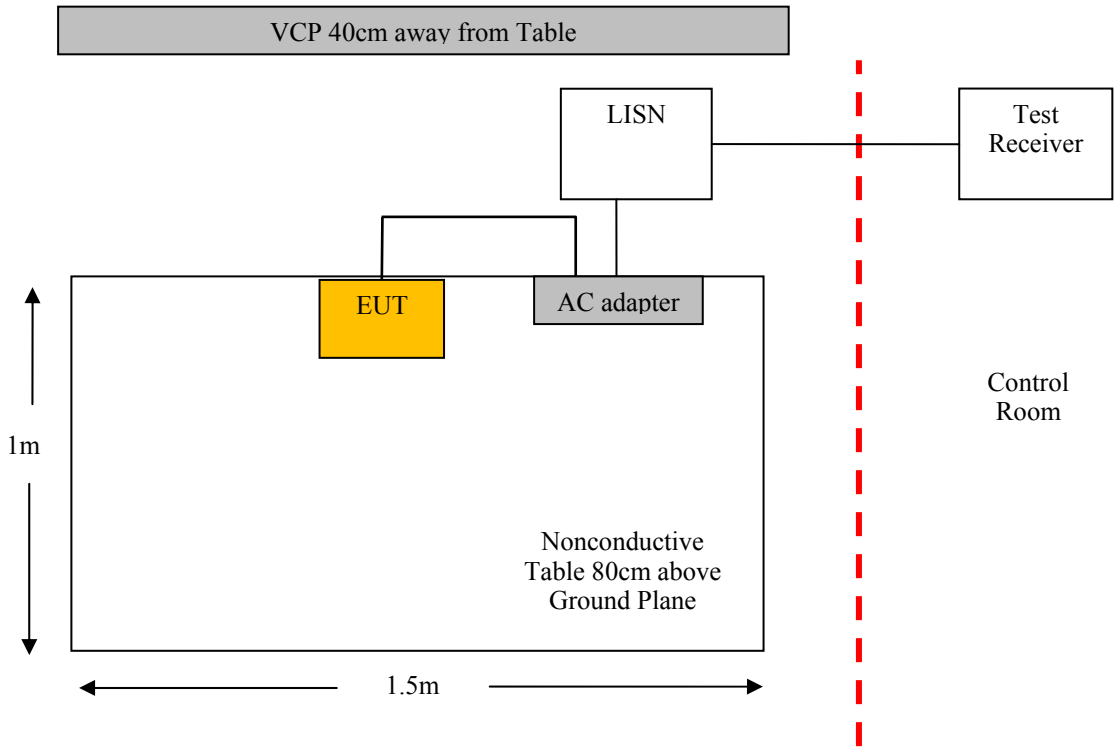
6.3 Test Procedure

During the conducted emissions test, the power adapter of the EUT was connected to a power strip on the table which is then connected to the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a “QP.” Average readings are distinguished with an “Ave”.

6.4 Test Setup Block Diagram



6.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Cable Loss (CL), the Attenuator Factor (Atten) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + CL + Atten

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (10 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Cal. Date	Cal. Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2016-06-24	1 year
Rohde & Schwarz	Impulse Limiter	ESH3-Z2	101963	2016-07-14	1year
Keysight Technologies	RF Limiter	11867A	MY42242931	2015-12-15	1year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2016-03-09	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/R
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2016-04-11	1year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

6.7 Test Environmental Conditions

Temperature:	20° C
Relative Humidity:	45 %
ATM Pressure:	101.94 kPa

The testing was performed by Frank Wang on 2016-09-29 at Ground Plane Test Site.

6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC standard's conducted emissions limits, with the margin reading of:

Model: IR529UWP-915D/K9

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-11.02	0.183815	Line	0.15-30

Model: IR529UBWP-915S/K9

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-10.68	0.188295	Line	0.15-30

Model: IR529UBWP-915D/K9

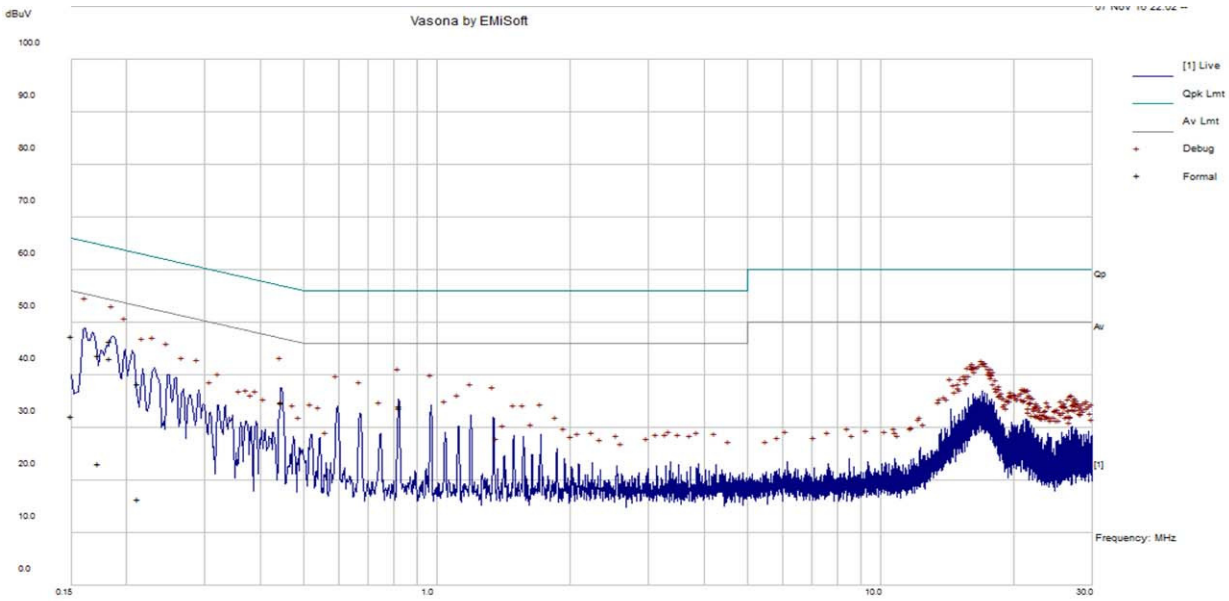
Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-10.26	0.182747	Neutral	0.15-30

6.9 Conducted Emissions Test Plots and Data

Model: IR529UWP-915D/K9

Worst case – High channel

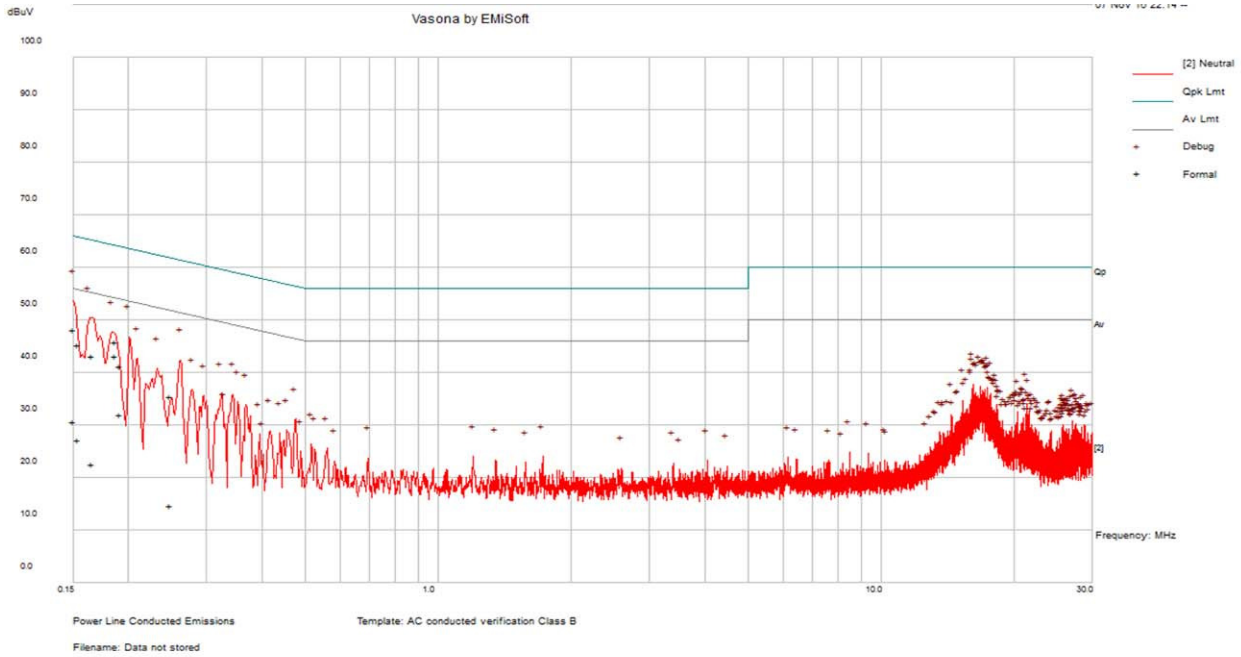
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.150177	47.42	Line	65.99	-18.57	QP
0.173187	43.69	Line	64.81	-21.11	QP
0.183815	46.51	Line	64.31	-17.80	QP
0.448457	34.67	Line	56.9	-22.23	QP
0.823639	33.74	Line	56	-22.26	QP
0.212361	38.35	Line	63.11	-24.76	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.150177	32.28	Line	55.99	-23.71	Ave.
0.173187	23.2	Line	54.81	-31.61	Ave.
0.183815	43.29	Line	54.31	-11.02	Ave.
0.448457	34.9	Line	46.9	-12	Ave.
0.823639	34.14	Line	46	-11.86	Ave.
0.212361	16.56	Line	53.11	-36.55	Ave.

120 V, 60 Hz – Neutral

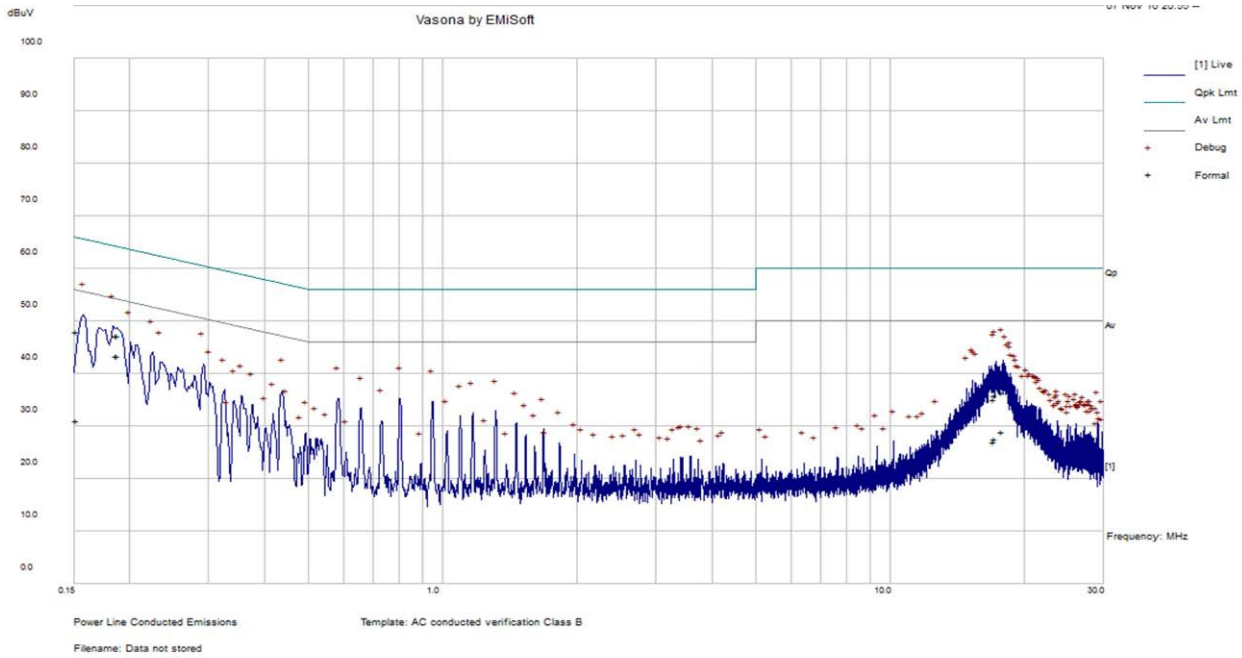


Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.150203	48.18	Neutral	65.99	-17.81	QP
0.154293	45.28	Neutral	65.77	-20.49	QP
0.165579	43.14	Neutral	65.18	-22.04	QP
0.186869	45.88	Neutral	64.17	-18.29	QP
0.248808	35.59	Neutral	61.8	-26.21	QP
0.19175	41.30	Neutral	63.96	-22.66	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.150203	30.63	Neutral	55.99	-25.36	Ave.
0.154293	27.33	Neutral	55.77	-28.44	Ave.
0.165579	22.73	Neutral	55.18	-32.45	Ave.
0.186869	43.12	Neutral	54.17	-11.06	Ave.
0.248808	14.78	Neutral	51.8	-37.02	Ave.
0.19175	32.04	Neutral	53.96	-21.92	Ave.

Model: IR529UBWP-915S/K9

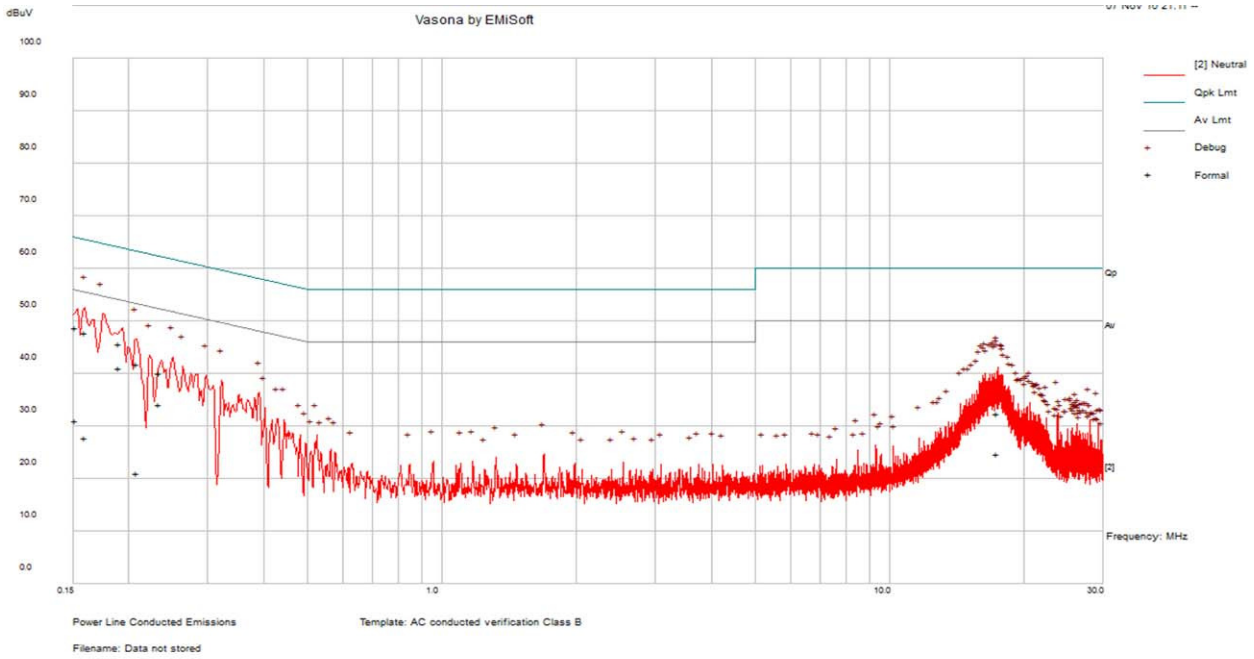
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.152242	47.94	Line	65.88	-17.94	QP
0.188295	47.28	Line	64.11	-16.83	QP
17.84641	36.48	Line	60	-23.52	QP
0.187103	47.25	Line	64.16	-16.92	QP
17.20283	35.91	Line	60	-24.09	QP
17.08769	35.15	Line	60	-24.85	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.152242	31.07	Line	55.88	-24.81	Ave.
0.188295	43.44	Line	54.11	-10.68	Ave.
17.84641	28.96	Line	50	-21.04	Ave.
0.187103	43.32	Line	54.16	-10.84	Ave.
17.20283	27.58	Line	50	-22.42	Ave.
17.08769	27.10	Line	50	-22.90	Ave.

120 V, 60 Hz – Neutral

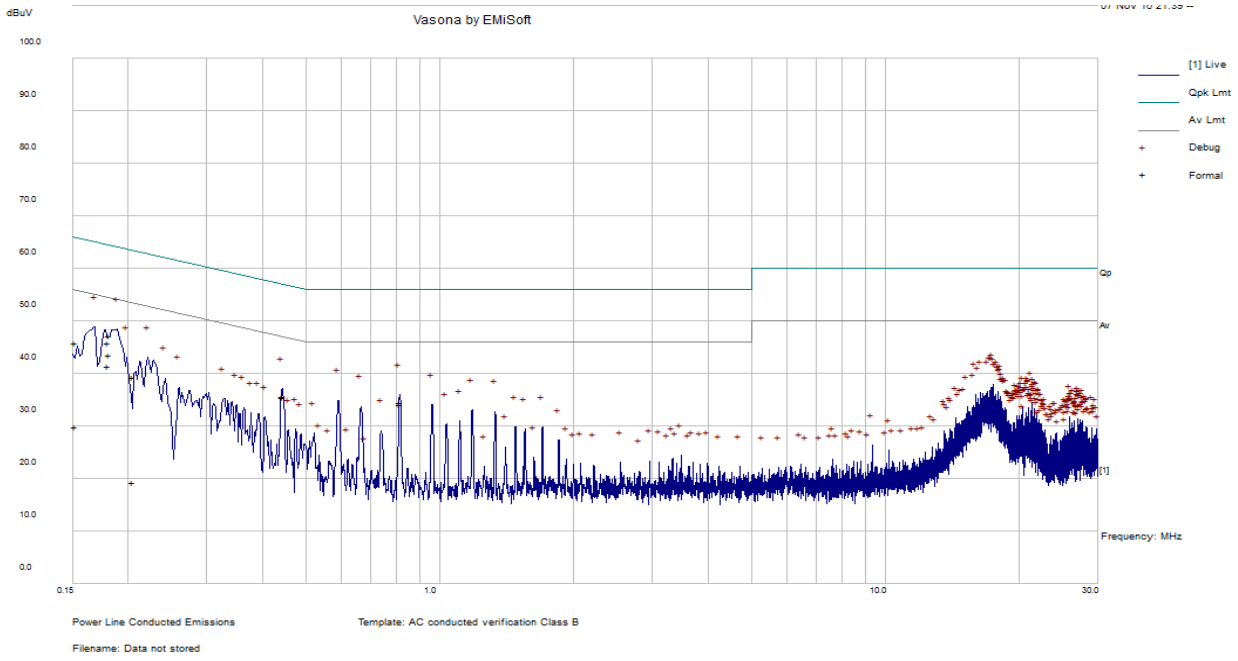


Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.151984	48.72	Neutral	65.89	-17.17	QP
0.159348	47.85	Neutral	65.5	-17.65	QP
0.190569	45.66	Neutral	64.01	-18.35	QP
0.234069	40.1	Neutral	62.3	-22.21	QP
17.43162	32.34	Neutral	60	-27.66	QP
0.208571	41.87	Neutral	63.26	-21.39	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.151984	31.08	Neutral	55.89	-24.82	Ave.
0.159348	27.82	Neutral	55.5	-27.68	Ave.
0.190569	41.01	Neutral	54.01	-13	Ave.
0.234069	34.09	Neutral	52.3	-18.22	Ave.
17.43162	24.65	Neutral	50	-25.35	Ave.
0.208571	21.06	Neutral	53.26	-32.21	Ave.

