Nemko Korea Co., Ltd.

155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 449-852 KOREA, REPUBLIC OF
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FCC and IC EVALUATION REPORT FOR CERTIFICATION

Applicant :

Samsung Electronics Co., Ltd.
129, Samsung-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, Korea
(Post code : 443-742)
Attn. : Mr. Dongwook. Shin

Dates of Issue : September 12, 2012
Test Report No. : NK-12-R-073
Test Site : Nemko Korea Co., Ltd.

FCC ID	**A3LLABGEOPA20**
Brand Name	**SAMSUNG**
Contact Person	**Samsung Electronics Co., Ltd.** **129, Samsung-ro, Yeongtong-gu,** **Suwon-si, Gyeonggi-do, Korea 443-742** **Mr. Dongwook. Shin** **Telephone No. : +82-31-200-5698**

Applied Standard:	FCC 47 CFR Part 15 Subpart C
Classification:	FCC part 15 Spread Spectrum Transmitter
EUT Type:	Immunology Analyser

The device bearing the brand name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2003. The client should not use it to claim product endorsement by TAF or any government agencies. The test results in the report only apply to the tested sample.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Sep. 12, 2012
Tested By : Minchul Shin
Engineer

Deokha Ryu Sep 12. 2012
Reviewed By : Deokha Ryu
Technical Manager

TABLE OF CONTENTS

1. SCOPE

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15 and IC RSS-210.

Responsible Party :	Samsung Electronics Co., Ltd.
Contact Person :	Mr. Dongwook. Shin
Manufacturer :	Samsung Electronics Co., Ltd. 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea 443-742

- FCC ID: A3LLABGEOPA20
- Model: Samsung LABGEO PA20
- Brand Name: SAMSUNG
- EUT Type: Immunology Analyser
- Classification: FCC part 15 Spread Spectrum Transmitter
- Applied Standard: FCC 47 CFR Part 15 subpart C
- Test Procedure(s): ANSI C63.4-2003 and FCC guidance of 558074 dated January 18, 2012 entitled “Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) Operating Under §15.247”
- Dates of Test: June 15, 2012 ~ July 24, 2012
- Place of Tests: Nemko Korea Co., Ltd.

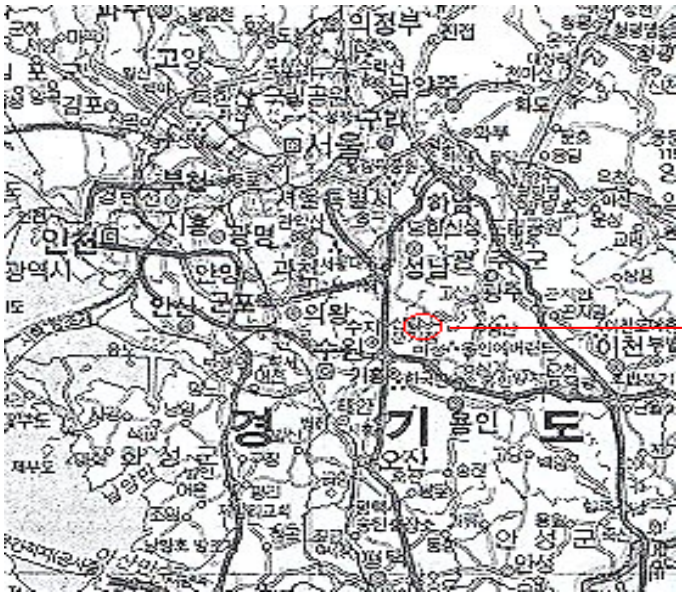
2. INTRODUCTION

2.1 Test facility

The measurement procedure described in 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 C63.4-2003) was used in determining radiated and conducted emissions emanating from **Samsung Electronics Co., Ltd.**
FCC ID : **A3LLABGEOPA20**

These measurement tests were conducted at ***Nemko Korea Co., Ltd. EMC Laboratory***.
The site address is 155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, 449-852 KOREA, REPUBLIC OF.

The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 km (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 km (18miles) south-southeast from central Seoul.
It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.
The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.4 2003.



Nemko Korea Co., Ltd.
EMC Lab.
155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, 449-852 KOREA, REPUBLIC OF
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Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows Nemko Korea Corporation Ltd. EMC Lab. and Incheon Airport.

2.2 Accreditation and listing

Accreditation type		Accreditation number
FC	FCC part 15/18 Filing site	Registration No. 97992
	CAB Accreditation for DOC	Designation No. KR0026
KOLAS	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)	Registration No. 155
Industry Canada	Canada IC Registered site	Site No. 2040E
VCCI	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
IECEE CB SCHEME	EMC CBTL	-
방송통신위원회	KCC(RRL)Designated Lab.	Registration No. KR0026
	SASO registered Lab and Certification Body	Registration No. 2008-15

3. TEST CONDITIONS & EUT INFORMATION

3.1 Operation During Test

The EUT is the SISO transceiver supporting the 802.11b/g/n mode.
During the test, the EUT was connected to laptop PC and then a test program was executed to operate EUT continuously. The EUT was tested at the lowest channel, middle channel and the highest channel with the maximum output power in accordance with the manufacturer's specifications. The worst data were recorded in the report.

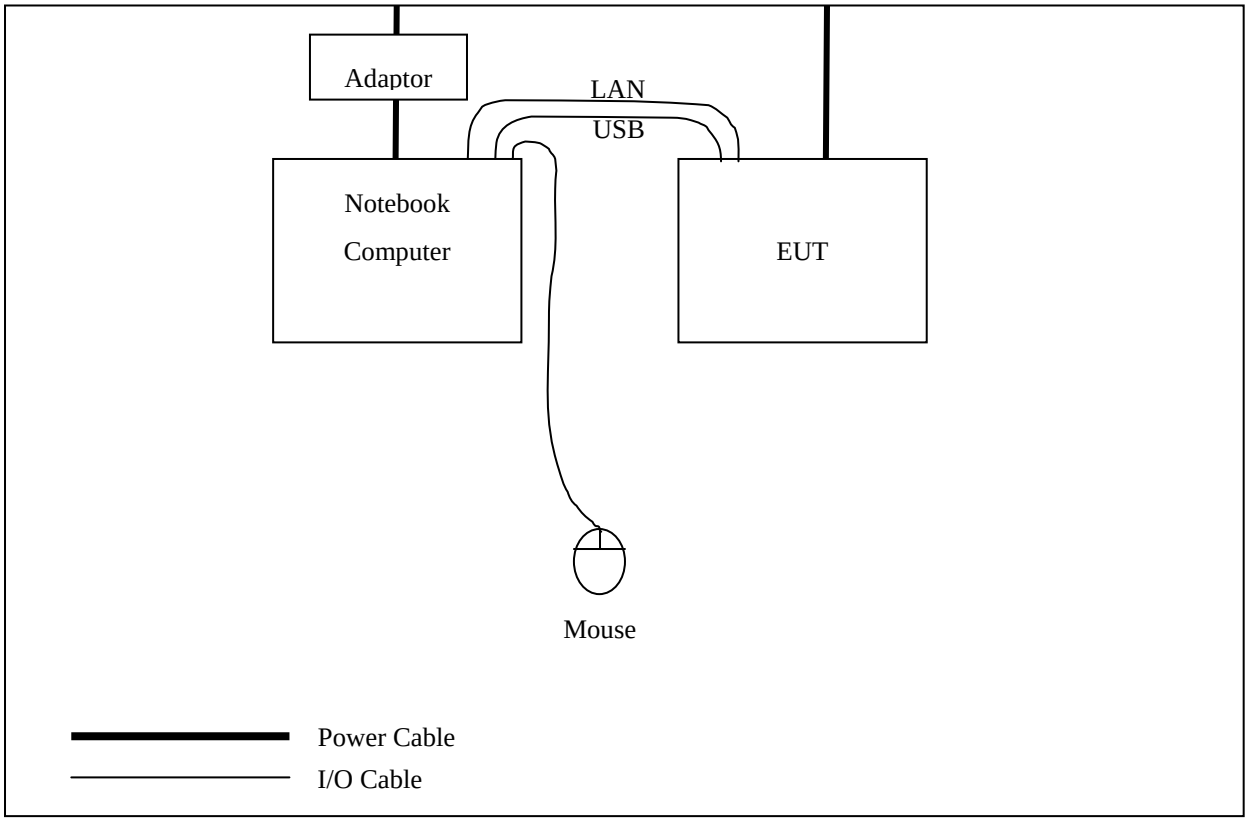
Table of test modes

Test Items	Mode	Data rate (Mbps)
Conducted Emissions	802.11g	54
Radiated Emissions	802.11g	54
6 dB Bandwidth	802.11b	11
	802.11g	54
	802.11n	MCS7
Peak Output Power	802.11b	11
	802.11g	54
	802.11n	MCS7
Peak Power Spectral Density	802.11b	11
	802.11g	54
	802.11n	MCS7
Conducted Spurious Emission, Radiated Spurious Emission, Band edge Emission	802.11b	11
	802.11g	54
	802.11n	MCS7

3.2 Support Equipment

Immunology Analyser (EUT)	Samsung Electronics Co., Ltd. Model : Samsung LABGEO PA20 1.5 m unshielded Power cable	FCC ID: A3LLABGEOPA20 S/N: N/A
Notebook Computer	Samsung Electronics Co., Ltd. Model : NT-RF510	S/N : ZZVL93EB301744D
Adaptor	Chicony Power Technology co., Ltd Model : A10-090P1A 2.0 m unshielded Power cable	S/N : CNBA4400215 ADON812700N8
Mouse	Anyjet Model : ANY-MU6000 1.5 m shielded USB cable	S/N : 9110002548
Laptop Computer	HP Model : G62-355TU 1.2 m shielded USB cable	FCC DOC S/N : CNF0452FN3
AC/DC Adapter	DELTA ELECTGONICS (JIANG SU), LTD. Model : PPP009D 1.2 m unshielded power cable	FCC DOC S/N : WBGSV0ACXZH162

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Samsung Immunology Analyser FCC ID: A3LLABGEOPA20.**

Specifications:

Category	Immunology Analyser
Model Name	SAMSUNG LABGEO PA20
Brand Name	SAMSUNG
Frequency of Operation	2412 MHz ~ 2462 MHz
Peak Power Output (Conducted)	802.11b : 21.10 dBm, 802.11g : 21.70 dBm 802.11n : 20.33 dBm
Channels	11 CH
TX Antenna Gain	0 dBi
Spreading	DSSS, OFDM
Modulations	BPSK, QPSK, 16QAM, 64QAM
Temperature Range	-20 ℃ ~ + 55 ℃
Voltage	a.c. 100-240 V, 120 W, 50-60 Hz
Test Voltage	a.c. 120 V, 60 Hz
Dimension(W x H x D)	246 mm x 289 mm x 375 mm
Weight	9.2 Kg
Remarks	-

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	FCC Paragraph No.	Result	Remark
Conducted Emission	15.207	Complies	
Radiated Emission	15.209	Complies	
6 dB Bandwidth	15.247(a)(2)	Complies	
Peak Power Output	15.247(b)(3)	Complies	
Power Spectral Density	15.247(e)	Complies	
Conducted Spurious Emission	15.247(d)	Complies	
Radiated Spurious Emission	15.247(d)	Complies	
Maximum Permissible Exposure	1.1307(b)	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung Immunology Analyser FCC ID: A3LLABGEOPA20** is in compliance with Part 15 Subpart C 15.247 of the FCC Rules.

6. ANTENNA REQUIREMENTS

§15.203 of the FCC Rules part 15 Subpart C

: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Samsung Immunology Analyser FCC ID: A3LLABGEOPA20 use the antenna that uses a unique coupling to the intentional radiator. It complies with the requirement of §15.203.

7. DESCRIPTION OF TESTS

7.1 Conducted Emissions

The Line conducted emission test facility is located inside a 4 x 7 x 2.5 meter shielded enclosure. It is manufactured by EM engineering. The shielding effectiveness of the shielded room is in accordance with MIL-STD-285 or NSA 65-6.
A 1 m x 1.5 m wooden table 0.8 m height is placed 0.4 m away from the vertical wall and 1.5 m away from the side of wall of the shielded room Rohde & Schwarz (ESH3-Z5) and (ESH2-Z5) of the 50 ohm/50 µH Line Impedance Stabilization Network (LISN) are bonded to the shielded room.
The EUT is powered from the Rohde & Schwarz LISN (ESH3-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH2-Z5). Power to the LISNs are filtered by high-current high insertion loss Power line filters. The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1 / 2 ”.
If DC power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs,
All interconnecting cables more than 1 meter were shortened by non inductive bundling (serpentinefashion) to a 1 meter length.
Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT.
The spectrum was scanned from 150 kHz to 30 MHz with 200 msec sweep time.
The frequency producing the maximum level was re-examined using the EMI test receiver.
(Rohde & Schwarz ESCS30).
The detector functions were set to CISPR quasi-peak mode & average mode.
The bandwidth of receiver was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.
Each emission was maximized by; switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; which ever determined the worst case emission.
Each EME reported was calibrated using the R&S signal generator.

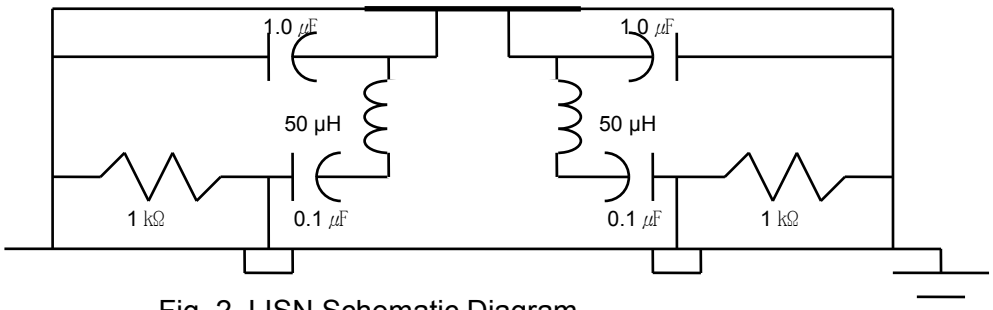


Fig. 2. LISN Schematic Diagram

7.2 Radiated Emissions

Measurement were made at 10 meter Semi-Anechoic Chamber using broad band antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The Technology configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna was note for each frequency found.
The test receiver was scanned from 9 kHz to 30 MHz using Loop Antenne(Rohde&Schwarz, HFH2-Z2) and 30 MHz to 1000 MHz using TRILOG Broadband Test Antenna (Schwarzbeck, VULB 9163) in semi anechoic chamber. Above 1 GHz, Horn antenna (Scwarzbeck BBHA 9120D: up to 18 GHz, Q-par Angus QSH20S20 : 18 to 26.5 GHz, QSH22K20: up to 40 GHz) was used.
The test equipment was placed on a wooden table.
Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
Each frequency found during measurements was reexamined and investigated using EMI test receiver. (ESU 40)
The detector function were set to CISPR quasi-peak mode and the bandwidth of the receiver were set to 120 kHz or 1 MHz depending on the frequency or type of signal.
The half wave dipole antenna was tuned to the frequency found during preliminary radiated measurements.
The EUT support equipment and interconnecting cables were re configured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8 m high non- metallic 1.0 x 1.5 meter table.
The EUT, support equipment and interconnecting cables were re-arranged and manipulated to maximize each EME emission.
The turn table containing the Technology was rotated; the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by : switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux a.c. outlet, if applicable; whichever determined the worst case emission.
Each EME reported was calibrated using the R/S signal generator.

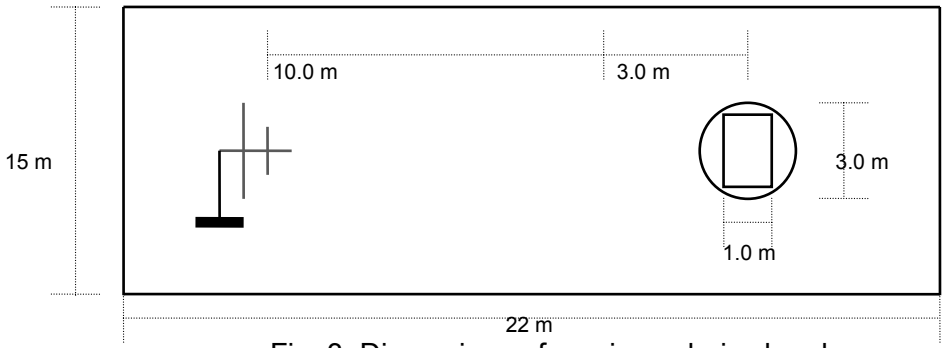
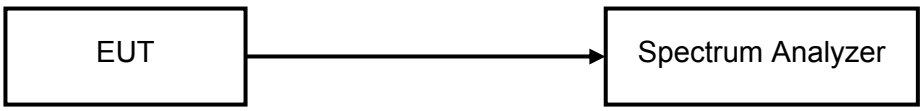


Fig. 3. Dimensions of semi anechoic chamber

7.3 6 dB Bandwidth

Test Setup

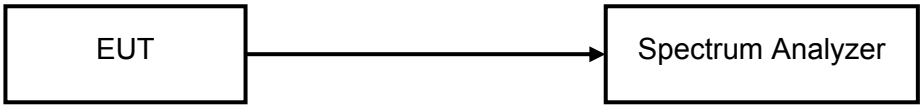


Test Procedure

EUTs 6 dB bandwidth is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.
The spectrum analyzer setting is as follows.
RBW = approximately 1-5 % of the emission bandwidth
VBW ≥ 3 x RBW
Detector = Peak
Trace mode = max hold
Sweep = auto couple
The bandwidth measurement function on the spectrum analyzer is used to measure the 6 dB bandwidth.

7.4 Maximum Peak Output Power

Test Setup

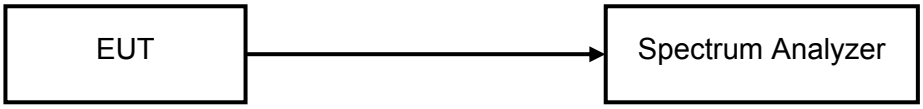


Test Procedure

EUTs Maximum Peak Conducted Output Power is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.
The spectrum analyzer setting is as follows.
RBW = 1 MHz
VBW = 3 MHz
Span = 5 -30 % greater than the EBW
Detector = peak
Sweep time = auto couple
The band power measurement function on the spectrum analyzer is used to measure the Maximum peak conducted output power.

7.5 Peak Power Spectral Density

Test Setup



Test Procedure

EUTs Peak Power Spectral Density is measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.

The spectrum analyzer setting is as follows.

RBW = 100 kHz

VBW ≥ 300 kHz

Span = 5 -30 % greater than the EBW

Detector = peak

Sweep time = auto couple

Trace mode = max hold

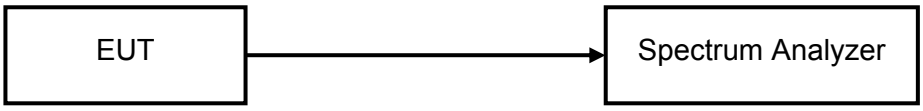
The peak search function on the spectrum analyzer is used to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

The observed power level is scaled to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor where

BWCF = 10log (3 kHz / 100 kHz = -15.2 dB)

7.6 Conducted Spurious Emissions

Test Setup



Test Procedure

EUTs Conducted spurious emissions are measured at low, middle, high channels with a spectrum analyzer connected to the antenna terminal while the EUTs operating at its maximum power control level.
The spectrum analyzer setting is as follows.

1) Reference Level
RBW = 100 kHz
VBW ≥300 kHz
Span = 5 -30 % greater than the EBW
Detector = peak
Sweep time = auto couple
Trace mode = max hold
The peak search function on the spectrum analyzer is used to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

2) Unwanted Emissions
RBW = 100 kHz
VBW ≥300 kHz
Span = encompass the spectrum to be examined
Detector = peak
Sweep time = auto couple
The amplitude of all unwanted emissions outside of the authorized frequency band is confirmed that it is attenuated by at least the minimum requirements specified.

8. TEST DATA

8.1 Conducted Emissions

FCC §15.207

2.4 GHz TX mode

Frequency	Level(dBµV)		*)Factor	**) Line	Limit(dBµV)		Margin(dB)	
(MHz)	Q-Peak	Average	(dB)		Q-Peak	Average	Q-Peak	Average
0.17	38.8	35.1	0.2	N	65.0	55.0	26.2	19.9
0.20	39.4	34.5	0.2	N	63.6	53.6	24.2	19.1
0.45	37.5	31.2	0.2	L	56.9	46.9	19.4	15.7
0.78	40.7	35.5	0.1	L	56.0	46.0	15.3	10.5
12.06	44.1	36.9	1.0	L	60.0	50.0	15.9	13.1
20.93	44.7	39.9	1.6	N	60.0	50.0	15.3	10.1

Line Conducted Emissions Tabulated Data

Notes:

1. ***Measurements using CISPR quasi-peak mode & average mode.***
2. ***All modes of operation were investigated and the worst -case emission are reported. See attached Plots.***
3. ****) Factor = LISN + Cable Loss***
4. *****) LINE : L = Line , N = Neutral***
5. ***The limit is on the FCC Part section 15.207(a).***

PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Line)***

NEMKO KOREA (NK-12-R-073) 24 Jul 2012 17:11

Conducted Emissions

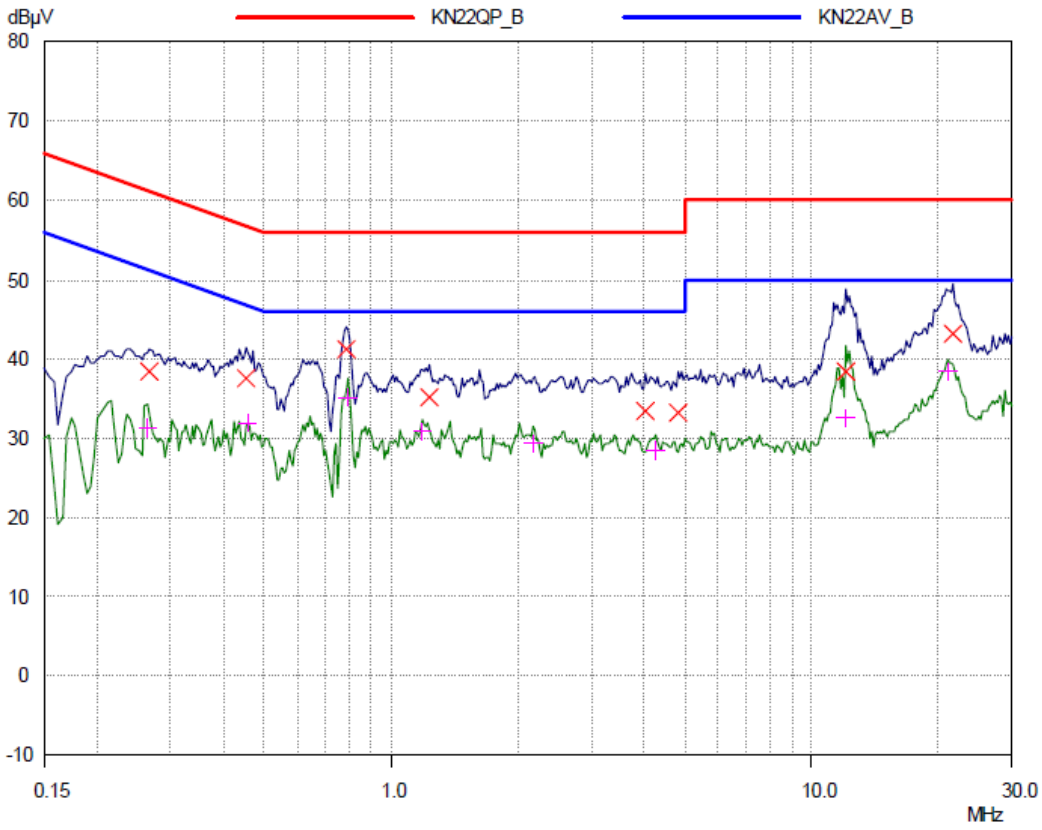
EUT:	EUT
Manuf:	Samsung
Op Cond:	a.c. 120 V, 60 Hz (Wireless lan TX mode, Mid ch)
Operator:	Minchul, Shin
Test Spec:	FCC Part 15.207
Comment:	MODEL : Samsung LABGEO PA20
	LINE : Line

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	ESH3_Z5_Line

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	8
	Acc Margin:	30 dB



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral)***

NEMKO KOREA (NK-12-R-073) 24 Jul 2012 17:29

Conducted Emissions

EUT:	EUT
Manuf:	Samsung
Op Cond:	a.c. 120 V, 60 Hz (Wireless lan TX mode, Mid ch)
Operator:	Minchul, Shin
Test Spec:	FCC Part 15.207
Comment:	MODEL : Samsung LABGEO PA20
	LINE : Neutral

