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Report On

FCC Testing of the Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3, B17, B26) & AXGP (TDD41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS
In accordance with FCC CFR 47 Part 15C (WLAN and Bluetooth Low Energy)

COMMERCIAL-IN-CONFIDENCE
FCC ID: APYHRO00214

Document 75928148 Report 06 Issue 1 December 2014

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REPORT ON

FCC Testing of the Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3, B17, B26) & AXGP (TDD41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS In accordance with FCC CFR 47 Part 15C (WLAN and Bluetooth Low Energy)

Document 75928148 Report 06 Issue 1

December 2014

PREPARED FOR

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Inspired
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PREPARED BY

Natalie Bennett
Senior Administrator, Project Support

APPROVED BY

Matthew Russell
Authorised Signatory

DATED 22 December 2014

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 15C. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

J Tuckwell J Hurley S Bennett T Guy N Rousell

Product Service

CONTENTS

Product Service

SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3, B17, B26) & AXGP
(TDD41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS
In accordance with FCC CFR 47 Part 15C (WLAN and Bluetooth Low Energy)

1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC Testing of the Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3, B17, B26) & AXGP (TDD41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS to the requirements of FCC CFR 47 Part 15C.

Objective	To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Sharp Corporation
Model Number(s)	SHV31
Serial Number(s)	IMEI 004401115315653 IMEI 004401115315919 IMEI 004401115315836 IMEI 004401115315646
Number of Samples Tested	4
Test Specification/Issue/Date	FCC CFR 47 Part 15C (2013)
Incoming Release Date	Application Form 31 October 2014
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	10329 20 October 2014
Start of Test	7 November 2014
Finish of Test	16 December 2014
Name of Engineer(s)	J Tuckwell J Hurley S Bennett T Guy N Rousell
Related Document(s)	ANSI C63.10: 2009 FCC KDB 558074 D01 v03r02

Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 15C is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
802.11(b)				
2.1	15.207	AC Line Conducted Emissions	Pass	
2.2	15.247 (a)(2)	6 dB Bandwidth	Pass	
2.3	15.247 (b)(3)	Maximum Peak Conducted Output Power	Pass	
2.4	15.247 (b)(4)	EIRP Peak Power	Pass	
2.5	15.247 (d)	Spurious and Band Edge Emissions	Pass	
2.6	15.247 (e)	Power Spectral Density	Pass	
802.11(g)				
2.2	15.247 (a)(2)	6 dB Bandwidth	Pass	
2.3	15.247 (b)(3)	Maximum Peak Conducted Output Power	Pass	
2.4	15.247 (b)(4)	EIRP Peak Power	Pass	
2.5	15.247 (d)	Spurious and Band Edge Emissions	Pass	
2.6	15.247 (e)	Power Spectral Density	Pass	
802.11(n)				
2.2	15.247 (a)(2)	6 dB Bandwidth	Pass	
2.3	15.247 (b)(3)	Maximum Peak Conducted Output Power	Pass	
2.4	15.247 (b)(4)	EIRP Peak Power	Pass	
2.5	15.247 (d)	Spurious and Band Edge Emissions	Pass	
2.6	15.247 (e)	Power Spectral Density	Pass	

Product Service

Section	Spec Clause	Test Description	Result	Comments/Base Standard
Bluetooth Low Energy				
2.2	15.247 (a)(2)	6 dB Bandwidth	Pass	
2.3	15.247 (b)(3)	Maximum Peak Conducted Output Power	Pass	
2.4	15.247 (b)(4)	EIRP Peak Power	Pass	
2.5	15.247 (d)	Spurious and Band Edge Emissions	Pass	
2.6	15.247 (e)	Power Spectral Density	Pass	

1.3 APPLICATION FORM

EQUIPMENT DESCRIPTION		
Model Name/Number	SHV31	
Part Number	CA282	
FCC ID (if applicable)		APYHRO00214
Industry Canada ID (if applicable)		N/A
Technical Description (Please provide a brief description of the intended use of the equipment)		Penta-band LTE(B1/B3/B17/B26/B41), Dual-band WCDMA(FDD-I/V), Quad-band GSM(850/900/1800/1900), Multimode Smartphone with BT, ANT+, WLAN, SRD and GPS.

Types of Modulations used by the Equipment	
☒	FHSS
☒	Other forms of modulation
In case of FHSS Modulation	
In case of non-Adaptive Frequency Hopping equipment:	
Number of Hopping Frequencies: N/A	
In case of Adaptive Frequency Hopping Equipment:	
Maximum number of Hopping Frequencies: Bluetooth (BR/EDR) : 79 / LE : 40	
Minimum number of Hopping Frequencies: 20	
Dwell Time: 3.75ms	
Minimum Channel Occupation Time: 1.25ms	
Adaptive / non-adaptive equipment:	
☐	non-adaptive Equipment
☒	adaptive Equipment without the possibility to switch to a non-adaptive mode
☐	adaptive Equipment which can also operate in a non-adaptive mode
In case of adaptive equipment:	
The Channel Occupancy Time implemented by the equipment: 13 ms	
☒	The equipment has implemented an LBT based DAA mechanism
In case of equipment using modulation different from FHSS:	
☐	The equipment is Frame Based equipment
☐	The equipment is Load Based equipment
☒	The equipment can switch dynamically between Frame Based and Load Based equipment
The CCA time implemented by the equipment: 34 µs	
The value q as referred to in clause 4.3.2.5.2.2.2 is: q = 32	
☐	The equipment has implemented an non-LBT based DAA mechanism
☐	The equipment can operate in more than one adaptive mode

Product Service

In case of non-adaptive Equipment:	
The maximum RF Output Power (e.i.r.p.): Bluetooth 3.97dBm, WLAN 16.5 dBm	
The maximum (corresponding) Duty Cycle: %	
Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):	
The worst case operational mode for each of the following tests:	
RF Output Power:	
Power Spectral Density:	
Duty cycle, Tx-Sequence, Tx-gap:	
Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment):	
Hopping Frequency Separation (only for FHSS equipment):	
Medium Utilisation:	
Adaptivity & Receiver Blocking:	
Occupied Channel Bandwidth:	
Transmitter unwanted emissions in the OOB domain:	
Transmitter unwanted emissions in the spurious domain:	
Receiver spurious emissions:	
The different transmit operating modes (tick all that apply):	
☒	Operating mode 1: Single Antenna Equipment
☒	Equipment with only 1 antenna
☐	Equipment with 2 diversity antennas but only 1 antenna active at any moment in time
☐	Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)
☐	Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming
☐	Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)
☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2
NOTE: Add more lines if more channel bandwidths are supported.	
☐	Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming
☐	Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)
☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2
NOTE: Add more lines if more channel bandwidths are supported.	
In case of Smart Antenna Systems:	
The number of Receive chains:	
The number of Transmit chains:	
☐	symmetrical power distribution
☐	asymmetrical power distribution
In case of beam forming, the maximum beam forming gain:	
NOTE: Beam forming gain does not include the basic gain of a single antenna.	

Product Service

Operating Frequency Range(s) of the equipment:	
Operating Frequency Range 1: 2402 MHz to 2480 MHz	Bluetooth (e.g Bluetooth for EU)
Operating Frequency Range 2: 2412 MHz to 2472 MHz	WLAN for EU (e.g WLAN for EU)
Operating Frequency Range 3: MHz to MHz	(e.g Bluetooth for FCC and/or Industry Canada)
Operating Frequency Range 4: MHz to MHz	(e.g WLAN for FCC and/or Industry Canada)
NOTE: Add more lines if more Frequency Ranges are supported.	
Occupied Channel Bandwidth(s):	
Occupied Channel Bandwidth1: Bluetooth (BR/EDR):1 MHz to LE:2 MHz	
Occupied Channel Bandwidth2: 20(802.11 b/g/n) MHz to 40(802. 11n) MHz	
NOTE: Add more lines if more channel bandwidths are supported.	
Type of Equipment (stand-alone, combined, plug-in radio device, etc.):	
☒ Stand-alone	
☐ Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)	
☐ Plug-in radio device (Equipment intended for a variety of host systems)	
☐ Other	
The extreme operating conditions that apply to the equipment:	
Operating temperature range: -10 °C to +55 °C	
Operating voltage range: 3.7 V to 4.0 V ☐ AC ☒ DC	
Details provided are for the:	
☒ stand-alone equipment	
☐ combined (or host) equipment	
☐ test jig	

Product Service

The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:			
Antenna Type:			
☒ Integral Antenna			
Antenna Gain: 0 dBi			
If applicable, additional beamforming gain (excluding basic antenna gain): dB			
☒ Temporary RF connector provided			
☐ No temporary RF connector provided			
☐ Dedicated Antennas (equipment with antenna connector)			
☐ Single power level with corresponding antenna(s)			
☐ Multiple power settings and corresponding antenna(s)			
Number of different Power Levels:			
Power Level 1: dBm			
Power Level 2: dBm			
Power Level 3: dBm			
Power Level 4: dBm			
NOTE 1: Add more lines in case the equipment has more power levels.			
NOTE 2: These power levels are conducted power levels (at antenna connector).			
For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable			
Power Level 1: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 2: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 3: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			

Product Service

The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:	
Details provided are for the: ☒ stand-alone equipment	
☐ combined (or host) equipment	
☐ test jig	
Supply Voltage ☐ AC mains State AC voltage	
☒ State DC voltage 4.0	
In case of DC, indicate the type of power source	
☐ Internal Power Supply	
☐ External Power Supply or AC/DC adapter	
☒ Battery	
☒ Other: Dummy battery from external DC supply (4.0V)	
Describe the test modes available which can facilitate testing:	
Teraterm	
The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):	
Bluetooth, IEEE 802.11b/g/n	
Combination for testing (see clause 5.1.3.3 of EN 300 328 V1.8.1)	
From all combinations of conducted power settings and intended antenna assembly(ies) specified in clause 3.1 m), specify the combination resulting in the highest e.i.r.p. for the radio equipment. Unless otherwise specified in EN 300 328, this power setting is to be used for testing against the requirements of EN 300 328. In case there is more than one such conducted power setting resulting in the same (highest) e.i.r.p. level, the highest power setting is to be used for testing. See also EN 300 328, clause 5.1.3.3.	
Highest overall e.i.r.p. value: dBm	
Corresponding Antenna assembly gain: dBi	Antenna Assembly #:
Corresponding conducted power setting: dBm	Listed as Power Setting #:
(also the power level to be used for testing)	
Additional information provided by the applicant	
Modulation	
ITU Class(es) of emission:	
Can the transmitter operate unmodulated? ☐ Yes ☐ No	
Duty Cycle	
The transmitter is intended for:	
☐ Continuous duty	
☐ Intermittent duty	
☒ Continuous operation possible for testing purposes	
About the UUT	
☐ The equipment submitted are representative production models	
☐ If not, the equipment submitted are pre-production models ?	
☒ If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested	
☐ If not, supply full details	
☐ The equipment submitted is CE marked	
☐ In addition to the CE mark, the Class-II identifier (Alert Sign) is affixed.	

	Additional items and/or supporting equipment provided
☐	Spare batteries (e.g. for portable equipment)
☒	Battery charging device
☐	External Power Supply or AC/DC adapter
☐	Test Jig or interface box
☐	RF test fixture (for equipment with integrated antennas)
☐	Host System
	Manufacturer
	Model
	Model Name
☐	Combined equipment
	Manufacturer
	Model
	Model Name
☐	User Manual
☐	Technical documentation (Handbook and circuit diagrams)

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature: Yoshifumi Kohda Name: Yoshifumi Kohda

Position held: Manager Date: 31st October, 2014

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3, B17, B26) & AXGP (TDD41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS. A full technical description can be found in the manufacturer's documentation.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 4.0 V DC supply.

FCC Measurement Facility Registration Number
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard were made during testing.

1.7 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.

Product Service

SECTION 2

TEST DETAILS

FCC Testing of the
Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3, B17, B26) & AXGP
(TDD41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS
In accordance with FCC CFR 47 Part 15C (WLAN and Bluetooth Low Energy)

2.1 AC LINE CONDUCTED EMISSIONS

2.1.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.207

2.1.2 Equipment Under Test and Modification State

SHV31 S/N: IMEI 004401115315646 - Modification State 0

2.1.3 Date of Test

13 December 2014

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

A test environment and testing arrangement meeting the specification of ANSI C63.4 was used during all testing. The Equipment Under Test (EUT) was set upon a non-conducting platform at an elevation of 80 cm above a horizontal reference ground plane. A vertical reference ground plane was situated 40 cm from the EUT and bonded to the horizontal reference ground plane.

The EUT was powered by a Line Impedance Stabilization Network (LISN), whereby emissions measurements of the current-carrying conductors were made through this LISN. The LISN was bonded to the horizontal reference ground plane with a separation distance greater than 80 cm from the EUT. A mains supply cable of 1 m length was used to supply mains power to the EUT from the LISN.

A preliminary emissions scan was conducted for each current-carrying conductor of the EUT, using a peak detector over a frequency range of 150 kHz to 30 MHz. At least six of the greatest peak emissions, frequency positions were selected from each preliminary emissions scan for further evaluation as final measuring points.

Final measurement points were measured using quasi-peak and average detectors. All final measurements were assessed against the emission limits in Clause 15.207 of FCC CFR 47 FCC Part 15.

