

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

**Test Report No.** : OT-189-RWD-052  
**AGR No.** : A189A-120  
**Applicant** : Samsung Electronics Co., Ltd.  
**Address** : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 17113 Republic of Korea  
**Manufacturer** : Samsung Electronics Co., Ltd.  
**Address** : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 17113 Republic of Korea  
**Type of Equipment** : ARTIK-0530  
**FCC ID.** : A3LSIP005AFS30  
**IC Certification No.** : 649E-SIP005AFS30  
**Model Name** : SIP005AFS30  
**Multiple Model Name** : N/A  
**Serial number** : N/A  
**Total page of Report** : 122 pages (including this page)  
**Date of Incoming** : September 02, 2018  
**Date of issue** : September 28, 2018

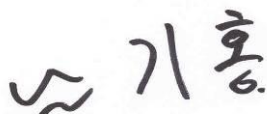
## SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART E Section 15.407 and IC RSS-Gen Issue 4 Nov 2014 and RSS-247 Issue 2 February 2017*

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.

Reviewed by:



Ki-Hong, Nam / Chief Engineer  
ONETECH Corp.

Approved by:



Keun-Young, Choi / Vice President  
ONETECH Corp.

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**Revision History**

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-189-RWD-052	2018.09.28	Initial Release	All

## 1. VERIFICATION OF COMPLIANCE

Applicant : Samsung Electronics Co., Ltd.  
 Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 17113 Republic of Korea  
 Contact Person : Lee, Jae-Hyuk  
 Telephone No. : +82-10-8848-6628  
 FCC ID : A3LSIP005AFS30  
 IC Certification No. : 649E-SIP005AFS30  
 Model Name : SIP005AFS30  
 Serial Number : N/A  
 Date : September 28, 2018

EQUIPMENT CLASS	FCC : Unlicensed National Information infrastructure(UNII) IC : Low Power License-Exempt Radio-communication Device
E.U.T. DESCRIPTION	Modular Transmitter, ARTIK-0530
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
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 KDB 789033 D02 General UNII Test Procedures New Rules V02r01 RSS-Gen Issue 4 Nov 2014, RSS-247 Issue 2 February 2017
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC&IC 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
15.205(a) 15.209(a) 15.407(b)(1) 15.407(b)(2) 15.407(b)(3) 15.407(b)(4)	RSS-Gen Issue 4 8.9 RSS-247 Issue 2 6.2.1 (2) RSS-247 Issue 2 6.2.2 (2) RSS-247 Issue 2 6.2.3 (2) RSS-247 Issue 2 6.2.4 (2)	Transmitter radiated spurious emissions	Met the Limit / PASS
15.407(a)	RSS-Gen Issue 4 6.6	99 % Bandwidth	PASS (Note1)
15.407(e)	RSS-247 Issue 2 6.2.4 (1)	6 dB Bandwidth	PASS (Note1)
15.407(a)(1) 15.407(a)(2) 15.407(a)(3)	RSS-247 Issue 2 6.2.1 (1) RSS-247 Issue 2 6.2.2 (1) RSS-247 Issue 2 6.2.3 (1) RSS-247 Issue 2 6.2.4 (1)	Maximum Conducted Output Power	Met the Limit / PASS
15.407(a)(1) 15.407(a)(2) 15.407(a)(3)	RSS-247 Issue 2 6.2.1 (1) RSS-247 Issue 2 6.2.2 (1) RSS-247 Issue 2 6.2.3 (1) RSS-247 Issue 2 6.2.4 (1)	Peak Power Spectral Density	PASS (Note1)
15.207	RSS-Gen Issue 4 8.8	AC Power Line Conducted Emissions	PASS (Note1)
15.407(h)	RSS-247 Issue 2 6.3	DFS -Channel closing transmission time -Channel move time -Non occupied period	PASS (Note1)

Note1 - The EUT have a RF Test already approved. (Report No: 16K23791-E4V3)

## 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, IC RSS-Gen Issue 4 Nov 2014 and RSS-247 Issue 2 February 2017

## 2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

## 2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666 / T-1842

IC (Industry Canada) – Registration No. Site# 3736A-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

### 3. GENERAL INFORMATION

#### 3.1 Product Description

The Samsung Electronics Co., Ltd., Model SIP005AFS30 (referred to as the EUT in this report) is a ARTIK-0530. Product specification information described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	ARTIK-0530	
Operating Frequency	2 402 MHz ~ 2 480 MHz (Bluetooth, Bluetooth Low Energy), 2 405 MHz ~ 2 475 MHz (Zigbee), 2 412 MHz ~ 2 462 MHz (11b/g/n_HT20), 5 745 MHz ~ 5 825 MHz (UNII 3: 11a/n_HT20), 5 755 MHz ~ 5 795 MHz (UNII 3: 11n_HT40), 5 180 MHz ~ 5 240 MHz (UNII 1: 11a/n_HT20), 5 190 MHz ~ 5 230 MHz (UNII 1: 11n_HT40), 5 260 MHz ~ 5 320 MHz (UNII 2A: 11a/n_HT20), 5 270 MHz ~ 5 310 MHz (UNII 2A: 11n_HT40), 5 500 MHz ~ 5 720 MHz (UNII 2C: 11a/n_HT20), 5 510 MHz ~ 5 710 MHz (UNII 2C: 11n_HT40),	
Modulation Type	DSSS, OFDM, GFSK, $\pi/4$ DQPSK, 8DPSK	
Number of Channels	79 channel (Bluetooth), 40 channel (Bluetooth Low Energy), 15 channel (Zigbee), 11 channel (11b/g/n_HT20), 5 channel (UNII 3: 11a/n_HT20), 2 channel (UNII 3: 11n_HT40), 4 channel (UNII 1: 11a/n_HT20), 2 channel (UNII 1: 11n_HT40), 4 channel (UNII 2A: 11a/n_HT20), 2 channel (UNII 2A: 11n_HT40), 9 channel (UNII 2C: 11a/n_HT20), 4 channel (UNII 2C: 11n_HT40)	
Antenna Type	Dipole antenna	
Antenna Gain	Bluetooth(BDR / EDR / LE), Zigbee WLAN 2.4 GHz Band	3.80 dBi
	WLAN 5 GHz Band	5.50 dBi

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

-. None

#### 3.3 Mode of operation during the test

To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XZ” axis, but the worst data was recorded in this test report.



#### 4. EUT MODIFICATIONS

-. None

## 5. Transmitter Radiated Spurious Emissions

### 5.1 Operating environment

Temperature : 24.3 °C  
 Relative humidity : 43.9 % R.H.

### 5.2 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 40 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

### 5.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 14, 2018 (1Y)
■ - ESU	Rohde & Schwarz	EMI Test Receiver	100261	Mar. 29, 2018 (1Y)
■ - 310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 28, 2018 (1Y)
■ - BBV9718	Schwarzbeck	Amplifier	310	Mar. 30, 2018 (1Y)
■ - SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Mar. 15, 2018 (1Y)
■ - DT3000-3t	Innco System	Turn Table	DT3000/093	N/A
■ - MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
■ - VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-419	Oct. 17, 2017 (2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jul. 28, 2017 (2Y)

All test equipment used is calibrated on a regular basis.

**5.4 Test Data for Radiated Emission**

**5.4.1 Radiated Emission which fall in the Restricted Band (U-NII 1)**

**5.4.1.1 Test Data for 802.11a**

- Test Date : September 12, 2018 ~ September 21, 2018
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Result : PASSED


Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
4 677.90	45.95	Peak	H	31.28	12.65	35.19	54.69	74.00	19.31
5 134.55	34.19	Average	H	31.28	12.65	35.19	42.93	54.00	11.07
5 046.43	41.94	Peak	V	31.28	12.65	35.19	50.68	74.00	23.32
5 107.27	34.22	Average	V	31.28	12.65	35.19	42.96	54.00	11.04

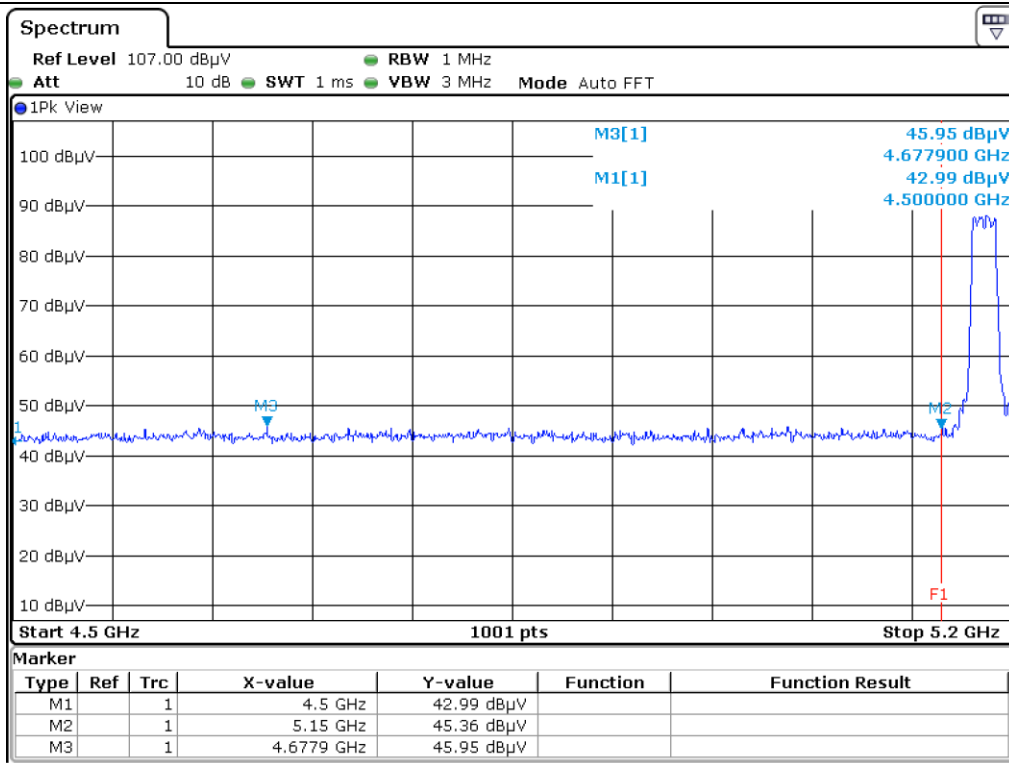
Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

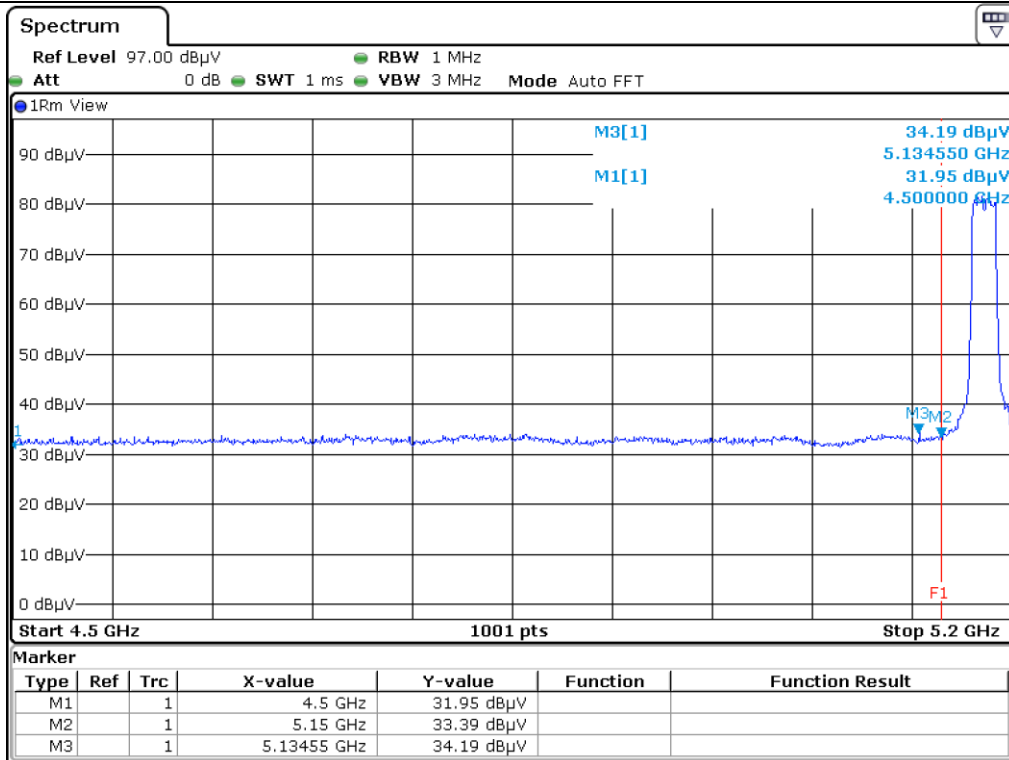
$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$

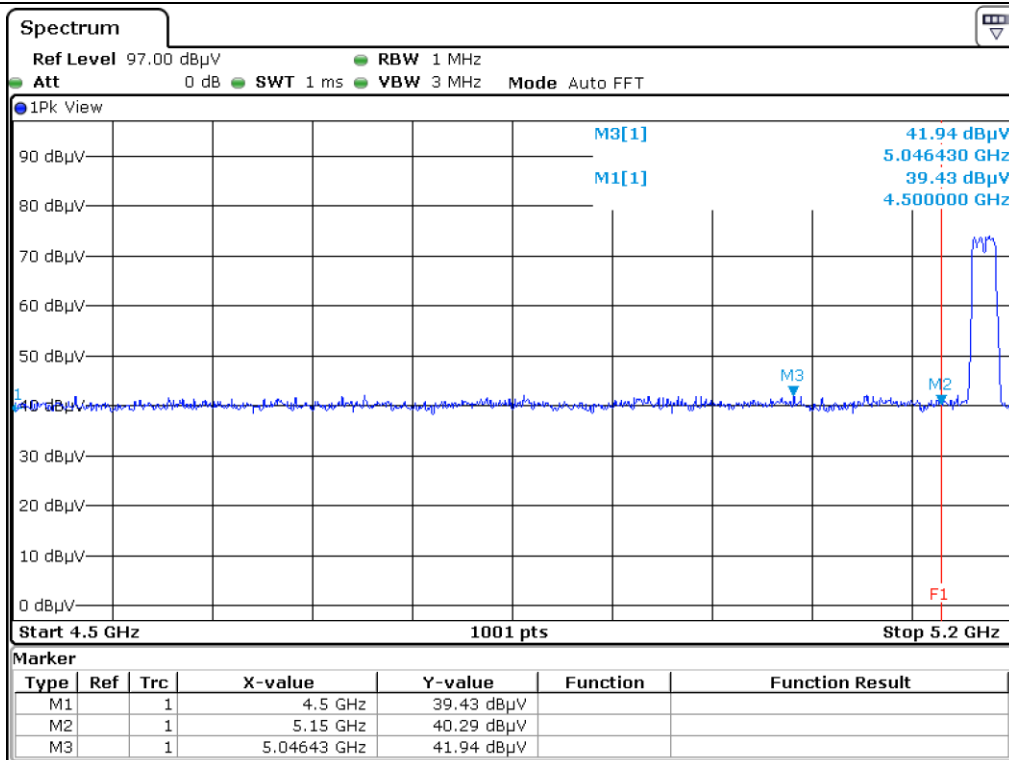
  
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**Tested by: Tae-Ho, Kim / Senior Manager**



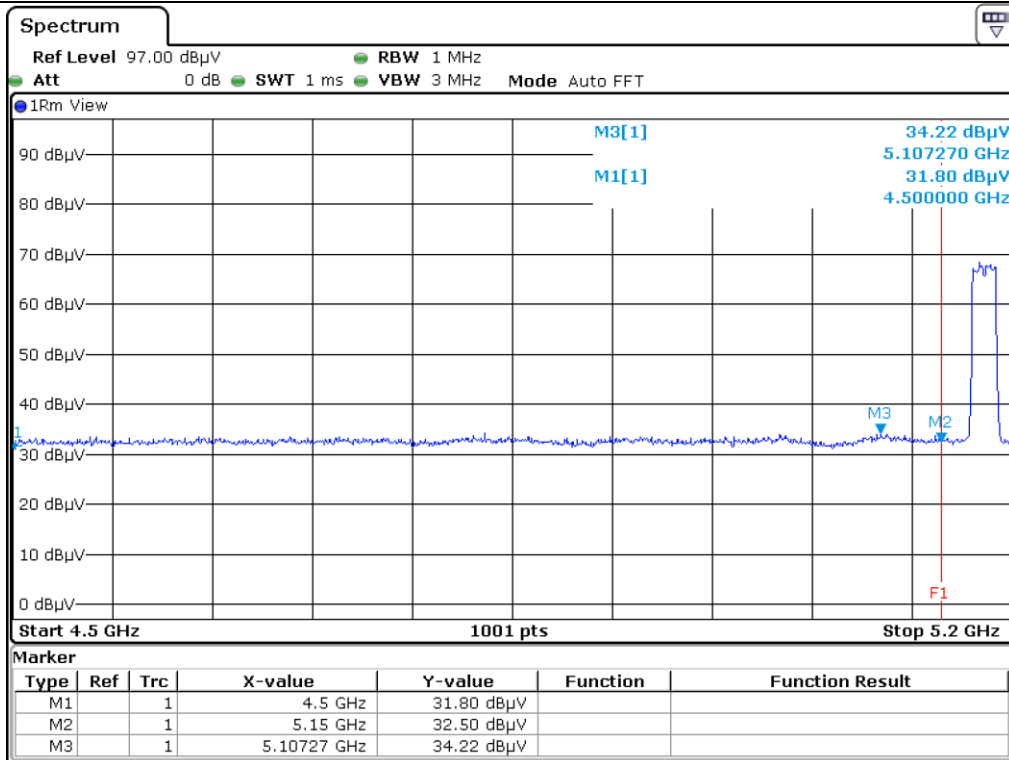
Low Channel\_Horizontal\_Peak



Low Channel\_Horizontal\_Average



Low Channel\_Vertical\_Peak



Low Channel\_Vertical\_Average

**5.4.1.2 Test Data for 802.11n20**

- Test Date : September 12, 2018 ~ September 21, 2018
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
4 914.27	42.58	Peak	H	31.28	12.65	35.19	51.32	74.00	22.68
5 145.73	34.21	Average	H	31.28	12.65	35.19	42.95	54.00	11.05
4 991.89	42.96	Peak	V	31.28	12.65	35.19	51.70	74.00	22.30
5 106.57	34.05	Average	V	31.28	12.65	35.19	42.79	54.00	11.21

Tabulated test data for Restricted Band

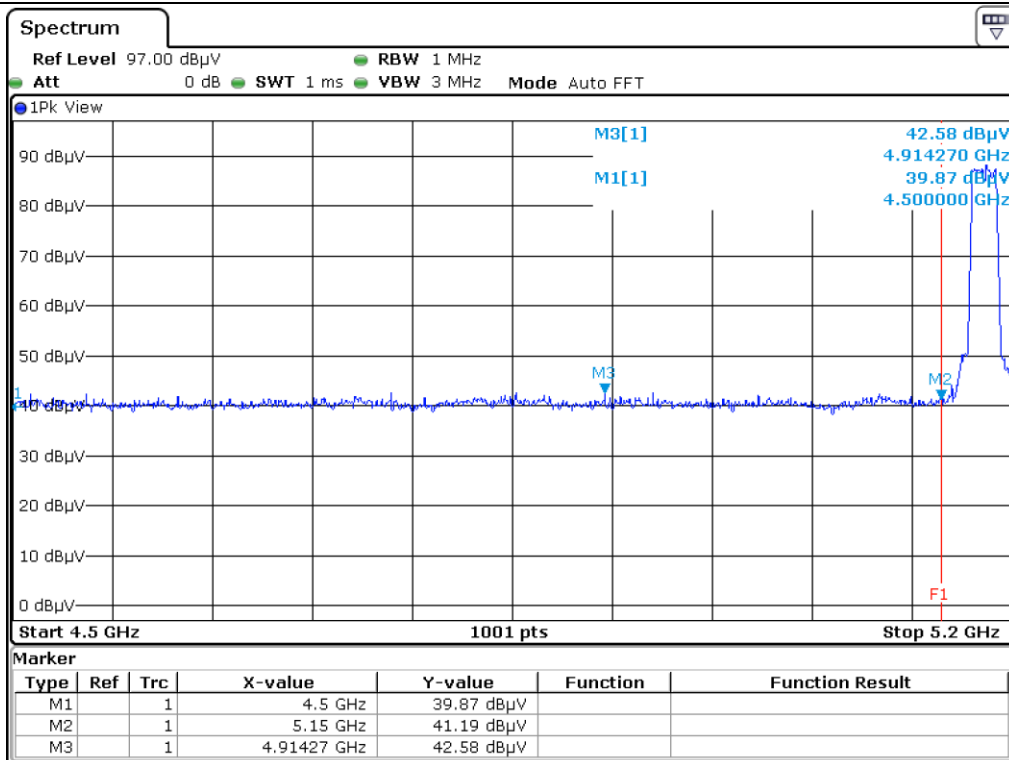
Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

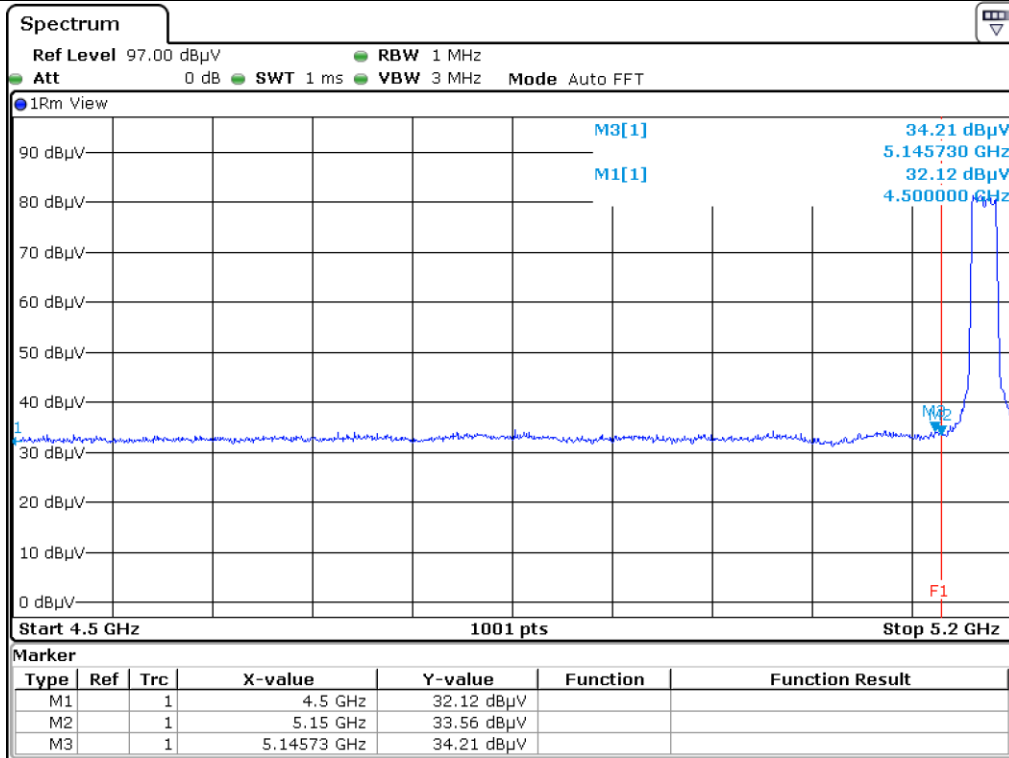
$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



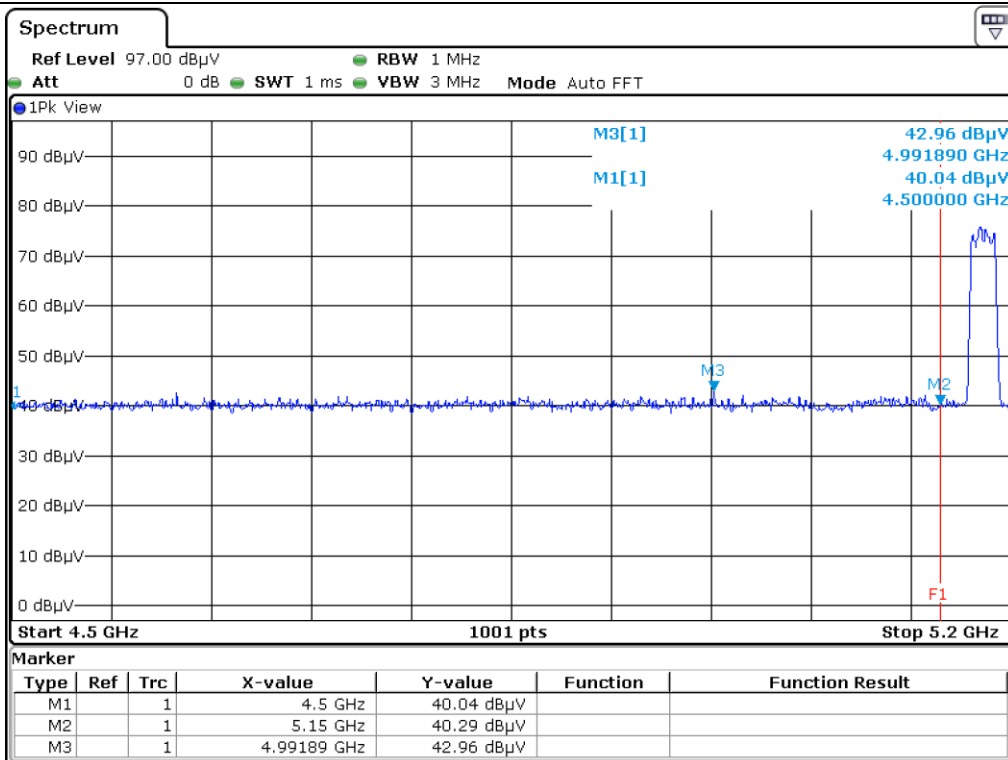
Tested by: **Tae-Ho, Kim / Senior Manager**