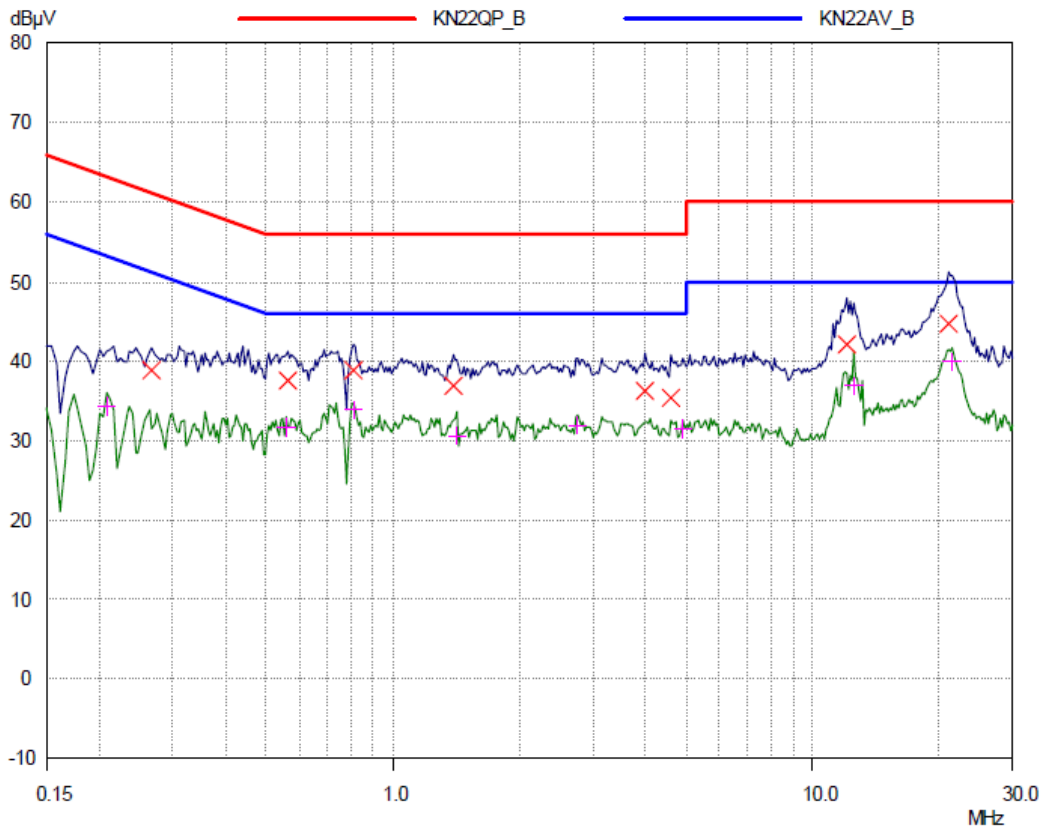
Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	10 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	ESH3_Z5_Neutral

Final Measurement:

Detectors:	X QP / + AV
Meas Time:	1sec
Subranges:	8
Acc Margin:	30 dB



8.2 Radiated Emissions

FCC §15.209

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Antenna Heights (cm)	Turntable Angles (°)	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
32.57	58.2	V	100	221	-23.8	34.4	40.0	5.6
83.40	62.4	H	230	249	-26.2	36.2	40.0	3.8
250.00	62.8	H	100	150	-22.4	40.4	46.0	5.6
297.00	65.0	H	100	219	-21.0	44.0	46.0	2.0
458.98	58.5	H	100	255	-17.0	41.5	46.0	4.5
875.06	50.1	H	100	7	-10.7	39.4	46.0	6.6

Radiated Measurements at 3meters

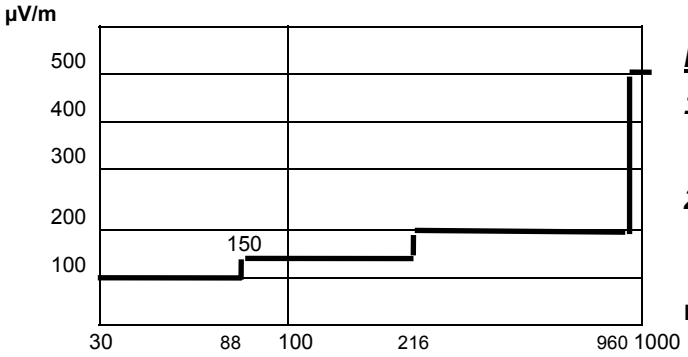


Fig. 4. Limits at 3 meters

Notes:

1. All modes were measured and the worst-case emission was reported.

2 The radiated limits are shown on Figure 4.

Above 1 GHz the limit is 500 µV/m.

Notes:

1. *Pol. H = Horizontal V = Vertical

2. **Corr. = Antenna Factor + Cable Loss + Amplifier.

3. Measurements using CISPR quasi-peak mode below 1 GHz.

4. The limit is on the FCC Part section 15.209(a).

TEST DATA

8.3 6 dB Modulated Bandwidth

FCC §15.247(a)(2)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

802.11b mode

Channel	Frequency(MHz)	Result(kHz)	Limit(kHz)	Margin(kHz)
Low	2412	7475	500	6975
Middle	2437	7611	500	7111
High	2462	7318	500	6818

802.11g mode

Channel	Frequency(MHz)	Result(kHz)	Limit(kHz)	Margin(kHz)
Low	2412	16085	500	15585
Middle	2437	16119	500	15619
High	2462	16254	500	15754

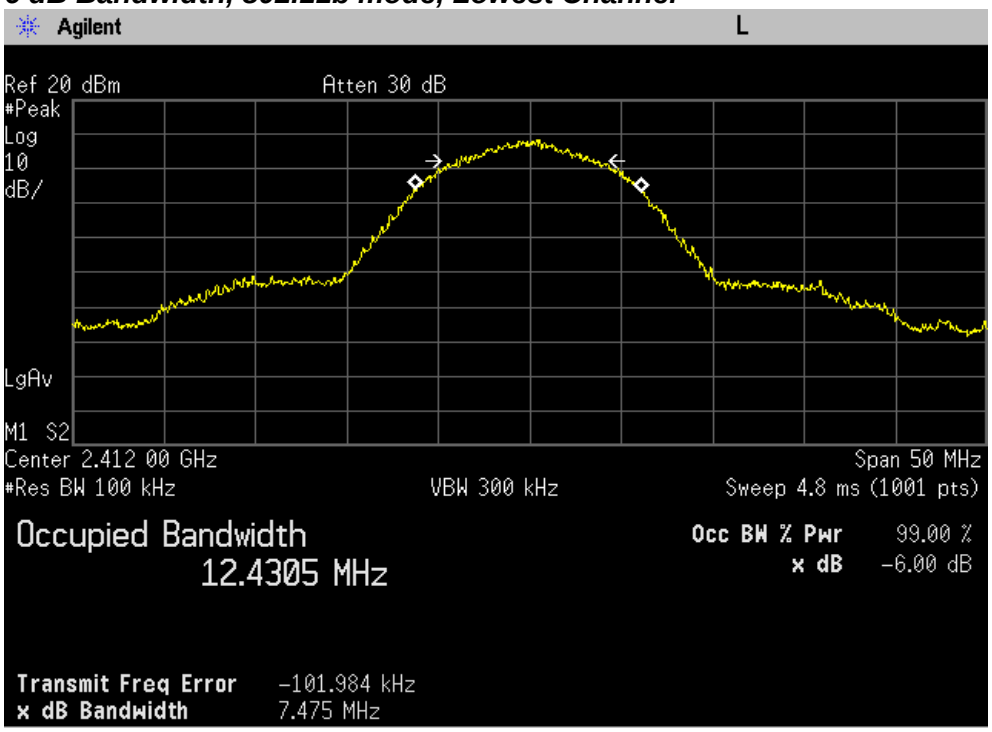
802.11n mode

Channel	Frequency(MHz)	Result(kHz)	Limit(kHz)	Margin(kHz)
Low	2412	17495	500	16995
Middle	2437	17463	500	16963
High	2462	17433	500	16933

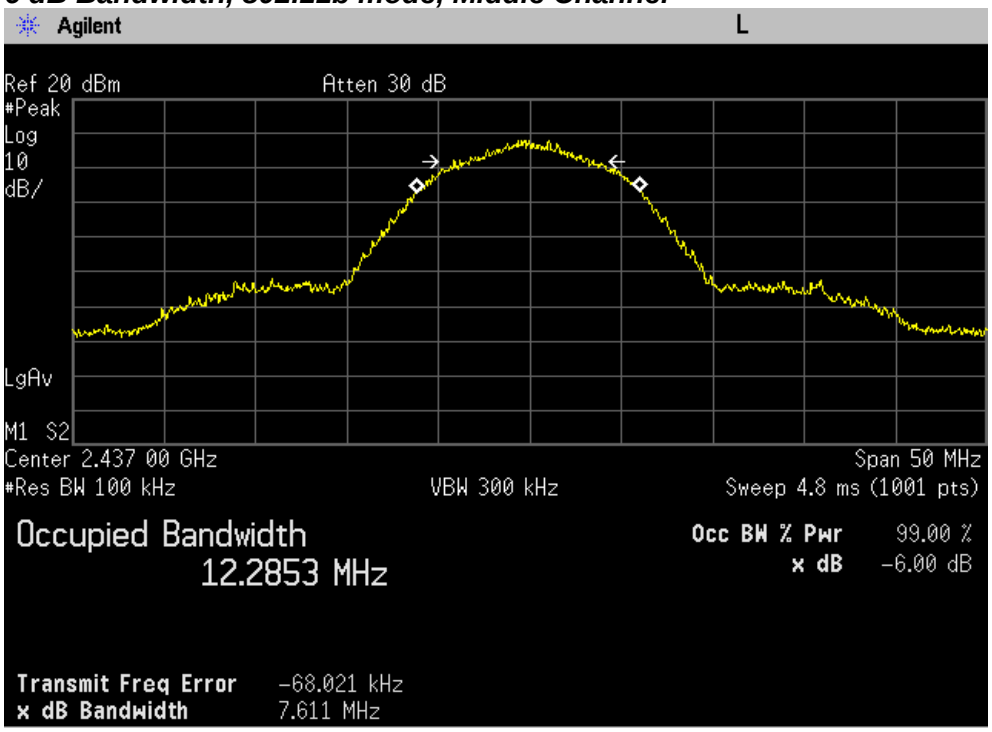
PLOTS OF EMISSIONS

802.11b mode

6 dB Bandwidth, 802.11b mode, Lowest Channel

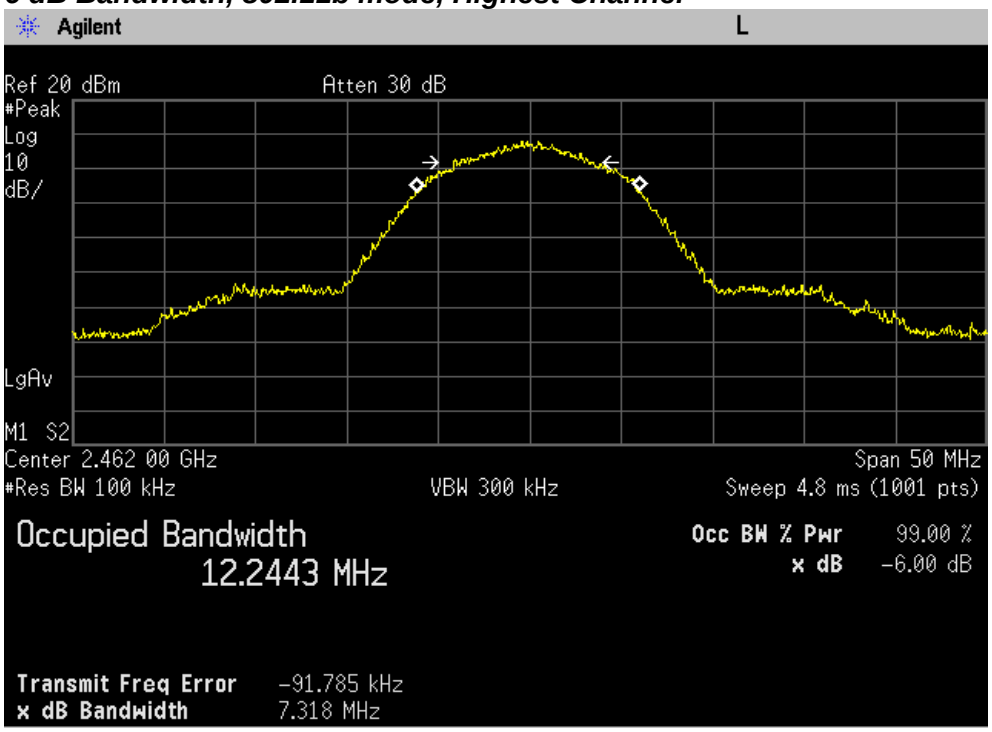


6 dB Bandwidth, 802.11b mode, Middle Channel



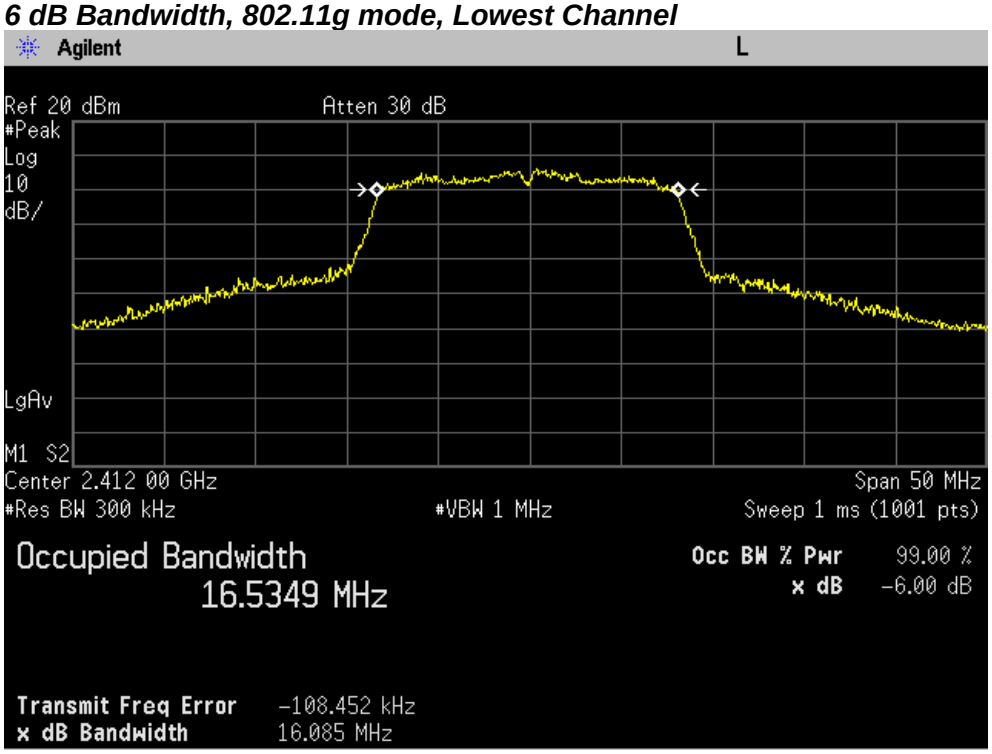
PLOTS OF EMISSIONS

6 dB Bandwidth, 802.11b mode, Highest Channel



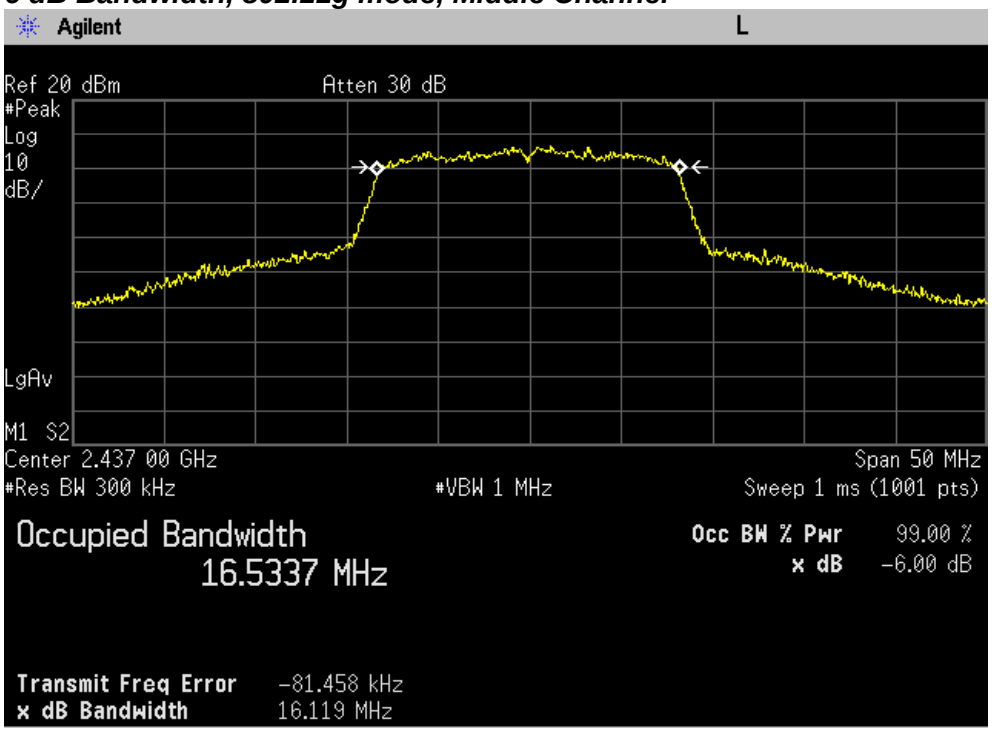
802.11g mode

6 dB Bandwidth, 802.11g mode, Lowest Channel

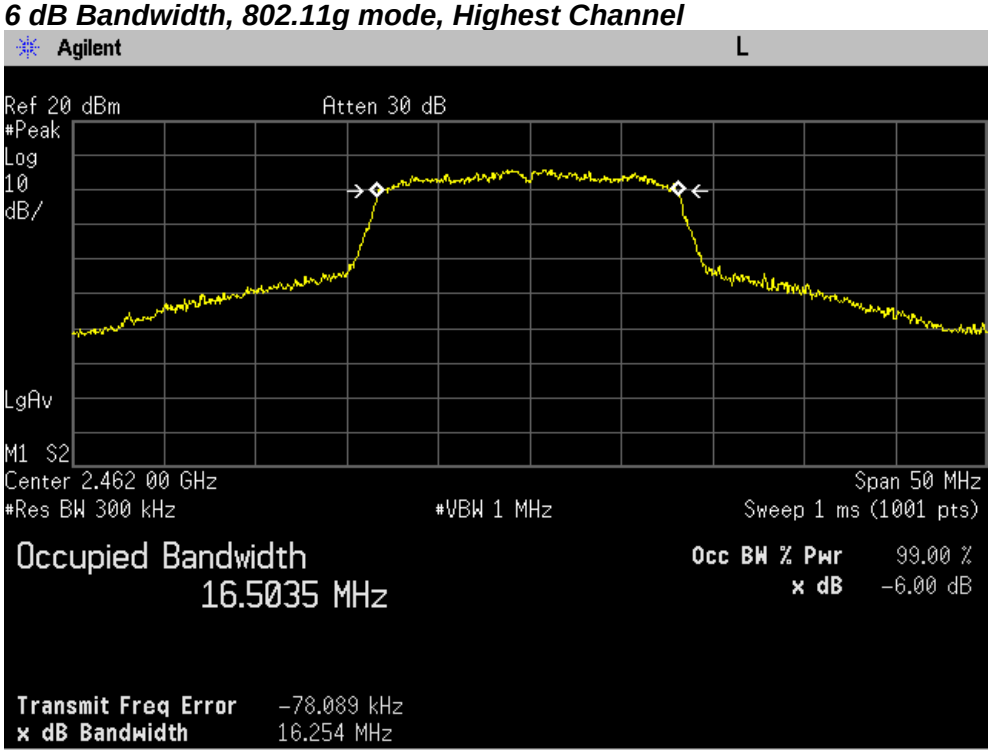


PLOTS OF EMISSIONS

6 dB Bandwidth, 802.11g mode, Middle Channel



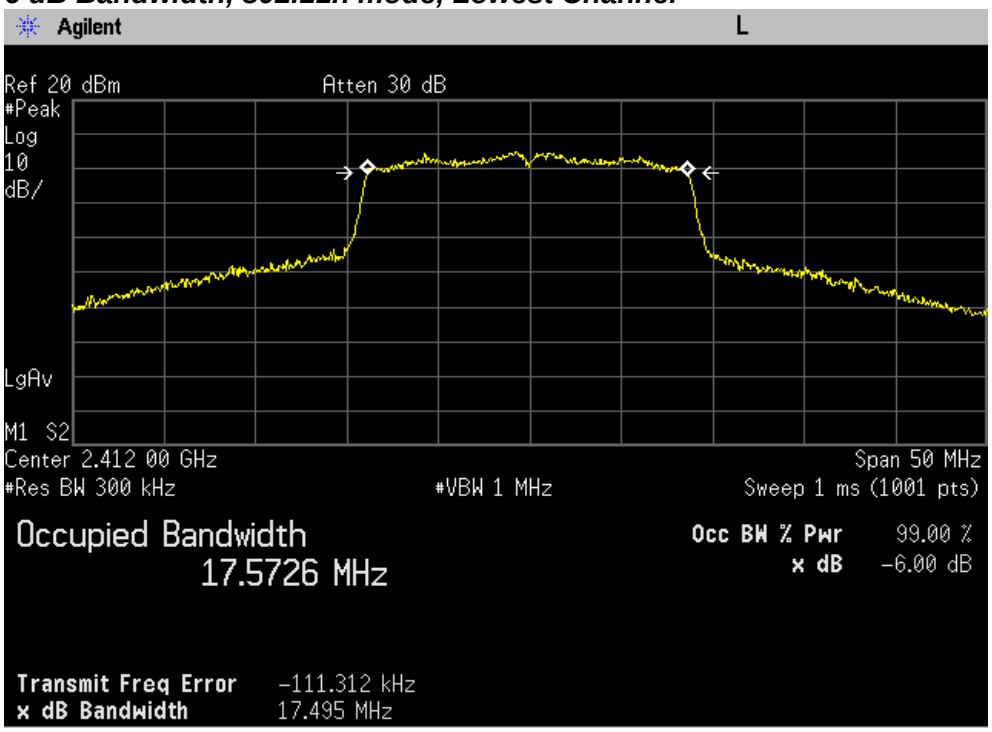
6 dB Bandwidth, 802.11g mode, Highest Channel



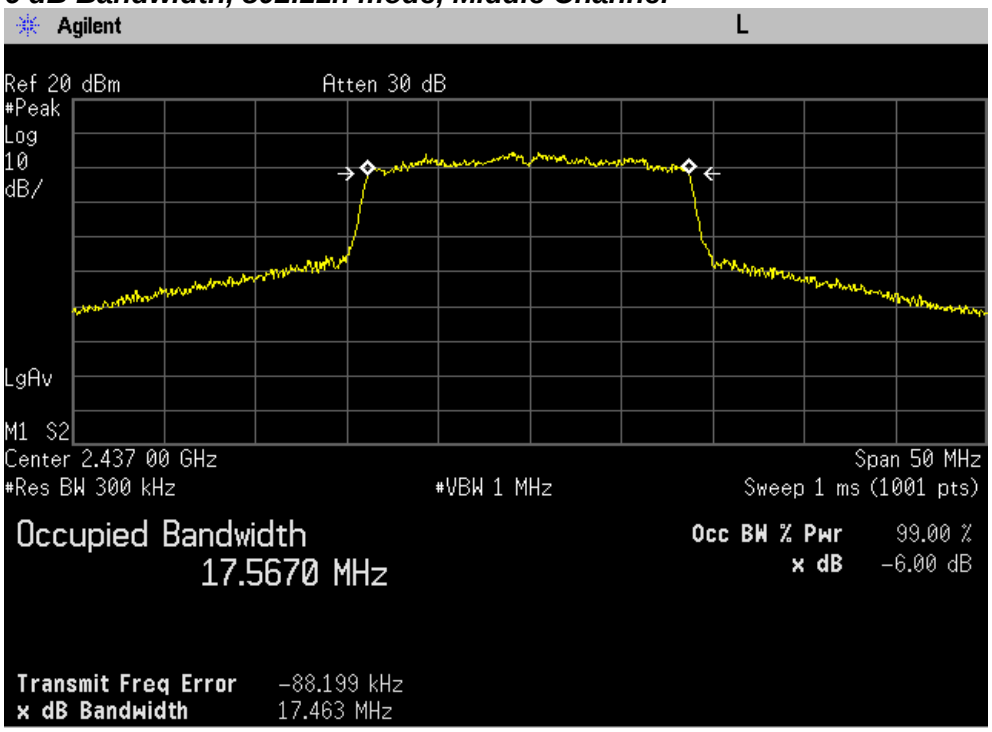
PLOTS OF EMISSIONS

802.11n mode

6 dB Bandwidth, 802.11n mode, Lowest Channel

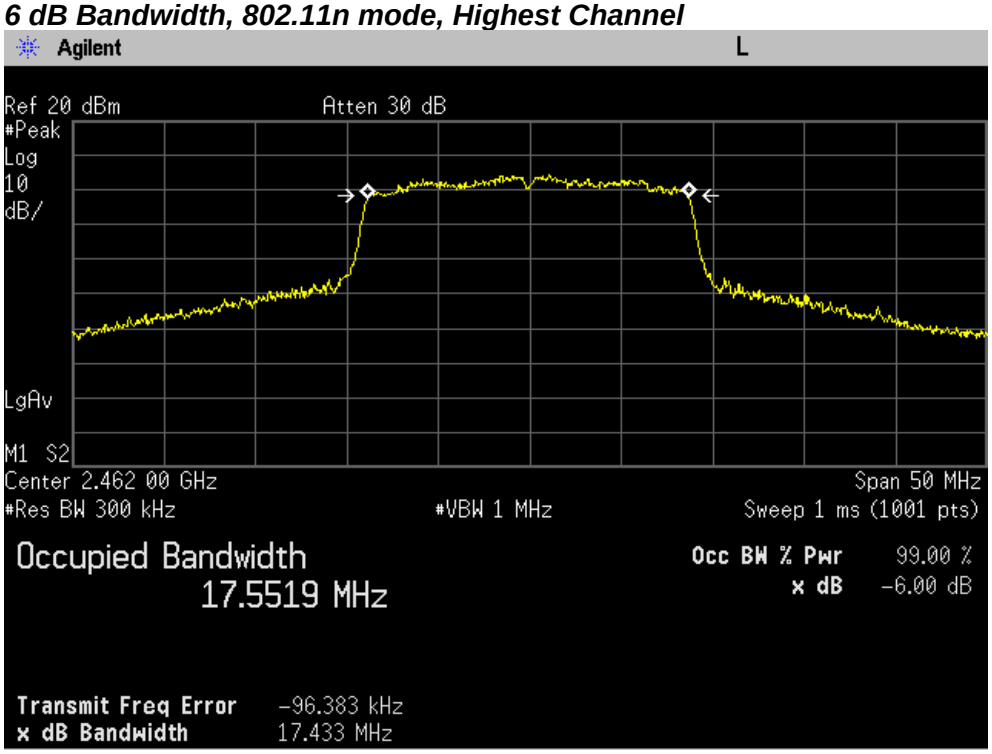


6 dB Bandwidth, 802.11n mode, Middle Channel



PLOTS OF EMISSIONS

6 dB Bandwidth, 802.11n mode, Highest Channel



8.4 Maximum Peak Power Output

FCC §15.247(b)(3)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

802.11b mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	21.08	30.00	8.92
Middle	2437	21.10	30.00	8.90
High	2462	20.90	30.00	9.10

