Test Report

47 CFR FCC Part 15 subpart C
Intentional Radiators

Report reference no...... :	28109934 001
FCC Designation Number ..... :	IT0008
FCC Test Firm Registration # ..... :	804595
Tested by (name + signature)…….:	Riccardo Pfeiffer \ Tester
Approved by (name + signature)……:	Giovanni Molteni \ TM
Date of issue..... :	October 07th 2016
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Applicant's name ..... :	RCF S.p.a.
Address..... :	Via Raffaello Sanzio, 13 – 42124 Mancasale (RE) - ITALY
Test item description..... :	Professional Mixer
Trade Mark..... :	RCF
Manufacturer..... :	RCF S.p.a..
Model/Type reference..... :	M18
Ratings..... :	100-240Vac,50W ~ 50/60Hz
Sample ..... :	Mixer M18 with WiFi Module
Samples received on ..... :	May 27th 2016
TUV reference samples..... :	160266 (EUT sampled by Applicant)
Samples tested n. ..... :	1
Testing ..... :	
Start Date: ..... :	July 20th 2016
End Date: ..... :	September 26th 2016

The results in this Test Report are exclusively referred to the tested samples. Without the written authorization of TÜV Rheinland Italia S.r.l., this document can be reproduced only integrally

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1. Reference Standards	
Standard	**Description**
FCC Part 15 (Subpart C)	§15.247 Operation within the bands 902-928 MHz, 2400-2483,5 MHz, and 5725-5850 MHz.
FCC Part 15 (Subpart C)	§15.207 Conducted Limits
FCC Part 15 (Subpart C)	§15.209 Radiated emission limits; general requirements
FCC Part 15 (Subpart C)	§15.203 Antenna Requirement
ANSI C63.4:2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2014	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
FCC GUIDE 15.247 (DTS): April 8,2016	Guidance for performing compliance measurements on digital transmission systems (dts) operating under §15.247

2. Summary of testing:

FCC Rule Part	Test Item	Result	Remarks
15.207	AC POWER CONDUCTED EMISSION	PASS	Meet the requirement of limit
15.205 15.209 15.247(d)	RADIATED EMISSIONS	PASS	Meet the requirement of limit
15.247(a)(2)	6dB BANDWIDTH	PASS	Meet the requirement of limit
15.247(b)(3)(4)	OUTPUT POWER_1 (external antenna)	PASS	EIRP calculated is based on an antenna gain of 5dBi
15.247(b)(3)	OUTPUT POWER_2 (internal antenna)	PASS	Meet the requirement of limit
15.247(d)	CONDUCTED ANTENNA PORT SPURIOUS EMISSIONS (external antenna)	PASS	Meet the requirement of limit
15.247(d)	RADIATED SPURIOUS EMISSIONS (external antenna)	PASS	Meet the requirement of limit
15.247(d)	RADIATED SPURIOUS EMISSIONS (internal antenna)	PASS	Meet the requirement of limit
15.247(e)	POWER SPECTRAL DENSITY	PASS	Meet the requirement of limit
15.203	ANTENNA REQUIREMENT	PASS	Professional equipment (RP SMA)
15.247(b)	RF EXPOSURE REQUIREMENTS	PASS	Meet the requirement of limit

Possible test case verdicts:	
- test case does not apply to the test object ....:	N/A
- test object does meet the requirement .....:	PASS
- test object does not meet the requirement ....:	FAIL

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

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"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a comma (point) is used as the decimal separator.

3. General product information

SMALL-FORMAT WIFI-CONTROLLED DIGITAL MIXER

Fader-free, all-in-one M 18 has an on-board WiFi access point with both external and internal antennas, enabling full wireless control from up to 5 tablets. It features a total of 18 analog inputs, 8 mic preamps, up to 19 simultaneous studio-grade effects and a full suite of plug-in algorithms and professional internal effects, including a high-quality stereo reverb and classic emulations of guitar and bass amplifiers.

The input EQs (Standard, Vintage and Smooth) enable a wide range of sounds and a flexible sound-sculpting environment. A master processor on the main outputs allows a final fine-tuning of the overall sound.

A USB port for the internal two-track player and recorder, MIDI ports and footswitch input provide maximum flexibility.

WIRELESS SPECIFICATIONS

Internal Access Point:yes

Dual Band:yes

IEEE802.11 b/g standard:2.4 GHz

Antennas:2 int. + 1 ext.GHz

4. General Chipset information

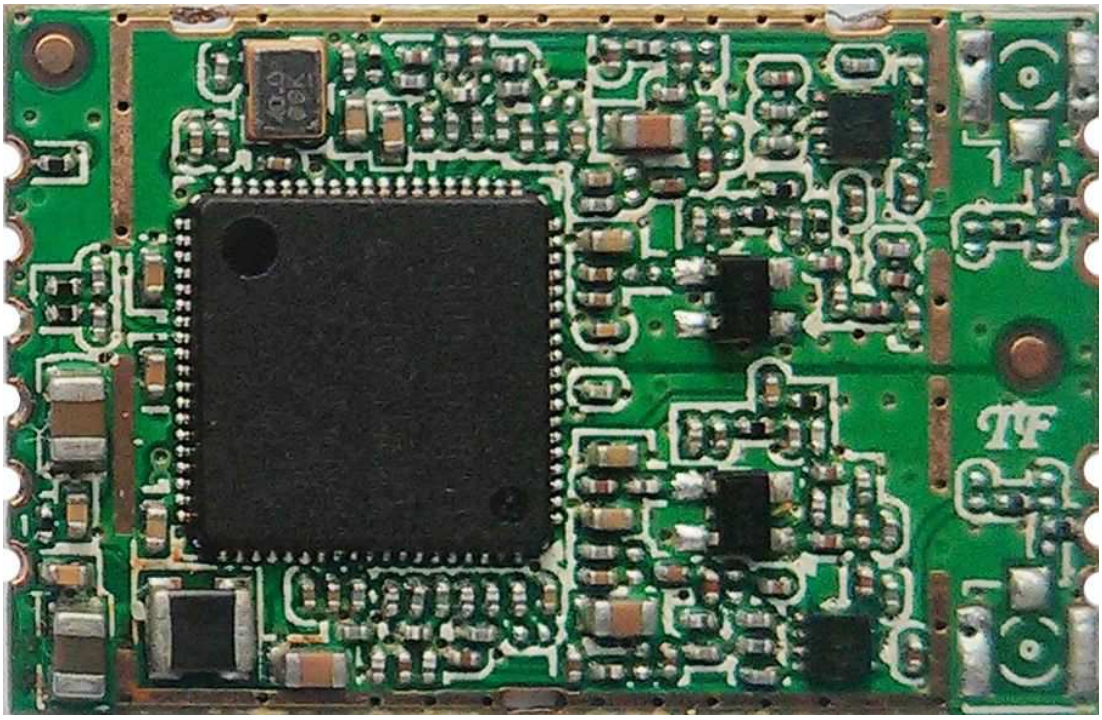
BL-R8192RD1 product is designed base on Realtek RTL8192DU chipset .It combines CMOS MAC,

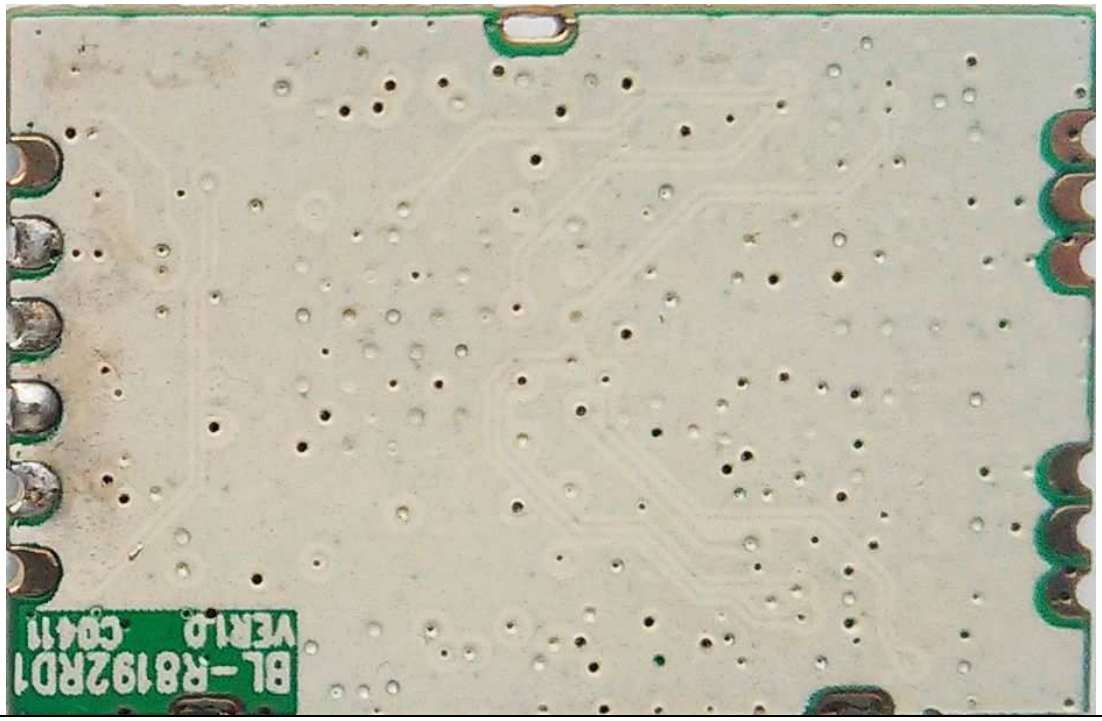
Baseband PHY and RF in a single chip for IEEE 802.11a/b/g/n compatible. It supports IEEE802.11i safety protocol, along with IEEE 802.11e standard service quality. It supports the new data encryption on 64/128 bit WEP and safety mechanism on WPA-PSK/WPA2-PSK, WPA/WPA2. It can implement the wireless network function on the laptop/desktop/MID and other wireless devices easily . This module has implemented some efficient mechanisms in its software and hardware to maximize the performance

Item	Description
Product Name	BL-R8192RD1
Major Chipset	RTL8192DU-VS
Host Interface	USB2.0
Standard	IEEE 802.11a, IEEE 802.11b, IEEE 802.11g,IEEE 802.11n,
Frequency Range	2.4GHz~2.4835GHz 5.15GHz~5.845GHz
Modulation Type	802.11b: CCK, DQPSK, DBPSK 802.11a/g: 64-QAM,16-QAM, QPSK, BPSK 802.11n: 64-QAM,16-QAM, QPSK, BPSK
Working Mode	Infrastructure, Ad-Hoc
Data Transfer Rate	1,2,5.5,6,11,12,18,22,24,30,36,48,54,60,90,120 and maximum of 300Mbps
Spread Spectrum	IEEE 802.11a: ISM(Industrial Scientific Medical) IEEE 802.11b: DSSS (Direct Sequence Spread Spectrum) IEEE 802.11g/n:OFDM (Orthogonal Frequency Division Multiplexing)
Sensitivity @PER	1M: -90dBm@8%PER 6M: -88dBm@10%PER 11M:-85dBm@8%PER 54/135M:-73dBm@10%PER
RF Power	< 18dBm@11b,< 14dBm@11g ,< 13dBm@11n,< 12dBm@11a
Antenna type	Connect to the external antenna through the half hole
The transmit distance	Indoor 100M, Outdoor 300M, according the local environment
Dimension(L*W*H)	27.0 x 17.7 x 1.9mm (LxWxH) ;Tolerance: +-0.2mm
Power supply	3.3V +/-0.2V
Power Consumption	standby mode 203mA@3.3V , TX mode 381mA@3.3V
Clock source	40MHz
Working Temperature	-20ºC to +70ºC
Storage temperature	-55°C ~ +125°C

Channel	Low Frequency	Center Frequency	High Frequency
1	2.401GHz	2.412GHz	2.423GHz
2	2.406GHz	2.417GHz	2.428GHz
3	2.411GHz	2.422GHz	2.433GHz
4	2.416GHz	2.427GHz	2.438GHz
5	2.421GHz	2.432GHz	2.443GHz
6	2.426GHz	2.437GHz	2.448GHz
7	2.431GHz	2.442GHz	2.453GHz
8	2.436GHz	2.447GHz	2.458GHz
9	2.441GHz	2.452GHz	2.463GHz
10	2.446GHz	2.457GHz	2.468GHz
11	2.451GHz	2.462GHz	2.473GHz

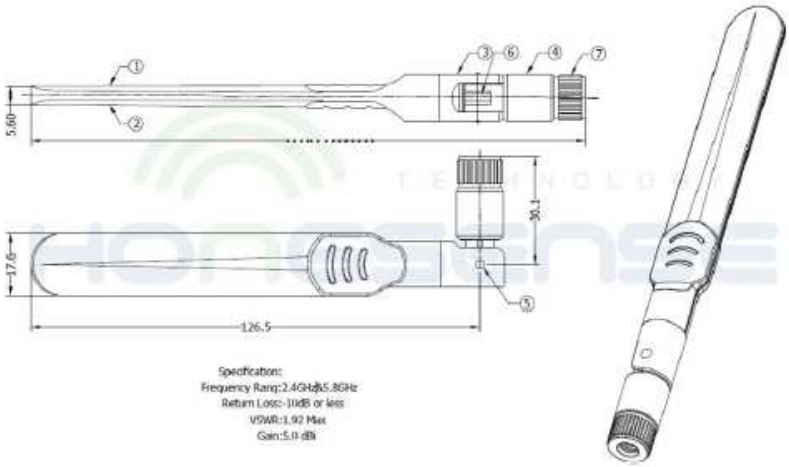
As declared by manufacturer standard IEEE 802.11a not used: locked by SW

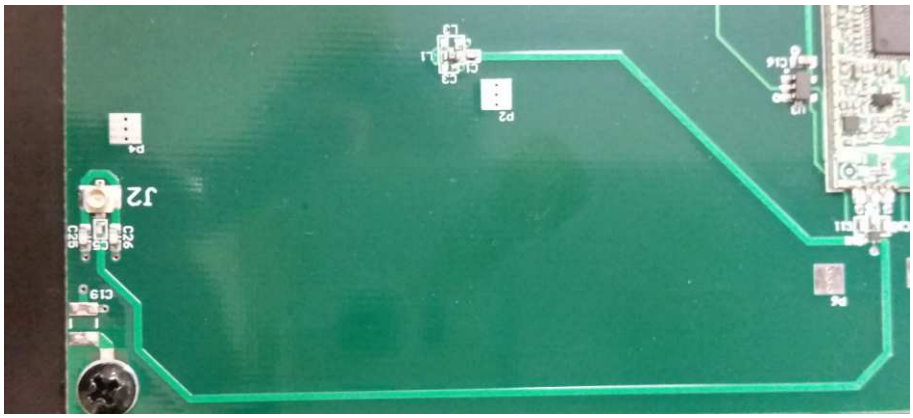



BL-R8192RD1
VER1.0 C041

5. General Antennas information

1_EXTERNAL ANTENNA

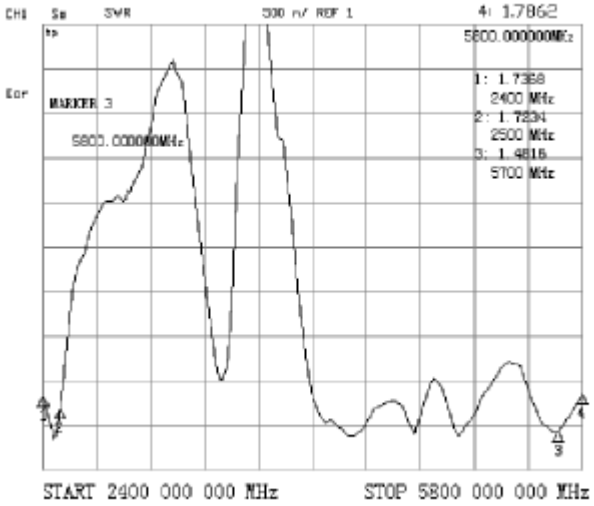




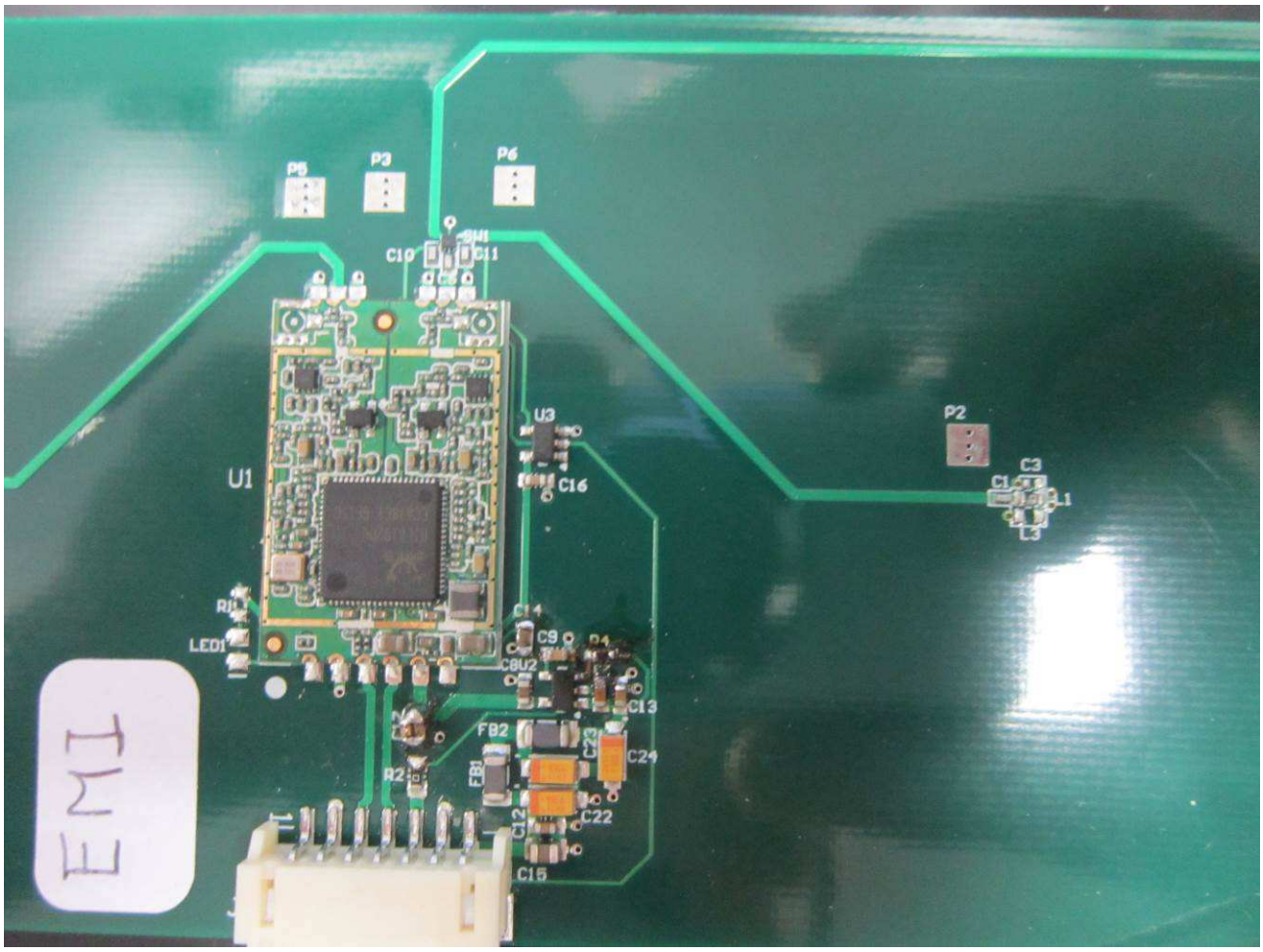
SPECIFICATIONS

Item		Specifications
Antenna	Frequency Range	2400-2483/5700-5800MHz
	Polarization	Linear
	Gain	5dBi（Zenith）
	V.S.W.R（min）	＜2.5
	Impendance	50Ω
	Size(mm)	17.6*156.6mm
	Connector	RP-SMA
	Weight(g)	30
Environmenta l	Operating Temperature	-40℃~+85℃
	Vibration	10 to 55Hz with 1.5mm amplitude 2hours
	Environmentally Friendly	ROHS Compliant

STATIONARY WAVE PATTERN (V.S.W.R.)



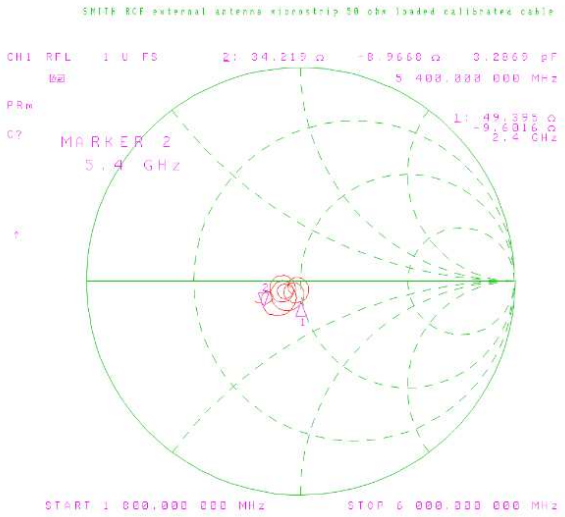
2_INTERNAL ANTENNA

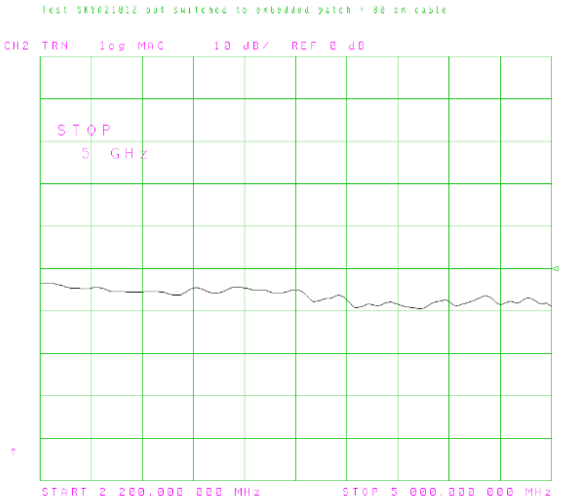


SPECIFICATIONS

Frequency Range	2400-2483/5700-5800MHz
Polarization	Linear
Gain (2400-2483)	-2dBi
Connector	Integral

POLAR DIAGRAM / ATTENUATION





6. Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	Mixer with WiFi Module	RCF S.p.A.	M18	---
AE	Tablet	Apple	Ipad Air	Used to set the WiFi Module
AE	PC	Lenovo	T430	Used to set the WiFi Module

Note:

* Use :

EUT - Equipment Under Test,
AE - Auxiliary/Associated Equipment, or
SIM - Simulator (Not Subjected to Test)

No other Auxiliary/Associated Equipment was connected/installed on the EUT

7. Input/Output Ports:

CONNECTIONS

Port		Description	Connection	Cable lenght
1	Enclosure	Plastic	---	---
2	AC Power Port	AC	115Vac ~ 60 Hz	<3m
3	DC Power Port	DC	Not Present	---
4	LAN	TP	Used to maintenance	>3m
5	USB	I/O	Used to maintenance	>3m

*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
TP = Telecommunication Ports

8. Power Interface						
Mode #	**Voltage (V)**	**Current (A)**	**Power (W)**	**Frequency (DC/AC-Hz)**	**Phases (#)**	**Comments**
Rated	115	0,5	50	60Hz	1	---

9. EUT Operation Modes	
Operation mode	**Description**
#1	EUT turn on with Wi-Fi Module in transmission mode on External Antenna
#2	EUT turn on with Wi-Fi Module in transmission mode on Internal Antenna
#3	EUT turn on with Wi-Fi Module in transmission mode (MIMO 2X2 Antennas)

10. EUT Configuration Modes:	
Mode #	**Description**
---	---

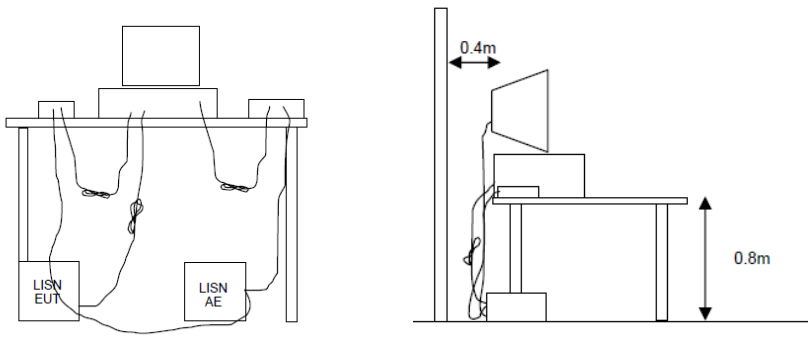
11. Test Conditions and Results – AC POWER CONDUCTED EMISSION

12	TEST: AC Power Conducted Emission		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	21°C	
	Relative Humidity (%)	56%	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	115V ~ 60Hz	AC Mains	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.207		
Frequency (MHz)	Quasi-peak (dBuV)	Average (dBuV)	Result
0.15-0.5	66 to 56	56 to 46	PASS
0.5-5	56	46	PASS
5-30	60	50	PASS

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

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

Further information to test setup

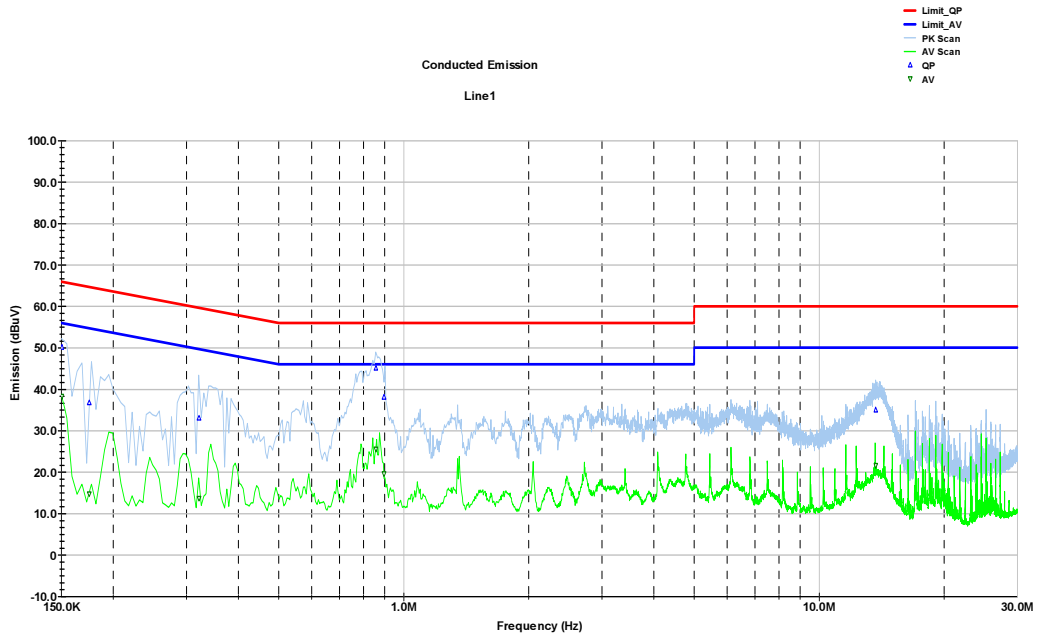


Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	04/2016	04/2017
LISN	PMM	PMM L3-64	87020466	09/2015	09/2016
20dB Attenuator	RS Components	Huber & Suhner	87020534	10/2015	10/2016
Stabilized Power Supply	Elettrotest	TPS T 30K60S	87020490	09/2015	09/2018

Graphical representation of Mains Terminal Disturbance Voltage Measurement

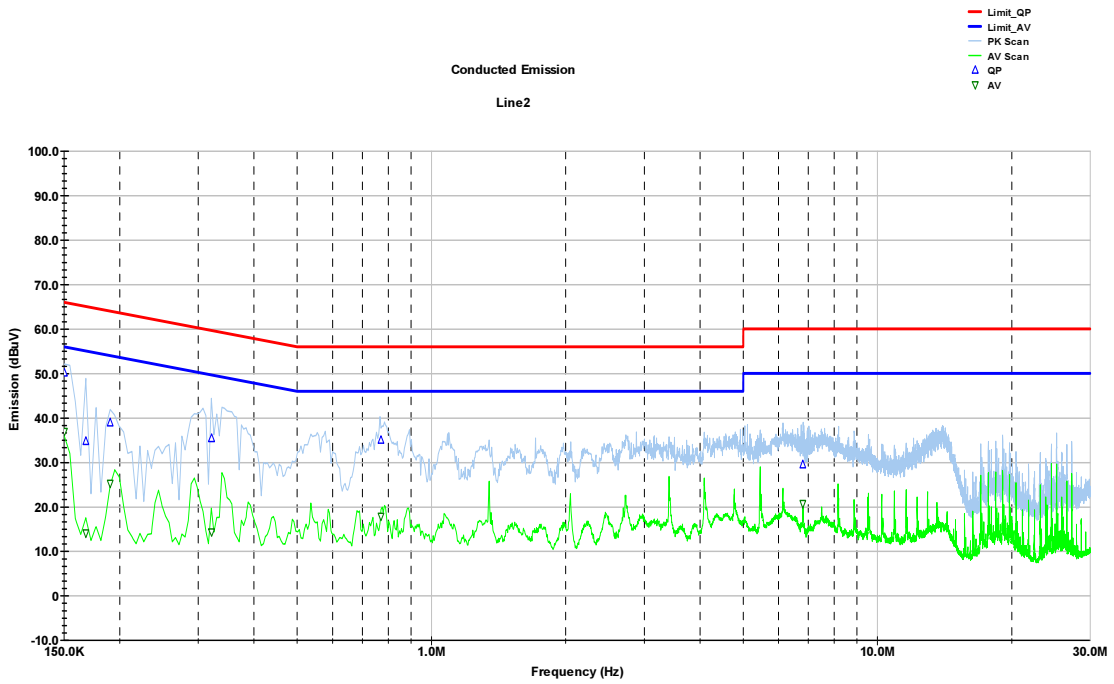
Operation Mode: #1

Line 1



Frequency (MHz)	QP (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AV (dBuV)	AV Limit (dBuV)	AV Margin (dB)	factor_total_L1 ()
150.750 KHz	50.09	65.96	-15.87	38.17	55.96	-17.79	9.680
175.234 KHz	36.71	64.71	-28.00	14.86	54.71	-39.84	9.695
320.992 KHz	32.96	59.68	-26.72	13.74	49.68	-35.94	9.811
856.479 KHz	45.10	56.00	-10.90	25.46	46.00	-20.54	10.000
897.008 KHz	38.09	56.00	-17.91	19.53	46.00	-26.47	10.000
13.711 MHz	34.93	60.00	-25.07	21.66	50.00	-28.34	10.237

Graphical representation of Mains Terminal Disturbance Voltage Measurement
Operation Mode: #1
Line 2



Frequency (MHz)	QP (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AV (dBuV)	AV LImit (dBuV)	AV Margin (dB)
150.750 KHz	50.16	65.96	-15.80	37.02	55.96	-18.94
167.996 KHz	34.85	65.06	-30.21	14.11	55.06	-40.95
190.496 KHz	38.87	64.01	-25.14	25.40	54.01	-28.62
320.992 KHz	35.43	59.68	-24.25	14.43	49.68	-35.25
771.004 KHz	34.92	56.00	-21.08	17.85	46.00	-28.15
6.818 MHz	29.49	60.00	-30.51	20.70	50.00	-29.30

12. Test Conditions and Results – RADIATED EMISSION

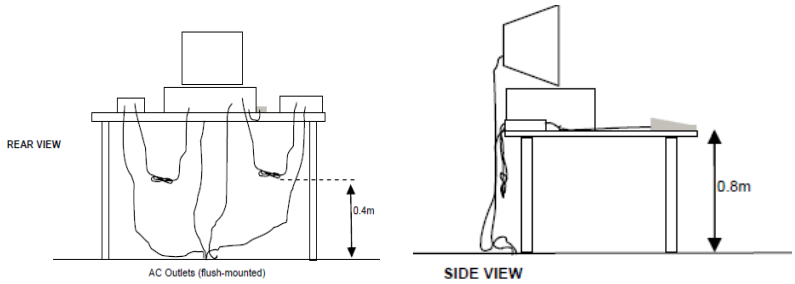
13	TEST: Radiated Emission		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22°C	
	Relative Humidity (%)	54%	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	115V ~ 60Hz	Enclosure	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.205; §15.209; §15.247		
Frequency (MHz)	Quasi-peak (dBuV)	Average (dBuV)	Result
0.15-0.5	66 to 56	56 to 46	PASS
0.5-5	56	46	PASS
5-30	60	50	PASS

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

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

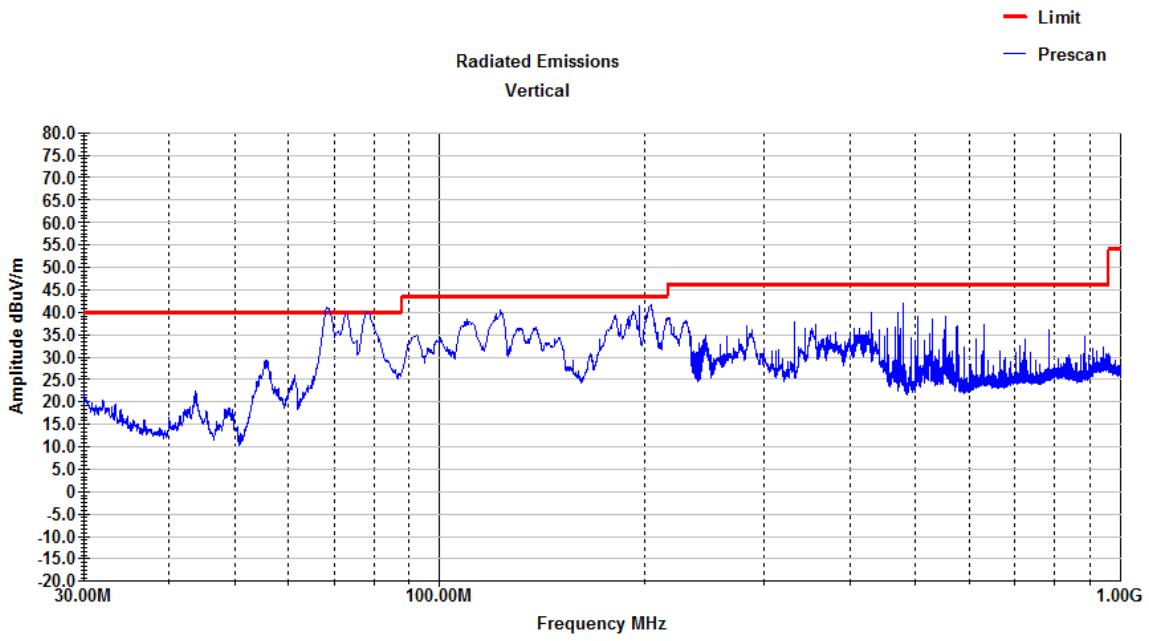
**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this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

Further information to test setup

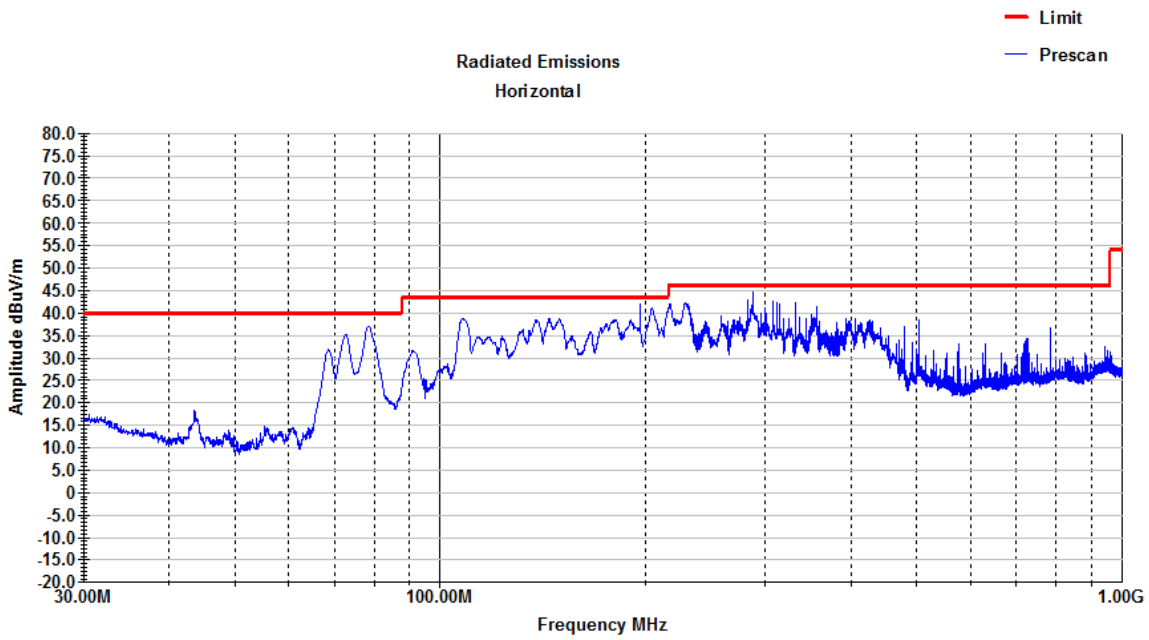


Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
CSSA	ETS Lindgren	FACT3	87020484	10/2015	10/2016
EMI Test Receiver	R&S	ESU40	87020455	04/2016	04/2017
Antenna BiConiLog	ETS Lindgren	3124E-PA	87020457	04/2014	04/2017
Antenna Horn with Preamplifier	ETS Lindgren	3117-PA	87020458	04/2014	04/2017
2xAntenna Horn with Preamplifier	ETS Lindgren	114514 120722	87020459 87020460	04/2014	04/2017

Graphical representation of Radiated Emission Measurement
Operation Mode: #1
Frequency: 30MHz – 1GHz
Antenna Polarization: Vertical
Channel: Low / Standard: IEE 802.11g (worst case)



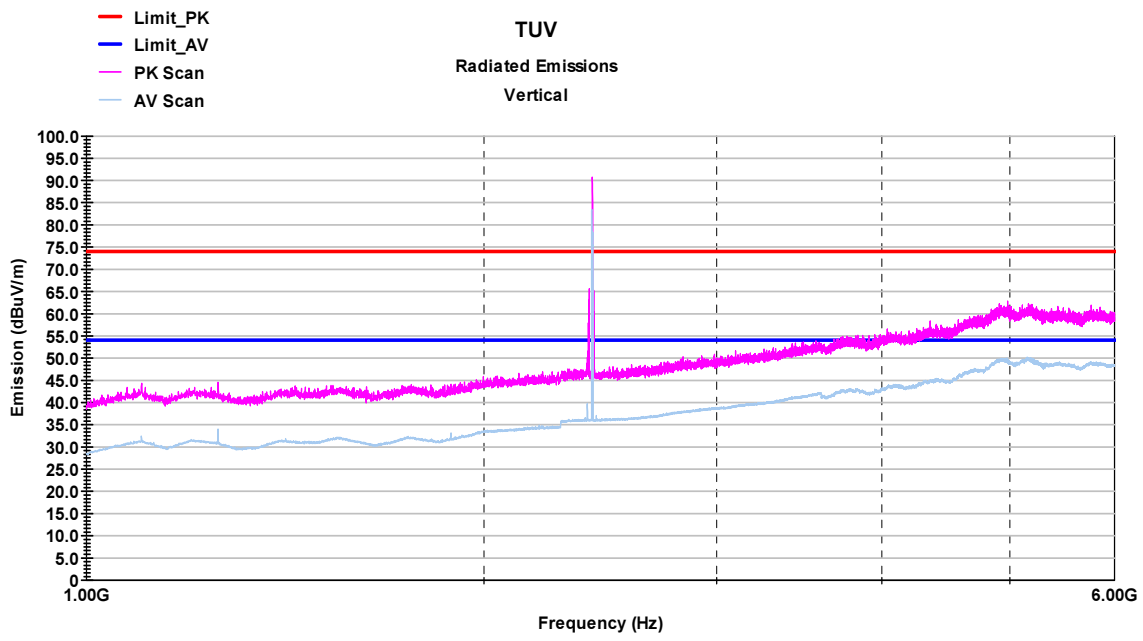
Graphical representation of Radiated Emission Measurement
Operation Mode: #1
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal
Channel: Low / Standard: IEE 802.11g (worst case)