2.1.6 Environmental Conditions

Ambient Temperature	20.5°C
Relative Humidity	26.0%

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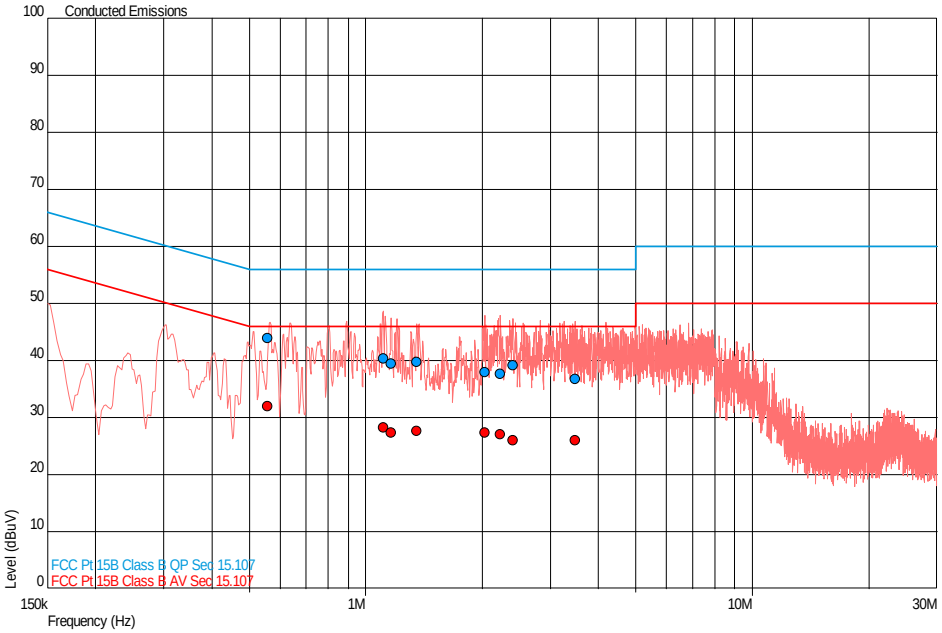
2.1.7 Test Results

802.11(b)

Live Line



Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.558	44.0	56.0	-12.0	32.0	46.0	-14.0
1.112	40.4	56.0	-15.6	28.2	46.0	-17.8
1.164	39.5	56.0	-16.5	27.4	46.0	-18.6
1.356	39.8	56.0	-16.2	27.6	46.0	-18.4
2.027	37.9	56.0	-18.1	27.3	46.0	-18.7
2.227	37.7	56.0	-18.3	27.1	46.0	-18.9
2.402	39.2	56.0	-16.8	26.1	46.0	-19.9
3.473	36.8	56.0	-19.2	26.1	46.0	-19.9

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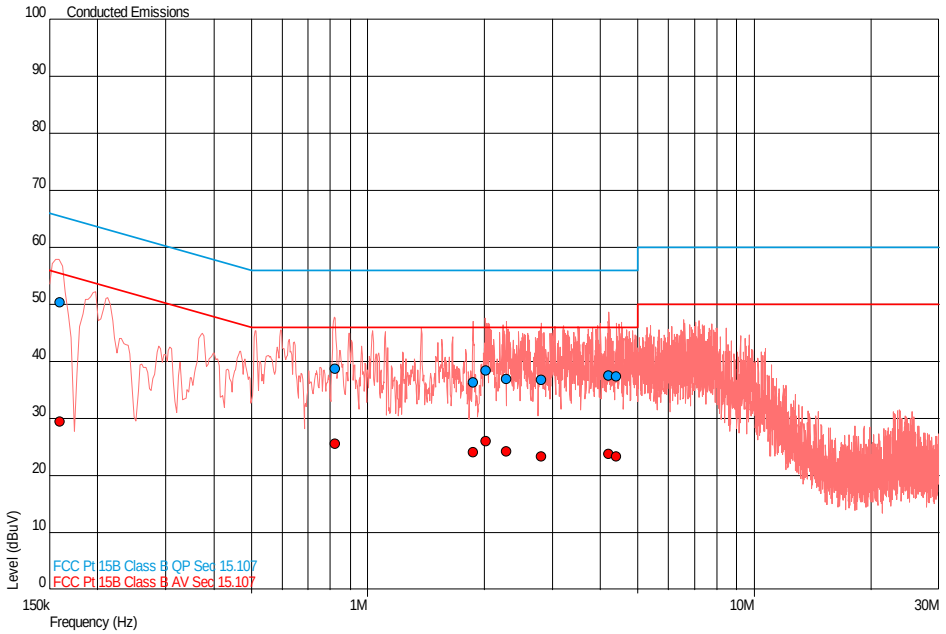
Neutral Line



Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.160	50.3	65.5	-15.2	29.4	55.5	-26.0
0.825	38.7	56.0	-17.3	25.6	46.0	-20.4
1.872	36.4	56.0	-19.6	24.0	46.0	-22.0
2.017	38.4	56.0	-17.6	26.1	46.0	-19.9
2.284	36.9	56.0	-19.1	24.2	46.0	-21.8
2.811	36.8	56.0	-19.2	23.4	46.0	-22.6
4.188	37.5	56.0	-18.5	23.8	46.0	-22.2
4.403	37.4	56.0	-18.6	23.3	46.0	-22.7

2.2 6 dB BANDWIDTH

2.2.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (a)(2)

2.2.2 Equipment Under Test and Modification State

SHV31 S/N: IMEI 004401115315836 - Modification State 0

2.2.3 Date of Test

20 November 2014 & 27 November 2014

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.247 (a) and FCC KDB 558074 D01 DTS Meas Guidance v03r02 Clause 8.1 Option 2.

The EUT was transmitting at maximum power, for bottom, middle and top channels on all supported data rates. The EUT was connected to a spectrum analyser via a cable and attenuator. The Analyser settings were adjusted to an RBW of 100 kHz, video bandwidth of 3 x RBW with peak detector and trace set to max hold. The measurement function of the spectrum analyser was used to measure the 6 dB bandwidth.

The plots on the following pages show the resultant display from the Spectrum Analyser.

2.2.6 Environmental Conditions

Ambient Temperature	22.4 - 22.8°C
Relative Humidity	32.2 - 42.1%

2.2.7 Test Results

802.11(b)

4.0 V DC Supply

Frequency (MHz)	Data Rate (Mbps)	6 dB Bandwidth (MHz)
2412 MHz	1	8.080
	2	8.040
	5.5	7.959
	11	8.270
2437 MHz	1	8.575
	2	7.862
	5.5	8.843
	11	7.951
2462 MHz	1	8.561
	2	8.053
	5.5	8.584
	11	8.290

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2412 MHz

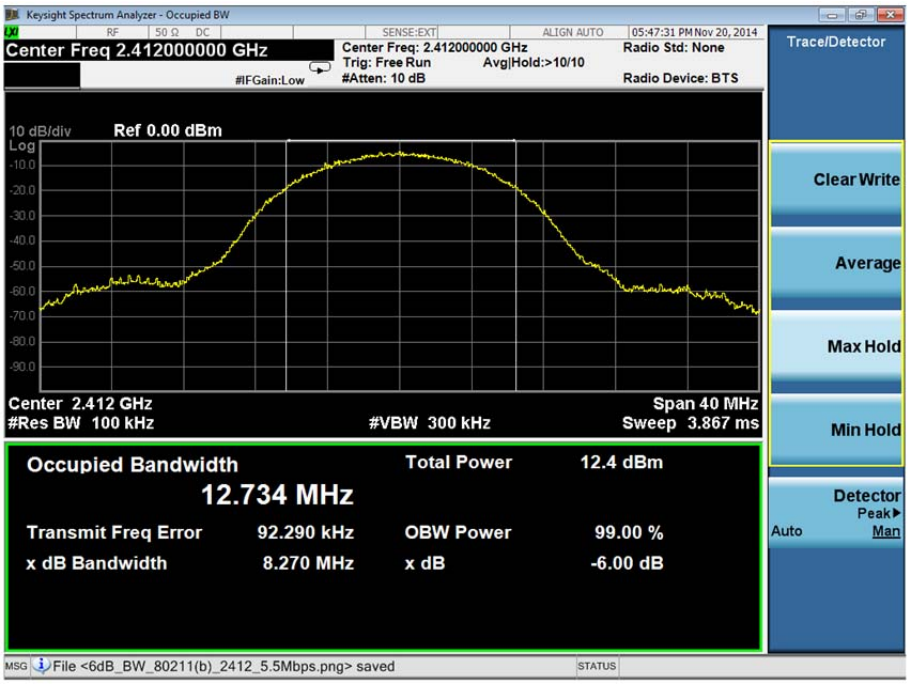
1 Mbps

2 Mbps

Product Service

5.5 Mbps

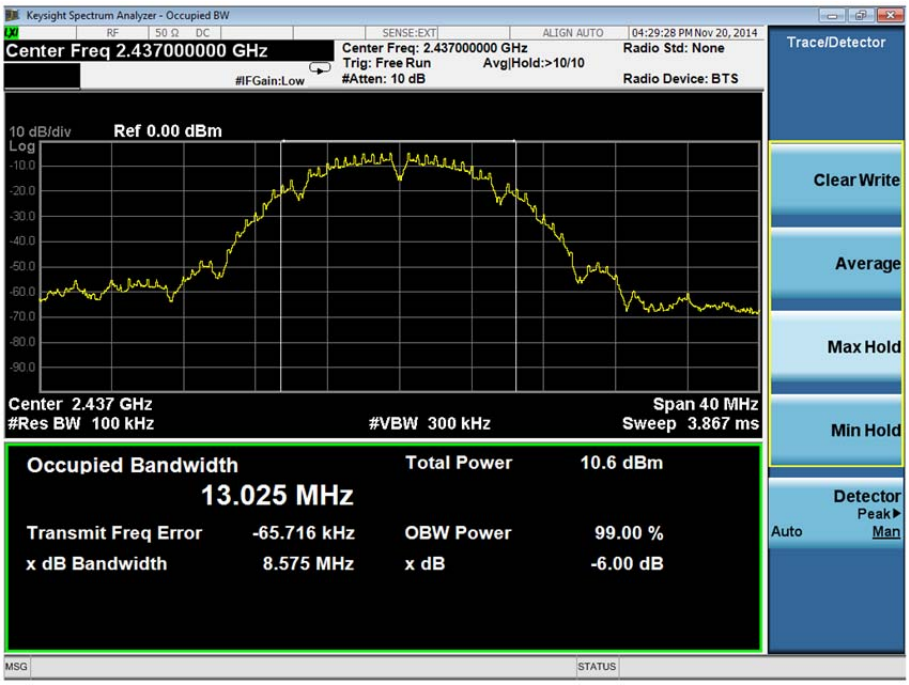
11 Mbps



Product Service

2437 MHz

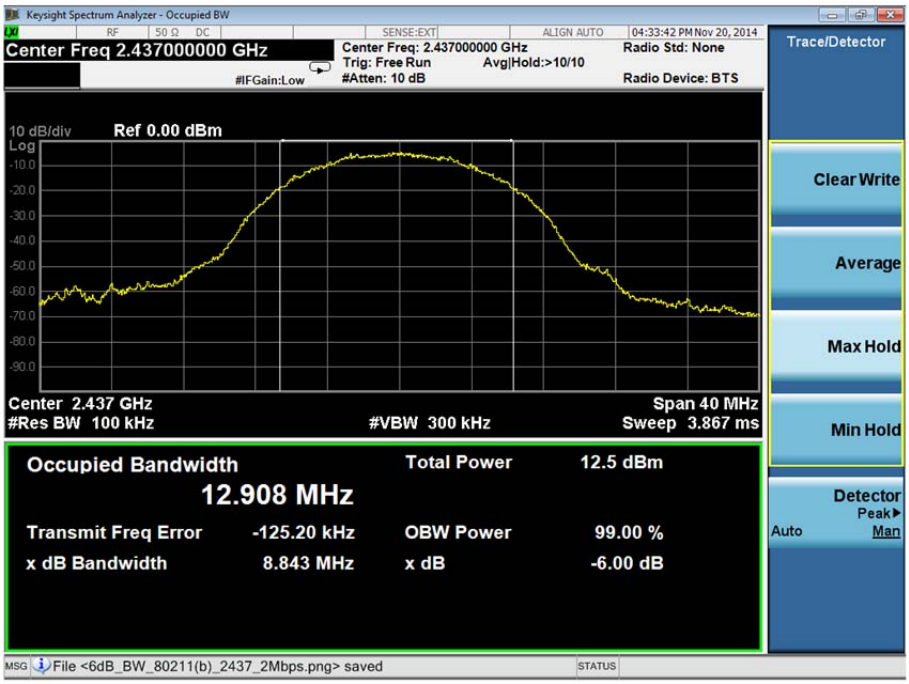
1 Mbps



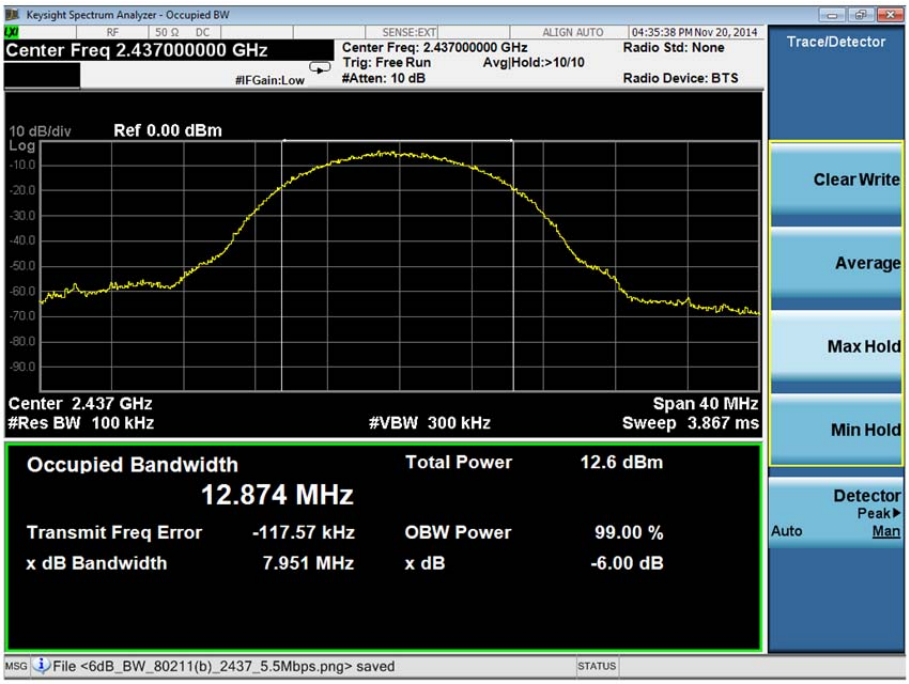
2 Mbps

Product Service

5.5 Mbps



11 Mbps



Product Service

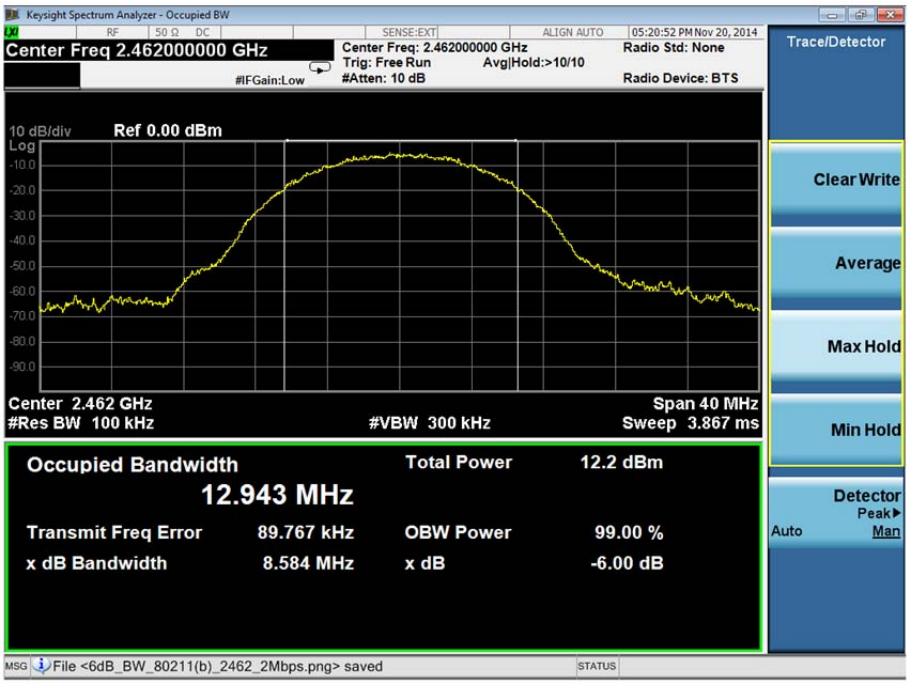
2462 MHz

1 Mbps

2 Mbps

Product Service

5.5 Mbps



11 Mbps

Limit Clause

The minimum 6 dB Bandwidth shall be at least 500 kHz.

