



Test Report No.: NK-13-R-083-1

FCC Certification

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 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. Jaywoo. Lee

Dates of Issue : June 13, 2013
Test Report No. : NK-13-R-083-1
Test Site : Nemko Korea Co., Ltd.

FCC ID

A3LHR44

Brand Name

SAMSUNG

Contact Person

Samsung Electronics Co., Ltd.
129, Samsung-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, Korea, 443-742.
Mr. Jaywoo. Lee
Telephone No. : +82-31-277-2569

Applied Standard: FCC 47 CFR Part 15.247
Classification: Digital modulation Transmitter
EUT Type: Set-top box

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, ANSI C63.10-2009. 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.


Jun. 13, 2013
Tested By : Jin-ha Ko
Engineer

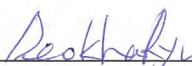

Jun. 13, 2013
Reviewed By : Deokha Ryu
Technical Manager

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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 15.247.

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

- FCC ID: A3LHR44
- Model: HR44-200
- Brand Name: SAMSUNG
- EUT Type: Set-top box
- Ports: Satellite antenna in x 1, Component video out x 1
Audio out L/R x 1, Coaxial out x 1, Optical x 1,
HDMI x 1, Ethernet x 1, USB x 2, eSATA x 1,
RJ-11 x 1, d.c. power in x 1
- Classification: Digital modulation Transmitter
- Applied Standard: FCC 47 CFR Part 15.247
- Test Procedure(s): ANSI C63.4-2003, ANSI C63.10 and FCC guidance of
558074 D01 v03r01
- Dates of Test: March 30, 2013 ~ Jun 9, 2013
- 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), the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2009) was used in determining radiated and conducted emissions emanating from **Samsung Electronics Co., Ltd. FCC ID : A3LHR44**.

These measurement tests were conducted at **Nemko Korea Co., Ltd. EMC Laboratory**.

The site address 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.



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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
	FCC part 15/18 Filing site	Registration No. 97992
	CAB Accreditation for DOC	Designation No. KR0026
	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)	Registration No. 155
	Canada IC Registered site	Site No. 2040E
	VCCI registration site(RE/CE/Telecom CE)	Member No. 2118
	EMC CBTL	-
	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 contains a MIMO transceiver which is support 802.11a/b/g/n mode (2TX/2RX). The EUT was connected to laptop PC and then a test program was executed to operate EUT continuously. After the setting of the EUT, the laptop PC was removed from test area.

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. During the test, the EUT was operating with a duty cycle 100 %.

The EUT was programmed with the following output power setting that was used during testing:

2.4 GHz:

Test frequency		2412 MHz	2442 MHz	2472 MHz
802.11b	Power Level	18	18	18
802.11g	Power Level	12	18	14
802.11n	Power Level	12	18	12

5 GHz:

Test frequency		5745 MHz	5785 MHz	5825 MHz
802.11a	Power Level	14	18	14
802.11n	Power Level	14	18	14

3.1.1 Table of test modes for 2.4 GHz band:

Test Items	Mode	Data rate	Test Channel (CH)
Conducted Emissions	802.11n	MCS0	6
Radiated Emissions	802.11n	MCS0	6
6 dB Bandwidth	802.11b	1 Mbps	1/6/11
	802.11g	6 Mbps	1/6/11
	802.11n	MCS0	1/6/11
Maximum Conducted Power Output	802.11b	1 Mbps ~ 11 Mbps	1/6/11
	802.11g	6 Mbps ~ 54 Mbps	1/6/11
	802.11n	MCS0 ~ MCS15	1/6/11
Power Spectral Density	802.11b	1 Mbps	1/6/11
	802.11g	6 Mbps	1/6/11
	802.11n	MCS0	1/6/11
Conducted Spurious Emission	802.11b	1 Mbps	1/6/11
	802.11g	6 Mbps	1/6/11
	802.11n	MCS0	1/6/11
Radiated Spurious Emission, Band edge Emission	802.11b	1 Mbps	1/6/11
	802.11g	6 Mbps	1/6/11
	802.11n	MCS0	1/6/11

3.1.2 Table of test modes for 5 GHz band:

Test Items	Mode	Data rate	Test Channel (CH)
Conducted Emissions	802.11n	MCS0	157
Radiated Emissions	802.11n	MCS0	157
6 dB Bandwidth	802.11a	6 Mbps	149/157/165
	802.11n	MCS0	149/157/165
Maximum Conducted Power Output	802.11a	6 Mbps ~ 54 Mbps	149/157/165
	802.11n	MCS0 ~ MCS15	149/157/165
Power Spectral Density	802.11a	6 Mbps	149/157/165
	802.11n	MCS0	149/157/165
Conducted Spurious Emission	802.11a	6 Mbps	149/157/165
	802.11n	MCS0	149/157/165
Radiated Spurious Emission, Band edge Emission	802.11a	6 Mbps	149/157/165
	802.11n	MCS0	149/157/165

3.1.3 Antenna information:

Frequency band	Mode	Antenna TX mode	Support MIMO
2.4 GHz	802.11b	☐ 1TX, ☒ 2TX	☒ Yes, ☐ No
	802.11g	☐ 1TX, ☒ 2TX	☒ Yes, ☐ No
	802.11n	☐ 1TX, ☒ 2TX	☒ Yes, ☐ No
5 GHz	802.11a	☐ 1TX, ☒ 2TX	☒ Yes, ☐ No
	802.11n	☐ 1TX, ☒ 2TX	☒ Yes, ☐ No

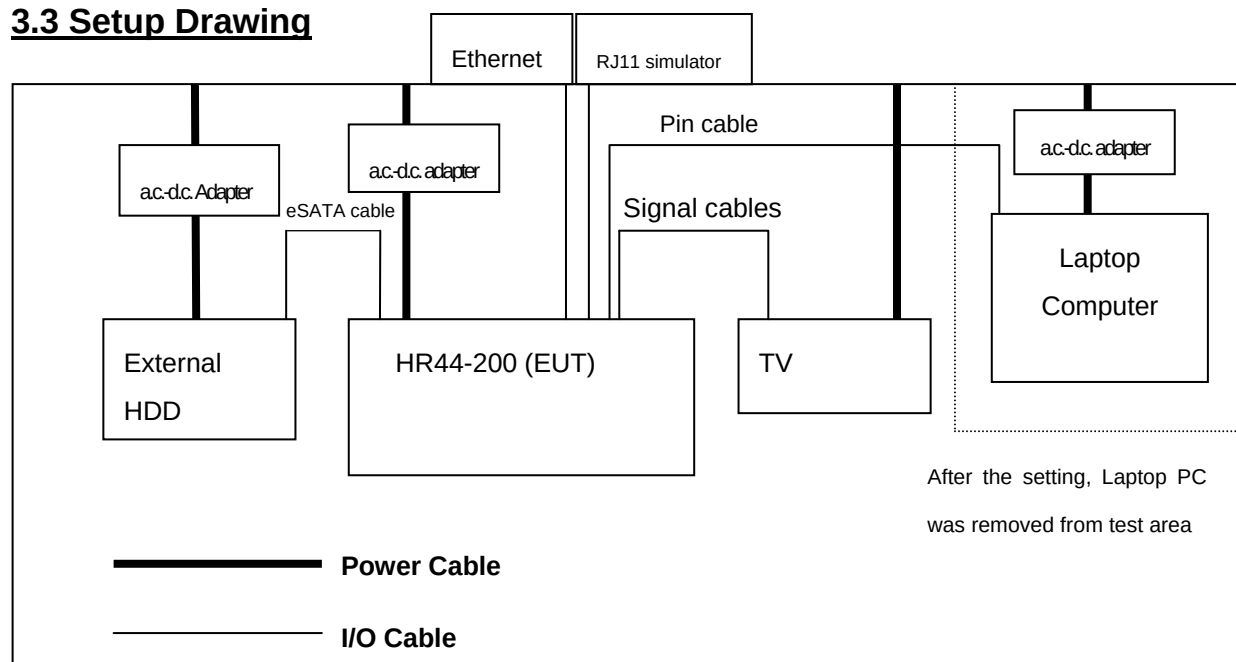
Note(s) :

The EUT support both chains transmit and receive simultaneously for 802.11a/b/g/n mode.
It does not support SISO mode.

3.2 Support Equipment

EUT	Samsung Electronics Co., Ltd. Model: HR44-200 FCC ID: A3LHR44 1.2 m Unshielded RJ-11 cable 1.5 m Unshielded Ethernet cable 1.2 m Shielded Coaxial cable 1.2 m Shielded Composite video cable	S/N: C33BB3BF300005
a.c.-d.c. Adapter	LiteOn Technology Corp. Model: EPS44R0-08	S/N: LA13A124301112
TV	Samsung Electronics Co., Ltd. Model: EL23KO 1.2 m Shielded Component video cable 1.2 m Shielded Audio cable 1.5 m Shielded HDMI cable 1.2 m Unshielded power cable	S/N: ZPXNH1KB20448V
External HDD	HGST Singapore, Pte, Ltd. Model:0G00199 1.0 m Shielded eSATA cable	S/N: YHH8JD5A
a.c.-d.c. Adapter	Asian Power Devices Inc. Model: WA-24E12FU 1.5 m Unshielded power cable	S/N: Y538311921001700900
Laptop Computer	Samsung Electronics Co., Ltd. Model : NT-R55 1.0 m unshielded pin connector cable	FCC DOC S/N : 408L93AP400115W
a.c.-d.c. Adapter	Chicony Power Technology Co., Ltd. Model : AD-9019S 1.5 m unshielded power cable	FCC DOC S/N : CNBA4400215ADON81BT01V8

3.3 Setup Drawing



3.4 EUT Information

The EUT is the **Samsung Set-top box FCC ID: A3LHR44**.

Specifications:

Category	Set-top box
Model Name	HR44-200
Brand Name	SAMSUNG
Frequency of Operation	<u>For 2.4 GHz Band</u> 802.11b,g,n: 2412 MHz ~ 2462 MHz <u>For 5 GHz Band</u> 802.11a,n : 5745 MHz ~ 5825 MHz
Power Output (Conducted)	<u>For 2.4 GHz Band</u> 802.11b : 20.00 dBm 802.11g : 20.12 dBm 802.11n : 20.02 dBm <u>For 5 GHz Band</u> 802.11a : 19.44 dBm 802.11n : 19.32 dBm
Channels	<u>For 2.4 GHz Band</u> 802.11b,g,n: 11 CH <u>For 5 GHz Band</u> 802.11a,n : 5 CH
Antenna Gain (peak)	<u>For 2.4 GHz Band</u> Ant 0 : 2.85 dBi, Ant1 : 2.82 dBi <u>For 5 GHz Band</u> Ant 0 : 4.42 dBi, Ant1 : 3.50 dBi
Antenna Setup	2TX / 2RX
Modulations	DSSS(BPSK,QPSK,CCK) for 802.11b OFDM(BPSK,QPSK,16QAM,64QAM) for 802.11a,g,n
Temperature Range	-20 °C ~ +60 °C
Voltage	120 Vac, 60 Hz
Dimensions (W x D x H)	333 mm x 246 mm x 46 mm
Weight	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	
Maximum Conducted 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 Set-top box FCC ID: A3LHR44** is in compliance with Part 15.247 of the FCC Rule.

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 Set-top box FCC ID: A3LHR44** 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 (ESH2-Z5) of the 50 ohm/50 μ H 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 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; whichever determined the worst case emission.

Each EME reported was calibrated using the R&S signal generator.

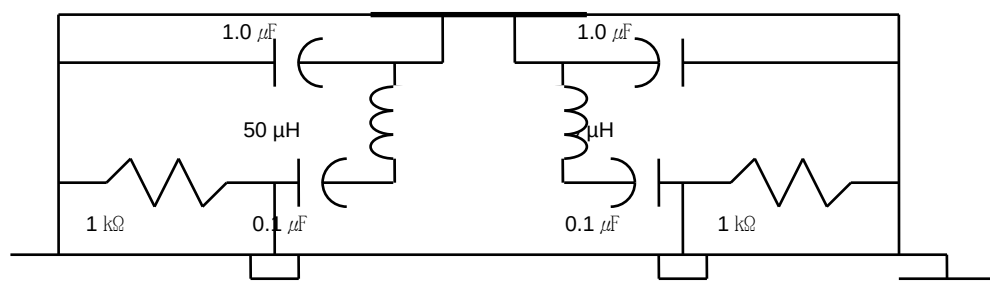


Fig. 2. LISN Schematic Diagram

7.2 Radiated Emissions

The measurement was performed at the test site that is specified in accordance with ANSI C63.4-2003 and ANCI C63.10-2009.

The spurious emission was scanned from 9 kHz to 30 MHz using Loop Antenna(Rohde&Schwarz, HFH2-Z2) and 30 to 1000 MHz using Trilog broadband test antenna(Schwarzbeck, VULB 9168). Above 1 GHz, Horn antenna (Schwarzbeck 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 turntable with 0.8 m above ground. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The EUT, cable, wire arrangement and mode of operation that has the highest amplitude relative to the limit was selected. Then, the turn table was rotated from 0° to 360° and an antenna mast was moved from 1 m to 4 m height to maximize the suspected highest amplitude signal. The final maximized level was recorded.

At frequencies below 1000 MHz, measurements performed using the CISPR quasi-peak detection.

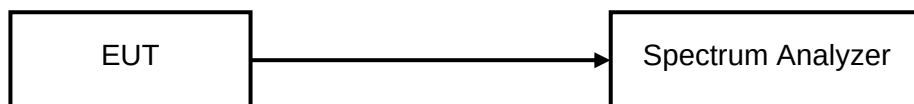
At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in KDB “558074D01 DTS Meas Guidance v03r01” in section 12.2.4 and 12.2.5.1. Peak emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Trace mode = max hold. Average emission levels were measured by setting the analyzer RBW = 1 MHz, VBW = 3 MHz, Detector = RMS, Trace averaging in power averaging (RMS) mode over a minimum of 100 traces, when the EUT was configured to transmit with duty cycle ≥ 98 percent.

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

Radiated Emissions Limits per 47 CFR 15.209(a)

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 = 100 kHz

VBW $\geq 3 \times$ RBW

Detector = Peak

Trace mode = max hold

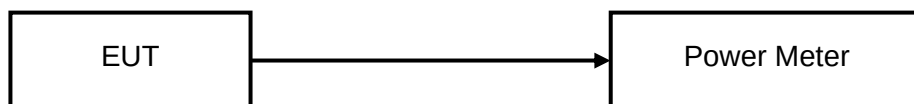
Sweep = auto couple

Allow the trace to stabilize

The bandwidth measurement function on the spectrum analyzer is used to measure the 6 dB bandwidth.

7.4 Maximum Conducted Output Power

Test Setup

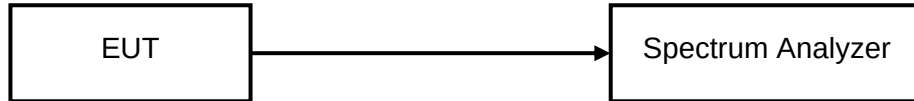


Test Procedure

EUTs Maximum Conducted Output Power is measured at low, middle, high channels with a wideband RF power meter connected to the antenna terminal while the EUTs operating at its maximum power control level.

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.

Center frequency = DTS channel center frequency

Span = 1.5 times the DTS bandwidth

RBW : 3 kHz $\leq$ RBW $\leq$ 100 kHz

VBW $\geq$ 3 x RBW

Detector = peak

Sweep time = auto couple

Trace mode = max hold

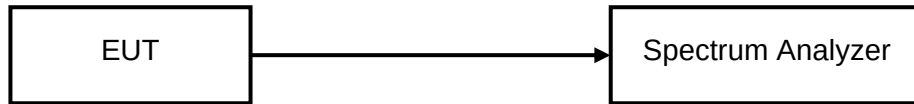
Allow trace to fully stabilize.

The peak marker function on the spectrum analyzer is used to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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

Center frequency = DTS channel center frequency

Span $\geq$ 1.5 times the DTS bandwidth

RBW = 100 kHz

VBW $\geq$ 3 x RBW

Detector = peak

Sweep time = auto couple

Trace mode = max hold

Allow trace to fully stabilize.

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

2) Unwanted Emissions

Set the center frequency and span to encompass frequency range to be measured.

RBW = 100 kHz

VBW $\geq$ 3 x RBW

Detector = peak

Ensure that the number of measurement points $\geq$ span/RBW

Sweep time = auto couple

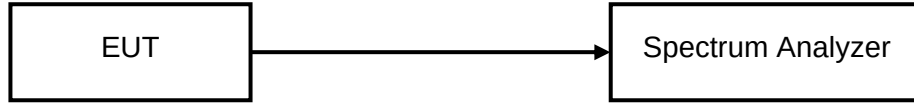
Trace mode = max hold

Allow trace to fully stabilize.

The peak marker function on the spectrum analyzer is used to determine the maximum amplitude level of all unwanted emissions outside of the authorized frequency band. The unwanted emissions are attenuated by at least the minimum requirements specified.

7.7 Duty Cycle

Test Setup



Test Procedure

EUTs duty cycle are measured at middle channel 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.

Center frequency = Center frequency of the transmission

Span = zero

RBW = 8 MHz

VBW = 8 MHz

Detector = peak

Sweep time = 10 ms

Trace mode = view

The marker function on the spectrum analyzer is used to determine the duty cycle.

Following the result of the duty cycle measurement according to the above test procedure, the duty cycles of 802.11b/g/n mode were 100 %.

8. TEST DATA

8.1 Conducted Emissions

FCC §15.207

2.4 GHz band

Frequency (MHz)	* Level(dB μ V)		** Line	Limit(dB μ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.16	48.9	37.7	N	65.5	55.5	16.6	17.8
0.18	42.8	27.4	N	64.5	54.5	21.7	27.1
0.32	44.4	38.2	N	59.7	49.7	15.3	11.5
0.36	38.8	31.7	L	58.7	48.7	19.9	17.0
3.77	32.3	25.1	N	56.0	46.0	23.7	20.9
29.90	31.5	28.8	L	60.0	50.0	28.5	21.2

Line Conducted Emissions Tabulated Data

5 GHz band

Frequency (MHz)	* Level(dB μ V)		** Line	Limit(dB μ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	50.6	43.1	L	66.0	56.0	15.4	12.9
0.16	48.1	35.1	L	65.5	55.5	17.4	20.4
0.18	44.7	33.7	N	64.5	54.5	19.8	20.8
0.27	41.7	33.9	N	61.1	51.1	19.4	17.2
0.32	45.0	40.3	N	59.7	49.7	14.7	9.4
3.65	31.7	23.7	N	56.0	46.0	24.3	22.3

Line Conducted Emissions Tabulated Data

Note(s):

- Measurements using CISPR quasi-peak mode & average mode.
- All modes of operation were investigated and the worst -case emission are reported. See attached Plots.
- * Correction factor was included to test level (dB μ V)
- ** LINE : L = Line , N = Neutral
- The limit is on the FCC Part section 15.207(a).

PLOTS OF EMISSIONS

2.4 GHz band

Conducted Emission at the Mains port (Line)

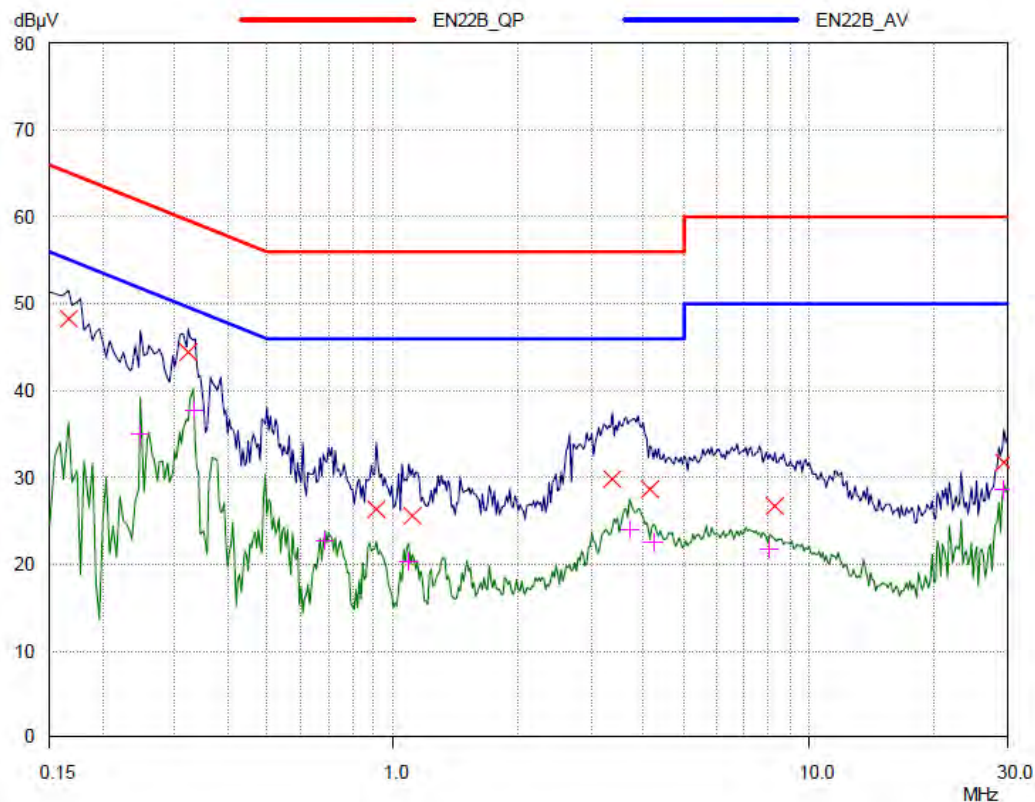
NEMKO KOREA (NK-13-R-083)

19 Apr 2013 21:12

Conducted Emissions

EUT: Set-top box
 Manuf: Samsung Electronics
 Op Cond: a.c. 120 V, 60 Hz (802.11n HT20 ch6, MIMO)
 Operator: Jinha. KO
 Test Spec: FCC Part 15.207
 Comment: MODEL : HR44-200
 LINE : L1

Scan Settings			(1 Range)		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)

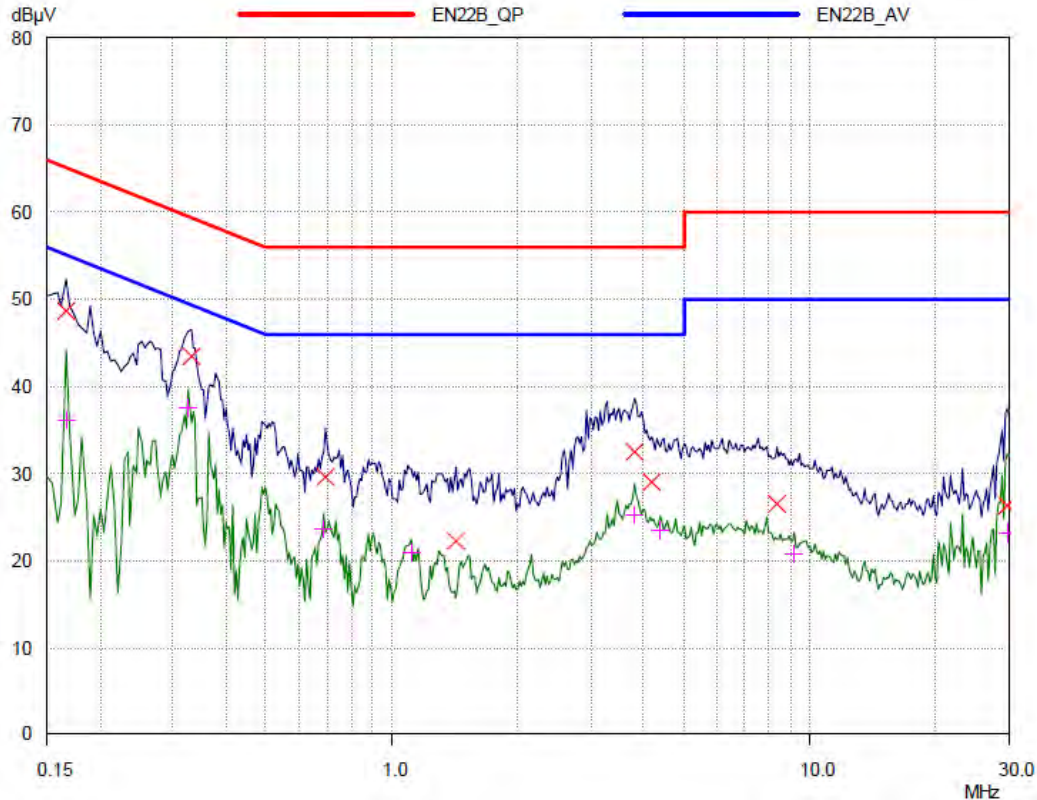
NEMKO KOREA (NK-13-R-083)

19 Apr 2013 20:33

Conducted Emissions

EUT: Set-top box
Manuf: Samsung Electronics
Op Cond: a.c. 120 V, 60 Hz (802.11n HT20 ch6, MIMO)
Operator: Jinha. KO
Test Spec: FCC Part 15.207
Comment: MODEL : HR44-200
LINE : Neutral

Scan Settings		(1 Range)			Receiver Settings				
Frequencies									
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						



PLOTS OF EMISSIONS

5 GHz band

Conducted Emission at the Mains port (Line)

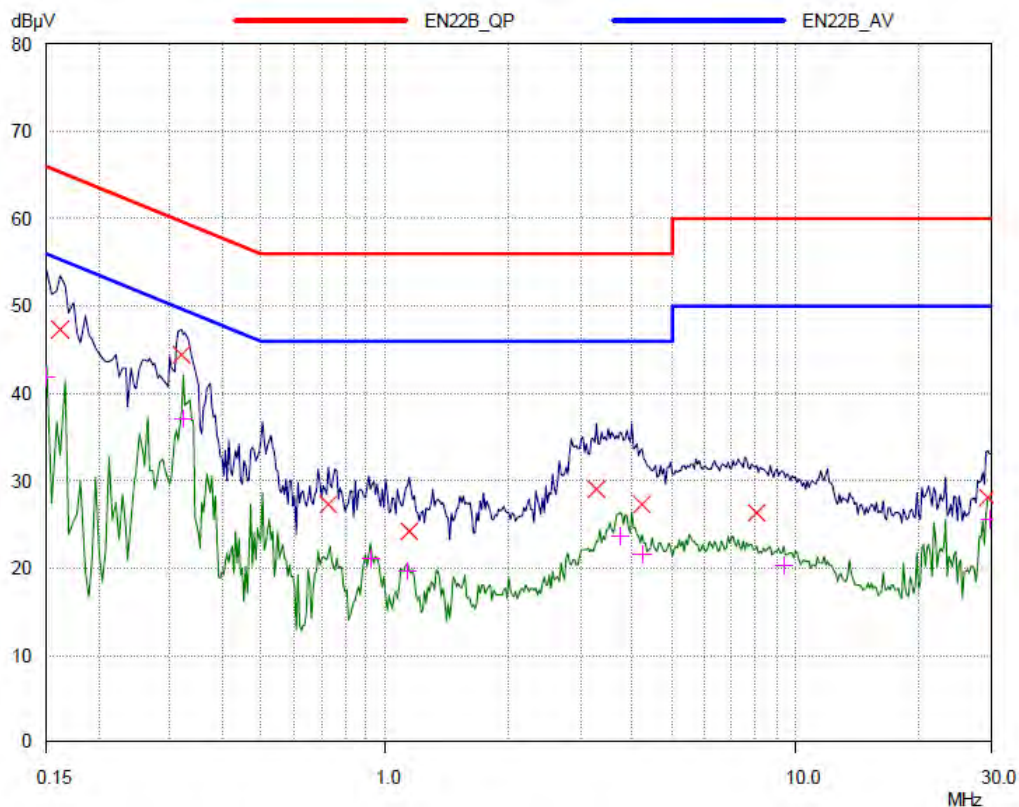
NEMKO KOREA (NK-13-R-083)

19 Apr 2013 22:17

Conducted Emissions

EUT: Set-top box
 Manuf: Samsung Electronics
 Op Cond: a.c. 120 V, 60 Hz (802.11n HT20 ch157, MIMO)
 Operator: Jinha. KO
 Test Spec: FCC Part 15.207
 Comment: MODEL : HR44-200
 LINE : L1

Scan Settings		(1 Range)						
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)

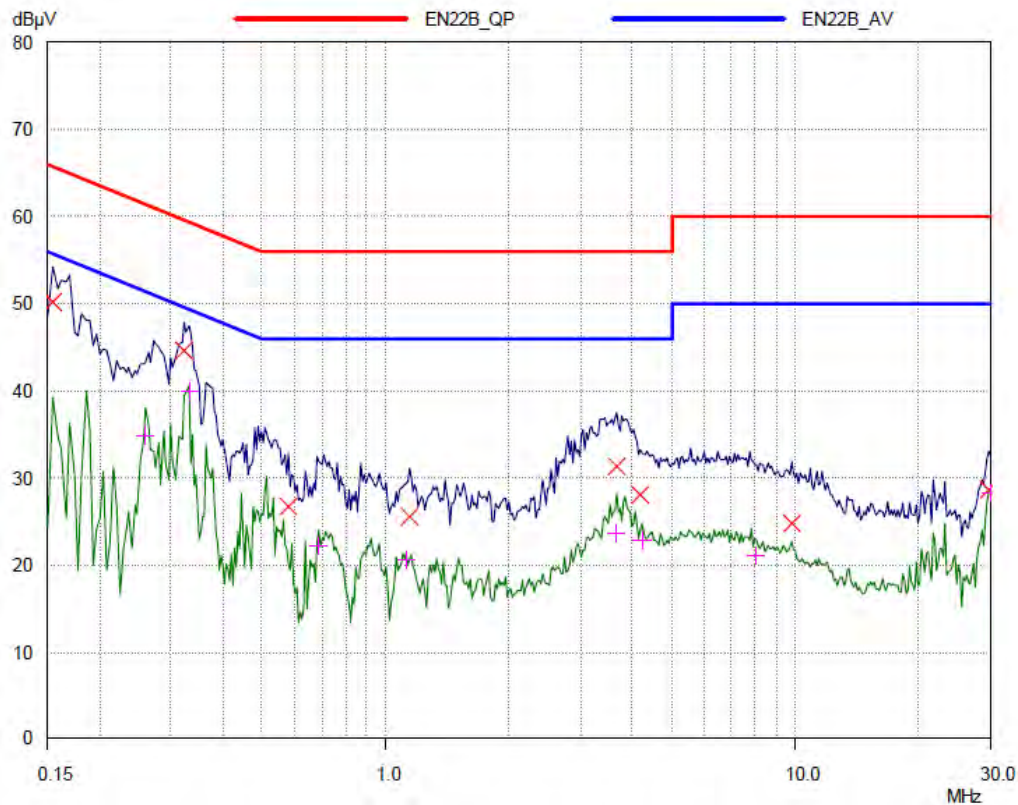
NEMKO KOREA (NK-13-R-083)

19 Apr 2013 22:04

Conducted Emissions

EUT: Set-top box
Manuf: Samsung Electronics
Op Cond: a.c. 120 V, 60 Hz (802.11n HT20 ch157, MIMO)
Operator: Jinha. KO
Test Spec: FCC Part 15.207
Comment: MODEL : HR44-200
LINE : Neutral

Scan Settings		(1 Range)			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						



TEST DATA

8.2 Radiated Emissions

FCC §15.209

2.4 GHz band

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)
122.22	49.31	V	101	325	-19.9	29.4	43.5	14.1
214.90	58.11	H	160	73	-19.1	39.0	43.5	4.5
324.00	43.00	H	141	70	-13.6	29.4	46.0	16.6
399.95	48.70	H	102	350	-13.6	35.1	46.0	10.9
833.01	41.47	V	101	40	-3.4	38.1	46.0	7.9
899.78	42.67	V	100	315	-3.4	39.3	46.0	6.7

Radiated Measurements at 3meters

5 GHz band

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)
122.22	49.61	V	100	323	-19.9	29.7	43.5	13.8
214.90	58.41	H	158	75	-19.1	39.3	43.5	4.2
324.00	42.70	H	140	69	-13.6	29.1	46.0	16.9
399.93	48.20	H	100	356	-13.6	34.6	46.0	11.4
833.00	41.17	V	100	37	-3.4	37.8	46.0	8.2
899.78	42.97	V	100	311	-3.4	39.6	46.0	6.4

Radiated Measurements at 3meters

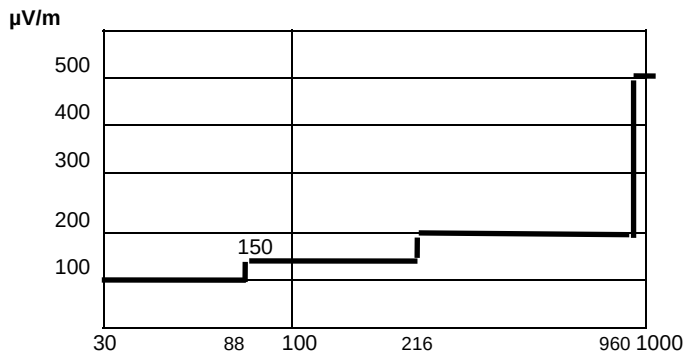


Fig. 3. Limits at 3 meters

Note(s):

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

2 The radiated limits are shown on Figure 3.

Above 1 GHz the limit is 500 μV/m.

MHz

3. *Pol. H = Horizontal, V = Vertical

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

5. Measurements using CISPR quasi-peak mode.

TEST DATA

8.3 6 dB Bandwidth

8.3.1 6 dB Bandwidth – 2.4 GHz band

FCC §15.247(a)(2)

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

802.11b mode

Channel	Frequency(MHz)	Result(MHz)		Limit (MHz)
		Chain 0	Chain 1	
Low	2412	10.12	10.12	0.5
Middle	2437	10.12	10.11	0.5
High	2462	10.11	10.12	0.5

802.11g mode

Channel	Frequency(MHz)	Result(MHz)		Limit (MHz)
		Chain 0	Chain 1	
Low	2412	16.39	16.41	0.5
Middle	2437	16.36	16.40	0.5
High	2462	16.37	16.39	0.5

802.11n mode

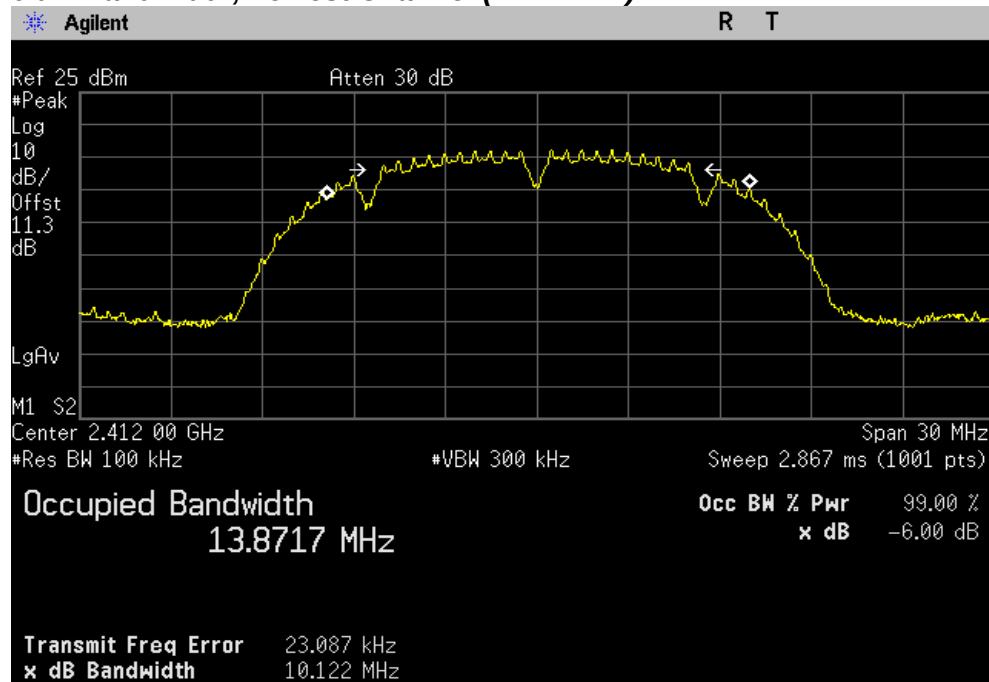
Channel	Frequency(MHz)	Result(MHz)		Limit (MHz)
		Chain 0	Chain 1	
Low	2412	17.58	17.60	0.5
Middle	2437	17.59	17.38	0.5
High	2462	17.57	17.35	0.5

PLOTS OF EMISSIONS

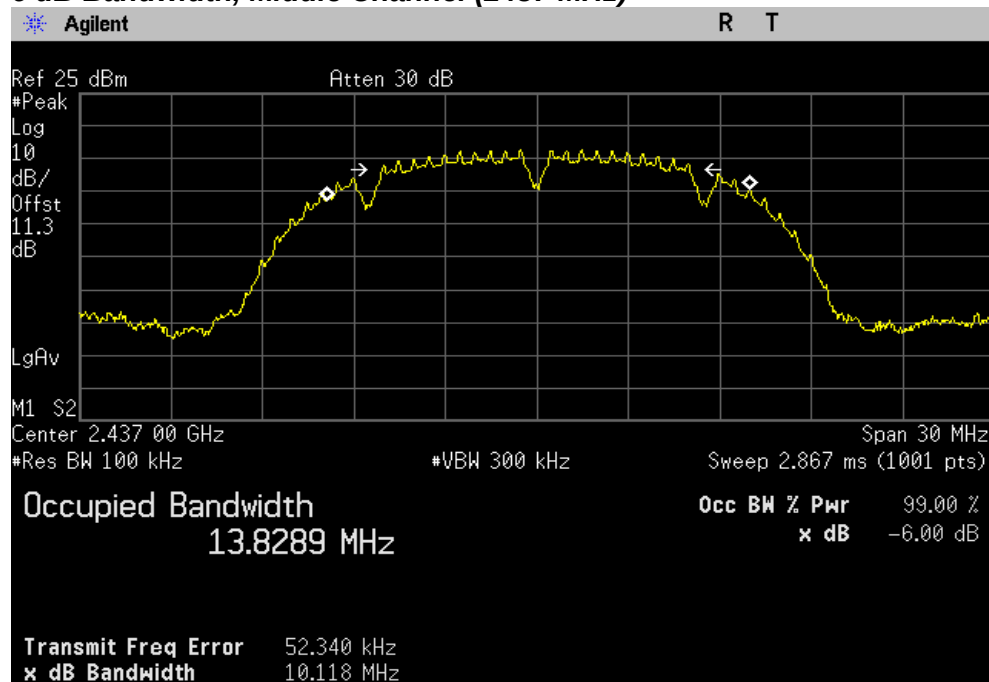
802.11b mode

Chain 0

6 dB Bandwidth, Lowest Channel (2412 MHz)

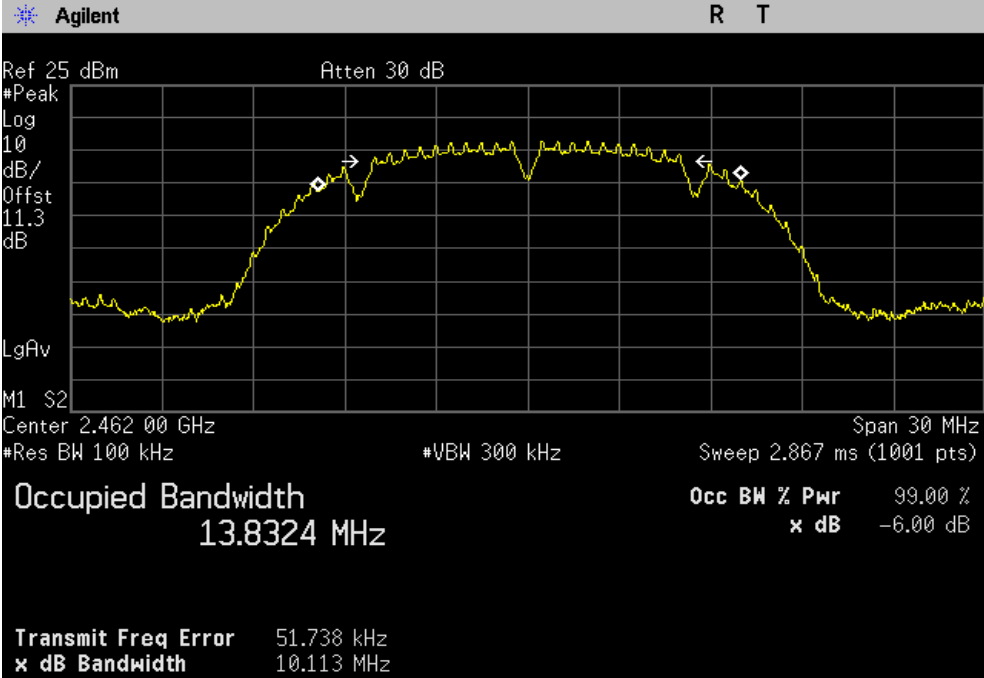


6 dB Bandwidth, Middle Channel (2437 MHz)



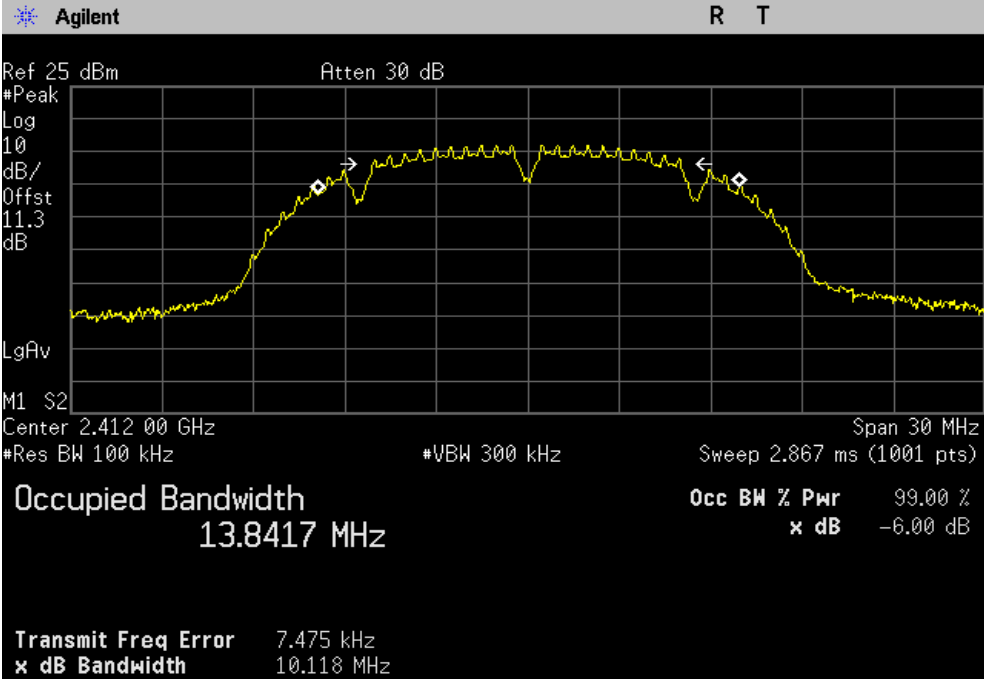
PLOTS OF EMISSIONS

6 dB Bandwidth, Highest Channel (2462 MHz)



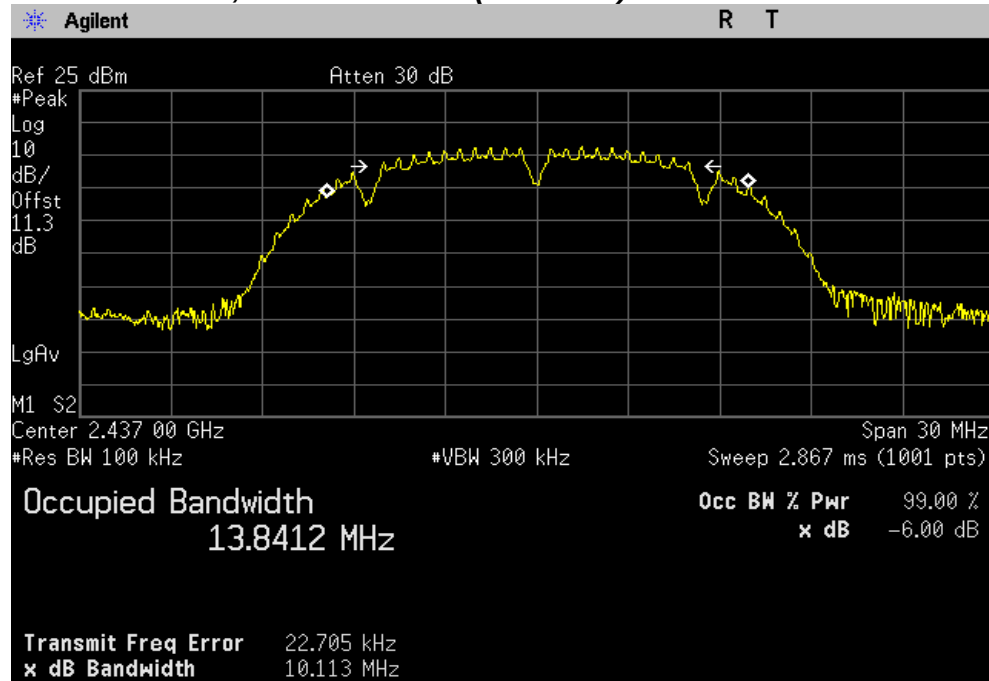
Chain 1

6 dB Bandwidth, Lowest Channel (2412 MHz)

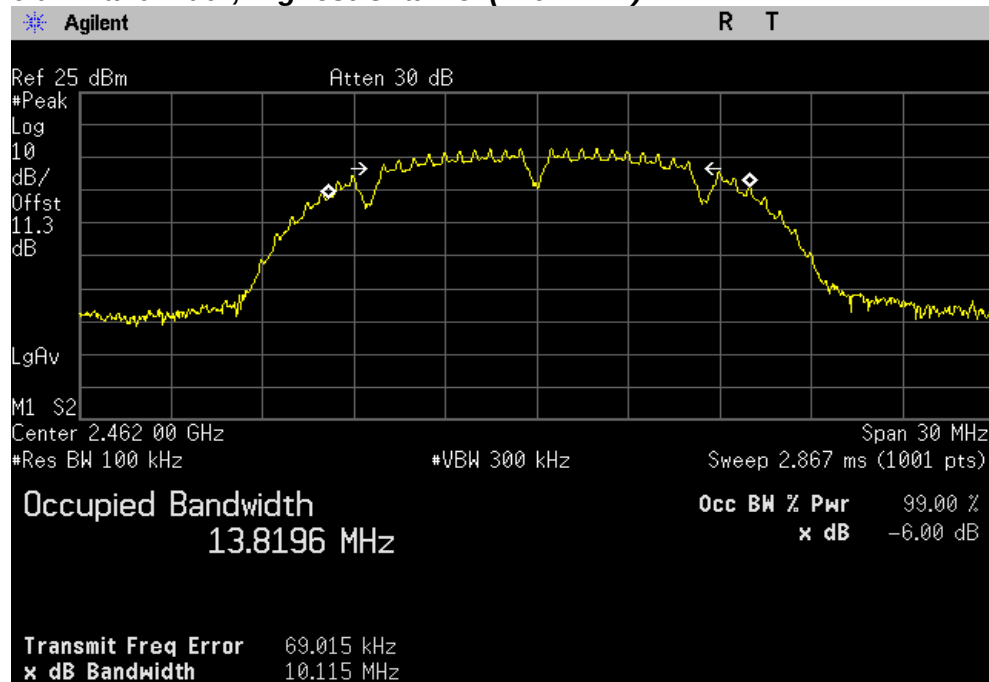


PLOTS OF EMISSIONS

6 dB Bandwidth, Middle Channel (2437 MHz)



6 dB Bandwidth, Highest Channel (2462 MHz)

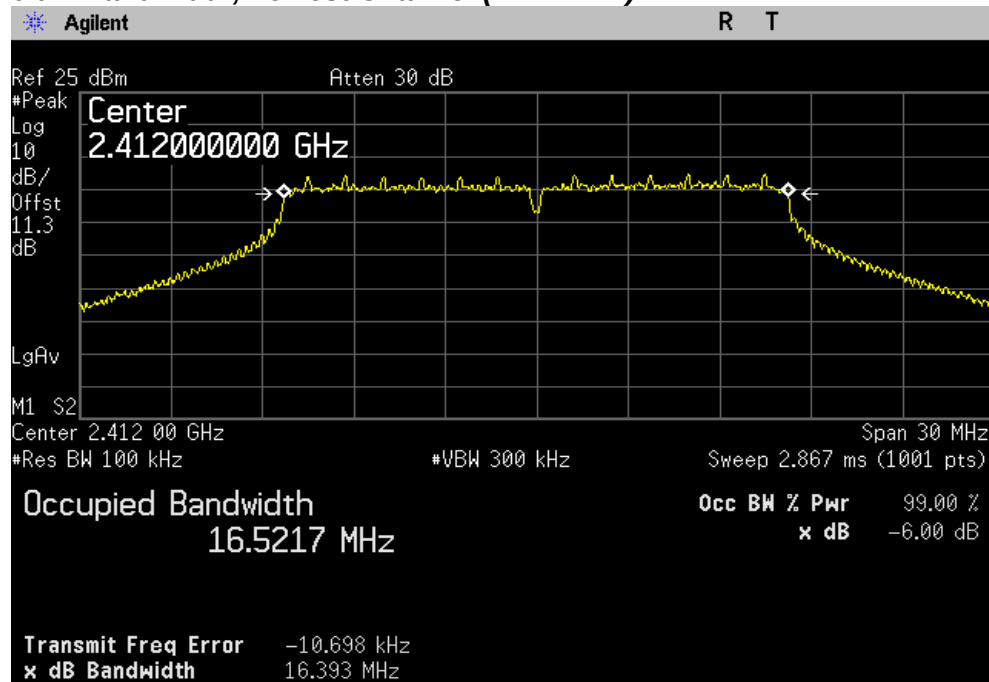


PLOTS OF EMISSIONS

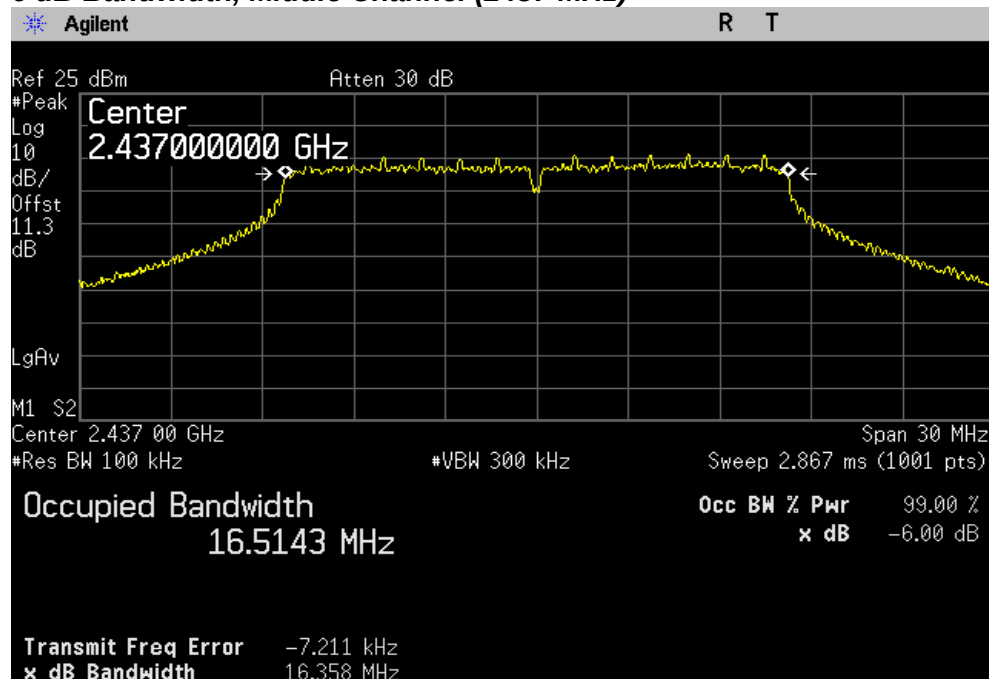
802.11g mode

Chain 0

6 dB Bandwidth, Lowest Channel (2412 MHz)

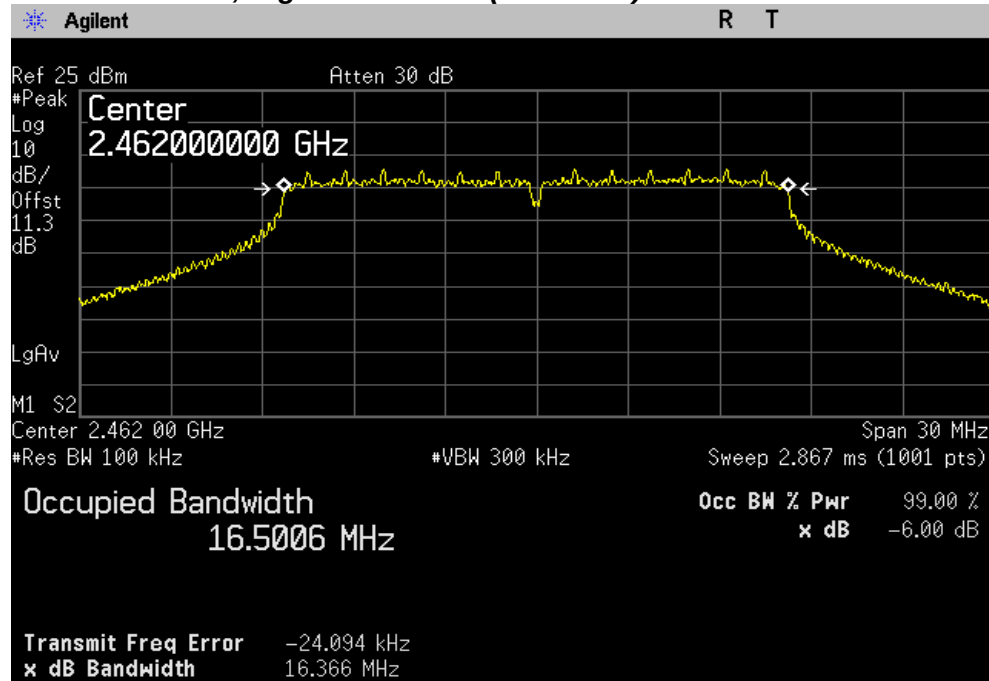


6 dB Bandwidth, Middle Channel (2437 MHz)