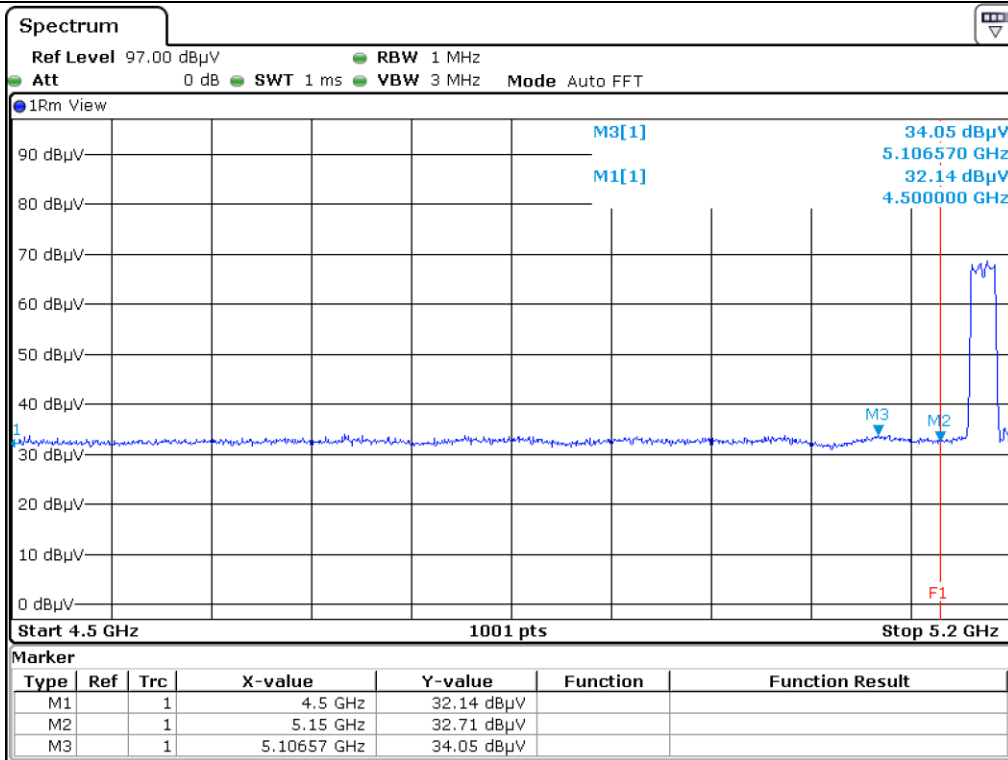
Low Channel\_Horizontal\_Peak



Low Channel\_Horizontal\_Average



Low Channel\_Verical\_Peak



Low Channel\_Verical\_Average



**5.4.1.3 Test Data for 802.11n40**

- Test Date : September 12, 2018 ~ September 21, 2018
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
5 112.94	42.68	Peak	H	31.28	12.65	35.19	51.42	74.00	22.58
5 127.62	34.58	Average	H	31.28	12.65	35.19	43.32	54.00	10.68
5 104.55	42.62	Peak	V	31.28	12.65	35.19	51.36	74.00	22.64
5 111.54	34.11	Average	V	31.28	12.65	35.19	42.85	54.00	11.15

Tabulated test data for Restricted Band

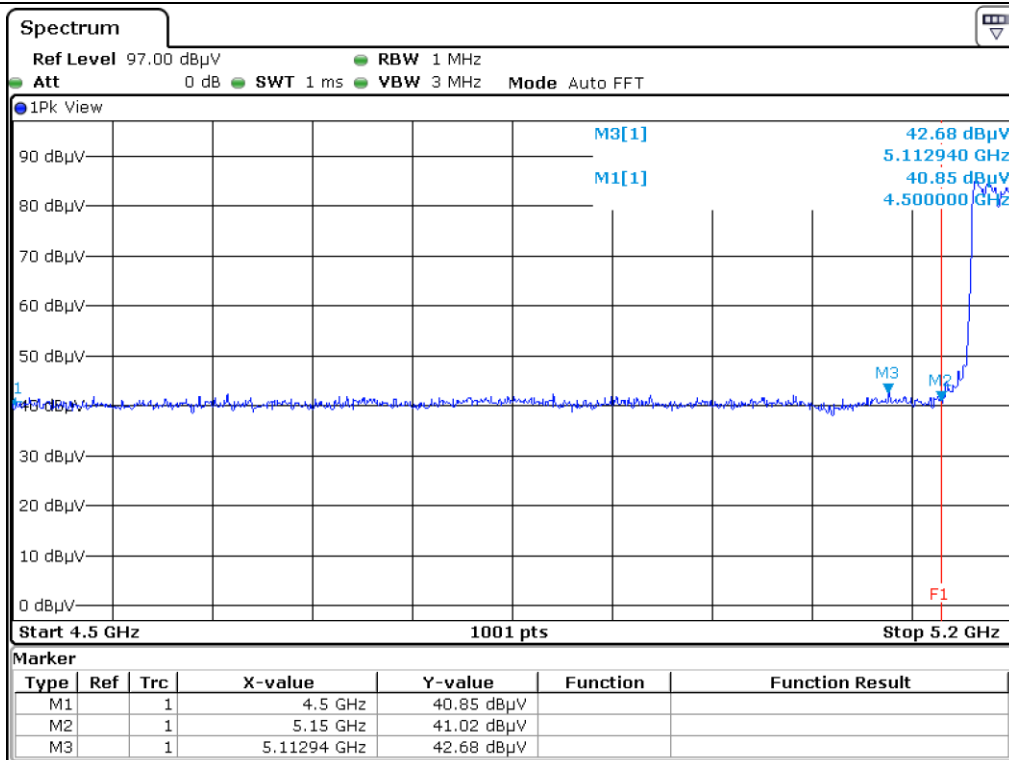
Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

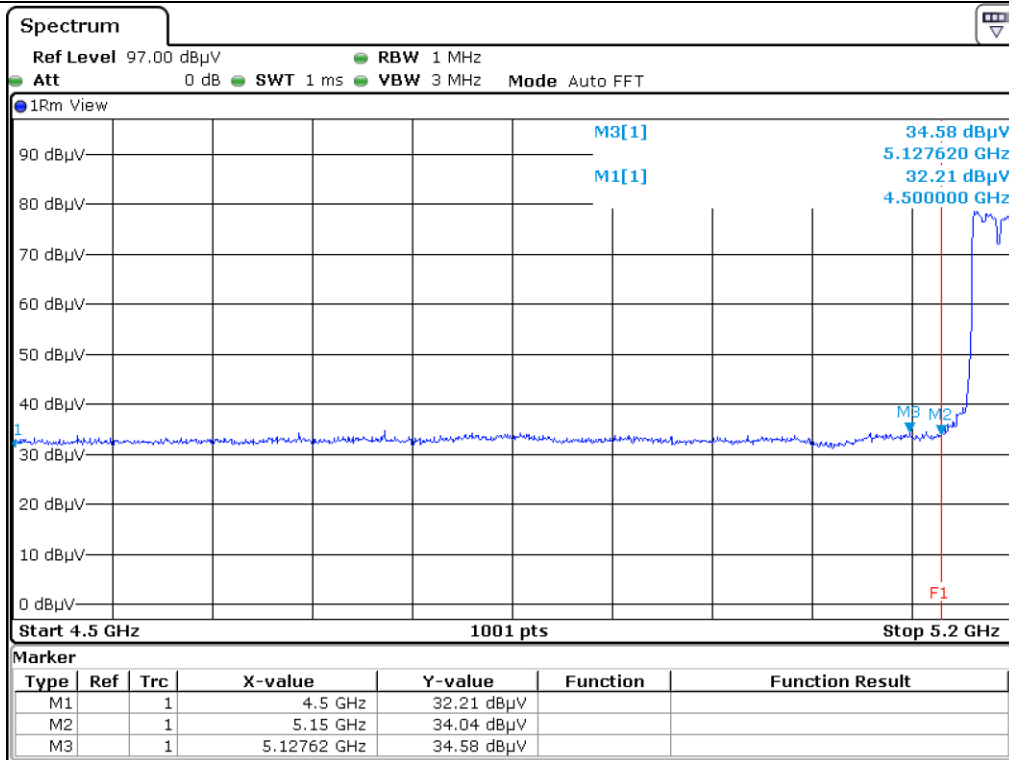
$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



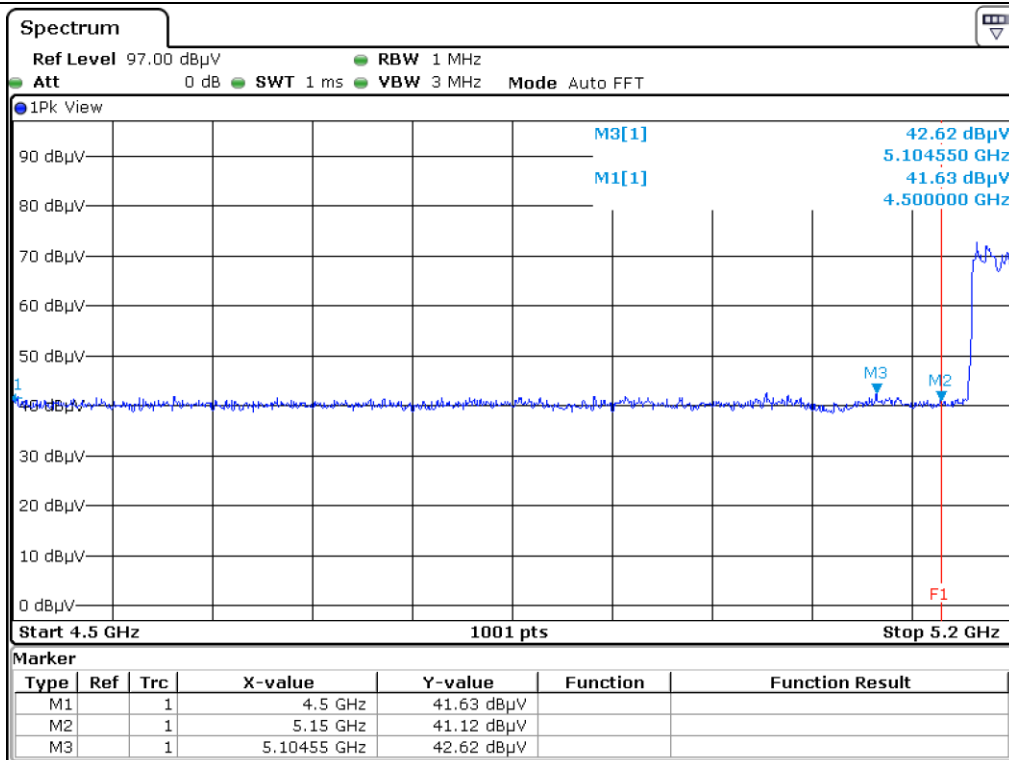
**Tested by: Tae-Ho, Kim / Senior Manager**



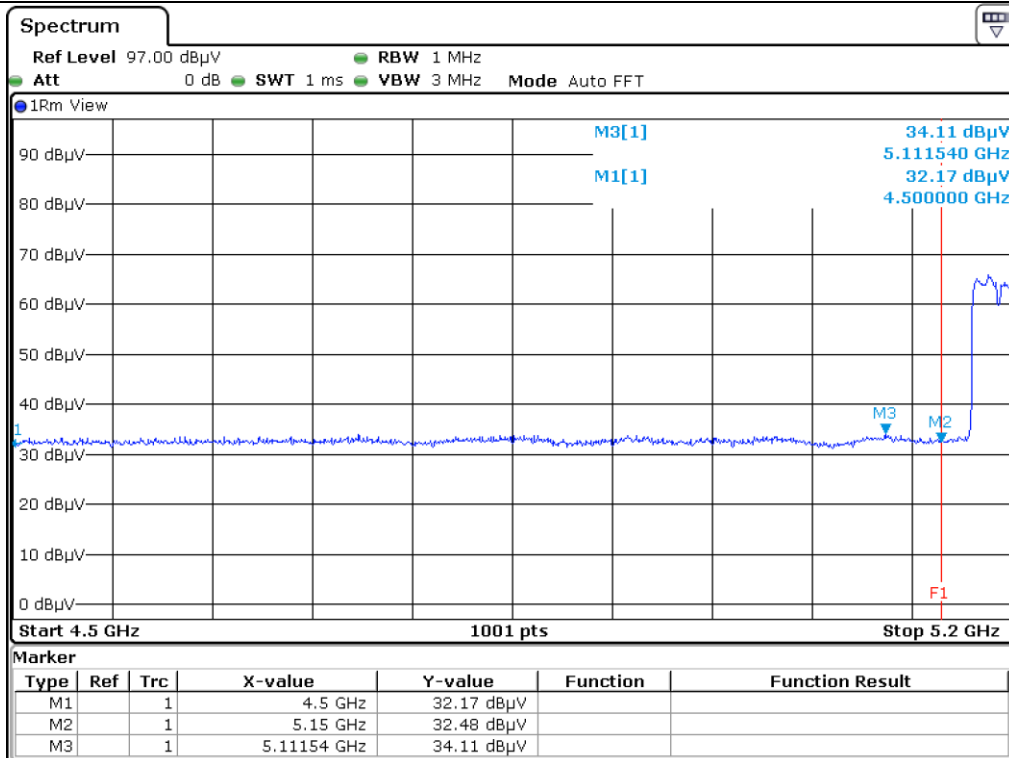
Low Channel\_Horizontal\_Peak



Low Channel\_Horizontal\_Average



Low Channel\_Vertical\_Peak



Low Channel\_Vertical\_Average

**5.4.2 Radiated Emission which fall in the Restricted Band (U-NII 2A)**

**5.4.2.1 Test Data for 802.11a**

- . Test Date : September 12, 2018 ~ September 21, 2018
- . Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Measurement distance : 3 m
- . Result : PASSED


Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for High Channel</b>									
5 350.27	46.92	Peak	H	31.50	12.33	35.01	55.74	74.00	18.26
5 350.00	37.05	Average	H	31.50	12.33	35.01	45.87	54.00	8.13
5 358.58	42.24	Peak	V	31.50	12.33	35.01	51.06	74.00	22.94
5 356.18	32.61	Average	V	31.50	12.33	35.01	41.43	54.00	12.57

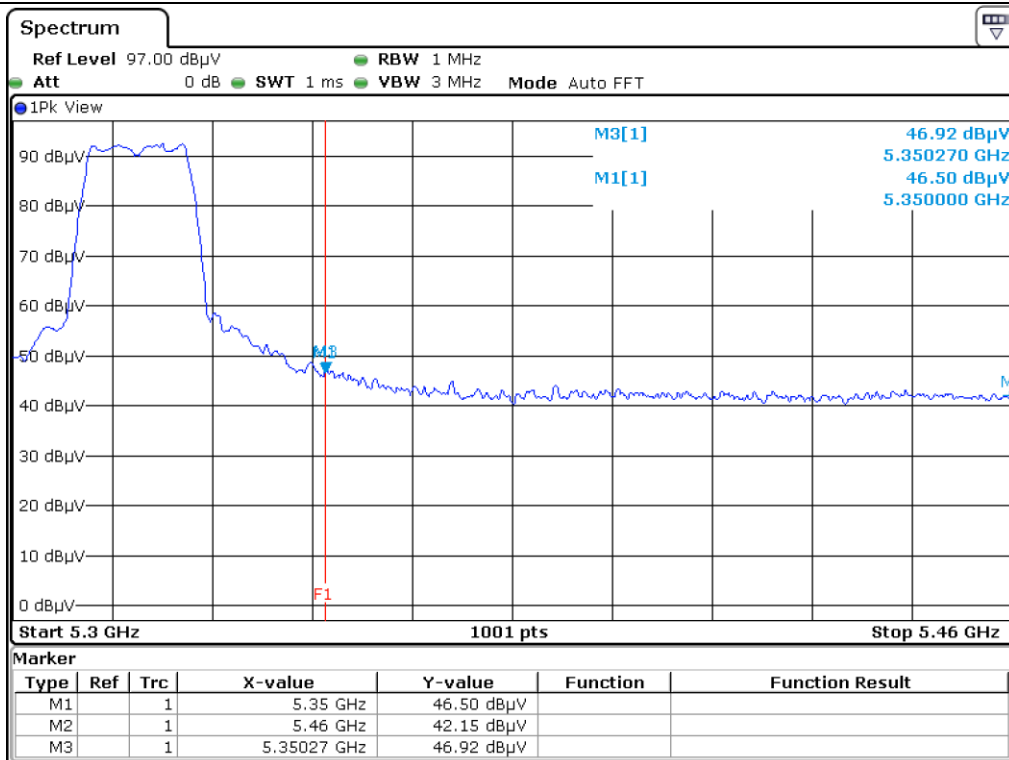
Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

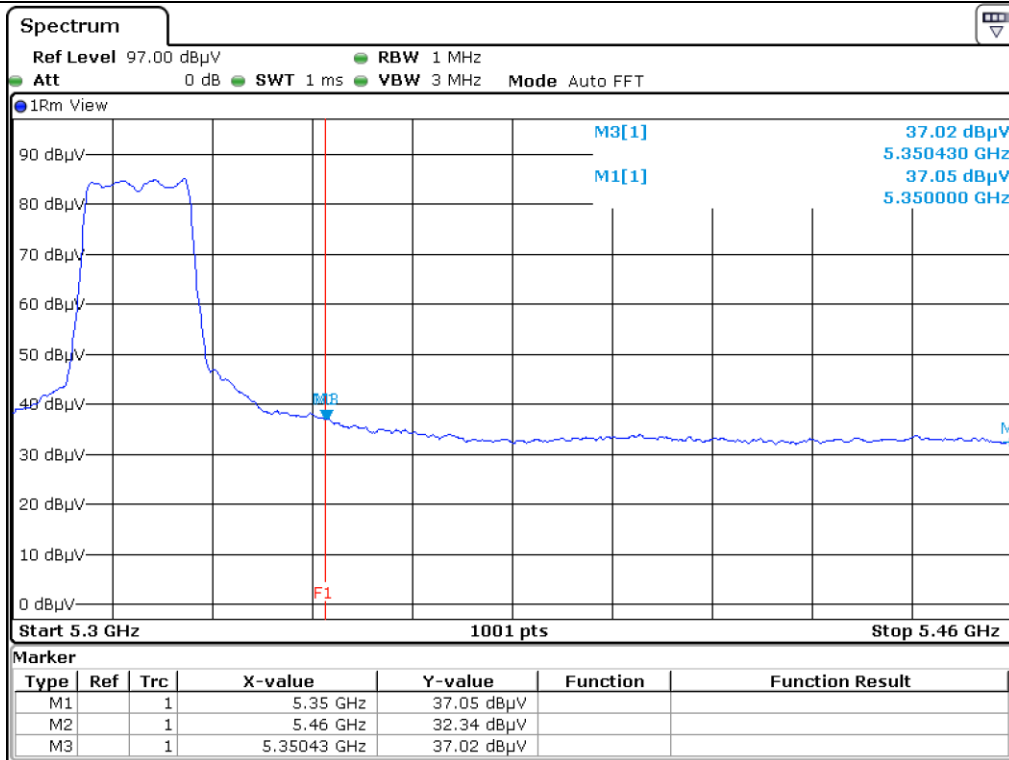
$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$

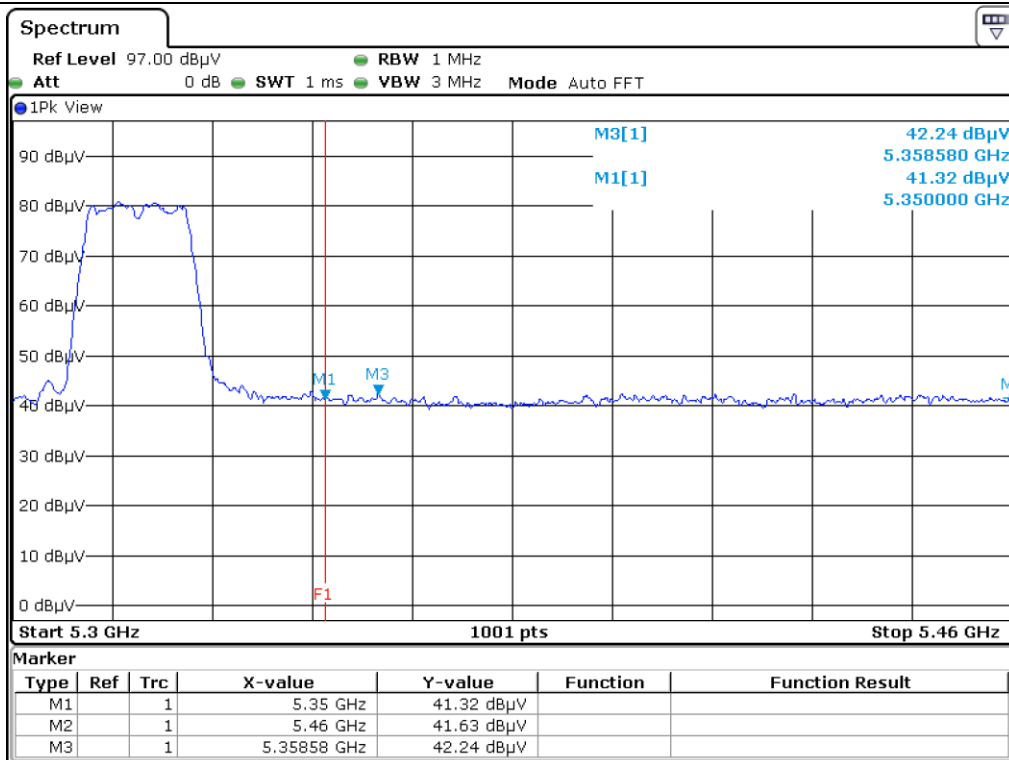
  
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**Tested by: Tae-Ho, Kim / Senior Manager**



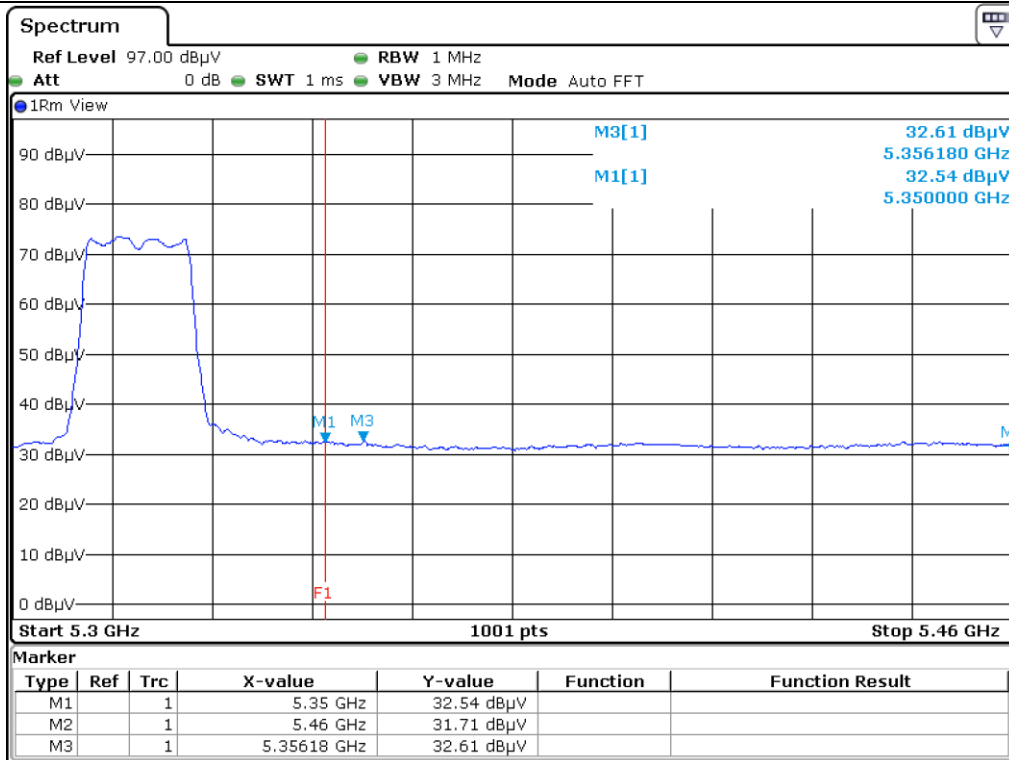
High Channel\_Horizontal\_Peak



High Channel\_Horizontal\_Average



High Channel\_Vertical\_Peak



High Channel\_Vertical\_Average

**5.4.2.2 Test Data for 802.11n20**

- Test Date : September 12, 2018 ~ September 21, 2018
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for High Channel</b>									
5 351.07	46.87	Peak	H	31.50	12.33	35.01	55.69	74.00	18.31
5 350.00	37.01	Average	H	31.50	12.33	35.01	45.83	54.00	8.17
5 451.13	43.04	Peak	V	31.50	12.33	35.01	51.86	74.00	22.14
5 351.55	32.68	Average	V	31.50	12.33	35.01	41.50	54.00	12.50

