

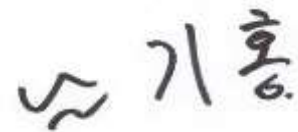
# ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

**Test Report No.** : OT-209-RWD-047  
**Reception No.** : 2008003235  
**Applicant** : Samsung Electronics Co Ltd  
**Address** : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States  
**Manufacturer** : Samsung Electronics Co Ltd  
**Address** : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do 16677, Korea  
**Type of Equipment** : Wi-Fi/BT Transceiver  
**FCC ID.** : A3LWCA731M  
**Model Name** : WCA731M  
**Multiple Model Name** : WCA734M  
**Serial number** : N/A  
**Total page of Report** : 93 pages (including this page)  
**Date of Incoming** : August 20, 2020  
**Date of issue** : September 21, 2020

## 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.





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**Revision History**

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-209-RWD-047	September 21, 2020	Initial Release	All

**1. VERIFICATION OF COMPLIANCE**

Applicant : Samsung Electronics Co Ltd  
 Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States  
 Contact Person : Youngjoong Noh / Principal Engineer  
 Telephone No. : +82-31-277-0598  
 FCC ID : A3LWCA731M  
 Model Name : WCA731M  
 Brand Name :   
 Serial Number : N/A  
 Date : September 21, 2020

EQUIPMENT CLASS	DSS – PART 15 SPREAD SPECTRUM TRANSMITTER
E.U.T. DESCRIPTION	Modular Transmitter, Wi-Fi/BT Transceiver
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 KDB 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-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

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 WCA731M (referred to as the EUT in this report) is a Wi-Fi/BT Transceiver. The product specification described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	Wi-Fi/BT Transceiver	
Temperature Range	-20 °C ~ 50 °C	
OPERATING FREQUENCY	Bluetooth LE	2 402 MHz ~ 2 480 MHz
	Bluetooth	2 402 MHz ~ 2 480 MHz
	WLAN 2.4 GHz	2 412 MHz ~ 2 472 MHz (802.11b/g/n(HT20))
		2 422 MHz ~ 2 462 MHz (802.11n(HT40))
	5 150 MHz ~ 5 250 MHz Band	5 180 MHz ~ 5 240 MHz (802.11a/n(HT20)/ac(VHT20))
		5 190 MHz ~ 5 230 MHz (802.11n(HT40)/ac(VHT40))
		5 210 MHz (802.11ac(VHT80))
	5 250 MHz ~ 5 350 MHz Band	5 260 MHz ~ 5 320 MHz (802.11a/n(HT20)/ac(VHT20))
		5 270 MHz ~ 5 310 MHz (802.11n(HT40)/ac(VHT40))
		5 290 MHz (802.11ac(VHT80))
	5 470 MHz ~ 5 725 MHz Band	5 500 MHz ~ 5 700 MHz (802.11a/n(HT20)/ac(VHT20))
		5 510 MHz ~ 5 670 MHz (802.11n(HT40)/ac(VHT40))
		5 530 MHz (802.11ac(VHT80))
	5 725 MHz ~ 5 850 MHz Band	5 745 MHz ~ 5 825 MHz (802.11a/n(HT20)/ac(VHT20))
		5 755 MHz ~ 5 795 MHz (802.11n(HT40)/ac(VHT40))
5 775 MHz (802.11ac(VHT80))		
MODULATION TYPE	Bluetooth LE	GFSK for 1 Mbps / 2 Mbps
	Bluetooth	GFSK for 1Mbps, $\pi/4$ -DQPSK for 2Mbps, 8-DPSK for 3Mbps
	WLAN 2.4 GHz	802.11b: DSSS Modulation(DBPSK/DQPSK/CCK)
		802.11g/n(HT20)/n(HT40): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
WLAN 5 GHz	802.11a/n(HT20)/n(HT40)/ac(VHT80): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)	



RF OUTPUT POWER	Bluetooth LE	1 Mbps	11.06 dBm	
		2 Mbps	11.07 dBm	
	Bluetooth	1 Mbps	11.07 dBm	
		2 Mbps	10.74 dBm	
		3 Mbps	10.80 dBm	
	WLAN 2.4 GHz	Antenna 0	18.09 dBm(802.11b)	
			14.56 dBm(802.11g)	
			14.34 dBm(802.11n_HT20)	
			12.40 dBm(802.11n_HT40)	
		Antenna 1	20.03 dBm(802.11b)	
			14.26 dBm(802.11g)	
Multiple Antenna	14.14 dBm(802.11n_HT20)			
	12.20 dBm(802.11n_HT40)			
	17.42 dBm(802.11g)			
		17.25 dBm(802.11n_HT20)		
		15.31 dBm(802.11n_HT40)		

RF OUTPUT POWER	5 150 MHz ~ 5 250 MHz Band	Antenna 0	15.50 dBm(802.11a) 13.81 dBm(802.11n_HT20) 13.85 dBm(802.11n_HT40) 13.95 dBm(802.11ac_VHT80)
		Antenna 1	12.85 dBm(802.11a) 12.91 dBm(802.11n_HT20) 12.24 dBm(802.11n_HT40) 11.15 dBm(802.11ac_VHT80)
		Multiple Antenna	17.38 dBm(802.11a) 16.18 dBm(802.11n_HT20) 16.04 dBm(802.11n_HT40) 15.78 dBm(802.11ac_VHT80)
	5 250 MHz ~ 5 350 MHz Band	Antenna 0	14.95 dBm(802.11a) 12.94 dBm(802.11n_HT20) 13.25 dBm(802.11n_HT40) 12.46 dBm(802.11ac_VHT80)
		Antenna 1	12.96 dBm(802.11a) 12.68 dBm(802.11n_HT20) 11.37 dBm(802.11n_HT40) 10.71 dBm(802.11ac_VHT80)
		Multiple Antenna	17.08 dBm(802.11a) 15.71 dBm(802.11n_HT20) 15.42 dBm(802.11n_HT40) 14.68 dBm(802.11ac_VHT80)

RF OUTPUT POWER	5 470 MHz ~ 5 725 MHz Band	Antenna 0	14.54 dBm(802.11a) 11.51 dBm(802.11n_HT20) 12.40 dBm(802.11n_HT40) 10.77 dBm(802.11ac_VHT80)
		Antenna 0_Straddle	12.82 dBm(802.11a) 12.95 dBm(802.11n_HT20) 11.61 dBm(802.11n_HT40) 11.90 dBm(802.11ac_VHT80)
		Antenna 1	12.72 dBm(802.11a) 10.85 dBm(802.11n_HT20) 11.73 dBm(802.11n_HT40) 8.73 dBm(802.11ac_VHT80)
		Antenna 1_Straddle	14.04 dBm(802.11a) 14.11 dBm(802.11n_HT20) 13.53 dBm(802.11n_HT40) 12.55 dBm(802.11ac_VHT80)
		Multiple Antenna	16.65 dBm(802.11a) 14.06 dBm(802.11n_HT20) 15.09 dBm(802.11n_HT40) 12.88 dBm(802.11ac_VHT80)
		Multiple Antenna _Straddle	16.48 dBm(802.11a) 16.58 dBm(802.11n_HT20) 15.69 dBm(802.11n_HT40) 15.25 dBm(802.11ac_VHT80)

RF OUTPUT POWER	5 725 MHz ~ 5 850 MHz Band	Antenna 0	13.89 dBm(802.11a) 13.84 dBm(802.11n_HT20) 12.19 dBm(802.11n_HT40) 11.41 dBm(802.11ac_VHT80)
		Antenna 0_Straddle	5.28 dBm(802.11a) 5.39 dBm(802.11n_HT20) -0.48 dBm(802.11n_HT40) -2.93 dBm(802.11ac_VHT80)
		Antenna 1	13.35 dBm(802.11a) 14.23 dBm(802.11n_HT20) 11.53 dBm(802.11n_HT40) 10.94 dBm(802.11ac_VHT80)
		Antenna 1_Straddle	5.61 dBm(802.11a) 6.29 dBm(802.11n_HT20) 1.25 dBm(802.11n_HT40) -1.99 dBm(802.11ac_VHT80)
		Multiple Antenna	16.75 dBm(802.11a) 16.87 dBm(802.11n_HT20) 14.76 dBm(802.11n_HT40) 14.19 dBm(802.11ac_VHT80)
		Multiple Antenna _Straddle	8.46 dBm(802.11a) 8.87 dBm(802.11n_HT20) 3.48 dBm(802.11n_HT40) 0.58 dBm(802.11ac_VHT80)

ANTENNA TYPE	Chip Antenna			
ANTENNA GAIN	Bluetooth LE	-4.00 dBi		
	Bluetooth	-4.00 dBi		
	WLAN 2.4 GHz	Antenna 0	-1.54 dBi	
		Antenna 1	1.72 dBi	
		Multiple Antenna	3.40 dBi	
	5 150 MHz ~ 5 250 MHz Band	Antenna 0	-2.68 dBi	
		Antenna 1	-0.90 dBi	
		Multiple Antenna	1.31 dBi	
	5 250 MHz ~ 5 350 MHz Band	Antenna 0	-2.54 dBi	
		Antenna 1	-0.55 dBi	
		Multiple Antenna	1.58 dBi	
	5 470 MHz ~ 5 725 MHz Band	Antenna 0	-0.70 dBi	
		Antenna 1	-0.29 dBi	
		Multiple Antenna	2.52 dBi	
	5 725 MHz ~ 5 850 MHz Band	Antenna 0	-1.26 dBi	
		Antenna 1	-2.11 dBi	
		Multiple Antenna	1.35 dBi	
	List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		40 MHz	

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

-. The following lists consist of the added model and their differences.

Model Name	Differences	Tested
WCA731M	Basic Model	<input checked="" type="checkbox"/>
WCA734M	The difference from the basic model is the removal of mic part.	<input checked="" type="checkbox"/>

Note: 1. Applicant consigns only basic model to test. Therefore this test report just guarantees the units, which have been tested.  
 2. The Applicant/manufacturer is responsible for the compliance of all variants.

**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	Samsung Electronics Co Ltd	WCA731M	N/A

### 5.2 Peripheral equipment

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

Model	Manufacturer	Description	Connected to
WCA731M	Samsung Electronics Co Ltd	Wi-Fi/BT Transceiver (EUT)	
HP Probook	HP	Notebook PC	EUT
PPP009L-E	LIE-ON TECHNOLOGY (CHANGZHOU)CO.,LTD.	AC Adapter	

### 5.3 Mode of operation during the test

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

For final testing, the EUT was set at 2 402 MHz, 2 441 MHz, and 2 480 MHz to get a maximum emission levels from the EUT. The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis, but the worst data was recorded in this report.

-. Frequency / Channel Operations

Channel	Frequency
00	2 402
39	2 441
78	2 480

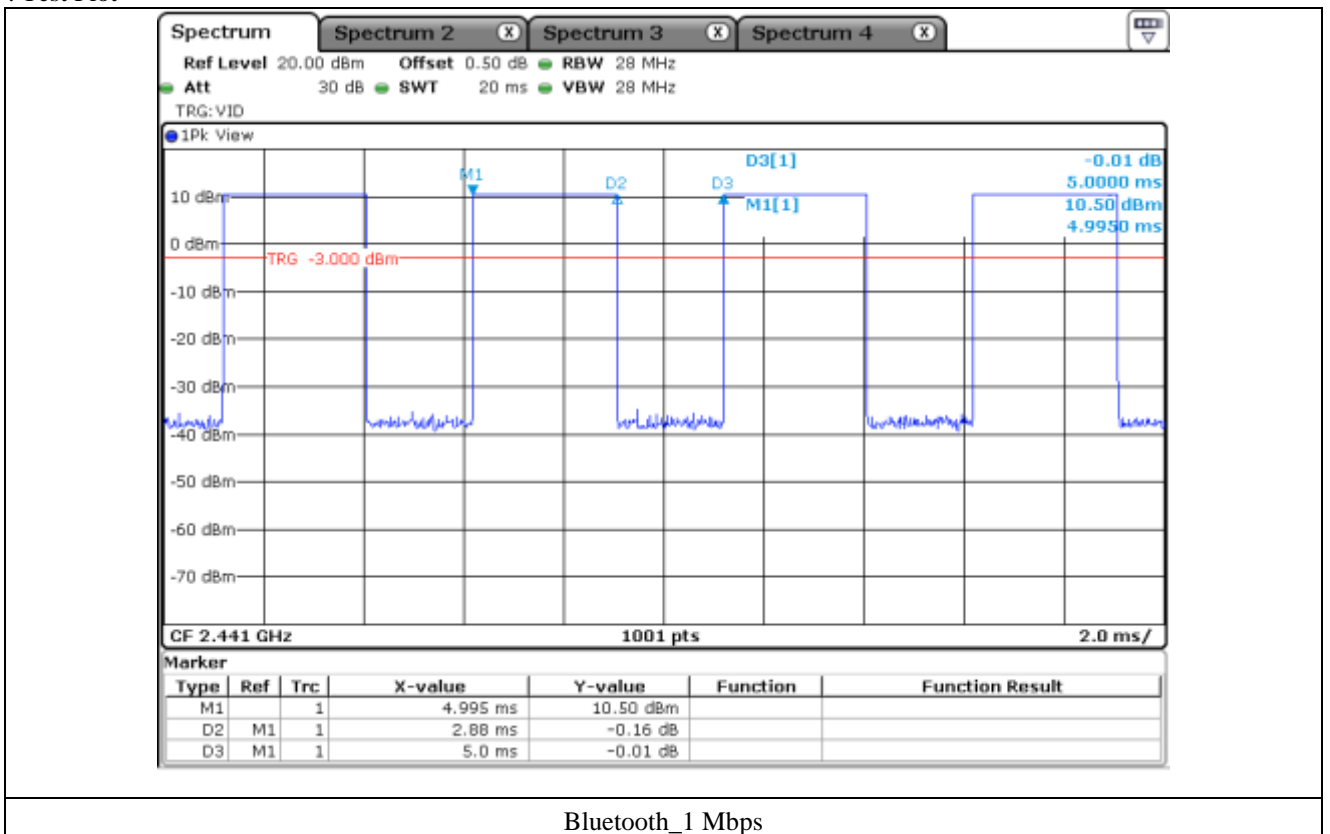
- Duty Cycle

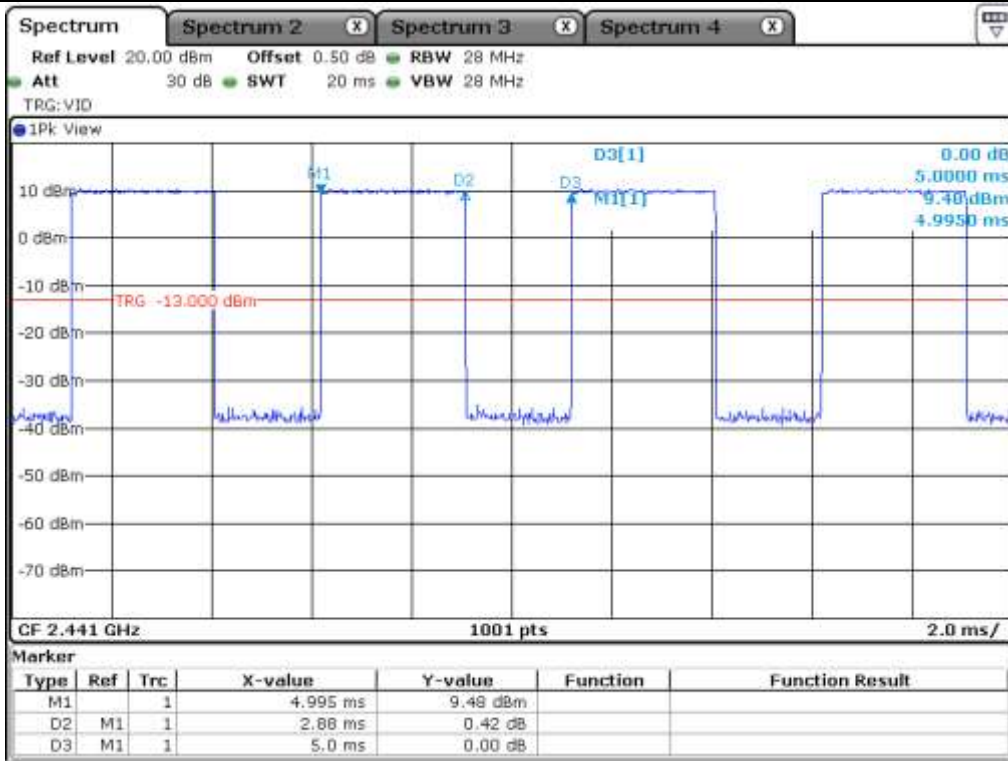
Mode	Tx On Time [ ms ]	Tx Off Time [ ms ]	Duty Cycle [ % ]	Correction Factor [ dB ]
Bluetooth [ 1 Mbps ]	2.88	2.12	57.60	2.40
Bluetooth [ 2 Mbps ]	2.88	2.12	57.60	2.40
Bluetooth [ 3 Mbps ]	2.88	2.12	57.60	2.40

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

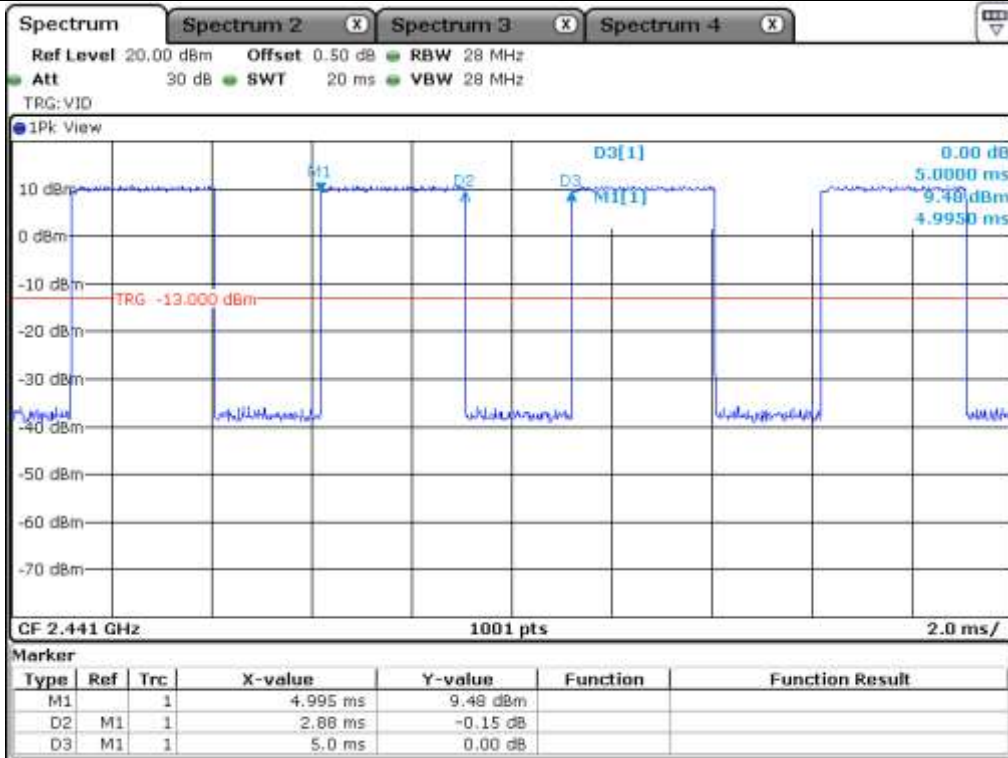
Correction Factor : 10 \* Log(1 / (Duty Cycle / 100))

- Test Plot





Bluetooth\_2 Mbps



Bluetooth\_3 Mbps



### 5.4 Configuration of Test System

**Line Conducted Test:** The EUT was connected to USB and the power of USB was connected to Notebook PC. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 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 Chip 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)
Transmitting 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	X

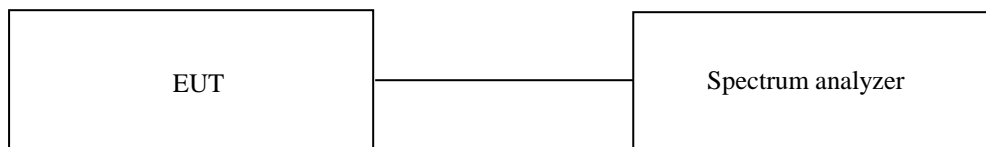
## 7. MINIMUM 20 dB BANDWIDTH

### 7.1 Operating environment

Temperature : 23 °C  
Relative humidity : 41 % 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 10 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.

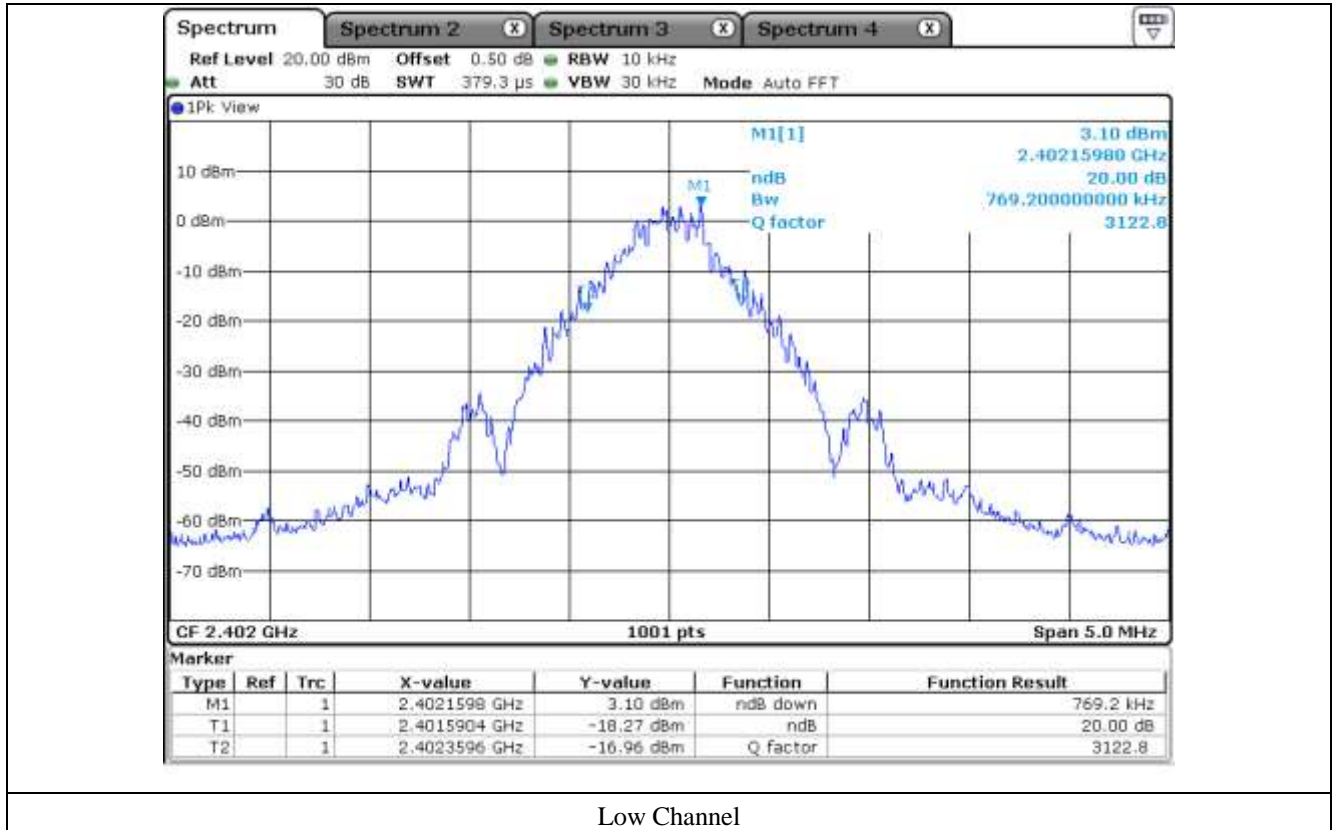


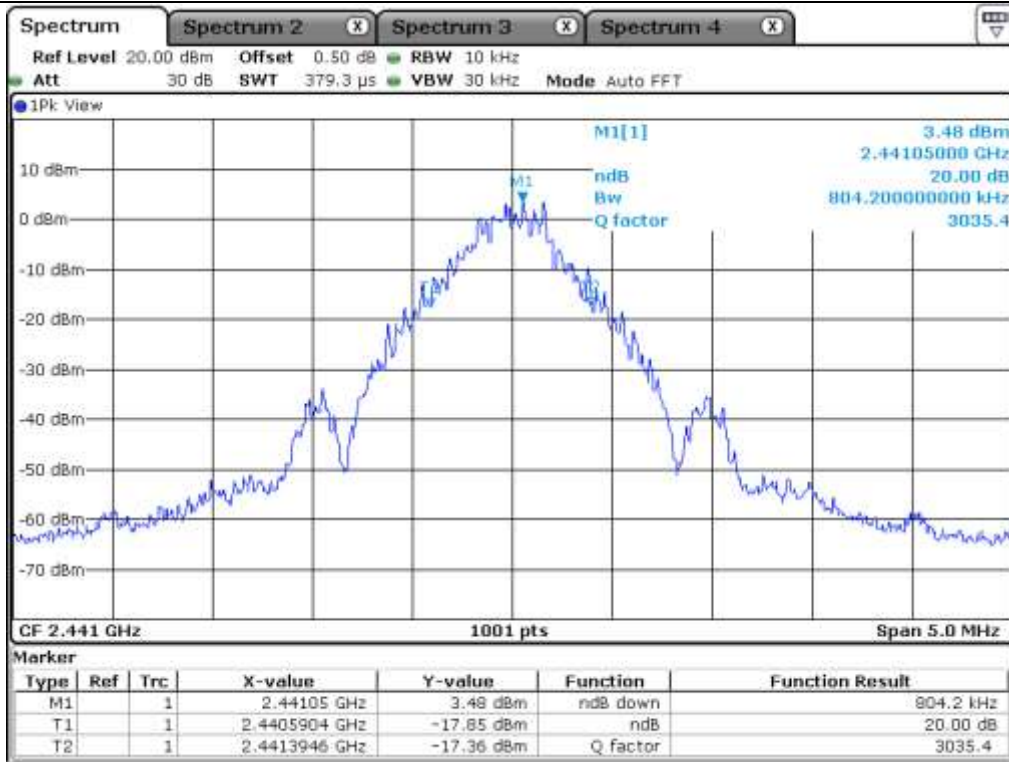
### 7.3 Test Date

August 21, 2020 ~ September 08, 2020

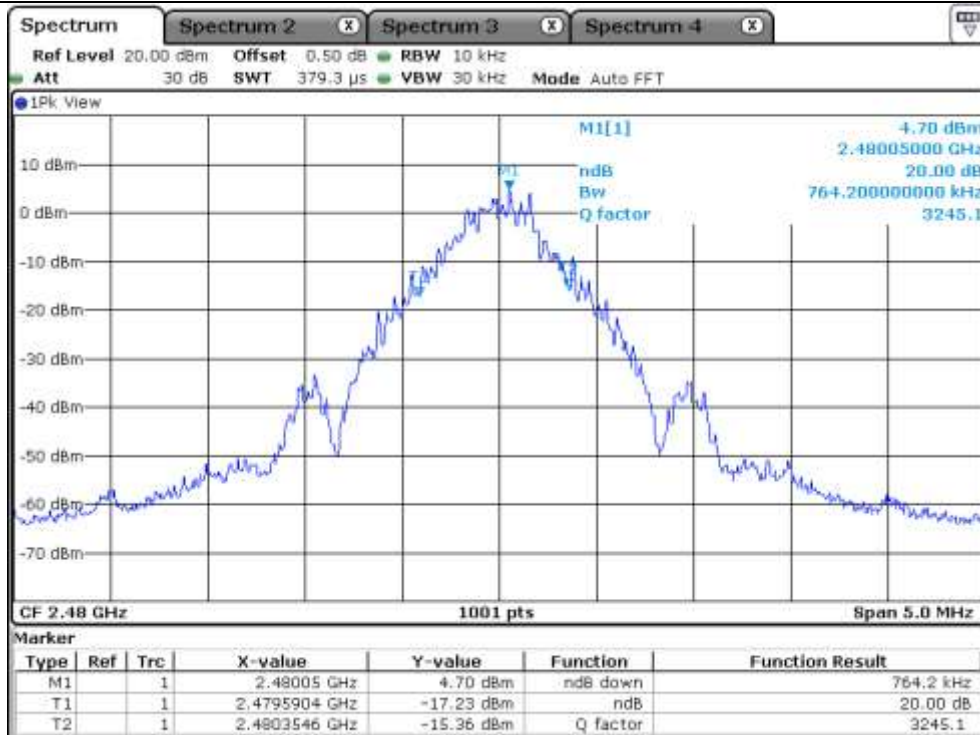
**7.4 Test data for 1 Mbps**

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402.00	769.20
Middle	2 441.00	804.20
High	2 480.00	764.20





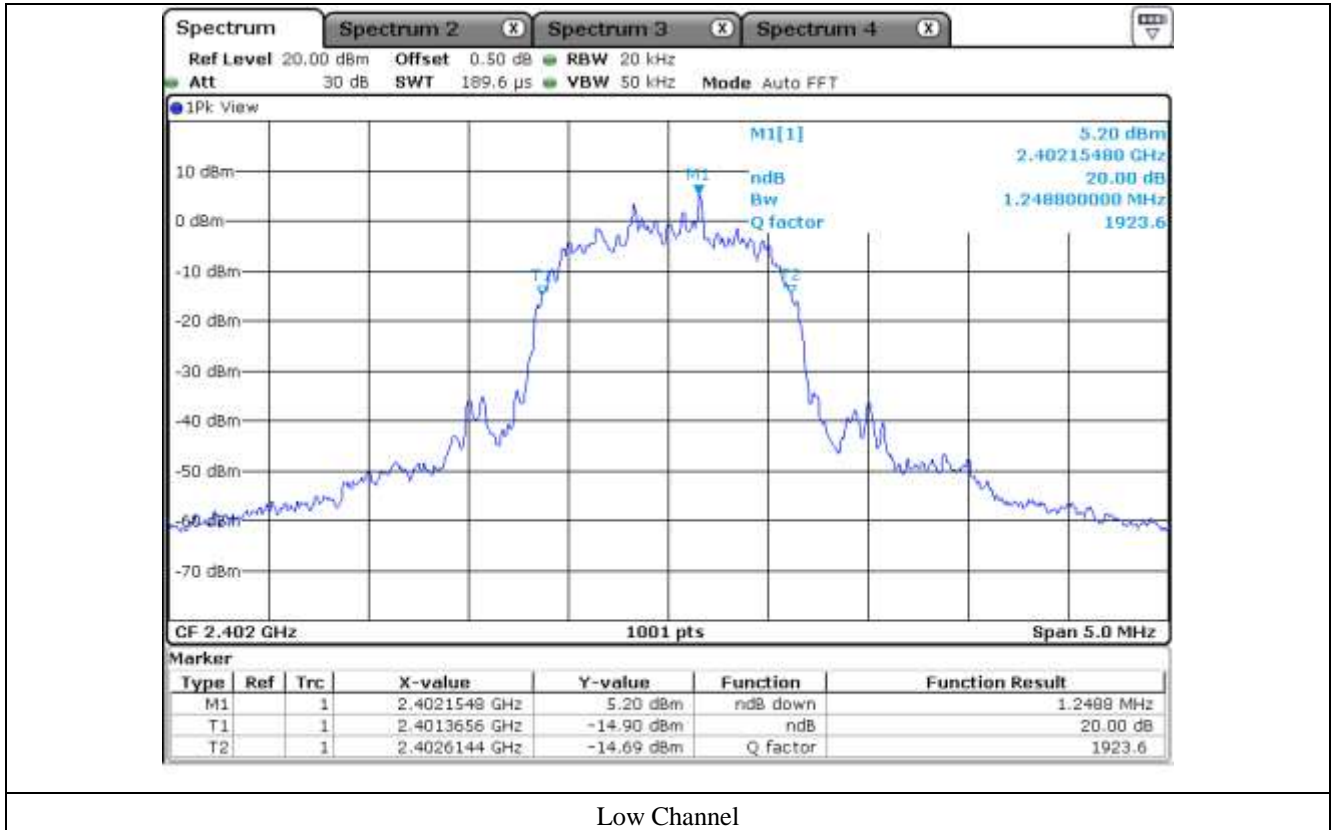
Middle Channel

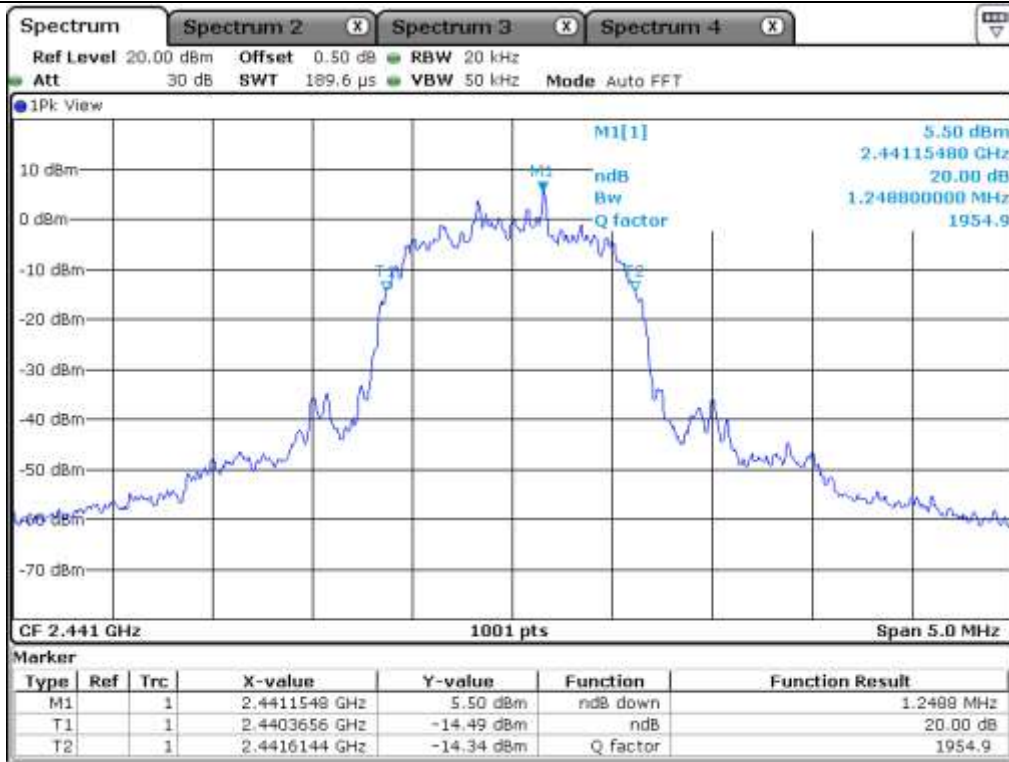


High Channel

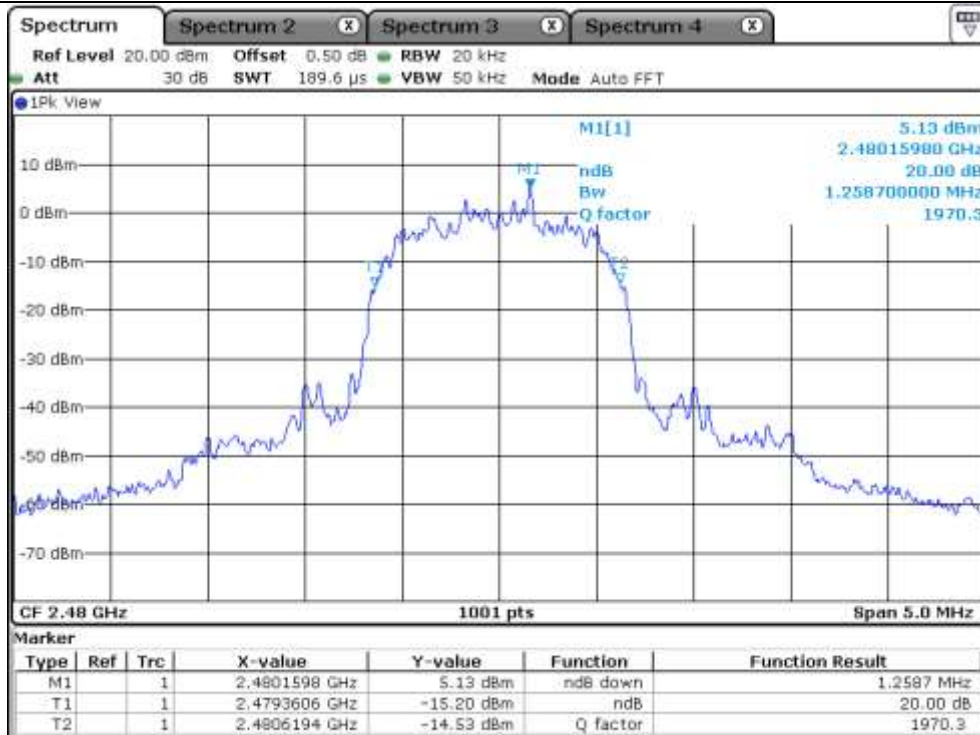
**7.5 Test data for 2 Mbps**

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402.00	1 248.80
Middle	2 441.00	1 248.80
High	2 480.00	1 258.70