Model: IR529UBWP-915D/K9

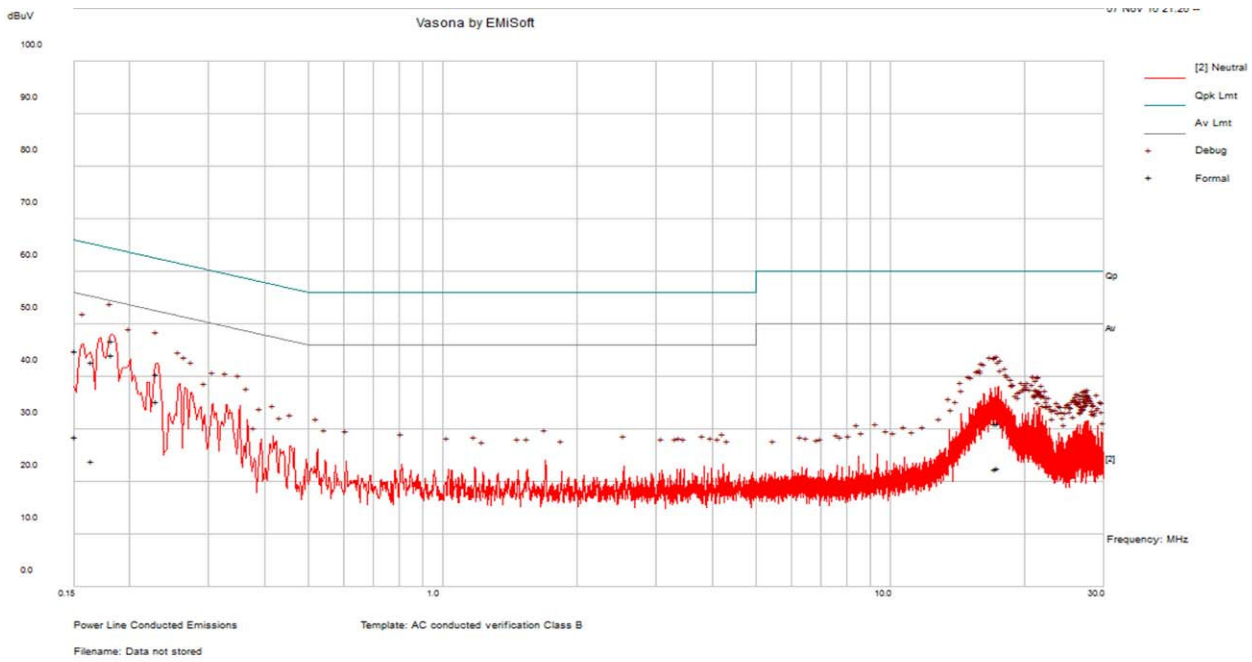
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.18032	45.91	Line	64.47	-18.56	QP
0.152599	45.87	Line	65.86	-19.99	QP
0.204599	39.31	Line	63.42	-24.11	QP
0.444	35.61	Line	56.99	-21.38	QP
0.814395	34.23	Line	56	-21.77	QP
0.181925	47.25	Line	64.4	-17.15	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.18032	41.44	Line	54.47	-13.03	Ave.
0.152599	29.88	Line	55.86	-25.97	Ave.
0.204599	19.29	Line	53.42	-34.13	Ave.
0.444	35.66	Line	46.99	-11.32	Ave.
0.814395	34.59	Line	46	-11.41	Ave.
0.181925	43.56	Line	54.4	-10.84	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.164866	42.76	Neutral	65.22	-22.46	QP
0.151234	44.93	Neutral	65.93	-21.01	QP
0.229407	40.50	Neutral	62.47	-21.97	QP
0.182747	46.77	Neutral	64.36	-17.59	QP
17.40964	31.06	Neutral	60	-28.94	QP
17.14006	31.14	Neutral	60	-28.86	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.164866	23.97	Neutral	55.22	-31.25	Ave.
0.151234	28.58	Neutral	55.93	-27.35	Ave.
0.229407	35.28	Neutral	52.47	-17.19	Ave.
0.182747	44.10	Neutral	54.36	-10.26	Ave.
17.40964	22.67	Neutral	50	-27.33	Ave.
17.14006	22.44	Neutral	50	-27.56	Ave.

7 FCC §15.205, §15.209 & §15.247(d) – Spurious Radiated Emissions

7.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

7.3 Test Procedure

The measurements are based on ANSI C63.10: 2013 as described below:

For the radiated emissions test, the EUT host, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter or 1.5 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

7.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2016-01-19	16 months
Sunol Sciences	Controller, System	SC104V	122303-1	Cal. Not required	Cal. Not required
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2015-07-11	2 years
Agilent	Pre-amplifier	8447D	2944A10187	2016-03-23	1 year
HP/ Agilant	Pre-amplifier	8449B OPT HO2	3008A0113	2016-05-23	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	2 years
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100044	2015-07-23	2 years
IW	Armored High Frequency Cable	DC 1531	KPS-1501A3960KPS	2016-08-05	1 year
-	SMA cable	-	C0005	Each Time[1]	-
-	N-Type Cable	-	C00013	2016-04-28	1 year
-	N-Type Cable	-	C00014	2016-05-28	1 year
Wainwright Instruments	Wainwright Instruments	Band Reject Filter	1	Each Time[1]	-
Vasona	Test software	V6.0 build 11	10400213	Cal. Not required	Cal. Not required

Note 1: cable and attenuator included in the test set-up will be calibrated each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

7.6 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	42 %
ATM Pressure:	101.44 kPa

The testing was performed by Frank Wang on 2016-09-20 to 2015-09-23 at chamber 3.

7.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15C standard's radiated emissions limits, and had the worst margin of:

Model: IR529UWP-915D/K9

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-0.13	941.394	Vertical	30-1000

1-10 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (GHz)**
-4.493	2707.76	Vertical	1-10

Model: IR529UBWP-915S/K9

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-3.30	888.6855	Vertical	30-1000

1-10 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (GHz)**
-10.373	2707.233	Horizontal	1-10

Model: IR529UBWP-915D/K9

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-0.97	941.5938	Vertical	30-1000

1-10 GHz:

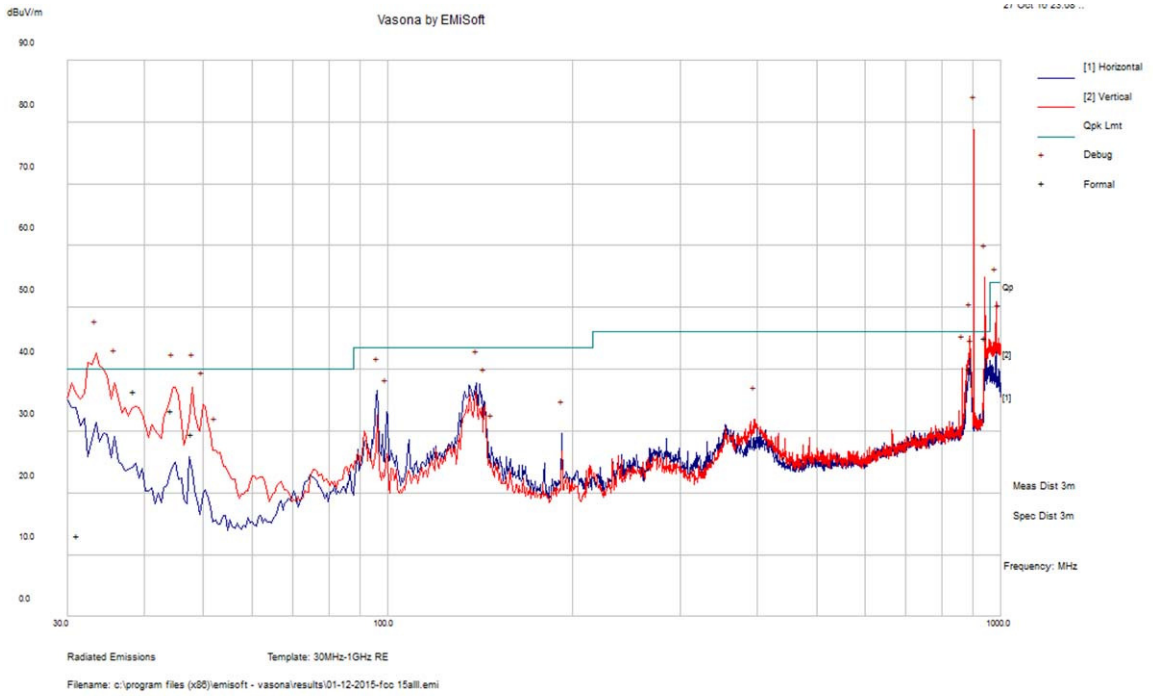
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (GHz)**
-0.513	2707.12	Vertical	1-10

Please refer to the following table and plots for specific test result details.

7.8 Radiated Emissions Test Data and Plots

Model: IR529UWP-915D/K9

1) 30 MHz – 1 GHz, Measured at 3 meters



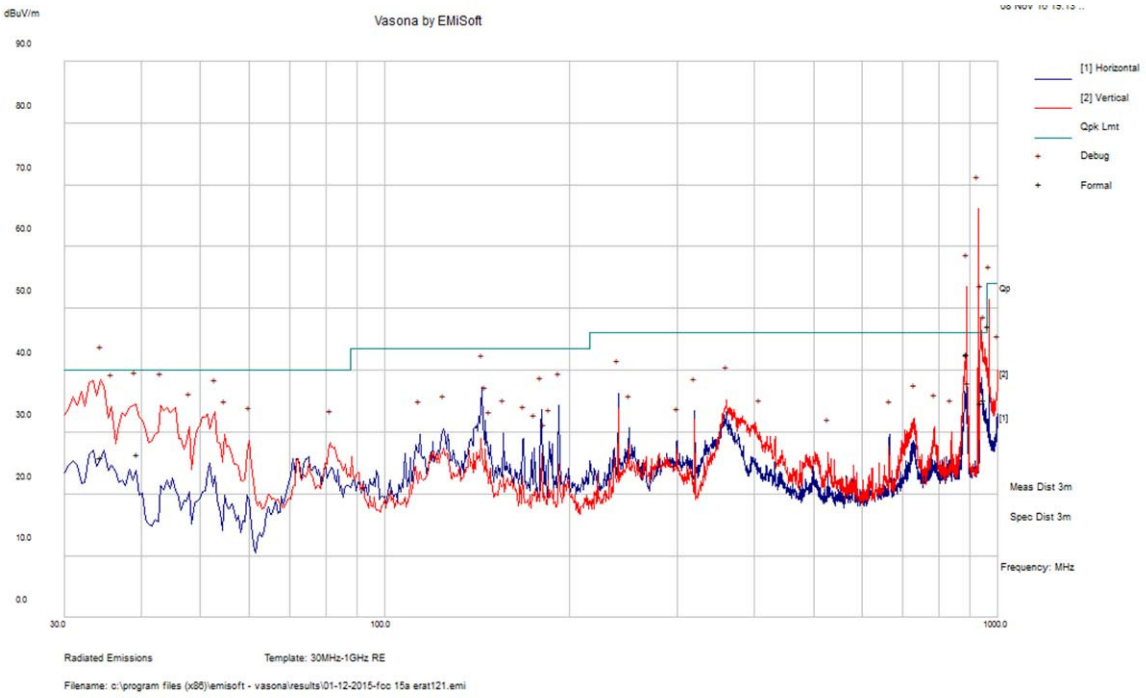
Frequency (MHz)	Cord. Reading (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (PK/QP/Ave.)
941.394	45.87	101	V	273	46	-0.13	QP
38.339	24.65	246	V	1	40	-15.35	QP
889.278	40.55	138	V	102	46	-5.45	QP
44.19525	21.26	386	V	246	40	-18.74	QP
47.8765	29.46	257	V	140	40	-10.54	QP
31.171	13.12	103	H	277	40	-26.88	QP

2) 1-10 GHz, Measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel: 902.5 MHz											
1805.16	70.98	330	300	H	27.218	4.39	30.75	71.838	93.52[1]	-21.682	Peak
1805.23	71.33	166	241	V	27.218	4.39	30.75	72.188	103.22[1]	-31.032	Peak
2707.9	54.7	300	55	H	29.077	5.73	39.46	50.047	74	-23.953	Peak
2707.9	45.87	154	279	H	29.077	5.73	39.46	41.217	54	-12.783	Ave
2707.76	59.22	100	300	V	29.077	5.73	39.46	54.567	74	-19.433	Peak
2707.76	54.16	100	300	V	29.077	5.73	39.46	49.507	54	-4.493	Ave
3612.71	46.53	99	100	H	31.431	6.7	39.2	45.461	74	-28.539	Peak
3612.71	33.79	99	100	H	31.431	6.7	39.2	32.721	54	-21.279	Ave
3613.47	47.35	0	100	V	31.431	6.7	39.2	46.281	74	-27.719	Peak
3613.47	33.8	0	100	V	31.431	6.7	39.2	32.731	54	-21.269	Ave
Middle Channel: 915 MHz											
1829.72	74.96	100	100	H	27.218	4.39	30.75	75.818	93.1[1]	-17.282	Peak
1829.9	73.79	157	227	V	27.218	4.39	30.75	74.648	102.77[1]	-28.122	Peak
2744.88	52.26	66	197	H	29.077	5.73	39.46	47.607	74	-26.393	Peak
2744.88	39.78	66	197	H	29.077	5.73	39.46	35.127	54	-18.873	Ave
2745.35	55.82	0	100	V	29.077	5.73	39.46	51.167	74	-22.833	Peak
2745.35	44.01	0	100	V	29.077	5.73	39.46	39.357	54	-14.643	Ave
3646.41	47.83	0	100	H	31.431	6.7	39.2	46.761	74	-27.239	Peak
3646.41	34.96	0	100	H	31.431	6.7	39.2	33.891	54	-20.109	Ave
3659.58	47.51	0	100	V	31.431	6.7	39.2	46.441	74	-27.559	Peak
3659.58	34.97	0	100	V	31.431	6.7	39.2	33.901	54	-20.099	Ave
High Channel: 927.5 MHz											
1855.18	70.69	100	100	H	27.218	4.39	30.75	71.548	93.22[1]	-21.672	Peak
1854.81	69.47	210	211	V	27.218	4.39	30.75	70.328	104.65[1]	-34.322	Peak
2782.15	48.94	0	100	H	28.969	5.73	39.46	44.179	74	-29.821	Peak
2782.15	36.14	0	100	H	28.969	5.73	39.46	31.379	54	-22.621	Ave
2782.86	48.12	0	100	V	28.969	5.73	39.46	43.359	74	-30.641	Peak
2782.86	37	0	100	V	28.969	5.73	39.46	32.239	54	-21.761	Ave
3710.95	48.87	0	100	H	31.892	6.7	39.2	48.262	74	-25.738	Peak
3710.95	36.68	0	100	H	31.892	6.7	39.2	36.072	54	-17.928	Ave
3710.6	48.18	0	100	V	31.892	6.7	39.2	47.572	74	-26.428	Peak
3710.6	36.24	0	100	V	31.892	6.7	39.2	35.632	54	-18.368	Ave

Model: IR529UBWP-915S/K9

1) 30 MHz – 1 GHz, Measured at 3 meters



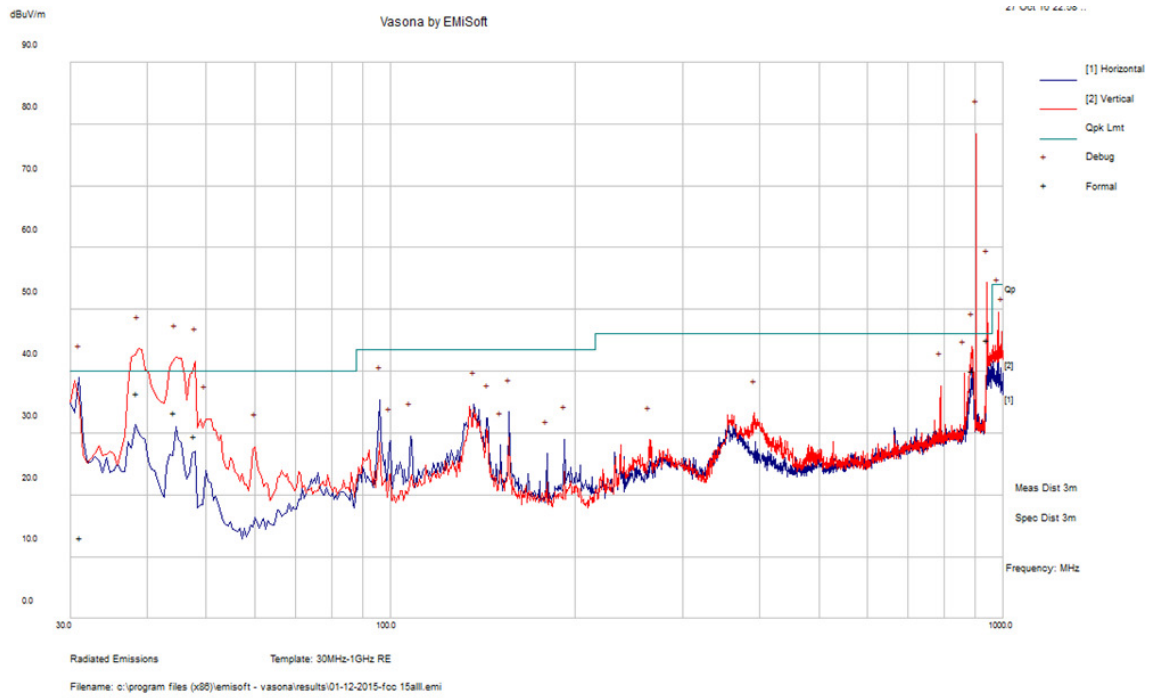
Frequency (MHz)	Cord. Reading (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (PK/QP/Ave.)
888.6855	42.7	101	V	44	46	-3.30	QP
937.3518	34.68	161	V	220	46	-11.32	QP
34.407	25.97	197	V	187	40	-14.03	QP
966.313	47.23	141	V	293	54	-6.77	QP
950.4668	35.23	101	V	227	46	-10.77	QP
39.41525	26.41	100	V	108	40	-13.59	QP

