Nemko Korea CO., Ltd.

67-1 & 300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, KOREA
TEL:+82 31 330 1700 FAX:+82 31 322 2332

FCC and IC EVALUATION REPORT FOR CERTIFICATION

Applicant :

Samsung Electronics Co., Ltd.
416, Maetan-3Dong, Yeongtong-Gu,
Suwon-Si, Gyeonggi-Do, Korea.
(Post code : 443-742)
Attn. : Mr. Sukjun. Lee

Dates of Issue : February 28, 2012
Test Report No. : NK-12-R-015
Test Site : Nemko Korea Co., Ltd.

FCC ID	**A3LDNURS11**
IC	**649E-DNURS11**
Brand Name	**SAMSUNG**
Contact Person	**Samsung Electronics Co., Ltd.** **416, Maetan-3Dong, Yeongtong-Gu,** **Suwon-Si, Gyeonggi-Do, Korea, 443-742.** **Mr. Sukjun. Lee** **Telephone No. : +82-31-200-6772**

Applied Standard:	FCC 47 CFR Part 15C and IC RSS-210
Classification:	FCC part 15 Spread Spectrum Transmitter
EUT Type:	WiFi module

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.

Feb. 28, 2012
Tested By : Jin-ha, Ko
Engineer

Feb. 28. 2012
Reviewed By : Hyunho. Kim
Manager & Chief Engineer

TABLE OF CONTENTS

1.	**Scope**	**4**
2.	**Introduction (Site Description)**	**5**
	2.1 Test facility	5
	2.2 Accreditation and listing	6
3.	**Test Conditions & EUT Information**	**7**
	3.1 Operation During Test	7
	3.2 Support Equipment	9
	3.3 Setup Drawing	9
	3.4 EUT Information	10
4.	**Summary of Test Results**	**11**
5.	**Recommendation / Conclusion**	**12**
6.	**Antenna Requirements**	**12**
7.	**Description of Test**	**13**
	7.1 Conducted Emissions	13
	7.2 Radiated Emissions	14
	7.3 6 dB Bandwidth	15
	7.4 Maximum Peak Output Power	15
	7.5 Peak Power Spectral Density	16
	7.6 Conducted Spurious Emissions	16
8.	**Test Data**	**17**
	8.1 Conducted Emissions	17
	8.2 Radiated Emissions	20
	8.3 6 dB Modulated Bandwidth	21
	8.4 Peak Power Output	27
	8.5 Peak Power Spectral Density	28
	8.6 Conducted Spurious Emissions	34

8.7 Radiated Spurious Emissions 47

9 Accuracy of Measurement 62

10. Test Equipment 64

Appendix A: Labeling Requirement 65

Appendix B: Photographs of Test Set-up 66

Appendix C: EUT Photographs 68

Appendix D: Maximum Permissible Exposure 71

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. Sukjun. Lee
Manufacturer :	Samsung Electronics Co., Ltd. 416 Maetan-3Dong, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 443-742 KOREA

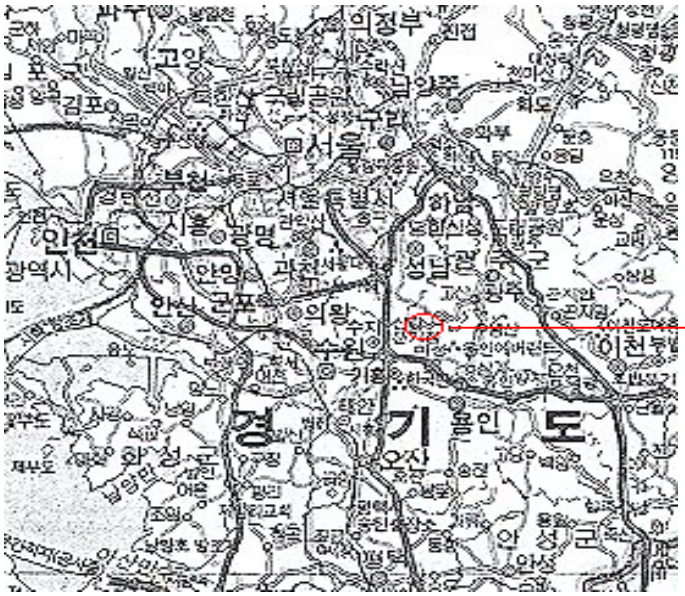
- FCC ID: A3LDUNRS11
- Model: DNUR-S1(1)
- Brand Name: SAMSUNG
- EUT Type: WiFi module
- Classification: FCC part 15 Spread Spectrum Transmitter
- Applied Standard: FCC 47 CFR Part 15 subpart C and IC RSS-210
- Test Procedure(s): ANSI C63.4-2003 and FCC procedure dated March 23, 2005 entitled “Measurements of Digital Transmission Systems Operating Under Section 15.247”
- Dates of Test: February 10, 2012 ~ February 23, 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 : A3LDNURS11 and **IC : 649E-DNURS11**

These measurement tests were conducted at ***Nemko Korea Co., Ltd. EMC Laboratory***.
The site address is 67-1 & 300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, KOREA.
The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 kilo-meters (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (18 miles) 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.
67-1 & 300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do,
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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-1
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 which is module 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 operating voltage of EUT was 5 Vdc supplied from a USB port on Laptop PC. 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.

The EUT is programmed with the following setting during the testing:

Test frequency		2412 MHz	2437 MHz	2462 MHz
802.11b	Programed Level	11	16	16
	Data rate (Mbps)	1	1	1
802.11g	Programed Level	1E	1D	1D
	Data rate (Mbps)	54	54	54
802.11n	Programed Level	1E	1E	1E
	Data rate (Mbps)	MCS7	MCS7	MCS7

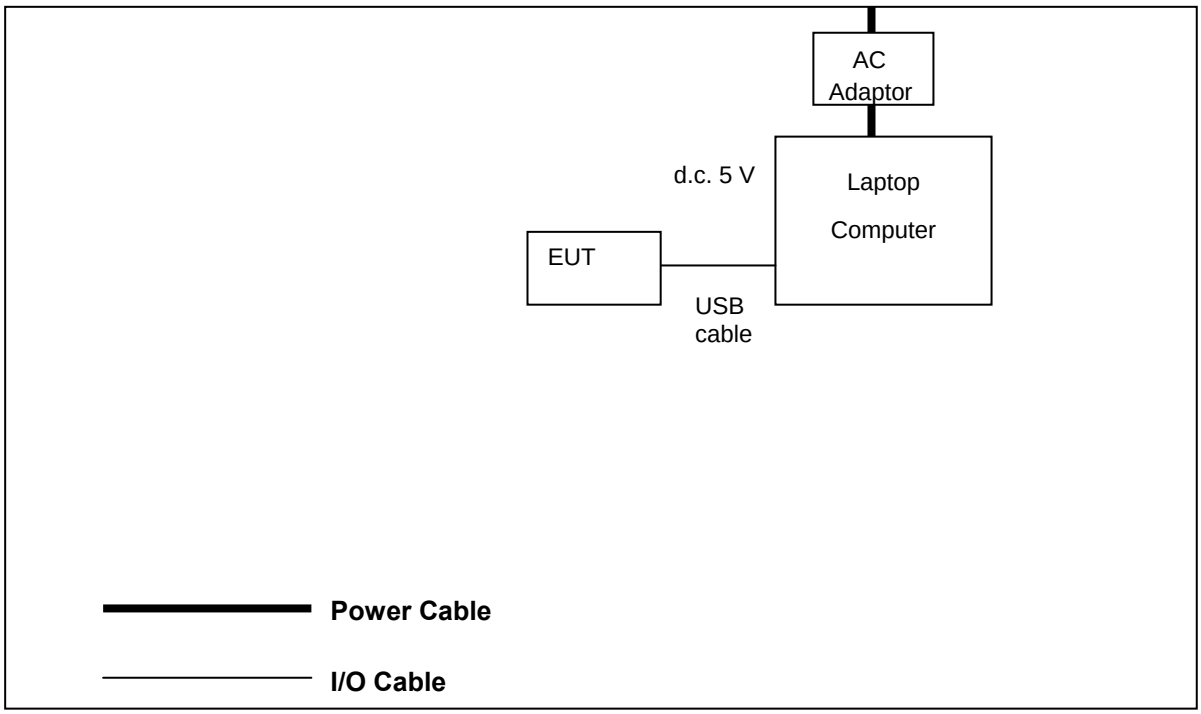
Table of test modes

Test Items	Mode	Data rate (Mbps)
Conducted Emissions	802.11g	54
Radiated Emissions	802.11g	54
6 dB Bandwidth	802.11b	1
	802.11g	54
	802.11n	MCS7
Peak Output Power	802.11b	1
	802.11g	54
	802.11n	MCS7
Peak Power Spectral Density	802.11b	1
	802.11g	54
	802.11n	MCS7
Conducted Spurious Emission, Radiated Spurious Emission, Band edge Emission	802.11b	1
	802.11g	54
	802.11n	MCS7

3.2 Support Equipment

WiFi module (EUT)	Samsung Electronics Co., Ltd. Model : DNUR-S1(1)	S/N: N/A
Laptop PC	Samsung Electronics Co., Ltd. Model : NT-R520 0.3 m Unshielded USB cable	FCC DOC S/N: ZK6V93FS800012Y
AC Adaptor	Chicony Power Technology Co., Ltd. Model : AD-6019R 1.2 m unshielded power cable	FCC DOC S/N: CNBA4400242A

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Samsung WiFi module FCC ID: A3LDNURS11, IC: 649E-DNURS11.**

Specifications:

EUT Type	WiFi module
Model Name	DUNR-S1(1)
Brand Name	SAMSUNG
Frequency of Operation	2412 MHz to 2462 MHz
Peak Power Output (Conducted)	802.11b : 19.71 dBm, 802.11g : 25.82 dBm 802.11n : 25.36dBm
Channels	802.11b,g,n : 11 CH
TX Antenna Gain	1.02 dBi
Spreading	DSSS, OFDM
Modulations	BPSK, QPSK, 16QAM, 64QAM
Temperature Range	-20 ℃ ~ +55 ℃
Voltage	5.0 Vdc
Dimension(W x H x D)	20 mm x 56 mm x 3 mm
Weight	3 g
Remarks	-

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	FCC Paragraph No.	IC Paragraph No.	Result	Remark
Conducted Emission	15.207	RSS-GEN 7.2.4	Complies	
Radiated Emission	15.205 15.209	RSS-GEN 7.2.2	Complies	
6 dB Bandwidth	15.247(a)(2)	RSS-210 A8.2	Complies	
Peak Power Output	15.247(b)(3)	RSS-210 A8.4	Complies	
Peak Power Spectral Density	15.247(e)	RSS-210 A8.2	Complies	
Conducted Spurious Emission	15.247(d)	RSS-210 A8.5	Complies	
Radiated Spurious Emission	15.247(d)	RSS-210 A8.5	Complies	
Maximum Permissible Exposure	1.1307(b)	RSS-102	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung WiFi module FCC ID: A3LDNURS11, IC: 649E-DNURS11** 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.

The antenna of the **Samsung WiFi module FCC ID: A3LDNURS11, IC: 649E-DNURS11** is **Permanently attached** and there are no provisions for connection to an external antenna. 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 Rohde & Schwarz (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 (serpentine fashion) 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 ms 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; whichever determined the worst case emission.
Each EME reported was calibrated using the R&S signal generator.

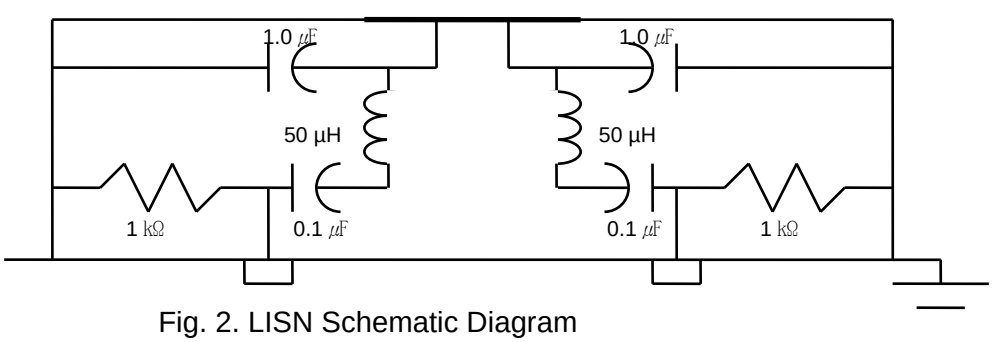


Fig. 2. LISN Schematic Diagram

7.2 Radiated Emissions

Preliminary measurements were made indoors at 3 meter 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 spectrum was scanned from 9 kHz to 30 MHz using Loop Antenne(Rohde&Schwarz, HFH2-Z2) and 30 to 1000 MHz using Bi-conical log Antenna(ARA, LPB-2520/A). 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. Final Measurements were made outdoors at 3 or 10 m test range using Loop Antenne(Rohde&Schwarz, HFH2-Z2) and Logbicon Super Antenna (Schwarzbeck, VULB9168) or Horn antenna.(Scwarzbeck BBHA 9120D: up to 18 GHz , Q-par Angus QSH20S20 : 18 to 26.5 GHz, QSH22K20: up to 40 GHz).
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 pre-scan measurements was reexamined and investigated using EMI test receiver (ESCS30) & (FSP40). The detector function was set to CISPR peak mode or quasi-peak mode or average mode and the band-width of the receiver was 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 4meter 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 AC outlet, if applicable; whichever determined the worst case emission.
Each EME reported was calibrated using the R/S signal generator.

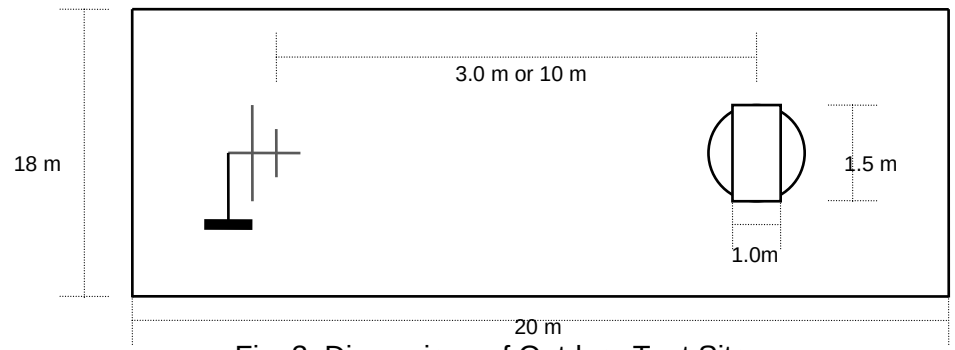
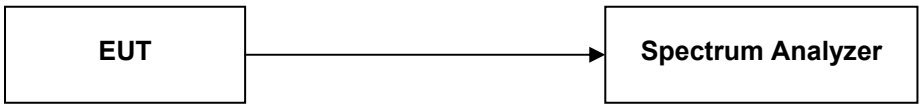


Fig. 3. Dimensions of Outdoor Test Site

7.3 6 dB Bandwidth

Test Setup

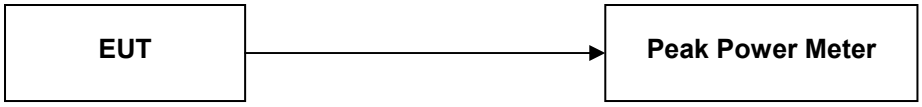


Test Procedure

The transmitter is set to the Low, Middle, High channels is connected to the spectrum analyzer. The RBW and VBW of spectrum analyzer are set to 100 kHz.
The sweep time is coupled.
The spectrum analyzer is set for peak detected and Max hold scan mode.

7.4 Maximum Peak Output Power

Test Setup

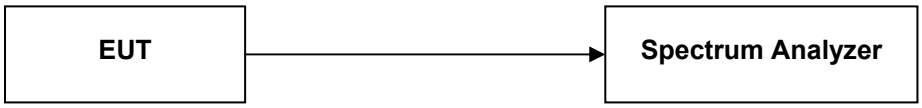


Test Procedure

The transmitter is set to the Low, Middle, High channels is connected to the Peak Power Meter.

7.5 Peak Power Spectral Density

Test Setup

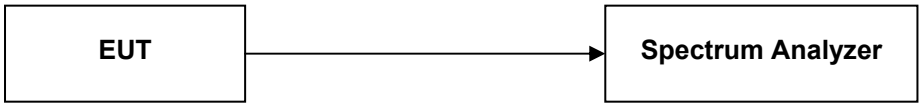


Test Procedure

The transmitter is connected to the Spectrum analyzer.
The maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer.
The RBW of spectrum analyzer is set to 3 kHz and VBW is set to 10 kHz.
The sweep time is set to Span/3 kHz and video averaging is turned off.
The PPSD is the highest level found across the emission in any 3 kHz band.

7.6 Conducted Spurious Emissions

Test Setup



Test Procedure

The transmitter is connected to the spectrum analyzer.
The RBW of spectrum analyzer is set to 100 kHz and VBW is set to the 300 kHz.
Measurements are made over the 30 MHz to 25 GHz range with the transmitter set to the Lowest, middle and highest channels.