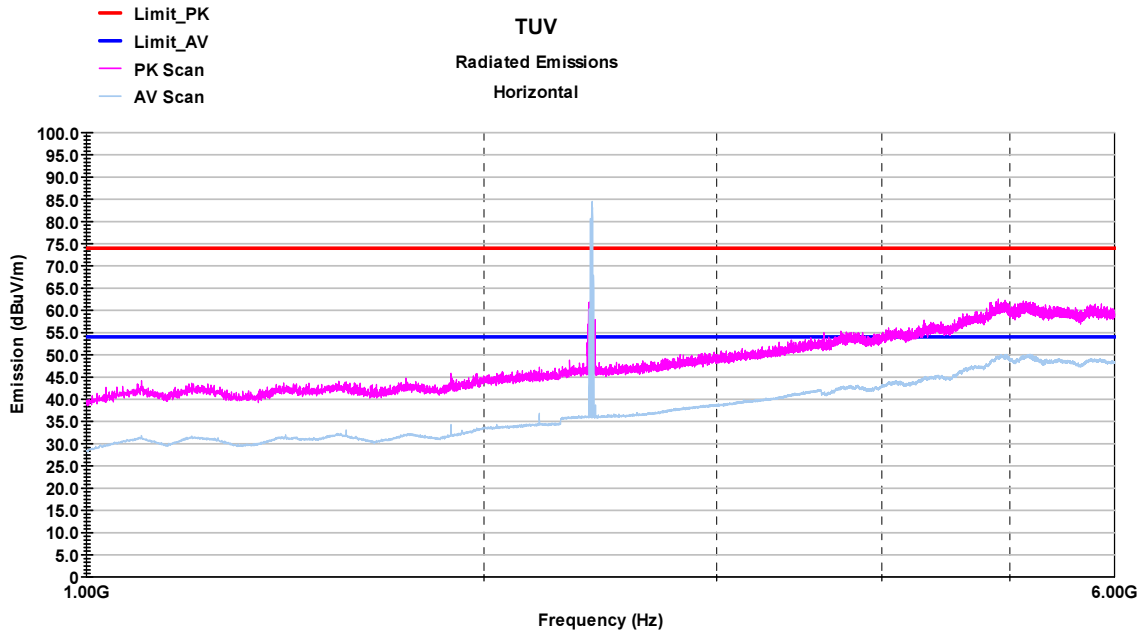
Tabulated results of Radiated Emission Measurement
Operation Mode: #1
Frequency: 30MHz – 1GHz

Frequency (MHz)	QP (dBuV/m)	Margin (dB)	TT (deg)	Tower (cm)	Polarization (H or V)	Correction (dB)
68.470 MHz	36.057	-3.943	90.000	108.000	V	6.897
72.910 MHz	38.756	-1.244	21.000	116.000	V	6.983
78.370 MHz	38.718	-1.282	164.000	104.000	V	7.027
287.980 MHz	33.105	-12.915	360.000	120.000	H	13.132

Graphical representation of Radiated Emission Measurement
Operation Mode: #1
Frequency: 1GHz – 6GHz
Antenna Polarization: Vertical
Channel: Low / Standard: IEE 802.11g (worst case)

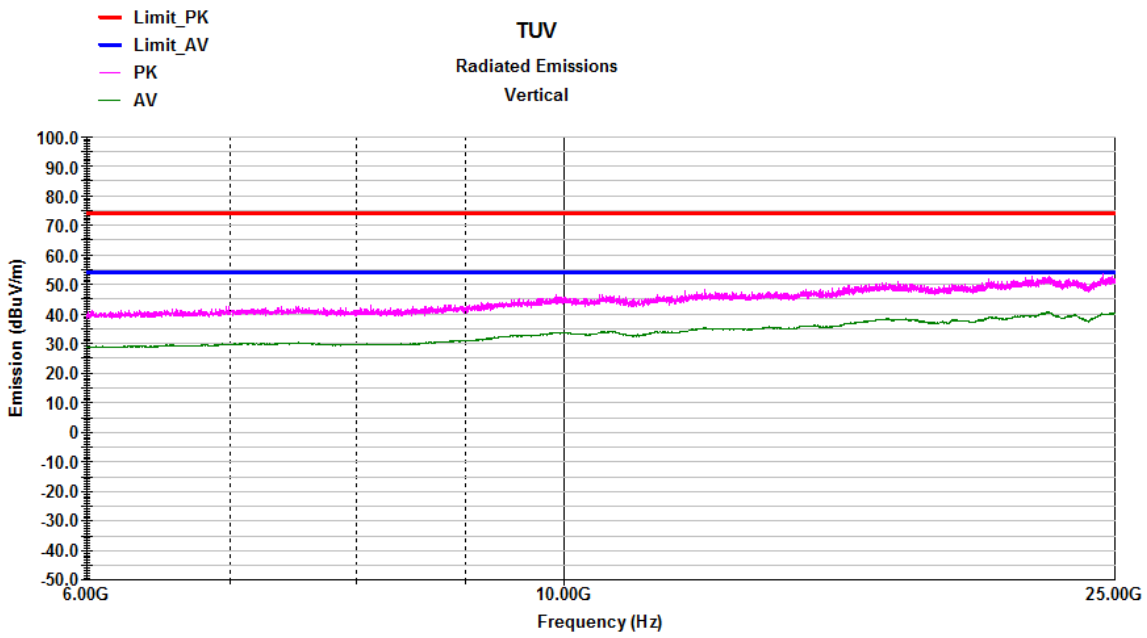


Graphical representation of Radiated Emission Measurement
Operation Mode: #1
Frequency: 1GHz – 6GHz
Antenna Polarization: Horizontal
Channel: Low / Standard: IEE 802.11g (worst case)

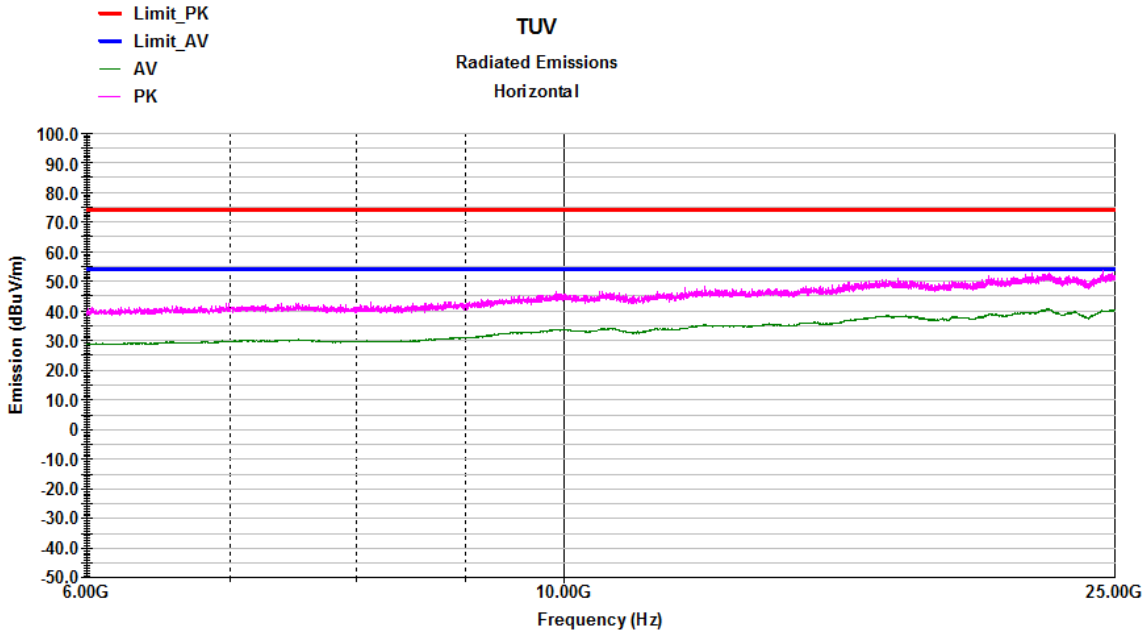


Tabulated results of Radiated Emission Measurement
Operation Mode: #1
Frequency: 1GHz - 6GHz

Graphical representation of Radiated Emission Measurement
Operation Mode: #1
Frequency: 6GHz – 25GHz
Antenna Polarization: Vertical
Channel: Low / Standard: IEE 802.11g (worst case)



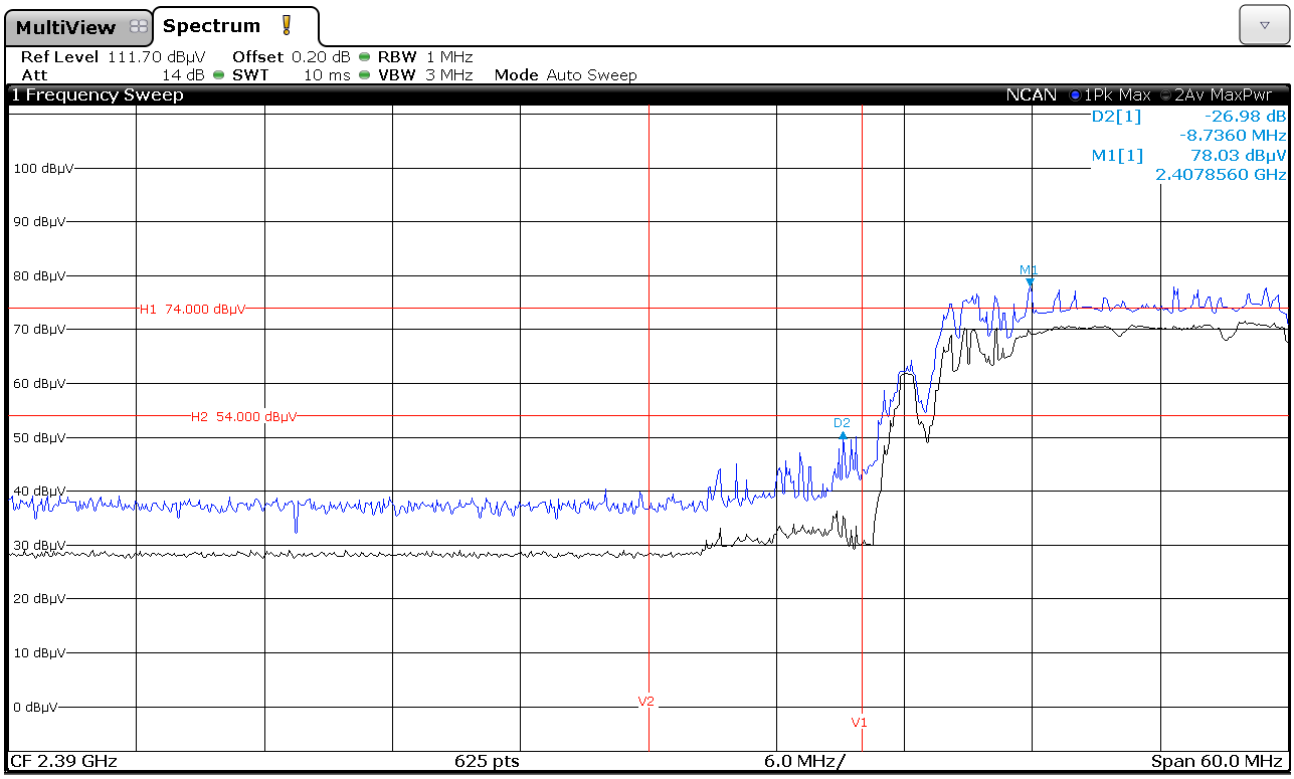
Graphical representation of Radiated Emission Measurement
Operation Mode: #1
Frequency: 6GHz – 25GHz
Antenna Polarization: Horizontal
Channel: Low / Standard: IEE 802.11g (worst case)



Tabulated results of Radiated Emission Measurement
Operation Mode: #1
Frequency: 6GHz - 25GHz

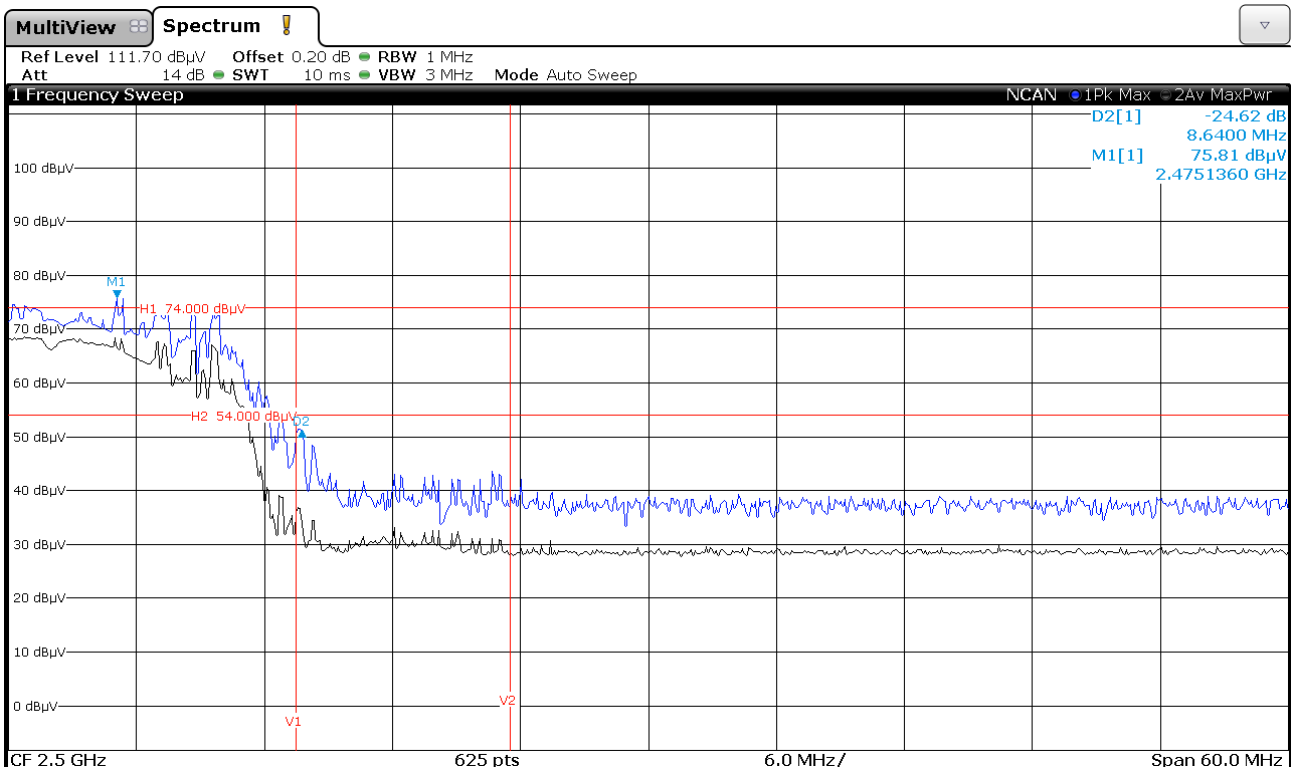
Graphical representation of Antenna Port Spurious Emission - Radiated
Operation Mode: #1
Standard: IEE 802.11g (worst case)
Channel: Low

BAND EDGE

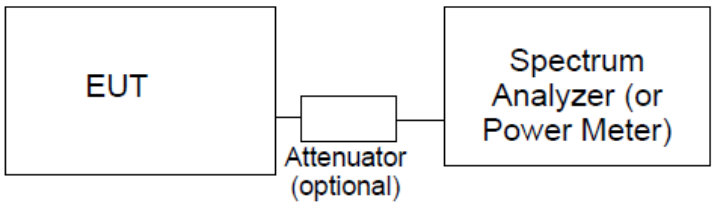


Graphical representation of Antenna Port Spurious Emission - Radiated
Operation Mode: #1
Standard: IEE 802.11g (worst case)
Channel: High

BAND EDGE

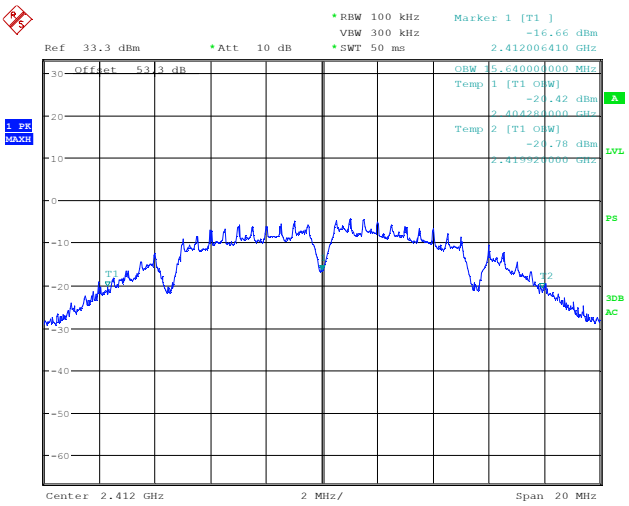


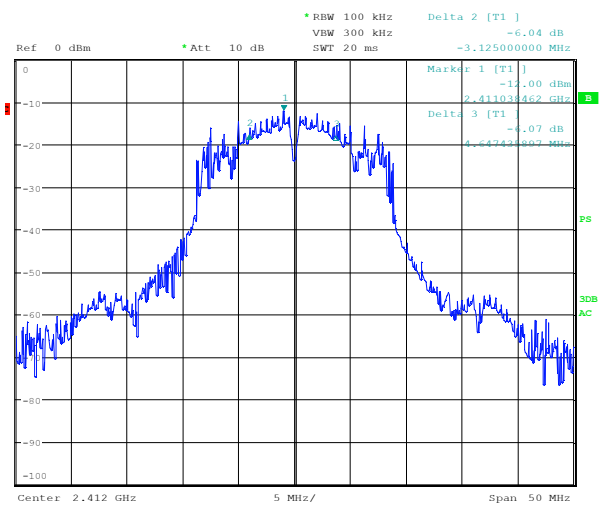
13. Test Conditions and Results – 6dB BANDWIDTH

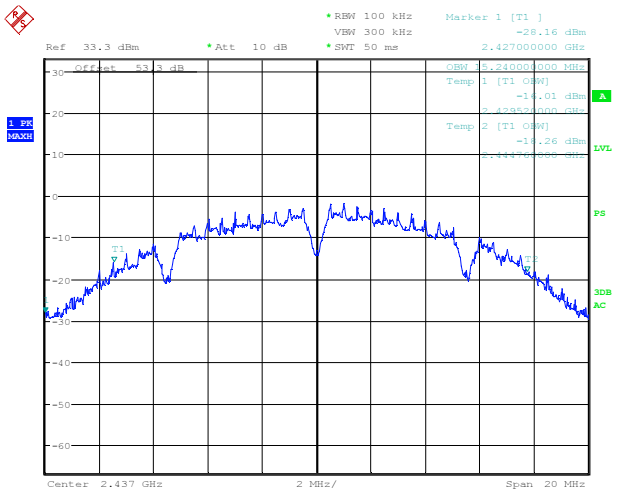
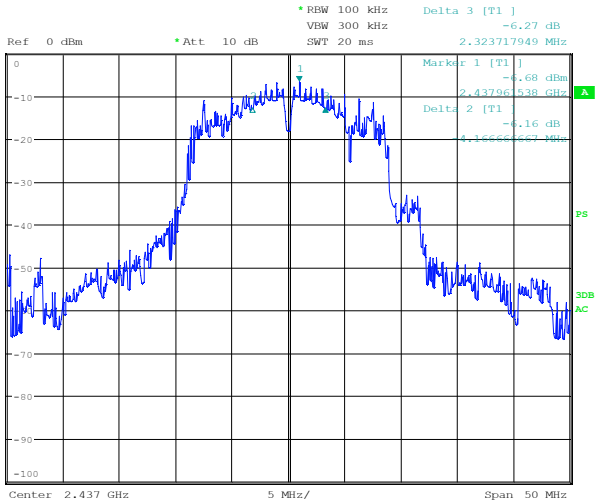
14	TEST: Radiated Emission		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	24°C	
	Relative Humidity (%)	48%	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	115V ~ 60Hz	SMA Connector	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.247		
Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.			
Further information to test setup			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	04/2016	04/2017
20dB Attenuator	RS Components	Huber & Suhner	87020534	10/2015	10/2016

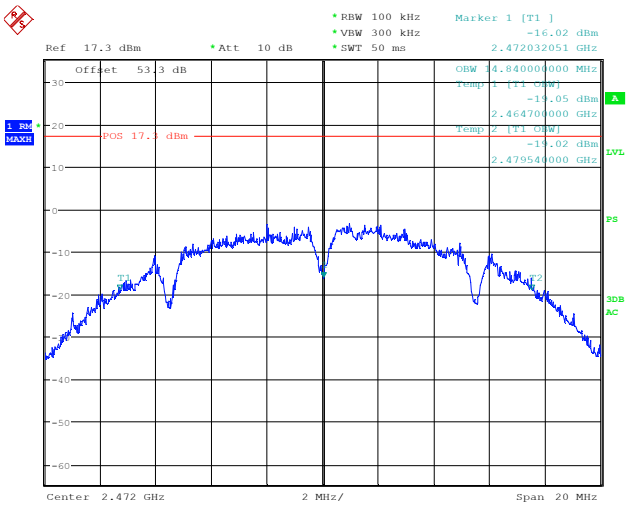
Graphical representation of 6dB Bandwidth
Operation Mode: #1
Standard: IEE 802.11b
Channel: #1

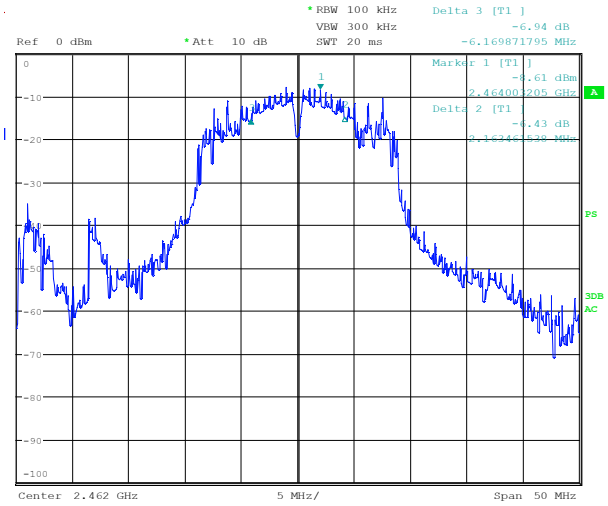




Graphical representation of 6dB Bandwidth	
Operation Mode: #1	
Standard: IEE 802.11b	
Channel: #6	
	

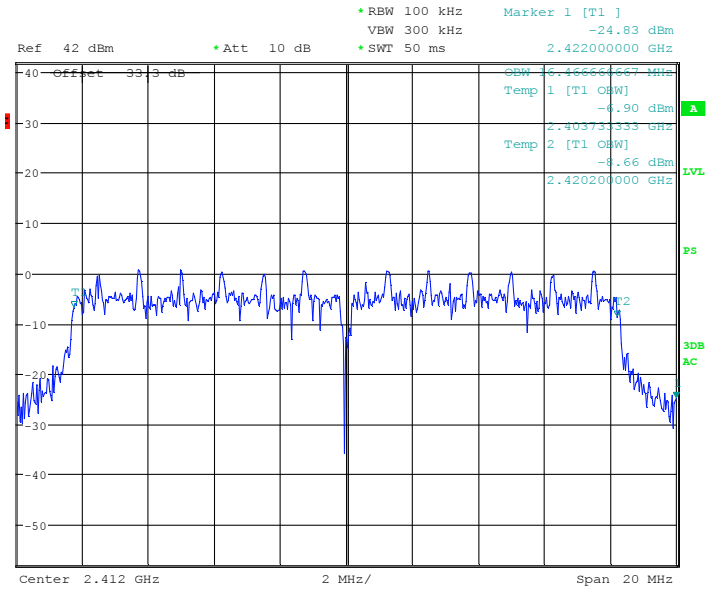
Graphical representation of 6dB Bandwidth
Operation Mode: #1
Standard: IEE 802.11b
Channel: #11

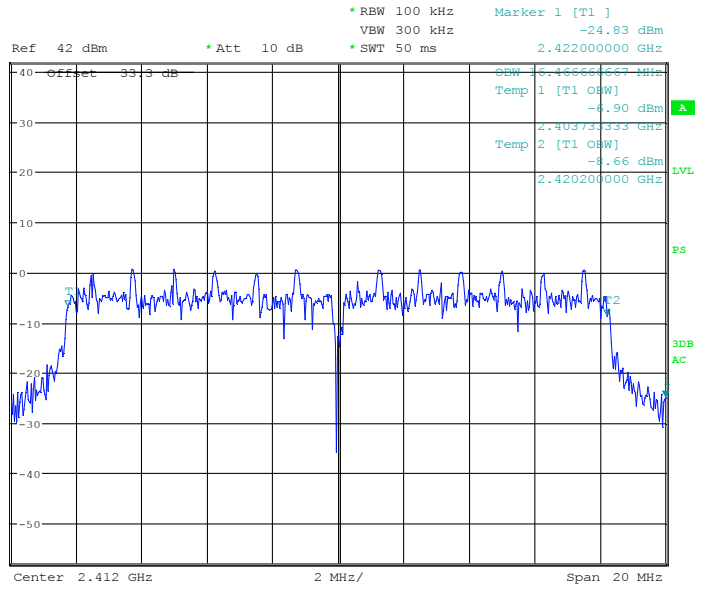


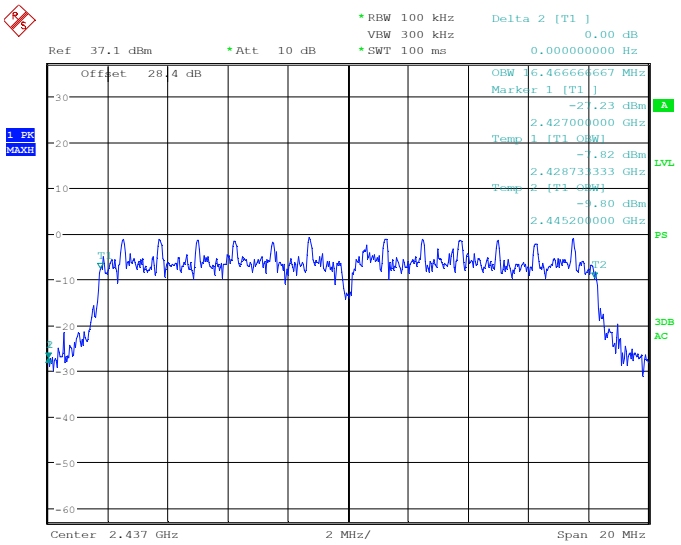
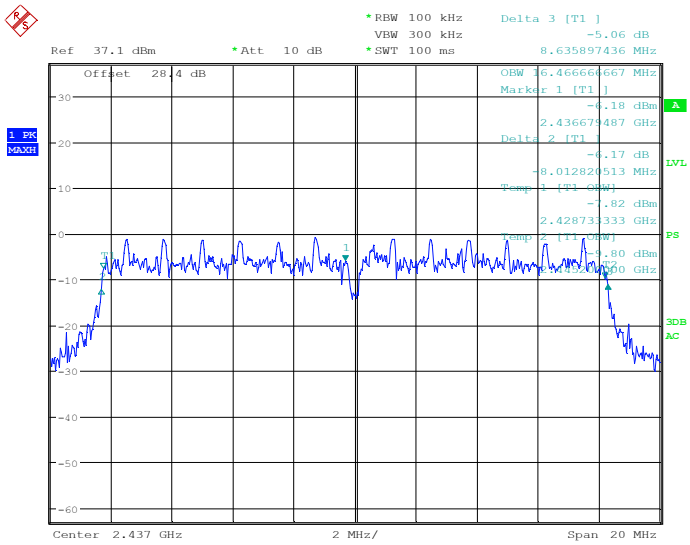


Test Results			
Channel	Frequency (MHz)	6dB Bandwidth (Mhz)	Minimum Limit (MHz)
1	2412	7,76	0,5
6	2437	6,48	0,5
11	2462	8,32	0,5

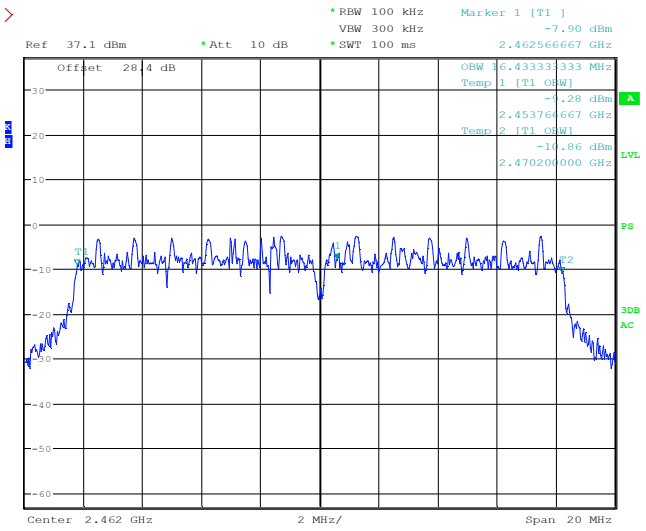
Graphical representation of 6dB Bandwidth
Operation Mode: #1
Standard: IEE 802.11g
Channel: #1

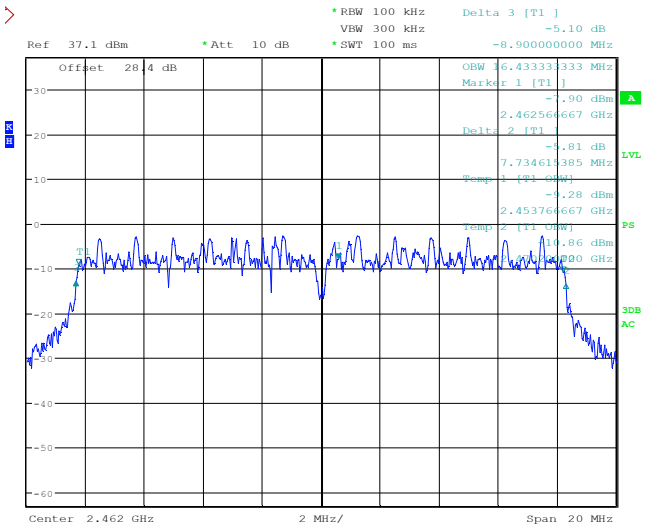




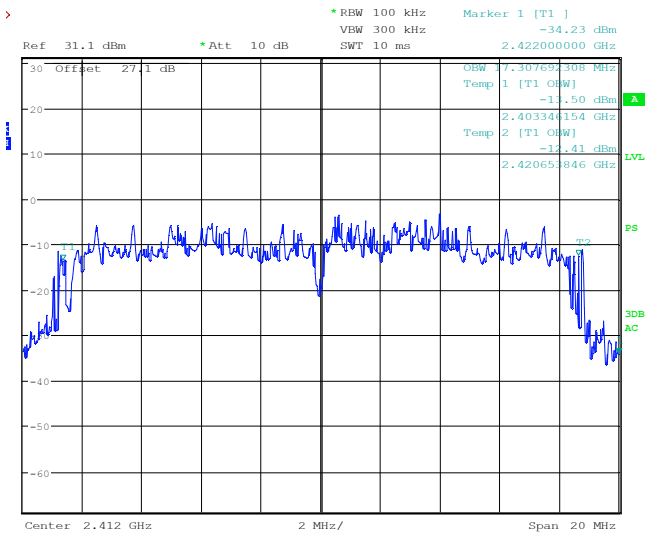
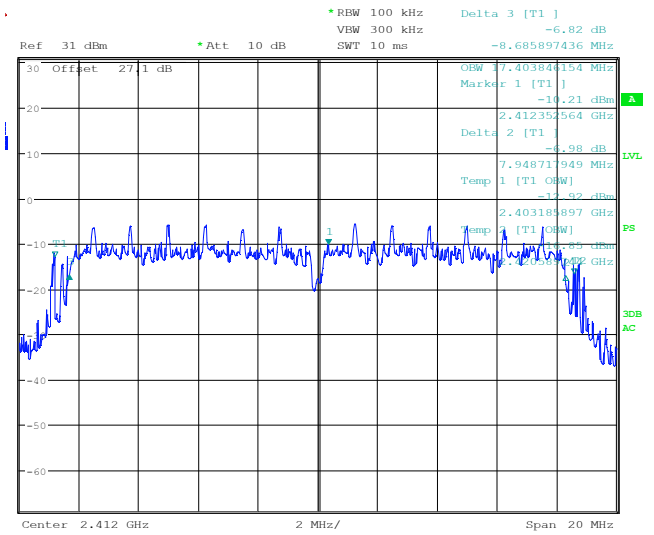
Graphical representation of 6dB Bandwidth	
Operation Mode: #1	
Standard: IEE 802.11g	
Channel: #6	
	

Graphical representation of 6dB Bandwidth
Operation Mode: #1
Standard: IEE 802.11g
Channel: #11

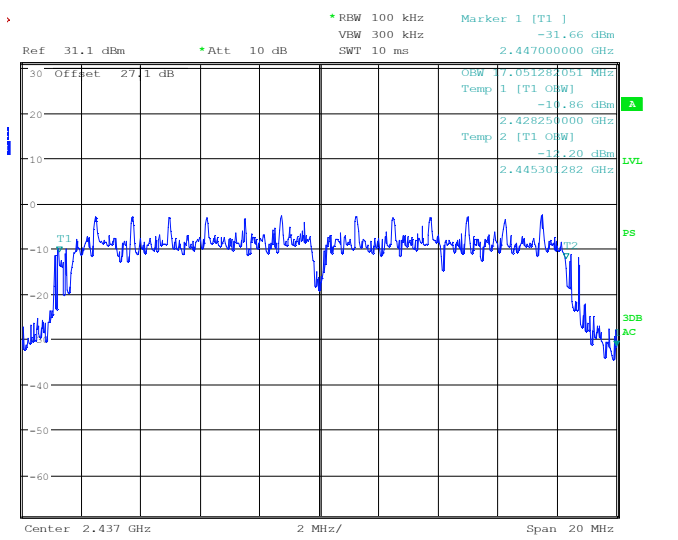


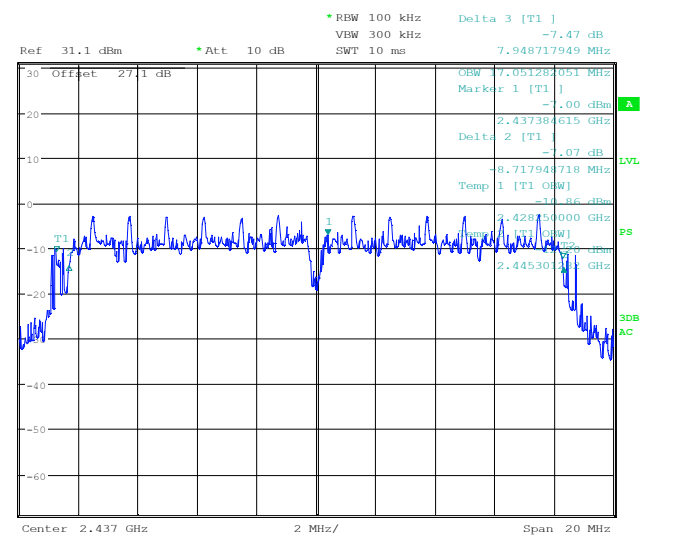


Test Results			
Channel	Frequency (MHz)	6dB Bandwidth (Mhz)	Minimum Limit (MHz)
1	2412	16,78	0,5
6	2437	16,63	0,5
11	2462	16,63	0,5

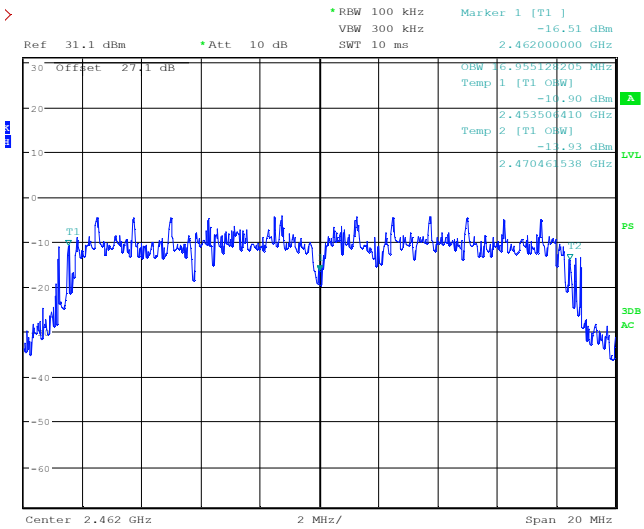
Graphical representation of 6dB Bandwidth	
Operation Mode: #1	
Standard: IEE 802.11n	
Channel: #1	
	

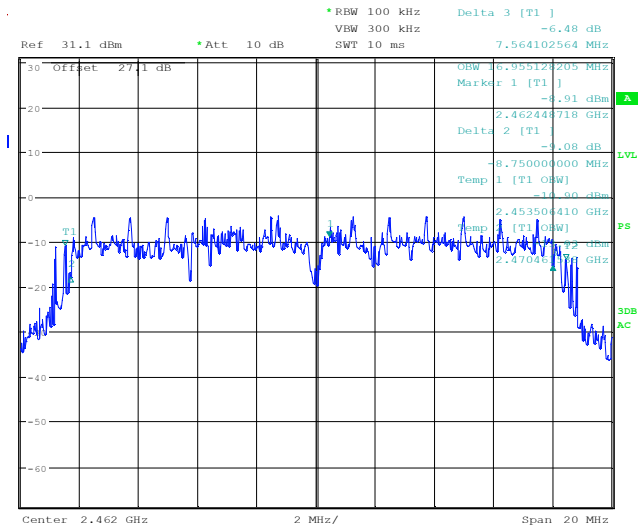
Graphical representation of 6dB Bandwidth
Operation Mode: #1
Standard: IEE 802.11n
Channel: #6





Graphical representation of 6dB Bandwidth
Operation Mode: #1
Standard: IEE 802.11n
Channel: #11





Test Results			
Channel	Frequency (MHz)	6dB Bandwidth (Mhz)	Minimum Limit (MHz)
1	2412	16,62	0,5
6	2437	16,66	0,5
11	2462	16,31	0,5

14. Test Conditions and Results – OUTPUT POWER_1 (external antenna)

15	TEST: Output Power 1 (external antenna)		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22,5°C	
	Relative Humidity (%)	51%	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	115V ~ 60Hz	SMA Connector	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.247		

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

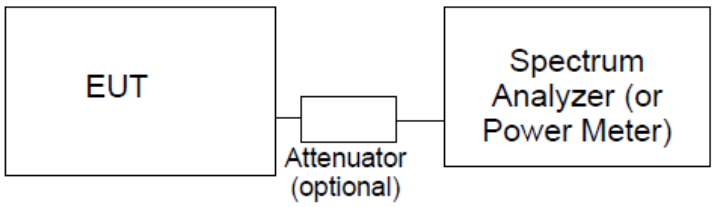
(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Further information to test setup



Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
Fast Power Sensor	R&S	NRP-Z81	87020796	08/2015	08/2017
20dB Attenuator	RS Components	Huber & Suhner	87020534	10/2015	10/2016

Test result of Peak Output Power (802.11b)

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	12,20	0,017	1
Middle Channel	2437	12,44	0,017	1
High Channel	2462	12,44	0,017	1

Test result of Peak Output Power (802.11g)

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	17,31	0,054	1
Middle Channel	2437	17,56	0,057	1
High Channel	2462	17,81	0,060	1