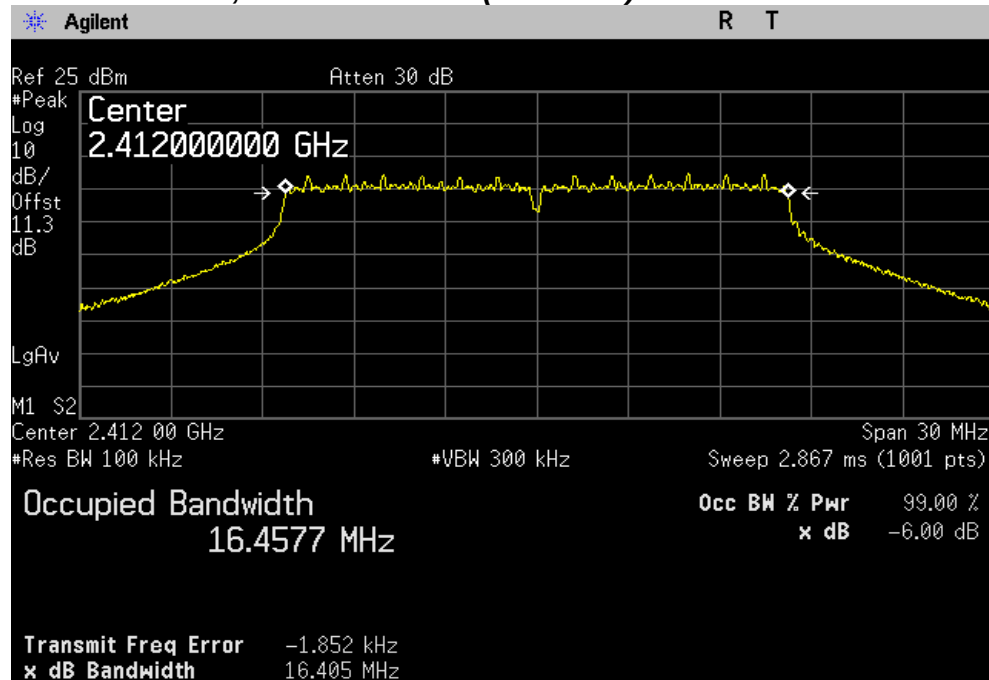
PLOTS OF EMISSIONS

6 dB Bandwidth, Highest Channel (2462 MHz)



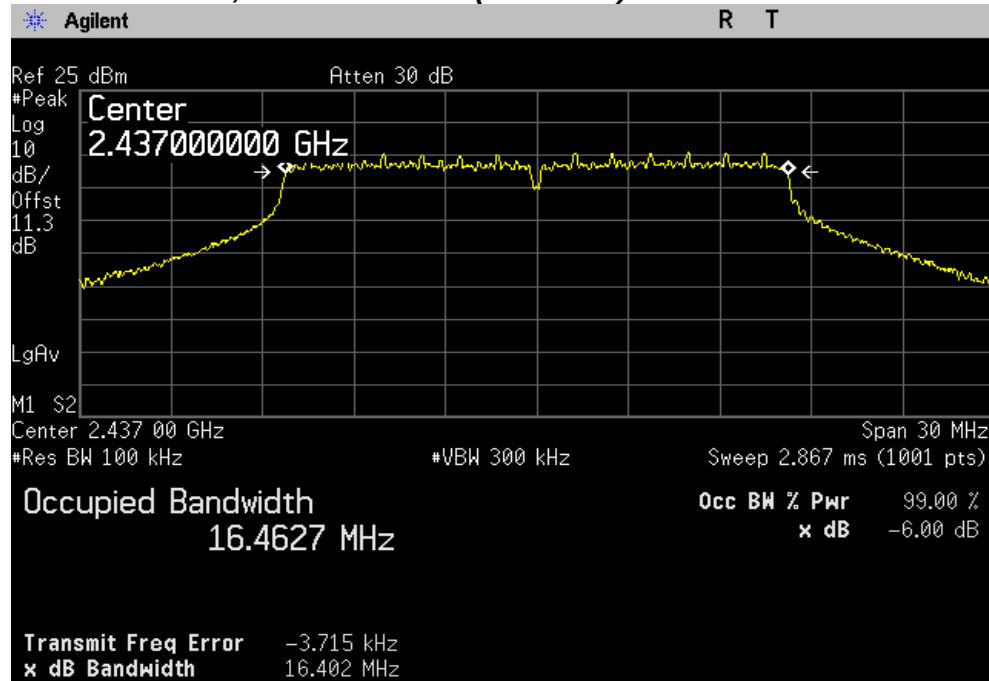
Chain 1

6 dB Bandwidth, Lowest Channel (2412 MHz)

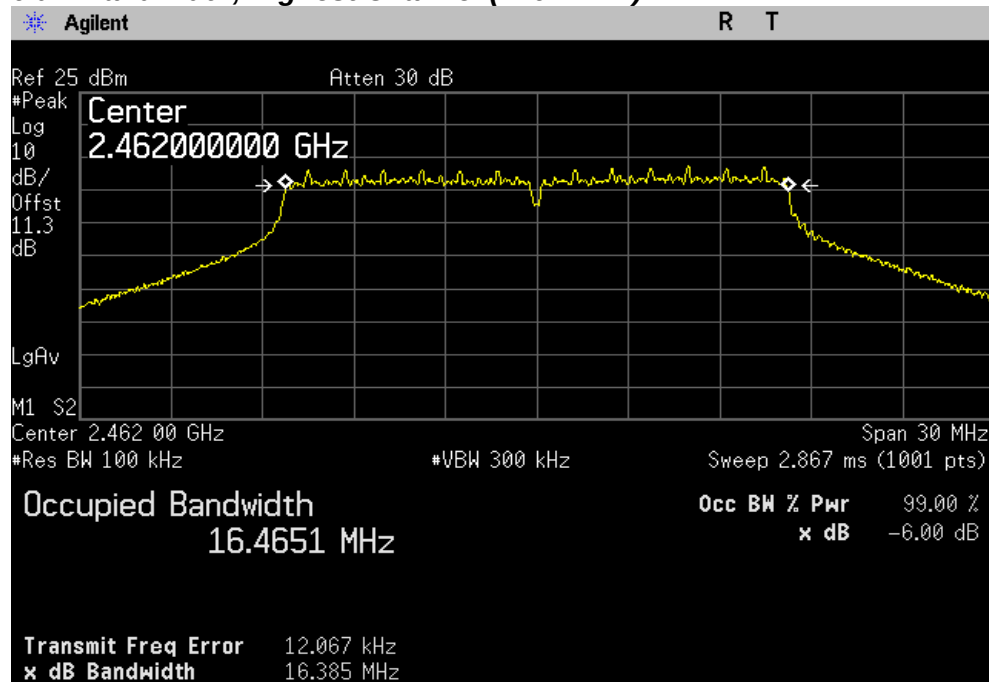


PLOTS OF EMISSIONS

6 dB Bandwidth, Middle Channel (2437 MHz)



6 dB Bandwidth, Highest Channel (2462 MHz)

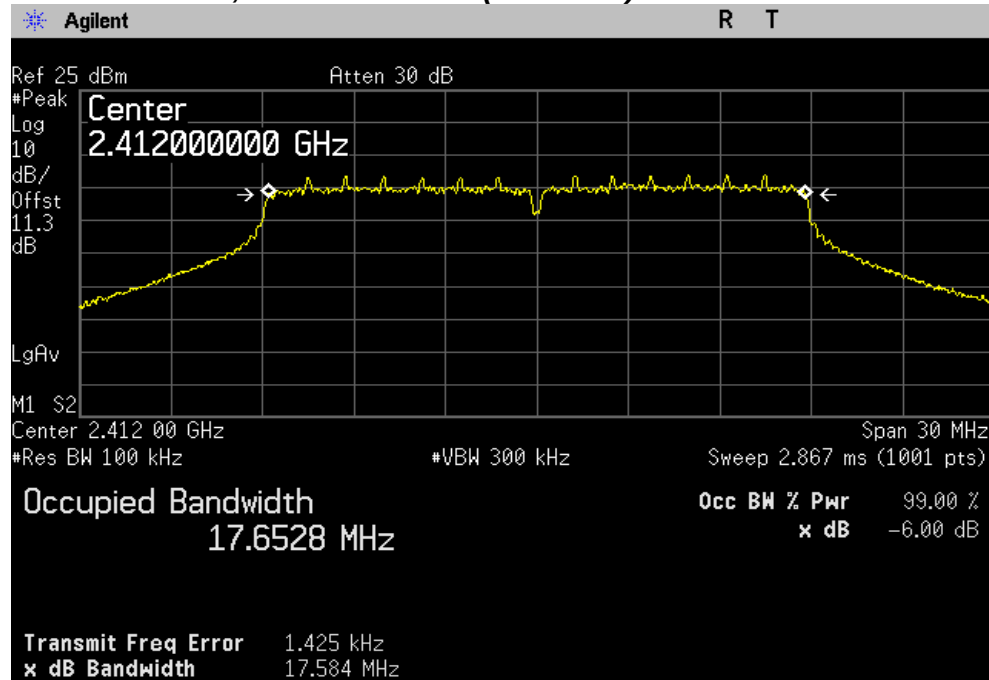


PLOTS OF EMISSIONS

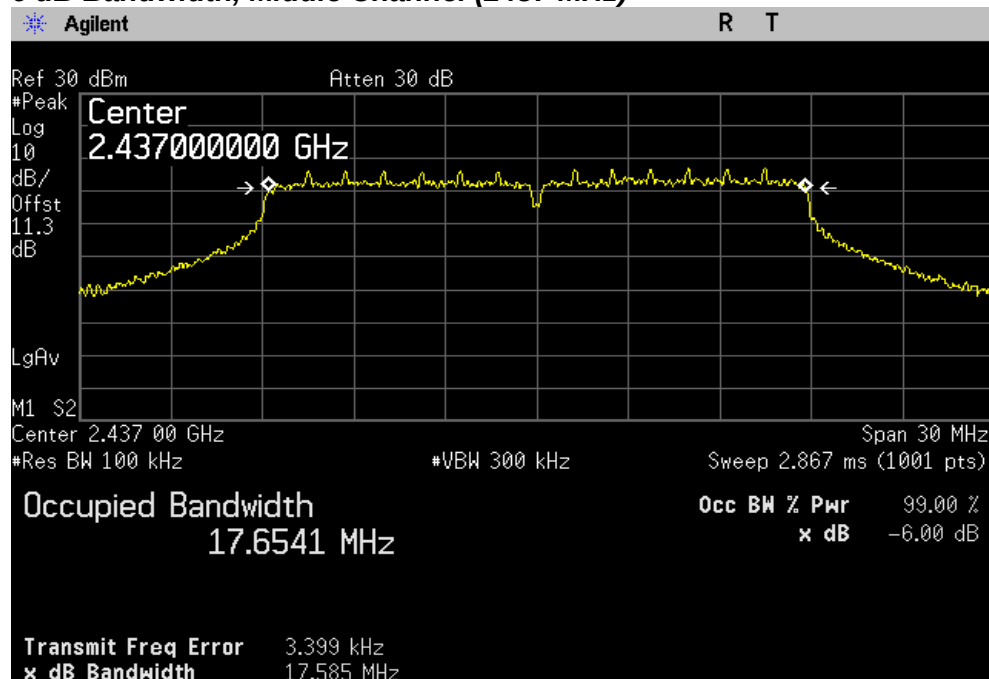
802.11n mode

Chain 0

6 dB Bandwidth, Lowest Channel (2412 MHz)

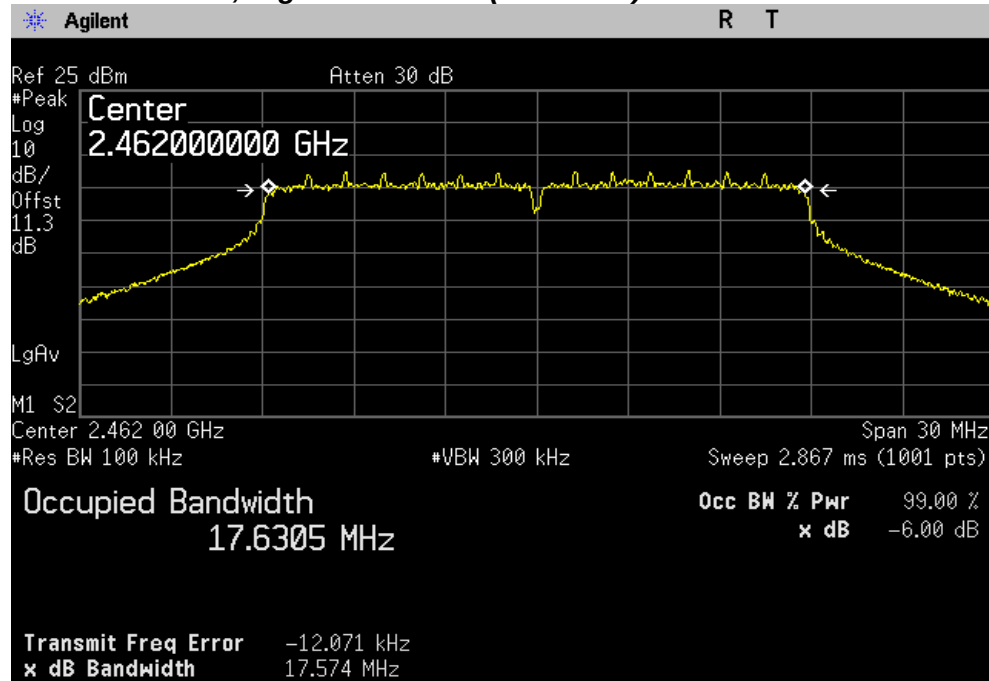


6 dB Bandwidth, Middle Channel (2437 MHz)



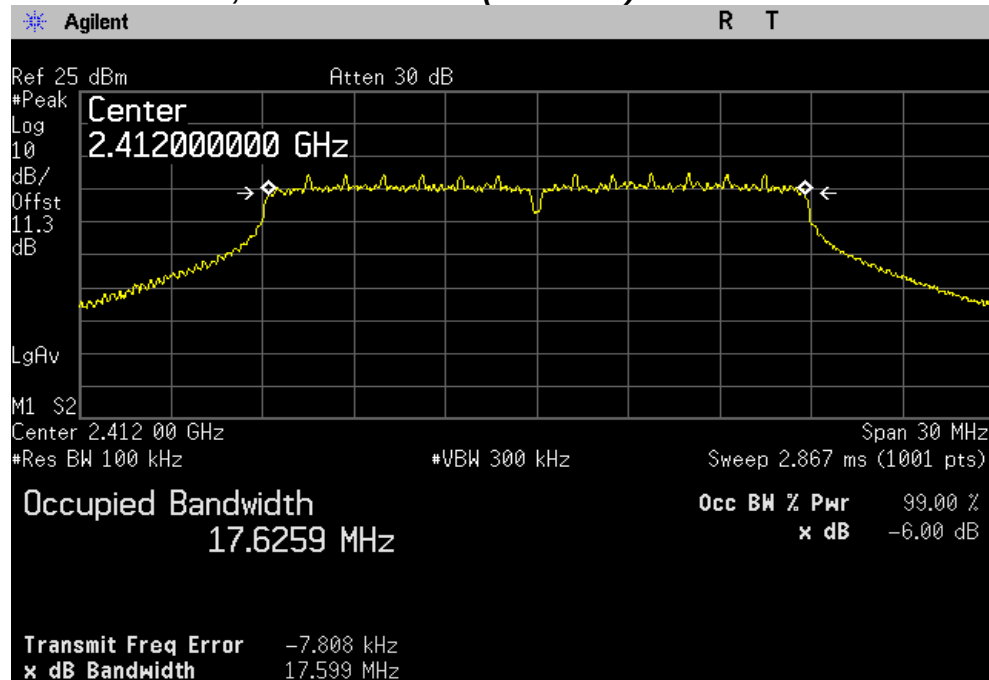
PLOTS OF EMISSIONS

6 dB Bandwidth, Highest Channel (2462 MHz)



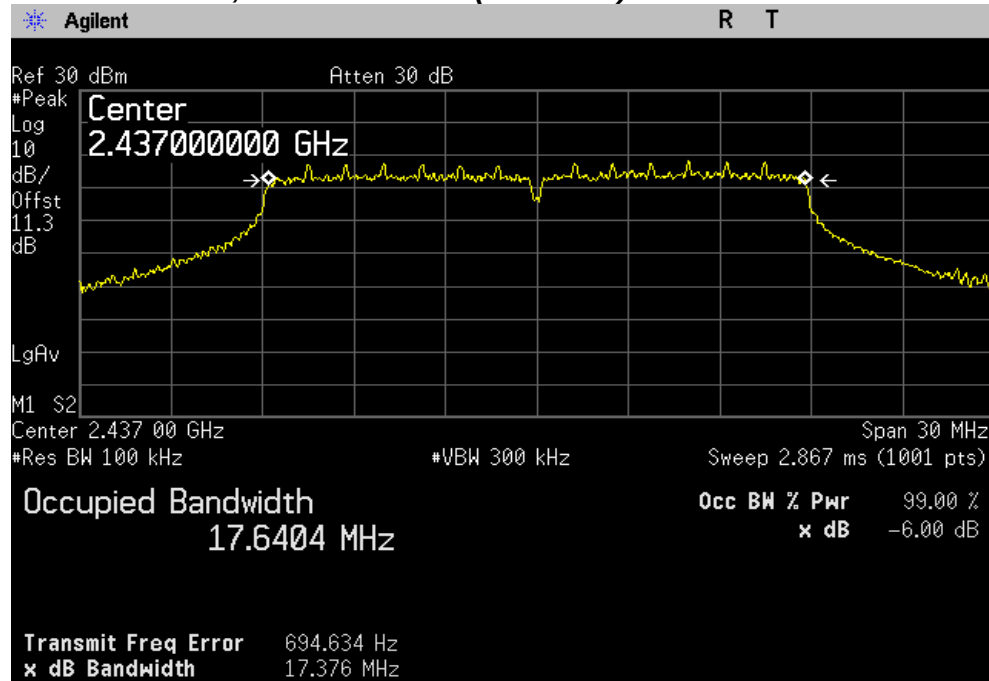
Chain 1

6 dB Bandwidth, Lowest Channel (2412 MHz)

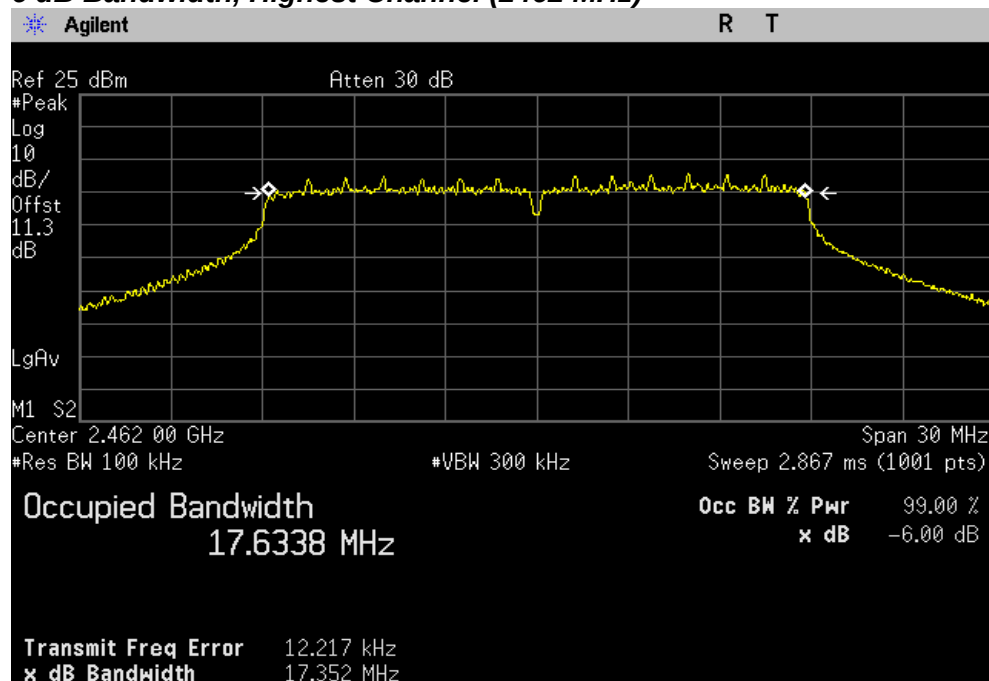


PLOTS OF EMISSIONS

6 dB Bandwidth, Middle Channel (2437 MHz)



6 dB Bandwidth, Highest Channel (2462 MHz)



TEST DATA

8.3.2 6 dB Modulated Bandwidth – 5 GHz band

FCC §15.247(a)(2)

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

802.11a mode

Channel	Frequency(MHz)	Result(MHz)		Limit (MHz)
		Chain 0	Chain 1	
Low	5745	16.35	16.40	0.5
Middle	5785	16.35	16.42	0.5
High	5825	16.37	16.40	0.5

802.11n mode

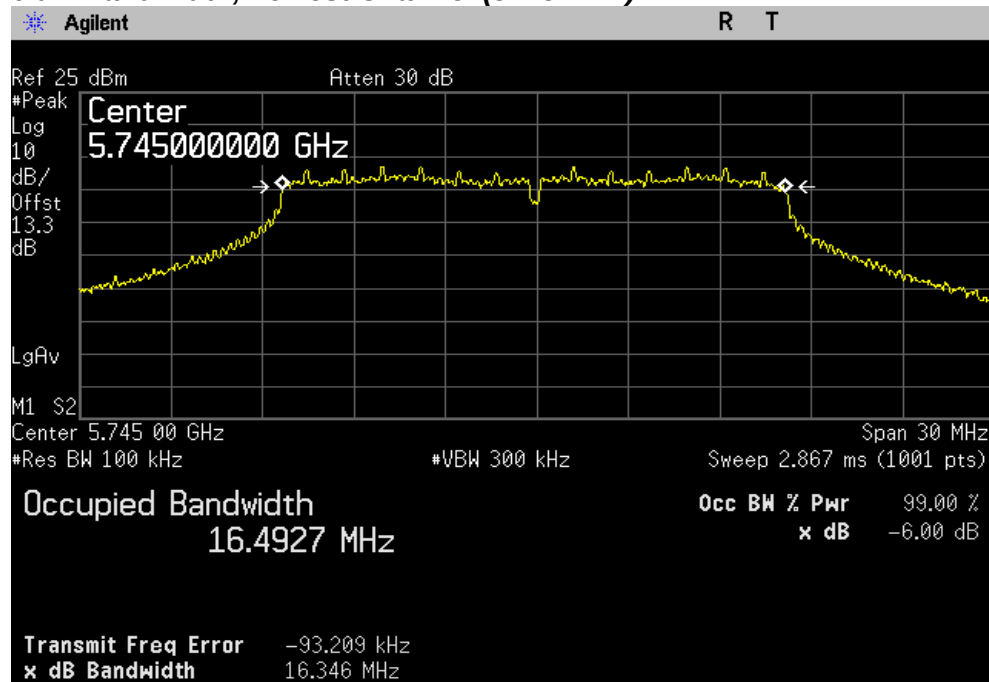
Channel	Frequency(MHz)	Result(MHz)		Limit (MHz)
		Chain 0	Chain 1	
Low	5745	17.58	17.58	0.5
Middle	5785	17.10	17.62	0.5
High	5825	17.56	17.60	0.5

PLOTS OF EMISSIONS

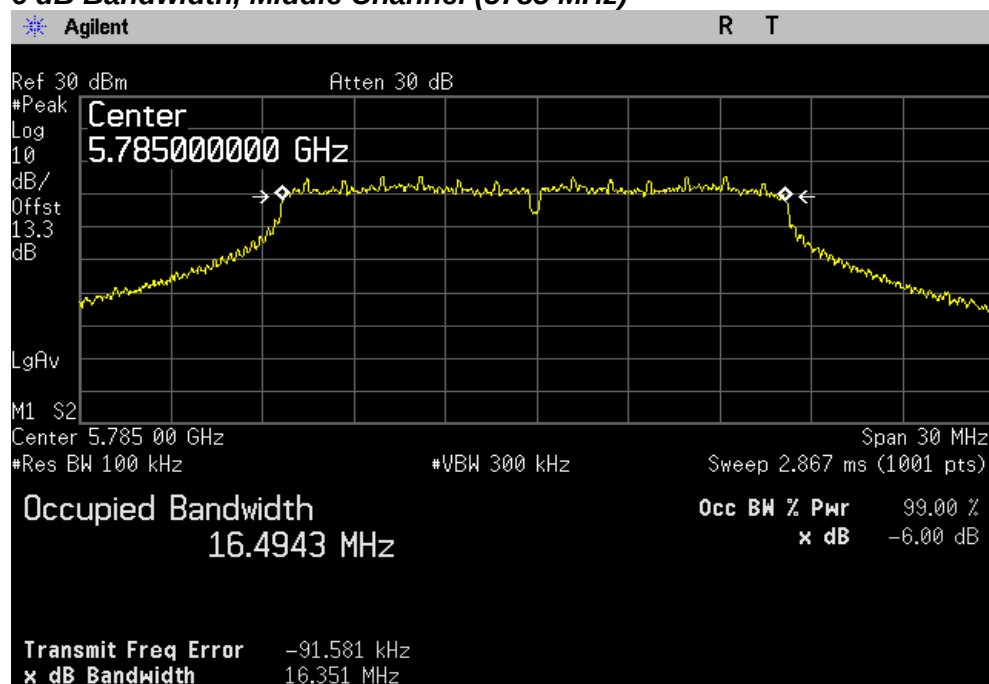
802.11a mode

Chain 0

6 dB Bandwidth, Lowest Channel (5745 MHz)

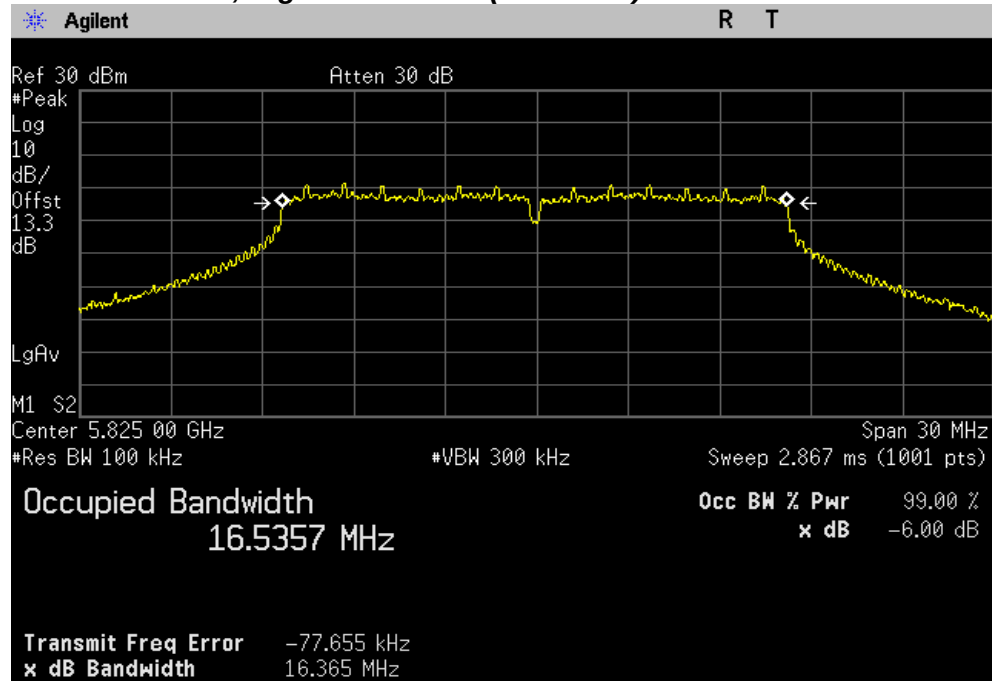


6 dB Bandwidth, Middle Channel (5785 MHz)



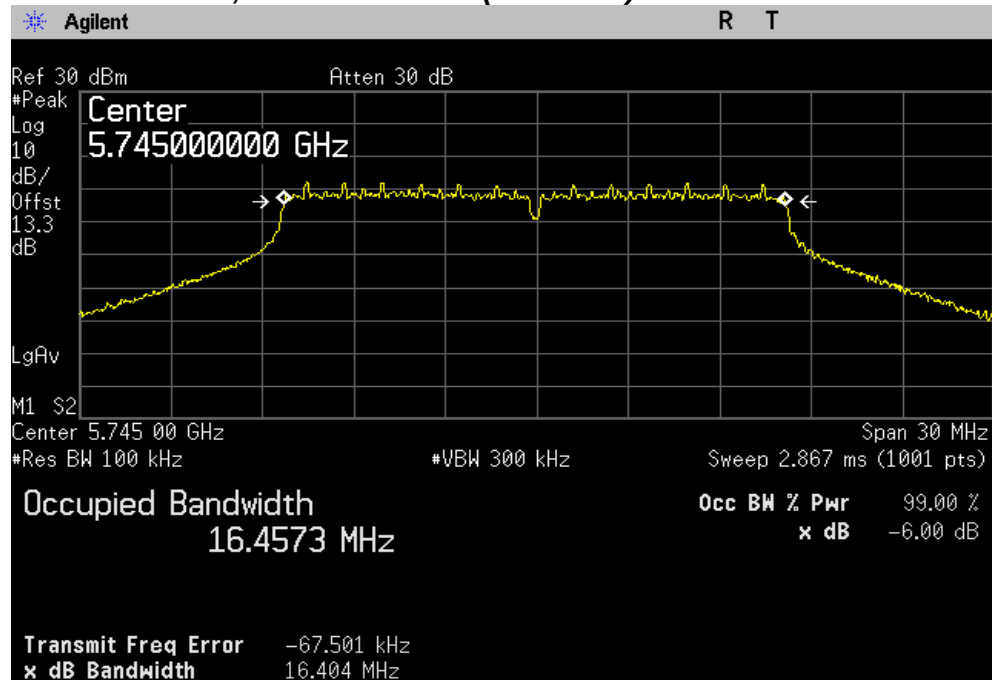
PLOTS OF EMISSIONS

6 dB Bandwidth, Highest Channel (5825 MHz)



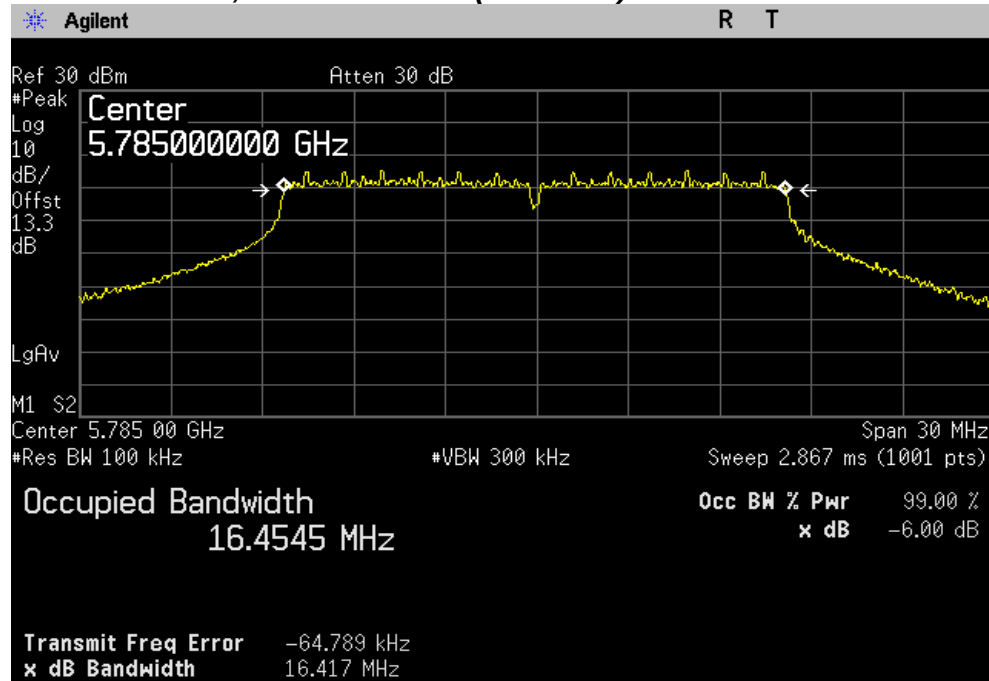
Chain 1

6 dB Bandwidth, Lowest Channel (5745 MHz)

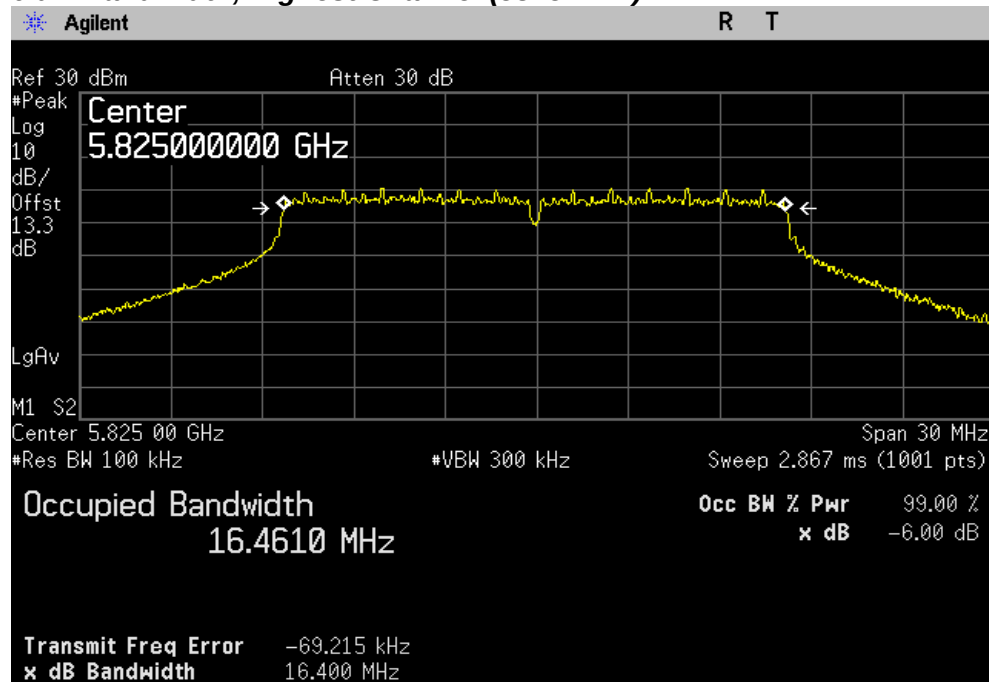


PLOTS OF EMISSIONS

6 dB Bandwidth, Middle Channel (5785 MHz)



6 dB Bandwidth, Highest Channel (5825 MHz)

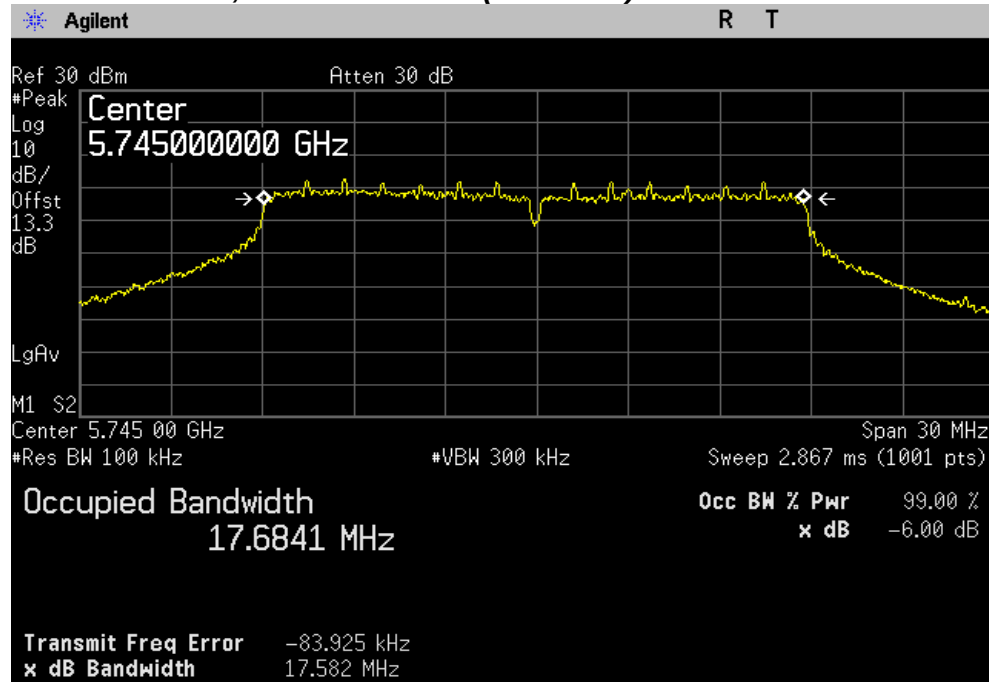


PLOTS OF EMISSIONS

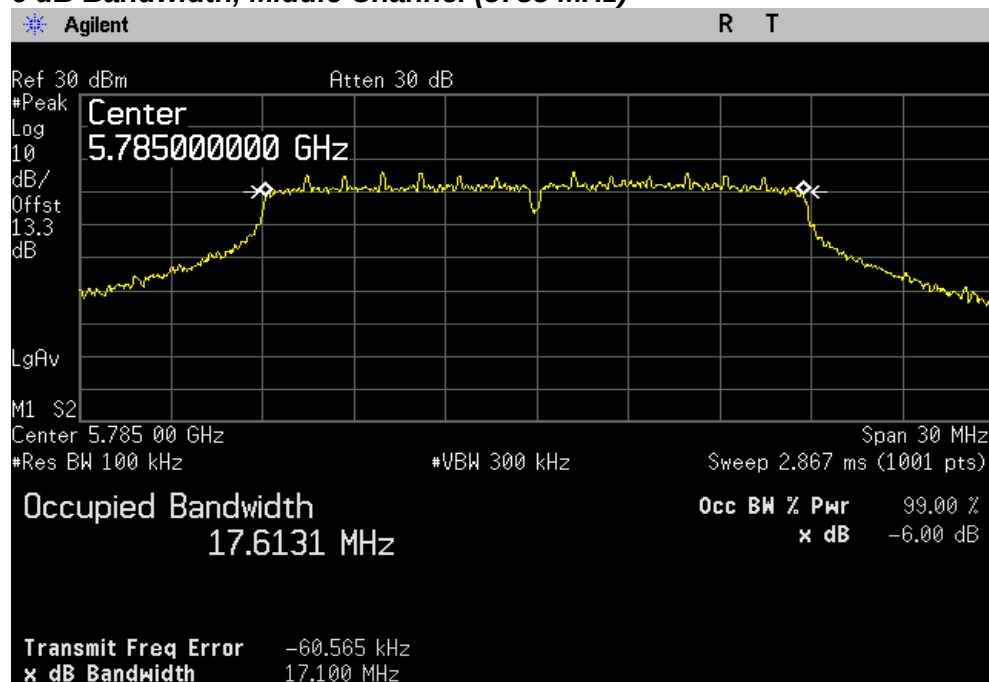
802.11n mode

Chain 0

6 dB Bandwidth, Lowest Channel (5745 MHz)

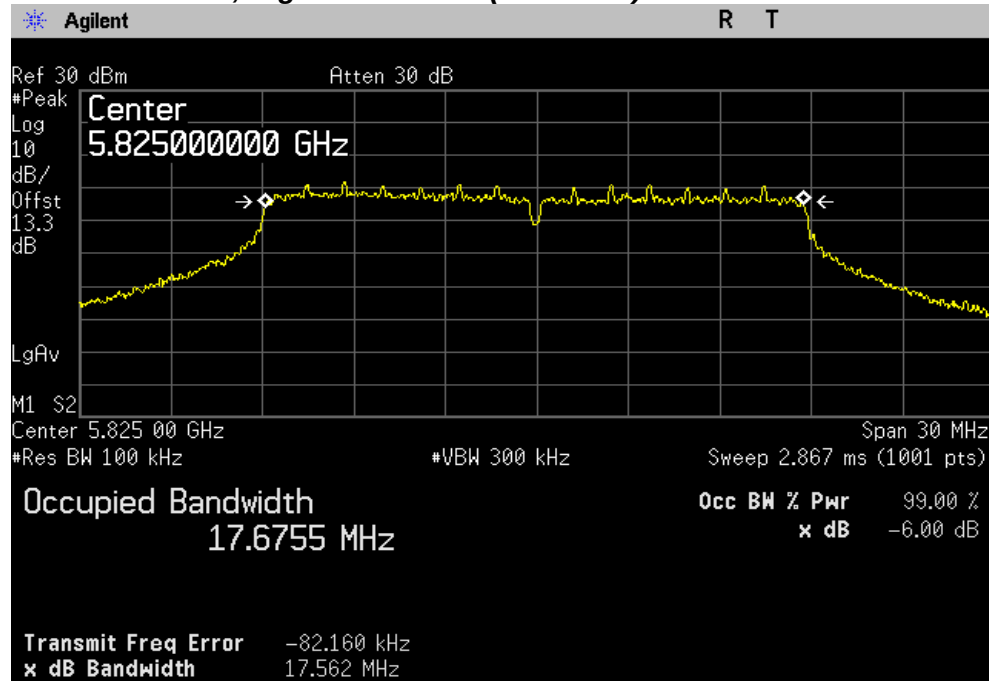


6 dB Bandwidth, Middle Channel (5785 MHz)



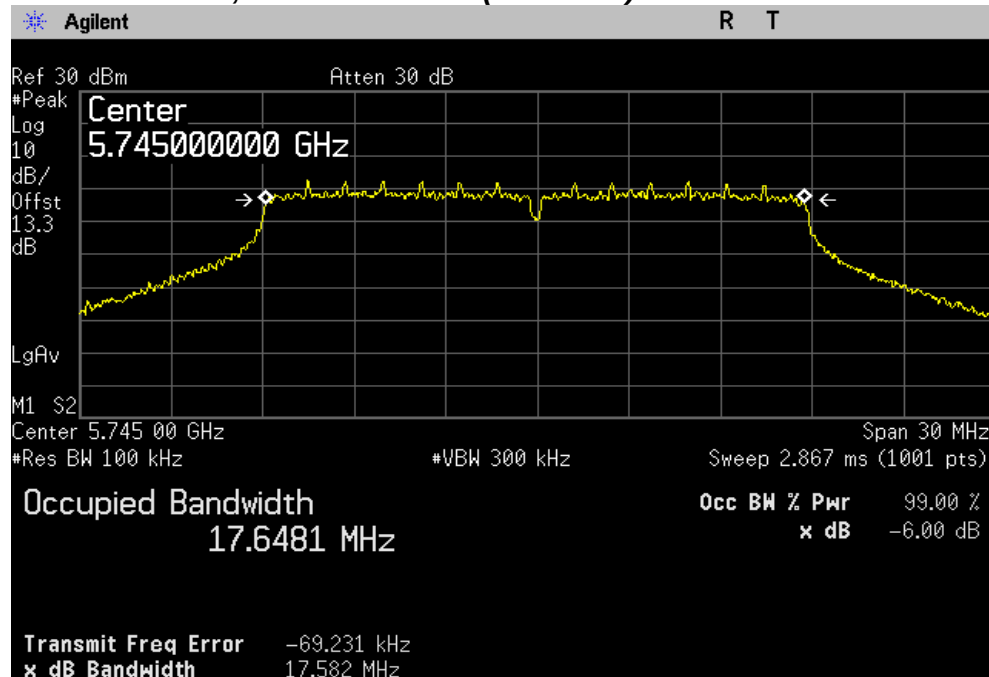
PLOTS OF EMISSIONS

6 dB Bandwidth, Highest Channel (5825 MHz)



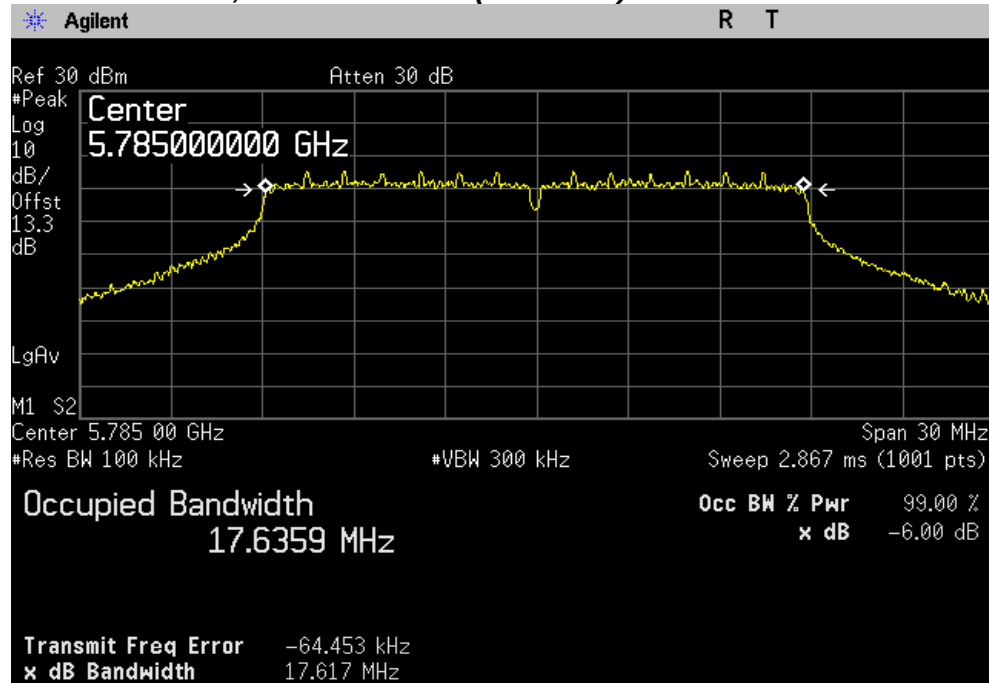
Chain 1

6 dB Bandwidth, Lowest Channel (5745 MHz)

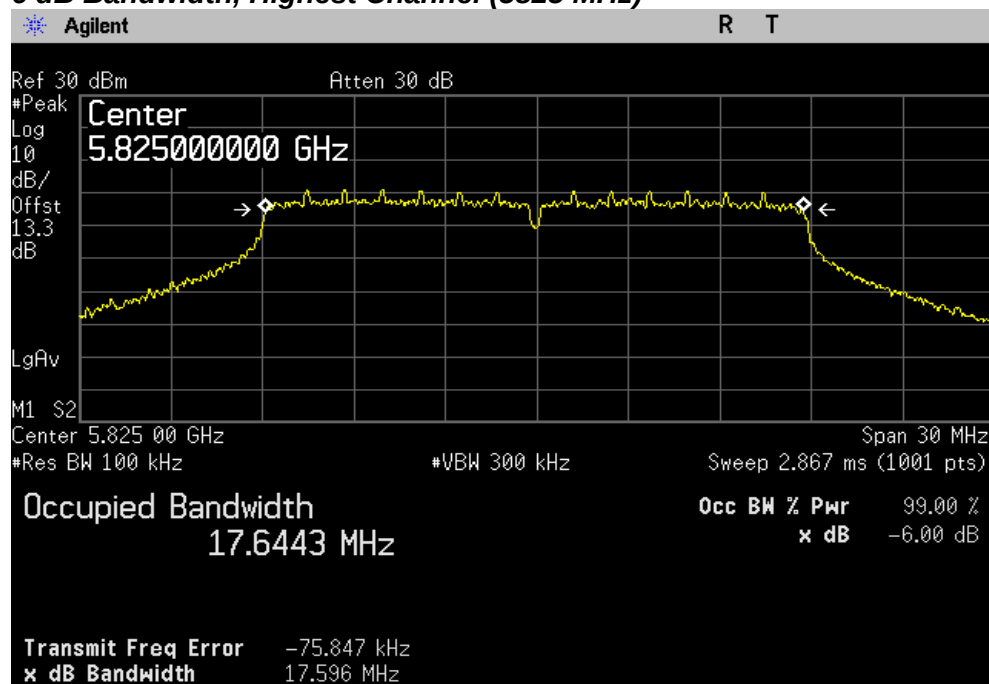


PLOTS OF EMISSIONS

6 dB Bandwidth, Middle Channel (5785 MHz)



6 dB Bandwidth, Highest Channel (5825 MHz)



TEST DATA

8.4 Maximum Conducted Output Power

8.4.1 Maximum Conducted Output Power – 2.4 GHz band

FCC §15.247(b)(3)

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

802.11b mode

Frequency (MHz)	Data rate (Mbps)	Conducted Output Power (dBm)		¹⁾ Total Output Power (dBm)	Limit (dBm)	Margin (dB)
		Chain 0	Chain 1			
2412	1	16.54	16.28	19.42	30.00	10.58
	2	16.50	16.25	19.39	30.00	10.61
	5.5	16.49	16.27	19.39	30.00	10.61
	11	16.48	16.22	19.36	30.00	10.64
2436	1	16.81	16.68	19.76	30.00	10.24
	2	16.78	16.72	19.76	30.00	10.24
	5.5	16.77	16.72	19.76	30.00	10.24
	11	16.75	16.70	19.74	30.00	10.26
2462	1	16.86	17.11	20.00	30.00	10.00
	2	16.66	17.05	19.87	30.00	10.13
	5.5	16.71	17.12	19.93	30.00	10.07
	11	16.62	16.98	19.81	30.00	10.19

802.11g mode

Frequency (MHz)	Data rate (Mbps)	Conducted Output Power (dBm)		¹⁾ Total Output Power (dBm)	Limit (dBm)	Margin (dB)
		Chain 0	Chain 1			
2412	6	10.52	10.62	13.58	30.00	16.42
	9	10.50	10.58	13.55	30.00	16.45
	12	10.53	10.60	13.58	30.00	16.42
	18	10.52	10.56	13.55	30.00	16.45
	24	10.53	10.56	13.56	30.00	16.44
	36	10.18	10.11	13.16	30.00	16.84
	48	10.49	10.11	13.31	30.00	16.69
	54	10.50	10.07	13.30	30.00	16.70
2437	6	16.84	17.36	20.12	30.00	9.88
	9	16.80	17.33	20.08	30.00	9.92
	12	16.80	17.30	20.07	30.00	9.93
	18	16.77	17.33	20.07	30.00	9.93
	24	16.75	16.91	19.84	30.00	10.16
	36	16.76	16.90	19.84	30.00	10.16
	48	16.71	16.88	19.81	30.00	10.19
	54	16.66	16.30	19.49	30.00	10.51
2462	6	12.75	13.34	16.07	30.00	13.93
	9	12.64	13.28	15.98	30.00	14.02
	12	12.65	13.27	15.98	30.00	14.02
	18	13.14	13.25	16.21	30.00	13.79
	24	12.63	13.27	15.97	30.00	14.03
	36	12.68	12.75	15.73	30.00	14.27
	48	12.69	12.75	15.73	30.00	14.27
	54	12.66	12.76	15.72	30.00	14.28

802.11n mode

Frequency (MHz)	Data rate	Conducted Output Power (dBm)		¹⁾ Total Output Power (dBm)	Limit (dBm)	Margin (dB)
		Chain 0	Chain 1			
2412	MCS0	10.44	10.58	13.52	30.00	16.48
	MCS1	10.40	10.56	13.49	30.00	16.51
	MCS2	10.43	10.02	13.24	30.00	16.76
	MCS3	10.42	10.53	13.49	30.00	16.51
	MCS4	10.41	10.08	13.26	30.00	16.74
	MCS5	10.07	10.03	13.06	30.00	16.94
	MCS6	10.42	10.10	13.27	30.00	16.73
	MCS7	10.41	10.02	13.23	30.00	16.77
	MCS8	10.44	10.53	13.50	30.00	16.50
	MCS9	10.44	10.51	13.49	30.00	16.51
	MCS10	10.05	10.02	13.05	30.00	16.95
	MCS11	10.05	9.99	13.03	30.00	16.97
	MCS12	10.06	9.98	13.03	30.00	16.97
	MCS13	10.08	9.96	13.03	30.00	16.97
	MCS14	10.09	10.06	13.09	30.00	16.91
2437	MCS0	16.63	17.36	20.02	30.00	9.98
	MCS1	16.60	17.34	20.00	30.00	10.00
	MCS2	16.61	17.27	19.96	30.00	10.04
	MCS3	16.58	16.82	19.71	30.00	10.29
	MCS4	16.58	16.87	19.74	30.00	10.26
	MCS5	16.57	16.78	19.69	30.00	10.31
	MCS6	16.60	16.67	19.65	30.00	10.35
	MCS7	16.60	16.77	19.70	30.00	10.30
	MCS8	16.50	17.30	19.93	30.00	10.07
	MCS9	16.56	16.82	19.70	30.00	10.30
	MCS10	16.59	16.84	19.73	30.00	10.27
	MCS11	16.57	16.80	19.70	30.00	10.30
	MCS12	16.58	16.79	19.70	30.00	10.30
	MCS13	16.57	16.78	19.69	30.00	10.31
	MCS14	16.53	16.78	19.67	30.00	10.33
2462	MCS0	10.42	11.27	13.88	30.00	16.12
	MCS1	10.39	11.18	13.81	30.00	16.19
	MCS2	10.38	11.17	13.80	30.00	16.20
	MCS3	10.40	11.15	13.80	30.00	16.20
	MCS4	10.38	11.21	13.83	30.00	16.17
	MCS5	9.93	10.84	13.42	30.00	16.58
	MCS6	10.37	10.83	13.62	30.00	16.38
	MCS7	10.38	10.81	13.61	30.00	16.39
	MCS8	10.39	11.27	13.86	30.00	16.14
	MCS9	10.37	11.25	13.84	30.00	16.16
	MCS10	10.37	11.28	13.86	30.00	16.14
	MCS11	10.36	10.86	13.63	30.00	16.37
	MCS12	9.88	10.85	13.40	30.00	16.60
	MCS13	9.95	10.81	13.41	30.00	16.59
	MCS14	9.92	10.85	13.42	30.00	16.58
	MCS15	9.90	10.86	13.42	30.00	16.58

Note(s):

The following equation was used for spectrum offset:

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

$$^1) \text{Total Peak power} = 10 \log [10^{(\text{Chain 0 Power}/10)} + 10^{(\text{Chain 1 Power}/10)}]$$

According to the KDB 662911 D01 v01r02, the directional gain of the correlated signal for the output power is as in the following table.