Tabulated test data for Restricted Band

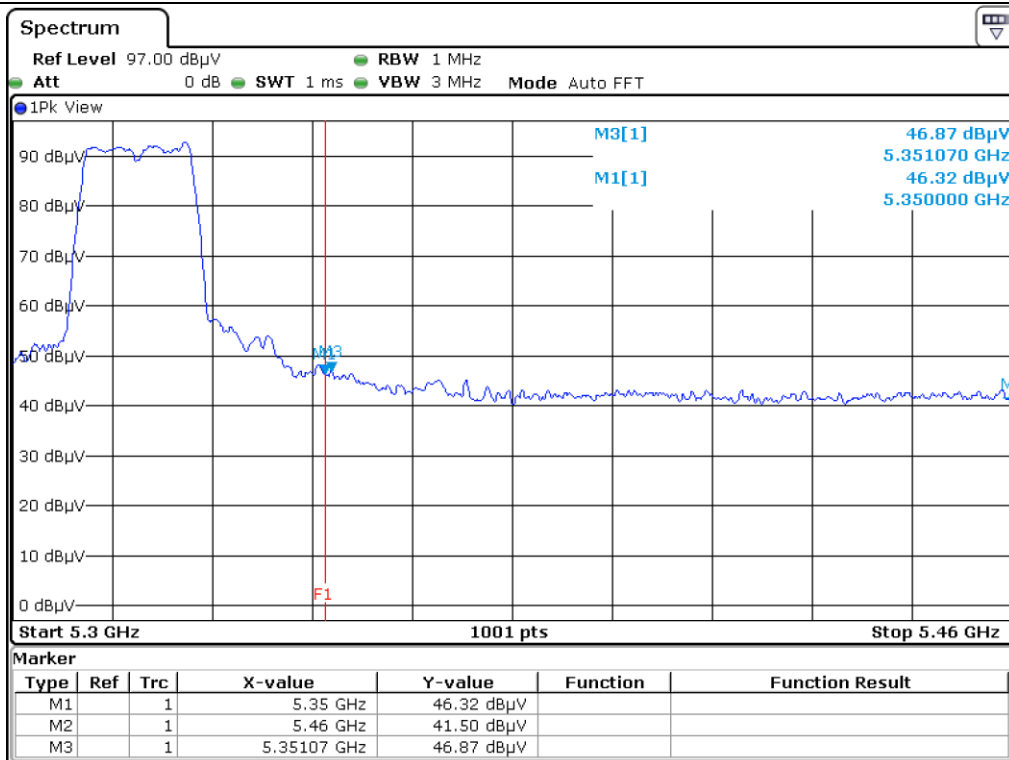
Remark: "H": Horizontal, "V": Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

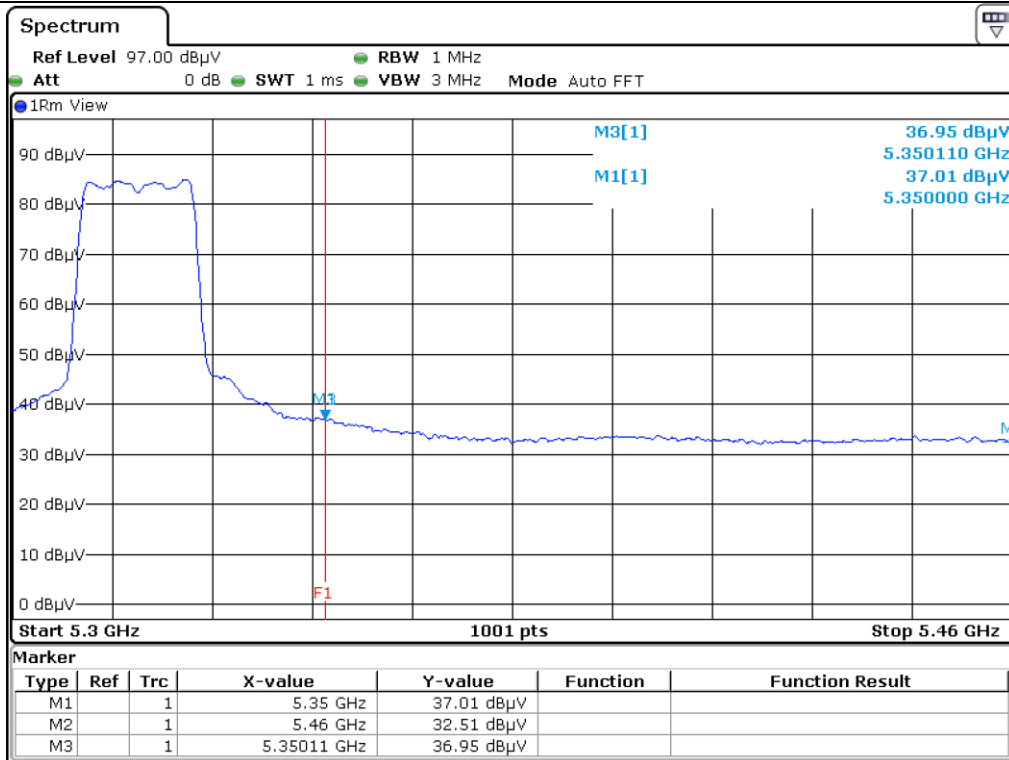
$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



Tested by: Tae-Ho, Kim / Senior Manager

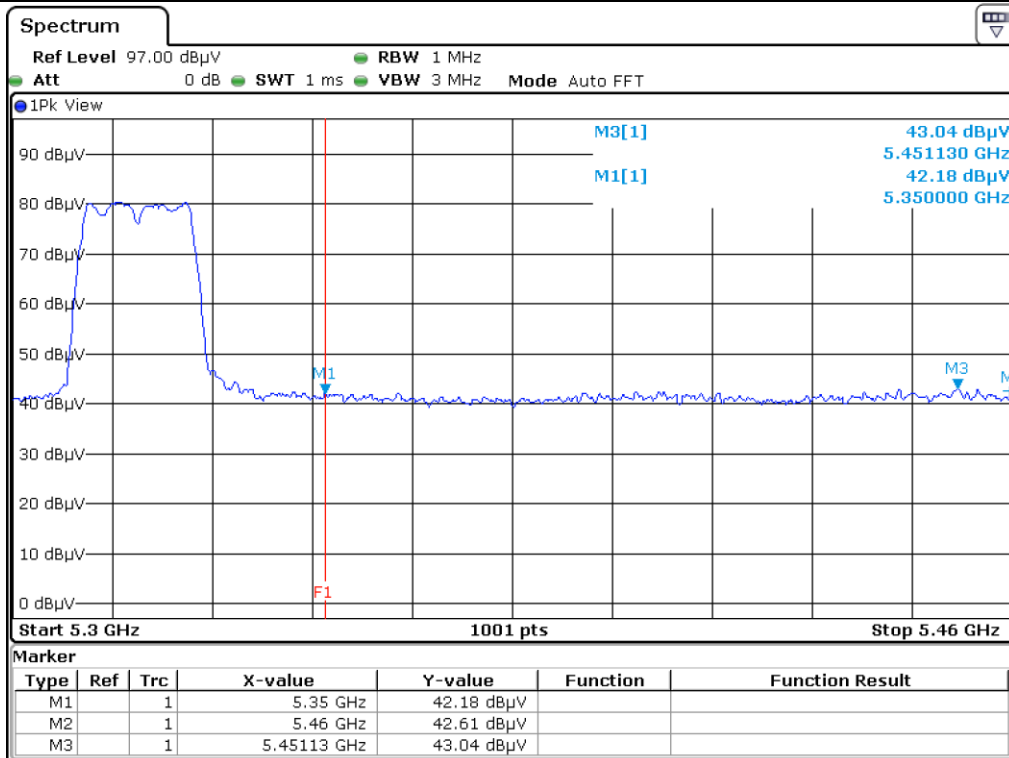


High Channel\_Horizontal\_Peak

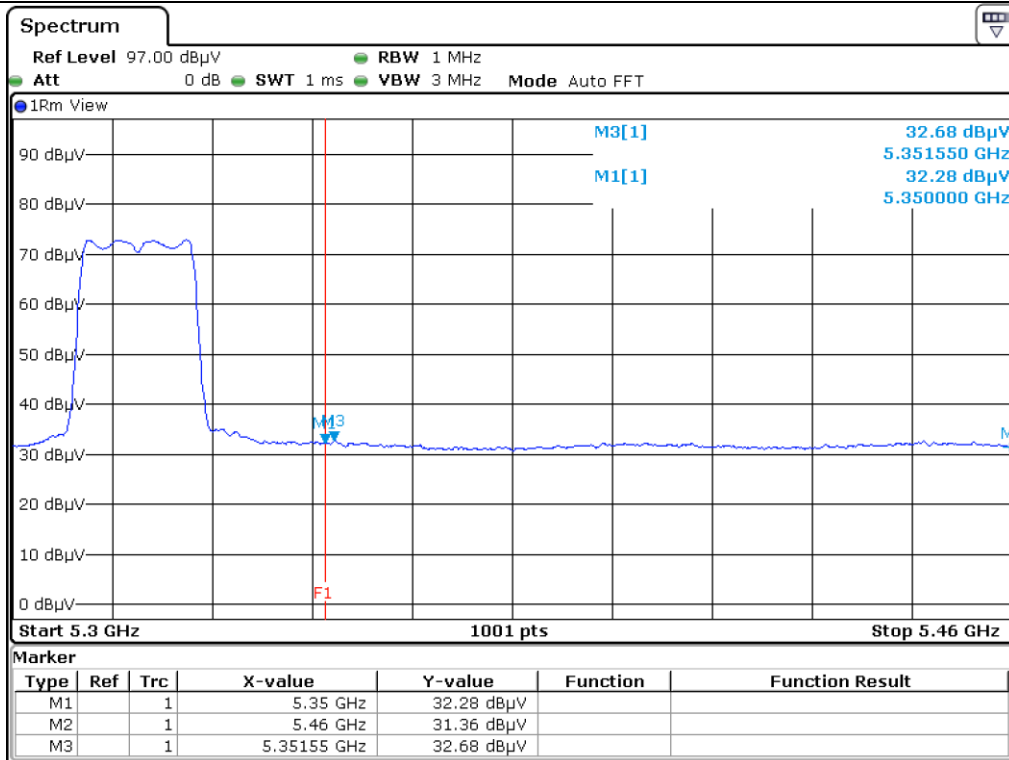


High Channel\_Horizontal\_Average





High Channel\_Vertical\_Peak



High Channel\_Vertical\_Average

**5.4.2.3 Test Data for 802.11n40**

- . Test Date : September 12, 2018 ~ September 21, 2018
- . Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Measurement distance : 3 m
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for High Channel</b>									
5 350.27	50.09	Peak	H	31.50	12.33	35.01	58.91	74.00	15.09
5 350.43	39.37	Average	H	31.50	12.33	35.01	48.19	54.00	5.81
5 350.91	42.31	Peak	V	31.50	12.33	35.01	51.13	74.00	22.87
5 350.27	32.98	Average	V	31.50	12.33	35.01	41.80	54.00	12.20

Tabulated test data for Restricted Band

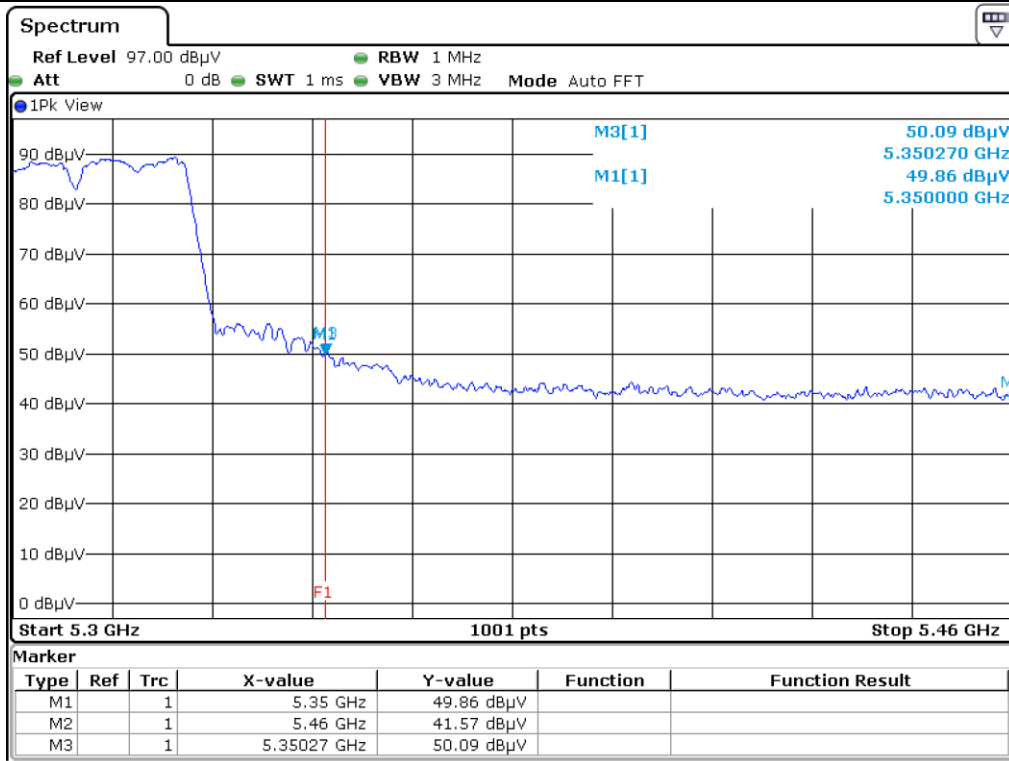
Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

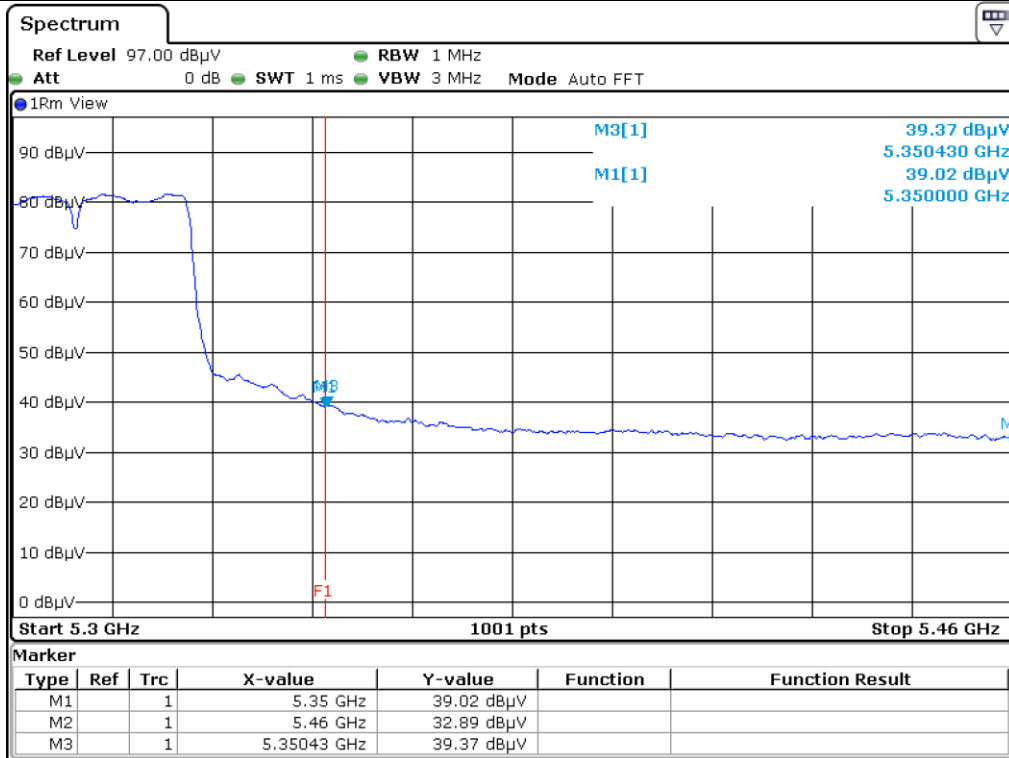
$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



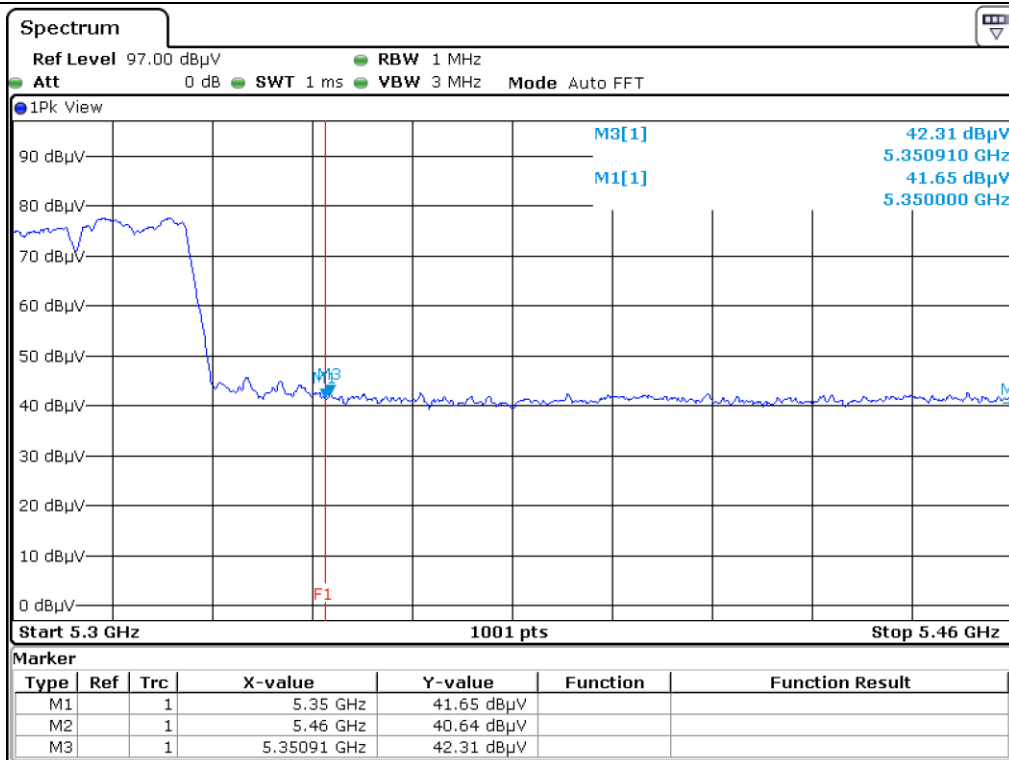
**Tested by: Tae-Ho, Kim / Senior Manager**



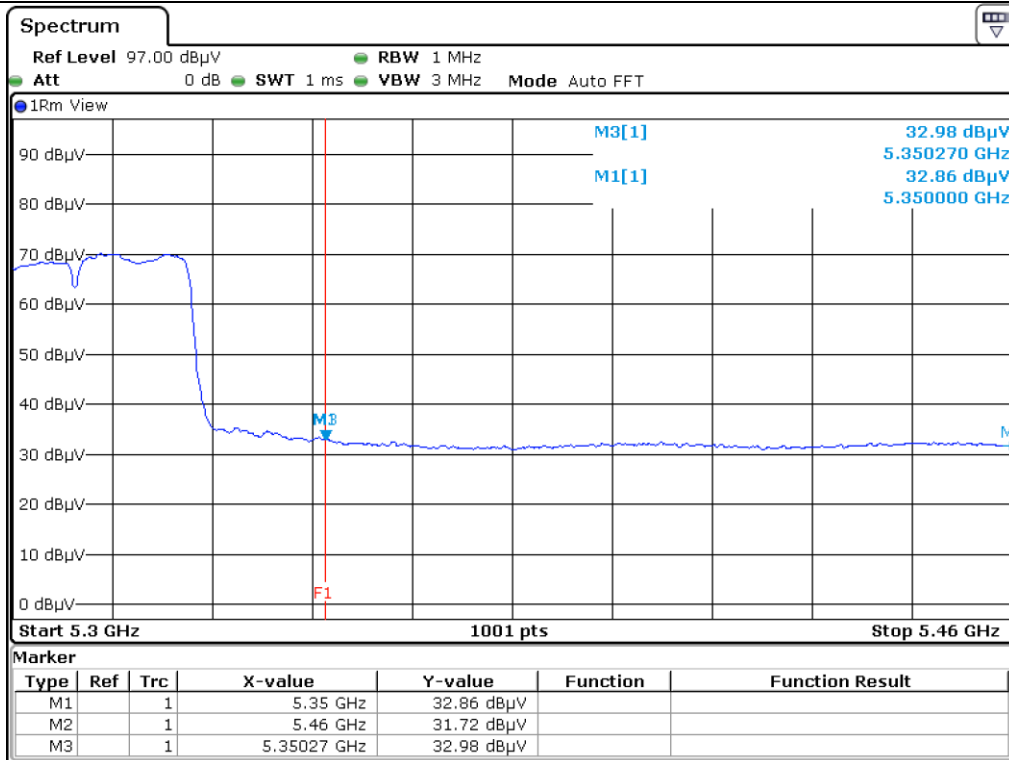
High Channel\_Horizontal\_Peak



High Channel\_Horizontal\_Average



High Channel\_Vertical\_Peak



High Channel\_Vertical\_Average

**5.4.3 Radiated Emission which fall in the Restricted Band (U-NII 2C)**

**5.4.3.1 Test Data for 802.11a**

- . Test Date : September 12, 2018 ~ September 21, 2018
- . Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Measurement distance : 3 m
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
5 454.98	43.41	Peak	H	31.60	12.17	34.99	52.19	74.00	21.81
5 452.71	33.38	Average	H	31.60	12.17	34.99	42.16	54.00	11.84
5 452.88	42.98	Peak	V	31.60	12.17	34.99	51.76	74.00	22.24
5 443.62	32.69	Average	V	31.60	12.17	34.99	41.47	54.00	12.53

Tabulated test data for Restricted Band

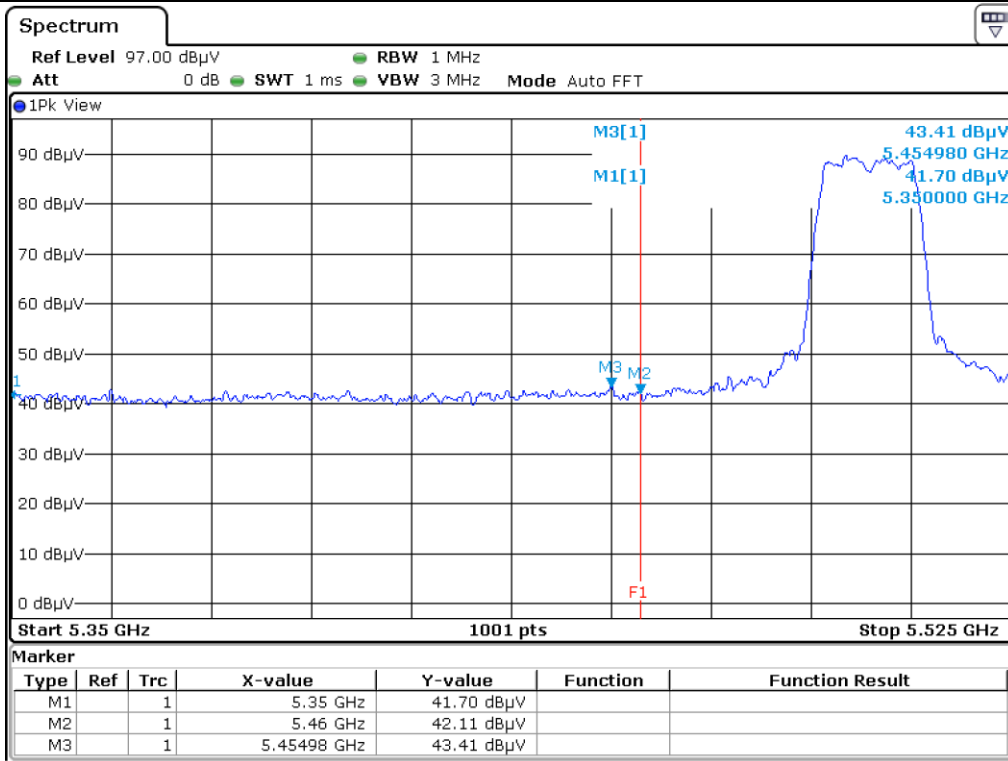
Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

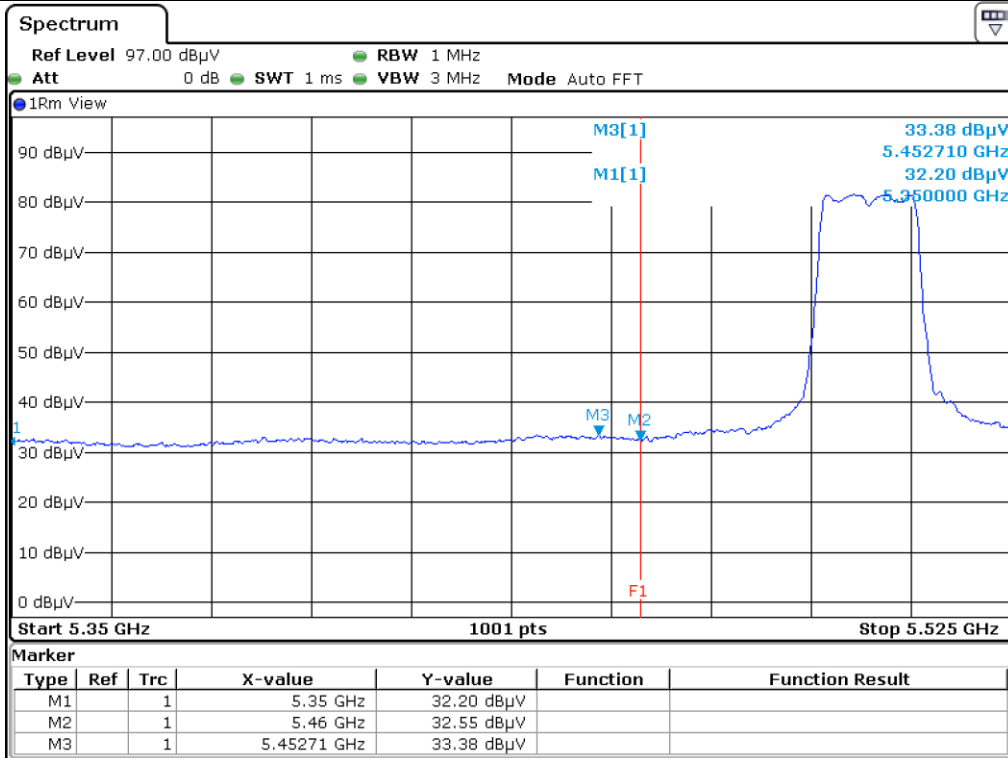
$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