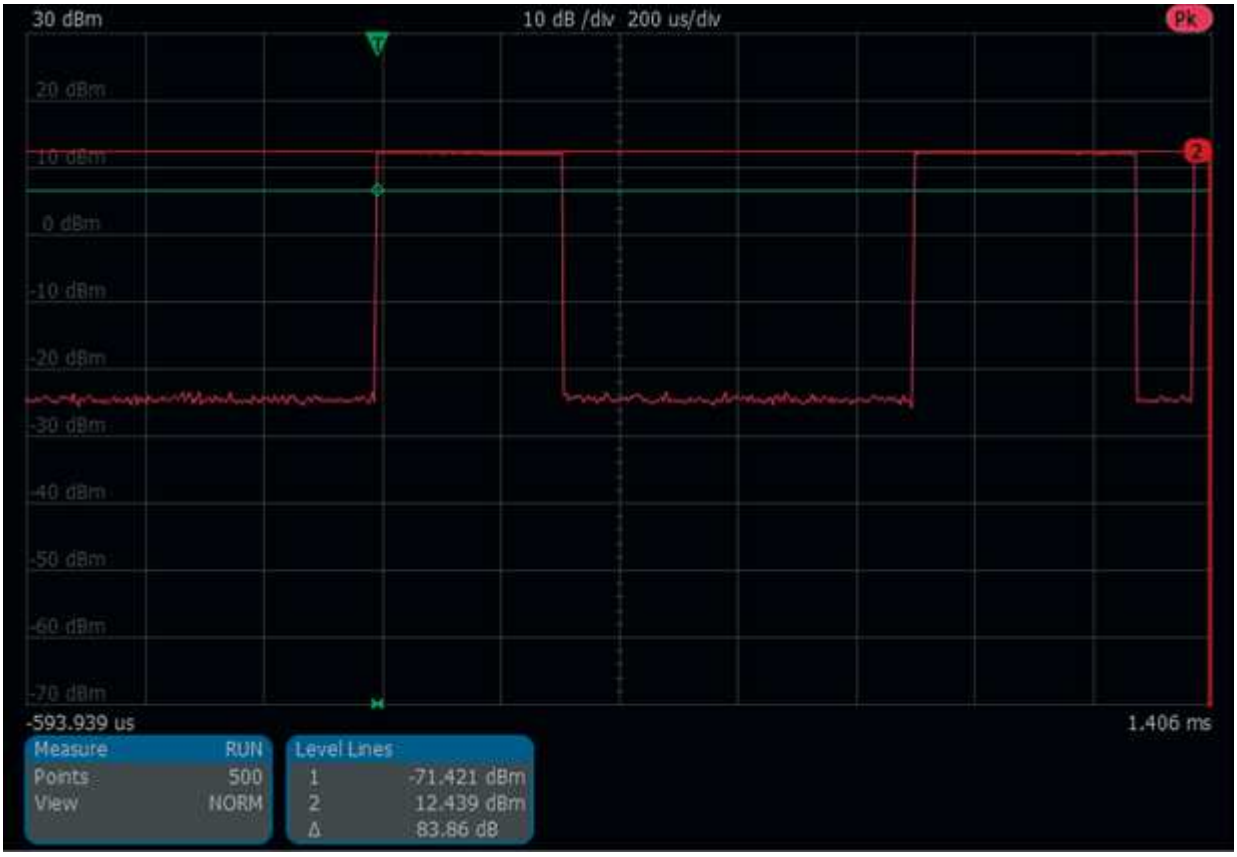
Test result of Peak Output Power (802.11n)

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	14,63	0,029	1
Middle Channel	2437	14,63	0,029	1
High Channel	2462	14,39	0,027	1

Graphical representation of RF Output Power - Conducted
Operation Mode: #1
Standard: IEE 802.11b
Channel: #1

Graphical representation of RF Output Power - Conducted
Operation Mode: #1
Standard: IEE 802.11b
Channel: #6

Graphical representation of RF Output Power - Conducted
Operation Mode: #1
Standard: IEE 802.11b
Channel: #11

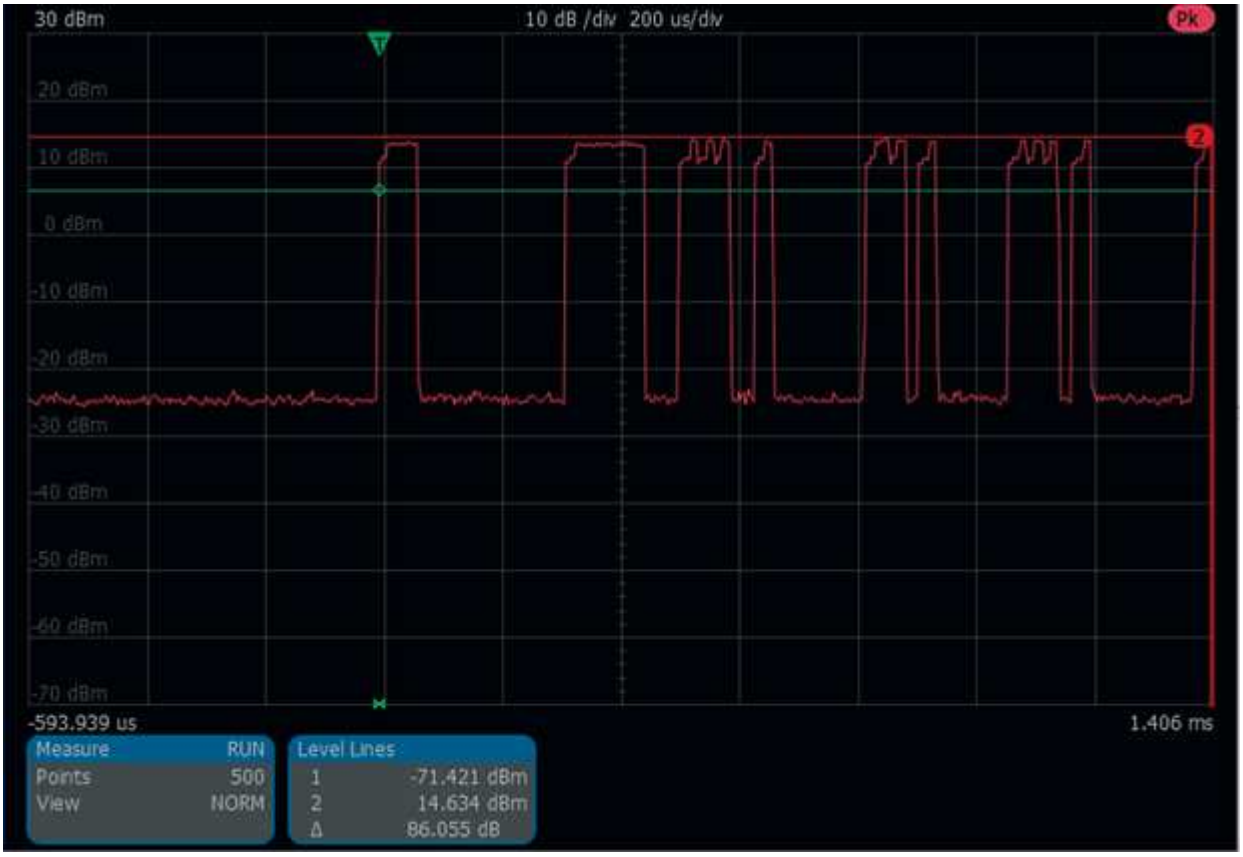


Graphical representation of RF Output Power - Conducted
Operation Mode: #1
Standard: IEE 802.11g
Channel: #1

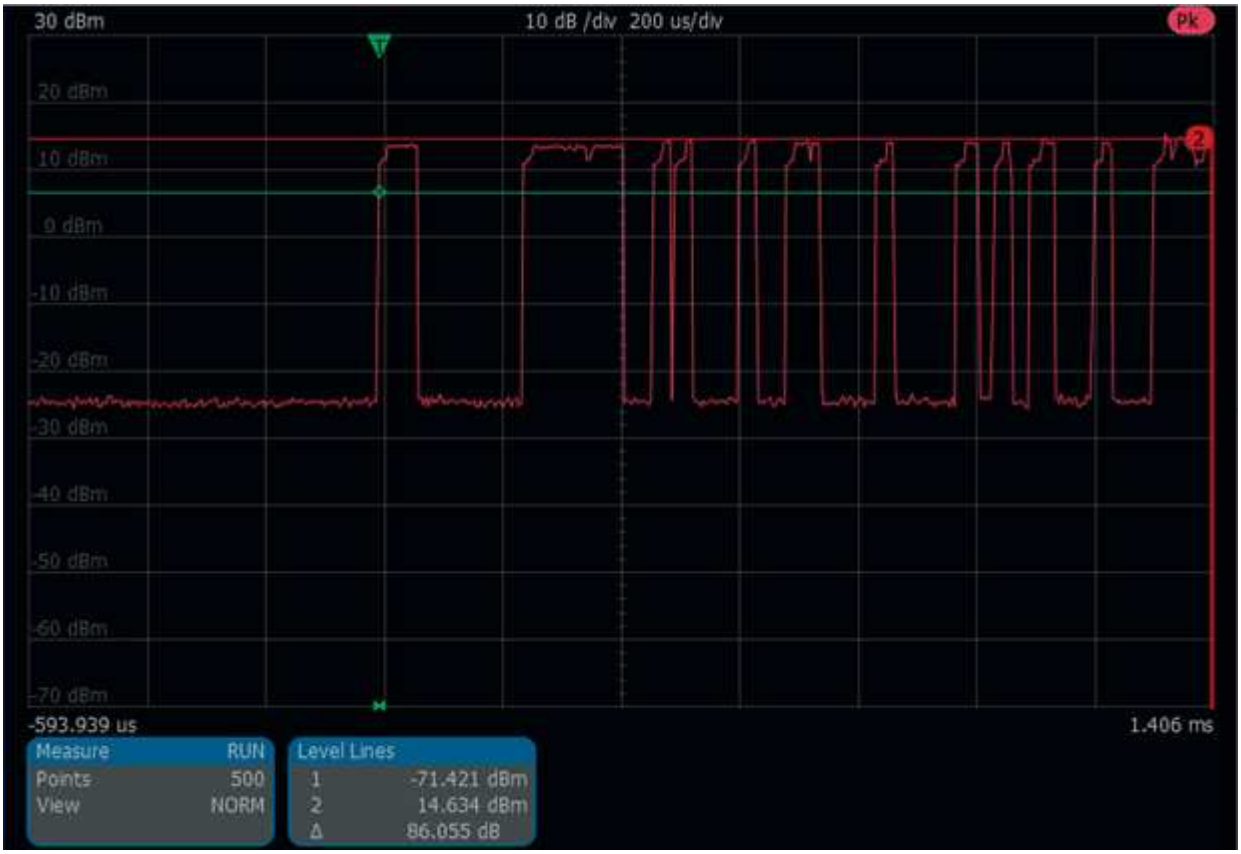
Graphical representation of RF Output Power - Conducted
Operation Mode: #1
Standard: IEE 802.11g
Channel: #6

Graphical representation of RF Output Power - Conducted
Operation Mode: #1
Standard: IEE 802.11g
Channel: #11

Graphical representation of RF Output Power - Conducted
Operation Mode: #1
Standard: IEE 802.11n
Channel: #1



Graphical representation of RF Output Power - Conducted
Operation Mode: #1
Standard: IEE 802.11n
Channel: #6



Graphical representation of RF Output Power - Conducted
Operation Mode: #1
Standard: IEE 802.11b
Channel: #11

15. Test Conditions and Results – OUTPUT POWER_2 (internal antenna)

16	TEST: Output Power 2 (Internal Antenna)	PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22,5°C
	Relative Humidity (%)	51%
	Air pressure (hPa)	1020
—	Frequency	Application Point
Fully configured sample tested at the power line frequency	115V ~ 60Hz	Enclosure
Equipment mode:	Operation mode	#1
FCC Standard	§15.247 (B)(3)	

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

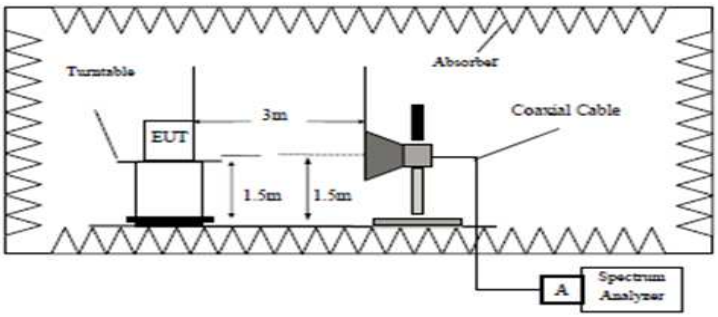
(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Further information to test setup



Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
CSSA	ETS Lindgren	FACT3	87020484	10/2015	10/2016
EMI Test Receiver	R&S	ESU40	87020455	04/2016	04/2017
Antenna BiConiLog	ETS Lindgren	3124E-PA	87020457	04/2014	04/2017
Antenna Horn with Preamplifier	ETS Lindgren	3117-PA	87020458	04/2014	04/2017

Test result of Peak Output Power (802.11b)

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	18,21	0,066	1
Middle Channel	2437	16,81	0,048	1
High Channel	2462	17,38	0,055	1

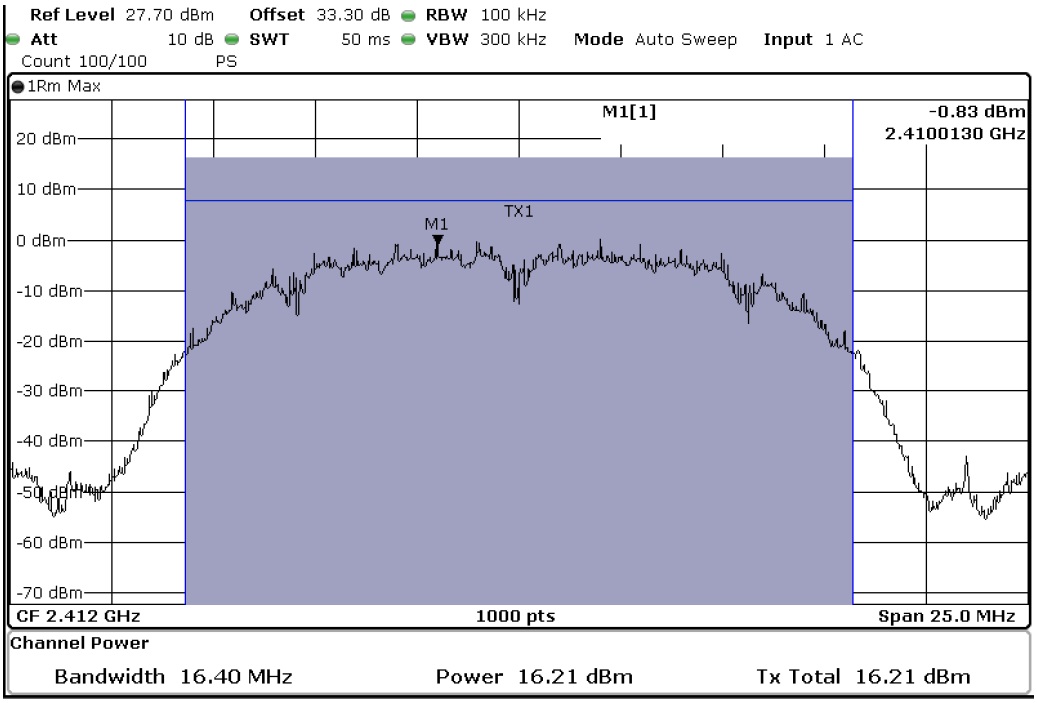
Test result of Peak Output Power (802.11g)

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	13,22	0,021	1
Middle Channel	2437	16,58	0,045	1
High Channel	2462	15,28	0,034	1

Test result of Peak Output Power (802.11n)

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	12,83	0,020	1
Middle Channel	2437	16,74	0,047	1
High Channel	2462	15,36	0,034	1

Test Executed according to FCC Meas Guidance **9.2.2.6 Method AVGSA-3 (RMS detection across on and off times of the EUT with max hold)**
Graphical representation of RF Output Power - Radiated
Operation Mode: #2
Standard: IEE 802.11b
Channel: #1

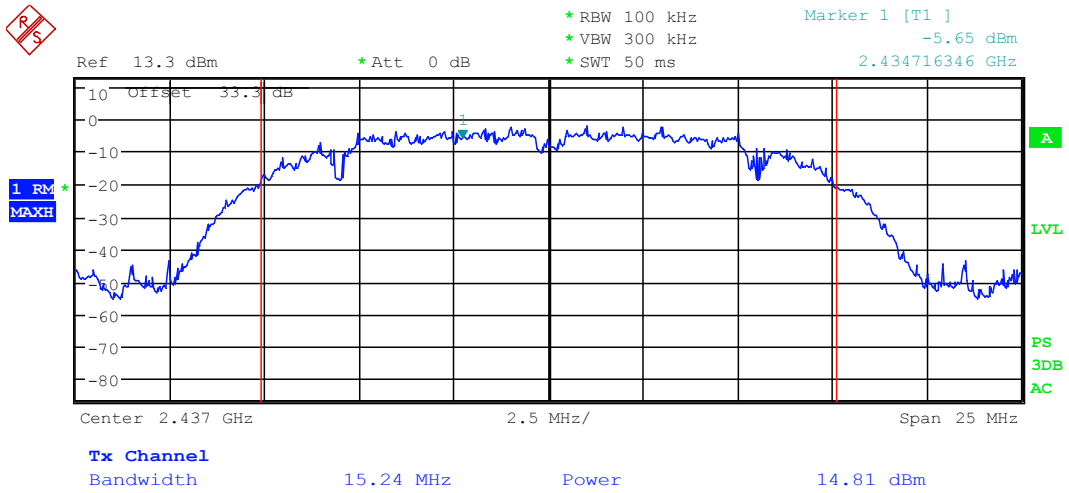


Measured Band Power=16,21dBm

Maximum peak conducted output power = Measured Band Power – antenna gain = 16,21-(-2)= 18,21 dBm

18,21 dBm = 66,22 mW (< 1W)

Graphical representation of RF Output Power - Radiated
Operation Mode: #2
Standard: IEE 802.11b
Channel: #6

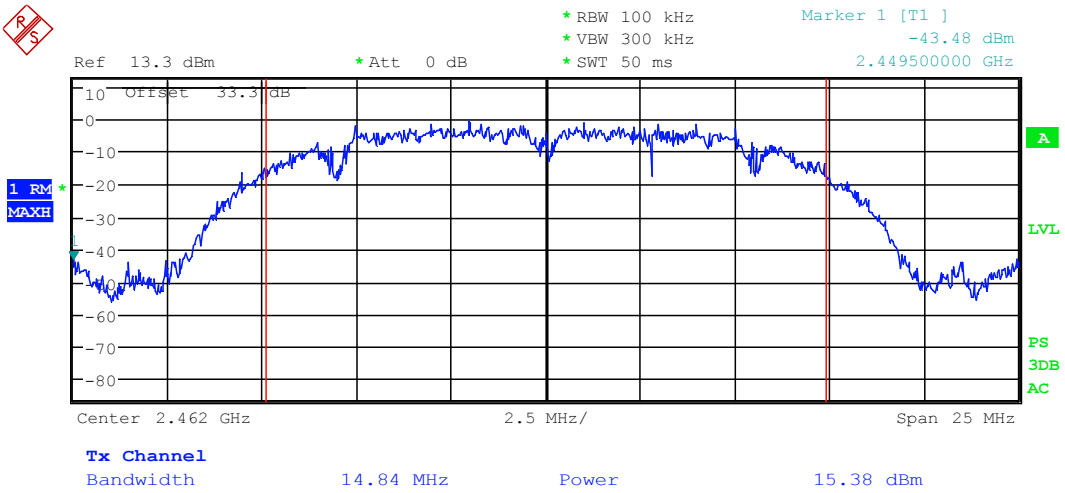


Measured Band Power=14,81dBm

maximum peak conducted output power = Measured Band Power – antenna gain = 14,81-(-2)= 16,81 dBm

16,81 dBm= 47,97 mW (< 1W)

Graphical representation of RF Output Power - Radiated
Operation Mode: #2
Standard: IEE 802.11b
Channel: #11

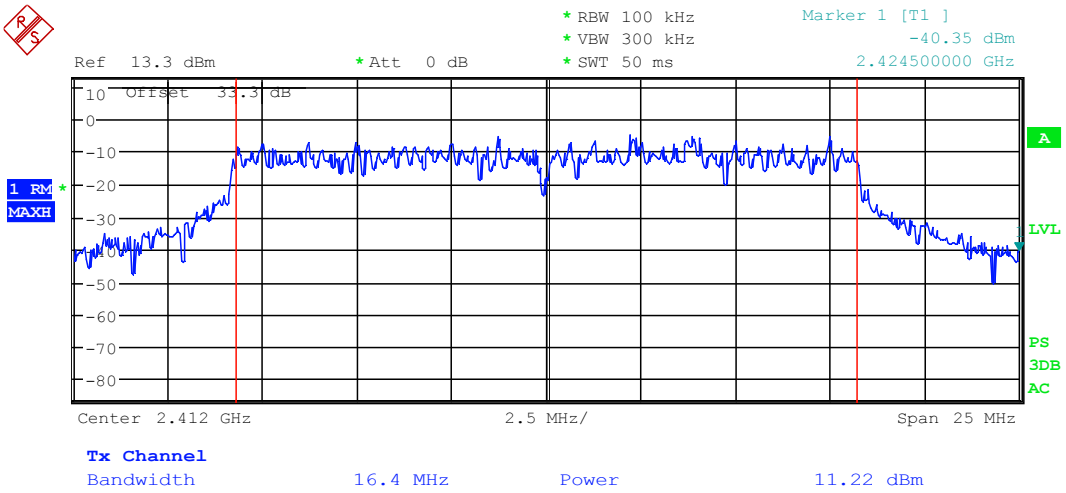


Measured Band Power=15,38dBm

Maximum peak conducted output power = Measured Band Power – antenna gain = 15,38-(-2)= 17,38dBm

17,38 dBm= 54,70 mW (< 1W)

Graphical representation of RF Output Power - Radiated
Operation Mode: #2
Standard: IEE 802.11g
Channel: #1

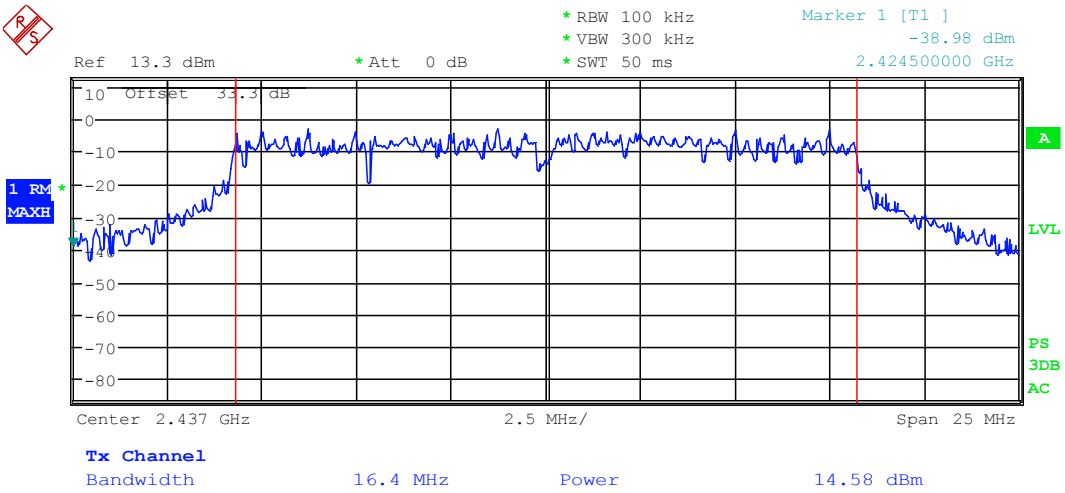


Measured Band Power=11,22dBm

Maximum peak conducted output power = Measured Band Power – antenna gain = 11,22-(-2)= 13,22 dBm

13,22 dBm= 20,98 mW (< 1W)

Graphical representation of RF Output Power - Radiated
Operation Mode: #2
Standard: IEE 802.11g
Channel: #6

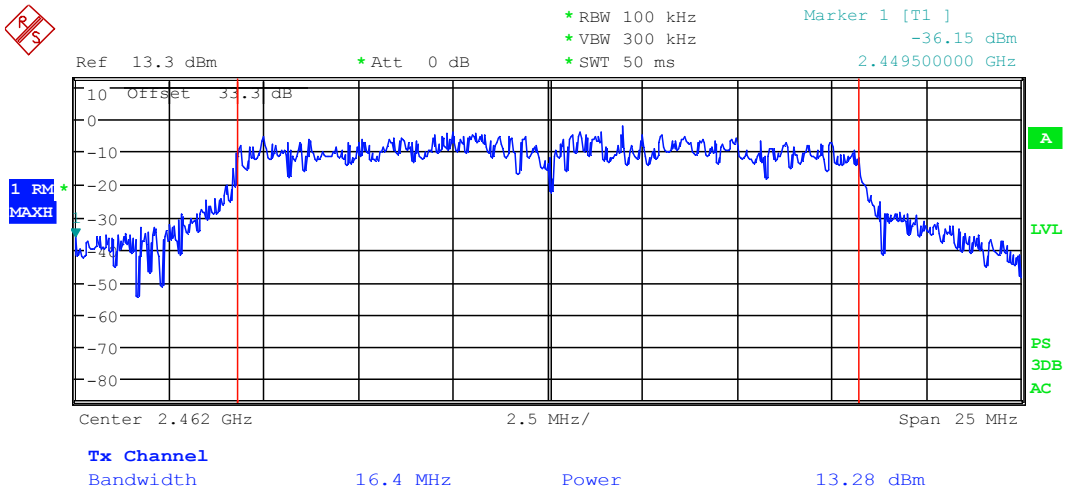


Measured Band Power=14,58dBm

Maximum peak conducted output power = Measured Band Power – antenna gain = 14,58-(-2)= 16,58 dBm

16,58 dBm = 45,50 mW (< 1W)

Graphical representation of RF Output Power - Radiated
Operation Mode: #2
Standard: IEE 802.11g
Channel: #11

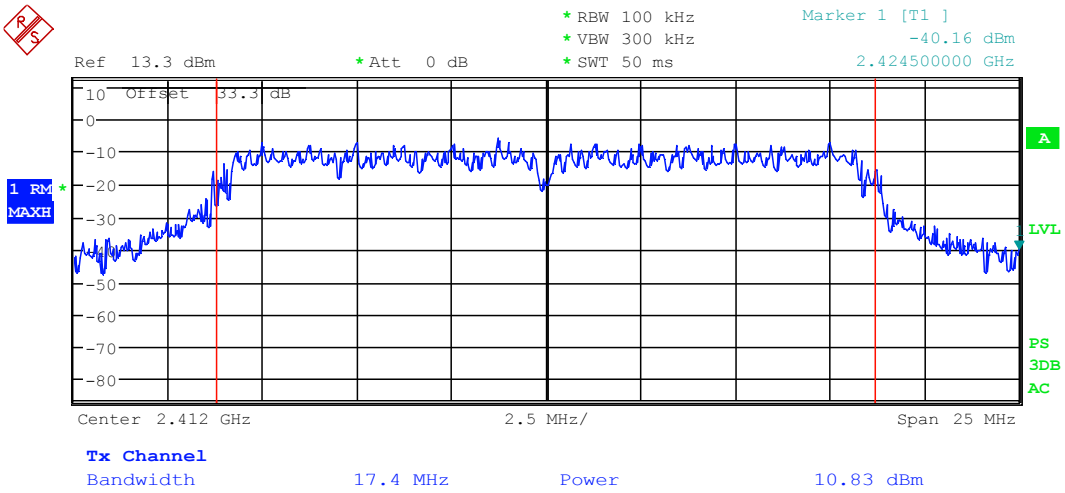


Measured Band Power=13,28dBm

Maximum peak conducted output power = Measured Band Power – antenna gain = 13,28-(-2)= 15,28dBm

15,28 dBm= 33,73 mW (< 1W)

Graphical representation of RF Output Power - Radiated
Operation Mode: #2
Standard: IEE 802.11n
Channel: #1

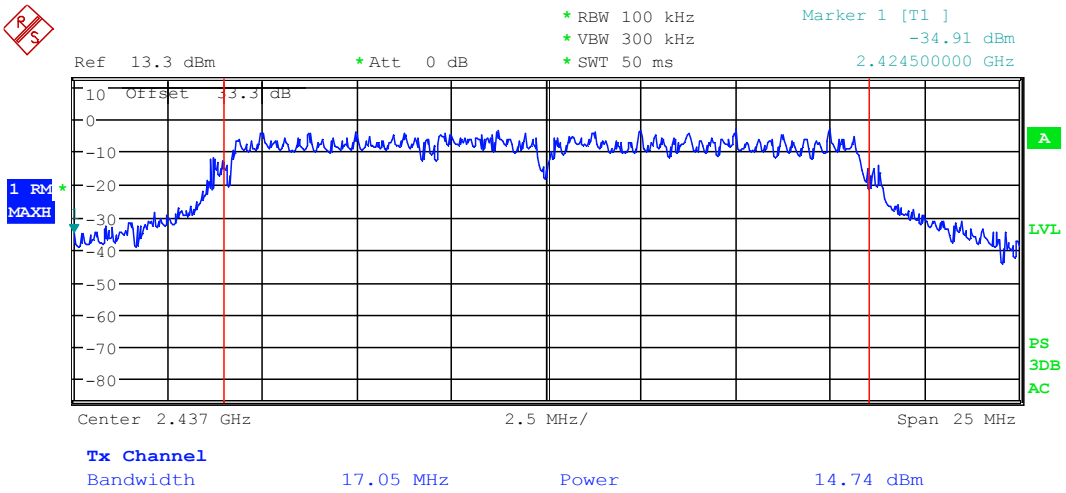


Measured Band Power=10,83dBm

Maximum peak conducted output power = Measured Band Power – antenna gain = 10,83-(-2)= 12,83 dBm

12,83 dBm= 19,19 mW (< 1W)

Graphical representation of RF Output Power - Radiated
Operation Mode: #2
Standard: IEE 802.11n
Channel: #6

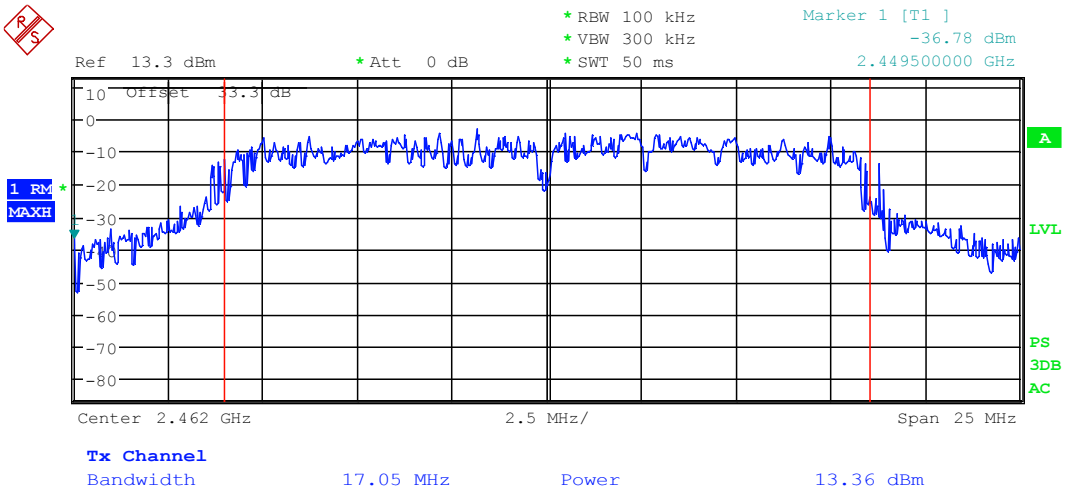


Measured Band Power=14,74dBm

Maximum peak conducted output power = Measured Band Power – antenna gain = 14,74-(-2)= 16,74 dBm

16,74 dBm= 82,41 mW (< 1W)

Graphical representation of RF Output Power - Radiated
Operation Mode: #2
Standard: IEE 802.11n
Channel: #11



Measured Band Power=13,36dBm

Maximum peak conducted output power = Measured Band Power – antenna gain = 13,36-(-2)= 15,36dBm

15,36 dBm= 34,35 mW (< 1W)

Test Conditions and Results – OUTPUT POWER (MIMO 2X2 ANTENNAS)

Equipment mode:	Operation mode	#3

DIRECTIONAL GAIN CALCULATION

$10*LOG\ [(10^{G1/20} + 10^{G2/20})^2 / N\ ant] = 10*LOG\ [(1,77 + 0,79)^2 / 2 = +5,15\ dBi$

Test result of Peak Output Power (802.11b)

Channel	Channel Frequency (MHz)	Output Power (W)			Limit
		CH0	CH1	Final Power	(W)
Low Channel	2412	0,017	0,066	0,083	1
Middle Channel	2437	0,017	0,048	0,065	1
High Channel	2462	0,017	0,055	0,072	1

Test result of Peak Output Power (802.11g)

Channel	Channel Frequency (MHz)	Output Power (W)			Limit
		CH0	CH1	Final Power	(W)
Low Channel	2412	0,054	0,021	0,075	1
Middle Channel	2437	0,057	0,045	0,102	1
High Channel	2462	0,060	0,034	0,094	1

Test result of Peak Output Power (802.11n)

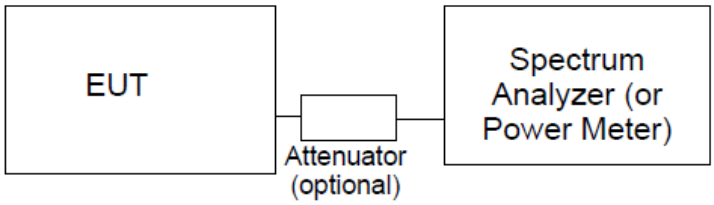
Channel	Channel Frequency (MHz)	Output Power (W)			Limit
		CH0	CH1	Final Power	(W)
Low Channel	2412	0,029	0,020	0,049	1
Middle Channel	2437	0,029	0,047	0,076	1
High Channel	2462	0,027	0,034	0,061	1

16. Test Conditions and Results – CONDUCTED ANTENNA PORT SPURIOUS EMISSIONS (external antenna)

17	TEST: Conducted Antenna Port Spurious Emission (external antenna)	PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22°C
	Relative Humidity (%)	50%
	Air pressure (hPa)	1020
—	Frequency	Application Point
Fully configured sample tested at the power line frequency	115V ~ 60Hz	SMA Connector
Equipment mode:	Operation mode	#1
FCC Standard	§15.247	

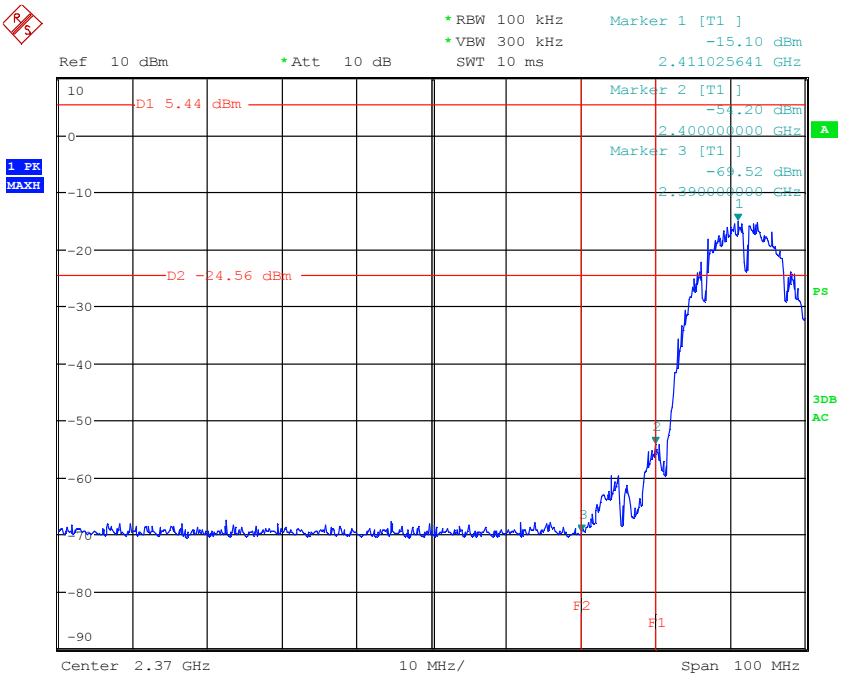
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains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

Further information to test setup

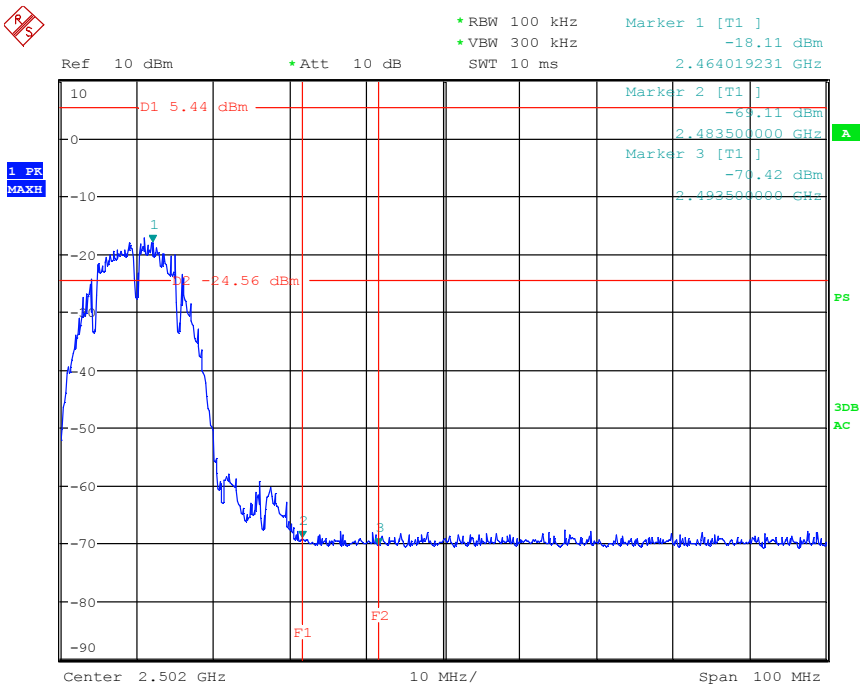


Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	04/2016	04/2017
20dB Attenuator	RS Components	Huber & Suhner	87020534	10/2015	10/2016

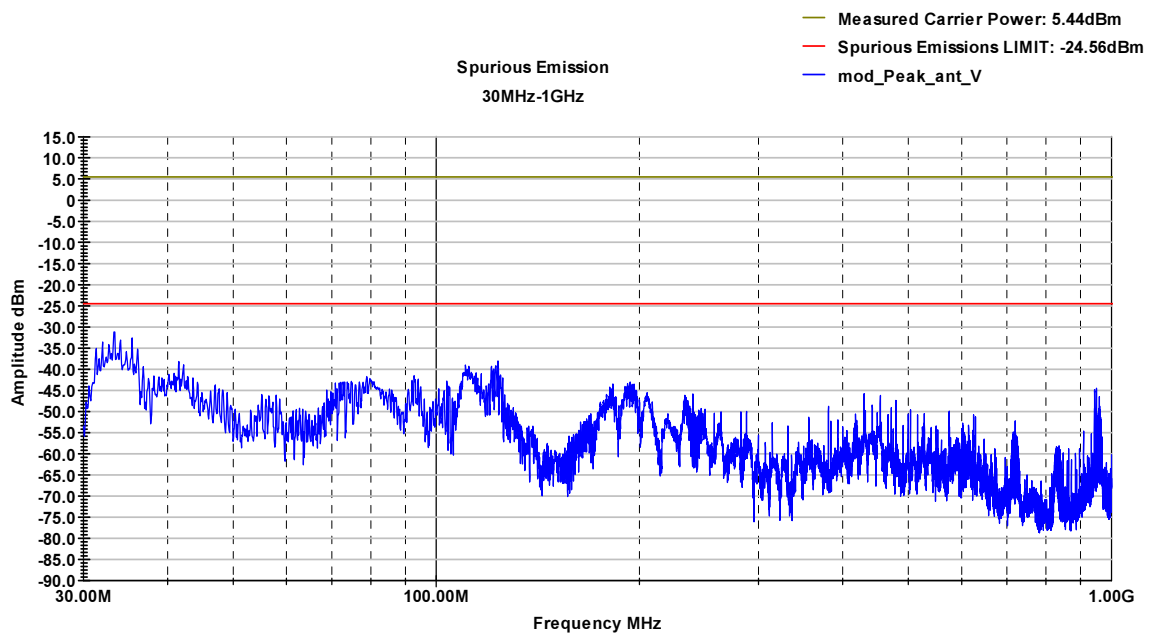
Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11b
Channel: #1
BAND EDGE