2) 1-10 GHz, Measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel: 902.5 MHz											
1805.283	74.69	96	100	H	27.218	4.39	30.75	75.548	94.1[1]	-18.552	Peak
1805	74.76	96	102	V	27.218	4.39	30.75	75.618	99.77[1]	-24.152	Peak
2707.233	54.21	96	103	H	29.077	5.73	39.46	49.557	74	-24.443	Peak
2707.233	48.28	96	103	H	29.077	5.73	39.46	43.627	54	-10.373	Ave
2707.233	54.33	97	103	V	29.077	5.73	39.46	49.677	74	-24.323	Peak
2707.233	47.98	97	103	V	29.077	5.73	39.46	43.327	54	-10.673	Ave
3610.45	46.31	99	100	H	31.431	6.7	39.2	45.241	74	-28.759	Peak
3610.21	32.72	99	100	H	31.431	6.7	39.2	31.651	54	-22.349	Ave
3609.8	46.52	0	100	V	31.431	6.7	39.2	45.451	74	-28.549	Peak
3609.8	32.72	0	100	V	31.431	6.7	39.2	31.651	54	-22.349	Ave
Middle Channel: 915 MHz											
1829.77	72.37	80	151	H	27.218	4.39	30.75	73.228	94.46[1]	-21.232	Peak
1830.21	72.38	78	155	V	27.218	4.39	30.75	73.238	99.72[1]	-26.482	Peak
2744.53	49.86	165	156	H	29.077	5.73	39.46	45.207	74	-28.793	Peak
2744.53	41.05	165	156	H	29.077	5.73	39.46	36.397	54	-17.603	Ave
2744.38	49.59	166	156	V	29.077	5.73	39.46	44.937	74	-29.063	Peak
2744.38	40.64	166	156	V	29.077	5.73	39.46	35.987	54	-18.013	Ave
3650.5	47.03	0	100	H	31.431	6.7	39.2	45.961	74	-28.039	Peak
3650.5	34.57	0	100	H	31.431	6.7	39.2	33.501	54	-20.499	Ave
3650.5	48.18	0	100	V	31.431	6.7	39.2	47.111	74	-26.889	Peak
3650.5	34.58	0	100	V	31.431	6.7	39.2	33.511	54	-20.489	Ave
High Channel: 927.5 MHz											
1854.76	69.81	255	158	H	27.218	4.39	30.75	70.668	94.17[1]	-23.502	Peak
1854.83	69.64	258	159	V	27.218	4.39	30.75	70.498	102.96[1]	-32.462	Peak
2782.15	47.7	0	100	H	28.969	5.73	39.46	42.939	74	-31.061	Peak
2782.15	35.55	0	100	H	28.969	5.73	39.46	30.789	54	-23.211	Ave
2782.86	48.87	0	100	V	28.969	5.73	39.46	44.109	74	-29.891	Peak
2782.86	35.53	0	100	V	28.969	5.73	39.46	30.769	54	-23.231	Ave
3712.88	46.58	0	100	H	31.892	6.7	39.2	45.972	74	-28.028	Peak
3712.88	34.18	0	100	H	31.892	6.7	39.2	33.572	54	-20.428	Ave
3710.6	45.92	0	100	V	31.892	6.7	39.2	45.312	74	-28.688	Peak
3710.6	33.91	0	100	V	31.892	6.7	39.2	33.302	54	-20.698	Ave

Model: IR529UBWP-915D/K9

1) 30 MHz – 1 GHz, Measured at 3 meters



Frequency (MHz)	Cord. Reading (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (PK/QP/Ave.)
941.5938	45.03	152	V	111	46	-0.97	QP
38.48075	36.42	178	V	155	40	-3.58	QP
44.316	33.34	223	V	86	40	-6.66	QP
47.8535	29.46	257	V	140	40	-10.54	QP
31.171	13.12	103	H	277	40	-26.88	QP
889.207	40.15	191	V	245	46	-5.85	QP

2) 1-10 GHz, Measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel: 902.5 MHz											
1805.18	78.1	84	195	H	27.218	4.39	30.75	78.958	93.22[1]	-14.262	Peak
1805.2	79.27	213	194	V	27.218	4.39	30.75	80.128	102[1]	-21.872	Peak
2707.42	54.51	349	196	H	29.077	5.73	39.46	49.857	74	-24.143	Peak
2707.42	47.16	349	196	H	29.077	5.73	39.46	42.507	54	-11.493	Ave
2707.12	61.17	14	207	V	29.077	5.73	39.46	56.517	74	-17.483	Peak
2707.12	58.14	14	207	V	29.077	5.73	39.46	53.487	54	-0.513	Ave
3610	45.93	0	100	H	31.431	6.7	39.2	44.861	74	-29.139	Peak
3610	33.87	0	100	H	31.431	6.7	39.2	32.801	54	-21.199	Ave
3609.8	47.81	0	100	V	31.431	6.7	39.2	46.741	74	-27.259	Peak
3609.8	33.64	0	100	V	31.431	6.7	39.2	32.571	54	-21.429	Ave
Middle Channel: 915 MHz											
1829.76	79.12	91	201	H	27.218	4.39	30.75	79.978	94.67[1]	-14.692	Peak
1829.78	79.51	207	211	V	27.218	4.39	30.75	80.368	102.67[1]	-22.302	Peak
2745.63	52.71	275	270	H	29.077	5.73	39.46	48.057	74	-25.943	Peak
2475.63	46.87	275	270	H	29.077	5.73	39.46	42.217	54	-11.783	Ave
2745.2	55.71	163	185	V	29.077	5.73	39.46	51.057	74	-22.943	Peak
2745.2	51.08	163	185	V	29.077	5.73	39.46	46.427	54	-7.573	Ave
4574.96	47.9	0	100	H	31.431	6.7	39.2	46.831	74	-27.169	Peak
4574.96	36.31	0	100	H	31.431	6.7	39.2	35.241	54	-18.759	Ave
4575.61	51.8	0	150	V	31.431	6.7	39.2	50.731	74	-23.269	Peak
4575.61	34.06	0	150	V	31.431	6.7	39.2	32.991	54	-21.009	Ave
High Channel: 927.5 MHz											
1855.18	71.57	248	100	H	27.218	4.39	30.75	72.428	91.63[1]	-19.202	Peak
1854.81	71.65	196	232	V	27.218	4.39	30.75	72.508	101.55[1]	-29.042	Peak
2782.15	50.22	0	100	H	28.969	5.73	39.46	45.459	74	-28.541	Peak
2782.15	36.68	0	100	H	28.969	5.73	39.46	31.919	54	-22.081	Ave
2782.86	49.61	0	100	V	28.969	5.73	39.46	44.849	74	-29.151	Peak
2782.86	36.17	0	100	V	28.969	5.73	39.46	31.409	54	-22.591	Ave
3710.6	48.09	0	100	H	31.892	6.7	39.2	47.482	74	-26.518	Peak
3710.6	34.62	0	100	H	31.892	6.7	39.2	34.012	54	-19.988	Ave
3710.6	48.51	0	100	V	31.892	6.7	39.2	47.902	74	-26.098	Peak
3710.6	36.63	0	100	V	31.892	6.7	39.2	36.022	54	-17.978	Ave

Note[1]: The peak limit for the twice harmonic channel (1800 MHz) is 20 dB lower than the fundamental signal which is list in the following form.
Note[2]: Fundamental signal can be seen in the following form.

Fundamental signal Field Strength

Model: IR529UWP-915D/K9

Channel	Frequency (MHz)	S.A. Reading (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Cord. Reading (dBµV/m)	Ant. Polarity (H/V)
Low	902.5	89.29	22.46	1.77	113.52	H
Low	902.5	98.99	22.46	1.77	123.22	V
Middle	915	88.87	22.46	1.77	113.10	H
Middle	915	98.54	22.46	1.77	122.77	V
High	927.5	89.06	22.39	1.77	113.22	H
High	927.5	100.49	22.39	1.77	124.65	V

Model: IR529UBWP-915S/K9

Channel	Frequency (MHz)	S.A. Reading (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Cord. Reading (dBµV/m)	Ant. Polarity (H/V)
Low	902.5	89.87	22.46	1.77	114.10	H
Low	902.5	95.54	22.46	1.77	119.77	V
Middle	915	90.23	22.46	1.77	114.46	H
Middle	915	95.49	22.46	1.77	119.72	V
High	927.5	90.01	22.39	1.77	114.17	H
High	927.5	98.8	22.39	1.77	122.96	V

Model: IR529UBWP-915D/K9

Channel	Frequency (MHz)	S.A. Reading (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Cord. Reading (dBµV/m)	Ant. Polarity (H/V)
Low	902.5	88.99	22.46	1.77	113.22	H
Low	902.5	97.77	22.46	1.77	122.00	V
Middle	915	90.44	22.46	1.77	114.67	H
Middle	915	98.44	22.46	1.77	122.67	V
High	927.5	87.47	22.39	1.77	111.63	H
High	927.5	97.39	22.39	1.77	121.55	V

8 FCC §15.247(a) – Hopping Channel Bandwidth

8.1 Applicable Standard

According to FCC §15.247(a) (1): the maximum 20 dB bandwidth of the hopping channel shall be presented.

8.2 Measurement Procedure

Span = approximately 2 to 5 times the 99% occupied bandwidth, centered on a hopping channel

RBW = 1% to 5 % of the 99% occupied bandwidth

VBW = 3*RBW

Sweep = auto

Detector function = peak

Trace = max hold

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2016-01-19	1 year
-	SMA cable	-	C0001	Each Time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: These items shall be calibrated before every test.
***Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

8.4 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	33 %
ATM Pressure:	101.2 kPa

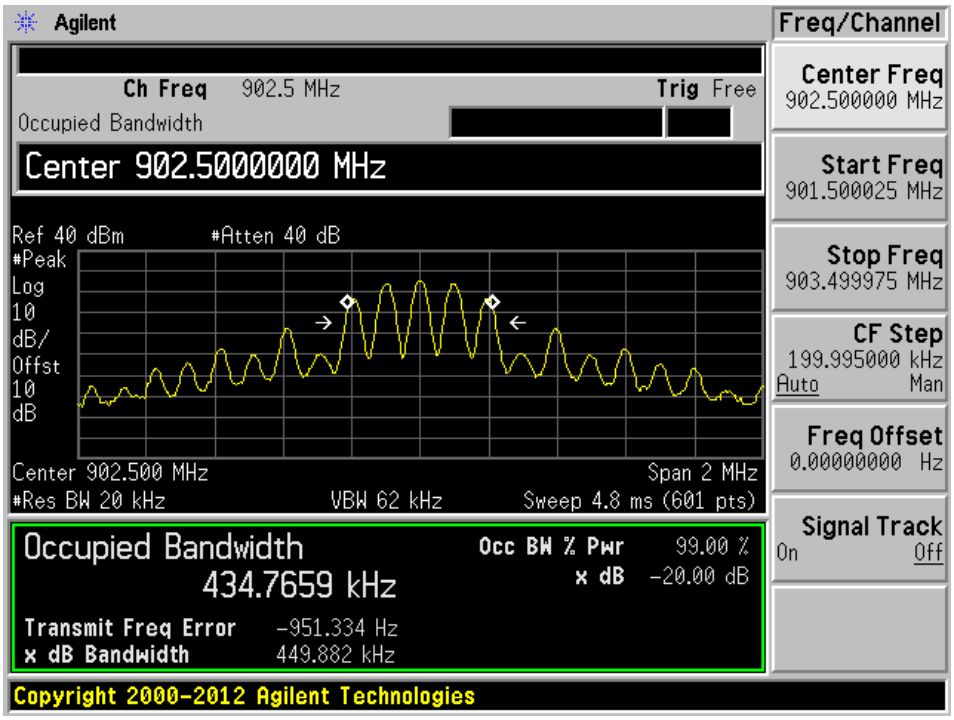
The testing was performed by Frank Wang on 2016-09-19 at the RF site.

8.5 Test Results

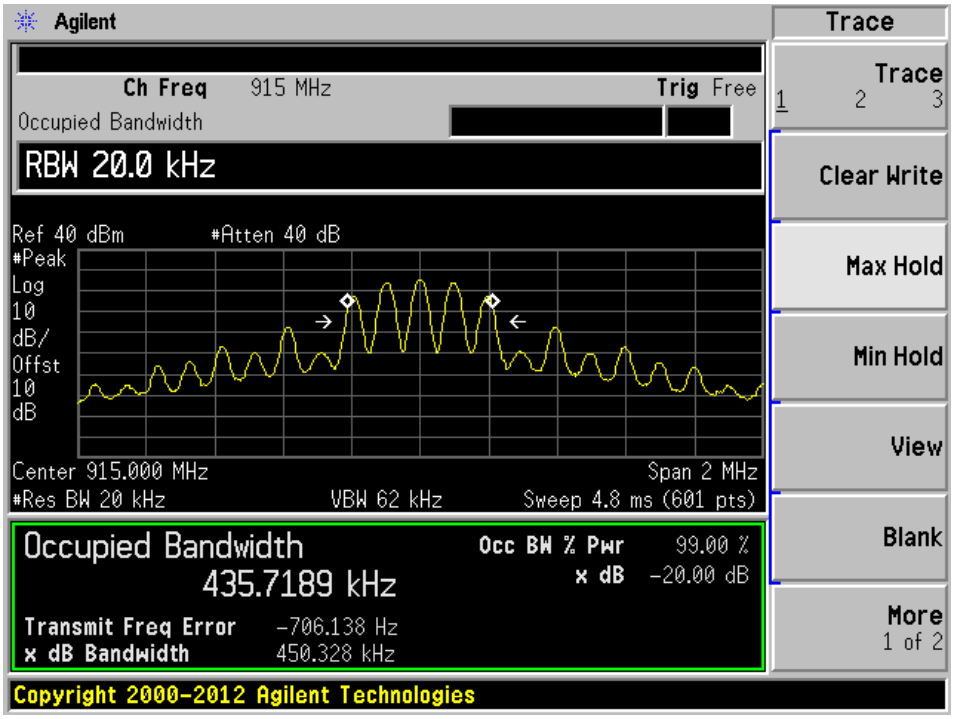
Channel	Frequency (MHz)	20 dB Emission Bandwidth (kHz)	99% Emission Bandwidth (kHz)	Results
Low	902.5	449.88	434.77	Compliant
Middle	915	450.33	435.72	Compliant
High	927.5	449.98	434.62	Compliant

Please refer to the following plots for detailed test results.

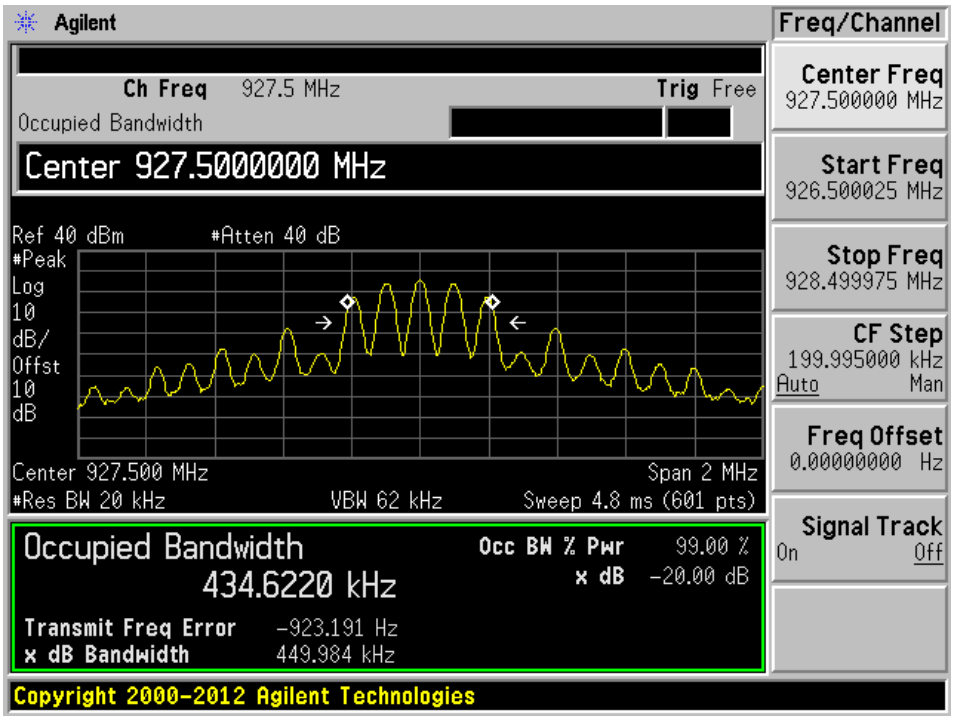
Low channel



Middle channel



High channel



9 FCC §15.247(a) (1) - Hopping Channel Separation

9.1 Applicable Standard

According to FCC §15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

9.2 Measurement Procedure

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2016-01-19	1 year
-	SMA cable	-	C0001	Each Time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: These items shall be calibrated before every test.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

9.4 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	33 %
ATM Pressure:	101.2 kPa

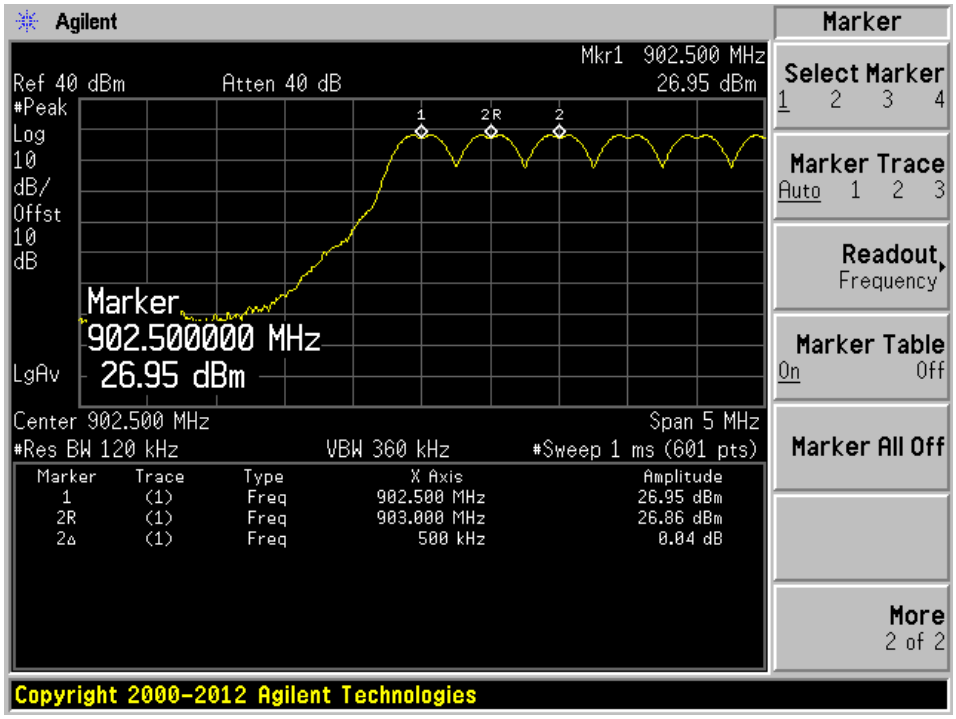
The testing was performed by Frank Wang on 2016-9-20 at the RF site.