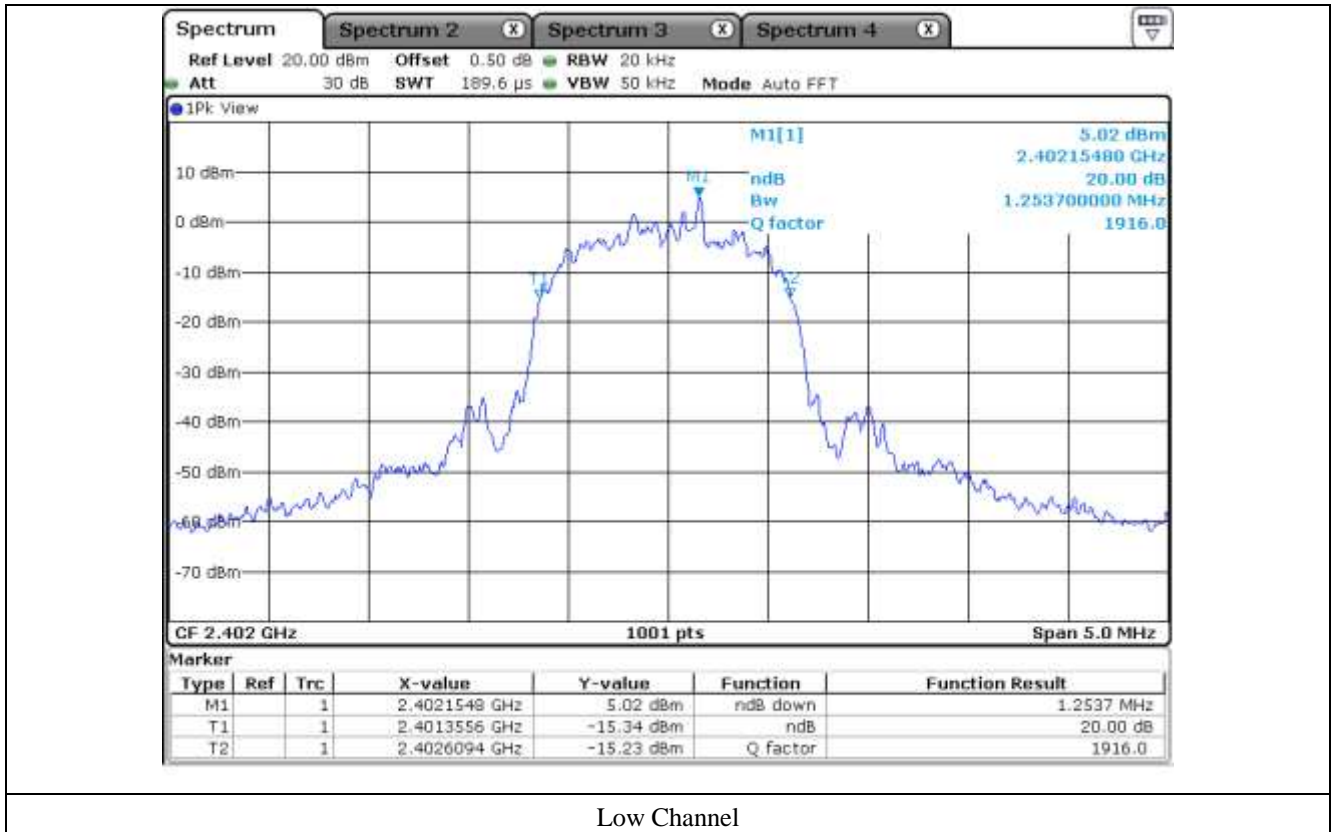
Middle Channel



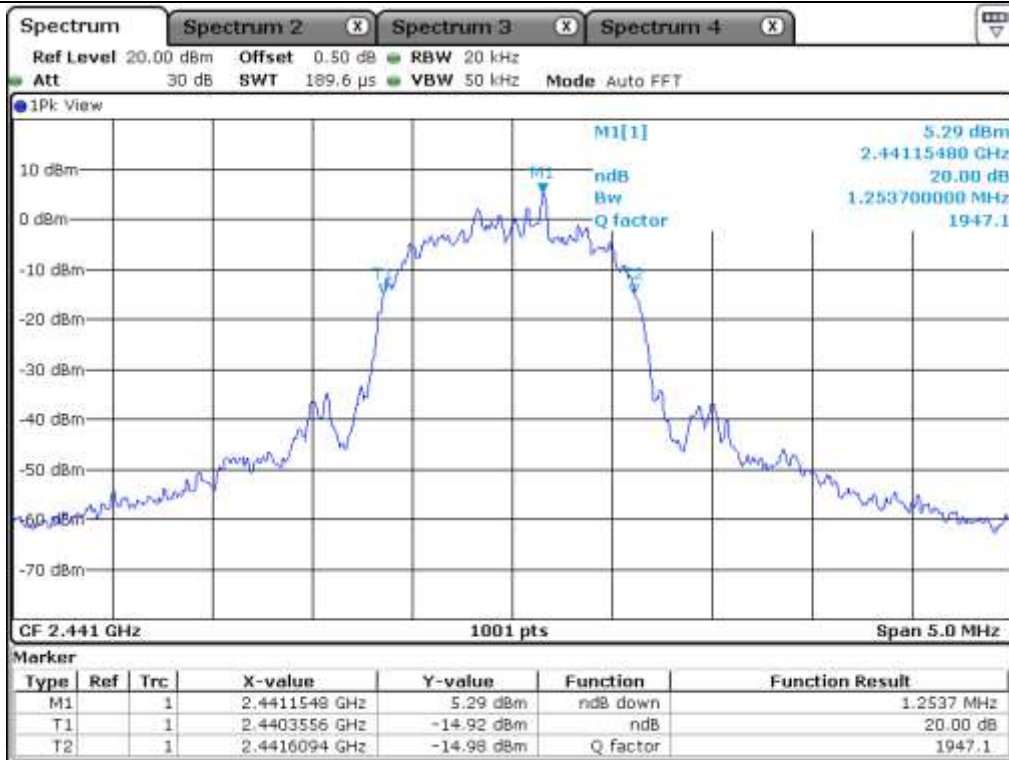
High Channel

**7.6 Test data for 3 Mbps**

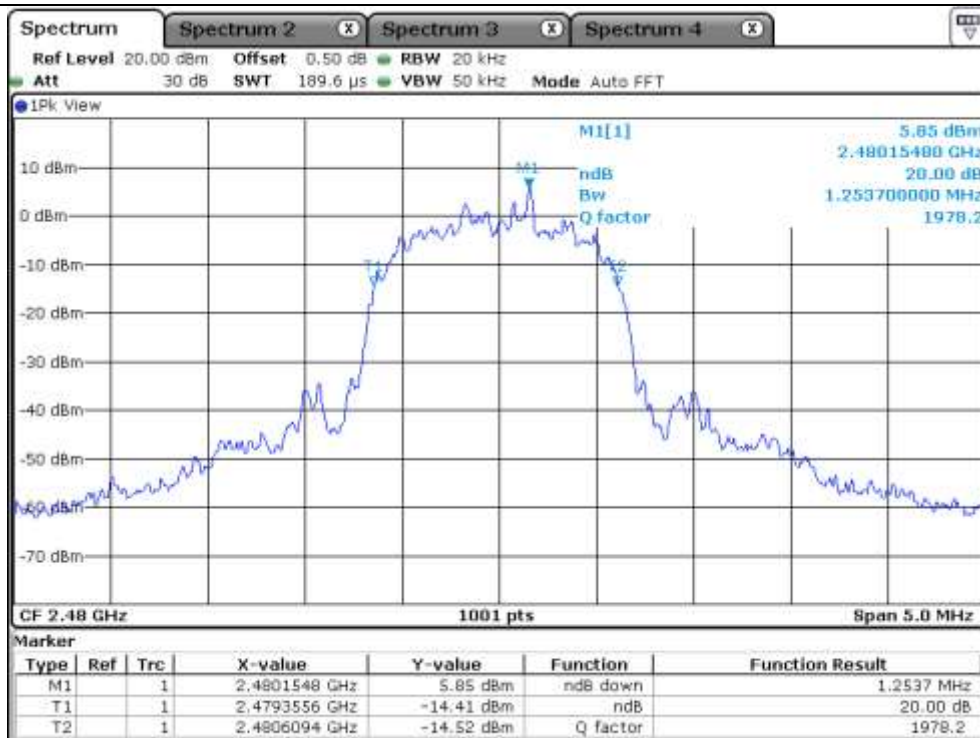
CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402.00	1 253.70
Middle	2 441.00	1 253.70
High	2 480.00	1 253.70







Middle Channel



High Channel



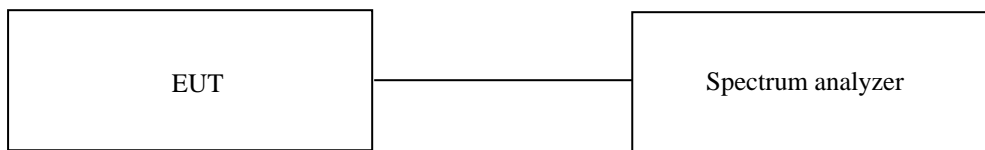
## 8. HOPPING FREQUENCY SEPARATION

### 8.1 Operating environment

Temperature : 23 °C  
 Relative humidity : 41 % 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.



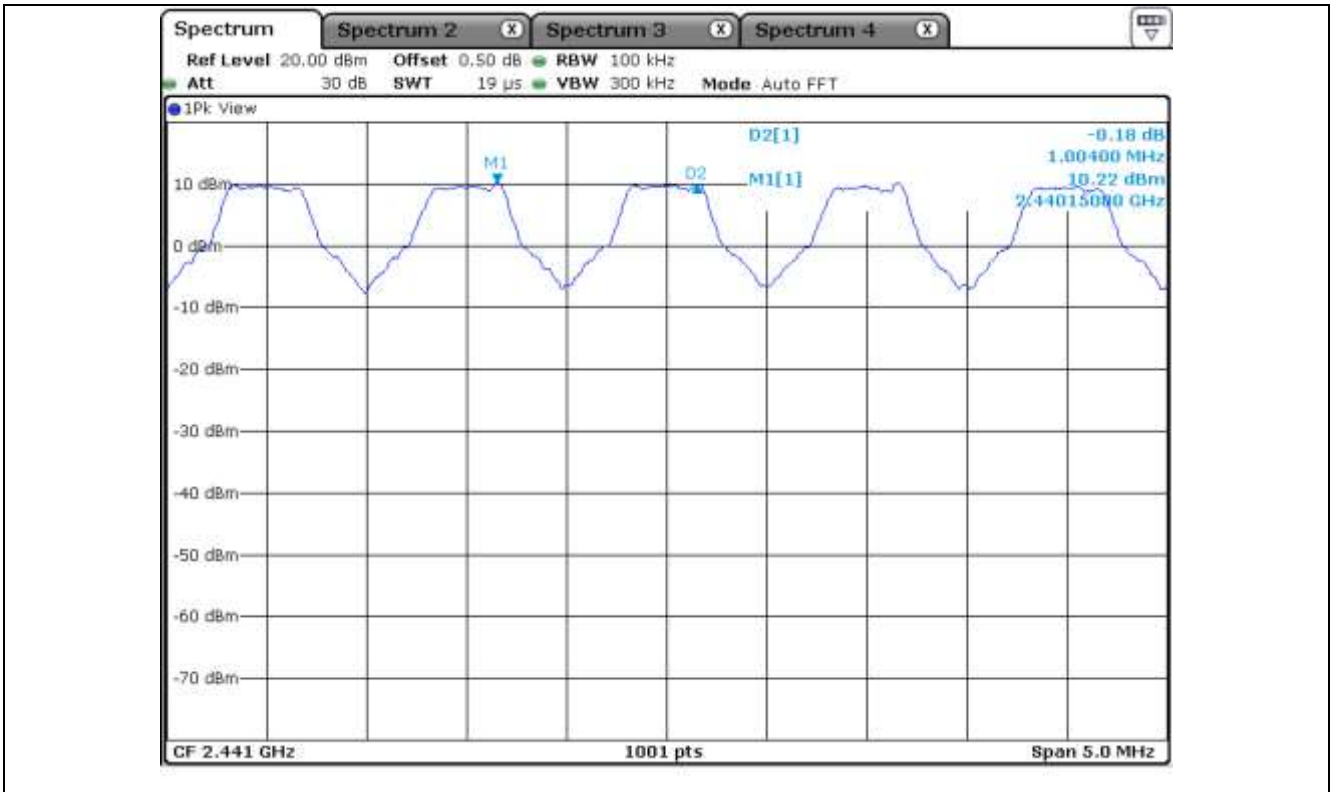
### 8.3 Test Date

August 21, 2020 ~ September 08, 2020

### 8.4 Test data for 1 Mbps

-. Test Result : Pass

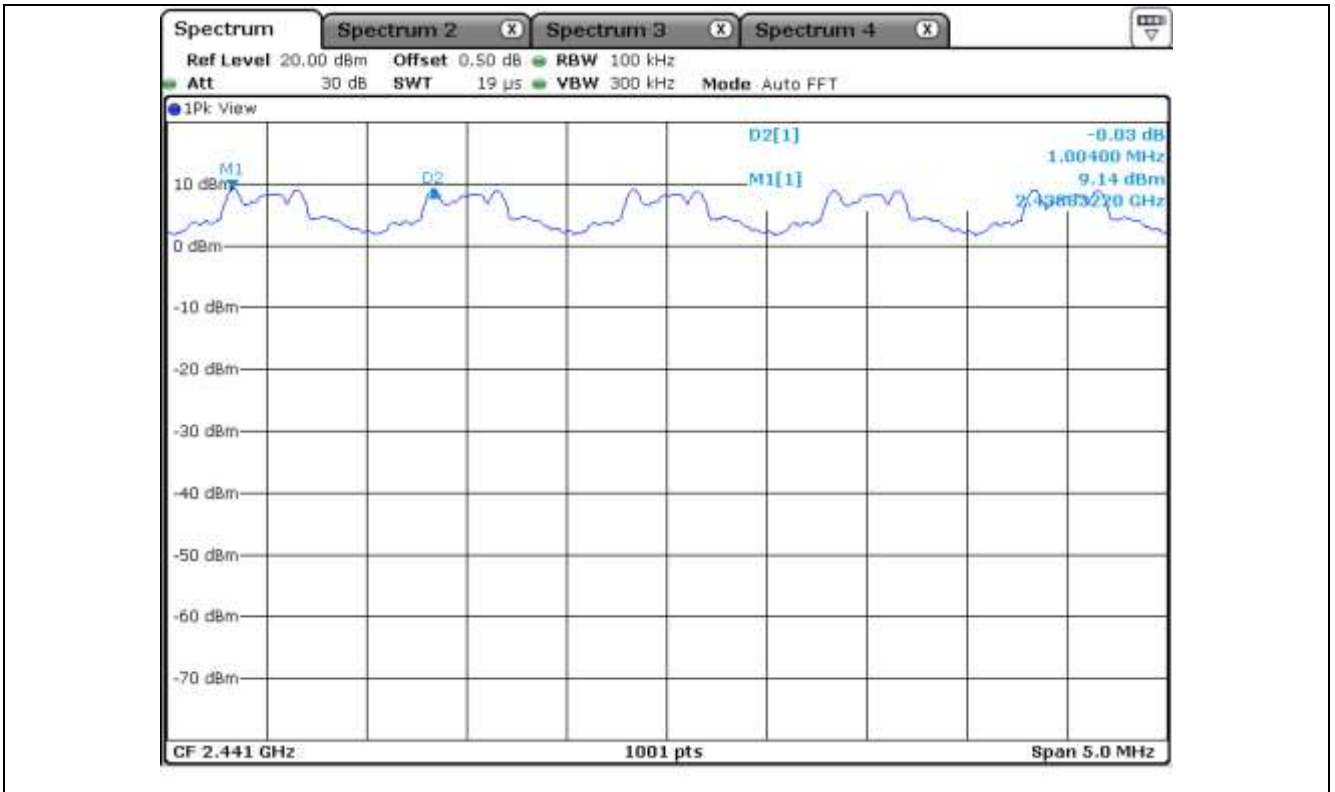
MEASURED VLAUE (MHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
1.004	536.13	Separated by a minimum of 536.13 kHz



8.5 Test data for 2 Mbps

-. Test Result : Pass

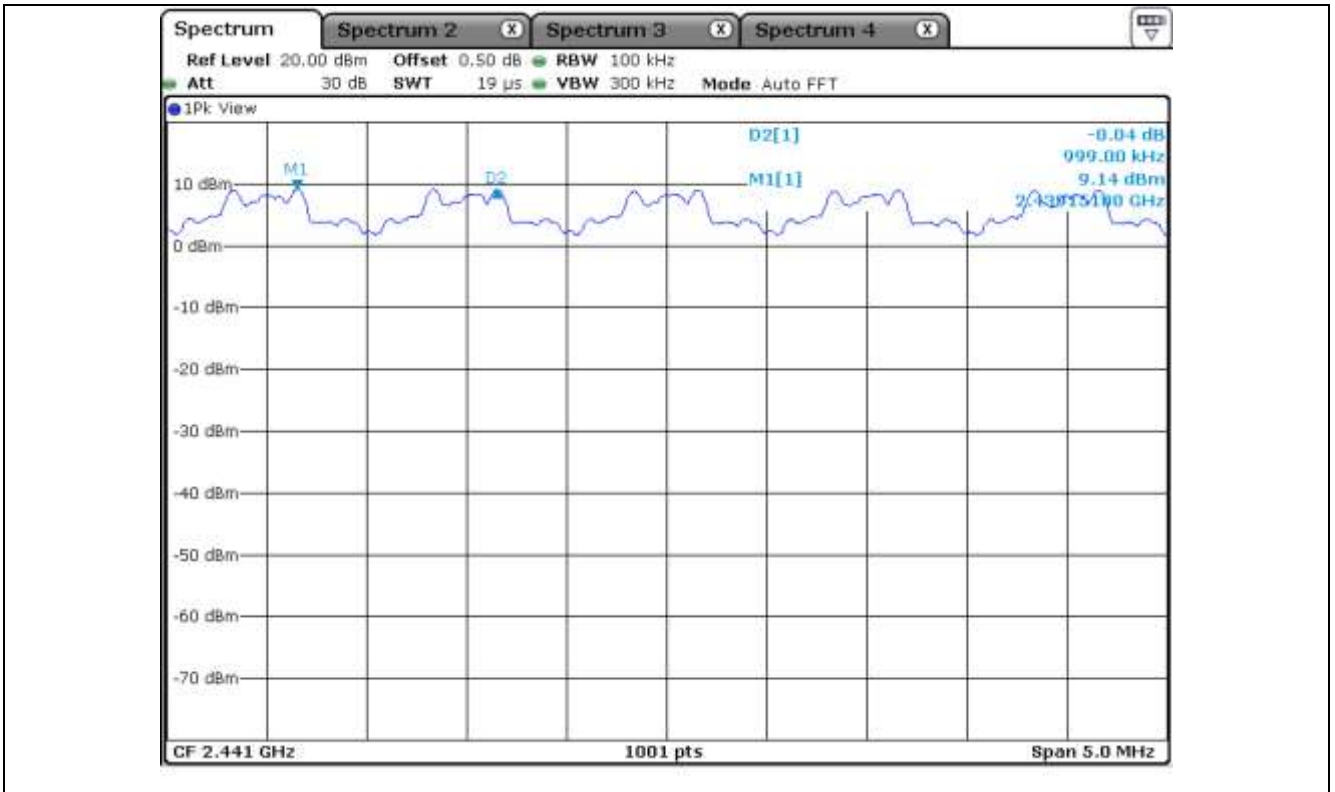
MEASURED VLAUE (MHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
1.004	832.53	Separated by a minimum of 832.53 kHz



### 8.6 Test data for 3 Mbps

-. Test Result : Pass

MEASURED VLAUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
999.00	835.80	Separated by a minimum of 835.80 kHz



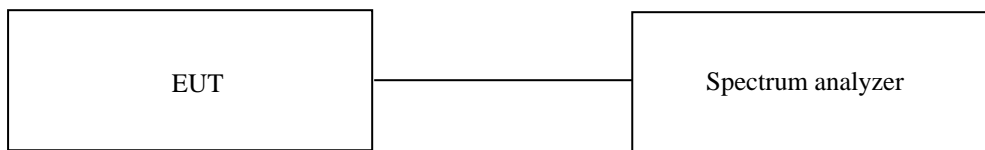
## 9. NUMBER OF HOPPING CHANNELS

### 9.1 Operating environment

Temperature : 23 °C  
Relative humidity : 41 % 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.



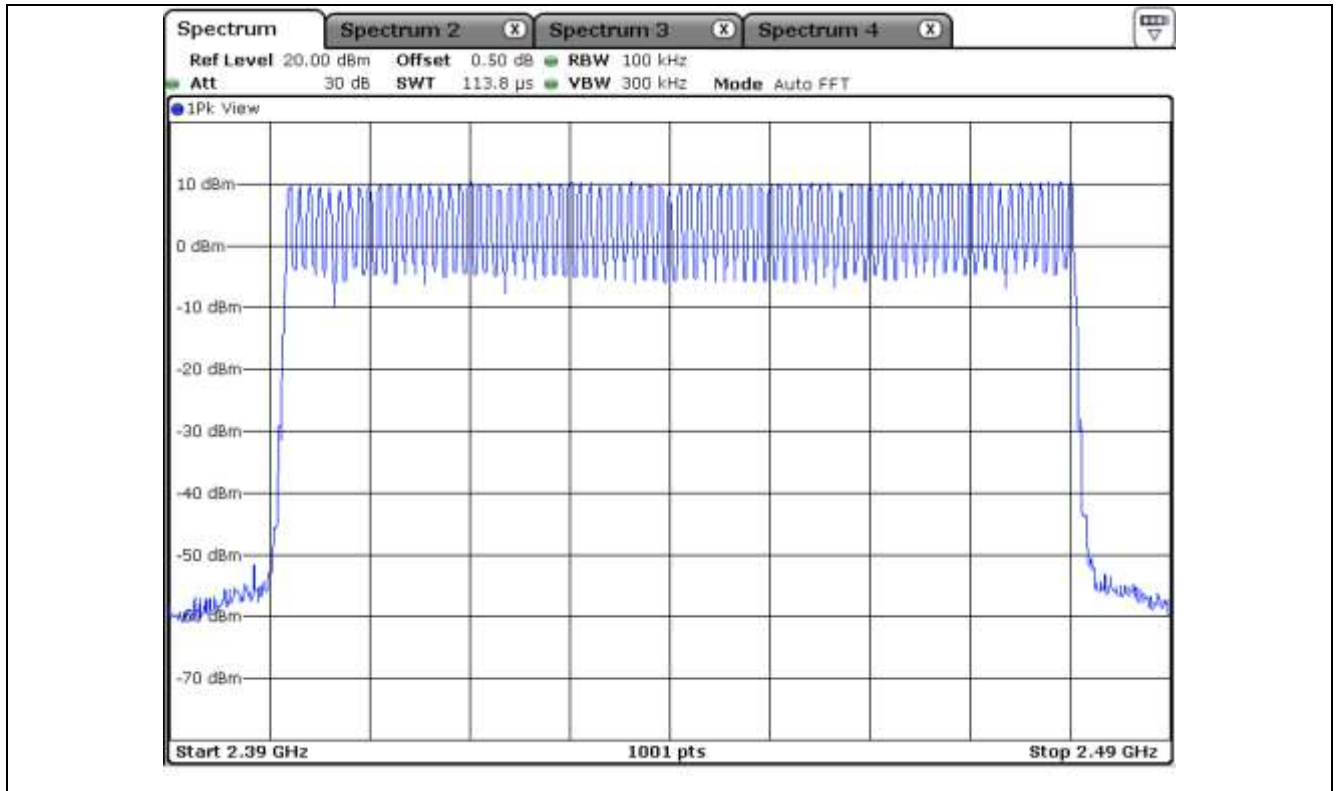
### 9.3 Test Date

August 21, 2020 ~ September 08, 2020

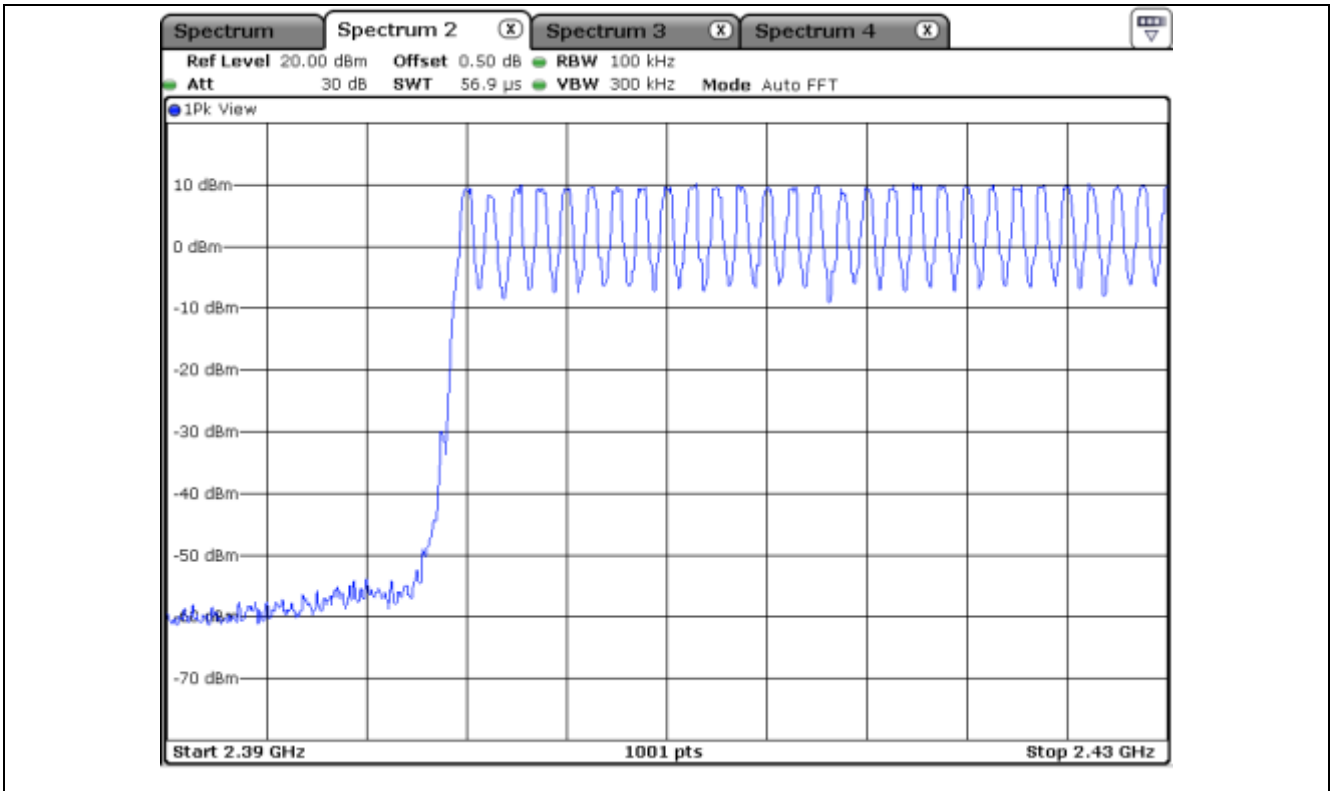
9.4 Test data for 1 Mbps

-. Test Result : Pass

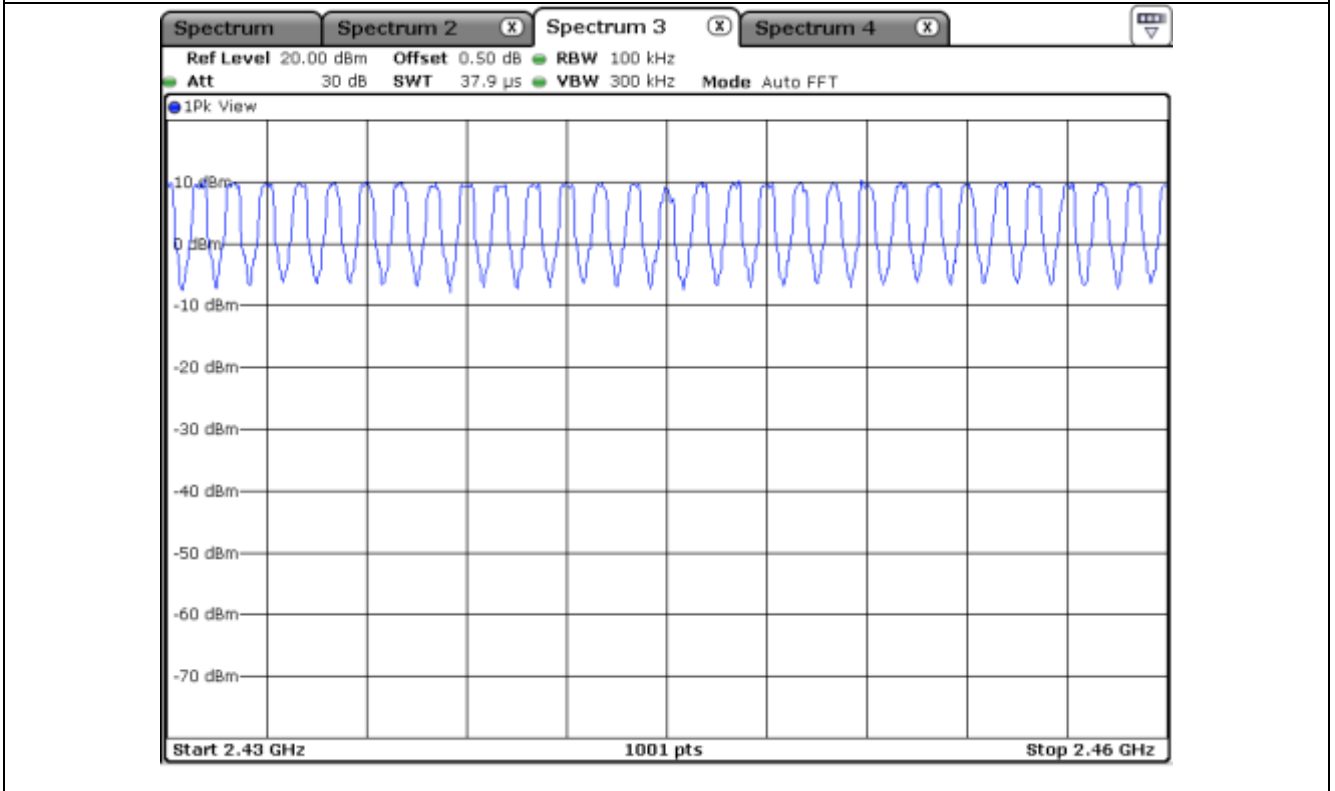
Data Transfer Rate	Measured value (Number)	Limit (Number)	Margin (Number)
1 Mbps	79	Minimum of 15	64



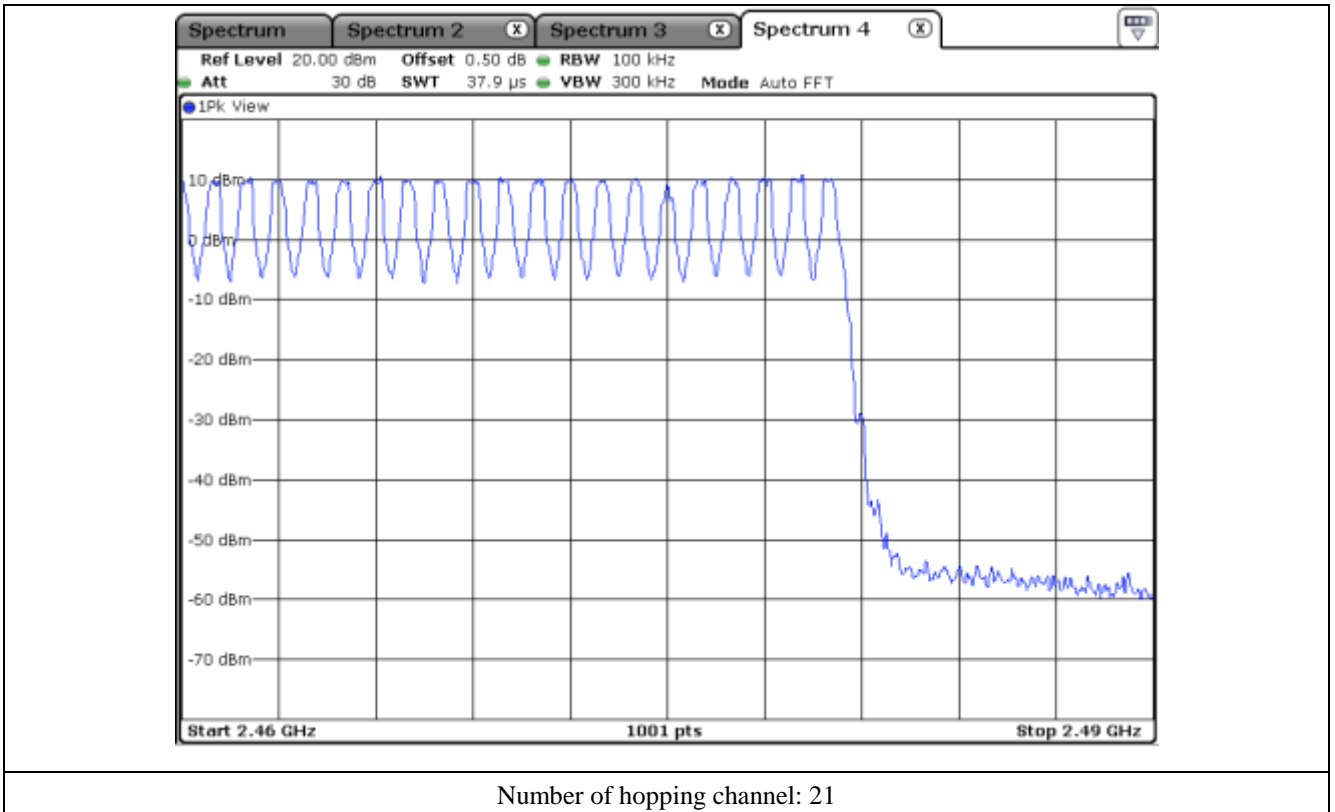
Total number of hopping channel:  $28+30+21 = 79$



Number of hopping channel: 28



Number of hopping channel: 30

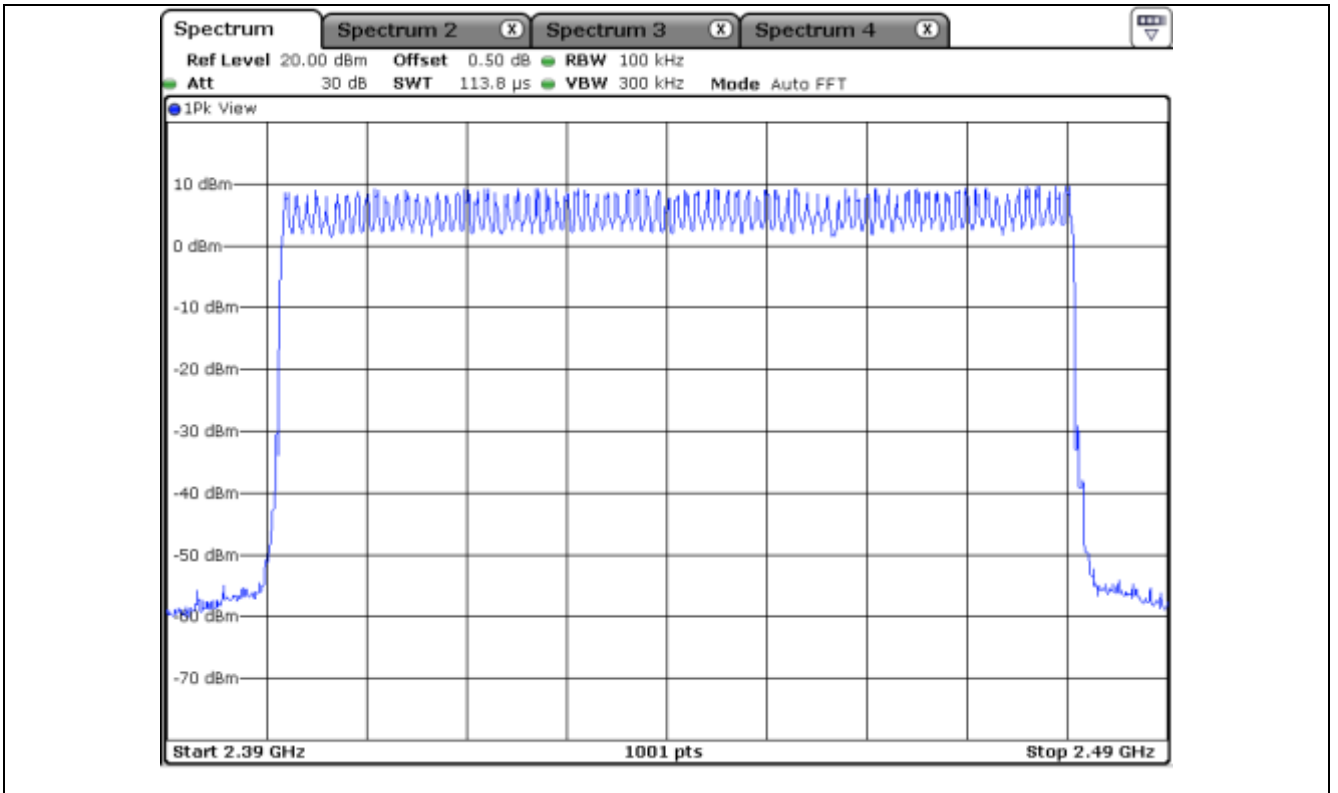




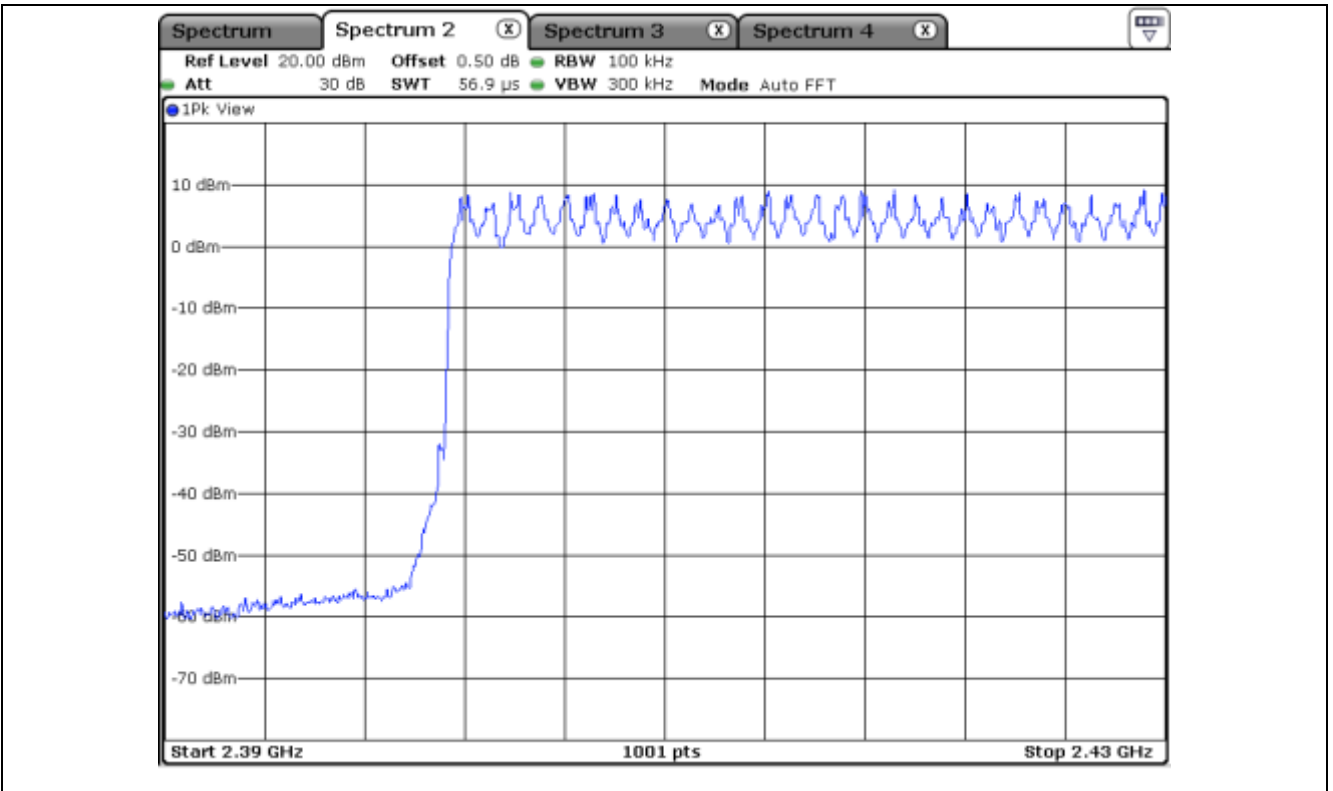
### 9.5 Test data for 2 Mbps

-. Test Result : Pass

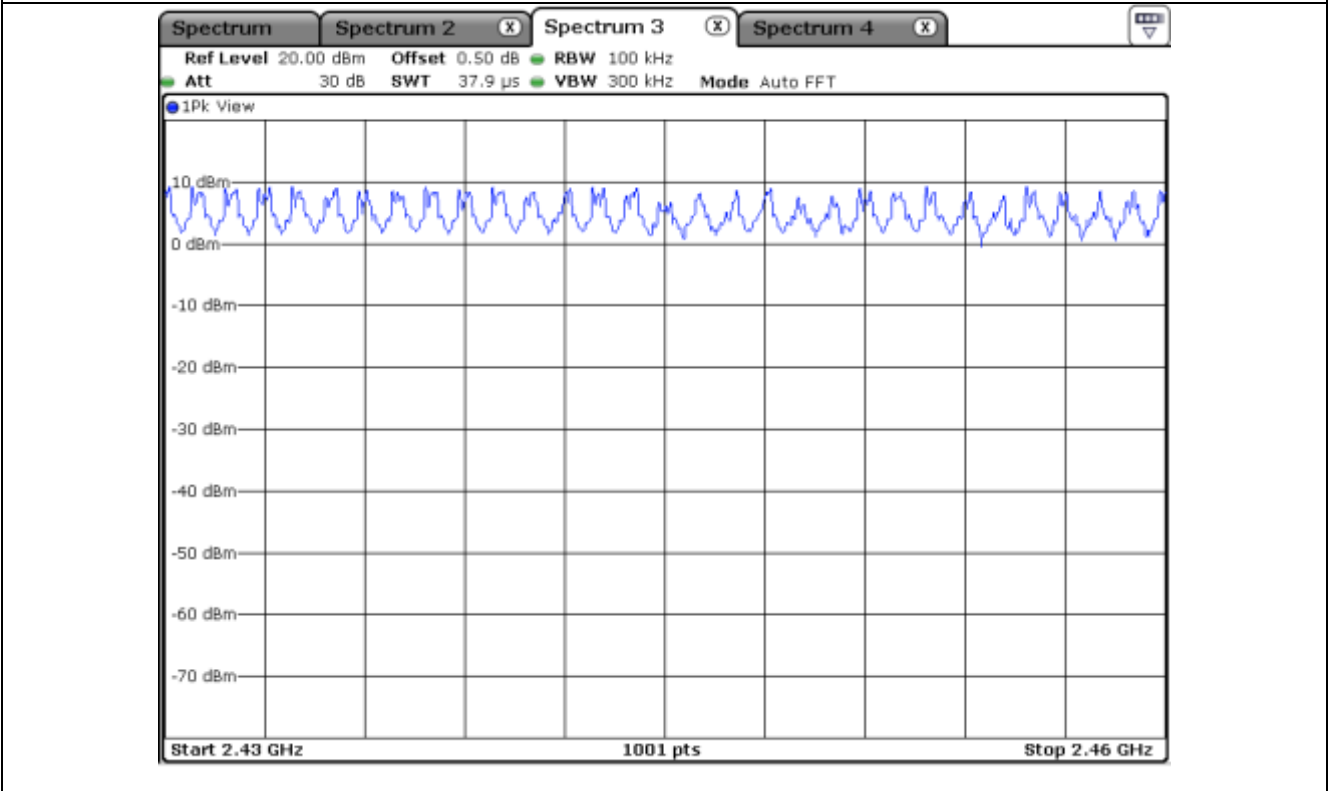
Data Transfer Rate	Measured value (Number)	Limit (Number)	Margin (Number)
2 Mbps	79	Minimum of 15	64