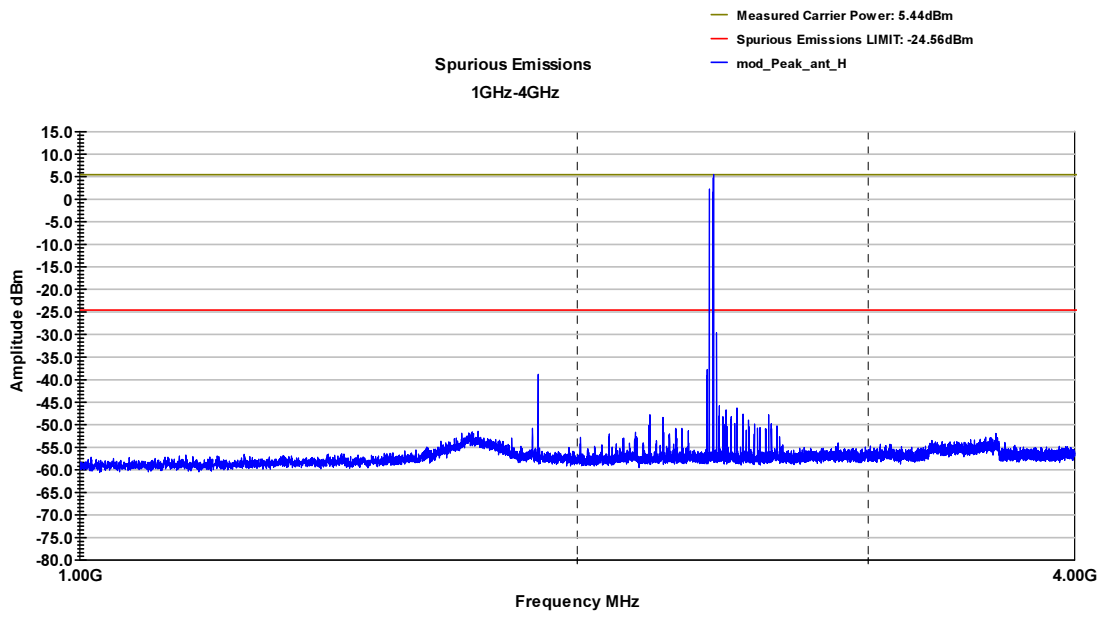


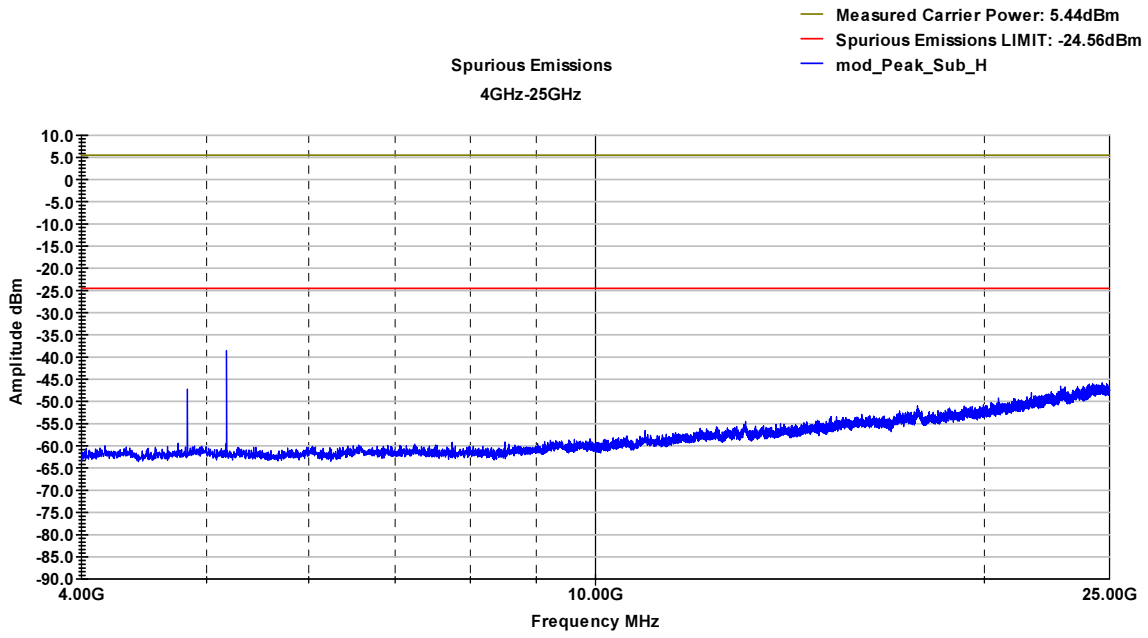
Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11b
Channel: #11
BAND EDGE



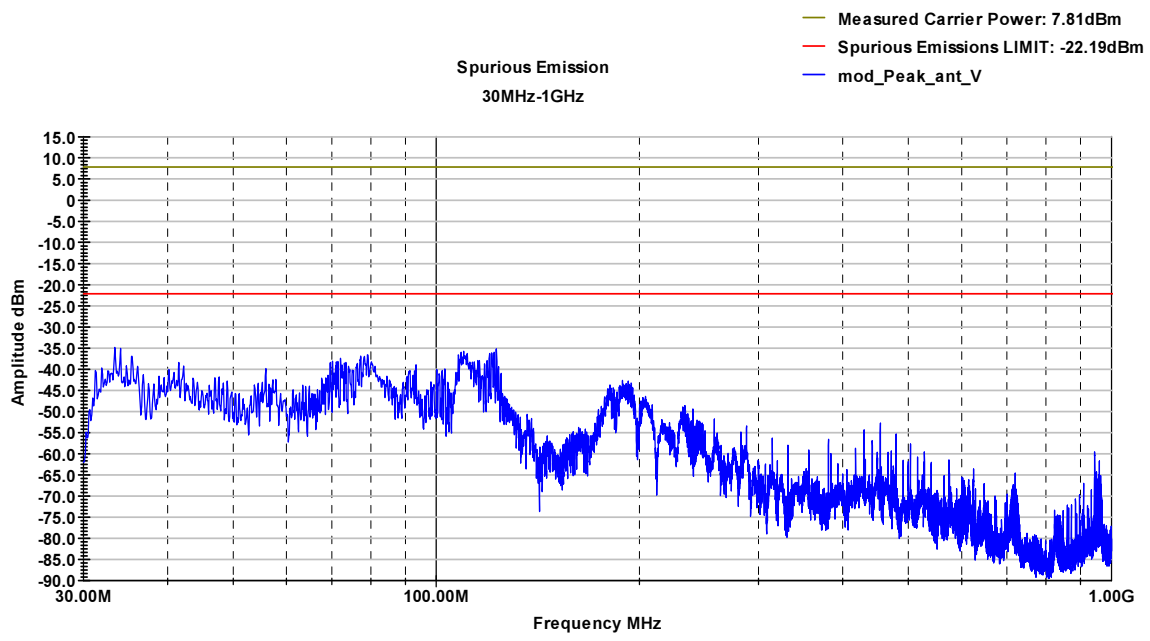
Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11b
Channel: #1

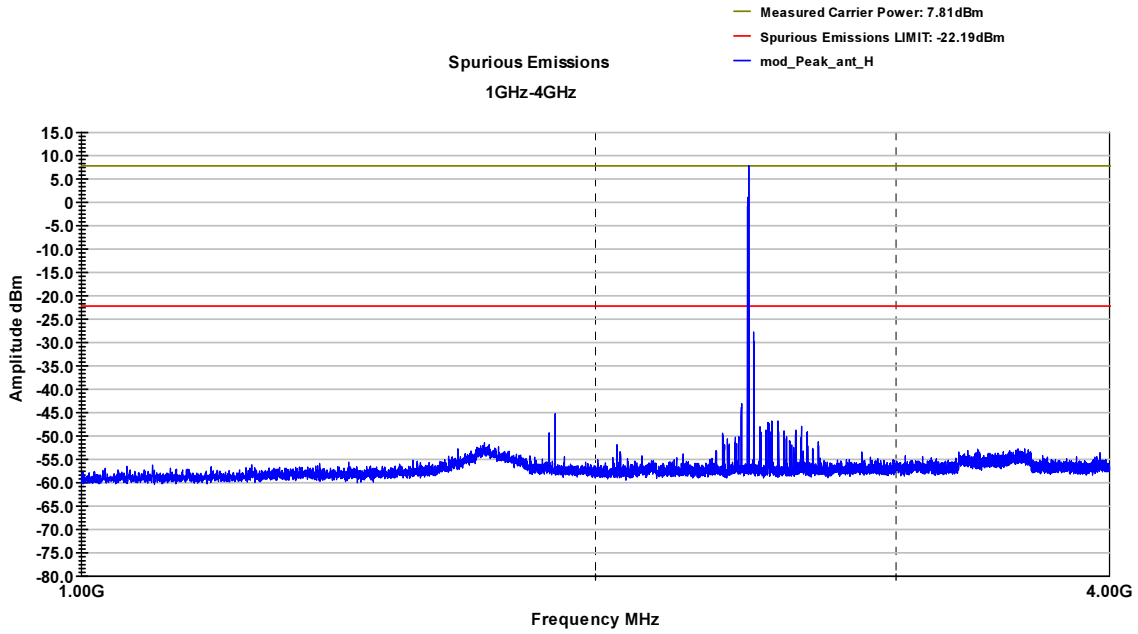


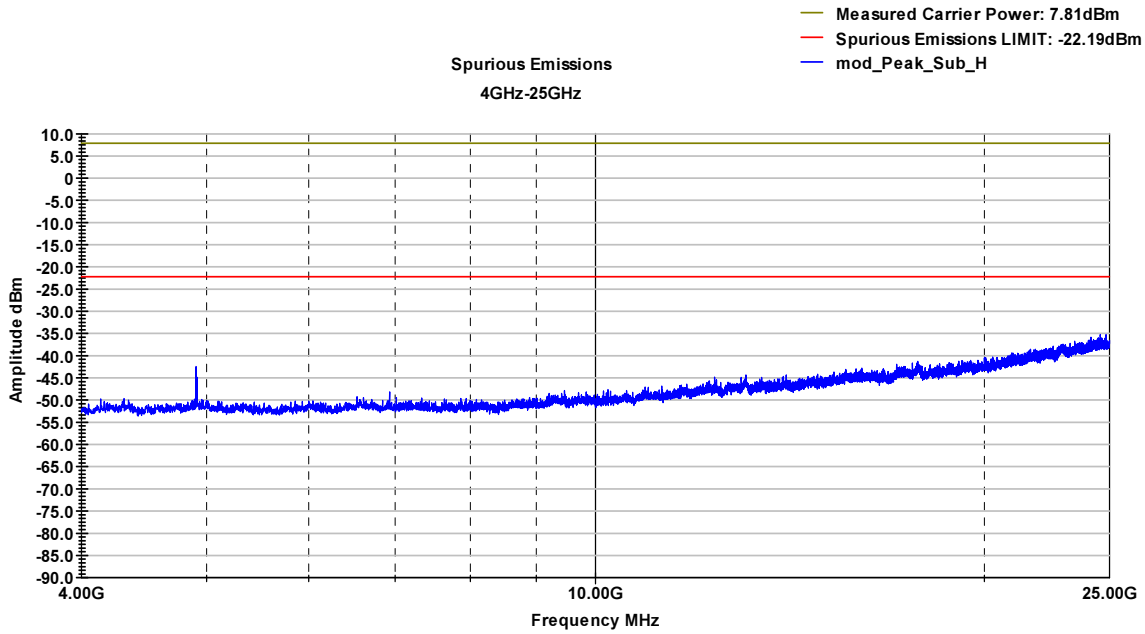

Measured Carrier Power: 5.44dBm
Spurious Emissions LIMIT: -24.56dBm
mod_Peak_ant_H
Spurious Emissions
1GHz-4GHz
Amplitude dBm
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
1.00G
4.00G
Frequency MHz


Measured Carrier Power: 5.44dBm
Spurious Emissions LIMIT: -24.56dBm
mod_Peak_Sub_H
Spurious Emissions
4GHz-25GHz
Amplitude dBm
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
-85.0
-90.0
4.00G
10.00G
25.00G
Frequency MHz

Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11b
Channel: #11

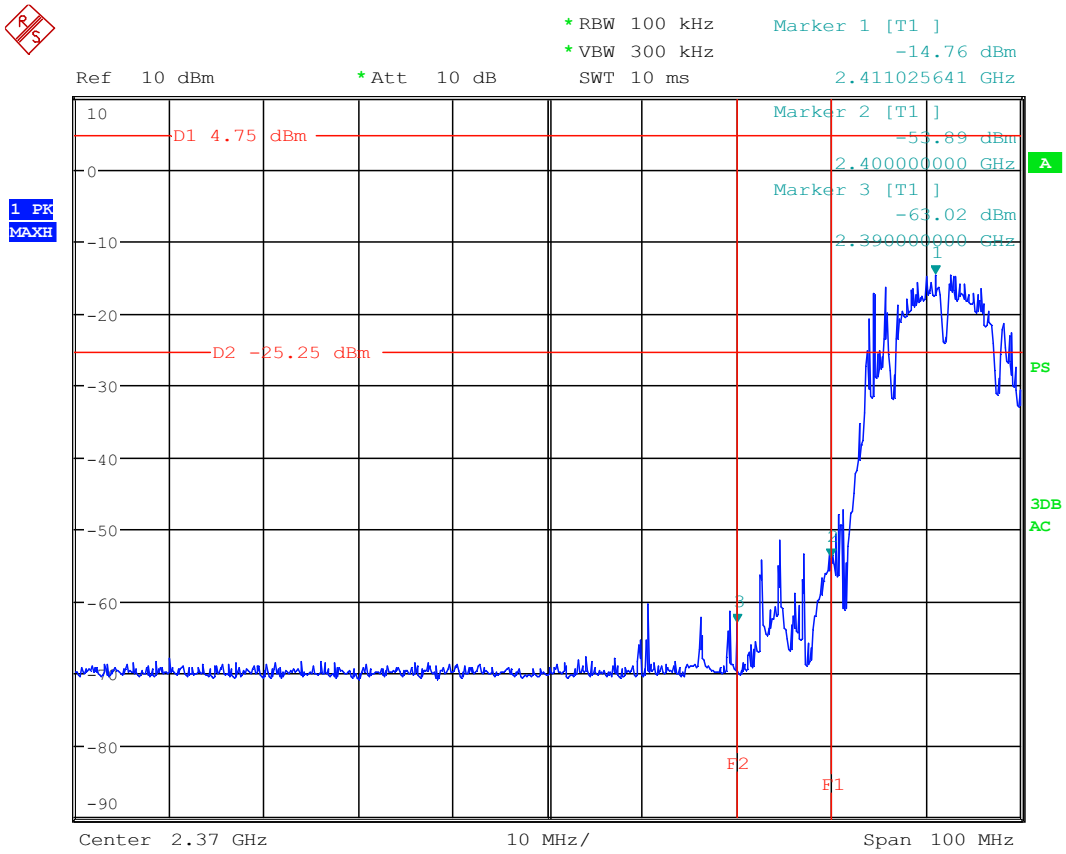



Measured Carrier Power: 7.81dBm
Spurious Emissions LIMIT: -22.19dBm
mod_Peak_ant_H
Spurious Emissions
1GHz-4GHz
Amplitude dBm
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
1.00G
4.00G
Frequency MHz

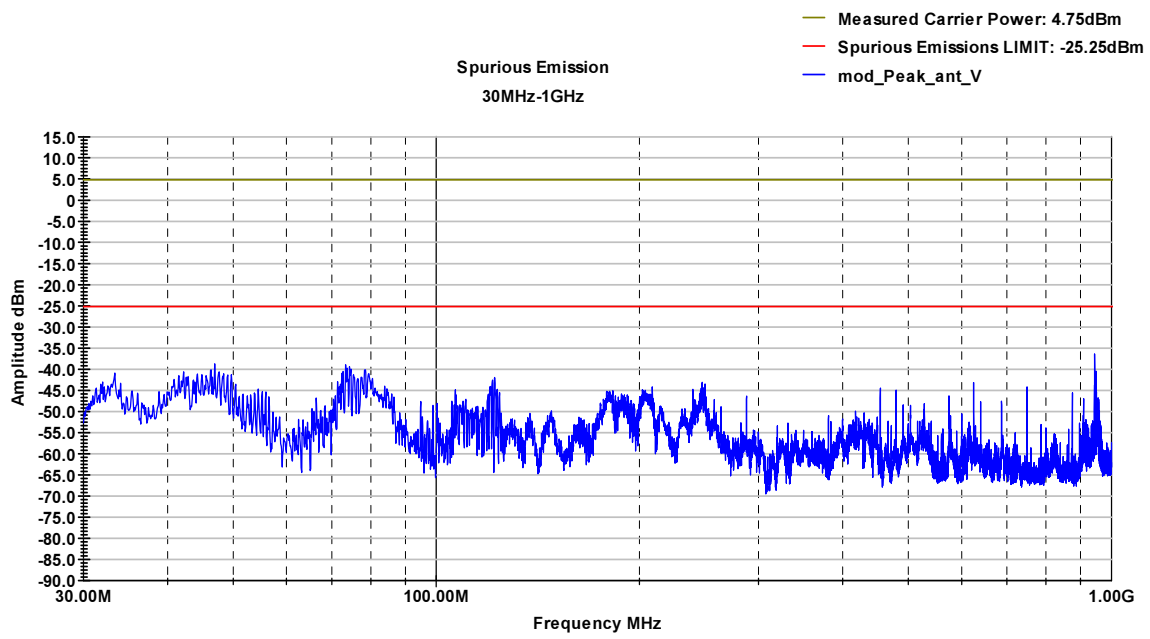

Measured Carrier Power: 7.81dBm
Spurious Emissions LIMIT: -22.19dBm
mod_Peak_Sub_H
Spurious Emissions
4GHz-25GHz
Amplitude dBm
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
-85.0
-90.0
4.00G
10.00G
25.00G
Frequency MHz

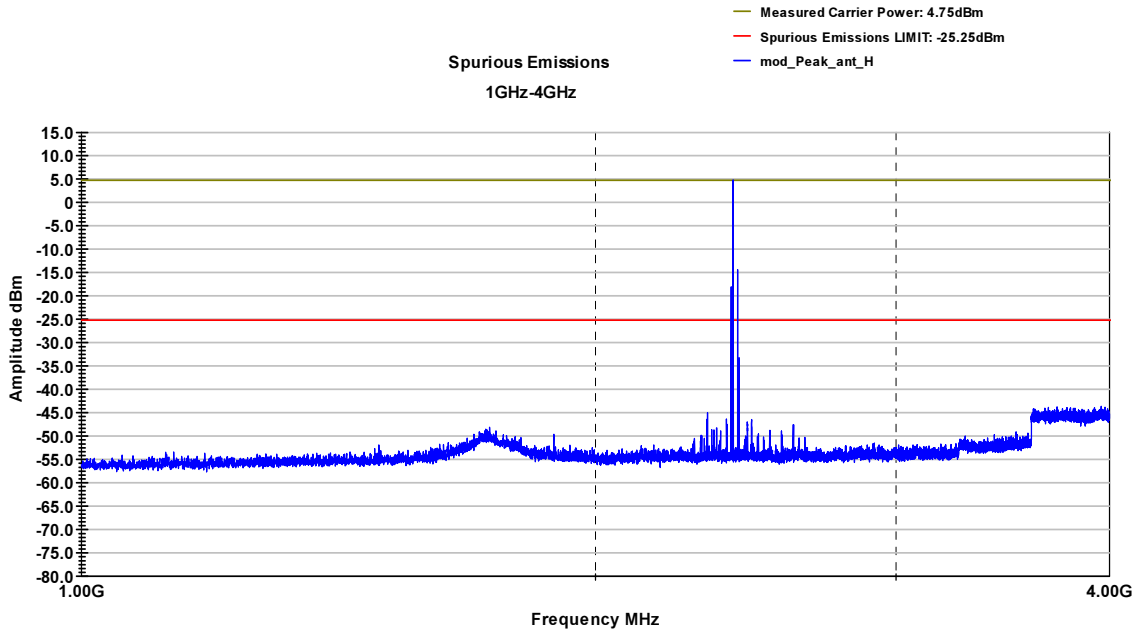
Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11g
Channel: #1

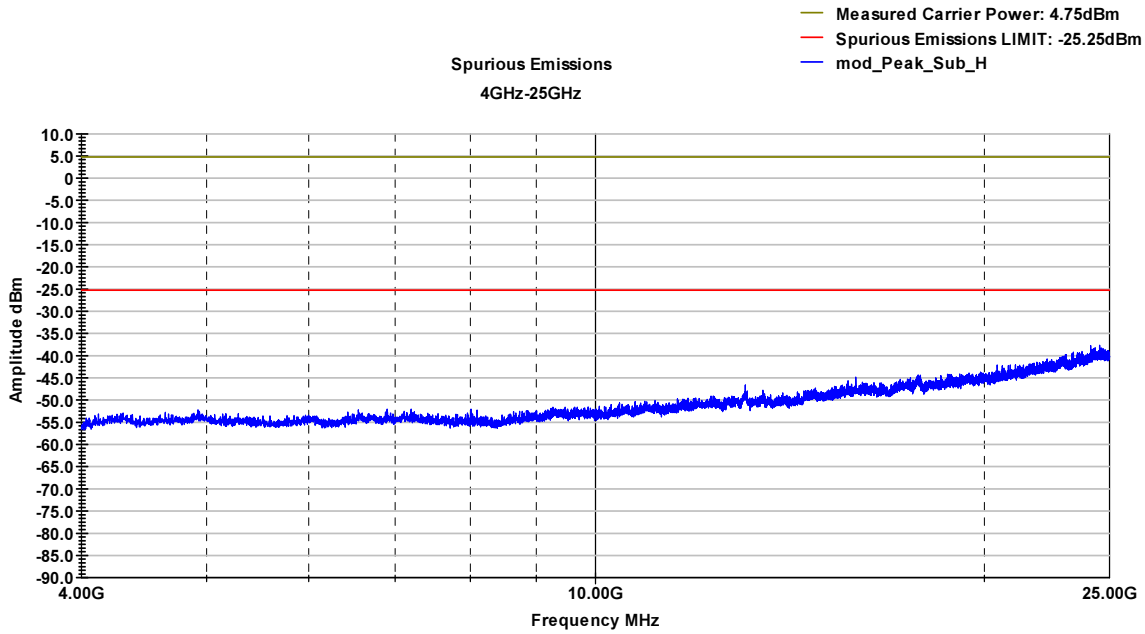
BAND EDGE



Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11g
Channel: #1

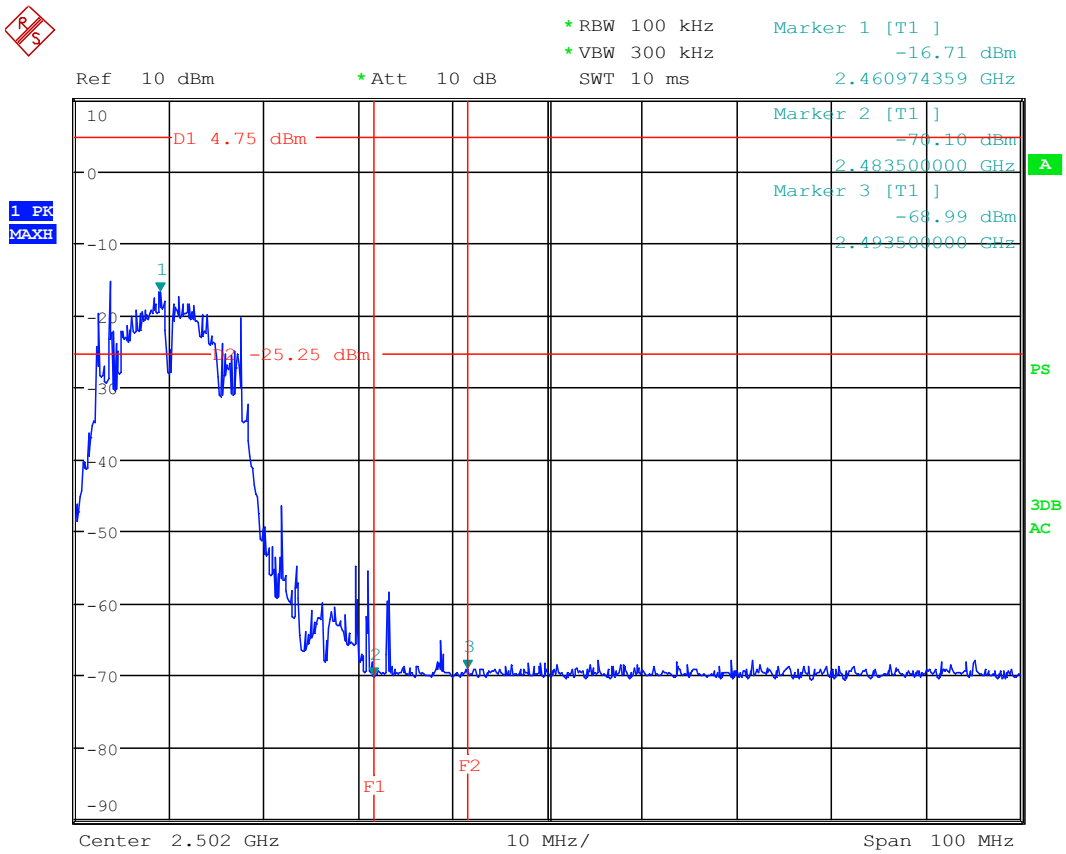



Measured Carrier Power: 4.75dBm
Spurious Emissions LIMIT: -25.25dBm
mod_Peak_ant_H
Spurious Emissions
1GHz-4GHz
Amplitude dBm
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
1.00G
4.00G
Frequency MHz

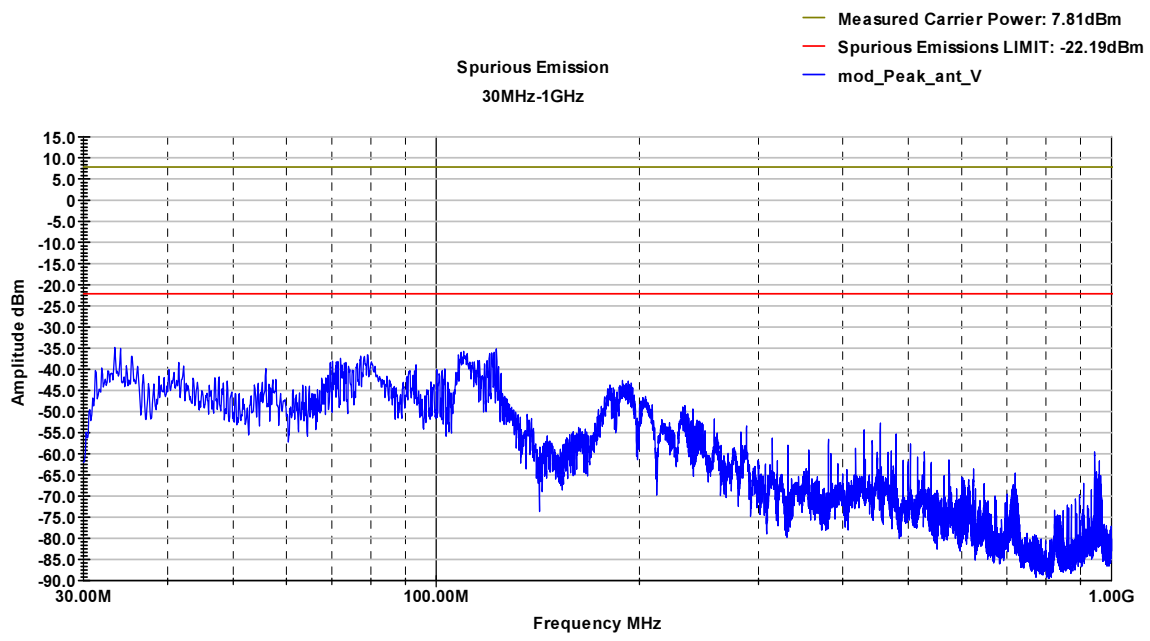

Measured Carrier Power: 4.75dBm
Spurious Emissions LIMIT: -25.25dBm
mod_Peak_Sub_H
Spurious Emissions
4GHz-25GHz
Amplitude dBm
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
-85.0
-90.0
4.00G
10.00G
25.00G
Frequency MHz

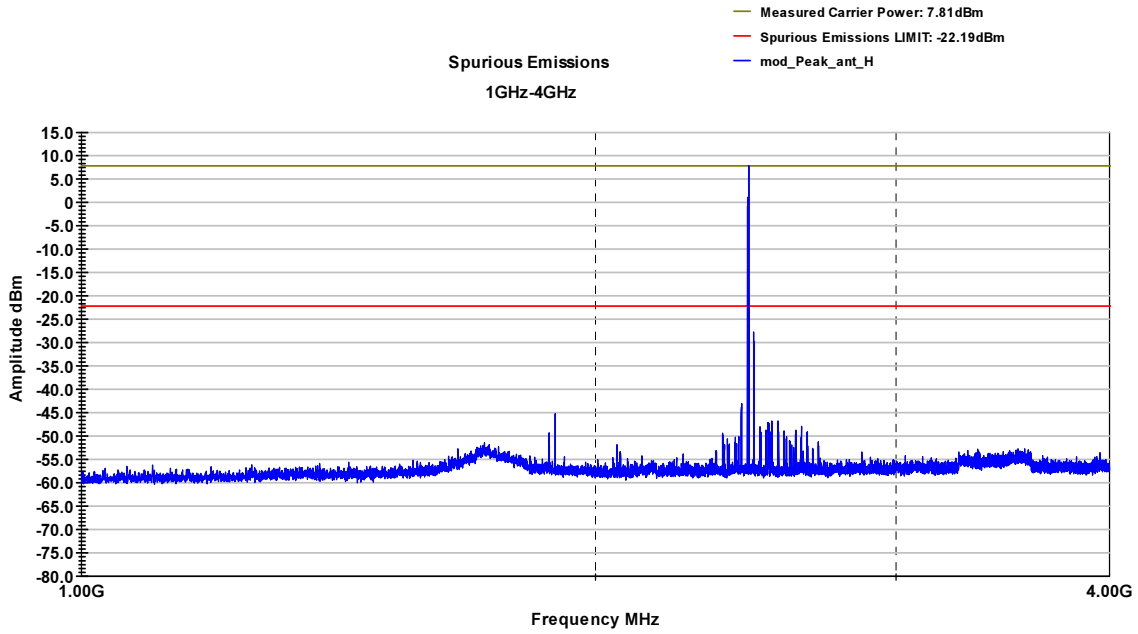
Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11g
Channel: #11

BAND EDGE



Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11g
Channel: #11




Measured Carrier Power: 7.81dBm
Spurious Emissions LIMIT: -22.19dBm
mod_Peak_ant_H
Spurious Emissions
1GHz-4GHz
Amplitude dBm
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
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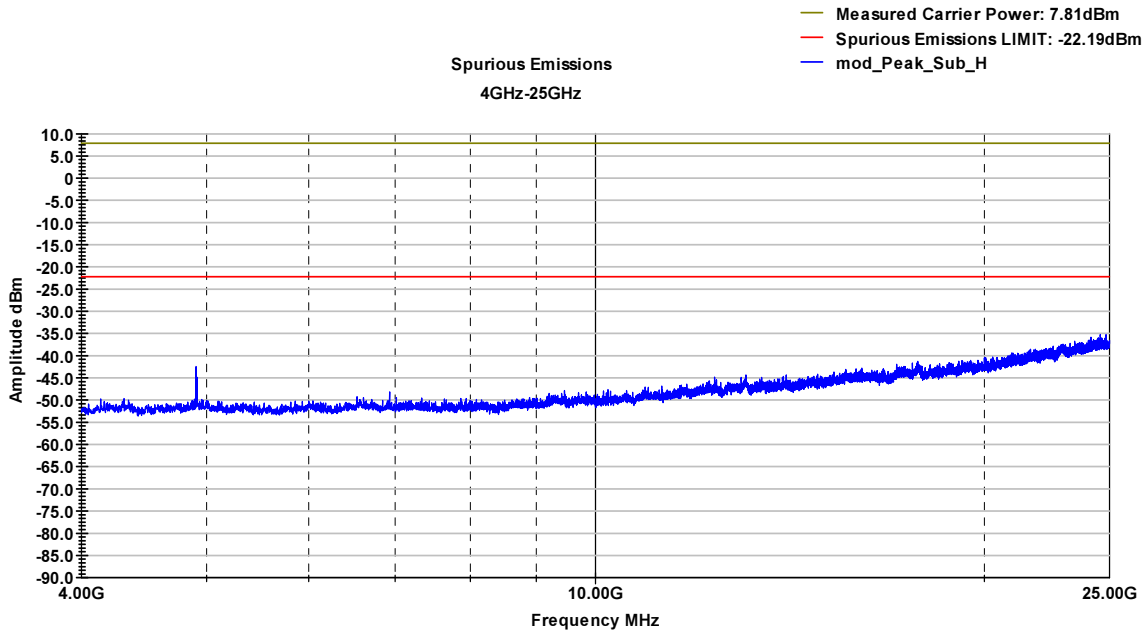
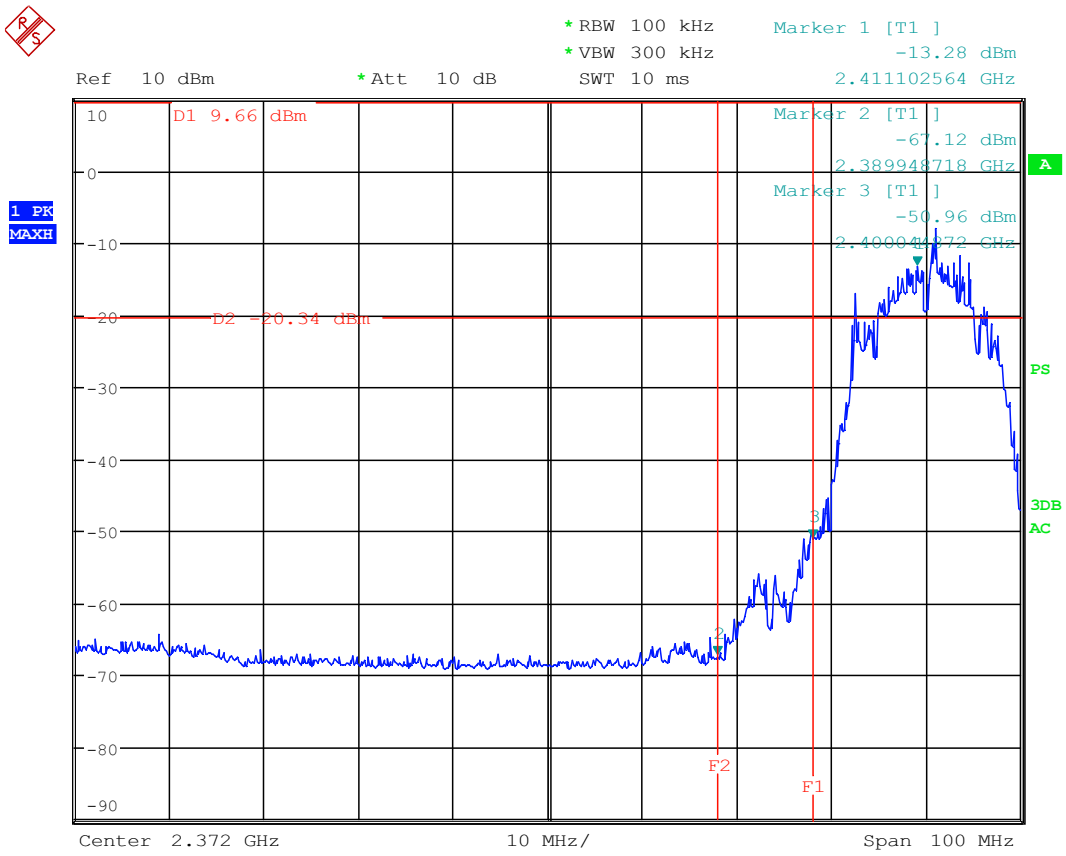
1.00G
4.00G
Frequency MHz

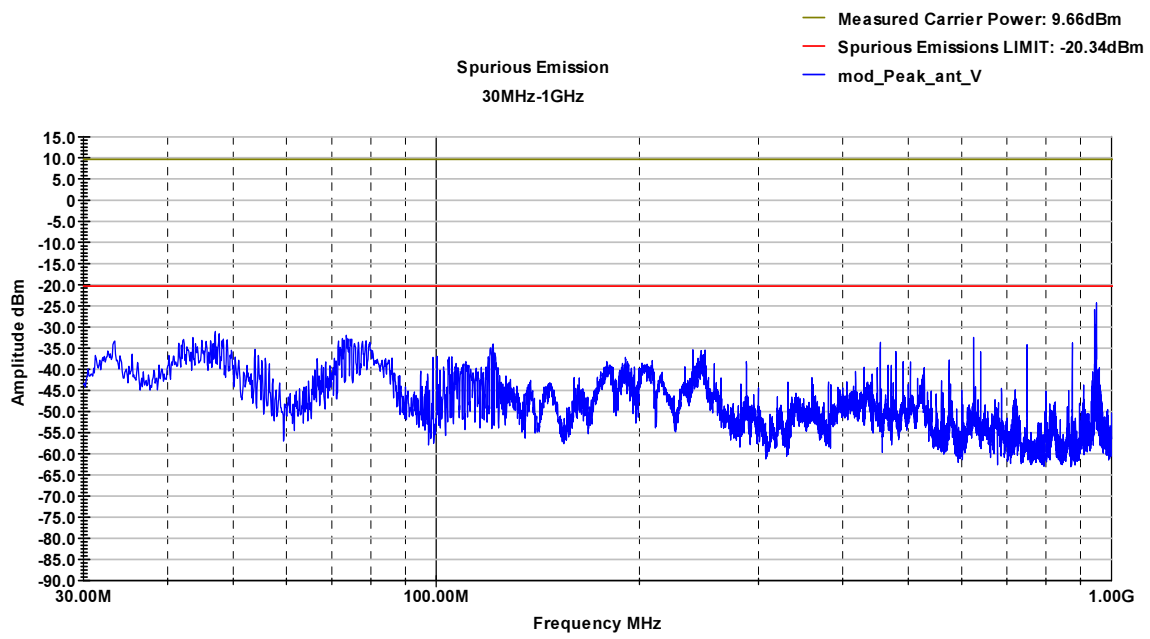

Measured Carrier Power: 7.81dBm
Spurious Emissions LIMIT: -22.19dBm
mod_Peak_Sub_H
Spurious Emissions
4GHz-25GHz
Amplitude dBm
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
-85.0
-90.0
4.00G
10.00G
25.00G
Frequency MHz

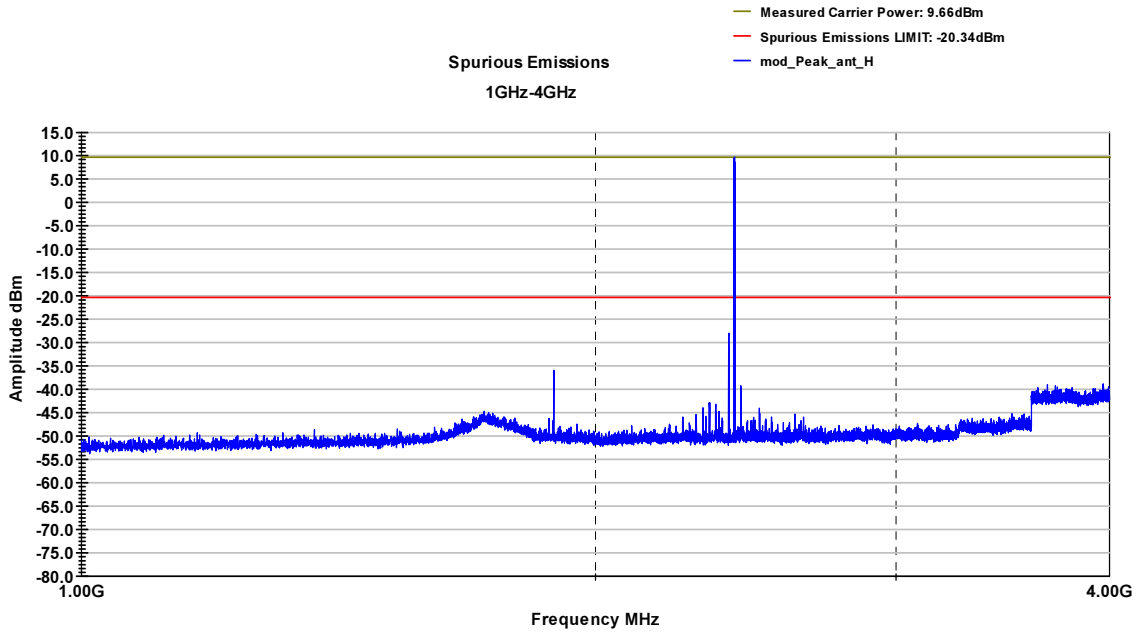
Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11n
Channel: #1