9.5 Test Results

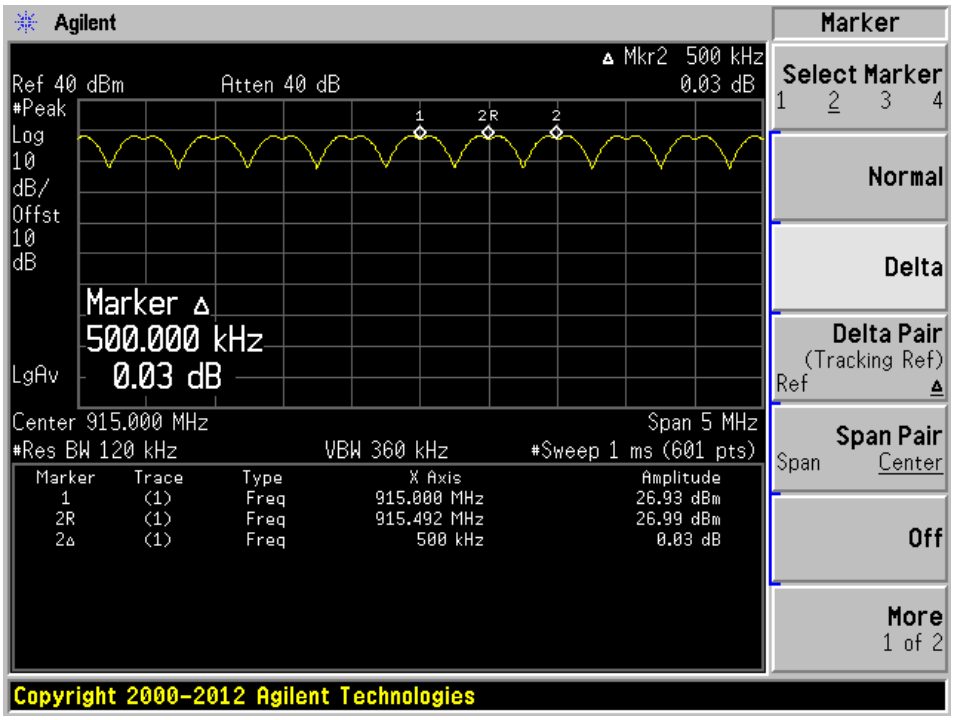
Channel	Frequency (MHz)	Channel Separation (kHz)	Limit > 20 dB OBW (kHz)	Result
Low	902.5	500	449.88	Pass
Middle	915	500	450.33	Pass
High	927.5	500	449.98	Pass

Please refer to the following plots.

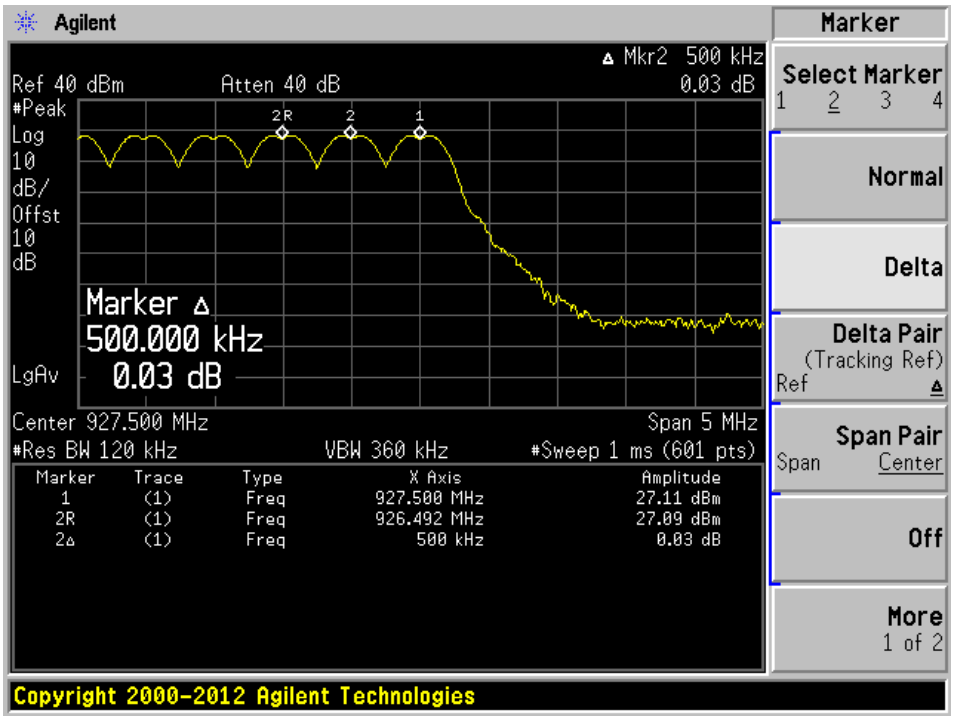
Low channel



Middle Channel



High Channel



10 FCC §15.247(a)(1)(i) - Number of Hopping Channels

10.1 Applicable Standard

According to FCC §15.247(a)(1)(i), for frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

10.2 Measurement Procedure

Span = the frequency band of operation

RBW < 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2016-01-19	1 year
-	SMA cable	-	C0001	Each Time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: These items shall be calibrated before every test.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

10.4 Test Environmental Conditions

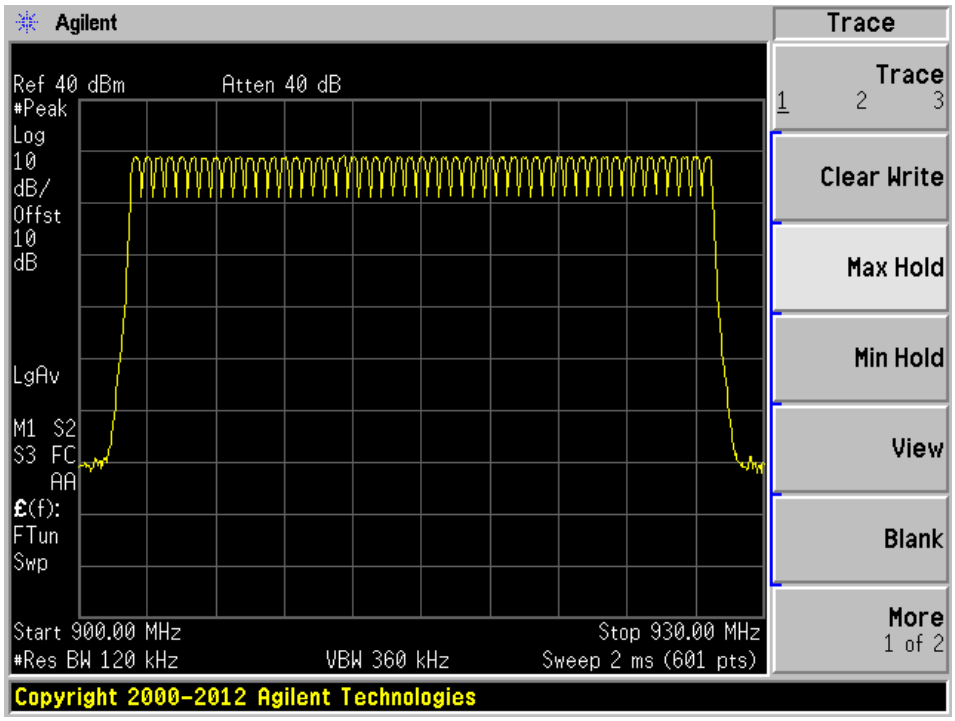
Temperature:	23° C
Relative Humidity:	33 %
ATM Pressure:	101.2 kPa

The testing was performed by Frank Wang on 2016-09-20 at the RF site.

10.5 Test Results

Total 51 channels; please refer to the plots hereinafter.

Hopping Channel Number: Total 51 Channels



11 FCC §15.247(a)(1)(i) - Dwell Time

11.1 Applicable Standard

According to FCC §15.247 (a)(1)(i), for frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

11.2 Measurement Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel
RBW ≤ channel spacing and where possible RBW should be set >> 1/*T*, where *T* is the expected dwell time per channel
Sweep = as necessary to capture the entire dwell time per hopping channel
Detector function = peak
Trace = max hold

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2016-01-19	1 year
-	SMA cable	-	C0001	Each Time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: These items shall be calibrated before every test.
***Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

11.4 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	33 %
ATM Pressure:	101.2 kPa

The testing was performed by Frank Wang on 2016-09-20 at the RF site.

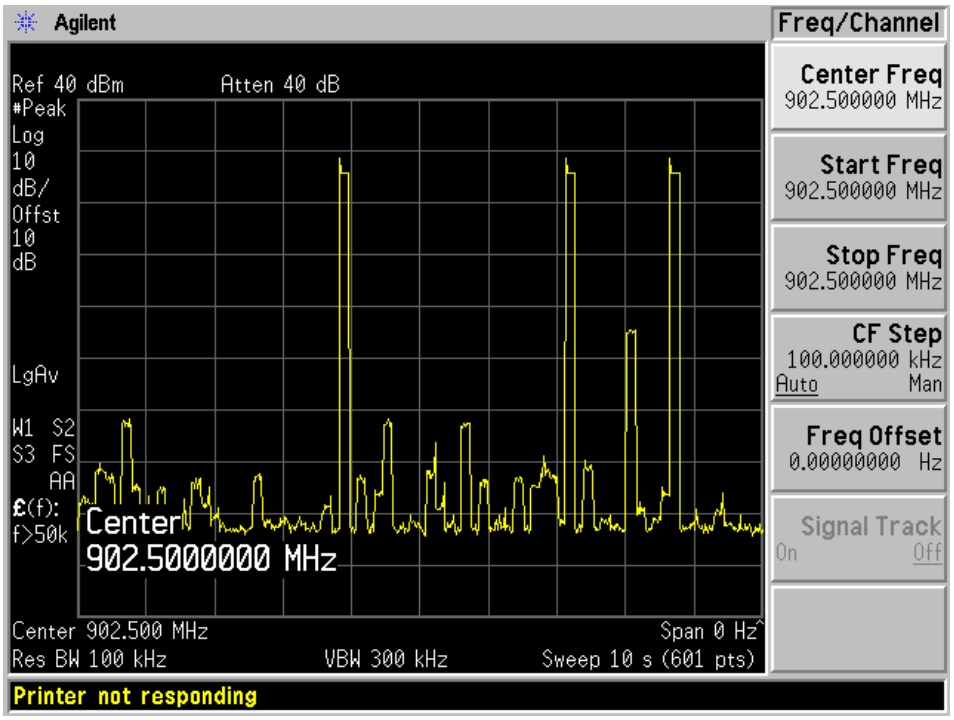
11.5 Test Results

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
Low	125	0.375	0.4	Compliant
Middle	125.8	0.3774	0.4	Compliant
High	126.7	0.3801	0.4	Compliant

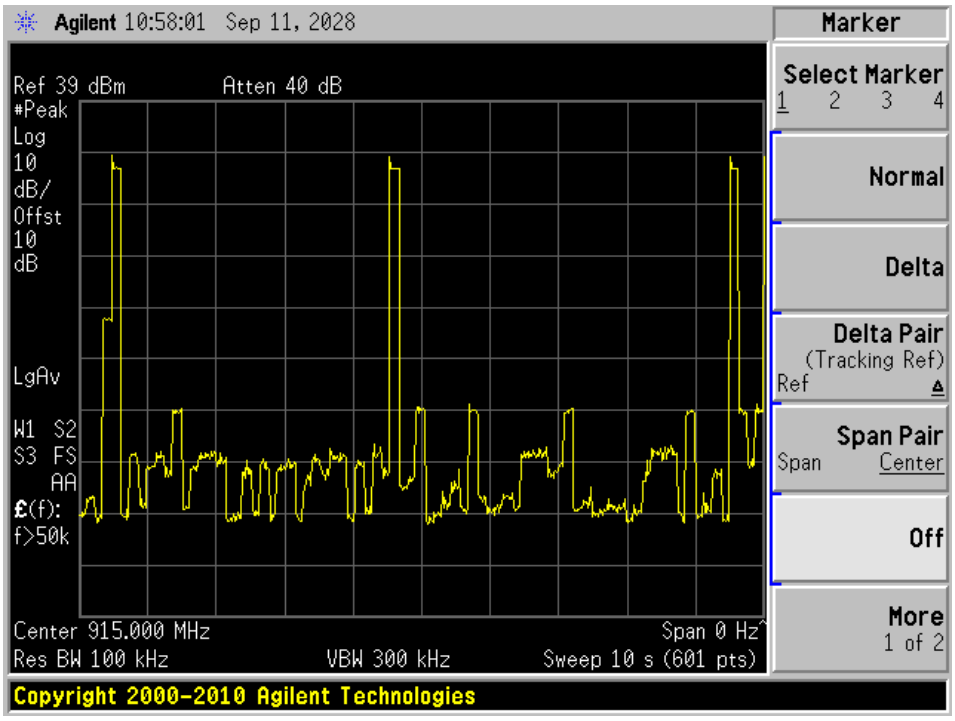
Note: There are 3 pulses in each 10 seconds.

Please refer to following plots:

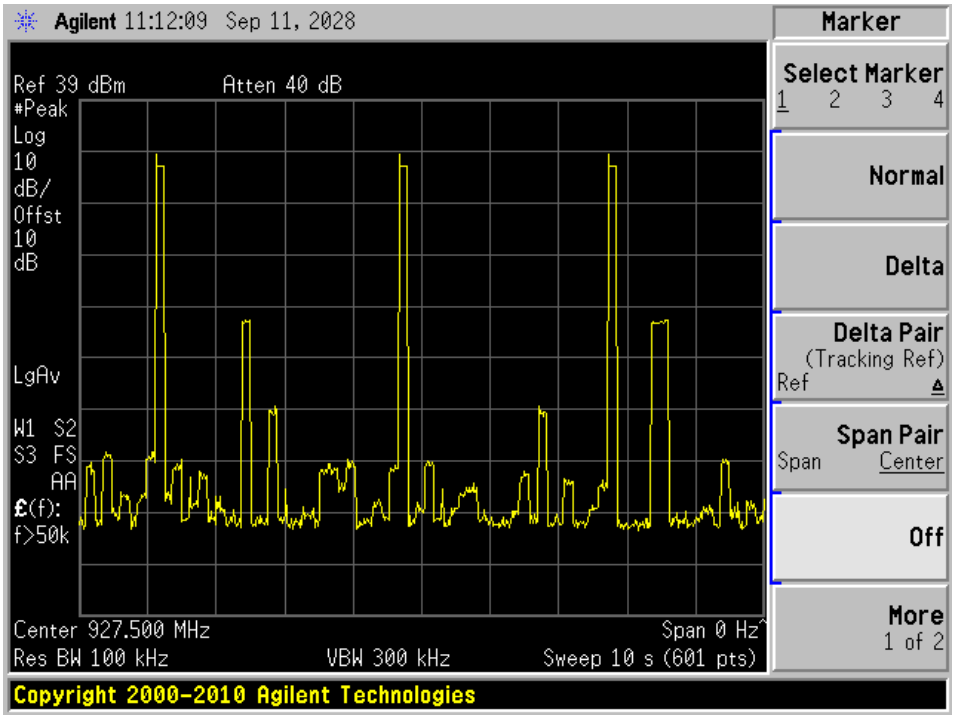
Low channel



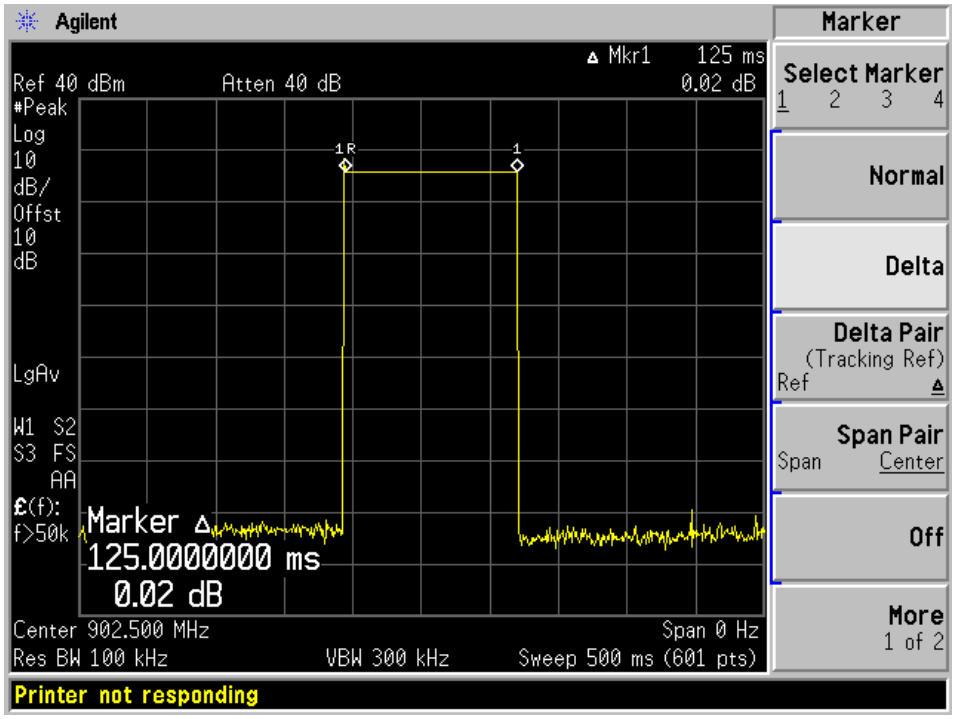
Middle channel



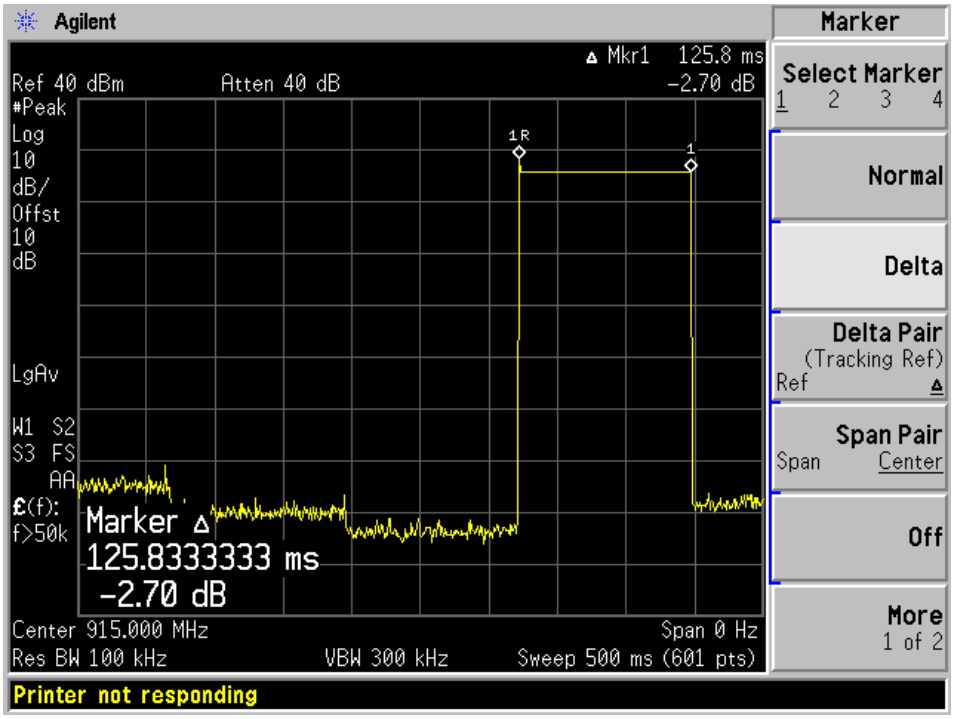
High channel



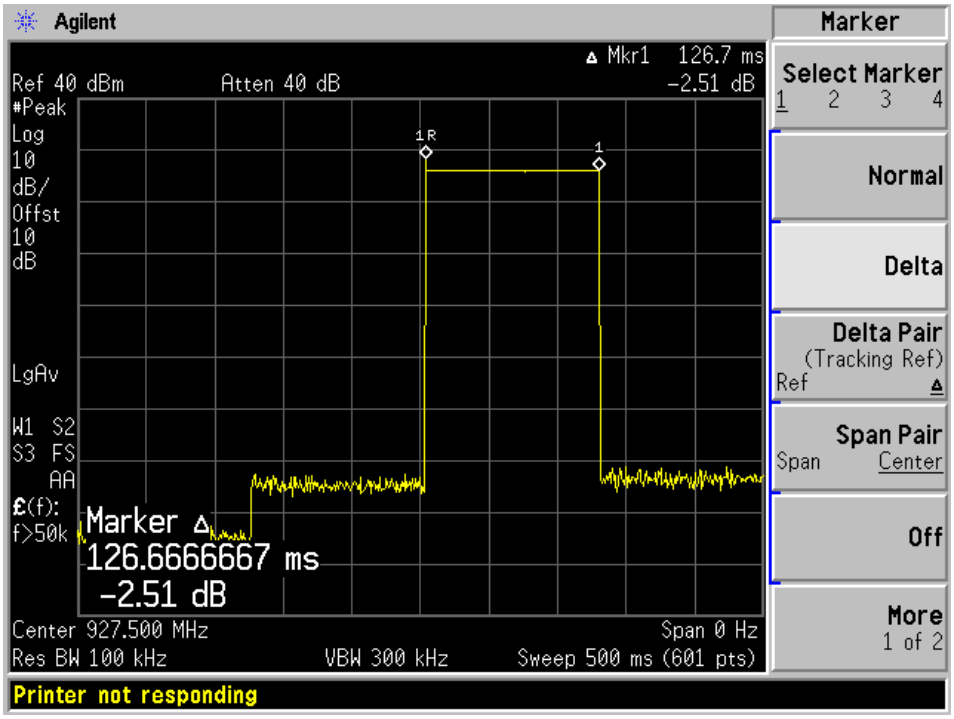
Low channel



Middle channel



High channel



12 FCC §15.247(b) – Peak Output Power Measurement

12.1 Applicable Standard

According to FCC §15.247(b) for systems using digital modulation in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands: 1 Watt.