802.11g mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	21.53	30.00	8.47
Middle	2437	21.70	30.00	8.30
High	2462	21.57	30.00	8.43

802.11n mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	20.33	30.00	9.67
Middle	2437	20.17	30.00	9.83
High	2462	20.11	30.00	9.89

Note:

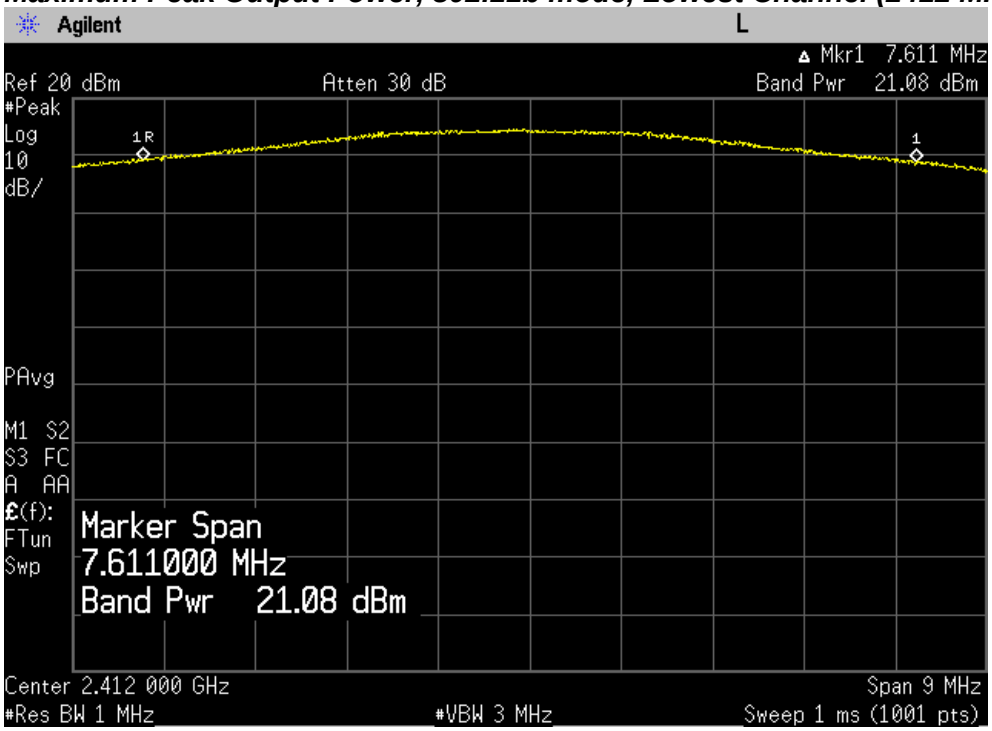
The following equation was used for spectrum offset:

Spectrum offset (dB) = Attenuator (dB) + Cable Loss (dB) + SMA Type Connector Loss (dB)

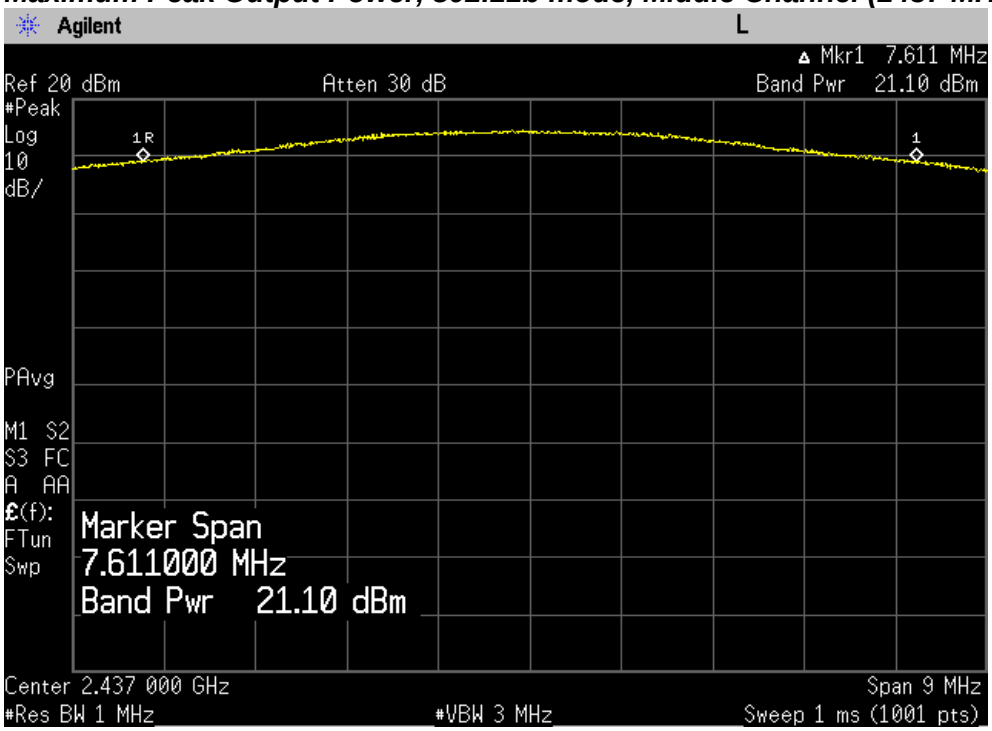
PLOT OF TEST DATA

802.11b mode

Maximum Peak Output Power, 802.11b mode, Lowest Channel (2412 MHz)

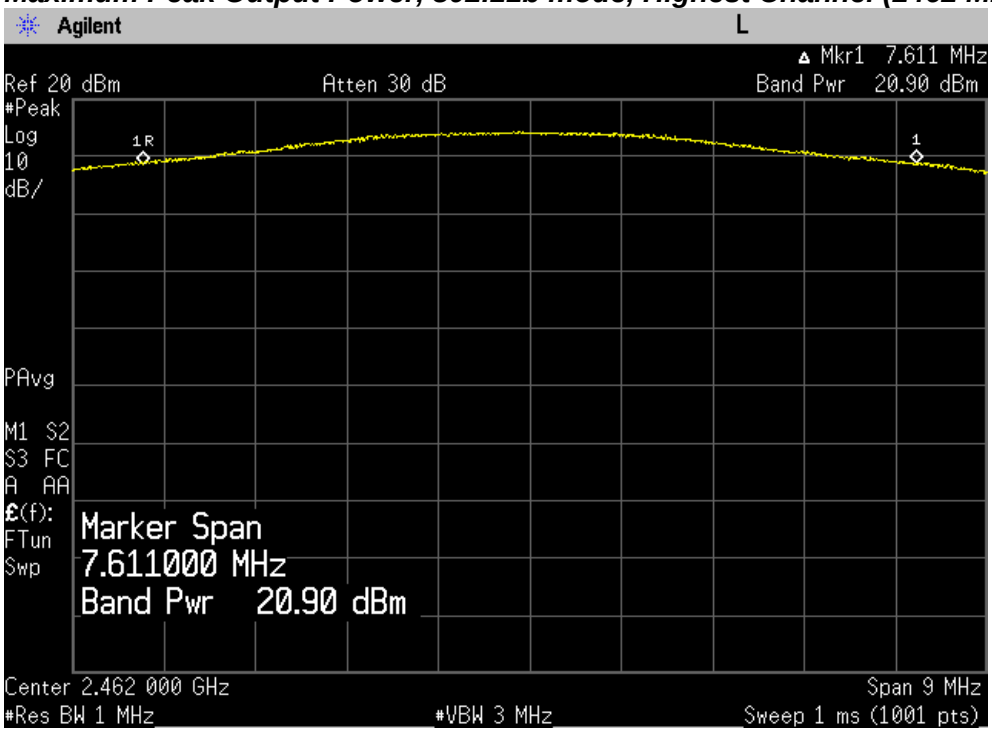


Maximum Peak Output Power, 802.11b mode, Middle Channel (2437 MHz)



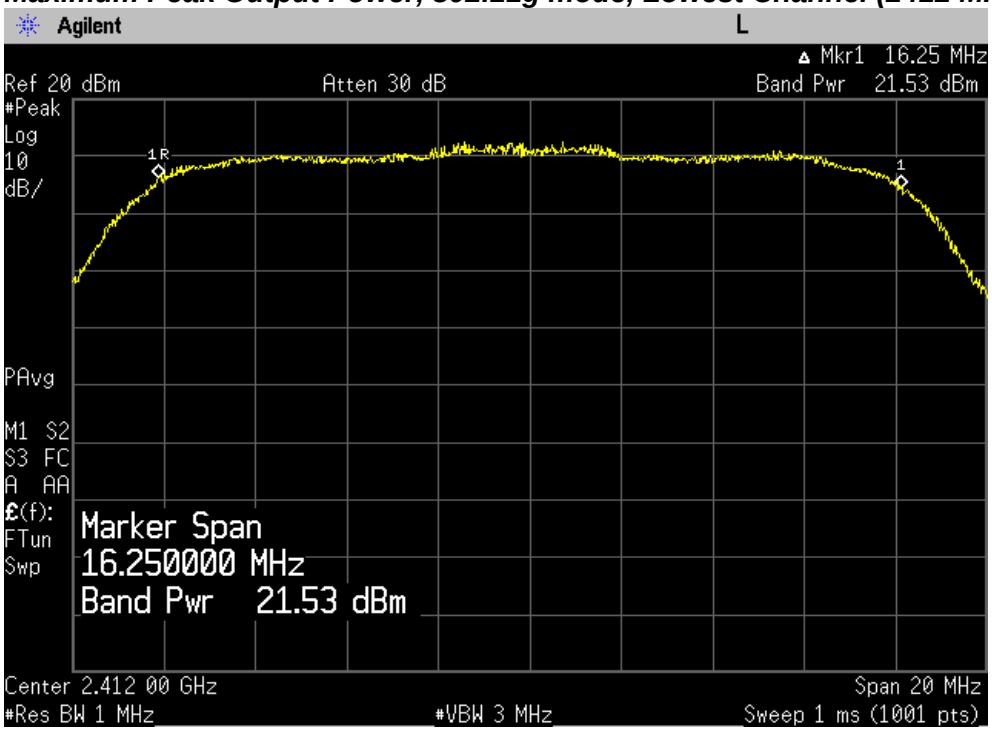
PLOT OF TEST DATA

Maximum Peak Output Power, 802.11b mode, Highest Channel (2462 MHz)



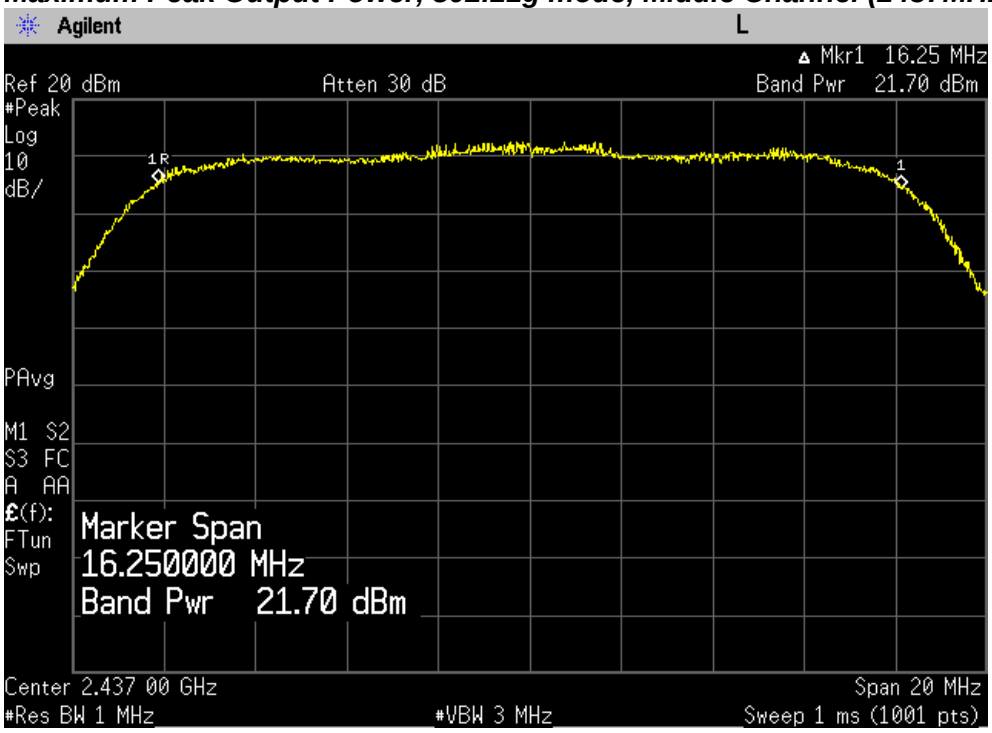
802.11g mode

Maximum Peak Output Power, 802.11g mode, Lowest Channel (2412 MHz)

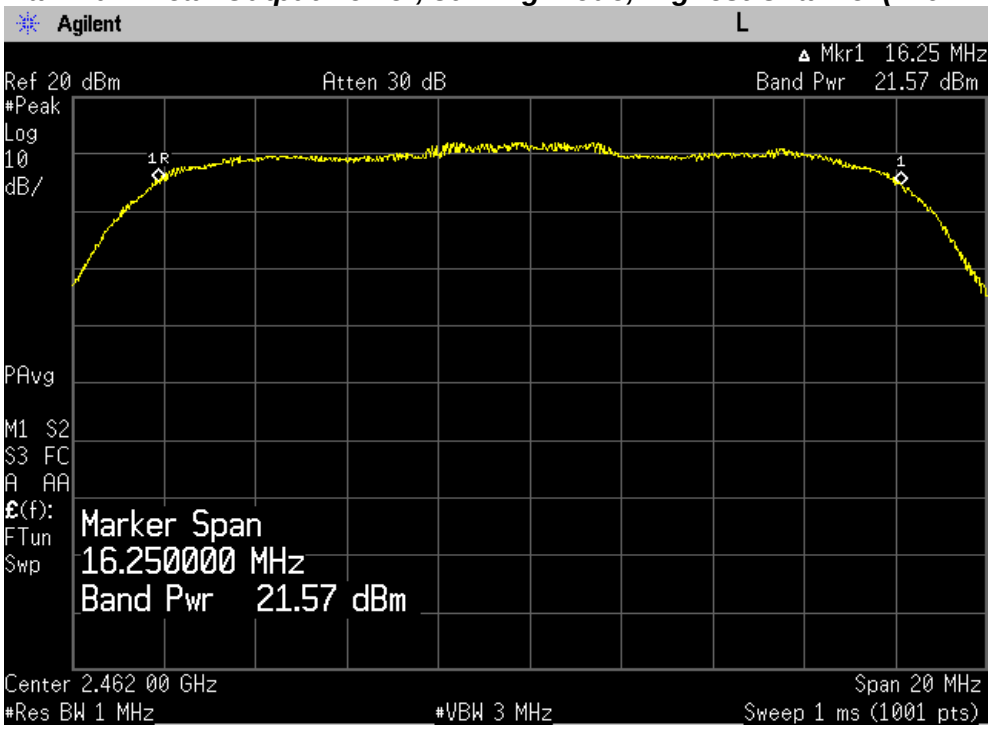


PLOT OF TEST DATA

Maximum Peak Output Power, 802.11g mode, Middle Channel (2437MHz)



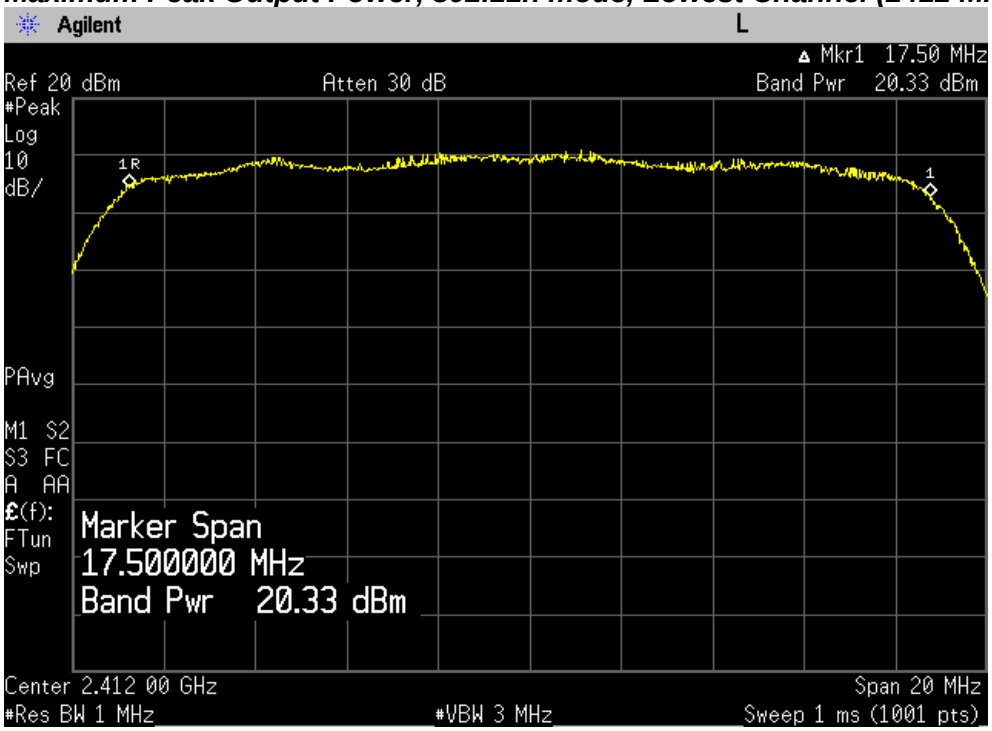
Maximum Peak Output Power, 802.11g mode, Highest Channel (2462 MHz)



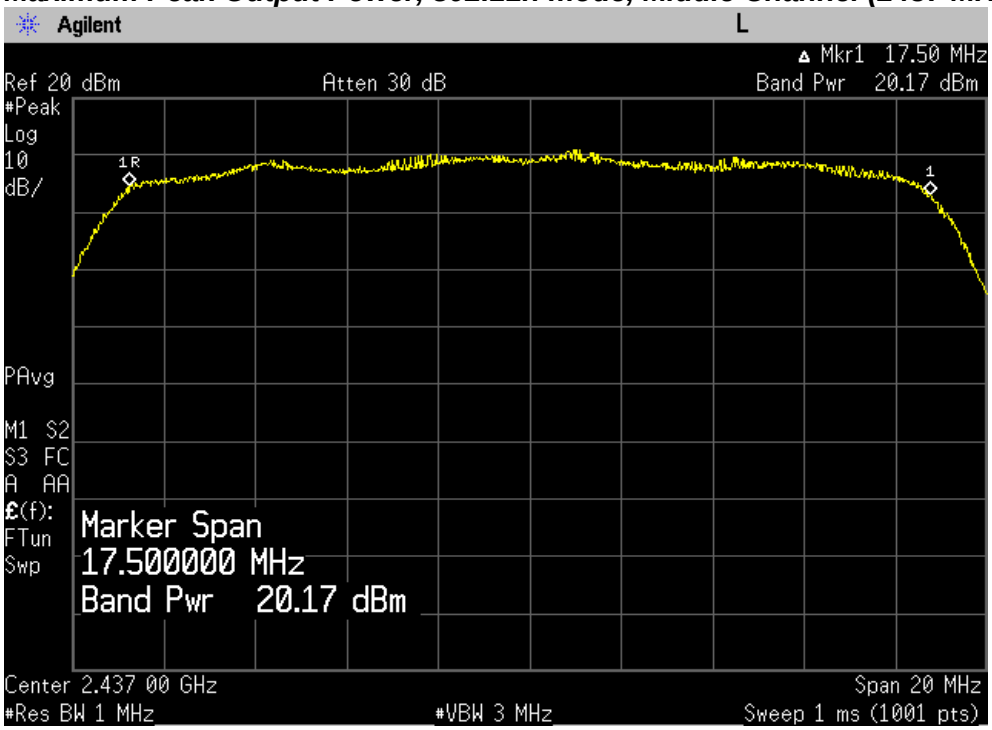
PLOT OF TEST DATA

802.11n mode

Maximum Peak Output Power, 802.11n mode, Lowest Channel (2412 MHz)

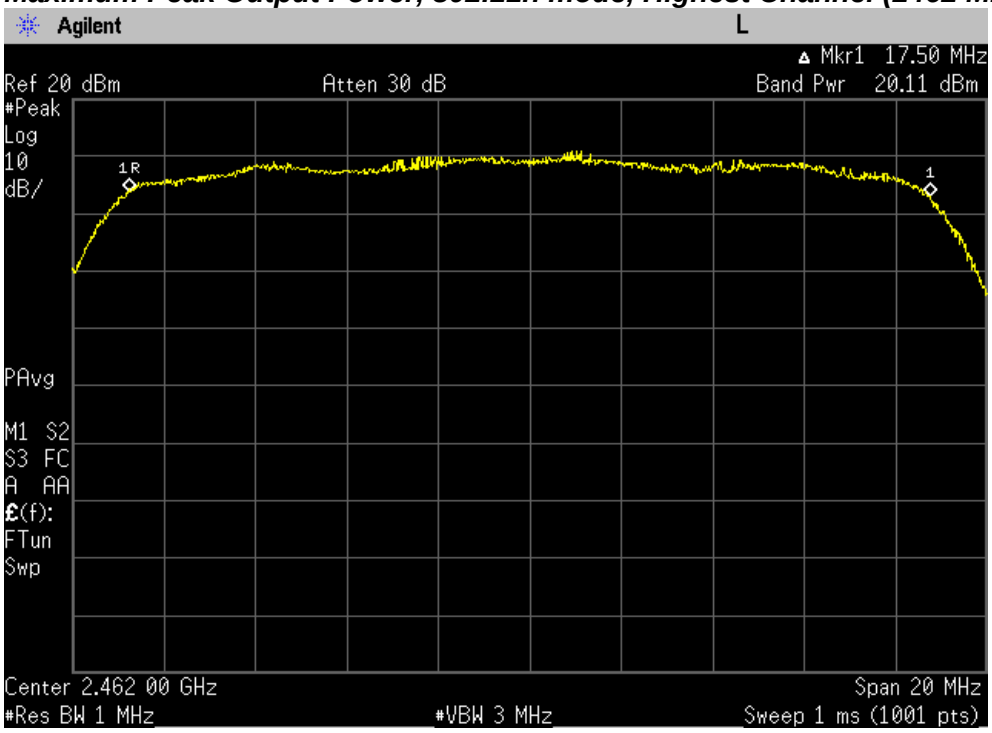


Maximum Peak Output Power, 802.11n mode, Middle Channel (2437 MHz)



PLOT OF TEST DATA

Maximum Peak Output Power, 802.11n mode, Highest Channel (2462 MHz)



8.5 Power Spectral Density

FCC §15.247(e)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

802.11b mode

Channel	Frequency (MHz)	Measured Power Spectral Density (dBm)	*Bandwidth Correction Factor(dB)	**Corrected Power Spectral Density (dBm)	Limit (dBm)	Margin (dB)
Low	2412	8.81	-15.23	-6.42	8	14.42
Middle	2437	8.33	-15.23	-6.90	8	14.90
High	2462	7.90	-15.23	-7.33	8	15.33

802.11g mode

Channel	Frequency (MHz)	Measured Power Spectral Density (dBm)	*Bandwidth Correction Factor(dB)	**Corrected Power Spectral Density (dBm)	Limit (dBm)	Margin (dB)
Low	2412	2.73	-15.23	-12.50	8	20.50
Middle	2437	3.30	-15.23	-11.93	8	19.93
High	2462	2.75	-15.23	-12.48	8	20.48

