

Produkte
Products

Prüfbericht - Nr.: 19660145 001		Seite 1 von 172	
<i>Test Report No.:</i>		<i>Page 1 of 172</i>	
Auftraggeber: <i>Client:</i>		Redpine Signals Inc 2107 N.First Street, Suite 680, San Jose, CA 95131-2019 United States	
Gegenstand der Prüfung: <i>Test item:</i>		Dual Band Combo Module	
Bezeichnung: <i>Identification:</i>	RS9113DB	Serien-Nr.: <i>Serial No.</i>	Engineering Sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	18030552861	Eingangsdatum: <i>Date of receipt:</i>	11.11.2014
Prüfört: <i>Testing location:</i>		Refer Page 4 of 172 for test facilities	
Prüfgrundlage: <i>Test specification:</i>		FCC Part 15: Subpart C Section 15.247 ANSI C63.4-2009	
Prüfergebnis: <i>Test Result:</i>		Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). <i>The test items passed the test specification(s).</i>	
Prüflaboratorium: <i>Testing Laboratory:</i>		TÜV Rheinland (India) Pvt. Ltd. 82/A, 3rd Main, West Wing, Electronic City Phase 1 Hosur Road, Bangalore – 560 100. India FCC Registration No.: 176555	
geprüft / tested by:		kontrolliert / reviewed by:	
08.12.2014	Vinay N Sr. Engineer	08.12.2014	Raghavendra Kulkarni Sr. Manager
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
			Name/Stellung <i>Name/Position</i>
			Unterschrift <i>Signature</i>
Sonstiges / Other Aspects: FCC ID : XF6-RS9113DB			
Abkürzungen:		Abbreviations:	
P(ass) = entspricht Prüfgrundlage		P(ass) = passed	
F(ail) = entspricht nicht Prüfgrundlage		F(ail) = failed	
N/A = nicht anwendbar		N/A = not applicable	
N/T = nicht getestet		N/T = not tested	
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>			

Test Result Summary

Clause	Test Item	Result
FCC 15.247(b) (3)	Maximum Average Conducted Output Power	Pass
FCC 15.247(a) (2)	6dB Bandwidth	Pass
FCC 15.247(e)	Maximum Power Spectral Density	Pass
FCC 15.247(d)	Band-edge compliance	Pass
FCC 15.209 / FCC 15.205	Spurious Radiated Emissions and Restricted Bands of Operation	Pass

Note: Conducted measurements are done according to the procedure given in KDB No. **558074**
D01 DTS Meas Guidance v03r02

Content

List of Test and Measurement Instruments	4
General Product Information	5
Product Function and Intended Use	5
Ratings and System Details.....	5
Test Set-up and Operation Mode	6
Principle of Configuration Selection	6
Test Operation and Test Software	6
Test Modes – Data Rates and Modulations	6
Test Methodology	7
Radiated Emission Test	7
Test Results.....	8
Maximum Average Conducted Output Power	Section 15.247(b) (3)8
Maximum Power Spectral Density	Section 15.247(e).....36
6 dB Bandwidth	Section 15.247(a) (2).....64
Band-edge Compliance	Section 15.247(d)116
Spurious Radiated Emissions and.....	158
Restricted Bands of Operation	Section 15.209 and 15.205158
Conducted Emission Test on A.C. Power Line	Section 15.207.....167
Appendix 1: Test Setup Photo	
Appendix 2: EUT External Photo	
Appendix 3: EUT Internal Photo	
Appendix 4: FCC Label and Label Location	
Appendix 5: Block Diagram	
Appendix 6: Specification of EUT	
Appendix 7: Schematic Diagrams	
Appendix 8: Bill of Material	
Appendix 9: User Manual	
Appendix 10: Maximum Permissible Exposure Calculation	

www.tuv.com

List of Test and Measurement Instruments

TUV Rheinland (India) Pvt. Ltd. , Bangalore

Equipment	Manufacturer	Model	S/N	Calibration Due Date
EMI Test Receiver	Rohde &Schwarz	ESU 40	100288	04.10.2015
Hybrid Log Periodic antenna	ETS Lindgren	3142D	00081354	26.07.2015
Broadband Horn Antenna	Frankonia	HAX-18	HAX18-802	23.03.2015
Double-Ridged Waveguide Horn Antenna	ETS Lindgren	116794	00133356	01.09.2015
Emission Horn Antenna	ETS Lindgren	116706	00107323	24.08.2015
Active Loop Antenna	Frankonia	LAX-10	LAX-10-800	11.04.2015
Spectrum Analyser	Agilent Technologies	E4407B	US41192772	27.03.2015

Testing Facilities:

- 1) TUV Rheinland (India) Private Limited
No. 108, West Wing
Electronic city Phase I
Bangalore – 560100

General Product Information

Product Function and Intended Use

The RS9113 module integrates a multi-threaded MAC processor with integrated analog peripherals and support for digital peripherals, baseband digital signal processor, analog front-end, crystal oscillator, calibration OTP memory, Dual band RF transceiver, Dual-band high-power amplifiers, baluns, diplexers, diversity switch and Quad-SPI Flash thus providing a fully-integrated solution for embedded wireless applications. The RS9113 based chips and modules leverage and improve upon Redpine's proven low power innovations from Lite-FTM products (RS9110) and provide WLAN 802.11n, BT4.0 and ZigBee convergence solution for integration into mobile and M2M communication devices. It can connect to a host processor through SDIO, USB, SPI or UART interfaces.

Ratings and System Details

Operating Frequency Range	2400MHz – 2483.50MHz	
No. of channel	11 – Wi-Fi (2.4GHz), 5 – Wi-Fi (5GHz) 15 – Zigbee 79 – BT Classic 40 – BT LE	
Channel Spacing	5MHz – Wi-Fi, Zigbee 1MHz – BT Classic 2MHz – BT LE	
Transmitted Power	802.11b	17.42dBm
	802.11g	17.74dBm
	802.11n	17.85dBm
	802.11a – 5GHz	12.02dBm
	802.11n – 5GHz	12.08dBm
	Bluetooth LE	14.63dBm
	Zigbee	15.42dBm
Data Rate	802.11b: 1,2, 5.5,11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: 6.5, 14.4, 21.7, 28.9, 39, 57.8, 65Mbps Bluetooth – 1,2,3 Mbps Zigbee – 250Kbps	
Number of antenna	One	
Antenna Gain and Antenna type	PCB Trace Antenna, 0.5dBi	
Supply Voltage to Module	3.1V – 3.6V DC from Host device	
Environmental	Operational Temperature: -40°C to 85° C	

Test Conditions:

Supply Voltage: 5V DC from USB

Environmental conditions:

Temperature: +24 °C RH: 62%

www.tuv.com

Test Set-up and Operation Mode

Principle of Configuration Selection

Transmission was enabled with 100% duty cycle duty on low, mid and high channel.

Test Operation and Test Software

Test software was used to enable the transmission with 100% duty cycle, changing channels (low/mid/high) and data rates on the EUT for the tests in this report.

Special Accessories and Auxiliary Equipment

- None

Countermeasures to achieve EMC Compliance

- None

Test Modes – Data Rates and Modulations

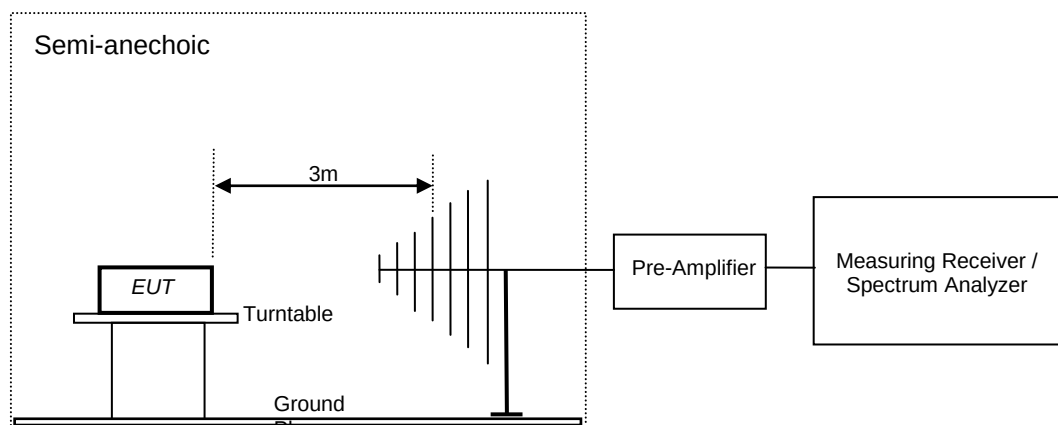
For Radiated spurious emissions, the tests were performed for all data rates and only worst case results are reported in this report.

www.tuv.com

Test Methodology

Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.4-2009. The equipment under test (EUT) was placed at the middle of the 80 cm high turntable, and the EUT is 3 meters far from the measuring antenna. The turntable was rotated 360° for obtaining the maximum emission. The height of the measuring antennas was scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurement above 1000MHz was performed by horn antenna. The measurement below 30MHz was performed by loop antenna. The EUT was rotated around the X-, Y-, and Z-Axis and the results from worst case axis are recorded.



www.tuv.com

Test Results

Maximum Average Conducted Output Power

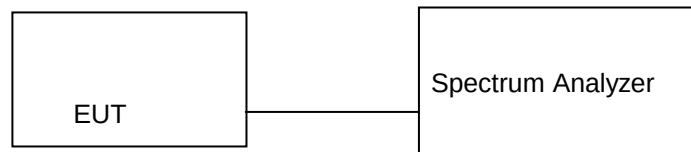
Section 15.247(b) (3)

Result

Pass

Test Specification	FCC Part 15 Subpart C
Measurement Bandwidth (RBW)	300 kHz/1MHz
Requirement	<1 watt (30dBm).

Test Method:

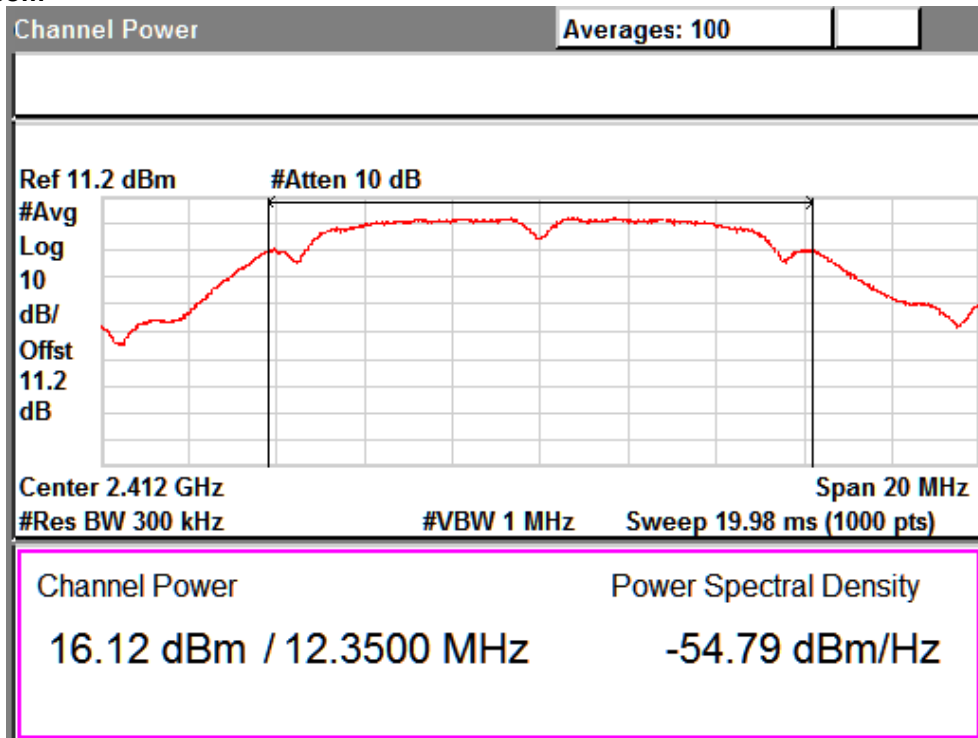


Note: For measurement of Maximum Average conducted output power method AVGSA-1 was used

Test Result: Wi-Fi

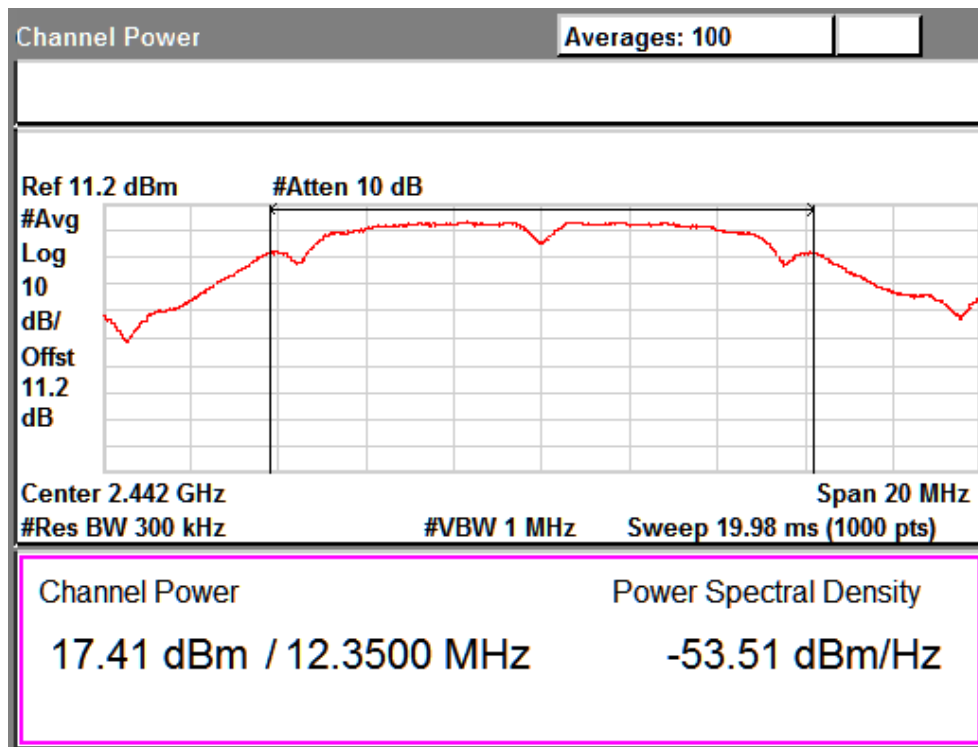
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Margin (dB)
b	1	2412.00	16.12	30.00	-13.88
		2442.00	17.41	30.00	-12.59
		2462.00	15.80	30.00	-14.20
	11	2412.00	16.79	30.00	-13.41
		2442.00	17.40	30.00	-12.60
		2462.00	16.53	30.00	-13.47

www.tuv.com



Data rate: 1 Mbps

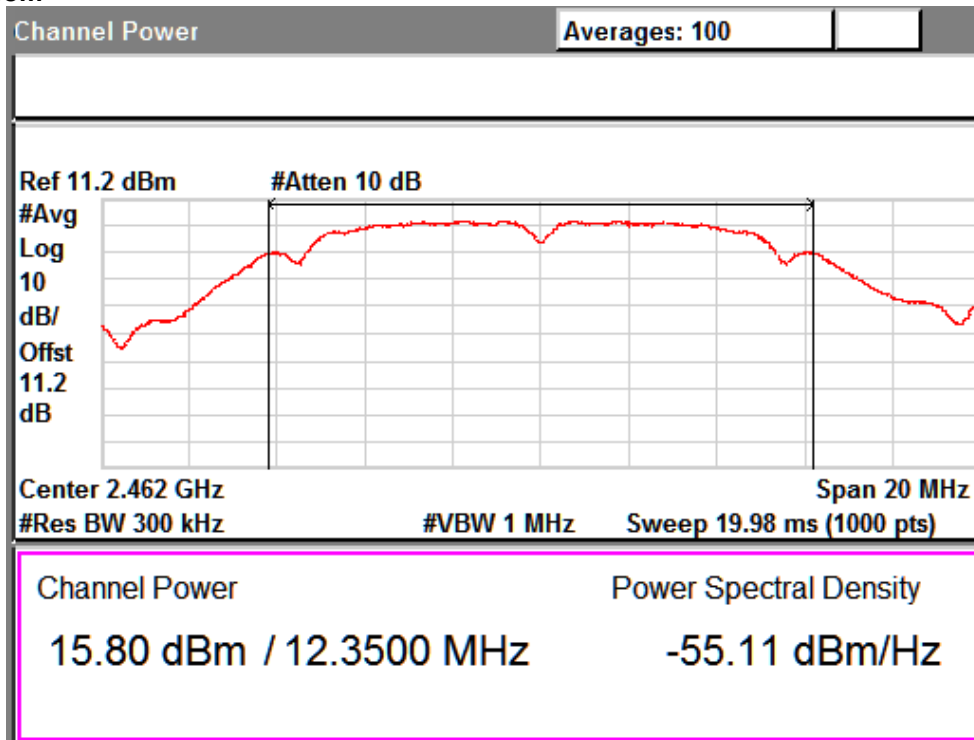
Channel Frequency: 2412 MHz



Data rate: 1 Mbps

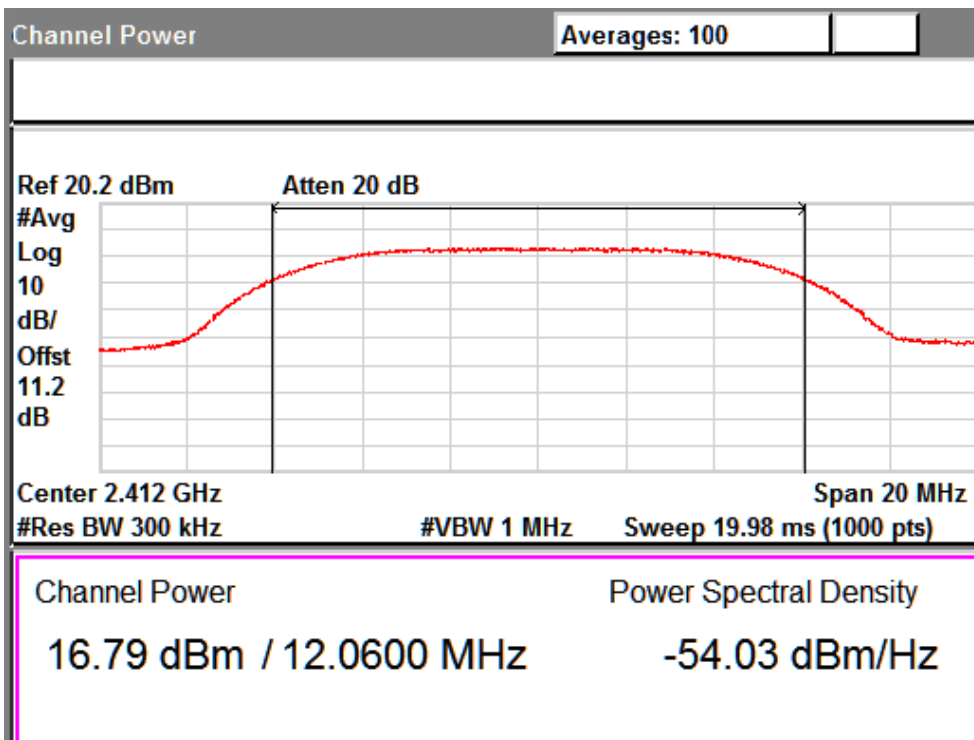
Channel Frequency: 2442 MHz

www.tuv.com



Data rate: 1 Mbps

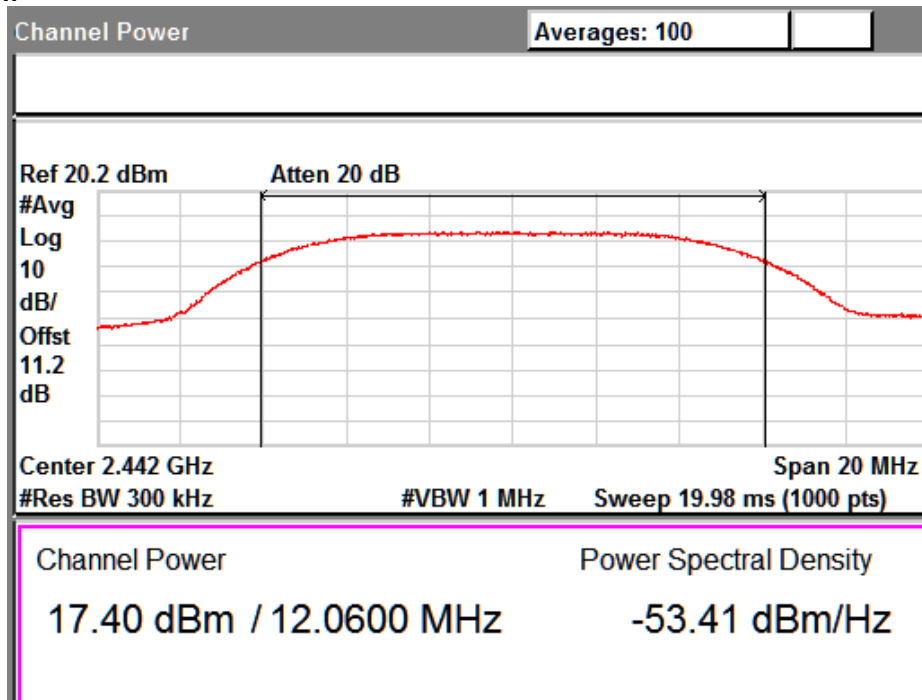
Channel Frequency: 2462 MHz



Data rate: 11 Mbps

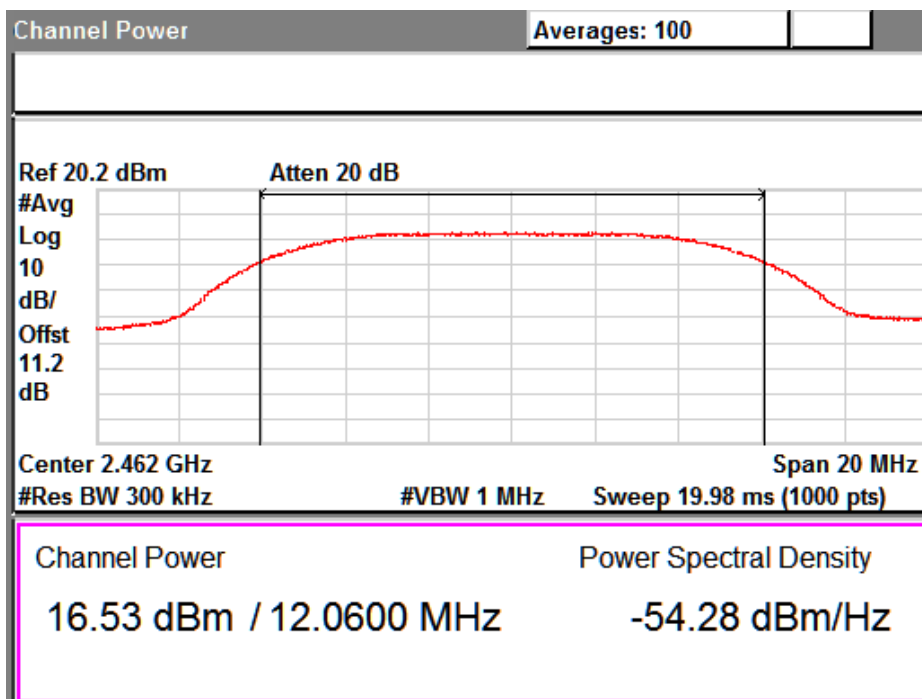
Channel Frequency: 2412 MHz

www.tuv.com



Data rate: 11 Mbps

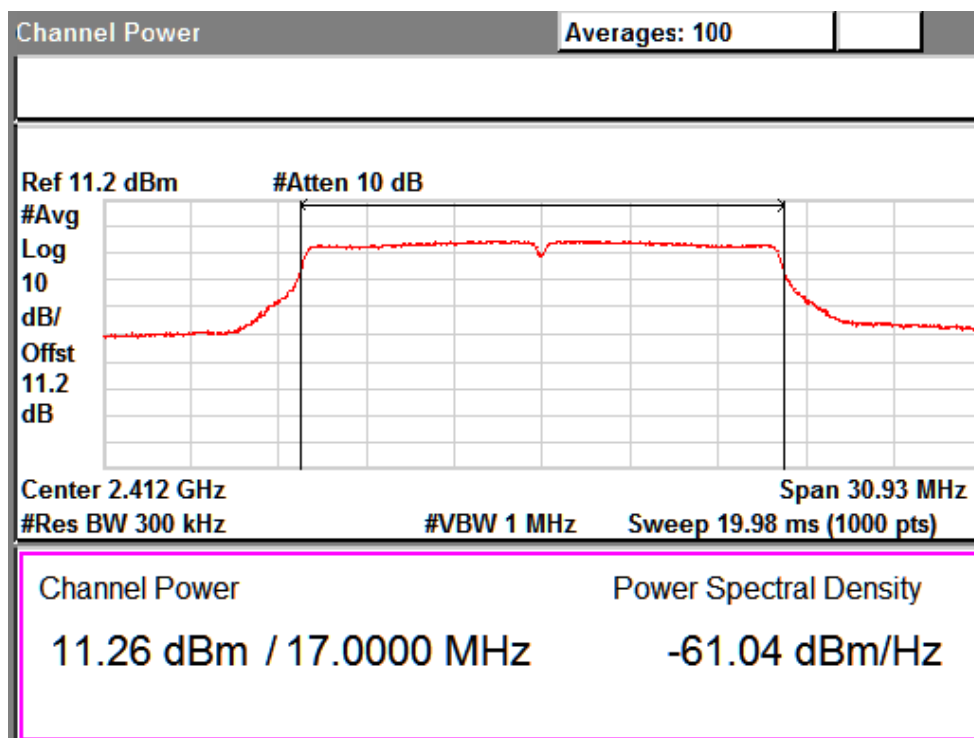
Channel Frequency: 2442 MHz



Data rate: 11 Mbps

Channel Frequency: 2462 MHz

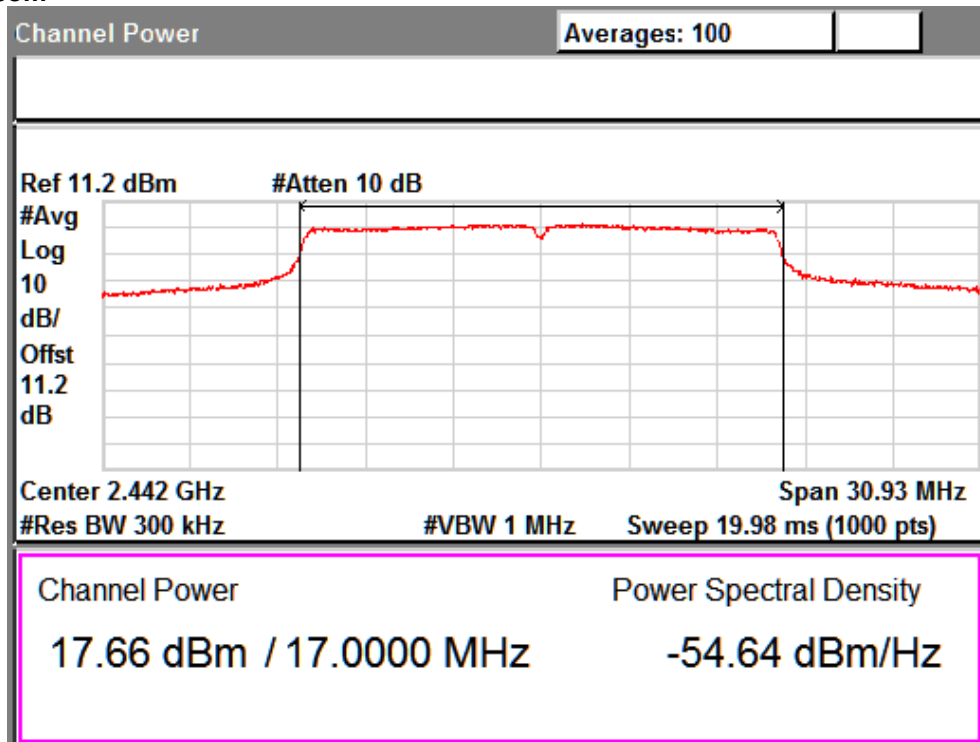
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Margin (dB)
g	6	2412	11.26	30.00	-18.74
		2442	17.66	30.00	-12.34
		2462	09.79	30.00	-20.21
	24	2412	11.09	30.00	-18.91
		2442	17.69	30.00	-12.31
		2462	10.30	30.00	-19.7
	54	2412	11.18	30.00	-18.82
		2442	17.74	30.00	-12.26
		2462	10.29	30.00	-19.71



Data rate: 6 Mbps

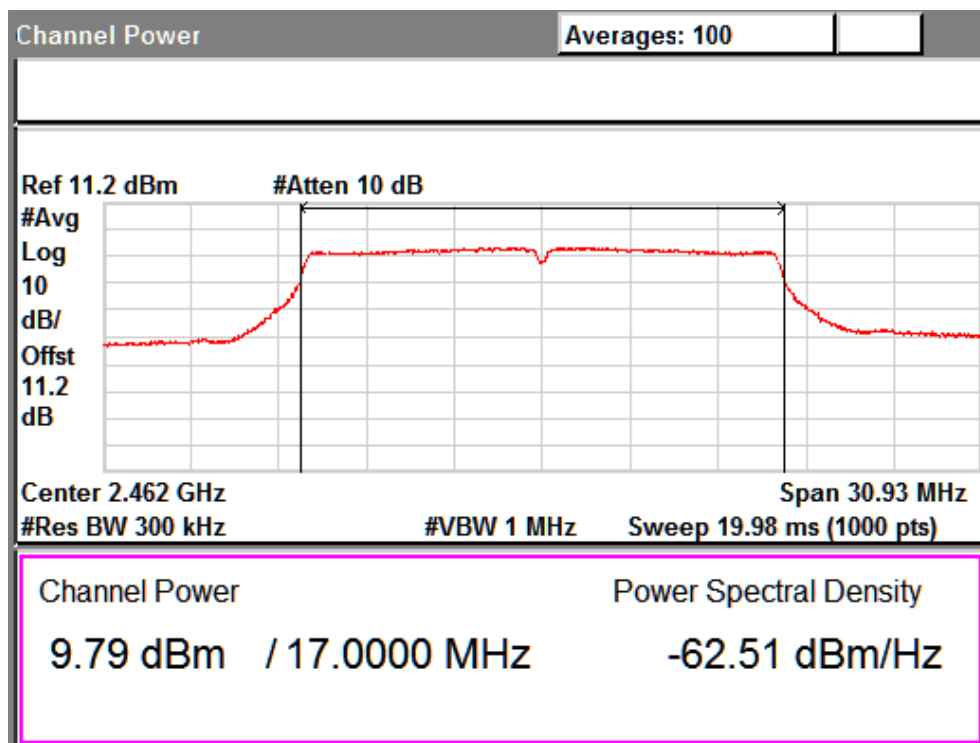
Channel Frequency: 2412 MHz

www.tuv.com



Data rate: 6 Mbps

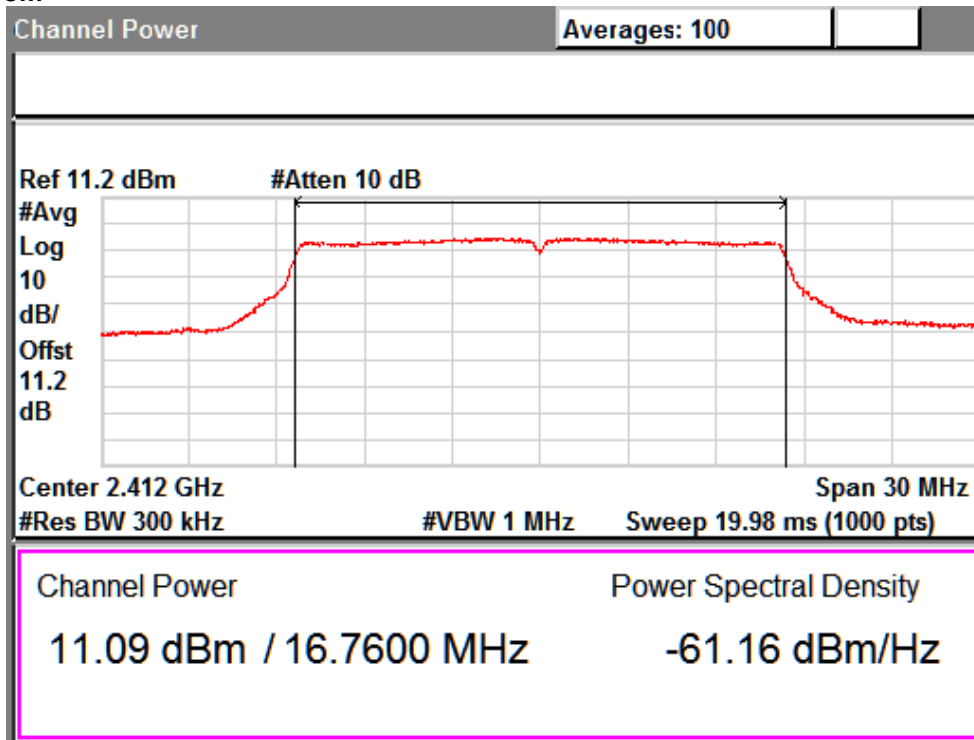
Channel Frequency: 2442 MHz



Data rate: 6 Mbps

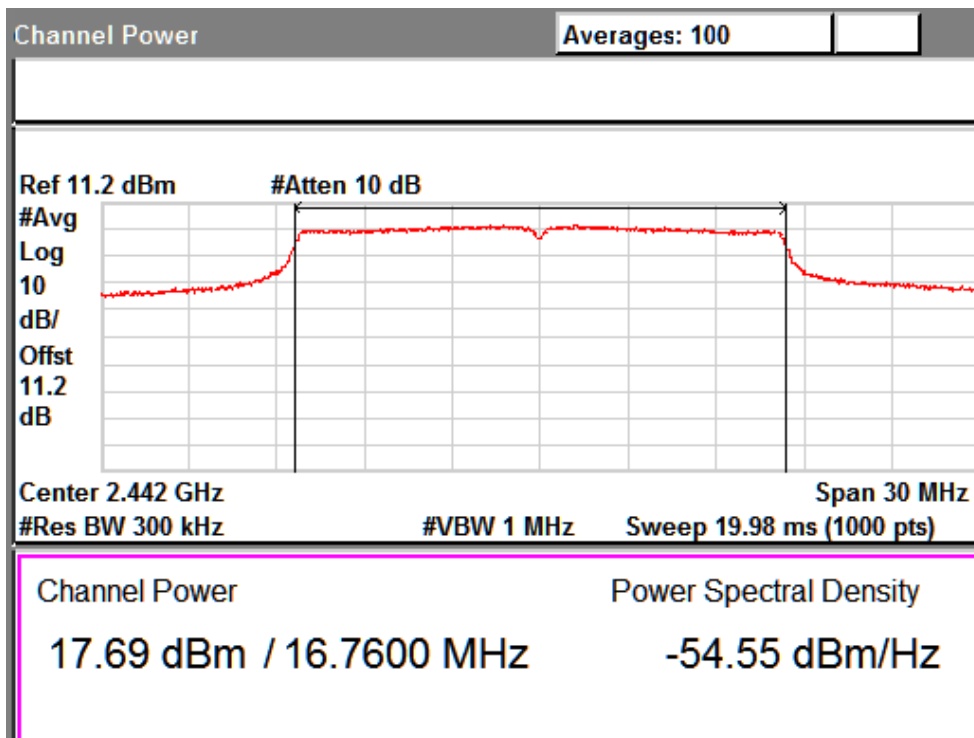
Channel Frequency: 2462 MHz

www.tuv.com



Data rate: 24 Mbps

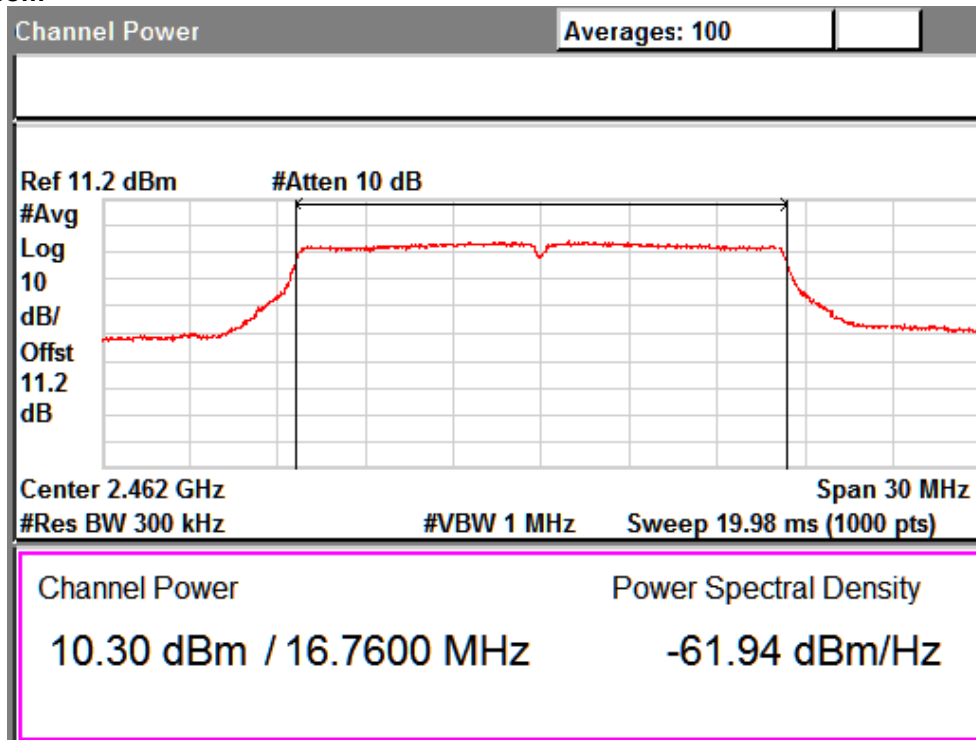
Channel Frequency: 2412 MHz



Data rate: 24 Mbps

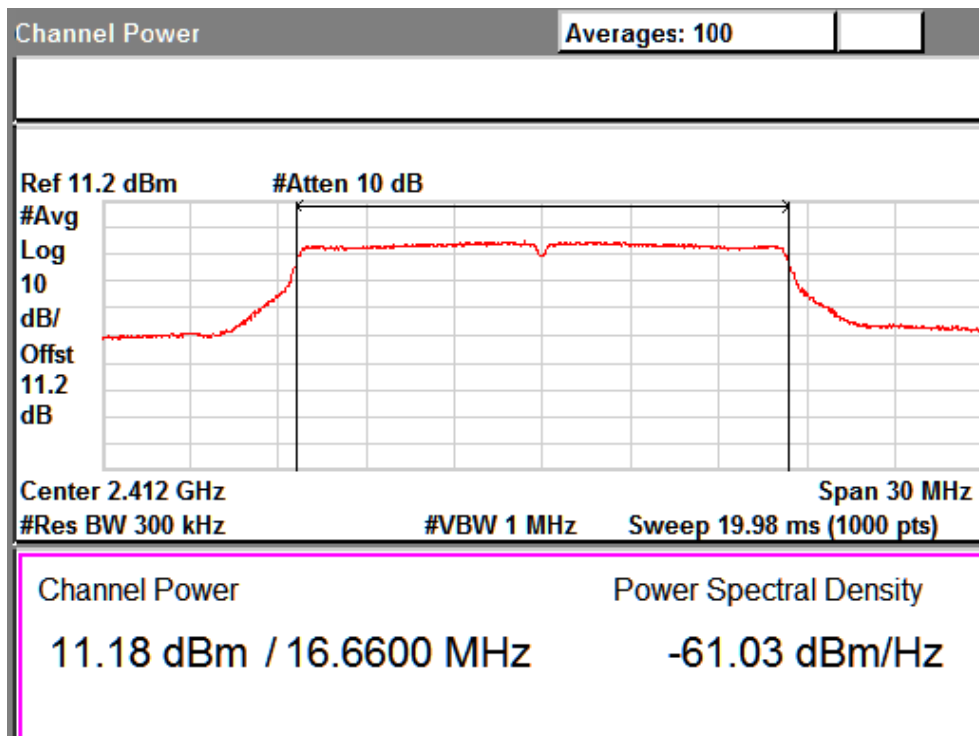
Channel Frequency: 2442 MHz

www.tuv.com



Data rate: 24 Mbps

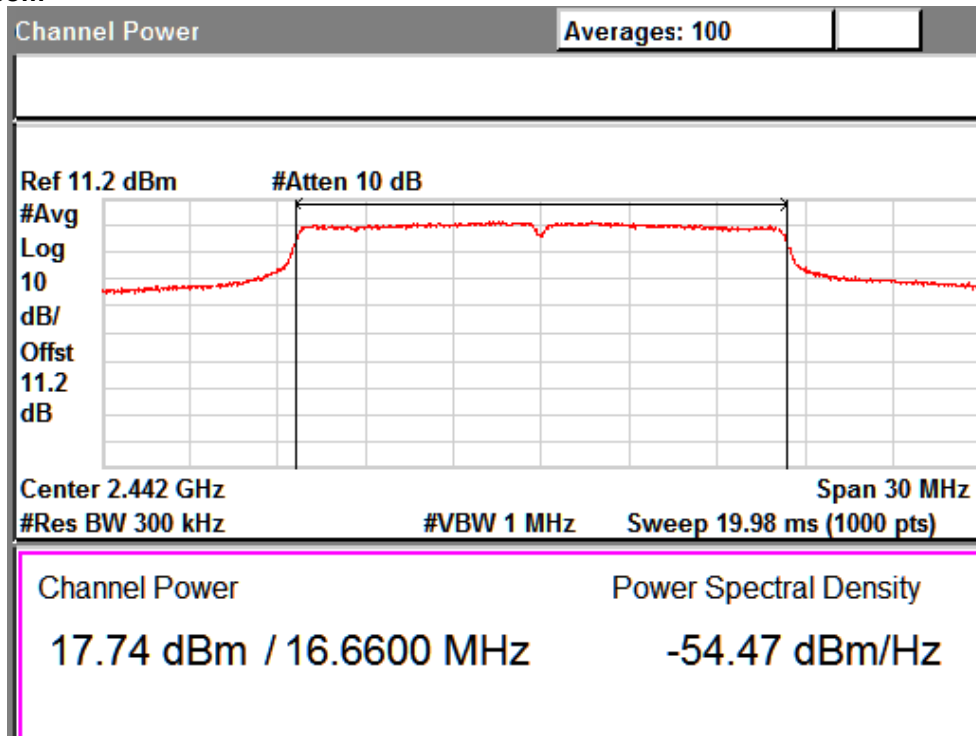
Channel Frequency: 2462 MHz



Data rate: 54 Mbps

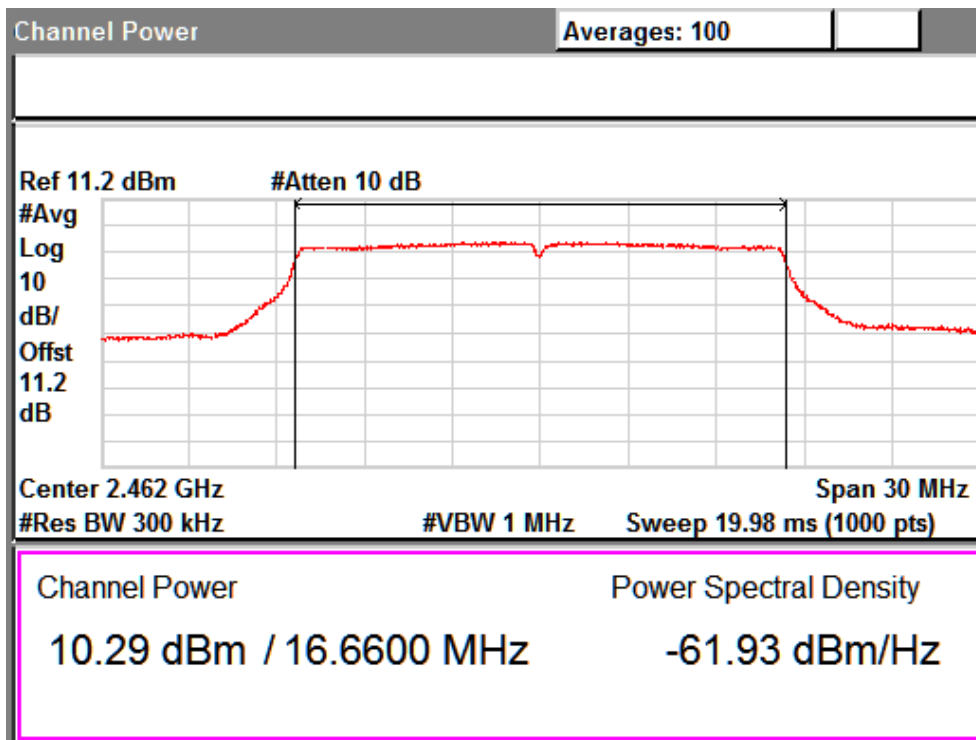
Channel Frequency: 2412 MHz

www.tuv.com



Data rate: 54 Mbps

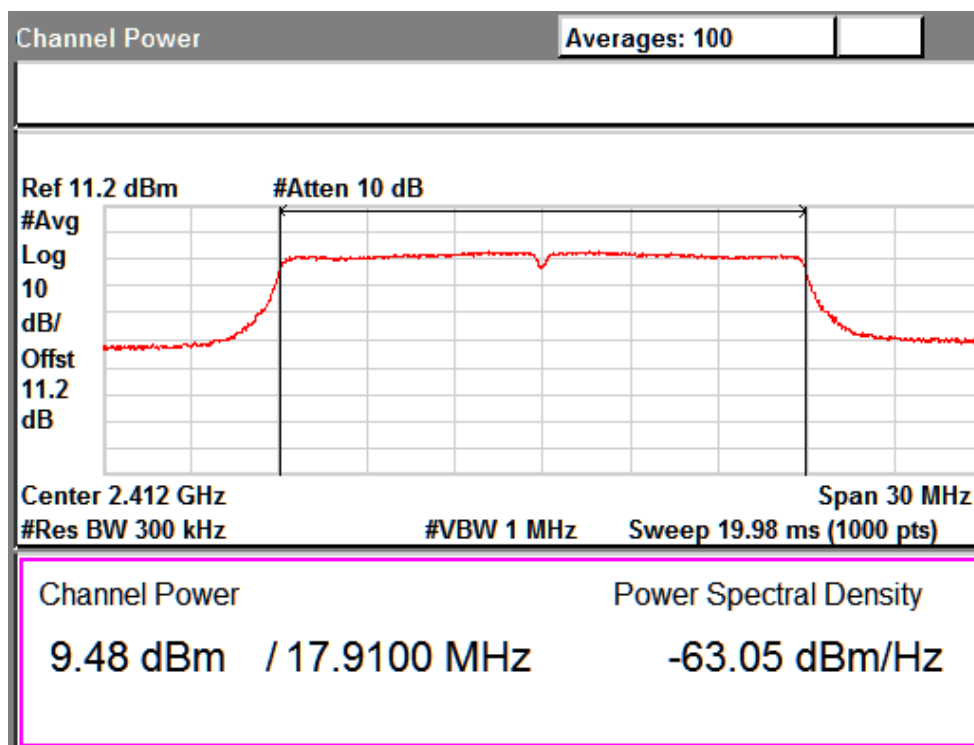
Channel Frequency: 2442 MHz



Data rate: 54 Mbps

Channel Frequency: 2462 MHz

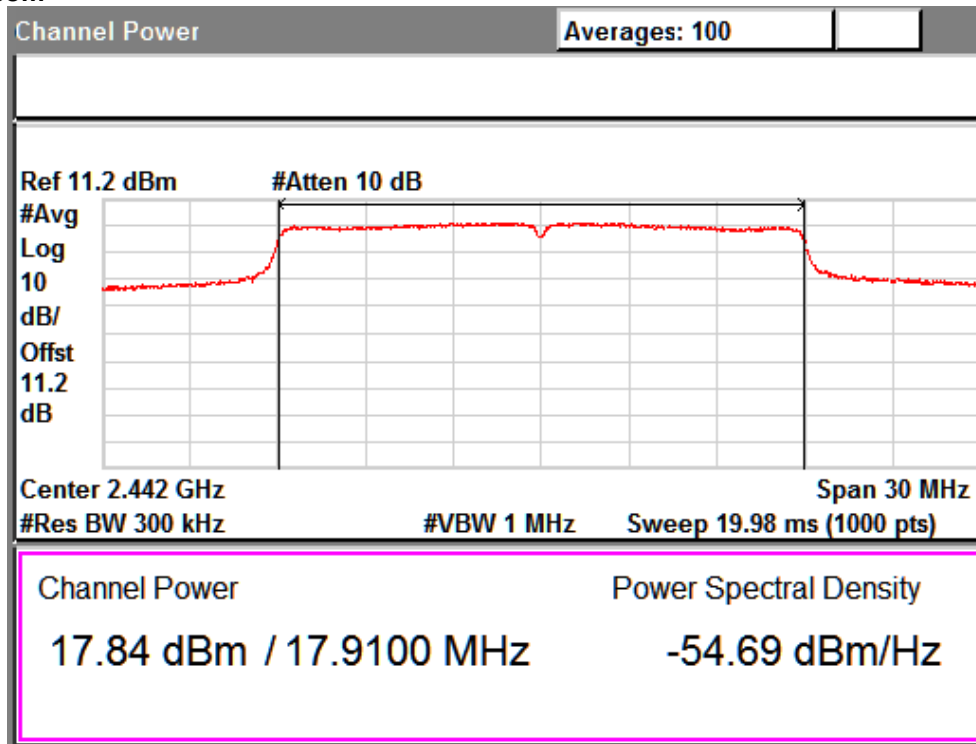
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Margin (dB)
n	6.5	2412.00	09.48	30.00	-20.52
		2442.00	17.84	30.00	-12.16
		2462.00	06.06	30.00	-23.94
	39	2412.00	09.84	30.00	-20.16
		2442.00	17.68	30.00	-12.32
		2462.00	08.07	30.00	-21.93
	65	2412.00	09.38	30.00	-20.62
		2442.00	17.85	30.00	-12.15
		2462.00	08.07	30.00	-21.93



Data Rate: 6.5 Mbps

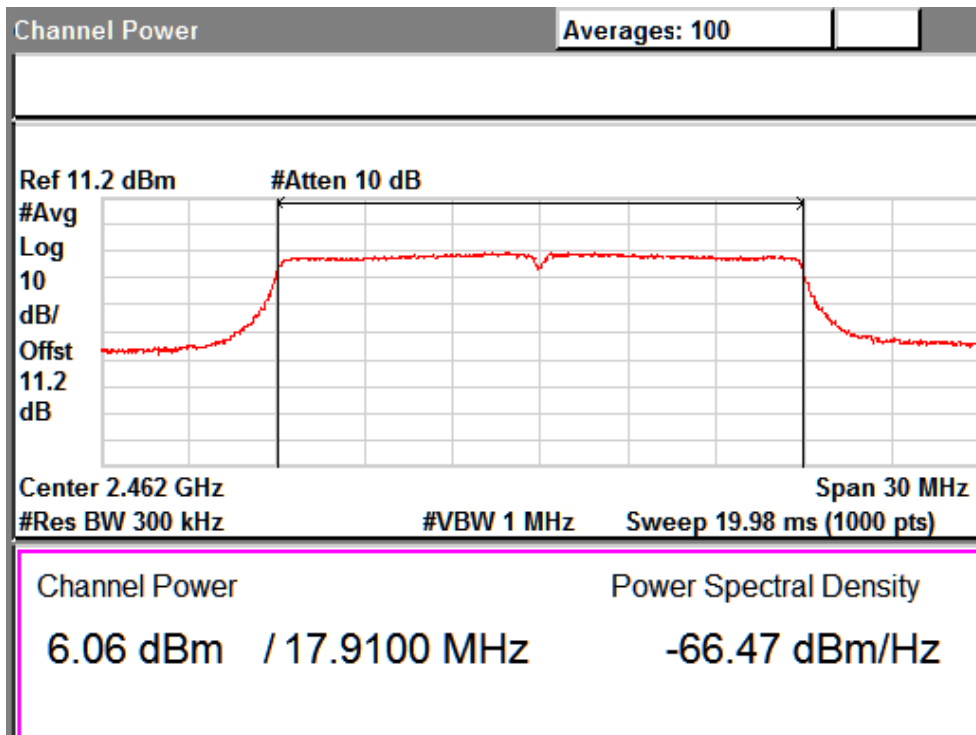
Channel Frequency: 2412 MHz

www.tuv.com



Data Rate: 6.5 Mbps

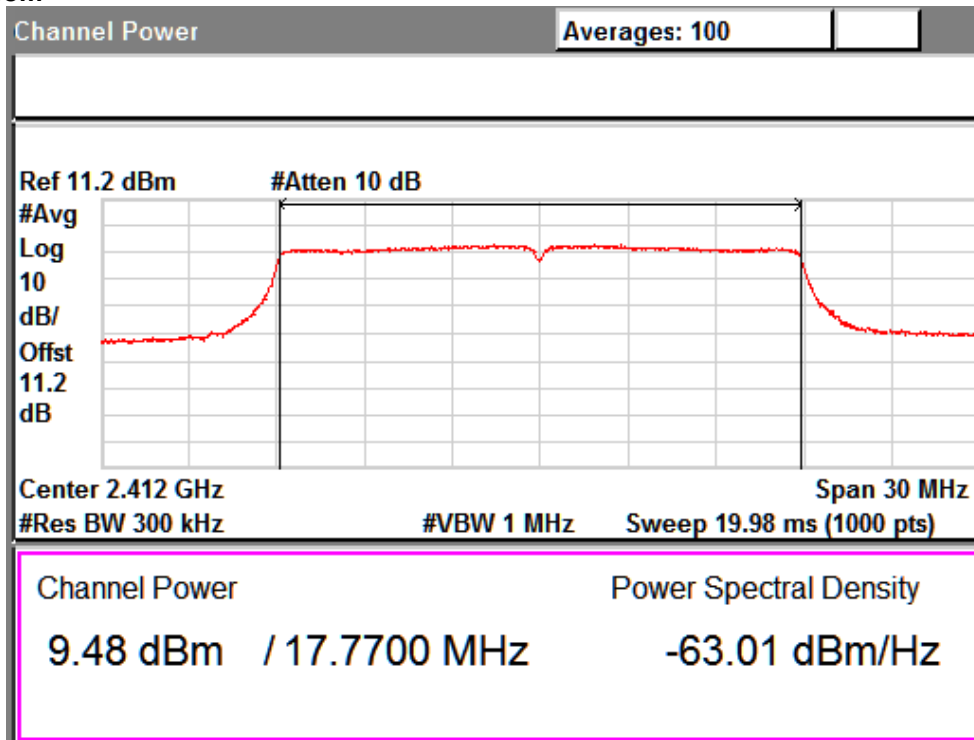
Channel Frequency: 2442 MHz



Data Rate: 6.5 Mbps

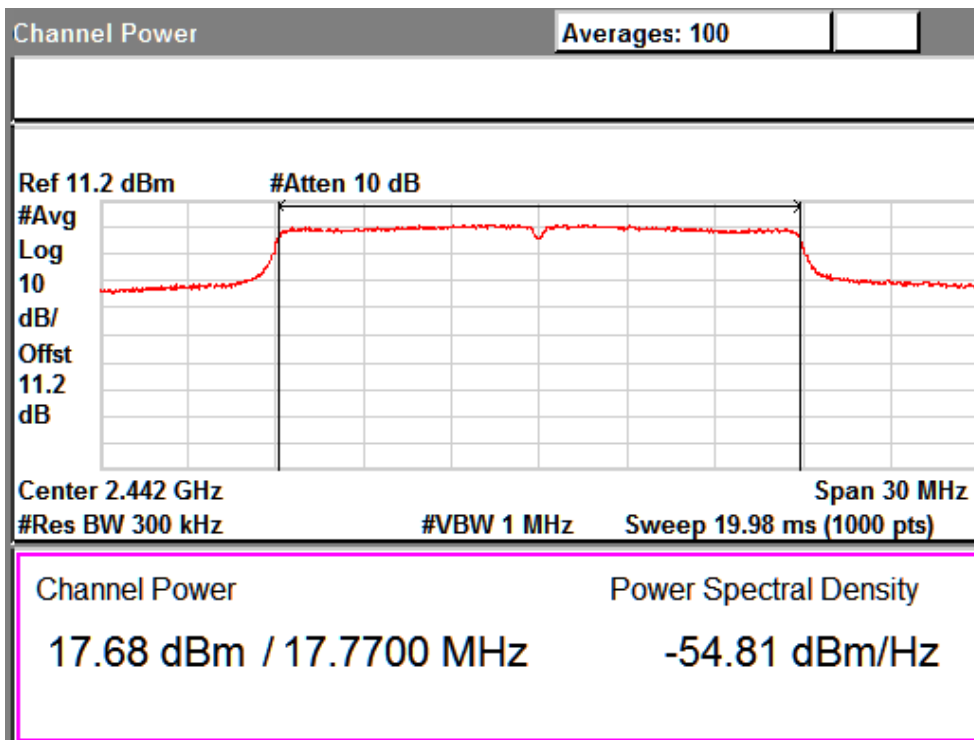
Channel Frequency: 2462 MHz

www.tuv.com



Data Rate: 39 Mbps

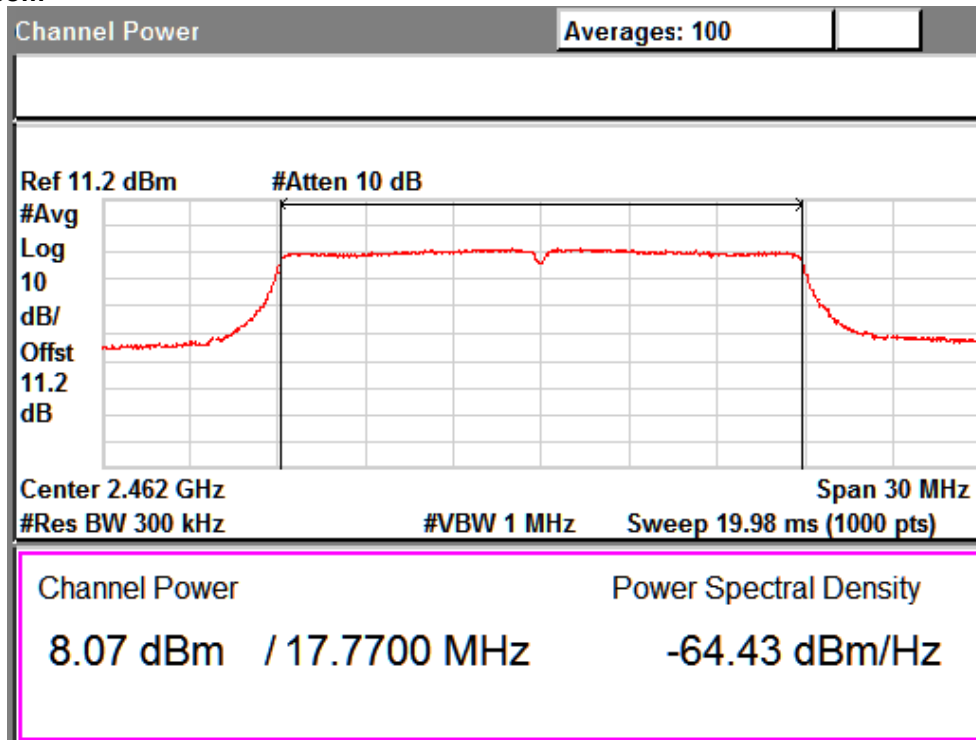
Channel Frequency: 2412 MHz



Data Rate: 39 Mbps

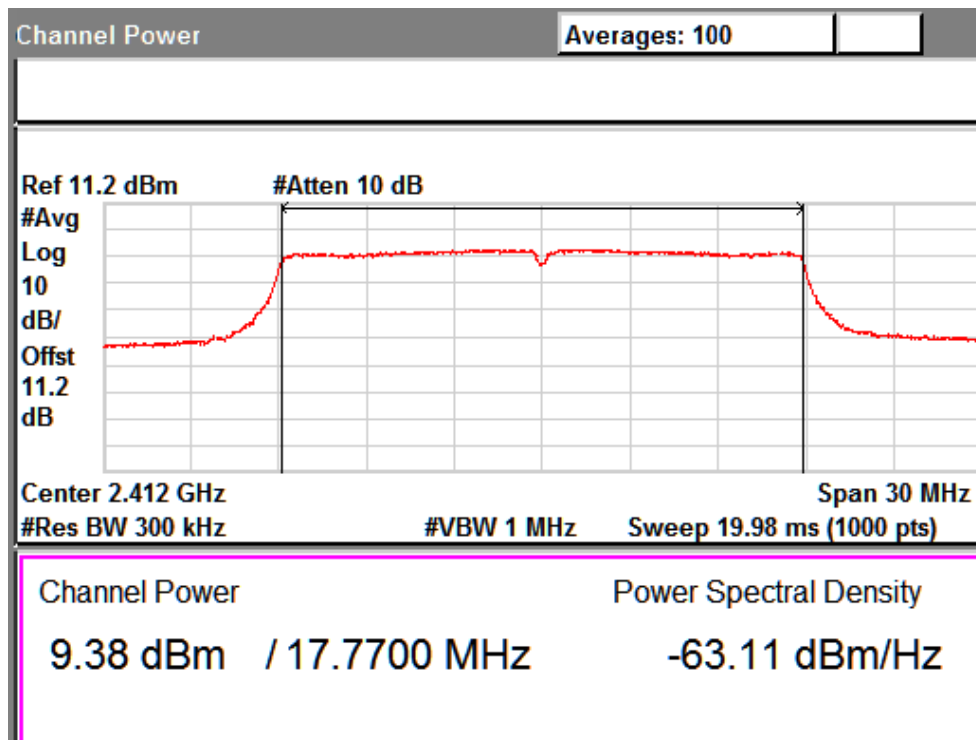
Channel Frequency: 2442 MHz

www.tuv.com



Data Rate: 39 Mbps

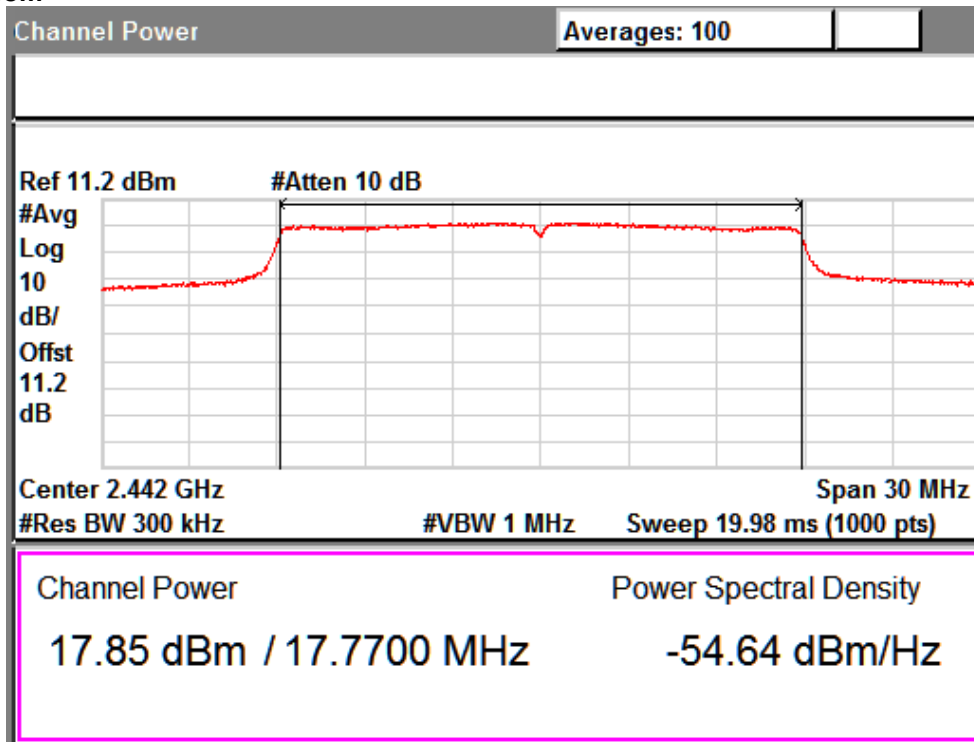
Channel Frequency: 2462 MHz



Data Rate: 65 Mbps

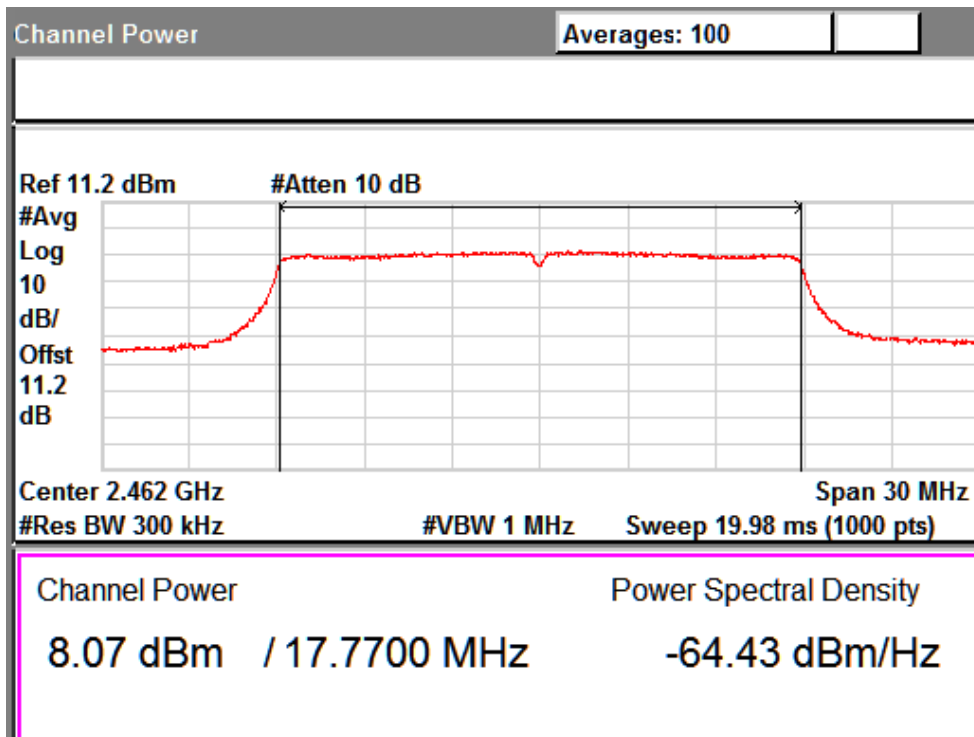
Channel Frequency: 2412 MHz

www.tuv.com



Data Rate: 65 Mbps

Channel Frequency: 2442 MHz



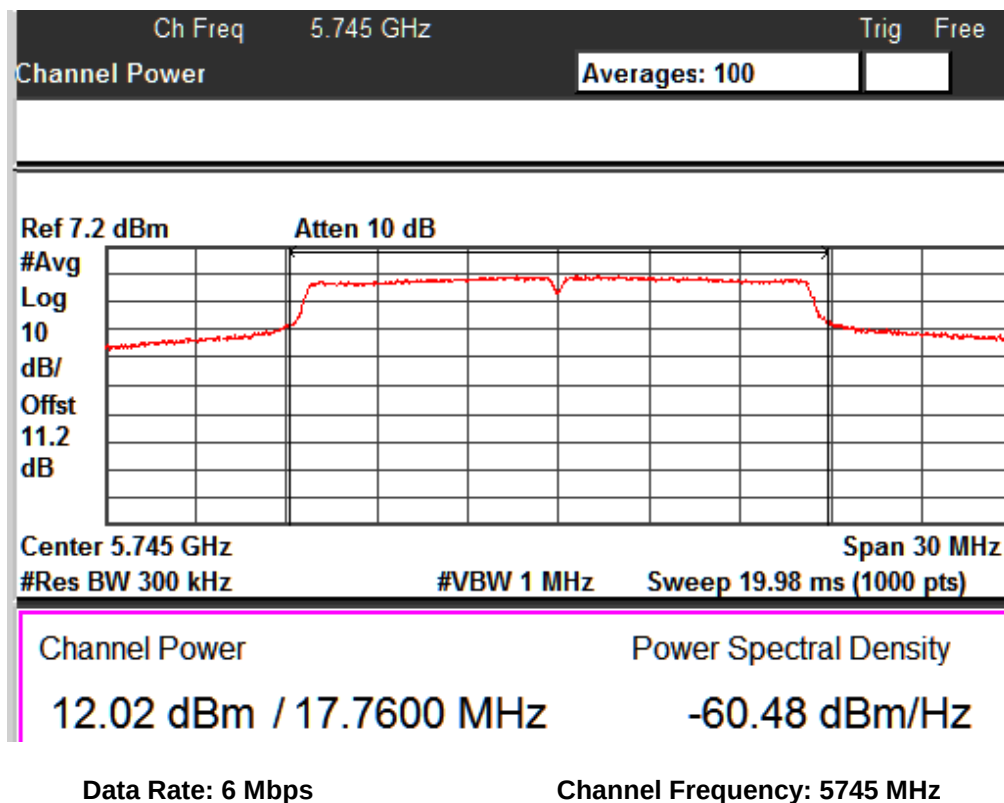
Data Rate: 65 Mbps

Channel Frequency: 2462 MHz

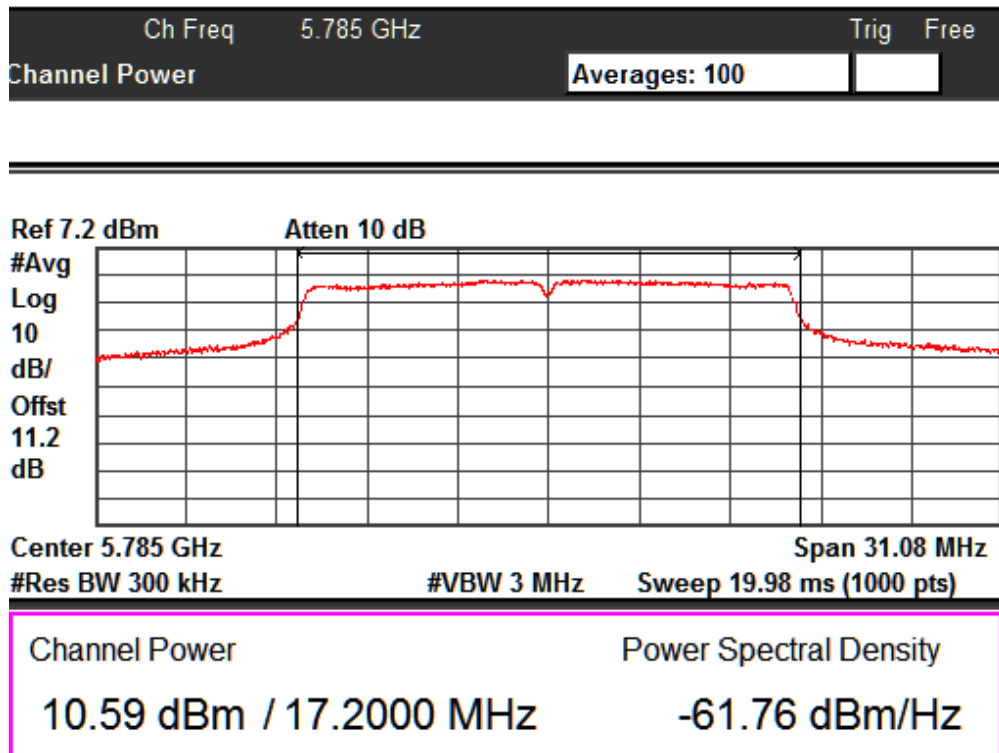
www.tuv.com

5GHz Band

802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Margin (dB)
a	6	5745	12.02	30.00	-17.98
		5785	10.59	30.00	-19.41
		5825	10.18	30.00	-19.82
	24	5745	11.97	30.00	-18.03
		5785	10.51	30.00	-19.49
		5825	10.12	30.00	-19.88
	54	5745	12.02	30.00	-17.98
		5785	10.42	30.00	-19.58
		5825	10.17	30.00	-19.83