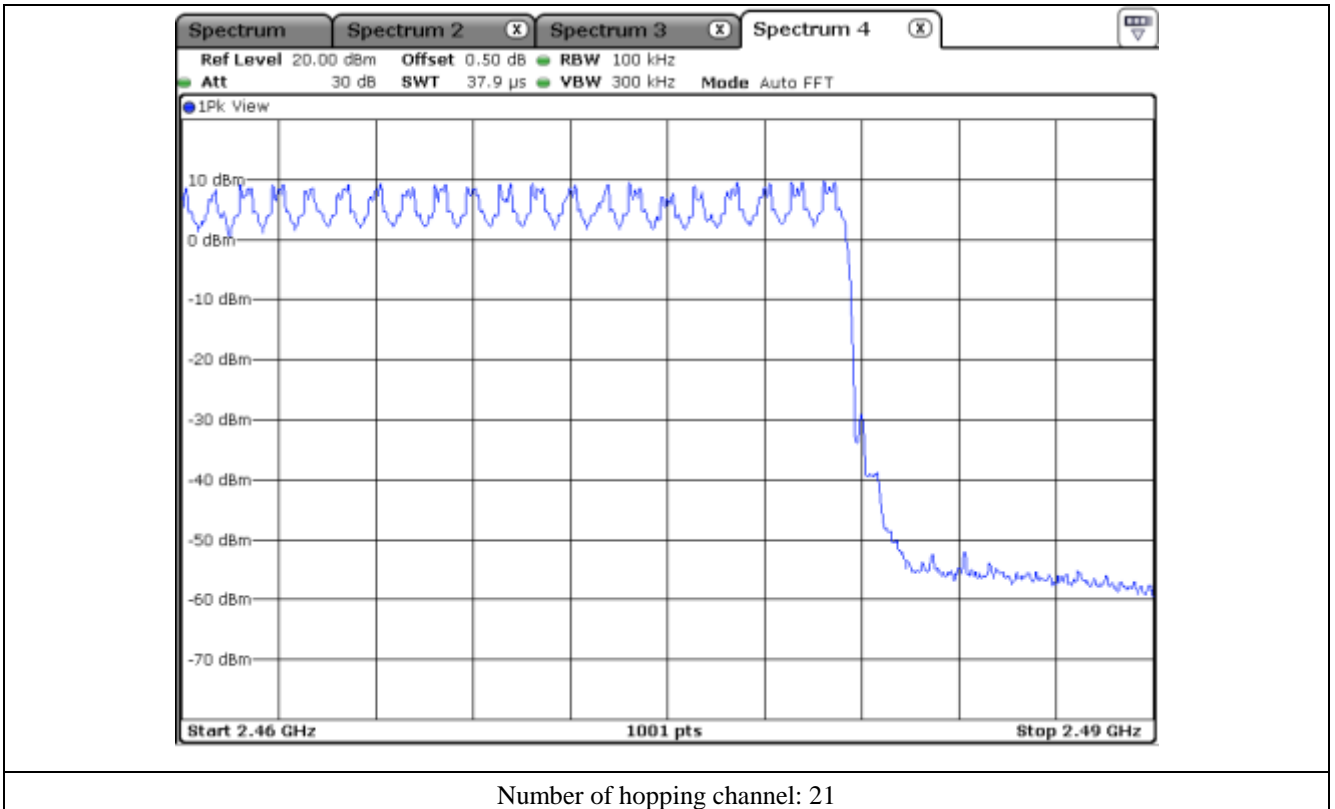
Total number of hopping channel:  $28+30+21 = 79$



Number of hopping channel: 28



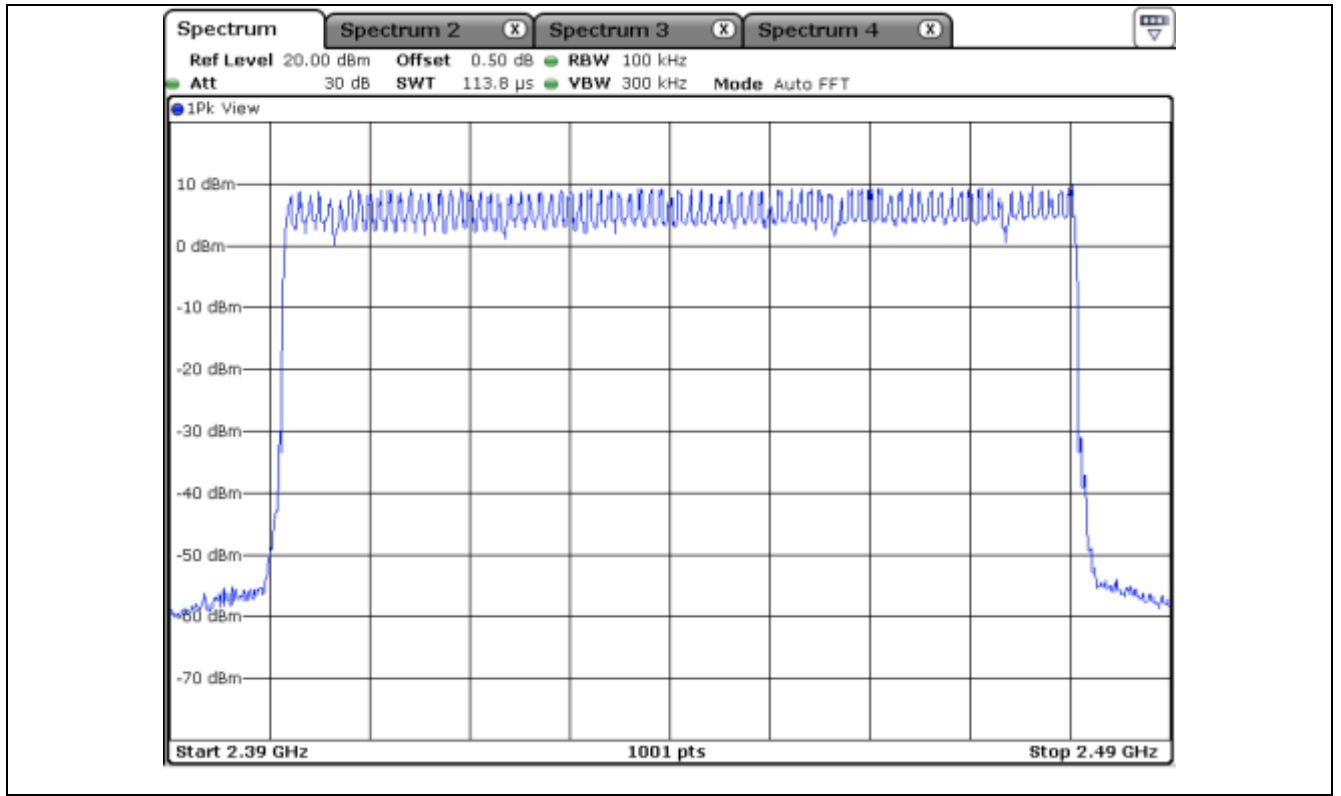
Number of hopping channel: 30



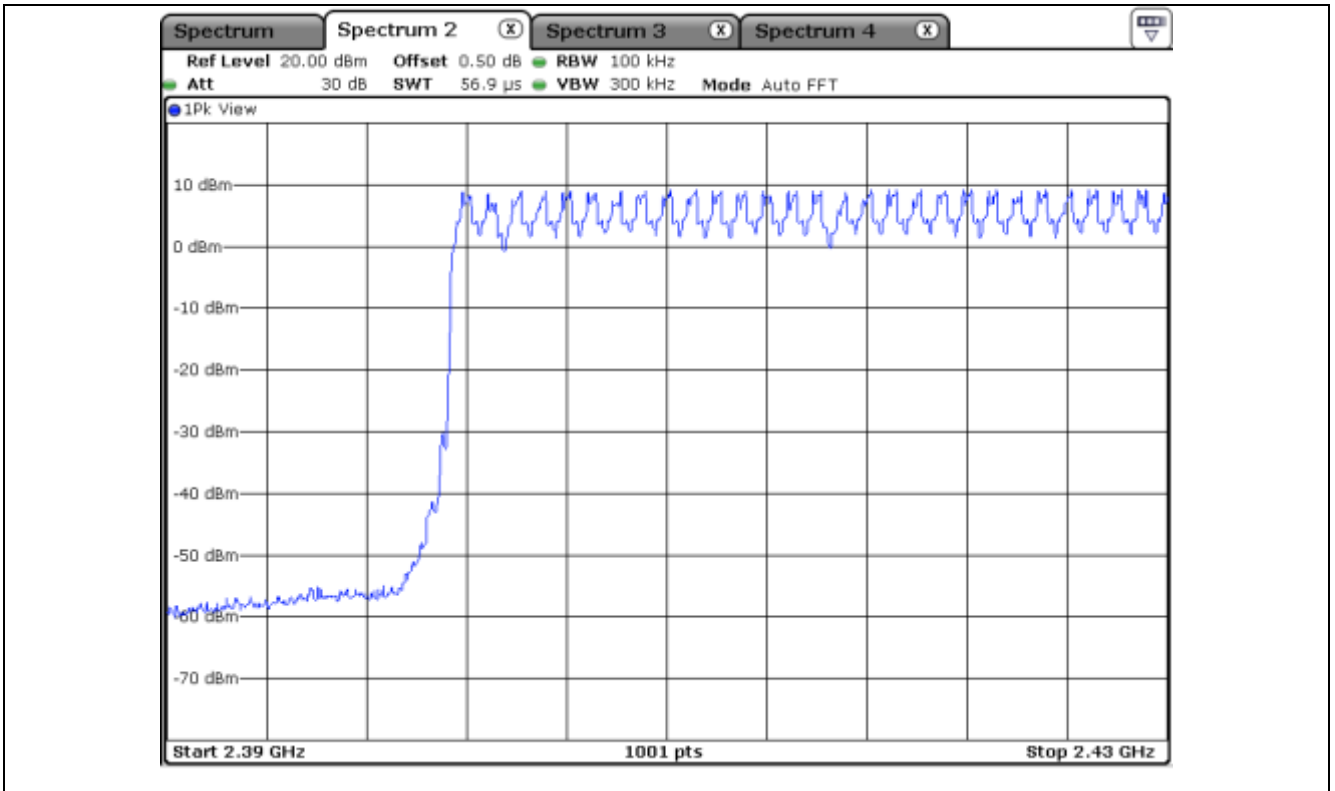
### 9.6 Test data for 3 Mbps

-. Test Result : Pass

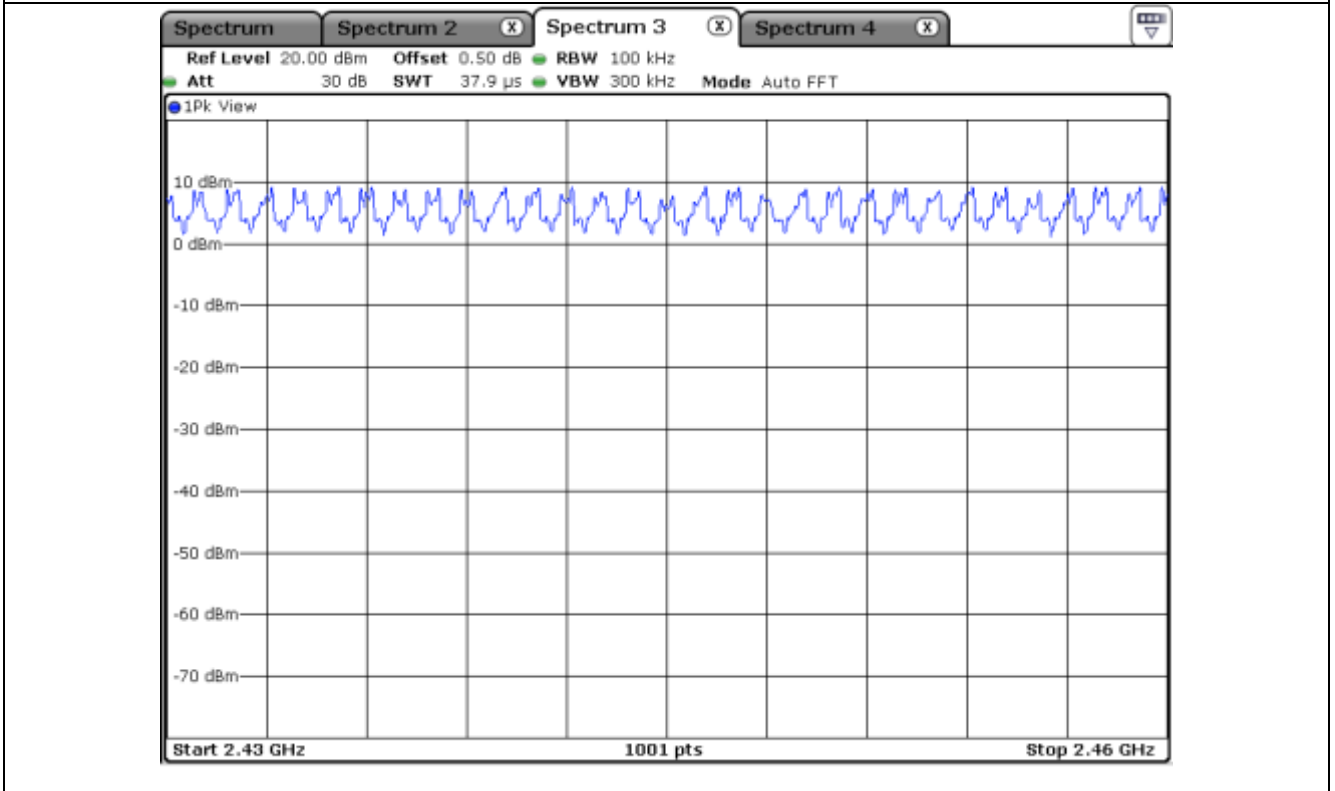
Data Transfer Rate	Measured value (Number)	Limit (Number)	Margin (Number)
3 Mbps	79	Minimum of 15	64



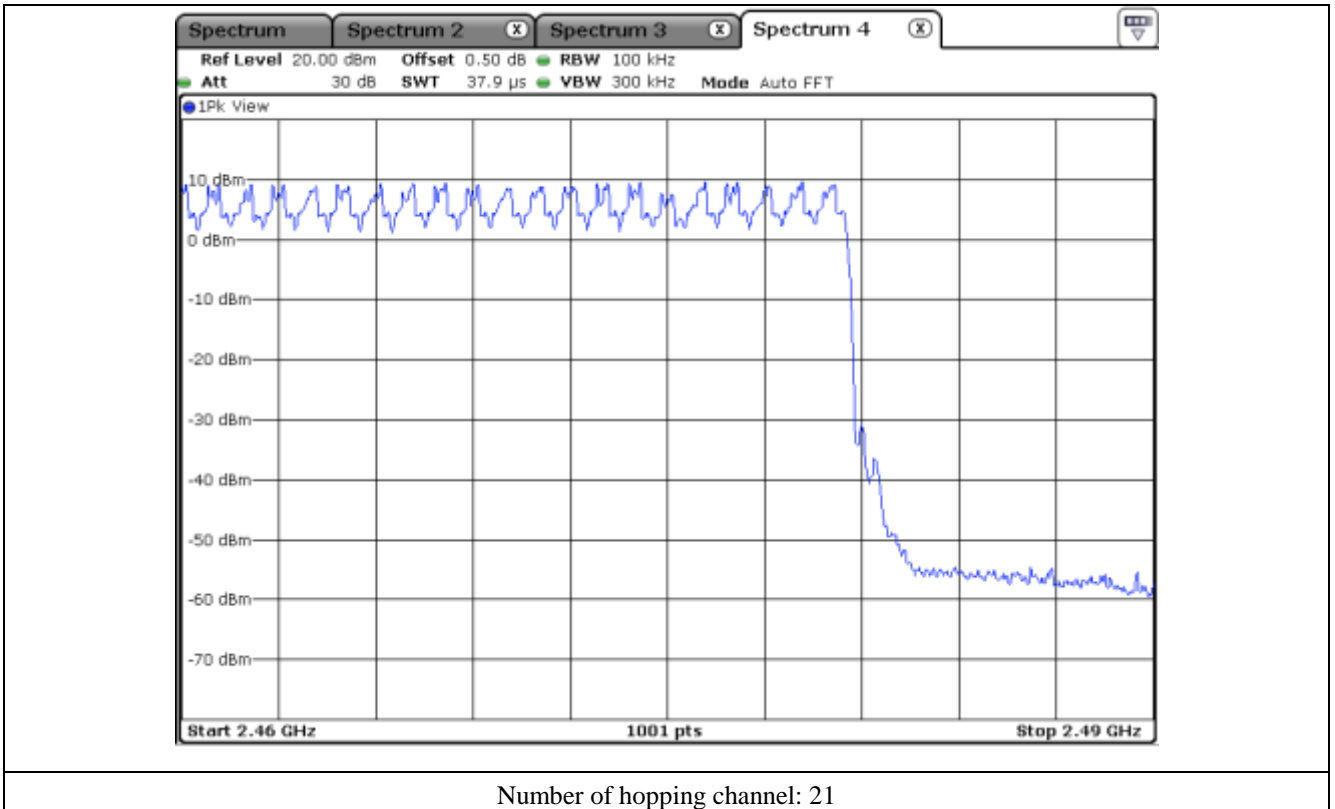
Total number of hopping channel:  $28+30+21 = 79$



Number of hopping channel: 28



Number of hopping channel: 30



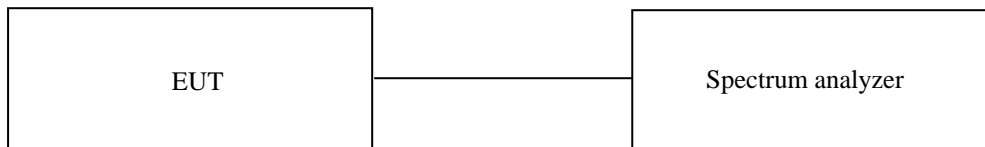
## 10. TIME OF OCCUPANCY

### 10.1 Operating environment

Temperature : 23 °C  
Relative humidity : 41 % 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 Hz. 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 Date

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### 10.4 Test data for 1 Mbps

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

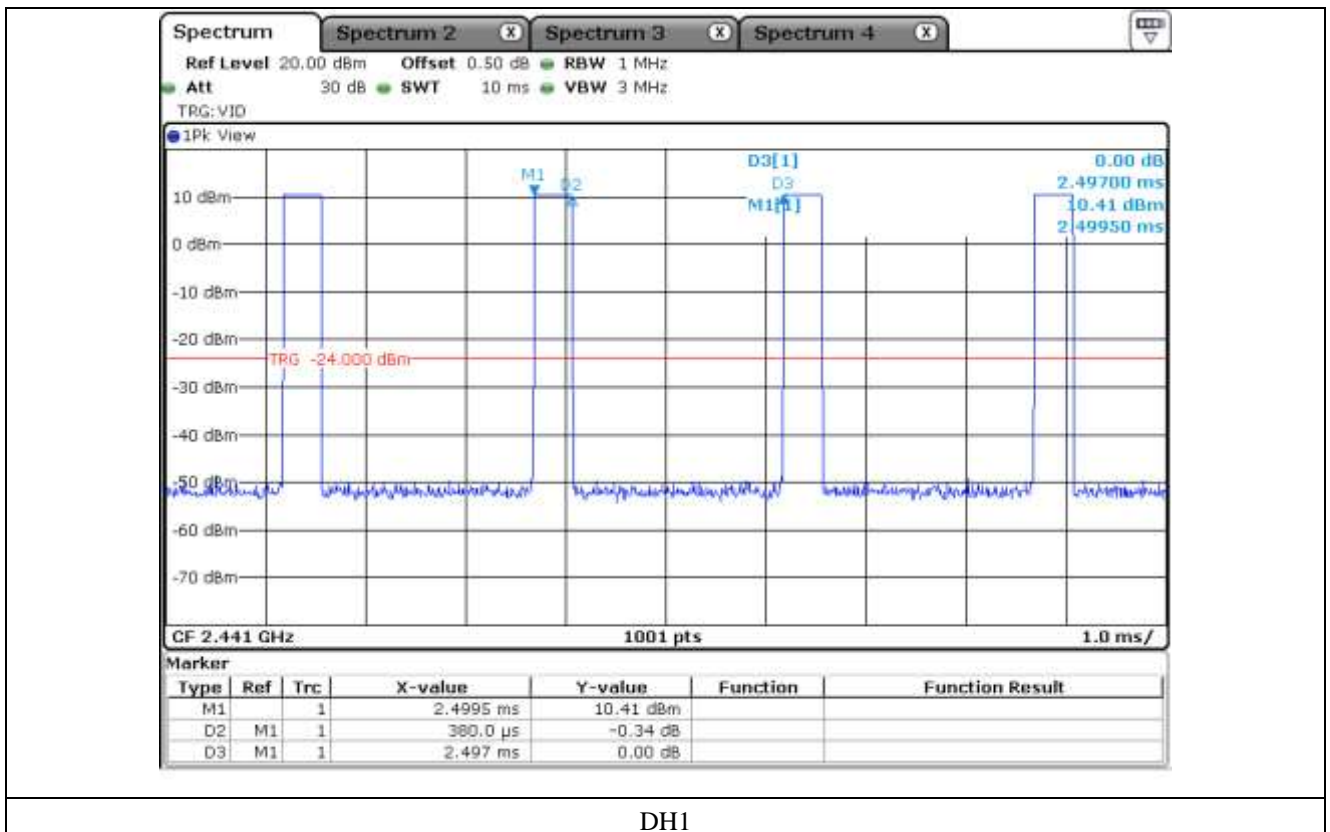
For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel 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	0.380	10.13	31.60	121.64	400	PASS
DH3	1.632	5.06	31.60	260.95	400	
DH5	2.912	3.38	31.60	311.02	400	

Total dwell time is calculated as following.

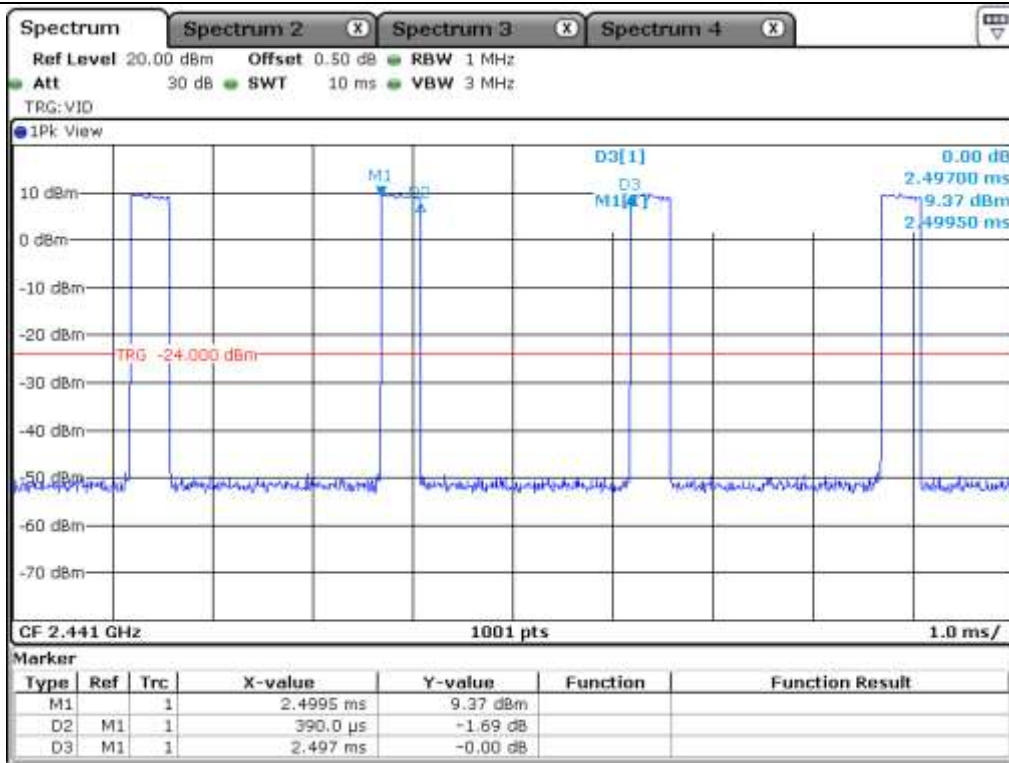
$$\text{Total Dwell Time} = \text{Pulse time} * \text{Hops per second with channels} * \text{period time}$$

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

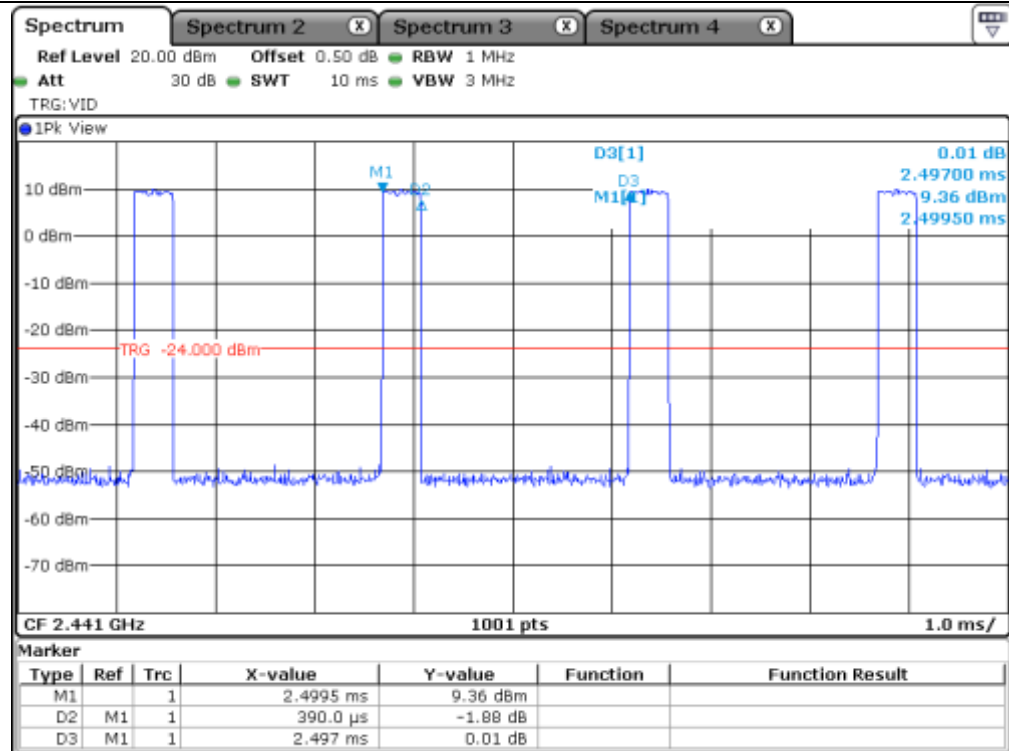


DH1





DH3



DH5

### 10.5 Test data for 2 Mbps

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

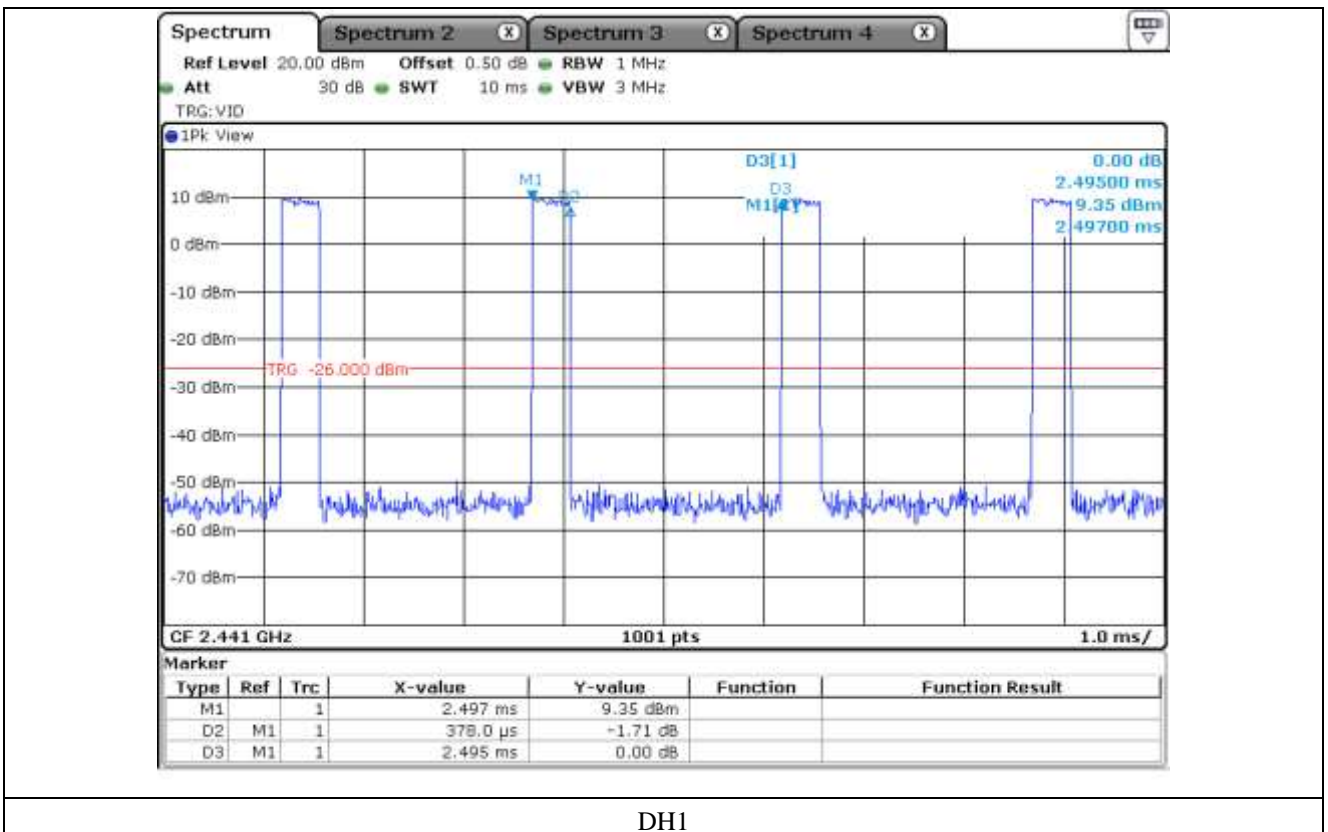
For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel 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.

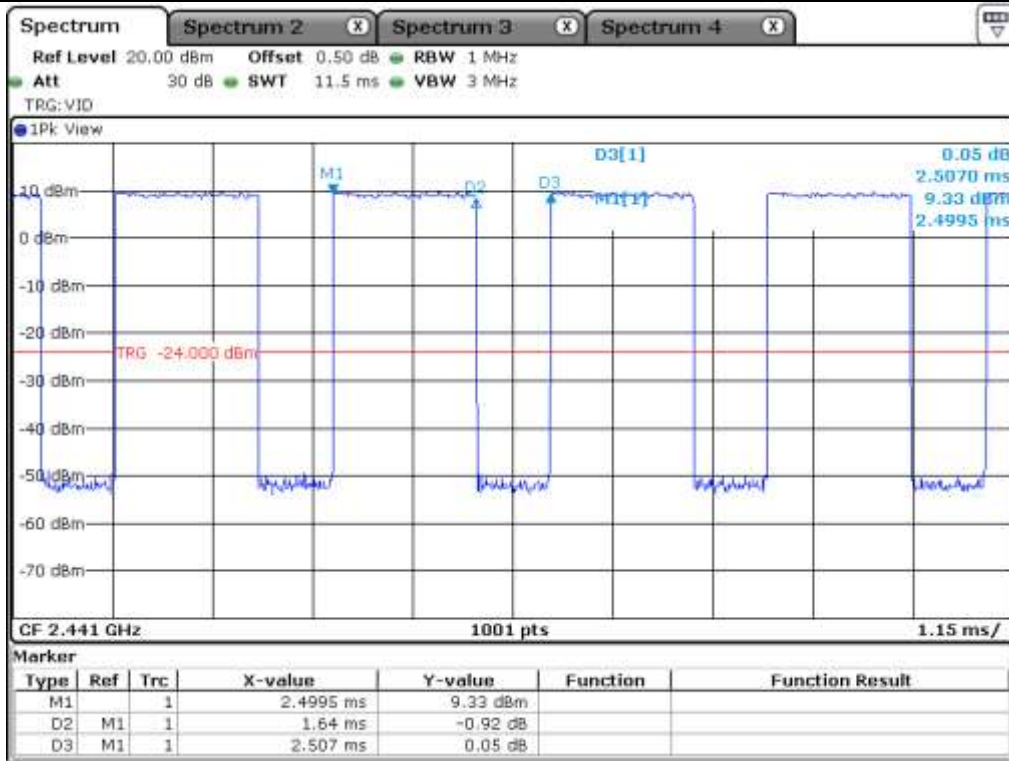
Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.378	10.13	31.60	121.00	400	PASS
DH3	1.640	5.06	31.60	262.23	400	
DH5	2.905	3.38	31.60	310.28	400	

Total dwell time is calculated as following.