802.11n mode

Channel	Frequency (MHz)	Measured Power Spectral Density (dBm)	*Bandwidth Correction Factor(dB)	**Corrected Power Spectral Density (dBm)	Limit (dBm)	Margin (dB)
Low	2412	1.78	-15.23	-13.45	8	21.45
Middle	2437	1.69	-15.23	-13.54	8	21.54
High	2462	1.58	-15.23	-13.65	8	21.65

Note:

The following equation was used for spectrum offset for Power Spectral Density:

Spectrum offset (dB) = Attenuator (dB) + Cable Loss (dB) + SMA Type Connector Loss (dB)

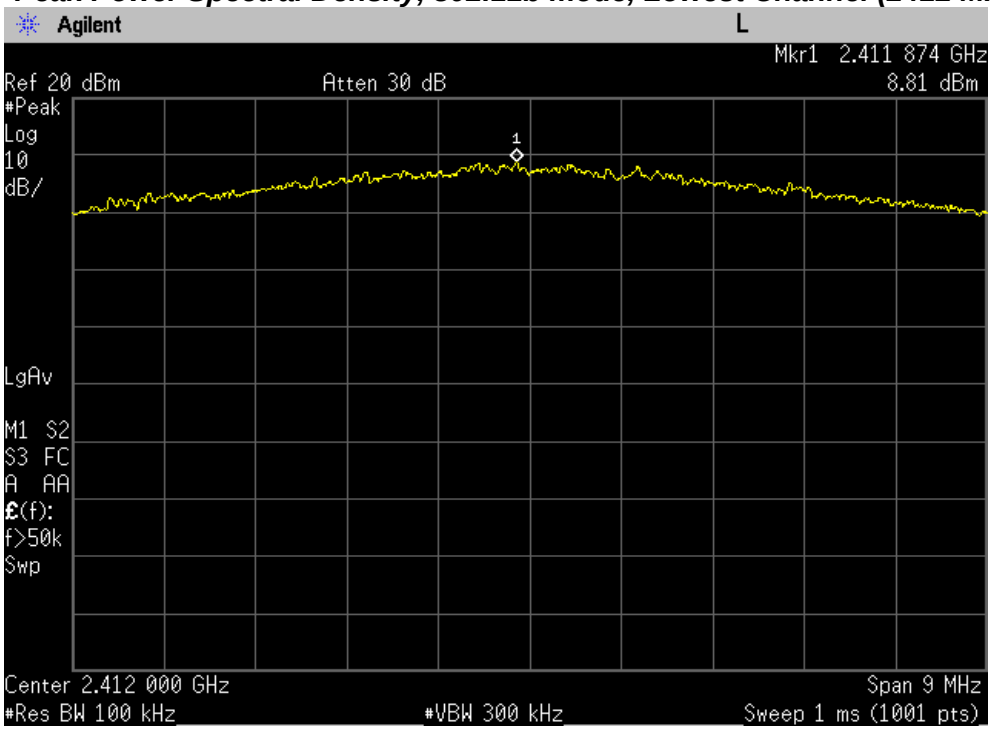
Bandwidth Correction Factor (dB) =** ***10log (3 kHz / 100 kHz = -15.23 dB)

****Corrected Power Spectral Density (dBm) = Measured Power Spectral Density + Bandwidth Correction Factor**

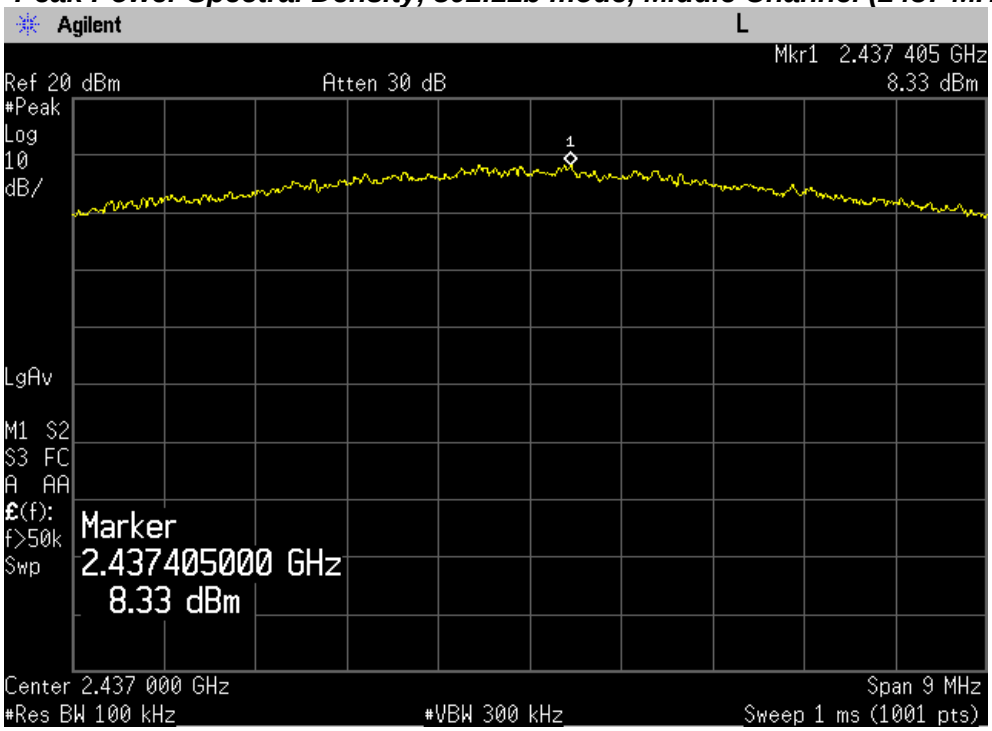
PLOT OF TEST DATA

802.11b mode

Peak Power Spectral Density, 802.11b mode, Lowest Channel (2412 MHz)

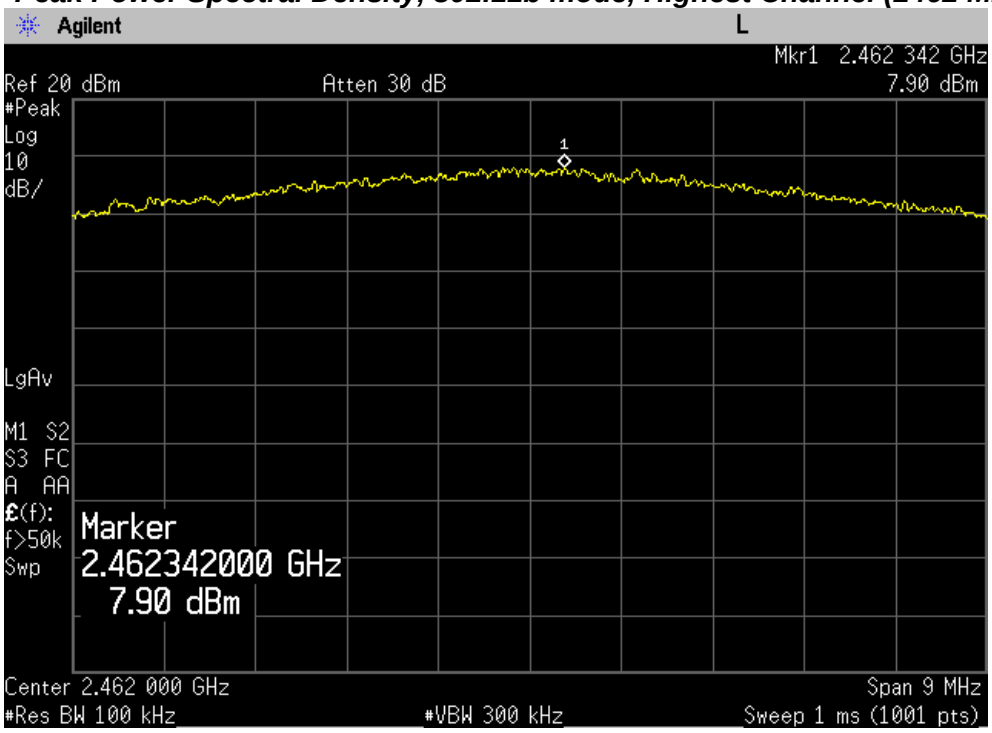


Peak Power Spectral Density, 802.11b mode, Middle Channel (2437 MHz)



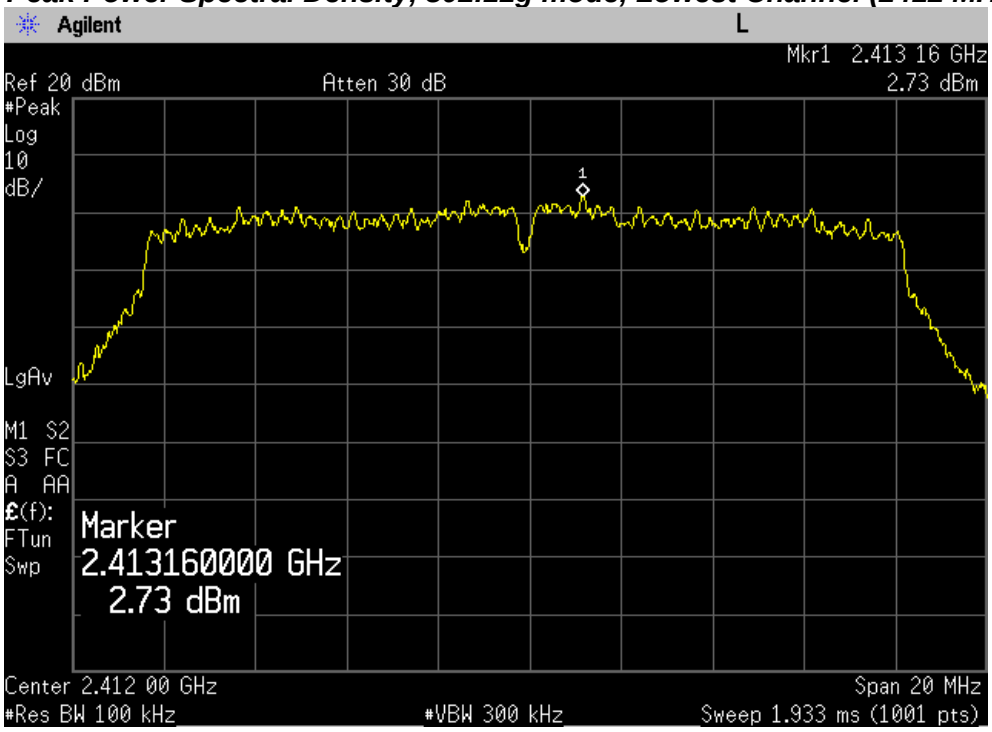
PLOT OF TEST DATA

Peak Power Spectral Density, 802.11b mode, Highest Channel (2462 MHz)



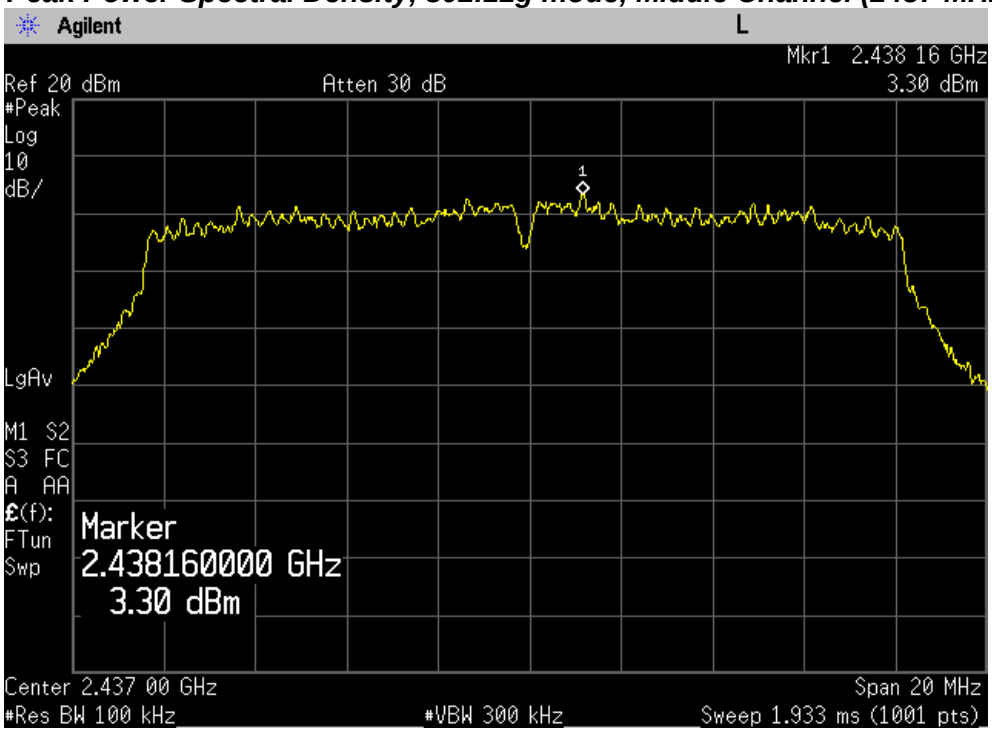
802.11g mode

Peak Power Spectral Density, 802.11g mode, Lowest Channel (2412 MHz)

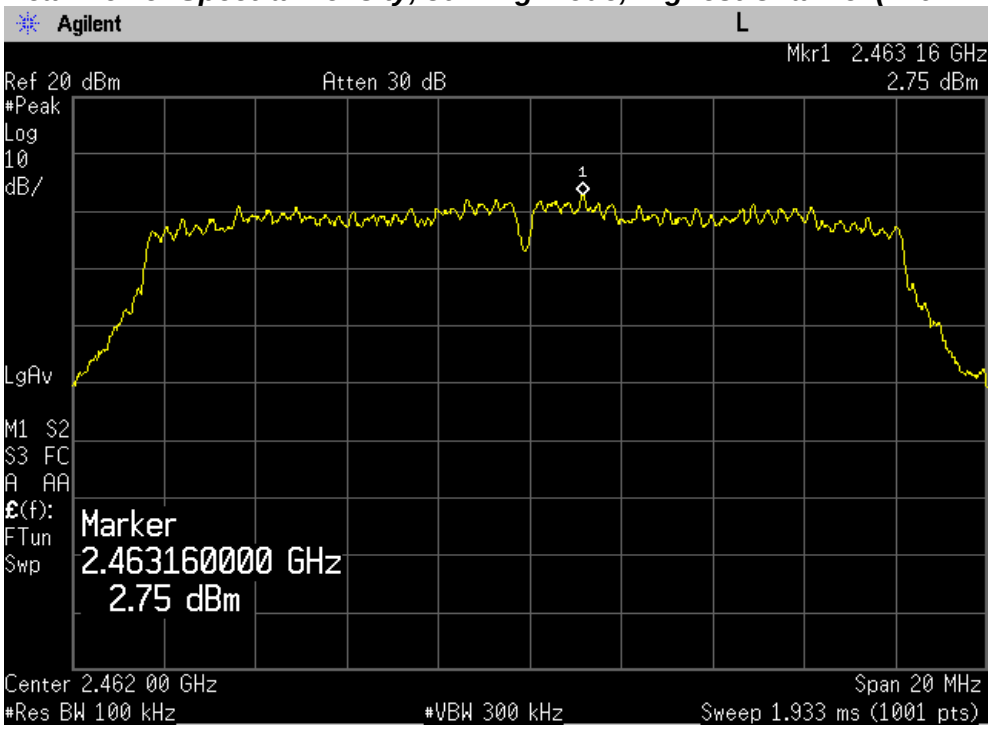


PLOT OF TEST DATA

Peak Power Spectral Density, 802.11g mode, Middle Channel (2437 MHz)



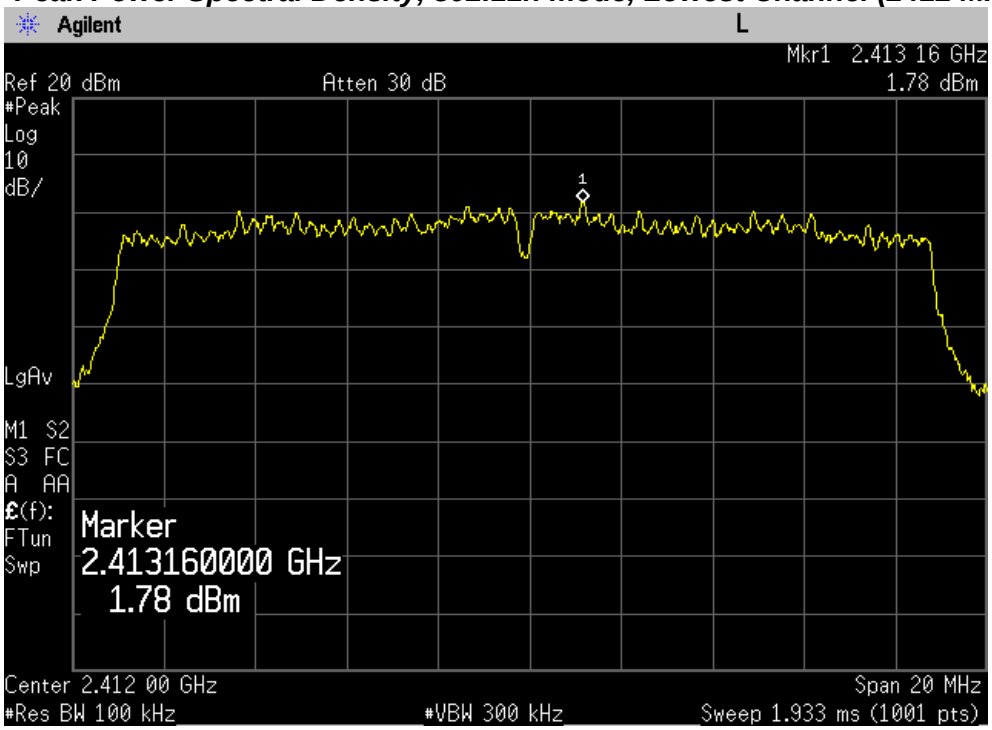
Peak Power Spectral Density, 802.11g mode, Highest Channel (2462 MHz)



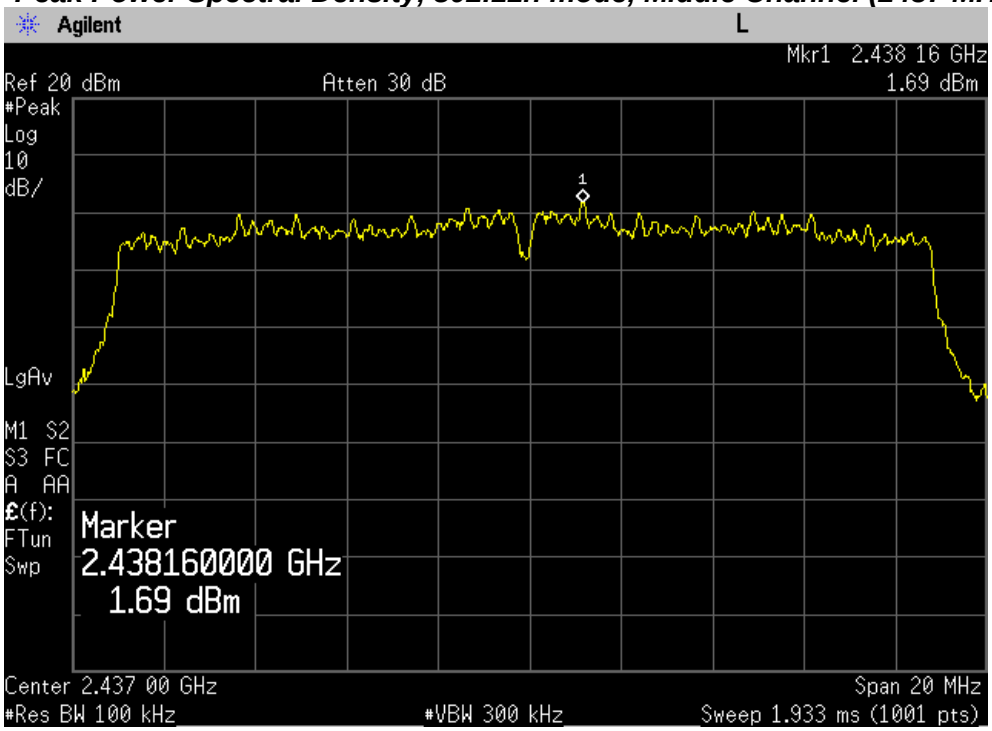
PLOT OF TEST DATA

802.11n mode

Peak Power Spectral Density, 802.11n mode, Lowest Channel (2412 MHz)

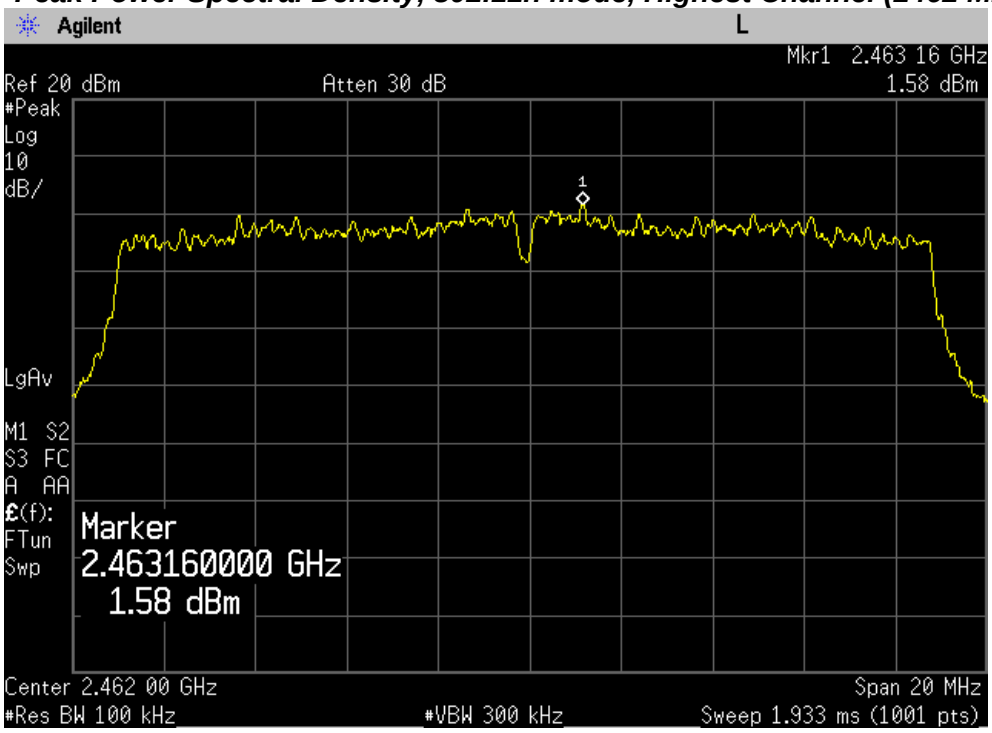


Peak Power Spectral Density, 802.11n mode, Middle Channel (2437 MHz)



PLOT OF TEST DATA

Peak Power Spectral Density, 802.11n mode, Highest Channel (2462 MHz)



8.6 Conducted Spurious Emissions

FCC §15.247(d)

Test Mode : Set to Lowest channel, Middle channel and Highest channel

802.11b/g/n mode

Channel	Frequency(MHz)	Result(dBc)	Limit(dBc)
Low	2412	More than 20 dBc	20
Middle	2437	More than 20 dBc	20
High	2462	More than 20 dBc	20

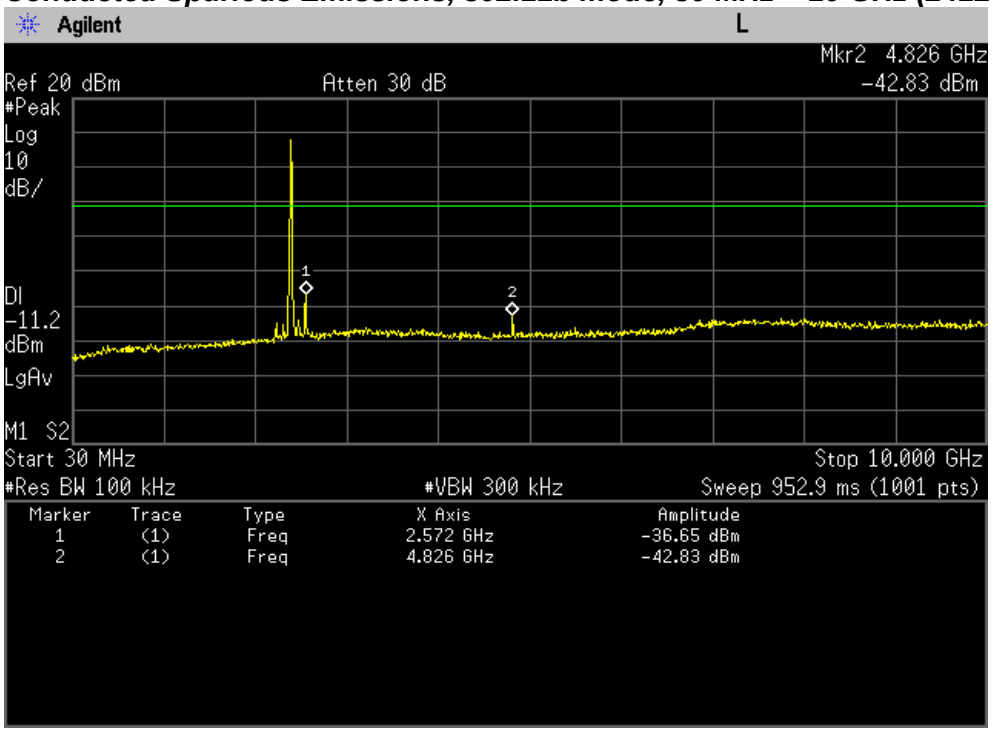
Note:

The cable and attenuator loss from 30 MHz to 25 GHz was reflected in spectrum analyzer with correction factor for the spurious emissions test.