Frequency Band (GHz)	Antenna G1 (dBi)	Antenna G2 (dBi)	²⁾ Directional gain for CCD mode (dBi)	³⁾ Directional gain for correlated signal (dBi)	Antenna limit (dBi)
2.4	2.85	2.82	2.85	5.85	6.00

$$^2) \text{ Directional gain for CCD mode (correlated signal)} = G_{ANT} + 0 \text{ dB for } N_{ANT} = 2$$

$$^3) \text{ Directional gain for the correlated signal with unequal antenna gains, with equal transmit powers} \\ = 10 \log [(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}] \text{ dBi for } N_{ANT} = 2$$

The maximum directional gain is 5.85 dBi.

TEST DATA

8.4.2 Maximum Conducted Power Output – 5 GHz band

FCC §15.247(b)(3)

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

802.11a mode

Frequency (MHz)	Data rate (Mbps)	Conducted Output Power (dBm)		¹⁾ Total Output Power (dBm)	²⁾ Limit (dBm)	Margin (dB)
		Chain 0	Chain 1			
5745	6	12.58	13.44	16.04	29.02	12.98
	9	12.39	13.42	15.95	29.02	13.07
	12	12.39	13.41	15.94	29.02	13.08
	18	12.76	13.38	16.09	29.02	12.93
	24	12.42	13.38	15.94	29.02	13.08
	36	12.42	13.39	15.94	29.02	13.08
	48	12.41	13.42	15.95	29.02	13.07
	54	12.46	13.41	15.97	29.02	13.05
5785	6	16.28	16.58	19.44	29.02	9.58
	9	16.26	16.44	19.36	29.02	9.66
	12	16.23	16.32	19.29	29.02	9.73
	18	16.24	16.40	19.33	29.02	9.69
	24	16.24	16.43	19.35	29.02	9.67
	36	16.12	16.38	19.26	29.02	9.76
	48	16.16	16.37	19.28	29.02	9.74
	54	16.17	16.36	19.28	29.02	9.74
5825	6	11.72	11.94	14.84	29.02	14.18
	9	11.64	11.85	14.76	29.02	14.26
	12	11.59	11.87	14.74	29.02	14.28
	18	11.52	11.77	14.66	29.02	14.36
	24	11.49	11.85	14.68	29.02	14.34
	36	11.45	11.77	14.62	29.02	14.40
	48	11.56	11.78	14.68	29.02	14.34
	54	11.49	11.78	14.65	29.02	14.37

802.11n mode

Frequency (MHz)	Data rate	Conducted Output Power (dBm)		¹⁾ Total Output Power (dBm)	²⁾ Limit (dBm)	Margin (dB)
		Chain 0	Chain 1			
5745	MCS0	12.81	13.38	16.11	29.02	12.91
	MCS1	12.79	13.35	16.09	29.02	12.93
	MCS2	12.70	13.40	16.07	29.02	12.95
	MCS3	12.35	13.37	15.90	29.02	13.12
	MCS4	12.33	13.35	15.88	29.02	13.14
	MCS5	12.37	13.31	15.88	29.02	13.14
	MCS6	12.54	13.23	15.91	29.02	13.11
	MCS7	12.52	13.21	15.89	29.02	13.13
	MCS8	12.46	13.26	15.89	29.02	13.13
	MCS9	12.49	13.34	15.95	29.02	13.07
	MCS10	12.35	13.32	15.87	29.02	13.15
	MCS11	12.35	13.36	15.89	29.02	13.13
	MCS12	12.27	13.32	15.84	29.02	13.18
	MCS13	12.32	13.33	15.86	29.02	13.16
	MCS14	12.36	13.29	15.86	29.02	13.16
	MCS15	12.44	13.24	15.87	29.02	13.15
5785	MCS0	16.36	16.26	19.32	29.02	9.70
	MCS1	16.26	16.24	19.26	29.02	9.76
	MCS2	16.22	16.29	19.27	29.02	9.75
	MCS3	15.72	16.20	18.98	29.02	10.04
	MCS4	15.71	16.25	19.00	29.02	10.02
	MCS5	16.24	16.21	19.24	29.02	9.78
	MCS6	15.95	16.08	19.03	29.02	9.99
	MCS7	15.80	15.96	18.89	29.02	10.13
	MCS8	16.30	16.26	19.29	29.02	9.73
	MCS9	16.24	16.23	19.25	29.02	9.77
	MCS10	16.19	16.20	19.21	29.02	9.81
	MCS11	16.22	16.20	19.22	29.02	9.80
	MCS12	15.65	16.22	18.95	29.02	10.07
	MCS13	15.71	16.15	18.95	29.02	10.07
	MCS14	15.60	16.14	18.89	29.02	10.13
	MCS15	15.55	16.16	18.88	29.02	10.14
5825	MCS0	11.86	11.77	14.83	29.02	14.19
	MCS1	11.83	11.59	14.72	29.02	14.30
	MCS2	11.82	11.74	14.79	29.02	14.23
	MCS3	11.32	11.71	14.53	29.02	14.49
	MCS4	11.30	11.59	14.46	29.02	14.56
	MCS5	11.27	11.69	14.50	29.02	14.52
	MCS6	11.25	11.54	14.41	29.02	14.61
	MCS7	11.20	11.55	14.39	29.02	14.63
	MCS8	11.75	11.71	14.74	29.02	14.28
	MCS9	11.76	11.68	14.73	29.02	14.29
	MCS10	11.30	11.55	14.44	29.02	14.58
	MCS11	11.82	11.56	14.70	29.02	14.32
	MCS12	11.28	11.59	14.45	29.02	14.57
	MCS13	11.35	11.60	14.49	29.02	14.53
	MCS14	11.31	11.63	14.48	29.02	14.54
	MCS15	11.38	11.64	14.52	29.02	14.50

Note(s):

The following equation was used for spectrum offset:

$$\text{Spectrum offset (dB)} = \text{Attenuator (dB)} + \text{Cable Loss (dB)} + \text{SMA Type Connector Loss (dB)}$$

$$^1) \text{ Total Peak power} = 10 \log [10^{(\text{Chain 0 Power}/10)} + 10^{(\text{Chain 1 Power}/10)}]$$

²⁾ As the directional gain is 6.98 dBi, the maximum conducted output power limit 30 dBm should be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.

Therefore, the maximum conducted output limit is 29.02 dBm.

According to the KDB 662911 D01 v01r02, the directional gain of the correlated signal for the output power is as in the following table.

Frequency Band (GHz)	Antenna G1 (dBi)	Antenna G2 (dBi)	³⁾ Directional gain for CCD mode (dBi)	⁴⁾ Directional gain for correlated signal (dBi)	Antenna limit (dBi)
5.7	4.42	3.50	4.42	6.98	6.00

$$^3) \text{ Directional gain for CCD mode (correlated signal)} = G_{ANT} + 0 \text{ dB for } N_{ANT} = 2$$

$$^4) \text{ Directional gain for the correlated signal with unequal antenna gains, with equal transmit powers} \\ = 10 \log [(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}] \text{ dBi for } N_{ANT} = 2$$

The maximum directional gain is 6.98 dBi.

TEST DATA

8.5 Power Spectral Density

8.5.1 Power Spectral Density – 2.4 GHz band

FCC §15.247(e)

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

802.11b

Frequency (MHz)	TX Chain	Power Spectral Density (dBm)	¹⁾ 10 log(N _{ANT}) (dB)	²⁾ Total Power Density(dBm)	Limit (dBm)	Margin (dB)
2412	Chain 0	-1.25	3.01	1.76	8.00	6.24
	Chain 1	-1.34	3.01	1.67	8.00	6.33
2437	Chain 0	-0.84	3.01	2.17	8.00	5.83
	Chain 1	-0.72	3.01	2.29	8.00	5.71
2462	Chain 0	-1.02	3.01	1.99	8.00	6.01
	Chain 1	-0.25	3.01	2.76	8.00	5.24

802.11g

Frequency (MHz)	TX Chain	Power Spectral Density (dBm)	¹⁾ 10 log(N _{ANT}) (dB)	²⁾ Total Power Density(dBm)	Limit (dBm)	Margin (dB)
2412	Chain 0	-8.47	3.01	-5.46	8.00	13.46
	Chain 1	-7.94	3.01	-4.93	8.00	12.93
2437	Chain 0	-1.95	3.01	1.06	8.00	6.94
	Chain 1	-1.27	3.01	1.74	8.00	6.26
2462	Chain 0	-6.01	3.01	-3.00	8.00	11.00
	Chain 1	-5.69	3.01	-2.68	8.00	10.68

802.11n

Frequency (MHz)	TX Chain	Power Spectral Density (dBm)	¹⁾ 10 log(N _{ANT}) (dB)	²⁾ Total Power Density(dBm)	Limit (dBm)	Margin (dB)
2412	Chain 0	-9.70	3.01	-6.69	8.00	14.69
	Chain 1	-9.67	3.01	-6.66	8.00	14.66
2437	Chain 0	-3.21	3.01	-0.20	8.00	8.20
	Chain 1	-2.77	3.01	0.24	8.00	7.76
2462	Chain 0	-9.93	3.01	-6.92	8.00	14.92
	Chain 1	-8.70	3.01	-5.69	8.00	13.69

Note(s):

The following equation was used for spectrum offset:

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

¹⁾ According to “KDB 662911 D01 Multiple Transmitter Output v1r02 In-band Power Spectral Density (PSD) Measurement”, 10 log (N_{ANT}) was be added at each output of the device.

Since the device have two antennas, 10 log(N_{ANT}) will be 3.01 dB.

²⁾ Total power density = Each of the spectral power density (dBm) + 10 log(N_{ANT}) (dB)

According to the KDB 662911 D01 v01r02, the directional gain of the correlated signal for the power spectral density is as in the following table.

Frequency Band (GHz)	Antenna G1 (dBi)	Antenna G2 (dBi)	³⁾ Directional gain for CCD mode (dBi)	⁴⁾ Directional gain for correlated signal (dBi)	Antenna limit (dBi)
2.4	2.85	2.82	5.86	5.85	6.00

³⁾ Directional gain for CCD mode (correlated signal) = G_{ANT} + 10log(N_{ANT}/N_{SS}) dB for N_{ANT} = 2, N_{SS} = 1

⁴⁾ Directional gain for the correlated signal with unequal antenna gains, with equal transmit powers = 10 log[(10^{G1/20} + 10^{G2/20})/N_{ANT}] dBi for N_{ANT} = 2

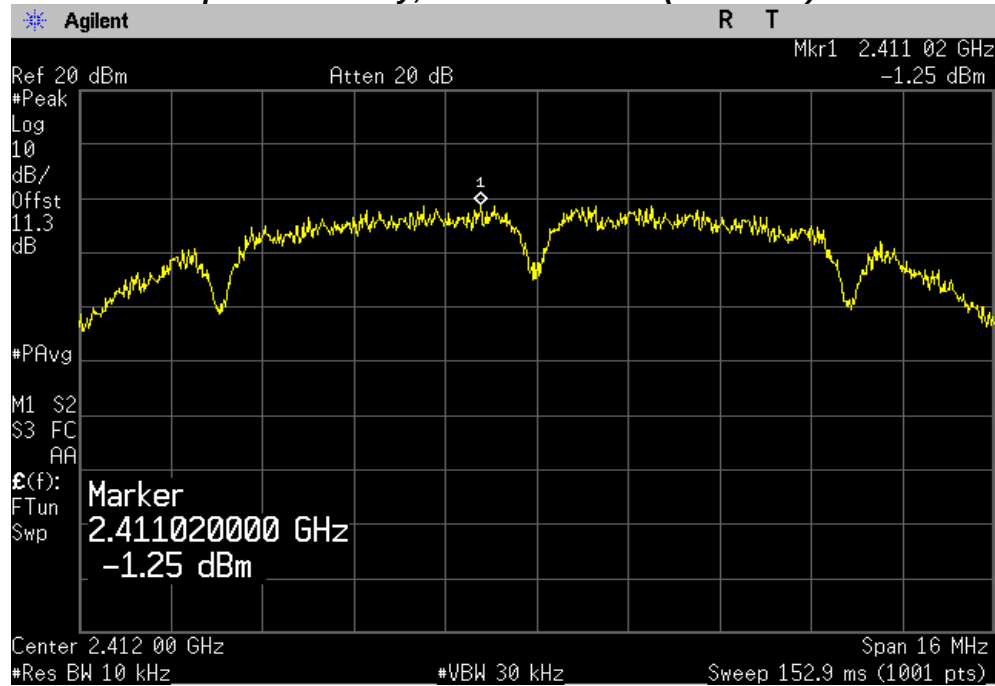
The maximum directional gain is 5.86 dBi.

PLOT OF TEST DATA

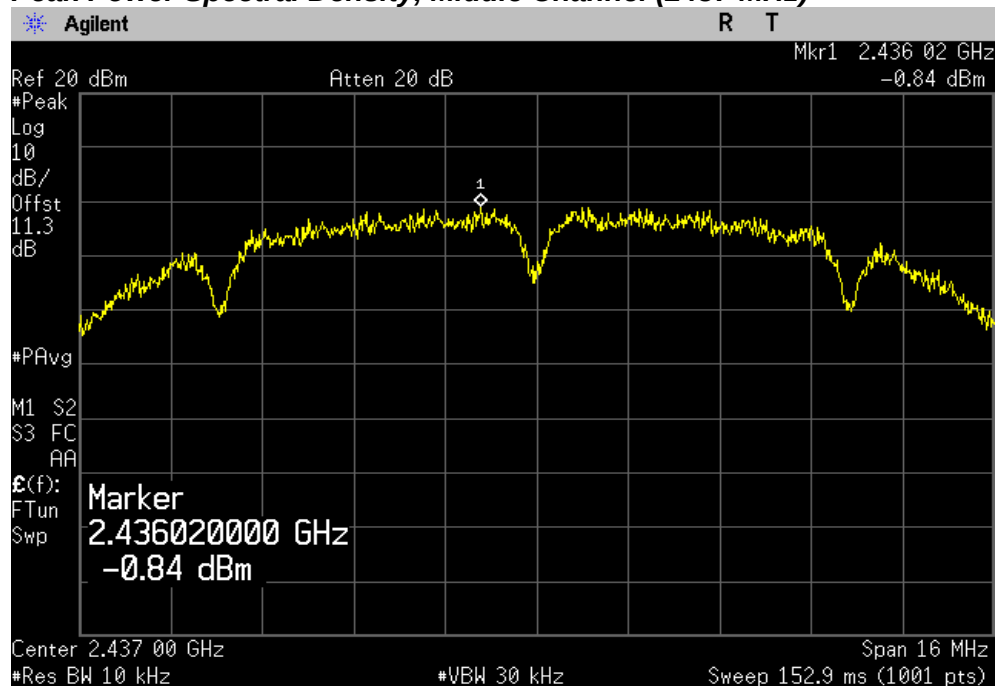
802.11b mode

Chain 0

Peak Power Spectral Density, Lowest Channel (2412 MHz)

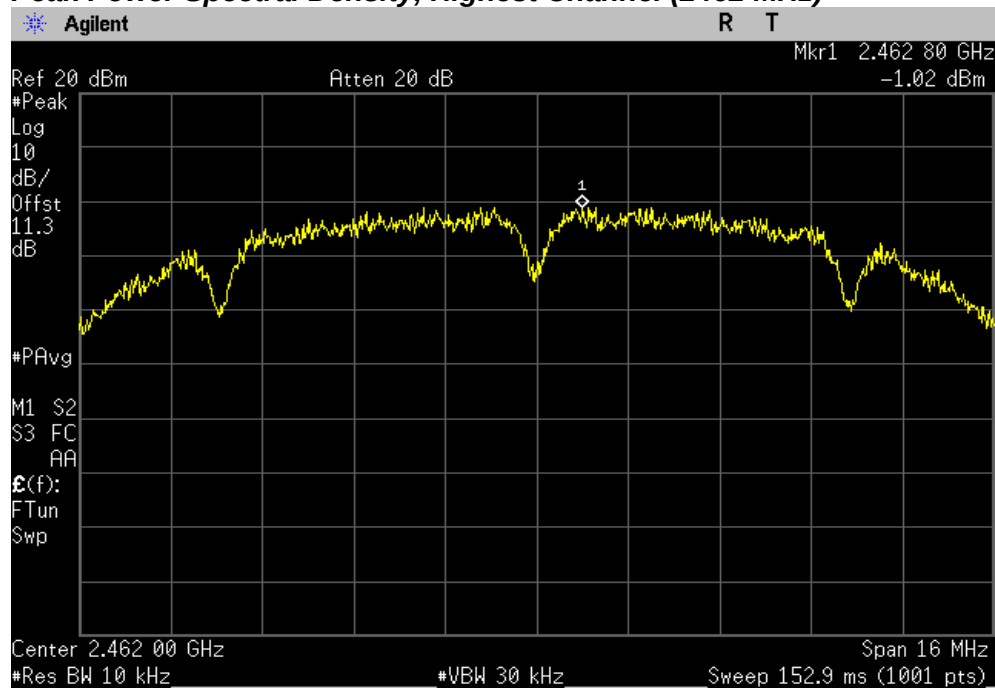


Peak Power Spectral Density, Middle Channel (2437 MHz)



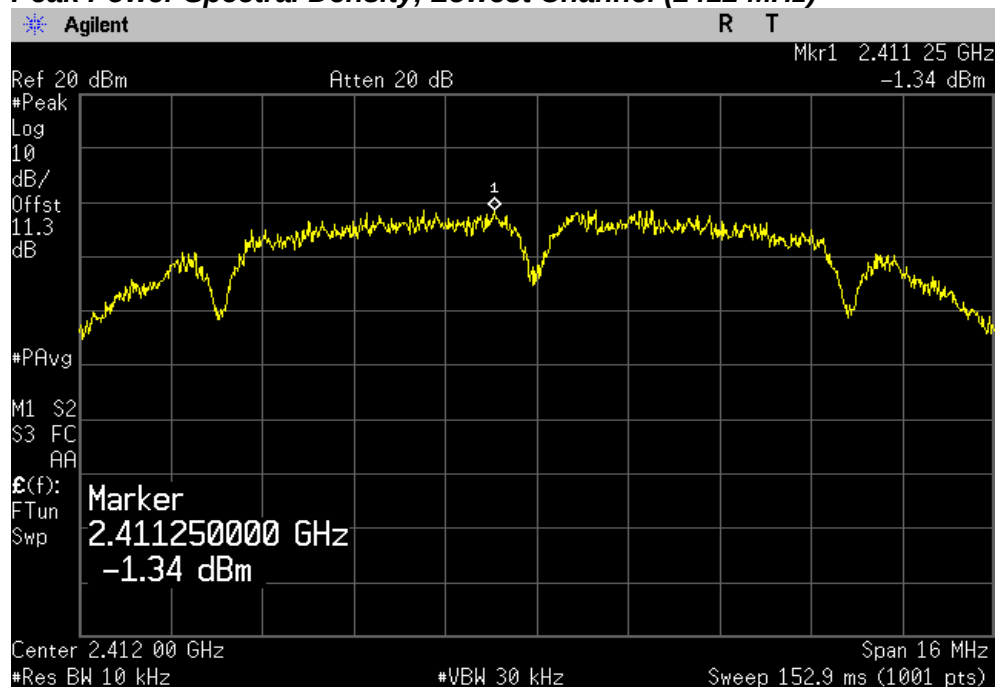
PLOT OF TEST DATA

Peak Power Spectral Density, Highest Channel (2462 MHz)



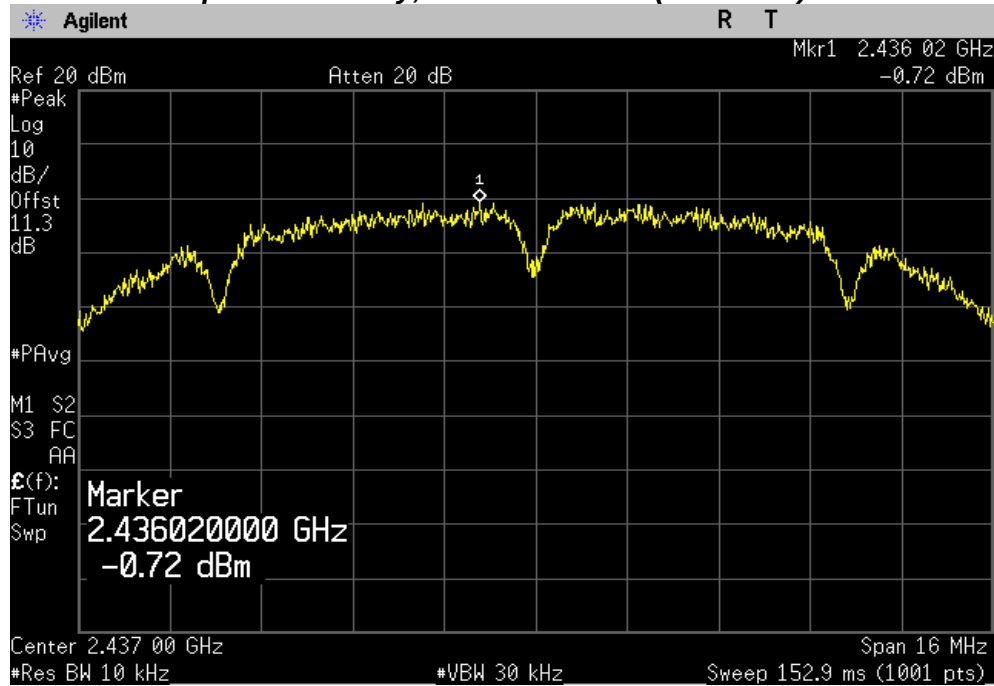
Chain 1

Peak Power Spectral Density, Lowest Channel (2412 MHz)

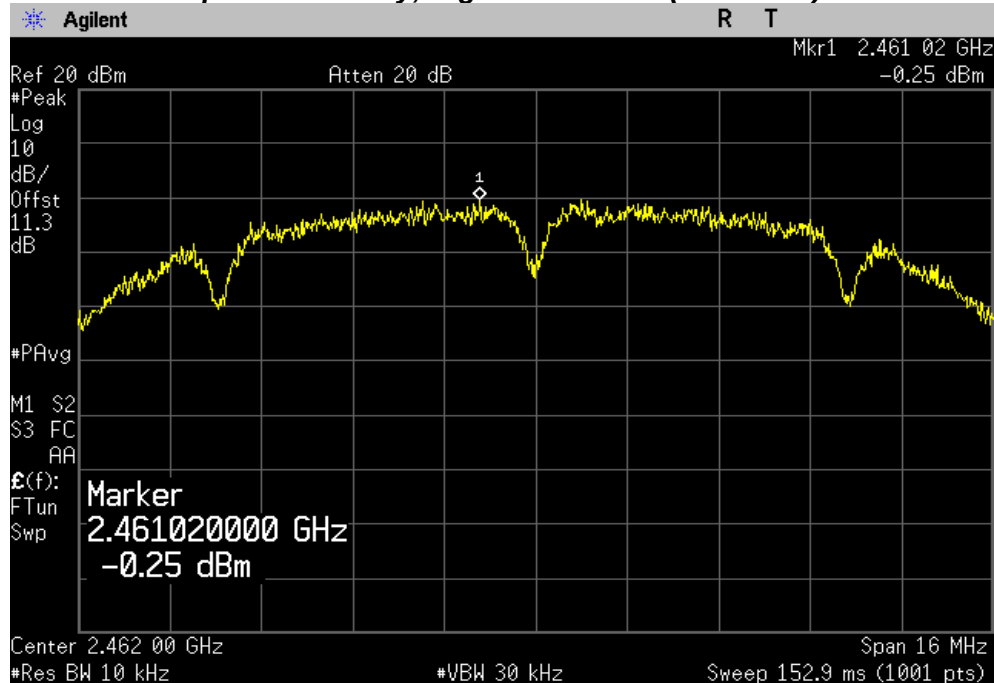


PLOT OF TEST DATA

Peak Power Spectral Density, Middle Channel (2437 MHz)



Peak Power Spectral Density, Highest Channel (2462 MHz)

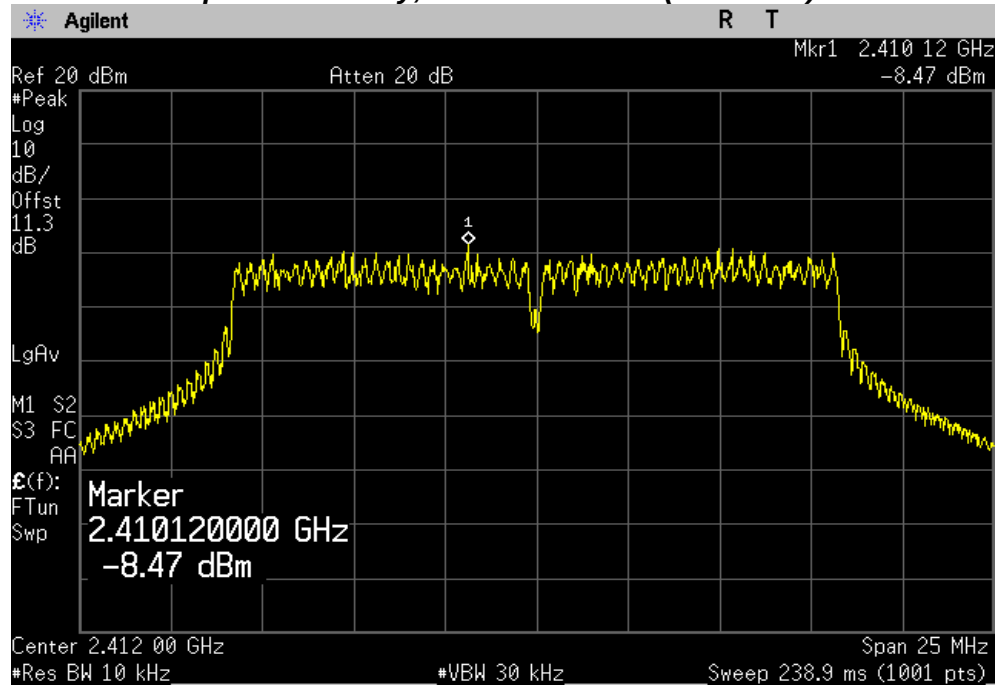


PLOT OF TEST DATA

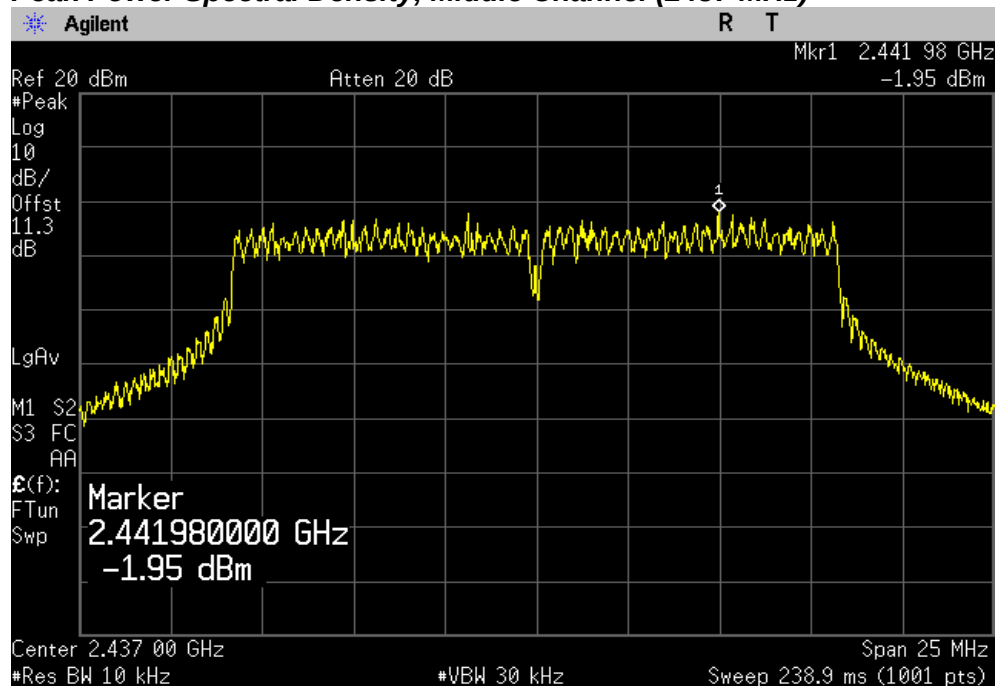
802.11g mode

Chain 0

Peak Power Spectral Density, Lowest Channel (2412 MHz)

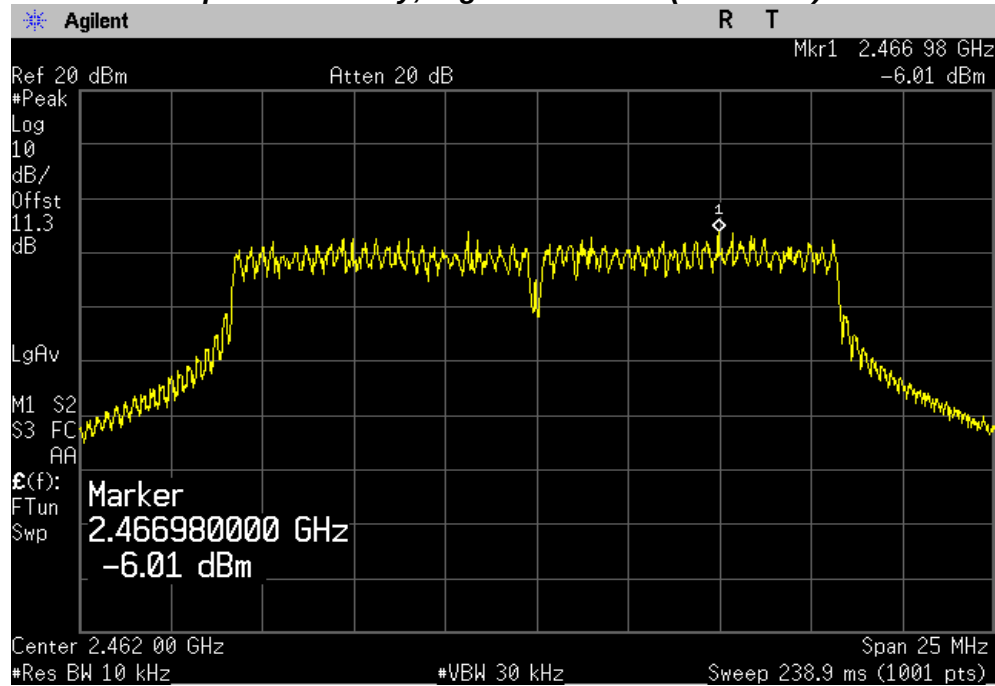


Peak Power Spectral Density, Middle Channel (2437 MHz)



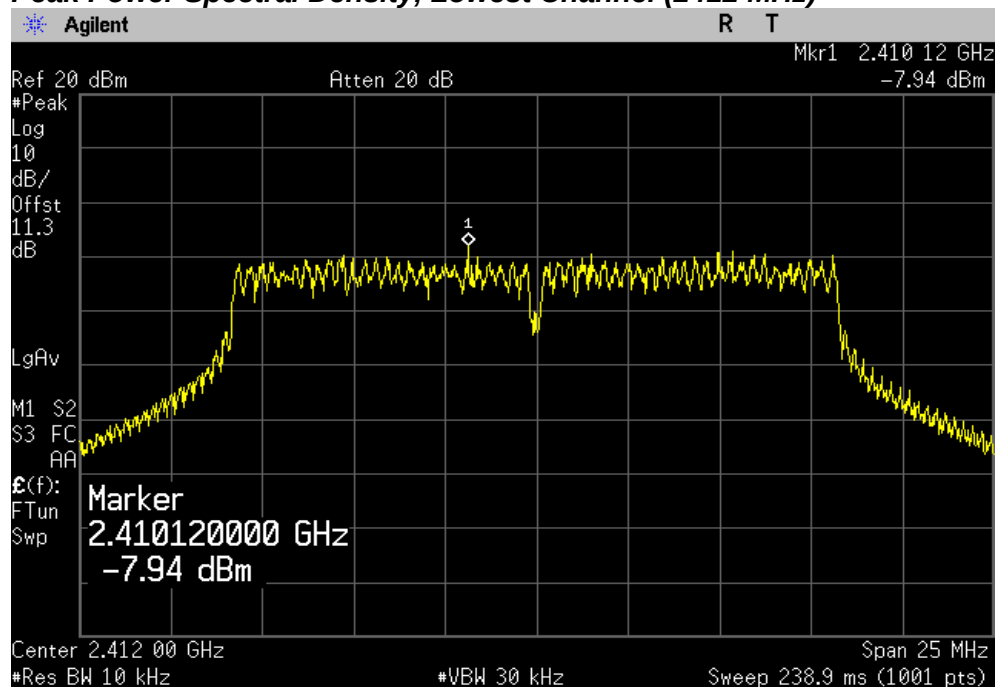
PLOT OF TEST DATA

Peak Power Spectral Density, Highest Channel (2462 MHz)



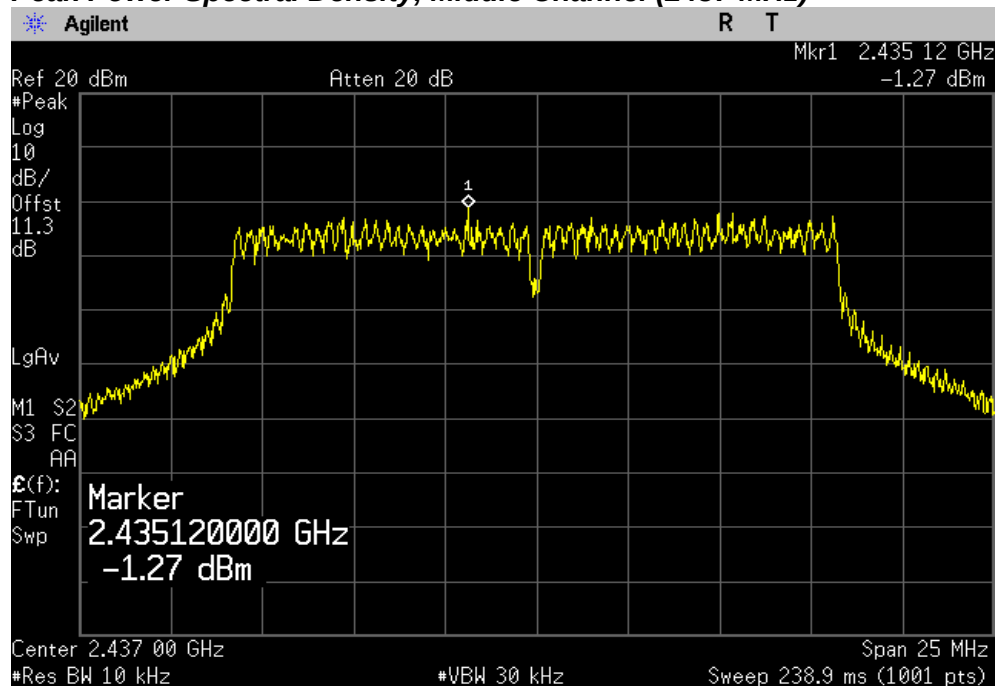
Chain 1

Peak Power Spectral Density, Lowest Channel (2412 MHz)

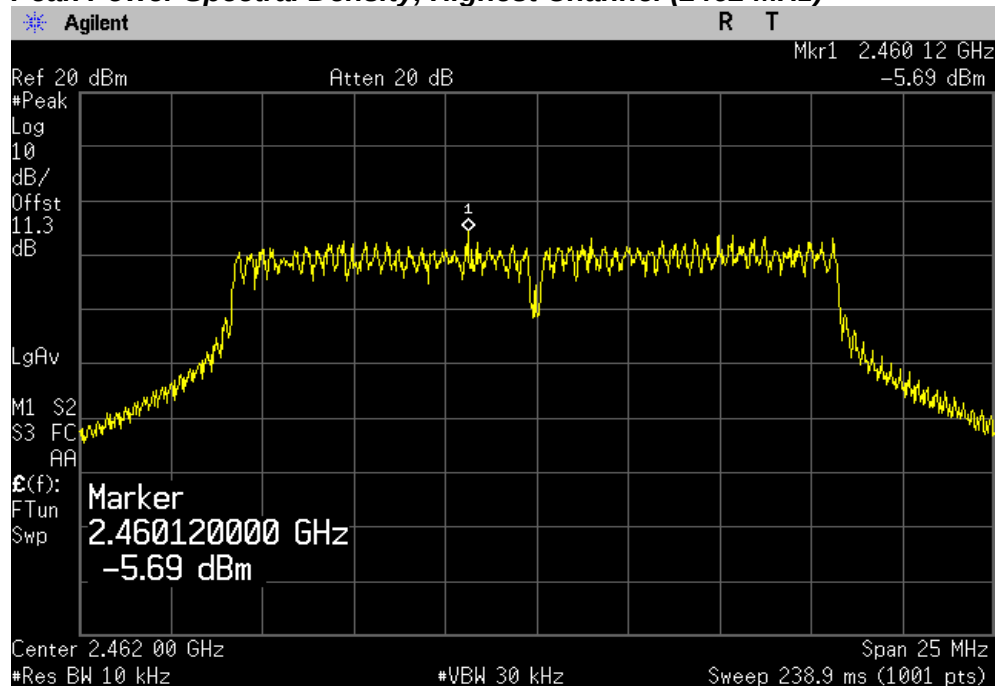


PLOT OF TEST DATA

Peak Power Spectral Density, Middle Channel (2437 MHz)



Peak Power Spectral Density, Highest Channel (2462 MHz)

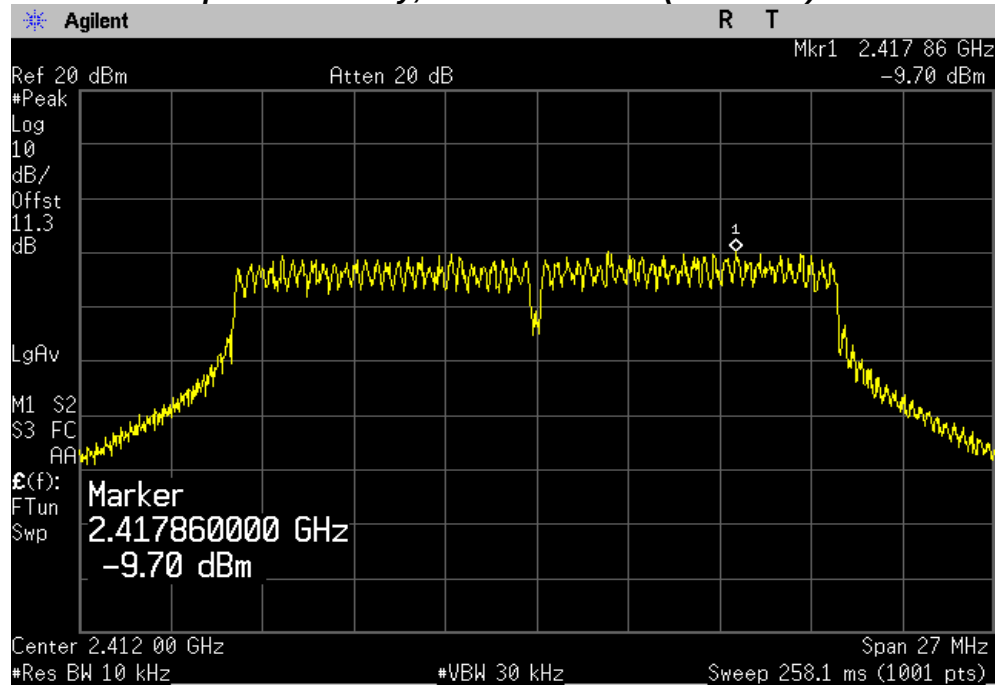


PLOT OF TEST DATA

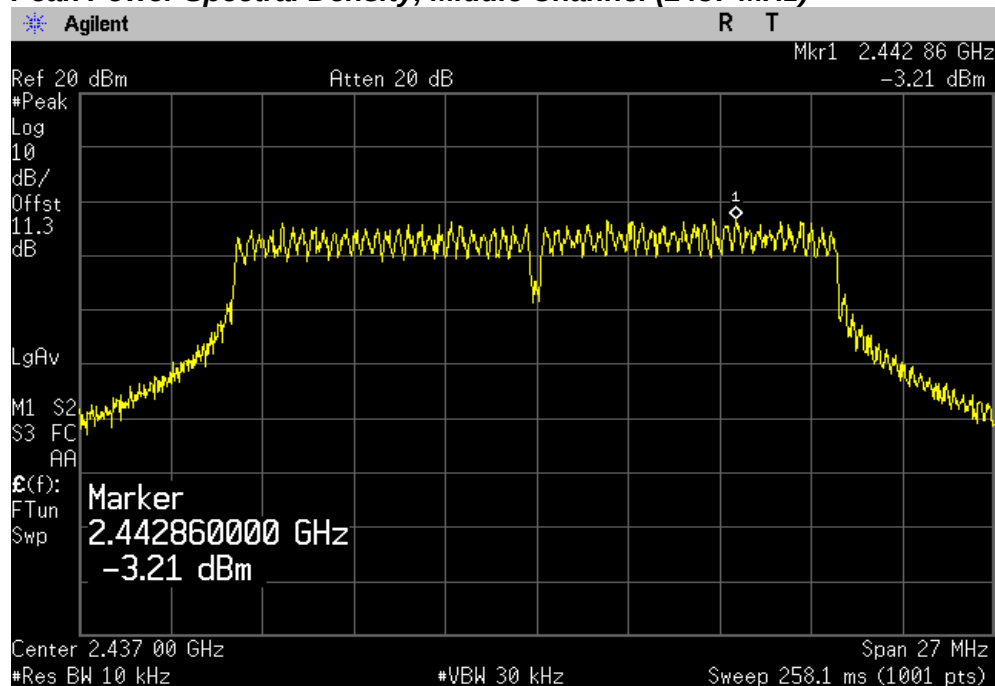
802.11n mode

Chain 0

Peak Power Spectral Density, Lowest Channel (2412 MHz)

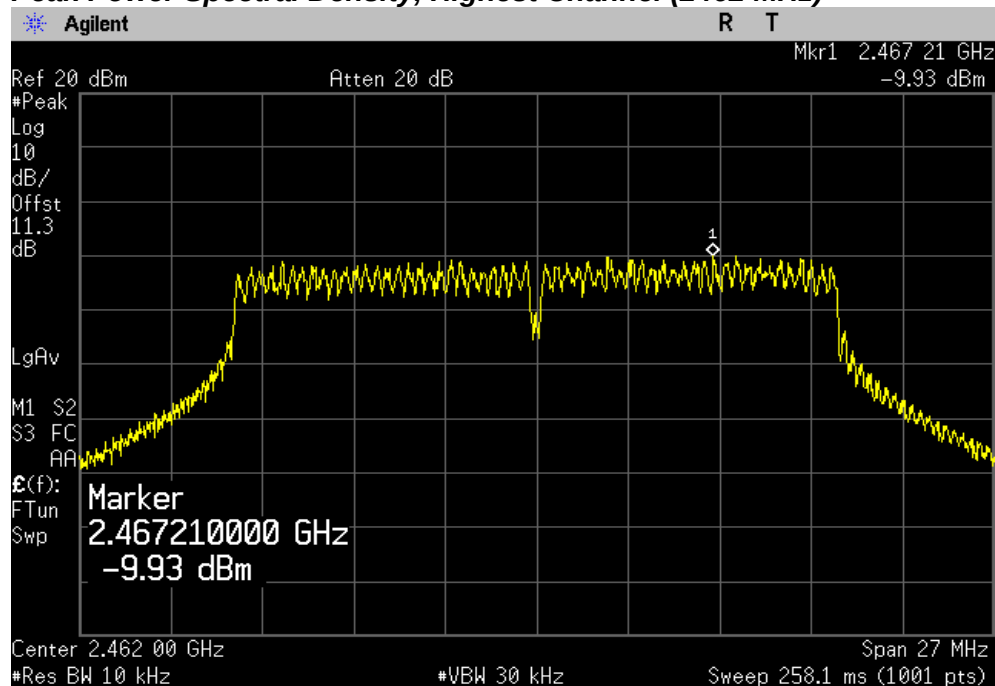


Peak Power Spectral Density, Middle Channel (2437 MHz)



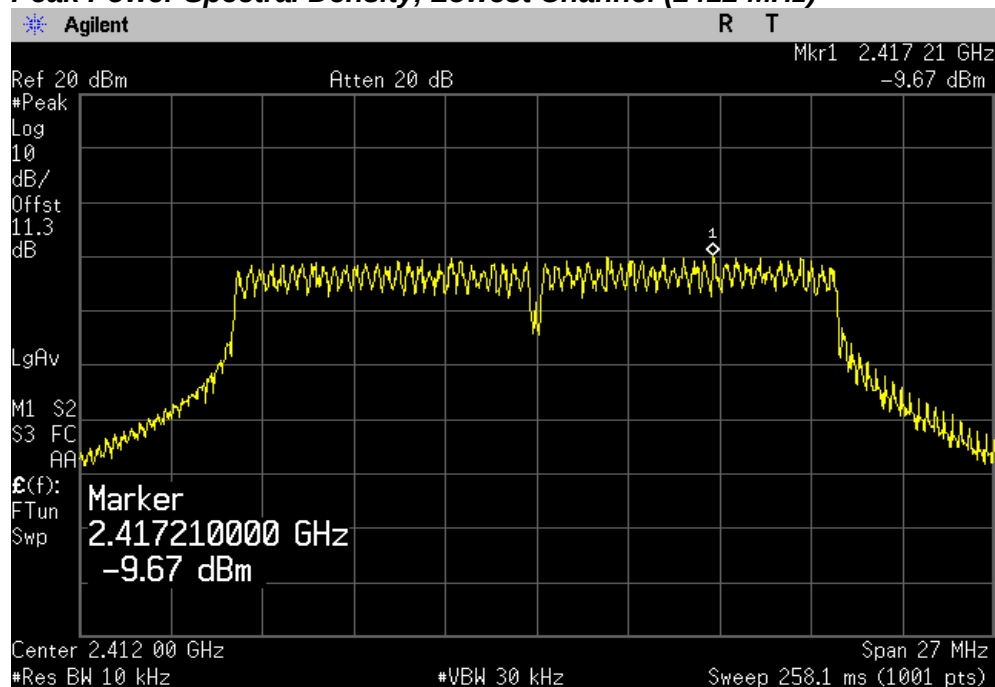
PLOT OF TEST DATA

Peak Power Spectral Density, Highest Channel (2462 MHz)



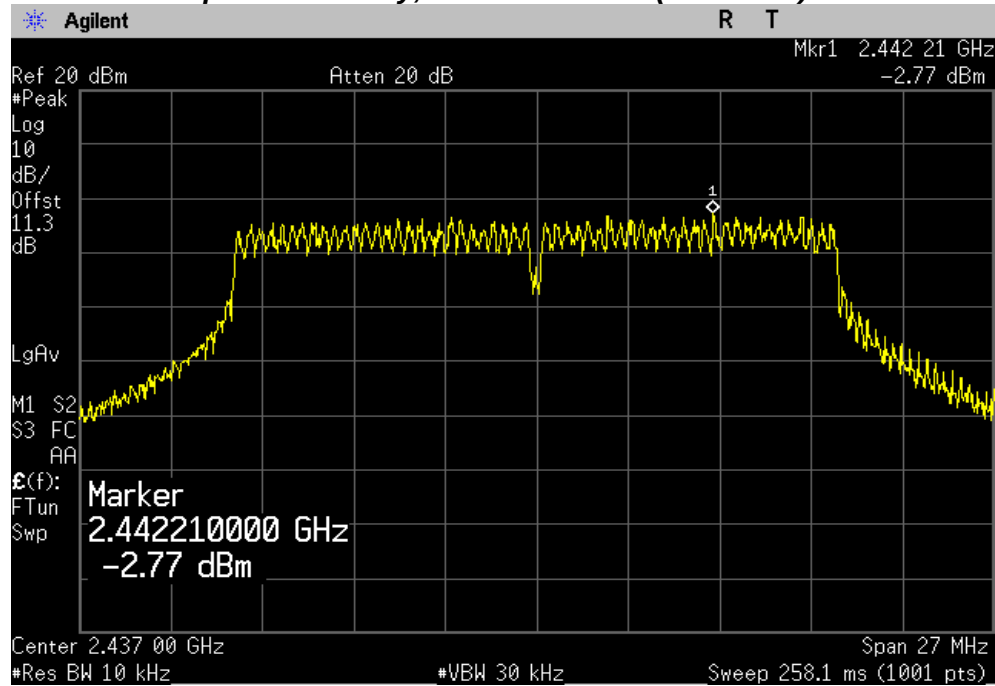
Chain 1

Peak Power Spectral Density, Lowest Channel (2412 MHz)

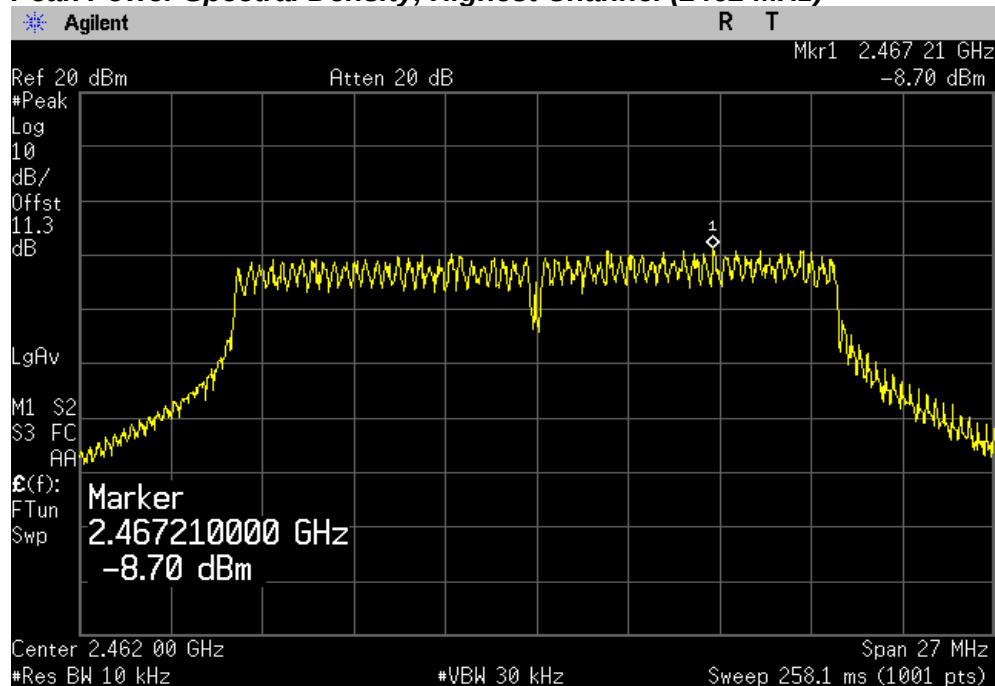


PLOT OF TEST DATA

Peak Power Spectral Density, Middle Channel (2437 MHz)



Peak Power Spectral Density, Highest Channel (2462 MHz)



TEST DATA

8.5.2 Power Spectral Density – 5 GHz band

FCC §15.247(e)

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

802.11a

Frequency (MHz)	TX Chain	Power Spectral Density (dBm)	¹⁾ 10 log(N _{ANT}) (dB)	²⁾ Total Power Density(dBm)	³⁾ Limit (dBm)	Margin (dB)
5745	Chain 0	-5.65	3.01	-2.64	6.57	9.21
	Chain 1	-5.20	3.01	-2.19	6.57	8.76
5785	Chain 0	-1.97	3.01	1.04	6.57	5.53
	Chain 1	-2.18	3.01	0.83	6.57	5.74
5825	Chain 0	-6.46	3.01	-3.45	6.57	10.02
	Chain 1	-7.23	3.01	-4.22	6.57	10.79

802.11n

Frequency (MHz)	TX Chain	Power Spectral Density (dBm)	¹⁾ 10 log(N _{ANT}) (dB)	²⁾ Total Power Density(dBm)	³⁾ Limit (dBm)	Margin (dB)
5745	Chain 0	-7.25	3.01	-4.24	6.57	10.81
	Chain 1	-7.11	3.01	-4.10	6.57	10.67
5785	Chain 0	-3.96	3.01	-0.95	6.57	7.52
	Chain 1	-4.44	3.01	-1.43	6.57	8.00
5825	Chain 0	-8.19	3.01	-5.18	6.57	11.75
	Chain 1	-8.98	3.01	-5.97	6.57	12.54

Note(s):

The following equation was used for spectrum offset:

$$\text{Spectrum offset (dB)} = \text{Attenuator (dB)} + \text{Cable Loss (dB)} + \text{SMA Type Connector Loss (dB)}$$

¹⁾ According to “KDB 662911 D01 Multiple Transmitter Output v1r02 In-band Power Spectral Density (PSD) Measurement”, $10 \log(N_{ANT})$ was be added at each output of the device.

