

# RADIO PERFORMANCE TEST REPORT

**Test Report No.** : OT-231-RWD-034

**Reception No.** : 2212003940

**Applicant** : Westcom Wireless Inc.

**Address** : 2773 Leechburg Road, Lower Burrell, Pennsylvania, 15068, United States

**Manufacturer** : Westcom Wireless Inc.

**Address** : 2773 Leechburg Road, Lower Burrell, Pennsylvania, 15068, United States

**Type of Equipment** : ProCom

**FCC ID.** : 2AO37-ATLASAIR

**Model Name** : ATLAS AIR

**Multiple Model Name** : ATLASAIR-S

**Serial number** : N/A

**Total page of Report** : 92 pages (including this page)

**Date of Incoming** : October 28, 2022

**Date of issue** : January 31, 2023

## 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.

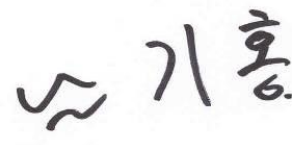
This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.



Tested by  
Soon-Ki, Choi / Engineer  
ONETECH Corp.



Reviewed by  
Tae-Ho, Kim / General Manager  
ONETECH Corp.



Approved by  
Ki-Hong, Nam / General Manager  
ONETECH Corp.

## CONTENTS

	Page
<b>1. VERIFICATION OF COMPLIANCE .....</b>	<b>6</b>
<b>2. TEST SUMMARY .....</b>	<b>7</b>
<b>2.1 Test items and results .....</b>	<b>7</b>
<b>2.2 Additions, deviations, exclusions from standards .....</b>	<b>8</b>
<b>2.3 Related Submittal(s) / Grant(s).....</b>	<b>8</b>
<b>2.4 Purpose of the test.....</b>	<b>8</b>
<b>2.5 Test Methodology .....</b>	<b>8</b>
<b>2.6 Test Facility .....</b>	<b>8</b>
<b>3. GENERAL INFORMATION.....</b>	<b>9</b>
<b>3.1 Product Description.....</b>	<b>9</b>
<b>3.2 Alternative type(s)/model(s); also covered by this test report.....</b>	<b>9</b>
<b>4. EUT MODIFICATIONS.....</b>	<b>9</b>
<b>5. SYSTEM TEST CONFIGURATION .....</b>	<b>10</b>
<b>5.1 Justification .....</b>	<b>10</b>
<b>5.2 Peripheral equipment .....</b>	<b>10</b>
<b>5.3 Mode of operation during the test.....</b>	<b>10</b>
<b>5.4 Configuration of Test System .....</b>	<b>16</b>
<b>5.5 Antenna Requirement .....</b>	<b>16</b>
<b>6. PRELIMINARY TEST .....</b>	<b>16</b>
<b>6.1 AC Power line Conducted Emissions Tests .....</b>	<b>16</b>
<b>6.2 General Radiated Emissions Tests .....</b>	<b>16</b>
<b>7. MAXIMUM PEAK OUTPUT POWER .....</b>	<b>17</b>
<b>7.1 Operating environment .....</b>	<b>17</b>
<b>7.2 Test set-up .....</b>	<b>17</b>
<b>7.3 Test Date.....</b>	<b>17</b>
<b>7.4 Test data for Mode 1_Normal.....</b>	<b>18</b>
<b>7.5 Test data for Mode 2_Long.....</b>	<b>20</b>
<b>7.6 Test data for Mode 3_Repeat.....</b>	<b>22</b>
<b>8. BAND EDGES .....</b>	<b>24</b>
<b>8.1 Operating environment .....</b>	<b>24</b>
<b>8.2 Test set-up .....</b>	<b>24</b>

