

Report on the Radio Testing

For

SmarDTV (UK) Limited
on

Project N63

Report no. TRA-029575-02-45-08C

2nd December 2016

RFXXX

Report Number: TRA-029575-02-45-08C
Issue: C

REPORT ON THE RADIO TESTING OF A
SmarDTV (UK) Limited
Project N63
WITH RESPECT TO SPECIFICATION
FCC 47CFR Subpart E

TEST DATE: 25th April - 26th September 2016

Tested by: A Longley

A Longley - A Tosif - A Wong
Radio Test Engineer

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Date: 2nd December 2016

Disclaimers:

- [1] THIS DOCUMENT MAY BE REPRODUCED ONLY IN ITS ENTIRETY AND WITHOUT CHANGE
[2] THE RESULTS CONTAINED IN THIS DOCUMENT RELATE ONLY TO THE ITEM(S) TESTED

1 Revision Record

<i>Issue Number</i>	<i>Issue Date</i>	<i>Revision History</i>
A	14 th November 2016	Original
C	2 nd December 2016	EUT name change

2 Summary

TEST REPORT NUMBER: TRA-029575-02-45-08C

WORKS ORDER NUMBER TRA-029575-02

PURPOSE OF TEST: Testing of radio frequency equipment per the relevant authorization procedure of chapter 47 of CFR (code of federal regulations) Part 2, subpart J.

TEST SPECIFICATION: 47CFR15 Subpart E

EQUIPMENT UNDER TEST (EUT): Project N63

FCC IDENTIFIER: DKN-AVBX1

EUT SERIAL NUMBER: 1604210679 & 14604210698

MANUFACTURER/AGENT: SmarDTV (UK) Limited

ADDRESS: Beckside Design Centre
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ORDER NUMBER: POR01251

TEST DATE: 25th April - 26th September 2016

TESTED BY: A Longley - A Tosif - A Wong
Element

2.1 Test Summary

Test Method and Description		Requirement Clause	Applicable to this equipment	Result / Note
		47CFR15		
Radiated spurious emissions (restricted bands of operation and cabinet radiation)		15.205	<input checked="" type="checkbox"/>	Pass
AC power line conducted emissions		15.207	<input type="checkbox"/>	Note 1
Occupied bandwidth		15.407(e)	<input checked="" type="checkbox"/>	Pass
Output power	Conducted	15.407(a)	<input checked="" type="checkbox"/>	Pass
	PSD		<input checked="" type="checkbox"/>	
	RPE		<input type="checkbox"/>	
Conducted / radiated RF power out-of-band		15.407(b)	<input checked="" type="checkbox"/>	Pass
Duty cycle		15.35(c)	<input type="checkbox"/>	N/A
TPC and DFS		15.407(h)	<input type="checkbox"/>	Note 2

Note s:

1. See Test report TRA-029575-02-45-05A
2. See Test report TRA-029575-02-45-07A

The results contained in this report relate only to the items tested, in the condition at time of test, and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set-up and exercised using the configurations, modes of operation and arrangements defined in this report only. Any modifications made are identified in Section 8 of this report.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 5.2 of this test report (Deviations from Test Standards).

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4 Introduction

This report TRA-029575-02-45-08C presents the results of the Radio testing on a EchoStar Europe, Project N63 to specification 47CFR15 Radio Frequency Devices and RSS-247 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

The testing was carried out for EchoStar Europe by Element, at the address(es) detailed below.

- | | |
|---|---|
| <input checked="" type="checkbox"/> Element Hull
Unit E
South Orbital Trading Park
Hedon Road
Hull
HU9 1NJ
UK | <input type="checkbox"/> Element Skelmersdale
Unit 1
Pendle Place
Skelmersdale
West Lancashire
WN8 9PN
UK |
|---|---|

This report details the configuration of the equipment, the test methods used and any relevant modifications where appropriate.

FCC Site Listing:

The test laboratory is accredited for the above sites under the US-EU MRA, Designation number UK0009.

IC Registration Number(s):

Element Skelmersdale	3930B
Element Hull	3483A

The test site requirements of ANSI C63.4-2014 are met up to 1GHz.

The test site SVSWR requirements of CISPR 16-1-4:2010 are met over the frequency range 1 GHz to 18 GHz.

5 Test Specifications

5.1 Normative References

- FCC 47 CFR Ch. I – Part 15 – Radio Frequency Devices.
- FCC KDB Publication 905462 D02 v01 r02 – Compliance measurement procedures for unlicensed-national information infrastructure devices operating in the 5250-5350 MHz and 5470-5725 MHz bands incorporating dynamic frequency selection.
- ANSI C63.10-2013 – American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- ANSI C63.4-2014 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

5.2 Deviations from Test Standards

There were no deviations from the test standard.

6 Glossary of Terms

§	denotes a section reference from the standard, not this document
AC	Alternating Current
ANSI	American National Standards Institute
BW	bandwidth
C	Celsius
CAC	Channel Availability Check
CFR	Code of Federal Regulations
CW	Continuous Wave
dB	decibel
dBm	dB relative to 1 milliwatt
DC	Direct Current
DFS	Dynamic Frequency Selection
DSSS	Direct Sequence Spread Spectrum
ERP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
Hz	hertz
IC	Industry Canada
ITU	International Telecommunication Union
LBT	Listen Before Talk
LE-LAN	Licence-Exempt Local Area Network
m	metre
max	maximum
MIMO	Multiple Input and Multiple Output
min	minimum
MRA	Mutual Recognition Agreement
N/A	Not Applicable
PCB	Printed Circuit Board
PDF	Portable Document Format
Pt-mpt	Point-to-multipoint
Pt-pt	Point-to-point
PSD	Power Spectral Density
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
Rx	receiver
s	second
SVSWR	Site Voltage Standing Wave Ratio
TPC	Transmitter Power Control
Tx	transmitter
UKAS	United Kingdom Accreditation Service
U-NII	Unlicensed-National Information Infrastructure
V	volt
W	watt
Ω	ohm

7 Equipment Under Test

7.1 EUT Identification

- Name: Project N63
- Serial Number: 1604210679 & 14604210698
- Model Number: S60
- Software Revision: Not Applicable
- Build Level / Revision Number: Not Applicable

7.2 System Equipment

Equipment listed below forms part of the overall test setup and is required for equipment functionality and/or monitoring during testing. The compliance levels achieved in this report relate only to the EUT and not items given in the following list.

Sample No.	Description	Model No.	Serial No.
S08	EUT 12 Vdc Power Adapter	EADP-40MB A	HBBD45F00A7
S11	Lenovo ThinkPad	E560	34546
S14	Thurlby Thandar Audio Generator	TF215	045441
S15	LG TV	M227WDL	002MAAK4P824
S17	Channel Master DVR	CM-7500TB1	R5YFKZ00228D
S27	Dlink USB to Ethernet adapter	DUB-E100	Q8041AA002873

7.3 EUT Mode of Operation

7.3.1 Transmission

The mode of operation for transmitter tests was as follows.

Wi-Fi transmitter control was via commands sent through MTool v2.0.3.2 software. The commands provided by the manufacturer setup the device into a permanent transmit mode. For each type of test, lowest and highest data rates were investigated to find the worst case data rate. Only the worst case results are reported. The commands allowed adjustment of the following parameters of significant interest.

CDD modes were selected as the worst case from initial investigative measurements.

Modulation Scheme / Mode	Channel	Data rate	Power setting
802.11a / CDD	36	OFDM6	28
		OFDM54	28
	52	OFDM6	47
		OFDM54	47
	64	OFDM6	49
		OFDM54	49
	100	OFDM6	49
		OFDM54	49
	116	OFDM6	49
		OFDM54	49
	144	OFDM6	37
		OFDM54	37
	149	OFDM6	62
		OFDM54	62
	157	OFDM6	62
		OFDM54	62
	165	OFDM6	62
		OFDM54	62

Modulation Scheme	Channel	Data rate	Power setting
802.11n/ac 20 MHz / CDD	36	mcs0	28
		mcs11	28
	52	mcs0	47
		mcs11	47
	64	mcs0	49
		mcs11	48
	100	mcs0	49
		mcs11	49
	116	mcs0	49
		mcs11	49
	144	mcs0	37
		mcs11	37
	149	mcs0	62
		mcs11	62
	157	mcs0	62
		mcs11	62
	165	mcs0	62
		mcs11	62

Modulation Scheme	Channel	Data rate	Power setting
802.11n/ac 40 MHz / CDD	38	mcs0	32
		mcs9	32
	54	mcs0	59
		mcs9	50
	62	mcs0	52
		mcs9	50
	102	mcs0	60
		mcs9	50
	110	mcs0	57
		mcs9	50
	142	mcs0	49
		mcs9	50
	151	mcs0	62
		mcs9	62
	159	mcs0	62
		mcs9	62

Modulation Scheme	Channel	Data rate	Power setting
802.11ac 80 MHz / CDD	42	mcs0	28
		mcs9	28
	58	mcs0	56
		mcs9	56
	106	mcs0	60
		mcs9	50
	122	mcs0	60
		mcs9	50
	138	mcs0	61
		mcs9	50
	155	mcs0	62
		mcs9	62

All Power settings are in format XXq dBm

7.3.2 Reception

This report covers transmitter operation only. Results for unintentional emissions can be found in test report TRA-029575-44-00B.

7.4 EUT Radio Frequency Parameters

7.4.1 General

Frequency of operation:	5.15 GHz – 5.35 GHz; 5.47 GHz – 5.725 GHz; 5.725GHz – 5.85 GHz
Modulation type(s):	OFDM, MCS0-9
Occupied channel bandwidth(s):	20 MHz / 40 MHz / 80 MHz
Nominal Supply Voltage:	110 Vac

7.4.2 Antennas

Type:	Integral
Frequency range:	5.15 GHz – 5.35 GHz; 5.47 GHz – 5.725 GHz; 5.725GHz – 5.85 GHz
Impedance:	50 Ohms
Gain:	See table below
Connector type:	U-FL
Mounting:	Case Mounted

Antenna Gain				
Frequency [MHz]	Antenna 3	Antenna 2	Antenna 1	Antenna 0
4900	3.1	3.8	4.2	4.3
4950	2.9	4.3	4.6	4
5000	2.7	4.9	4.6	3.6
5050	2.7	4.8	4.4	3.9
5100	2.7	4.9	4.1	4.2
5150	3.3	5.1	4.4	4.5
5200	3.8	5.3	4.5	4.7
5250	4.2	5.2	4.4	4.8
5300	4.4	4.9	4.5	4.8
5350	4.5	4.9	4.5	4.7
5400	4.1	5	4.4	4
5450	3.8	4.9	4.3	4.4
5500	4	4.9	4.1	4.7
5550	3.5	4.8	4.3	4.8
5600	3.8	5	4.1	4.7
5650	4.2	5.5	4.4	4.2
5700	4.1	6	4.2	4.2
5750	4	6.4	4.5	4.6
5800	4.4	6.5	4.1	5.2
5850	4.4	6.4	4.3	5.6
5900	4.1	5.8	4	5.3

7.4.3 Product specific declarations

Multiple antenna configuration(s), e.g. MIMO:	MIMO
Simultaneous tx (yes/no):	Yes

7.5 EUT Description

The EUT is a dual band Wi-Fi router with Bluetooth. The radios are contained on two separate modules. One module contains a 5 GHz Wi-Fi Access Point, and the other module contains a dual-band Wi-Fi Client and a dual-mode Bluetooth radio. All radios within the device are capable of simultaneous transmission. It is intended for both indoor and outdoor use (mobile, not portable).

This report only covers 5 GHz Wi-Fi Client. This radio is a DFS Slave device without radar detect. It uses the following operating schemes (beamformig is not supported):

- SISO (single antenna transmission)
- SM-MIMO (multiple antenna transmission, uncorrelated)
- STBC (multiple antenna transmission, uncorrelated)
- CDD (multiple antenna transmission, correlated)

Testing is only performed in CDD mode with both antennas' active.

It uses 6 modulation schemes in the 5 GHz band:

- 802.11a (20 MHz)
- 802.11n (20 MHz)
- 802.11n (40 MHz)
- 802.11ac (20 MHz)
- 802.11ac (40 MHz)
- 802.11ac (80 MHz)

And can transmit in the following bands:

- U-NII-1
- U-NII-2A
- U-NII-2C
- U-NII-3

There are 2 antennas of known gain

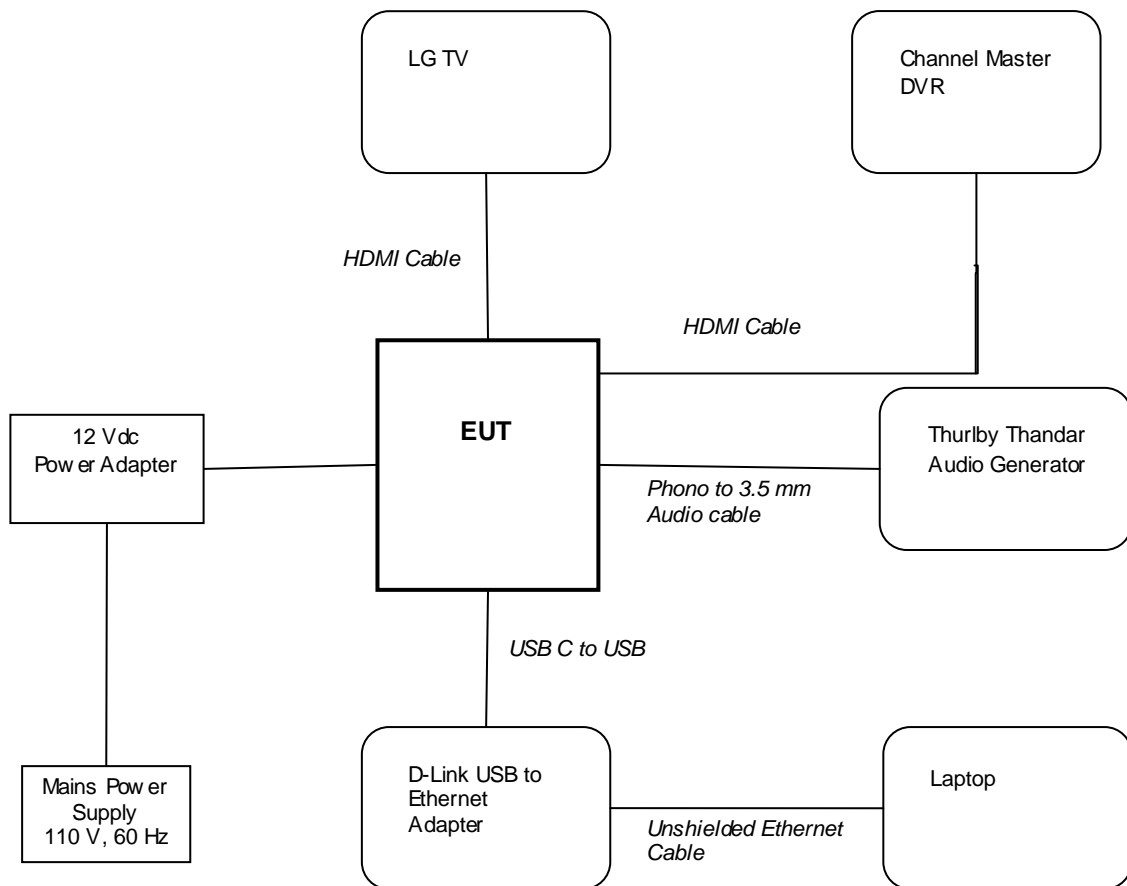
8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

9.1 Block Diagram

The following diagram shows basic EUT interconnections with cable type and cable lengths identified:



9.2 General Set-up Photograph

The following photograph shows basic EUT set-up:

Pictures removed for confidentiality

10 General Technical Parameters

10.1 Normal Conditions

The E U T was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was approx. 110 V ac from the mains.

10.2 Varying Test Conditions

Variation of supply voltage is required to ensure stability of the declared output power and frequency. During carrier power testing the following variations were made:

	<i>Category</i>	<i>Nominal</i>	<i>Variation</i>
<input checked="" type="checkbox"/>	Mains	110V ac +/-2%	85% and 115%
<input type="checkbox"/>	Battery	New battery	N/A

11 Occupied Bandwidth

11.1 Definition

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

11.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Wireless Laboratory 1
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.9
EUT Channels / Frequencies Measured:	Low / Mid / High
EUT Channel Bandwidths:	20 / 40 / 80 MHz
EUT Test Modulations:	OFDM, VHT20MCS0, VHT40MCS0, VHT80MCS0
Deviations From Standard:	None
Measurement BW: (FCC requirement: 100 kHz)	100 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	300 kHz
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 °C to +35 °C (as declared)
Humidity: 50%RH	20%RH to 75%RH (as declared)
Supply: 12V dc	

Test Limits

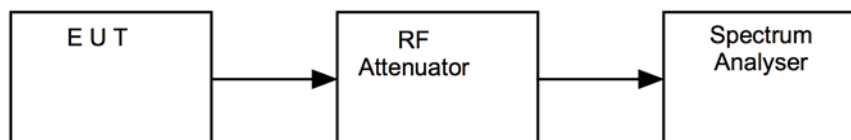
Within the 5.725–5.85 GHz band, the minimum 6 dB bandwidth of U–NII devices shall be at least 500 kHz.

11.3 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iii, the bandwidth of the EUT was measured on a spectrum analyser.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst-case configuration in each bandwidth.

Figure iii Test Setup



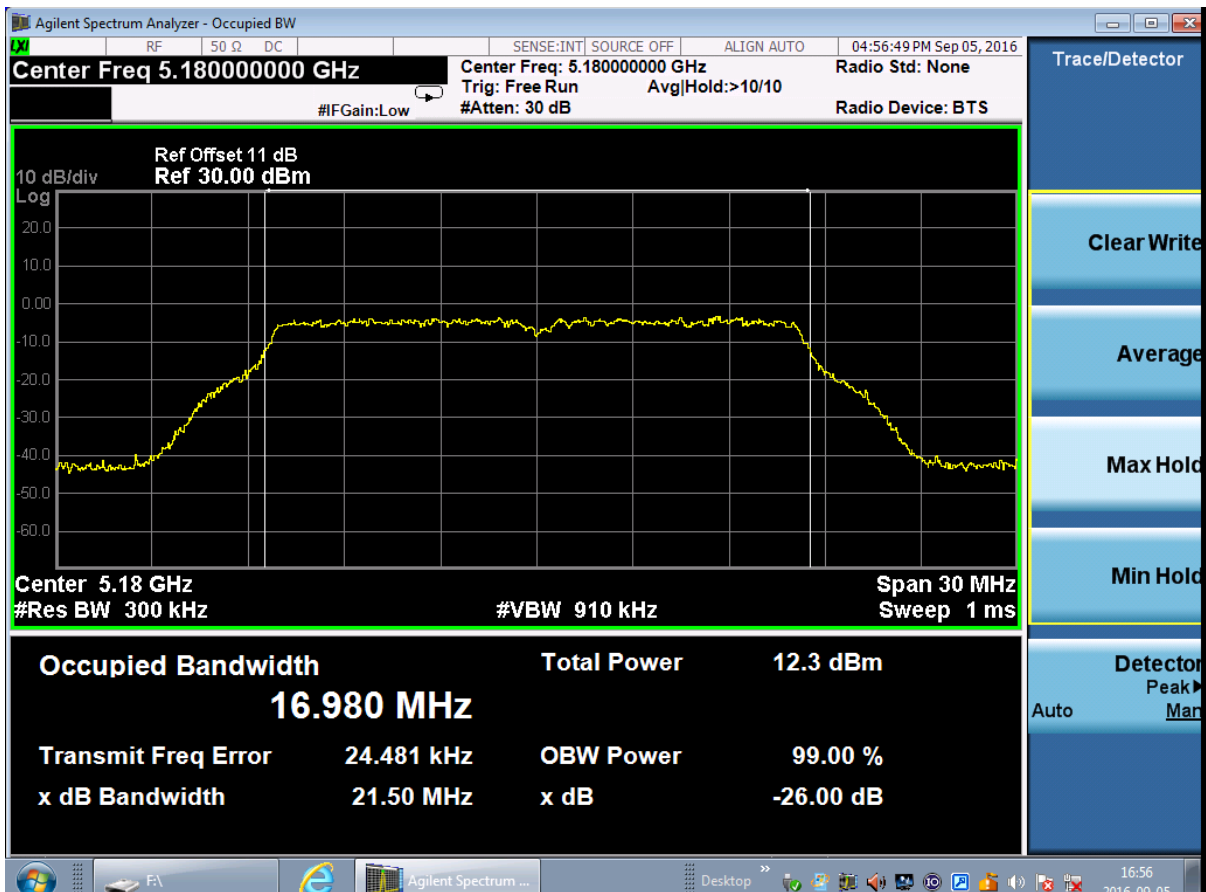
11.4 Test Equipment

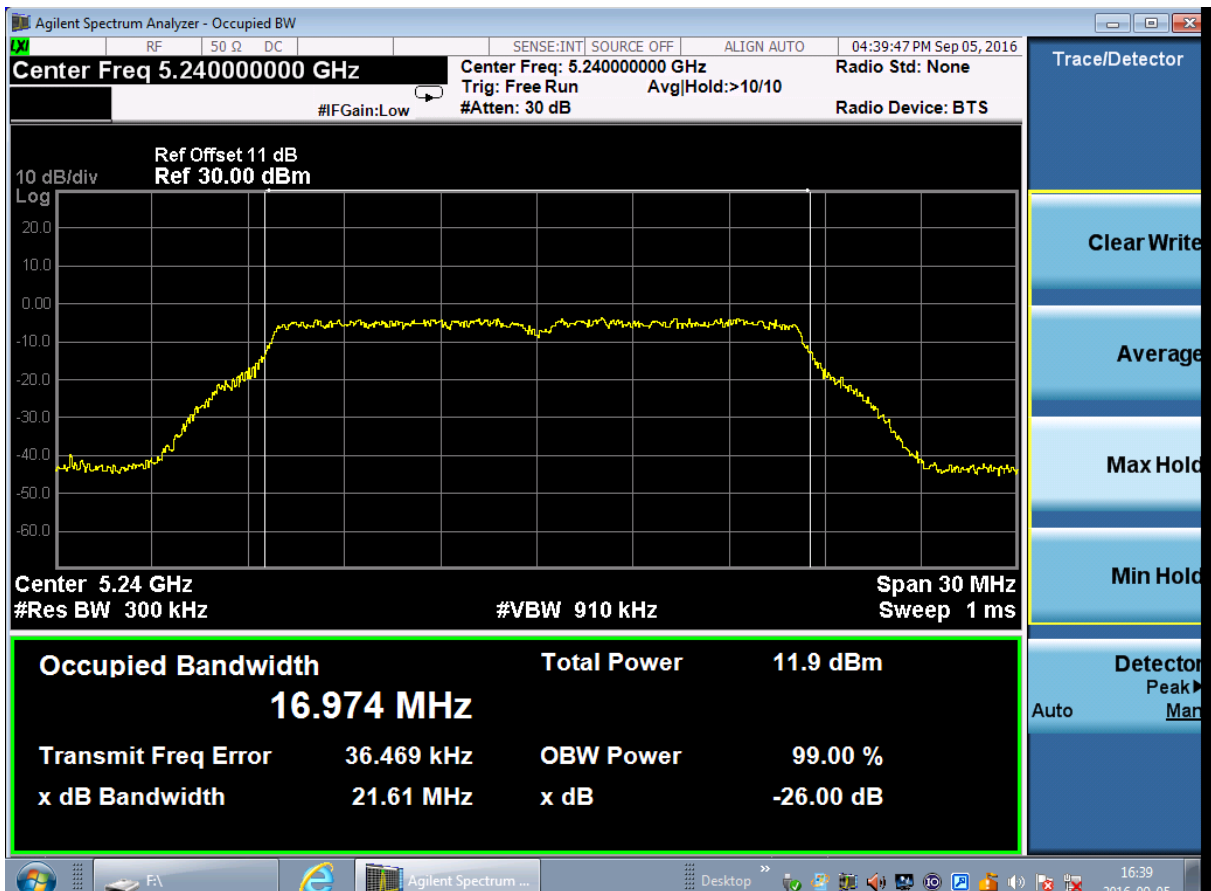
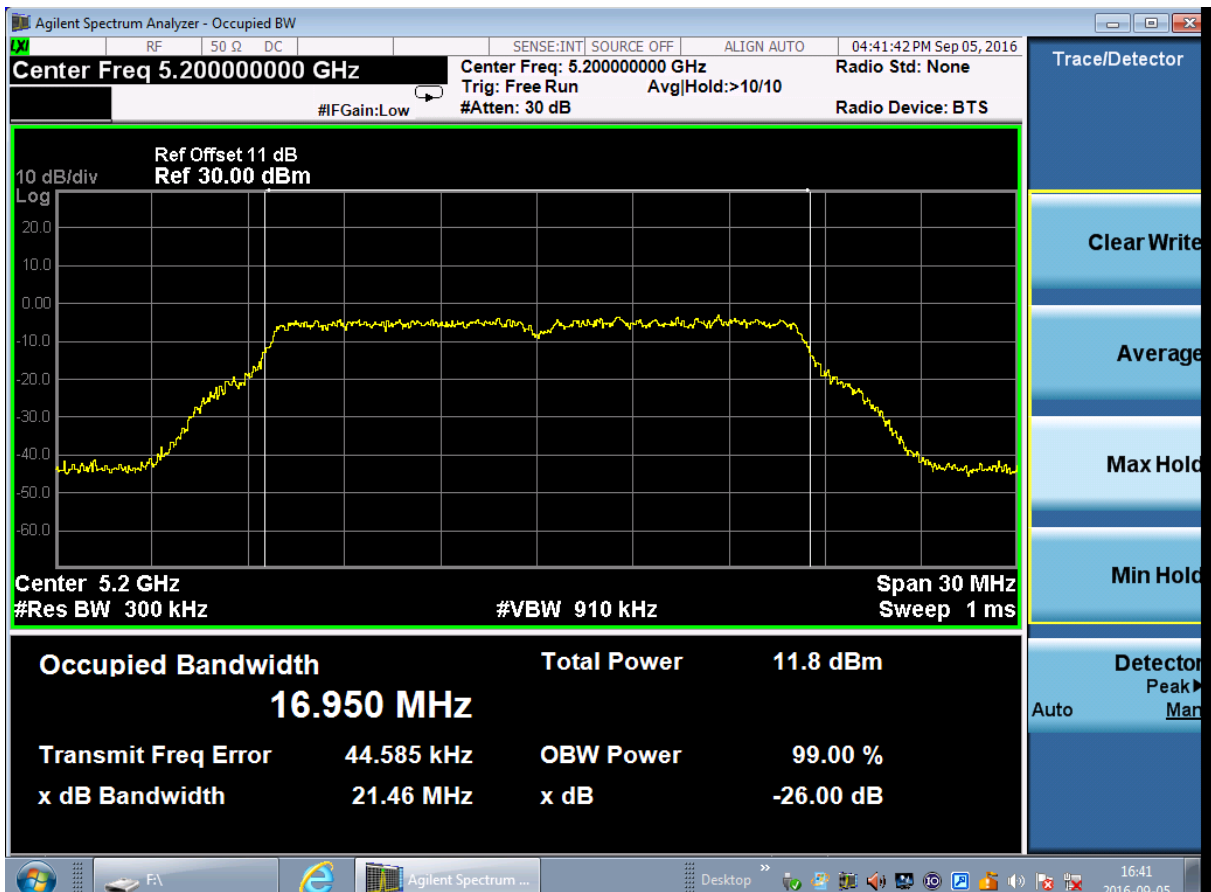
<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Last Cal Calibration</i>	<i>Calibration Period</i>	<i>Due For Calibration</i>
3 Hz to 44 GHz	Agilent	Spectrum Analyser	REF2167	13-10-15	12 months	13-10-16
Wideband	DARE	Power Meter	REF2083	17/11/2015	12	17/11/2016
20dB	N/A	RF pad	RFG373	12-2-16	12 months	12-2-17
3 Hz to 26.5 GHz	Agilent	Spectrum Analyser	REF837	22-6-16	12 months	22-6-17
10 Hz to 13.6 GHz	R&S	Spectrum Analyser	MCS299	14-07-16	12 months	14-07-17

11.5 Test Results

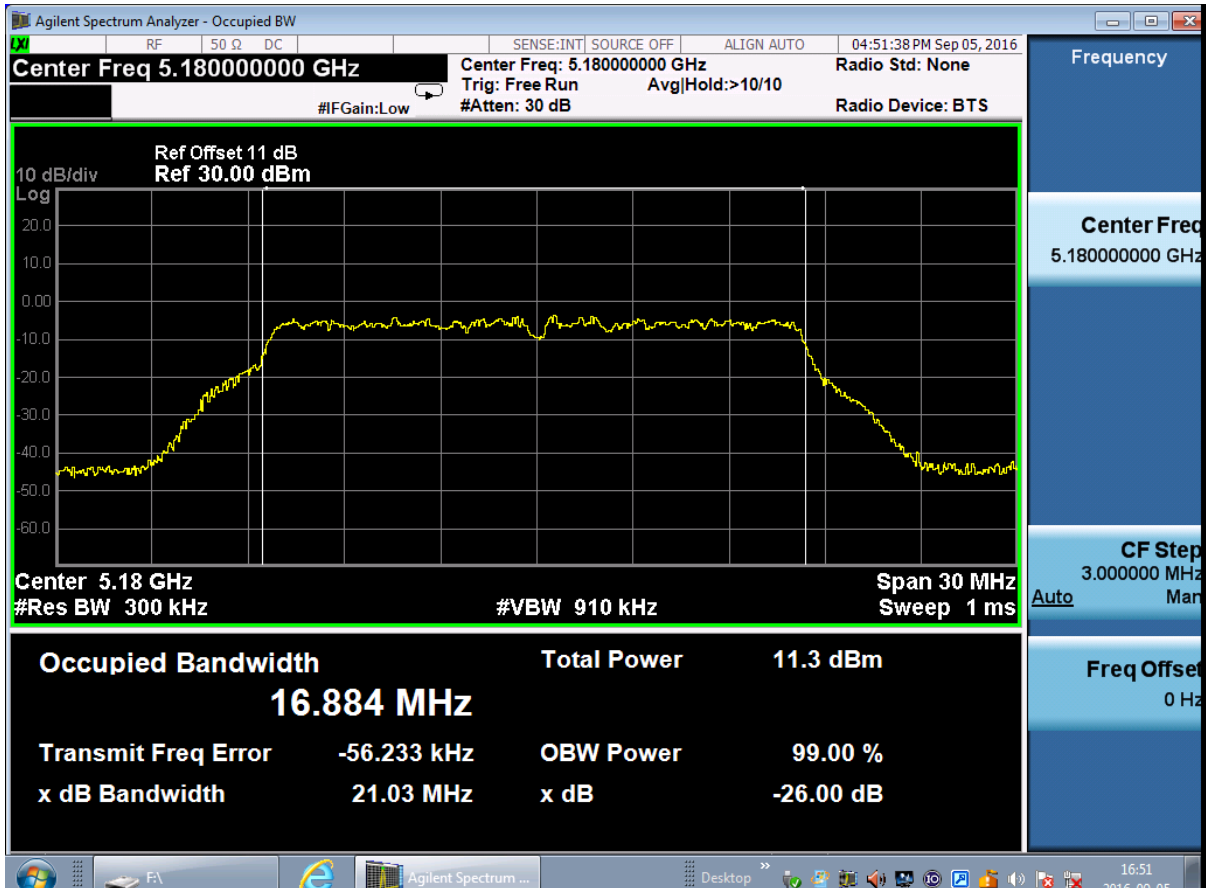
U-NII-1

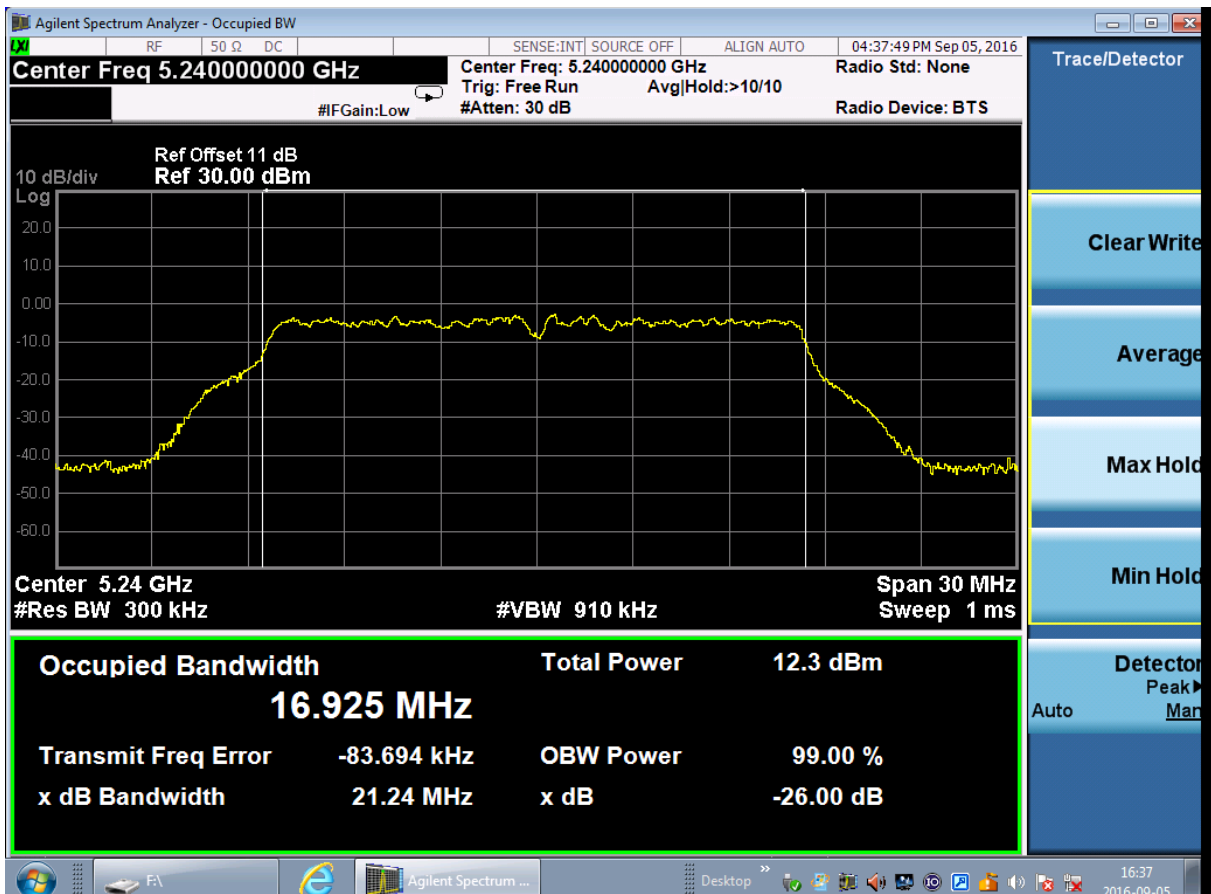
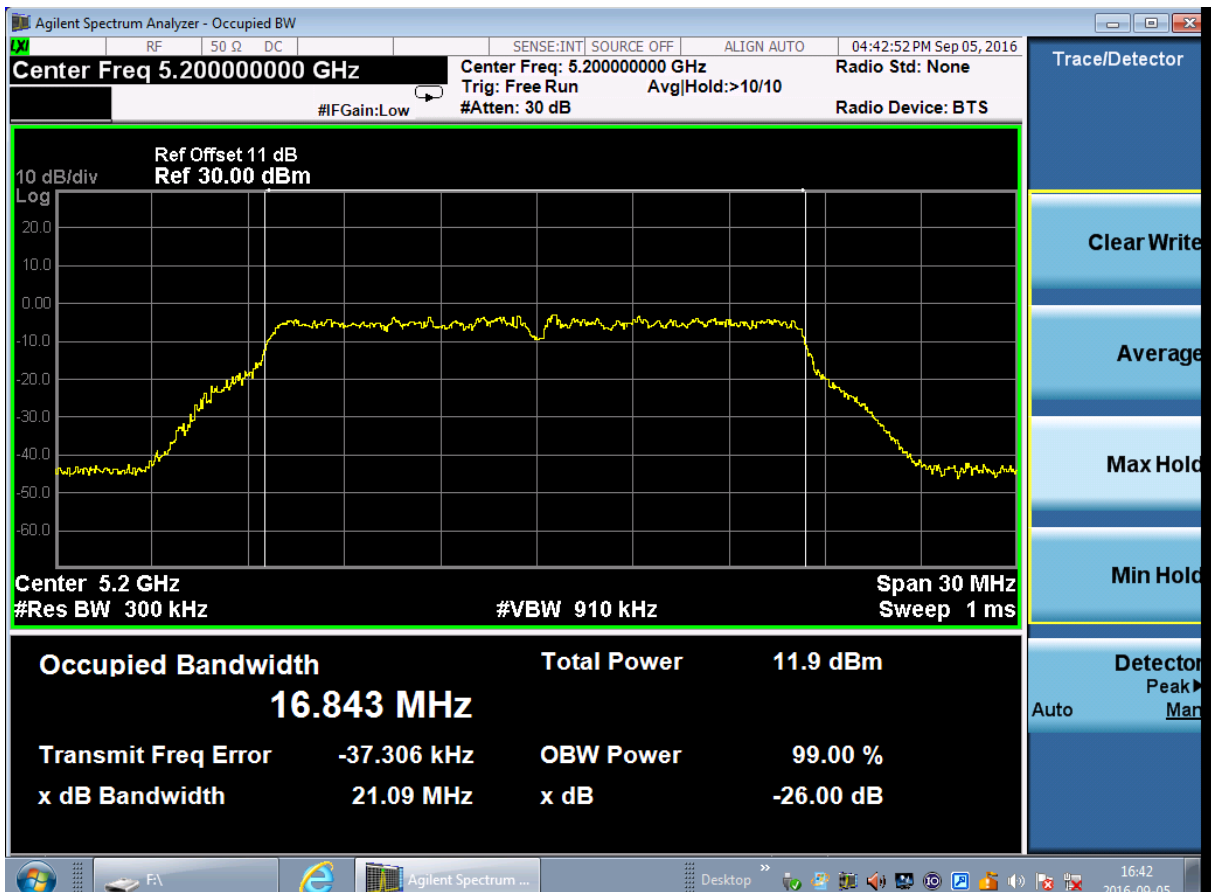
Modulation: OFDM; Data rate: 6 Mbps; Power setting: 28q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5180	21.50	16.980	N/A
5200	21.46	16.950	N/A
5240	21.61	16.974	N/A



