

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No. : E141R-012
AGR No. : A13NA-058, A13NA-059
Applicant : LG Innotek Co., Ltd.
Address : 978-1, Jangduk-dong, Gwangsan-gu, Gwangju, Korea. 506-731
Manufacturer : LG Innotek Co., Ltd.
Address : 978-1, Jangduk-dong, Gwangsan-gu, Gwangju, Korea. 506-731
Type of Equipment : Wi-Fi module
FCC ID. : YZP-TWFML006D
IC Certification No. : 7414C-TWFML006D
Model Name : TWFM-L006D
Serial number : N/A
Total page of Report : 435 pages (including this page)
Date of Incoming : December 03, 2013
Date of issue : January 07, 2014

SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART E Section 15.407 and IC RSS-Gen Issue 3 and RSS 210 Issue 8.*

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
E141R-012	January 07, 2014	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

Applicant : LG Innotek Co., Ltd.
 Address : 978-1, Jangduk-dong, Gwangsan-gu, Gwangju, Korea. 506-731
 Contact Person : IC Jeong / Senior engineer
 Telephone No. : +82-62-950-0332
 FCC ID : YZP-TWFML006D
 CERTIFICATION NO. : 7414C-TWFML006D
 Model Name : TWFM-L006D
 Serial Number : N/A
 Date : January 07, 2014

EQUIPMENT CLASS	FCC: Unlicensed National Information infrastructure(UNII) IC: Low Power License-Exempt Radio-communication Device
E.U.T. DESCRIPTION	Wi-Fi module
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2009
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART E Section 15.407 and RSS 210 Issue 8, RSS-Gen Issue 3.
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m open area test site

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION		TEST ITEMS	RESULTS
15.407(a)	RSS-210 A9.2	26 dB Bandwidth & 99 % Occupied Bandwidth	PASS
15.407(a)	RSS-210 A9.2	Maximum Conducted Output Power	Met the Limit / PASS
15.407(a)	RSS-210 A9.2	Peak Power Spectral Density	Met the Limit / PASS
15.407(a)		Peak Excursion	Met the Limit / PASS
15.407(g)	RSS-210 A1.1.4	Frequency Stability	Met the Limit / PASS
15.407(b)	RSS-210 A9.2&RSS Gen	Undesirable Emissions	Met the Limit / PASS
15.205, 15.407(b)		General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Met the Limit / PASS
15.207	RSS GEN	AC Conducted Emissions 150 kHz-30 MHz	Met the Limit / PASS
15.407(h)	RSS-210 A9.3	Dynamic frequency Selection	Met the Limit / PASS

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART E Section 15.407 and IC RSS-Gen Issue 3 and RSS 210 Issue 8

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2009. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The open area test site is located at 307-51 Daessangryung-ri, Chowol-eup, Gwangju-si, Gyeonggi-do and 10 m Semi Anechoic Chamber (SAC) and conducted measurement facilities are located at 301-14, Daessangryung-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862, Korea. The Onetech Corp. has been accredited as a Conformity Assessment Body (CAB) with designation number KR0013 under APEC TEL MAR between the RRA and the FCC.

3. GENERAL INFORMATION

3.1 Product Description

The LG Innotek Co., Ltd., Model TWFM-L006D (referred to as the EUT in this report) is a Wi-Fi module. Product specification information described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	Wi-Fi module			
FREQUENCY RANGE	5 150 MHz ~ 5 250 MHz Band	5 180 MHz ~ 5 240 MHz_20 MHz BW		
		5 190 MHz ~ 5 230 MHz_40 MHz BW		
	5 250 MHz ~ 5 350 MHz Band	5 260 MHz ~ 5 320 MHz_20 MHz BW		
		5 270 MHz ~ 5 310 MHz_40 MHz BW		
	5 470 MHz ~ 5 725 MHz Band	5 500 MHz ~ 5 700 MHz_20 MHz BW		
		5 510 MHz ~ 5 670 MHz_40 MHz BW		
MAX. RF OUTPUT POWER	Ant.0	5 150 MHz ~ 5 250 MHz Band	Wi-Fi 802.11a (8.82 dBm) Wi-Fi 802.11n_20 MHz (6.74 dBm) Wi-Fi 802.11n_40 MHz (5.87 dBm)	
		5 250 MHz ~ 5 350 MHz Band	Wi-Fi 802.11a (8.54 dBm) Wi-Fi 802.11n_20 MHz (7.16 dBm) Wi-Fi 802.11n_40 MHz (6.53 dBm)	
		5 470 MHz ~ 5 725 MHz Band	Wi-Fi 802.11a (8.27 dBm) Wi-Fi 802.11n_20 MHz (6.82 dBm) Wi-Fi 802.11n_40 MHz (5.96 dBm)	
	Ant.1	5 150 MHz ~ 5 250 MHz Band	Wi-Fi 802.11a (8.37 dBm) Wi-Fi 802.11n_20 MHz (6.63 dBm) Wi-Fi 802.11n_40 MHz (5.62 dBm)	
		5 250 MHz ~ 5 350 MHz Band	Wi-Fi 802.11a (8.92 dBm) Wi-Fi 802.11n_20 MHz (7.90 dBm) Wi-Fi 802.11n_40 MHz (6.87 dBm)	
		5 470 MHz ~ 5 725 MHz Band	Wi-Fi 802.11a (8.88 dBm) Wi-Fi 802.11n_20 MHz (7.78 dBm) Wi-Fi 802.11n_40 MHz (6.26 dBm)	
	MODULATION TYPE	802.11a/g/n(HT20)/n(HT40): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)		
	Antenna Gain	1.5 dBi		
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	40 MHz			

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	LG Innotek Co., Ltd.	TWFM-L006D	N/A

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
TWFM-L006D	LG Innotek Co., Ltd.	Wi-Fi module (EUT)	Note PC
LGR51	LG Electronics	Notebook PC	EUT

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting mode is programmed.

Maximum Output Power (5 150 MHz ~ 5 250 MHz Band)

Modulation & Channel selected	DATA RATE	OUTPUT POWER	
		Ant 0	Ant 1
802.11 a (Middle Channel)	6 Mbps	7.28	8.25
	9 Mbps	7.09	8.13
	12 Mbps	6.93	7.98
	18 Mbps	6.70	7.73
	24 Mbps	6.66	7.48
	36 Mbps	5.79	6.96
	48 Mbps	5.45	6.65
	54 Mbps	5.20	6.43
HT 20 (Middle Channel)	6.5 Mbps	6.06	6.04
	13 Mbps	5.82	5.62
	19.5 Mbps	5.58	5.44
	26 Mbps	5.29	5.14
	39 Mbps	4.81	4.70
	52 Mbps	4.37	4.34
	58.5 Mbps	4.26	4.24
	65 Mbps	3.71	4.06
HT 40 (High Channel)	13 Mbps	5.87	5.62
	26 Mbps	4.89	4.68
	39 Mbps	4.41	4.15
	52 Mbps	3.09	3.65
	78 Mbps	2.62	3.12
	104 Mbps	2.23	1.80
	117 Mbps	2.11	1.66
	130 Mbps	2.02	1.57

Maximum Output Power (5 250 MHz ~ 5 350 MHz Band)

Modulation & Channel selected	DATA RATE	OUTPUT POWER	
		Ant 0	Ant 1
802.11 a (Middle Channel)	6 Mbps	8.18	8.92
	9 Mbps	8.01	8.78
	12 Mbps	7.86	8.56
	18 Mbps	7.64	8.25
	24 Mbps	7.56	8.14
	36 Mbps	6.88	7.67
	48 Mbps	6.61	7.42
	54 Mbps	6.36	7.26
HT 20 (Middle Channel)	6.5 Mbps	6.85	7.90
	13 Mbps	6.53	7.55
	19.5 Mbps	6.32	7.41
	26 Mbps	6.17	7.18
	39 Mbps	5.95	6.80
	52 Mbps	5.66	6.51
	58.5 Mbps	5.52	6.27
	65 Mbps	5.05	6.16
HT 40 (High Channel)	13 Mbps	5.90	6.87
	26 Mbps	5.07	6.06
	39 Mbps	4.82	5.70
	52 Mbps	4.08	5.07
	78 Mbps	3.73	4.79
	104 Mbps	3.48	4.38
	117 Mbps	3.40	4.28
	130 Mbps	3.36	4.23

Maximum Output Power (5 470 MHz ~ 5 725 MHz Band)

Modulation & Channel selected	DATA RATE	OUTPUT POWER	
		Ant 0	Ant 1
802.11 a (Middle Channel)	6 Mbps	7.11	8.43
	9 Mbps	7.05	8.11
	12 Mbps	6.84	7.97
	18 Mbps	6.46	7.69
	24 Mbps	6.12	7.33
	36 Mbps	5.52	6.78
	48 Mbps	5.13	6.41
	54 Mbps	4.94	6.13
HT 20 (Middle Channel)	6.5 Mbps	5.25	7.03
	13 Mbps	4.64	6.50
	19.5 Mbps	4.38	6.17
	26 Mbps	4.09	5.90
	39 Mbps	3.69	5.46
	52 Mbps	3.28	4.98
	58.5 Mbps	3.18	4.88
	65 Mbps	3.02	4.71
HT 40 (Middle Channel)	13 Mbps	4.85	5.25
	26 Mbps	3.86	4.81
	39 Mbps	3.25	4.35
	52 Mbps	2.82	3.39
	78 Mbps	2.29	2.63
	104 Mbps	1.79	2.01
	117 Mbps	1.36	1.86
	130 Mbps	1.40	1.79

The worse case data rate for each modulation is determined 6 Mbps(Ant.0) / 6 Mbps(Ant.1) for IEEE 802.11a, 6.5 Mbps(Ant.0) / 6.5 Mbps(Ant.1) for HT20, 13 Mbps(Ant.0) / 13 Mbps(Ant.1) for HT40.

- To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis.

5.4 Configuration of Test System

Line Conducted Test: The EUT was connected to USB and the power of USB was connected to Notebook PC. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2009 7.3.3 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2009 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter open area test site.
The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

For intentional device, according to section 15.203, 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.

Antenna Construction:

The transmitter antenna of the EUT is a PIFA antenna, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X
Receiving Mode	-

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X
Receiving Mode	-

7. MIMIMUM 26 dB BANDWIDTH & 99 % OCCUPIED BANDWIDTH

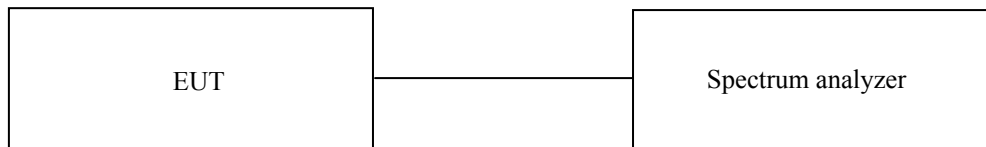
7.1 Operating environment

Temperature : 24 °C

Relative humidity : 43 % R.H.

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 26 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 26 dB.



7.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	R/S	Spectrum Analyzer	101372	May 20, 2013

All test equipment used is calibrated on a regular basis.

7.4.1 Test data for 802.11a RLAN Mode

7.4.1.1 Test data for Antenna 0

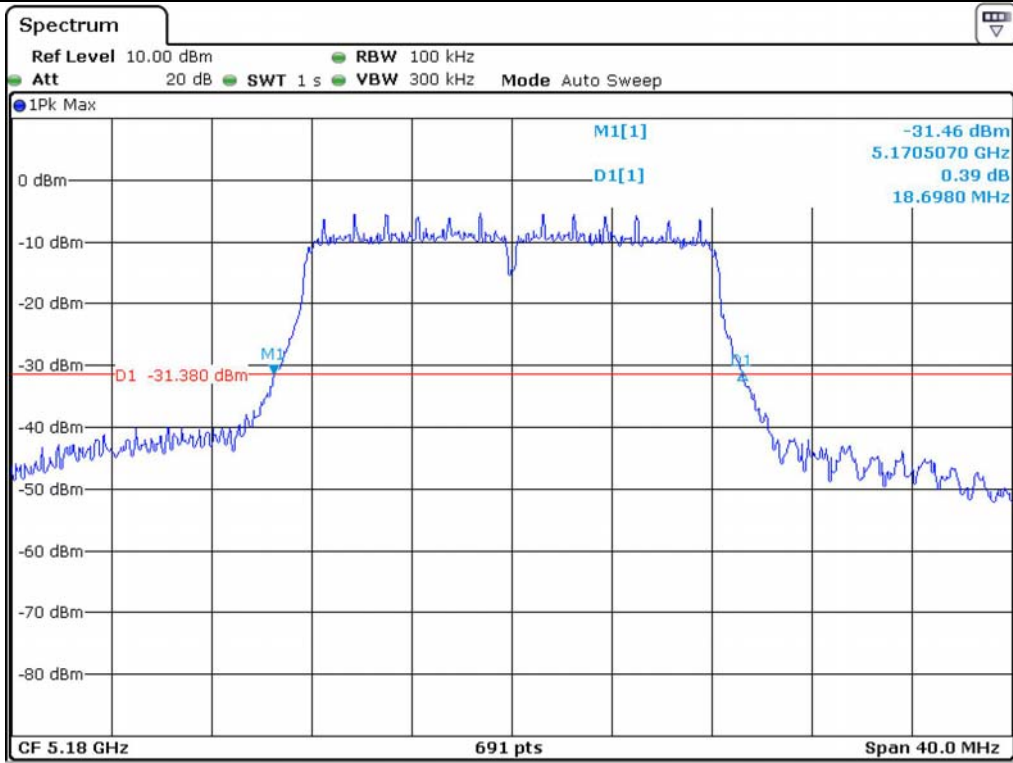
-. Test Date : December 16, 2013

-. Test Result : Pass

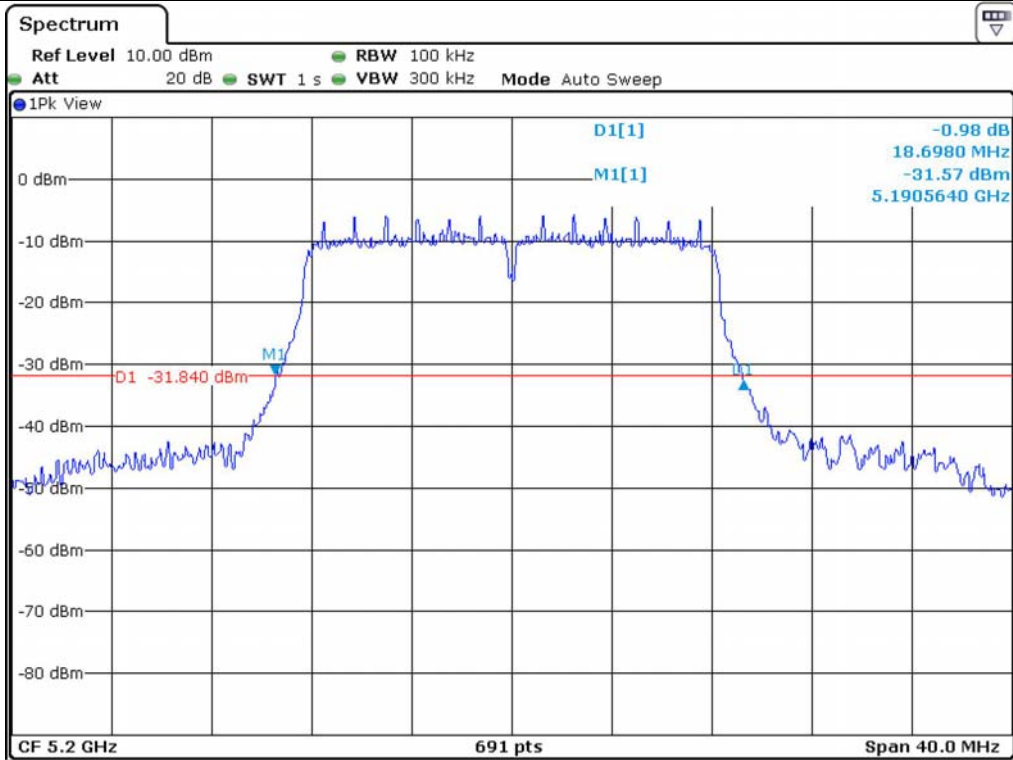
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
5 150 ~ 5 250	Low	5 180	18.70	16.38
	Middle	5 200	18.70	16.38
	High	5 240	18.70	16.38
5 250 ~ 5 350	Low	5 260	18.47	16.38
	Middle	5 300	18.47	16.38
	High	5 320	18.47	16.38
5 470 ~ 5 725	Low	5 500	18.47	16.38
	Middle	5 600	18.47	16.38
	High	5 700	18.47	16.38



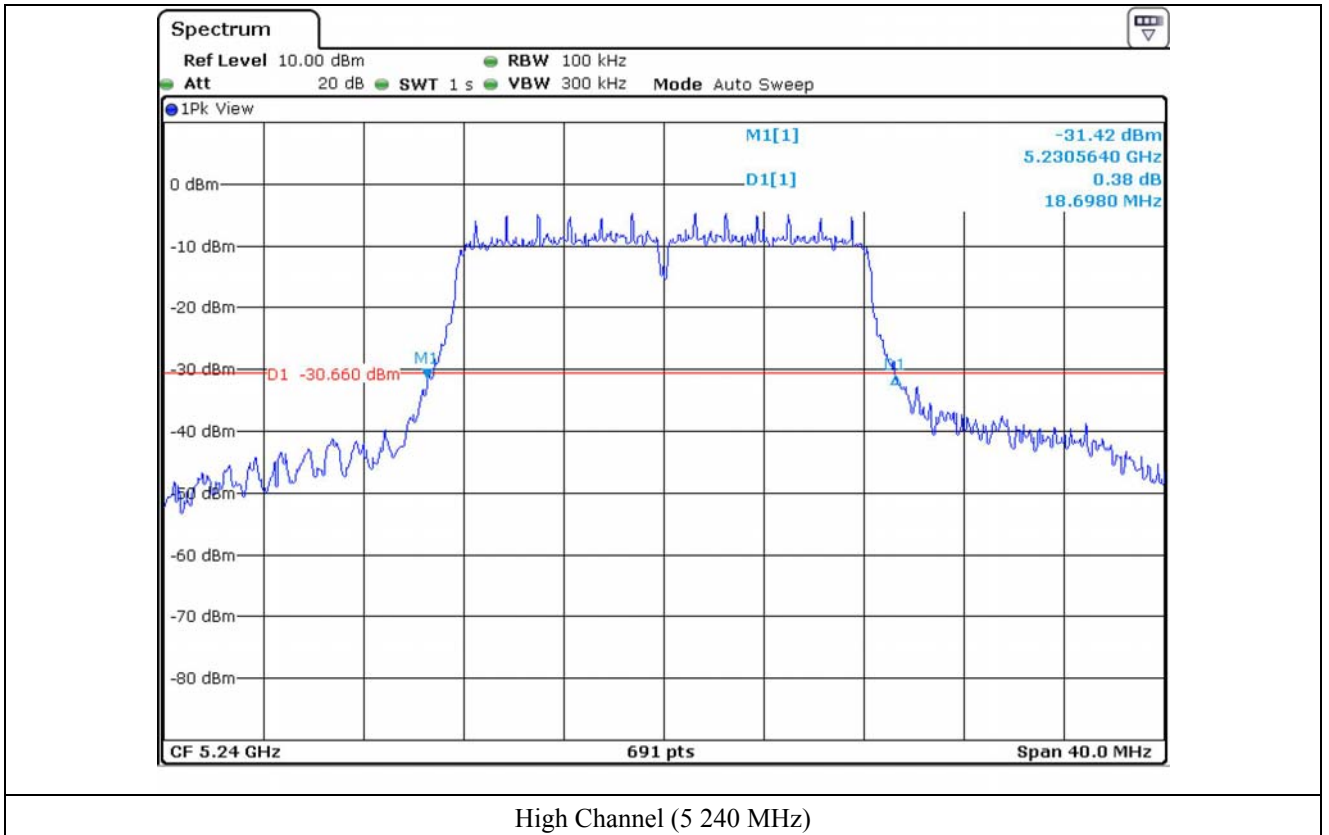
Tested by: Hong-Kyu, Lee/ Engineer



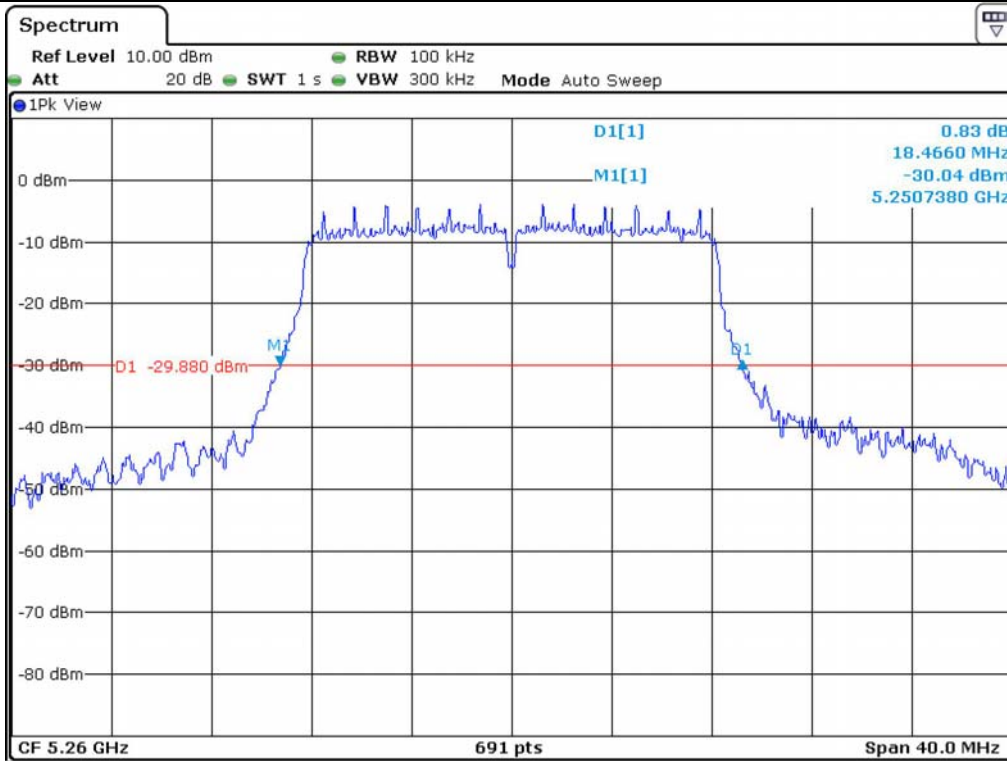
Low Channel (5 180 MHz)



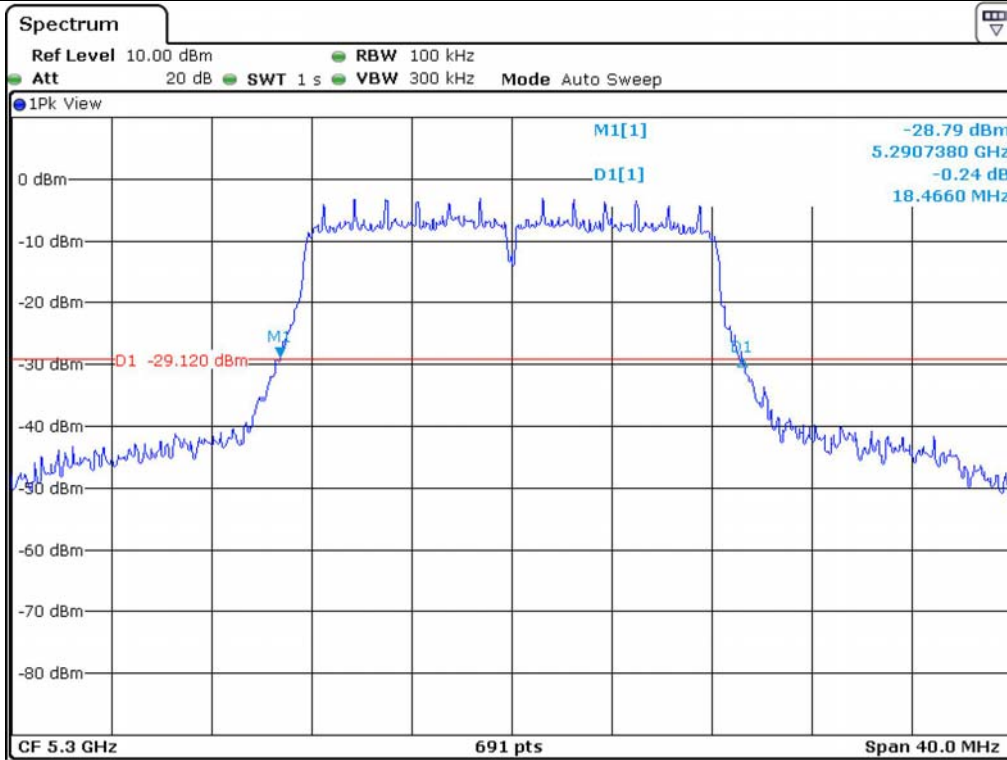
Middle Channel (5 200 MHz)



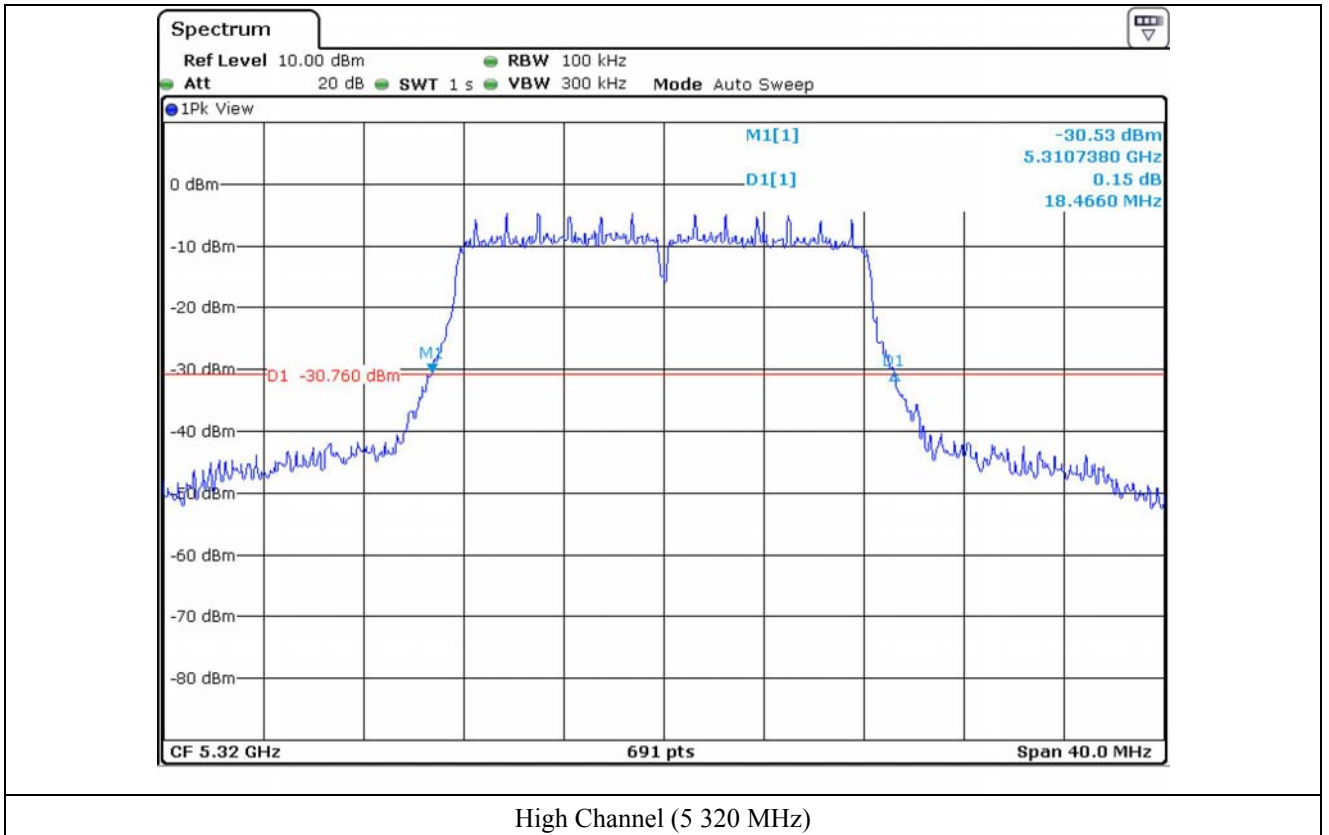
High Channel (5 240 MHz)

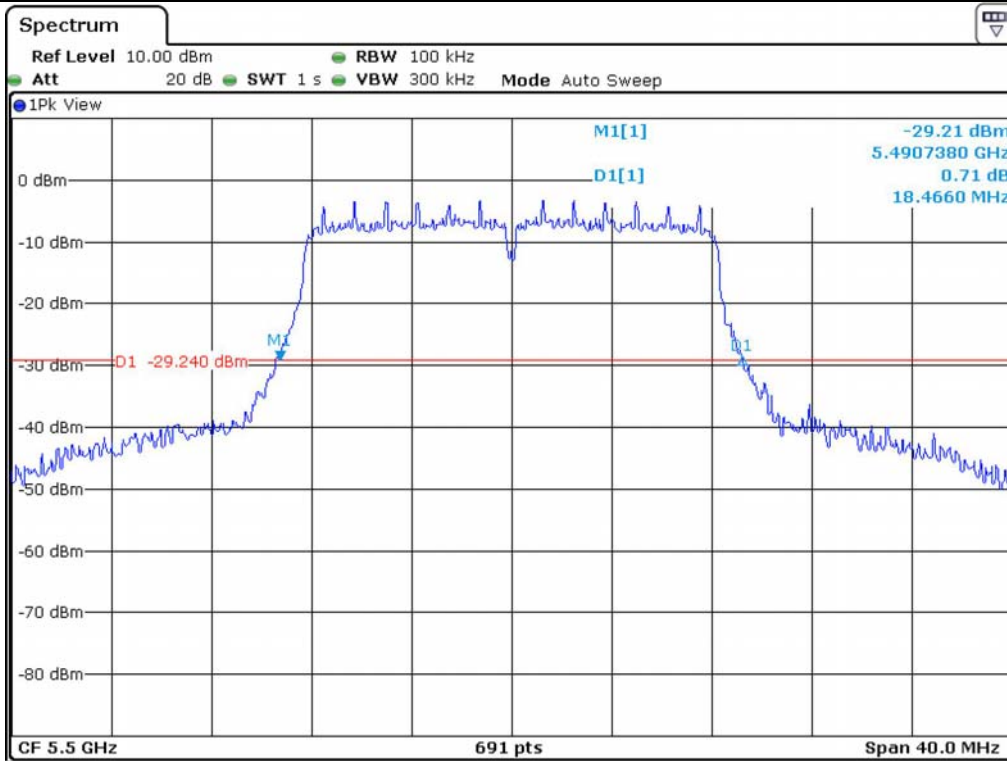


Low Channel (5 260 MHz)

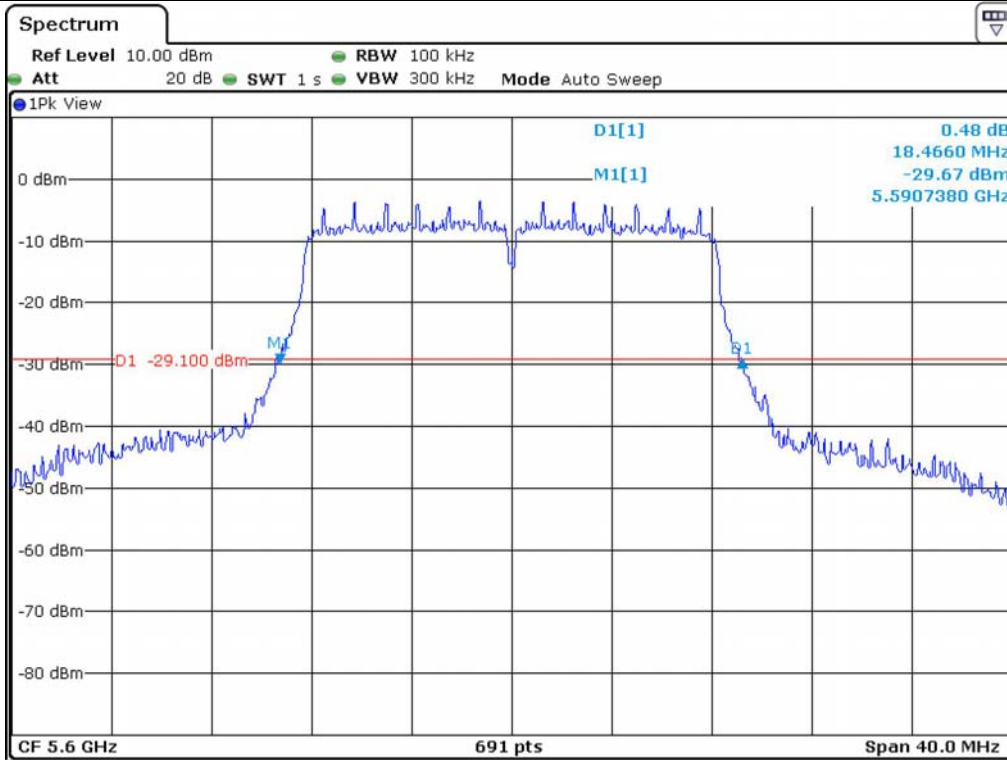


Middle Channel (5 300 MHz)