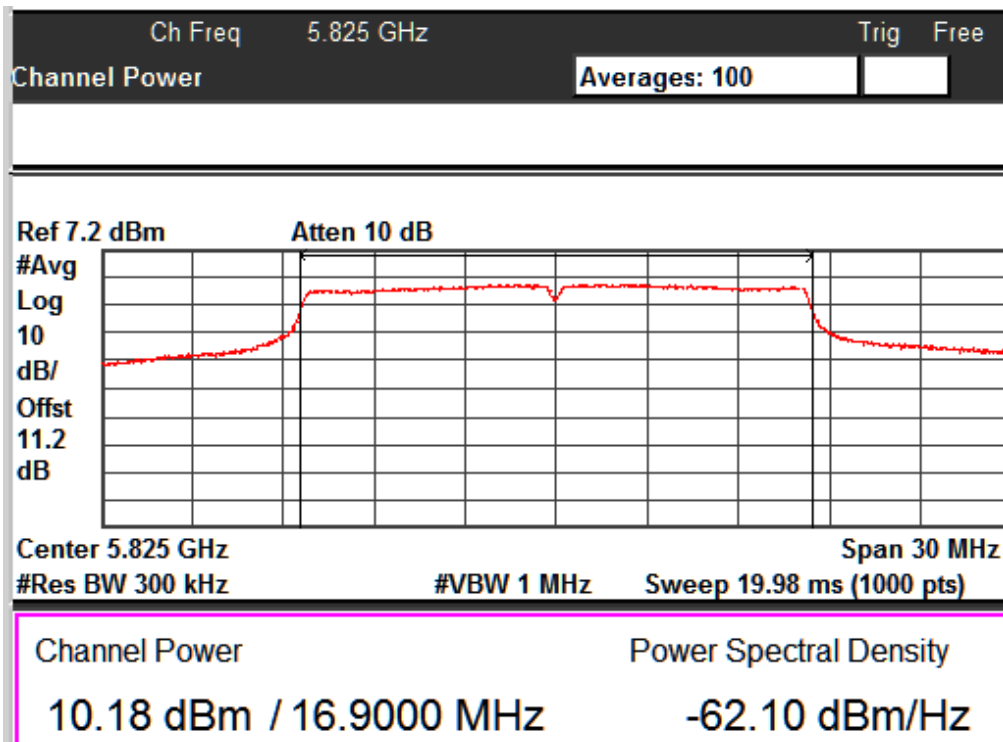


www.tuv.com



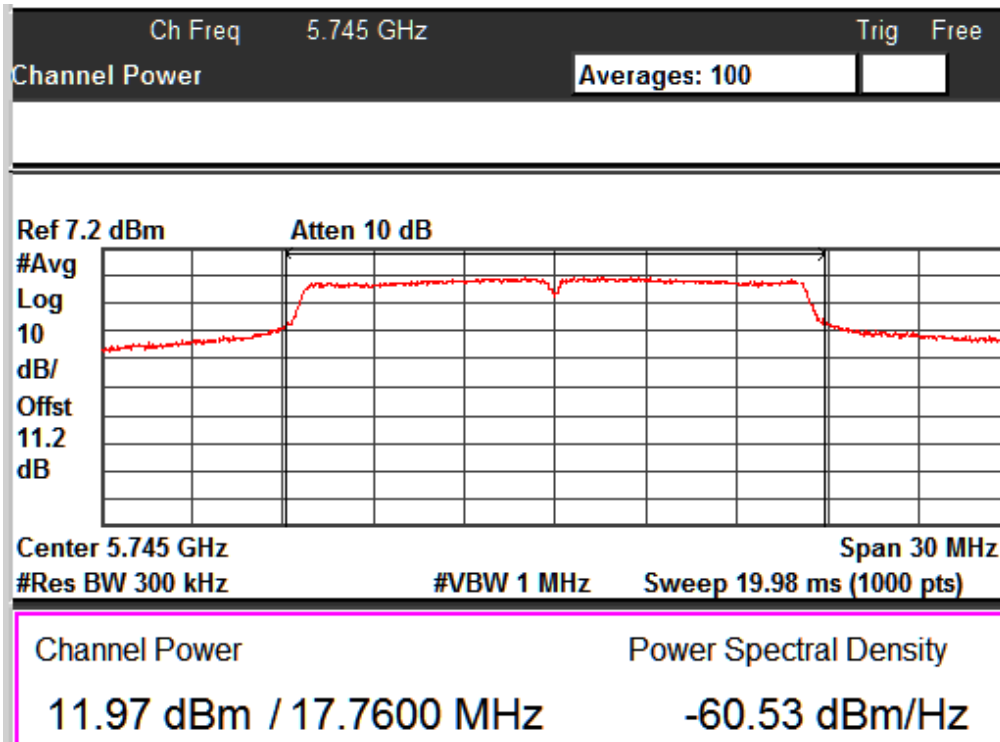
Data Rate: 6 Mbps

Channel Frequency: 5785 MHz



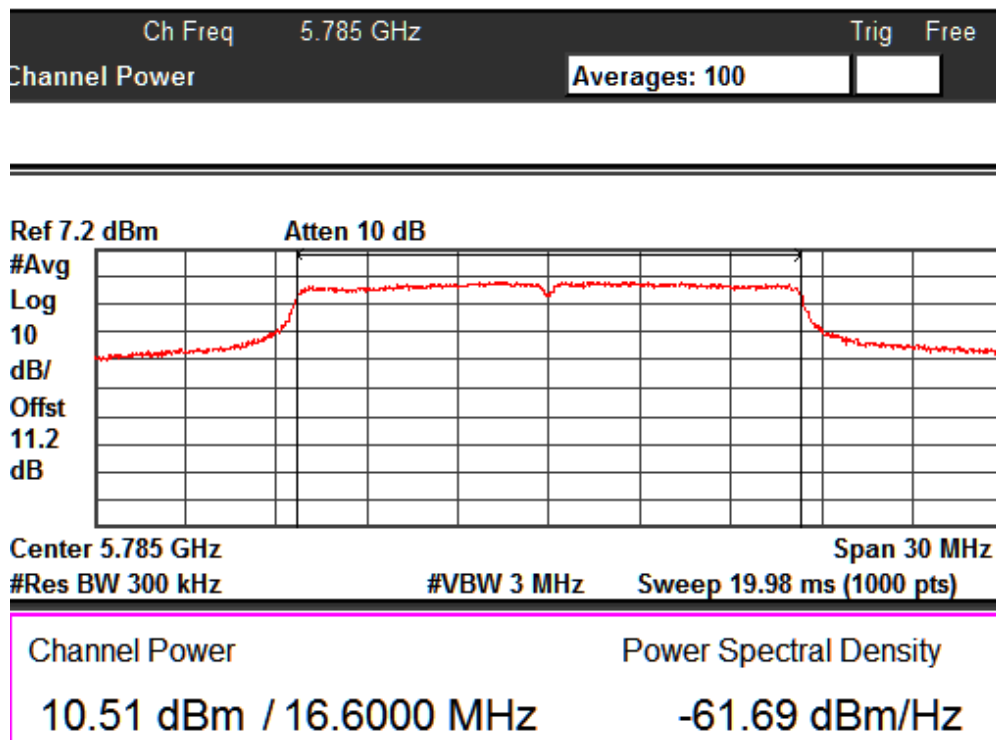
Data Rate: 6 Mbps

Channel Frequency: 5825 MHz



Data Rate: 24 Mbps

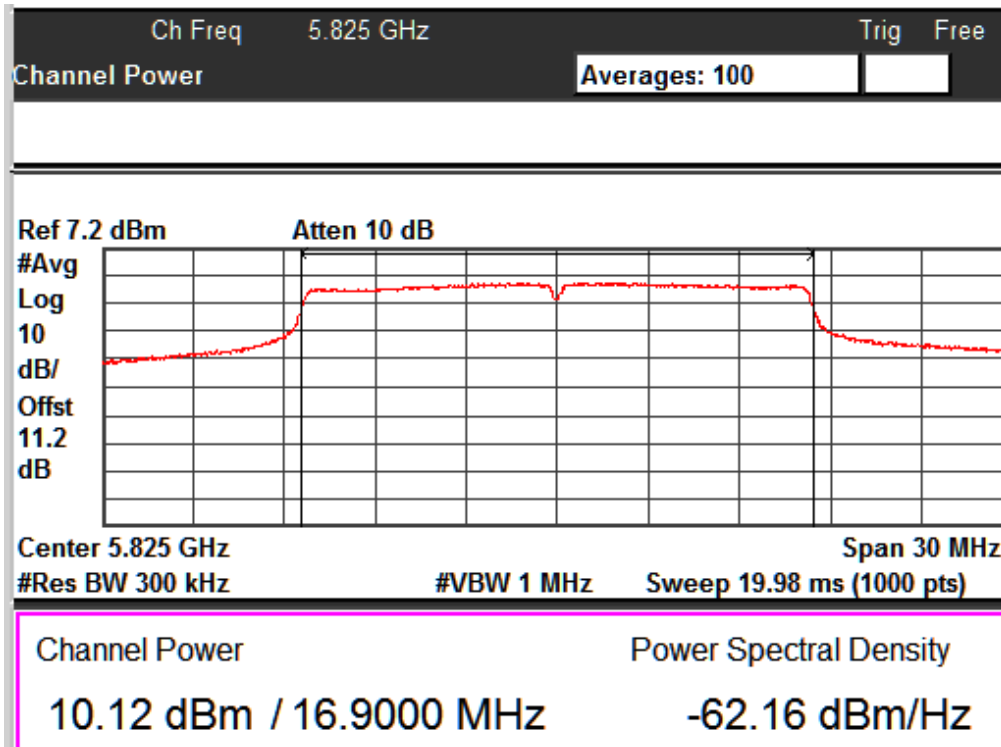
Channel Frequency: 5745 MHz



Data Rate: 24 Mbps

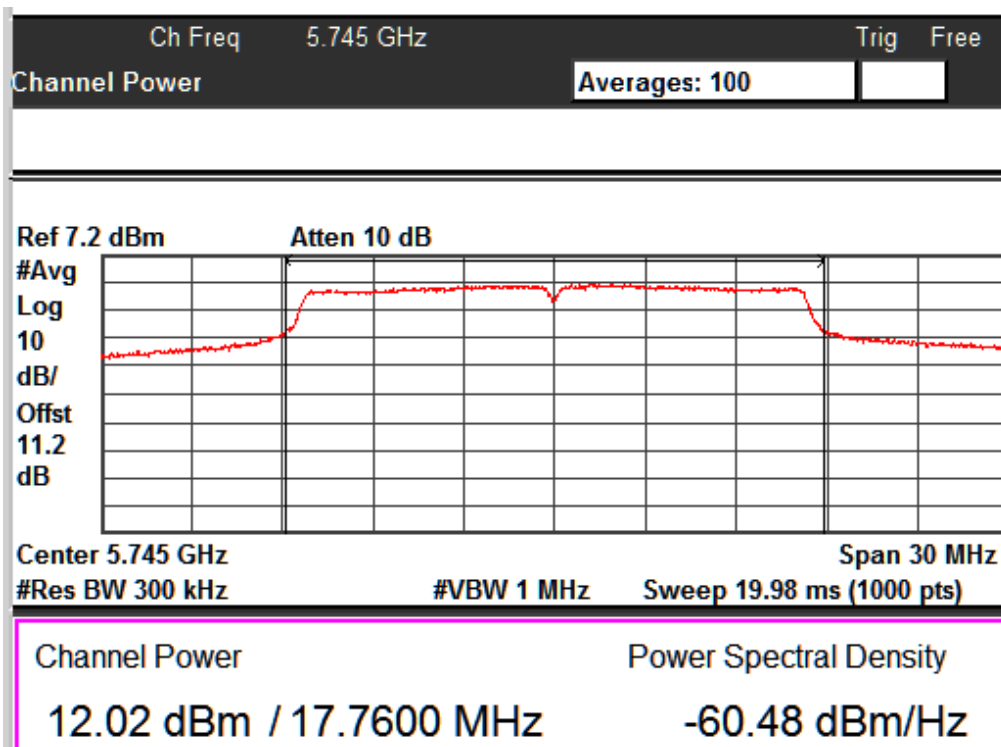
Channel Frequency: 5785 MHz

www.tuv.com



Data Rate: 24 Mbps

Channel Frequency: 5825 MHz

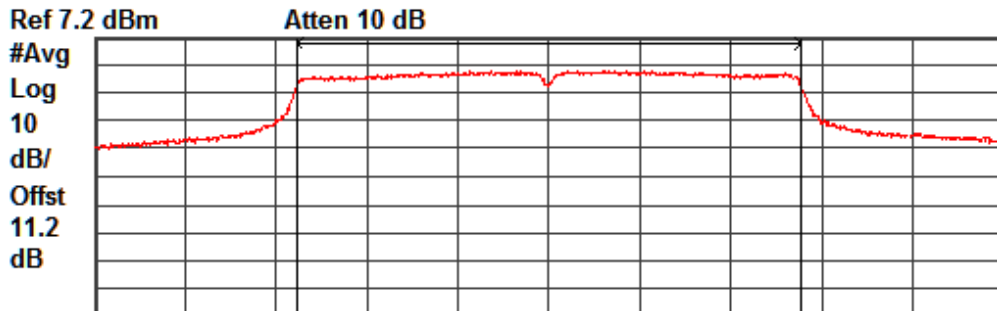


Data Rate: 54 Mbps

Channel Frequency: 5745 MHz

www.tuv.com

Ch Freq	5.785 GHz	Trig	Free
Channel Power	Averages: 100		



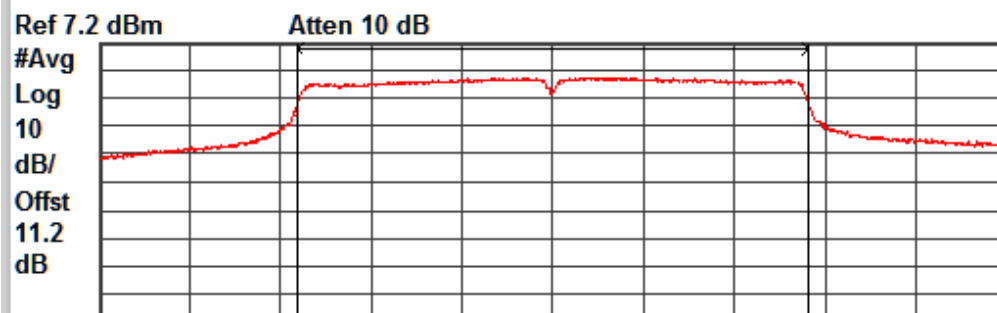
Center 5.785 GHz Span 30 MHz
#Res BW 300 kHz #VBW 3 MHz Sweep 19.98 ms (1000 pts)

Channel Power	Power Spectral Density
10.42 dBm / 16.6000 MHz	-61.78 dBm/Hz

Data Rate: 54 Mbps

Channel Frequency: 5785 MHz

Ch Freq	5.825 GHz	Trig	Free
Channel Power	Averages: 100		



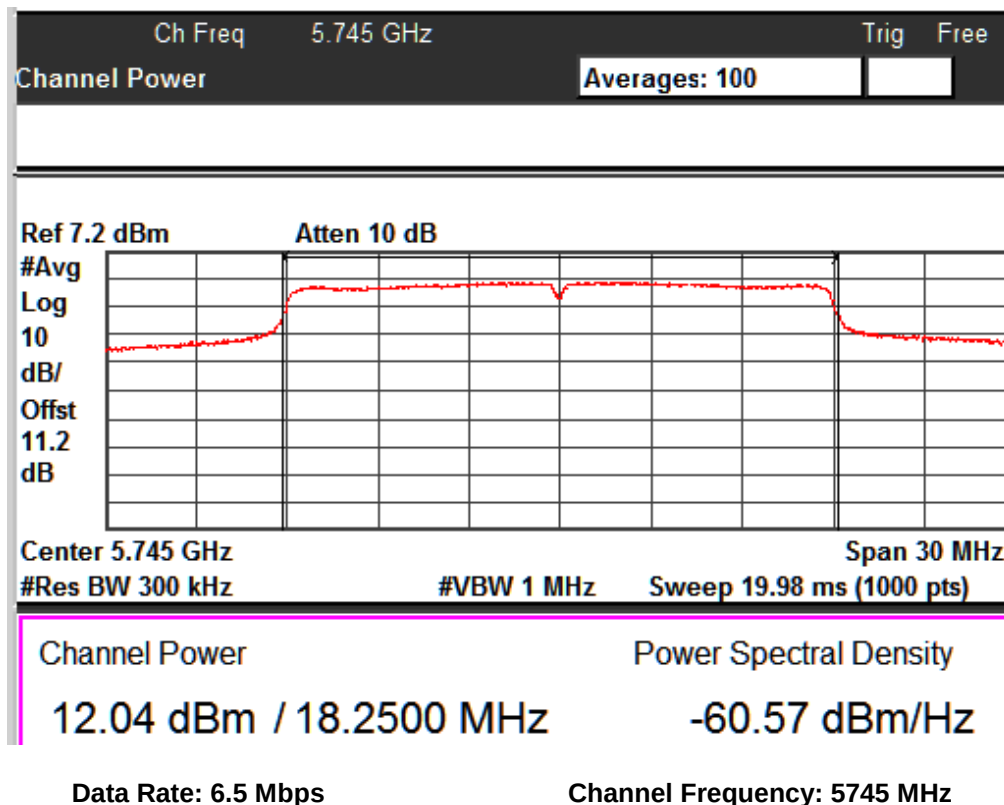
Center 5.825 GHz Span 30 MHz
#Res BW 300 kHz #VBW 1 MHz Sweep 19.98 ms (1000 pts)

Channel Power	Power Spectral Density
10.17 dBm / 16.9000 MHz	-62.10 dBm/Hz

Data Rate: 54 Mbps

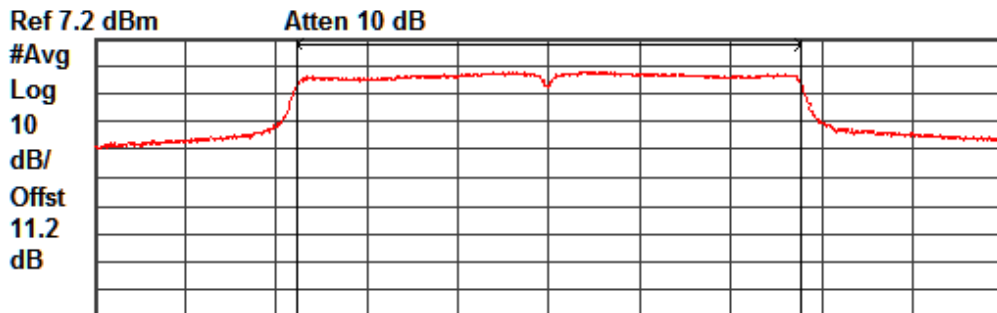
Channel Frequency: 5825 MHz

802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Margin (dB)
n	6.5	5745	12.04	30.00	-17.96
		5785	10.75	30.00	-19.25
		5825	10.54	30.00	-19.46
	39	5745	12.08	30.00	-17.92
		5785	10.69	30.00	-19.31
		5825	10.51	30.00	-19.49
	65	5745	12.05	30.00	-17.95
		5785	10.64	30.00	-19.36
		5825	10.34	30.00	-19.66



www.tuv.com

Ch Freq	5.785 GHz	Trig	Free
Channel Power	Averages: 100		



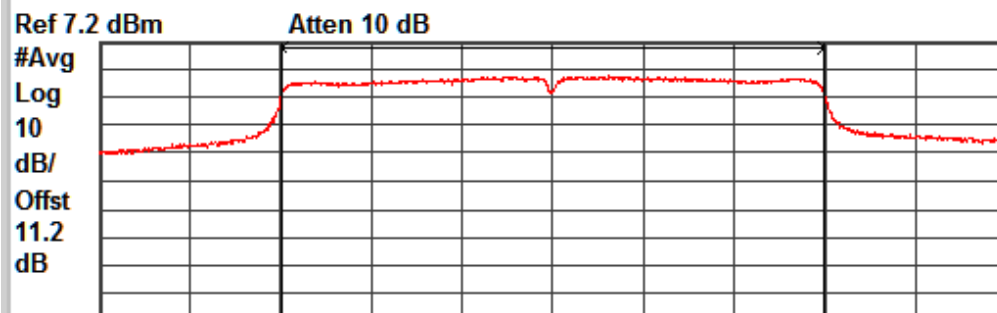
Center 5.785 GHz Span 31.99 MHz
#Res BW 300 kHz #VBW 3 MHz Sweep 19.98 ms (1000 pts)

Channel Power	Power Spectral Density
10.75 dBm / 17.7000 MHz	-61.73 dBm/Hz

Data Rate: 6.5 Mbps

Channel Frequency: 5785 MHz

Ch Freq	5.825 GHz	Trig	Free
Channel Power	Averages: 100		

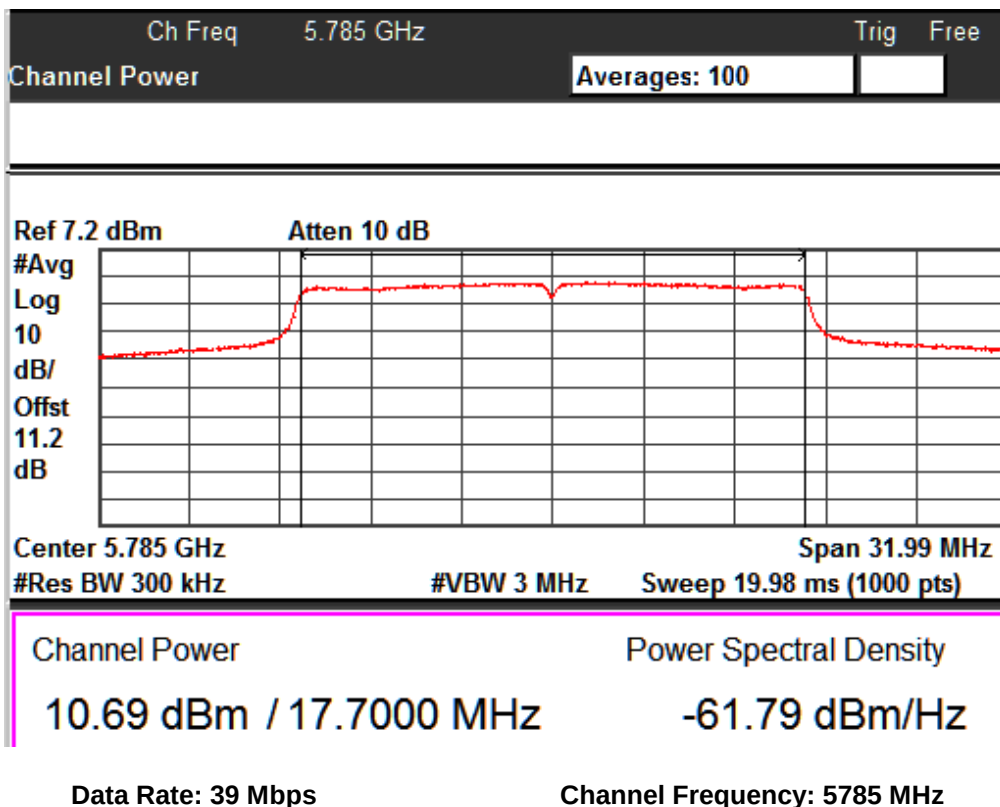
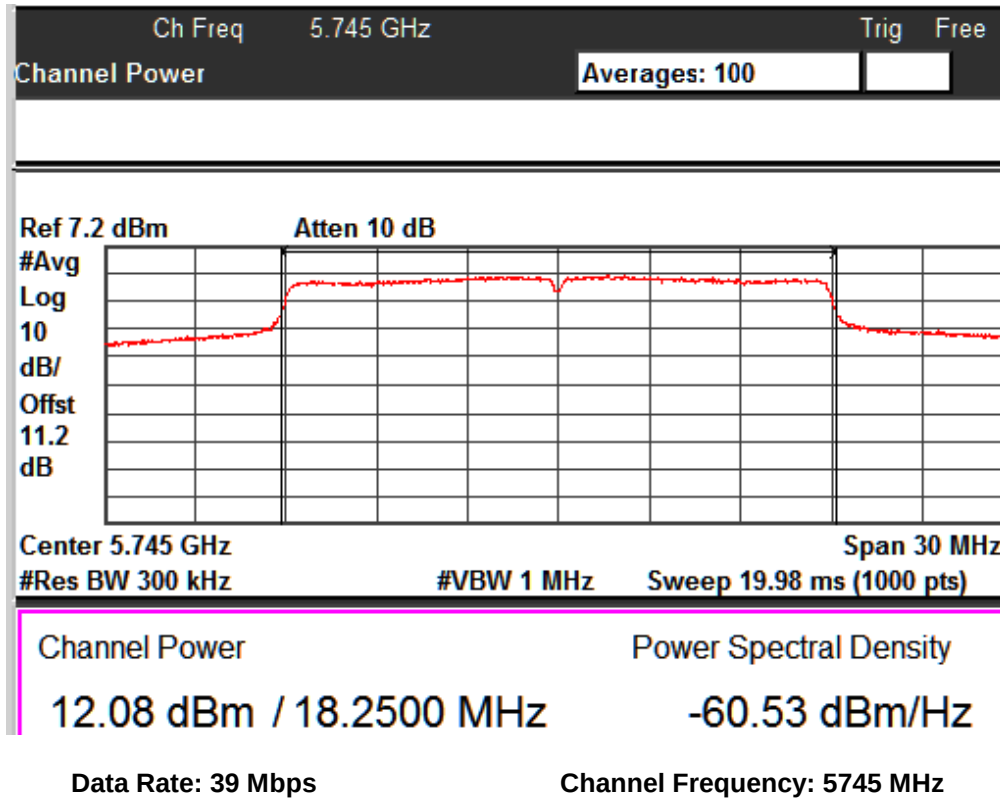


Center 5.825 GHz Span 30 MHz
#Res BW 300 kHz #VBW 1 MHz Sweep 19.98 ms (1000 pts)

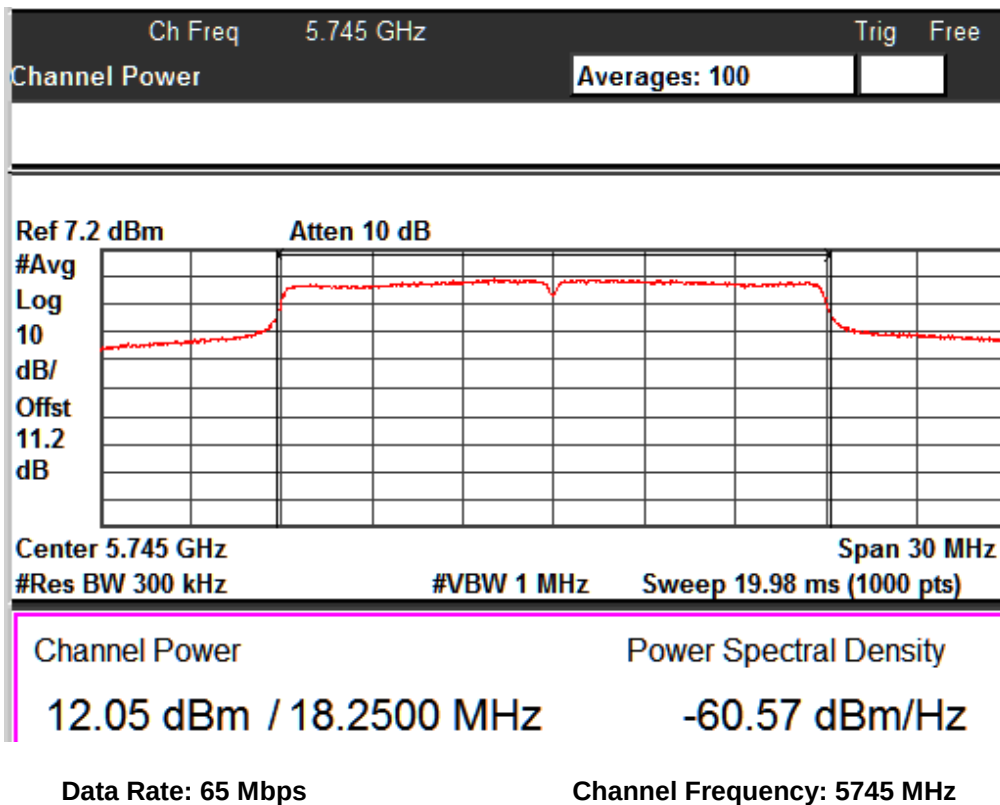
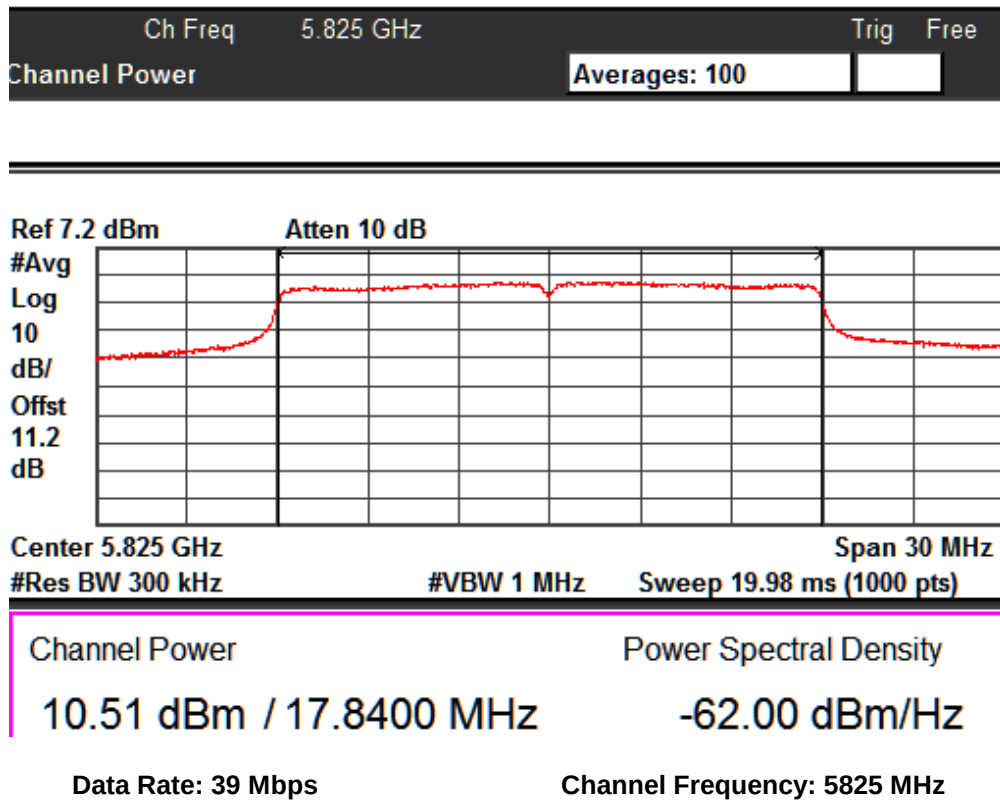
Channel Power	Power Spectral Density
10.54 dBm / 17.8400 MHz	-61.98 dBm/Hz

Data Rate: 6.5 Mbps

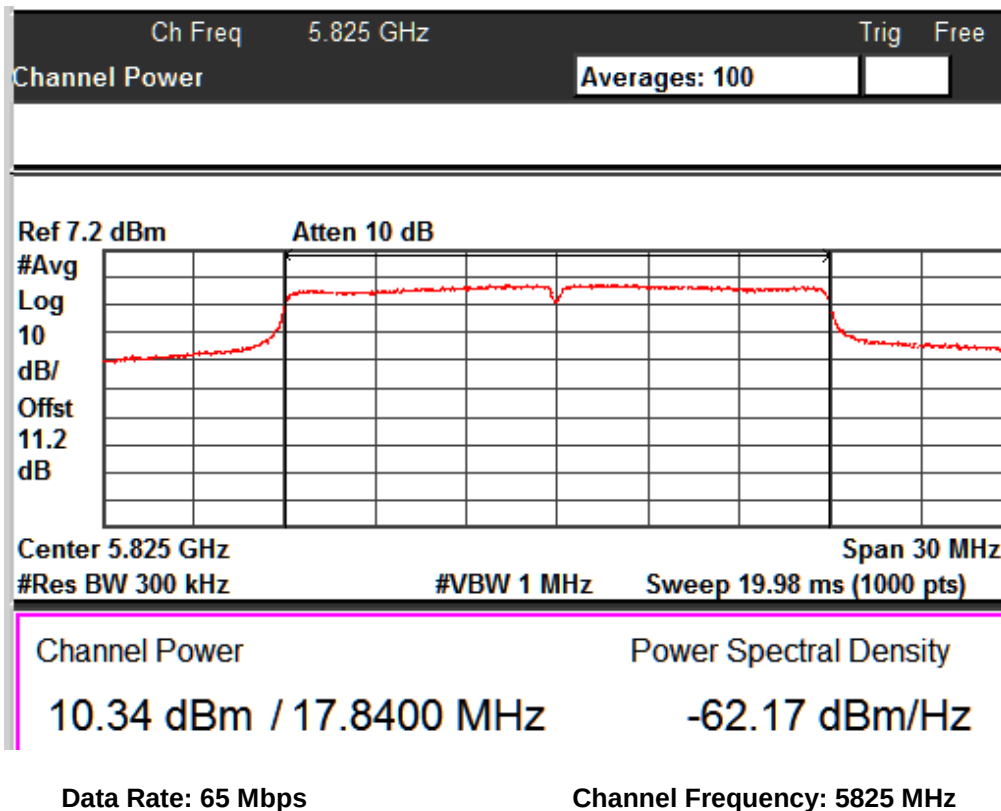
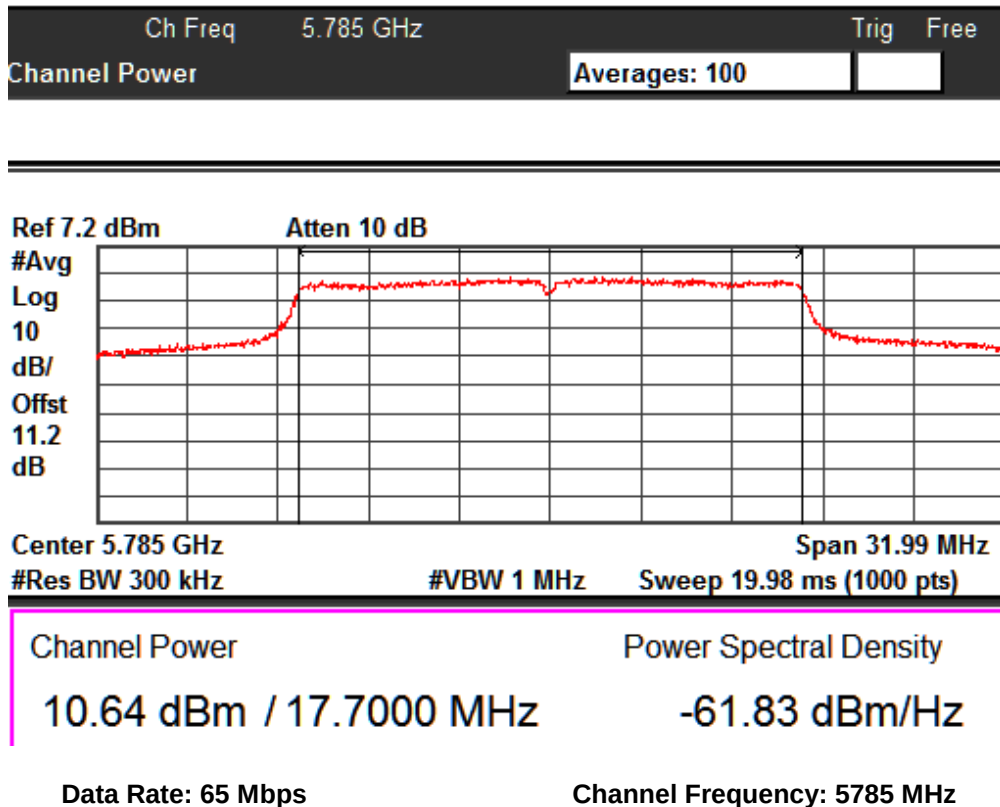
Channel Frequency: 5825 MHz



www.tuv.com

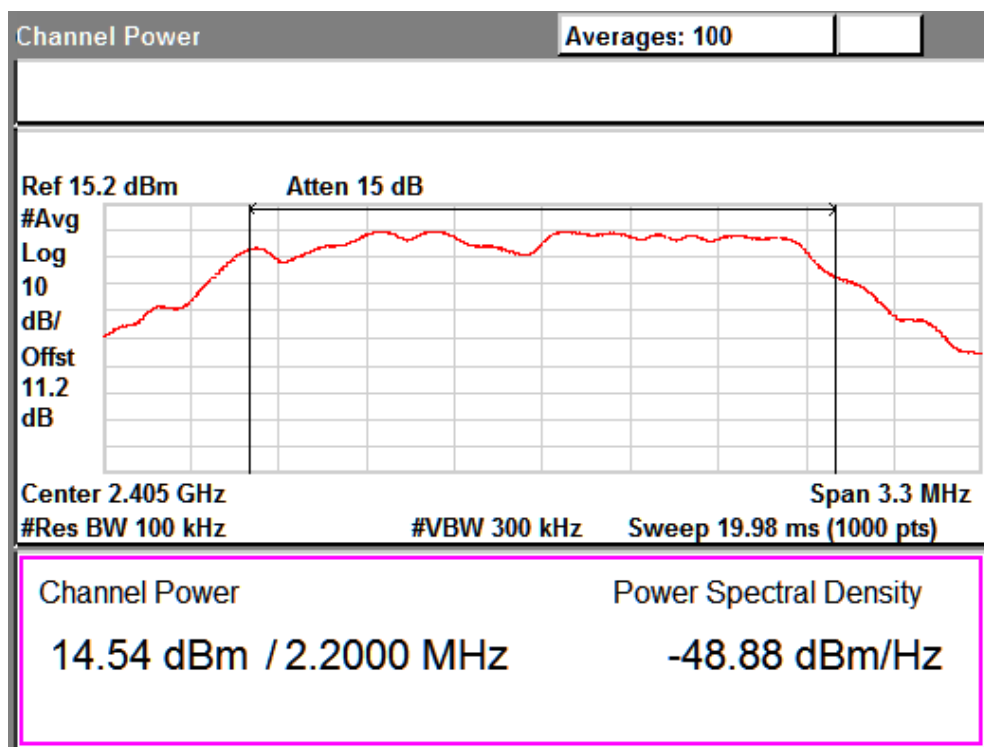


www.tuv.com

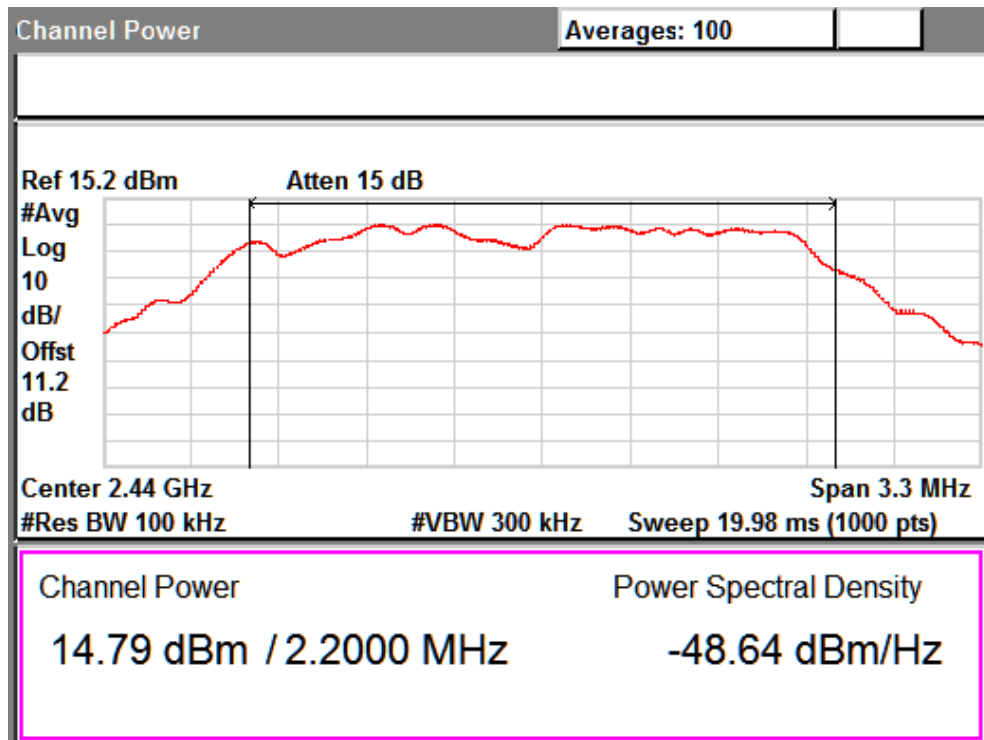


Test Result: ZigBee

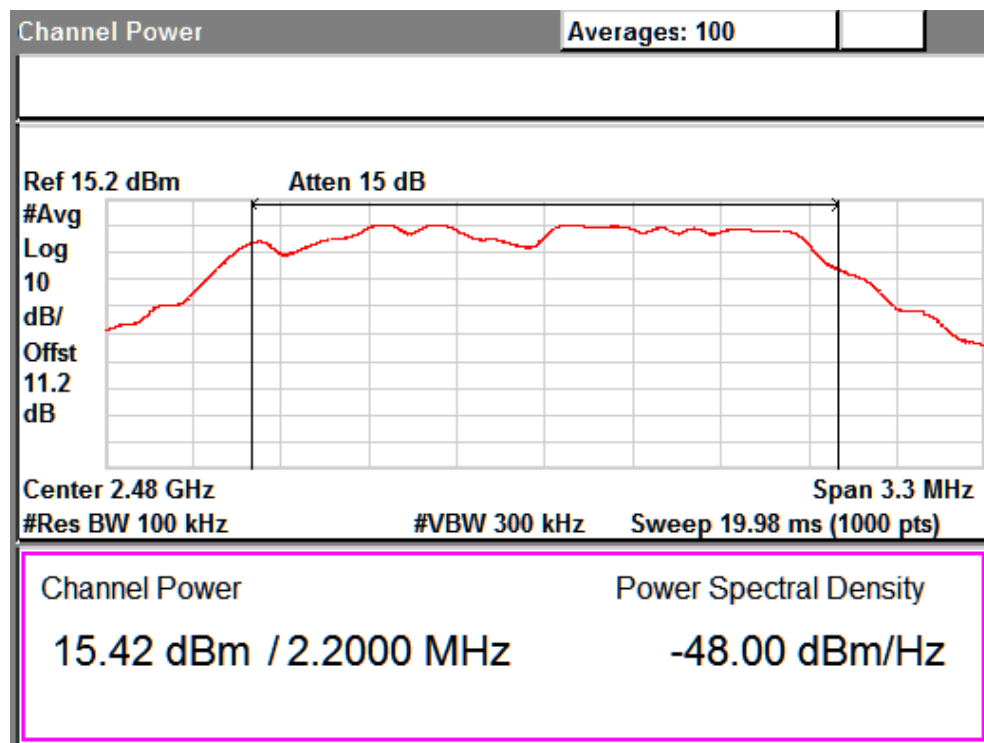
Channel Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Margin (dB)
2405.00	14.54	30.00	-15.46
2440.00	14.79	30.00	-15.21
2480.00	15.42	30.00	-14.58



Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz

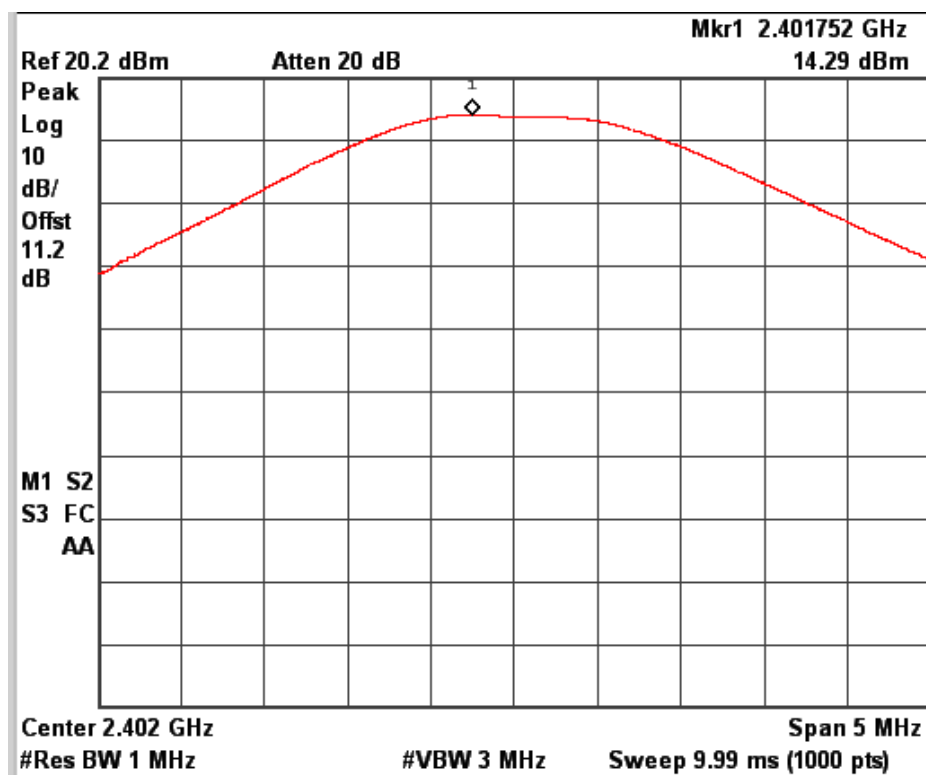


Channel Frequency: 2480 MHz

www.tuv.com

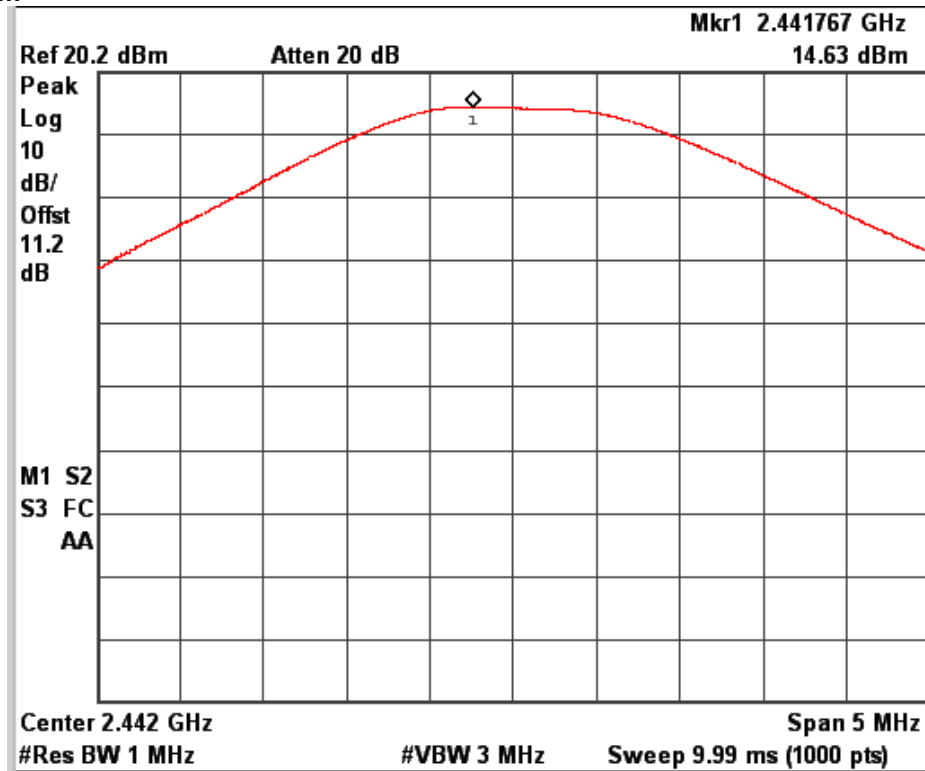
Test Result: Bluetooth LE

Channel Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Margin (dB)
2402.00	14.29	30.00	-15.71
2442.00	14.63	30.00	-15.37
2480.00	14.60	30.00	-15.40

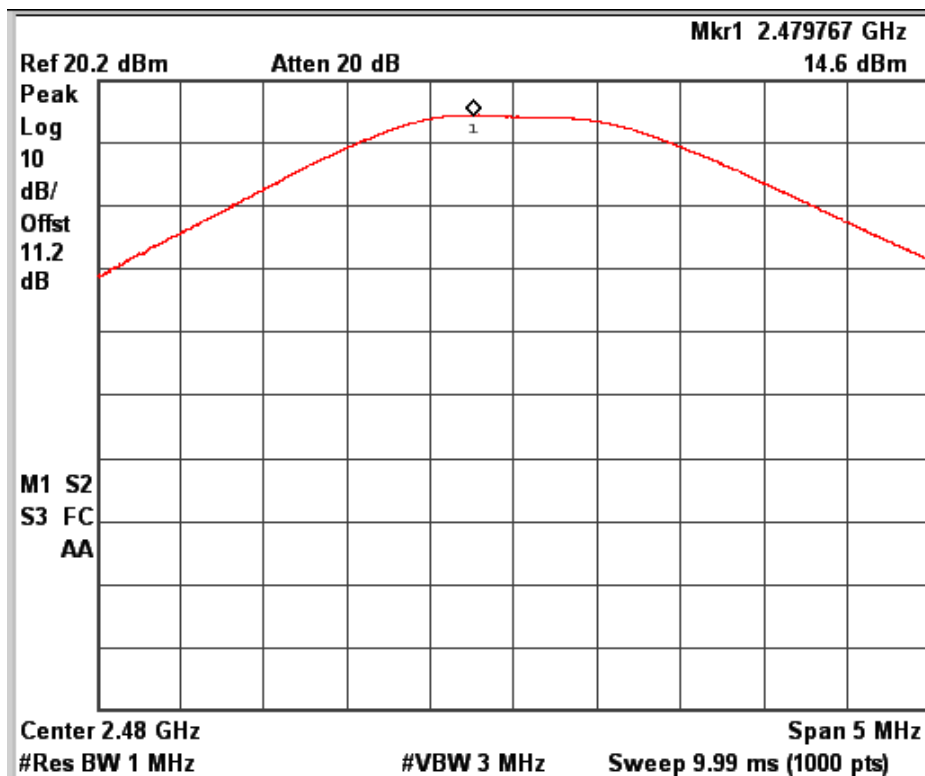


Channel Frequency: 2402 MHz

www.tuv.com



Channel Frequency: 2440 MHz



Channel Frequency: 2480 MHz

www.tuv.com

Maximum Power Spectral Density

Section 15.247(e)

Result

Pass

Test Specification
Detector Function
Requirement

FCC Part 15 Section 15.247 (e)
Peak

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm.

Note: For measurement of Maximum power spectral density option 1 was used

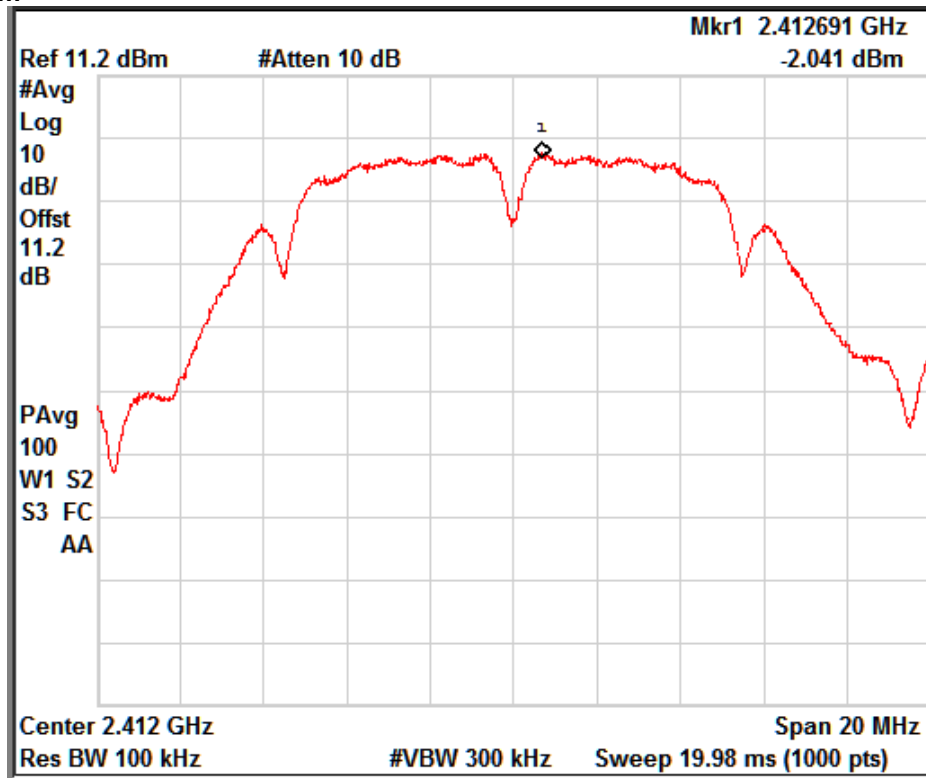
Test Method:



Test Result:

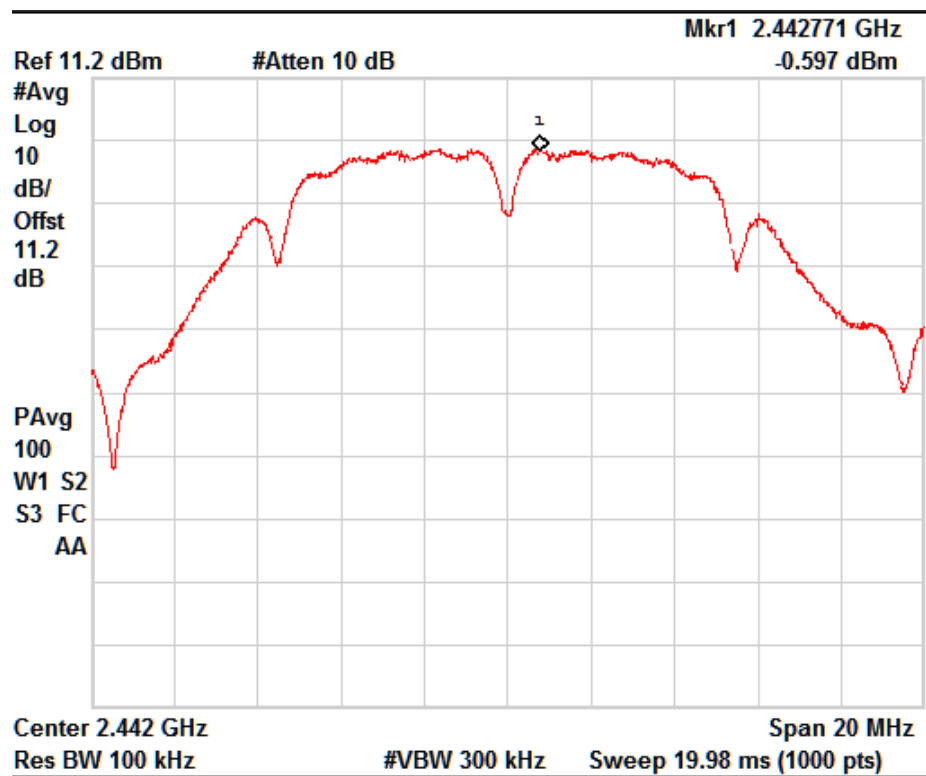
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
b	1	2412.00	-02.04	8.00	-10.04
		2442.00	-00.59	8.00	-08.59
		2462.00	-01.90	8.00	-09.90
	11	2412.00	-00.95	8.00	-08.95
		2442.00	-00.97	8.00	-08.97
		2462.00	-01.17	8.00	-09.17

www.tuv.com



Data rate: 1 Mbps

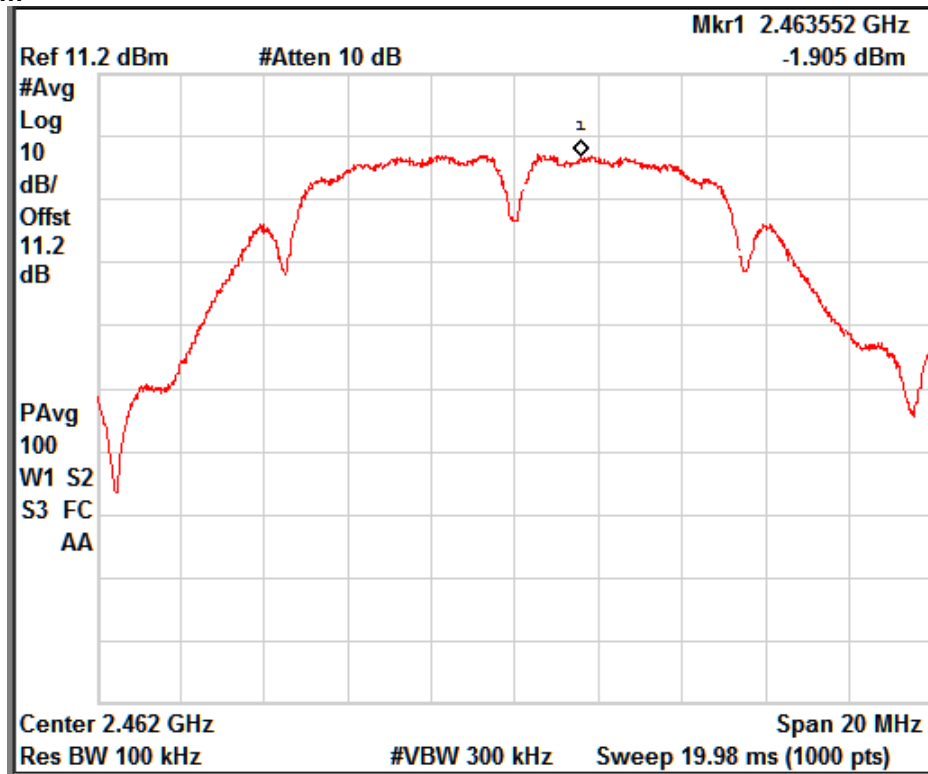
Channel Frequency: 2412 MHz



Data rate: 1 Mbps

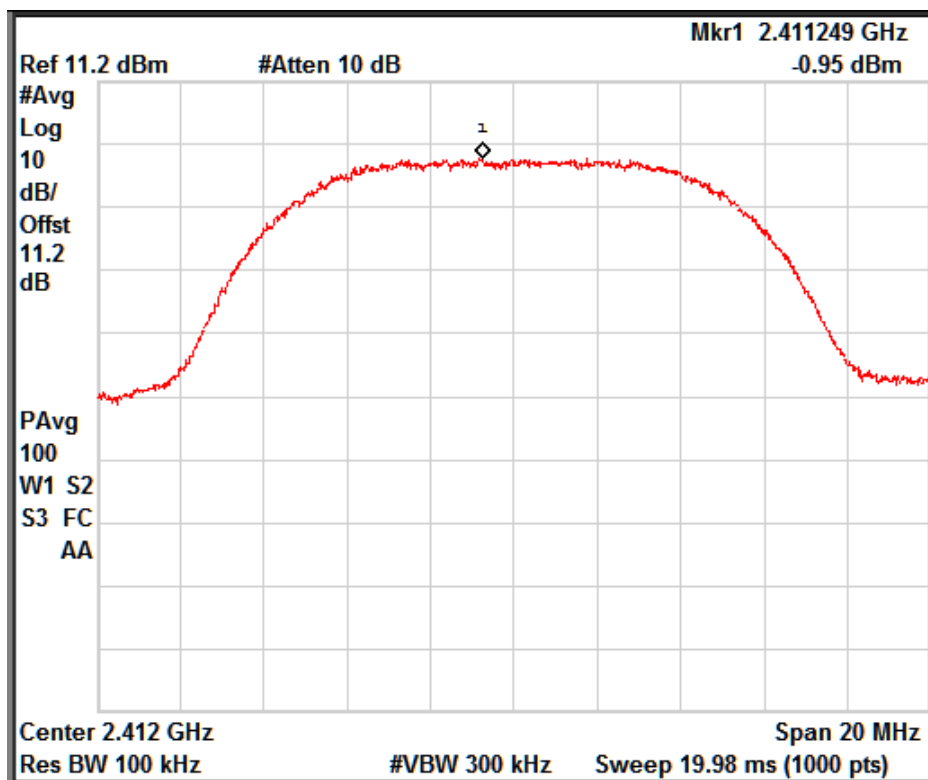
Channel Frequency: 2442 MHz

www.tuv.com



Data rate: 1 Mbps

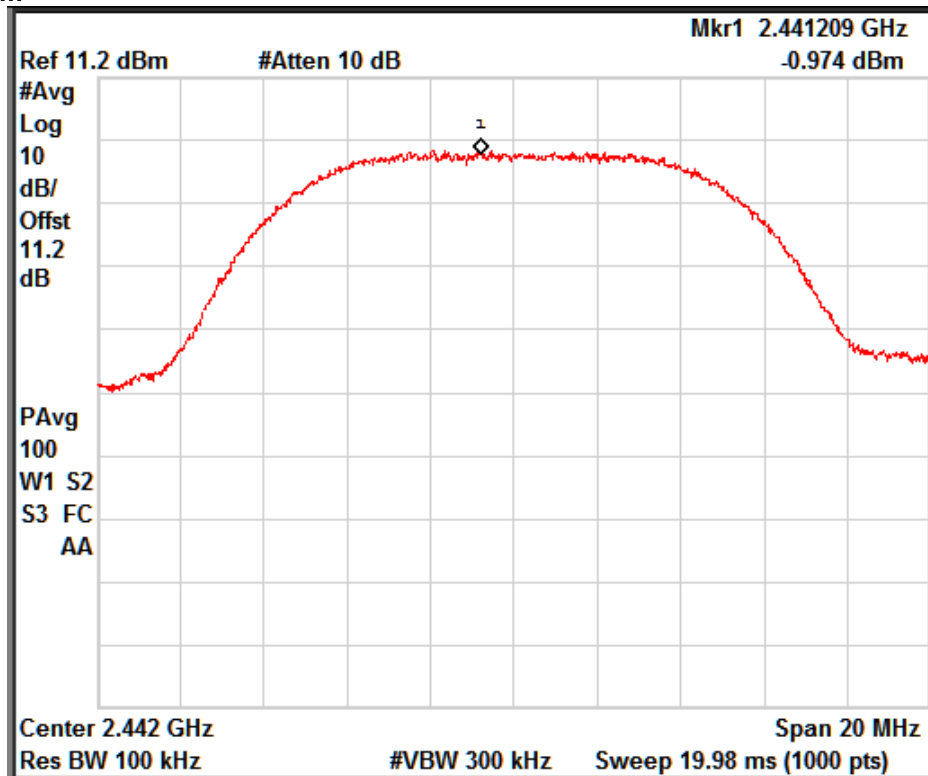
Channel Frequency: 2462 MHz



Data rate: 11 Mbps

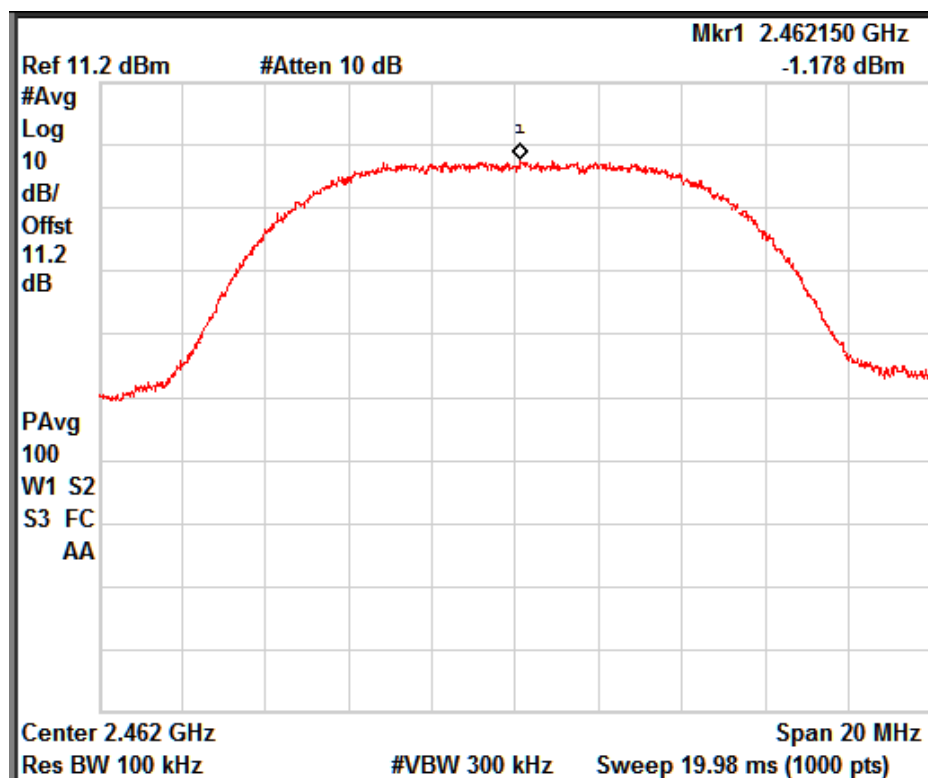
Channel Frequency: 2412 MHz

www.tuv.com



Data rate: 11 Mbps

Channel Frequency: 2442 MHz

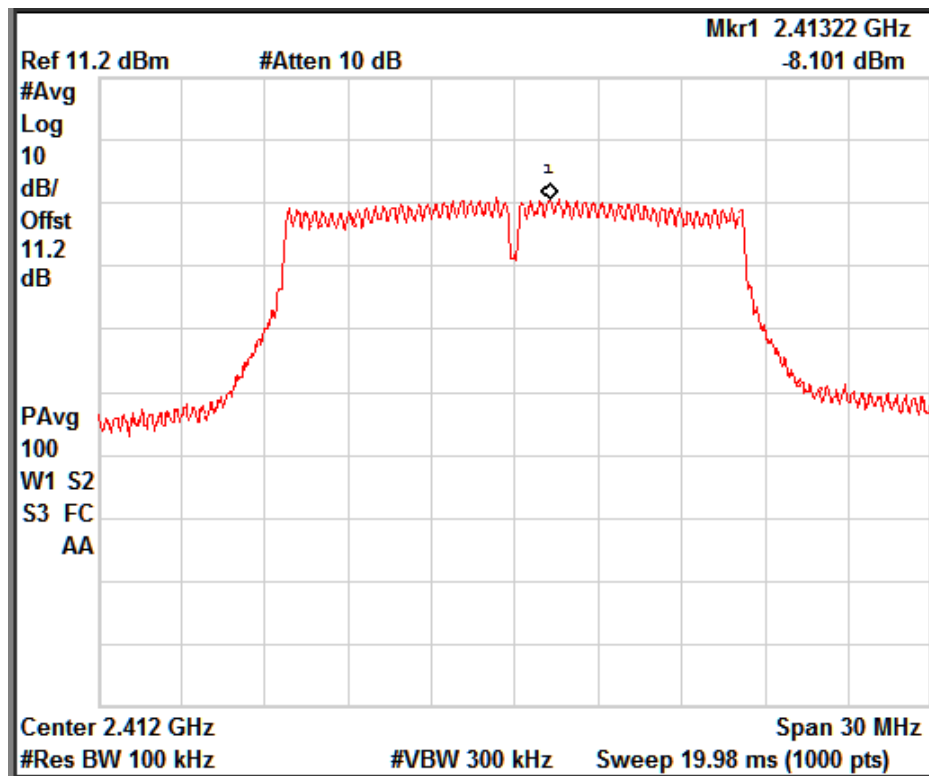


Data rate: 11 Mbps

Channel Frequency: 2462 MHz

www.tuv.com

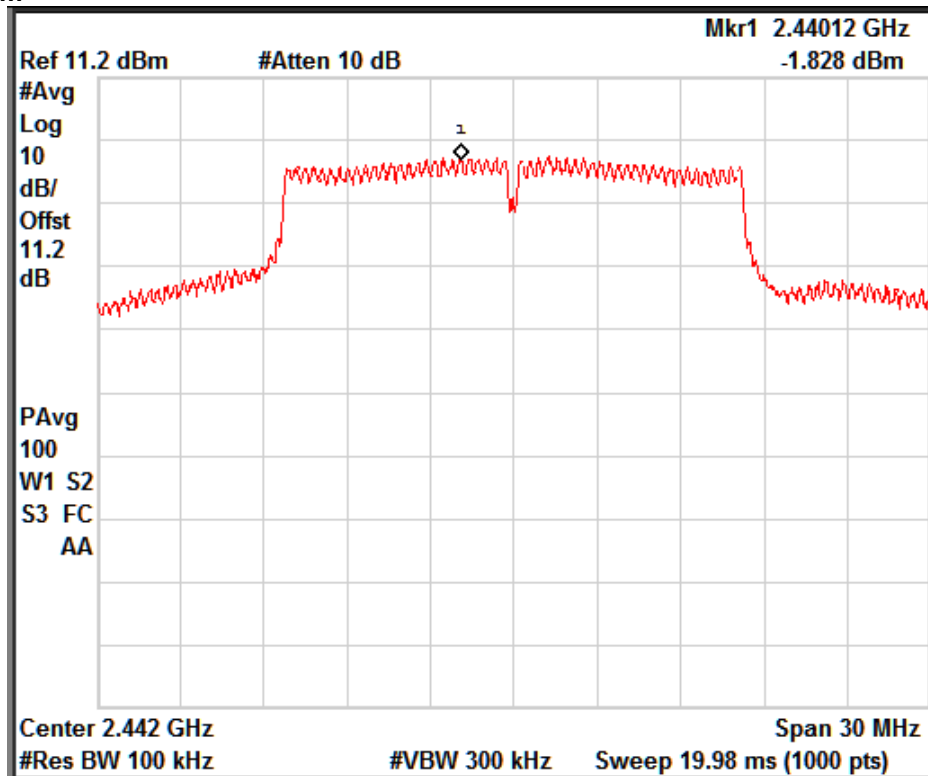
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
g	6	2412.00	-08.10	8.00	-16.10
		2442.00	-01.82	8.00	-09.82
		2462.00	-09.72	8.00	-17.72
	24	2412.00	-08.38	8.00	-16.38
		2442.00	-01.90	8.00	-09.90
		2462.00	-09.04	8.00	-17.04
	54	2412.00	-08.54	8.00	-16.54
		2442.00	-01.60	8.00	-09.60
		2462.00	-09.51	8.00	-17.51