8.3 Test Date.....	24
8.4 Test data for Mode 1_Normal.....	25
8.5 Test data for Mode 2_Long.....	27
8.6 Test data for Mode 3_Repeat.....	29
<b>9. FREQUENCY SEPARATION / OCCUPIED BANDWIDTH (20 dB BANDWIDTH).....</b>	<b>31</b>
9.1 Operating environment .....	31
9.2 Test set-up .....	31
9.3 Test Date.....	31
9.4 Test data for Mode 1_Normal.....	32
9.4.1 Carrier Frequency / 20 dB Bandwidth .....	32
9.5 Test data for Mode 2_Long.....	35
9.5.1 Carrier Frequency Separation / 20 dB Bandwidth .....	35
9.6 Test data for Mode 3_Repeat.....	38
9.6.1 Carrier Frequency / 20 dB Bandwidth .....	38
<b>10. NUMBER OF HOPPING FREQUENCY .....</b>	<b>41</b>
10.1 Operating environment .....	41
10.2 Test set-up .....	41
10.3 Test Date.....	41
10.4 Test data for Mode 1_Normal.....	42
10.5 Test data for Mode 2_Long.....	43
10.6 Test data for Mode 3_Repeat.....	44
<b>11. TIME OF OCCUPANCY (DWELL TIME) .....</b>	<b>45</b>
11.1 Operating environment .....	45
11.2 Test set-up .....	45
11.3 Test Date.....	45
11.4 Test data for Mode 1_Normal.....	46
11.5 Test data for Mode 2_Long.....	48
11.6 Test data for Mode 3_Repeat.....	50
<b>12. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND .....</b>	<b>52</b>
12.1 Operating environment .....	52
12.2 Test set-up for conducted / radiated measurement .....	52
12.3 Test Date.....	53
12.4 Test data for conducted emission .....	54
12.4.1 Test data for Mode 1_Normal .....	54
12.4.2 Test data for Mode 2_Long .....	61
12.4.3 Test data for Mode 3_Repeat.....	68

12.5 Test data for Transmitting mode radiated emission (Transmitting Mode) .....	75
12.5.1 Spurious & Harmonic Radiated Emission above 1 GHz.....	75
<b>13. RADIATED EMISSION TEST .....</b>	<b>78</b>
13.1 Operating environment .....	78
13.2 Test set-up .....	78
13.3 Test Date.....	78
13.4 Test data for Transmitting Mode .....	79
13.4.1 Test data for Mode 1_Normal .....	79
13.4.2 Test data for Mode 2_Long .....	81
13.4.3 Test data for Mode 3_Repeat.....	83
<b>14. CONDUCTED EMISSION TEST .....</b>	<b>85</b>
14.1 Operating environment .....	85
14.2 Test set-up .....	85
14.3 Test Date.....	85
14.4 Test Data for Trasmitting Mode.....	86
14.4.1 Test data for Mode 1_Normal .....	86
14.4.2 Test data for Mode 2_Long .....	88
14.4.3 Test data for Mode 3_Repeat.....	90
<b>15. LIST OF TEST EQUIPMENT .....</b>	<b>92</b>

**Revision History**

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-231-RWD-034	January 31, 2023	Initial Release	All

### 1. VERIFICATION OF COMPLIANCE

Applicant : Westcom Wireless Inc.  
 Address : 2773 Leechburg Road, Lower Burrell, Pennsylvania, 15068, United States  
 Manufacturer : Westcom Wireless Inc.  
 Address : 2773 Leechburg Road, Lower Burrell, Pennsylvania, 15068, United States  
 Contact Person : Frank Girardi / President  
 Telephone No. : +1-724-337-1400  
 FCC ID : 2AO37-ATLASAIR  
 Model Name : ATLAS AIR  
 Brand Name : -  
 Serial Number : N/A  
 Date : January 31, 2023

EQUIPMENT CLASS	DSS – PART 15 SPREAD SPECTRUM TRANSMITTER
E.U.T. DESCRIPTION	ProCom
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)(i)	20 dB Bandwidth	Met the Limit / PASS
15.247(b)(2)	Conducted Maximum Peak Output Power	Met the Limit / PASS
15.247(a)(1)	Carrier Frequency Separation	Met the Limit / PASS
15.247(a)(1)(i)	Number of Hopping Frequencies	Met the Limit / PASS
15.247(a)(1)(i)	Time of Occupancy	Met the Limit / PASS
15.247(d)	Conducted Spurious Emissions	Met the Limit / PASS
15.247(d)	Band Edge(Out of Band Emissions)	Met the Limit / PASS
15.207(a)	AC Power line Conducted Emissions	Met the Limit / PASS
15.247(d), 15.205(a), 15.209(a)	Radiated Spurious Emissions	Met the Limit / PASS
15.247(d), 15.205(a), 15.209(a)	Radiated Restricted Band Edge	Met the Limit / PASS

Note.: All test items have been performed for each Normal (CH 20 ~ CH 220), Long (CH12 ~ CH 138) and Repeat (CH 20 ~ CH 220) Mode. And the conducted Emissions and Radiated Spurious Emissions have been performed for Transmitting mode.