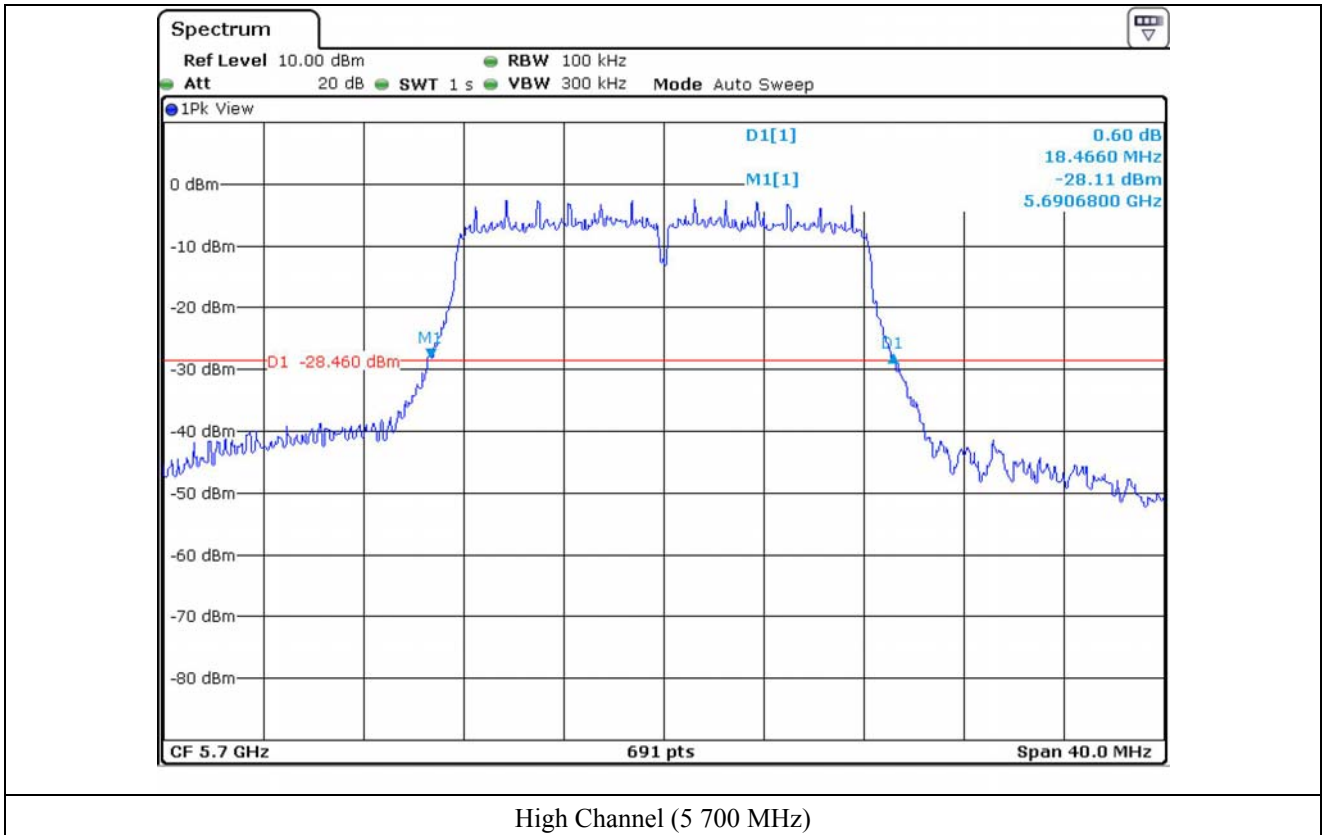




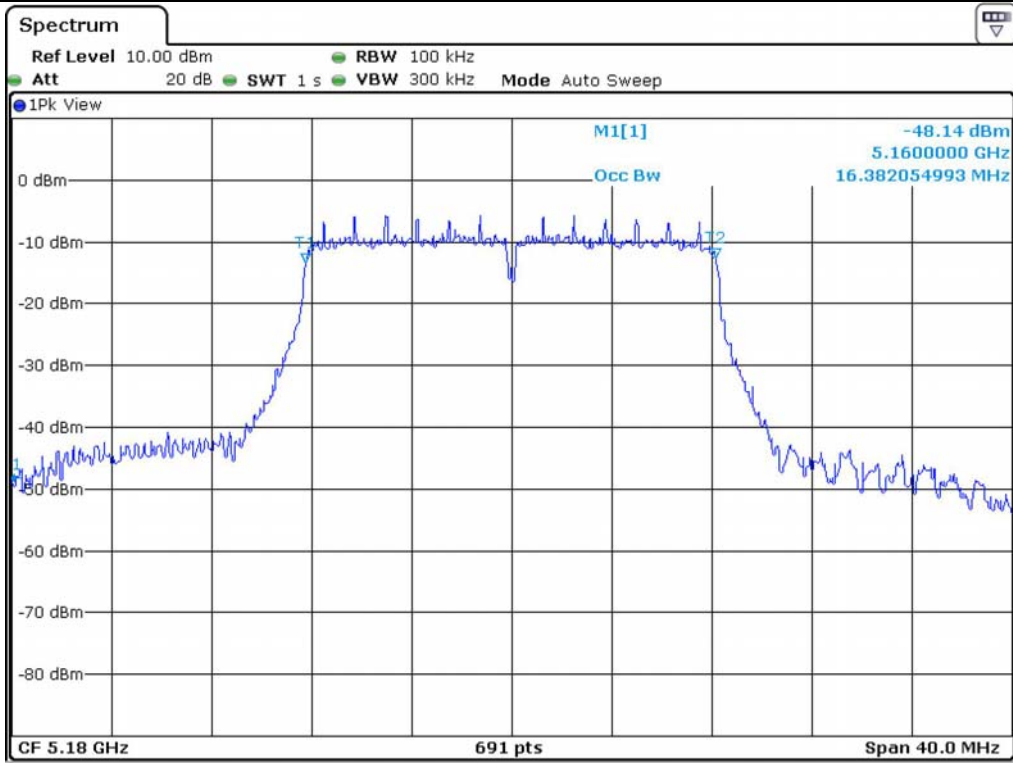
Low Channel (5 500 MHz)



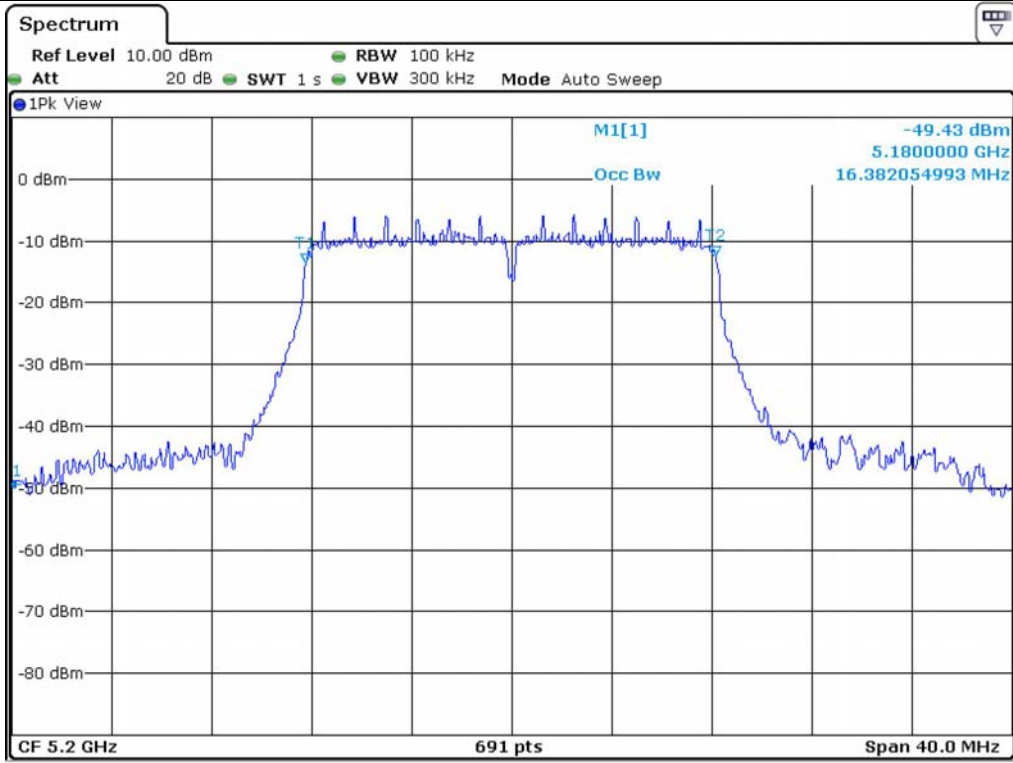
Middle Channel (5 600 MHz)



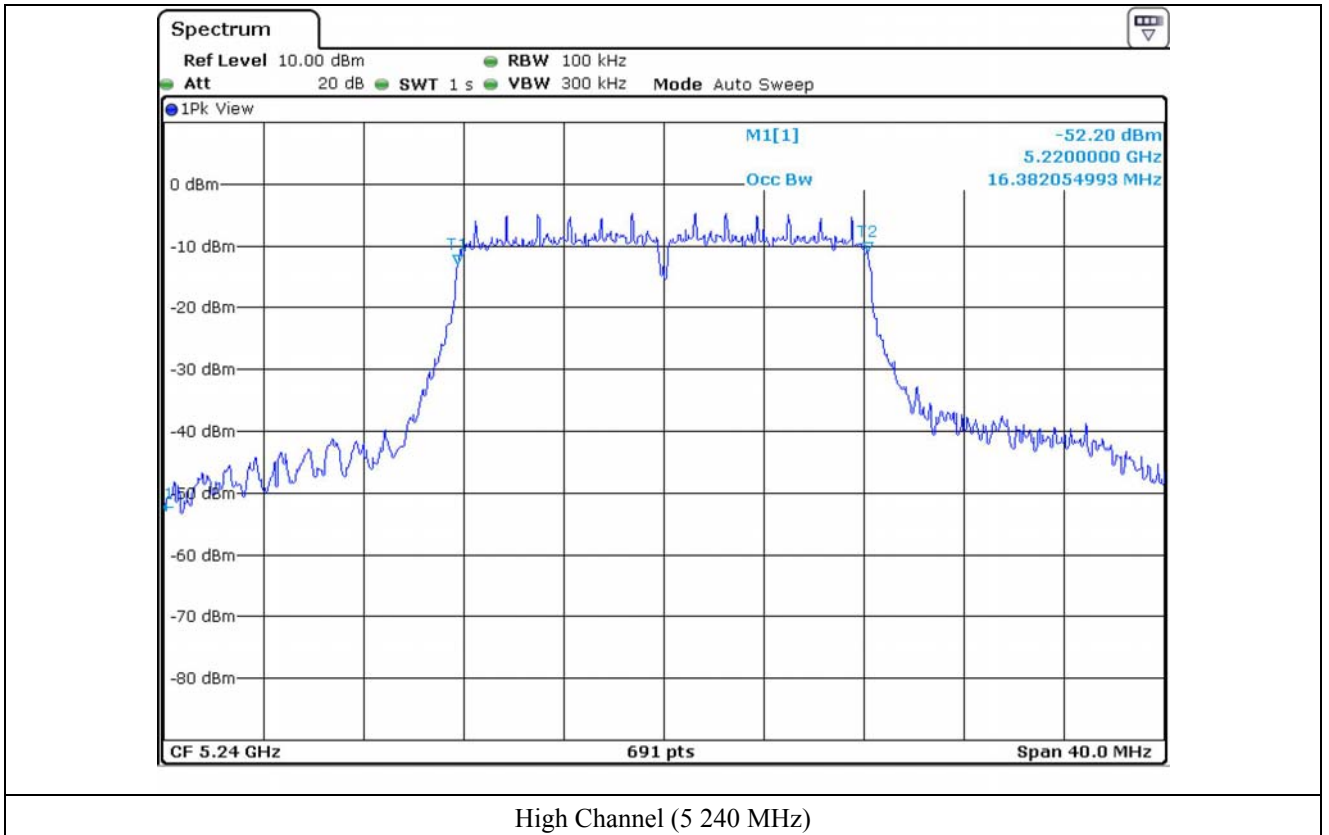
High Channel (5 700 MHz)

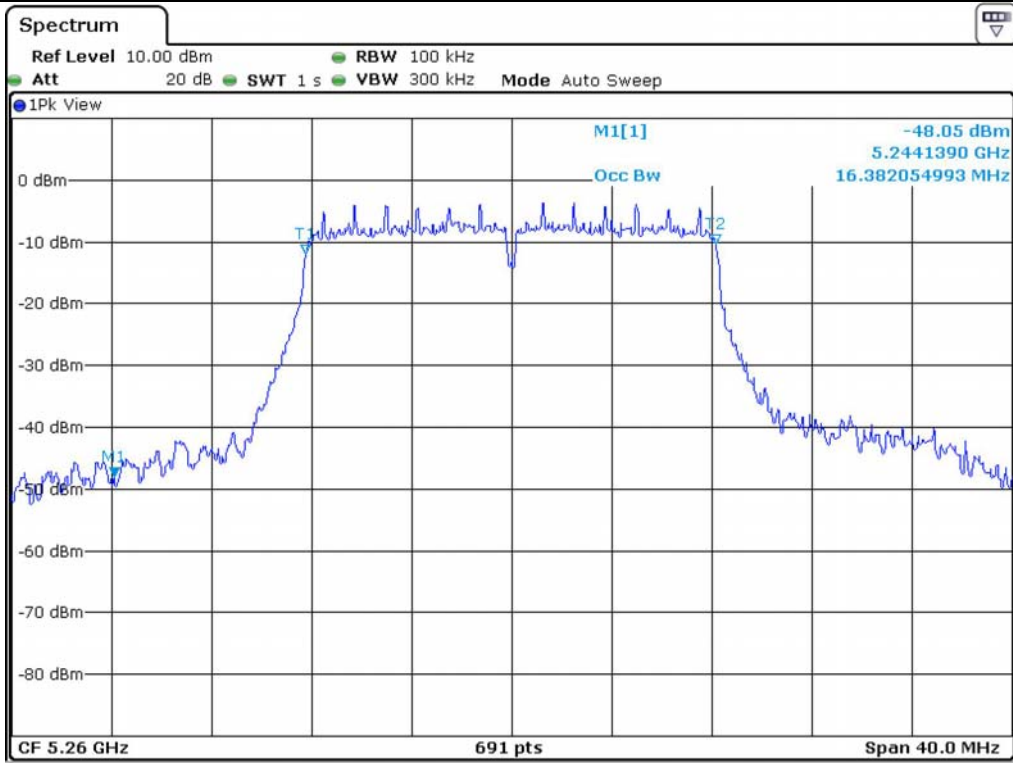


Low Channel (5 180 MHz)

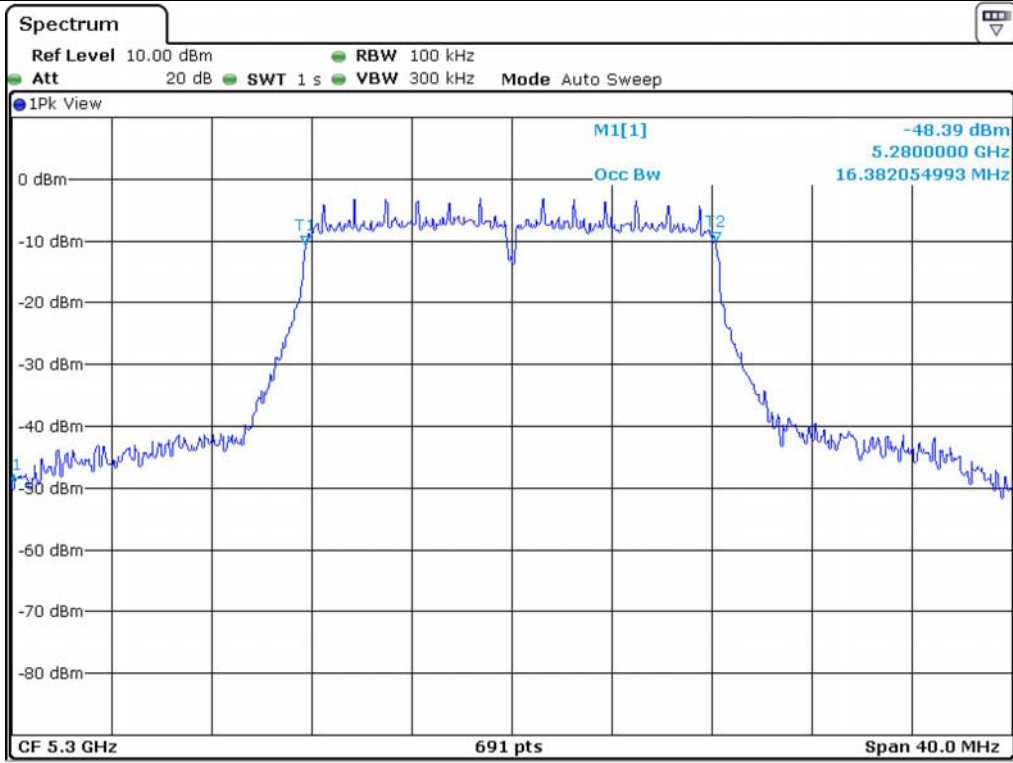


Middle Channel (5 200 MHz)

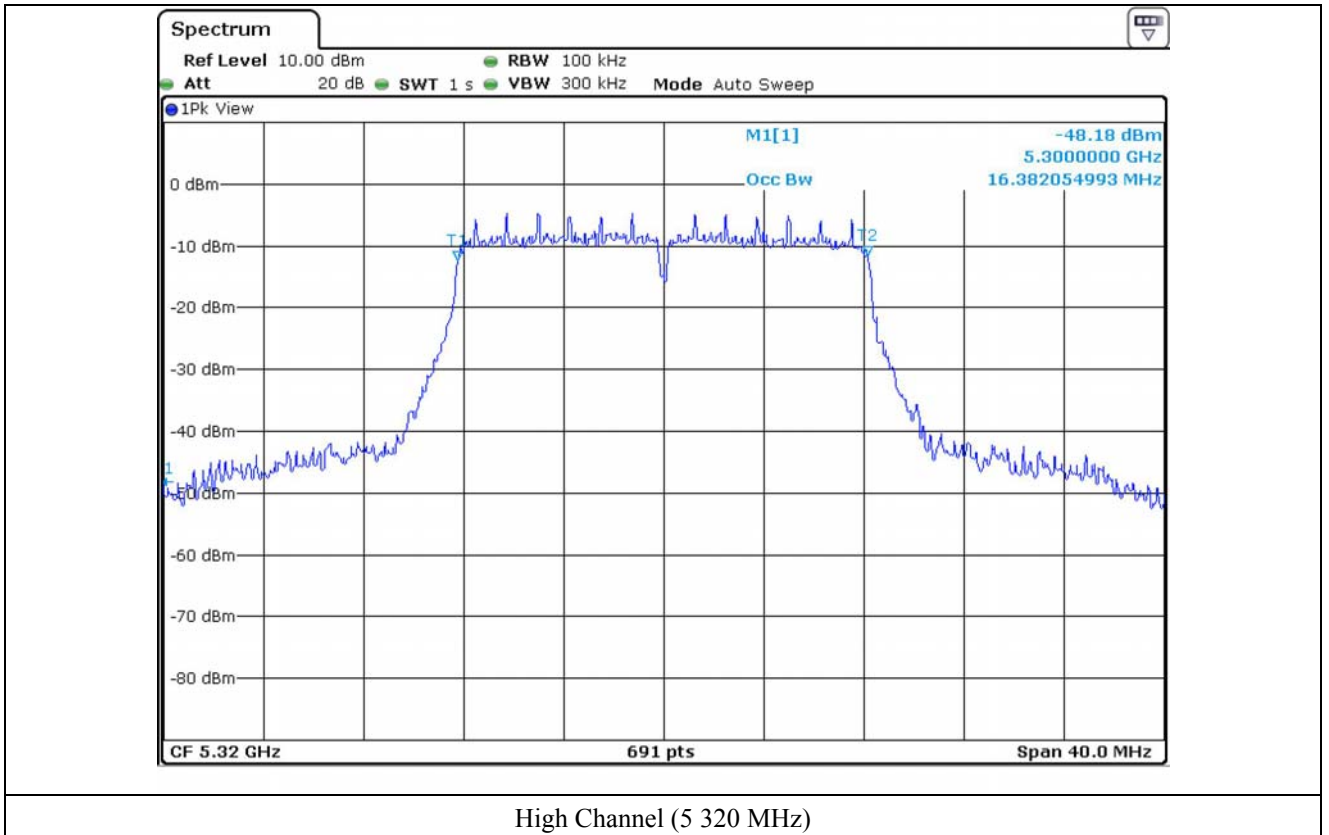




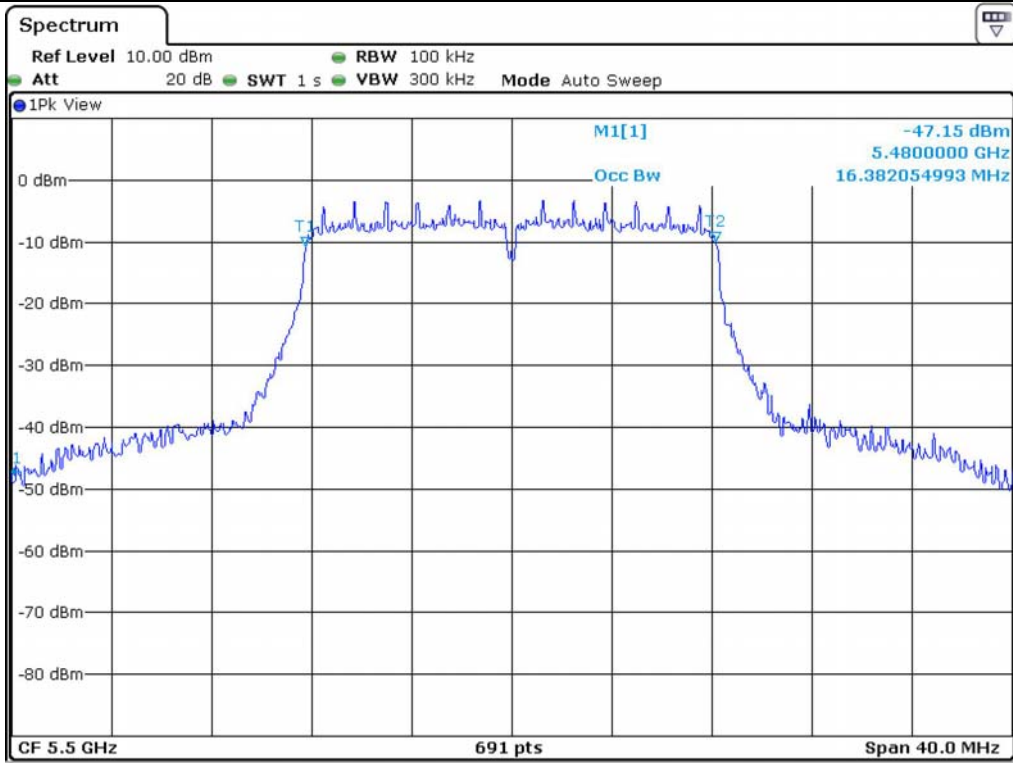
Low Channel (5 260 MHz)



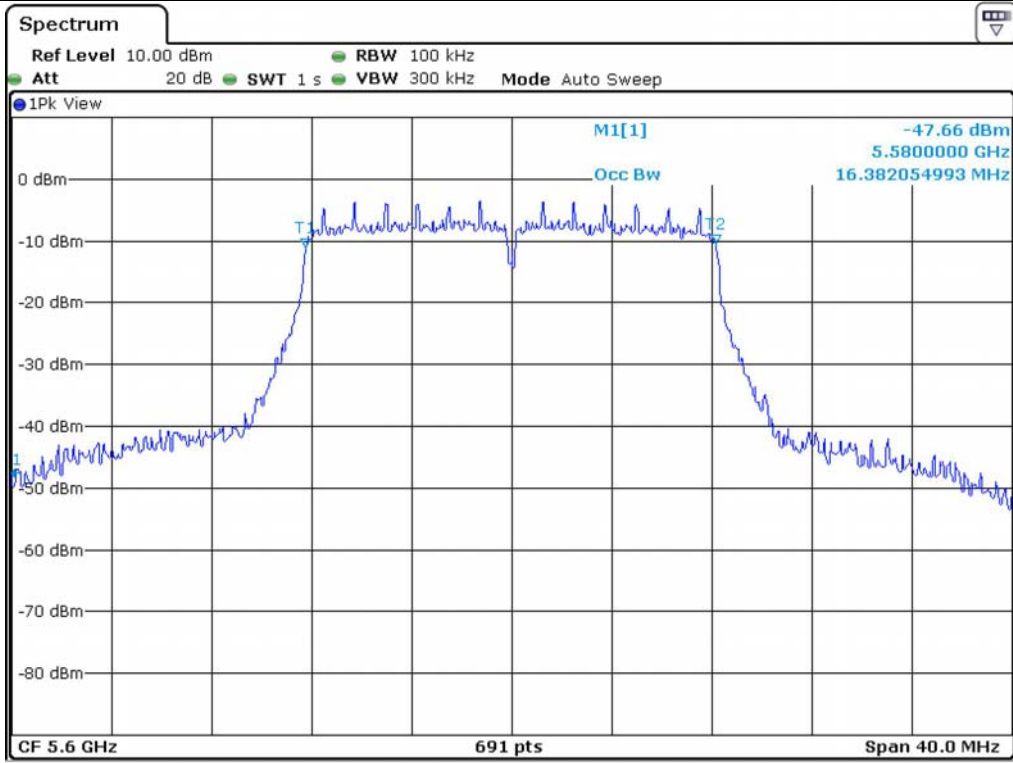
Middle Channel (5 300 MHz)



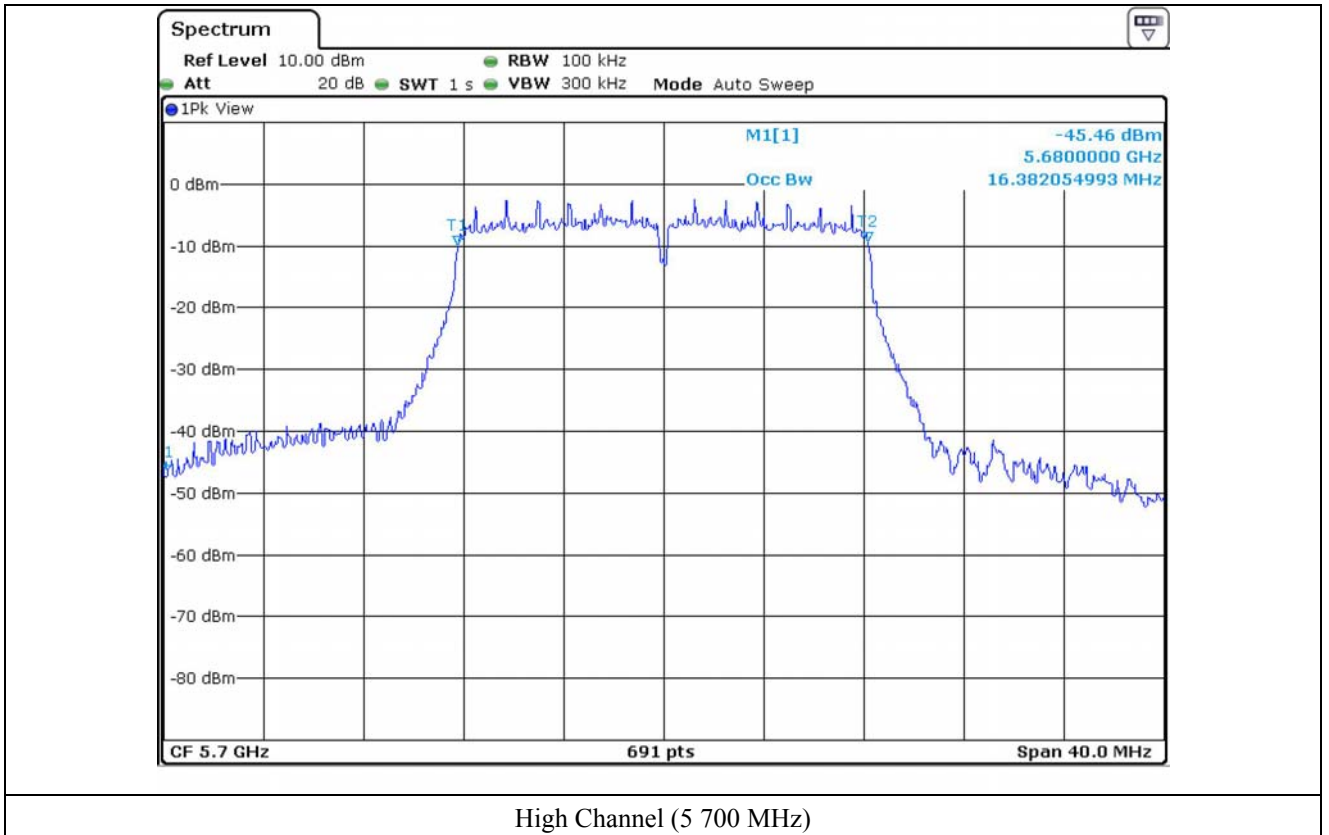
High Channel (5 320 MHz)



Low Channel (5 500 MHz)



Middle Channel (5 600 MHz)



7.4.1.2 Test data for Antenna 1

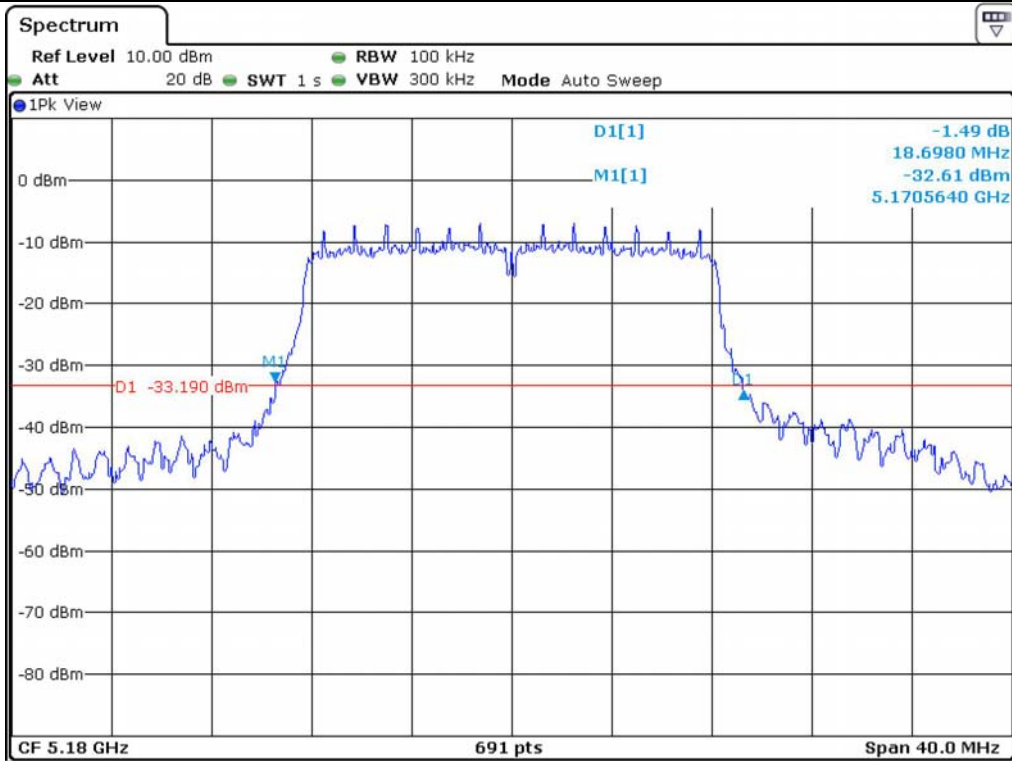
-. Test Date : December 16, 2013

-. Test Result : Pass

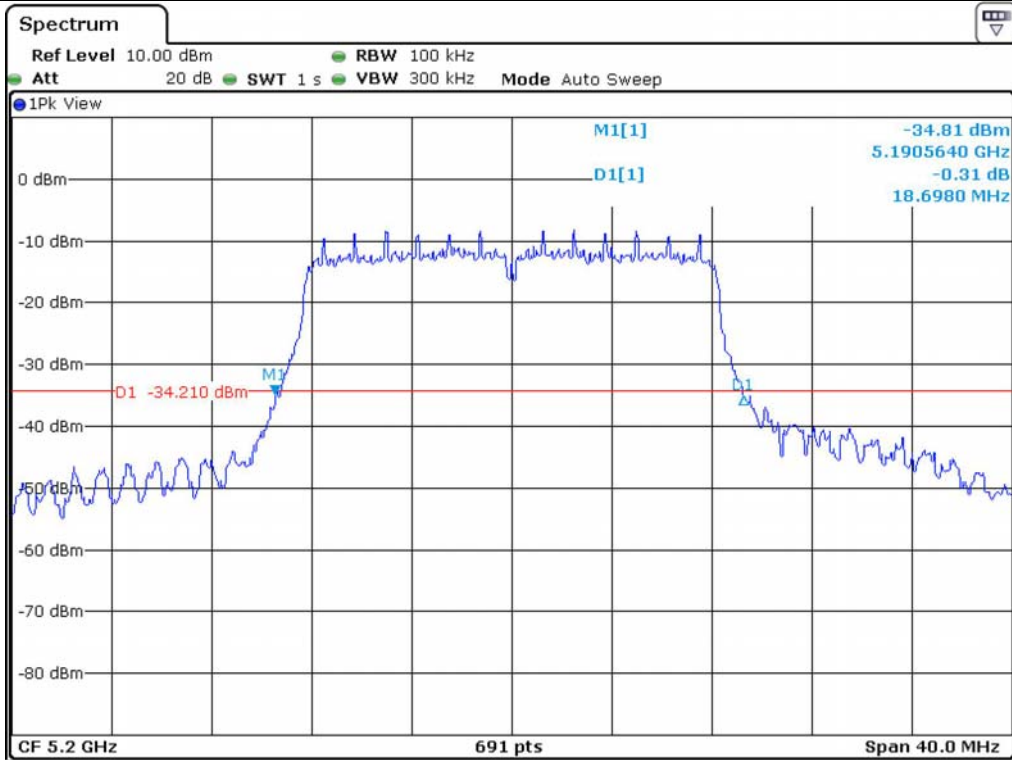
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
5 150 ~ 5 250	Low	5 180	18.70	16.38
	Middle	5 200	18.70	16.38
	High	5 240	18.70	16.38
5 250 ~ 5 350	Low	5 260	18.47	16.38
	Middle	5 300	18.47	16.38
	High	5 320	18.47	16.38
5 470 ~ 5 725	Low	5 500	18.47	16.38
	Middle	5 600	18.47	16.38
	High	5 700	18.47	16.38