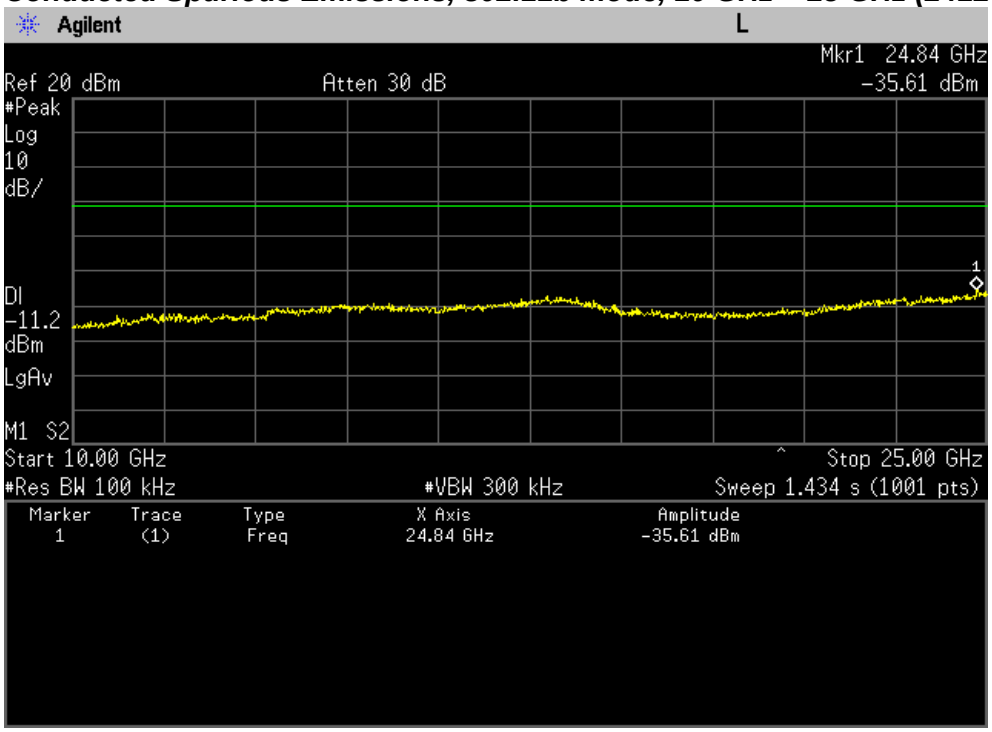
PLOT OF TEST DATA

802.11b mode

Conducted Spurious Emissions, 802.11b mode, 30 MHz ~ 10 GHz (2412 MHz)

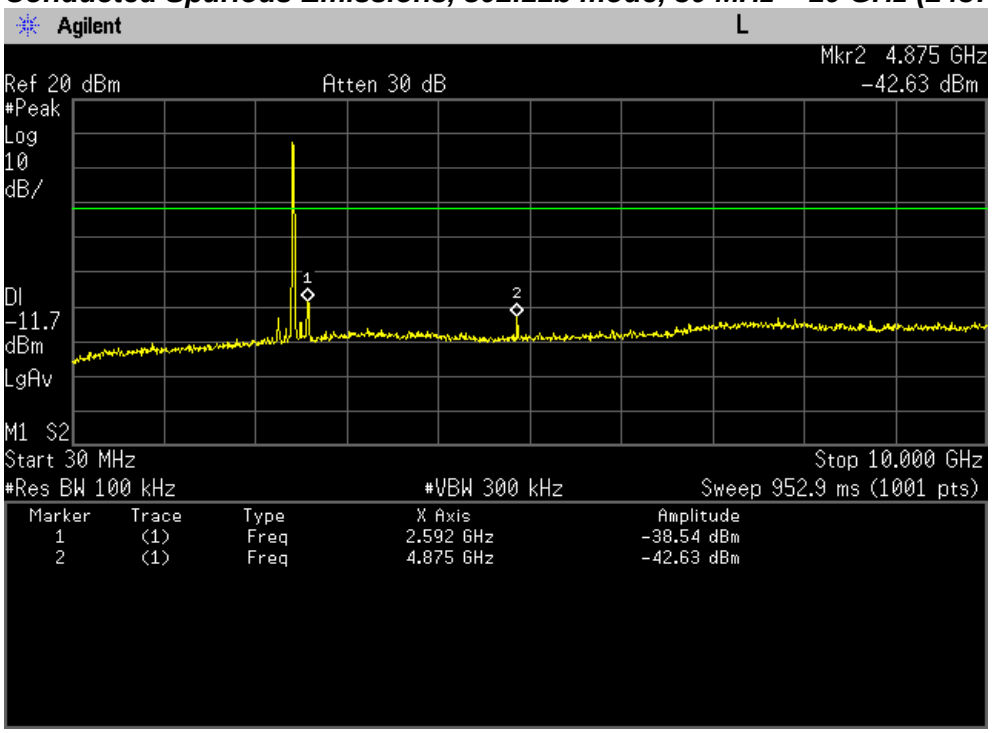


Conducted Spurious Emissions, 802.11b mode, 10 GHz ~ 25 GHz (2412 MHz)

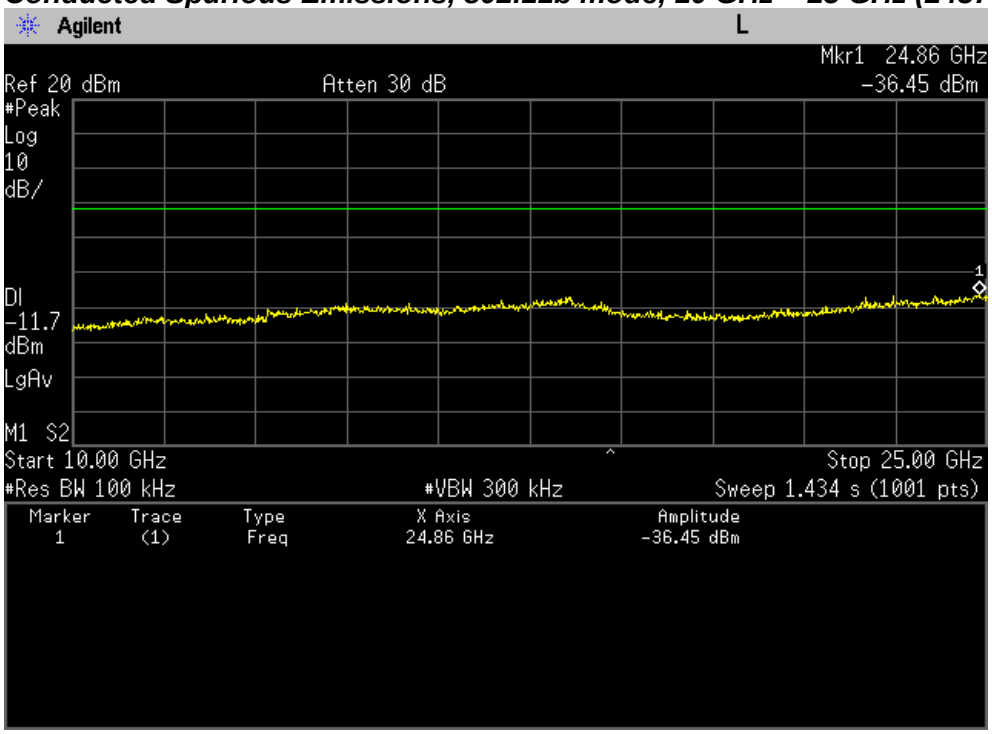


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11b mode, 30 MHz ~ 10 GHz (2437 MHz)

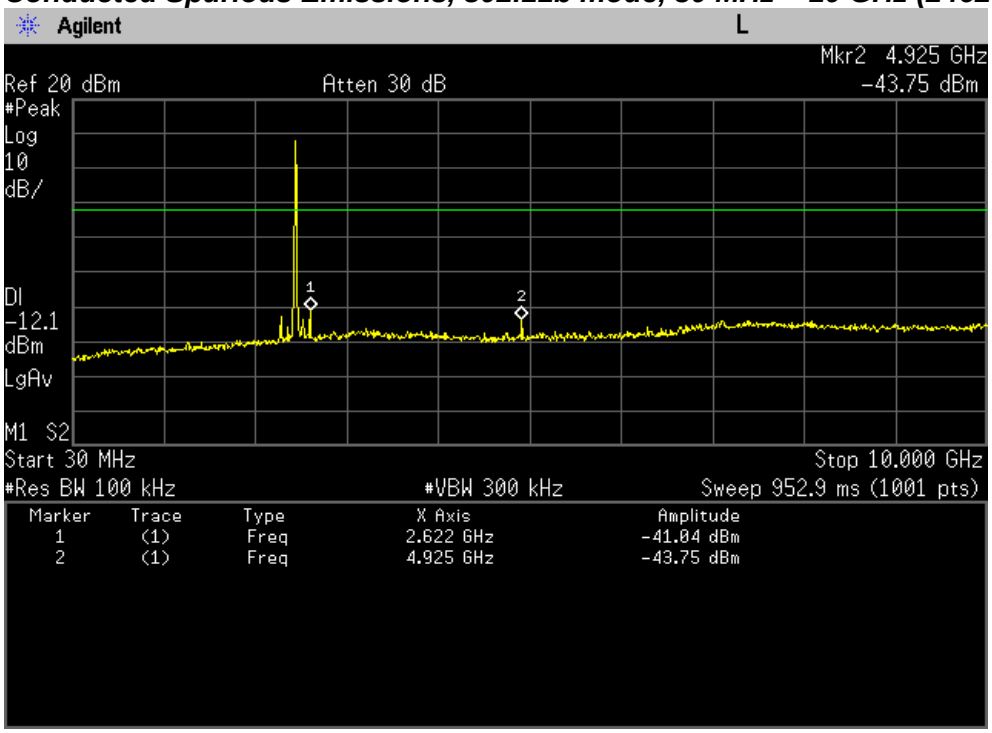


Conducted Spurious Emissions, 802.11b mode, 10 GHz ~ 25 GHz (2437 MHz)

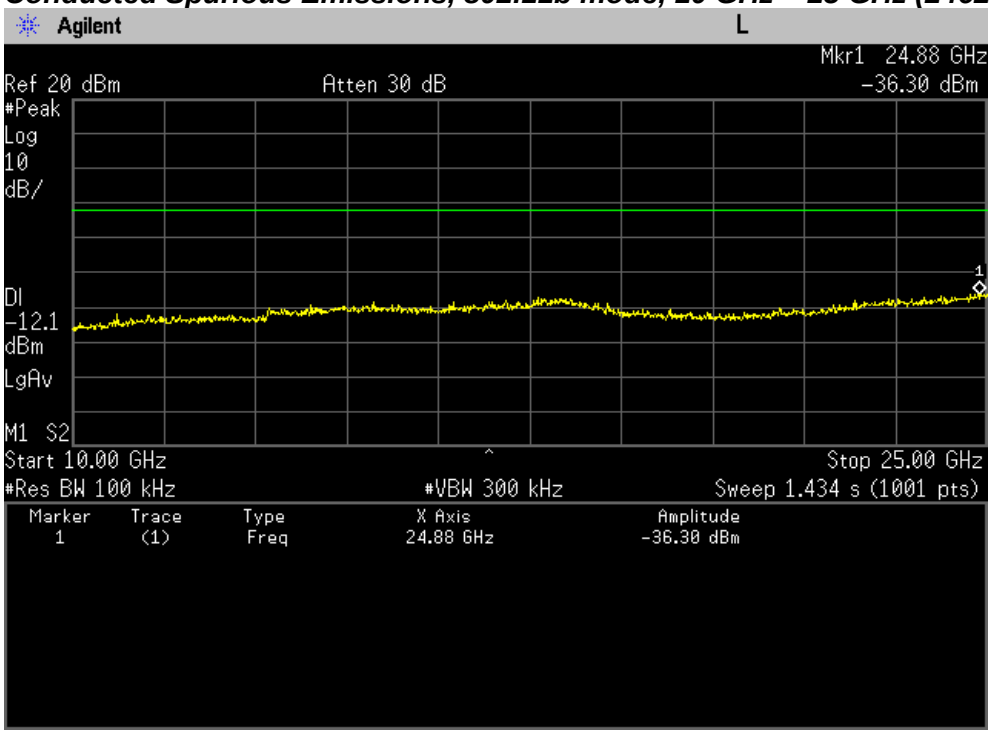


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11b mode, 30 MHz ~ 10 GHz (2462 MHz)



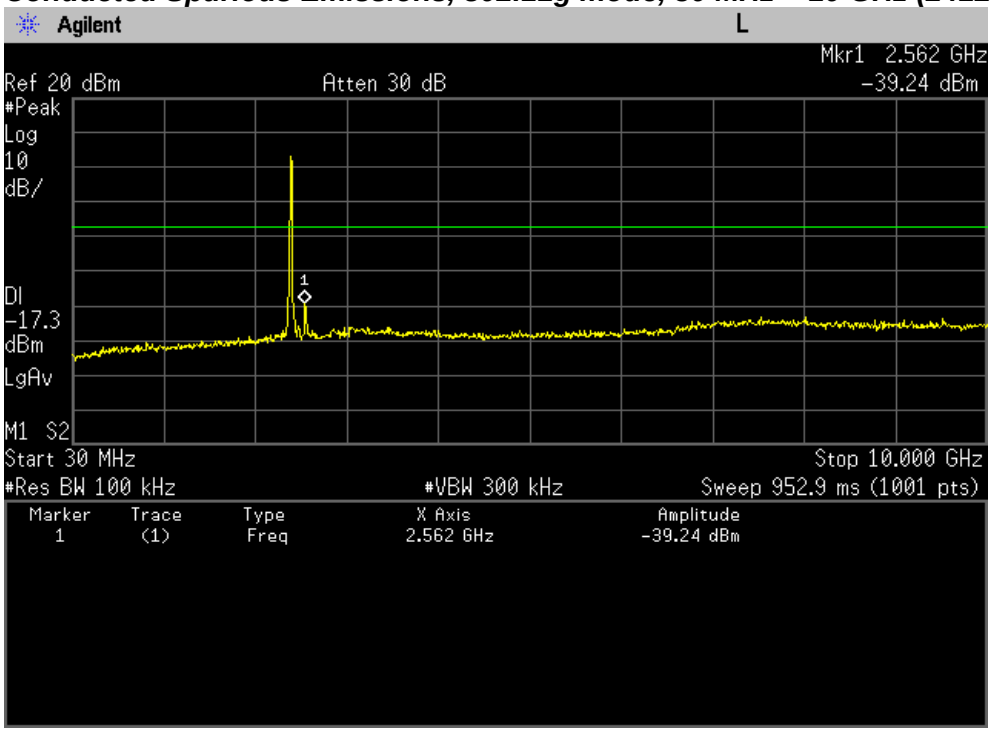
Conducted Spurious Emissions, 802.11b mode, 10 GHz ~ 25 GHz (2462 MHz)



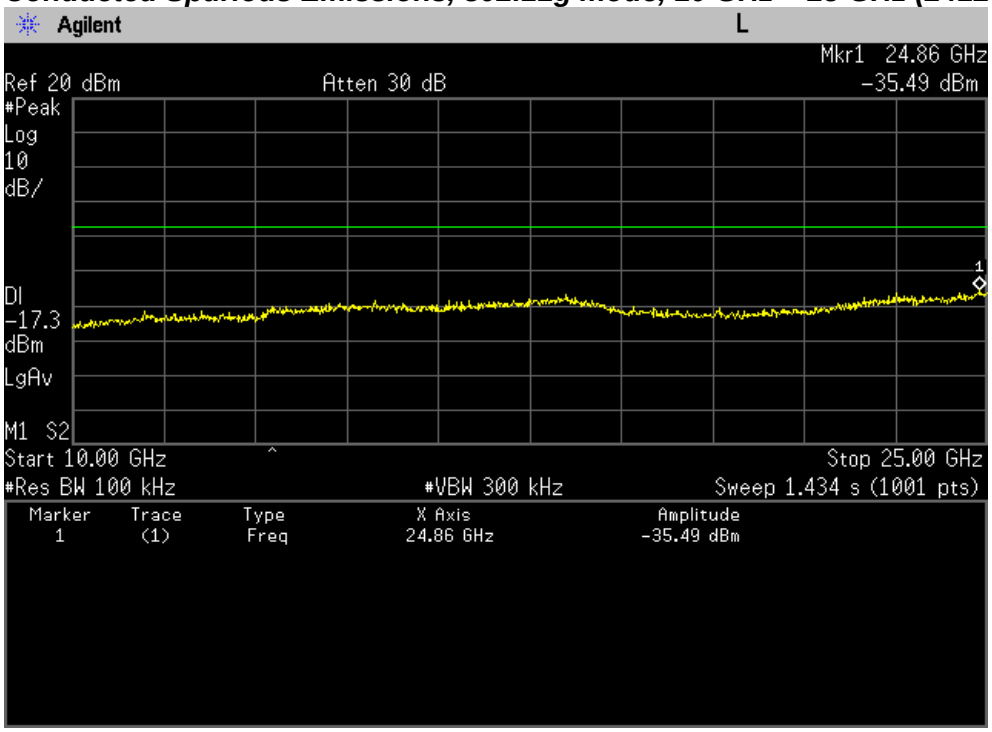
PLOT OF TEST DATA

802.11g mode

Conducted Spurious Emissions, 802.11g mode, 30 MHz ~ 10 GHz (2412 MHz)

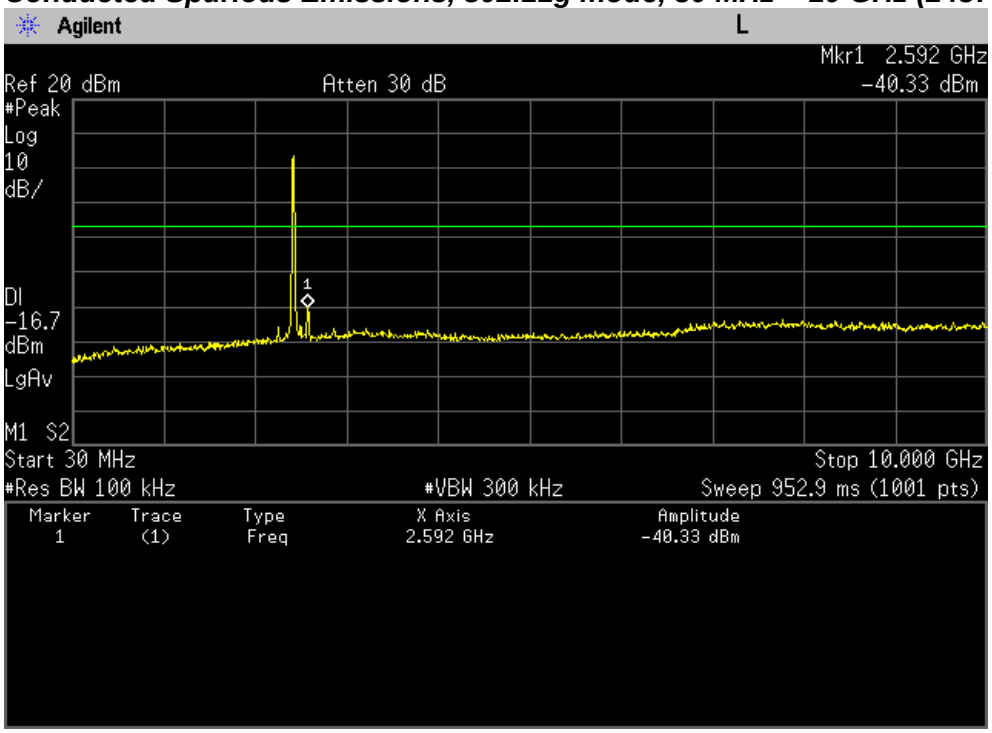


Conducted Spurious Emissions, 802.11g mode, 10 GHz ~ 25 GHz (2412 MHz)

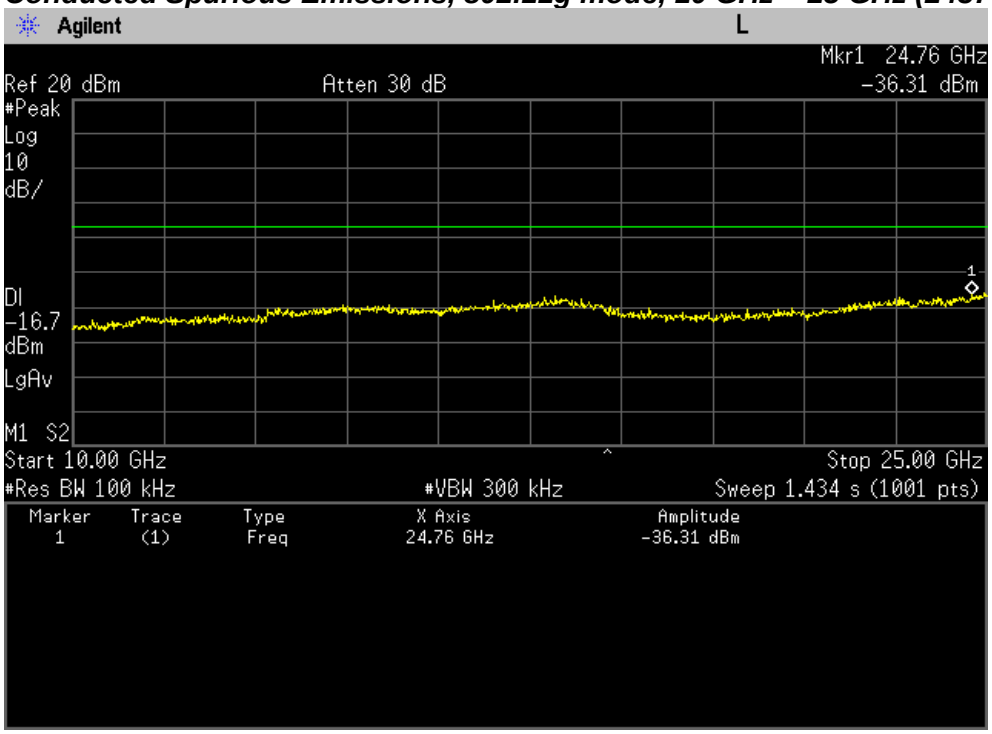


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11g mode, 30 MHz ~ 10 GHz (2437 MHz)

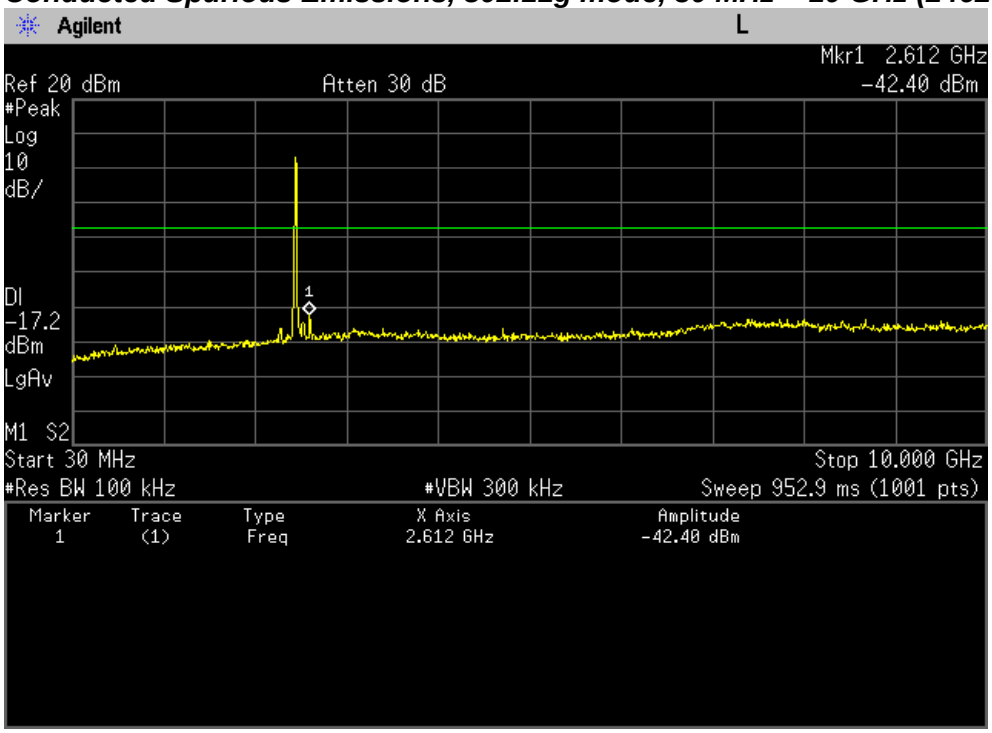


Conducted Spurious Emissions, 802.11g mode, 10 GHz ~ 25 GHz (2437 MHz)