Since the device have two antennas, $10 \log(N_{ANT})$ will be 3.01 dB.

²⁾ Total power density = Each of the spectral power density (dBm) + $10 \log(N_{ANT})$ (dB)

³⁾ As the directional gain is 7.43 dBi, the peak power spectral density limit 8 dBm should be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.

Therefore, the power spectral density limit is 6.57 dBm.

According to the KDB 662911 D01 v01r02, the directional gain of the correlated signal for the power spectral density is as in the following table.

Frequency Band (GHz)	Antenna G1 (dBi)	Antenna G2 (dBi)	⁴⁾ Directional gain for CCD mode (dBi)	⁵⁾ Directional gain for correlated signal (dBi)	Antenna limit (dBi)
5.7	4.42	3.50	7.43	6.98	6.00

⁴⁾ Directional gain for CCD mode (correlated signal) = $G_{ANT} + 10 \log(N_{ANT}/N_{SS})$ dB for $N_{ANT} = 2$, $N_{SS} = 1$

⁵⁾ Directional gain for the correlated signal with unequal antenna gains, with equal transmit powers
 $= 10 \log[(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}]$ dBi for $N_{ANT} = 2$

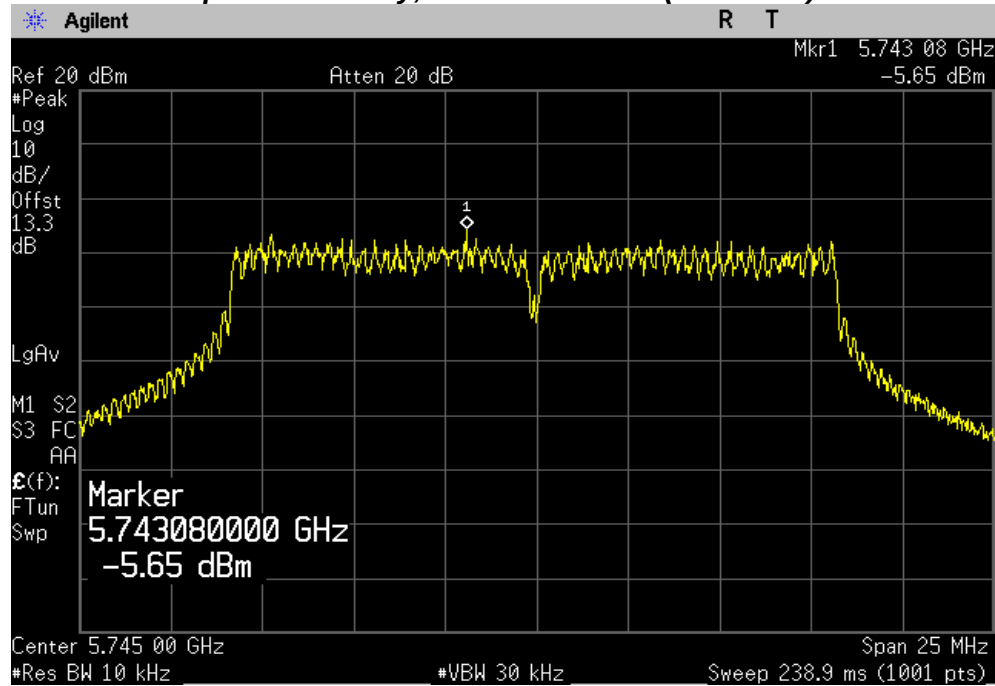
The maximum directional gain is 7.43 dBi.

PLOT OF TEST DATA

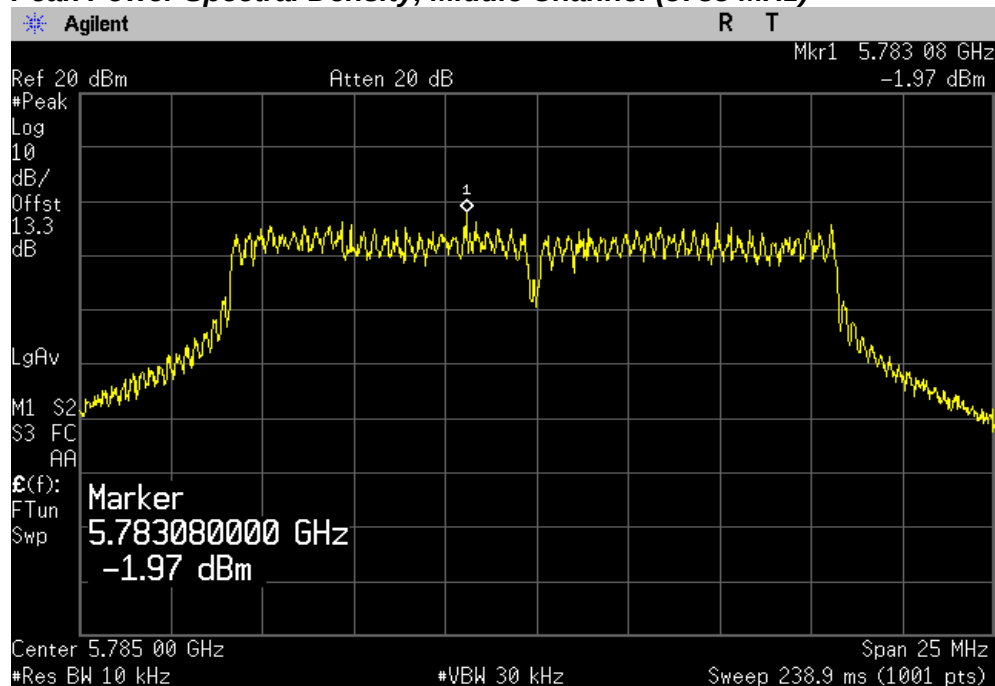
802.11a mode

Chain 0

Peak Power Spectral Density, Lowest Channel (5745 MHz)

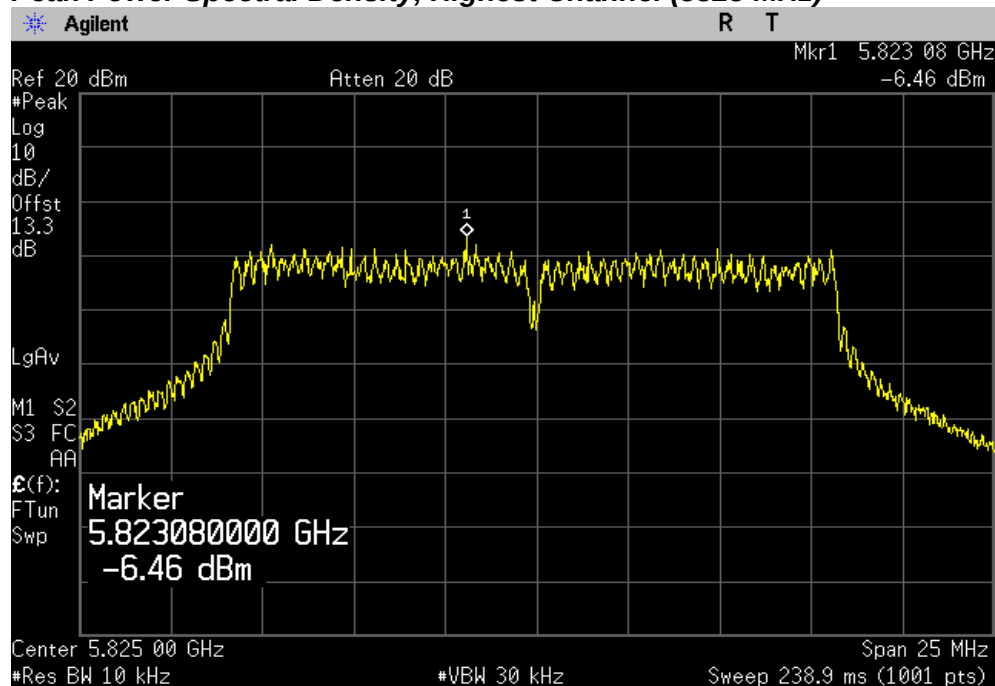


Peak Power Spectral Density, Middle Channel (5785 MHz)



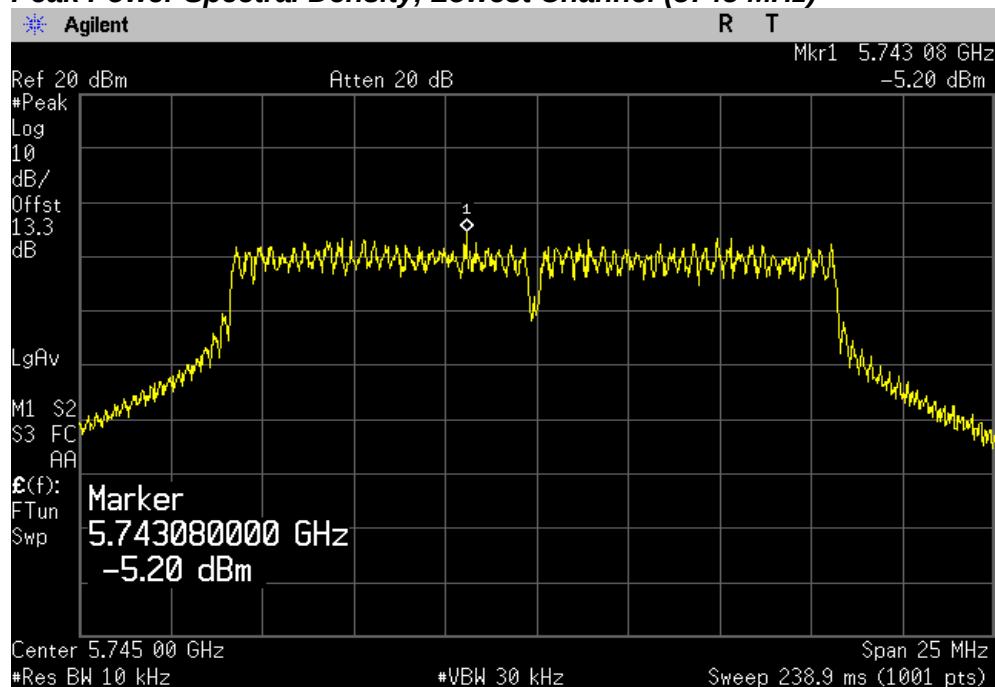
PLOT OF TEST DATA

Peak Power Spectral Density, Highest Channel (5825 MHz)



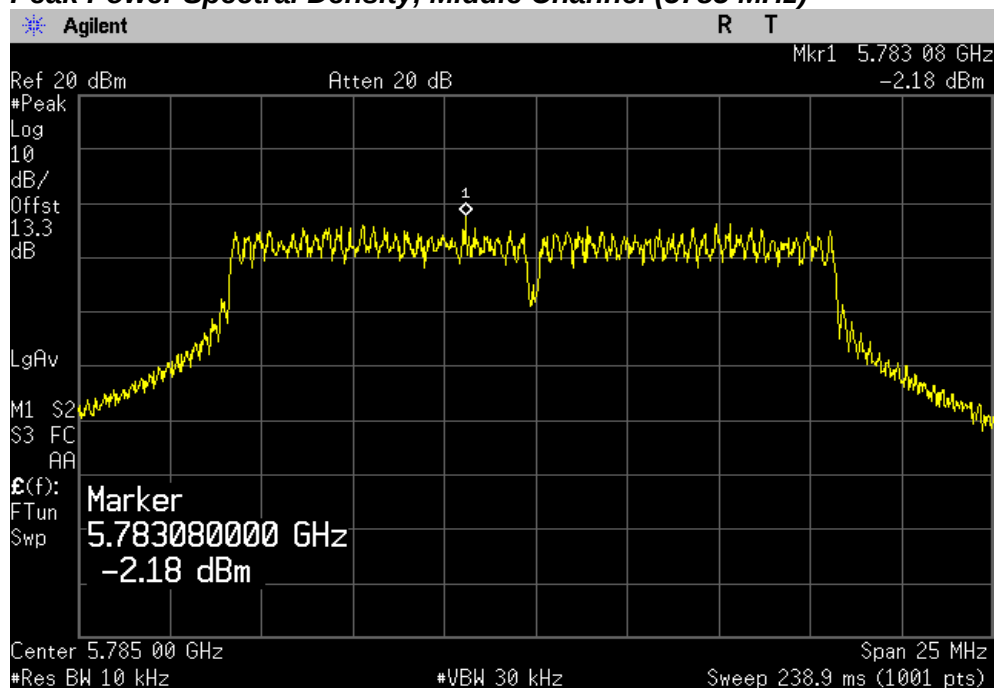
Chain 1

Peak Power Spectral Density, Lowest Channel (5745 MHz)

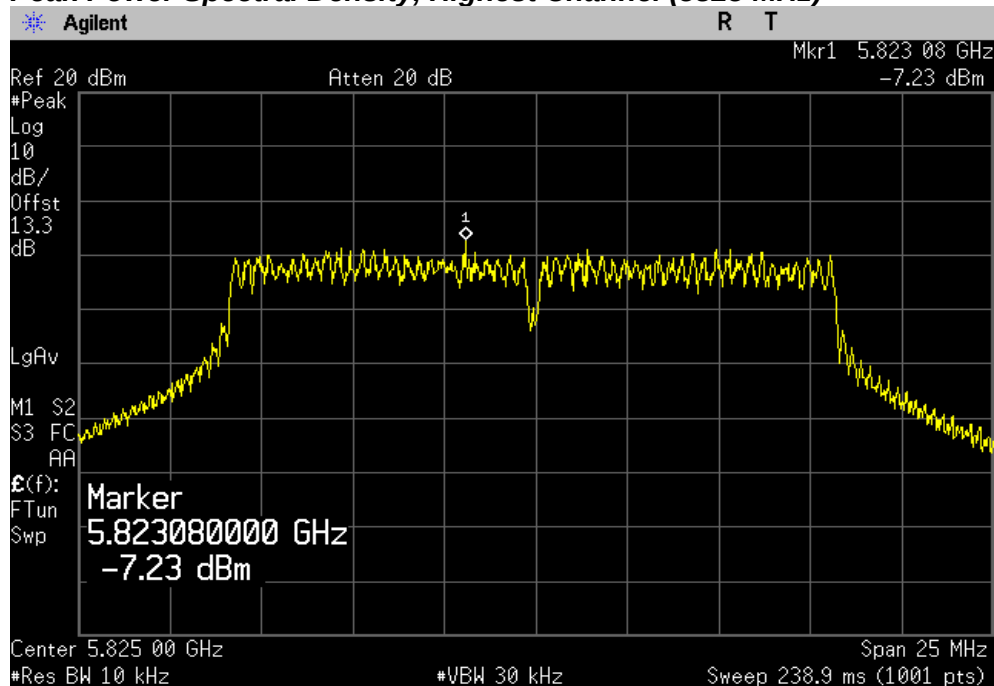


PLOT OF TEST DATA

Peak Power Spectral Density, Middle Channel (5785 MHz)



Peak Power Spectral Density, Highest Channel (5825 MHz)

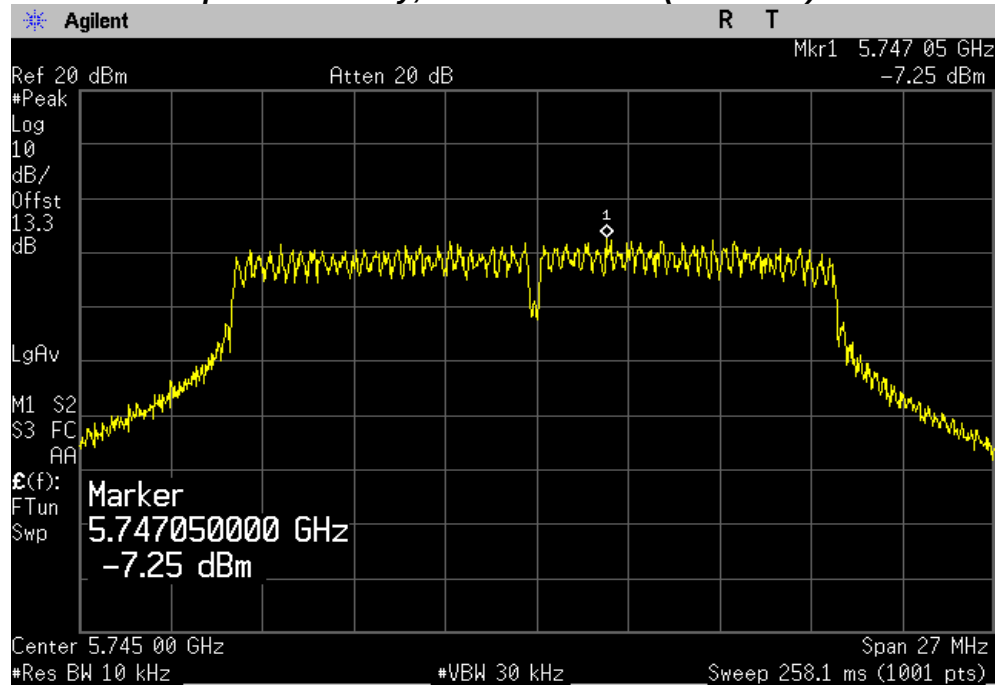


PLOT OF TEST DATA

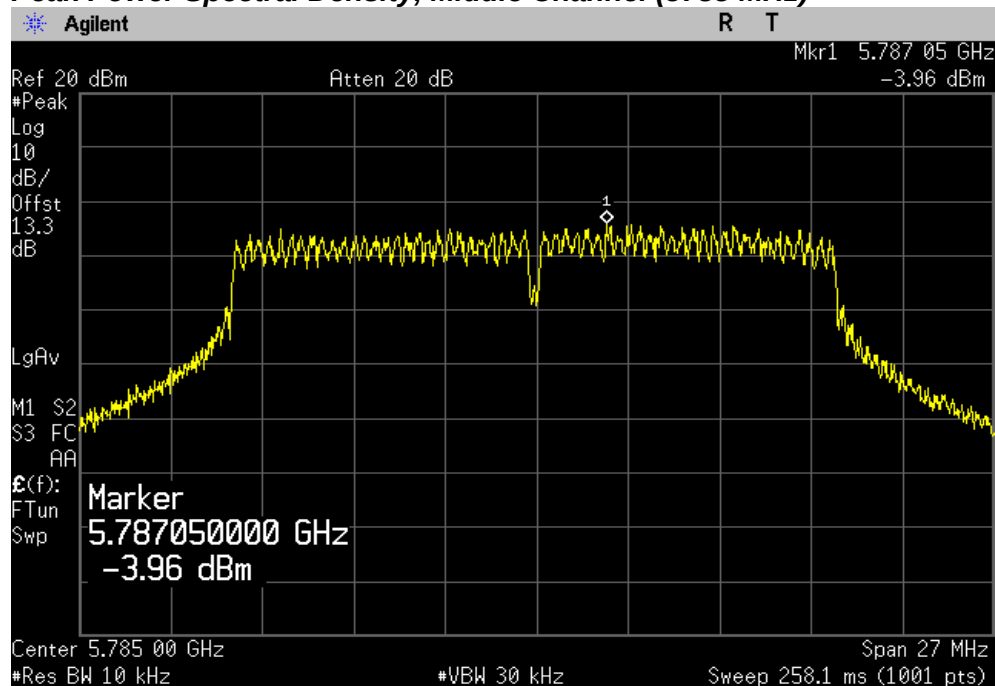
802.11n mode

Chain 0

Peak Power Spectral Density, Lowest Channel (5745 MHz)

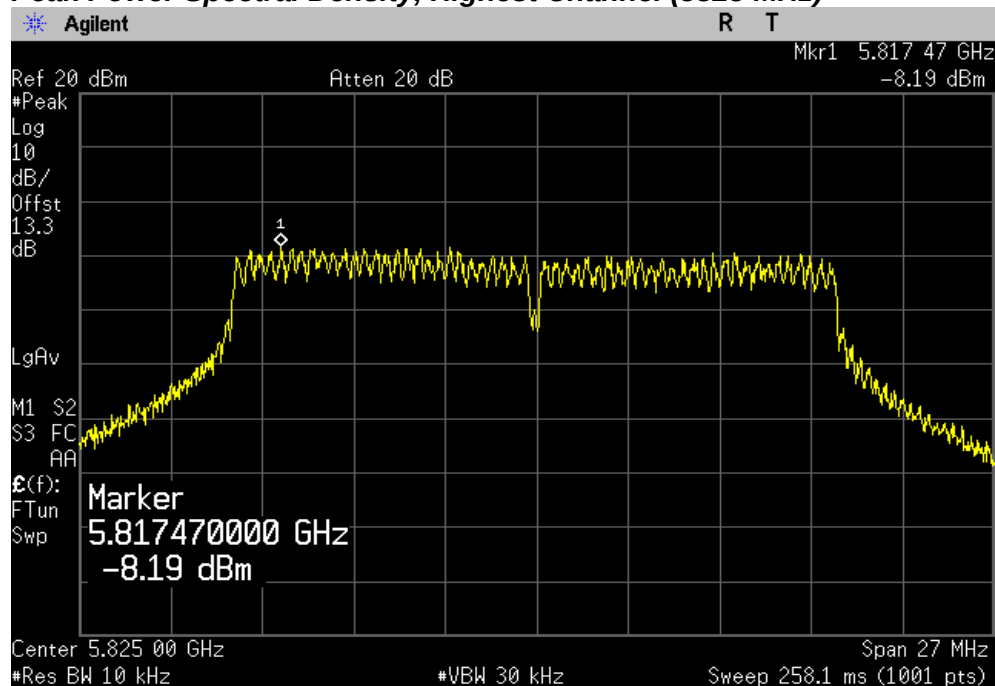


Peak Power Spectral Density, Middle Channel (5785 MHz)



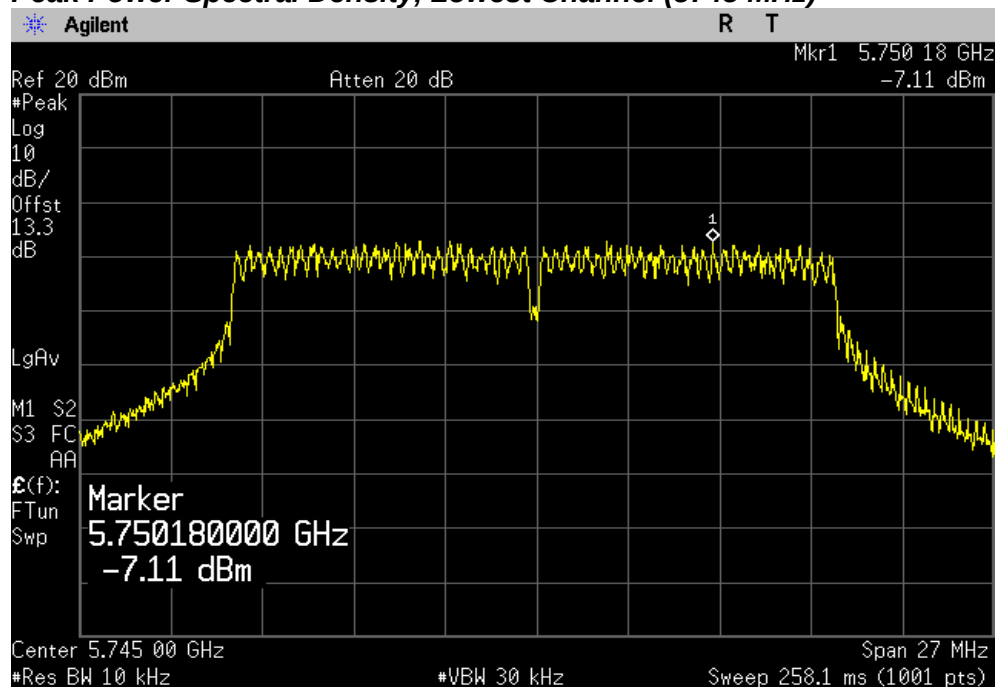
PLOT OF TEST DATA

Peak Power Spectral Density, Highest Channel (5825 MHz)



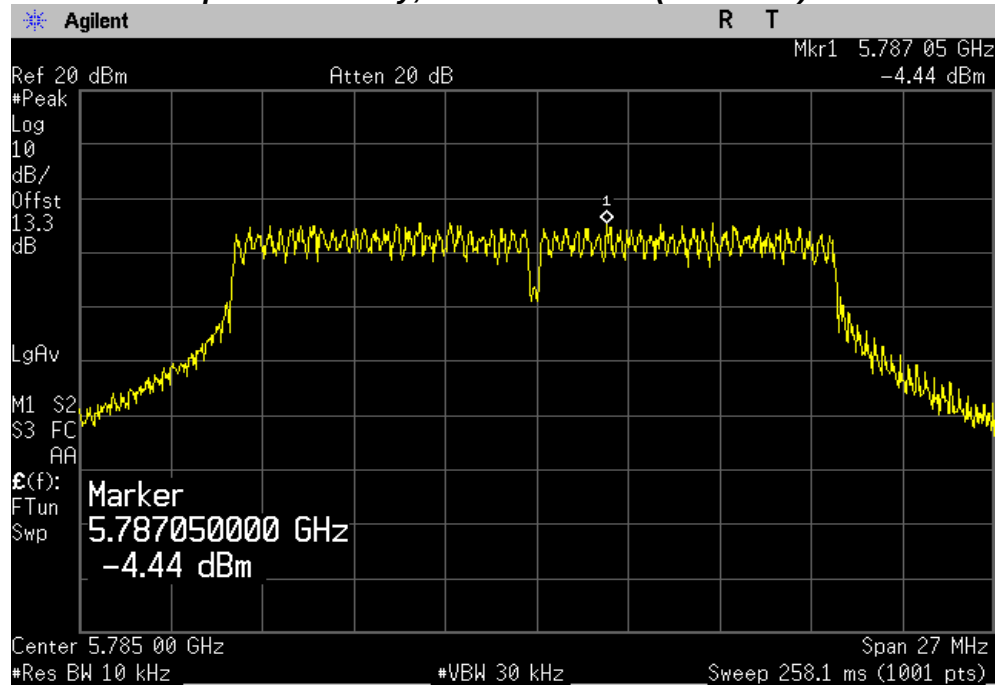
Chain 1

Peak Power Spectral Density, Lowest Channel (5745 MHz)

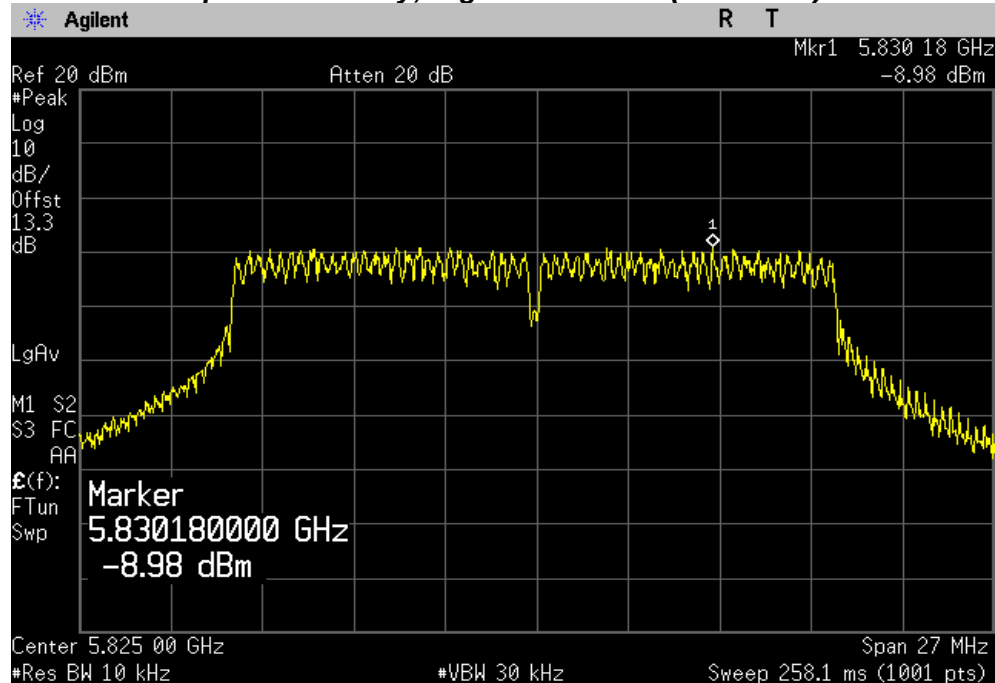


PLOT OF TEST DATA

Peak Power Spectral Density, Middle Channel (5785 MHz)



Peak Power Spectral Density, Highest Channel (5825 MHz)



TEST DATA

8.6 Conducted Spurious Emissions

8.6.1 Conducted Spurious Emissions – 2.4 GHz band

FCC §15.247(d)

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

802.11b mode

Channel	Frequency (MHz)	Reference Level (dBm)		Conducted Spurious Emissions (dBc)	Limit (dBc)
		Chain 0	Chain 1		
Low	2412	6.64	6.70	More than 30 dBc	30
Middle	2437	6.85	6.82	More than 30 dBc	30
High	2462	6.91	7.30	More than 30 dBc	30

802.11g mode

Channel	Frequency (MHz)	Reference Level (dBm)		Conducted Spurious Emissions (dBc)	Limit (dBc)
		Chain 0	Chain 1		
Low	2412	-0.40	-0.12	More than 30 dBc	30
Middle	2437	6.34	6.74	More than 30 dBc	30
High	2462	2.43	2.81	More than 30 dBc	30

802.11n mode

Channel	Frequency (MHz)	Reference Level (dBm)		Conducted Spurious Emissions (dBc)	Limit (dBc)
		Chain 0	Chain 1		
Low	2412	-0.28	-0.10	More than 30 dBc	30
Middle	2437	6.20	6.81	More than 30 dBc	30
High	2462	-0.20	0.86	More than 30 dBc	30

Notes:

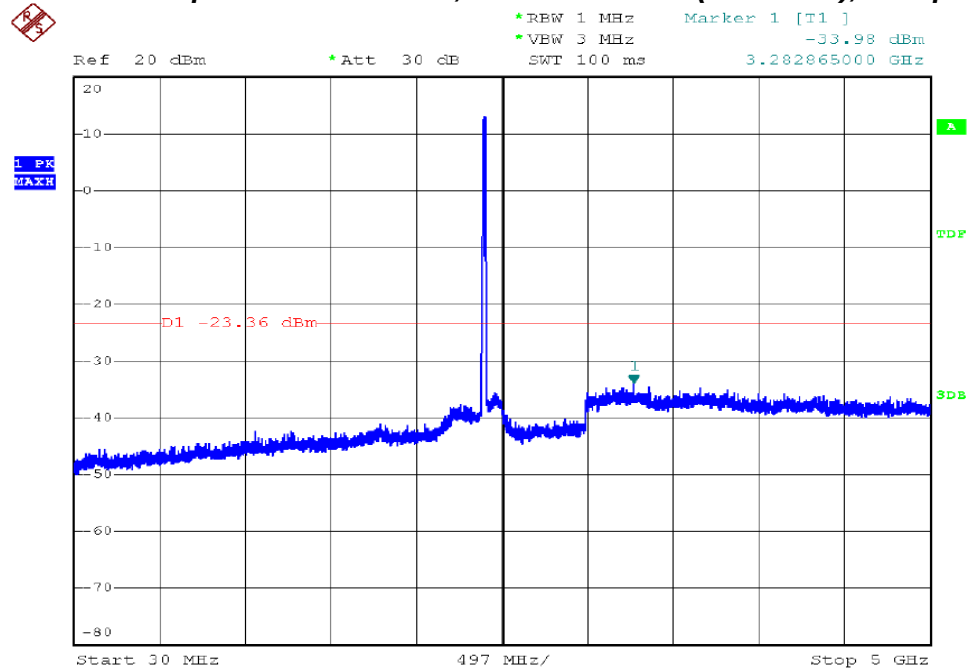
1. The cable and attenuator loss from 30 MHz to 25 GHz was reflected in spectrum analyzer with correction factor for the spurious emissions test.
2. RBW was set to 1 MHz rather than 100 kHz in order to increase the test span.
3. The display line shown in the following plots indicates the limit at 30 dB below the fundamental emission level measured in a 100 kHz bandwidth.
4. For plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced RBW to ensure that no emissions were present.
5. For the following out of band conducted spurious emissions plots, the EUT was investigated in all available data rates for 802.11a,b,g,n modes. The worst case spurious emissions for the 2.4 GHz band were found while transmitting in 802.11g mode at 6 Mbps and are shown in the plots below.
6. During the test, the sweep point was set 8001 for the conducted spurious emissions test and 1001 for the Band Edge test.

PLOT OF TEST DATA

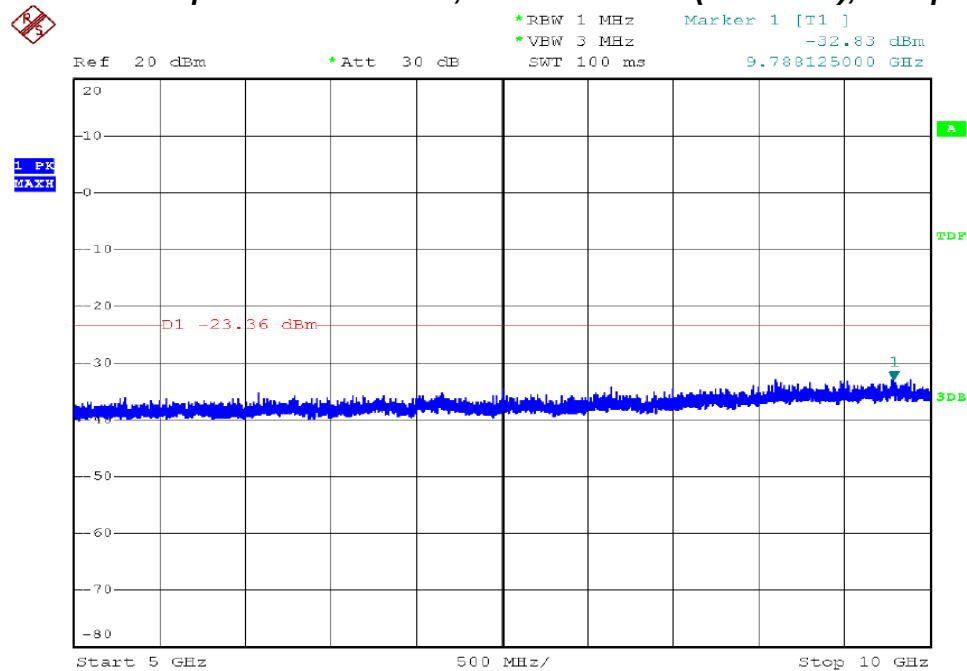
802.11g mode

Chain 0

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (2412 MHz), 6 Mbps data rate

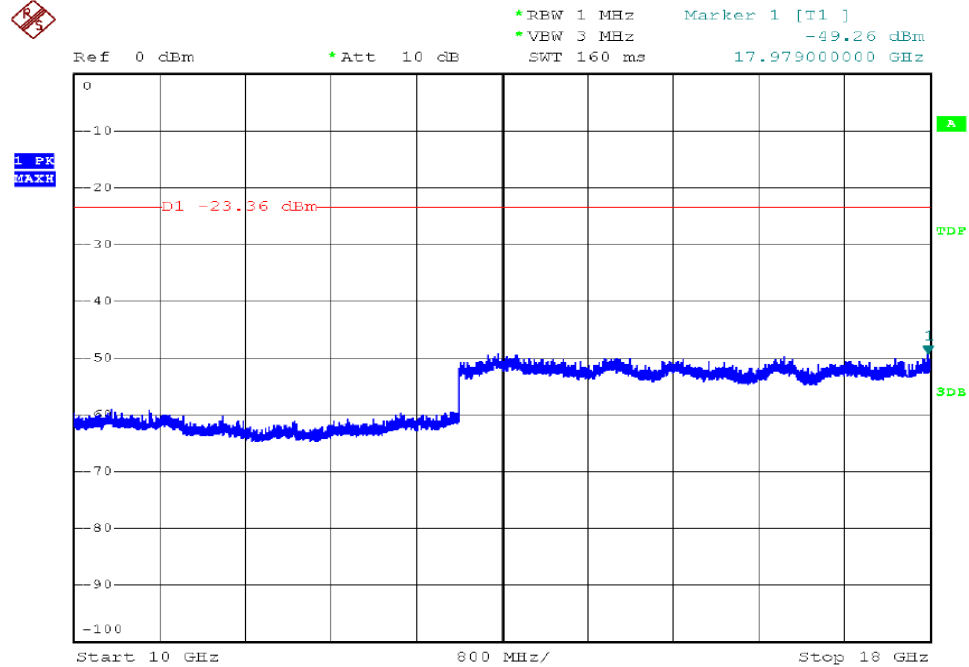


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (2412 MHz), 6 Mbps data rate

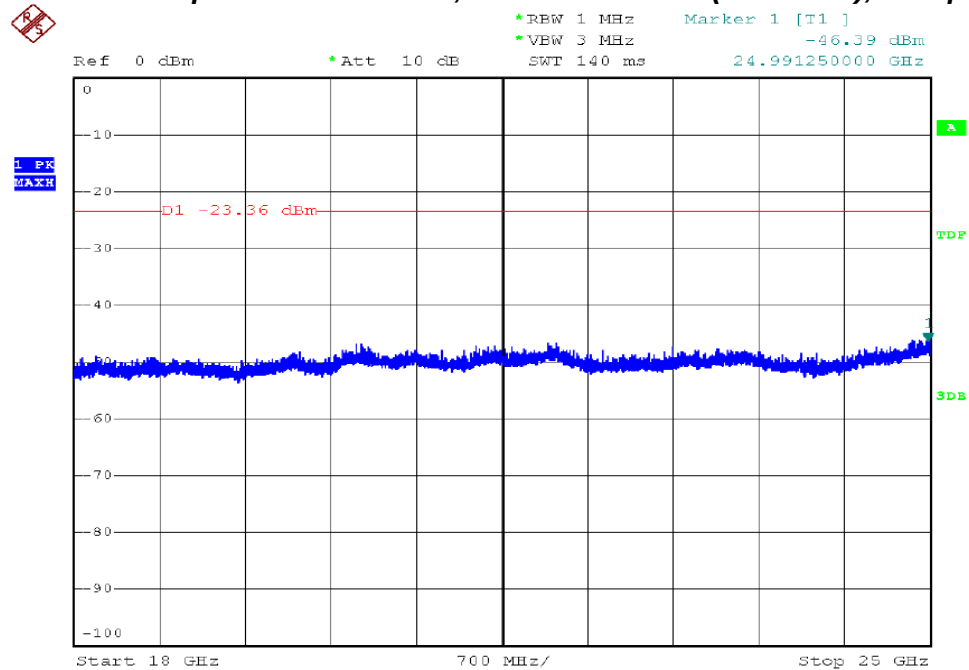


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (2412 MHz, 6 Mbps data rate)



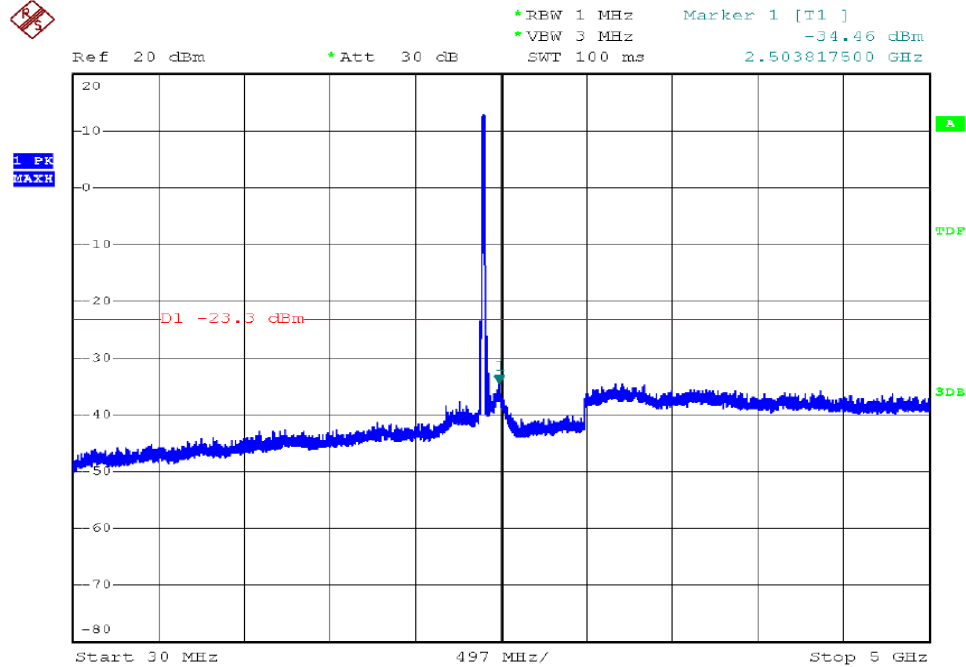
Conducted Spurious Emissions, 18 GHz ~ 25 GHz (2412 MHz), 6 Mbps data rate



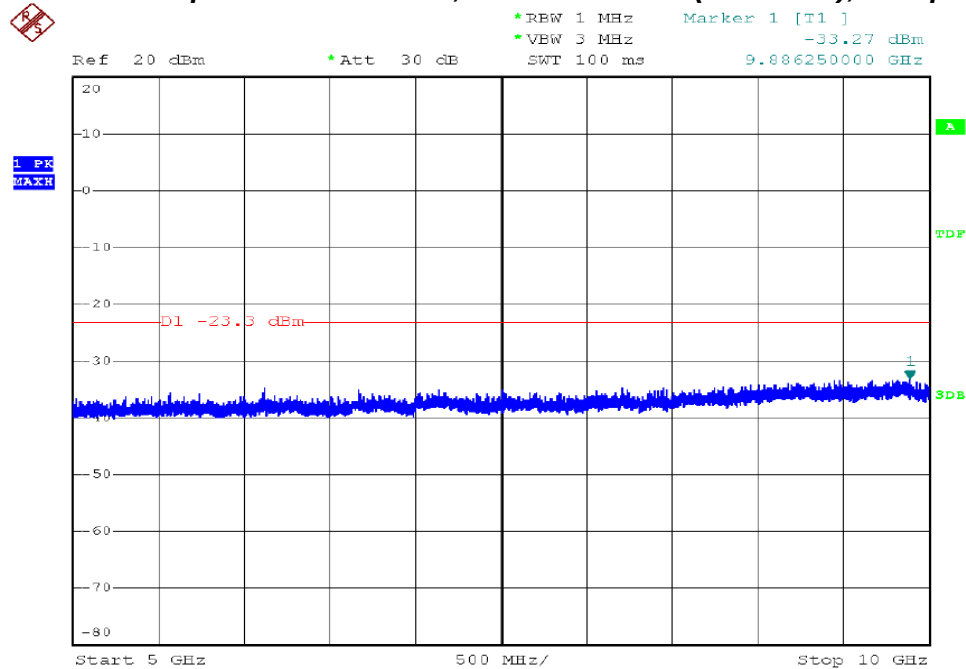
PLOT OF TEST DATA

Chain 1

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (2412 MHz), 6 Mbps data rate

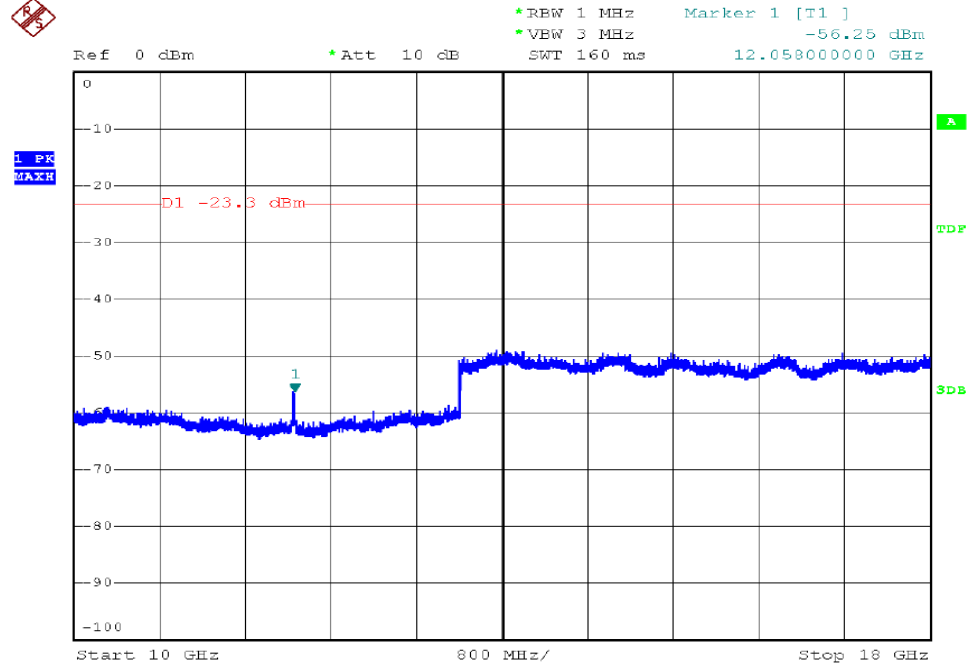


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (2412 MHz), 6 Mbps data rate

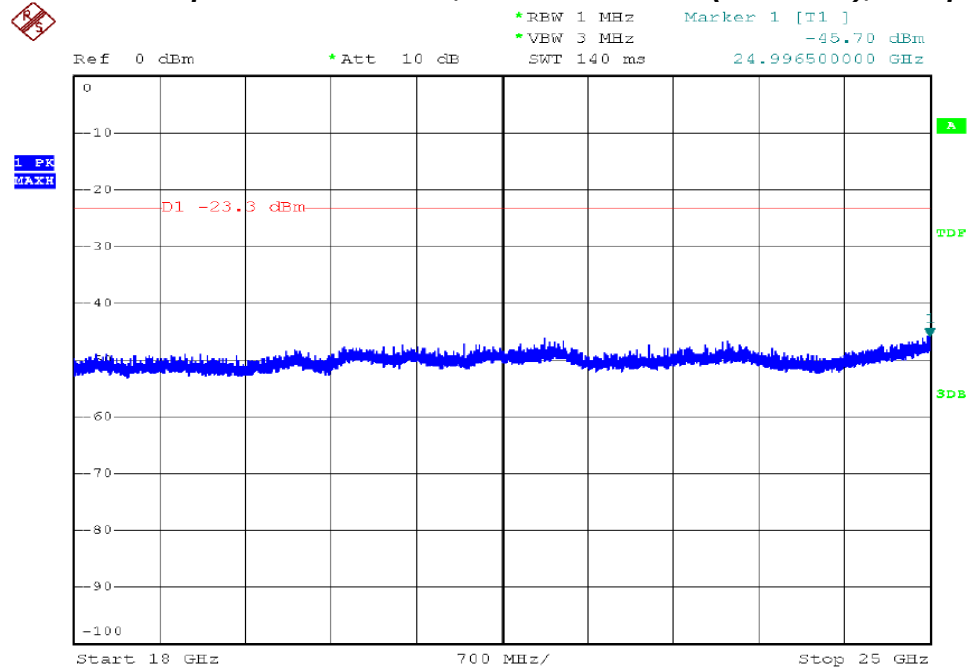


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (2412 MHz), 6 Mbps data rate



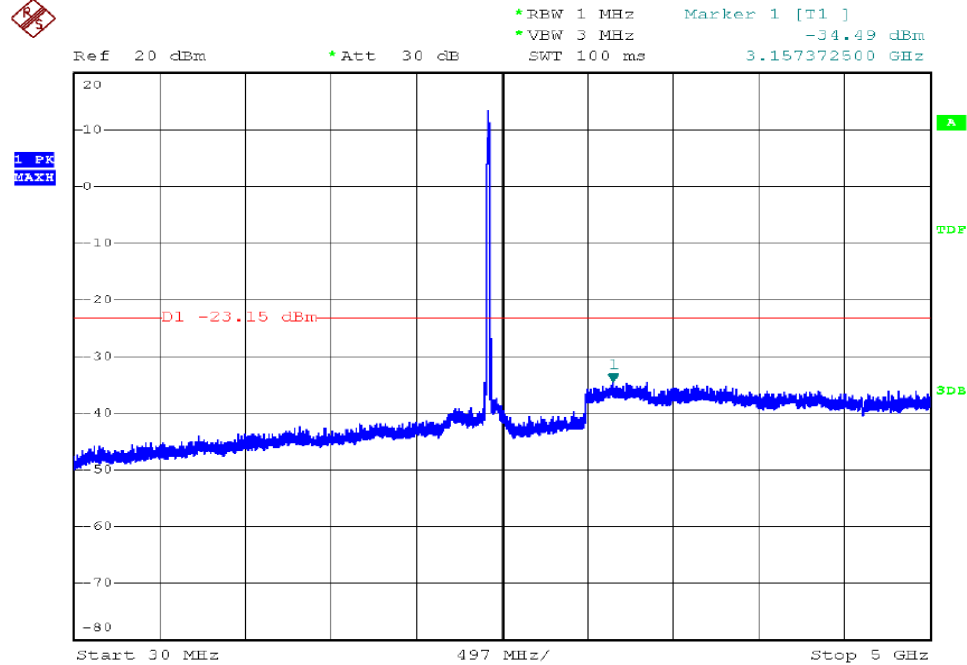
Conducted Spurious Emissions, 18 GHz ~ 25 GHz (2412 MHz), 6 Mbps data rate



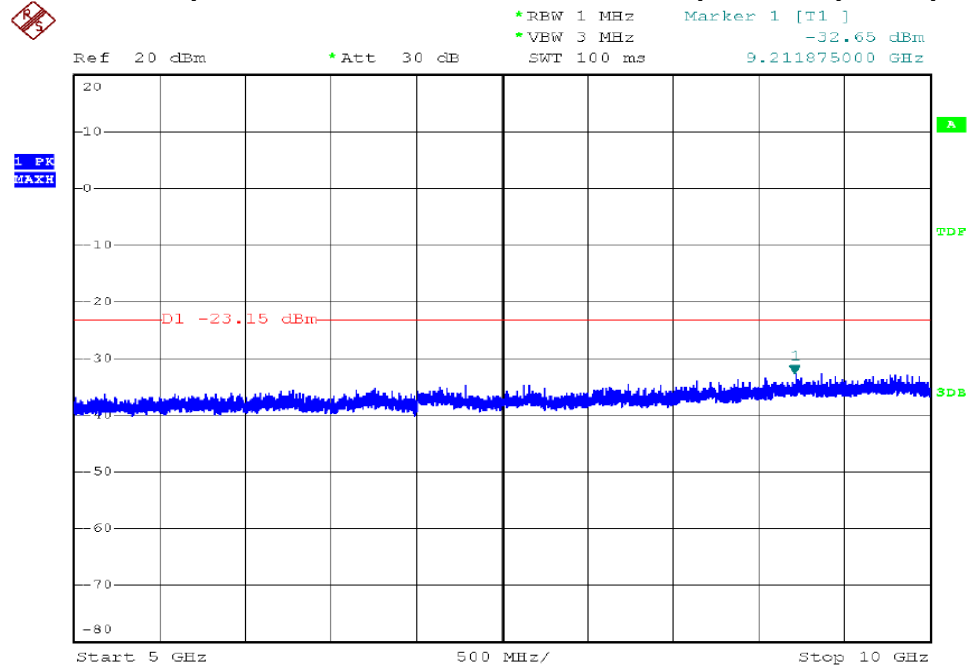
PLOT OF TEST DATA

Chain 0

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (2437 MHz), 6 Mbps data rate

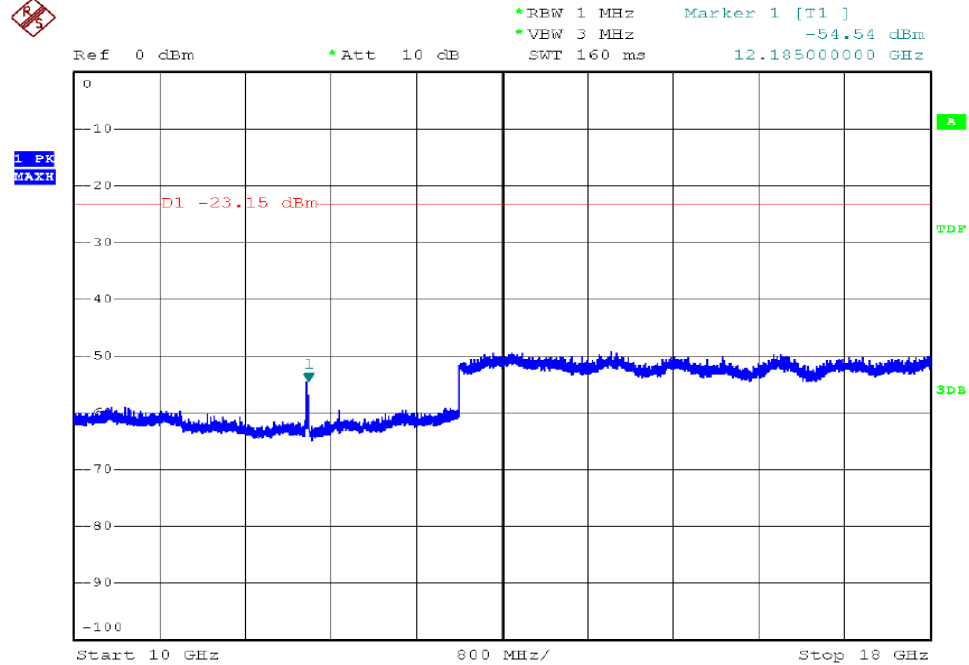


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (2437 MHz), 6 Mbps data rate