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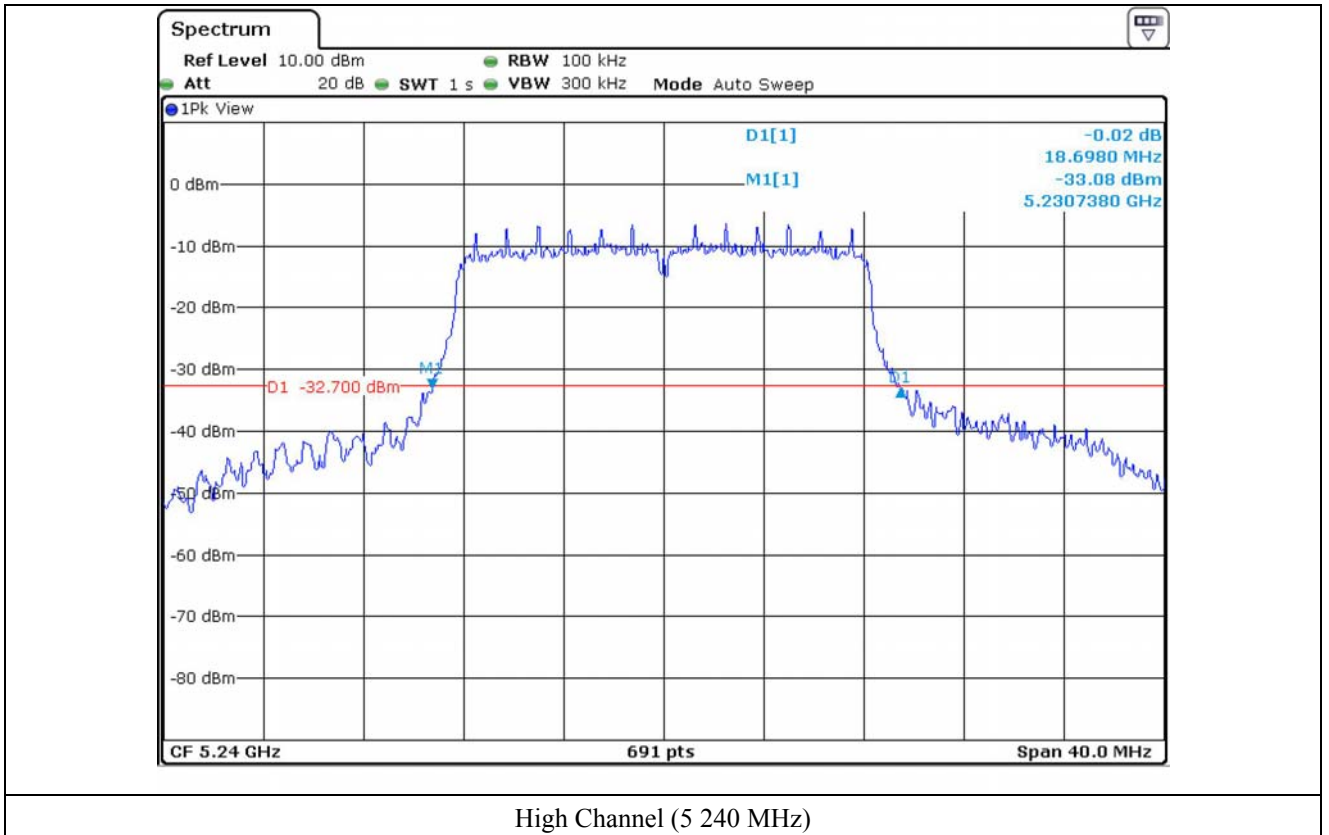
Tested by: Hong-Kyu, Lee/ Engineer

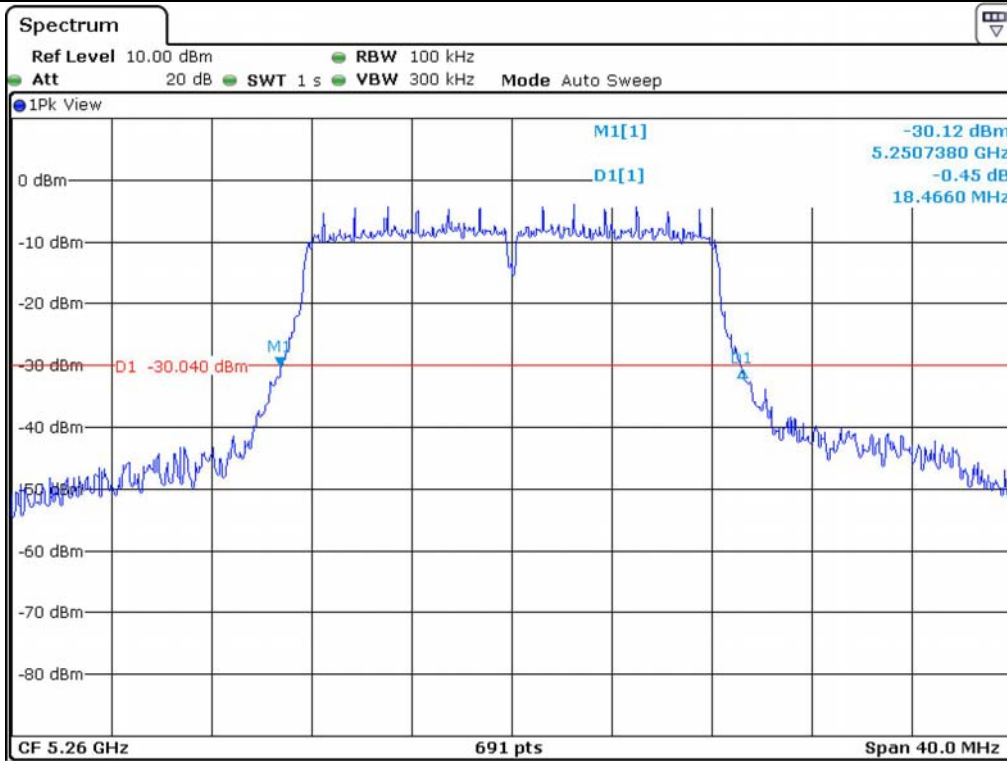


Low Channel (5 180 MHz)

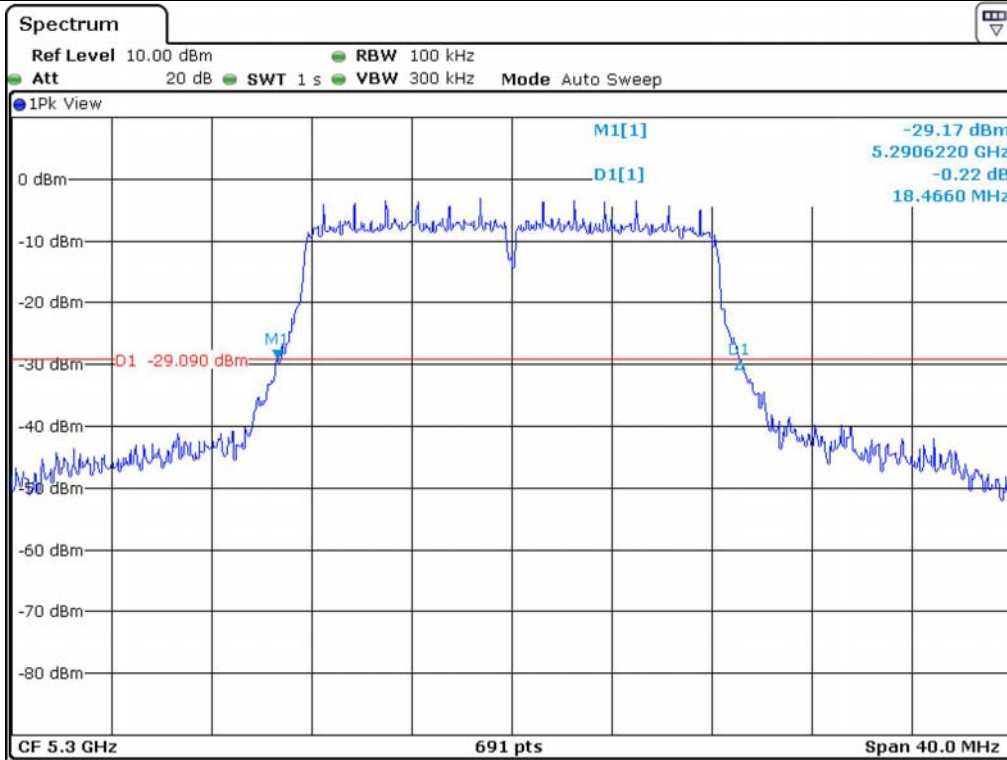


Middle Channel (5 200 MHz)

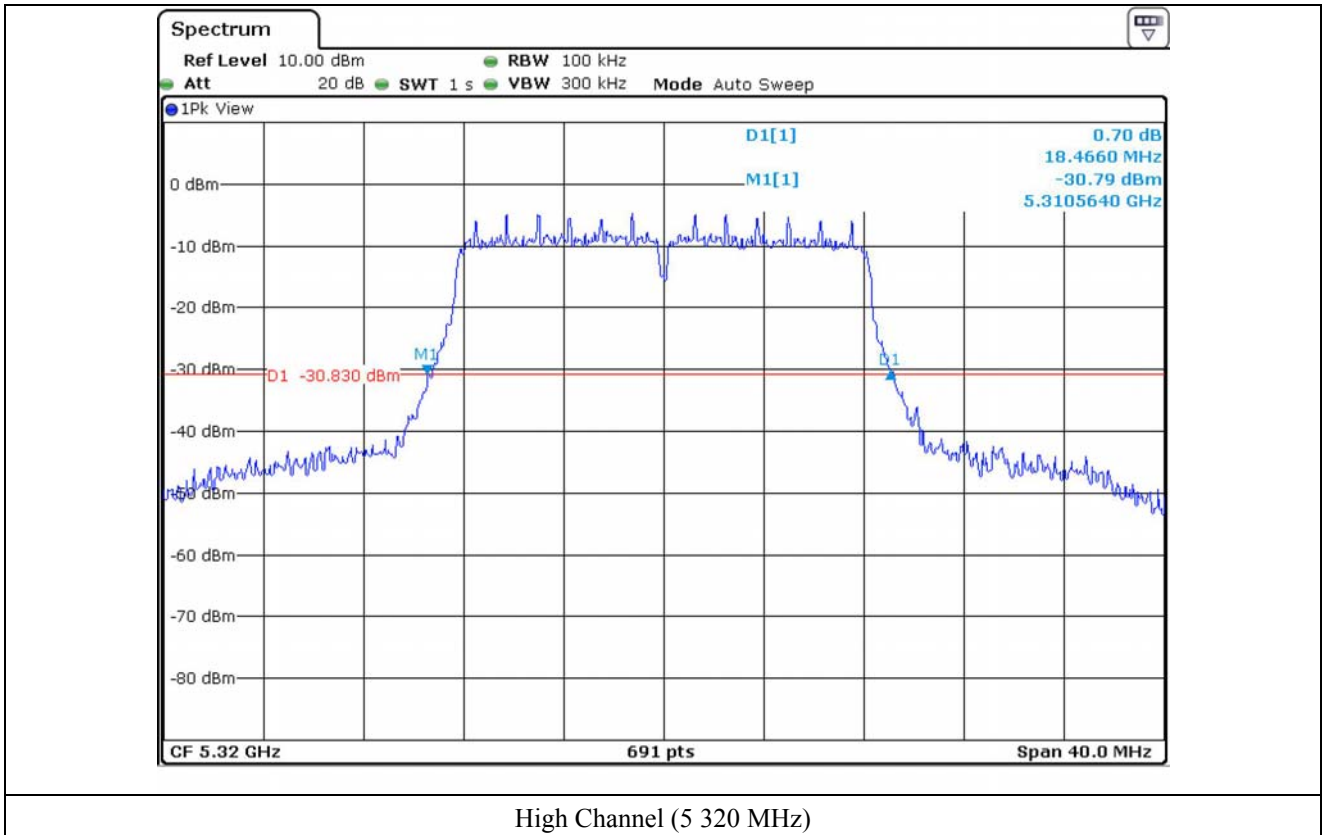




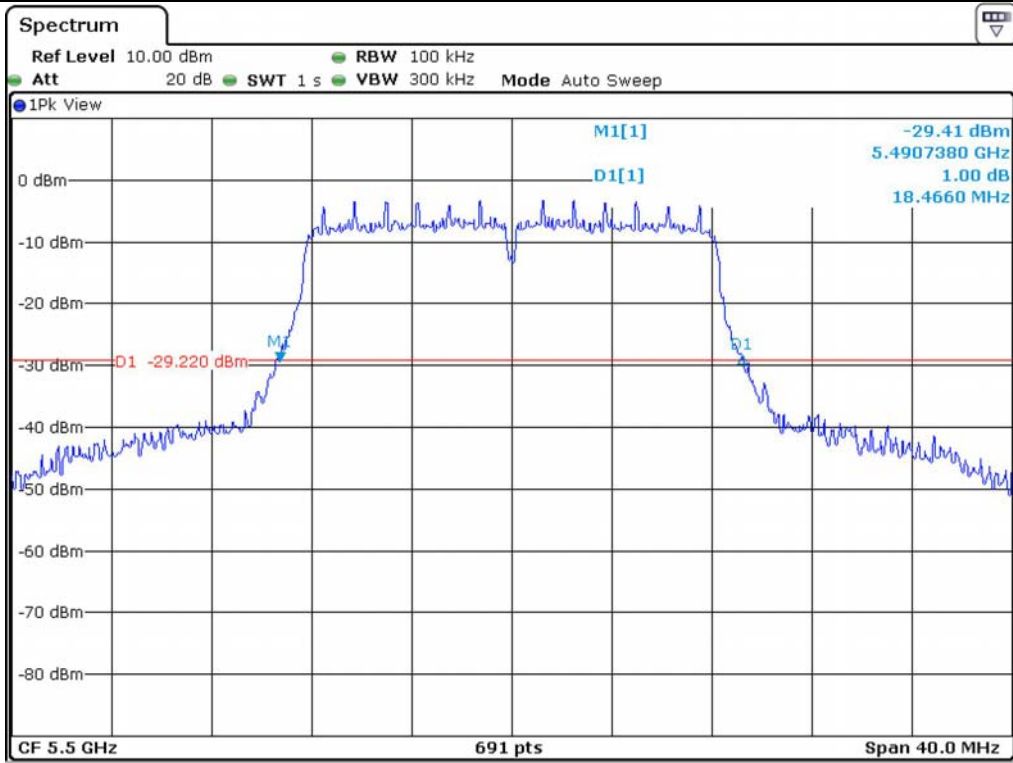
Low Channel (5 260 MHz)



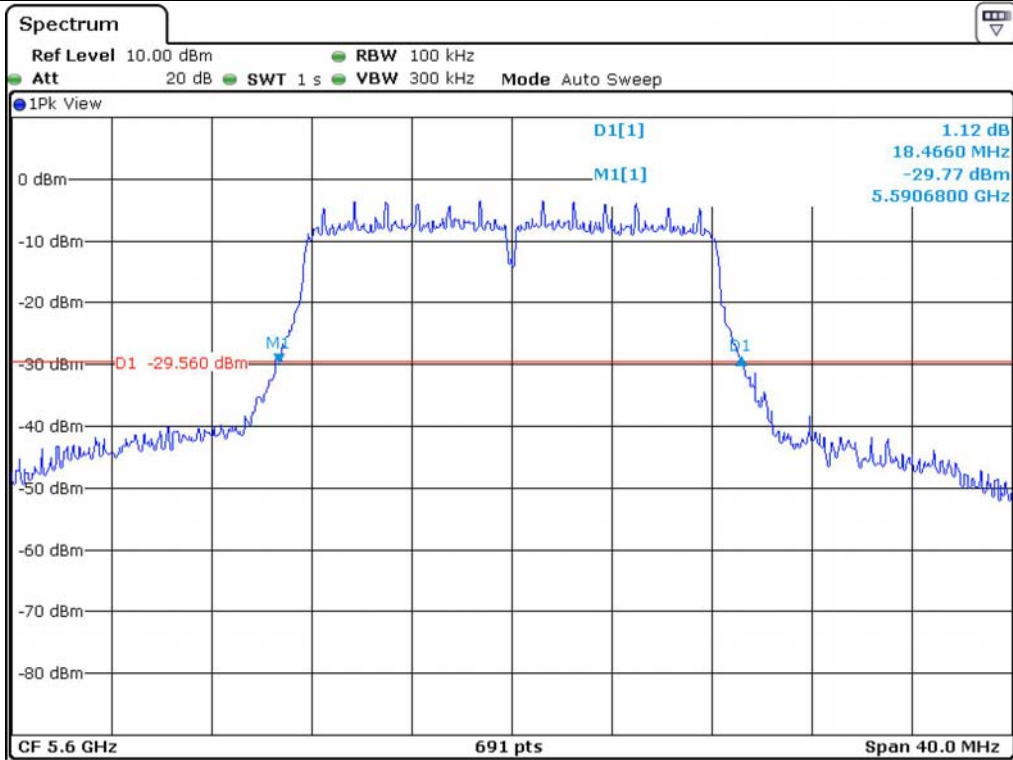
Middle Channel (5 300 MHz)



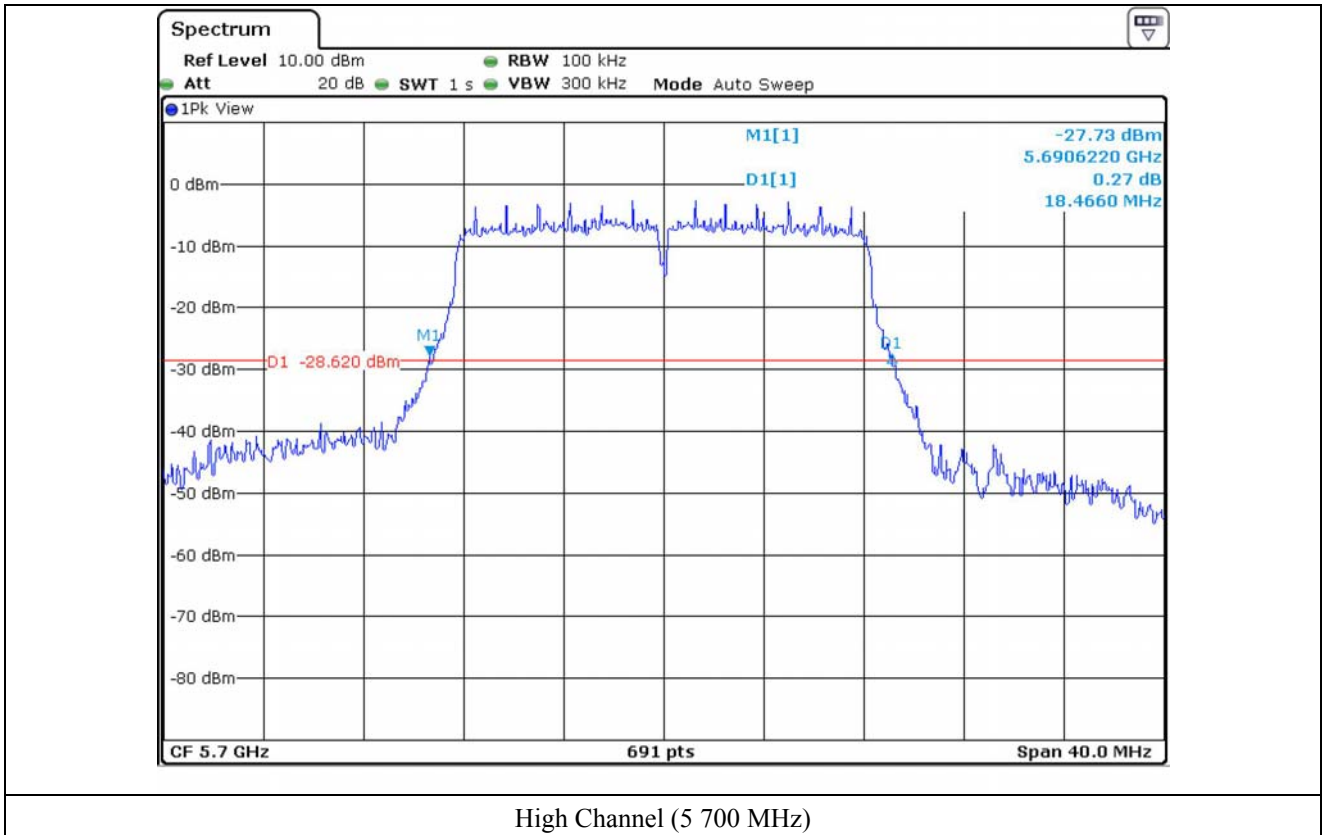
High Channel (5 320 MHz)

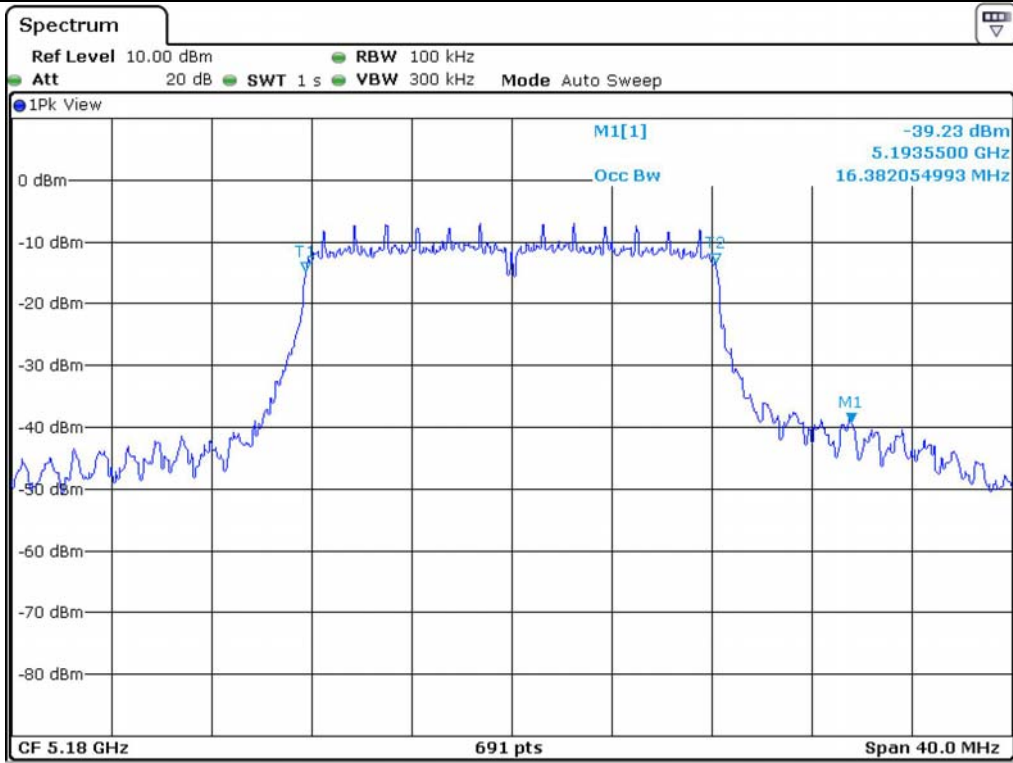


Low Channel (5 500 MHz)

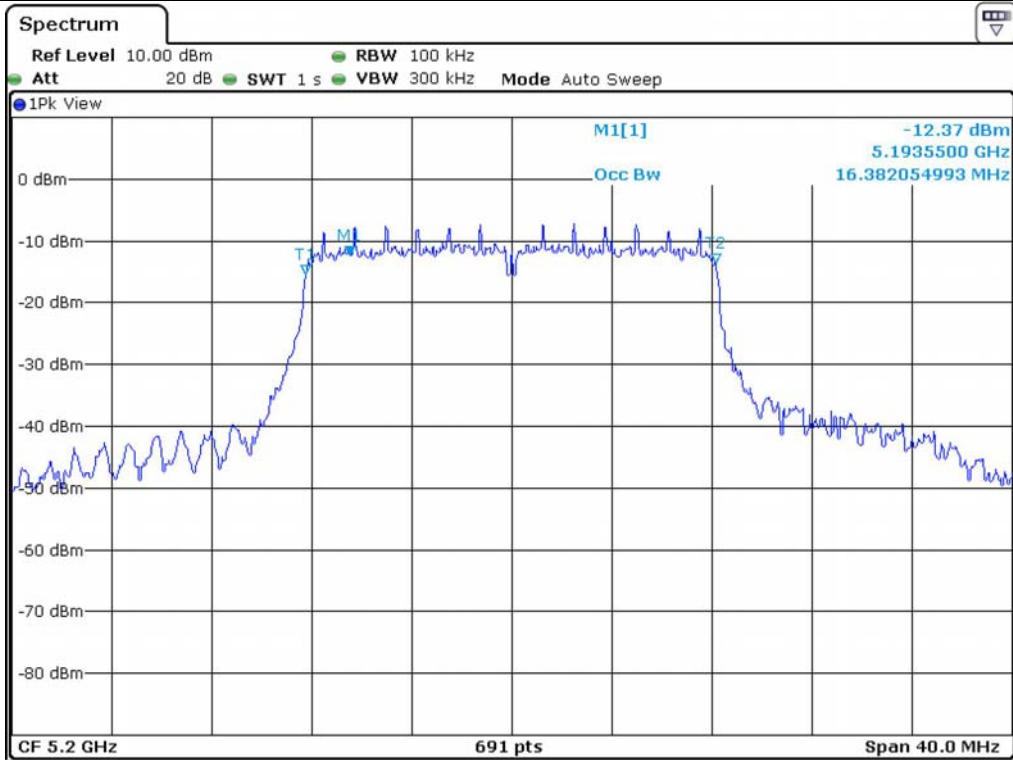


Middle Channel (5 600 MHz)

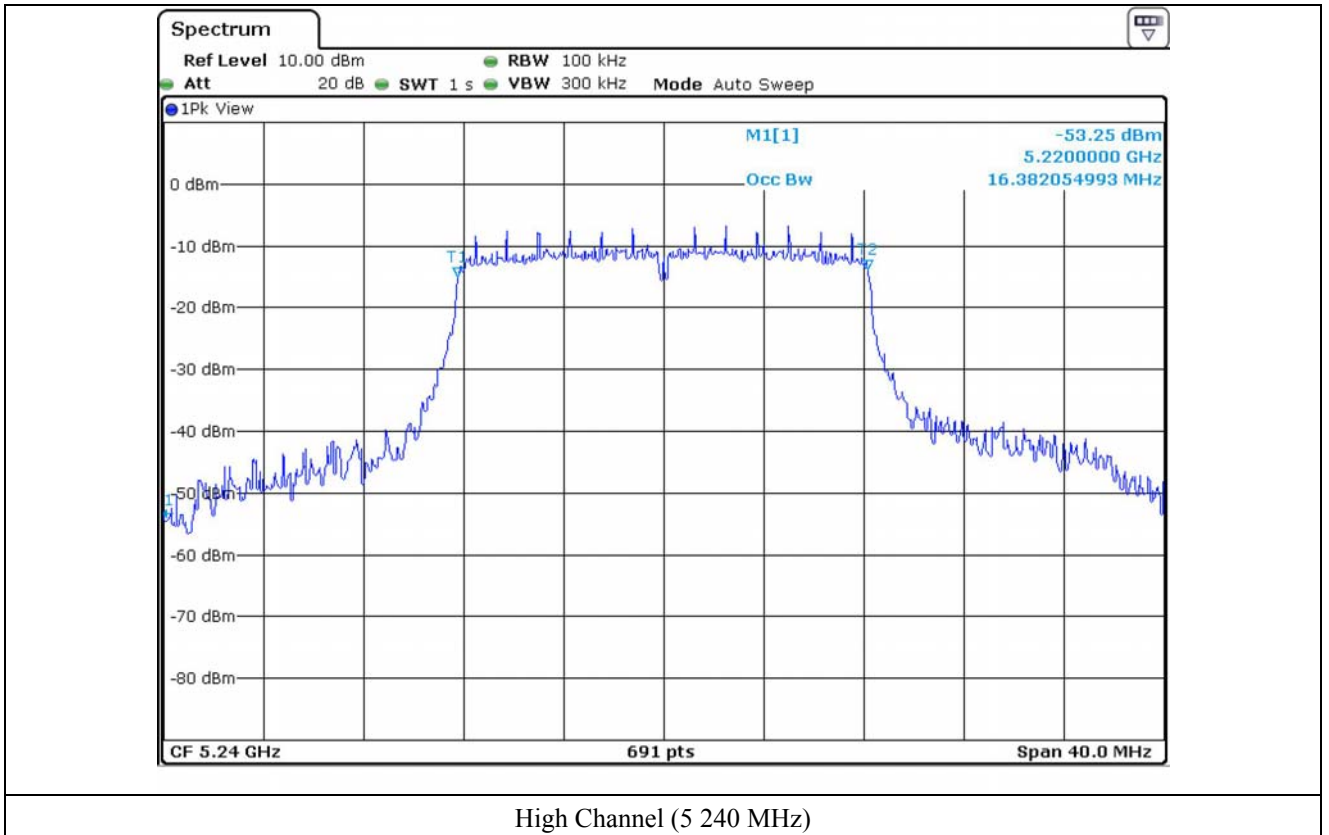




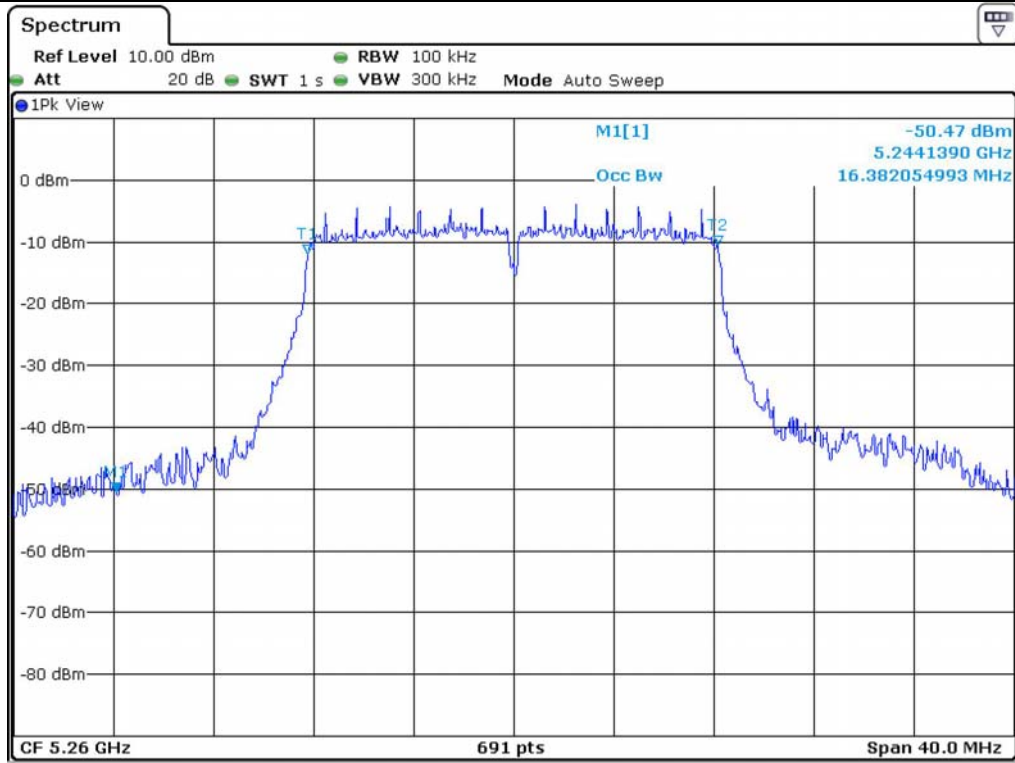
Low Channel (5 180 MHz)



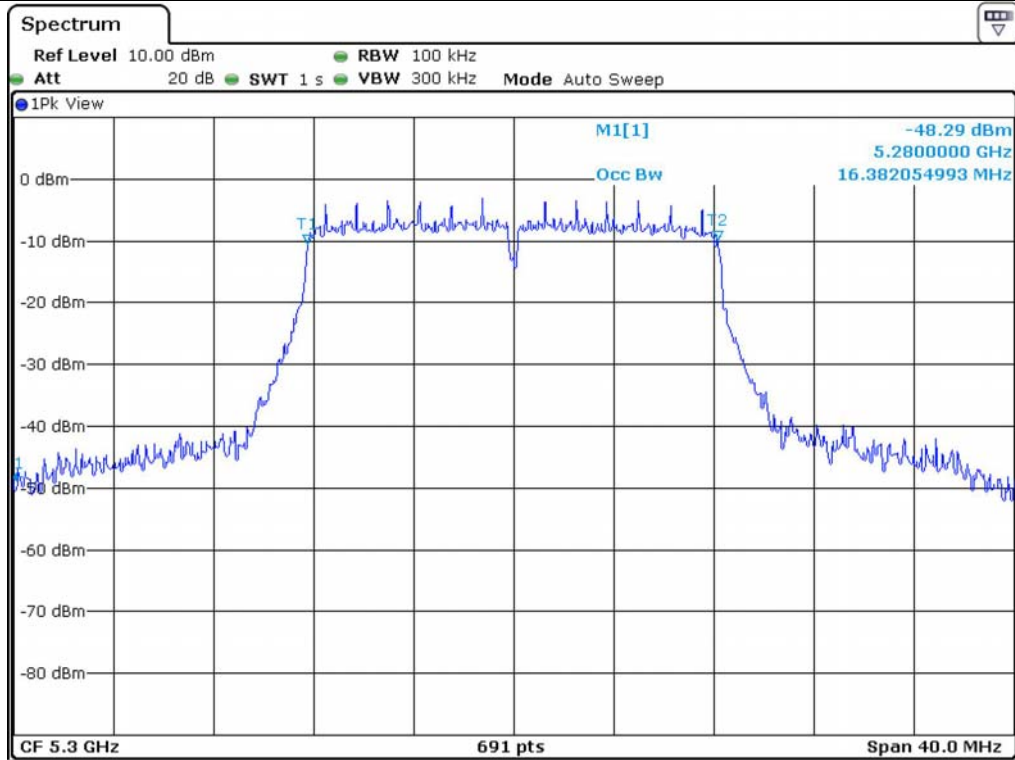
Middle Channel (5 200 MHz)