12.2 Measurement Procedure

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2016-01-19	1 year
-	SMA cable	-	C0001	Each Time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: These items shall be calibrated before every test.
***Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

12.4 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	33 %
ATM Pressure:	101.2 kPa

The testing was performed by Frank Wang on 2016-09-28 at the RF site.

12.5 Test Results

Model: IR529UWP-915D/K9

Channel	Frequency (MHz)	Chain 0 Conducted Output Power (dBm)	Chain 1 Conducted Output Power (dBm)	Limit* (dBm)	Chain 0 Margin (dBm)	Chain1 Margin (dBm)
Low	902.5	26.49	25.16	27	-0.51	-1.84
Middle	915	26.34	25.39	27	-0.66	-1.61
High	927.5	26.16	26.25	27	-0.84	-0.75

Model: IR529UBWP-915S/K9

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	902.5	29.54	30	-0.46
Middle	915	29.65	30	-0.35
High	927.5	29.79	30	-0.21

Model: IR529UBWP-915D/K9

Channel	Frequency (MHz)	Chain 0 Conducted Output Power (dBm)	Chain 1 Conducted Output Power (dBm)	Limit* (dBm)	Chain 0 Margin (dBm)	Chain1 Margin (dBm)
Low	902.5	26.49	25.61	27	-0.51	-1.39
Middle	915	26.20	25.85	27	-0.8	-1.15
High	927.5	25.82	26.27	27	-1.18	-0.73

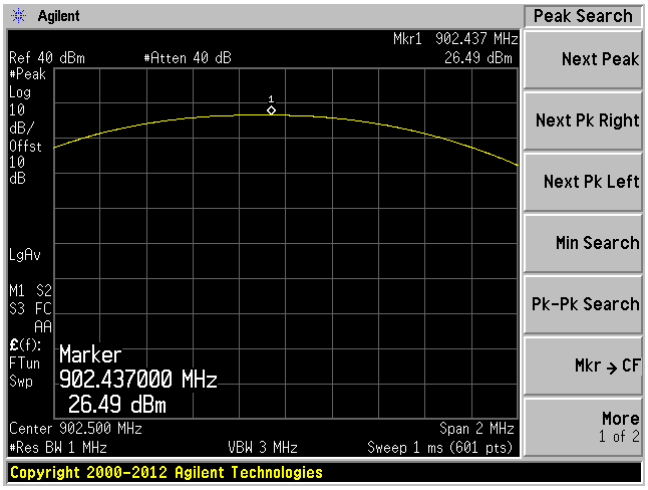
*Antenna gain is 9 dBi, which is 3 dB higher than 6 dBi. Thus, 3 dB was subtracted from the conducted output power limit.

Please refer to the following plots for detailed test results.