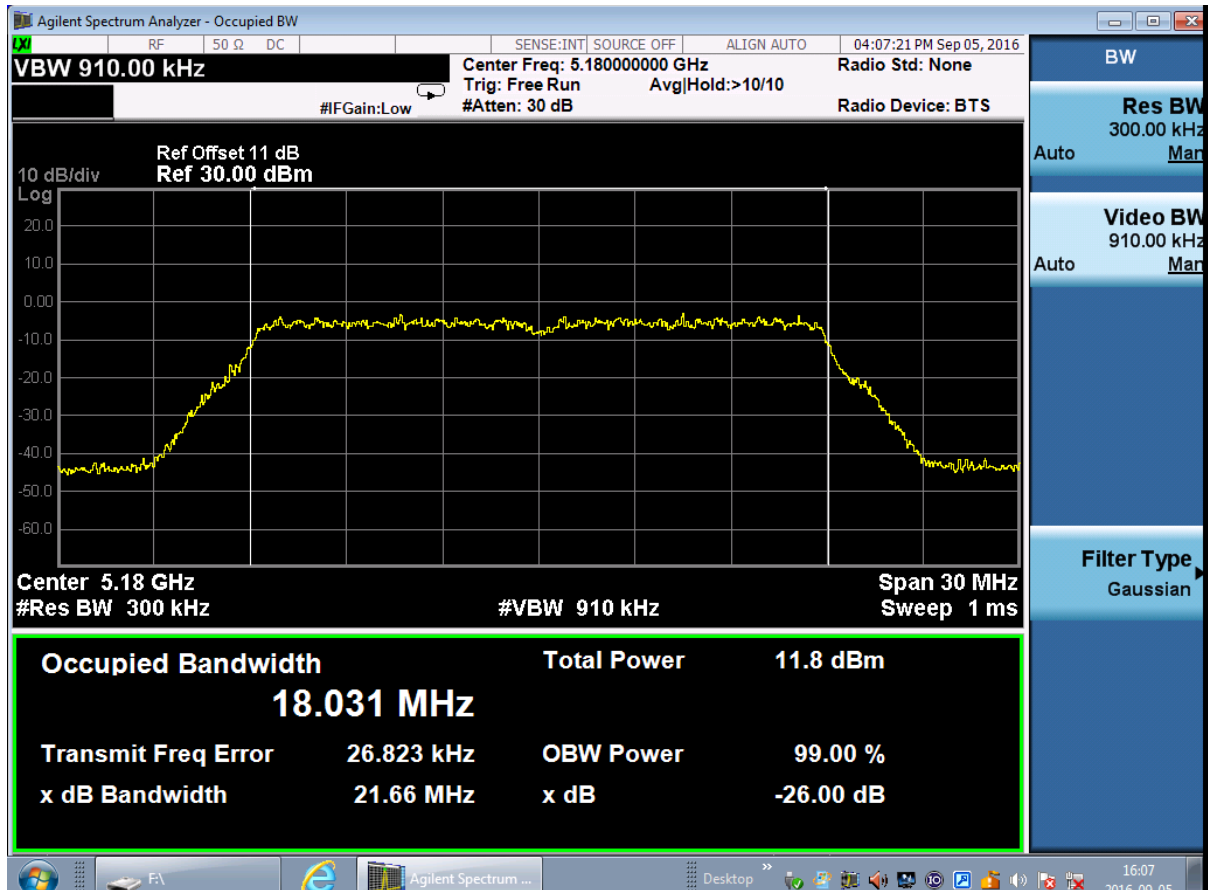


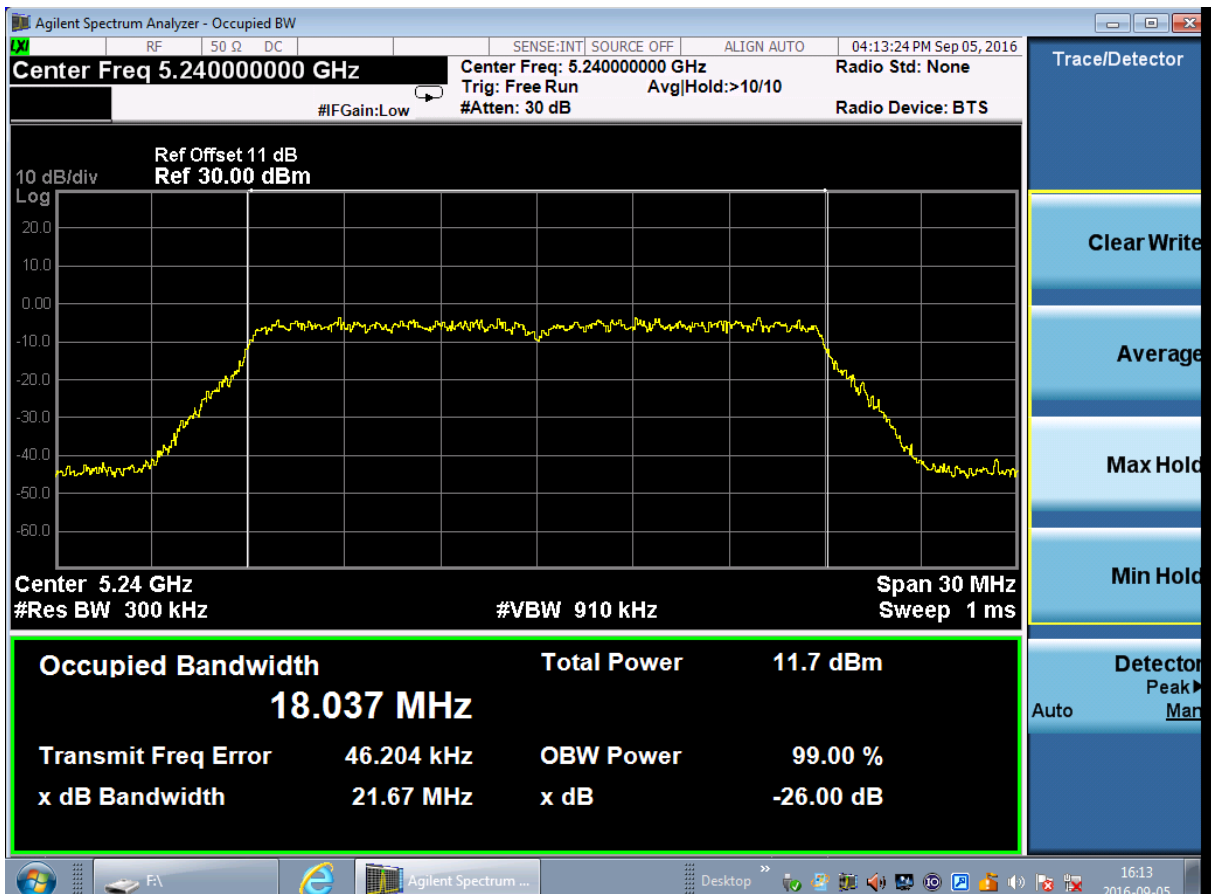
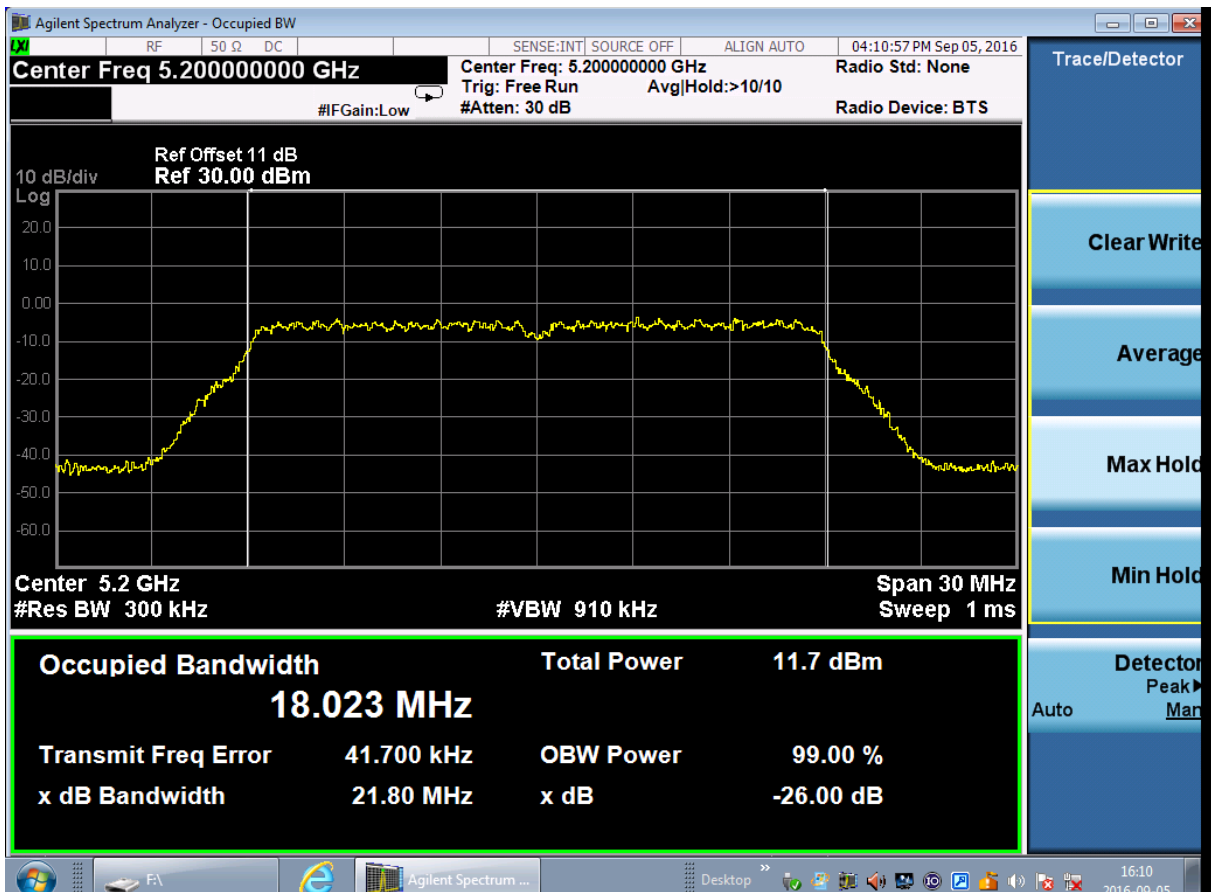
Modulation: OFDM; Data rate: 54 Mbps; Power setting: 28q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5180	21.03	16.884	N/A
5200	21.09	16.843	N/A
5240	21.24	16.925	N/A



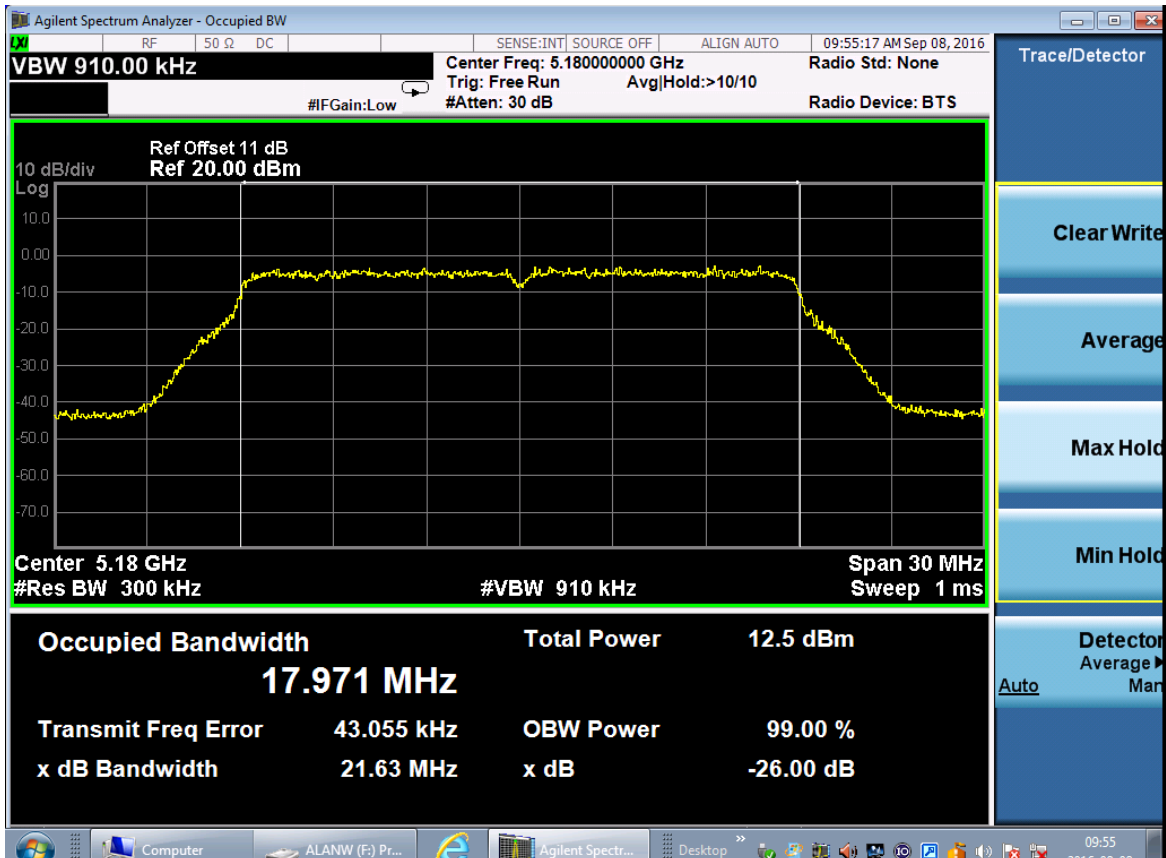


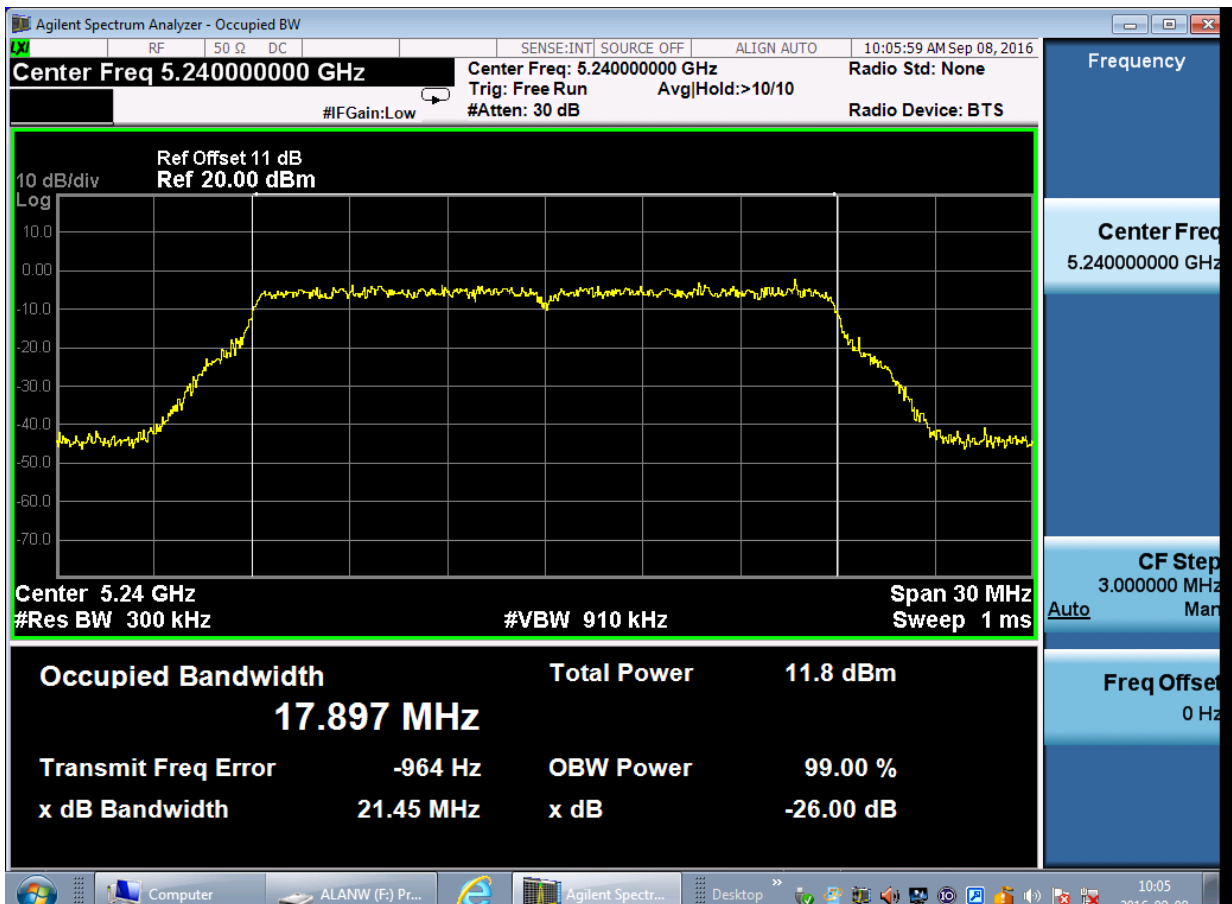
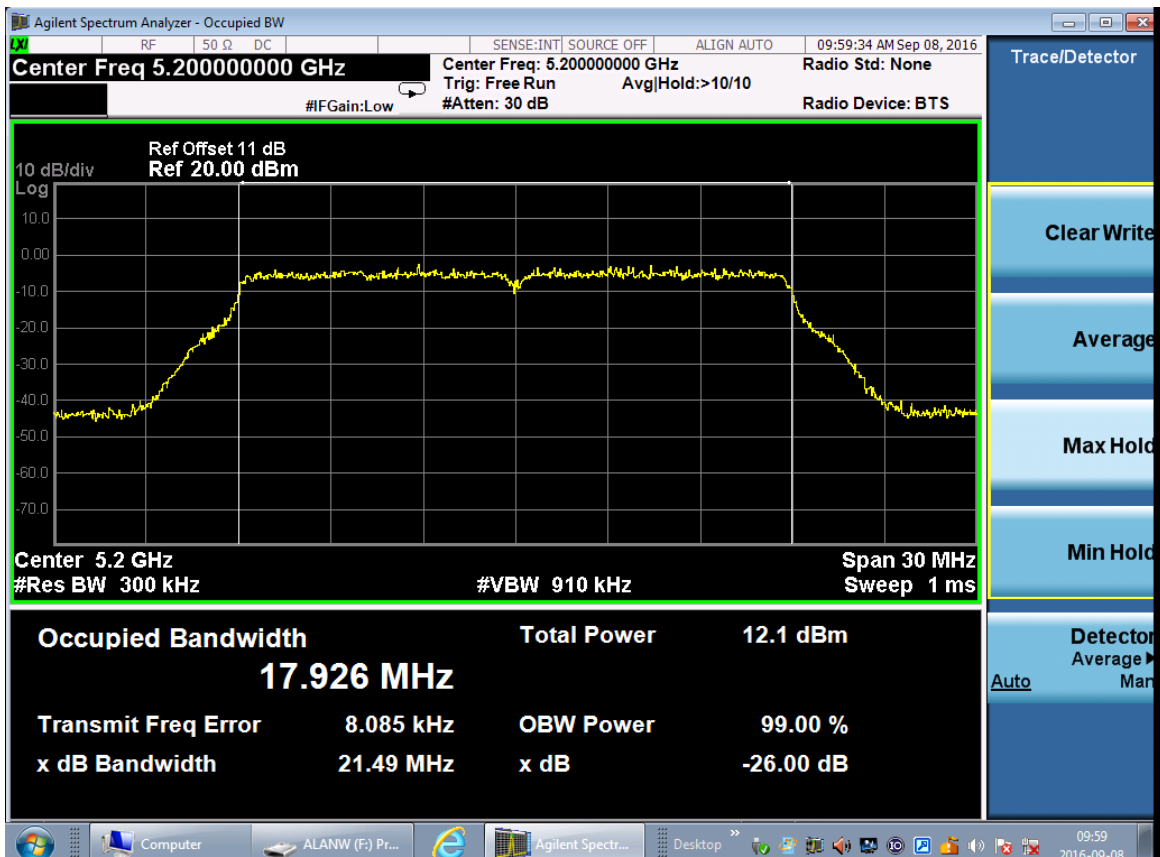
Modulation: VHT20; Data rate: MCS0NSS1; Power setting: 28q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5180	21.66	18.031	N/A
5200	21.80	18.023	N/A
5240	21.67	18.037	N/A



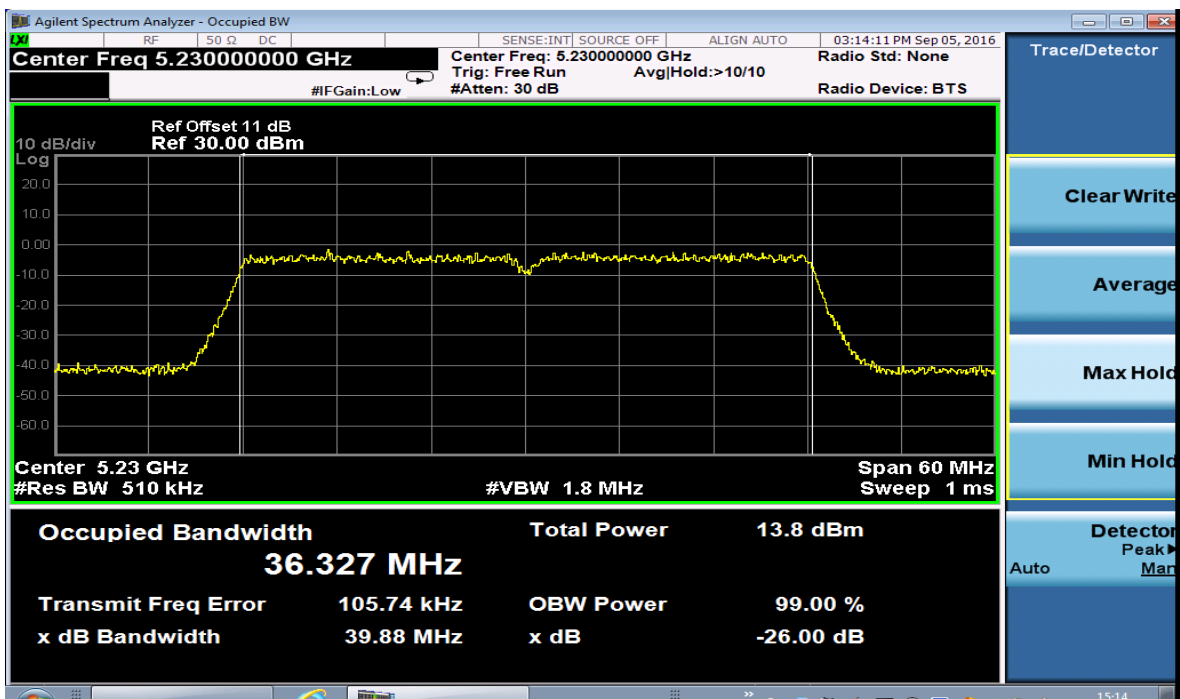
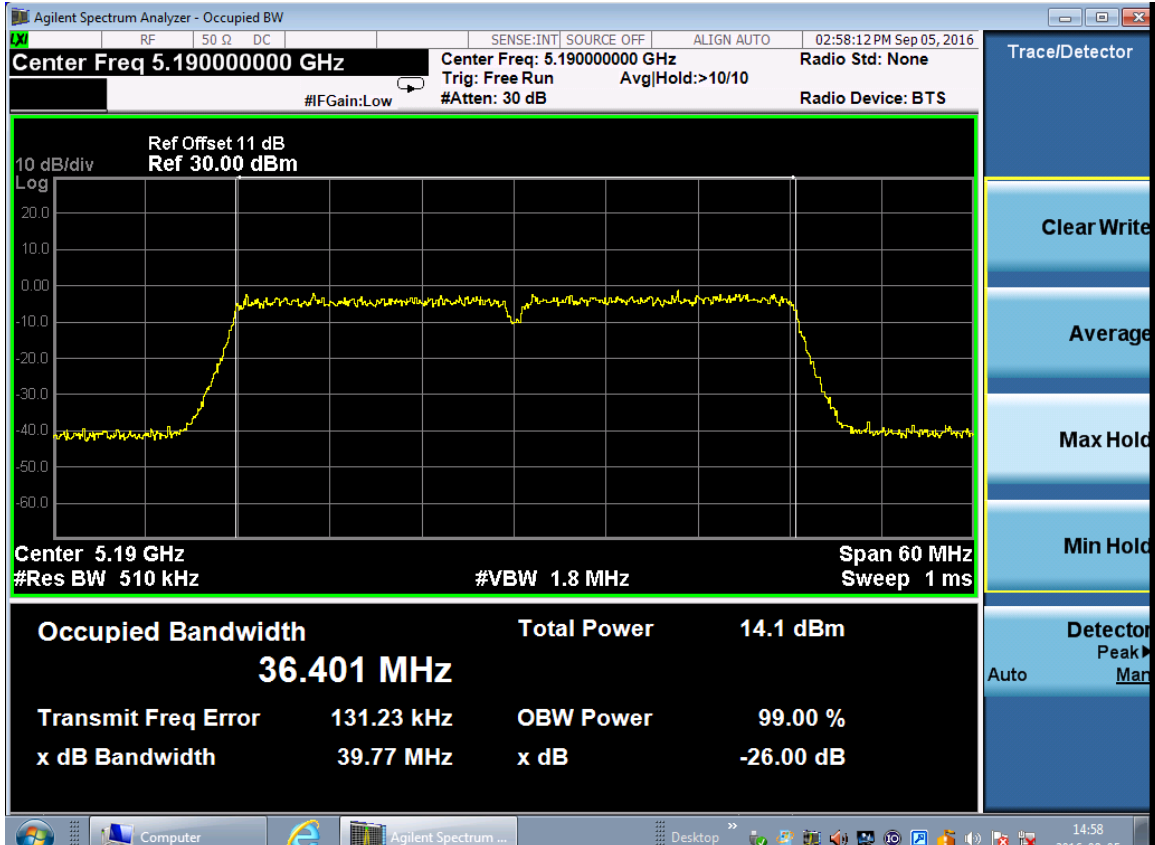


Modulation: VHT20; Data rate: MCS11NSS1; Power setting: 28q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5180	21.63	17.971	N/A
5200	21.49	17.926	N/A
5240	21.45	17.897	N/A