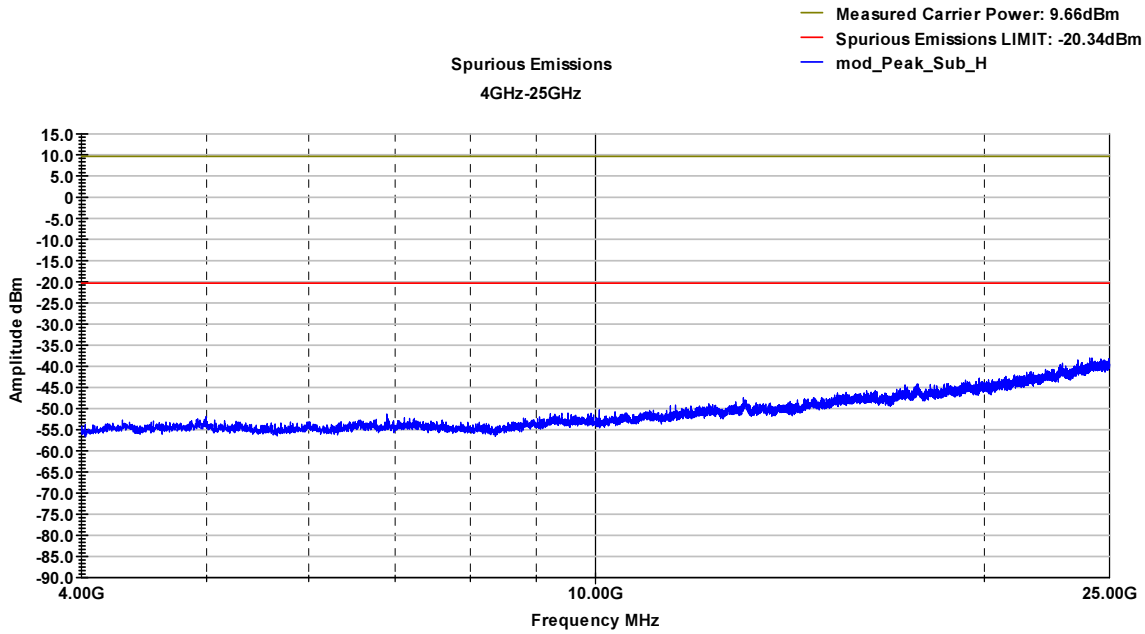
BAND EDGE



Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11n
Channel: #1

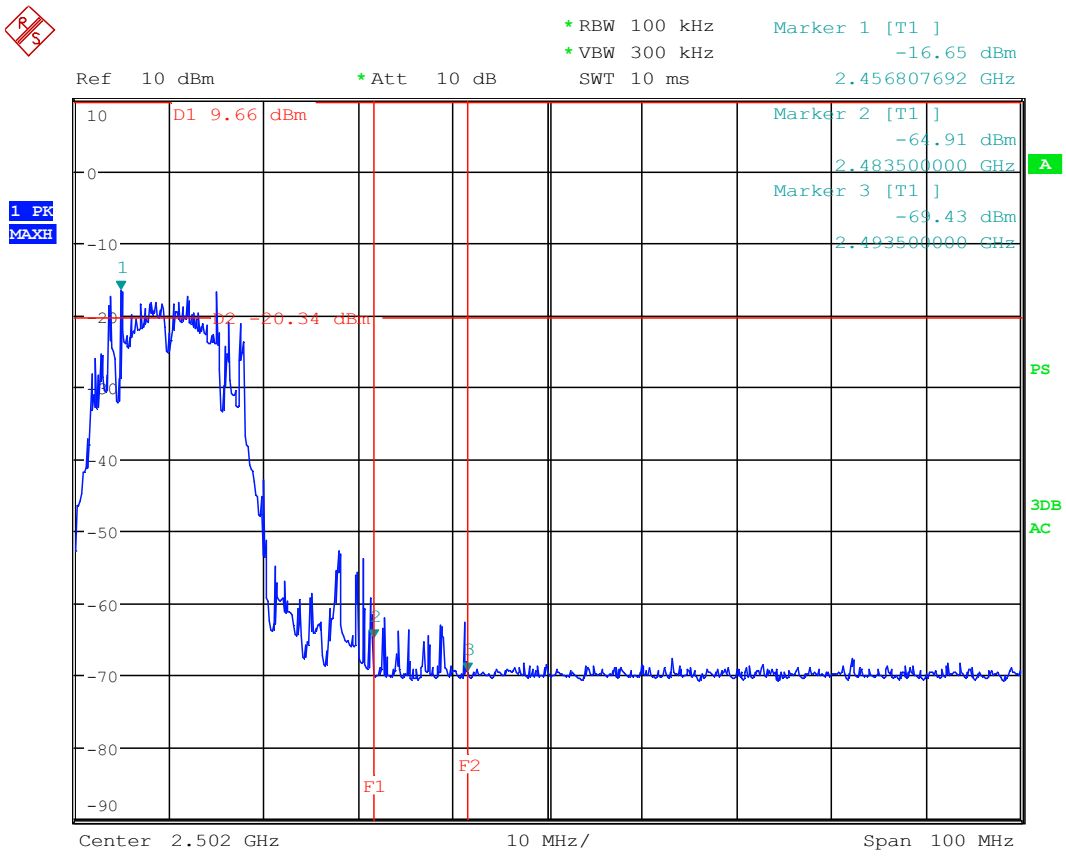



Measured Carrier Power: 9.66dBm
Spurious Emissions LIMIT: -20.34dBm
mod_Peak_ant_H
Spurious Emissions
1GHz-4GHz
Amplitude dBm
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
1.00G
4.00G
Frequency MHz

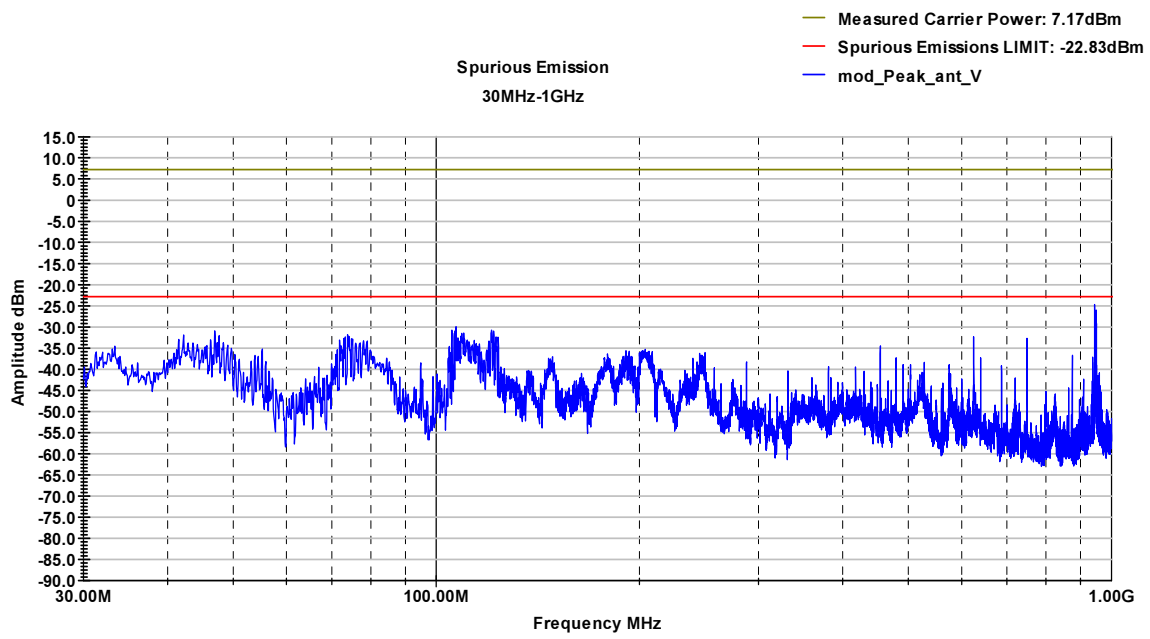

Measured Carrier Power: 9.66dBm
Spurious Emissions LIMIT: -20.34dBm
mod_Peak_Sub_H
Spurious Emissions
4GHz-25GHz
Amplitude dBm
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
-85.0
-90.0
4.00G
10.00G
25.00G
Frequency MHz

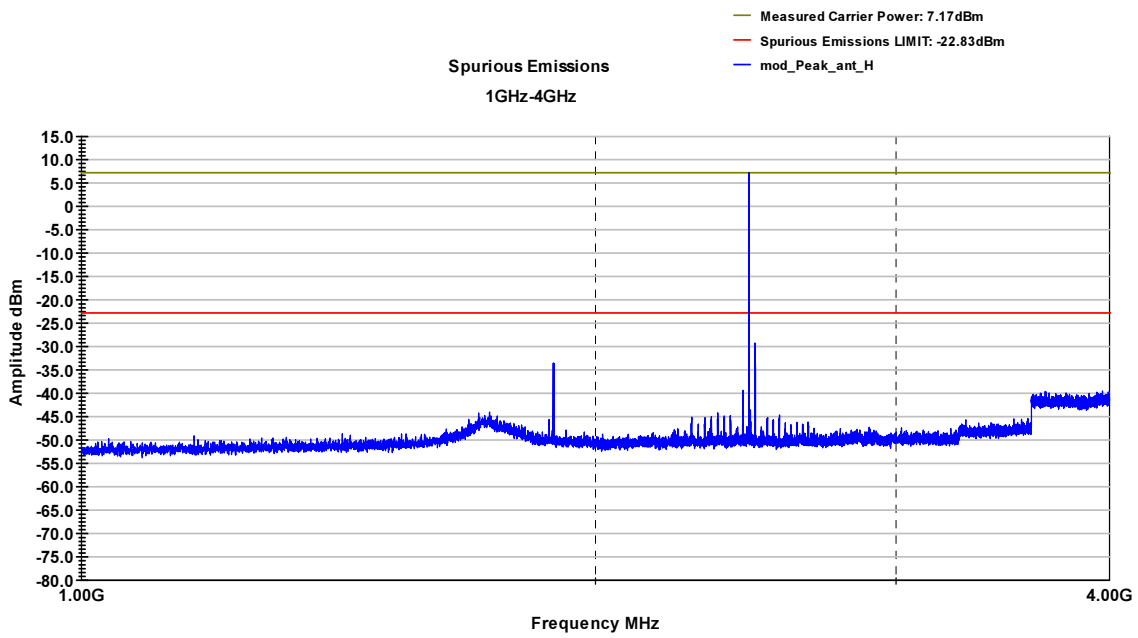
Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11n
Channel: #11

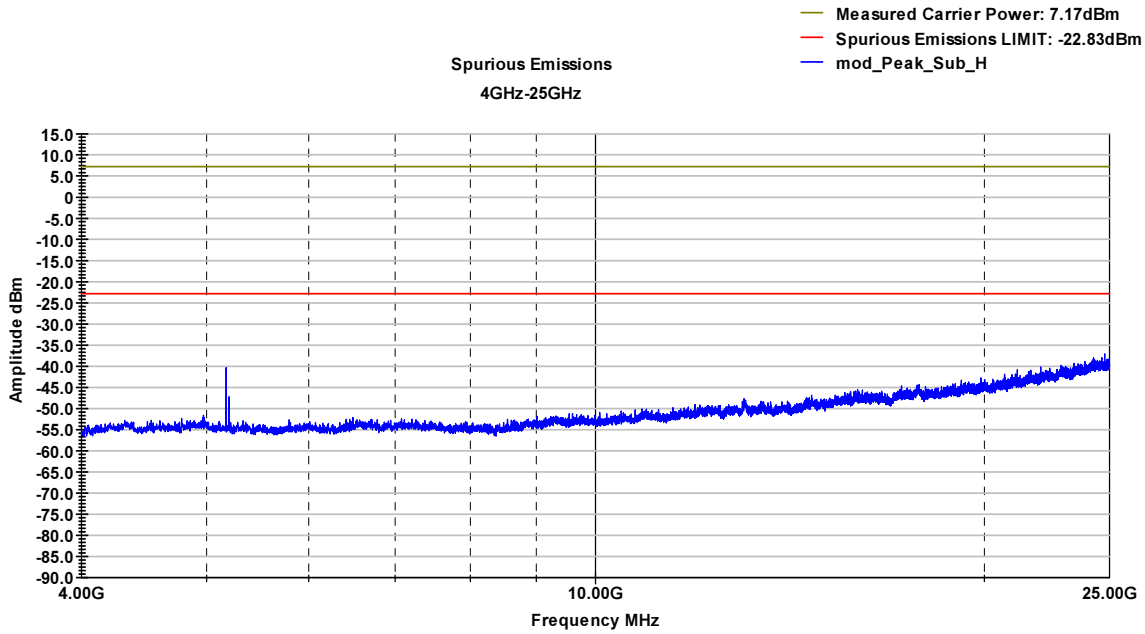
BAND EDGE



Graphical representation of Antenna Port Spurious Emission - Conducted
Operation Mode: #1
Standard: IEE 802.11n
Channel: #11




Measured Carrier Power: 7.17dBm
Spurious Emissions LIMIT: -22.83dBm
mod_Peak_ant_H
Spurious Emissions
1GHz-4GHz
Amplitude dBm
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
1.00G
4.00G
Frequency MHz

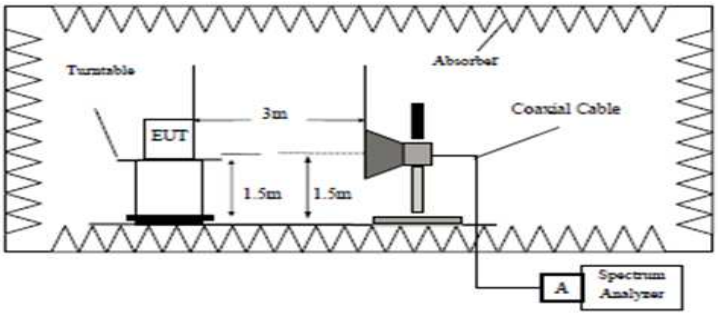

Measured Carrier Power: 7.17dBm
Spurious Emissions LIMIT: -22.83dBm
mod_Peak_Sub_H
Spurious Emissions
4GHz-25GHz
Amplitude dBm
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
-85.0
-90.0
4.00G
10.00G
25.00G
Frequency MHz

17. Test Conditions and Results – RADIATED ANTENNA PORT SPURIOUS EMISSION (external antenna)

18	TEST: Radiated Antenna Port Spurious Emission (external antenna)	PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	21°C
	Relative Humidity (%)	52%
	Air pressure (hPa)	1020
—	Frequency	Application Point
Fully configured sample tested at the power line frequency	115V ~ 60Hz	Enclosure
Equipment mode:	Operation mode	#1
FCC Standard	§15.247	

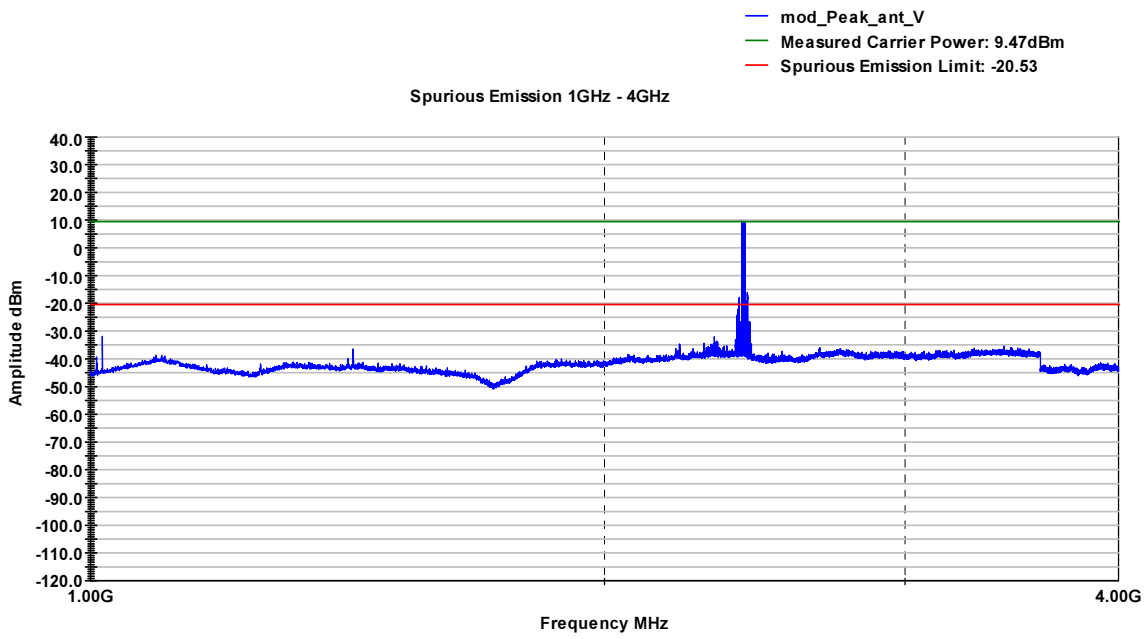
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains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

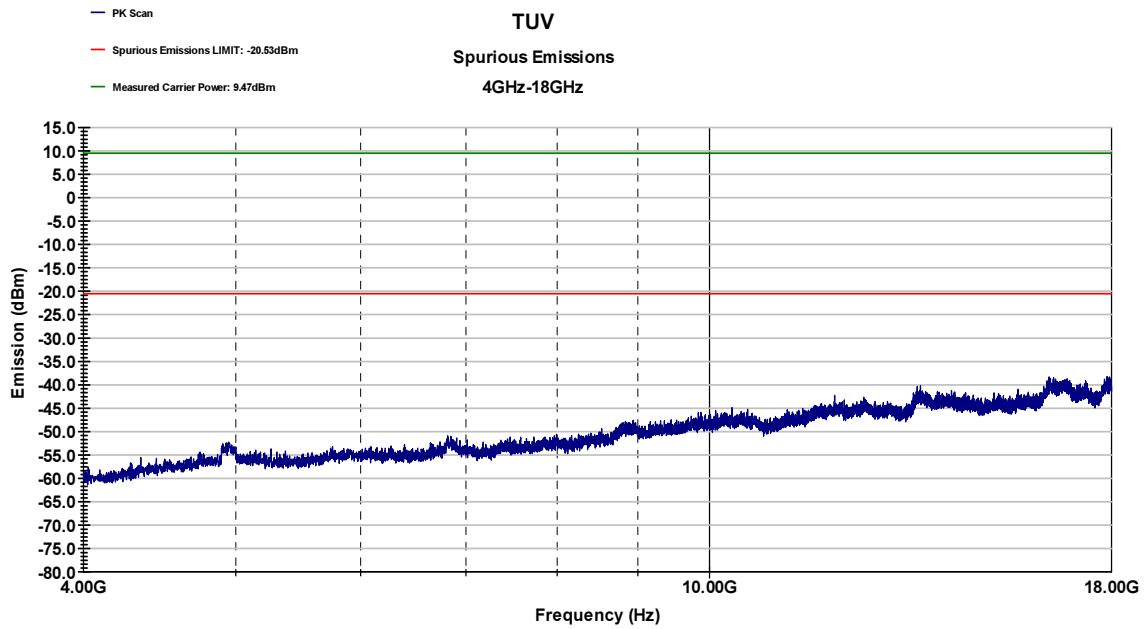
Further information to test setup

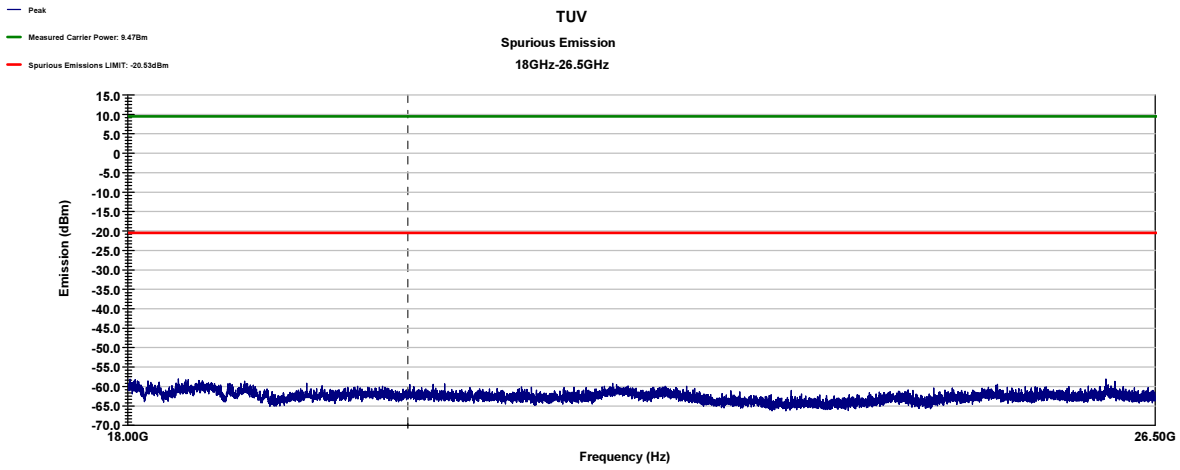


Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
CSSA	ETS Lindgren	FACT3	87020484	10/2015	10/2016
EMI Test Receiver	R&S	ESU40	87020455	04/2016	04/2017
Antenna BiConiLog	ETS Lindgren	3124E-PA	87020457	04/2014	04/2017
Antenna Horn with Preamplifier	ETS Lindgren	3117-PA	87020458	04/2014	04/2017
2xAntenna Horn with Preamplifier	ETS Lindgren	114514 120722	87020459 87020460	04/2014	04/2017

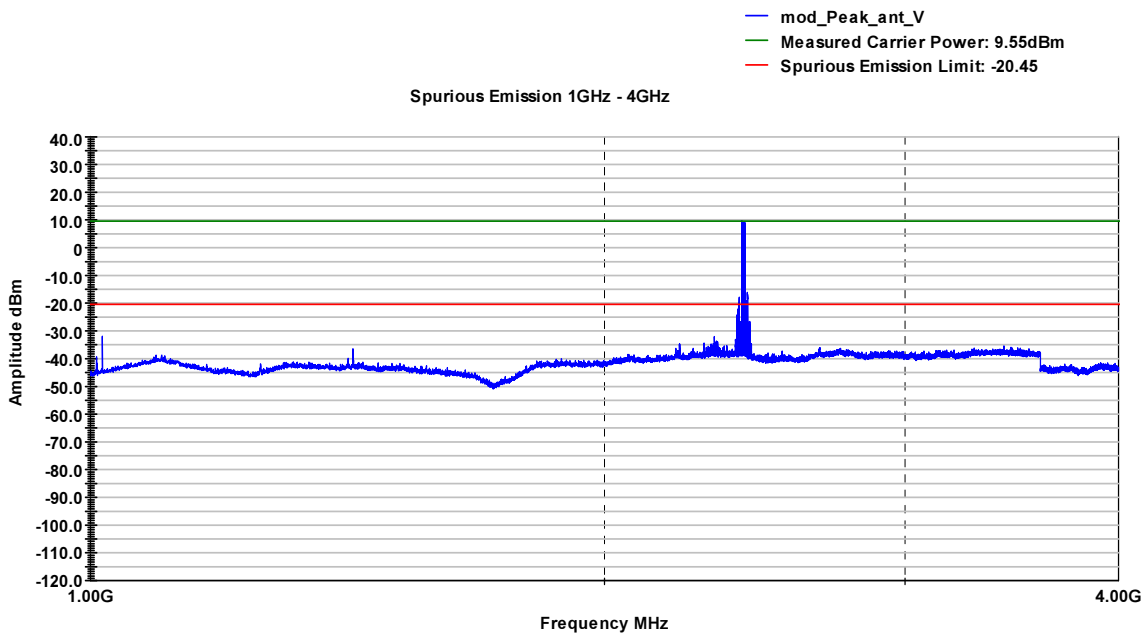
Graphical representation of Antenna Port Spurious Emission - Radiated
Operation Mode: #1
Standard: IEE 802.11b
Channel: #1 (worst condition)

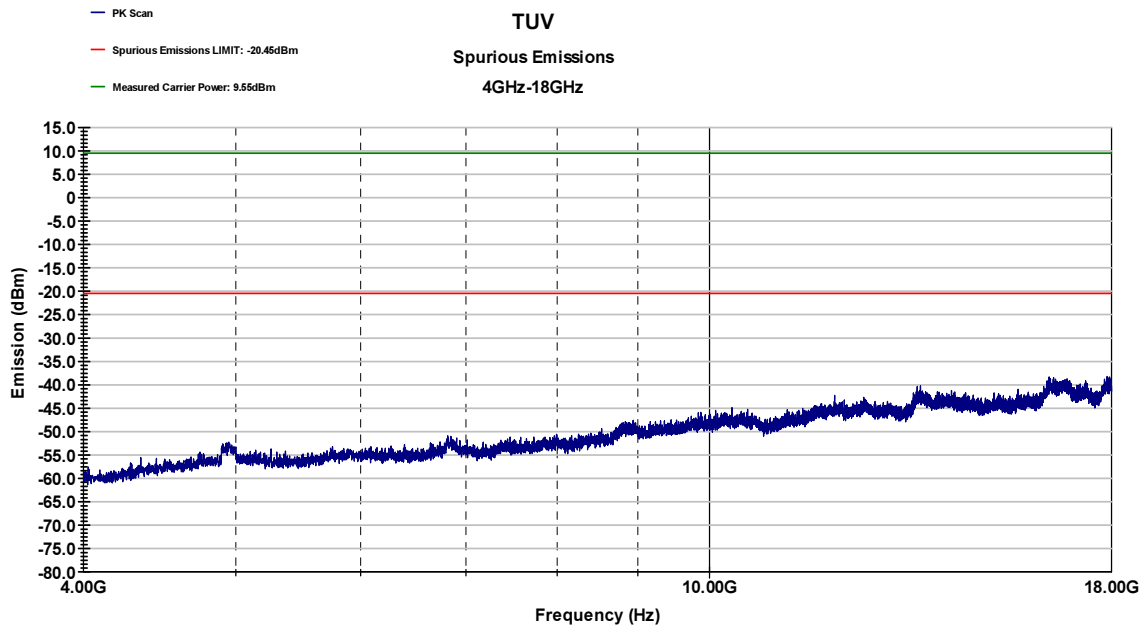


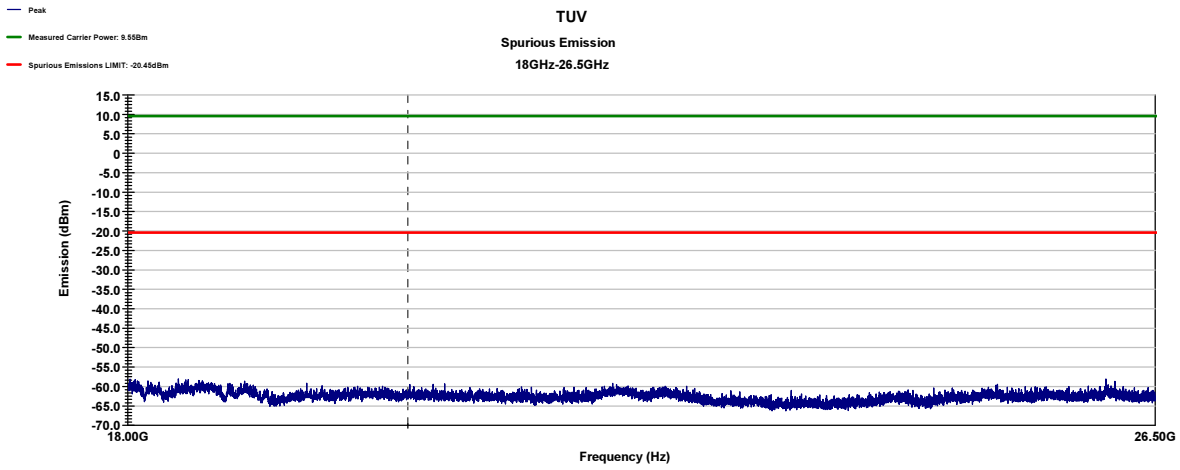

PK Scan
Spurious Emissions LIMIT: -20.53dBm
Measured Carrier Power: 9.47dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)


Peak
Measured Carrier Power: 9.47Bm
Spurious Emissions LIMIT: -20.53dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

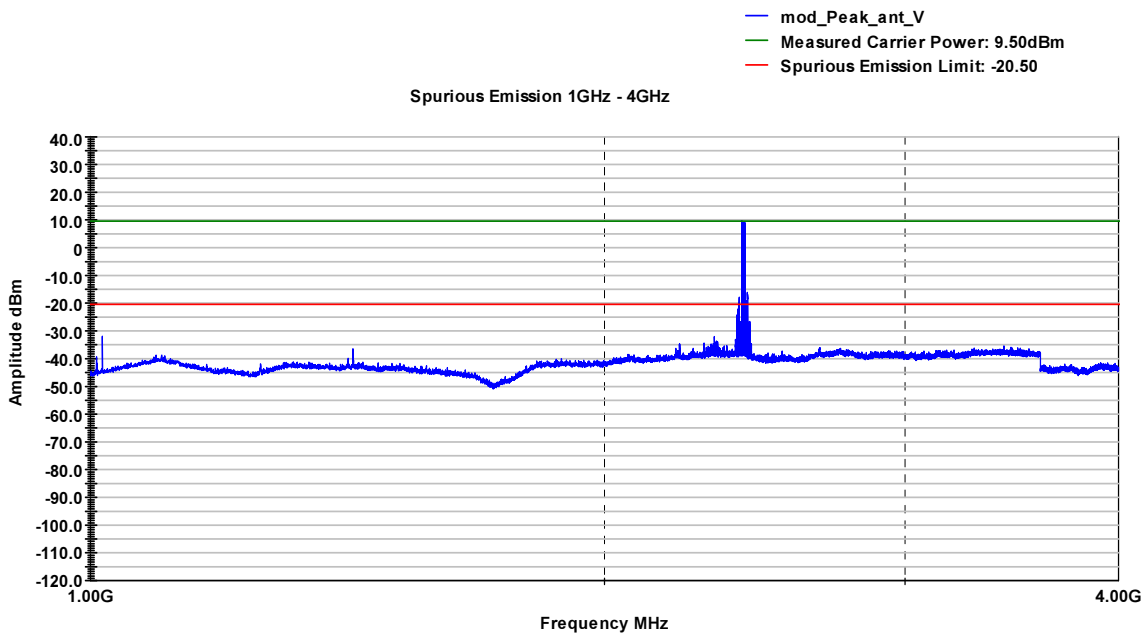
Graphical representation of Antenna Port Spurious Emission - Radiated
Operation Mode: #1
Standard: IEE 802.11g
Channel: #1 (worst condition)

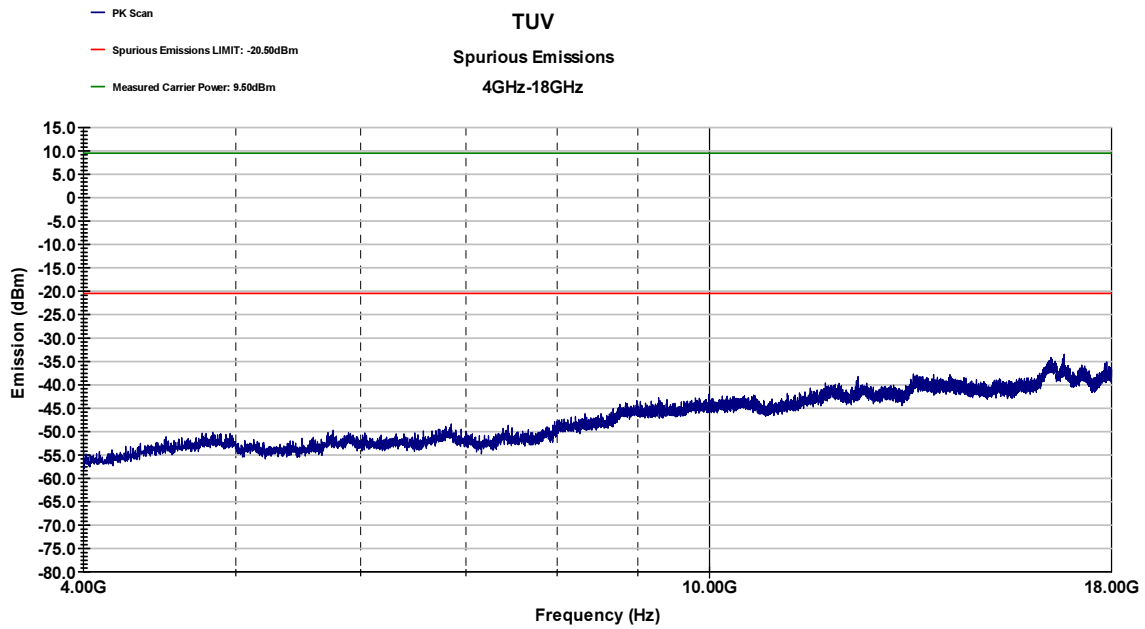


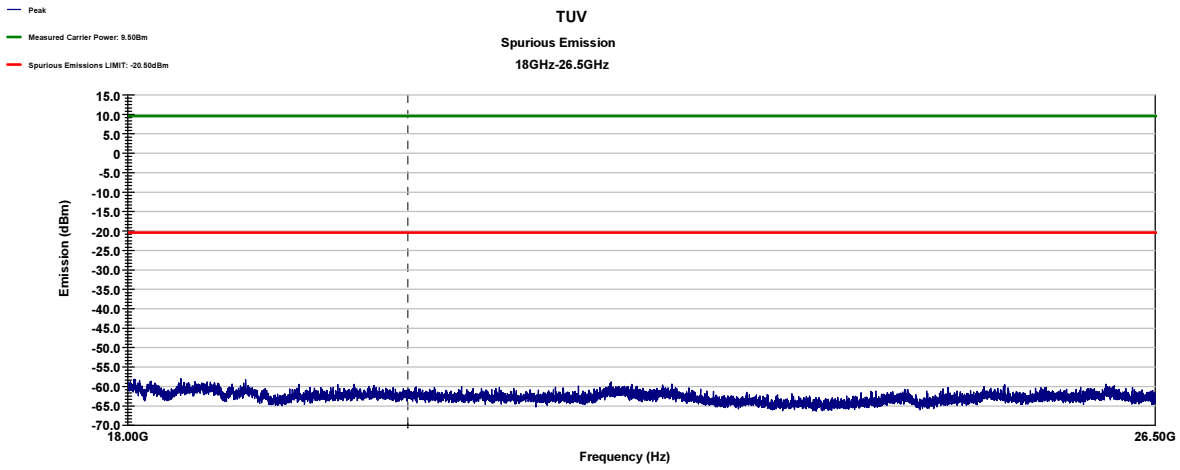

PK Scan
Spurious Emissions LIMIT: -20.45dBm
Measured Carrier Power: 9.55dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)


Peak
Measured Carrier Power: 9.55Bm
Spurious Emissions LIMIT: -20.45dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

Graphical representation of Antenna Port Spurious Emission - Radiated
Operation Mode: #1
Standard: IEE 802.11n
Channel: #1 (worst condition)




PK Scan
Spurious Emissions LIMIT: -20.50dBm
Measured Carrier Power: 9.50dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

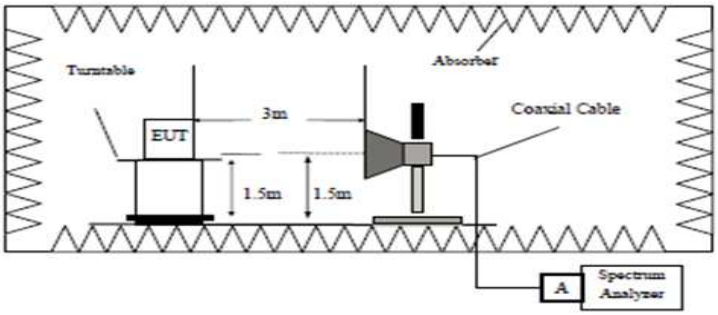

Peak
Measured Carrier Power: 9.50Bm
Spurious Emissions LIMIT: -20.50dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

18. Test Conditions and Results – RADIATED ANTENNA PORT SPURIOUS EMISSIONS (internal antenna)

19	TEST: Radiated Antenna Port Spurious Emission (internal antenna)	PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	21°C
	Relative Humidity (%)	49%
	Air pressure (hPa)	1020
—	Frequency	Application Point
Fully configured sample tested at the power line frequency	115V ~ 60Hz	Enclosure
Equipment mode:	Operation mode	#1
FCC Standard	§15.247	

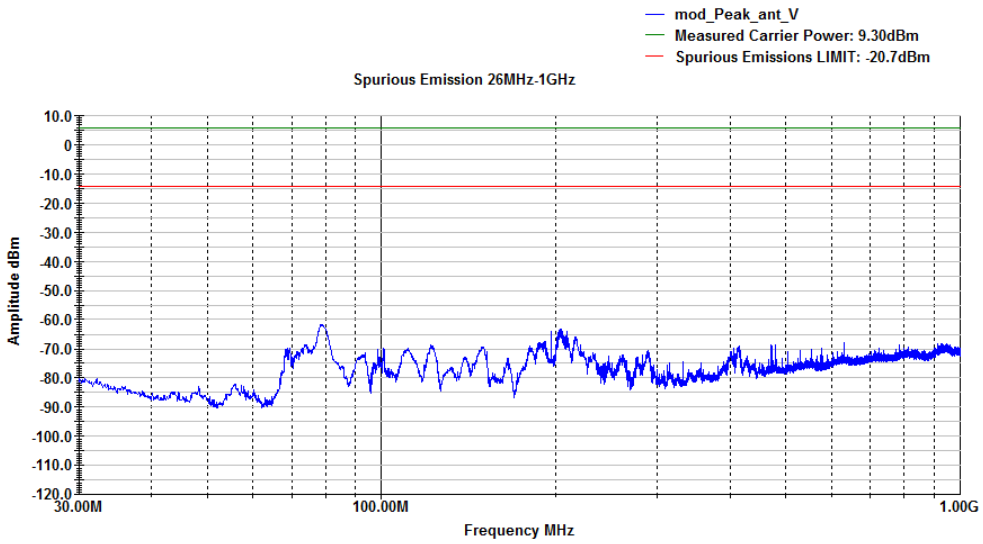
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains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