Data rate: 6 Mbps

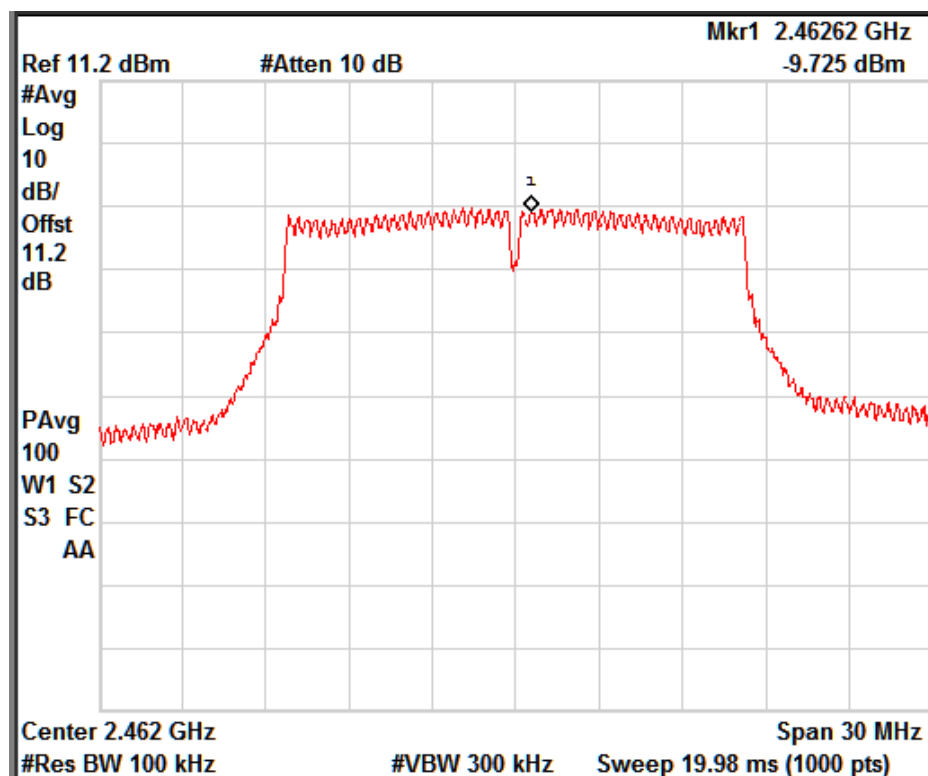
Channel Frequency: 2412 MHz

www.tuv.com



Data rate: 6 Mbps

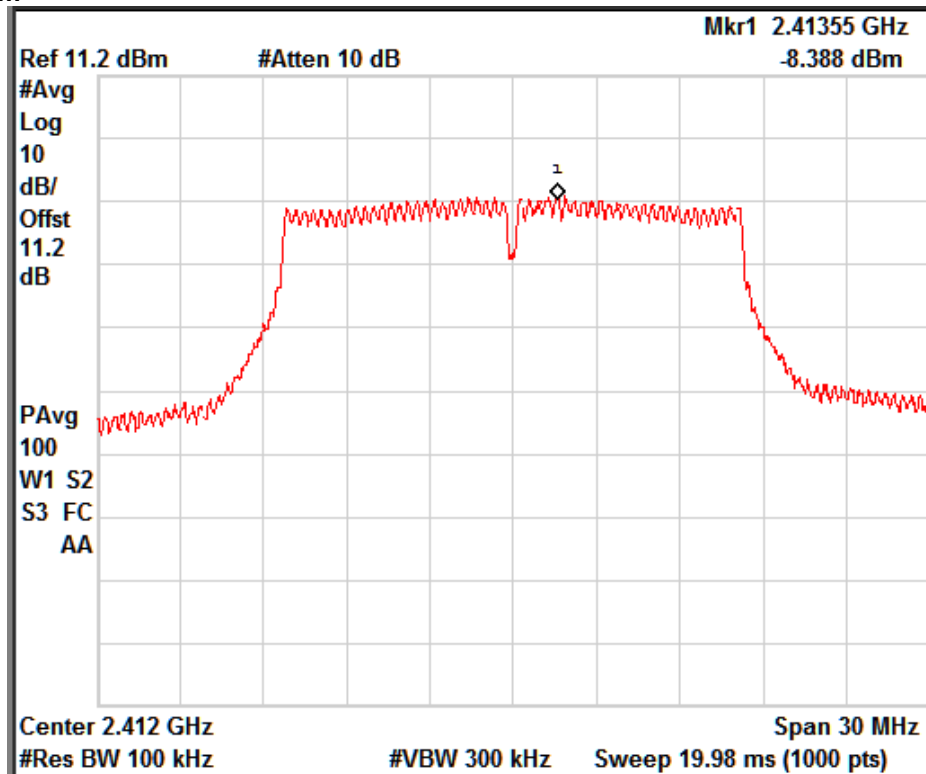
Channel Frequency: 2442 MHz



Data rate: 6 Mbps

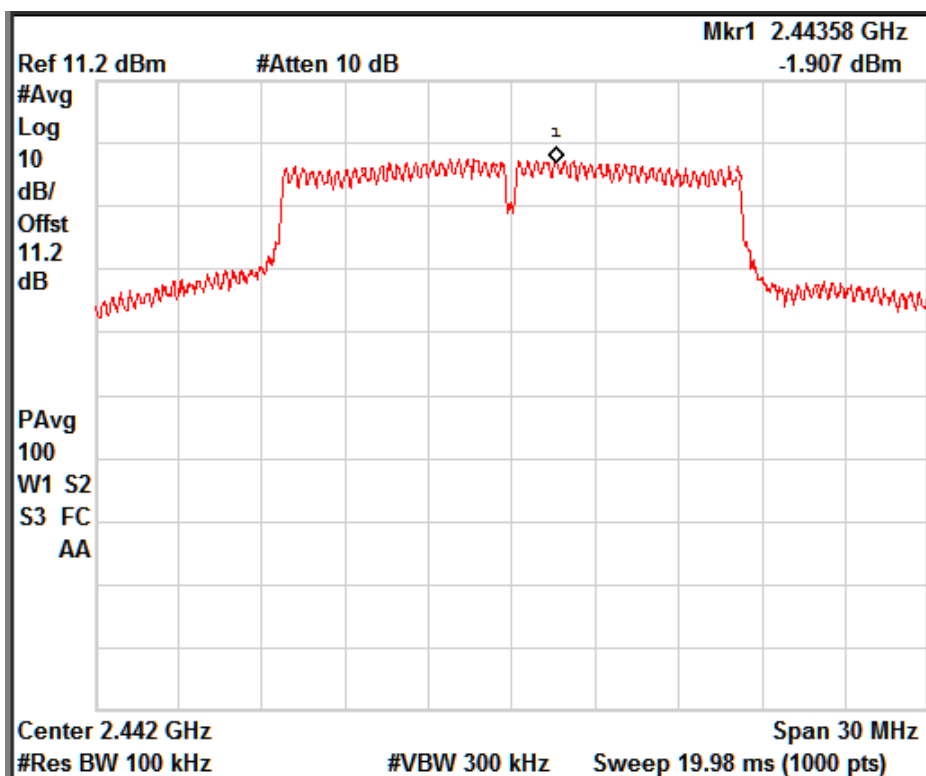
Channel Frequency: 2462 MHz

www.tuv.com



Data rate: 24 Mbps

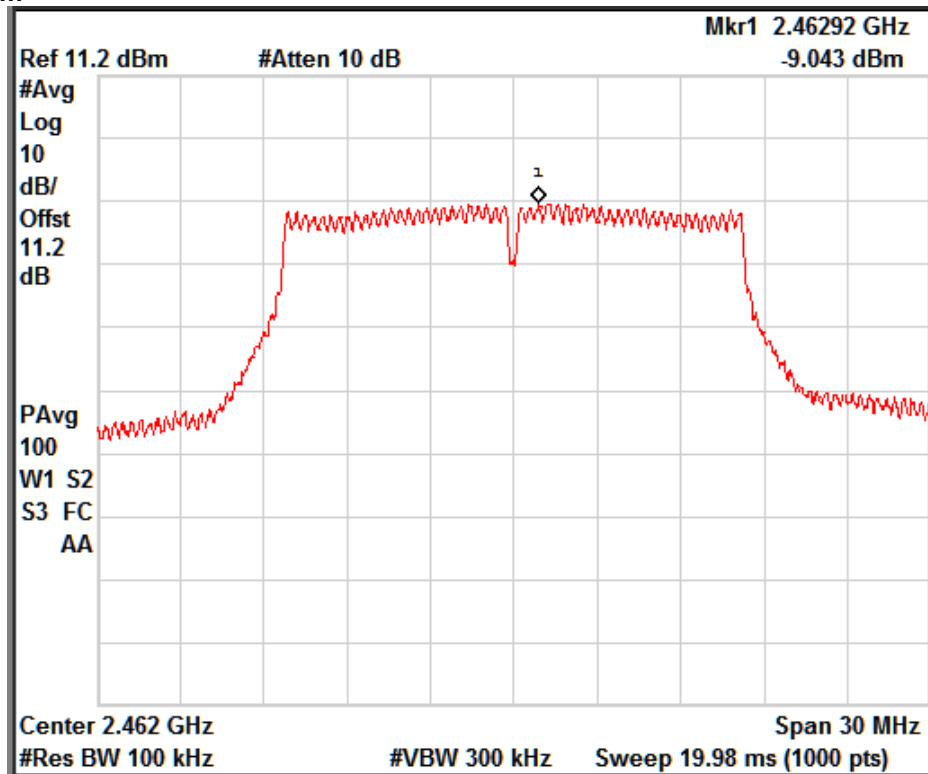
Channel Frequency: 2412 MHz



Data rate: 24 Mbps

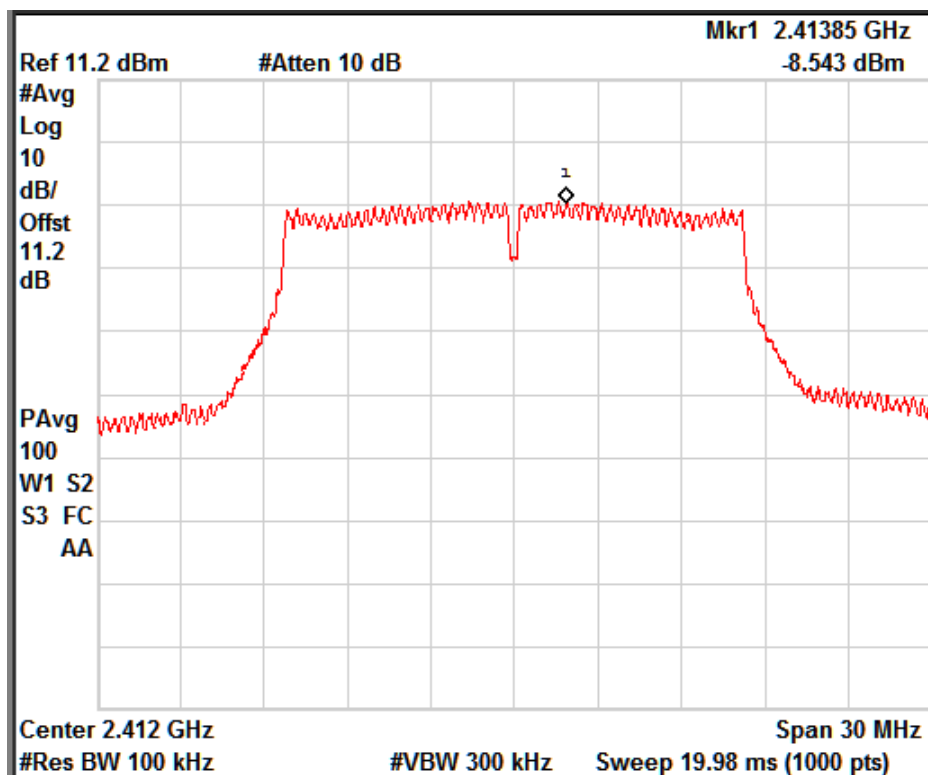
Channel Frequency: 2442 MHz

www.tuv.com



Data rate: 24 Mbps

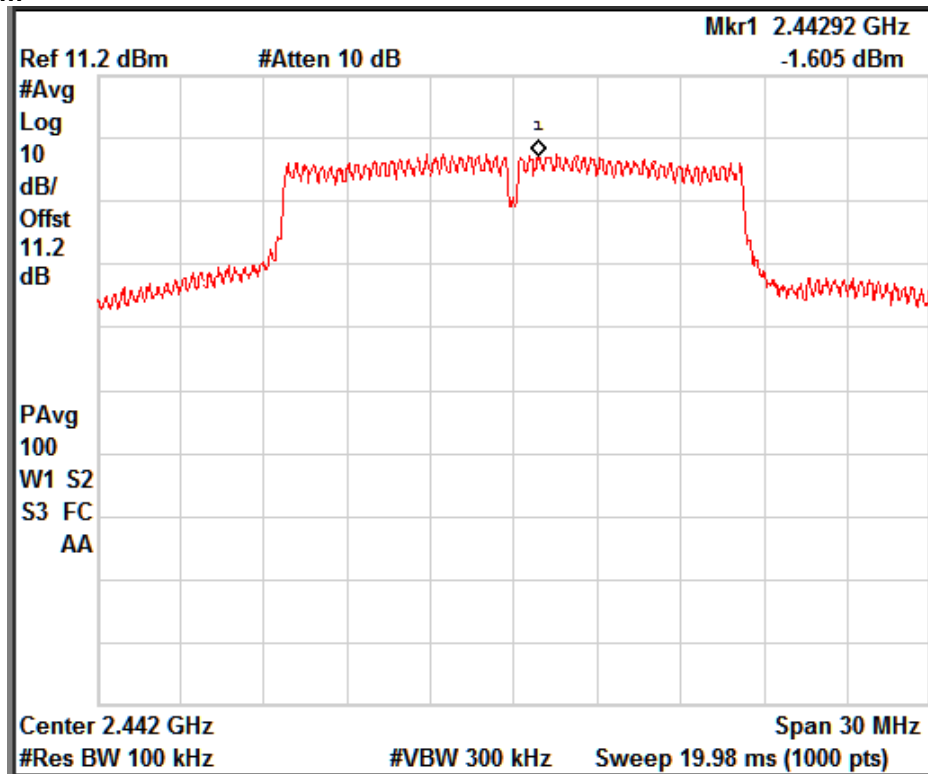
Channel Frequency: 2462 MHz



Data rate: 54 Mbps

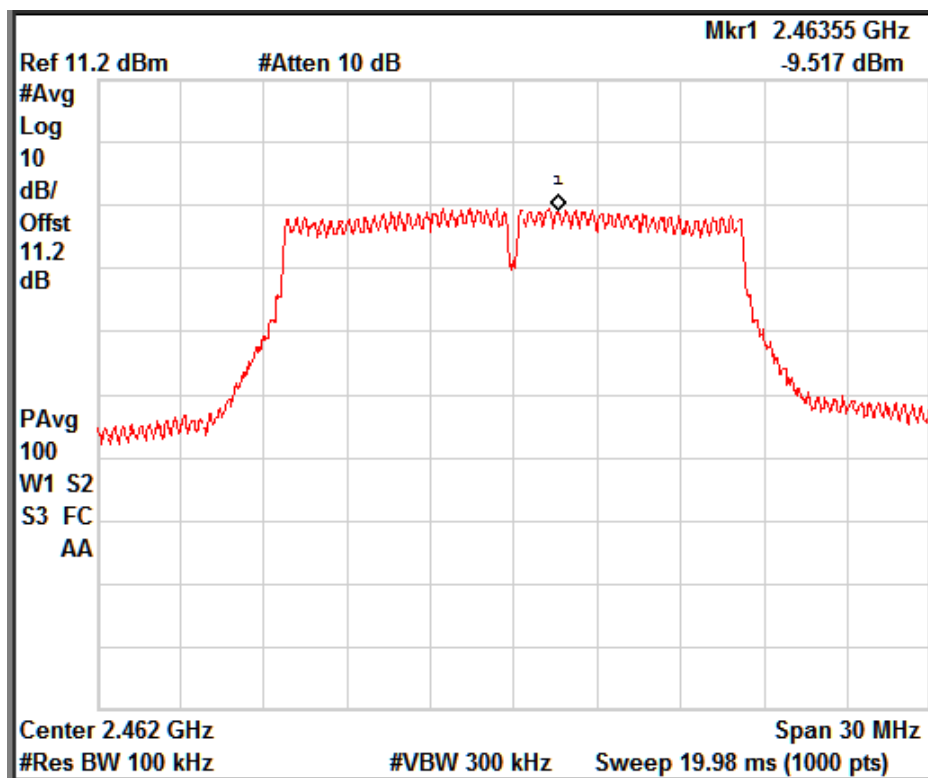
Channel Frequency: 2412 MHz

www.tuv.com



Data rate: 54 Mbps

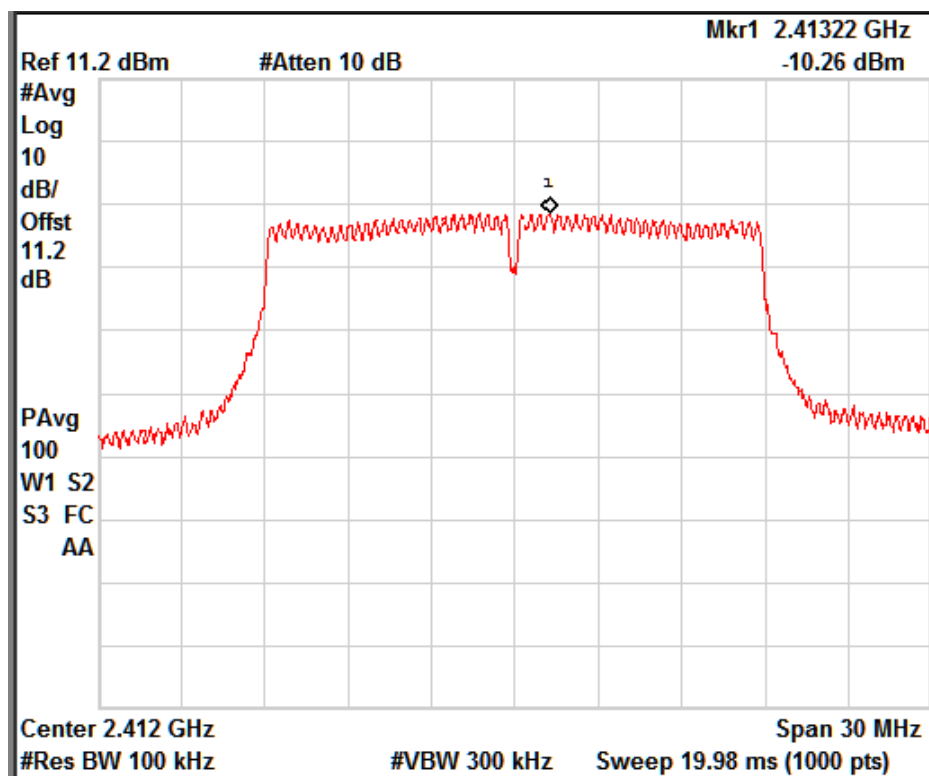
Channel Frequency: 2442 MHz



Data rate: 54 Mbps

Channel Frequency: 2462 MHz

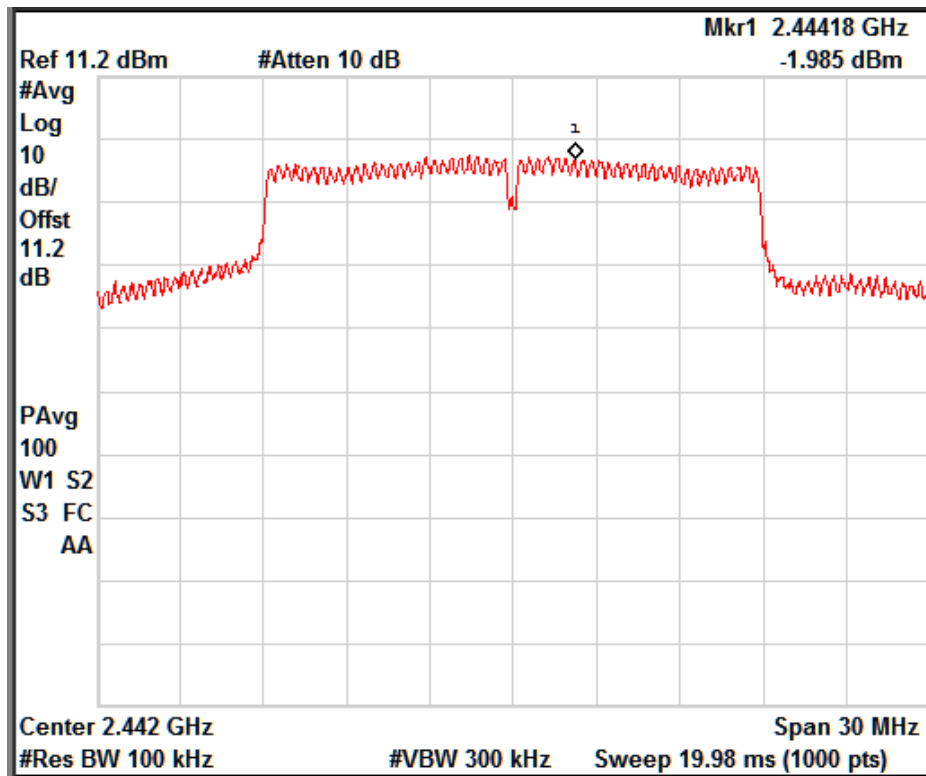
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
n	6.5	2412.00	-10.26	8.00	-18.26
		2442.00	-01.98	8.00	-09.98
		2462.00	-11.50	8.00	-19.50
	39	2412.00	-10.76	8.00	-18.76
		2442.00	-01.32	8.00	-09.32
		2462.00	-11.61	8.00	-19.61
	65	2412.00	-10.55	8.00	-18.55
		2442.00	-01.27	8.00	-09.27
		2462.00	-11.53	8.00	-19.53



Data rate: 6.5 Mbps

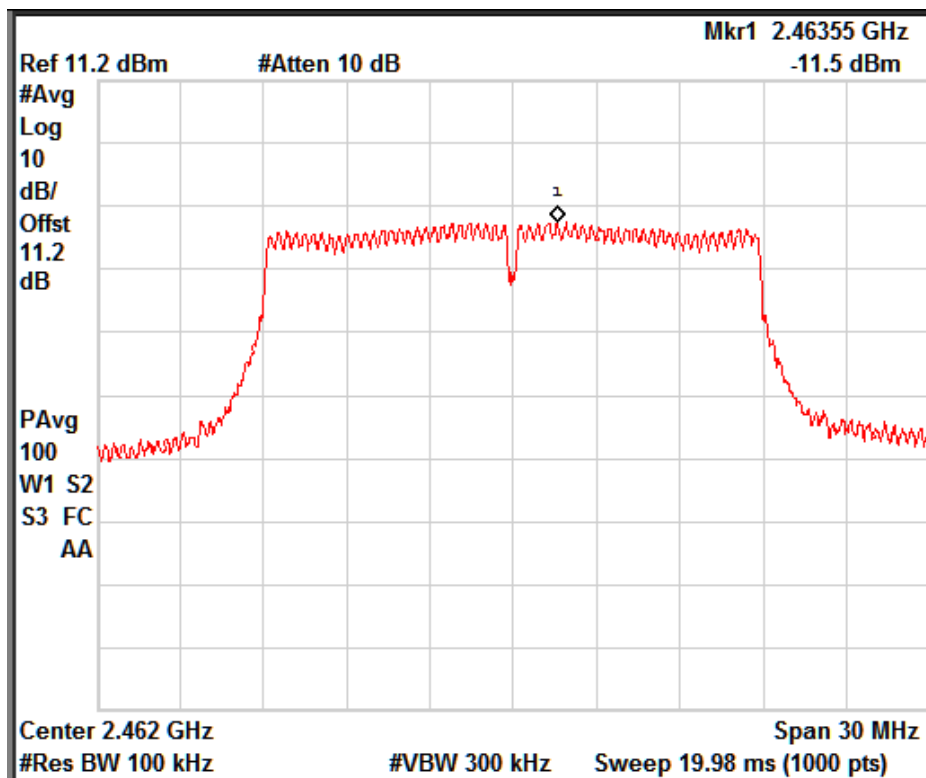
Channel Frequency: 2412 MHz

www.tuv.com



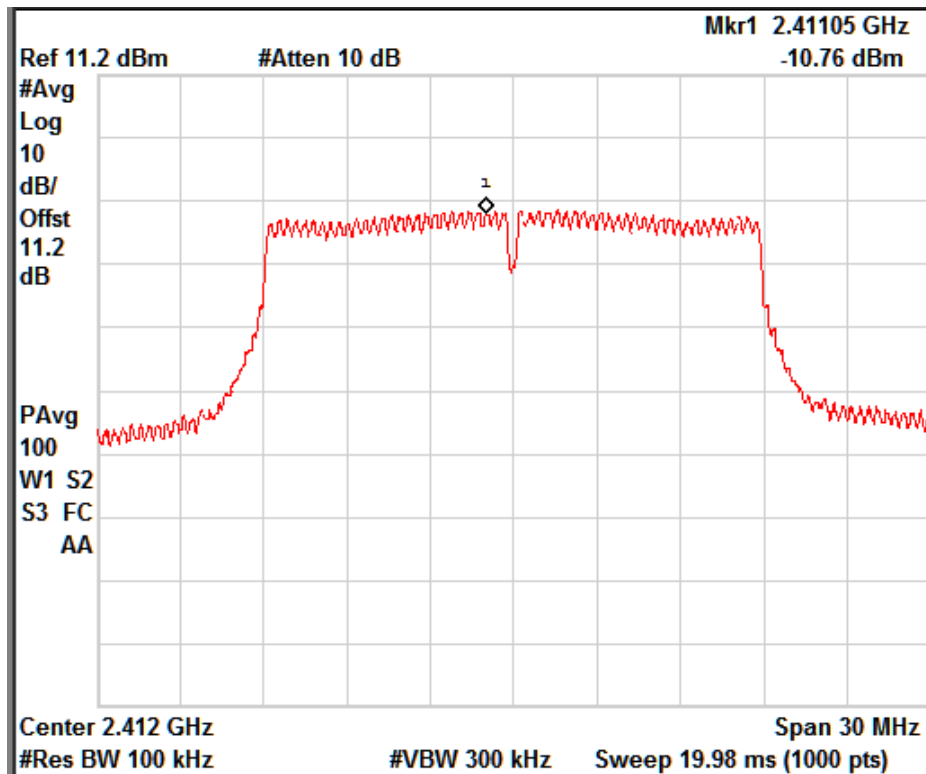
Data rate: 6.5 Mbps

Channel Frequency: 2442 MHz



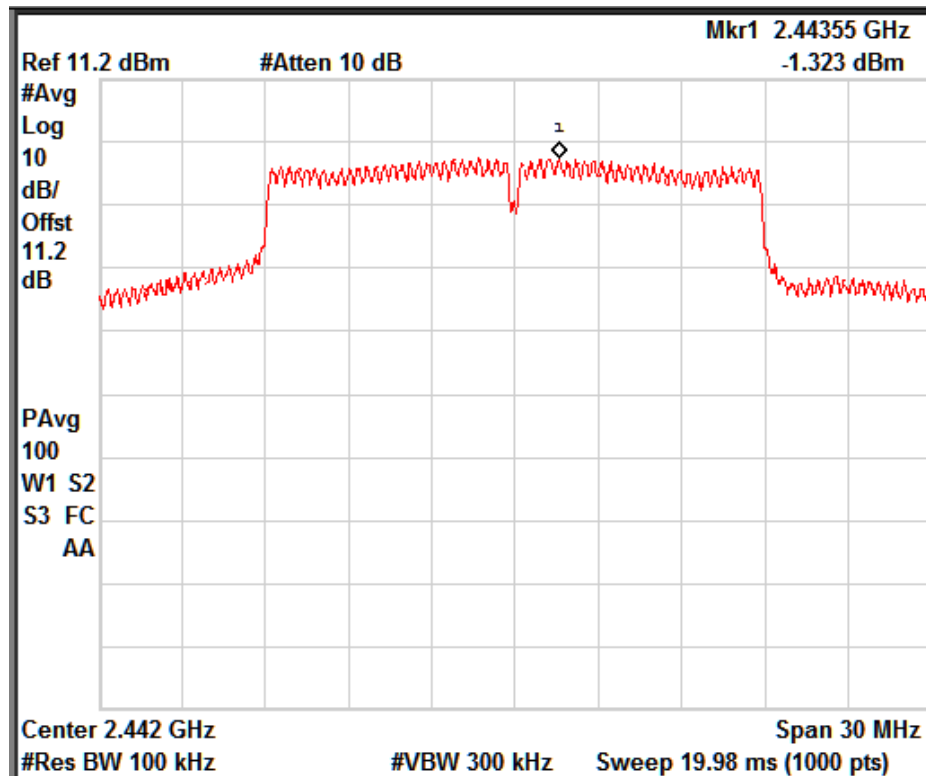
Data rate: 6.5 Mbps

Channel Frequency: 2462 MHz



Data rate: 39 Mbps

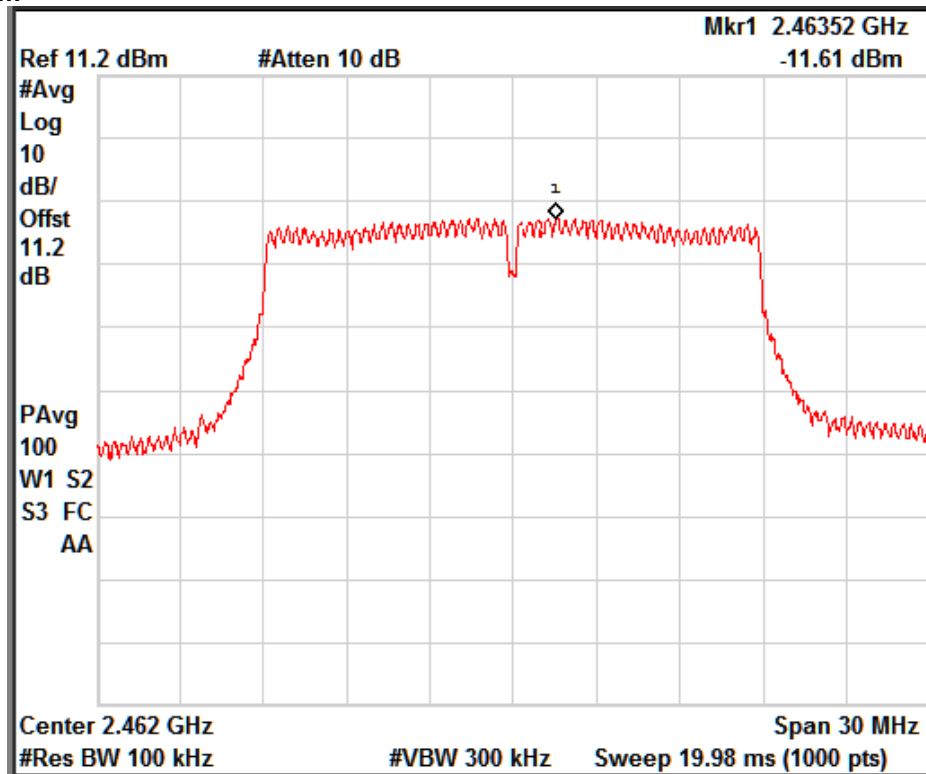
Channel Frequency: 2412 MHz



Data rate: 39 Mbps

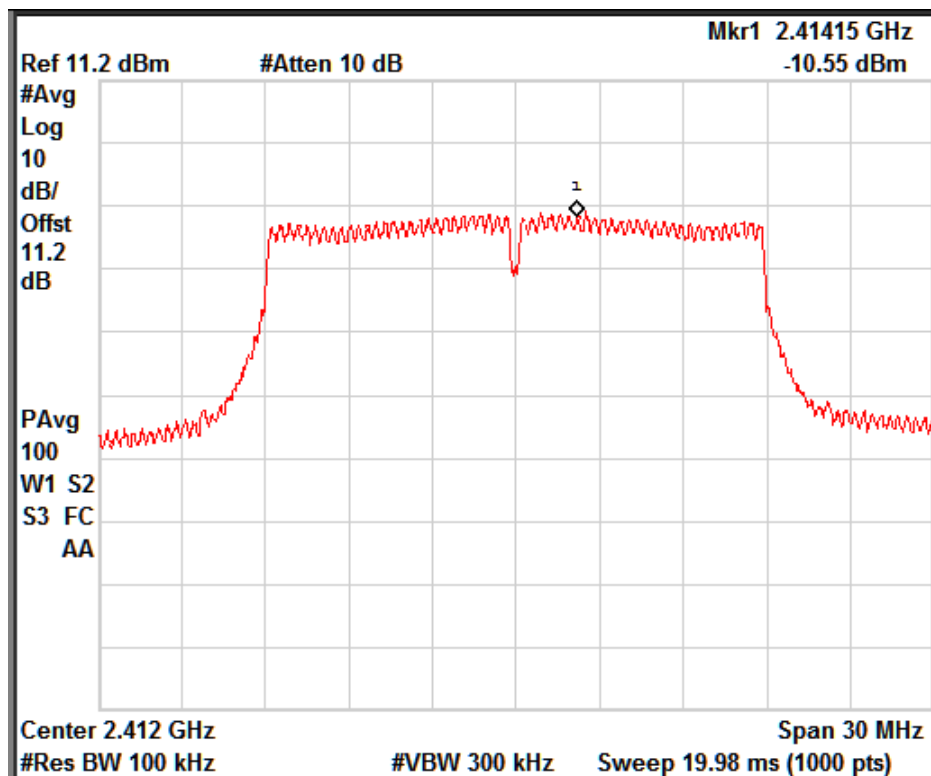
Channel Frequency: 2442 MHz

www.tuv.com



Data rate: 39 Mbps

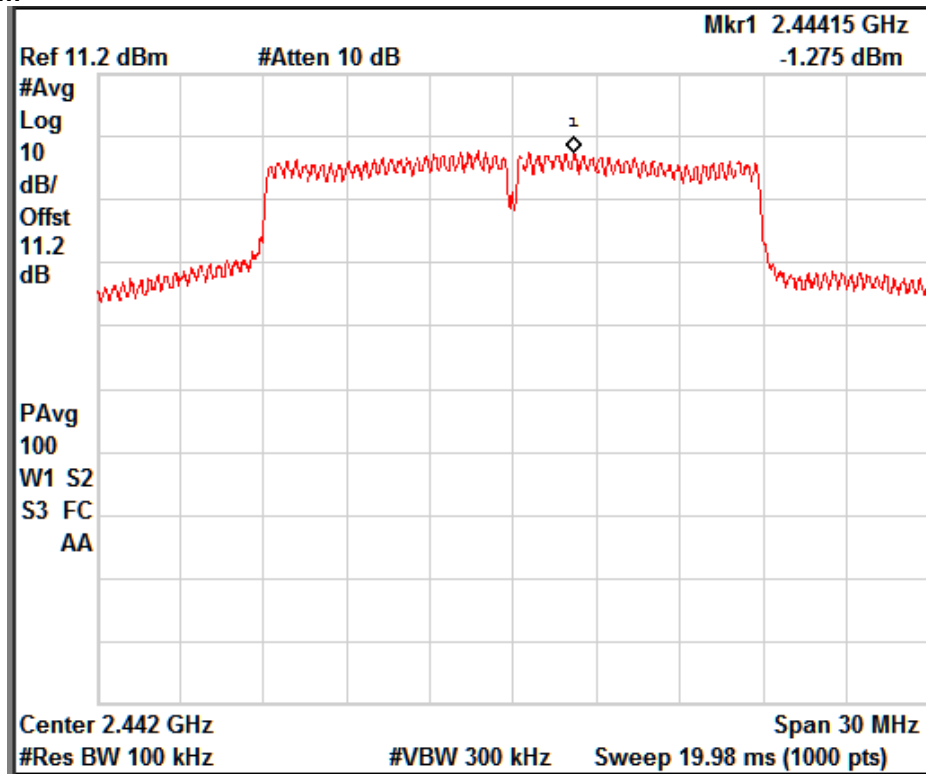
Channel Frequency: 2462 MHz



Data rate: 65 Mbps

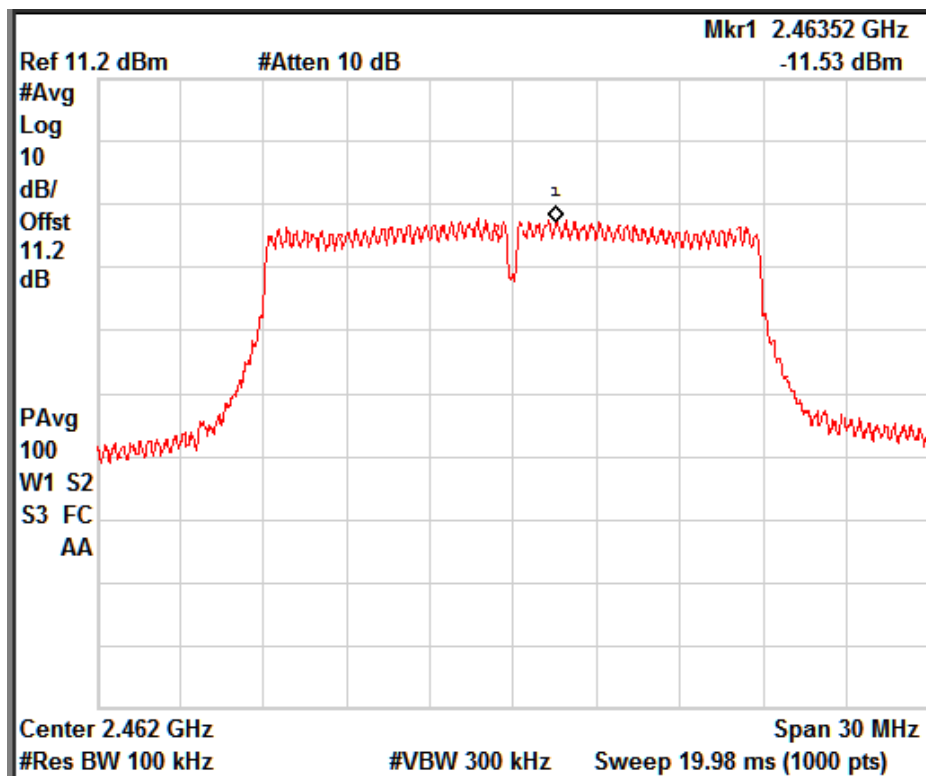
Channel Frequency: 2412 MHz

www.tuv.com



Data rate: 65 Mbps

Channel Frequency: 2442 MHz



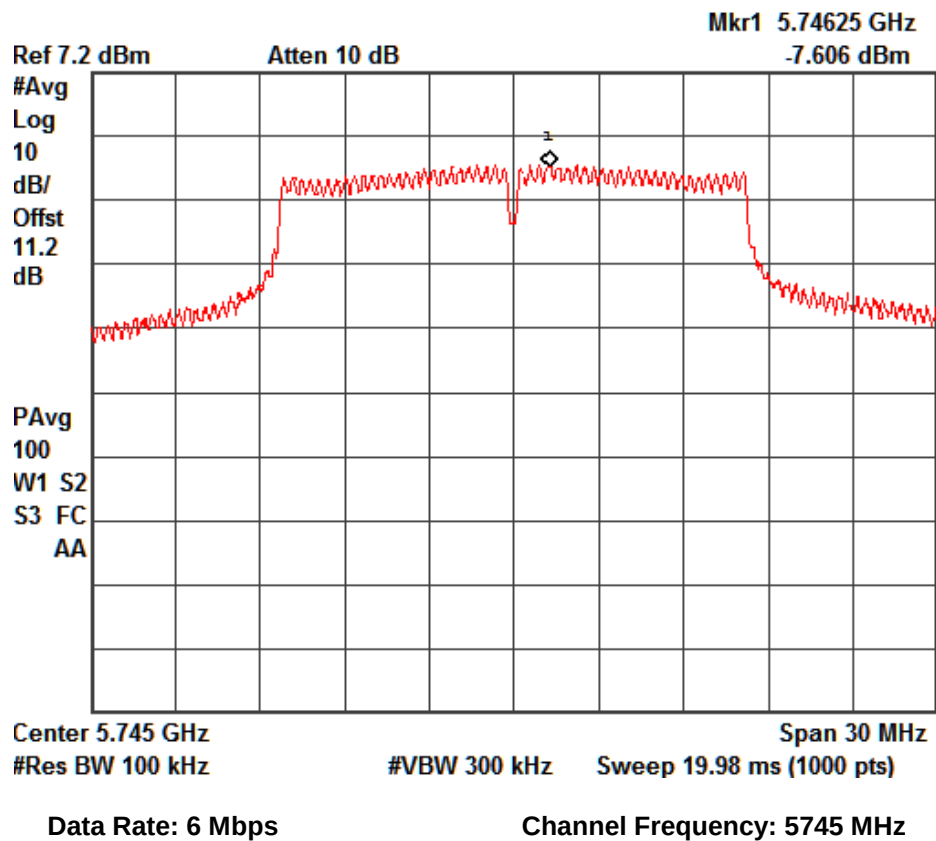
Data rate: 65 Mbps

Channel Frequency: 2462 MHz

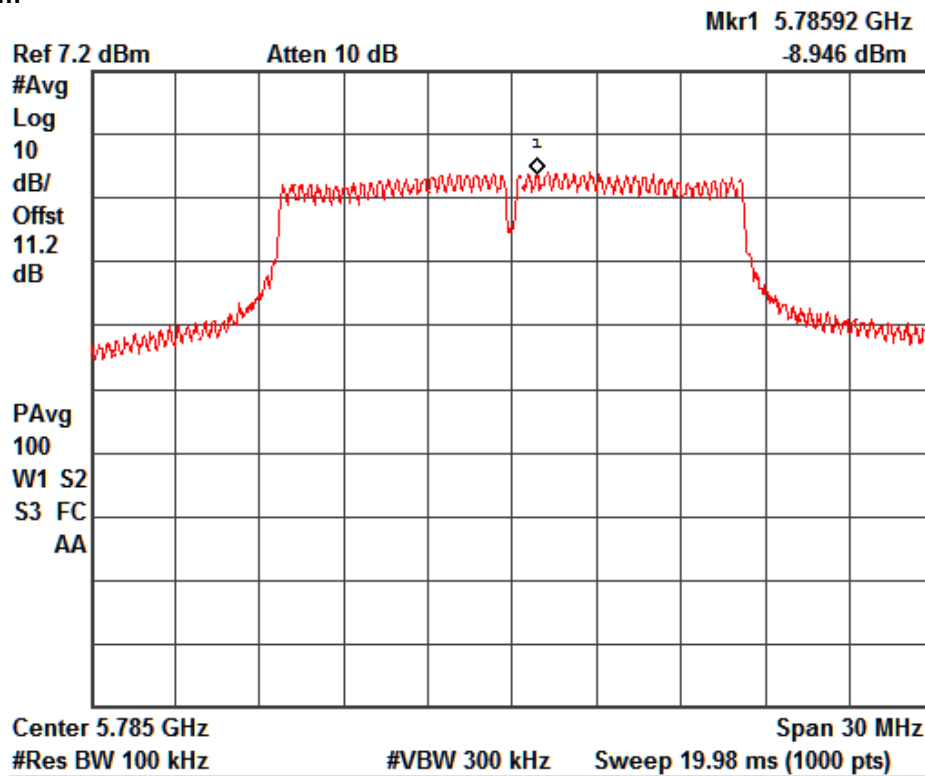
www.tuv.com

5GHz Band

802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Margin (dB)
a	6	5745	-8.60	8.00	-16.60
		5785	-8.94	8.00	-16.94
		5825	-8.90	8.00	-16.90
	24	5745	-7.58	8.00	-15.58
		5785	-8.76	8.00	-16.76
		5825	-9.14	8.00	-17.14
	54	5745	-7.64	8.00	-15.64
		5785	-8.51	8.00	-16.51
		5825	-8.67	8.00	-16.67

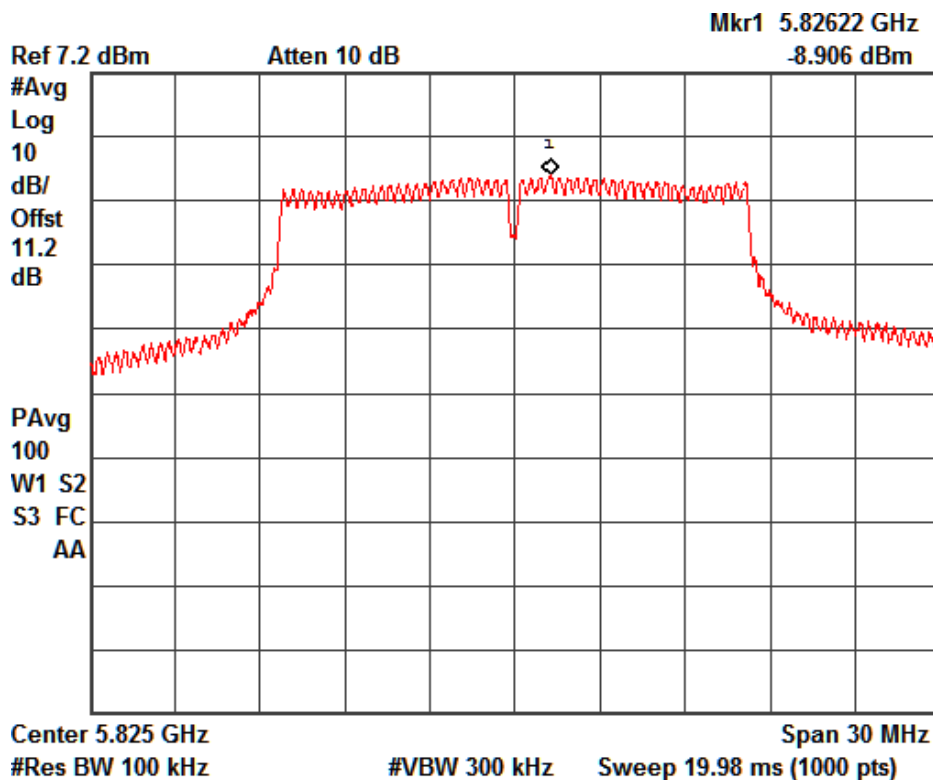


www.tuv.com



Data Rate: 6 Mbps

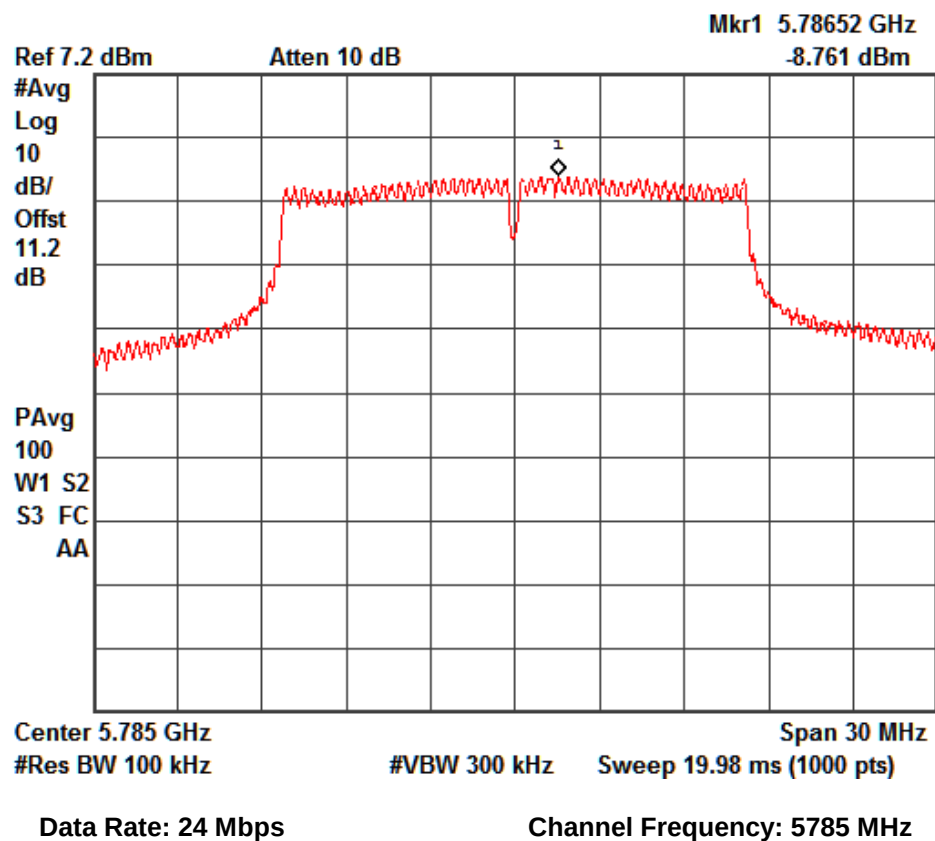
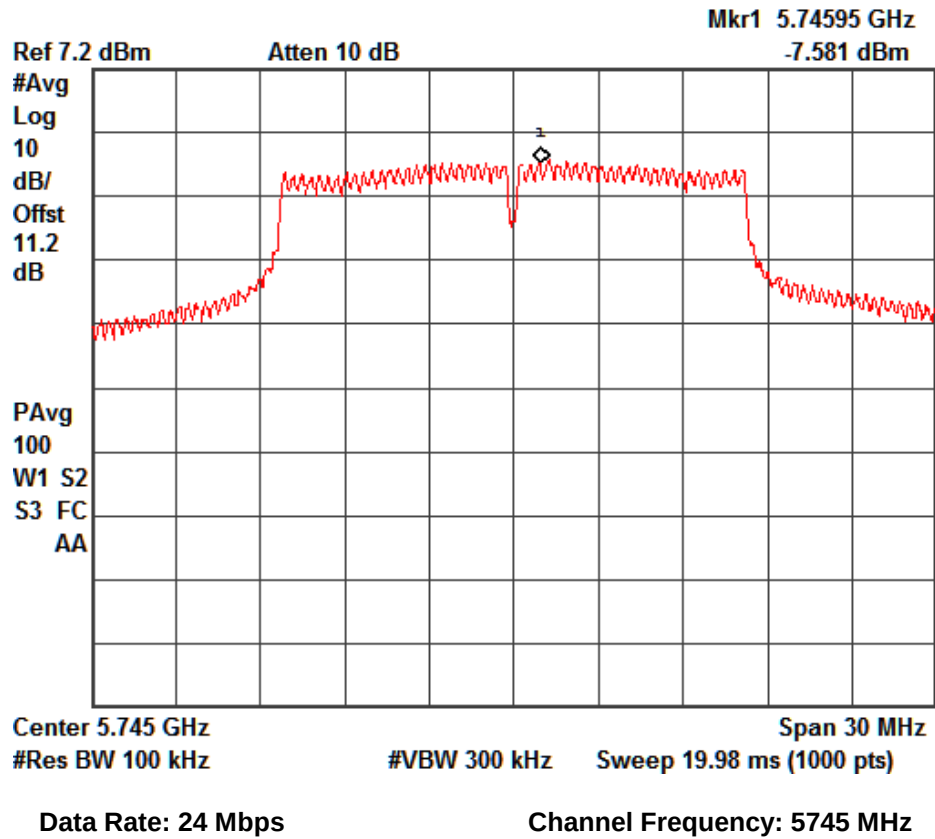
Channel Frequency: 5785 MHz

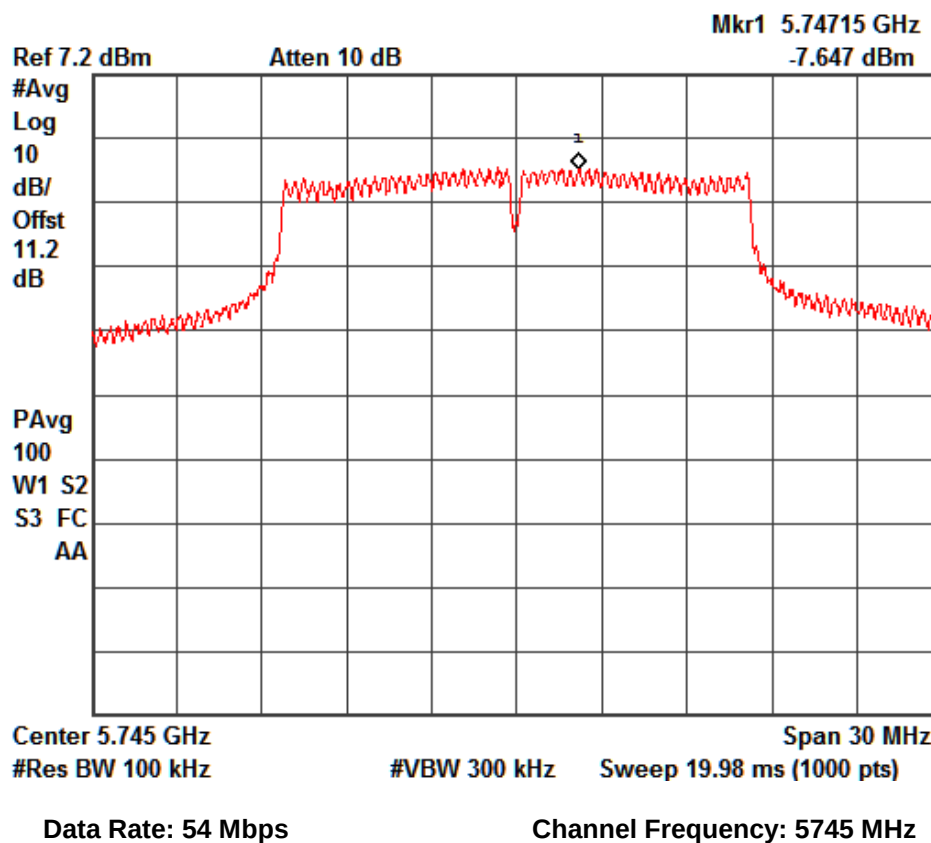
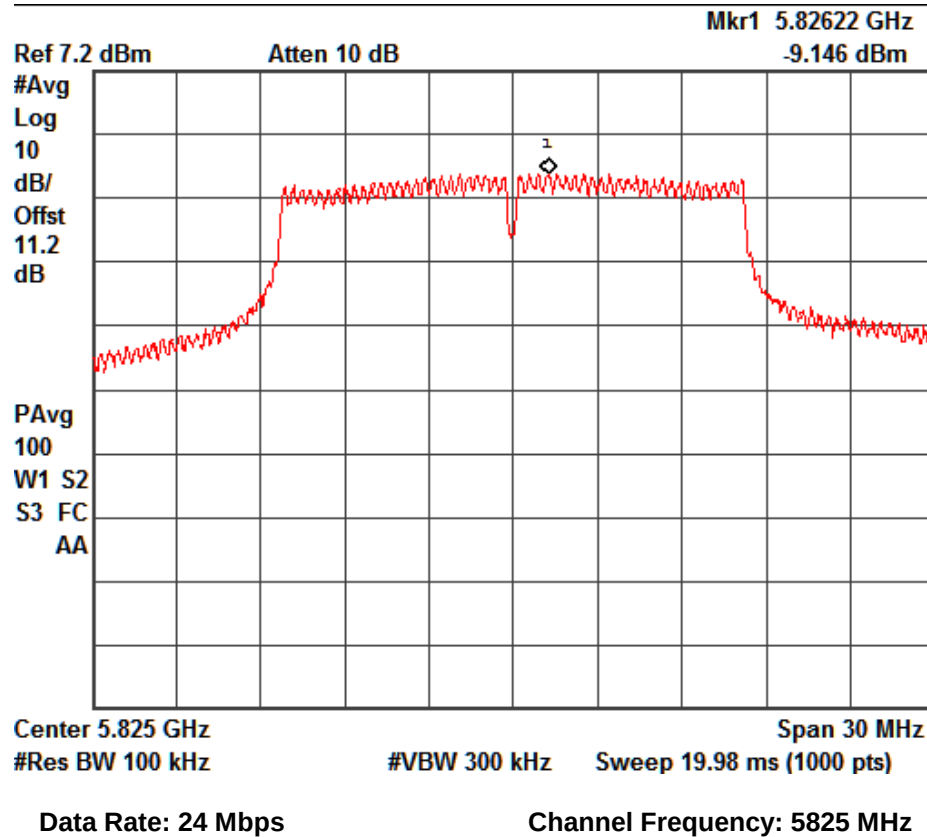


Data Rate: 6 Mbps

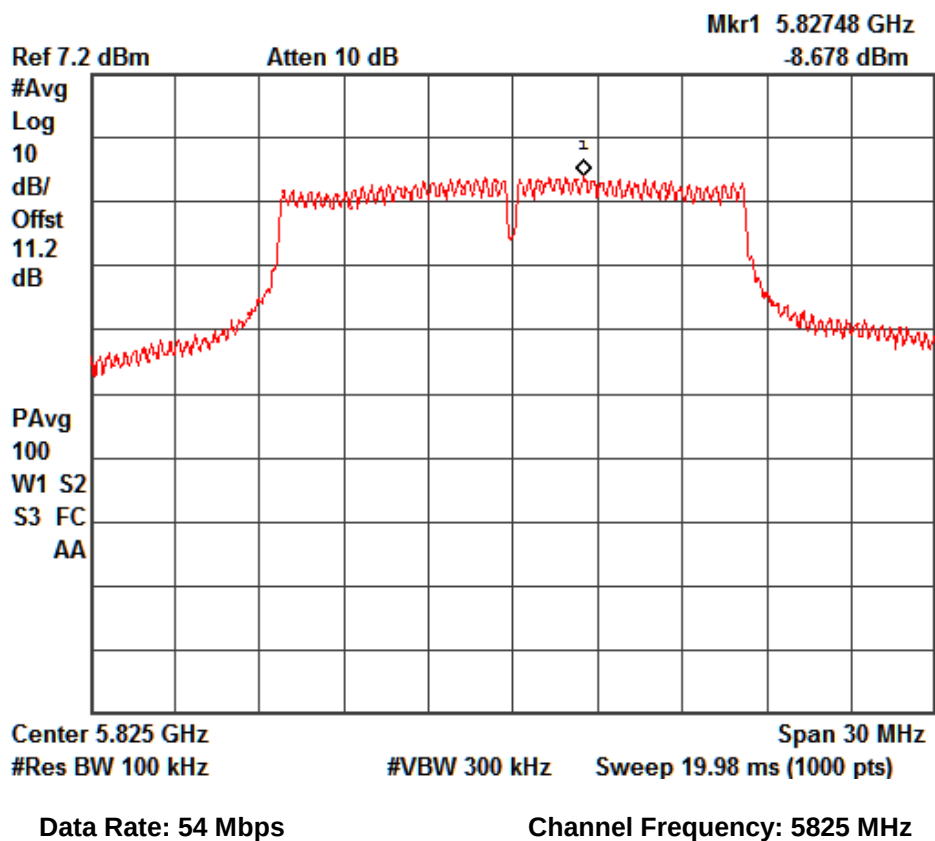
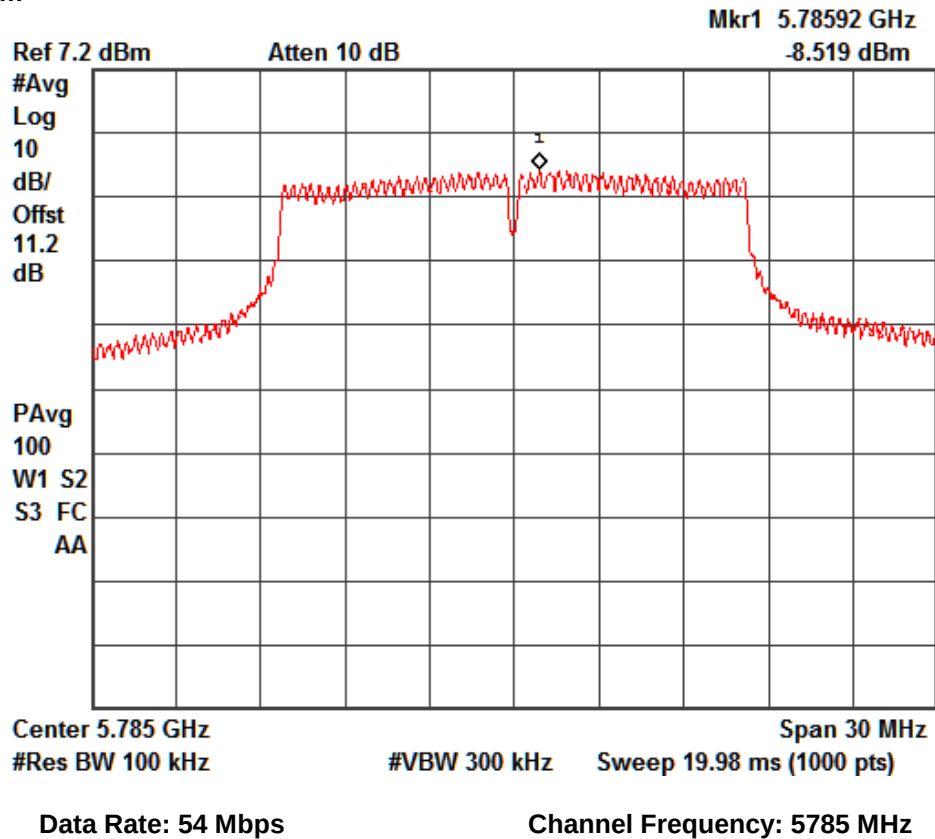
Channel Frequency: 5825 MHz

www.tuv.com

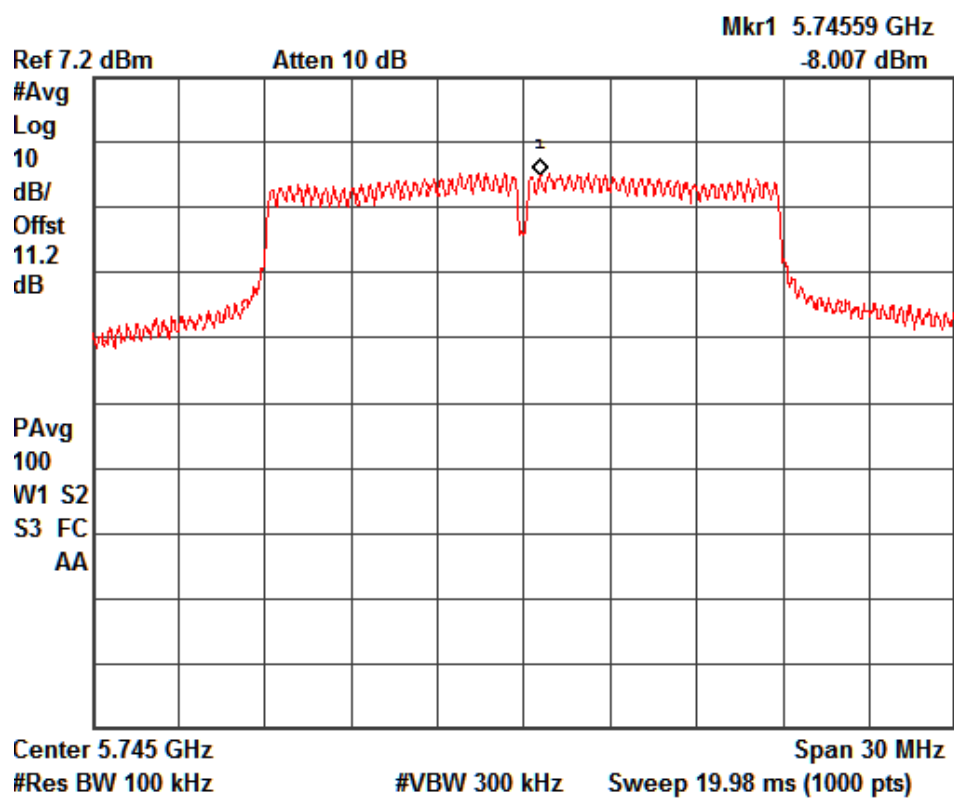




www.tuv.com



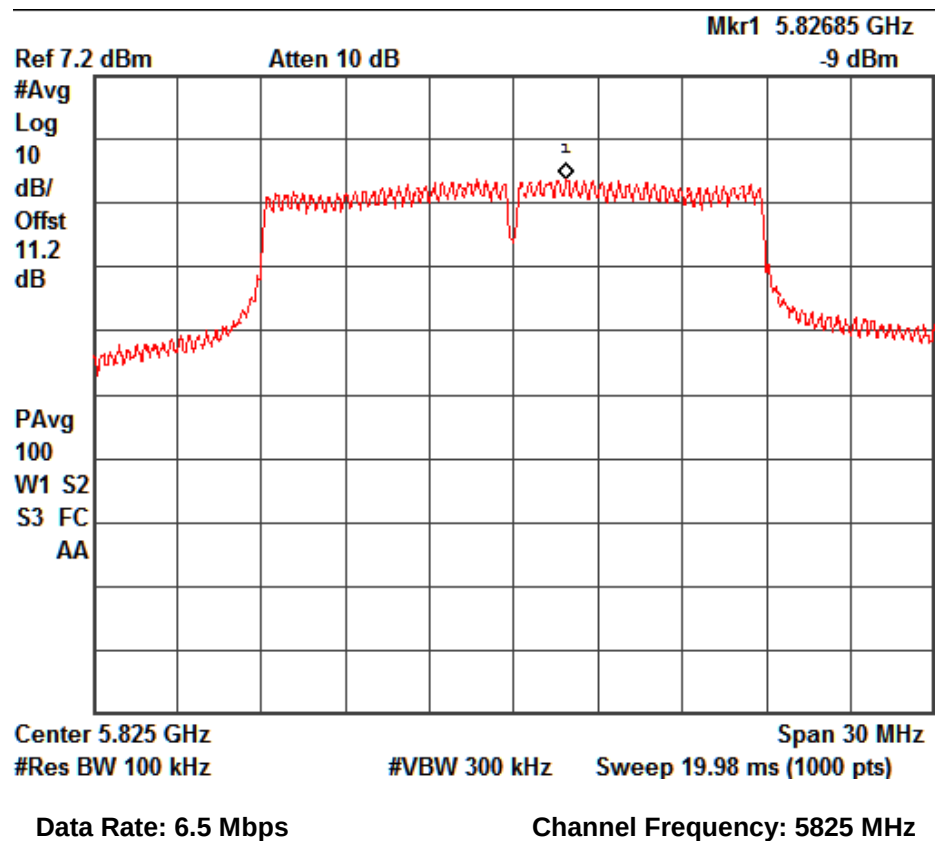
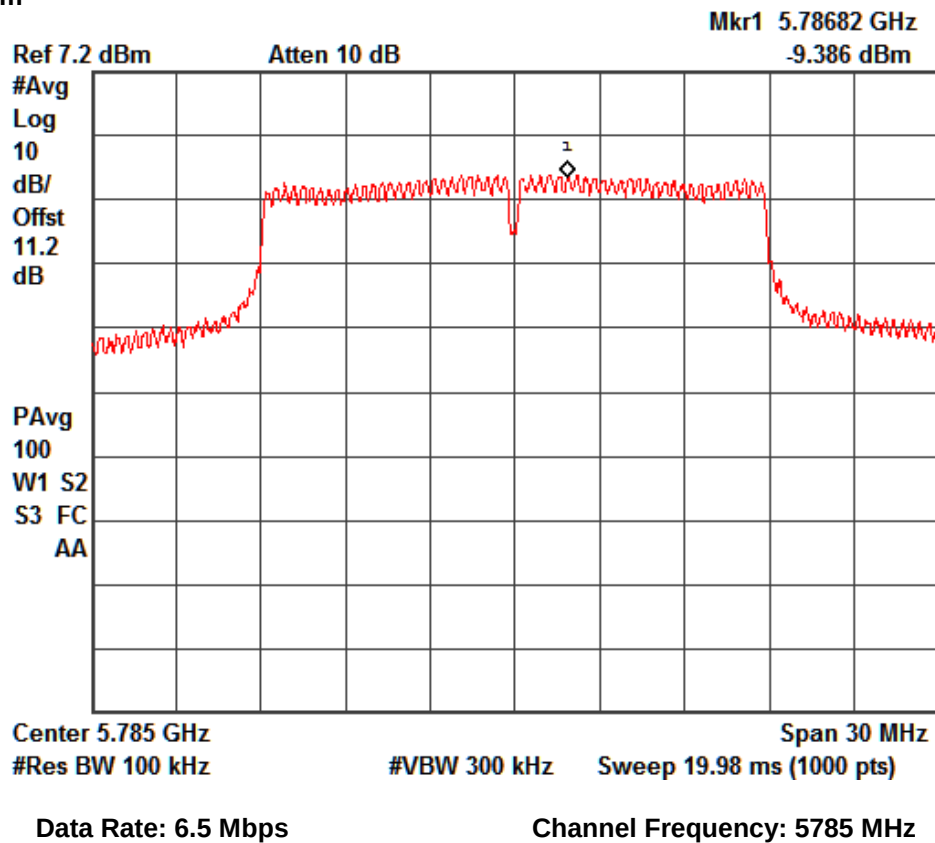
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Margin (dB)
n	6.5	5745	-8.00	8.00	-16.00
		5785	-9.86	8.00	-17.86
		5825	-9.00	8.00	-17.00
	39	5745	-7.83	8.00	-15.83
		5785	-9.21	8.00	-17.21
		5825	-9.89	8.00	-17.89
	65	5745	-7.67	8.00	-15.67
		5785	-9.30	8.00	-17.30
		5825	-9.41	8.00	-17.41



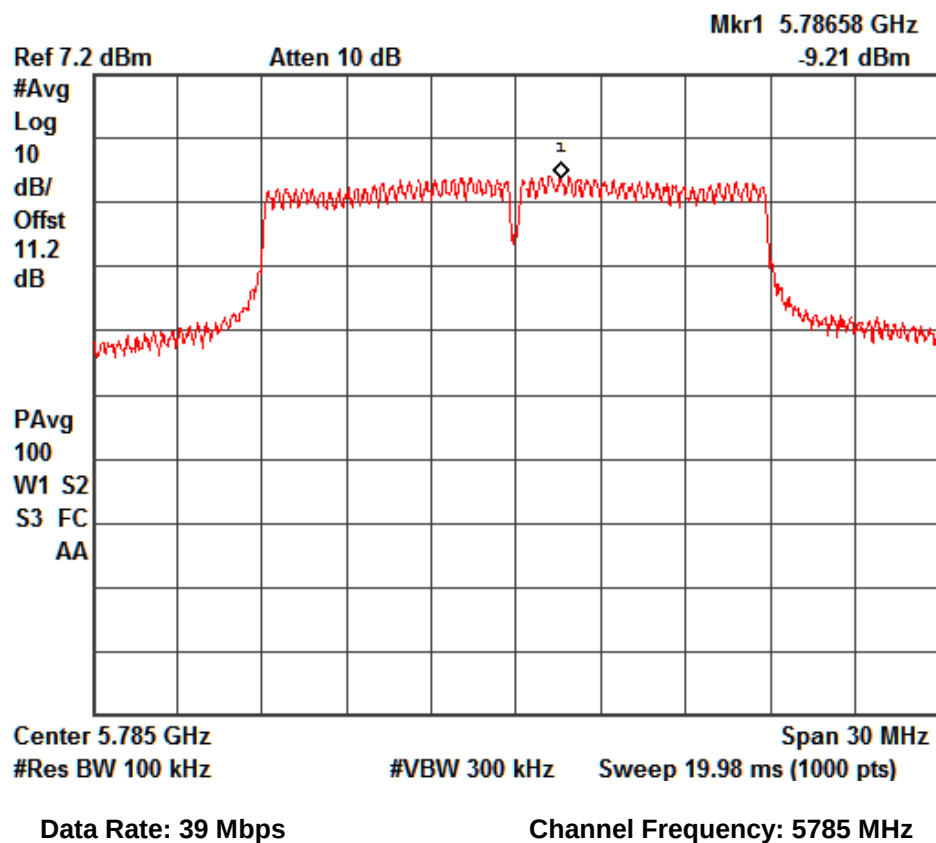
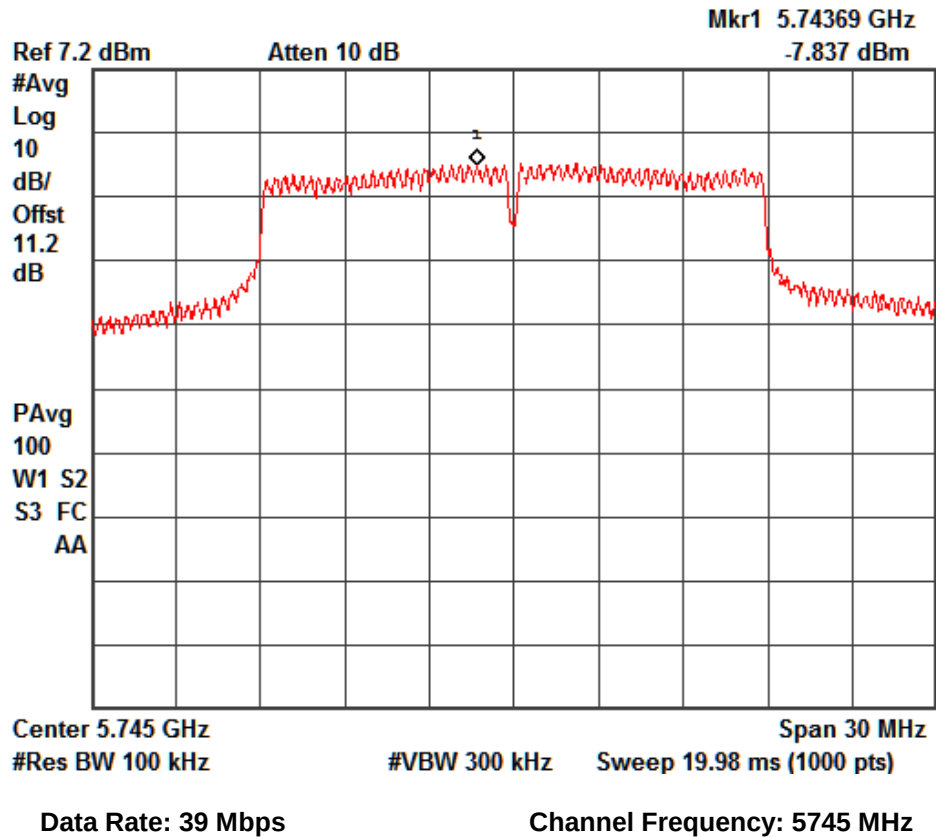
Data Rate: 6.5 Mbps

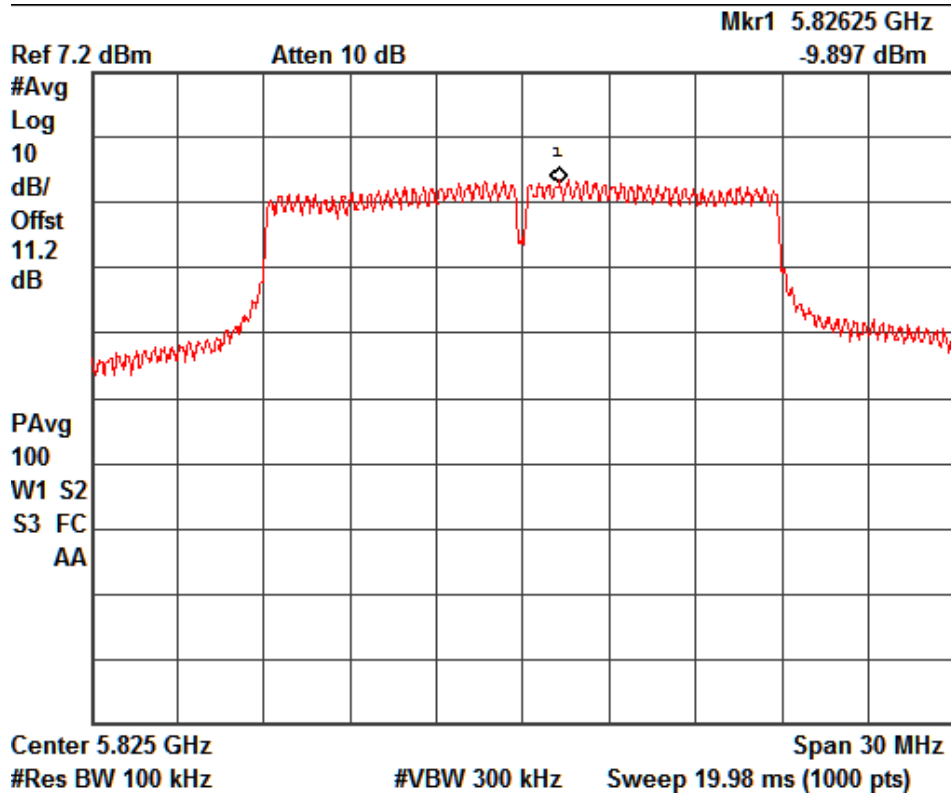
Channel Frequency: 5745 MHz

www.tuv.com



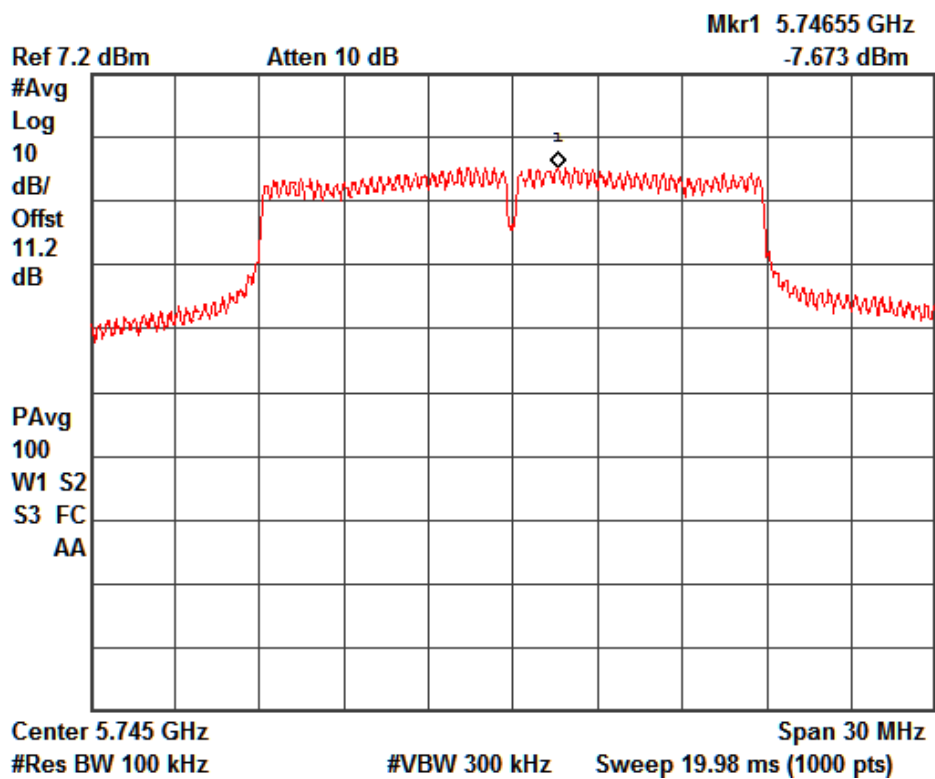
www.tuv.com





Data Rate: 39 Mbps

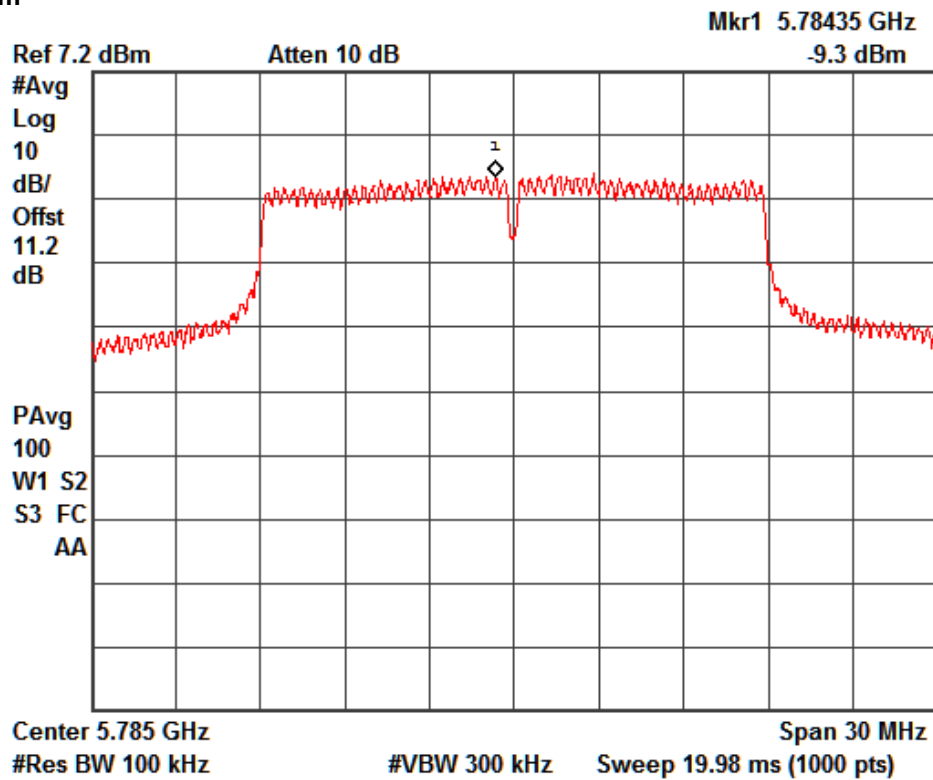
Channel Frequency: 5825 MHz



Data Rate: 65 Mbps

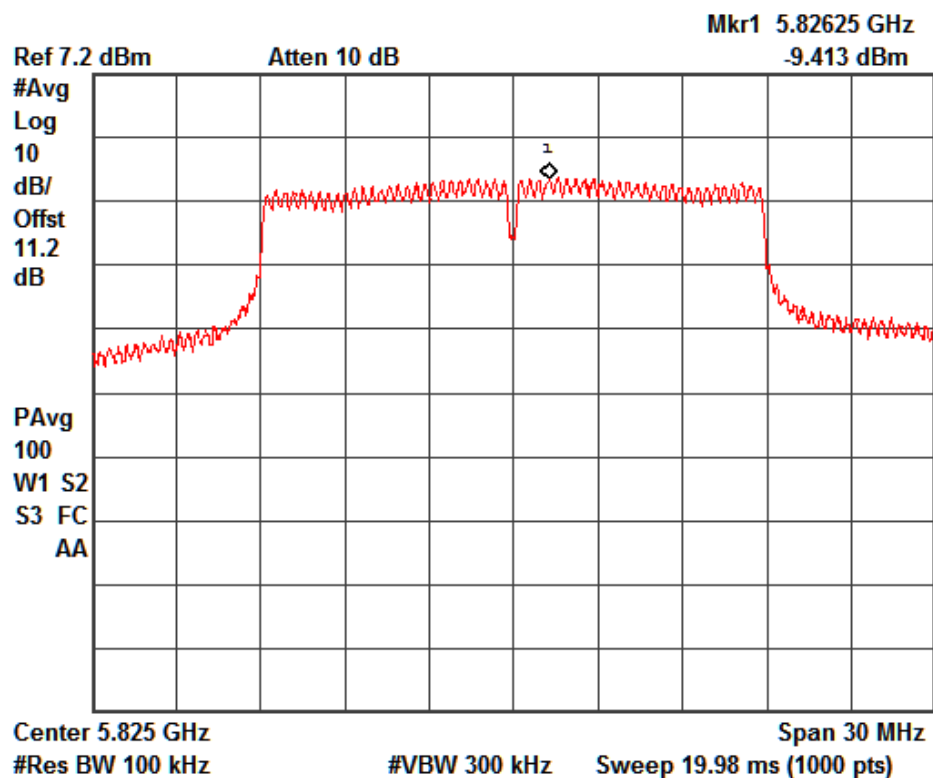
Channel Frequency: 5745 MHz

www.tuv.com



Data Rate: 65 Mbps

Channel Frequency: 5785 MHz



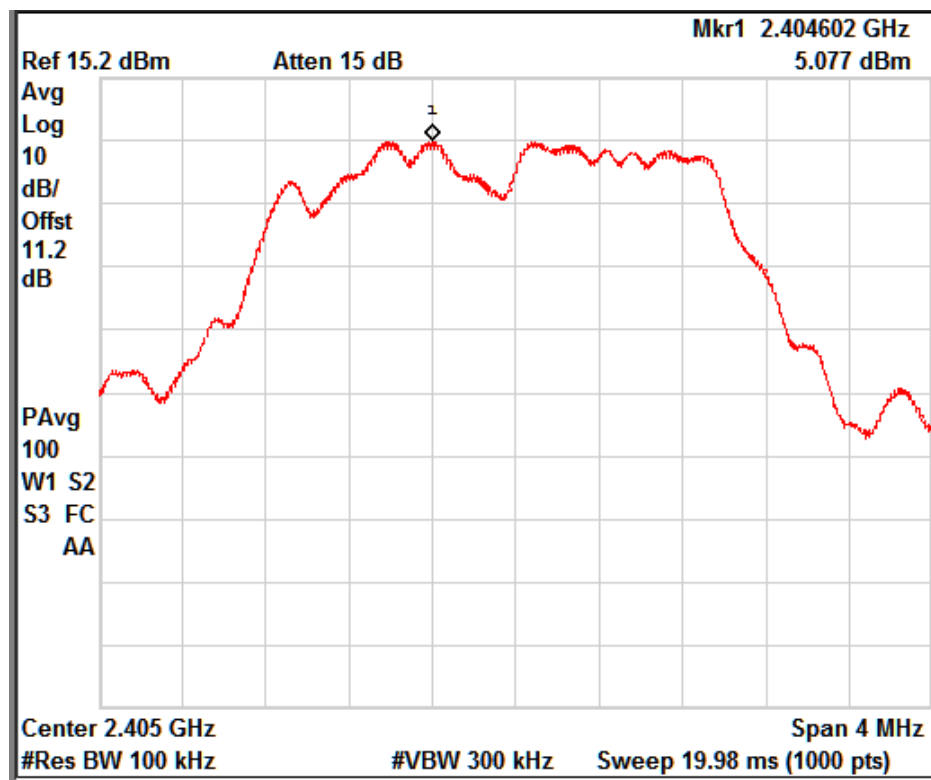
Data Rate: 65 Mbps

Channel Frequency: 5825 MHz

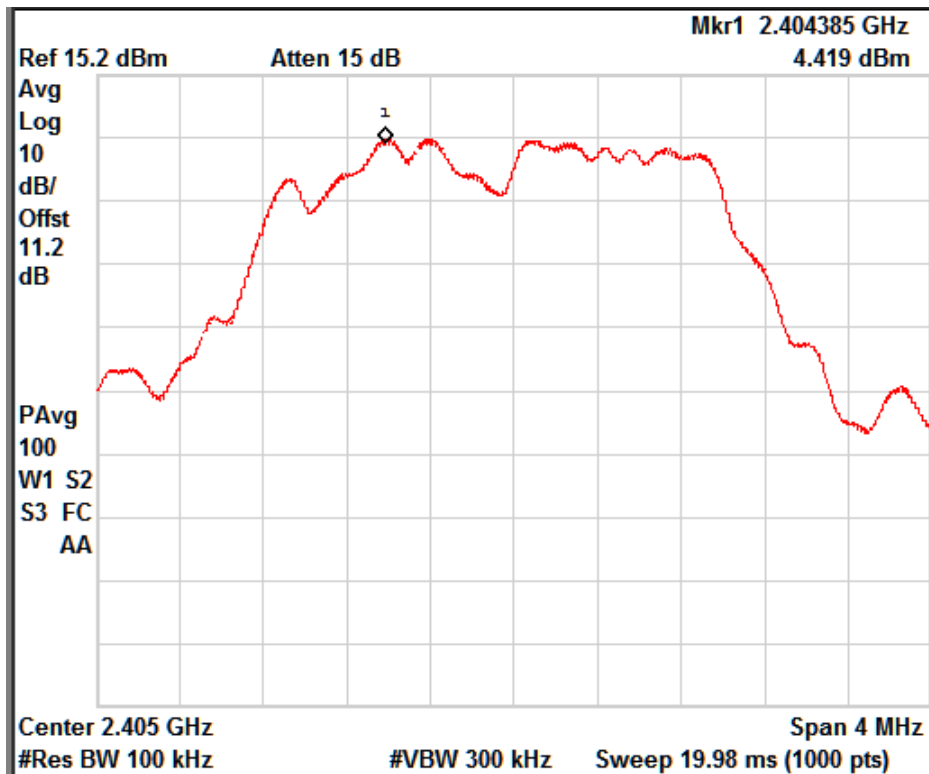
www.tuv.com

Test Result: ZigBee

Channel Frequency (MHz)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
2405.00	05.07	8.00	-02.93
2440.00	04.41	8.00	-03.59
2480.00	06.34	8.00	-01.66

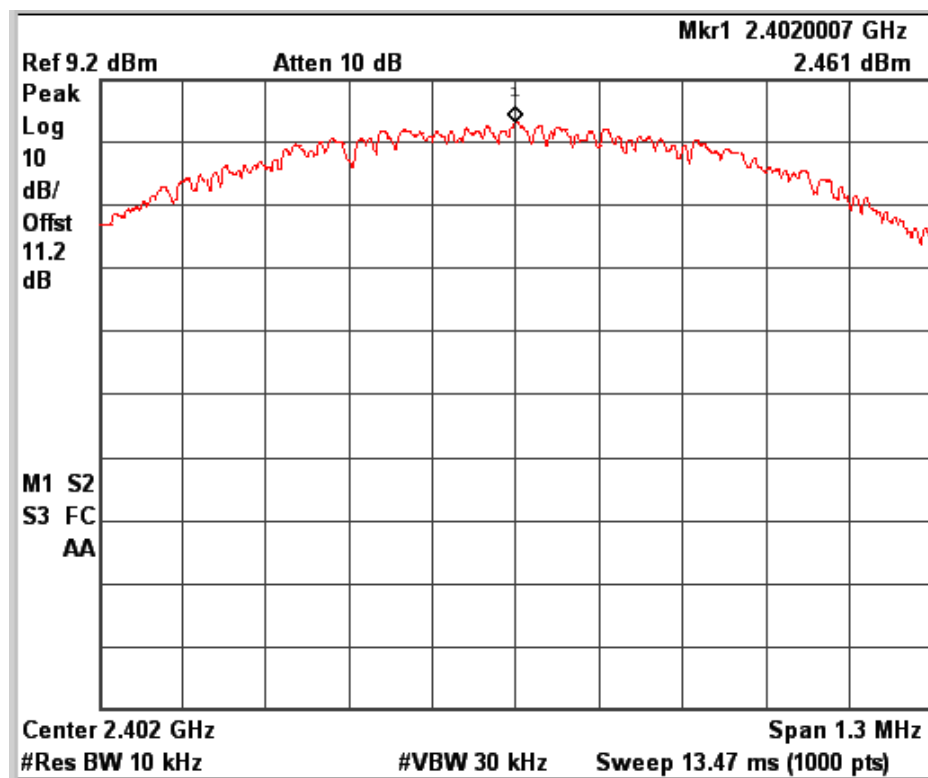


Channel Frequency: 2405 MHz

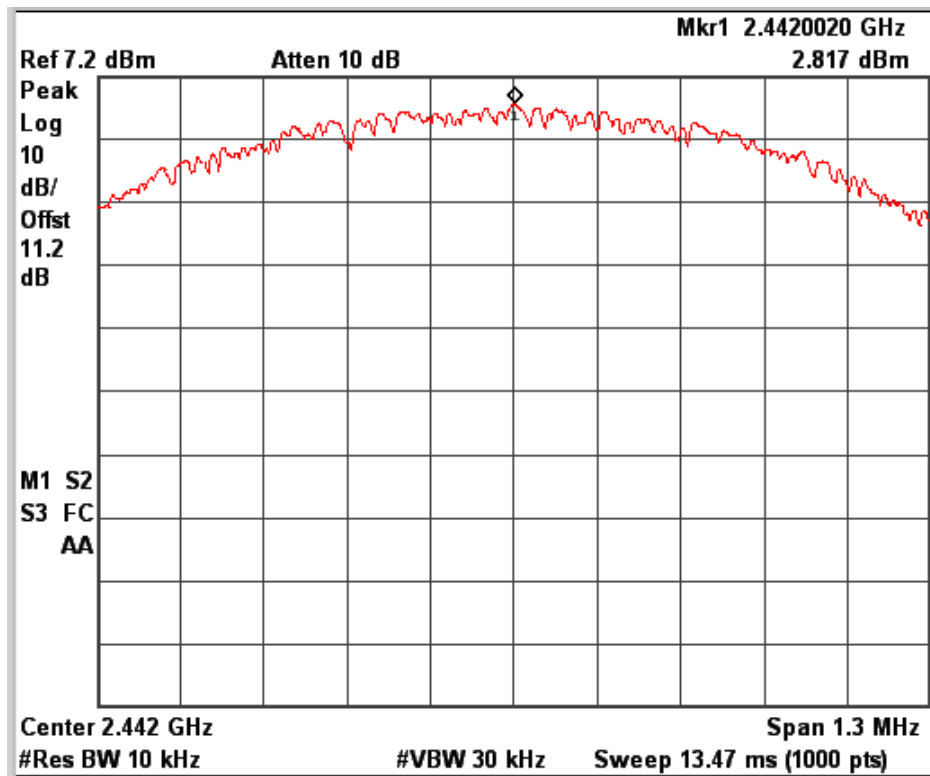


Test Result: Bluetooth LE

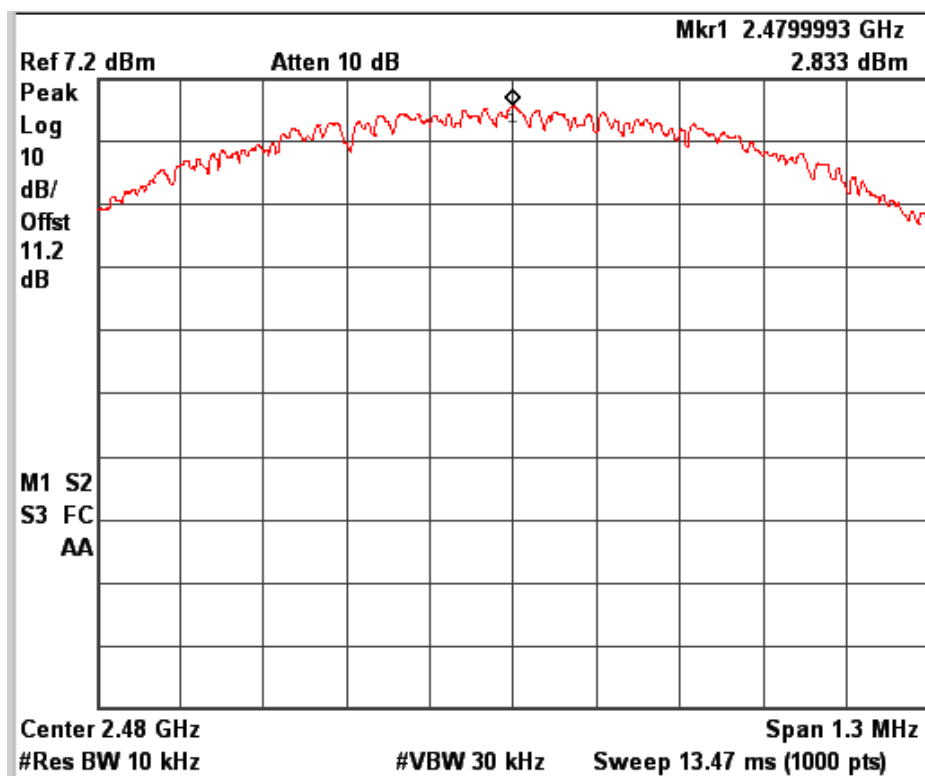
Channel Frequency (MHz)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
2402.00	02.46	8.00	-05.54
2442.00	02.81	8.00	-05.19
2480.00	02.83	8.00	-05.17



Channel Frequency: 2402 MHz



Channel Frequency: 2442 MHz



Channel Frequency: 2480 MHz

www.tuv.com
6 dB Bandwidth

Section 15.247(a) (2)

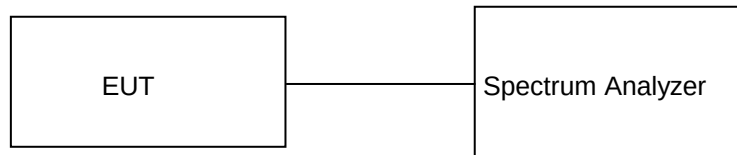
Result

Pass

Test Specification
Requirement

FCC Part 15 Section 15.247 (a) (2)
The minimum 6 dB bandwidth shall be at least 500 kHz.