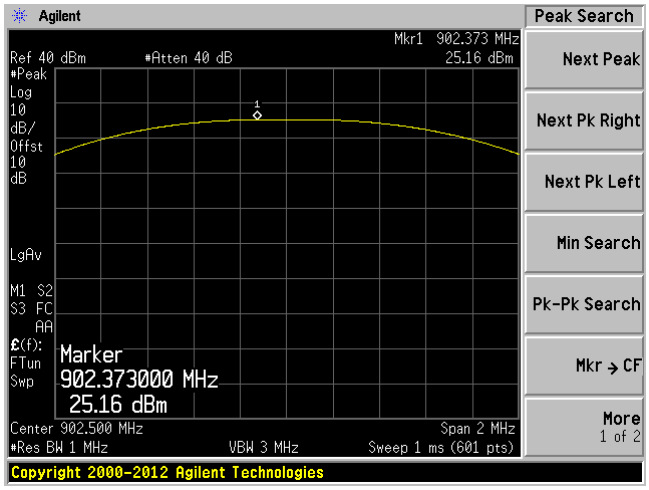
Model: IR529UWP-915D/K9

Low channel

Chain 0

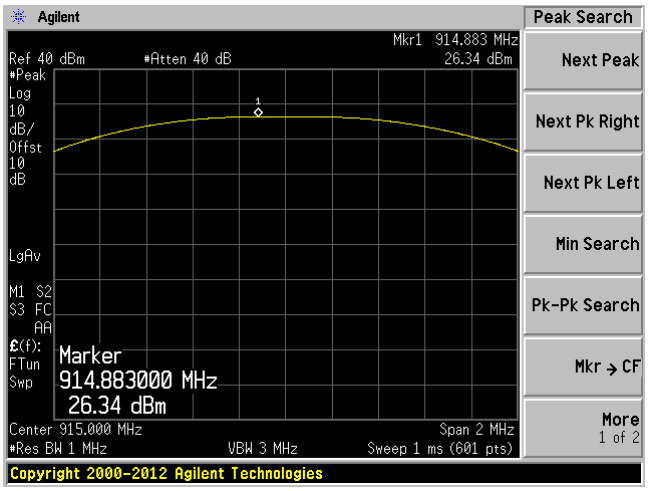


Chain 1

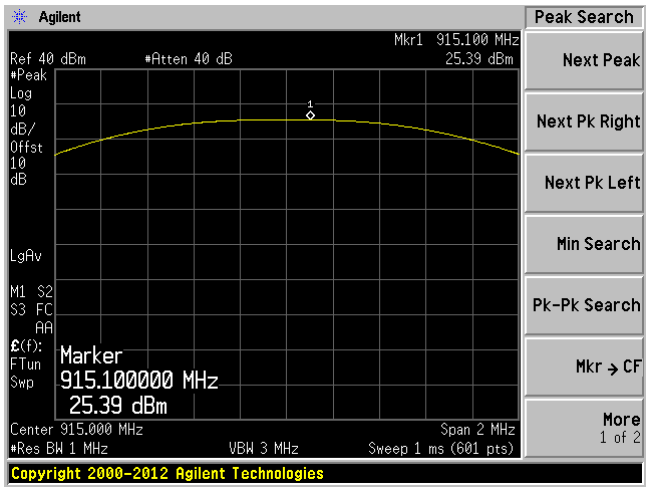


Middle channel

Chain 0

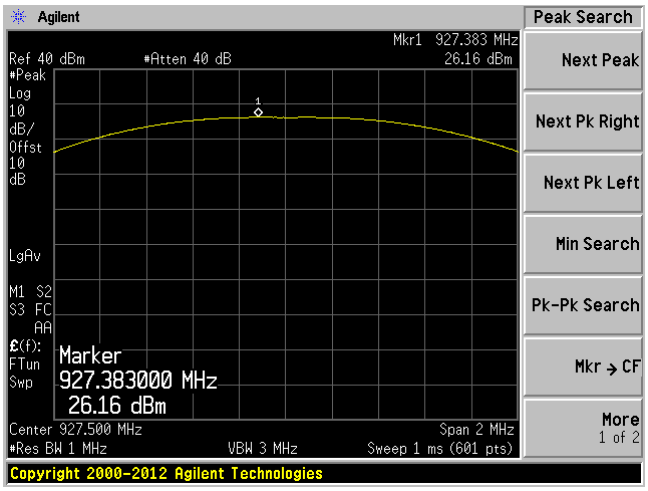


Chain 1

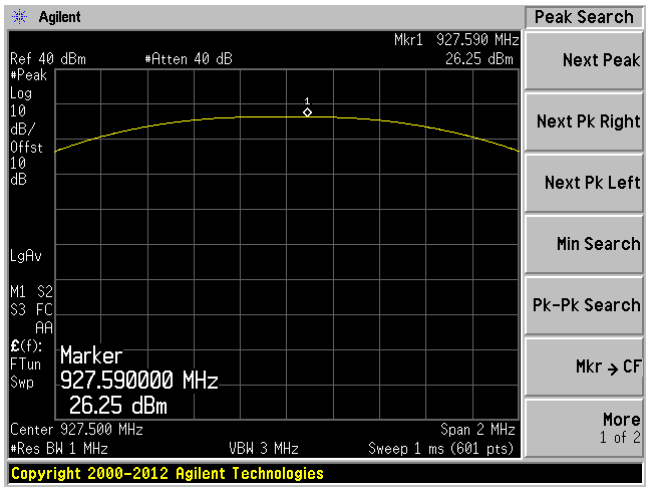


High channel

Chain 0

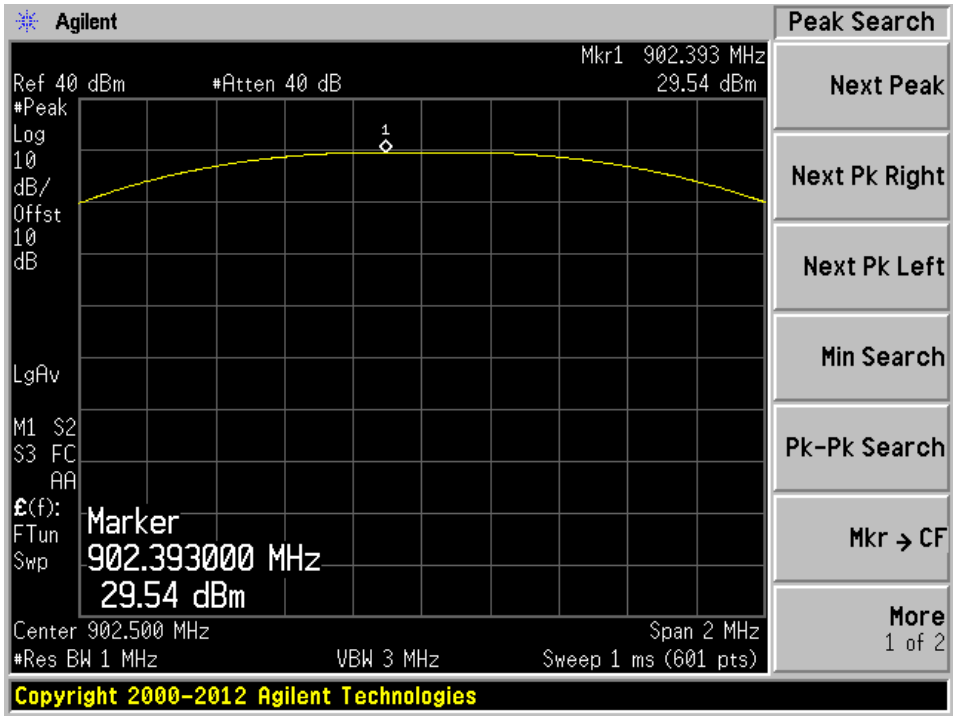


Chain 1

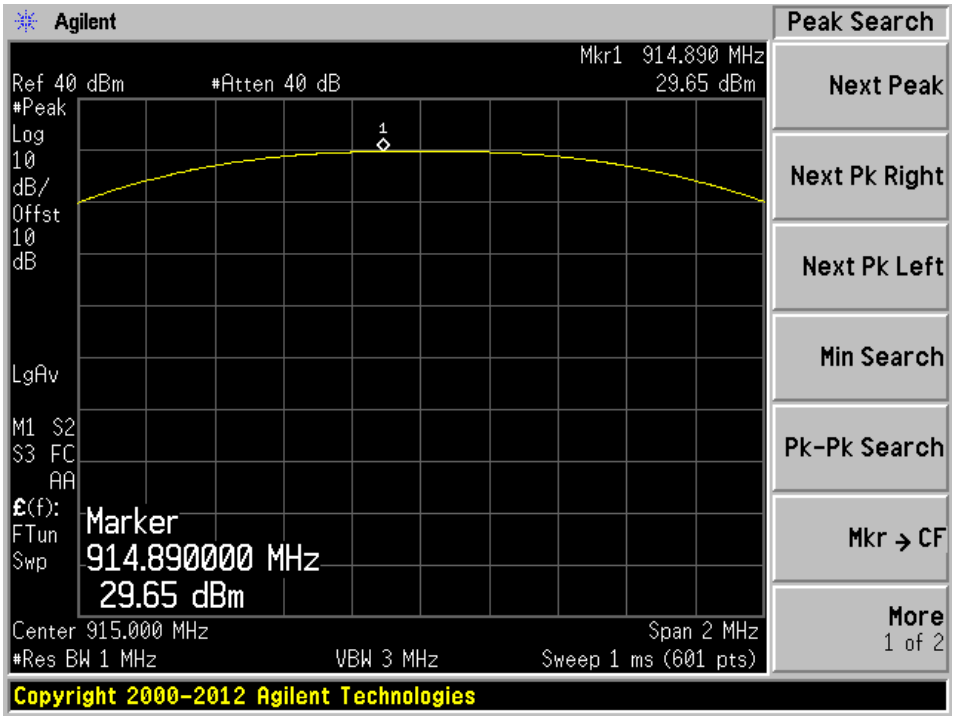


Model: IR529UBWP-915S/K9

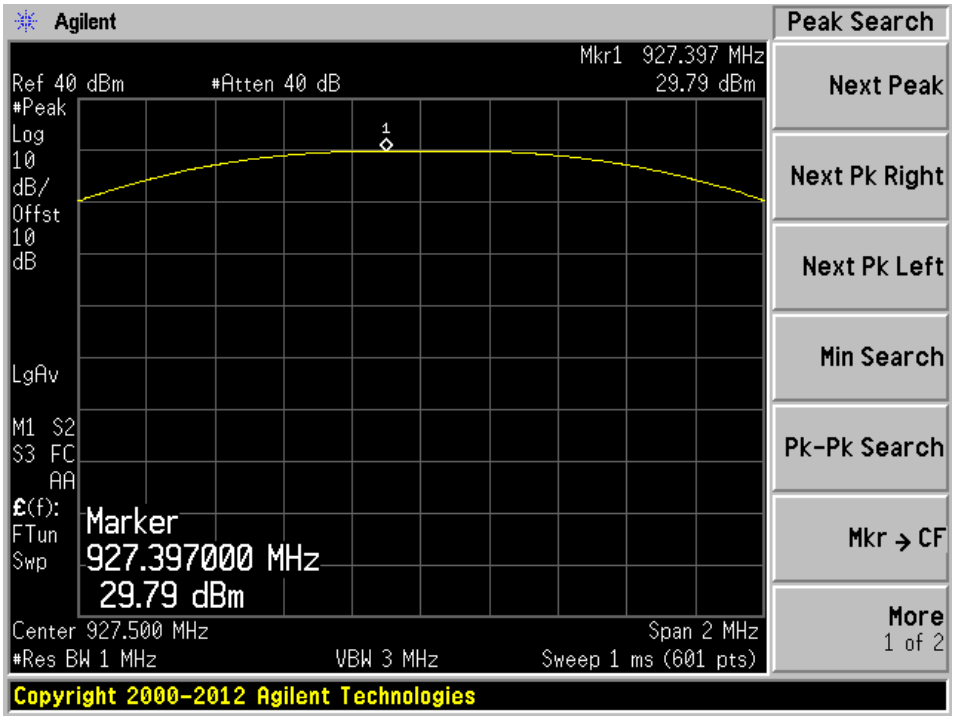
Low channel



Middle channel



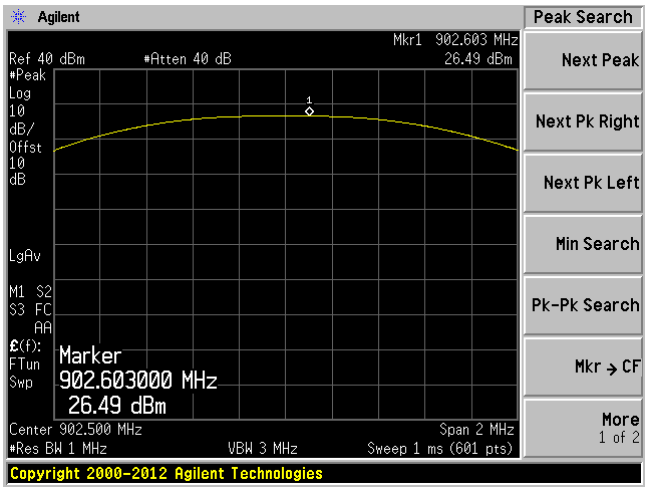
High channel



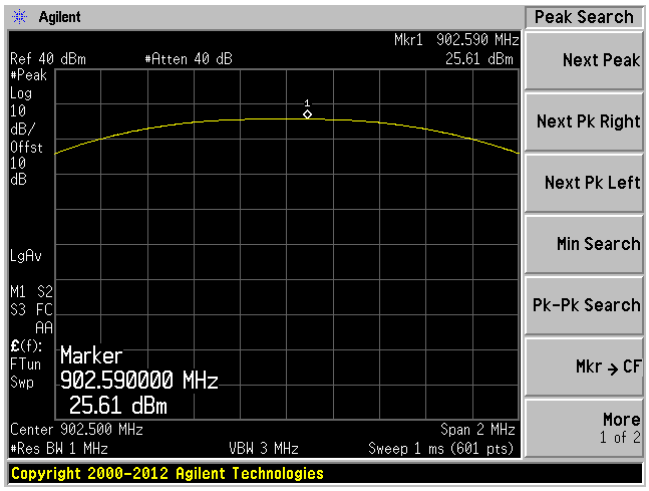
Model: IR529UBWP-915D/K9

Low channel

Chain 0

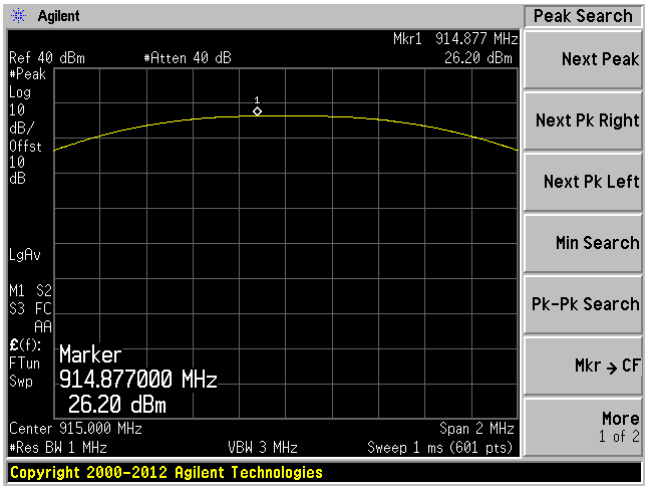


Chain 1

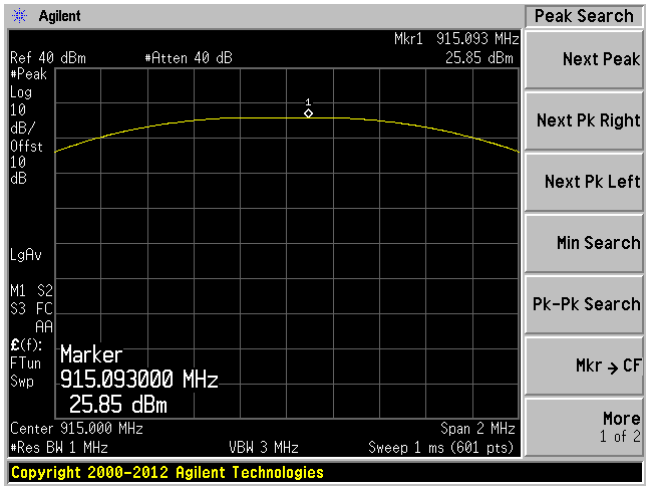


Middle channel

Chain 0

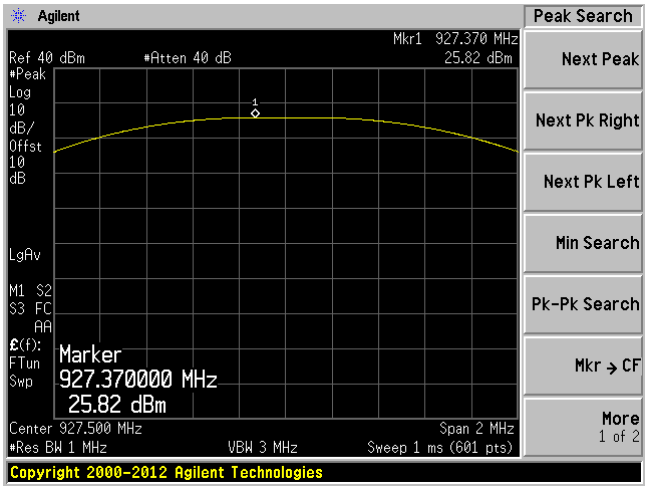


Chain 1

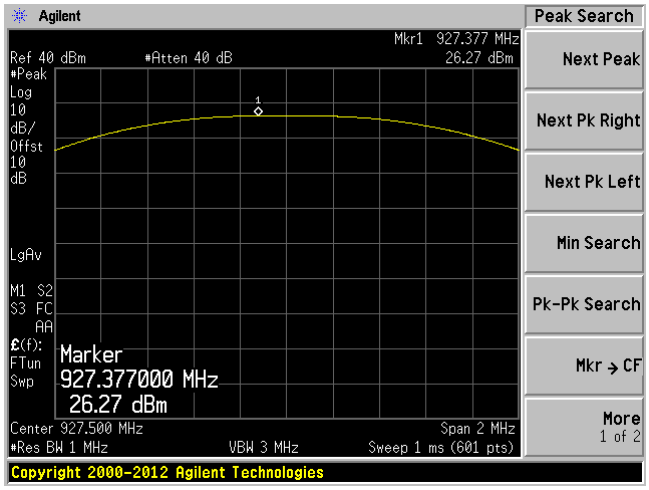


High channel

Chain 0



Chain 1



13 FCC §15.247(d) – 100 kHz Bandwidth of Band Edges

13.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

13.2 Measurement Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation

RBW = 100 kHz
VBW = 300 kHz
Sweep = coupled
Detector function = peak
Trace = max hold

13.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2016-01-19	1 year
-	SMA cable	-	C0001	Each Time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: These items shall be calibrated before every test.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

13.4 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	33 %
ATM Pressure:	101.2 kPa

The testing was performed by Frank Wang on 2016-09-28 at the RF site.

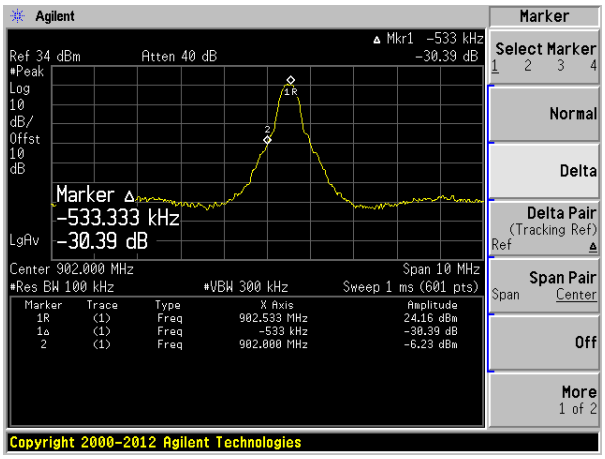
13.5 Test Results

Please refer to following pages for plots of band edge.

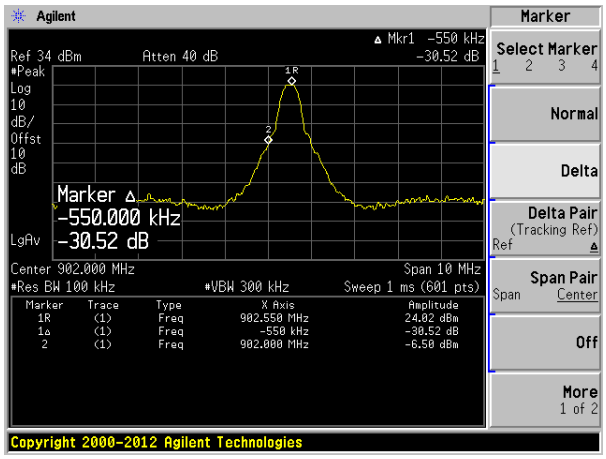
Model: IR529UWP-915D/K9

Low Channel Band Edge

Chain 0

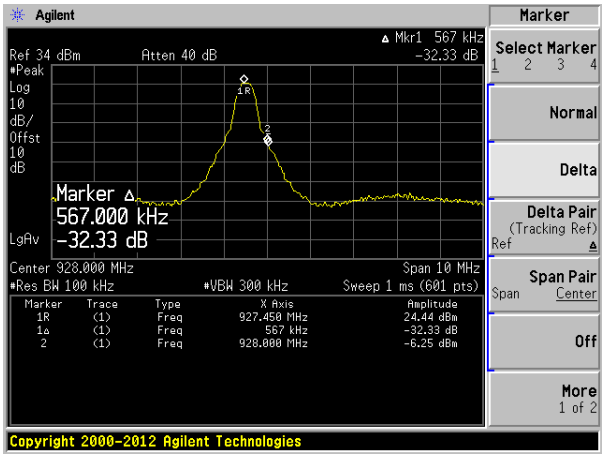


Chain 1

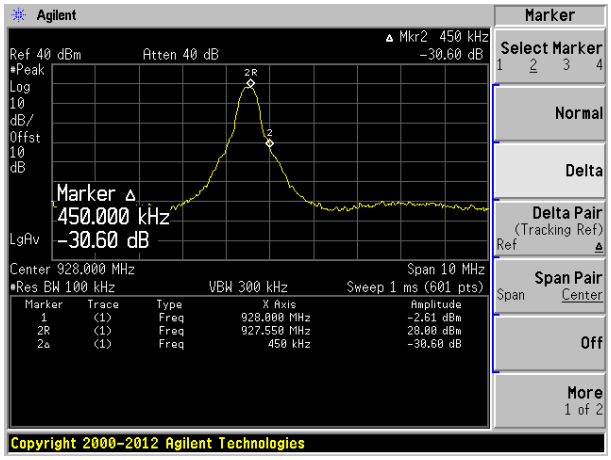


High Channel Band Edge

Chain 0

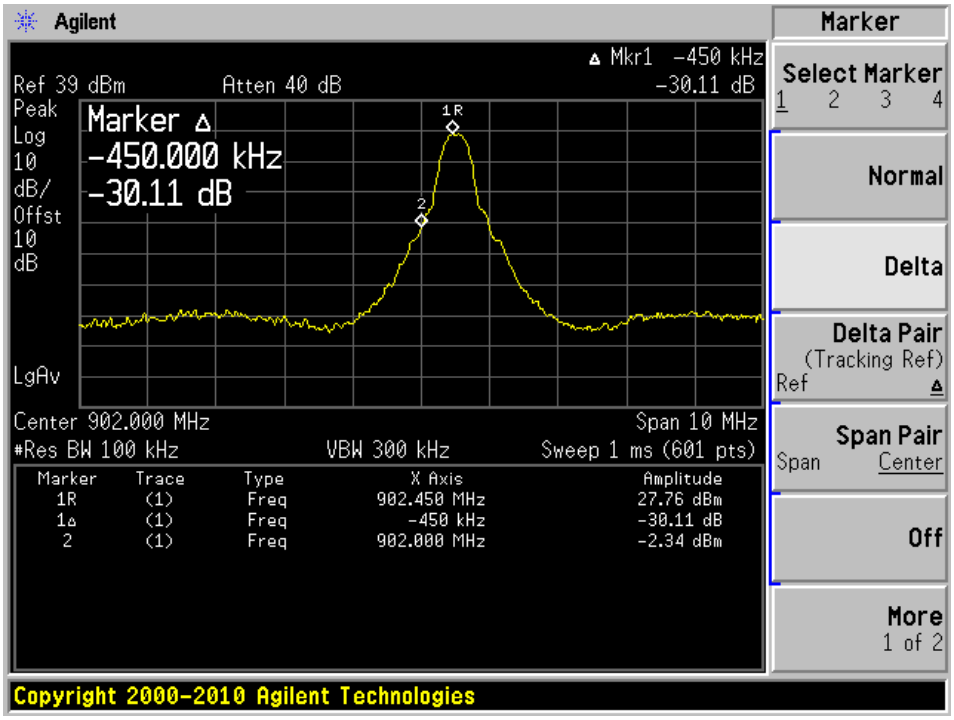


Chain 1

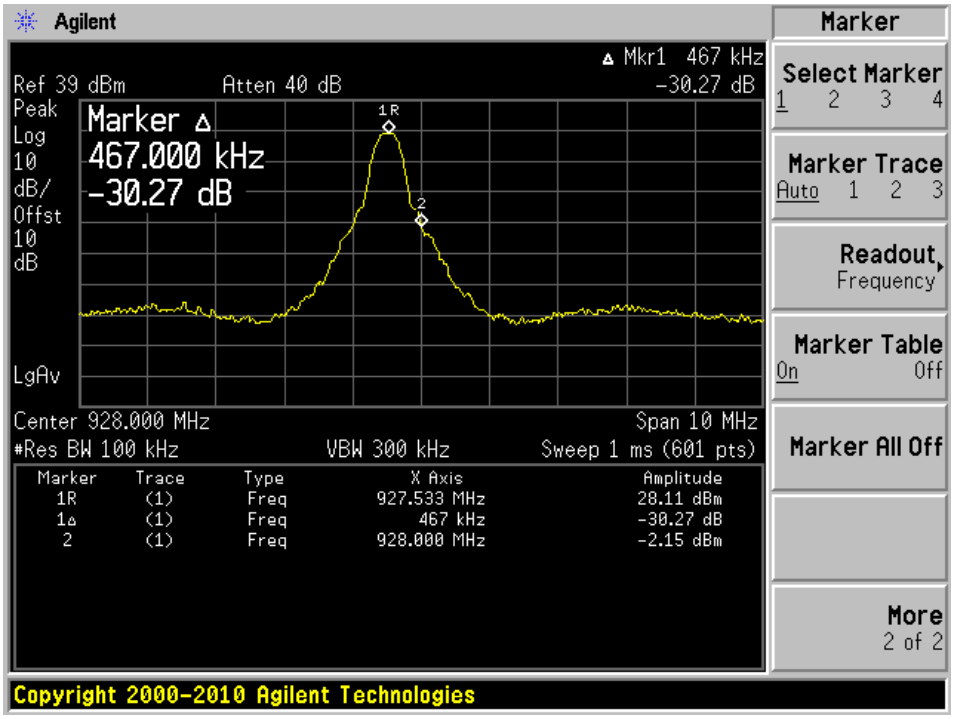


Model: IR529UBWP-915S/K9

Low Channel Band Edge



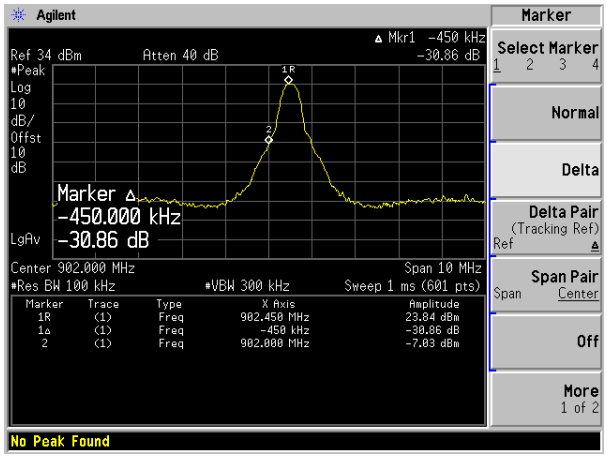
High Channel Band Edge



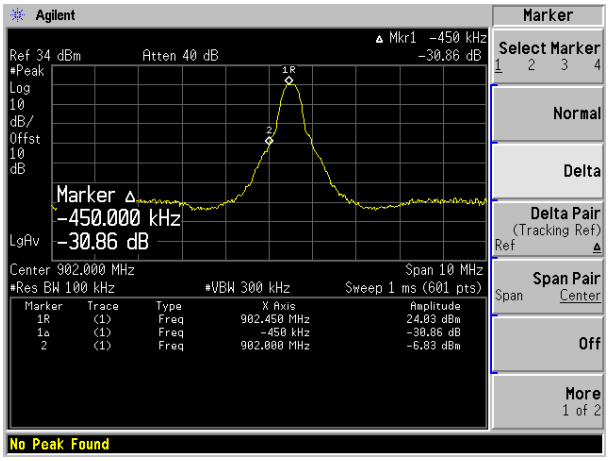
Model: IR529UBWP-915D/K9

Low Channel Band Edge

Chain 0

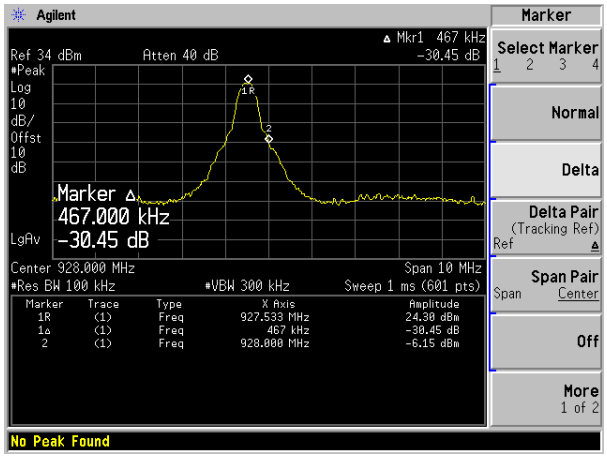


Chain 1

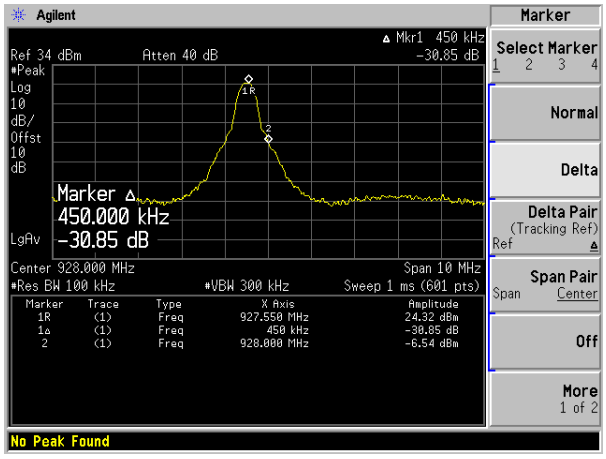


High Channel Band Edge

Chain 0



Chain 1



14 FCC §15.247(d) - Spurious Emissions at Antenna Terminals

14.1 Applicable Standard

For FCC §15.247(d) in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

14.2 Measurement Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

14.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2016-01-19	1 year
-	SMA cable	-	C0001	Each Time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: These items shall be calibrated before every test.
***Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

14.4 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	33 %
ATM Pressure:	101.2 kPa

The testing was performed by Frank Wang on 2016-09-28 at the RF site.

14.5 Test Results

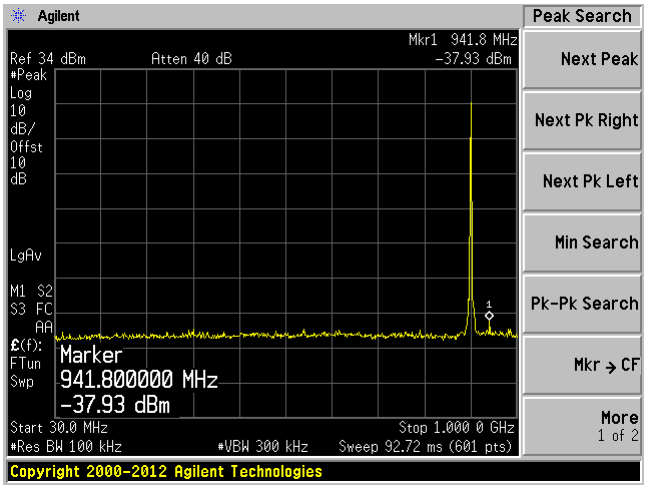
Please refer to following plots.

