


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

**Test Report No.** : OT-198-RWD-034  
**AGR No.** : A198A-112  
**Applicant** : BLUECOM Co., Ltd.  
**Address** : 116, Venture-ro, Yeonsu-gu, Incheon, 22013, South Korea  
**Manufacturer** : BLUECOM VINA CO., Ltd  
**Address** : C5-4 area, Trang Due, Hai Phong IZ, An Duong Dist, Hai Phong City, Vietnam  
**Type of Equipment** : Bluetooth Headset  
**FCC ID.** : U3WBCS150  
**Model Name** : BCS-150  
**Serial number** : N/A  
**Total page of Report** : 98 pages (including this page)  
**Date of Incoming** : August 06, 2019  
**Date of issue** : August 14, 2019

## SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART C Section 15.247*  
 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:   
 \_\_\_\_\_  
 Tae-Ho, Kim / Senior Manager  
 ONETECH Corp.

Approved by:   
 \_\_\_\_\_  
 Ki-Hong, Nam / Chief Engineer  
 ONETECH Corp.

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**Revision History**

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-198-RWD-034	August 14, 2019	Initial Release	All

## 1. VERIFICATION OF COMPLIANCE

Applicant : BLUECOM Co., Ltd.  
Address : 116, Venture-ro, Yeonsu-gu, Incheon, 22013, South Korea  
Contact Person : Ki-eok, Park / Principal Engineer  
Telephone No. : +82-32-8100-582  
FCC ID : U3WBCS150  
Model Name : BCS-150  
Brand Name : -  
Serial Number : N/A  
Date : August 14, 2019

EQUIPMENT CLASS	DSS – PART 15 SPREAD SPECTRUM TRANSMITTER
E.U.T. DESCRIPTION	Bluetooth Headset
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 C Section 15.247 558074 D01 15.247 Meas Guidance v05r02
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 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
15.247 (a) (1)	Carrier Frequency Separation	Met the Limit / PASS
15.247 (a) (1) (iii)	Minimum Number of Hopping Channels	Met the Limit / PASS
15.247 (a) (1) (iii)	Average Time of Occupancy	Met the Limit / PASS
15.247 (b) (1)	Maximum Peak Conducted Output Power	Met the Limit / PASS
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (d)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met requirement / 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 C Section 15.247.

### 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 BLUECOM Co., Ltd., Model BCS-150 (referred to as the EUT in this report) is a Bluetooth Headset. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Bluetooth Headset	
Temperature Range	-10 °C ~ 50 °C	
OPERATING FREQUENCY	2 402 MHz ~ 2 480 MHz	
MODULATION TYPE	GFSK for 1Mbps, /4-DQPSK for 2Mbps, 8-DPSK for 3Mbps	
RF OUTPUT POWER	1 Mbps	5.56 dBm
	2 Mbps	6.30 dBm
	3 Mbps	6.38 dBm
ANTENNA TYPE	FPCB Antenna	
ANTENNA GAIN	1.57 dBi	
Number of Channel	79	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	16 MHz	
RATED SUPPLY VOLTAGE	DC 3.70 V	

#### 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	BLUECOM VINA CO., Ltd	BCS-150 MAIN 2L REV1.0	N/A
Power Board	BLUECOM VINA CO., Ltd	BCS-150 SUB	N/A
Battery	N/A	CEL 751224	N/A

### 5.2 Peripheral equipment

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

#### -. Charging mode

Model	Manufacturer	Description	Connected to
BCS-150	BLUECOM VINA CO., Ltd	Bluetooth Headset (EUT)	Adaptor
OR-QC20U	SHENZHEN RUIYU TECHNOLOGY CO., LTD	Adaptor	EUT

#### -. Transmitting Mode

Model	Manufacturer	Description	Connected to
BCS-150	BLUECOM VINA CO., Ltd	Bluetooth Headset (EUT)	Jig Board
UMFT234XD	FTDI Chip	Jig Board	Notebook PC
Pavilion	HP	Notebook PC	Jig Board

### 5.3 Mode of operation during the test

For Bluetooth function testing, software used to control the EUT for staying in continuous transmitting and receiving mode is programmed. The EUT was set at Low Channel (2 402 MHz), Middle Channel (2 441 MHz), and High Channel (2 480 MHz) with each data transfer rate, 1 Mbps, 2 Mbps, and 3 Mbps. 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 “XY” axis, but the worst data was recorded in this test report.

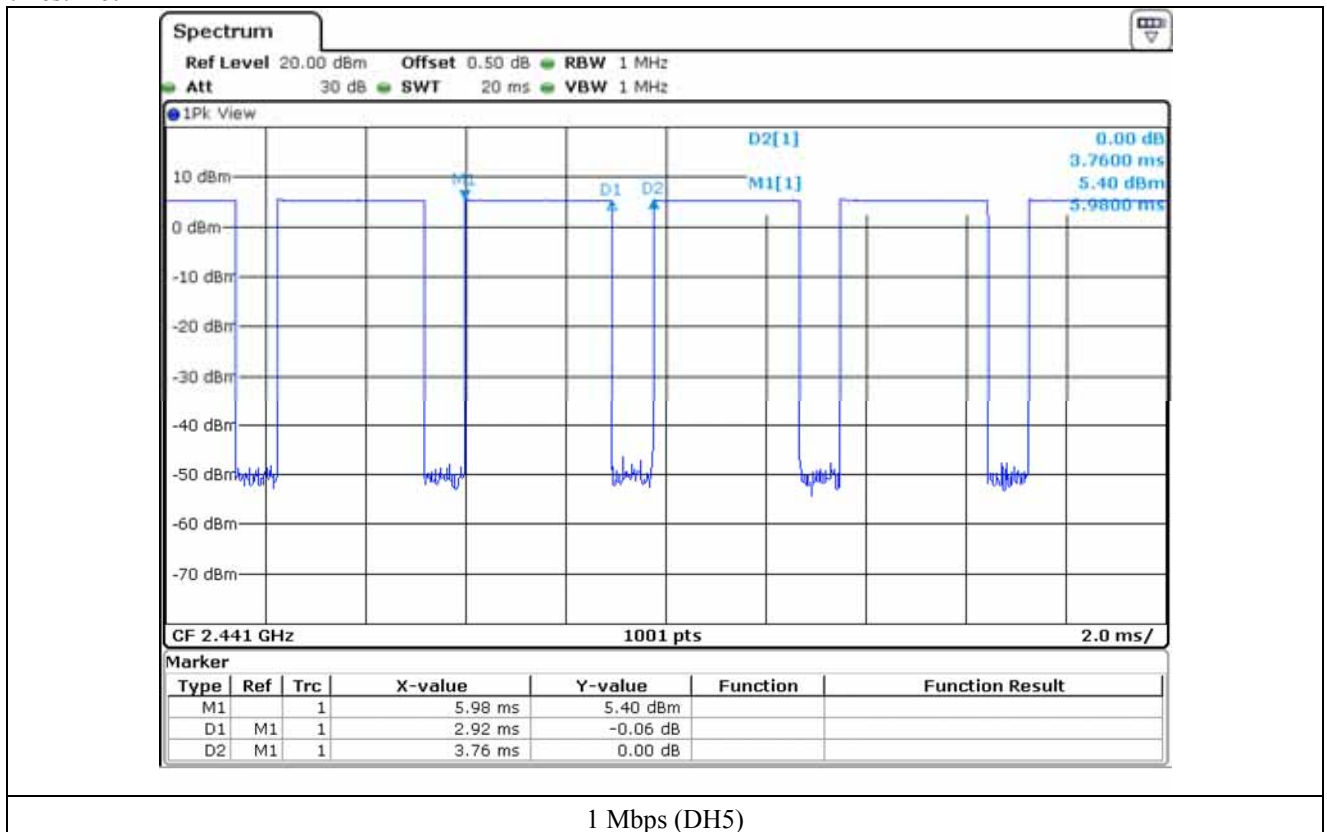
### - Duty Cycle

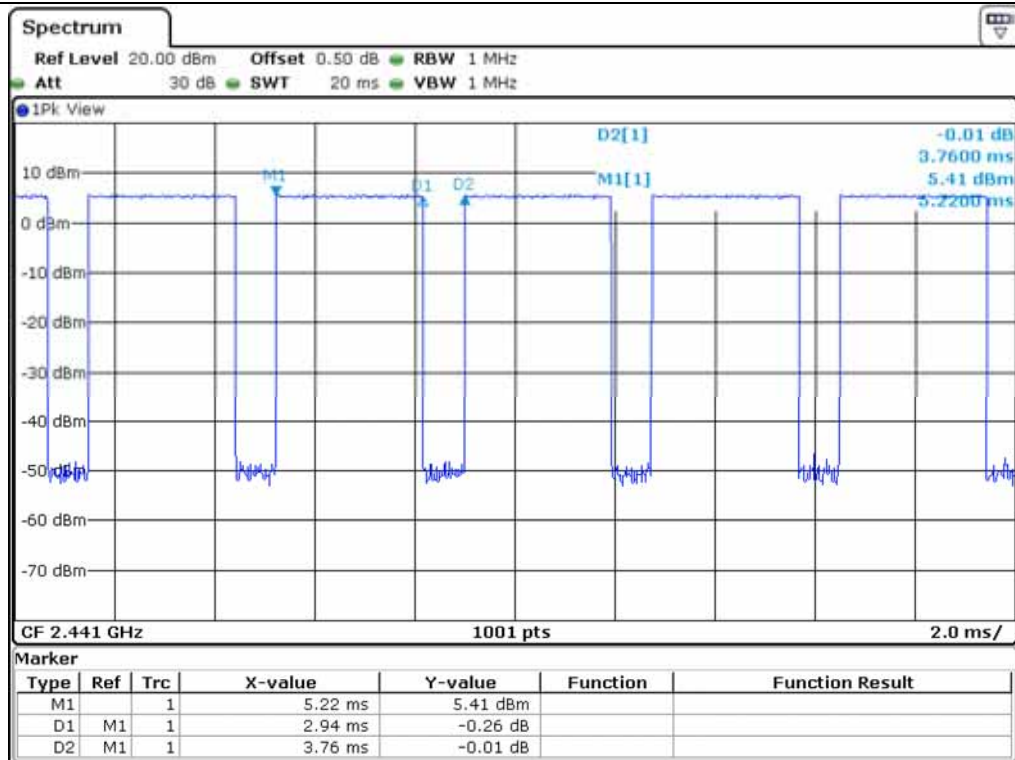
Mode	Tx On Time [ ms ]	Tx Off Time [ ms ]	Duty Cycle [ % ]	Correction Factor [ dB ]
1 Mbps (DH5)	2.92	0.84	77.66	1.10
2 Mbps (DH5)	2.94	0.82	78.19	1.07
3 Mbps (DH5)	2.92	0.84	77.66	1.10

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) \* 100

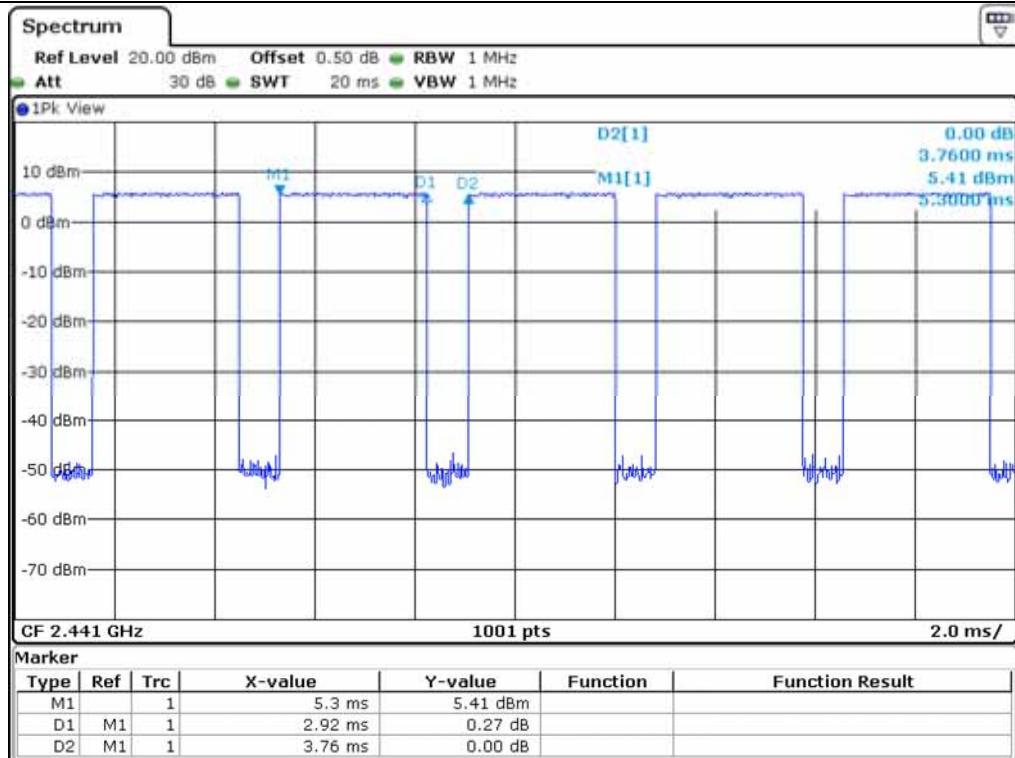
Correction Factor : 10 \* Log(1 / (Duty Cycle / 100))

### - Test Plot





2 Mbps (DH5)



3 Mbps (DH5)

## 5.4 Configuration of Test System

**Line Conducted Test:** The EUT was tested in a Charging mode. The EUT was connected to USB and the power of USB was connected to Adaptor. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

**Radiated Emission Test:** Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter Semi Anechoic Chamber.

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 antenna of the EUT is a FPCB Antenna on the main board in the EUT, 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)
Charging mode	X

### 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 & Charging mode	X

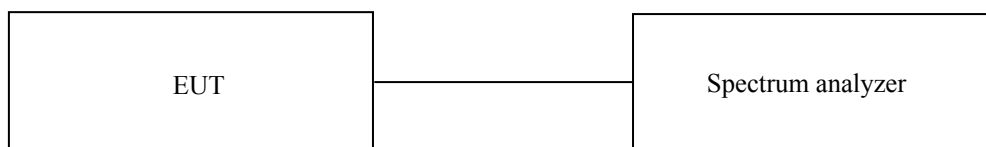
## 7. MINIMUM 20 dB BANDWIDTH

### 7.1 Operating environment

Temperature : 23 °C  
Relative humidity : 45 % 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 1 % ~ 5 % of the OBW(10 kHz / 20 kHz), and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



### 7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)

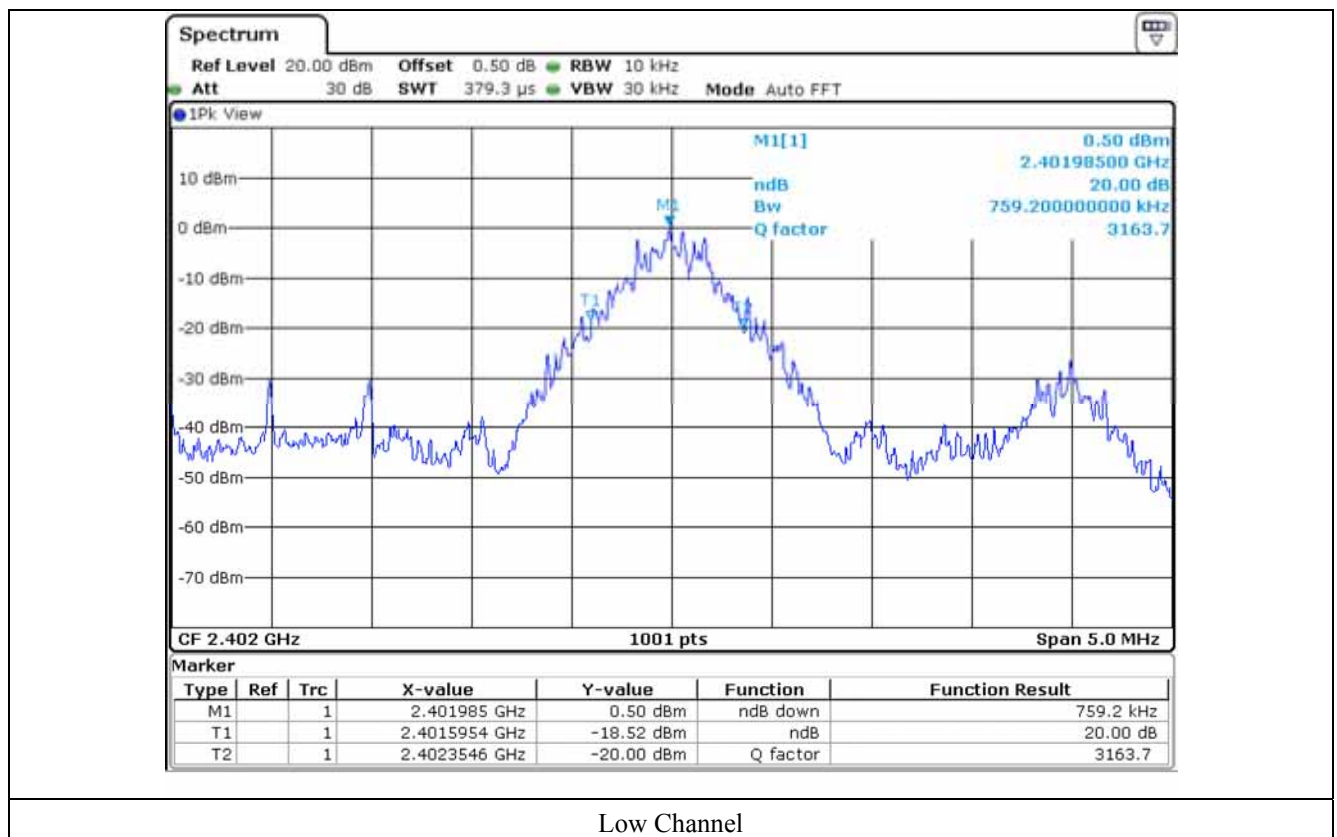
All test equipment used is calibrated on a regular basis.

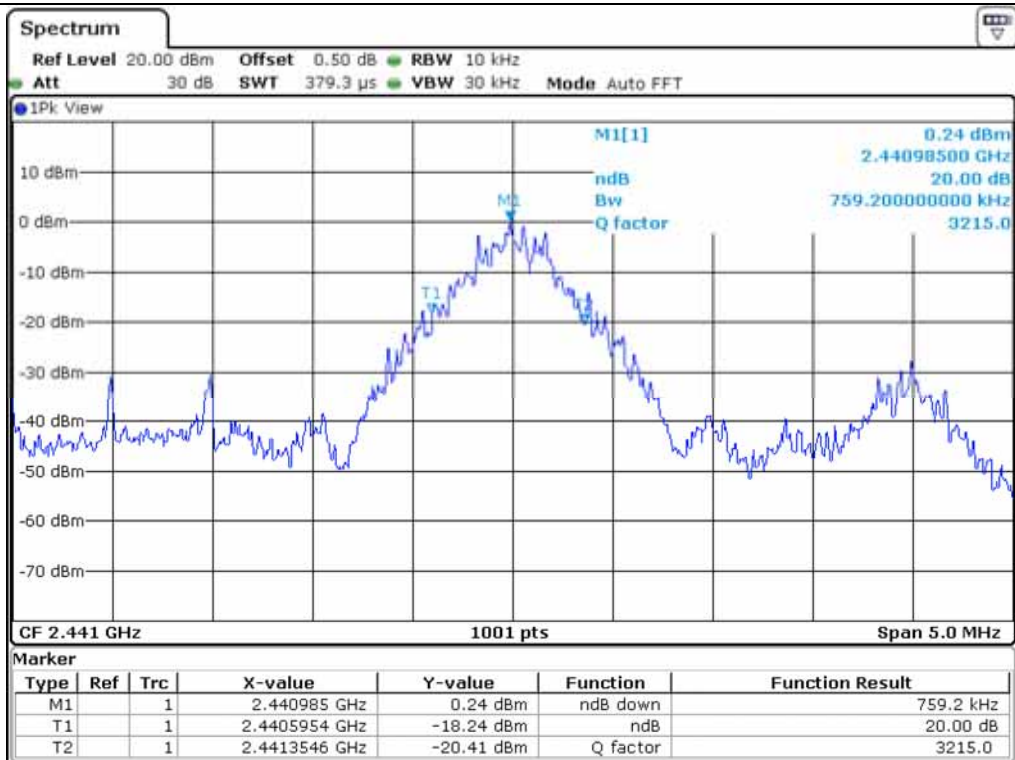
## 7.4 Test data for 1 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019

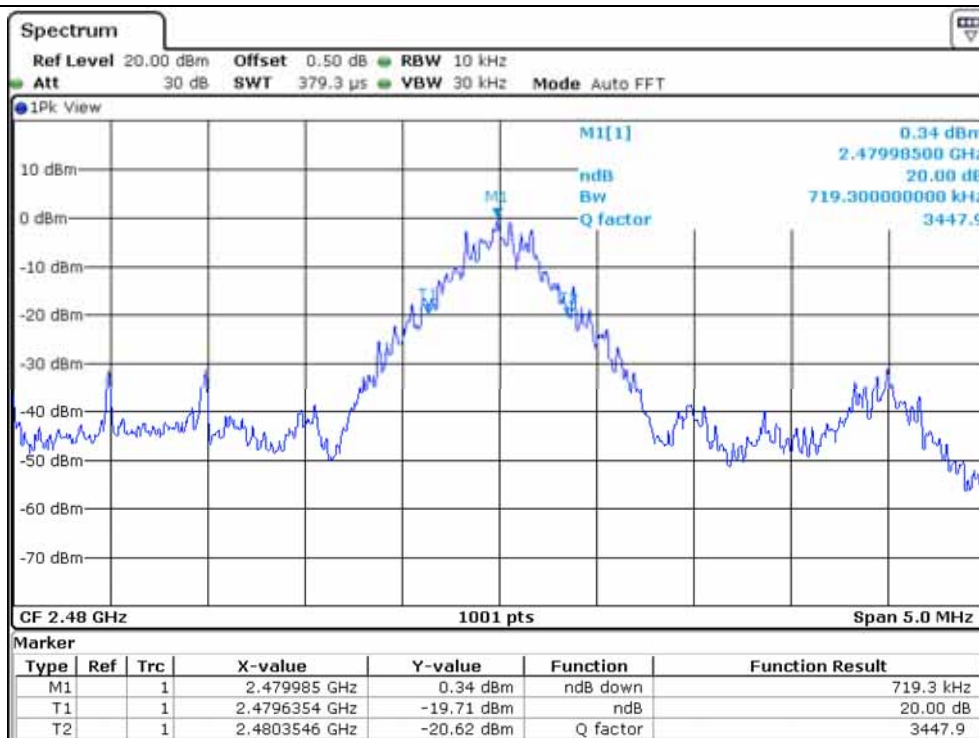
CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402.00	759.20
Middle	2 441.00	759.20
High	2 480.00	719.30

Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

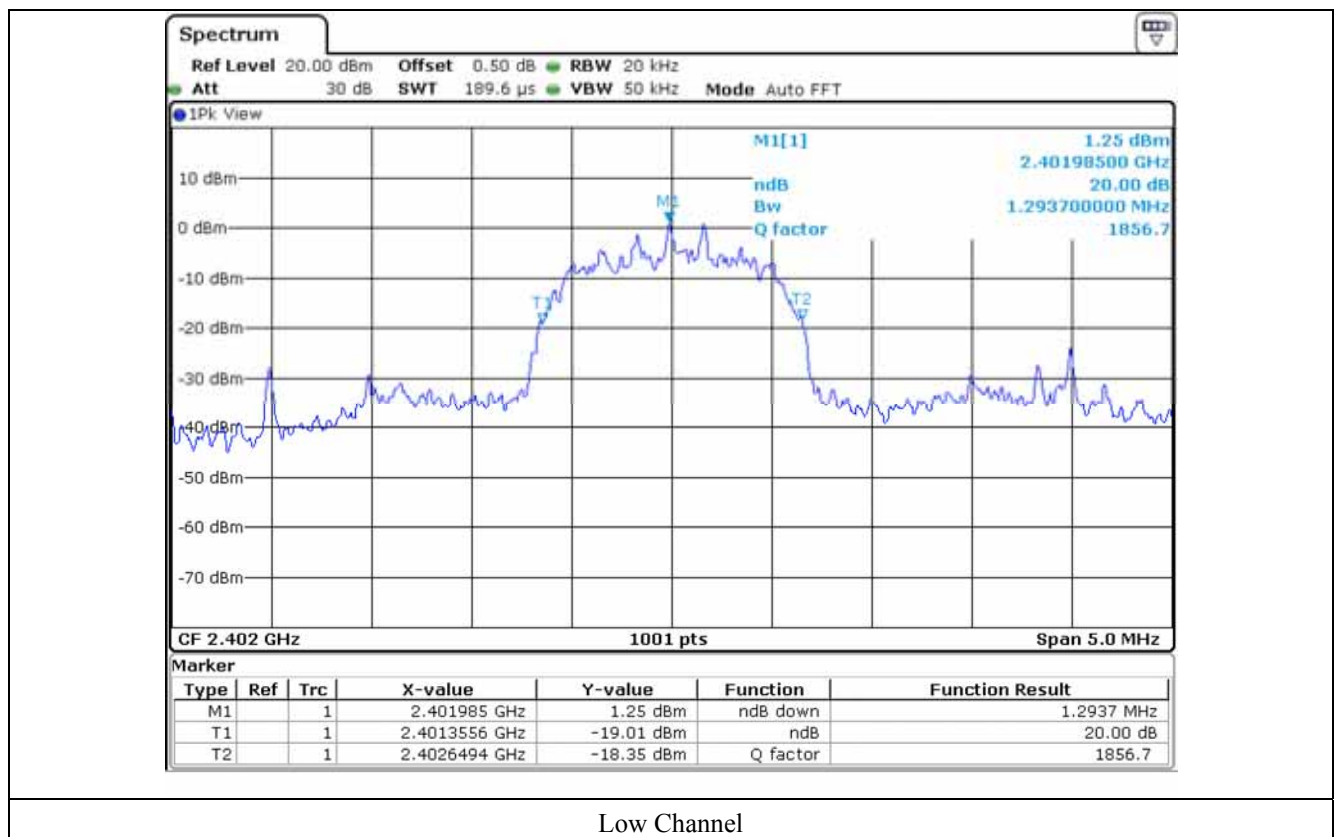


## 7.5 Test data for 2 Mbps

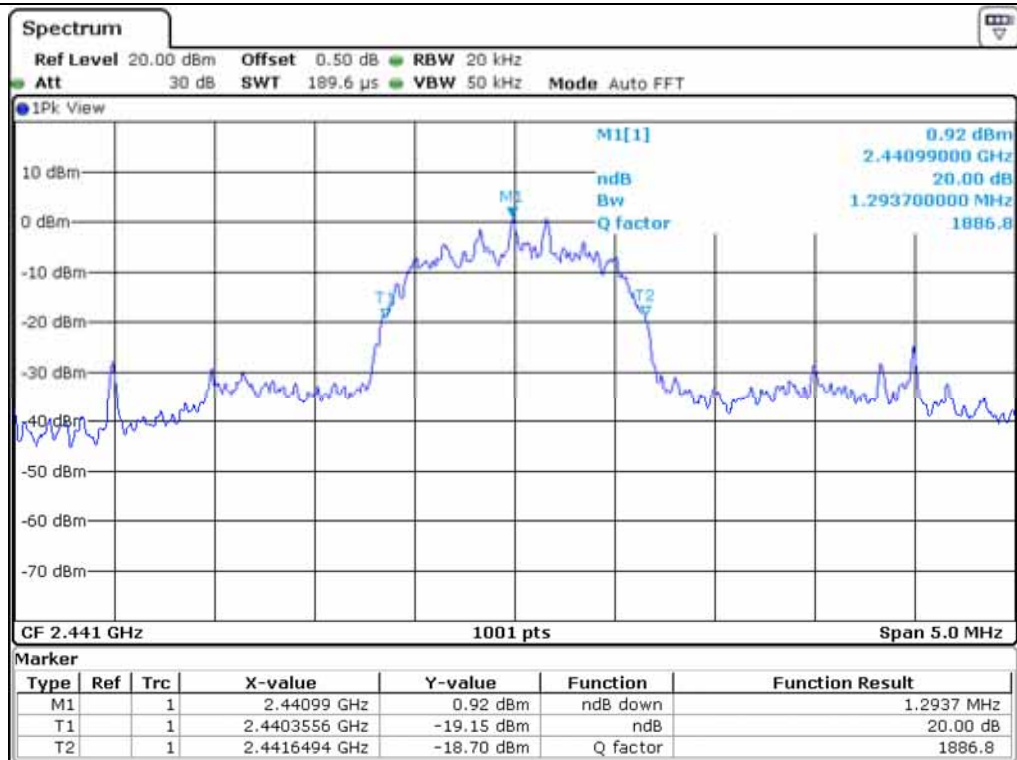
-. Test Date : August 06, 2019 ~ August 09, 2019

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402.00	1 293.70
Middle	2 441.00	1 293.70
High	2 480.00	1 293.70

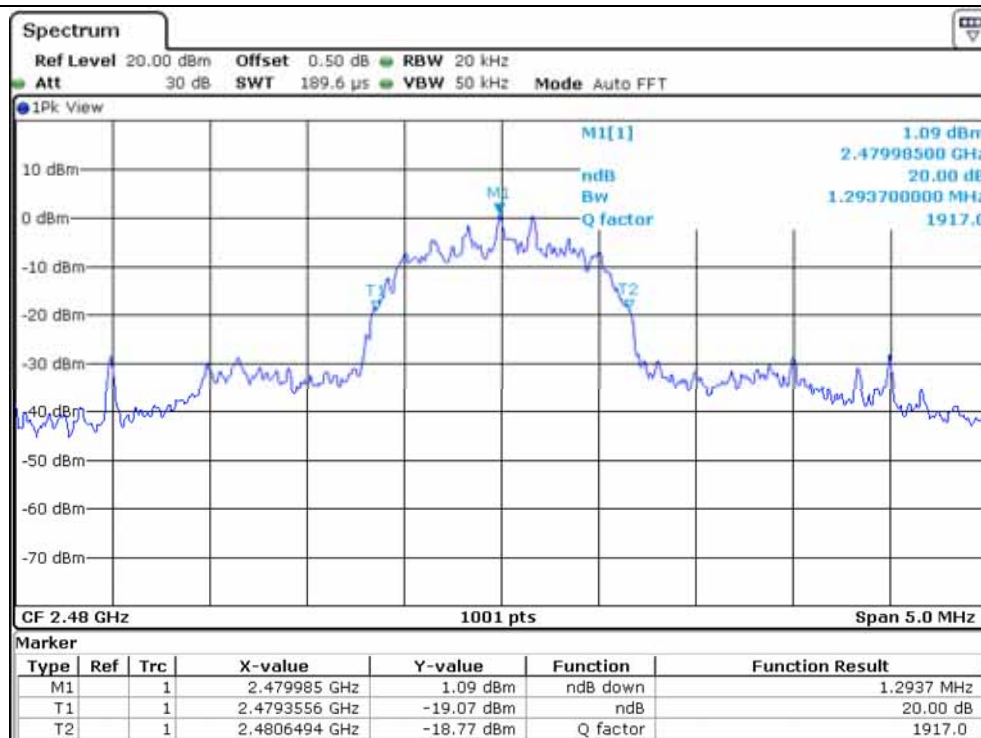
Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel



Middle Channel



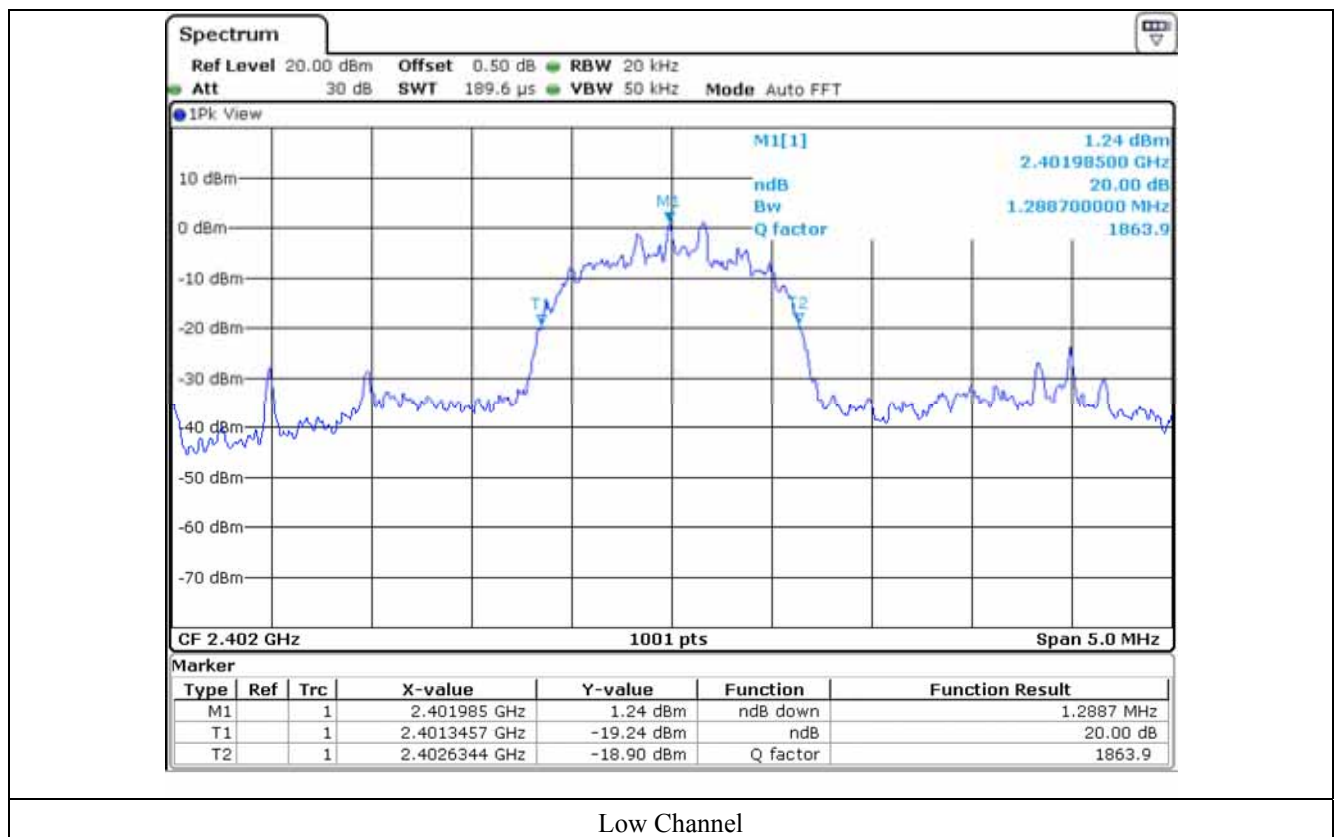
High Channel

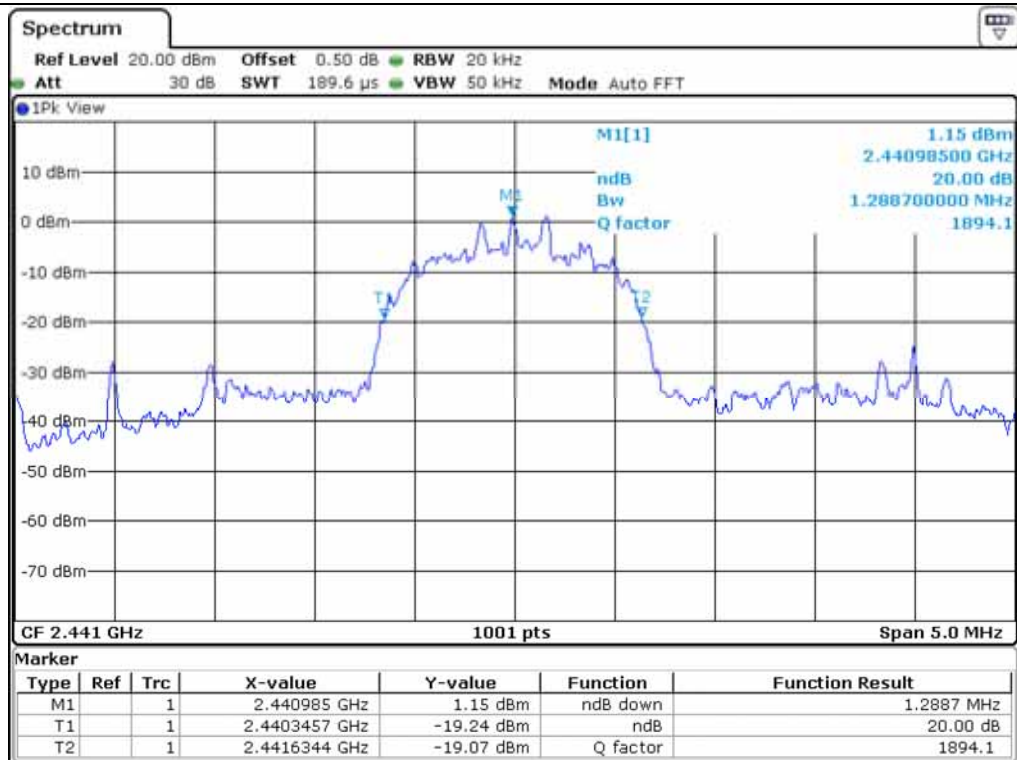
## 7.6 Test data for 3 Mbps

-. Test Date : August 06, 2019 ~ August 09, 2019

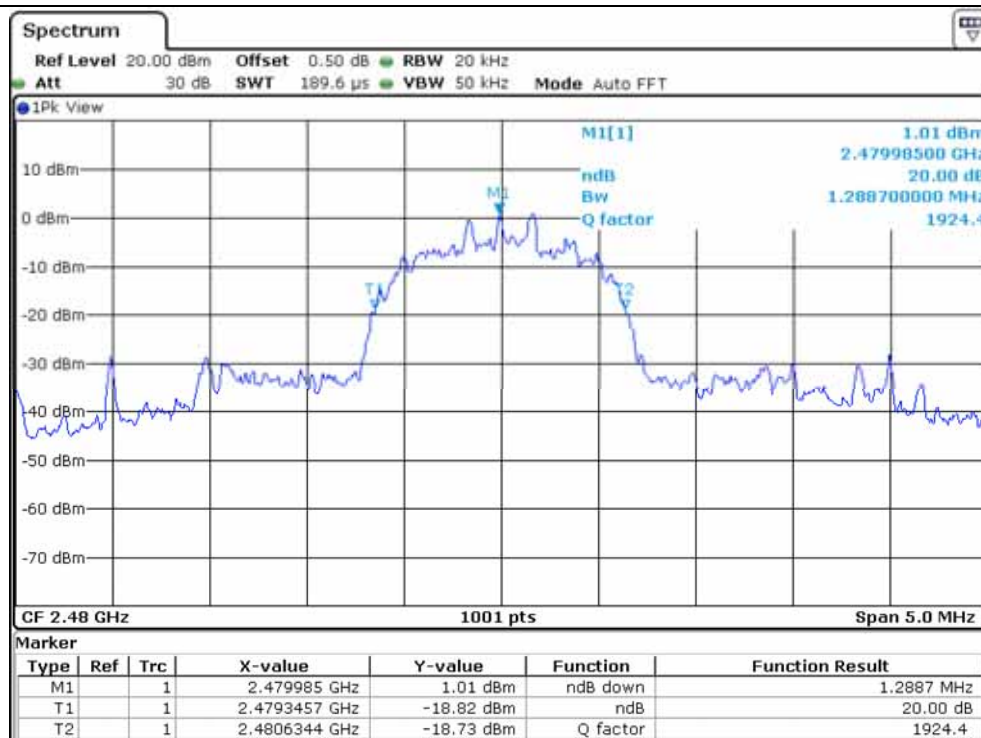
CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402.00	1 288.70
Middle	2 441.00	1 288.70
High	2 480.00	1 288.70

Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

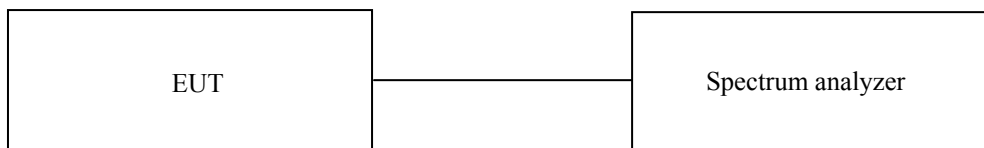
## 8. HOPPING FREQUENCY SEPARATION

### 8.1 Operating environment

Temperature : 23 °C  
Relative humidity : 45 % R.H.