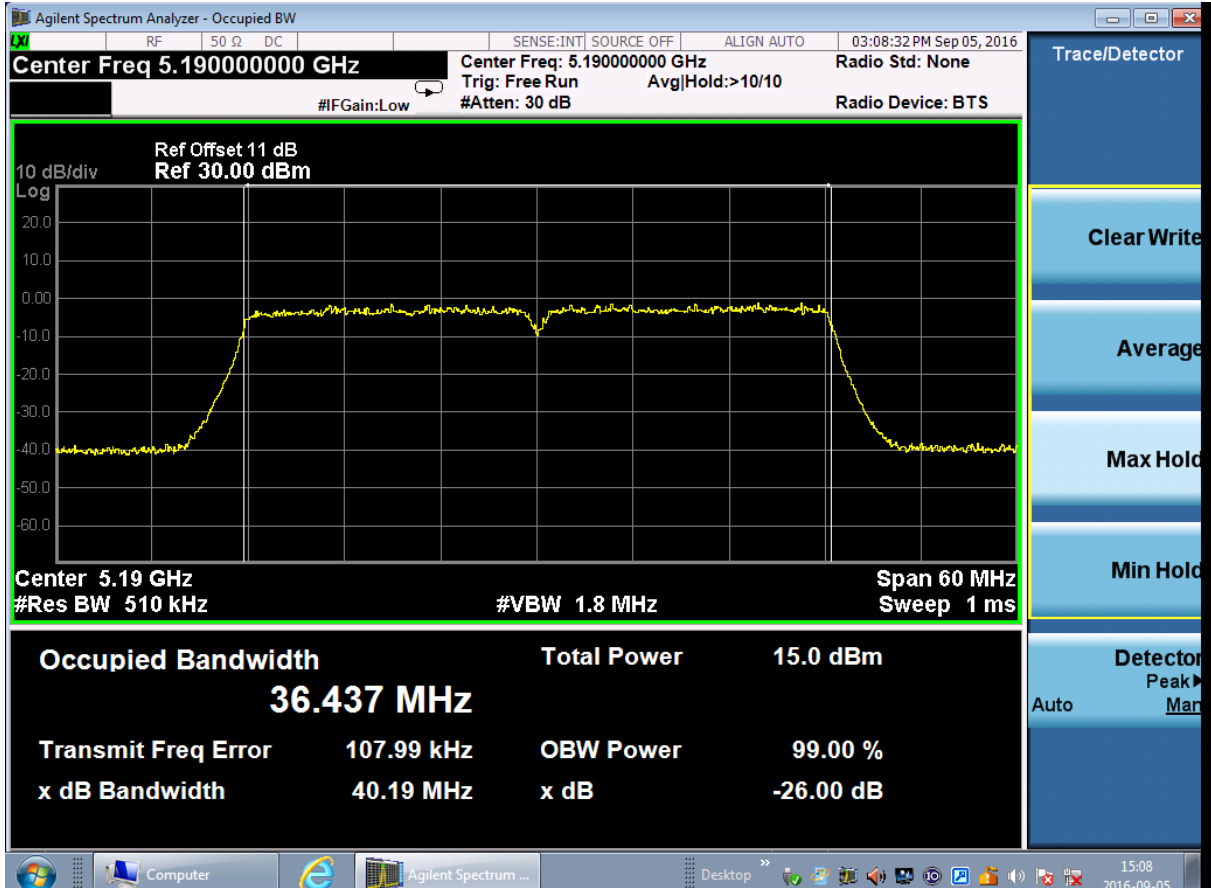


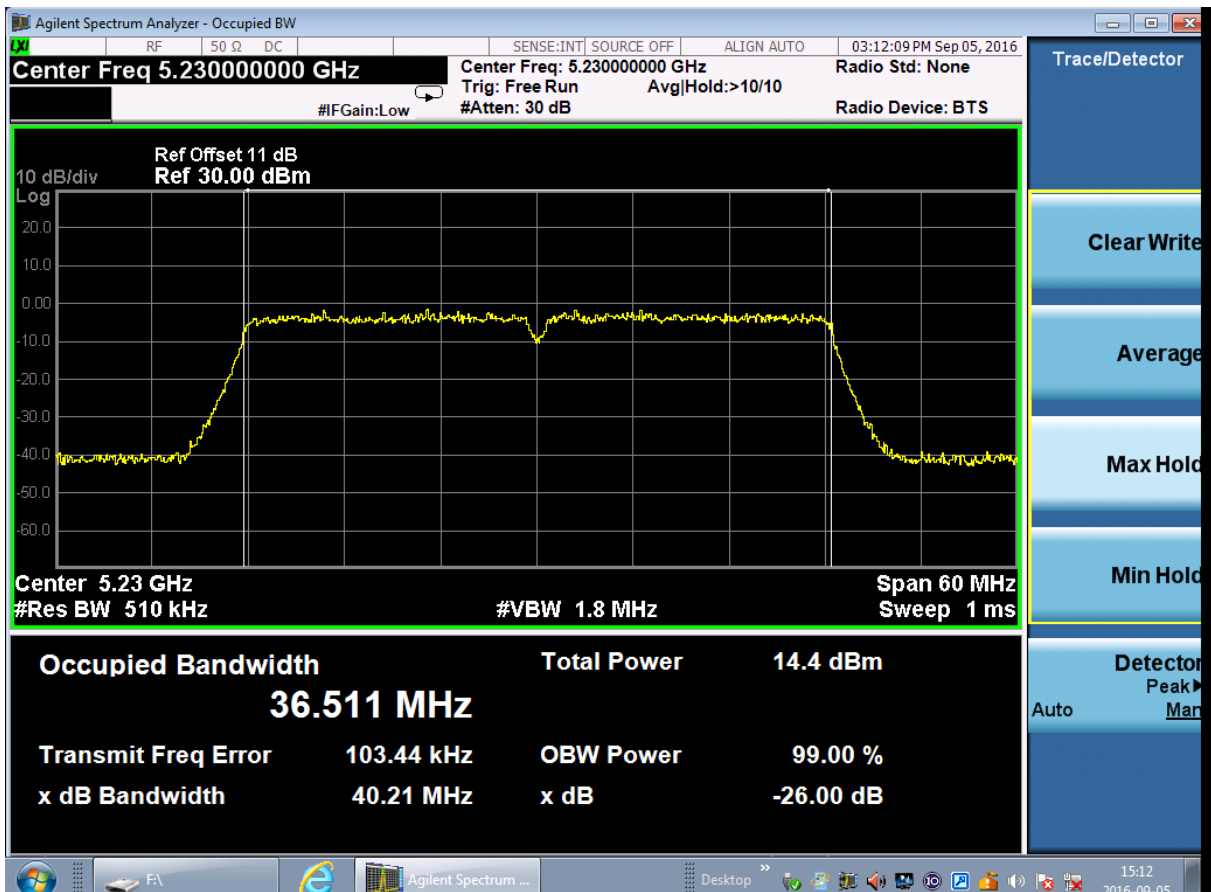


Modulation: VHT40; Data rate: MCS0NSS1; Power setting: 32q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5190	39.77	36.401	N/A
5230	39.88	36.327	N/A

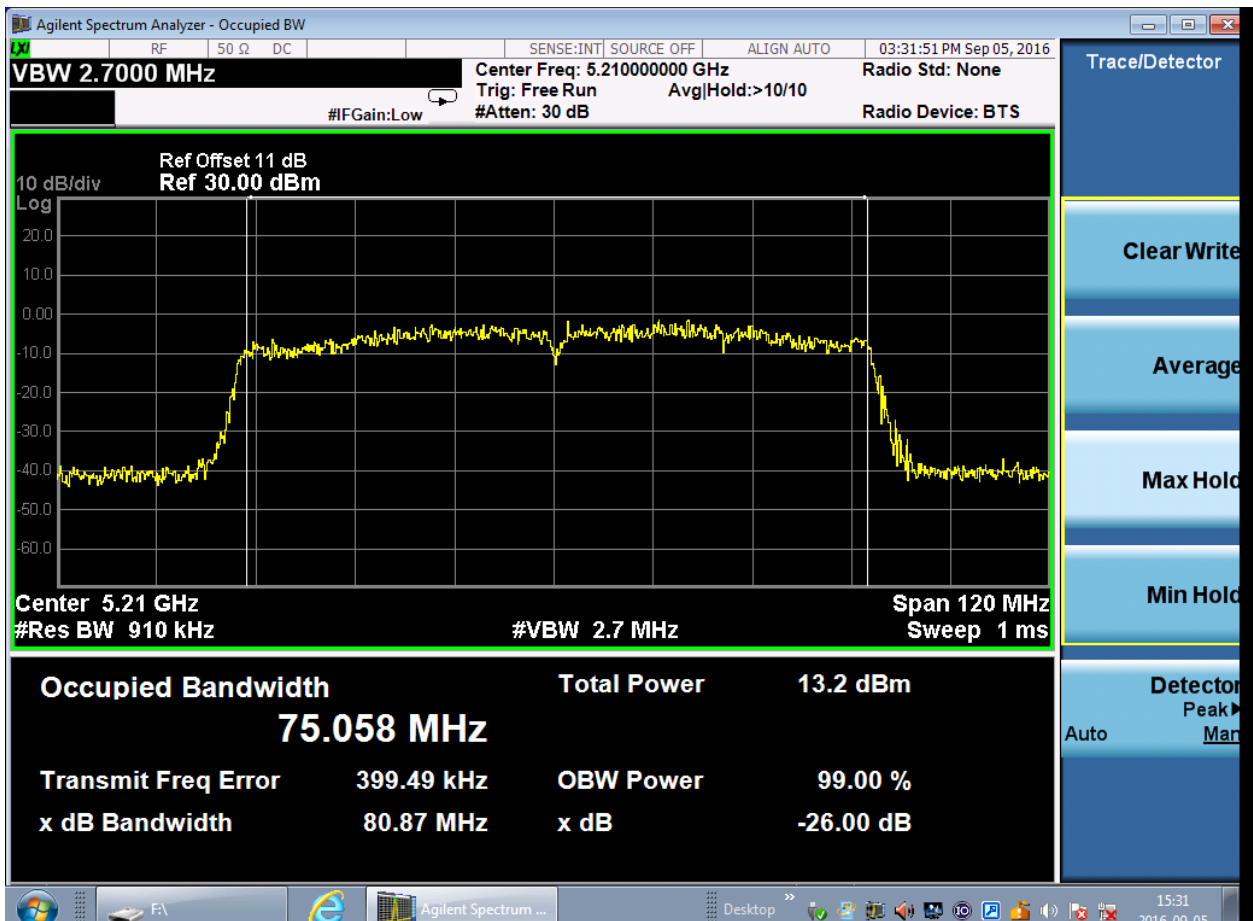


Modulation: VHT40; Data rate: MCS11NSS1; Power setting: 32q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5190	40.19	36.437	N/A
5230	40.21	36.511	N/A

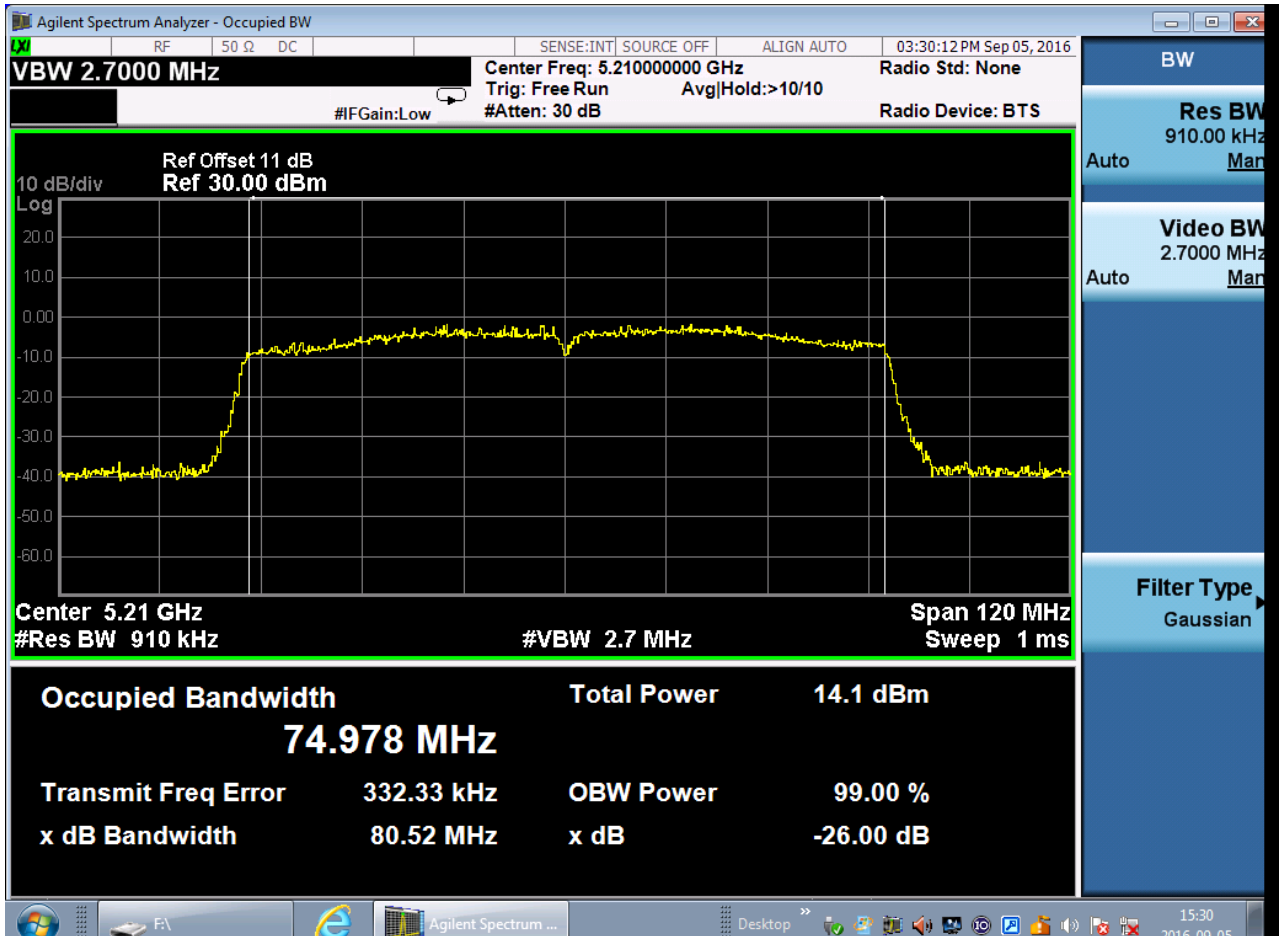




Modulation: VHT80; Data rate: MCS0NSS1; Power setting: 32q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5210	80.87	75.058	N/A

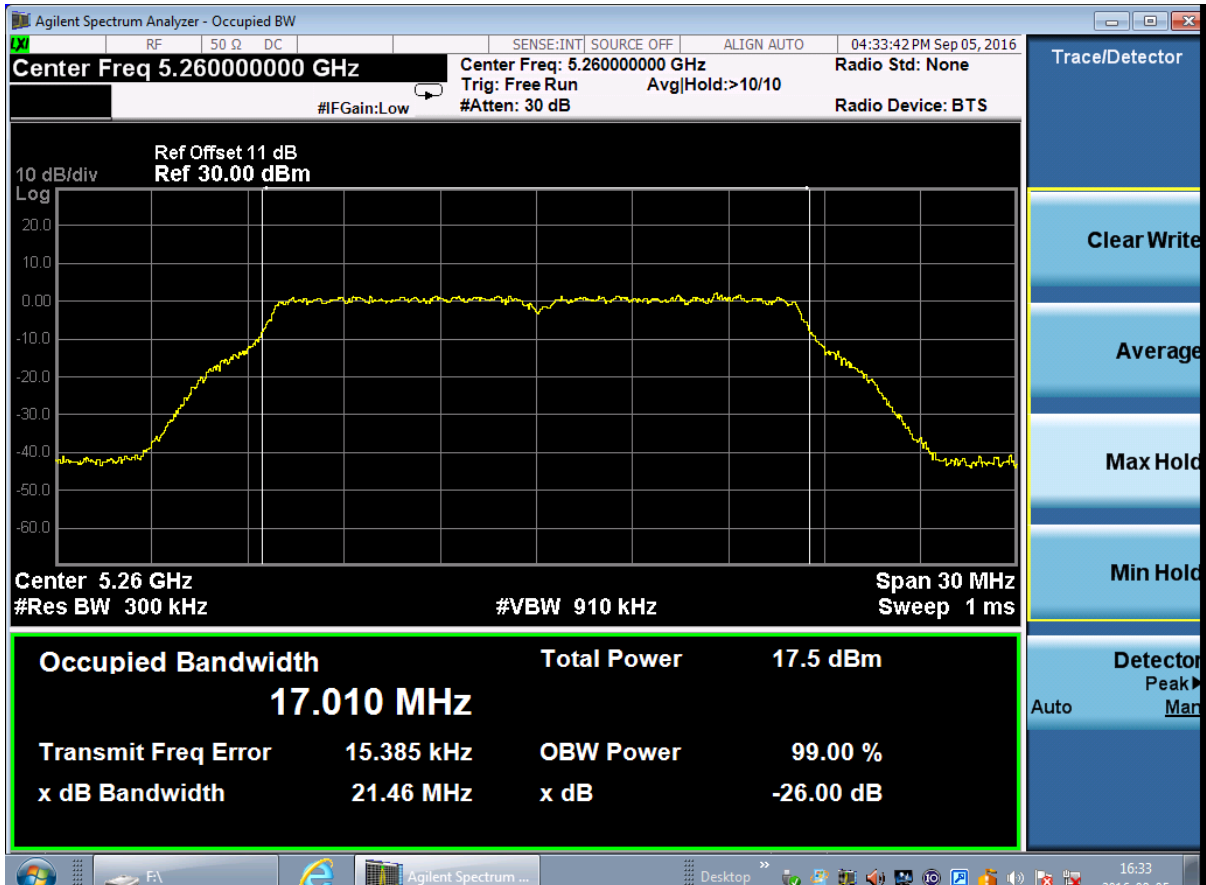


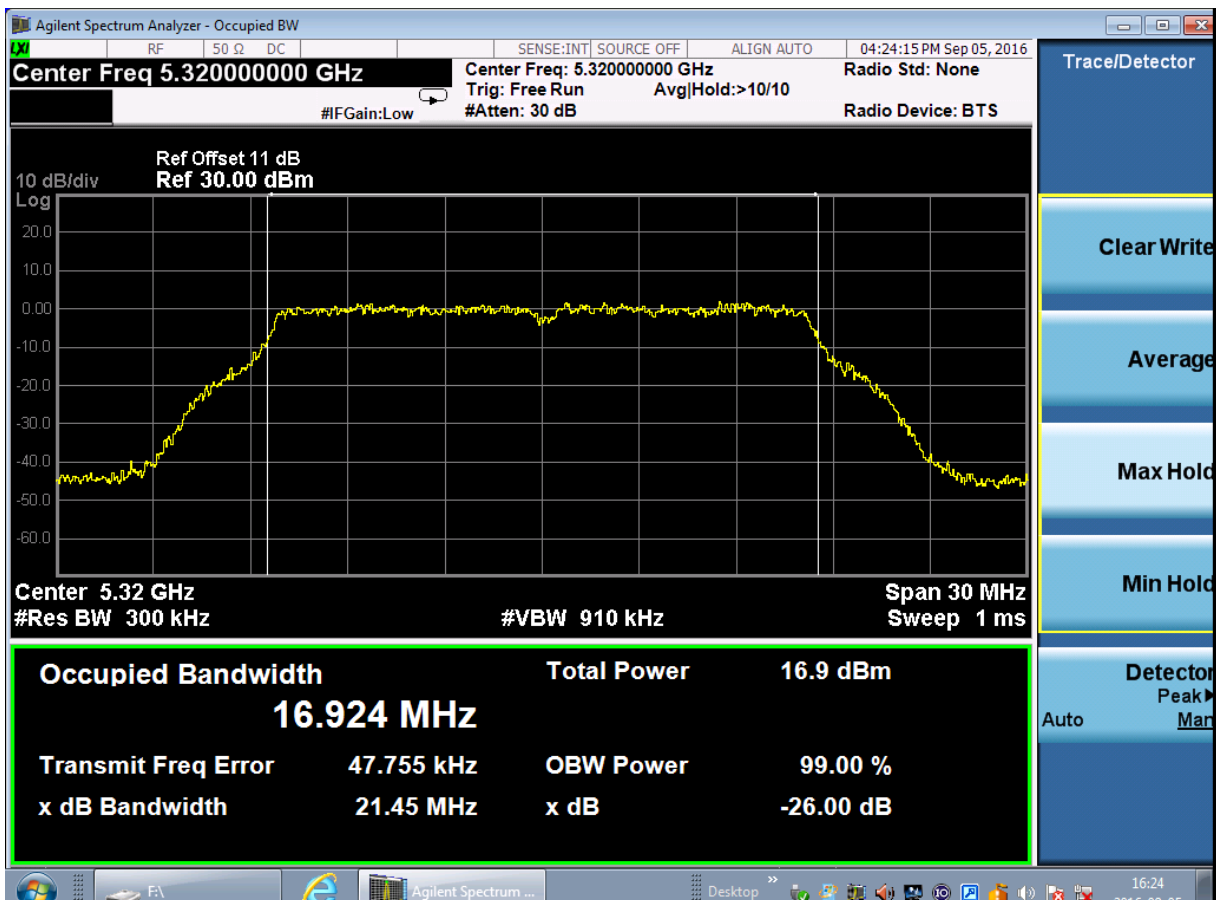
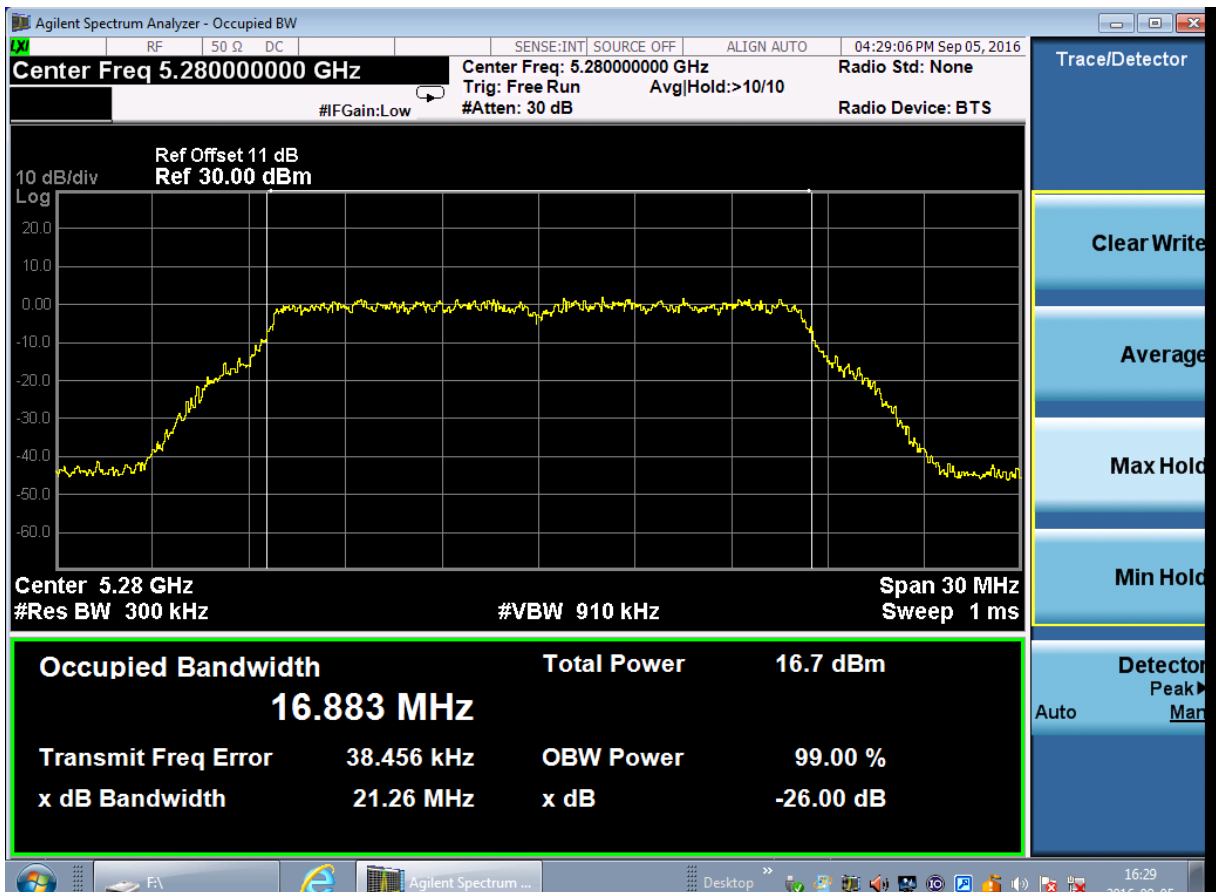
Modulation: VHT80; Data rate: MCS11NSS1; Power setting: 32q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5210	80.52	74.978	N/A



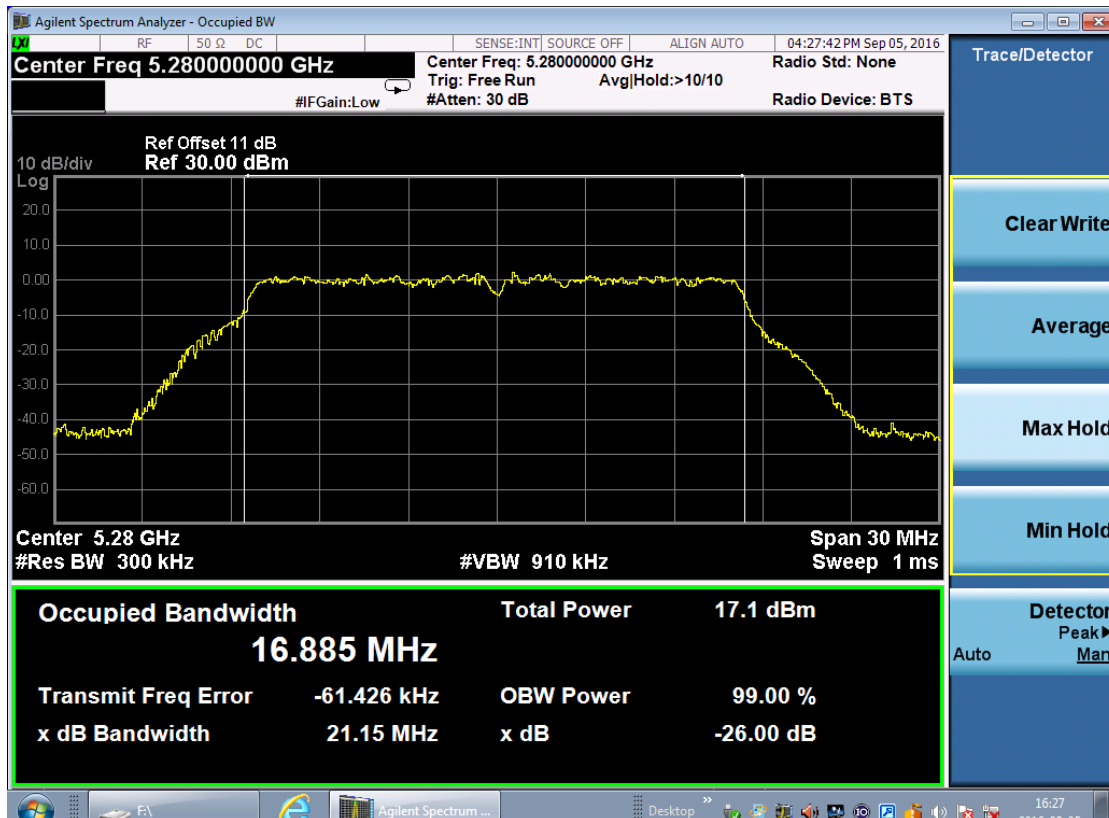
U-NII-2A

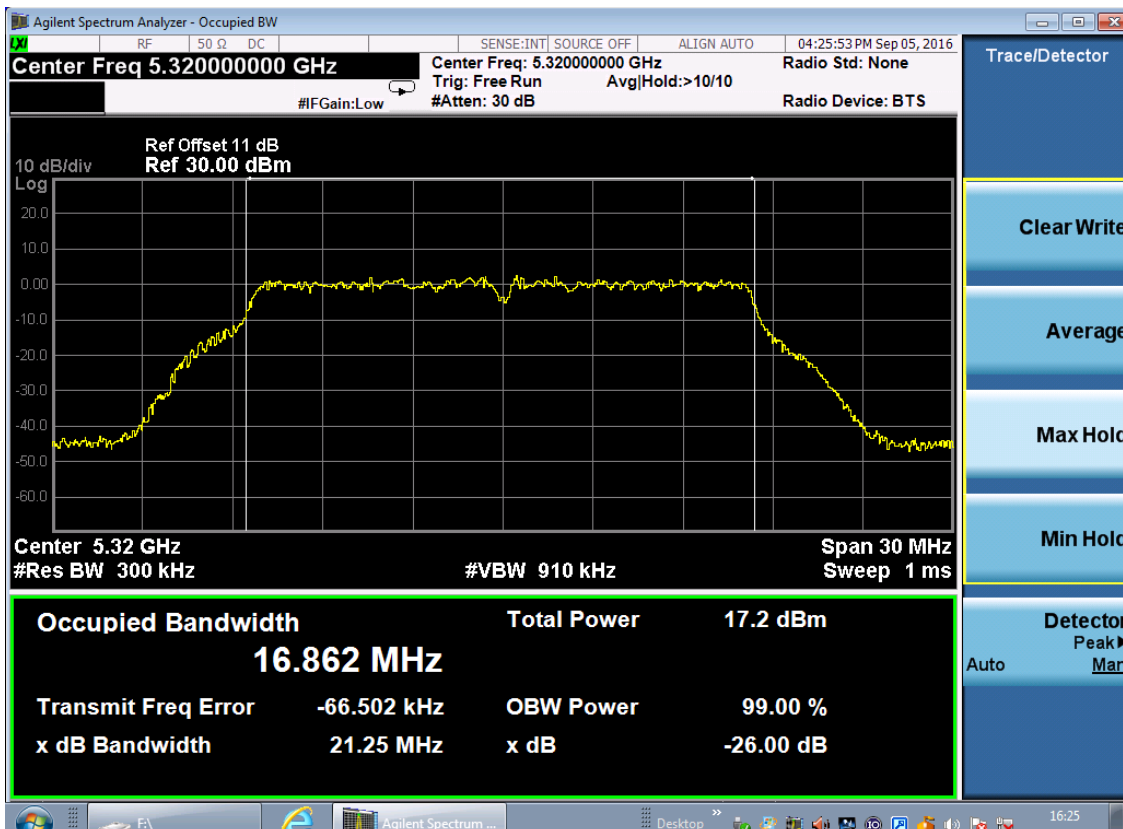
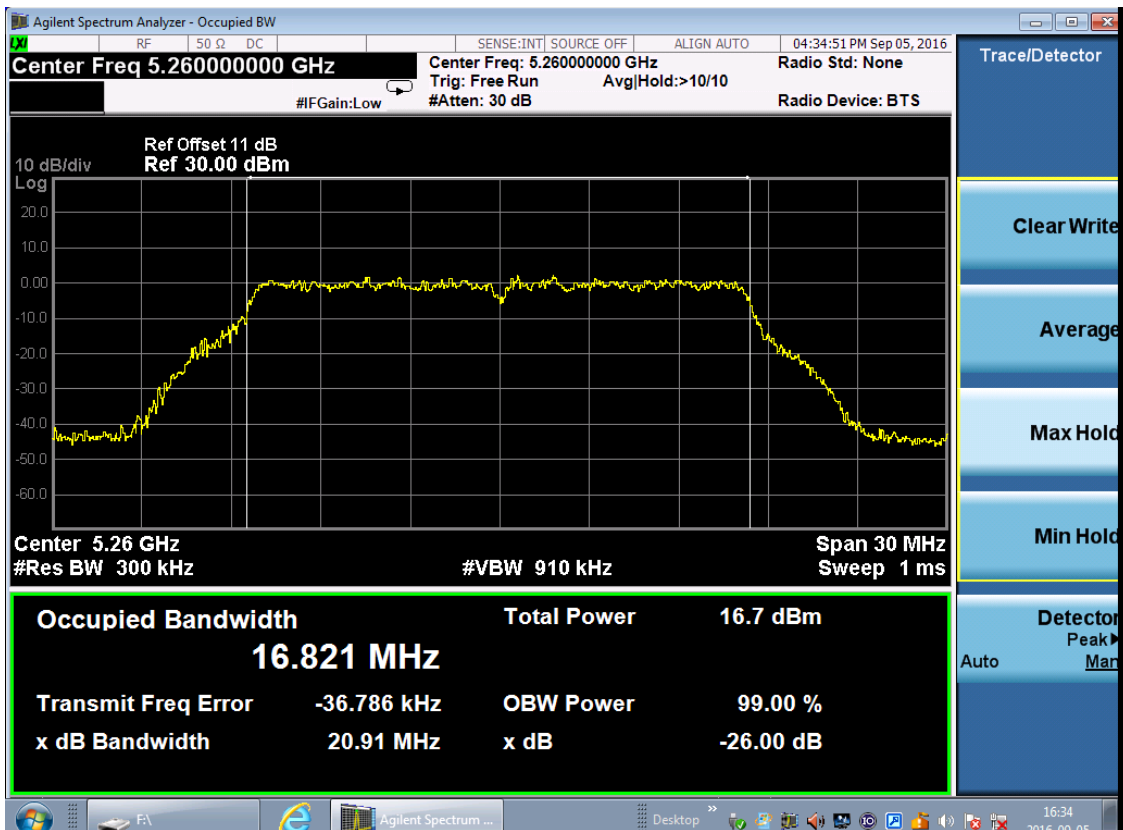
Modulation: OFDM; Data rate: 6 Mbps; Power setting: 47q or *49q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5260	21.46	17.010	N/A
5280	21.26	16.883	N/A
5320*	21.45	16.924	N/A