## 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 Westcom Wireless Inc., Model ATLAS AIR(referred to as the EUT in this report) is a ProCom. Product specification information described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	ProCom	
Temperature Range	-10 °C ~ 50 °C	
OPERATING FREQUENCY	902 MHz ~ 928 MHz	
MODULATION TYPE	GFSK	
RF OUTPUT POWER	Mode 1_Normal	23.01 dBm
	Mode 2_Long	29.70 dBm
	Mode 3_Repeat	29.60 dBm
ANTENNA TYPE	Helical Antenna	
ANTENNA GAIN	4.05 dBi	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	48 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
ATLAS AIR	Basic Model (Dual Muff and Speaker applied)	<input checked="" type="checkbox"/>
ATLASAIR-S	This model is identical to the basic model except that this model applies Single Muff and the Speaker is only equipped on the side applying muff. (See Note 3)	<input 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.
3. As the Worst case of Emission test for the basic model has been performed, the test for the different emission of Multiple model has not been tested.

### 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	Westcom Wireless Inc.	ATLAS AIR	N/A
Sub Board	Westcom Wireless Inc.	ATLAS AIR	N/A
Power Board	Westcom Wireless Inc.	ATLAS AIR	N/A
Battery	Mirim Technology	MS35E-M	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
ATLAS AIR	Westcom Wireless Inc.	ProCom (EUT)	
HP ProBook 450 G7	HP	NoteBook PC	Test JIG
JIG	Bicom	Test JIG	NetBook PC

### 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 EUT was set as below to get a maximum emission levels from the EUT.

Mode 1 (Normal): 902.5 MHz, 915.0 MHz, and 927.5 MHz (Low/Middle/High)

Mode 2 (Long): 902.4 MHz, 914.8 MHz, and 927.6 MHz (Low/Middle/High)

Mode 3 (Repeat): 902.5 MHz, 915.0 MHz, and 927.5 MHz (Low/Middle/High)

The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XZ” axis, but the worst data was recorded in this report.