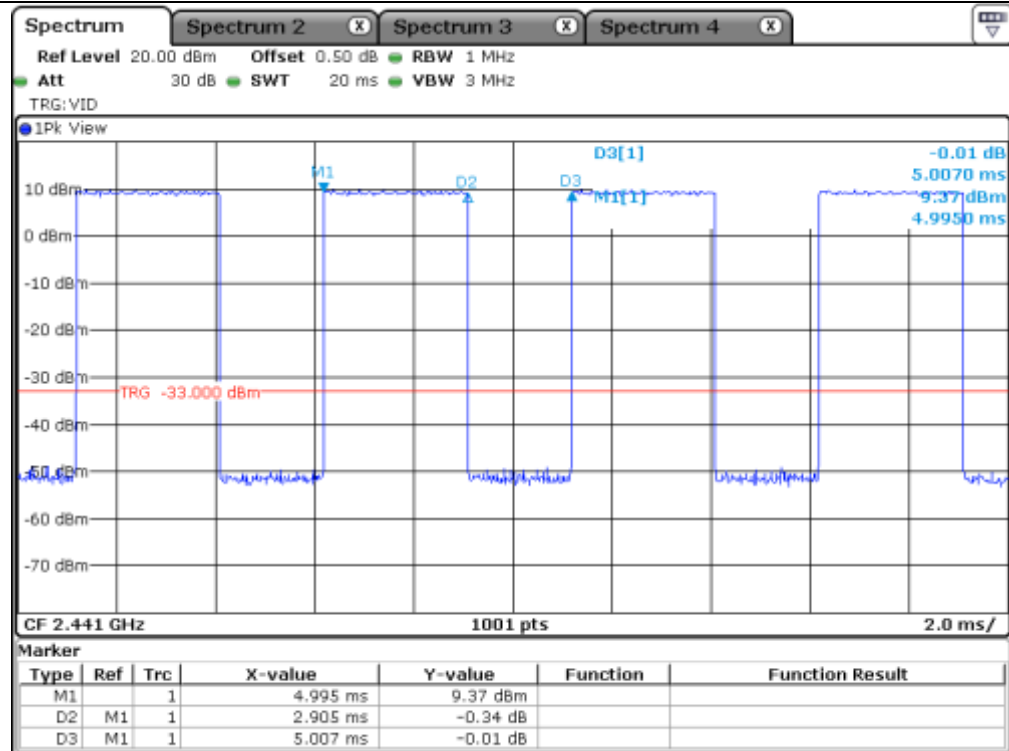
$$\text{Total Dwell Time} = \text{Pulse time} * \text{Hops per second with channels} * \text{period time}$$

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





DH3



DH5

### 10.6 Test data for 3 Mbps

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

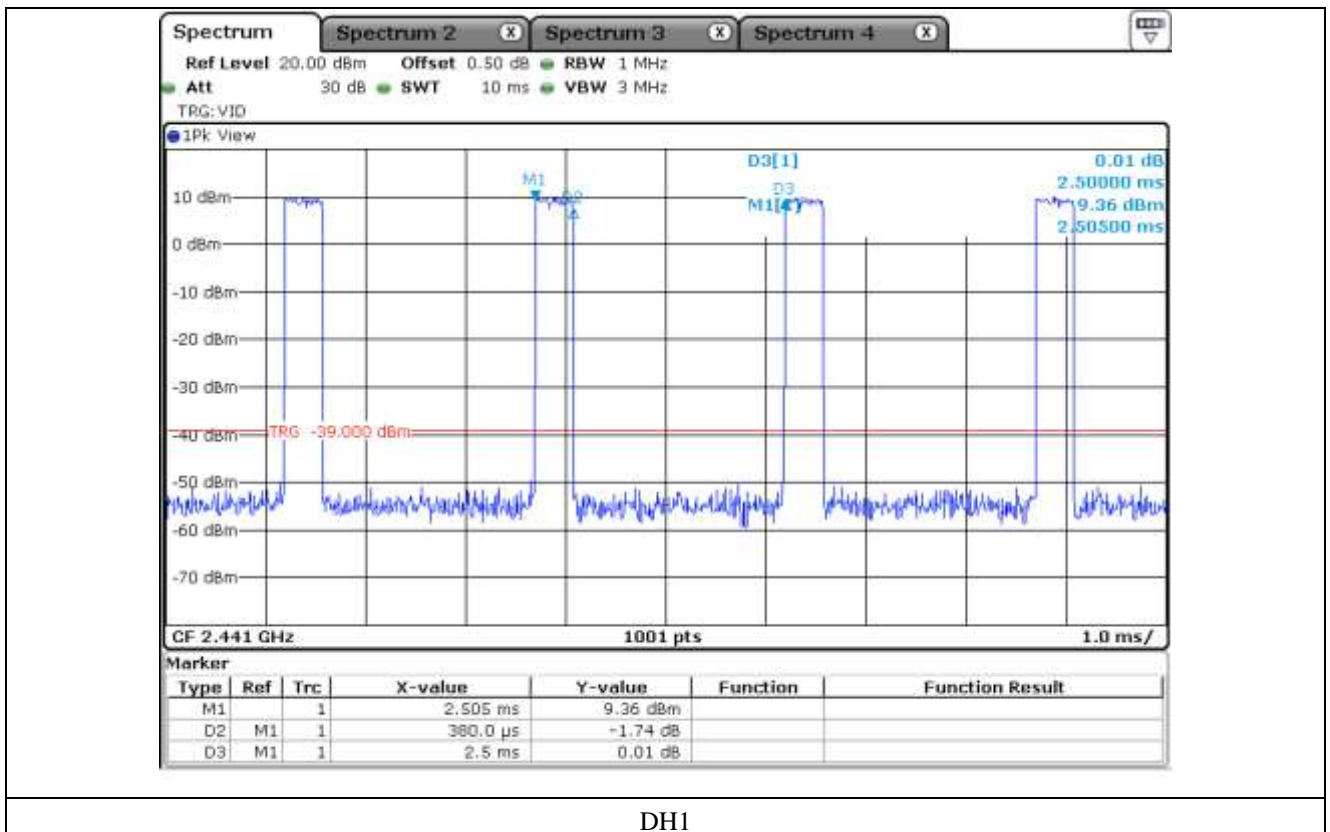
For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel 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	0.380	10.13	31.60	121.64	400	PASS
DH3	1.640	5.06	31.60	262.23	400	
DH5	2.905	3.38	31.60	310.28	400	

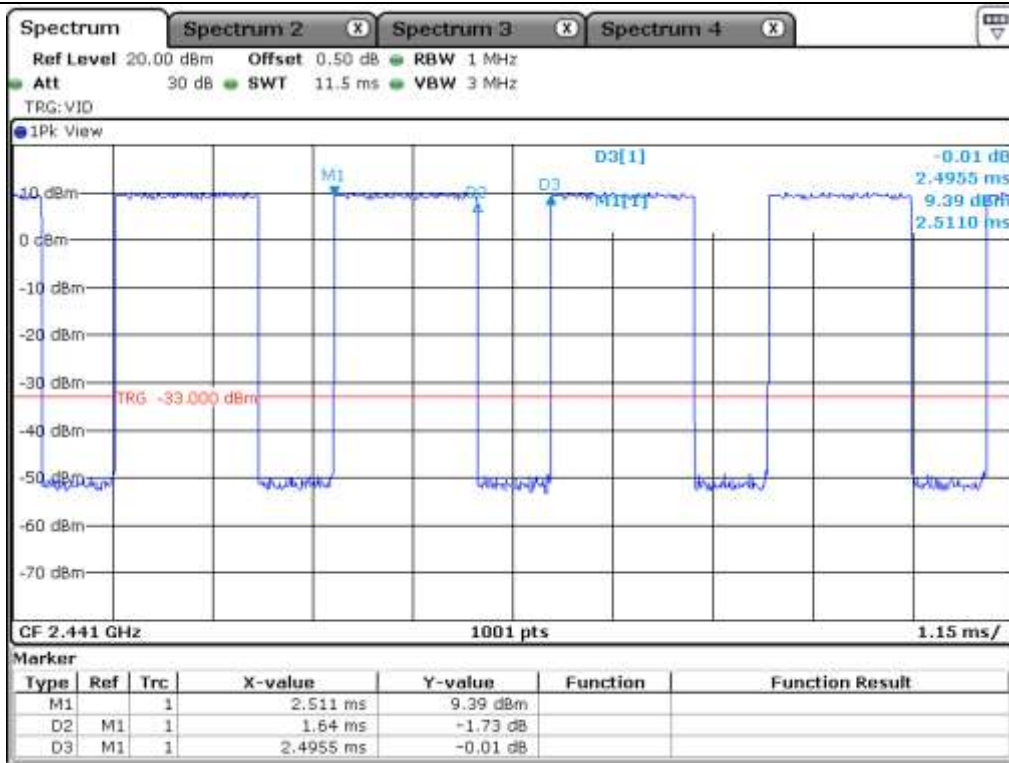
Total dwell time is calculated as following.

$$\text{Total Dwell Time} = \text{Pulse time} * \text{Hops per second with channels} * \text{period time}$$

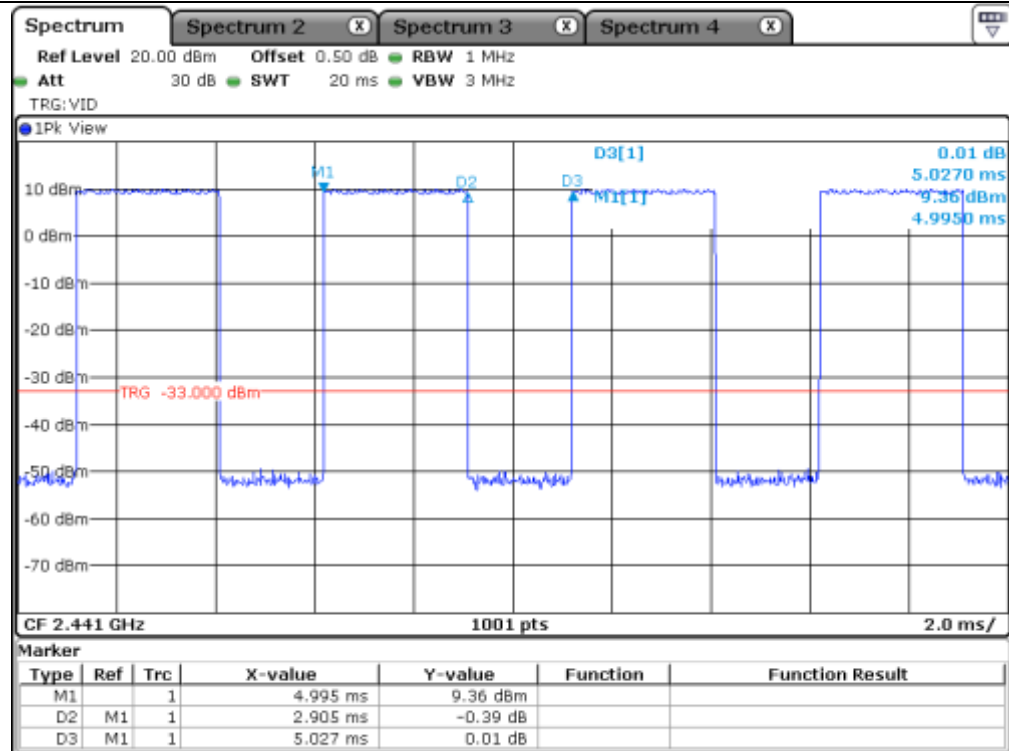
Remark: See next page for an overview sweep performed with peak detector.



DH1



DH3



DH5

## 11. MAXIMUM PEAK OUTPUT POWER

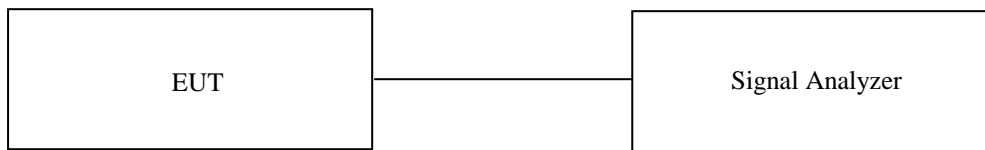
### 11.1 Operating environment

Temperature : 23 °C  
 Relative humidity : 41 % 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  $\geq$  DTS Bandwidth, the video bandwidth is set to 3 times the resolution bandwidth.



### 11.3 Test Date

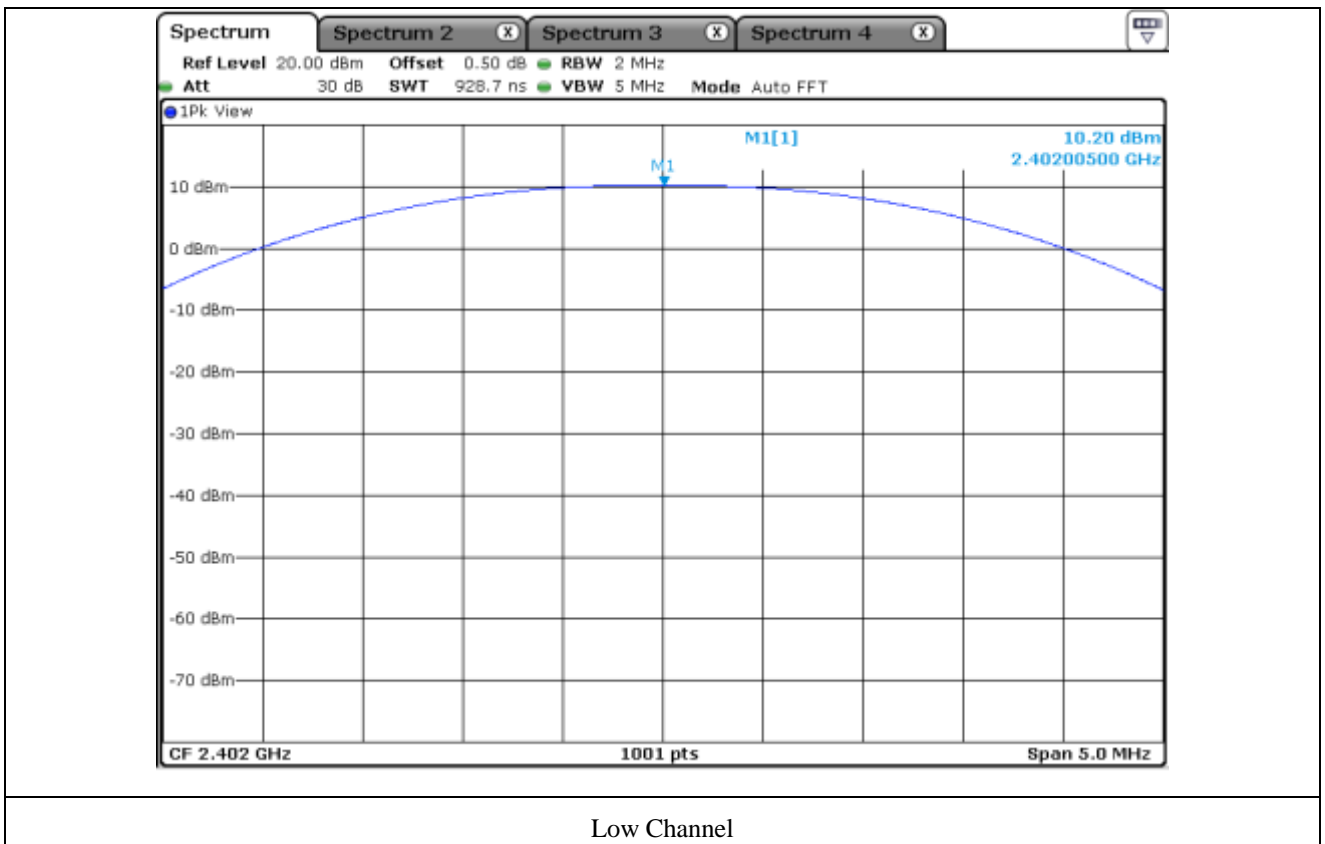
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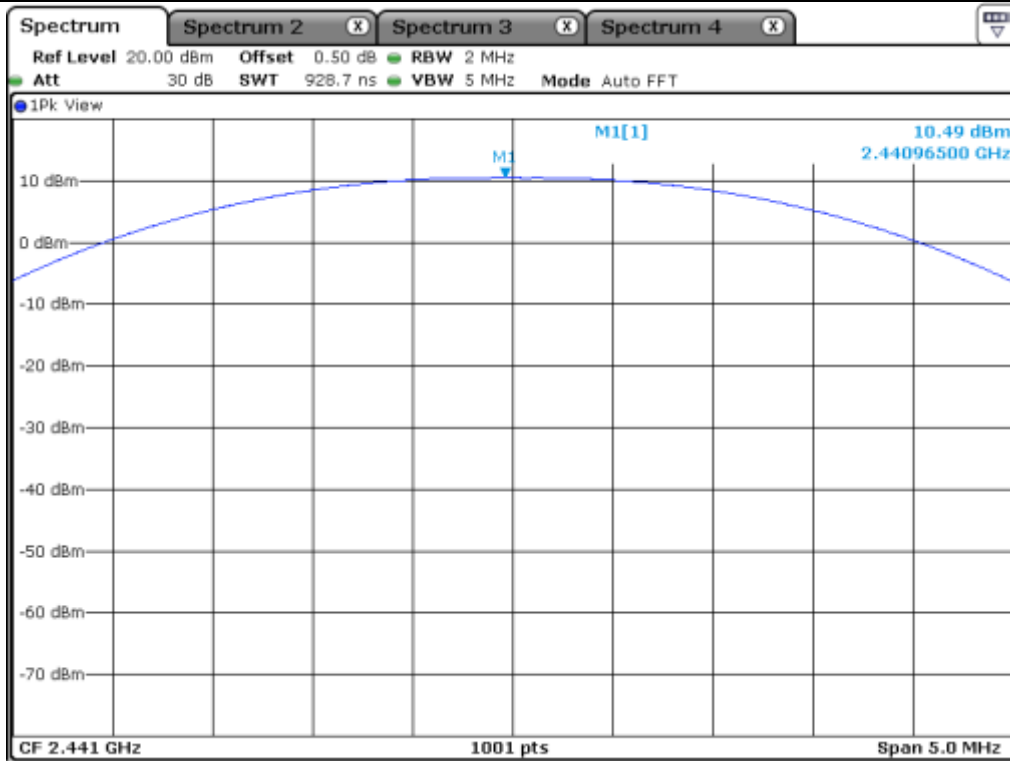
### 11.4 Test data for 1 Mbps

-. Test Result : Pass

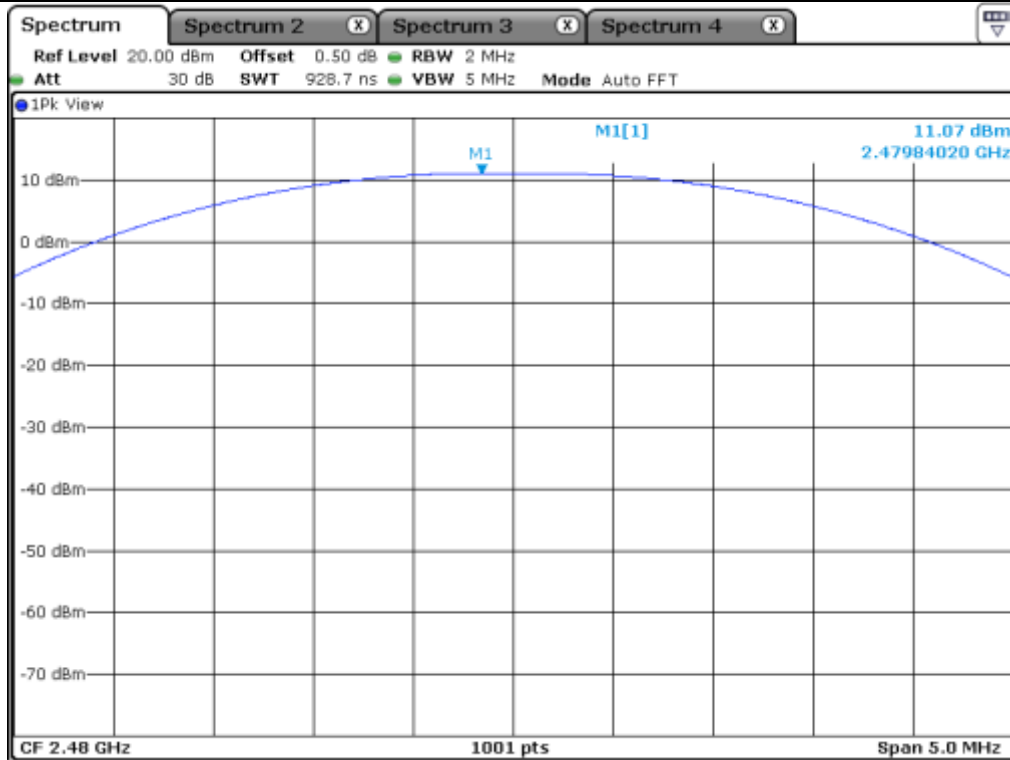
CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	10.20	21.00	10.80
MIDDLE	2 441.00	10.49	21.00	10.51
HIGH	2 480.00	11.07	21.00	9.93

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





Middle Channel



High Channel

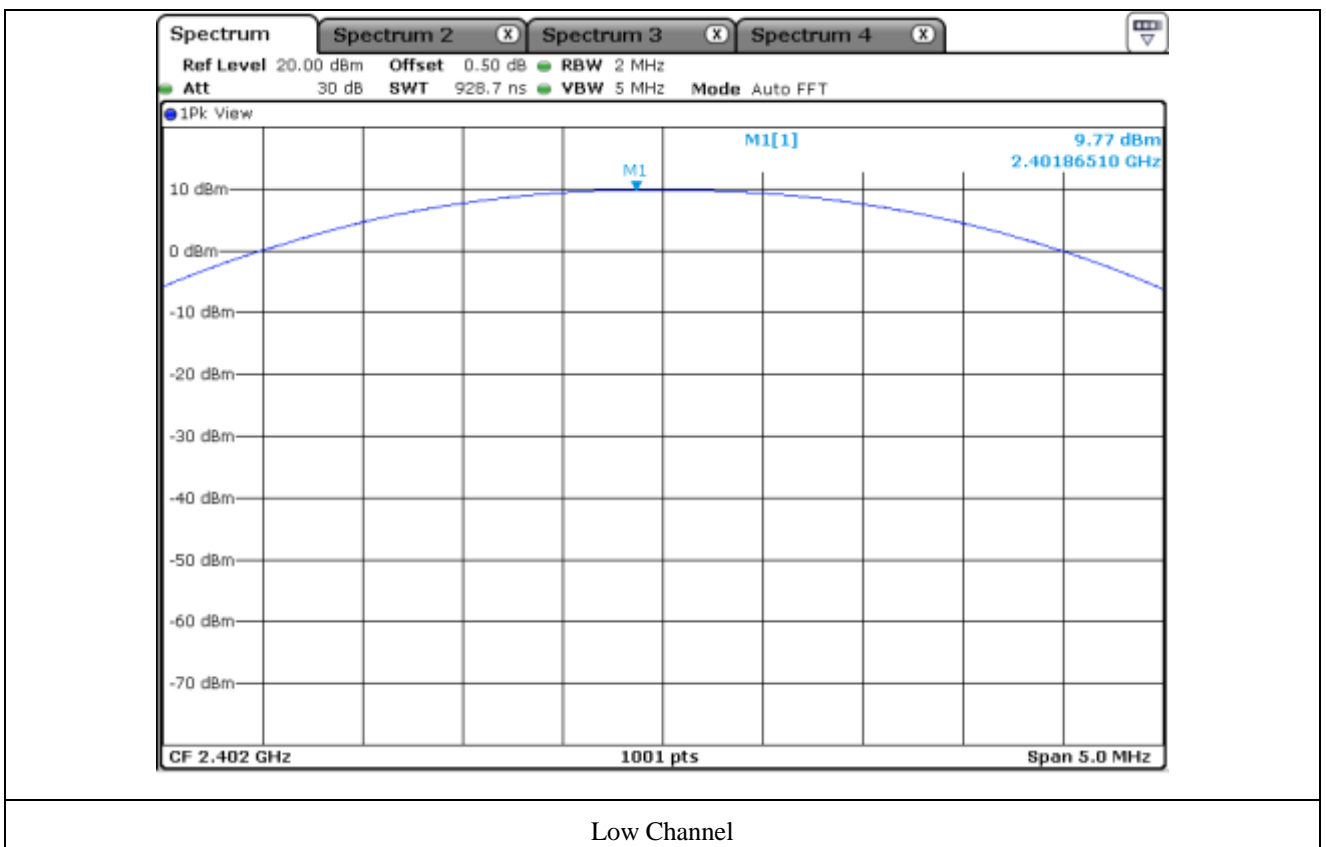


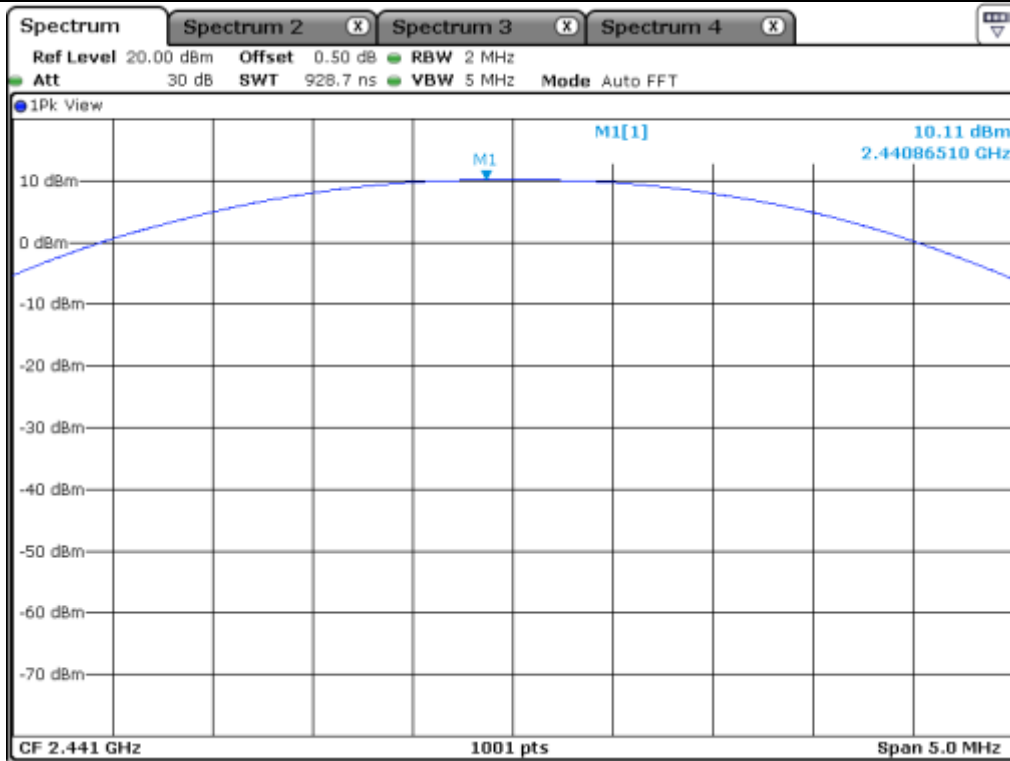
### 11.5 Test data for 2 Mbps

-. Test Result : Pass

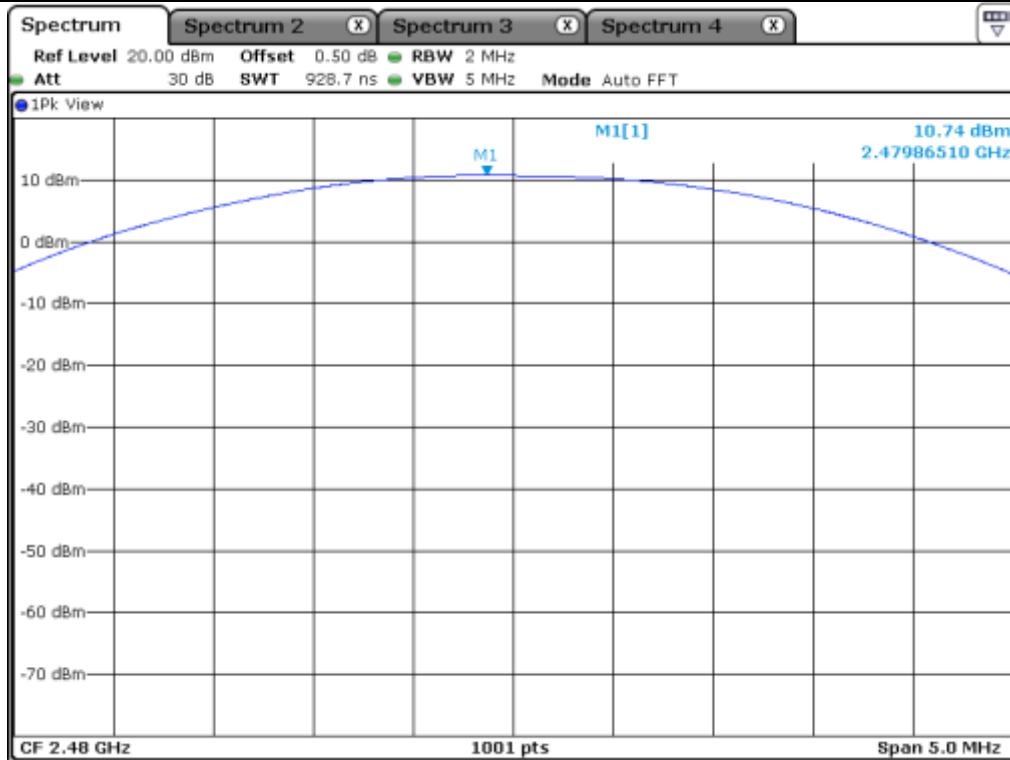
CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	9.77	21.00	11.23
MIDDLE	2 441.00	10.11	21.00	10.89
HIGH	2 480.00	10.74	21.00	10.26

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





Middle Channel



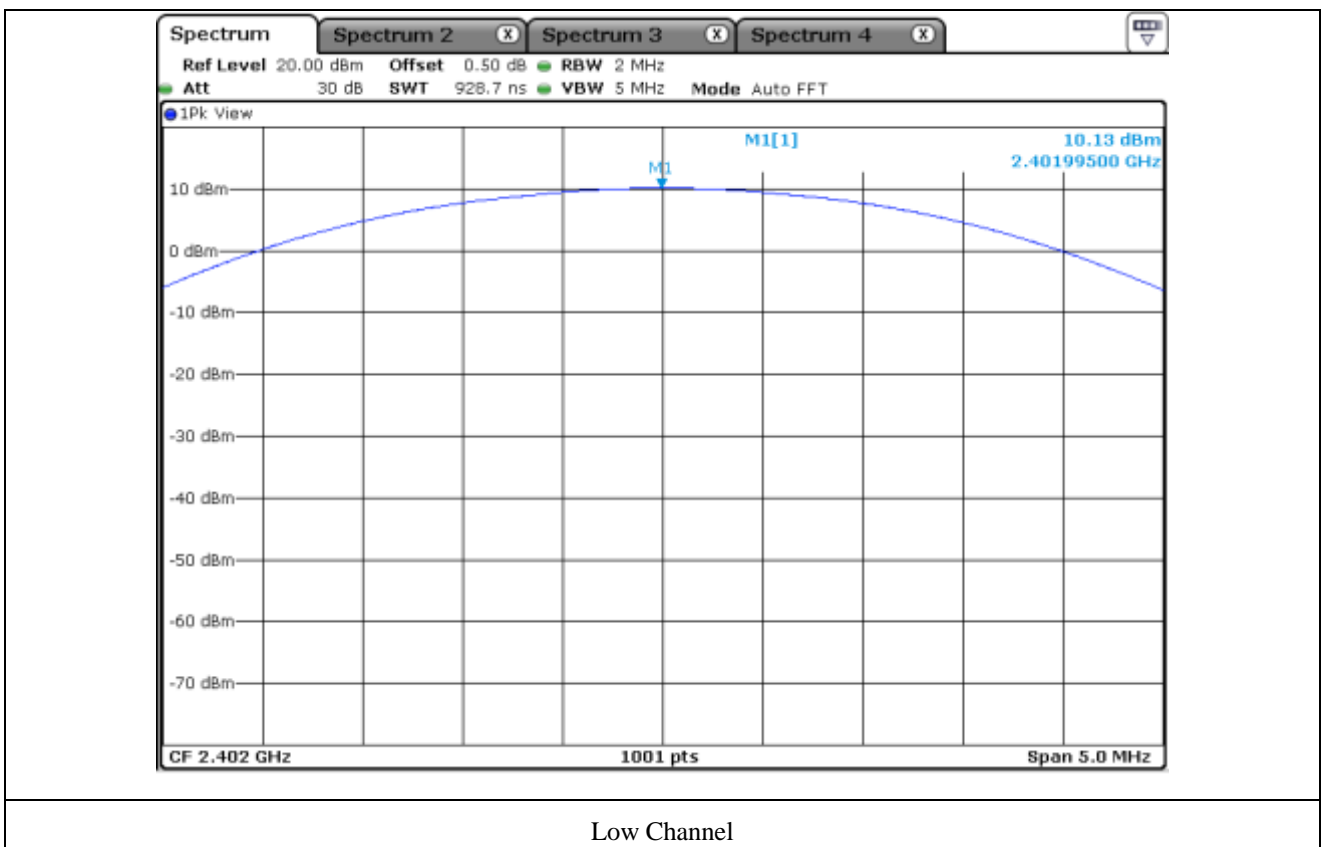
High Channel

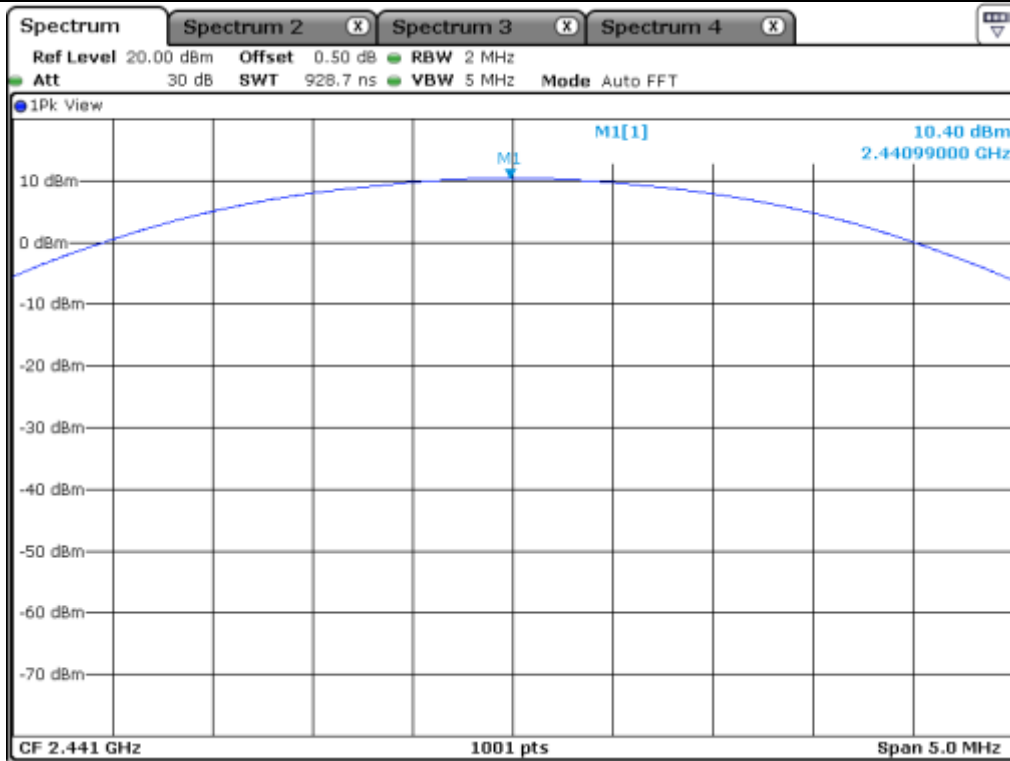
### 11.6 Test data for 3 Mbps

-. Test Result : Pass

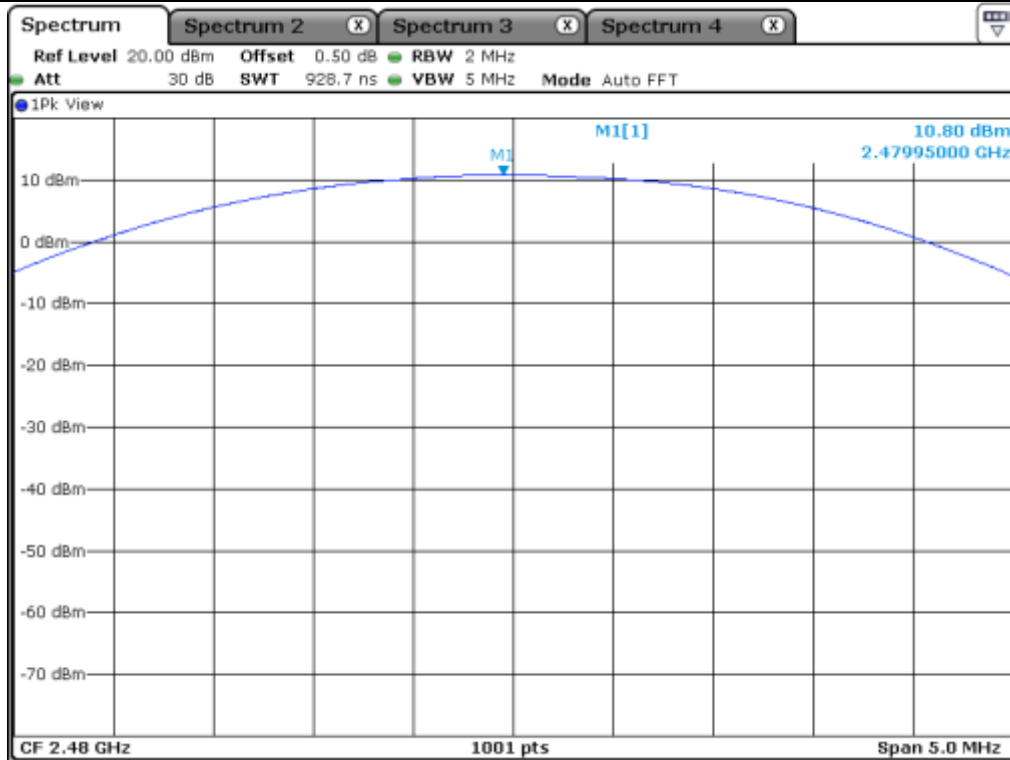
CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	10.13	21.00	10.87
MIDDLE	2 441.00	10.40	21.00	10.60
HIGH	2 480.00	10.80	21.00	10.20

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





Middle Channel



High Channel

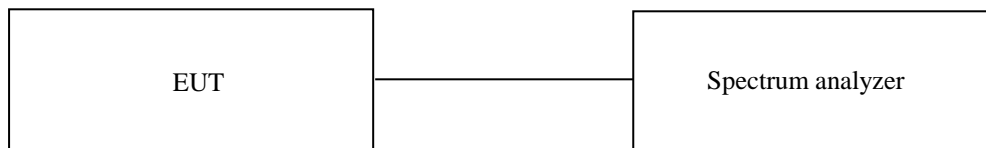
## 12. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

### 12.1 Operating environment

Temperature : 23 °C  
 Relative humidity : 41 % 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.