802.11(g)

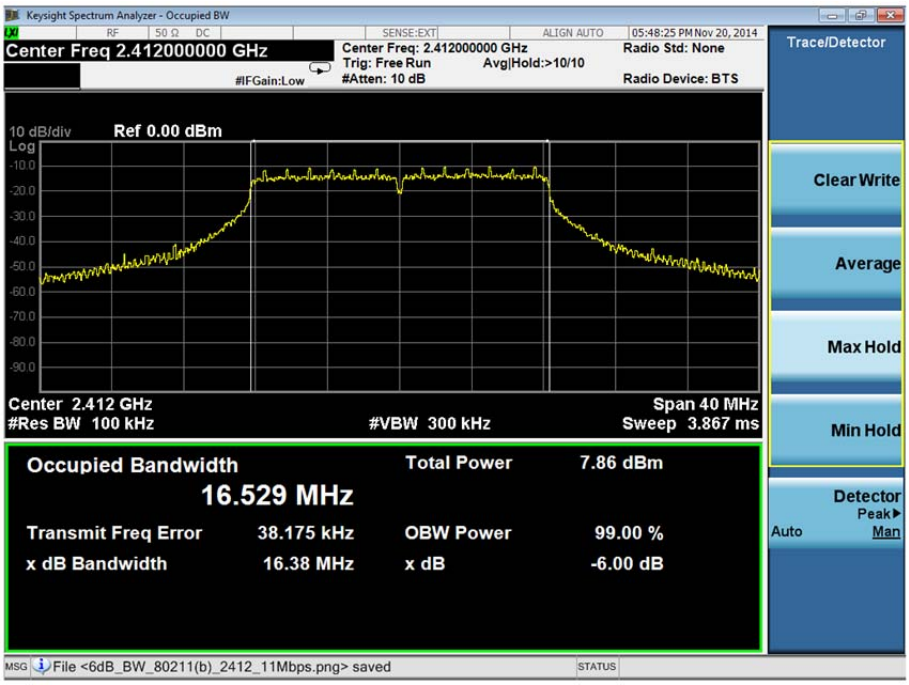
4.0 V DC Supply

Frequency (MHz)	Data Rate (Mbps)	6 dB Bandwidth (MHz)
2412 MHz	6	16.38
	9	16.38
	12	16.45
	18	16.45
	24	16.50
	36	16.52
	48	16.53
	54	16.53
2437 MHz	6	16.35
	9	16.35
	12	16.17
	18	16.41
	24	16.48
	36	16.51
	48	16.53
	54	16.50
2462 MHz	6	16.40
	9	16.39
	12	16.47
	18	16.48
	24	16.52
	36	16.53
	48	16.53
	54	16.54