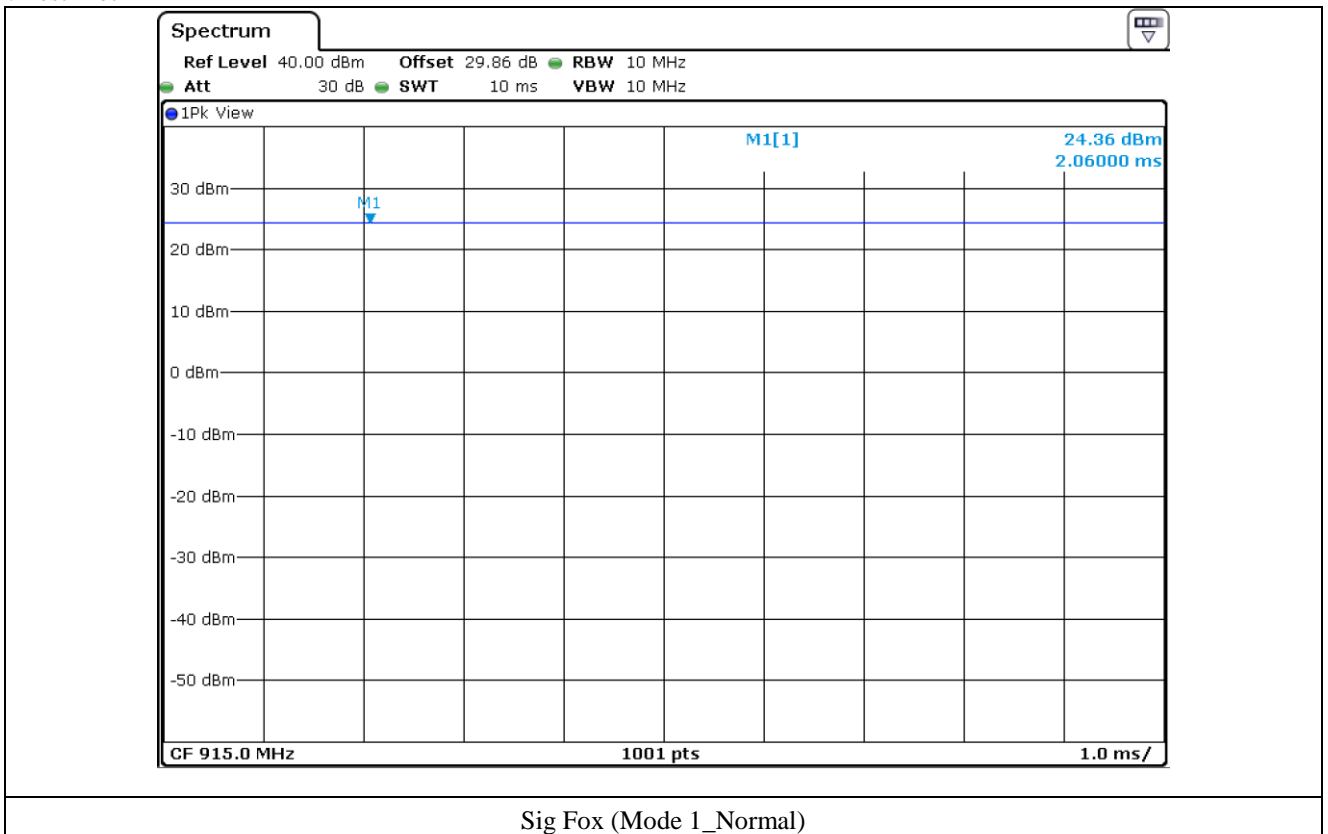
- Duty Cycle

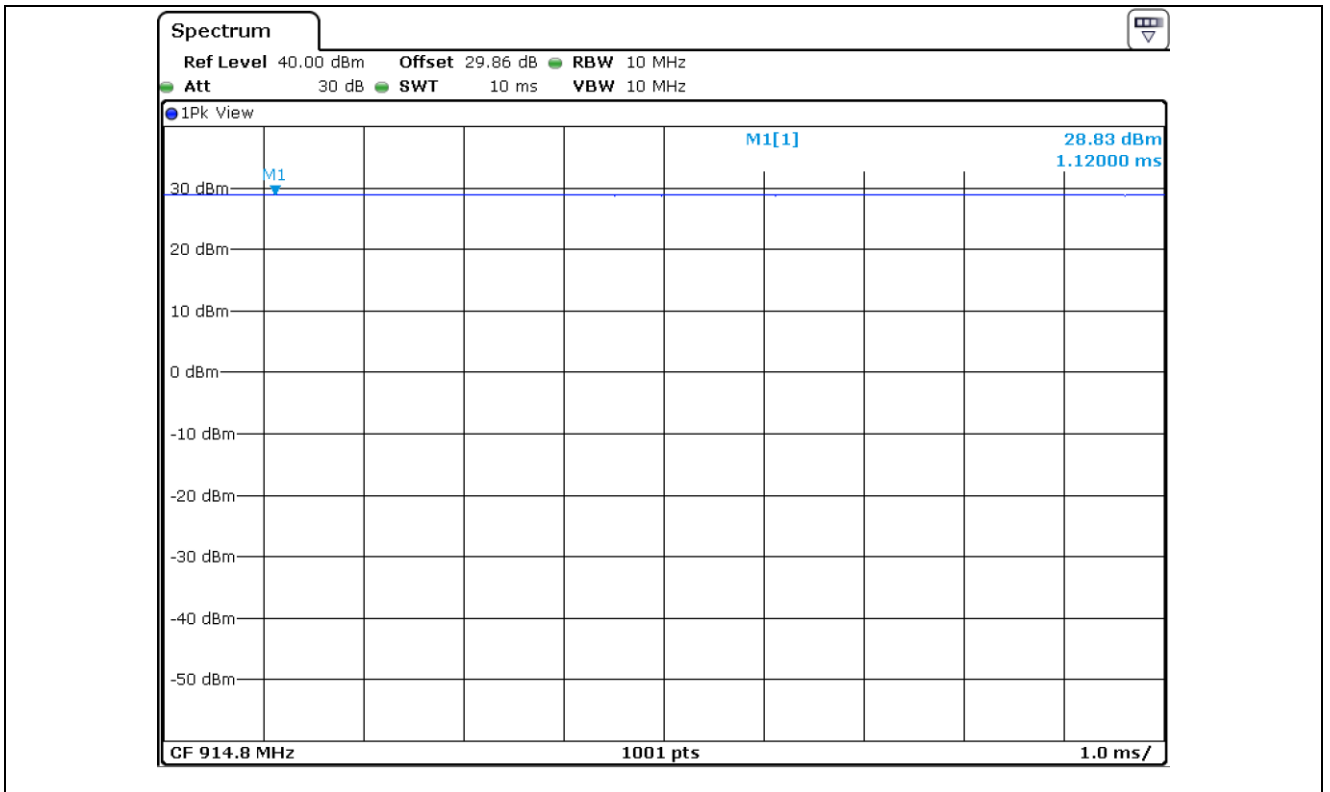
Mode	Tx On Time [ ms ]	Tx Off Time [ ms ]	Duty Cycle [ % ]	Correction Factor [ dB ]
GFSK (Mode 1_Normal)	-	-	100 %	-
GFSK (Mode 2_Long)	-	-	100 %	-
GFSK (Mode 3_Repeat)	-	-	100 %	-