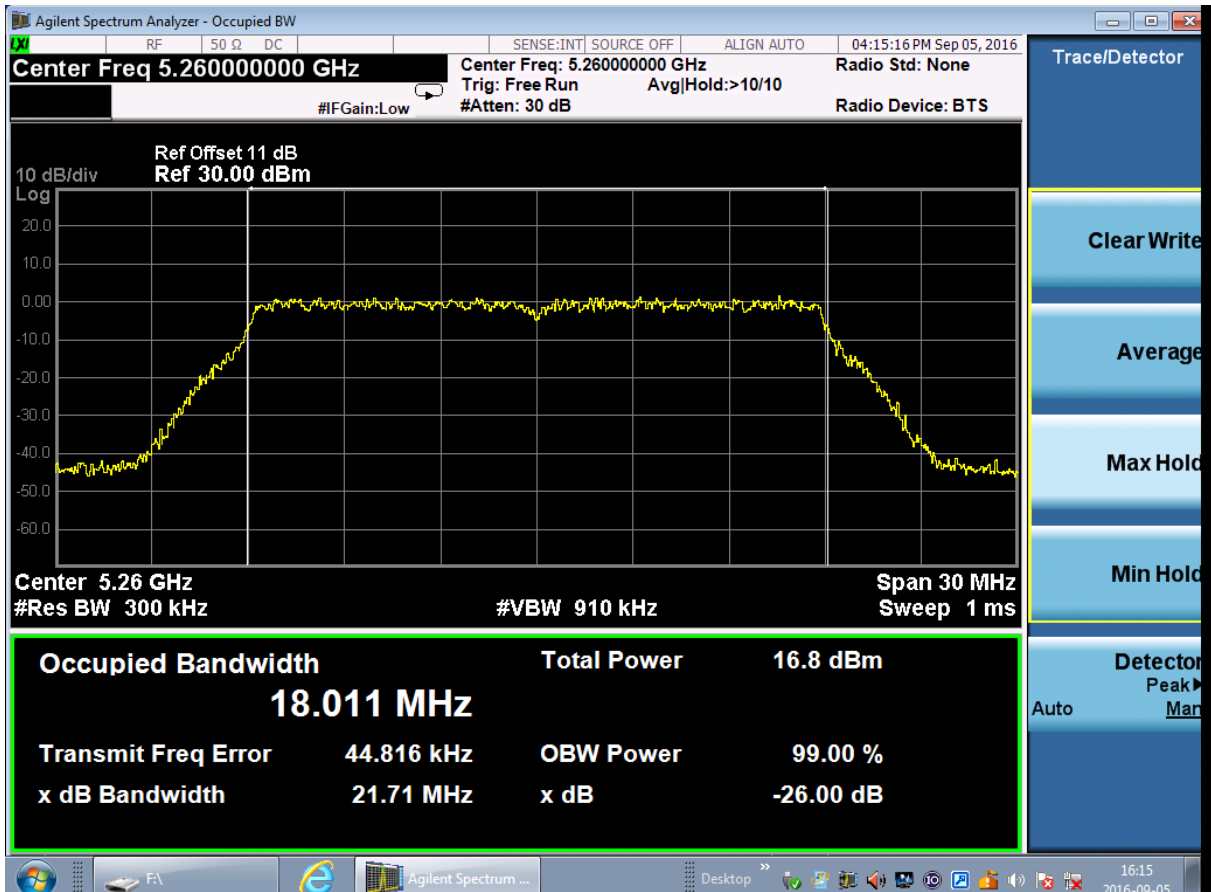


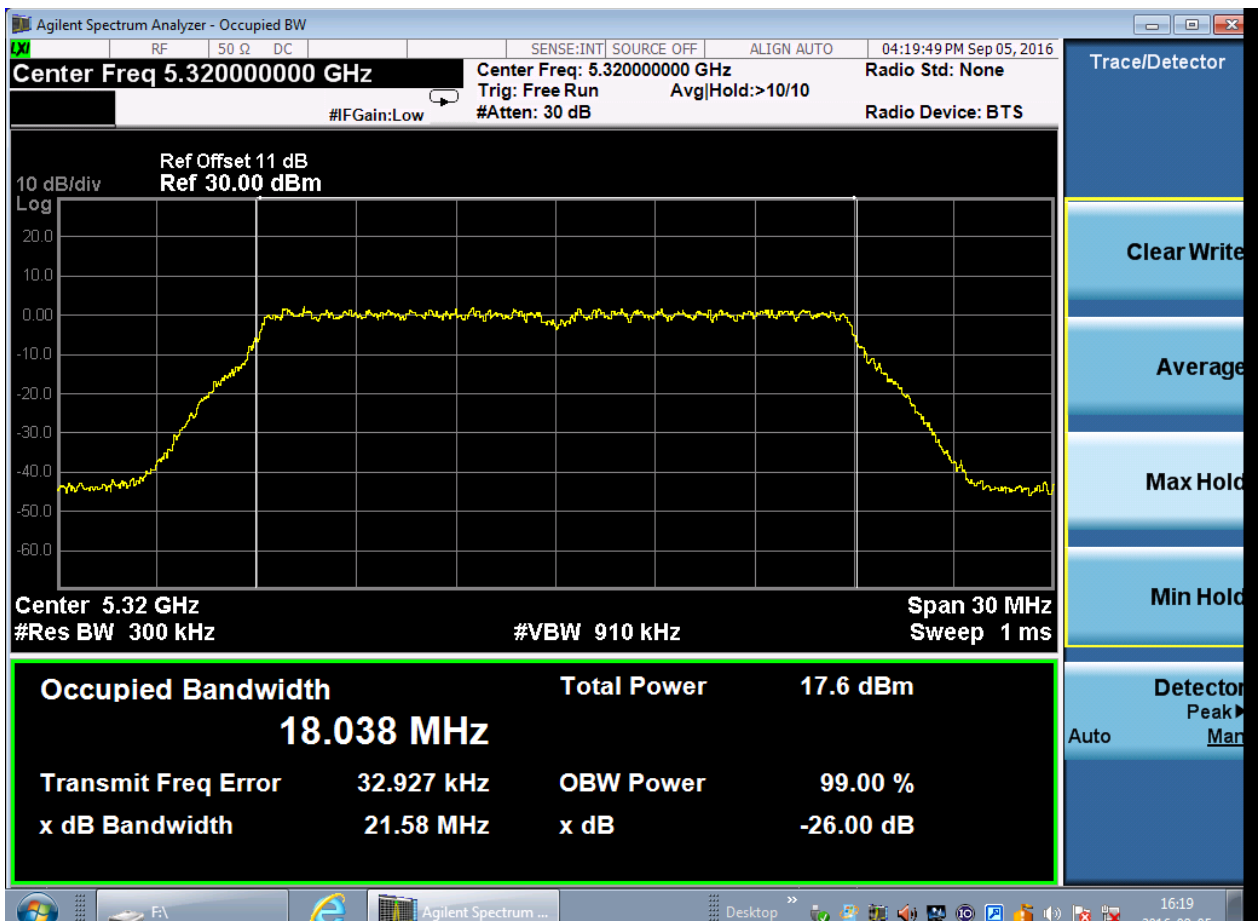
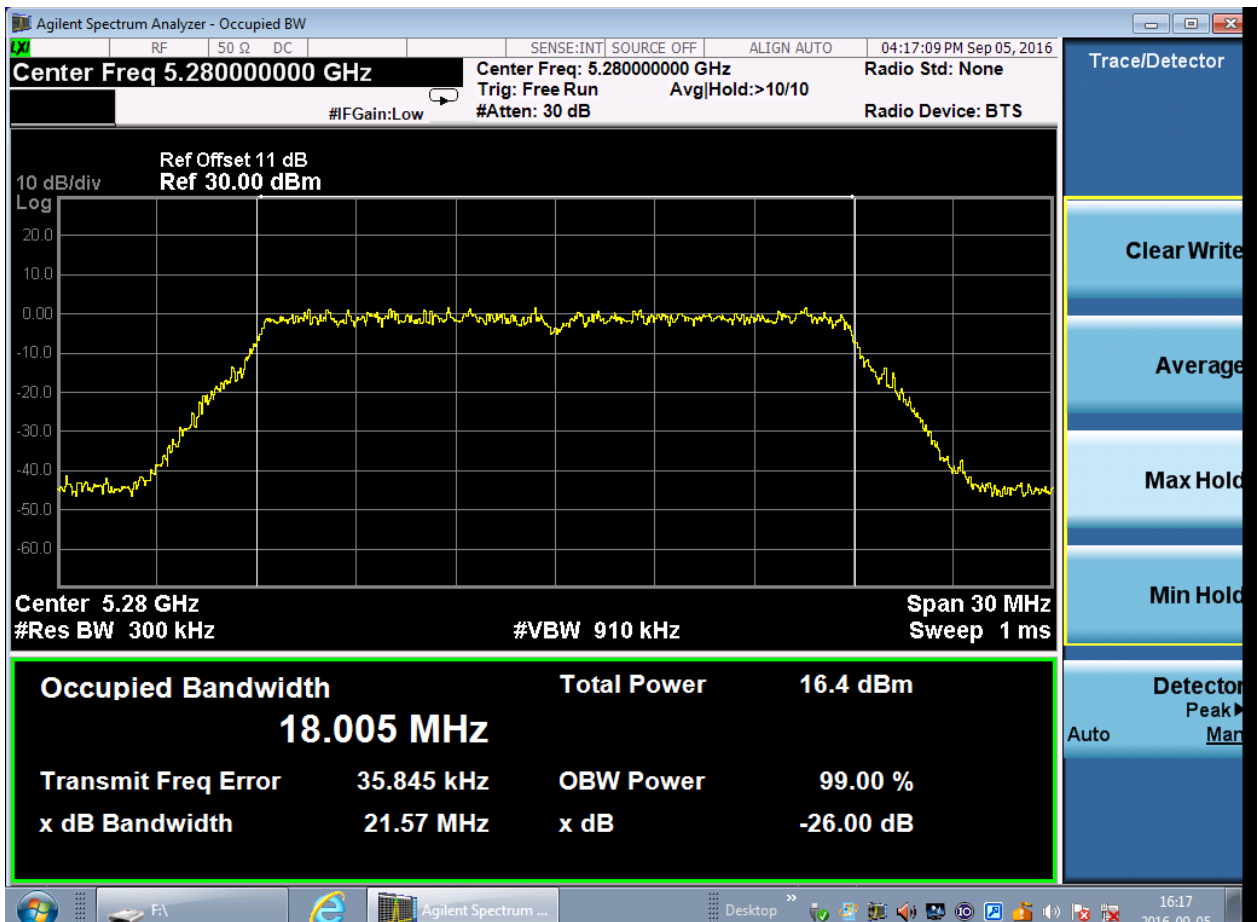
Modulation: OFDM; Data rate: 54 Mbps; Power setting: 47q or *49q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5260	21.15	16.885	N/A
5280	20.91	16.821	N/A
5320*	21.25	16.862	N/A





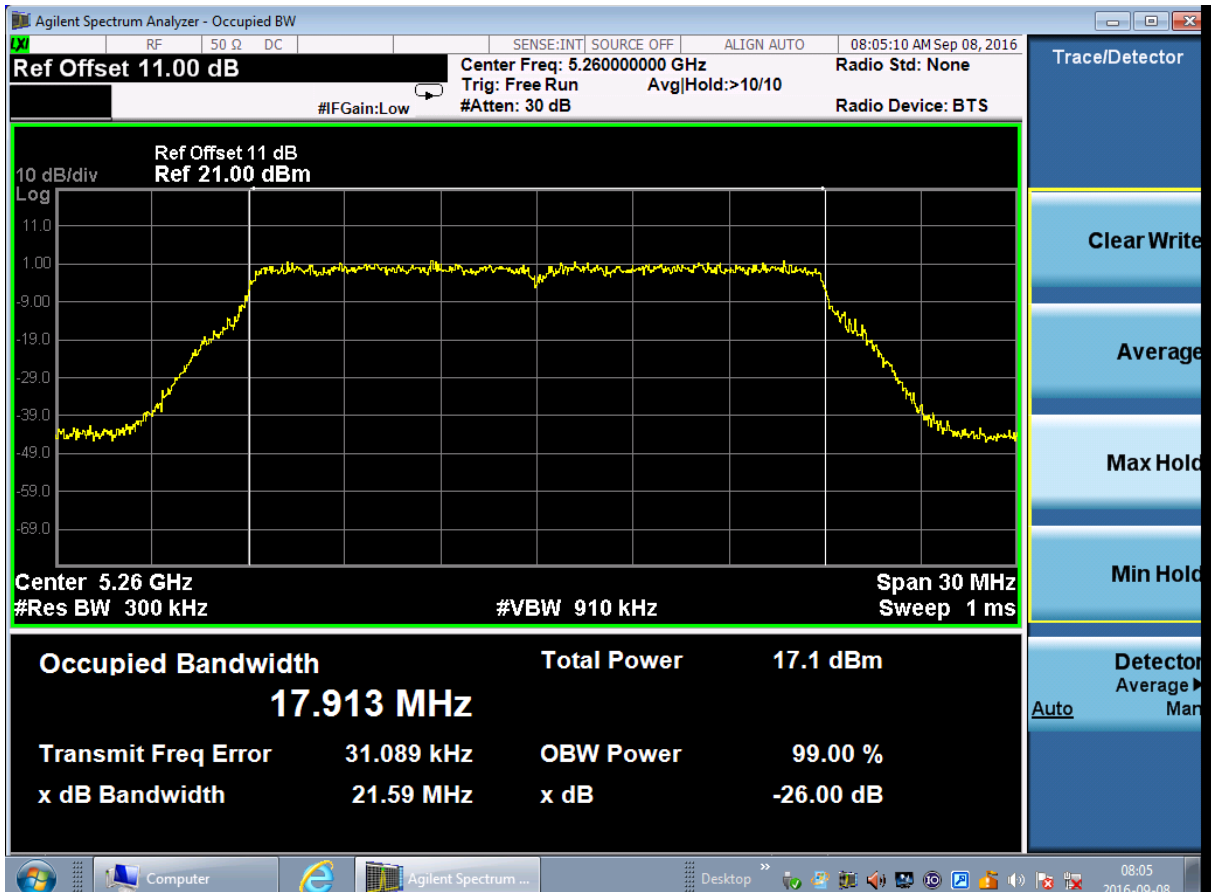
Modulation: VHT20; Data rate: MCS0NSS1; Power setting: 47q or *49q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5260	21.71	18.011	N/A
5280	21.57	18.005	N/A
5320*	21.58	18.038	N/A

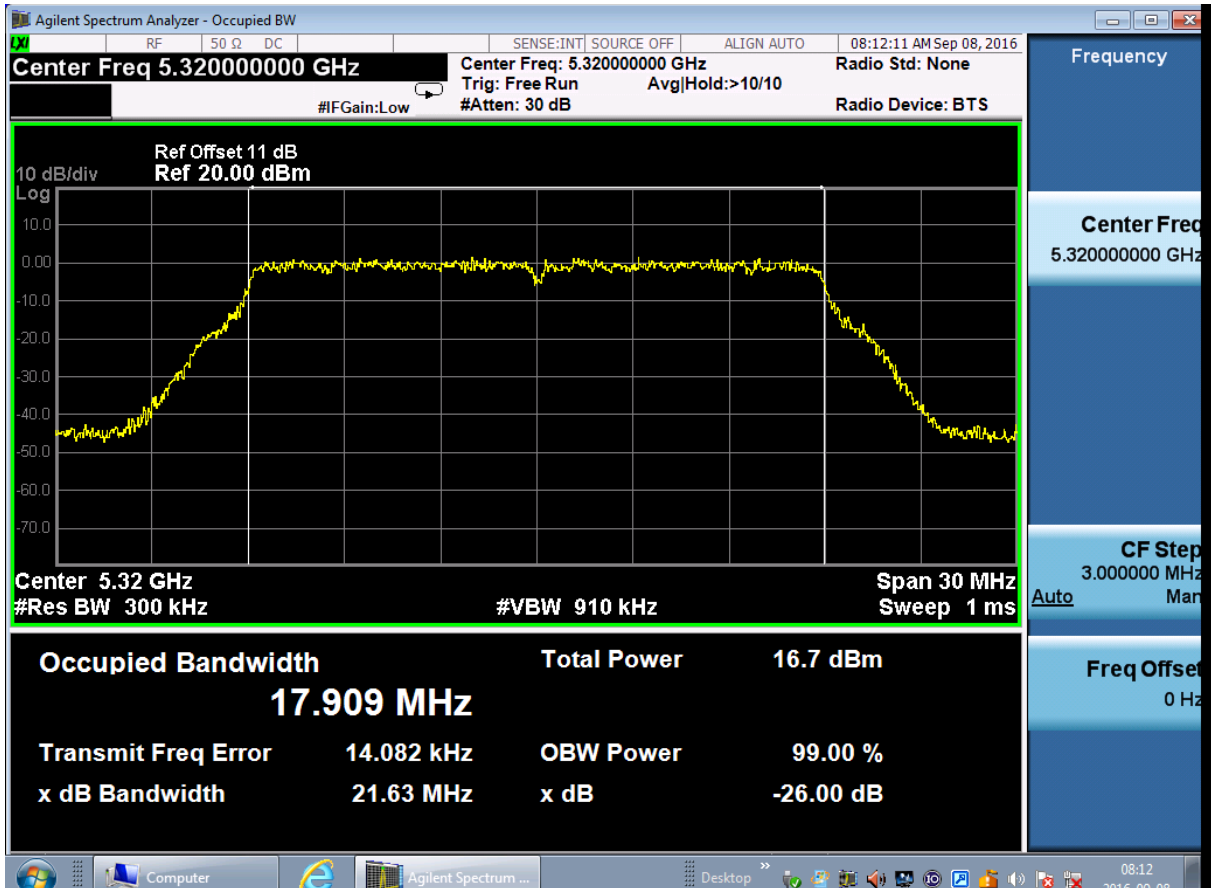
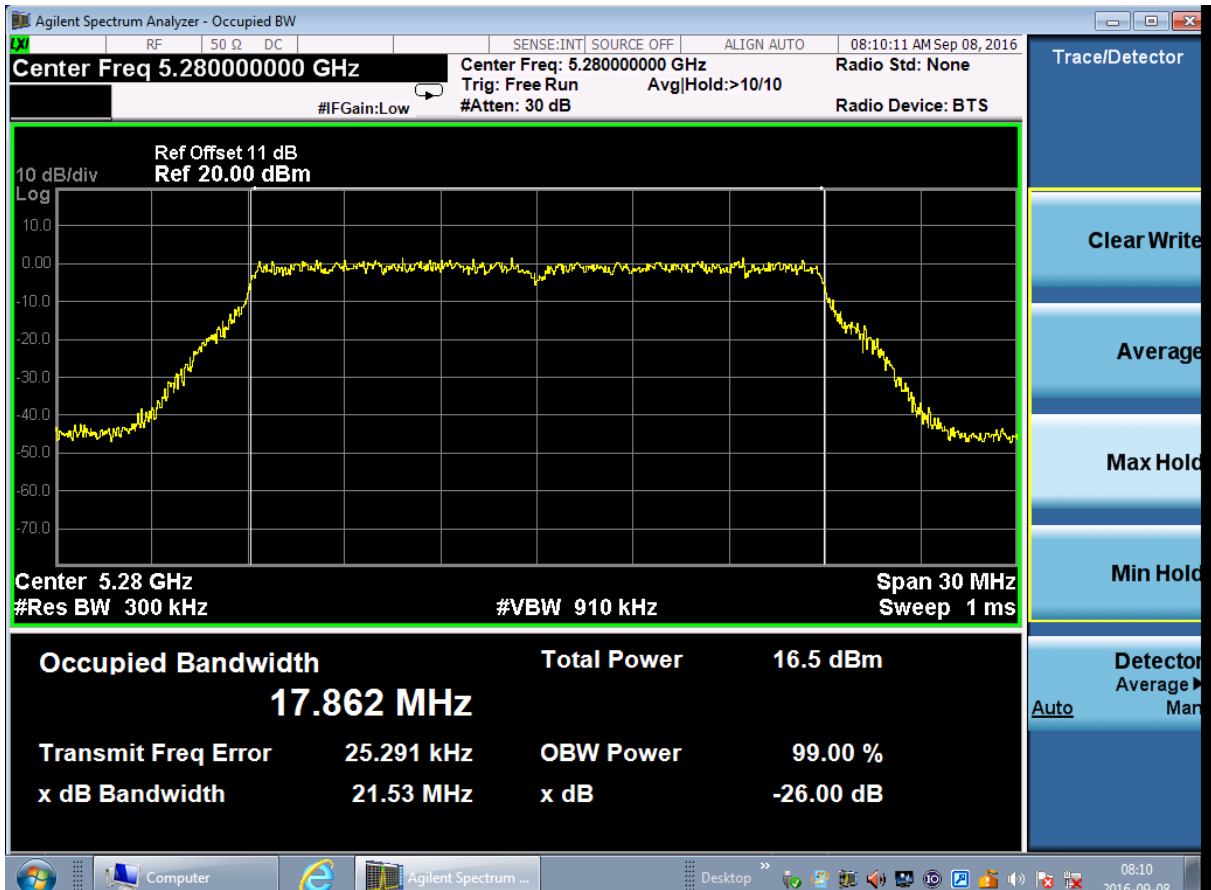




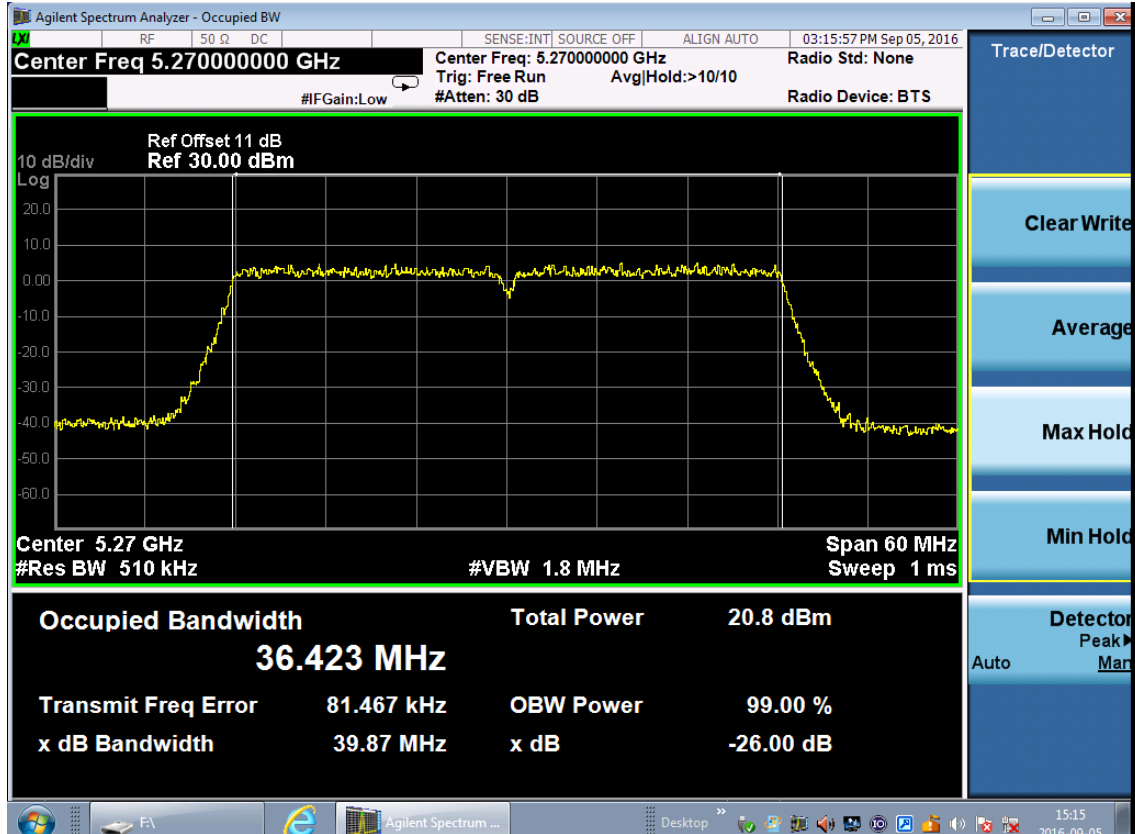
Modulation: VHT20; Data rate: MCS11NSS1; Power setting: 47q or *48q dBm;

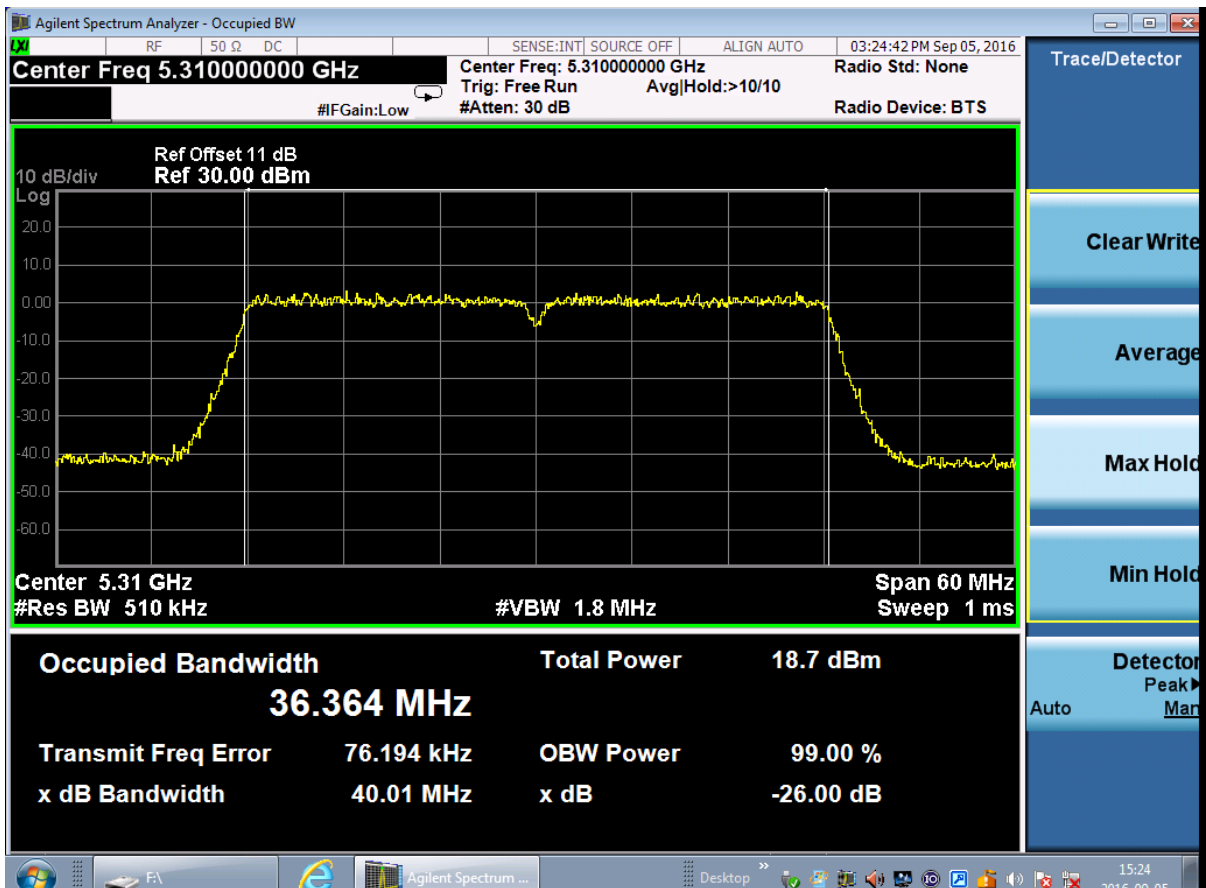
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5260	21.59	17.913	N/A
5280	21.53	17.862	N/A
5320*	21.63	17.909	N/A



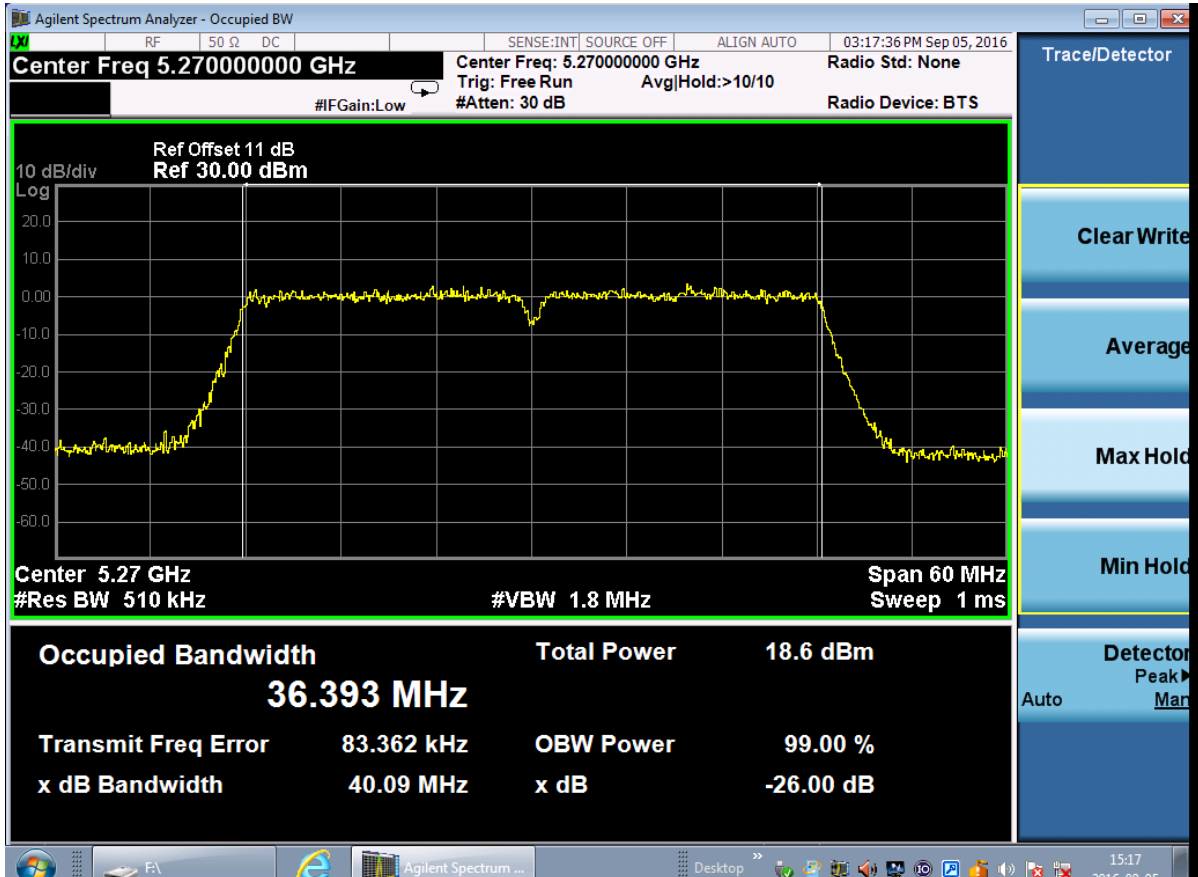


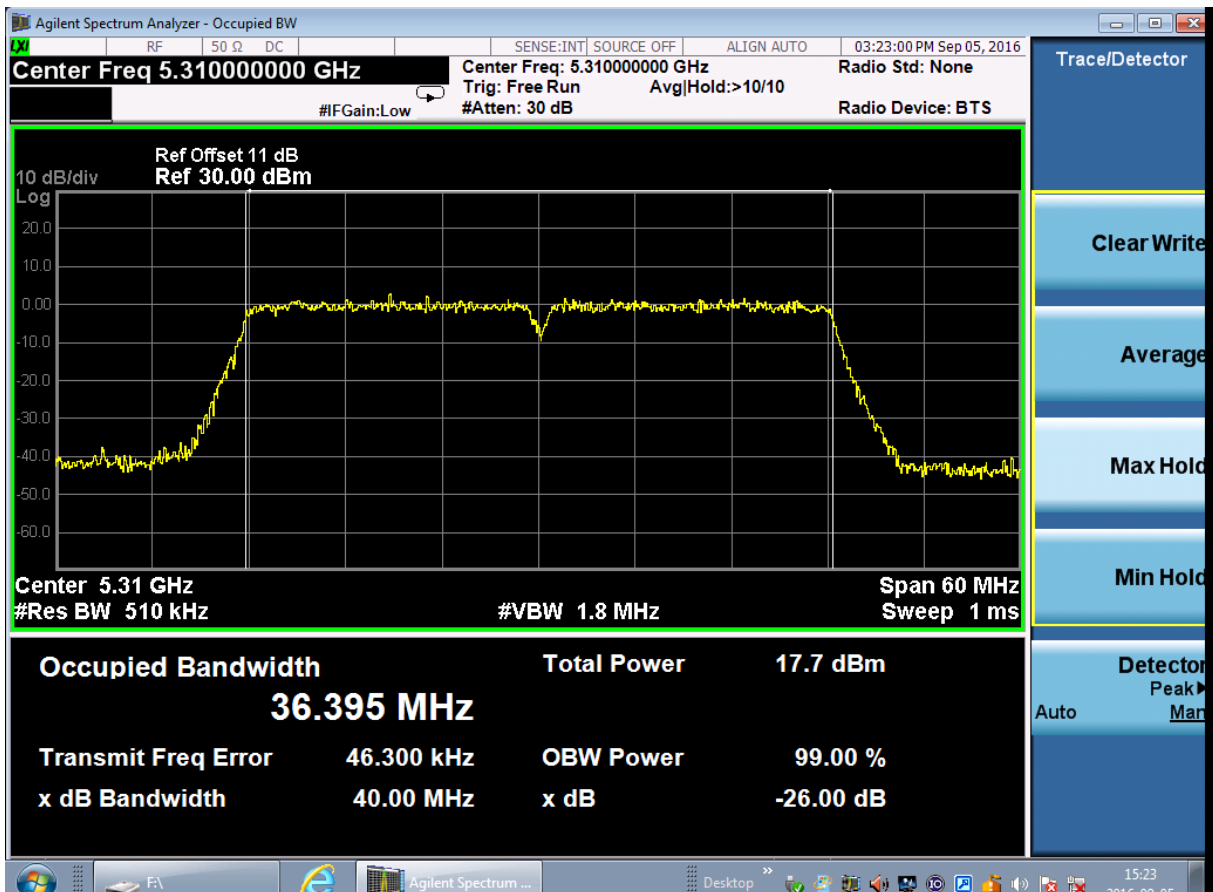
Modulation: VHT40; Data rate: MCS0NSS1; Power setting: 59q or 52q* dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5270	39.87	36.423	N/A
5310*	40.01	36.364	N/A