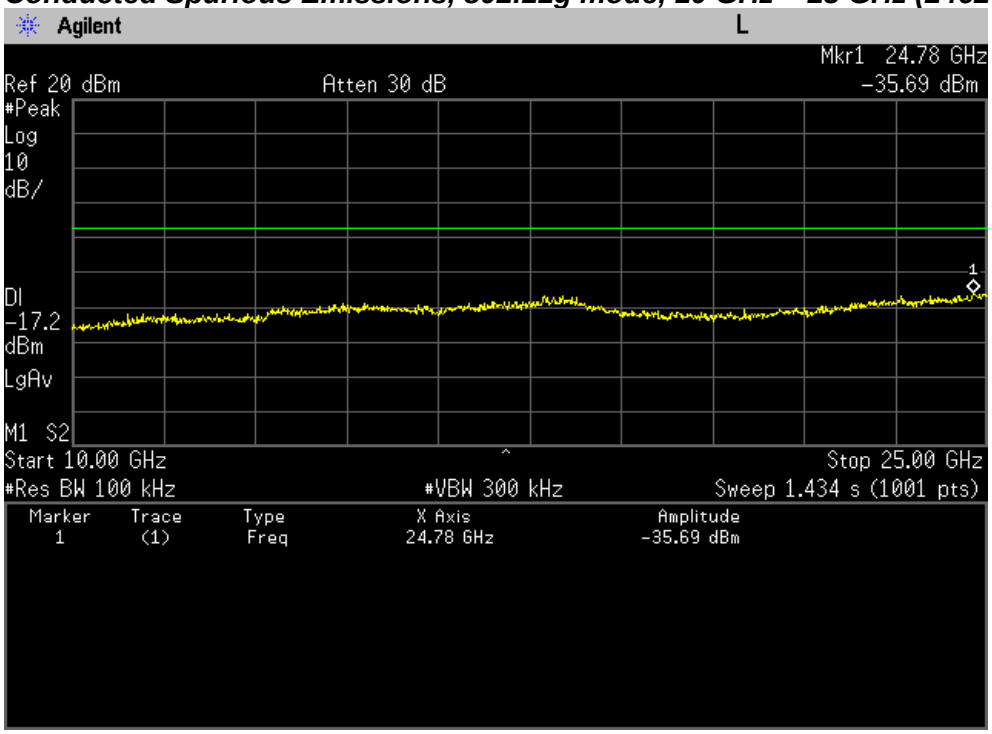


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11g mode, 30 MHz ~ 10 GHz (2462 MHz)



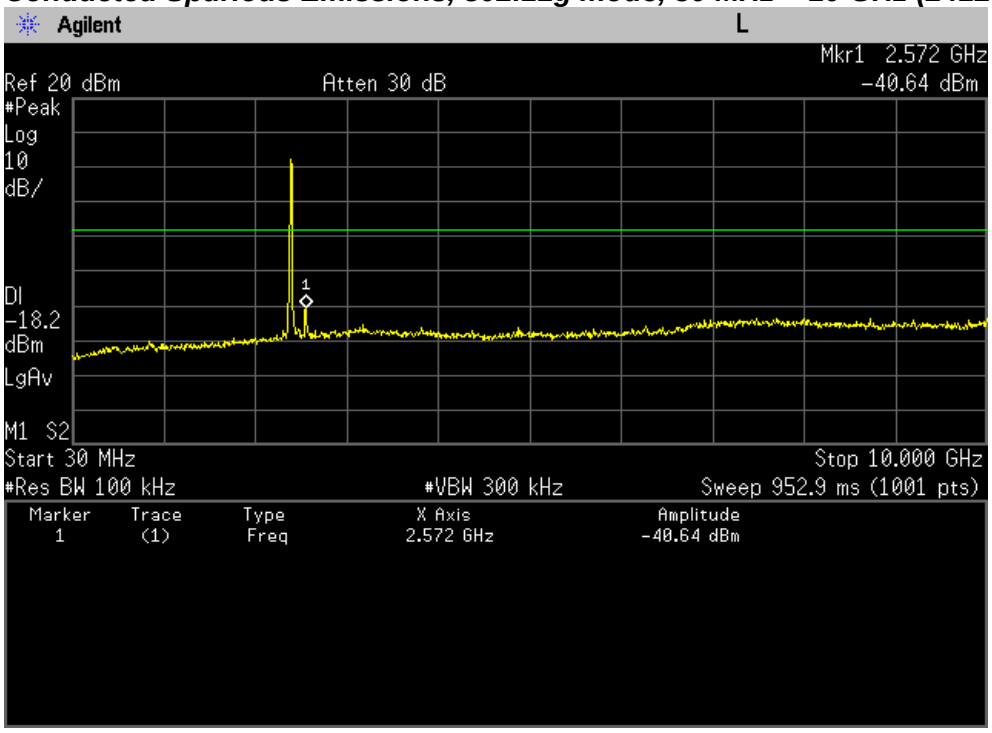
Conducted Spurious Emissions, 802.11g mode, 10 GHz ~ 25 GHz (2462 MHz)



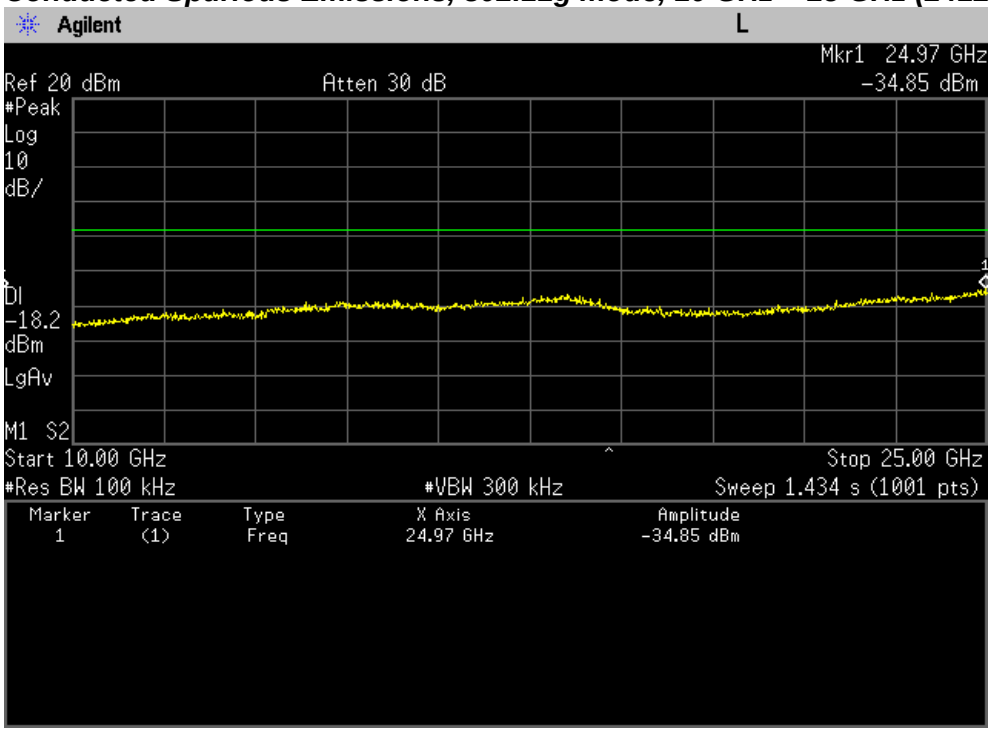
PLOT OF TEST DATA

802.11g mode

Conducted Spurious Emissions, 802.11g mode, 30 MHz ~ 10 GHz (2412 MHz)

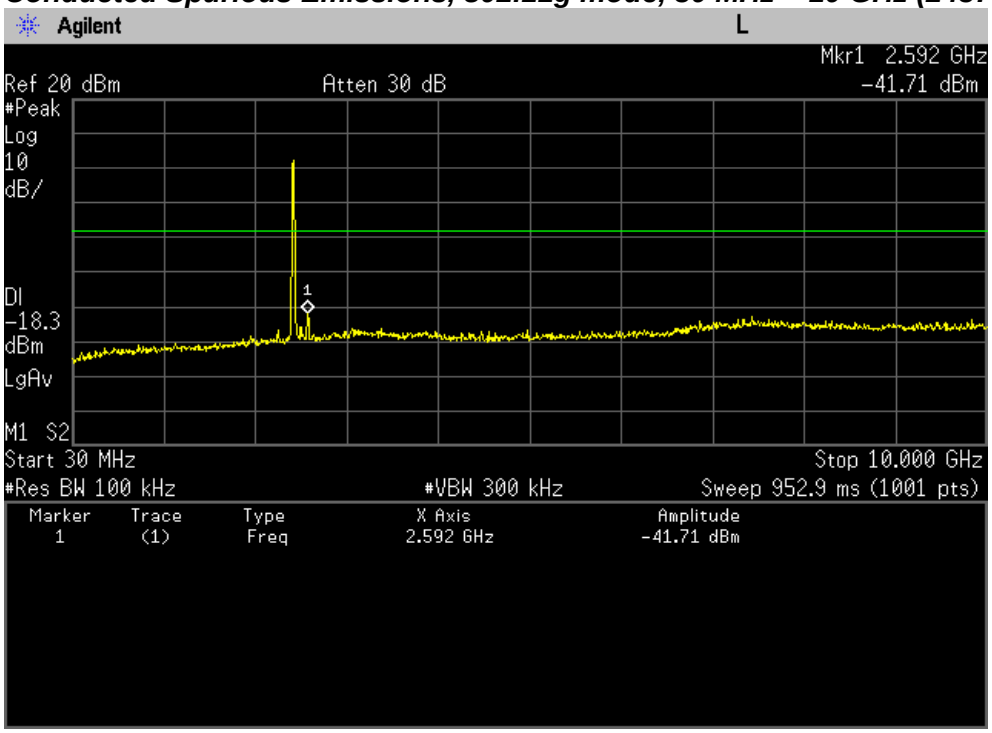


Conducted Spurious Emissions, 802.11g mode, 10 GHz ~ 25 GHz (2412 MHz)

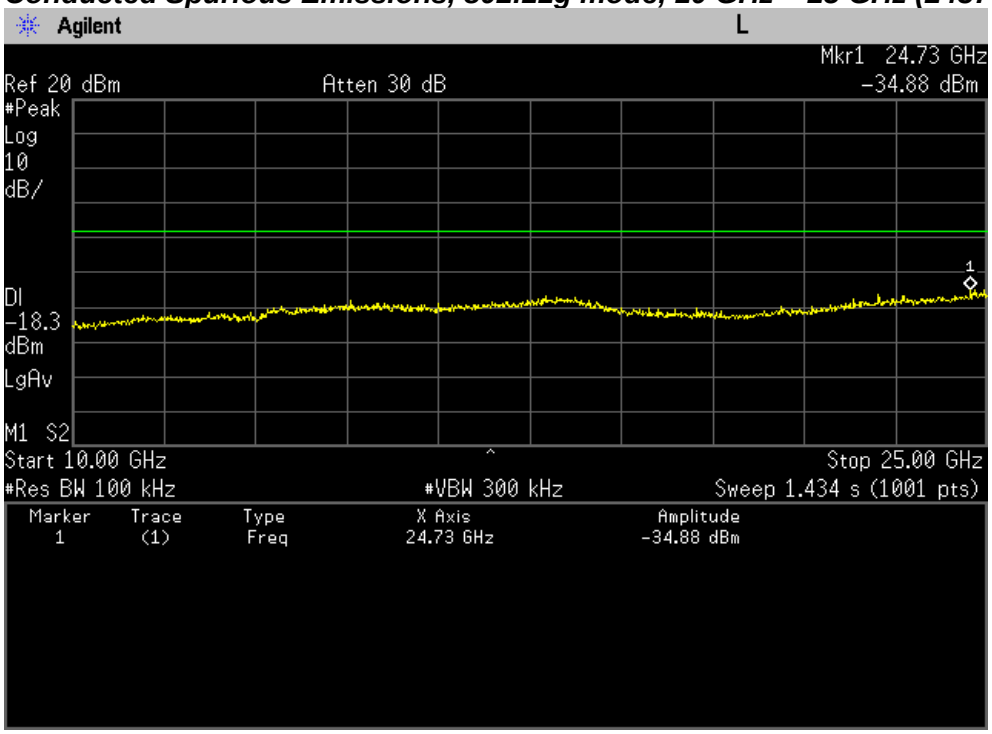


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11g mode, 30 MHz ~ 10 GHz (2437 MHz)

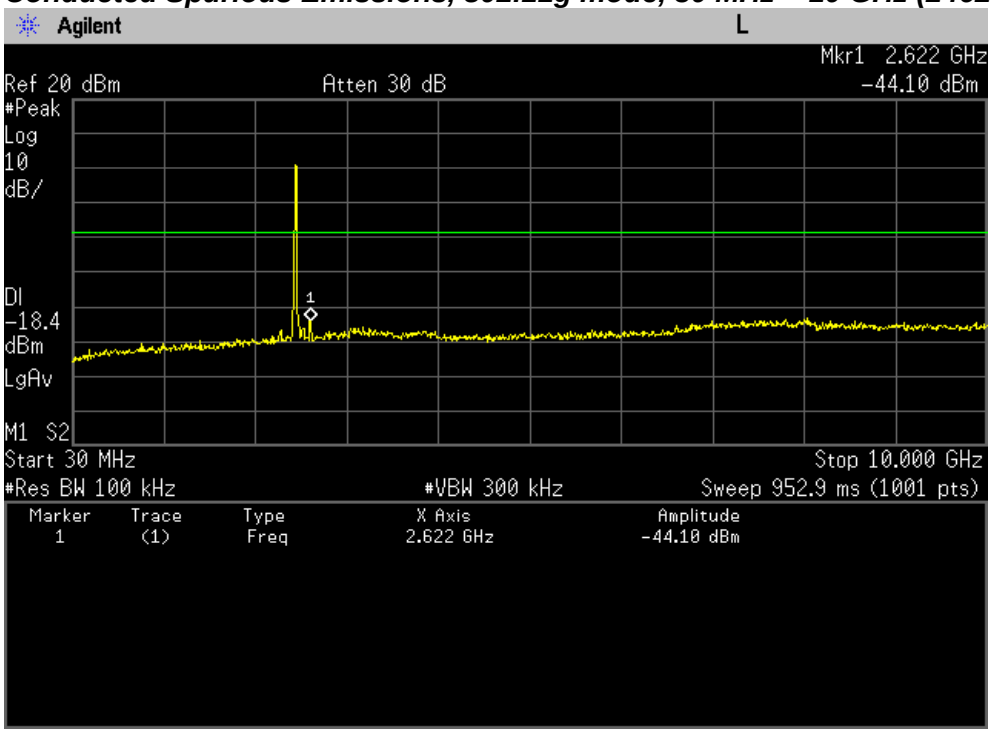


Conducted Spurious Emissions, 802.11g mode, 10 GHz ~ 25 GHz (2437 MHz)

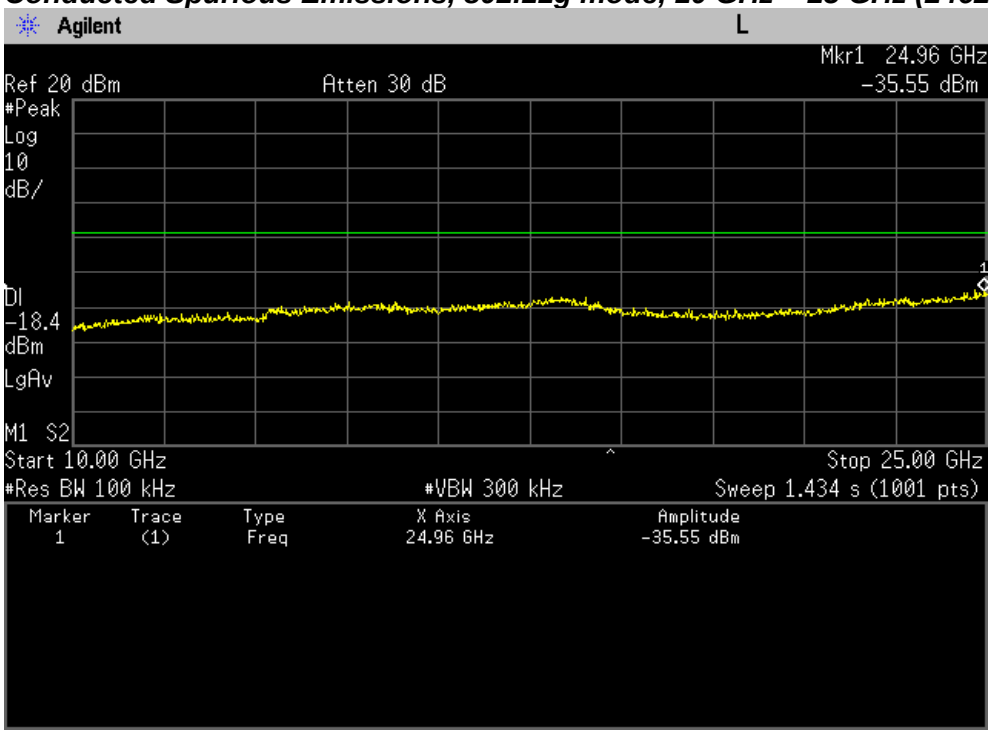


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11g mode, 30 MHz ~ 10 GHz (2462 MHz)



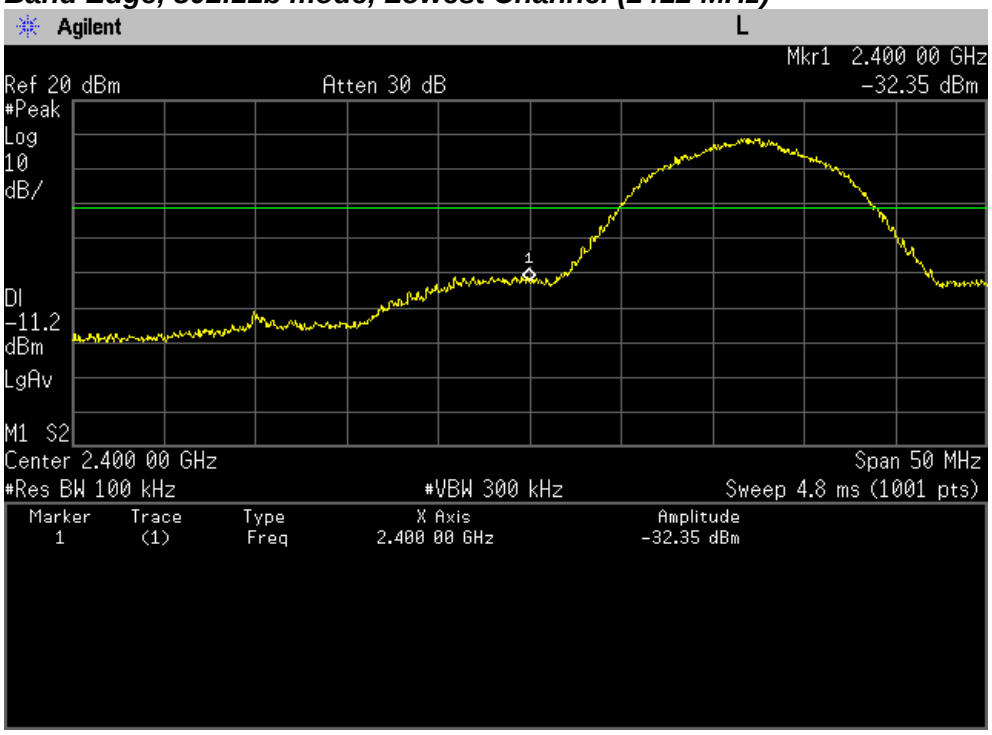
Conducted Spurious Emissions, 802.11g mode, 10 GHz ~ 25 GHz (2462 MHz)



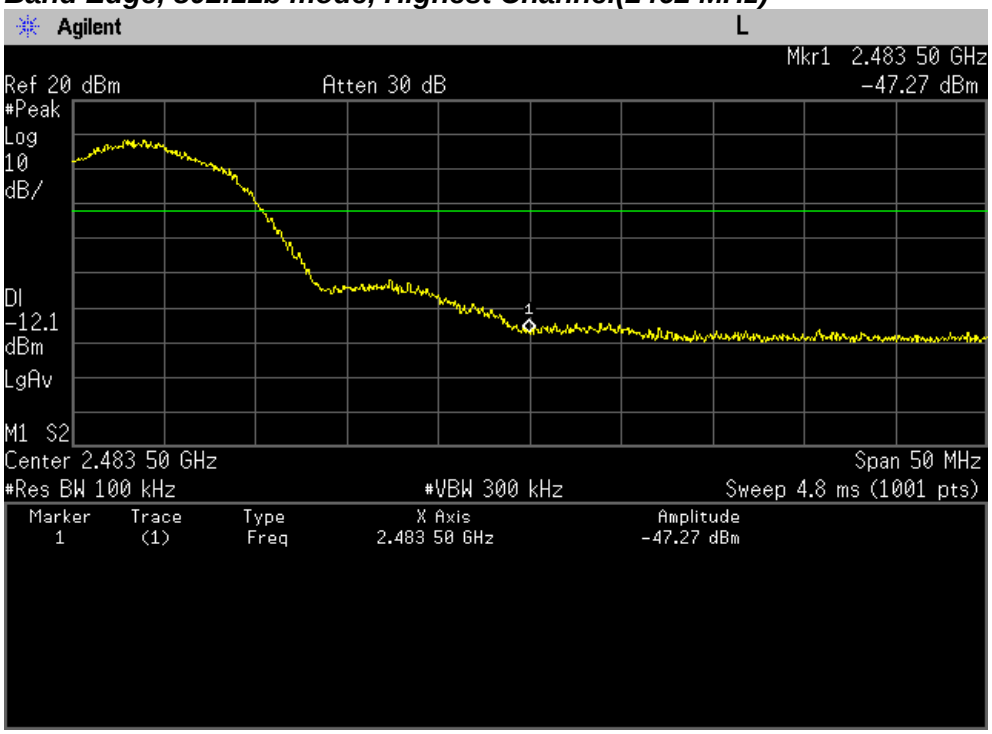
PLOT OF TEST DATA

802.11b mode

Band Edge, 802.11b mode, Lowest Channel (2412 MHz)



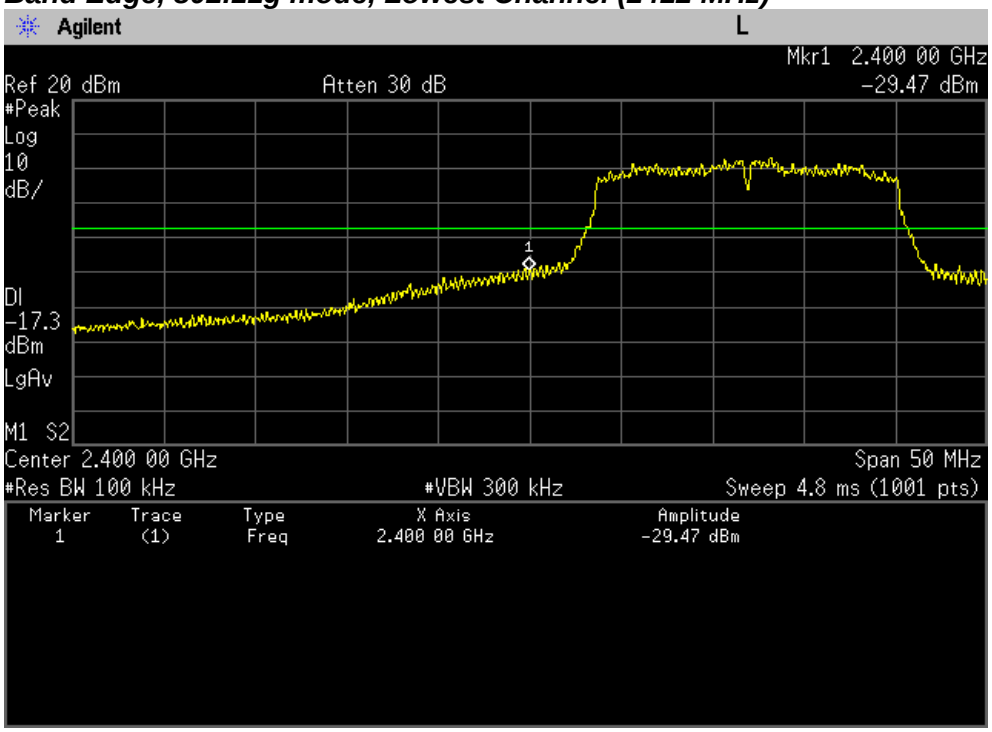
Band Edge, 802.11b mode, Highest Channel(2462 MHz)