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

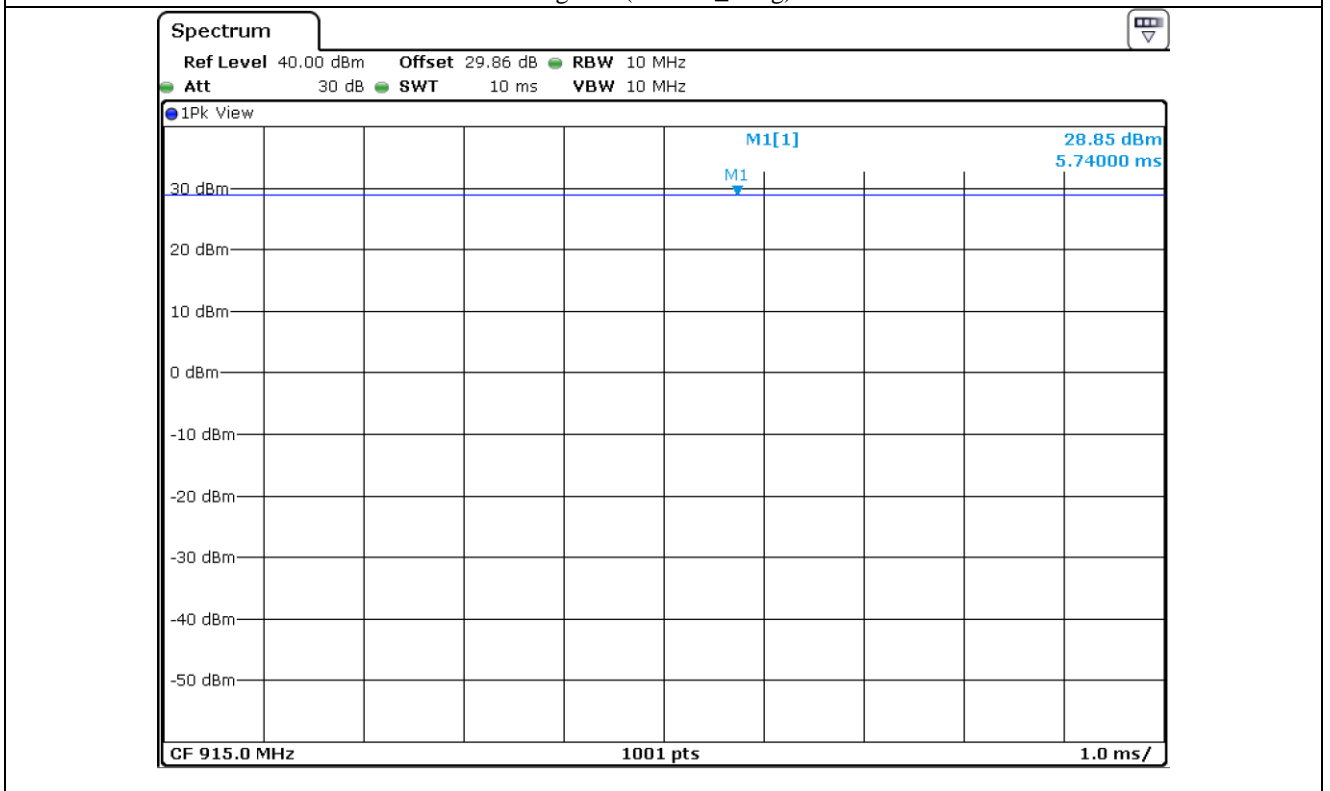
Correction Factor : 10 \* Log(1 / (Duty Cycle / 100))