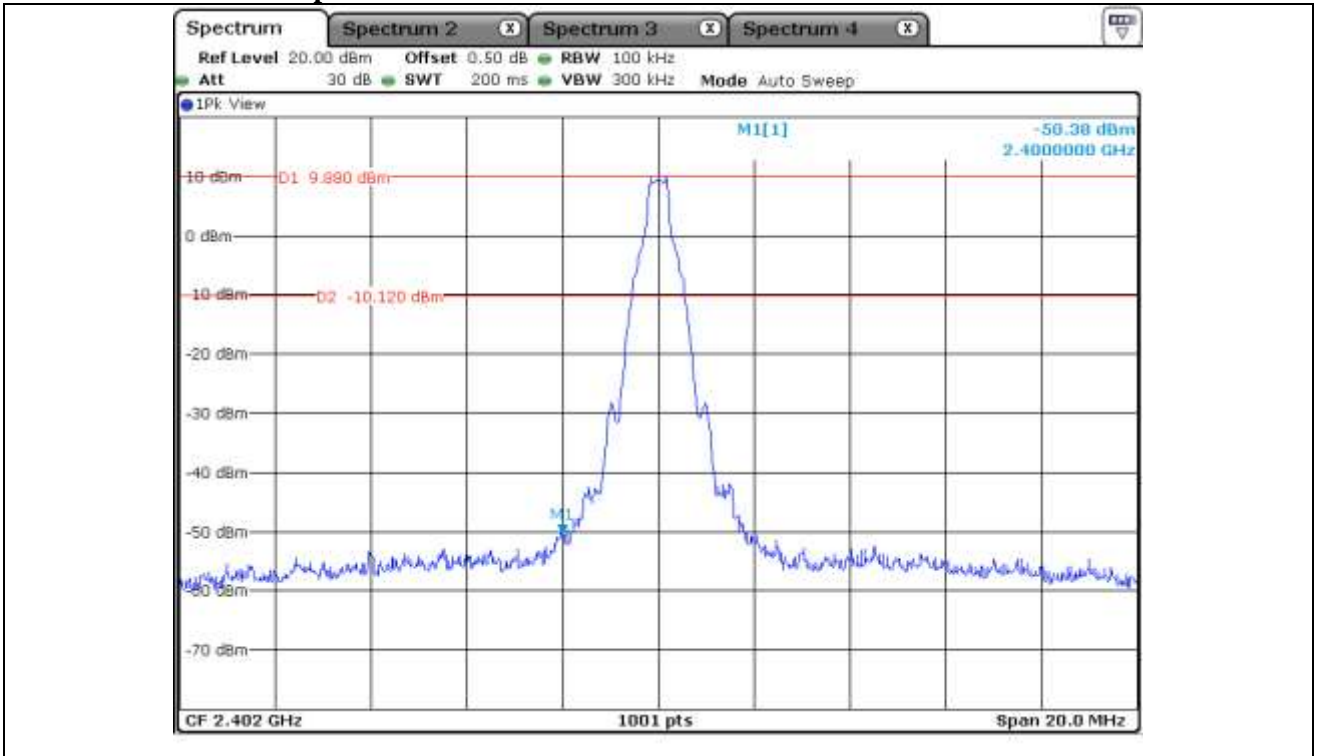
The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal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

### 12.4 Test Date

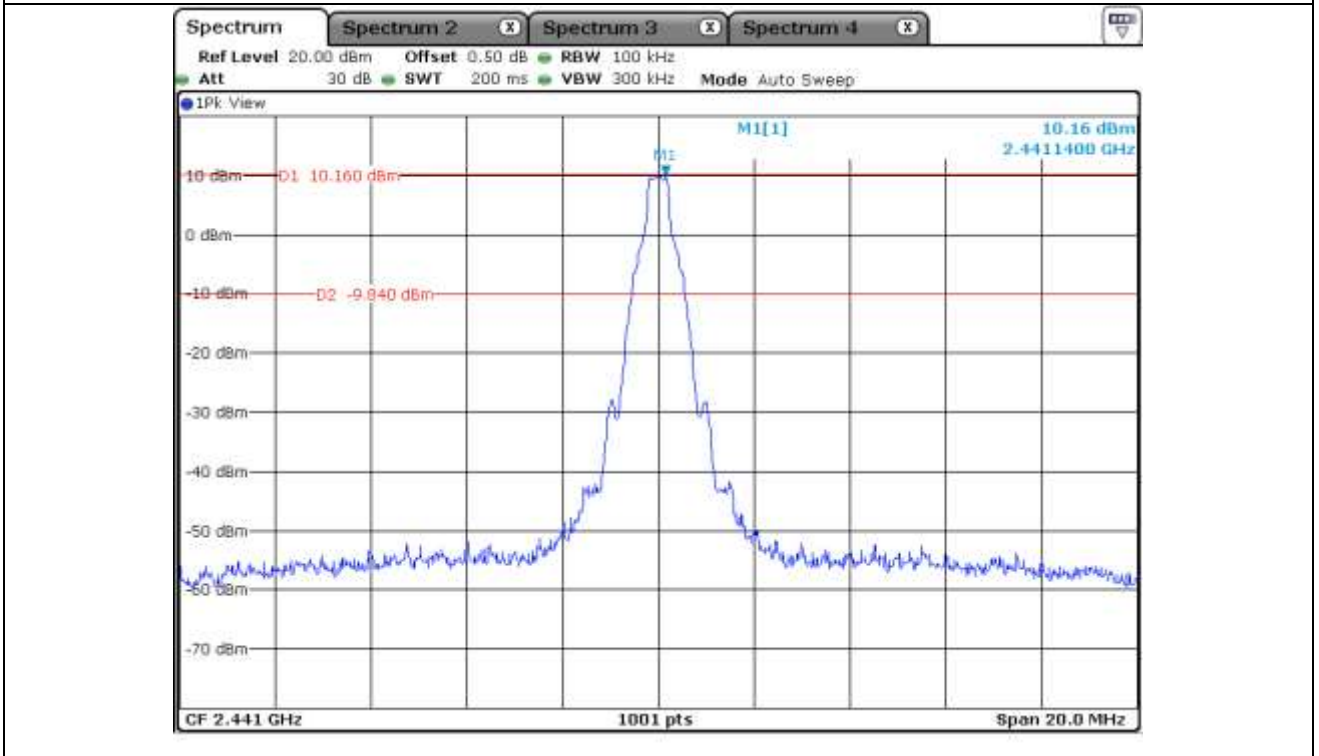
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12.5 Test data for conducted emission