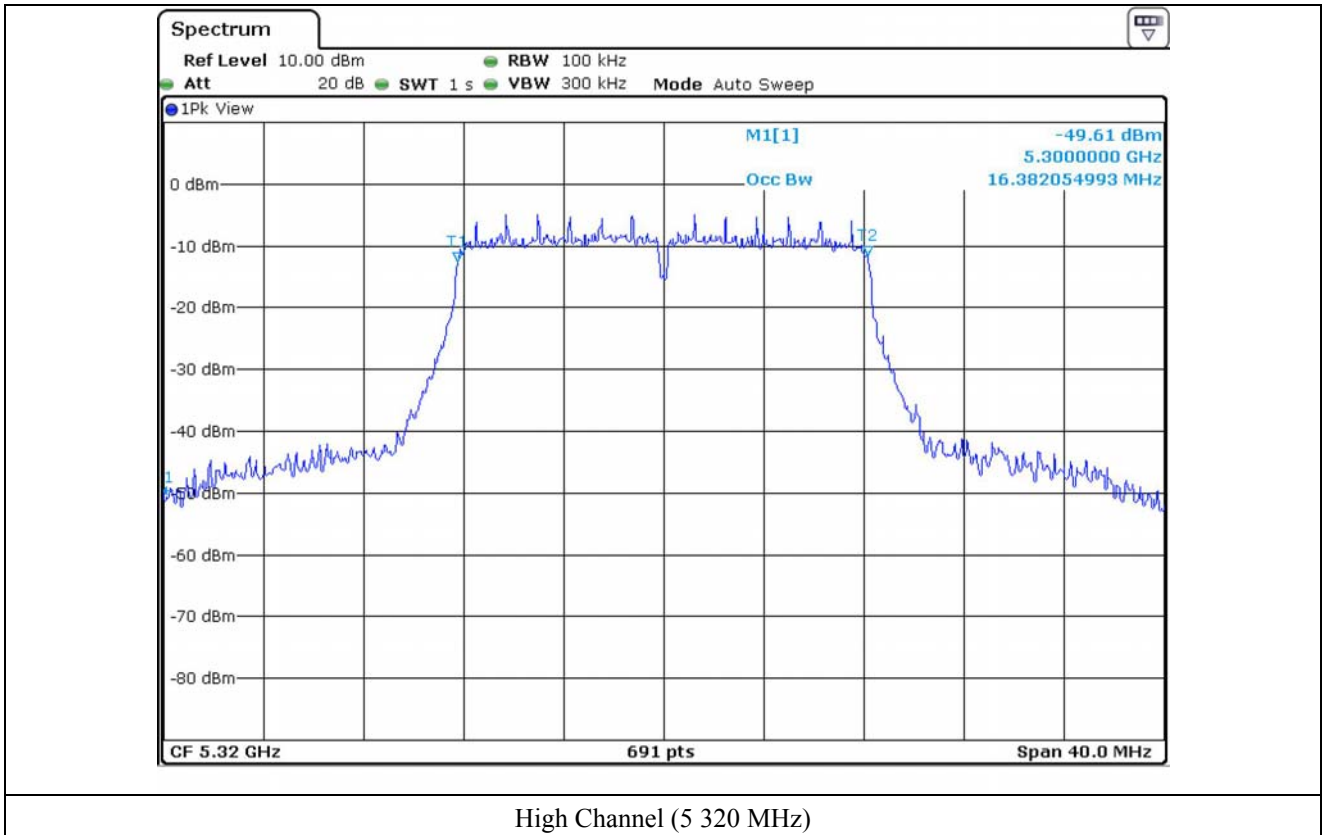
High Channel (5 240 MHz)

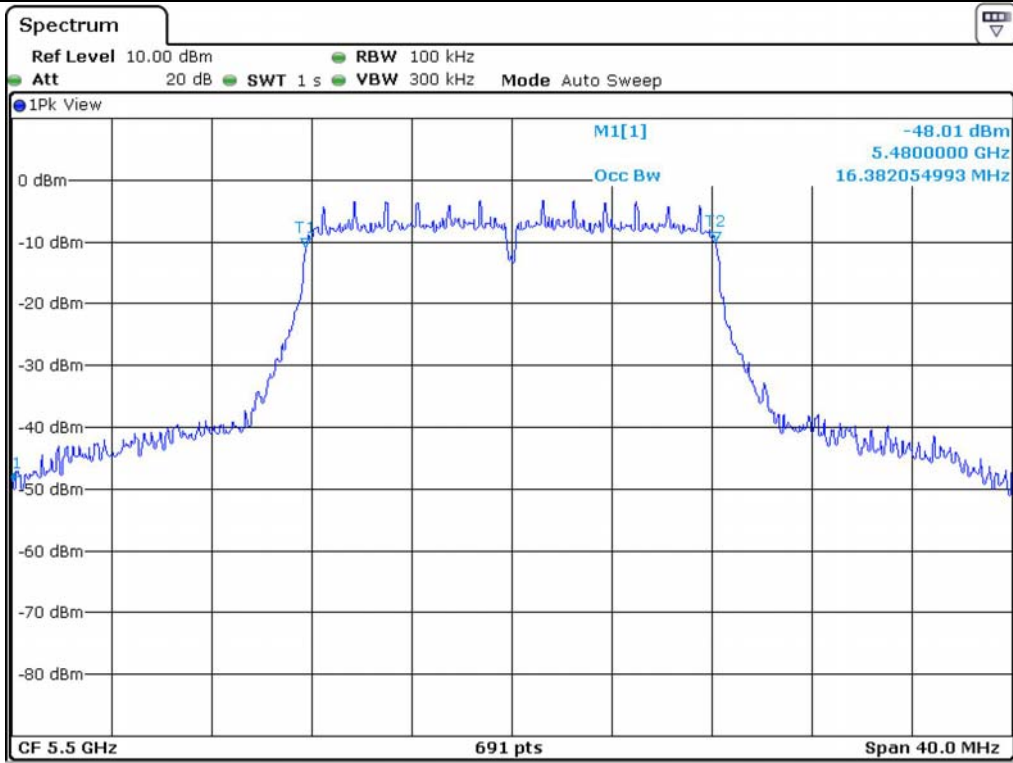


Low Channel (5 260 MHz)

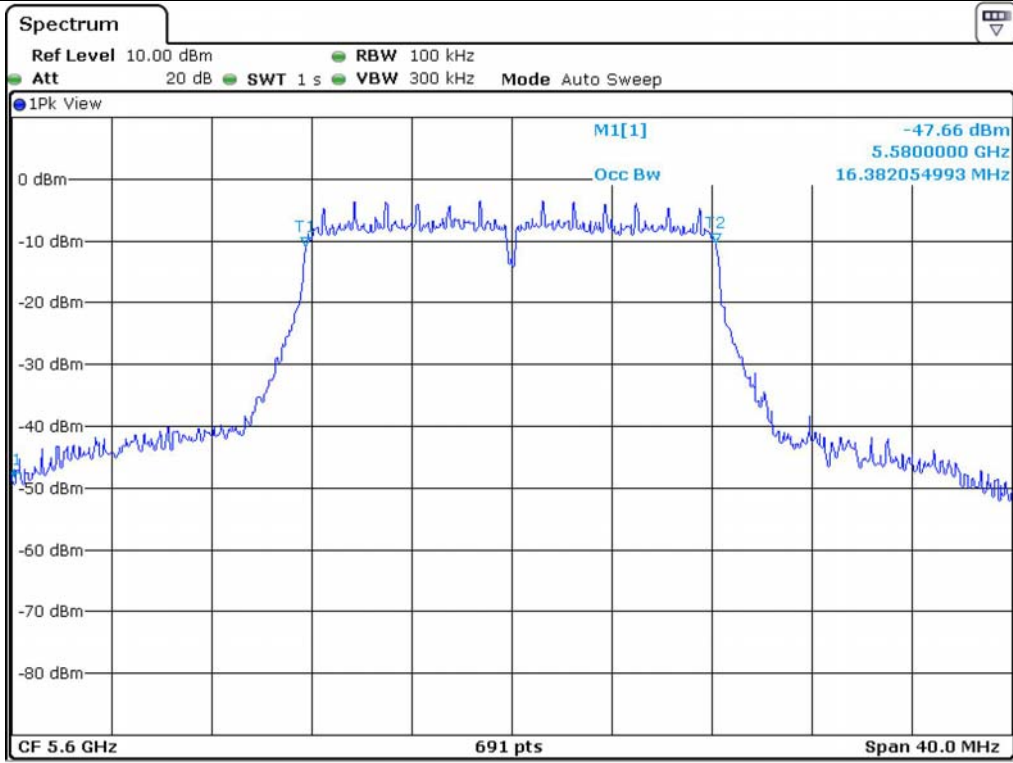


Middle Channel (5 300 MHz)

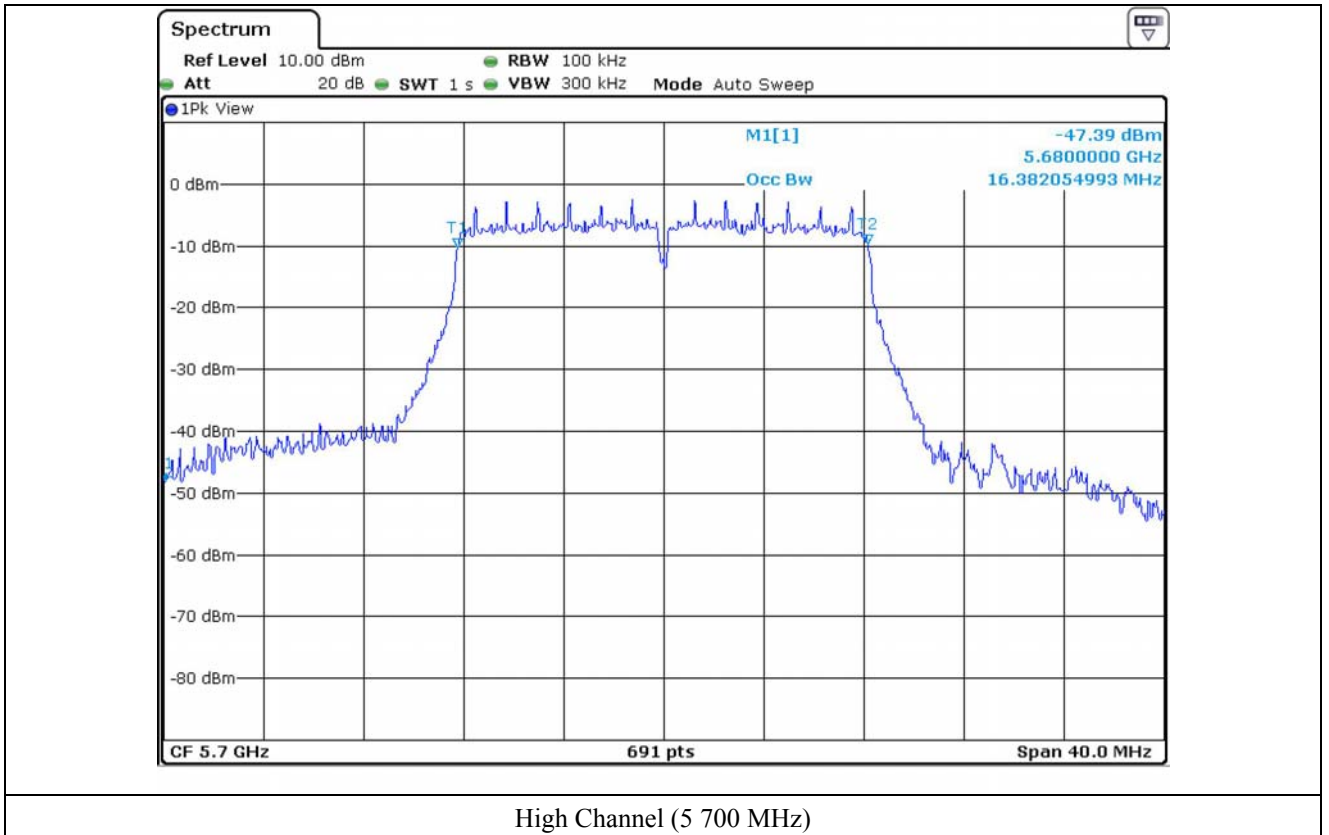




Low Channel (5 500 MHz)



Middle Channel (5 600 MHz)



7.4.2 Test data for 802.11n_HT20 RLAN Mode

7.4.2.1 Test data for Antenna 0

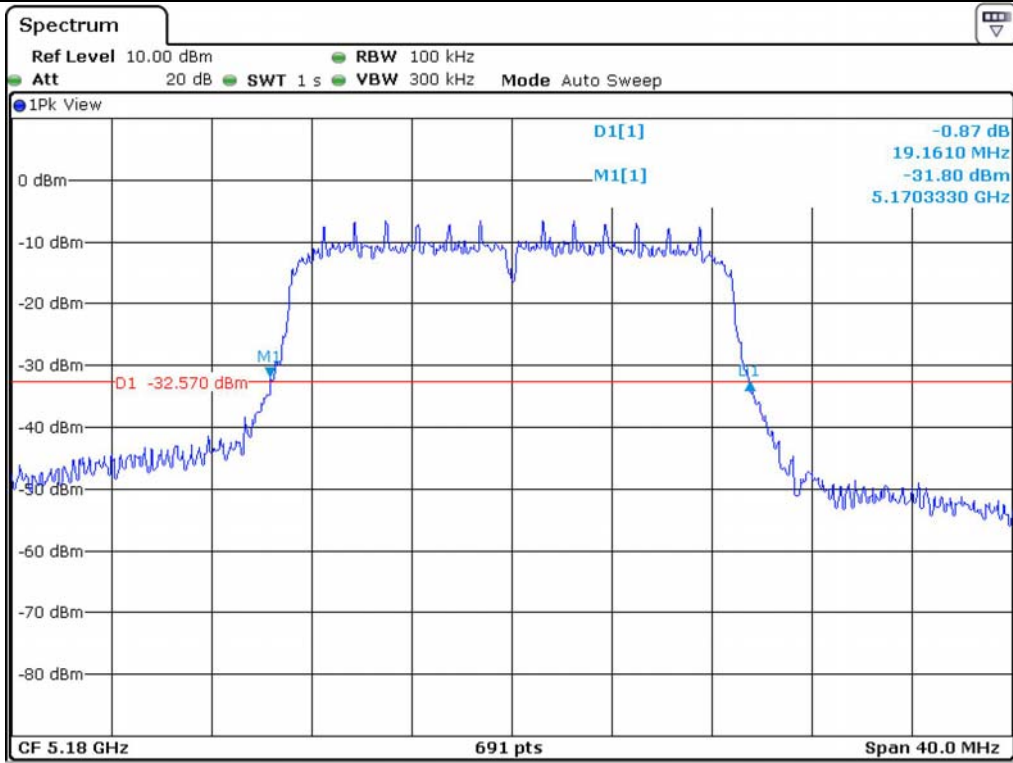
-. Test Date : December 16, 2013

-. Test Result : Pass

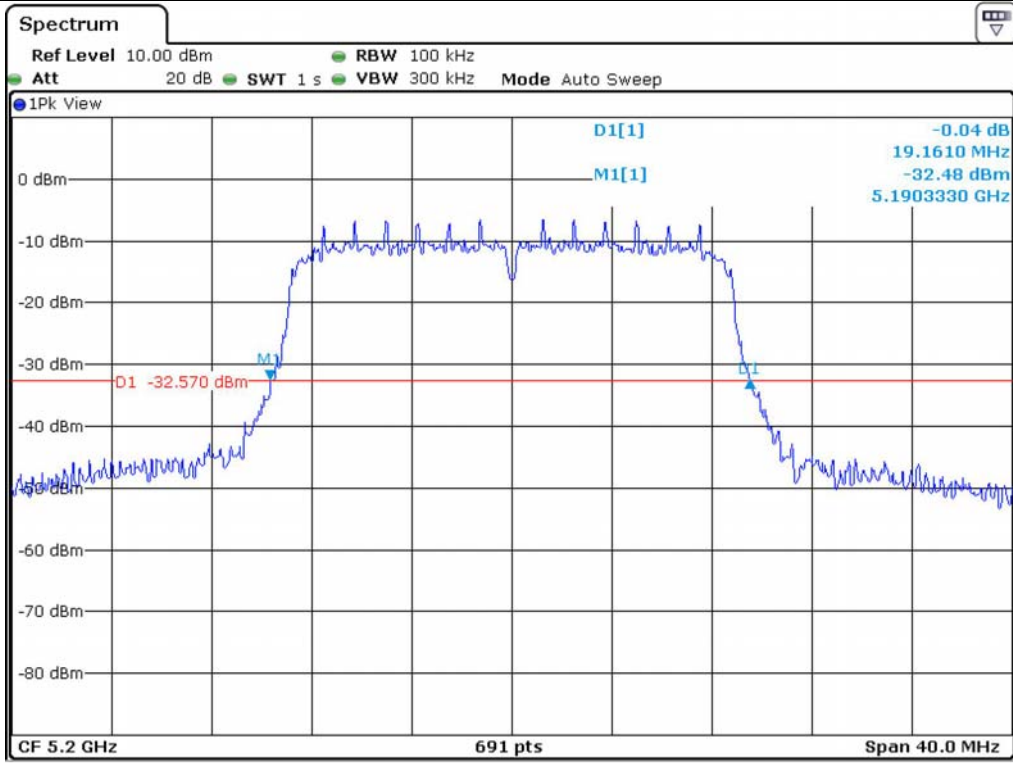
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
5 150 ~ 5 250	Low	5 180	19.16	17.42
	Middle	5 200	19.16	17.42
	High	5 240	19.16	17.42
5 250 ~ 5 350	Low	5 260	19.10	17.42
	Middle	5 300	19.10	17.42
	High	5 320	19.10	17.42
5 470 ~ 5 725	Low	5 500	19.10	17.42
	Middle	5 600	19.10	17.42
	High	5 700	19.10	17.42



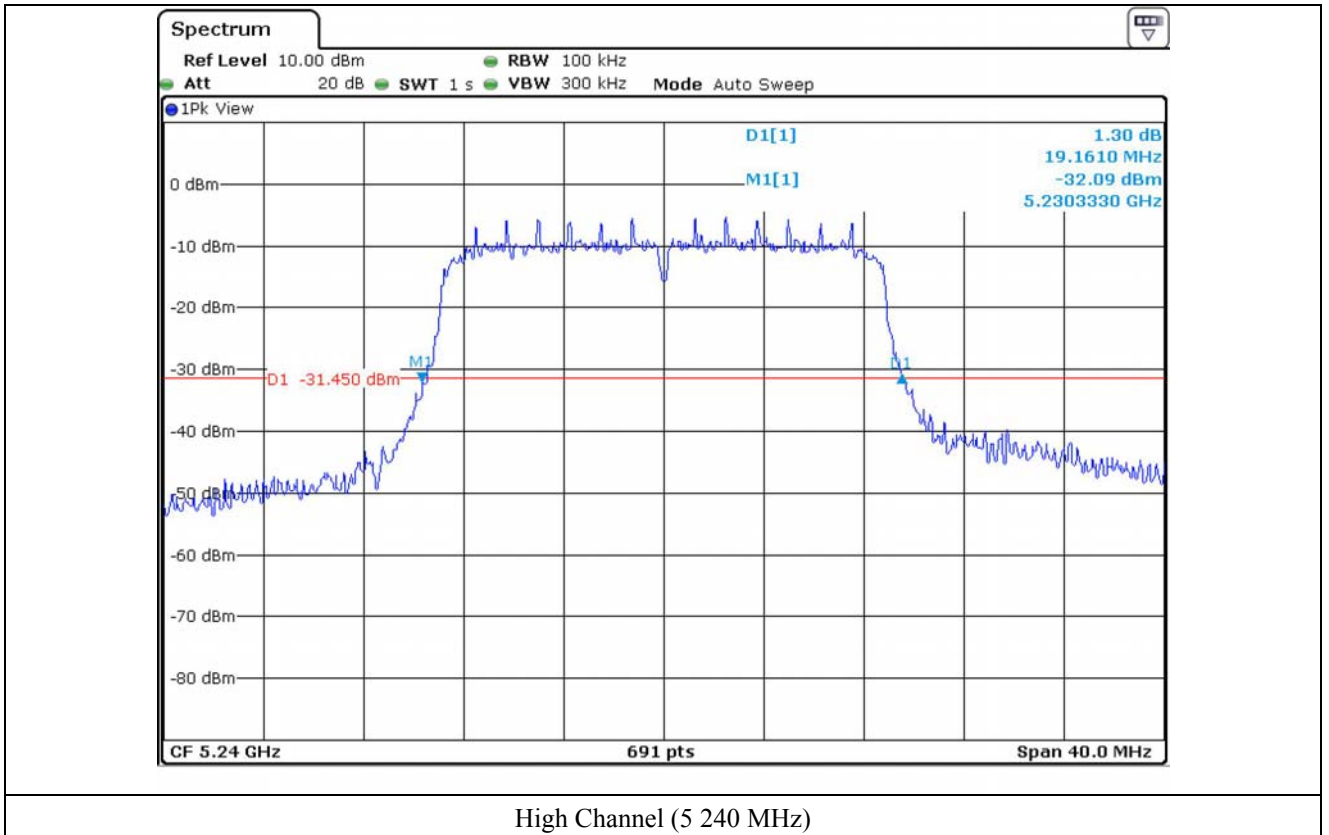
Tested by: Hong-Kyu, Lee/ Engineer

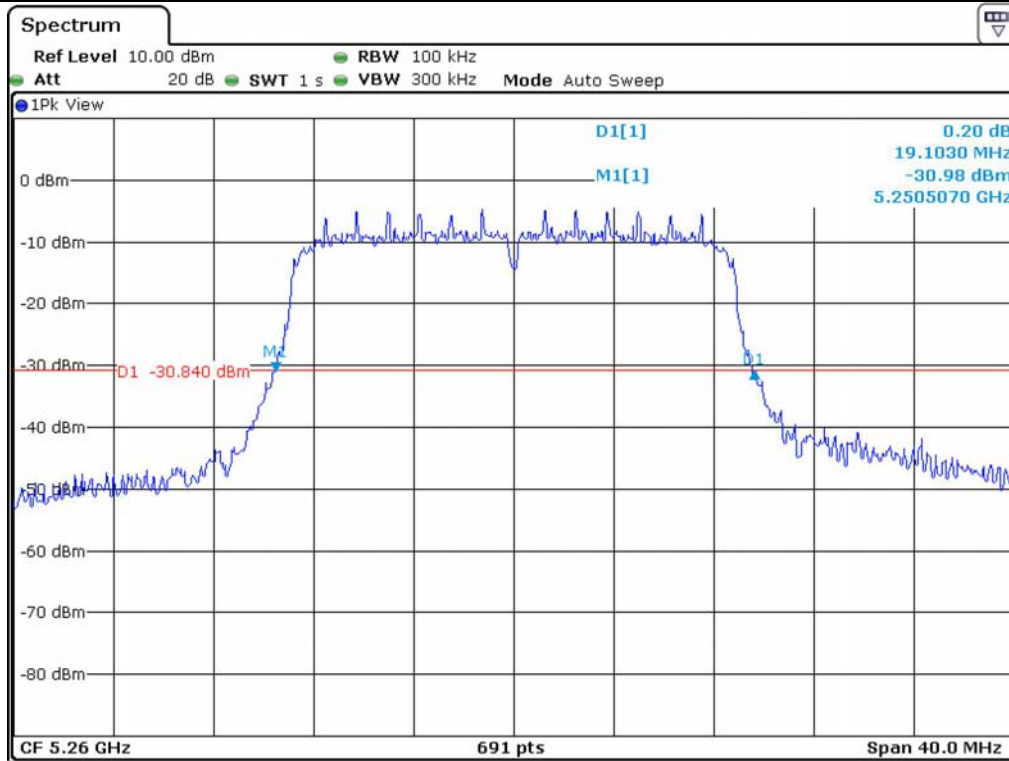


Low Channel (5 180 MHz)

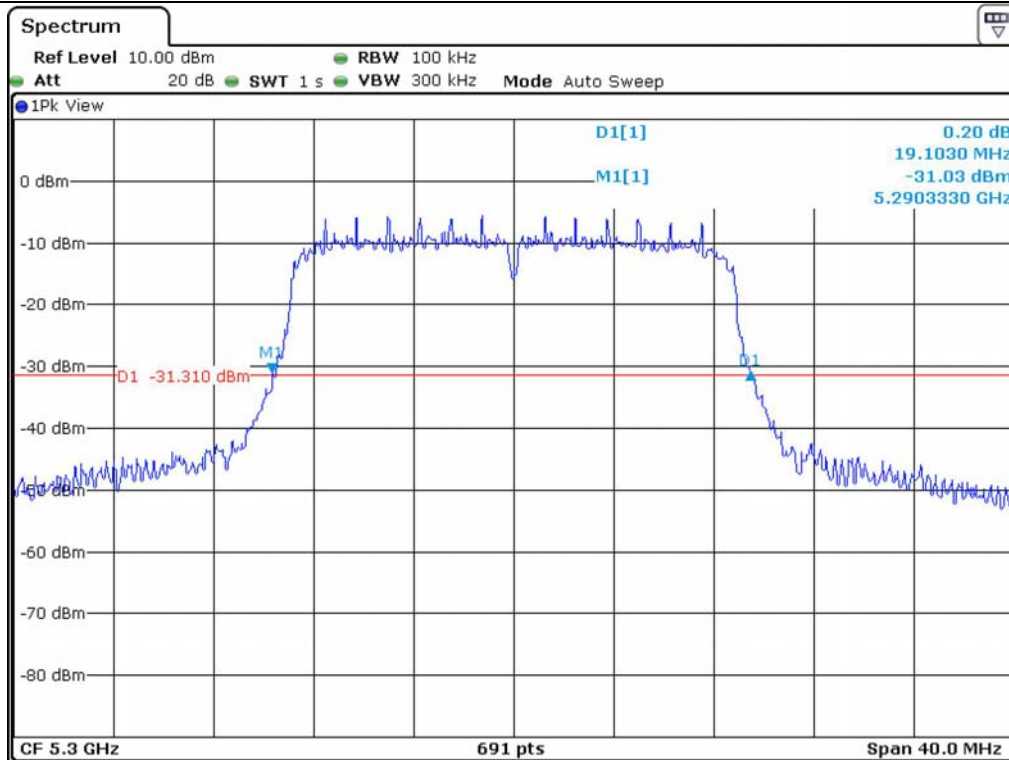


Middle Channel (5 200 MHz)

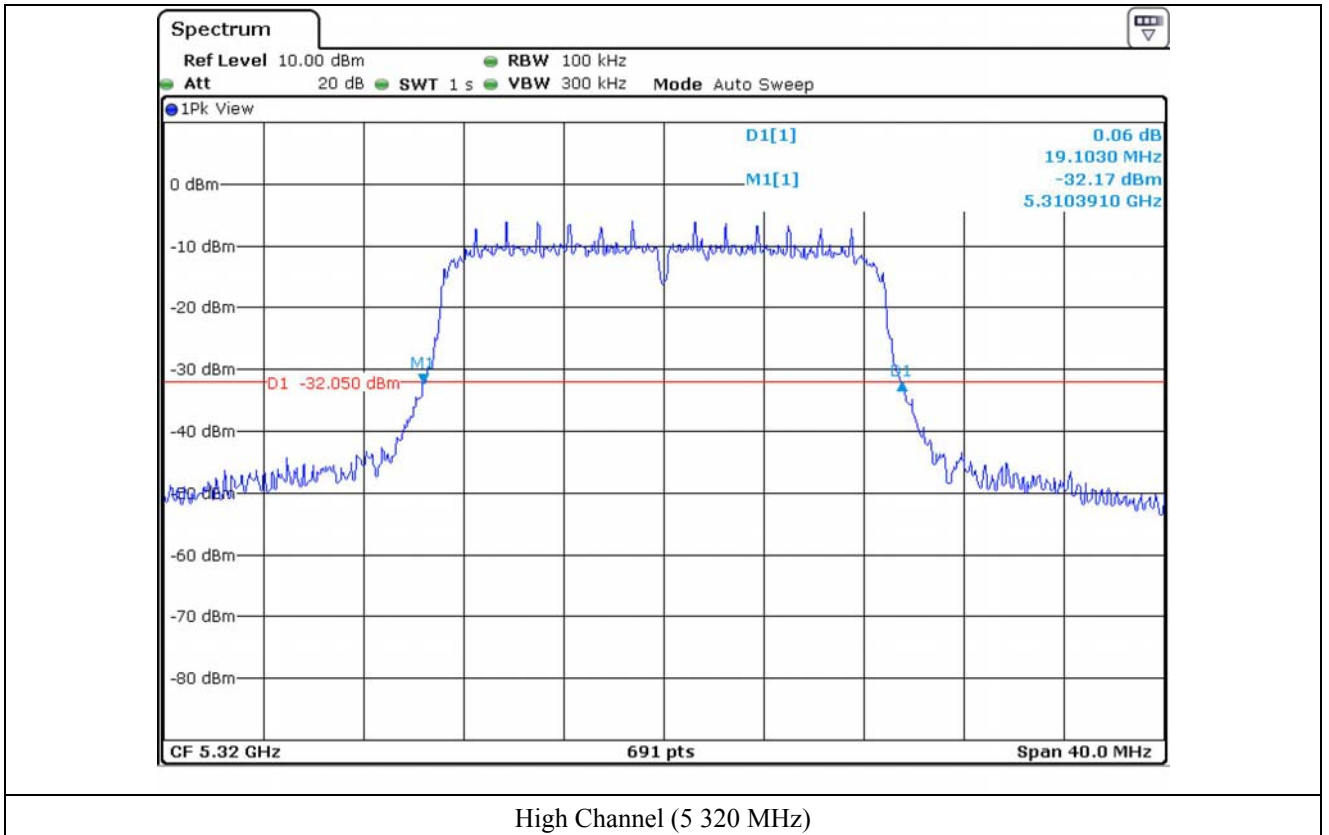




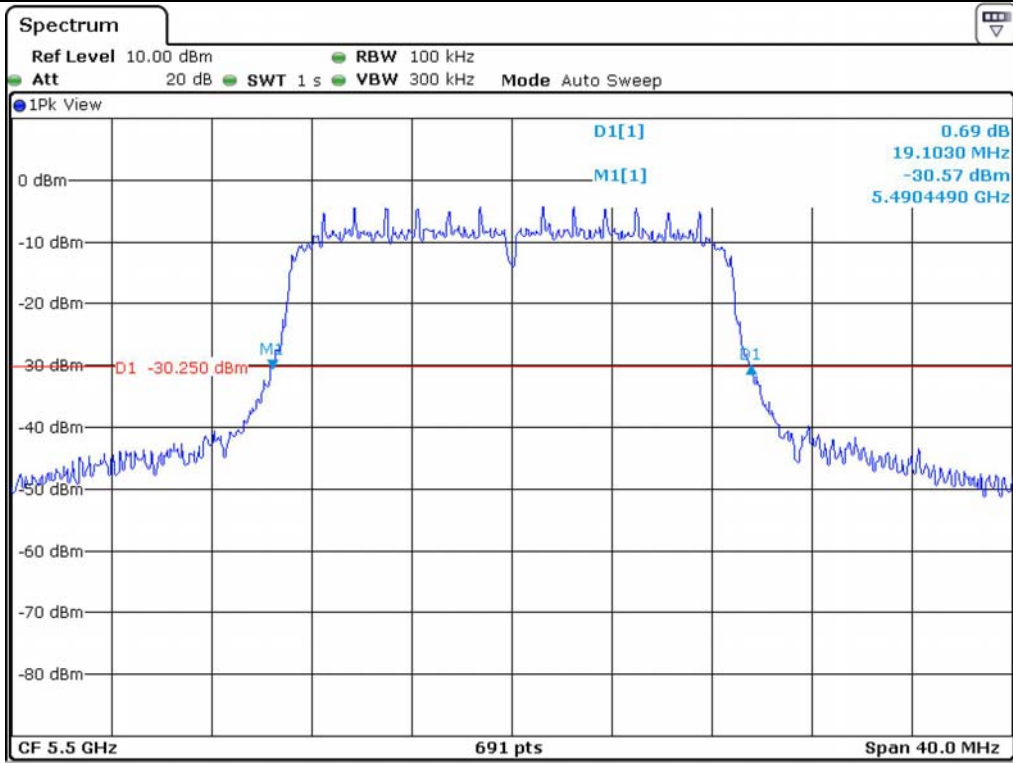
Low Channel (5 260 MHz)



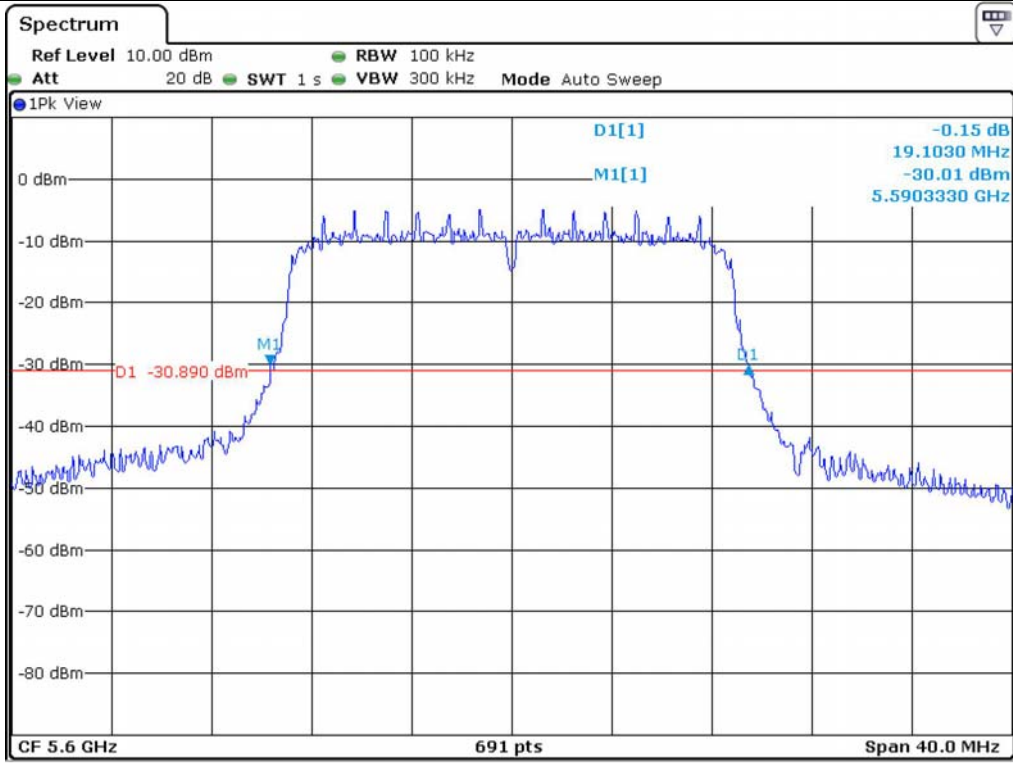
Middle Channel (5 300 MHz)