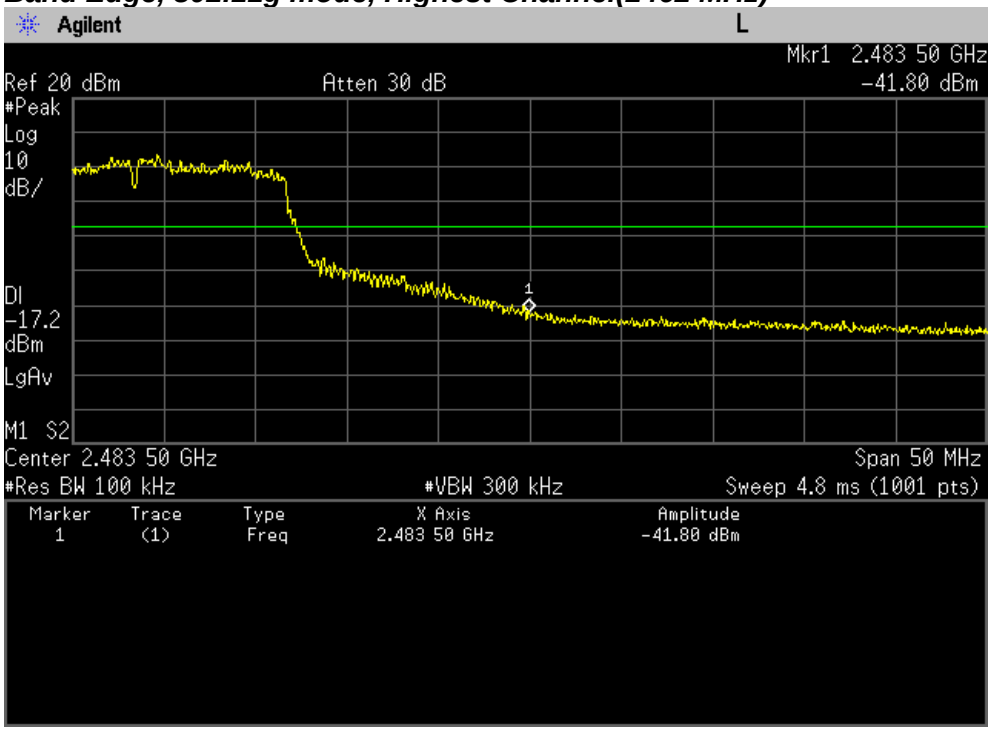
PLOT OF TEST DATA

802.11g mode

Band Edge, 802.11g mode, Lowest Channel (2412 MHz)



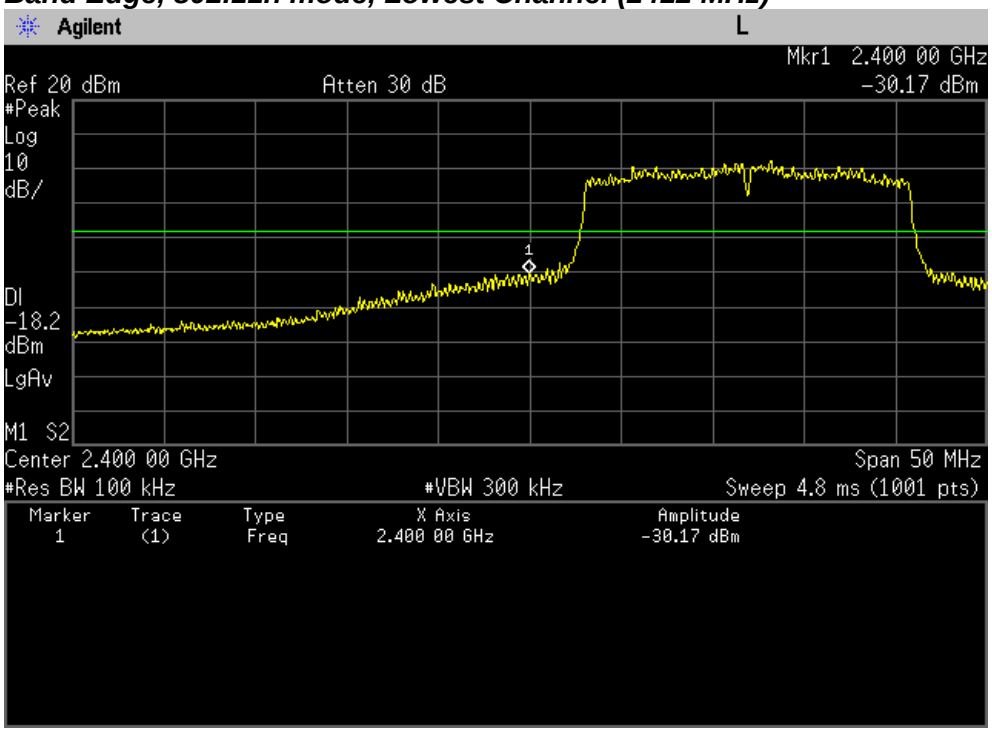
Band Edge, 802.11g mode, Highest Channel(2462 MHz)



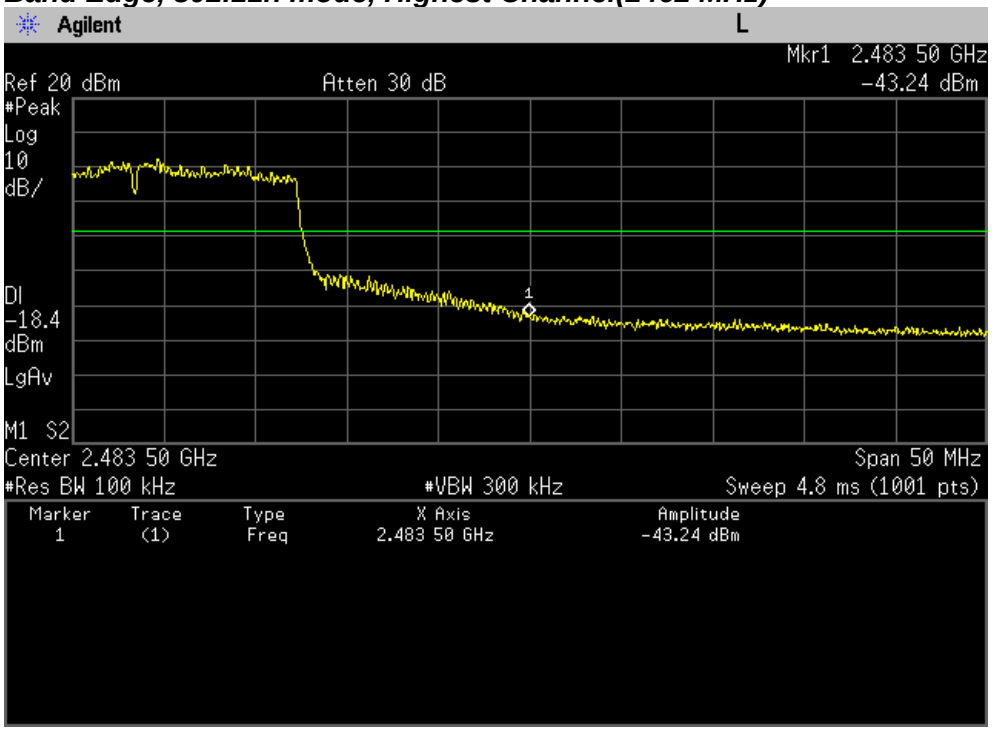
PLOT OF TEST DATA

802.11n mode

Band Edge, 802.11n mode, Lowest Channel (2412 MHz)



Band Edge, 802.11n mode, Highest Channel(2462 MHz)



8.7 Radiated Spurious Emissions

FCC §15.247(d), RSS-210 A8.5

Test Mode : Set to Lowest channel, Middle channel and Highest channel

802.11b mode

Lowest Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1800.00	41.70	H	peak	-2.70	39.00	74.0	35.00
1800.00	32.90	H	average	-2.70	30.20	54.0	23.80
2100.00	41.00	V	peak	-1.90	39.10	74.0	34.90
2100.00	32.70	V	average	-1.90	30.80	54.0	23.20
2494.00	53.30	V	peak	-0.30	53.00	74.0	21.00
2494.00	45.80	V	average	-0.30	45.50	54.0	8.50
4824.00	40.40	V	peak	9.40	49.80	74.0	24.20
4824.00	35.20	V	average	9.40	44.60	54.0	9.40

Middle Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1200.00	46.70	V	peak	-4.40	42.30	74.0	31.70
1200.00	38.70	V	average	-4.40	34.30	54.0	19.70
2278.00	50.20	V	peak	-1.20	49.00	74.0	25.00
2278.00	43.50	V	average	-1.20	42.30	54.0	11.70
2358.00	47.20	V	peak	-0.80	46.40	74.0	27.60
2358.00	38.80	V	average	-0.80	38.00	54.0	16.00
4872.00	40.50	V	peak	9.20	49.70	74.0	24.30
4872.00	33.30	V	average	9.20	42.50	54.0	11.50
7308.00	40.90	V	peak	15.70	56.60	74.0	17.40
7308.00	31.00	V	average	15.70	46.70	54.0	7.30

Highest Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1200.00	47.10	V	peak	-4.40	42.70	74.0	31.30
1200.00	36.90	V	average	-4.40	32.50	54.0	21.50
1496.00	44.30	V	peak	-3.50	40.80	74.0	33.20
1496.00	35.60	V	average	-3.50	32.10	54.0	21.90
2382.00	45.50	V	peak	-0.80	44.70	74.0	29.30
2382.00	38.00	V	average	-0.80	37.20	54.0	16.80
4924.00	41.10	V	peak	9.30	50.40	74.0	23.60
4924.00	34.00	V	average	9.30	43.30	54.0	10.70

802.11g mode

Lowest Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1200.00	49.40	V	peak	-4.40	45.00	74.0	29.00
1200.00	39.50	V	average	-4.40	35.10	54.0	18.90
2250.00	44.50	V	peak	-1.30	43.20	74.0	30.80
2250.00	35.70	V	average	-1.30	34.40	54.0	19.60
2334.00	47.40	V	peak	-0.90	46.50	74.0	27.50
2334.00	37.30	V	average	-0.90	36.40	54.0	17.60
2494.00	53.90	V	peak	-0.30	53.60	74.0	20.40
2494.00	45.30	V	average	-0.30	45.00	54.0	9.00
4824.00	40.10	V	peak	9.00	49.10	74.0	24.90
4824.00	29.60	V	average	9.00	38.60	54.0	15.40

Middle Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1200.00	45.80	V	peak	-4.40	41.40	74.0	32.60
1200.00	37.70	V	average	-4.40	33.30	54.0	20.70
1498.00	44.60	H	peak	-3.50	41.10	74.0	32.90
1498.00	36.00	H	average	-3.50	32.50	54.0	21.50
2278.00	47.20	V	peak	-1.20	46.00	74.0	28.00
2278.00	37.90	V	average	-1.20	36.70	54.0	17.30
2358.00	44.70	V	peak	-0.80	43.90	74.0	30.10
2358.00	36.70	V	average	-0.80	35.90	54.0	18.10

Highest Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1200.00	43.80	V	peak	-4.40	39.40	74.0	34.60
1200.00	35.30	V	average	-4.40	30.90	54.0	23.10
1350.00	43.50	V	peak	-3.80	39.70	74.0	34.30
1350.00	34.40	V	average	-3.80	30.60	54.0	23.40
1500.00	43.40	V	peak	-3.50	39.90	74.0	34.10
1500.00	34.40	V	average	-3.50	30.90	54.0	23.10

802.11n mode

Lowest Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1200.00	46.20	V	peak	-4.40	41.80	74.0	32.20
1200.00	36.20	V	average	-4.40	31.80	54.0	22.20
2254.00	44.90	V	peak	-1.30	43.60	74.0	30.40
2254.00	35.40	V	average	-1.30	34.10	54.0	19.90
2334.00	54.20	V	peak	-0.90	53.30	74.0	20.70
2334.00	36.90	V	average	-0.90	36.00	54.0	18.00
2494.00	53.60	V	peak	-0.30	53.30	74.0	20.70
2494.00	43.50	V	average	-0.30	43.20	54.0	10.80
4824.00	41.30	V	peak	9.00	50.30	74.0	23.70
4824.00	30.10	V	average	9.00	39.10	54.0	14.90

Middle Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1200.00	45.50	V	peak	-4.40	41.10	74.0	32.90
1200.00	36.10	V	average	-4.40	31.70	54.0	22.30
1500.00	44.90	H	peak	-3.50	41.40	74.0	32.60
1500.00	35.00	H	average	-3.50	31.50	54.0	22.50
2276.00	48.00	V	peak	-1.20	46.80	74.0	27.20
2276.00	38.20	V	average	-1.20	37.00	54.0	17.00
2358.00	45.40	V	peak	-0.80	44.60	74.0	29.40
2358.00	36.50	V	average	-0.80	35.70	54.0	18.30
4872.00	39.80	V	peak	9.20	49.00	74.0	25.00
4872.00	29.60	V	average	9.20	38.80	54.0	15.20

Highest Channel

Frequency (GHz)	Reading (dBµV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1200.00	46.50	V	peak	-4.40	42.10	74.0	31.90
1200.00	36.80	V	average	-4.40	32.40	54.0	21.60
1350.00	43.30	V	peak	-3.80	39.50	74.0	34.50
1350.00	35.50	V	average	-3.80	31.70	54.0	22.30
1500.00	43.40	H	peak	-3.50	39.90	74.0	34.10
1500.00	35.80	H	average	-3.50	32.30	54.0	21.70
2302.00	48.40	V	peak	-1.10	47.30	74.0	26.70
2302.00	38.10	V	average	-1.10	37.00	54.0	17.00
2384.00	44.30	V	peak	-0.80	43.50	74.0	30.50
2384.00	34.60	V	average	-0.80	33.80	54.0	20.20

Note:

1. *Pol. H = Horizontal V = Vertical

2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.

3. Other spurious are under 20 dB below Fundamental.

4. The radiated emissions testing were made by rotating through three orthogonal axes. The worst date was recorded.

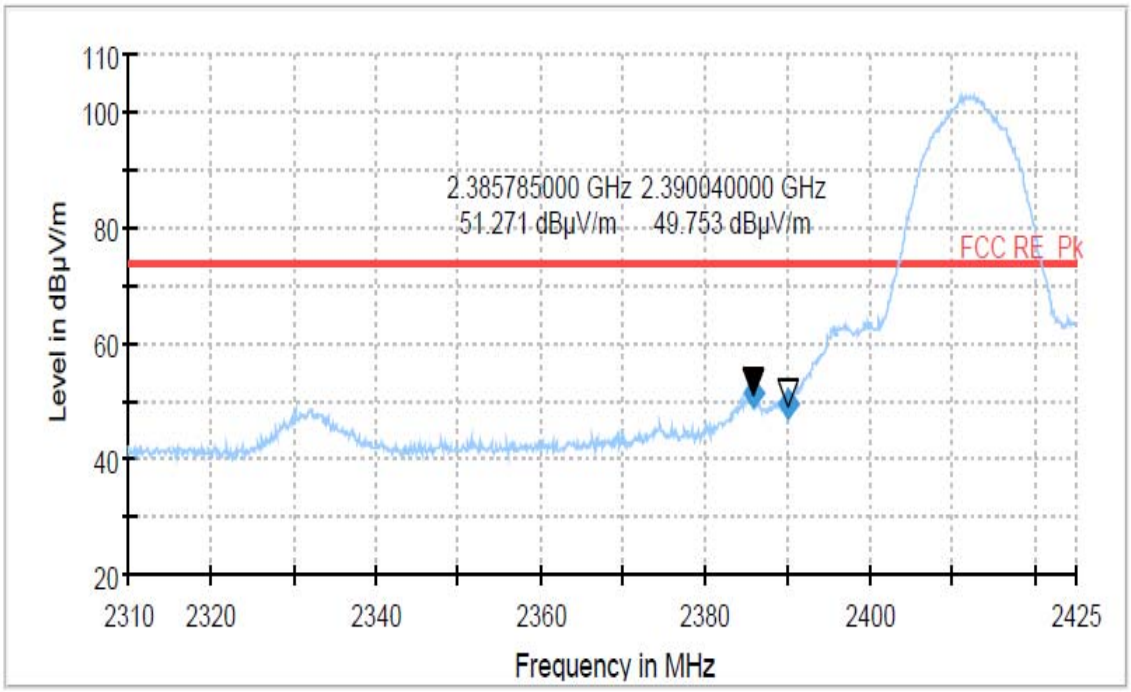
5. For measurements the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

6. The spectrum is measured from 9 kHz to 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.

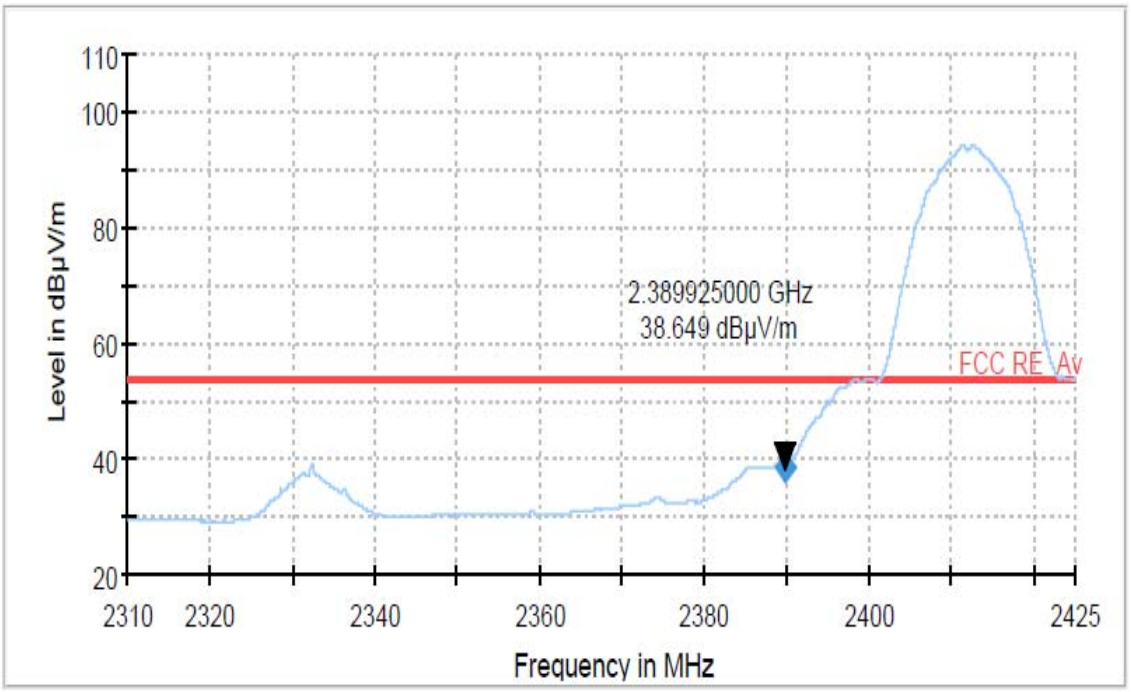
PLOT OF TEST DATA

802.11b mode

Restricted Band Spurious Emissions, 802.11b mode, Lowest channel(Peak)

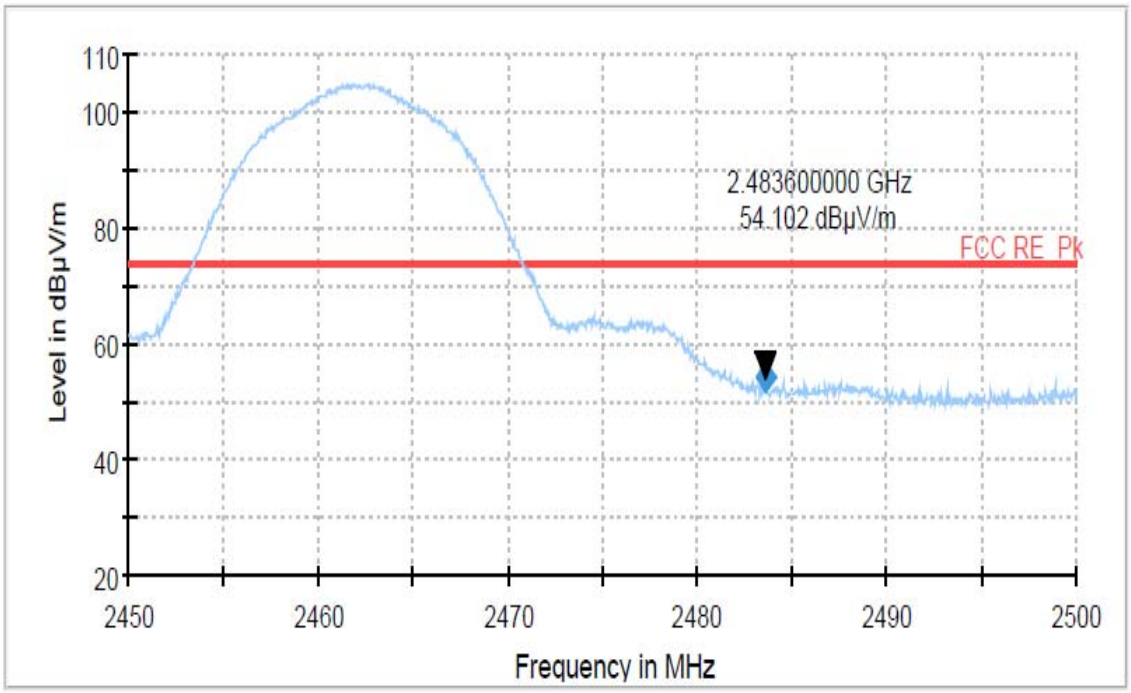


Restricted Band Spurious Emissions, 802.11b mode, Lowest channel(Average)

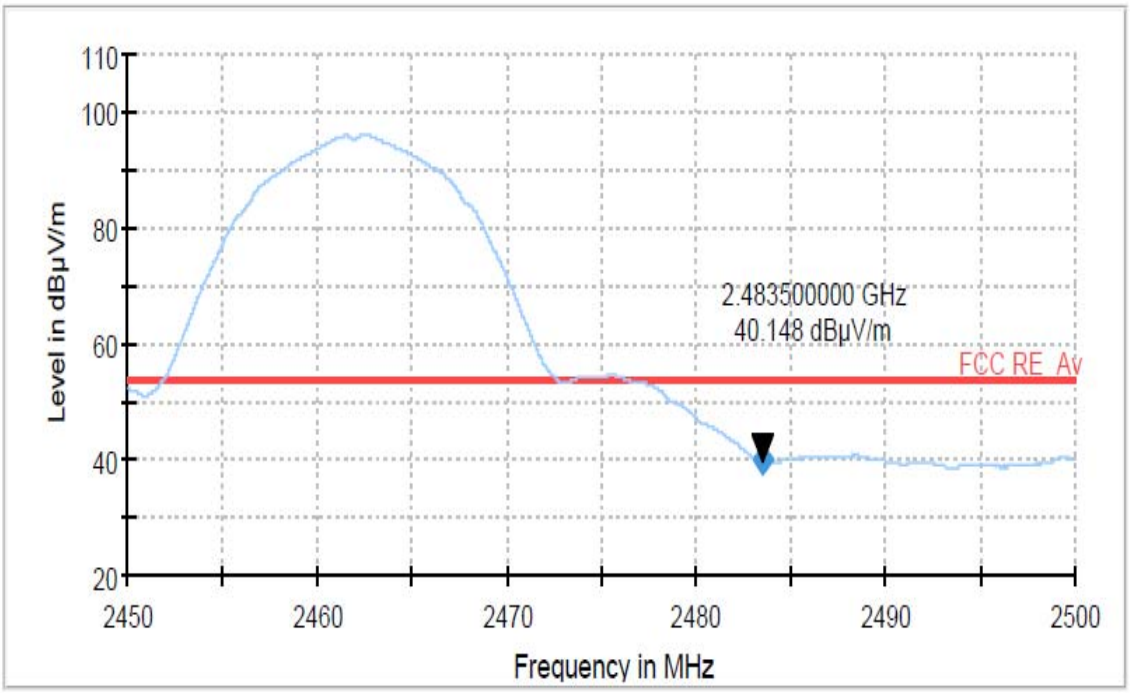


PLOT OF TEST DATA

Restricted Band Spurious Emissions, 802.11b mode, Highest channel(Peak)



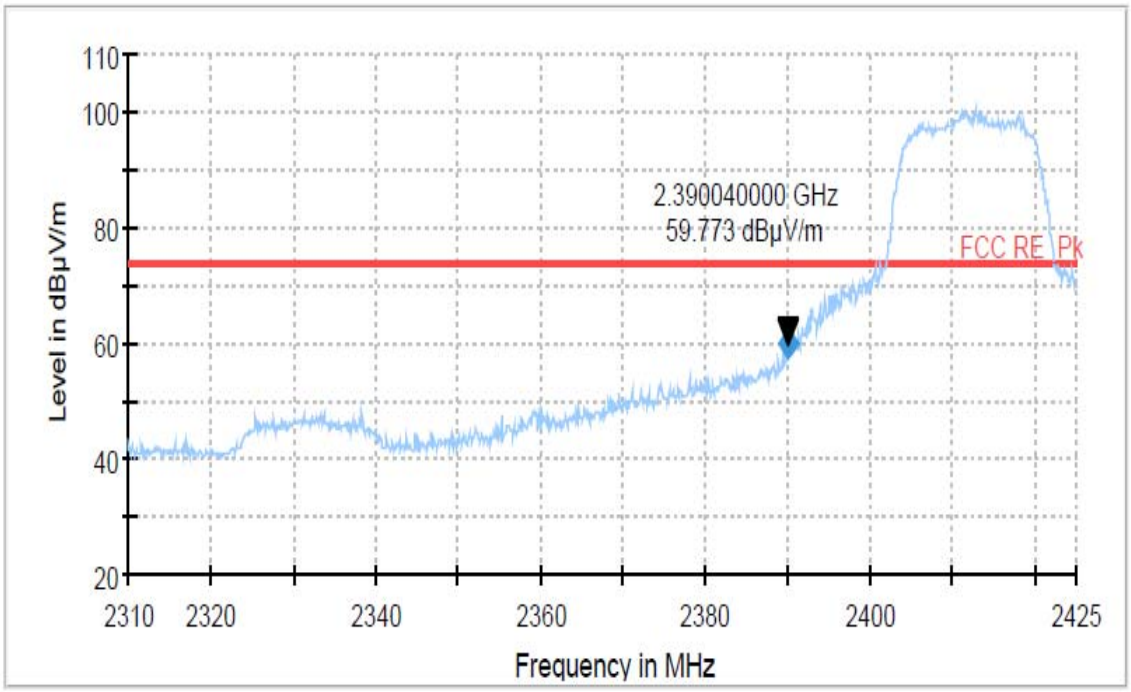
Restricted Band Spurious Emissions, 802.11b mode, Highest channel(Average)