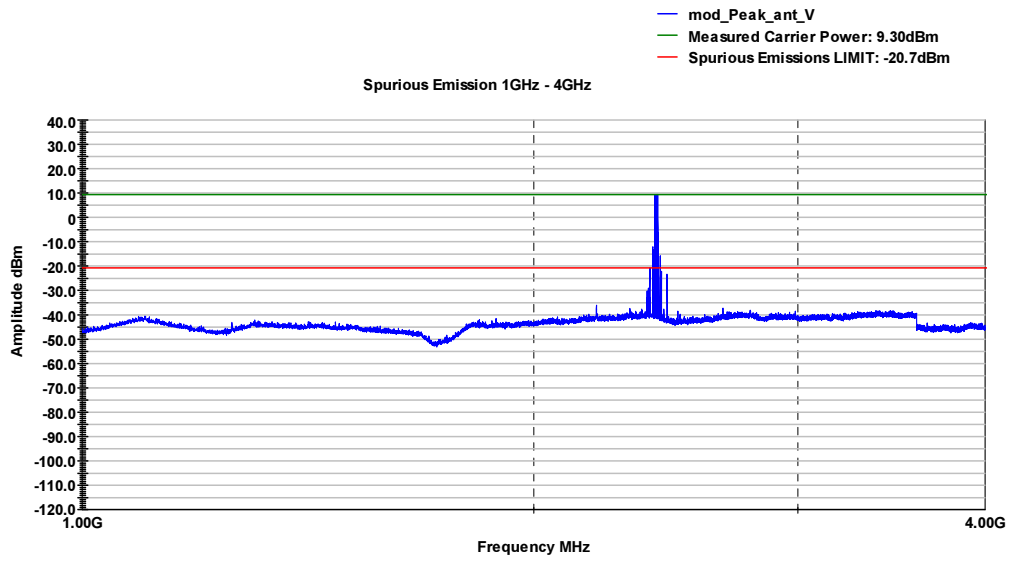
Further information to test setup

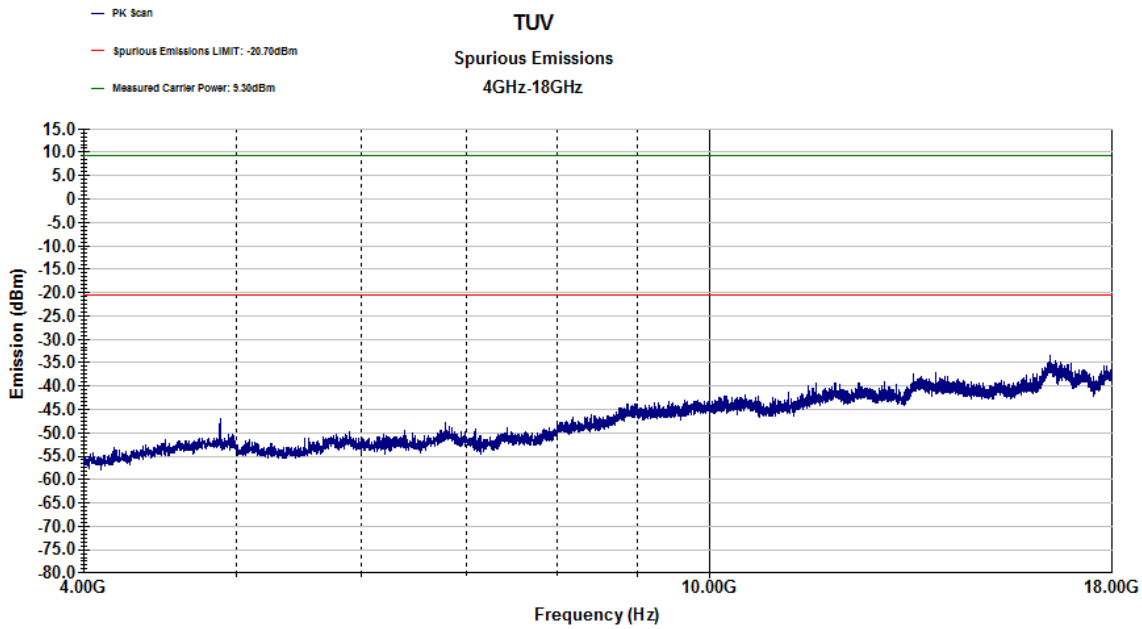


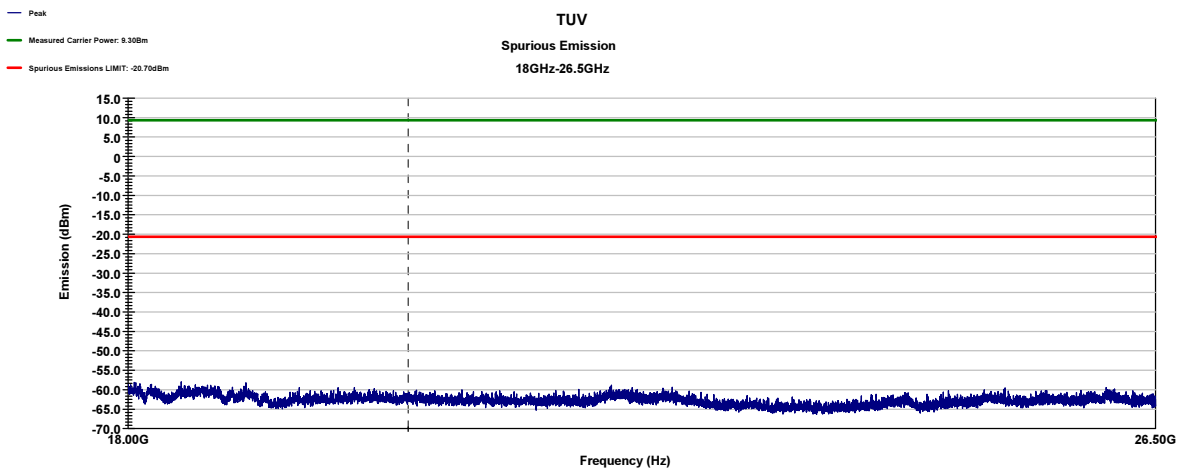
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
CSSA	ETS Lindgren	FACT3	87020484	10/2015	10/2016
EMI Test Receiver	R&S	ESU40	87020455	04/2016	04/2017
Antenna BiConiLog	ETS Lindgren	3124E-PA	87020457	04/2014	04/2017
Antenna Horn with Preamplifier	ETS Lindgren	3117-PA	87020458	04/2014	04/2017

Graphical representation of Antenna Port Spurious Emission - Radiated
Operation Mode: #2
Standard: IEE 802.11b
Channel: #11
SPURIOUS EMISSION - VERTICAL

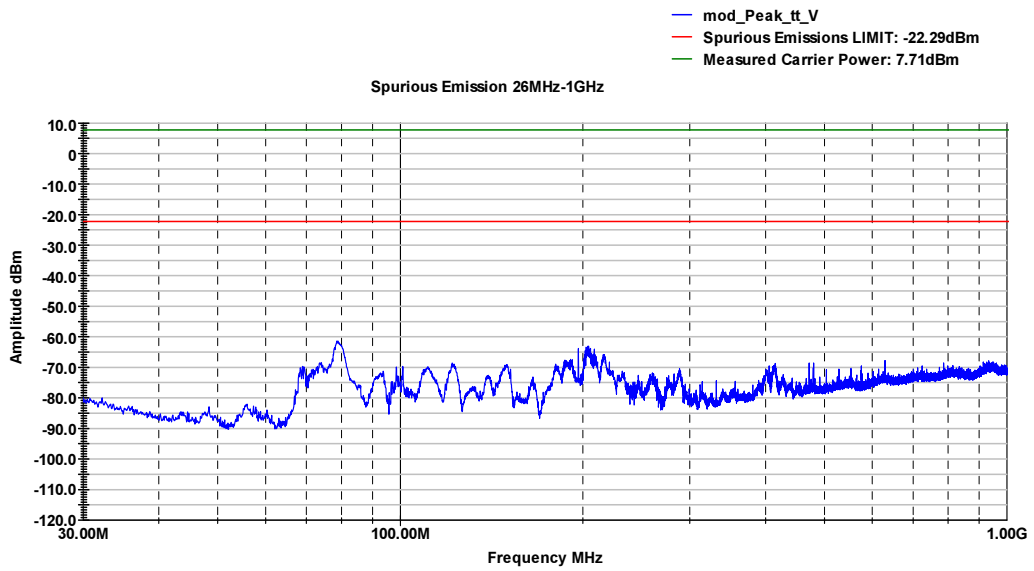


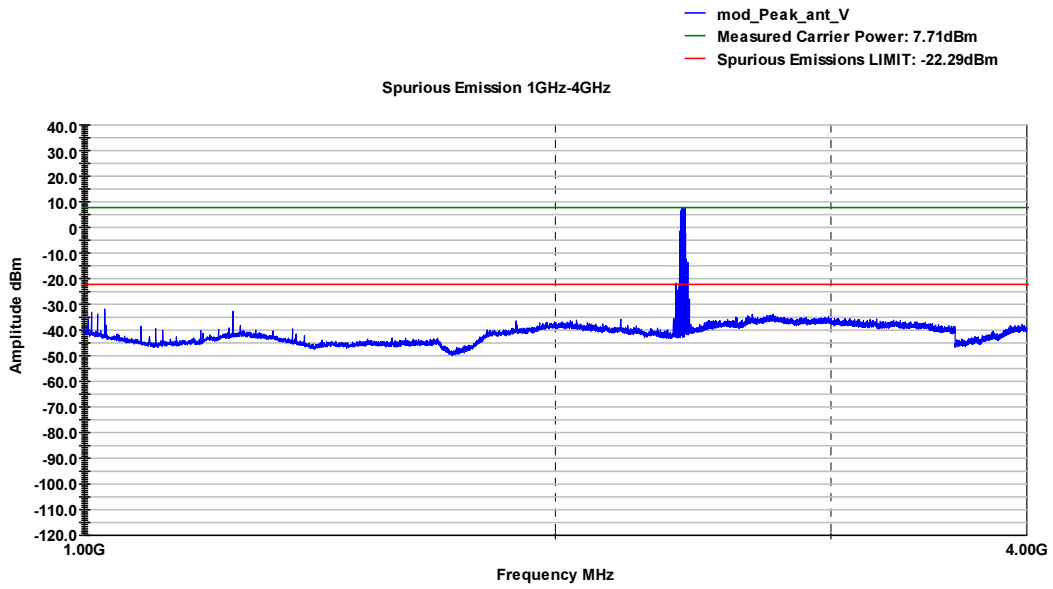

mod_Peak_ant_V
Measured Carrier Power: 9.30dBm
Spurious Emissions LIMIT: -20.7dBm
Spurious Emission 1GHz - 4GHz
Amplitude dBm
40.0
30.0
20.0
10.0
0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0
-120.0
1.00G
4.00G
Frequency MHz

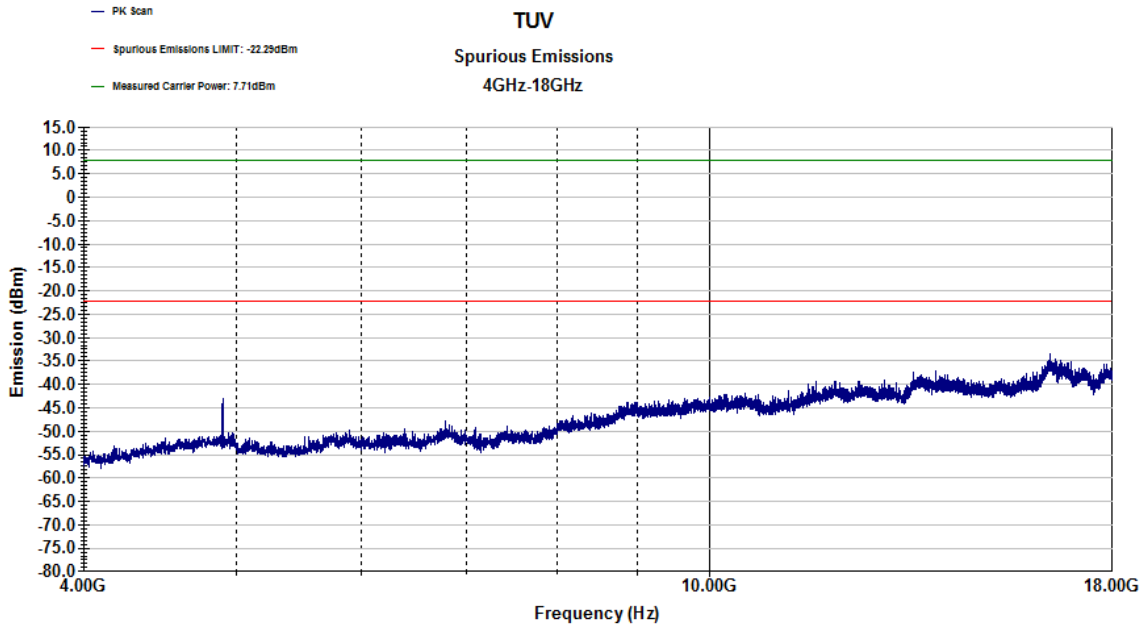

PK Scan
Spurious Emissions LIMIT: -20.70dBm
Measured Carrier Power: 9.30dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

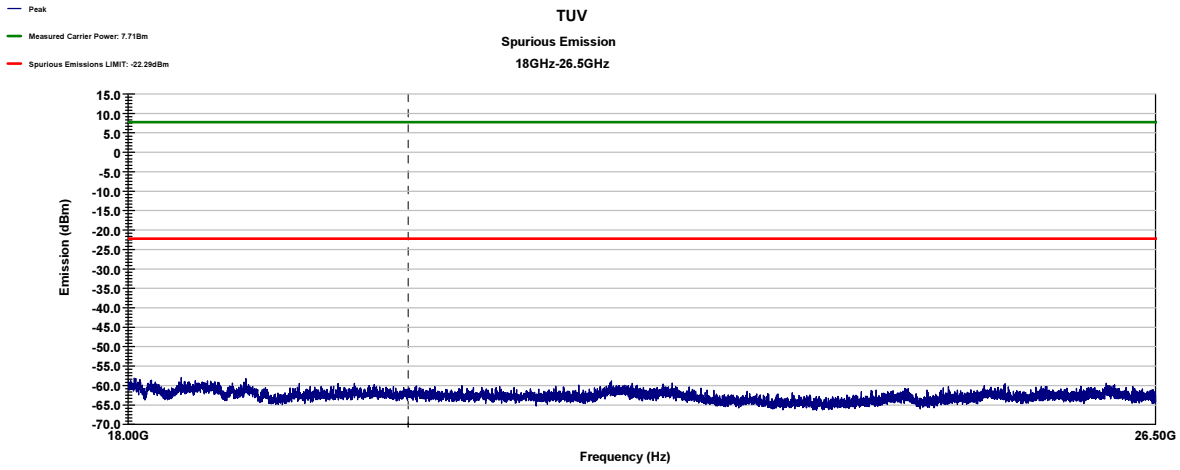

Peak
Measured Carrier Power: 9.30Bm
Spurious Emissions LIMIT: -20.70dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

SPURIOUS EMISSION - HORIZONTAL

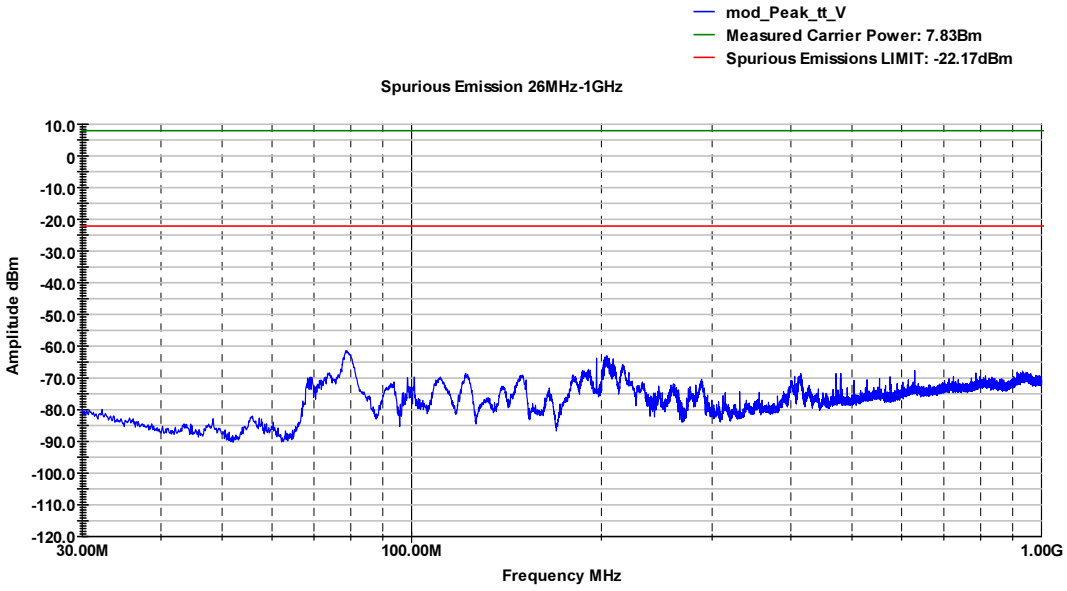


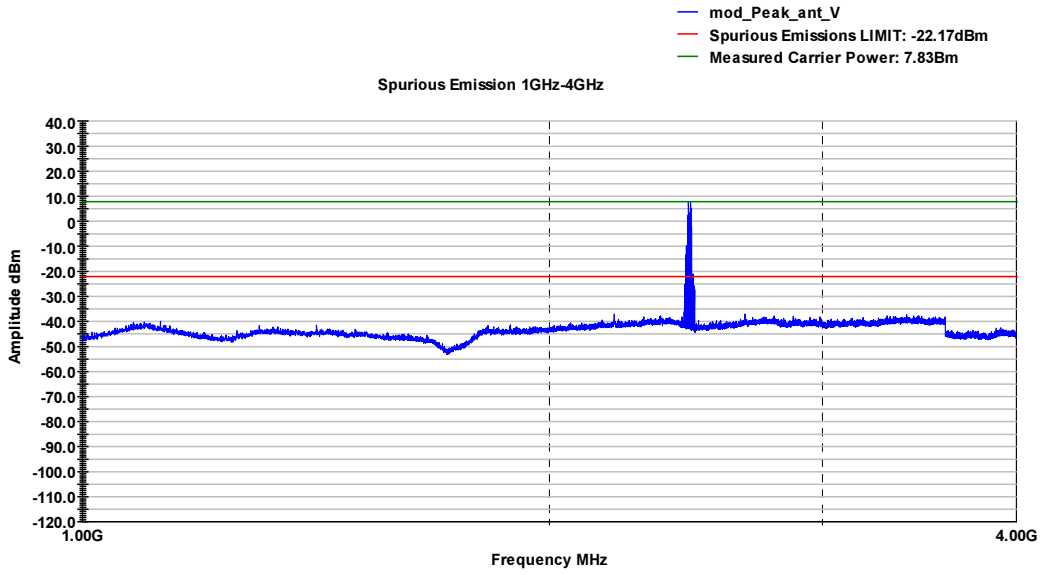


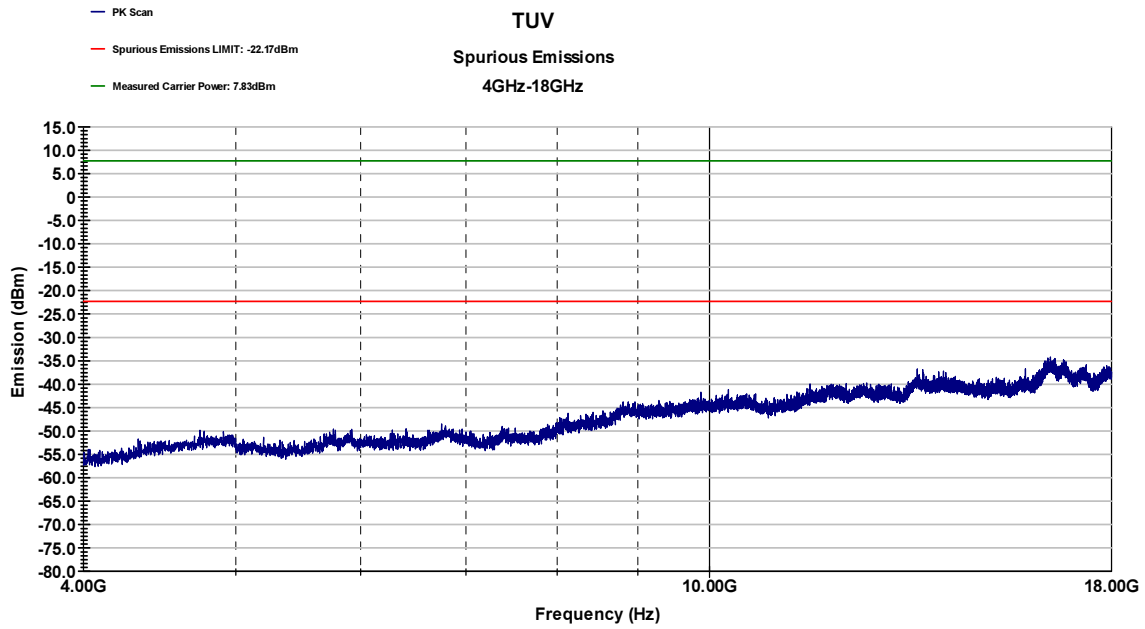

PK Scan
Spurious Emissions LIMIT: -22.29dBm
Measured Carrier Power: 7.71dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

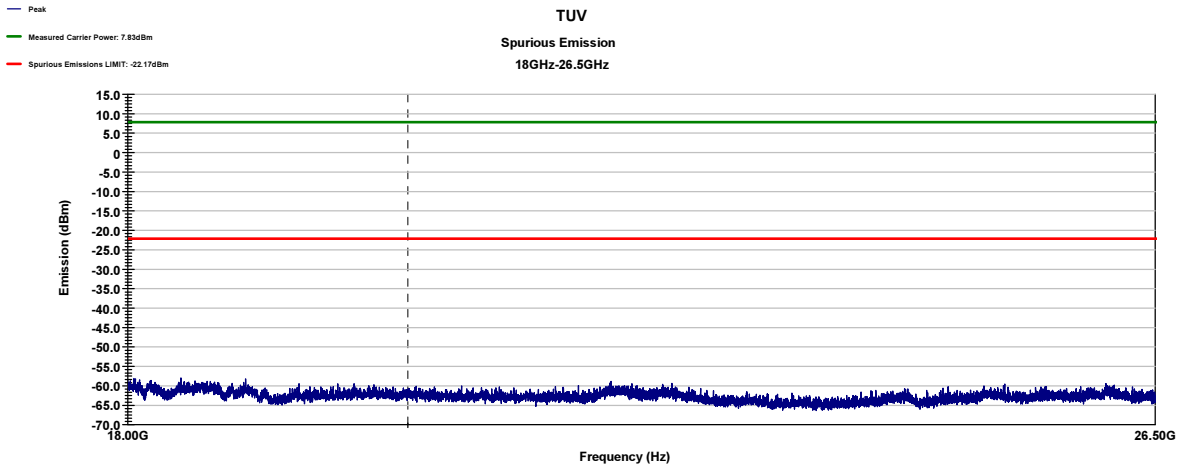

Peak
Measured Carrier Power: 7.71Bm
Spurious Emissions LIMIT: -22.29dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

Graphical representation of Antenna Port Spurious Emission - Radiated
Operation Mode: #2
Standard: IEE 802.11b
Channel: #11
SPURIOUS EMISSION - VERTICAL

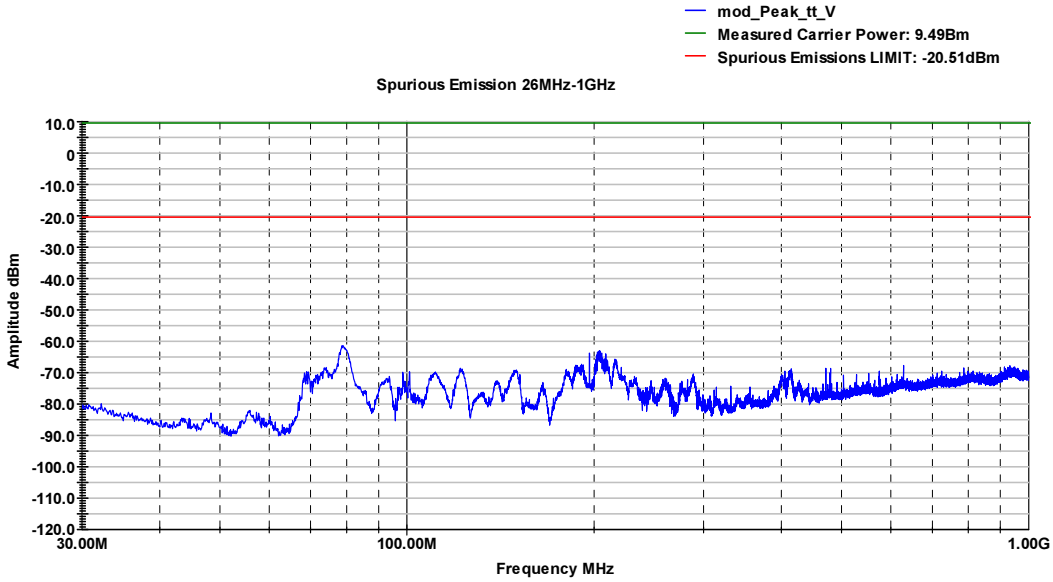


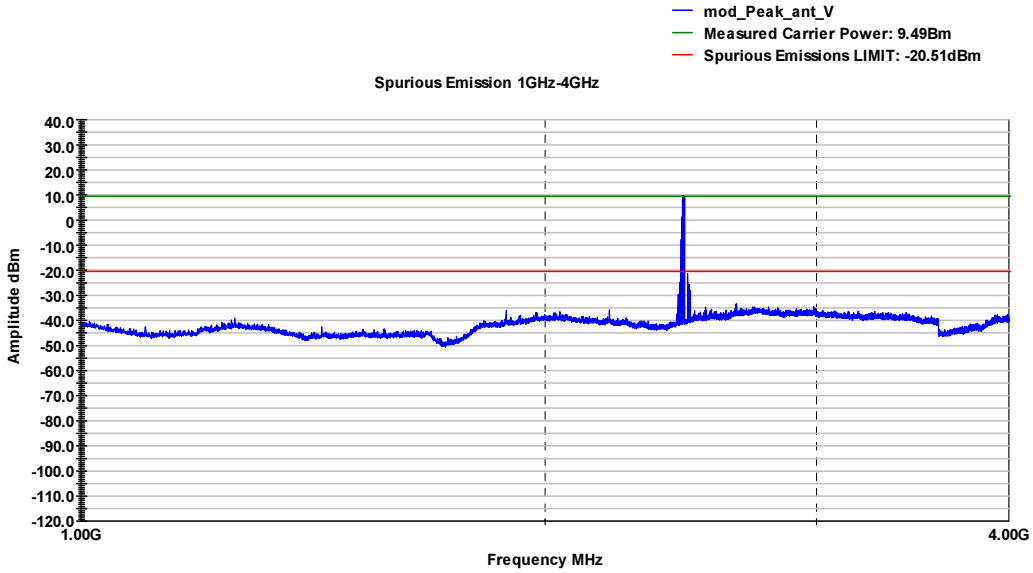


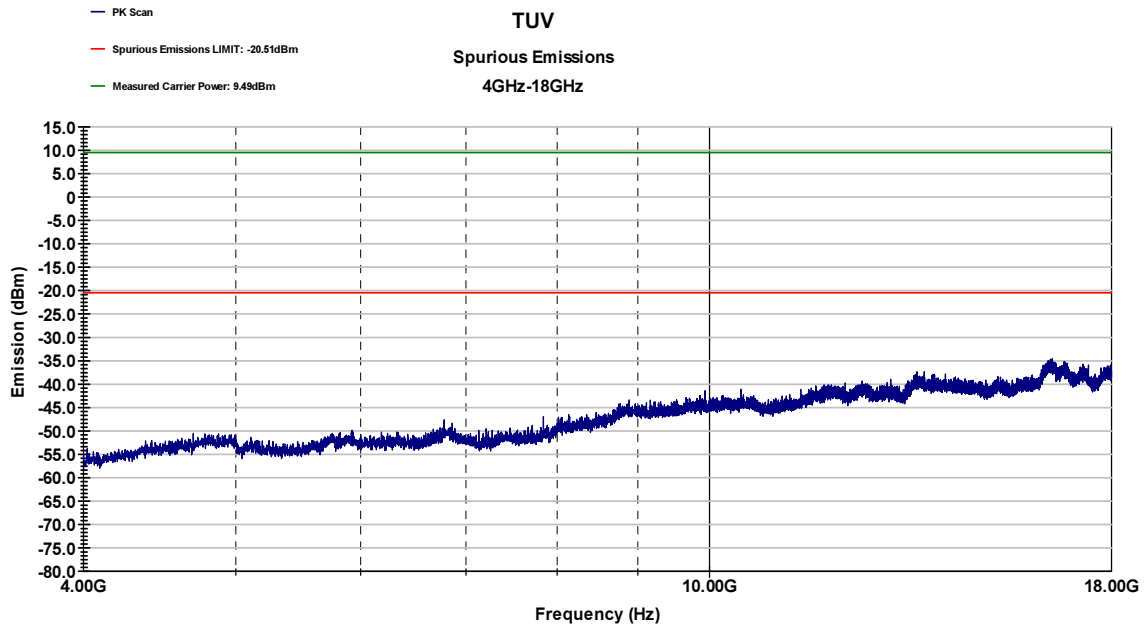

PK Scan
Spurious Emissions LIMIT: -22.17dBm
Measured Carrier Power: 7.83dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

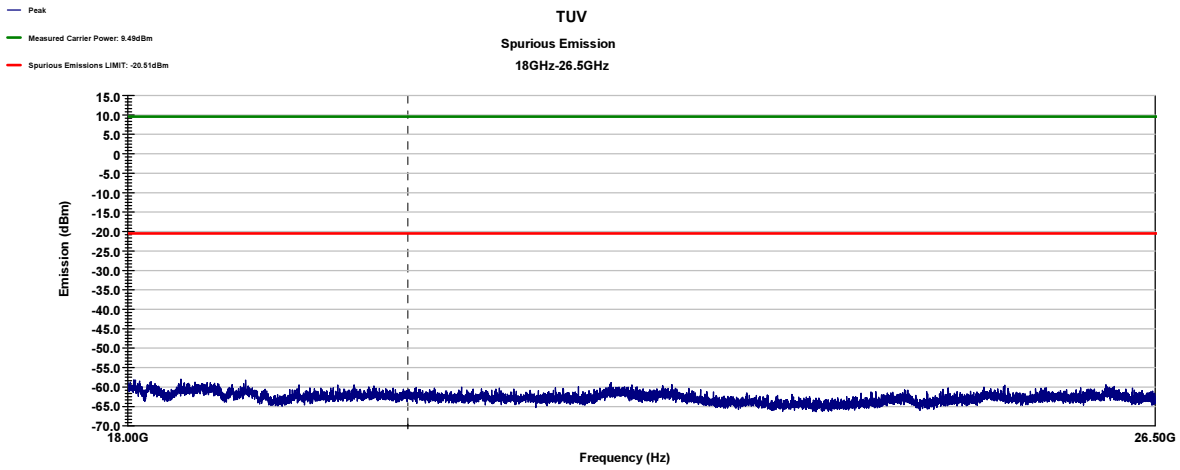

Peak
Measured Carrier Power: 7.83dBm
Spurious Emissions LIMIT: -22.17dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

SPURIOUS EMISSION - HORIZONTAL

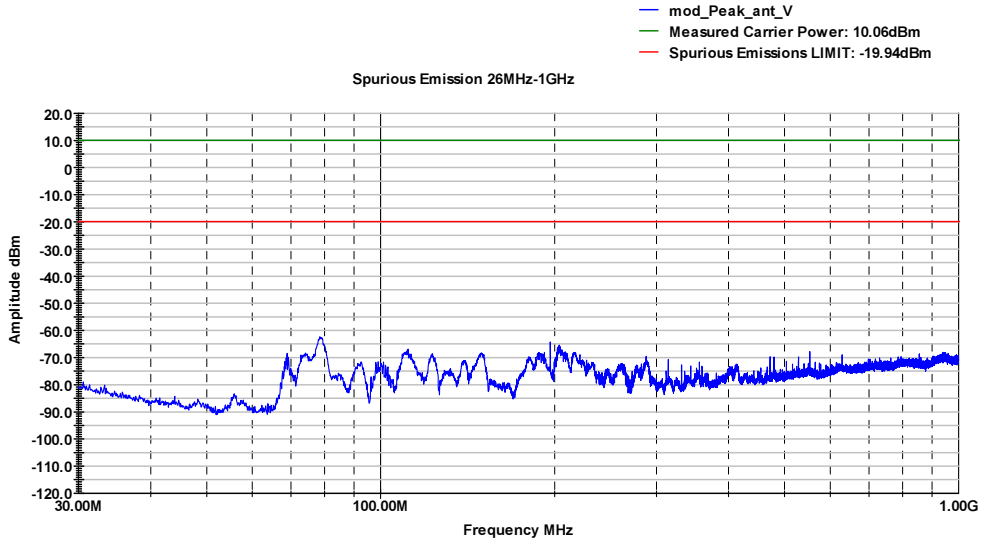


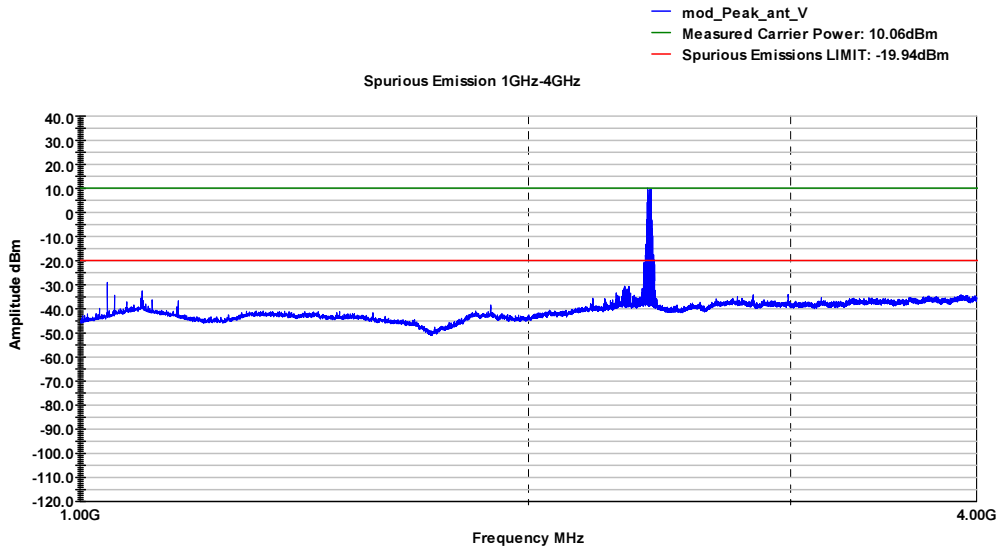


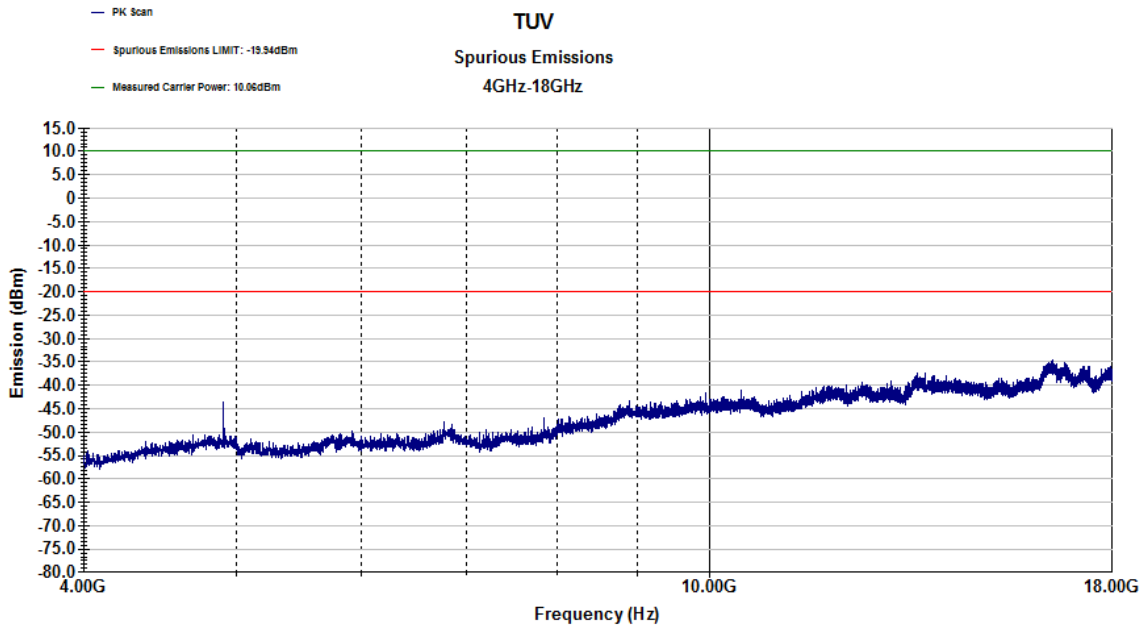

PK Scan
Spurious Emissions LIMIT: -20.51dBm
Measured Carrier Power: 9.49dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

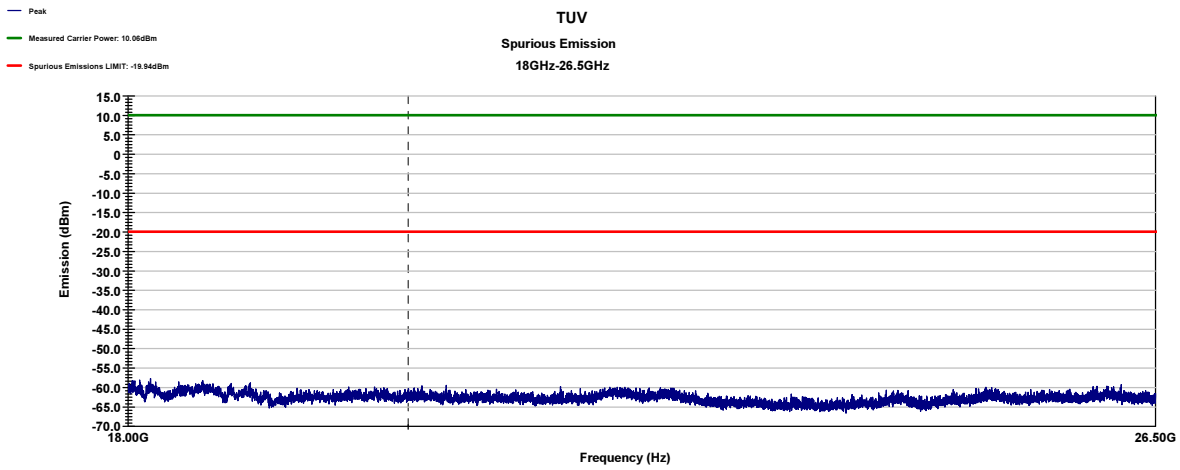

Peak
Measured Carrier Power: 9.49dBm
Spurious Emissions LIMIT: -20.51dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

Graphical representation of Antenna Port Spurious Emission - Radiated
Operation Mode: #2
Standard: IEE 802.11g
Channel: #1
SPURIOUS EMISSION - VERTICAL

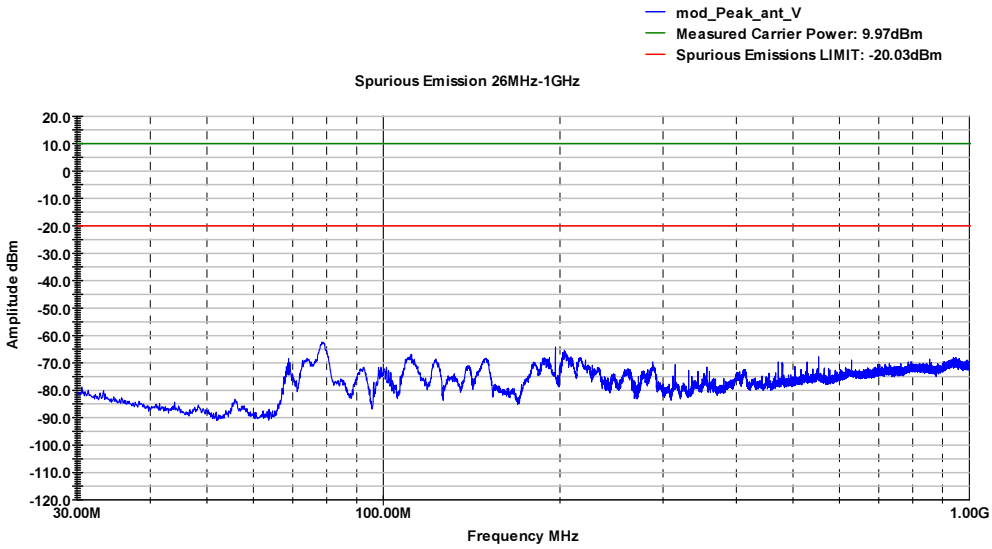


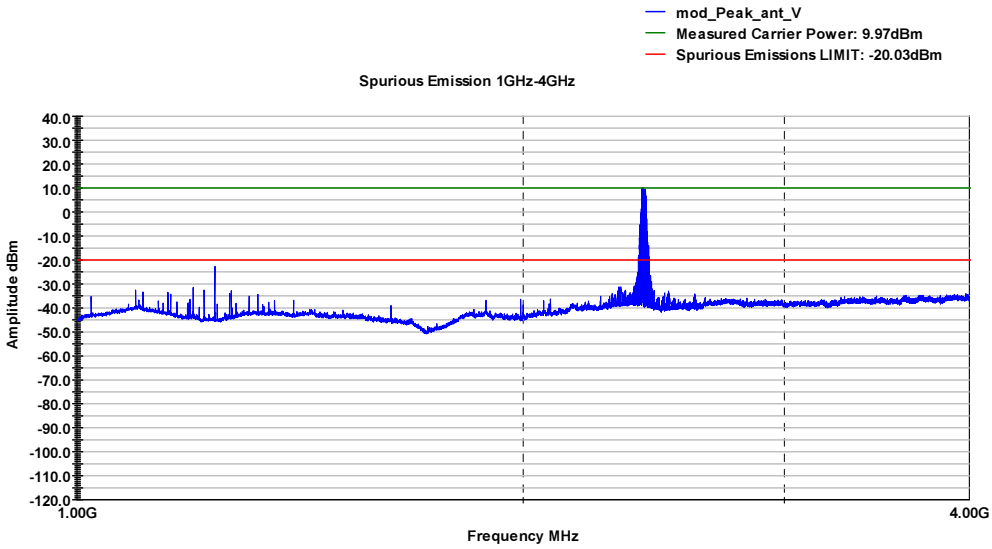


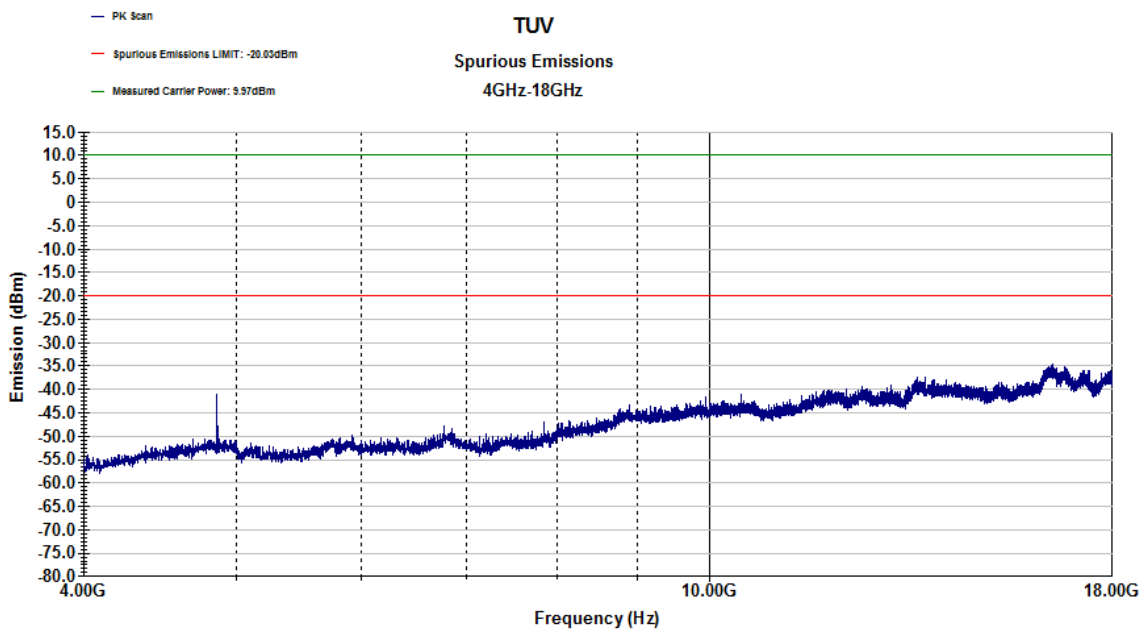

PK Scan
Spurious Emissions LIMIT: -19.94dBm
Measured Carrier Power: 10.06dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