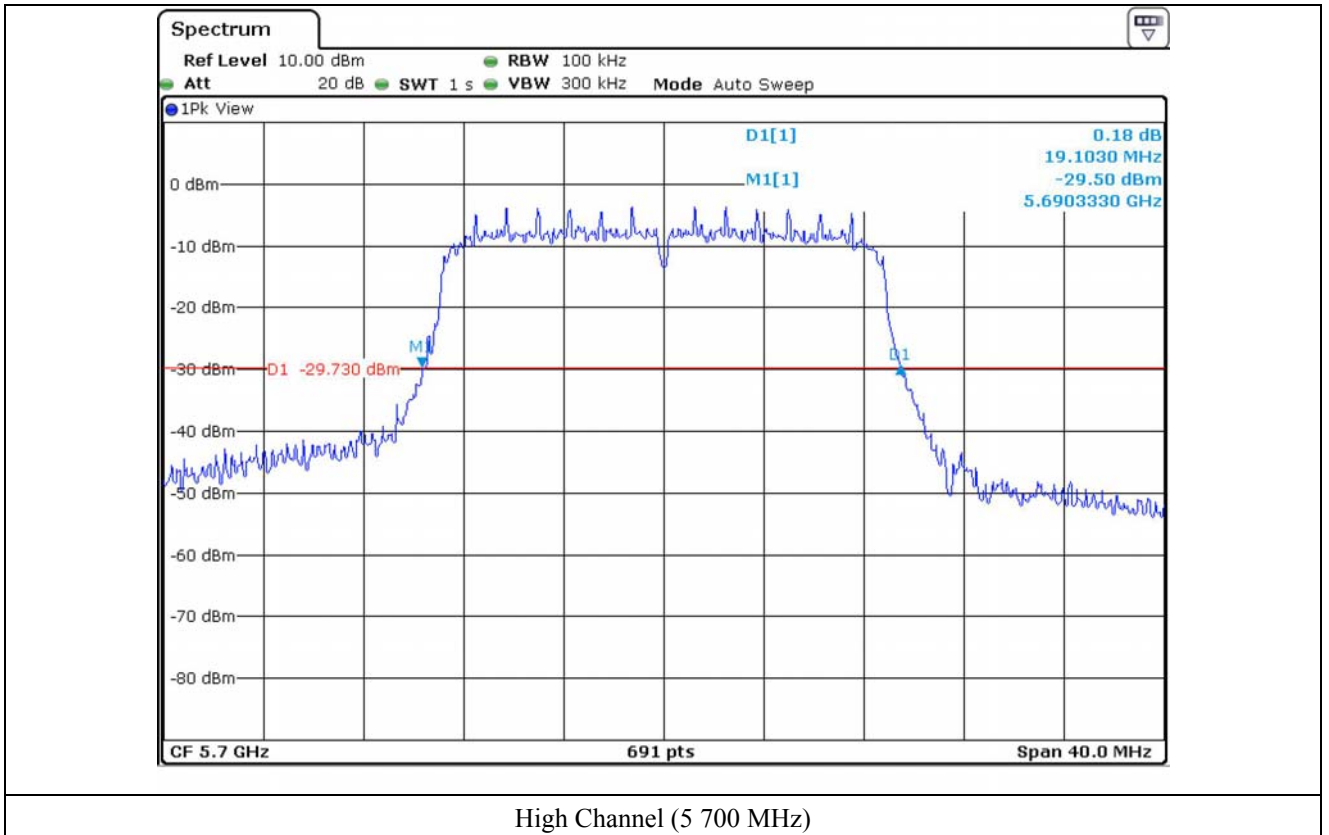
High Channel (5 320 MHz)



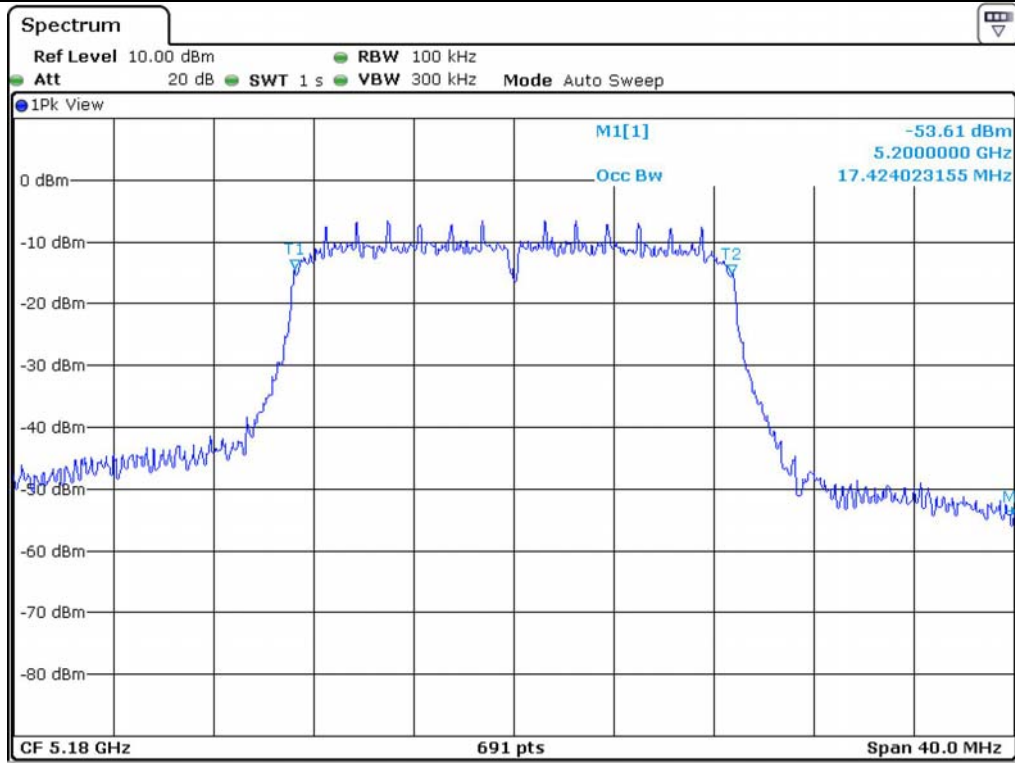
Low Channel (5 500 MHz)



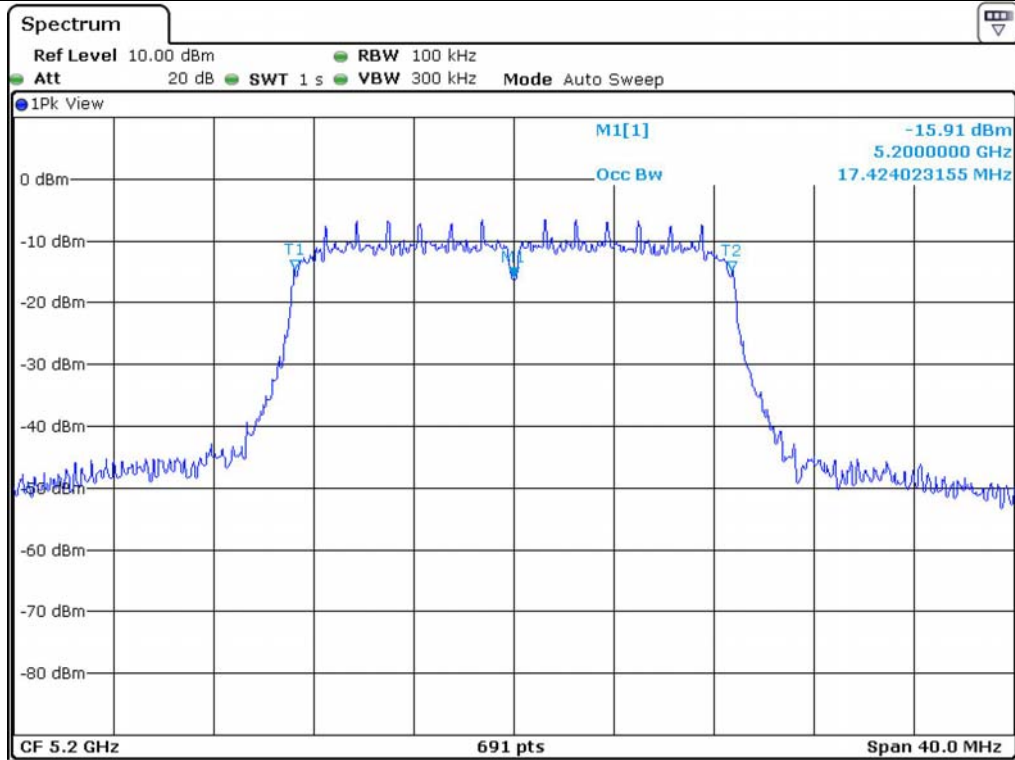
Middle Channel (5 600 MHz)



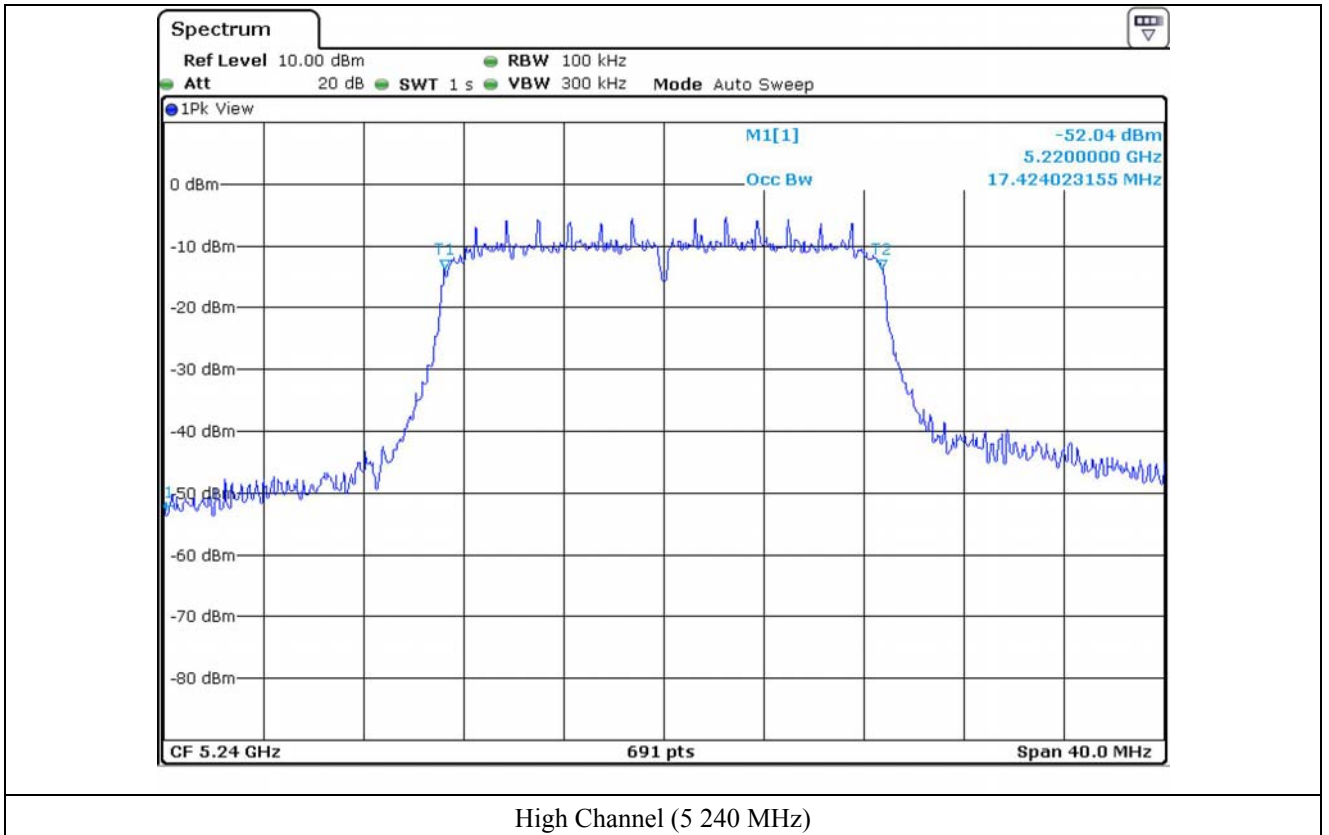
High Channel (5 700 MHz)

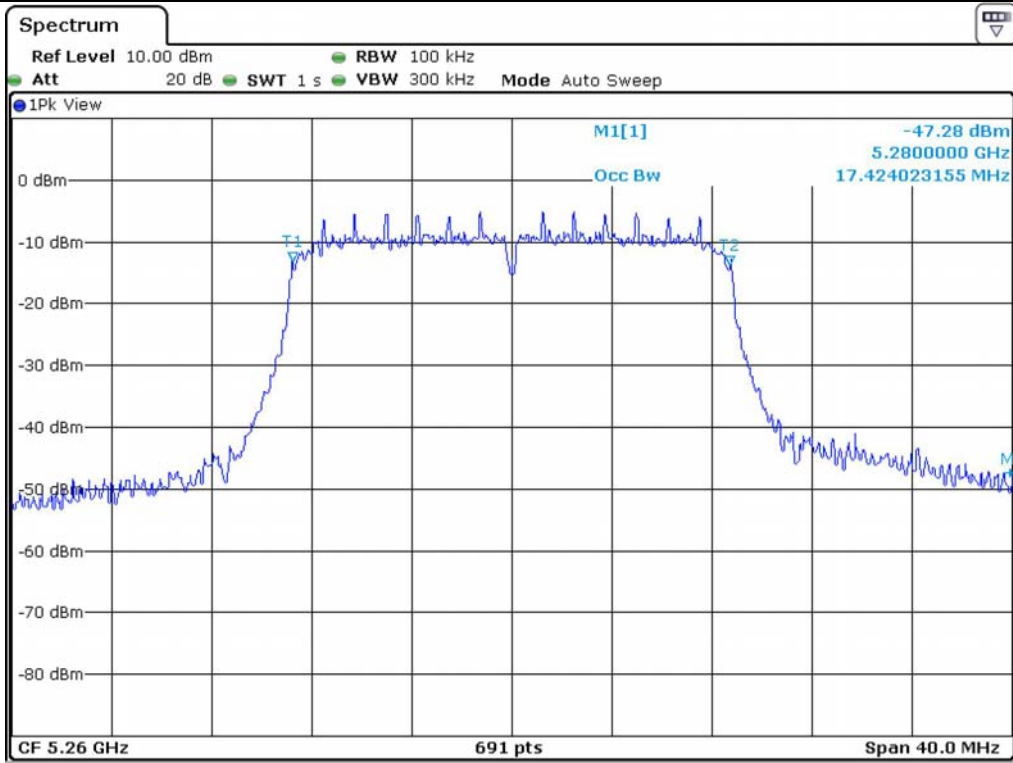


Low Channel (5 180 MHz)

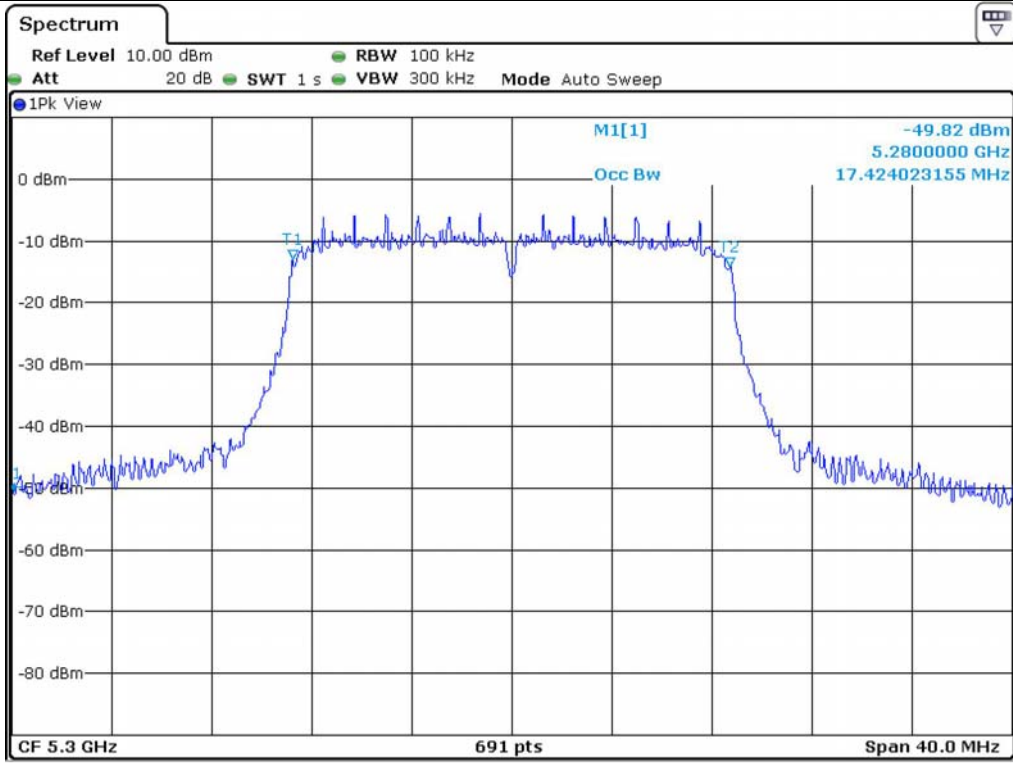


Middle Channel (5 200 MHz)

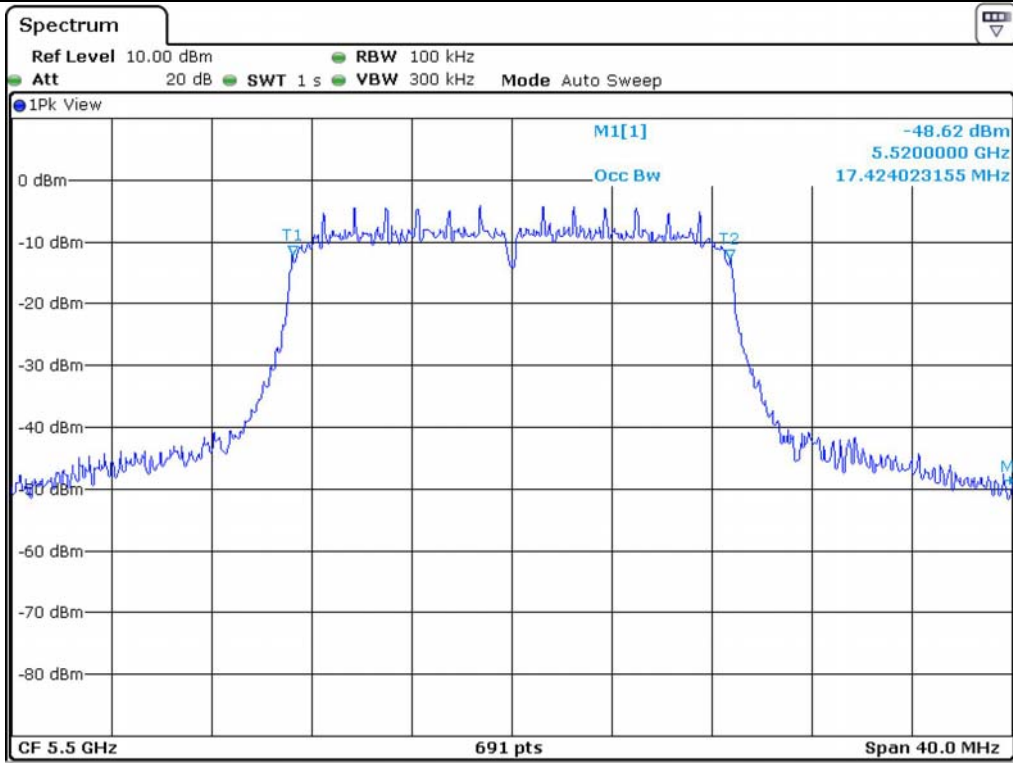




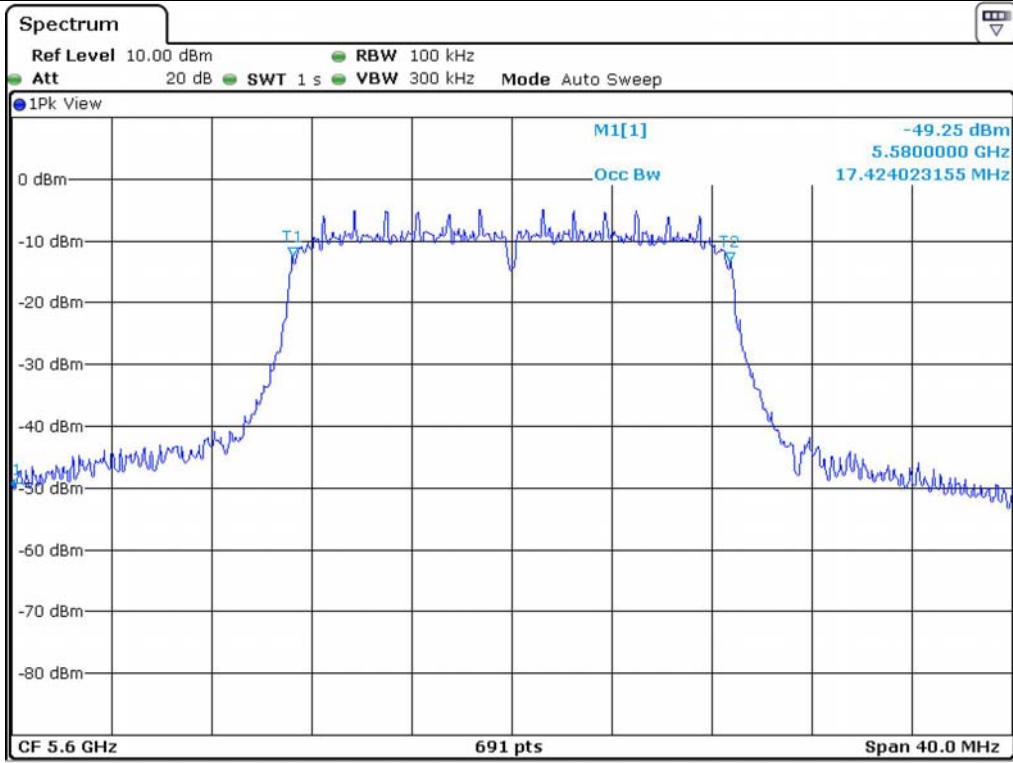
Low Channel (5 260 MHz)



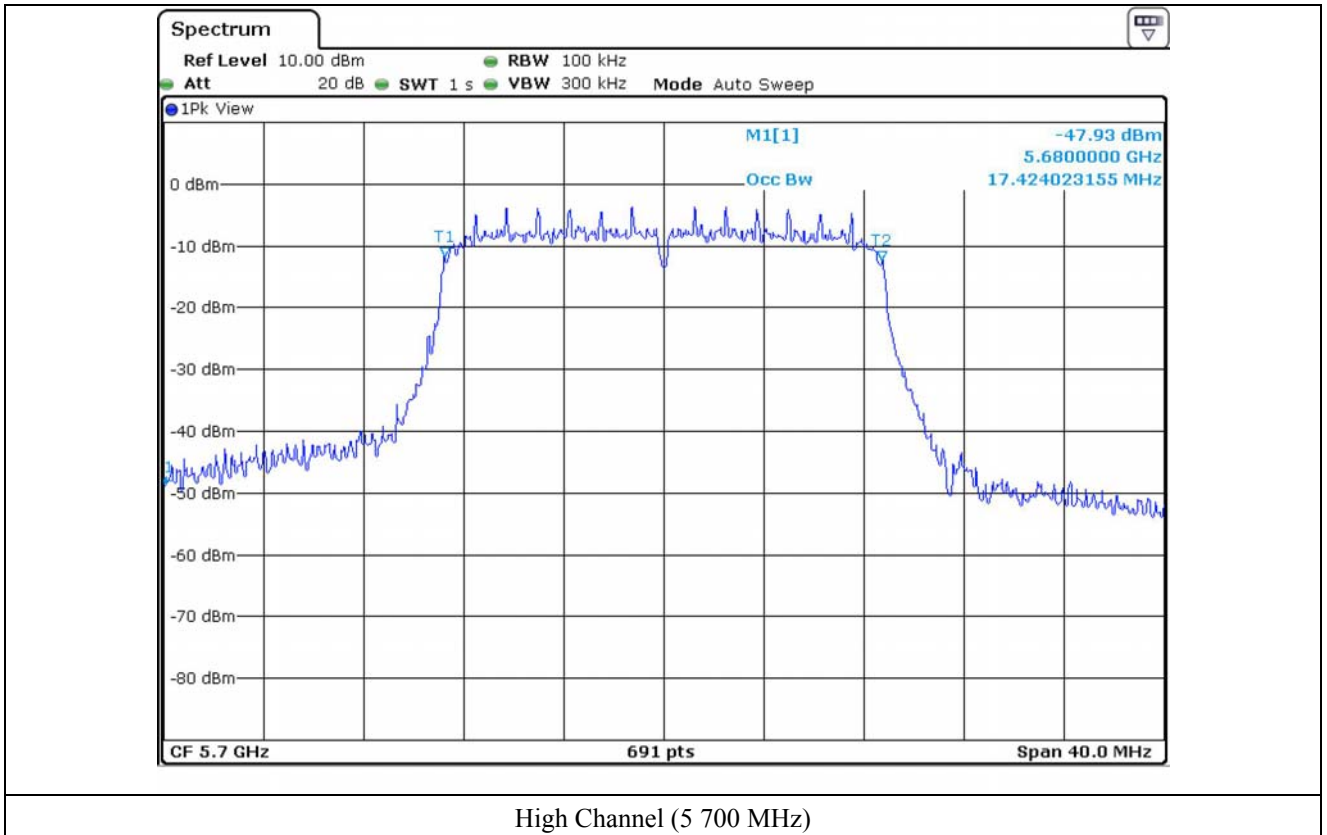
Middle Channel (5 300 MHz)



Low Channel (5 500 MHz)



Middle Channel (5 600 MHz)



High Channel (5 700 MHz)

7.4.2.2 Test data for Antenna 1

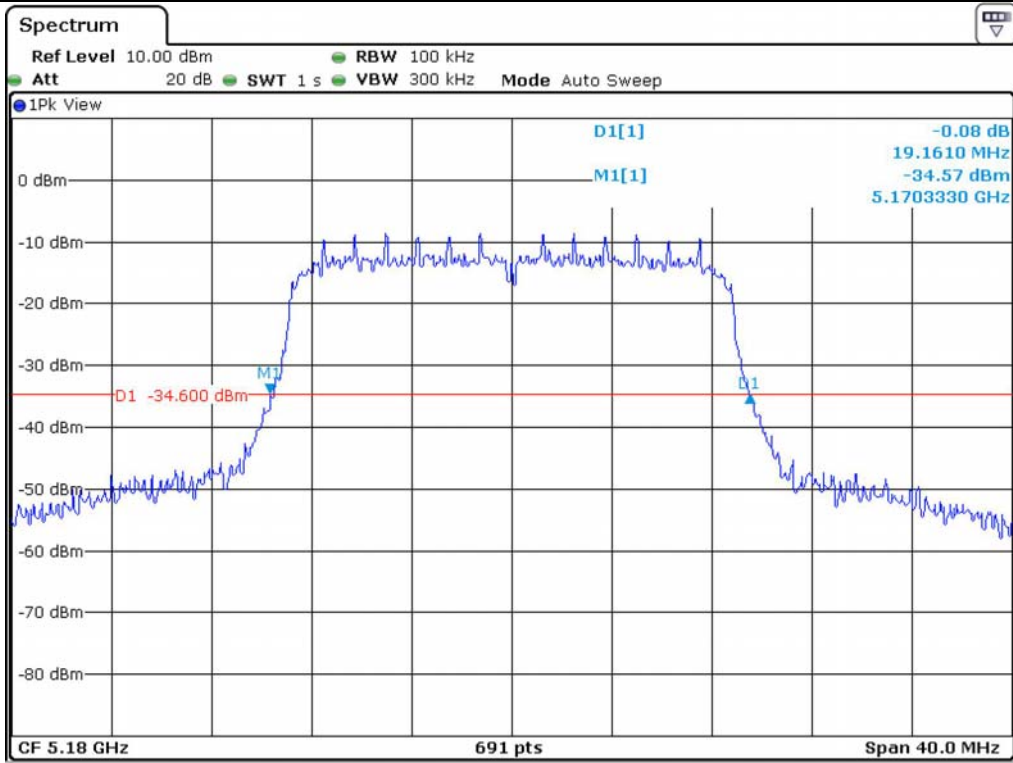
-. Test Date : December 16, 2013

-. Test Result : Pass

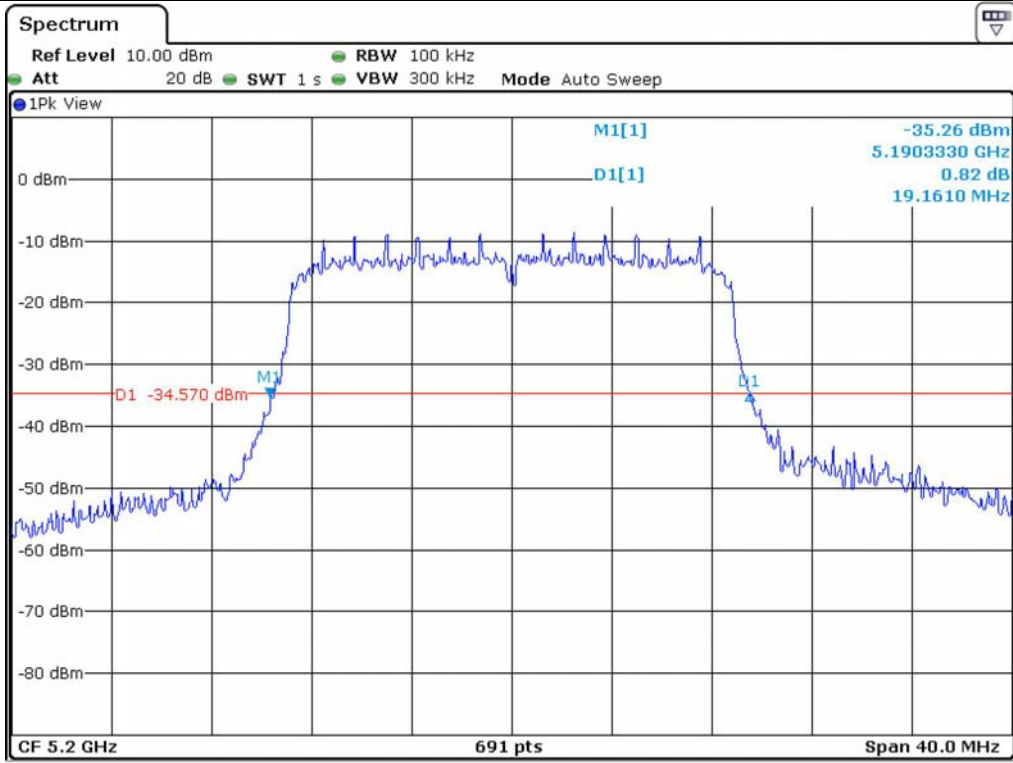
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
5 150 ~ 5 250	Low	5 180	19.16	17.42
	Middle	5 200	19.16	17.42
	High	5 240	19.16	17.42
5 250 ~ 5 350	Low	5 260	19.10	17.42
	Middle	5 300	19.10	17.42
	High	5 320	19.10	17.42
5 470 ~ 5 725	Low	5 500	19.10	17.42
	Middle	5 600	19.10	17.42
	High	5 700	19.10	17.42

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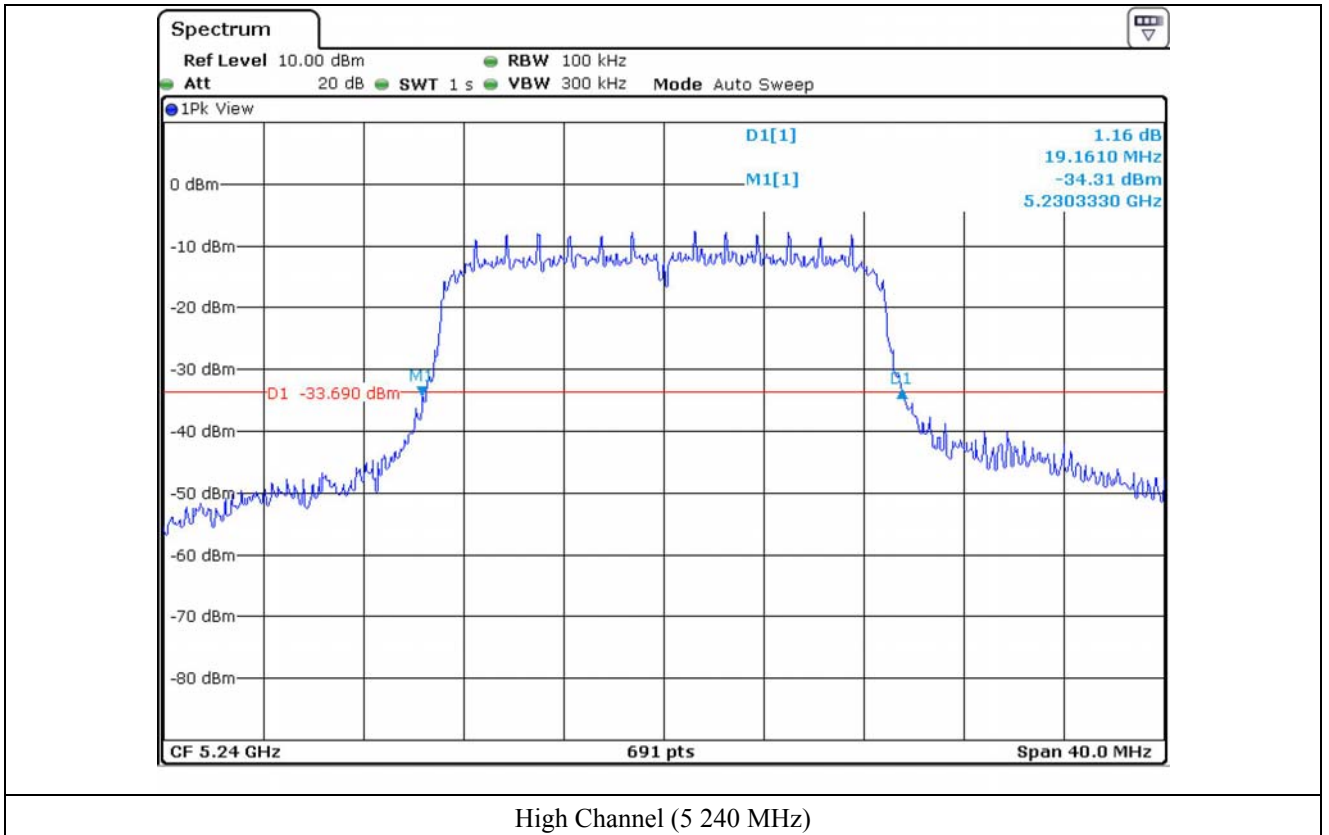
Tested by: Hong-Kyu, Lee/ Engineer

