



**FCC 47 CFR PART 15 SUBPART E**

**CLASS III PERMISSIVE CHANGE**

**CERTIFICATION TEST REPORT**

**FOR**

**Intelligent Backhaul Radio UNII 5.6GHz and 5.8GHz Bands**

**MODEL NUMBER: IBR-121x-83-NA**

**FCC ID: 2AAEH-105**

**REPORT NUMBER: 15U20219-4 Revision A**

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---	3/20/15	Initial release	F. de Anda
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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** CBF NETWORKS, INC., DBA FASTBACK NETWORKS  
2460 N. FIRST STREET, SUITE 200  
SAN JOSE, CA 95131, USA

**EUT DESCRIPTION:** Intelligent Backhaul Radio

**MODEL:** IBR-121x-83-NA

**SERIAL NUMBER:** 40314380088 (conducted), 40314390023 (radiated)

**DATE TESTED:** February 20, 2015 – March 3, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For  
UL Verification Services Inc. By:



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Francisco deAnda  
PROJECT LEAD/ PROGRAM MANAGER  
UL VERIFICATION SERVICES INC.

Tested By:



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Chris Xiong  
EMC ENGINEER  
UL VERIFICATION SERVICES INC.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, ANSI C63.10-2009.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street		47266 Benicia Street	
<input type="checkbox"/>	Chamber A	<input type="checkbox"/>	Chamber D
<input type="checkbox"/>	Chamber B	<input type="checkbox"/>	Chamber E
<input type="checkbox"/>	Chamber C	<input type="checkbox"/>	Chamber F

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

Fixed Point-to-Point radio in 5.6GHz unlicensed band with a proprietary communication management interface Intelligent Backhaul Radio.

This device uses 40MHz, 20MHz and 10MHz bandwidths with QAM4, QAM16, QAM64, QAM256 modulation. It transmits dual stream uncorrelated MIMO.

### 5.2. CLASS III PERMISSIVE CHANGE

Additional frequencies added to 5.6 GHz band. New non straddle high channel added. Supported frequency range remains the same.

#### 5.6 GHz Band

Granted Frequency Ranges		Proposed CLASS III PERMISSIVE CHANGE
Bandwidth (MHz)	Frequency Range (MHz)	
10	5478 - 5725	5478 - 5725
20	5482 - 5725	5482 - 5725
40	5492 - 5725	5492 - 5725

The additional frequencies for the 5.6 GHz Band are:

10 MHZ BW Frequency (MHz)	20 MHZ BW Frequency (MHz)	40 MHZ BW Frequency (MHz)
X	5710	5725

### 5.8 GHz Band

Granted Frequency Ranges		Proposed CLASS III PERMISSIVE CHANGE
Bandwidth (MHz)	Frequency Range (MHz)	
10	5731-5844	
20	5736-5839	
40	5746-5829	

The additional frequencies for the 5.8 GHz Band are:

10 MHZ BW Frequency (MHz)	20 MHZ BW Frequency (MHz)	40 MHZ BW Frequency (MHz)
5725	5725	5725

### 5.3. MAXIMUM OUTPUT POWER

For the additional frequencies, the transmitter has a maximum conducted output power as follows:

#### 5.6 GHz BAND

Bandwidth (MHz)	Frequency (MHz)	Mode	Output Power (dBm)	Output Power (mW)
<b>5.6 GHz Band, 2Tx - IBR-121x-83-NA</b>				
20	5710	FDD	13.52	22.49

#### 5.8 GHz BAND

Bandwidth (MHz)	Frequency (MHz)	Mode	Output Power (dBm)	Output Power (mW)
<b>5.8 GHz Band, 2Tx - IBR-120x-83-NA</b>				
10	5725	FDD	10.71	11.78
20	5725	FDD	13.37	21.73
40	5725	FDD	15.25	33.50

### 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Dipole array antenna, with a maximum gain of 14.5dBi for IBR-121x-83-NA.

### 5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Build SVN Revision: 5248

The test utility software used during testing was Micro monitor 1.6.0

### 5.6. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

All radiated testing was performed with the EUT in normal use orientation.

Based on the baseline scan, the worst-case data rates were:

10MHz bandwidth QAM 4

20MHz bandwidth QAM 4

40MHz bandwidth QAM 4

Data rate 30 Msamples/s for all bandwidths

## 5.7. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	Think Pad	R9-D497T 11/04	QDS-BRCM 1046
POE	PHIHONG	POE36U-1AT-R	P21601123D1	N/A
AC/DC Adapter	Lenovo	N/A	11S45N0113Z1ZH819P0FN	N/A

### I/O CABLES

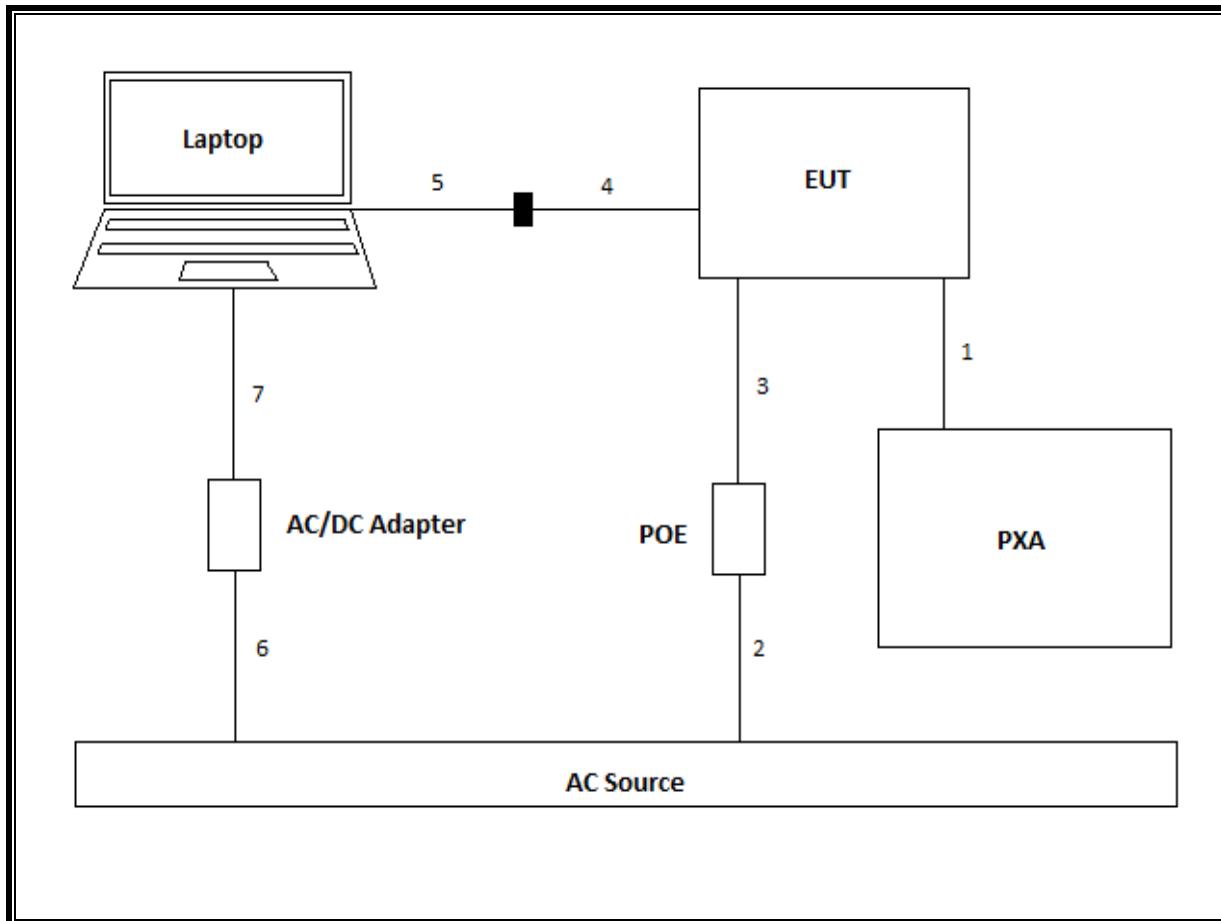
I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	U.FL	Sheilded	0.3	N/A
2	AC	2	3 Prong	Un-Sheilded	1	N/A
3	POE/LAN	1	RJ45	Sheilded	1	N/A
4	USB	1	USB	Sheilded	0.3	N/A
5	Serial	1	9 Pin Sub D	Sheilded	1	N/A
6	AC	2	3 Prong	Un-Sheilded	1	N/A
7	DC	1	Barrel	Un-Sheilded	1	N/A

### TEST SETUP

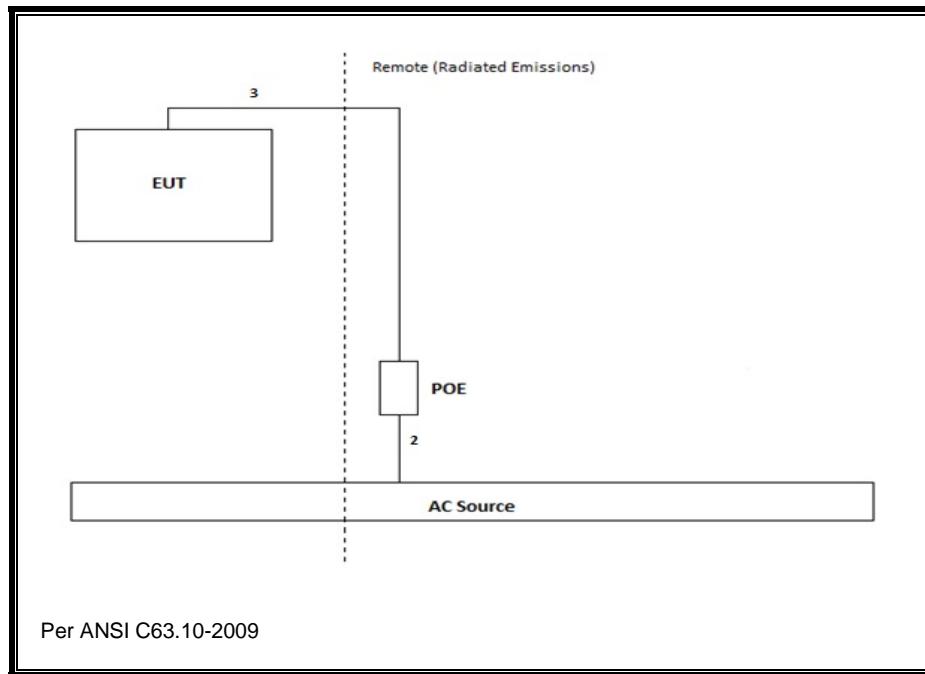
The EUT is a P-P outdoor radio used as a stand-alone device. Test software exercised the radio module.

**SETUP DIAGRAM FOR TESTS**

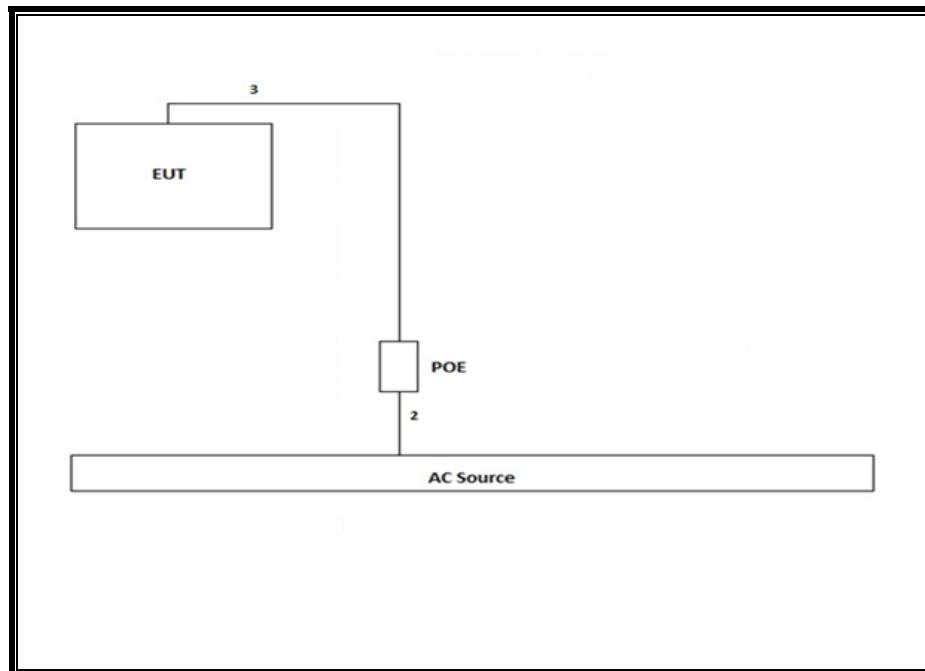
**CONDUCTED**



**RADIATED**



**AC LINE CONDUCTED**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List						
Description	Manufacturer	Model	T No.	Cal Date	Cal Due	
<b>Chamber G</b>						
Antenna, Horn 18 GHz	ETS Lindgren	3117	862	04/14/14	04/14/15	
Antenna, Biconolog, 30MHz-1GHz	Sunol Sciences	JB3	899	05/14/14	04/27/15	
High Pass Filter, fc: 3.0GHz, 50 Ohms	Micro-Tronics	HPM17543	898	05/13/14	05/13/15	
Low Pass Filter, fc: 5GHz, 50 Ohms	Micro-Tronics	LPS17541	892	05/13/14	05/13/15	
High Pass Filter, fc: 6GHz, 50 Ohms	Micro-Tronics	HPS17542	893	05/14/14	05/13/15	
RF PreAmplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	491	05/15/15	06/05/15	
Preamp, 1000MHz	Sonoma	310N	834	05/16/15	06/05/15	
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	905	05/17/15	05/17/15	
<b>Conducted</b>						
Spectrum Analyzer	Agilent	E4440A	189	05/09/14	05/09/15	
Power Meter, P-series single channel	Agilent	N1911A	382	04/09/14	04/09/15	
Power Sensor, Peak and average, 50 MHz to 6 GHz, 5 MHz BW	Agilent	E9323A	400	05/02/14	05/02/15	
Power Meter, P-series single channel	Agilent	N1911A	385	04/30/14	04/30/15	
Power Sensor, Peak and average, 50 MHz to 18 GHz, 5 MHz BW	Agilent	E9327A	117	05/15/14	05/15/15	
LISN for Conducted Emissions CISPR-16	FCC	50/250-25-2	24	01/16/15	01/16/16	
Rohde & Schwarz	ESCI 7	100773	212	08/14/14	08/14/15	

## 7. MEASUREMENT METHODS

26 dB Emission BW: KDB 789033 D02 v01r, Section C.

Conducted Output Power: KDB 789033 D02 v01, Section E.2.b (Method SA-1).

Power Spectral Density: KDB 789033 D02 v01, Section F.

Unwanted emissions in restricted bands: KDB 789033 D02 v01, Sections G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v01, Sections G.3, G.4, and G.6.

KDB 662911 D02 MIMO with Cross-Polarized Antennas v01

## 8. ANTENNA PORT TEST RESULTS

## 8.1. ON TIME AND DUTY CYCLE

## LIMITS

None; for reporting purposes only.