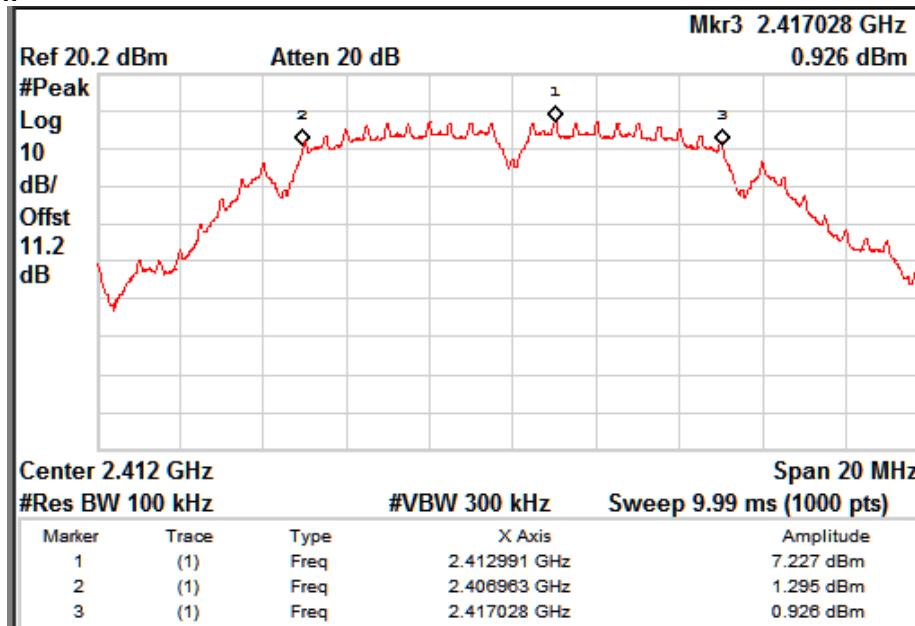
Test Method:



Test Result:

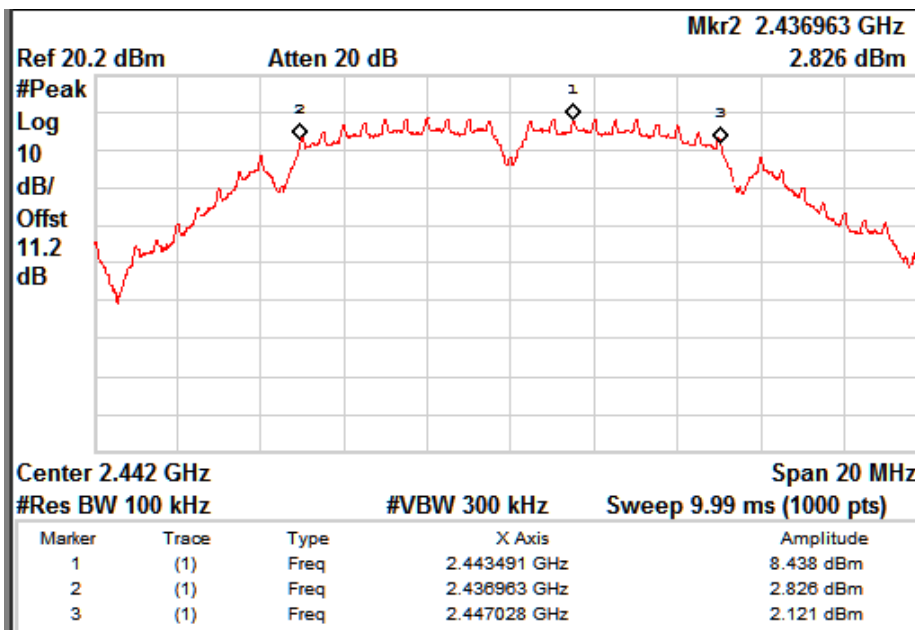
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
b	1	2412.00	2406.963	2417.028	10.065	12.069
		2442.00	2436.963	2447.028	10.065	12.359
		2462.00	2456.963	2467.028	10.065	12.166
	11	2412.00	2407.203	2416.788	9.585	11.958
		2442.00	2437.203	2446.707	9.504	12.065
		2462.00	2457.003	2466.788	9.785	11.960

www.tuv.com



Data Rate: 1 Mbps

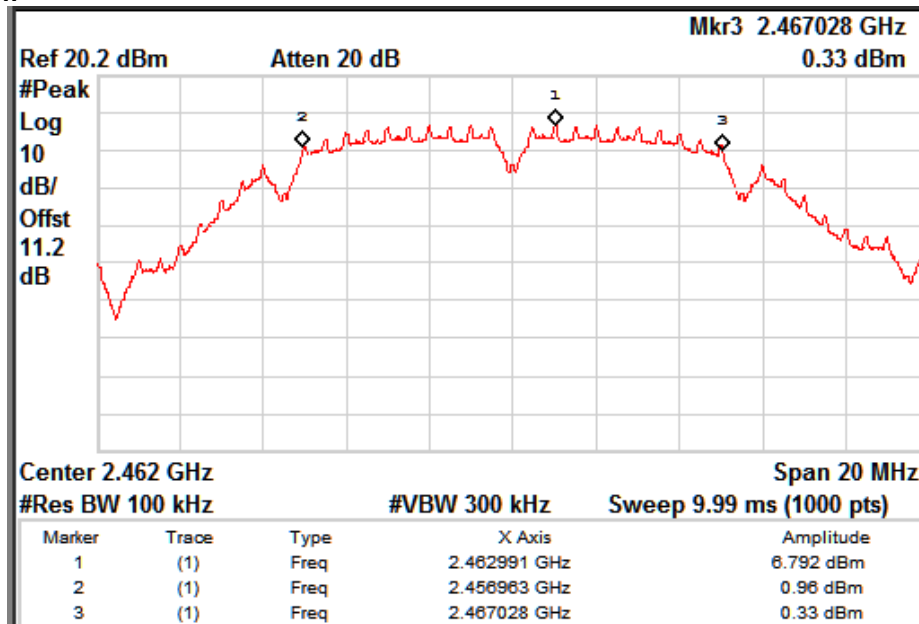
Channel frequency: 2412 MHz



Data Rate: 1 Mbps

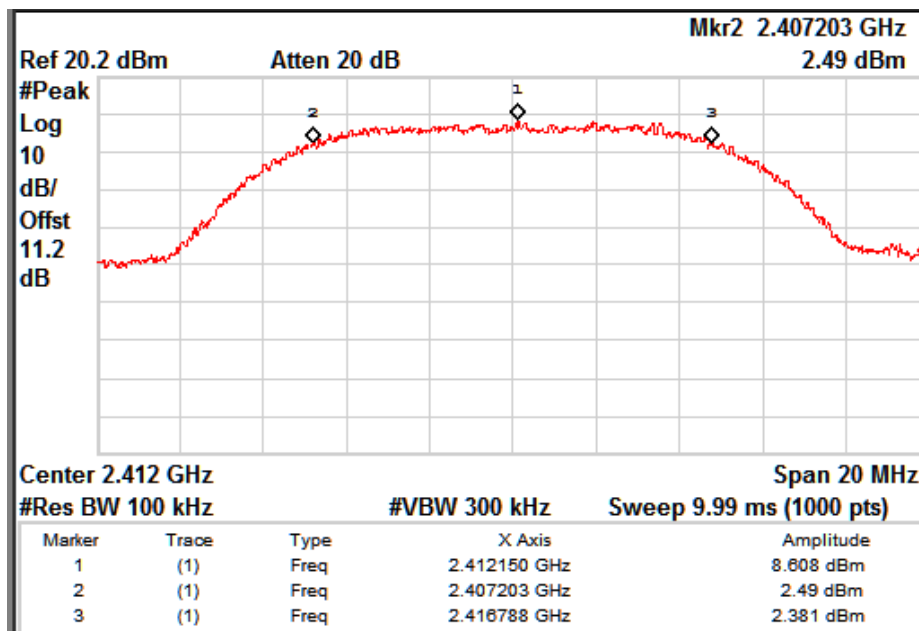
Channel frequency: 2442 MHz

www.tuv.com



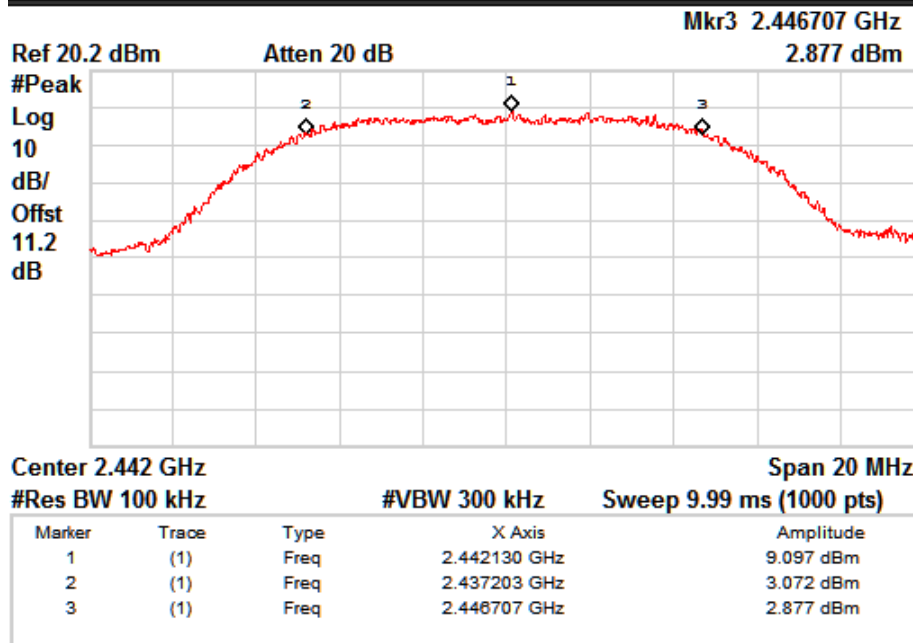
Data Rate: 1 Mbps

Channel frequency: 2462 MHz



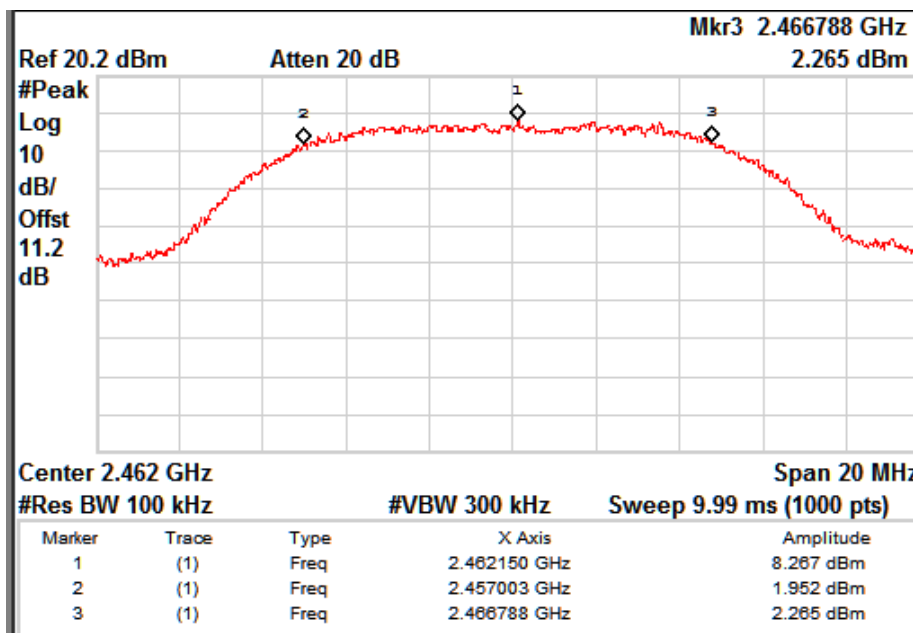
Data Rate: 11 Mbps

Channel frequencies: 2412 MHz



Data Rate: 11 Mbps

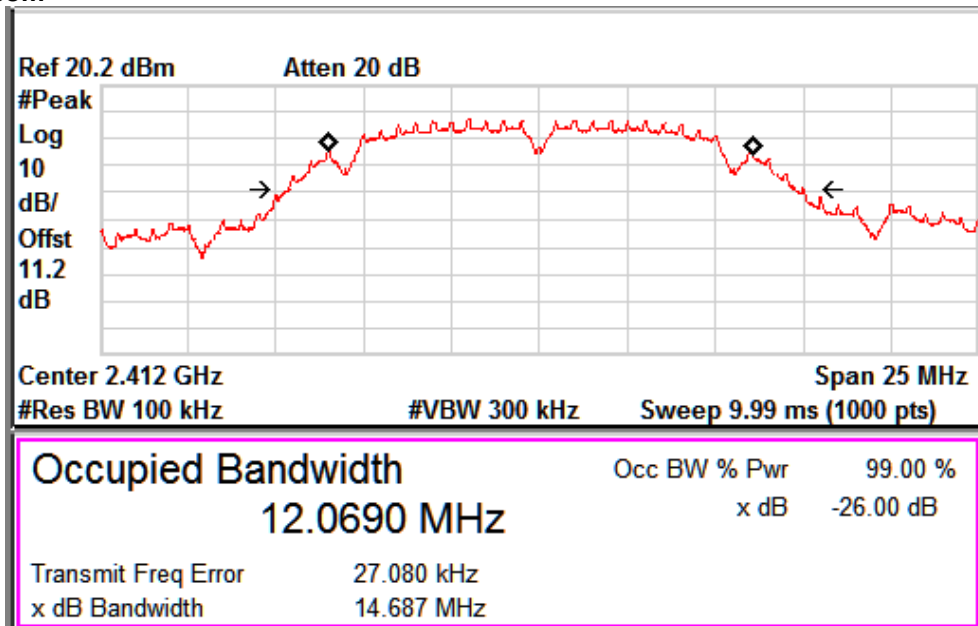
Channel frequency: 2442 MHz



Data Rate: 11 Mbps

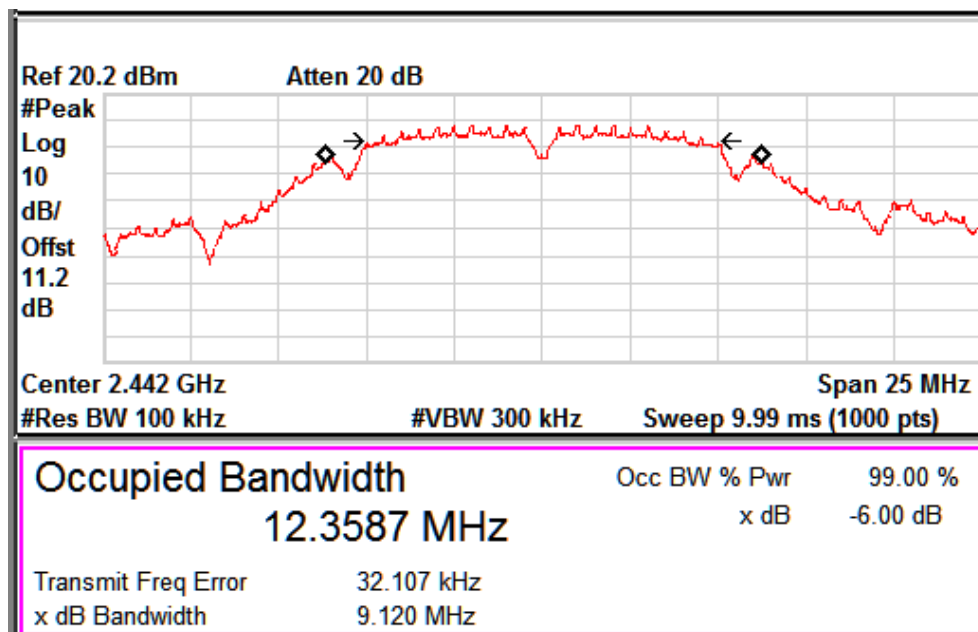
Channel frequency: 2462 MHz

www.tuv.com



Data rate: 1 Mbps

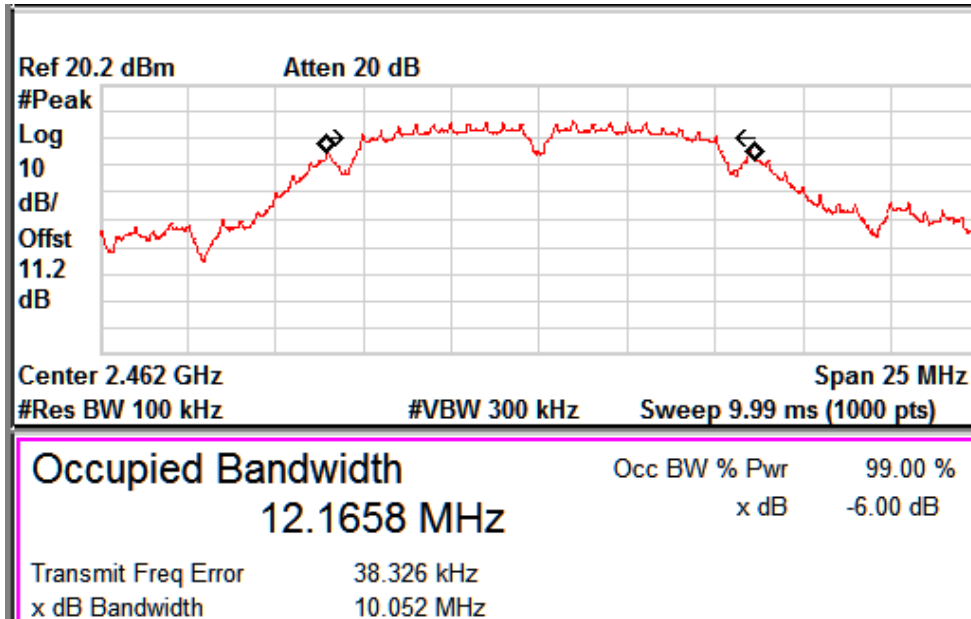
99% Occupied Bandwidth: Channel 2412MHz



Data rate: 1 Mbps

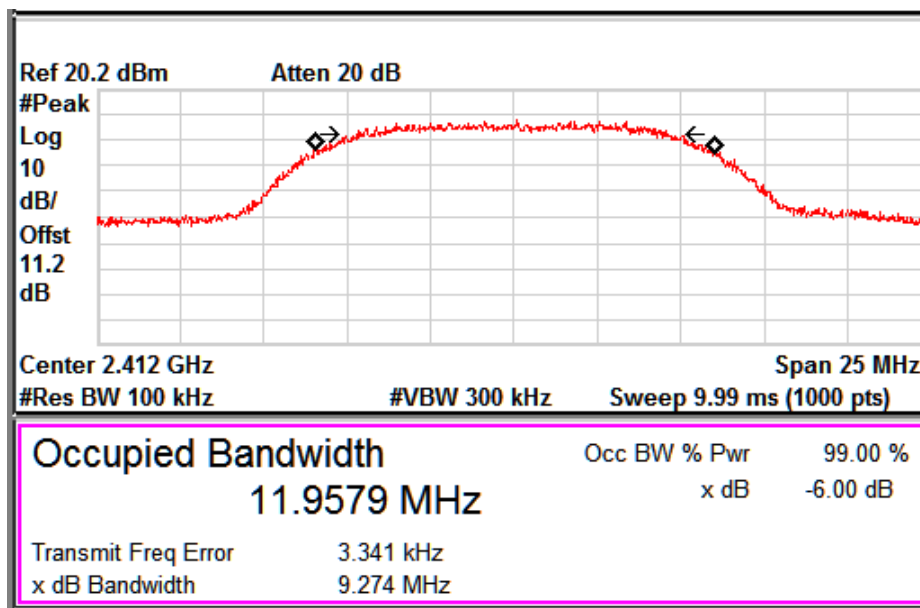
99% Occupied Bandwidth: Channel 2442MHz

www.tuv.com



Data rate: 1 Mbps

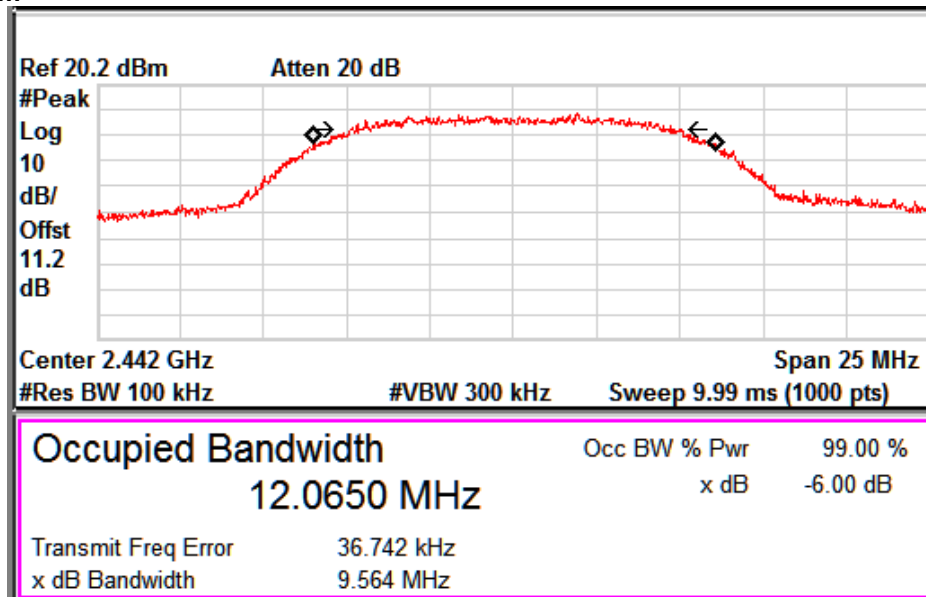
99% Occupied Bandwidth: Channel 2462MHz



Data rate: 11 Mbps

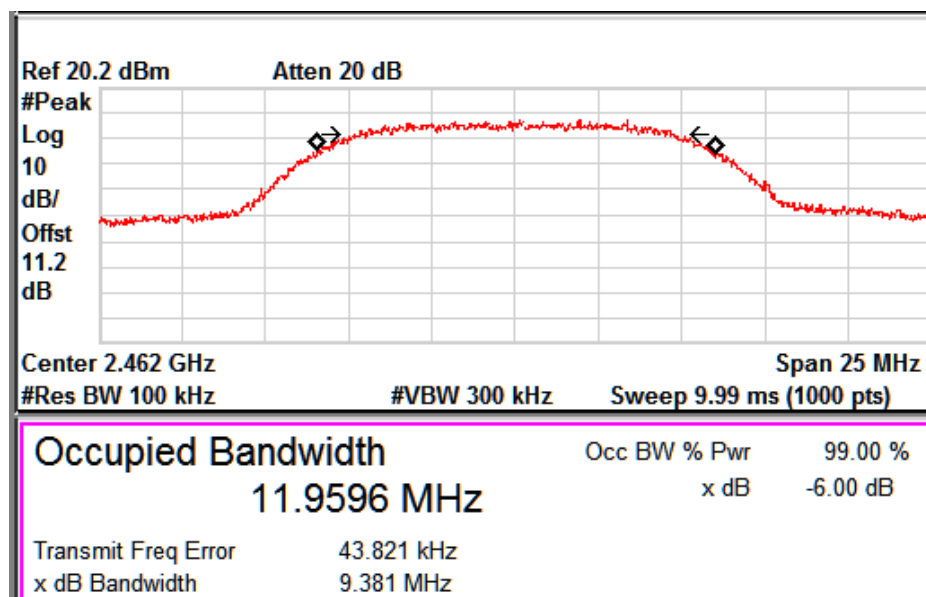
99% Occupied Bandwidth: Channel 2412MHz

www.tuv.com



Data rate: 11 Mbps

99% Occupied Bandwidth: Channel 2442MHz

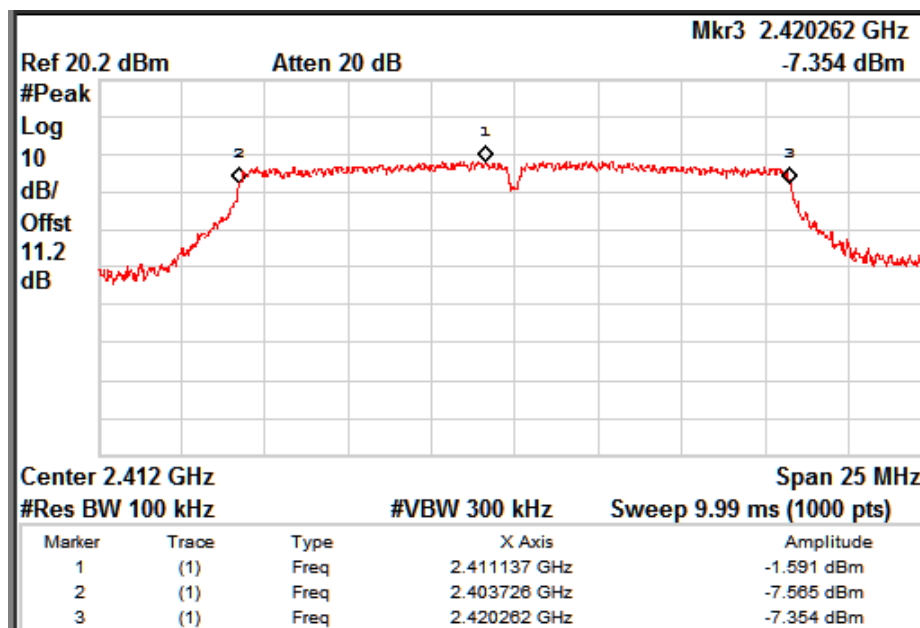


Data rate: 11 Mbps

99% Occupied Bandwidth: Channel 2462MHz

www.tuv.com

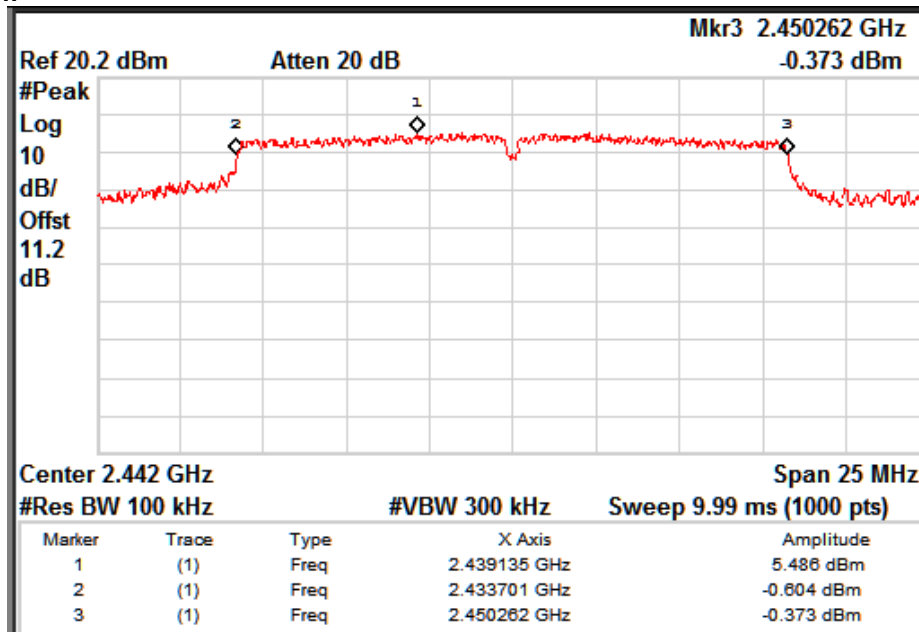
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
g	6	2412.00	2403.726	2420.262	16.536	16.493
		2442.00	2433.701	2450.262	16.561	17.009
		2462.00	2453.726	2470.262	16.536	16.493
	24	2412.00	2403.726	2420.262	16.536	16.425
		2442.00	2433.726	2450.237	16.511	16.767
		2462.00	2453.701	2470.262	16.561	16.448
	54	2412.00	2403.726	2420.262	16.536	16.446
		2442.00	2433.726	2450.237	16.511	16.663
		2462.00	2453.701	2470.262	16.561	16.458



Data Rate: 6 Mbps

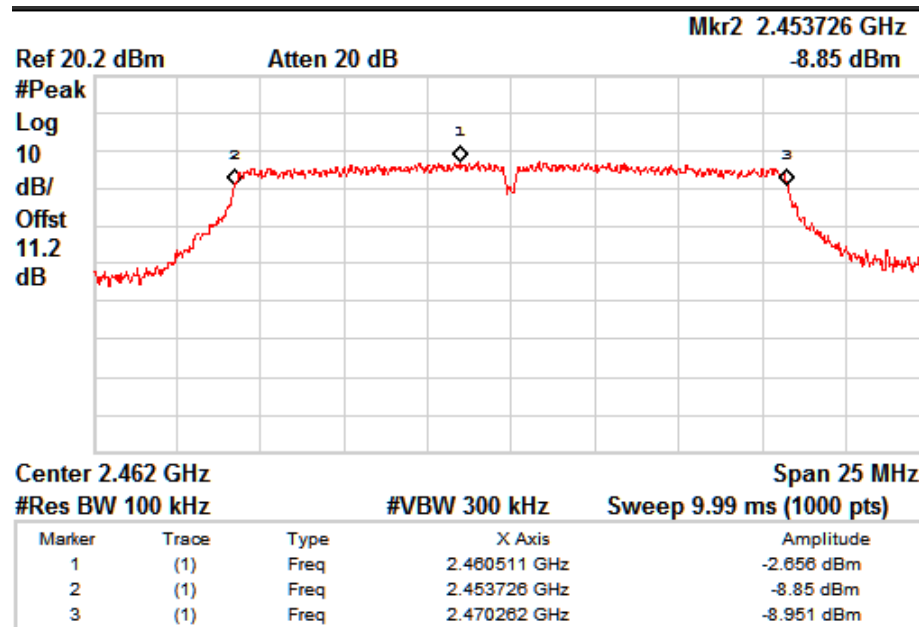
Channel frequencies: 2412 MHz

www.tuv.com



Data Rate: 6 Mbps

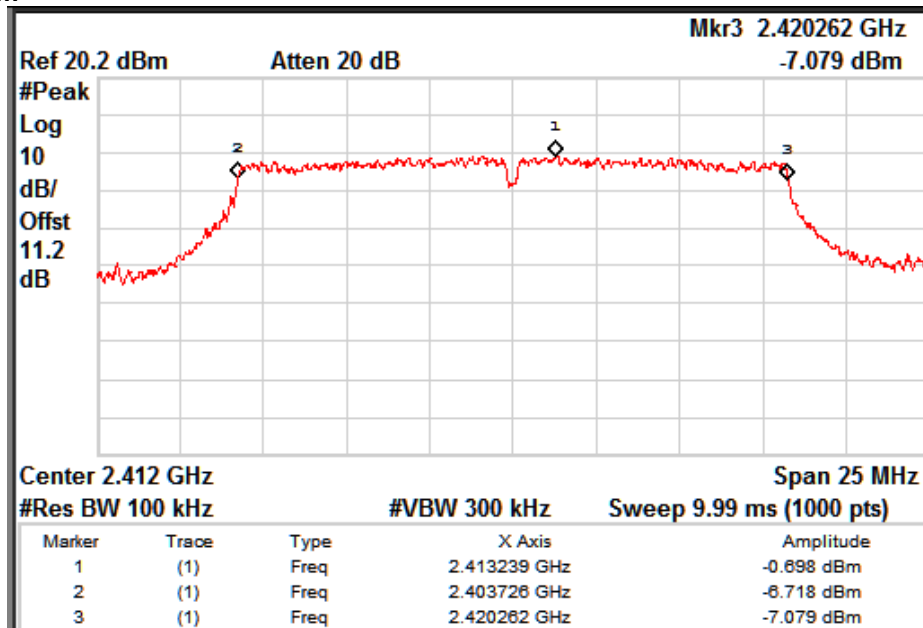
Channel frequencies: 2442 MHz



Data Rate: 6 Mbps

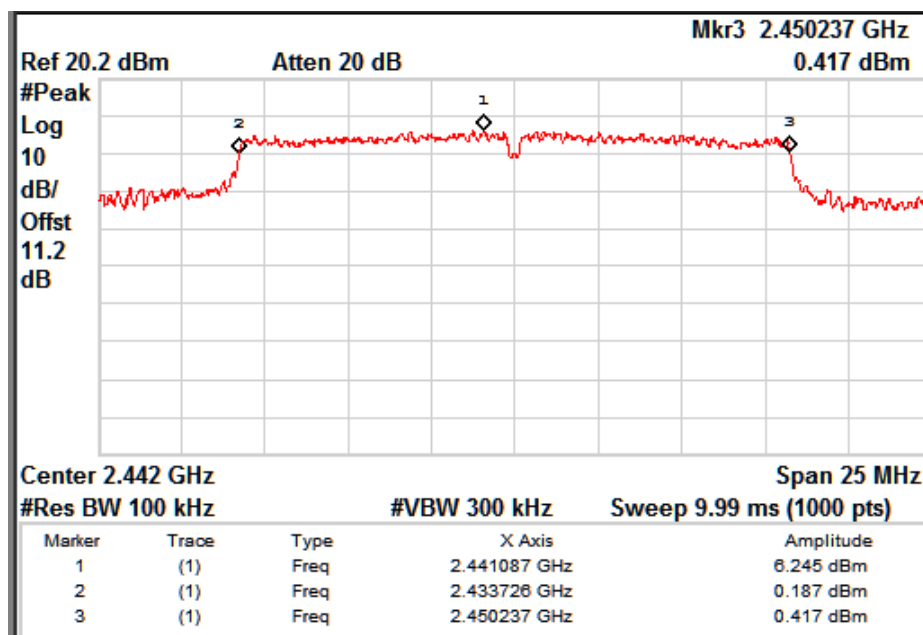
Channel frequencies: 2462 MHz

www.tuv.com



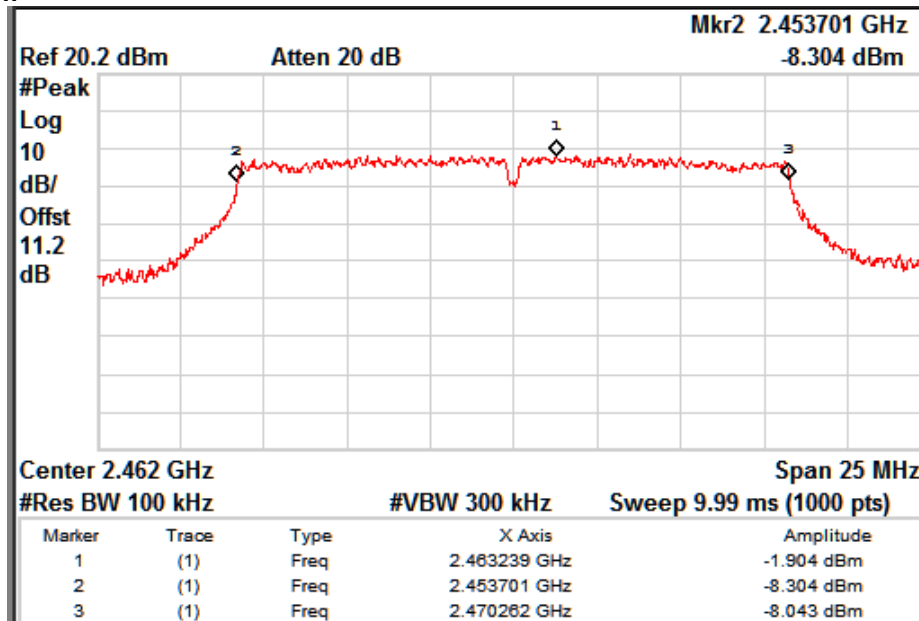
Data Rate: 24 Mbps

Channel frequencies: 2412 MHz



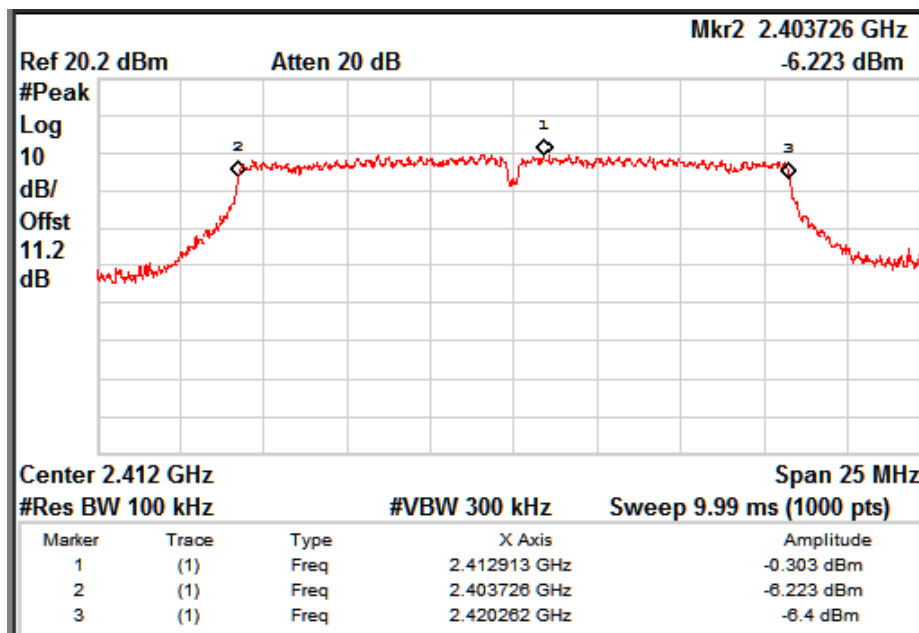
Data Rate: 24 Mbps

Channel frequencies: 2442 MHz



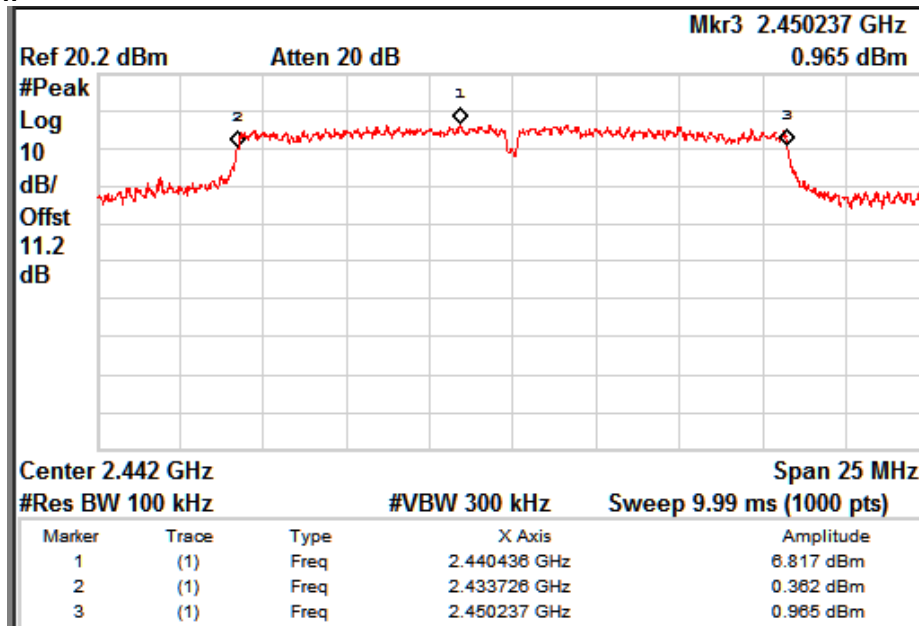
Data Rate: 24 Mbps

Channel frequencies: 2462 MHz



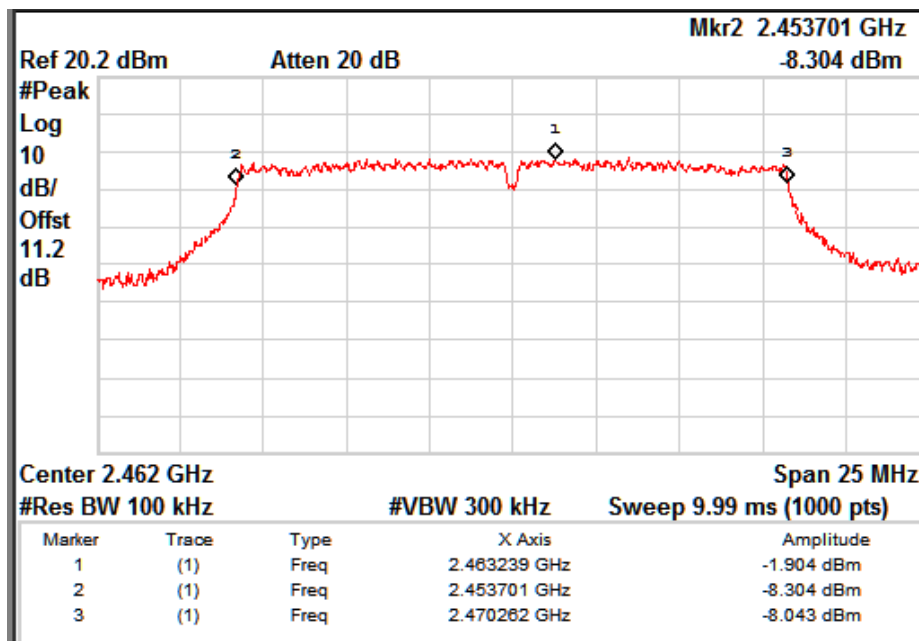
Data Rate: 54 Mbps

Channel frequencies: 2412 MHz



Data Rate: 54 Mbps

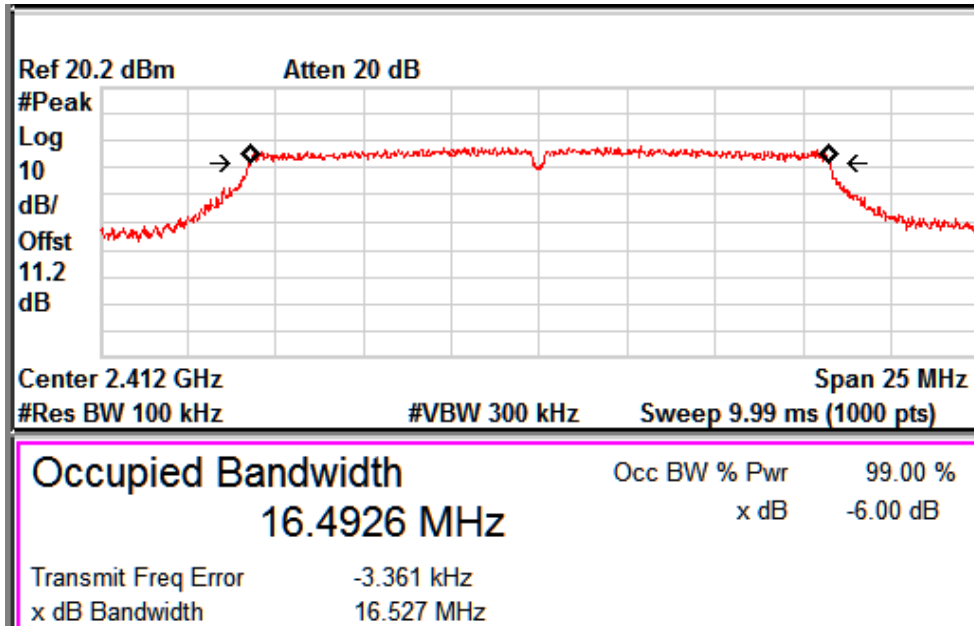
Channel frequencies: 2442MHz



Data Rate: 54 Mbps

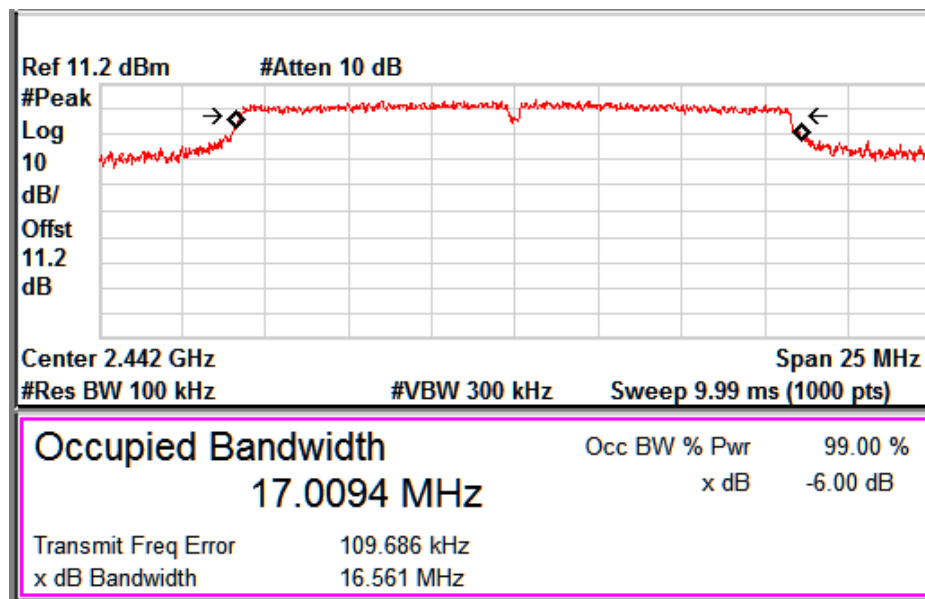
Channel frequencies: 2472 MHz

www.tuv.com



Data Rate: 6 Mbps

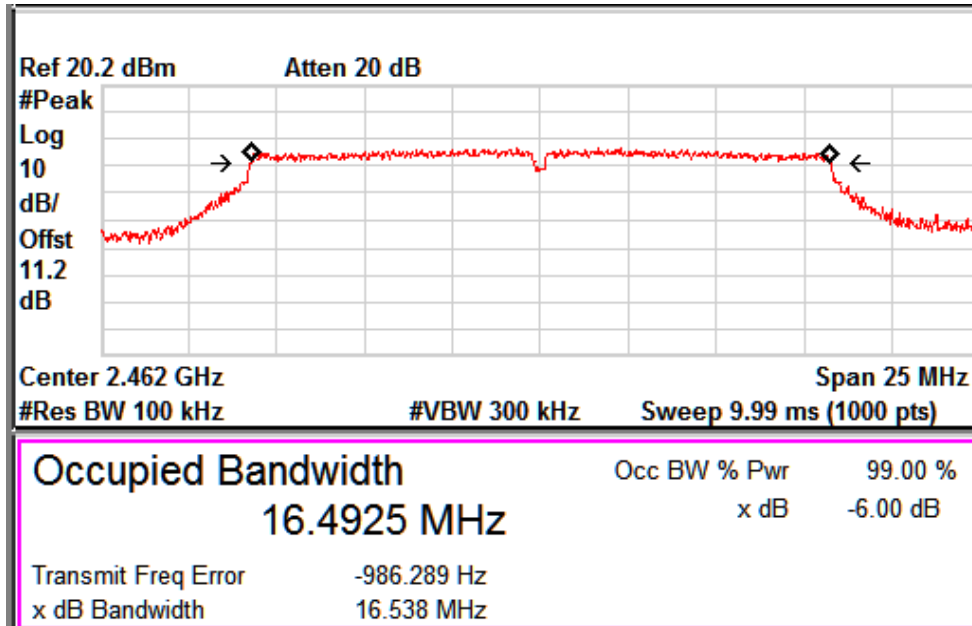
99% Occupied Bandwidth: Channel 2412MHz



Data Rate: 6 Mbps

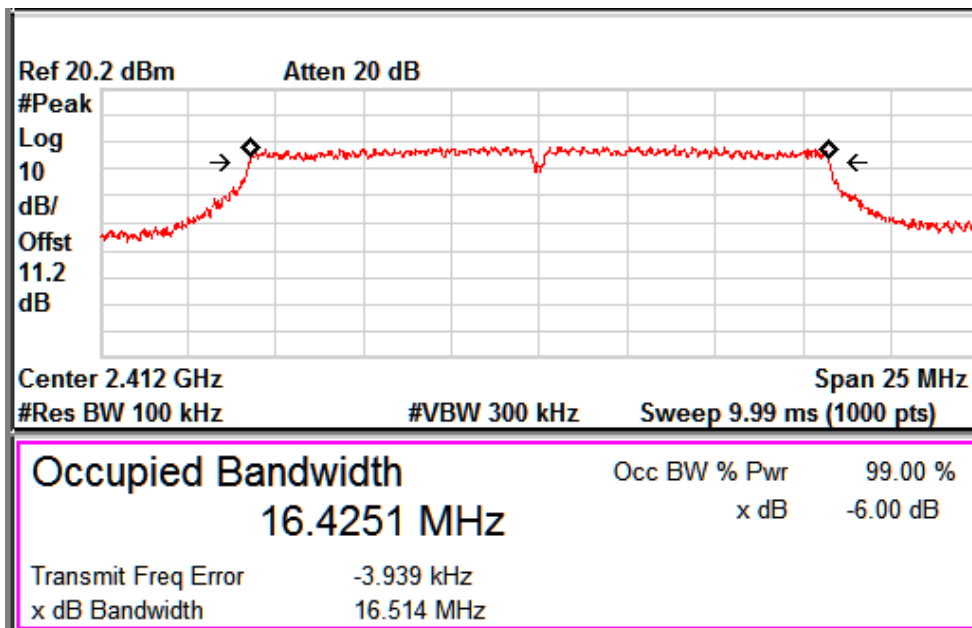
99% Occupied Bandwidth: Channel 2442MHz

www.tuv.com



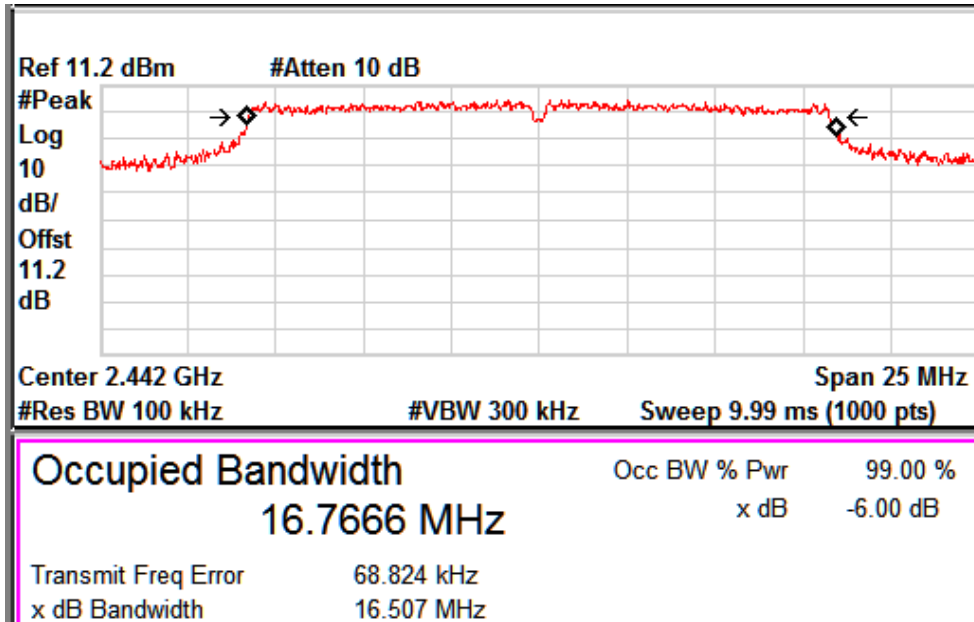
Data Rate: 6 Mbps

99% Occupied Bandwidth: Channel 2462MHz



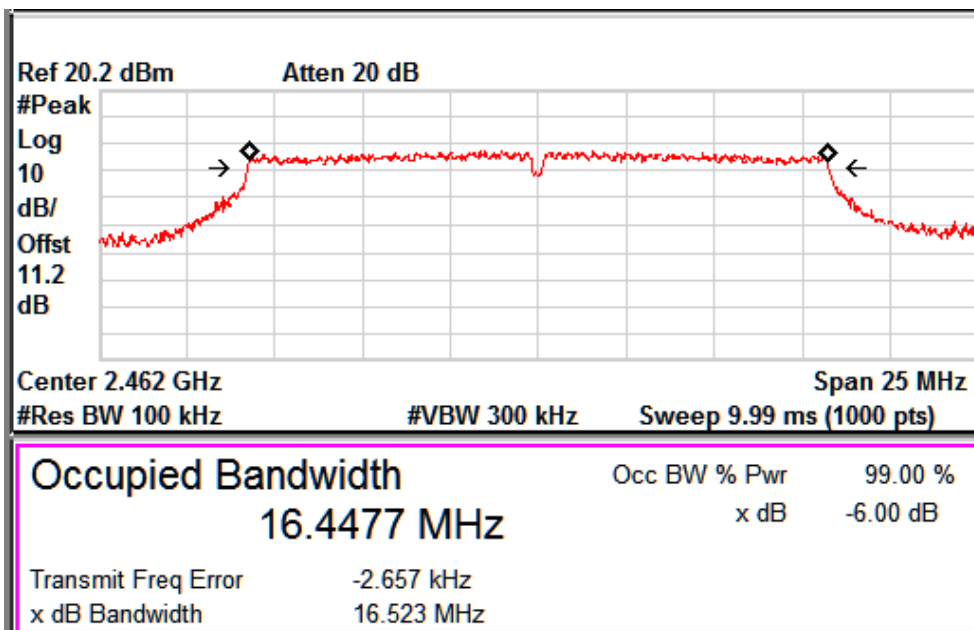
Data Rate: 24 Mbps

99% Occupied Bandwidth: Channel 2412MHz



Data Rate: 24 Mbps

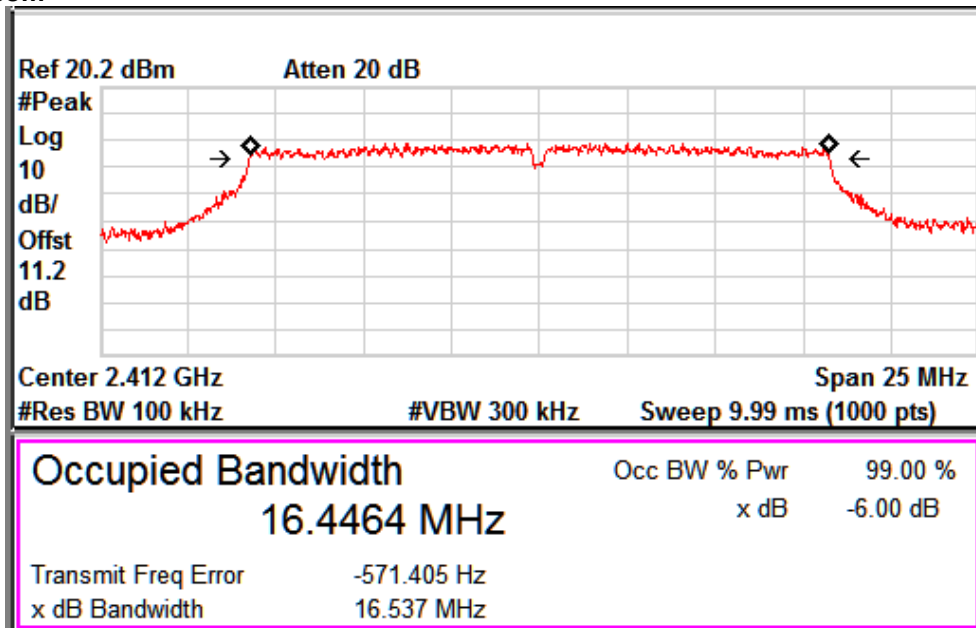
99% Occupied Bandwidth: Channel 2442MHz



Data Rate: 24 Mbps

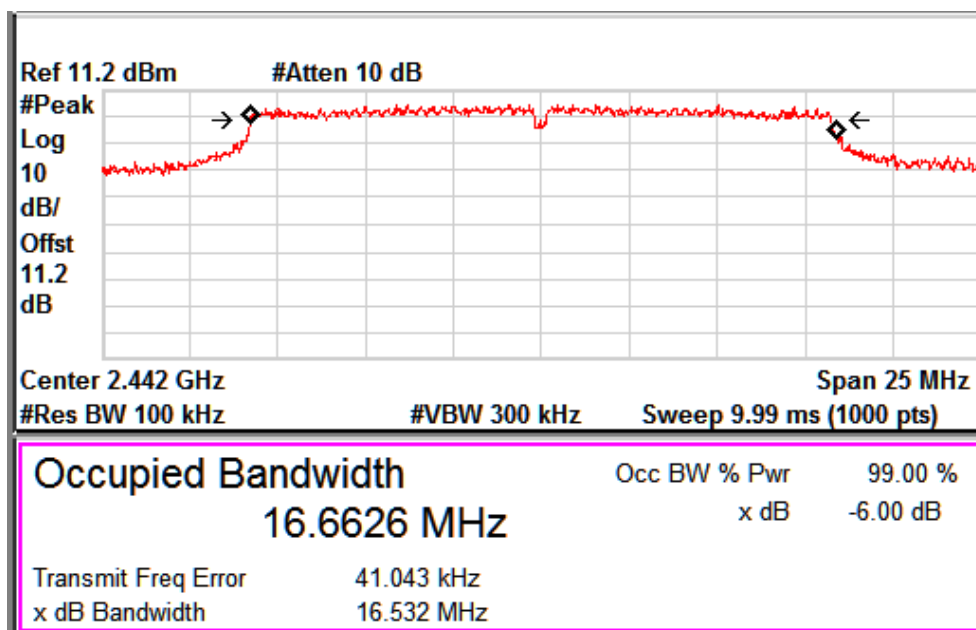
99% Occupied Bandwidth: Channel 2462MHz

www.tuv.com



Data Rate: 54 Mbps

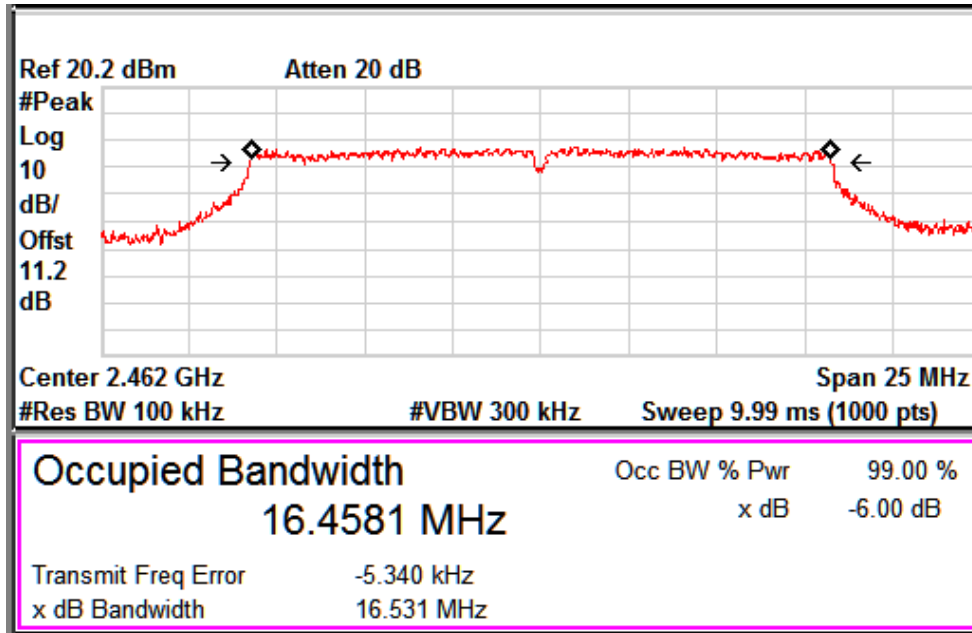
99% Occupied Bandwidth: Channel 2412MHz



Data Rate: 54 Mbps

99% Occupied Bandwidth: Channel 2442MHz

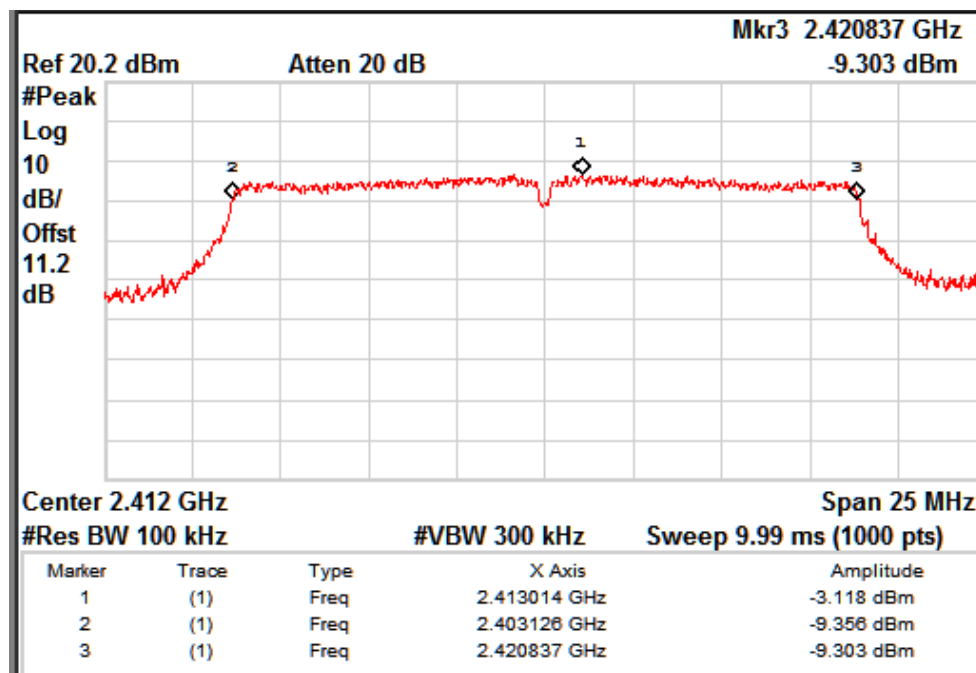
www.tuv.com



Data Rate: 54 Mbps

99% Occupied Bandwidth: Channel 2462MHz

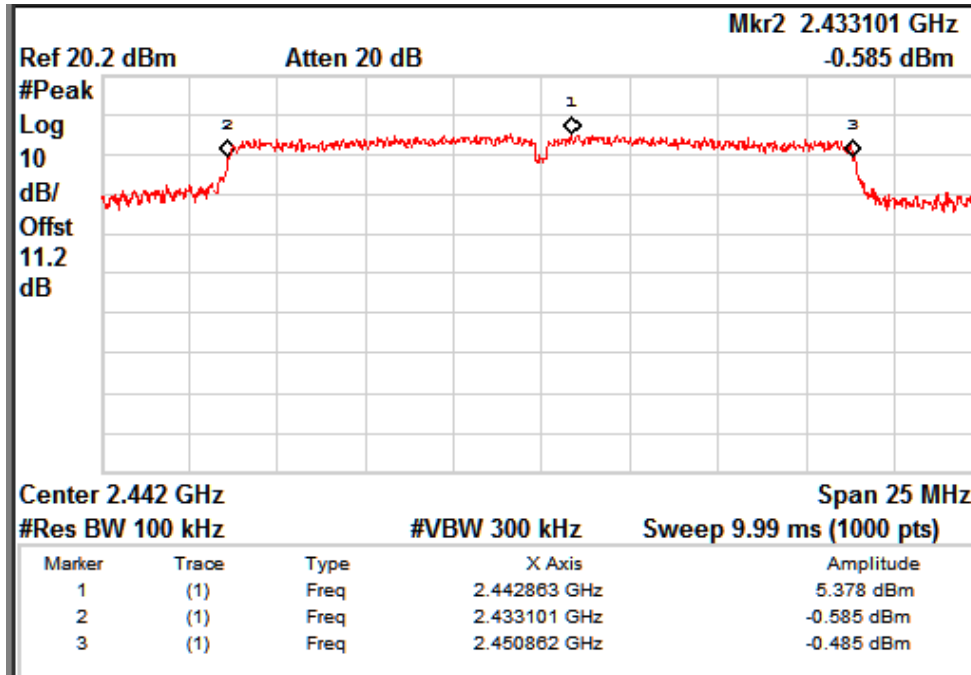
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
n	6.5	2412.00	2403.126	2420.837	17.711	17.632
		2442.00	2433.101	2450.862	17.761	17.916
		2462.00	2453.101	2470.887	17.786	17.639
	39	2412.00	2403.101	2420.837	17.736	17.620
		2442.00	2433.101	2450.862	17.761	17.773
		2462.00	2453.101	2470.887	17.786	17.614
	65	2412.00	2403.101	2420.862	17.761	17.617
		2442.00	2433.101	2450.887	17.786	17.773
		2462.00	2453.101	2470.887	17.786	17.629