- Test Plot





Sig Fox (Mode 2\_Long)



Sig Fox (Mode 1\_Repeat)

-. Channel List

[Mode 1\_Normal]

Channel	Frequency[MHz]	Channel	Frequency[MHz]	Channel	Frequency[MHz]
20	902.500	96	912.000	172	921.500
24	903.000	100	912.500	176	922.000
28	903.500	104	913.000	180	922.500
32	904.000	108	913.500	184	923.000
36	904.500	112	914.000	188	923.500
40	905.000	116	914.500	192	924.000
44	905.500	120	915.000	196	924.500
48	906.000	124	915.500	200	925.000
52	906.500	128	916.000	204	925.500
56	907.000	132	916.500	208	926.000
60	907.500	136	917.000	212	926.500
64	908.000	140	917.500	216	927.000
68	908.500	144	918.000	220	927.500
72	909.000	148	918.500	-	-
76	909.500	152	919.000	-	-
80	910.000	156	919.500	-	-
84	910.500	160	920.000	-	-
88	911.000	164	920.500	-	-
92	911.500	168	921.000	-	-

[Mode 2\_Long]

Channel	Frequency[MHz]	Channel	Frequency[MHz]	Channel	Frequency[MHz]
12	902.400	60	912.000	108	921.600
14	902.800	62	912.400	110	922.000
16	903.200	64	912.800	112	922.400
18	903.600	66	913.200	114	922.800
20	904.000	68	913.600	116	923.200
22	904.400	70	914.000	118	923.600
24	904.800	72	914.400	120	924.000
26	905.200	74	914.800	122	924.400
28	905.600	76	915.200	124	924.800
30	906.000	78	915.600	126	925.200
32	906.400	80	916.000	128	925.600
34	906.800	82	916.400	130	926.000
36	907.200	84	916.800	132	926.400
38	907.600	86	917.200	134	926.800
40	908.000	88	917.600	136	927.200
42	908.400	90	918.000	138	927.600
44	908.800	92	918.400	-	-
46	909.200	94	918.800	-	-
48	909.600	96	919.200	-	-
50	910.000	98	919.600	-	-
52	910.400	100	920.000	-	-
54	910.800	102	920.400	-	-
56	911.200	104	920.800	-	-
58	911.600	106	921.200	-	-

[Mode 3\_Repeat]

Channel	Frequency[MHz]	Channel	Frequency[MHz]	Channel	Frequency[MHz]
20	902.500	92	911.500	164	920.500
24	903.000	96	912.000	168	921.000
28	903.500	100	912.500	172	921.500
32	904.000	104	913.000	176	922.000
36	904.500	108	913.500	180	922.500
40	905.000	112	914.000	184	923.000
44	905.500	116	914.500	188	923.500
48	906.000	120	915.000	192	924.000
52	906.500	124	915.500	196	924.500
56	907.000	128	916.000	200	925.000
60	907.500	132	916.500	204	925.500
64	908.000	136	917.000	208	926.000
68	908.500	140	917.500	212	926.500
72	909.000	144	918.000	216	927.000
76	909.500	148	918.500	220	927.500
80	910.000	152	919.000	-	-
84	910.500	156	919.500	-	-
88	911.000	160	920.000	-	-

### 5.4 Configuration of Test System

**Line Conducted Test:** 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 Helical 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. MAXIMUM PEAK OUTPUT POWER

### 7.1 Operating environment

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

### 7.2 Test set-up

The maximum peak output power of the intentional radiator shall not exceed the following:

1. For frequency hopping systems operating in the 902-928 MHz band: 1 watt (30 dBm) for systems employing at least 50 hopping channels; and, 0.25 watts (24 dBm) for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.
2. The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.
3. The e.i.r.p of this module not exceed 4 W because the antenna gain not exceed not 6 dBi.