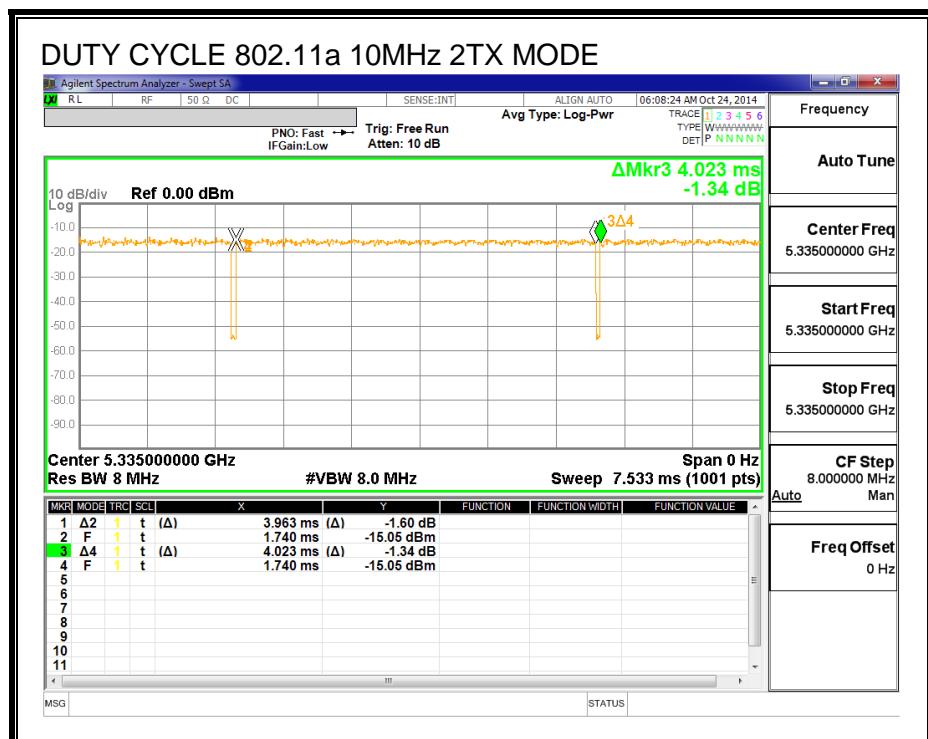
## **PROCEDURE**

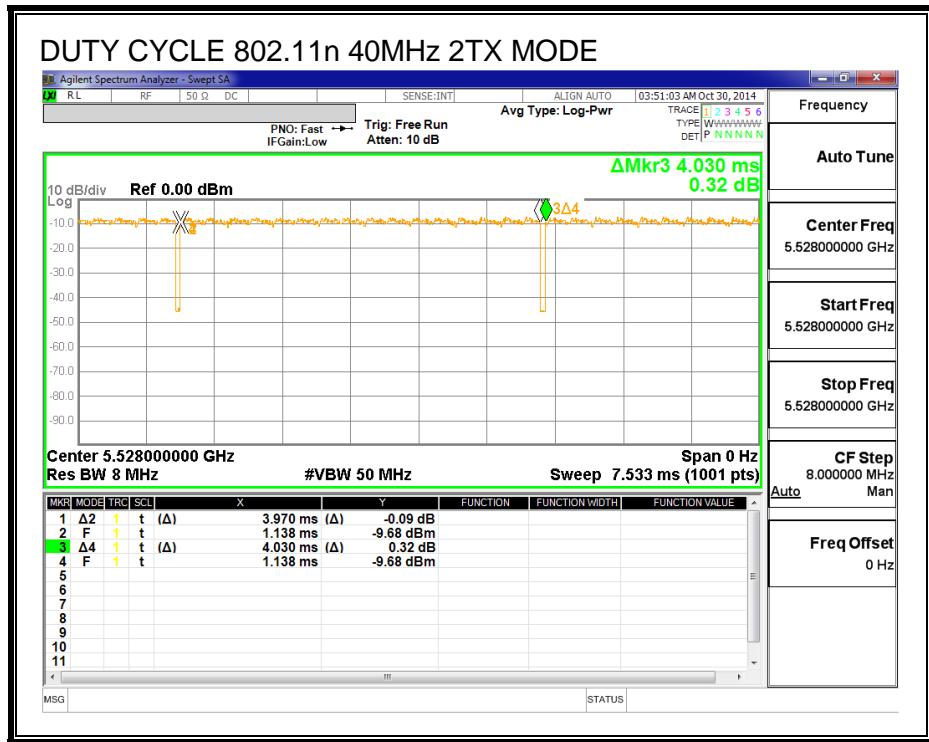
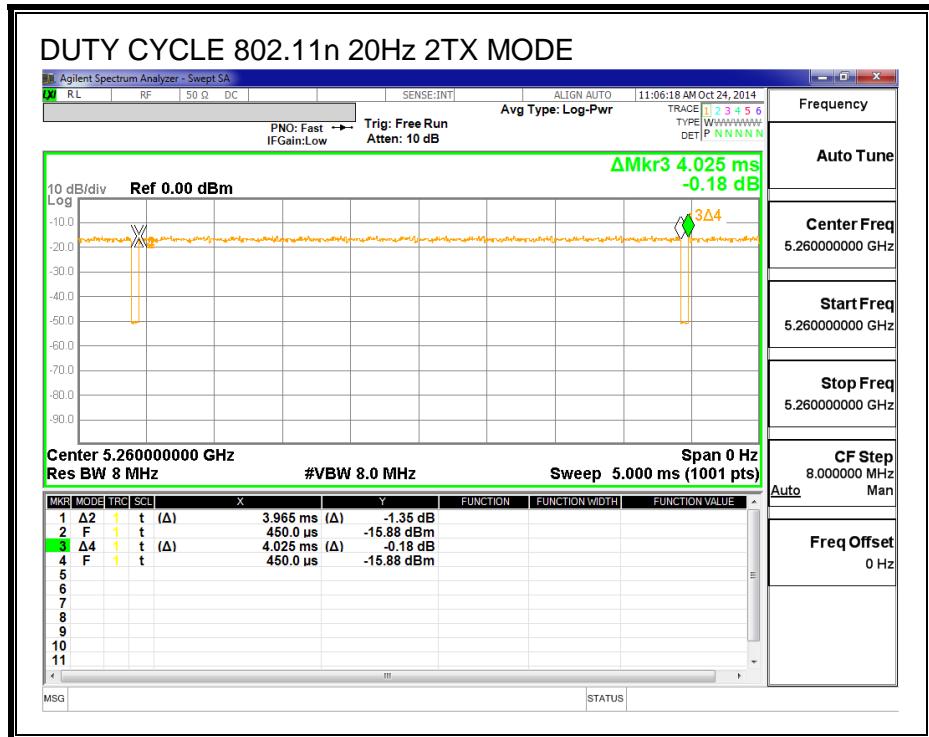
KDB 789033 Zero-Span Spectrum Analyzer Method.

## ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11a 10MHz 2TX	3.963	4.023	0.985	98.51%	0.00	0.010
802.11n 20MHz 2TX	3.965	4.025	0.985	98.51%	0.00	0.010
802.11n 40MHz 2TX	3.970	4.030	0.985	98.51%	0.00	0.010

## DUTY CYCLE PLOTS





## 8.2. 20MHz 2Tx MODE IN THE 5.6 GHz BAND (IBR-121x-83-NA)

### 8.2.1. 26 dB BANDWIDTH

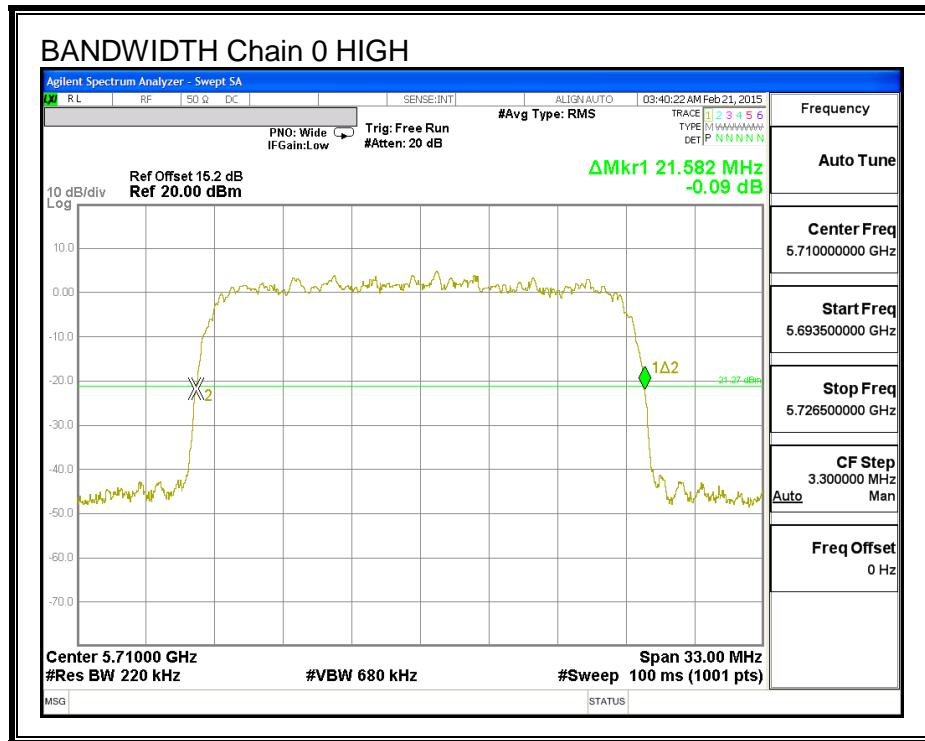
#### LIMITS

None; for reporting purposes only.

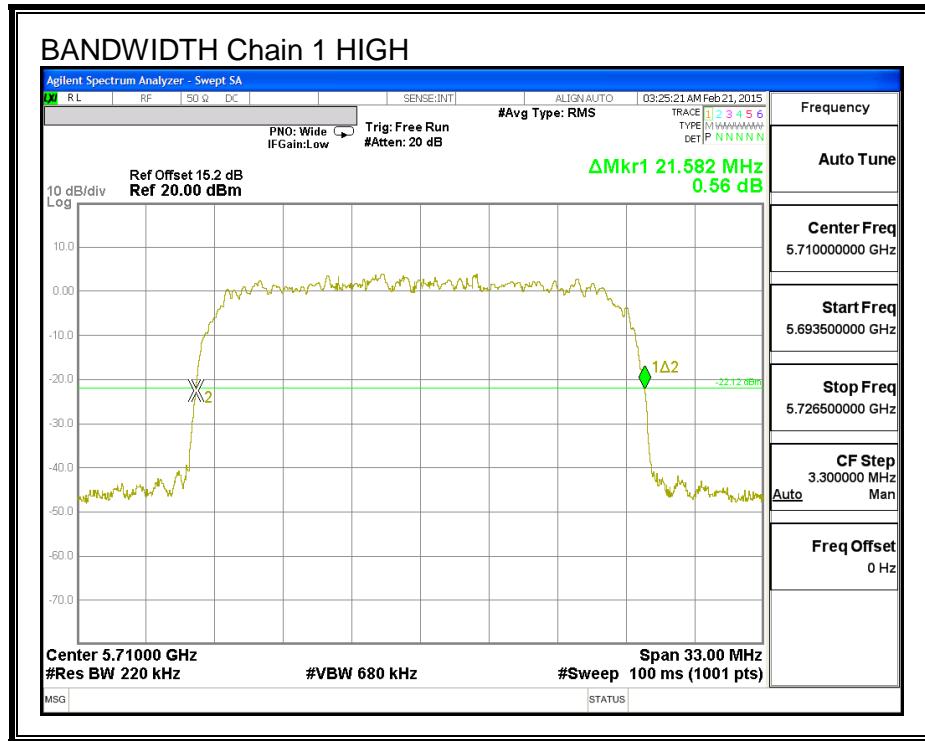
#### RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
High	5710	21.582	21.582

## 26 dB BANDWIDTH, Chain 0



## 26 dB BANDWIDTH, Chain 1



## 8.2.2. OUTPUT POWER AND PSD

### LIMITS

#### FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain.

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
14.50	14.50	14.50

## RESULTS

### Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
High	5710	21.58	14.50	14.50	15.50	2.50

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power & PSD
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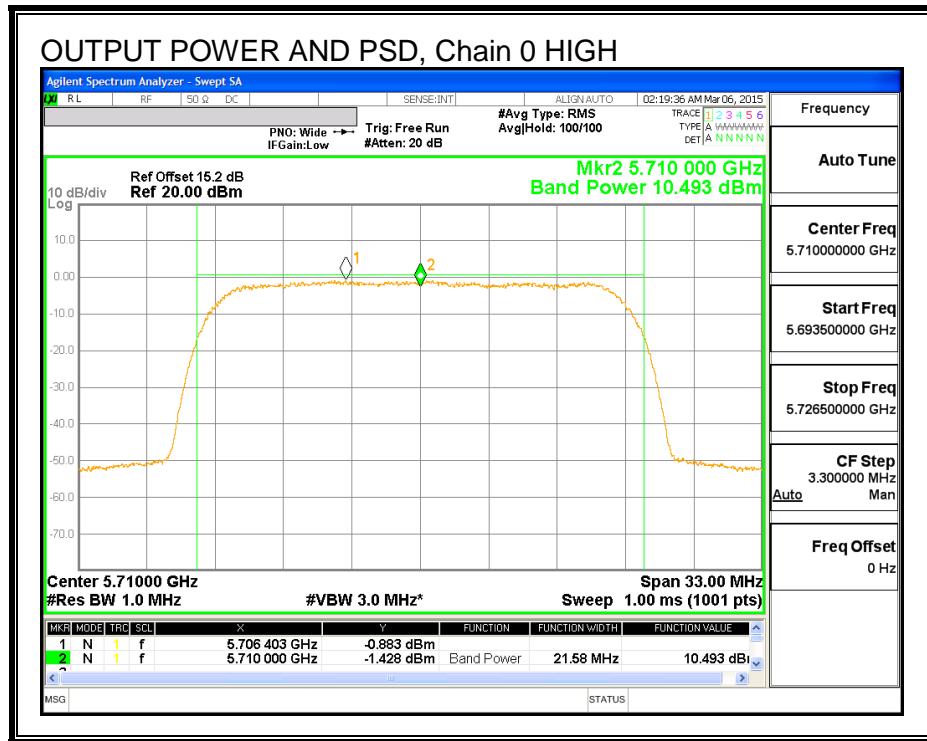
### Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
High	5710	10.49	10.52	13.52	15.50	-1.98

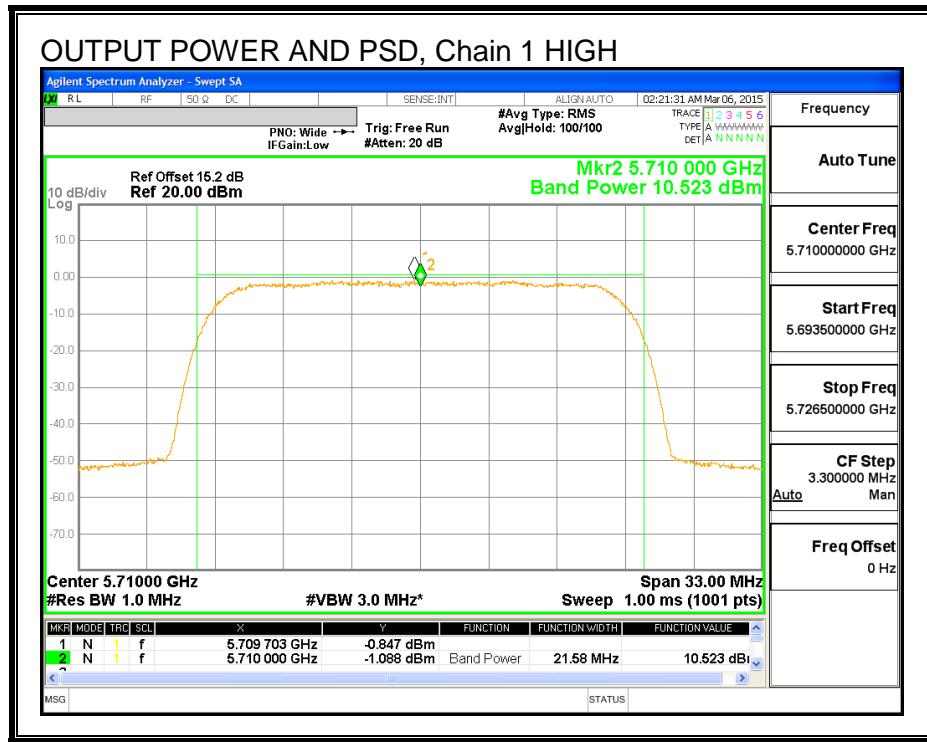
### PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
High	5710	-0.88	-0.85	2.15	2.50	-0.35

## OUTPUT POWER AND PSD, Chain 0



## OUTPUT POWER AND PSD, Chain 1



### 8.2.3. CONDUCTED BANDEDGE

#### LIMITS

FCC §15.205 and §15.209

#### PART 15, SUBPART E

##### Radiated LIMIT:

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

Conducted: Limits

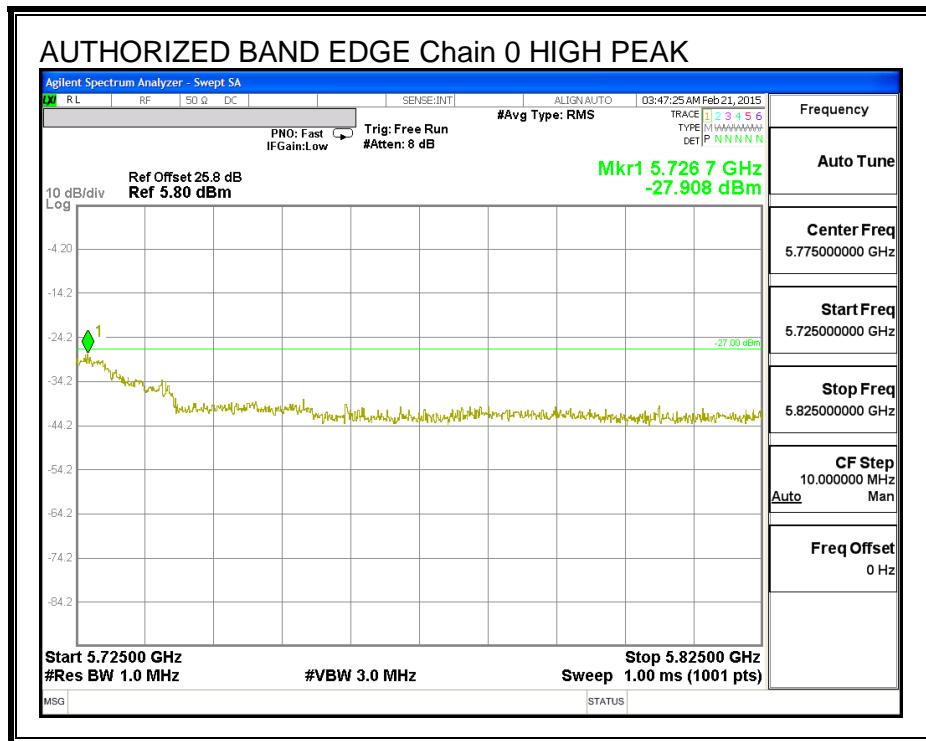
#### Procedure

KDB 789033 D02 General UNII Test Procedures New Rules v01, Section II, G5, G6

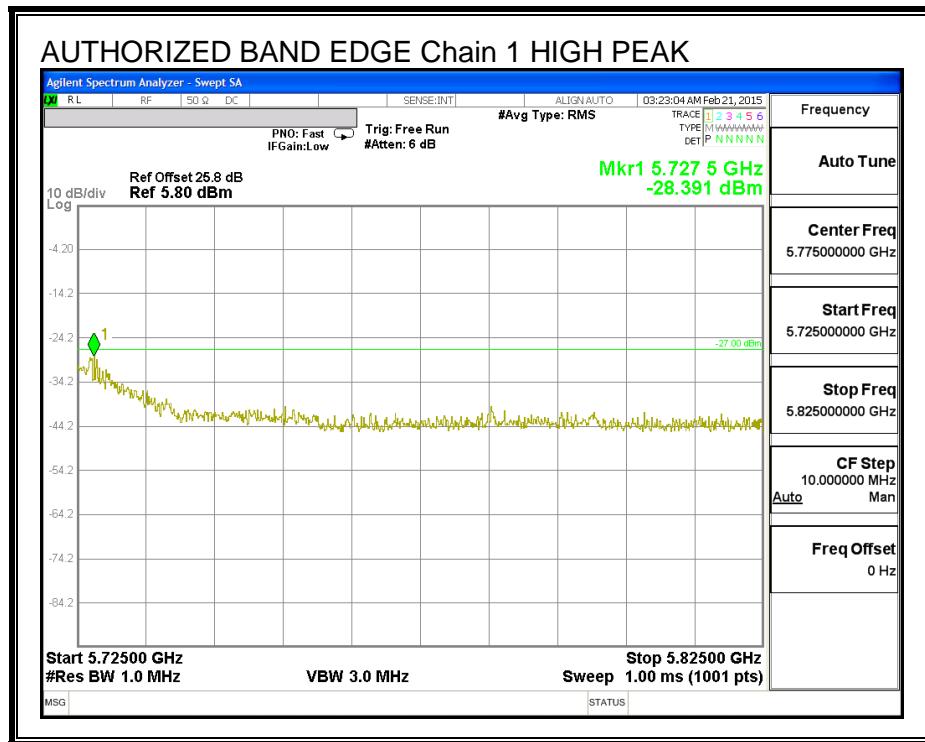
Conducted measurements are being used to demonstrate compliance with the spurious limits in the restricted band (all other spurious emissions are measured using the radiated test method with the antennas connected). The limits are 54dBuV/m average and 74dBuV/m peak, which are equivalent to eirp of -41.2 dBm and -21.2dBm respectively. The plots include an offset to account for the EUT antenna gain and external attenuation between EUT antenna port and spectrum analyzer. As the two antenna chains feed cross polarized antennas with un- correlated signals the two chains are treated independently and the emissions do not need to be summed.