### 8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The frequency span is set to 5 MHz. The analyzer is set to peak hold then a pseudo-random hopping sequence of the transmitter is captured. The mark delta function was used to measure the frequency separation between two adjacent hopping channels.



### 8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

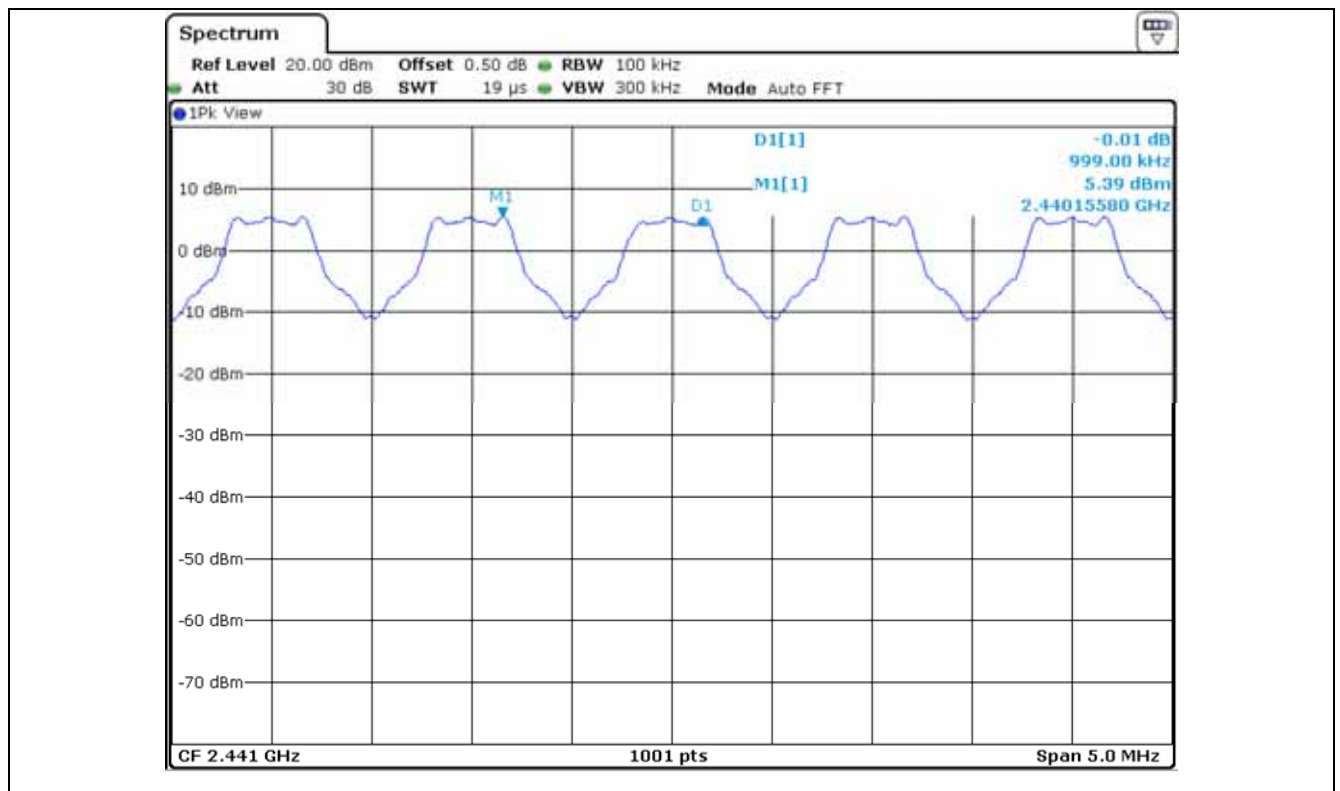
#### 8.4 Test data for 1 Mbps

-. Test Date : August 06, 2019 ~ August 09, 2019

-. Test Result : Pass

MEASURED VLAUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
999.00	506.13	Separated by a minimum of 25 kHz

Tested by: Hyung-Kwon, Oh / Assistant Manager



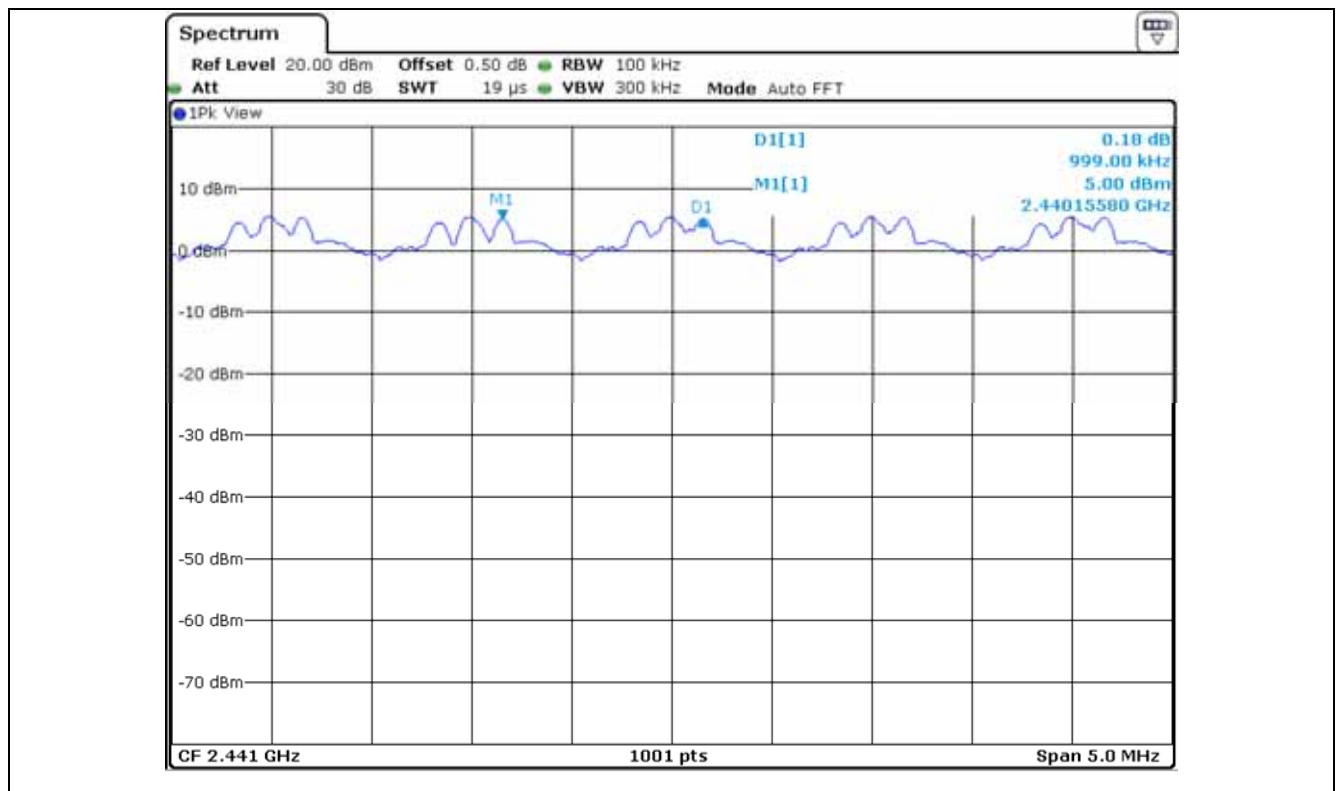
### 8.5 Test data for 2 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019

- Test Result : Pass

MEASURED VLAUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
999.00	862.47	Separated by a minimum of 25 kHz

Tested by: Hyung-Kwon, Oh / Assistant Manager



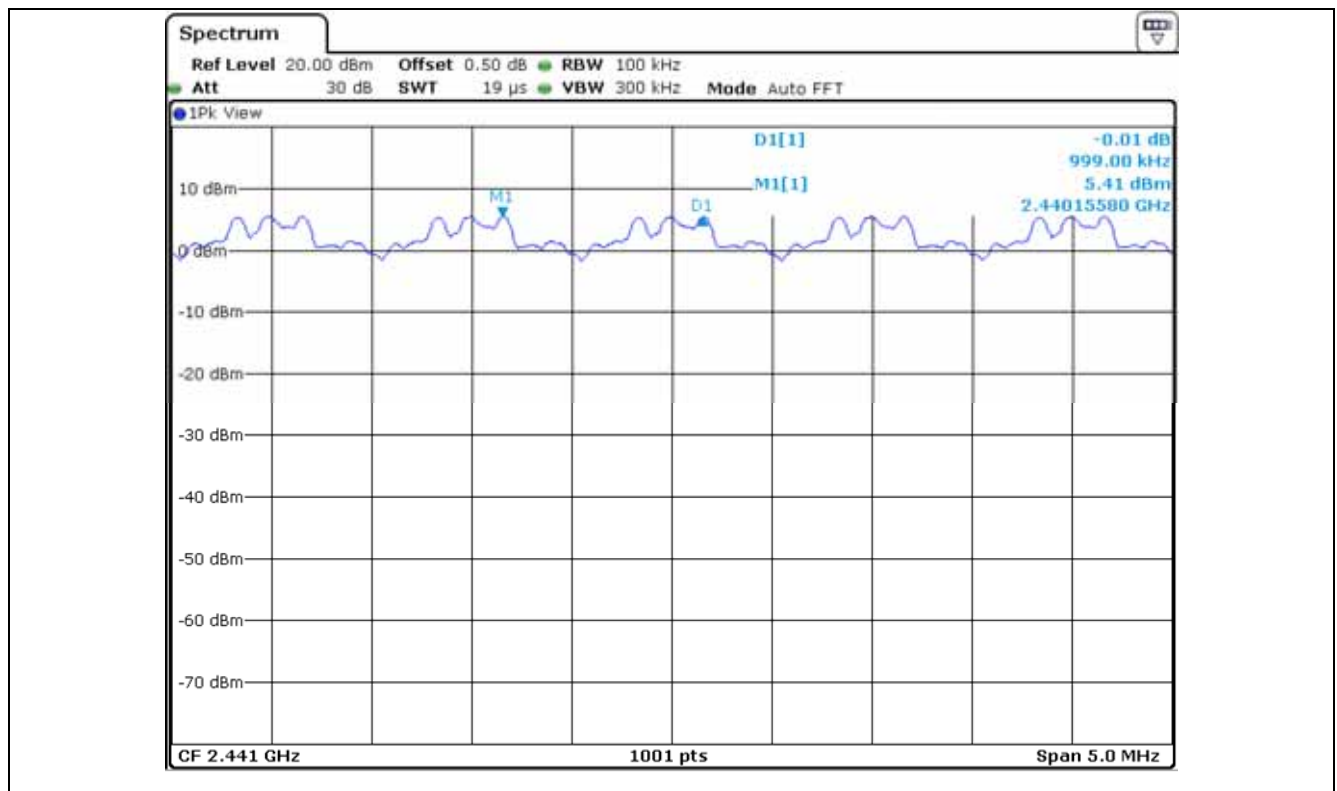
## 8.6 Test data for 3 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019

- Test Result : Pass

MEASURED VLAUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
999.00	859.13	Separated by a minimum of 25 kHz

Tested by: Hyung-Kwon, Oh / Assistant Manager





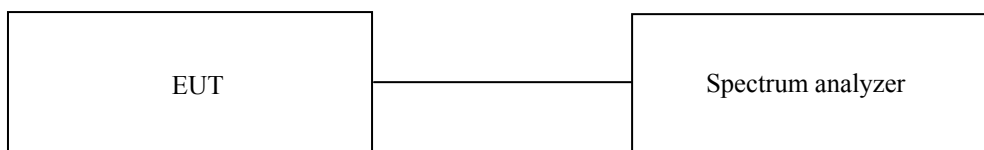
## 9. NUMBER OF HOPPING CHANNELS

### 9.1 Operating environment

Temperature : 23 °C  
Relative humidity : 45 % R.H.

### 9.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The frequency span is set to 100 MHz and the resolution bandwidth is set to 100 kHz. The analyzer is set to peak hold and then complete pseudo-random hopping sequence of the transmitter is captured.



### 9.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

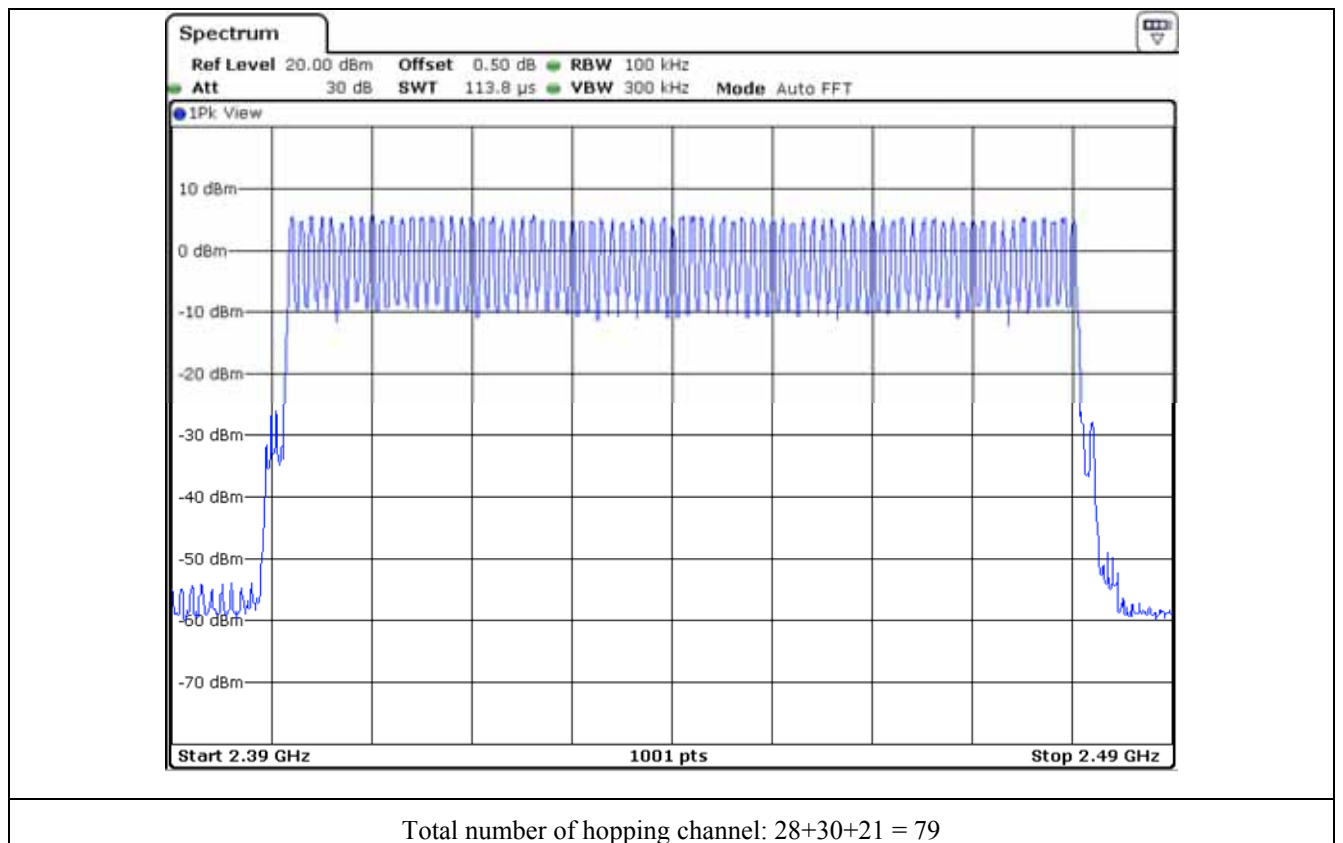
#### 9.4 Test data for 1 Mbps

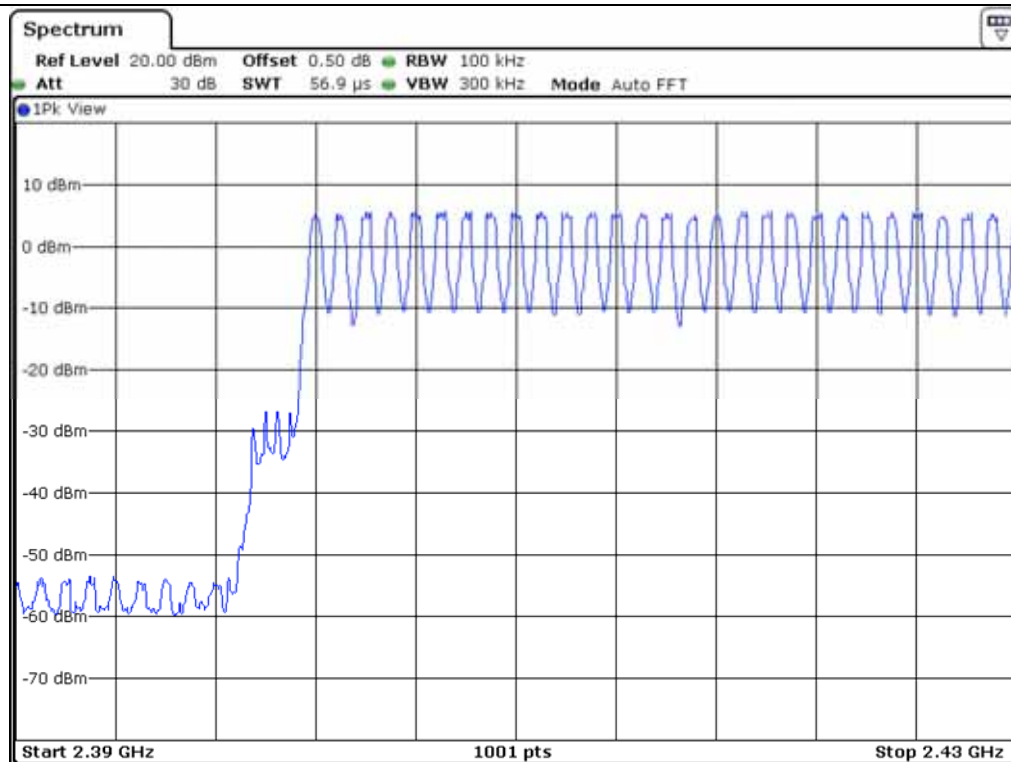
- Test Date : August 06, 2019 ~ August 09, 2019
- Test Result : Pass

Data Transfer Rate	Measured value (Number)	Limit (Number)	Margin (Number)
1 Mbps	79	Minimum of 15	64

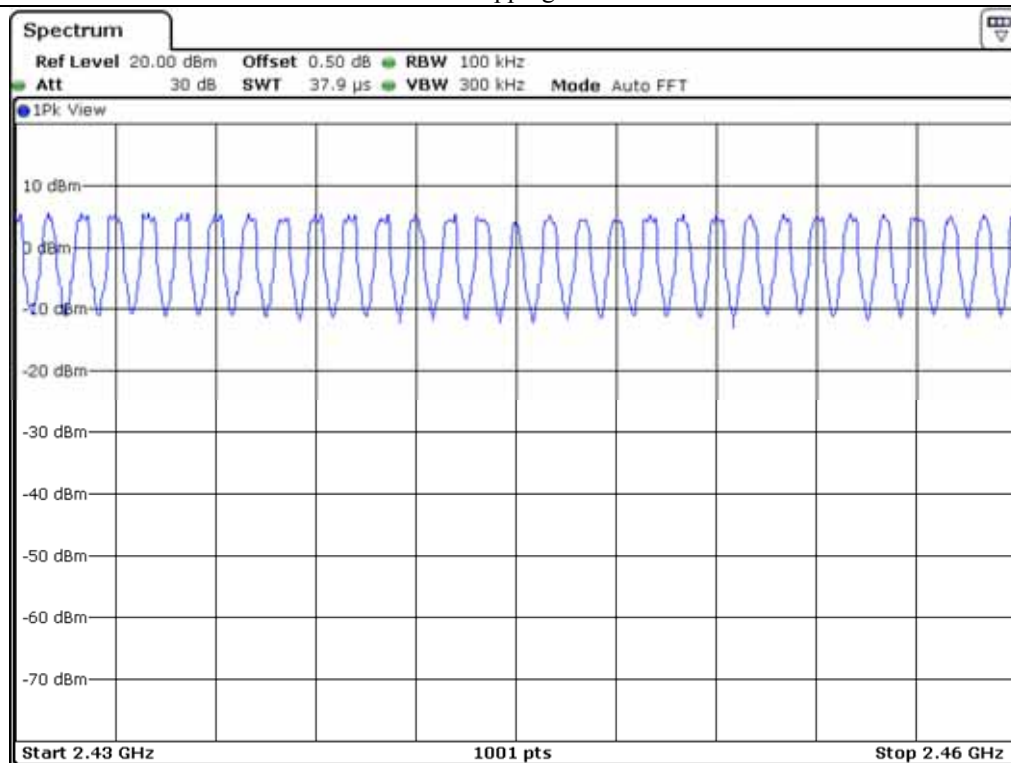


Tested by: Hyung-Kwon, Oh / Assistant Manager

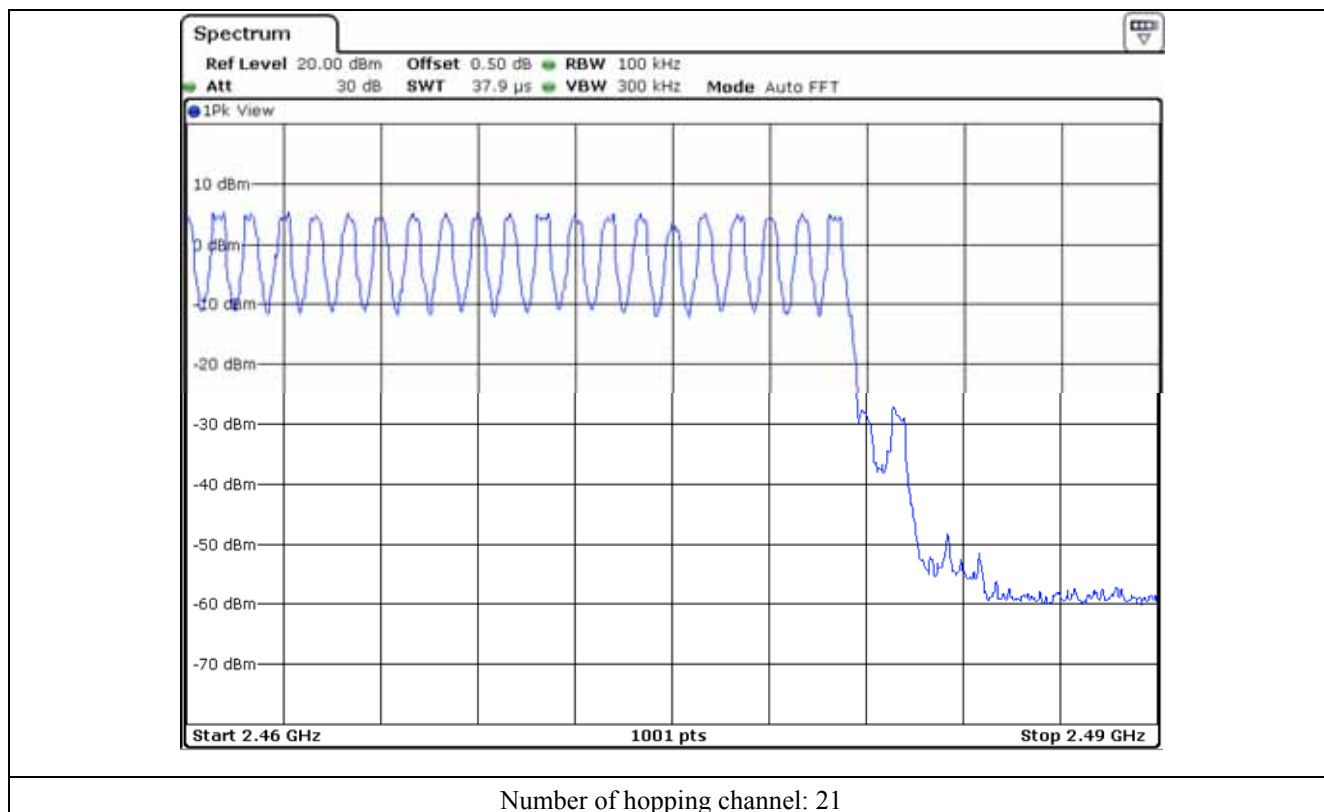




Number of hopping channel: 28




Number of hopping channel: 30

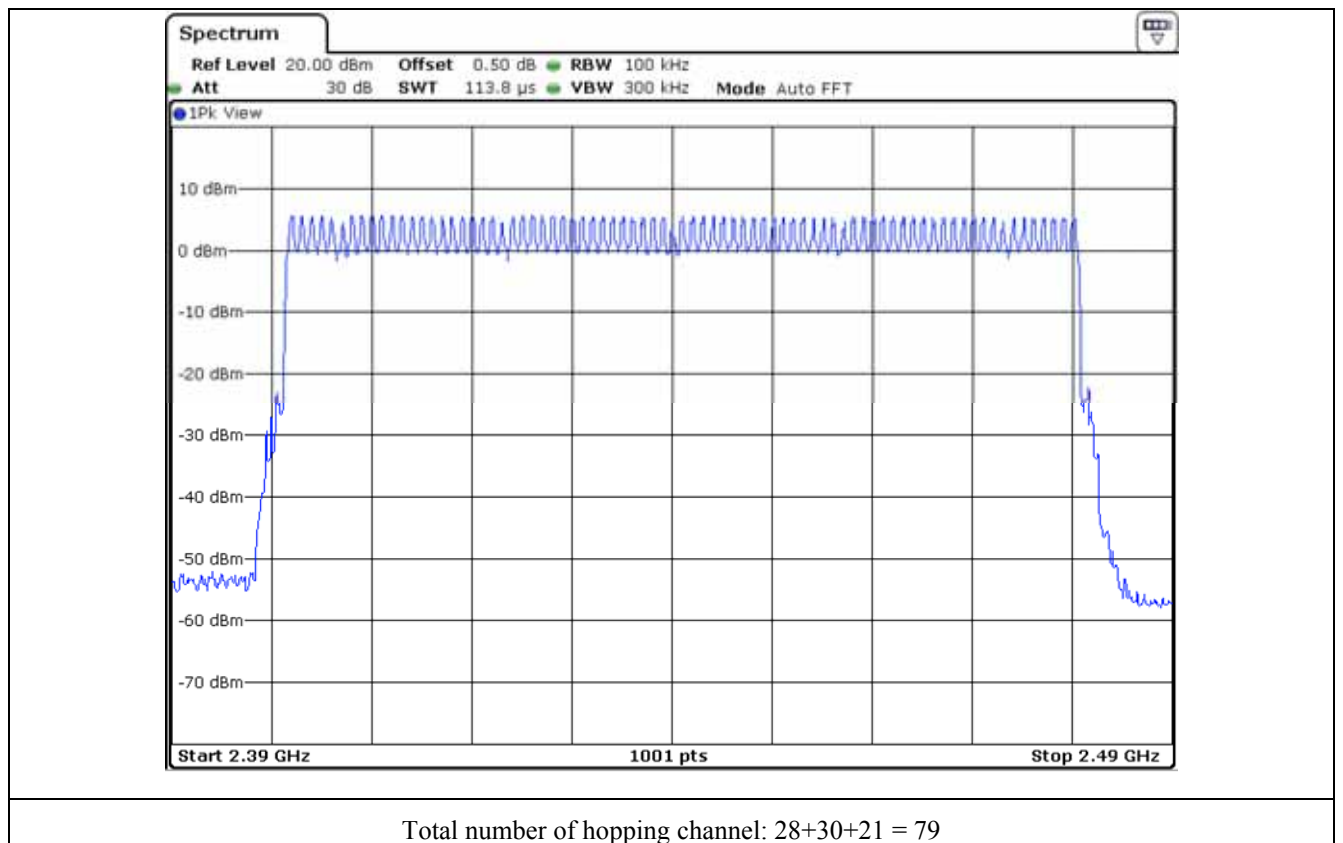


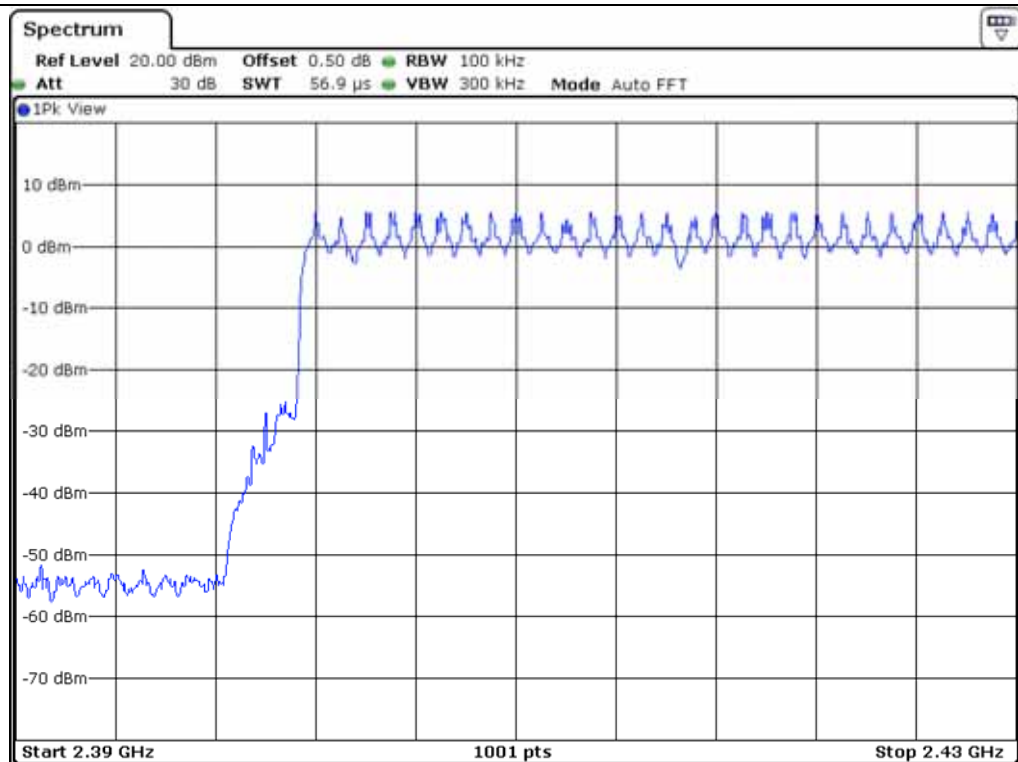
### 9.5 Test data for 2 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019
- Test Result : Pass

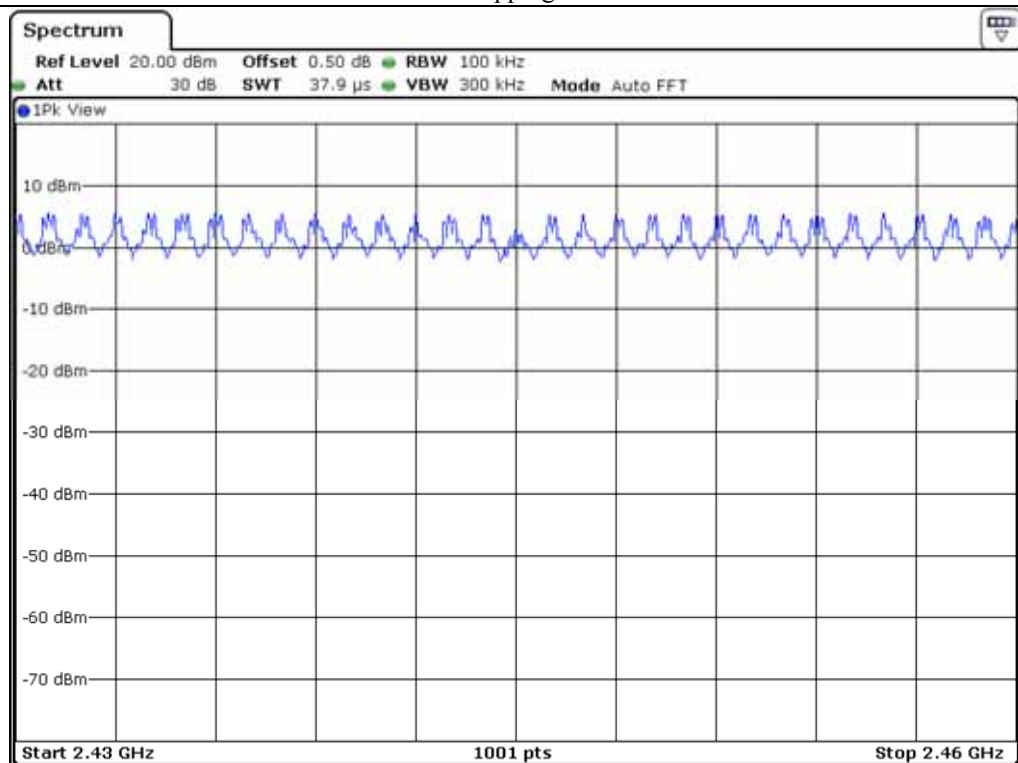
Data Transfer Rate	Measured value (Number)	Limit (Number)	Margin (Number)
2 Mbps	79	Minimum of 15	64