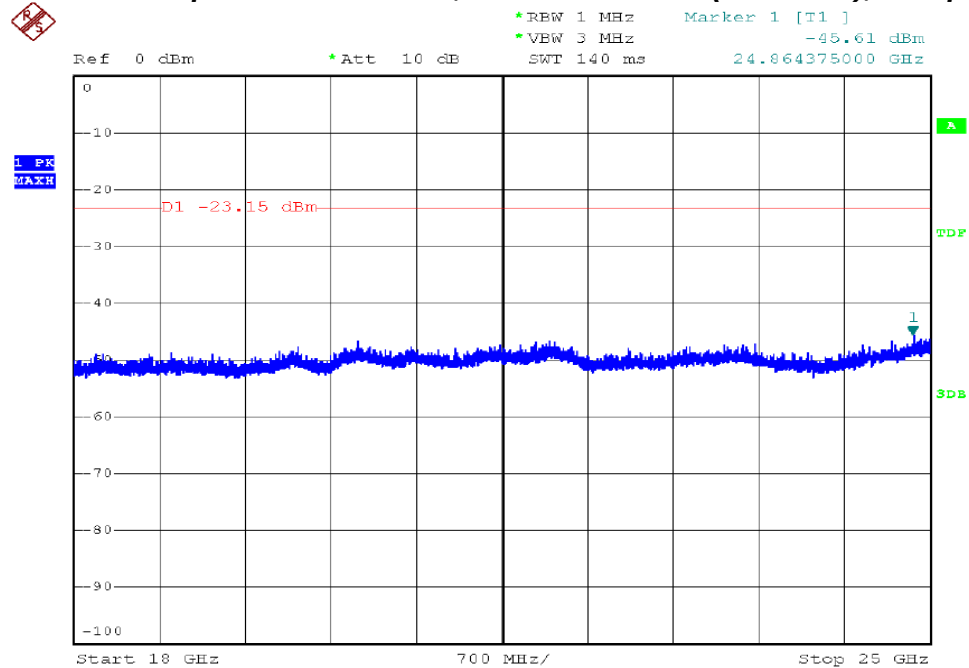


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (2437 MHz), 6 Mbps data rate



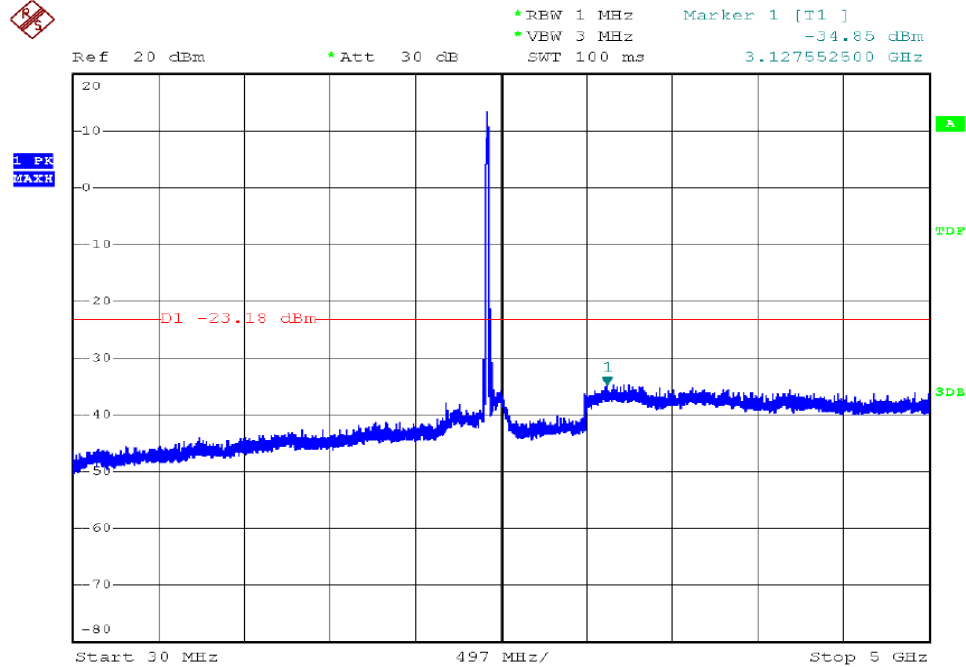
Conducted Spurious Emissions, 18 GHz ~ 25 GHz (2437 MHz), 6 Mbps data rate



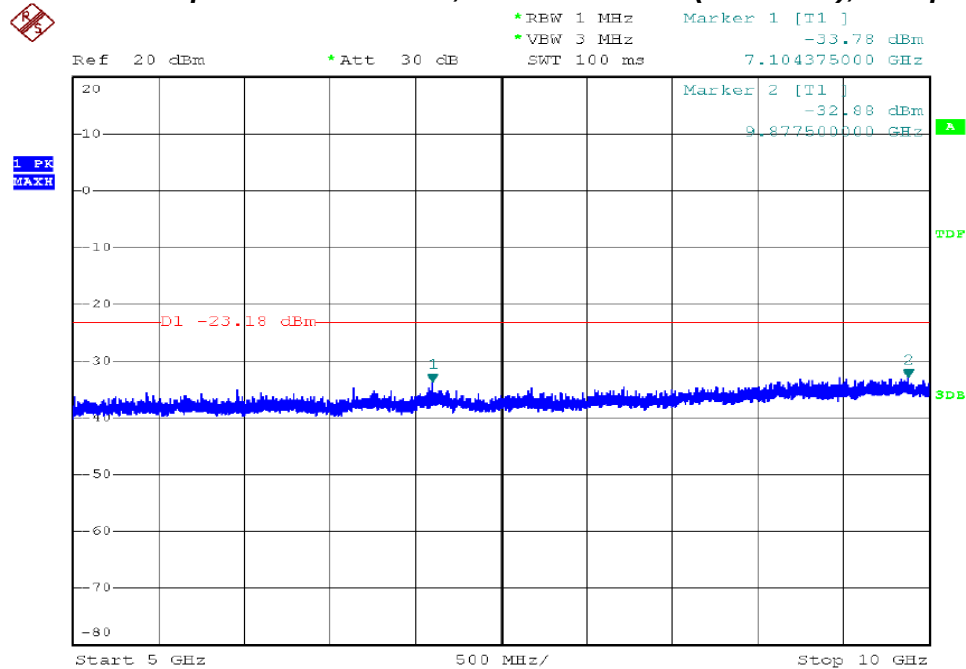
PLOT OF TEST DATA

Chain 1

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (2437 MHz), 6 Mbps data rate

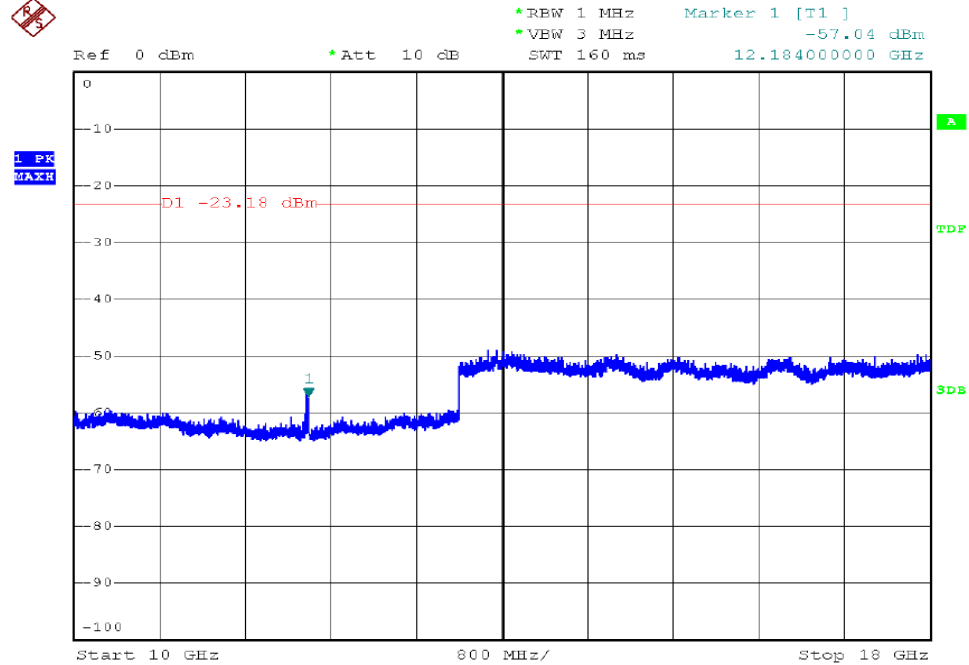


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (2437 MHz), 6 Mbps data rate

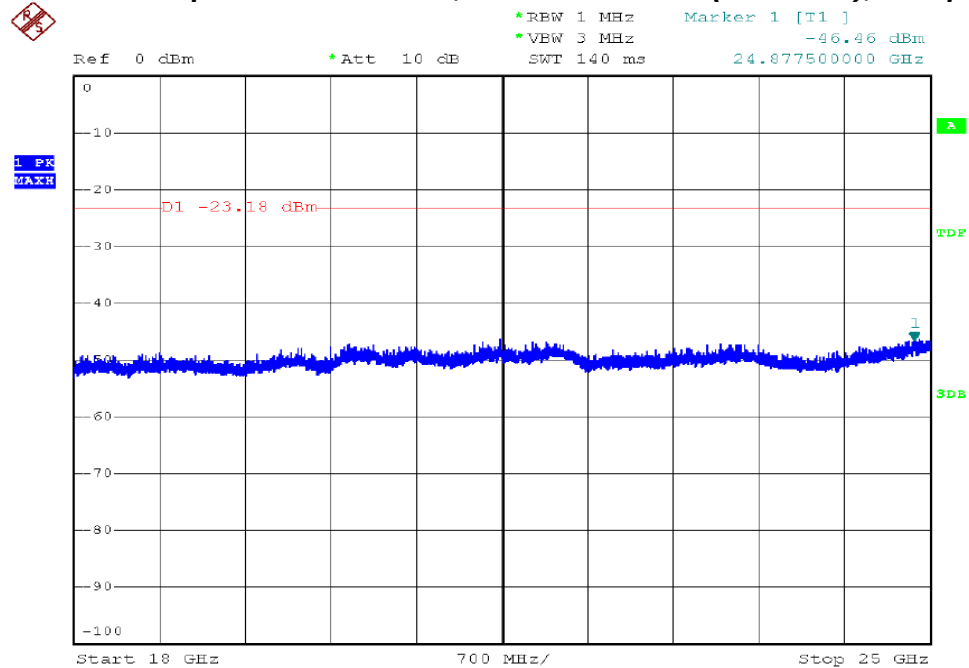


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (2437 MHz), 6 Mbps data rate



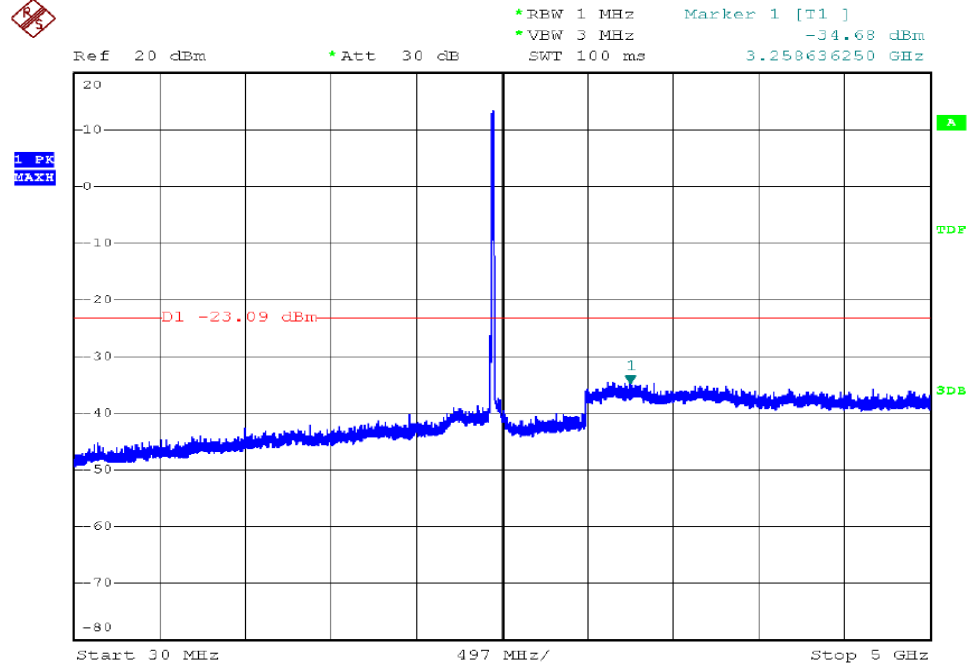
Conducted Spurious Emissions, 18 GHz ~ 25 GHz (2437 MHz), 6 Mbps data rate



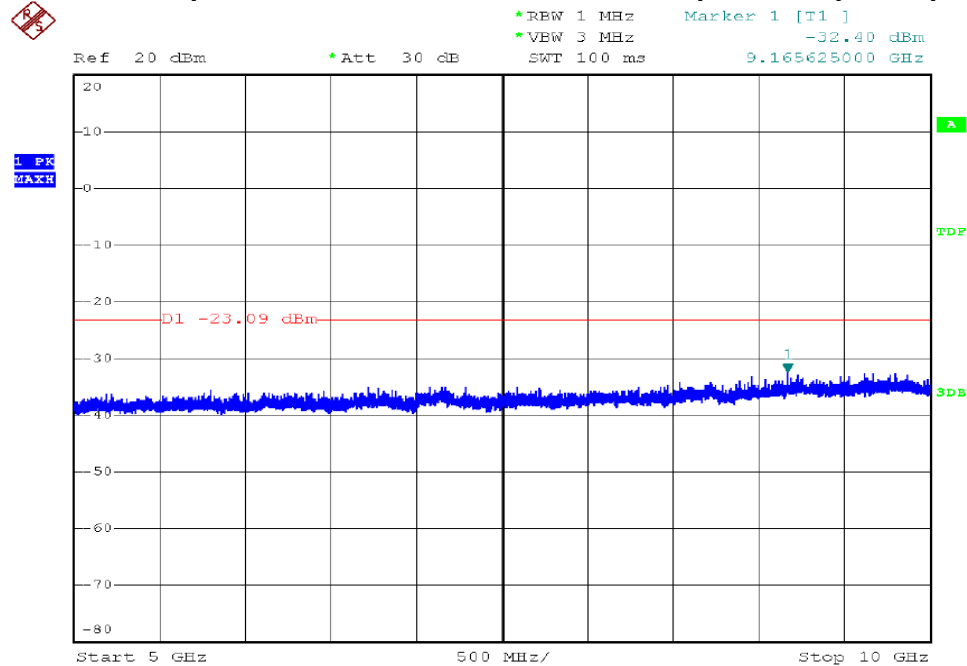
PLOT OF TEST DATA

Chain 0

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (2462 MHz), 6 Mbps data rate

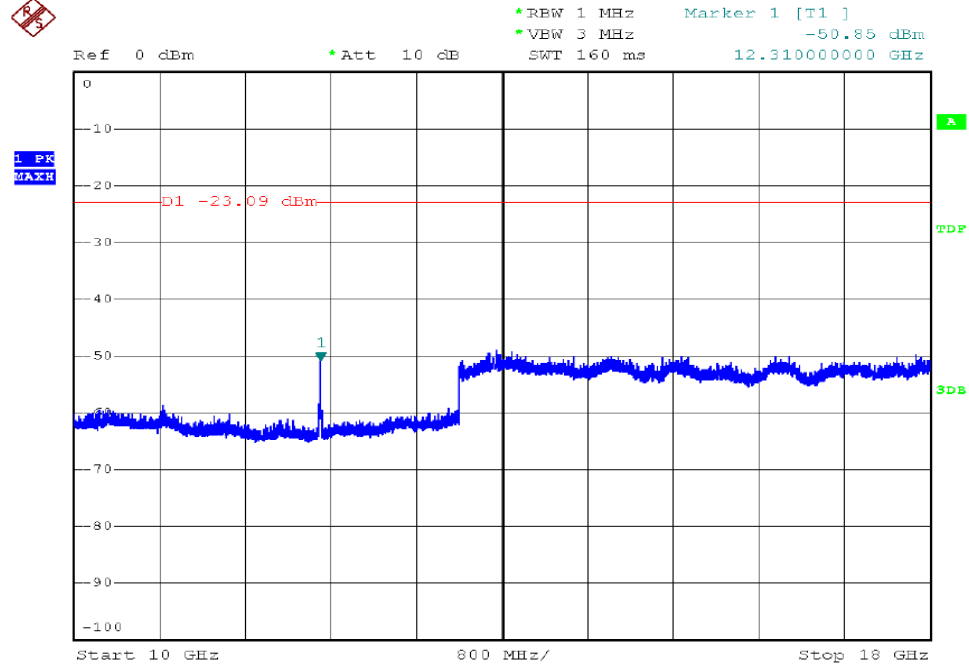


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (2462 MHz), 6 Mbps data rate

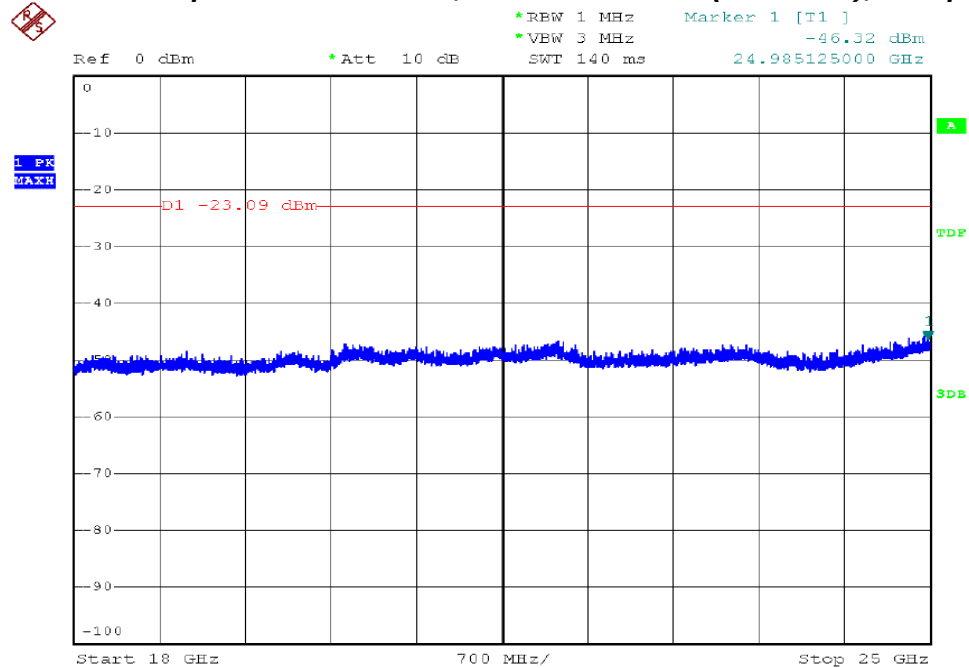


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (2462 MHz), 6 Mbps data rate



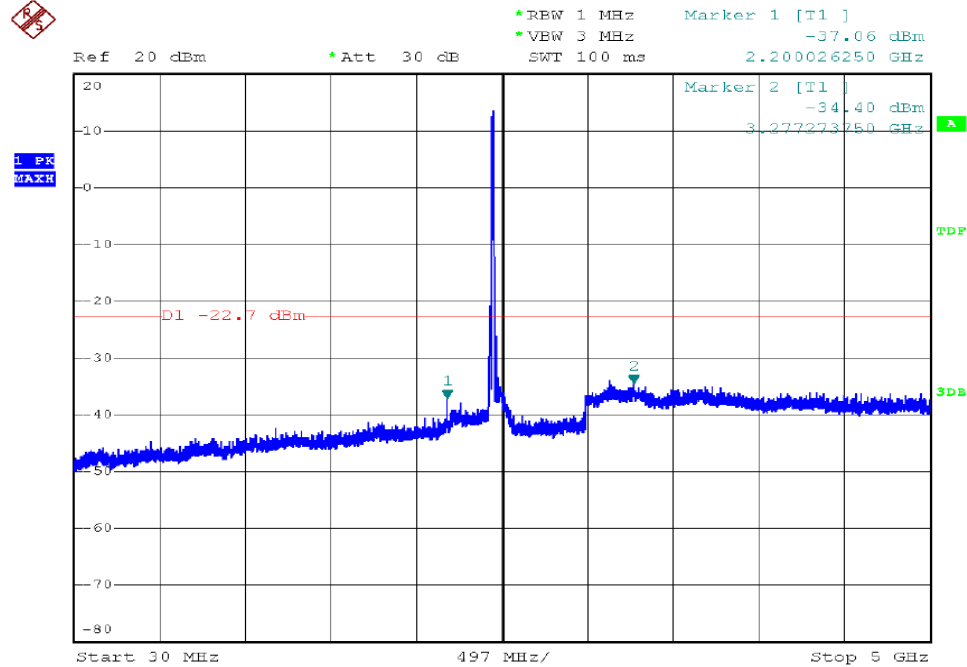
Conducted Spurious Emissions, 18 GHz ~ 25 GHz (2462 MHz), 6 Mbps data rate



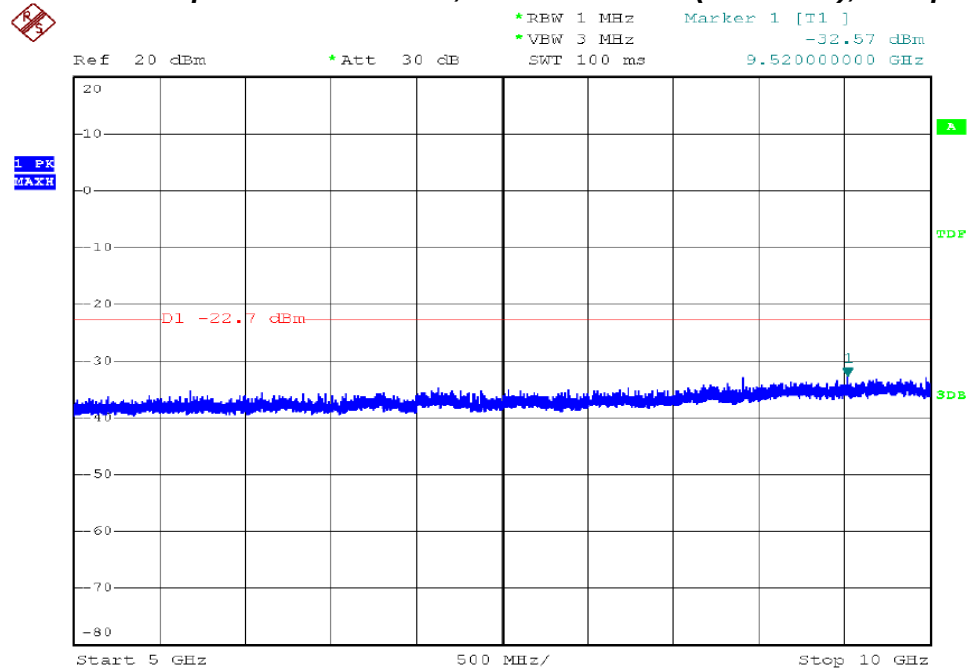
PLOT OF TEST DATA

Chain 1

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (2462 MHz), 6 Mbps data rate

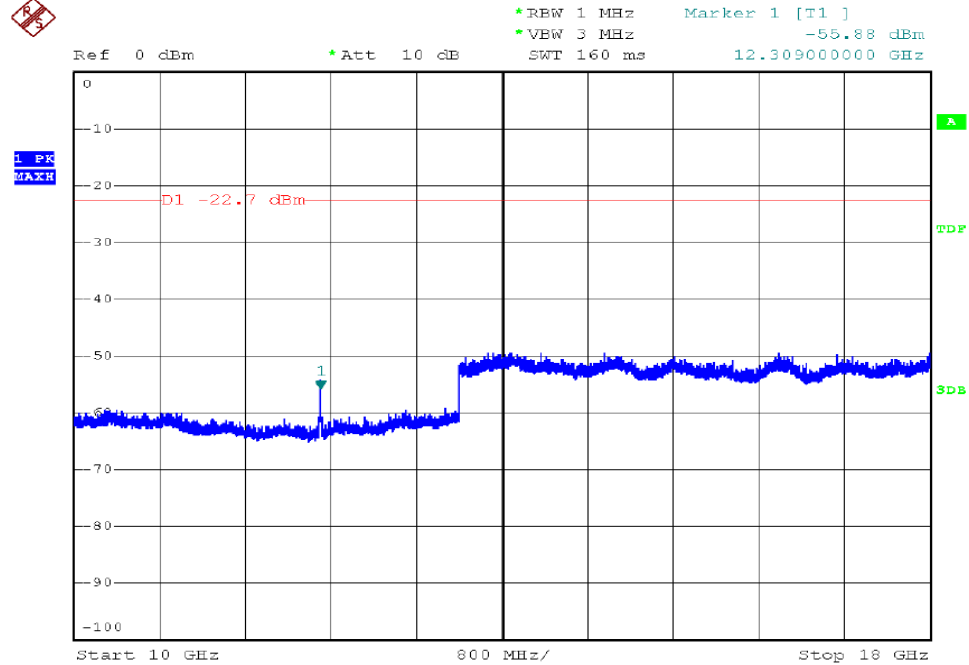


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (2462 MHz), 6 Mbps data rate

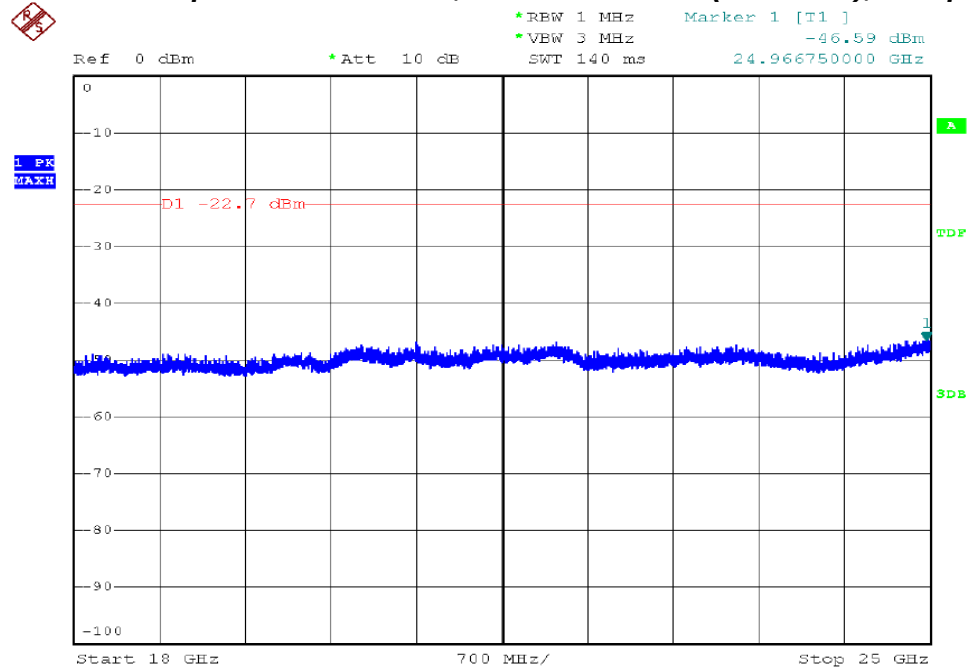


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (2462 MHz), 6 Mbps data rate



Conducted Spurious Emissions, 18 GHz ~ 25 GHz (2462 MHz), 6 Mbps data rate

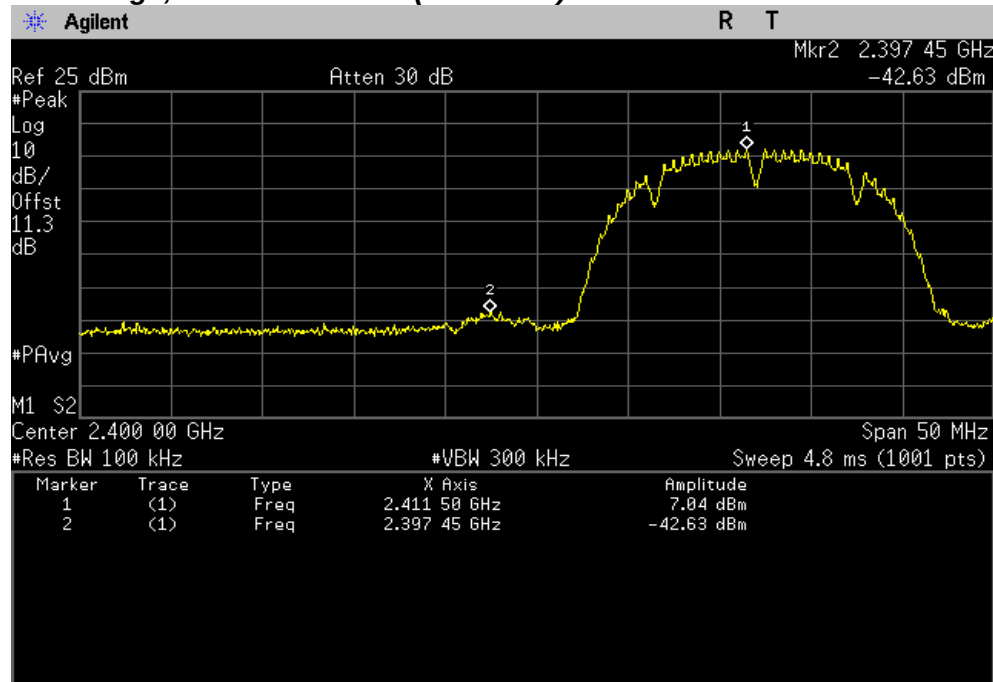


PLOT OF TEST DATA

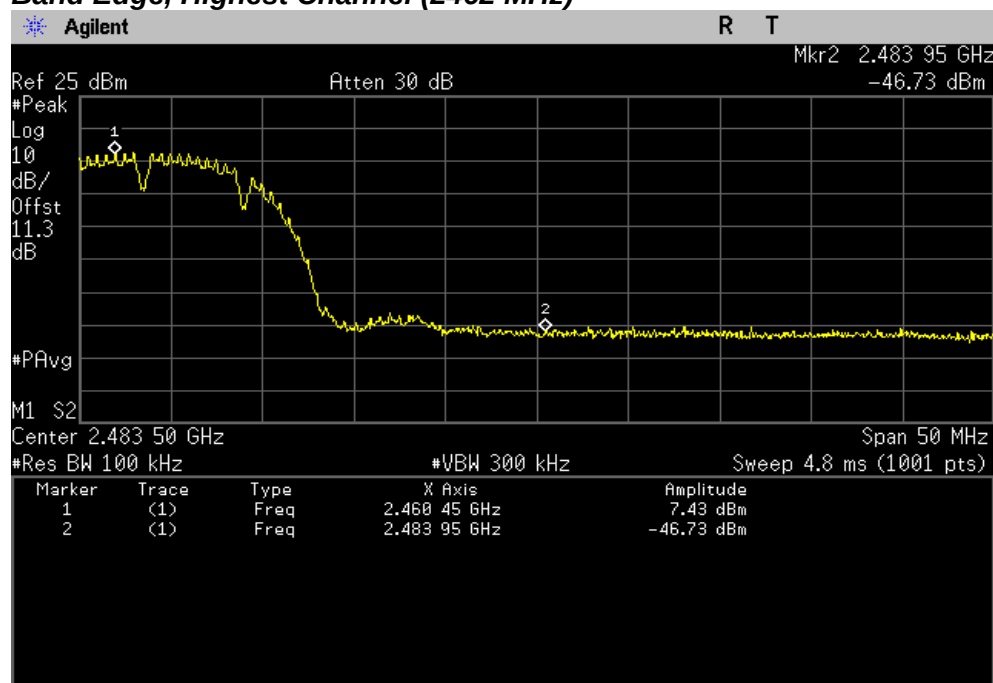
802.11b mode

Chain 0

Band Edge, Lowest Channel (2412 MHz)



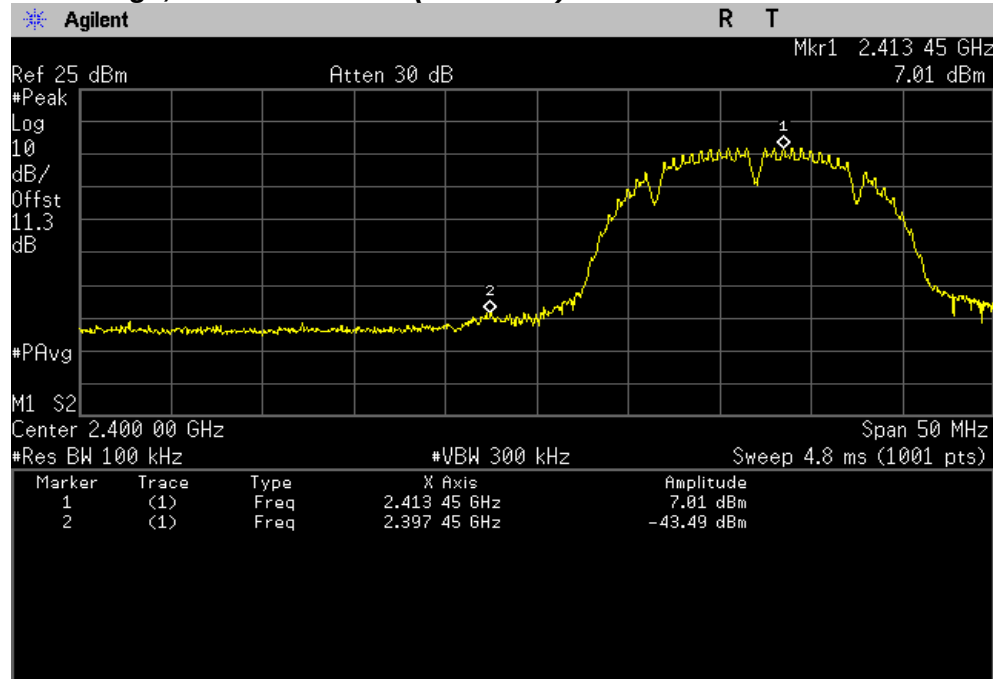
Band Edge, Highest Channel (2462 MHz)



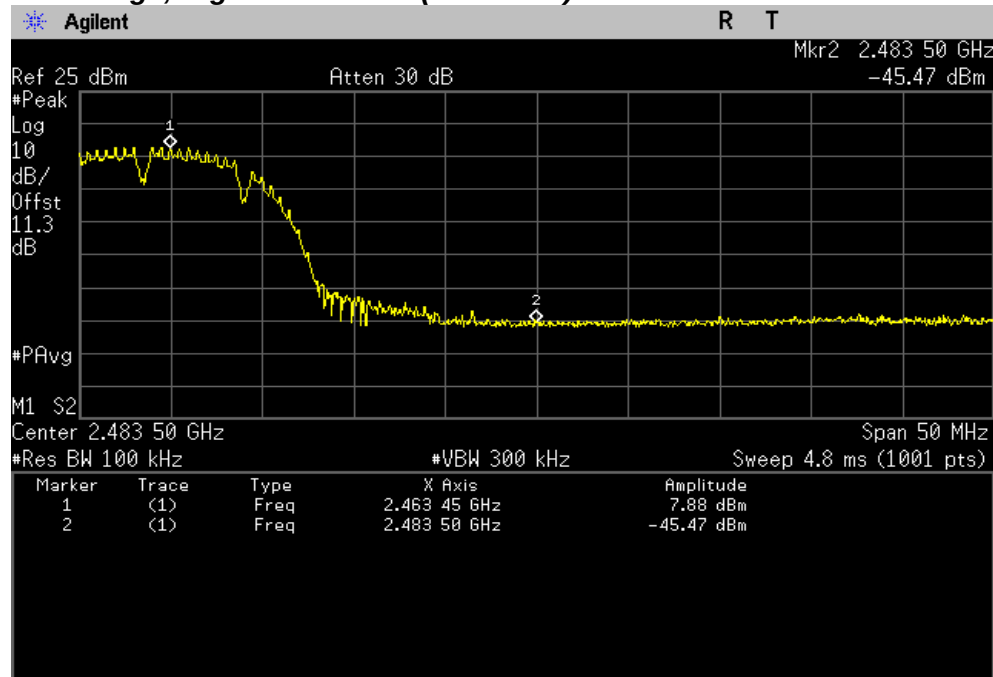
PLOT OF TEST DATA

Chain 1

Band Edge, Lowest Channel (2412 MHz)



Band Edge, Highest Channel (2462 MHz)

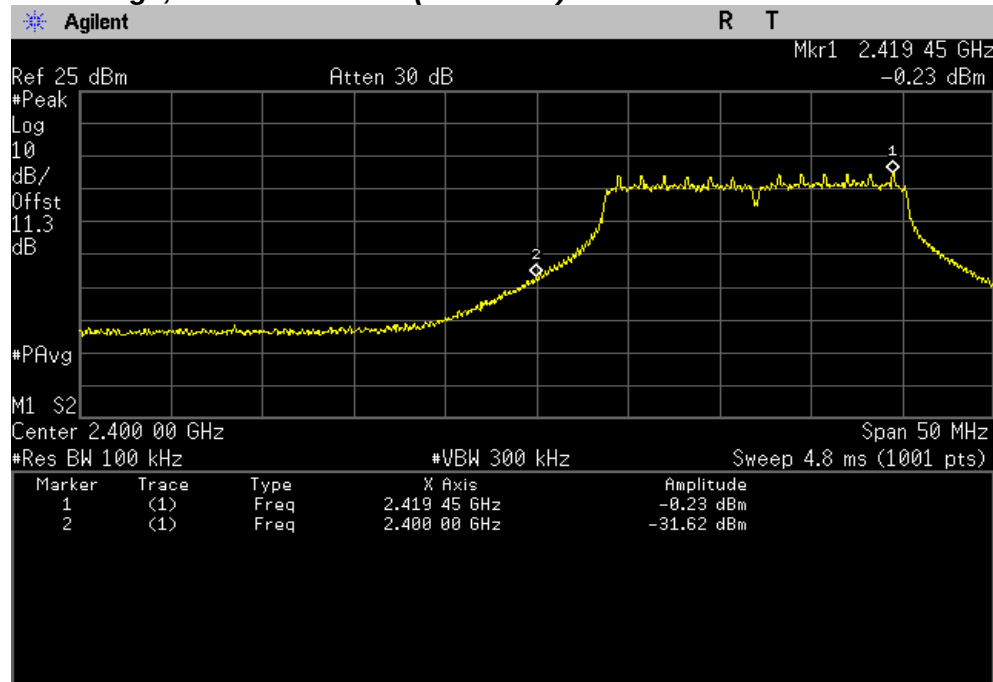


PLOT OF TEST DATA

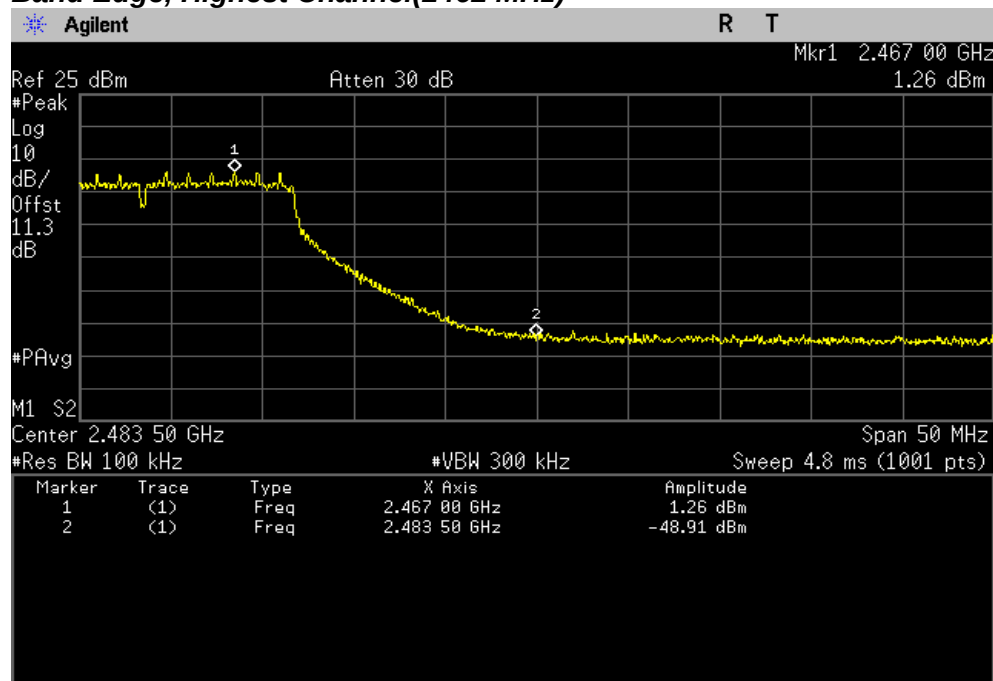
802.11g mode

Chain 0

Band Edge, Lowest Channel (2412 MHz)



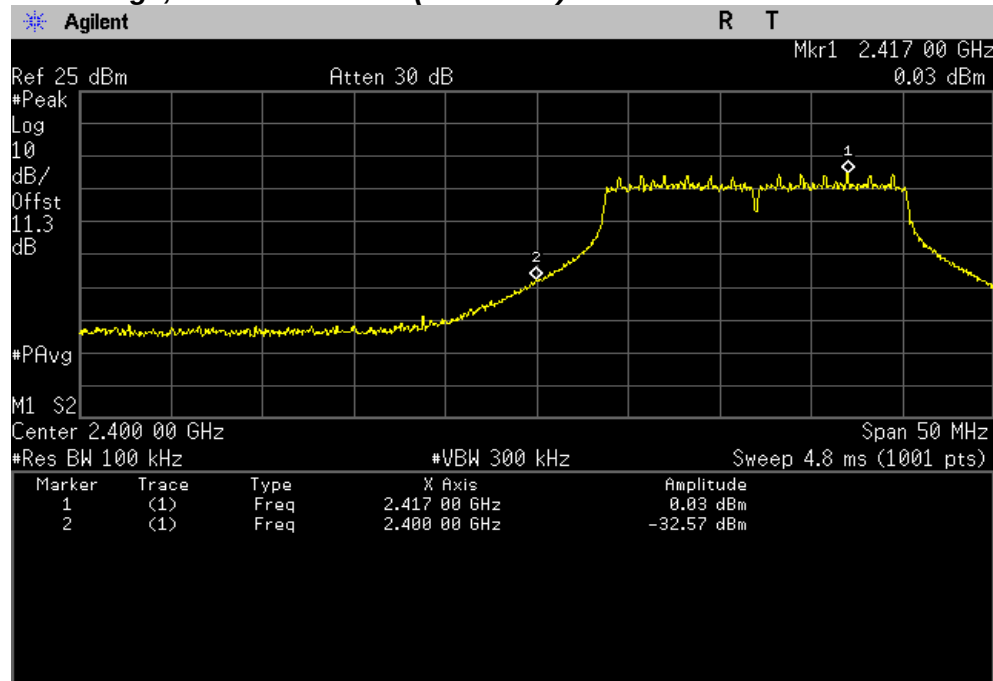
Band Edge, Highest Channel(2462 MHz)



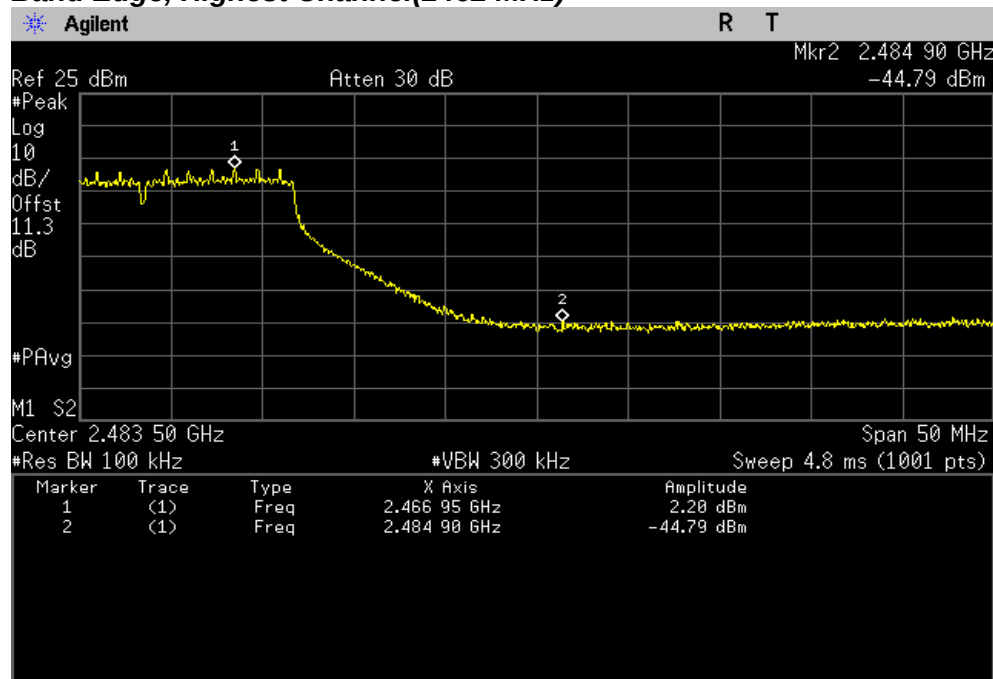
PLOT OF TEST DATA

Chain 1

Band Edge, Lowest Channel (2412 MHz)



Band Edge, Highest Channel(2462 MHz)

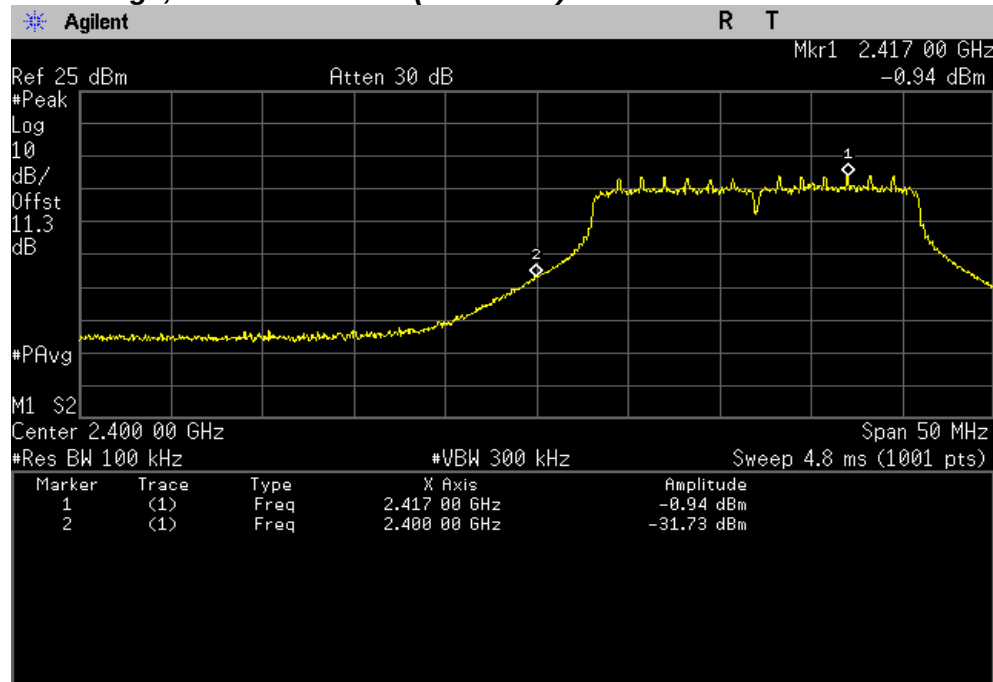


PLOT OF TEST DATA

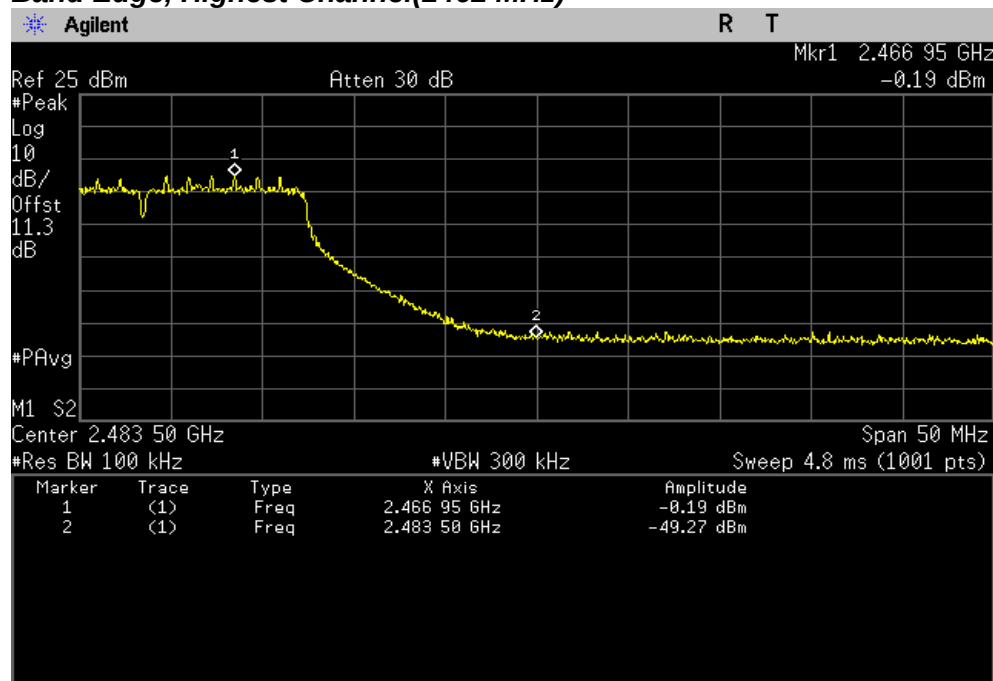
802.11n mode

Chain 0

Band Edge, Lowest Channel (2412 MHz)



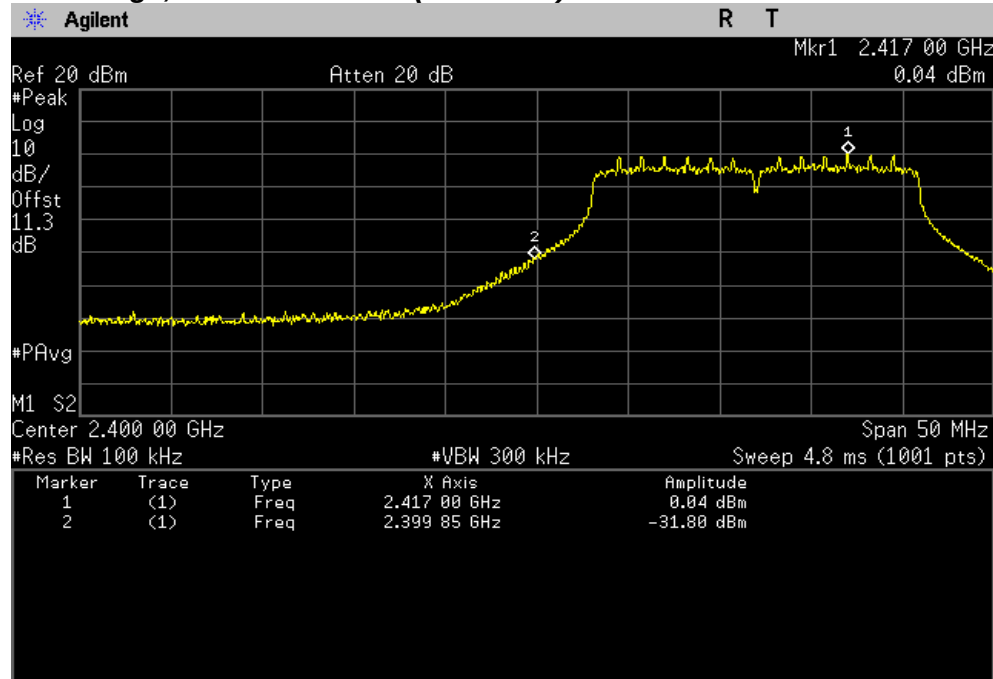
Band Edge, Highest Channel(2462 MHz)



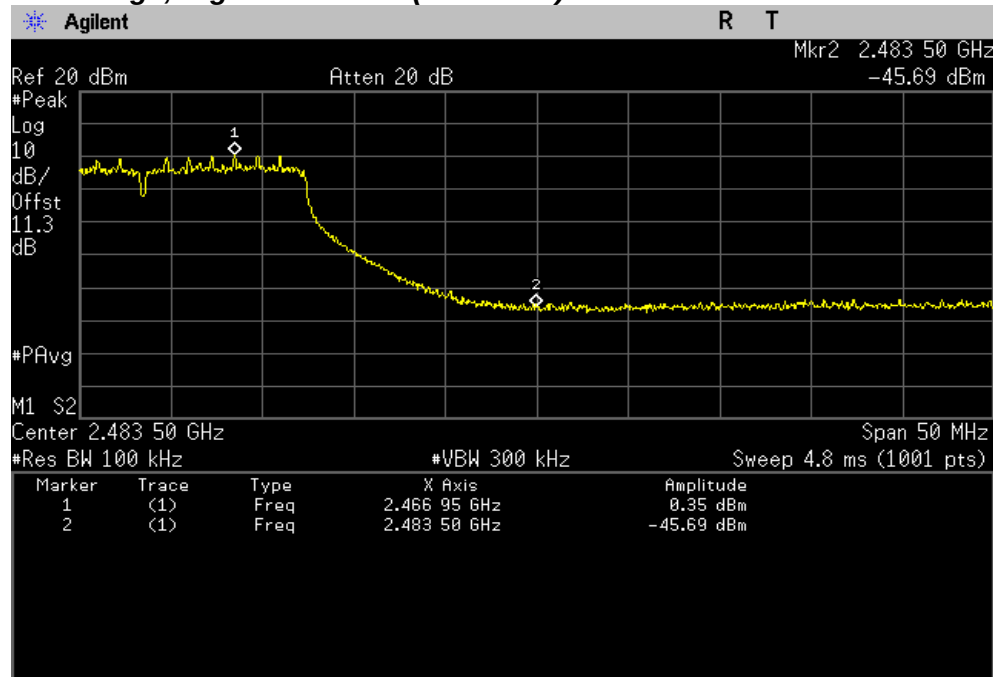
PLOT OF TEST DATA

Chain 1

Band Edge, Lowest Channel (2412 MHz)



Band Edge, Highest Channel(2462 MHz)



TEST DATA

8.6.2 Conducted Spurious Emissions – 5 GHz band

FCC §15.247(d)

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

802.11a mode

Channel	Frequency (MHz)	Reference Level (dBm)		Conducted Spurious Emissions (dBc)	Limit (dBc)
		Chain 0	Chain 1		
Low	5745	2.60	2.65	More than 30 dBc	30
Middle	5785	5.33	5.33	More than 30 dBc	30
High	5825	1.39	0.89	More than 30 dBc	30

802.11n mode

Channel	Frequency (MHz)	Reference Level (dBm)		Conducted Spurious Emissions (dBc)	Limit (dBc)
		Chain 0	Chain 1		
Low	5745	2.54	2.35	More than 30 dBc	30
Middle	5785	5.57	5.19	More than 30 dBc	30
High	5825	1.30	1.08	More than 30 dBc	30

Notes:

1. The cable and attenuator loss from 30 MHz to 40 GHz was reflected in spectrum analyzer with correction factor for the spurious emissions test.
2. RBW was set to 1 MHz rather than 100 kHz in order to increase the test span.
3. The display line shown in the following plots indicates the limit at 30 dB below the fundamental emission level

measured in a 100 kHz bandwidth.