## **RESULTS**

## **HIGH CHANNEL BANDEDGE, Chain 0**



**HIGH CHANNEL BANDEDGE, Chain 1**



### 8.3. 10MHz 2Tx MODE IN THE 5.8 GHz BAND

#### 8.3.1. 26 dB BANDWIDTH

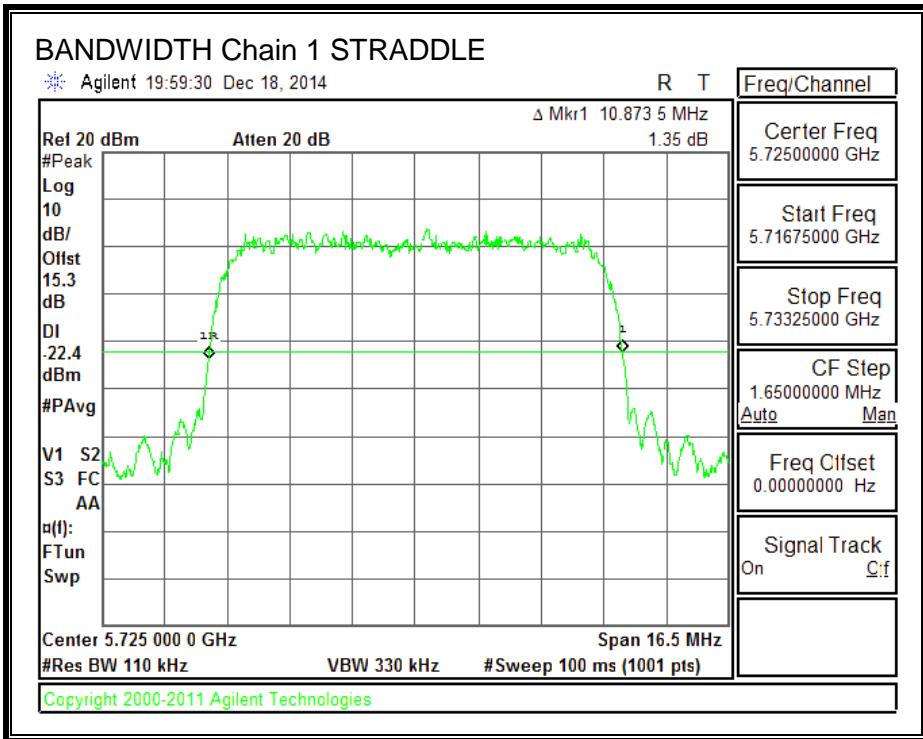
##### LIMITS

None; for reporting purposes only.

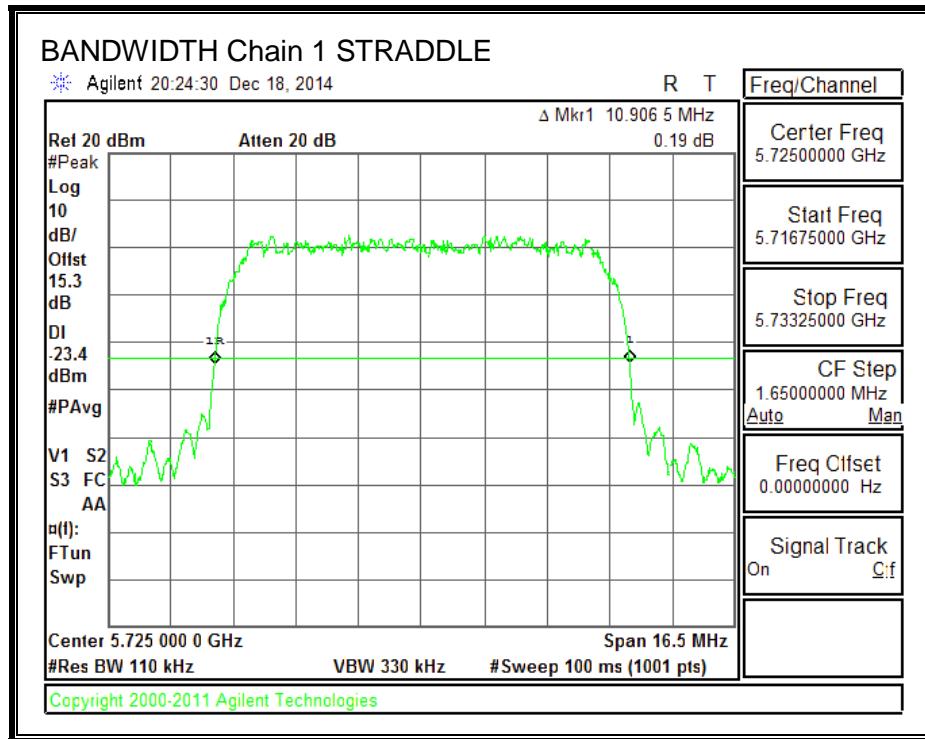
##### RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Straddle	5725	10.87	10.91

## 26 dB BANDWIDTH, Chain 0



## 26 dB BANDWIDTH, Chain 1



### 8.3.2. OUTPUT POWER

#### LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain.

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
14.50	14.50	14.50

## RESULTS

### Bandwidth, Antenna Gain, and Limits

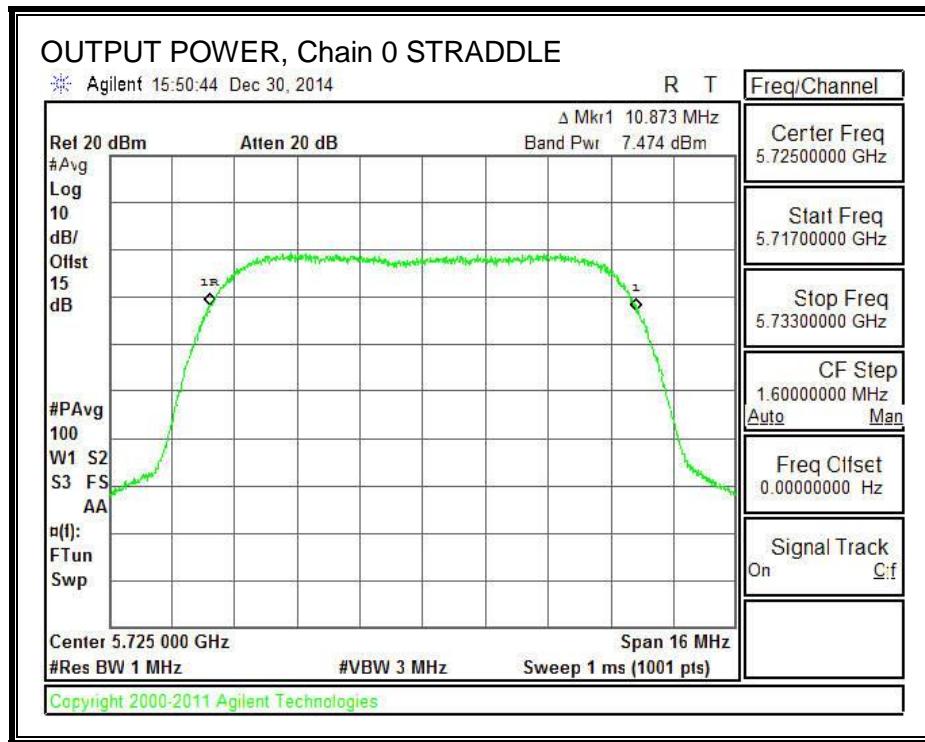
Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Straddle	5725	10.64	14.50	14.50	12.77	2.50

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power & PSD
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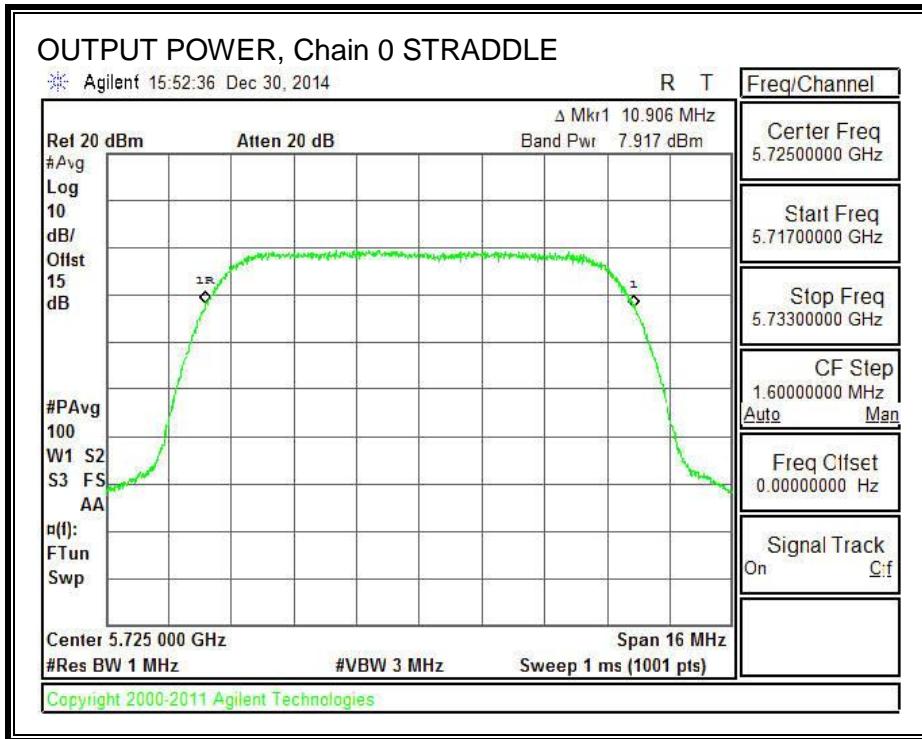
### Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Straddle	5725	7.47	7.92	10.71	12.77	-2.06

## OUTPUT POWER AND PSD, Chain 0



## OUTPUT POWER AND PSD, Chain 1



### 8.3.3. STRADDLE CHANNEL RESULTS

#### UNII-2C BAND

##### Bandwidth and Antenna Gain

Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
5725	5.34	14.50	14.50

##### Limits

Frequency (MHz)	FCC Power Limit (dBm)	PPSD Limit (dBm)
5725	9.77	2.50

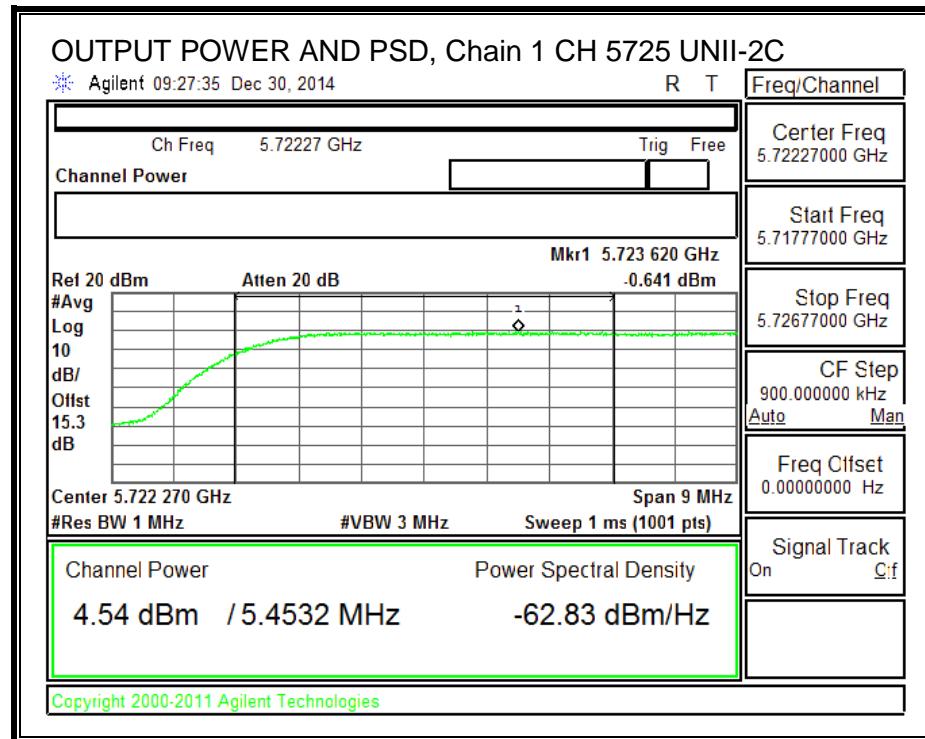
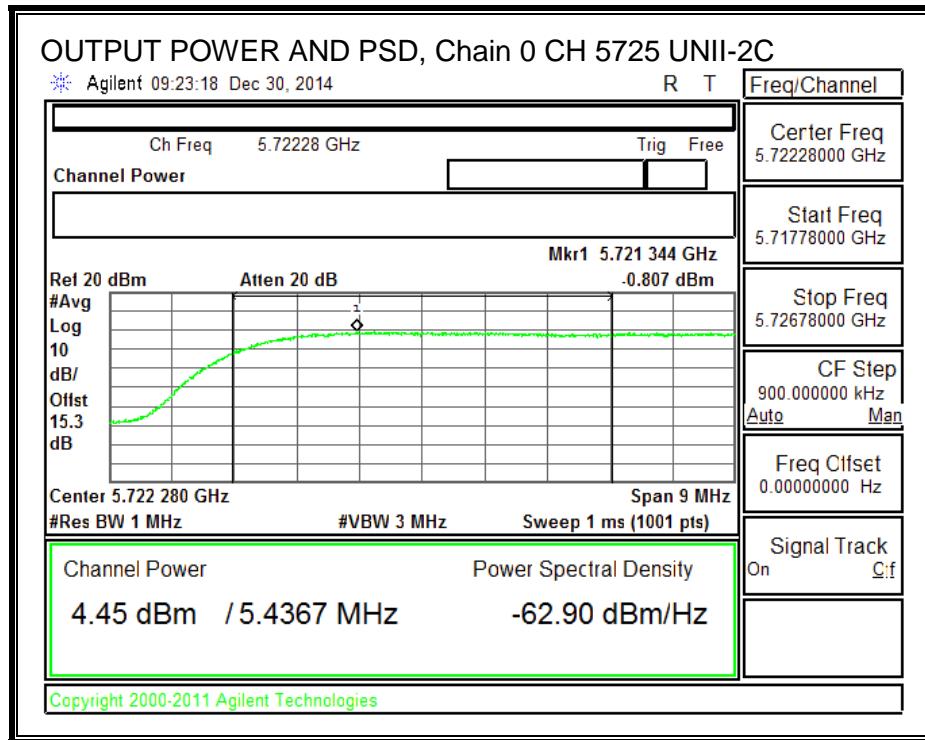
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power & PPSD
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##### Output Power Results

Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
5725	4.45	4.54	7.51	9.77	-2.27

##### PPSD Results

Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
5725	-0.81	-0.64	2.29	2.50	-0.21