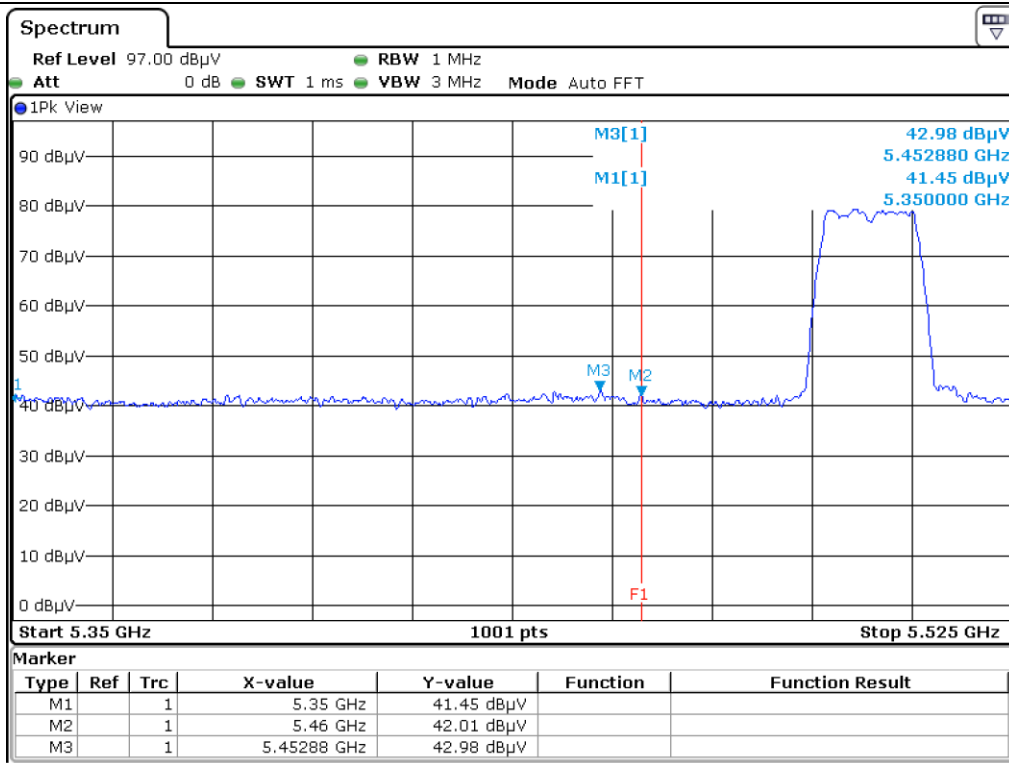
**Tested by: Tae-Ho, Kim / Senior Manager**



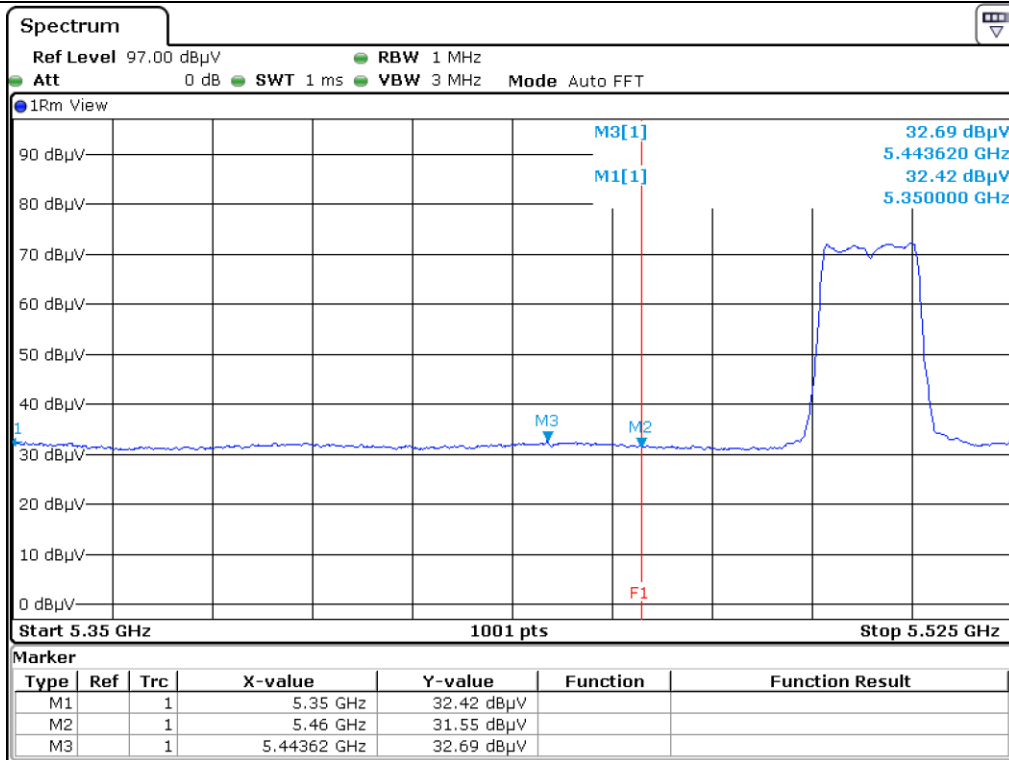
Low Channel\_Horizontal\_Peak



Low Channel\_Horizontal\_Average



Low Channel\_Vertical\_Peak



Low Channel\_Vertical\_Average

**5.4.3.2 Test Data for 802.11n20**

- Test Date : September 12, 2018 ~ September 21, 2018
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
5 458.83	42.92	Peak	H	31.60	12.17	34.99	51.70	74.00	22.30
5 456.21	33.97	Average	H	31.60	12.17	34.99	42.75	54.00	11.25
5 452.19	42.29	Peak	V	31.60	12.17	34.99	51.07	74.00	22.93
5 454.81	32.47	Average	V	31.60	12.17	34.99	41.25	54.00	12.75

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

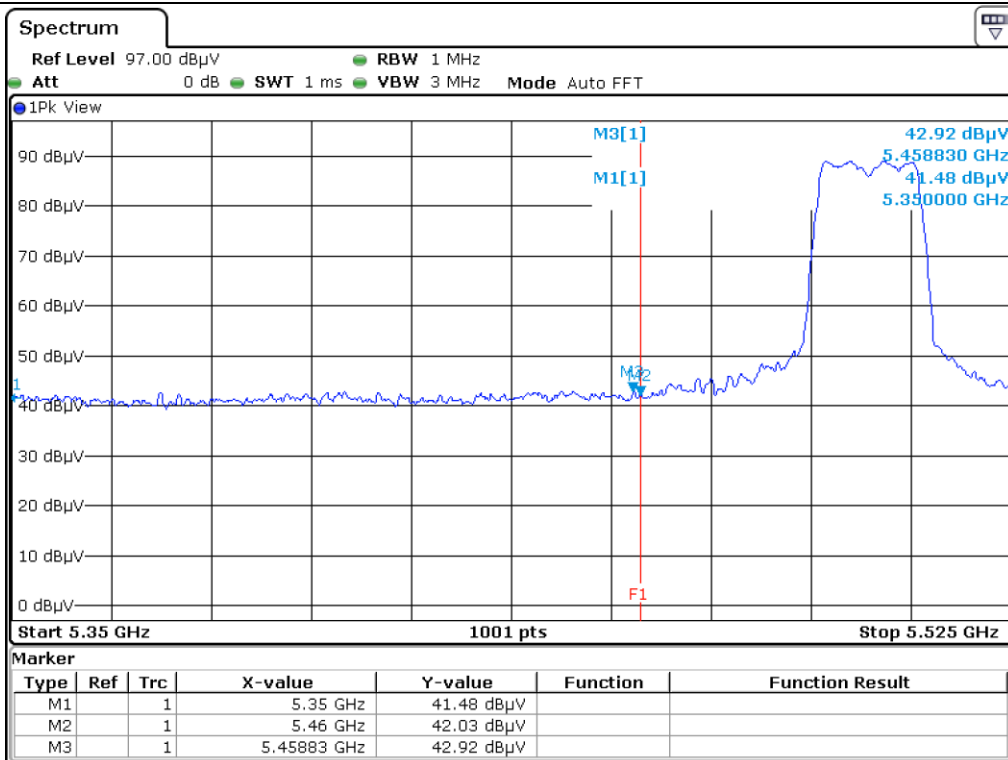
$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$

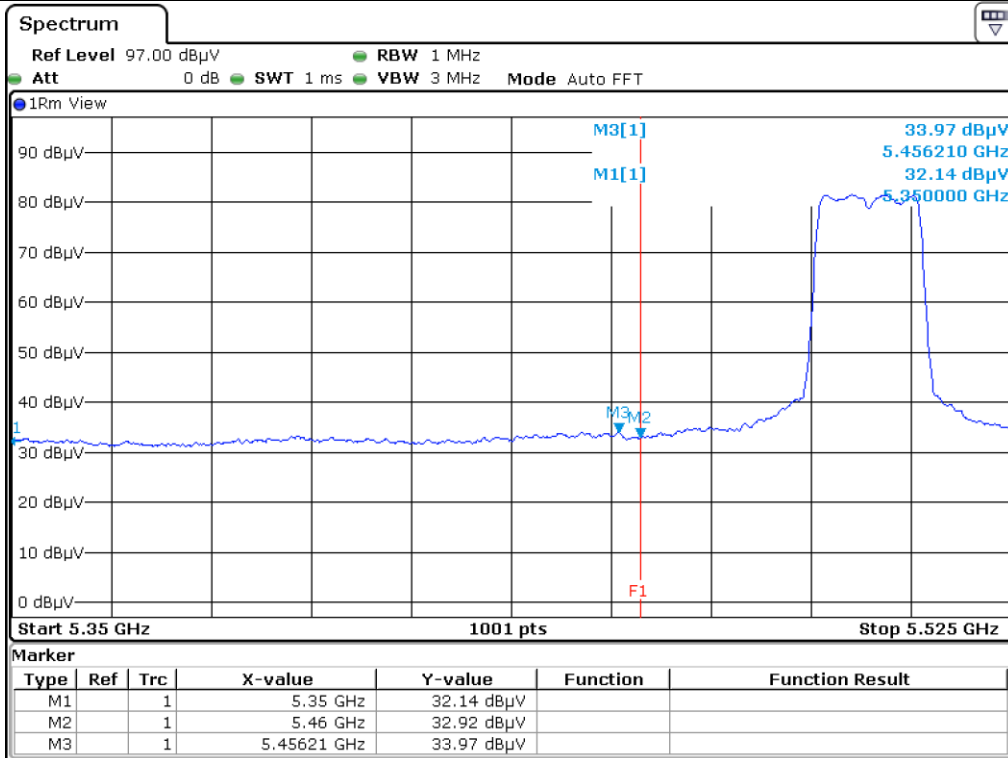


**Tested by: Tae-Ho, Kim / Senior Manager**

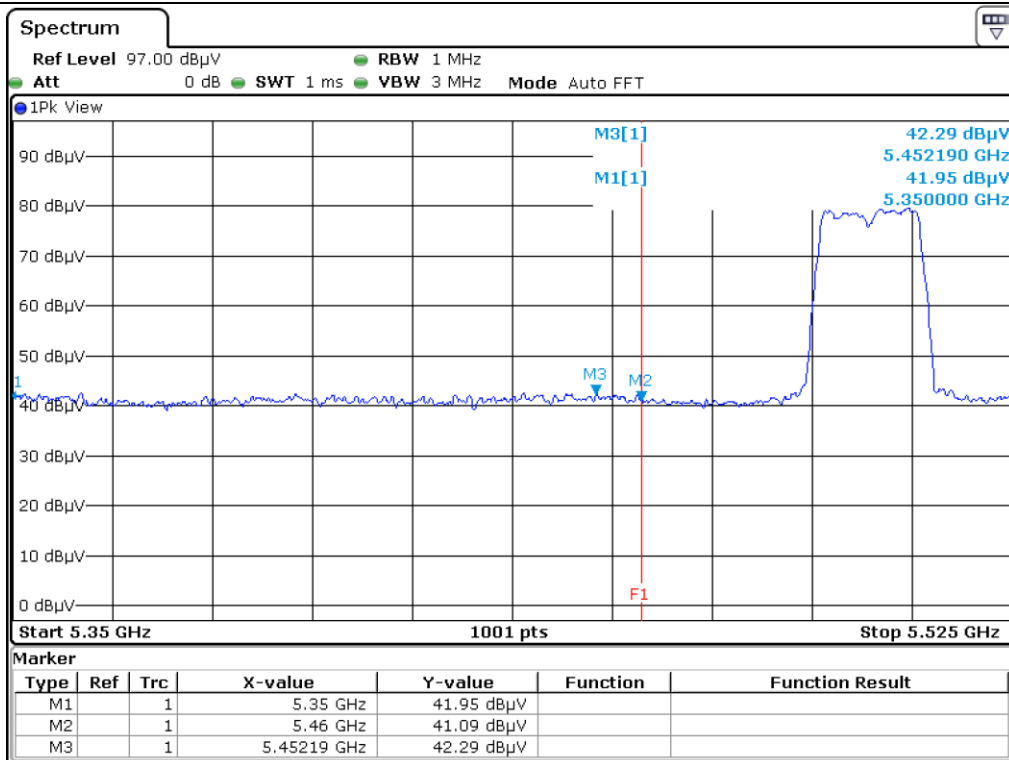




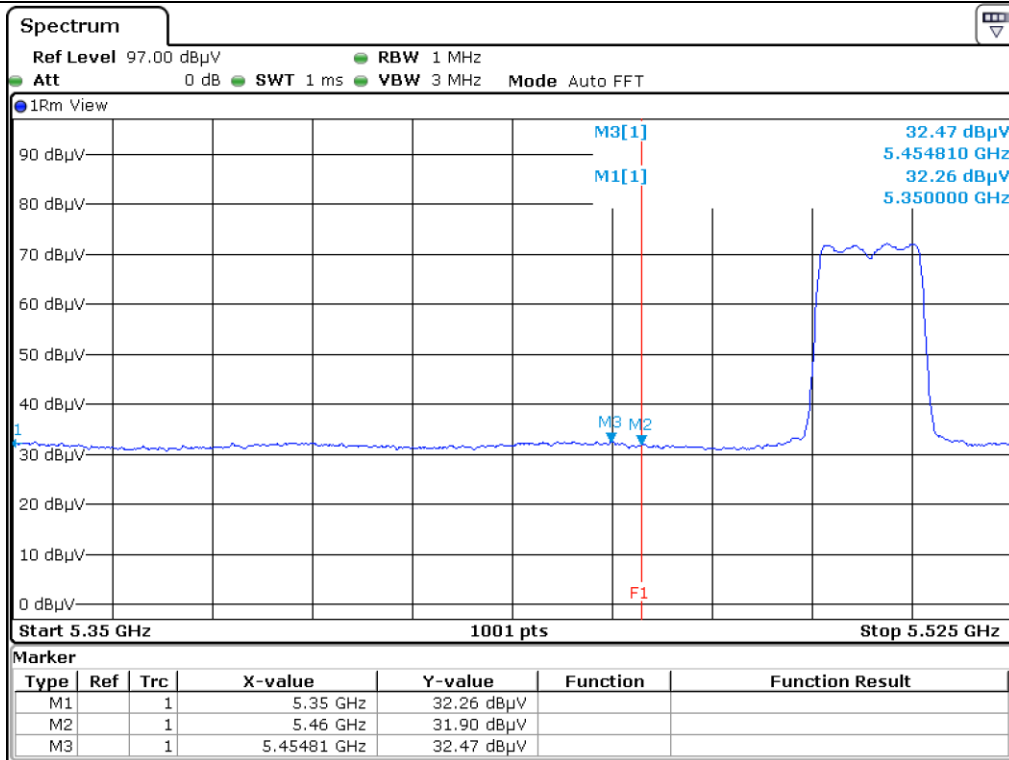
Low Channel\_Horizontal\_Peak



Low Channel\_Horizontal\_Average



Low Channel\_Vertical\_Peak



Low Channel\_Vertical\_Average

**5.4.3.3 Test Data for 802.11n40**

- Test Date : September 12, 2018 ~ September 21, 2018
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
5 447.99	44.28	Peak	H	31.60	12.17	34.99	53.06	74.00	20.94
5 449.56	35.42	Average	H	31.60	12.17	34.99	44.20	54.00	9.80
5 446.42	43.47	Peak	V	31.60	12.17	34.99	52.25	74.00	21.75
5 448.69	32.41	Average	V	31.60	12.17	34.99	41.19	54.00	12.81

Tabulated test data for Restricted Band

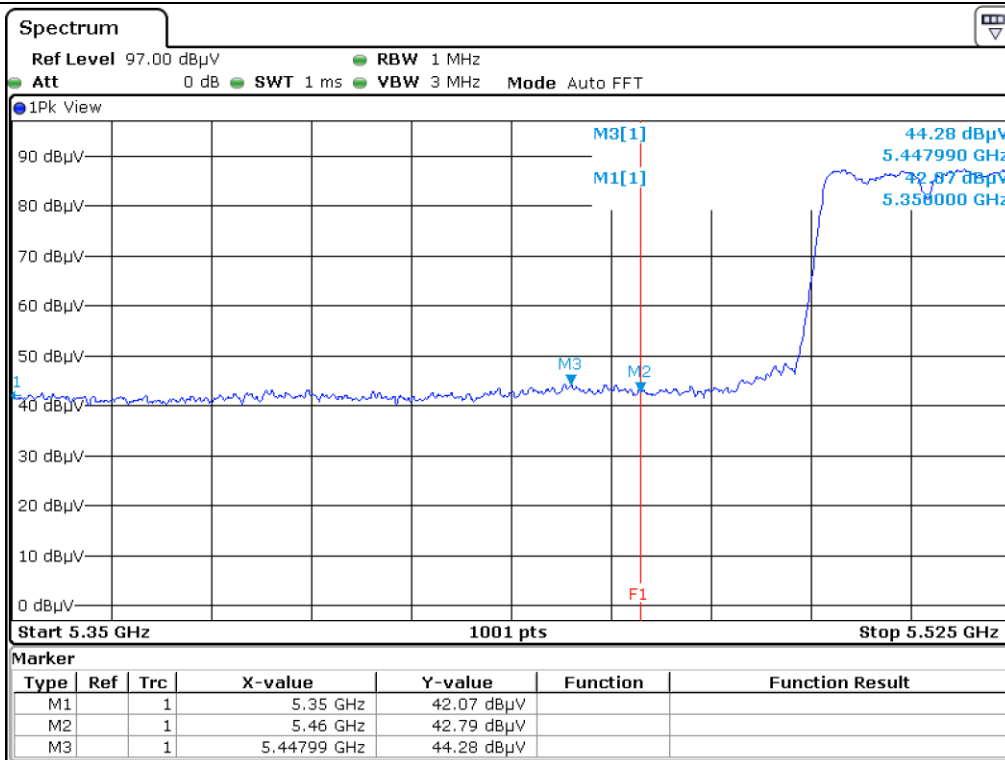
Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

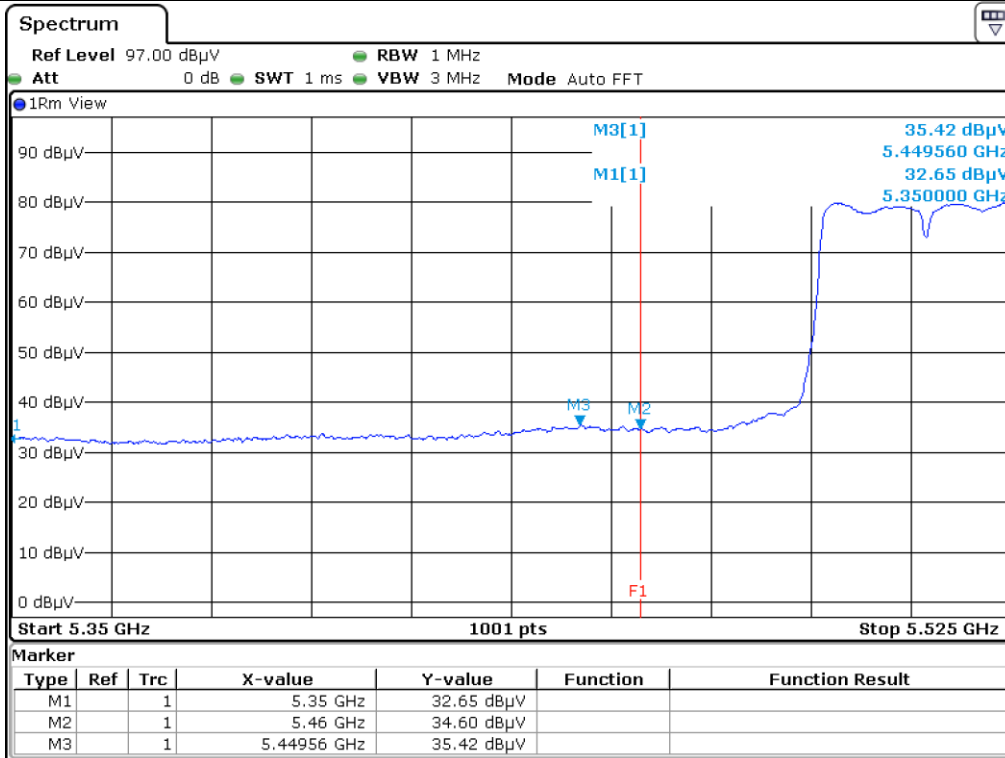
$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



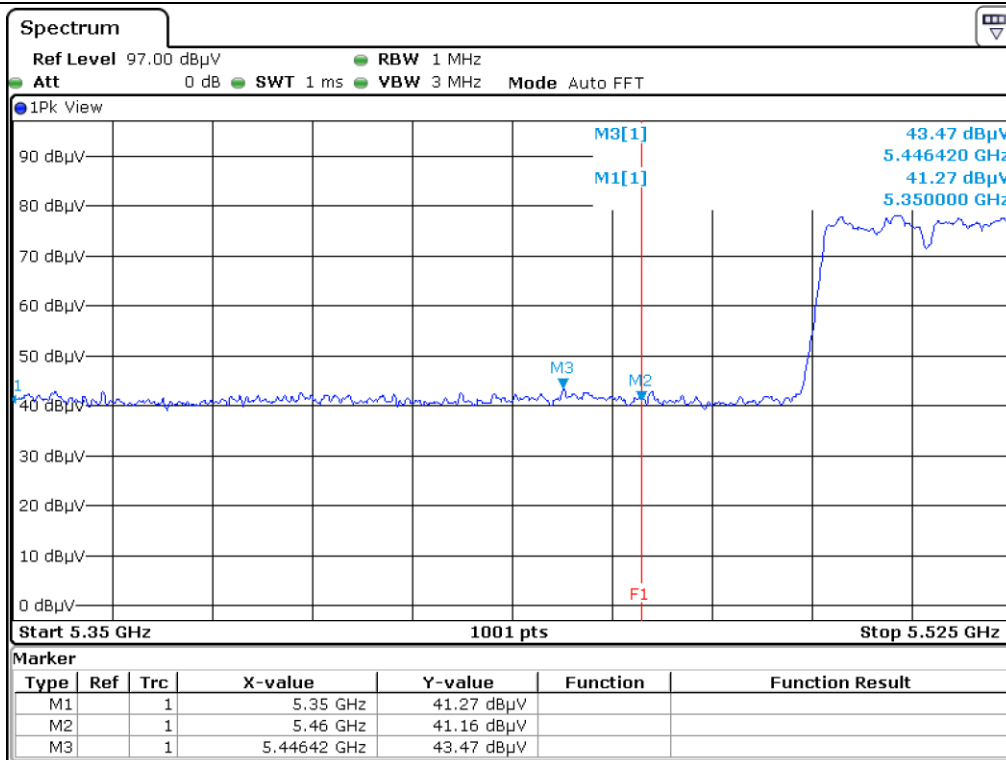
**Tested by: Tae-Ho, Kim / Senior Manager**