8. TEST DATA

8.1 Conducted Emissions

FCC §15.207, RSS-Gen 7.2.4

Frequency	Level(dBµV)		*)Factor	**) Line	Limit(dBµV)		Margin(dB)	
(MHz)	Q-Peak	Average	(dB)		Q-Peak	Average	Q-Peak	Average
0.17	56.3	36.7	0.2	N	65.0	55.0	8.7	18.3
0.23	50.2	34.0	0.2	N	62.4	52.4	12.2	18.4
0.30	44.7	28.3	0.2	N	60.2	50.2	15.5	21.9
0.36	40.8	23.9	0.2	N	58.7	48.7	17.9	24.8
0.54	37.0	21.4	0.2	N	56.0	46.0	19.0	24.6
0.90	32.3	17.2	0.1	N	56.0	46.0	23.7	28.8

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 were 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-015) 23 Feb 2012 19:33

Conducted Emissions

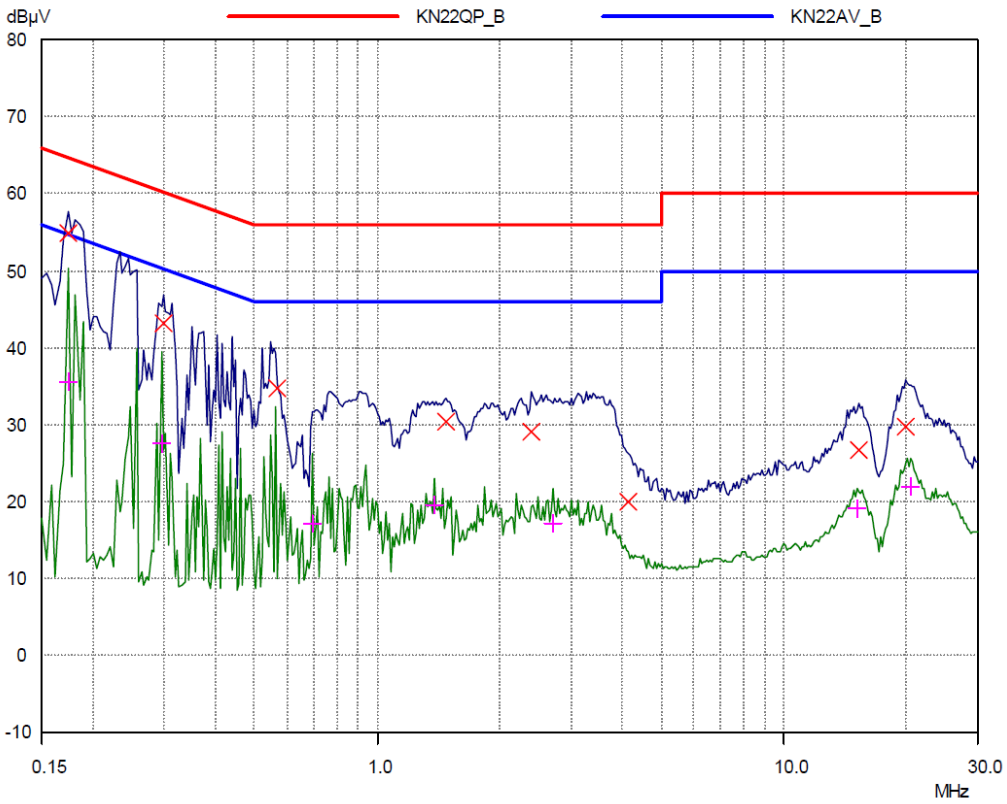
EUT:	WIFI Module
Manuf:	Samsung Electronics
Op Cond:	a.c. 120 V, 60 Hz
Operator:	Jinha. KO
Test Spec:	FCC Part 15.207
Comment:	MODEL : DNUR-S1(1)
	LINE : L1

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-015) 23 Feb 2012 19:24

Conducted Emissions

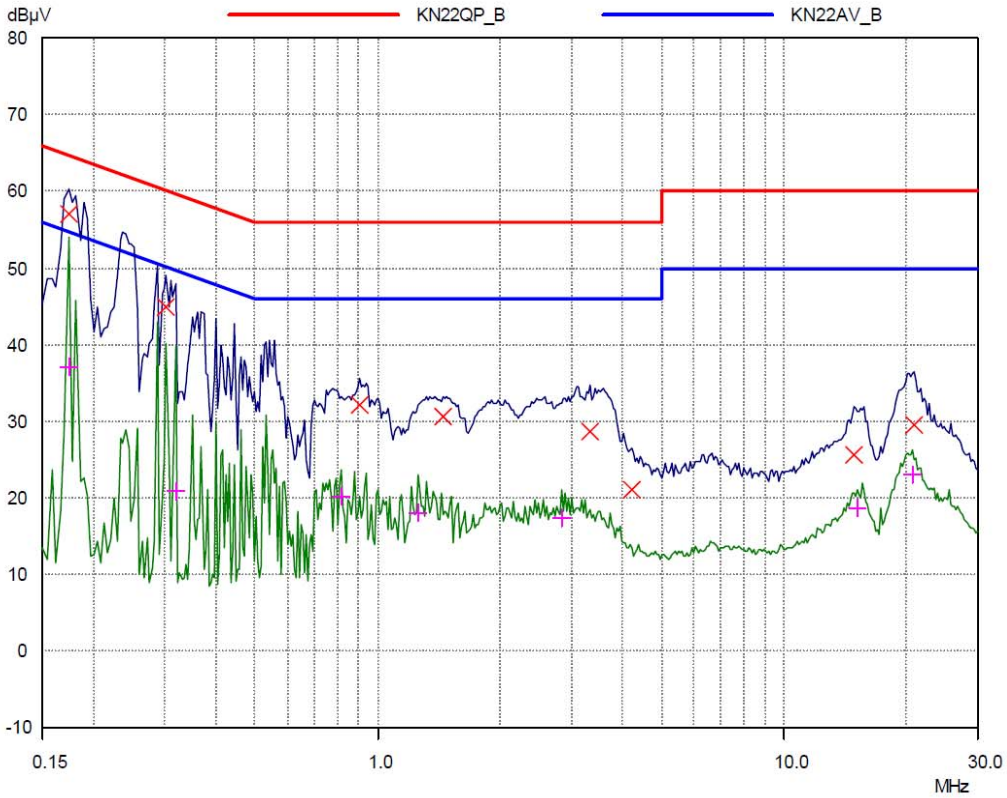
EUT:	WIFI Module
Manuf:	Samsung Electronics
Op Cond:	a.c. 120 V, 60 Hz
Operator:	Jinha. KO
Test Spec:	FCC Part 15.207
Comment:	MODEL : DNUR-S1(1)
	LINE : Neutral

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	20 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, RSS-210 A8.5

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)
31.27	50.7	V	102	241	-23.5	27.2	40.0	12.8
223.25	43.9	H	155	60	-15.4	28.5	46.0	17.5
228.92	46.1	H	129	49	-15.4	30.7	46.0	15.3
247.93	42.8	H	127	107	-15.4	27.4	46.0	18.6
305.35	42.0	H	101	350	-13.8	28.2	46.0	17.8
480.26	42.5	H	110	147	-11.3	31.2	46.0	14.8

Radiated Measurements at 3 meters

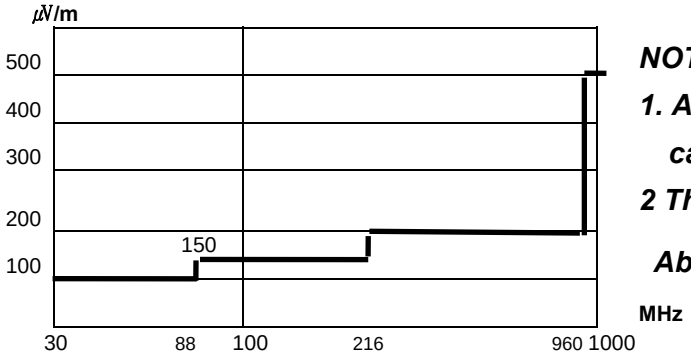


Fig. 4. Limits at 3 meters

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

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

4. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst date was recorded.

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

8.3 6 dB Modulated Bandwidth

FCC §15.247(a)(2), RSS-210 A8.2

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

Result:

802.11b mode

Channel	Frequency(MHz)	Result(MHz)	Limit(MHz)
Low	2412	12.13	0.5
Middle	2437	12.12	0.5
High	2462	12.11	0.5

802.11g mode

Channel	Frequency(MHz)	Result(MHz)	Limit(MHz)
Low	2412	16.53	0.5
Middle	2437	16.51	0.5
High	2462	16.50	0.5

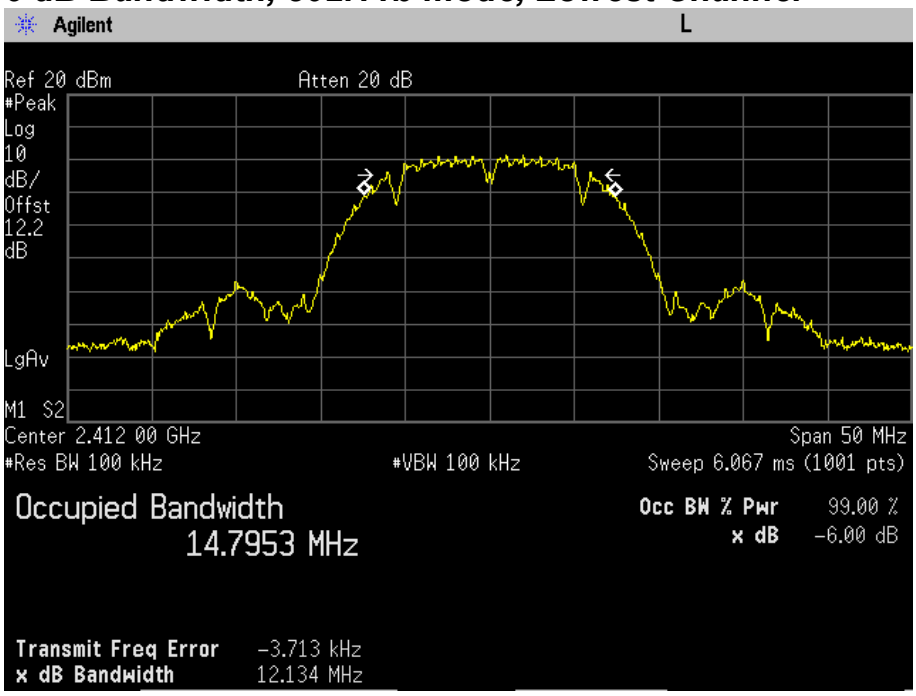
802.11n mode

Channel	Frequency(MHz)	Result(MHz)	Limit(MHz)
Low	2412	17.72	0.5
Middle	2437	17.70	0.5
High	2462	17.65	0.5

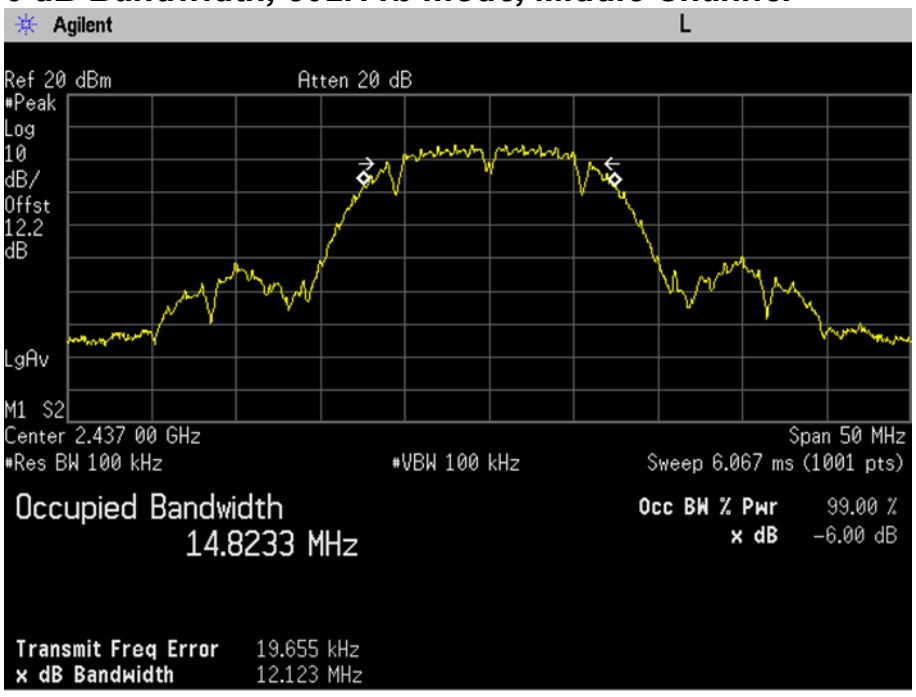
PLOTS OF EMISSIONS

802.11b mode

6 dB Bandwidth, 802.11b mode, Lowest Channel

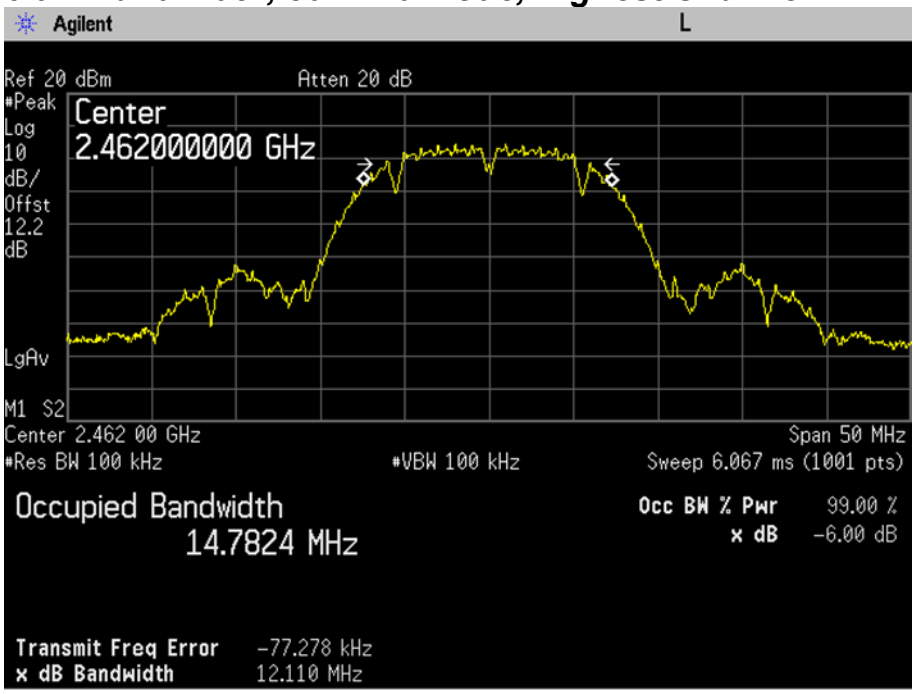


6 dB Bandwidth, 802.11b mode, Middle Channel



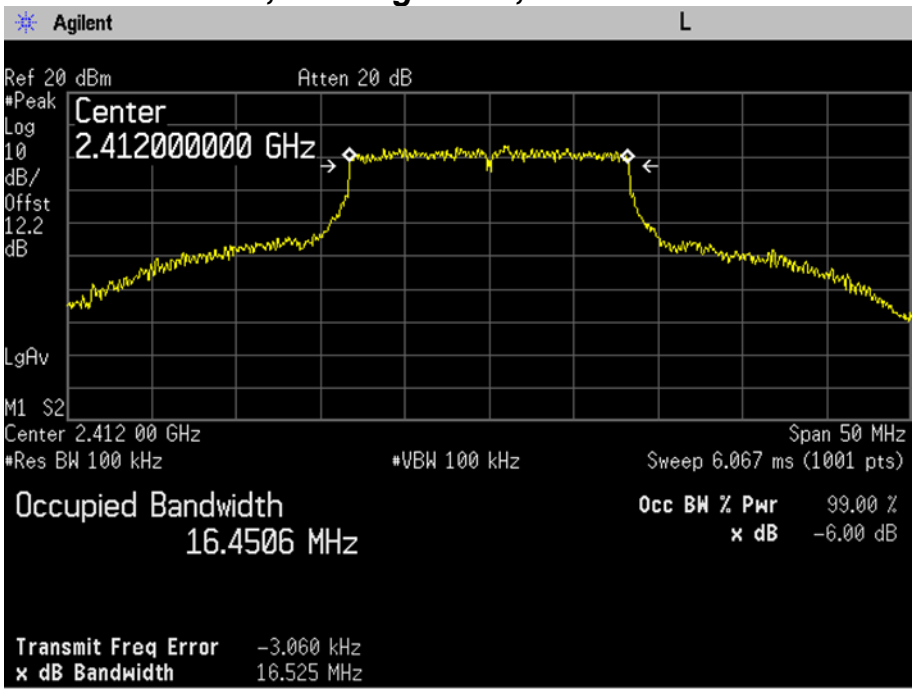
PLOTS OF EMISSIONS

6 dB Bandwidth, 802.11b mode, Highest Channel



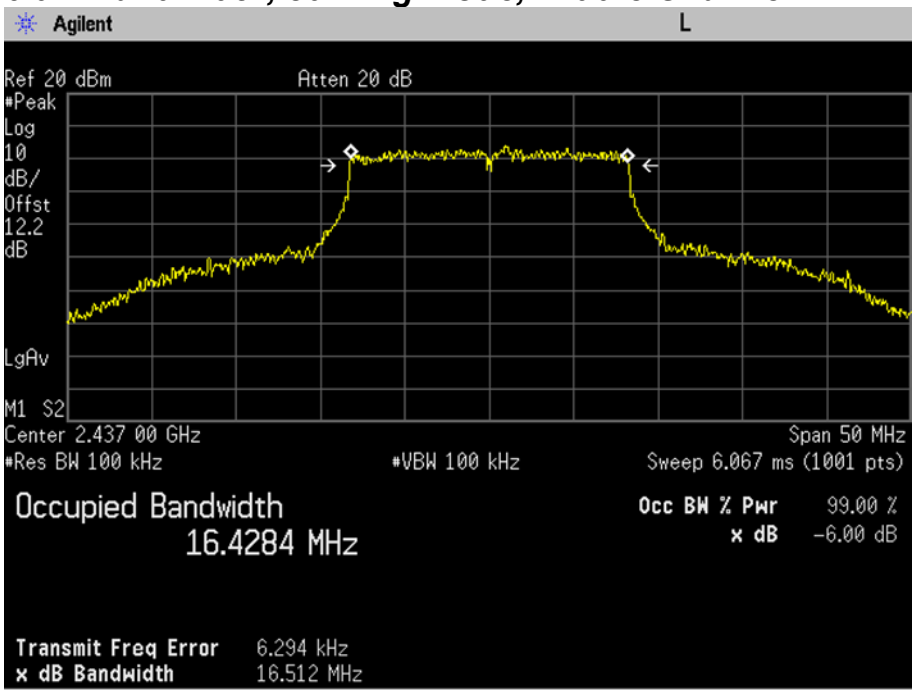
802.11g mode

6 dB Bandwidth, 802.11g mode, Lowest Channel

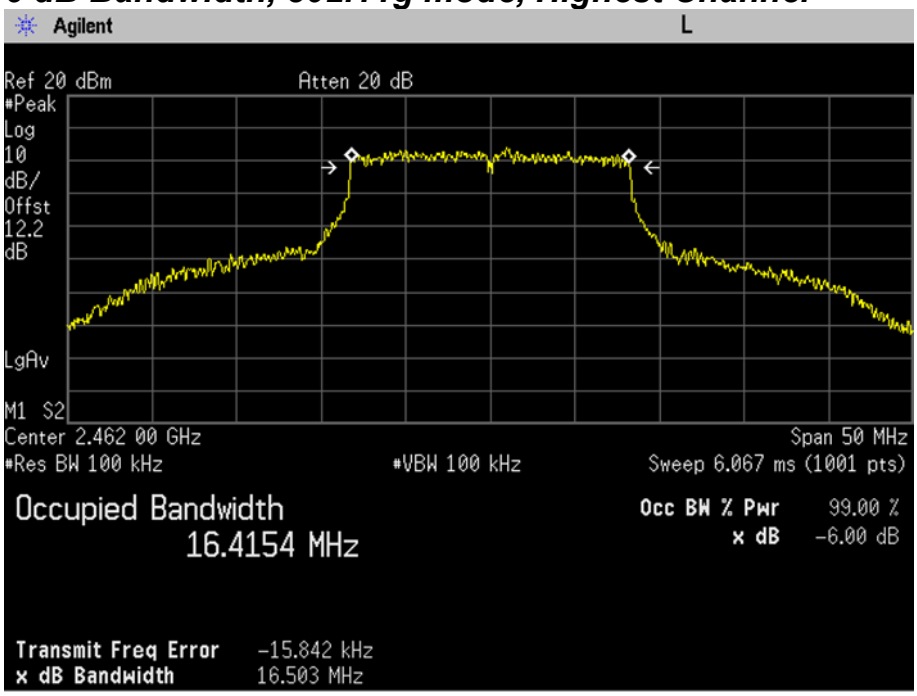


PLOTS OF EMISSIONS

6 dB Bandwidth, 802.11g mode, Middle Channel



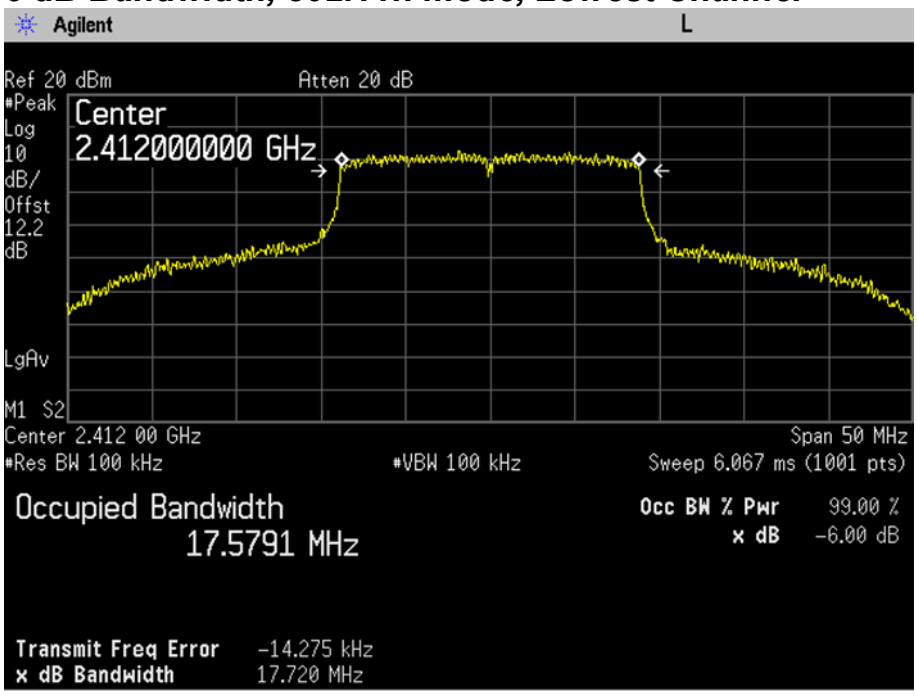
6 dB Bandwidth, 802.11g mode, Highest Channel