  
 Tested by: Hyung-Kwon, Oh / Assistant Manager

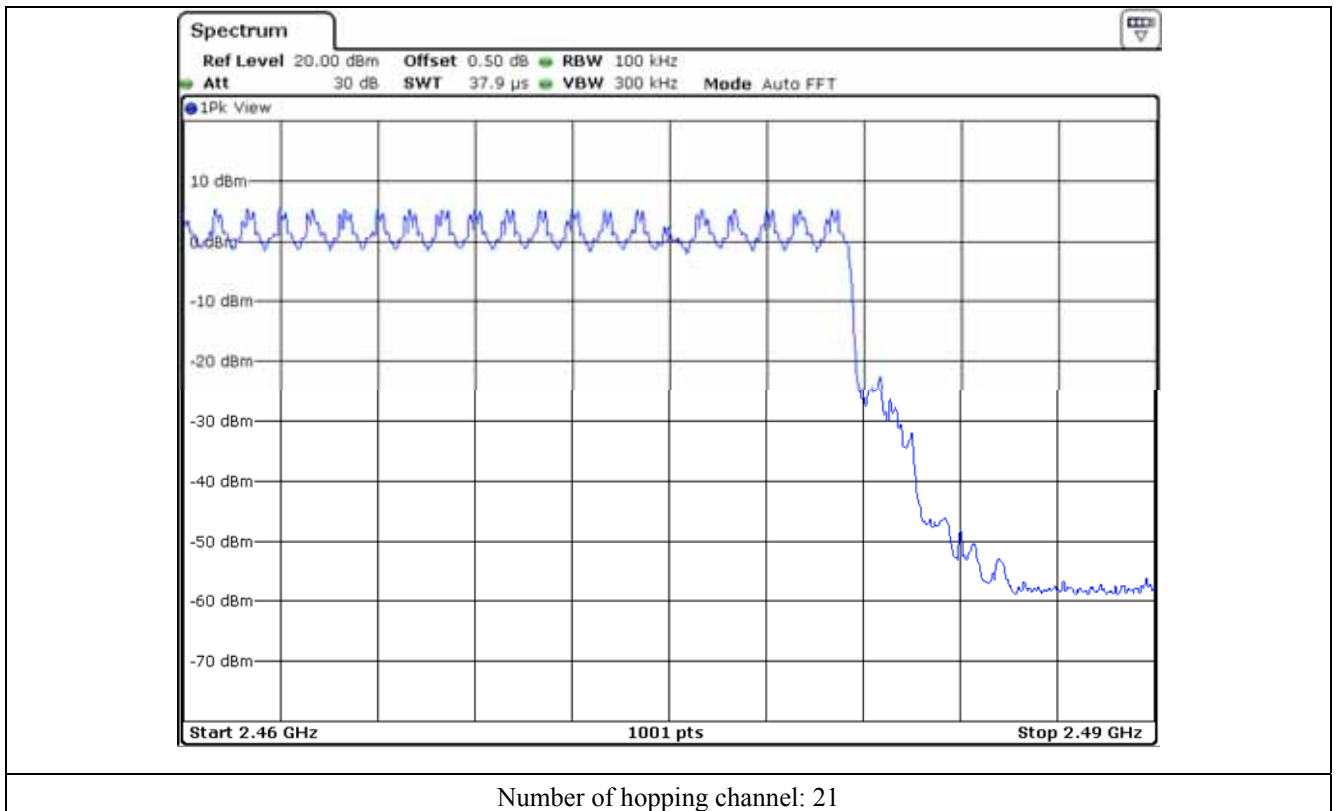




Number of hopping channel: 28




Number of hopping channel: 30

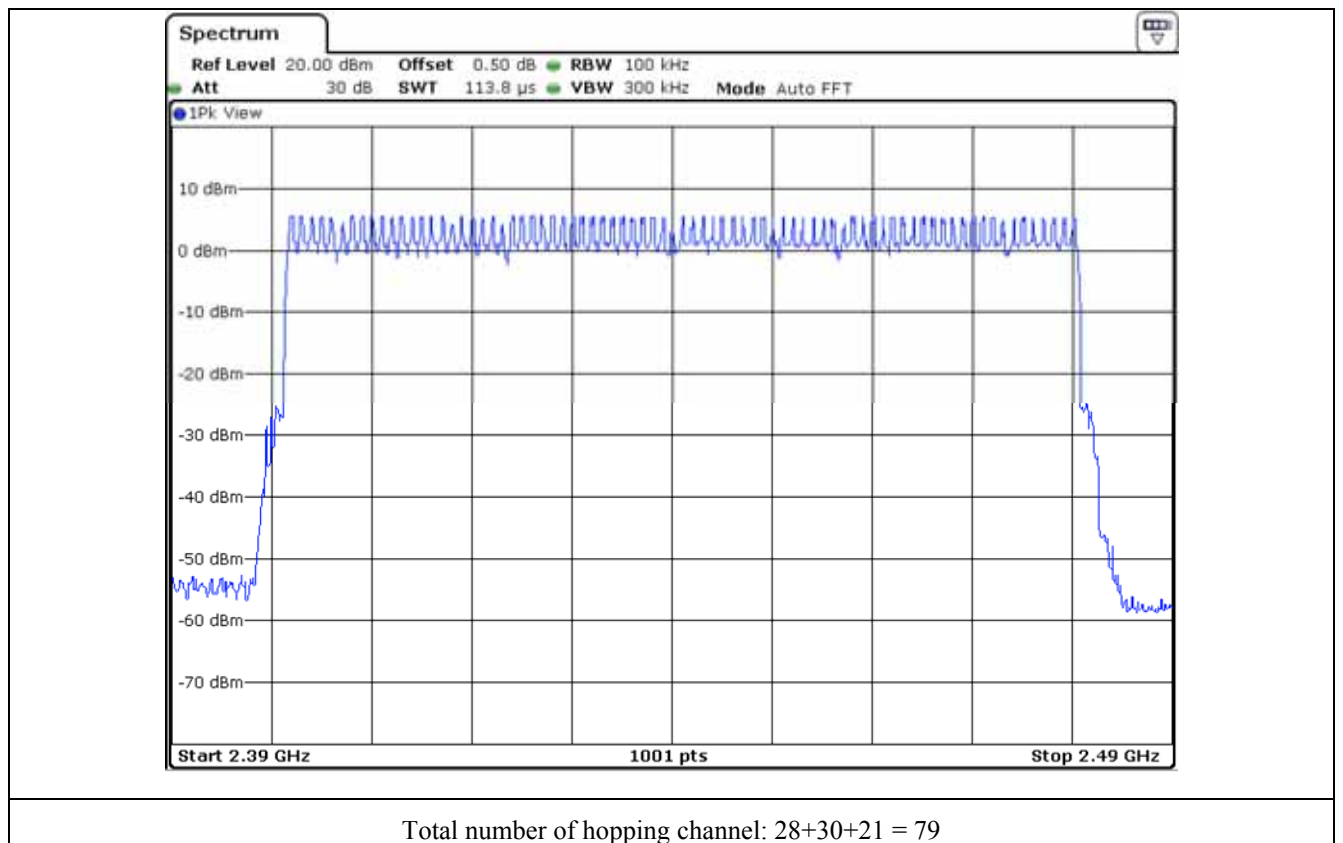


## 9.6 Test data for 3 Mbps

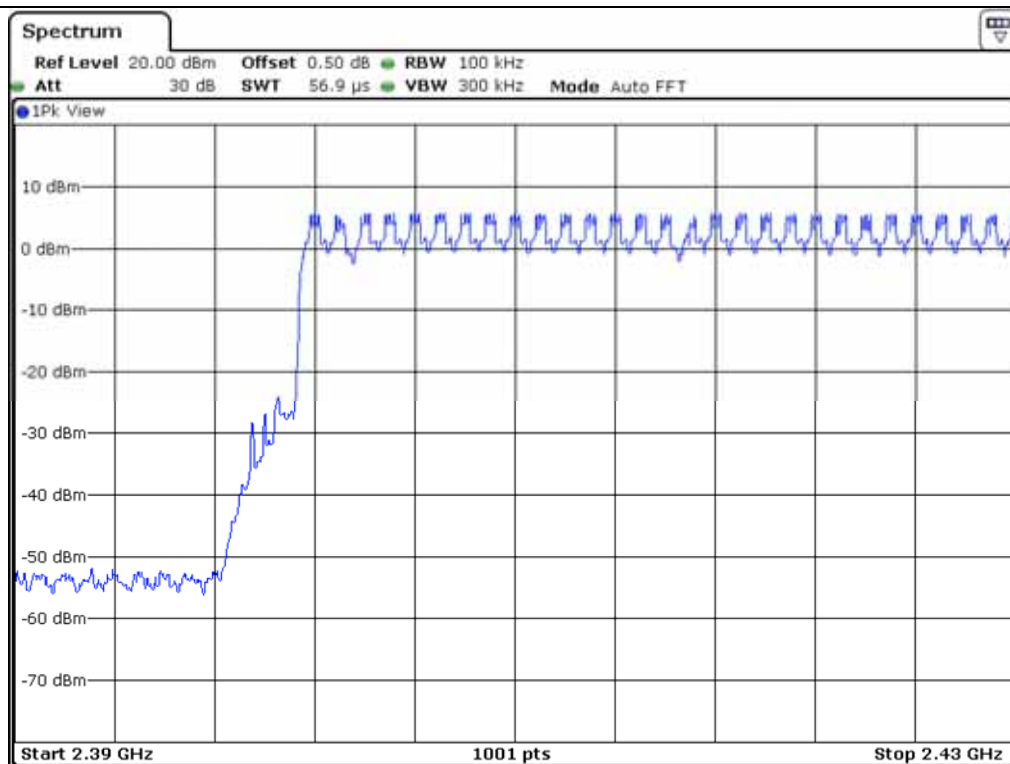
- Test Date : August 06, 2019 ~ August 09, 2019
- Test Result : Pass

Data Transfer Rate	Measured value (Number)	Limit (Number)	Margin (Number)
3 Mbps	79	Minimum of 15	64

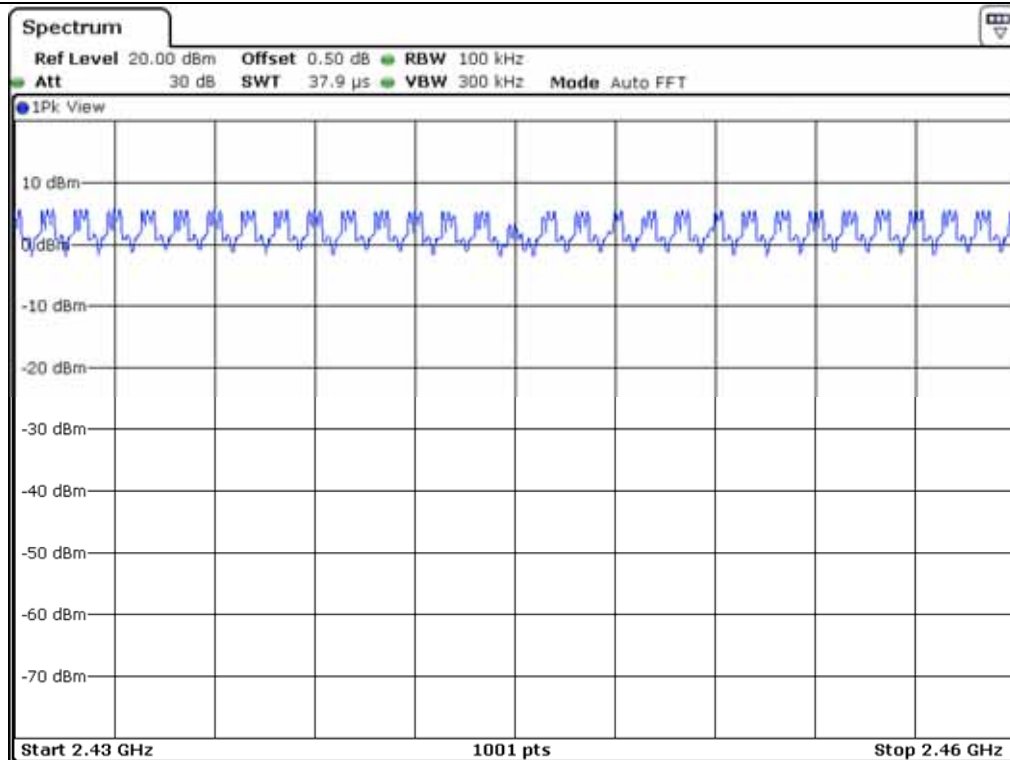
  
 Tested by: Hyung-Kwon, Oh / Assistant Manager



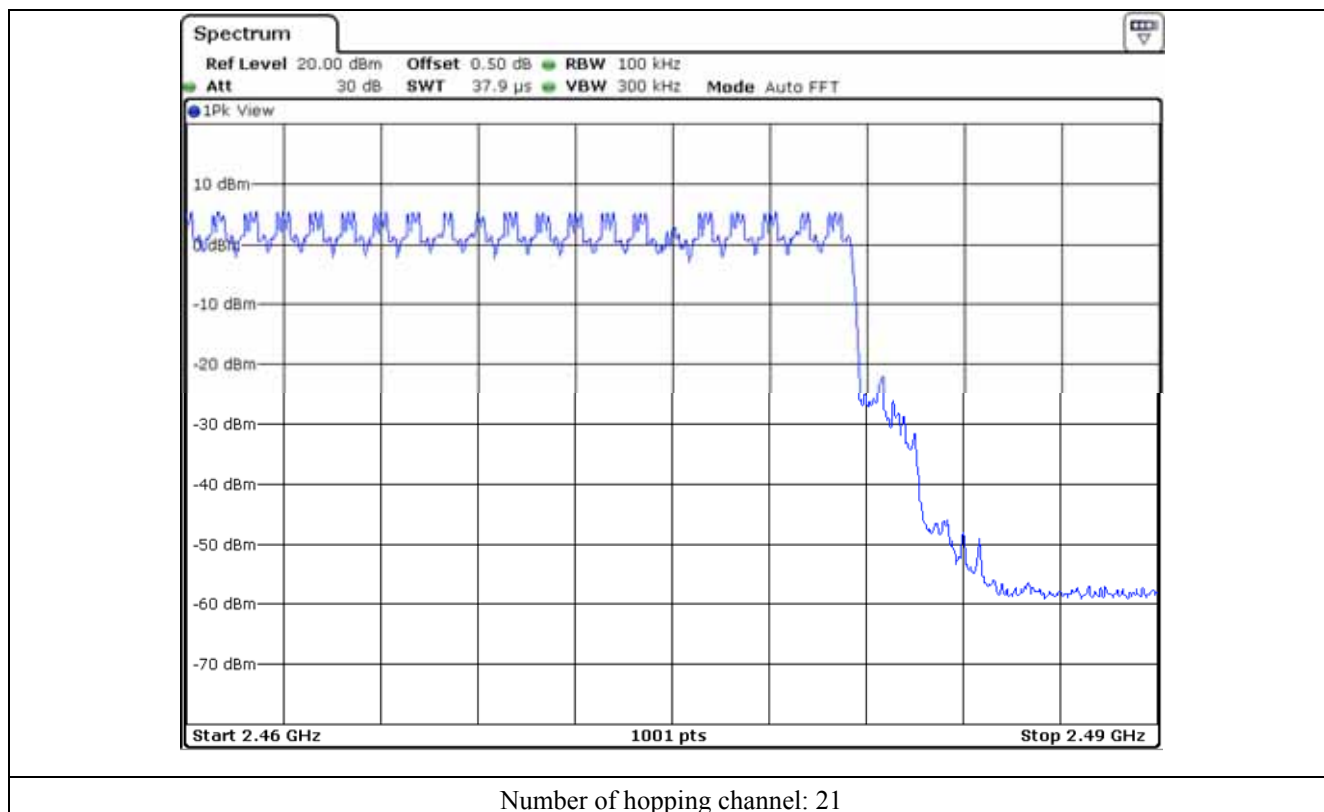




Number of hopping channel: 28



Number of hopping channel: 30



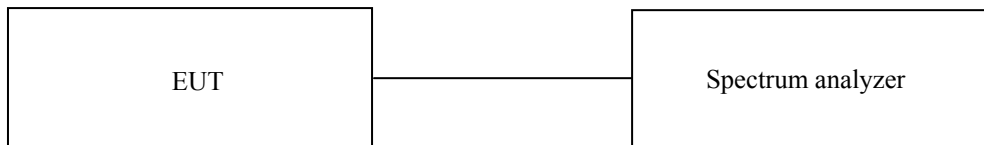
## 10. TIME OF OCCUPANCY

### 10.1 Operating environment

Temperature : 23 °C  
Relative humidity : 45 % R.H.

### 10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The transmitter is set to operate in its normal frequency hopping mode. The center frequency of the spectrum analyzer is set to one of hopping channels near the center of the operating band and span is set to Zero Span. The sweep time is set to display one complete pulse. The mark delta function is used to measure the duration of the pulses.



### 10.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

#### 10.4 Test data for 1 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019

The system makes worst case 1 600 hops per second or 1 time slot has a length of 625  $\mu$ s with 79 channels.

For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel for 10.13 times per second ( $= 1\,600/2/79$ ) for DH1, and 5.06 times ( $= 1\,600/4/79$ ) for DH3, and 3.38 times ( $= 1\,600/6/79$ ) for DH5.

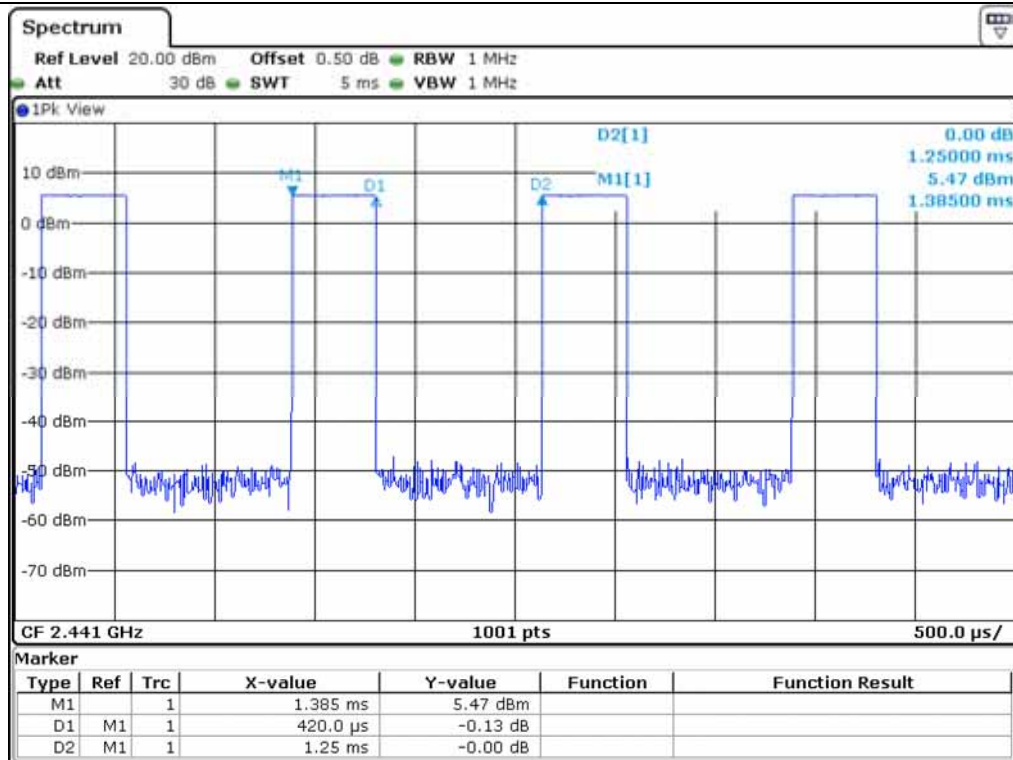
Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.420	10.13	31.60	134.45	400.00	PASS
DH3	1.680	5.06	31.60	268.63	400.00	
DH5	2.920	3.38	31.60	311.88	400.00	

Total dwell time is calculated as following.

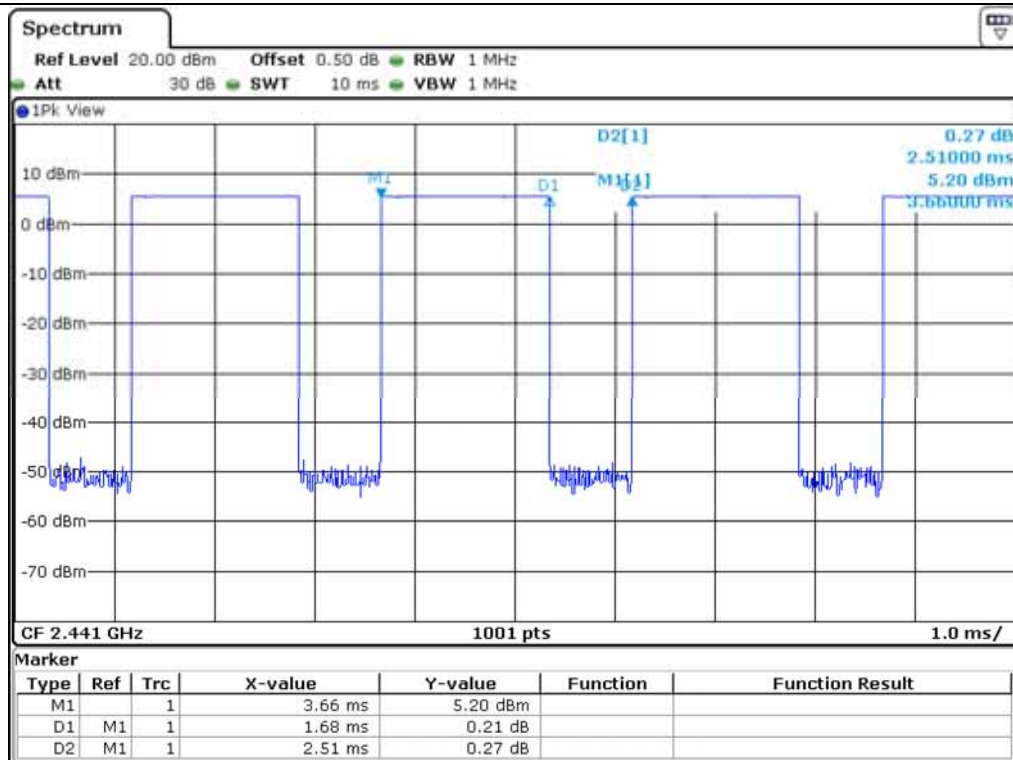
Total Dwell Time = Pulse time \* Hops per second with channels \* period time

Remark: See next page for an overview sweep performed with peak detector.

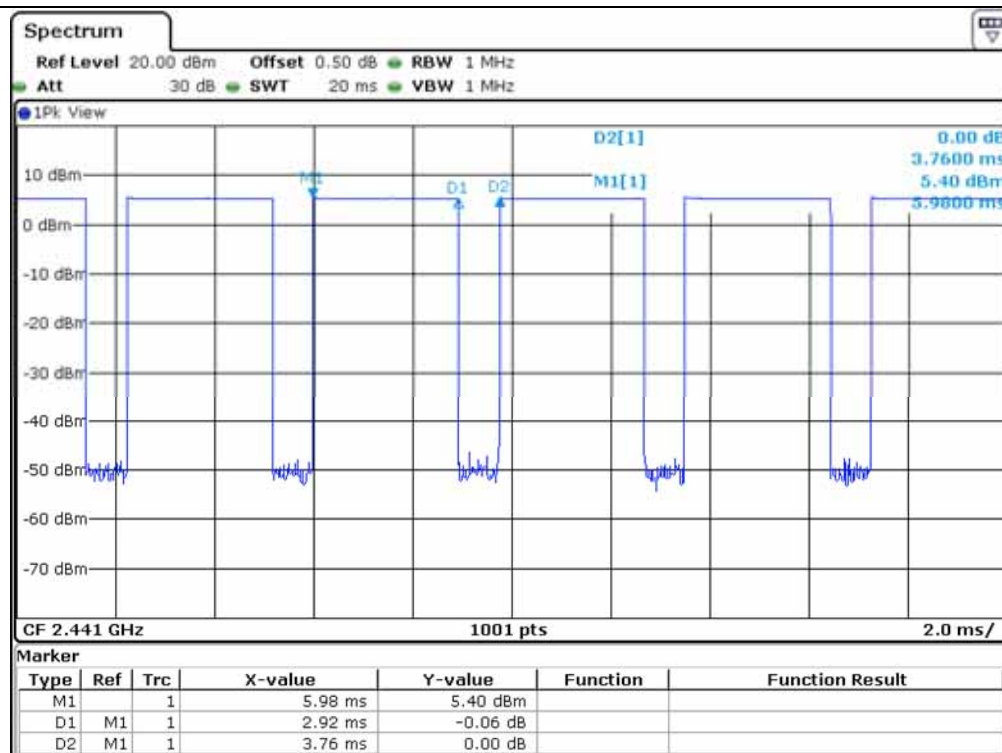
  
Tested by: Hyung-Kwon, Oh / Assistant Manager



DH1



DH3



DH5

### 10.5 Test data for 2 Mbps

-. Test Date : August 06, 2019 ~ August 09, 2019

The system makes worst case 1 600 hops per second or 1 time slot has a length of 625  $\mu$ s with 79 channels.

For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel for 10.13 times per second ( $= 1\,600/2/79$ ) for DH1, and 5.06 times ( $= 1\,600/4/79$ ) for DH3, and 3.38 times ( $= 1\,600/6/79$ ) for DH5.

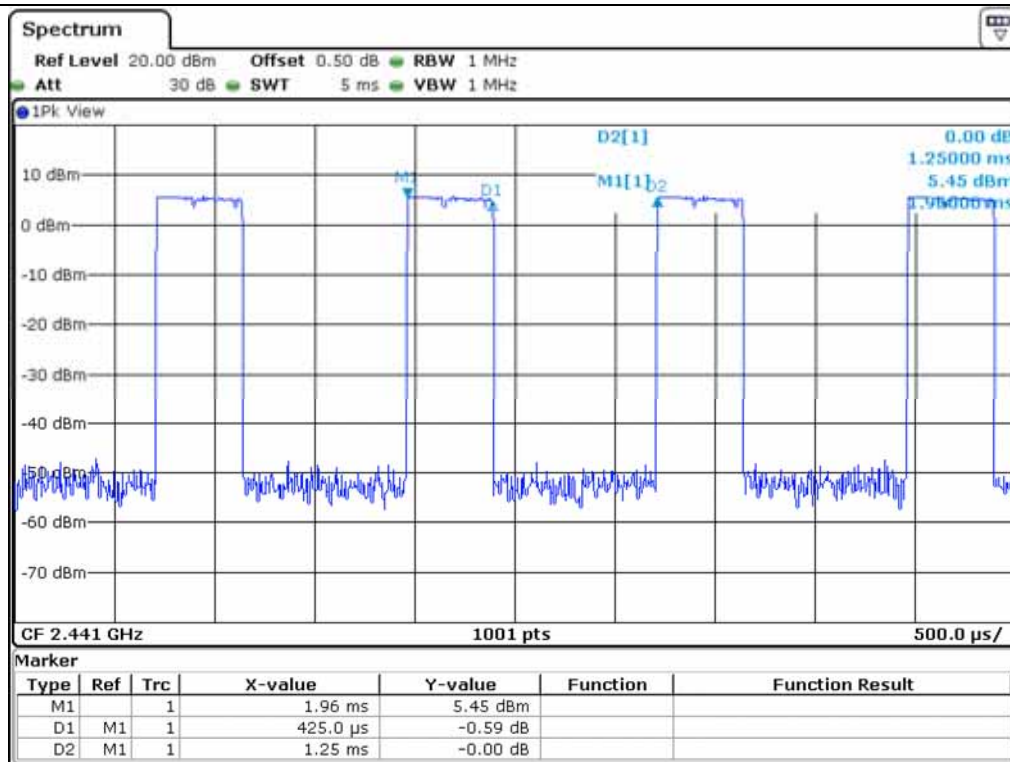
Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.425	10.13	31.60	136.05	400.00	PASS
DH3	1.680	5.06	31.60	268.63	400.00	
DH5	2.940	3.38	31.60	314.02	400.00	

Total dwell time is calculated as following.

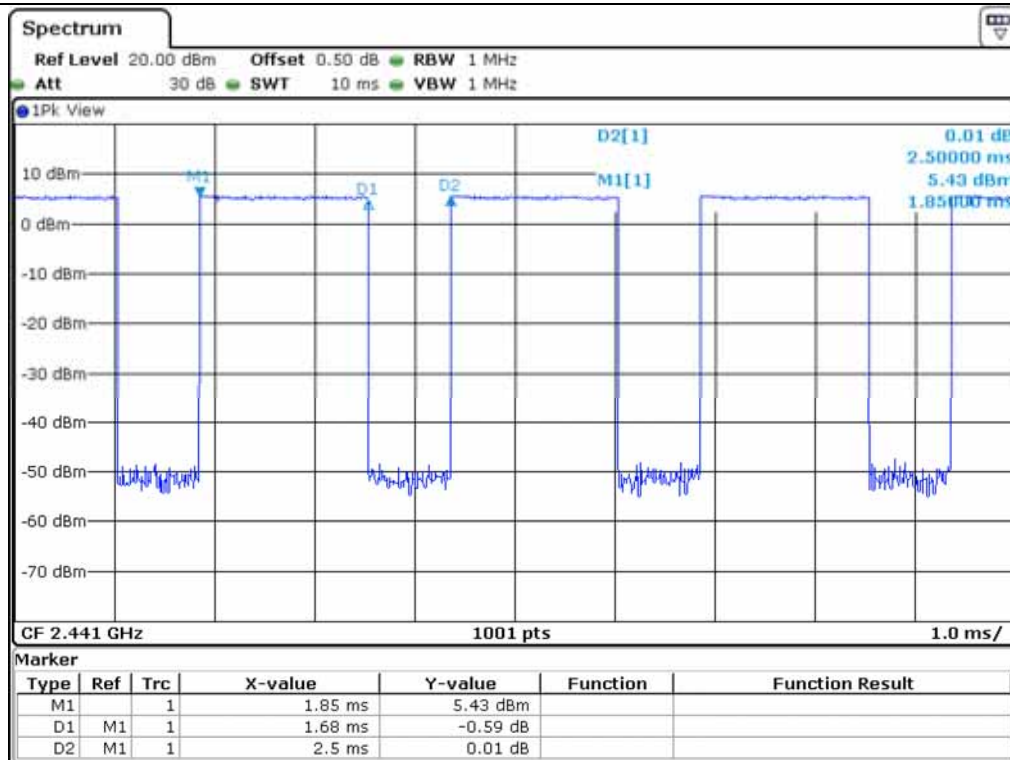
Total Dwell Time = Pulse time \* Hops per second with channels \* period time

Remark: See next page for an overview sweep performed with peak detector.

  
Tested by: Hyung-Kwon, Oh / Assistant Manager

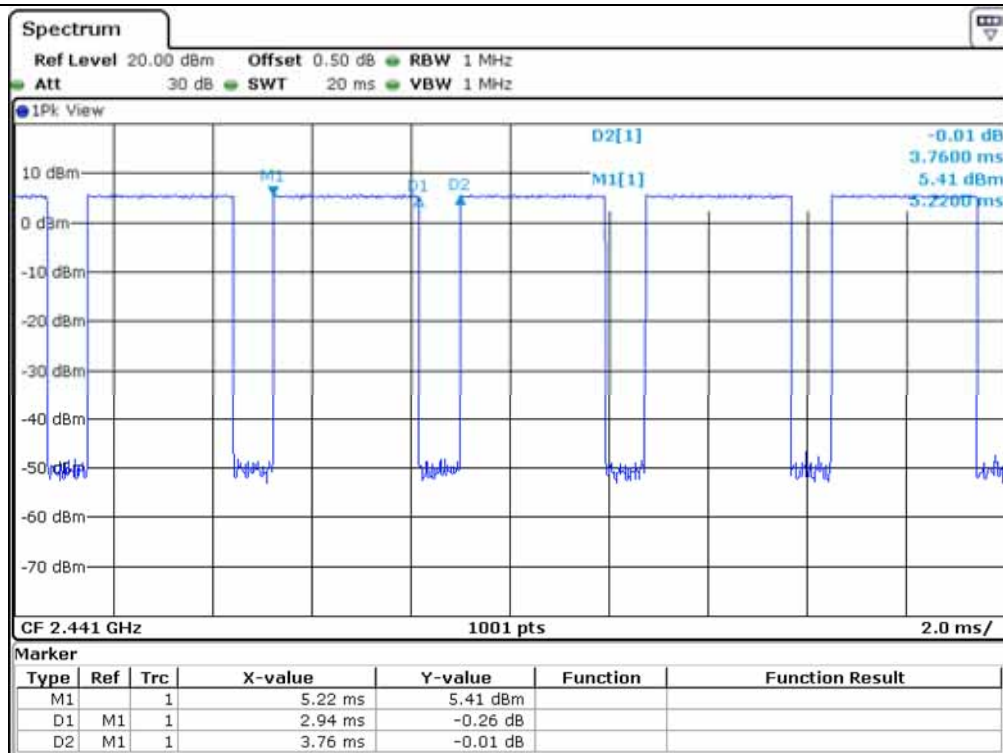


DH1



DH3





DH5

## 10.6 Test data for 3 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019

The system makes worst case 1 600 hops per second or 1 time slot has a length of 625  $\mu$ s with 79 channels.

For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel for 10.13 times per second ( $= 1\,600/2/79$ ) for DH1, and 5.06 times ( $= 1\,600/4/79$ ) for DH3, and 3.38 times ( $= 1\,600/6/79$ ) for DH5.

Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.430	10.13	31.60	137.65	400.00	PASS
DH3	1.680	5.06	31.60	268.63	400.00	
DH5	2.920	3.38	31.60	311.88	400.00	

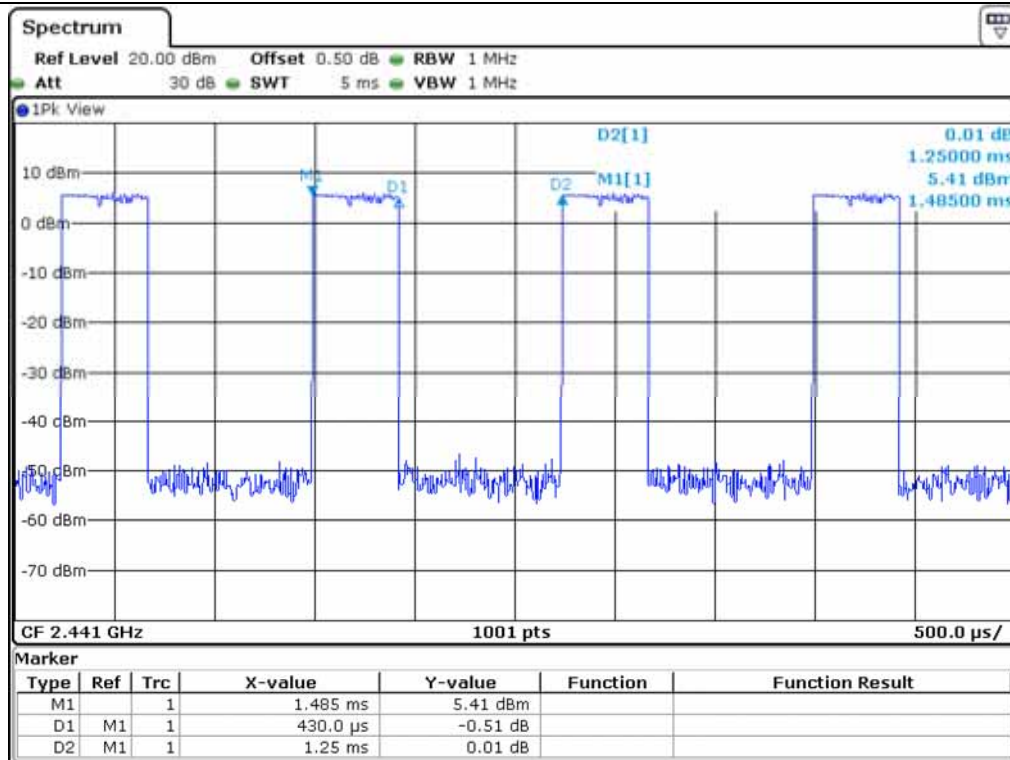
Total dwell time is calculated as following.

Total Dwell Time = Pulse time \* Hops per second with channels \* period time

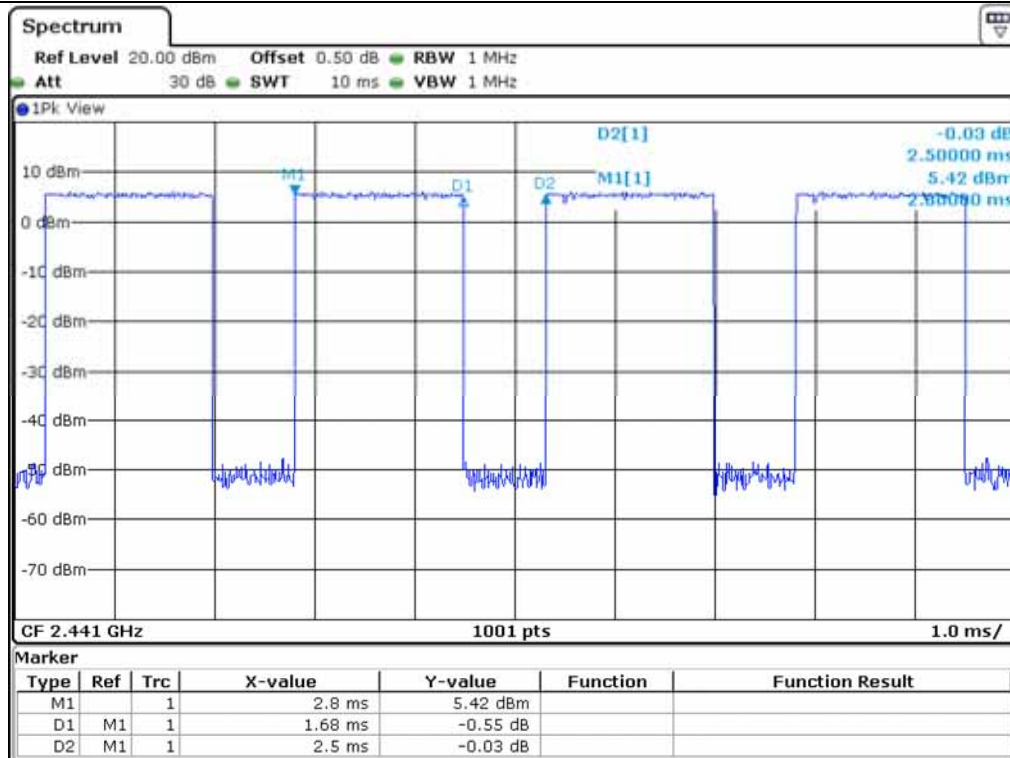
Remark: See next page for an overview sweep performed with peak detector.