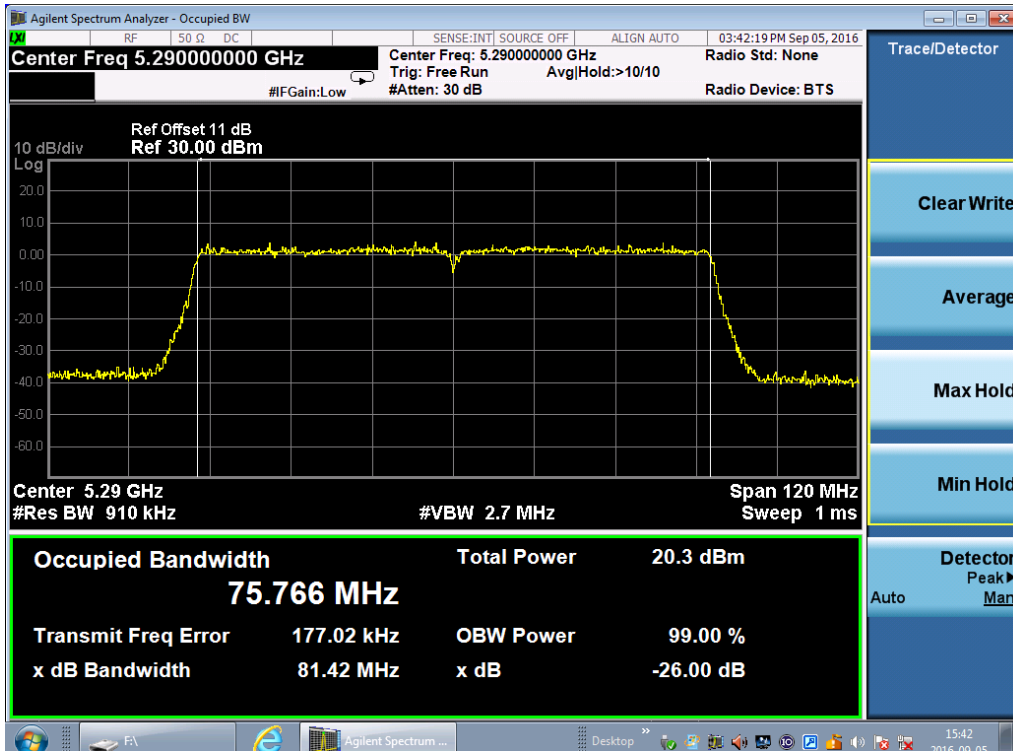


Modulation: VHT40; Data rate: MCS11NSS1; Power setting: 50q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5270	40.09	36.393	N/A
5310	40.00	36.395	N/A

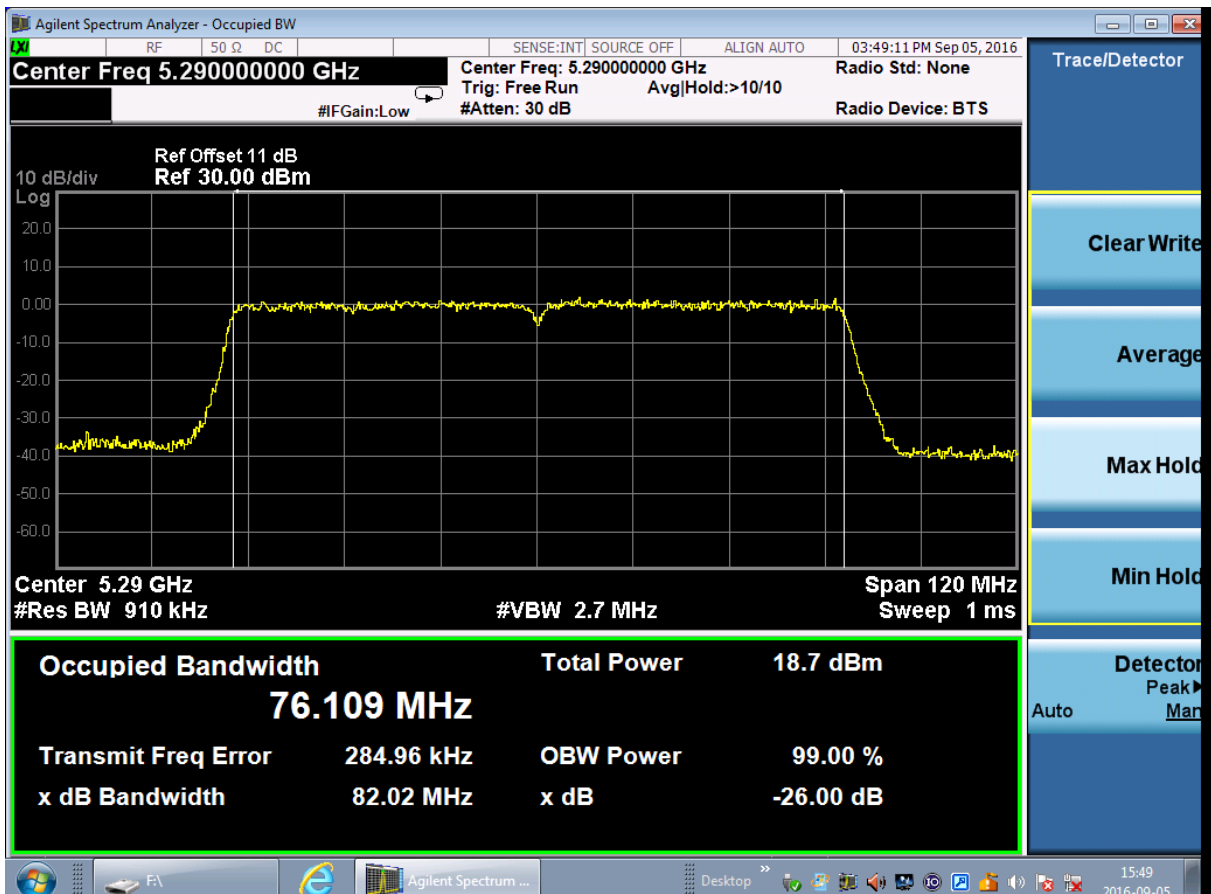




Modulation: VHT80; Data rate: MCS0NSS1; Power setting: 56q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5290	81.42	75.766	N/A

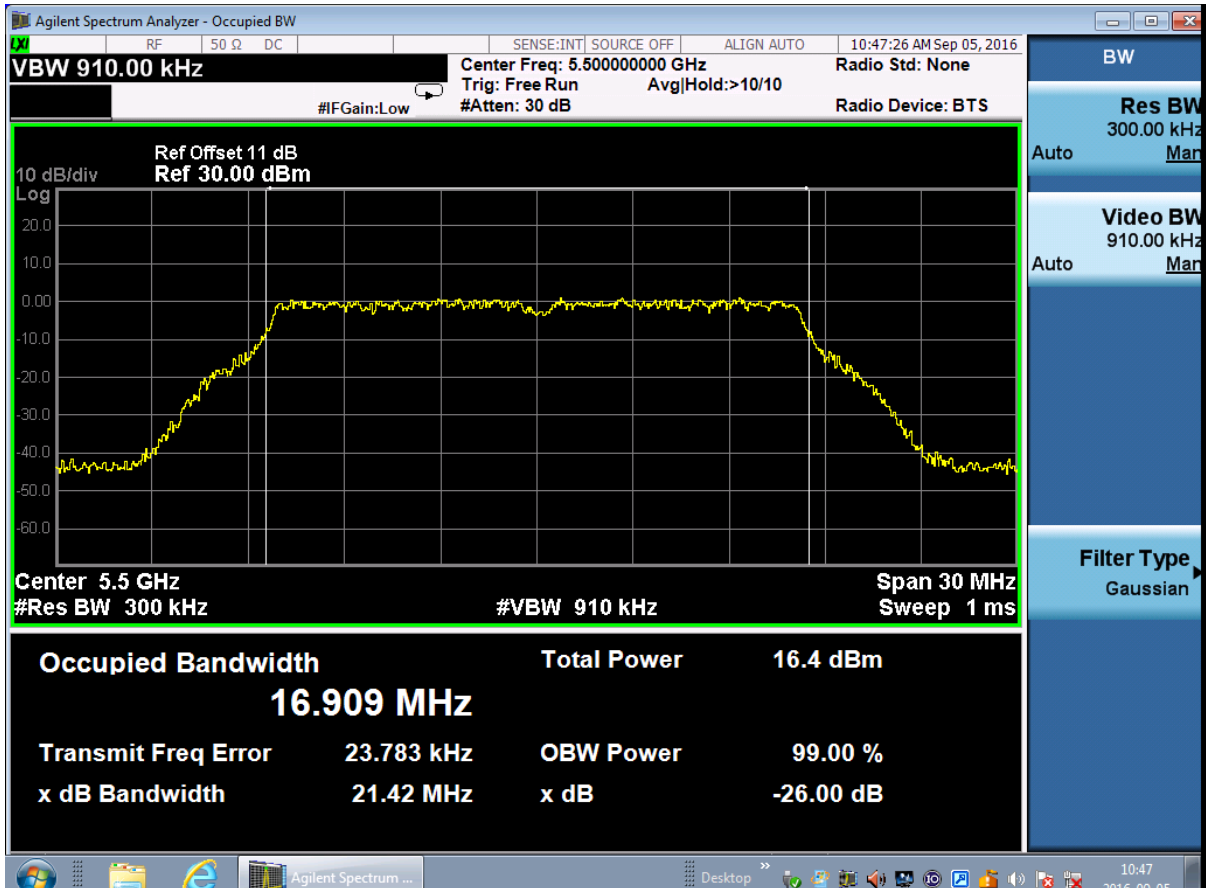


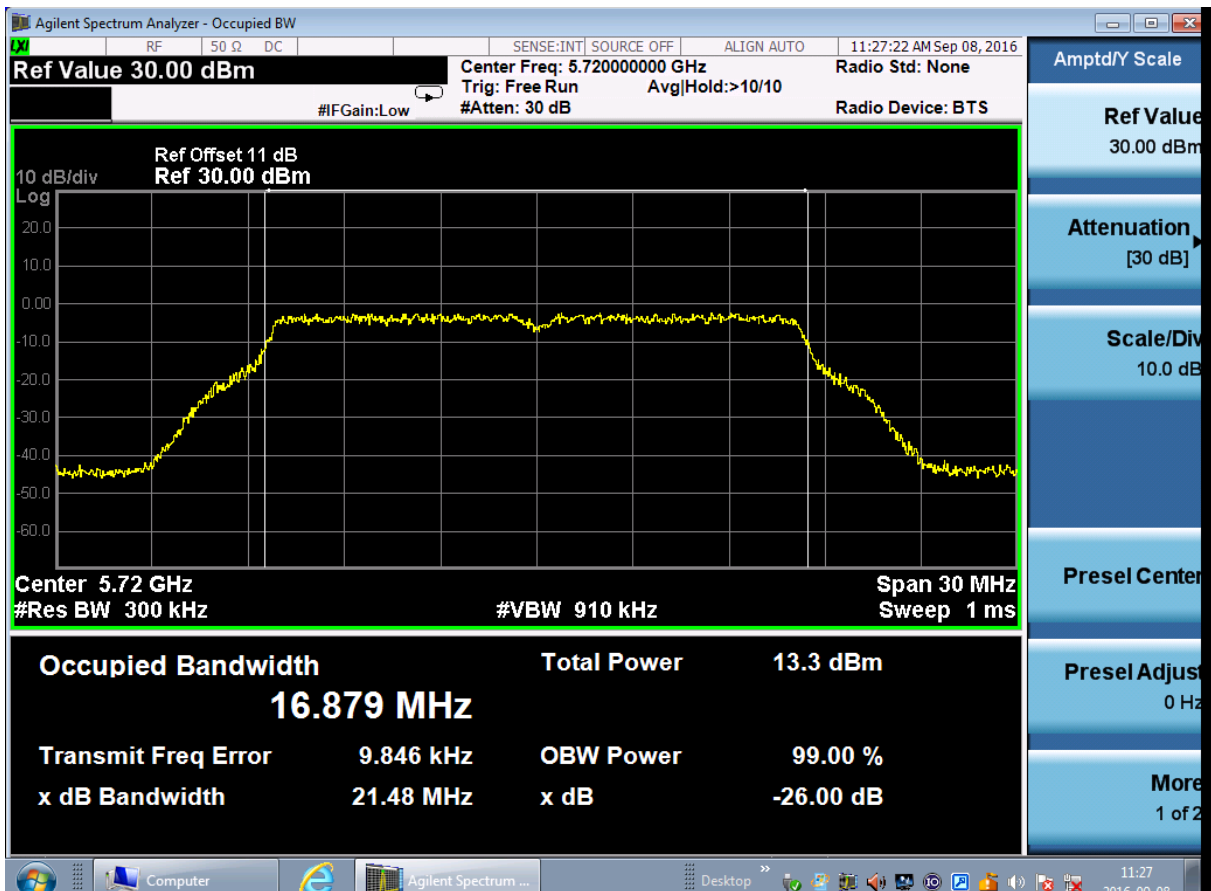
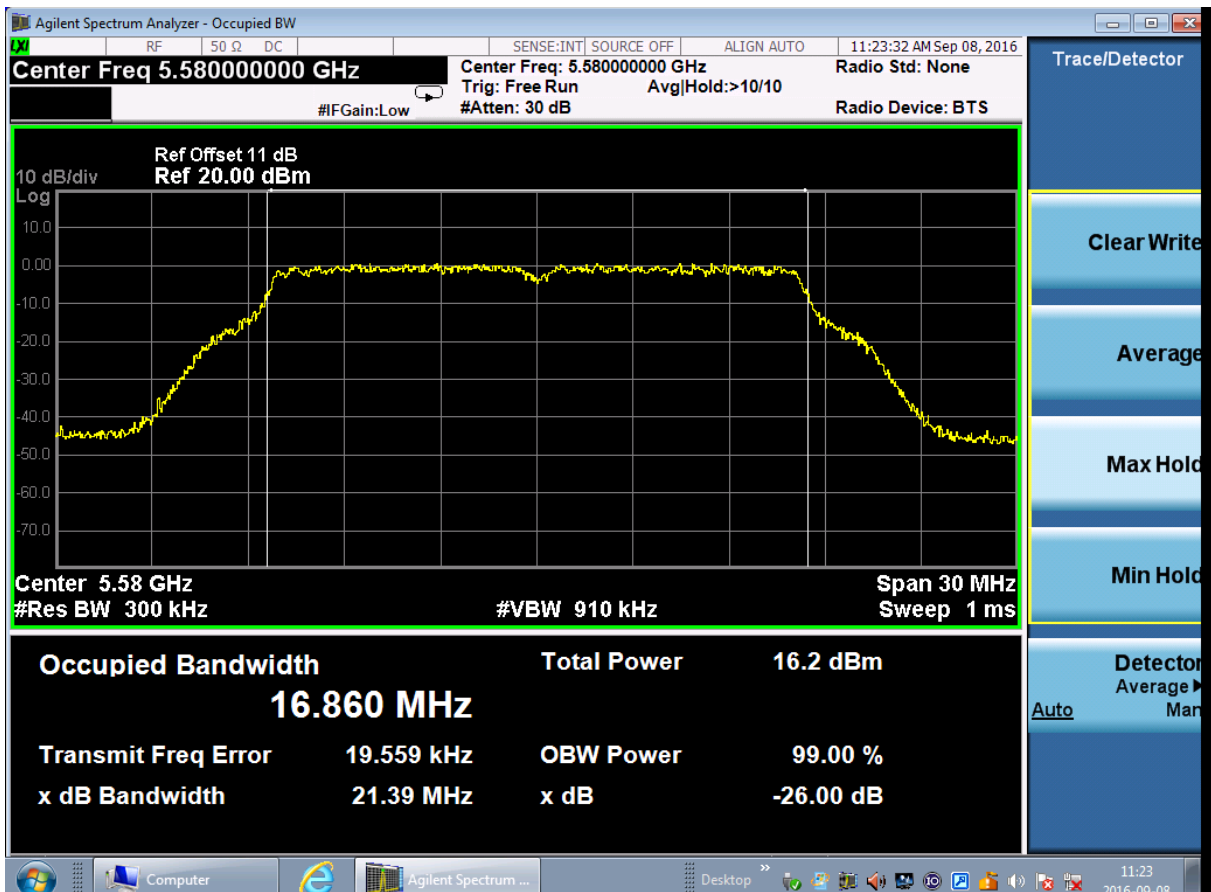
Modulation: VHT80; Data rate: MCS11NSS1; Power setting: 50q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5290	82.02	76.109	N/A



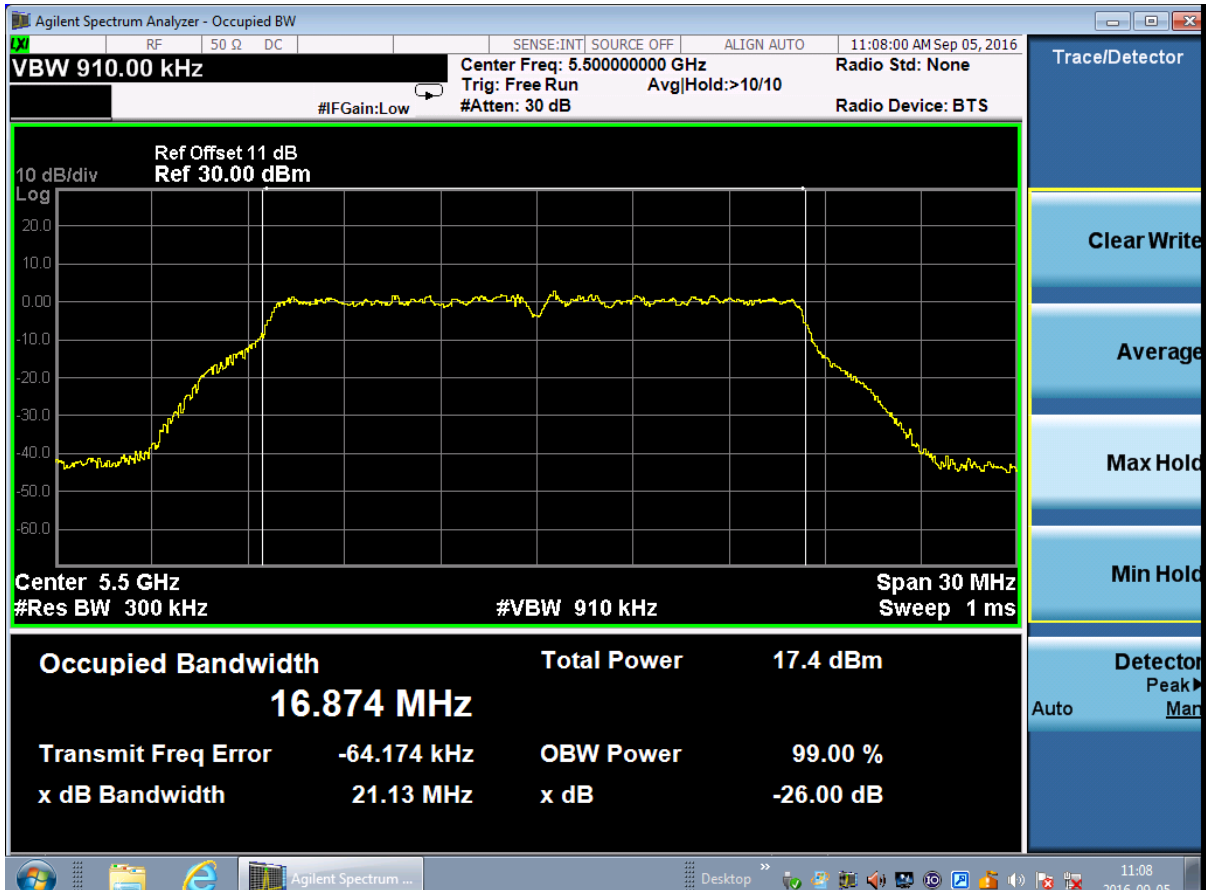
U-NII-2C

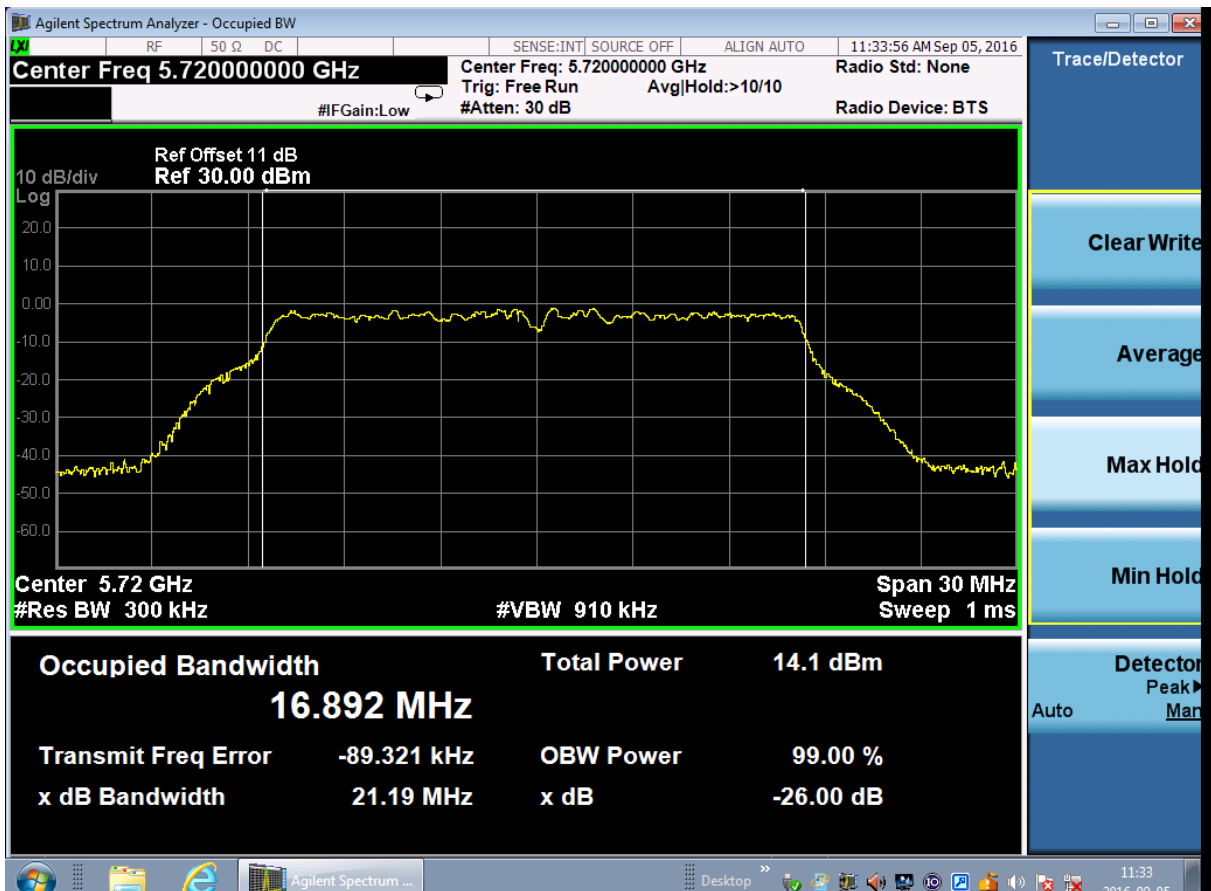
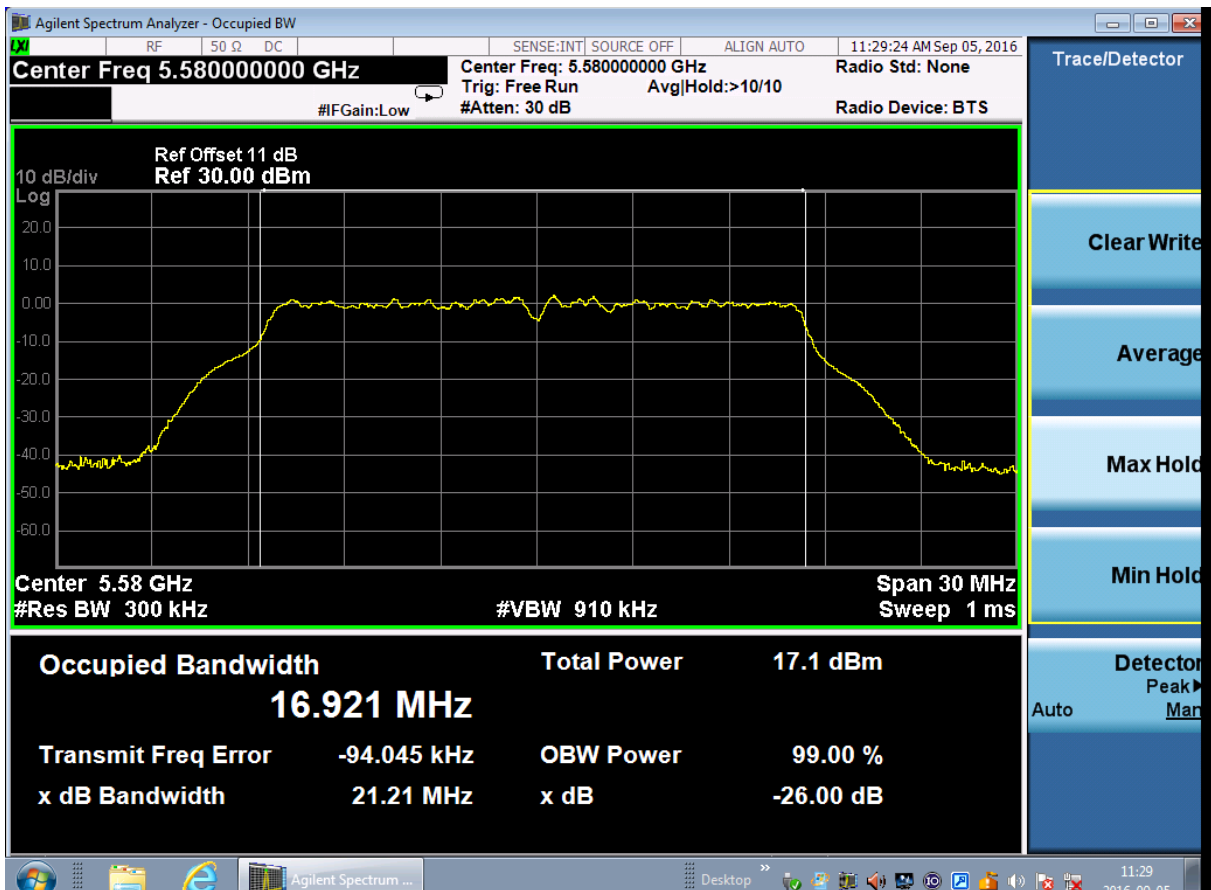
Modulation: OFDM; Data rate: 6 Mbps; Power setting: 49q or 37*q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5500	21.42	16.909	N/A
5580	21.39	16.860	N/A
5720*	21.48	16.879	N/A



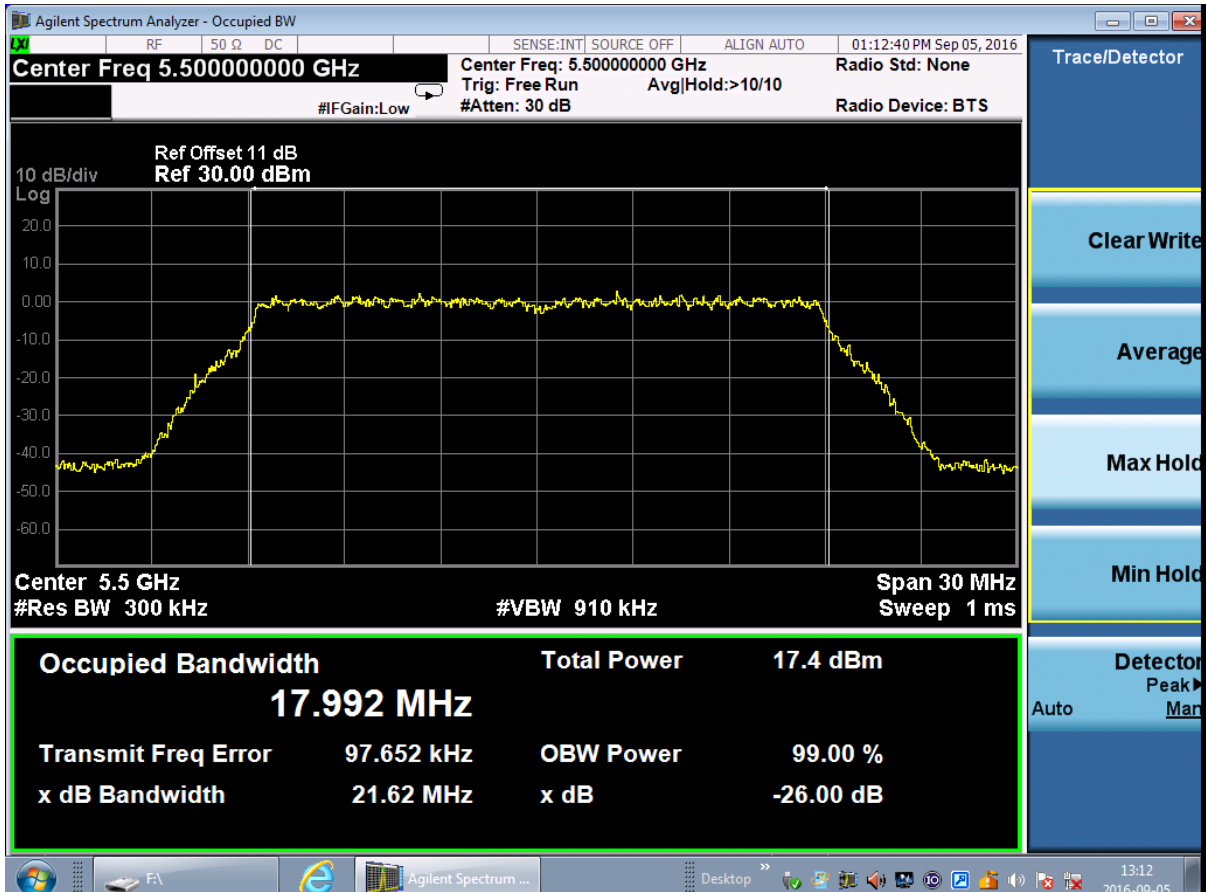


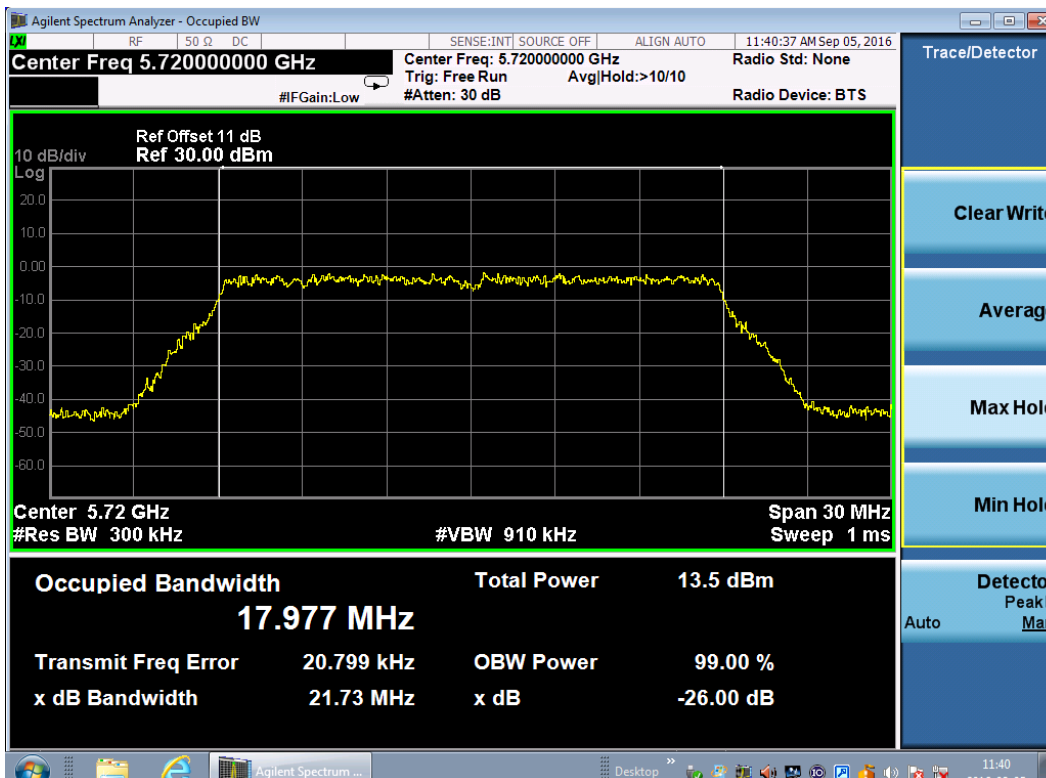
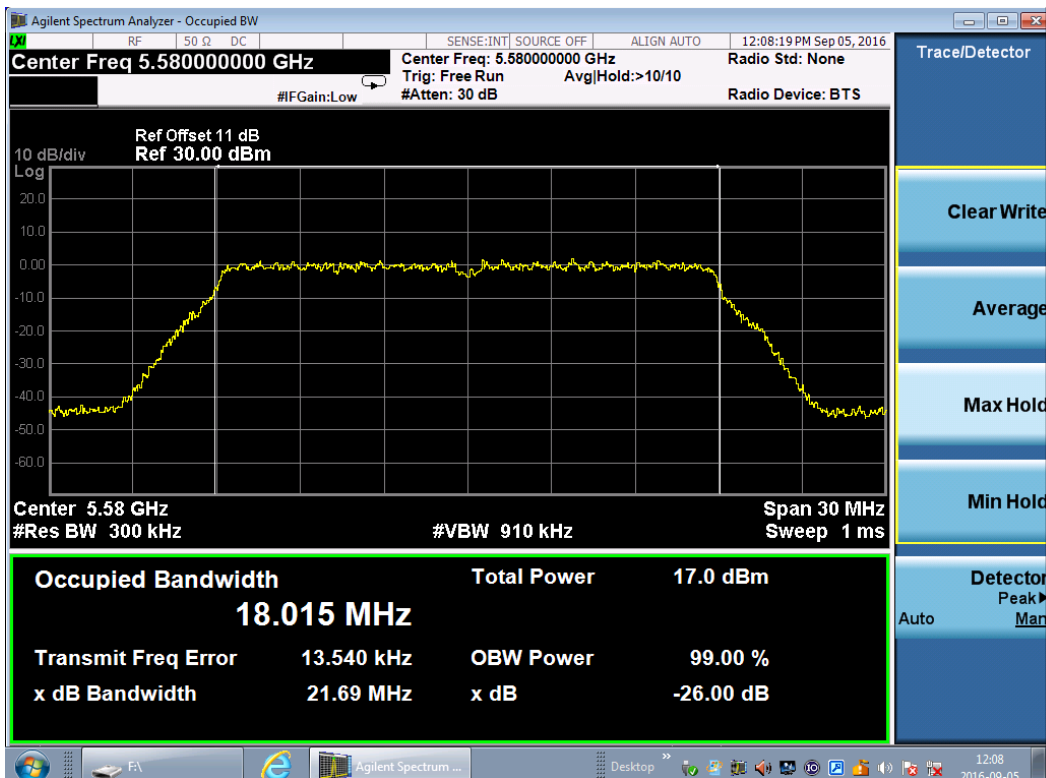
Modulation: OFDM; Data rate: 54 Mbps; Power setting: 49q or 37*q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5500	21.13	16.874	N/A
5580	21.21	16.921	N/A
5720*	21.19	16.892	N/A