Data Rate: 6.5 Mbps

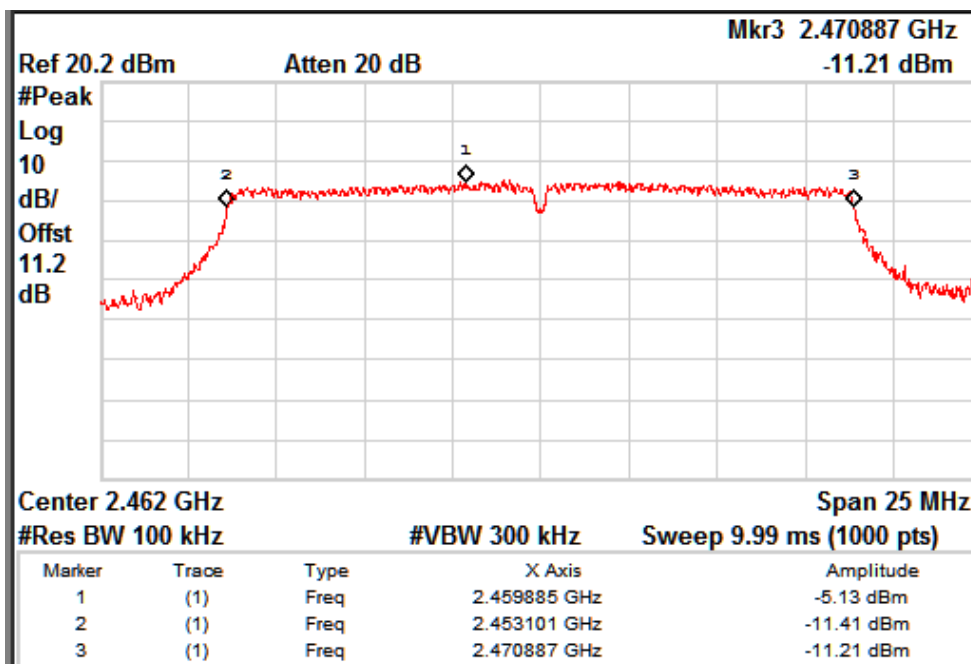
Channel: 2412 MHz

www.tuv.com



Data Rate: 6.5 Mbps

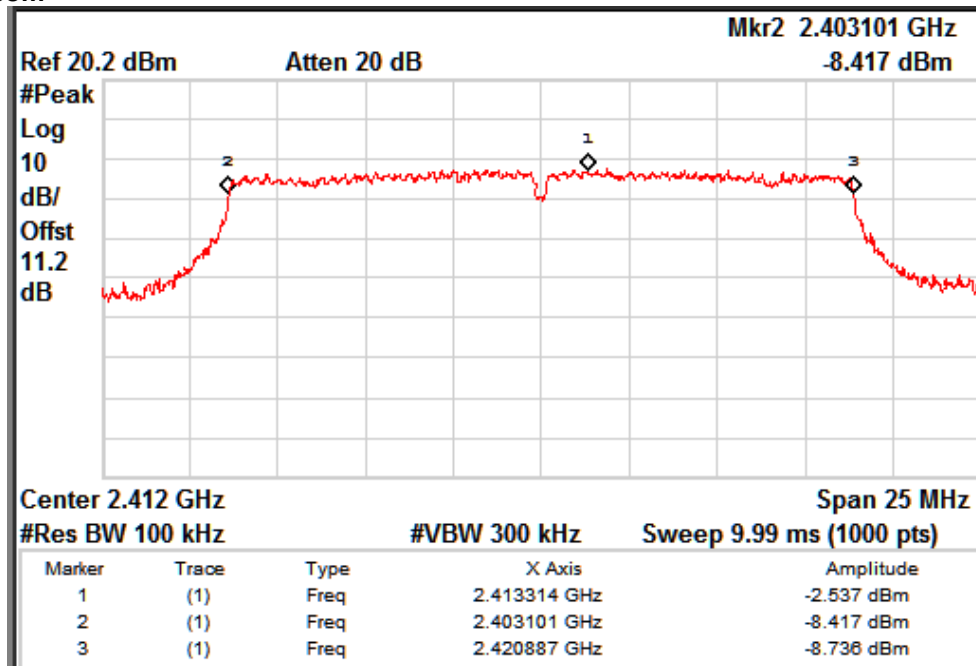
Channel: 2442 MHz



Data Rate: 6.5 Mbps

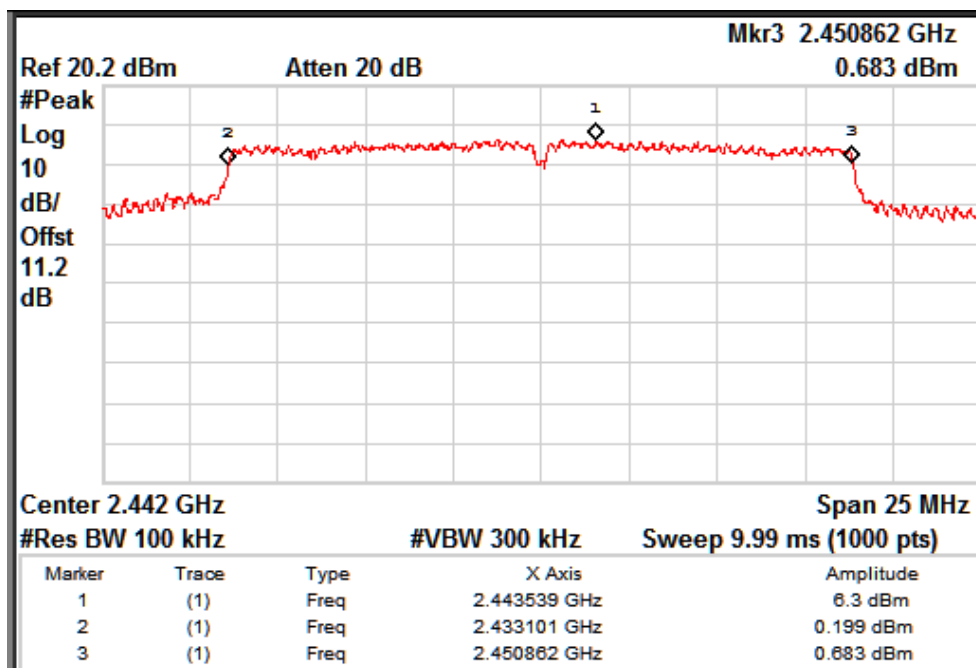
Channel: 2462 MHz

www.tuv.com



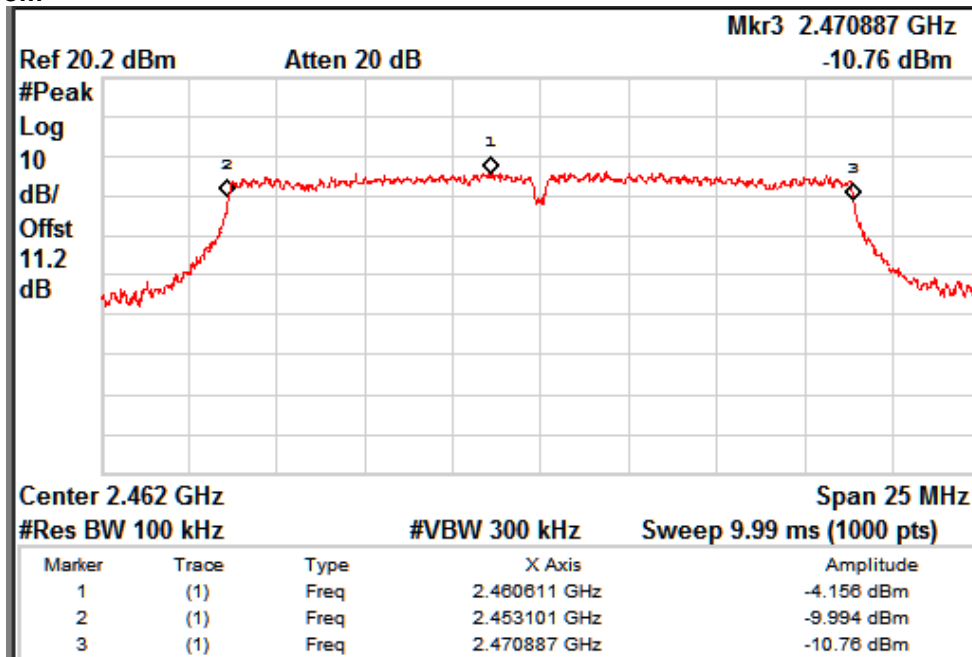
Data Rate: 39 Mbps

Channel: 2412 MHz



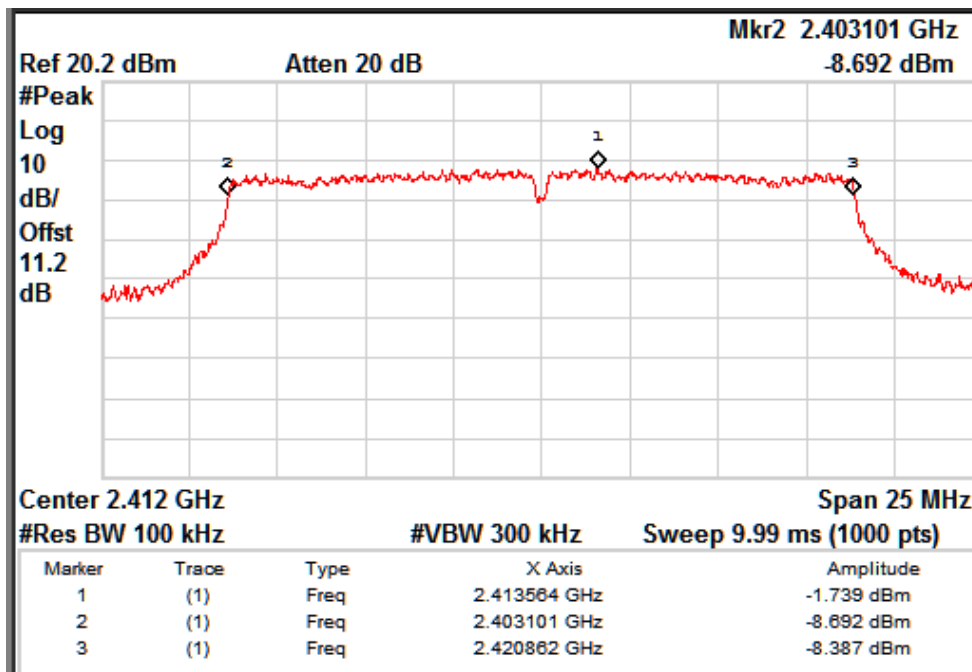
Data Rate: 39 Mbps

Channel: 2442 MHz



Data Rate: 39 Mbps

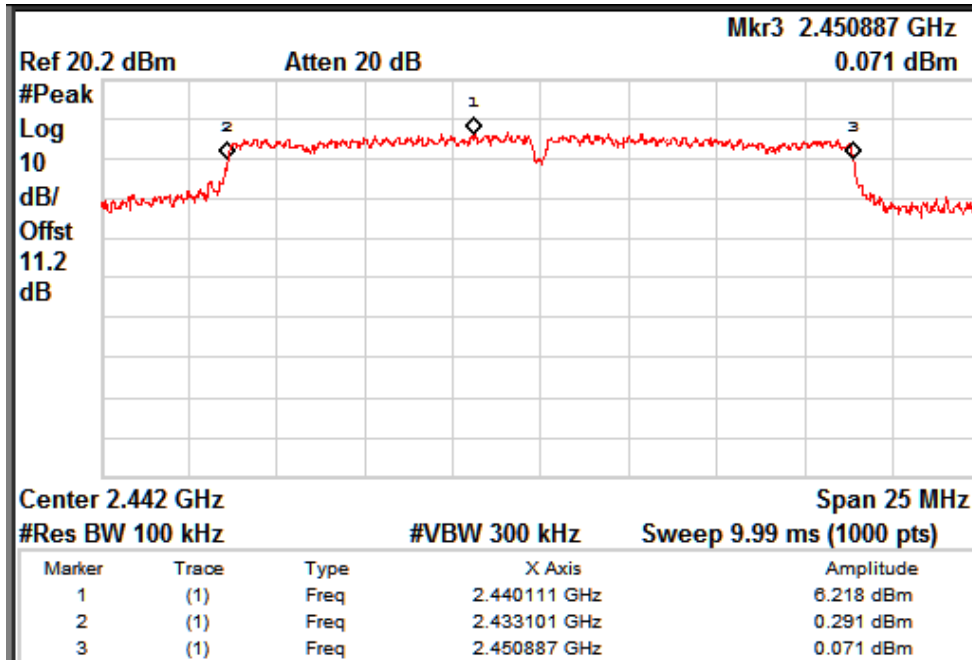
Channel: 2462 MHz



Data Rate: 65 Mbps

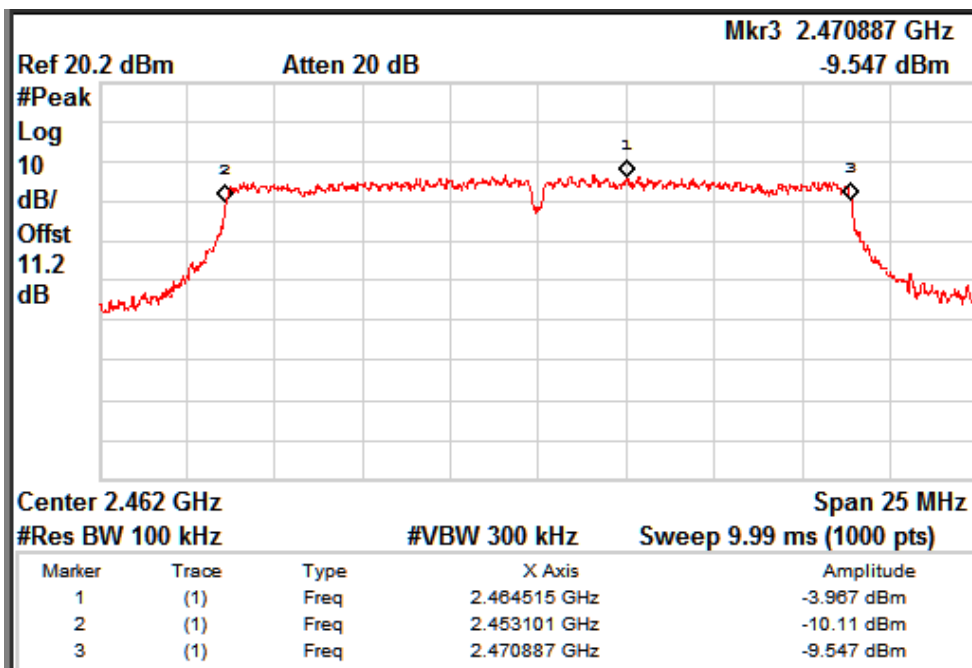
Channel: 2412 MHz

www.tuv.com



Data Rate: 65 Mbps

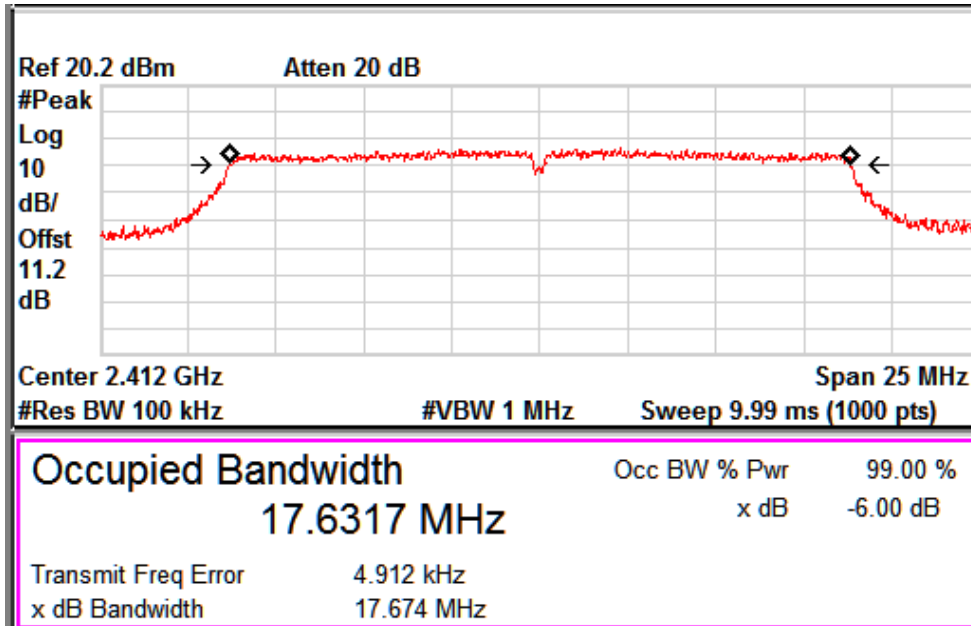
Channel: 2442MHz



Data Rate: 65 Mbps

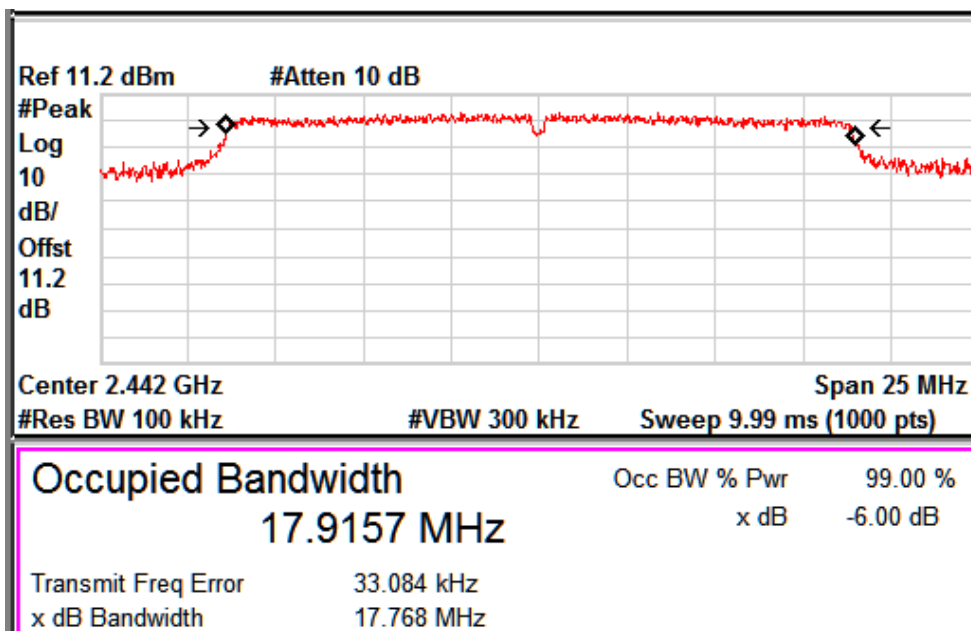
Channel: 2462 MHz

www.tuv.com



Data Rate: 6.5 Mbps

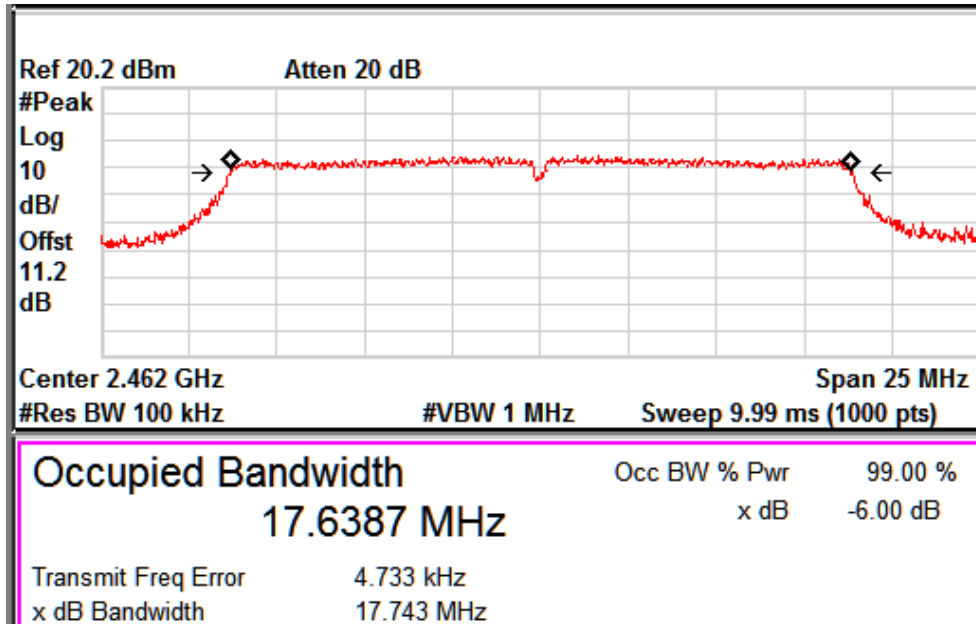
99% Occupied Bandwidth: Channel 2412MHz



Data Rate: 6.5 Mbps

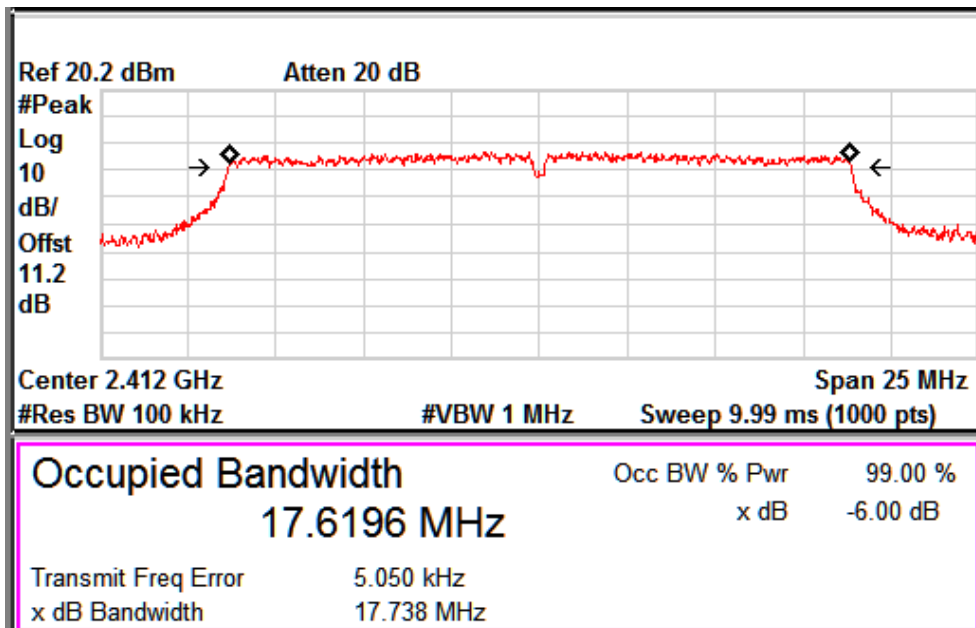
99% Occupied Bandwidth: Channel 2442MHz

www.tuv.com



Data Rate: 6.5 Mbps

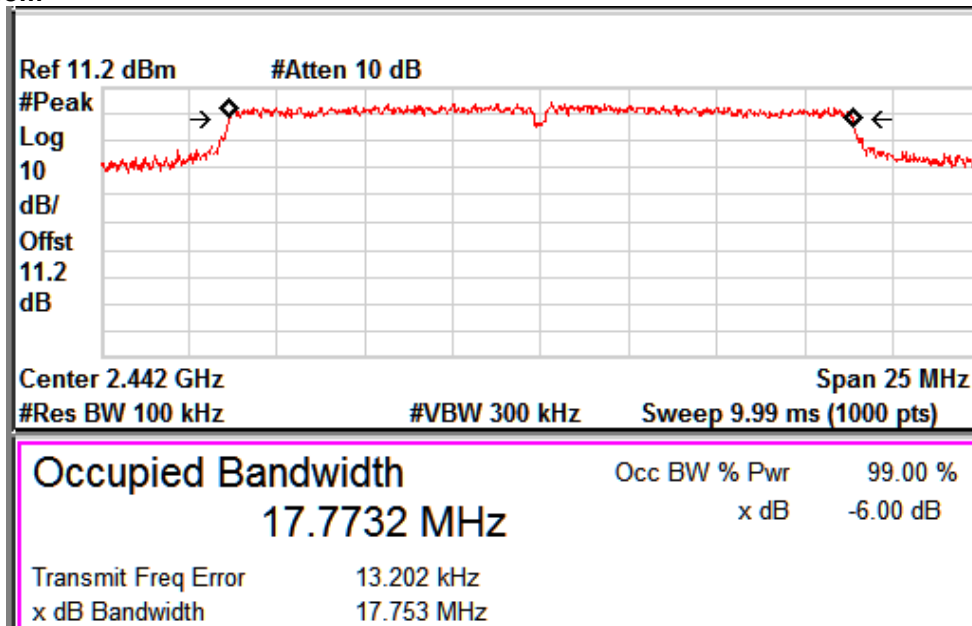
99% Occupied Bandwidth: Channel 2462MHz



Data Rate: 39 Mbps

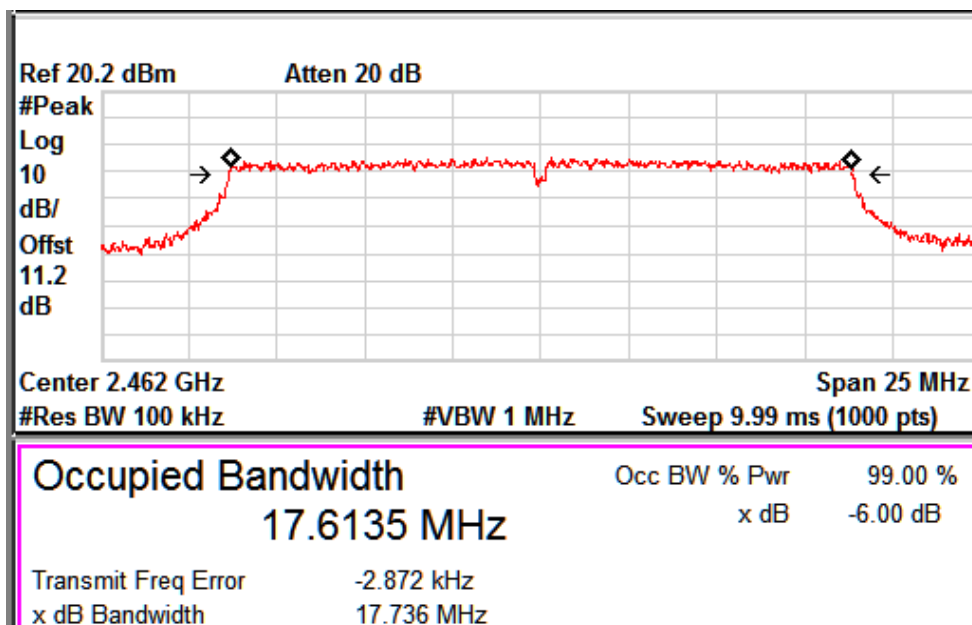
99% Occupied Bandwidth: Channel 2412MHz

www.tuv.com



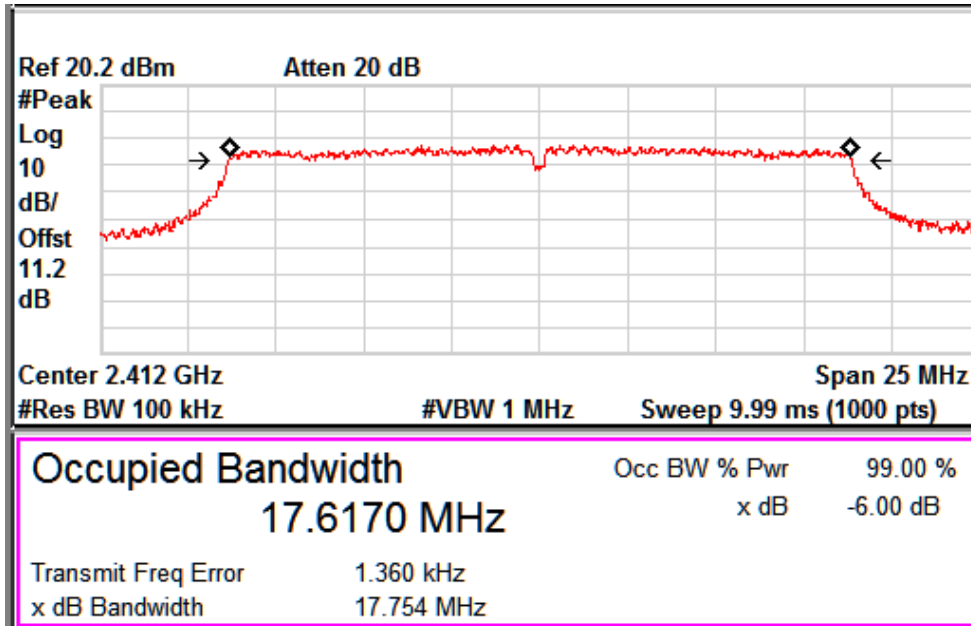
Data Rate: 39 Mbps

99% Occupied Bandwidth: Channel 2442MHz



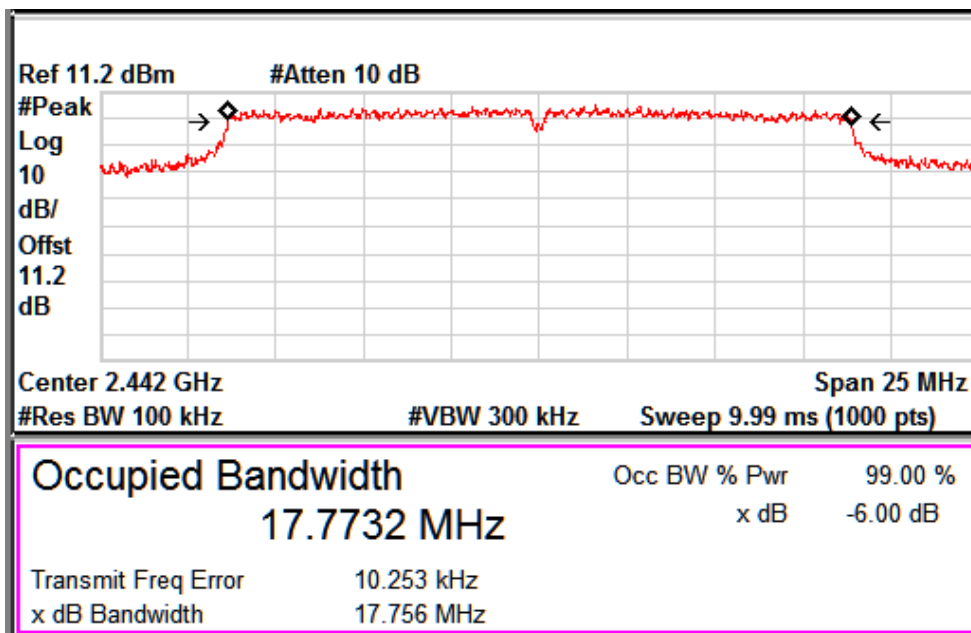
Data Rate: 39 Mbps

99% Occupied Bandwidth: Channel 2462MHz



Data Rate: 65 Mbps

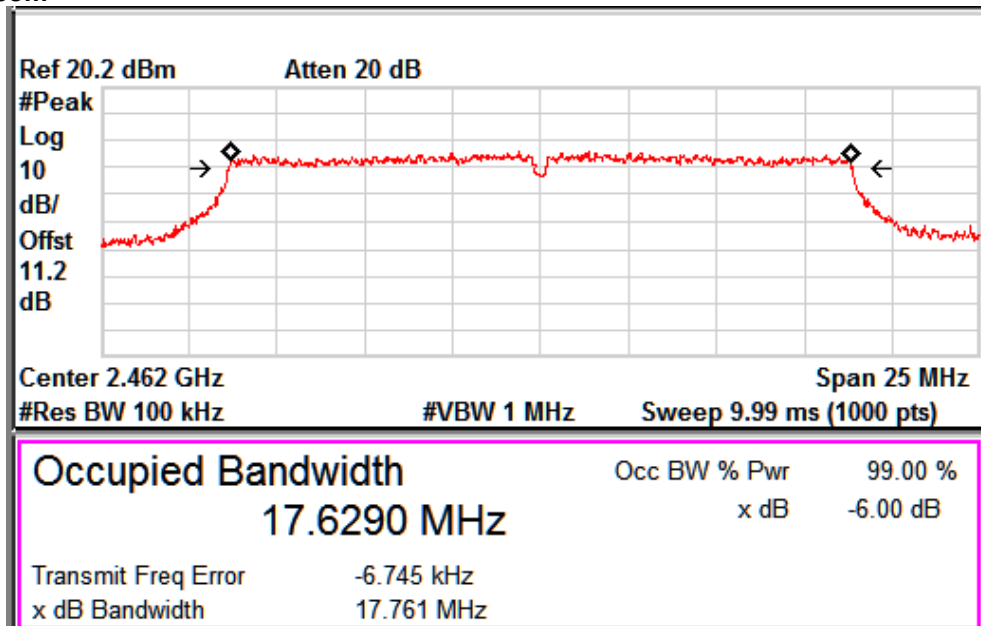
99% Occupied Bandwidth: Channel 2412MHz



Data Rate: 65 Mbps

99% Occupied Bandwidth: Channel 2442MHz

www.tuv.com



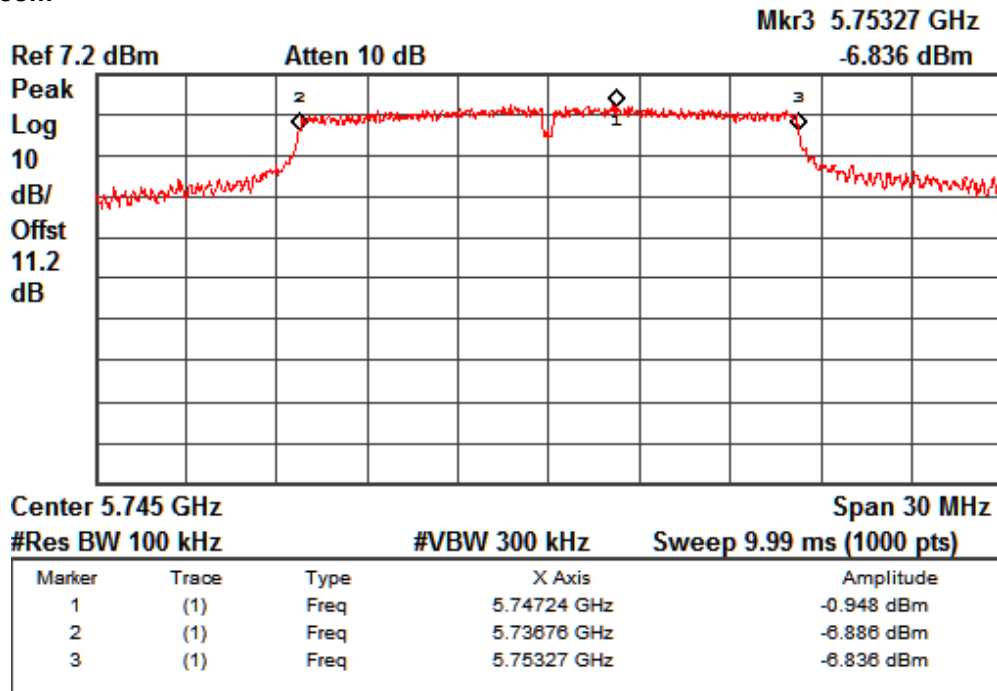
Data Rate: 65 Mbps

99% Occupied Bandwidth: Channel 2462MHz

5GHz Band

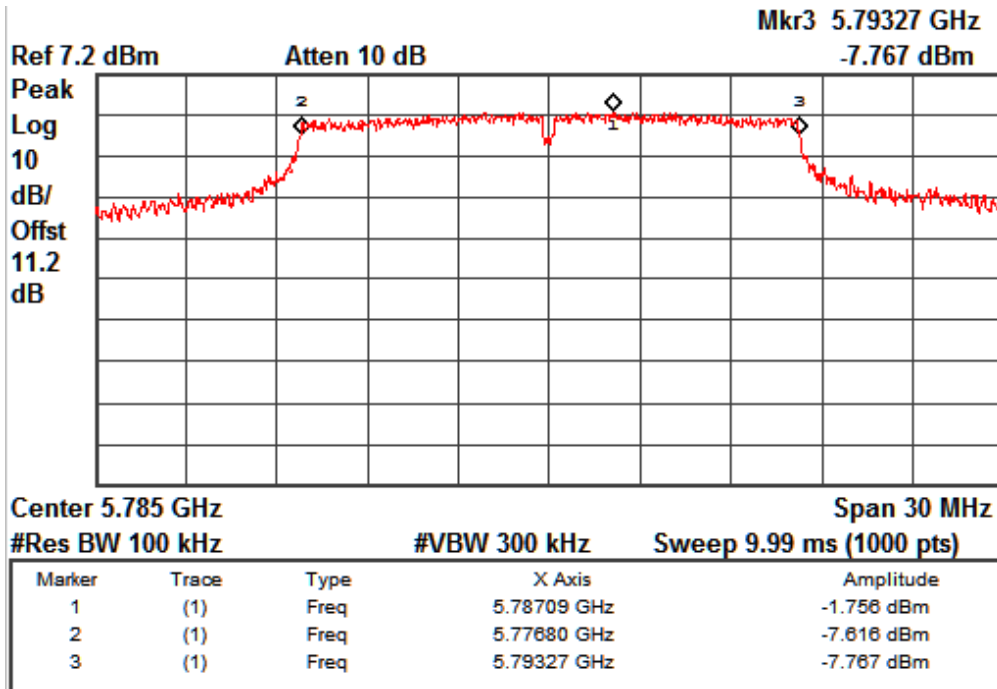
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
a	6	5745	5736.76	5753.27	16.51	17.71
		5785	5776.8	5793.27	16.47	17.22
		5825	5816.73	5833.27	16.54	16.9
	24	5745	5736.73	5753.27	16.54	16.97
		5785	5776.75	5793.27	16.52	16.61
		5825	5816.73	5833.27	16.54	16.62
	54	5745	5736.73	5753.27	16.54	16.88
		5785	5776.74	5793.27	16.53	16.68
		5825	5816.73	5833.27	16.54	16.69

www.tuv.com



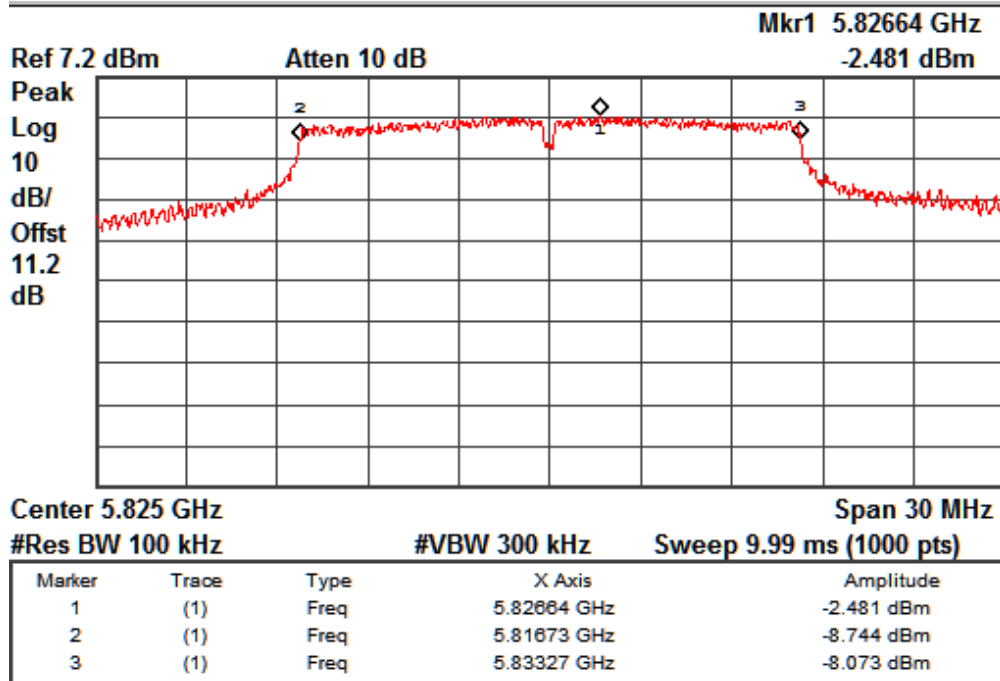
Data Rate: 6 Mbps

Channel: 5745 MHz



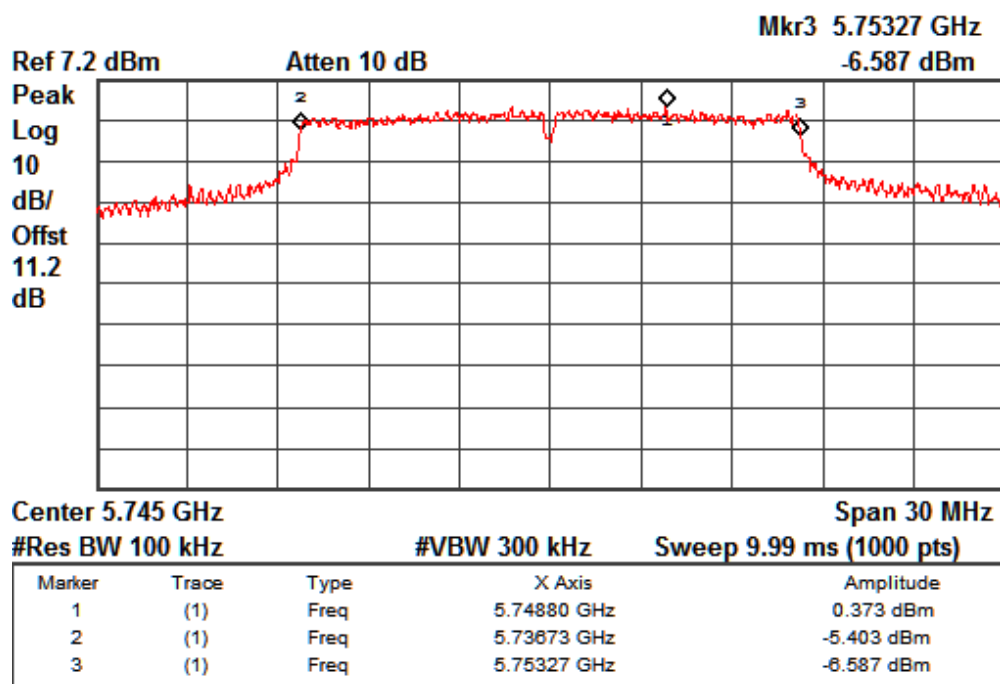
Data Rate: 6 Mbps

Channel: 5785 MHz



Data Rate: 6 Mbps

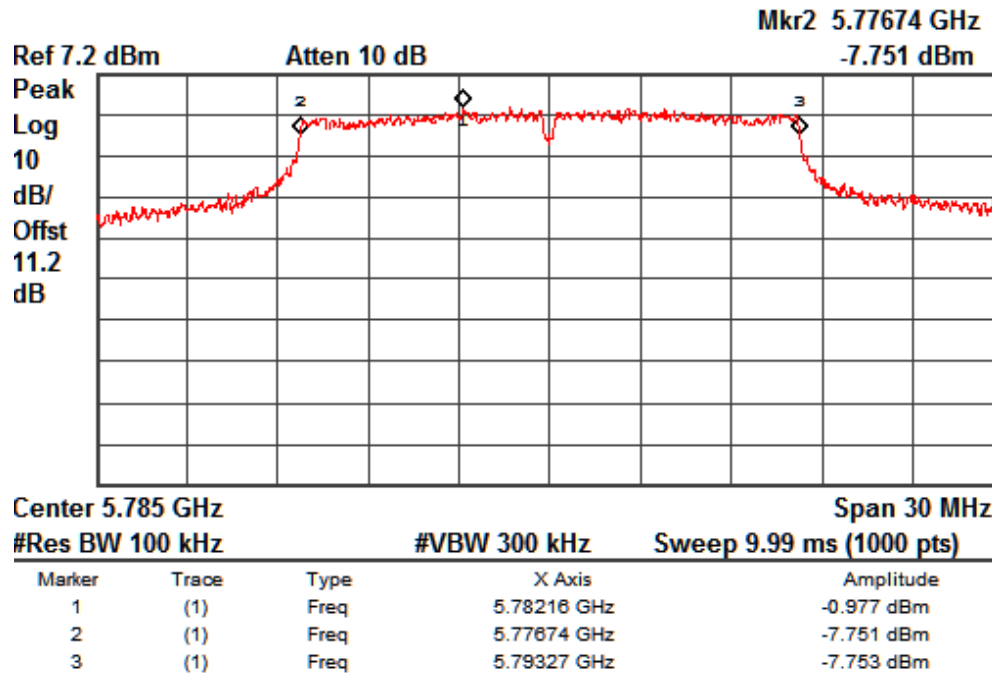
Channel: 5825 MHz



Data Rate: 24 Mbps

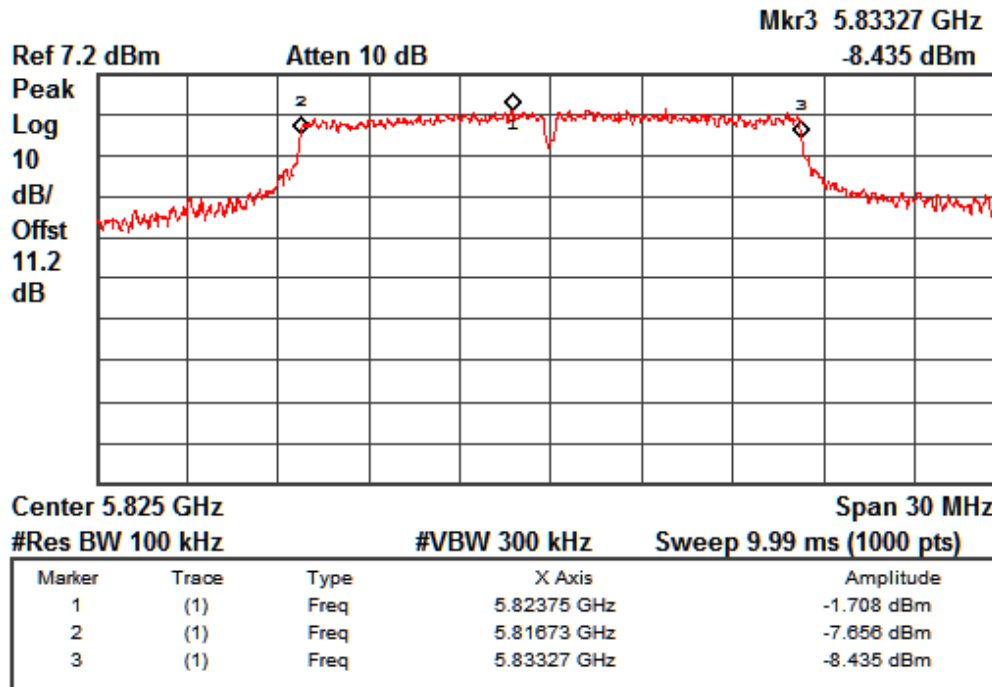
Channel: 5745 MHz

www.tuv.com



Data Rate: 24 Mbps

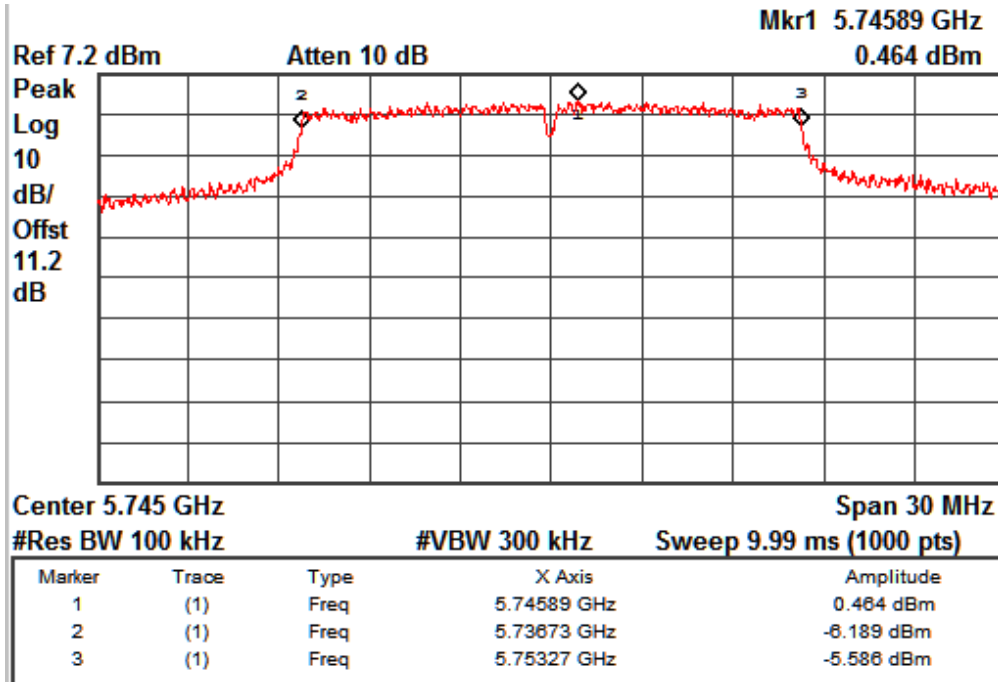
Channel: 5785 MHz



Data Rate: 24 Mbps

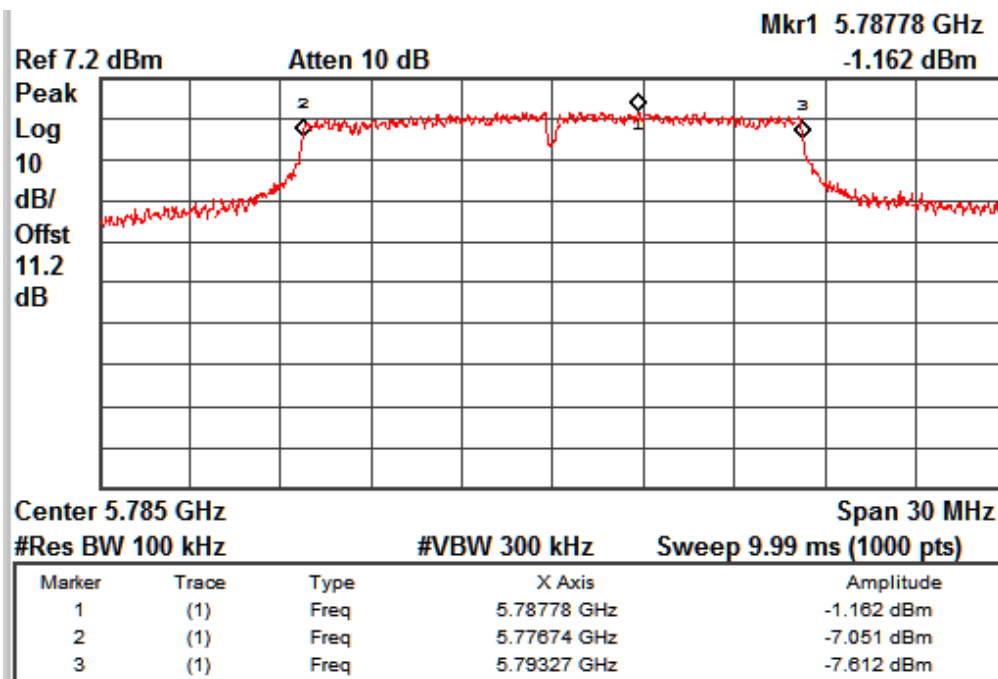
Channel: 5825 MHz

www.tuv.com



Data Rate: 54 Mbps

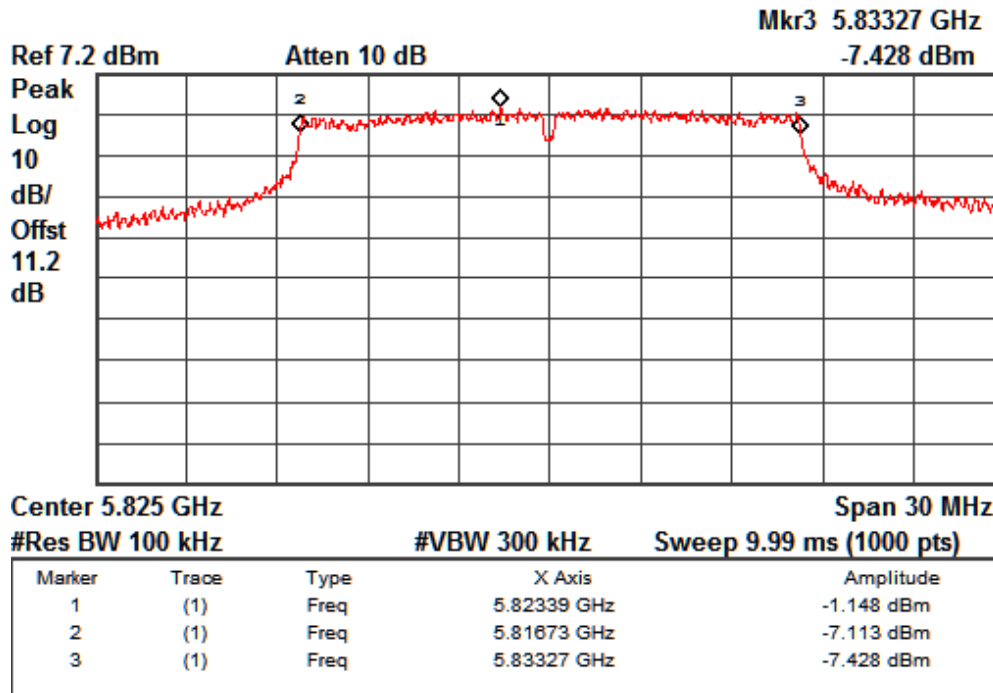
Channel: 5745 MHz



Data Rate: 54 Mbps

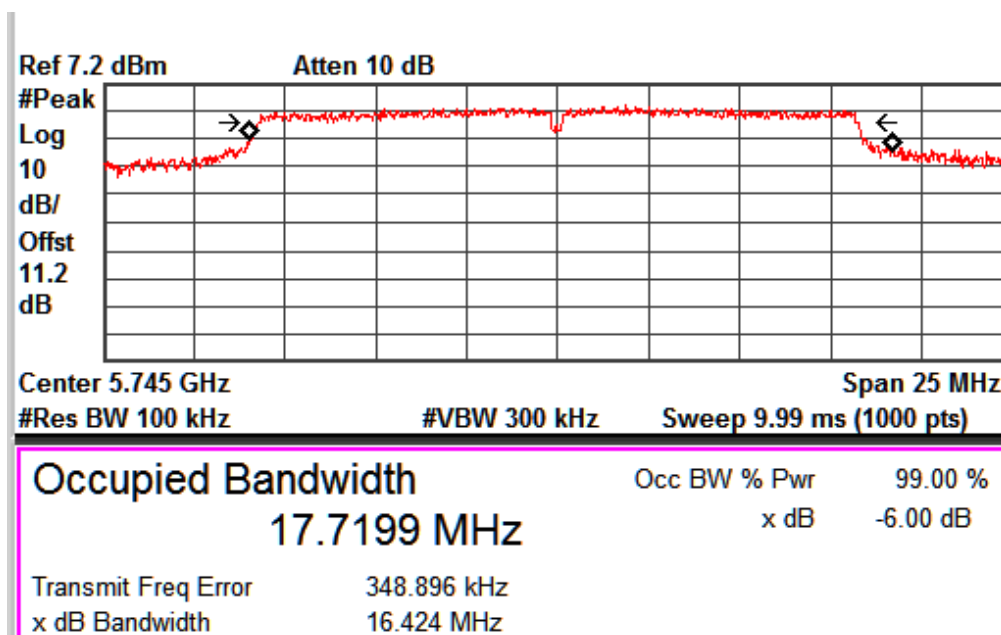
Channel: 5785 MHz

www.tuv.com



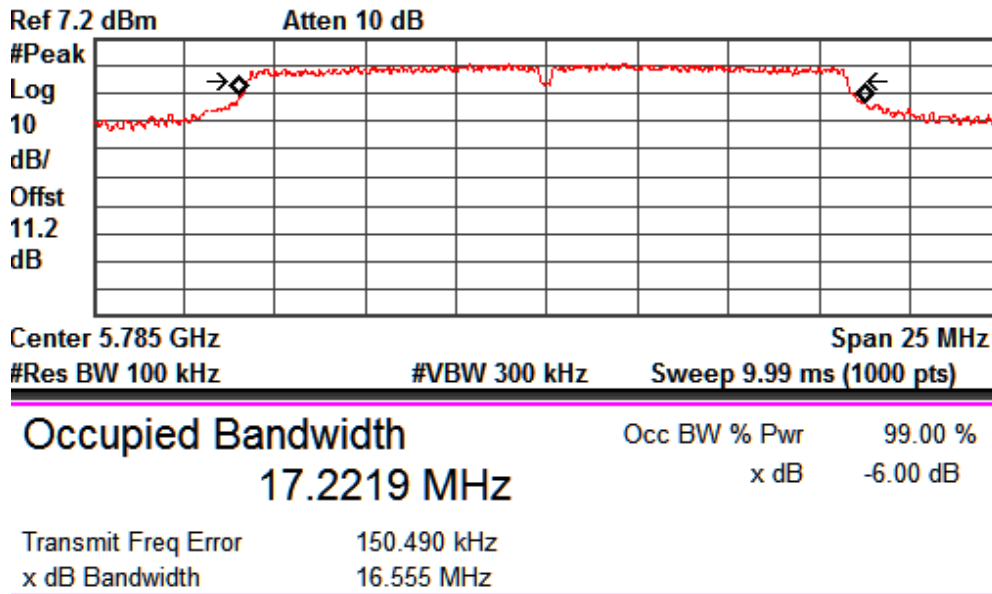
Data Rate: 54 Mbps

Channel: 5825 MHz



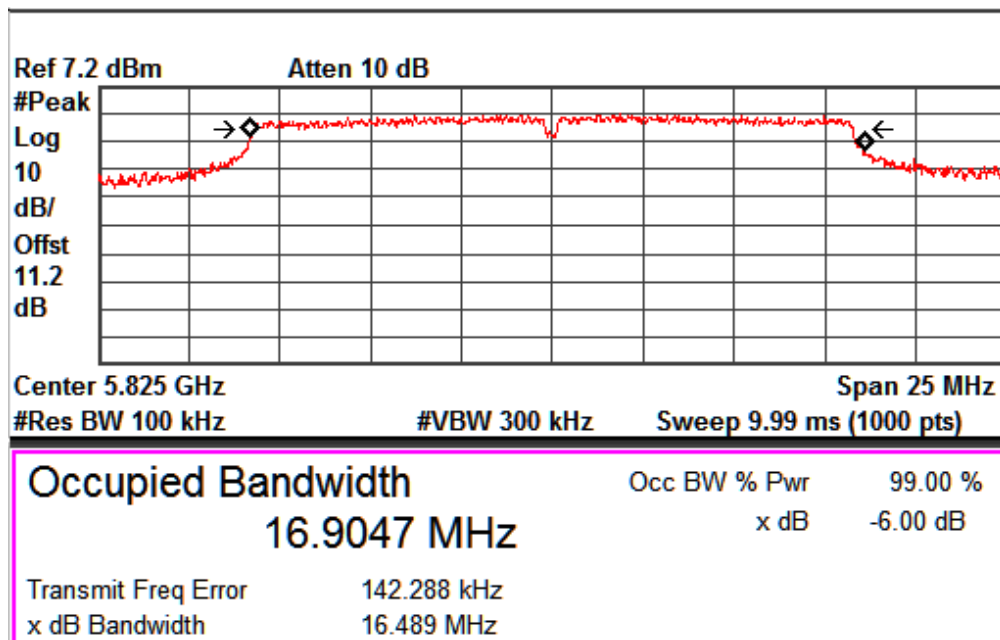
Data Rate: 6 Mbps

99% Occupied Bandwidth: Channel 5745MHz



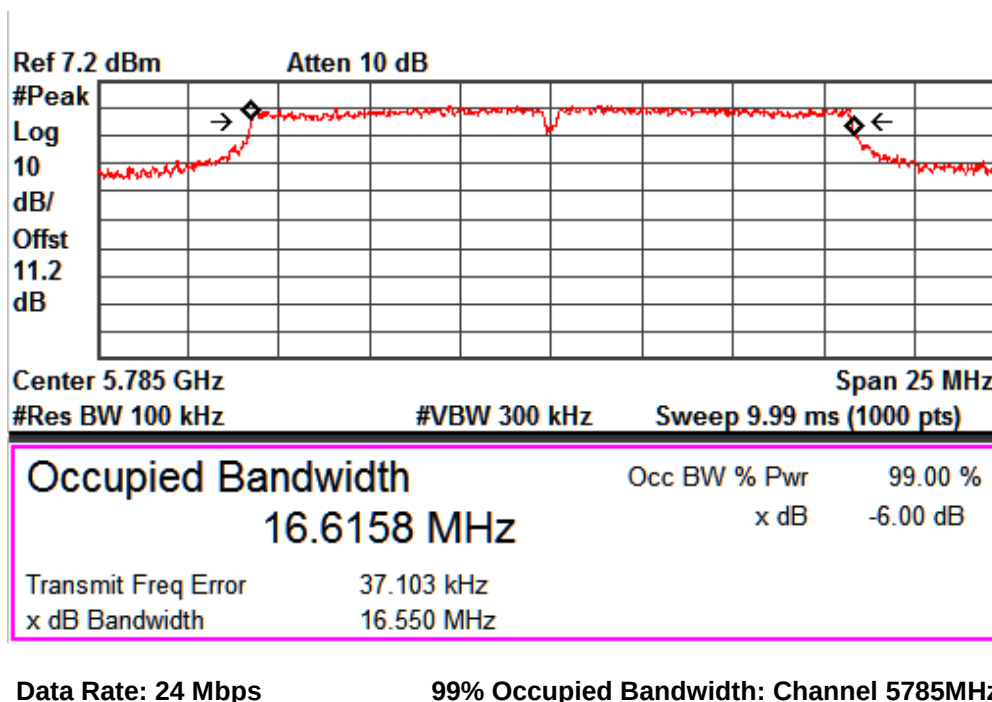
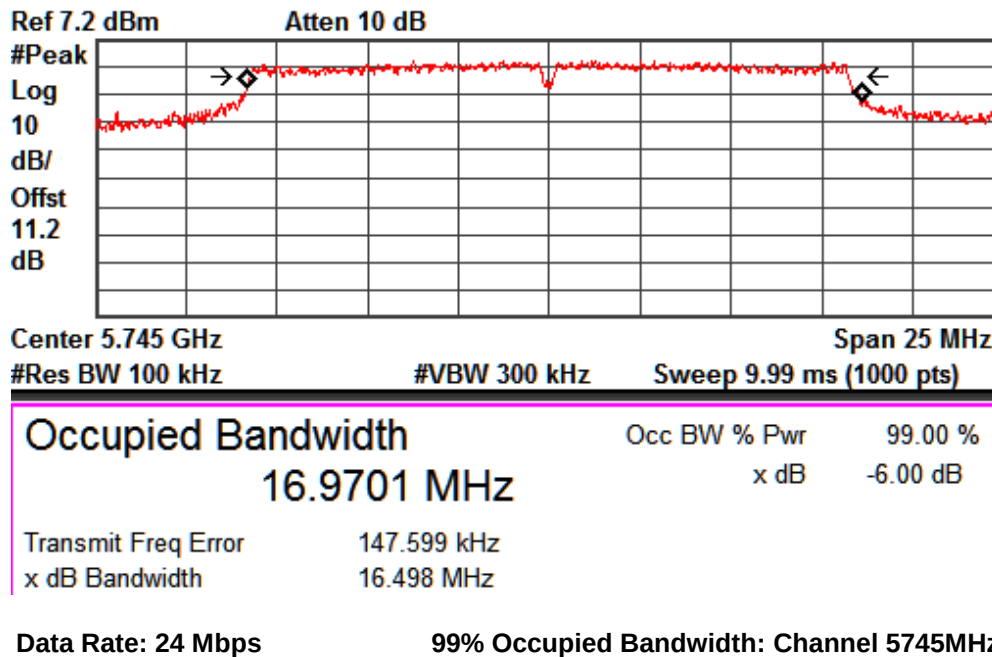
Data Rate: 6 Mbps

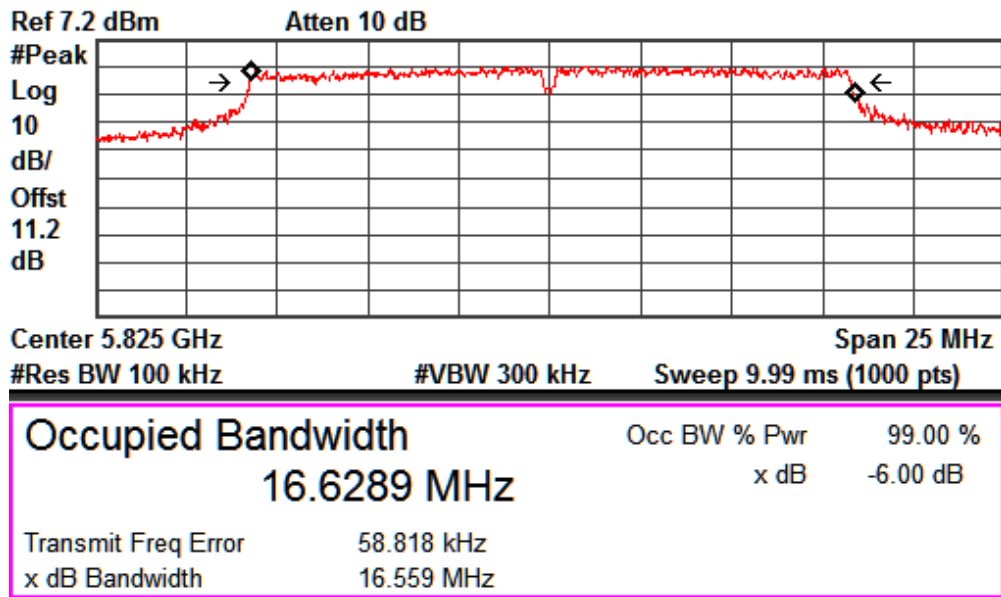
99% Occupied Bandwidth: Channel 5785MHz



Data Rate: 6 Mbps

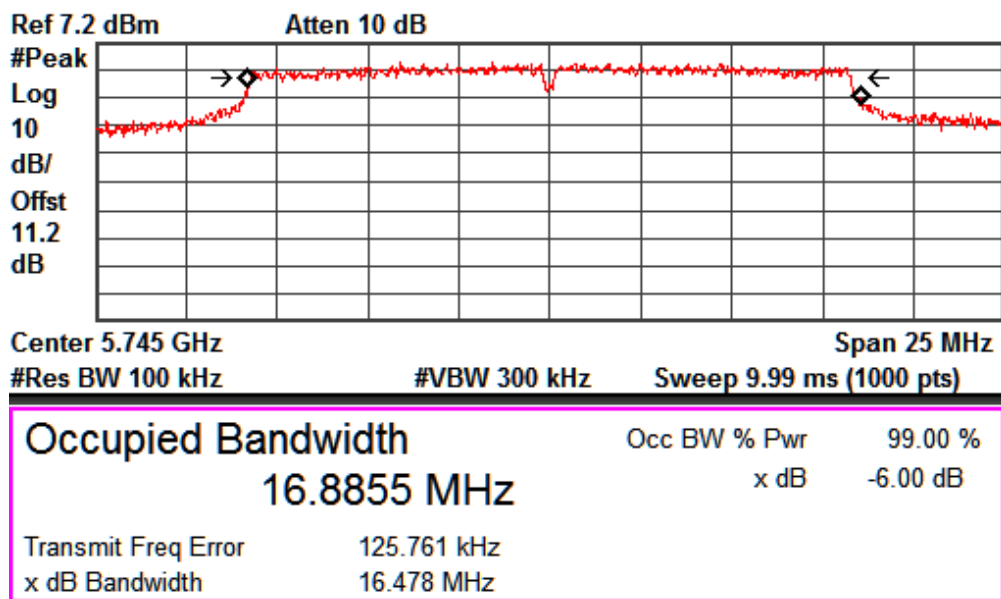
99% Occupied Bandwidth: Channel 5825MHz





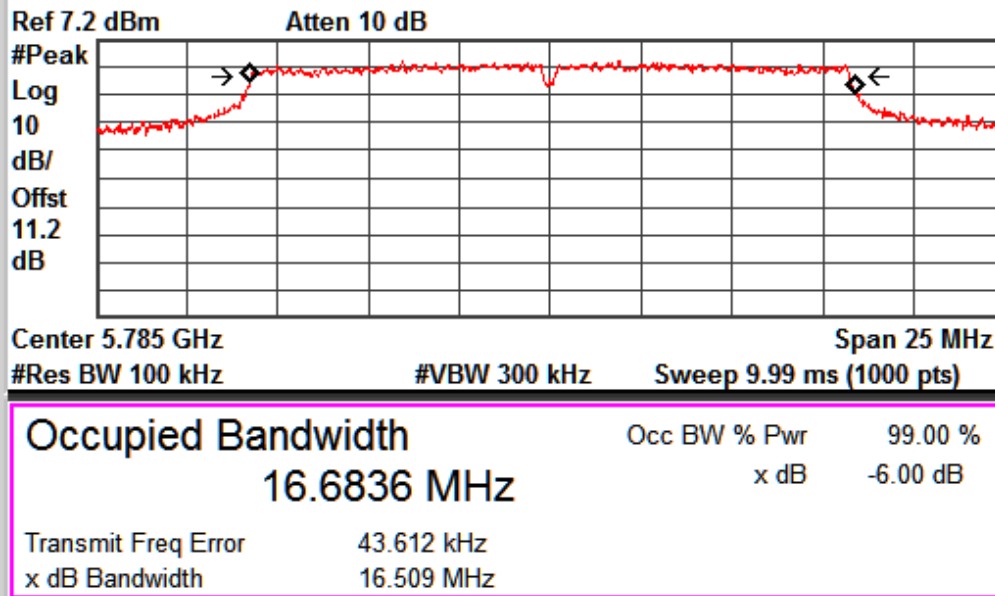
Data Rate: 24 Mbps

99% Occupied Bandwidth: Channel 5825MHz

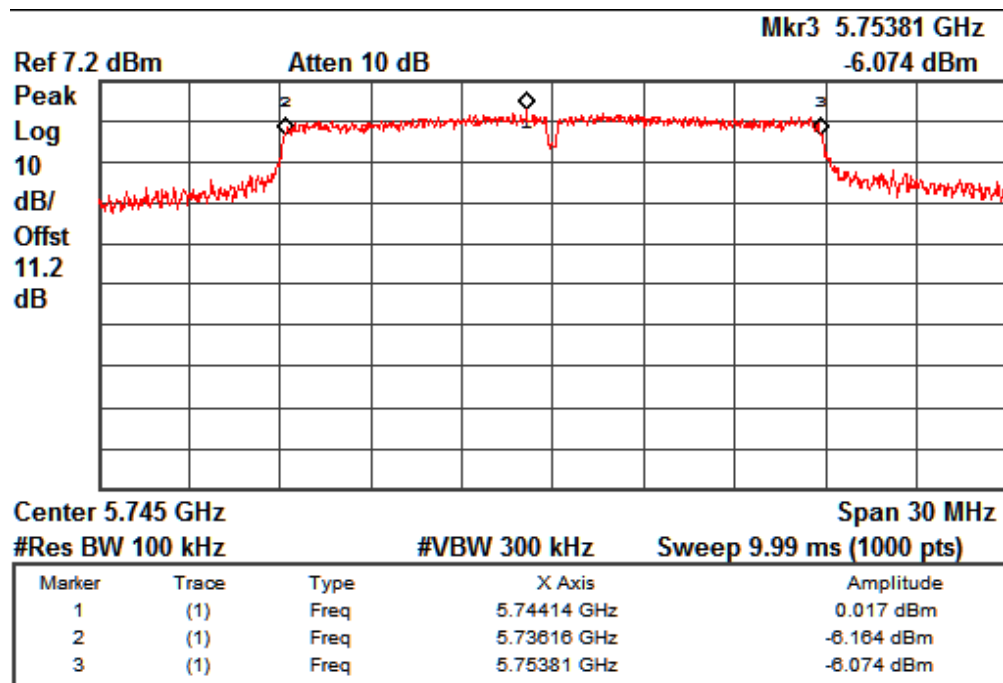


Data Rate: 54 Mbps

99% Occupied Bandwidth: Channel 5745MHz



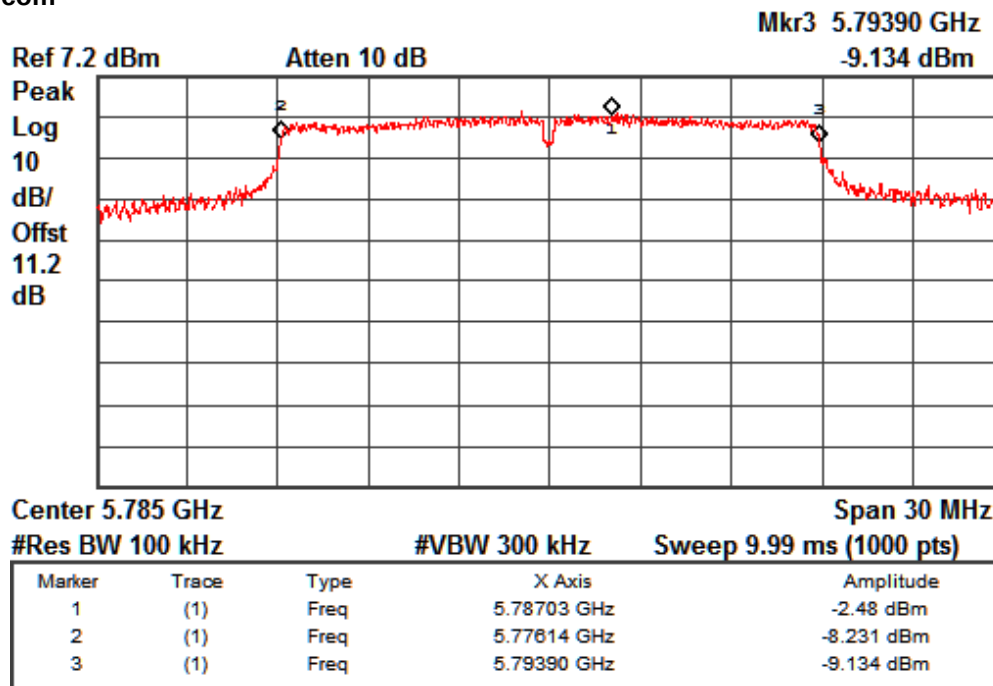
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
n	6.5	5745	5736.16	5753.81	17.65	18.29
		5785	5776.14	5793.9	17.76	17.94
		5825	5816.16	5833.87	17.71	17.84
	39	5745	5736.13	5753.87	17.74	17.88
		5785	5776.11	5793.87	17.76	17.72
		5825	5816.16	5833.87	17.71	17.71
	65	5745	5736.13	5753.87	17.74	17.85
		5785	5776.14	5793.87	17.73	17.74
		5825	5816.13	5833.87	17.74	17.7