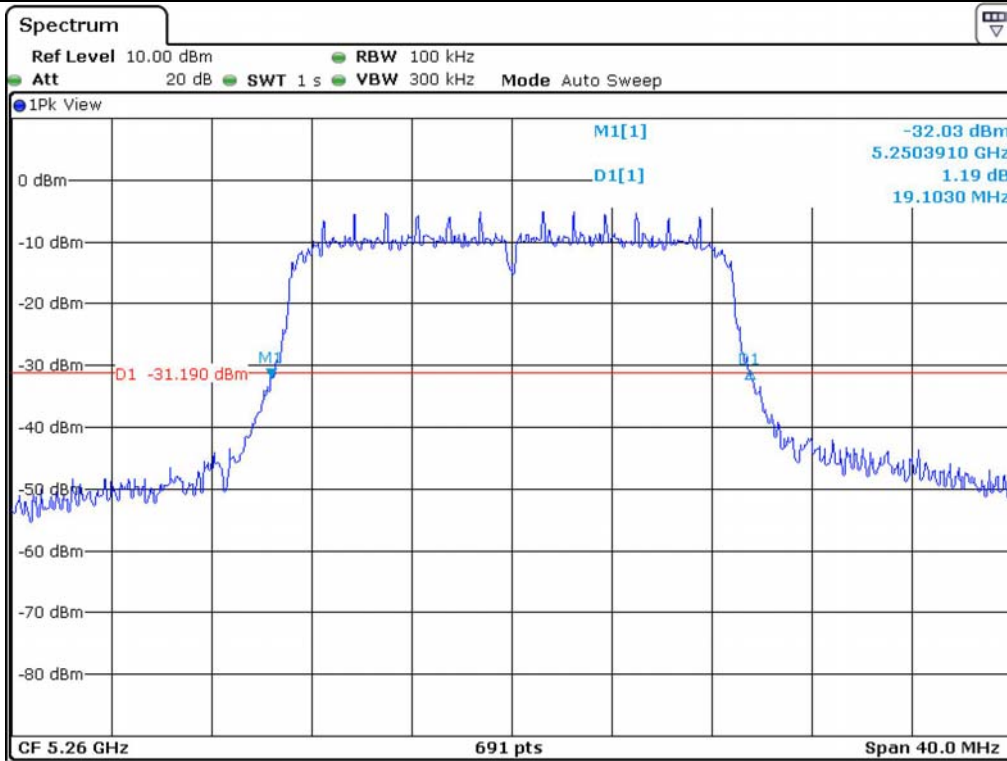


Low Channel (5 180 MHz)

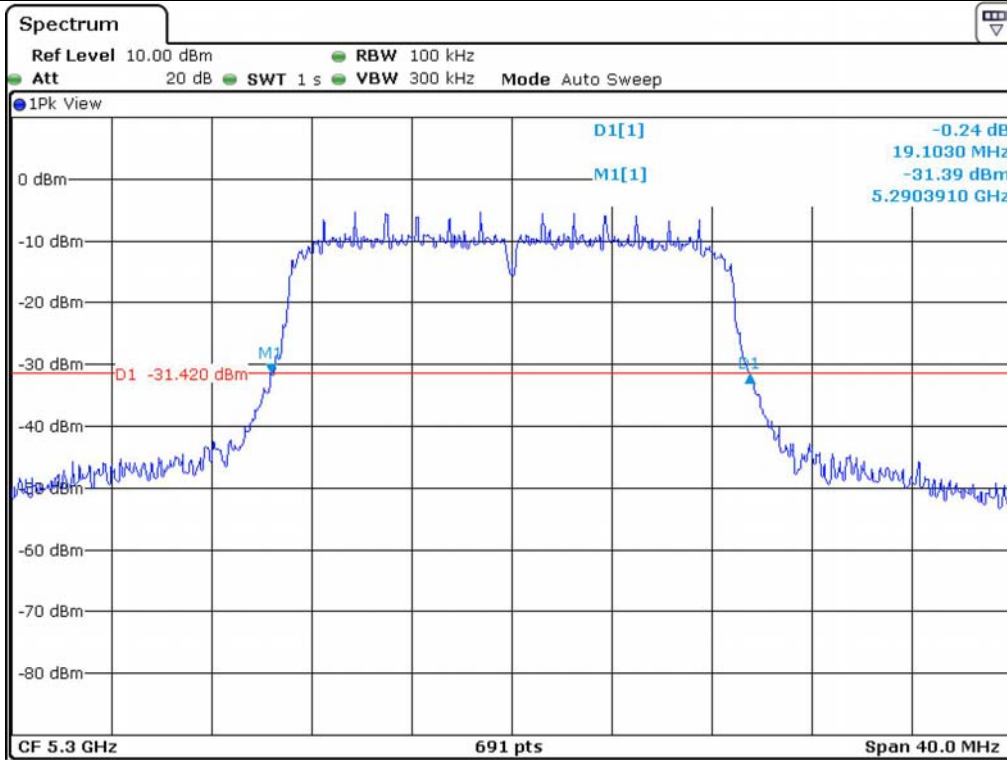


Middle Channel (5 200 MHz)

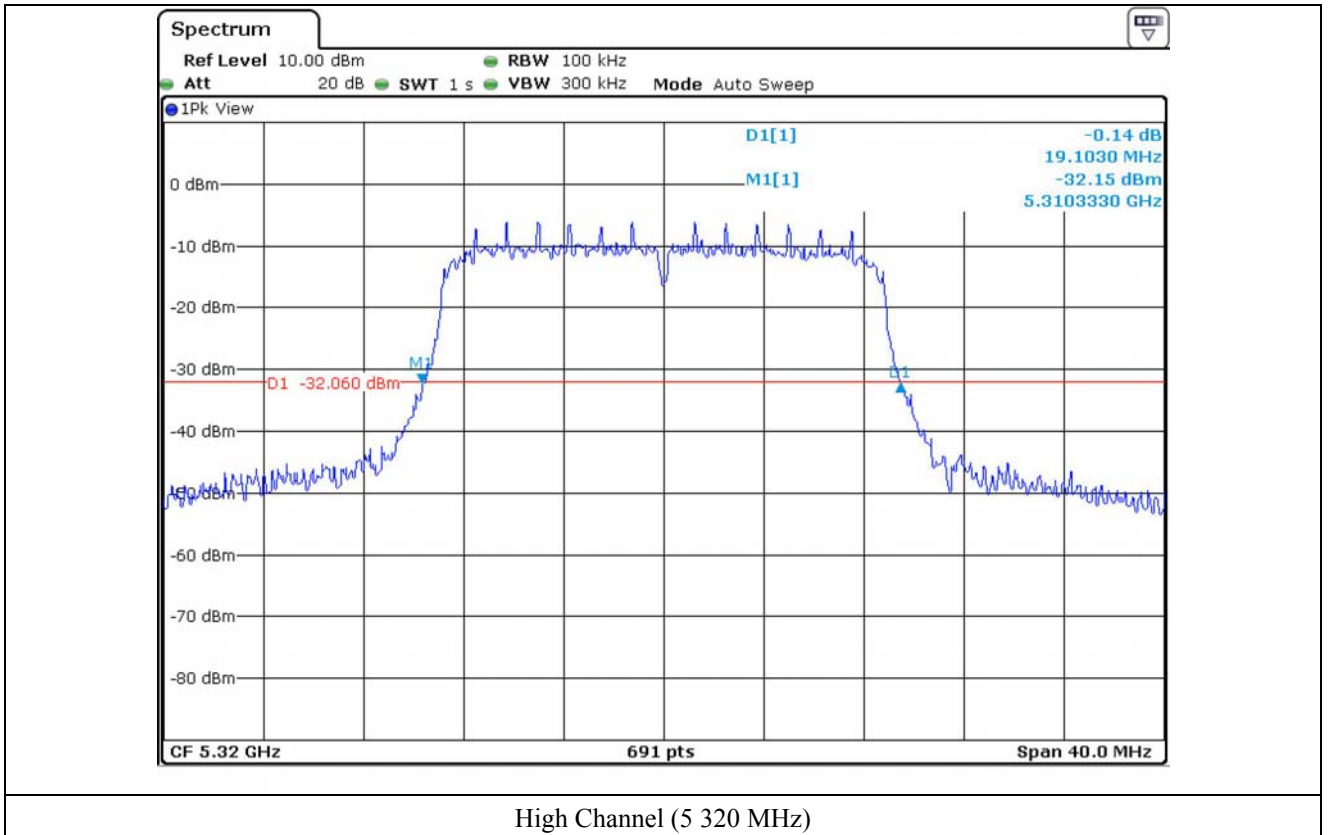




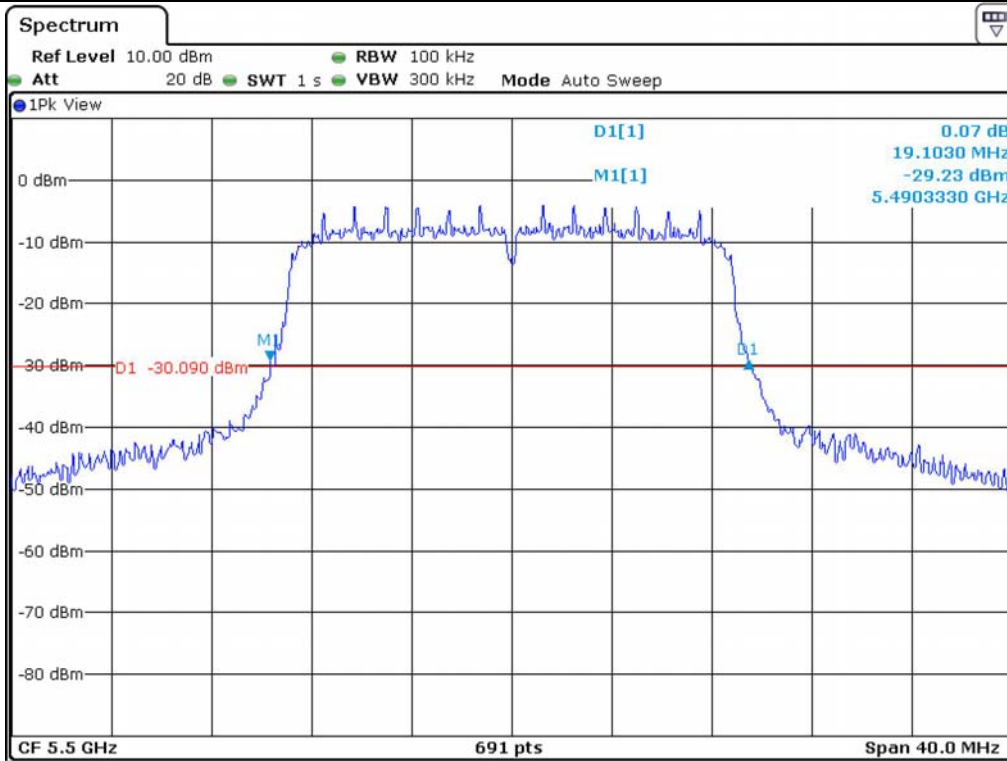
Low Channel (5 260 MHz)



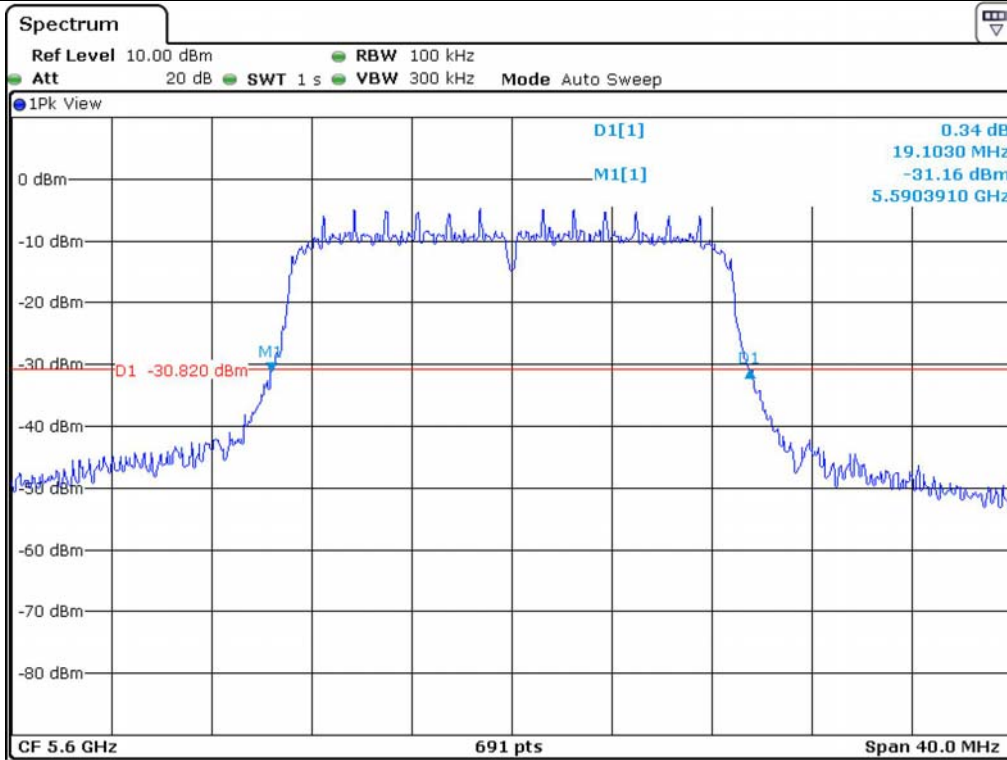
Middle Channel (5 300 MHz)



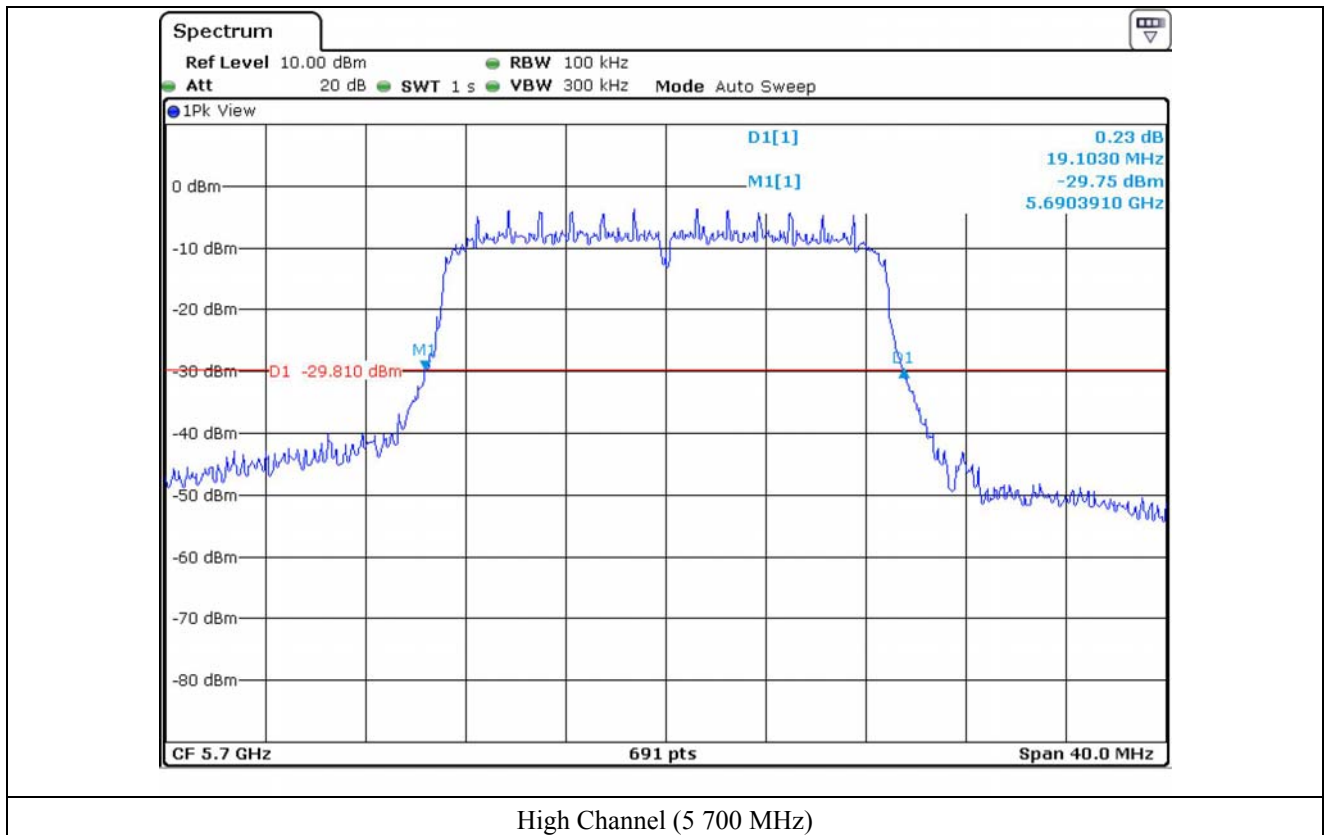
High Channel (5 320 MHz)



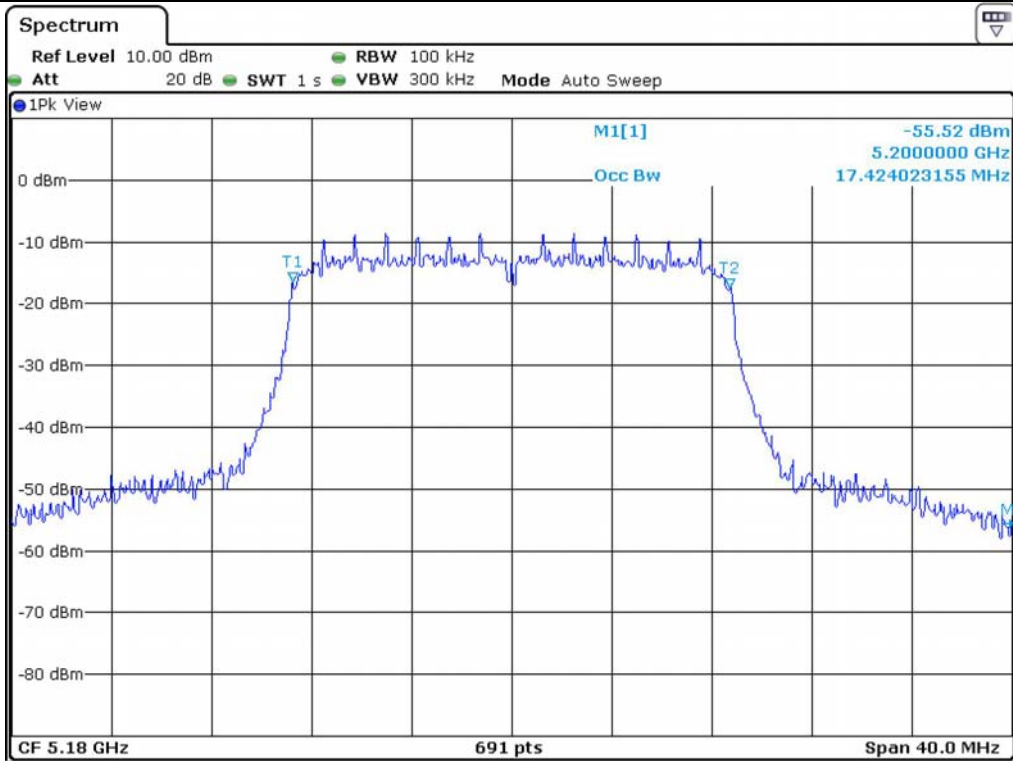
Low Channel (5 500 MHz)



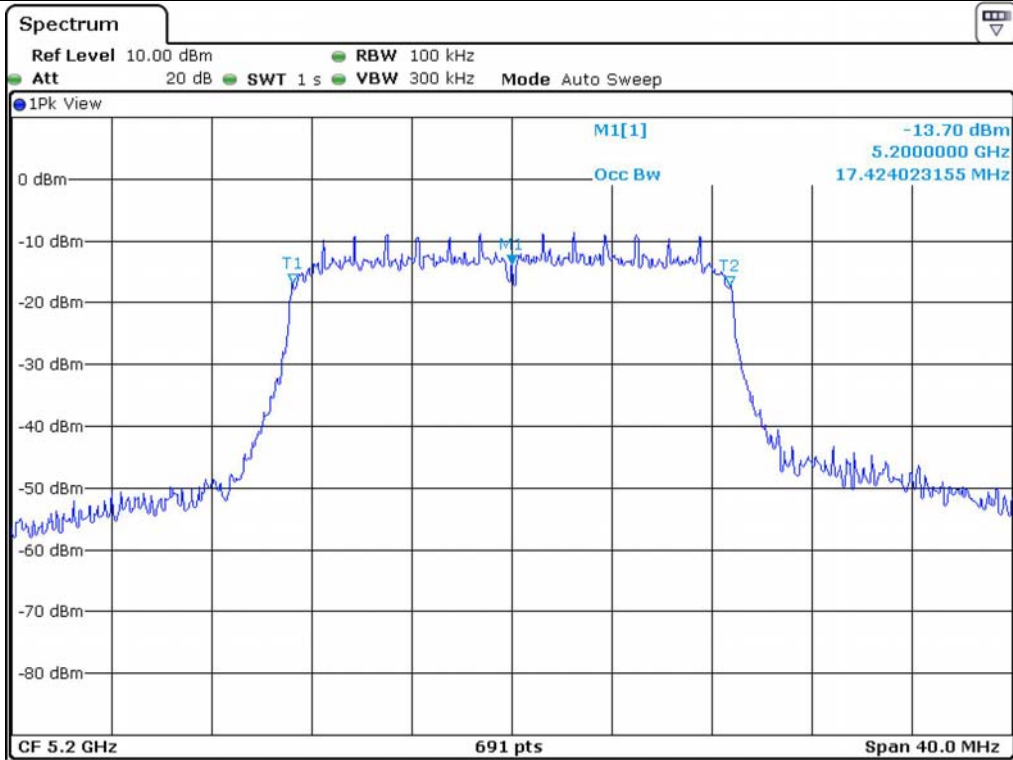
Middle Channel (5 600 MHz)



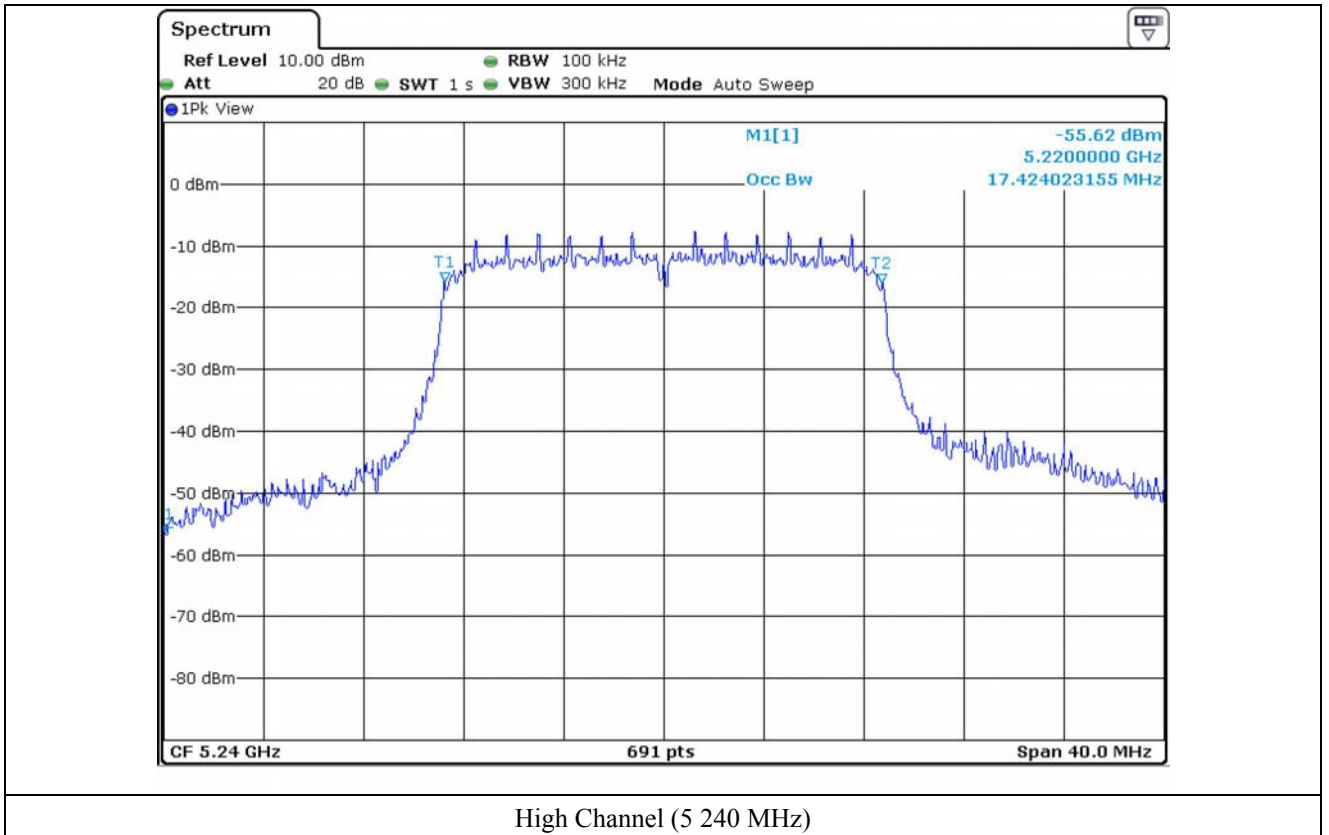
High Channel (5 700 MHz)



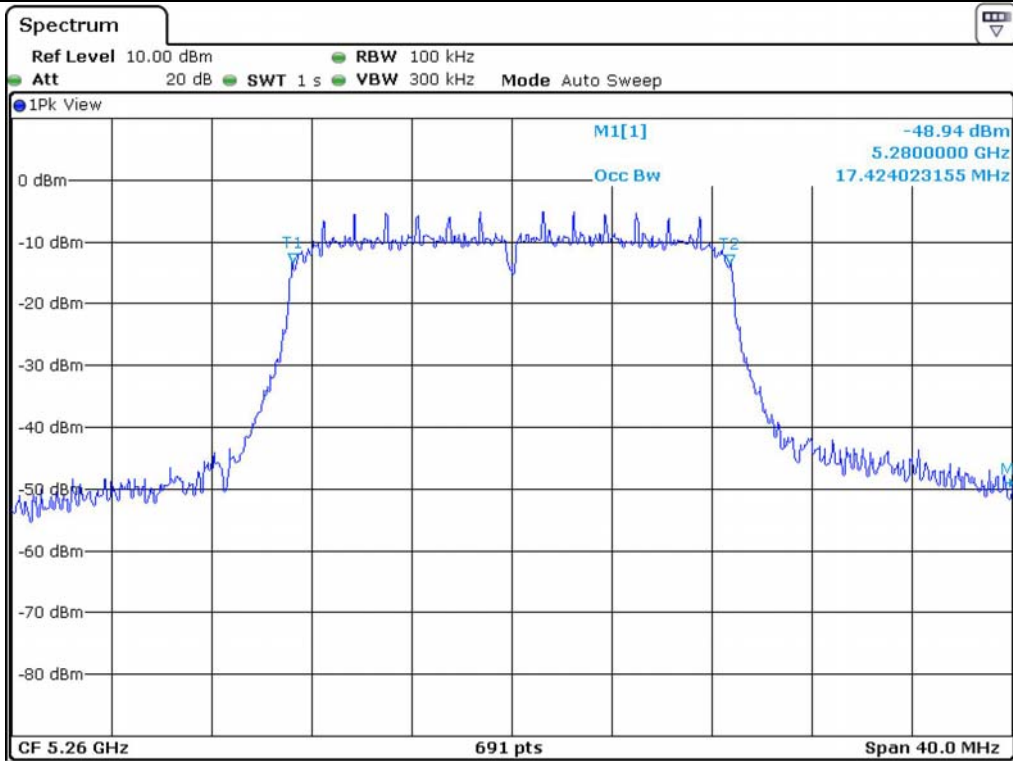
Low Channel (5 180 MHz)



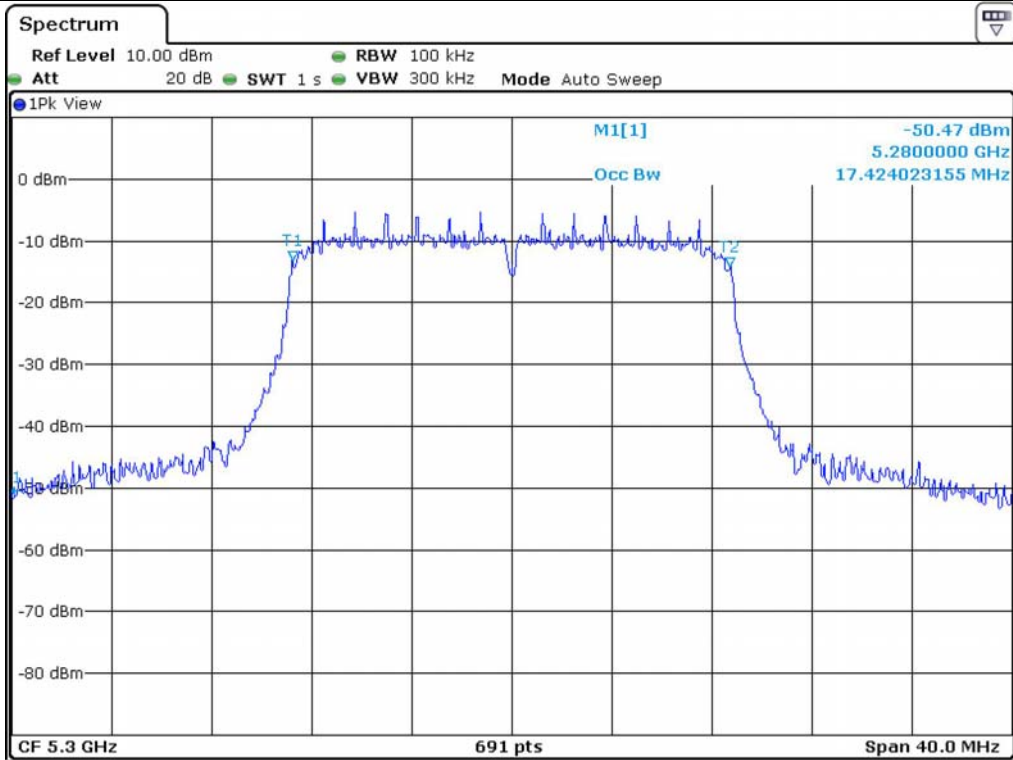
Middle Channel (5 200 MHz)



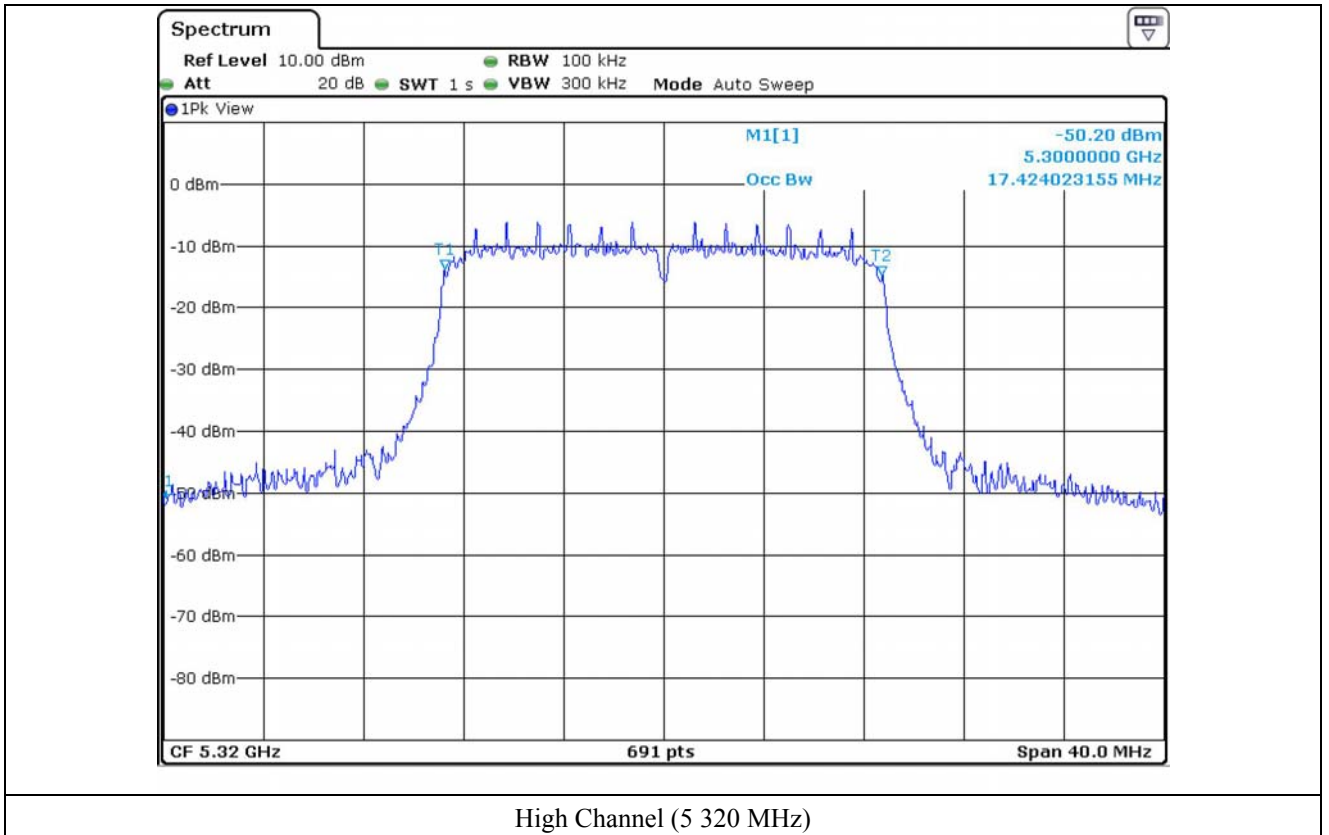
High Channel (5 240 MHz)

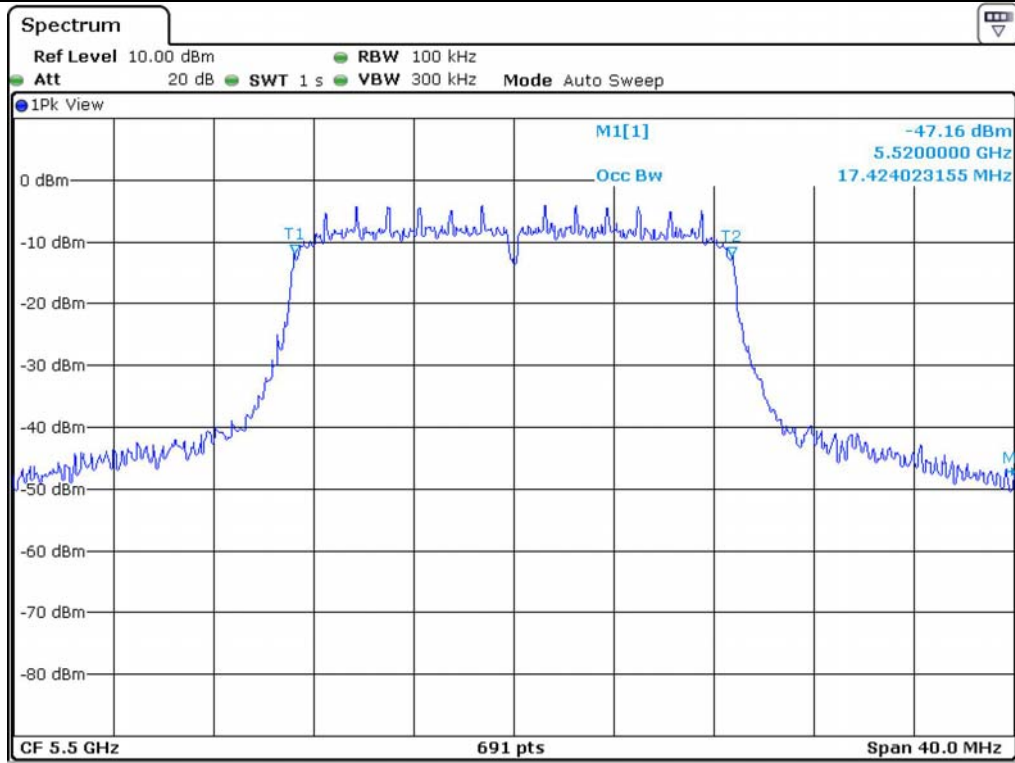


Low Channel (5 260 MHz)