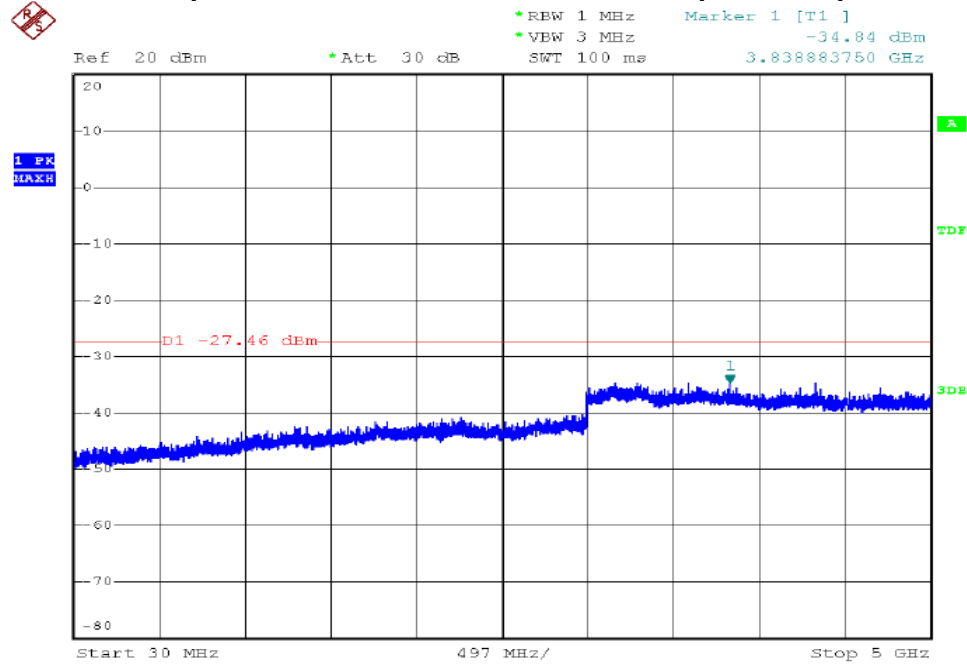
- 4. For plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced RBW to ensure that no emissions were present.*
- 5. For the following out of band conducted spurious emissions plots, the EUT was investigated in all available data rates for 802.11a,b,g,n modes. The worst case spurious emissions for the 5.8 GHz band were found while transmitting in 802.11n mode at MCS0 and are shown in the plots below.*
- 6. During the test, the sweep point was set 8001 for the conducted spurious emissions test and 1001 for the Band Edge test.*

PLOT OF TEST DATA

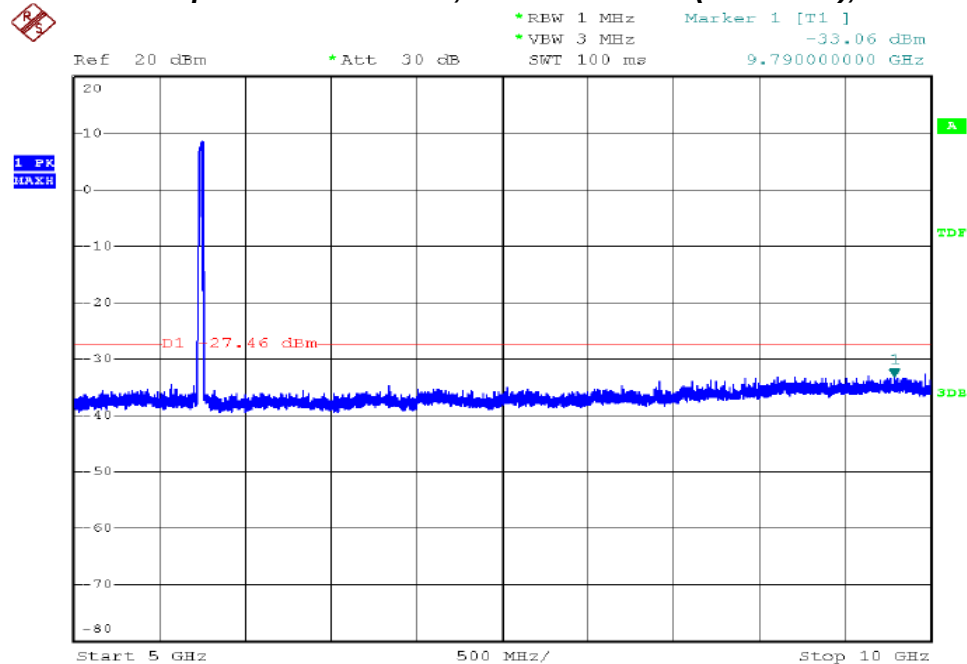
802.11n mode

Chain 0

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (5745 MHz), MCS0 data rate

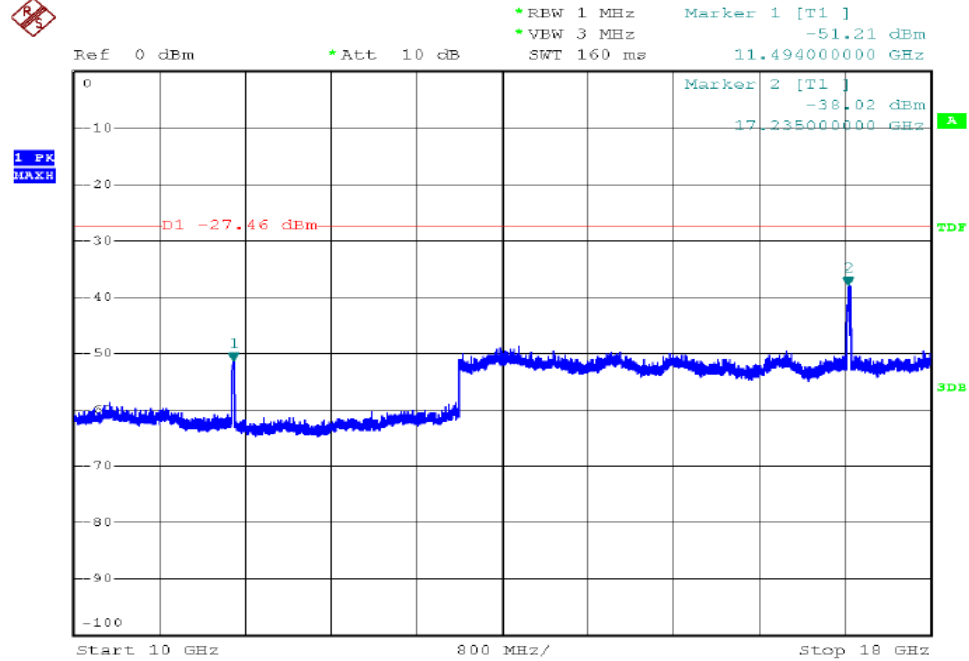


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (5745 MHz), MCS0 data rate

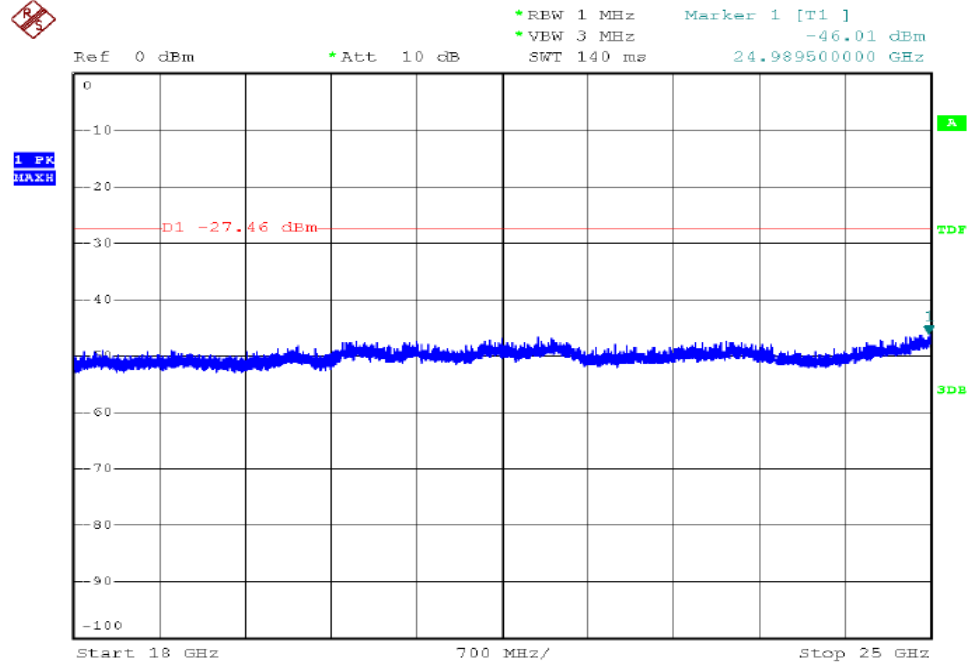


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (5745 MHz), MCS0 data rate

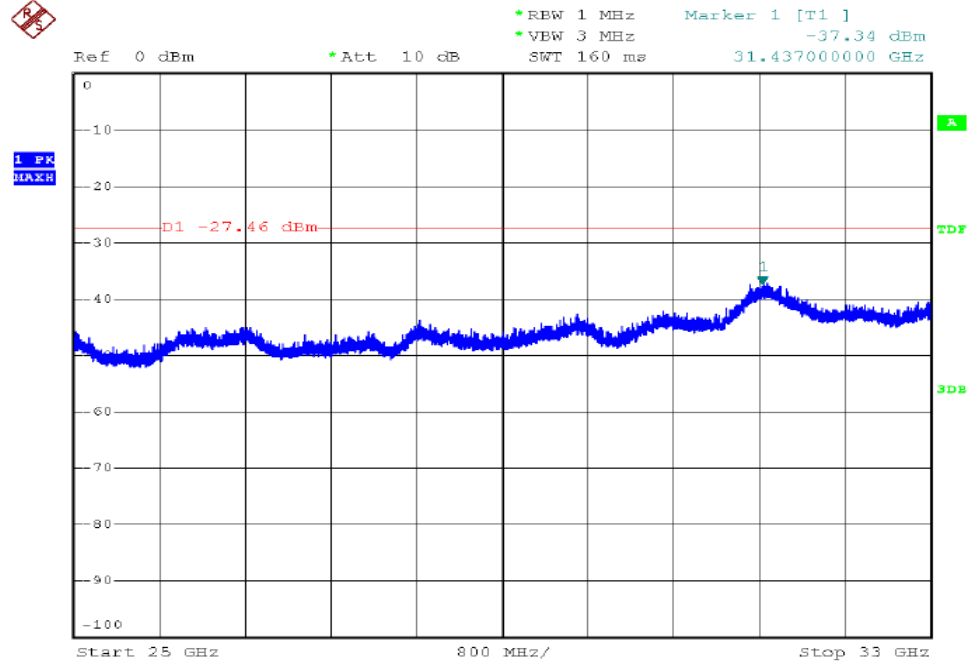


Conducted Spurious Emissions, 18 GHz ~ 25 GHz (5745 MHz), MCS0 data rate

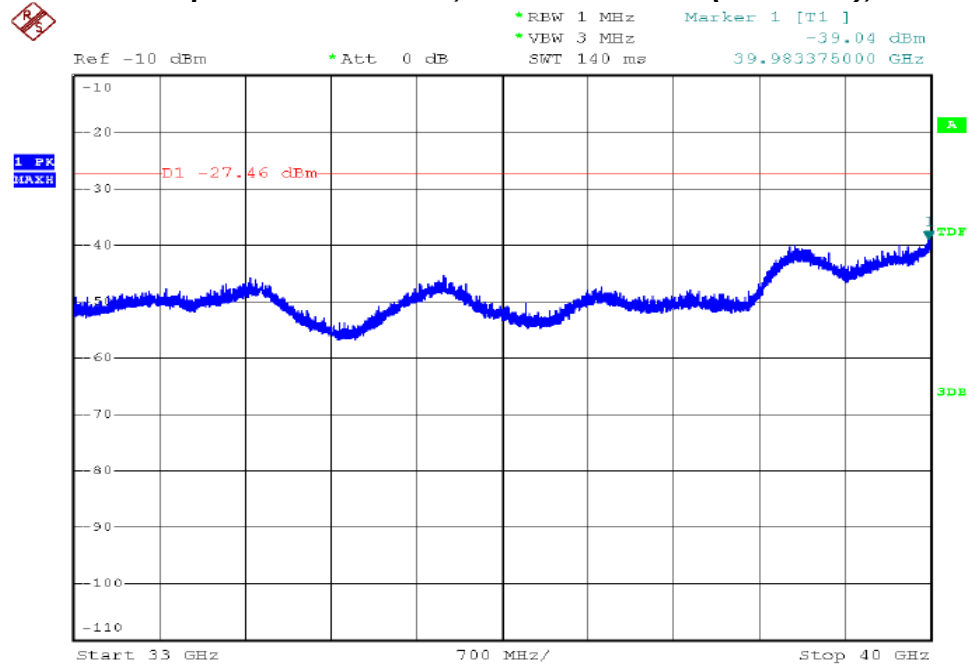


PLOT OF TEST DATA

Conducted Spurious Emissions, 25 GHz ~ 33 GHz (5745 MHz), MCS0 data rate



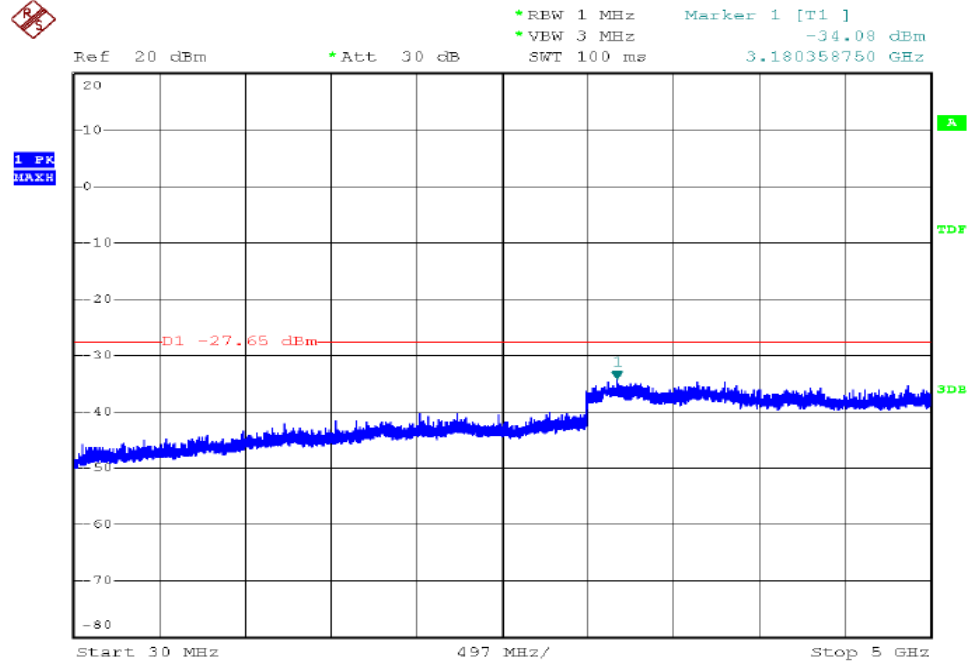
Conducted Spurious Emissions, 33 GHz ~ 40 GHz (5745 MHz), MCS0 data rate



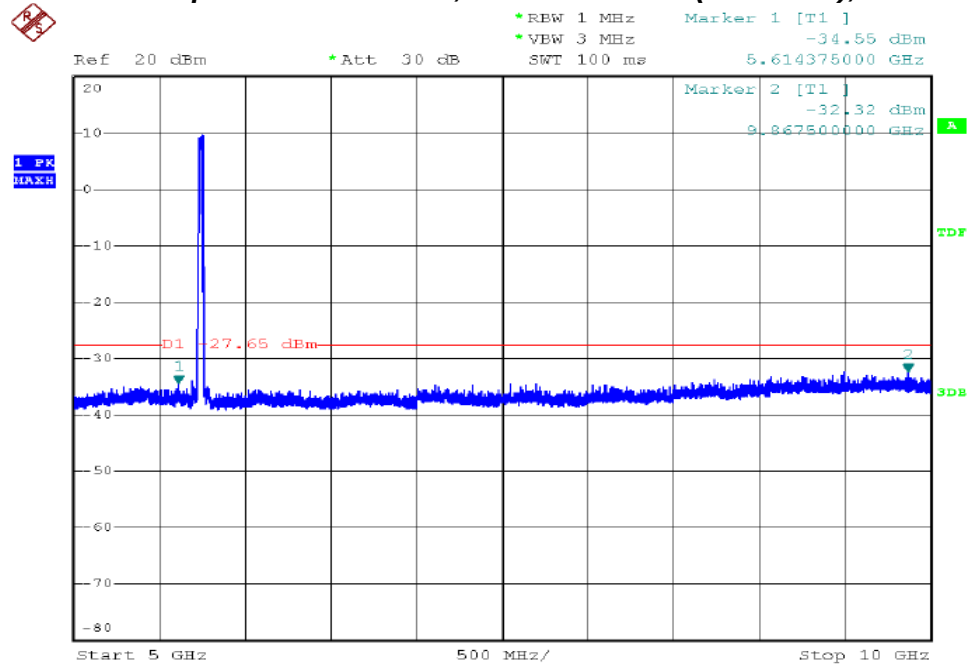
PLOT OF TEST DATA

Chain 1

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (5745 MHz), MCS0 data rate

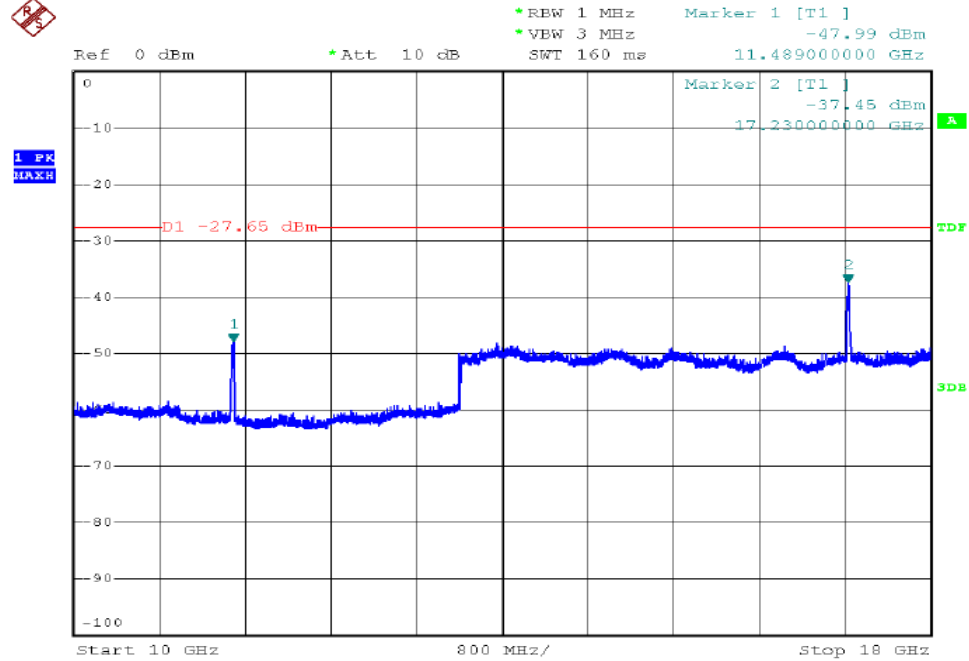


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (5745 MHz), MCS0 data rate

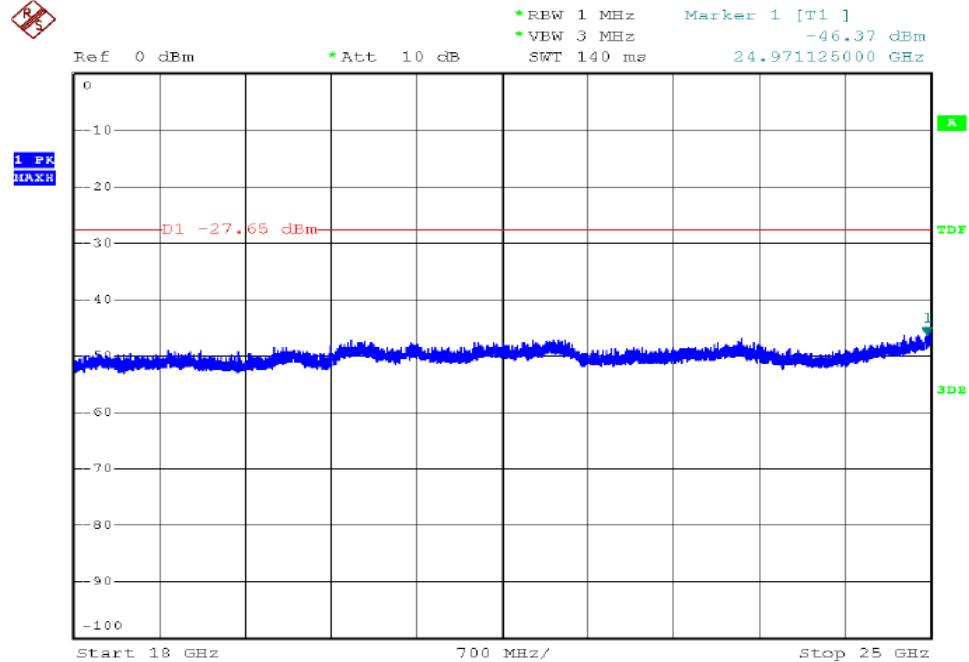


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (5745 MHz), MCS0 data rate

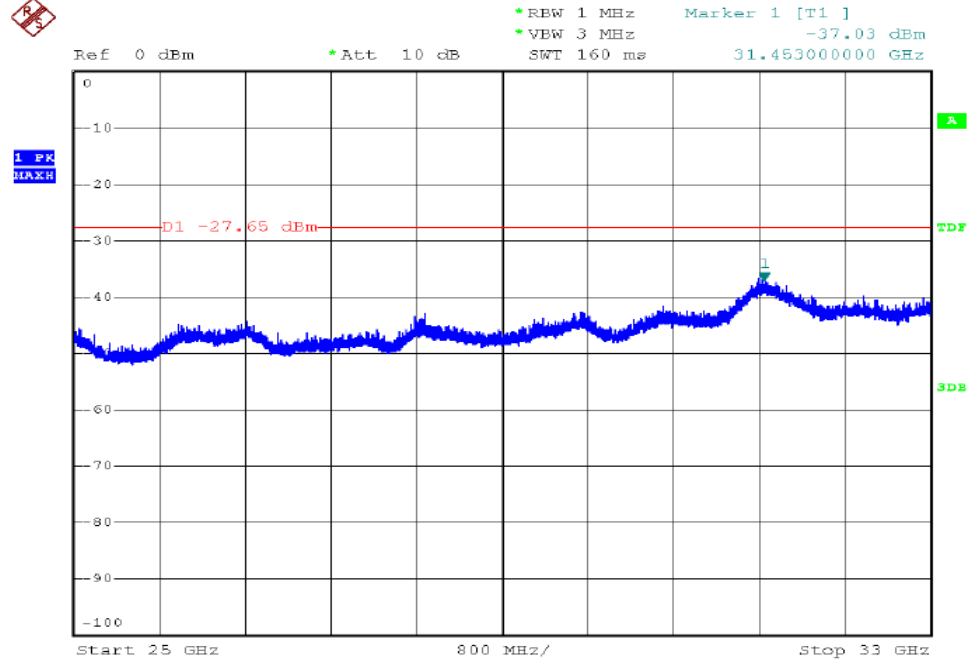


Conducted Spurious Emissions, 18 GHz ~ 25 GHz (5745 MHz), MCS0 data rate

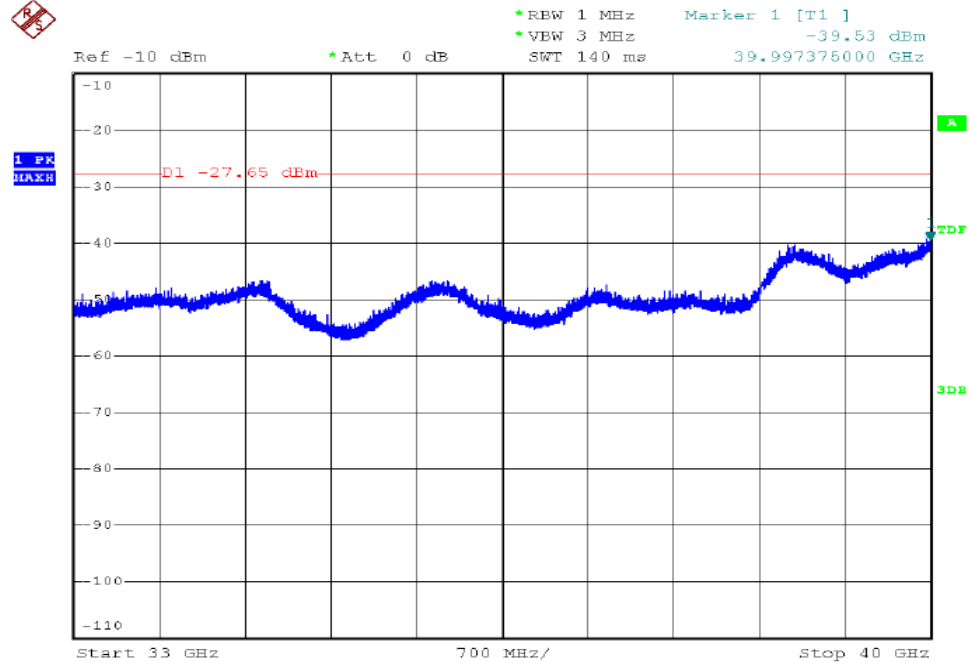


PLOT OF TEST DATA

Conducted Spurious Emissions, 25 GHz ~ 33 GHz (5745 MHz), MCS0 data rate



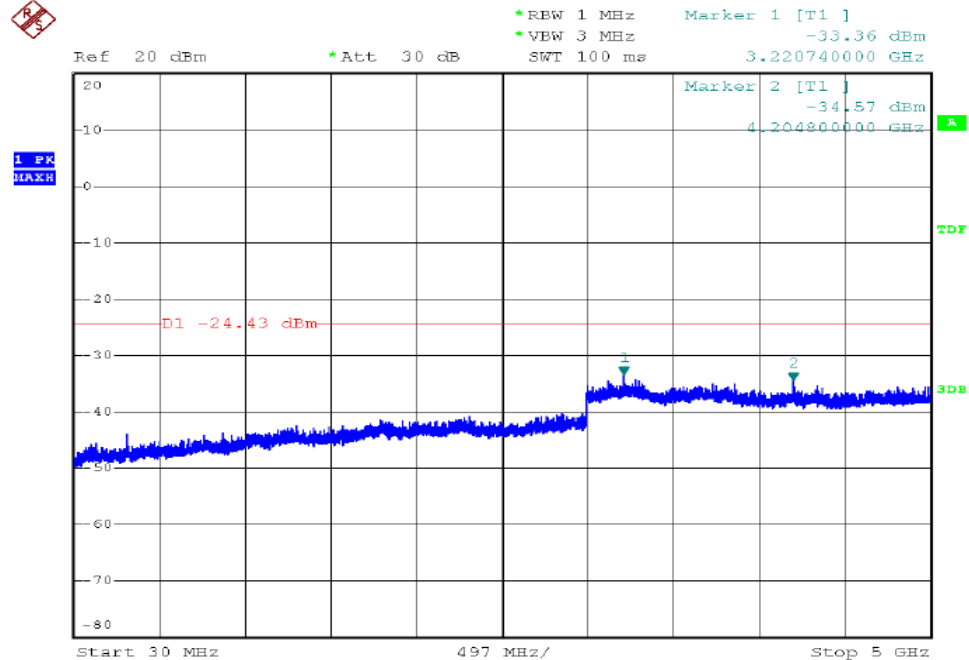
Conducted Spurious Emissions, 33 GHz ~ 40 GHz (5745 MHz), MCS0 data rate



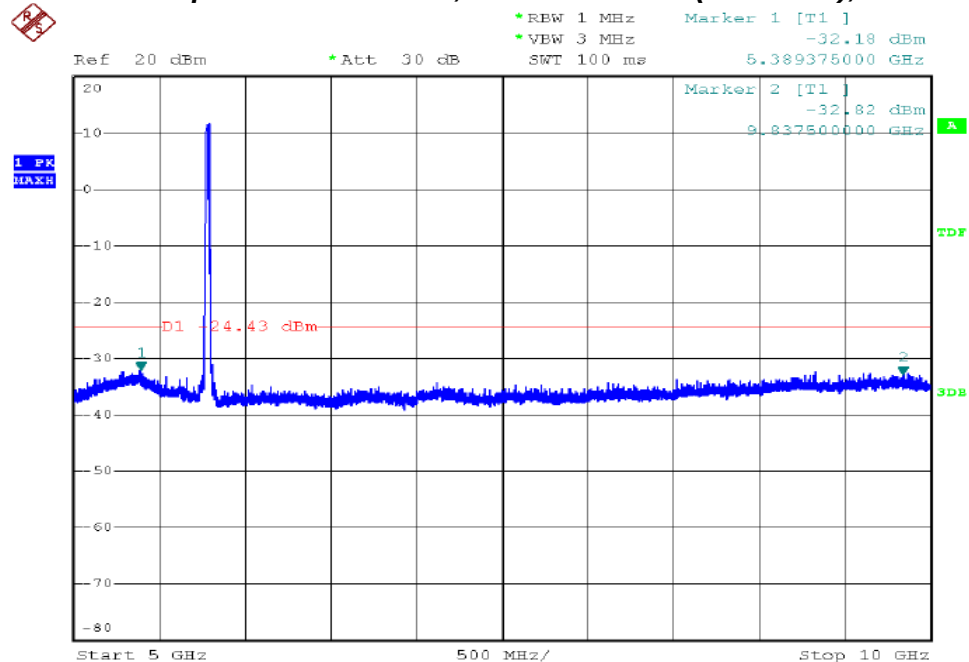
PLOT OF TEST DATA

Chain 0

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (5785 MHz), MCS0 data rate

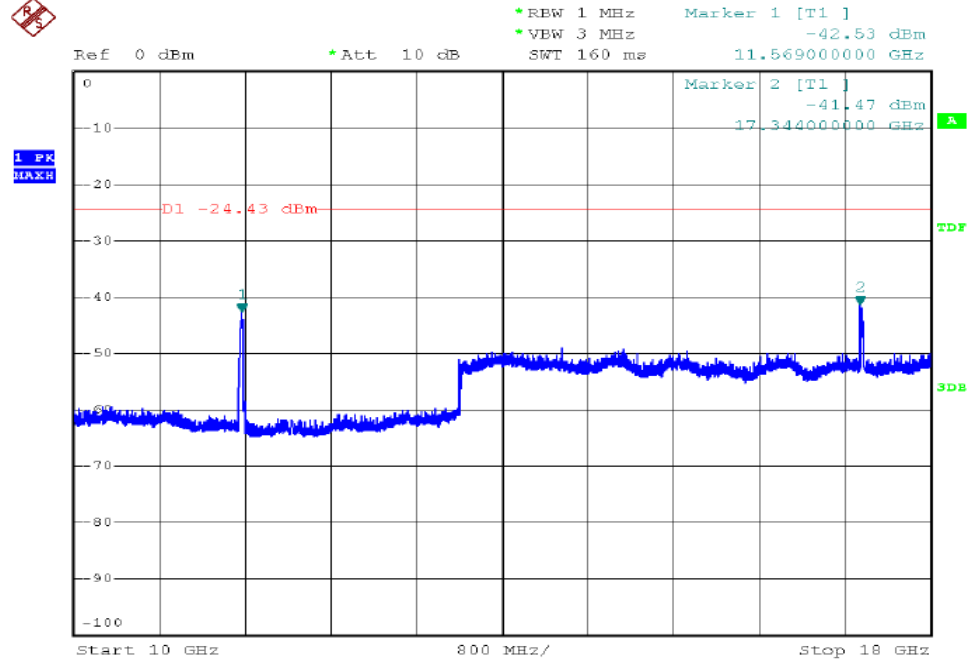


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (5785 MHz), MCS0 data rate

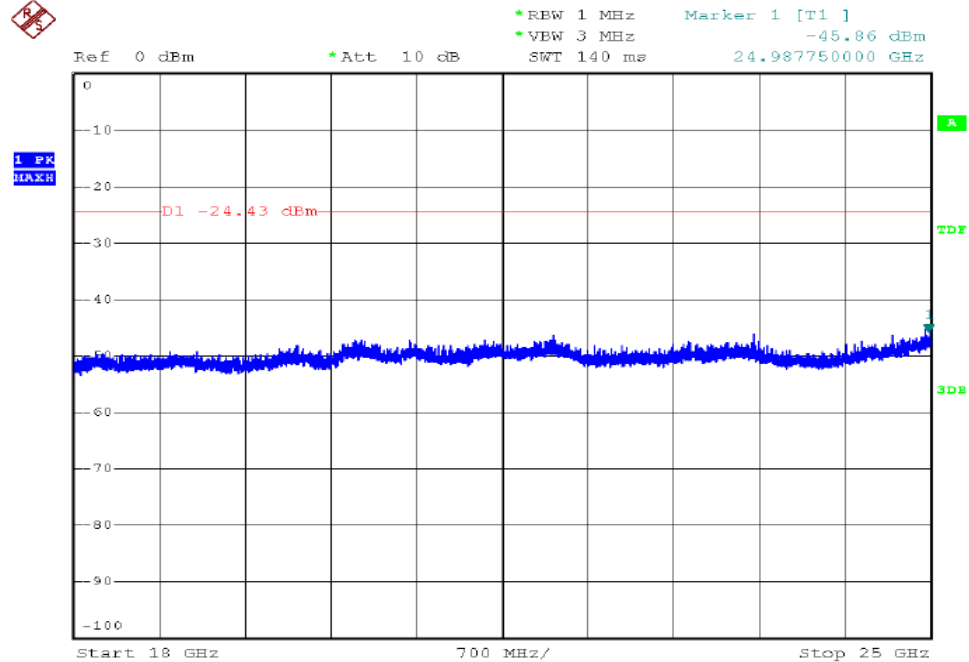


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (5785 MHz), MCS0 data rate

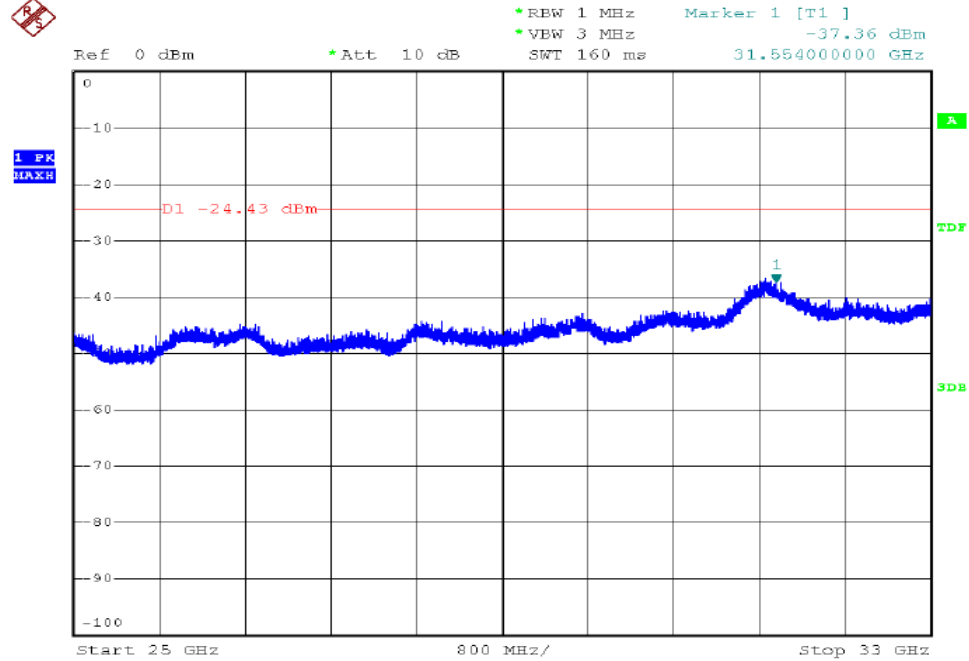


Conducted Spurious Emissions, 18 GHz ~ 25 GHz (5785 MHz), MCS0 data rate

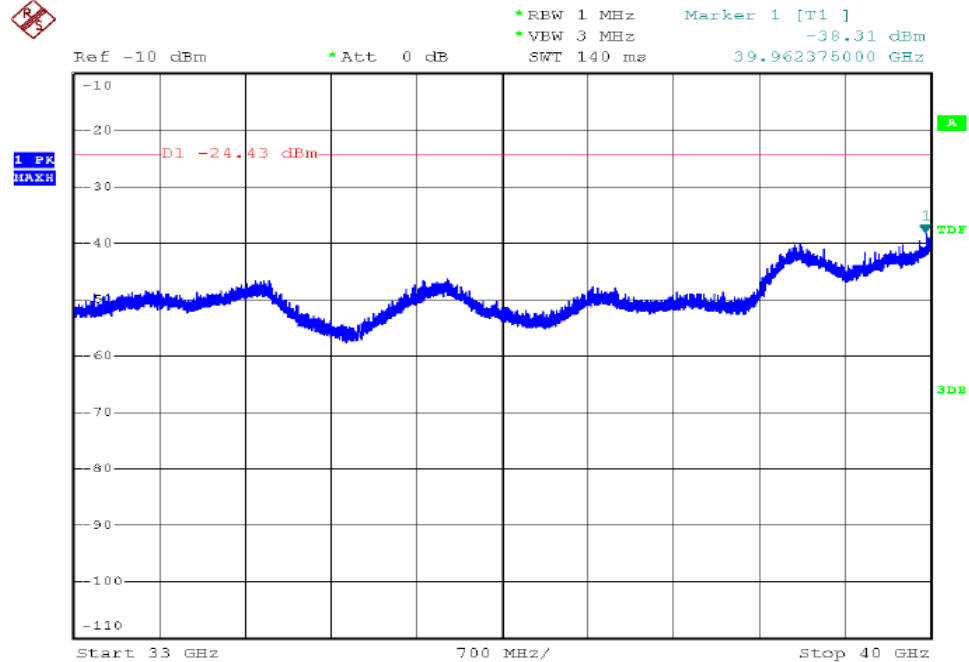


PLOT OF TEST DATA

Conducted Spurious Emissions, 25 GHz ~ 33 GHz (5785 MHz), MCS0 data rate



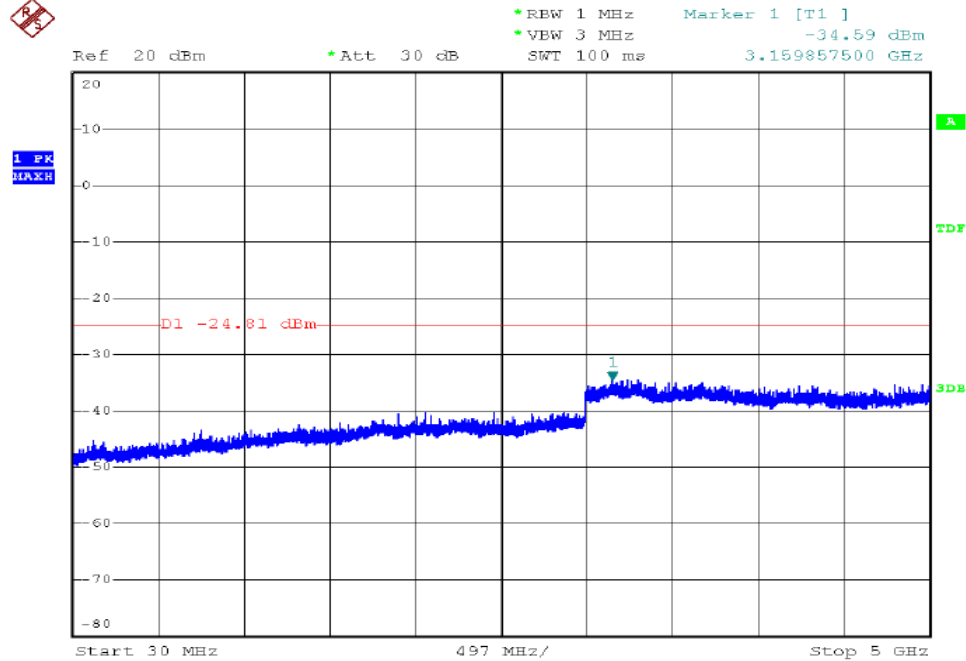
Conducted Spurious Emissions, 33 GHz ~ 40 GHz (5785 MHz), MCS0 data rate



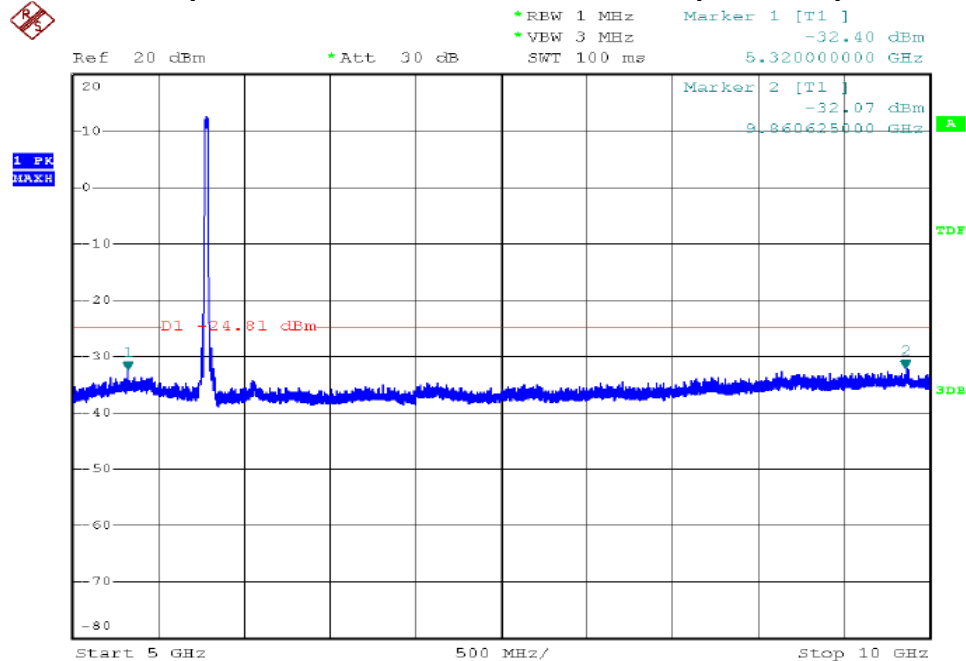
PLOT OF TEST DATA

Chain 1

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (5785 MHz), MCS0 data rate

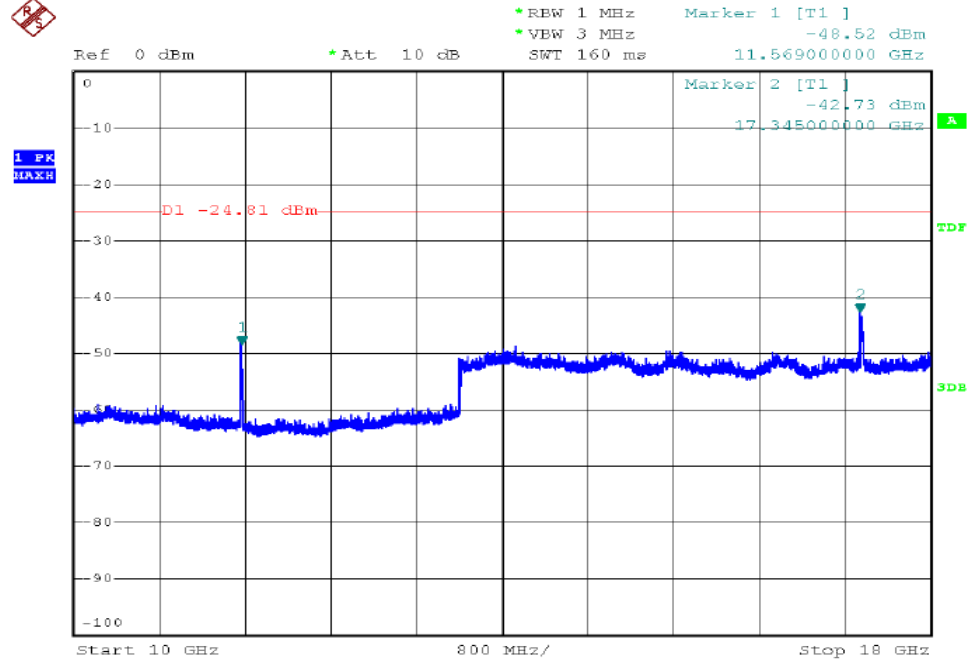


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (5785 MHz), MCS0 data rate

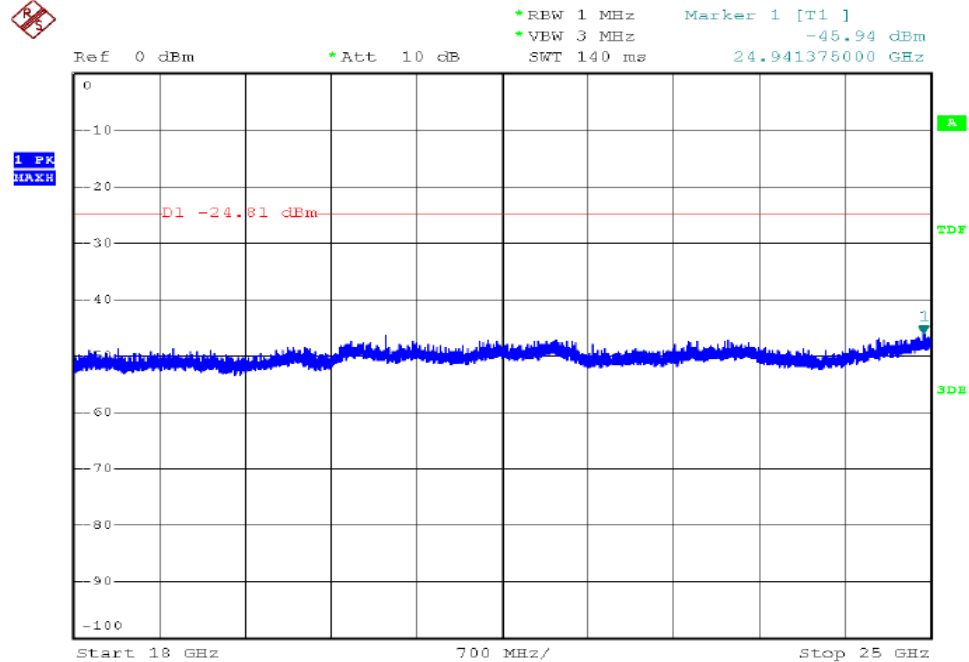


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (5785 MHz), MCS0 data rate

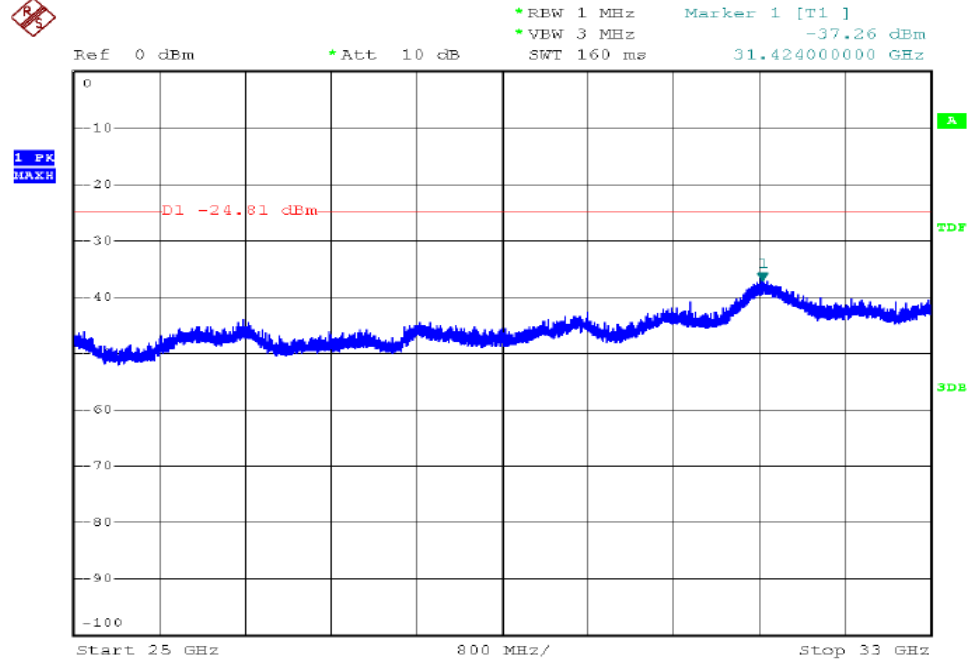


Conducted Spurious Emissions, 18 GHz ~ 25 GHz (5785 MHz), MCS0 data rate

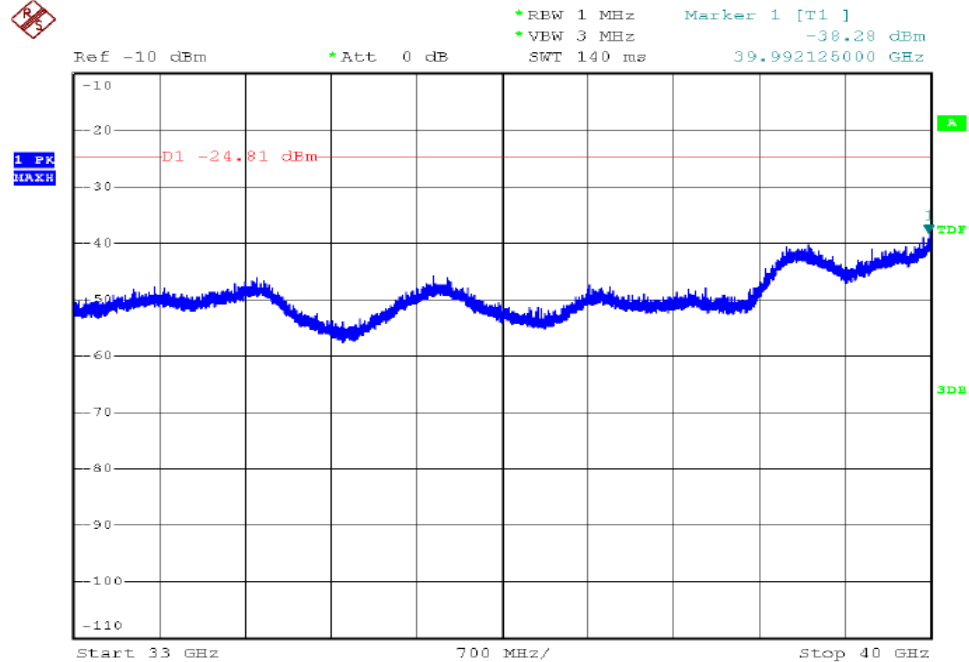


PLOT OF TEST DATA

Conducted Spurious Emissions, 25 GHz ~ 33 GHz (5785 MHz), MCS0 data rate



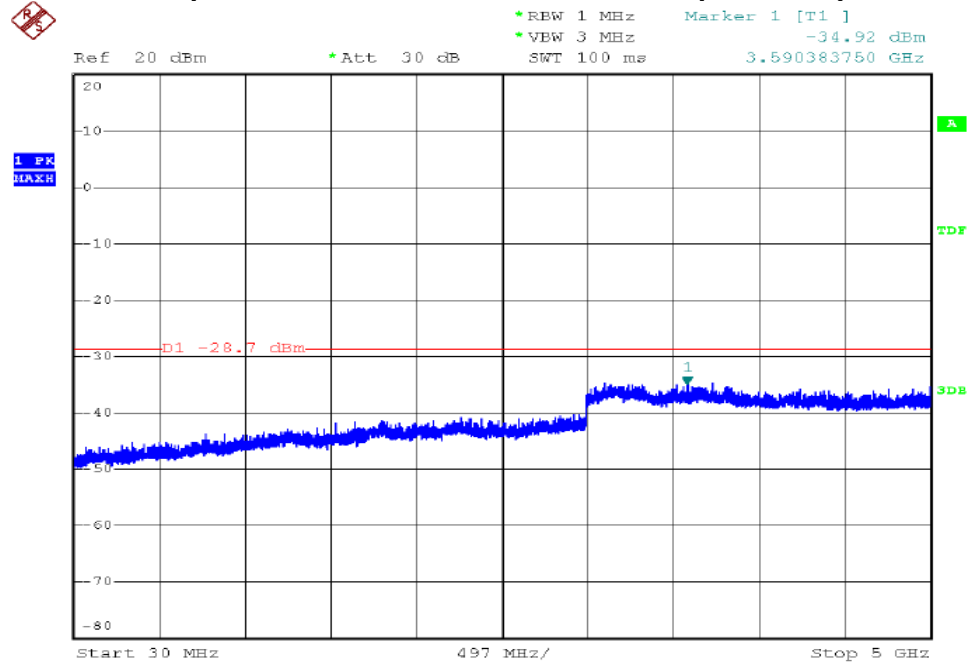
Conducted Spurious Emissions, 33 GHz ~ 40 GHz (5785 MHz), MCS0 data rate