Data Rate: 6.5 Mbps

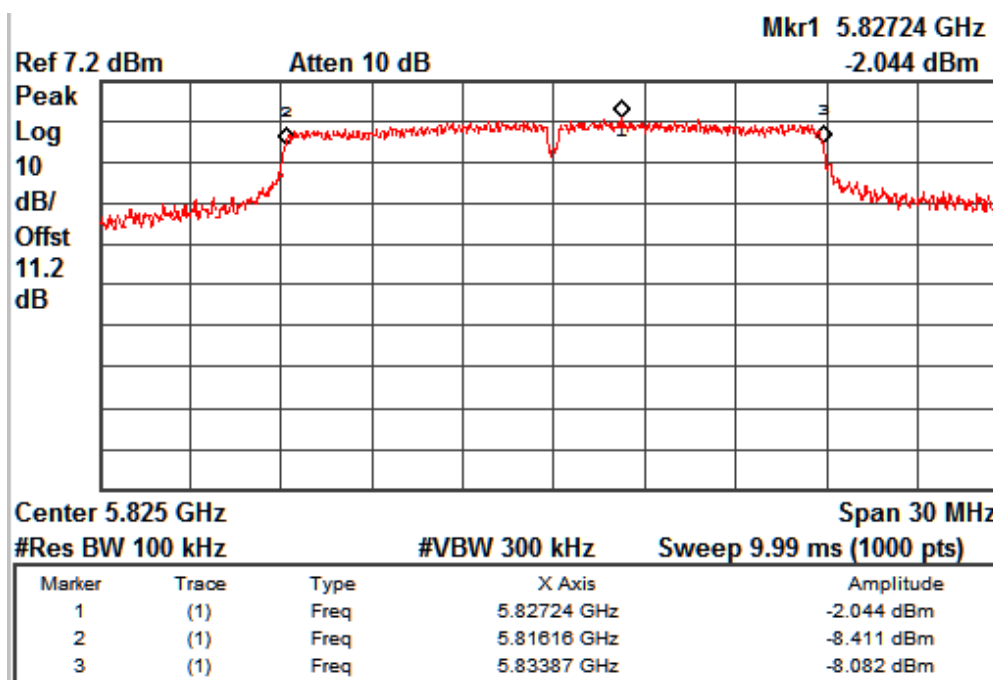
Channel: 5745 MHz

www.tuv.com



Data Rate: 6.5 Mbps

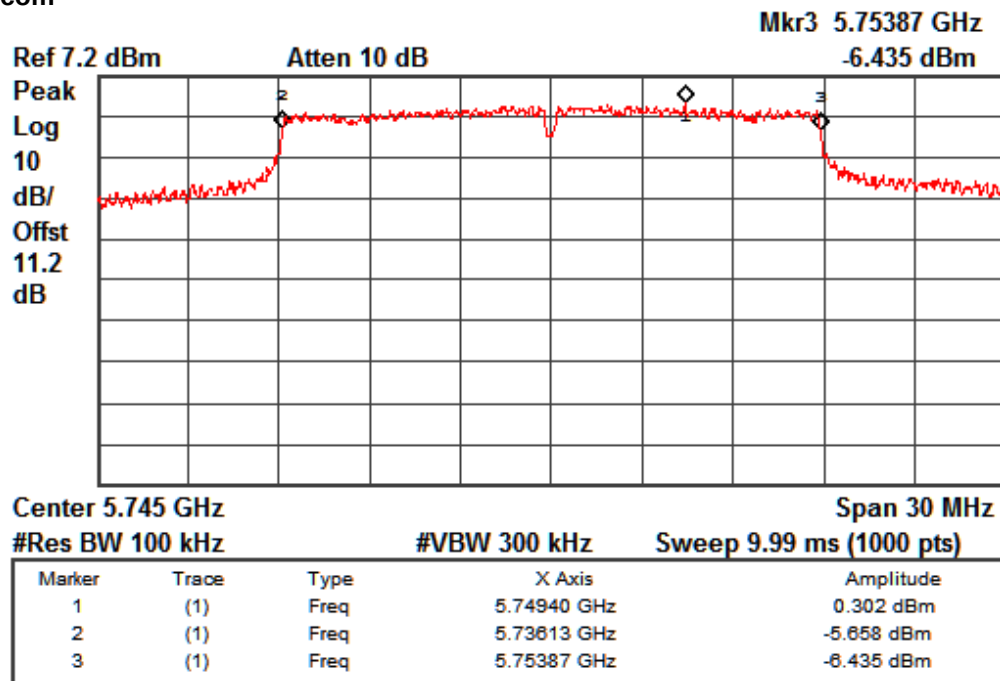
Channel: 5785 MHz



Data Rate: 6.5 Mbps

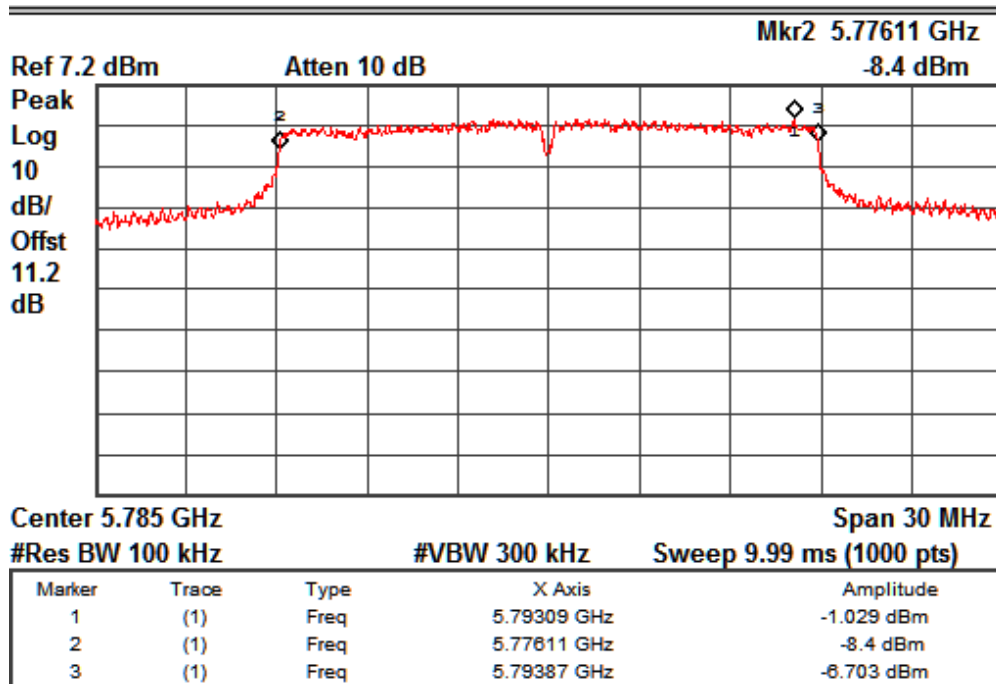
Channel: 5825 MHz

www.tuv.com



Data Rate: 39 Mbps

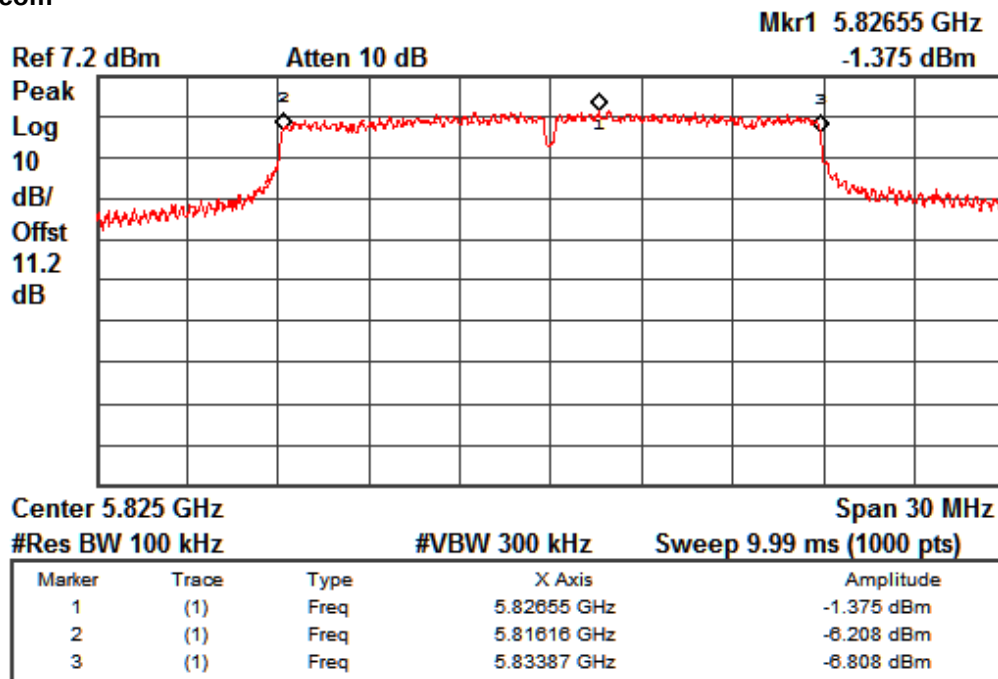
Channel: 5745 MHz



Data Rate: 39 Mbps

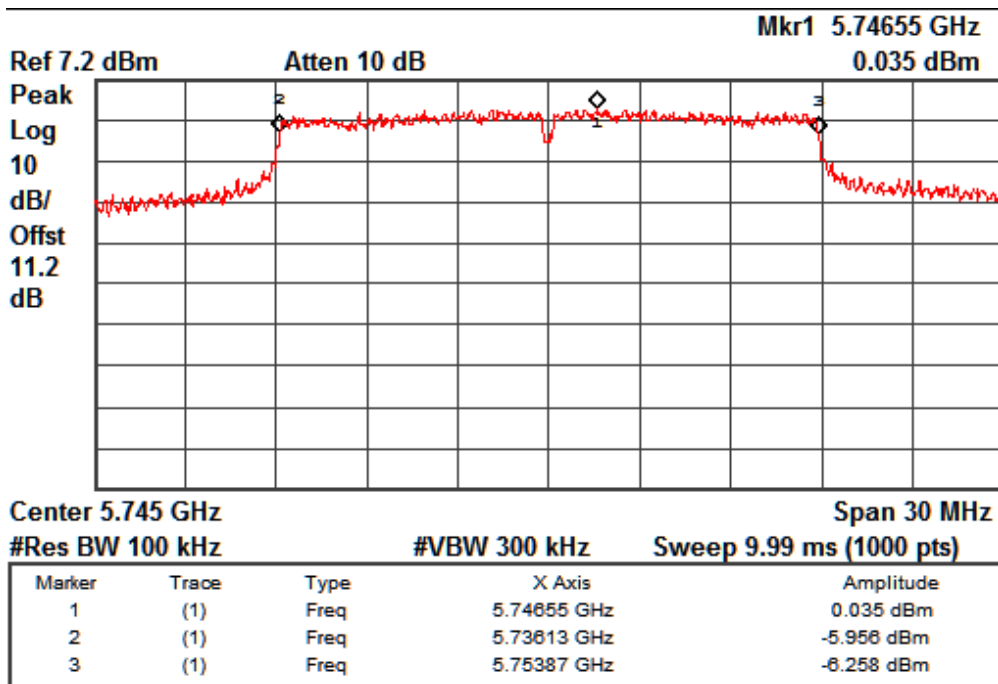
Channel: 5785 MHz

www.tuv.com



Data Rate: 39 Mbps

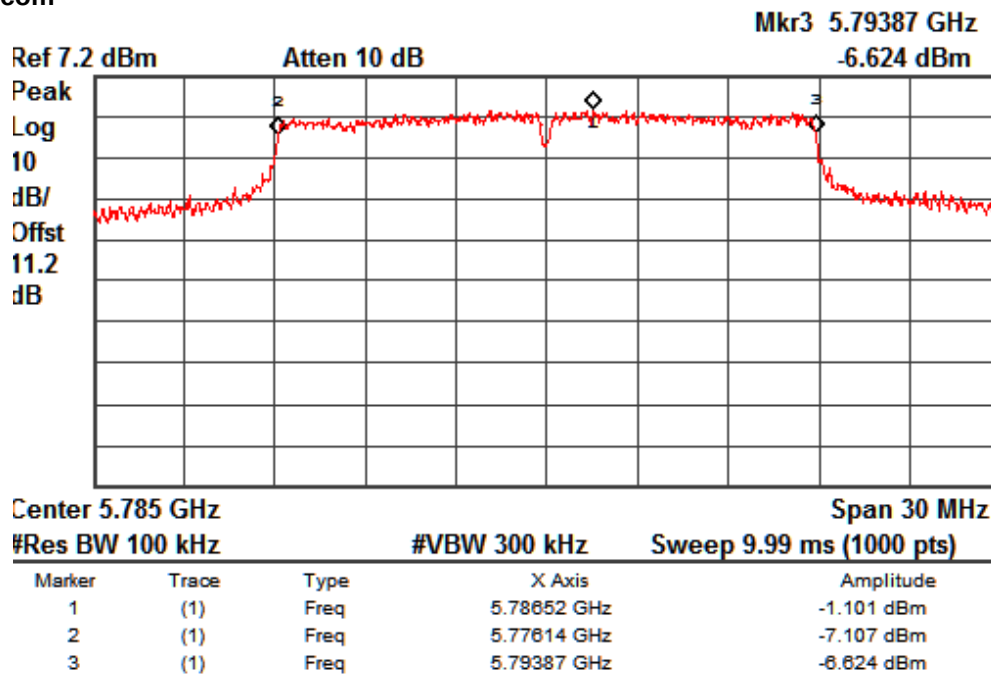
Channel: 5825 MHz



Data Rate: 65 Mbps

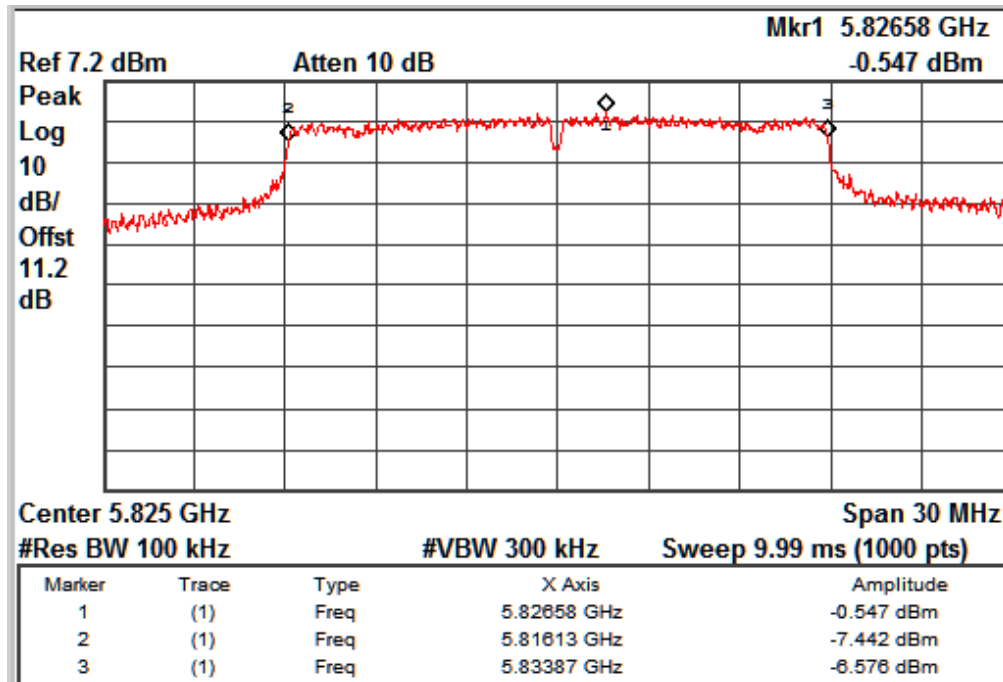
Channel: 5745 MHz

www.tuv.com



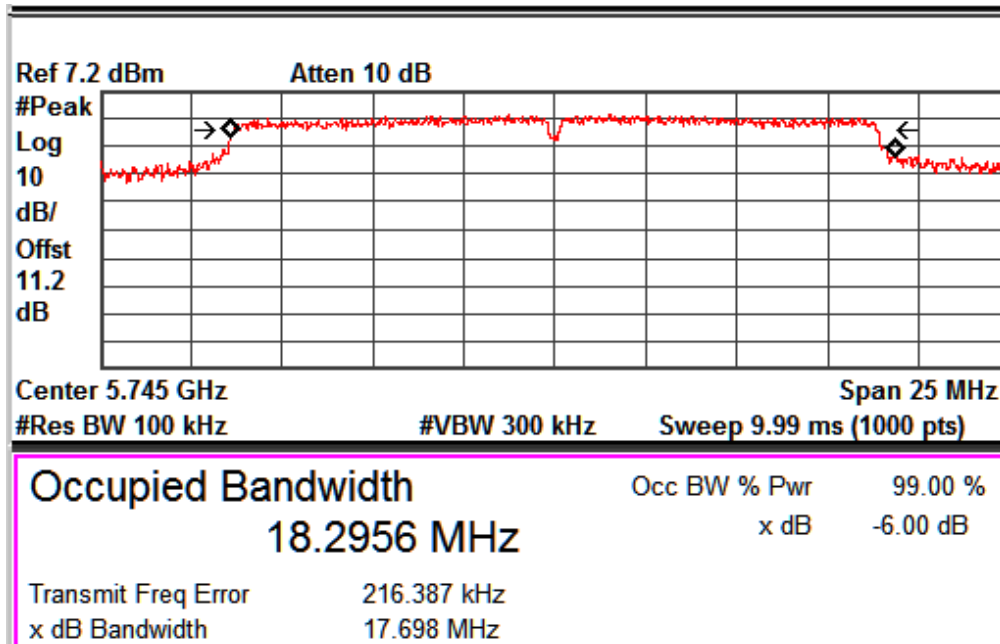
Data Rate: 65 Mbps

Channel: 5785 MHz



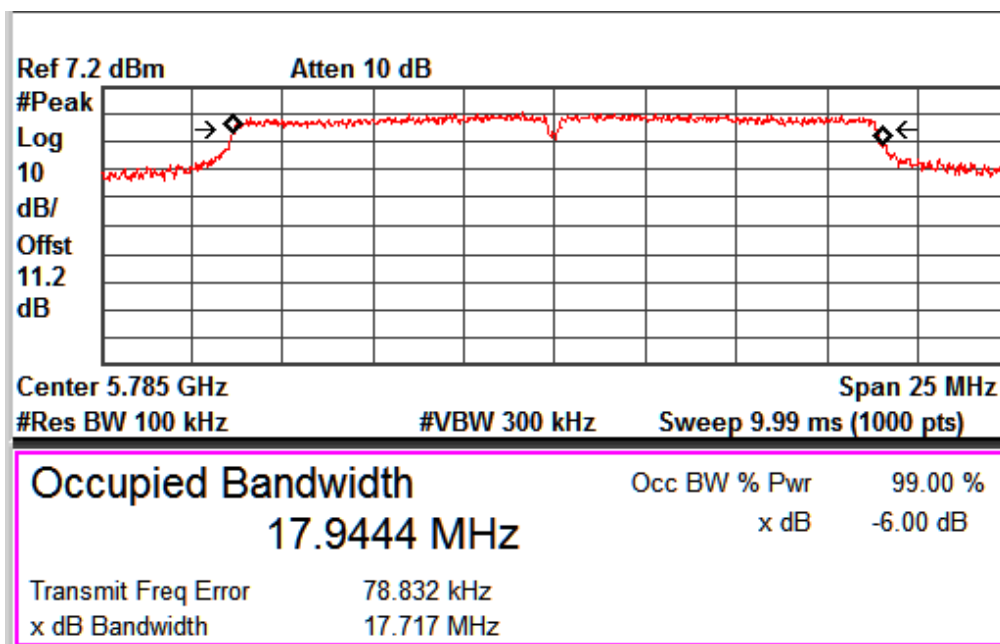
Data Rate: 65 Mbps

Channel: 5825 MHz



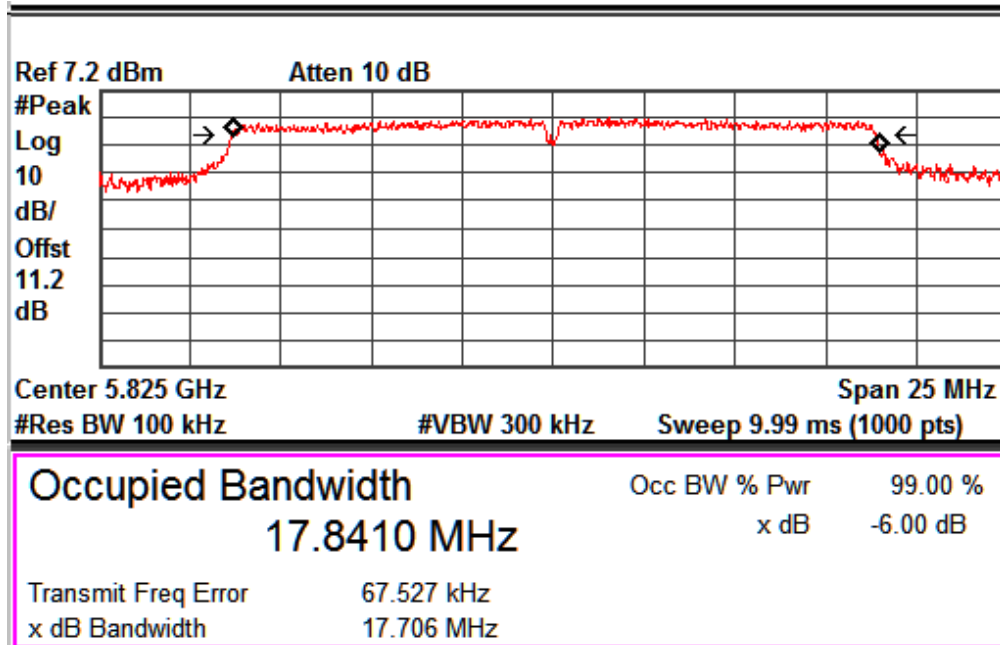
Data Rate: 6.5 Mbps

99% Occupied Bandwidth: Channel 5745MHz



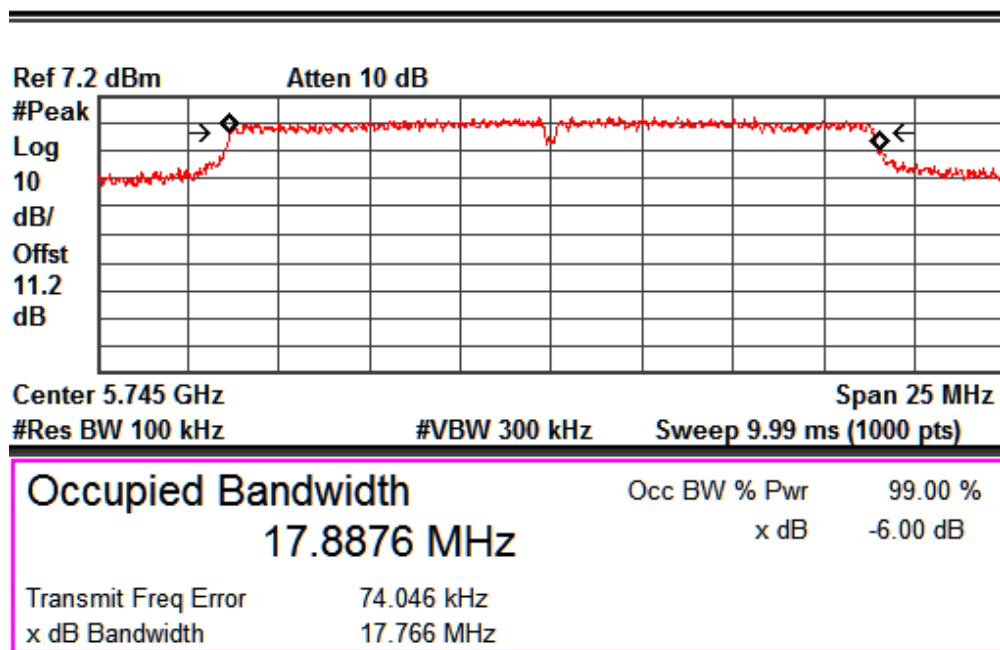
Data Rate: 6.5 Mbps

99% Occupied Bandwidth: Channel 5785MHz



Data Rate: 6.5 Mbps

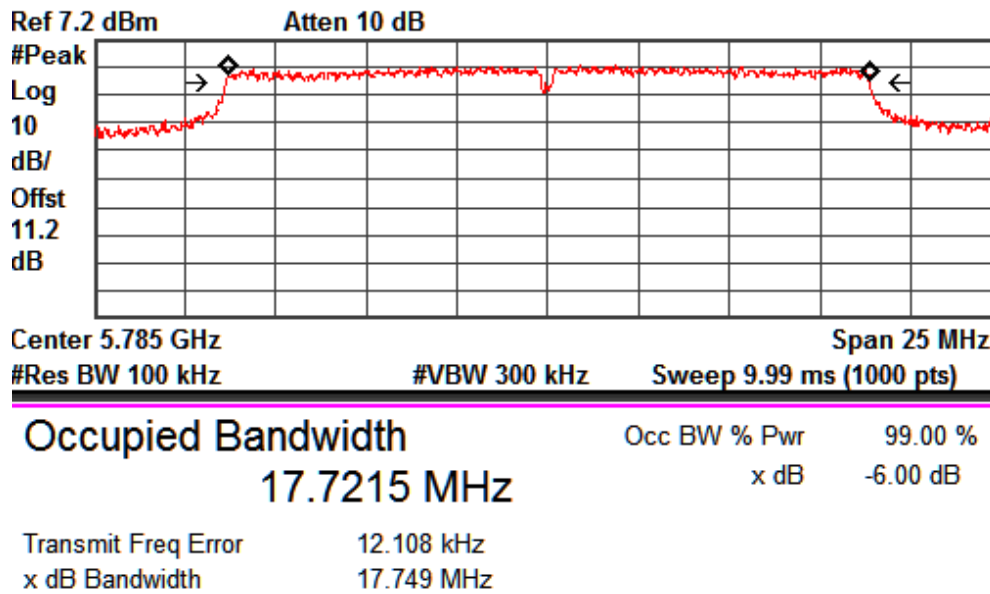
99% Occupied Bandwidth: Channel 5825MHz



Data Rate: 39 Mbps

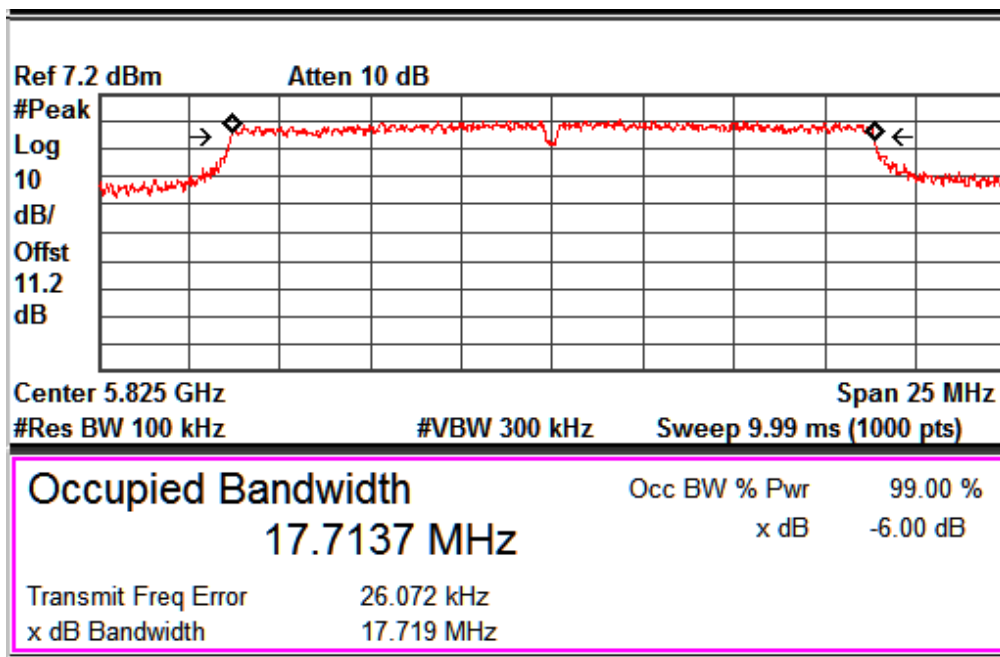
99% Occupied Bandwidth: Channel 5745MHz

www.tuv.com



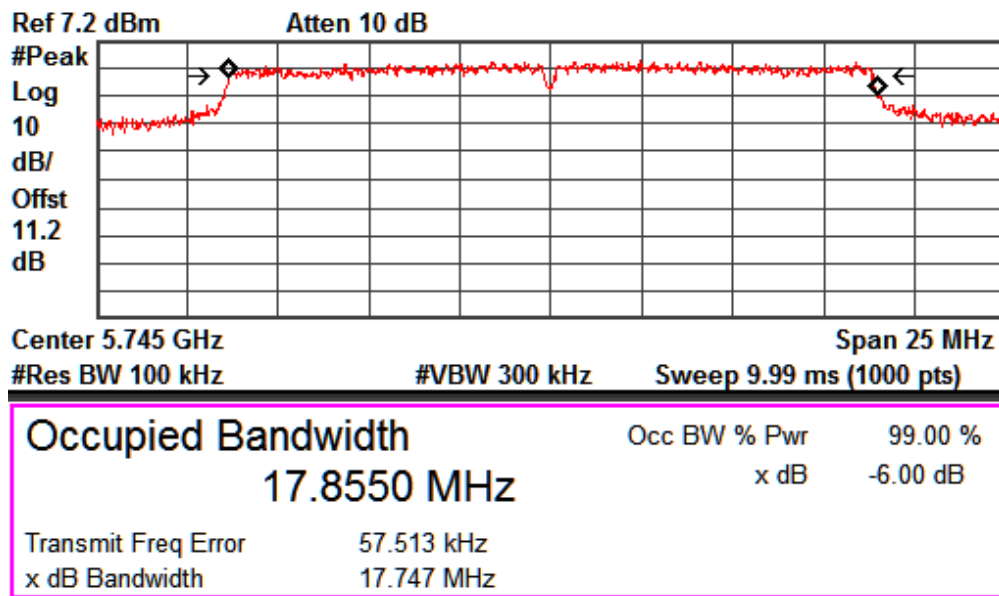
Data Rate: 39 Mbps

99% Occupied Bandwidth: Channel 5785MHz



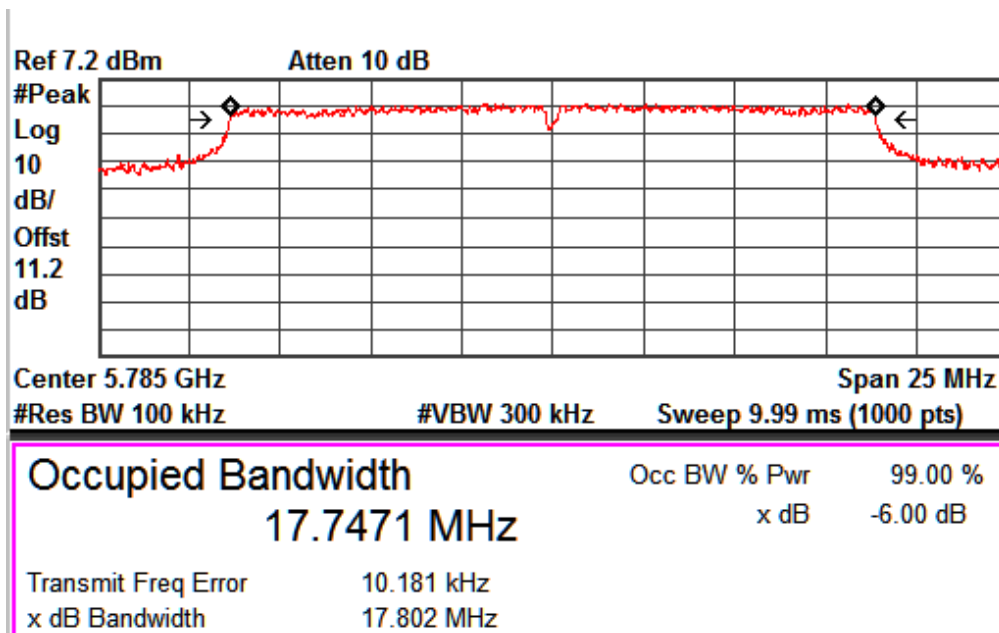
Data Rate: 39 Mbps

99% Occupied Bandwidth: Channel 5825MHz



Data Rate: 65 Mbps

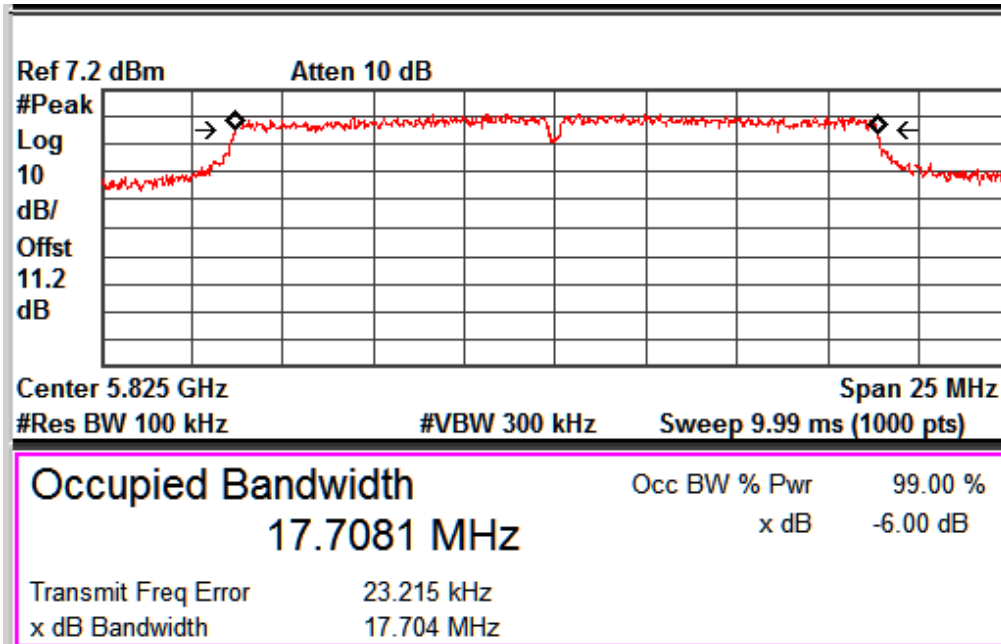
99% Occupied Bandwidth: Channel 5745MHz



Data Rate: 65 Mbps

99% Occupied Bandwidth: Channel 5785MHz

www.tuv.com

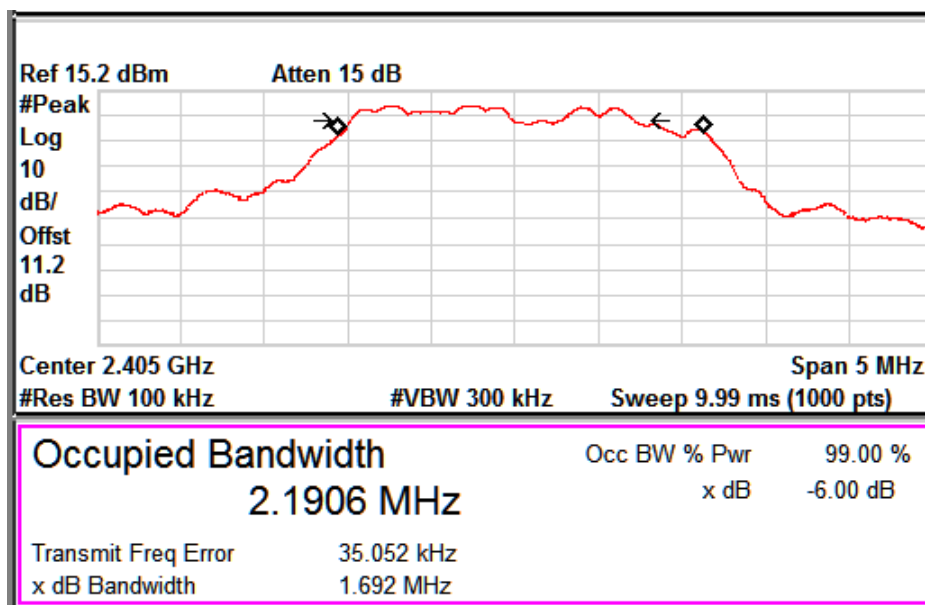
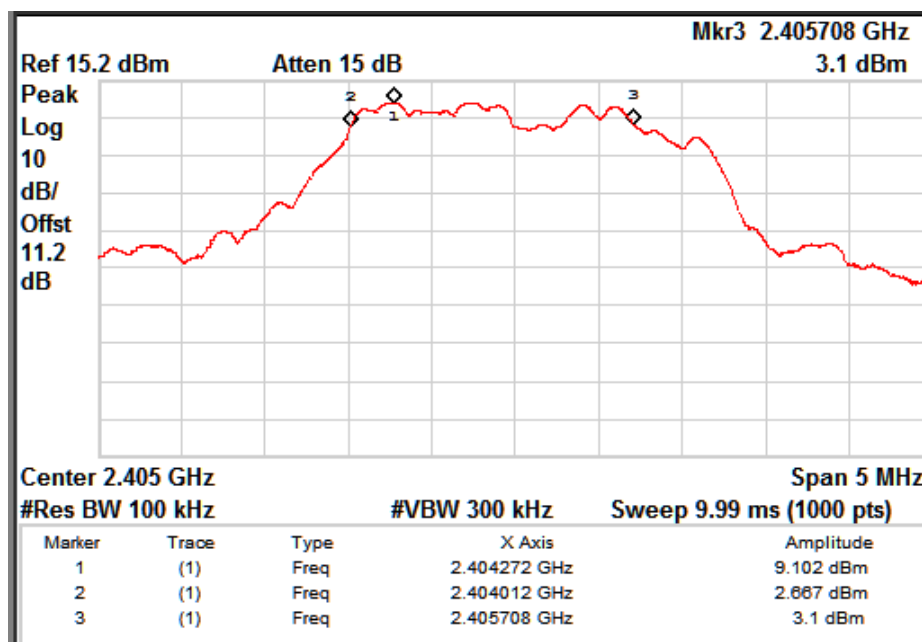


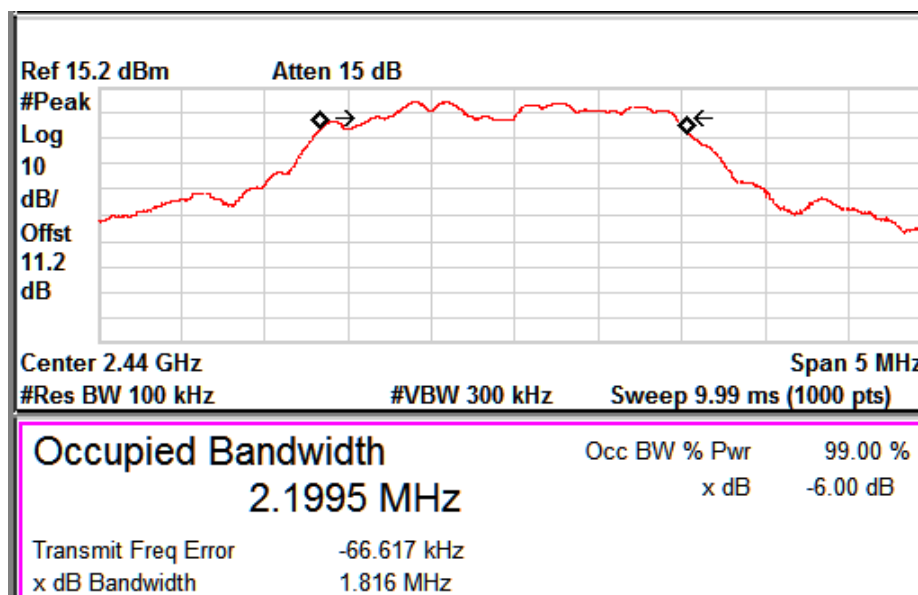
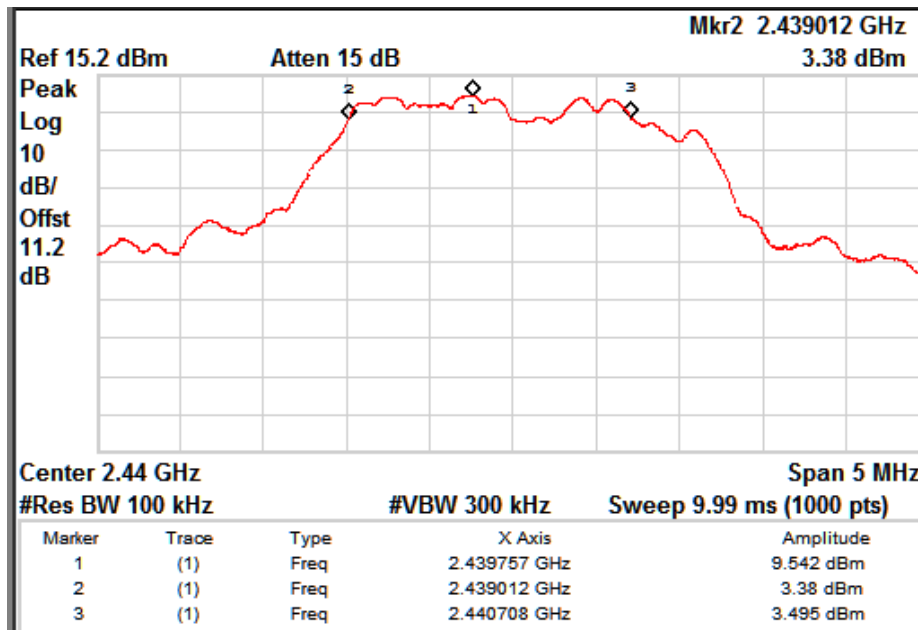
Data Rate: 65 Mbps

99% Occupied Bandwidth: Channel 5825MHz

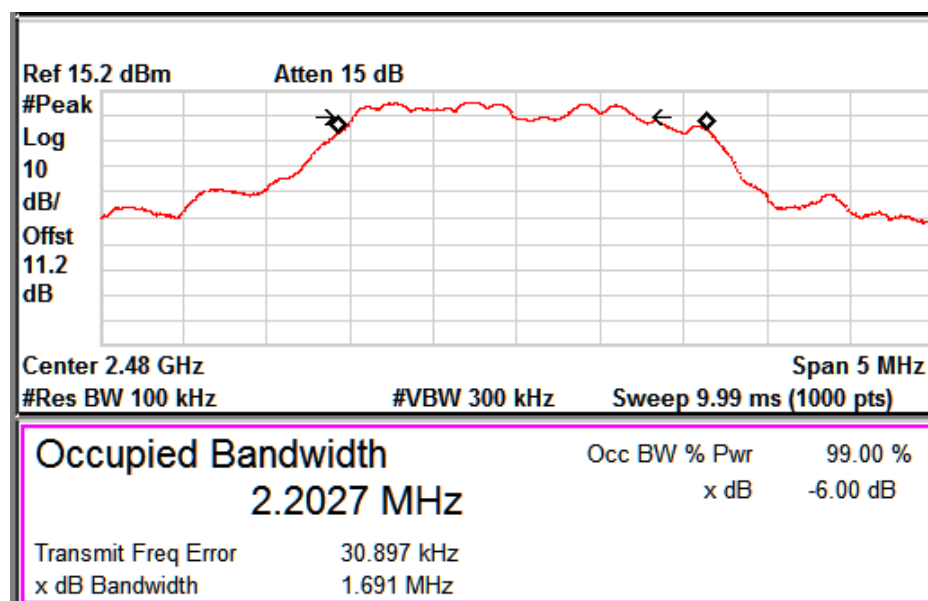
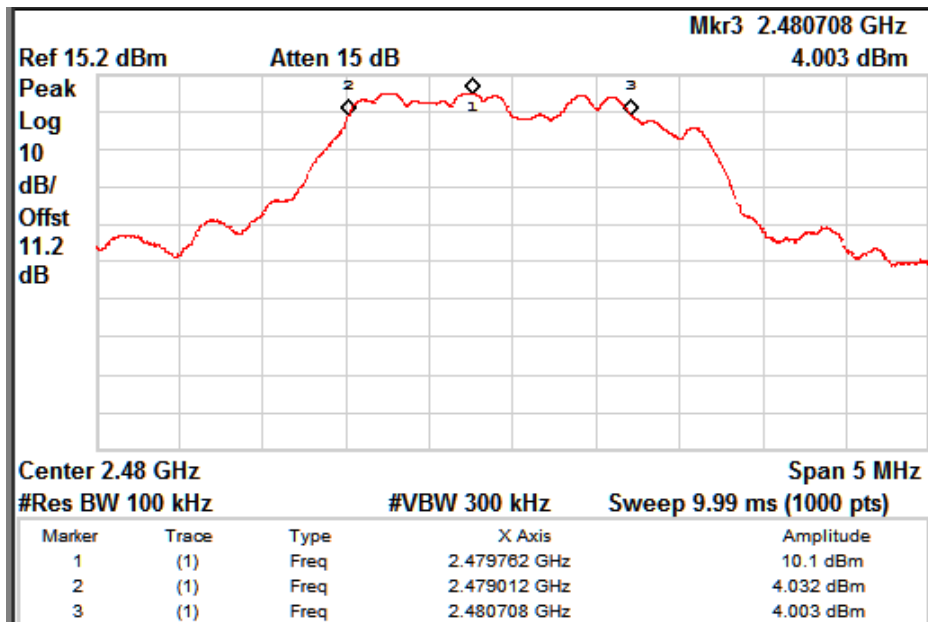
Test Result: ZigBee

Channel Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
2405.00	2404.012	2405.708	1.696	2.191
2440.00	2439.012	2440.708	1.696	2.200
2480.00	2479.012	2480.708	1.696	2.203


Channel Frequency: 2405 MHz

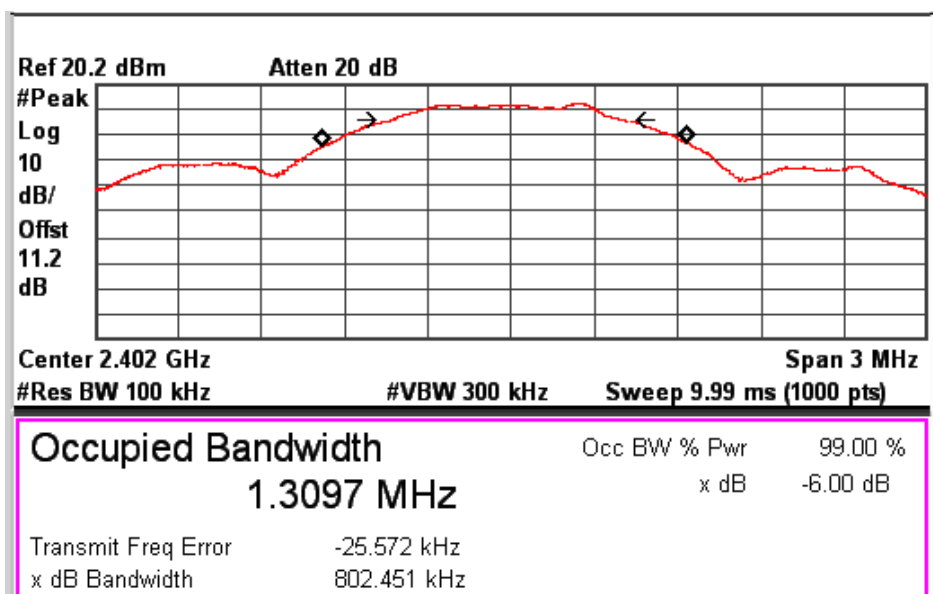
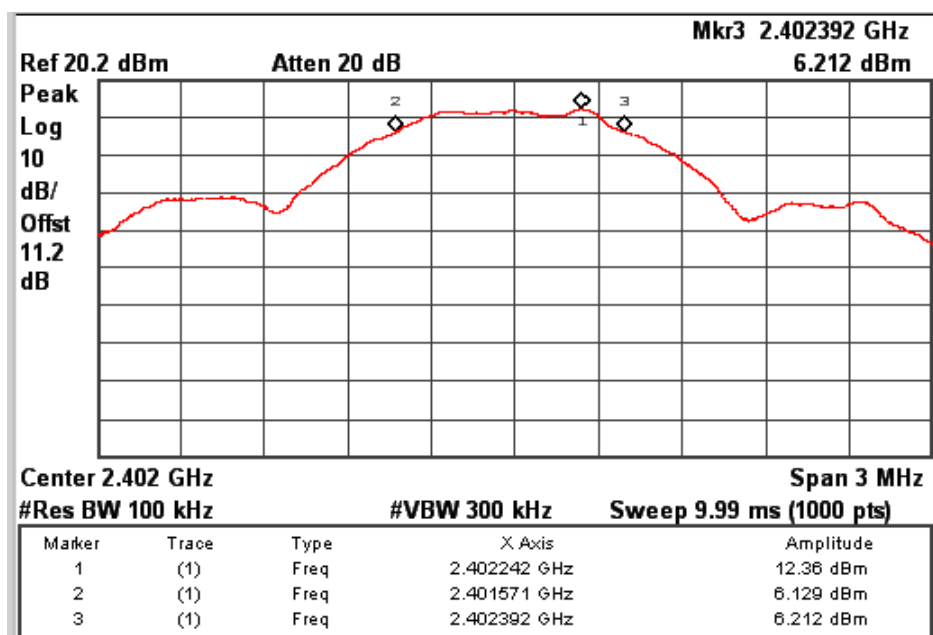


Channel Frequency: 2440 MHz

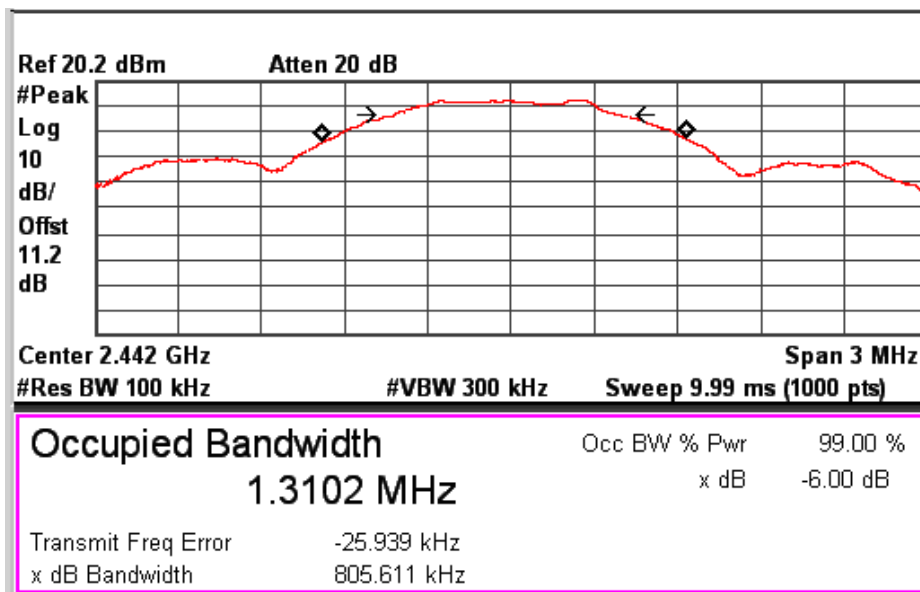
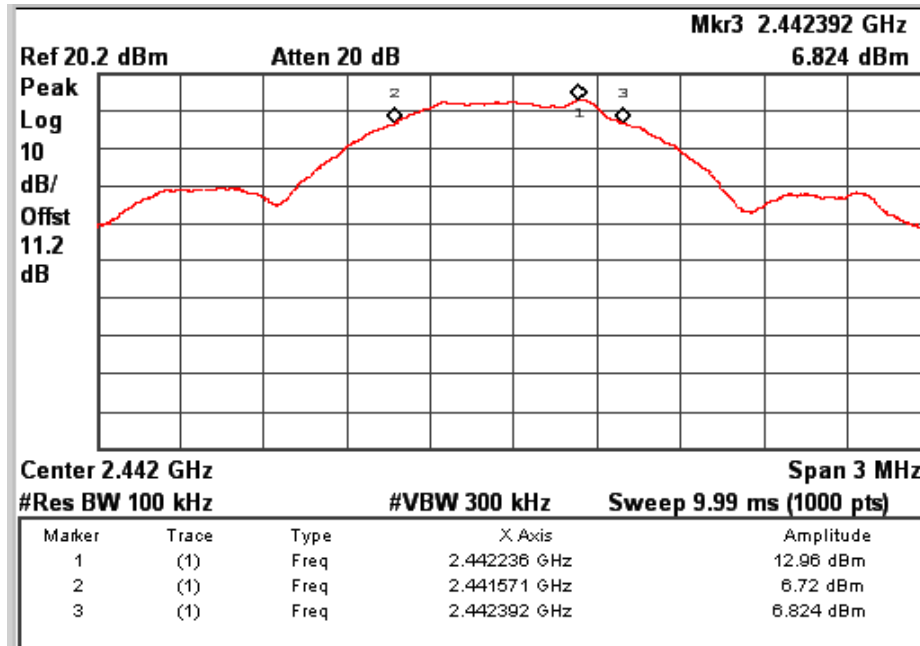


Channel Frequency: 2480 MHz

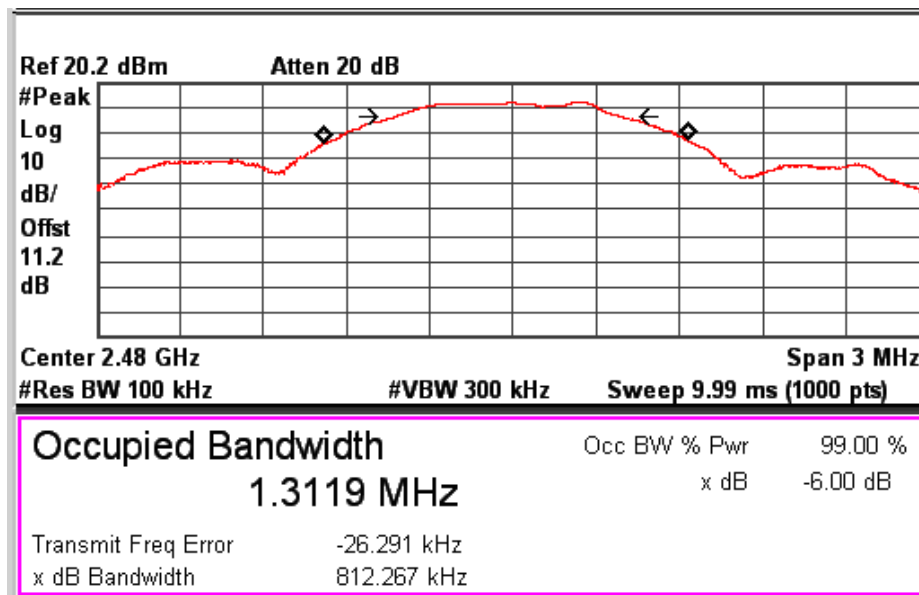
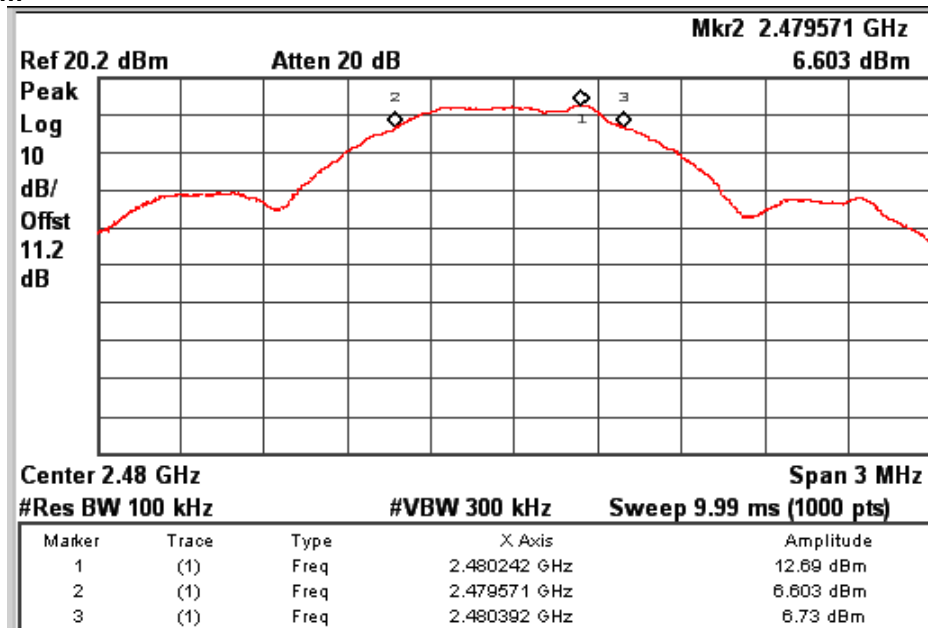
Channel Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
2402.00	2401.571	2402.392	0.806	1.310
2442.00	2441.571	2442.392	0.809	1.310
2480.00	2479.571	2480.392	0.818	1.312



Channel Frequency: 2402 MHz



Channel Frequency: 2442 MHz



Channel Frequency: 2480 MHz

www.tuv.com
Band-edge Compliance

Section 15.247(d)

Result

Pass

Test Specification
 Detector Function
 Requirement

FCC Part 15 Section 15.247(d)

Peak

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

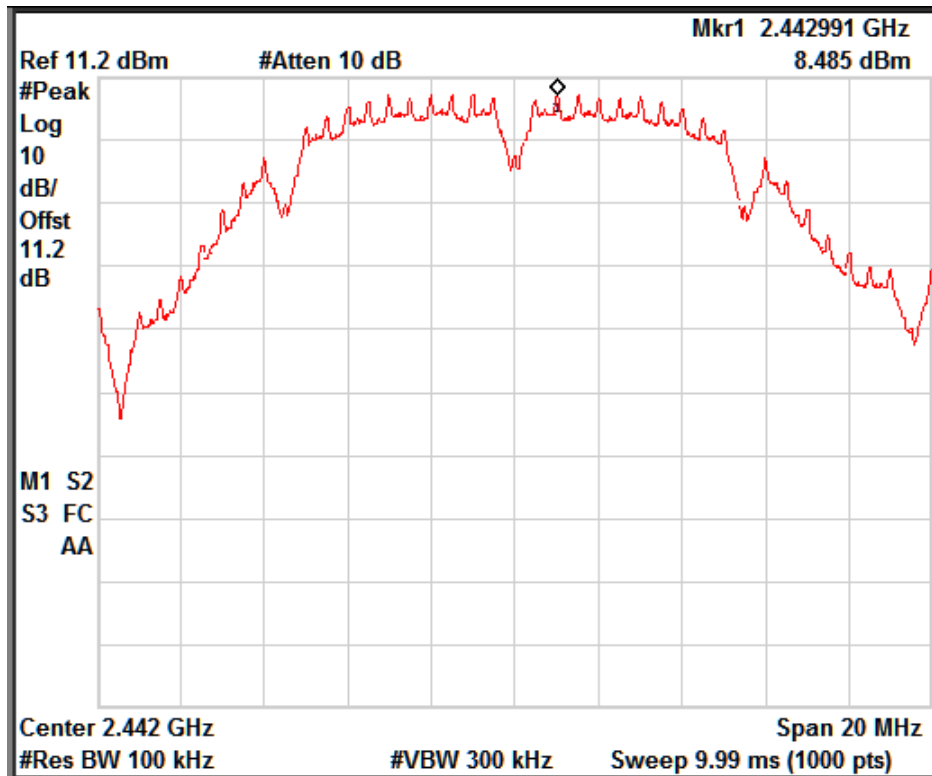
Test Method:



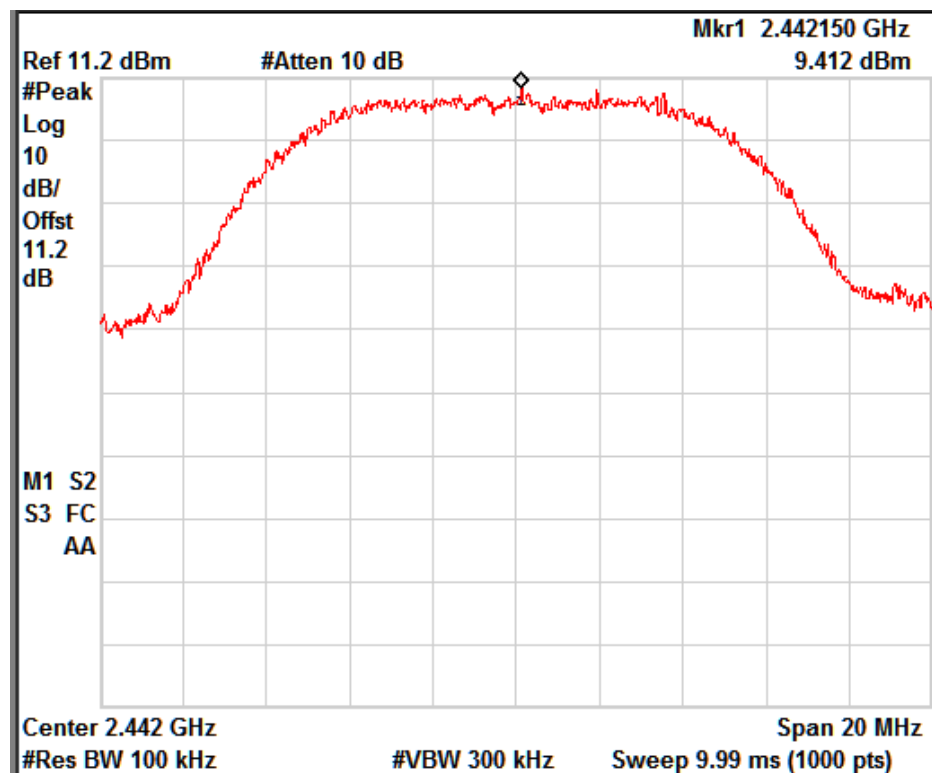
Test Result: Wi-Fi

802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Value at Band Edge		Reference Value B (dBm)	Band Edge Value A-B (dBc)	Limit (dBc)
			Frequency (MHz)	Value A (dBm)			
b	1	2412	2397.05	-35.13	8.48	-43.61	-30.00
		2462	2483.5	-39.52	8.48	-48.00	-30.00
	11	2412	2397.49	-29.49	9.41	-38.90	-30.00
		2462	2484.43	-42.22	9.41	-51.63	-30.00

Note: The channel no. 7 (2442 MHz) found to contain the maximum PSD level and is used to establish the reference level.

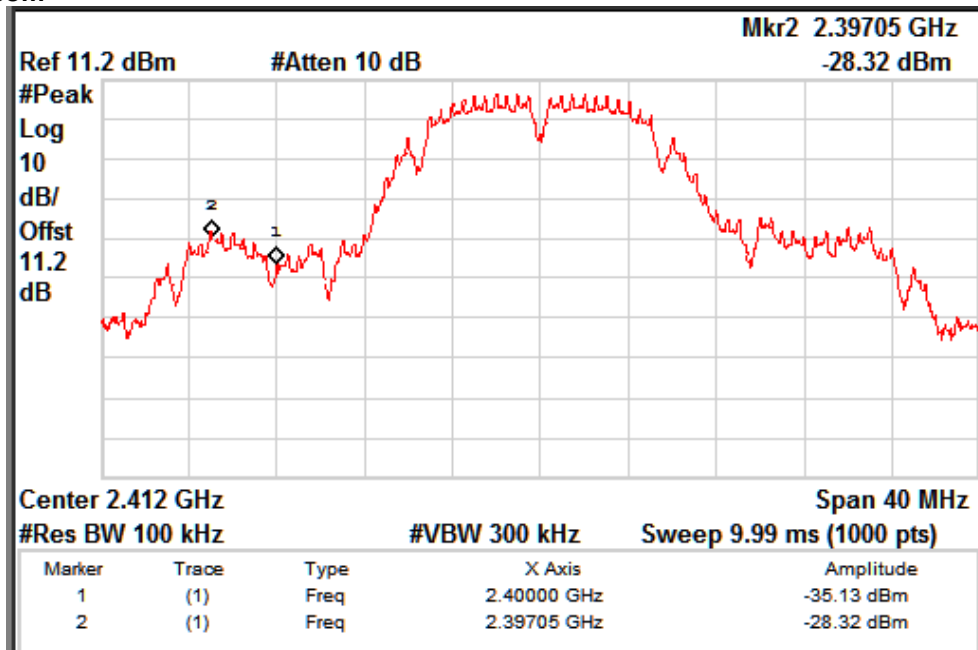


Reference Level Plot: 1Mbps



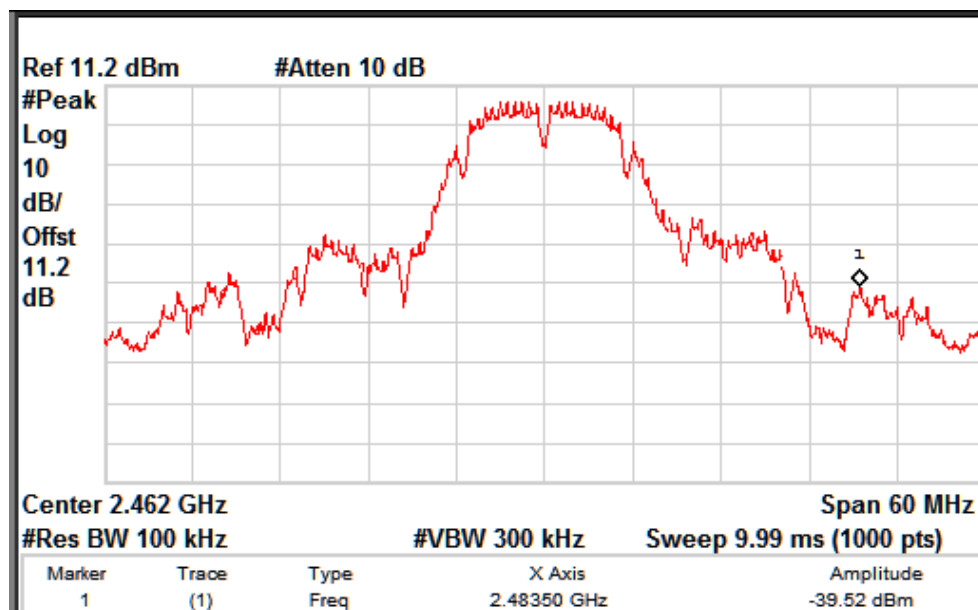
Reference Level Plot: 11Mbps

www.tuv.com



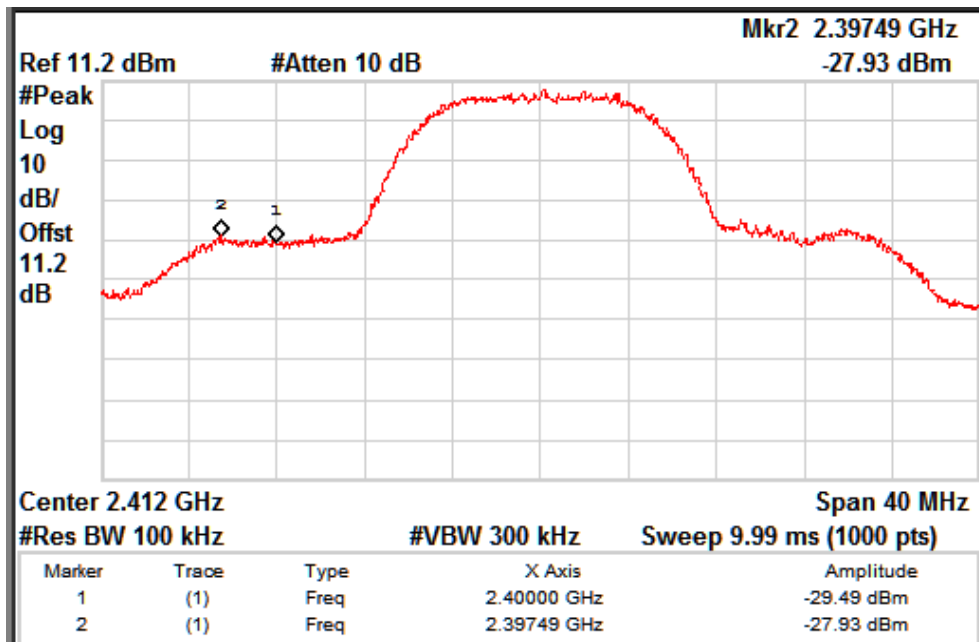
Data Rate: 1 Mbps

Channel frequency: 2412 MHz



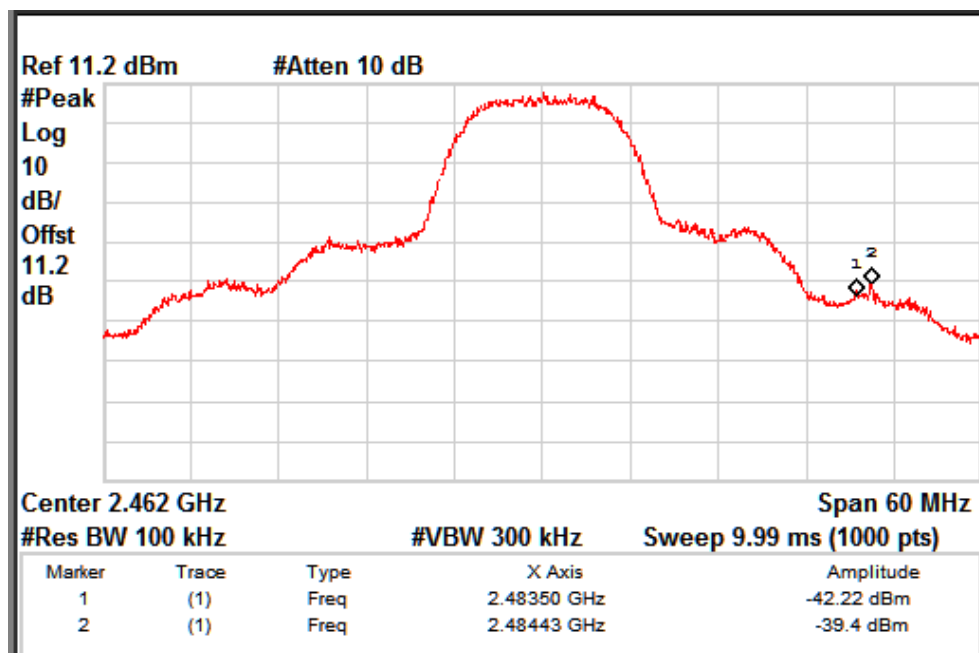
Data Rate: 1 Mbps

Channel frequency: 2462 MHz



Data Rate: 11 Mbps

Channel frequency: 2412 MHz



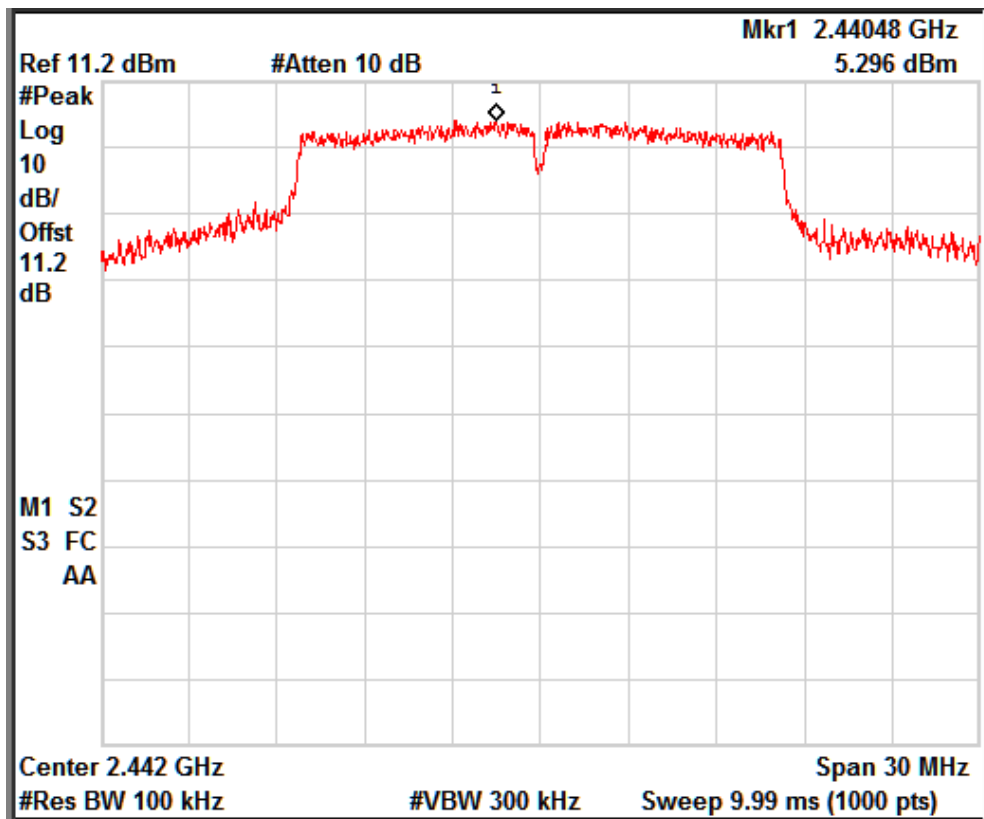
Data Rate: 11 Mbps

Channel frequency: 2462 MHz

www.tuv.com

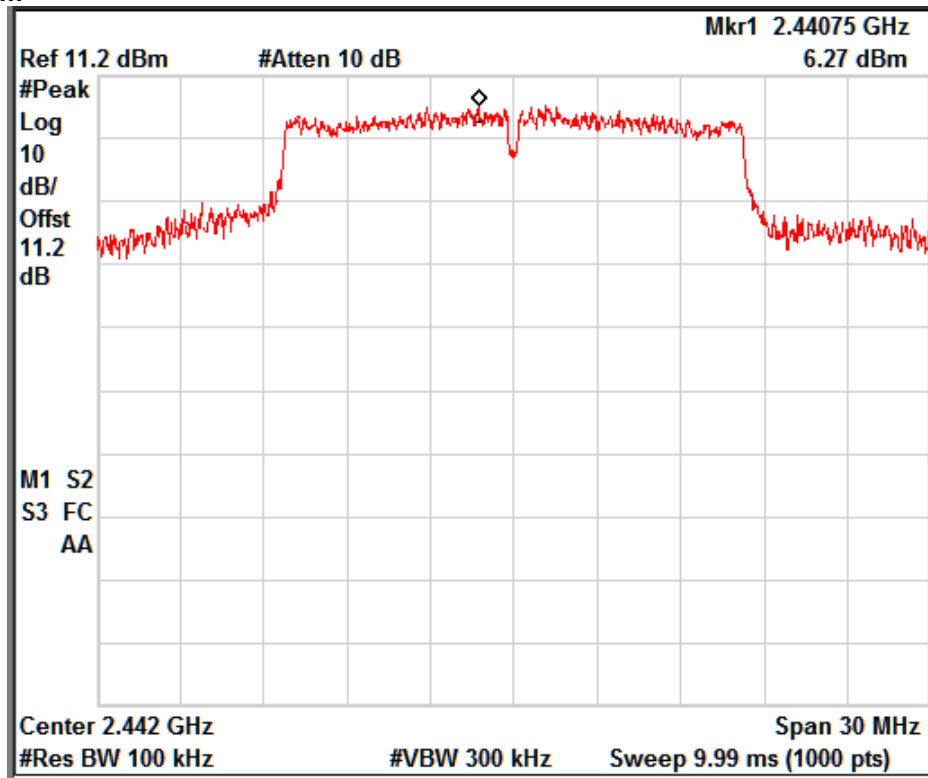
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Value at Band Edge		Reference Value B (dBm)	Band Edge Value A-B (dBc)	Limit (dBc)
			Frequency (MHz)	Value A (dBm)			
g	6	2412	2398.61	-32.97	5.30	-38.27	-30.00
		2462	2483.5	-39.82	5.30	-45.12	-30.00
	24	2412	2395.8	-33.14	6.27	-39.41	-30.00
		2462	2483.5	-38.74	6.27	-45.01	-30.00
	54	2412	2439.885	-30.82	6.09	-36.91	-30.00
		2462	2483.5	-38.64	6.09	-44.73	-30.00

Note: The channel no. 7 (2442 MHz) found to contain the maximum PSD level and is used to establish the reference level.