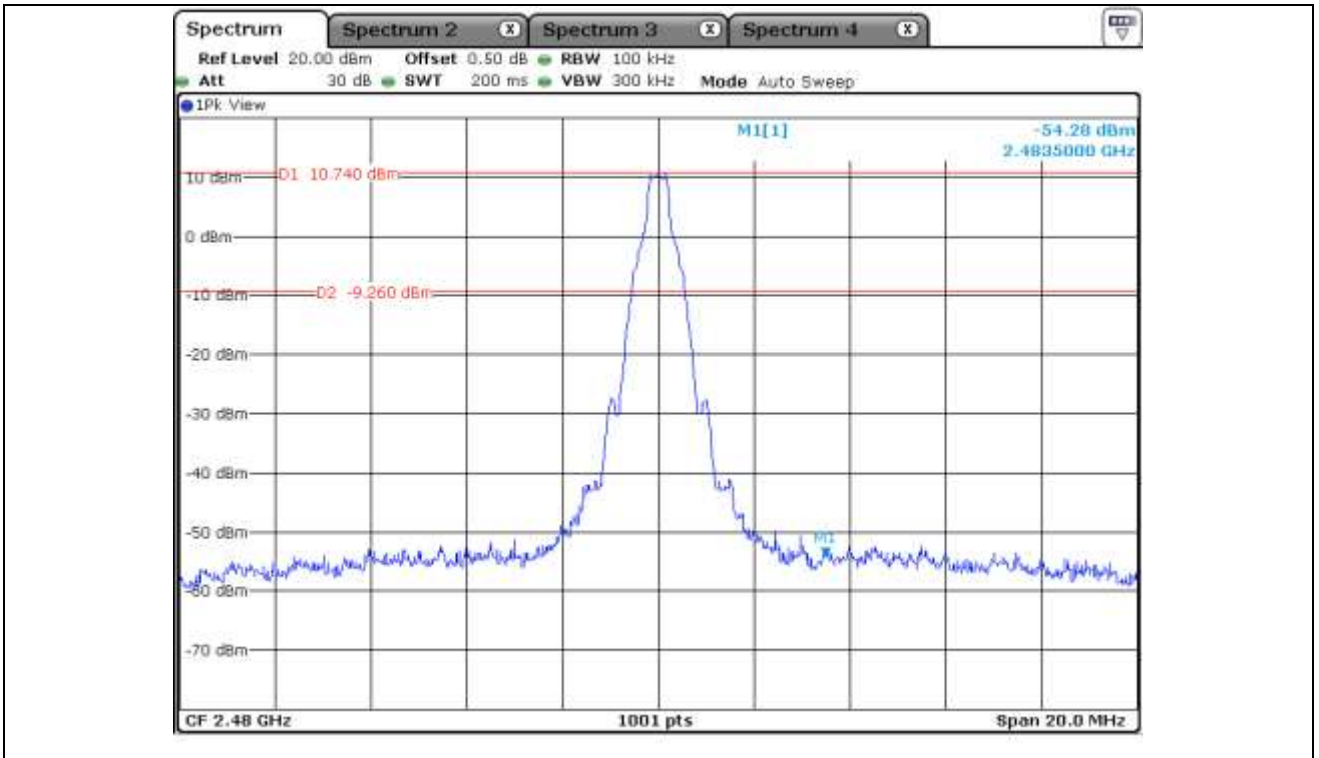
12.5.1 Test data for 1 Mbps



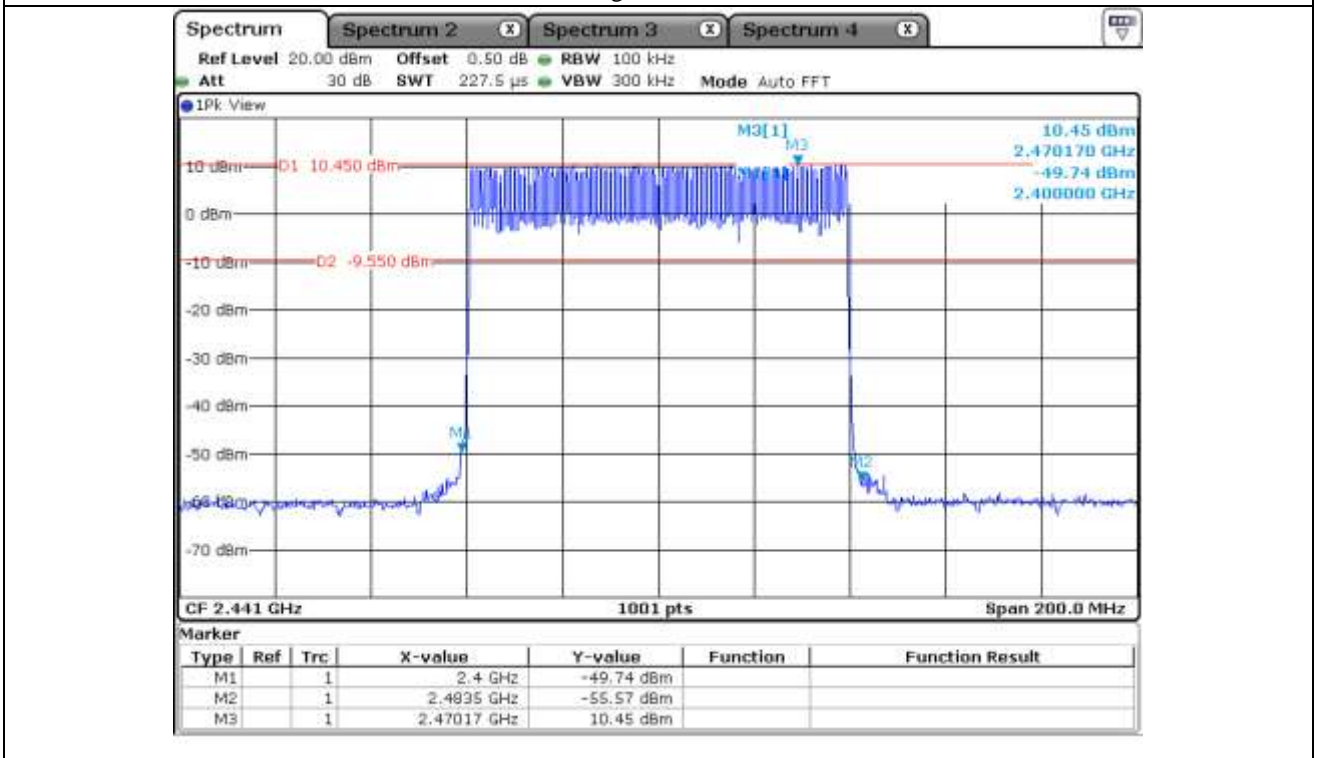
Low Channel



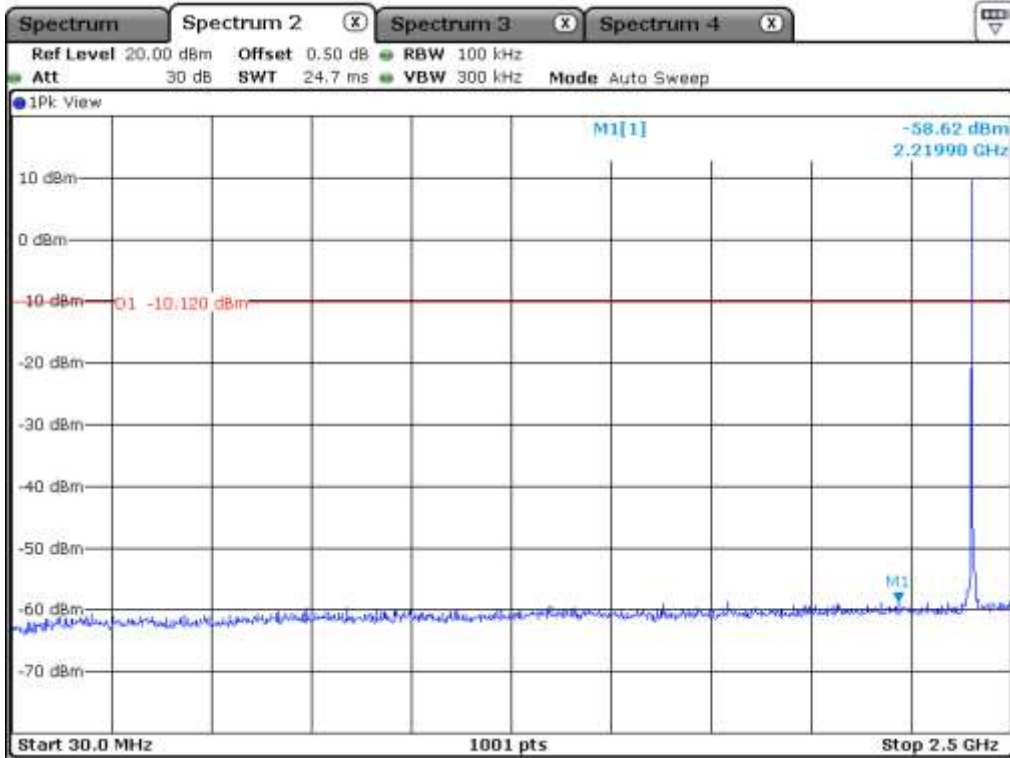
Middle Channel



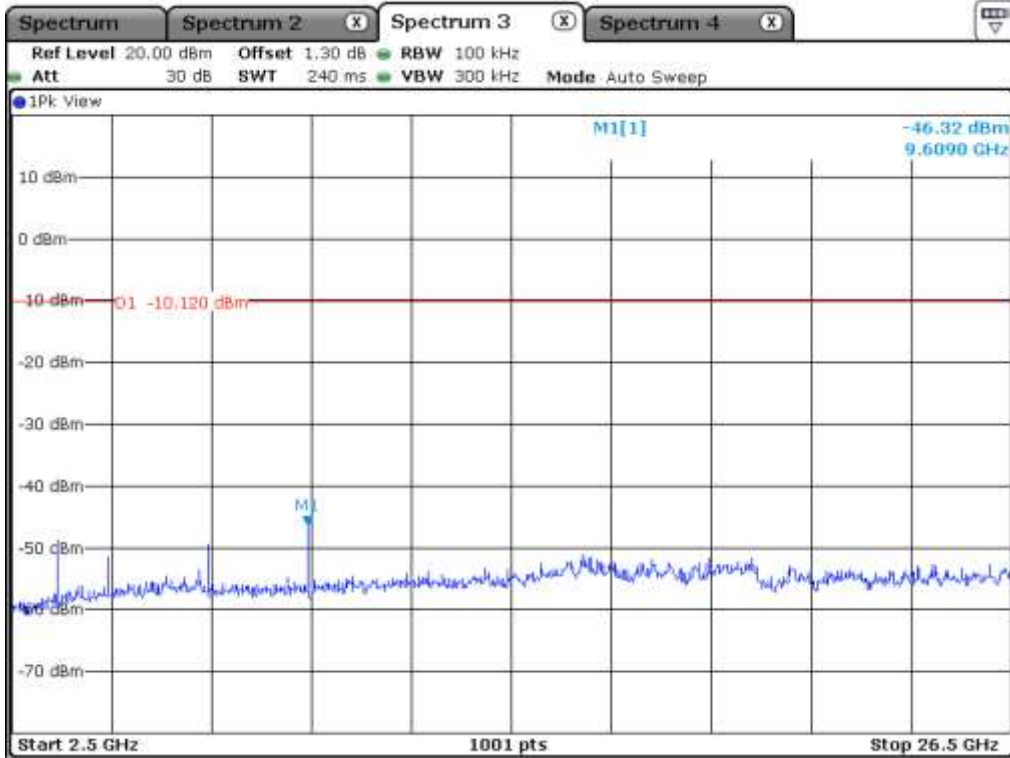
High Channel



Hopping Mode

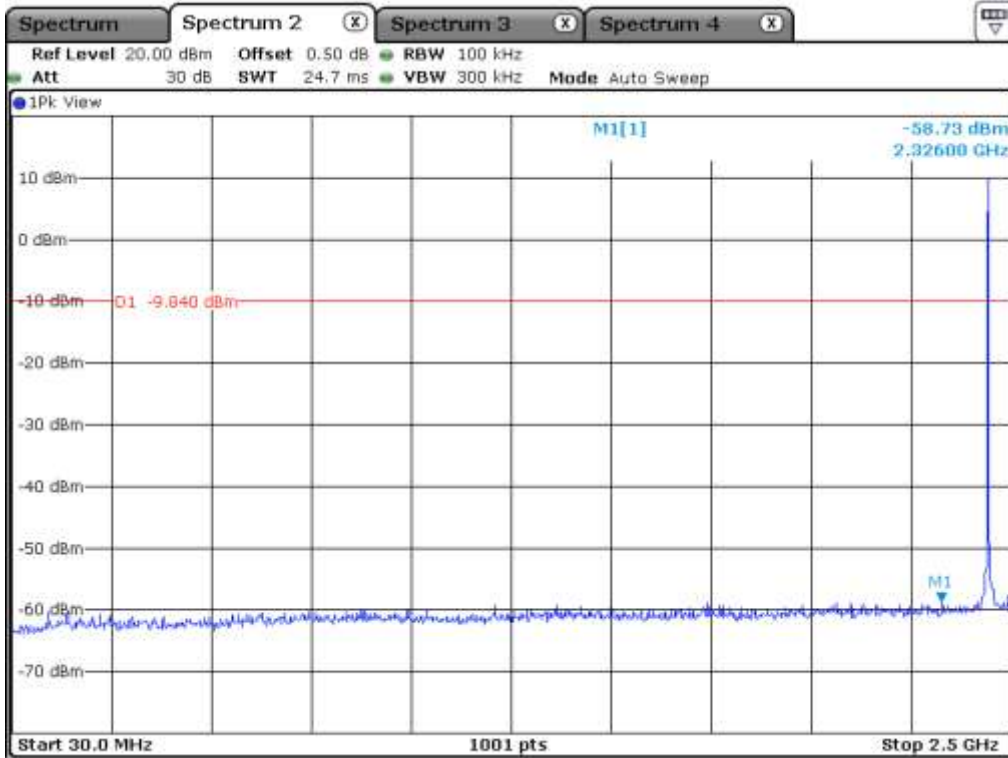


Low Channel

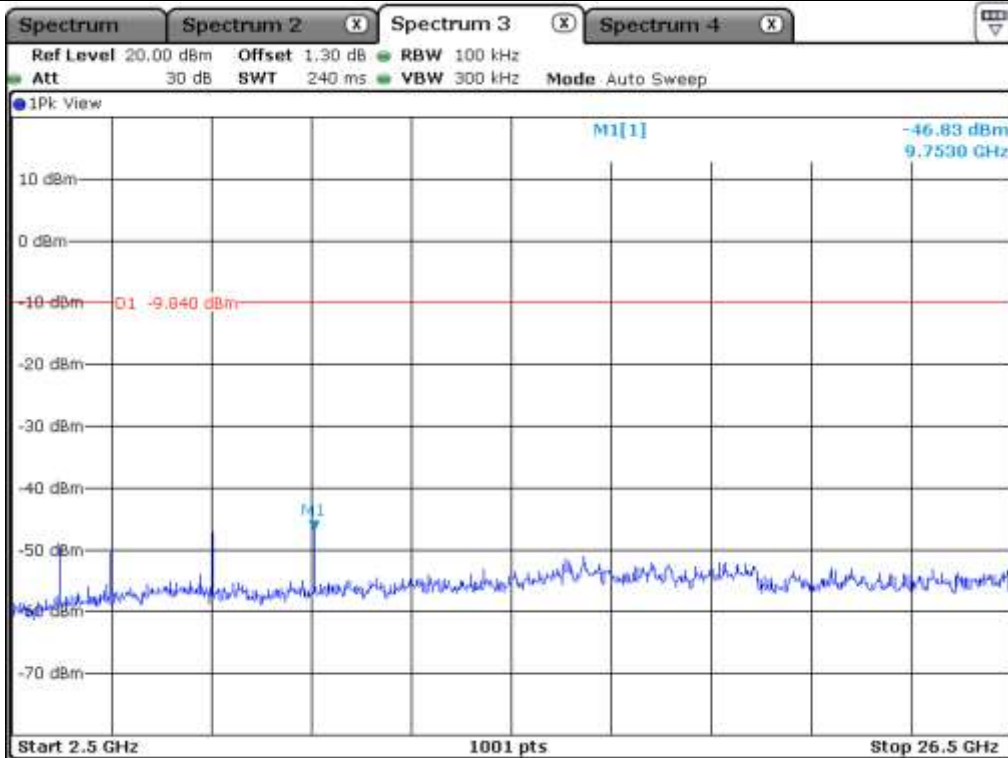


Low Channel

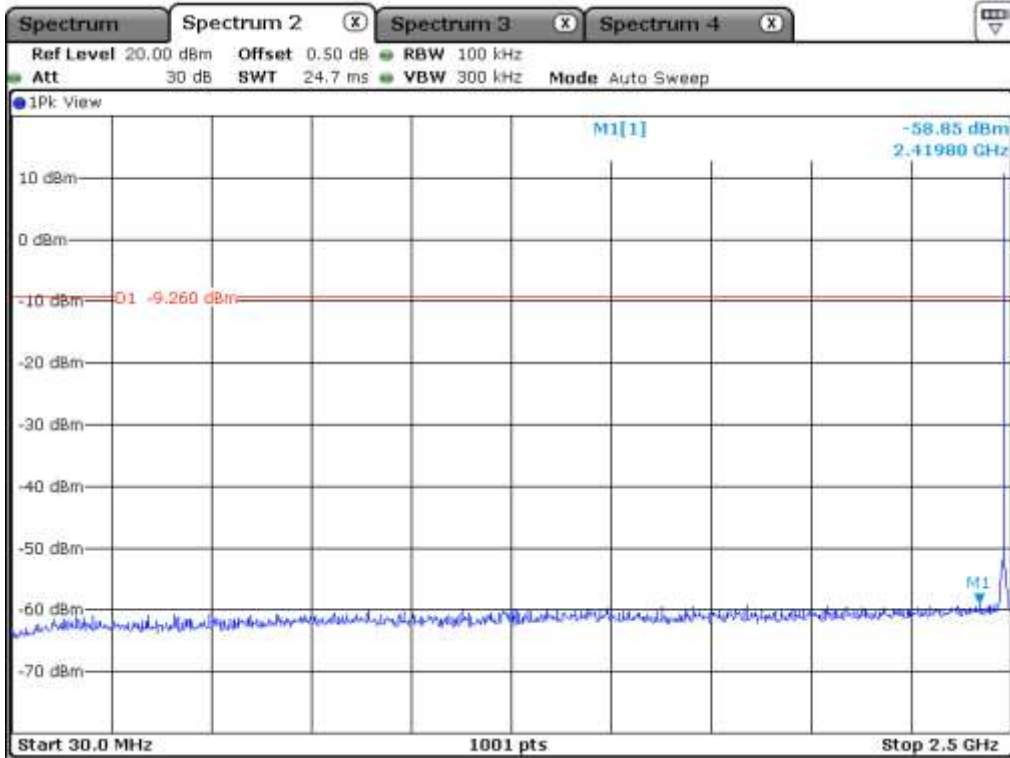




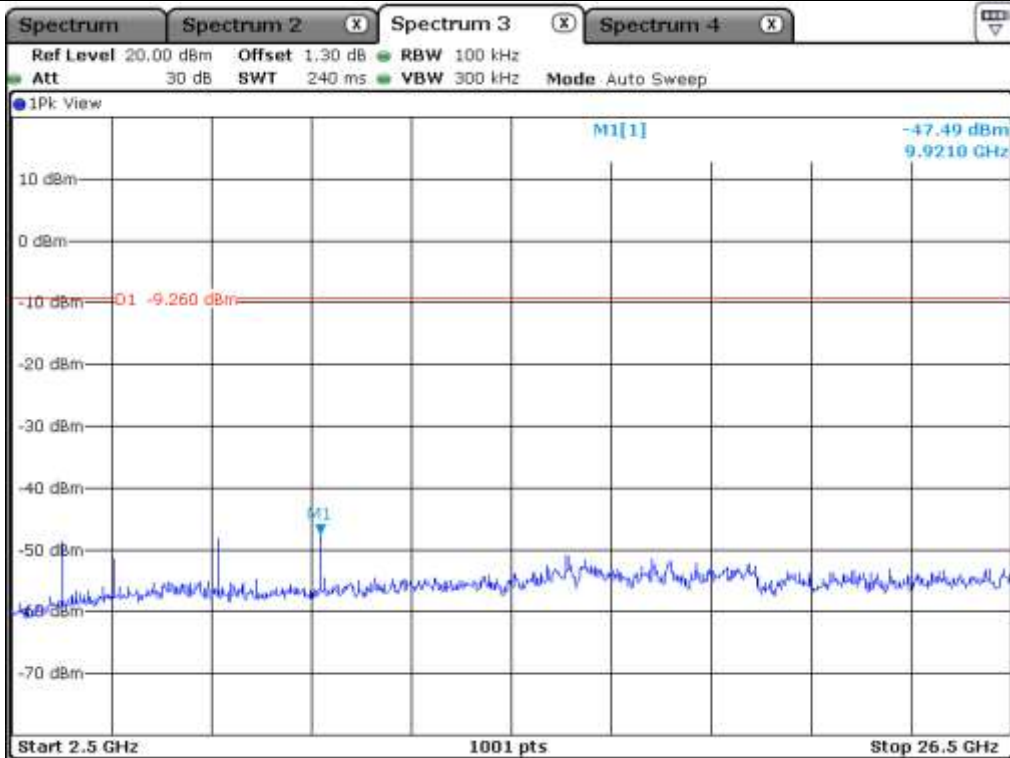
Middle Channel



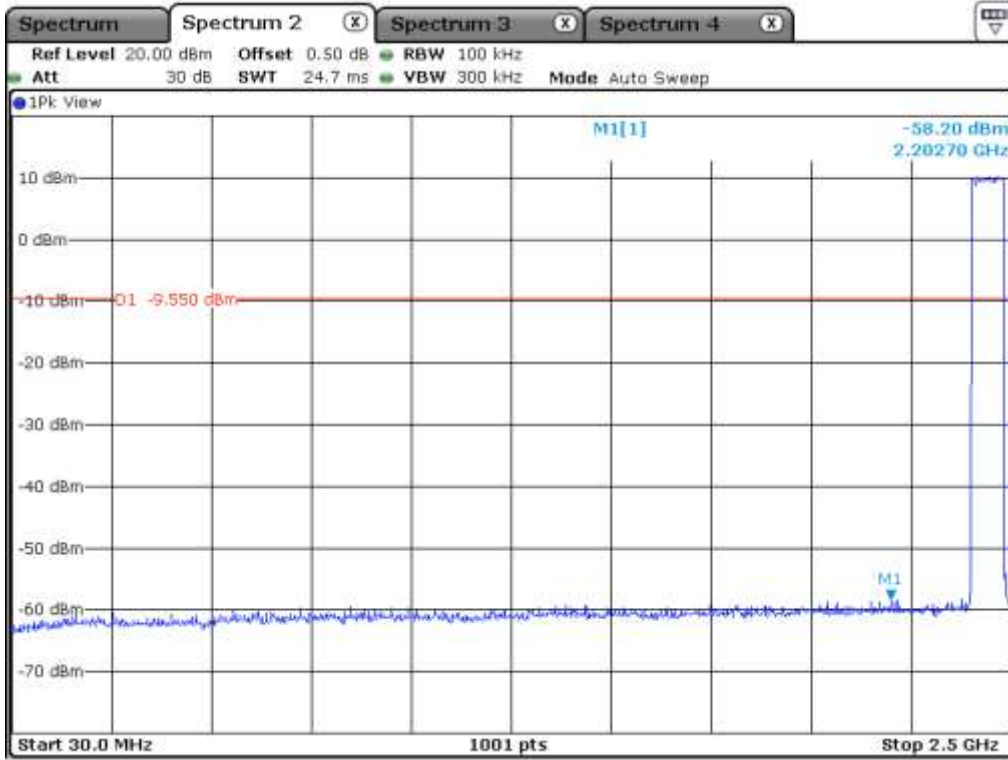
Middle Channel



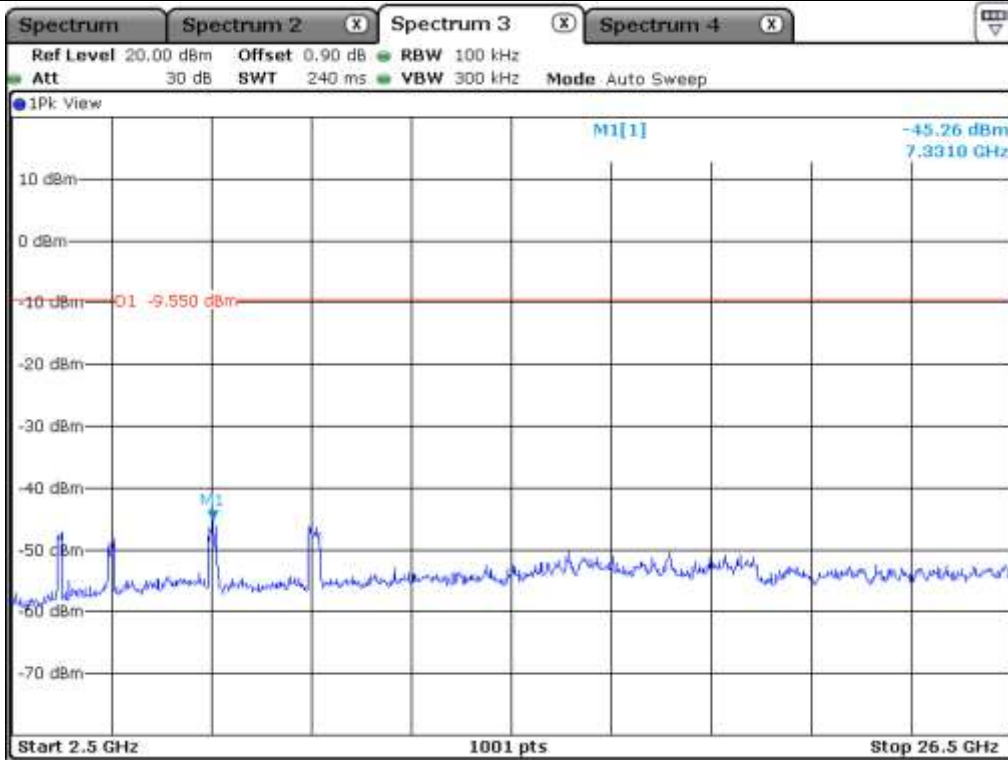
High Channel



High Channel

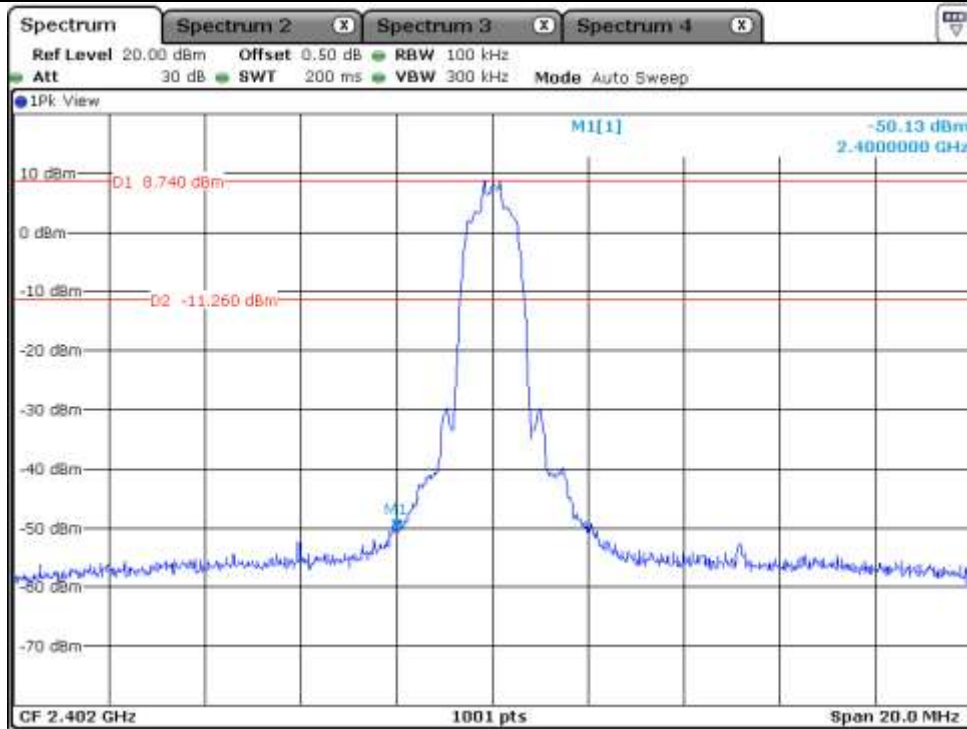


Hopping Mode

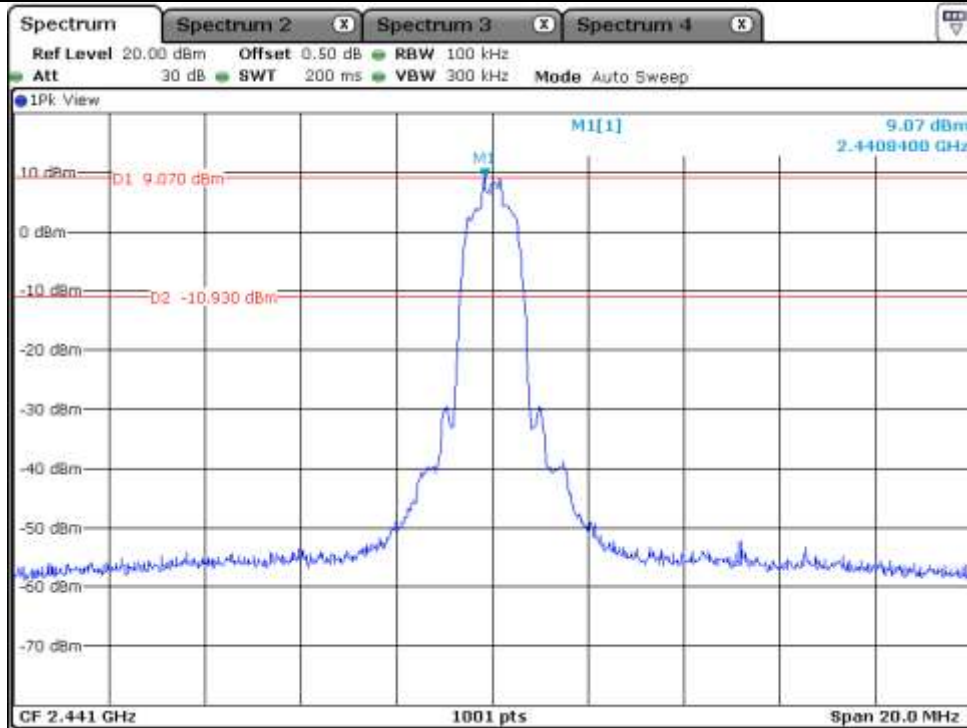


Hopping Mode

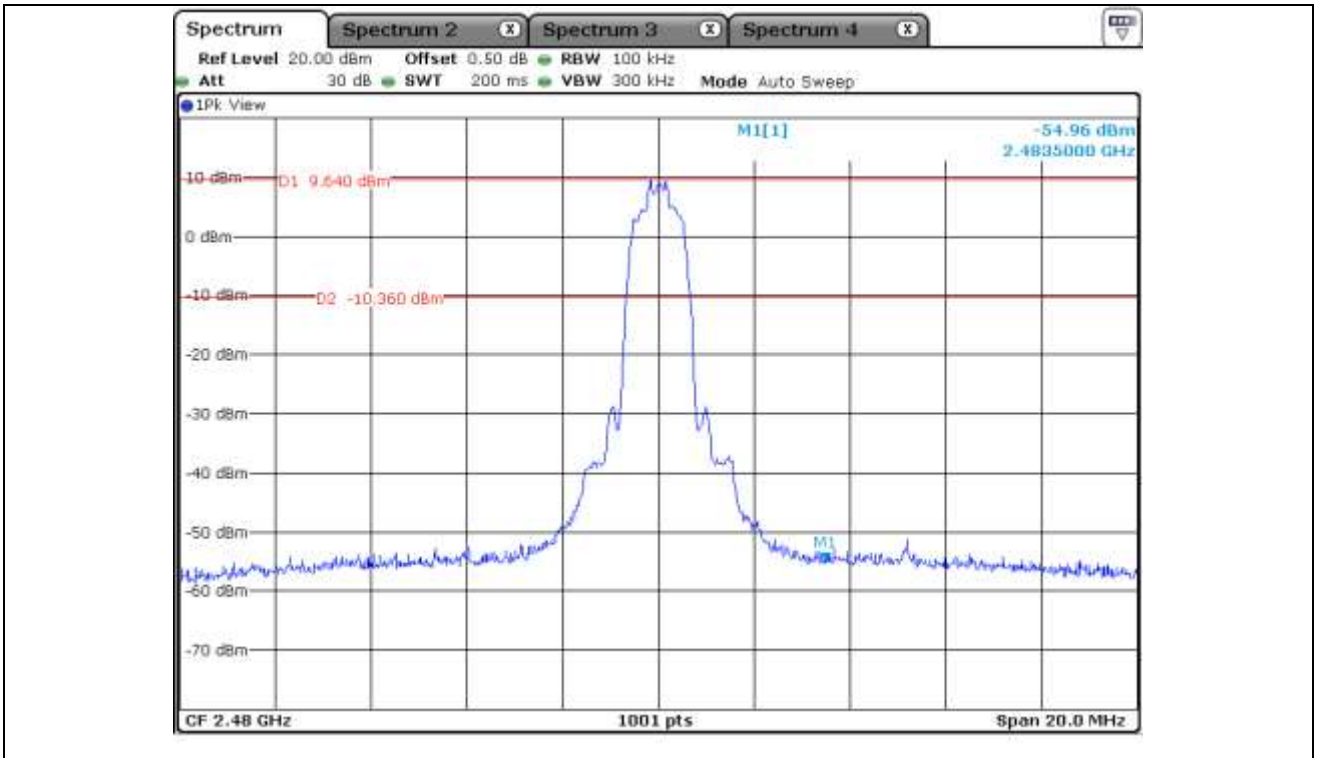
12.5.2 Test data for 2 Mbps



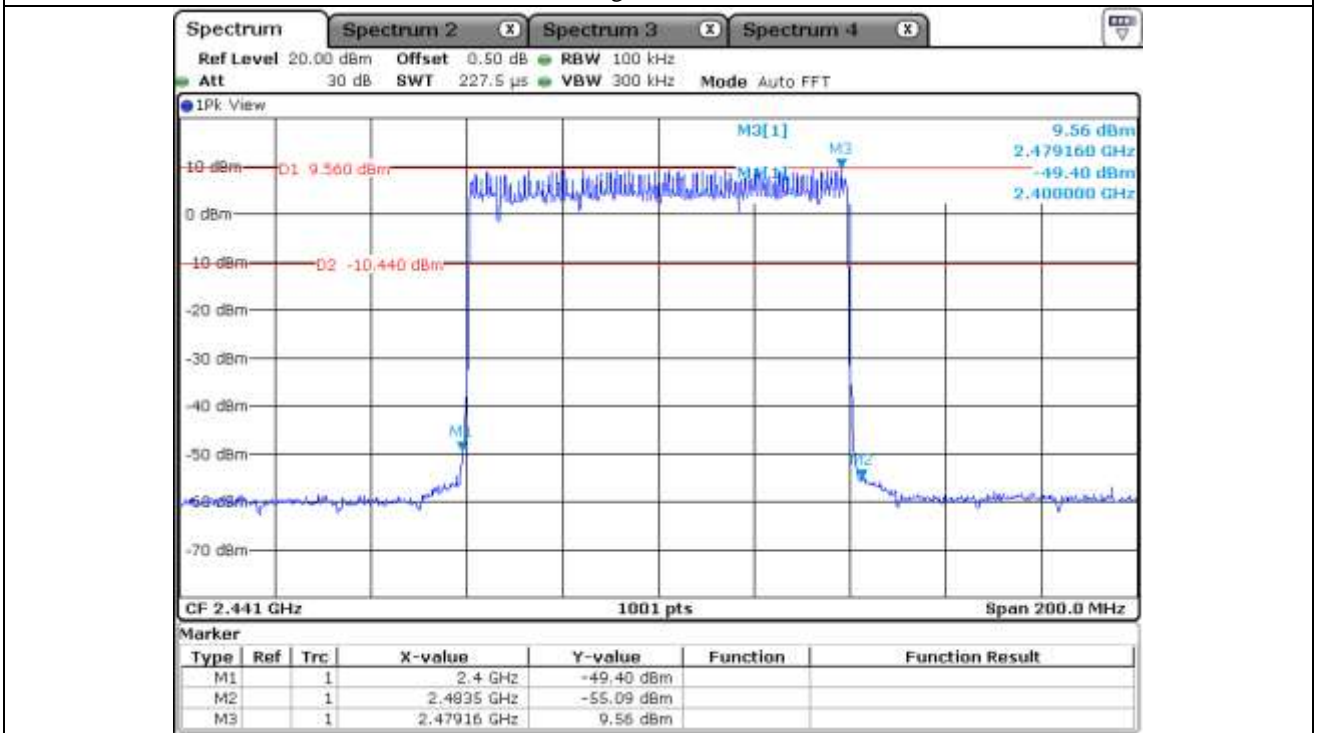
Low Channel



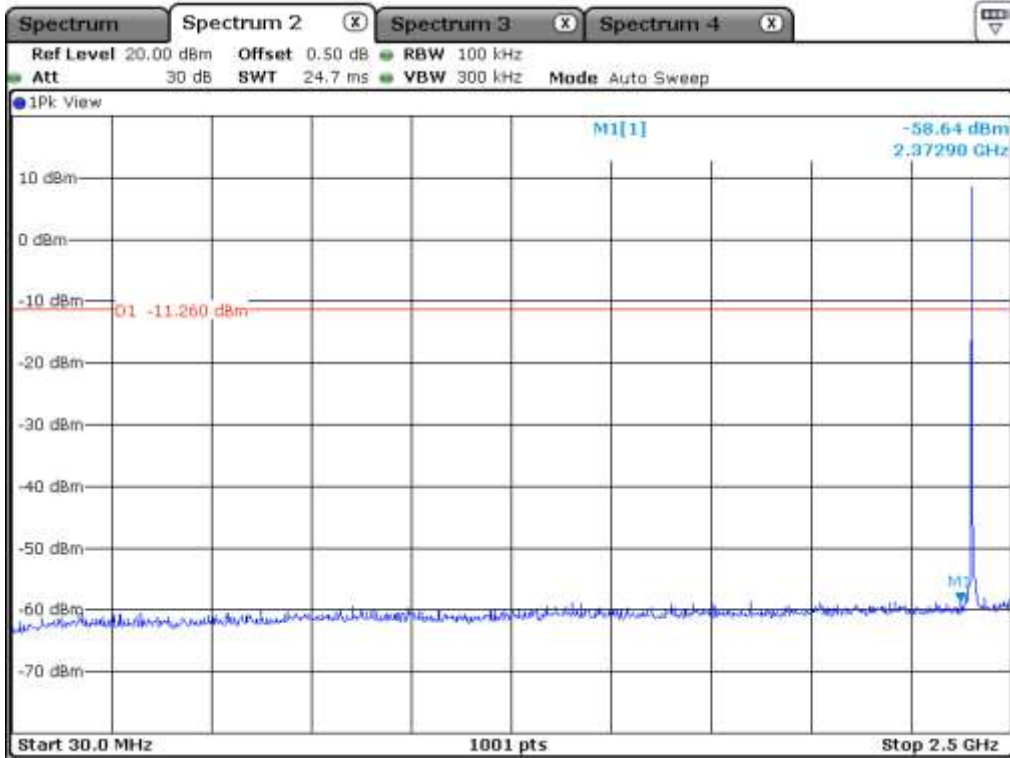
Middle Channel



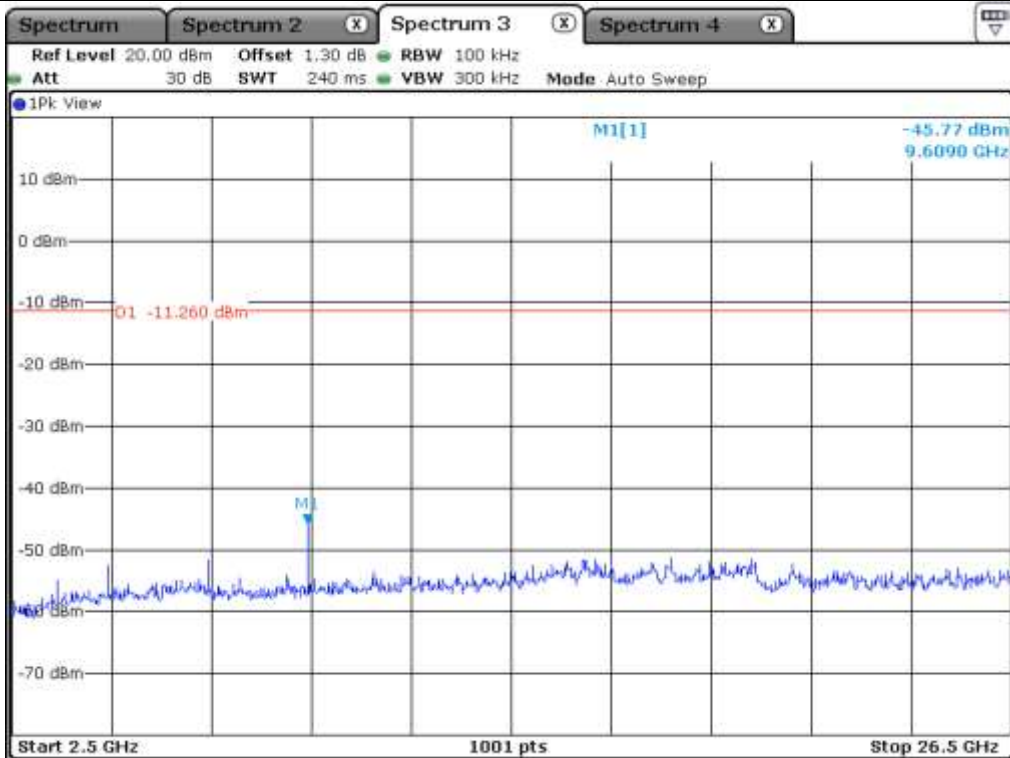
High Channel



Hopping Mode

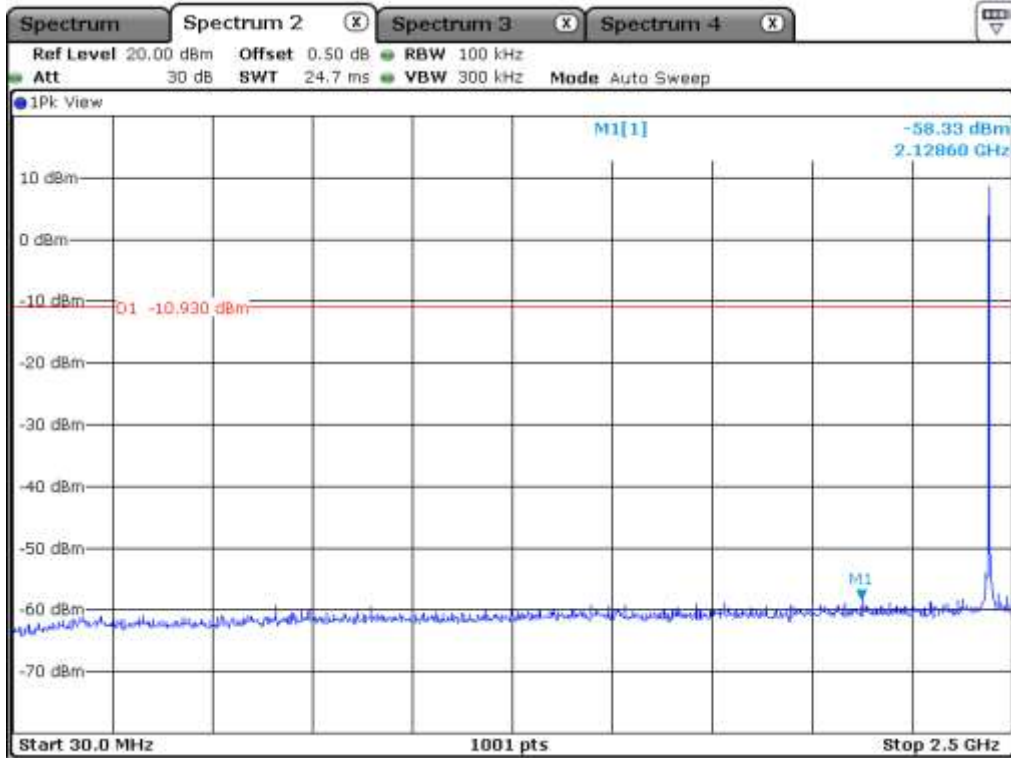


Low Channel

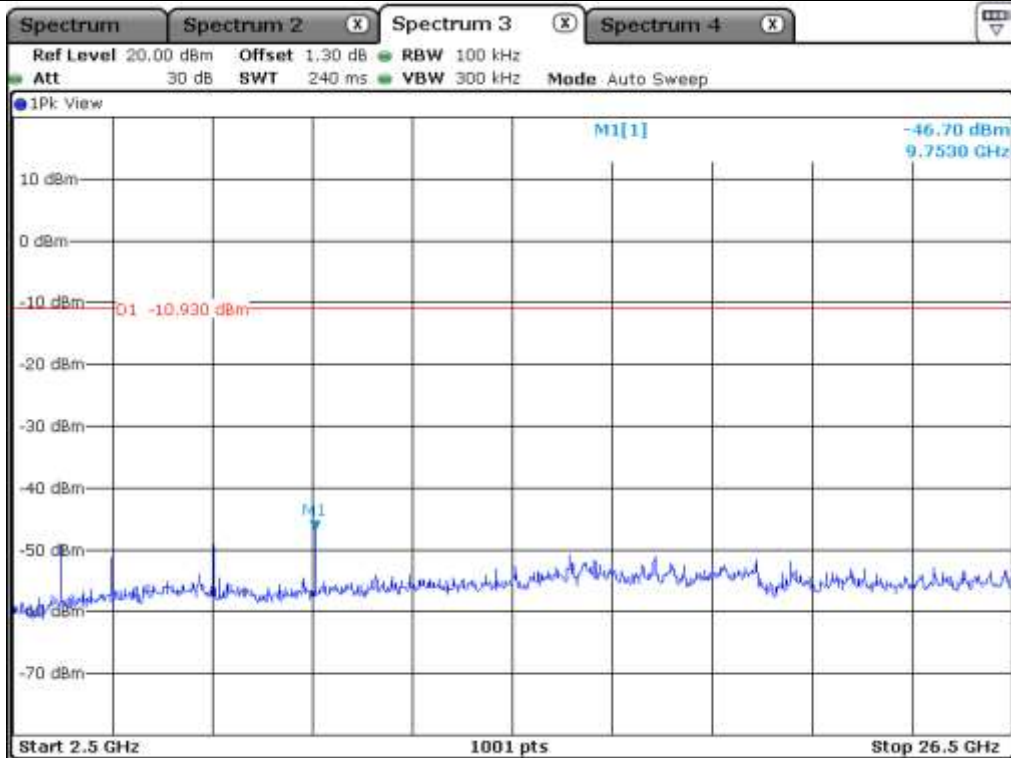


Low Channel

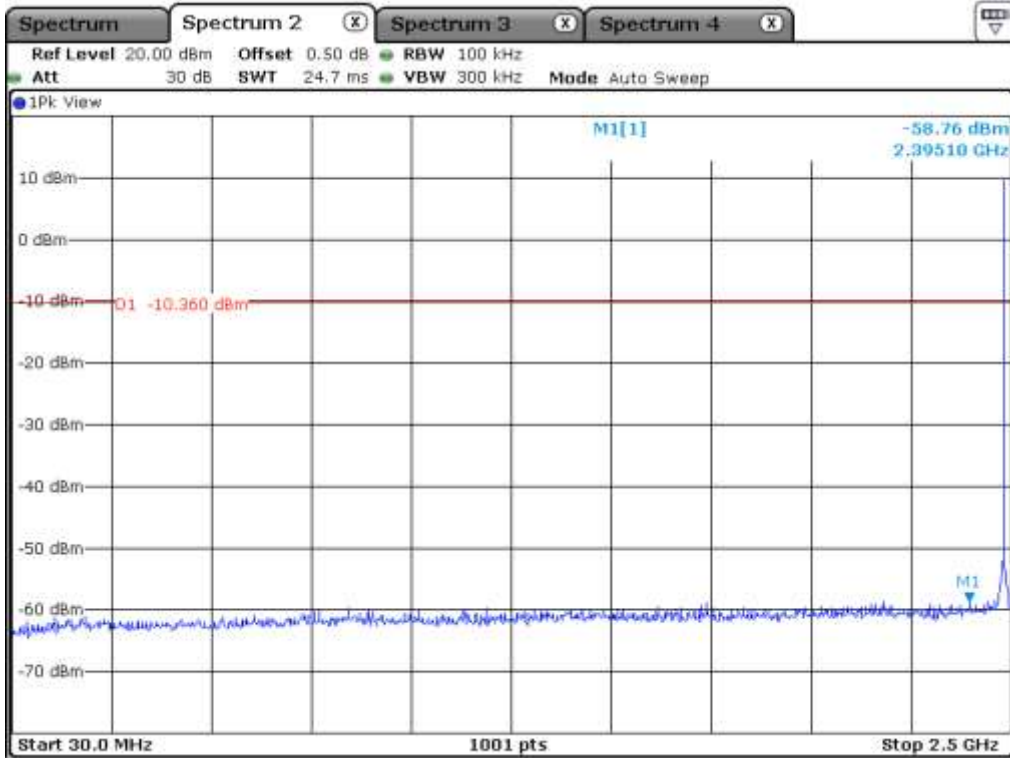




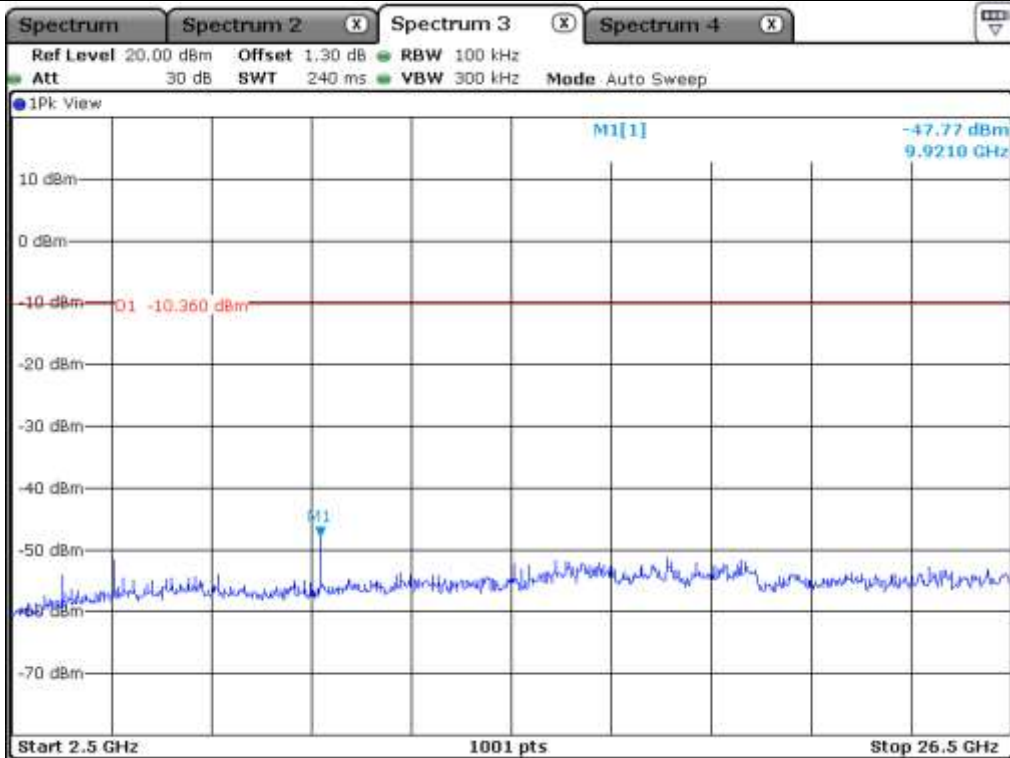
Middle Channel



Middle Channel

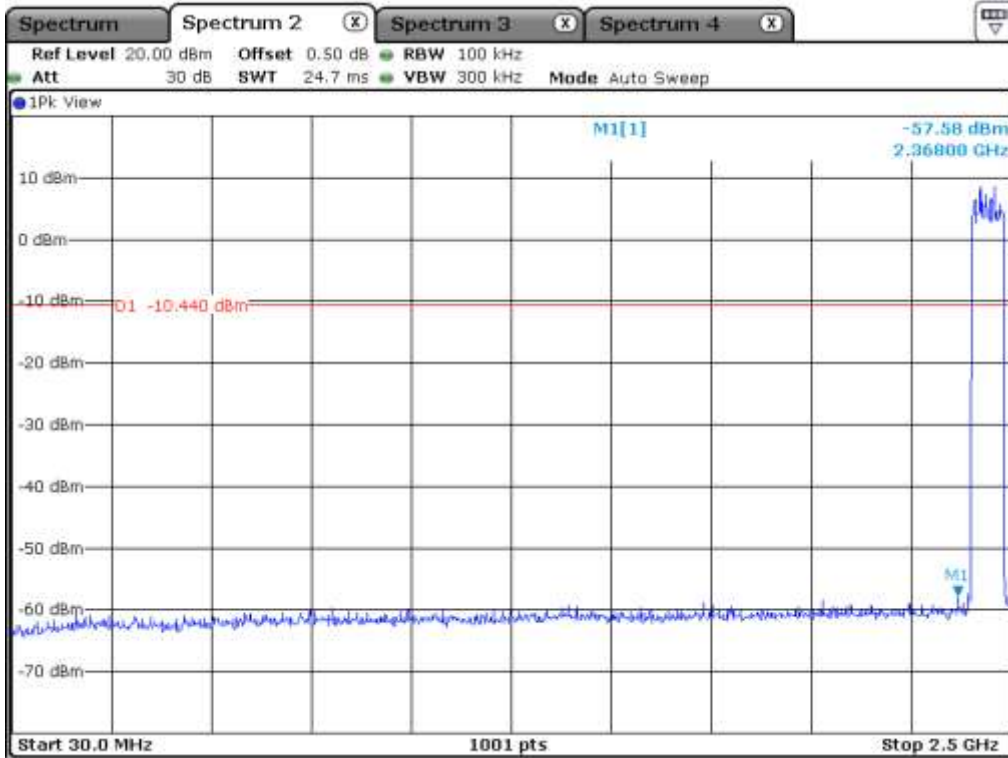


High Channel

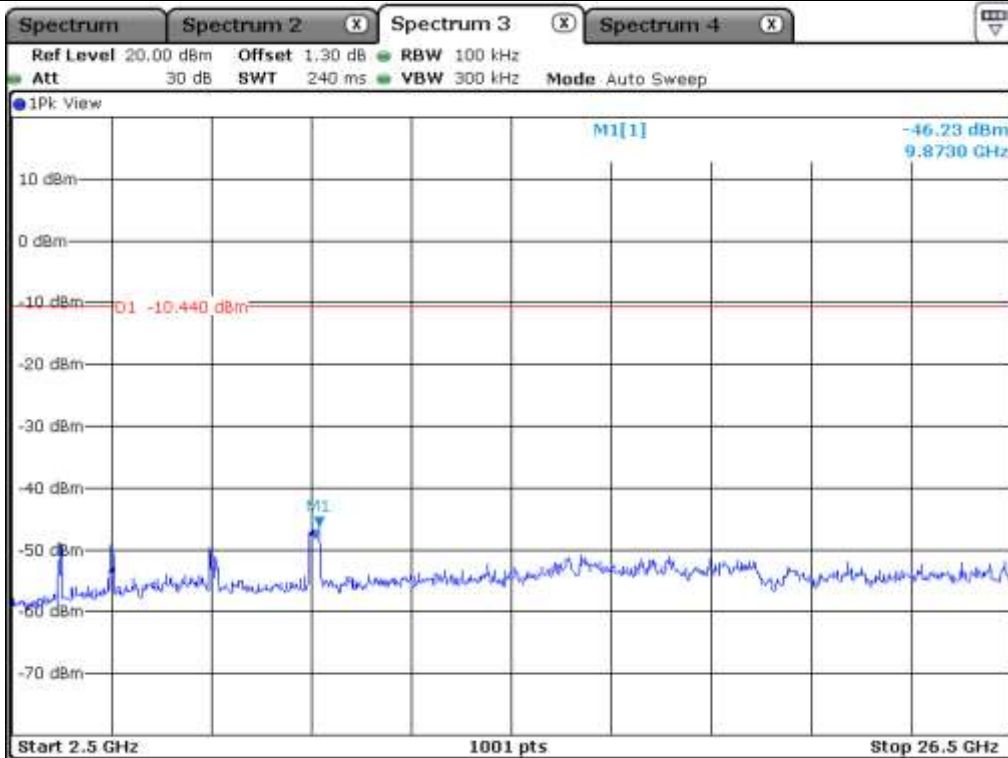


High Channel



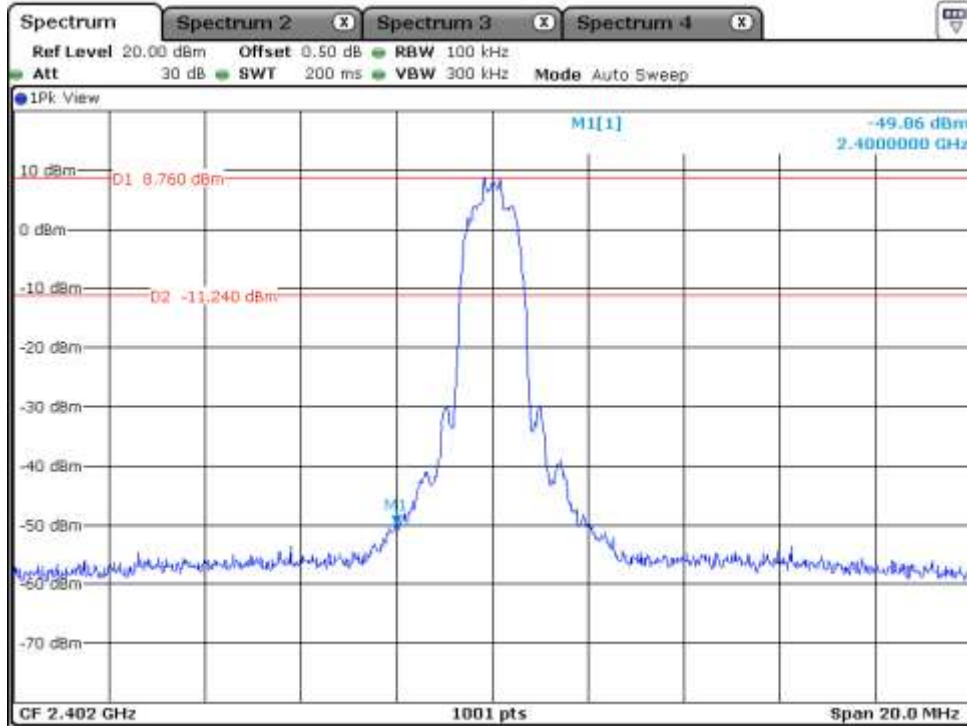


Hopping Mode

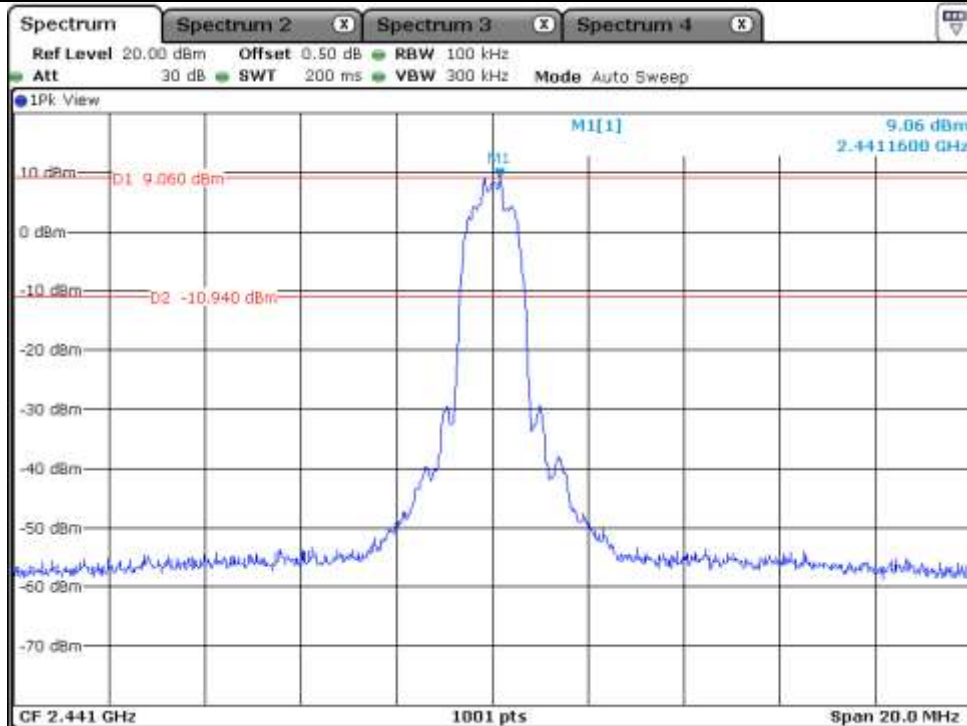


Hopping Mode

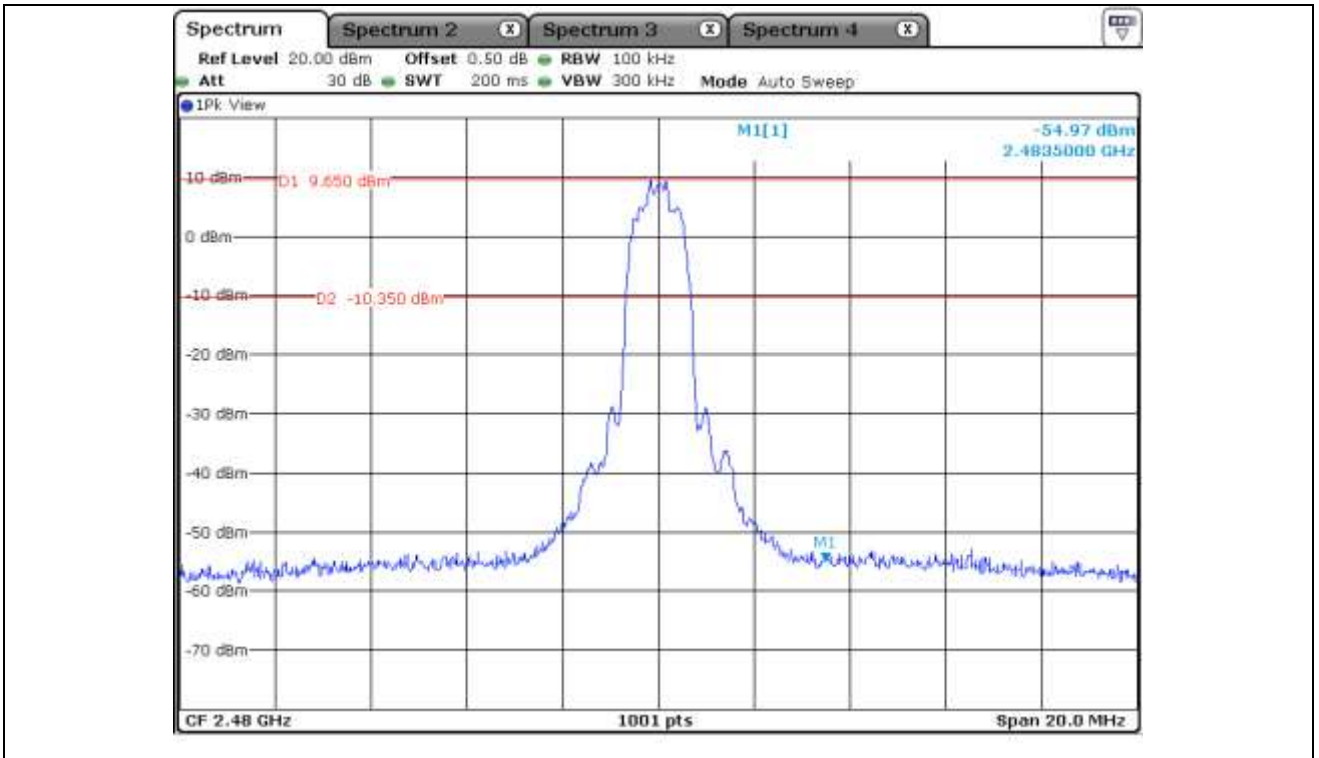
12.5.3 Test data for 3 Mbps



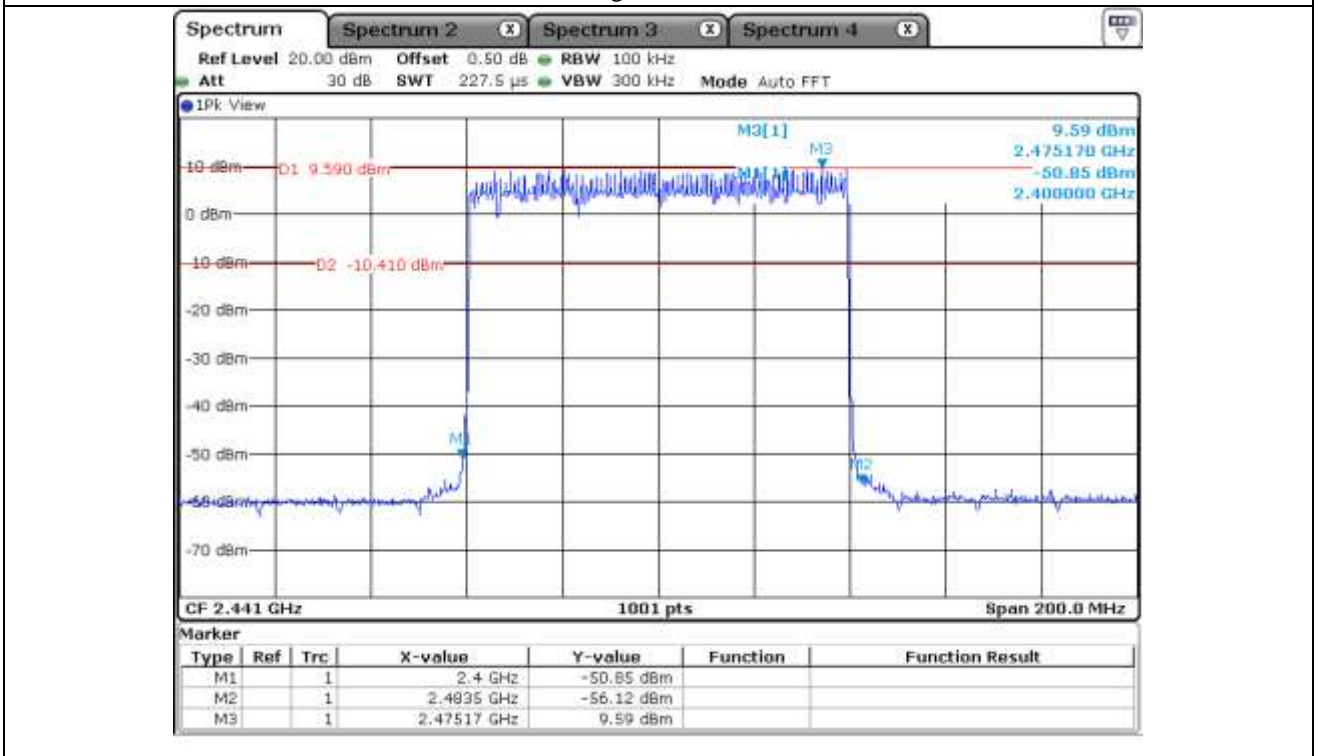
Low Channel



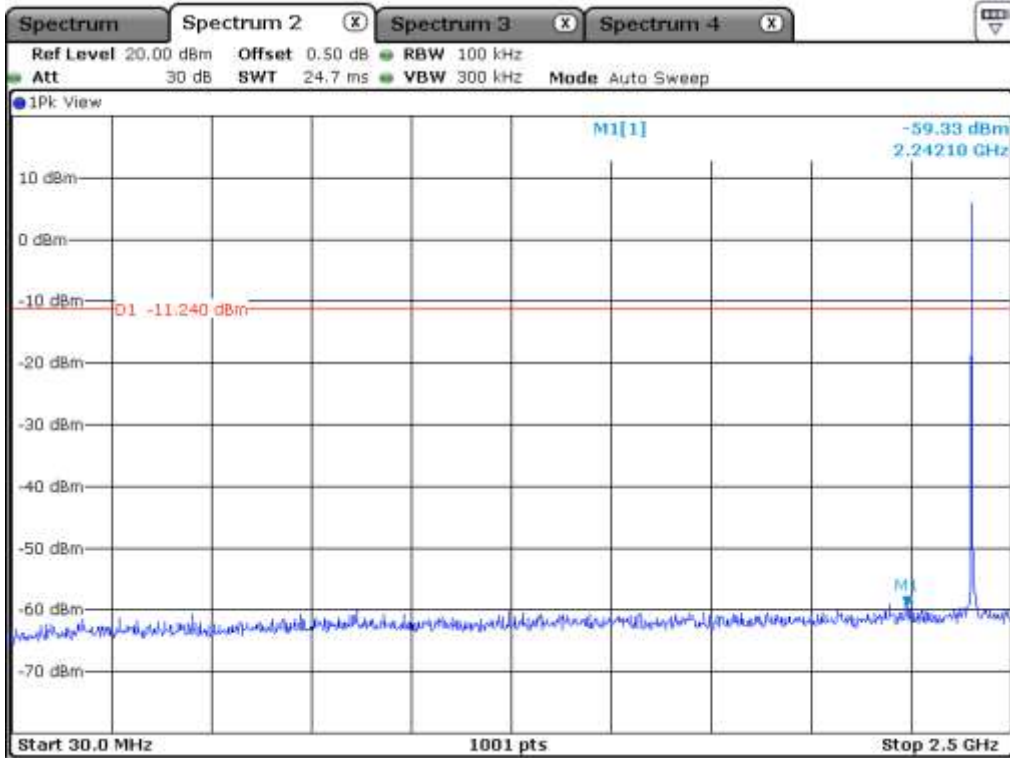
Middle Channel



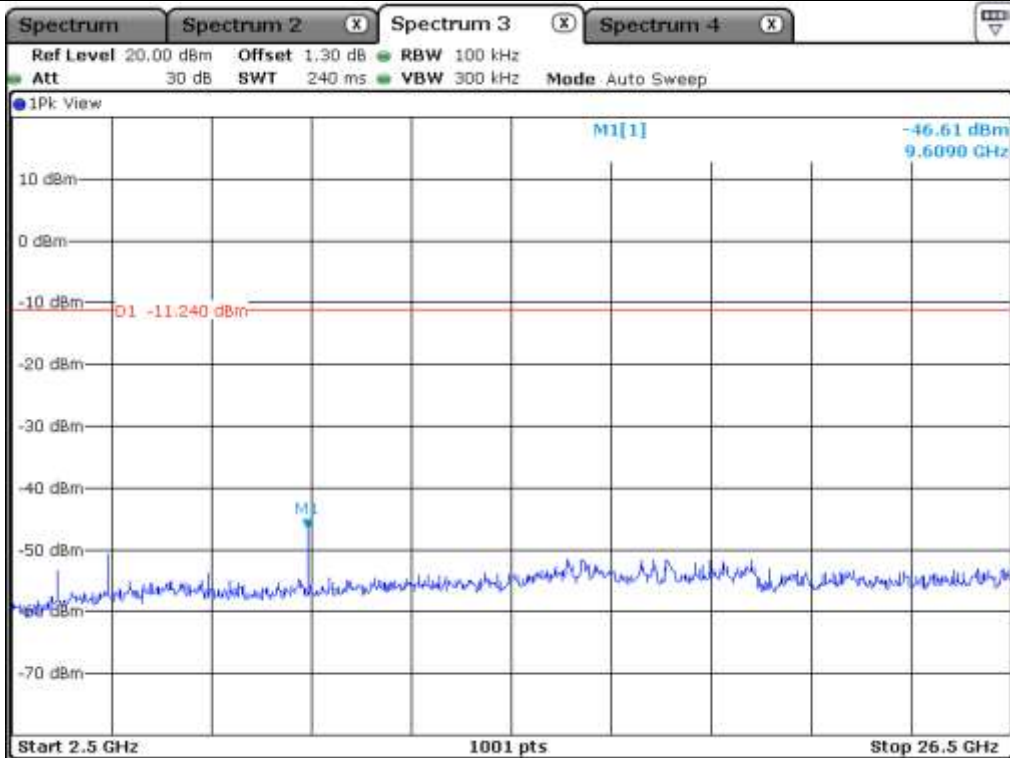
High Channel



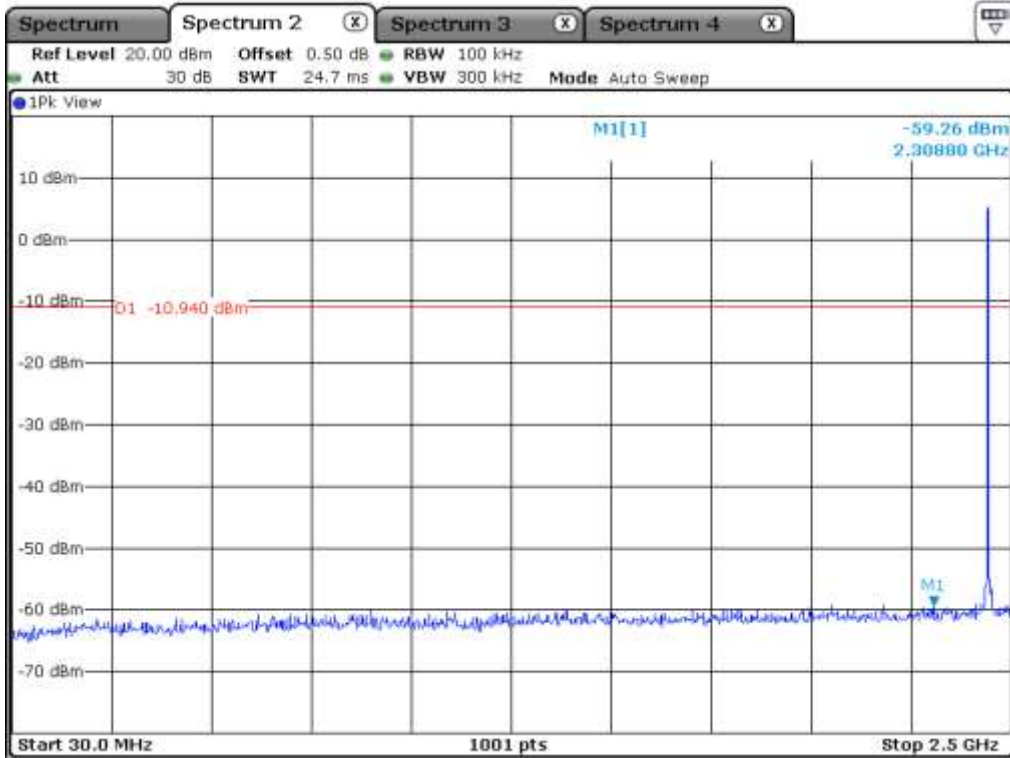
Hopping Mode



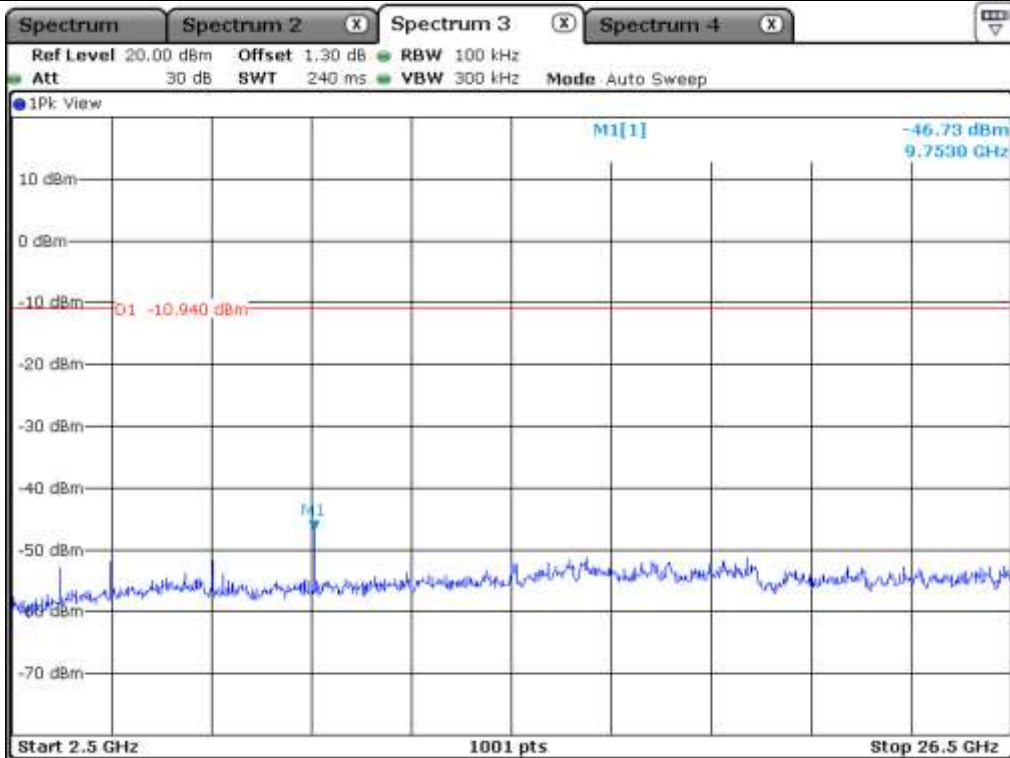
Low Channel



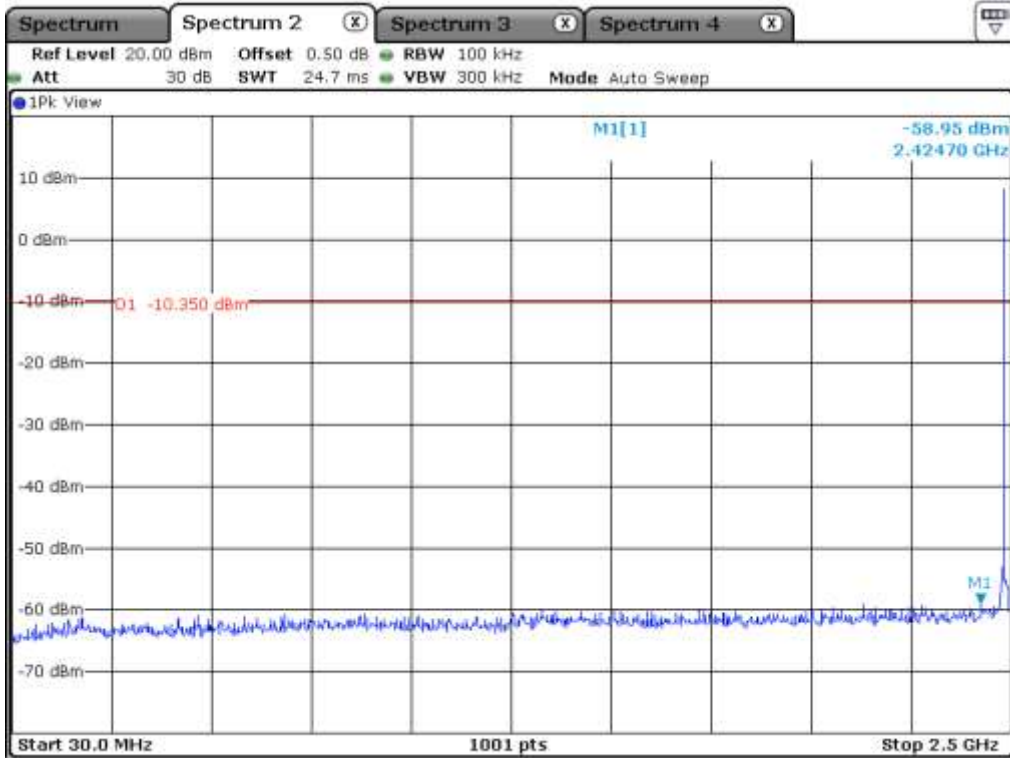
Low Channel



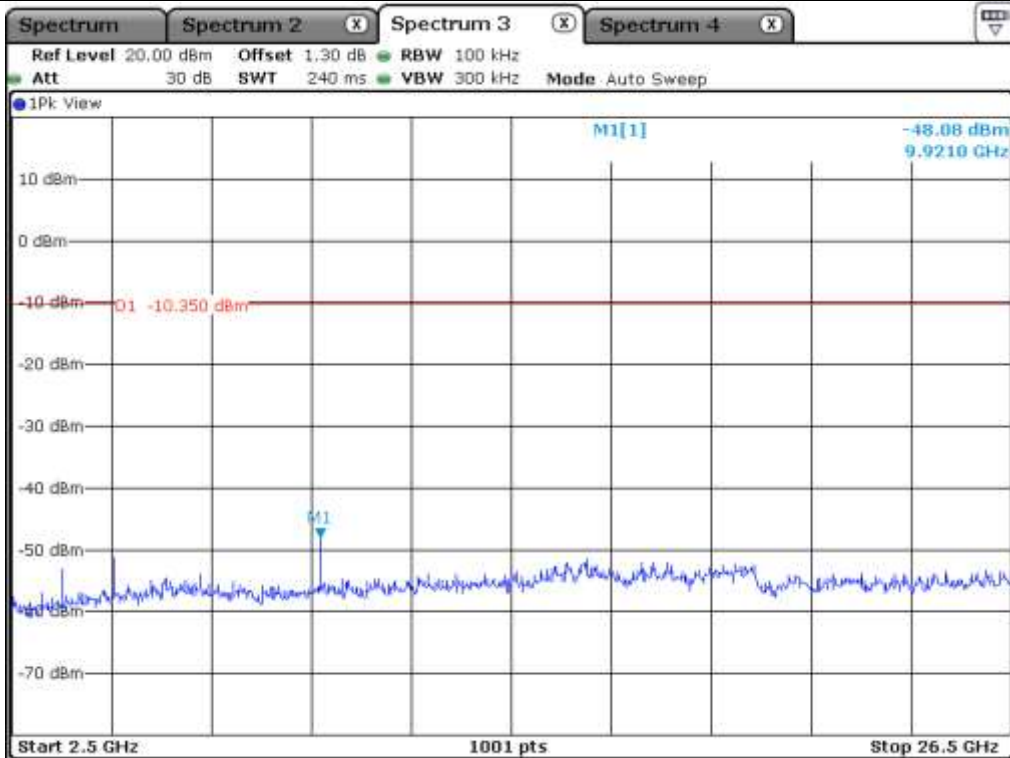
Middle Channel



Middle Channel

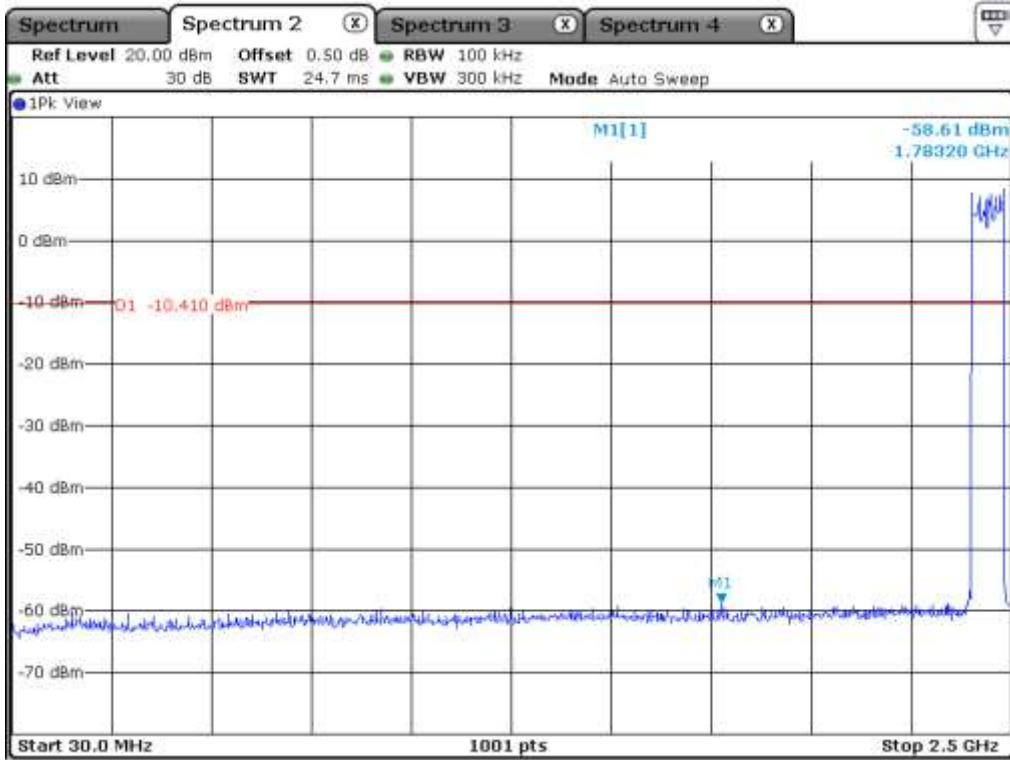


High Channel

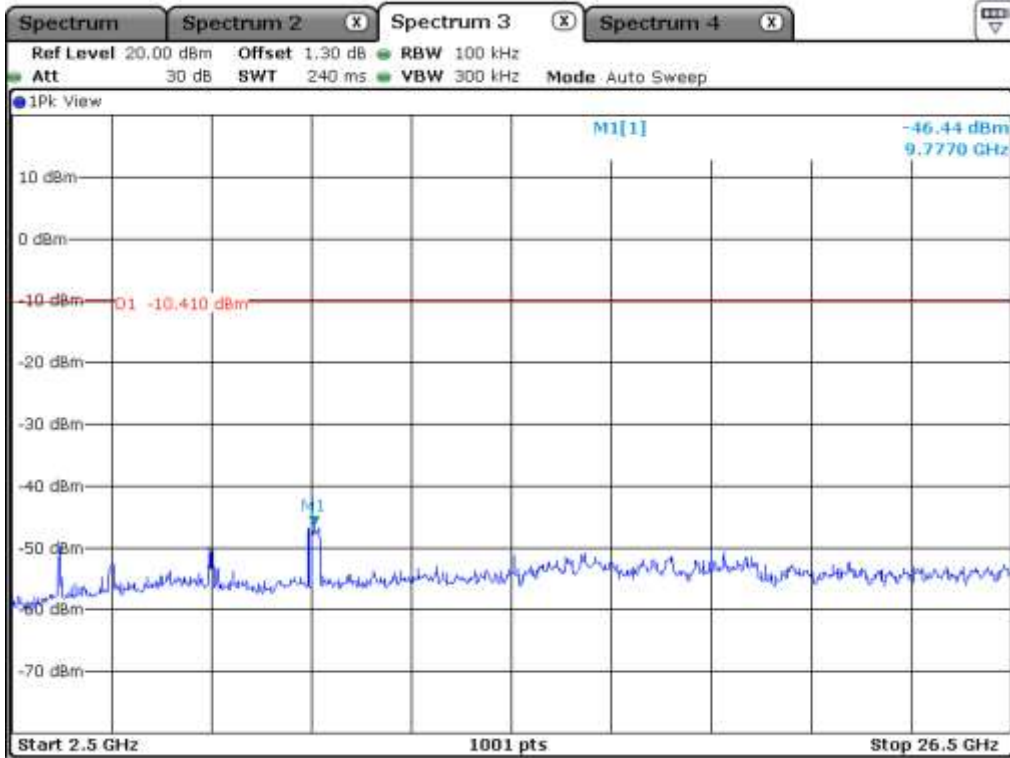


High Channel





Hopping Mode



Hopping Mode

**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**

- 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 : 57.60 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	C.F (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
2 346.735	17.18	Peak	H	26.90	3.07	-	47.15	74.00	26.85
2 339.386	6.63	Average	H	26.90	3.07	2.40	39.00	54.00	15.00
2 348.872	18.73	Peak	V	26.90	3.07	-	48.70	74.00	25.30
2 341.611	6.76	Average	V	26.90	3.07	2.40	39.13	54.00	14.87
<b>Test Data for High Channel</b>									
2 486.505	19.95	Peak	H	26.60	3.16	-	49.71	74.00	24.29
2 483.885	9.48	Average	H	26.60	3.16	2.40	41.64	54.00	12.36
2 498.364	16.66	Peak	V	26.60	3.16	-	46.42	74.00	27.58
2 483.508	4.67	Average	V	26.60	3.16	2.40	36.83	54.00	17.17

Tabulated test data for Restricted Band

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

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

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



**12.6.1.2 Test data for 2 Mbps**

- 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 : 57.60 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	C.F (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
2 346.675	18.06	Peak	H	26.90	3.07	-	48.03	74.00	25.97
2 341.709	6.45	Average	H	26.90	3.07	2.40	38.82	54.00	15.18
2 344.165	18.02	Peak	V	26.90	3.07	-	47.99	74.00	26.01
2 338.460	6.22	Average	V	26.90	3.07	2.40	38.59	54.00	15.41
<b>Test Data for High Channel</b>									
2 485.346	18.67	Peak	H	26.60	3.16	-	48.43	74.00	25.57
2 483.508	9.00	Average	H	26.60	3.16	2.40	41.16	54.00	12.84
2 497.262	17.60	Peak	V	26.60	3.16	-	47.36	74.00	26.64
2 492.397	4.52	Average	V	26.60	3.16	2.40	36.68	54.00	17.32

Tabulated test data for Restricted Band

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

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

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

**12.6.1.3 Test data for 3 Mbps**

- 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 : 57.60 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	C.F (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
2 344.246	16.84	Peak	H	26.90	3.07	-	46.81	74.00	27.19
2 340.078	5.92	Average	H	26.90	3.07	2.40	38.29	54.00	15.71
2 342.438	16.95	Peak	V	26.90	3.07	-	46.92	74.00	27.08
2 338.493	7.25	Average	V	26.90	3.07	2.40	39.62	54.00	14.38
<b>Test Data for High Channel</b>									
2 483.546	19.00	Peak	H	26.60	3.16	-	48.76	74.00	25.24
2 483.735	9.79	Average	H	26.60	3.16	2.40	41.95	54.00	12.05
2 490.300	17.01	Peak	V	26.60	3.16	-	46.77	74.00	27.23
2 491.139	5.27	Average	V	26.60	3.16	2.40	37.43	54.00	16.57

Tabulated test data for Restricted Band

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

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

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

## 12.6.2 Spurious & Harmonic Radiated Emission above 1 GHz

### 12.6.2.1 Test data for 1 Mbps

- 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 : 57.60 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	C.F (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
4 804.000	18.35	Peak	H	28.20	4.85	-	51.40	74.00	22.60
4 804.000	7.63	Average	H	28.20	4.85	2.40	43.08	54.00	10.92
4 804.000	18.50	Peak	V	28.20	4.85	-	51.55	74.00	22.45
4 804.000	6.12	Average	V	28.20	4.85	2.40	41.57	54.00	12.43
<b>Test Data for Middle Channel</b>									
4 882.000	19.00	Peak	H	28.30	4.91	-	52.21	74.00	21.79
4 882.000	8.31	Average	H	28.30	4.91	2.40	43.92	54.00	10.08
4 882.000	17.69	Peak	V	28.30	4.91	-	50.90	74.00	23.10
4 882.000	7.48	Average	V	28.30	4.91	2.40	43.09	54.00	10.91
<b>Test Data for High Channel</b>									
4 960.000	19.00	Peak	H	28.60	5.04	-	52.64	74.00	21.36
4 960.000	7.36	Average	H	28.60	5.04	2.40	43.40	54.00	10.60
4 960.000	18.78	Peak	V	28.60	5.04	-	52.42	74.00	21.58
4 960.000	6.77	Average	V	28.60	5.04	2.40	42.81	54.00	11.19

Tabulated test data for Restricted Band

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

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

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

**12.6.2.2 Test data for 2 Mbps**

- 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 : 57.60 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	C.F (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
4 804.000	18.84	Peak	H	28.20	4.85	-	51.89	74.00	22.11