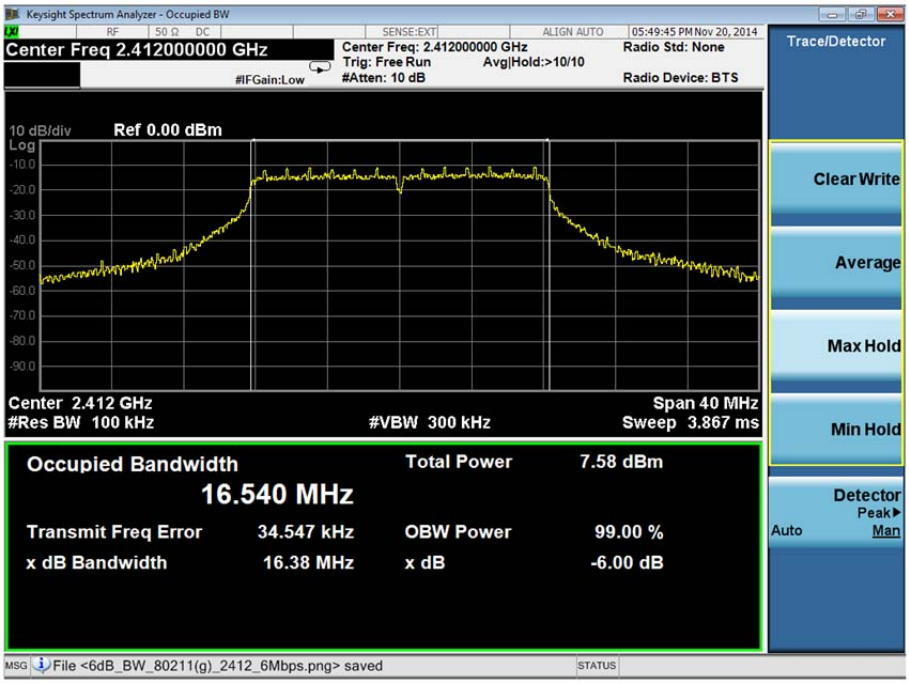
Product Service

2412 MHz

6 Mbps

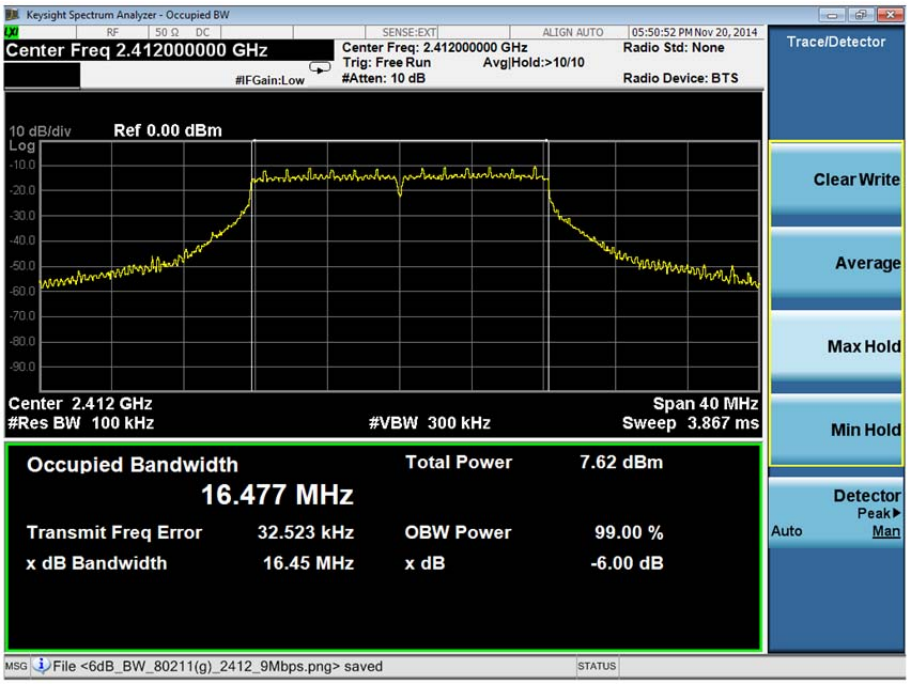


9 Mbps

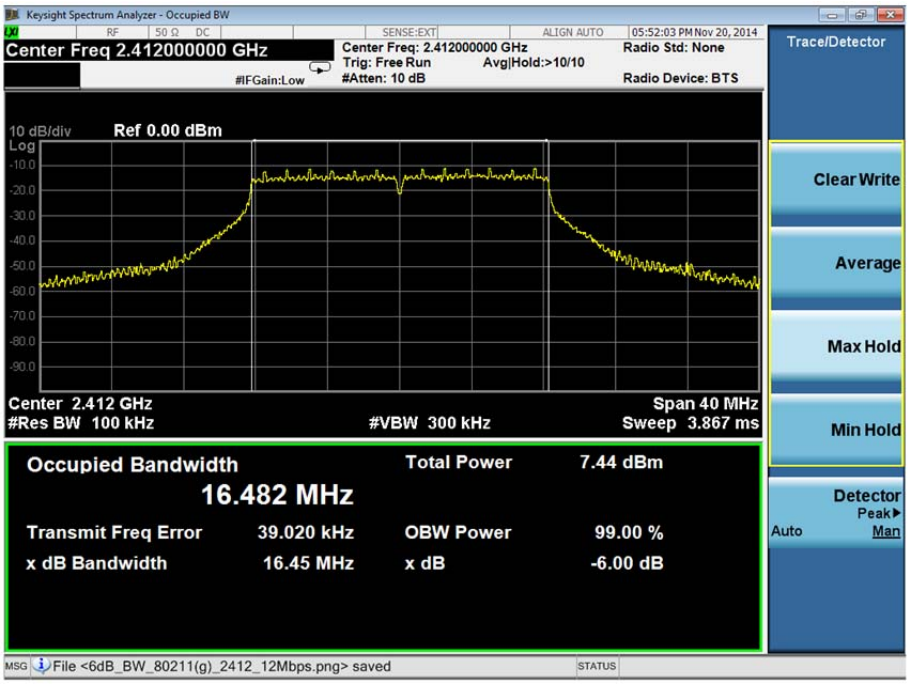


Product Service

12 Mbps



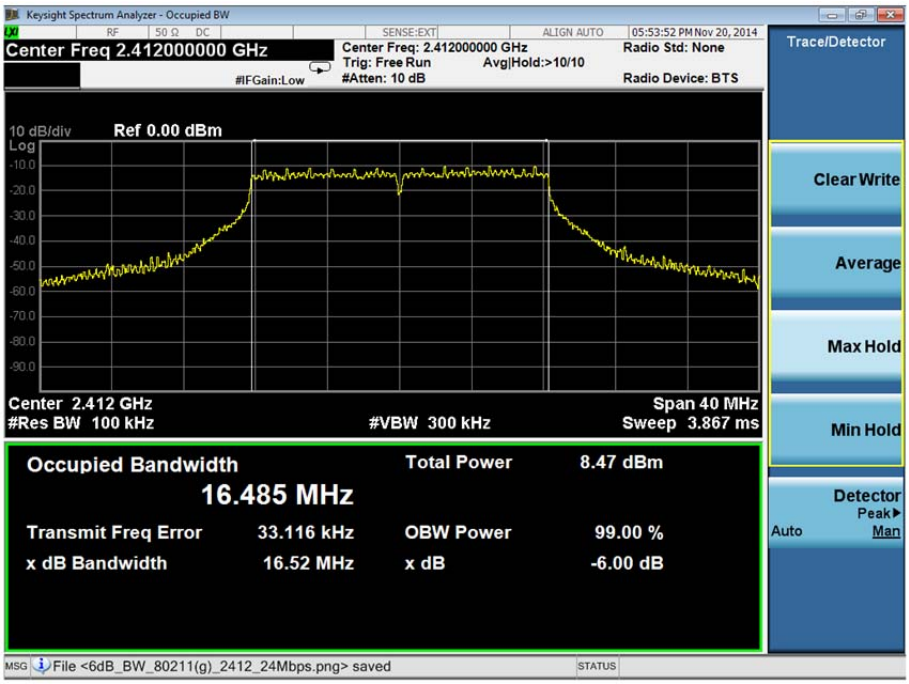
18 Mbps



Product Service

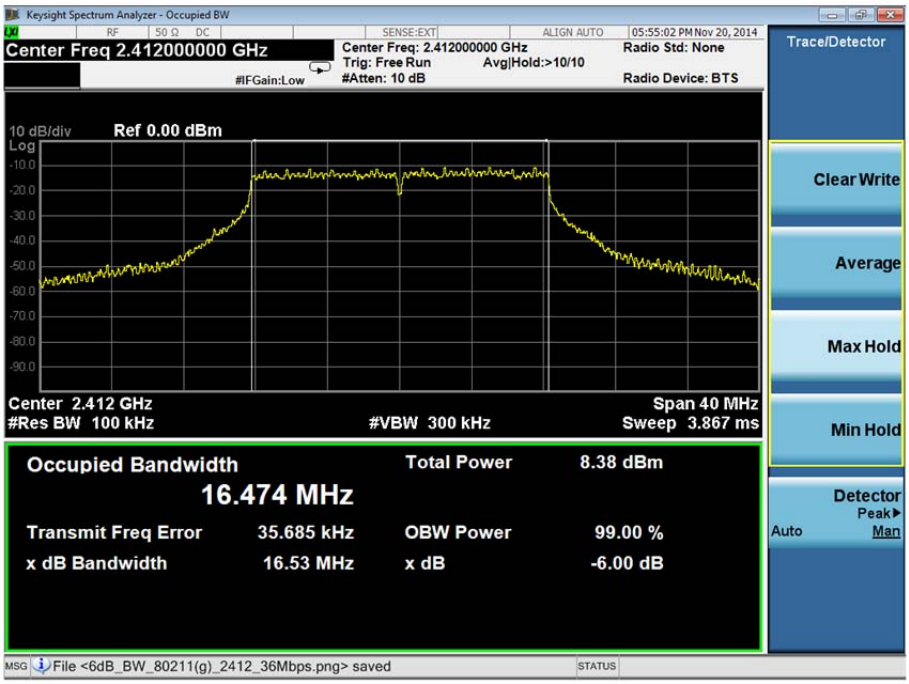
24 Mbps

36 Mbps

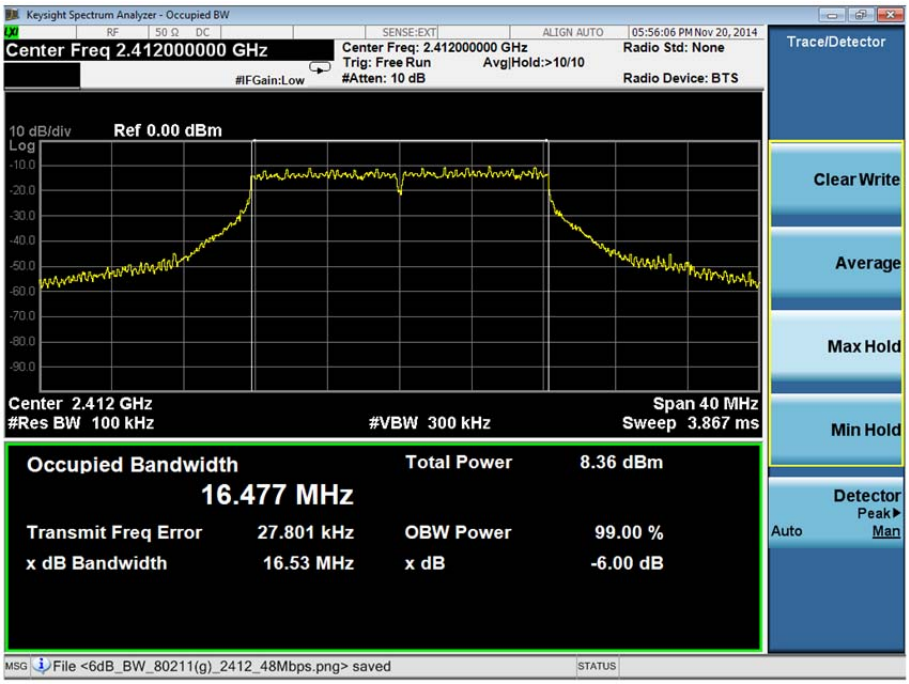


Product Service

48 Mbps



54 Mbps



Product Service

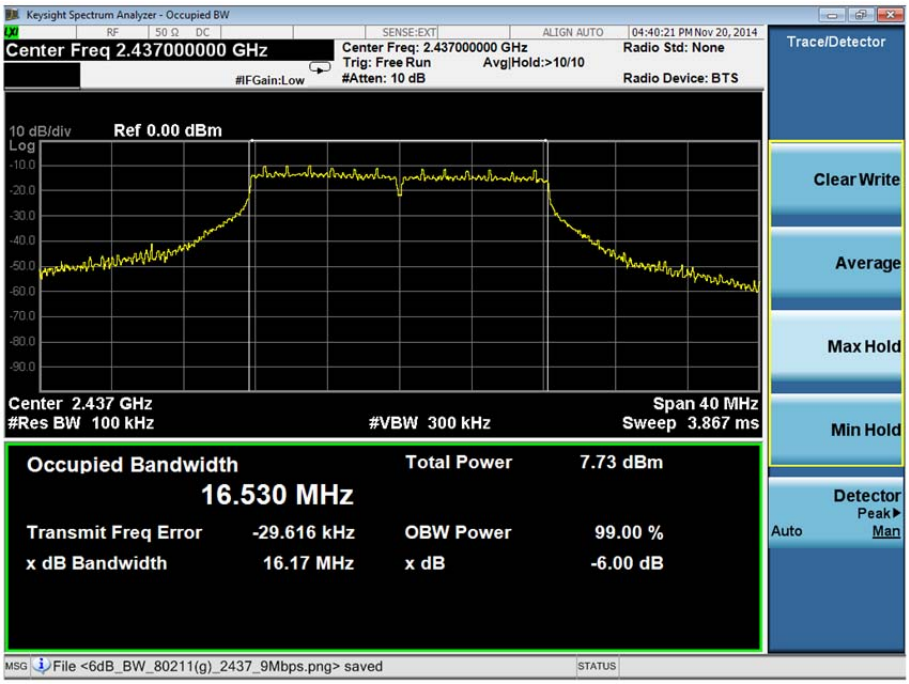
2437 MHz

6 Mbps

9 Mbps

Product Service

12 Mbps



18 Mbps

Product Service

24 Mbps

36 Mbps

Product Service

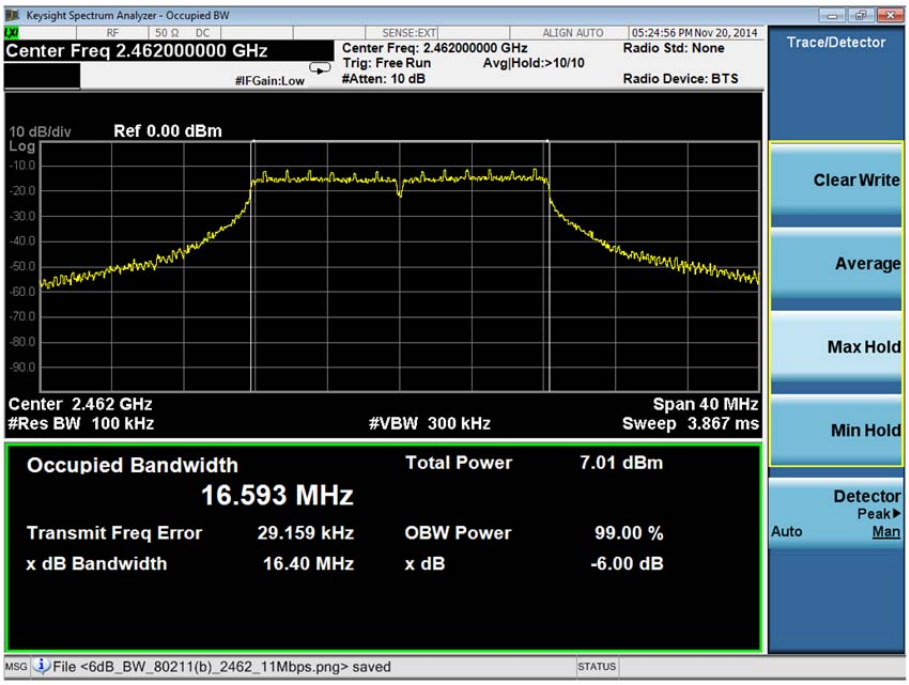
48 Mbps

54 Mbps

Product Service

2462 MHz

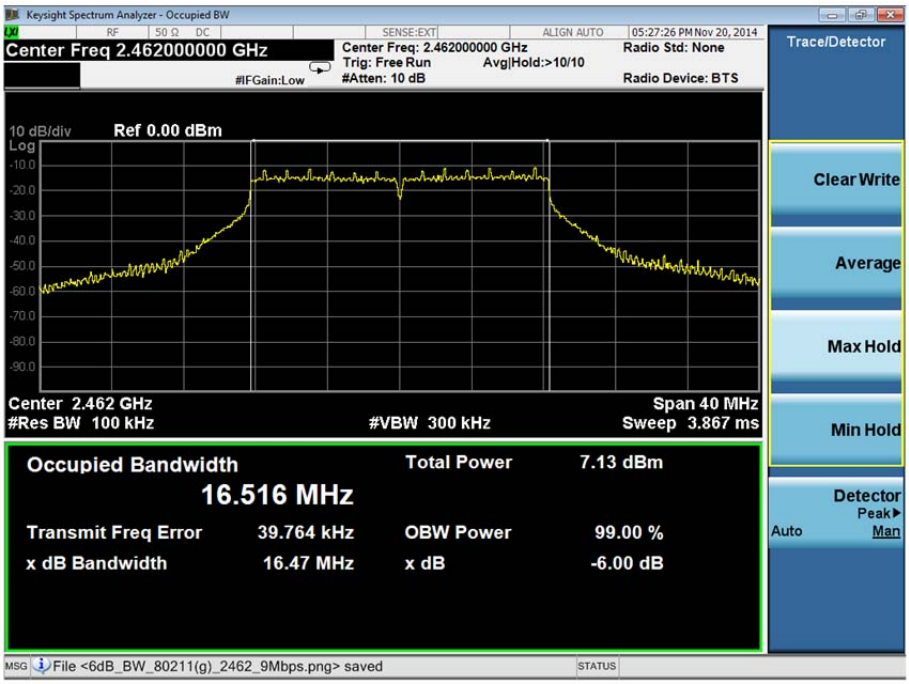
6 Mbps



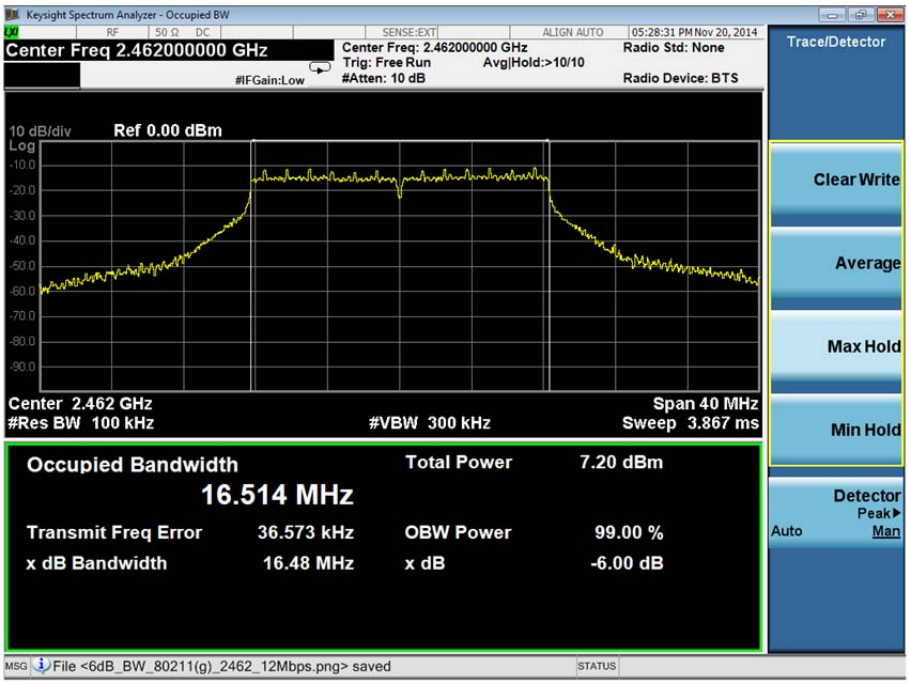
9 Mbps

Product Service

12 Mbps



18 Mbps



Product Service

24 Mbps

36 Mbps

48 Mbps

54 Mbps

Limit Clause

The minimum 6 dB Bandwidth shall be at least 500 kHz.

802.11(n)

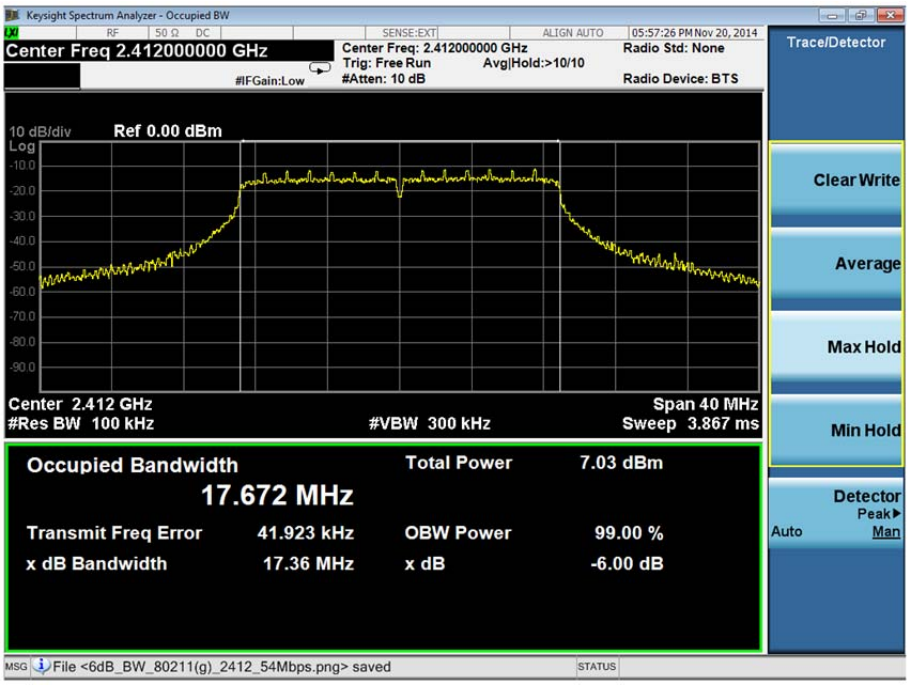
4.0 V DC Supply

Frequency (MHz)	Data Rate (Mbps)	6 dB Bandwidth (MHz)
2412 MHz	6.5	17.36
	13	17.67
	19.5	17.61
	26	17.74
	39	17.73
	52	17.75
	58.5	17.71
	65	17.72
2437 MHz	6.5	16.97
	13	17.64
	19.5	17.36
	26	17.69
	39	17.72
	52	17.72
	58.5	17.75
	65	17.75
2462 MHz	6.5	17.61
	13	17.66
	19.5	17.70
	26	17.74
	39	17.75
	52	17.74
	58.5	17.75
	65	17.75