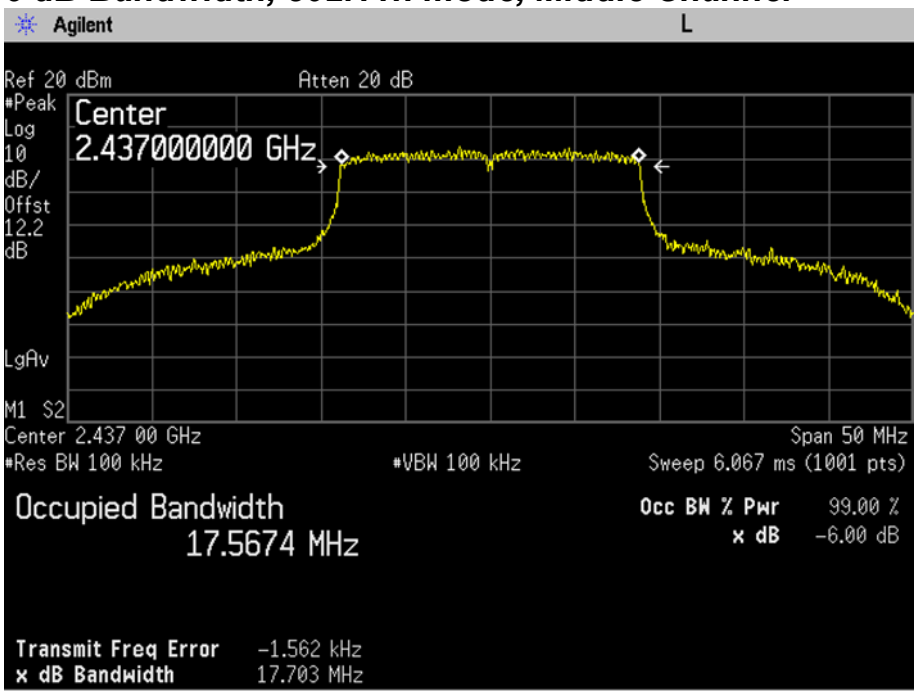
PLOTS OF EMISSIONS

802.11n mode

6 dB Bandwidth, 802.11n mode, Lowest Channel

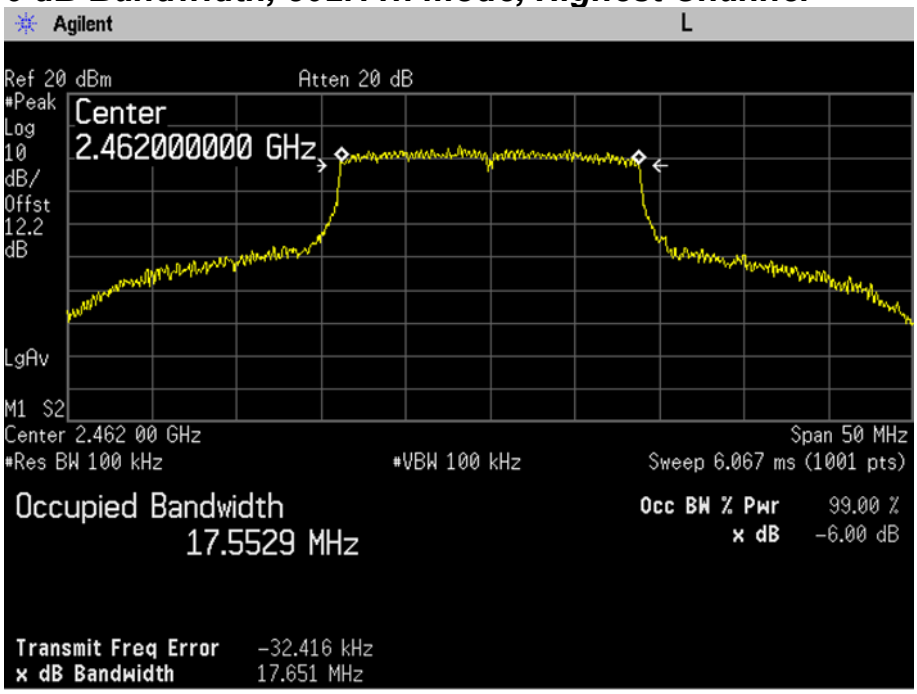


6 dB Bandwidth, 802.11n mode, Middle Channel



PLOTS OF EMISSIONS

6 dB Bandwidth, 802.11n mode, Highest Channel



TEST DATA

8.4 Peak Power Output

FCC §15.247(b)(3), RSS-210 A8.4

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

Result:

802.11b mode

Channel	Frequency(MHz)	Peak Power(dBm)	Limit(dBm)
Low	2412	16.87	30
Middle	2437	19.71	30
High	2462	19.00	30

802.11g mode

Channel	Frequency(MHz)	Peak Power(dBm)	Limit(dBm)
Low	2412	25.24	30
Middle	2437	25.82	30
High	2462	25.56	30

802.11n mode

Channel	Frequency(MHz)	Peak Power(dBm)	Limit(dBm)
Low	2412	24.37	30
Middle	2437	25.36	30
High	2462	24.87	30

TEST DATA

8.5 Peak Power Spectral Density

FCC §15.247(e), RSS-210 A8.2

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

Result:

802.11b mode

Channel	Frequency(MHz)	PPSD(dBm)	Limit(dBm)
Low	2412	-9.96	8
Middle	2437	-7.75	8
High	2462	-7.93	8

802.11g mode

Channel	Frequency(MHz)	PPSD(dBm)	Limit(dBm)
Low	2412	-4.75	8
Middle	2437	-3.74	8
High	2462	-3.93	8

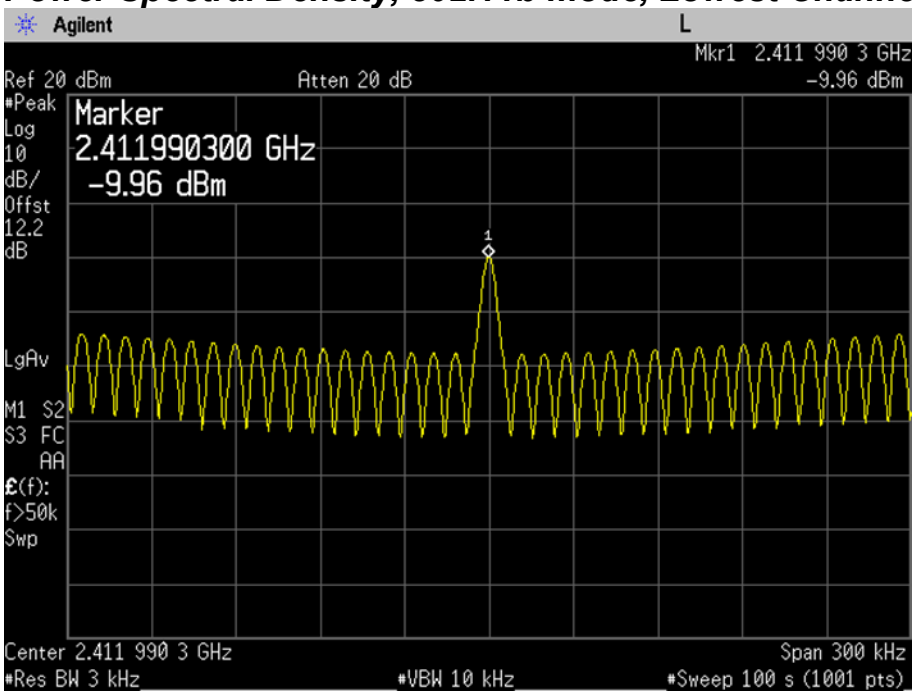
802.11n mode

Channel	Frequency(MHz)	PPSD(dBm)	Limit(dBm)
Low	2412	-4.64	8
Middle	2437	-3.60	8
High	2462	-3.66	8

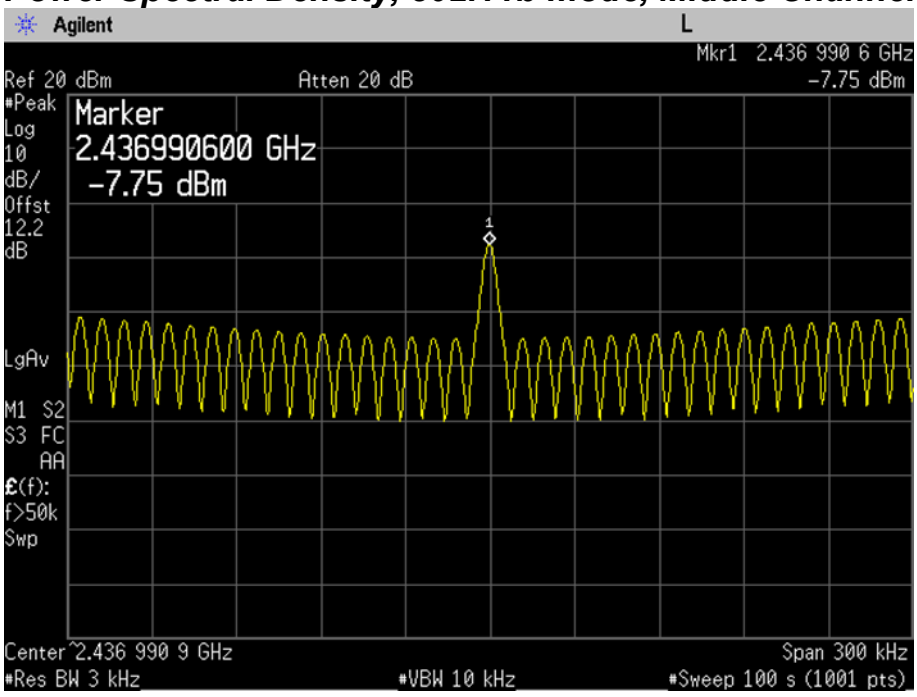
PLOTS OF EMISSIONS

802.11b mode

Power Spectral Density, 802.11b mode, Lowest Channel

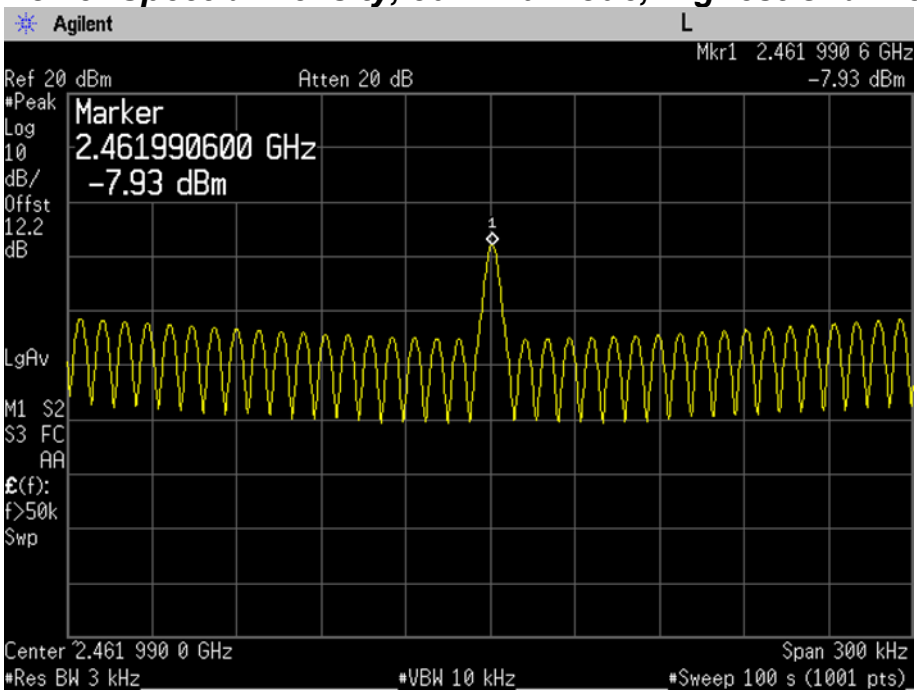


Power Spectral Density, 802.11b mode, Middle Channel



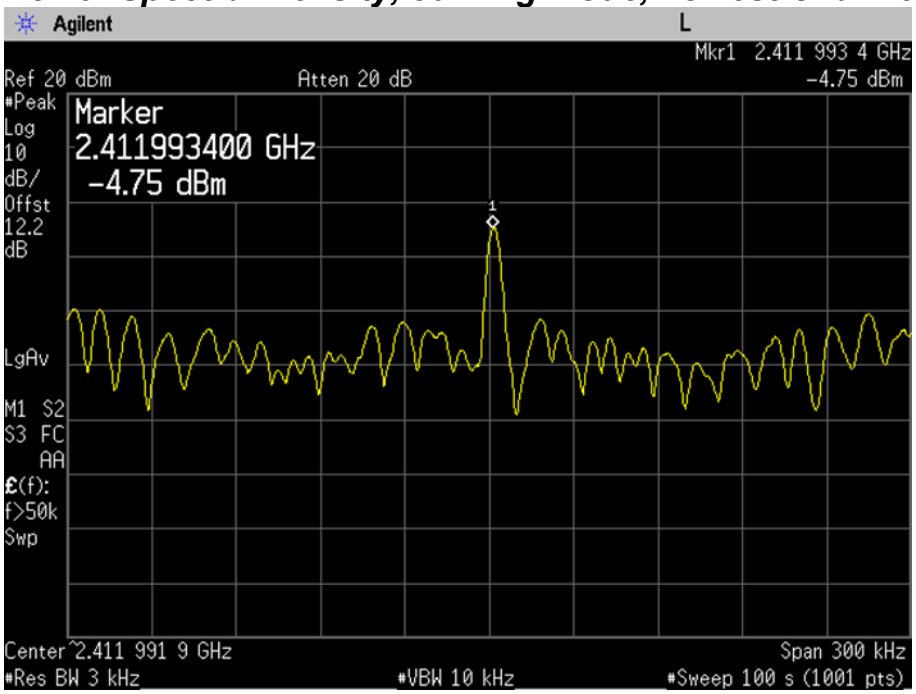
PLOTS OF EMISSIONS

Power Spectral Density, 802.11b mode, Highest Channel



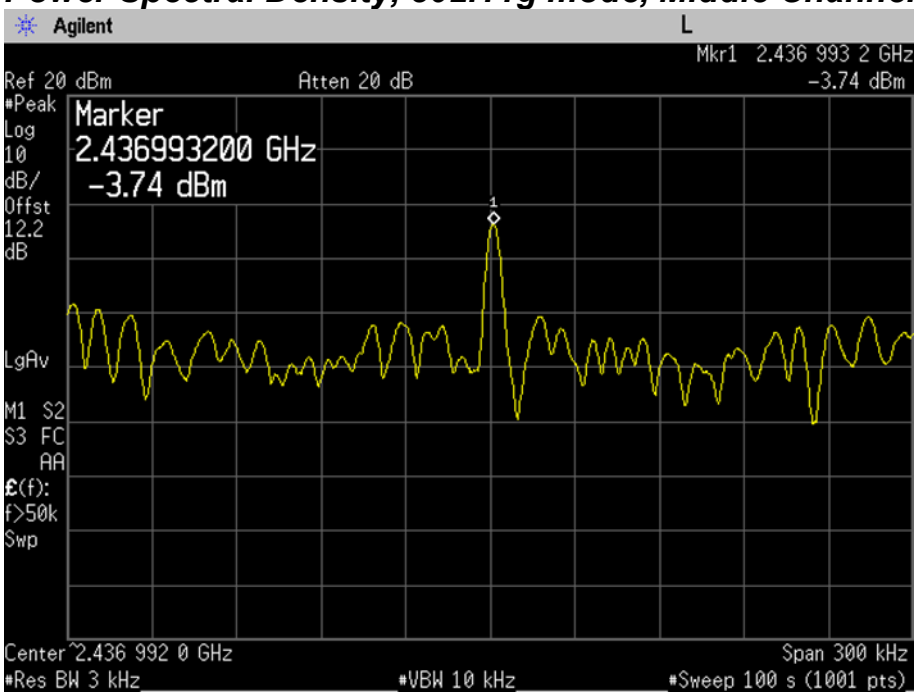
802.11g mode

Power Spectral Density, 802.11g mode, Lowest Channel

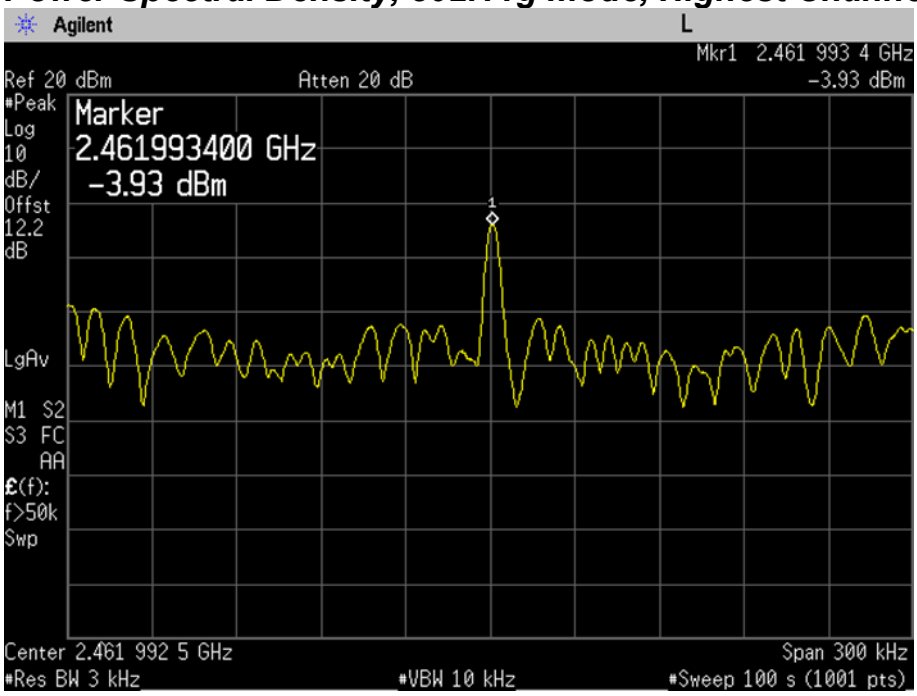


PLOTS OF EMISSIONS

Power Spectral Density, 802.11g mode, Middle Channel



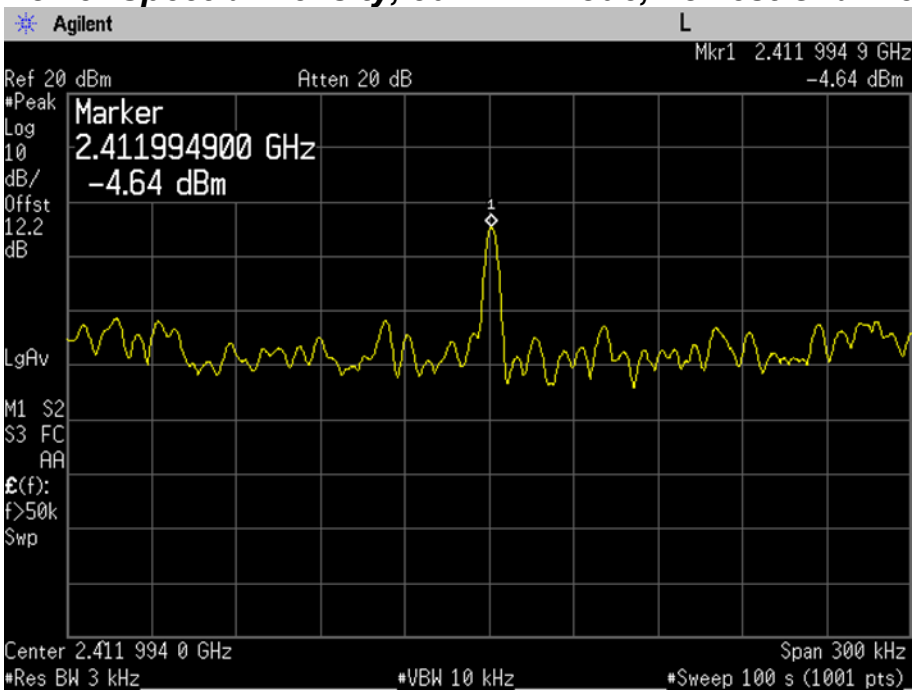
Power Spectral Density, 802.11g mode, Highest Channel