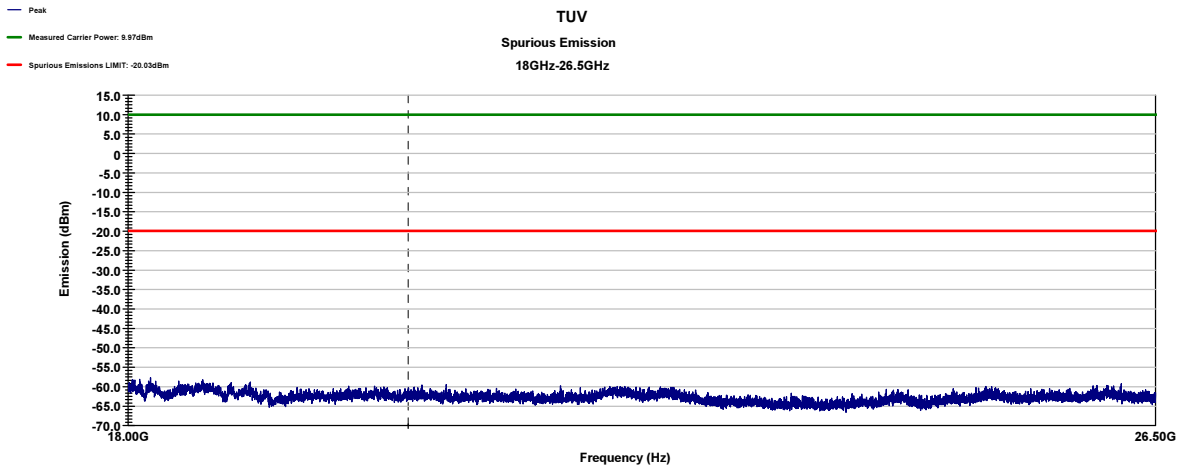

Peak
Measured Carrier Power: 10.06dBm
Spurious Emissions LIMIT: -19.94dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

SPURIOUS EMISSION - HORIZONTAL

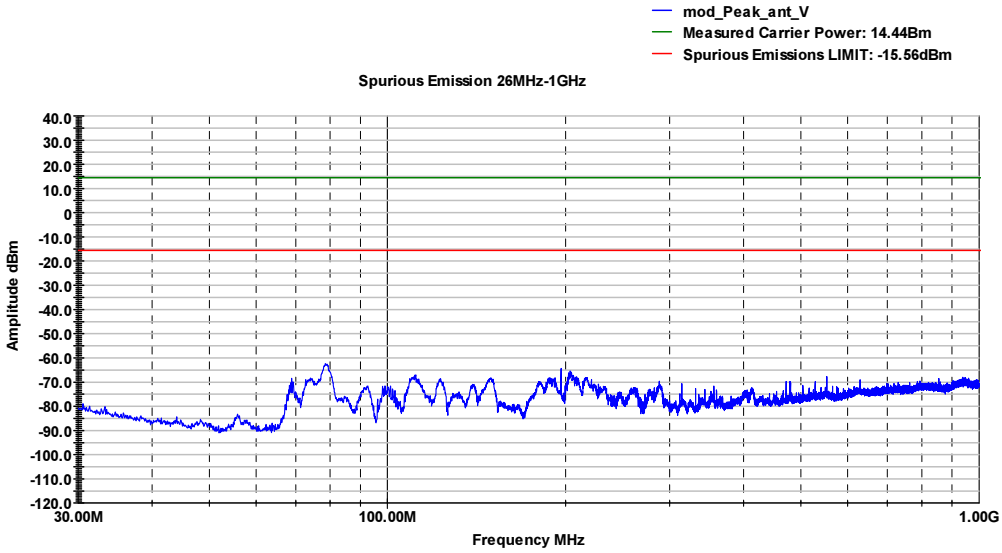


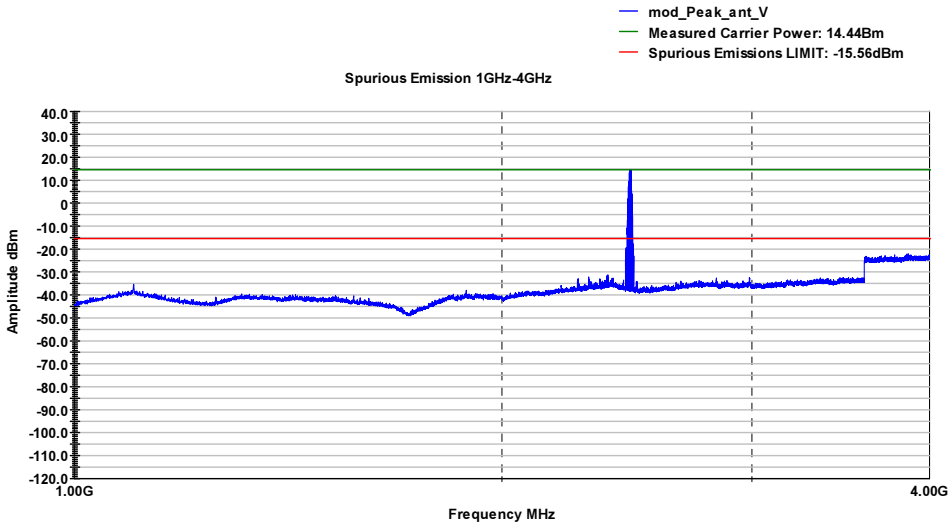


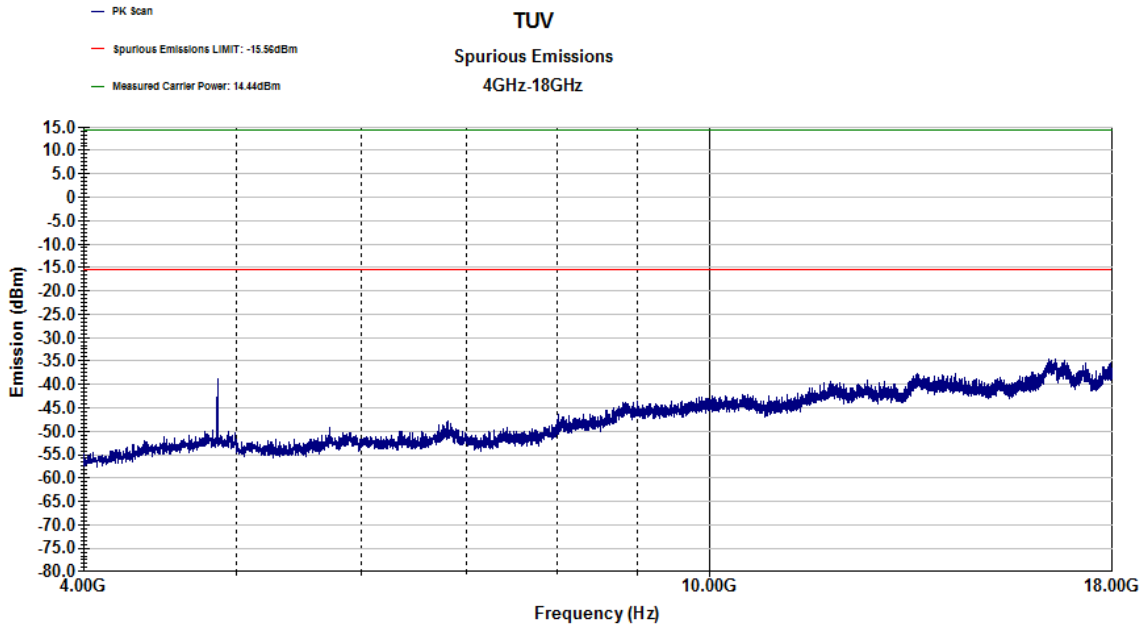

PK Scan
Spurious Emissions LIMIT: -20.03dBm
Measured Carrier Power: 9.97dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

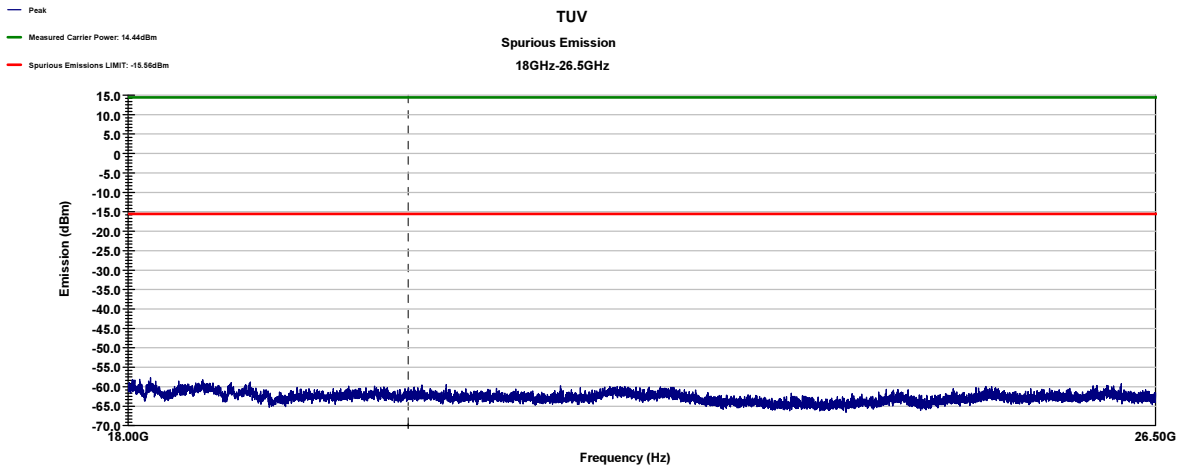

Peak
Measured Carrier Power: 9.97dBm
Spurious Emissions LIMIT: -20.03dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

Graphical representation of Antenna Port Spurious Emission - Radiated
Operation Mode: #2
Standard: IEE 802.11g
Channel: #11
SPURIOUS EMISSION - VERTICAL

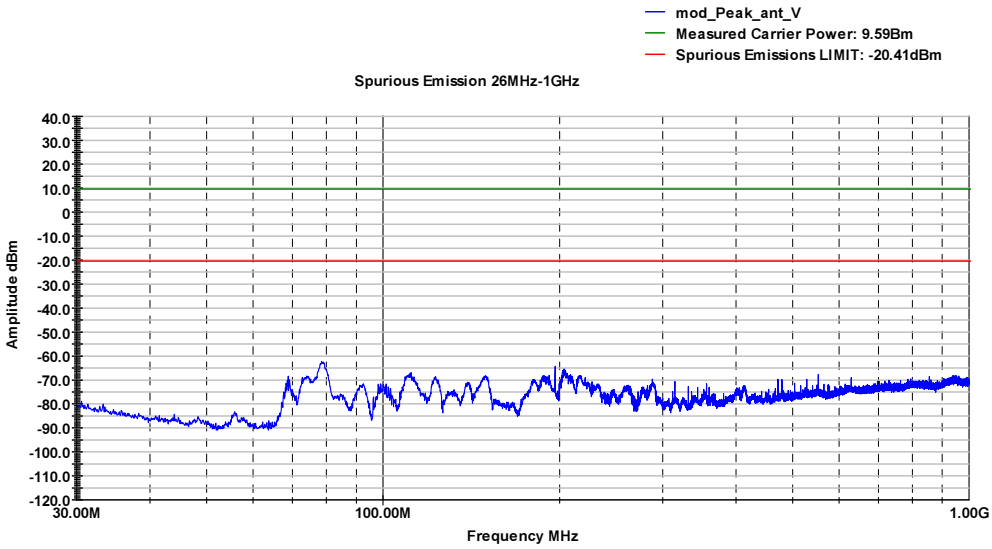


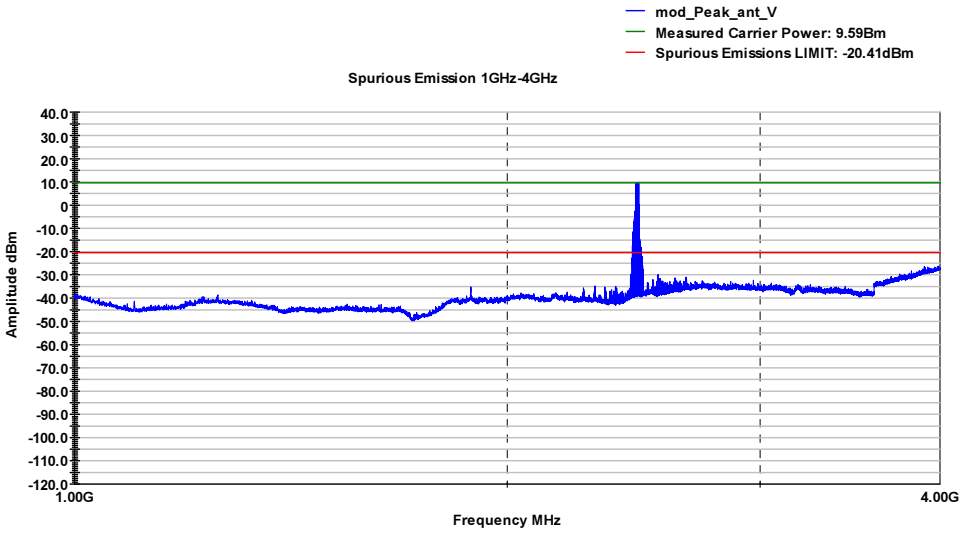


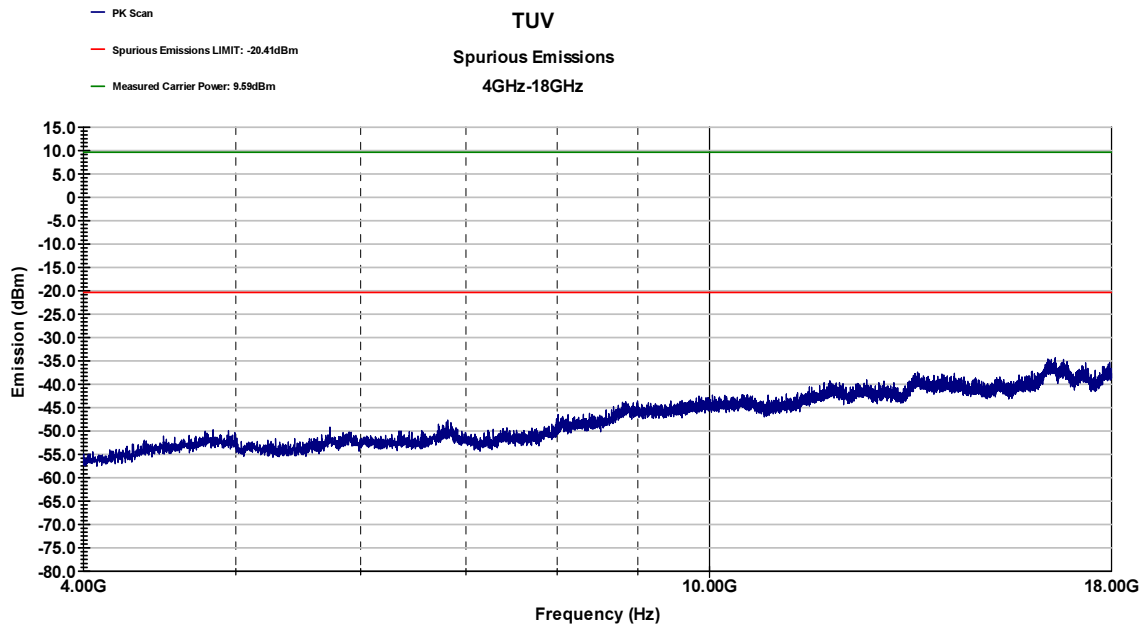

PK Scan
Spurious Emissions LIMIT: -15.56dBm
Measured Carrier Power: 14.44dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

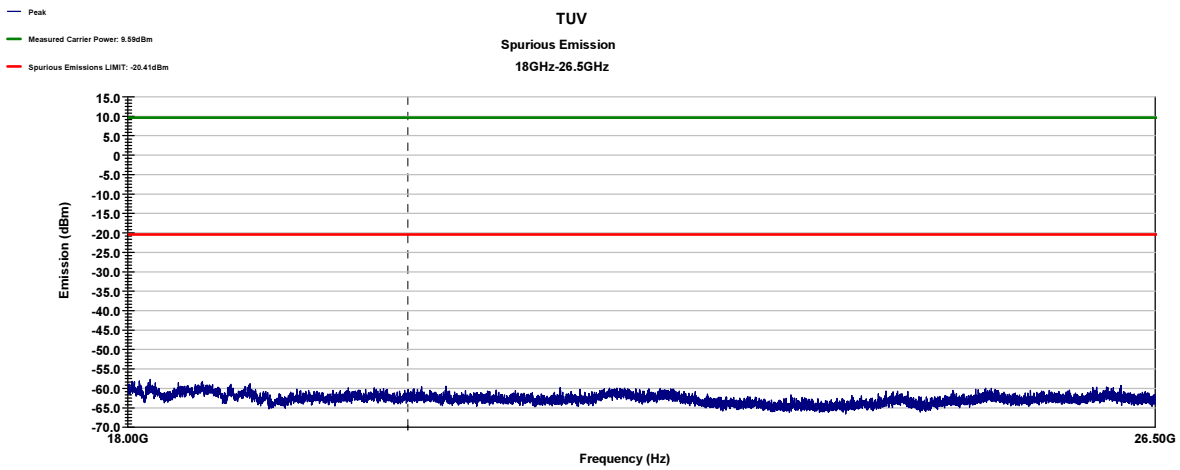

Peak
Measured Carrier Power: 14.44dBm
Spurious Emissions LIMIT: -15.56dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

SPURIOUS EMISSION - HORIZONTAL

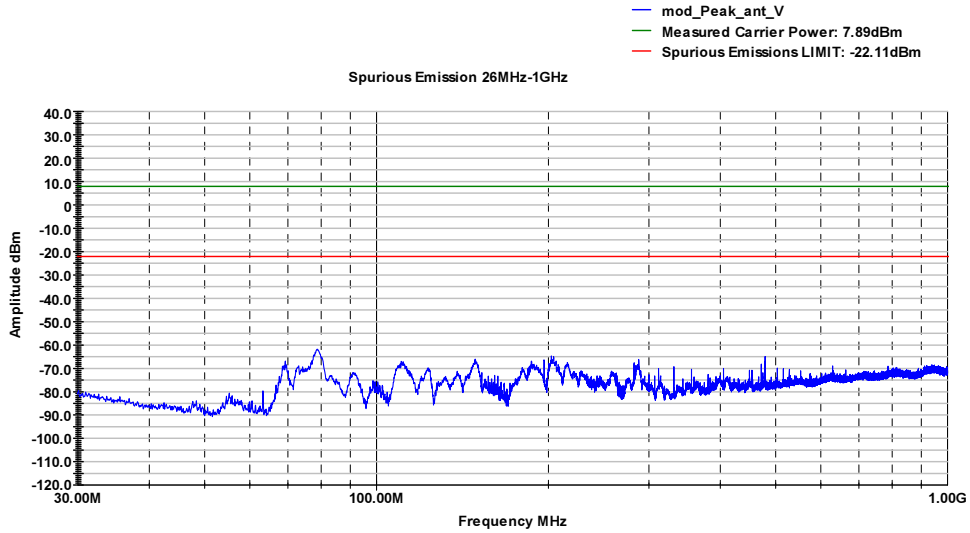


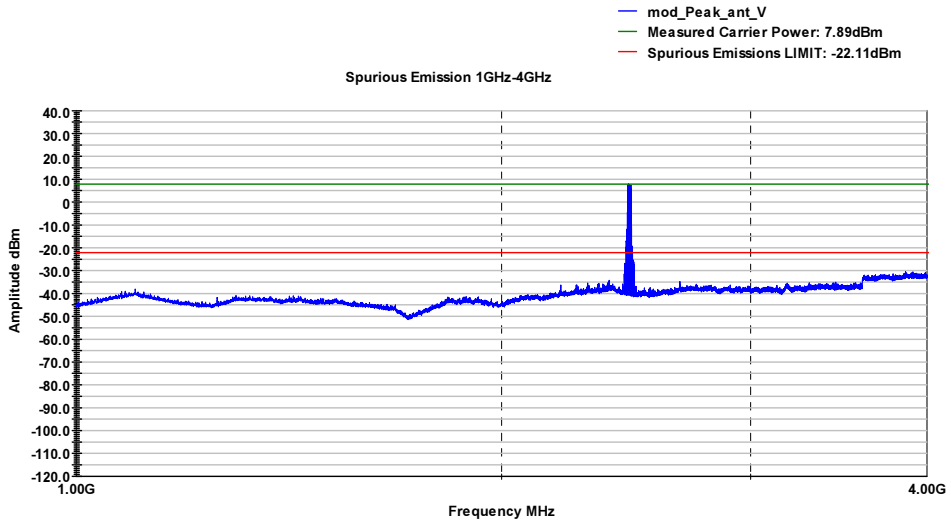


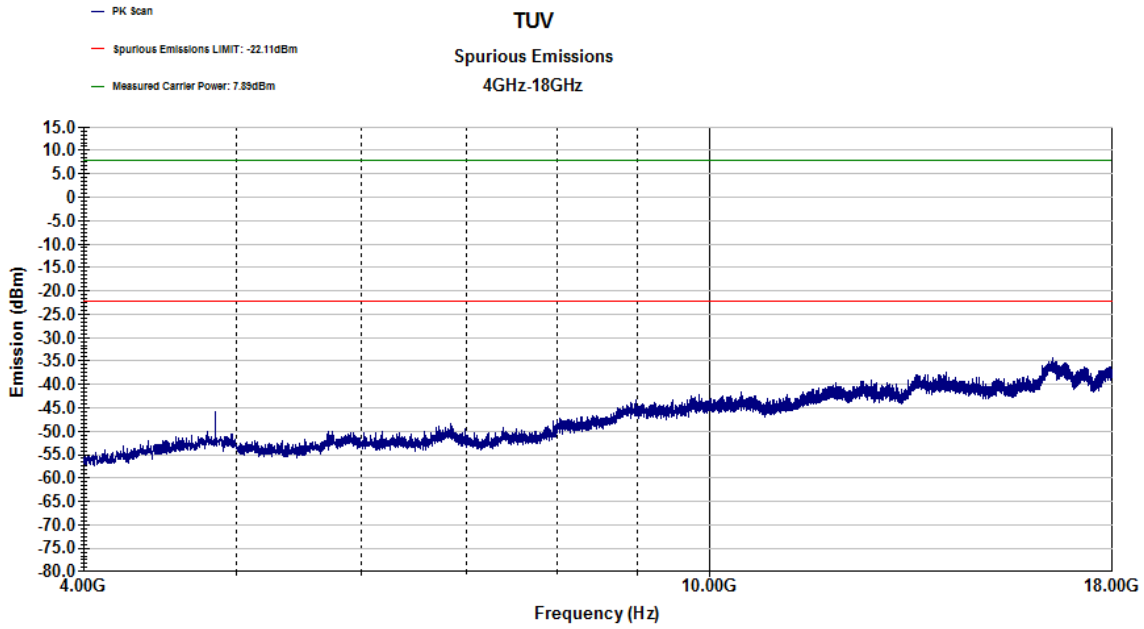

PK Scan
Spurious Emissions LIMIT: -20.41dBm
Measured Carrier Power: 9.59dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

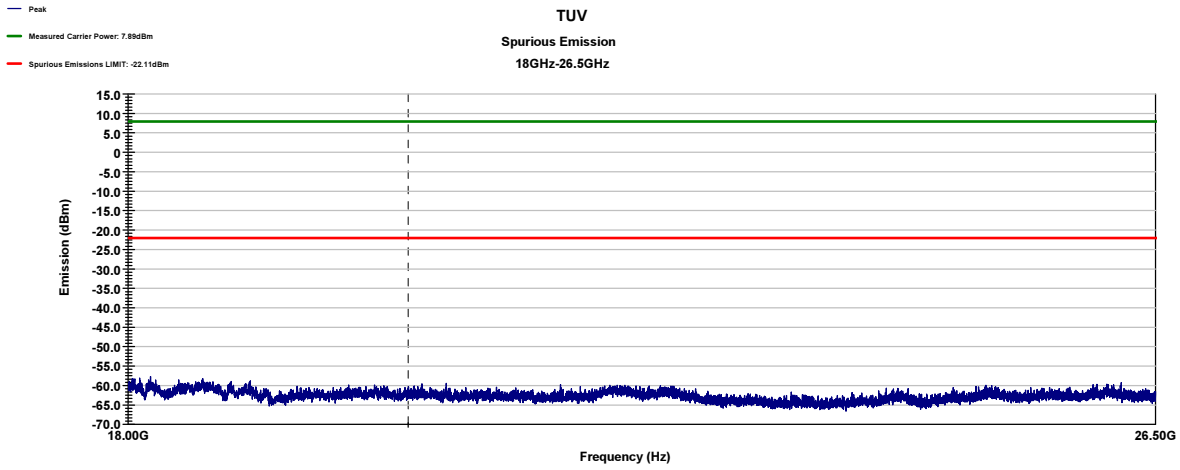

Peak
Measured Carrier Power: 9.59dBm
Spurious Emissions LIMIT: -20.41dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

Graphical representation of Antenna Port Spurious Emission - Radiated
Operation Mode: #2
Standard: IEE 802.11n
Channel: #1
SPURIOUS EMISSION - VERTICAL

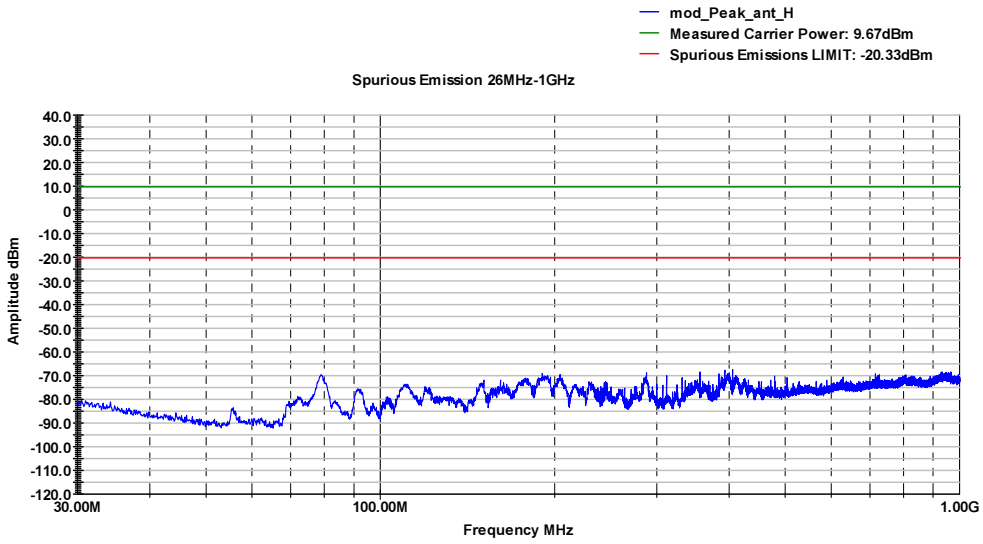


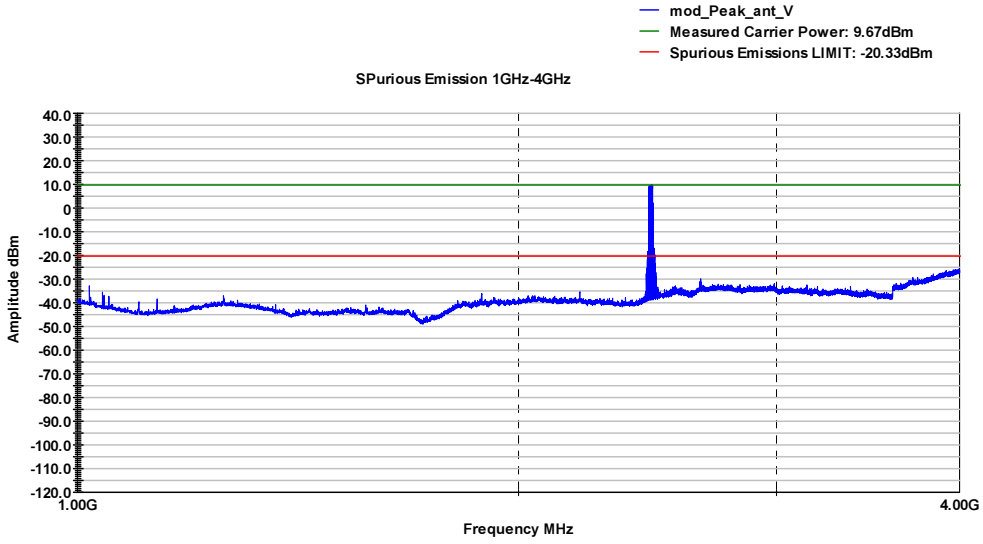


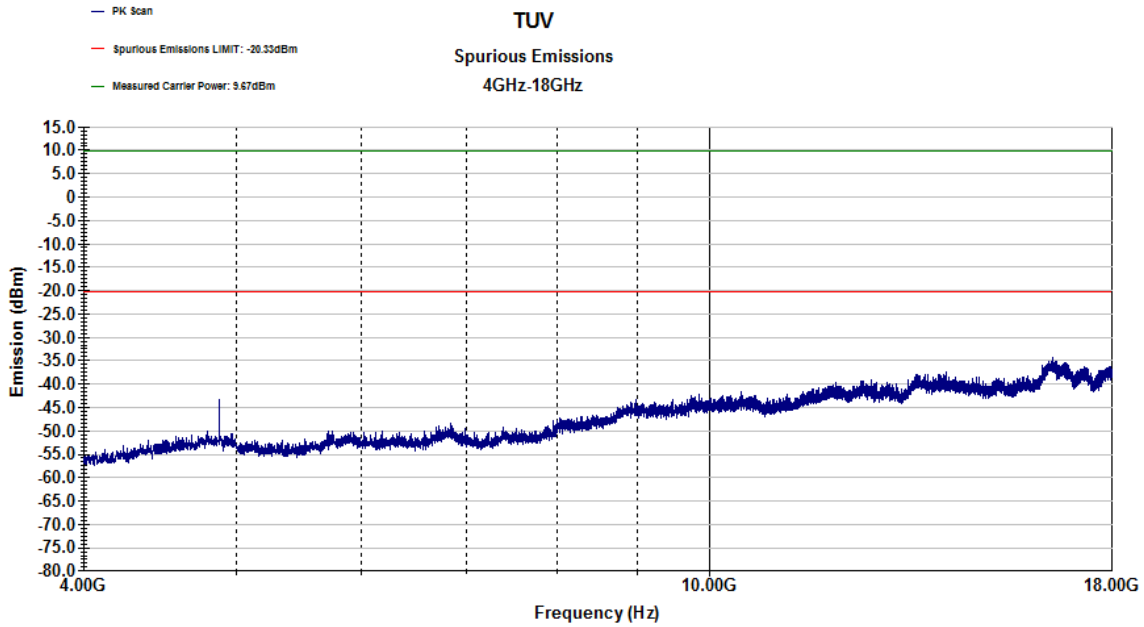

PK Scan
Spurious Emissions LIMIT: -22.11dBm
Measured Carrier Power: 7.89dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

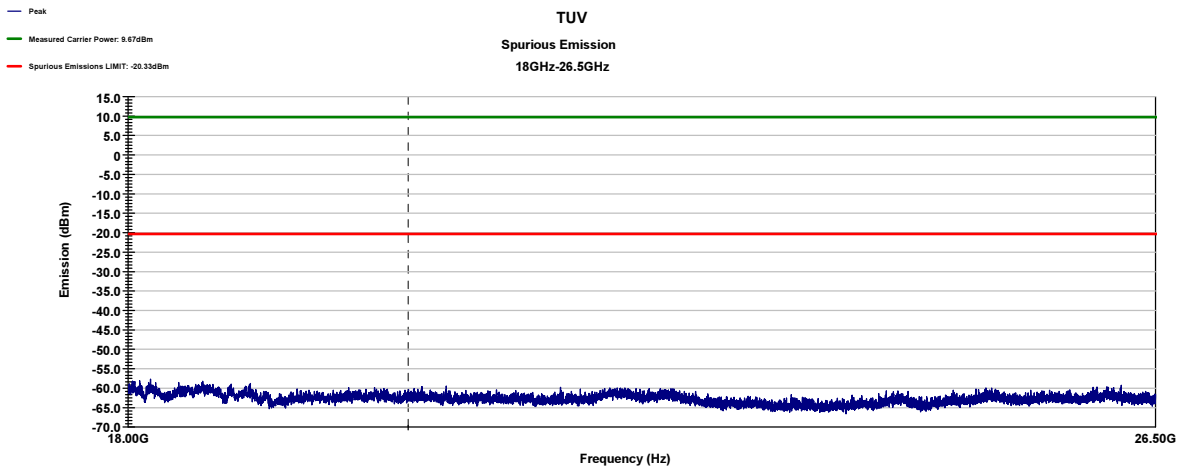

Peak
Measured Carrier Power: 7.89dBm
Spurious Emissions LIMIT: -22.11dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

SPURIOUS EMISSION - HORIZONTAL



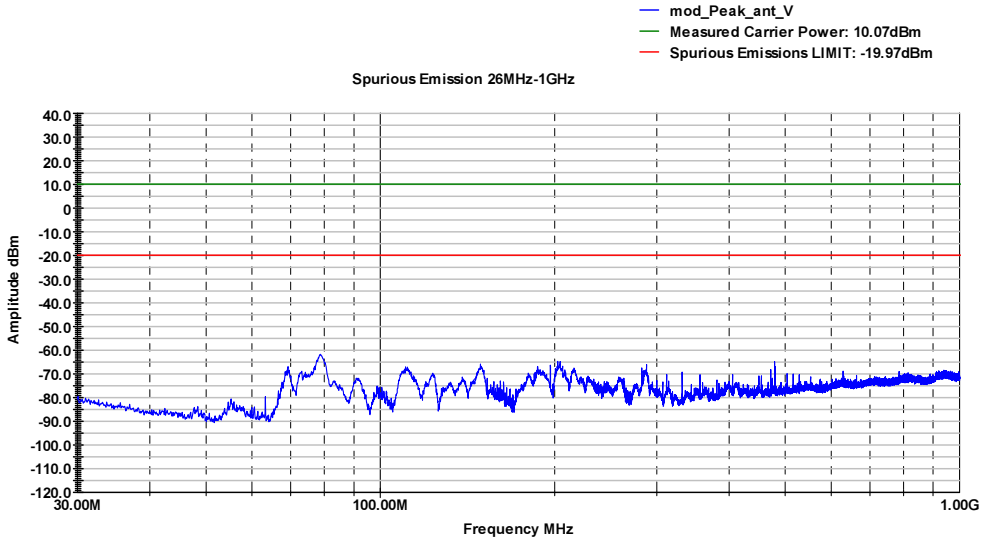


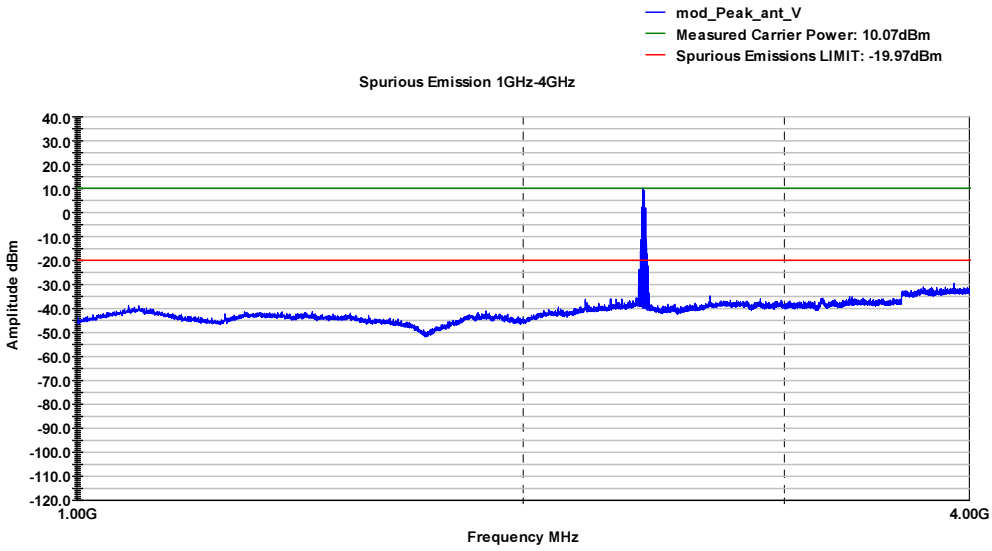

PK Scan
Spurious Emissions LIMIT: -20.33dBm
Measured Carrier Power: 9.67dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

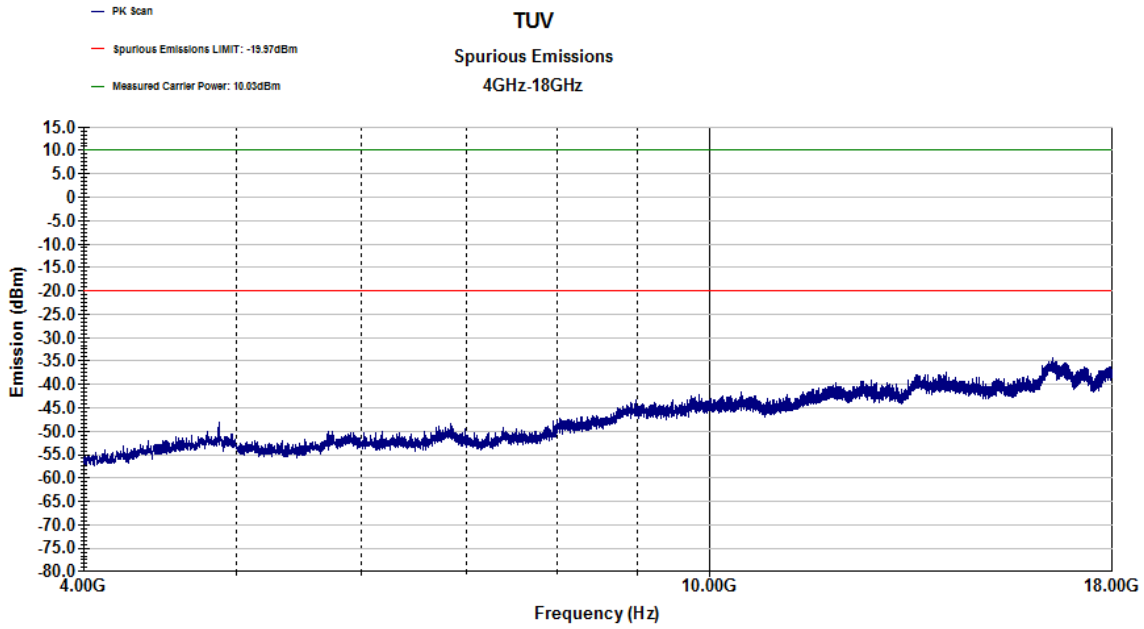

Peak
Measured Carrier Power: 9.67dBm
Spurious Emissions LIMIT: -20.33dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