Model: IR529UWP-915D/K9

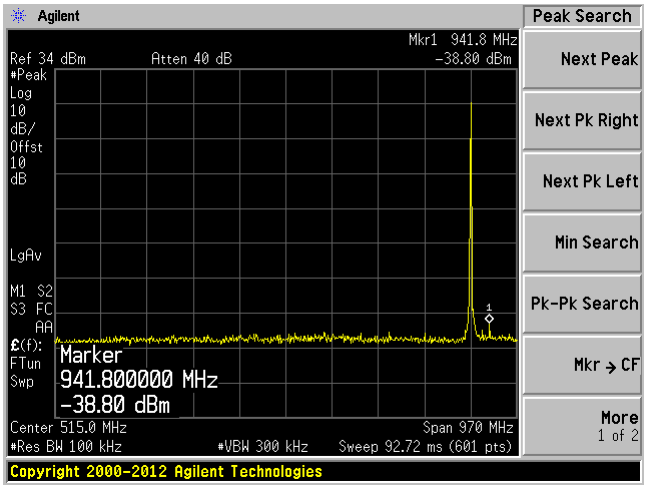
Low Channel

30 MHz to 1 GHz

Chain 0

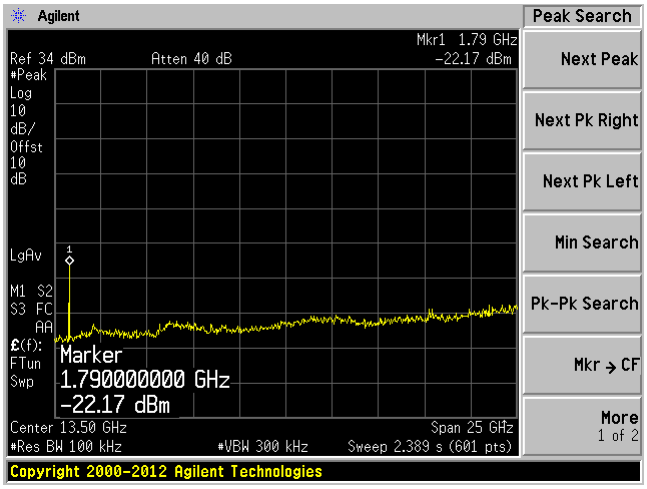


Chain 1

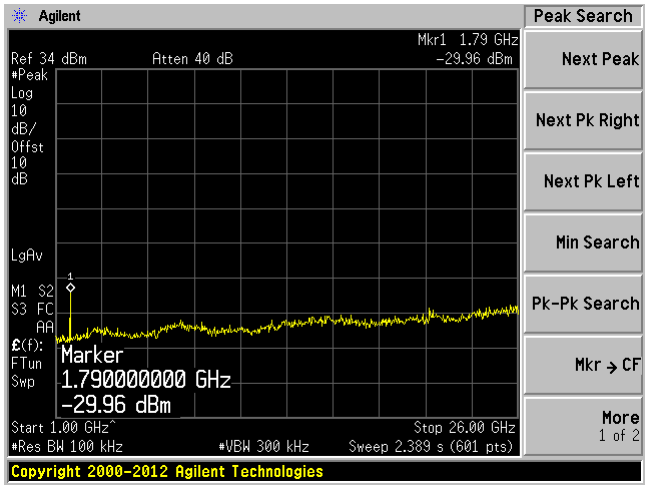


1 GHz to 26 GHz

Chain 0



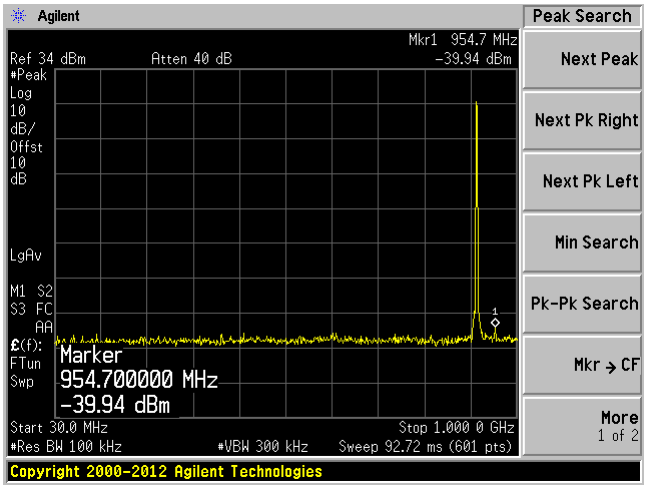
Chain 1



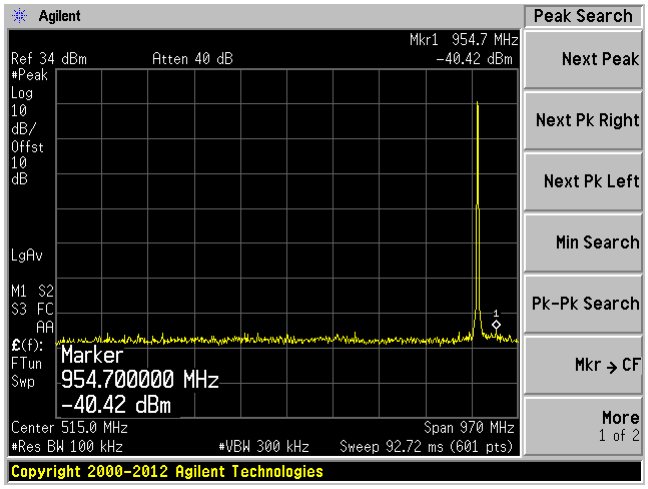
Middle Channel

30 MHz to 1 GHz

Chain 0

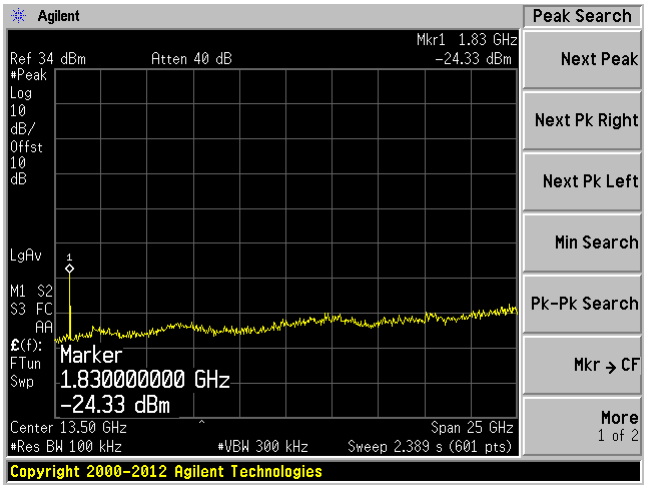


Chain 1

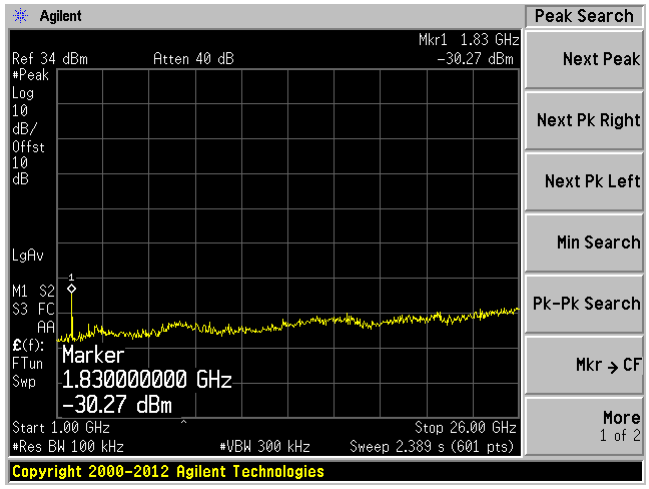


1 GHz to 26 GHz

Chain 0



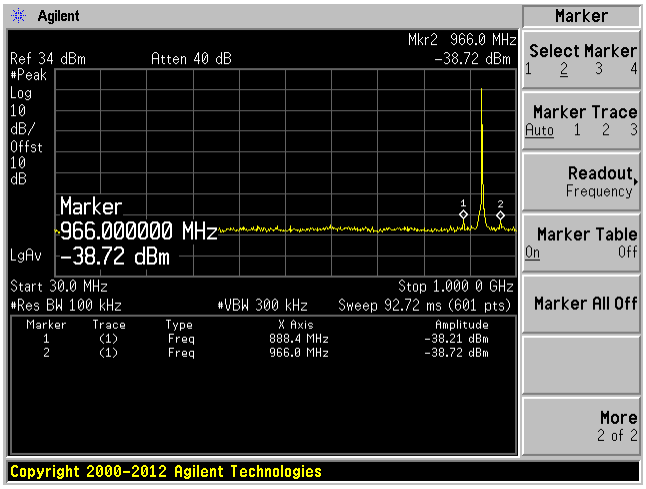
Chain 1



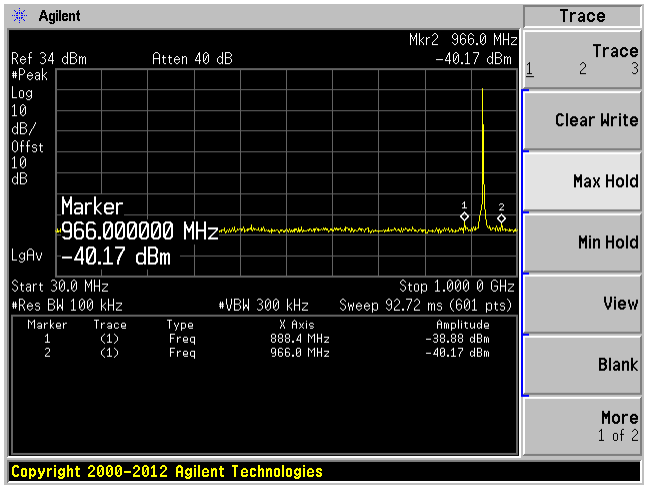
High Channel

30 MHz to 1 GHz

Chain 0

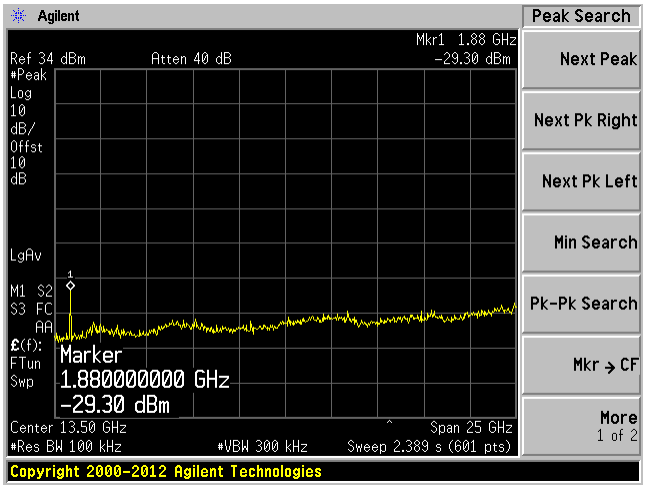


Chain 1

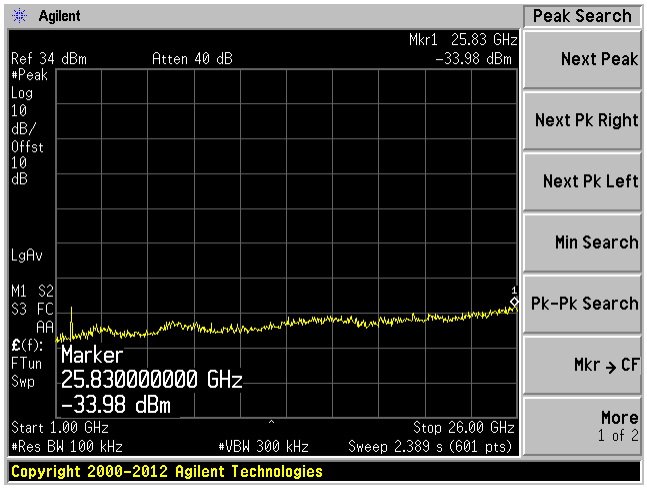


1 GHz to 26 GHz

Chain 0



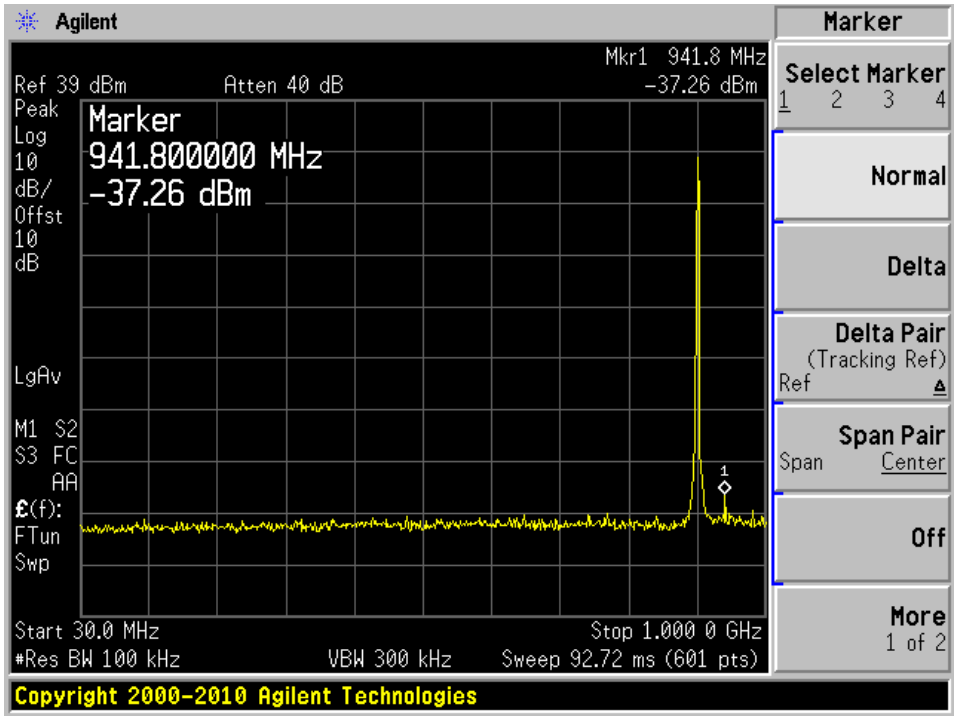
Chain 1



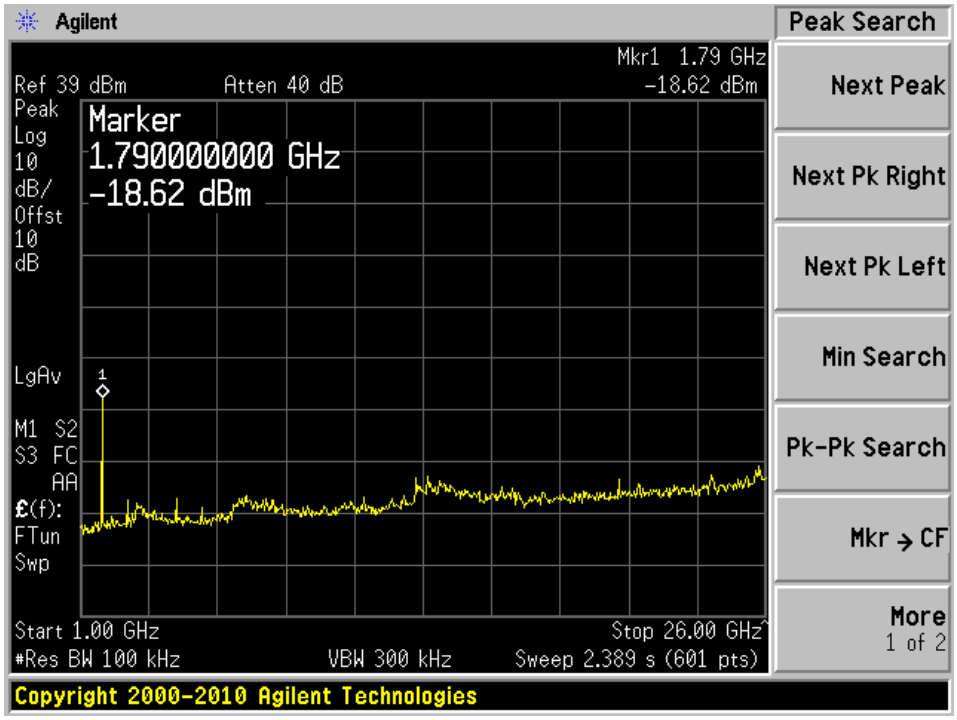
Model: IR529UBWP-915S/K9

Low Channel

30 MHz to 1 GHz

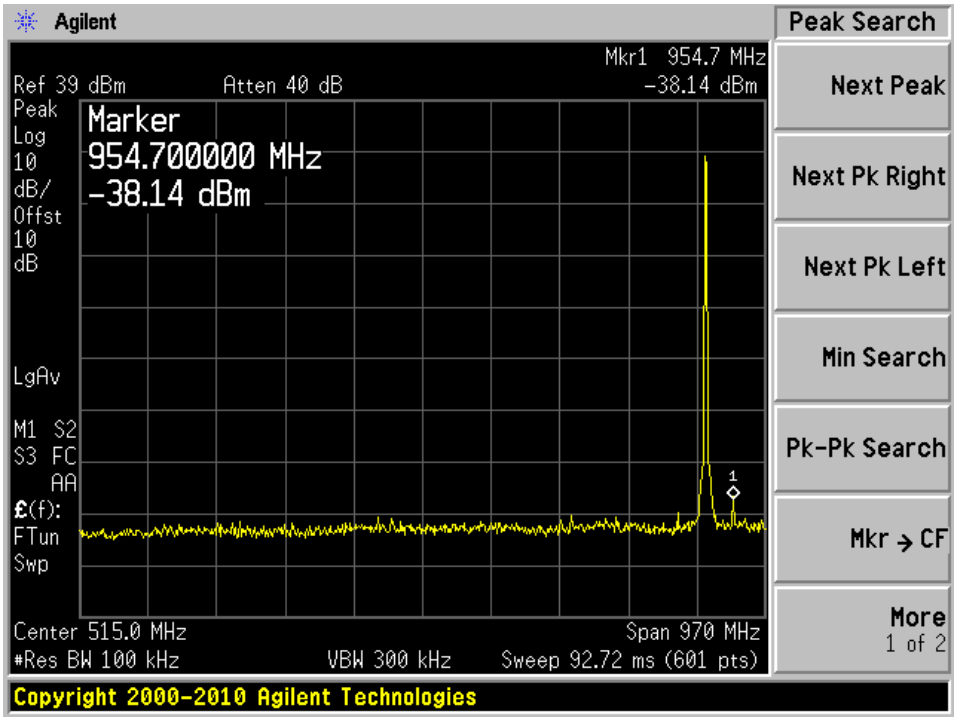


1 GHz to 26 GHz

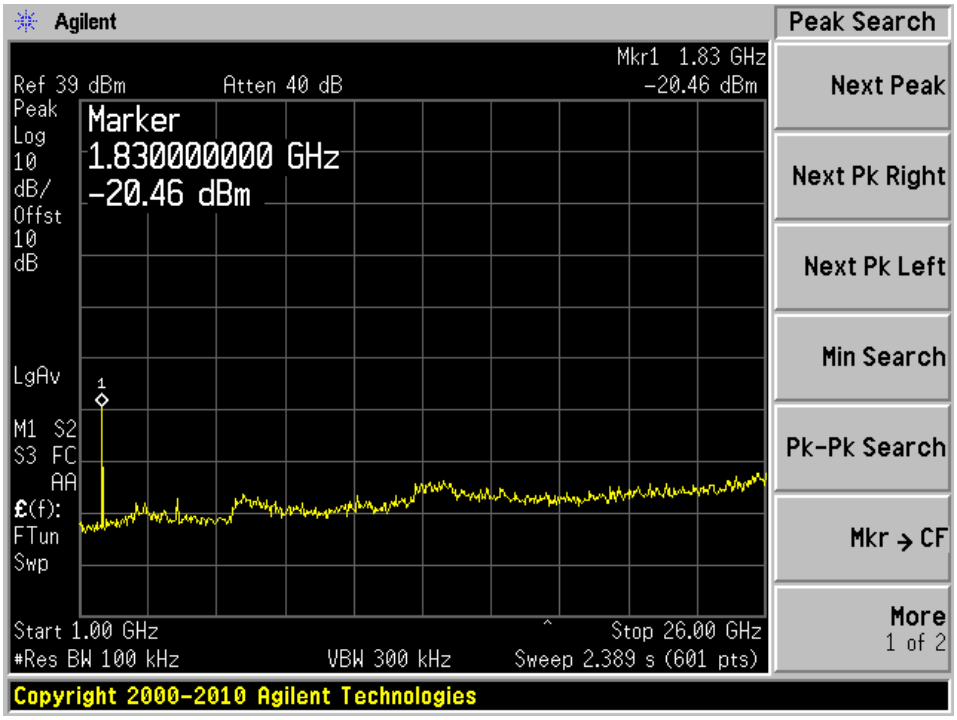


Middle Channel

30 MHz to 1 GHz