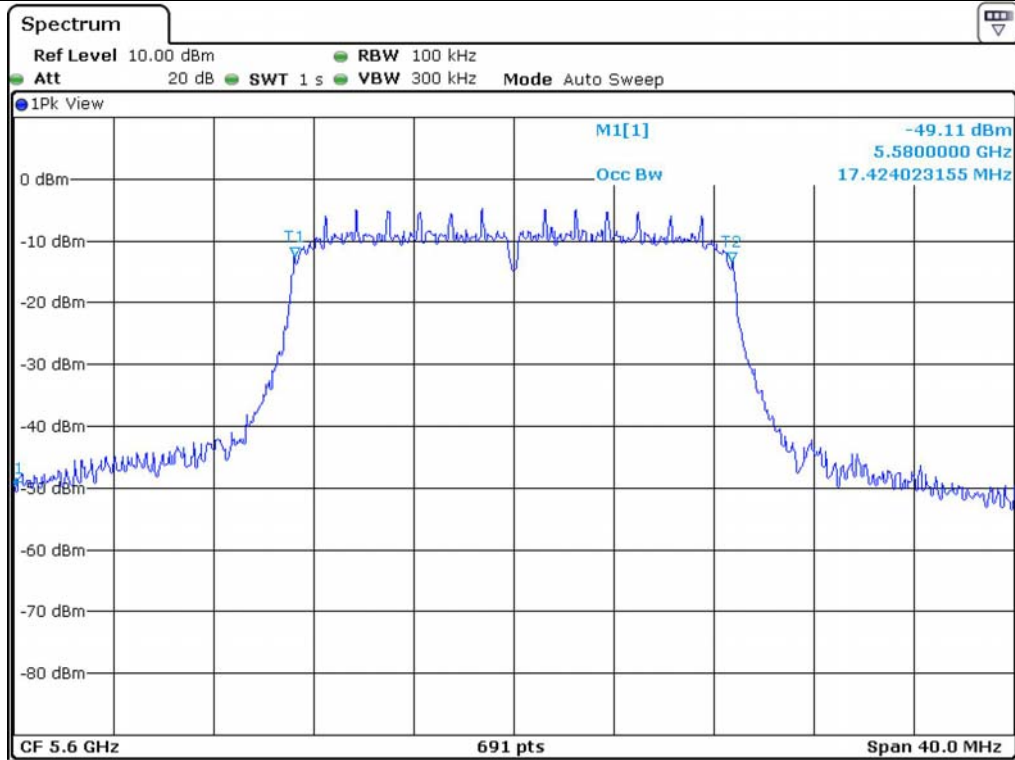


Middle Channel (5 300 MHz)

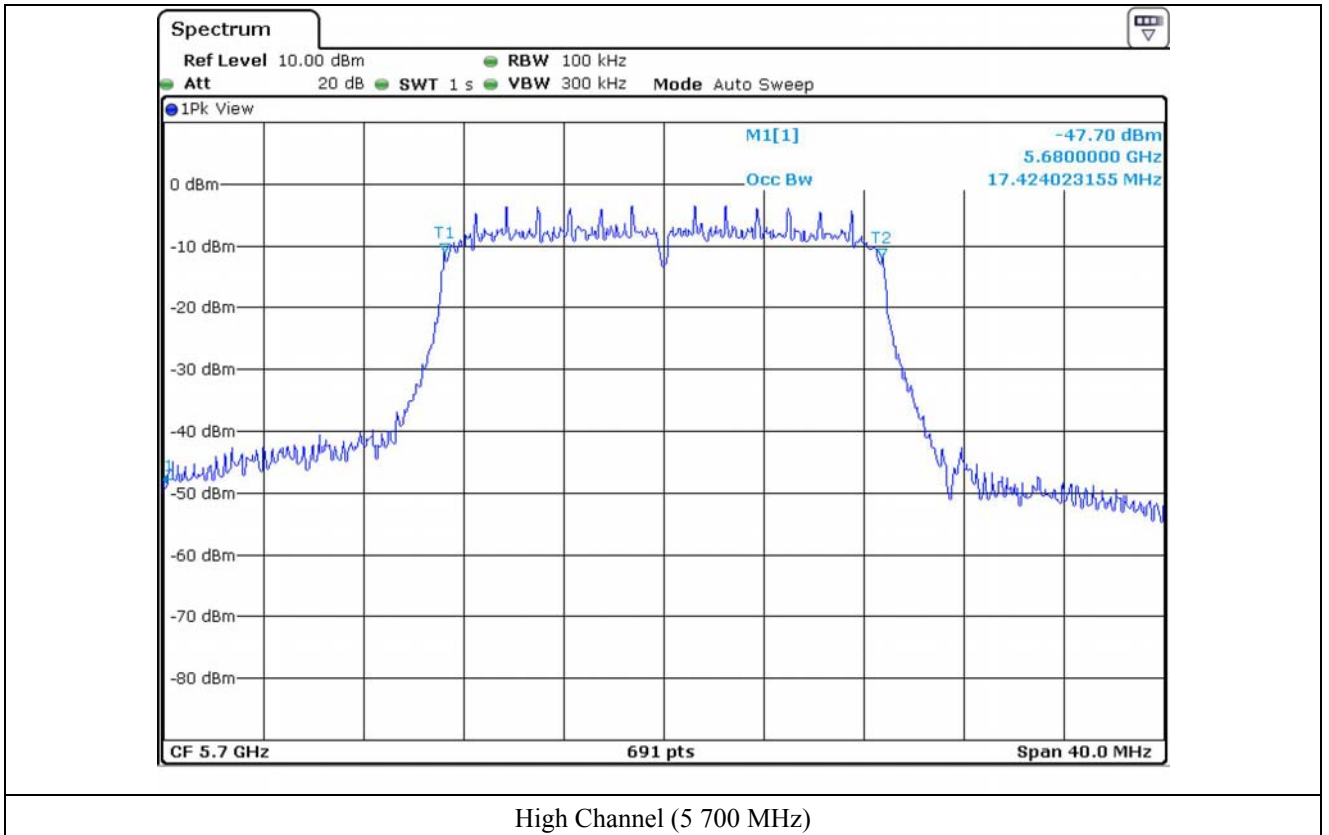




Low Channel (5 500 MHz)



Middle Channel (5 600 MHz)



High Channel (5 700 MHz)

7.4.3 Test data for 802.11n_HT40 RLAN Mode

7.4.3.1 Test data for Antenna 0

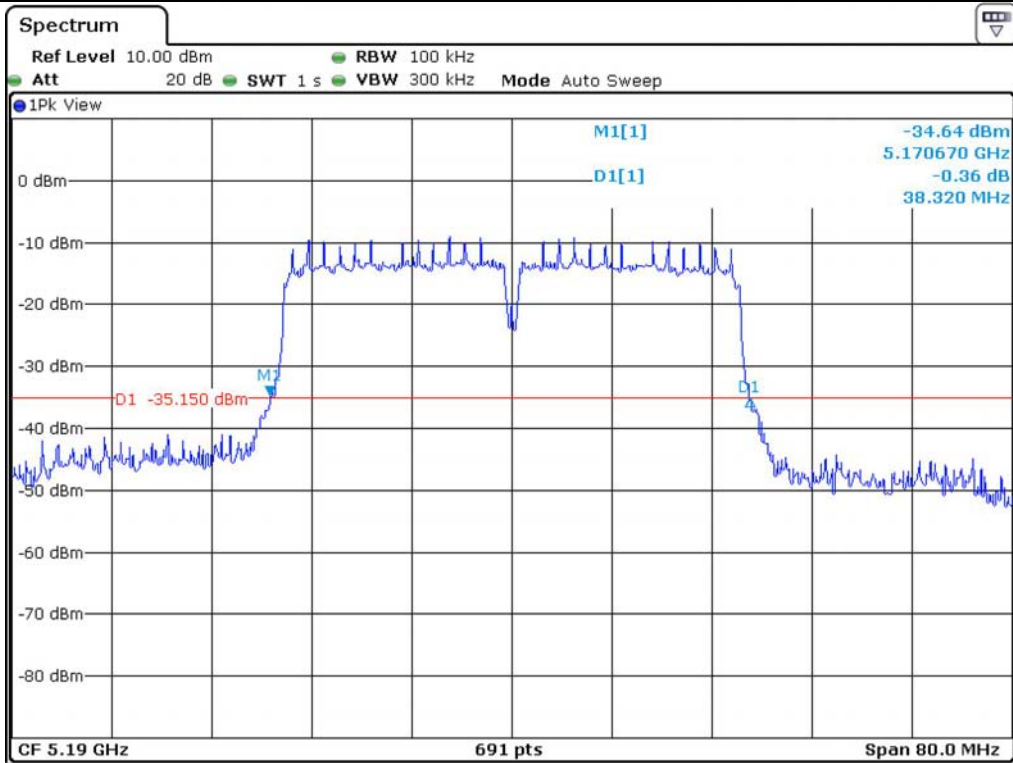
-. Test Date : December 16, 2013

-. Test Result : Pass

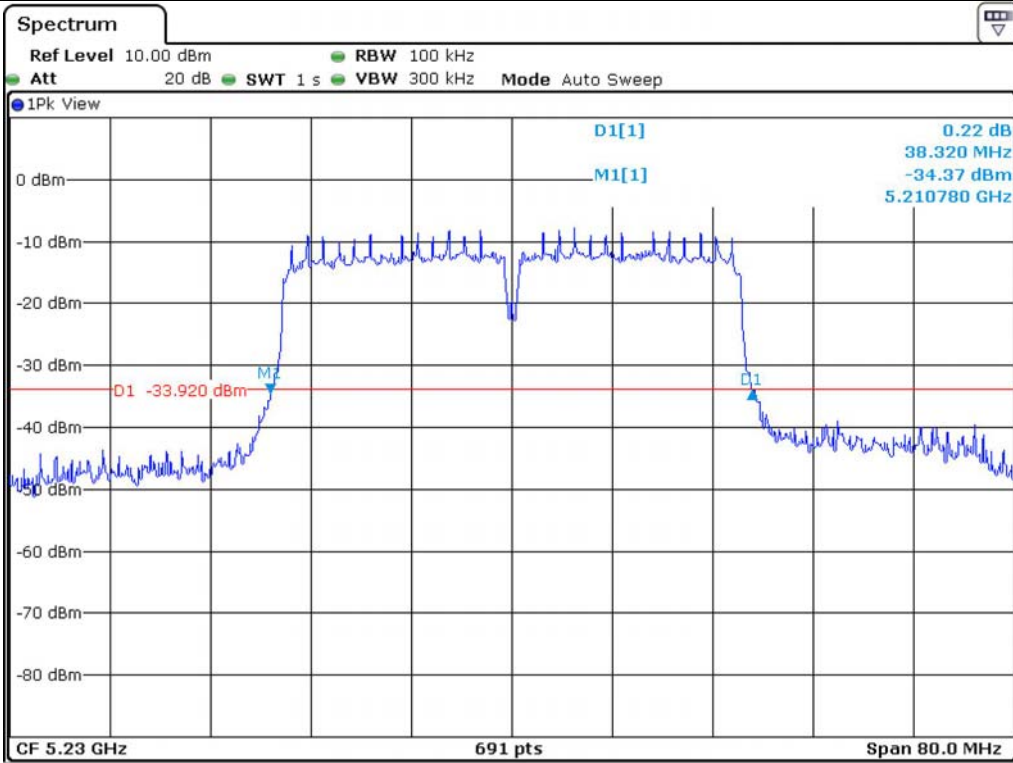
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
5 150 ~ 5 250	Low	5 190	38.32	35.89
	High	5 230	38.32	35.89
5 150 ~ 5 250	Low	5 270	38.09	35.77
	High	5 310	38.09	35.77
5 470 ~ 5 725	Low	5 510	38.21	35.89
	Middle	5 590	38.21	35.89
	High	5 670	38.21	35.89

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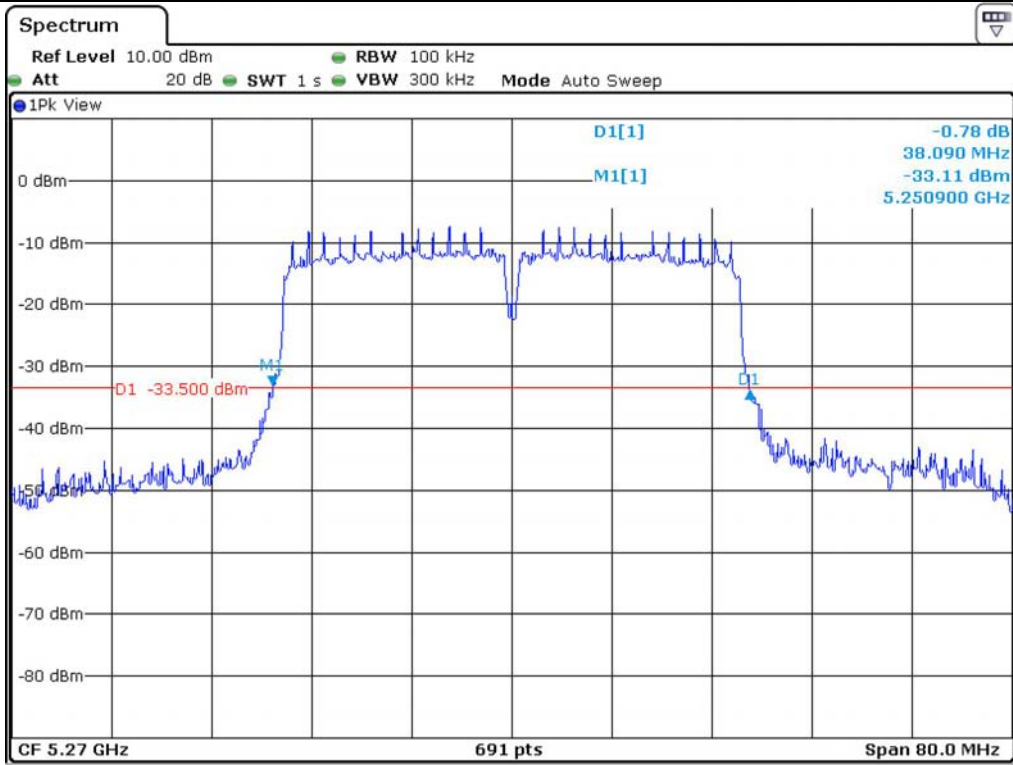
Tested by: Hong-Kyu, Lee/ Engineer



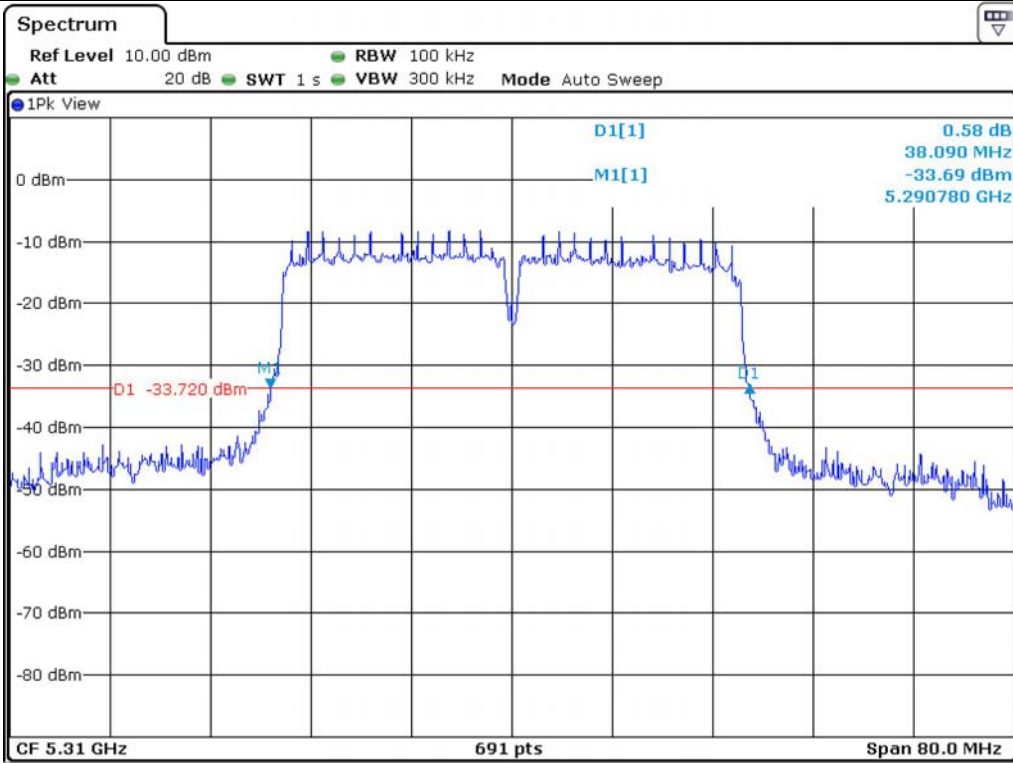
Low Channel (5 190 MHz)



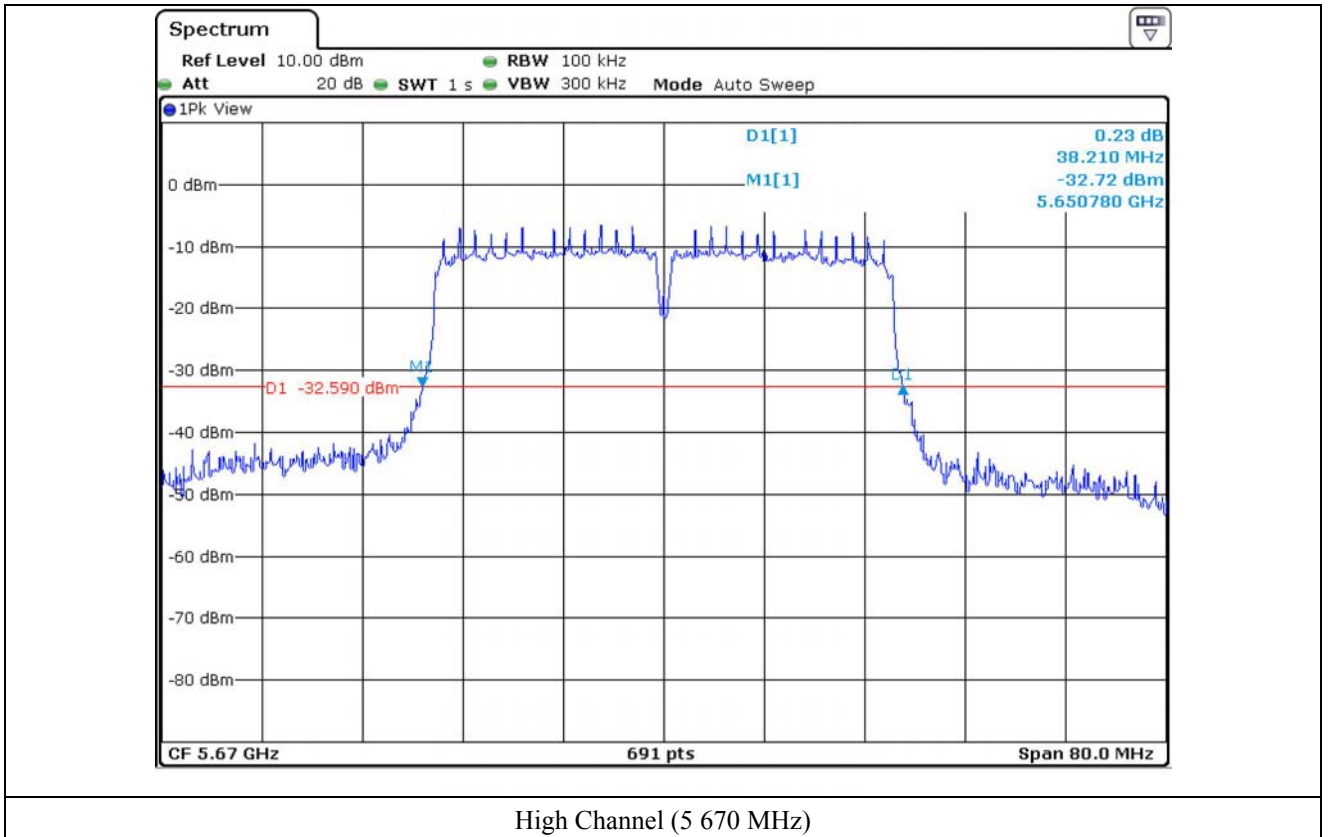
High Channel (5 230 MHz)



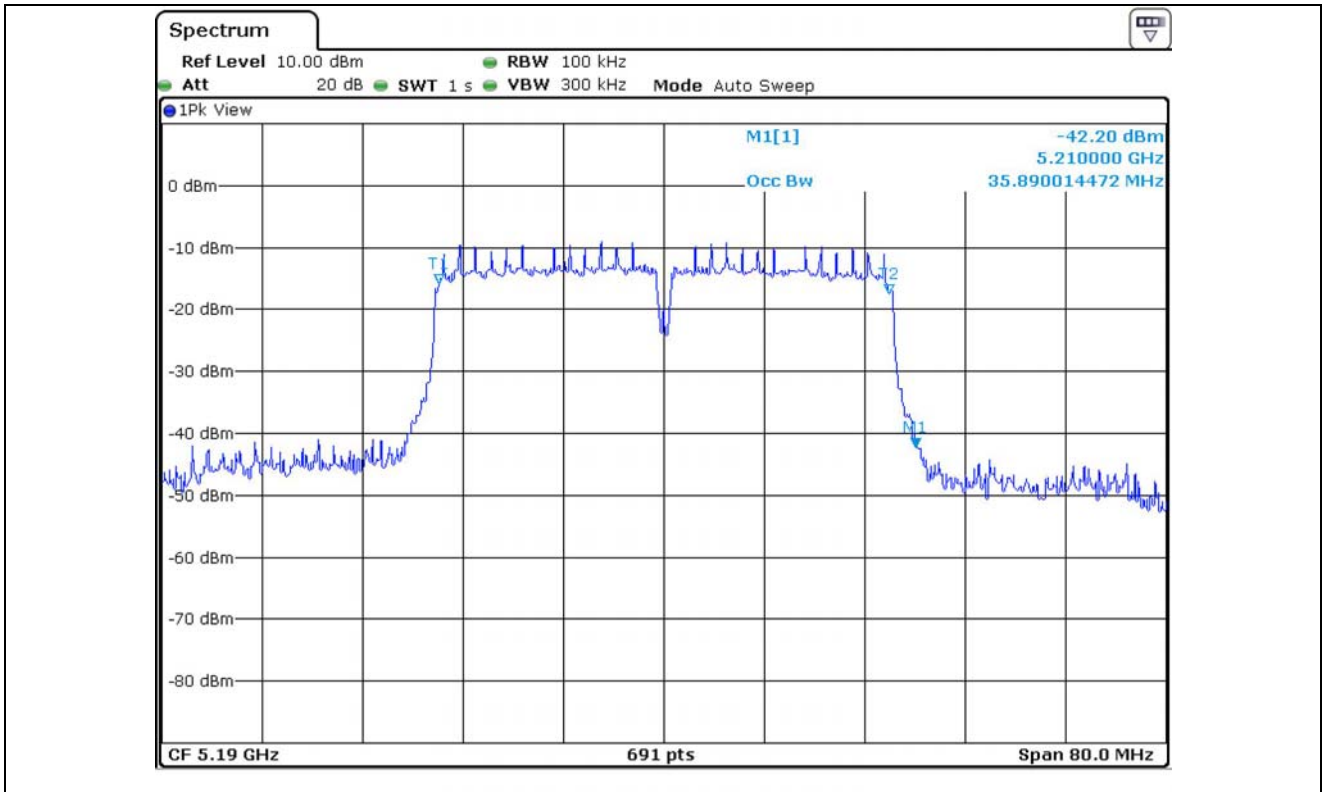
Low Channel (5 270 MHz)



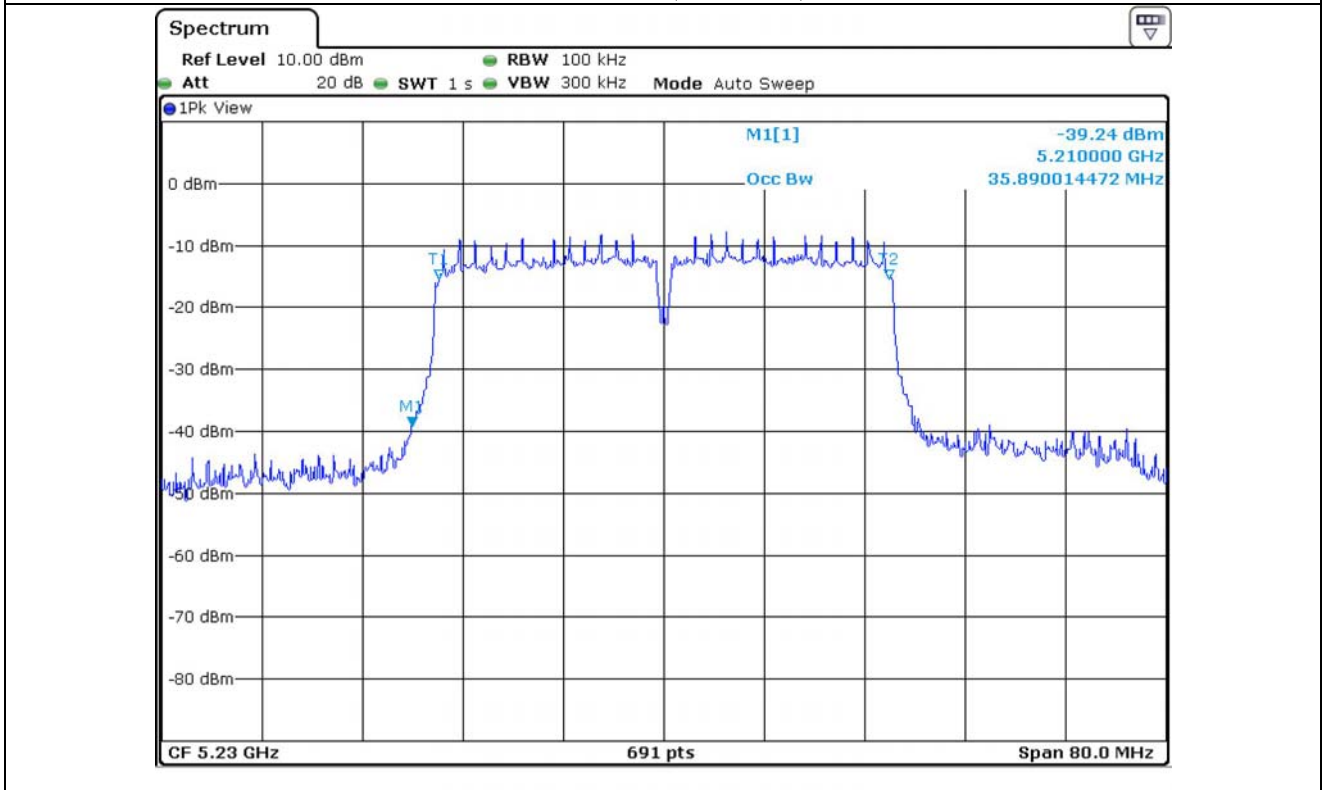
High Channel (5 310 MHz)



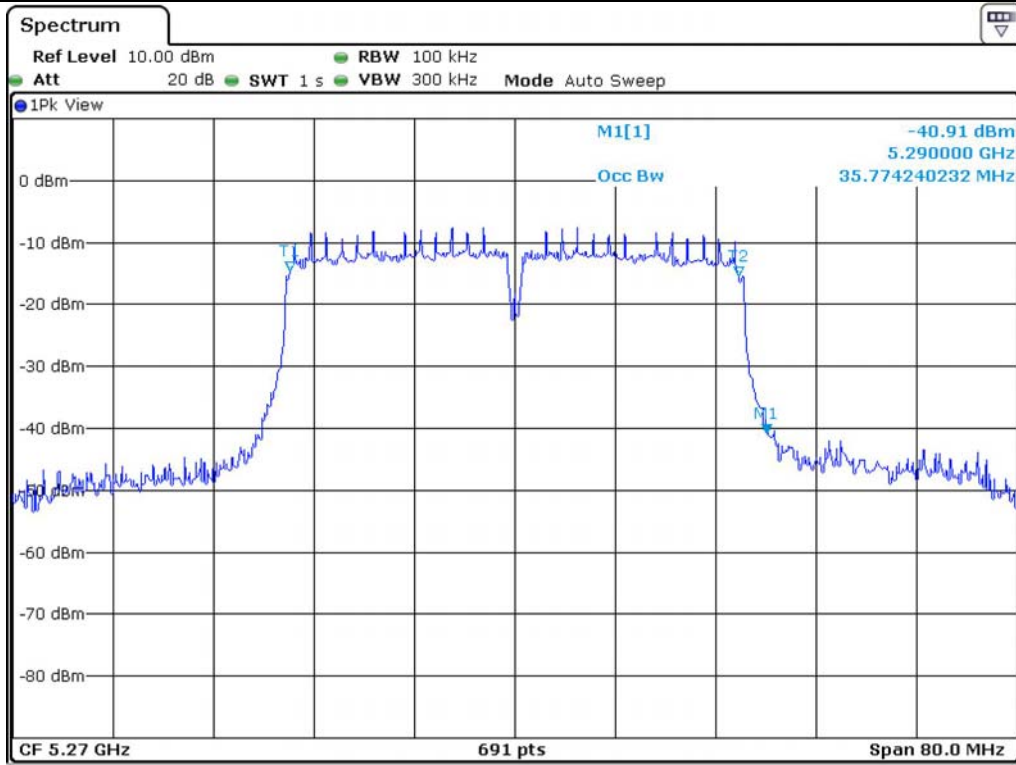
High Channel (5 670 MHz)



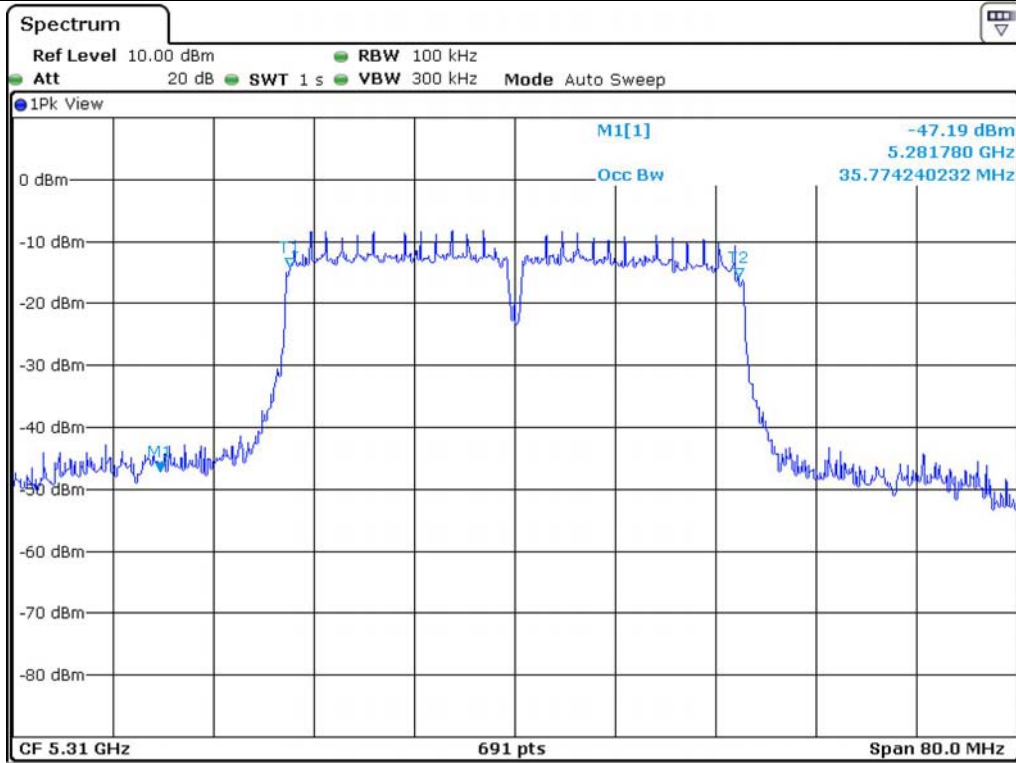
Low Channel (5 190 MHz)



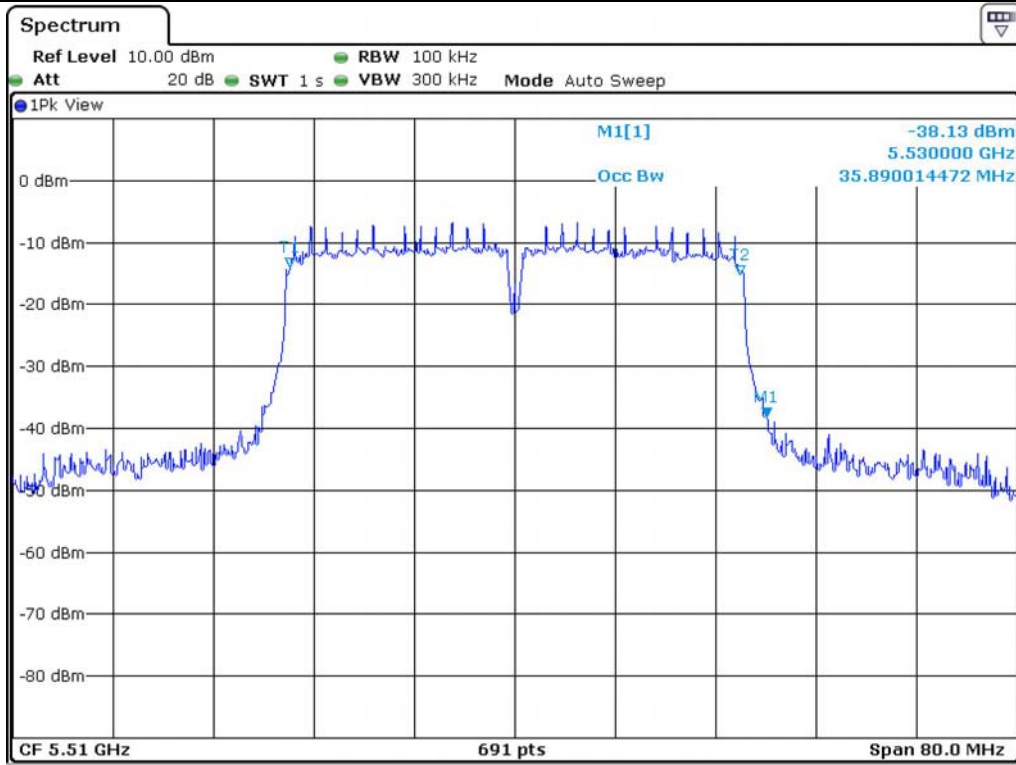
High Channel (5 230 MHz)