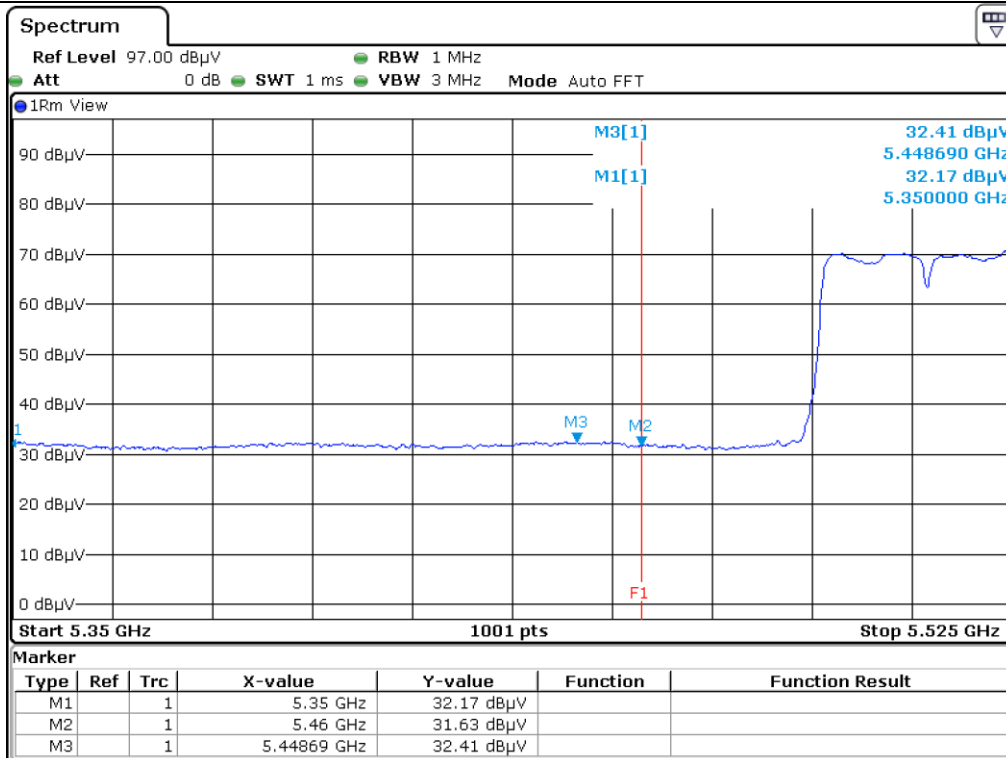
Low Channel\_Horizontal\_Peak



Low Channel\_Horizontal\_Average



Low Channel\_Vertical\_Peak



Low Channel\_Vertical\_Average

**5.4.4 Radiated Emission which fall in the Restricted Band (U-NII 3)**

**5.4.4.1 Test Data for 802.11a**

- Test Date : September 12, 2018 ~ September 21, 2018
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
5 650.00	44.92	Peak	H	32.17	12.09	35.05	54.13	80.00	25.87
5 715.00	45.90	Peak	H	32.17	12.09	35.05	55.11	121.20	66.09
5 722.83	47.64	Peak	H	32.17	12.09	35.05	56.85	129.05	72.20
5 725.00	46.42	Peak	H	32.17	12.09	35.05	55.63	134.00	78.37
5 650.00	44.64	Peak	V	32.17	12.09	35.05	53.85	80.00	26.15
5 696.19	46.83	Peak	V	32.17	12.09	35.05	56.04	114.18	58.14
5 715.00	45.32	Peak	V	32.17	12.09	35.05	54.53	121.20	66.67
5 725.00	45.30	Peak	V	32.17	12.09	35.05	54.51	134.00	79.49

Test Data for High Channel									
5 850.00	45.33	Peak	H	32.17	12.09	34.85	54.74	134.00	79.26
5 860.00	45.70	Peak	H	32.17	12.09	34.85	55.11	121.20	66.09
5 925.00	45.32	Peak	H	32.17	12.09	34.85	54.73	80.00	25.27
5 857.73	46.68	Peak	H	32.17	12.09	34.85	56.09	121.84	65.75
5 850.00	45.60	Peak	V	32.17	12.09	34.85	55.01	134.00	78.99
5 860.00	45.54	Peak	V	32.17	12.09	34.85	54.95	121.20	66.25
5 925.00	44.70	Peak	V	32.17	12.09	34.85	54.11	80.00	25.89
5 868.17	46.69	Peak	V	32.17	12.09	34.85	56.10	118.91	62.81

Tabulated test data for Restricted Band

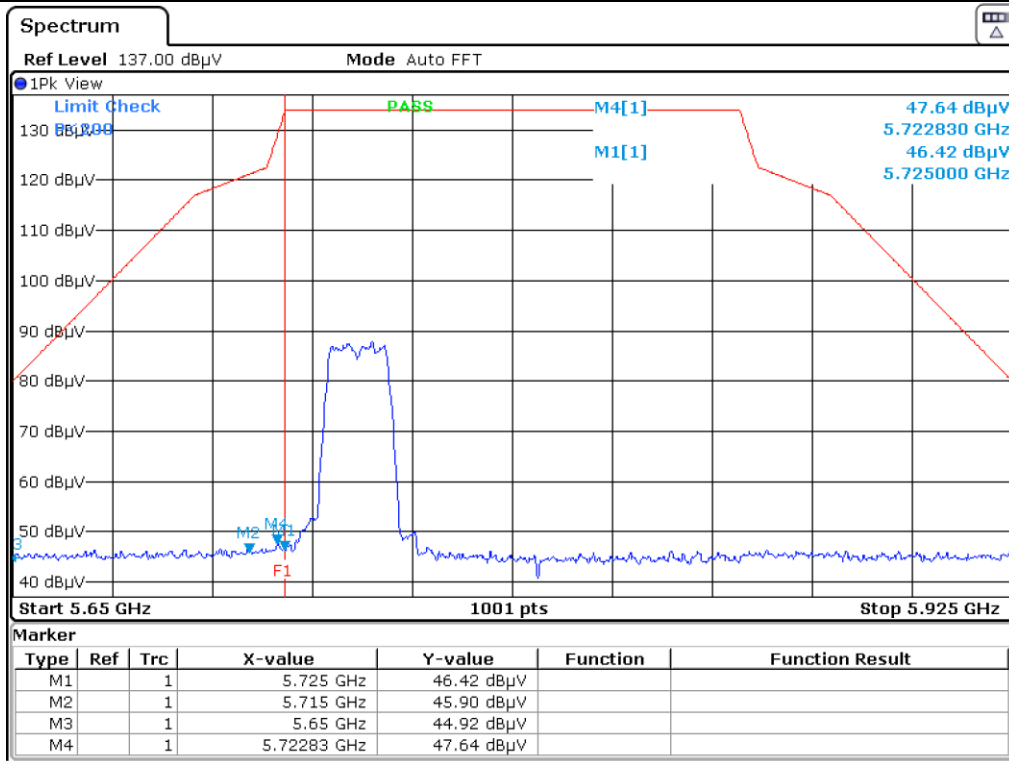
Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

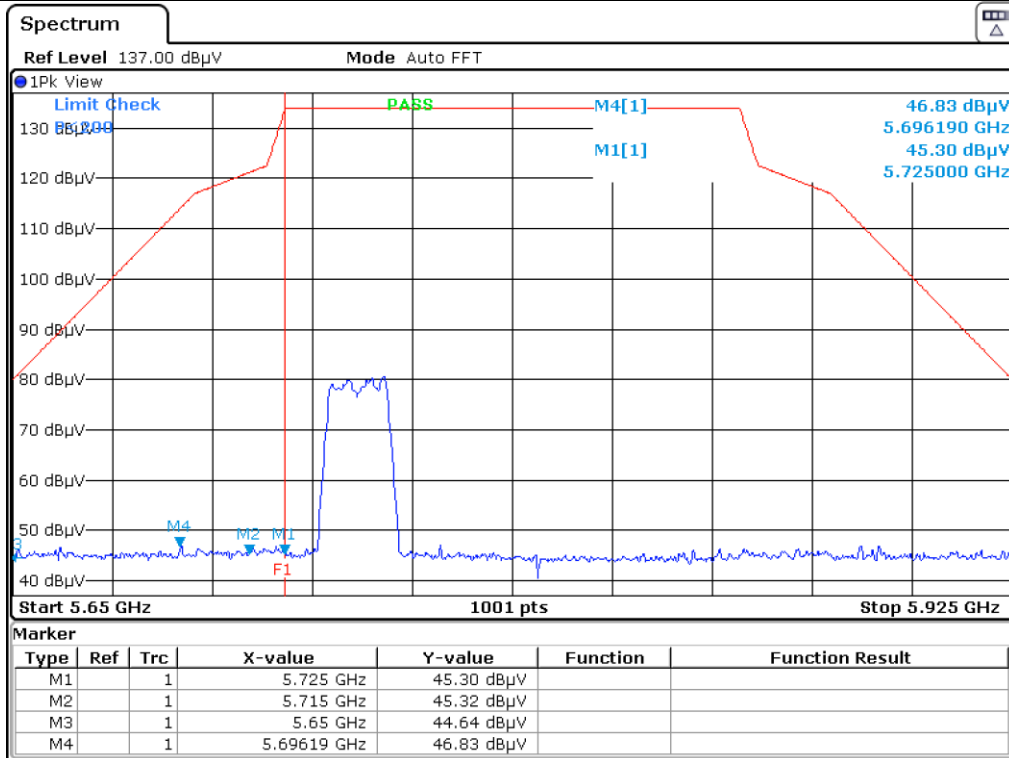
$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



**Tested by: Tae-Ho, Kim / Senior Manager**

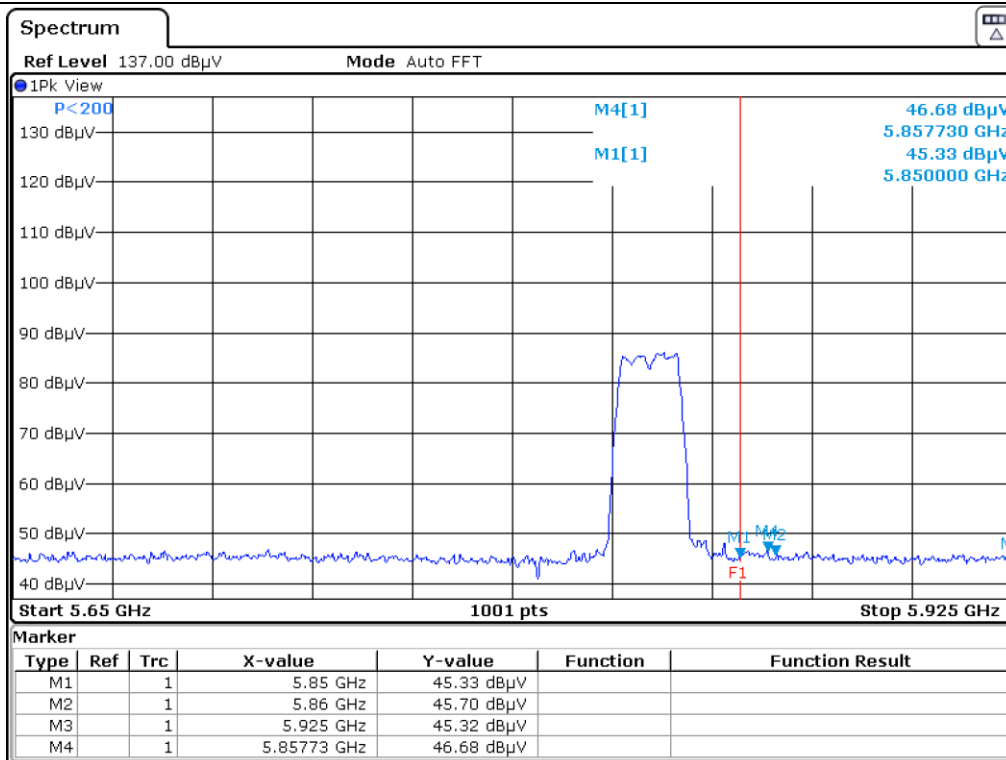


Low Channel\_Horizontal\_Peak

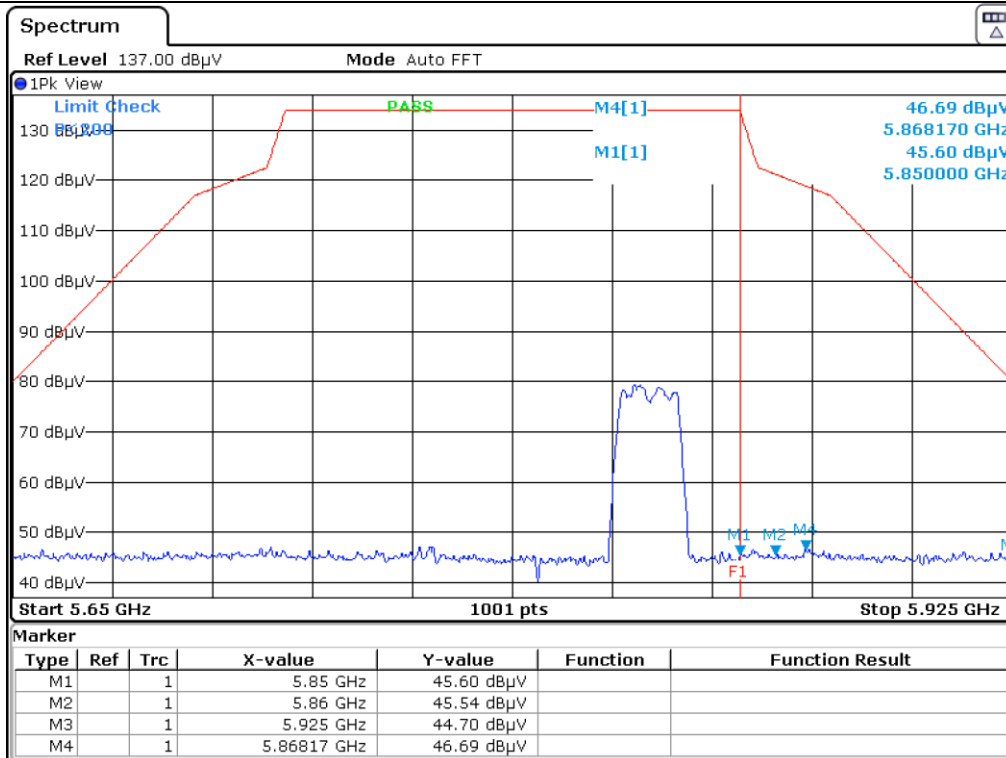


Low Channel\_Vertical\_Peak





High Channel\_Horizontal\_Peak



High Channel\_Vertical\_Peak

**5.4.4.2 Test Data for 802.11n20**

- Test Date : September 12, 2018 ~ September 21, 2018
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
5 650.00	45.45	Peak	H	32.17	12.09	35.05	54.66	80.00	25.34
5 715.00	46.03	Peak	H	32.17	12.09	35.05	55.24	121.20	65.96
5 718.16	47.29	Peak	H	32.17	12.09	35.05	56.50	122.08	65.58
5 725.00	46.31	Peak	H	32.17	12.09	35.05	55.52	134.00	78.48
5 650.00	45.27	Peak	V	32.17	12.09	35.05	54.48	80.00	25.52
5 715.00	45.66	Peak	V	32.17	12.09	35.05	54.87	121.20	66.33
5 723.93	46.62	Peak	V	32.17	12.09	35.05	55.83	131.56	75.73
5 725.00	46.05	Peak	V	32.17	12.09	35.05	55.26	134.00	78.74

Test Data for High Channel									
5 850.00	45.95	Peak	H	32.17	12.09	34.85	55.36	134.00	78.64
5 860.00	46.13	Peak	H	32.17	12.09	34.85	55.54	121.20	65.66
5 871.46	47.16	Peak	H	32.17	12.09	34.85	56.57	117.99	61.42
5 925.00	46.44	Peak	H	32.17	12.09	34.85	55.85	80.00	24.15
5 850.00	45.79	Peak	V	32.17	12.09	34.85	55.20	134.00	78.80
5 860.00	45.15	Peak	V	32.17	12.09	34.85	54.56	121.20	66.64
5 865.42	46.38	Peak	V	32.17	12.09	34.85	55.79	119.68	63.89
5 925.00	45.04	Peak	V	32.17	12.09	34.85	54.45	80.00	25.55

Tabulated test data for Restricted Band

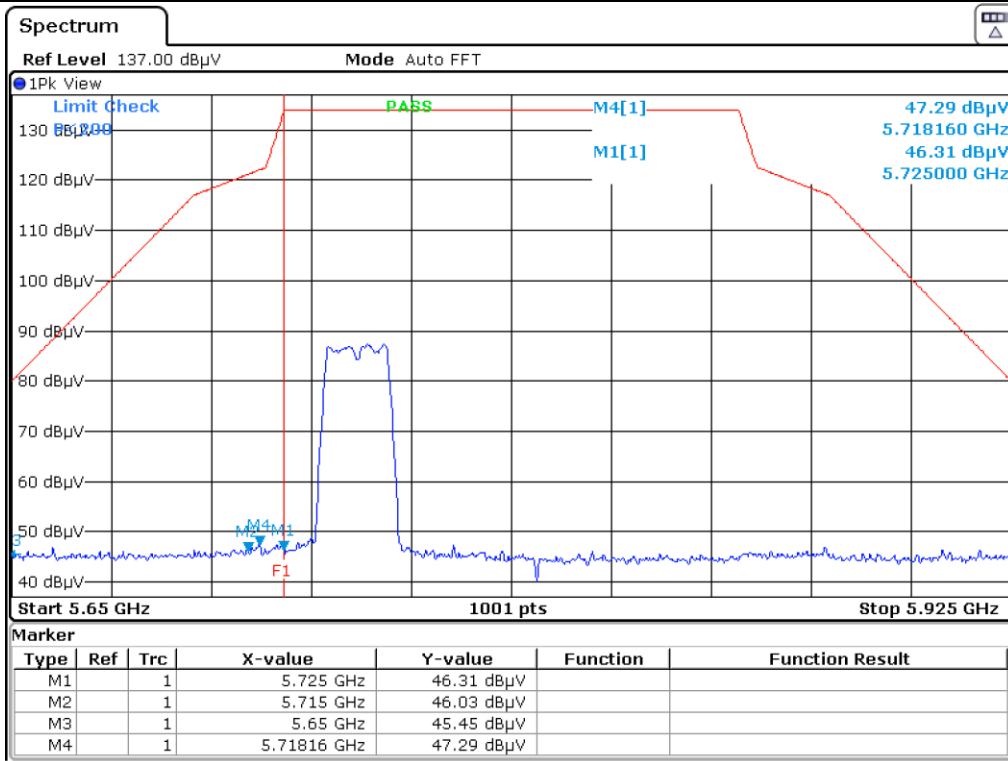
Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

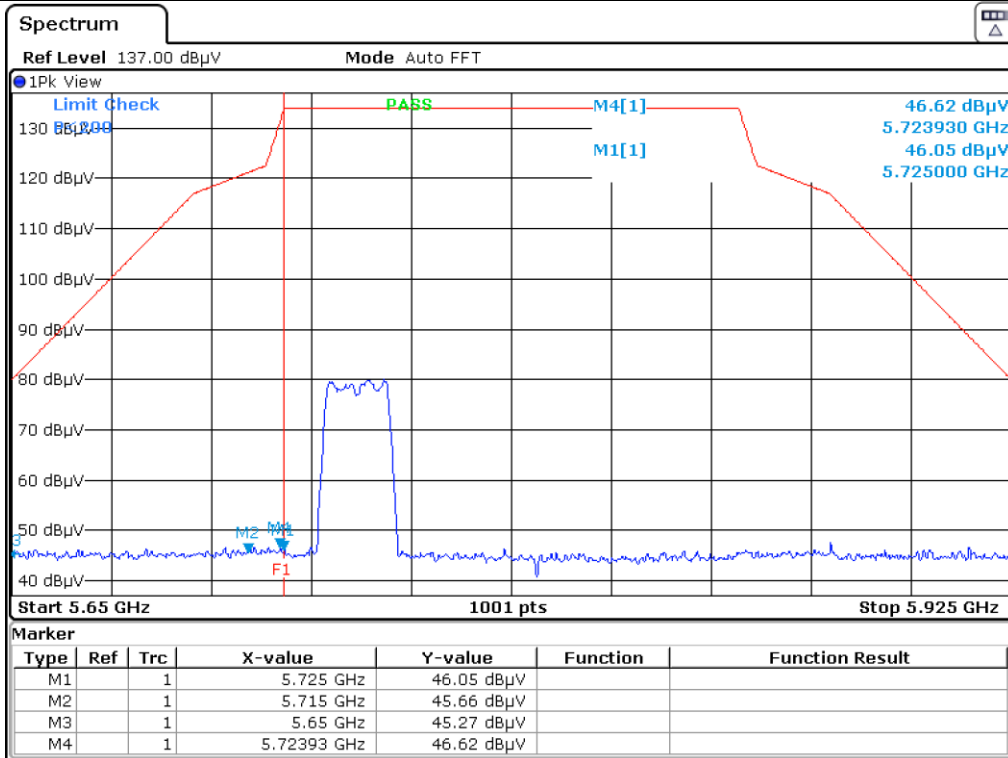
$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



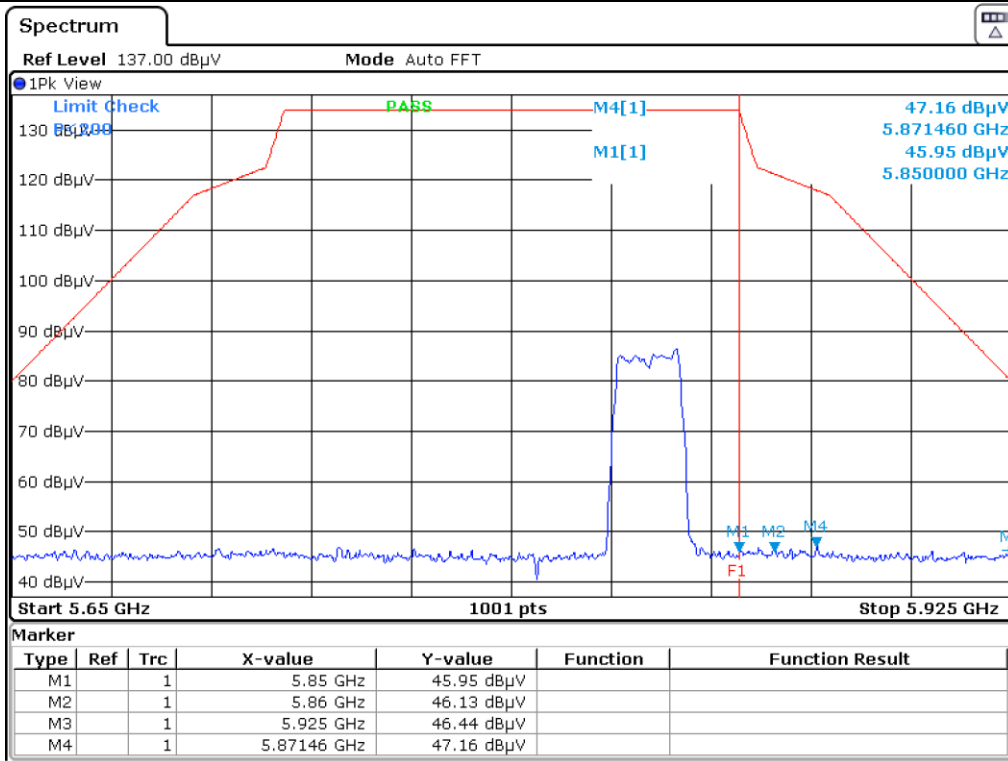
**Tested by: Tae-Ho, Kim / Senior Manager**



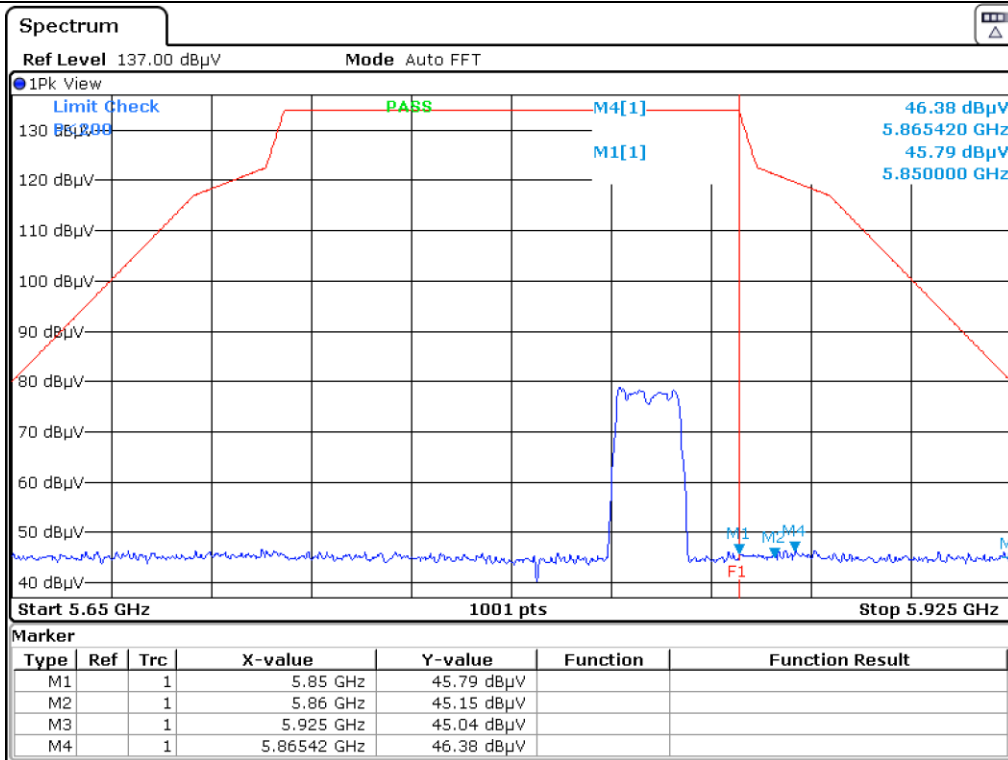
Low Channel\_Horizontal\_Peak



Low Channel\_Vertical\_Peak



High Channel\_Horizontal\_Peak



High Channel\_Vertical\_Peak

**5.4.4.3 Test Data for 802.11n40**

- Test Date : September 12, 2018 ~ September 21, 2018
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
5 650.00	45.50	Peak	H	32.17	12.09	35.05	54.71	80.00	25.29
5 710.75	48.22	Peak	H	32.17	12.09	35.05	57.43	121.01	63.58
5 715.00	46.35	Peak	H	32.17	12.09	35.05	55.56	121.20	65.64
5 725.00	46.93	Peak	H	32.17	12.09	35.05	56.14	134.00	77.86
5 650.00	44.81	Peak	V	32.17	12.09	35.05	54.02	80.00	25.98
5 688.49	46.23	Peak	V	32.17	12.09	35.05	55.44	108.48	53.04
5 715.00	45.37	Peak	V	32.17	12.09	35.05	54.58	121.20	66.62
5 725.00	45.44	Peak	V	32.17	12.09	35.05	54.65	134.00	79.35