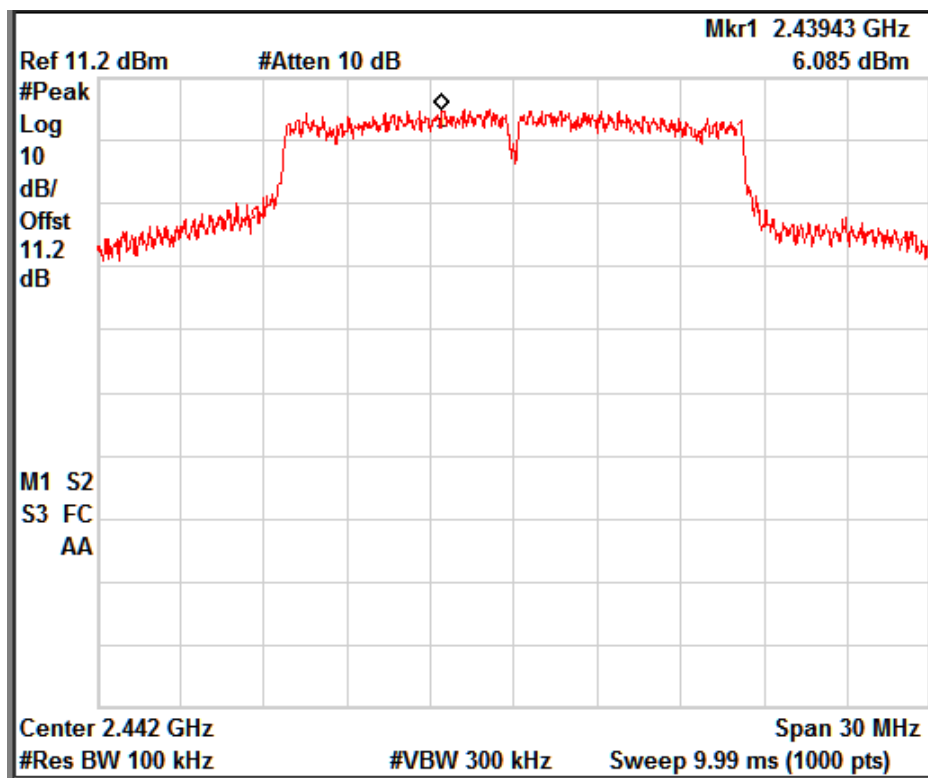


Reference Level Plot: 6 Mbps

www.tuv.com

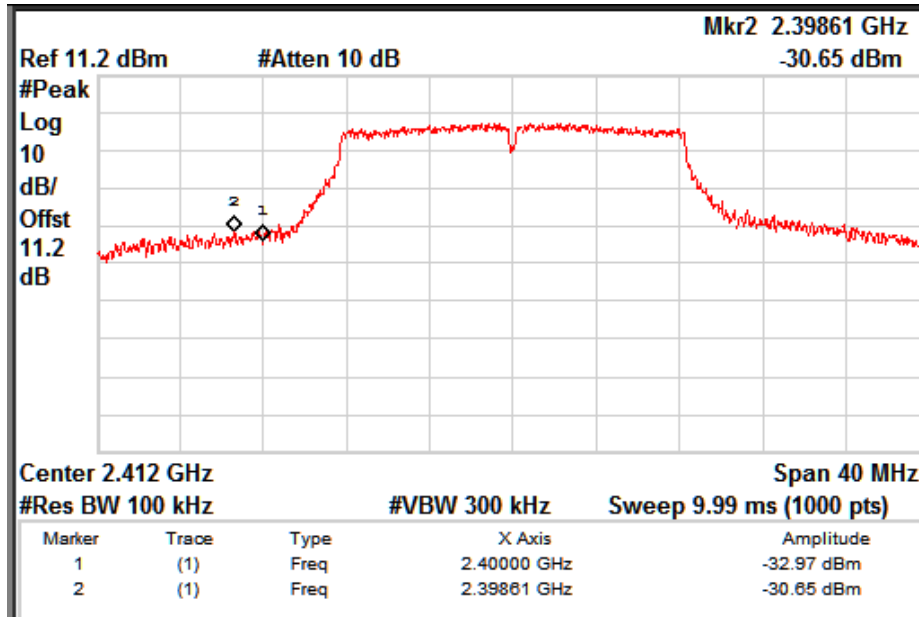


Reference Level Plot: 24 Mbps



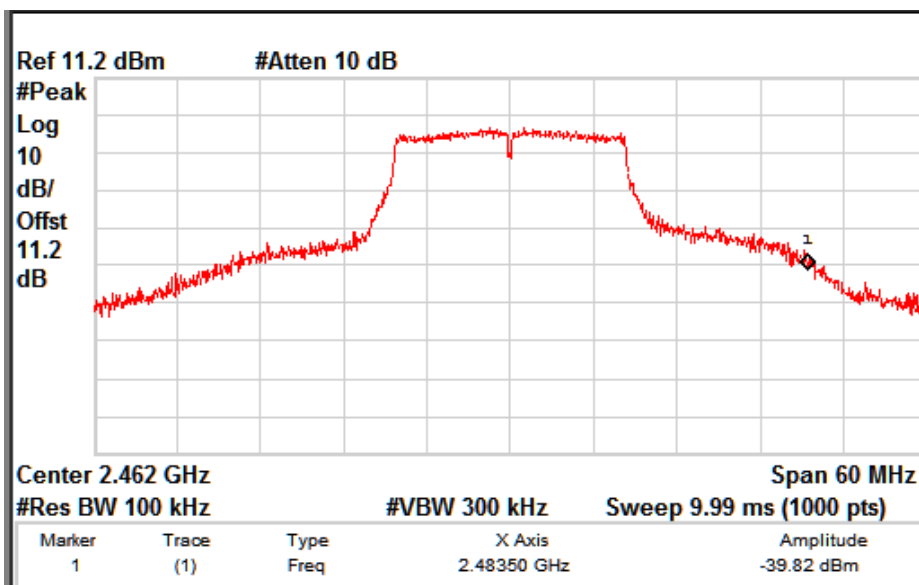
Reference Level Plot: 54 Mbps

www.tuv.com



Data Rate: 6 Mbps

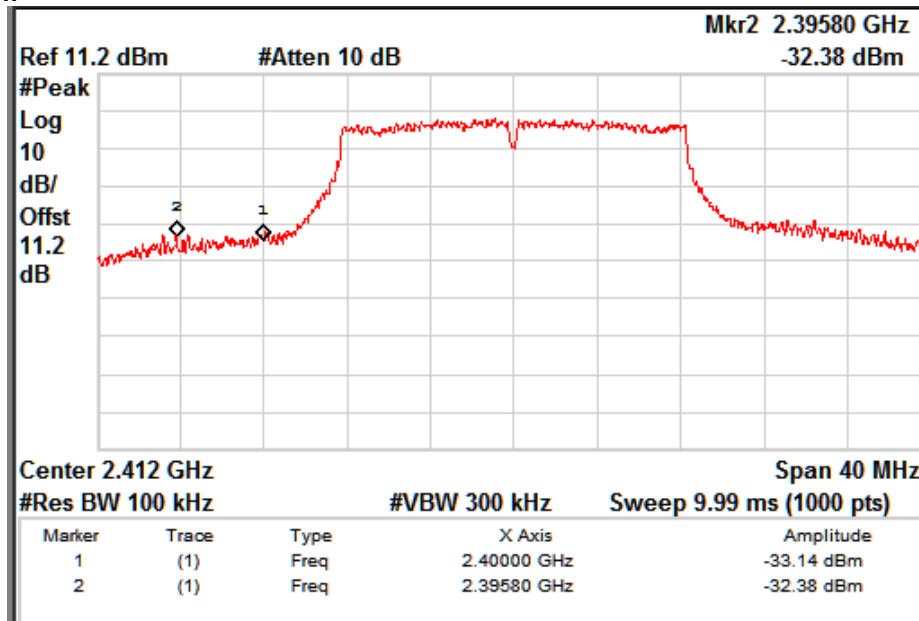
Channel frequency: 2412 MHz



Data Rate: 6 Mbps

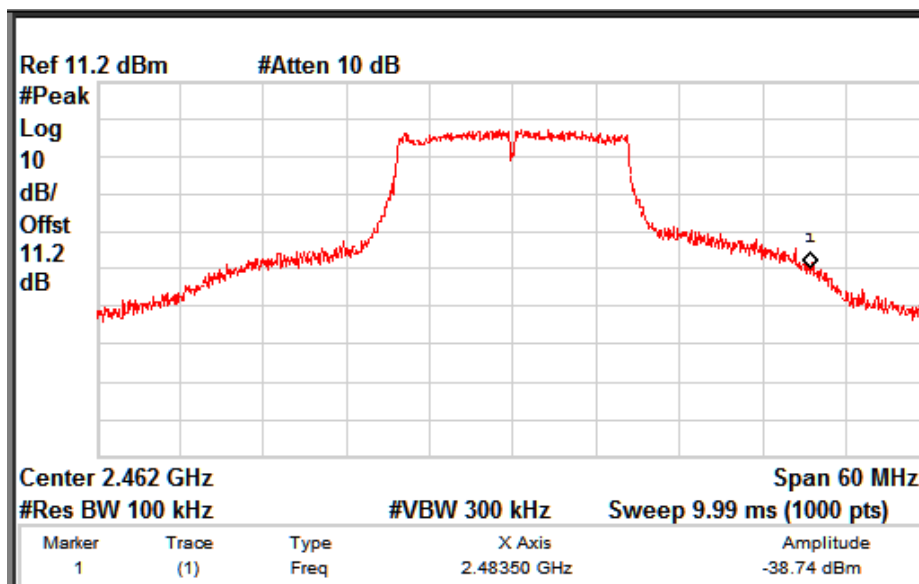
Channel frequency: 2462 MHz

www.tuv.com



Data Rate: 24 Mbps

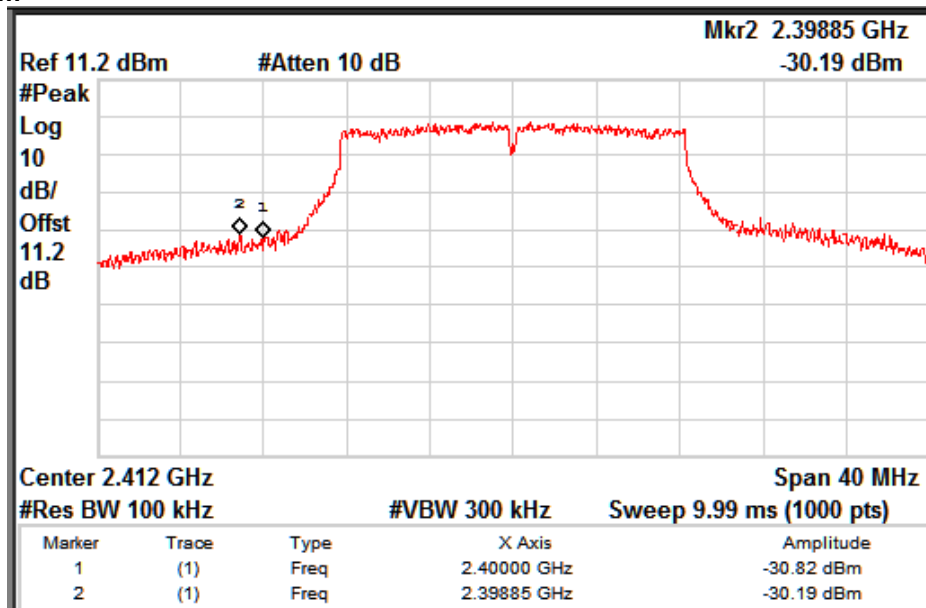
Channel frequency: 2412 MHz



Data Rate: 24 Mbps

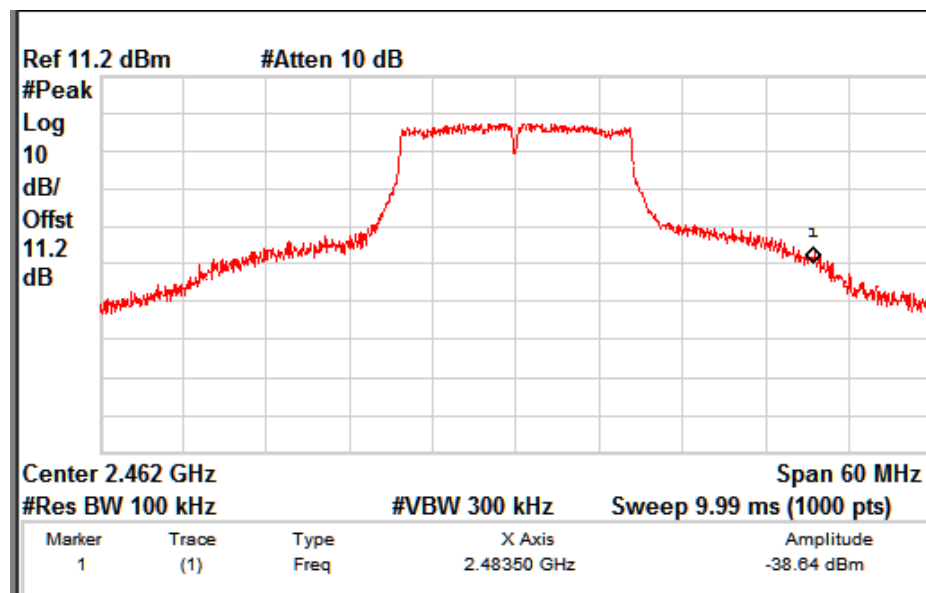
Channel frequency: 2462 MHz

www.tuv.com



Data Rate: 54 Mbps

Channel frequency: 2412 MHz



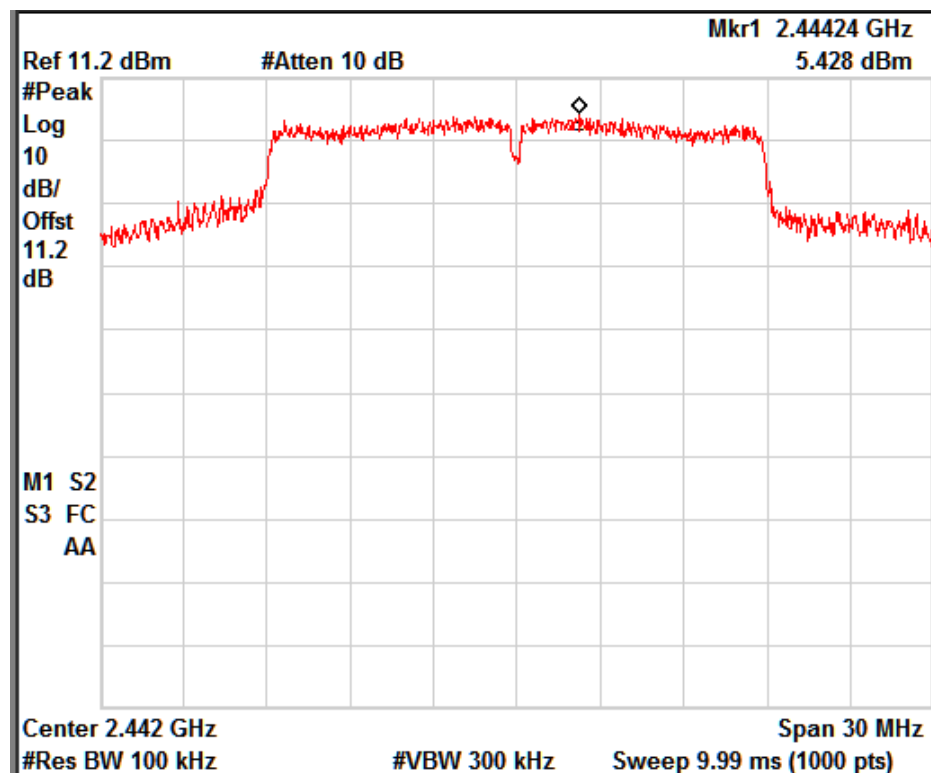
Data Rate: 54 Mbps

Channel frequency: 2462 MHz

www.tuv.com

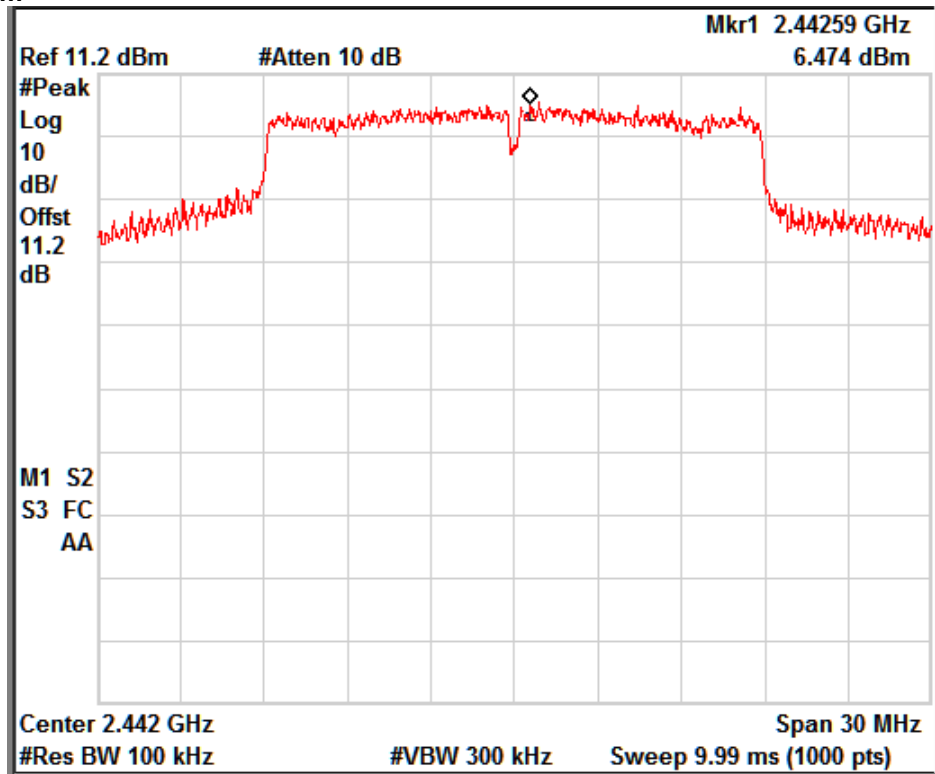
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Value at Band Edge		Reference Value B (dBm)	Band Edge Value A-B (dBc)	Limit (dBc)
			Frequency (MHz)	Value A (dBm)			
n	MCS0 (6.5)	2412	2398.57	-34.39	5.43	-39.82	-30.00
		2462	2483.5	-39.43	5.43	-44.86	-30.00
	MCS4 (39)	2412	2400	-34.29	6.47	-40.76	-30.00
		2462	2483.5	-39.60	6.47	-46.07	-30.00
	MCS7 (65)	2412	2399.85	-35.67	6.25	-41.92	-30.00
		2462	2483.5	-38.76	6.25	-45.01	-30.00

Note: The channel no. 7 (2442 MHz) found to contain the maximum PSD level and is used to establish the reference level.

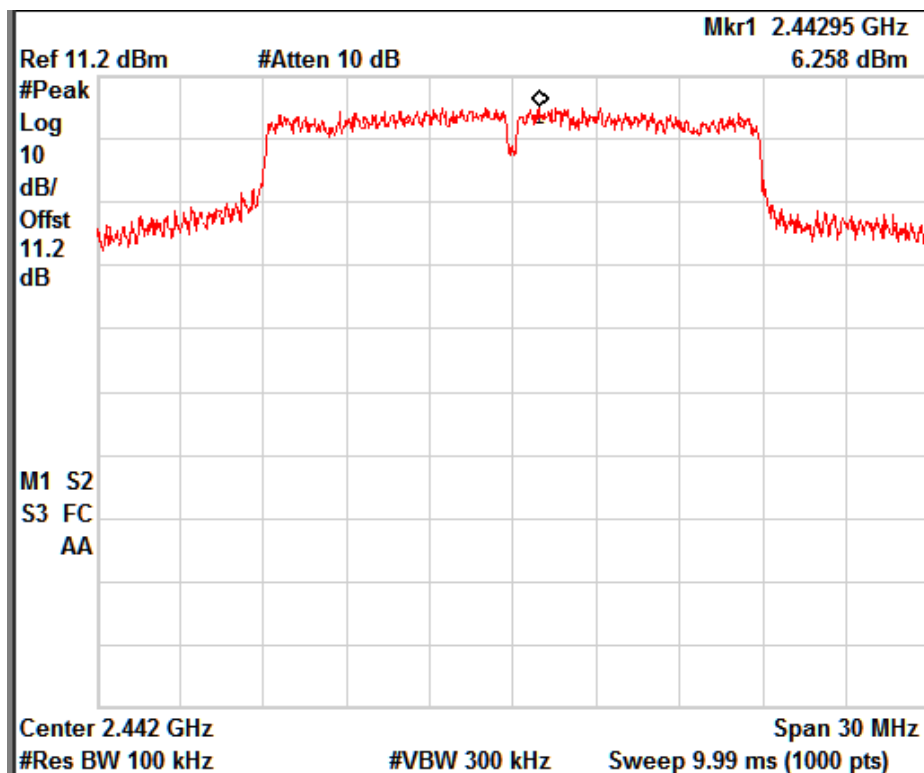


Reference Level Plot: 6.5 Mbps

www.tuv.com

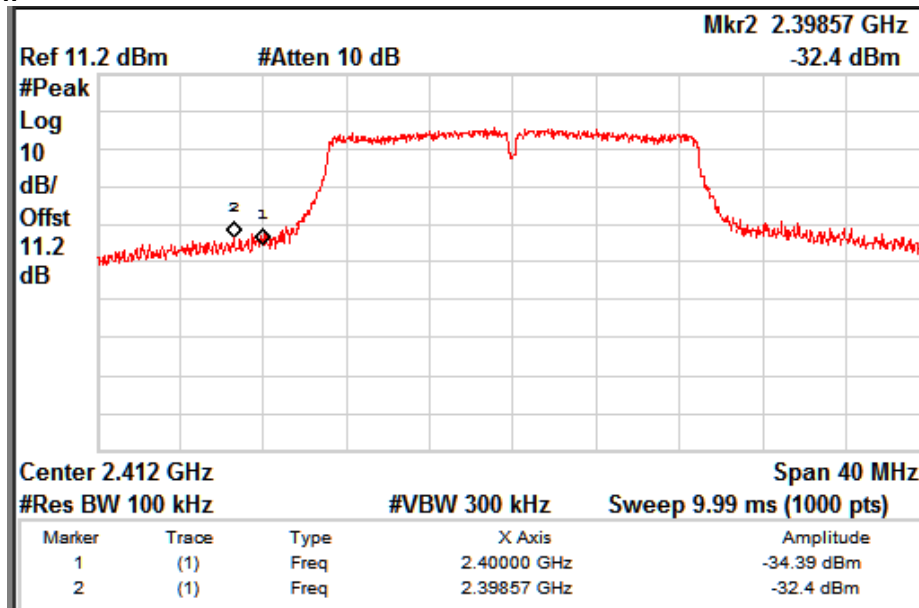


Reference Level Plot: 39 Mbps



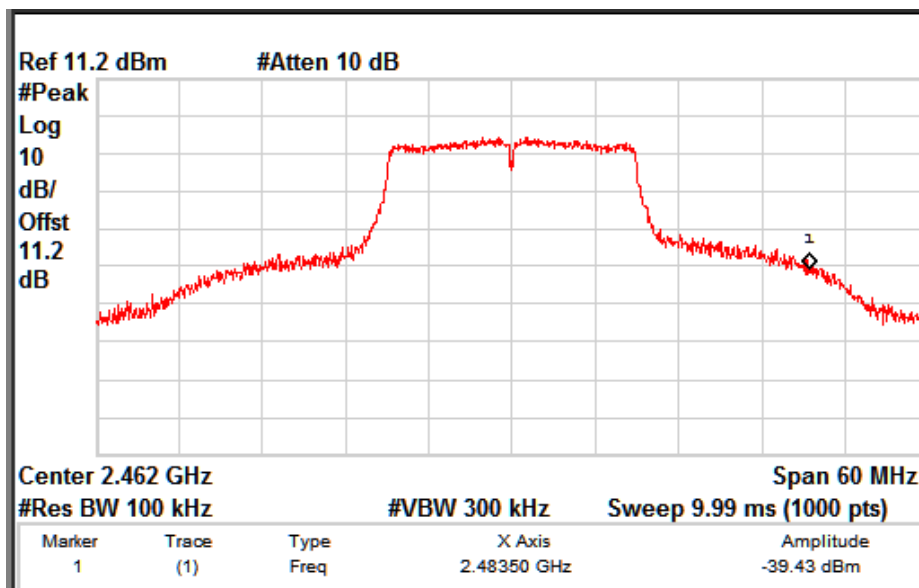
Reference Level Plot: 65 Mbps

www.tuv.com



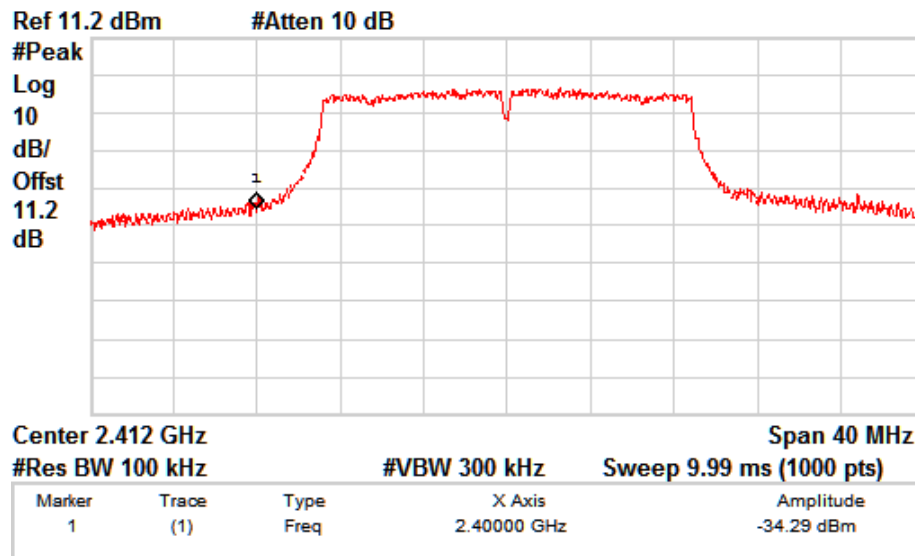
Data Rate: 6.5 Mbps

Channel frequency: 2412 MHz



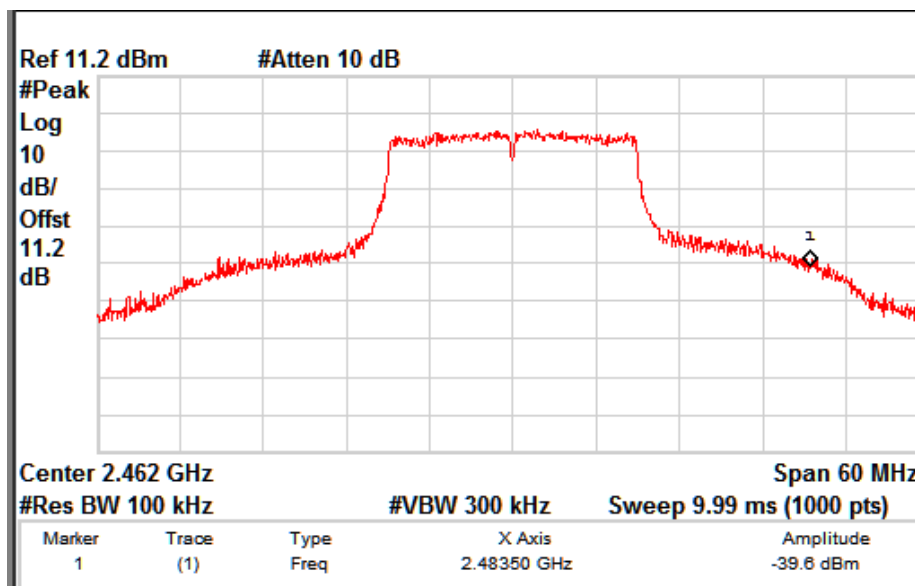
Data Rate: 6.5 Mbps

Channel frequency: 2462 MHz



Data Rate: 39 Mbps

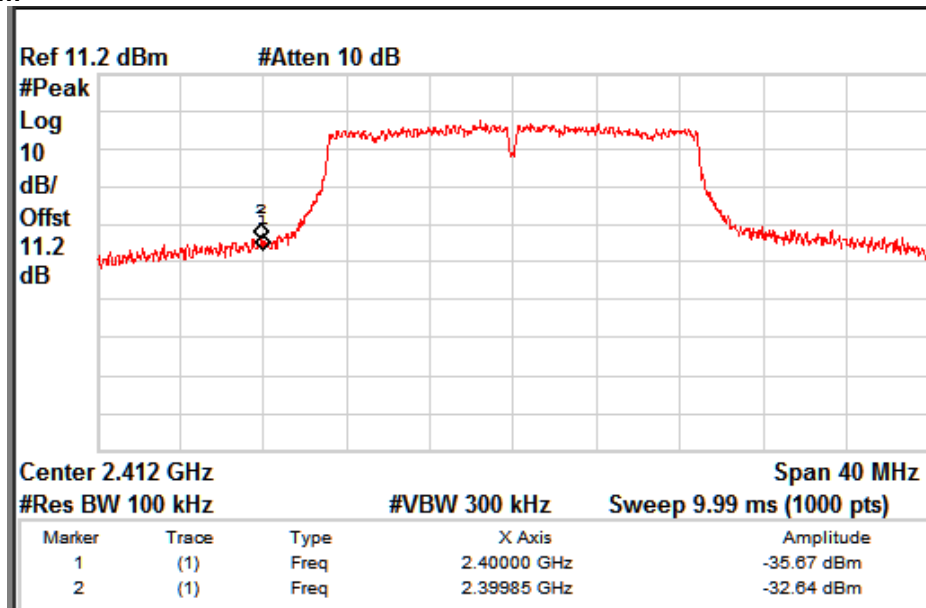
Channel frequency: 2412 MHz



Data Rate: 39 Mbps

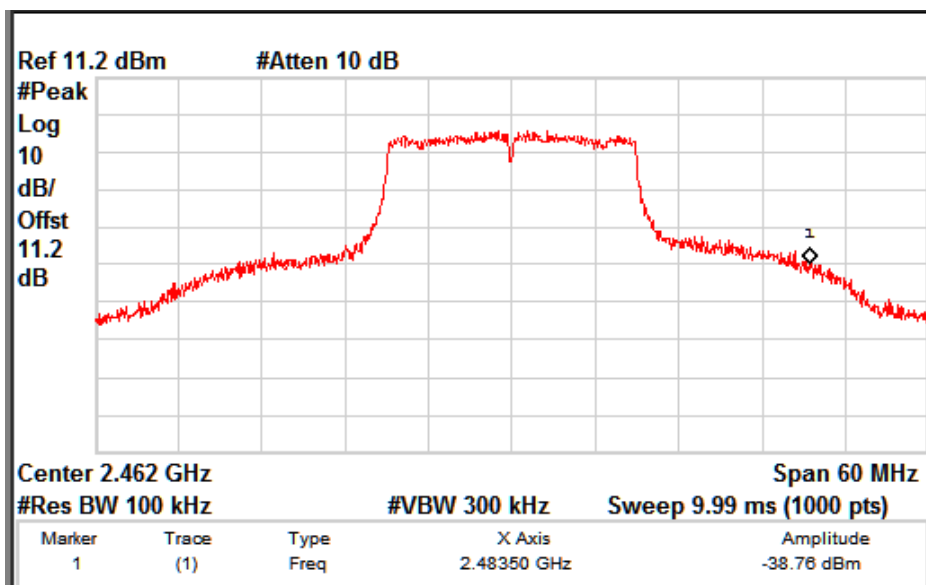
Channel frequency: 2462 MHz

www.tuv.com



Data Rate: 65 Mbps

Channel frequency: 2412 MHz



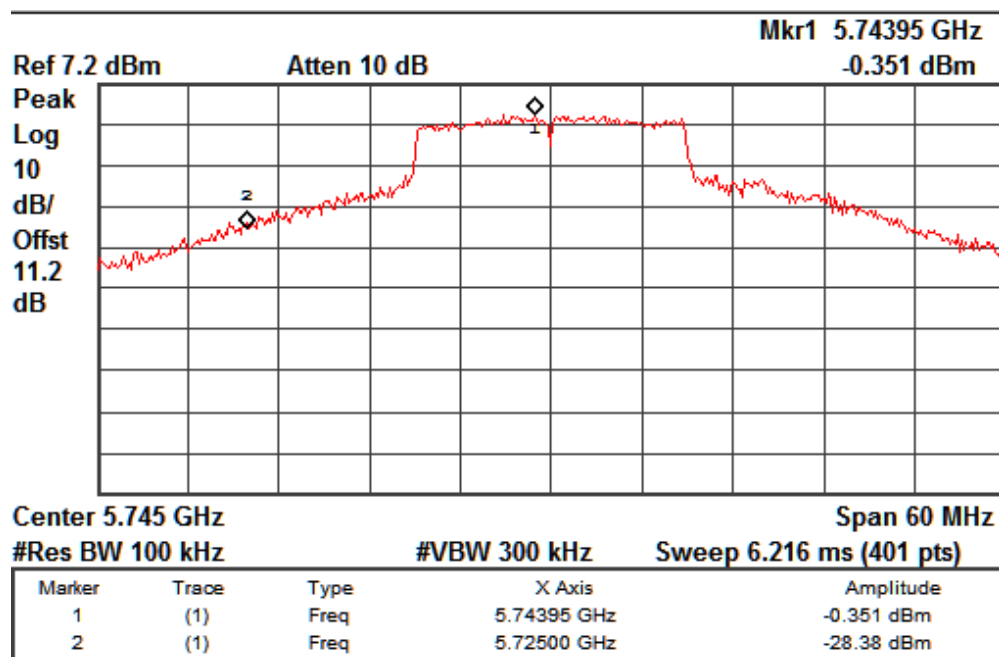
Data Rate: 65 Mbps

Channel frequency: 2462 MHz

www.tuv.com

5GHz Band

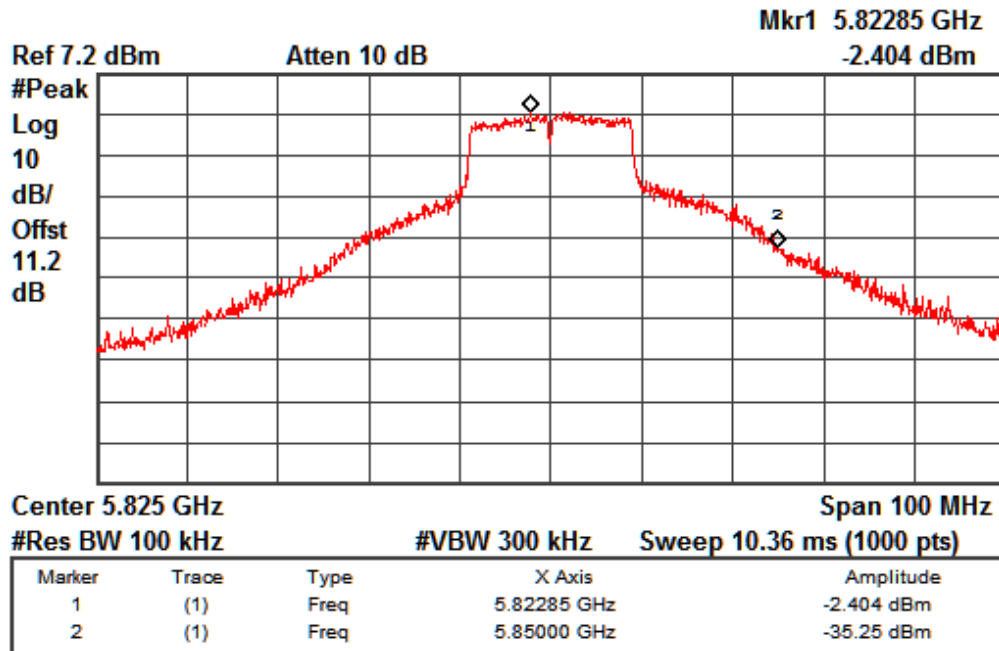
802.11 Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Value at Band Edge		Reference Value B (dBm)	Band Edge Value A-B (dBc)	Limit (dBc)
			Frequency (MHz)	Value A (dBm)			
n	6.5	5745	5725	-28.38	-0.35	-28.03	-20
		5825	5850	-35.25	-2.40	-32.85	-20
	39	5745	5725	-28.37	-0.47	-27.90	-20
		5825	5850	-35.08	-1.95	-33.13	-20
	65	5745	5725	-29.17	0.37	-29.54	-20
		5825	5850	-34.96	-1.24	-33.72	-20



Data Rate: 6.5 Mbps

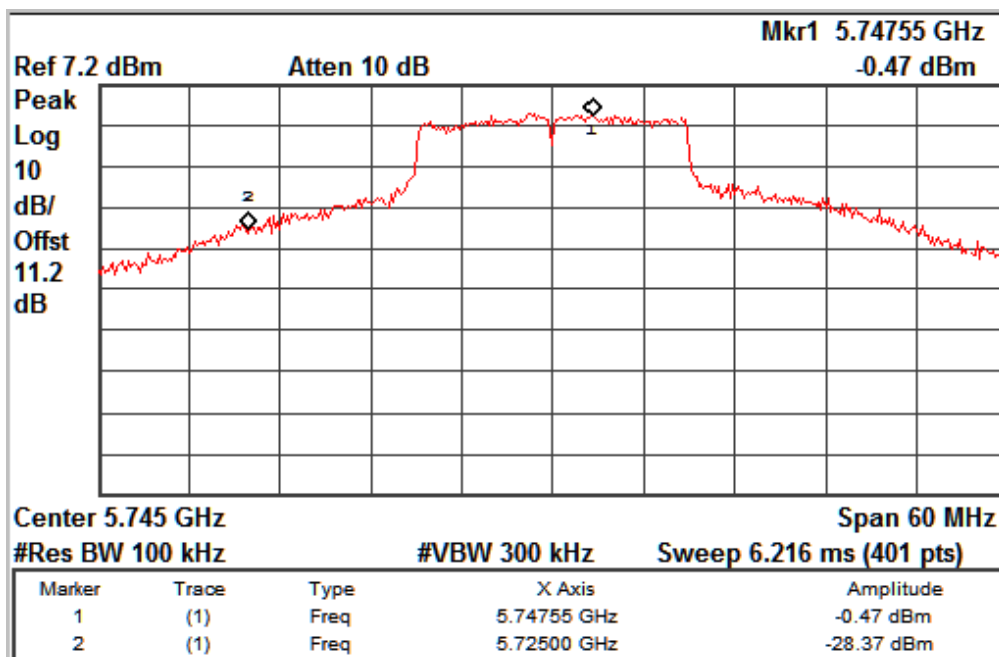
Channel frequency: 5745 MHz

www.tuv.com



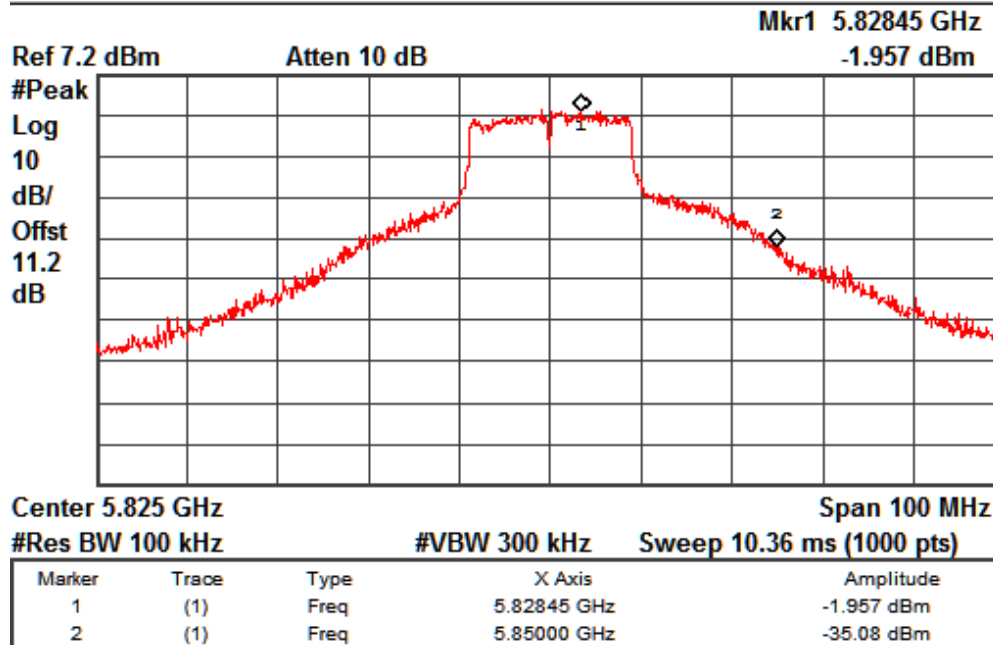
Data Rate: 6.5 Mbps

Channel frequency: 5825 MHz



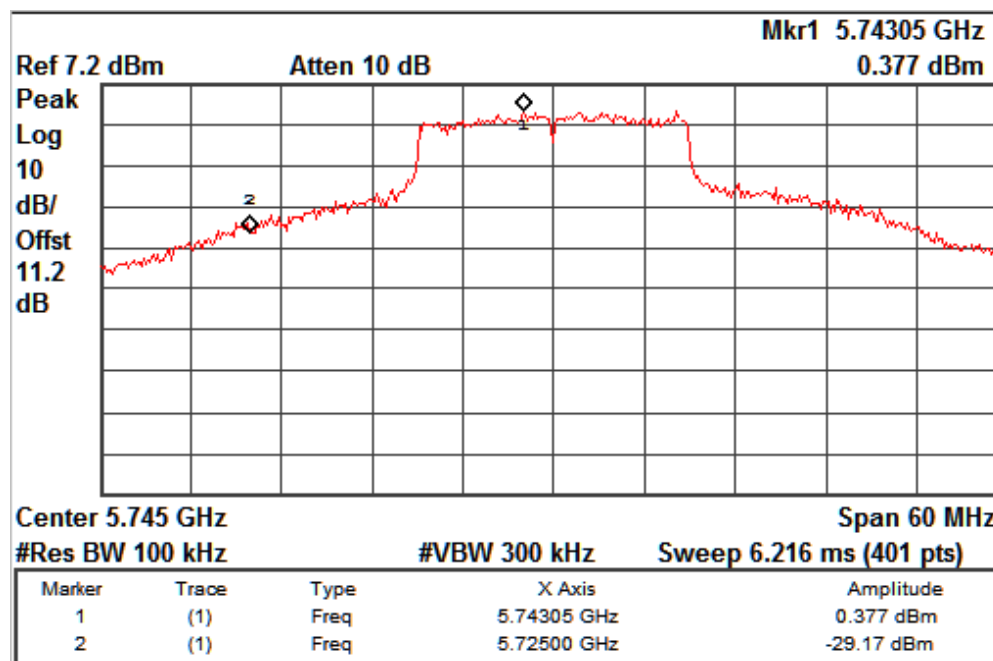
Data Rate: 39 Mbps

Channel frequency: 5745 MHz



Data Rate: 39 Mbps

Channel frequency: 5825 MHz

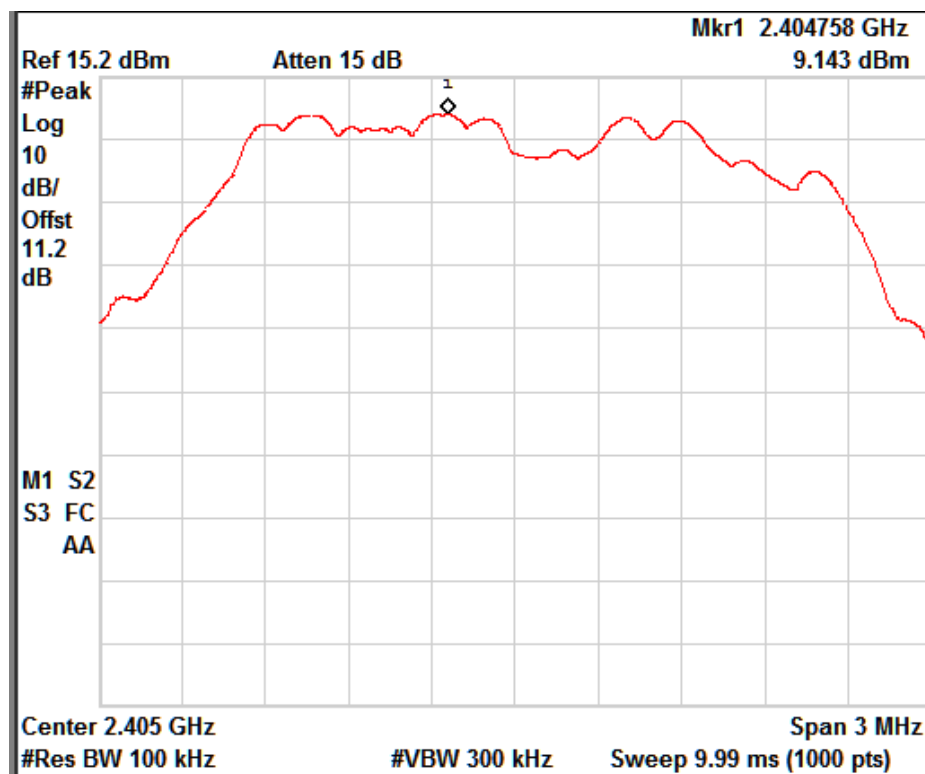


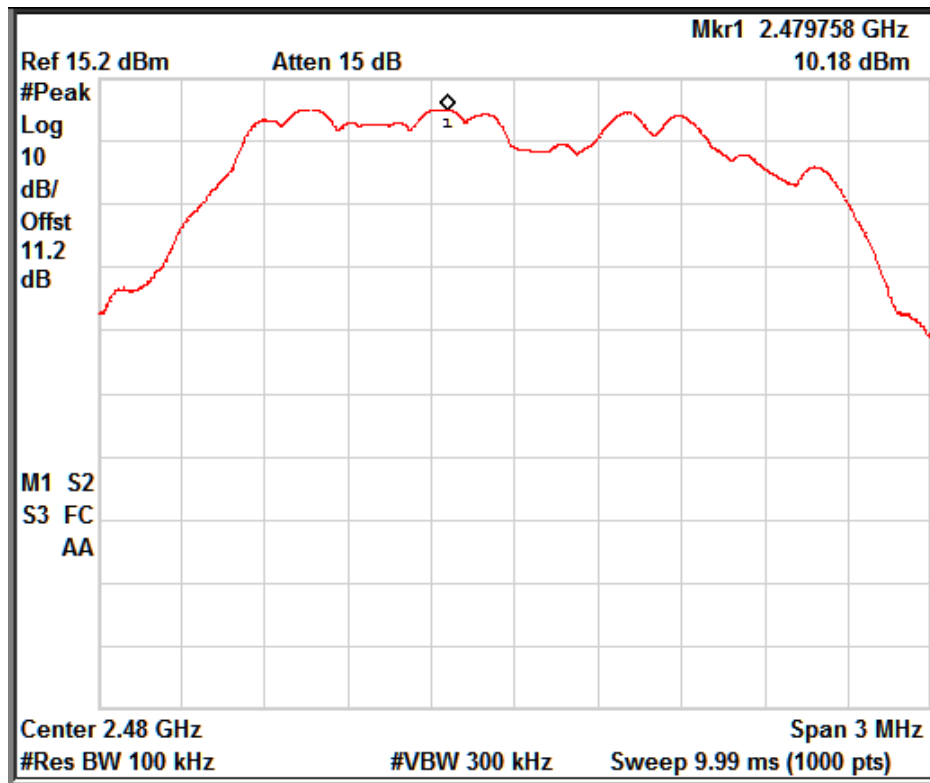
Data Rate: 65 Mbps

Channel frequency: 5745 MHz

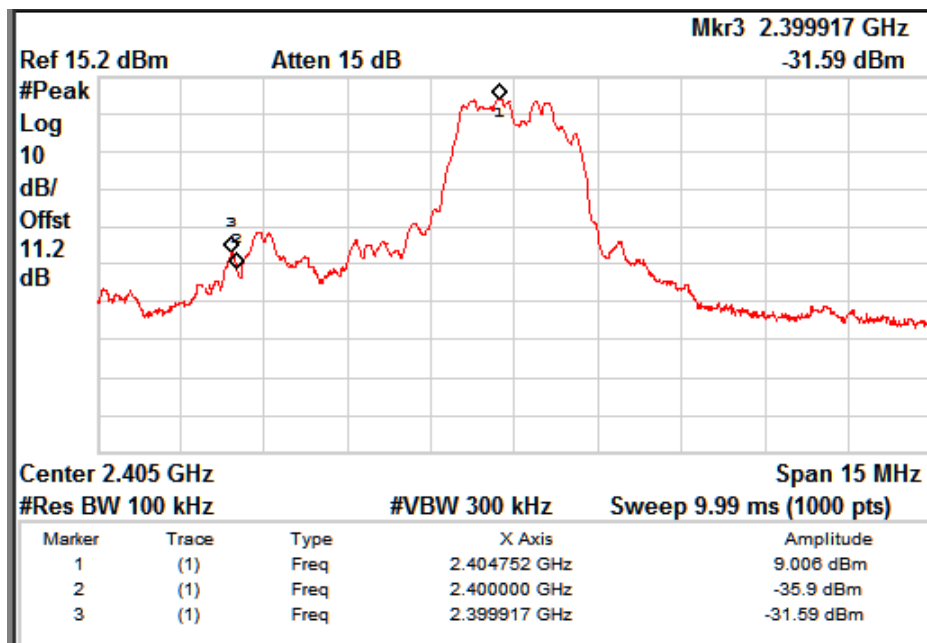
Test Result: ZigBee

Channel Frequency (MHz)	Value at Band Edge		Reference PSD Value B (dBm)	Band Edge Value A-B (dBc)	Limit (dBc)
	Frequency (MHz)	Value A (dBm)			
2405	2399.91	-35.90	9.14	-45.04	-30.00
2480	2483.50	-45.32	10.18	-55.50	-30.00


Reference Level Plot Channel Low

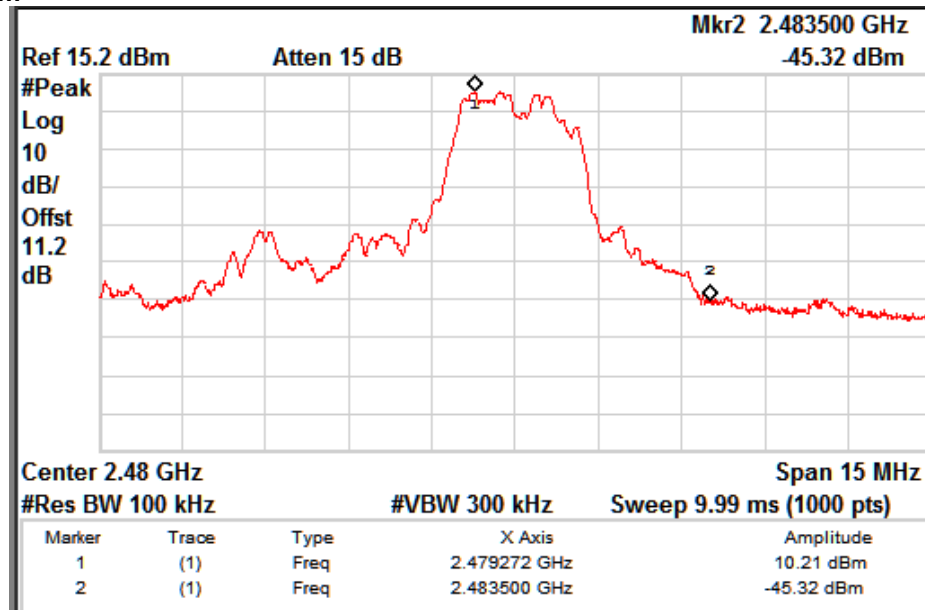


Reference Level Plot Channel High



Channel Frequency 2405 MHz

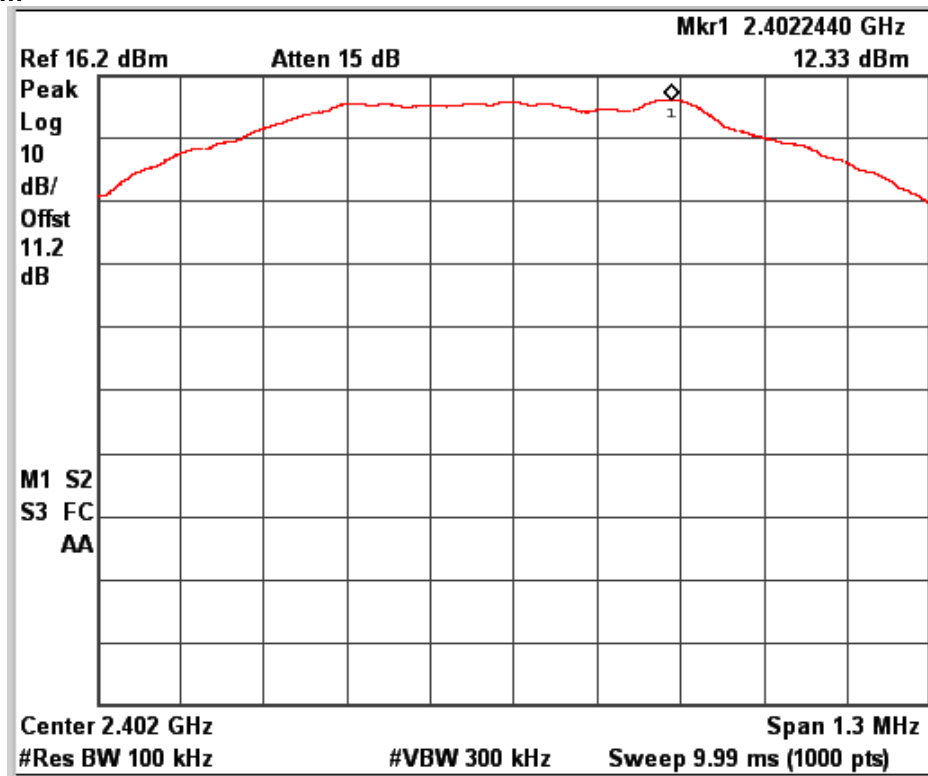
www.tuv.com



Channel Frequency 2480 MHz

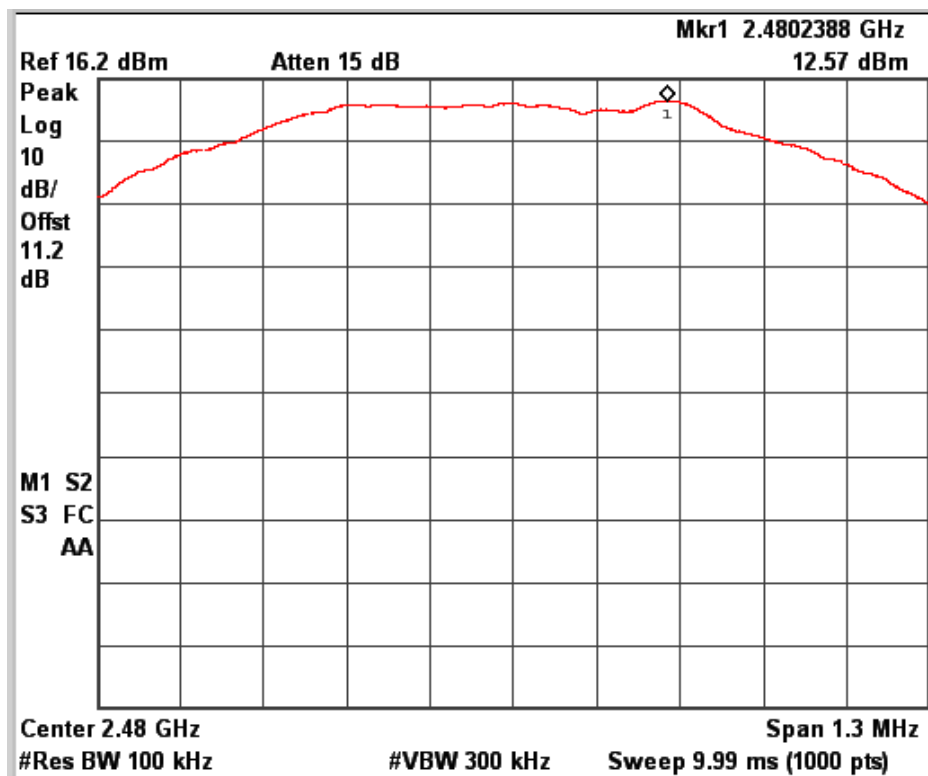
Test Result: Bluetooth LE

Channel Frequency (MHz)	Value at Band Edge		Reference PSD Value B (dBm)	Band Edge Value A-B (dBc)	Limit (dBc)
	Frequency (MHz)	Value A (dBm)			
2405	2399.74	-26.55	12.33	-38.88	-30.00
2480	2483.50	-48.10	12.57	-60.67	-30.00



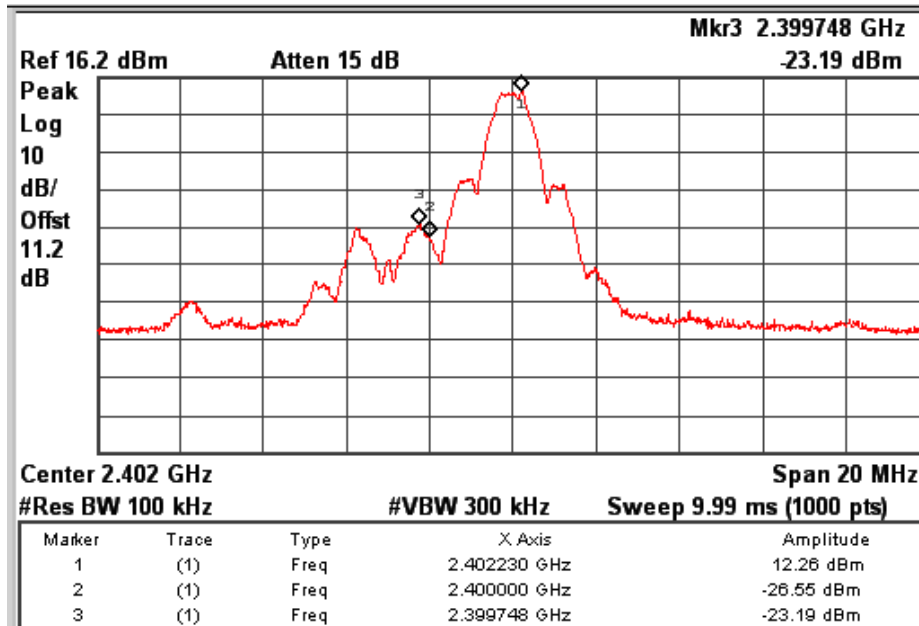
Reference Level Plot

Channel Frequency: 2402MHz

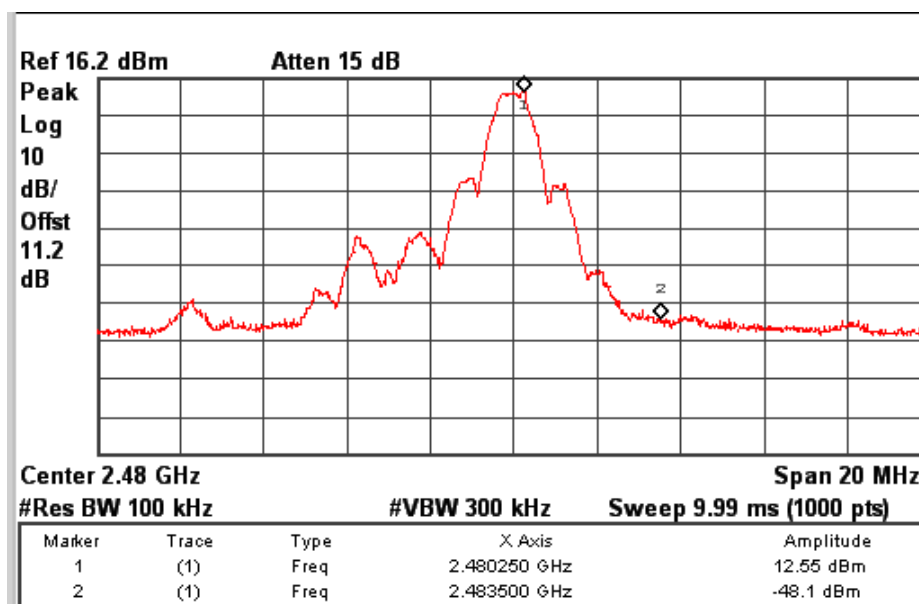


Reference Level Plot

Channel Frequency: 2480MHz



Channel Frequency 2402 MHz

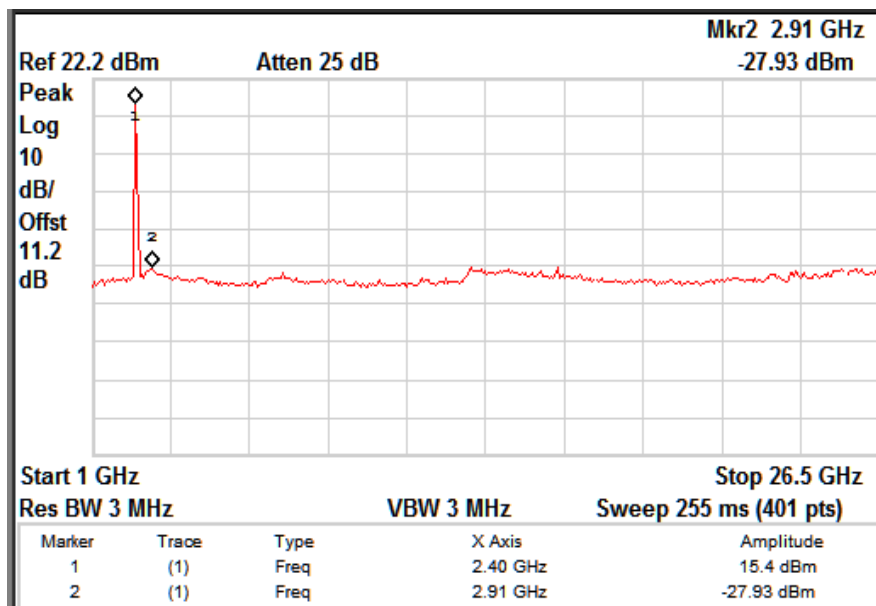
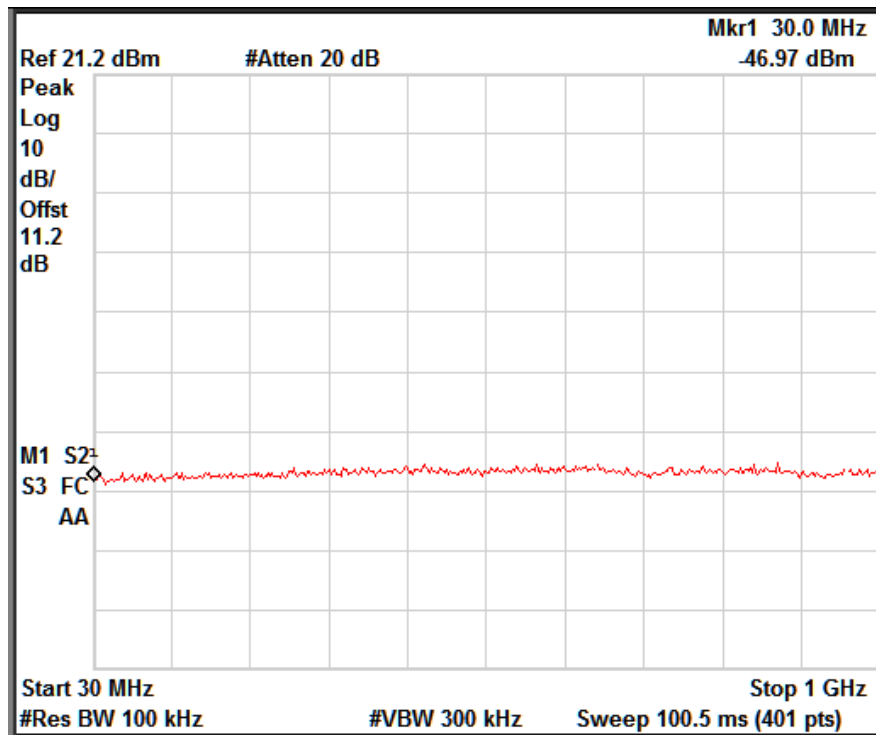


Channel Frequency 2480 MHz

www.tuv.com

Conducted Spurious Emission

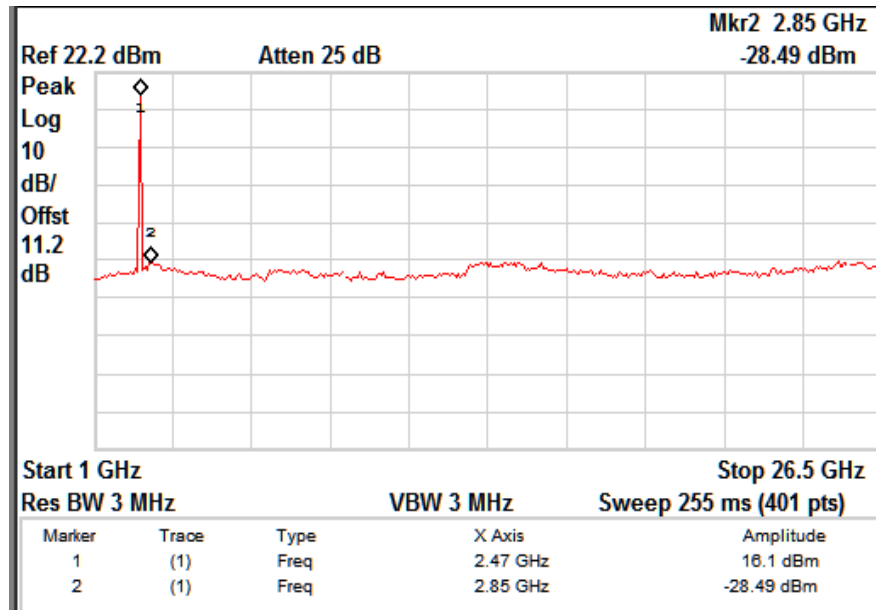
WiFi



Data Rate: 1Mbps

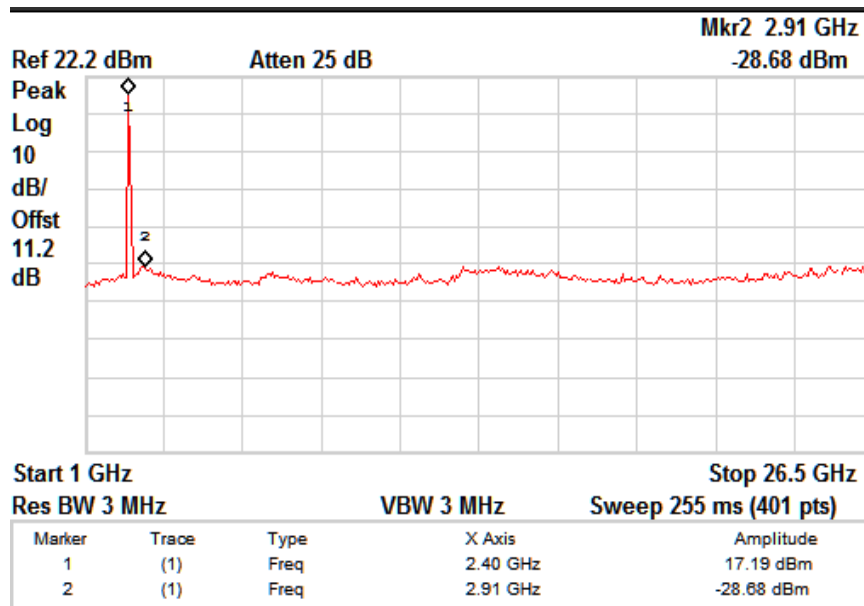
Channel frequency: 2412 MHz

www.tuv.com



Data Rate: 1Mbps

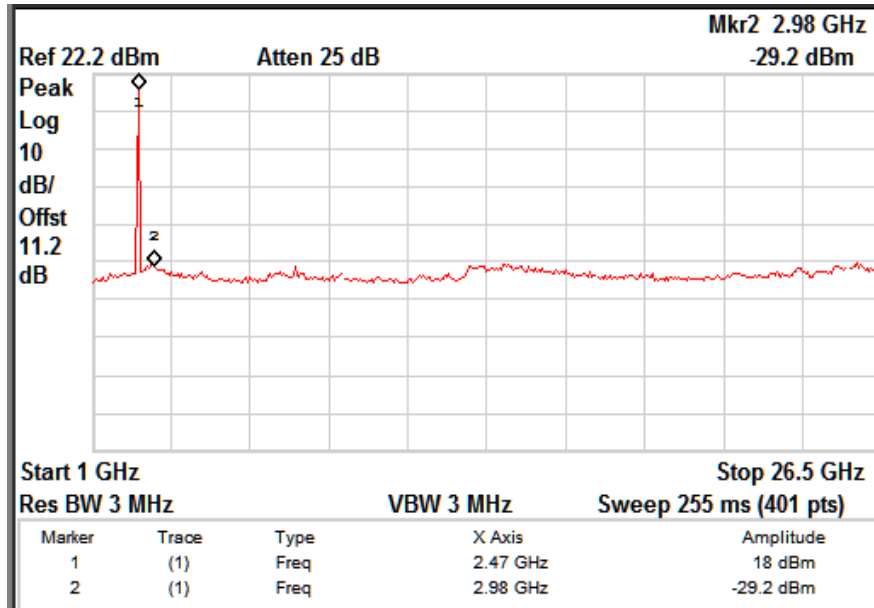
Channel frequency: 2462 MHz



Data Rate: 11Mbps

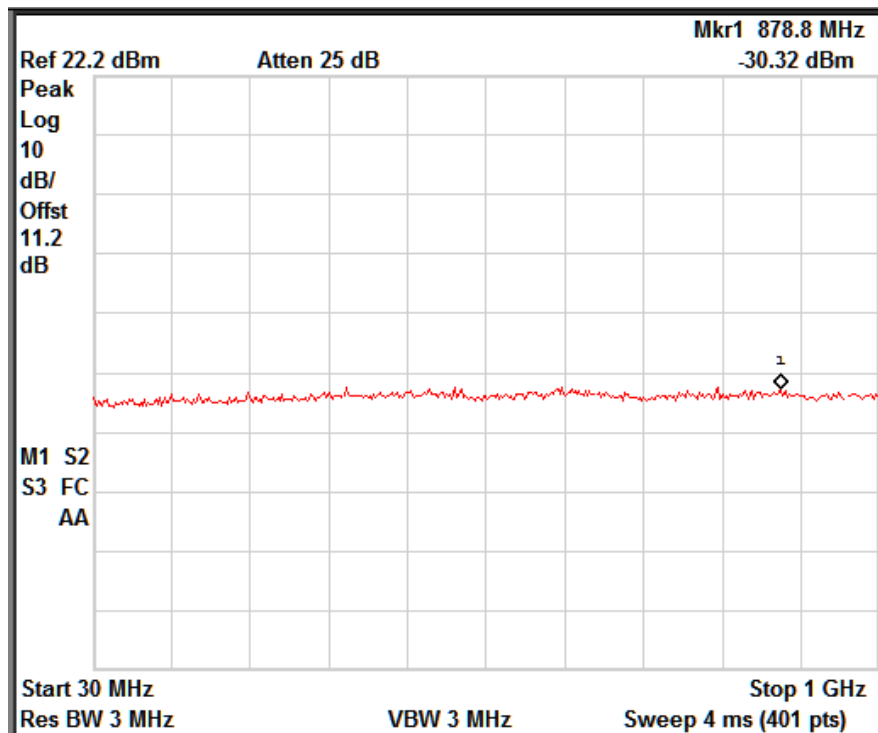
Channel frequency: 2412 MHz

www.tuv.com

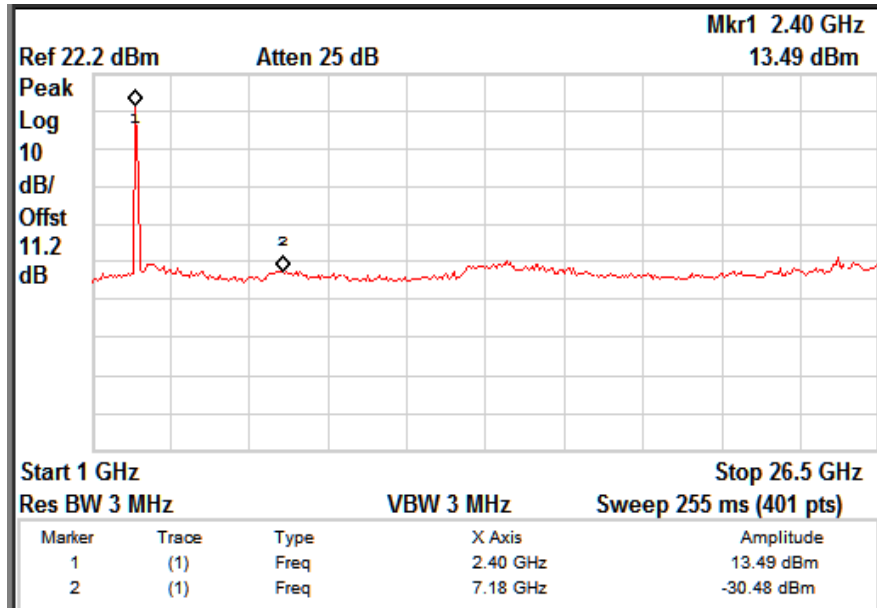


Data Rate: 11Mbps

Channel frequency: 2462 MHz

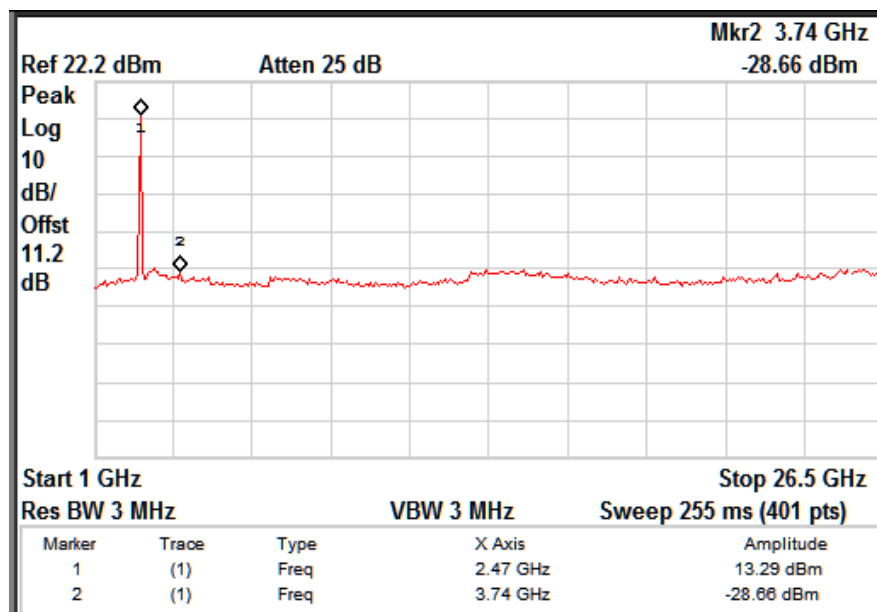


www.tuv.com



Data Rate: 6Mbps

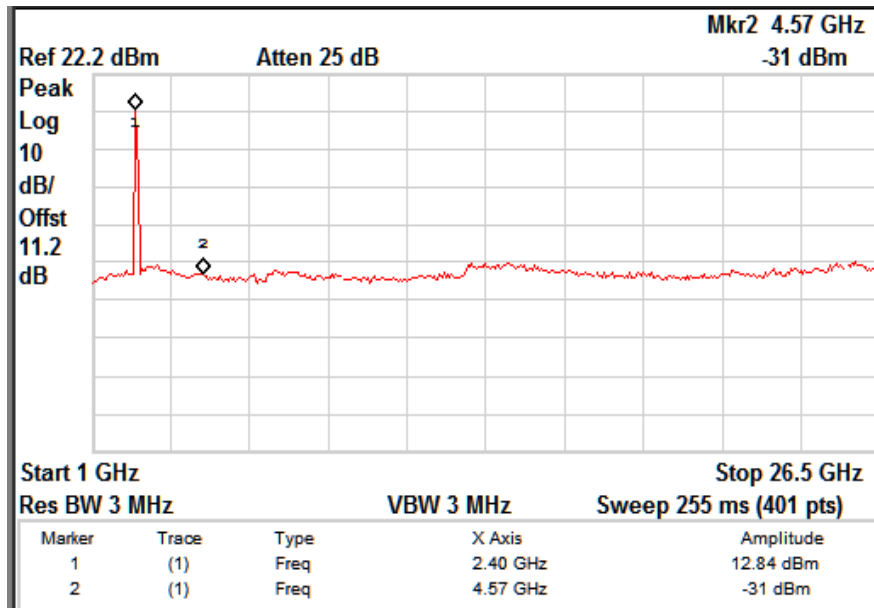
Channel frequency: 2412 MHz



Data Rate: 6Mbps

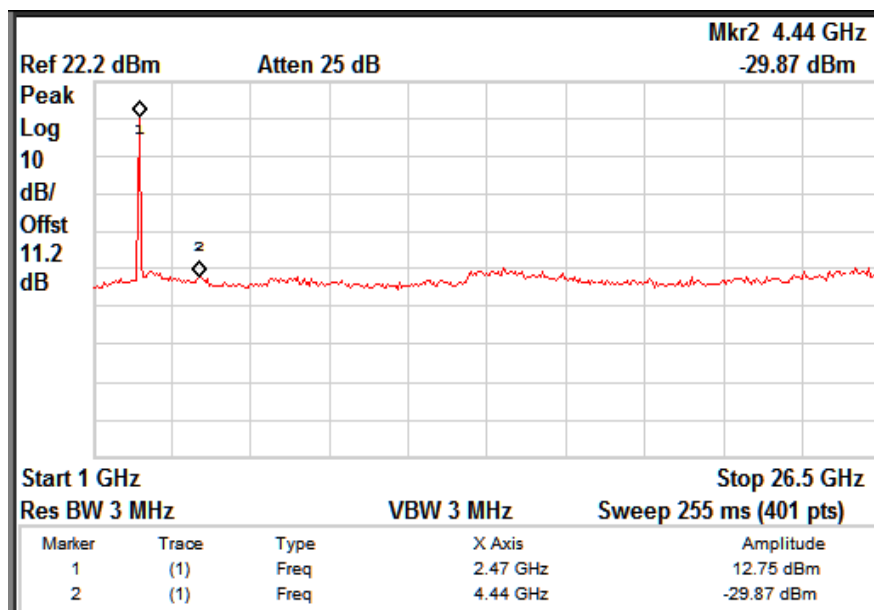
Channel frequency: 2462 MHz

www.tuv.com



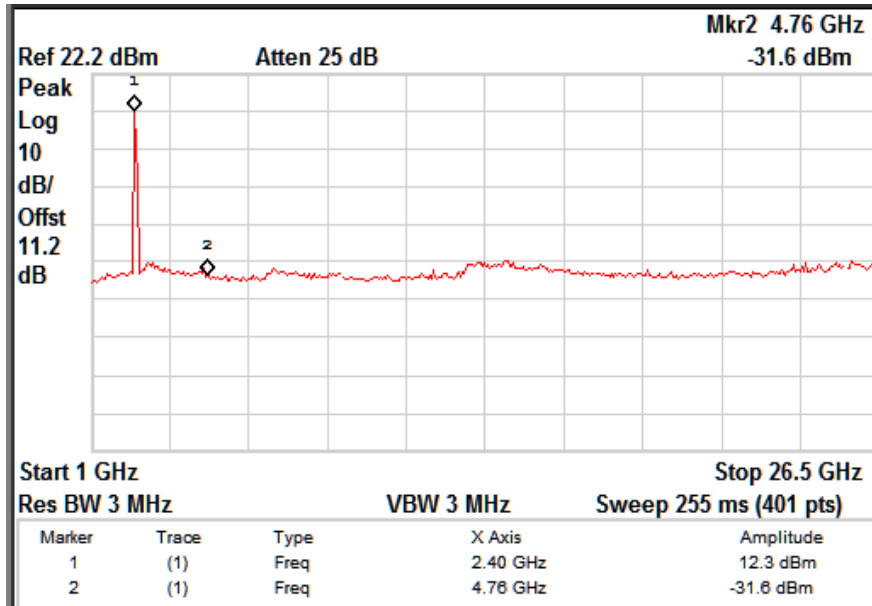
Data Rate: 24Mbps

Channel frequency: 2412 MHz



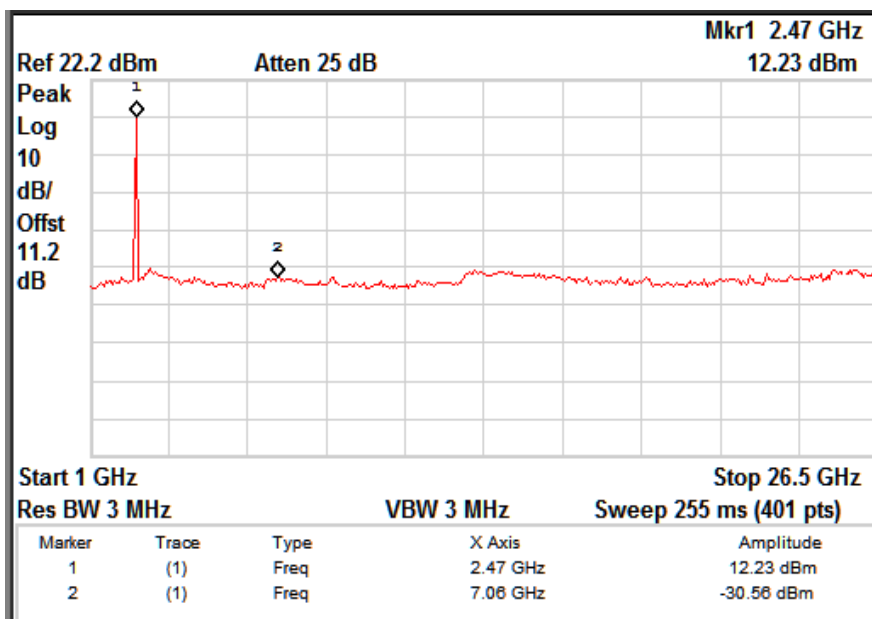
Data Rate: 24Mbps

Channel frequency: 2462 MHz



Data Rate: 54Mbps

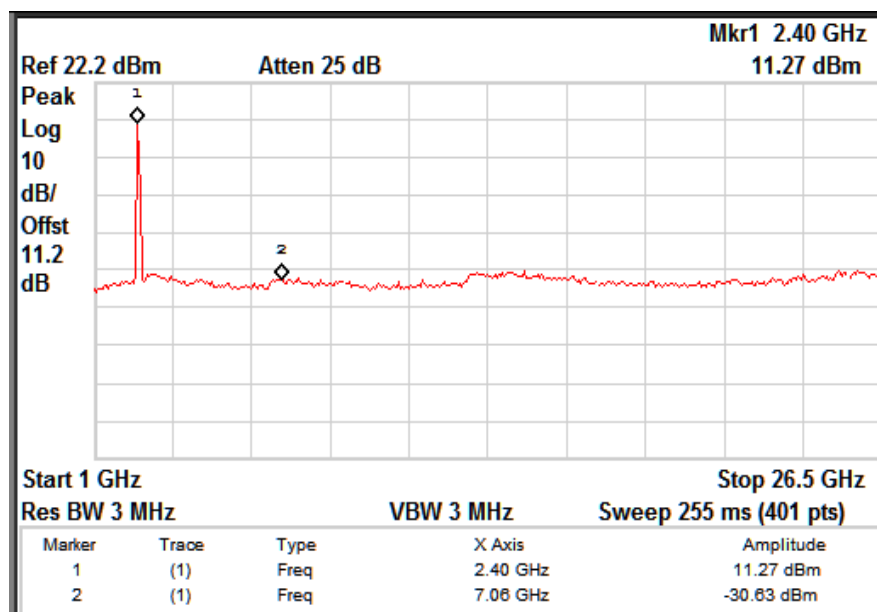
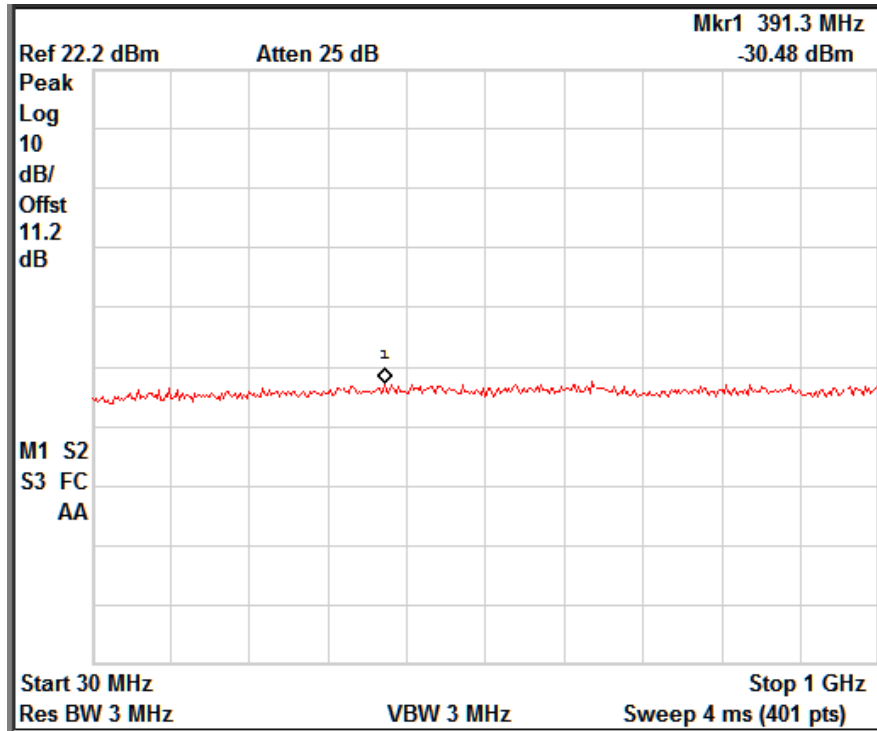
Channel frequency: 2412 MHz