4 804.000	7.42	Average	H	28.20	4.85	2.40	42.87	54.00	11.13
4 804.000	18.75	Peak	V	28.20	4.85	-	51.80	74.00	22.20
4 804.000	6.85	Average	V	28.20	4.85	2.40	42.30	54.00	11.70
<b>Test Data for Middle Channel</b>									
4 882.000	18.83	Peak	H	28.30	4.91	-	52.04	74.00	21.96
4 882.000	7.45	Average	H	28.30	4.91	2.40	43.06	54.00	10.94
4 882.000	18.63	Peak	V	28.30	4.91	-	51.84	74.00	22.16
4 882.000	7.31	Average	V	28.30	4.91	2.40	42.92	54.00	11.08
<b>Test Data for High Channel</b>									
4 960.000	18.27	Peak	H	28.60	5.04	-	51.91	74.00	22.09
4 960.000	7.61	Average	H	28.60	5.04	2.40	43.65	54.00	10.35
4 960.000	17.59	Peak	V	28.60	5.04	-	51.23	74.00	22.77
4 960.000	6.78	Average	V	28.60	5.04	2.40	42.82	54.00	11.18

Tabulated test data for Restricted Band

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

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

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

**12.6.2.3 Test data for 3 Mbps**

- 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 : 57.60 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	C.F (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
<b>Test Data for Low Channel</b>									
4 804.000	18.47	Peak	H	28.20	4.85	-	51.52	74.00	22.48
4 804.000	6.77	Average	H	28.20	4.85	2.40	42.22	54.00	11.78
4 804.000	18.71	Peak	V	28.20	4.85	-	51.76	74.00	22.24
4 804.000	7.42	Average	V	28.20	4.85	2.40	42.87	54.00	11.13
<b>Test Data for Middle Channel</b>									
4 882.000	18.58	Peak	H	28.30	4.91	-	51.79	74.00	22.21
4 882.000	8.30	Average	H	28.30	4.91	2.40	43.91	54.00	10.09
4 882.000	17.96	Peak	V	28.30	4.91	-	51.17	74.00	22.83
4 882.000	6.75	Average	V	28.30	4.91	2.40	42.36	54.00	11.64
<b>Test Data for High Channel</b>									
4 960.000	18.24	Peak	H	28.60	5.04	-	51.88	74.00	22.12
4 960.000	6.50	Average	H	28.60	5.04	2.40	42.54	54.00	11.46
4 960.000	18.52	Peak	V	28.60	5.04	-	52.16	74.00	21.84
4 960.000	6.56	Average	V	28.60	5.04	2.40	42.60	54.00	11.40

Tabulated test data for Restricted Band

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

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

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

## 13. RADIATED EMISSION TEST

### 13.1 Operating environment

Temperature : 23 °C  
Relative humidity : 41 % 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 Date

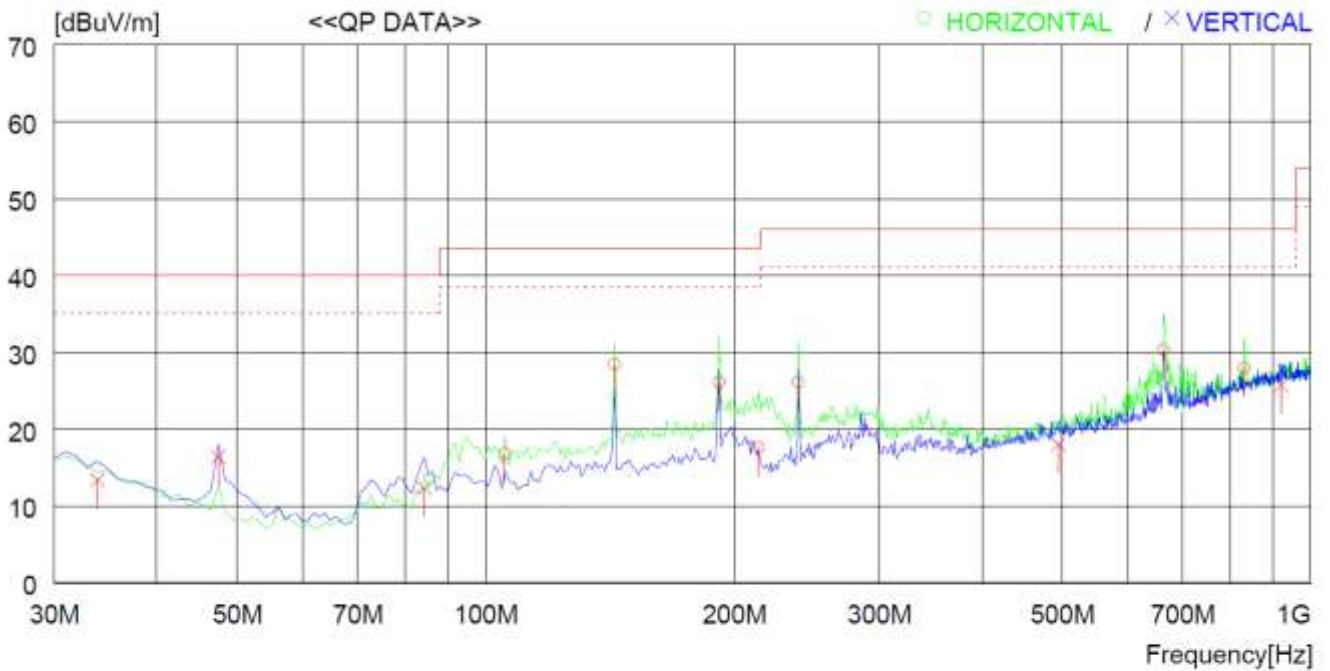
August 21, 2020 ~ September 08, 2020

13.4 Test data for 30 MHz ~ 1000 MHz

13.4.1 Test data for Basic Model (WCA731M)

13.4.1.1 Test data for Bluetooth Mode

- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 000 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 [cm]	TABLE [DEG]
----- Horizontal -----										
1	105.660	38.7	9.8	1.0	32.7	16.8	43.5	26.7	400	97
2	143.490	48.9	11.1	1.1	32.7	28.4	43.5	15.1	400	355
3	191.990	44.6	12.8	1.3	32.6	26.1	43.5	17.4	400	355
4	214.300	36.9	11.9	1.4	32.6	17.6	43.5	25.9	400	148
5	239.520	46.6	10.6	1.5	32.6	26.1	46.0	19.9	400	18
6	663.406	40.2	20.5	2.5	32.9	30.3	46.0	15.7	400	355
7	831.211	35.6	22.4	2.3	32.4	27.9	46.0	18.1	400	180
----- Vertical -----										
8	33.880	34.5	11.0	0.5	32.6	13.4	40.0	26.6	400	5
9	47.460	38.4	10.1	0.6	32.7	16.4	40.0	23.6	400	243
10	84.320	36.4	7.8	0.8	32.7	12.3	40.0	27.7	400	5
11	494.631	31.0	17.7	2.2	32.9	18.0	46.0	28.0	400	5
12	920.448	31.3	23.4	2.9	31.9	25.7	46.0	20.3	400	356

**13.4.1.2 Test data for Intermodulation Mode(Bluetooth + WLAN 2.4 GHz + WLAN 5 GHz)**

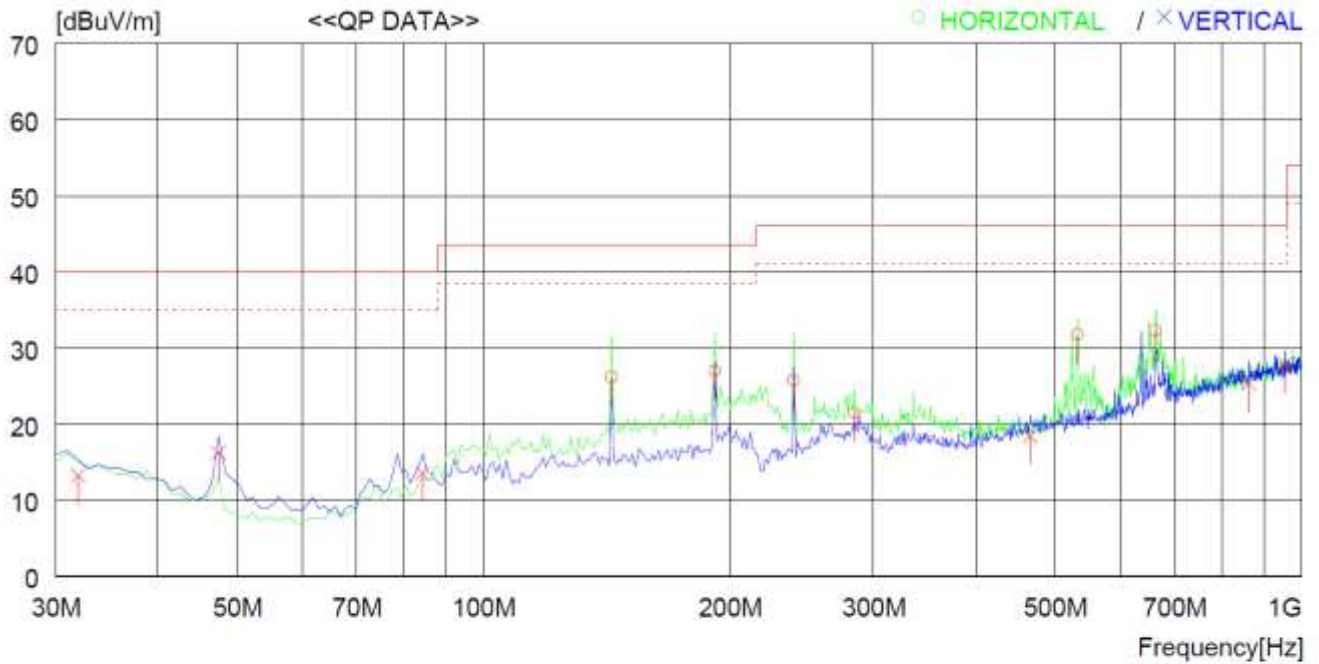
Humidity Level : 41 % R.H. Temperature: 23 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : Wi-Fi/BT Transceiver

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



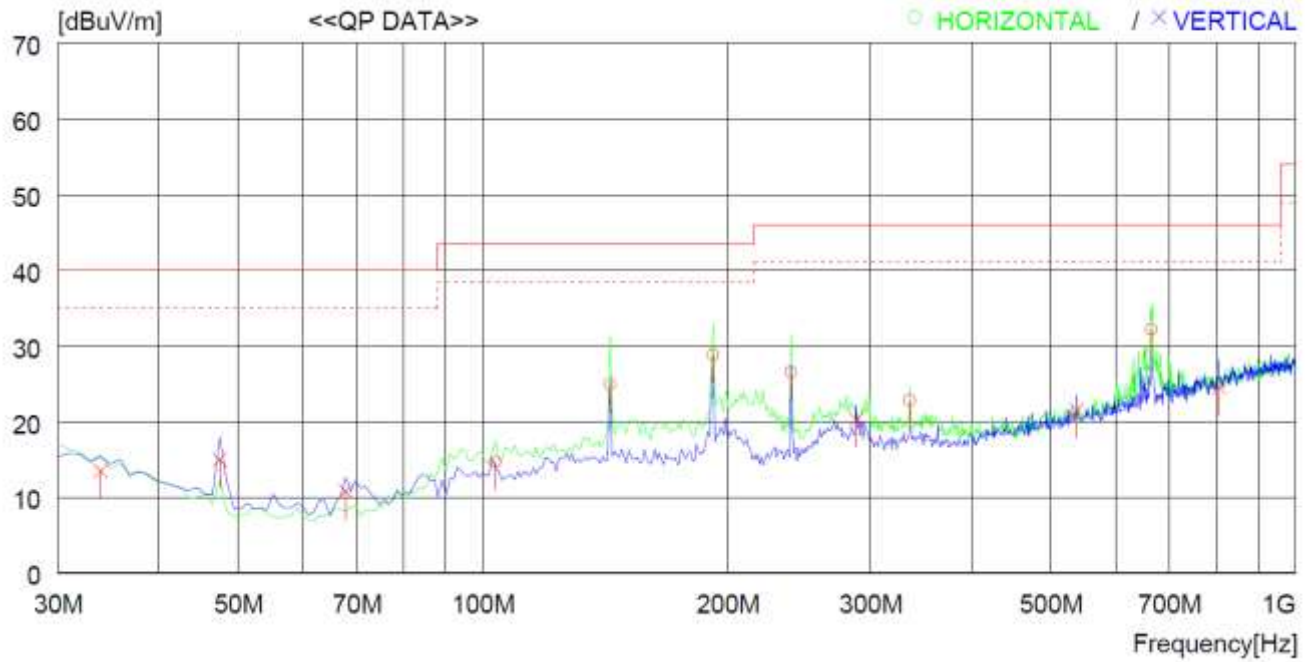
No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	143.490	46.7	11.1	1.1	32.7	26.2	43.5	17.3	400	359
2	191.990	45.5	12.8	1.3	32.6	27.0	43.5	16.5	400	359
3	239.520	46.2	10.6	1.5	32.6	25.7	46.0	20.3	400	359
4	284.140	40.1	12.5	1.6	32.7	21.5	46.0	24.5	400	359
5	532.460	44.0	18.4	2.2	32.9	31.7	46.0	14.3	400	359
6	663.406	42.2	20.5	2.5	32.9	32.3	46.0	13.7	400	317
----- Vertical -----										
7	31.940	34.4	10.9	0.5	32.6	13.2	40.0	26.8	400	1
8	47.460	38.2	10.1	0.6	32.7	16.2	40.0	23.8	400	1
9	84.320	37.7	7.8	0.8	32.7	13.6	40.0	26.4	400	1
10	465.531	31.8	17.3	2.1	32.8	18.4	46.0	27.6	400	1
11	862.250	32.1	22.8	2.6	32.2	25.3	46.0	20.7	400	1
12	955.367	33.0	23.5	3.0	31.7	27.8	46.0	18.2	400	1



13.4.2 Test data for Multiple Model (WCA734M)

13.4.2.1 Test data for Bluetooth Mode

- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 000 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 [cm]	TABLE [DEG]
----- Horizontal -----										
1	103.720	30.1	15.0	2.1	32.5	14.7	43.5	28.8	400	355
2	143.490	36.5	18.6	2.3	32.5	24.9	43.5	18.6	400	355
3	191.990	42.4	16.2	2.7	32.5	28.8	43.5	14.7	400	355
4	239.520	38.7	17.2	3.0	32.4	26.5	46.0	19.5	400	11
5	335.550	31.7	20.1	3.5	32.5	22.8	46.0	23.2	400	163
6	665.346	33.3	26.4	5.1	32.6	32.2	46.0	13.8	400	355
----- Vertical -----										
7	33.880	26.7	18.0	1.3	32.5	13.5	40.0	26.5	400	225
8	47.460	26.4	19.6	1.5	32.5	15.0	40.0	25.0	400	310
9	67.830	23.4	18.1	1.8	32.5	10.8	40.0	29.2	400	2
10	288.020	30.4	19.1	3.2	32.4	20.3	46.0	25.7	400	2
11	538.280	25.4	24.4	4.4	32.7	21.5	46.0	24.5	400	348
12	805.022	23.2	28.2	5.4	32.3	24.5	46.0	21.5	400	2

13.4.2.2 Test data for Intermodulation Mode(Bluetooth + WLAN 2.4 GHz + WLAN 5 GHz)

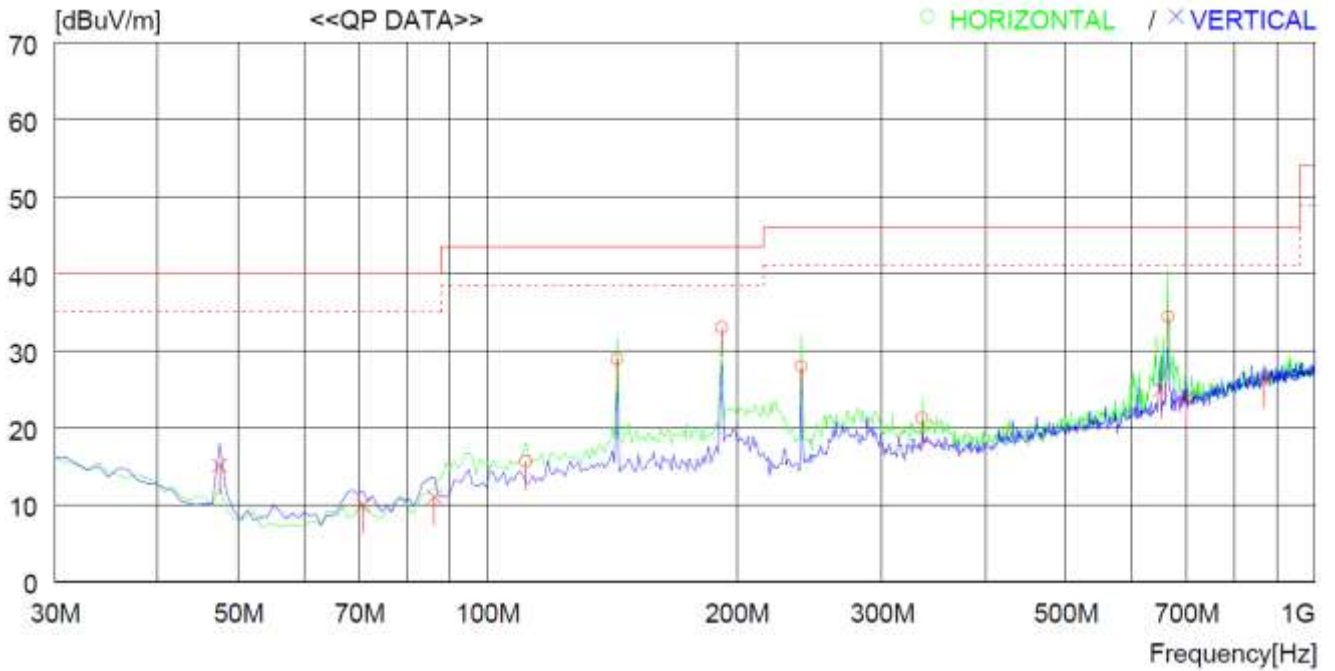
Humidity Level : 41 % R.H. Temperature: 23 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : Wi-Fi/BT Transceiver

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	111.480	30.0	15.9	2.2	32.5	15.6	43.5	27.9	400	355
2	143.490	40.5	18.6	2.3	32.5	28.9	43.5	14.6	400	355
3	191.990	46.6	16.2	2.7	32.5	33.0	43.5	10.5	400	355
4	239.520	40.1	17.2	3.0	32.4	27.9	46.0	18.1	400	355
5	335.550	30.1	20.1	3.5	32.5	21.2	46.0	24.8	400	6
6	664.376	35.5	26.4	5.1	32.6	34.4	46.0	11.6	400	355
----- Vertical -----										
7	47.460	26.5	19.6	1.5	32.5	15.1	40.0	24.9	400	5
8	70.740	23.2	17.5	1.8	32.5	10.0	40.0	30.0	400	354
9	86.260	27.6	14.0	1.9	32.5	11.0	40.0	29.0	400	310
10	650.796	26.4	26.2	5.0	32.6	25.0	46.0	21.0	400	202
11	700.265	24.4	26.8	5.3	32.6	23.9	46.0	22.1	400	5
12	870.010	23.8	28.8	5.7	31.9	26.4	46.0	19.6	400	278

**13.5 Test data for Below 30 MHz**

- 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)
Emission from the EUT more than 20 dB below the limit in each frequency range.								