**UNII-3 BAND**

**Bandwidth and Antenna Gain**

Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
5725	5.34	14.50	14.50

**Limits**

Frequency (MHz)	FCC Power Limit (dBm)	FCC PPSD Limit (dBm)
5725	30.00	30.00

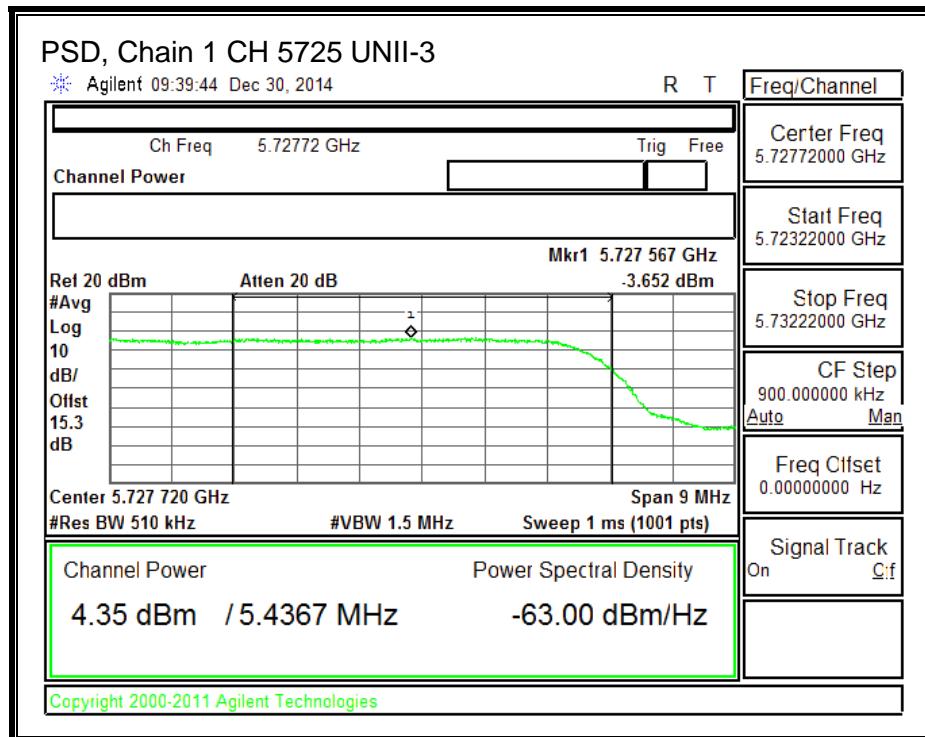
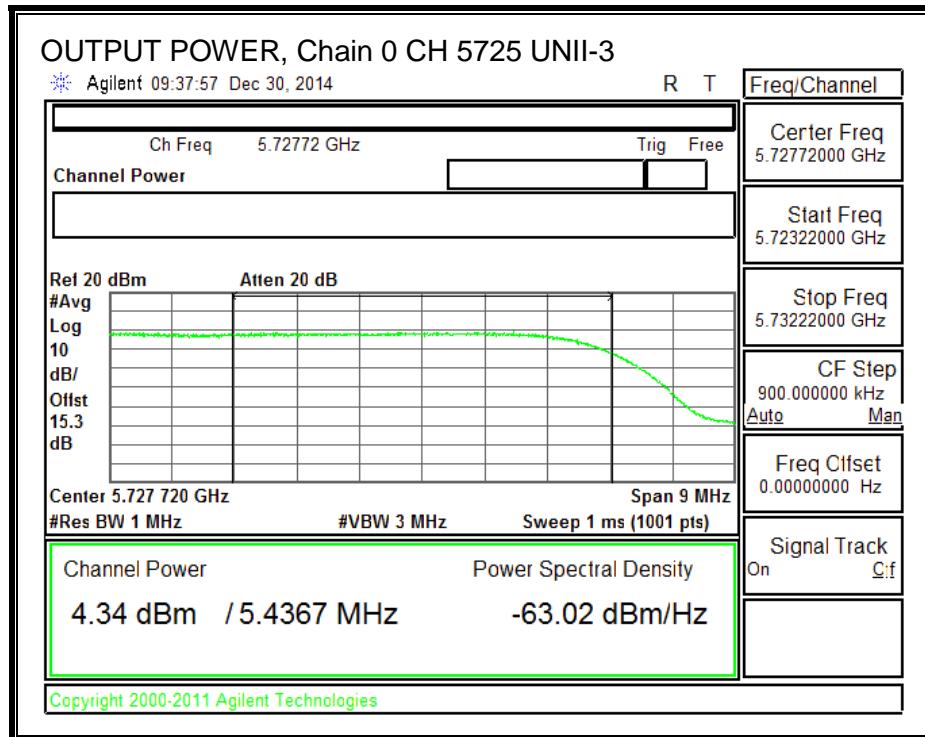
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power & PPSD
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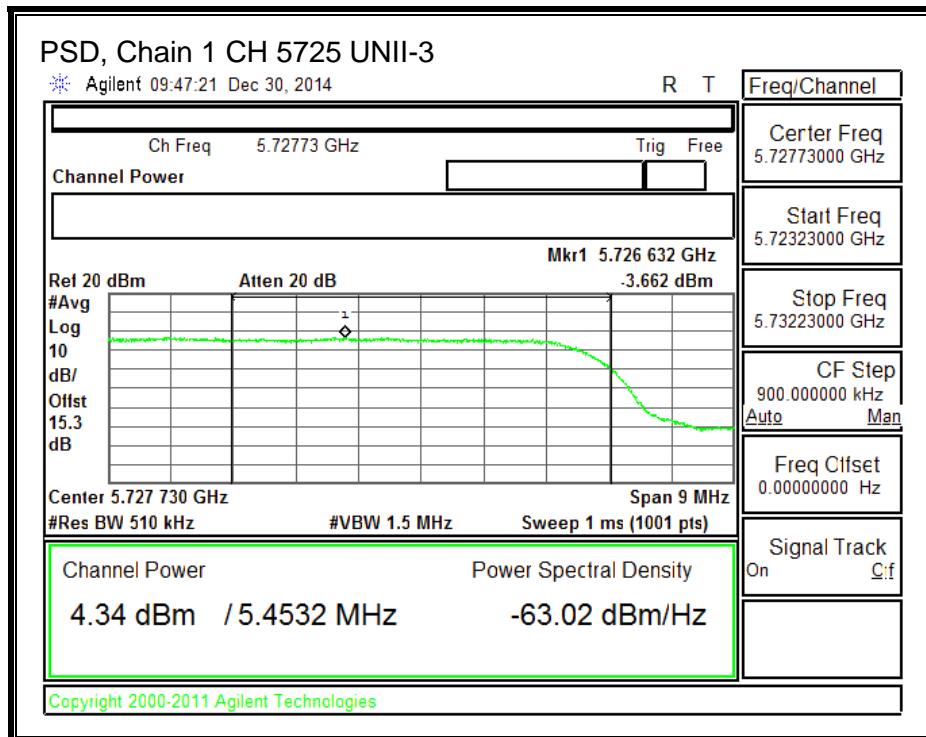
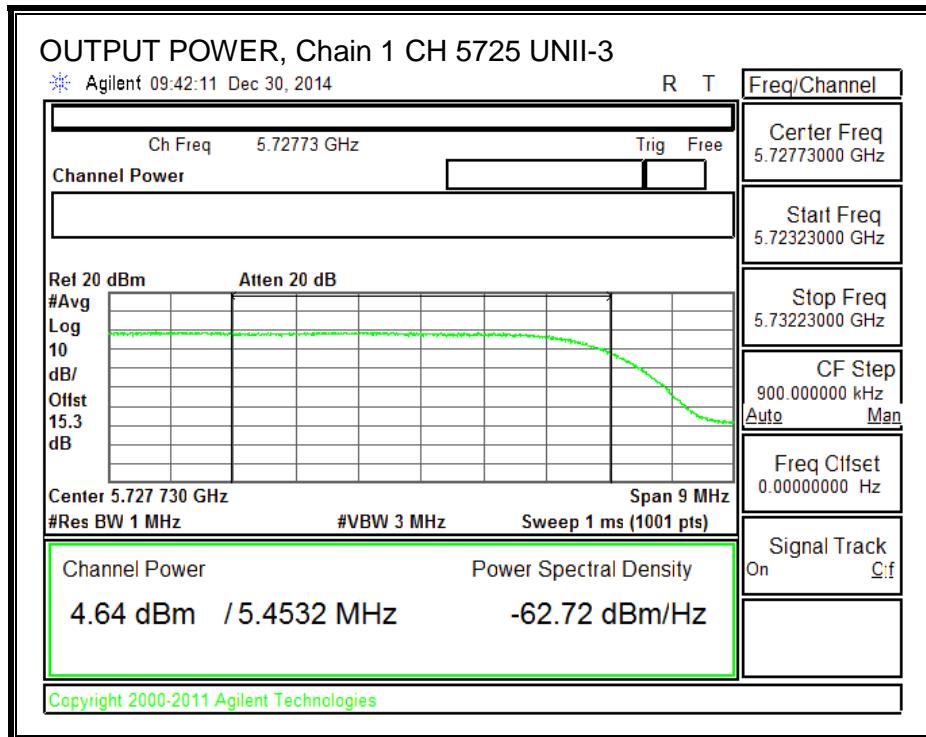
**Output Power Results**

Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
5725	4.34	4.64	7.50	30.00	-22.50

**PPSD Results**

Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
5725	-3.65	-3.66	-0.65	30.00	-30.65





## 8.4. 20MHz 2Tx MODE IN THE 5.8 GHz BAND

### 8.4.1. 26 dB BANDWIDTH

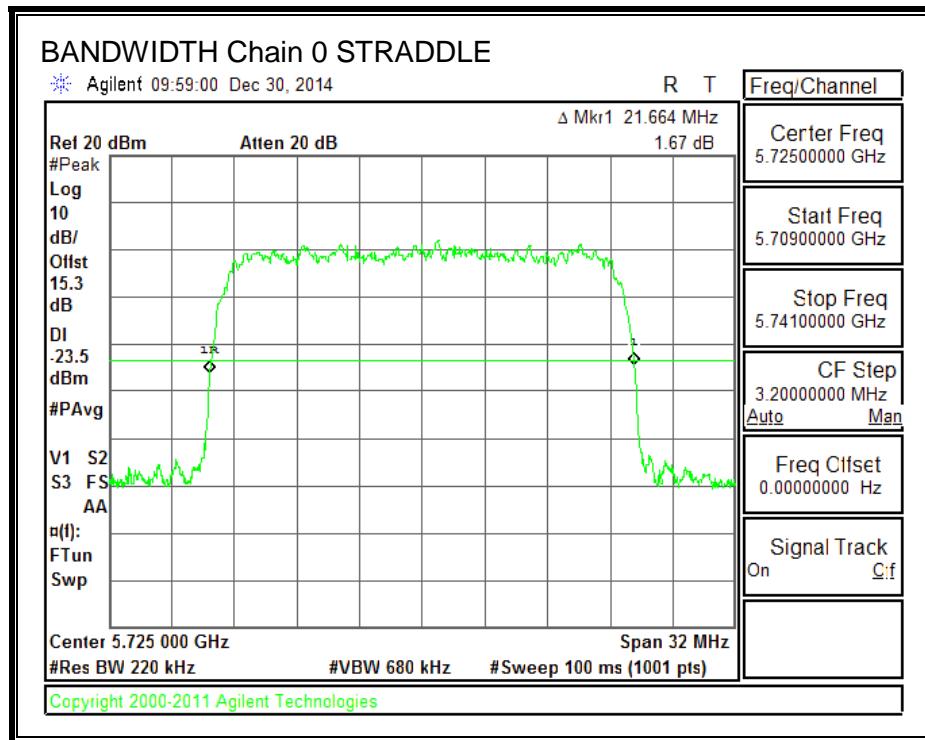
#### LIMITS

None; for reporting purposes only.

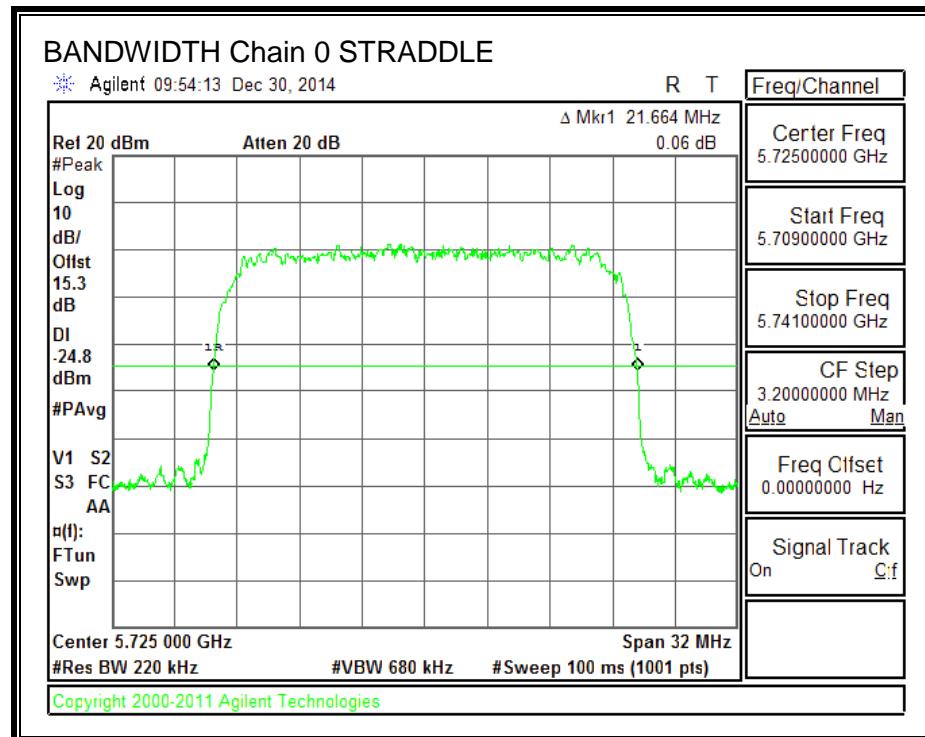
#### RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Straddle	5725	21.66	21.66

## 26 dB BANDWIDTH, Chain 0



## 26 dB BANDWIDTH, Chain 1



#### 8.4.2. OUTPUT POWER

##### LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

##### DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain.

<b>Chain 0 Antenna Gain (dBi)</b>	<b>Chain 1 Antenna Gain (dBi)</b>	<b>Uncorrelated Chains Directional Gain (dBi)</b>
14.50	14.50	14.50

## RESULTS

### Bandwidth, Antenna Gain, and Limits

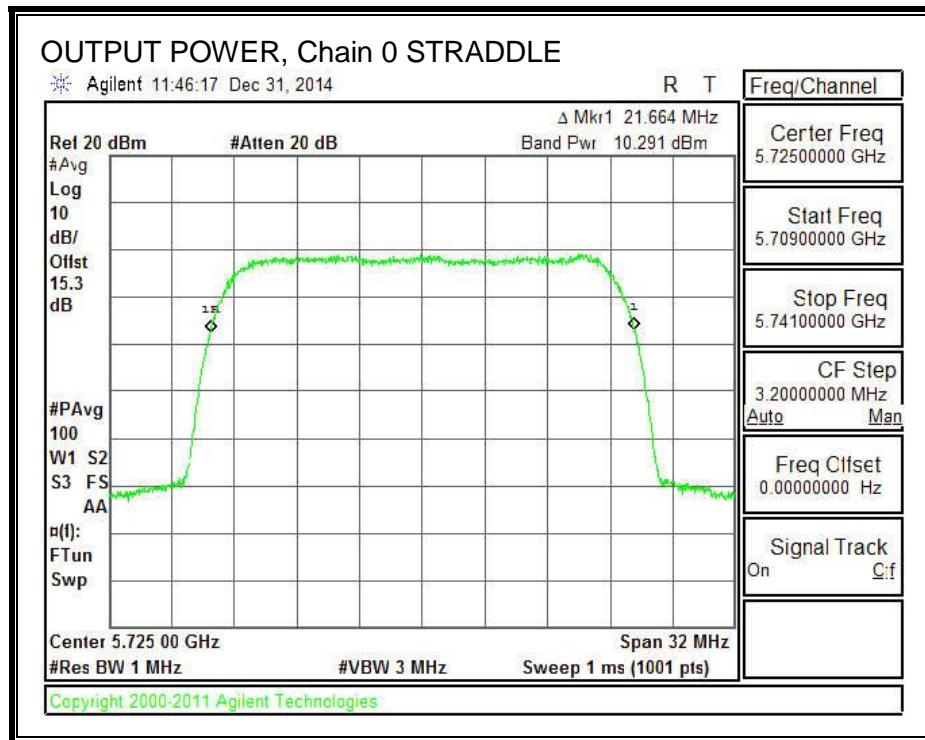
Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Straddle	5725	21.65	14.50	14.50	15.50	2.50

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power & PSD
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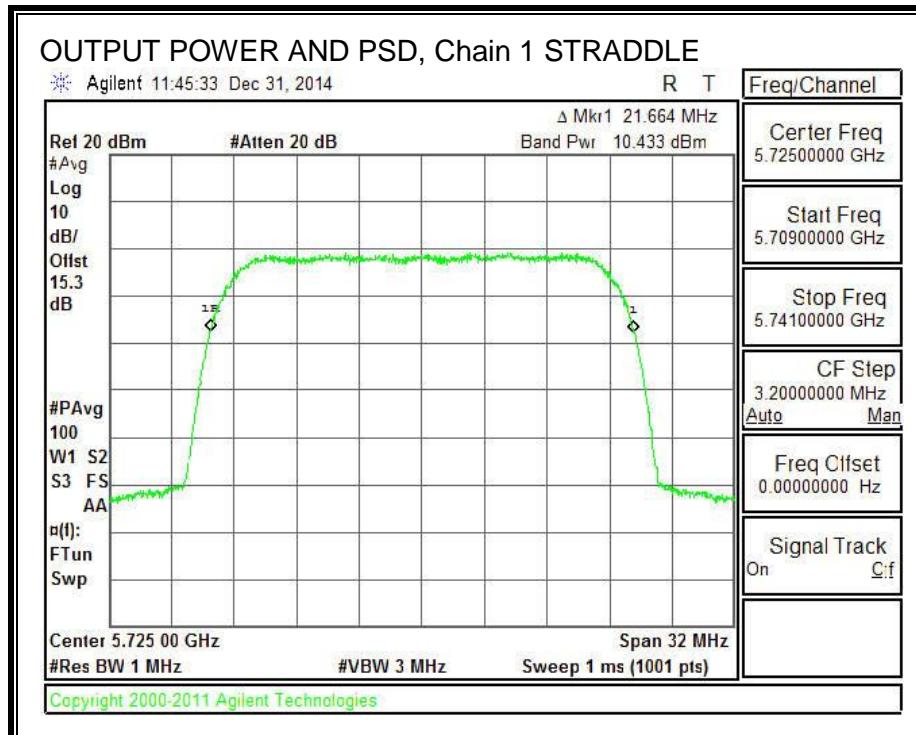
### Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Straddle	5725	10.29	10.43	13.37	15.50	-2.13

## OUTPUT POWER AND PSD, Chain 0



## OUTPUT POWER AND PSD, Chain 1



### 8.4.3. STRADDLE CHANNEL RESULTS

#### UNII-2C BAND

##### Bandwidth and Antenna Gain

Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
5725	10.83	14.50	14.50

##### Limits

Frequency (MHz)	FCC Power Limit (dBm)	PPSD Limit (dBm)
5725	12.84	2.50

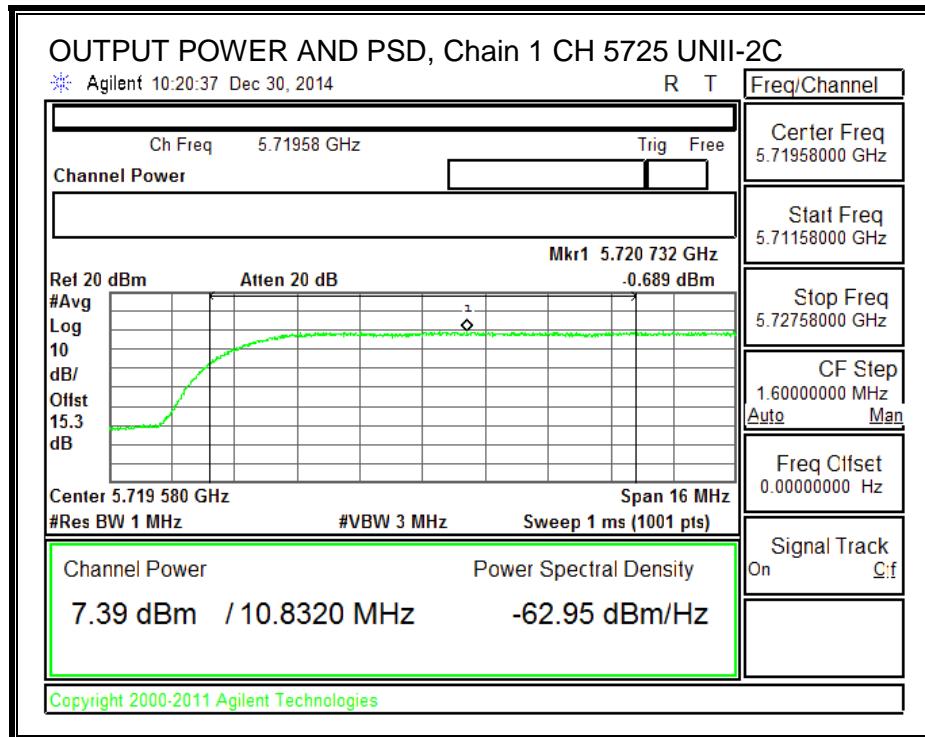
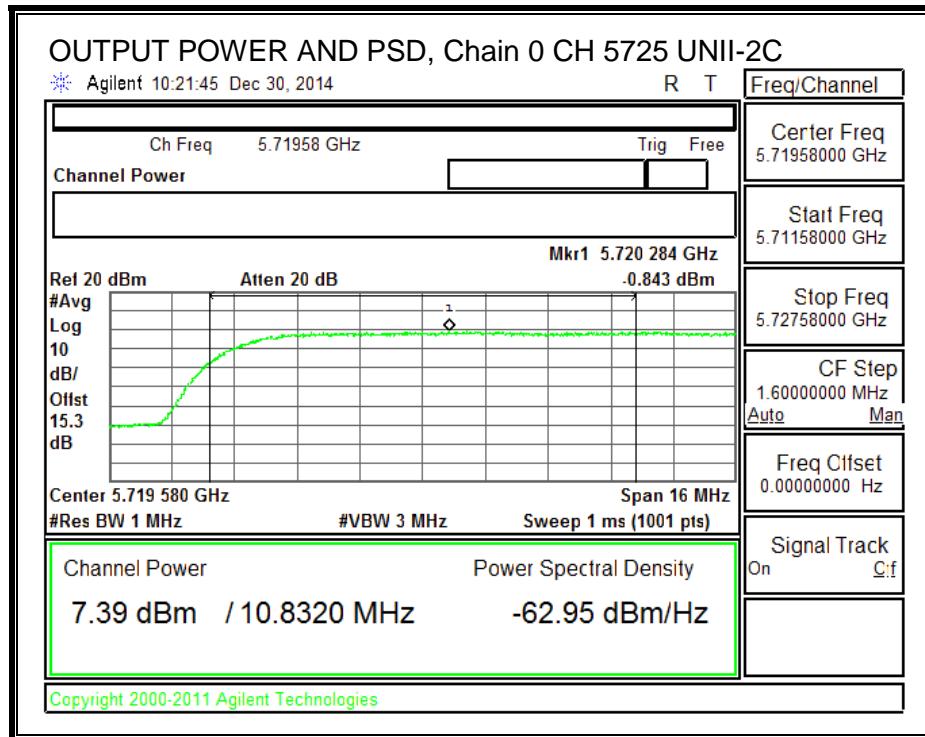
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power & PPSD
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##### Output Power Results

Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
5725	7.39	7.39	10.40	12.84	-2.44

##### PPSD Results

Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
5725	-0.84	-0.69	2.24	2.50	-0.26



**UNII-3 BAND**

**Bandwidth and Antenna Gain**

Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
5725	10.83	14.50	14.50

**Limits**

Frequency (MHz)	FCC Power Limit (dBm)	FCC PPSD Limit (dBm)
5725	30.00	30.00

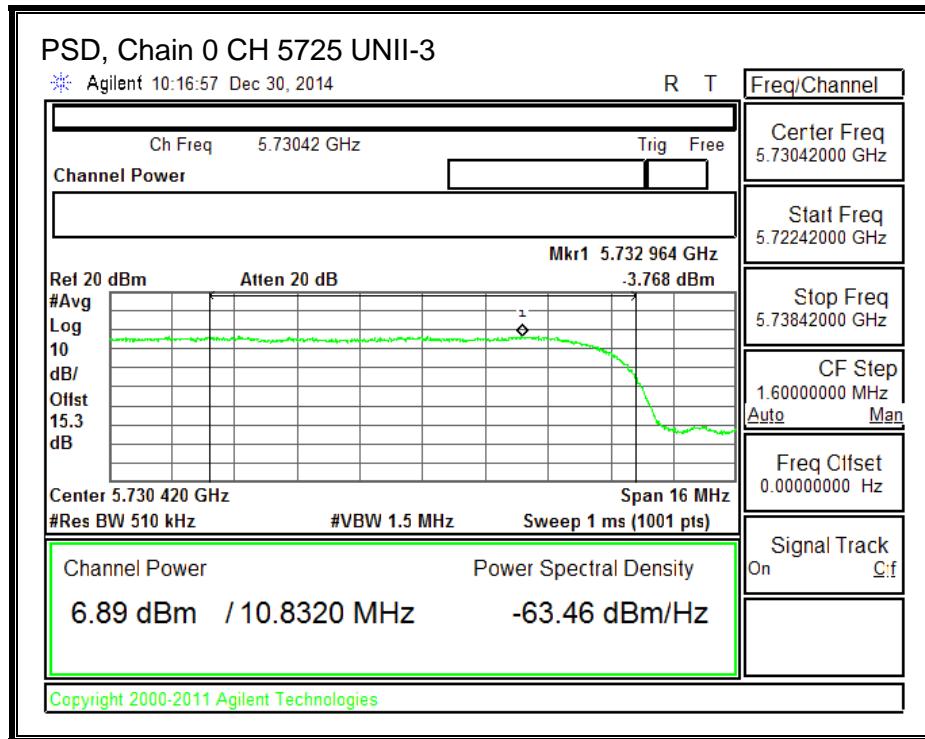
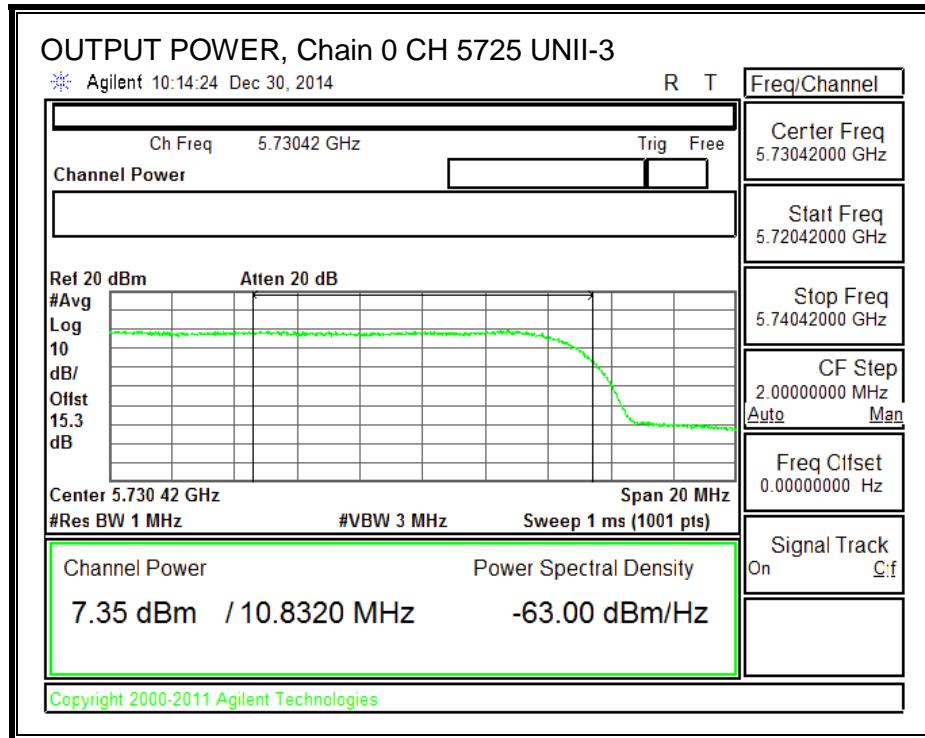
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power & PPSD
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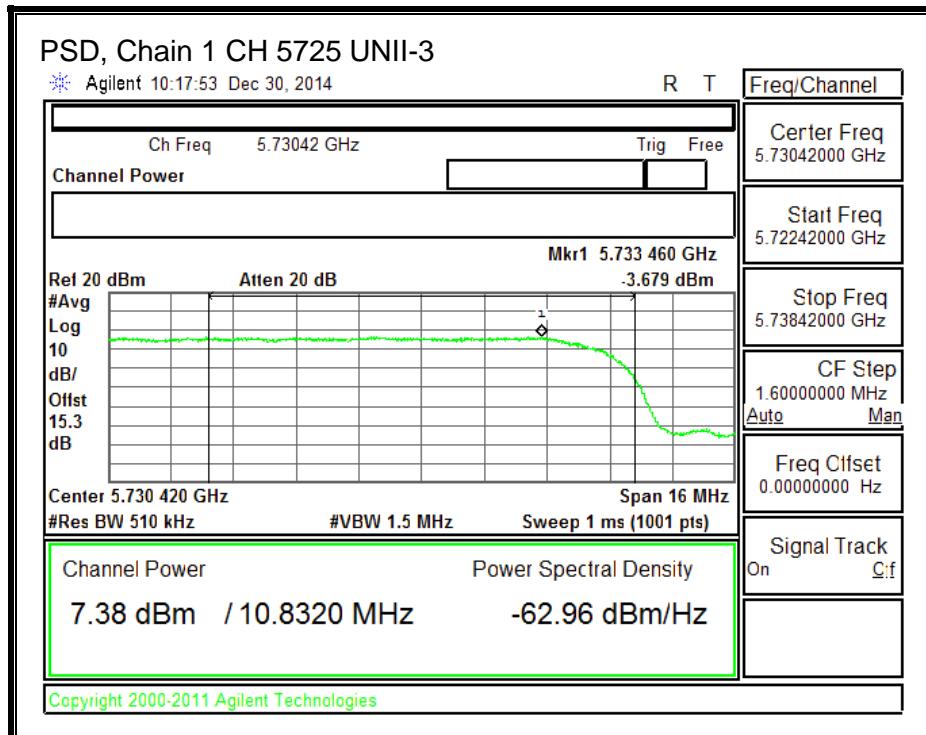
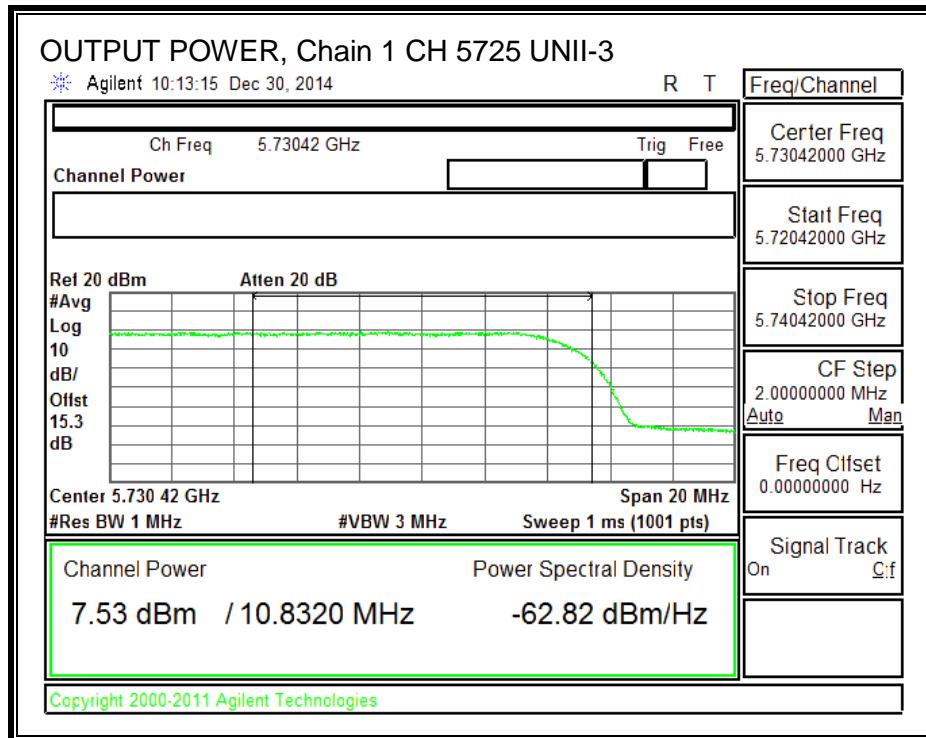
**Output Power Results**

Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
5725	7.35	7.53	10.45	30.00	-19.55

**PPSD Results**

Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
5725	-3.77	-3.68	-0.71	30.00	-30.71





## 8.5. 40MHz 2 Tx MODE IN THE 5.8 GHz BAND

### 8.5.1. 26 dB BANDWIDTH

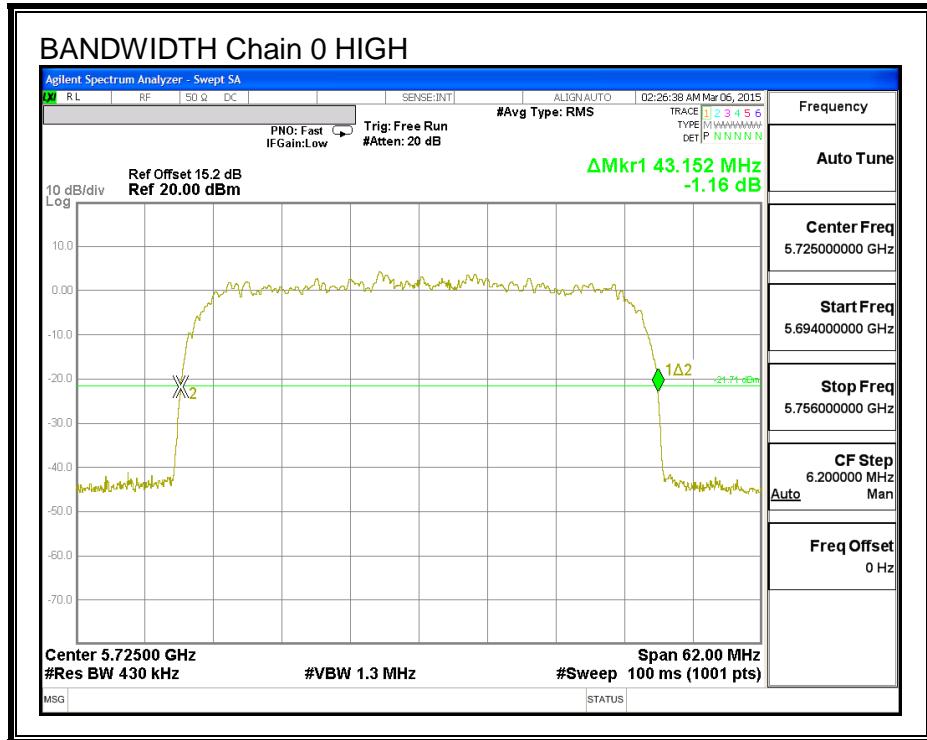
#### LIMITS

None; for reporting purposes only.

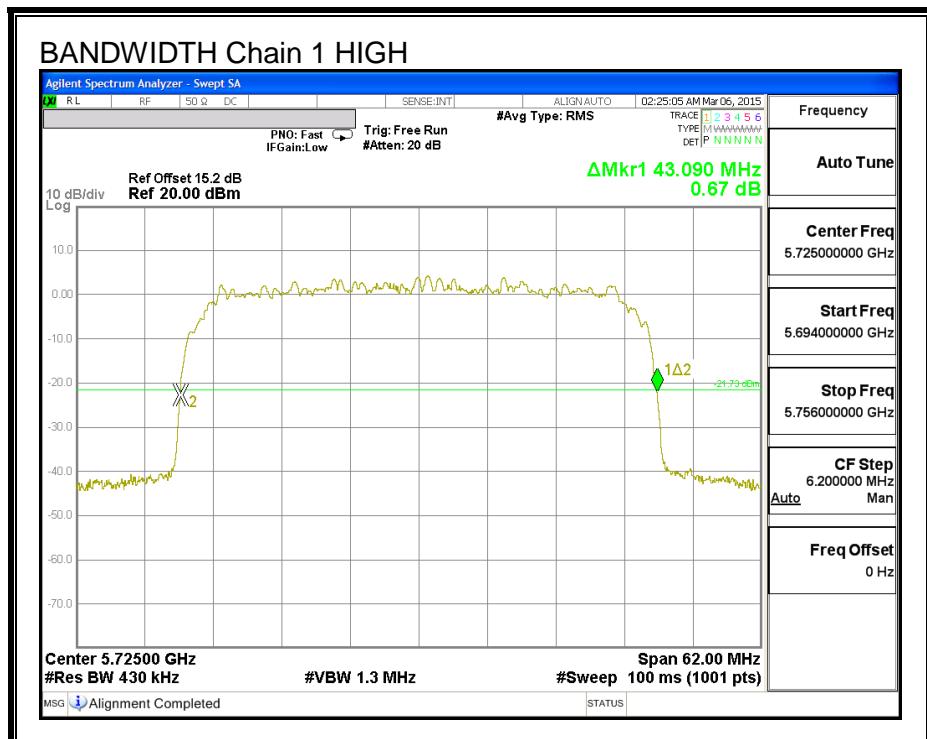
#### RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
High	5725	43.152	43.090

## 26 dB BANDWIDTH, Chain 0



## 26 dB BANDWIDTH, Chain 1



### 8.5.2. OUTPUT POWER

#### LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain.

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
14.50	14.50	14.50

## RESULTS

### Bandwidth, Antenna Gain, and Limits

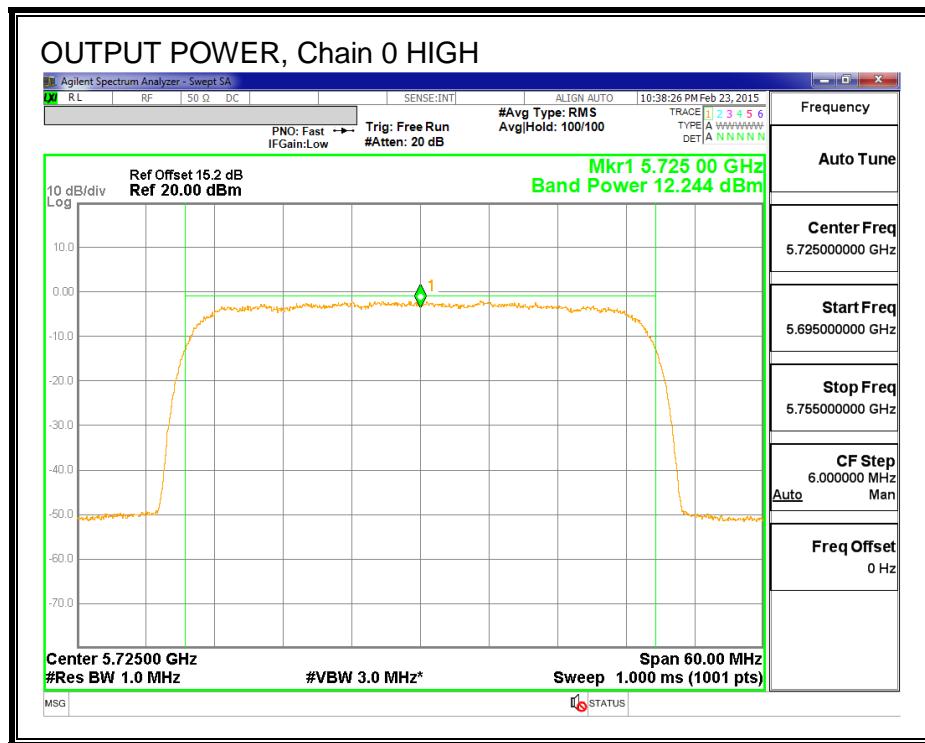
Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
High	5725	21.58	14.50	14.50	15.50	2.50