Data Rate: 54Mbps

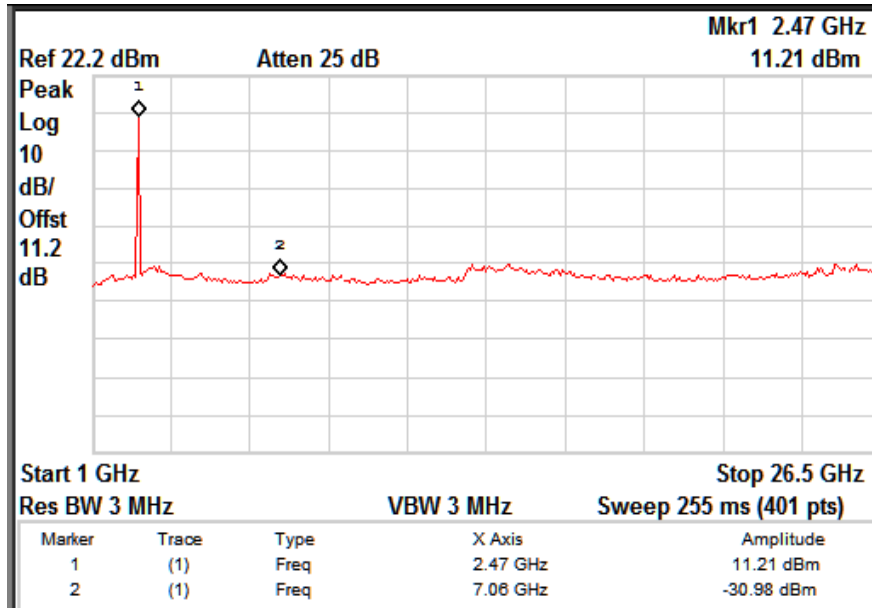
Channel frequency: 2462 MHz

www.tuv.com



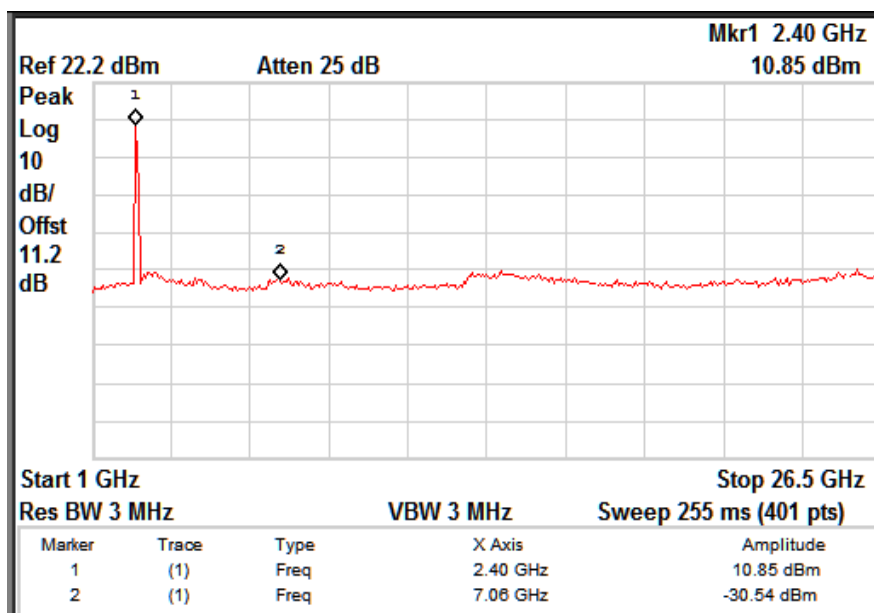
Data Rate: 6.5 Mbps

Channel frequency: 2412 MHz



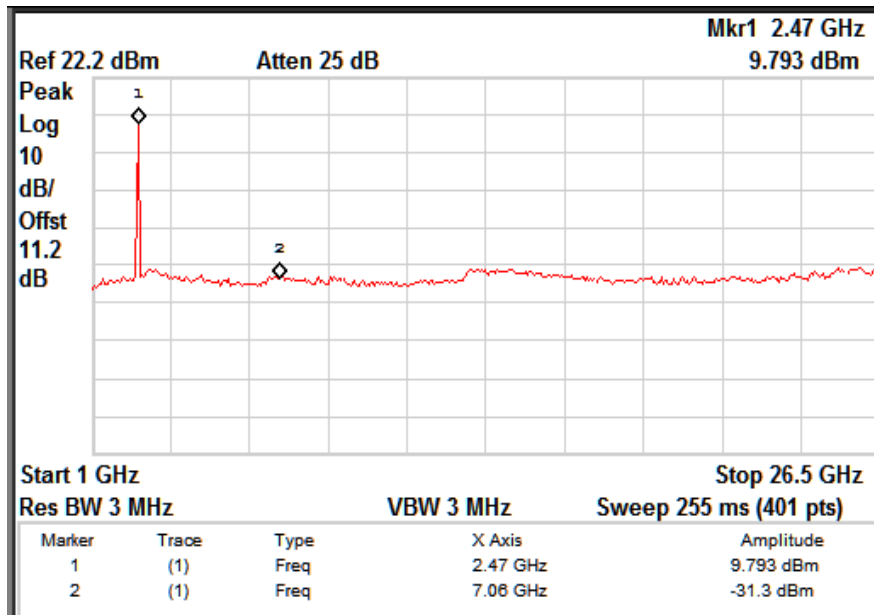
Data Rate: 6.5 Mbps

Channel frequency: 2462 MHz



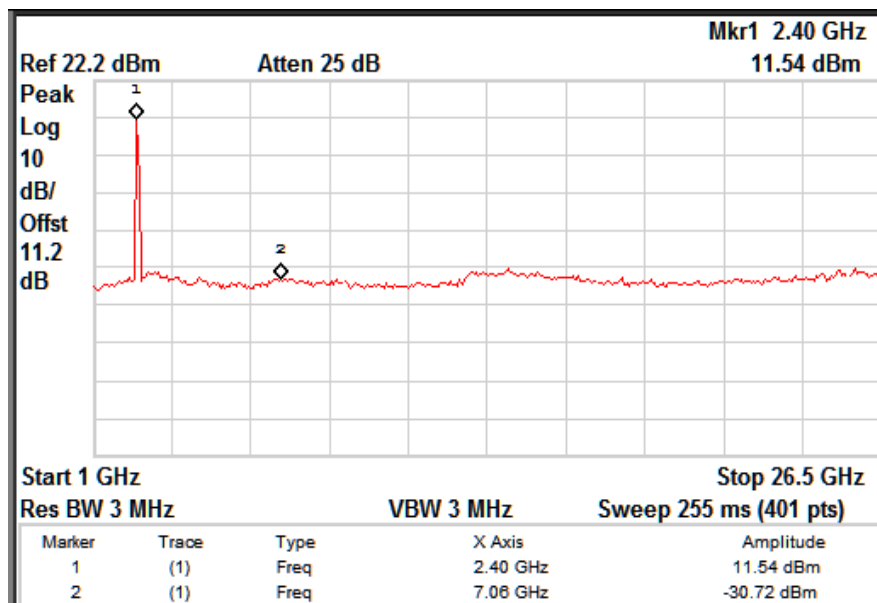
Data Rate: 39 Mbps

Channel frequency: 2412 MHz



Data Rate: 39 Mbps

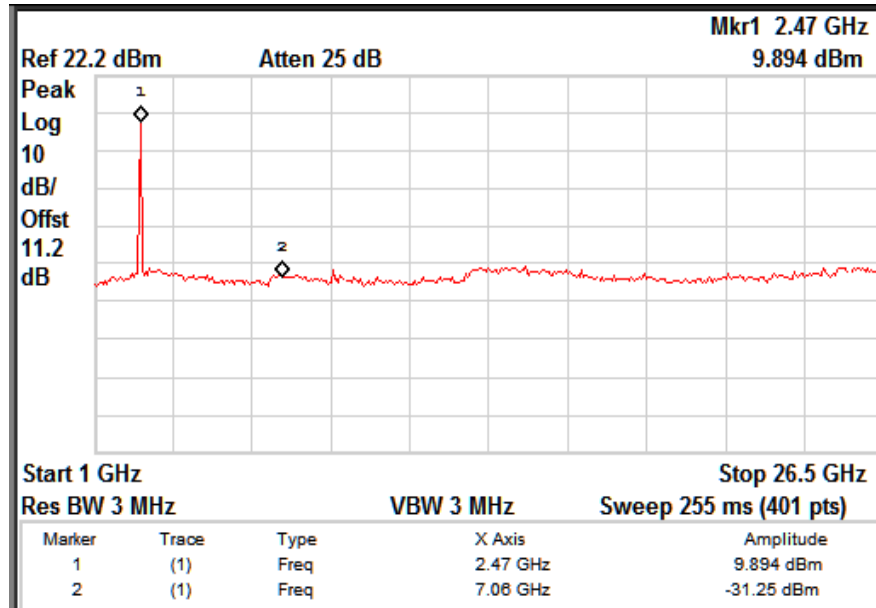
Channel frequency: 2462 MHz



Data Rate: 65 Mbps

Channel frequency: 2412 MHz

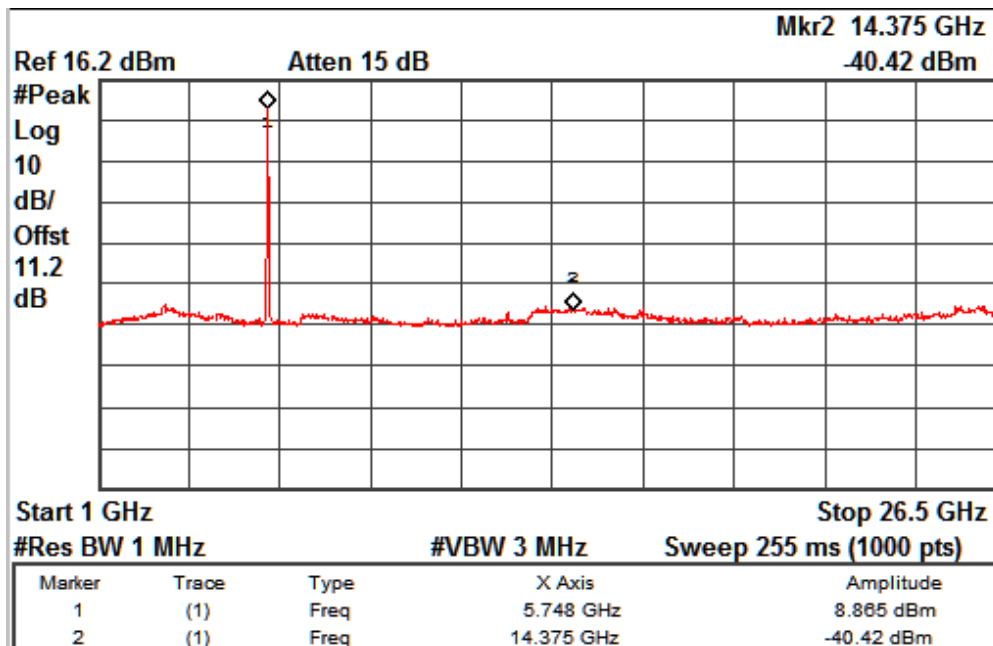
www.tuv.com



Data Rate: 65 Mbps

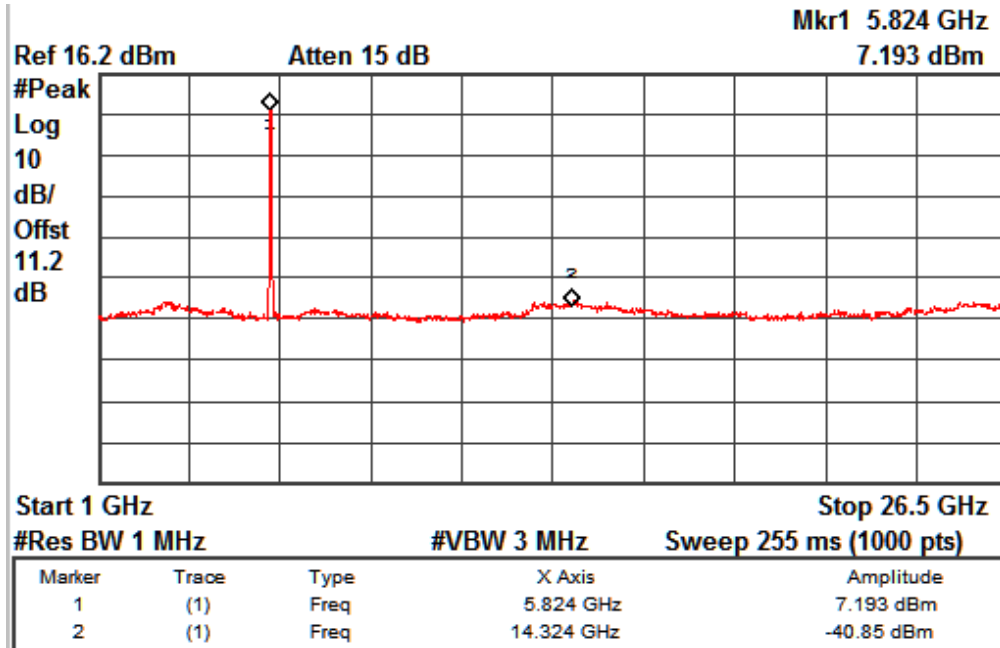
Channel frequency: 2462 MHz

5GHz Band



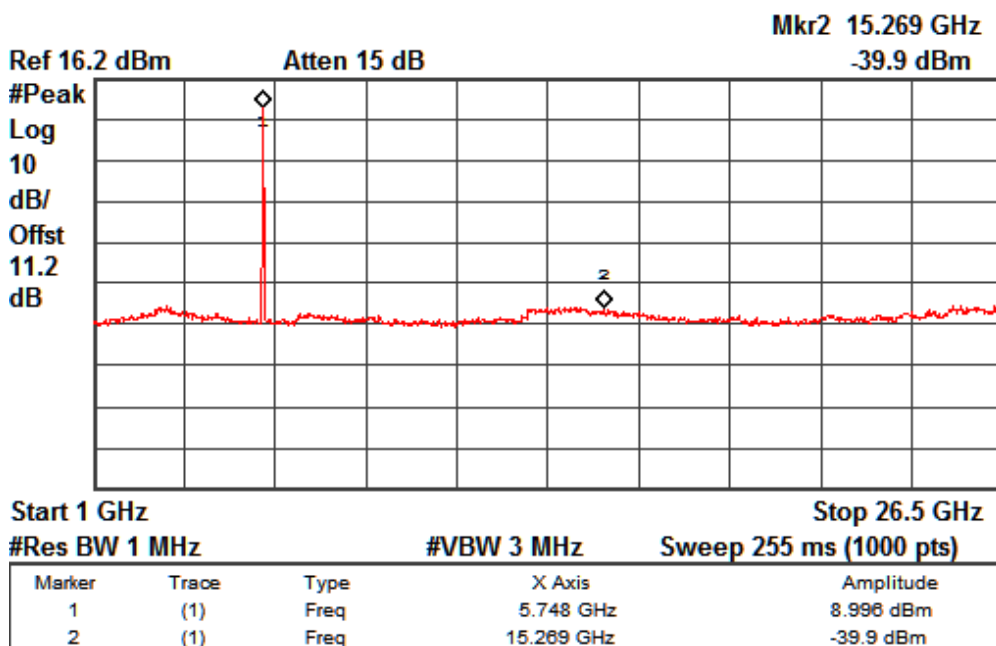
Data Rate: 6 Mbps

Channel Frequency: 5745 MHz



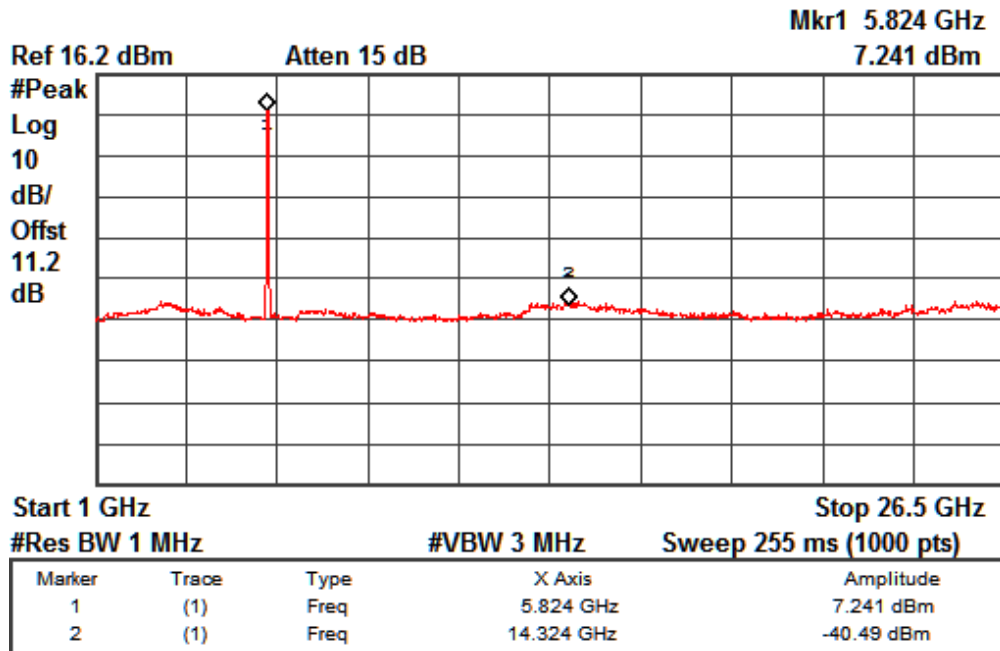
Data Rate: 6 Mbps

Channel Frequency: 5825 MHz



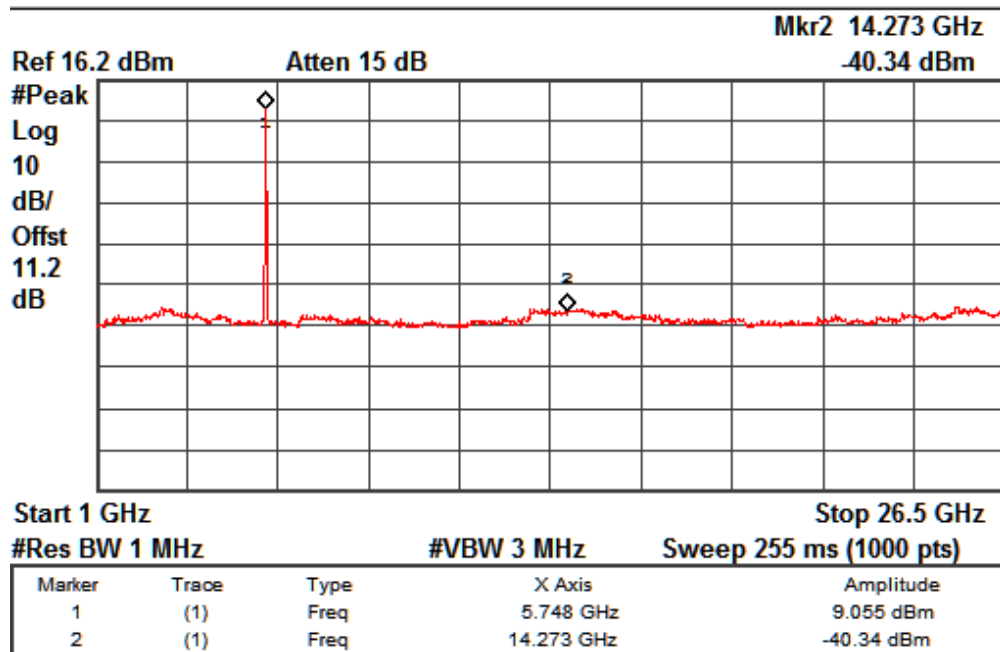
Data Rate: 24 Mbps

Channel Frequency: 5745 MHz



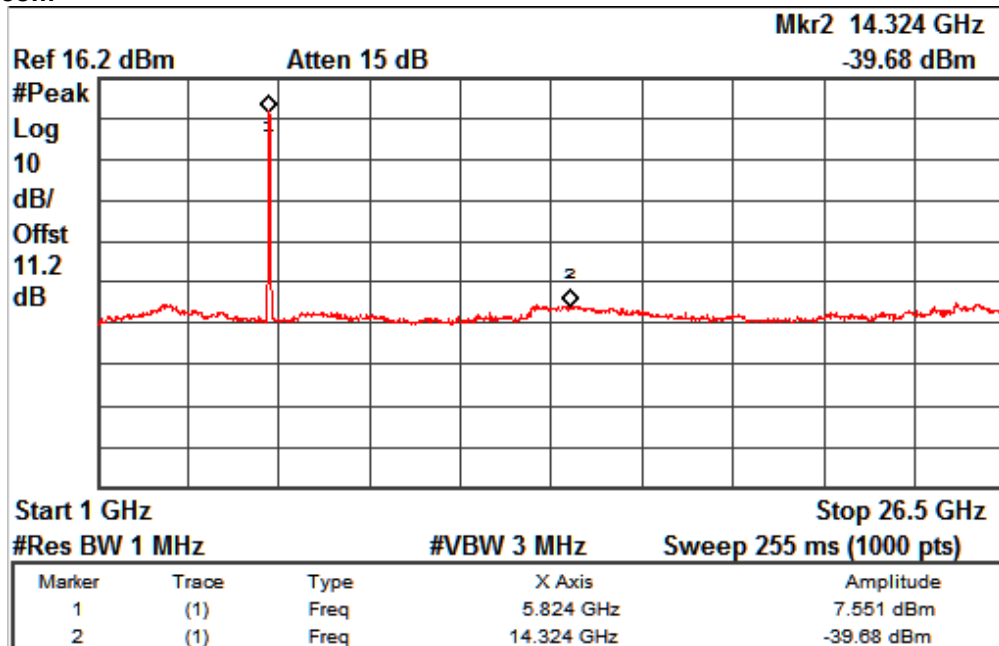
Data Rate: 24 Mbps

Channel Frequency: 5825 MHz



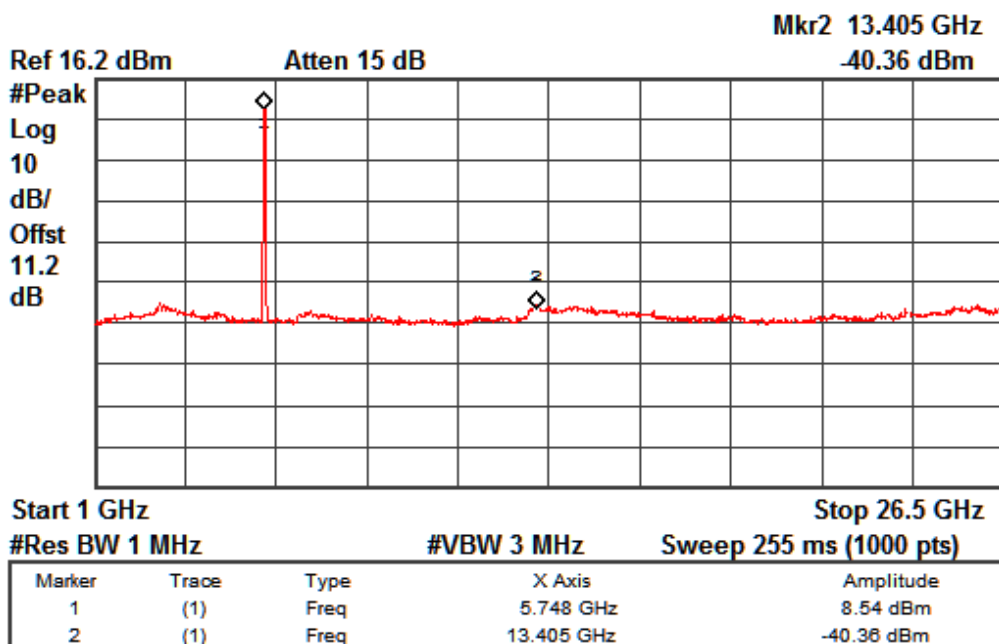
Data Rate: 54 Mbps

Channel Frequency: 5745 MHz



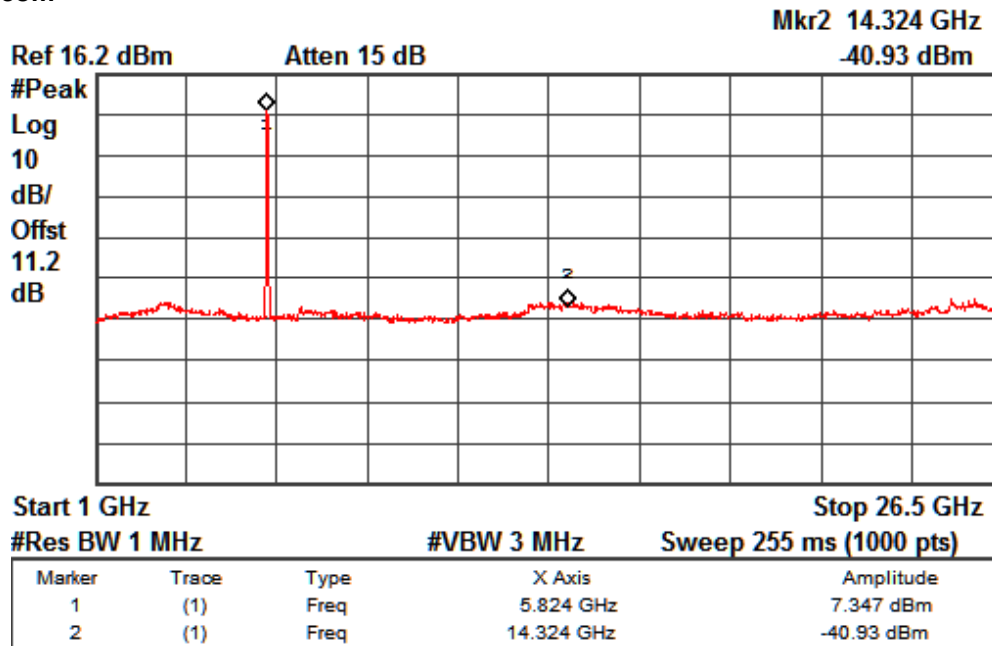
Data Rate: 54 Mbps

Channel Frequency: 5825 MHz



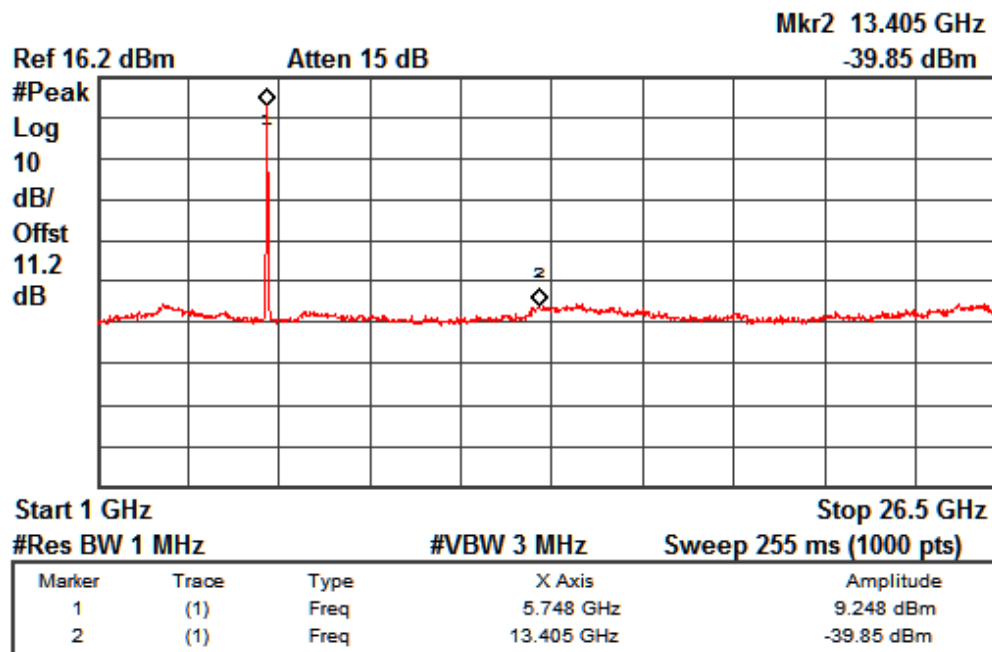
Data Rate: 6.5 Mbps

Channel Frequency: 5745 MHz



Data Rate: 6.5 Mbps

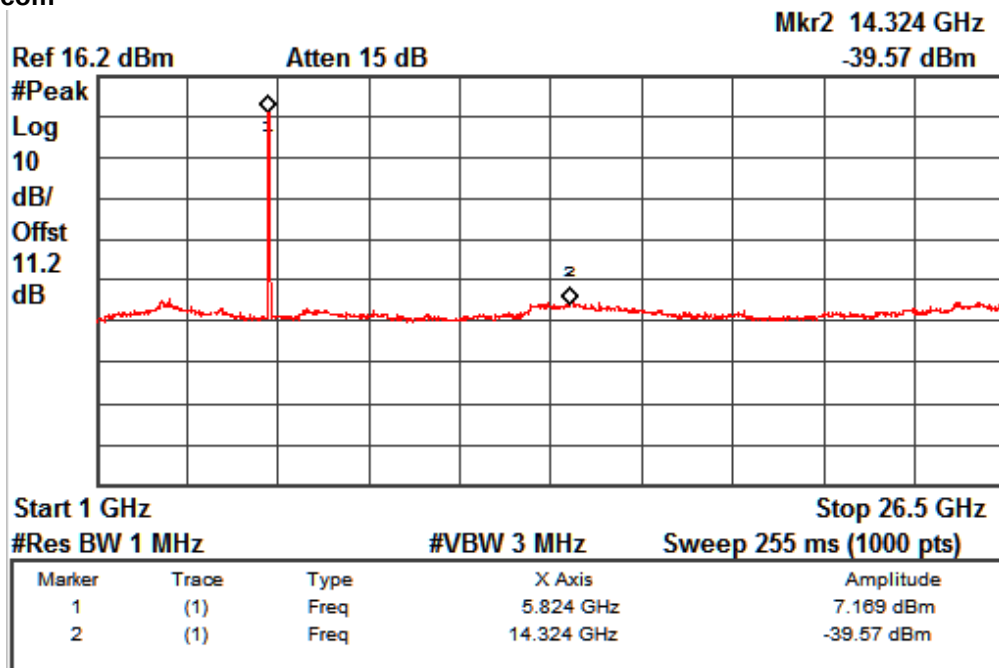
Channel Frequency: 5825 MHz



Data Rate: 39 Mbps

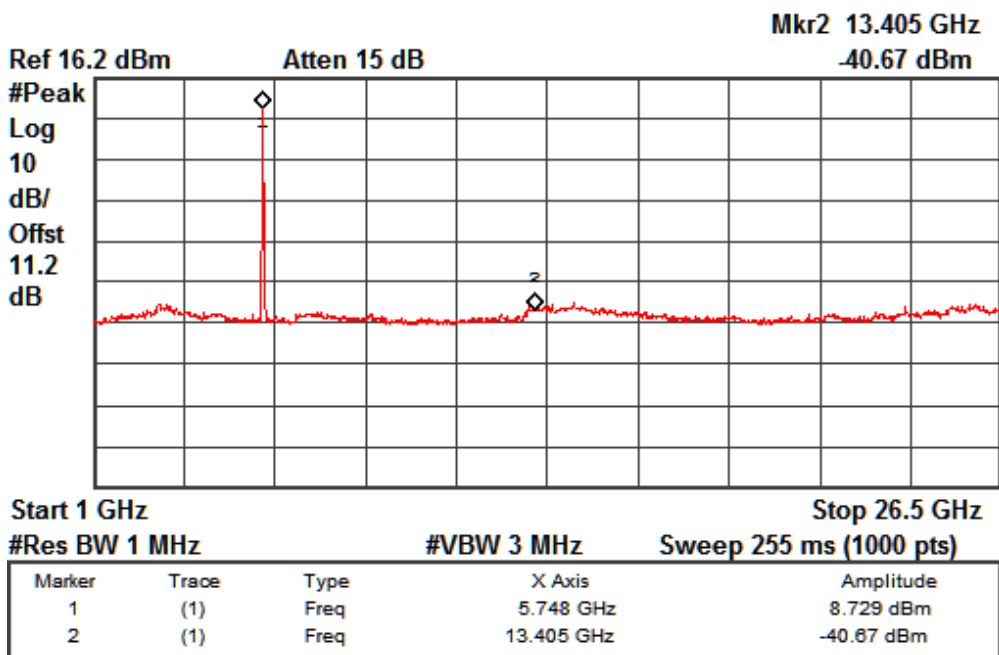
Channel Frequency: 5745 MHz

www.tuv.com



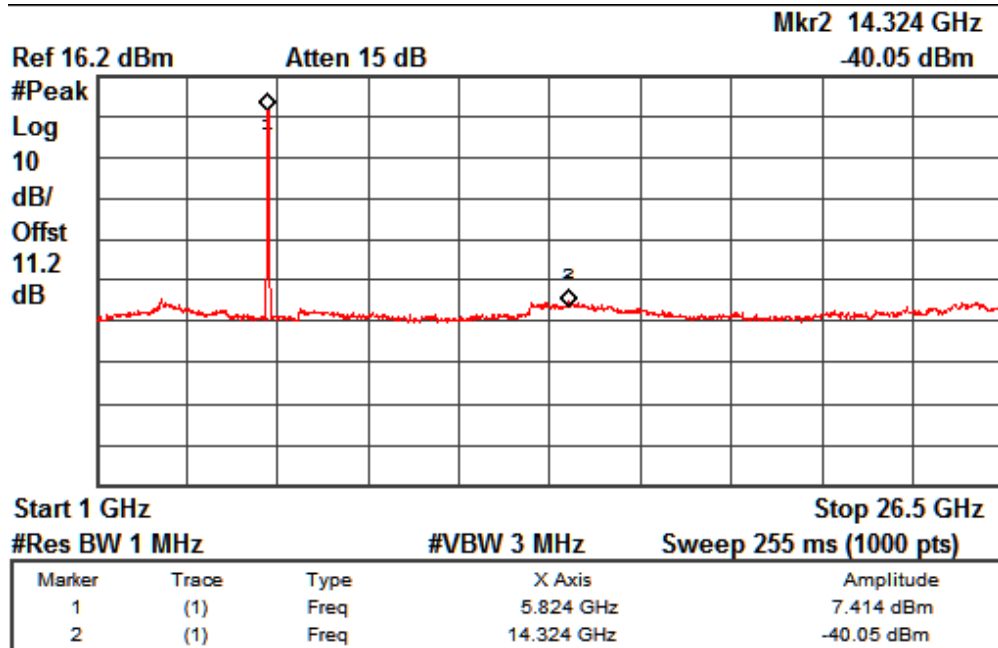
Data Rate: 39 Mbps

Channel Frequency: 5825 MHz



Data Rate: 65 Mbps

Channel Frequency: 5745 MHz

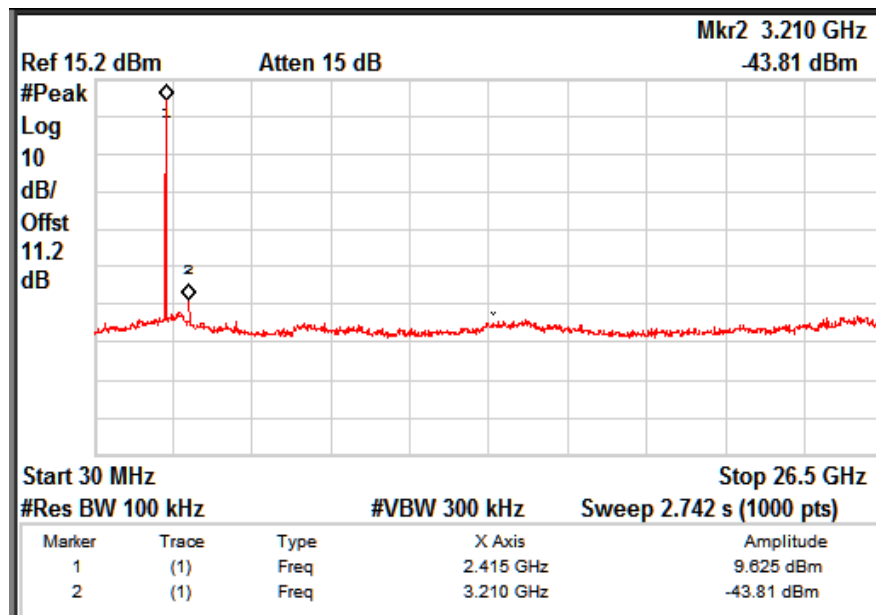


Data Rate: 65 Mbps

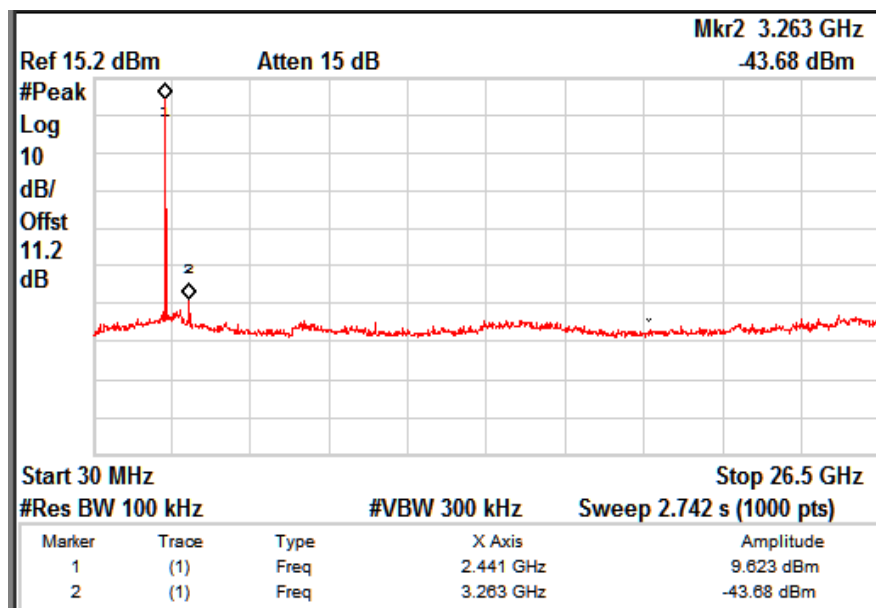
Channel Frequency: 5825 MHz

www.tuv.com

ZigBee

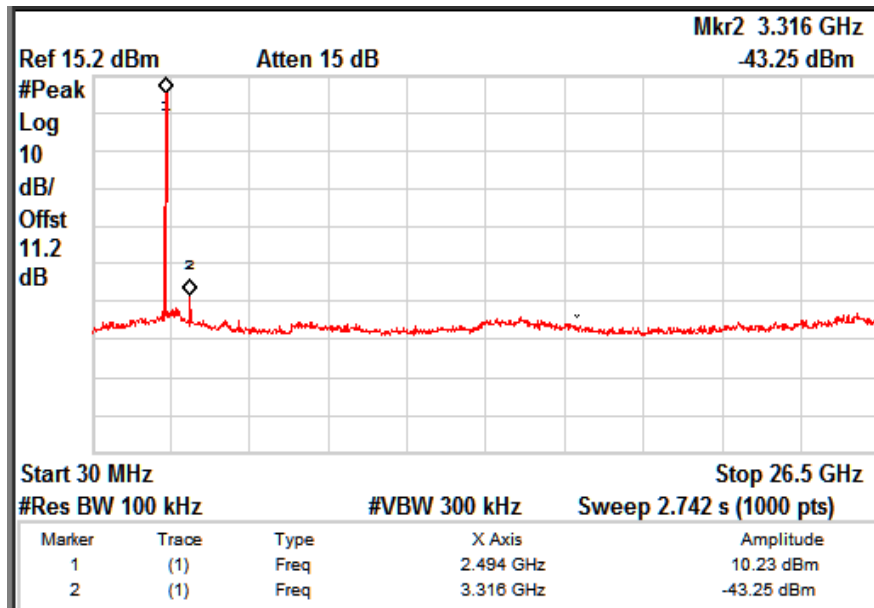


Channel Frequency 2405 MHz



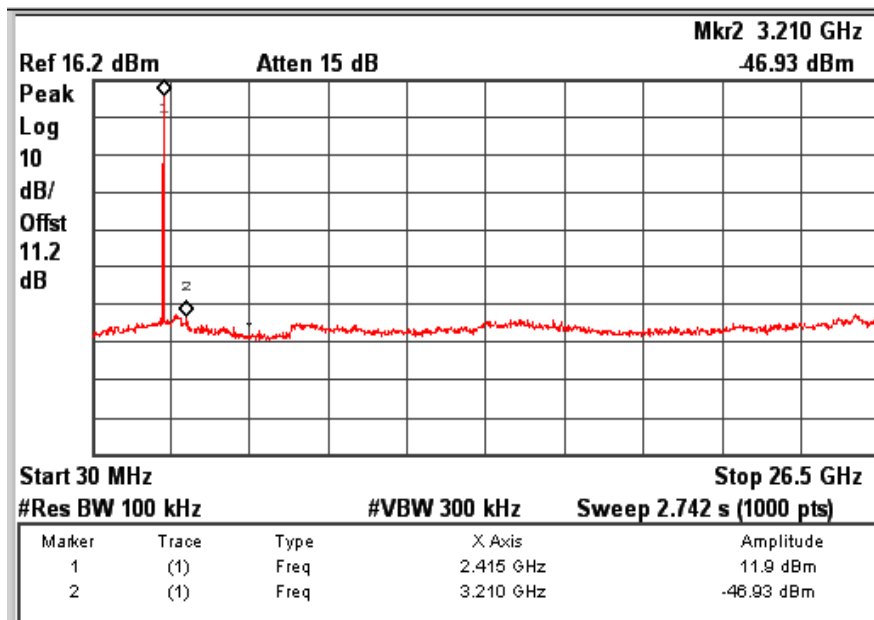
Channel Frequency 2440 MHz

www.tuv.com

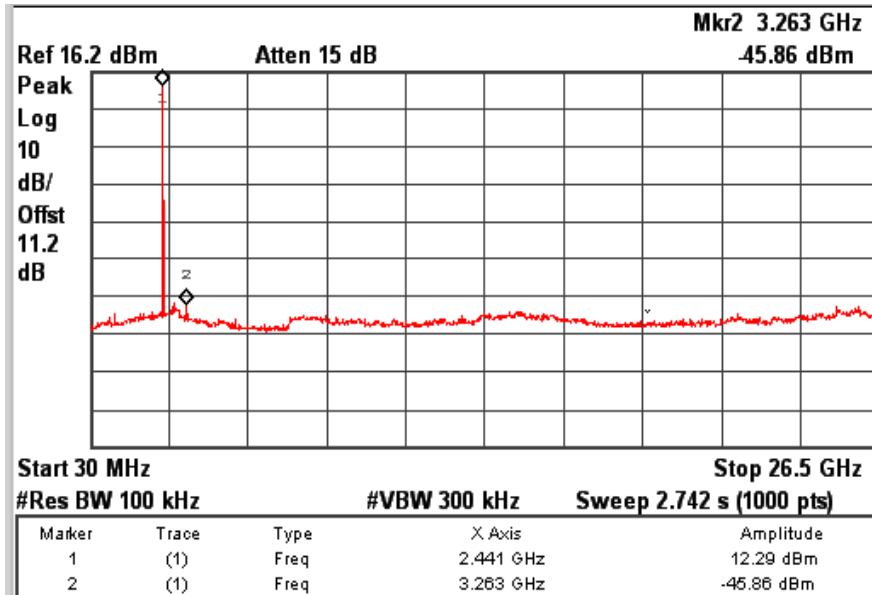


Channel Frequency 2480 MHz

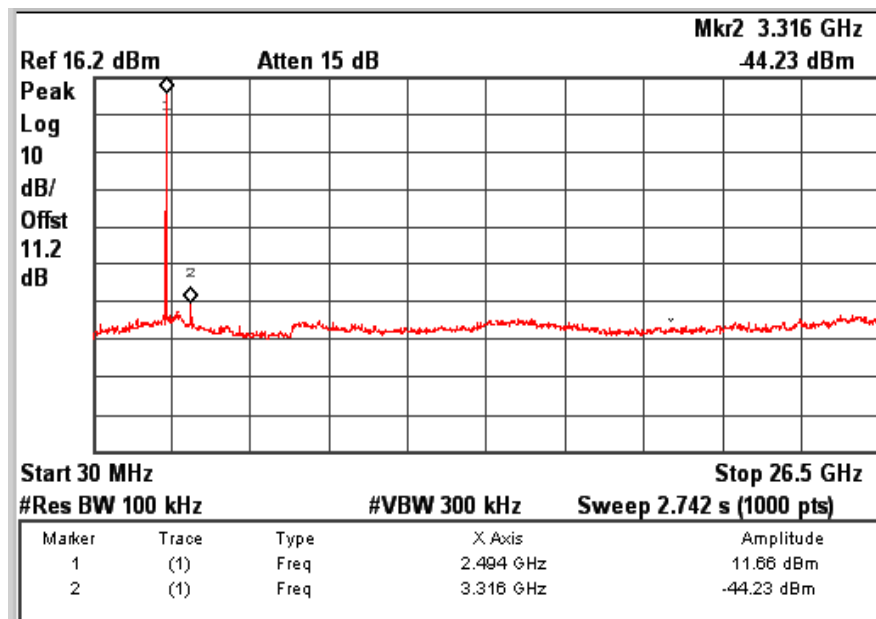
Bluetooth LE



Channel Frequency 2402 MHz



Channel Frequency 2442 MHz



Channel Frequency 2480 MHz

www.tuv.com

**Spurious Radiated Emissions and
Restricted Bands of Operation**

Section 15.209 and 15.205

Result

Pass

Test Specification	FCC Part 15 Section 15.209 & 15.205
Test Method	ANSI C63.4-2009
Measurement Location	Semi Anechoic Chamber
Measuring Distance	3m
Detection	QP for frequency below 1GHz, Average for frequency above 1GHz
Requirement	As per the limits mentioned in the below table

Limit for Radiated Emission of Section 15.209:

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300 meter, 30 meter and 30 meter range respectively, which corresponds to 88.50 – 53.80, 53.80 – 43.00 and 49.5dBμV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

www.tuv.com

Test results:

For frequency Range 9kHz - 1 GHz

No emissions found in this frequency range.

For frequency above 1GHz

Test results for worst case data rate are listed below.

WiFi:

B Mode: 1Mbps					
Channel	Polarization	Frequency (MHz)	Emission level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Low	V	2390 (Pk)	51.62	74.00	-22.38
		2390 (Av)	45.39	54.00	-8.61
		2412 (Pk)	97.38	-	*
		2412 (Av)	94.29	-	*
		4824 (Pk)	53.29	74.00	-20.71
		4824 (Av)	47.88	54.00	-6.12
		7236 (Pk)	56.54	74.00	-17.46
		7236 (Av)	43.92	54.00	-10.08
	H	2390 (Pk)	58.62	74.00	-15.38
		2390 (Av)	53.01	54.00	-0.99
		2412 (Pk)	105.15	-	*
		2412 (Av)	102.52	-	*
		4824 (Pk)	57.33	74.00	-16.67
		4824 (Av)	53.01	54.00	-0.99
		7236 (Pk)	57.91	74.00	-16.09
		7236 (Av)	47.05	54.00	-6.95
Mid	V	4874 (Pk)	53.36	74.00	-20.64
		4874 (Av)	47.96	54.00	-6.04
		7311 (Pk)	57.38	74.00	-16.62
		7311 (Av)	44.61	54.00	-9.39
	H	4874 (Pk)	55.69	74.00	-18.31
		4874 (Av)	52.18	54.00	-1.82
		7311 (Pk)	57.51	74.00	-16.49
		7311 (Av)	47.49	54.00	-6.51
High	V	2462 (Pk)	97.33	-	*
		2462 (Av)	94.45	-	*
		2483.5 (Pk)	50.06	74.00	-23.94
		2483.5 (Av)	44.59	54.00	-9.41
		4924 (Pk)	53.29	74.00	-20.71

www.tuv.com

		4924 (Av)	47.92	54.00	-6.08
		7386 (Pk)	57.29	74.00	-16.71
		7386 (Av)	44.81	54.00	-9.19
	H	2462 (Pk)	104.34	-	*
		2462 (Av)	101.75	-	*
		2483.5 (Pk)	57.98	74.00	-16.02
		2483.5 (Av)	53.47	54.00	-0.53
		4924 (Pk)	57.21	74.00	-16.79
		4924 (Av)	53.28	54.00	-0.72
		7386 (Pk)	56.98	74.00	-17.02
		7386 (Av)	47.22	54.00	-6.78

B Mode: 11Mbps					
Channel	Polarization	Frequency (MHz)	Emission level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Low	V	2390 (Pk)	54.37	74.00	-19.63
		2390 (Av)	43.23	54.00	-10.77
		2412 (Pk)	102.43	-	*
		2412 (Av)	94.36	-	*
		4824 (Pk)	51.47	74.00	-22.53
		4824 (Av)	38.64	54.00	-15.36
		7236 (Pk)	57.85	74.00	-16.15
		7236 (Av)	44.72	54.00	-9.28
	H	2390 (Pk)	63.15	74.00	-10.85
		2390 (Av)	51.77	54.00	-2.23
		2412 (Pk)	110.03	-	*
		2412 (Av)	102.55	-	*
		4824 (Pk)	56.73	74.00	-17.27
		4824 (Av)	43.55	54.00	-10.45
		7236 (Pk)	58.20	74.00	-15.80
		7236 (Av)	47.58	54.00	-6.42
Mid	V	4874 (Pk)	53.06	74.00	-20.94
		4874 (Av)	41.02	54.00	-12.98
		7311 (Pk)	54.57	74.00	-19.43
		7311 (Av)	42.59	54.00	-11.41
	H	4874 (Pk)	56.83	74.00	-17.17
		4874 (Av)	43.48	54.00	-10.52
		7311 (Pk)	56.80	74.00	-17.20
		7311 (Av)	41.91	54.00	-12.09
High	V	2462 (Pk)	102.29	-	*
		2462 (Av)	94.48	-	*
		2483.5 (Pk)	54.51	74.00	-19.49

www.tuv.com

		2483.5 (Av)	42.05	54.00	-11.95
		4924 (Pk)	54.37	74.00	-19.63
		4924 (Av)	40.76	54.00	-13.24
		7386 (Pk)	57.67	74.00	-16.33
		7386 (Av)	45.34	54.00	-8.66
	H	2462 (Pk)	109.64	-	*
		2462 (Av)	101.78	-	*
		2483.5 (Pk)	62.29	74.00	-11.71
		2483.5 (Av)	50.01	54.00	-3.99
		4924 (Pk)	59.56	74.00	-14.44
		4924 (Av)	46.55	54.00	-7.45
		7386 (Pk)	59.89	74.00	-14.11
		7386 (Av)	49.57	54.00	-4.43

G Mode: 6Mbps					
Channel	Polarization	Frequency (MHz)	Emission level (dBUV/m)	Limit (dBUV/m)	Margin (dB)
Low	V	2390 (Pk)	61.01	74.00	-12.99
		2390 (Av)	44.60	54.00	-9.40
		2412 (Pk)	96.44	-	*
		2412 (Av)	87.14	-	*
		4824 (Pk)	50.15	74.00	-23.85
		4824 (Av)	36.21	54.00	-17.79
		7236 (Pk)	55.21	74.00	-18.79
		7236 (Av)	42.98	54.00	-11.02
	H	2390 (Pk)	70.00	74.00	-4.00
		2390 (Av)	52.45	54.00	-1.55
		2412 (Pk)	104.08	-	*
		2412 (Av)	94.96	-	*
		4824 (Pk)	59.68	74.00	-14.32
		4824 (Av)	45.22	54.00	-8.78
		7236 (Pk)	60.21	74.00	-13.79
		7236 (Av)	46.89	54.00	-7.11
Mid	V	4874 (Pk)	55.45	74.00	-18.55
		4874 (Av)	41.43	54.00	-12.57
		7311 (Pk)	56.99	74.00	-17.01
		7311 (Av)	43.84	54.00	-10.16
	H	4874 (Pk)	55.41	74.00	-18.59
		4874 (Av)	42.24	54.00	-11.76
		7311 (Pk)	54.77	74.00	-19.23
		7311 (Av)	42.50	54.00	-11.50
High	V	2462 (Pk)	95.11	-	*

www.tuv.com

		2462 (Av)	85.95	-	*
		2483.5 (Pk)	63.36	74.00	-10.64
		2483.5 (Av)	45.20	54.00	-8.80
		4924 (Pk)	48.38	74.00	-25.62
		4924 (Av)	36.58	54.00	-17.42
		7386 (Pk)	56.88	74.00	-17.12
		7386 (Av)	42.69	54.00	-11.31
	H	2462 (Pk)	103.66	-	*
		2462 (Av)	93.96	-	*
		2483.5 (Pk)	71.27	74.00	-2.73
		2483.5 (Av)	53.25	54.00	-0.75
		4924 (Pk)	58.59	74.00	-15.41
		4924 (Av)	44.58	54.00	-9.42
		7386 (Pk)	59.89	74.00	-14.11
		7386 (Av)	46.58	54.00	-7.42

N Mode: MCS0					
Channel	Polarization	Frequency (MHz)	Emission level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Low	V	2390 (Pk)	61.91	74.00	-12.09
		2390 (Av)	43.79	54.00	-10.21
		2412 (Pk)	94.09	-	*
		2412 (Av)	85.11	-	*
		4824 (Pk)	50.10	74.00	-23.90
		4824 (Av)	37.89	54.00	-16.11
	H	2390 (Pk)	70.88	74.00	-3.12
		2390 (Av)	52.76	54.00	-1.24
		2412 (Pk)	101.78	-	*
		2412 (Av)	92.76	-	*
		4824 (Pk)	55.69	74.00	-18.31
		4824 (Av)	44.58	54.00	-9.42
Mid	V	4874 (Pk)	53.82	74.00	-20.18
		4874 (Av)	41.41	54.00	-12.59
	H	4874 (Pk)	55.28	74.00	-18.72
		4874 (Av)	42.62	54.00	-11.38
High	V	2462 (Pk)	93.48	-	*
		2462 (Av)	84.22	-	*
		2483.5 (Pk)	62.24	74.00	-11.76
		2483.5 (Av)	45.03	54.00	-8.97
		4924 (Pk)	50.29	74.00	-23.71
		4924 (Av)	37.89	54.00	-16.11
	H	2462 (Pk)	100.59	-	*

www.tuv.com

		2462 (Av)	91.29	-	*
		2483.5 (Pk)	70.20	74.00	-3.80
		2483.5 (Av)	52.14	54.00	-1.86
		4924 (Pk)	57.45	74.00	-16.55
		4924 (Av)	44.69	54.00	-9.31

5GHz Band

Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Polarization	Frequency (MHz)	Measured field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
802.11a	6	5745	V	5745 (Pk)	98.13	-	*
				5745 (Av)	87.98	-	*
				11490 (Pk)	No Harmonic Found		
				11490 (Av)			
			H	5745 (Pk)	108.27	-	*
				5745 (Av)	100.02	-	*
				11490 (Pk)	No Harmonic Found		
				11490 (Av)			
		5825	V	5825 (Pk)	97.45	-	*
				5825 (Av)	87.56	-	*
				11650 (Pk)	No Harmonic Found		
				11650 (Av)			
			H	5825 (Pk)	107.89	-	*
				5825 (Av)	99.67	-	*
				11650 (Pk)	No Harmonic Found		
				11650 (Av)			

www.tuv.com

Protocol	Data Rate (Mbps)	Channel Frequency (MHz)	Polarization	Frequency (MHz)	Measured field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
802.11n	6.5	5725	V	5745 (Pk)	98.43	-	*
				5745 (Av)	87.45	-	*
				5745 (Pk)	No Harmonic Found		
				5745 (Av)			
			H	11490 (Pk)	109.12	-	*
				11490 (Av)	100.24	-	*
				11650 (Pk)	No Harmonic Found		
				11650 (Av)			
		5825	V	5825 (Pk)	97.87	-	*
				5825 (Av)	88.11	-	*
				11650 (Pk)	No Harmonic Found		
				11650 (Av)			
			H	5745 (Pk)	108.78	-	*
				5745 (Av)	100.23	-	*
				11490 (Pk)	No Harmonic Found		
				11490 (Av)			

ZigBee:

Channel	Polarization	Frequency (MHz)	Emission level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Low	V	2390 (Pk)	50.03	74.00	-23.97
		2390 (Av)	32.33	54.00	-21.67
		2405 (Pk)	103.64	-	*
		2405 (Av)	98.84	-	*
		4810 (Pk)	54.22	74.00	-19.78
		4810 (Av)	46.60	54.00	-7.40
		7215 (Pk)	61.18	74.00	-12.82
		7215 (Av)	52.07	54.00	-1.93
	H	2390 (Pk)	49.96	74.00	-24.04
		2390 (Av)	39.91	54.00	-14.09
		2405 (Pk)	107.35	-	*
		2405 (Av)	103.67	-	*
		4810 (Pk)	55.67	74.00	-18.33
		4810 (Av)	48.45	54.00	-5.55
		7215 (Pk)	58.54	74.00	-15.46
		7215 (Av)	47.15	54.00	-6.85
Mid	V	4880 (Pk)	53.71	74.00	-20.29
		4880 (Av)	44.06	54.00	-9.94
		7320 (Pk)	61.61	74.00	-12.39
		7320 (Av)	49.27	54.00	-4.73

www.tuv.com

High	H	4880 (Pk)	54.61	74.00	-19.39
		4880 (Av)	45.85	54.00	-8.15
		7320 (Pk)	58.67	74.00	-15.33
		7320 (Av)	46.31	54.00	-7.69
	V	2480 (Pk)	103.22	-	*
		2480 (Av)	98.30	-	*
		2483.5 (Pk)	52.08	74.00	-21.92
		2483.5 (Av)	41.33	54.00	-12.67
		4960 (Pk)	52.23	74.00	-21.77
		4960 (Av)	40.74	54.00	-13.26
		7440 (Pk)	59.67	74.00	-14.33
		7440 (Av)	48.75	54.00	-5.25
	H	2480 (Pk)	107.47	-	*
		2480 (Av)	103.62	-	*
		2483.5 (Pk)	61.66	74.00	-12.34
		2483.5 (Av)	50.76	54.00	-3.24
		4960 (Pk)	55.10	74.00	-18.90
		4960 (Av)	46.11	54.00	-7.89
		7440 (Pk)	59.17	74.00	-14.83
		7440 (Av)	46.33	54.00	-7.67

Bluetooth LE:

Channel	Polarization	Frequency (MHz)	Emission level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Low	V	2390 (Pk)	44.98	74.00	-29.02
		2390 (Av)	31.38	54.00	-22.62
		2402 (Pk)	102.54	-	*
		2402 (Av)	93.42	-	*
		4804 (Pk)	52.12	74.00	-21.88
		4804 (Av)	40.01	54.00	-13.99
	H	2390 (Pk)	47.98	74.00	-26.02
		2390 (Av)	34.55	54.00	-19.45
		2402 (Pk)	106.78	-	*
		2402 (Av)	98.78	-	*
		4804 (Pk)	55.89	74.00	-18.11
		4804 (Av)	44.32	54.00	-9.68
Mid	V	4884 (Pk)	51.67	74.00	-22.33
		4884 (Av)	36.37	54.00	-17.63
	H	4884 (Pk)	56.15	74.00	-17.85
		4884 (Av)	37.43	54.00	-16.57

www.tuv.com

High	V	2480 (Pk)	102.01	-	*
		2480 (Av)	94.21	-	*
		2483.5 (Pk)	50.34	74.00	-23.66
		2483.5 (Av)	36.12	54.00	-17.88
		4960 (Pk)	52.33	74.00	-21.67
		4960 (Av)	38.53	54.00	-15.47
	H	2480 (Pk)	107.01	-	*
		2480 (Av)	101.2	-	*
		2483.5 (Pk)	52.54	74.00	-21.46
		2483.5 (Av)	36.23	54.00	-17.77
		4960 (Pk)	54.32	74.00	-19.68
		4960 (Av)	42.58	54.00	-11.42

www.tuv.com

Conducted Emission Test on A.C. Power Line

Section 15.207

Result

Pass

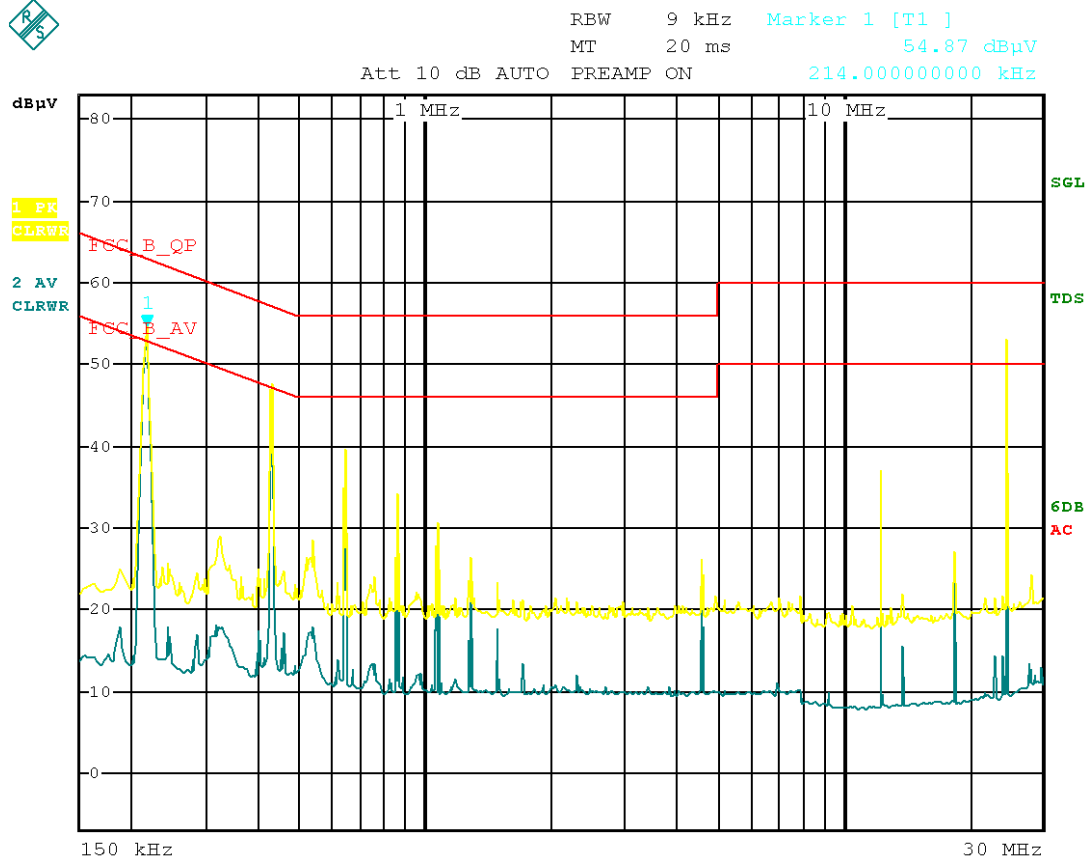
Test Specification : FCC Part 15 Section 15.207
Test Method : ANSI C63.4-2009
Testing Location : Screened room
Measurement Bandwidth : 9kHz
Frequency Range : 150kHz – 30MHz
Supply Voltage : 120VAC, 60Hz

Limit of section 15.207

Frequency of emission (MHz)	QP Limit (dB μ V)	AV Limit (dB μ V/m)
0.15 – 0.5	66 – 56*	56 – 46*
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency

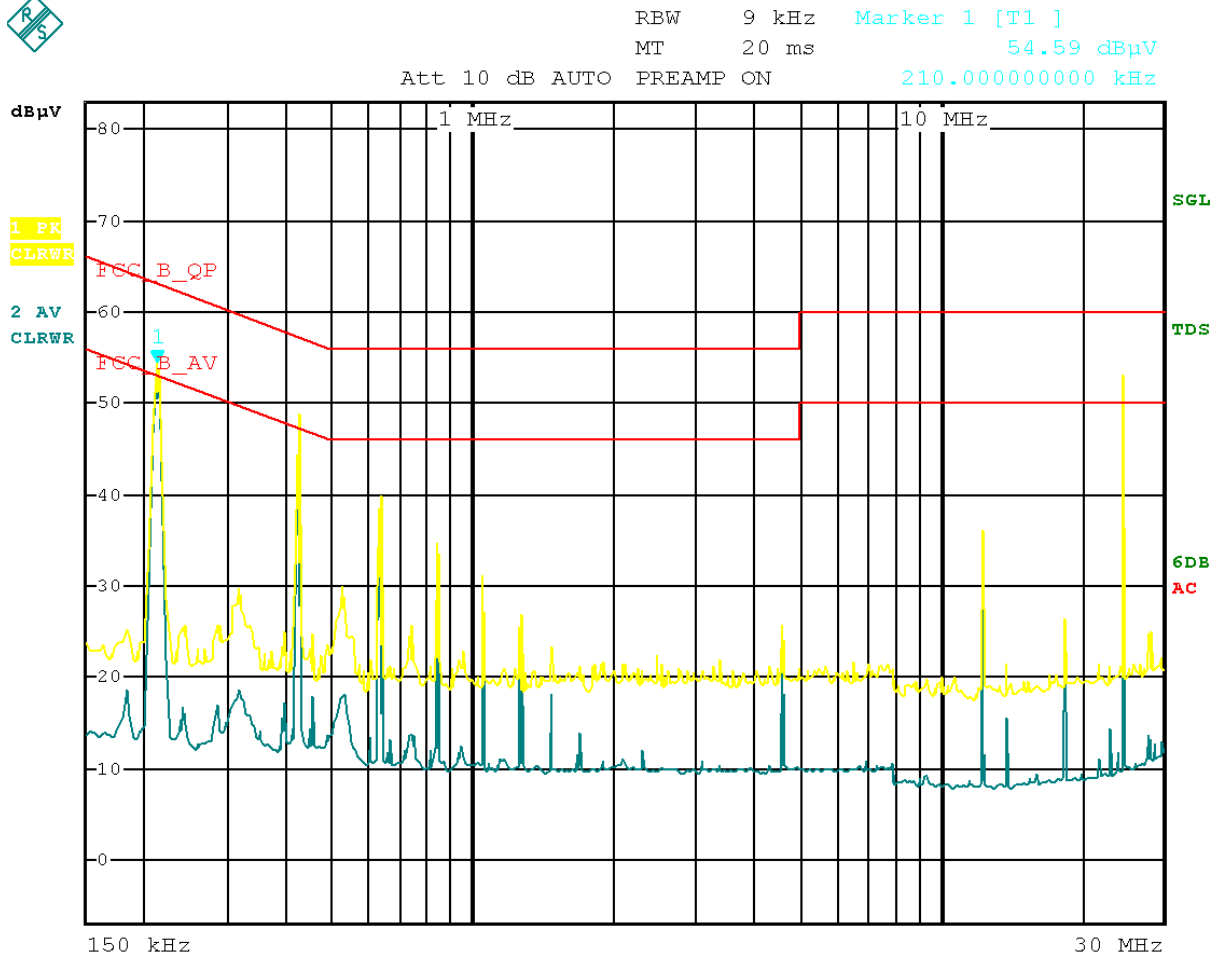
www.tuv.com
Test Result:



Line Graph

EDIT PEAK LIST (Final Measurement Results)				
Trace1:		FCC_B_QP		
Trace2:		FCC_B_AV		
Trace3:		---		
TRACE	FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
1 Quasi Peak	24.578 MHz	52.42	L1	-7.57
1 Quasi Peak	214 kHz	52.49	L1	-10.55
2 Average	12.29 MHz	36.01	L1	-13.98
2 Average	430 kHz	33.05	L1	-14.19
1 Quasi Peak	12.29 MHz	35.91	L1	-24.08
1 Quasi Peak	430 kHz	32.27	L1	-24.98
2 Average	642 kHz	20.54	L1	-25.45
2 Average	858 kHz	10.08	L1	-35.91
1 Quasi Peak	642 kHz	19.72	L1	-36.27
1 Quasi Peak	858 kHz	15.09	L1	-40.90

Line: Table



Neutral: Graph

www.tuv.com

EDIT PEAK LIST (Final Measurement Results)				
Trace1:		FCC_B_QP		
Trace2:		FCC_B_AV		
Trace3:		---		
TRACE	FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
2 Average	422 kHz	44.38	N	-3.02
1 Quasi Peak	24.578 MHz	52.45	N	-7.54
1 Quasi Peak	210 kHz	54.43	N	-8.76
1 Quasi Peak	422 kHz	43.99	N	-13.41
2 Average	12.29 MHz	34.97	N	-15.02
2 Average	634 kHz	25.64	N	-20.35
2 Average	842 kHz	22.81	N	-23.18
1 Quasi Peak	12.29 MHz	34.90	N	-25.09
1 Quasi Peak	634 kHz	24.70	N	-31.29
1 Quasi Peak	842 kHz	22.86	N	-33.13

Neutral: Table

www.tuv.com

Power level Settings used during testing:

		Channels		
Mode	Data Rate (Mbps)	Low	Mid	High
802.11 b	1	18	20	18
	11	19	20	19
802.11 g	6	13	20	12
	24	13	20	12
	54	13	20	12
802.11 n	MCS0	11	20	10
	MCS4	11	20	10
	MCS7	11	20	10
Bluetooth	1	15	15	15
	2	15	15	15
	3	15	15	15
	LE	15	15	15
Zigbee	250kbps	16	16	16