Test Data for High Channel									
5 850.00	45.80	Peak	H	32.17	12.09	34.85	55.21	134.00	78.79
5 853.88	46.52	Peak	H	32.17	12.09	34.85	55.93	125.15	69.22
5 860.00	44.82	Peak	H	32.17	12.09	34.85	54.23	121.20	66.97
5 925.00	45.02	Peak	H	32.17	12.09	34.85	54.43	80.00	25.57
5 850.00	45.64	Peak	V	32.17	12.09	34.85	55.05	134.00	78.95
5 860.00	44.88	Peak	V	32.17	12.09	34.85	54.29	121.20	66.91
5 874.21	46.51	Peak	V	32.17	12.09	34.85	55.92	117.22	61.30
5 925.00	45.43	Peak	V	32.17	12.09	34.85	54.84	80.00	25.16

Tabulated test data for Restricted Band

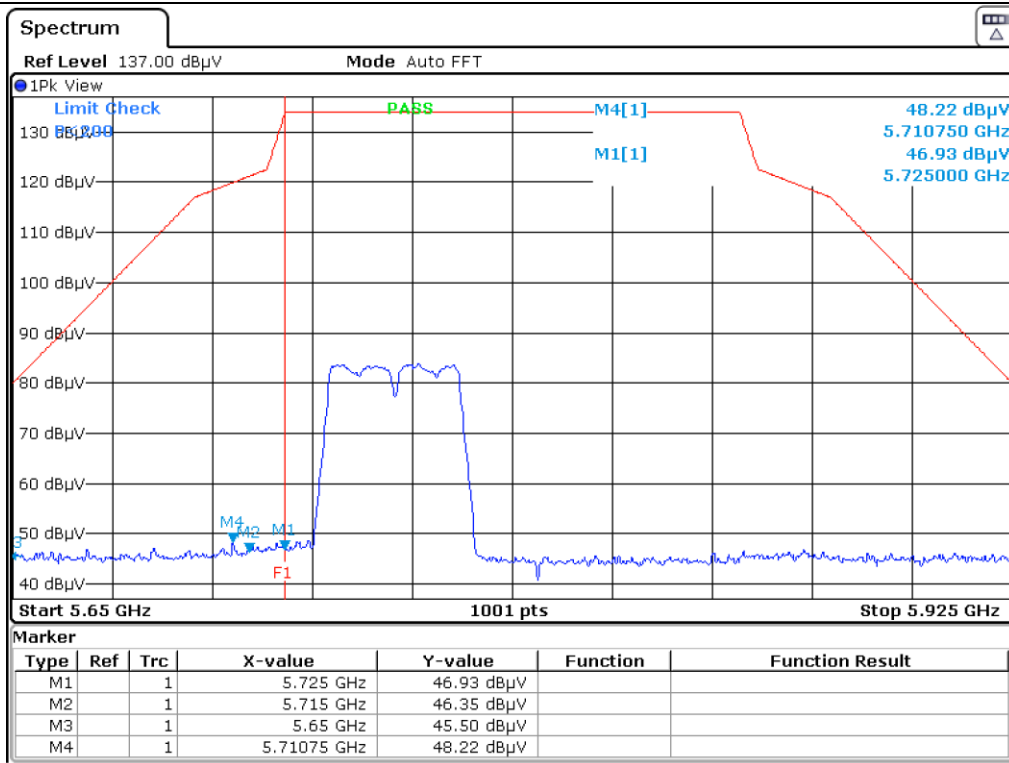
Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

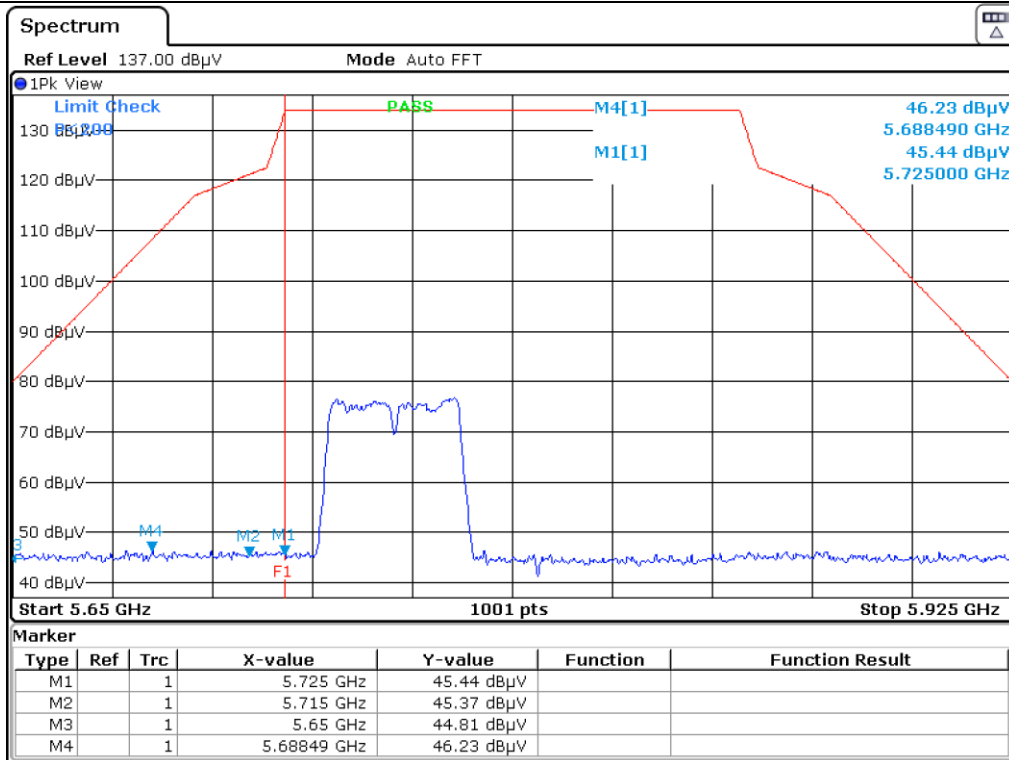
$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



**Tested by: Tae-Ho, Kim / Senior Manager**

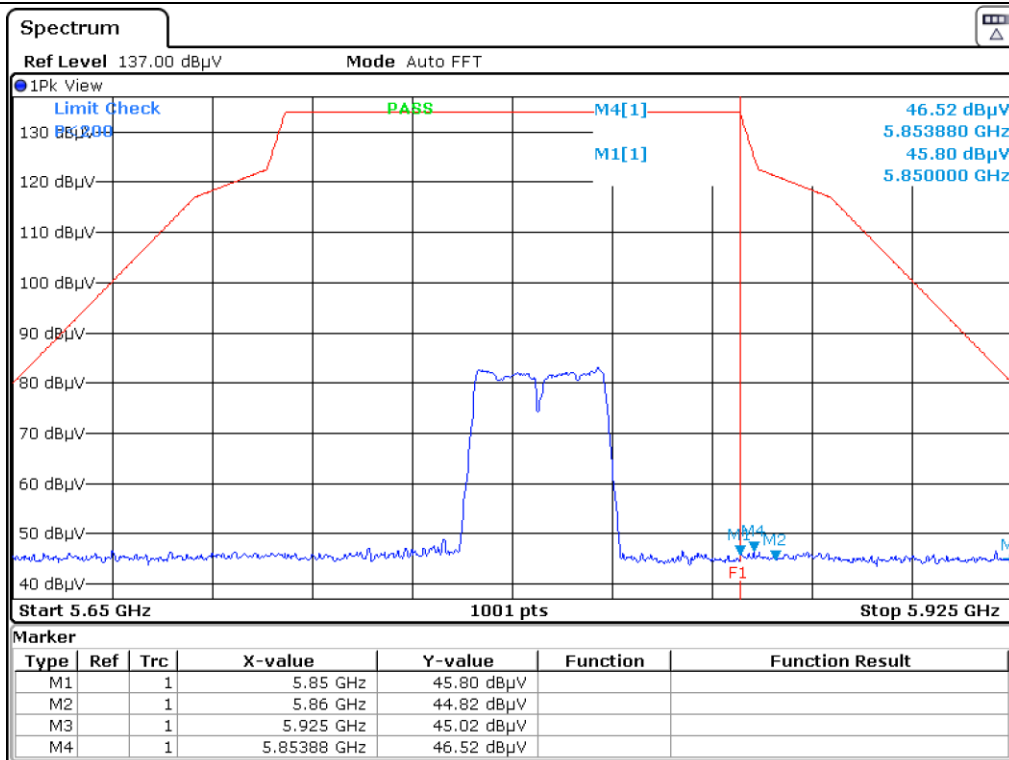


Low Channel\_Horizontal\_Peak

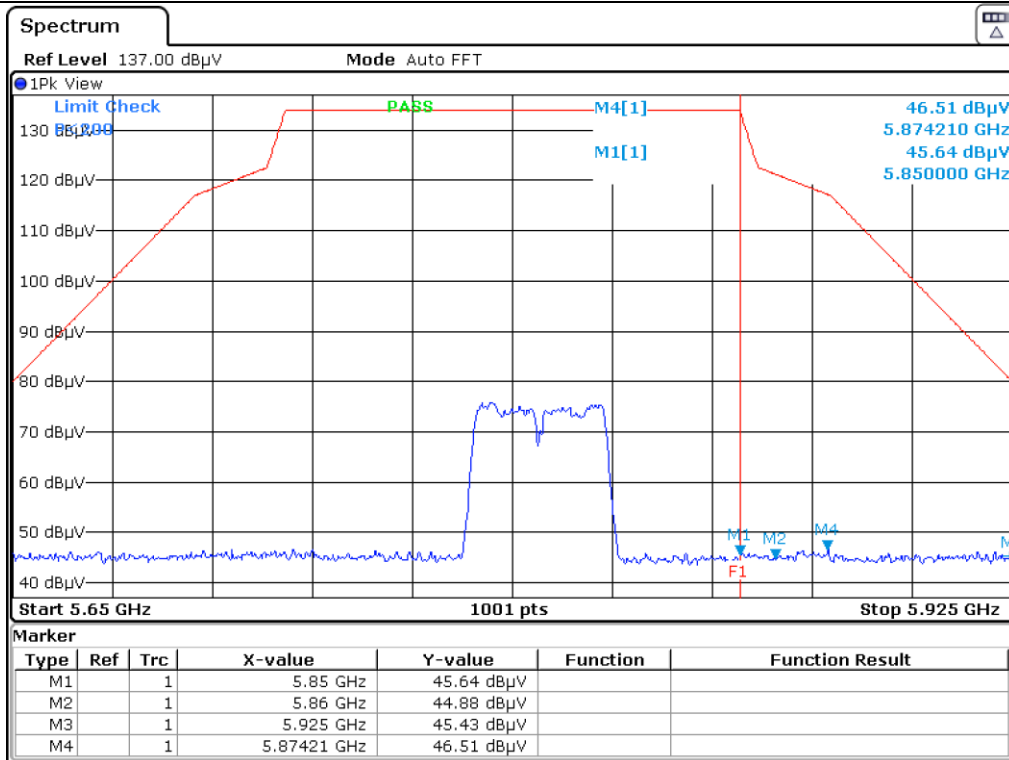


Low Channel\_Vertical\_Peak





High Channel\_Horizontal\_Peak



High Channel\_Vertical\_Peak

**5.4.5 Spurious & Harmonic Radiated Emission (U-NII 1)**

**5.4.5.1 Test Data for 802.11a**

- Test Date : September 12, 2018 ~ September 21, 2018
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,  
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band  
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 30 kHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
15 540.00	32.48	Peak	H	39.66	13.88	31.54	54.48	74.00	19.52
15 540.00	27.92	Avg	H	39.66	13.88	31.54	49.92	54.00	4.08
15 540.00	32.41	Peak	V	39.66	13.88	31.54	54.41	74.00	19.59
15 540.00	27.88	Avg	V	39.66	13.88	31.54	49.88	54.00	4.12
<b>Test Data for Middle Channel</b>									
15 600.00	33.32	Peak	H	39.84	14.24	31.52	55.88	74.00	18.12
15 600.00	28.10	Avg	H	39.84	14.24	31.52	50.66	54.00	3.34
15 600.00	32.27	Peak	V	39.84	14.24	31.52	54.83	74.00	19.17
15 600.00	28.11	Avg	V	39.84	14.24	31.52	50.67	54.00	3.33

Test Data for High Channel									
15 720.00	32.48	Peak	H	40.02	14.59	31.46	55.63	74.00	18.37
15 720.00	28.03	Avg	H	40.02	14.59	31.46	51.18	54.00	2.82
15 720.00	31.74	Peak	V	40.02	14.59	31.46	54.89	74.00	19.11
15 720.00	27.86	Avg	V	40.02	14.59	31.46	51.01	54.00	2.99

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$

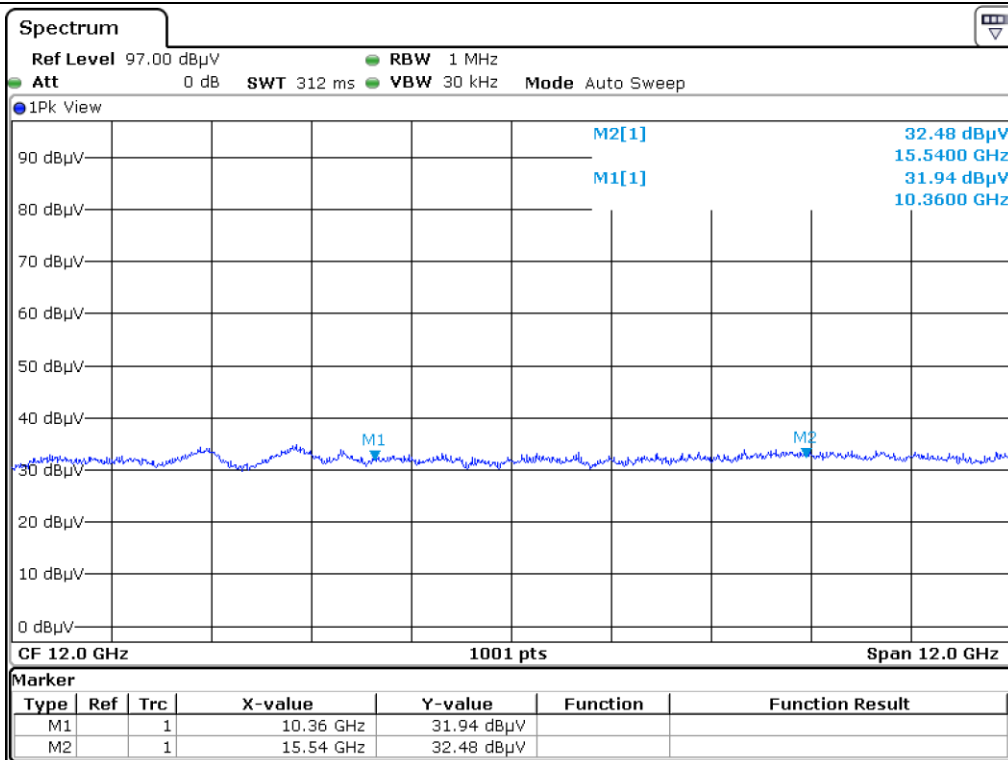
Remark: Emission was pre-scanned from 26.5 GHz ~ 40 GHz; No emissions were detected which was at least 20 dB

Below the specification limit (consider distance correction factor)

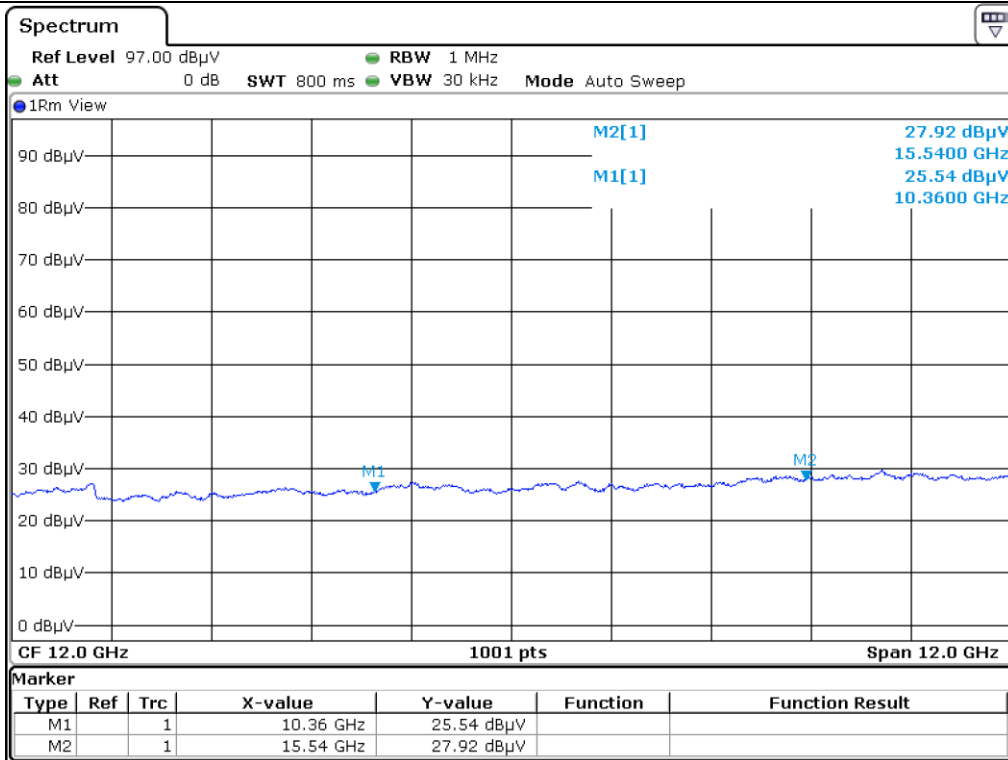
Per FCC part 15.31(o), test results were not reported.



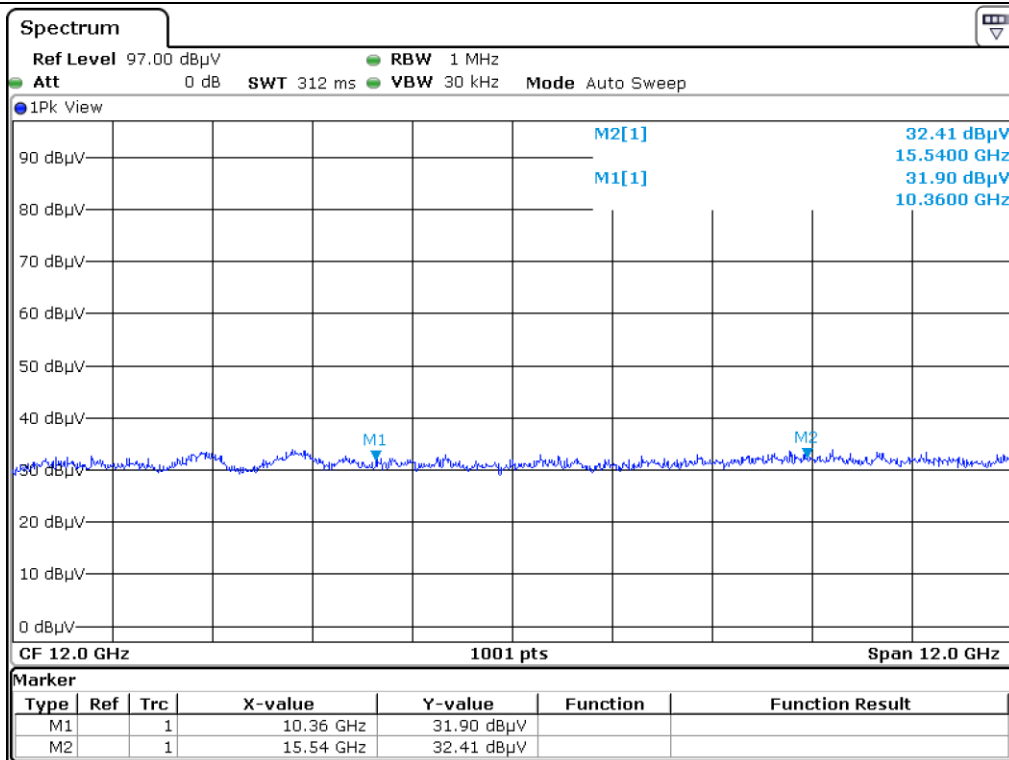
Tested by: **Tae-Ho, Kim / Senior Manager**