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power & PSD
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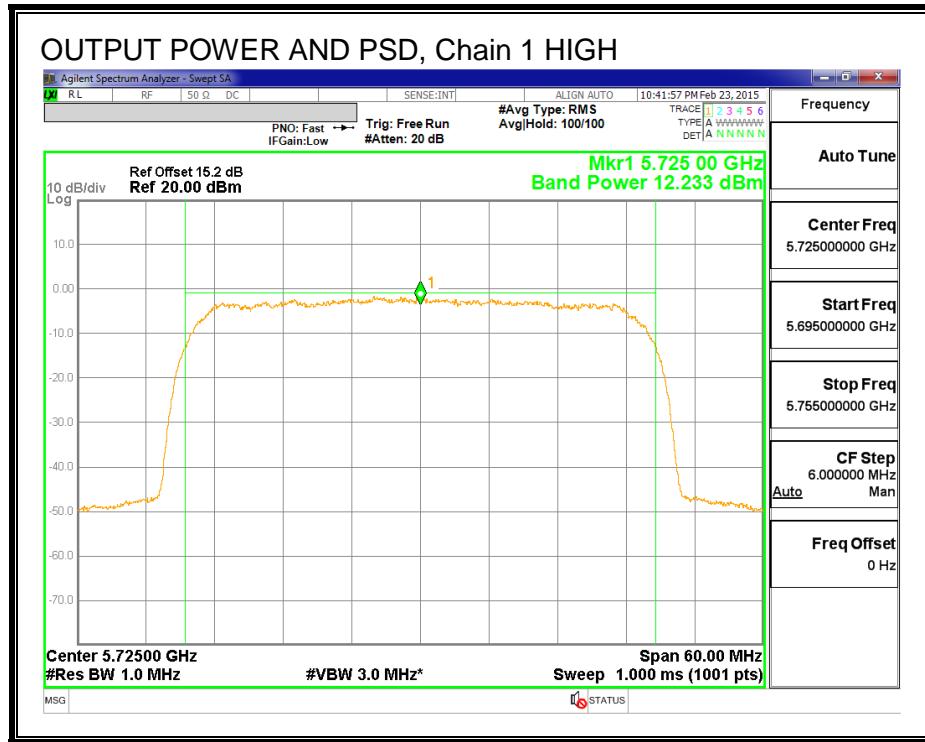
### Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
High	5725	12.24	12.23	15.25	15.50	-0.25

## OUTPUT POWER, Chain 0



## OUTPUT POWER, Chain 1



### 8.5.3. STRADDLE CHANNEL RESULTS

#### UNII-2C BAND

##### Bandwidth and Antenna Gain

Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
5725	43.09	14.50	14.50

##### Limits

Frequency (MHz)	FCC Power Limit (dBm)	PPSD Limit (dBm)
5725	15.50	2.50

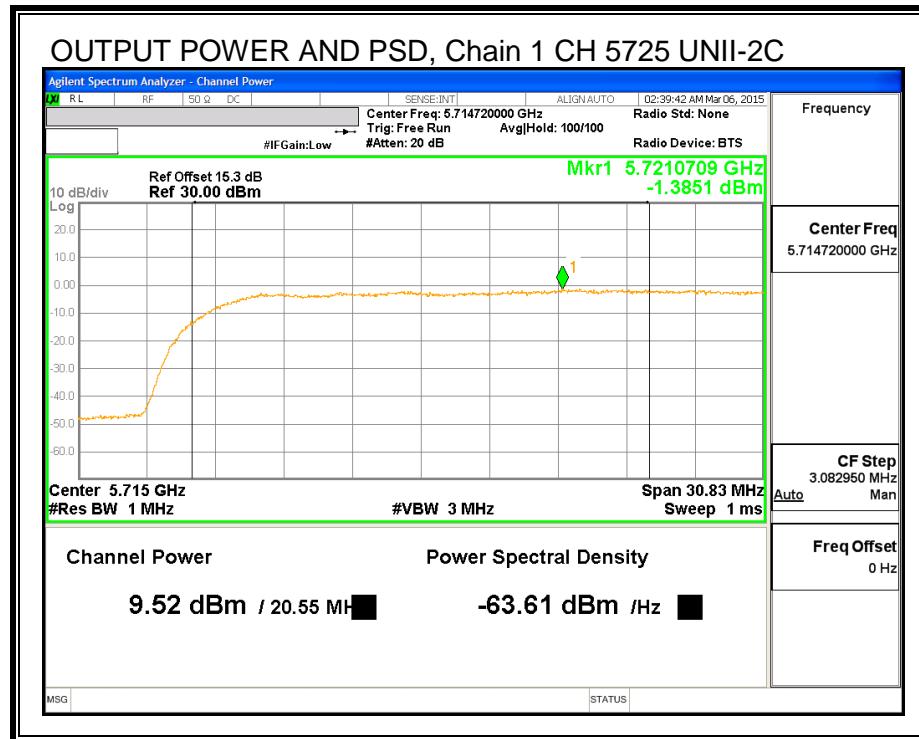
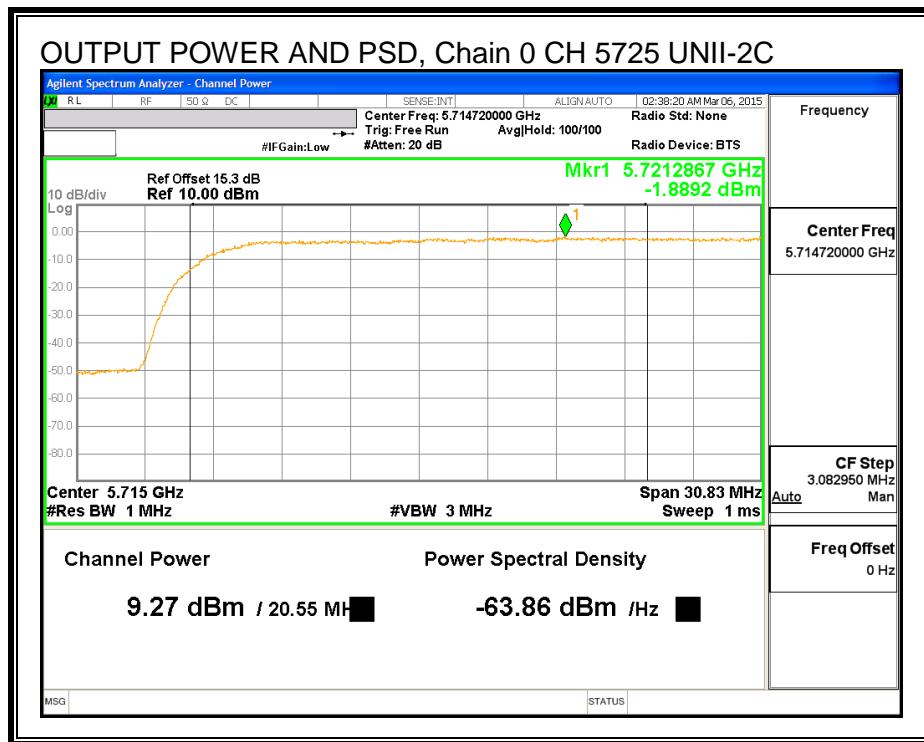
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power & PPSD
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##### Output Power Results

Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
5725	9.27	9.52	12.41	15.50	-3.09

##### PPSD Results

Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
5725	-1.89	-1.36	1.39	2.50	-1.11



**UNII-3 BAND**

**Bandwidth and Antenna Gain**

Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
5725	43.09	14.50	14.50

**Limits**

Frequency (MHz)	FCC Power Limit (dBm)	FCC PPSD Limit (dBm)
5725	30.00	30.00

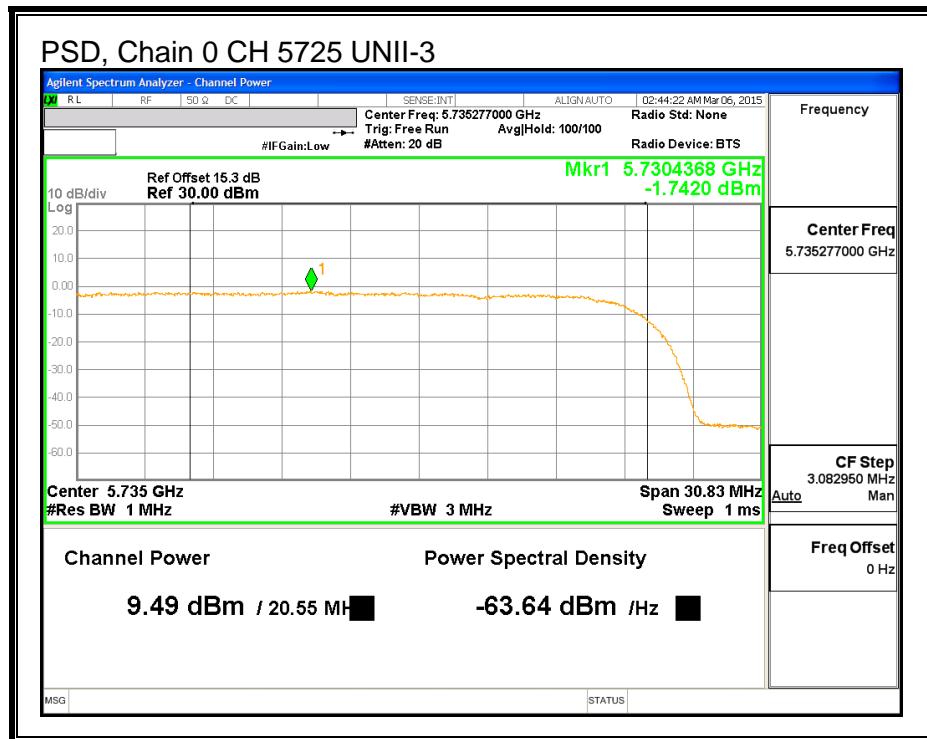
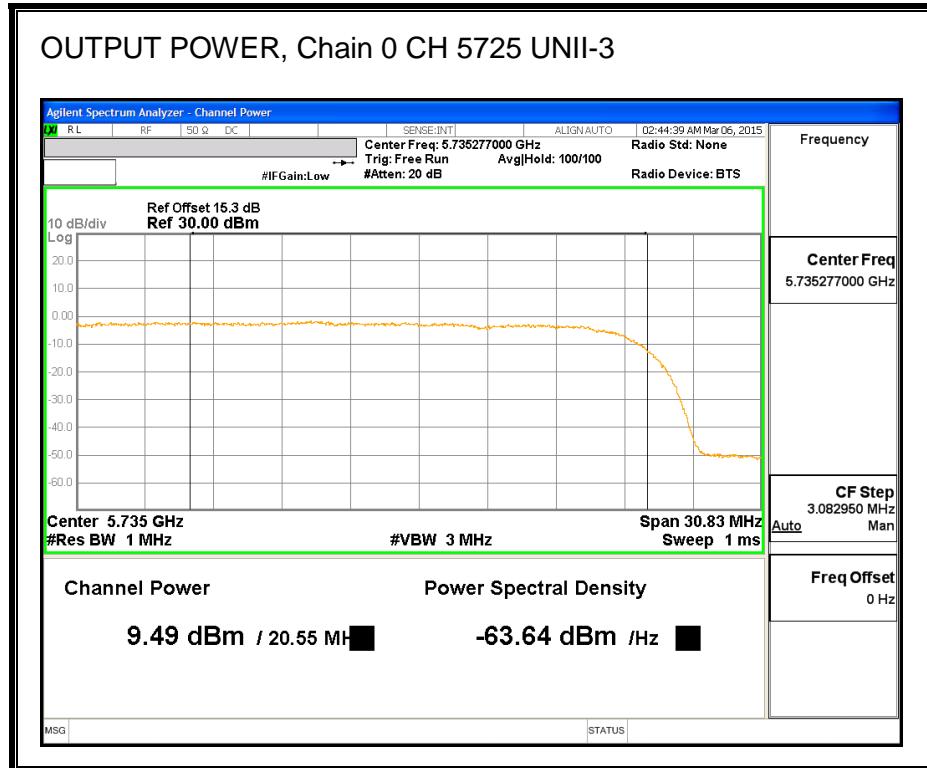
<b>Duty Cycle CF (dB)</b>	0.00	<b>Included in Calculations of Corr'd Power &amp; PPSD</b>
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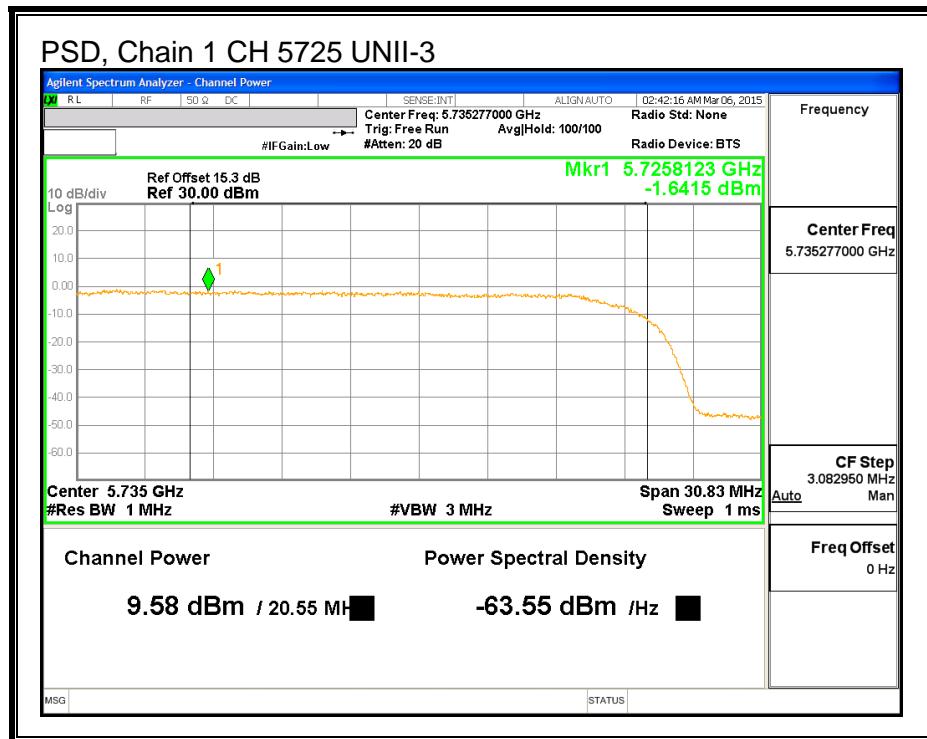
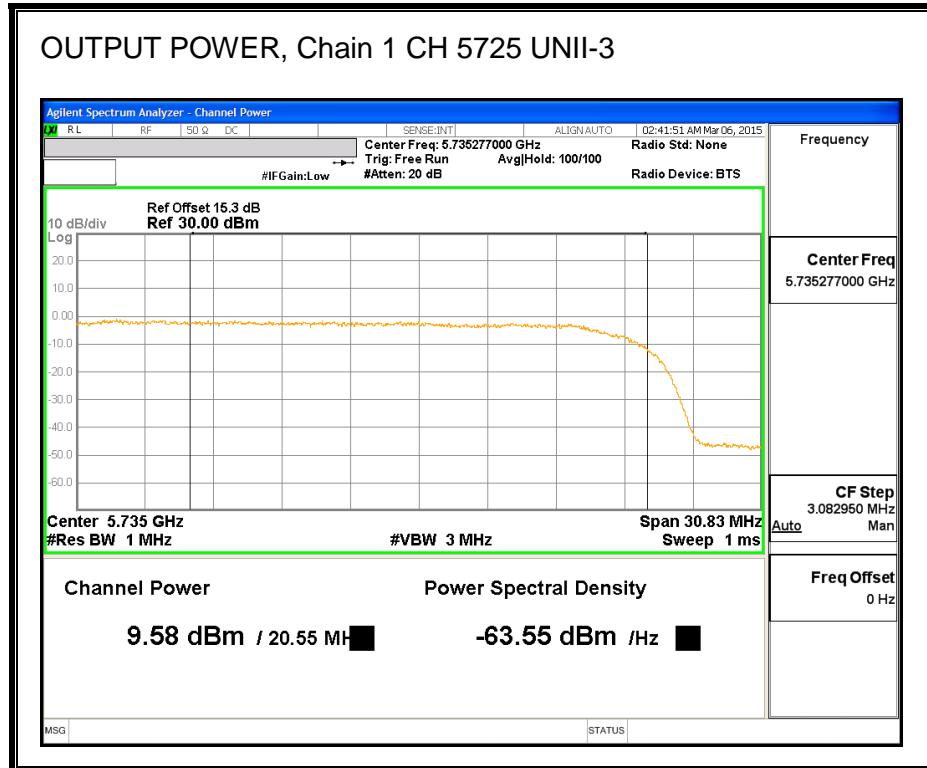
**Output Power Results**

Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
5725	9.49	9.58	12.55	30.00	-17.45

**PPSD Results**

Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
5725	-1.74	-1.64	1.32	30.00	-28.68