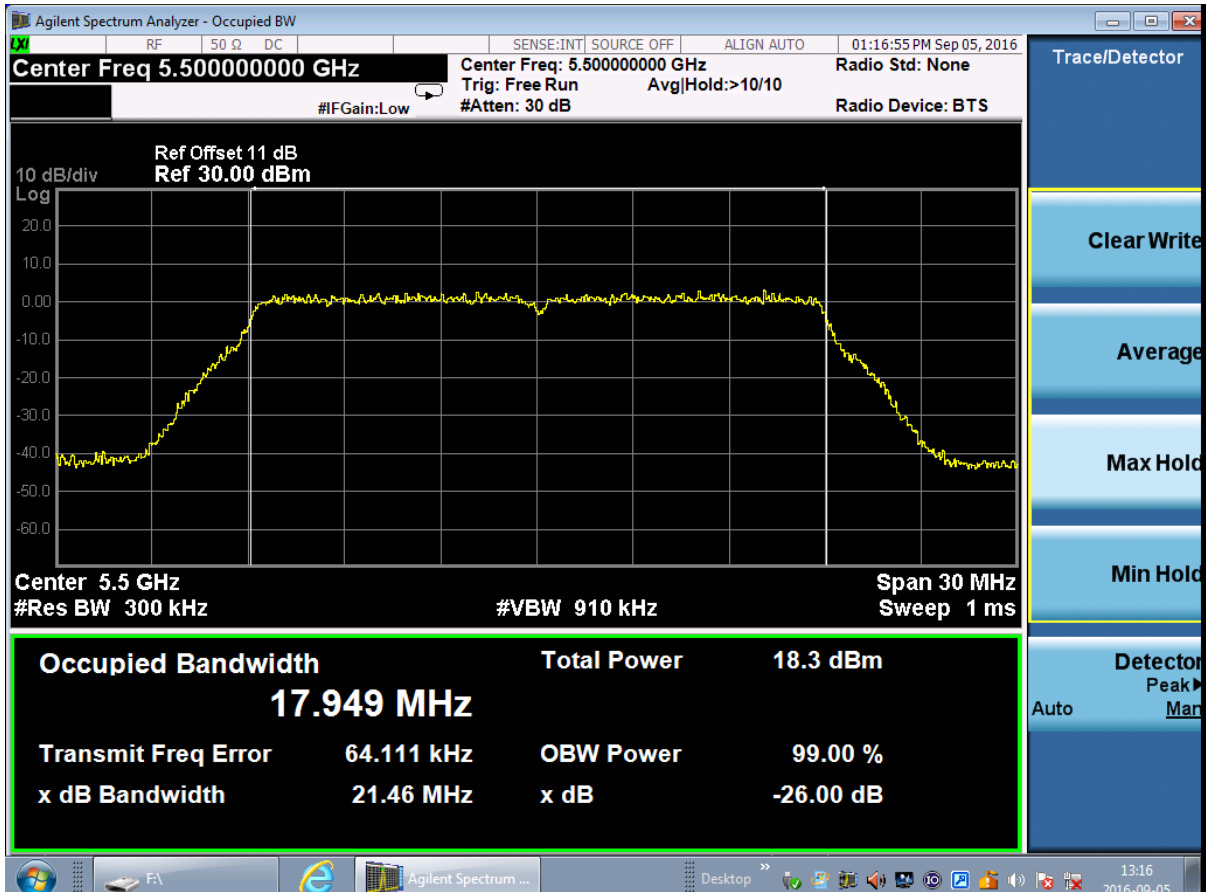


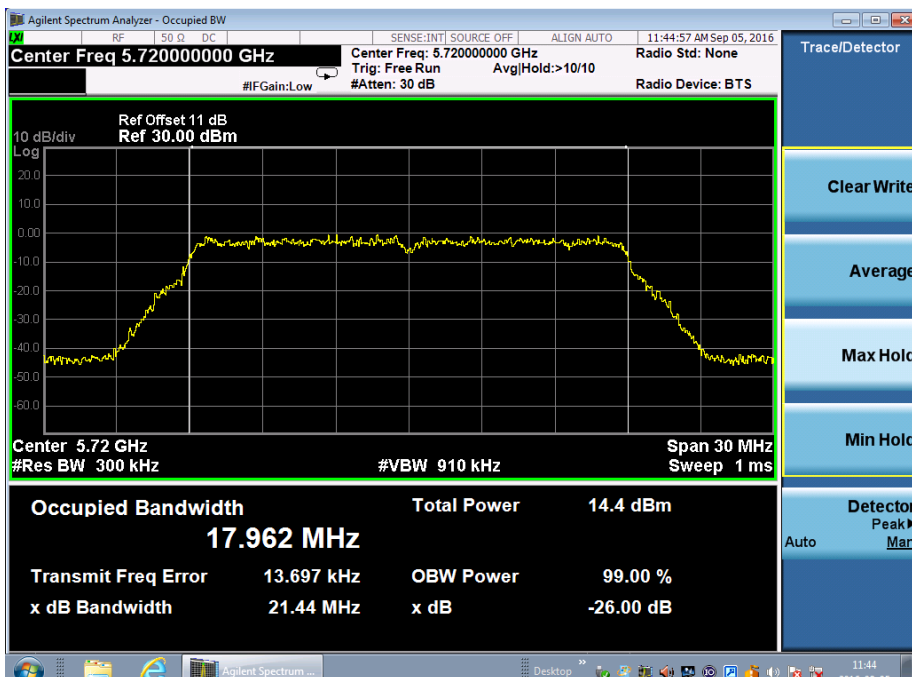
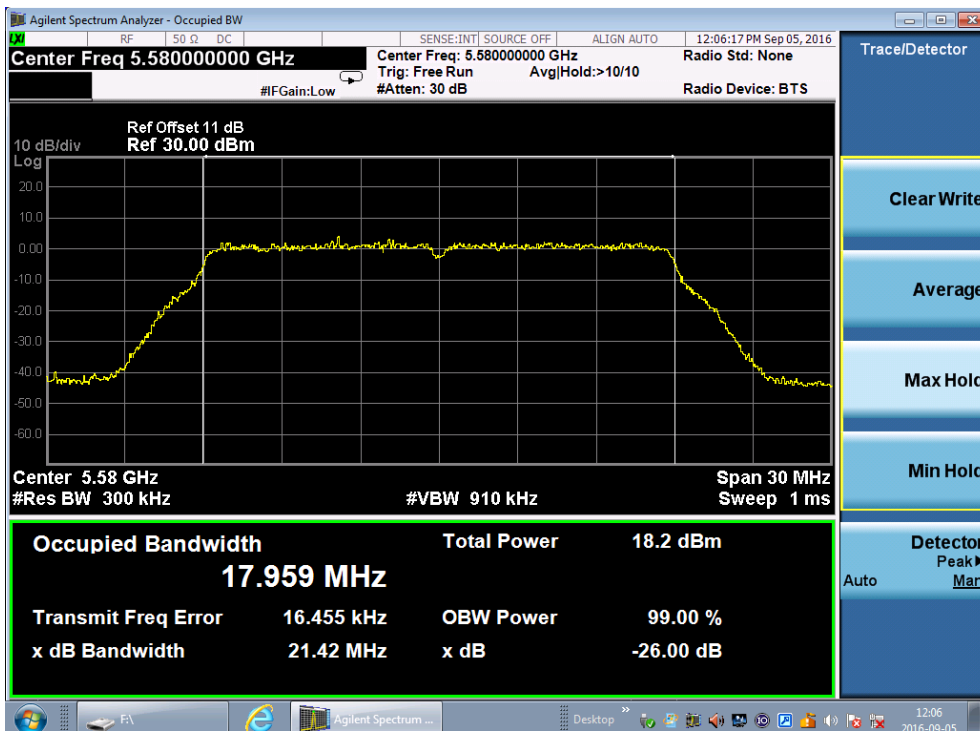
Modulation: VHT20; Data rate: MCS0NSS1; Power setting: 49q or 37*q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5500	21.62	17.992	N/A
5580	21.69	18.015	N/A
5720*	21.73	17.977	N/A





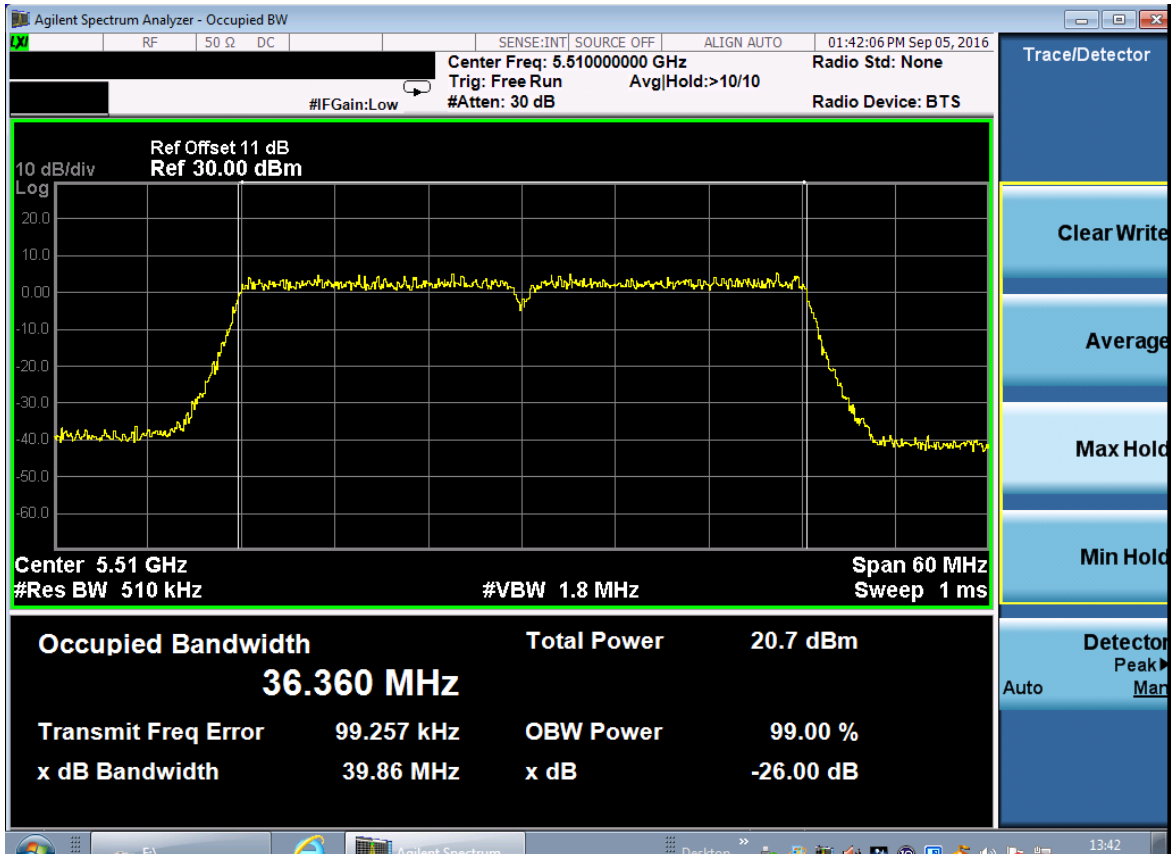
Modulation: VHT20; Data rate: MCS8NSS1; Power setting: 49q or 37*q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5500	21.46	17.949	N/A
5580	21.42	17.959	N/A
5720*	21.44	17.962	N/A

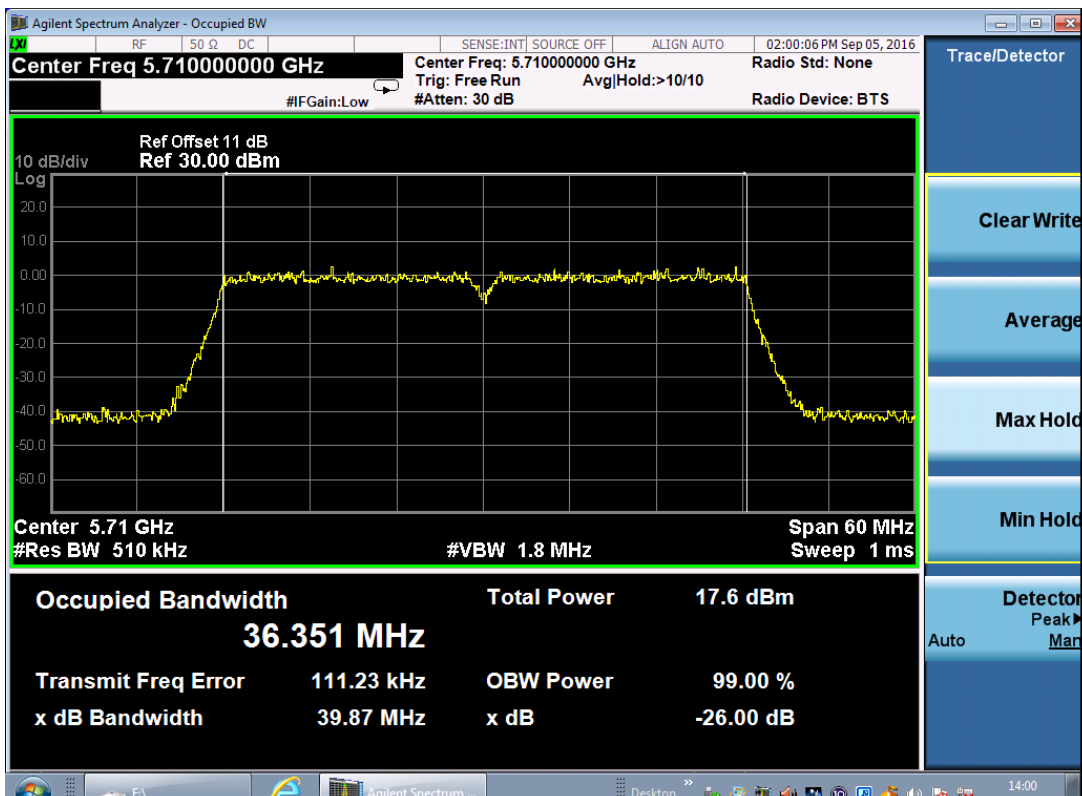
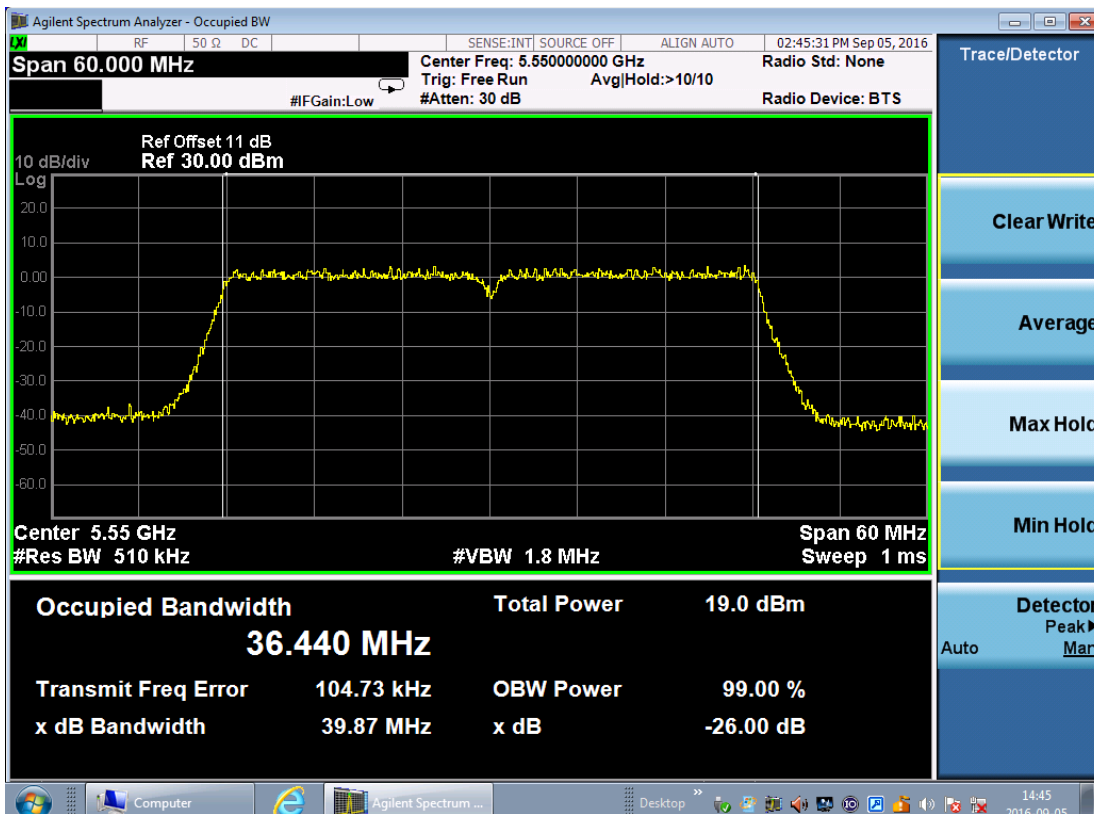




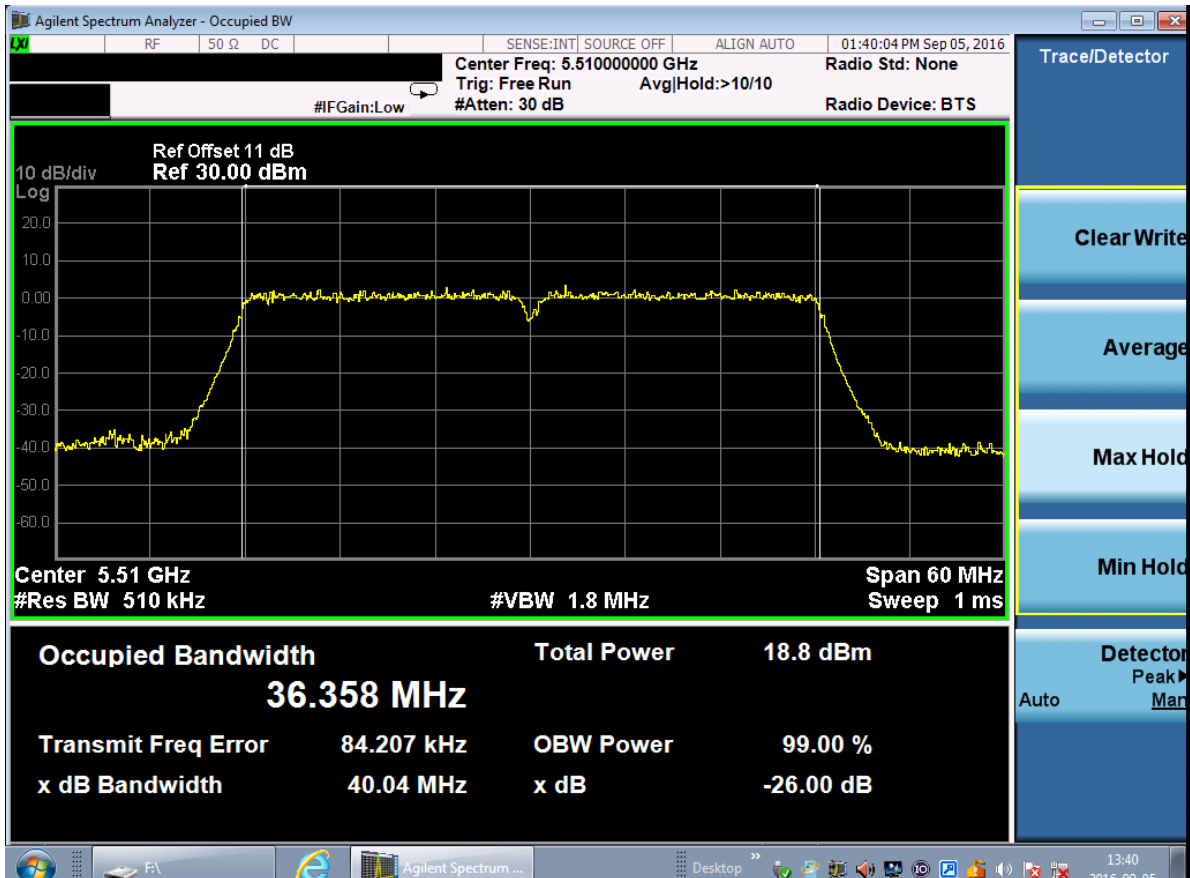
Modulation: VHT40; Data rate: MCS0NSS1; Power setting: 60, *57 or **49 q dBm;

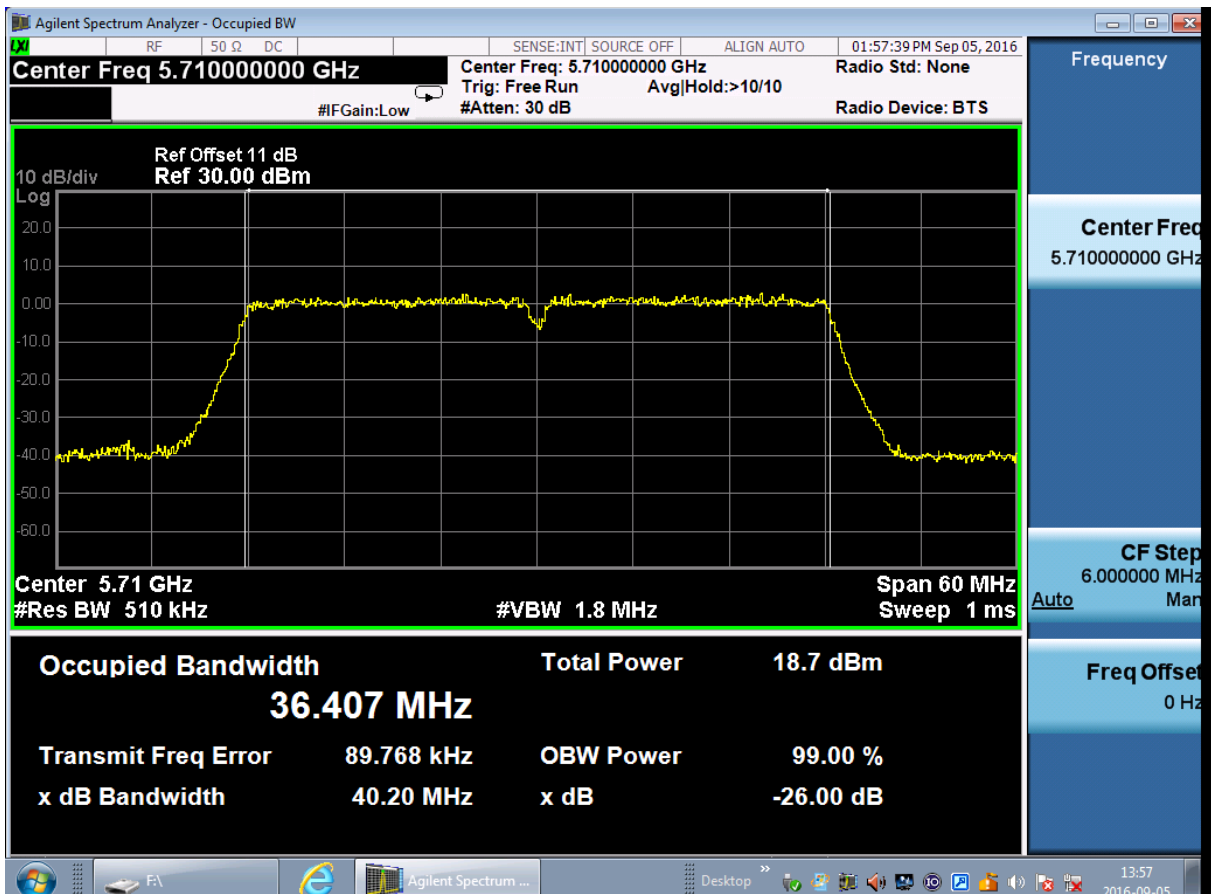
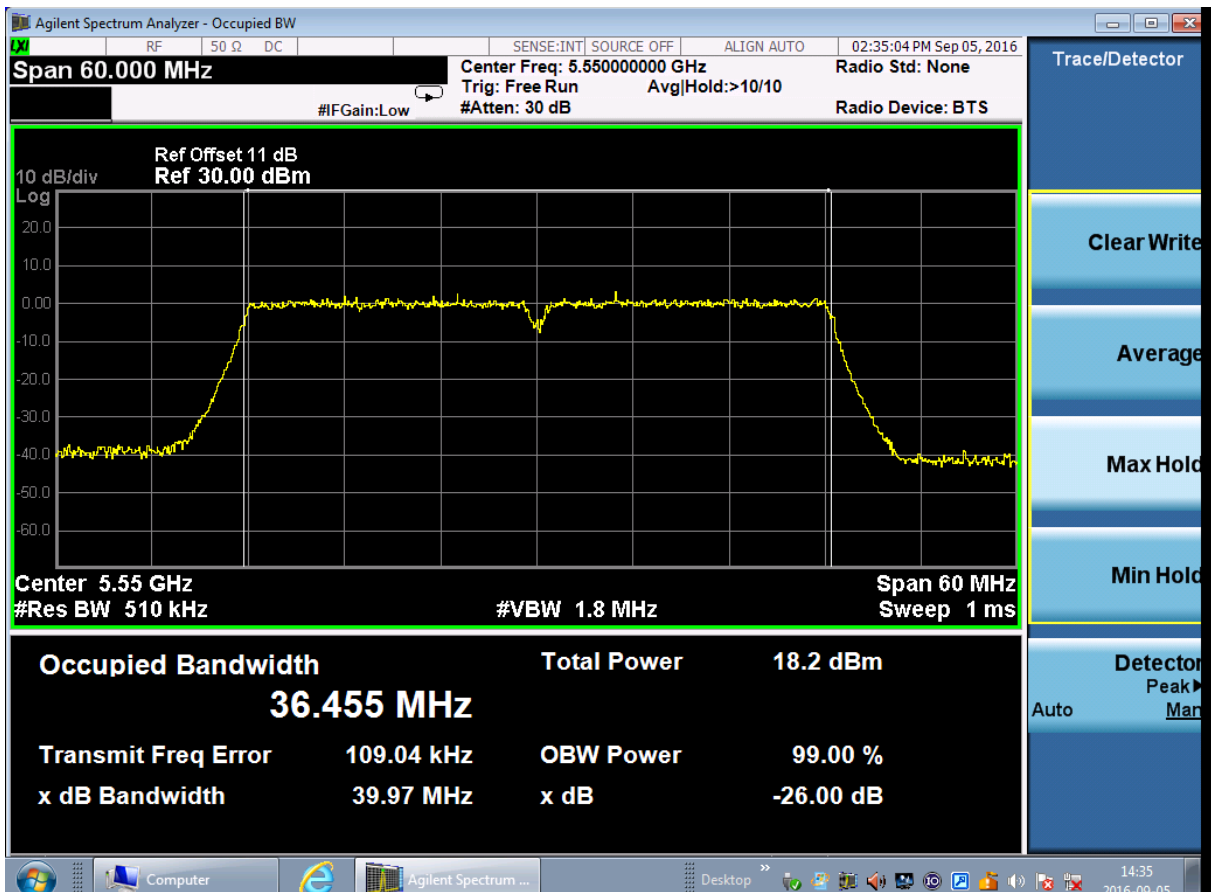
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5510	39.86	36.360	N/A
5550*	39.87	36.440	N/A
5710**	39.87	36.351	N/A





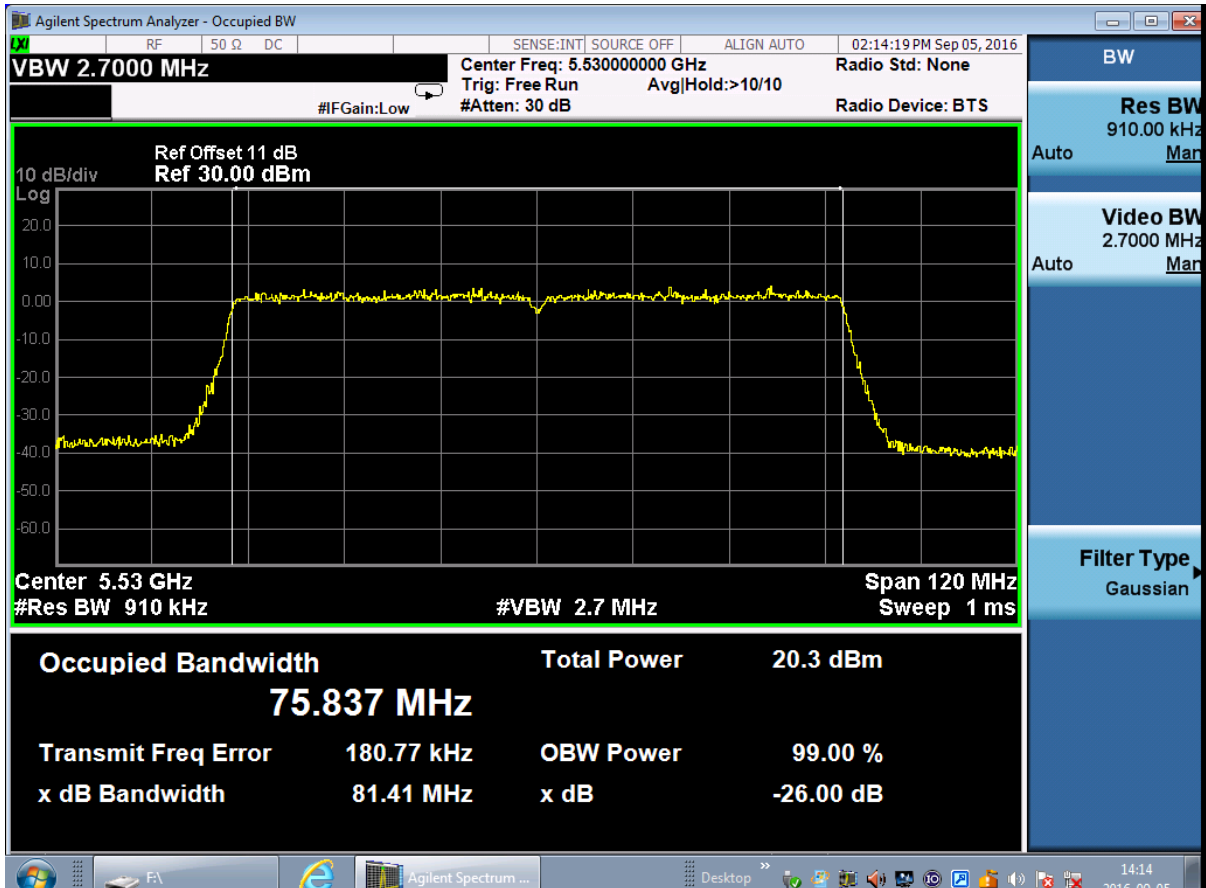
Modulation: VHT40; Data rate: MCS11NSS1; Power setting: 50q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5510	40.04	36.358	N/A
5550	39.97	36.455	N/A
5710	40.20	36.407	N/A