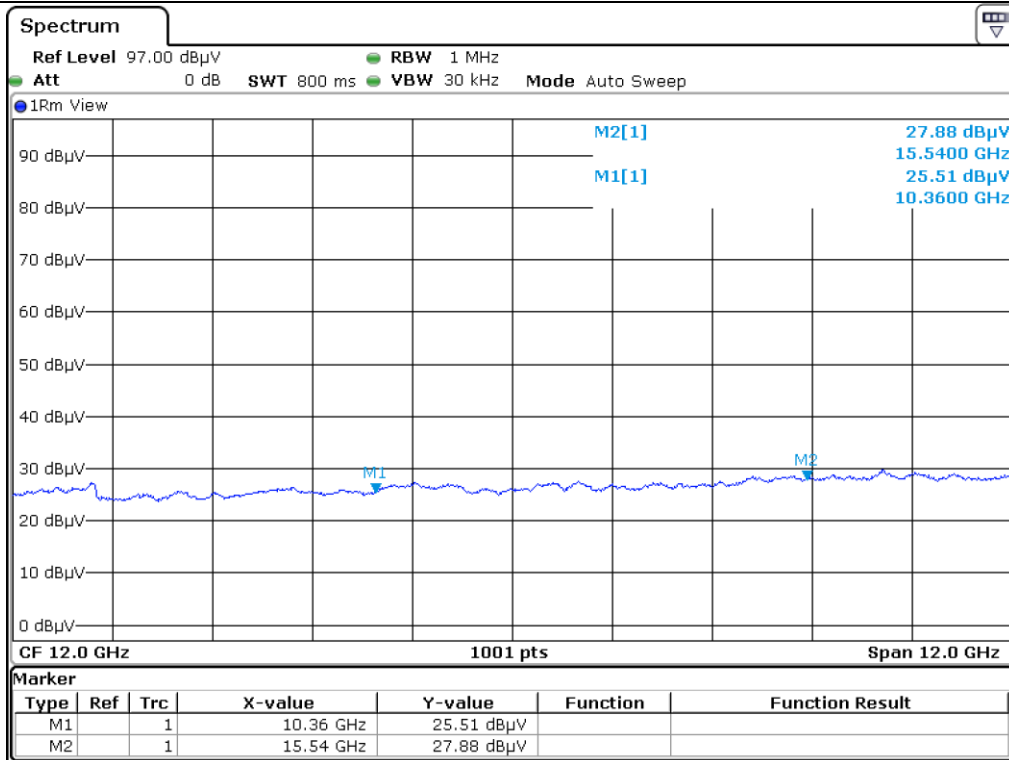
Low Channel\_Horizontal\_Peak



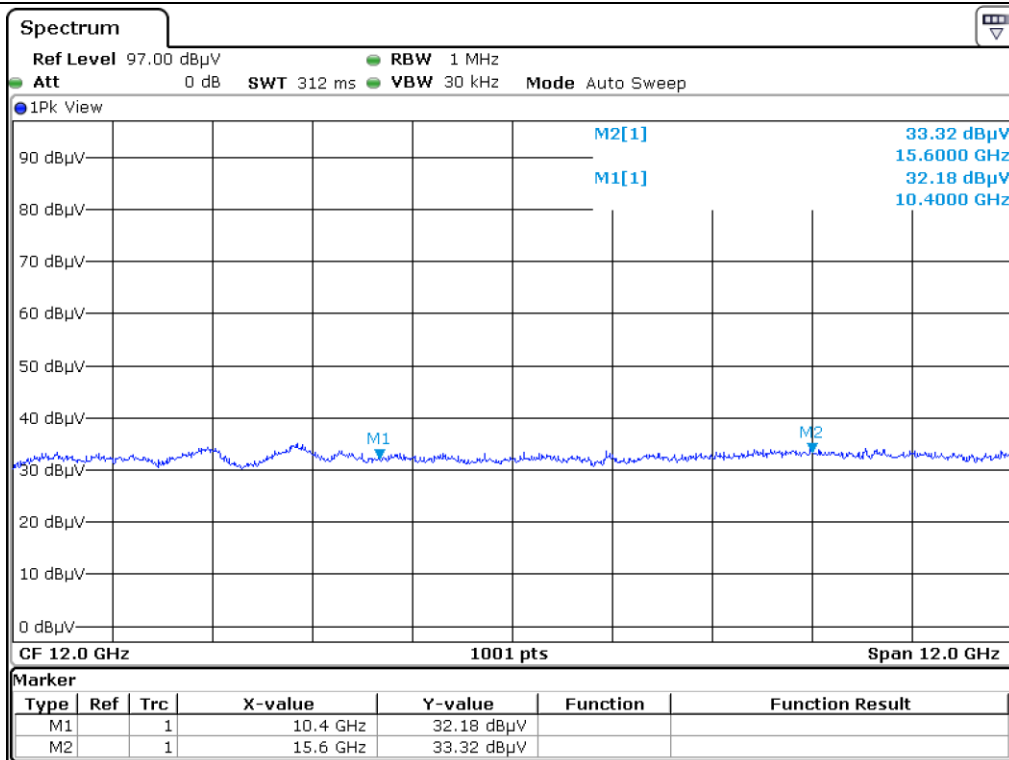
Low Channel\_Horizontal\_Average



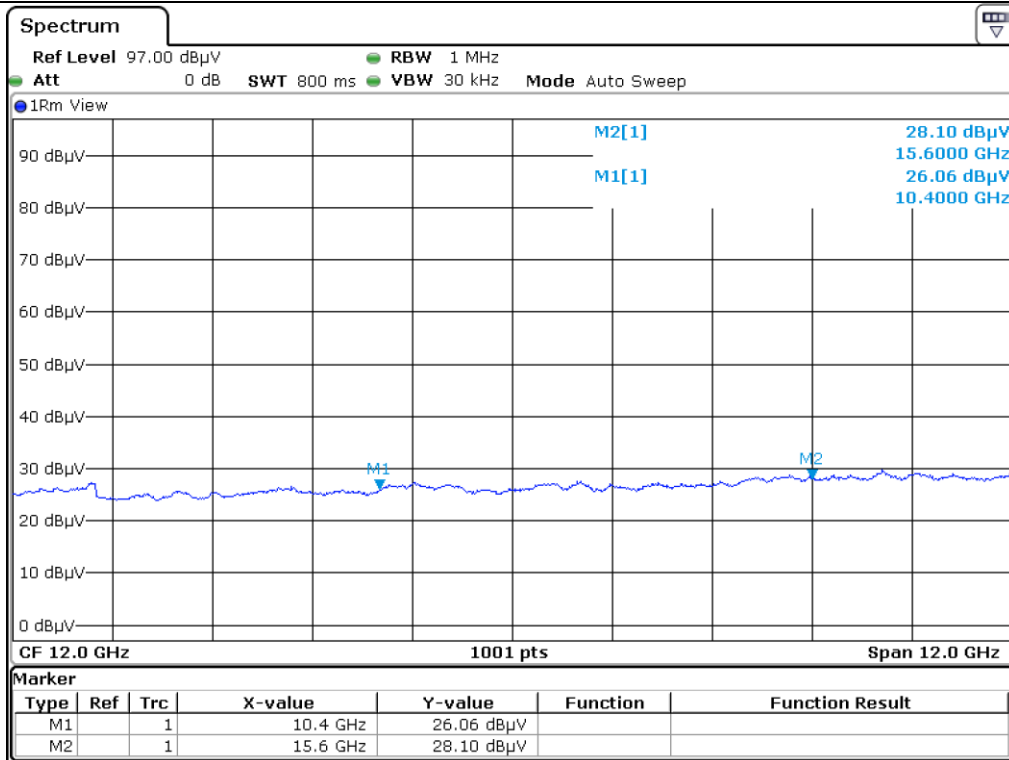
Low Channel\_Vertical\_Peak



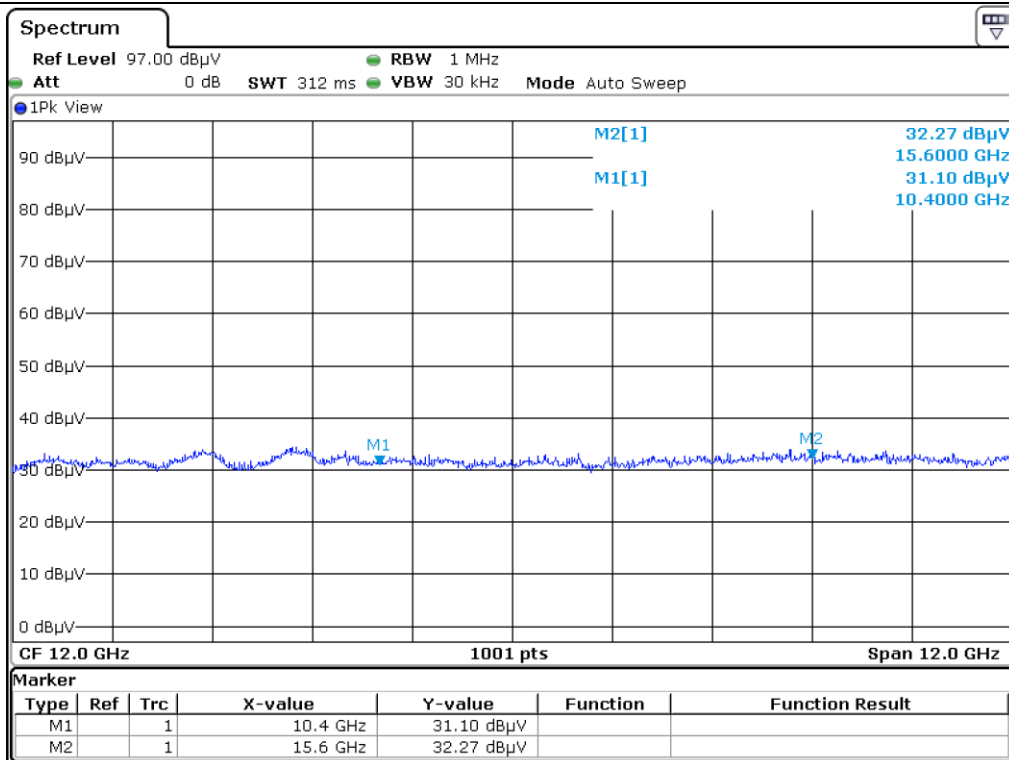
Low Channel\_Vertical\_Average



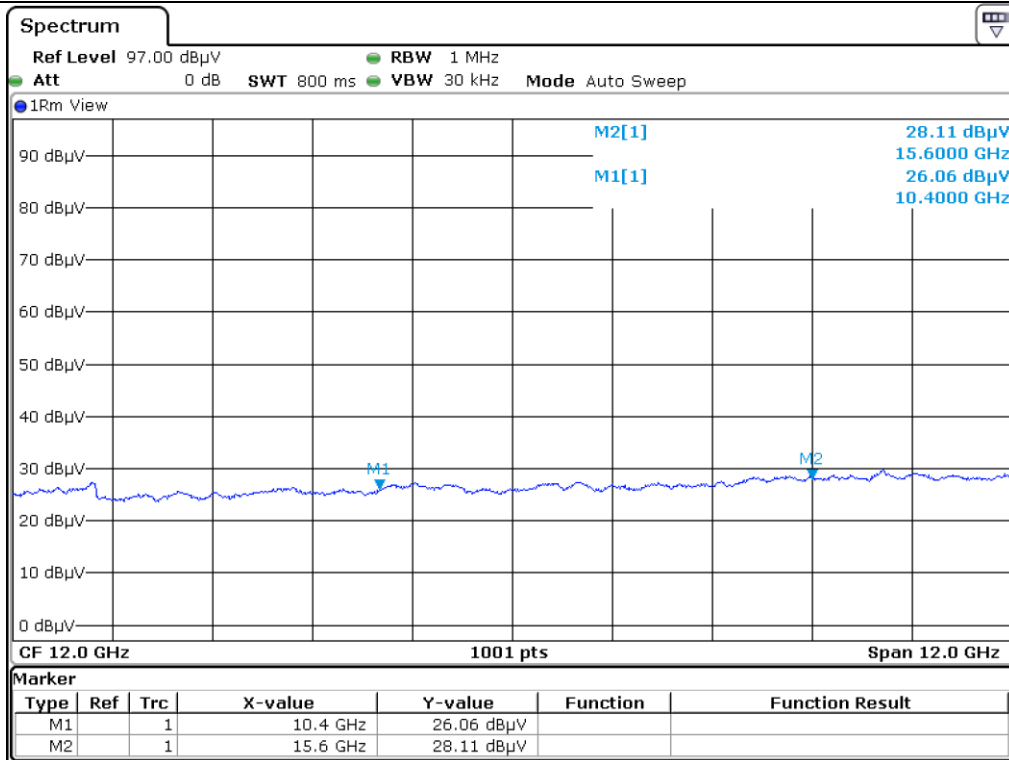
Middle Channel\_Horizontal\_Peak



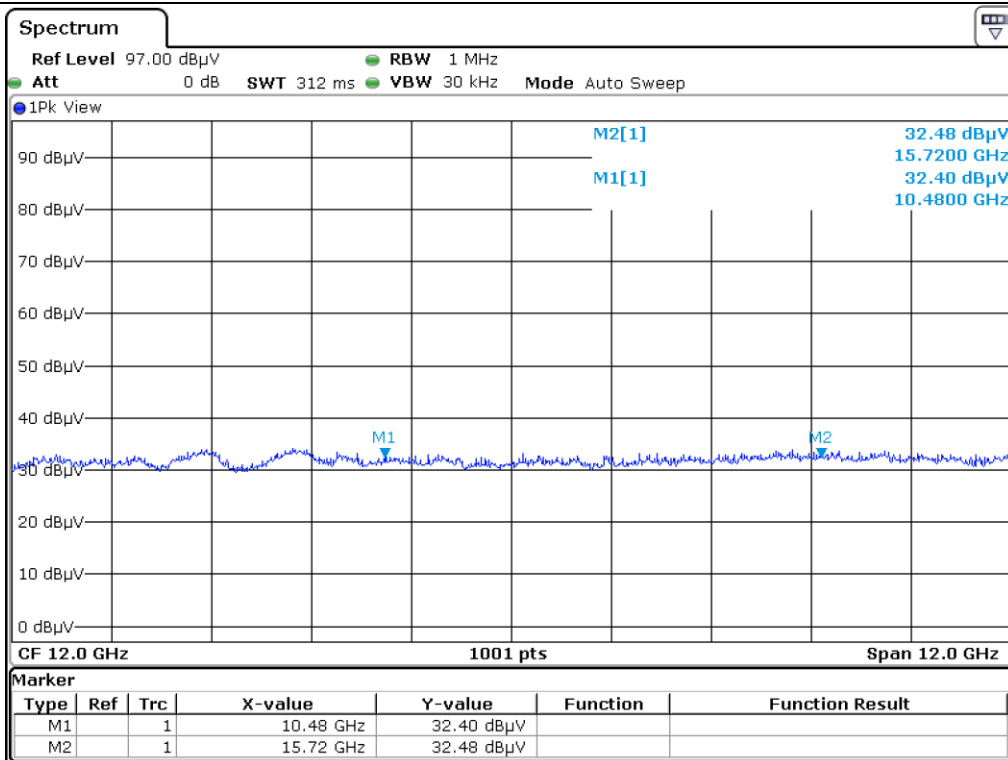
Middle Channel\_Horizontal\_Average



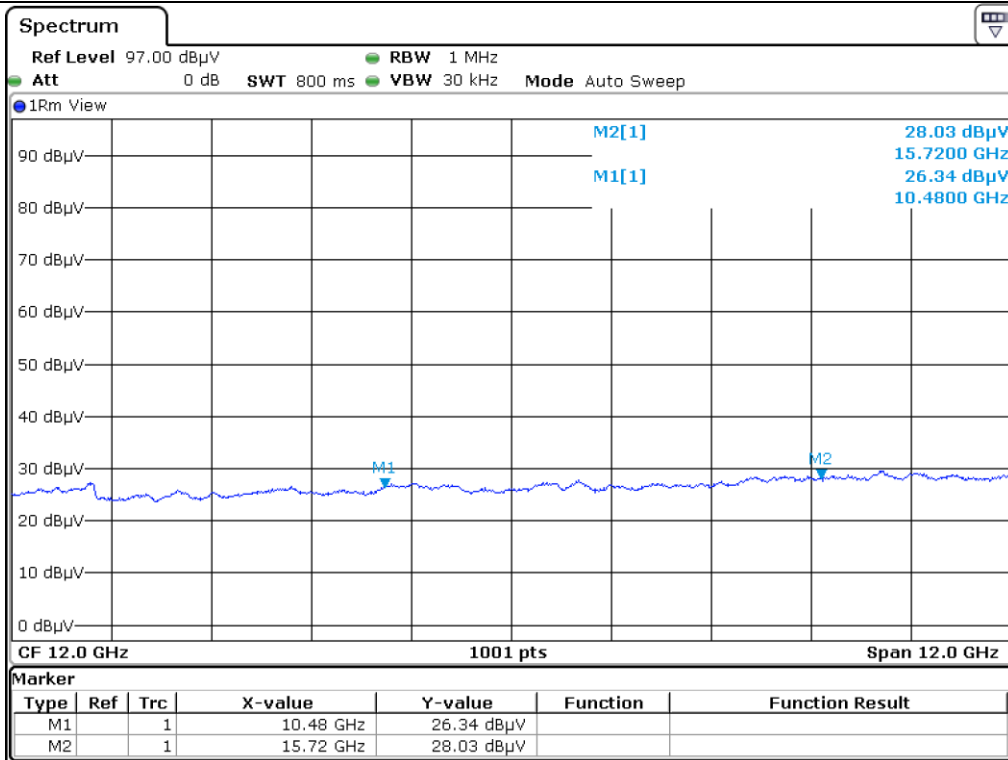
Middle Channel\_Vertical\_Peak



Middle Channel\_Vertical\_Average

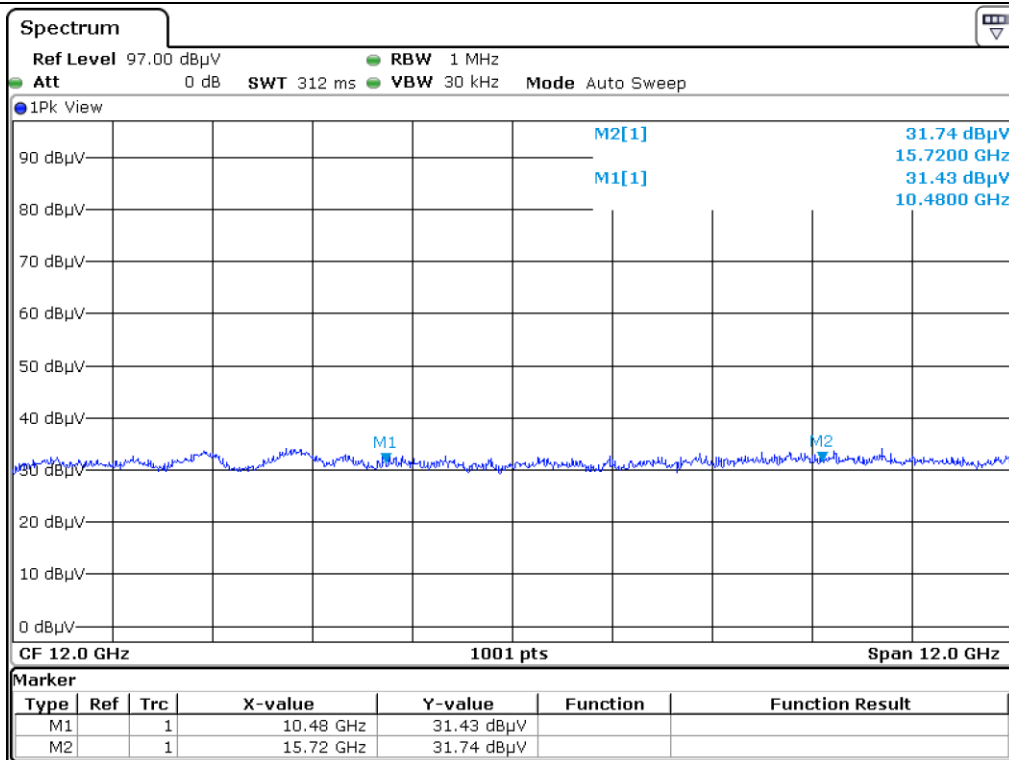


High Channel\_Horizontal\_Peak

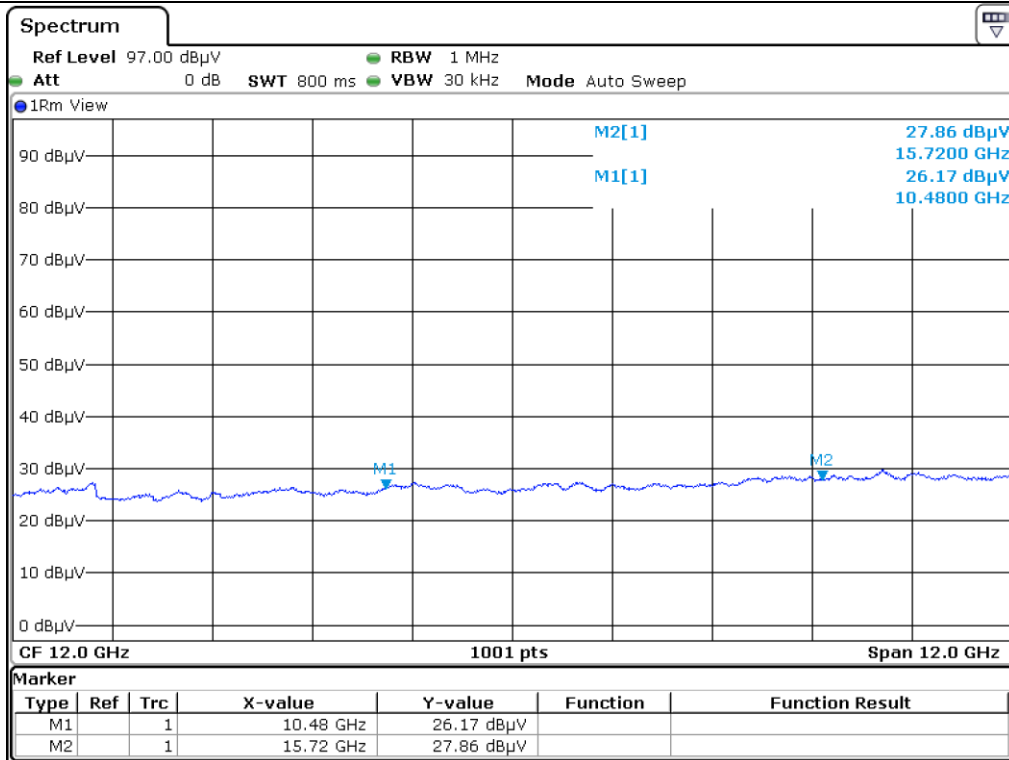


High Channel\_Horizontal\_Average





High Channel\_Vertical\_Peak



High Channel\_Vertical\_Average

**5.4.5.2 Test Data for 802.11n20**

- Test Date : September 12, 2018 ~ September 21, 2018
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,  
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band  
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 30 kHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dB $\mu$ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
15 540.00	33.57	Peak	H	39.66	13.88	31.54	55.57	74.00	18.43
15 540.00	28.22	Avg	H	39.66	13.88	31.54	50.22	54.00	3.78
15 540.00	33.02	Peak	V	39.66	13.88	31.54	55.02	74.00	18.98
15 540.00	28.08	Avg	V	39.66	13.88	31.54	50.08	54.00	3.92
<b>Test Data for Middle Channel</b>									
15 600.00	33.28	Peak	H	39.84	14.24	31.52	55.84	74.00	18.16
15 600.00	28.30	Avg	H	39.84	14.24	31.52	50.86	54.00	3.14
15 600.00	33.59	Peak	V	39.84	14.24	31.52	56.15	74.00	17.85
15 600.00	28.26	Avg	V	39.84	14.24	31.52	50.82	54.00	3.18

Test Data for High Channel									
15 720.00	40.44	Peak	H	40.02	14.59	31.46	63.59	74.00	10.41
15 720.00	28.04	Avg	H	40.02	14.59	31.46	51.19	54.00	2.81
15 720.00	40.20	Peak	V	40.02	14.59	31.46	63.35	74.00	10.65
15 720.00	28.03	Avg	V	40.02	14.59	31.46	51.18	54.00	2.82

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$

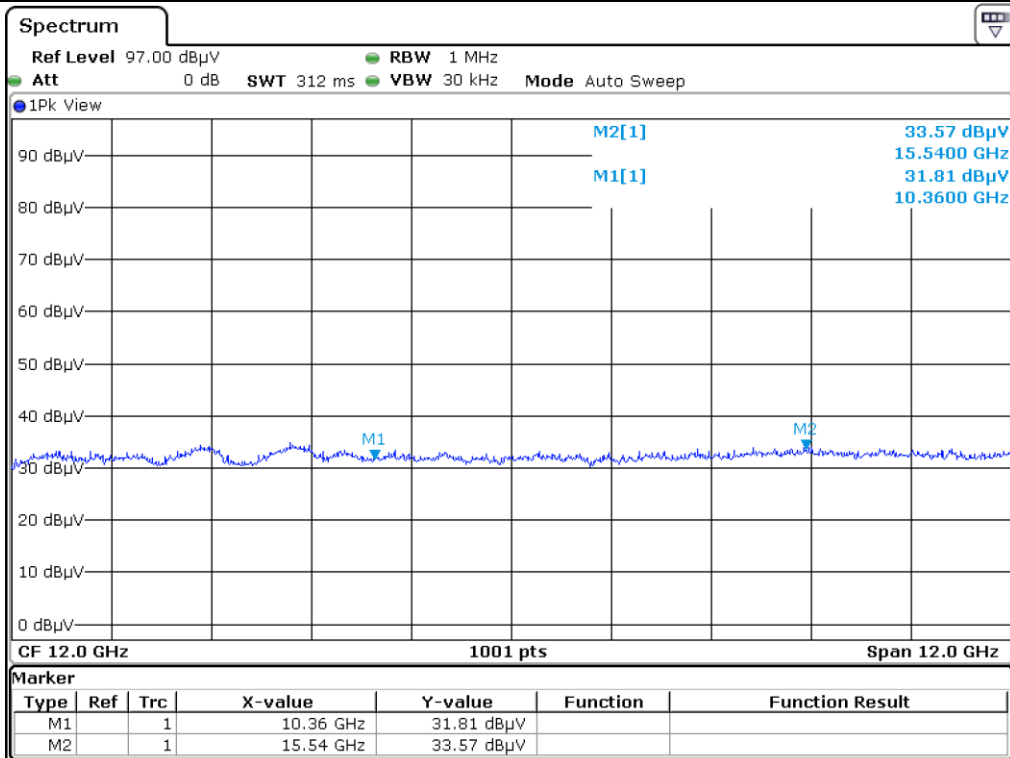
Remark: Emission was pre-scanned from 26.5 GHz ~ 40 GHz; No emissions were detected which was at least 20 dB

Below the specification limit (consider distance correction factor)

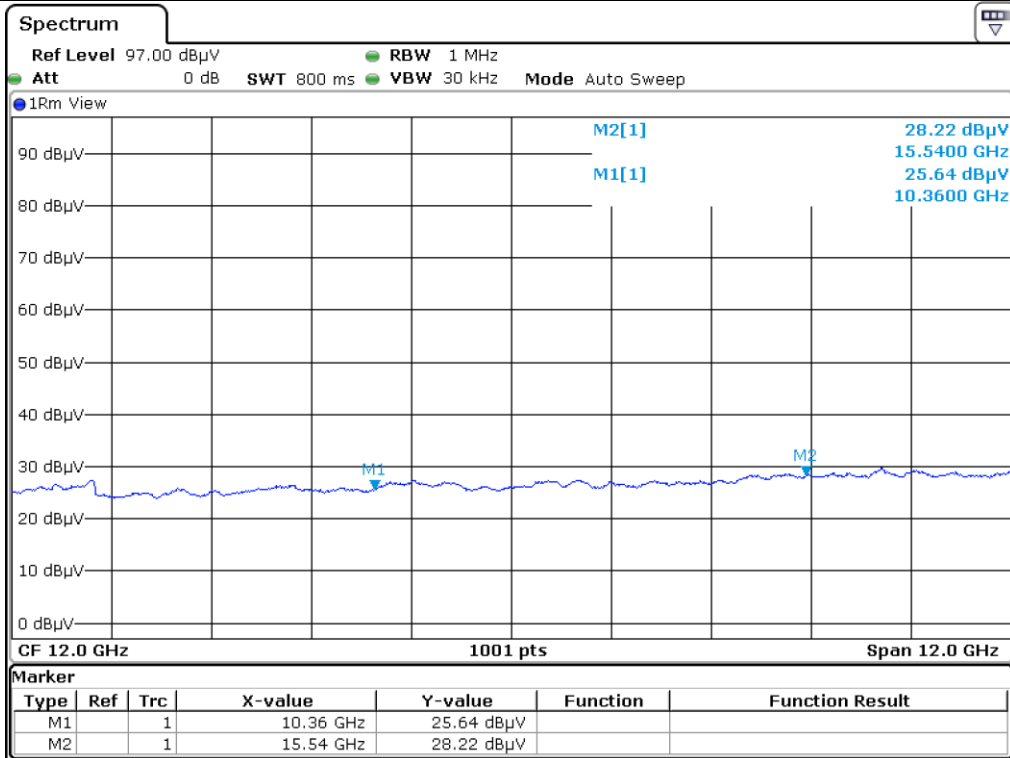
Per FCC part 15.31(o), test results were not reported.