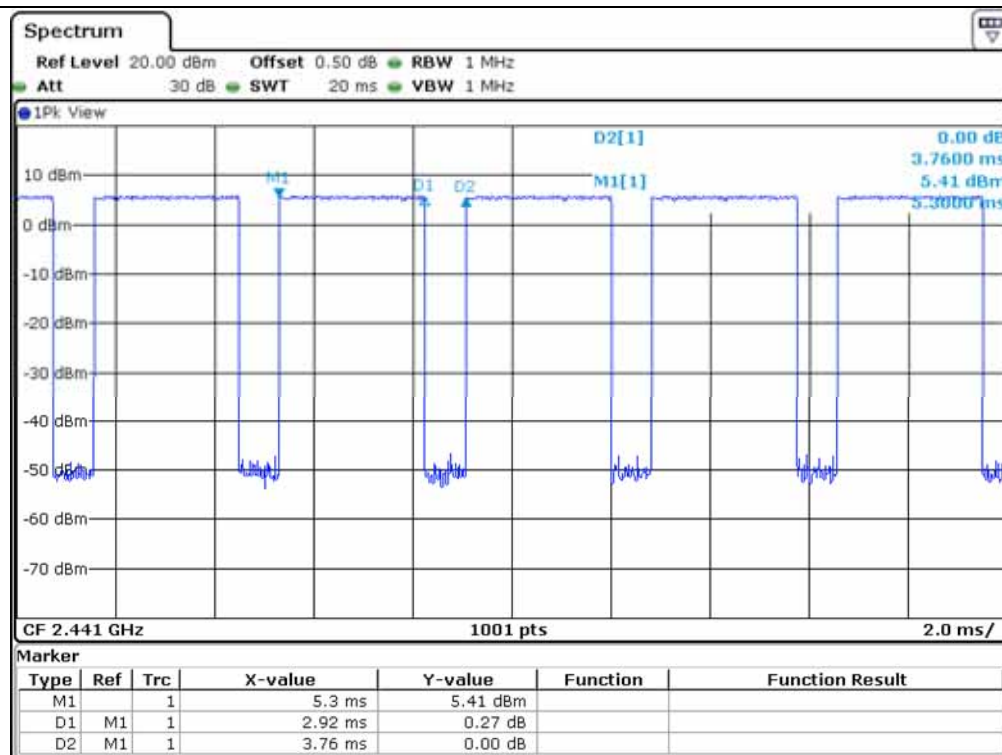
Tested by: Hyung-Kwon, Oh / Assistant Manager



DH1



DH3



DH5

## 11. MAXIMUM PEAK OUTPUT POWER

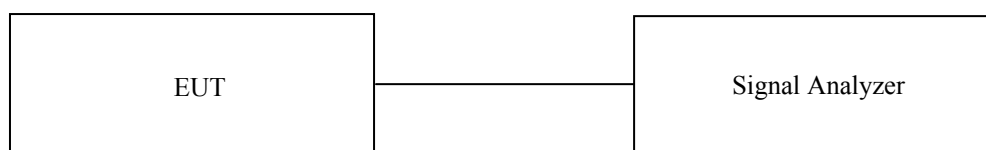
### 11.1 Operating environment

Temperature : 23 °C  
Relative humidity : 45 % R.H.

### 11.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to DTS Bandwidth, the video bandwidth is set to 3 times the resolution bandwidth.



### 11.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

#### 11.4 Test data for 1 Mbps

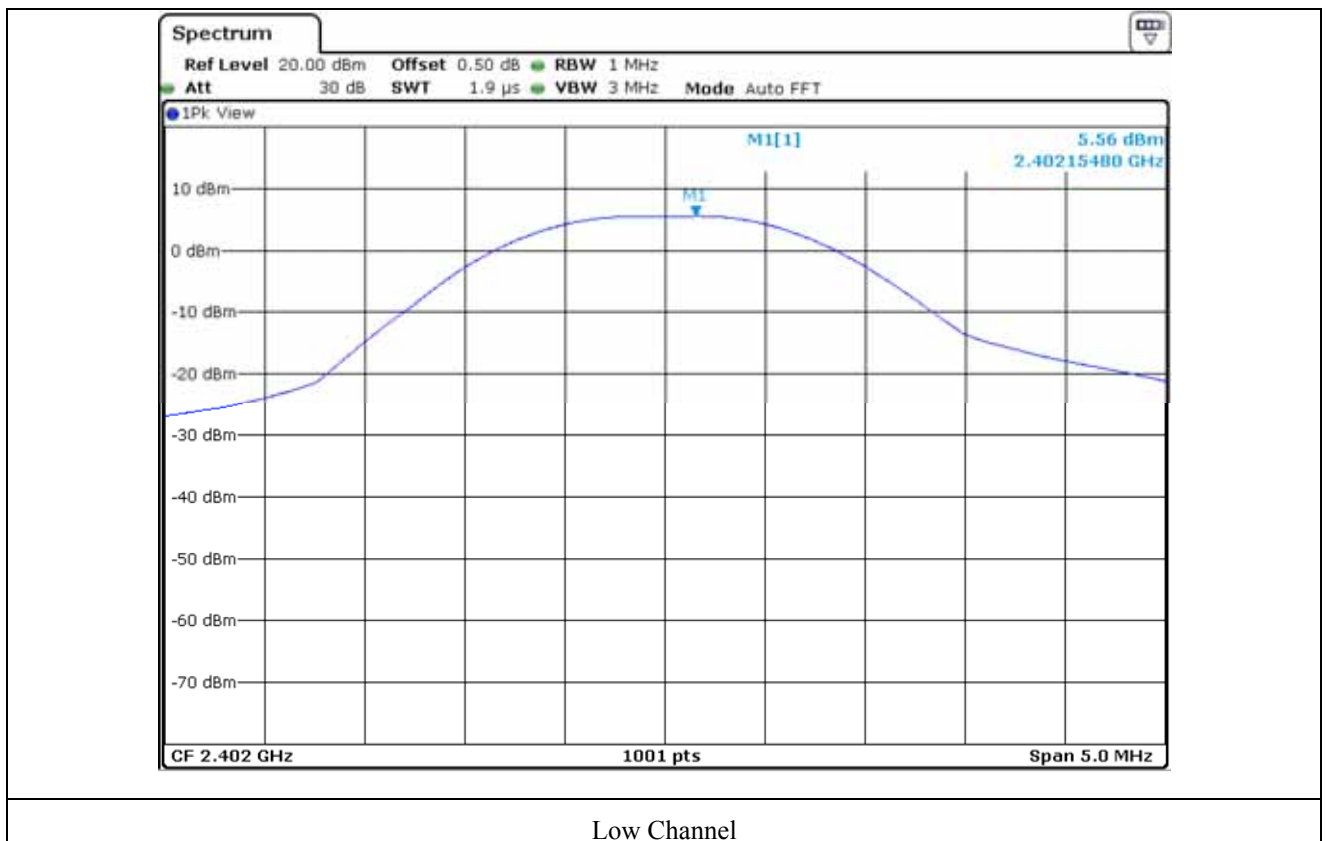
-. Test Date : August 06, 2019 ~ August 09, 2019

-. Test Result : Pass

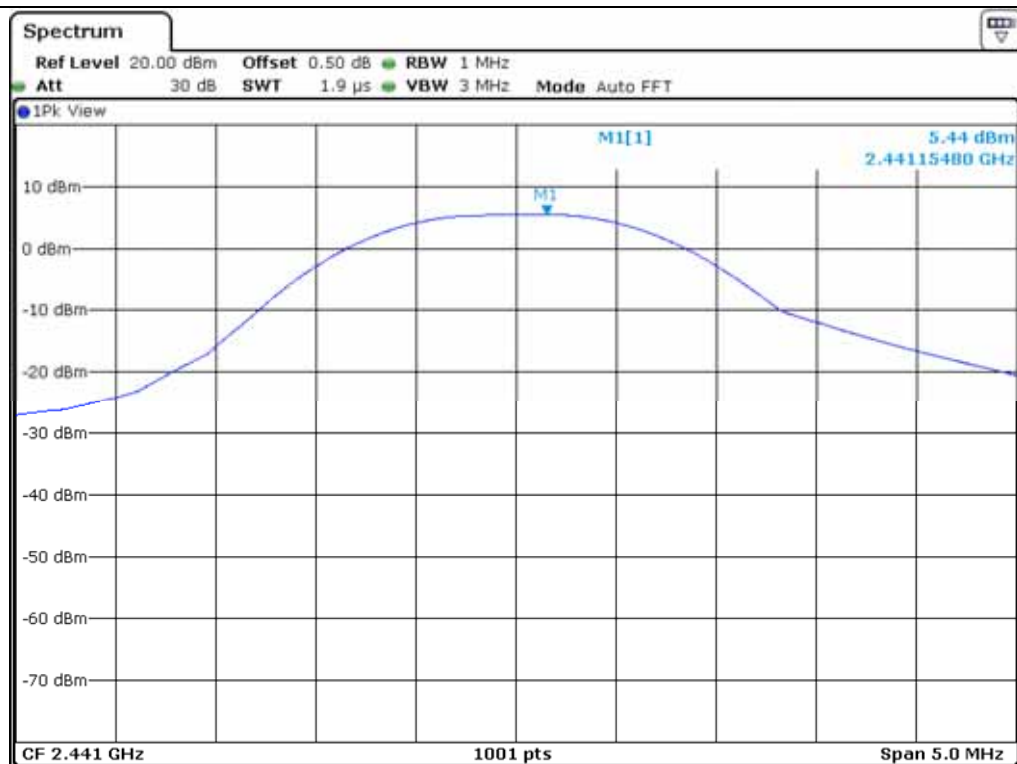
CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	5.56	21.00	15.44
MIDDLE	2 441.00	5.44	21.00	15.56
HIGH	2 480.00	5.27	21.00	15.73

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

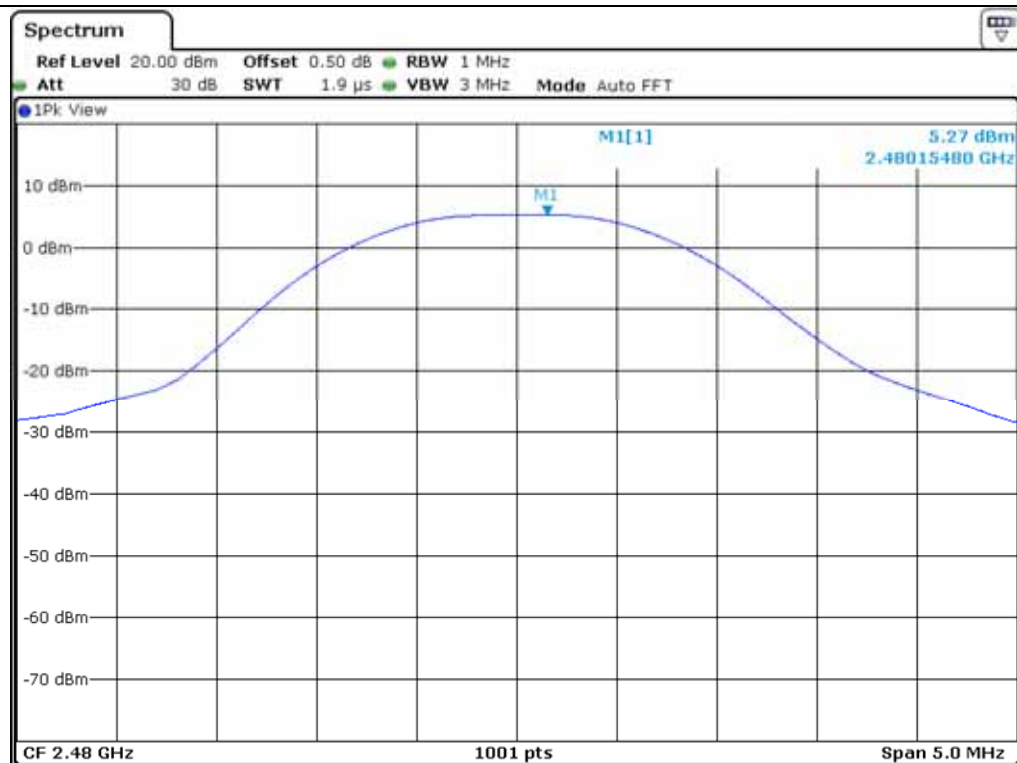
Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel



Middle Channel



High Channel

### 11.5 Test data for 2 Mbps

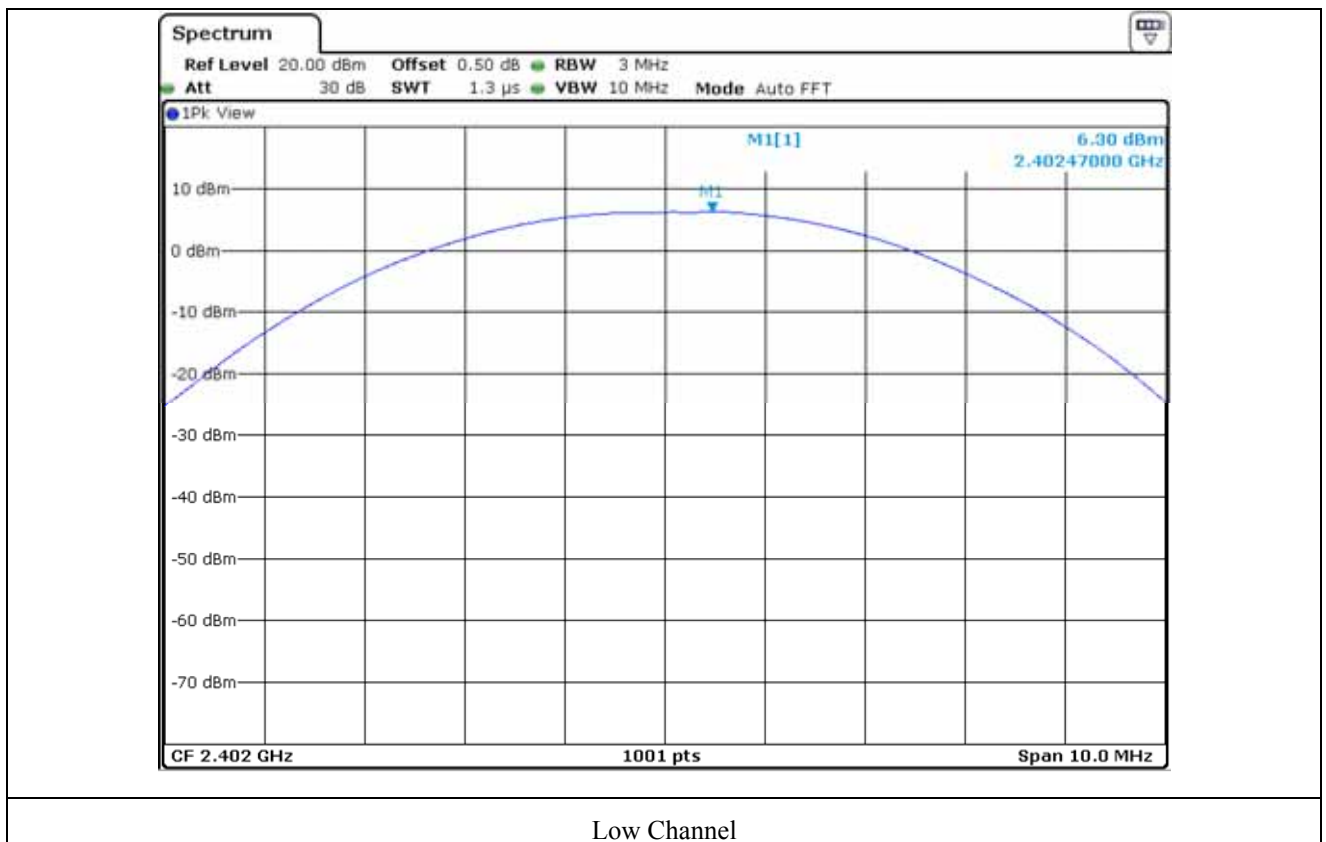
-. Test Date : August 06, 2019 ~ August 09, 2019

-. Test Result : Pass

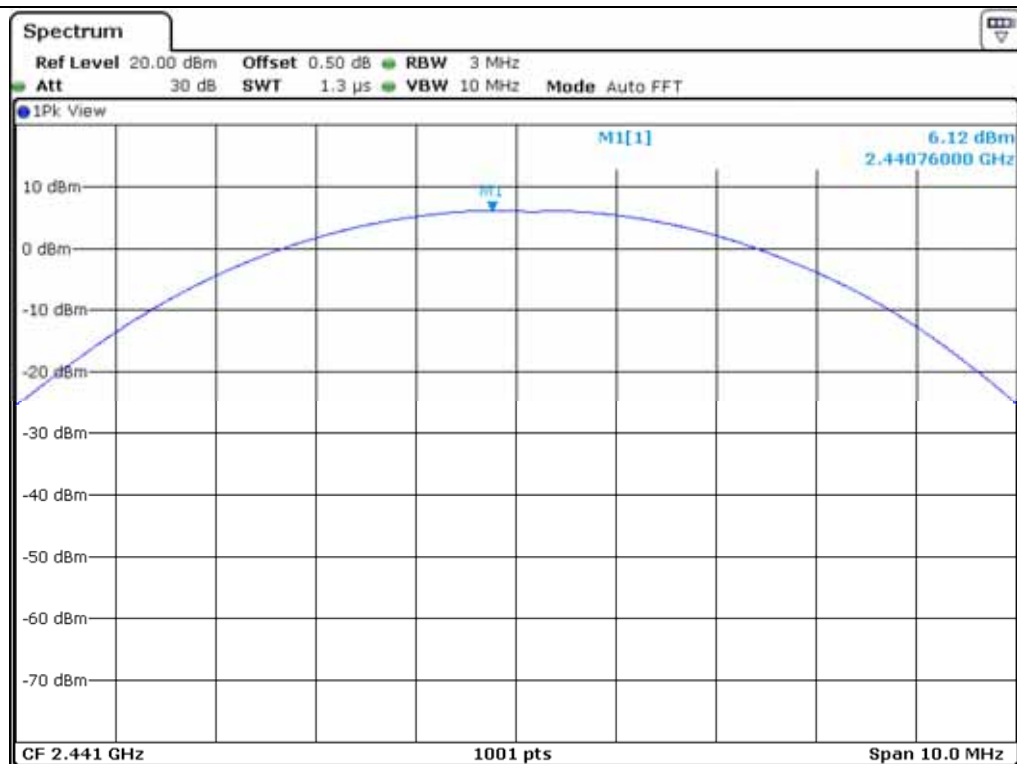
CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	6.30	21.00	14.70
MIDDLE	2 441.00	6.12	21.00	14.88
HIGH	2 480.00	5.87	21.00	15.13

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

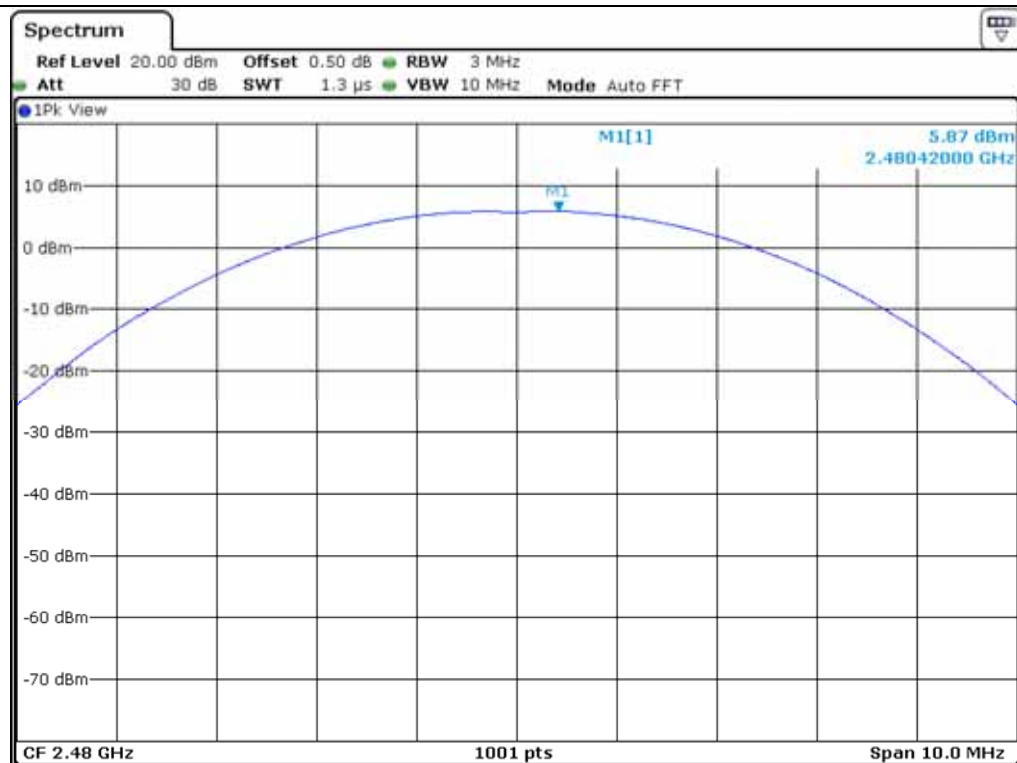
Tested by: Hyung-Kwon, Oh / Assistant Manager







Middle Channel



High Channel

### 11.6 Test data for 3 Mbps

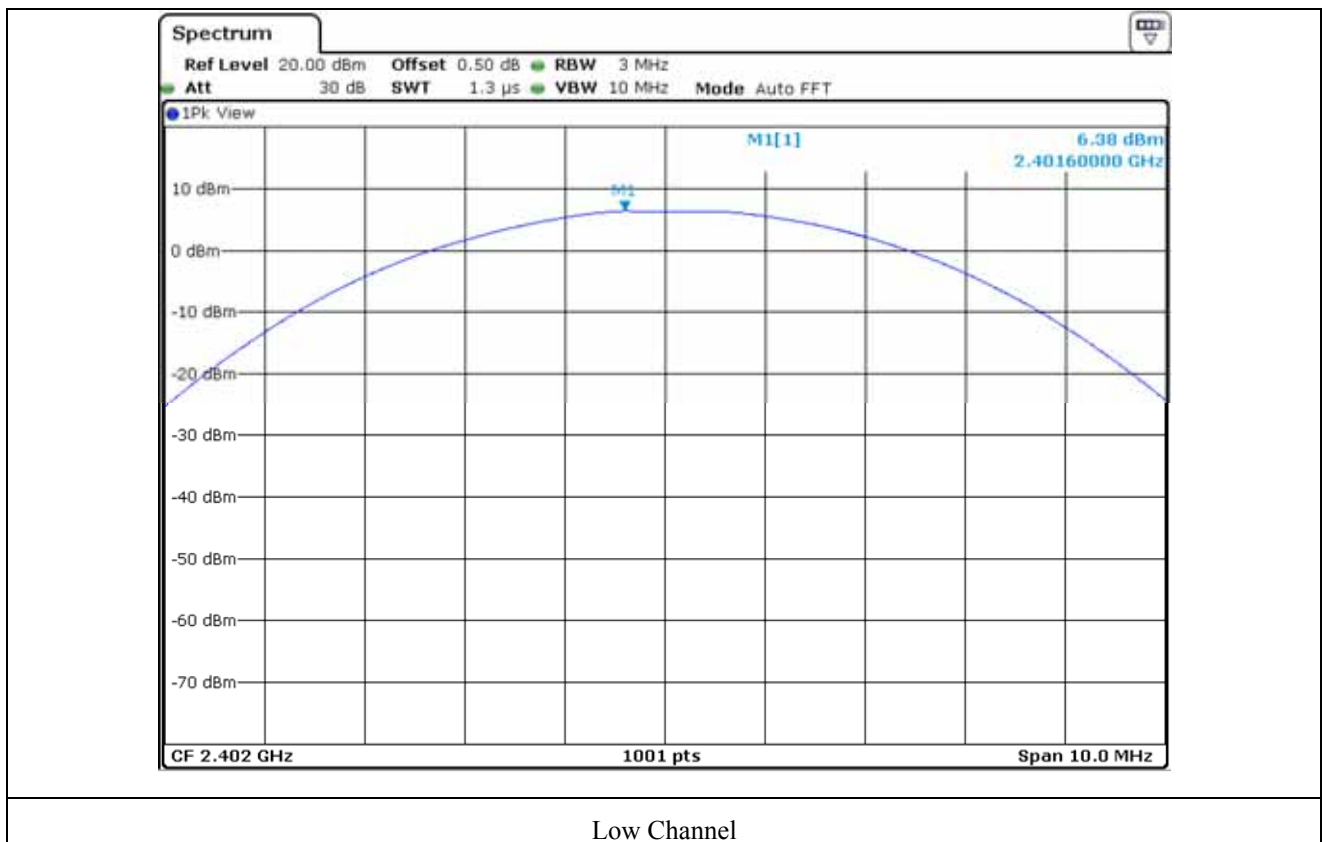
-. Test Date : August 06, 2019 ~ August 09, 2019

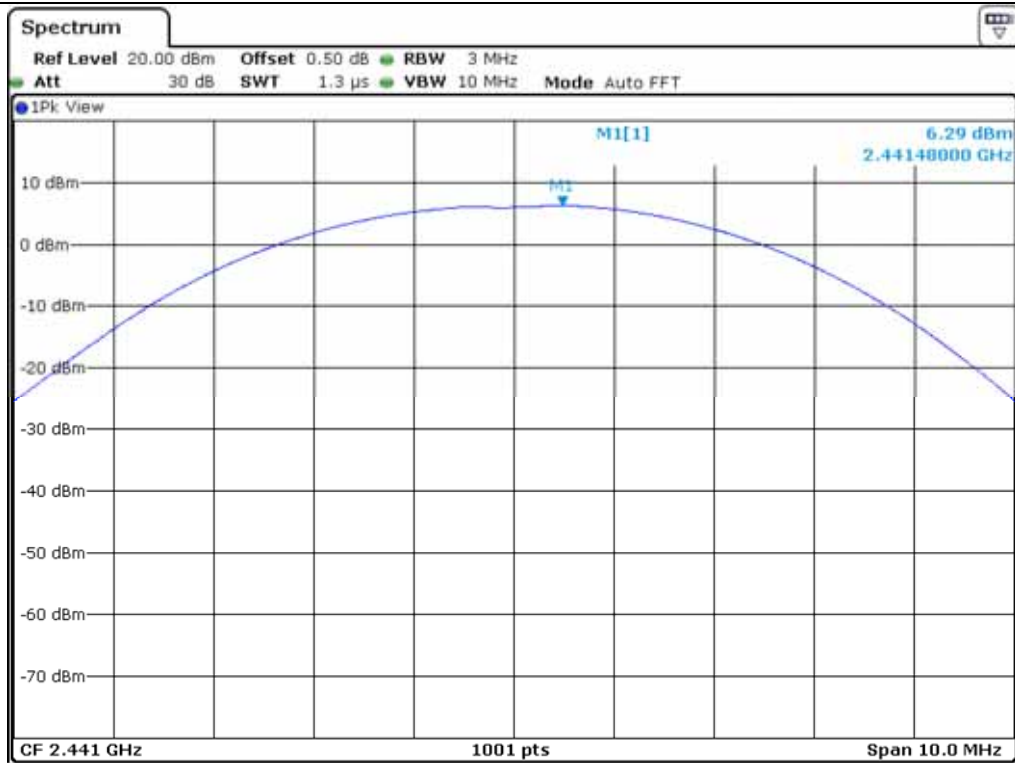
-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	6.38	21.00	14.62
MIDDLE	2 441.00	6.29	21.00	14.71
HIGH	2 480.00	6.10	21.00	14.90

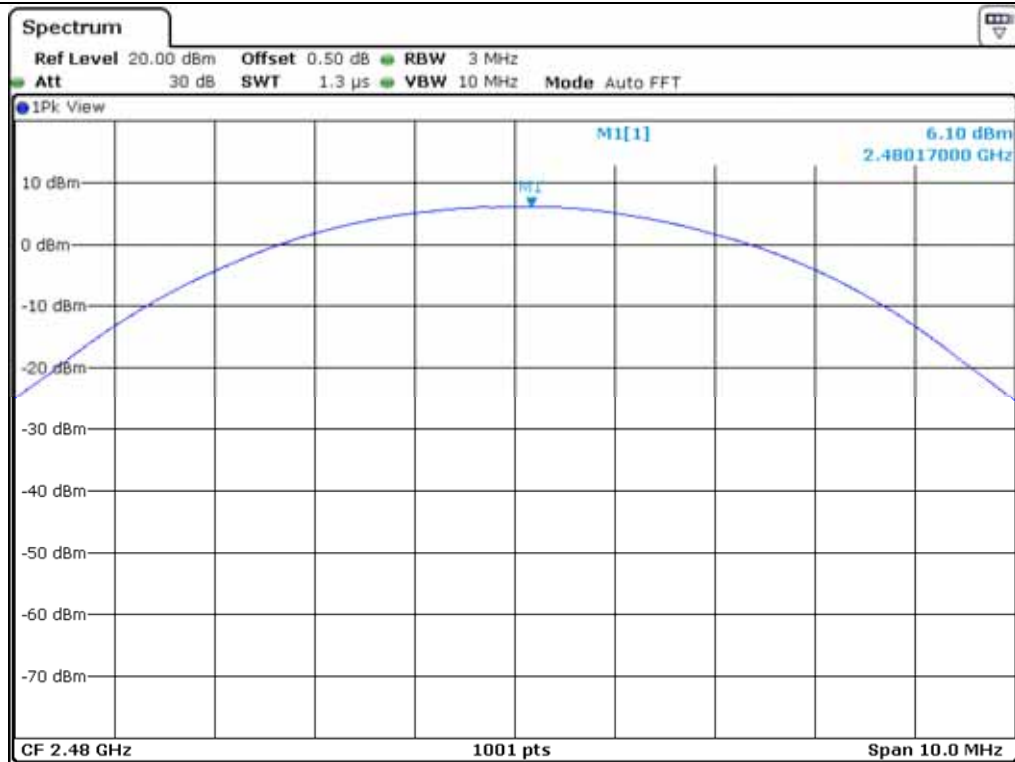
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

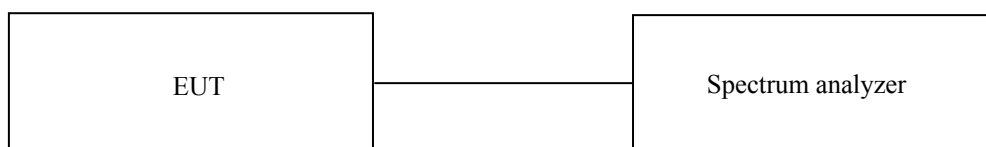
## 12. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

### 12.1 Operating environment

Temperature : 23 °C  
Relative humidity : 45 % R.H.

### 12.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution and video bandwidth is set to 100 kHz, and peak detection was used.



### 12.3 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 26.5 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.

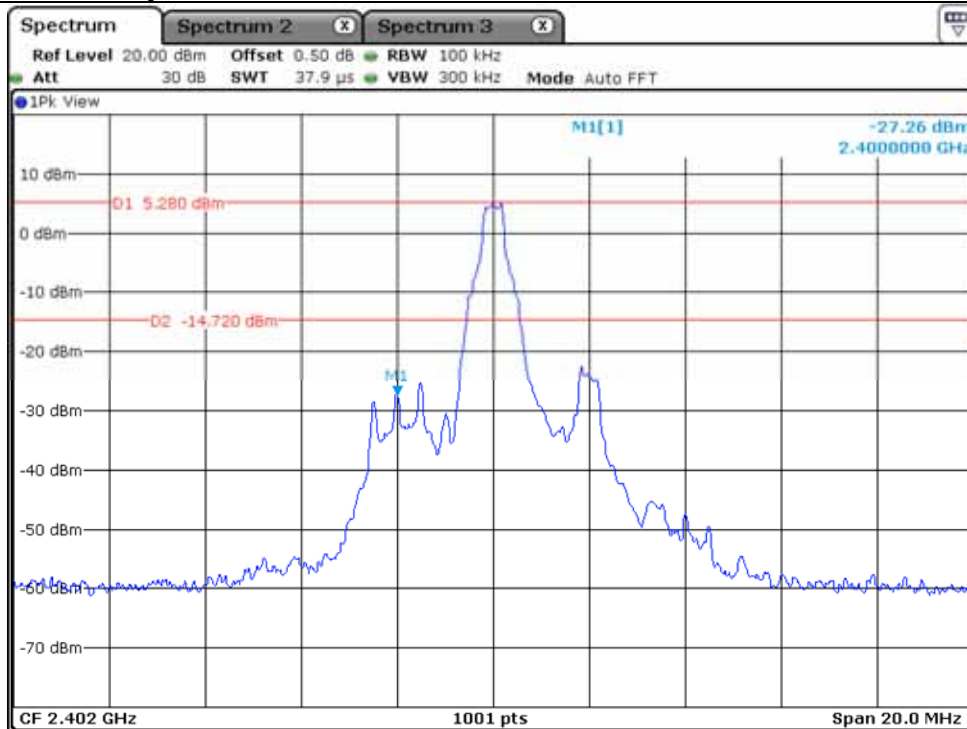
### 12.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Mar. 28, 2019 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 18, 2019 (1Y)
■ -	BBV 9718 B	Schwarzbeck	Amplifier	009	Mar. 20, 2019 (1Y)
■ -	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Mar. 11, 2019 (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	777	Apr. 13, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 16, 2019 (1Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 16, 2019 (1Y)

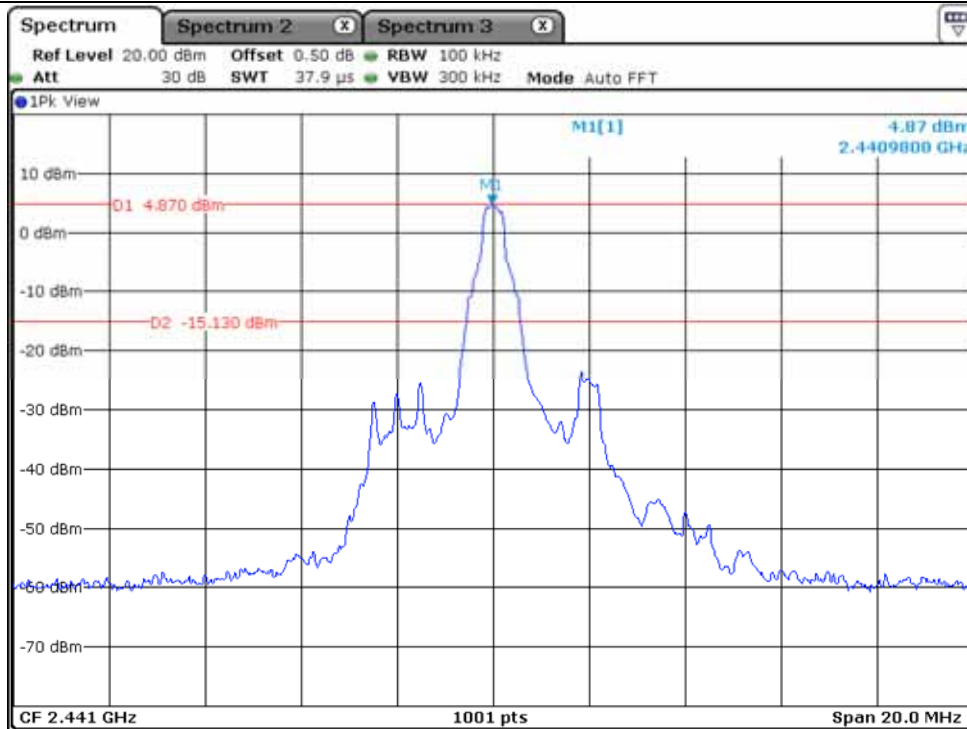
All test equipment used is calibrated on a regular basis.