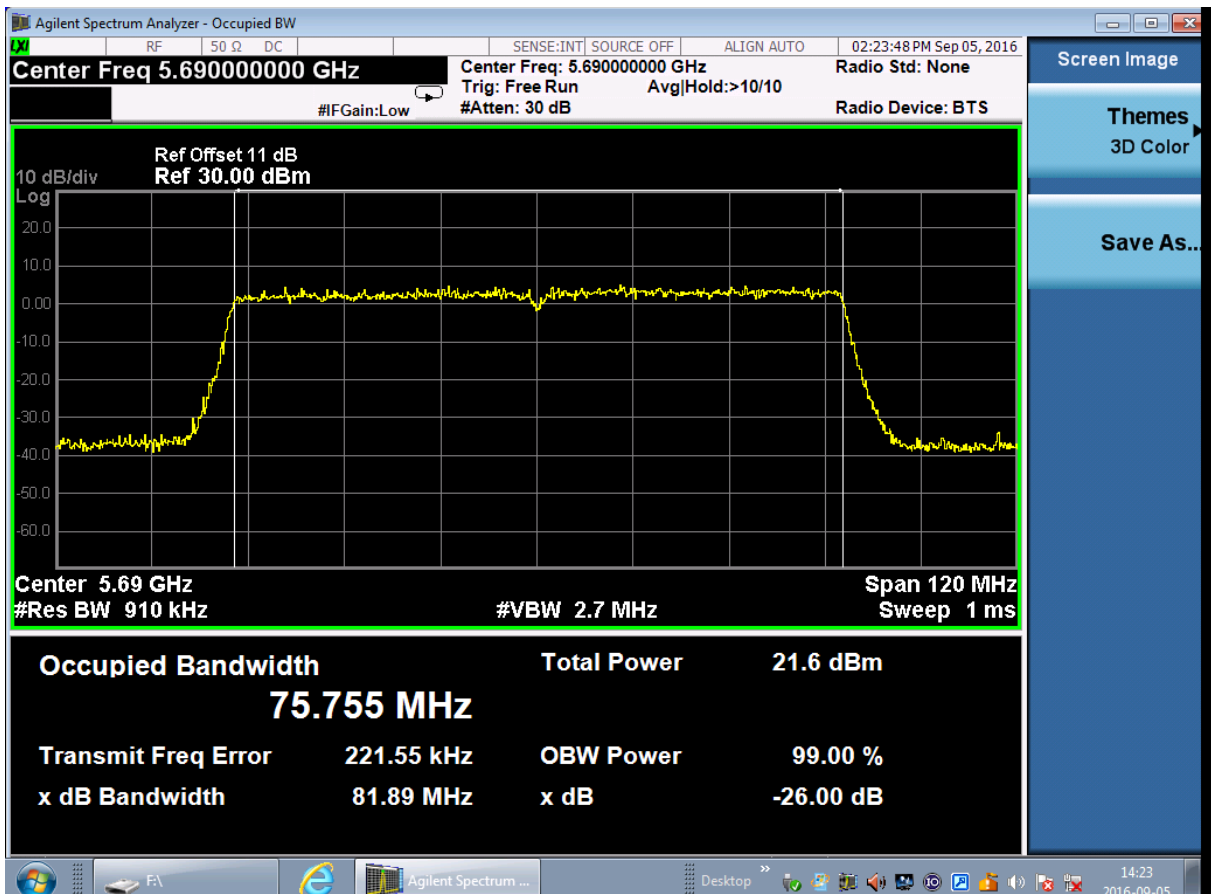
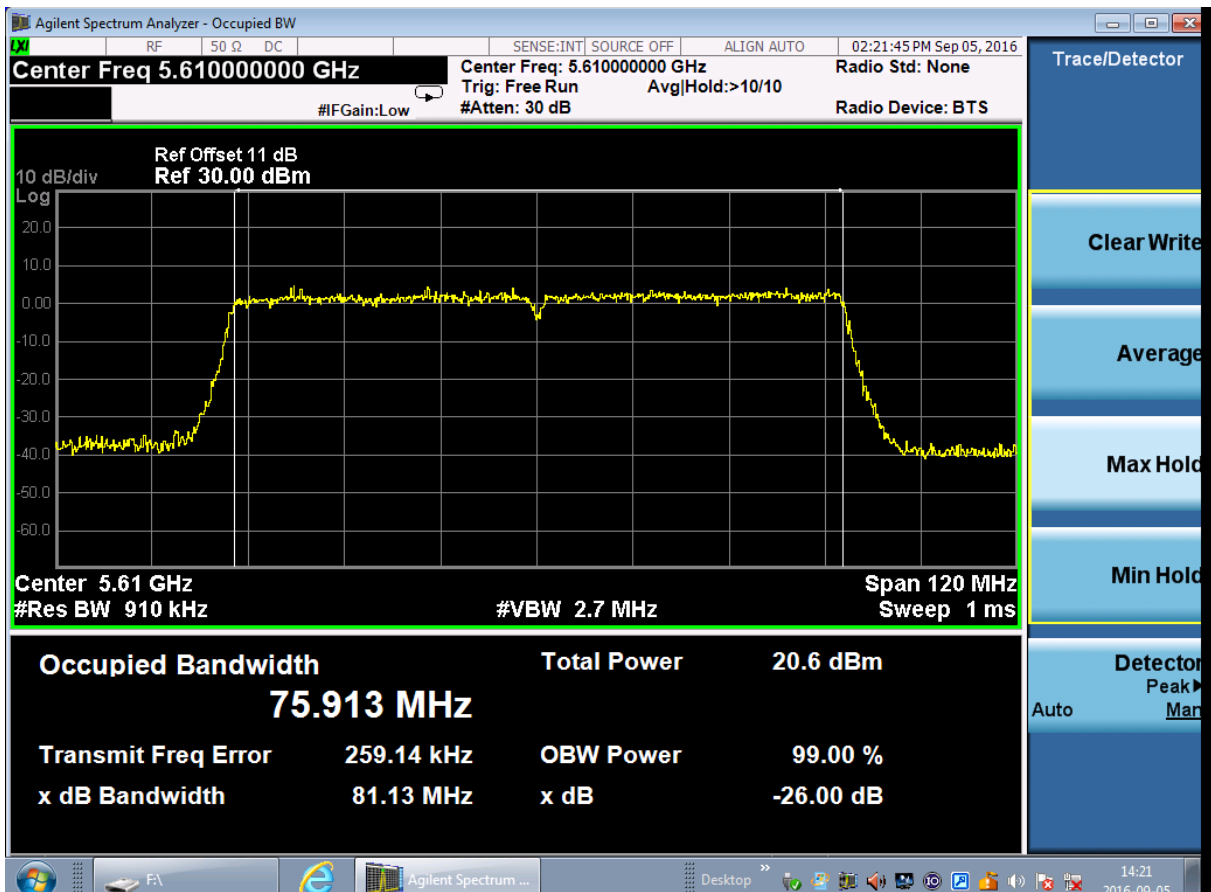




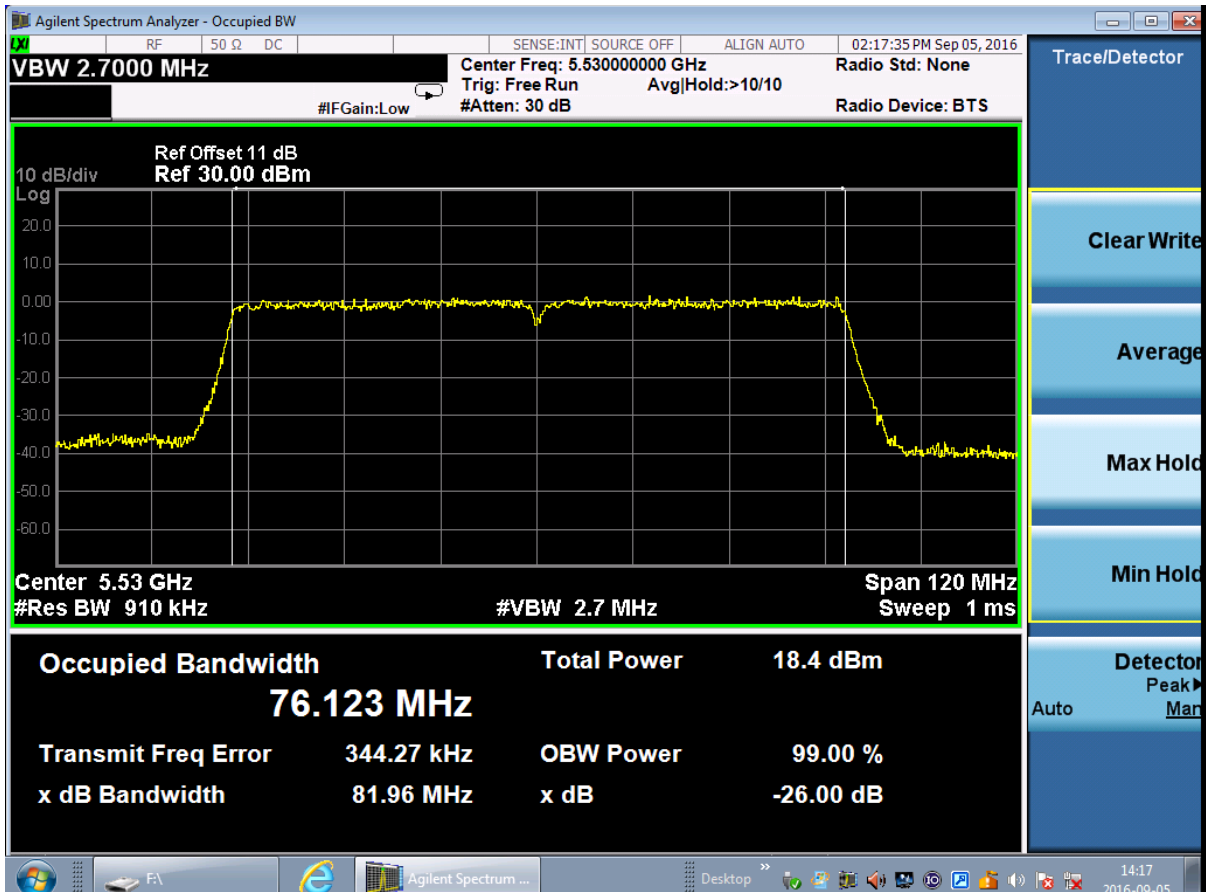
Modulation: VHT80; Data rate: MCS0NSS1; Power setting: 60q or *61q dBm;

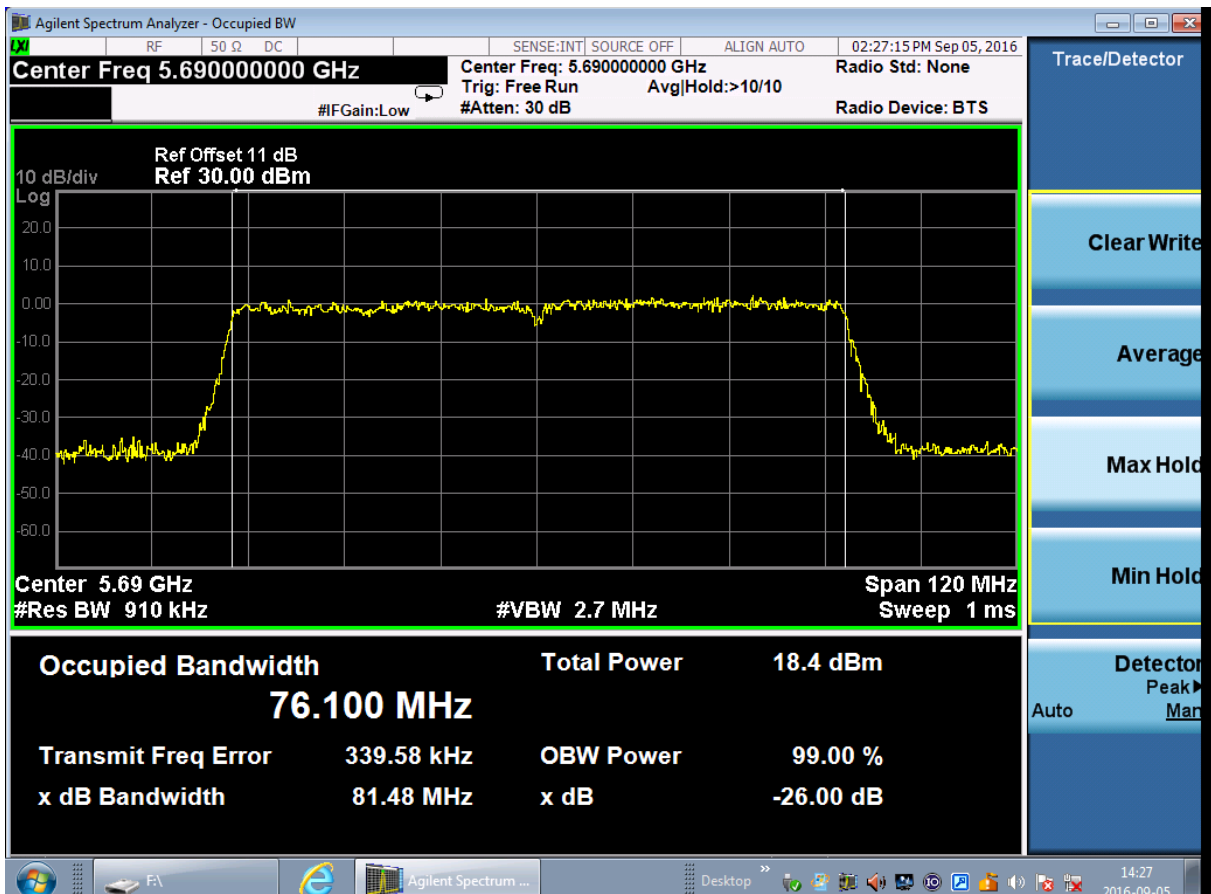
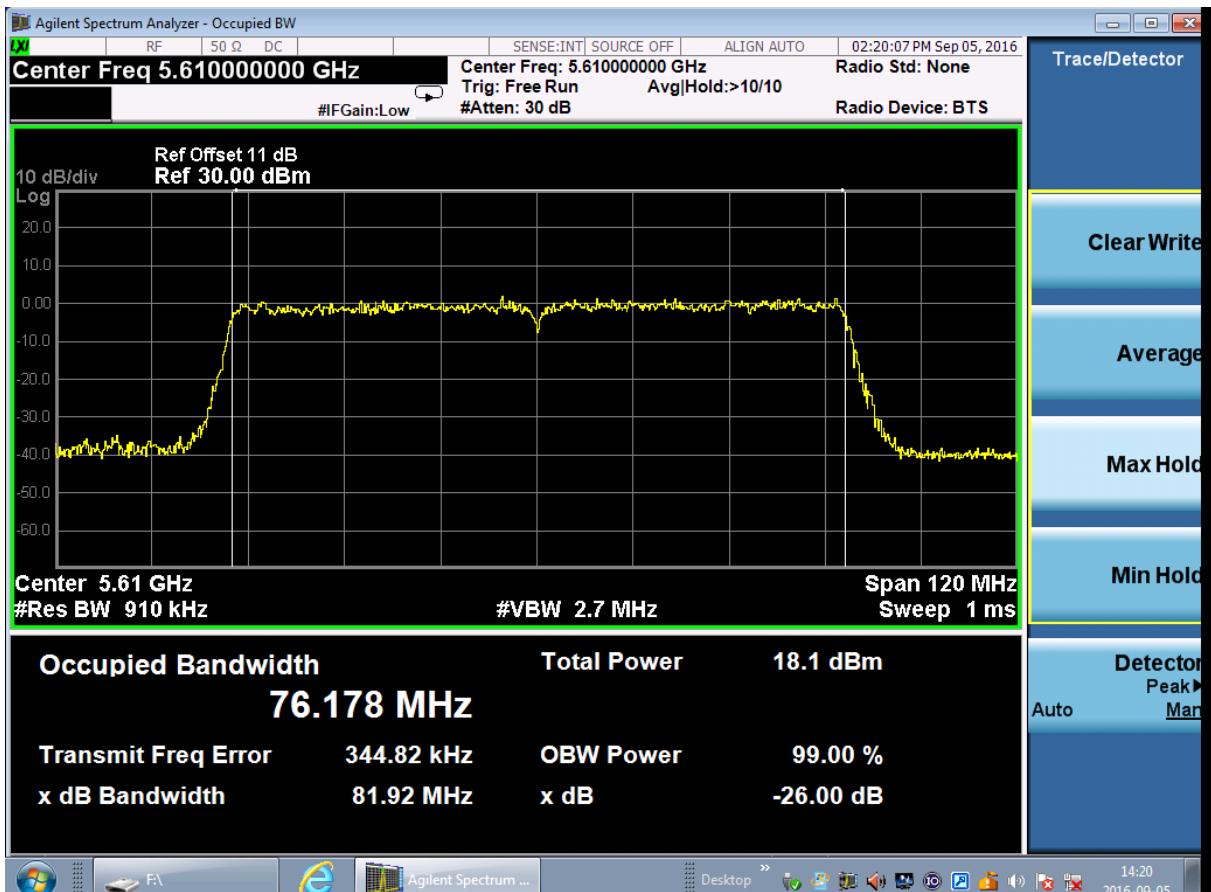
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5530	81.41	75.837	N/A
5610	81.13	75.913	N/A
5690*	81.89	75.755	N/A





Modulation: VHT80; Data rate: MCS11NSS1; Power setting: 50q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5530	81.96	76.123	N/A
5610	81.92	76.178	N/A
5690	81.48	76.100	N/A





U-NII-3

Modulation: OFDM; Data rate: 6 Mbps; Power setting: 62q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5745	21.360	16.7360	N/A
5785	21.653	17.0542	N/A
5825	21.144	16.7103	N/A

Agilent 11:25:26 Sep 19, 2016

Ch Freq 5.745 GHz
Trig Free

Occupied Bandwidth

Center 5.745000000 GHz

Ref 9 dBm
#Atten 30 dB

#Peak
Log

Center 5.745 000 GHz
Span 30 MHz

#Res BW 200 kHz
VBW 620 kHz
Sweep 1.092 ms (8192 pts)

Occupied Bandwidth

16.7360 MHz

Occ BW % Pwr 99.00 %

x dB -26.00 dB

Transmit Freq Error 20.907 kHz

x dB Bandwidth 21.360 MHz

Signal Track

On Off

File Operation Status, A:\SCREEN055.GIF file saved

Freq/Channel
Center Freq 5.745000000 GHz
Start Freq 5.730000000 GHz
Stop Freq 5.760000000 GHz
CF Step 3.000000000 MHz Auto Man
Freq Offset 0.000000000 Hz
Signal Track On Off

Agilent 11:47:50 Sep 19, 2016

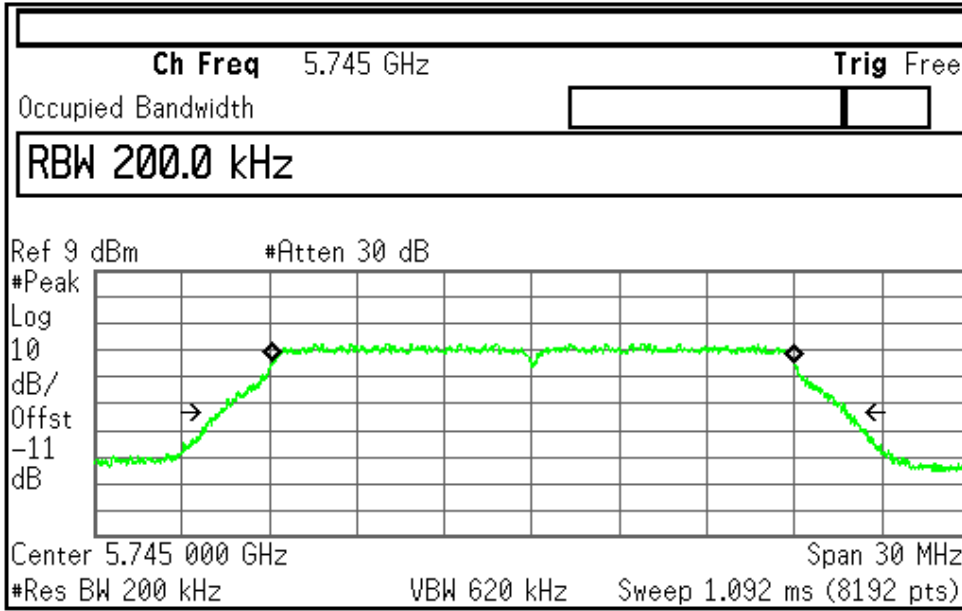
Ch Freq 5.785 GHz Trig Free		BW/Avg
Occupied Bandwidth [] []		Res BW 200.0 kHz Auto Man
VBW/RBW Ratio 3.00000		Video BW 620.0 kHz Auto Man
Ref 0 dBm #Atten 30 dB		VBW/RBW 3.00000 Auto Man
		Average 10 On Off
Center 5.785 000 GHz Span 30 MHz		Avg/VBW Type Log-Pwr (Video) Man
#Res BW 200 kHz VBW 620 kHz Sweep 1.092 ms (8192 pts)		
Occupied Bandwidth Occ BW % Pwr 99.00 % 17.0542 MHz x dB -26.00 dB Transmit Freq Error 43.831 kHz x dB Bandwidth 21.653 MHz		Span/RBW 106 Auto Man
File Operation Status, A:\SCREEN058.GIF file saved		

Agilent 11:20:25 Sep 19, 2016

Ch Freq 5.825 GHz Trig Free		Trace
Occupied Bandwidth [] []		1 2 3
VBW/RBW Ratio 3.00000		Clear Write
Ref 9 dBm #Atten 30 dB		Max Hold
		Min Hold
Center 5.825 000 GHz Span 30 MHz		View
#Res BW 200 kHz VBW 620 kHz Sweep 1.092 ms (8192 pts)		Blank
Occupied Bandwidth Occ BW % Pwr 99.00 % 16.7103 MHz x dB -26.00 dB Transmit Freq Error 13.190 kHz x dB Bandwidth 21.144 MHz		More 1 of 2
File Operation Status, C:\1K1.GIF file deleted		

Modulation: VHT20; Data rate: MCS0NSS1; Power setting: 62q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5745	21.478	17.8944	N/A
5785	21.476	17.8886	N/A
5825	21.682	17.8887	N/A

Agilent 11:06:53 Sep 19, 2016

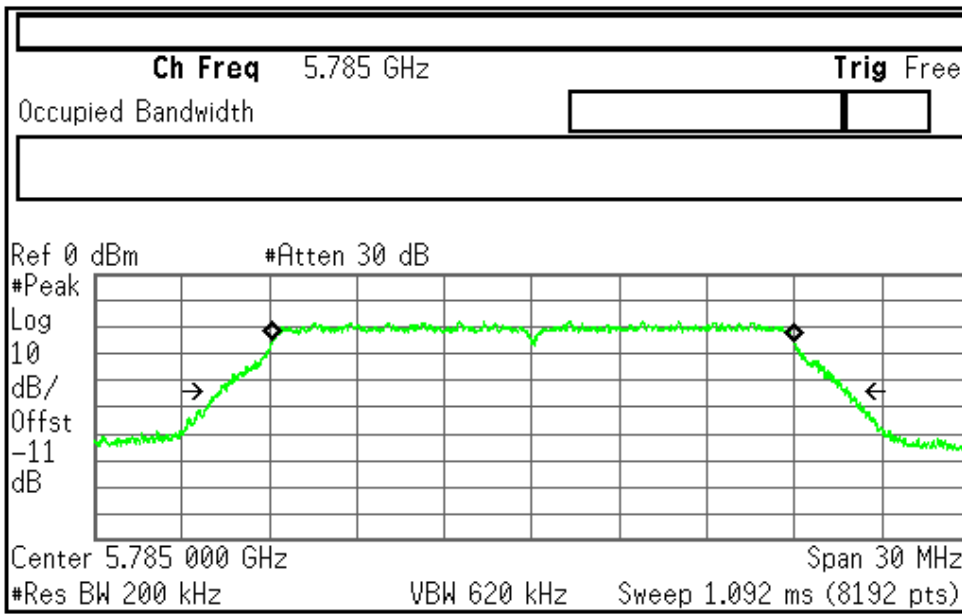


Trace		
1	Trace	3
2		
Clear Write		
Max Hold		
Min Hold		
View		
Blank		
More		
1 of 2		

Occupied Bandwidth	Occ BW % Pwr	99.00 %
17.8944 MHz	x dB	-26.00 dB
Transmit Freq Error		37.300 kHz
x dB Bandwidth		21.478 MHz

File Operation Status, A:\SCREEN047.GIF file saved

Agilent 11:51:27 Sep 19, 2016

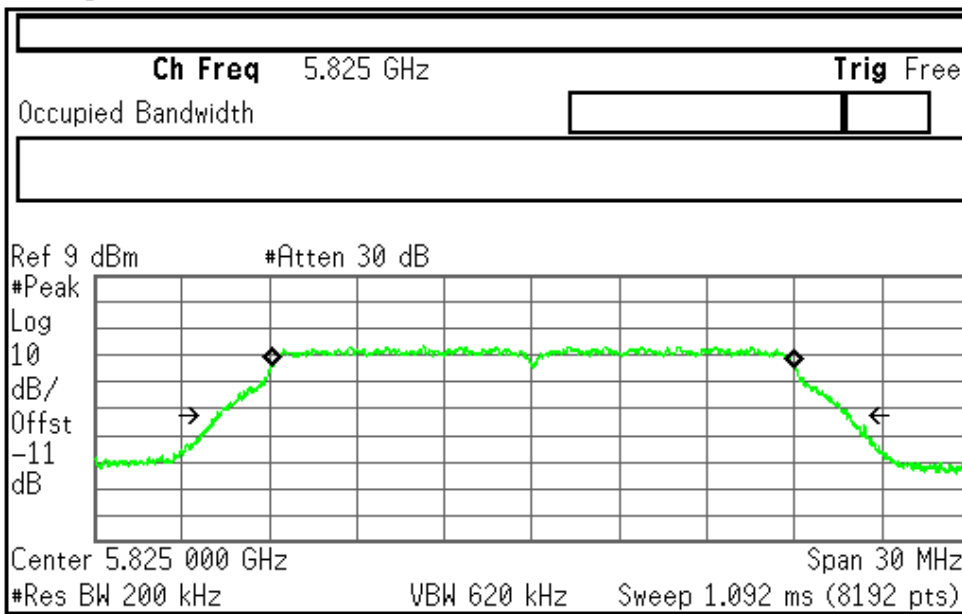


Occupied Bandwidth	Occ BW % Pwr	99.00 %
17.8886 MHz	x dB	-26.00 dB
Transmit Freq Error		50.356 kHz
x dB Bandwidth		21.476 MHz

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- Trace
- Trace 1 2 3
- Clear Write
- Max Hold
- Min Hold
- View
- Blank
- More 1 of 2

Agilent 11:13:28 Sep 19, 2016



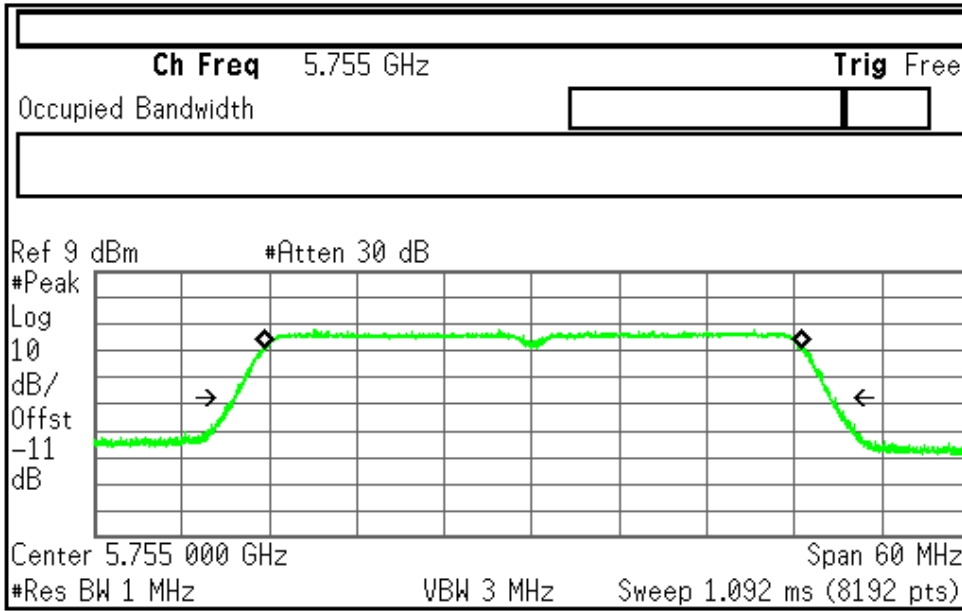
Occupied Bandwidth	Occ BW % Pwr	99.00 %
17.8887 MHz	x dB	-26.00 dB
Transmit Freq Error		38.752 kHz
x dB Bandwidth		21.682 MHz

File Operation Status, C:\SCREEN052.GIF file saved

- File
- Catalog>
- Save>
- Load>
- Delete>
- Copy>
- Rename>
- More 1 of 2

Modulation: VHT40; Data rate: MCS0NSS1; Power setting: 62q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5755	41.202	36.8828	N/A
5795	41.146	36.7616	N/A

Agilent 11:00:21 Sep 19, 2016



Occupied Bandwidth	Occ BW % Pwr	99.00 %
36.8828 MHz	x dB	-26.00 dB
Transmit Freq Error		60.942 kHz
x dB Bandwidth		41.202 MHz

File Operation Status, A:\SCREEN045.GIF file saved

Display
Full Screen
Display Line -25.00 dBm On Off
Limits
Active Fctn Position Top
Title
Preferences

Agilent 10:49:48 Sep 19, 2016

Ch Freq 5.795 GHz Trig Free

Occupied Bandwidth

Center 5.795000000 GHz

Ref 9 dBm #Atten 30 dB

#Res BW 1 MHz VBW 3 MHz Sweep 1.092 ms (8192 pts)

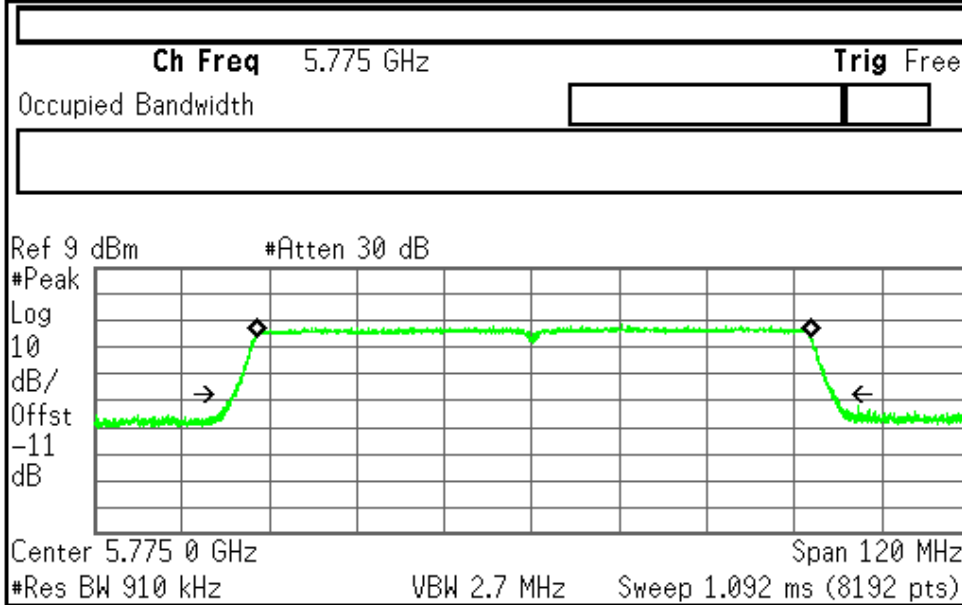
Occupied Bandwidth	Occ BW % Pwr	99.00 %
36.7616 MHz	x dB	-26.00 dB
Transmit Freq Error		93.130 kHz
x dB Bandwidth		41.146 MHz

File Operation Status, A:\80C157.GIF file saved

- File
- Catalog>
- Save>
- Load>
- Delete>
- Copy>
- Rename>
- More
1 of 2

Modulation: VHT80; Data rate: MCS0NSS1; Power setting: 62q dBm;			
Channel Frequency (MHz)	26dB bandwidth (MHz)	99% bandwidth (MHz)	Result
5775	82.354	75.9443	N/A

Agilent 10:36:50 Sep 19, 2016



Occupied Bandwidth	Occ BW % Pwr	99.00 %
75.9443 MHz	x dB	-26.00 dB
Transmit Freq Error	139.151 kHz	
x dB Bandwidth	82.354 MHz	

Printer not responding

Trace
Trace 1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More 1 of 2

12 Maximum conducted output power

12.1 Definition

The maximum conducted output power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

12.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Lab4 (Wireless Lab1)
Test Standard and Clause:	ANSI C63.10-2013, Clause 12.3
EUT Channels / Frequencies Measured:	Low / Mid / High
EUT Occupied Bandwidths:	20, 40 and 80 MHz
Deviations From Standard:	None
Measurement Detector:	Max. e.i.r.p readings on Dare Probe REF2112
Voltage Extreme Environment Test Range:	Mains Power = 85% and 115% of Nominal (FCC only requirement); Battery Power = new battery.

Environmental Conditions (Normal Environment)

Temperature: 21°C	+15 °C to +35 °C (as declared)
Humidity: 52%RH	20%RH to 75%RH (as declared)

Test Limits

For an access point operating in the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum e.i.r.p. at an elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW.

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands 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 megahertz. Transmit Power Control is not required where the e.i.r.p. is less than 500 mW.

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Fixed point-to-point U-NII devices operating in the band 5.725-5.85 GHz may employ antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power.

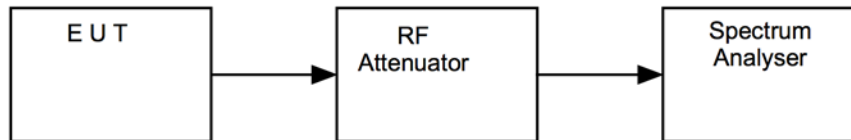
Fixed point-to-point U-NII devices operating in other bands may employ antennas with directional gain up to 23dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

12.3 Test Method

The EUT (Sample Host29 AP34) was setup as per section 9 of this report and, as per Figure iv, the analyser was used to measure each antenna output in turn, having taken account of all path losses. The resolution bandwidth of the spectrum analyser was set between 1 and 5 % of the EUT occupied bandwidth and the analyser band power function used to calculate the average power. The results were summed as in the tables below.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst case configuration in each bandwidth.