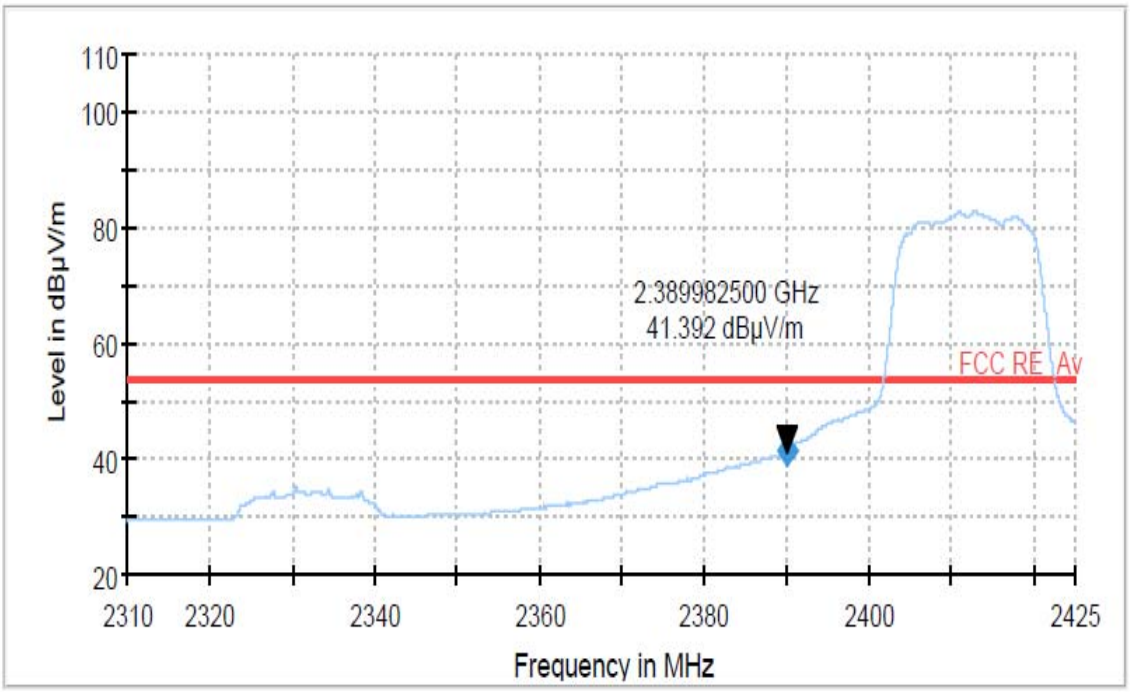
PLOT OF TEST DATA

802.11g mode

Restricted Band Spurious Emissions, 802.11g mode, Lowest channel(Peak)

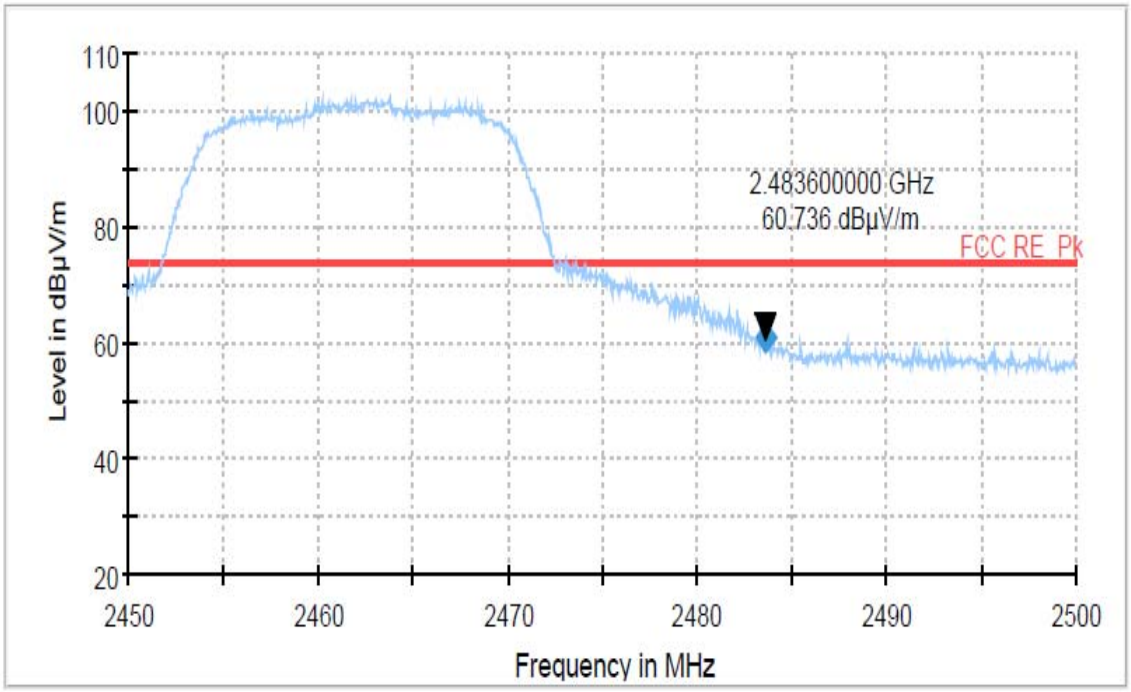


Restricted Band Spurious Emissions, 802.11g mode, Lowest channel(Average)

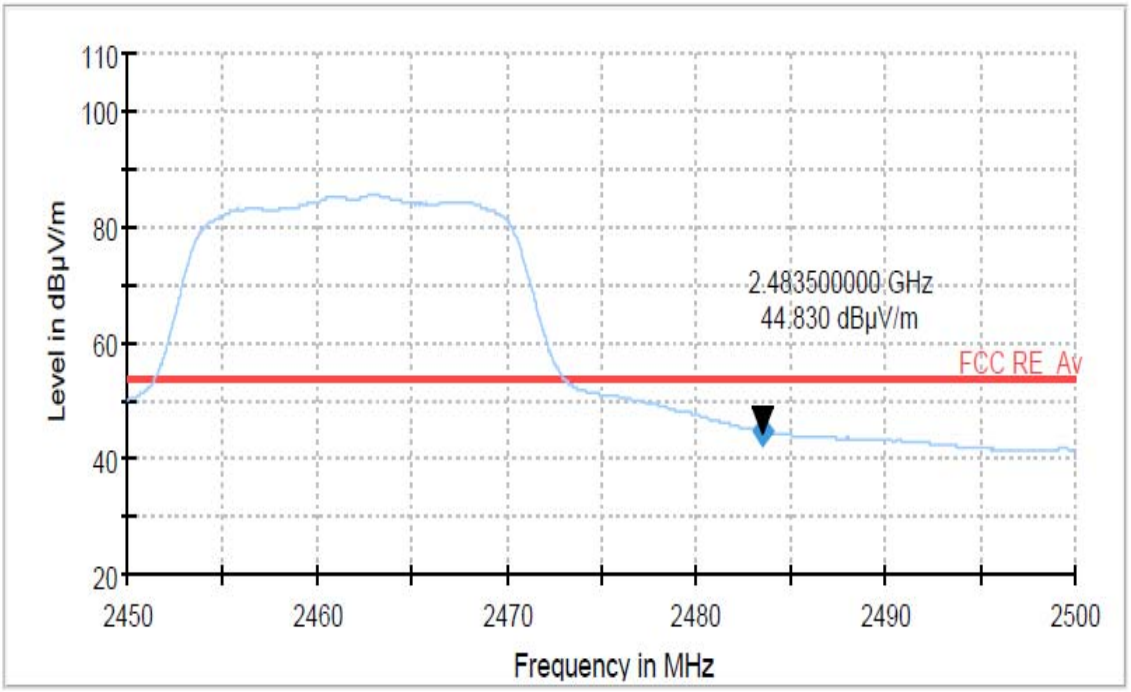


PLOT OF TEST DATA

Restricted Band Spurious Emissions, 802.11n mode, Highest channel(Peak)



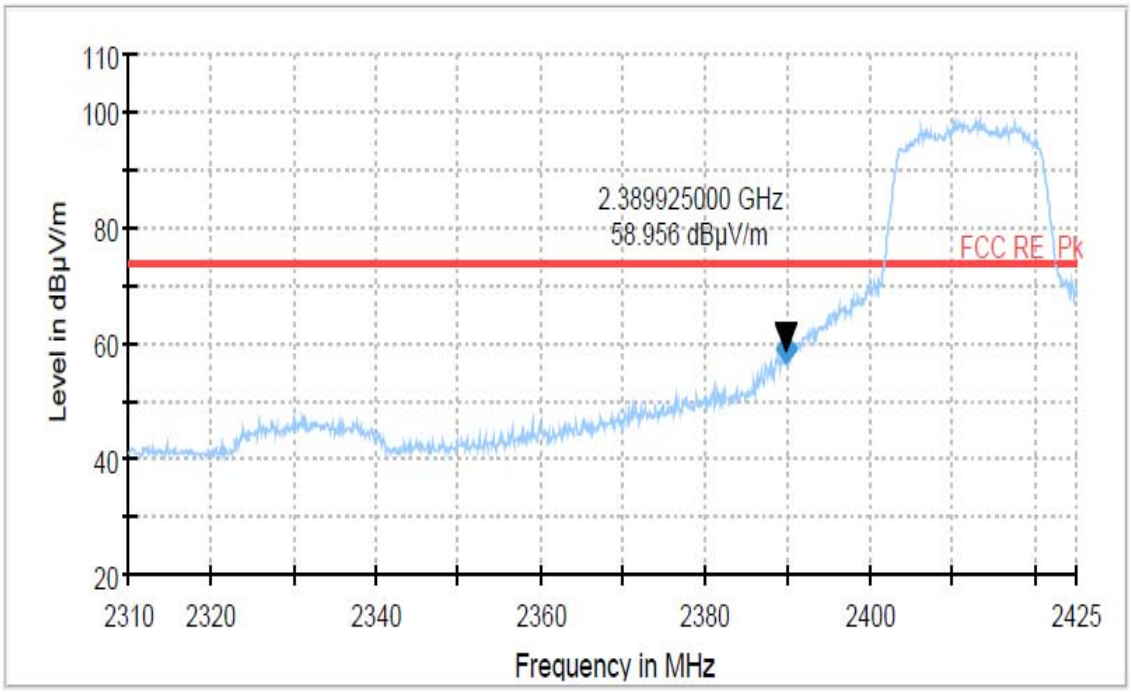
Restricted Band Spurious Emissions, 802.11n mode, Highest channel(Average)



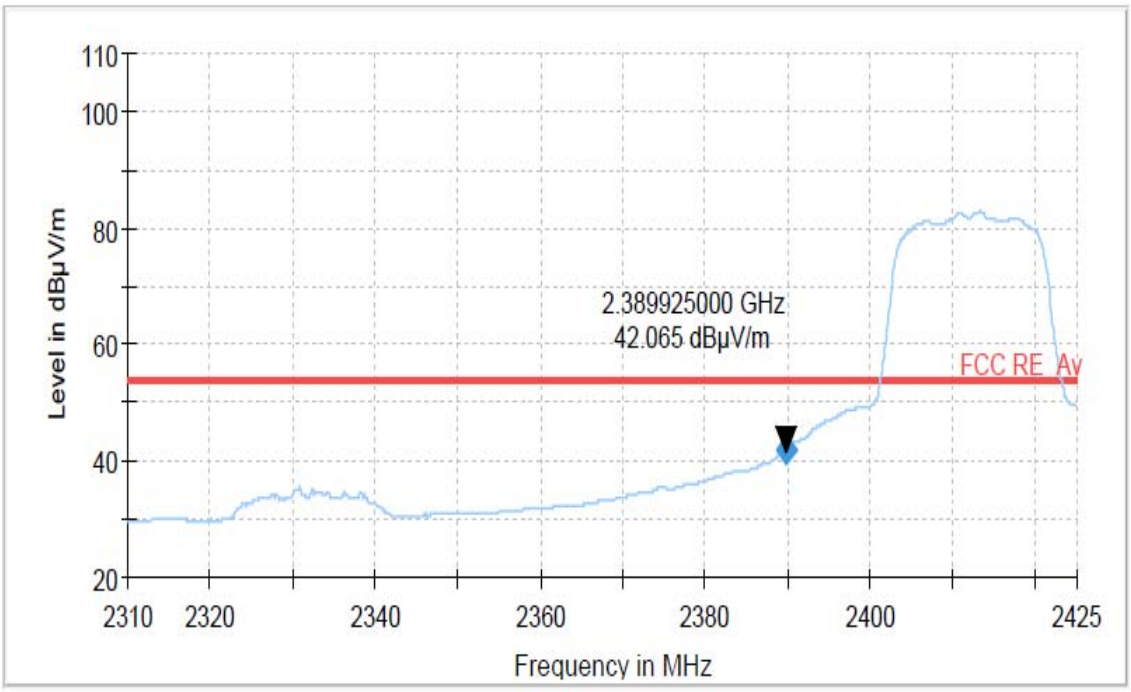
PLOT OF TEST DATA

802.11n mode

Restricted Band Spurious Emissions, 802.11n mode, Lowest channel(Peak)

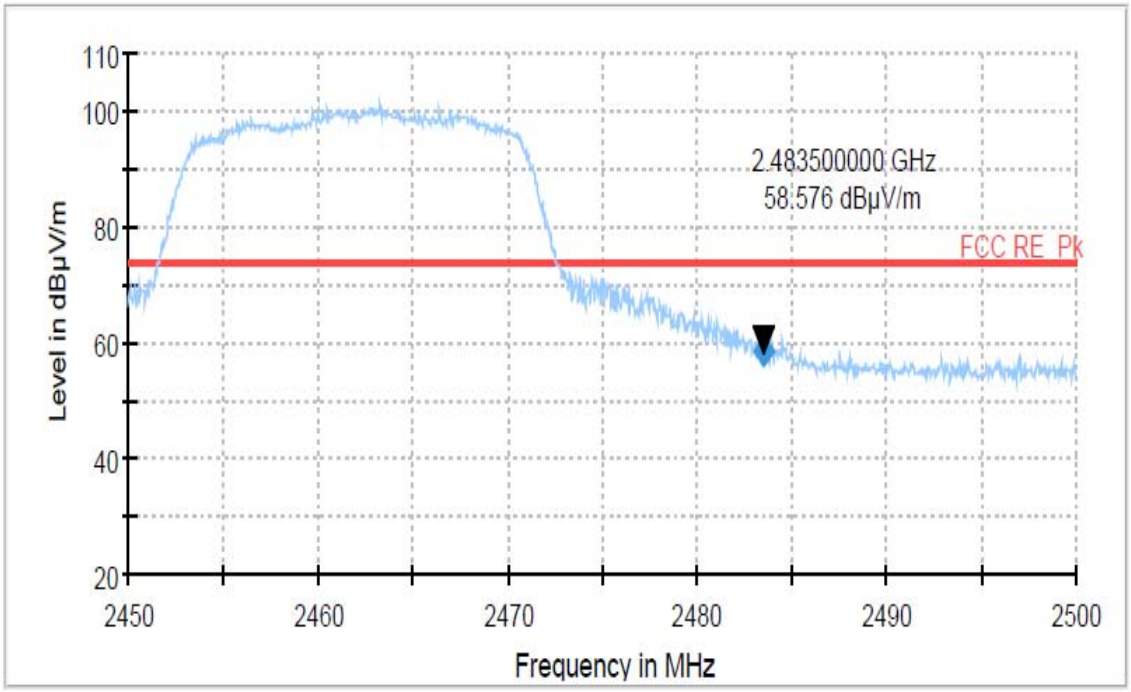


Restricted Band Spurious Emissions, 802.11n mode, Lowest channel(Average)

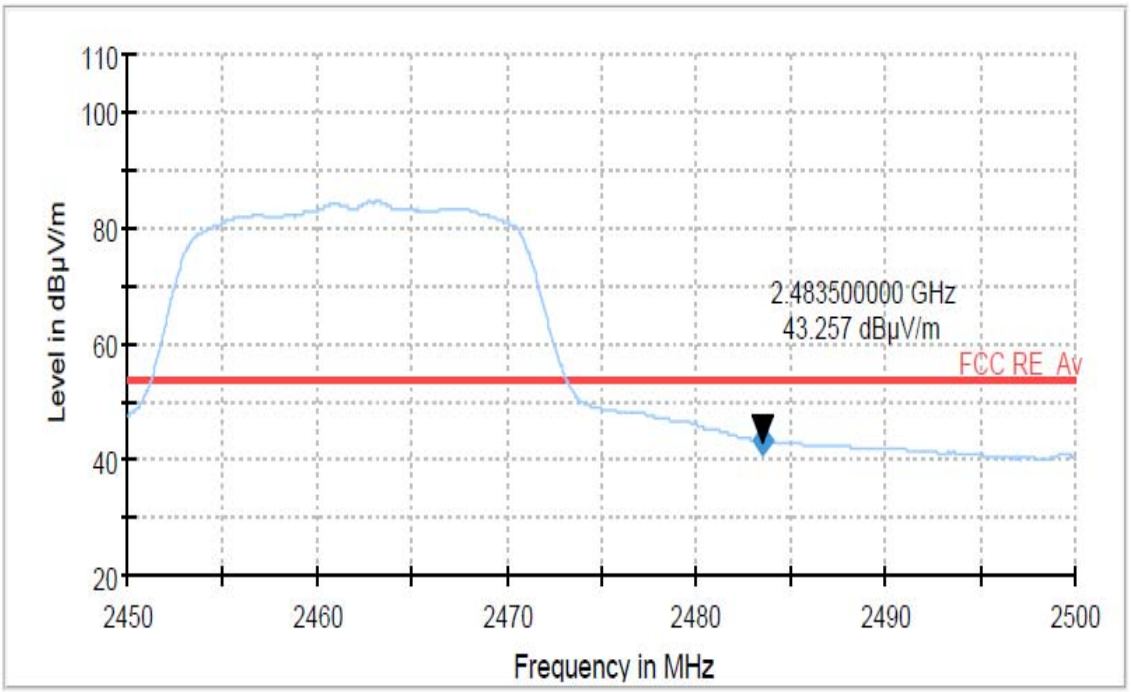


PLOT OF TEST DATA

Restricted Band Spurious Emissions, 802.11n mode, Highest channel(Peak)



Restricted Band Spurious Emissions, 802.11n mode, Highest channel(Average)



Note: For the radiated emission field strength measurements at the band edges, the resolution bandwidth was set to 1 MHz, and then the video bandwidth was set to 1 MHz for peak measurements and 10 Hz for average measurements.

9. ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95%

1. Conducted Uncertainty Calculation

Source of Uncertainty	*Xi*	Uncertainty of *Xi*		Coverage factor *k*	*u(Xi)* (dB)	*Ci*	*Ci u(Xi)* (dB)
		Value (dB)	Probability Distribution				
Receiver reading	***RI***	± 0.1	normal 1	1.000	0.1	1	0.1
Attenuation AMN-Receiver	***LC***	± 0.08	normal 2	2.000	0.04	1	0.04
AMN Voltage division factor	***LAMN***	± 0.8	normal 2	2.000	0.4	1	0.4
Sine wave voltage	***dVSW***	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	***dVPA***	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	***dVPR***	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	***dVNF***	± 0.00	-	-	0.00	1	0.00
AMN Impedance	***dZ***	± 1.80	triangular	2.449	0.73	1	0.73
ⓐ Mismatch	***M***	+ 0.70	U-Shaped	1.414	0.49	1	0.49
ⓑ Mismatch	***M***	- 0.80	U-Shaped	1.414	- 0.56	1	- 0.56
Measurement System Repeatability	***RS***	0.05	normal 1	1.000	0.05	1	0.05
Remark	ⓐ: AMN-Receiver Mismatch : + ⓑ: AMN-Receiver Mismatch : -						
Combined Standard Uncertainty	Normal			± 1.88			
Expended Uncertainty U	Normal (k = 2)			± 3.76			

2. Radiation Uncertainty Calculation

Source of Uncertainty	*Xi*	Uncertainty of *Xi*		Coverage factor *k*	*u(Xi)* (dB)	*Ci*	*Ci u(Xi)* (dB)
		Value (dB)	Probability Distribution				
Receiver reading	***RI***	± 0.10	normal 1	1.000	0.10	1	0.10
Sine wave voltage	***dVsw***	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	***dVpa***	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	***dVpr***	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	***dVnf***	± 0.50	normal 2	2.000	0.25	1	0.25
Antenna Factor Calibration	***AF***	± 1.50	normal 2	2.000	0.75	1	0.75
Attenuation Antenna-receiver	***CL***	± 0.52	normal 2	2.000	0.26	1	0.26
Antenna Directivity	***AD***	± 1.00	rectangular	1.732	0.58	1	0.58
Antenna Factor Height Dependence	***AH***	± 0.50	rectangular	1.732	0.29	1	0.29
Antenna Phase Centre Variation	***AP***	± 0.30	rectangular	1.732	0.17	1	0.17
Antenna Factor Frequency Interpolation	***AI***	± 0.30	rectangular	1.732	0.17	1	0.17
Site Imperfections	***SI***	± 4.00	triangular	2.449	1.63	1	1.63
Measurement Distance Variation	***DV***	± 0.10	rectangular	1.732	0.06	1	0.06
Antenna Balance	***Dbal***	± 0.90	rectangular	1.732	0.52	1	0.52
Cross Polarisation	***DCross***	± 0.90	rectangular	1.732	0.52	1	0.52
ⓐ Mismatch	***M***	+ 0.25	U-Shaped	1.414	0.18	1	0.18
ⓑ Mismatch	***M***	- 0.26	U-Shaped	1.414	- 0.18	1	- 0.18
ⓒ Mismatch	***M***	+ 0.98	U-Shaped	1.414	0.69	1	0.69
ⓓ Mismatch	***M***	- 1.11	U-Shaped	1.414	- 0.79	1	- 0.79
Measurement System Repeatability	***RS***	0.09	normal 1	1.000	0.09	1	0.09
Remark	ⓐ: Biconical Antenna-receiver Mismatch : + (< 200 MHz) ⓑ: Biconical Antenna-receiver Mismatch : - (< 200 MHz) ⓒ: Log Periodic Antenna-receiver Mismatch : + (≧ 200 MHz) ⓓ: Log Periodic Antenna-receiver Mismatch : - (≧ 200 MHz)						
Combined Standard Uncertainty	Normal			± 2.63 (< 200 MHz) ± 2.74 (≧200 MHz)			
Expended Uncertainty U	Normal (*k* = 2)			± 5.26 (< 200 MHz) ± 5.48 (≧200 MHz)			

10. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Jan. 12 2012	1 year
2	Test Receiver	R & S	ESCS 30	100302	Oct. 12 2011	1 year
3	*Amplifier	HP	8447F	2805A03427	Jul. 16 2012	1 year
4	*Amplifier	Sonoma Instrument	310N	291916	Jul. 16 2012	1 year
5	*Amplifier	R & S	SCU18	10065	Apr. 05 2012	1 year
6	*Amplifier	R & S	SCU26	10011	Jun. 01 2012	1 year
7	Amplifier	R & S	SCU40	10008	Jun. 01 2012	1 year
8	*Pre Amplifier	HP	8449B	3008A00107	Jan. 13 2012	1 year
9	*Pre Amplifier	HP	8447F	2805A03351	Oct. 06 2011	1 year
10	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Jul. 16 2012	1 year
11	*Spectrum Analyzer	Agilent	E4440A	MY44022567	Apr. 05 2012	1 year
12	*Spectrum Analyzer	R & S	FSP40	100361	Jul. 17 2012	1 year
13	*Loop Antenna	R & S	HFH2-Z2	100279	Feb. 21 2012	2 year
14	Wideband Power Sensor	R & S	NRP-Z81	100634	Apr. 05 2012	1 year
15	Peak Power Sensor	R & S	NRV-Z32	836019/028	Oct. 25 2011	1 year
16	Biconical Log Antenna	ARA	LPB-2520/A	1209	Dec. 21 2010	2 year
17	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-508	Dec. 24 2010	2 year
18	*Horn Antenna	Q-par Angus	QSH20S20	8179	Mar. 28 2011	2 year
19	Horn Antenna	Q-par Angus	QSH22K20	8180	Mar. 28 2011	2 year
20	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9163	9163-454	Feb. 24 2012	2 year
21	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-257	Apr. 26 2012	2 year
22	*LISN	R & S	ESH3-Z5	833874/006	Oct. 12 2011	1 year
23	*LISN	R & S	ESH2-Z5	100227	Apr. 04 2012	1 year
24	*Position Controller	Innco systems Gmb	CO2000-G	CO2000/562/23	N/A	N/A
25	*Turn Table	Innco systems Gmb	DT3000-3T	N/A	N/A	N/A
26	*Antenna Mast	Innco systems Gmb	DMA4000-EP	N/A	N/A	N/A
27	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
28	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
29	*Position Controller	Seo-Young EMC	N/A	N/A	N/A	N/A
30	*Turn Table	Seo-Young EMC	N/A	N/A	N/A	N/A
31	*Antenna Mast	Seo-Young EMC	N/A	N/A	N/A	N/A
32	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
33	Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A

*) Test equipment used during the test