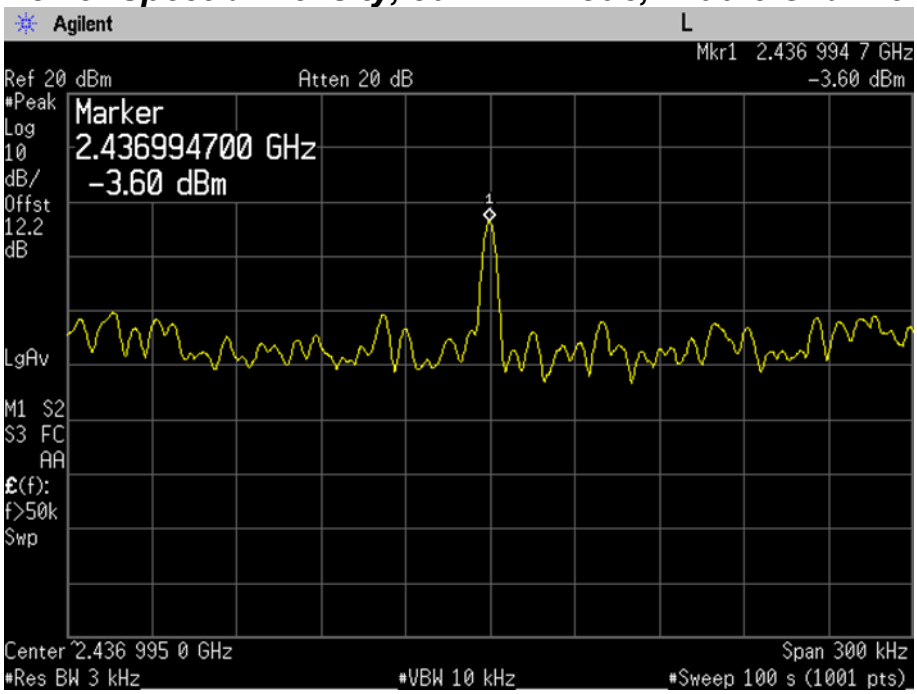
PLOTS OF EMISSIONS

802.11n mode

Power Spectral Density, 802.11n mode, Lowest Channel

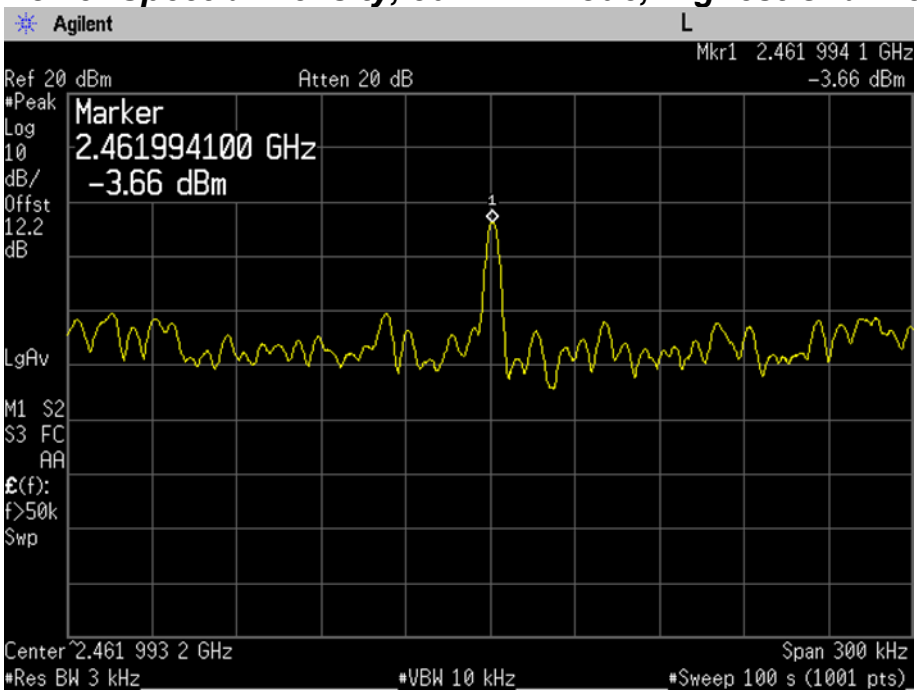


Power Spectral Density, 802.11n mode, Middle Channel



PLOTS OF EMISSIONS

Power Spectral Density, 802.11n mode, Highest Channel



TEST DATA

8.6 Conducted Spurious Emissions

FCC §15.247(d), RSS-210 A8.5

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

Result:

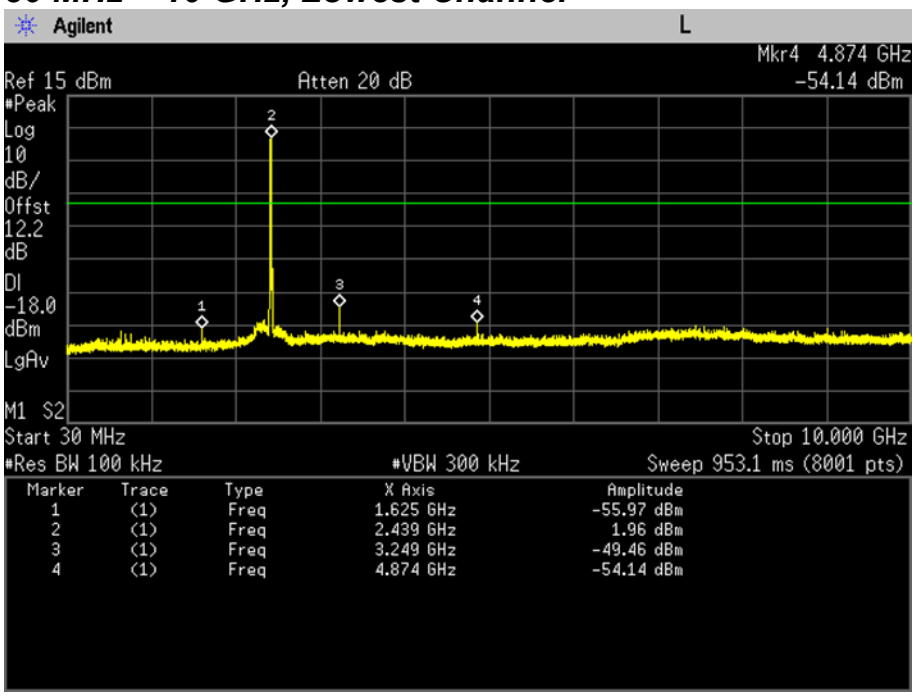
802.11b/g/n mode

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

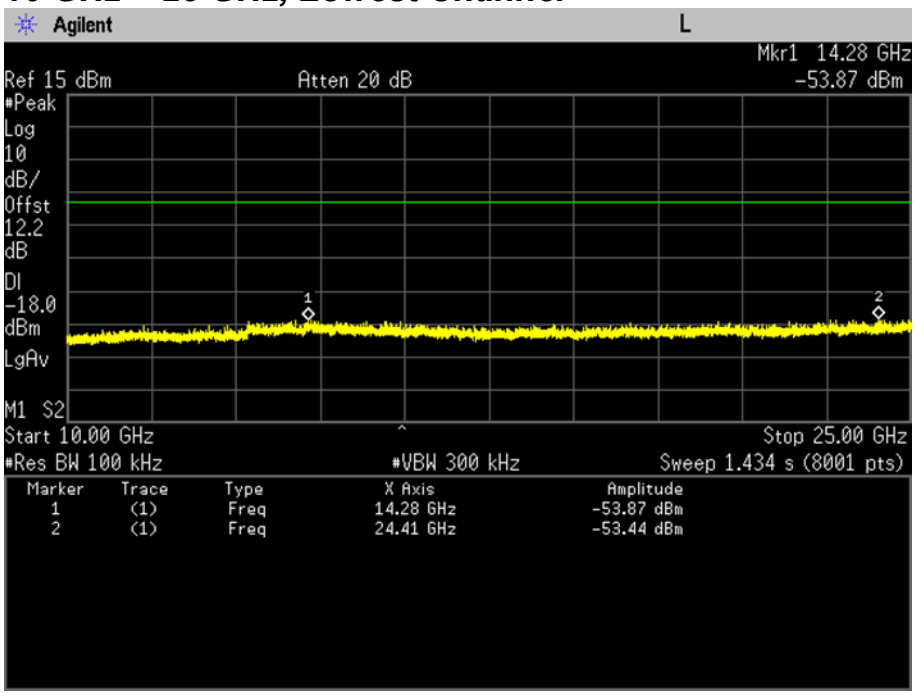
PLOT OF TEST DATA

802.11b mode

Conducted Spurious Emissions, 802.11b mode, 30 MHz ~ 10 GHz, Lowest Channel

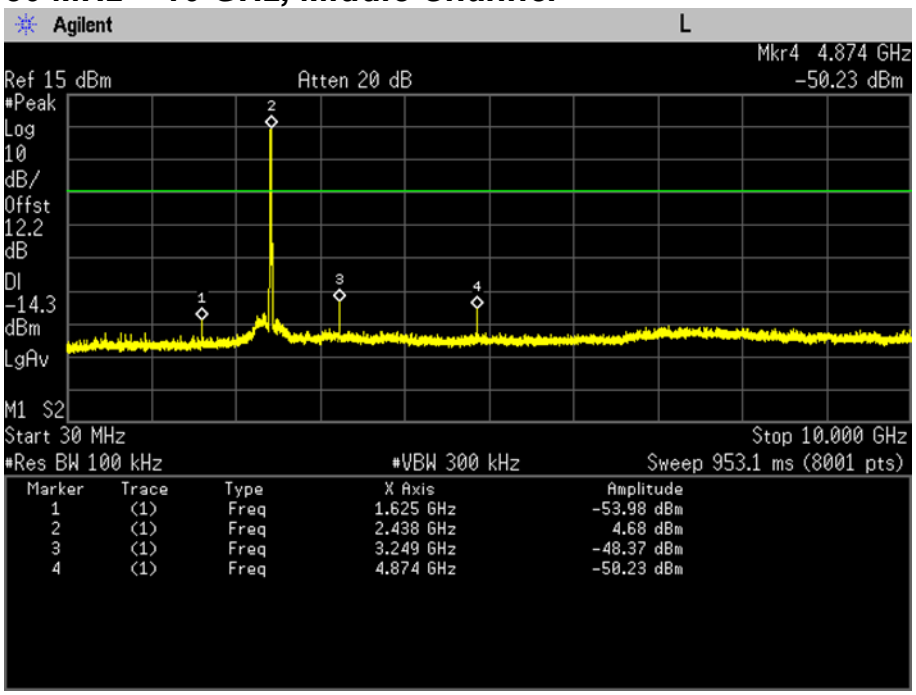


Conducted Spurious Emissions, 802.11b mode, 10 GHz ~ 25 GHz, Lowest Channel

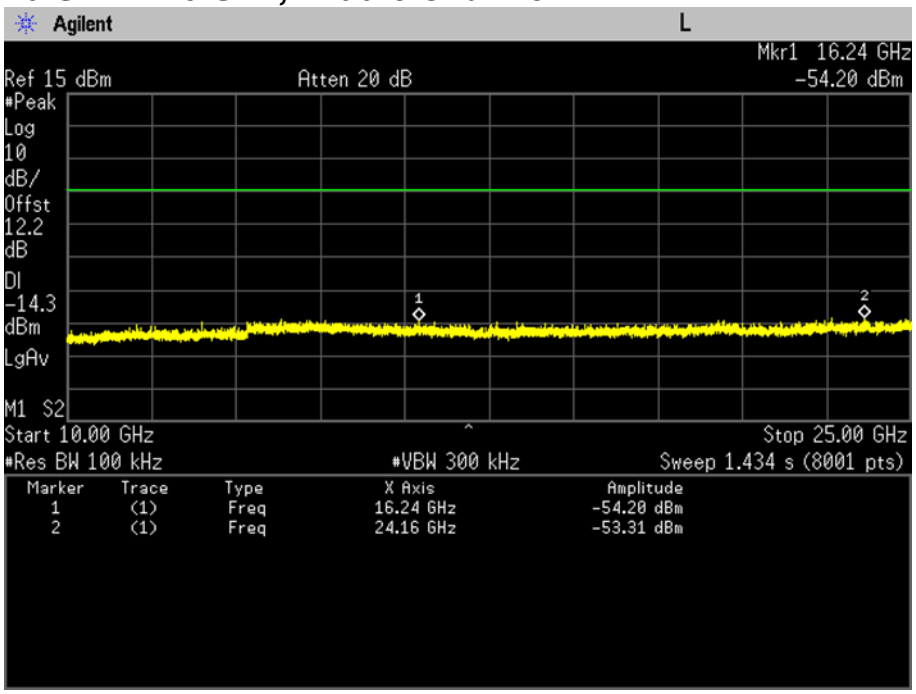


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11b mode, 30 MHz ~ 10 GHz, Middle Channel

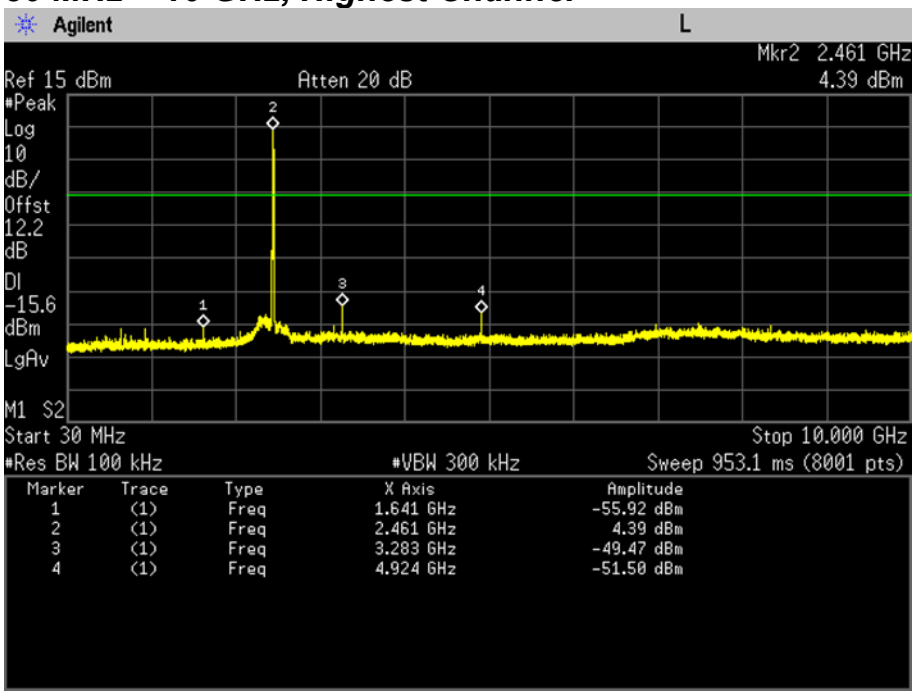


Conducted Spurious Emissions, 802.11b mode, 10 GHz ~ 25 GHz, Middle Channel

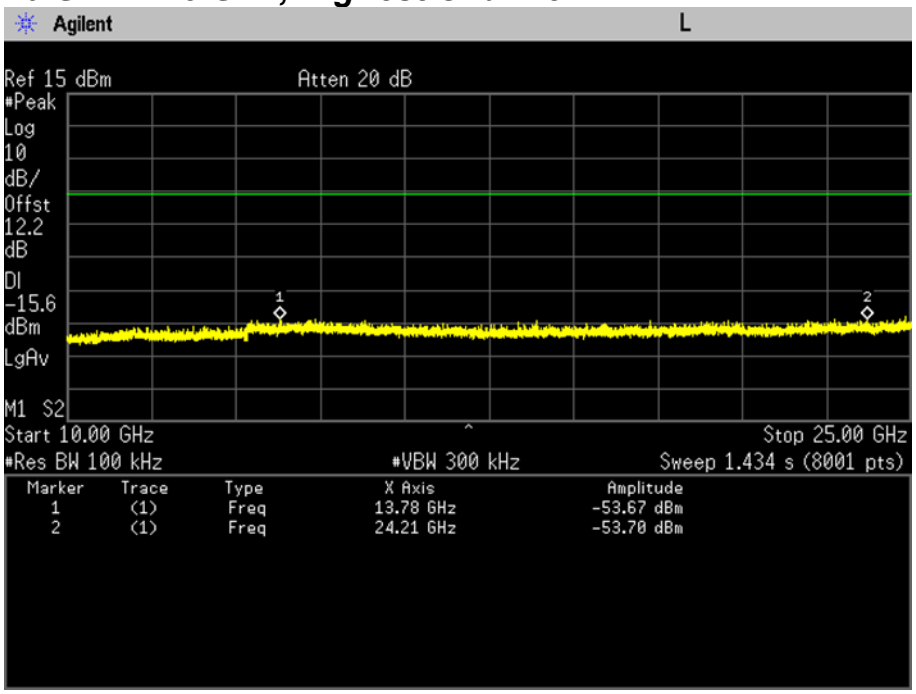


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11b mode, 30 MHz ~ 10 GHz, Highest Channel