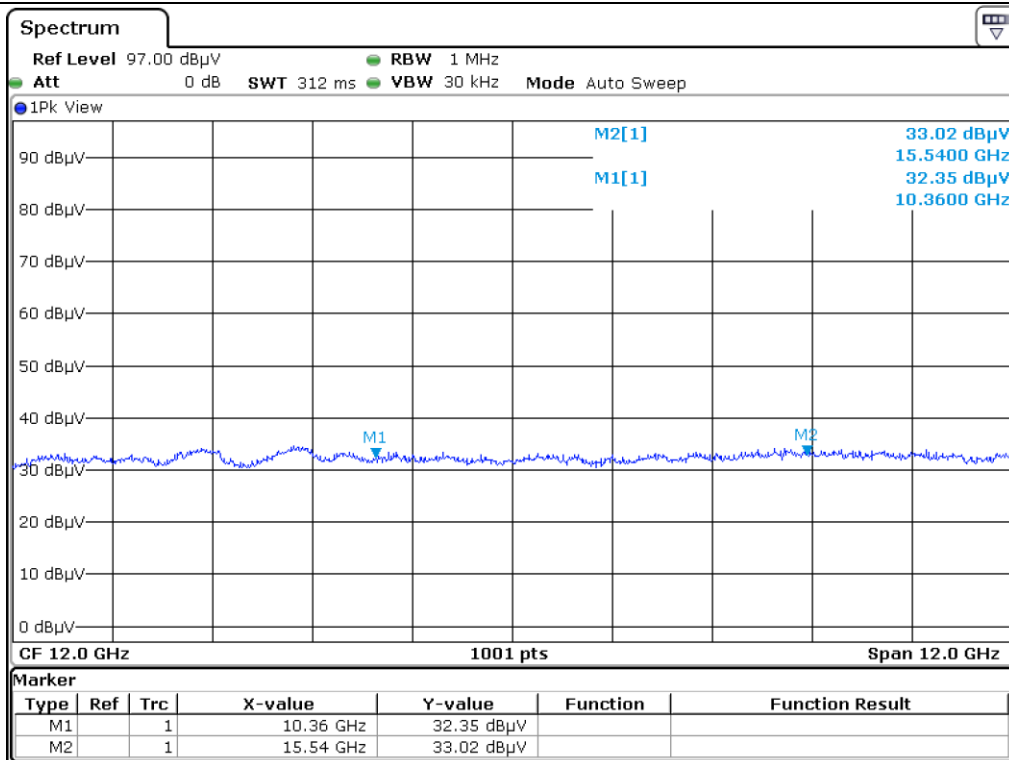
Tested by: **Tae-Ho, Kim / Senior Manager**



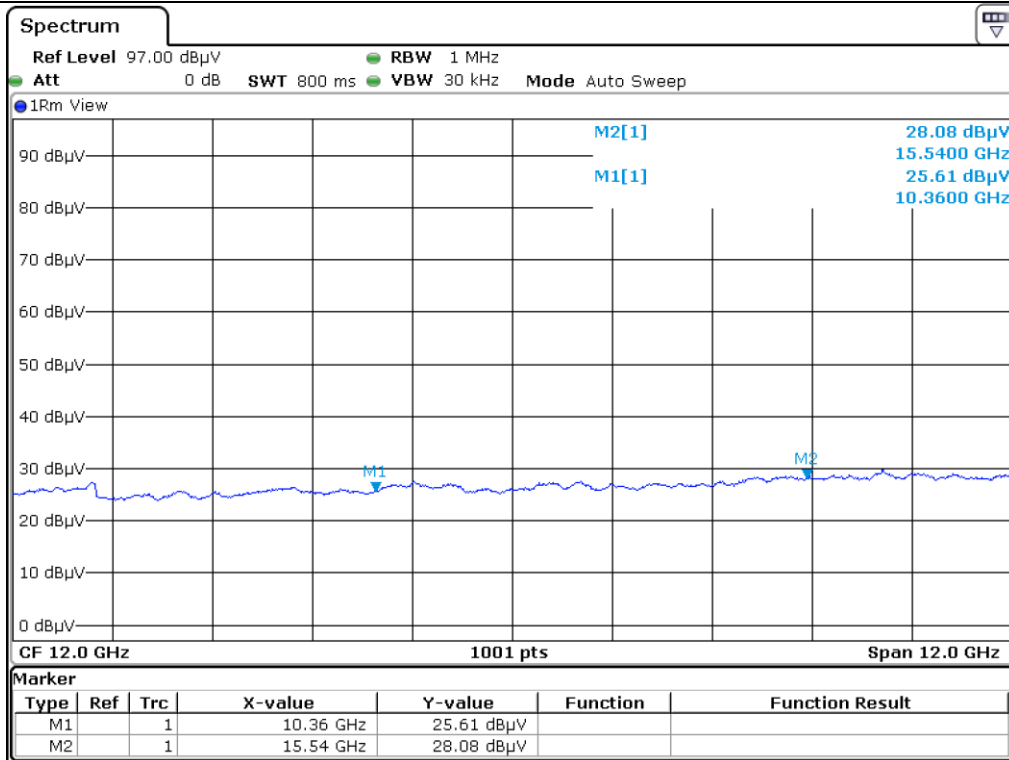
Low Channel\_Horizontal\_Peak



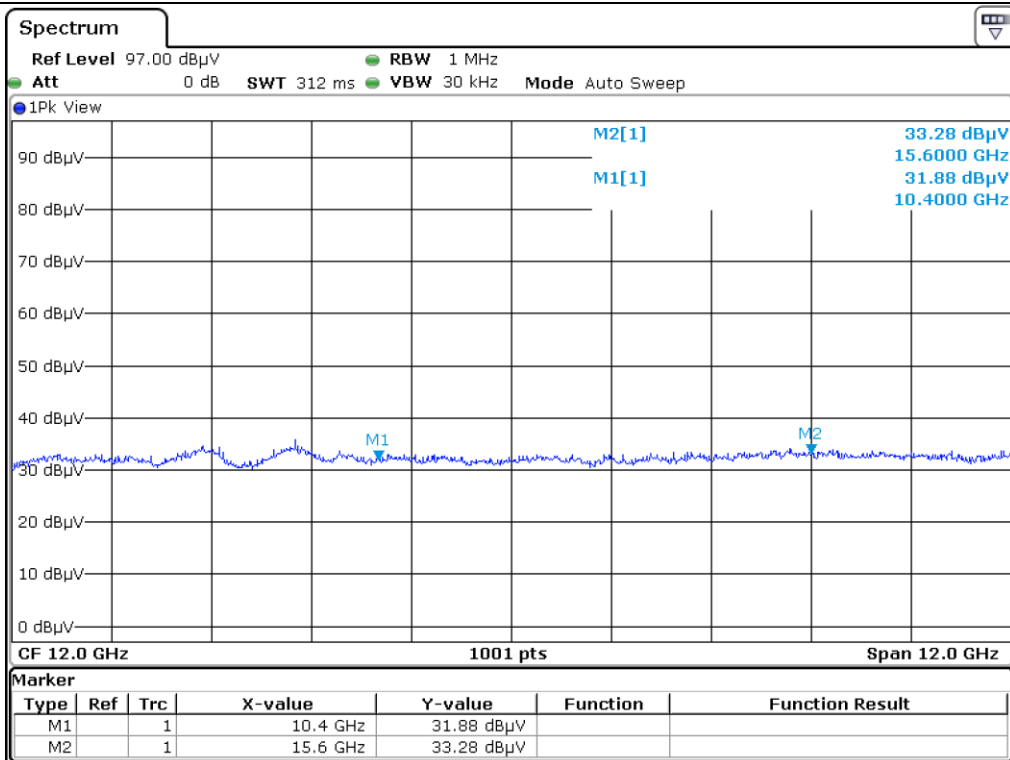
Low Channel\_Horizontal\_Average



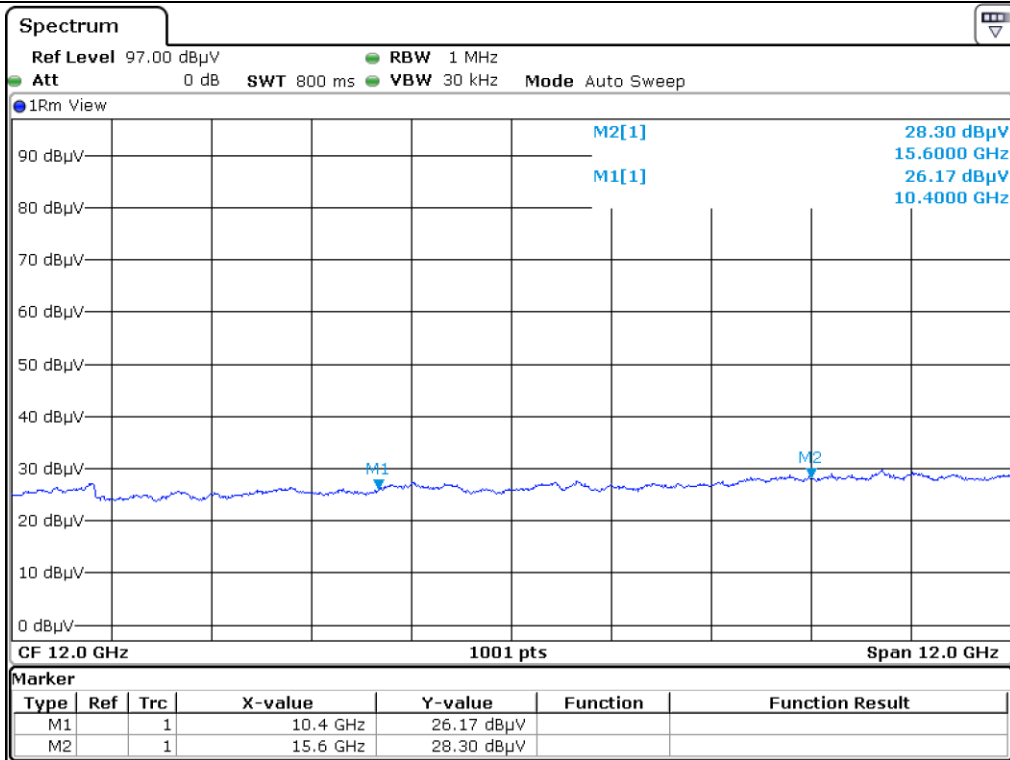
Low Channel\_Vertical\_Peak



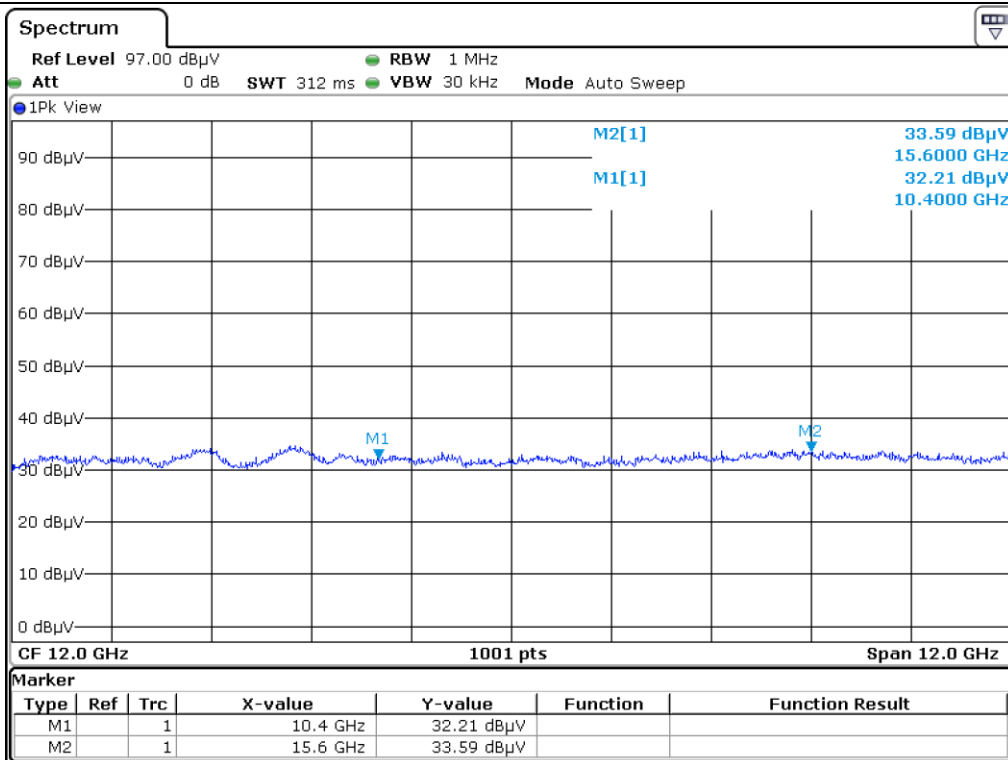
Low Channel\_Vertical\_Average



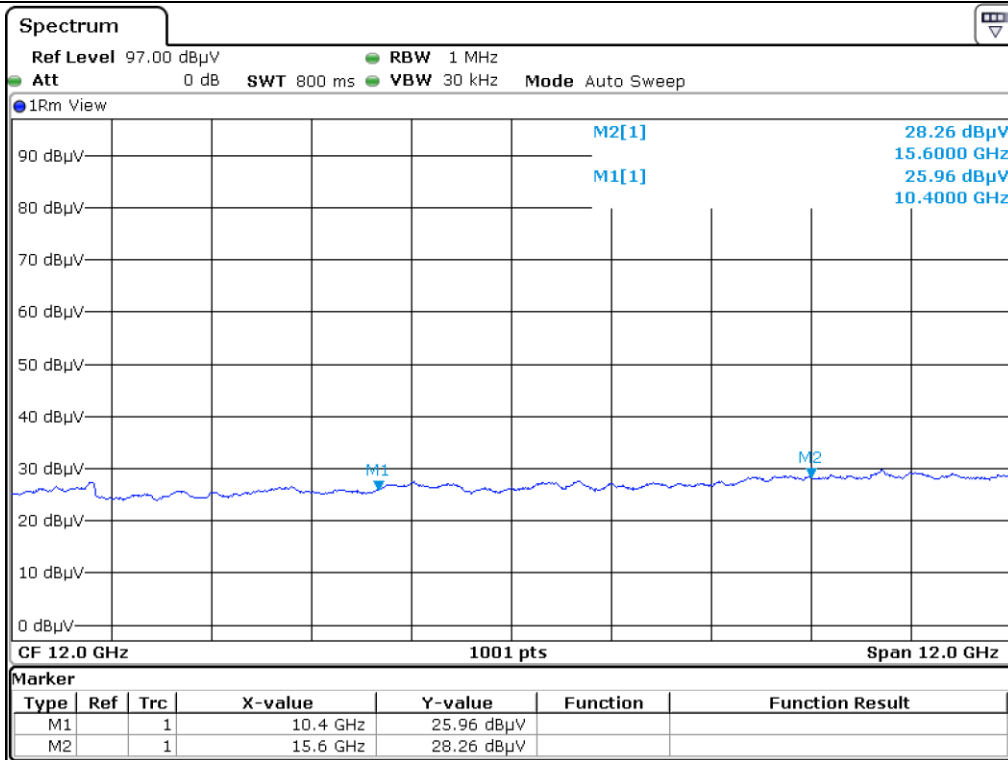
Middle Channel\_Horizontal\_Peak



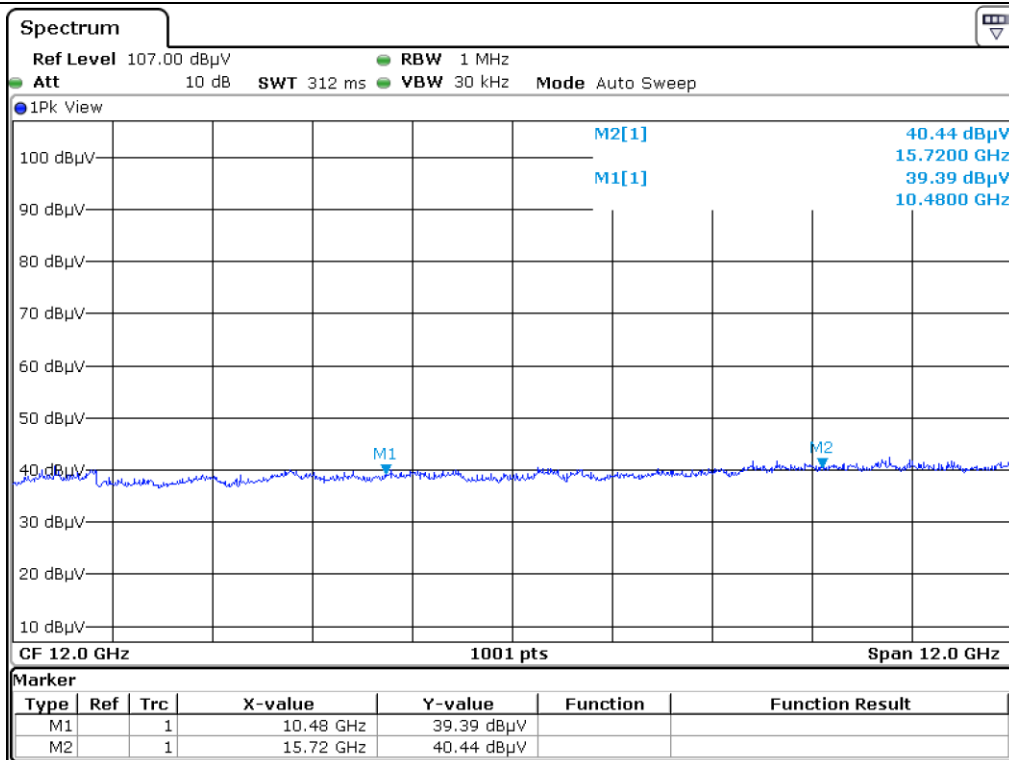
Middle Channel\_Horizontal\_Average



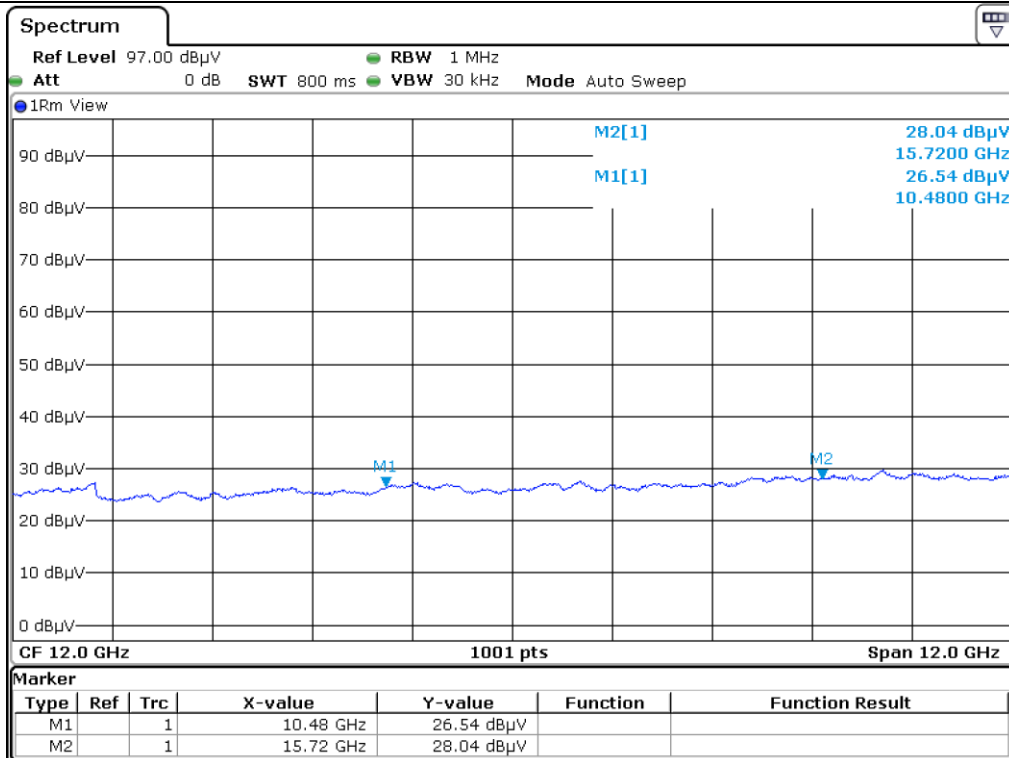
Middle Channel\_Vertical\_Peak



Middle Channel\_Vertical\_Average

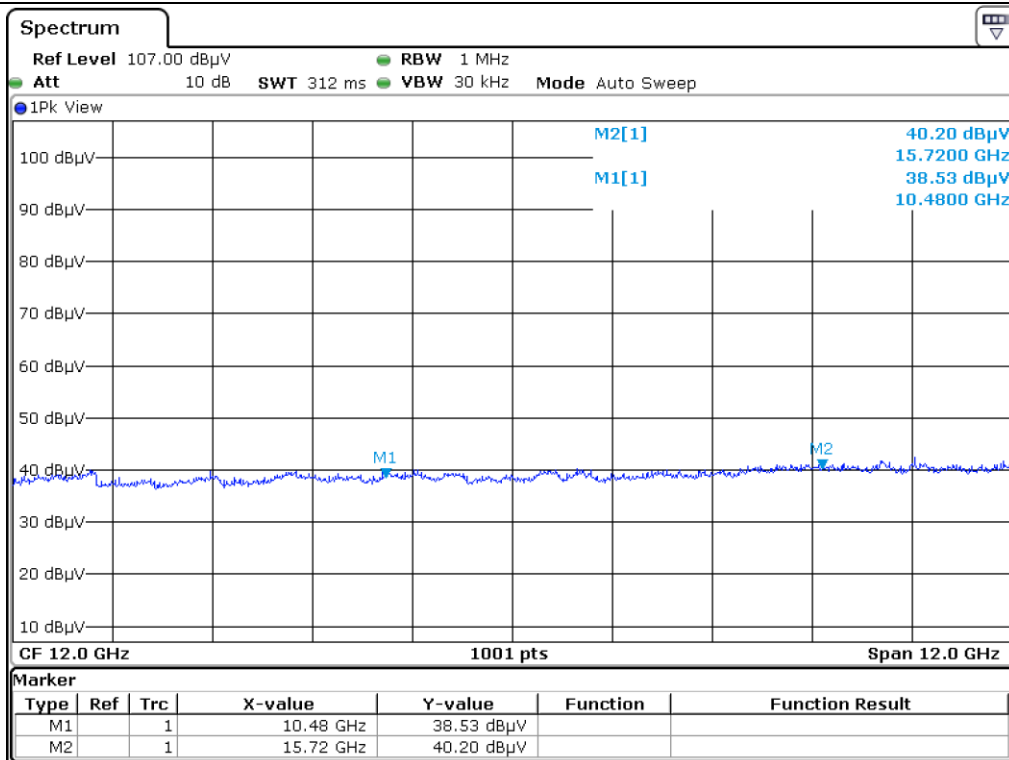


High Channel\_Horizontal\_Peak

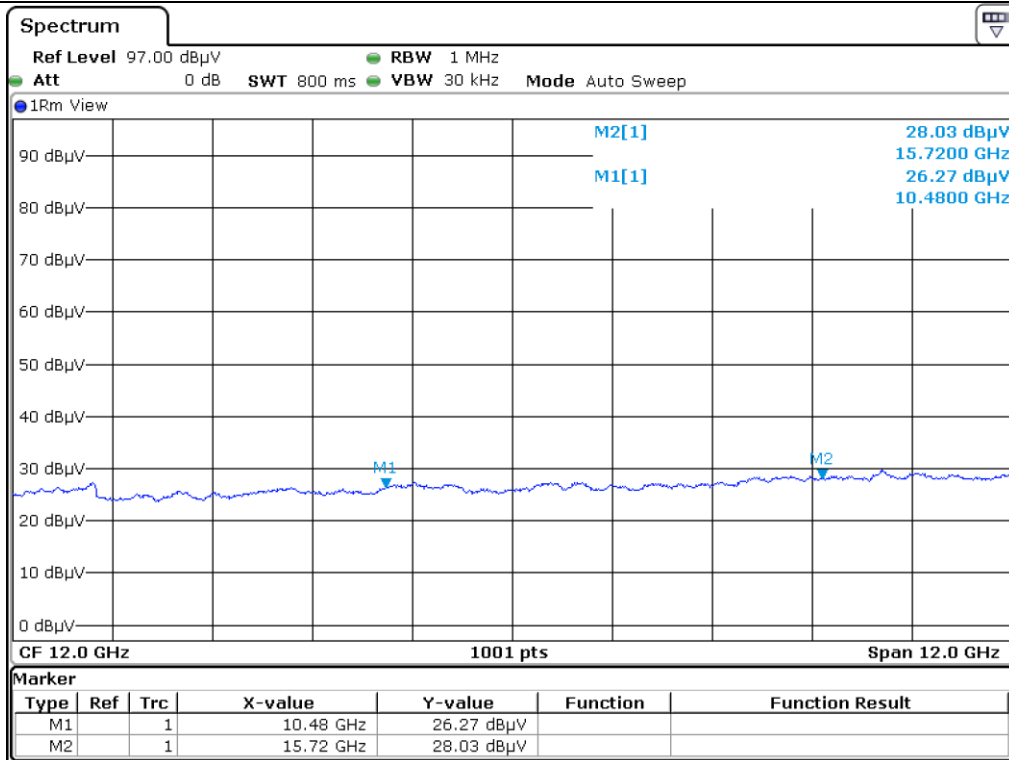


High Channel\_Horizontal\_Average





High Channel\_Vertical\_Peak



High Channel\_Vertical\_Average