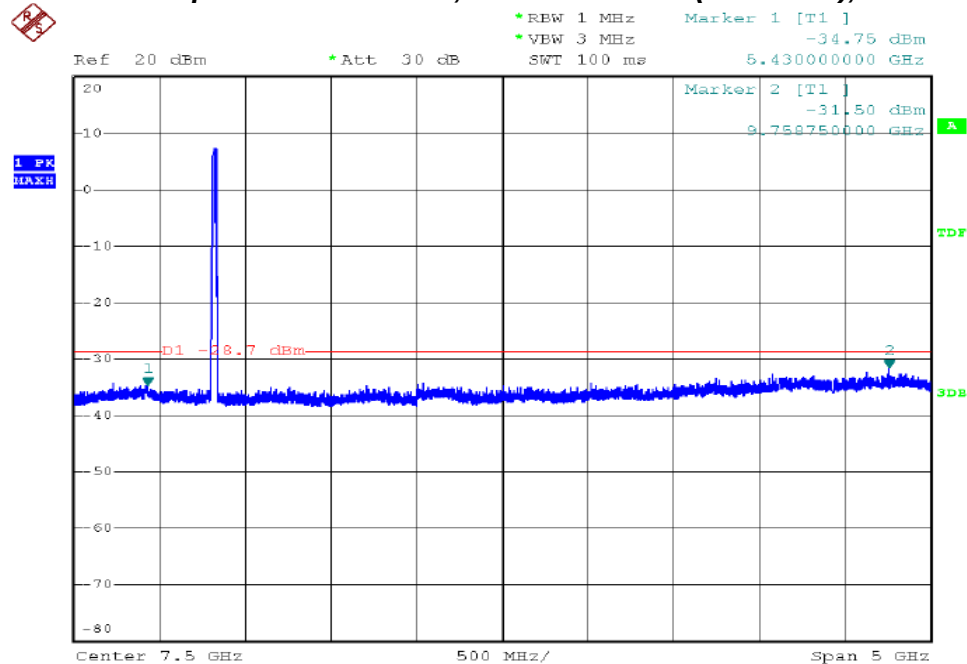
PLOT OF TEST DATA

Chain 0

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (5825 MHz), MCS0 data rate

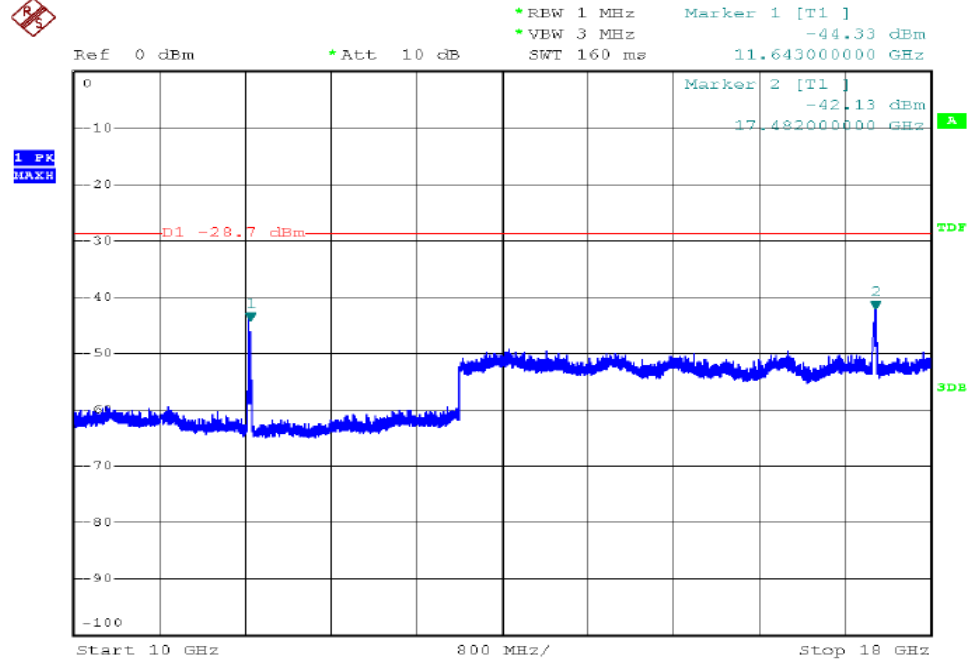


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (5825 MHz), MCS0 data rate

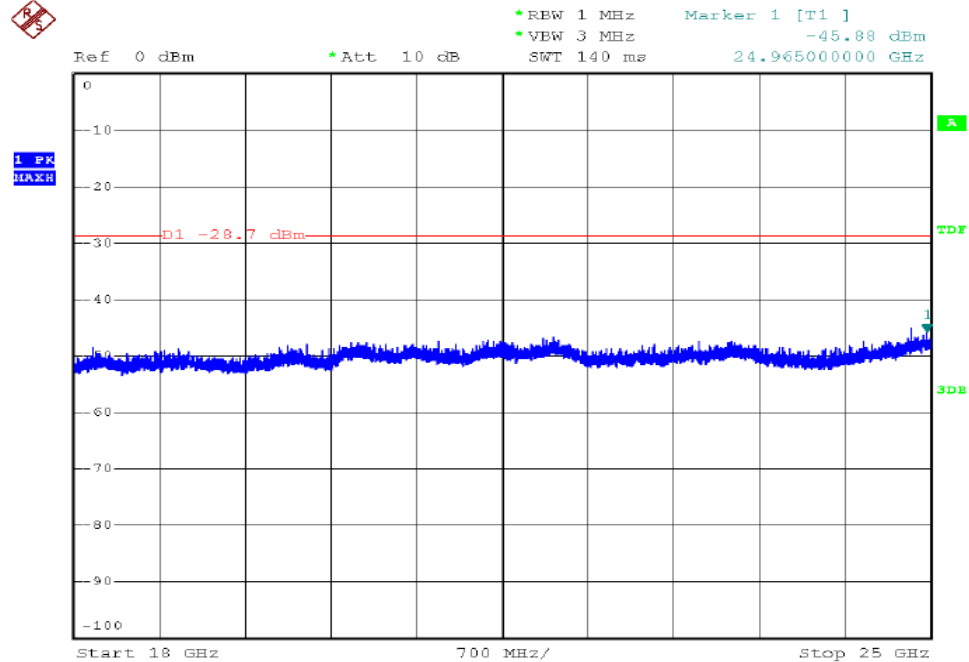


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (5825 MHz), MCS0 data rate

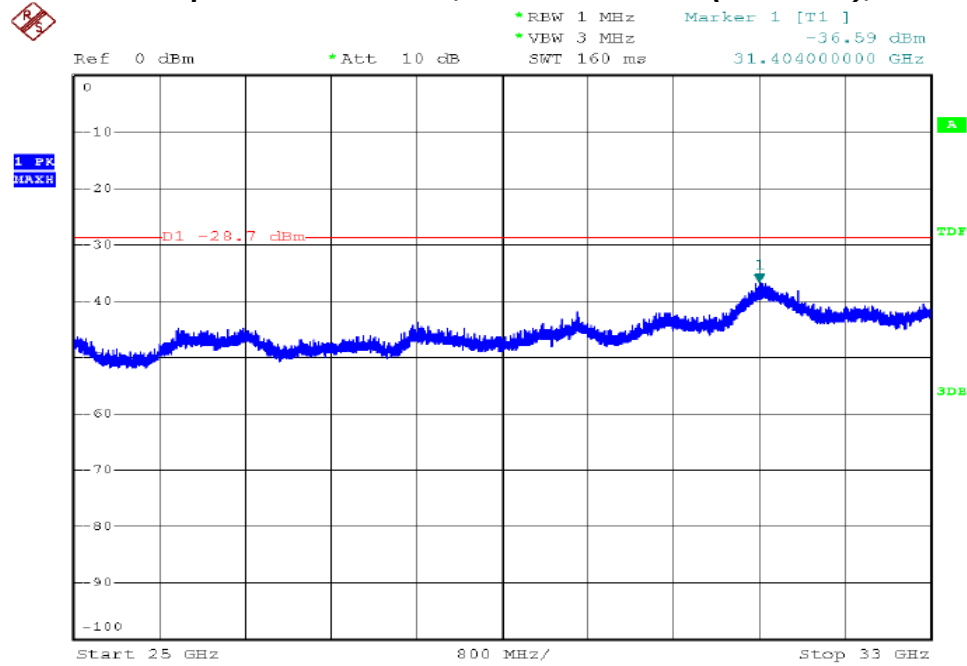


Conducted Spurious Emissions, 18 GHz ~ 25 GHz (5825 MHz), MCS0 data rate

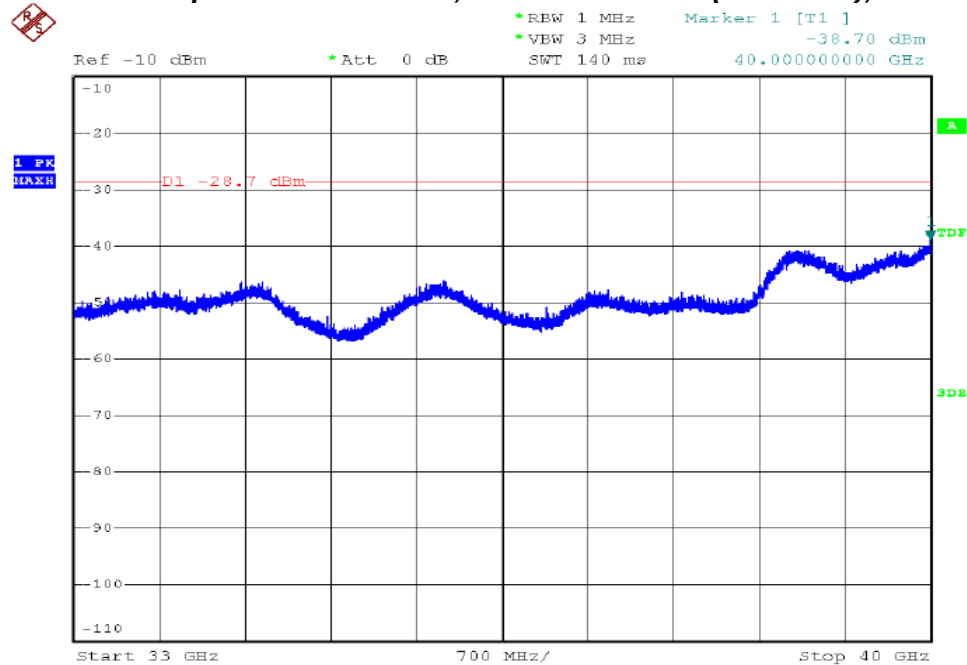


PLOT OF TEST DATA

Conducted Spurious Emissions, 25 GHz ~ 33 GHz (5825 MHz), MCS0 data rate



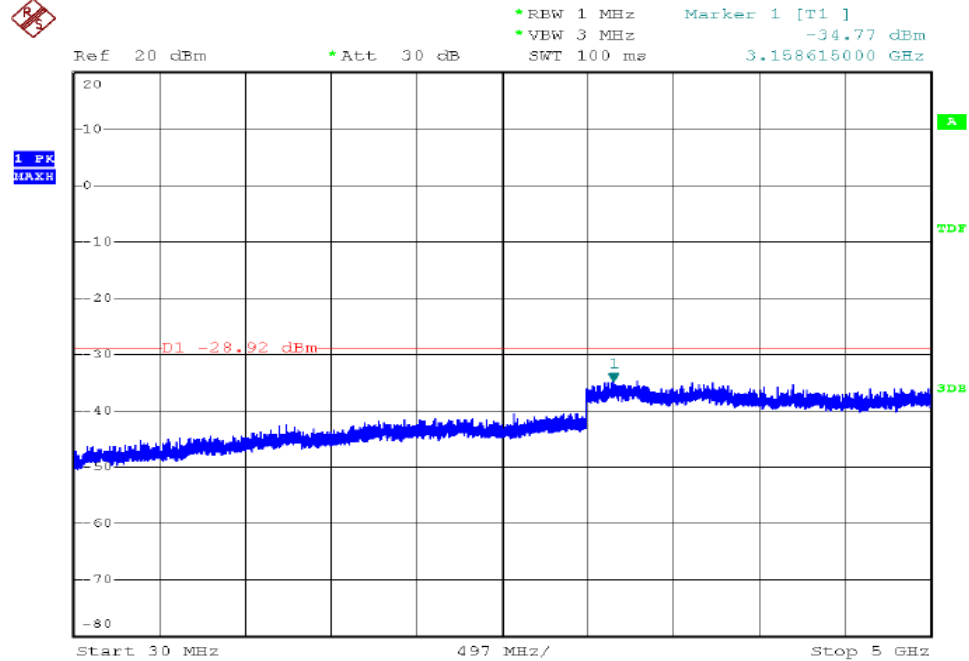
Conducted Spurious Emissions, 33 GHz ~ 40 GHz (5825 MHz), MCS0 data rate



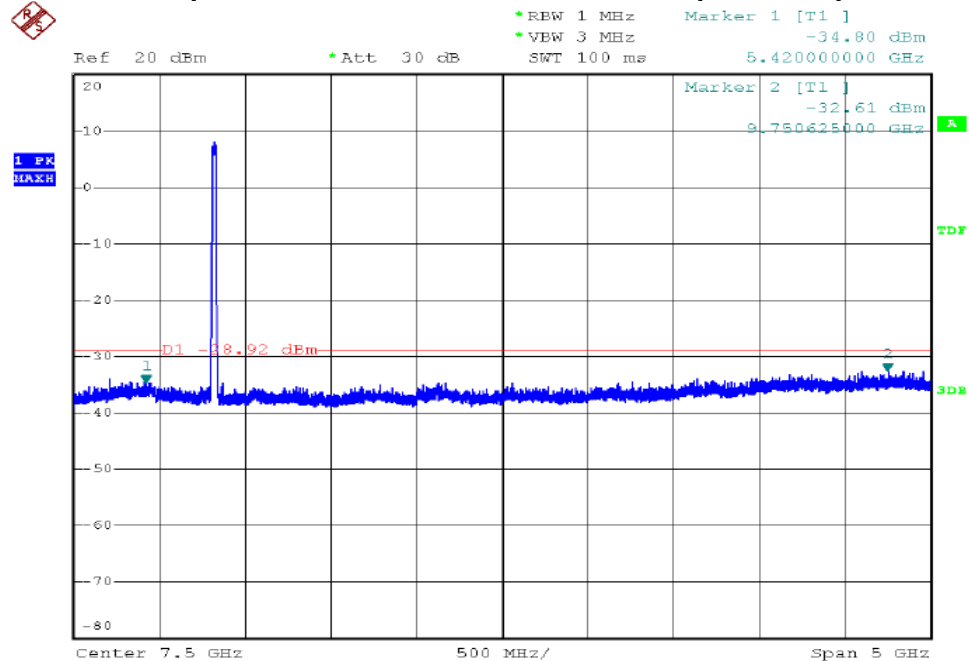
PLOT OF TEST DATA

Chain 1

Conducted Spurious Emissions, 30 MHz ~ 5 GHz (5825 MHz), MCS0 data rate

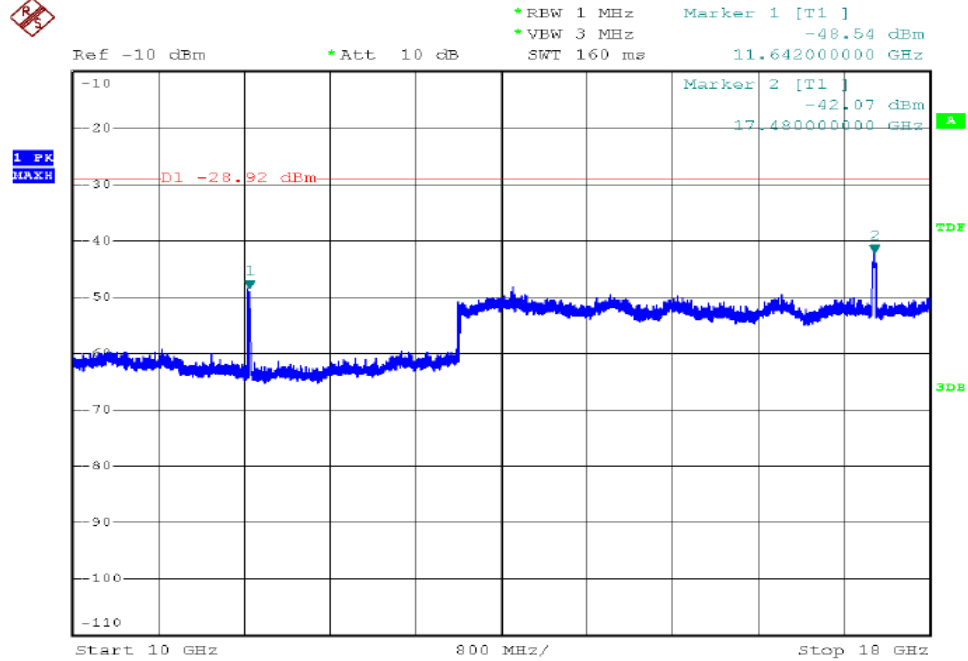


Conducted Spurious Emissions, 5 GHz ~ 10 GHz (5825 MHz), MCS0 data rate

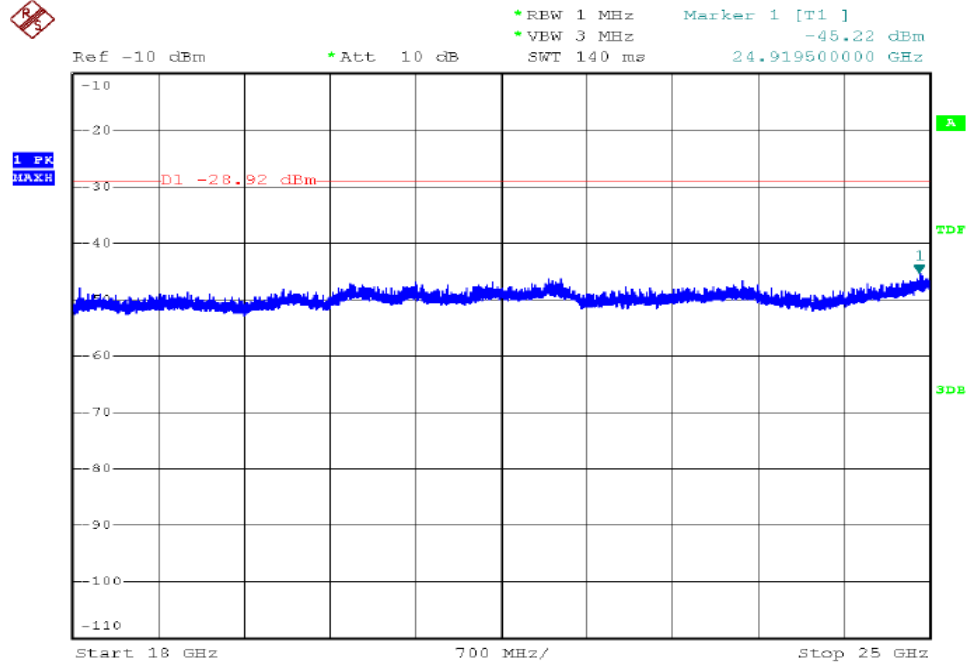


PLOT OF TEST DATA

Conducted Spurious Emissions, 10 GHz ~ 18 GHz (5825 MHz), MCS0 data rate

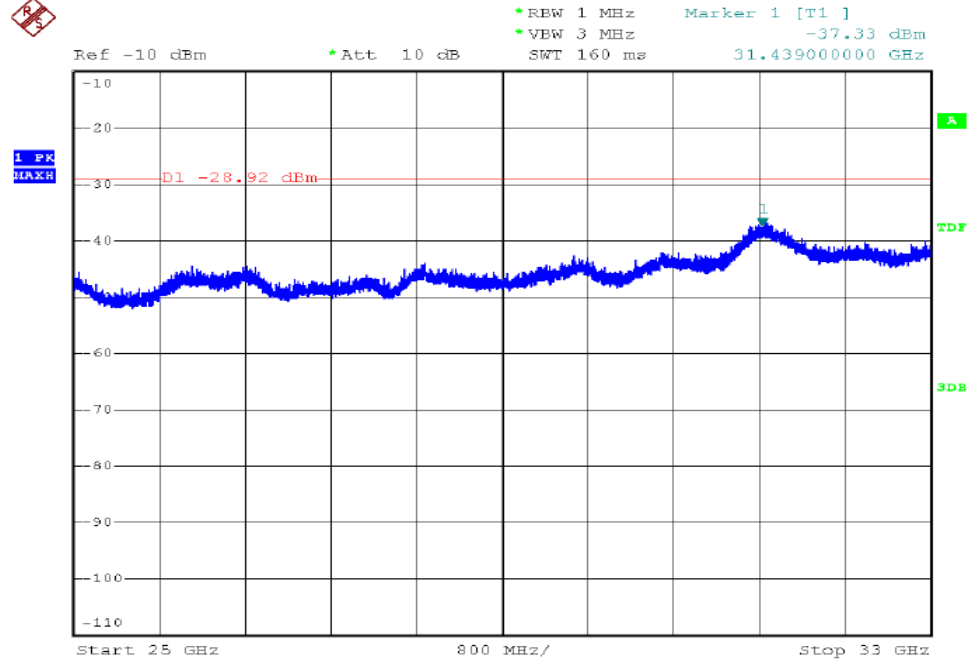


Conducted Spurious Emissions, 18 GHz ~ 25 GHz (5825 MHz), MCS0 data rate

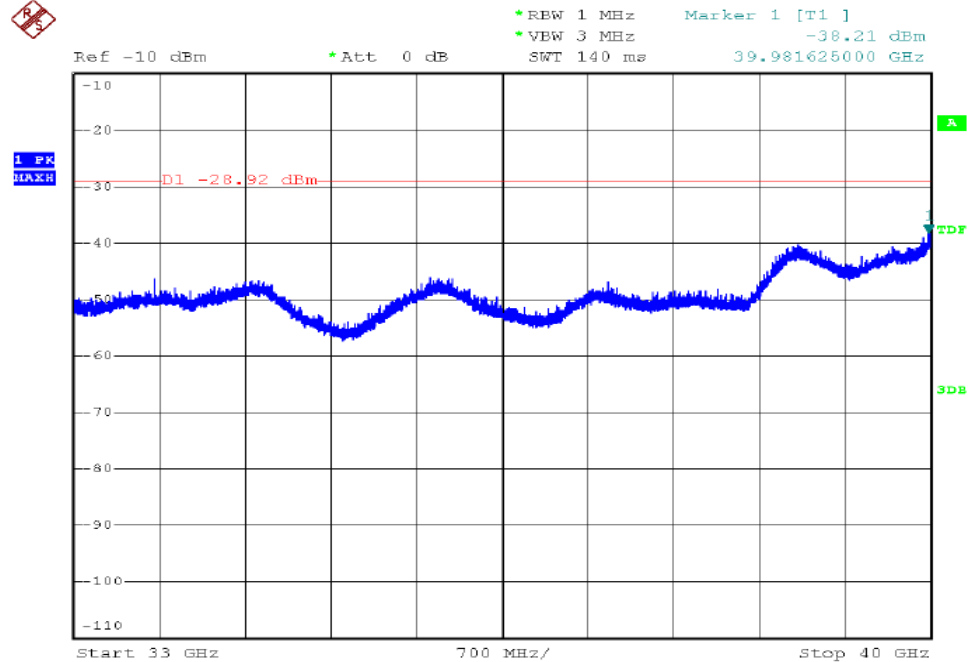


PLOT OF TEST DATA

Conducted Spurious Emissions, 25 GHz ~ 33 GHz (5825 MHz), MCS0 data rate



Conducted Spurious Emissions, 33 GHz ~ 40 GHz (5825 MHz), MCS0 data rate

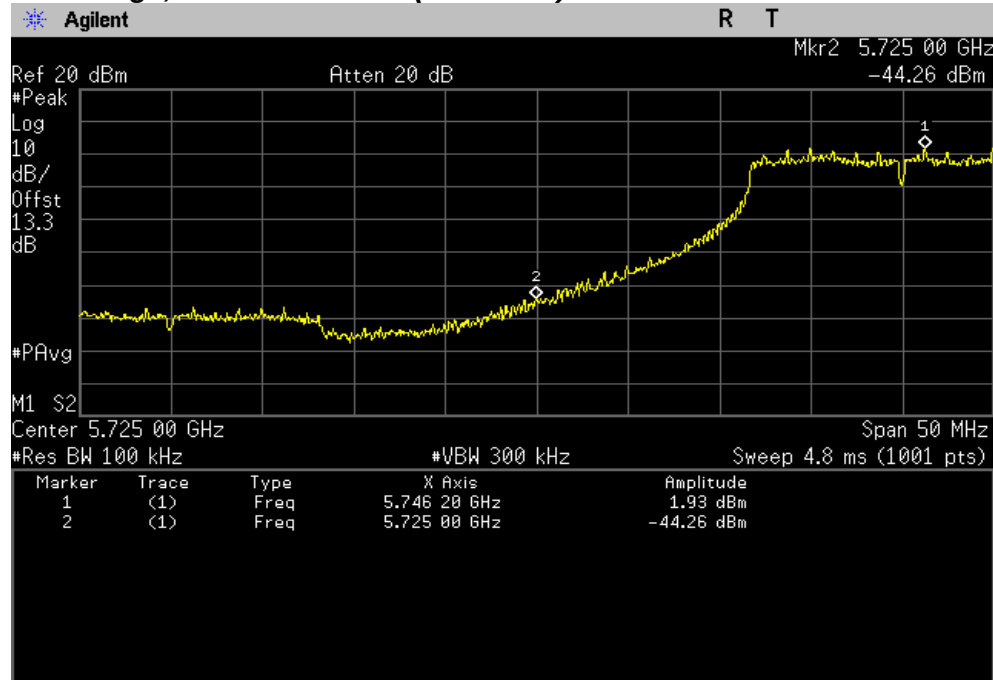


PLOT OF TEST DATA

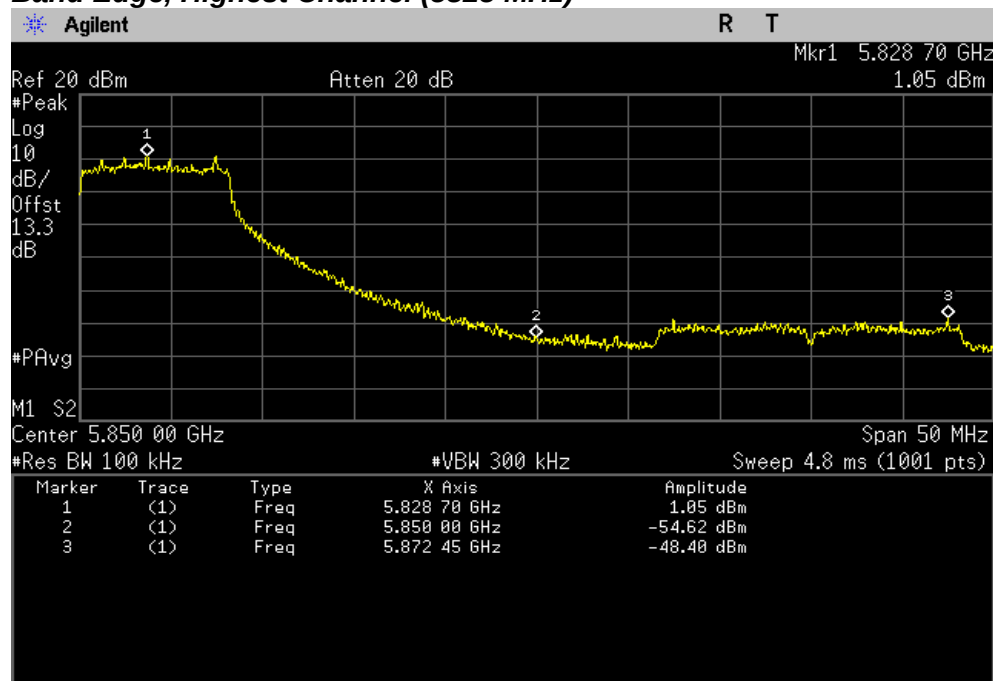
802.11a mode

Chain 0

Band Edge, Lowest Channel (5745 MHz)



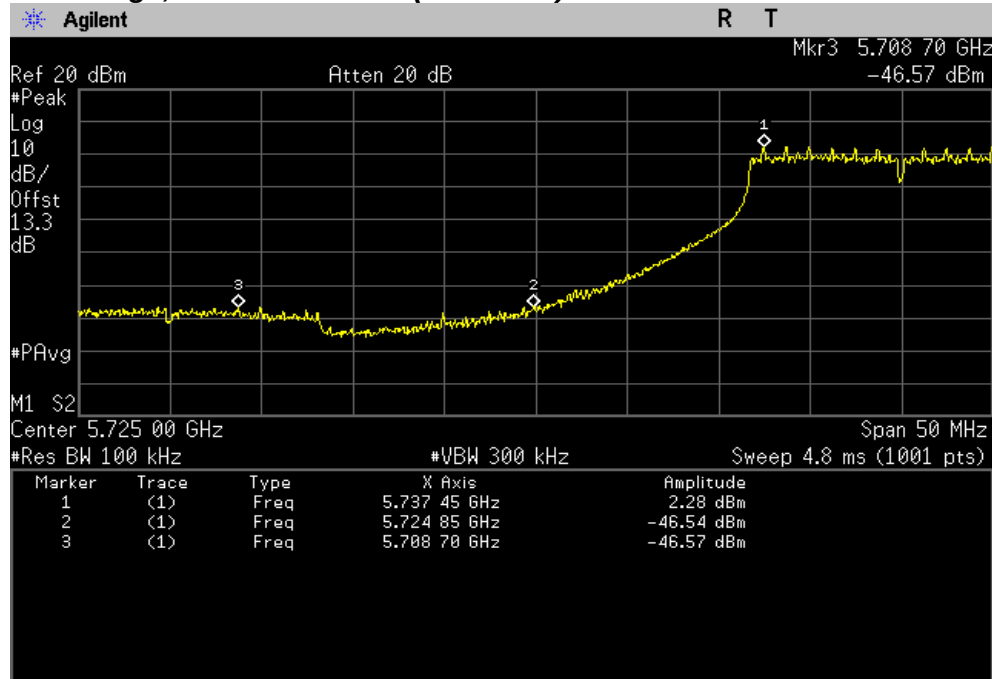
Band Edge, Highest Channel (5825 MHz)



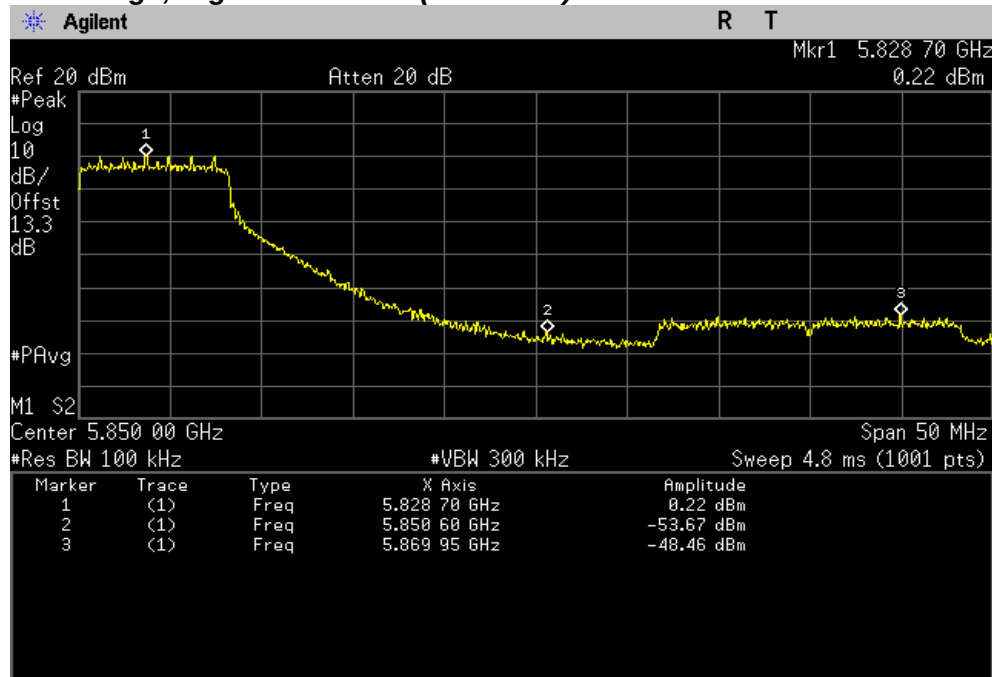
PLOT OF TEST DATA

Chain 1

Band Edge, Lowest Channel (5745 MHz)



Band Edge, Highest Channel (5825 MHz)

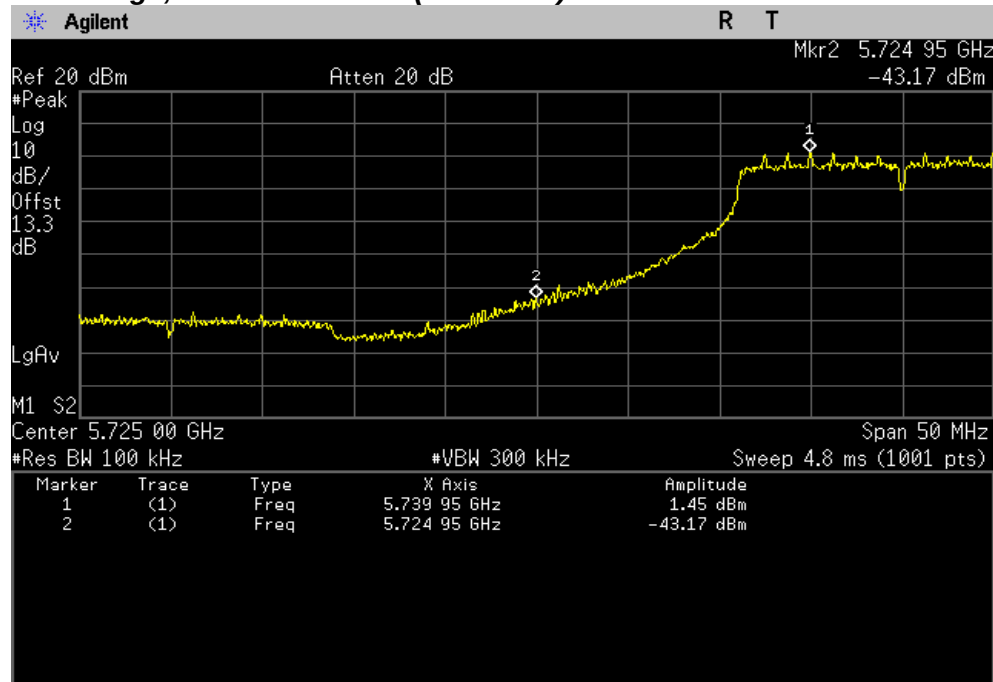


PLOT OF TEST DATA

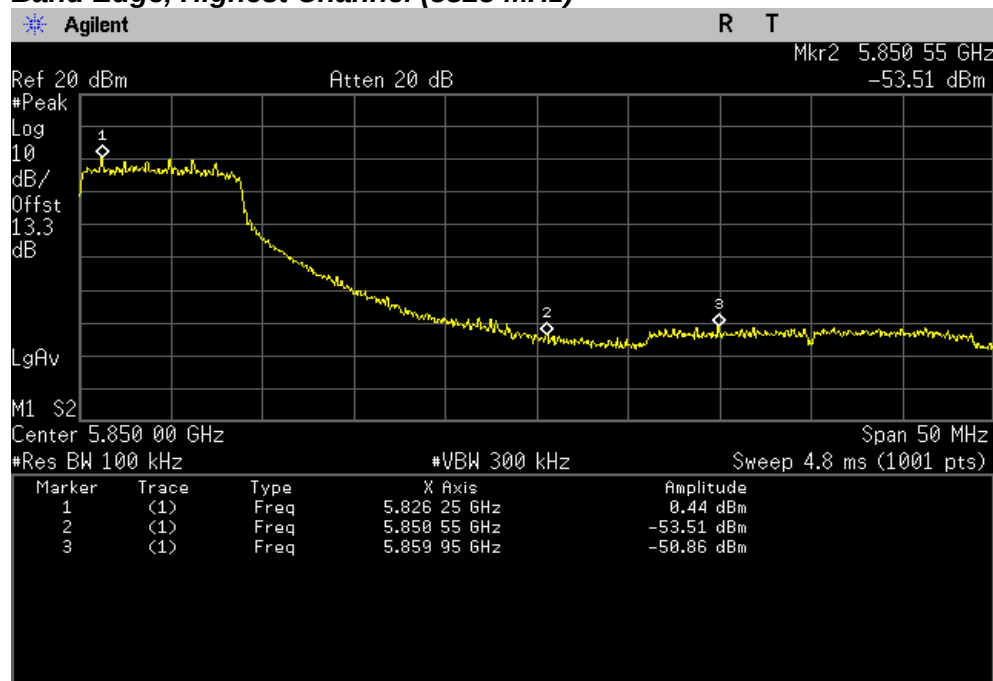
802.11n mode

Chain 0

Band Edge, Lowest Channel (5745 MHz)



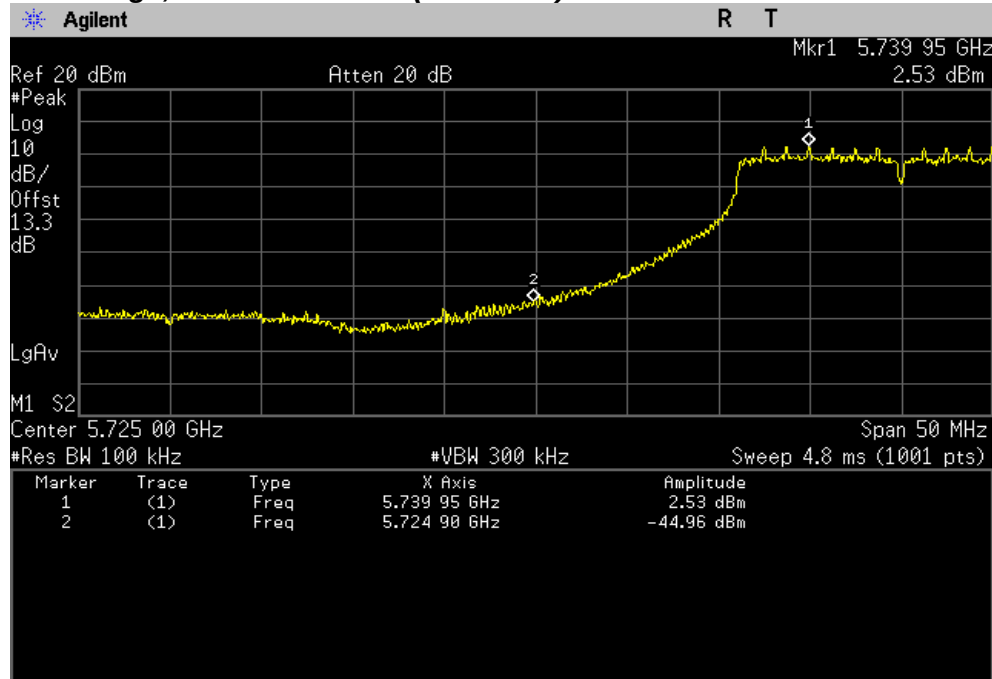
Band Edge, Highest Channel (5825 MHz)



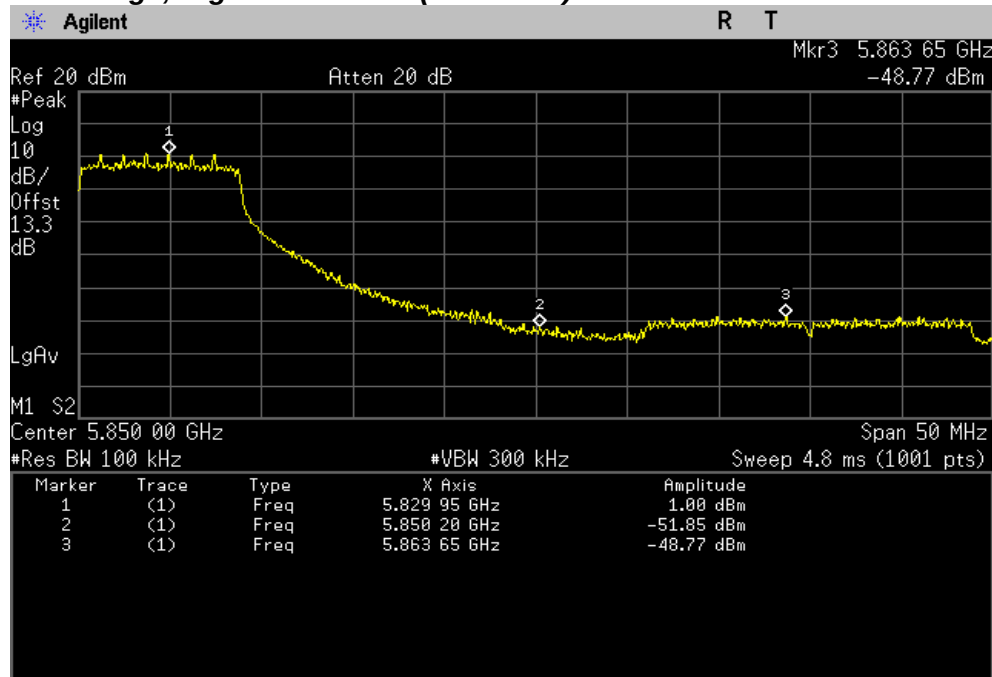
PLOT OF TEST DATA

Chain 1

Band Edge, Lowest Channel (5745 MHz)



Band Edge, Highest Channel (5825 MHz)



TEST DATA

8.7 Radiated Spurious Emissions

8.7.1 Radiated Spurious Emissions – 2.4 GHz band

FCC §15.247(d)

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

802.11 b mode

Lowest Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1497.75	56.8	V	peak	-3.7	53.1	74.0	20.9
1497.75	48.7	V	average	-3.7	45.0	54.0	9.0
1666.25	49.7	V	peak	-3.2	46.5	74.0	27.5
1666.25	44.8	V	average	-3.2	41.6	54.0	12.4
2240.00	56.6	V	peak	-1.5	55.1	74.0	18.9
2240.00	51.1	V	average	-1.5	49.6	54.0	4.4
4360.13	46.3	V	peak	7.3	53.6	74.0	20.4
4360.13	43.5	V	average	7.3	50.8	54.0	3.2
4824.00	47.5	V	peak	8.8	56.3	74.0	17.7
4824.00	37.5	V	average	8.8	46.3	54.0	7.7
7233.00	39.3	V	peak	15.8	55.1	74.0	18.9
7233.00	33.5	V	average	15.8	49.3	54.0	4.7

TEST DATA

Middle Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1495.50	58.4	V	peak	-3.8	54.6	74.0	19.4
1495.50	50.4	V	average	-3.8	46.6	54.0	7.4
1666.00	50.0	V	peak	-3.2	46.8	74.0	27.2
1666.00	46.6	V	average	-3.2	43.4	54.0	10.6
2240.25	56.2	V	peak	-1.5	54.7	74.0	19.3
2240.25	50.5	V	average	-1.5	49.0	54.0	5.0
4360.13	46.4	V	peak	7.3	53.7	74.0	20.3
4360.13	43.3	V	average	7.3	50.6	54.0	3.4
4873.88	44.3	V	peak	9.0	53.3	74.0	20.7
4873.88	37.2	V	average	9.0	46.2	54.0	7.8
7311.00	41.4	V	peak	16.1	57.5	74.0	16.5
7311.00	34.6	V	average	16.1	50.7	54.0	3.3

Highest Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1496.25	57.9	V	peak	-3.8	54.1	74.0	19.9
1496.25	50.4	V	average	-3.8	46.6	54.0	7.4
1666.00	49.8	V	peak	-3.2	46.6	74.0	27.4
1666.00	45.7	V	average	-3.2	42.5	54.0	11.5
2240.00	55.7	V	peak	-1.5	54.2	74.0	19.8
2240.00	50.7	V	average	-1.5	49.2	54.0	4.8
4360.13	46.1	V	peak	7.3	53.4	74.0	20.6
4360.13	43.6	V	average	7.3	50.9	54.0	3.1
4924.13	45.7	V	peak	9.2	54.9	74.0	19.1
4924.13	40.2	V	average	9.2	49.4	54.0	4.6
7386.00	40.6	V	peak	16.3	56.9	74.0	17.1
7386.00	32.2	V	average	16.3	48.5	54.0	5.5

TEST DATA

802.11g mode

Lowest Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1498.75	57.5	V	peak	-3.7	53.8	74.0	20.2
1498.75	49.3	V	average	-3.7	45.6	54.0	8.4
1666.00	49.4	V	peak	-3.2	46.2	74.0	27.8
1666.00	45.5	V	average	-3.2	42.3	54.0	11.7
2240.00	55.9	V	peak	-1.5	54.4	74.0	19.6
2240.00	50.9	V	average	-1.5	49.4	54.0	4.6
2320.00	55.1	V	peak	-1.2	53.9	74.0	20.1
2320.00	49.5	V	average	-1.2	48.3	54.0	5.7
4360.13	46.4	V	peak	7.3	53.7	74.0	20.3
4360.13	43.6	V	average	7.3	50.9	54.0	3.1
4824.38	39.6	V	peak	8.8	48.4	74.0	25.6
4824.38	31.4	V	average	8.8	40.2	54.0	13.8

Middle Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1493.50	57.6	V	peak	-3.8	53.8	74.0	20.2
1493.50	50.5	V	average	-3.8	46.7	54.0	7.3
1666.00	50.4	V	peak	-3.2	47.2	74.0	26.8
1666.00	46.2	V	average	-3.2	43.0	54.0	11.0
2240.00	58.4	V	peak	-1.5	56.9	74.0	17.1
2240.00	51.3	V	average	-1.5	49.8	54.0	4.2
4360.13	45.6	V	peak	7.3	52.9	74.0	21.1
4360.13	41.7	V	average	7.3	49.0	54.0	5.0
4876.88	45.5	V	peak	9.0	54.5	74.0	19.5
4876.88	34.0	V	average	9.0	43.0	54.0	11.0
7312.50	43.5	V	peak	16.1	59.6	74.0	14.4
7312.50	32.1	V	average	16.1	48.2	54.0	5.8

TEST DATA

Highest Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1499.00	59.0	V	peak	-3.7	55.3	74.0	18.7
1499.00	50.7	V	average	-3.7	47.0	54.0	7.0
1666.00	50.0	V	peak	-3.2	46.8	74.0	27.2
1666.00	45.9	V	average	-3.2	42.7	54.0	11.3
2240.00	55.3	V	peak	-1.5	53.8	74.0	20.2
2240.00	51.0	V	average	-1.5	49.5	54.0	4.5
2280.00	55.0	V	peak	-1.4	53.6	74.0	20.4
2280.00	49.8	V	average	-1.4	48.4	54.0	5.6
4360.13	45.6	V	peak	7.3	52.9	74.0	21.1
4360.13	43.2	V	average	7.3	50.5	54.0	3.5
4925.63	41.4	V	peak	9.2	50.6	74.0	23.4
4925.63	31.5	V	average	9.2	40.7	54.0	13.3

TEST DATA

802.11n mode

Lowest Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1499.00	58.5	V	peak	-3.7	54.8	74.0	19.2
1499.00	49.4	V	average	-3.7	45.7	54.0	8.3
1620.00	50.0	V	peak	-3.3	46.7	74.0	27.3
1620.00	43.9	V	average	-3.3	40.6	54.0	13.4
1666.00	49.5	V	peak	-3.2	46.3	74.0	27.7
1666.00	44.1	V	average	-3.2	40.9	54.0	13.1
1680.00	50.3	V	peak	-3.1	47.2	74.0	26.8
1680.00	44.5	V	average	-3.1	41.4	54.0	12.6
2240.00	55.7	V	peak	-1.5	54.2	74.0	19.8
2240.00	51.5	V	average	-1.5	50.0	54.0	4.0
4360.13	45.5	V	peak	7.3	52.8	74.0	21.2
4360.13	42.4	V	average	7.3	49.7	54.0	4.3

Middle Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1498.00	58.1	V	peak	-3.7	54.4	74.0	19.6
1498.00	49.9	V	average	-3.7	46.2	54.0	7.8
1666.00	49.0	V	peak	-3.2	45.8	74.0	28.2
1666.00	44.7	V	average	-3.2	41.5	54.0	12.5
2240.00	58.2	V	peak	-1.5	56.7	74.0	17.3
2240.00	52.1	V	average	-1.5	50.6	54.0	3.4
4360.00	45.9	V	peak	7.3	53.2	74.0	20.8
4360.00	42.0	V	average	7.3	49.3	54.0	4.7
4870.13	41.4	V	peak	9.0	50.4	74.0	23.6
4870.13	32.5	V	average	9.0	41.5	54.0	12.5
7318.50	44.1	V	peak	16.1	60.2	74.0	13.8
7318.50	32.2	V	average	16.1	48.3	54.0	5.7

TEST DATA

Highest Channel

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1497.50	58.5	V	peak	-3.7	54.8	74.0	19.2
1497.50	50.4	V	average	-3.7	46.7	54.0	7.3
1666.00	50.4	V	peak	-3.2	47.2	74.0	26.8
1666.00	45.7	V	average	-3.2	42.5	54.0	11.5
2240.00	57.2	V	peak	-1.5	55.7	74.0	18.3
2240.00	50.5	V	average	-1.5	49.0	54.0	5.0
2280.00	58.0	V	peak	-1.4	56.6	74.0	17.4
2280.00	51.4	V	average	-1.4	50.0	54.0	4.0
4360.13	45.6	V	peak	7.3	52.9	74.0	21.1
4360.13	43.0	V	average	7.3	50.3	54.0	3.7
4932.38	40.2	V	peak	9.2	49.4	74.0	24.6
4932.38	30.9	V	average	9.2	40.1	54.0	13.9

Note(s):

- *Pol. H = Horizontal V = Vertical
- **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
- Measurement of the radiated emissions is performed in vertical and horizontal polarizations.
The worst data were recorded.
- For peak measurements, the resolution bandwidth was set to 1 MHz and the video bandwidth was set to 3 MHz.
- For average measurements, "12.2.5.1 Average Power Measurement Procedures" at "558074 D01 DTS Meas Guidance v03r01" was used.
- The spectrum was measured from 9 kHz to 10th harmonic and the worst-case emissions were reported. No significant emissions were found beyond the third harmonic for this device.

TEST DATA

8.7.2 Radiated Spurious Emissions – 5 GHz band

FCC §15.247(d)

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

802.11a mode

Lowest Channel (5745 MHz)

Frequency (GHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
11.490	46.49	H	peak	8.69	-6.02	49.16	74.0	24.84
11.490	31.63	H	average	8.69	-6.02	34.30	54.0	19.70
11.490	52.09	V	peak	8.69	-6.02	54.76	74.0	19.24
11.490	36.76	V	average	8.69	-6.02	39.43	54.0	14.57

Middle Channel (5785 MHz)

Frequency (GHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
11.570	50.79	H	peak	9.21	-6.02	53.98	74.0	20.02
11.570	35.94	H	average	9.21	-6.02	39.13	54.0	14.87
11.570	59.01	V	peak	9.21	-6.02	62.20	74.0	11.80
11.570	40.89	V	average	9.21	-6.02	44.08	54.0	9.92

Highest Channel (5825 MHz)

Frequency (GHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
11.650	47.36	H	peak	8.48	-6.02	49.82	74.0	24.18
11.650	34.66	H	average	8.48	-6.02	37.12	54.0	16.88
11.650	55.02	V	peak	8.48	-6.02	57.48	74.0	16.52
11.650	37.43	V	average	8.48	-6.02	39.89	54.0	14.11

TEST DATA

802.11n mode

Lowest Channel (5745 MHz)

Frequency (GHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
11.490	44.34	H	peak	8.69	-6.02	47.01	74.0	26.99
11.490	33.48	H	average	8.69	-6.02	36.15	54.0	17.85
11.490	49.89	V	peak	8.69	-6.02	52.56	74.0	21.44
11.490	36.76	V	average	8.69	-6.02	39.43	54.0	14.57

Middle Channel (5785 MHz)

Frequency (GHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
11.570	51.28	H	peak	9.21	-6.02	54.47	74.0	19.53
11.570	35.54	H	average	9.21	-6.02	38.73	54.0	15.27
11.570	56.30	V	peak	9.21	-6.02	59.49	74.0	14.51
11.570	41.80	V	average	9.21	-6.02	44.99	54.0	9.01

Highest Channel (5825 MHz)

Frequency (GHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Distance (dB)***	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
11.650	45.46	H	peak	8.48	-6.02	47.92	74.0	26.08
11.650	34.75	H	average	8.48	-6.02	37.21	54.0	16.79
11.650	52.56	V	peak	8.48	-6.02	55.02	74.0	18.98
11.650	37.93	V	average	8.48	-6.02	40.39	54.0	13.61

Note(s):

- *Pol. H = Horizontal V = Vertical
- **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
- ***Distance factor = $20 \log (\text{test distance}/\text{specific distance}) = 20 \log (1.5 / 3)$
- Measurement of the radiated emissions is performed in vertical and horizontal polarizations.