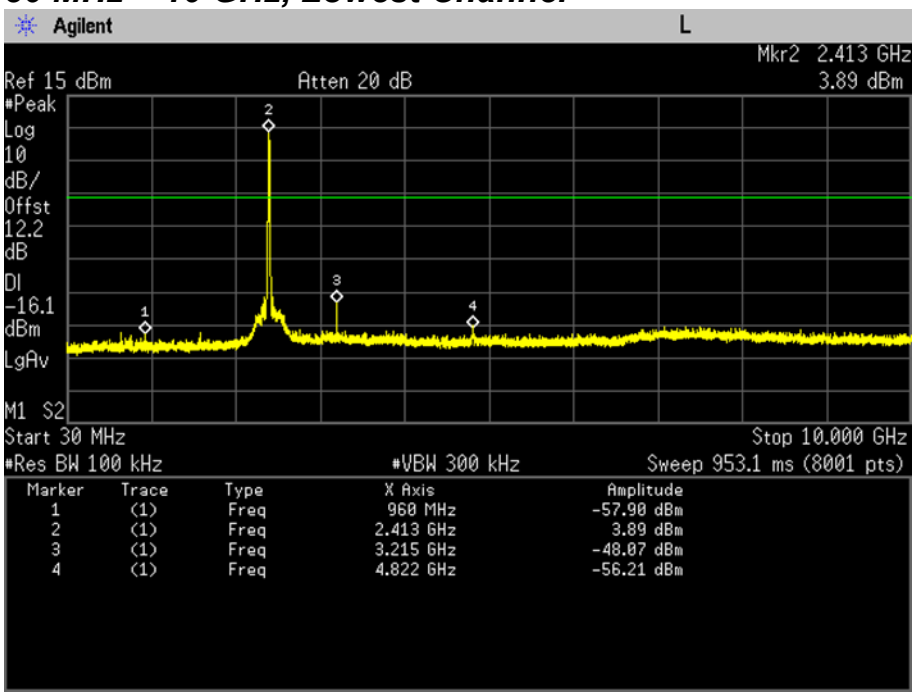
Conducted Spurious Emissions, 802.11b mode, 10 GHz ~ 25 GHz, Highest Channel



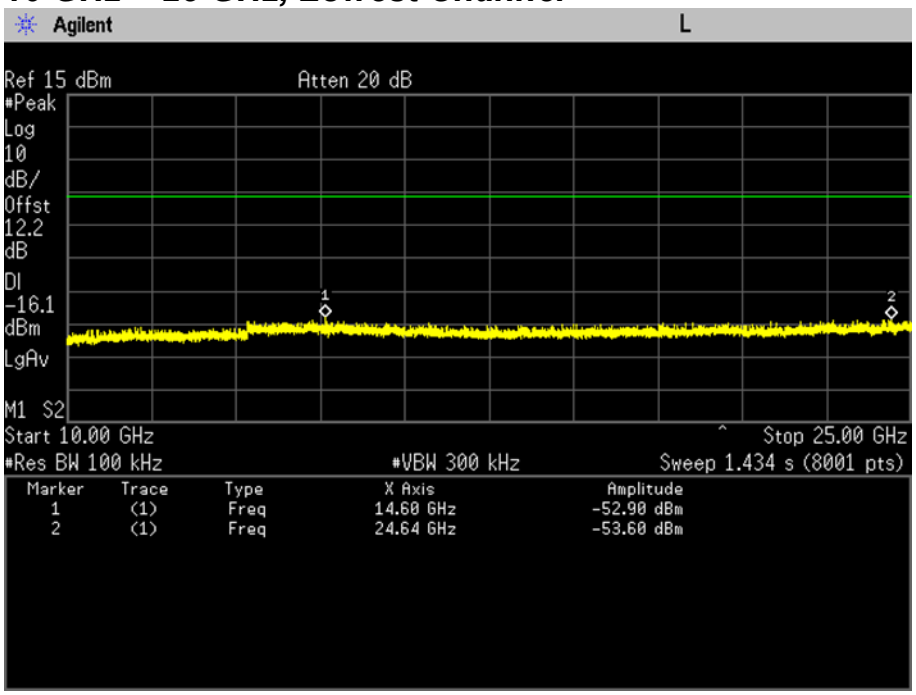
PLOT OF TEST DATA

802.11g mode

Conducted Spurious Emissions, 802.11g mode, 30 MHz ~ 10 GHz, Lowest Channel

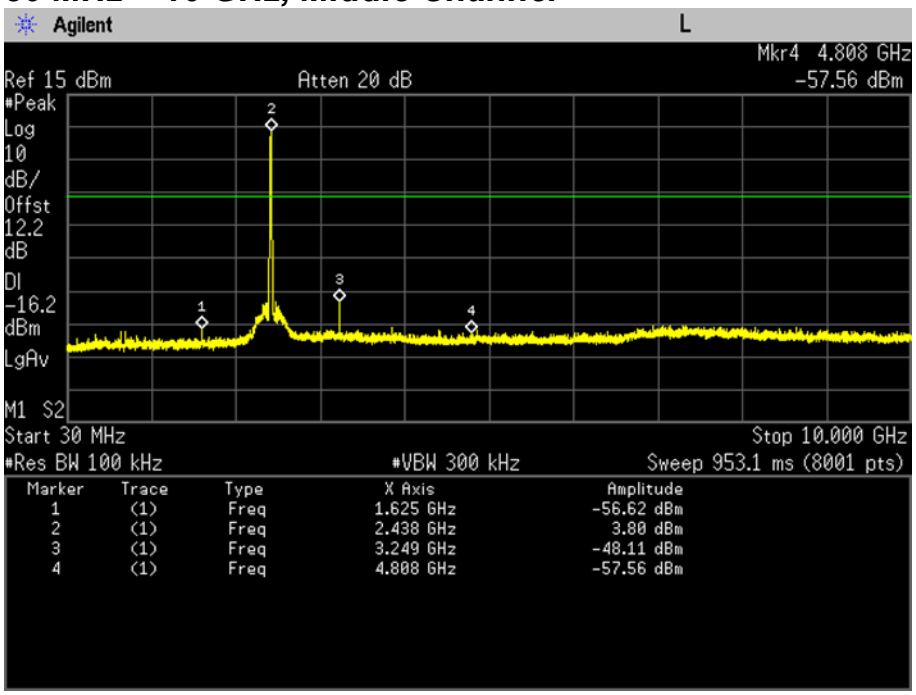


Conducted Spurious Emissions, 802.11g mode, 10 GHz ~ 25 GHz, Lowest Channel

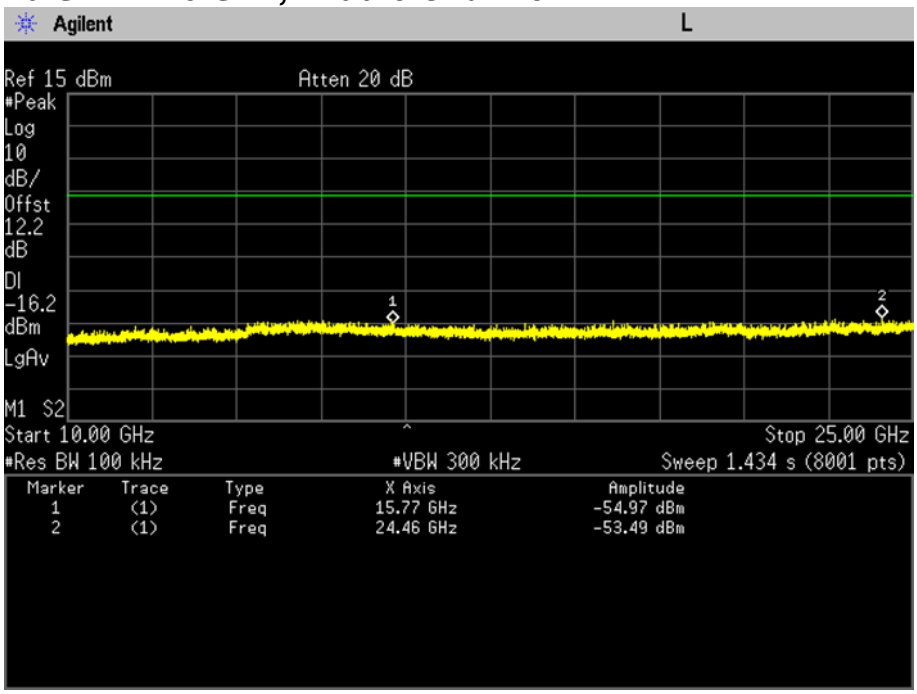


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11g mode, 30 MHz ~ 10 GHz, Middle Channel

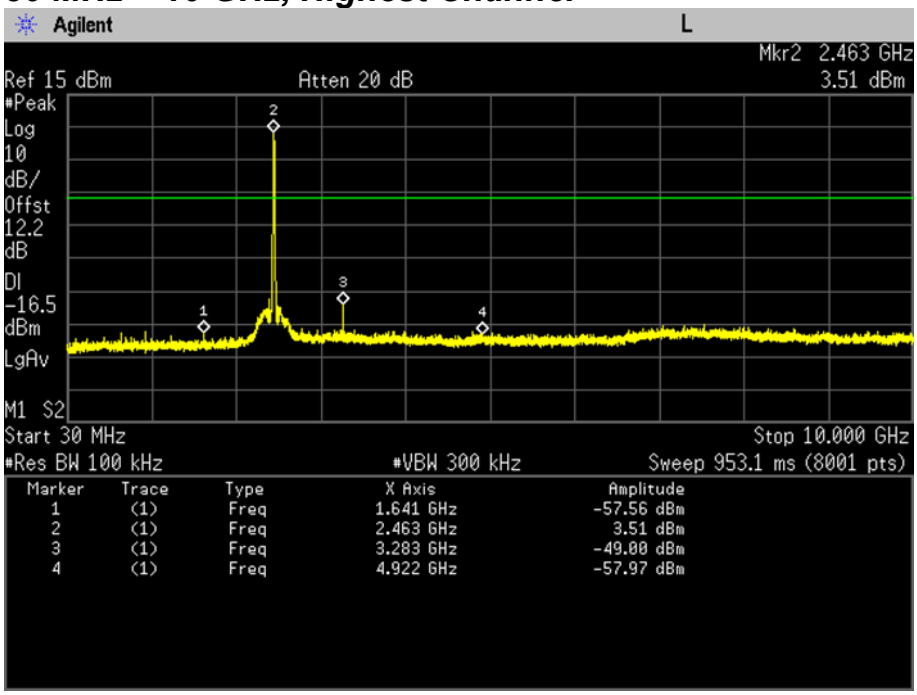


Conducted Spurious Emissions, 802.11g mode, 10 GHz ~ 25 GHz, Middle Channel

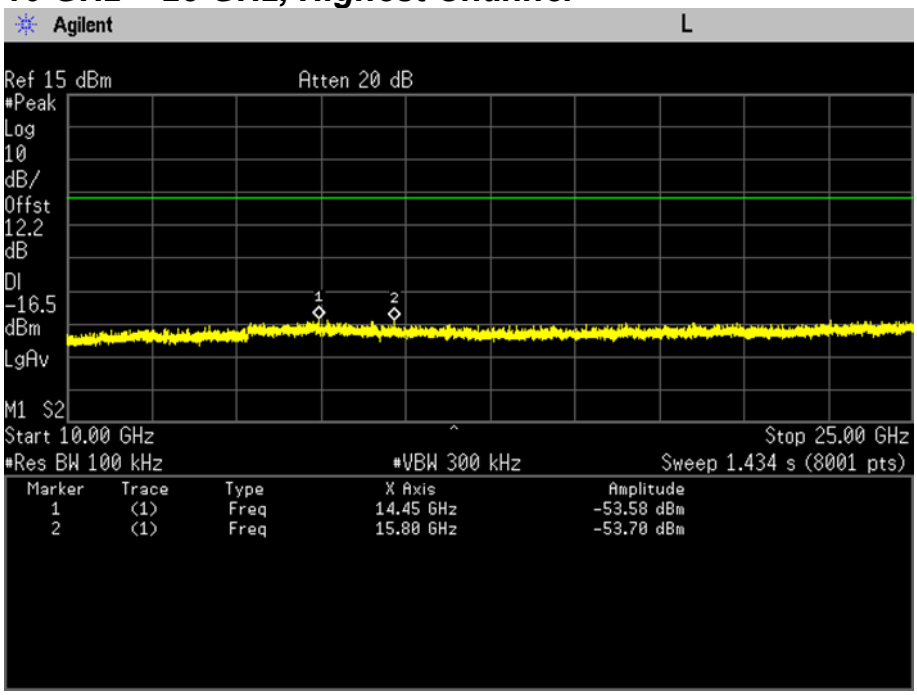


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11g mode, 30 MHz ~ 10 GHz, Highest Channel



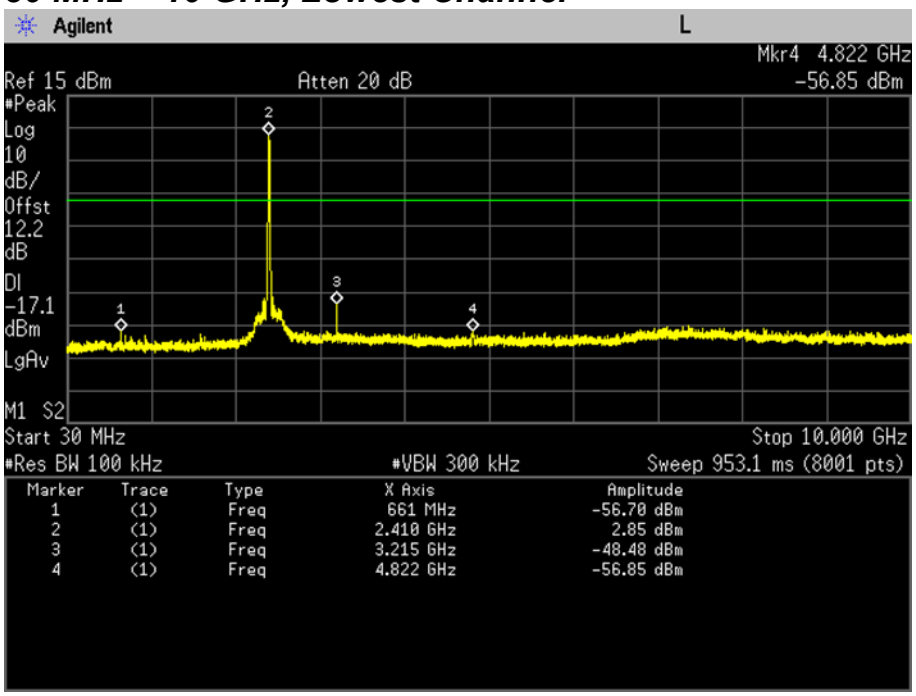
Conducted Spurious Emissions, 802.11g mode, 10 GHz ~ 25 GHz, Highest Channel



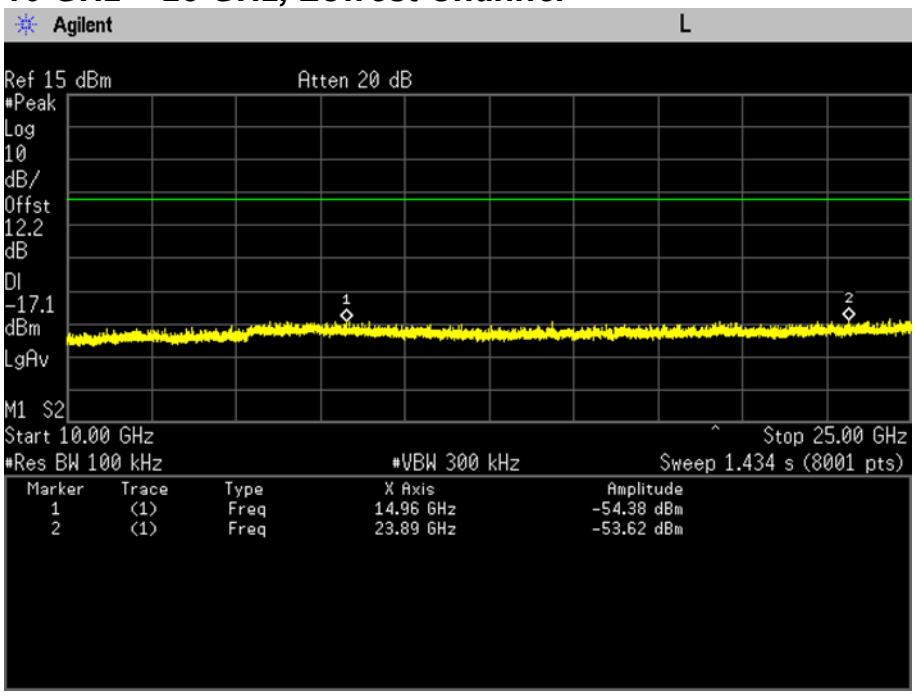
PLOT OF TEST DATA

802.11n mode

Conducted Spurious Emissions, 802.11n mode, 30 MHz ~ 10 GHz, Lowest Channel

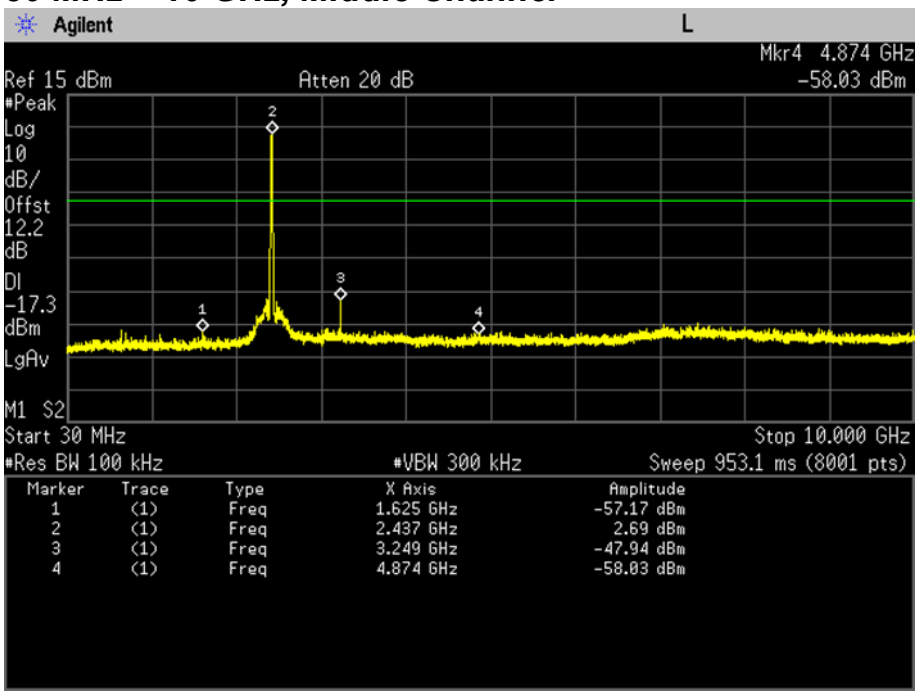


Conducted Spurious Emissions, 802.11n mode, 10 GHz ~ 25 GHz, Lowest Channel

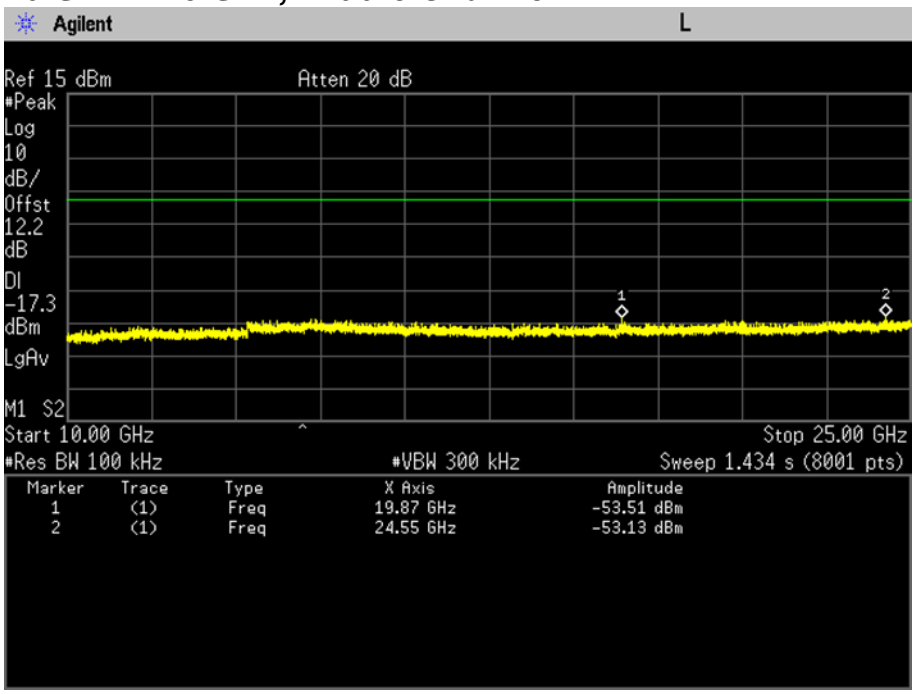


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11n mode, 30 MHz ~ 10 GHz, Middle Channel