## 12.5 Test data for conducted emission

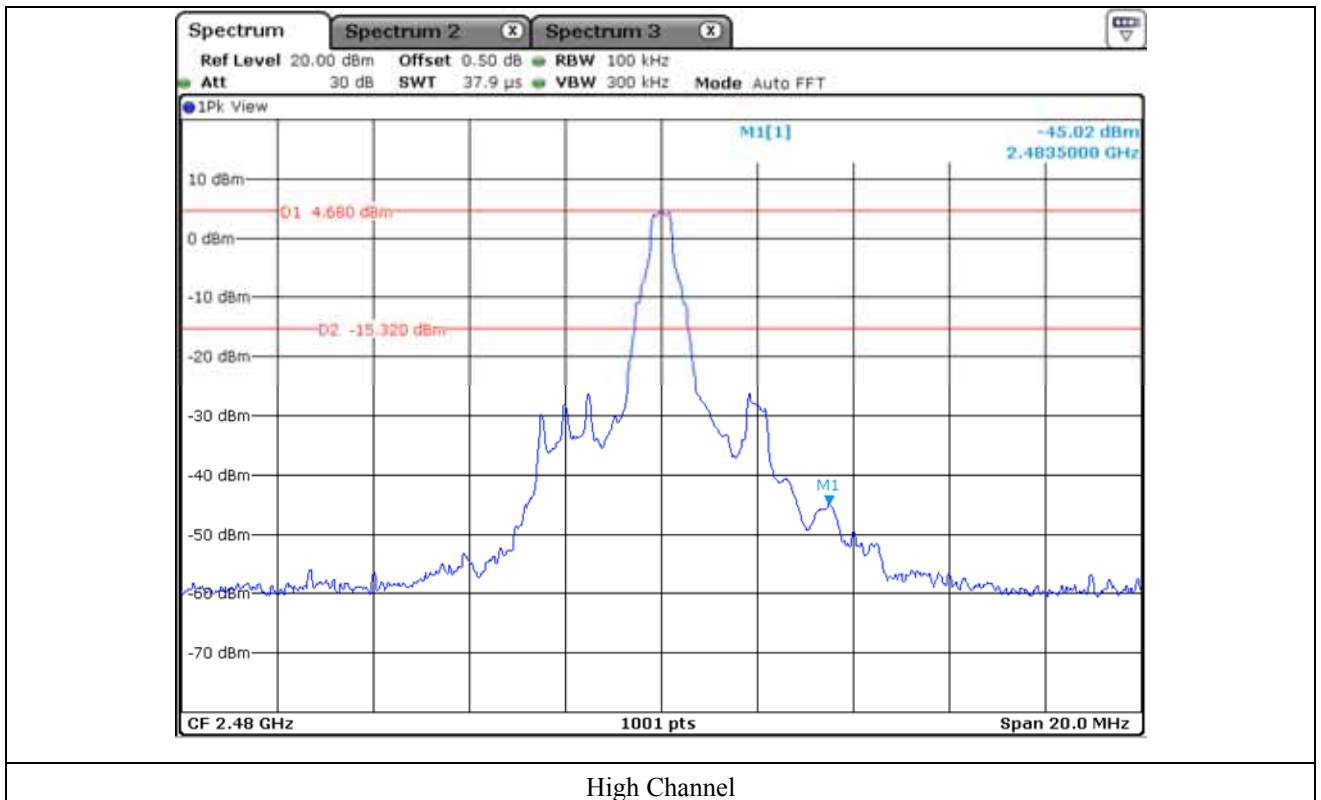
### 12.5.1 Test data for 1 Mbps

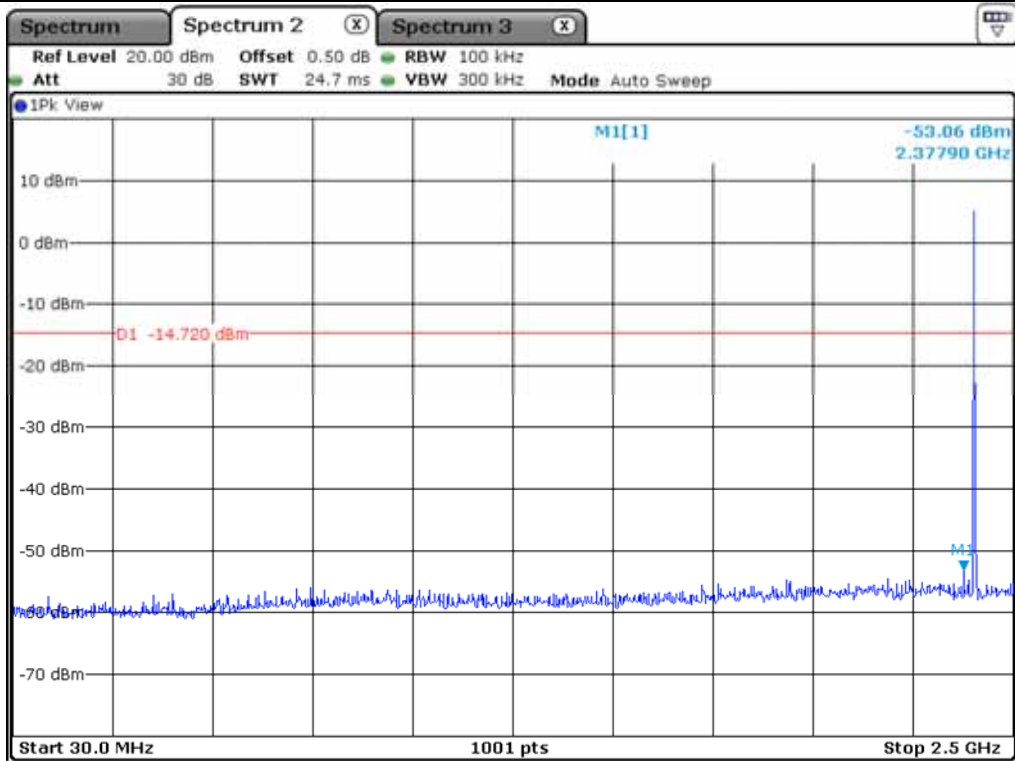


Low Channel

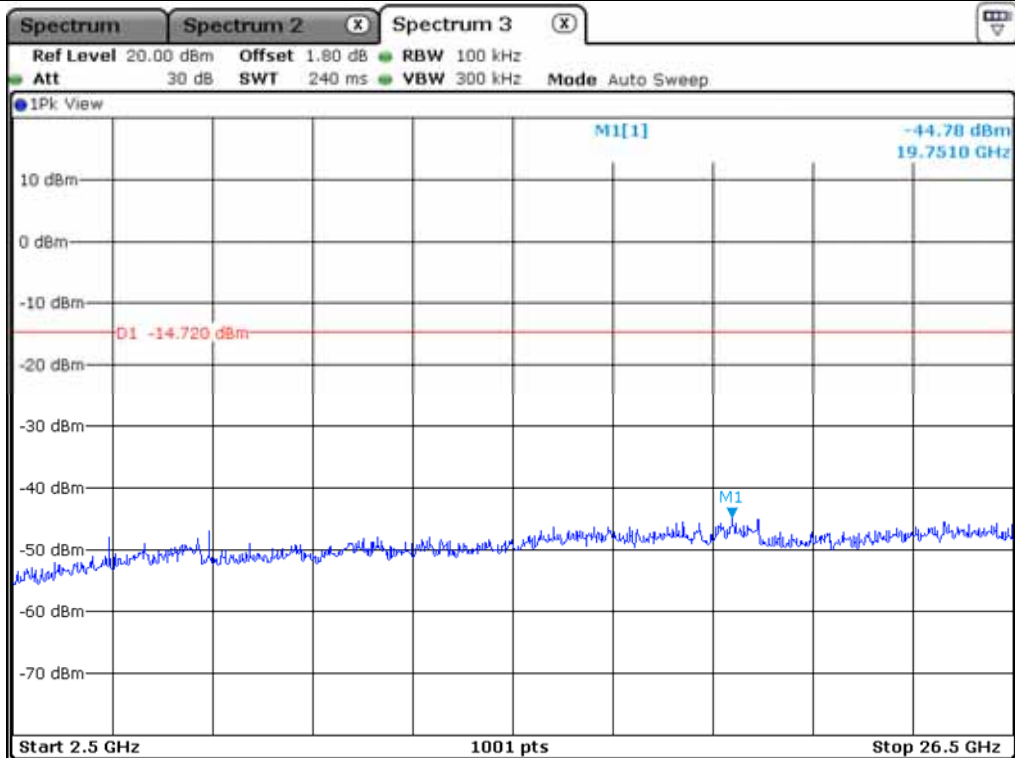


Middle Channel

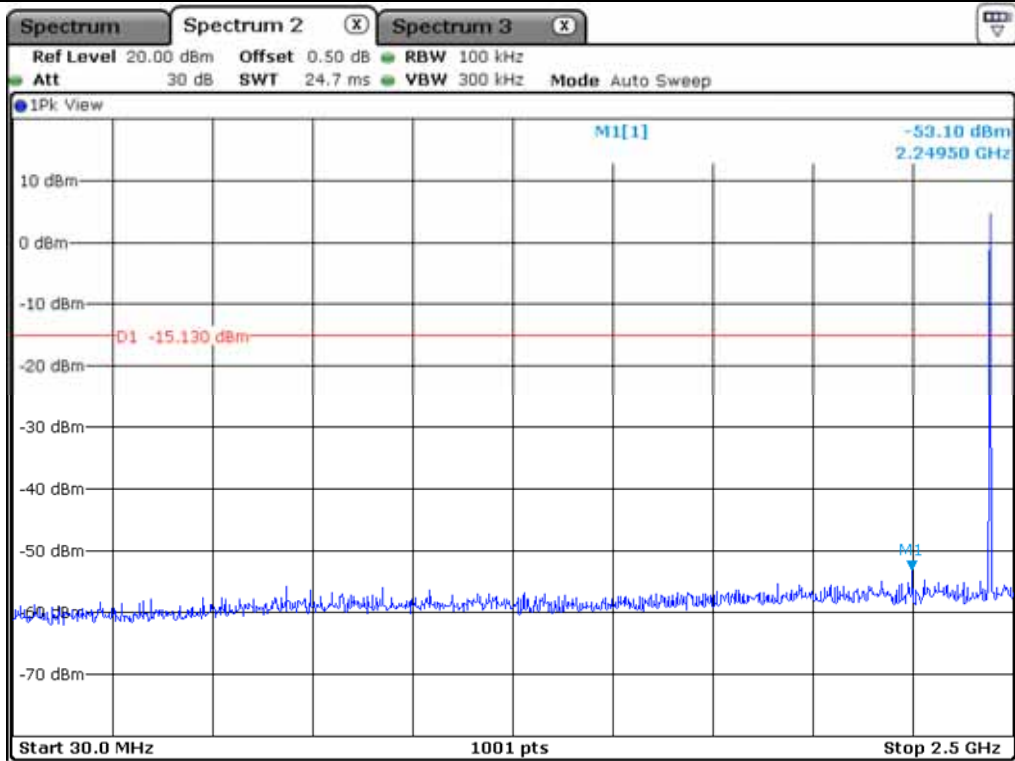




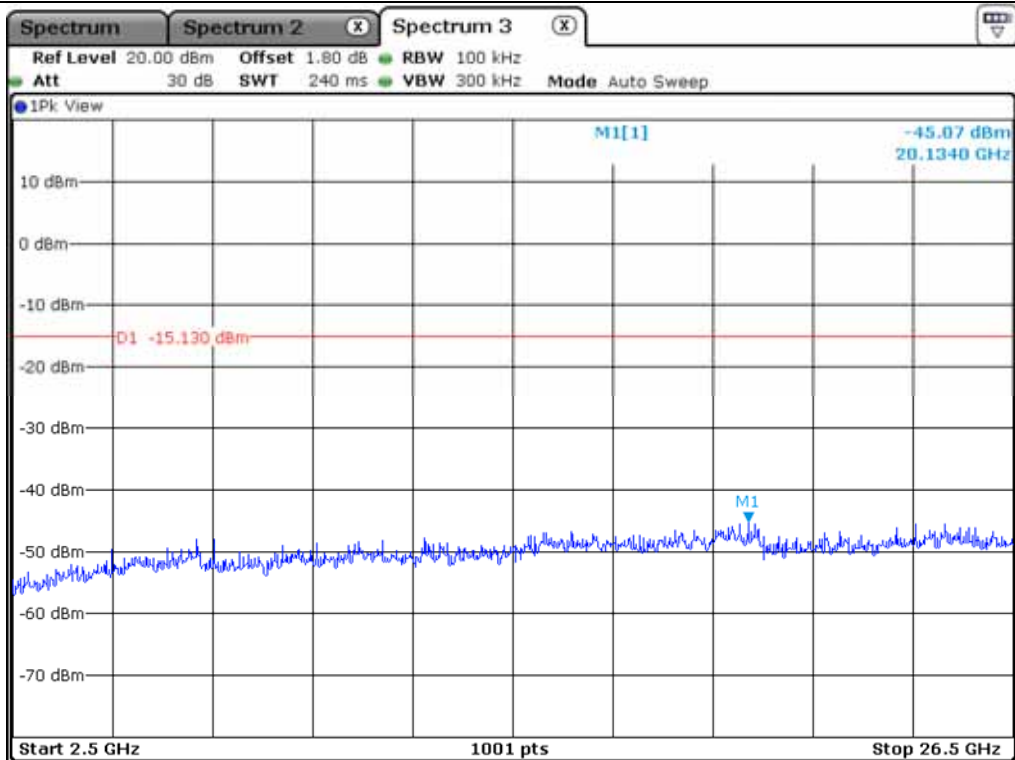
Low Channel



Low Channel

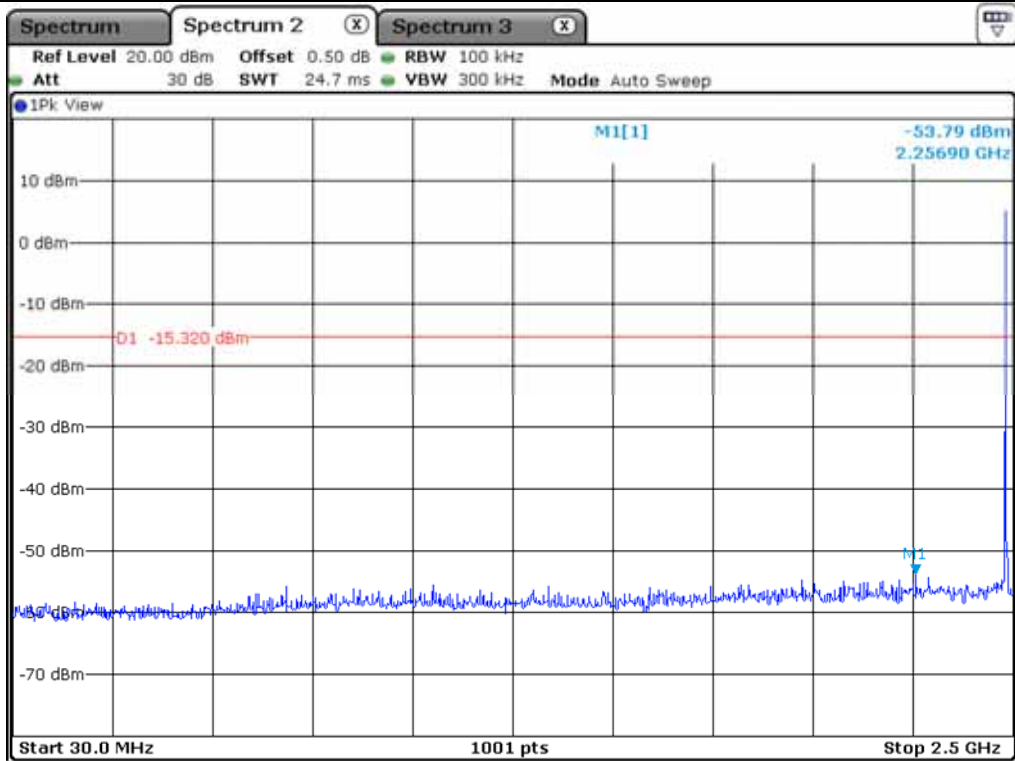


Middle Channel

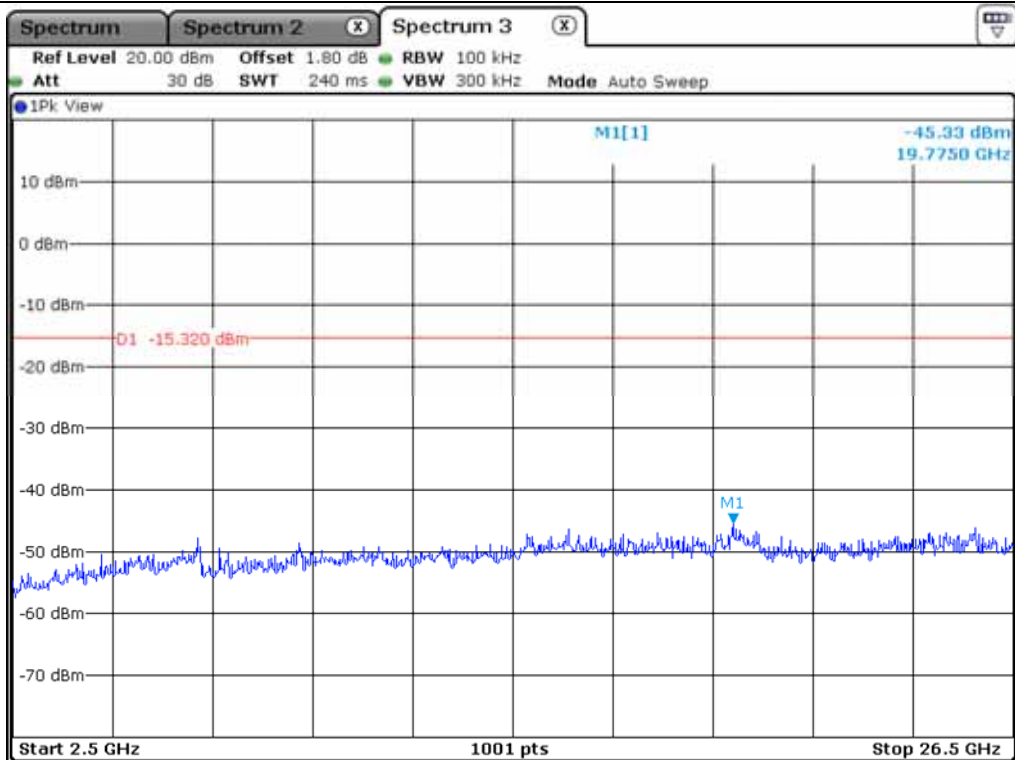


Middle Channel



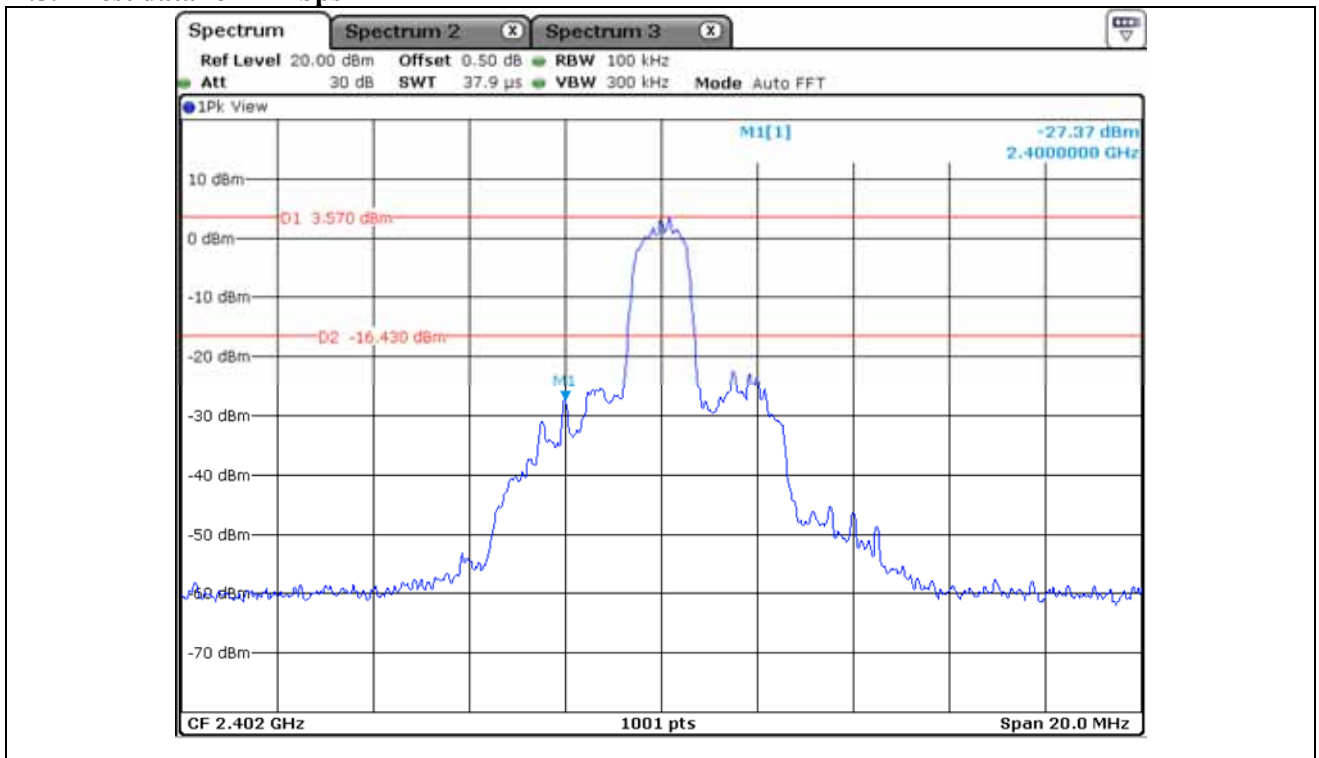


High Channel

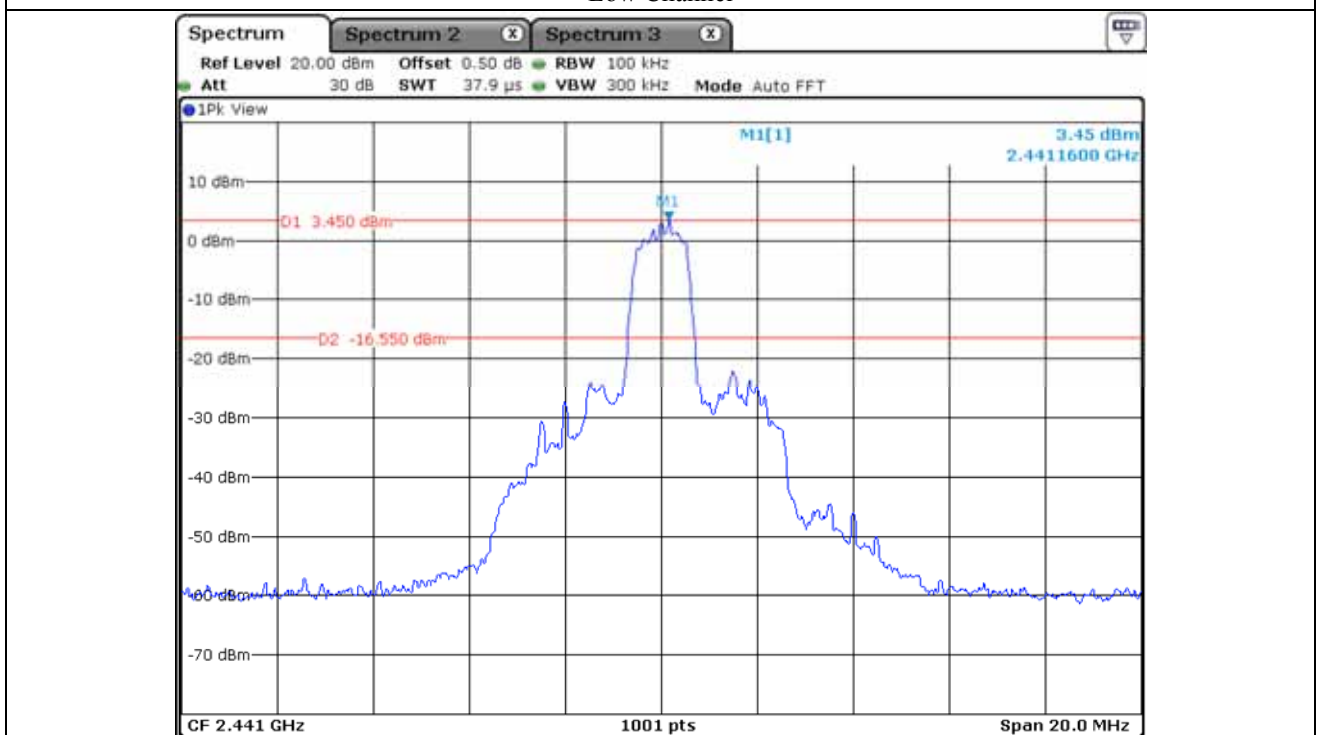


High Channel

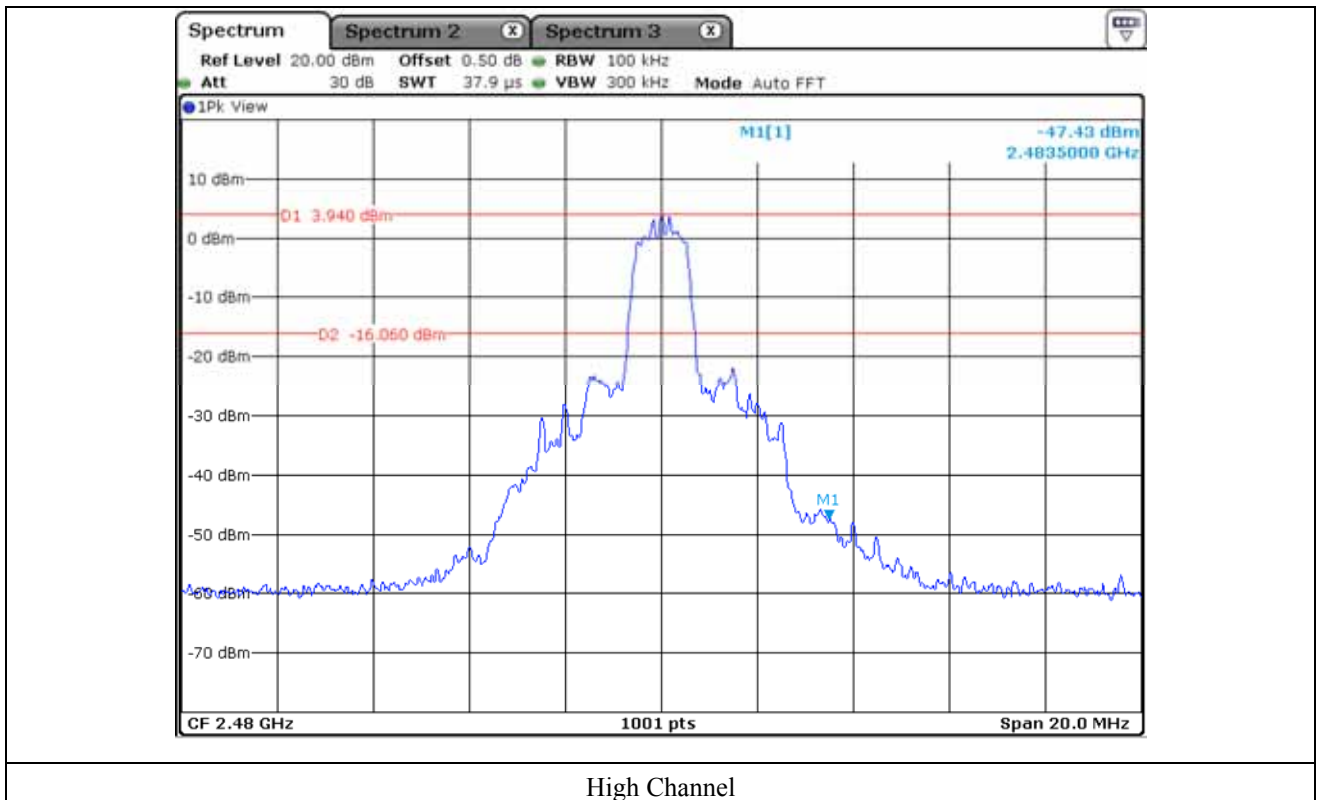
## 12.5.2 Test data for 2 Mbps

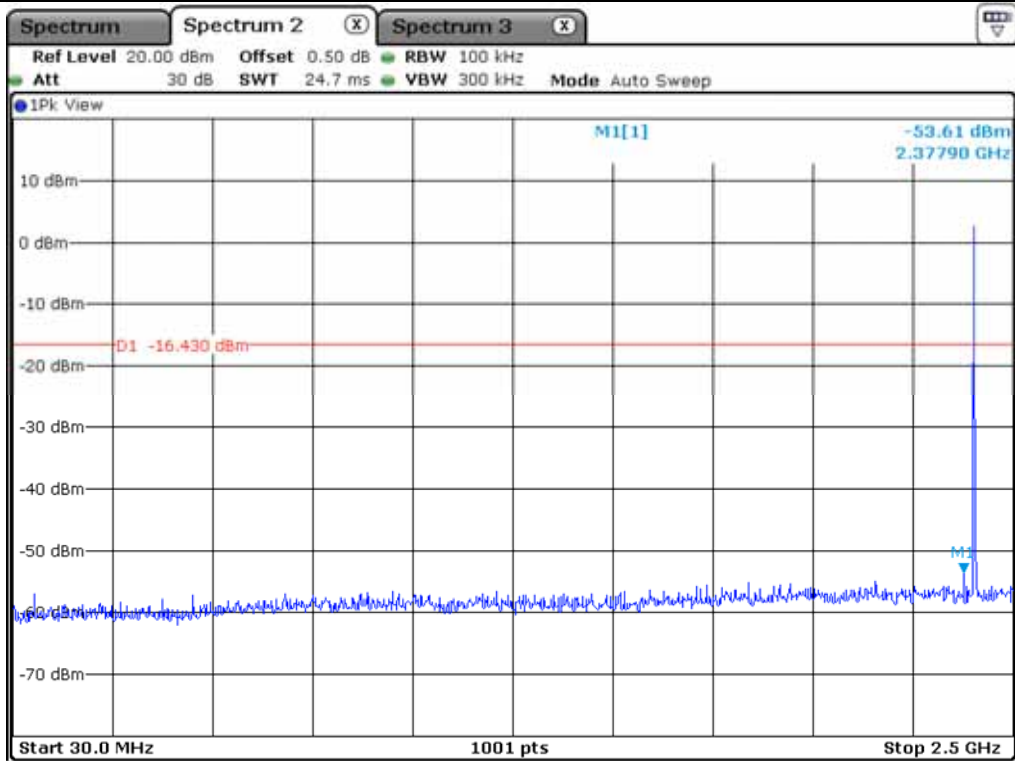


Low Channel

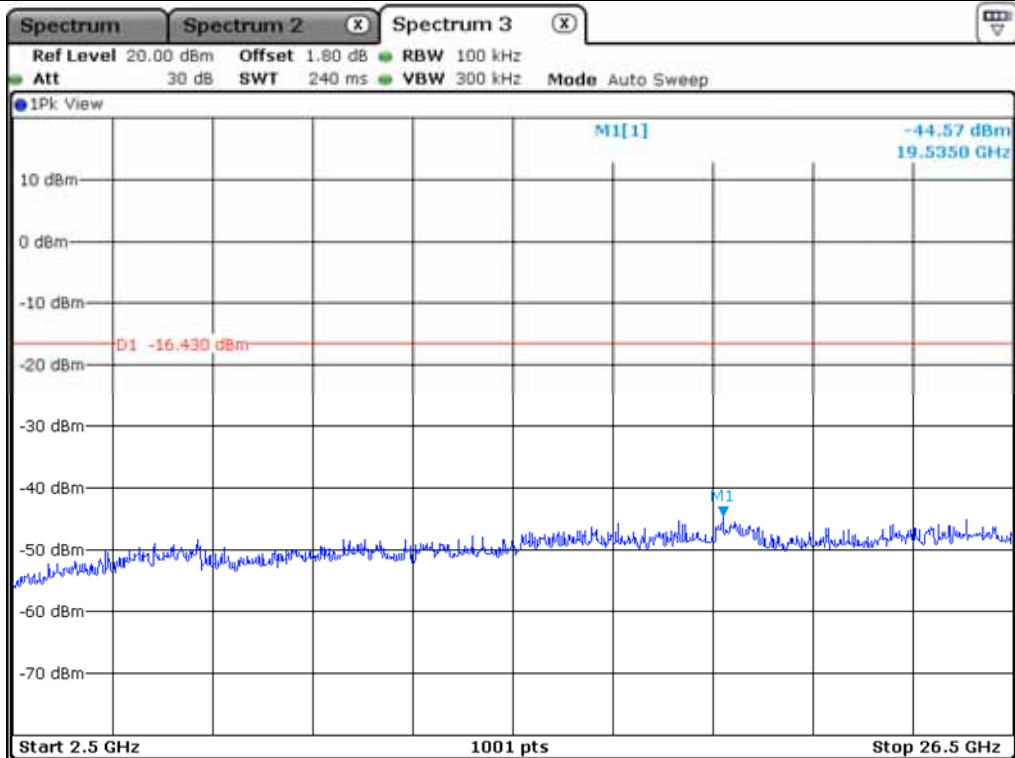


Middle Channel

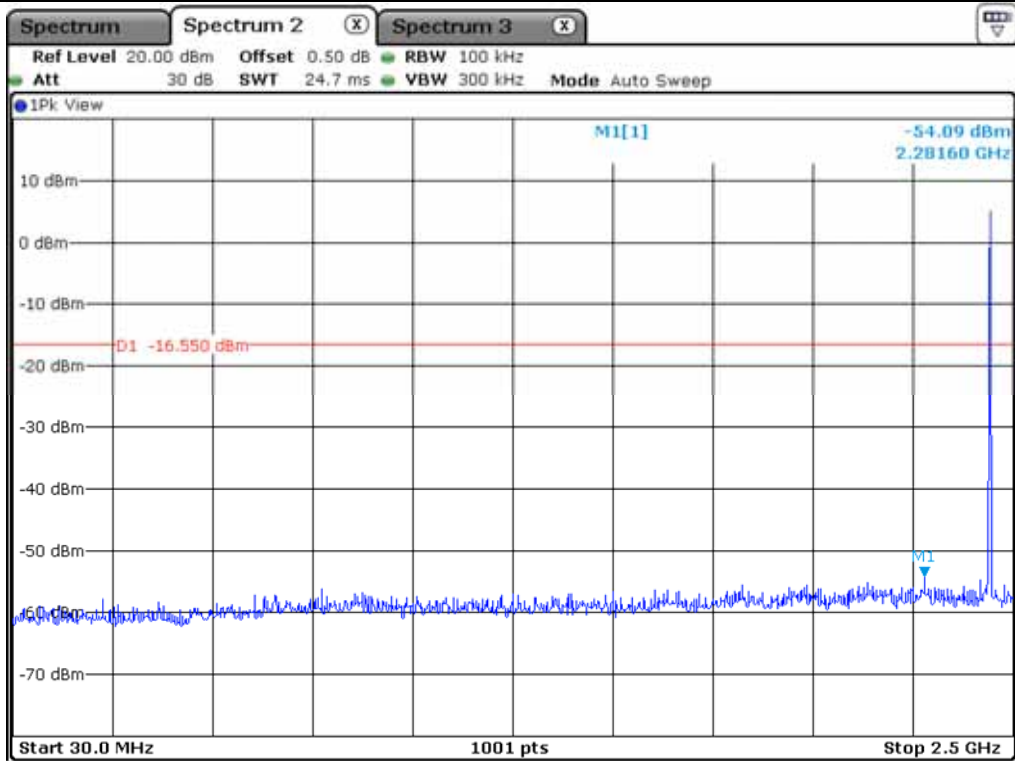




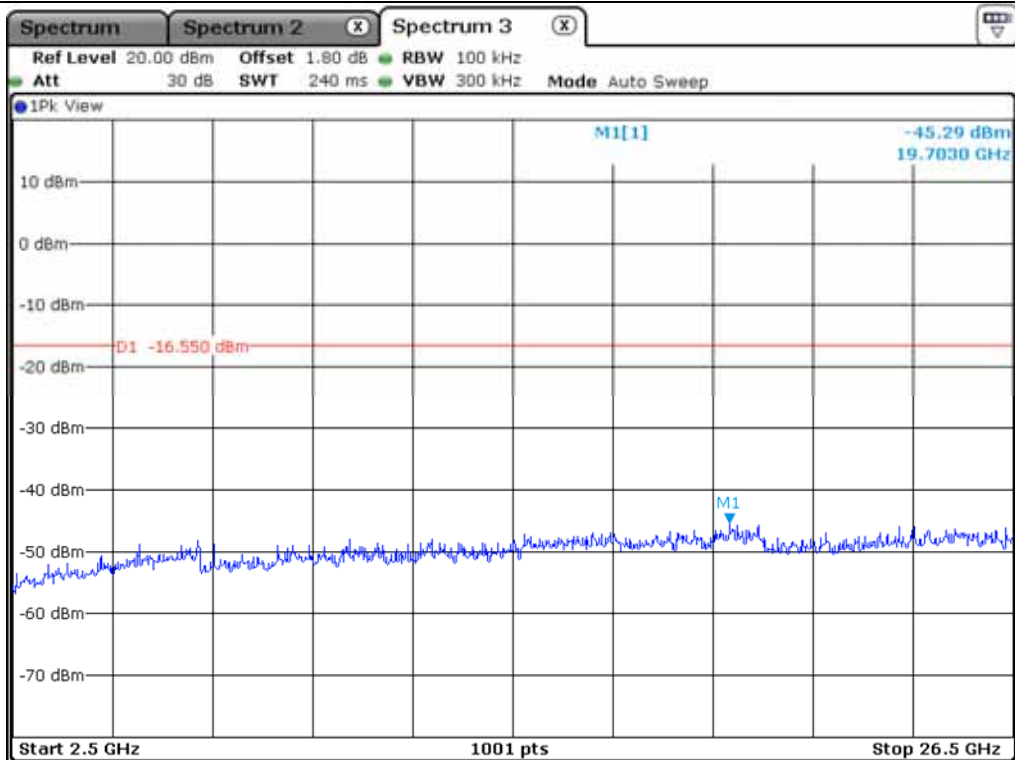
Low Channel



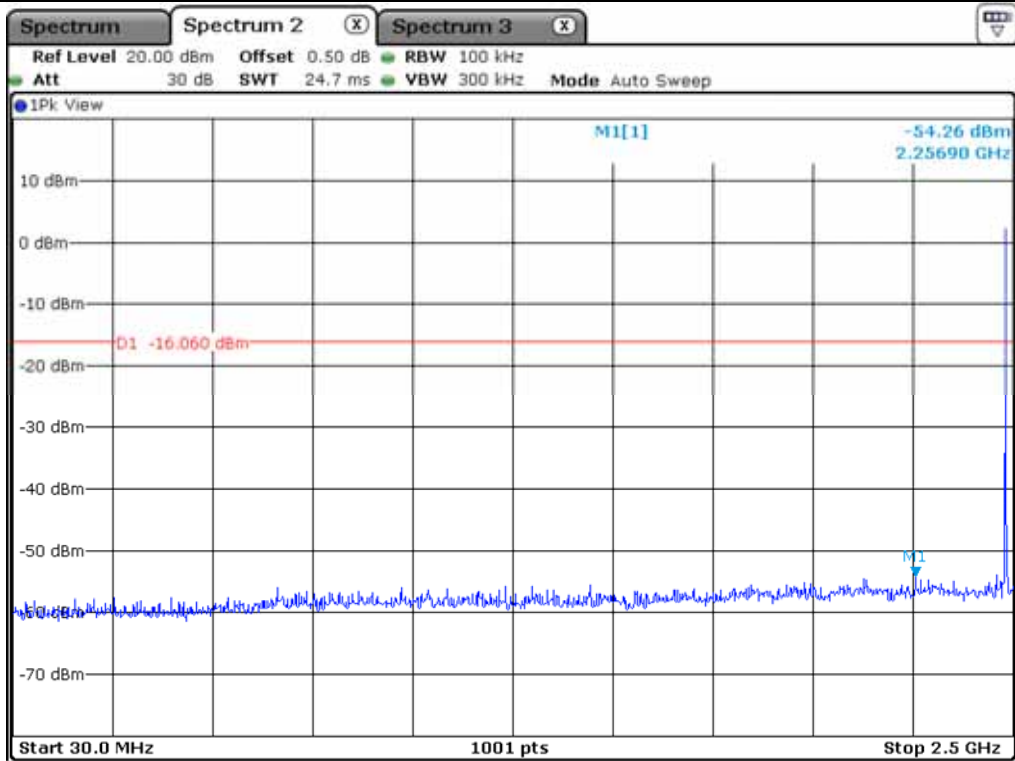
Low Channel



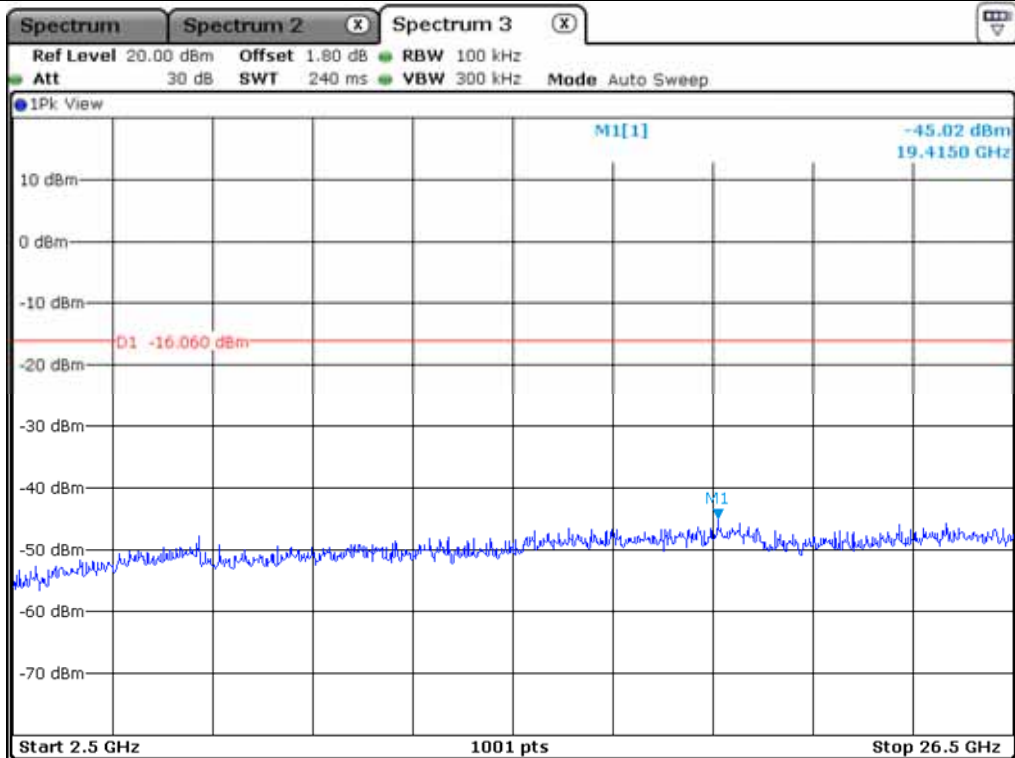
Middle Channel



Middle Channel

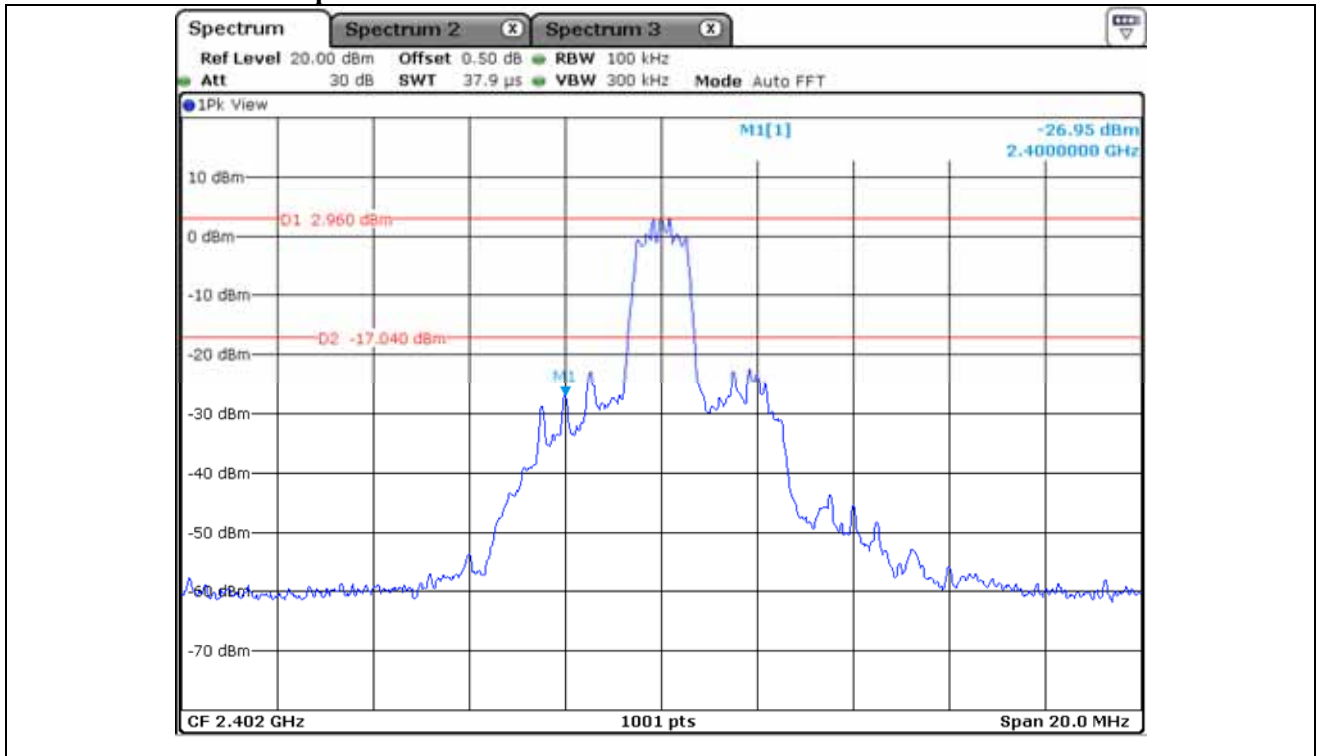


High Channel

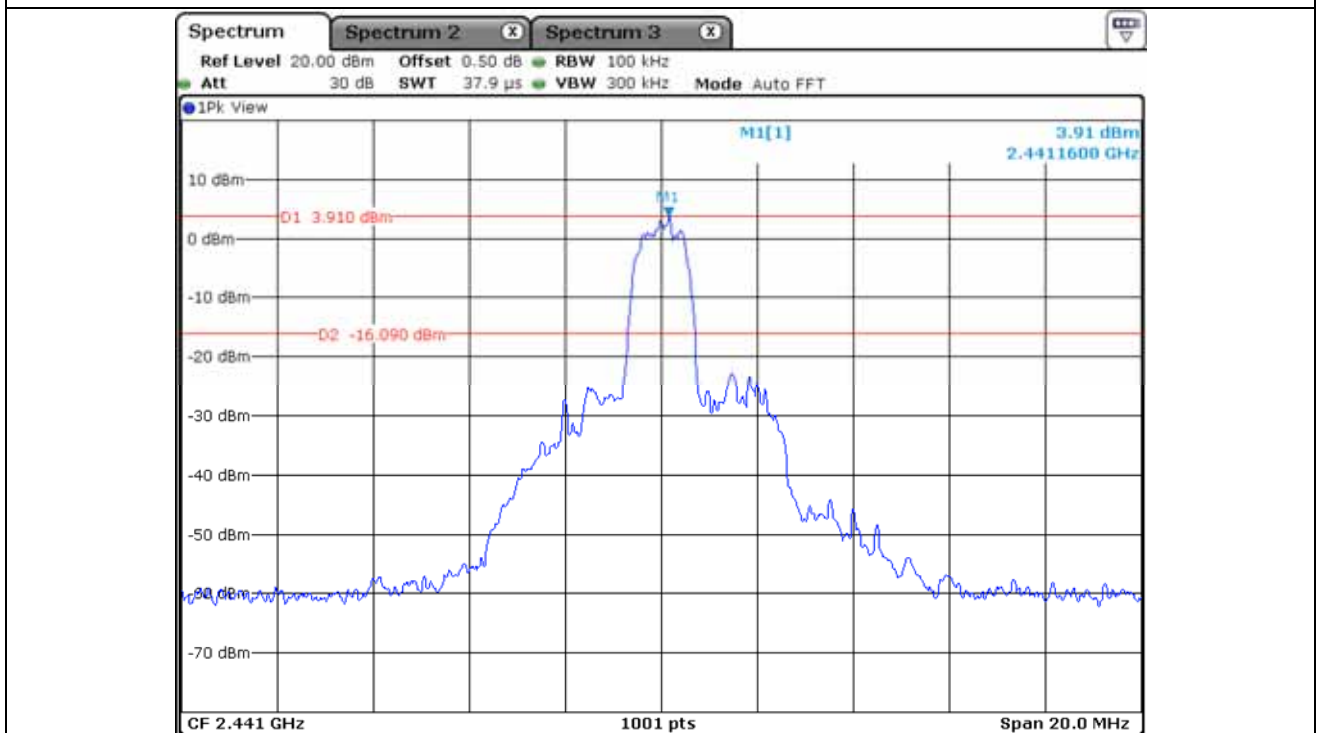


High Channel

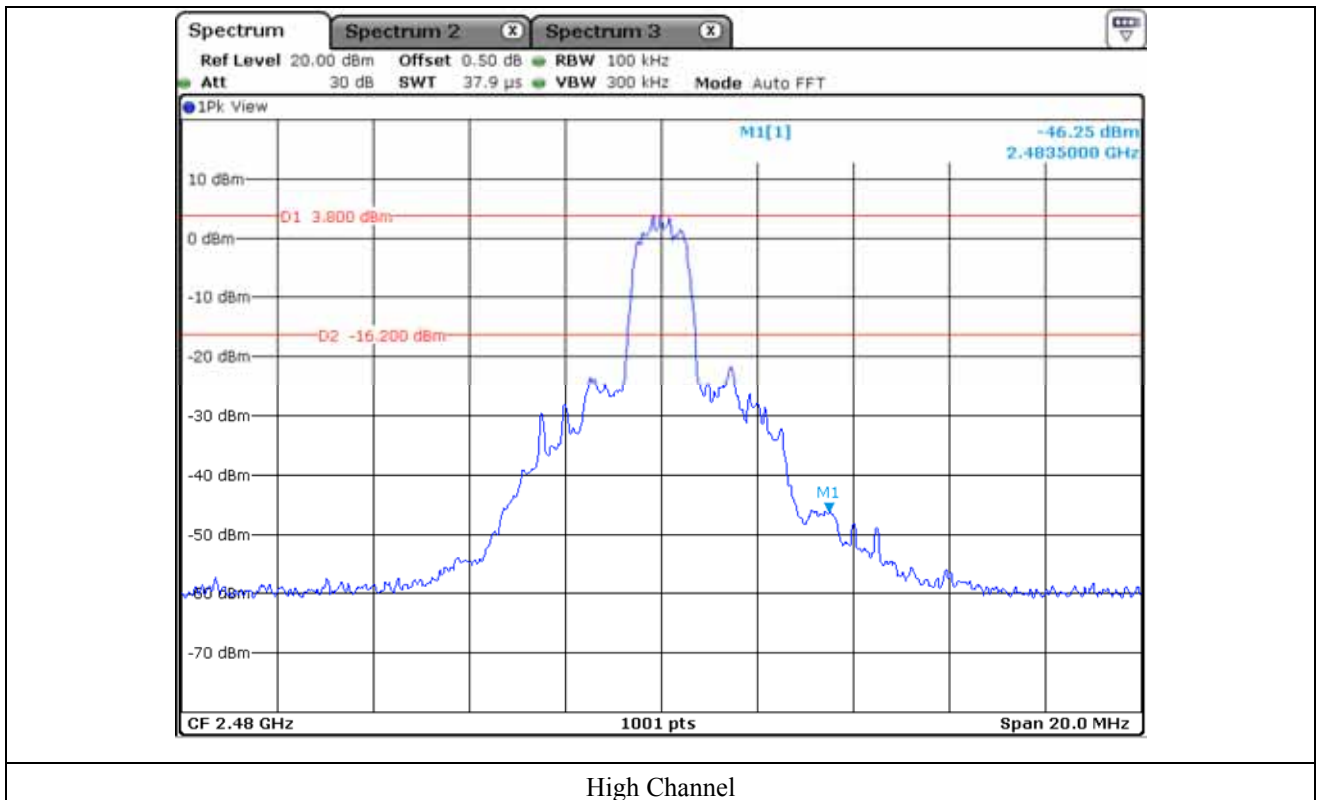
### 12.5.3 Test data for 3 Mbps



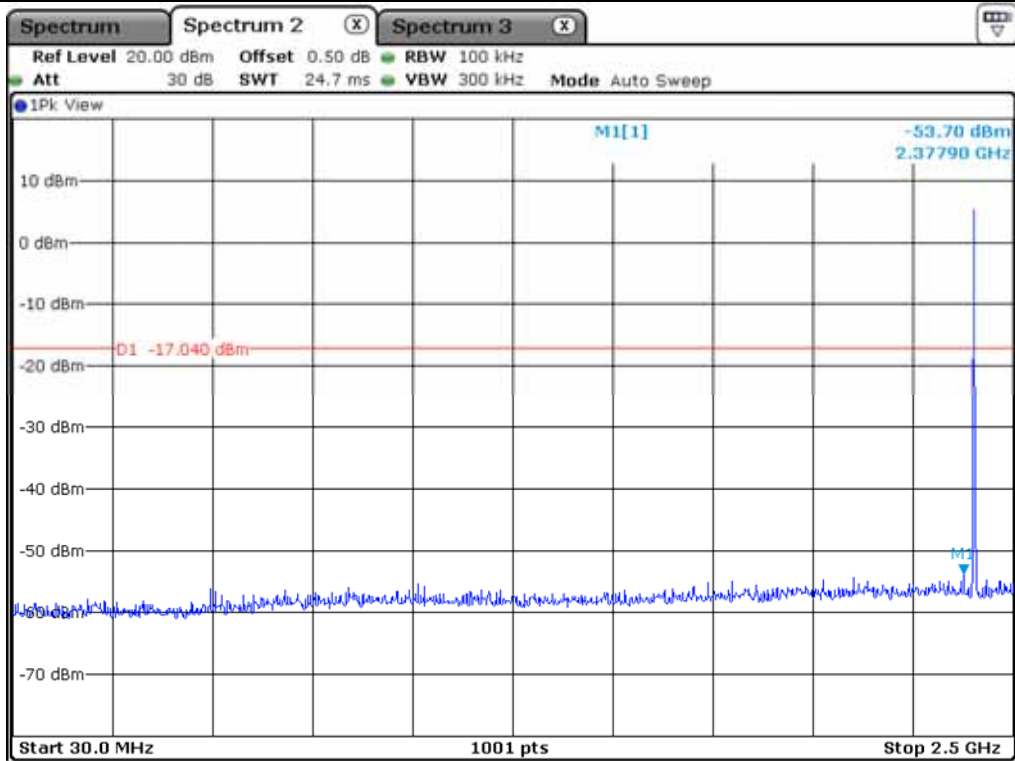
Low Channel



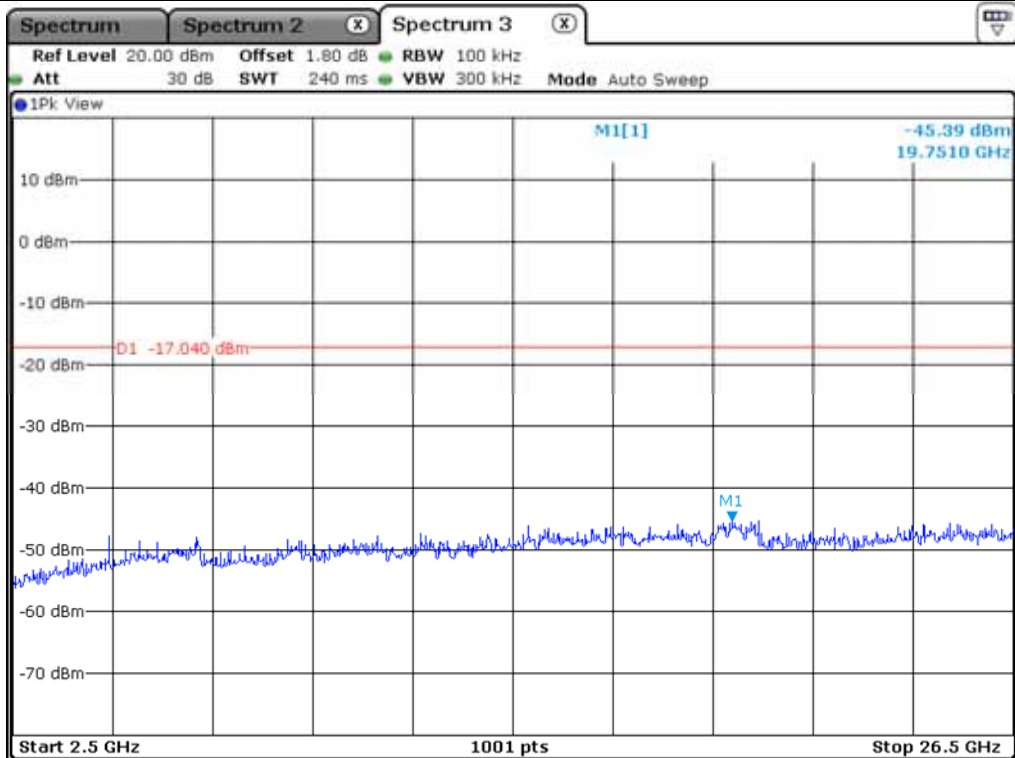
Middle Channel



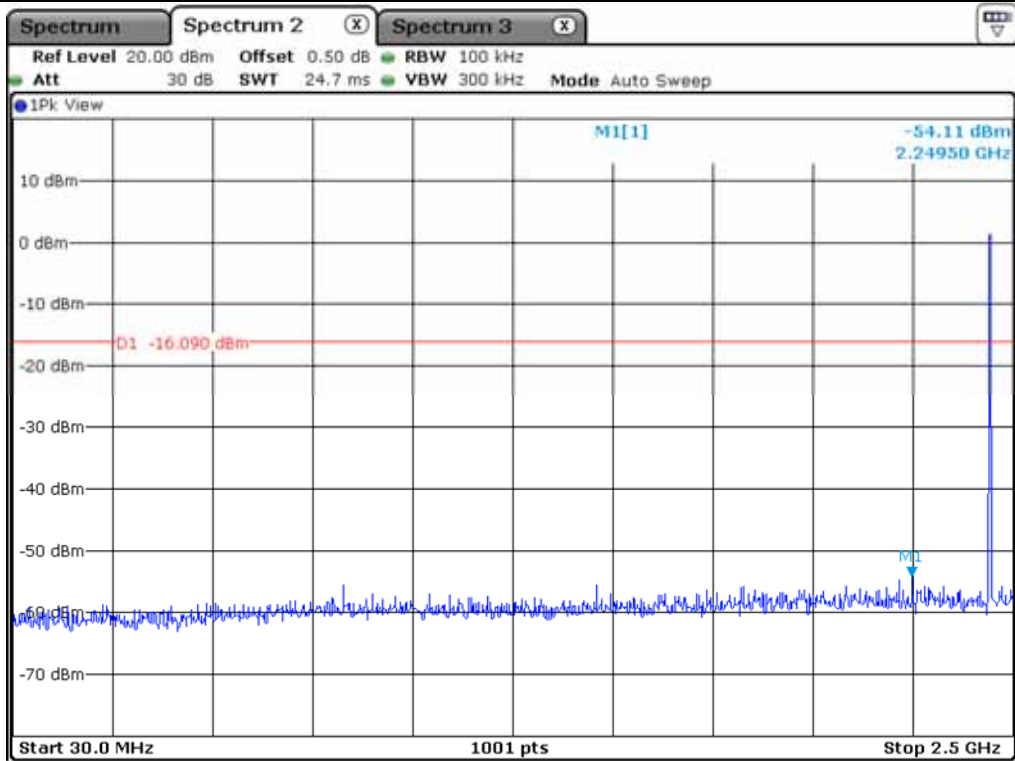




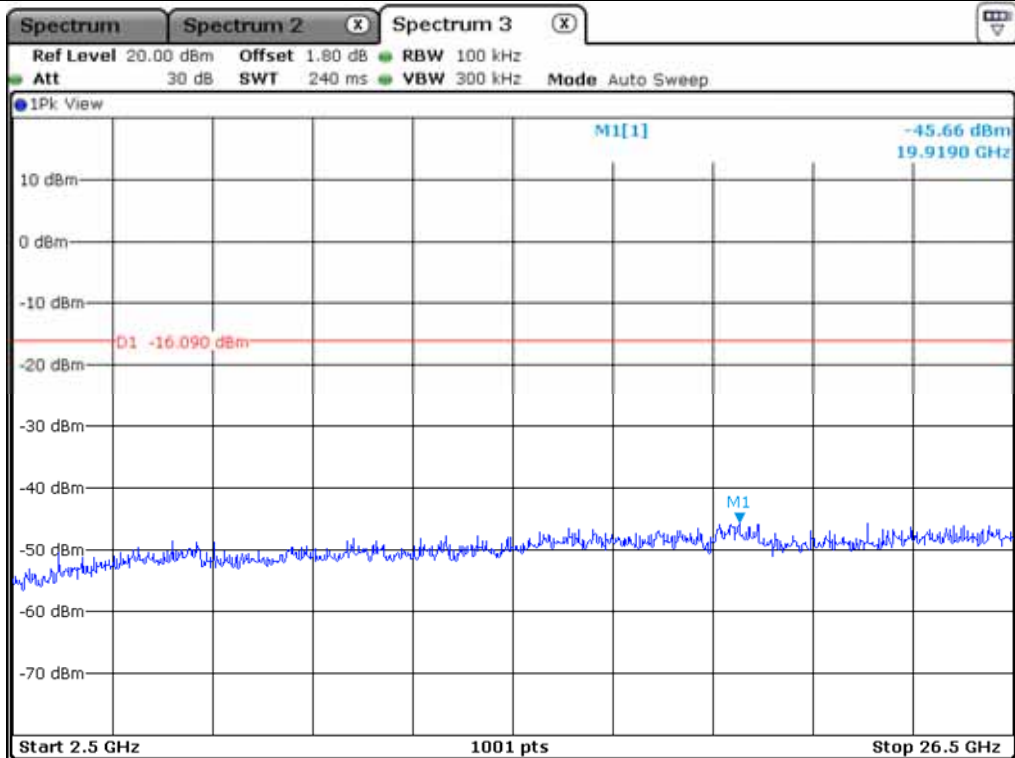
Low Channel



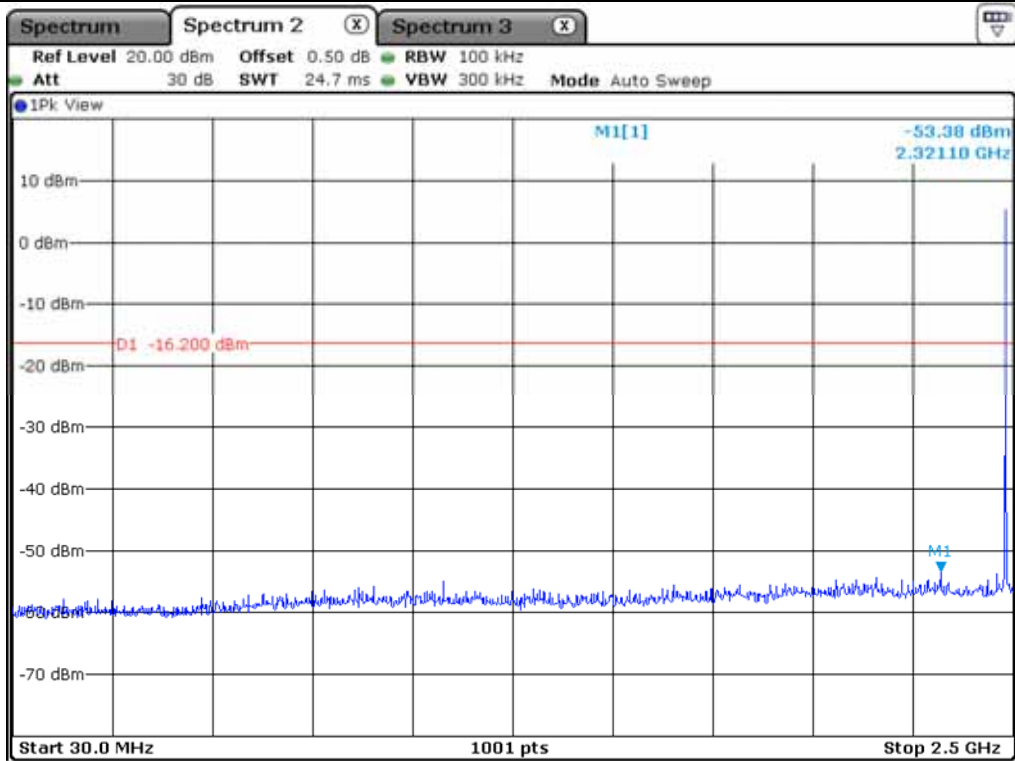
Low Channel



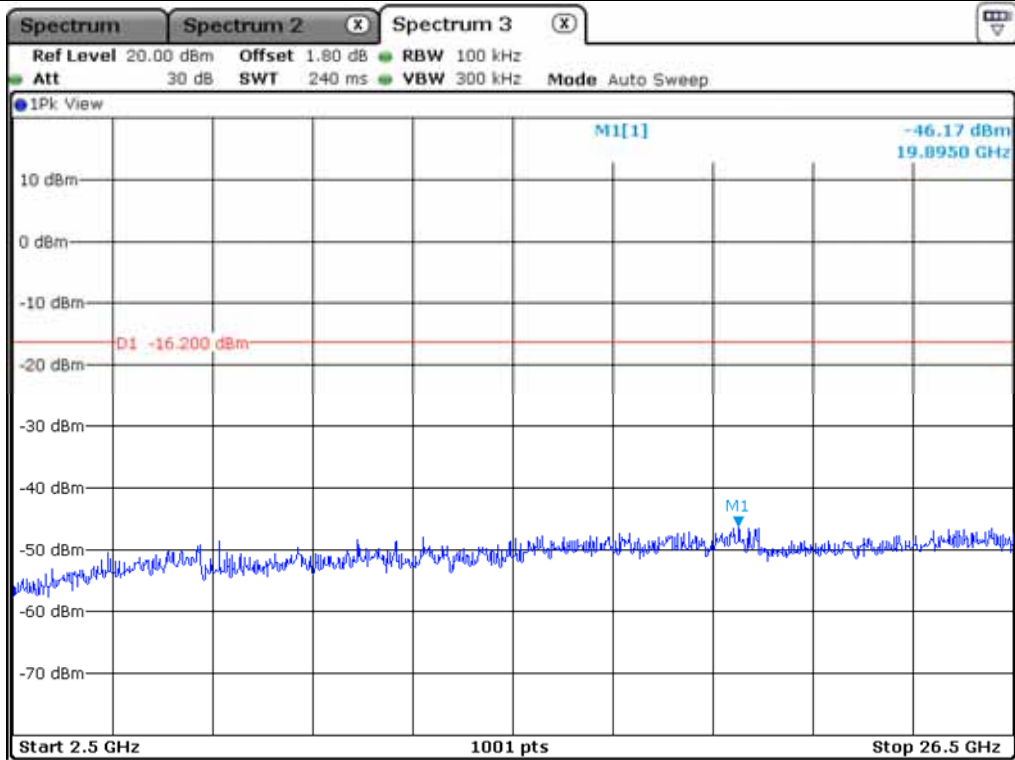
Middle Channel



Middle Channel



High Channel



High Channel