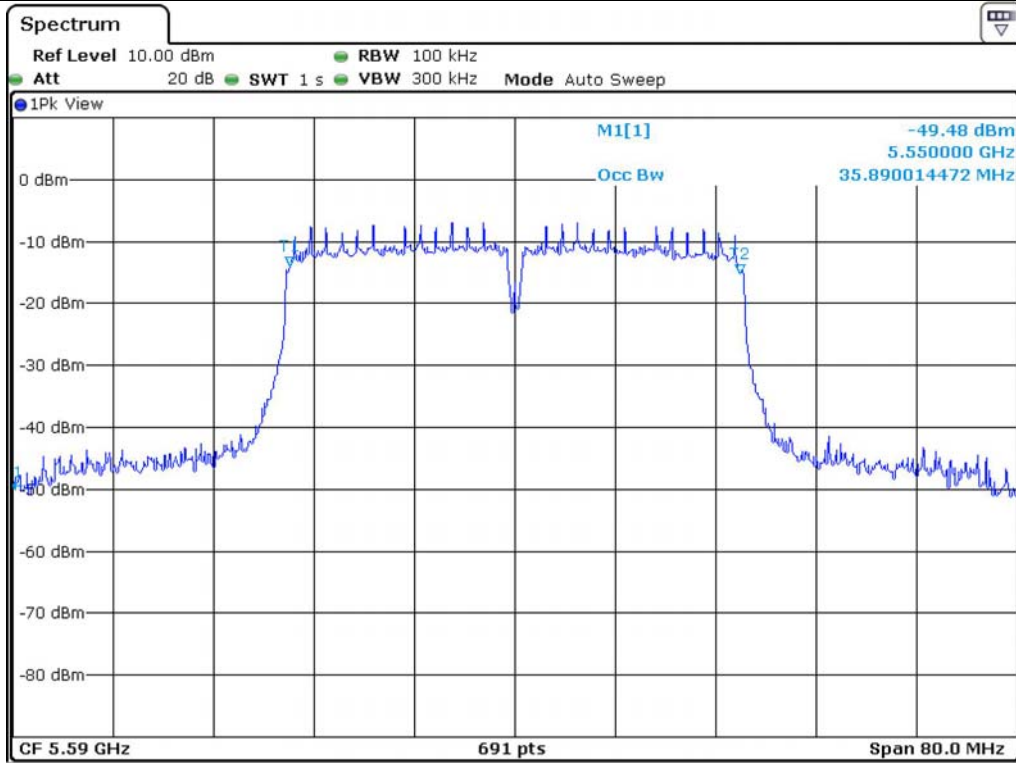
Low Channel (5 270 MHz)



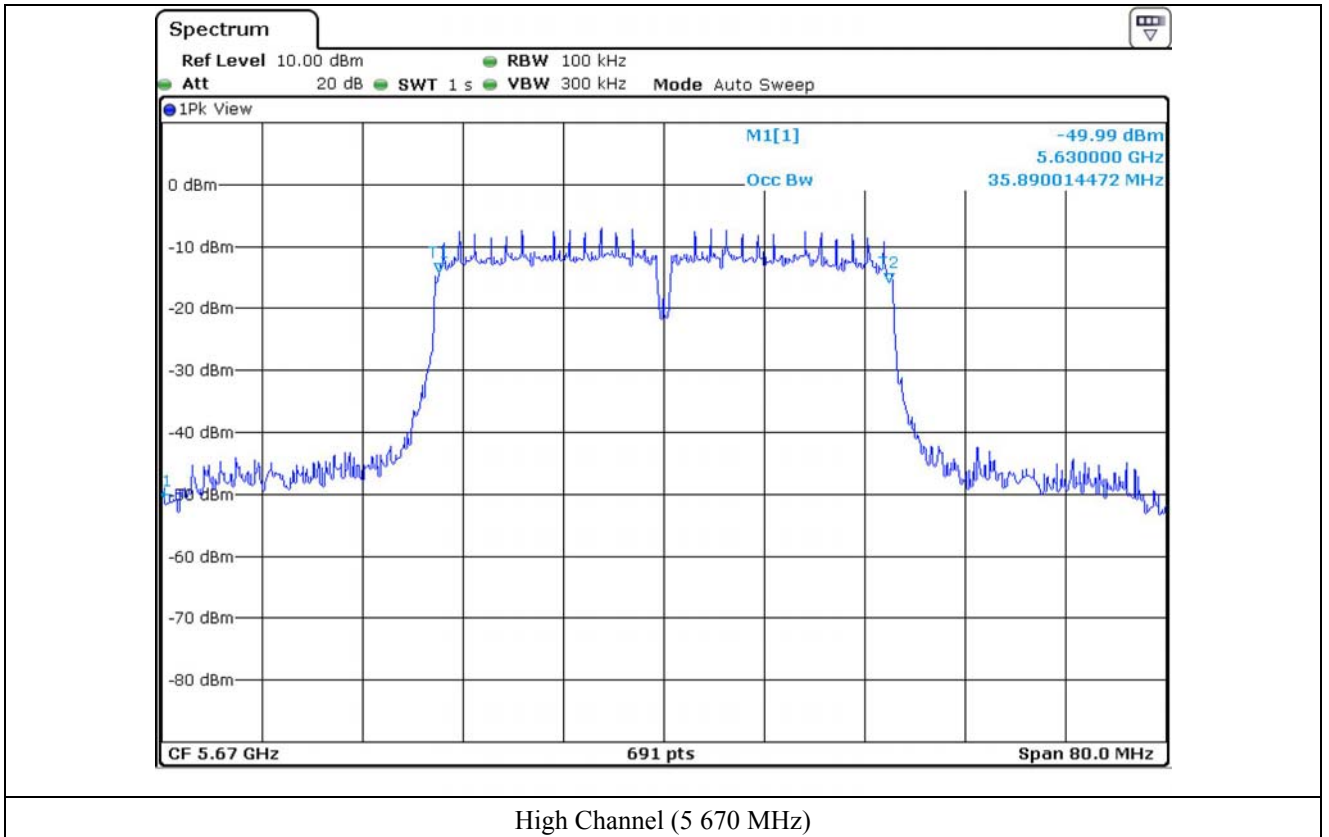
High Channel (5 310 MHz)



Low Channel (5 510 MHz)



Middle Channel (5 590 MHz)



High Channel (5 670 MHz)

7.4.3.2 Test data for Antenna 1

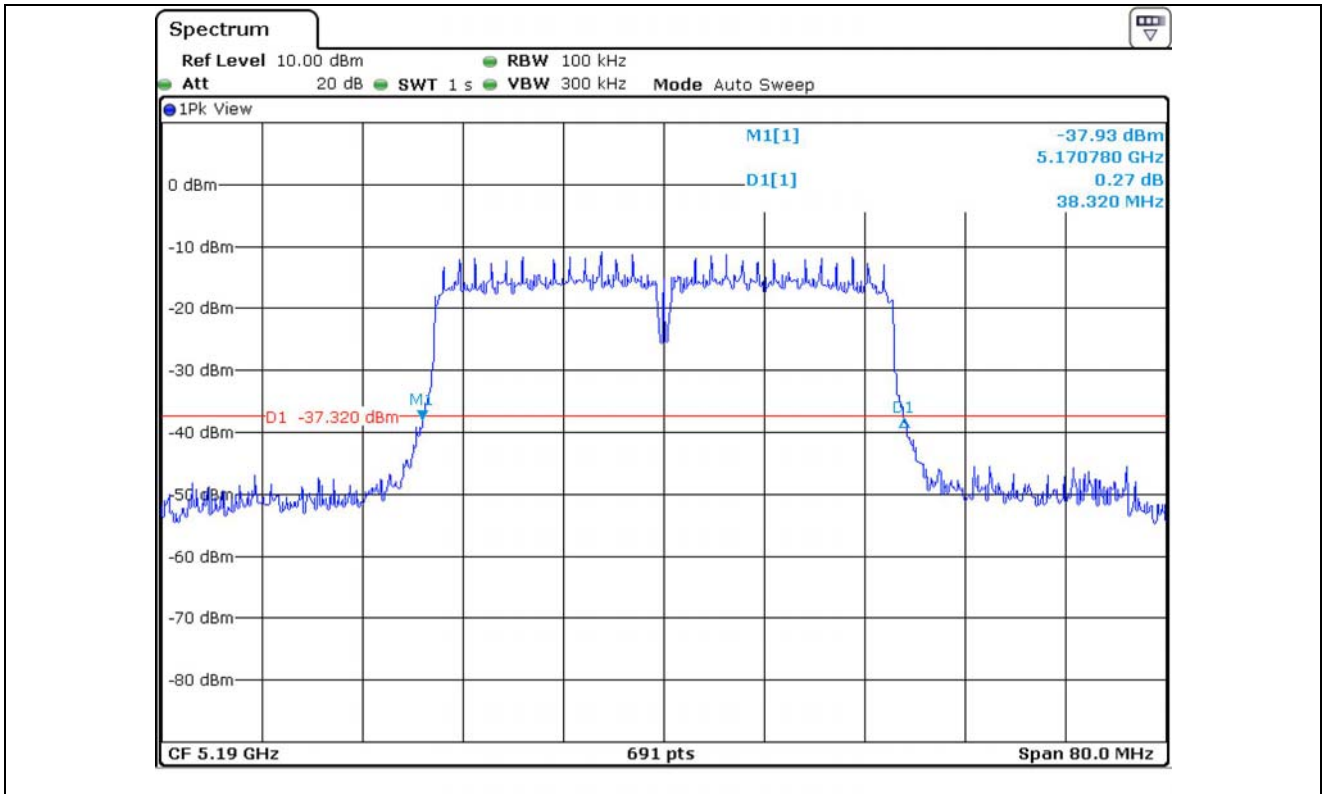
-. Test Date : December 16, 2013

-. Test Result : Pass

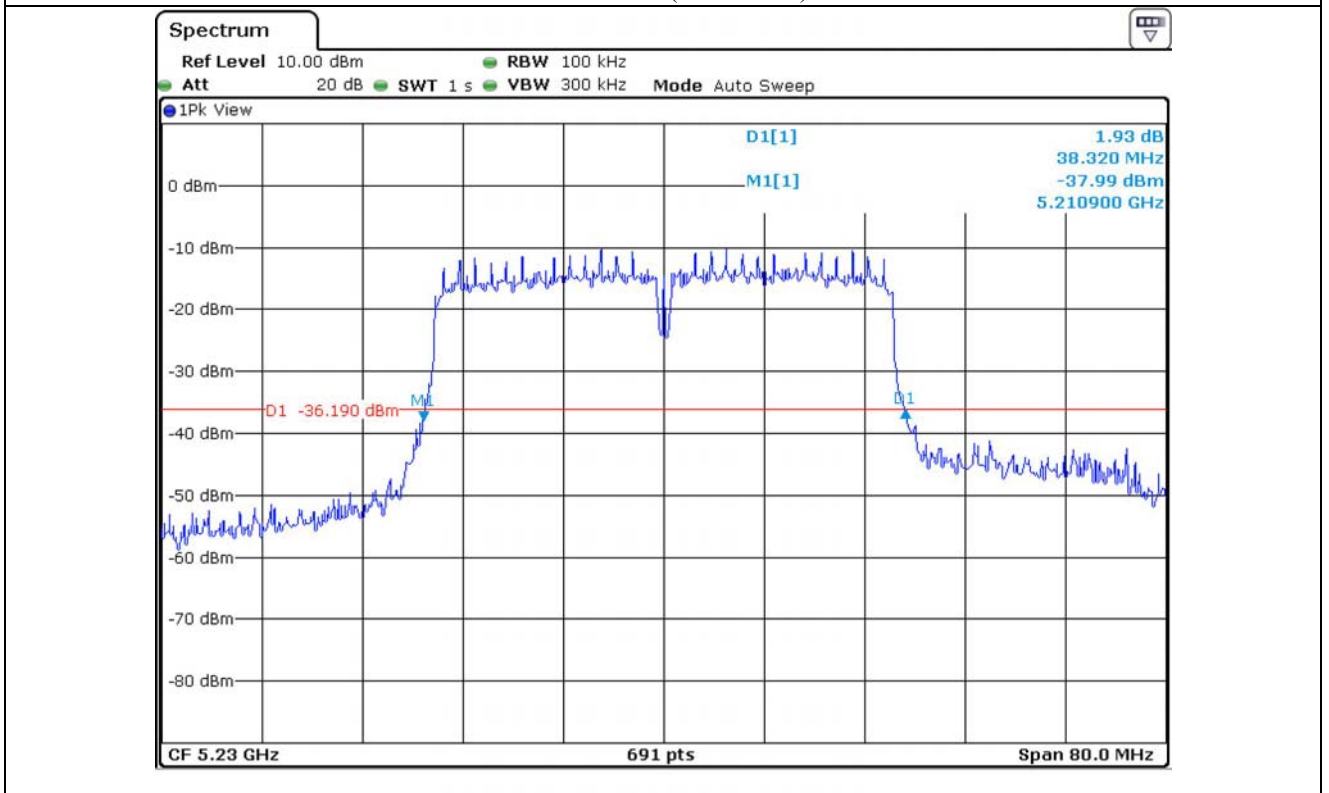
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
5 150 ~ 5 250	Low	5 190	38.32	35.89
	High	5 230	38.32	35.89
5 150 ~ 5 250	Low	5 270	38.09	35.77
	High	5 310	38.09	35.77
5 470 ~ 5 725	Low	5 510	38.21	35.89
	Middle	5 590	38.21	35.89
	High	5 670	38.21	35.89



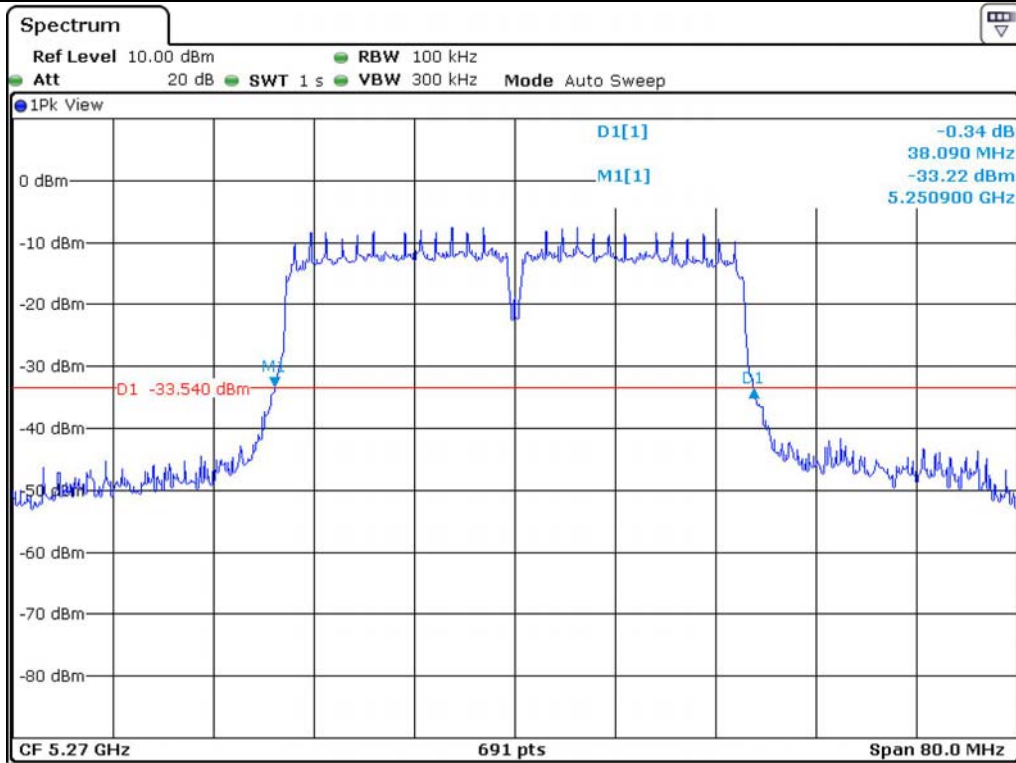
Tested by: Hong-Kyu, Lee/ Engineer



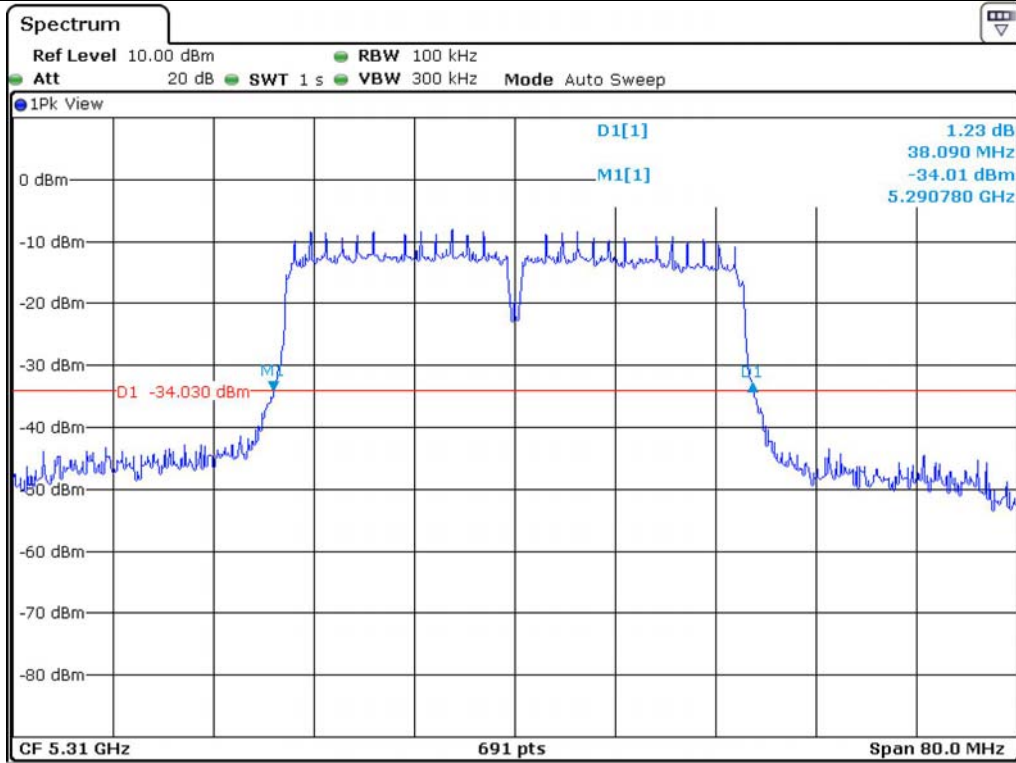
Low Channel (5 190 MHz)



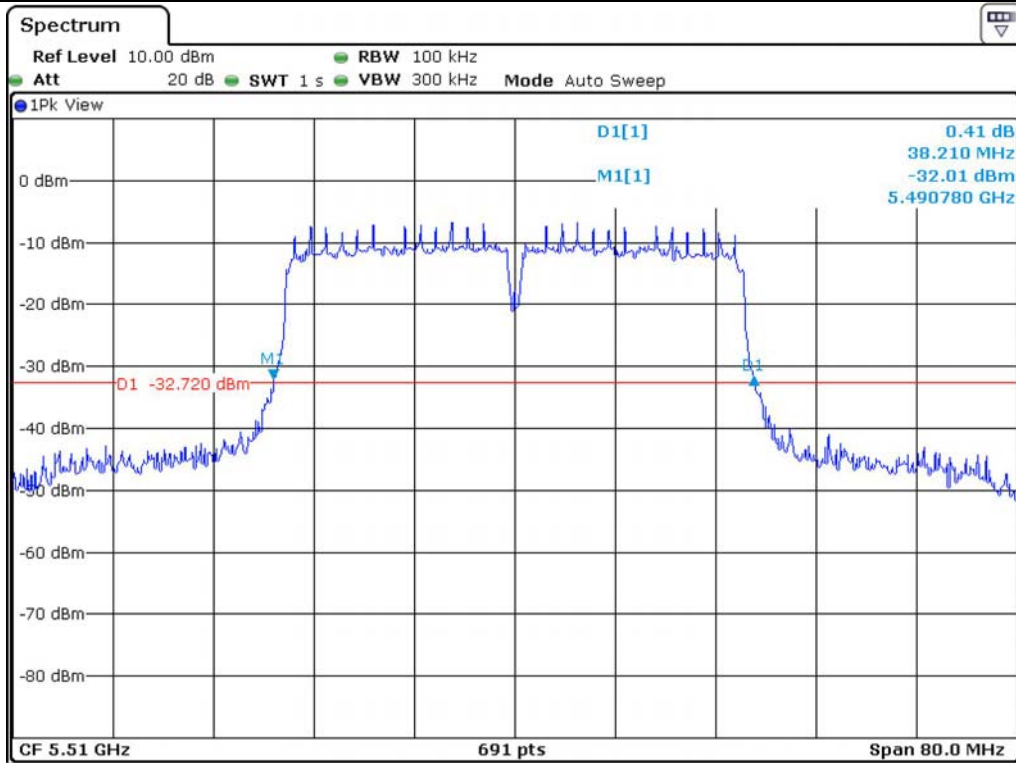
High Channel (5 230 MHz)



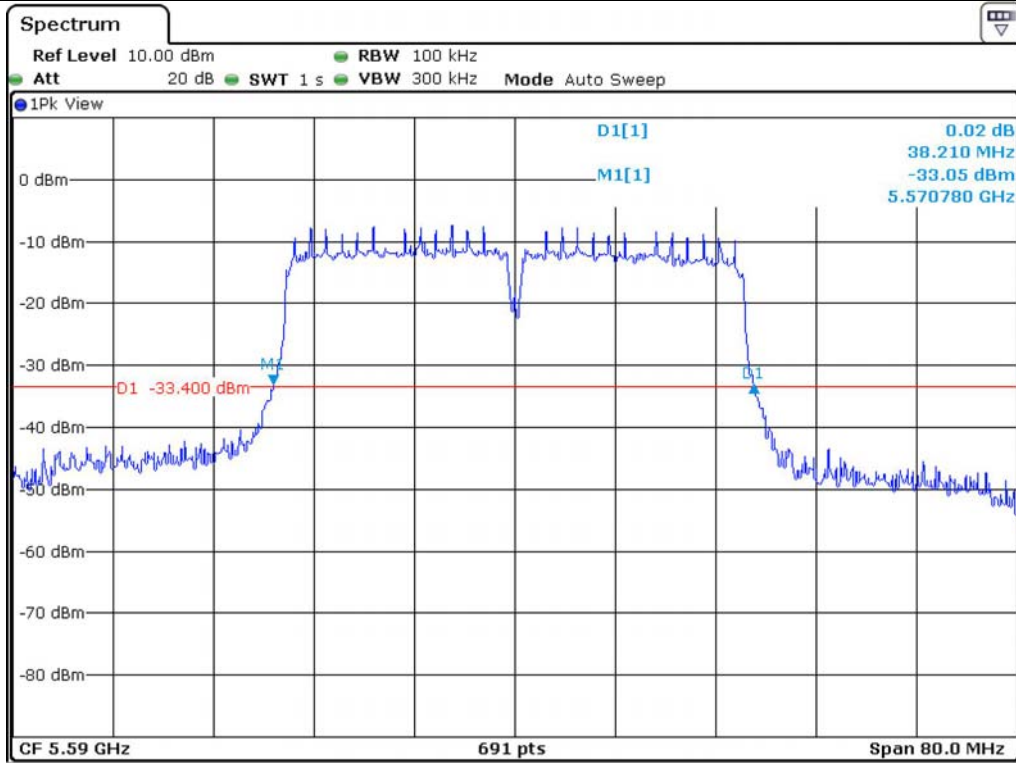
Low Channel (5 270 MHz)



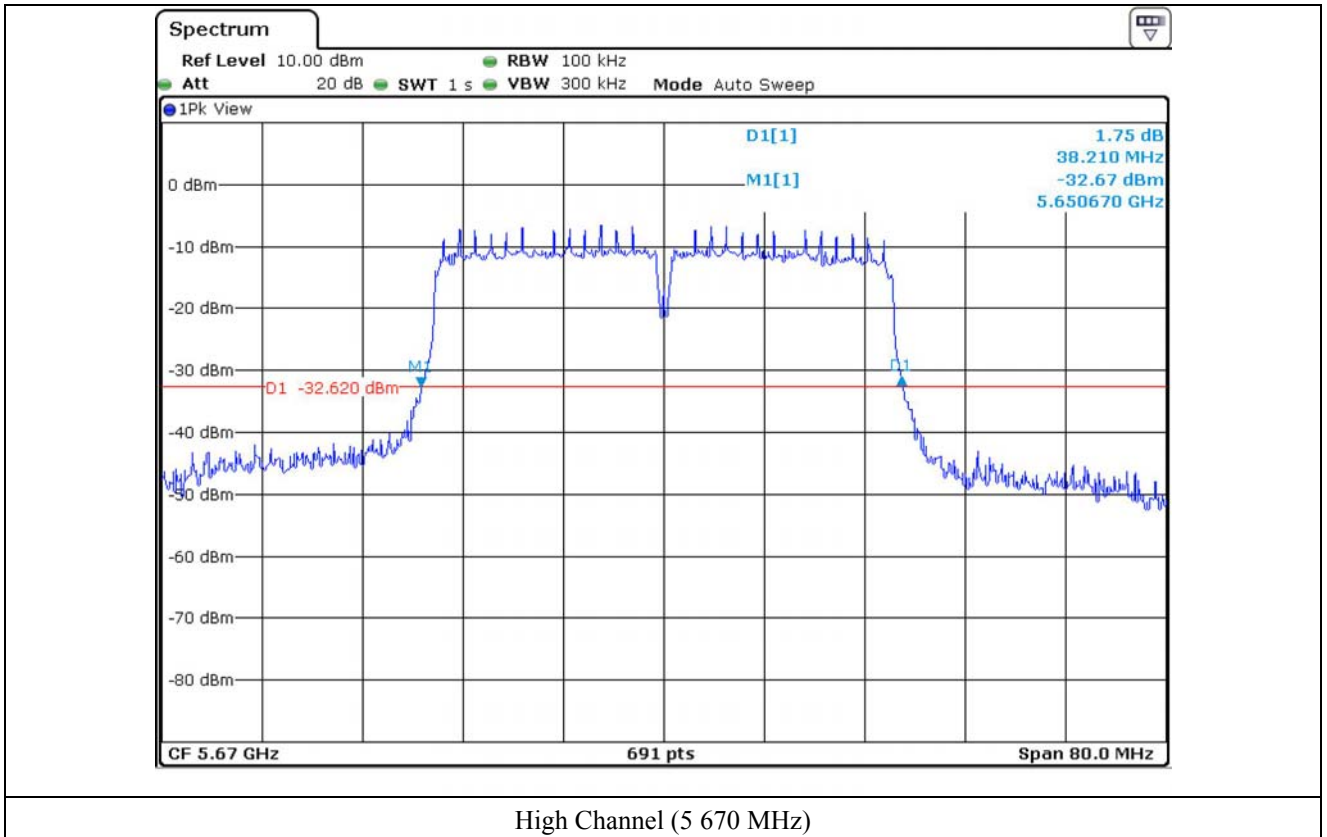
High Channel (5 310 MHz)

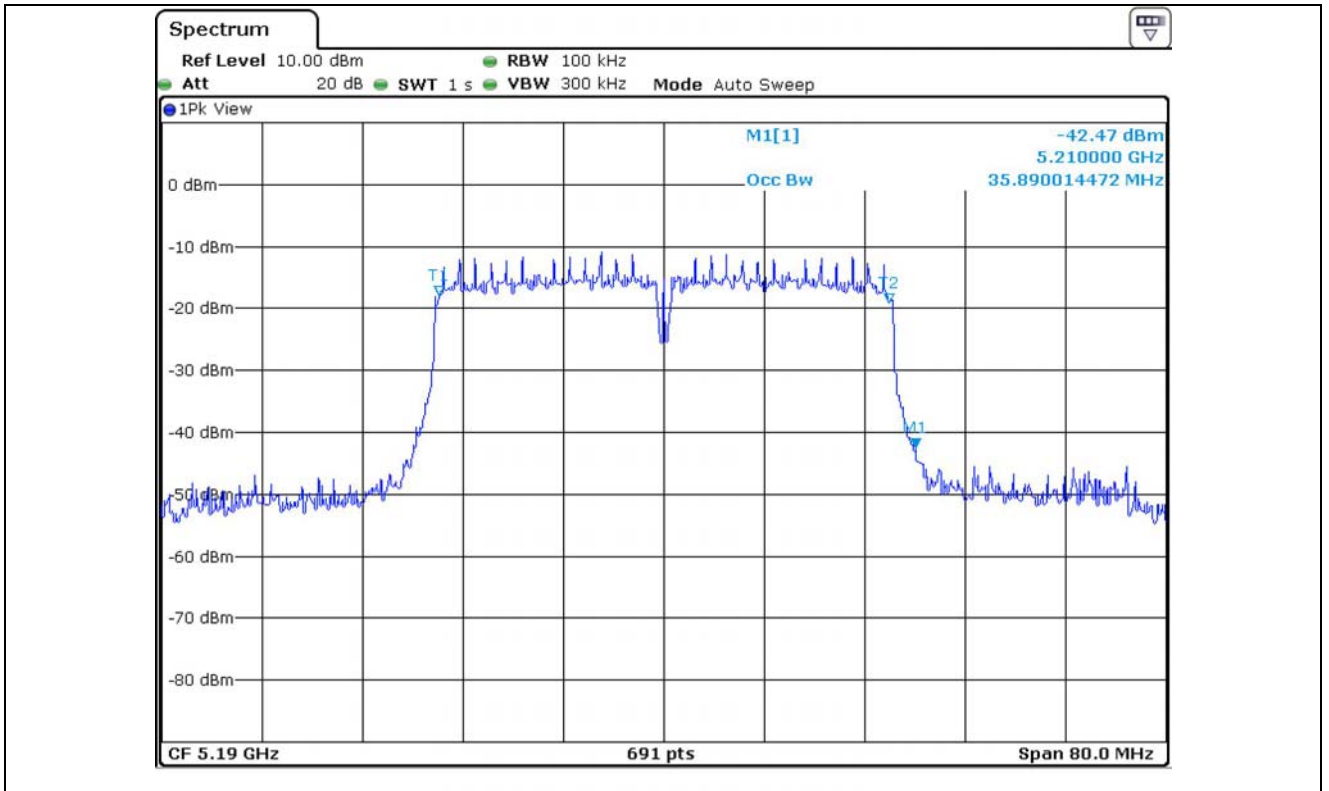


Low Channel (5 510 MHz)

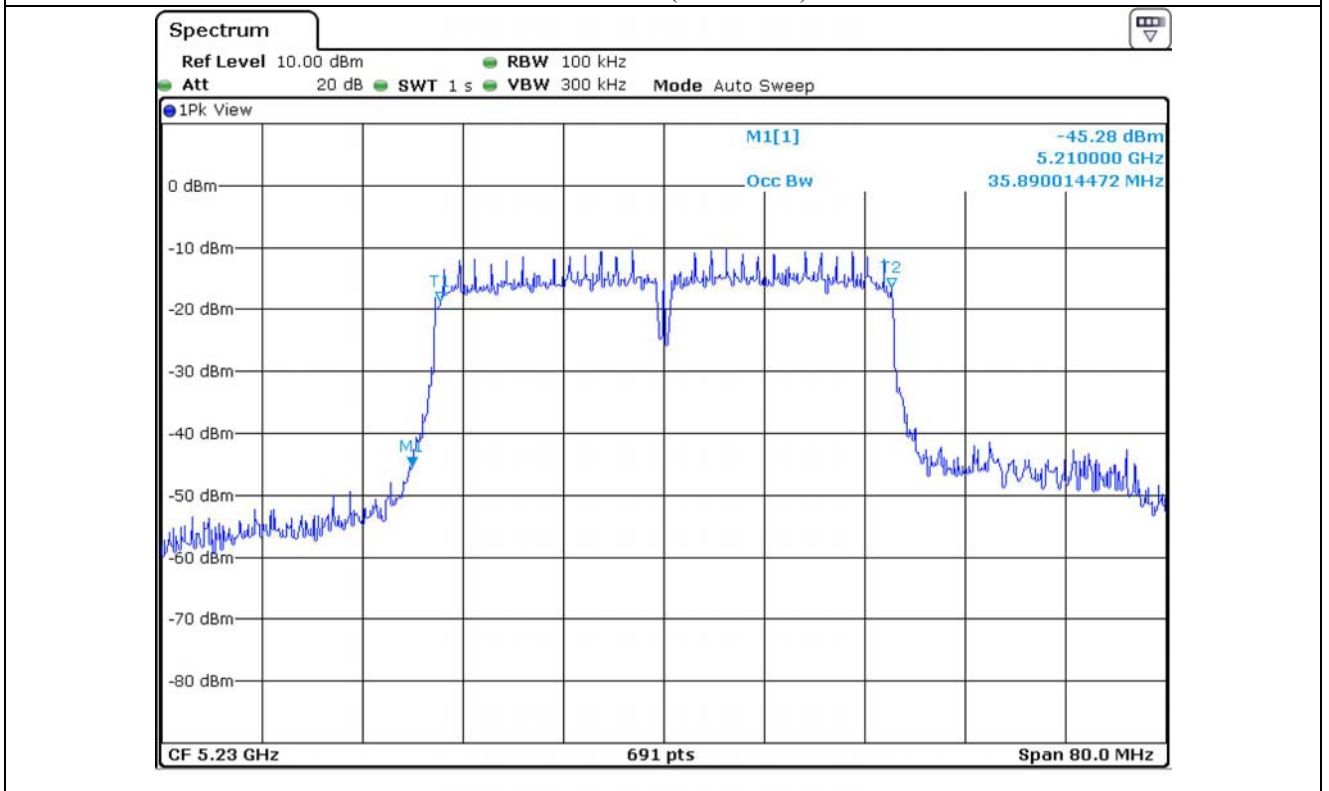


Middle Channel (5 590 MHz)





Low Channel (5 190 MHz)



High Channel (5 230 MHz)