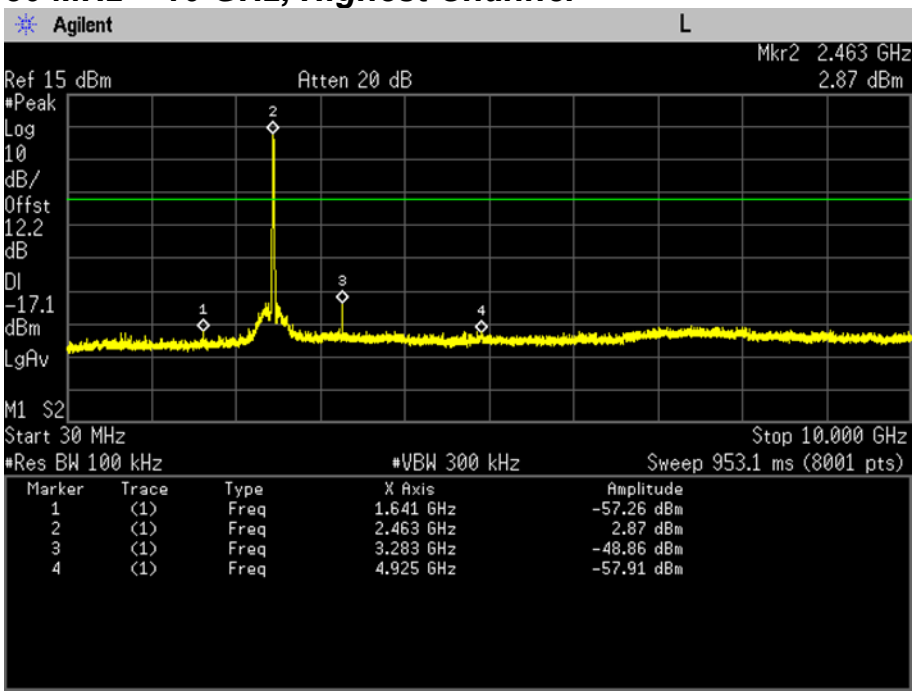


Conducted Spurious Emissions, 802.11n mode, 10 GHz ~ 25 GHz, Middle Channel

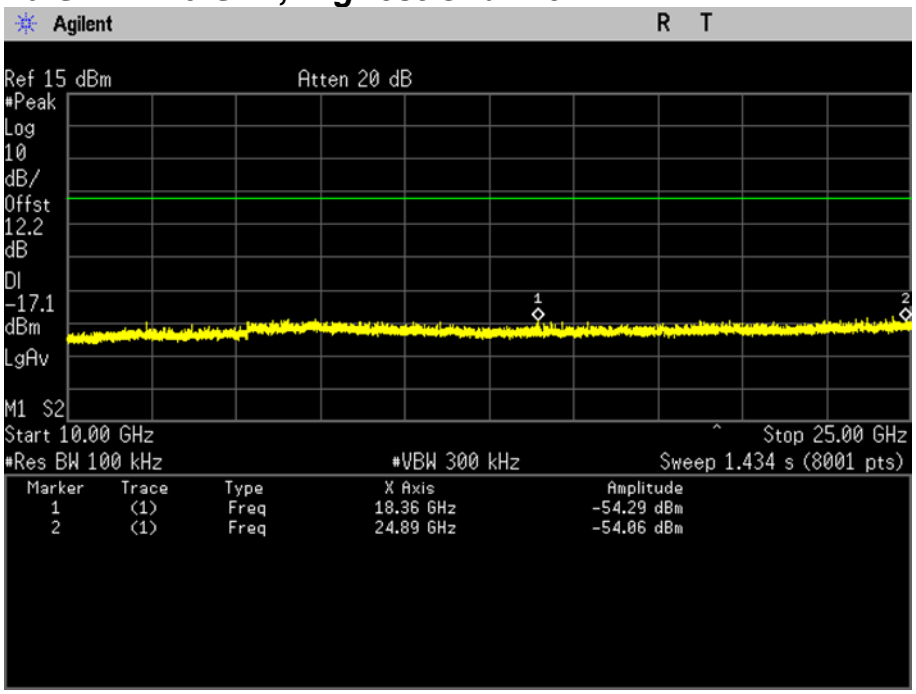


PLOT OF TEST DATA

Conducted Spurious Emissions, 802.11n mode, 30 MHz ~ 10 GHz, Highest Channel



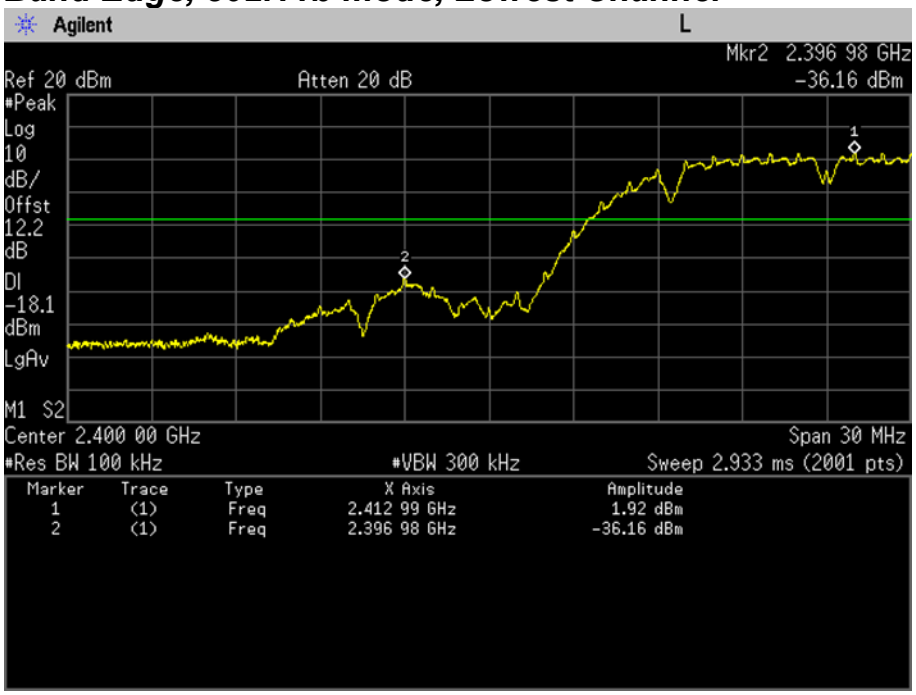
Conducted Spurious Emissions, 802.11n mode, 10 GHz ~ 25 GHz, Highest Channel



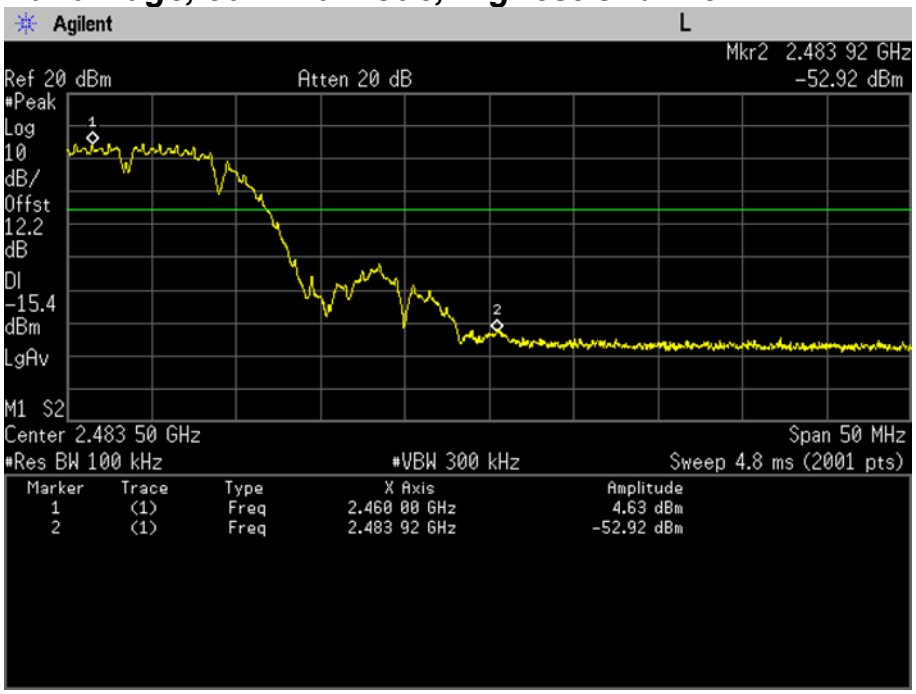
PLOT OF TEST DATA

802.11b mode

Band Edge, 802.11b mode, Lowest Channel



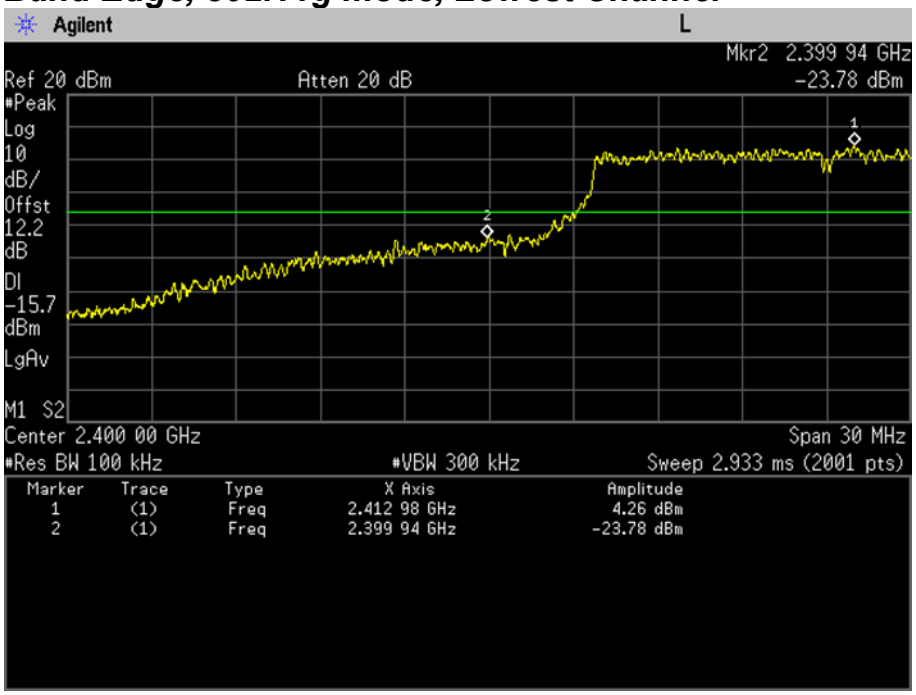
Band Edge, 802.11b mode, Highest Channel



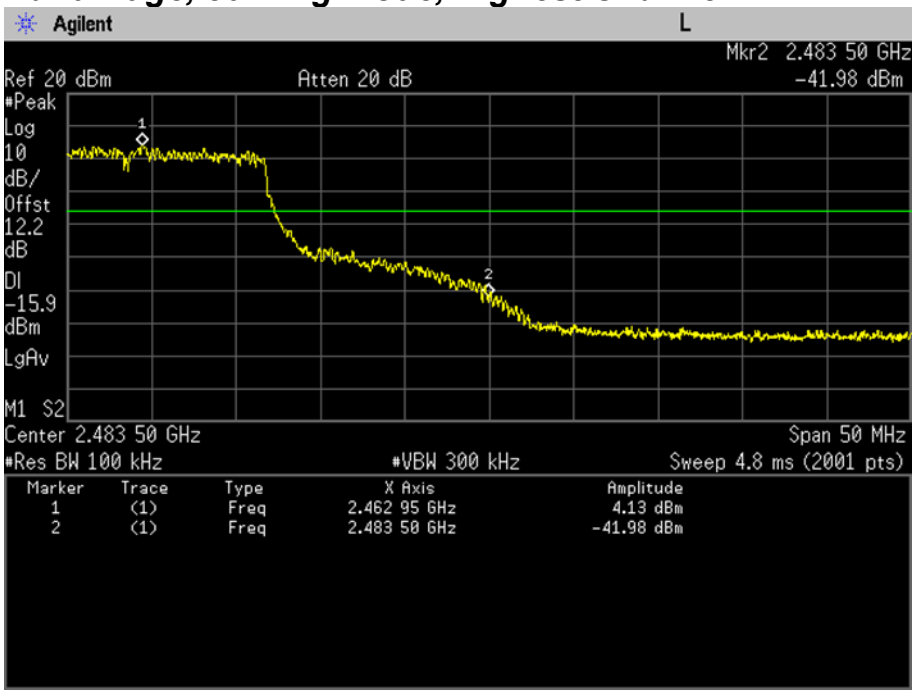
PLOT OF TEST DATA

802.11g mode

Band Edge, 802.11g mode, Lowest Channel



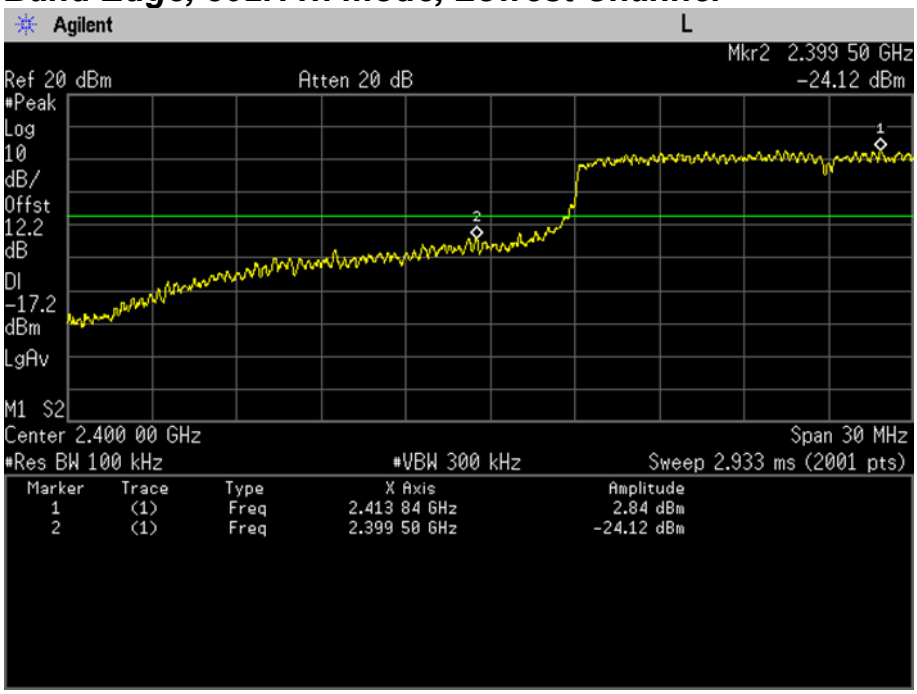
Band Edge, 802.11g mode, Highest Channel



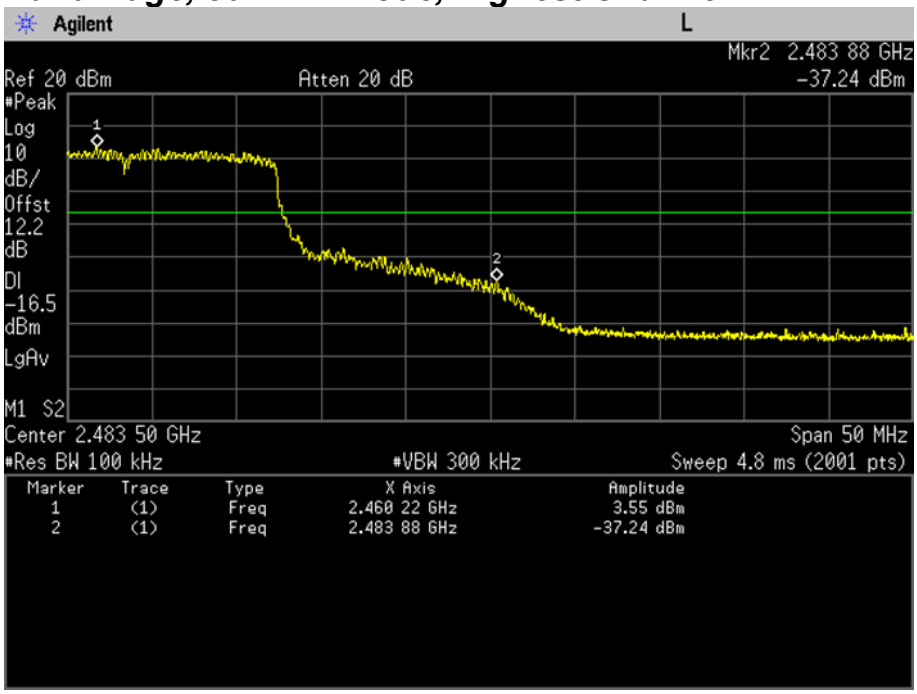
PLOT OF TEST DATA

802.11n mode

Band Edge, 802.11n mode, Lowest Channel



Band Edge, 802.11n mode, Highest Channel



TEST DATA

8.7 Radiated Spurious Emissions

FCC §15.247(d), RSS-210 A8.5

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

Result:

802.11b mode

Lowest Channel

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Detector	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1329.00	47.60	H	peak	-5.00	42.60	74.0	31.40
1329.00	37.30	H	average	-5.00	32.30	54.0	21.70
1440.50	47.40	H	peak	-4.70	42.70	74.0	31.30
1440.50	36.60	H	average	-4.70	31.90	54.0	22.10
1497.00	48.50	H	peak	-4.60	43.90	74.0	30.10
1497.00	37.50	H	average	-4.60	32.90	54.0	21.10
1595.50	46.60	V	peak	-4.30	42.30	74.0	31.70
1595.50	36.10	V	average	-4.30	31.80	54.0	22.20
1665.00	48.80	V	peak	-4.10	44.70	74.0	29.30
1665.00	36.70	V	average	-4.10	32.60	54.0	21.40
2248.00	49.90	V	peak	-2.40	47.50	74.0	26.50
2248.00	39.20	V	average	-2.40	36.80	54.0	17.20
4824.00	46.20	V	peak	9.30	55.50	74.0	18.50
4824.00	41.70	V	average	9.30	51.00	54.0	3.00