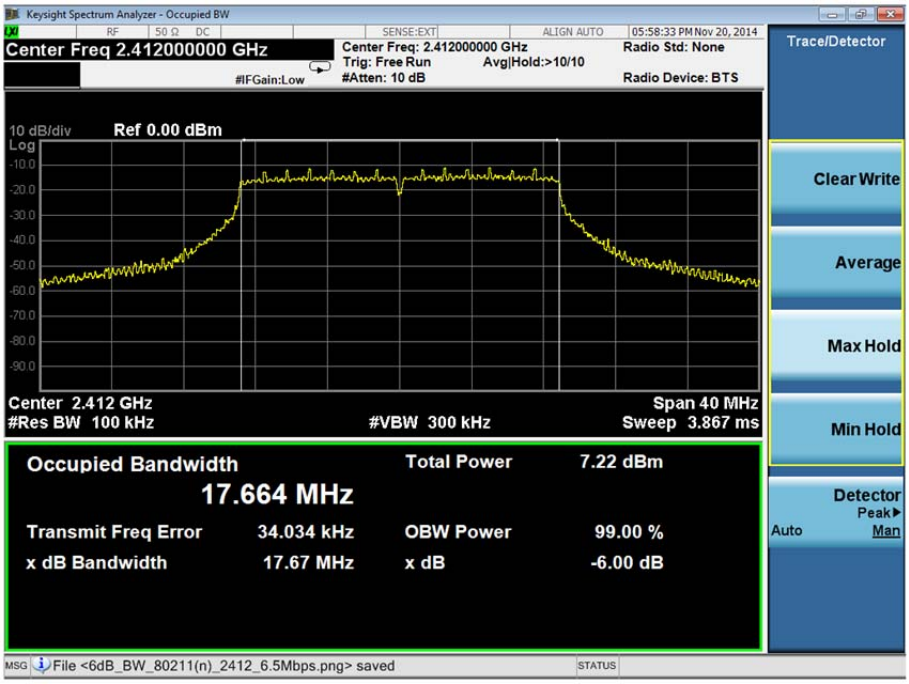
Product Service

2412 MHz

6.5 Mbps

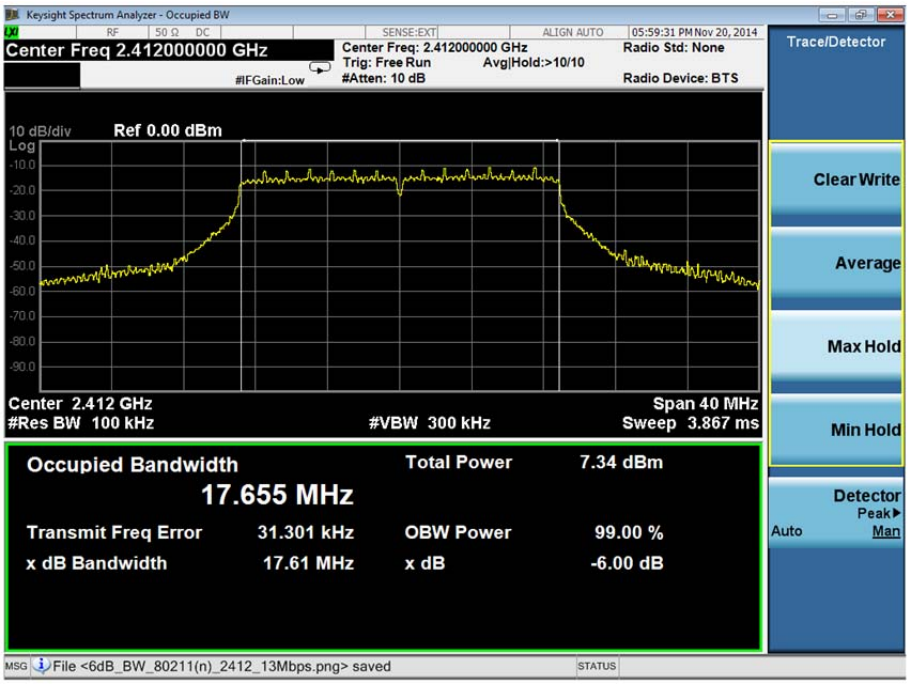


13 Mbps

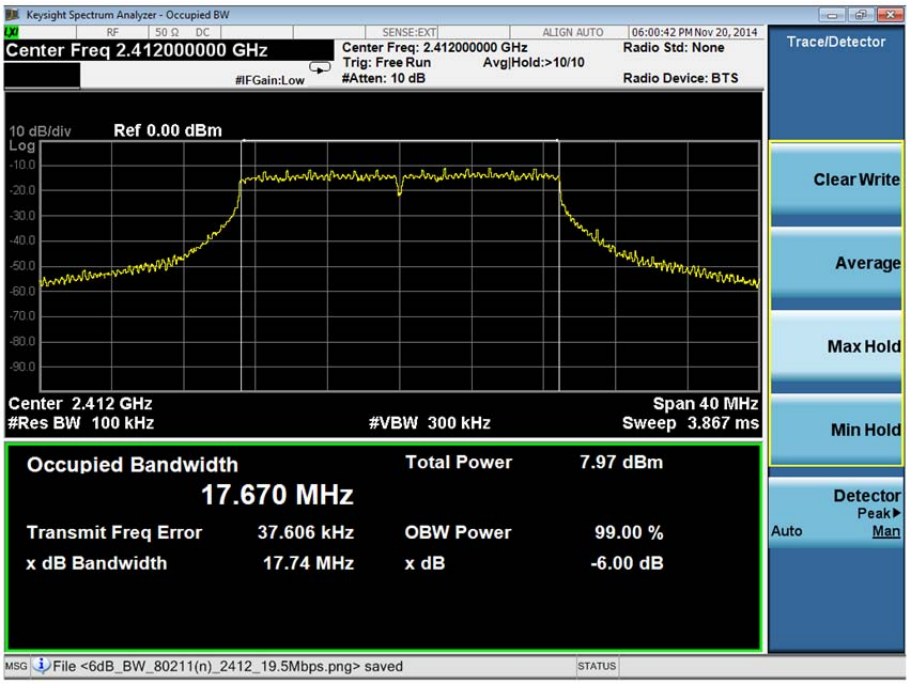


Product Service

19.5 Mbps

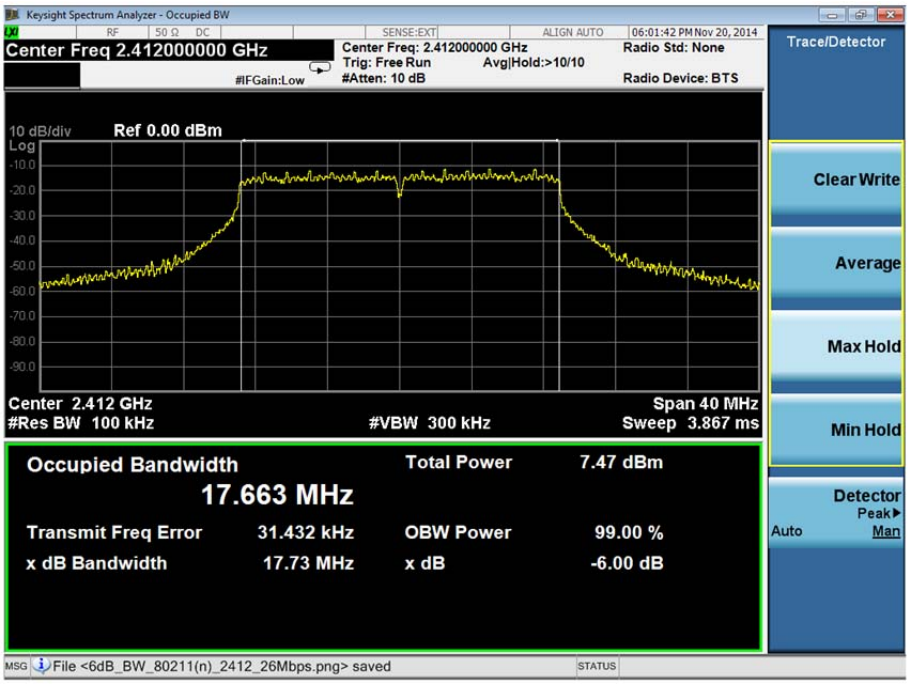


26 Mbps

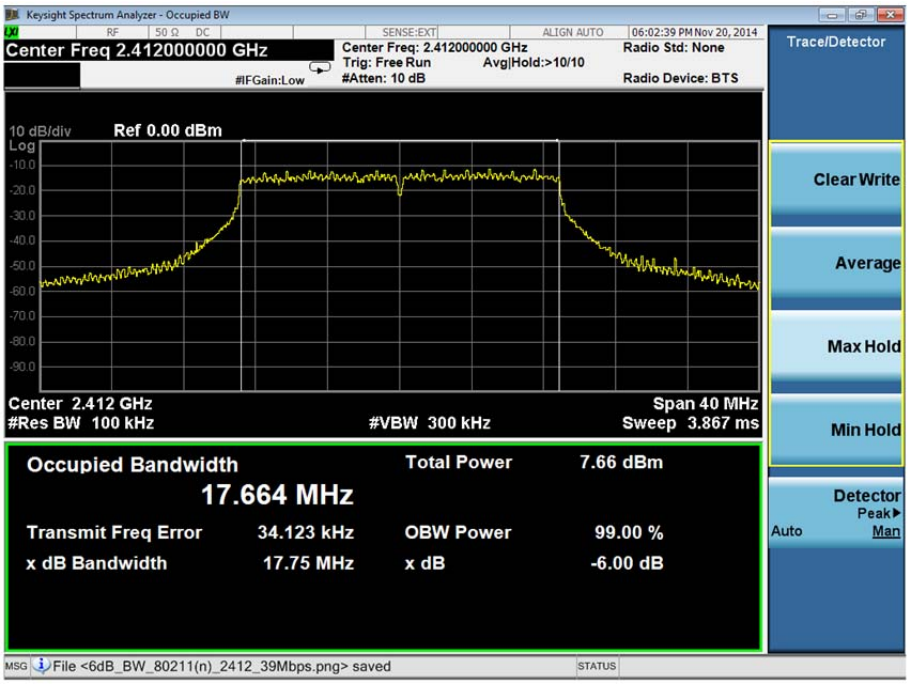


Product Service

39 Mbps

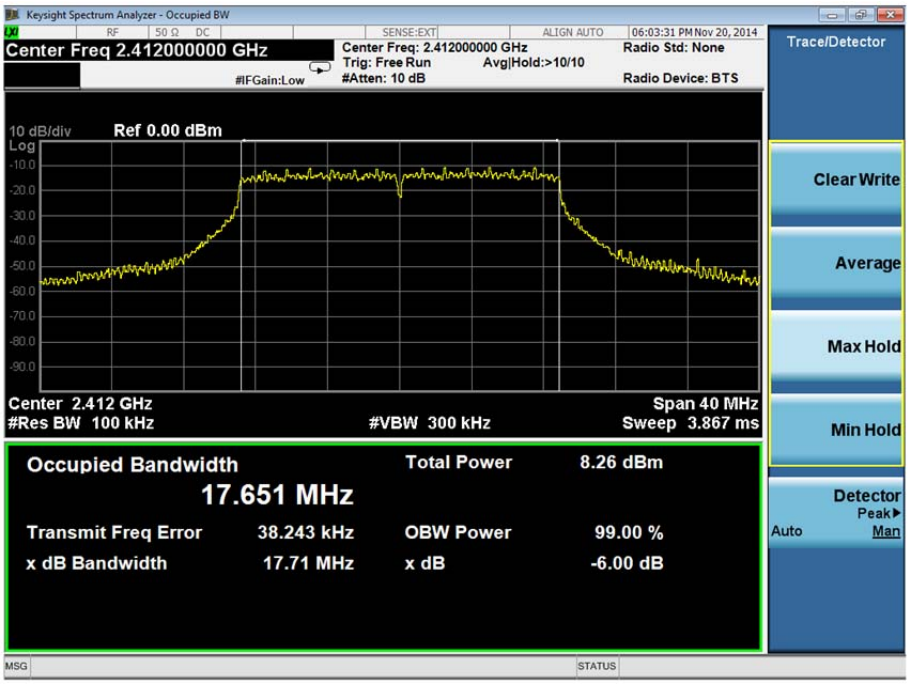


52 Mbps

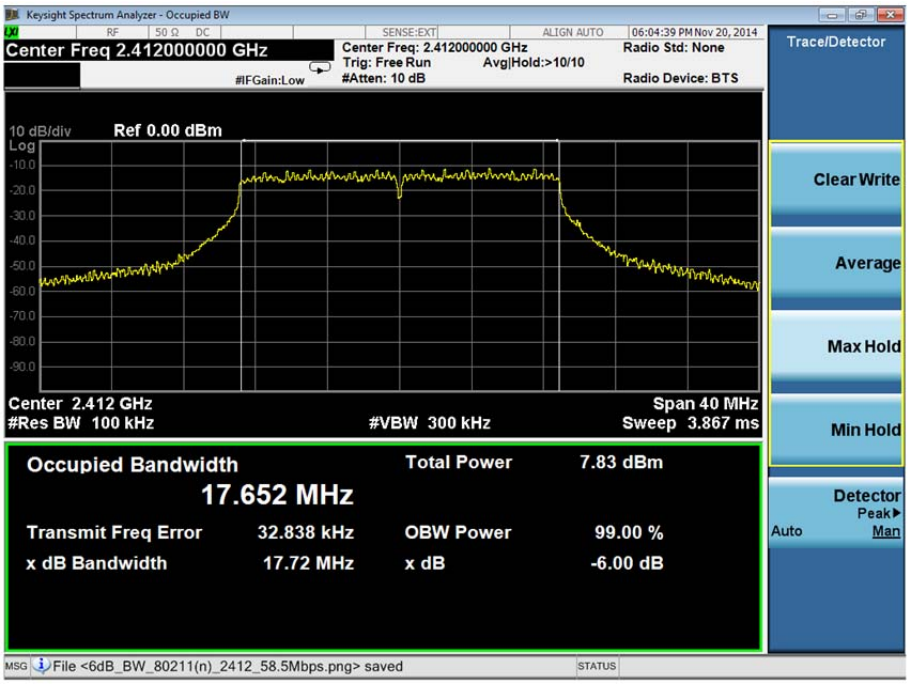


Product Service

58.5 Mbps



65 Mbps

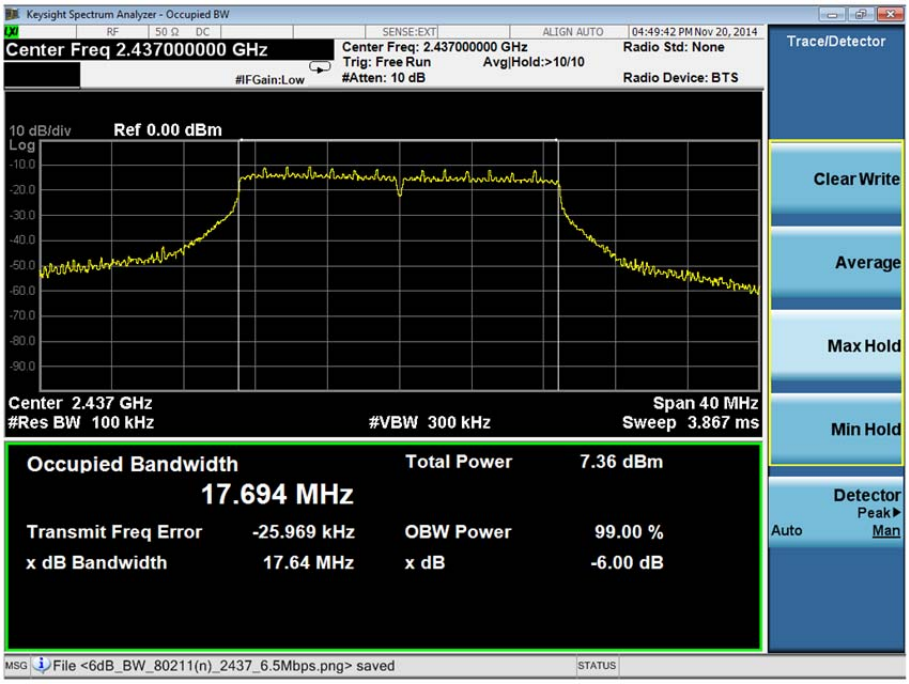


Product Service

2437 MHz

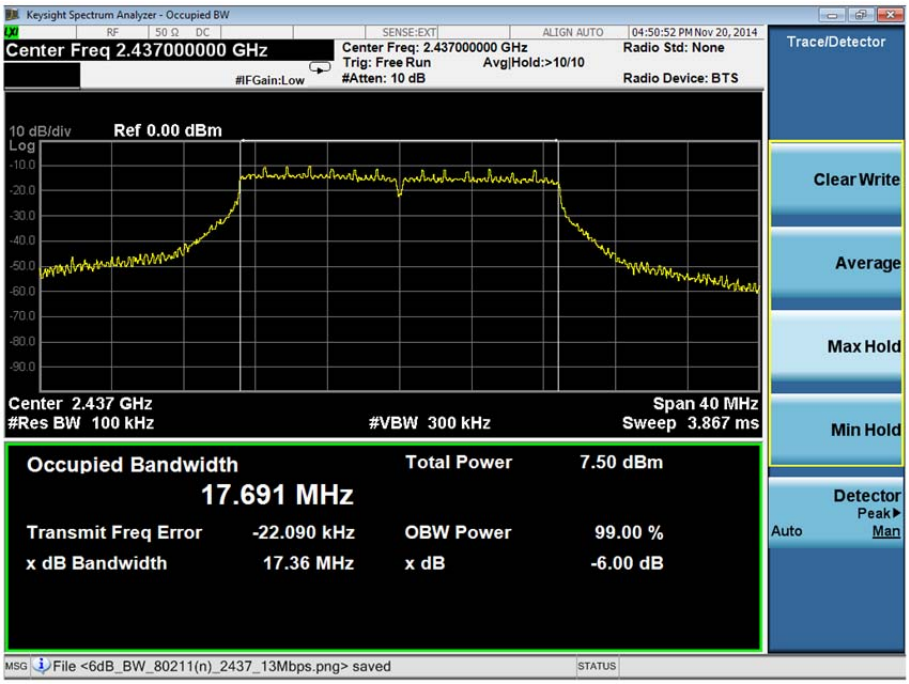
6.5 Mbps

13 Mbps

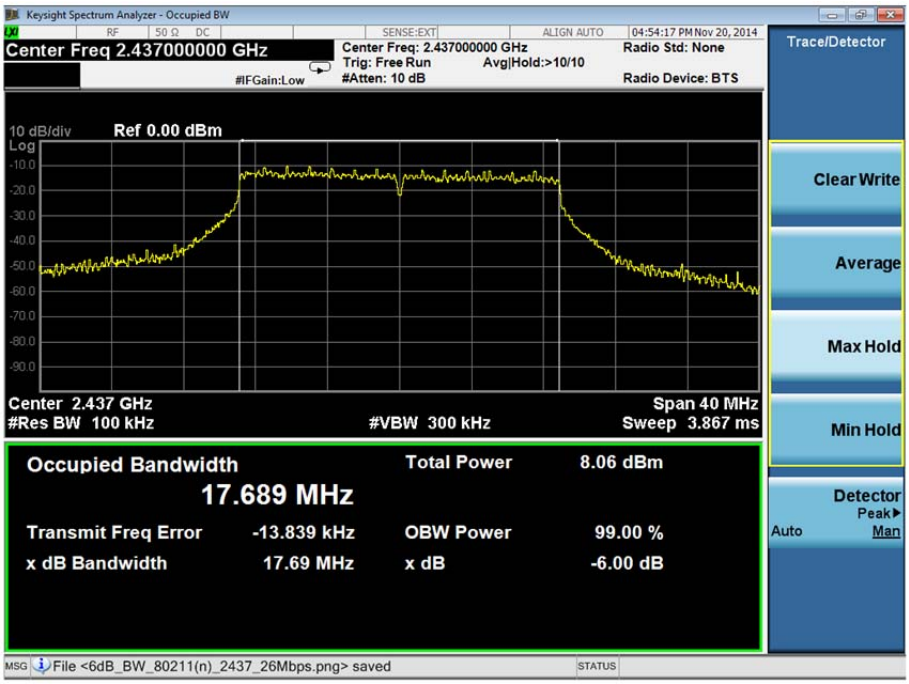


Product Service

19.5 Mbps

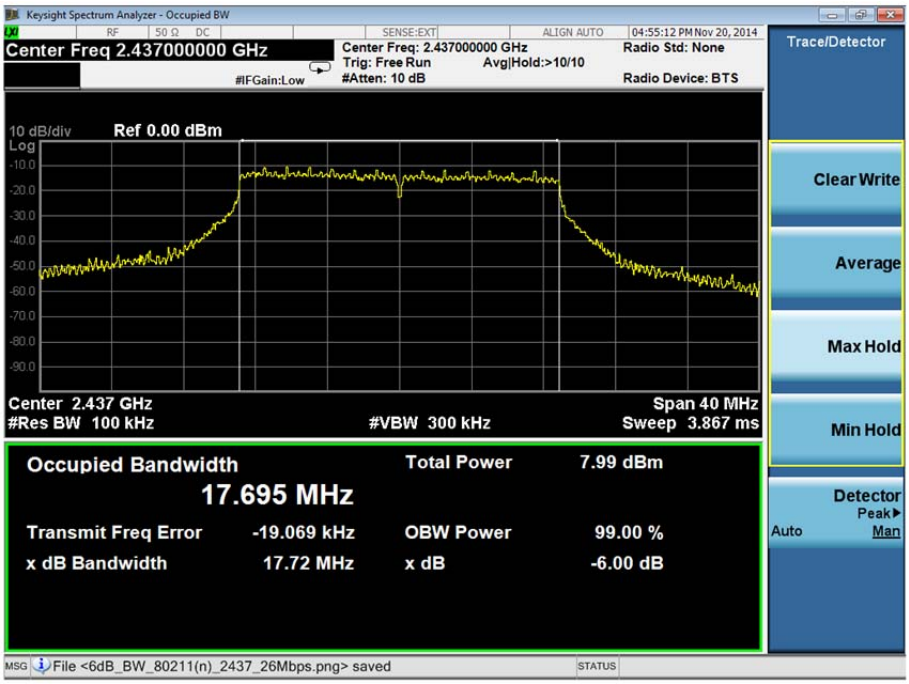


26 Mbps

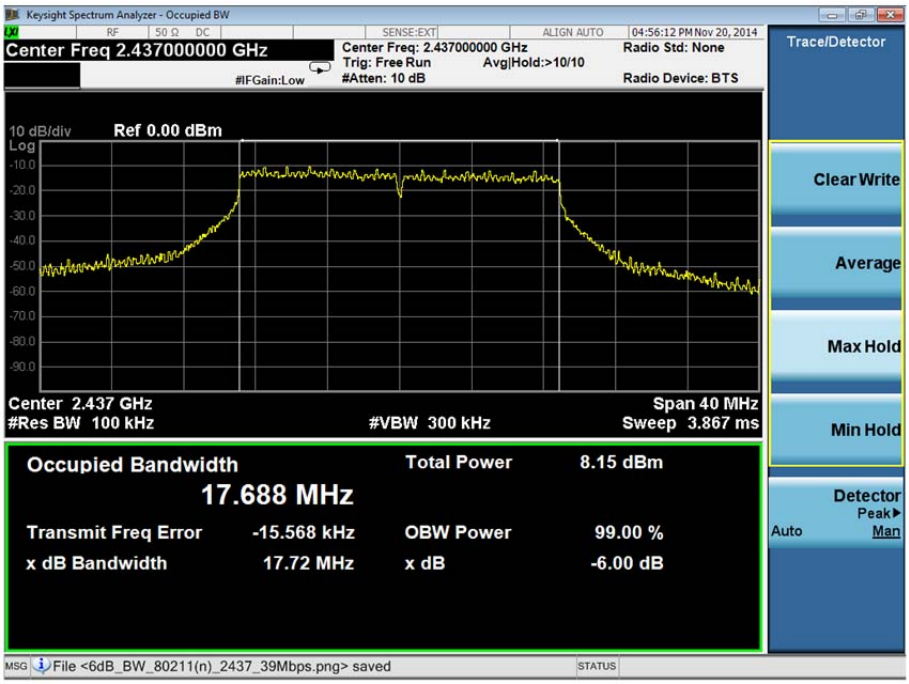


Product Service

39 Mbps

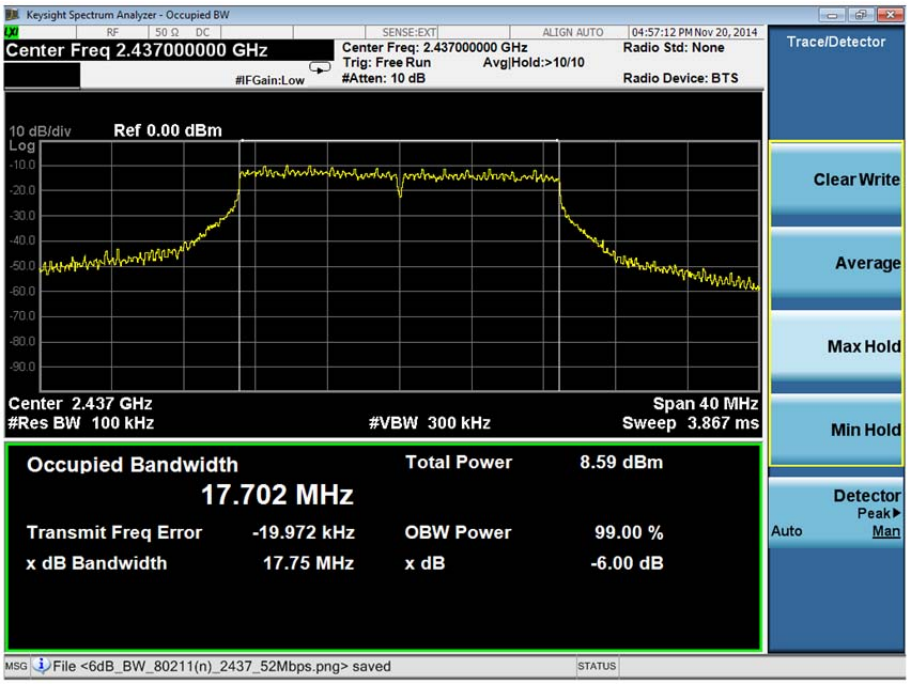


52 Mbps

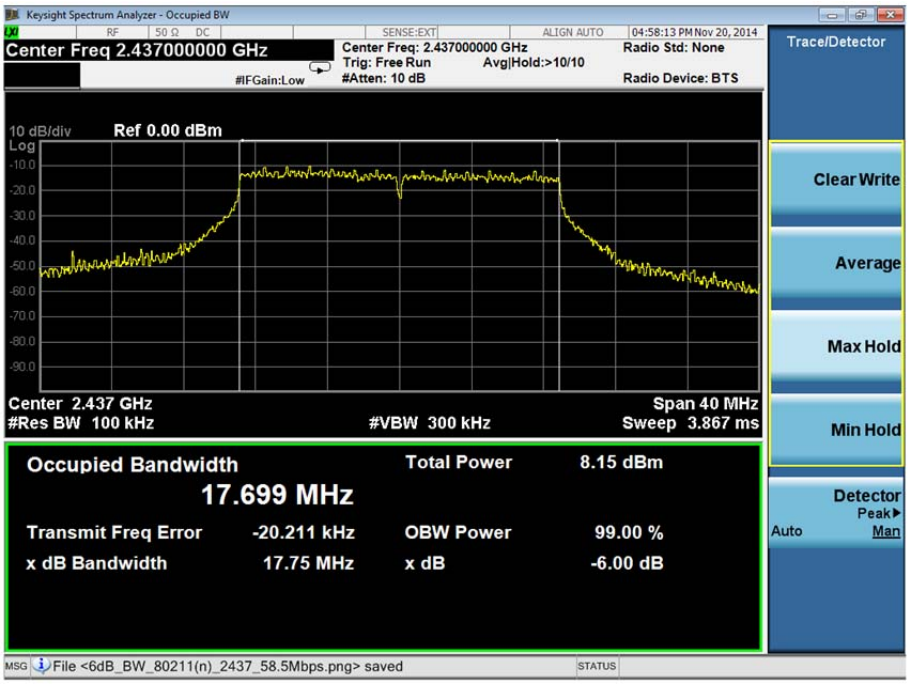


Product Service

58.5 Mbps



65 Mbps



Product Service

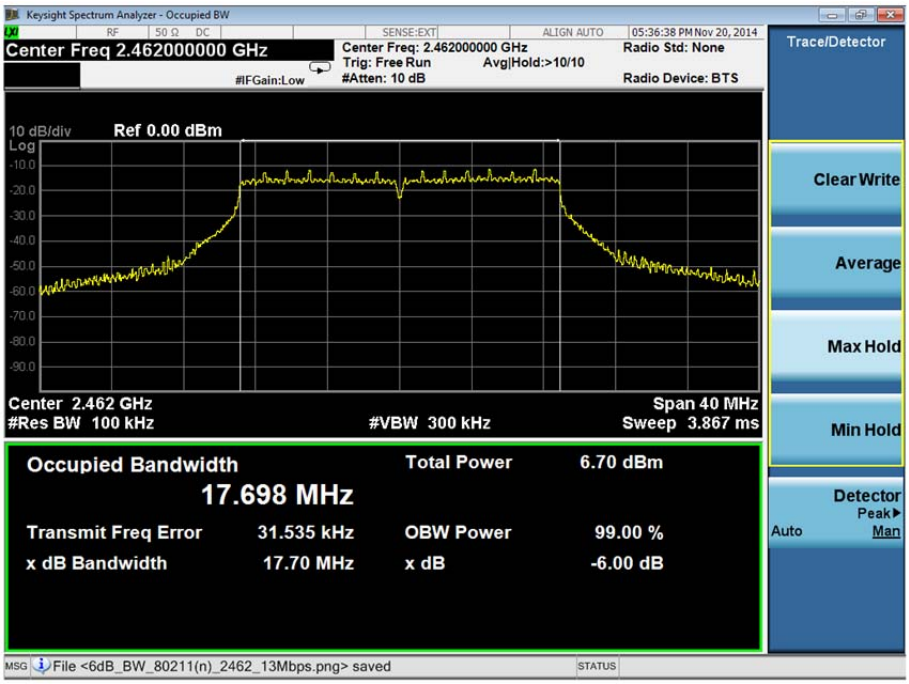
2462 MHz

6.5 Mbps

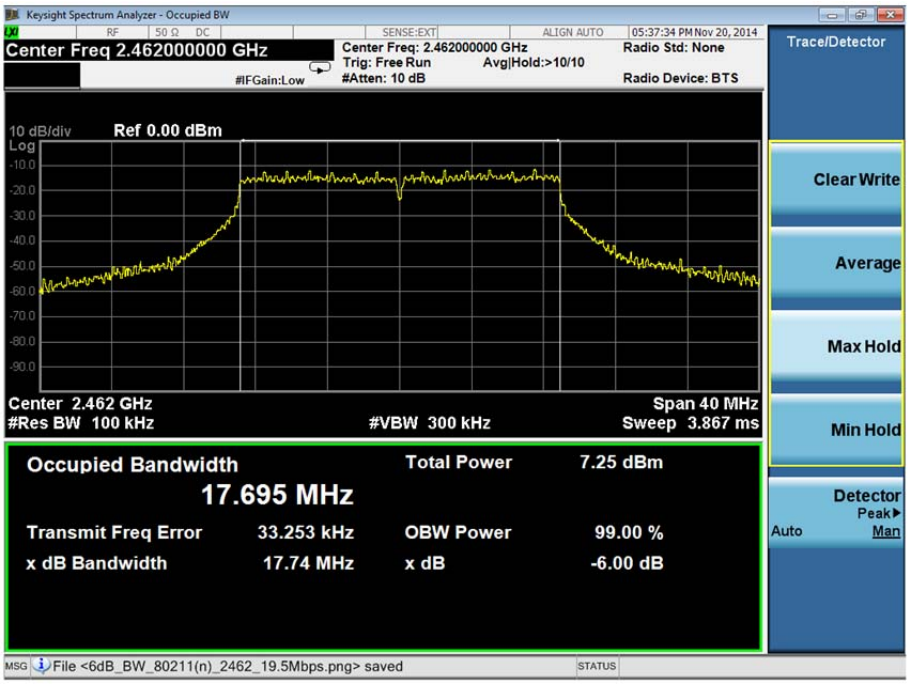
13 Mbps

Product Service

19.5 Mbps

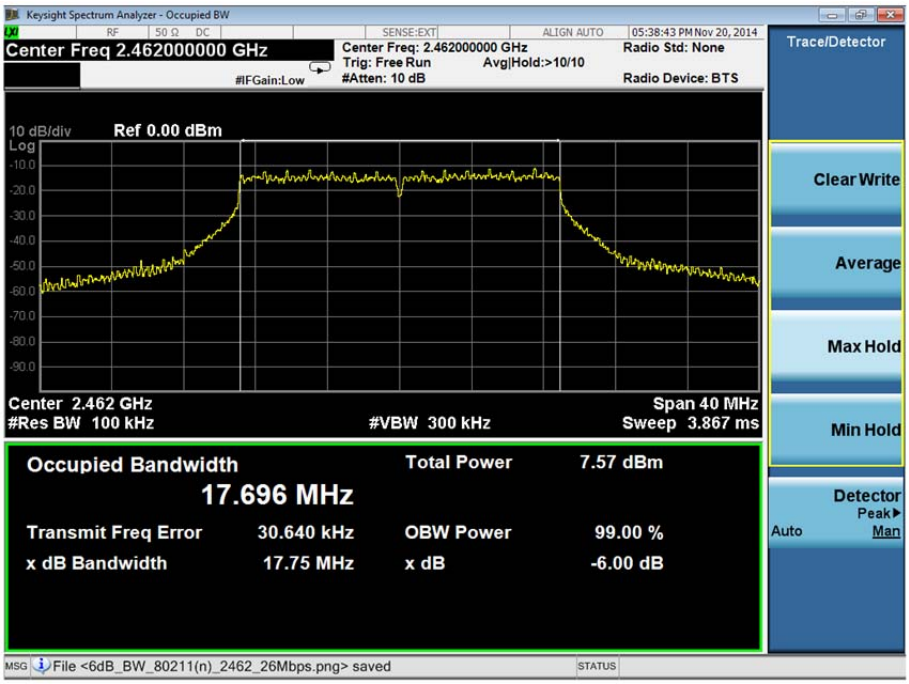


26 Mbps



Product Service

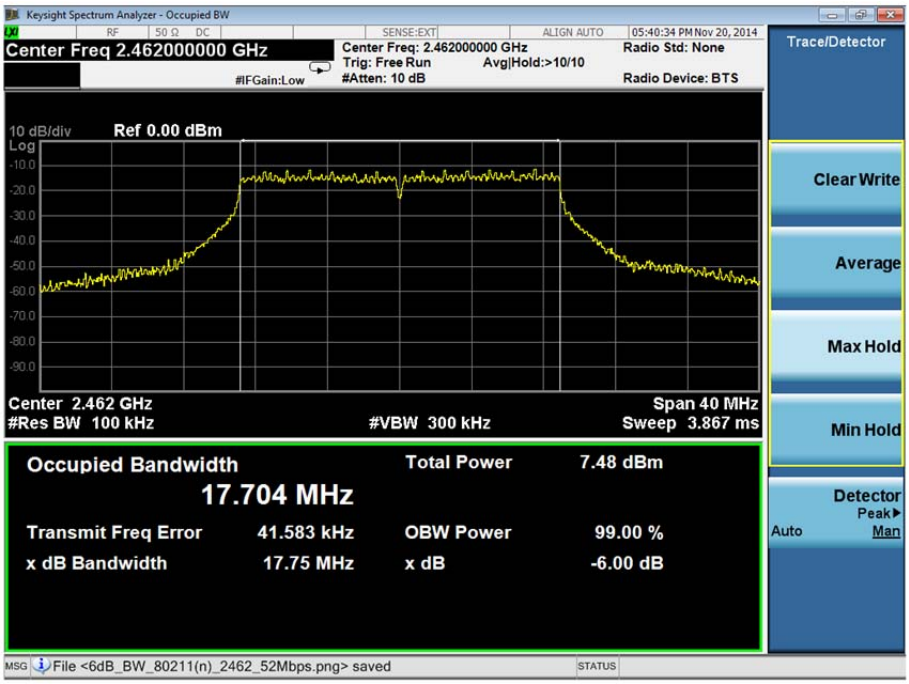
39 Mbps



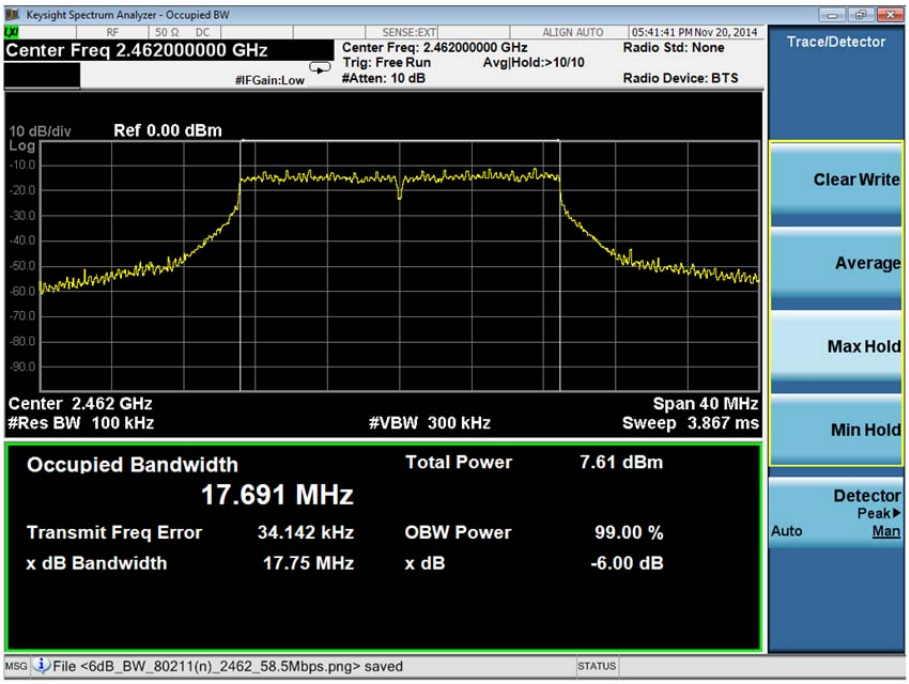
52 Mbps

Product Service

58.5 Mbps



65 Mbps



Limit Clause

The minimum 6 dB Bandwidth shall be at least 500 kHz.

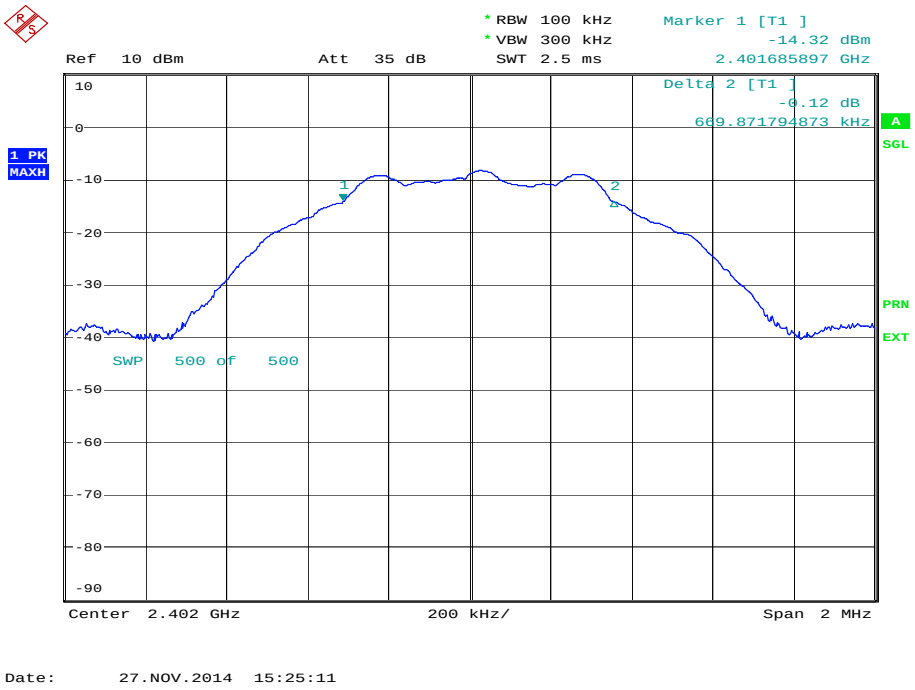
Bluetooth Low Energy

4.0 V DC Supply

Frequency (MHz)	Packet Type	6dB Bandwidth (kHz)
2402 MHz	DH1	669.87
2441 MHz	DH1	669.87
2480 MHz	DH1	666.67

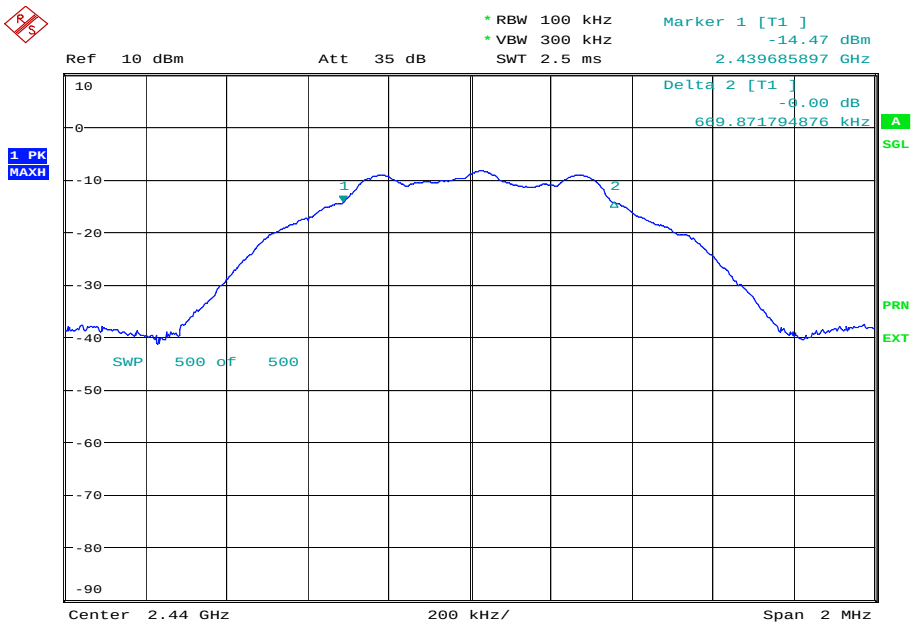
2402 MHz

DH1



2441 MHz

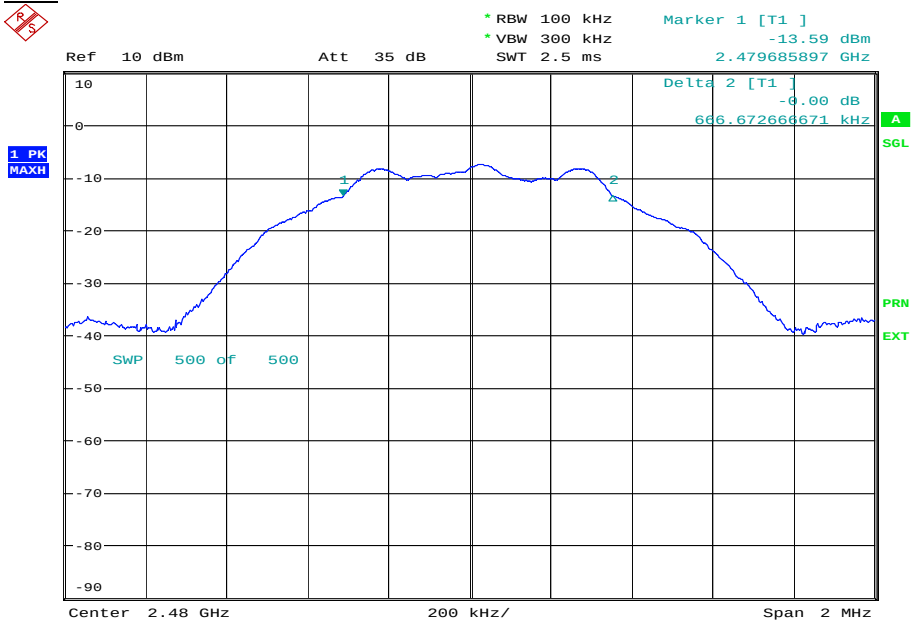
DH1



Date: 27.NOV.2014 15:28:36

2480 MHz

DH1



Date: 27.NOV.2014 15:35:06

Limit Clause

The minimum 6 dB Bandwidth shall be at least 500 kHz.

2.3 MAXIMUM PEAK CONDUCTED OUTPUT POWER

2.3.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (b)(3)

2.3.2 Equipment Under Test and Modification State