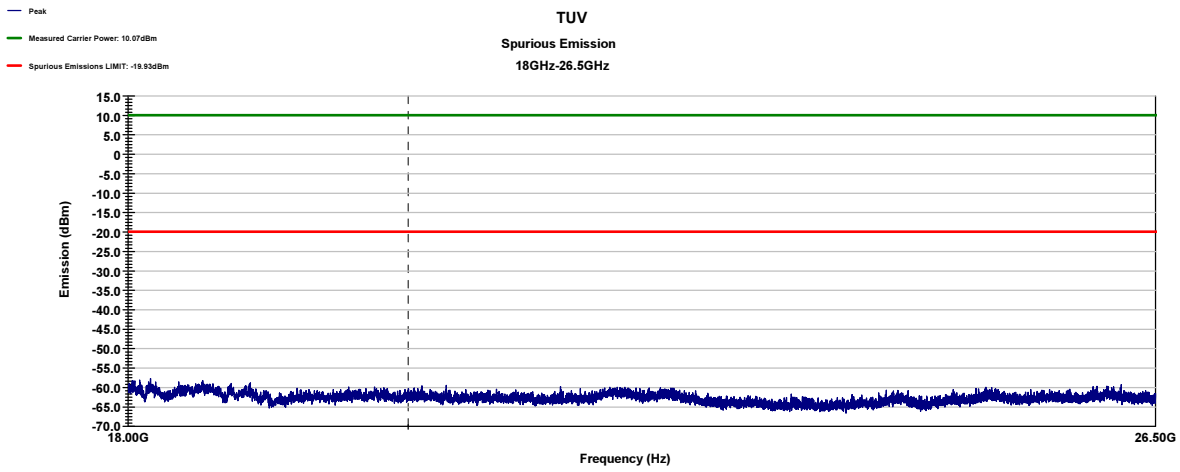
Graphical representation of Antenna Port Spurious Emission - Radiated
Operation Mode: #2
Standard: IEE 802.11n
Channel: #11

SPURIOUS EMISSION - VERTICAL

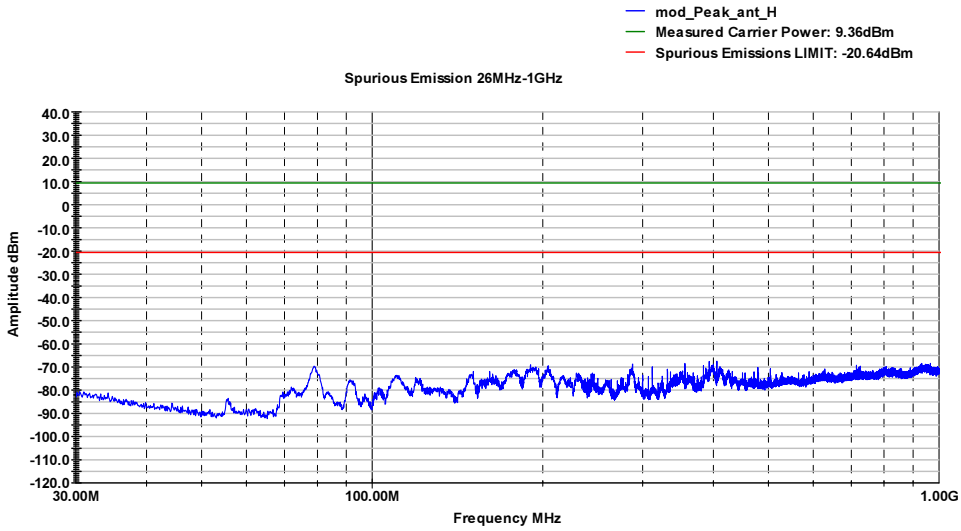


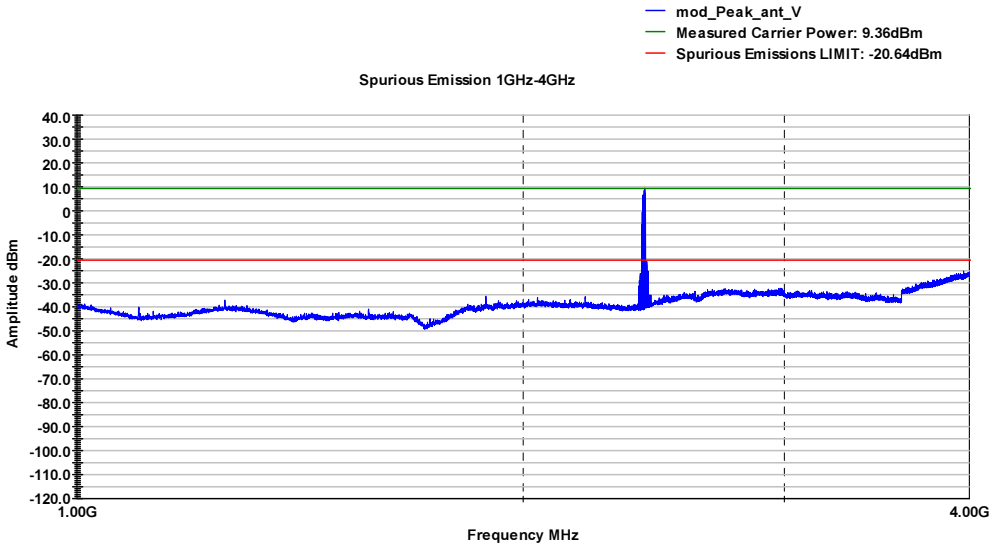


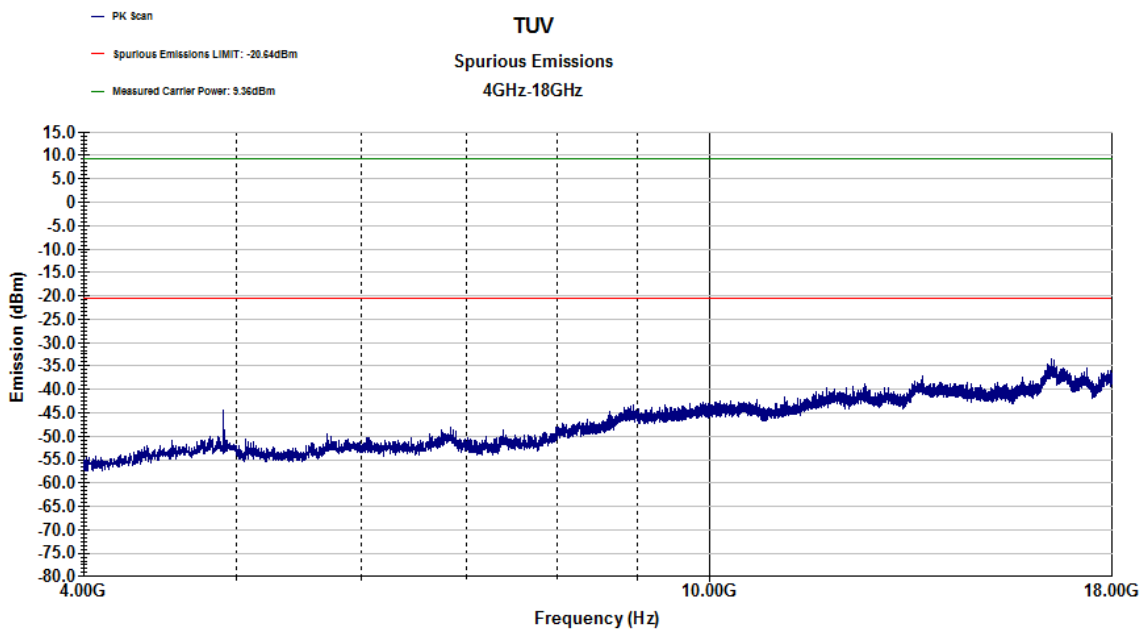

PK Scan
Spurious Emissions LIMIT: -19.97dBm
Measured Carrier Power: 10.03dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

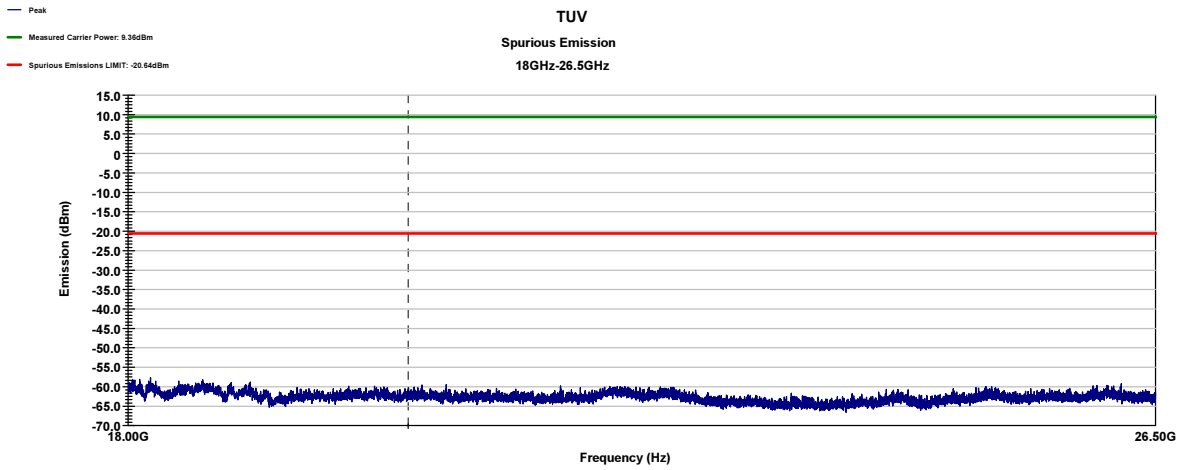

Peak
Measured Carrier Power: 10.07dBm
Spurious Emissions LIMIT: -19.93dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

SPURIOUS EMISSION - HORIZONTAL

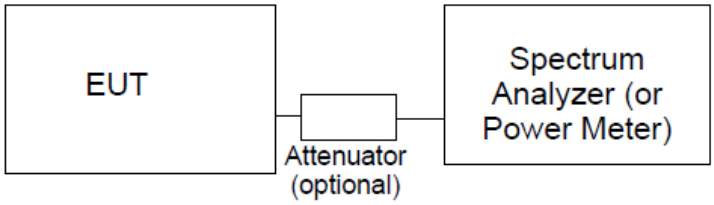





PK Scan
Spurious Emissions LIMIT: -20.64dBm
Measured Carrier Power: 9.36dBm
TUV
Spurious Emissions
4GHz-18GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
4.00G
10.00G
18.00G
Frequency (Hz)

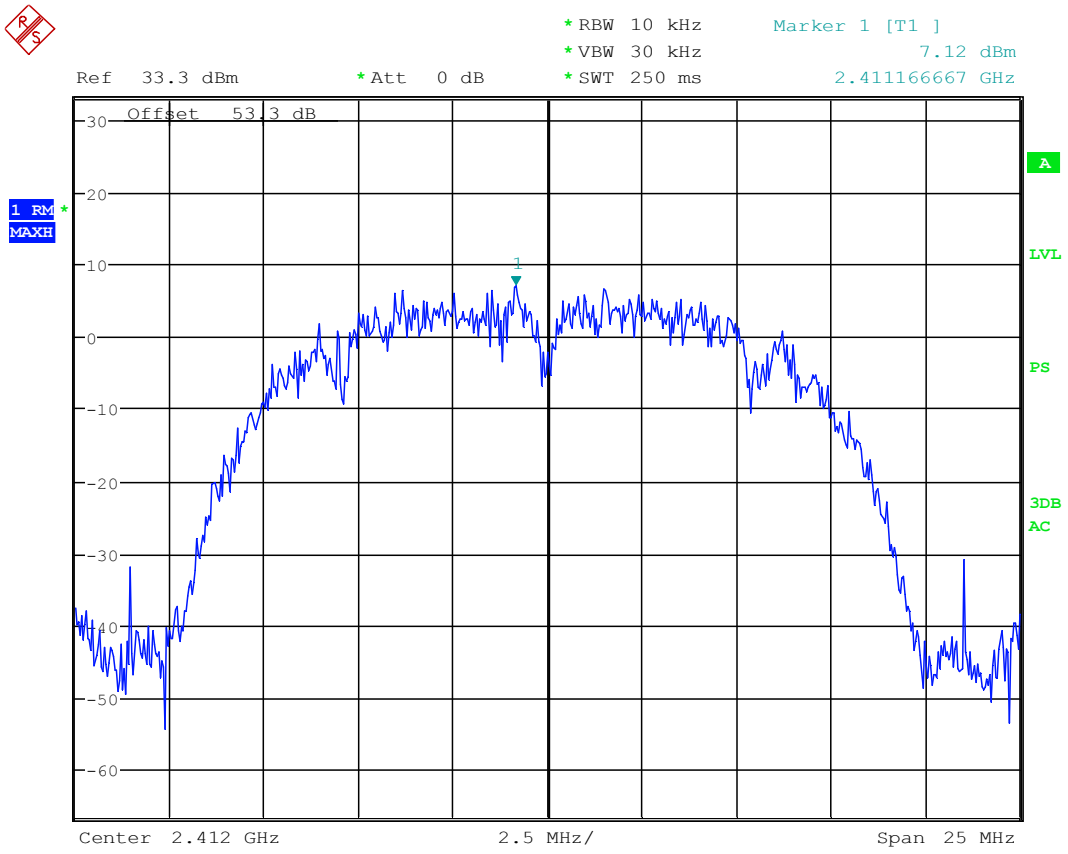

Peak
Measured Carrier Power: 9.36dBm
Spurious Emissions LIMIT: -20.64dBm
TUV
Spurious Emission
18GHz-26.5GHz
Emission (dBm)
15.0
10.0
5.0
0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
18.00G
26.50G
Frequency (Hz)

19. Test Conditions and Results – POWER SPECTRAL DENSITY

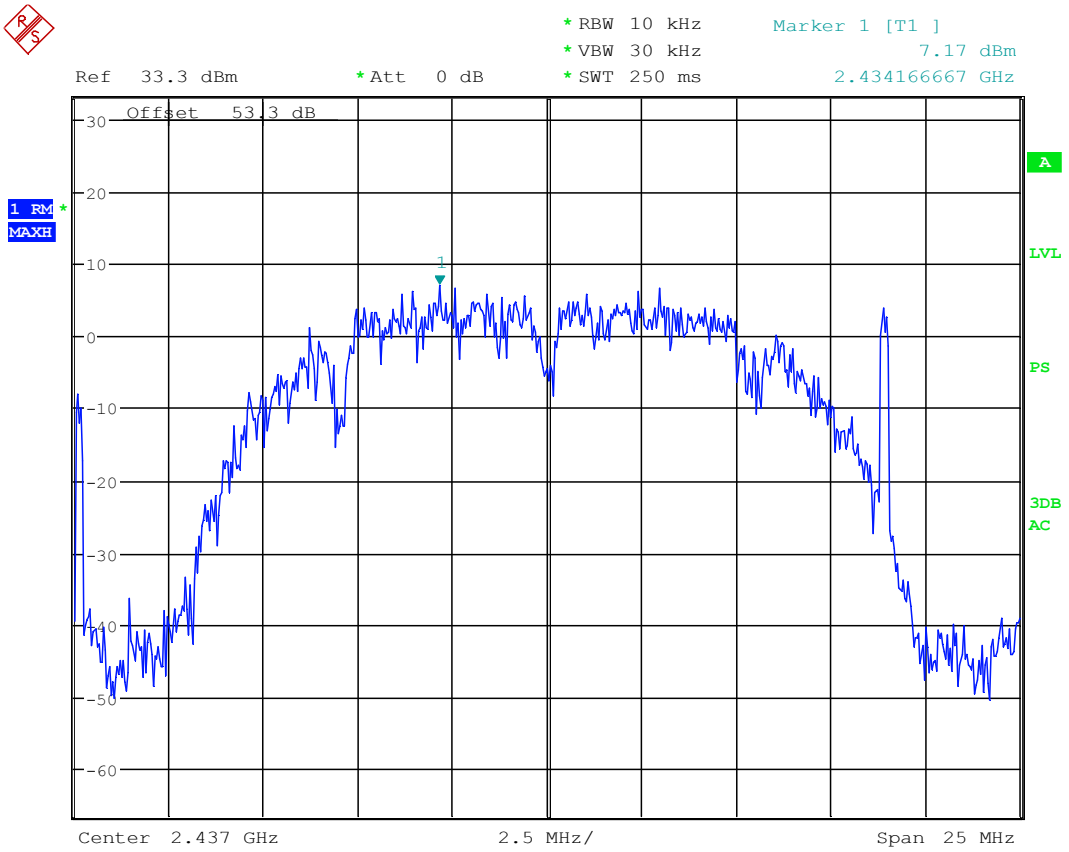
20	TEST: Power Spectral Density	PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	24°C
	Relative Humidity (%)	37%
	Air pressure (hPa)	1020
—	Frequency	Application Point
Fully configured sample tested at the power line frequency	115V ~ 60Hz	SMA Connector
Equipment mode:	Operation mode	#1
FCC Standard	§15.247	
(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.		
Further information to test setup		

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	04/2016	04/2017
20dB Attenuator	RS Components	Huber & Suhner	87020534	10/2015	10/2016

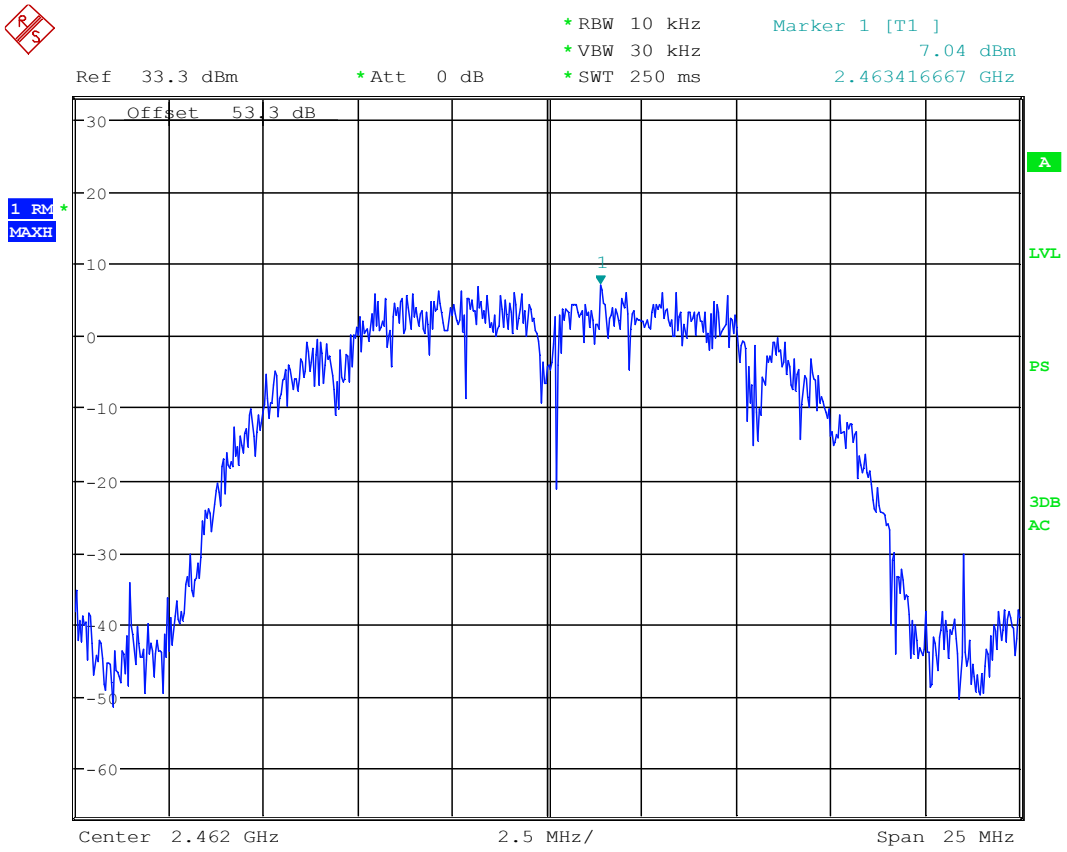
Graphical representation of Power Spectral Density
Operation Mode: #1
Standard: IEE 802.11b
Channel: #1



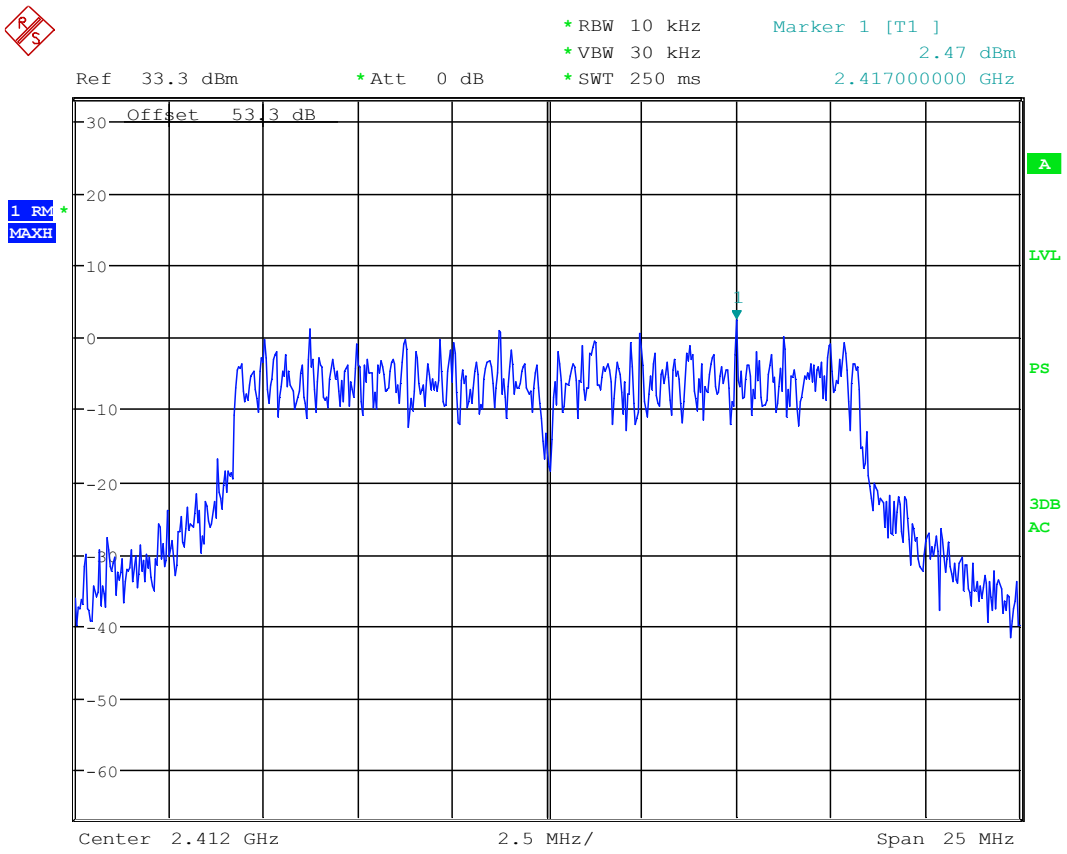
Graphical representation of Power Spectral Density
Operation Mode: #1
Standard: IEE 802.11b
Channel: #6



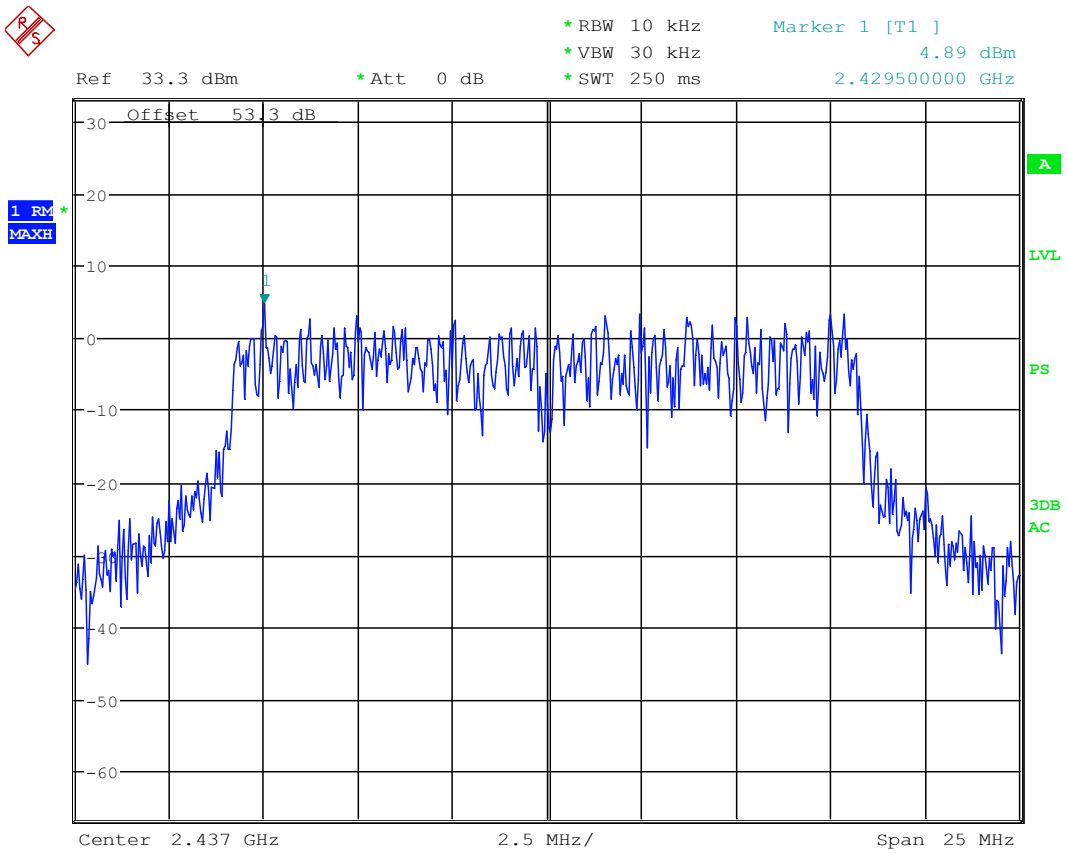
Graphical representation of Power Spectral Density
Operation Mode: #1
Standard: IEE 802.11b
Channel: #11



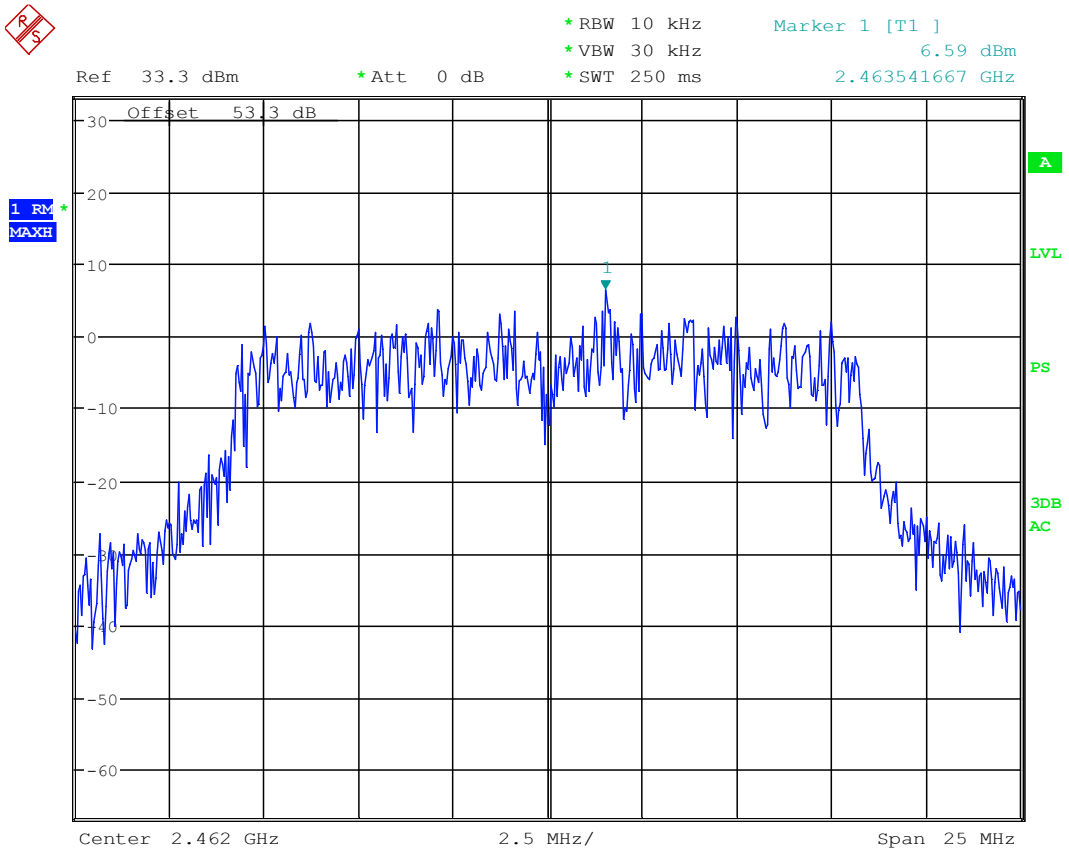
Graphical representation of Power Spectral Density
Operation Mode: #1
Standard: IEE 802.11g
Channel: #1



Graphical representation of Power Spectral Density
Operation Mode: #1
Standard: IEE 802.11g
Channel: #6

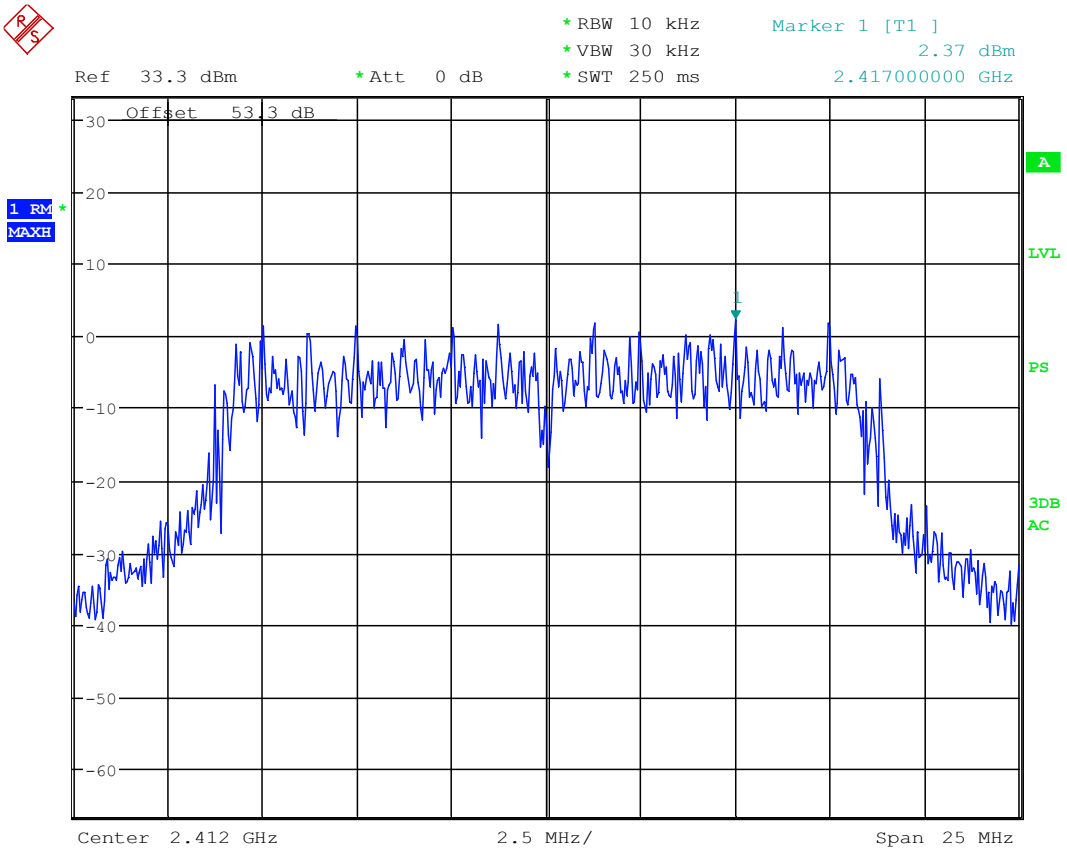


Graphical representation of Power Spectral Density
Operation Mode: #1
Standard: IEE 802.11g
Channel: #11

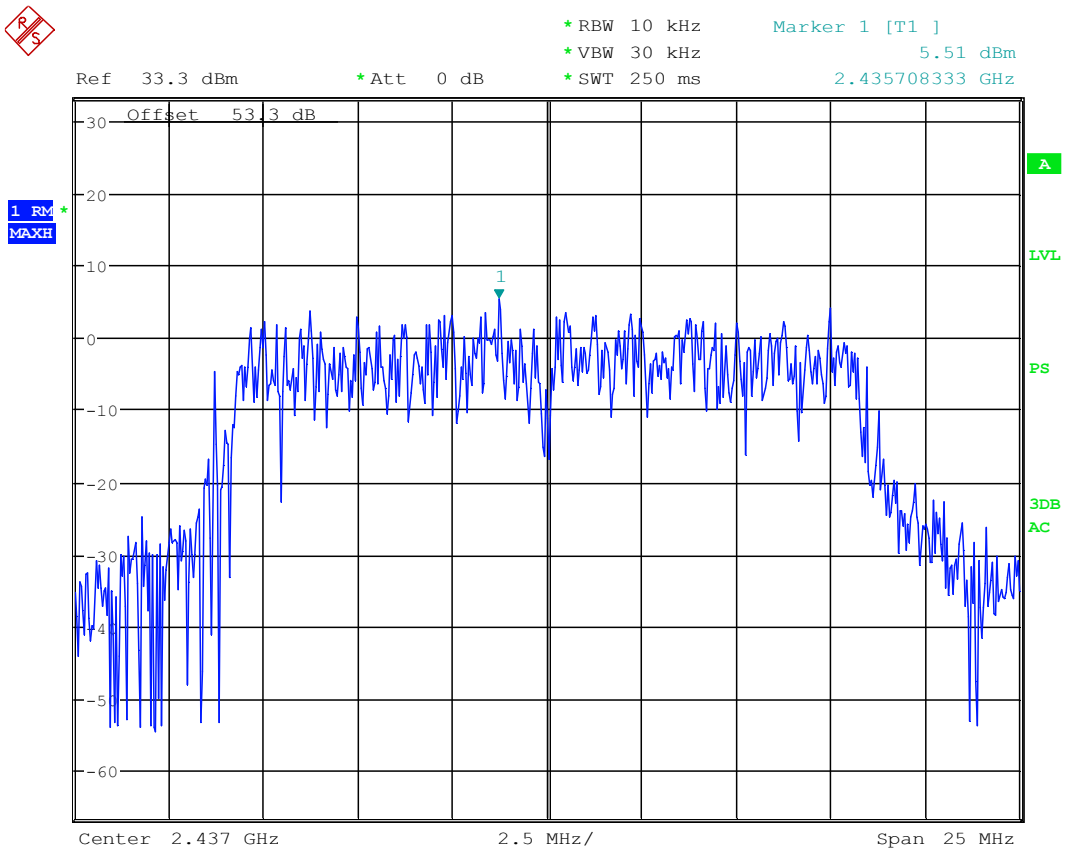


Date: 19.JAN.2017 08:22:01

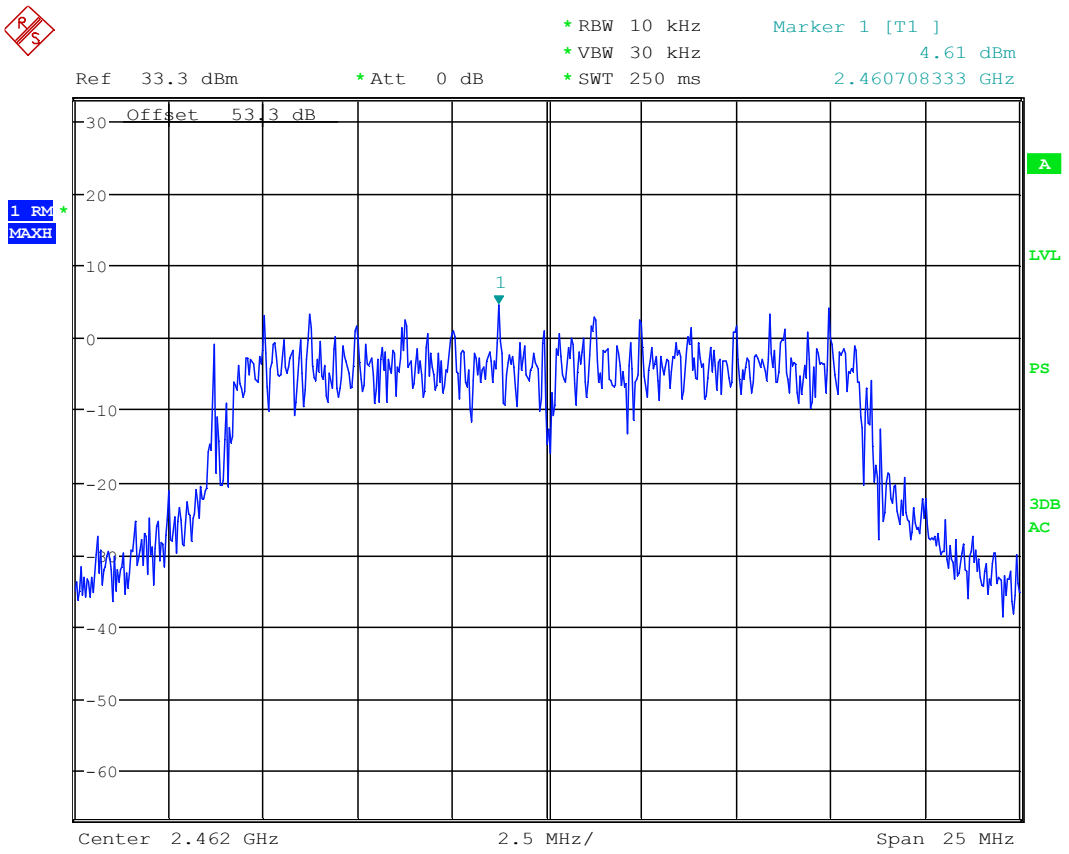
Graphical representation of Power Spectral Density
Operation Mode: #1
Standard: IEE 802.11n
Channel: #1



Graphical representation of Power Spectral Density
Operation Mode: #1
Standard: IEE 802.11g
Channel: #6



Graphical representation of Power Spectral Density
Operation Mode: #1
Standard: IEE 802.11g
Channel: #11



20. Test Conditions and Results – RF EXPOSURE REQUIREMENTS

21	TEST: RF Exposure Requirements	PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	---
	Relative Humidity (%)	---
	Air pressure (hPa)	1020
—	Frequency	Application Point
Fully configured sample tested at the power line frequency	115V ~ 60Hz	Enclosure
Equipment mode:	Operation mode	#1 #2 #3
FCC Standard	§15.247	

General Test Configuration

Calculation uses the free space transmission formula:

$$S = \frac{PG}{4\pi r^2} \quad \text{or equivalent} \quad S = \frac{EIRP}{4\pi r^2}$$

where
P = input power of the antenna
G = antenna gain relative to an isotropic antenna
r = distance from the antenna to the point of investigation.
EIRP = Effective Isotropic Radiated Power

Summary of Results

Device COMPLIES with Power Density requirements at 20cm separation

Directional Gain Calculation

Antenna: 5.15dBi (see pag.62)

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≥ 50 mm **447498 D01 General RF Exposure Guidance v06 – Appendix A**						
MHz	**50**	60	70	80	90	mm
100	474	481	487	494	501	SAR Test Exclusion Threshold (mW)
150	387	397	407	417	427	
300	274	294	314	334	354	
450	224	254	284	314	344	
835	164	220	275	331	387	
900	158	218	278	338	398	
1500	122	222	322	422	522	
1900	108	209	309	409	509	
2450	96	196	296	**396**	496	
3600	79	179	279	379	479	
5200	66	166	266	366	466	
5400	65	165	265	365	465	
5800	62	162	262	362	462	

The *test separation distances ≥ 80 mm* is applied to determine SAR test exclusion.

RESULTS			
CH	**TX Frequency (MHz)**	**Measured Power at Antenna Connector (chain0 + chain1) (dBm)**	**Antenna Gain (dBi)**
Middle Channel	2437	20.09	5.15

CH	TX Frequency (MHz)	Radiated power (dBm)	E.I.R.P. (mW)	Distance (mm)	{[Power allowed at numeric threshold for 80 mm in step a)] + [(test separation distance – 80 mm)·10]} mW, for > 1500 MHz and ≤ 6 GHz	Limits
Middle Channel	2437	25.14	326.58	80	396mW	328mW

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