The worst data were recorded.

- 5. For peak measurements, the resolution bandwidth was set to 1 MHz and the video bandwidth was set to 3 MHz.*
- 6. For average measurements, "12.2.5.1 Average Power Measurement Procedures" at "558074 D01 DTS Meas Guidance v03r01" was used.*
- 7. The spectrum was measured from 9 kHz to 10th harmonic and the worst-case emissions were reported. No significant emissions were found beyond the second harmonic for this device.*

TEST DATA

8.7.3 Radiated Band Edge

FCC §15.247(d)

Test Mode : Set to Lowest channel and Highest channel

802.11b mode

Lowest Channel (2412 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2320.03	56.80	V	peak	-1.20	55.60	74.0	18.40
2319.92	49.60	V	average	-1.20	48.40	54.0	5.60
2389.75	55.30	V	peak	-1.00	54.30	74.0	19.70
2389.90	46.60	V	average	-1.00	45.60	54.0	8.40

Highest Channel (2462 MHz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	mode	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2483.86	57.80	V	peak	-0.50	57.30	74.0	16.70
2483.68	48.40	V	average	-0.50	47.90	54.0	6.10
2499.10	60.90	V	peak	-0.50	60.40	74.0	13.60
2499.20	50.70	V	average	-0.50	50.20	54.0	3.80

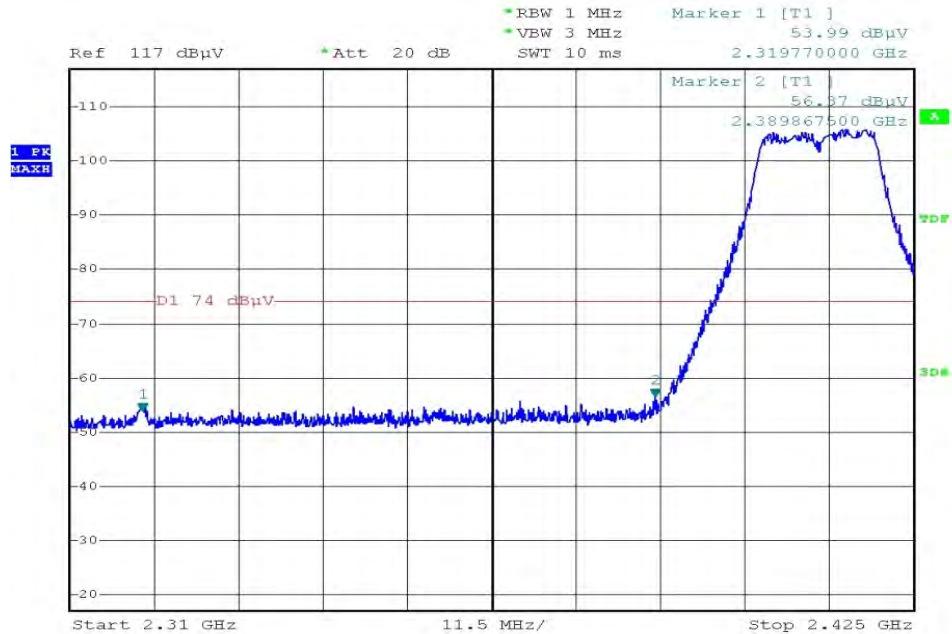
Note(s):

- *Pol. H = Horizontal V = Vertical
- **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
- Measurement of the radiated emissions is performed in vertical and horizontal polarizations. The worst data were recorded
- For peak measurements, the resolution bandwidth was set to 1 MHz and the video bandwidth was set to 3 MHz.
- For average measurements, "12.2.5.1 Average Power Measurement Procedures" at "558074 D01 DTS Meas Guidance v03r01" was used.

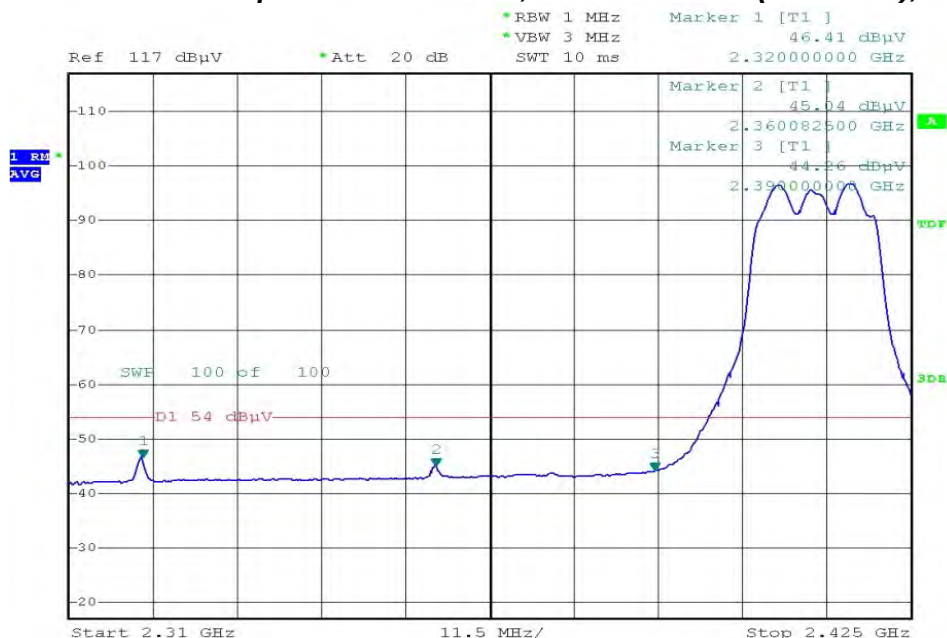
PLOT OF TEST DATA

802.11g mode

Restricted Band Spurious Emissions, Lowest channel(2412 MHz), Peak, 802.11g mode

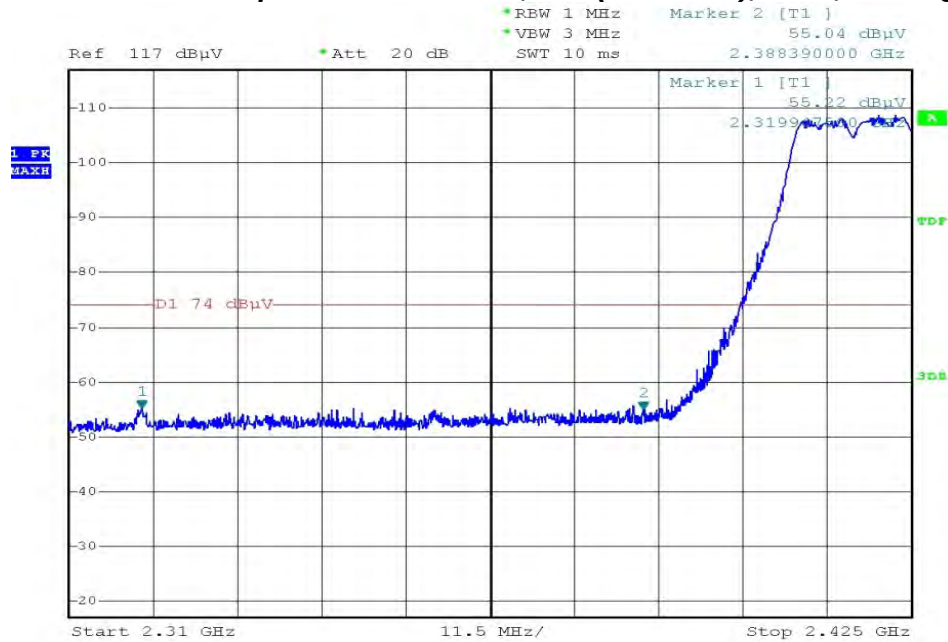


Restricted Band Spurious Emissions, Lowest channel(2412 MHz), Average, 802.11g mode

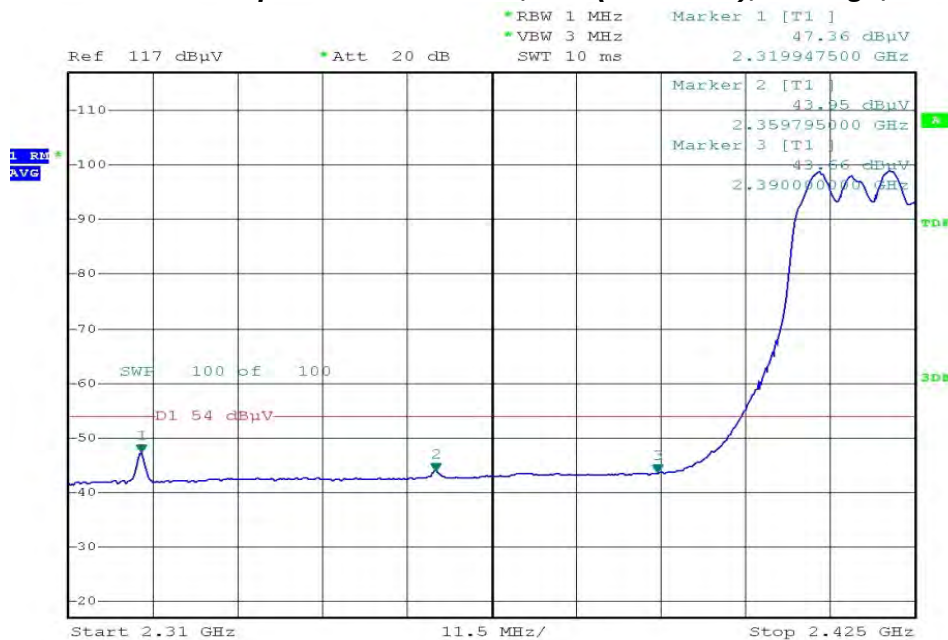


PLOT OF TEST DATA

Restricted Band Spurious Emissions, CH2(2417 MHz), Peak, 802.11g mode

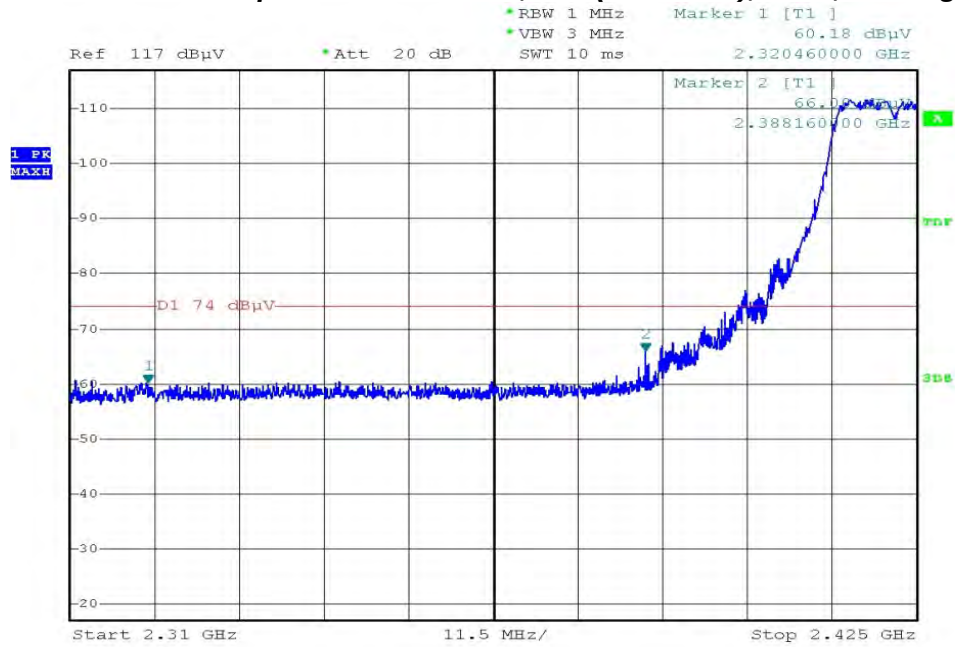


Restricted Band Spurious Emissions, CH2(2417 MHz), Average, 802.11g mode

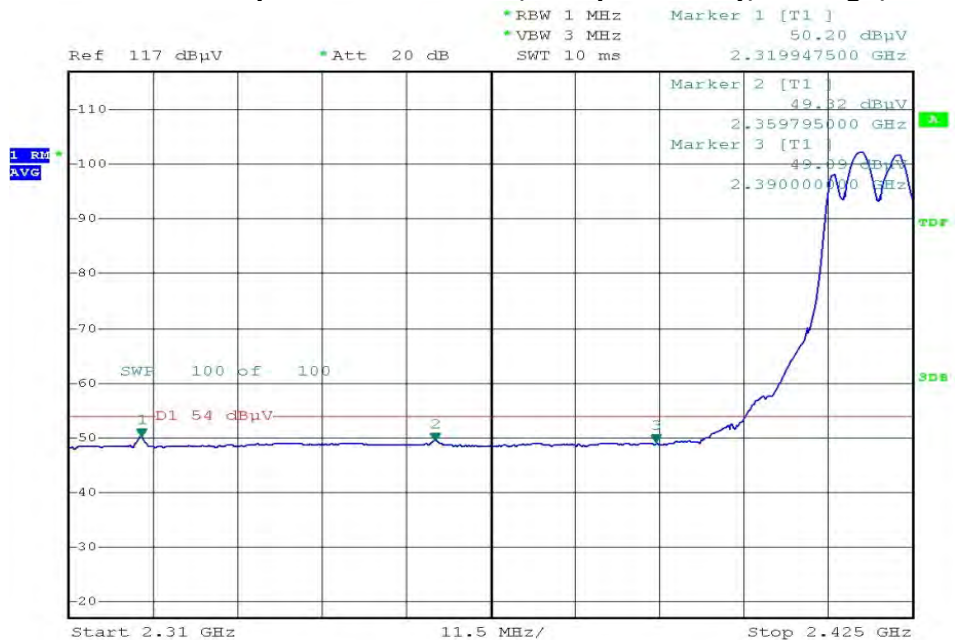


PLOT OF TEST DATA

Restricted Band Spurious Emissions, CH3(2422 MHz), Peak, 802.11g mode

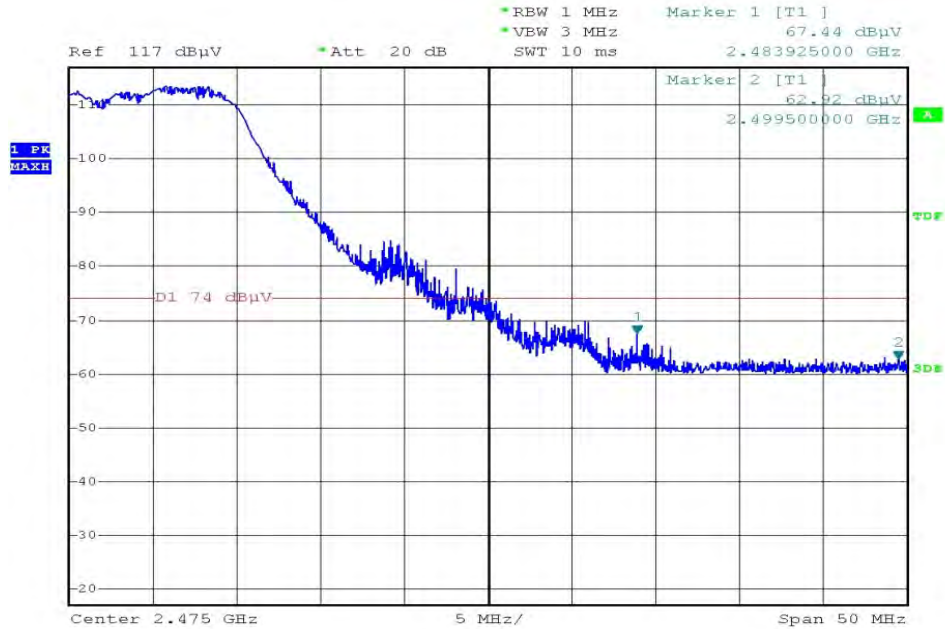


Restricted Band Spurious Emissions, CH3(2422 MHz), Average, 802.11g mode

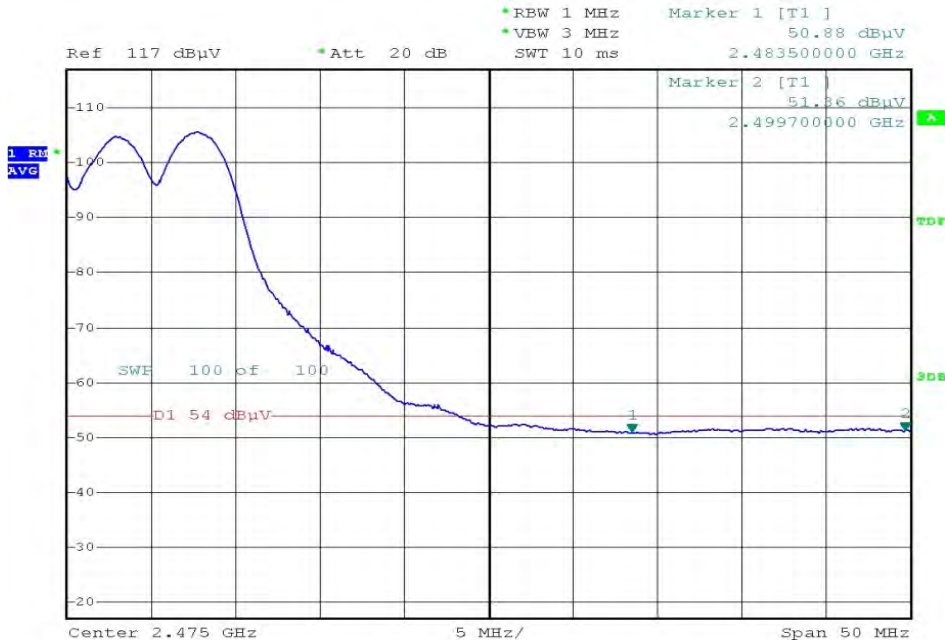


PLOT OF TEST DATA

Restricted Band Spurious Emissions, CH 9(2452 MHz), Peak, 802.11g mode

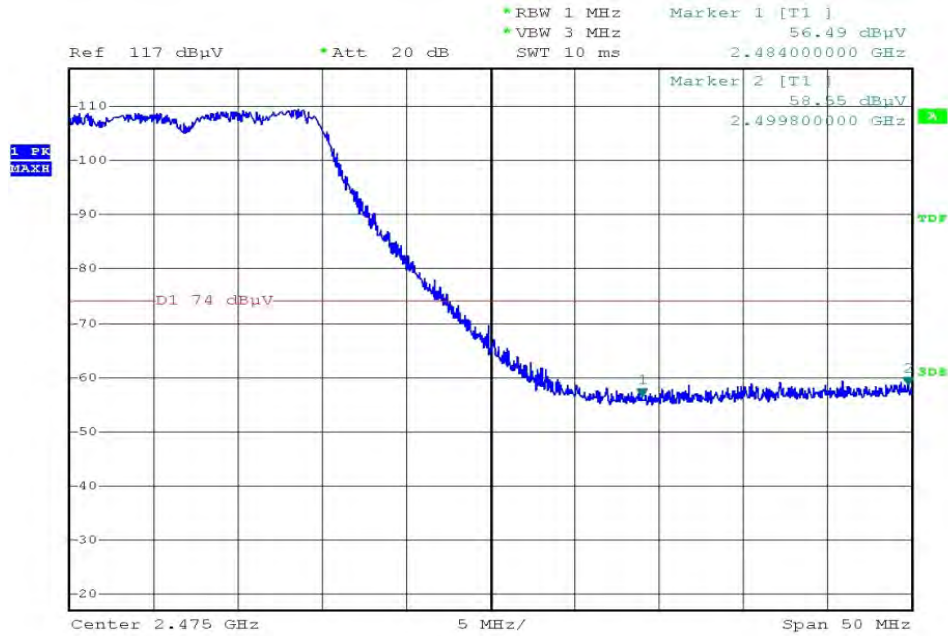


Restricted Band Spurious Emissions, CH 9(2452 MHz), Average, 802.11g mode

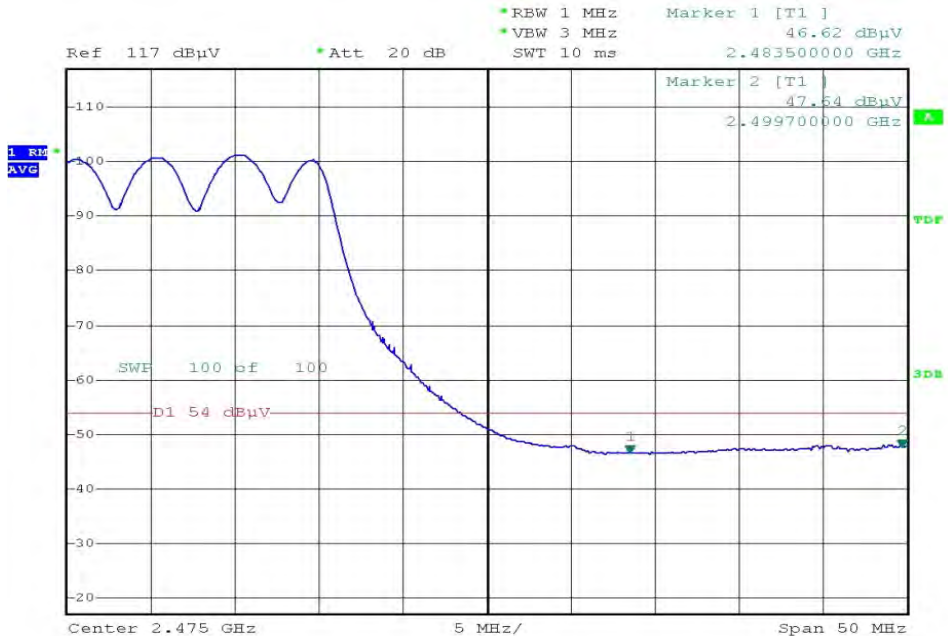


PLOT OF TEST DATA

Restricted Band Spurious Emissions, CH 10(2457 MHz), Peak, 802.11g mode

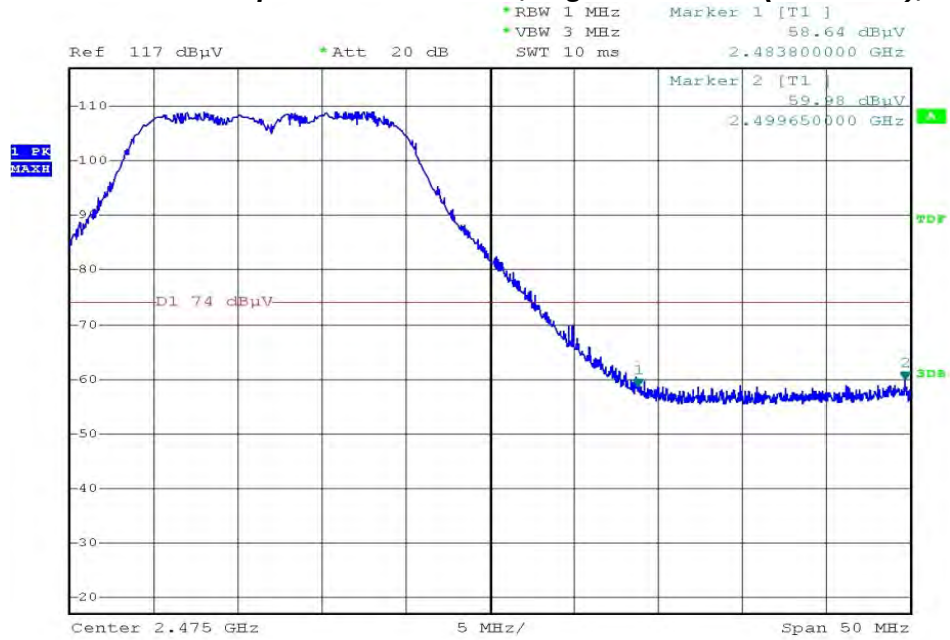


Restricted Band Spurious Emissions, CH 10(2457 MHz), Average, 802.11g mode

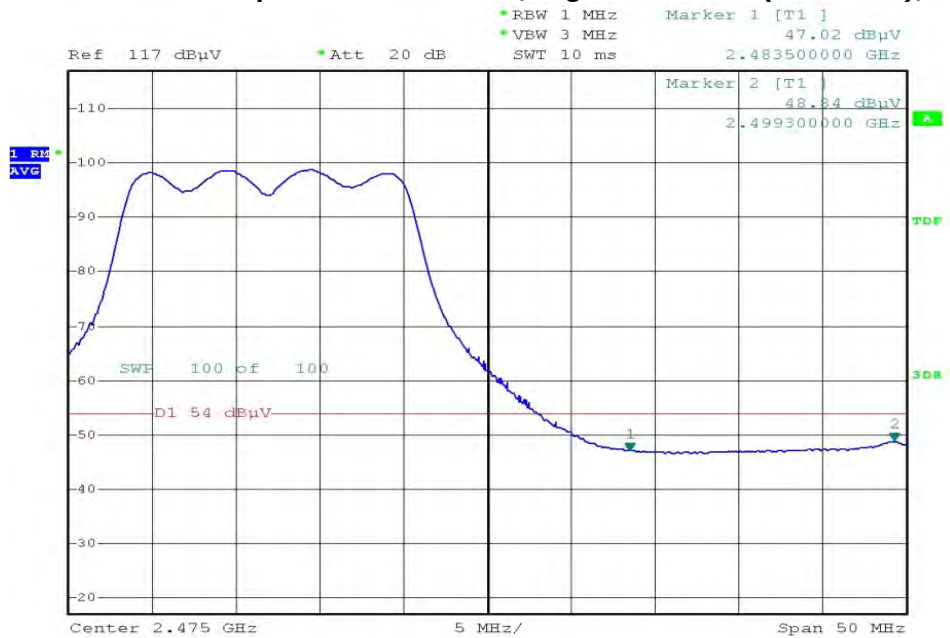


PLOT OF TEST DATA

Restricted Band Spurious Emissions, Highest channel(2462 MHz), Peak, 802.11g mode



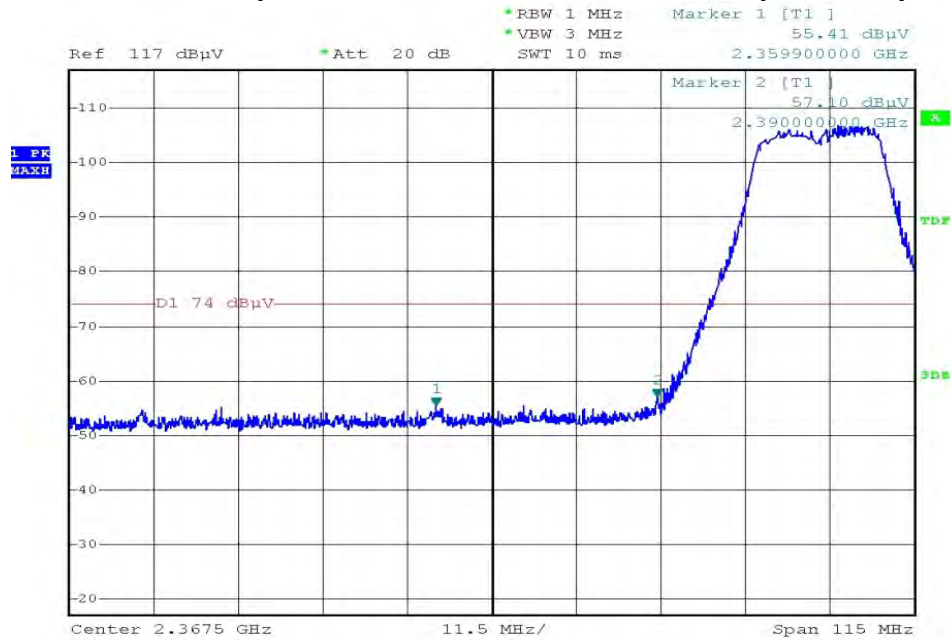
Restricted Band Spurious Emissions, Highest channel(2462 MHz), Average, 802.11g mode



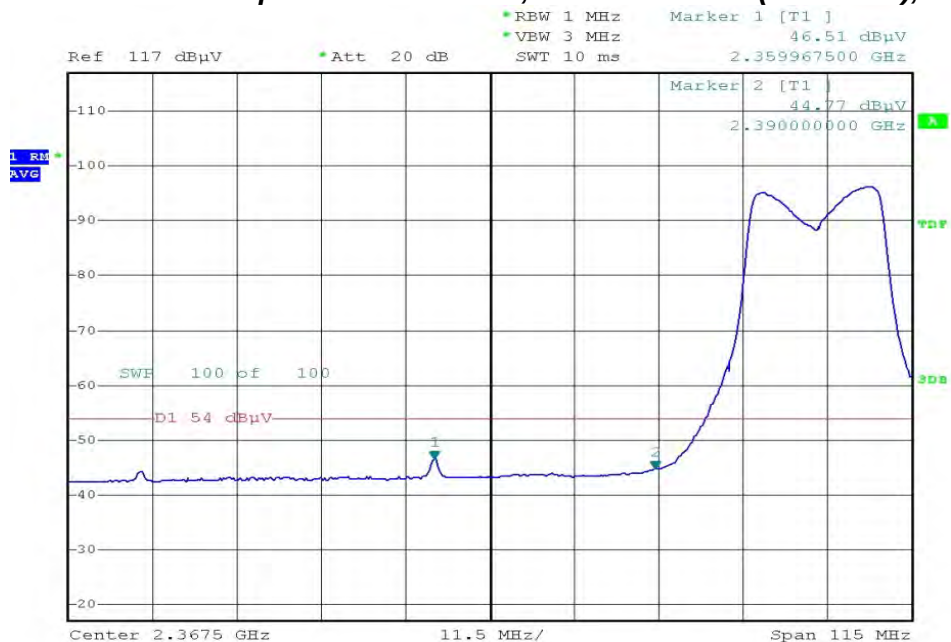
PLOT OF TEST DATA

802.11n mode

Restricted Band Spurious Emissions, Lowest channel(2412 MHz), Peak, 802.11n mode

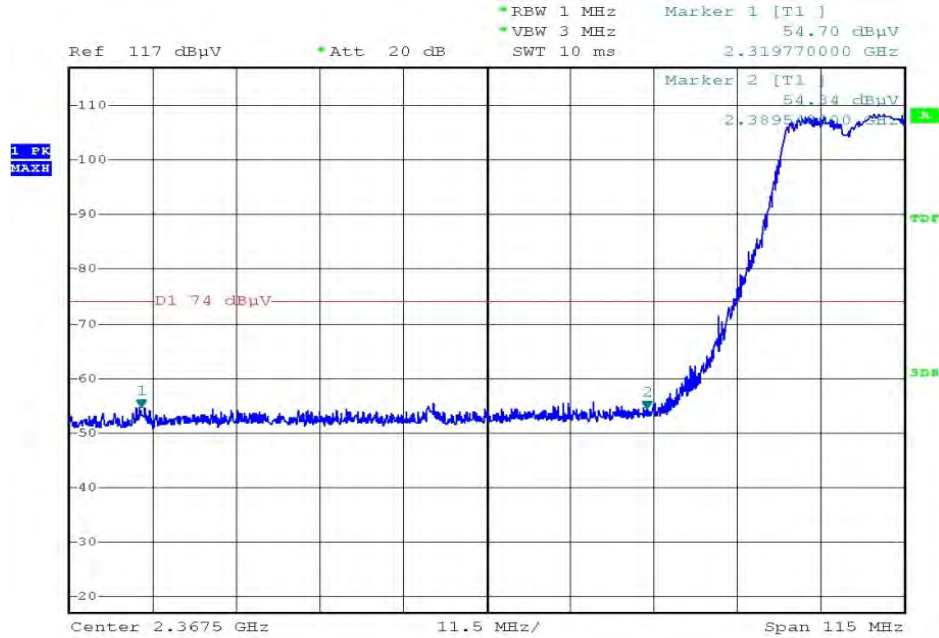


Restricted Band Spurious Emissions, Lowest channel(2412 MHz), Average, 802.11n mode

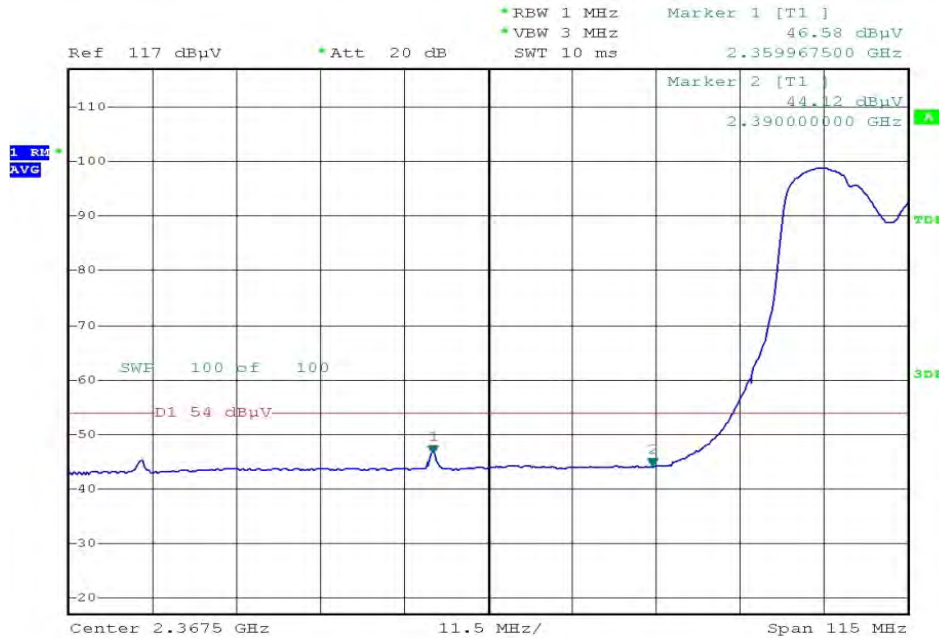


PLOT OF TEST DATA

Restricted Band Spurious Emissions, CH2(2417 MHz), Peak, 802.11n mode

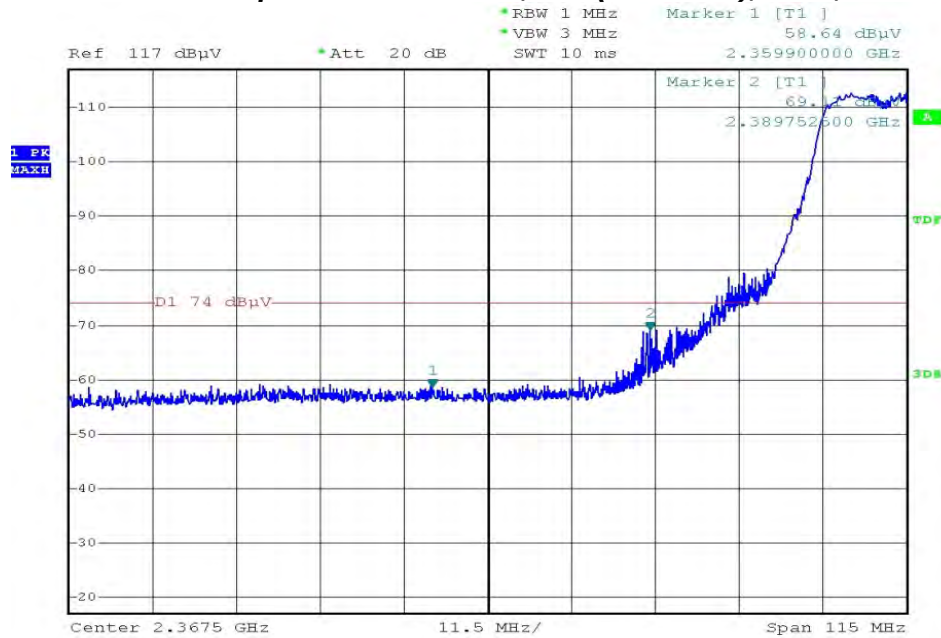


Restricted Band Spurious Emissions, CH2(2417 MHz), Average, 802.11n mode

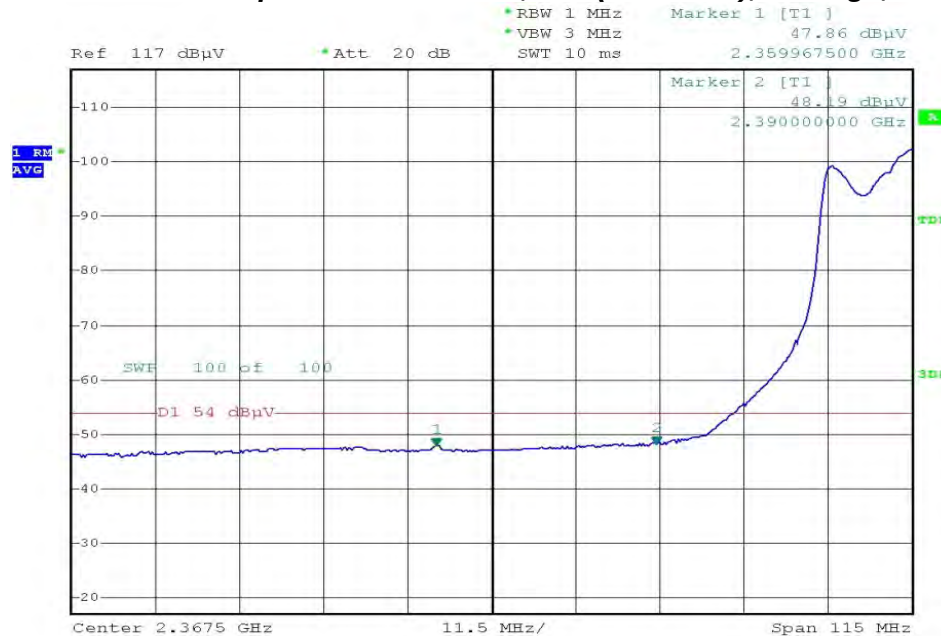


PLOT OF TEST DATA

Restricted Band Spurious Emissions, CH3(2422 MHz), Peak, 802.11n mode

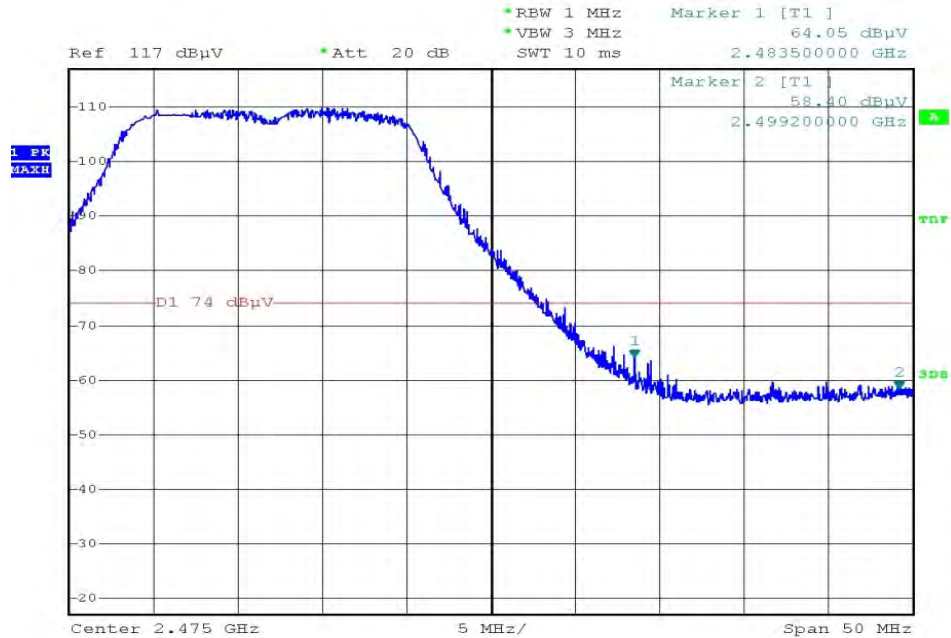


Restricted Band Spurious Emissions, CH3(2422 MHz), Average, 802.11n mode

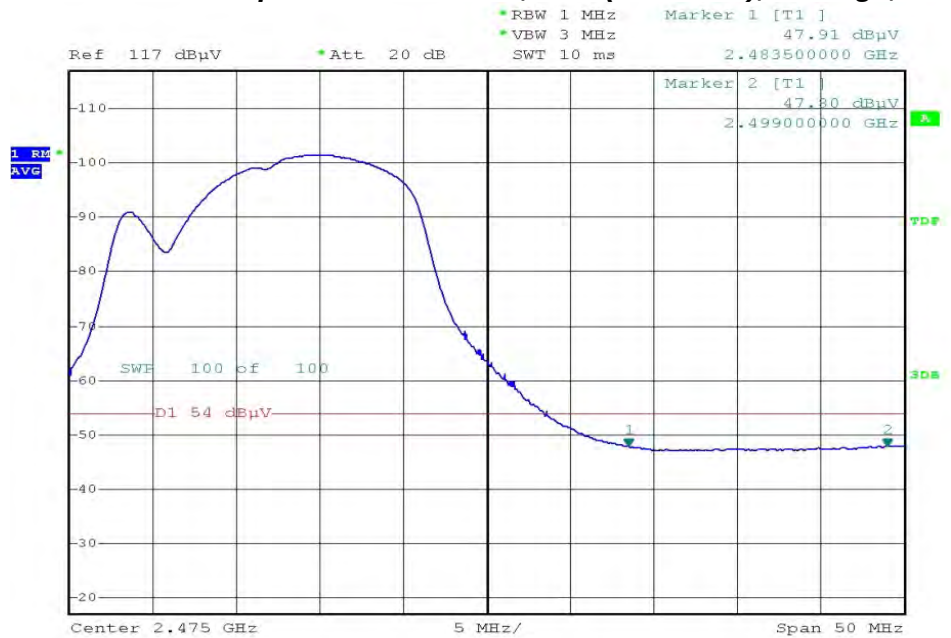


PLOT OF TEST DATA

Restricted Band Spurious Emissions, CH 9(2452 MHz), Peak, 802.11n mode

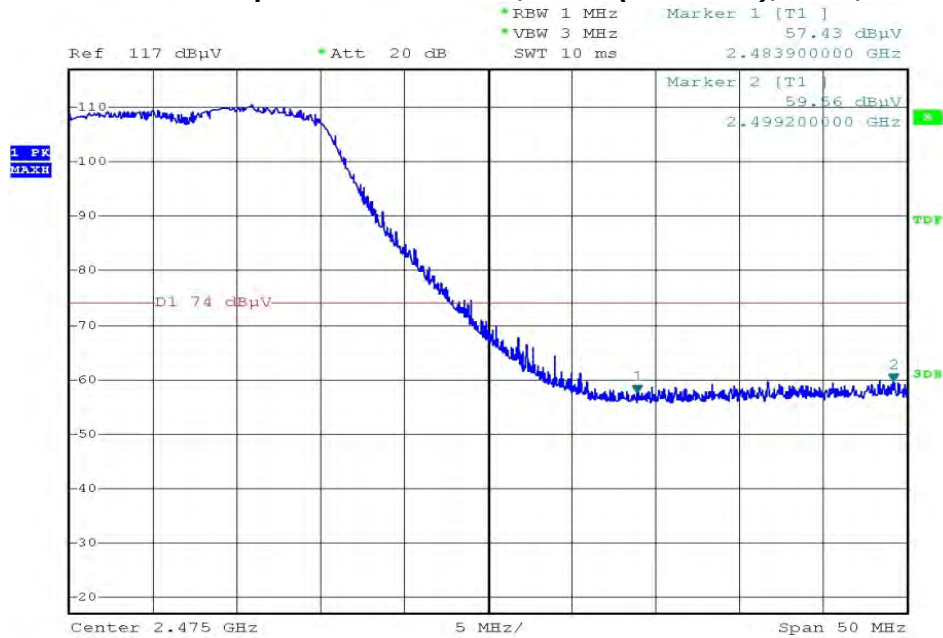


Restricted Band Spurious Emissions, CH 9(2452 MHz), Average, 802.11n mode

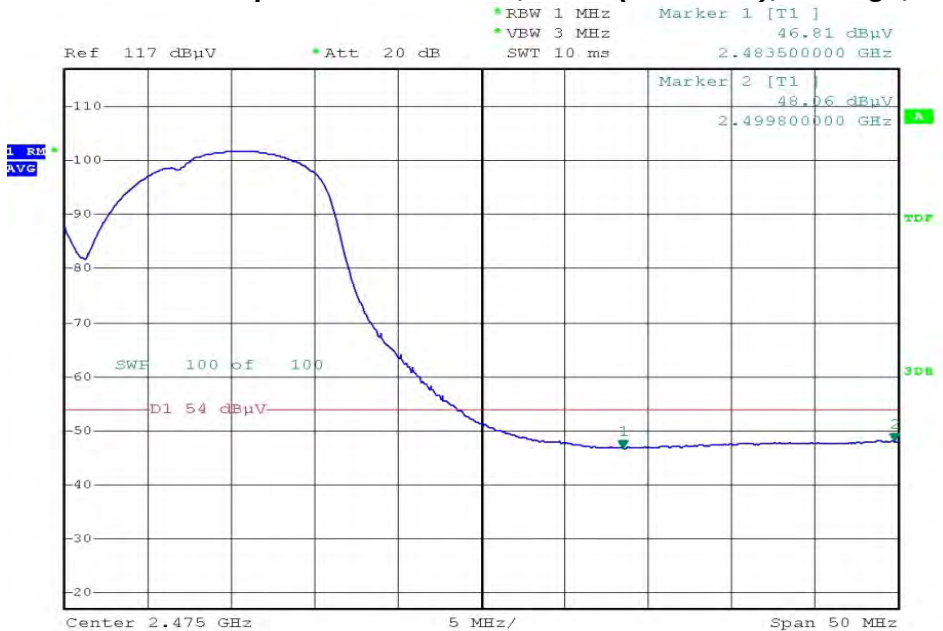


PLOT OF TEST DATA

Restricted Band Spurious Emissions, CH 10(2457 MHz), Peak, 802.11n mode

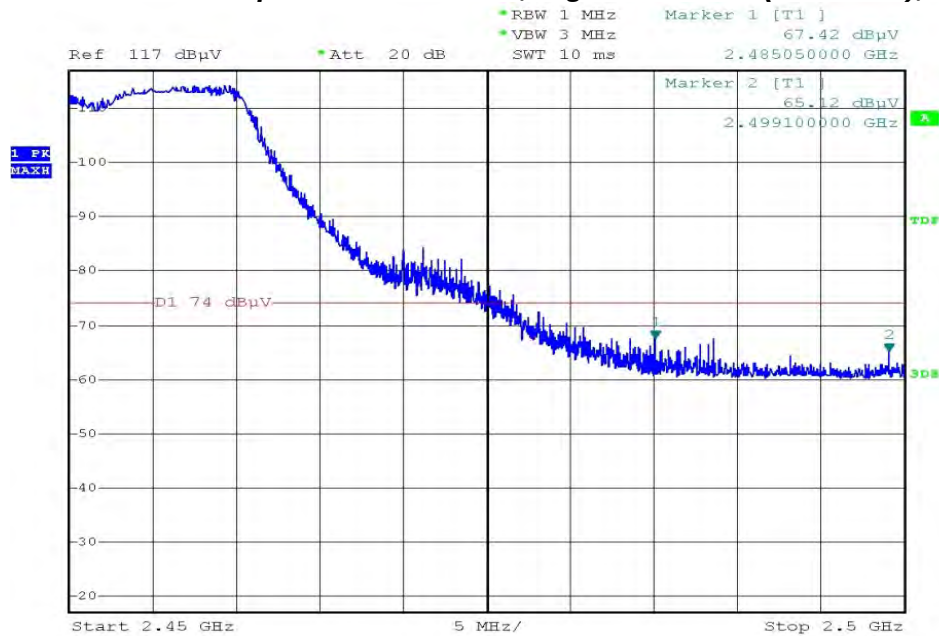


Restricted Band Spurious Emissions, CH 10(2457 MHz), Average, 802.11n mode

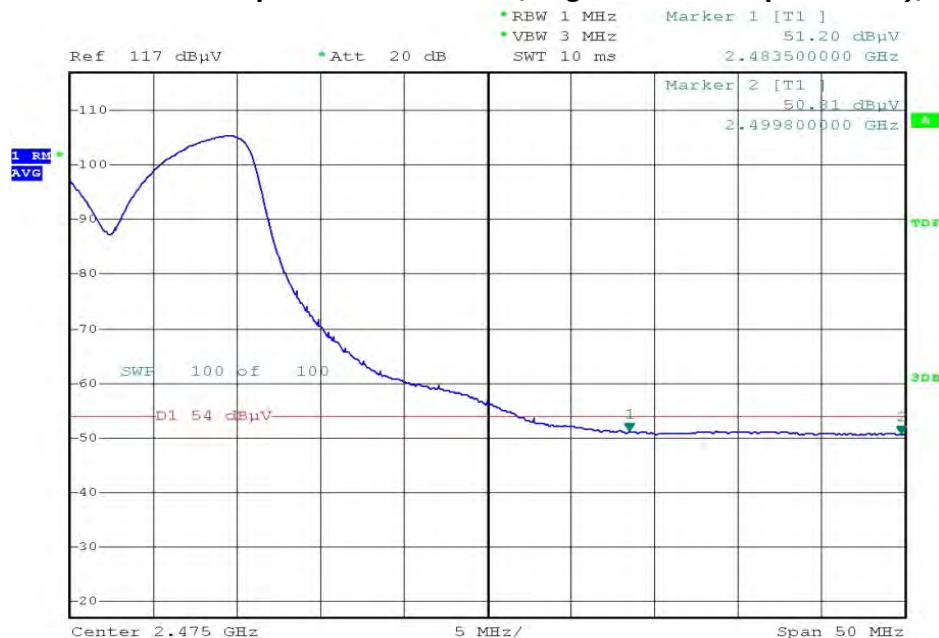


PLOT OF TEST DATA

Restricted Band Spurious Emissions, Highest channel(2462 MHz), Peak, 802.11n mode



Restricted Band Spurious Emissions, Highest channel(2462 MHz), Average, 802.11n mode



Note(s):

1. The antenna factor and cable loss were reflected in spectrum analyzer with correction factor for the Band edge radiated test.

2. *Measurement of the radiated emissions is performed in vertical and horizontal polarizations. The worst data were recorded*
3. *For the radiated band edge test, the EUT was investigated in all available data rates for 802.11b,g,n modes. The worst case band edge emissions were found while EUT was transmitting in 802.11b mode at 1 Mbps, 802.11g mode at 6 Mbps and 802.11n mode at MCS0*
4. *For peak measurements, the resolution bandwidth was set to 1 MHz and the video bandwidth was set to 3 MHz.*
5. *For average measurements, "12.2.5.1 Average Power Measurement Procedures" at "558074 D01 DTS Meas Guidance v03r01" was used.*

9. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Jan. 09 2013	1 year
2	*Test Receiver	R & S	ESCS 30	100302	Oct. 08 2012	1 year
3	*Amplifier	HP	8447F	2805A03427	Jul. 17 2012	1 year
4	*Amplifier	Sonoma Instrument	310N	291916	Jul. 16 2012	1 year
5	*Amplifier	R & S	SCU18	10065	**Apr. 05 2013	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. 09 2013	1 year
9	*Pre Amplifier	HP	8447F	2805A03351	Jul. 17 2012	1 year
10	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Jul. 16 2012	1 year
11	*Spectrum Analyzer	Agilent	E4440A	MY44022567	**Apr. 05 2013	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	Sep 22 2012	1 year
15	*Biconical Log Antenna	ARA	LPB-2520/A	1180	Apr. 26 2012	2 year
16	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-474	Aug. 13 2012	2 year
17	*Horn Antenna	Q-par Angus	QSH20S20	8179	Mar. 20 2013	2 year
18	*Horn Antenna	Q-par Angus	QSH22K20	8180	Mar. 20 2013	2 year
19	Trilog-Broadband Antenna	SCHWARZBECK	VULB 9163	9163-454	Feb. 24 2012	2 year
20	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-257	Apr. 26 2012	2 year
21	*LISN	R & S	ESH3-Z5	833874/006	Oct. 08 2012	1 year
22	*LISN	R & S	ESH2-Z5	100227	**Apr. 04 2013	1 year
23	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
24	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
25	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
26	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
27	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
28	*Position Controller	Seo-Young EMC	N/A	N/A	N/A	N/A
29	*Turn Table	Seo-Young EMC	N/A	N/A	N/A	N/A
30	*Antenna Mast	Seo-Young EMC	N/A	N/A	N/A	N/A
31	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
32	*Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A

Note(s)

- * Test equipment used during the test
- **The calibration of these equipments was performed for three days (4/3~4/5) and they were not used to test during this period.
- *** These equipments were not used to test after June 1, 2013.

10. 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	X_i	Uncertainty of X_i		Coverage factor k	$u(X_i)$ (dB)	C_i	$C_i u(X_i)$ (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	X_i	Uncertainty of X_i		Coverage factor k	$u(X_i)$ (dB)	C_i	$C_i u(X_i)$ (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 : + ($\geq$ 200 MHz) Ⓓ: Log Periodic Antenna-receiver Mismatch : - ($\geq$ 200 MHz)						
Combined Standard Uncertainty	Normal			± 2.63 (< 200 MHz) ± 2.74 ($\geq$ 200 MHz)			
Expanded Uncertainty U	Normal ($k = 2$)			± 5.26 (< 200 MHz) ± 5.48 ($\geq$ 200 MHz)			