SHV31 S/N: IMEI 004401115315919 - Modification State 0
SHV31 S/N: IMEI 004401115315836 - Modification State 0

2.3.3 Date of Test

7 November 2014, 10 November 2014 & 27 November 2014

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.247 (b) and FCC KDB 558074 D01 DTS Meas Guidance v03r02 Clause 9.1.2.

The EUT was connected to a broadband peak RF power meter via a cable and attenuator. The EUT was transmitting at maximum power, for bottom, middle and top channels on all supported data rates. The path loss between the EUT and sensor was measured and entered as a reference level offset. The peak power was recorded for measurements on the bottom, middle and top channels on all supported data rates.

2.3.6 Environmental Conditions

Ambient Temperature	22.4 - 22.7°C
Relative Humidity	41.0 - 42.1%

Product Service

2.3.7 Test Results

802.11(b)

4.0 V DC Supply

Modulation Data Rate (Mbps)	Maximum Peak Conducted Output Power					
	dBm			mW		
	2412 MHz	2437 MHz	2462 MHz	2412 MHz	2437 MHz	2462 MHz
1	18.35	18.40	18.83	68.391	69.183	76.384
2	18.40	18.30	18.69	69.183	67.608	73.961
5.5	18.54	18.27	18.69	71.450	67.143	73.961
11	18.46	18.40	18.60	70.146	69.183	72.444

Limit Clause

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

802.11(g)

4.0 V DC Supply

Modulation Data Rate (Mbps)	Maximum Peak Conducted Output Power					
	dBm			mW		
	2412 MHz	2437 MHz	2462 MHz	2412 MHz	2437 MHz	2462 MHz
6	21.70	21.56	21.78	147.911	143.219	150.611
9	21.69	21.53	21.80	147.571	145.546	151.356
12	21.75	21.58	21.79	149.624	149.624	143.880
18	21.70	21.73	21.91	147.911	147.936	155.239
24	21.75	21.63	21.93	149.624	145.546	155.955
36	21.76	21.72	21.86	149.968	148.594	153.462
48	21.78	21.65	21.78	150.661	146.218	150.611
54	21.34	21.74	21.82	136.144	149.279	152.055

Limit Clause

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

802.11(n)

4.0 V DC Supply

Modulation Data Rate (Mbps)	Maximum Peak Conducted Output Power					