TEST DATA

Middle Channel

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Detector	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1080.00	47.70	H	peak	-5.80	41.90	74.0	32.10
1080.00	35.80	H	average	-5.80	30.00	54.0	24.00
1329.50	47.80	H	peak	-5.00	42.80	74.0	31.20
1329.50	37.00	H	average	-5.00	32.00	54.0	22.00
1497.50	48.30	H	peak	-4.60	43.70	74.0	30.30
1497.50	37.30	H	average	-4.60	32.70	54.0	21.30
2243.00	49.80	V	peak	-2.50	47.30	74.0	26.70
2243.00	38.20	V	average	-2.50	35.70	54.0	18.30
2279.50	49.10	V	peak	-2.40	46.70	74.0	27.30
2279.50	38.20	V	average	-2.40	35.80	54.0	18.20
2360.50	49.00	V	peak	-1.90	47.10	74.0	26.90
2360.50	39.50	V	average	-1.90	37.60	54.0	16.40
4874.00	42.80	V	peak	9.50	52.30	74.0	21.70
4874.00	40.20	V	average	9.50	49.70	54.0	4.30

TEST DATA

Highest Channel

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Detector	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1196.00	47.80	H	peak	-5.40	42.40	74.0	31.60
1196.00	36.30	H	average	-5.40	30.90	54.0	23.10
1328.50	48.10	H	peak	-5.00	43.10	74.0	30.90
1328.50	37.40	H	average	-5.00	32.40	54.0	21.60
1497.00	49.00	H	peak	-4.60	44.40	74.0	29.60
1497.00	37.80	H	average	-4.60	33.20	54.0	20.80
1575.50	49.70	H	peak	-4.40	45.30	74.0	28.70
1575.50	37.80	H	average	-4.40	33.40	54.0	20.60
2244.00	50.60	V	peak	-2.50	48.10	74.0	25.90
2244.00	38.80	V	average	-2.50	36.30	54.0	17.70
4924.00	42.10	V	peak	9.60	51.70	74.0	22.30
4924.00	36.40	V	average	9.60	46.00	54.0	8.00

802.11g mode

Lowest Channel

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Detector	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1499.50	48.20	H	peak	-4.60	43.60	74.0	30.40
1499.50	37.90	H	average	-4.60	33.30	54.0	20.70
1570.50	46.80	H	peak	-4.40	42.40	74.0	31.60
1570.50	37.30	H	average	-4.40	32.90	54.0	21.10
1586.50	49.70	H	peak	-4.30	45.40	74.0	28.60
1586.50	37.40	H	average	-4.30	33.10	54.0	20.90
1663.00	47.20	H	peak	-4.10	43.10	74.0	30.90
1663.00	36.40	H	average	-4.10	32.30	54.0	21.70
1703.50	47.50	V	peak	-4.10	43.40	74.0	30.60
1703.50	36.70	V	average	-4.10	32.60	54.0	21.40
4824.00	48.90	V	peak	9.30	58.20	74.0	15.80
4824.00	36.60	V	average	9.30	45.90	54.0	8.10

TEST DATA

Middle Channel

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Detector	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1328.50	47.30	H	peak	-5.00	42.30	74.0	31.70
1328.50	37.10	H	average	-5.00	32.10	54.0	21.90
1464.00	47.20	H	peak	-4.60	42.60	74.0	31.40
1464.00	36.20	H	average	-4.60	31.60	54.0	22.40
1496.50	49.10	V	peak	-4.60	44.50	74.0	29.50
1496.50	37.90	V	average	-4.60	33.30	54.0	20.70
1596.00	46.50	V	peak	-4.30	42.20	74.0	31.80
1596.00	36.00	V	average	-4.30	31.70	54.0	22.30
1662.00	49.00	V	peak	-4.10	44.90	74.0	29.10
1662.00	36.50	V	average	-4.10	32.40	54.0	21.60
4874.00	46.60	V	peak	9.50	56.10	74.0	17.90
4874.00	32.10	V	average	9.50	41.60	54.0	12.40

TEST DATA

Highest Channel

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Detector	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1328.50	47.60	H	peak	-5.00	42.60	74.0	31.40
1328.50	37.30	H	average	-5.00	32.30	54.0	21.70
1440.50	48.60	H	peak	-4.70	43.90	74.0	30.10
1440.50	36.60	H	average	-4.70	31.90	54.0	22.10
1498.00	48.90	H	peak	-4.60	44.30	74.0	29.70
1498.00	37.90	H	average	-4.60	33.30	54.0	20.70
1595.00	46.80	V	peak	-4.30	42.50	74.0	31.50
1595.00	36.30	V	average	-4.30	32.00	54.0	22.00
1661.00	48.90	V	peak	-4.10	44.80	74.0	29.20
1661.00	36.40	V	average	-4.10	32.30	54.0	21.70
2244.50	49.00	V	peak	-2.40	46.60	74.0	27.40
2244.50	38.30	V	average	-2.40	35.90	54.0	18.10
4924.00	41.10	V	peak	9.60	50.70	74.0	23.30
4924.00	29.50	V	average	9.60	39.10	54.0	14.90

802.11n mode

Lowest Channel

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Detector	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1328.00	47.90	H	peak	-5.00	42.90	74.0	31.10
1328.00	37.70	H	average	-5.00	32.70	54.0	21.30
1495.00	48.10	H	peak	-4.60	43.50	74.0	30.50
1495.00	37.40	H	average	-4.60	32.80	54.0	21.20
1596.00	47.10	V	peak	-4.30	42.80	74.0	31.20
1596.00	36.20	V	average	-4.30	31.90	54.0	22.10
1661.50	48.60	V	peak	-4.10	44.50	74.0	29.50
1661.50	36.50	V	average	-4.10	32.40	54.0	21.60
1709.50	46.00	H	peak	-4.10	41.90	74.0	32.10
1709.50	36.30	H	average	-4.10	32.20	54.0	21.80
4824.00	44.00	V	peak	9.30	53.30	74.0	20.70
4824.00	33.30	V	average	9.30	42.60	54.0	11.40

TEST DATA

Middle Channel

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Detector	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1079.50	47.70	H	peak	-5.80	41.90	74.0	32.10
1079.50	36.00	H	average	-5.80	30.20	54.0	23.80
1198.50	46.20	H	peak	-5.40	40.80	74.0	33.20
1198.50	36.20	H	average	-5.40	30.80	54.0	23.20
1330.50	47.90	H	peak	-5.00	42.90	74.0	31.10
1330.50	37.40	H	average	-5.00	32.40	54.0	21.60
1497.00	48.70	H	peak	-4.60	44.10	74.0	29.90
1497.00	37.50	H	average	-4.60	32.90	54.0	21.10
1594.00	46.80	V	peak	-4.30	42.50	74.0	31.50
1594.00	36.10	V	average	-4.30	31.80	54.0	22.20
1661.50	48.40	V	peak	-4.10	44.30	74.0	29.70
1661.50	36.40	V	average	-4.10	32.30	54.0	21.70
4874.00	42.20	V	peak	9.50	51.70	74.0	22.30
4874.00	30.80	V	average	9.50	40.30	54.0	13.70

TEST DATA

Highest Channel

Frequency (MHz)	Reading (dBµV/m)	Pol* (H/V)	Detector	AF+CL+Amp (dB)**	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1329.50	47.90	H	peak	-5.00	42.90	74.0	31.10
1329.50	37.40	H	average	-5.00	32.40	54.0	21.60
1496.00	48.00	H	peak	-4.60	43.40	74.0	30.60
1496.00	37.50	H	average	-4.60	32.90	54.0	21.10
1596.00	46.90	V	peak	-4.30	42.60	74.0	31.40
1593.00	36.20	V	average	-4.30	31.90	54.0	22.10
1662.50	47.90	V	peak	-4.10	43.80	74.0	30.20
1662.50	36.20	V	average	-4.10	32.10	54.0	21.90
2242.50	48.30	V	peak	-2.50	45.80	74.0	28.20
2242.50	37.70	V	average	-2.50	35.20	54.0	18.80
4924.00	39.10	V	peak	9.60	48.70	74.0	25.30
4924.00	29.00	V	average	9.60	38.60	54.0	15.40

Note:

1. *Pol. H = Horizontal V = Vertical

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

3. Other spurious are 20 dB below than Fundamental.

4. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization.
The worst date was recorded.

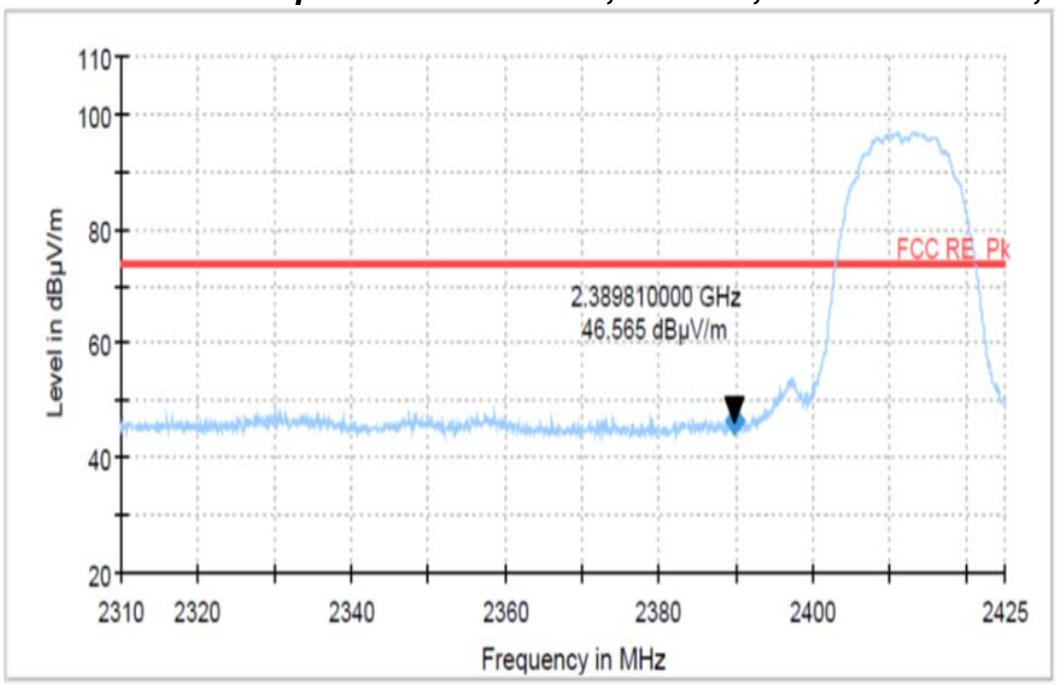
5. For measurements the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

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 4th harmonic for this device.

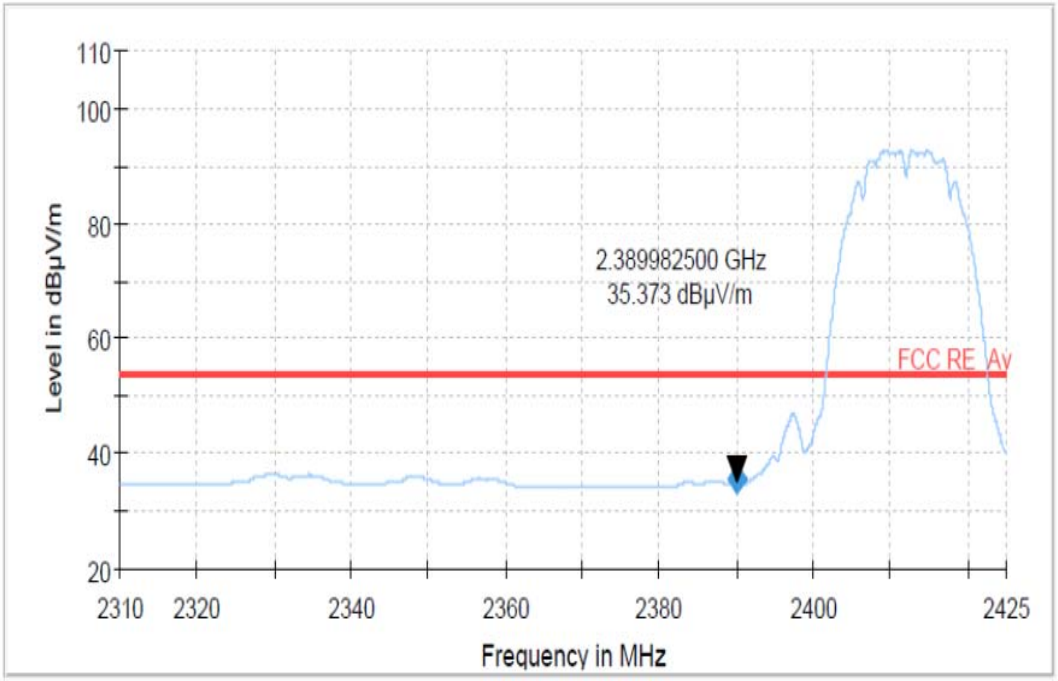
PLOT OF TEST DATA

802.11b mode

Restricted Band Spurious Emissions, 802.11b, Lowest channel, Peak

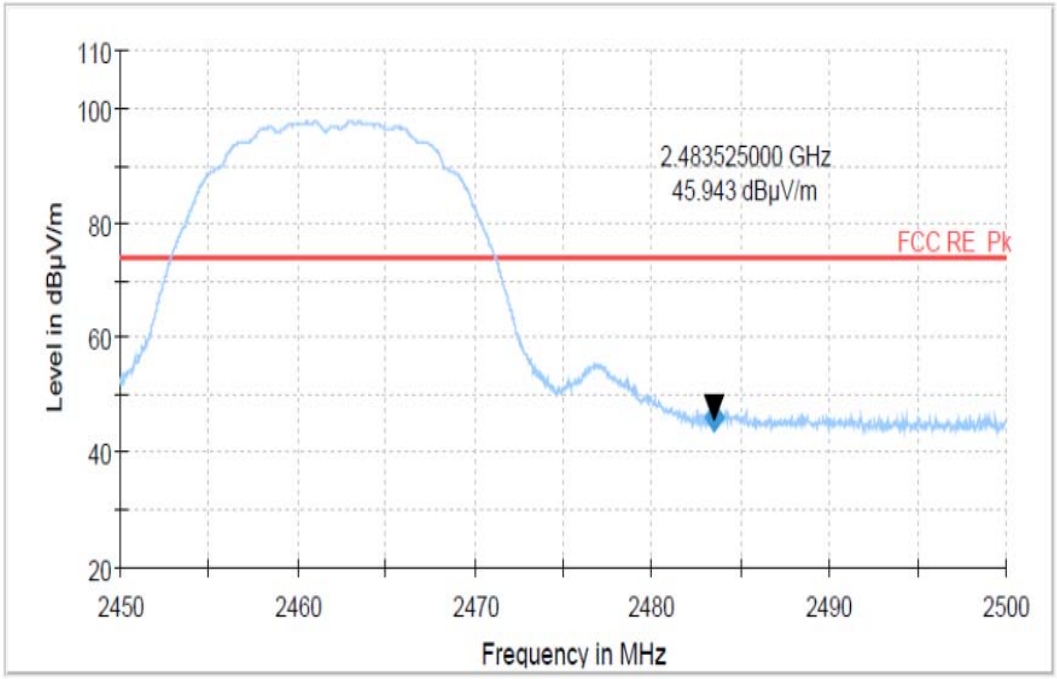


Restricted Band Spurious Emissions, 802.11b, Lowest channel, Average

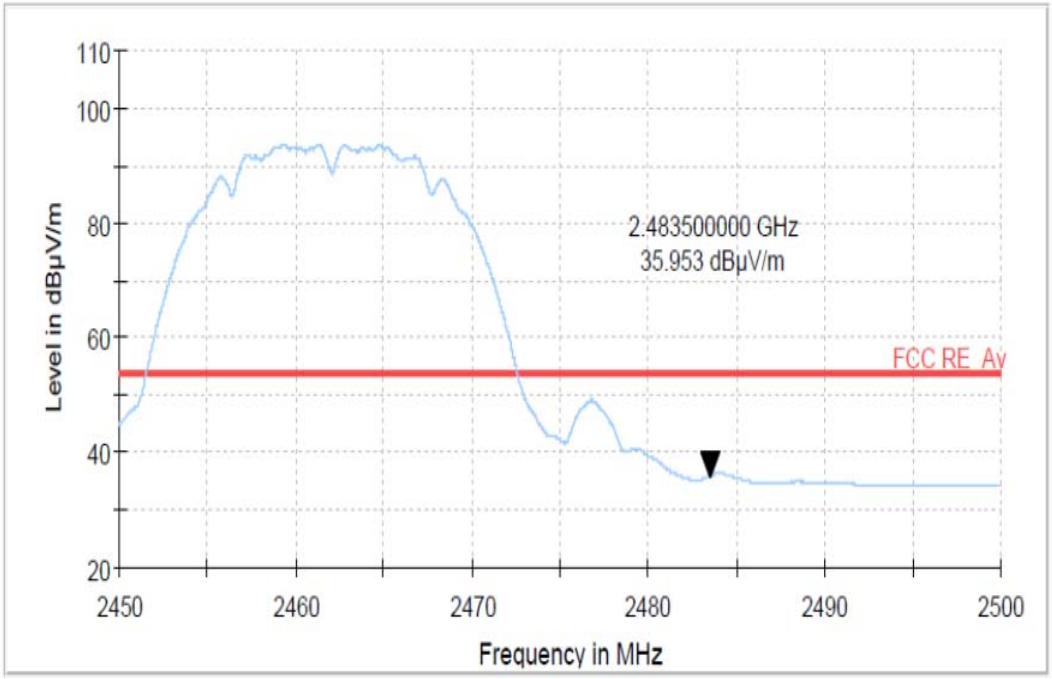


PLOT OF TEST DATA

Restricted Band Spurious Emissions, 802.11b, Highest channel, Peak



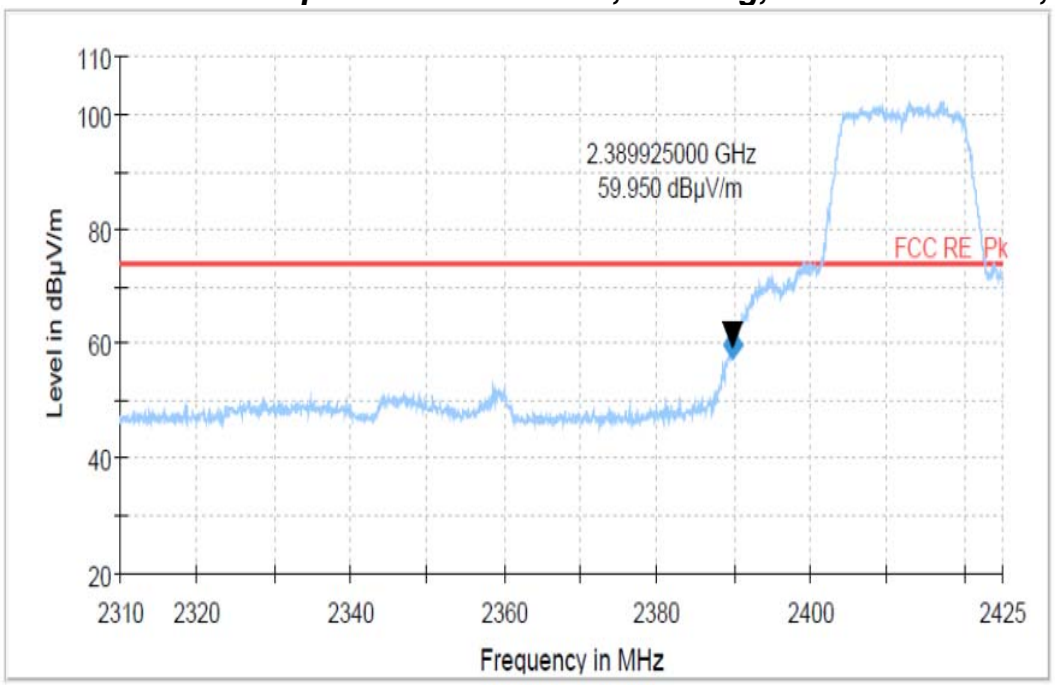
Restricted Band Spurious Emissions, 802.11b, Highest channel, Average