**13.6 Test data for above 1 GHz**

- 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)
Emission from the EUT more than 20 dB below the limit in each frequency range.								

## 14. CONDUCTED EMISSION TEST

### 14.1 Operating environment

Temperature : 23 °C  
Relative humidity : 41 % 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.

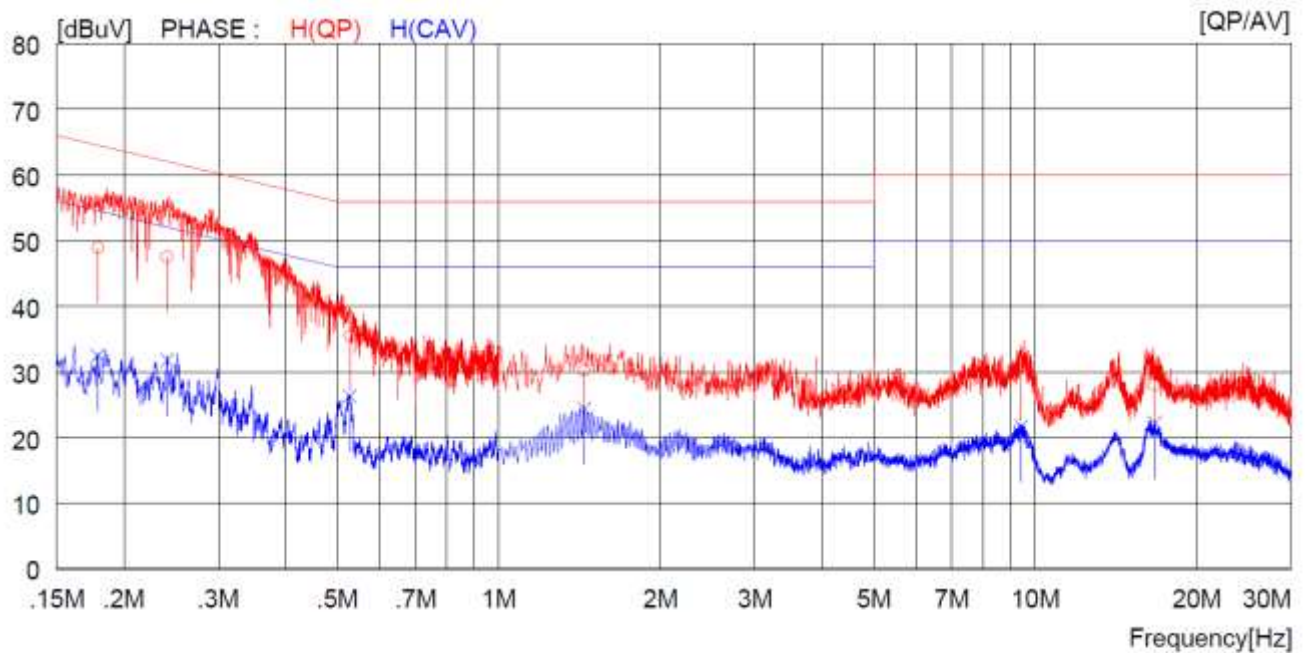
### 14.3 Test Date

August 21, 2020 ~ September 08, 2020

14.4 Test data for Basic Model (WCA731M)

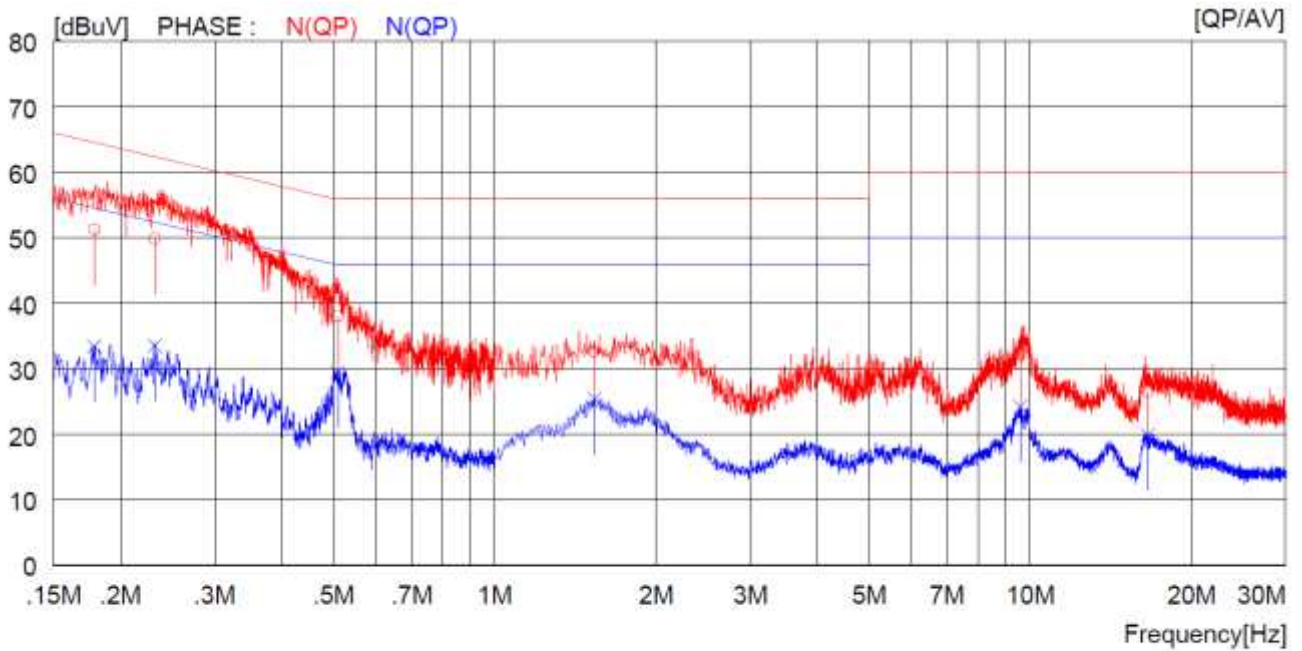
14.4.1 Test data for Bluetooth

- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ	READING		C.FACTOR		RESULT		LIMIT		MARGIN		PHASE
		QP	AV	QP	AV	QP	AV	QP	AV	QP	AV	
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.17900	38.9	---	10.0	48.9	---	64.5	---	15.6	---	H(QP)	
2	0.24100	37.6	---	9.9	47.5	---	62.1	---	14.6	---	H(QP)	
3	0.52800	25.5	---	10.0	35.5	---	56.0	---	20.5	---	H(QP)	
4	1.44400	20.1	---	10.1	30.2	---	56.0	---	25.8	---	H(QP)	
5	9.43500	20.8	---	10.2	31.0	---	60.0	---	29.0	---	H(QP)	
6	16.72000	17.7	---	10.3	28.0	---	60.0	---	32.0	---	H(QP)	
7	0.17900	---	22.5	10.0	---	32.5	---	54.5	---	22.0	H(CAV)	
8	0.24100	---	21.9	9.9	---	31.8	---	52.1	---	20.3	H(CAV)	
9	0.52800	---	16.3	10.0	---	26.3	---	46.0	---	19.7	H(CAV)	
10	1.44400	---	14.3	10.1	---	24.4	---	46.0	---	21.6	H(CAV)	
11	9.43500	---	11.5	10.2	---	21.7	---	50.0	---	28.3	H(CAV)	
12	16.72000	---	12.0	10.3	---	22.3	---	50.0	---	27.7	H(CAV)	

-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C.FACTOR		RESULT		LIMIT		MARGIN		PHASE
		QP	AV	QP	AV	QP	AV	QP	AV	QP	AV	
		[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.17900	41.2	---	10.0	51.2	---	64.5	---	13.3	---	N(QP)	
2	0.23200	39.9	---	9.9	49.8	---	62.4	---	12.6	---	N(QP)	
3	0.51000	28.0	---	10.0	38.0	---	56.0	---	18.0	---	N(QP)	
4	1.53600	22.5	---	10.1	32.6	---	56.0	---	23.4	---	N(QP)	
5	9.58500	21.9	---	10.2	32.1	---	60.0	---	27.9	---	N(QP)	
6	16.57000	16.2	---	10.3	26.5	---	60.0	---	33.5	---	N(QP)	
7	0.17900	---	23.4	10.0	---	33.4	---	54.5	---	21.1	N(CAV)	
8	0.23200	---	23.6	9.9	---	33.5	---	52.4	---	18.9	N(CAV)	
9	0.51000	---	19.5	10.0	---	29.5	---	46.0	---	16.5	N(CAV)	
10	1.53600	---	15.3	10.1	---	25.4	---	46.0	---	20.6	N(CAV)	
11	9.58500	---	14.0	10.2	---	24.2	---	50.0	---	25.8	N(CAV)	
12	16.57000	---	9.6	10.3	---	19.9	---	50.0	---	30.1	N(CAV)	

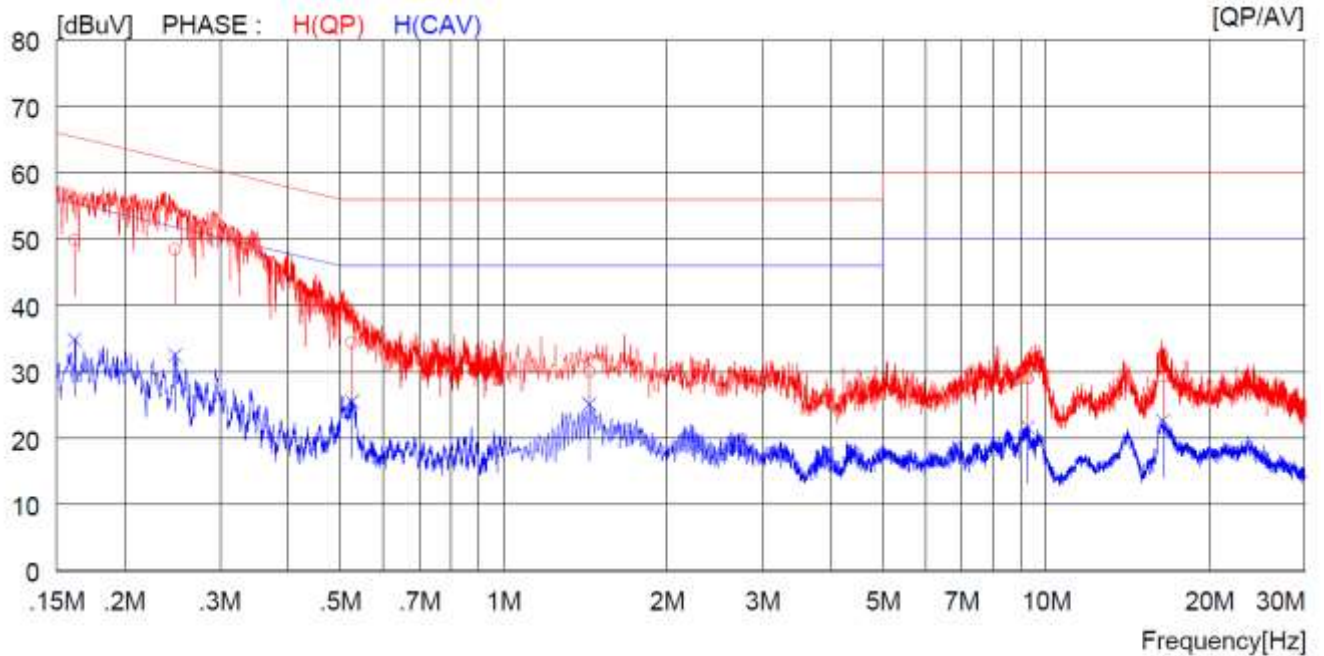
Remark: Margin (dB) = Limit – Level (Result)

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



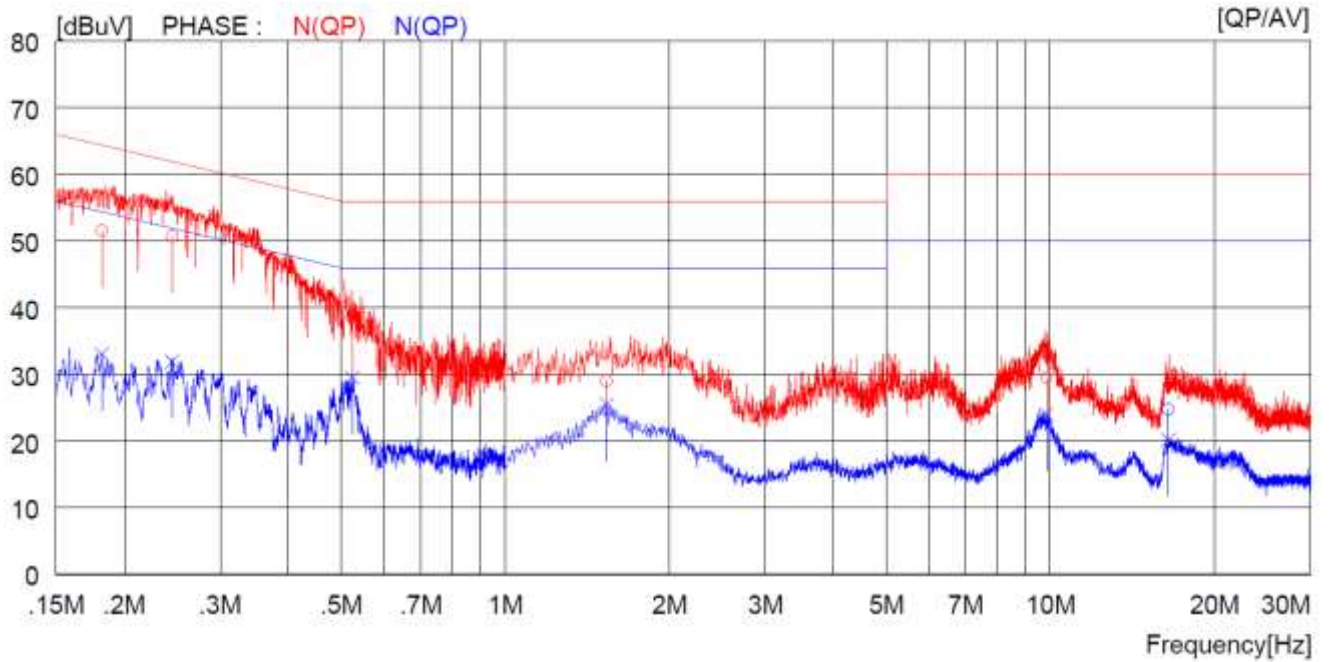
**14.4.2 Test data for Intermodulation Mode(Bluetooth + WLAN 2.4 GHz + WLAN 5 GHz)**

- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C.FACTOR		RESULT		LIMIT		MARGIN	PHASE
		QP	AV	QP	AV	QP	AV	QP	AV		
		[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]		
1	0.16200	39.8	---	10.0	49.8	---	65.4	---	15.6	---	H(QP)
2	0.24800	38.5	---	9.9	48.4	---	61.8	---	13.4	---	H(QP)
3	0.52500	24.4	---	10.0	34.4	---	56.0	---	21.6	---	H(QP)
4	1.44000	19.9	---	10.1	30.0	---	56.0	---	26.0	---	H(QP)
5	9.24500	18.8	---	10.2	29.0	---	60.0	---	31.0	---	H(QP)
6	16.42000	19.0	---	10.3	29.3	---	60.0	---	30.7	---	H(QP)
7	0.16200	---	24.8	10.0	---	34.8	---	55.4	---	20.6	H(CAV)
8	0.24800	---	22.6	9.9	---	32.5	---	51.8	---	19.3	H(CAV)
9	0.52500	---	15.5	10.0	---	25.5	---	46.0	---	20.5	H(CAV)
10	1.44000	---	15.0	10.1	---	25.1	---	46.0	---	20.9	H(CAV)
11	9.24500	---	11.5	10.2	---	21.7	---	50.0	---	28.3	H(CAV)
12	16.42000	---	12.3	10.3	---	22.6	---	50.0	---	27.4	H(CAV)

- Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT [dBuV]	MARGIN [dBuV]	PHASE		
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]					
1	0.18200	41.5	---	10.0	51.5	---	64.4	---	12.9	---	N(QP)
2	0.24500	40.8	---	9.9	50.7	---	61.9	---	11.2	---	N(QP)
3	0.52400	28.5	---	10.0	38.5	---	56.0	---	17.5	---	N(QP)
4	1.53600	18.9	---	10.1	29.0	---	56.0	---	27.0	---	N(QP)
5	9.83500	19.3	---	10.2	29.5	---	60.0	---	30.5	---	N(QP)
6	16.48000	14.5	---	10.3	24.8	---	60.0	---	35.2	---	N(CAV)
7	0.18200	---	23.0	10.0	---	33.0	---	54.4	---	21.4	N(CAV)
8	0.24500	---	22.0	9.9	---	31.9	---	51.9	---	20.0	N(CAV)
9	0.52400	---	19.5	10.0	---	29.5	---	46.0	---	16.5	N(CAV)
10	1.53600	---	15.4	10.1	---	25.5	---	46.0	---	20.5	N(CAV)
11	9.83500	---	13.8	10.2	---	24.0	---	50.0	---	26.0	N(CAV)
12	16.48000	---	9.9	10.3	---	20.2	---	50.0	---	29.8	N(CAV)

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

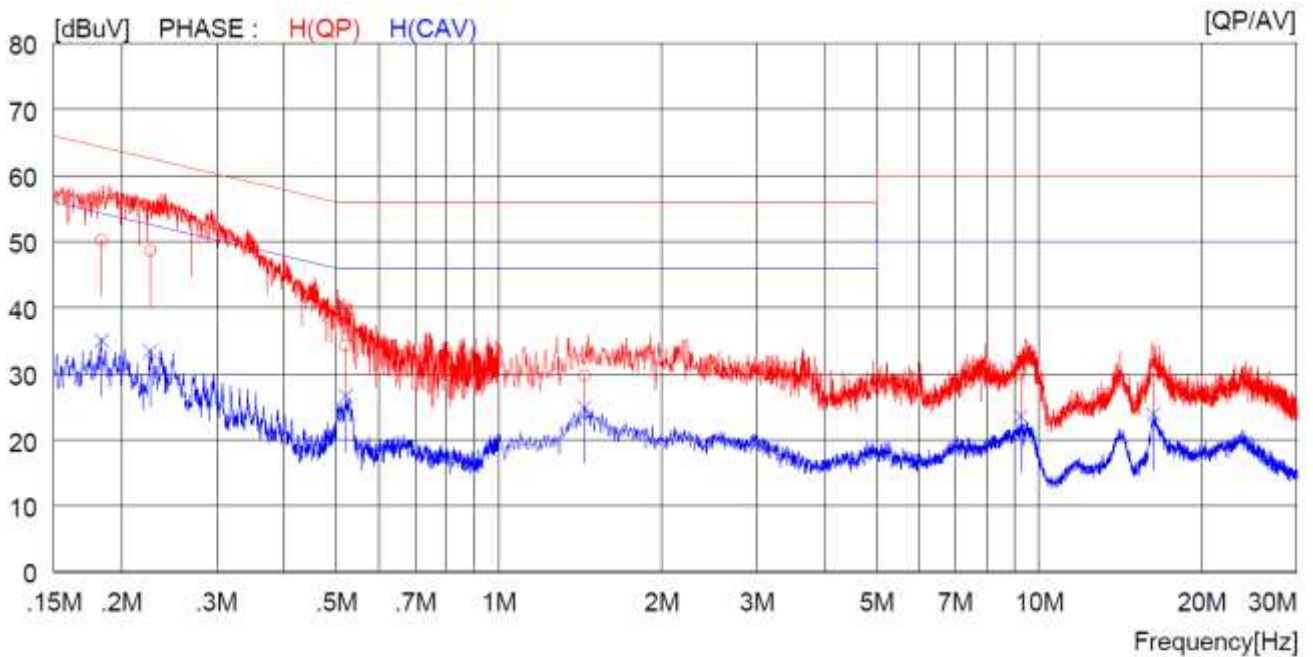
The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.



14.5 Test data for Multiple Model (WCA734M)

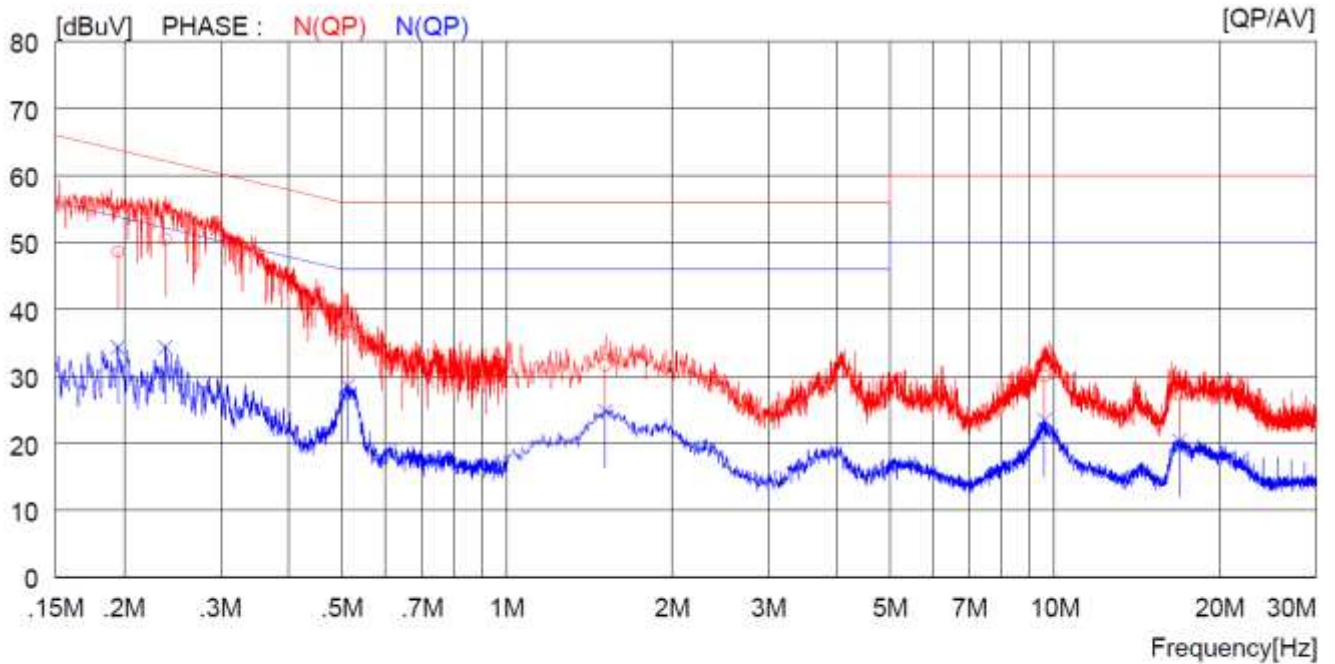
14.5.1 Test data for Bluetooth

- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ		READING		C.FACTOR		RESULT		LIMIT		MARGIN		PHASE
	QP	AV	QP	AV	QP	AV	QP	AV	QP	AV	QP	AV	
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.18400	40.2	---	10.0	50.2	---	64.3	---	14.1	---			H(QP)
2	0.22600	38.7	---	9.9	48.6	---	62.6	---	14.0	---			H(QP)
3	0.52000	24.3	---	10.0	34.3	---	56.0	---	21.7	---			H(QP)
4	1.44000	19.6	---	10.1	29.7	---	56.0	---	26.3	---			H(QP)
5	9.24500	19.9	---	10.2	30.1	---	60.0	---	29.9	---			H(QP)
6	16.28000	20.1	---	10.3	30.4	---	60.0	---	29.6	---			H(QP)
7	0.18400	---	25.0	10.0	---	35.0	---	54.3	---	19.3			H(CAV)
8	0.22600	---	23.5	9.9	---	33.4	---	52.6	---	19.2			H(CAV)
9	0.52000	---	16.6	10.0	---	26.6	---	46.0	---	19.4			H(CAV)
10	1.44000	---	14.8	10.1	---	24.9	---	46.0	---	21.1			H(CAV)
11	9.24500	---	13.4	10.2	---	23.6	---	50.0	---	26.4			H(CAV)
12	16.28000	---	13.6	10.3	---	23.9	---	50.0	---	26.1			H(CAV)

- Tested Line : NEUTRAL LINE



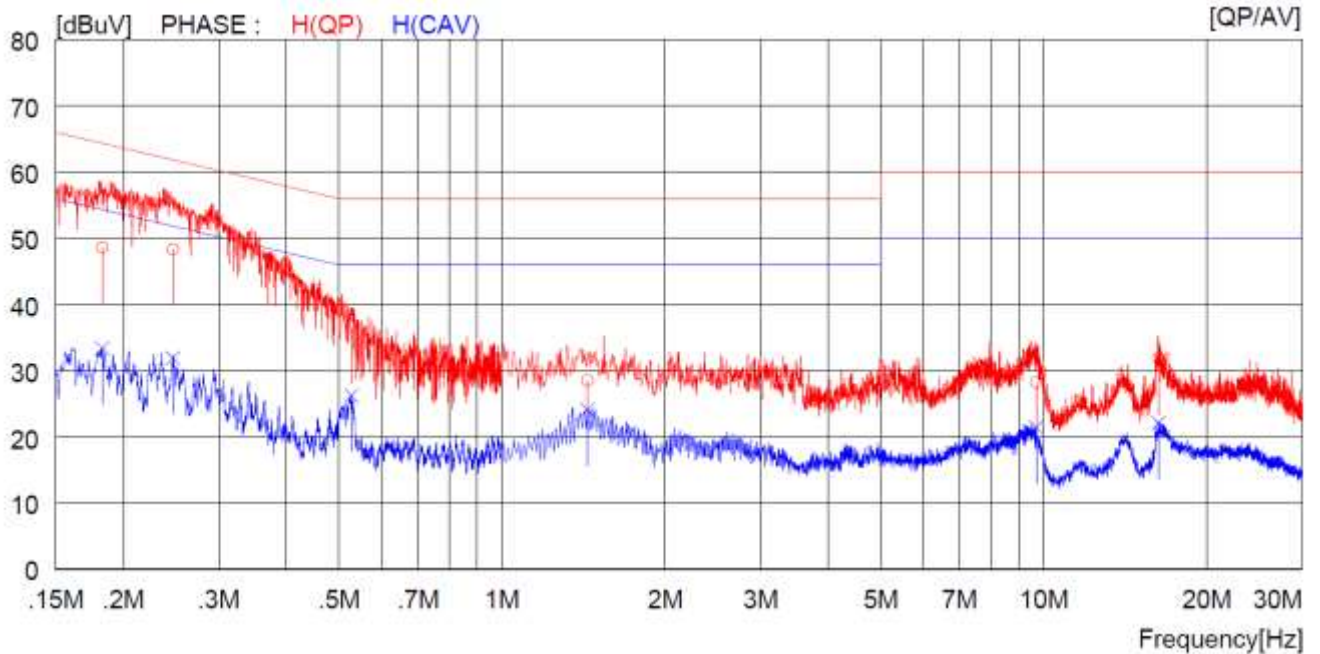
NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19500	38.6	----	10.0	48.6	----	63.8	----	15.2	----	N(QP)
2	0.23800	40.5	----	9.9	50.4	----	62.2	----	11.8	----	N(QP)
3	0.51200	26.6	----	10.0	36.6	----	56.0	----	19.4	----	N(QP)
4	1.51200	21.5	----	10.1	31.6	----	56.0	----	24.4	----	N(QP)
5	9.57500	19.8	----	10.2	30.0	----	60.0	----	30.0	----	N(QP)
6	16.89000	17.0	----	10.3	27.3	----	60.0	----	32.7	----	N(QP)
7	0.19500	----	24.3	10.0	----	34.3	----	53.8	----	19.5	N(CAV)
8	0.23800	----	24.4	9.9	----	34.3	----	52.2	----	17.9	N(CAV)
9	0.51200	----	18.6	10.0	----	28.6	----	46.0	----	17.4	N(CAV)
10	1.51200	----	14.7	10.1	----	24.8	----	46.0	----	21.2	N(CAV)
11	9.57500	----	13.3	10.2	----	23.5	----	50.0	----	26.5	N(CAV)
12	16.89000	----	10.1	10.3	----	20.4	----	50.0	----	29.6	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.

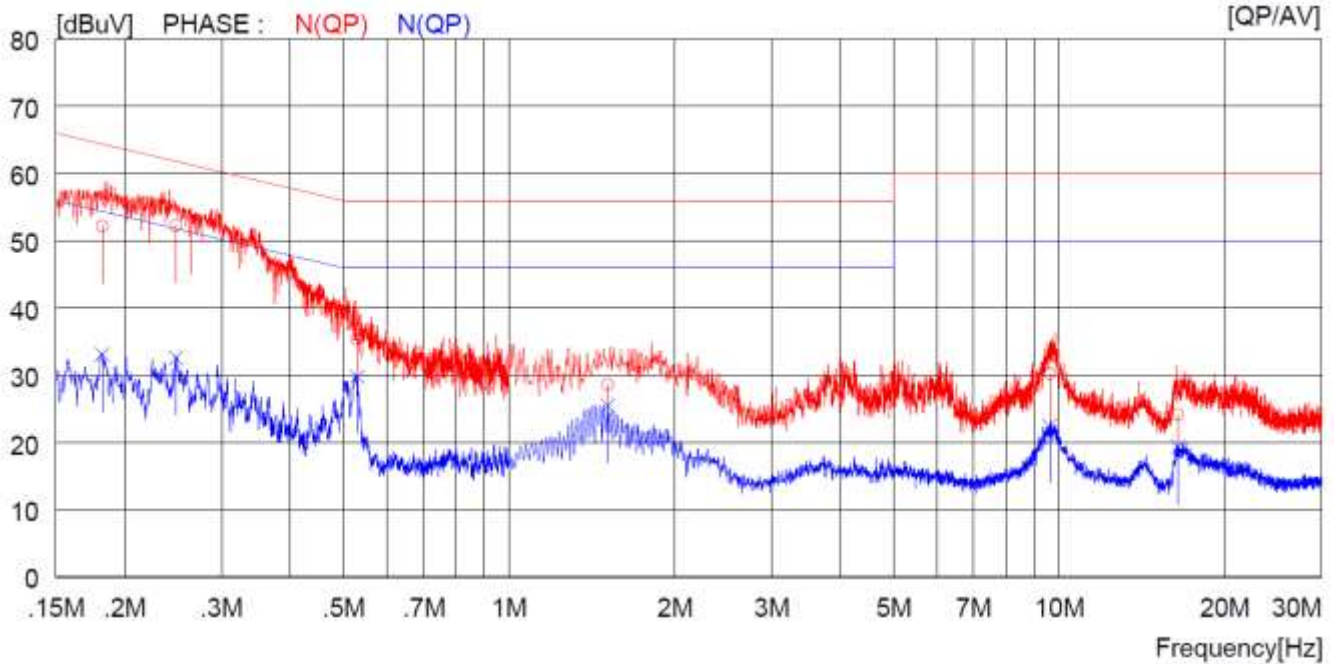
**14.5.2 Test data for Intermodulation Mode(Bluetooth + WLAN 2.4 GHz + WLAN 5 GHz)**

- 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	AV		QP	AV		QP	AV		
1	0.18300	38.6	---	10.0	48.6	---	64.3	---	15.7	---	H(QP)
2	0.24700	38.4	---	9.9	48.3	---	61.9	---	13.6	---	H(QP)
3	0.52700	26.6	---	10.0	36.6	---	56.0	---	19.4	---	H(QP)
4	1.44000	18.4	---	10.1	28.5	---	56.0	---	27.5	---	H(QP)
5	9.70500	18.0	---	10.2	28.2	---	60.0	---	31.8	---	H(QP)
6	16.31000	21.5	---	10.3	31.8	---	60.0	---	28.2	---	H(QP)
7	0.18300	---	23.4	10.0	---	33.4	---	54.3	---	20.9	H(CAV)
8	0.24700	---	22.0	9.9	---	31.9	---	51.9	---	20.0	H(CAV)
9	0.52700	---	16.2	10.0	---	26.2	---	46.0	---	19.8	H(CAV)
10	1.44000	---	14.0	10.1	---	24.1	---	46.0	---	21.9	H(CAV)
11	9.70500	---	11.3	10.2	---	21.5	---	50.0	---	28.5	H(CAV)
12	16.31000	---	11.8	10.3	---	22.1	---	50.0	---	27.9	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	0.18200	42.1	----	10.0	52.1	----	64.4	----	12.3	----	N(QP)
2	0.24800	42.3	----	9.9	52.2	----	61.8	----	9.6	----	N(QP)
3	0.52900	25.4	----	10.0	35.4	----	56.0	----	20.6	----	N(QP)
4	1.51200	18.5	----	10.1	28.6	----	56.0	----	27.4	----	N(QP)
5	9.62000	20.0	----	10.2	30.2	----	60.0	----	29.8	----	N(QP)
6	16.47000	13.8	----	10.3	24.1	----	60.0	----	35.9	----	N(QP)
7	0.18200	----	23.1	10.0	----	33.1	----	54.4	----	21.3	N(CAV)
8	0.24800	----	22.7	9.9	----	32.6	----	51.8	----	19.2	N(CAV)
9	0.52900	----	19.8	10.0	----	29.8	----	46.0	----	16.2	N(CAV)
10	1.51200	----	15.4	10.1	----	25.5	----	46.0	----	20.5	N(CAV)
11	9.62000	----	12.3	10.2	----	22.5	----	50.0	----	27.5	N(CAV)
12	16.47000	----	9.0	10.3	----	19.3	----	50.0	----	30.7	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.



**15. LIST OF TEST EQUIPMENT**

<b>Model Number</b>	<b>Manufacturer</b>	<b>Description</b>	<b>Serial Number</b>	<b>Last Cal.(Interval)</b>
FSV40-N	Rohde & Schwarz	Signal Analyzer	102165	Apr. 20, 2020 (1Y)
ESW	Rohde & Schwarz	EMI Test Receiver	101851	Mar. 27, 2020 (1Y)
310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 16, 2020 (1Y)
BBV 9718 B	Schwarzbeck	Broadband Preamplifier	00009	Mar. 16, 2020 (1Y)
SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Feb. 20, 2020 (1Y)
SCU18	Rohde & Schwarz	Signal Conditioning unit	102266	Jul. 15, 2020 (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. 08, 2020 (2Y)
BBHA 9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 23, 2020 (1Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jan. 07, 2020(1Y)
ESCI	Rohde & Schwarz	Test Receiver	101012	Oct. 22, 2019 (1Y)
NSLK8126	Schwarzbeck	AMN	8126-404	Mar. 16, 2020 (1Y)
3825/2	EMCO	AMN	9109-1869	Mar. 16, 2020 (1Y)