	dBm			mW		
	2412 MHz	2437 MHz	2462 MHz	2412 MHz	2437 MHz	2462 MHz
6.5	21.17	21.32	21.10	130.918	135.519	128.825
13	21.20	21.50	21.52	131.826	141.254	141.906
19.5	21.21	21.45	21.43	132.130	139.637	138.995
26	21.54	21.56	21.42	142.561	143.219	138.676
39	21.32	21.41	21.56	135.519	138.357	143.219
52	21.37	21.56	21.51	137.088	143.219	141.579
58.5	21.32	21.56	21.48	135.519	143.219	140.605
65	21.32	21.45	21.46	135.519	139.637	139.959

Limit Clause

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

Bluetooth Low Energy

4.0 V DC Supply

Packet Type	Maximum Peak Conducted Output Power					
	dBm			mW		
	2402 MHz	2441 MHz	2480 MHz	2402 MHz	2441 MHz	2480 MHz
DH1	2.87	2.87	3.70	1.94	1.94	2.34

Limit Clause

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

2.4 EIRP PEAK POWER

2.4.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (b)(4)

2.4.2 Equipment Under Test and Modification State

SHV31 S/N: IMEI 004401115315646 - Modification State 0
SHV31 S/N: IMEI 004401115315653 - Modification State 0

2.4.3 Date of Test

20 November 2014, 23 November 2014 & 30 November 2014

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.247 (b) and ANSI C63.10.

A test environment and testing arrangement meeting the specification of ANSI C63.4 was used during all testing. The Equipment Under Test (EUT) was set upon a non-conducting platform during testing. The EUT elevation was 80 cm above the horizontal reference ground plane. The Analyser settings were adjusted to display the resultant trace on screen and a resolution bandwidth and video bandwidth of 1 MHz were used to perform the measurement. The level on the spectrum analyser was maximised by rotating the EUT through 360° and a height search of the measuring antenna. A substitution was then performed using a suitable calibrated antenna and signal generator.

A calculation accounting for antenna gain and cable loss was then performed to obtain the final figure.