## 12.6 Test data for Transmitting mode radiated emission

### 12.6.1 Radiated Emission which fall in the Restricted Band

#### 12.6.1.1 Test data for 1 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019
- 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
- Duty Cycle : 77.66 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel Edge</b>									
2 387.947	16.57	Peak	H	25.94	2.75	-	45.26	74.00	28.74
2 387.188	4.85	Average	H	25.94	2.75	1.10	34.64	54.00	19.36
2 387.837	16.39	Peak	V	25.94	2.75	-	45.08	74.00	28.92
2 386.708	4.83	Average	V	25.94	2.75	1.10	34.62	54.00	19.38
<b>Test Data for Low Channel</b>									
2 376.054	17.72	Peak	H	25.94	2.75	-	46.41	74.00	27.59
2 343.686	6.03	Average	H	25.94	2.75	1.10	35.82	54.00	18.18
2 338.651	17.84	Peak	V	25.94	2.75	-	46.53	74.00	27.47
2 341.129	6.10	Average	V	25.94	2.75	1.10	35.89	54.00	18.11

Test Data for High Channel									
2 486.574	17.09	Peak	H	26.47	2.39	-	45.95	74.00	28.05
2 483.508	5.40	Average	H	26.47	2.39	1.10	35.36	54.00	18.64
2 492.409	17.52	Peak	V	26.47	2.39	-	46.38	74.00	27.62
2 492.113	5.34	Average	V	26.47	2.39	1.10	35.30	54.00	18.70
Test Data for High Channel Edge									
2 485.793	17.03	Peak	H	26.47	2.39	-	45.89	74.00	28.11
2 483.505	5.20	Average	H	26.47	2.39	1.10	35.16	54.00	18.84
2 485.123	16.93	Peak	V	26.47	2.39	-	45.79	74.00	28.21
2 483.505	5.09	Average	V	26.47	2.39	1.10	35.05	54.00	18.95

Tabulated test data for Restricted Band

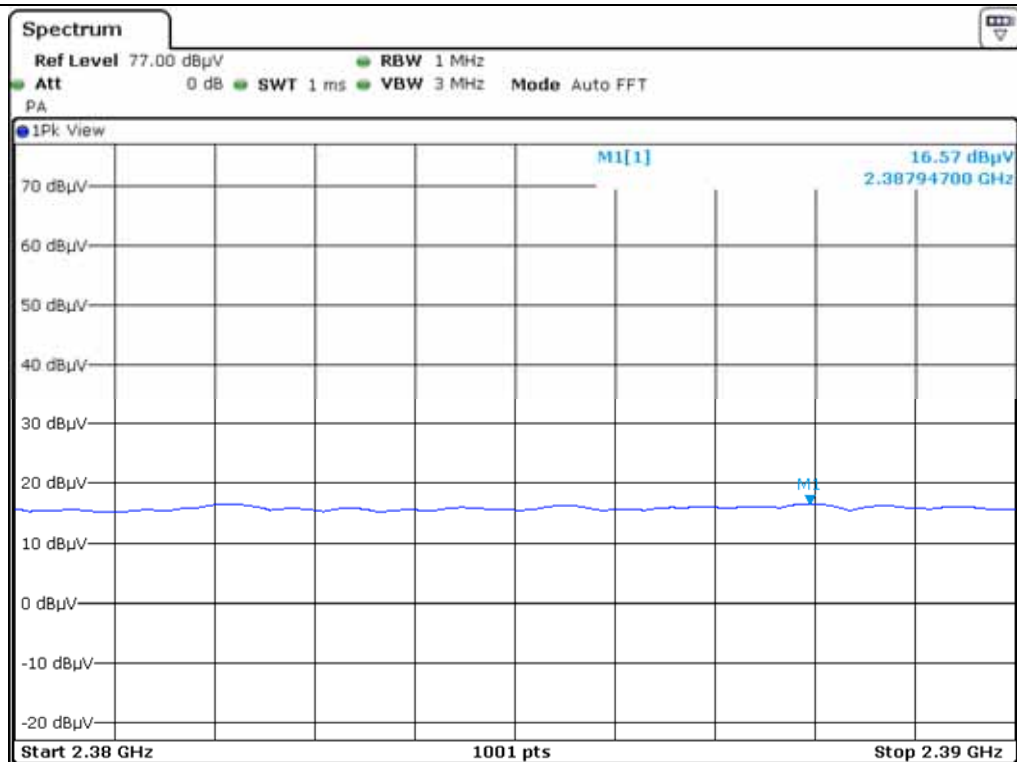
Remark: "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

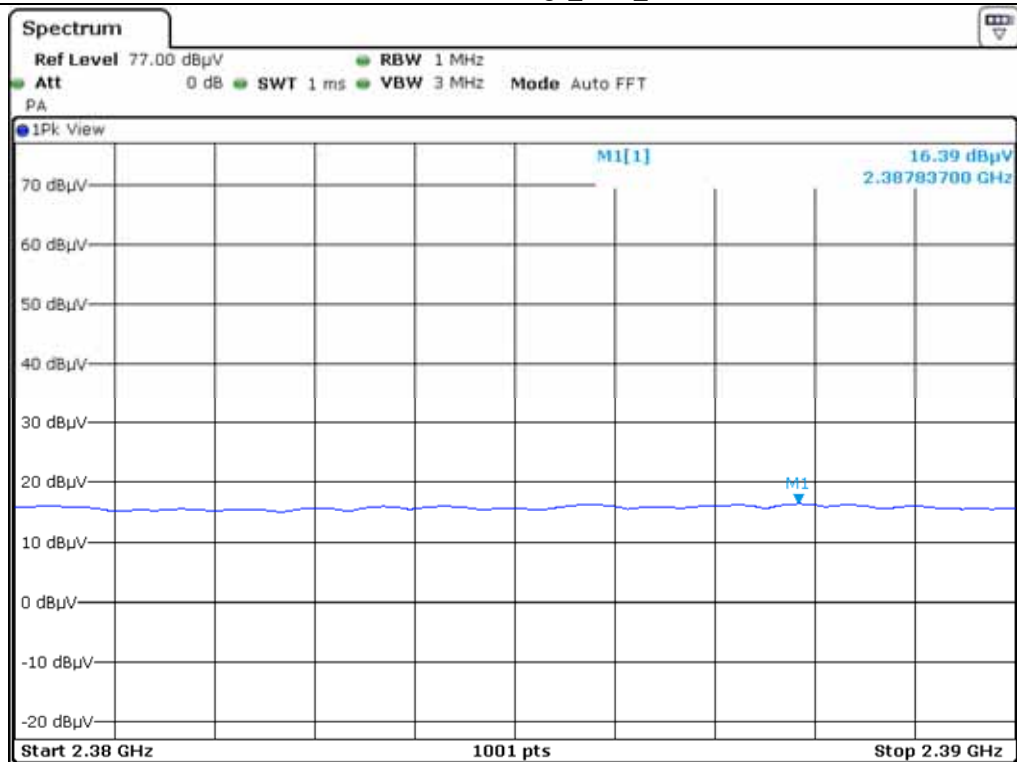
Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor



Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel Edge\_Peak\_H



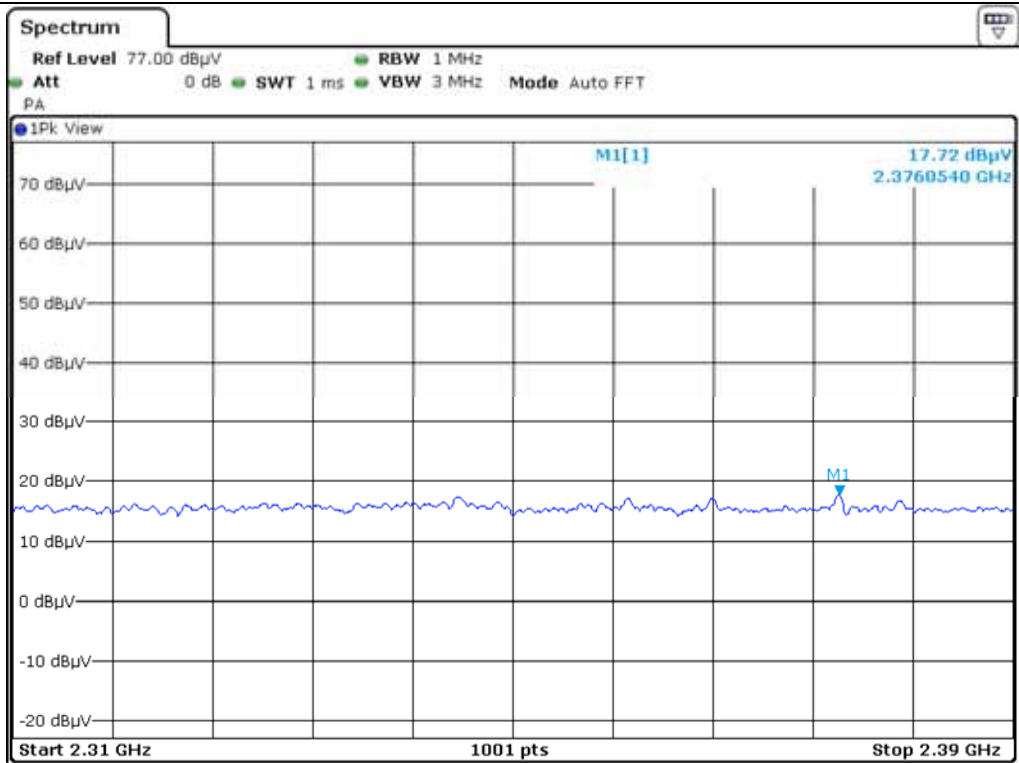
Low Channel Edge\_Peak\_V



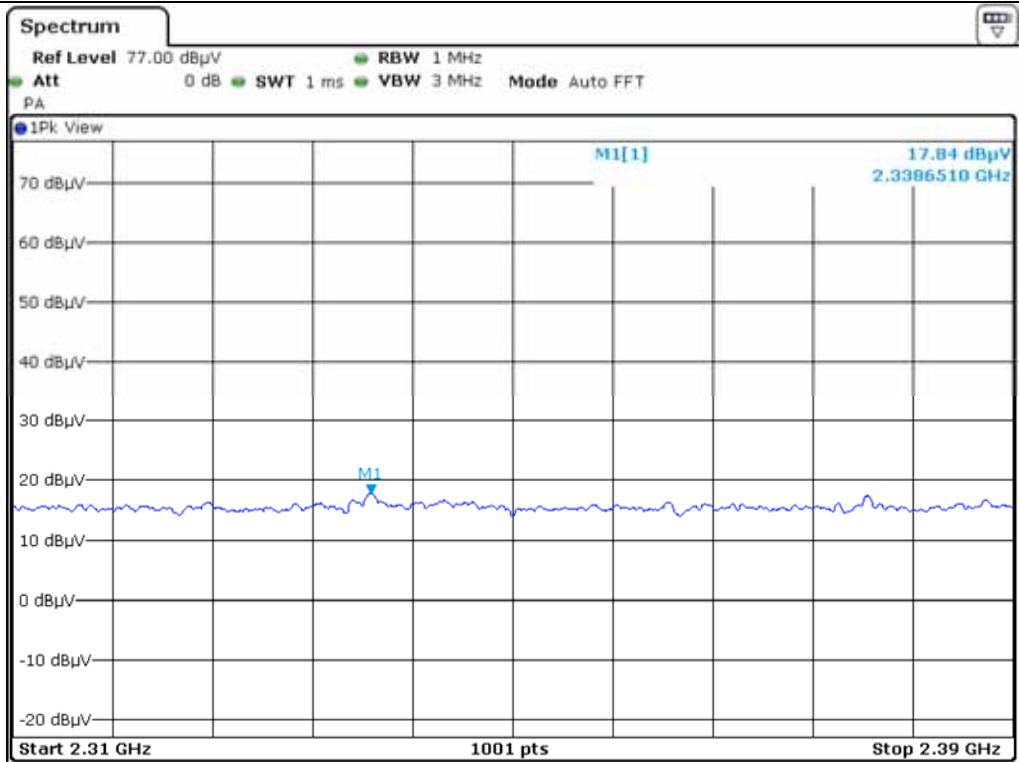
Low Channel Edge\_Average\_H



Low Channel Edge\_Average\_V

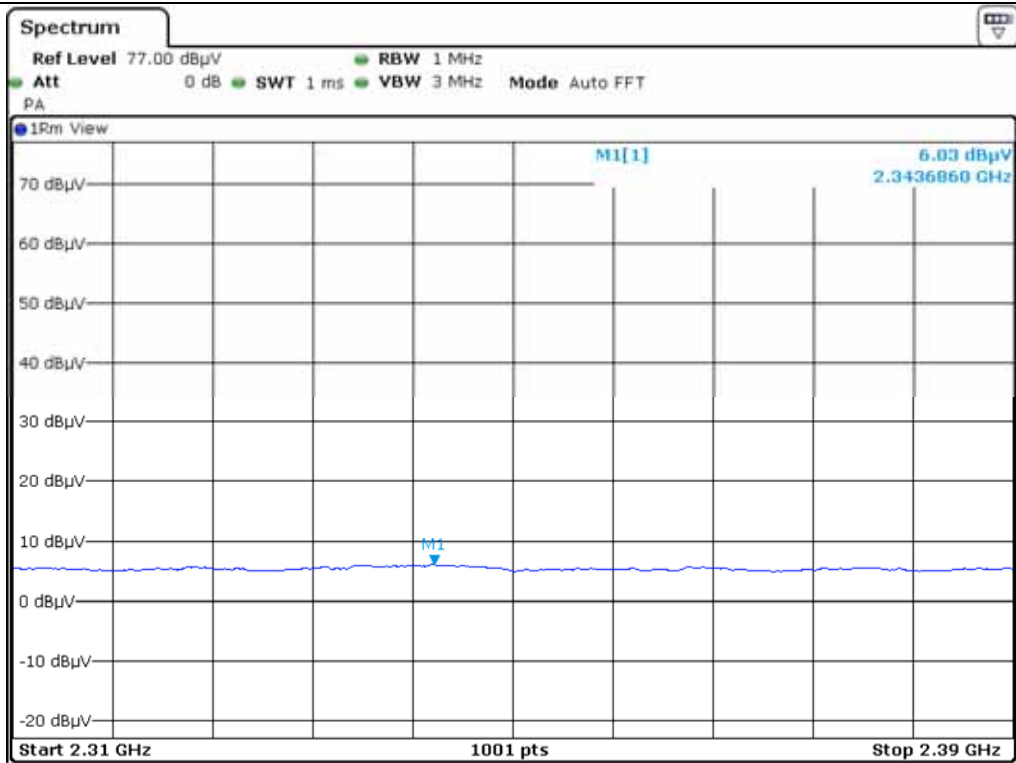


Low Channel\_Peak\_H

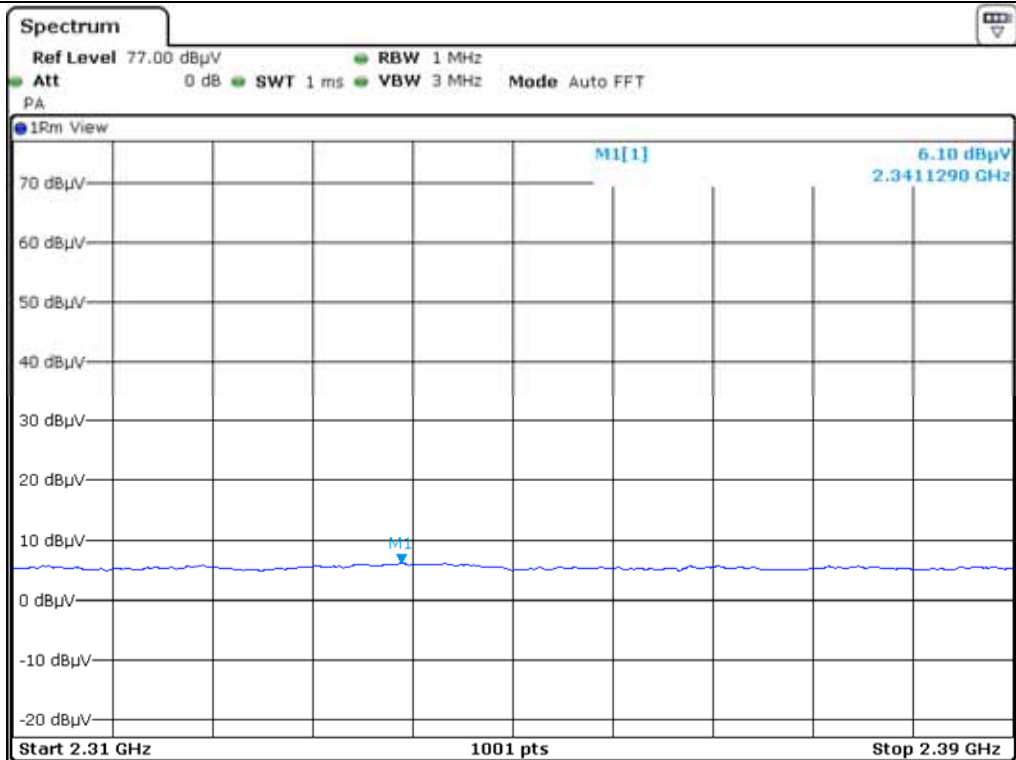


Low Channel\_Peak\_V

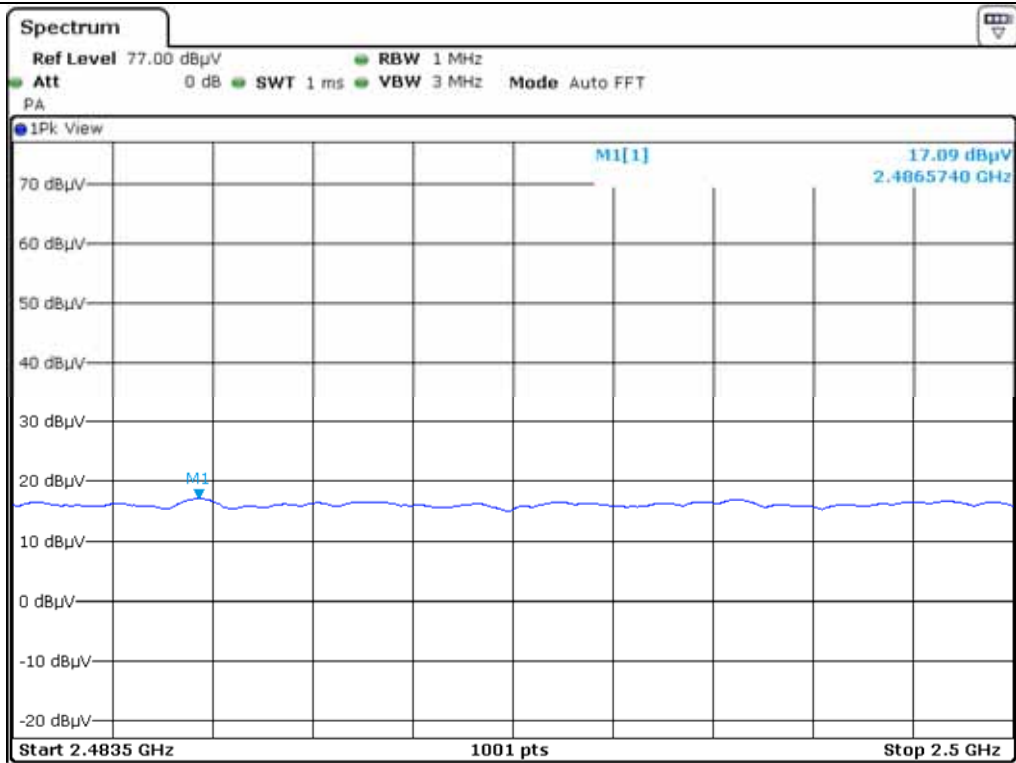




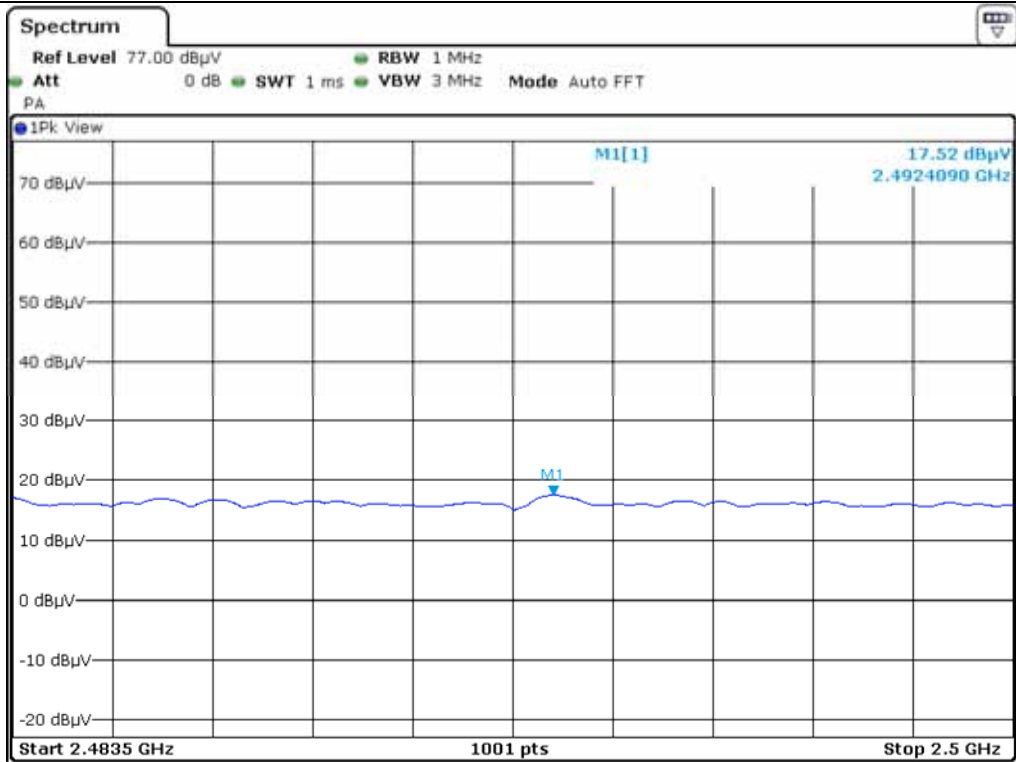
Low Channel\_Average\_H



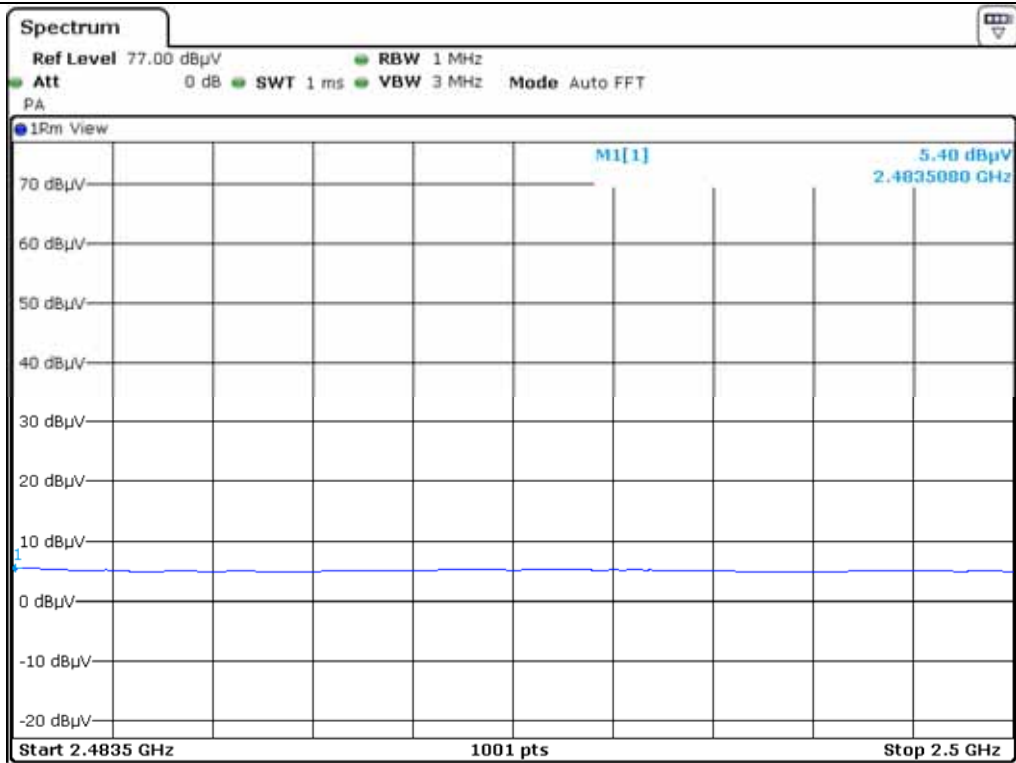
Low Channel\_Average\_V



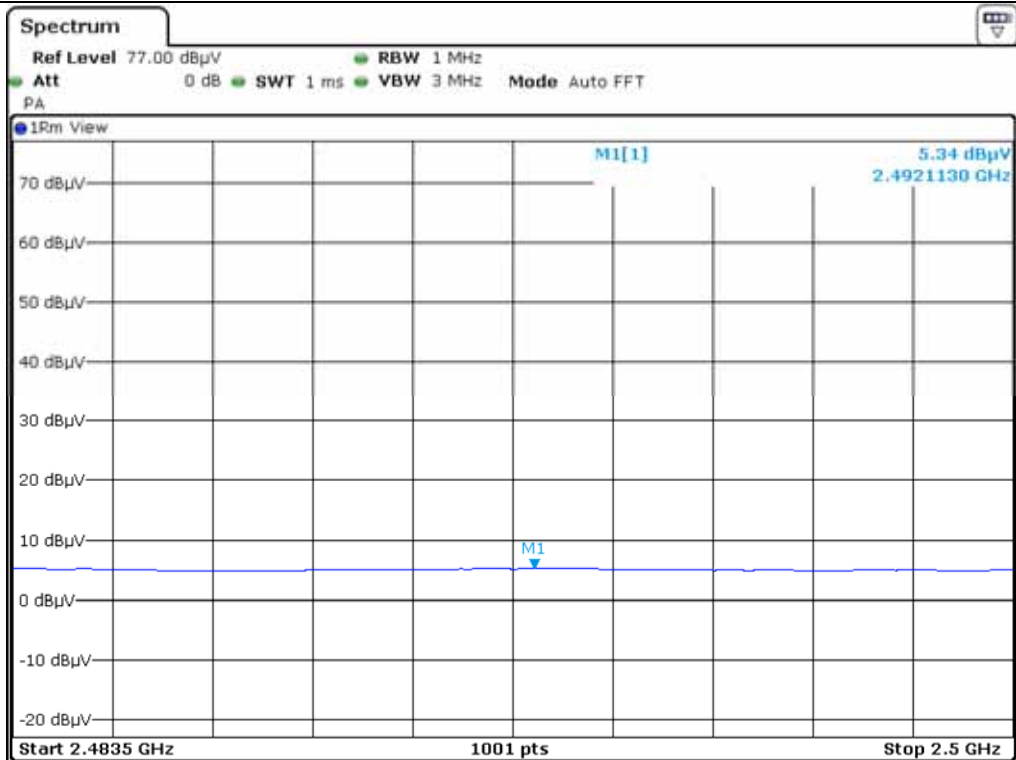
High Channel\_Peak\_H



High Channel\_Peak\_V



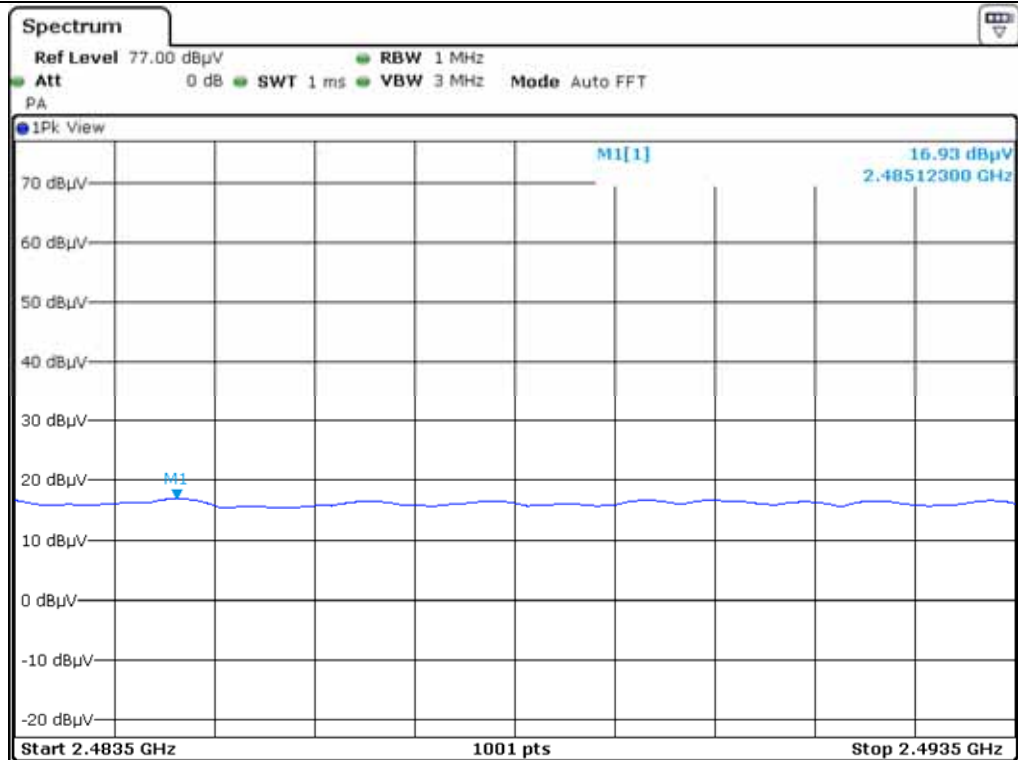
High Channel\_Average\_H



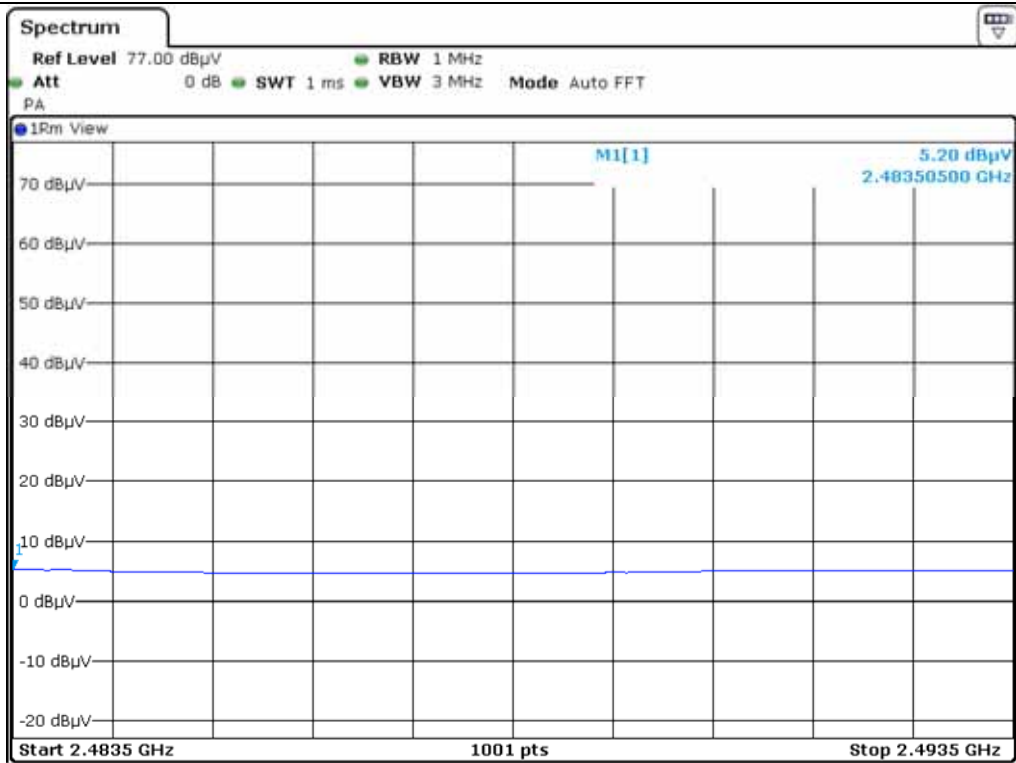
High Channel\_Average\_V



High Channel Edge\_Peak\_H



High Channel Edge\_Peak\_V



High Channel Edge\_Average\_H



High Channel Edge\_Average\_V

### 12.6.1.2 Test data for 2 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019
- 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
- Duty Cycle : 78.19 %
- Result : PASSED


Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correctio n Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
2 376.071	17.36	Peak	H	25.94	2.75	-	46.05	74.00	27.95
2 343.685	6.30	Average	H	25.94	2.75	1.07	36.06	54.00	17.94
2 338.644	17.04	Peak	V	25.94	2.75	-	45.73	74.00	28.27
2 341.120	6.63	Average	V	25.94	2.75	1.07	36.39	54.00	17.61
<b>Test Data for High Channel</b>									
2 486.580	16.97	Peak	H	26.47	2.39	-	45.83	74.00	28.17
2 483.508	5.70	Average	H	26.47	2.39	1.07	35.63	54.00	18.37
2 492.501	17.81	Peak	V	26.47	2.39	-	46.67	74.00	27.33
2 492.120	5.05	Average	V	26.47	2.39	1.07	34.98	54.00	19.02

Tabulated test data for Restricted Band

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

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor

  
Tested by: Hyung-Kwon, Oh / Assistant Manager

### 12.6.1.3 Test data for 3 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019
- 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
- Duty Cycle : 77.66 %
- Result : PASSED


Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correctio n Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
2 376.077	18.08	Peak	H	25.94	2.75	-	46.77	74.00	27.23
2 343.681	6.55	Average	H	25.94	2.75	1.10	36.34	54.00	17.66
2 338.640	17.67	Peak	V	25.94	2.75	-	46.36	74.00	27.64
2 341.117	6.47	Average	V	25.94	2.75	1.10	36.26	54.00	17.74
<b>Test Data for High Channel</b>									
2 486.570	16.74	Peak	H	26.47	2.39	-	45.60	74.00	28.40
2 483.524	5.59	Average	H	26.47	2.39	1.10	35.55	54.00	18.45
2 492.428	17.72	Peak	V	26.47	2.39	-	46.58	74.00	27.42
2 492.220	5.47	Average	V	26.47	2.39	1.10	35.43	54.00	18.57

Tabulated test data for Restricted Band

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

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor

  
Tested by: Hyung-Kwon, Oh / Assistant Manager

## 12.6.2 Spurious & Harmonic Radiated Emission above 1 GHz

### 12.6.2.1 Test data for 1 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019
- 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 : 3 MHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Duty Cycle : 77.66 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
4 804.000	18.63	Peak	H	27.84	5.28	-	51.75	74.00	22.25
4 804.000	6.80	Average	H	27.84	5.28	1.10	41.02	54.00	12.98
4 804.000	18.92	Peak	V	27.84	5.28	-	52.04	74.00	21.96
4 804.000	6.76	Average	V	24.84	5.28	1.10	37.98	54.00	16.02
<b>Test Data for Middle Channel</b>									
4 882.000	19.76	Peak	H	27.01	5.42	-	52.19	74.00	21.81
4 882.000	6.84	Average	H	27.01	5.42	1.10	40.37	54.00	13.63
4 882.000	18.66	Peak	V	27.01	5.42	-	51.09	74.00	22.91
4 882.000	6.85	Average	V	27.01	5.42	1.10	40.38	54.00	13.62
<b>Test Data for High Channel</b>									
4 960.000	19.01	Peak	H	28.15	5.40	-	52.56	74.00	21.44
4 960.000	7.10	Average	H	28.15	5.40	1.10	41.75	54.00	12.25
4 960.000	19.04	Peak	V	28.15	5.40	-	52.59	74.00	21.41
4 960.000	7.08	Average	V	28.15	5.40	1.10	41.73	54.00	12.27

Tabulated test data for Restricted Band

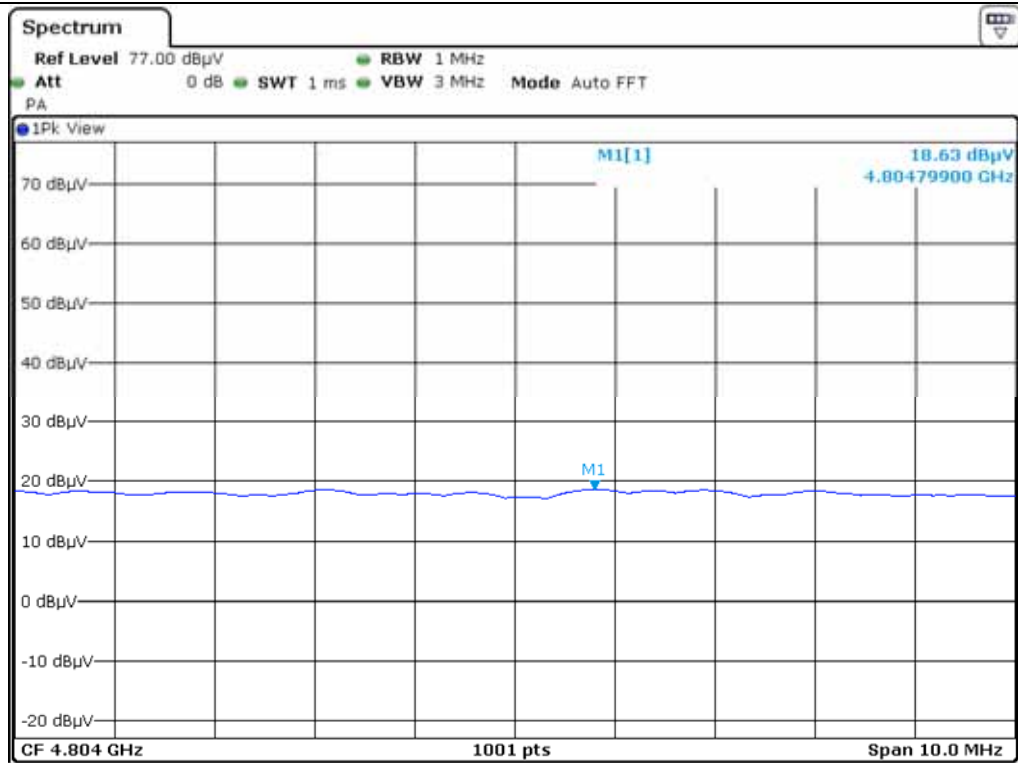
Remark: "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

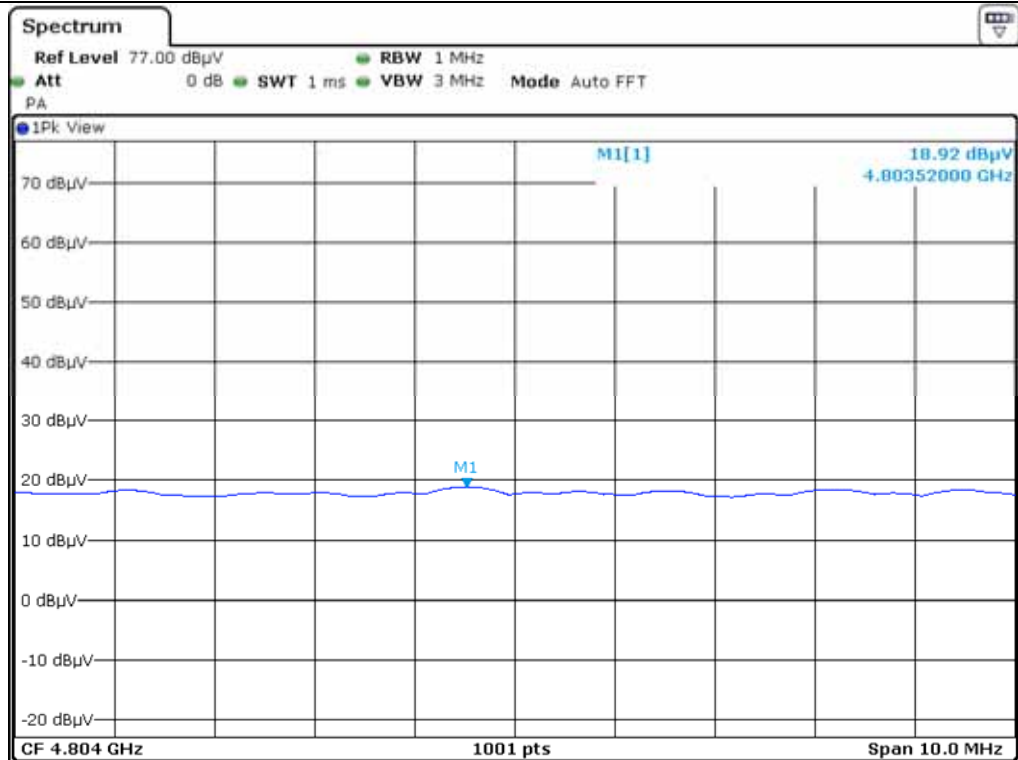
Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor