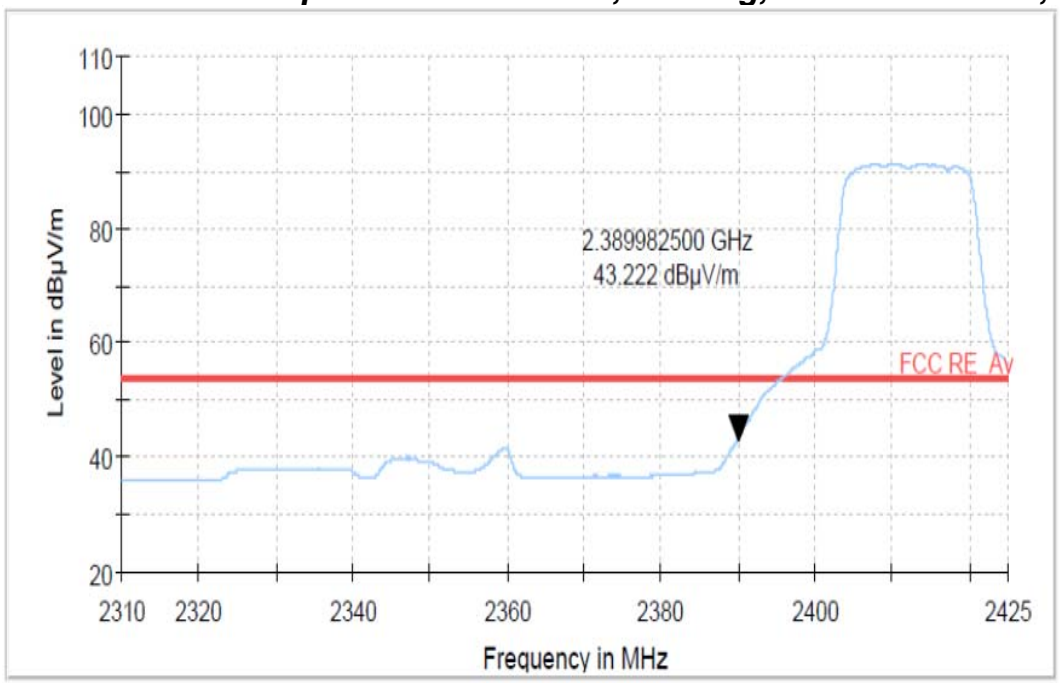
PLOT OF TEST DATA

802.11g mode

Restricted Band Spurious Emissions, 802.11g, Lowest channel, Peak

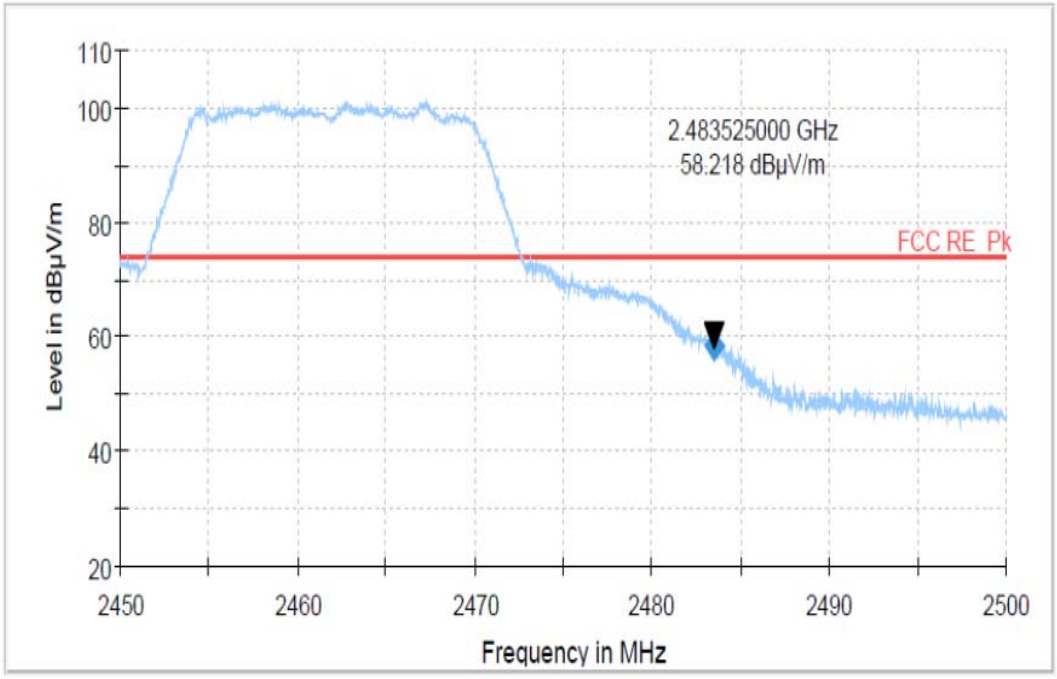


Restricted Band Spurious Emissions, 802.11g, Lowest channel, Average

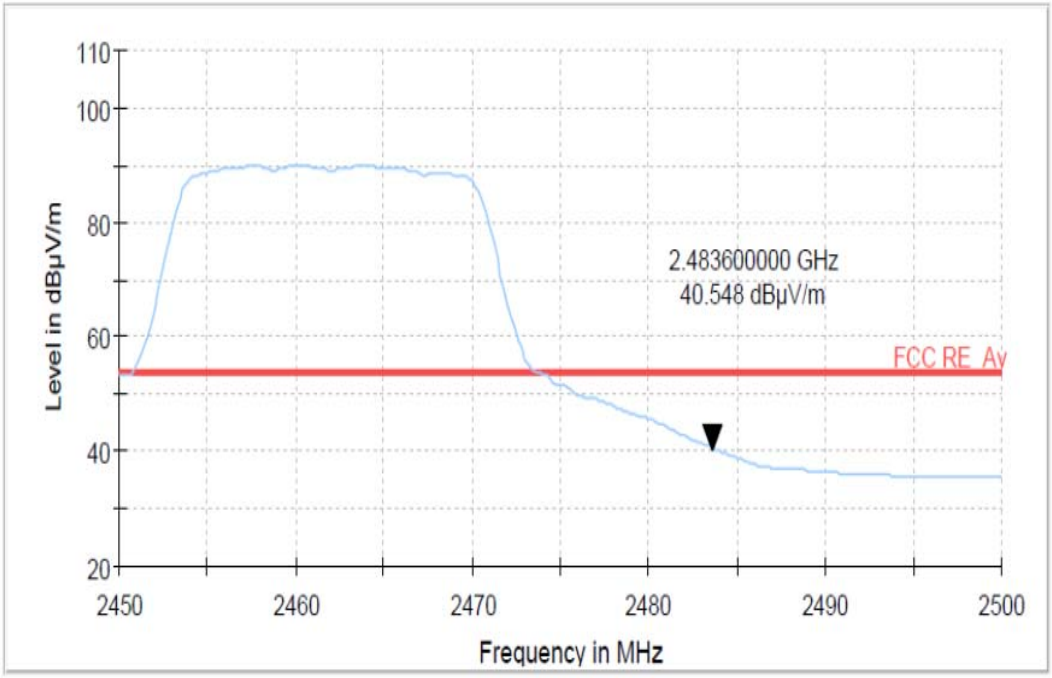


PLOT OF TEST DATA

Restricted Band Spurious Emissions, 802.11g, Highest channel, Peak



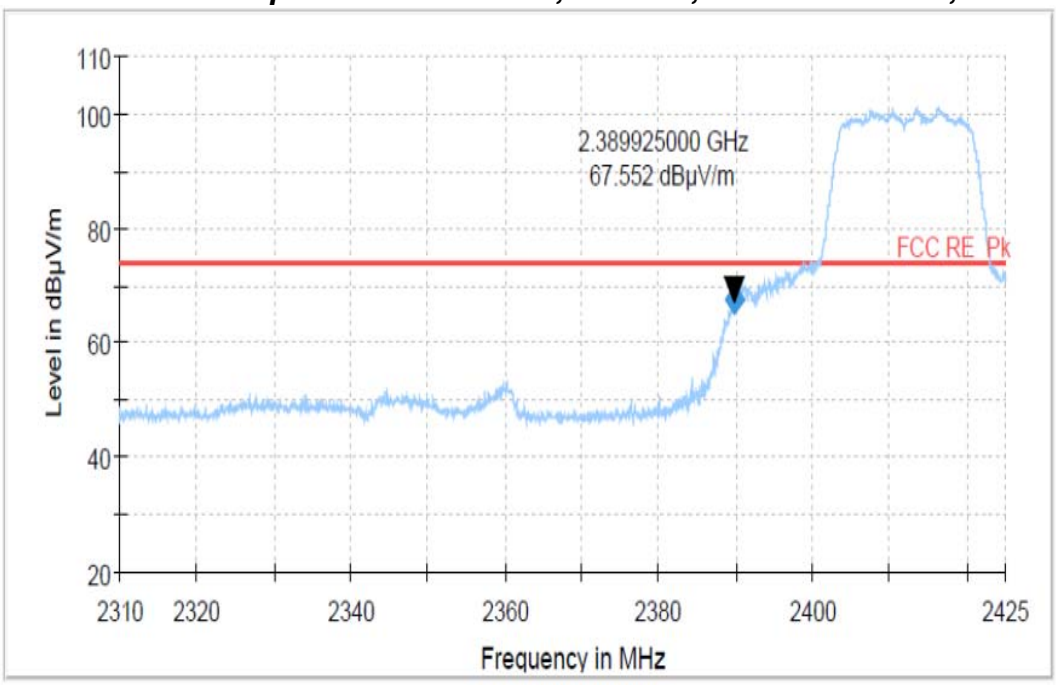
Restricted Band Spurious Emissions, 802.11g, Highest channel, Average



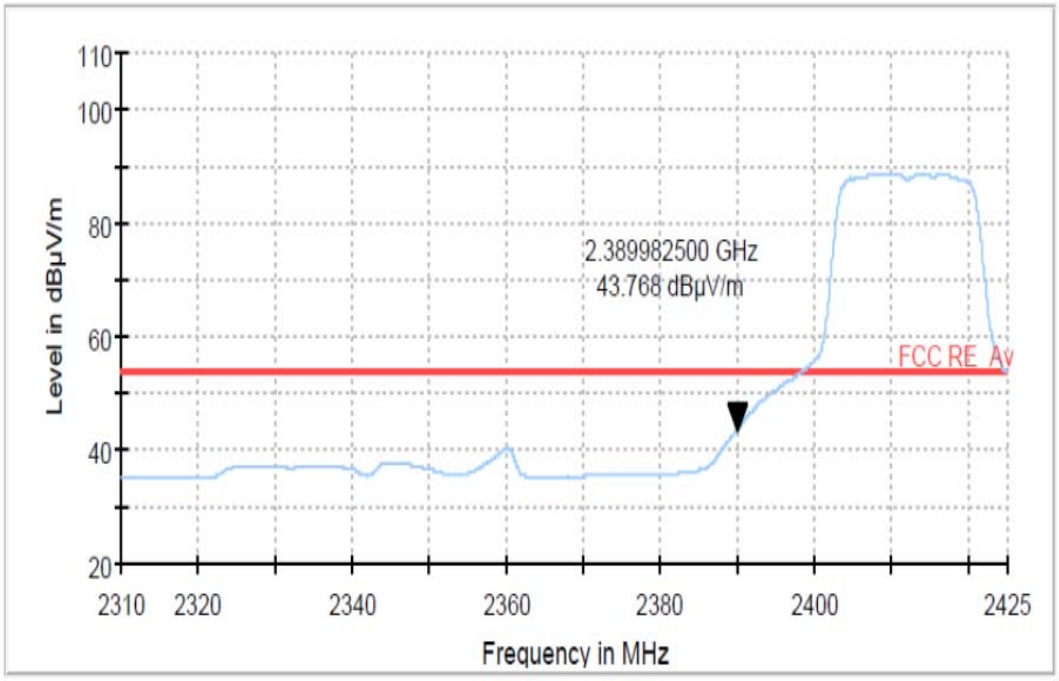
PLOT OF TEST DATA

802.11n mode

Restricted Band Spurious Emissions, 802.11n, Lowest channel, Peak

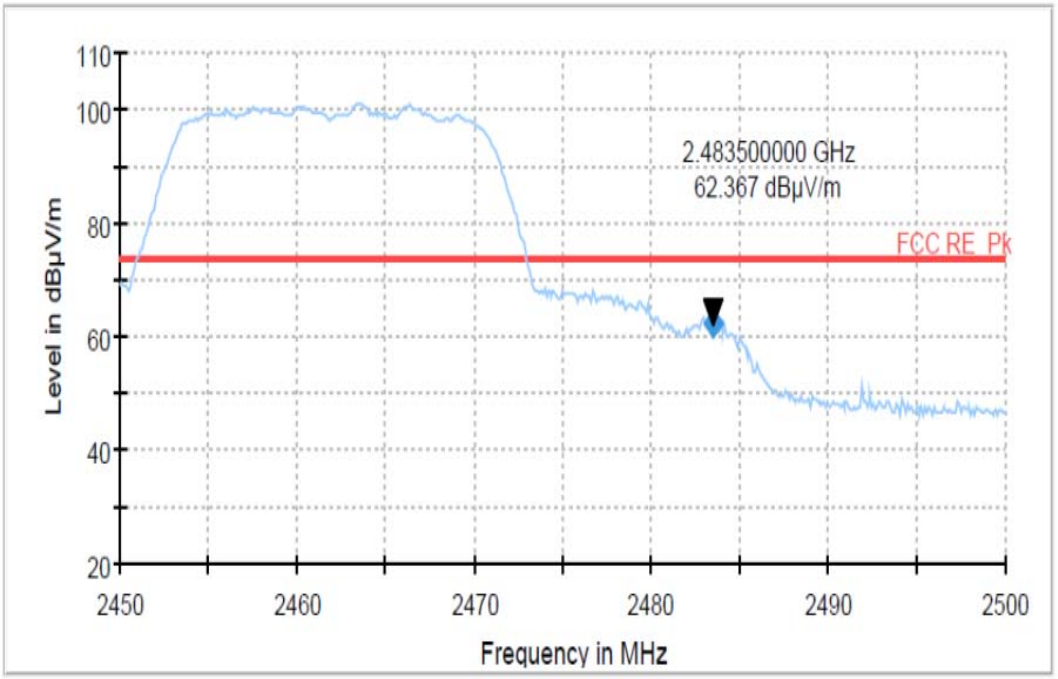


Restricted Band Spurious Emissions, 802.11n, Lowest channel, Average

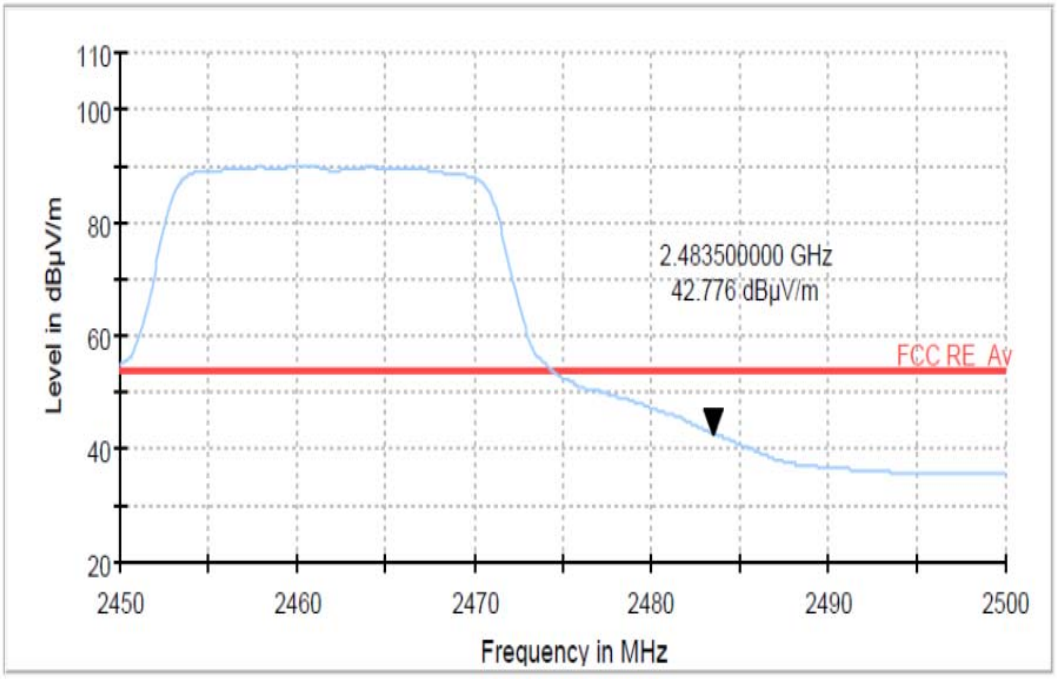


PLOT OF TEST DATA

Restricted Band Spurious Emissions, 802.11n, Highest channel, Peak



Restricted Band Spurious Emissions, 802.11n, Highest channel, Average



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

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	R & S	SCU01	10029	Apr. 06 2011	1 year
4	*Amplifier	Sonoma Instrument	310N	291916	Jul. 19 2011	1 year
5	*Amplifier	R & S	SCU-26	10011	Jun. 01 2011	1 year
6	*Pre Amplifier	HP	8449B	3008A00107	Jan. 13 2012	1 year
7	*Pre Amplifier	HP	8447F	2805A03351	Oct. 06 2011	1 year
8	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Jul. 19 2011	1 year
9	*Spectrum Analyzer	Agilent	E4440A	MY44022567	Apr. 05 2011	1 year
10	*Spectrum Analyzer	R & S	FSP40	100361	Jul. 19 2011	1 year
11	*Loop Antenna	R & S	HFH2-Z2	100279	Aug. 31 2011	2 year
12	*Wideband Power Sensor	R & S	NRP-Z81	100634	May. 03 2011	1 year
13	*Biconical Log Antenna	ARA	LPB-2520/A	1180	Apr. 14 2010	2 year
14	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-508	Dec. 24 2010	2 year
15	*Horn Antenna	Q-par Angus	QSH20S20	8179	Apr. 12 2010	2 year
16	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-257	Apr. 14 2010	2 year
17	Logbicon Antenna	SCHWARZBECK	VULB9166	1067	Jul. 14 2010	2 year
18	*LISN	R & S	ESH3-Z5	833874/006	Oct. 12 2011	1 year
19	LISN	R & S	ESH2-Z5	100227	Apr. 06 2011	1 year
20	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
21	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
22	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
23	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
24	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
25	*Position Controller	Seo-Young EMC	N/A	N/A	N/A	N/A
26	*Turn Table	Seo-Young EMC	N/A	N/A	N/A	N/A
27	*Antenna Mast	Seo-Young EMC	N/A	N/A	N/A	N/A
28	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
29	*Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A

***) Test equipment used during the test**