2.4.6 Environmental Conditions

Ambient Temperature	20.5°C
Relative Humidity	40.0 - 47.0%

2.4.7 Test Results

802.11(b)

4.0 V DC Supply

2412 MHz

EIRP (dBm)	EIRP (mW)
20.25	105.93

2437 MHz

EIRP (dBm)	EIRP (mW)
19.32	85.51

2462 MHz

EIRP (dBm)	EIRP (mW)
19.81	95.72

Limit

EIRP (dBm)	EIRP (mW)
36.0	4000

802.11(g)

4.0 V DC Supply

2412 MHz

EIRP (dBm)	EIRP (mW)
20.11	102.57

2437 MHz

EIRP (dBm)	EIRP (mW)
18.66	73.45

2462 MHz

EIRP (dBm)	EIRP (mW)
19.16	82.41

Limit

EIRP (dBm)	EIRP (mW)
36.0	4000

802.11(n)

4.0 V DC Supply

2412 MHz

EIRP (dBm)	EIRP (mW)
19.08	80.91

2437 MHz

EIRP (dBm)	EIRP (mW)
18.02	63.39

2462 MHz

EIRP (dBm)	EIRP (mW)
18.50	70.79

Limit

EIRP (dBm)	EIRP (mW)
36.0	4000

Bluetooth Low Energy

4.0 V DC Supply

2402 MHz

EIRP (dBm)	EIRP (mW)
5.83	14.29

2441 MHz

EIRP (dBm)	EIRP (mW)
6.69	17.42

2480 MHz

EIRP (dBm)	EIRP (mW)
5.00	11.80

Limit

EIRP (dBm)	EIRP (mW)
36.0	4000

2.5 SPURIOUS AND BAND EDGE EMISSIONS

2.5.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (d)

2.5.2 Equipment Under Test and Modification State

SHV31 S/N: IMEI 004401115315646 - Modification State 0
SHV31 S/N: IMEI 004401115315653 - Modification State 0

2.5.3 Date of Test

20 November 2014, 21 November 2014, 30 November 2014, 4 December 2014, 5 December 2014, 6 December 2014 & 7 December 2014

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.247 (d) and ANSI C63.10

The EUT was set to operate at maximum power on the bottom, middle and top channels for the data rate which resulted in the highest conducted average output power. The field strength of each fundamental frequency was measured in 100 kHz RBW, the resultant limit line on the trace was set at -20 dBc of this value. Measurements were performed from 30 MHz to 25 GHz and the path loss was incorporated as a transducer factor and entered into the spectrum analyser.

Band edge measurements were performed with the EUT operating on the lowest and highest channels for the data rate which gave the highest conducted power and the highest 6dB bandwidth. Peak measurements have been made at the relevant authorised band edge in a 100kHz RBW and 300kHz VBW. Peak and average measurements have been made at the relevant restricted band edges with 1MHz RBW / 3MHz VBW and 1MHz RBW / 10Hz VBW respectively.

A test environment and testing arrangement meeting the specification of ANSI C63.4 was used during all testing. The Equipment Under Test (EUT) was set upon a non-conducting platform at an elevation of 80 cm above a horizontal reference ground plane. The EUT was set upon a non-conducting platform during testing. When frequencies less than 18 GHz were measured; the EUT elevation was 80 cm above the horizontal reference ground plane. When frequencies greater than 18 GHz were measured; the EUT elevation was 1 m above the horizontal reference ground plane to ensure adequate vertical beam width coverage of the measuring antenna with respect to the EUT.

The horizontal reference ground plane encompasses a turntable which is used to adjust the azimuth of the EUT. An antenna positioner is used to elevate the measuring antenna above the horizontal reference ground plane whereby the antenna elevation is adjustable between 1 m and 4 m.

Exploratory radiated emissions measurements were made by azimuth emissions searches over a range of 0° and 360°. These exploratory radiated emissions measurements were made using a peak detector over a frequency range of 30 MHz to 25 GHz, with the measuring antenna in both vertical and horizontal polarizations.

At least six of the greatest peak emissions, frequency positions were selected from the exploratory radiated emissions measurements for further evaluation as final measuring points.

To ascertain the azimuth and measuring antenna polarization that yields the highest peak emission level, each final measurement frequency was investigated by continuous azimuth emissions searching with the measuring antenna in both vertical and horizontal polarizations. For each final measurement frequency, the respective peak emission azimuth and measuring antenna polarization was used during a measuring antenna elevation search from 1 m to 4 m. Each final measurement frequency was then measured with the EUT azimuth, measuring antenna height and polarization that yielded the greatest peak emission level.

Final measurement points over the frequency range of 30 MHz to 1 GHz were measured using a quasi-peak detector. Final measurement points over the frequency range of 1 GHz and 25 GHz were measured using peak and average methods. Peak measurements were made using a peak detector with 1 MHz RBW and 3MHz VBW. Average measurements were made using a peak detector with a RBW of 1MHz and VBW of 10Hz.

All final measurements were assessed against the Class B emission limits in Clause 15.209 of FCC CFR 47 FCC Part 15.

2.5.6 Environmental Conditions

Ambient Temperature	19.0 - 22.4°C
Relative Humidity	27.0 - 47.3%

Product Service

2.5.7 Test Results

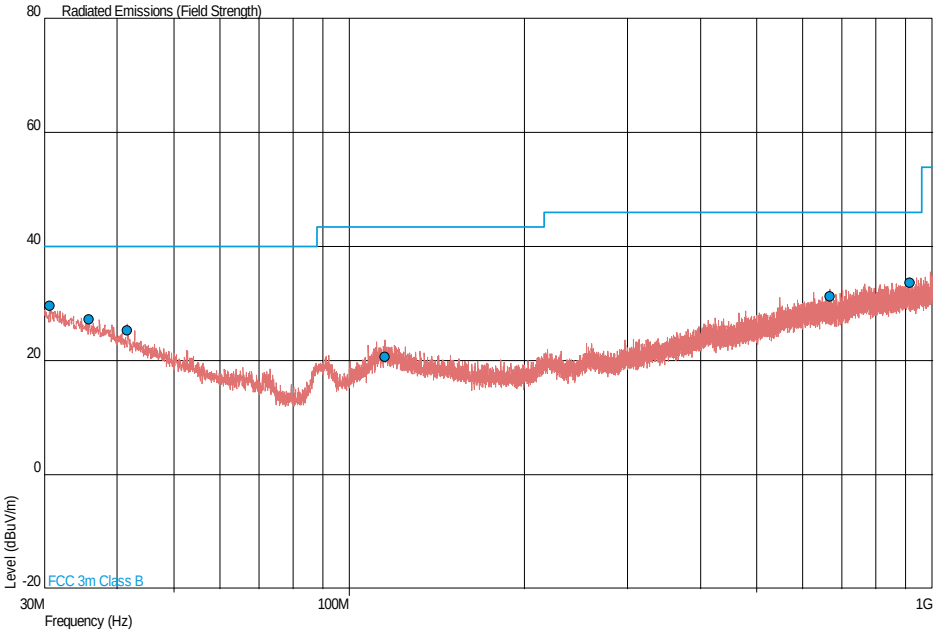
802.11(b)

4.0 V DC Supply

Spurious Radiated Emissions

2412 MHz

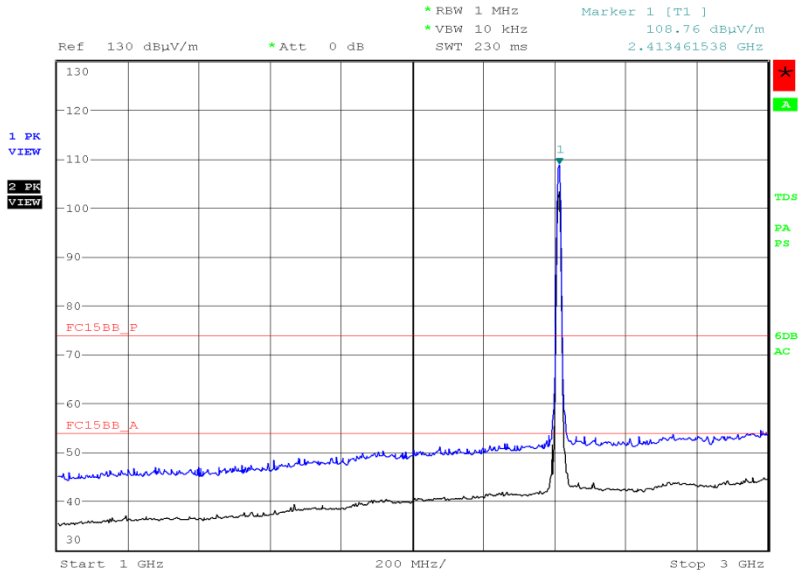
30 MHz to 1 GHz



Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.633	29.7	30.5	40.0	100	-10.3	-69.5	276	1.00	Vertical
35.781	27.3	23.2	40.0	100	-12.7	-76.8	0	1.00	Horizontal
41.643	25.3	18.4	40.0	100	-14.7	-81.6	316	1.00	Horizontal
115.231	20.6	10.7	43.5	150	-22.9	-139.3	100	1.00	Vertical
668.039	31.3	36.7	46.0	200	-14.7	-163.3	352	1.00	Vertical
913.729	33.7	48.4	46.0	200	-12.3	-151.6	152	2.62	Horizontal

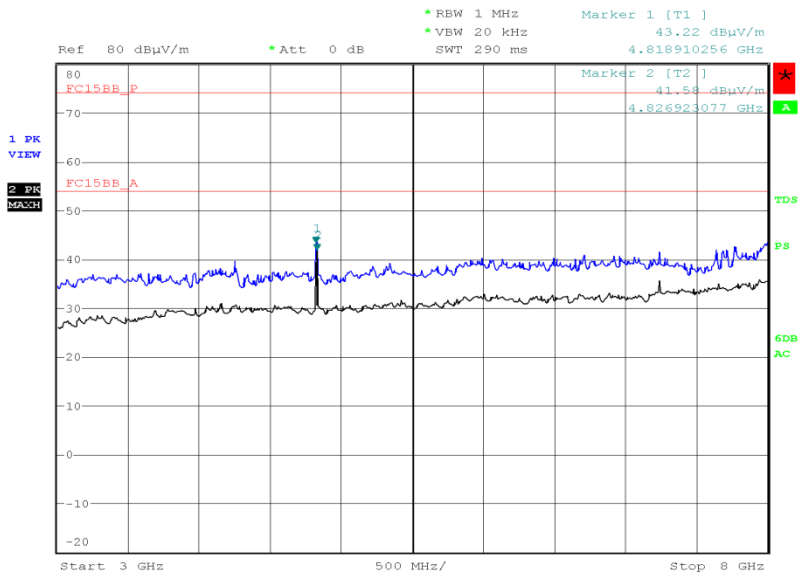
Product Service

1 GHz to 3 GHz



Date: 20.NOV.2014 04:30:13

3 GHz to 8 GHz



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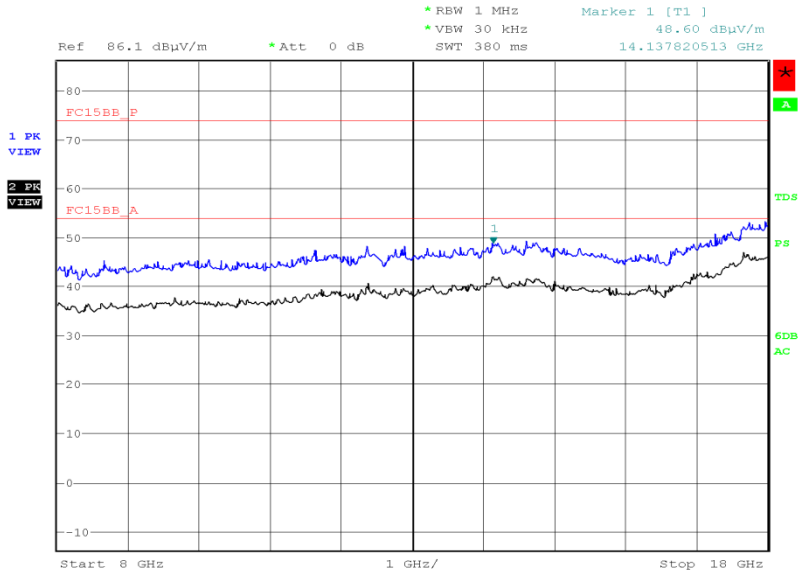
Product Service

8 GHz to 18 GHz



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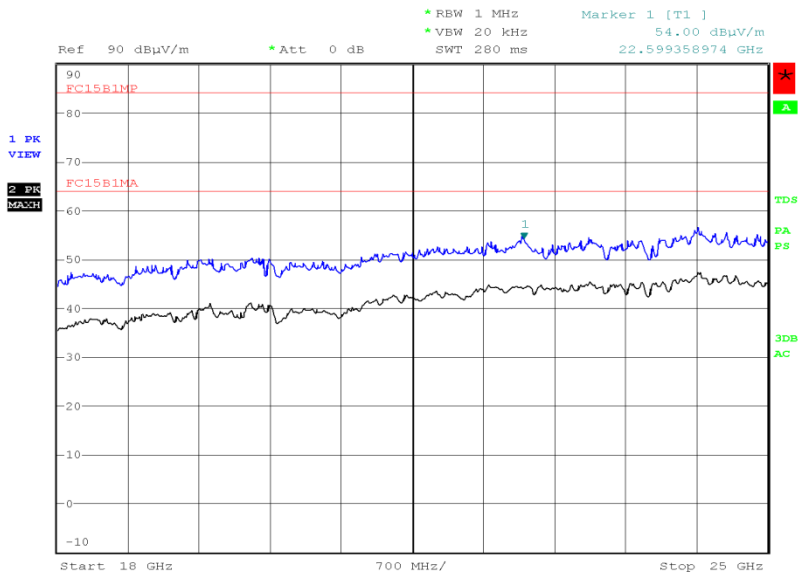
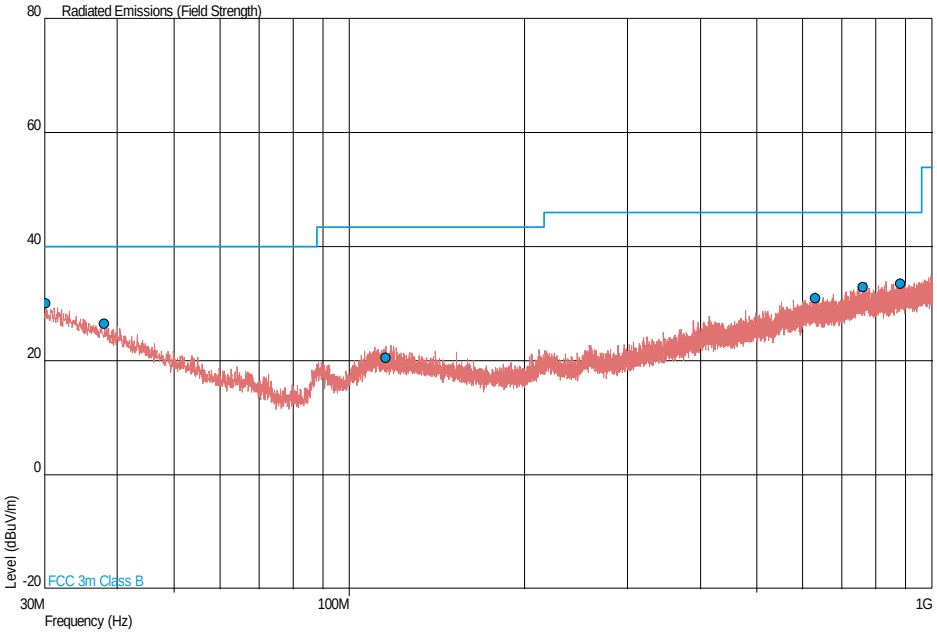
18 GHz to 25 GHz



Date: 6.DEC.2014 00:01:14

2437 MHz

30 MHz to 1 GHz



Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.196	30.0	31.6	40.0	100	-10.0	-68.4	168	3.87	Vertical
38.001	26.4	20.9	40.0	100	-13.6	-79.1	105	1.00	Vertical
115.539	20.5	10.6	43.5	150	-23.0	-139.4	188	1.00	Vertical
629.339	31.0	35.5	46.0	200	-15.0	-164.5	296	2.11	Vertical
759.719	32.9	44.2	46.0	200	-13.1	-155.8	0	1.00	Horizontal
881.680	33.5	47.3	46.0	200	-12.5	-152.7	236	4.00	Vertical