Figure iv Test Setup



12.4 Test Equipment

<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Last Cal Calibration</i>	<i>Calibration Period</i>	<i>Due For Calibration</i>
Power Meter	Dare	RPR3006W	REF2112	09/03/2016	12	09/03/2017

12.5 Test Results

Channel: 5180 MHz; Modulation: OFDM; Data rate: 54Mbit/s; Power Setting: 28q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-14.7	20	3.39
1	-14.5	20	3.55
2	-14.9	20	3.24
3	-14.8	20	3.31
Total:			13.48
Worst case Antenna Gain in Band = 5.3 dBi Which gives an e.i.r.p. value of:			45.68
Result:			Pass

Channel: 5200 MHz; Modulation: OFDM; Data rate: 54Mbit/s; Power Setting: 28q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-14.9	20	3.24
1	-14.7	20	3.39
2	-15.1	20	3.09
3	-14.6	20	3.47
Total:			13.18
Worst case Antenna Gain in Band = 5.3 dBi Which gives an e.i.r.p. value of:			44.66
Result:			Pass

Channel: 5240 MHz; Modulation: OFDM; Data rate: 54Mbit/s; Power Setting: 28q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-14.8	20	3.31
1	-14.7	20	3.39
2	-14.8	20	3.31
3	-15.1	20	3.09
Total:			13.10
Worst case Antenna Gain in Band = 5.3 dBi Which gives an e.i.r.p. value of:			44.39
Result:			Pass

Channel: 5260 MHz; Modulation: OFDM; Data rate: 54Mbit/s; Power Setting: 47q dBm			
Antenna Chain	Meter Level	Cable loss	Power
	(dBm)	(dB)	(mW)
0	-9.4	20	11.48
1	-8.8	20	13.18
2	-9.3	20	11.75
3	-9.4	20	11.48
Total:			47.89
Worst case Antenna Gain in Band = 5.2 dBi Which gives an e.i.r.p. value of:			158.58
Result:			Pass

Channel: 5280 MHz; Modulation: OFDM; Data rate: 54Mbit/s; Power Setting: 47q dBm			
Antenna Chain	Meter Level	Cable loss	Power
	(dBm)	(dB)	(mW)
0	-9.4	20	11.48
1	-9.1	20	12.30
2	-9.2	20	12.02
3	-9.5	20	11.22
Total:			47.03
Worst case Antenna Gain in Band = 5.2 dBi Which gives an e.i.r.p. value of:			155.73
Result:			Pass

Channel: 5320 MHz; Modulation: OFDM; Data rate: 54Mbit/s; Power Setting: 49q dBm			
Antenna Chain	Meter Level	Cable loss	Power
	(dBm)	(dB)	(mW)
0	-8.8	20	13.18
1	-8.5	20	14.13
2	-8.7	20	13.49
3	-9.1	20	12.30
Total:			53.10
Worst case Antenna Gain in Band = 5.2 dBi Which gives an e.i.r.p. value of:			175.83
Result:			Pass

Channel: 5500 MHz; Modulation: OFDM; Data rate: 54Mbit/s; Power Setting: 49q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-8.6	20	13.80
1	-8.8	20	13.18
2	-8.9	20	12.88
3	-9.0	20	12.59
Total:			52.46
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			229.00
Result:			Pass

Channel: 5580 MHz; Modulation: OFDM; Data rate: 54Mbit/s; Power Setting: 49q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-9.4	20	11.48
1	-9.3	20	11.75
2	-9.4	20	11.48
3	-9.5	20	11.22
Total:			45.93
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			200.49
Result:			Pass

Channel: 5720 MHz; Modulation: OFDM; Data rate: 54Mbit/s; Power Setting: 37q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-12.6	20	5.01
1	-11.8	20	6.61
2	-12.6	20	5.50
3	-13.0	20	5.01
Total:			22.13
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			96.60
Result:			Pass

Channel: 5745 MHz; Modulation: OFDM; Data rate: 6MBit/s; Power Setting: 62q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-6.0	20	25.12
1	-5.5	20	28.18
2	-6.1	20	24.55
3	-5.9	20	25.70
Total:			103.55
Worst case Antenna Gain in Band = 6.5 dBi Which gives an e.i.r.p. value of:			462.54
Result:			Pass

Channel: 5785 MHz; Modulation: OFDM; Data rate: 6MBit/s; Power Setting: 62q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-5.7	20	26.92
1	-5.4	20	28.84
2	-5.8	20	26.30
3	-5.7	20	26.92
Total:			108.97
Worst case Antenna Gain in Band = 6.5 dBi Which gives an e.i.r.p. value of:			486.75
Result:			Pass

Channel: 5825 MHz; Modulation: OFDM; Data rate: 6Mbit/s; Power Setting: 62q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-5.3	20	29.51
1	-5.3	20	29.51
2	-5.5	20	28.18
3	-5.6	20	27.54
Total:			114.75
Worst case Antenna Gain in Band = 6.5 dBi Which gives an e.i.r.p. value of:			512.57
Result:			Pass

Channel: 5180 MHz; Modulation and data rate: MCS0; Power Setting: 28q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-15.6	20	2.75
1	-15.2	20	3.02
2	-15.7	20	2.69
3	-15.6	20	2.75
Total:			11.22
Worst case Antenna Gain in Band = 5.3 dBi Which gives an e.i.r.p. value of:			38.02
Result:			Pass

Channel: 5200 MHz; Modulation and data rate: MCS0; Power Setting: 28q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-15.4	20	2.88
1	-15.1	20	3.09
2	-15.6	20	2.75
3	-15.3	20	2.95
Total:			11.68
Worst case Antenna Gain in Band = 5.3 dBi Which gives an e.i.r.p. value of:			39.58
Result:			Pass

Channel: 5240 MHz; Modulation and data rate: MCS0; Power Setting: 28q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-15.2	20	3.02
1	-14.8	20	3.31
2	-15.5	20	2.82
3	-15.1	20	3.09
Total:			12.24
Worst case Antenna Gain in Band = 5.3 dBi Which gives an e.i.r.p. value of:			41.47
Result:			Pass

Channel: 5260 MHz; Modulation and data rate: VHT20 MCS0; Power Setting: 47q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-9.7	20	10.72
1	-9.3	20	11.75
2	-9.5	20	11.22
3	-9.8	20	10.47
Total:			44.16
Worst case Antenna Gain in Band = 5.2 dBi Which gives an e.i.r.p. value of:			146.23
Result:			Pass

Channel: 5280 MHz; Modulation and data rate: VHT20 MCS0; Power Setting: 47q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-9.7	20	10.72
1	-9.4	20	11.48
2	-9.6	20	10.96
3	-9.8	20	10.47
Total:			43.63
Worst case Antenna Gain in Band = 5.2 dBi Which gives an e.i.r.p. value of:			144.47
Result:			Pass

Channel: 5320 MHz; Modulation and data rate: VHT20 MCS0; Power Setting: 49q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-9.1	20	12.30
1	-8.9	20	12.88
2	-9.2	20	12.02
3	-9.3	20	11.75
Total:			48.96
Worst case Antenna Gain in Band = 5.2 dBi Which gives an e.i.r.p. value of:			162.12
Result:			Pass

Channel: 5500 MHz; Modulation and data rate: VHT20 MCS0; Power Setting: 49q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-9.6	20	10.96
1	-9.4	20	11.48
2	-9.5	20	11.22
3	-9.3	20	11.75
Total:			45.42
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			198.27
Result:			Pass

Channel: 5580 MHz; Modulation and data rate: VHT20 MCS0; Power Setting: 49q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-9.4	20	11.48
1	-9.3	20	11.75
2	-9.1	20	12.30
3	-9.8	20	10.47
Total:			46.00
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			200.80
Result:			Pass

Channel: 5720 MHz; Modulation and data rate: VHT20 MCS0; Power Setting: 37q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-12.9	20	5.50
1	-12.1	20	6.17
2	-12.7	20	5.37
3	-12.6	20	5.50
Total:			22.53
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			98.35
Result:			Pass

Channel: 5745 MHz; Modulation and data rate: VHT20 MCS0; Power Setting: 62q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-5.9	20	25.70
1	-5.7	20	26.92
2	-5.9	20	25.70
3	-5.7	20	26.92
Total:			105.24
Worst case Antenna Gain in Band = 6.5 dBi Which gives an e.i.r.p. value of:			470.09
Result:			Pass

Channel: 5785 MHz; Modulation and data rate: VHT20 MCS0; Power Setting: 62q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-5.5	20	28.18
1	-5.6	20	27.54
2	-5.7	20	26.92
3	-5.9	20	25.70
Total:			108.35
Worst case Antenna Gain in Band = 6.5 dBi Which gives an e.i.r.p. value of:			483.98
Result:			Pass

Channel: 5825 MHz; Modulation and data rate: VHT20 MCS0; Power Setting: 62q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-5.5	20	28.18
1	-5.5	20	28.18
2	-5.6	20	27.54
3	-5.7	20	26.92
Total:			110.83
Worst case Antenna Gain in Band = 6.5 dBi Which gives an e.i.r.p. value of:			495.06
Result:			Pass

Channel: 5190 MHz; Modulation and data rate: VHT40 MCS0; Power Setting: 32q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-13.5	20	4.47
1	-13.5	20	4.47
2	-14.2	20	3.80
3	-14.2	20	3.80
Total:			16.54
Worst case Antenna Gain in Band = 5.3 dBi Which gives an e.i.r.p. value of:			56.04
Result:			Pass

Channel: 5230 MHz; Modulation and data rate: VHT40 MCS0; Power Setting: 32q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-13.7	20	4.27
1	-13.7	20	4.27
2	-14.3	20	3.72
3	-13.8	20	4.17
Total:			16.42
Worst case Antenna Gain in Band = 5.3 dBi Which gives an e.i.r.p. value of:			55.64
Result:			Pass

Channel: 5270 MHz; Modulation and data rate: VHT40 MCS0; Power Setting: 59q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-6.3	20	23.44
1	-6.3	20	23.44
2	-6.5	20	22.39
3	-6.6	20	21.88
Total:			91.15
Worst case Antenna Gain in Band = 5.2 dBi Which gives an e.i.r.p. value of:			301.83
Result:			Pass

Channel: 5310 MHz; Modulation and data rate: VHT40 MCS0; Power Setting: 52q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-8.3	20	14.79
1	-8.0	20	15.85
2	-8.5	20	14.13
3	-8.7	20	13.49
Total:			58.26
Worst case Antenna Gain in Band = 5.2 dBi Which gives an e.i.r.p. value of:			192.92
Result:			Pass

Channel: 5510 MHz; Modulation and data rate: VHT40 MCS0; Power Setting: 60q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-6.2	20	23.99
1	-6.3	20	23.44
2	-6.6	20	21.88
3	-6.6	20	21.88
Total:			91.19
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			398.06
Result:			Pass

Channel: 5550 MHz; Modulation and data rate: VHT40 MCS0; Power Setting: 61q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-6.4	20	22.91
1	-6.3	20	23.44
2	-6.4	20	22.91
3	-6.6	20	21.88
Total:			91.14
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			397.84
Result:			Pass

Channel: 5710 MHz; Modulation and data rate: VHT40 MCS0; Power Setting: 49q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-10.0	20	9.12
1	-9.3	20	11.75
2	-9.5	20	11.22
3	-10.4	20	9.12
Total:			41.21
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			179.89
Result:			Pass

Channel: 5755 MHz; Modulation and data rate: VHT40 MCS0; Power Setting: 62q dBm			
Antenna Chain	Meter Level	Cable loss	Power
	(dBm)	(dB)	(mW)
0	-5.8	20	26.30
1	-6.0	20	25.12
2	-5.9	20	25.70
3	-6.0	20	25.12
Total:			102.24
Worst case Antenna Gain in Band = 6.5 dBi Which gives an e.i.r.p. value of:			456.69
Result:			Pass

Channel: 5795 MHz; Modulation and data rate: VHT40 MCS0; Power Setting: 62q dBm			
Antenna Chain	Meter Level	Cable loss	Power
	(dBm)	(dB)	(mW)
0	-5.4	20	28.84
1	-5.8	20	26.30
2	-5.8	20	26.30
3	-6.2	20	23.99
Total:			105.43
Worst case Antenna Gain in Band = 6.5 dBi Which gives an e.i.r.p. value of:			470.94
Result:			Pass

Channel: 5210 MHz; Modulation and data rate: VHT80 MCS0; Power Setting: 32q dBm			
Antenna Chain	Antenna Chain	Antenna Chain	Power
	(dBm)	(dB)	(mW)
0	-13.7	20	4.27
1	-13.2	20	4.79
2	-13.6	20	4.37
3	-14.0	20	3.98
Total:			17.40
Worst case Antenna Gain in Band = 5.3 dBi Which gives an e.i.r.p. value of:			58.96
Result:			Pass

Channel: 5290 MHz; Modulation and data rate: VHT80 MCS0; Power Setting: 56q dBm			
Antenna Chain	Antenna Chain	Antenna Chain	Power
	(dBm)	(dB)	(mW)
0	-14.0	20	3.98
1	-13.8	20	4.17
2	-14.3	20	3.72
3	-14.0	20	3.98
Total:			15.85
Worst case Antenna Gain in Band = 5.2 dBi Which gives an e.i.r.p. value of:			52.48
Result:			Pass

Channel: 5530 MHz; Modulation and data rate: VHT80 MCS0; Power Setting: 60q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-6.9	20	20.42
1	-6.6	20	21.88
2	-7.0	20	19.95
3	-7.1	20	19.50
Total:			81.75
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			356.85
Result:			Pass

Channel: 5610 MHz; Modulation and data rate: VHT80 MCS0; Power Setting: 60q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-6.7	20	21.38
1	-6.0	20	25.12
2	-6.6	20	21.88
3	-6.5	20	22.39
Total:			90.76
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			396.18
Result:			Pass

Channel: 5690 MHz; Modulation and data rate: VHT80 MCS0; Power Setting: 61q dBm			
Antenna Chain	Meter Level (dBm)	Cable loss (dB)	Power (mW)
0	-5.9	20	21.88
1	-5.6	20	27.54
2	-6.2	20	23.99
3	-6.6	20	21.88
Total:			95.29
Worst case Antenna Gain in Band = 6.4 dBi Which gives an e.i.r.p. value of:			415.96
Result:			Pass

Channel: 5775 MHz; Modulation and data rate: VHT80 MCS0; Power Setting: 62q dBm			
Antenna Chain	Meter Level	Cable loss	Power
	(dBm)	(dB)	(mW)
0	-5.9	20	25.70
1	-5.8	20	26.30
2	-6.2	20	23.99
3	-6.9	20	20.56
Total:			96.55
Worst case Antenna Gain in Band = 6.5 dBi Which gives an e.i.r.p. value of:			431.27
Result:			Pass

13 Power spectral density

13.1 Definition

The power spectral density is the total energy output per unit bandwidth from a pulse or sequence of pulses for which the transmit power is at its maximum level, divided by the total duration of the pulses.

13.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Wireless Laboratory 1
Test Standard and Clause:	ANSI C63.10-2013, Clause 12.5 KDB789033 D02 v01r02
EUT Channels / Frequencies Measured:	Low / Mid / High
EUT Channel Bandwidths:	20 / 40 / 80 MHz
Deviations From Standard:	None
Measurement BW:	1 MHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	3 MHz
Measurement Span:	20 / 40 / 80 MHz
Measurement Detector:	RMS

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 °C to +35 °C (as declared)
Humidity: 53 %RH	20%RH to 75%RH (as declared)
Supply: 110 Vac	

Test Limits

For an access point operating in the band 5.15–5.25 GHz the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

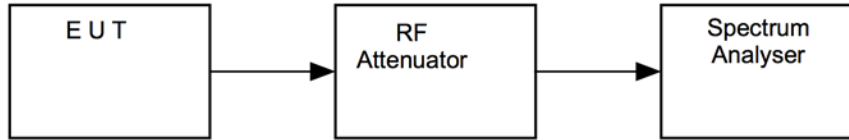
If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

13.3 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure v, the peak emission of the EUT was measured on a spectrum analyser, with path losses taken into account. The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst case configuration in each bandwidth.

Figure v Test Setup



13.4 Test Equipment

<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Last Cal Calibration</i>	<i>Calibration Period</i>	<i>Due For Calibration</i>
Spectrum Analyser	R&S	FSU26	REF909	26/04/2016	12	26/04/2017

13.5 Test Results

<i>U-NII- Band 1</i>										
Frequency MHz	Modulation	Data	Ant0 dBm	Ant1 dBm	Ant2 dBm	Ant3 dBm	Combined		Duty CF dB	PSD dBm/MHz
							mW	dBm		
5180	OFDM	48MBit/s	-7.87	-8.10	-9.25	-8.73	0.57	-2.43	0.32	-2.11
5200	OFDM	48MBit/s	-8.08	-7.71	-8.59	-7.84	0.63	-2.02	0.32	-1.70
5240	OFDM	48MBit/s	-7.84	-7.29	-8.40	-7.88	0.66	-1.82	0.32	-1.50
5180	VHT20	MCS11	-8.25	-8.01	-8.40	-8.27	0.60	-2.21	0.70	-1.51
5200	VHT20	MCS11	-7.59	-8.00	-8.72	-8.23	0.62	-2.10	0.70	-1.40
5240	VHT20	MCS11	-8.68	-8.37	-9.15	-8.20	0.55	-2.56	0.70	-1.86
5190	HT40	MCS6	-8.88	-9.48	-10.52	-9.84	0.43	-3.62	0.94	-2.68
5230	HT40	MCS6	-9.44	-9.26	-9.85	-9.92	0.44	-3.59	0.94	-2.65
5210	VHT80	MCS11	-11.71	-10.97	-11.26	-11.82	0.29	-5.40	1.44	-3.96

<i>U-NII- Band 2A</i>										
Frequency MHz	Modulation	Data	Ant0 dBm	Ant1 dBm	Ant2 dBm	Ant3 dBm	Combined		Duty CF dB	PSD dBm/MHz
							mW	dBm		
5260	OFDM	48MBit/s	-2.32	-1.98	-2.71	-2.56	2.31	3.64	0.32	3.96
5280	OFDM	48MBit/s	-2.14	-1.75	-2.38	-2.28	2.45	3.89	0.32	4.21
5320	OFDM	48MBit/s	-1.97	-1.48	-1.69	-1.80	2.68	4.29	0.32	4.61
5260	HT20	MCS6	-2.72	-2.24	-2.81	-3.05	2.15	3.32	0.36	3.68
5280	HT20	MCS6	-2.68	-2.07	-2.69	-2.91	2.21	3.44	0.36	3.80
5320	HT20	MCS6	-2.09	-1.97	-2.66	-2.77	2.32	3.66	0.36	4.02
5270	HT40	MCS6	-2.53	-2.06	-2.26	-2.32	2.36	3.73	0.94	4.67
5310	HT40	MCS6	-4.08	-3.97	-4.64	-4.93	1.46	1.64	0.94	2.58
5290	VHT80	MCS7	-6.87	-6.14	-6.98	-6.37	0.88	-0.55	1.17	0.62

U-NII- Band 2C										
Frequency MHz	Modulation	Data	Ant0 dBm	Ant1 dBm	Ant2 dBm	Ant3 dBm	Combined		Duty CF dB	PSD dBm/MHz
							mW	dBm		
5500	OFDM	48MBit/s	-1.80	-1.92	-1.86	-2.48	2.52	4.01	0.32	4.33
5580	OFDM	48MBit/s	-1.96	-2.19	-1.99	-2.44	2.44	3.88	0.32	4.20
5720	OFDM	48MBit/s	-4.63	-4.73	-4.85	-5.24	1.31	1.17	0.32	1.49
5500	HT20	MCS6	-2.57	-2.18	-2.51	-2.34	2.30	3.62	0.36	3.98
5580	HT20	MCS6	-2.43	-2.49	-2.48	-2.77	2.23	3.48	0.32	3.80
5720	HT20	MCS6	-5.26	-4.94	-5.29	-5.38	1.20	0.81	0.36	1.17
5510	HT40	MCS6	-2.00	-2.44	-3.06	-3.10	2.19	3.40	0.94	4.34
5550	HT40	MCS6	-2.48	-2.52	-2.56	-2.61	2.23	3.48	0.32	3.80
5710	HT40	MCS6	-4.73	-4.62	-4.56	-5.12	1.34	1.27	0.94	2.21
5530	VHT80	MCS7	-6.34	-6.04	-6.68	-6.59	0.92	-0.38	1.17	0.79
5610	VHT80	MCS7	-5.48	-5.52	-6.08	-6.60	1.03	0.12	1.17	1.29
5690	VHT80	MCS7	-4.57	-4.33	-5.10	-5.26	1.33	1.22	1.17	2.39

U-NII- Band 3										
Frequency MHz	Modulation	Data	Ant0 dBm	Ant1 dBm	Ant2 dBm	Ant3 dBm	Combined		Duty CF dB	PSD dBm/MHz
							mW	dBm		
5745	OFDM	6MBit/s	0.13	0.13	0.03	-0.10	4.04	6.07	0.32	6.39
5785	OFDM	6MBit/s	0.05	0.00	-0.22	-0.23	3.91	5.92	0.32	6.24
5825	OFDM	6MBit/s	0.14	0.10	-0.08	0.18	4.08	6.11	0.32	6.43
5745	HT20	MCS0	-0.33	-0.02	-0.41	-0.30	3.77	5.76	0.36	6.12
5785	HT20	MCS0	-0.14	-0.06	-0.45	-0.32	3.79	5.78	0.36	6.14
5825	HT20	MCS0	0.25	0.05	-0.05	-0.20	4.01	6.04	0.36	6.40
5755	HT40	MCS0	-3.07	-3.23	-3.78	-3.57	1.83	2.62	0.94	3.56
5795	HT40	MCS0	-3.40	-3.42	-3.10	-3.05	1.90	2.78	0.94	3.72
5755	HT40	MCS0	-3.07	-3.23	-3.78	-3.57	1.83	2.62	0.94	3.56

14 Out-of-band spurious emissions

14.1 Definition

Out-of-band emission.

Emission on a frequency or frequencies immediately outside the necessary bandwidth that results from the modulation process but excluding spurious emissions.

Spurious emission.

Emission on a frequency or frequencies that are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products, and frequency conversion products, but exclude out-of-band emissions.

14.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Lab16
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
EUT Channels / Frequencies Measured:	Low / Mid / High
EUT Channel Bandwidths:	20 MHz / 40 MHz / 80 MHz
Deviations From Standard:	None
Measurement BW:	30 MHz to 1 GHz: 120 kHz Above 1 GHz: 1 MHz
Measurement Detector:	Up to 1 GHz: quasi-peak Above 1 GHz: RMS average and Peak

Environmental Conditions (Normal Environment)

Temperature: 21.7°C	+15 °C to +35 °C (as declared)
Humidity: 44 %RH	20%RH to 75%RH (as declared)
Supply: 110 Vac	

Test Limits

15.407(b):

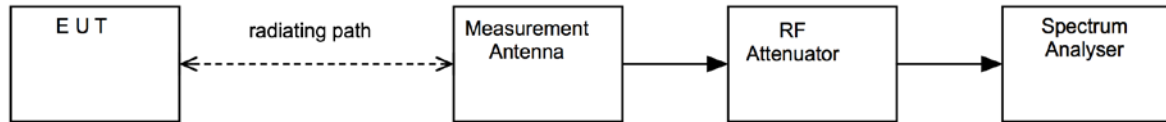
- (1) For transmitters operating in the 5.15–5.25 GHz band: All emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25–5.35 GHz band: All emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (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.
- (4) For transmitters operating in the 5.725–5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

14.3 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure vii, the emissions from the EUT were measured on a spectrum analyser.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst case configuration in each bandwidth.

Figure vii Test Setup



14.4 Test Equipment

<i>Equipment Description</i>	<i>Manufacturer</i>	<i>Equipment Type</i>	<i>Element No</i>	<i>Last Cal Calibration</i>	<i>Calibration Period</i>	<i>Due For Calibration</i>
Ferrite Lined Chamber	Rainford	ATS	REF886	21/07/14	36	21/07/17
Biconical Antenna	EMCO	3109	RFG095	17/05/16	36	17/05/19
Log Periodic Antenna	EMCO	3146	RFG191	17/05/16	36	17/05/19
Horn Antenna	EMCO	3115	RFG129	09/02/16	24	09/02/18
Horn Antenna	Q-Par	-	RFG629	30/09/15	24	30/09/17
Standard Gain Horn Antenna	FM	2240-25	REF820	19/07/16	12	19/07/18
Pre-Amp (9kHz – 1GHz)	Sonoma	310	REF927	30/06/16	24	30/06/18
Pre-Amp (1 – 26.5GHz)	Agilent	8449B	REF913	02/02/16	24	02/02/18
EMI Test Receiver	R&S	ESVS20	RFG126	23/05/16	12	23/05/17
Spectrum Analyser	R&S	FSU46	REF910	05/07/16	12	05/07/17
Receiver	R&S	ESU40	RFG701	29/12/15	12	29/12/16

14.5 Test Results

802.11a									
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)
Channel 36									
No Significant Emissions									
Channel 56									
No Significant Emissions									
Channel 64									
No Significant Emissions									
Channel 100									
Pk	7333.358	44.42	6.8	37	34.81	0	0	53.4	74.0
Av	7333.358	32.65	6.8	37	34.81	0	0	41.6	54.0
Channel 116									
Pk	7440.107	46.64	7	37.1	34.84	0	0	55.9	74.0
Av	7440.107	38.32	7	37.1	34.84	0	0	47.6	54.0
Channel 144									
Pk	7626.782	47.11	7	36.9	34.9	0	0	56.1	74.0
Av	7626.782	40.03	7	36.9	34.9	0	0	49.0	54.0
Channel 149									
Pk	11496.00	51.40	8.90	38.30	35.56	0.00	-9.54	53.50	54.0
Pk	17238.00	57.40	10.70	41.80	35.15	0.00	-6.62	68.13	68.2
Channel 157									
Pk	11567.43	51.69	9.30	38.40	35.57	0.00	-9.54	54.28	74.00
Av	11567.43	39.85	9.30	38.40	35.57	0.30	-9.54	42.74	54.00
Pk	17358.68	55.78	11.20	42.50	35.14	0.00	-9.54	64.80	68.20
Channel 165									
Pk	11649.00	52.20	8.90	38.50	35.58	0.00	-11.48	52.54	54.0
Pk	17476.00	50.30	11.00	43.10	35.14	0.00	-6.62	62.64	68.2

802.11ac VHT20									
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)
Channel 36									
No Significant Emissions									
Channel 56									
No Significant Emissions									
Channel 64									
No Significant Emissions									
Channel 100									
Pk	7333.405	44.01	6.8	37	34.81	0	0	53.0	74.0
Av	7333.405	32.17	6.8	37	34.81	0	0	41.2	54.0
Channel 116									
Pk	7440.178	46.85	7	37.1	34.84	0	0	56.1	74.0
Av	7440.178	39.99	7	37.1	34.84	0	0	49.3	54.0
Channel 144									
Pk	7626.857	46.61	7	36.9	34.9	0	0	55.6	74.0
Av	7626.857	39.9	7	36.9	34.9	0	0	48.9	54.0
Channel 149									
Pk	11498.00	50.60	8.90	38.30	35.56	0.00	-9.54	52.70	54.0
Pk	17233.00	57.00	10.70	41.80	35.15	0.00	-6.62	67.73	68.2
Channel 157									
Pk	11567.43	52.90	9.30	38.40	35.57	0.00	-9.54	55.49	74.00
Av	11567.43	40.14	9.30	38.40	35.57	0.30	-9.54	43.03	54.00
Pk	17358.68	53.63	11.20	42.50	35.14	0.00	-9.54	62.65	68.20
Channel 165									
Pk	11650.00	50.60	8.90	38.50	35.58	0.00	-11.48	50.94	54.0
Pk	17480.00	49.40	10.90	43.10	35.14	0.00	-6.62	61.64	68.2

802.11acVHT40									
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)
Channel 38									
Pk	1474.732	69.8	3	25.9	34.65	0	0	64.1	74.0
Av	1474.732	43.58	3	25.9	34.65	0	0	37.8	54.0
Channel 54									
No Significant Emissions									
Channel 62									
No Significant Emissions									
Channel 102									
Pk	7346.696	44.01	6.8	37	34.82	0	0	53.0	74.0
Av	7346.696	32.78	6.8	37	34.82	0	0	41.8	54.0
Channel 110									
Pk	7400.167	48.93	7	37.1	34.83	0	0	58.2	74.0
Av	7400.167	42.65	7	37.1	34.83	0	0	51.9	54.0
Channel 142									
No Significant Emissions									
Channel 151									
Pk	11508.00	47.00	9.50	38.30	35.57	0.00	-9.54	49.69	54.0
Pk	17246.00	52.50	10.70	41.90	35.15	0.00	-6.62	63.33	68.2
Channel 159									
Pk	11587.00	47.50	9.10	38.40	35.58	0.00	-9.54	49.88	54.0
Pk	17386.00	50.10	13.50	42.60	35.14	0.00	-6.62	64.44	68.2

802.11acVHT80									
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)
Channel 42									
No Significant Emissions									
Channel 58									
Pk	1186.793	59.4	2.4	25.7	35.11	0	0	52.4	74.0
Av	1186.793	39.45	2.4	25.7	35.11	0	0	32.4	54.0
Channel 106									
Pk	7373.383	44.15	6.8	37.1	34.82	0	0	53.2	74.0
Av	7373.383	32.63	6.8	37.1	34.82	0	0	41.7	54.0
Channel 122									
Pk	7480.229	47.44	7	37	34.85	0	0	56.6	74.0
Av	7480.229	41.36	7	37	34.85	0	0	50.5	54.0
Channel 138									
Pk	7586.880	47.54	7.1	36.9	34.88	0	0	56.7	74.0
Av	7586.880	40.83	7.1	36.9	34.88	0	0	50.0	54.0
Channel 155									
No Significant Emissions									

Conversion from field strength to eirp is as follows:

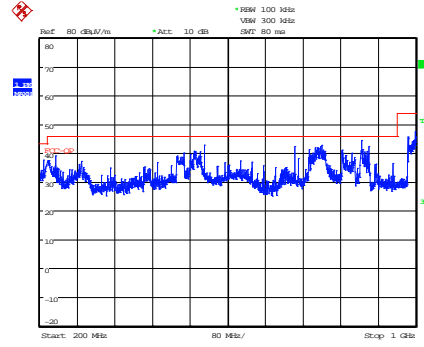
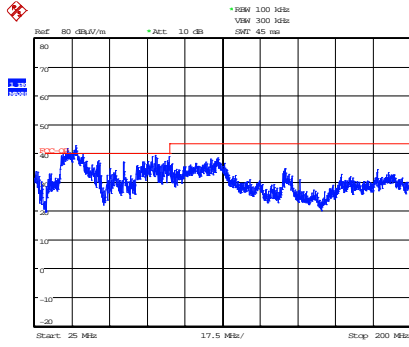
$$\text{EIRP} = E + 20\log(d) - 104.77, \text{ where}$$

EIRP is the equivalent isotropically radiated power in dBm;

E is field strength in dB μ V/m;

d is the measurement distance in meters.

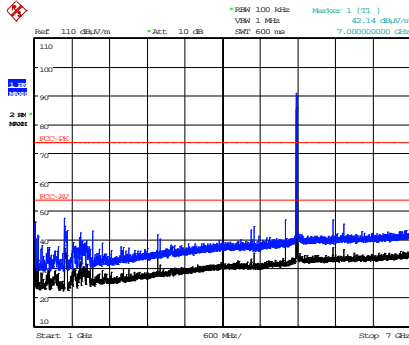
802.11a - Ch 36



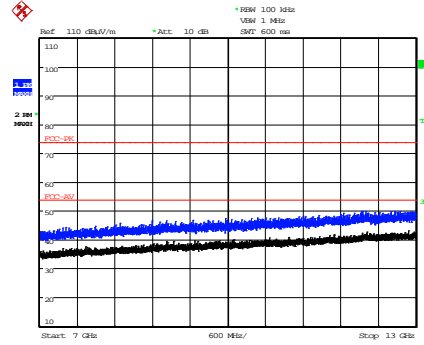
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Date: 23.SEP.2016 08:58:51

30 MHz – 200 MHz



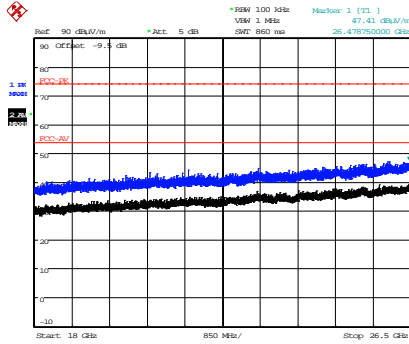
200 MHz – 1 GHz



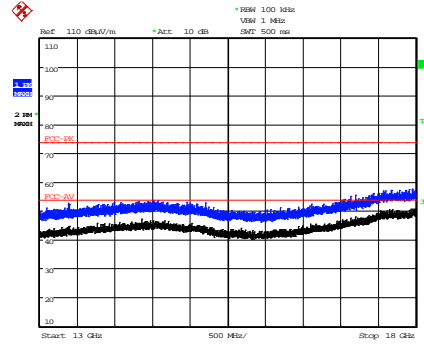
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Date: 7.SEP.2016 10:08:23

1 GHz – 7 GHz



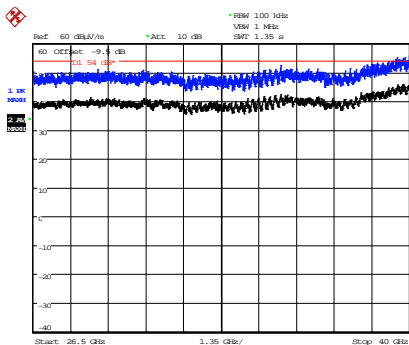
7 GHz – 13 GHz



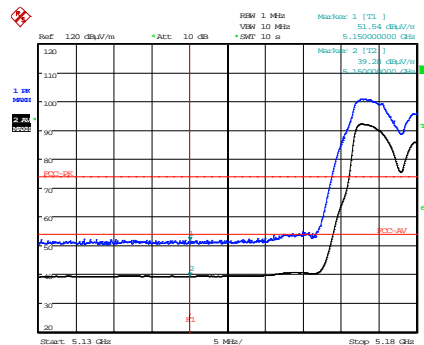
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Date: 7.SEP.2016 10:09:12

13 GHz – 18 GHz



18 GHz – 26.5 GHz



Date: 18.SEP.2016 21:38:52

Date: 30.AUG.2016 16:19:42

26.5 GHz – 40 GHz

Bandedge