## 9. RADIATED TEST RESULTS

### 9.1. LIMITS AND PROCEDURE

#### LIMITS

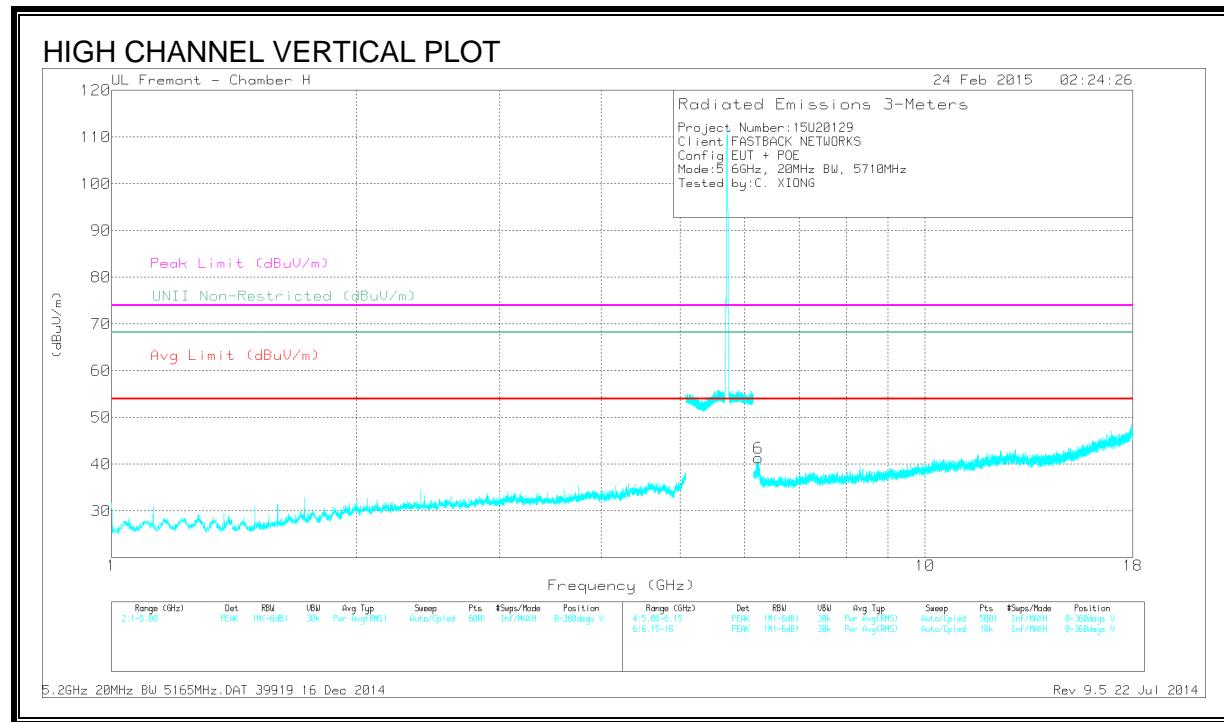
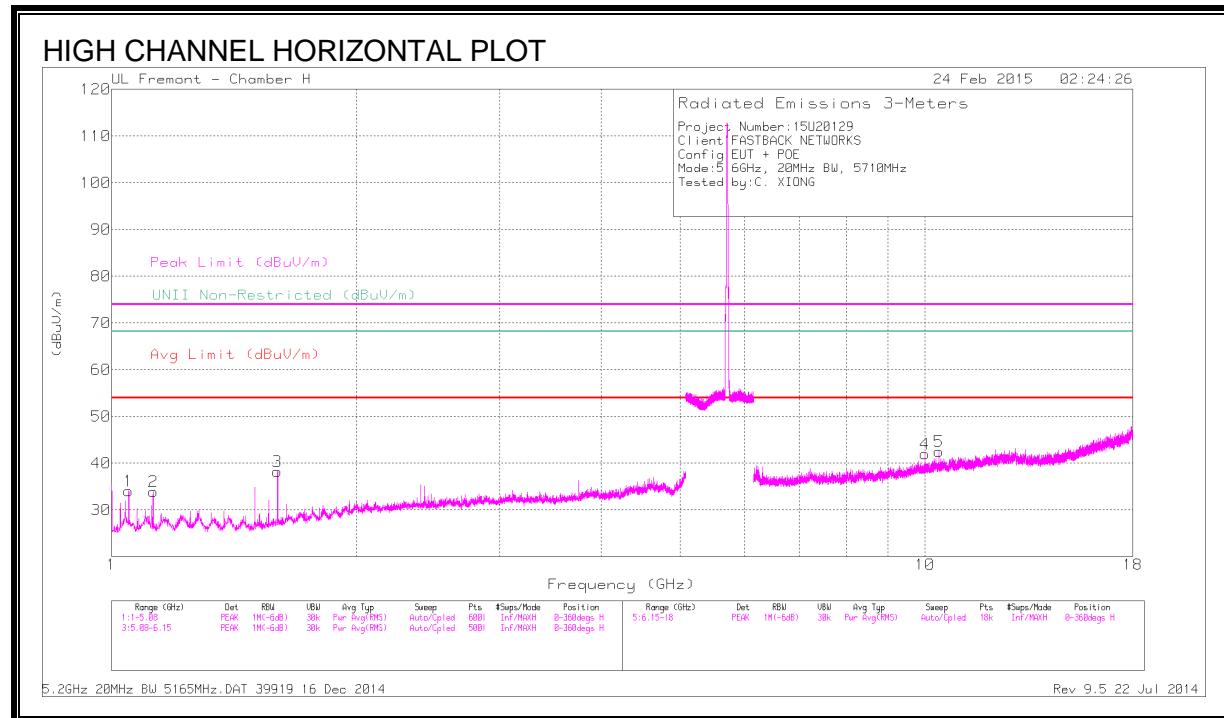
FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

## 9.2. TRANSMITTER ABOVE 1 GHz

### 9.2.1. TX ABOVE 1 GHz 20MHz 2 TX MODE IN THE 5.6 GHz BAND

#### HARMONICS AND SPURIOUS EMISSIONS



**DATA**

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ft tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.05	46.36	PK1	28	-35.5	38.86	-	-	74	-35.14	-	-	319	225	H
* 1.05	36.41	AD1	28	-35.5	28.91	54	-25.09	-	-	-	-	319	225	H
* 1.125	46.07	PK1	28.3	-35.6	38.77	-	-	74	-35.23	-	-	344	214	H
* 1.125	36.39	AD1	28.3	-35.6	29.09	54	-24.91	-	-	-	-	344	214	H
* 1.6	49.68	PK1	28.5	-35	43.18	-	-	74	-30.82	-	-	353	271	H
* 1.6	44.09	AD1	28.5	-35	37.59	54	-16.41	-	-	-	-	353	271	H
6.24	43.9	PK1	35.4	-31.2	48.1	-	-	-	-	68.2	-20.1	3	100	V
10	40.92	PK1	37.3	-26.3	51.92	-	-	-	-	68.2	-16.28	199	111	H
10.4	39.22	PK1	37.5	-25.8	50.92	-	-	-	-	68.2	-17.28	340	139	H

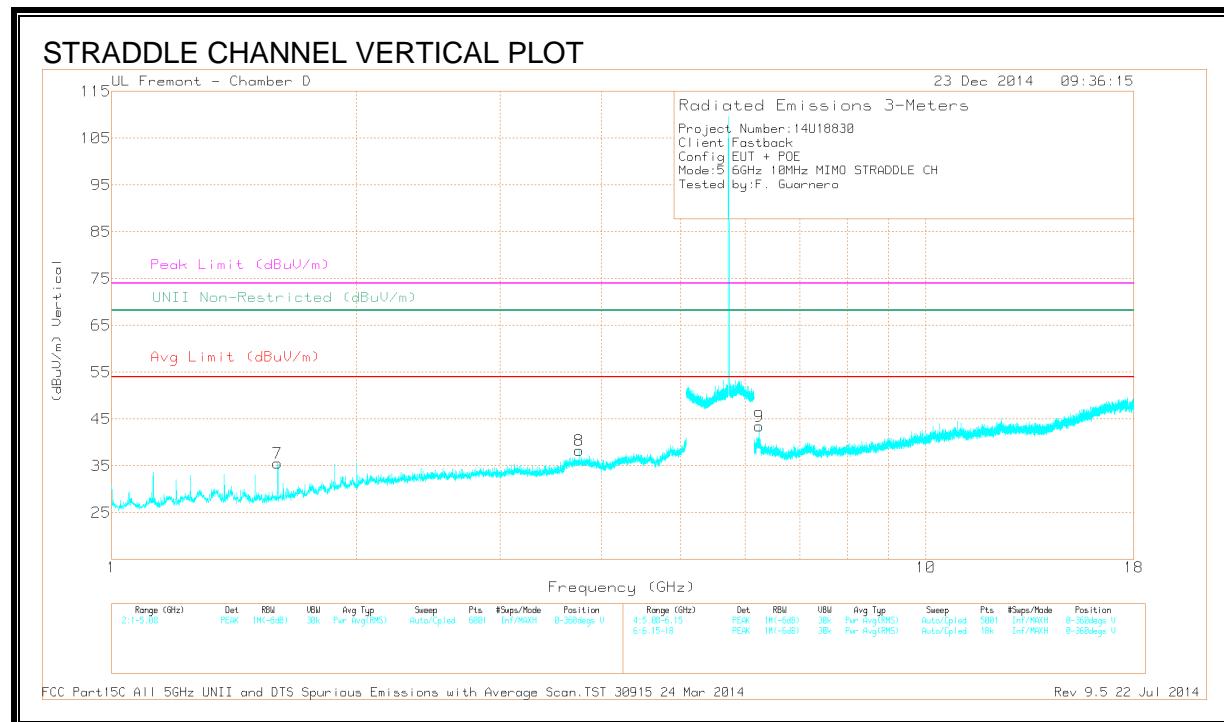
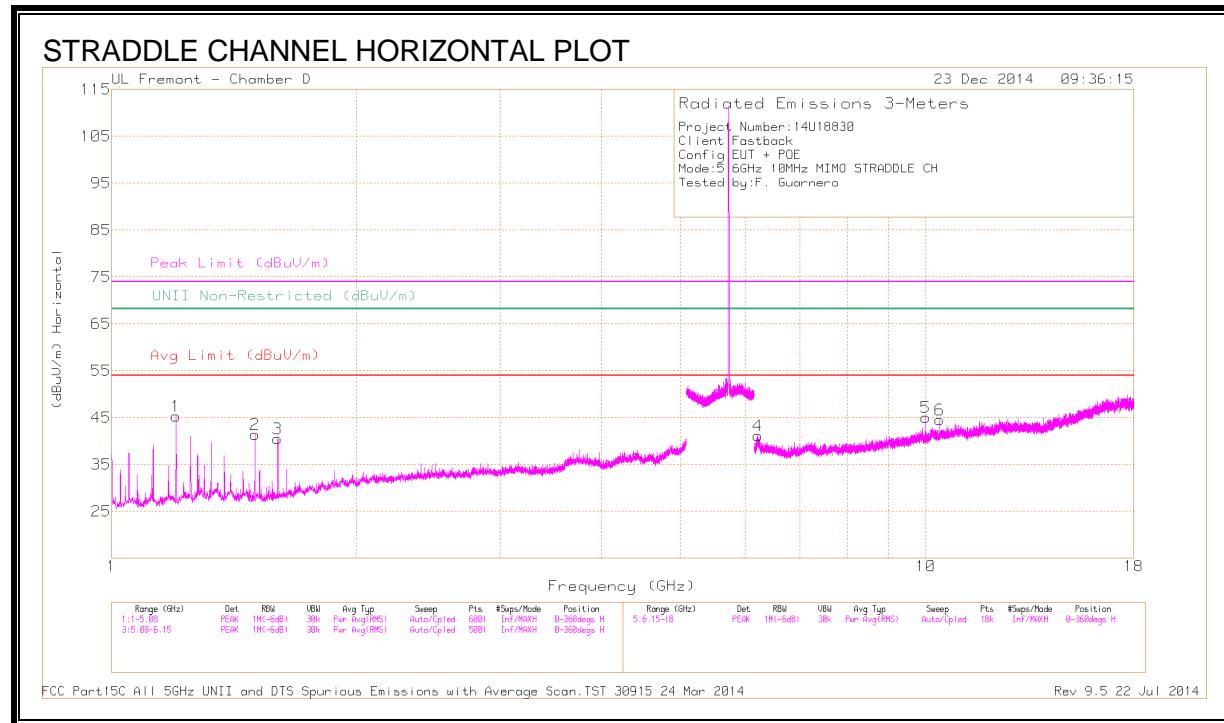
\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK1 - KDB789033 Method: Peak

AD1 - KDB789033 Method: AD Primary Power Average

## 9.2.2. TX ABOVE 1 GHz 10MHz 2 TX MODE IN THE 5.8 GHz BAND

### HARMONICS AND SPURIOUS EMISSIONS



## DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Ft tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.2	51.23	PK1	28.2	-32.1	47.33	-	-	74	-26.67	-	-	35	105	H
	* 1.2	47.78	AD1	28.2	-32.1	43.88	54	-10.12	-	-	-	-	35	105	H
2	* 1.5	46.2	PK1	28.1	-31.5	42.8	-	-	74	-31.2	-	-	360	116	H
	* 1.5	39.68	AD1	28.1	-31.5	36.28	54	-17.72	-	-	-	-	360	116	H
3	* 1.6	47.72	PK1	28.2	-31.6	44.32	-	-	74	-29.68	-	-	3	104	H
	* 1.6	42.33	AD1	28.2	-31.6	38.93	54	-15.07	-	-	-	-	3	104	H
8	* 1.6	44.54	PK1	28.2	-31.6	41.14	-	-	74	-32.86	-	-	343	212	V
	* 1.6	36.81	AD1	28.2	-31.6	33.41	54	-20.59	-	-	-	-	343	212	V
7	* 3.75	39.32	PK1	33.3	-28.6	44.02	-	-	74	-29.98	-	-	15	191	V
	* 3.75	29.79	AD1	33.3	-28.7	34.39	54	-19.61	-	-	-	-	15	191	V
4	6.219	41.34	PK1	35.5	-26.5	50.34	-	-	-	-	68.2	-17.86	44	101	H
9	6.241	41.03	PK1	35.5	-26.5	50.03	-	-	-	-	68.2	-18.17	25	101	V
5	10	38.05	PK1	37.1	-22.1	53.05	-	-	-	-	68.2	-15.15	208	104	H
6	10.4	36.17	PK1	37.5	-22.1	51.57	-	-	-	-	68.2	-16.63	4	226	H

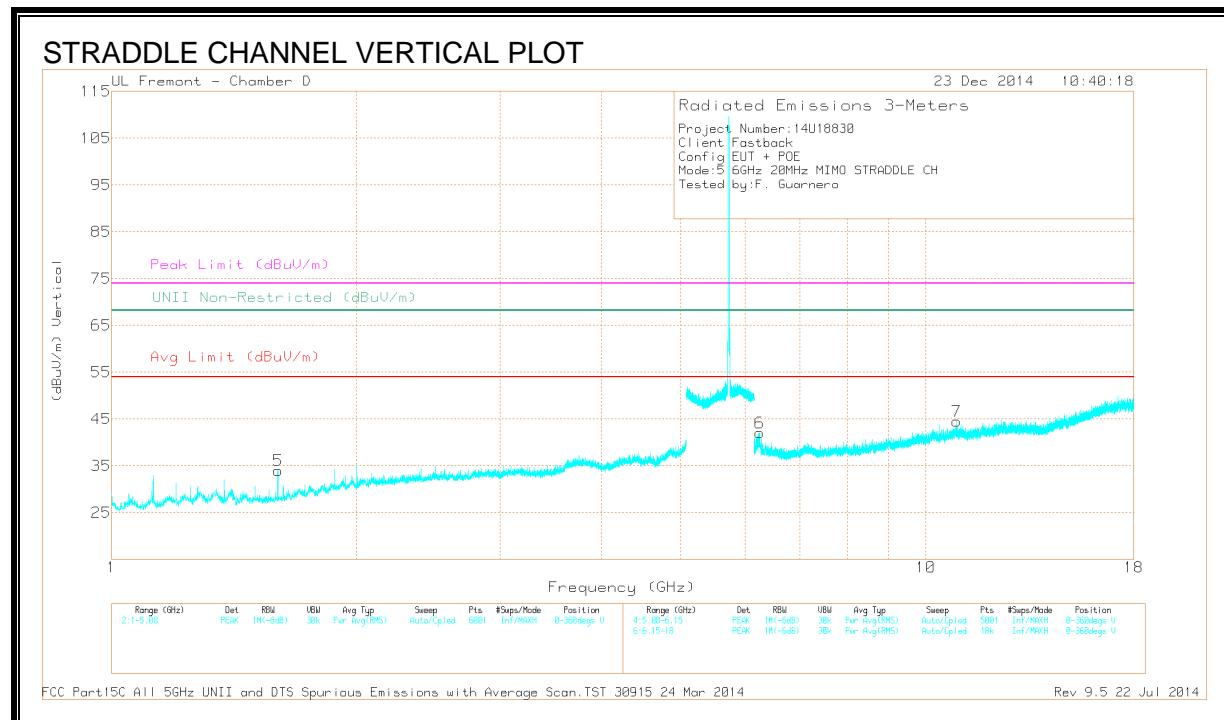
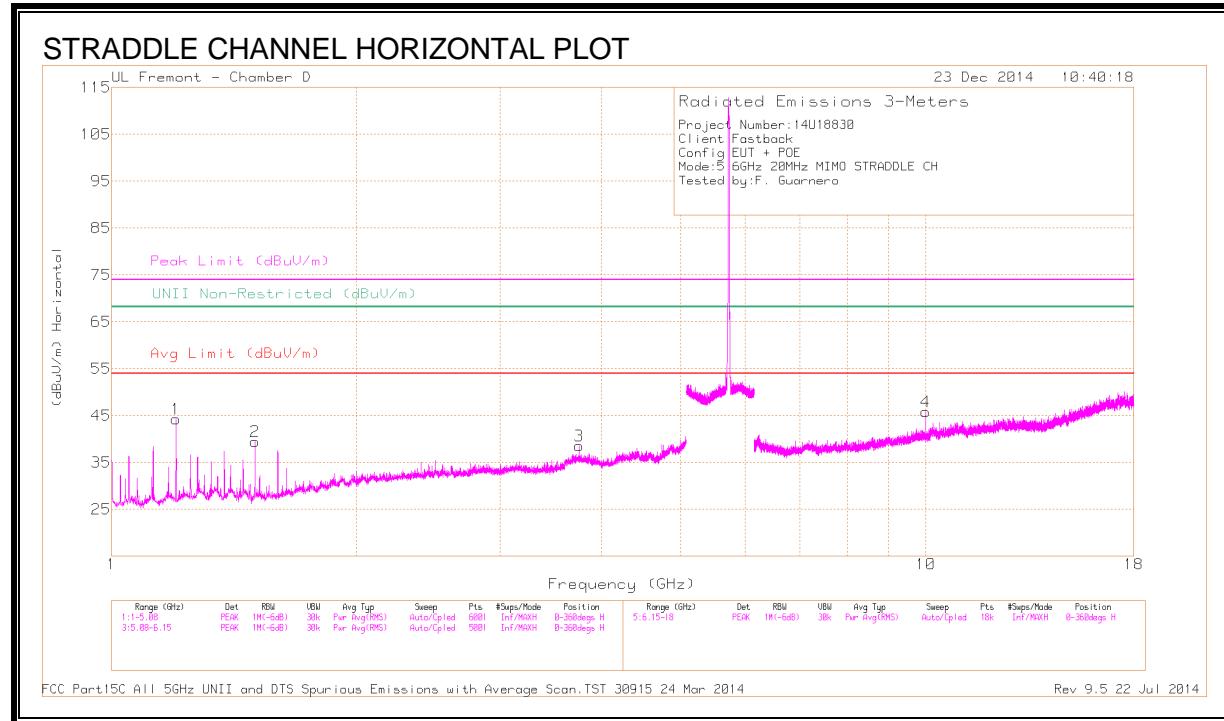
\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK1 - KDB789033 Method: Peak