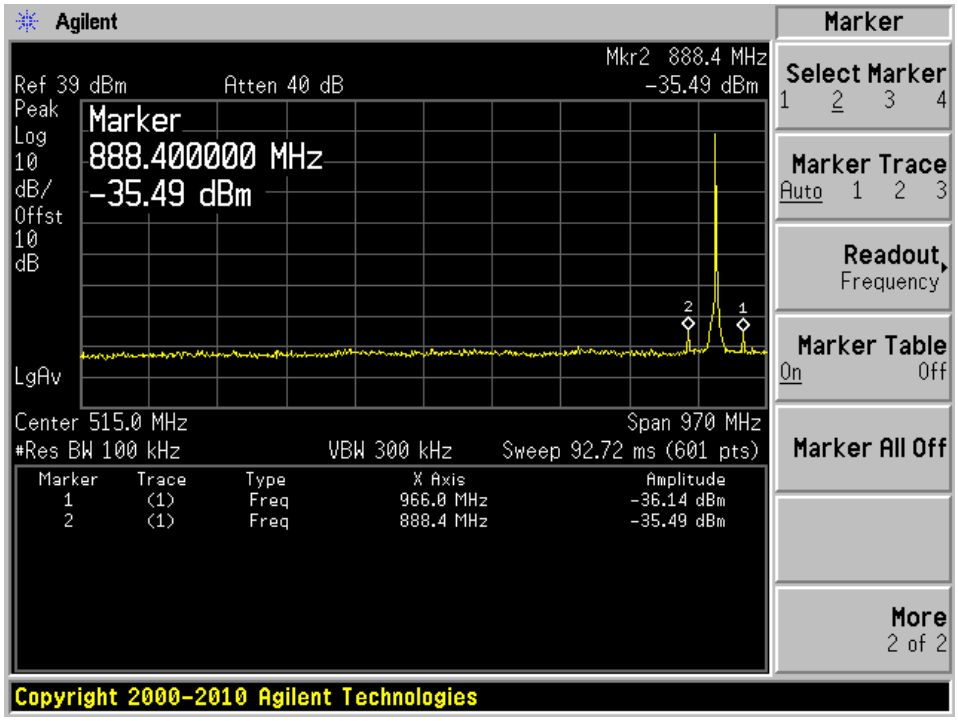


1 GHz to 26 GHz

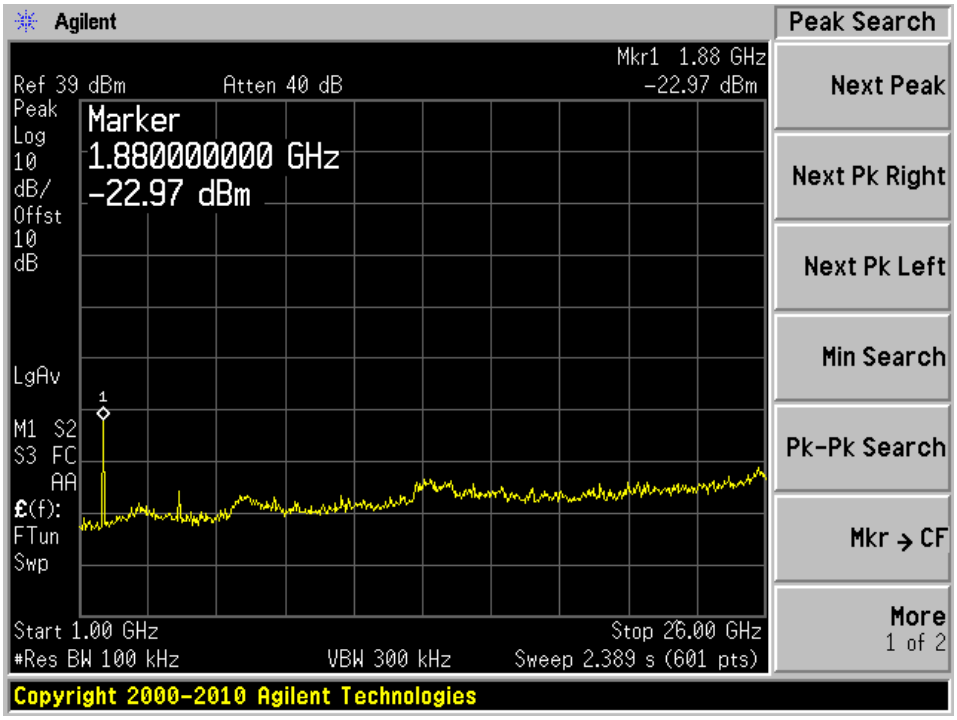


High Channel

30 MHz to 1 GHz



1 GHz to 26 GHz

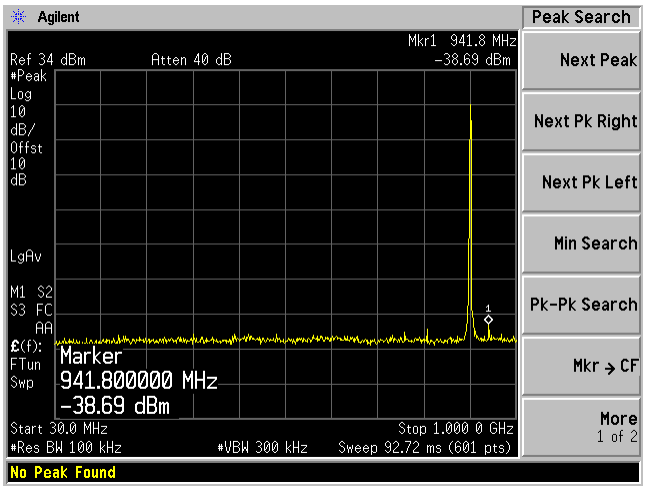


Model: IR529UBWP-915D/K9

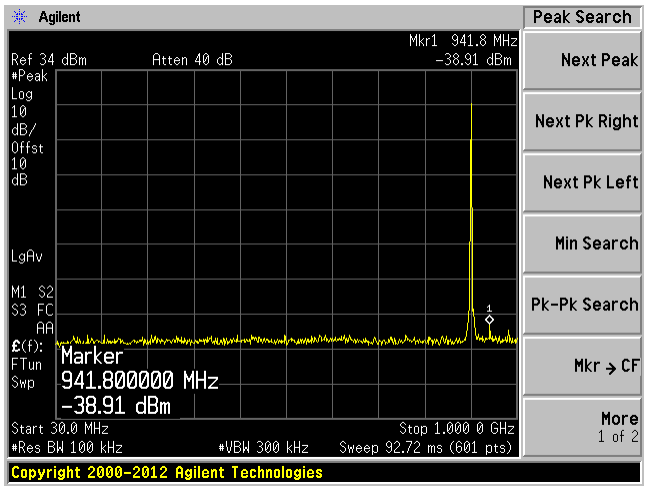
Low Channel

30 MHz to 1 GHz

Chain 0

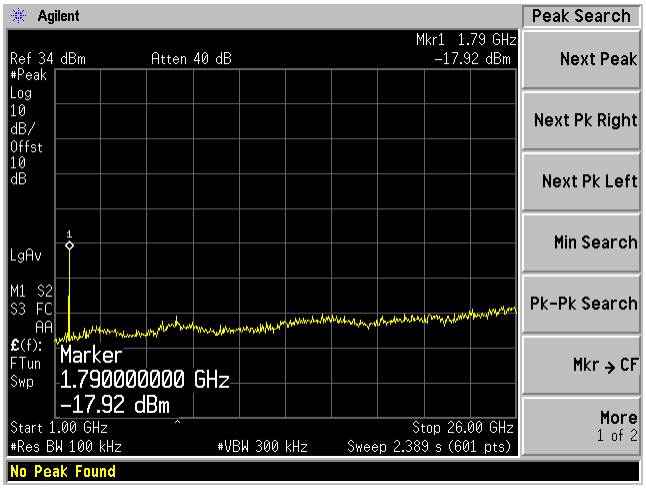


Chain 1

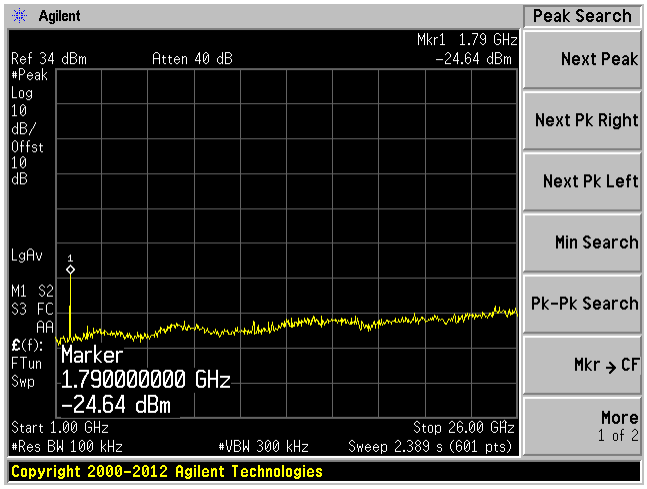


1 GHz to 26 GHz

Chain 0



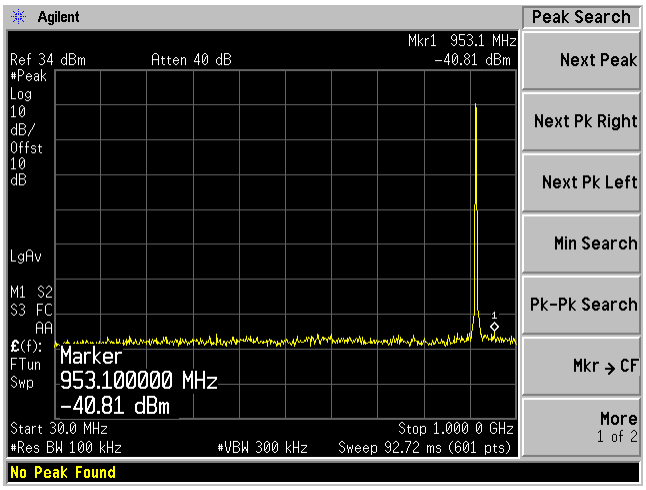
Chain 1



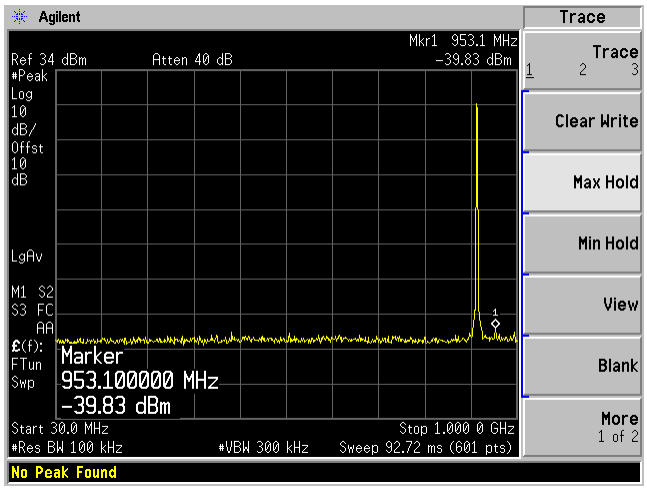
Middle Channel

30 MHz to 1 GHz

Chain 0

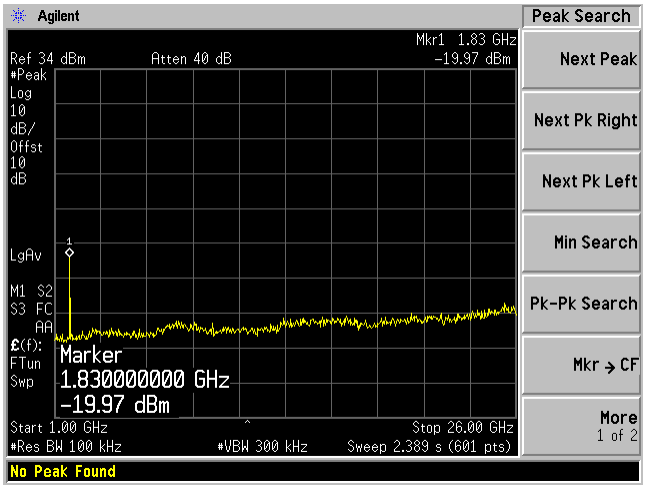


Chain 1

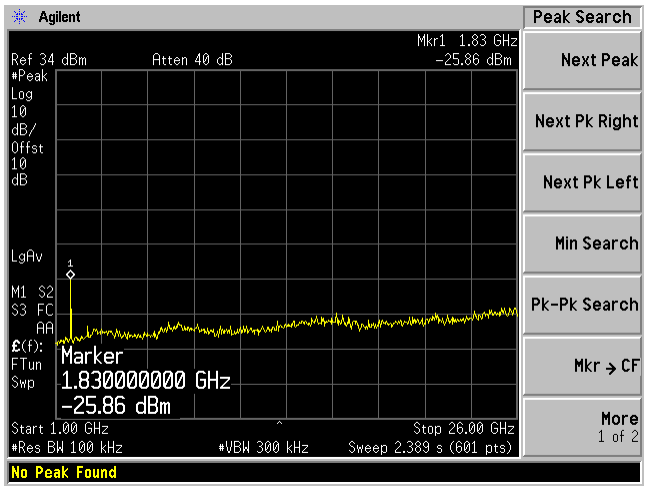


1 GHz to 26 GHz

Chain 0



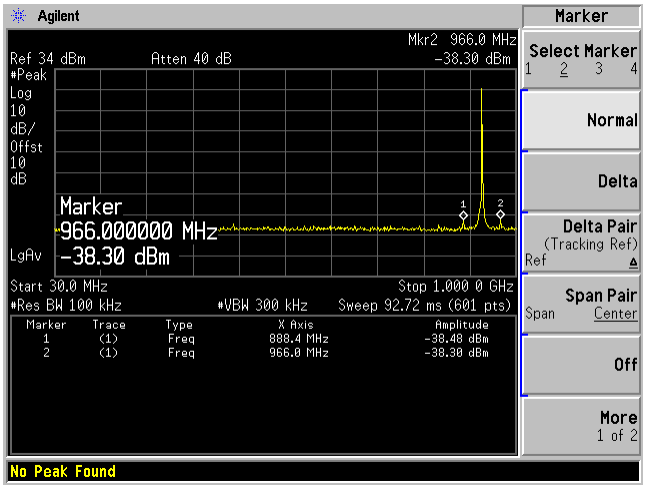
Chain 1



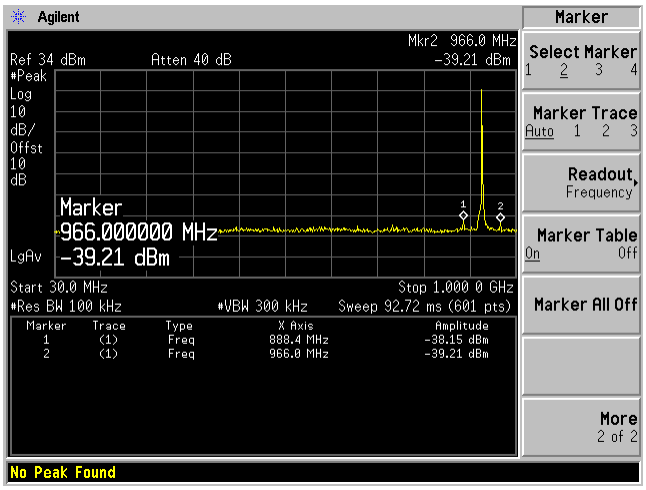
High Channel

30 MHz to 1 GHz

Chain 0

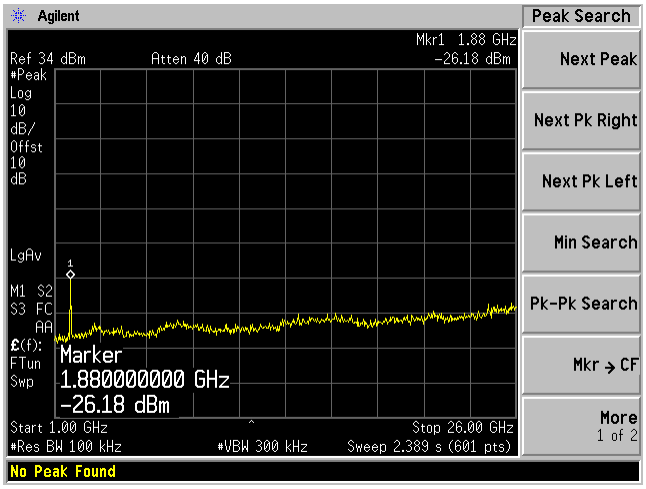


Chain 1

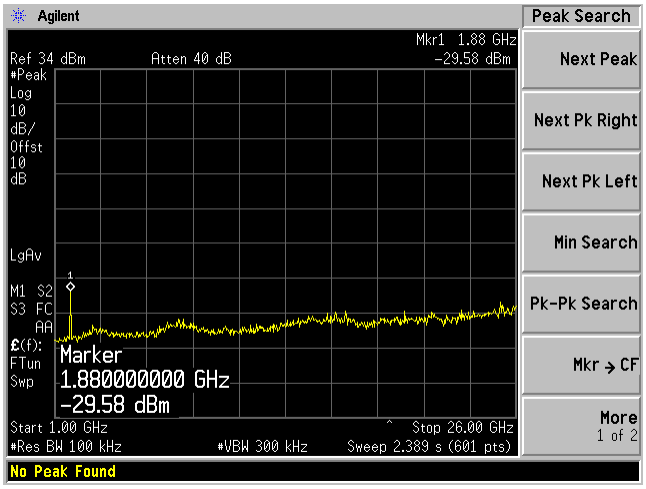


1 GHz to 26 GHz

Chain 0



Chain 1



Note: All emissions was ensured that they were 20 dB below the fundamental signal.