**Tested by: Hyung-Kwon, Oh / Assistant Manager**





Low Channel\_Peak\_H



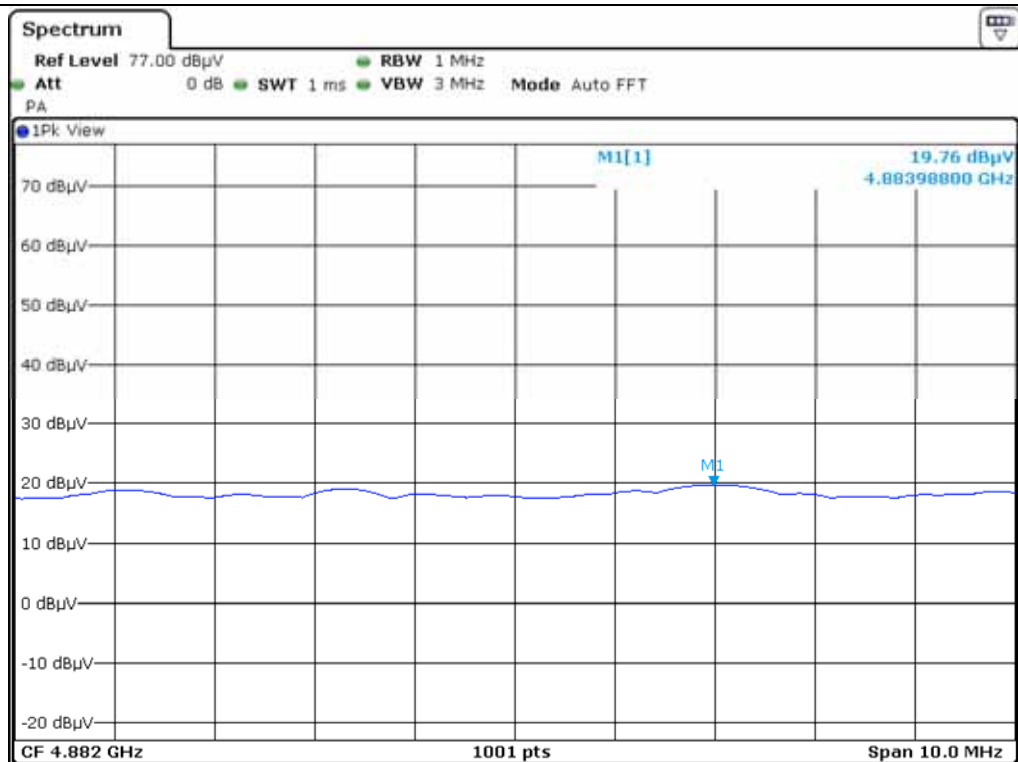
Low Channel\_Peak\_V



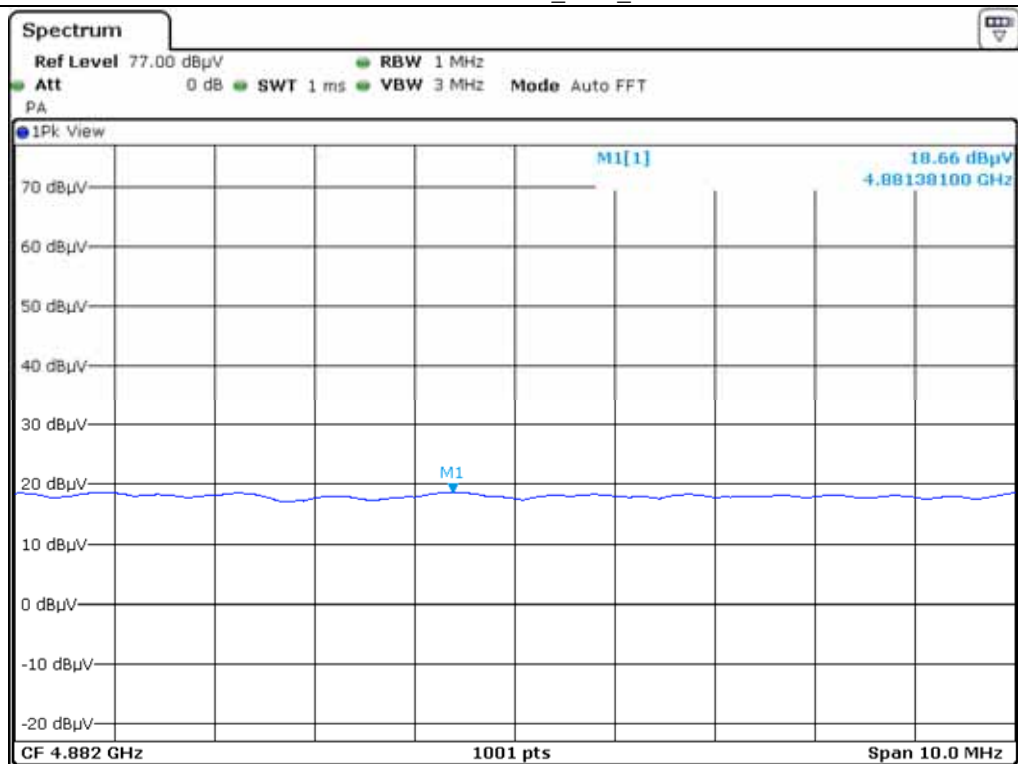
Low Channel\_Average\_H



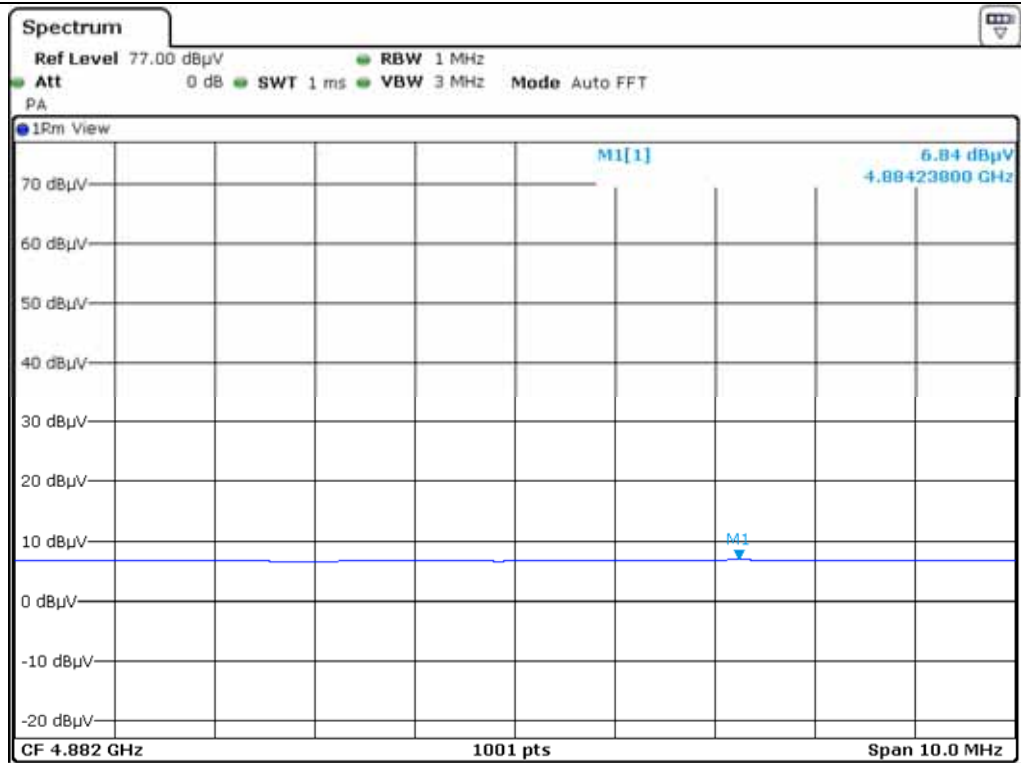
Low Channel\_Average\_V



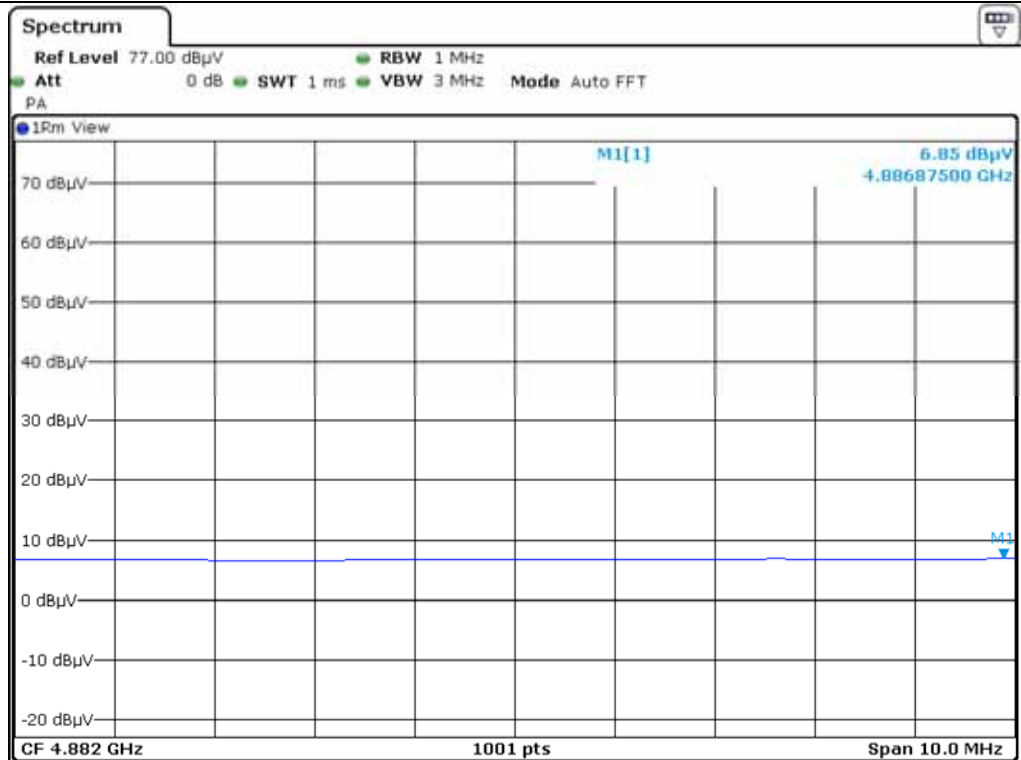
Middle Channel\_Peak\_H



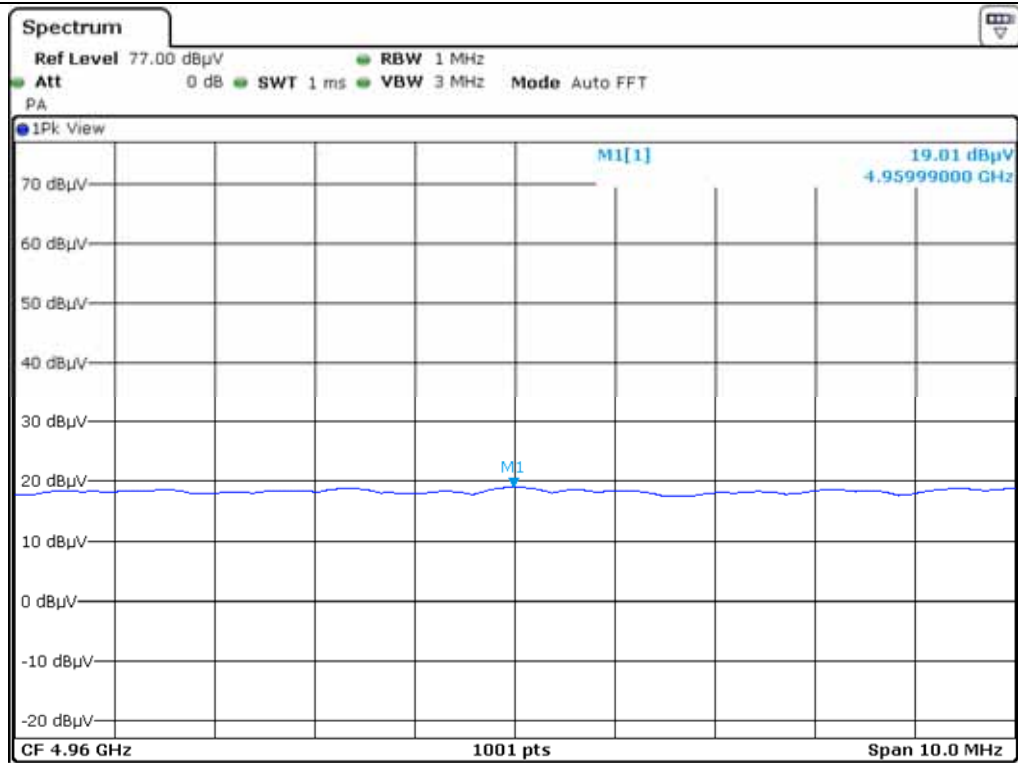
Middle Channel\_Peak\_V



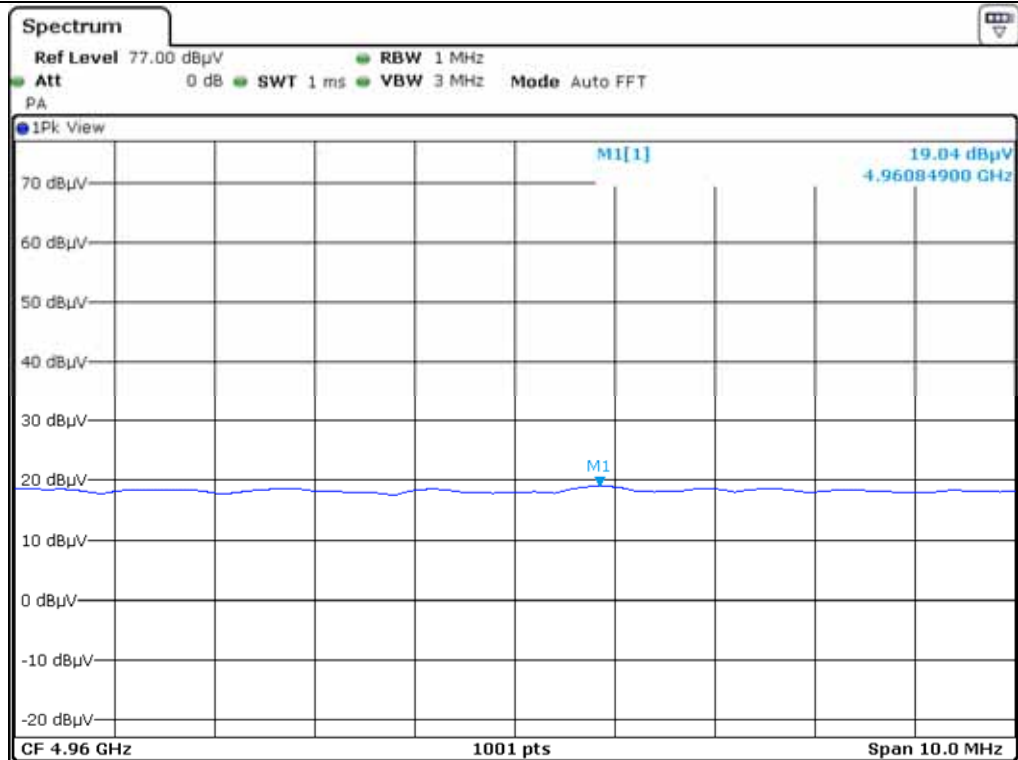
Middle Channel\_Average\_H



Middle Channel\_Average\_V



High Channel\_Peak\_H



High Channel\_Peak\_V



High Channel\_Average\_H



High Channel\_Average\_V

### 12.6.2.2 Test data for 2 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019
- 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 : 3 MHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Duty Cycle : 78.19 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
4 804.000	18.92	Peak	H	27.84	5.28	-	52.04	74.00	21.96
4 804.000	6.94	Average	H	27.84	5.28	1.07	41.13	54.00	12.87
4 804.000	18.65	Peak	V	27.84	5.28	-	51.77	74.00	22.23
4 804.000	6.91	Average	V	24.84	5.28	1.07	38.10	54.00	15.90
<b>Test Data for Middle Channel</b>									
4 882.000	19.93	Peak	H	27.01	5.42	-	52.36	74.00	21.64
4 882.000	6.57	Average	H	27.01	5.42	1.07	40.07	54.00	13.93
4 882.000	18.34	Peak	V	27.01	5.42	-	50.77	74.00	23.23
4 882.000	6.56	Average	V	27.01	5.42	1.07	40.06	54.00	13.94
<b>Test Data for High Channel</b>									
4 960.000	19.36	Peak	H	28.15	5.40	-	52.91	74.00	21.09
4 960.000	7.37	Average	H	28.15	5.40	1.07	41.99	54.00	12.01
4 960.000	19.11	Peak	V	28.15	5.40	-	52.66	74.00	21.34
4 960.000	6.98	Average	V	28.15	5.40	1.07	41.60	54.00	12.40

Tabulated test data for Restricted Band

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

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

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} + \text{Correction Factor}$$

Tested by: Hyung-Kwon, Oh / Assistant Manager

### 12.6.2.3 Test data for 3 Mbps

- Test Date : August 06, 2019 ~ August 09, 2019
- 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 : 3 MHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Duty Cycle : 77.66 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
4 804.000	18.93	Peak	H	27.84	5.28	-	52.05	74.00	21.95
4 804.000	6.53	Average	H	27.84	5.28	1.10	40.75	54.00	13.25
4 804.000	19.07	Peak	V	27.84	5.28	-	52.19	74.00	21.81
4 804.000	6.49	Average	V	24.84	5.28	1.10	37.71	54.00	16.29
<b>Test Data for Middle Channel</b>									
4 882.000	19.73	Peak	H	27.01	5.42	-	52.16	74.00	21.84
4 882.000	6.78	Average	H	27.01	5.42	1.10	40.31	54.00	13.69
4 882.000	18.84	Peak	V	27.01	5.42	-	51.27	74.00	22.73
4 882.000	6.24	Average	V	27.01	5.42	1.10	39.77	54.00	14.23
<b>Test Data for High Channel</b>									
4 960.000	19.36	Peak	H	28.15	5.40	-	52.91	74.00	21.09
4 960.000	6.99	Average	H	28.15	5.40	1.10	41.64	54.00	12.36
4 960.000	19.27	Peak	V	28.15	5.40	-	52.82	74.00	21.18
4 960.000	6.94	Average	V	28.15	5.40	1.10	41.59	54.00	12.41

Tabulated test data for Restricted Band

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

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor

**Tested by: Hyung-Kwon, Oh / Assistant Manager**



## 13. RADIATED EMISSION TEST

### 13.1 Operating environment

Temperature : 25 °C  
Relative humidity : 46 % R.H.

### 13.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

### 13.3 Test equipment used

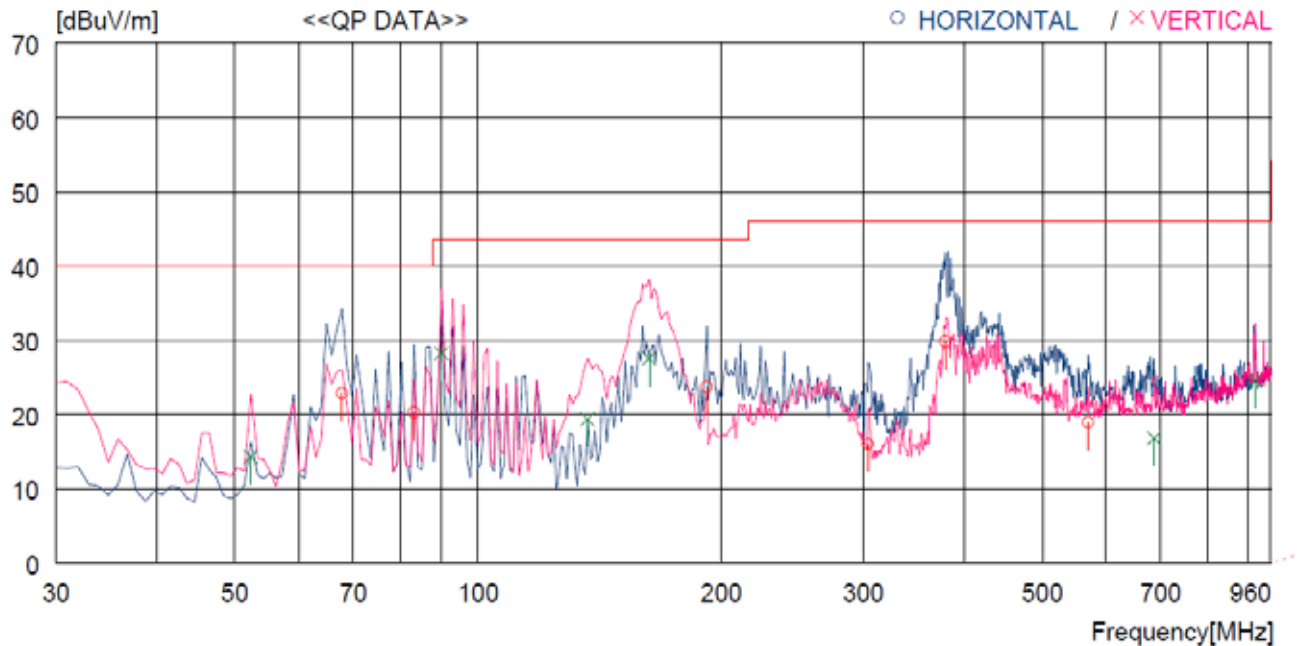
	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Mar. 28, 2019 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 18, 2019 (1Y)
■ -	BBV 9718 B	Schwarzbeck	Amplifier	009	Mar. 20, 2019 (1Y)
■	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Mar. 11, 2019 (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	777	Apr. 13, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 16, 2019 (1Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 16, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

### 13.4 Test data for Transmitting mode [BDR]

#### 13.4.1 Test data for 30 MHz ~ 960 MHz

- Test Date : August 06, 2019 ~ August 09, 2019
- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 960 MHz
- Measurement distance : 3 m



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR							
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	67.830	43.8	10.1	2.0	33.1	22.8	40.0	17.2	200	0
2	191.990	42.6	10.9	3.2	33.0	23.7	43.5	19.8	100	187
3	379.200	42.9	15.4	4.5	33.0	29.8	46.0	16.2	100	305
4	83.350	42.3	8.8	2.1	33.0	20.2	40.0	19.8	200	205
5	304.510	31.5	13.5	4.0	33.0	16.0	46.0	30.0	100	355
6	570.289	27.8	18.9	5.5	33.3	18.9	46.0	27.1	300	169
----- Vertical -----										
7	90.140	47.9	11.1	2.2	33.0	28.2	43.5	15.3	100	231
8	162.890	48.7	8.8	3.0	33.0	27.5	43.5	16.0	100	0
9	916.568	26.7	22.9	7.1	32.2	24.5	46.0	21.5	200	359
10	52.310	31.8	13.9	1.7	33.1	14.3	40.0	25.7	100	0
11	136.700	41.0	8.6	2.7	33.0	19.3	43.5	24.2	100	0
12	687.655	24.1	20.0	6.0	33.3	16.8	46.0	29.2	200	204

Tested by: Hyung-Kwon, Oh / Assistant Manager

### 13.4.2 Test data for Below 30 MHz


- Test Date : August 06, 2019 ~ August 09, 2019
- Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- Frequency range : 9 kHz ~ 30 MHz
- Measurement distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.								

### 13.4.3 Test data for above 1 GHz

- Test Date : August 06, 2019 ~ August 09, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m

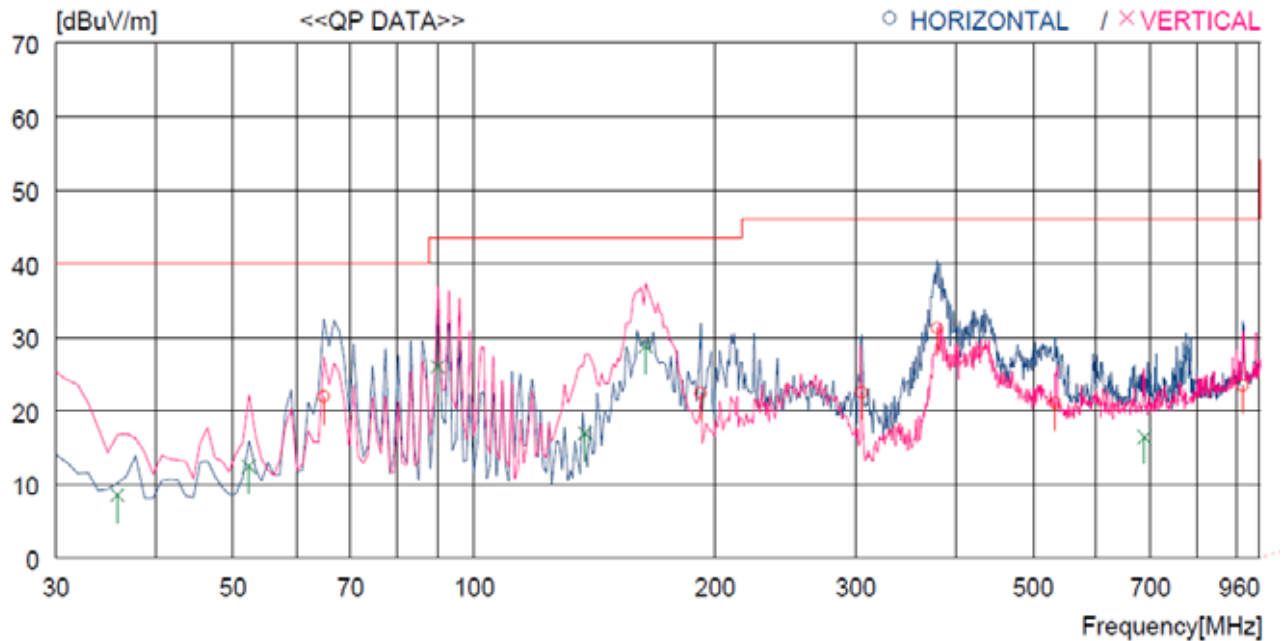
Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.								

  
 Tested by: Hyung-Kwon, Oh / Assistant Manager

### 13.5 Test data for Transmitting mode [EDR]

#### 13.5.1 Test data for 30 MHz ~ 960 MHz

- Test Date : August 06, 2019 ~ August 09, 2019
- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 960 MHz
- Measurement distance : 3 m



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA TABLE [cm]	TABLE [DEG]
----- Horizontal -----										
1	64.920	41.8	11.3	1.9	33.1	21.9	40.0	18.1	400	166
2	305.480	37.9	13.6	4.0	33.0	22.5	46.0	23.5	100	254
3	379.200	44.3	15.4	4.5	33.0	31.2	46.0	14.8	100	296
4	914.628	25.6	22.9	7.1	32.2	23.4	46.0	22.6	200	0
5	191.990	41.3	10.9	3.2	33.0	22.4	43.5	21.1	100	214
6	533.430	30.8	18.2	5.3	33.3	21.0	46.0	25.0	100	359
----- Vertical -----										
7	90.140	45.7	11.1	2.2	33.0	26.0	43.5	17.5	100	0
8	163.860	49.9	8.9	3.0	33.0	28.8	43.5	14.7	100	176
9	35.820	26.8	13.4	1.4	33.1	8.5	40.0	31.5	100	0
10	52.310	29.9	13.9	1.7	33.1	12.4	40.0	27.6	100	0
11	137.670	38.6	8.6	2.7	33.0	16.9	43.5	26.6	100	0
12	688.625	23.7	20.0	6.0	33.3	16.4	46.0	29.6	100	0

Tested by: Hyung-Kwon, Oh / Assistant Manager

### 13.5.2 Test data for Below 30 MHz


- Test Date : August 06, 2019 ~ August 09, 2019
- Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- Frequency range : 9 kHz ~ 30 MHz
- Measurement distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.								

### 13.5.3 Test data for above 1 GHz

- Test Date : August 06, 2019 ~ August 09, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m

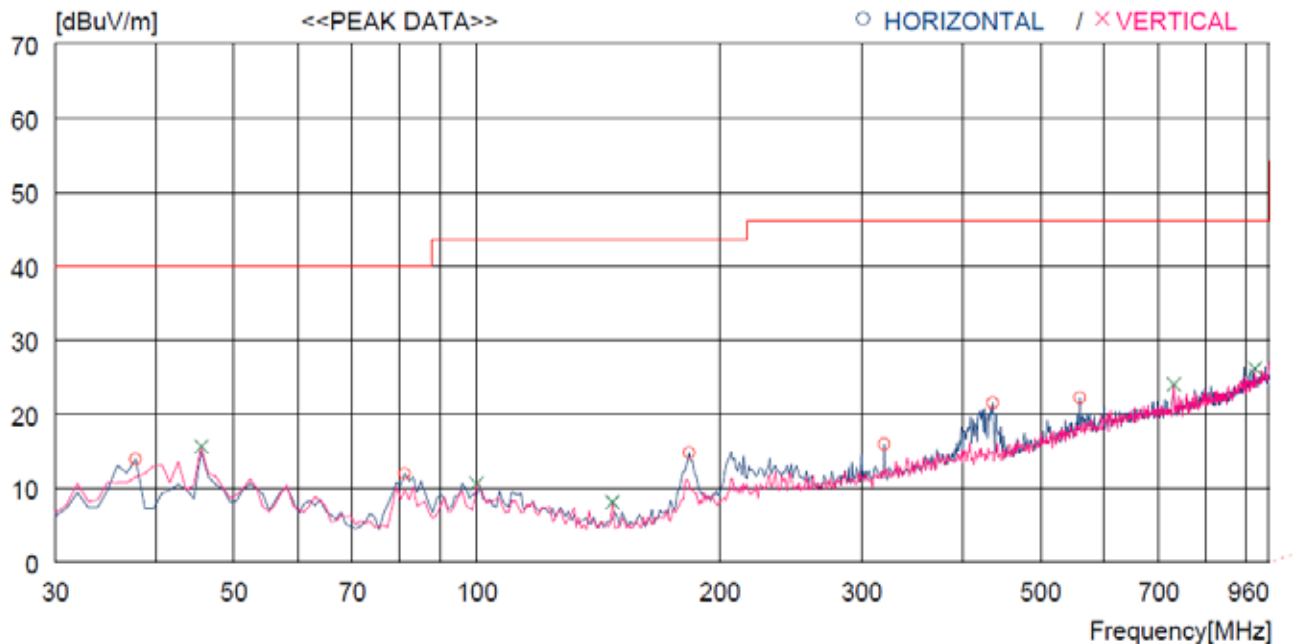
Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.								

  
 Tested by: Hyung-Kwon, Oh / Assistant Manager

### 13.6 Test data for Charging mode

#### 13.6.1 Test data for 30 MHz ~ 960 MHz

- Test Date : August 06, 2019 ~ August 09, 2019
- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 960 MHz
- Measurement distance : 3 m



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA TABLE [cm]	[DEG]
----- Horizontal -----										
1	37.760	31.8	13.8	1.4	33.1	13.9	40.0	26.1	400	26
2	81.410	34.9	8.1	1.9	33.0	11.9	40.0	28.1	300	96
3	183.260	35.1	10.1	2.6	33.0	14.8	43.5	28.7	400	0
4	320.030	31.5	14.0	3.4	33.0	15.9	46.0	30.1	100	359
5	436.431	34.5	16.0	4.1	33.1	21.5	46.0	24.5	100	359
6	559.619	32.3	18.7	4.5	33.3	22.2	46.0	23.8	200	32
----- Vertical -----										
7	45.520	32.7	14.5	1.5	33.1	15.6	40.0	24.4	100	0
8	99.840	29.1	12.5	2.0	33.0	10.6	43.5	32.9	100	280
9	147.370	30.2	8.5	2.4	33.0	8.1	43.5	35.4	200	145
10	731.304	31.5	20.4	5.3	33.2	24.0	46.0	22	200	45
11	921.418	29.4	22.9	6.0	32.2	26.1	46.0	19.9	200	359
12	960.217	29.1	23.3	5.8	32.4	25.8	54.0	28.2	300	7

Tested by: Hyung-Kwon, Oh / Assistant Manager

### 13.6.2 Test data for Below 30 MHz

- Test Date : August 06, 2019 ~ August 09, 2019
- Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- Frequency range : 9 kHz ~ 30 MHz
- Measurement distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.								

### 13.6.3 Test data for above 1 GHz

- Test Date : August 06, 2019 ~ August 09, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.								

  
 Tested by: Hyung-Kwon, Oh / Assistant Manager

## 14. CONDUCTED EMISSION TEST

### 14.1 Operating environment

Temperature : 25 °C  
Relative humidity : 46 % R.H.

### 14.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50  $\Omega$  / 50  $\mu$ H + 5  $\Omega$  Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

### 14.3 Test equipment used

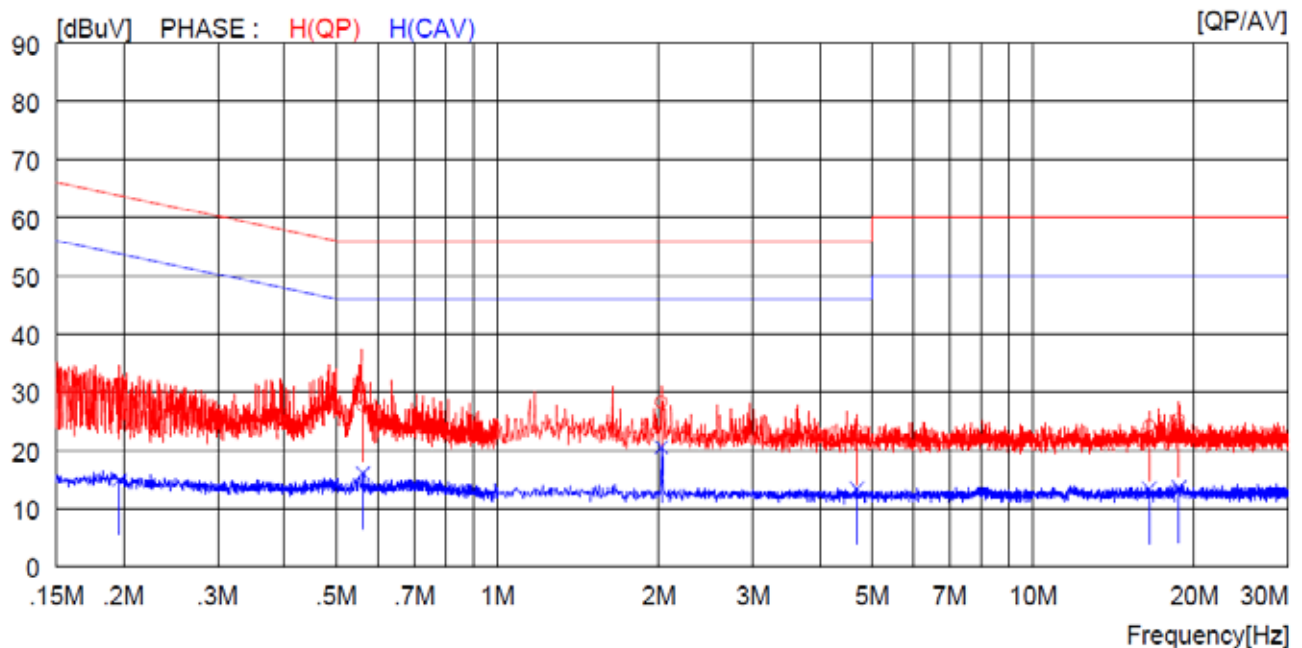
	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESCI	Rohde & Schwarz	Test Receiver	101012	Oct. 22, 2018 (1Y)
■ -	NSLK8128	SCHWARZ BECK	LISN	8128-216	Mar. 20, 2019 (1Y)
□ -	NNLK8121	SCHWARZ BECK	LISN	804	Oct. 22, 2018 (1Y)
■ -	ESH3Z2	Rohde & Schwarz	Pulse Limiter	100655	Mar. 20, 2019 (1Y)

All test equipment used is calibrated on a regular basis.



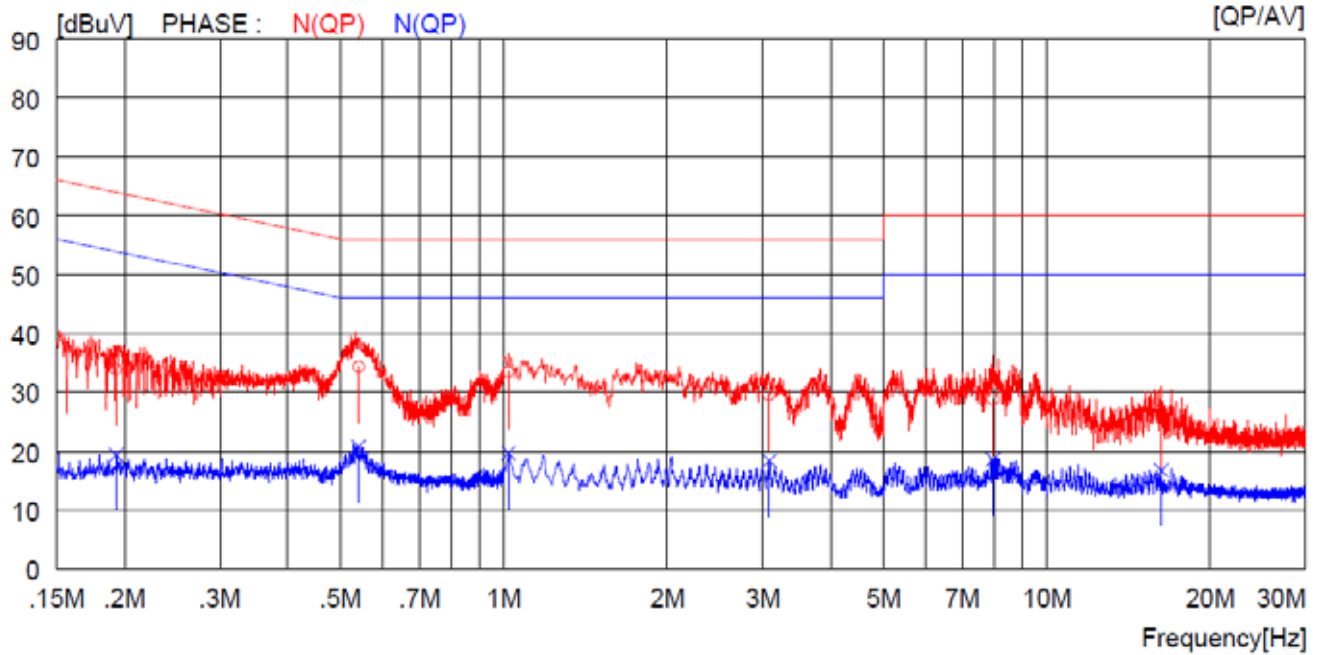
#### 14.4 Test data for Charging Mode

- Test Date : August 06, 2019 ~ August 09, 2019
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19700	21.4	----	10.1	31.5	----	63.7	----	32.2	----	H (QP)
2	0.56100	17.5	----	10.1	27.6	----	56.0	----	28.4	----	H (QP)
3	2.02400	18.2	----	10.1	28.3	----	56.0	----	27.7	----	H (QP)
4	4.69200	13.3	----	10.1	23.4	----	56.0	----	32.6	----	H (QP)
5	16.51000	13.8	----	10.4	24.2	----	60.0	----	35.8	----	H (QP)
6	18.75000	14.8	----	10.4	25.2	----	60.0	----	34.8	----	H (QP)
7	0.19700	----	4.9	10.1	----	15.0	----	53.7	----	38.7	H (CAV)
8	0.56100	----	6.0	10.1	----	16.1	----	46.0	----	29.9	H (CAV)
9	2.02400	----	10.4	10.1	----	20.5	----	46.0	----	25.5	H (CAV)
10	4.69200	----	3.2	10.1	----	13.3	----	46.0	----	32.7	H (CAV)
11	16.51000	----	2.9	10.4	----	13.3	----	50.0	----	36.7	H (CAV)
12	18.75000	----	3.2	10.4	----	13.6	----	50.0	----	36.4	H (CAV)

- Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19300	23.8	----	10.1	33.9	----	63.9	----	30.0	----	N (QP)
2	0.54000	24.2	----	10.1	34.3	----	56.0	----	21.7	----	N (QP)
3	1.02000	23.3	----	10.1	33.4	----	56.0	----	22.6	----	N (QP)
4	3.08000	19.5	----	10.1	29.6	----	56.0	----	26.4	----	N (QP)
5	7.96500	18.5	----	10.2	28.7	----	60.0	----	31.3	----	N (QP)
6	16.24000	16.5	----	10.4	26.9	----	60.0	----	33.1	----	N (QP)
7	0.19300	----	9.3	10.1	----	19.4	----	53.9	----	34.5	N (CAV)
8	0.54000	----	10.7	10.1	----	20.8	----	46.0	----	25.2	N (CAV)
9	1.02000	----	9.6	10.1	----	19.7	----	46.0	----	26.3	N (CAV)
10	3.08000	----	8.3	10.1	----	18.4	----	46.0	----	27.6	N (CAV)
11	7.96500	----	8.4	10.2	----	18.6	----	50.0	----	31.4	N (CAV)
12	16.24000	----	6.4	10.4	----	16.8	----	50.0	----	33.2	N (CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Hyung-Kwon, Oh / Assistant Manager