AD1 - KDB789033 Method: AD Primary Power Average

### 9.2.3. TX ABOVE 1 GHz 20MHz 2 TX MODE IN THE 5.8 GHz BAND

## **HARMONICS AND SPURIOUS EMISSIONS**



**DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Ft tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.2	50.43	PK1	28.2	-32.1	46.53	-	-	74	-27.47	-	-	38	106	H
	* 1.2	47	AD1	28.2	-32.1	43.1	54	-10.9	-	-	-	-	38	106	H
2	* 1.5	47.42	PK1	28.1	-31.5	44.02	-	-	74	-29.98	-	-	4	100	H
	* 1.5	41.76	AD1	28.1	-31.5	38.36	54	-15.64	-	-	-	-	4	100	H
3	* 3.75	39.39	PK1	33.3	-28.7	43.99	-	-	74	-30.01	-	-	14	156	H
	* 3.75	30.43	AD1	33.3	-28.7	35.03	54	-18.97	-	-	-	-	14	156	H
5	* 1.6	43.33	PK1	28.2	-31.6	39.93	-	-	74	-34.07	-	-	346	186	V
	* 1.6	35.29	AD1	28.2	-31.6	31.89	54	-22.11	-	-	-	-	346	186	V
7	* 10.916	33.43	PK1	38.1	-21.4	50.13	-	-	74	-23.87	-	-	139	332	V
	* 10.916	22.31	AD1	38.1	-21.4	39.01	54	-14.99	-	-	-	-	139	332	V
6	6.25	41.56	PK1	35.5	-26.4	50.66	-	-	-	-	68.2	-17.54	25	104	V
4	10	37.91	PK1	37.1	-22.1	52.91	-	-	-	-	68.2	-15.29	209	102	H

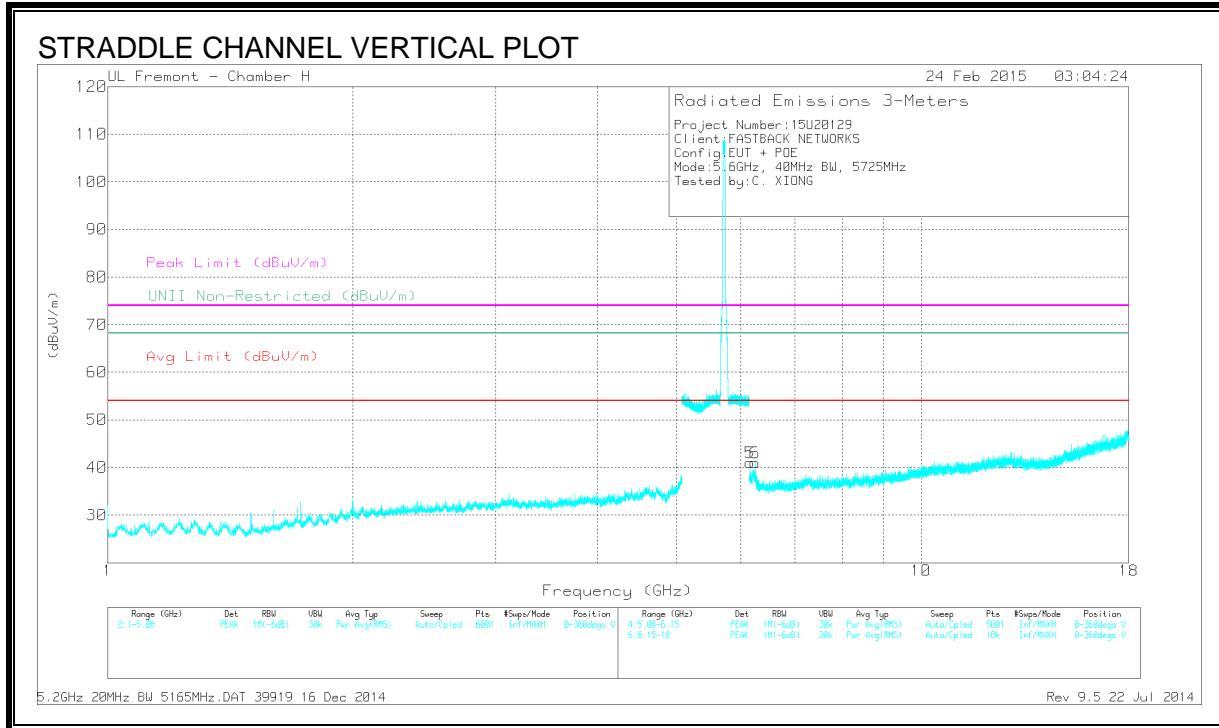
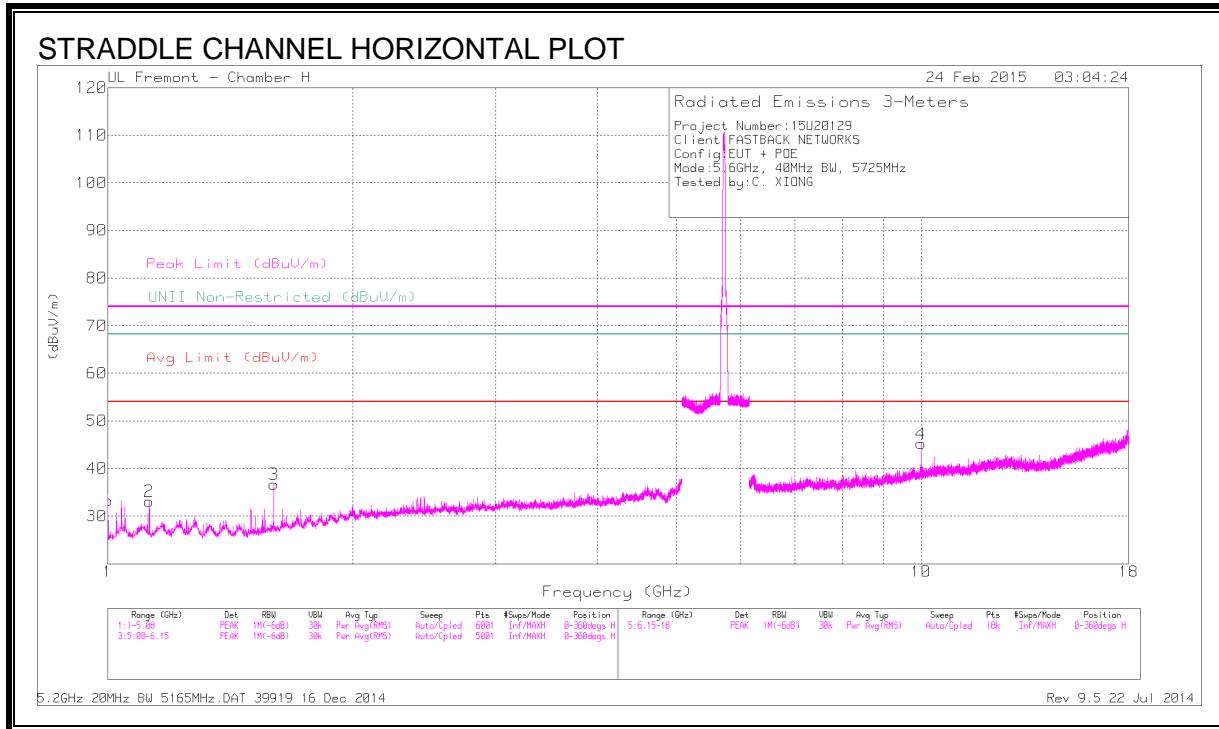
\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK1 - KDB789033 Method: Peak

AD1 - KDB789033 Method: AD Primary Power Average

## 9.2.4. TX ABOVE 1 GHz 40MHz 2 TX MODE IN THE 5.8 GHz BAND

## **HARMONICS AND SPURIOUS EMISSIONS**



**DATA**

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ft tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1	47.13	PK1	27.7	-35.6	39.23	-	-	74	-34.77	-	-	360	136	H
* 1	39.76	AD1	27.7	-35.6	31.86	54	-22.14	-	-	-	-	360	136	H
* 1	46.06	PK1	27.7	-35.6	38.16	-	-	74	-35.84	-	-	322	121	H
* 1	38.08	AD1	27.7	-35.6	30.18	54	-23.82	-	-	-	-	322	121	H
* 1.125	46.3	PK1	28.4	-35.6	39.1	-	-	74	-34.9	-	-	330	113	H
* 1.125	37.96	AD1	28.3	-35.6	30.66	54	-23.34	-	-	-	-	330	113	H
* 1.6	48.82	PK1	28.5	-35	42.32	-	-	74	-31.68	-	-	342	267	H
* 1.6	43.05	AD1	28.5	-35	36.55	54	-17.45	-	-	-	-	342	267	H
6.16	44.12	PK1	35.3	-30.5	48.92	-	-	-	-	68.2	-19.28	7	107	V
6.25	44.84	PK1	35.4	-31.3	48.94	-	-	-	-	68.2	-19.26	9	102	V
10	40.26	PK1	37.3	-26.3	51.26	-	-	-	-	68.2	-16.94	202	121	H

\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK1 - KDB789033 Method: Peak

AD1 - KDB789033 Method: AD Primary Power Average

## 10. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

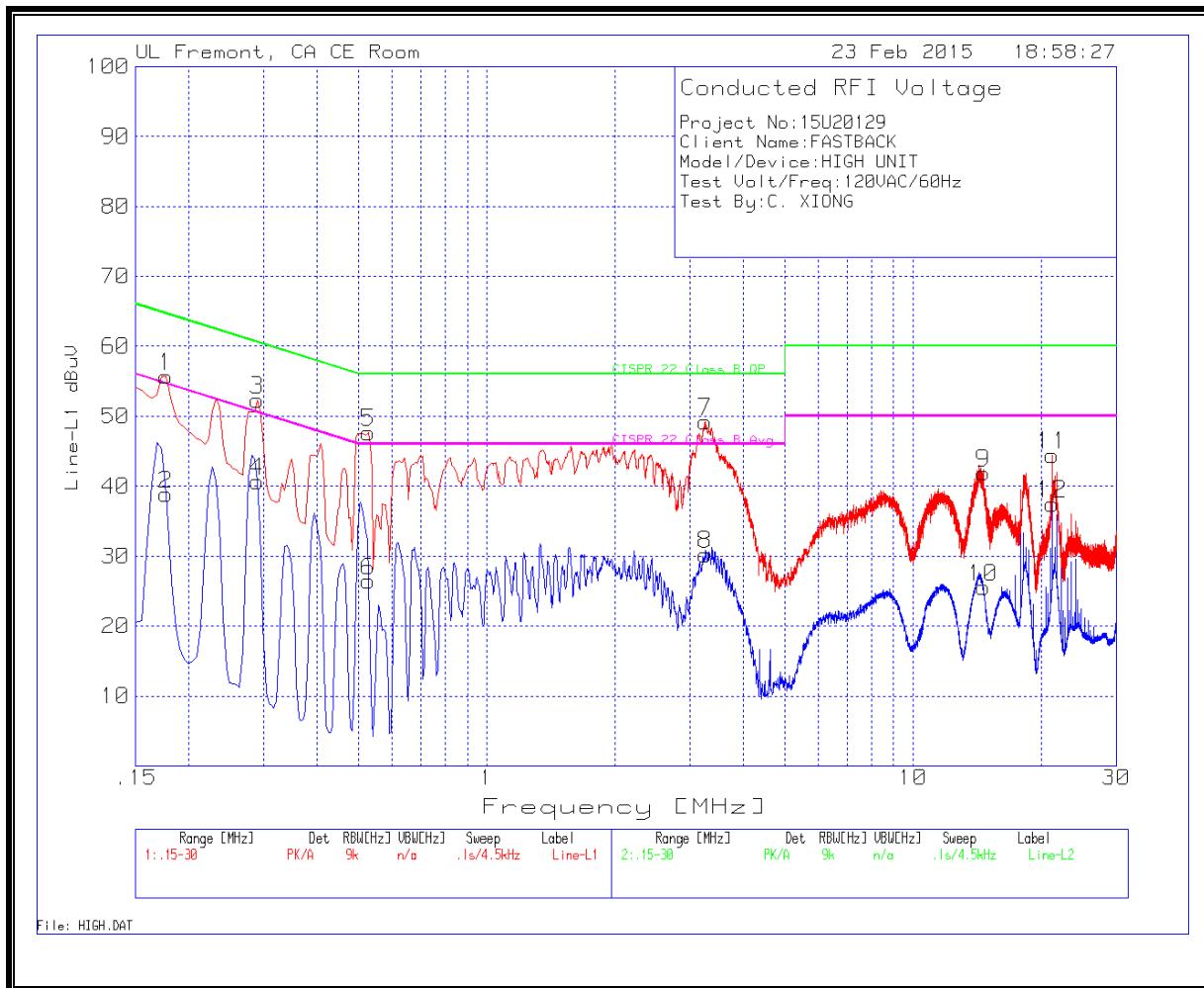
Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 <sup>*</sup>	56 to 46 <sup>*</sup>
0.5-5	56	46
5-30	60	50

<sup>\*</sup> Decreases with the logarithm of the frequency.

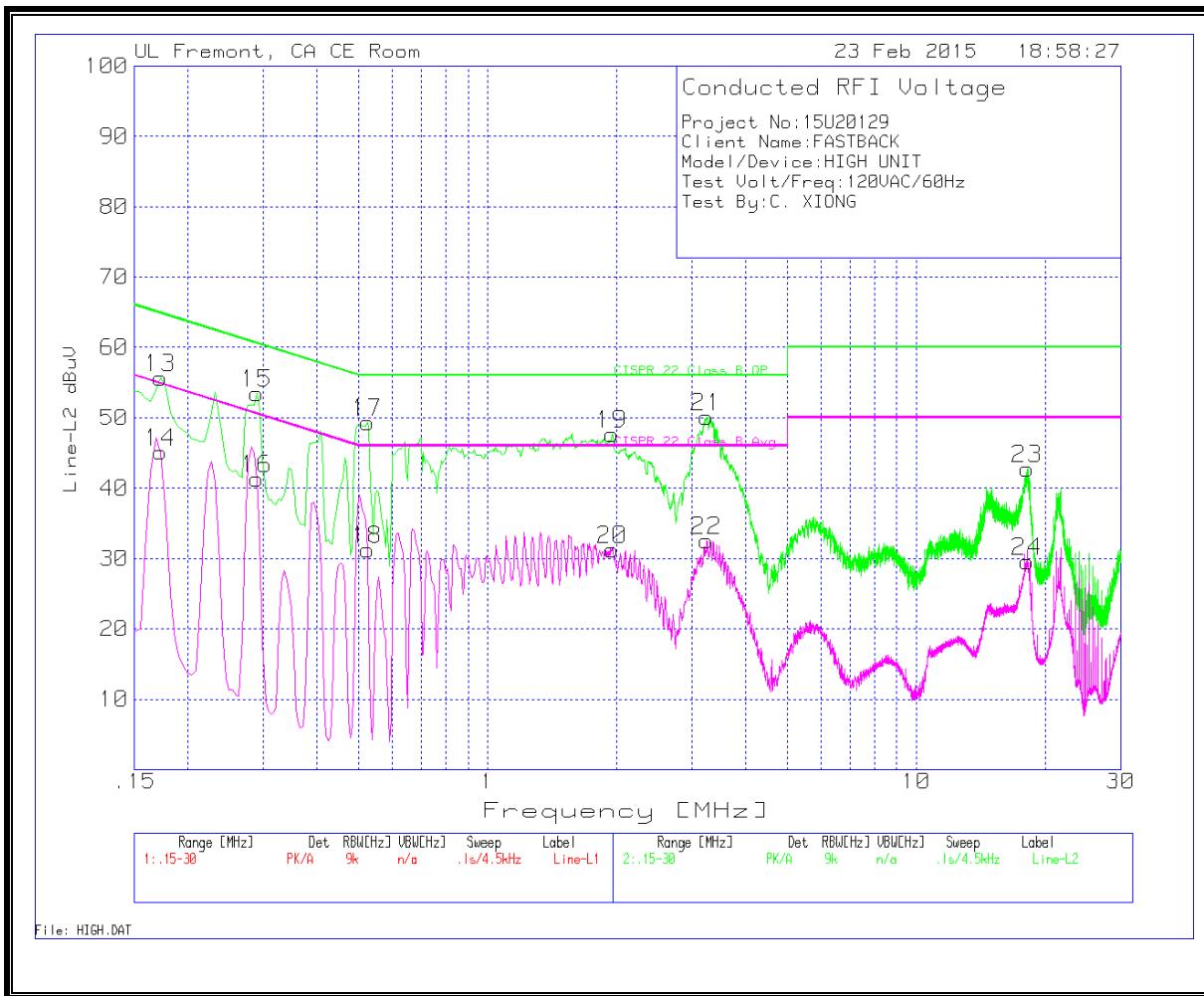
## 5.6GHz BAND

### WORST CASE RESULTS

#### LINE 1 RESULTS



**LINE 2 RESULTS**



**DATA**

**Line-L1 .15 - 30MHz**

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
1	.177	54.63	PK	1.1	0	55.73	64.6	-8.87	-	-
2	.177	37.72	Av	1.1	0	38.82	-	-	54.6	-15.78
3	.2895	51.77	PK	.6	0	52.37	60.5	-8.13	-	-
4	.2895	40.12	Av	.6	0	40.72	-	-	50.5	-9.78
5	.528	47.41	PK	.3	0	47.71	56	-8.29	-	-
6	.528	26.12	Av	.3	0	26.42	-	-	46	-19.58
7	3.255	48.97	PK	.2	.1	49.27	56	-6.73	-	-
8	3.255	29.94	Av	.2	.1	30.24	-	-	46	-15.76
9	14.6085	41.51	PK	.2	.2	41.91	60	-18.09	-	-
10	14.6085	25.12	Av	.2	.2	25.52	-	-	50	-24.48
11	21.228	43.93	PK	.3	.2	44.43	60	-15.57	-	-
12	21.228	37.01	Av	.3	.2	37.51	-	-	50	-12.49

**Line-L2 .15 - 30MHz**

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
13	.1725	54.46	PK	1.2	0	55.66	64.8	-9.14	-	-
14	.1725	43.94	Av	1.2	0	45.14	-	-	54.8	-9.66
15	.2895	52.83	PK	.6	0	53.43	60.5	-7.07	-	-
16	.2895	40.78	Av	.6	0	41.38	-	-	50.5	-9.12
17	.5235	48.95	PK	.4	0	49.35	56	-6.65	-	-
18	.5235	30.88	Av	.4	0	31.28	-	-	46	-14.72
19	1.9545	47.4	PK	.2	.1	47.7	56	-8.3	-	-
20	1.9545	31	Av	.2	.1	31.3	-	-	46	-14.7
21	3.246	49.79	PK	.2	.1	50.09	56	-5.91	-	-
22	3.246	32.2	Av	.2	.1	32.5	-	-	46	-13.5
23	18.159	42.26	PK	.3	.2	42.76	60	-17.24	-	-
24	18.159	29.07	Av	.3	.2	29.57	-	-	50	-20.43

PK - Peak detector

Av - average detection