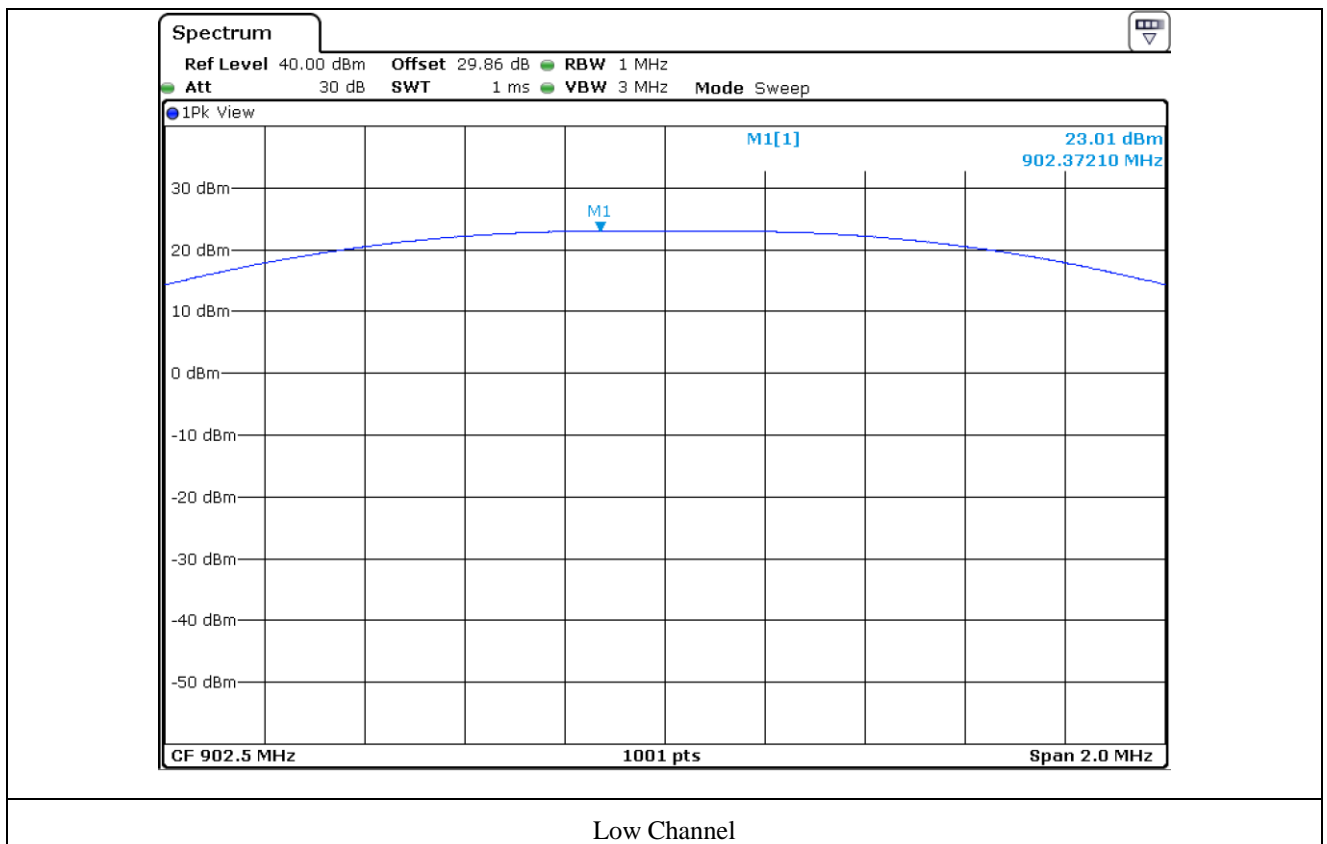
### 7.3 Test Date

October 28, 2022 ~ January 18, 2023

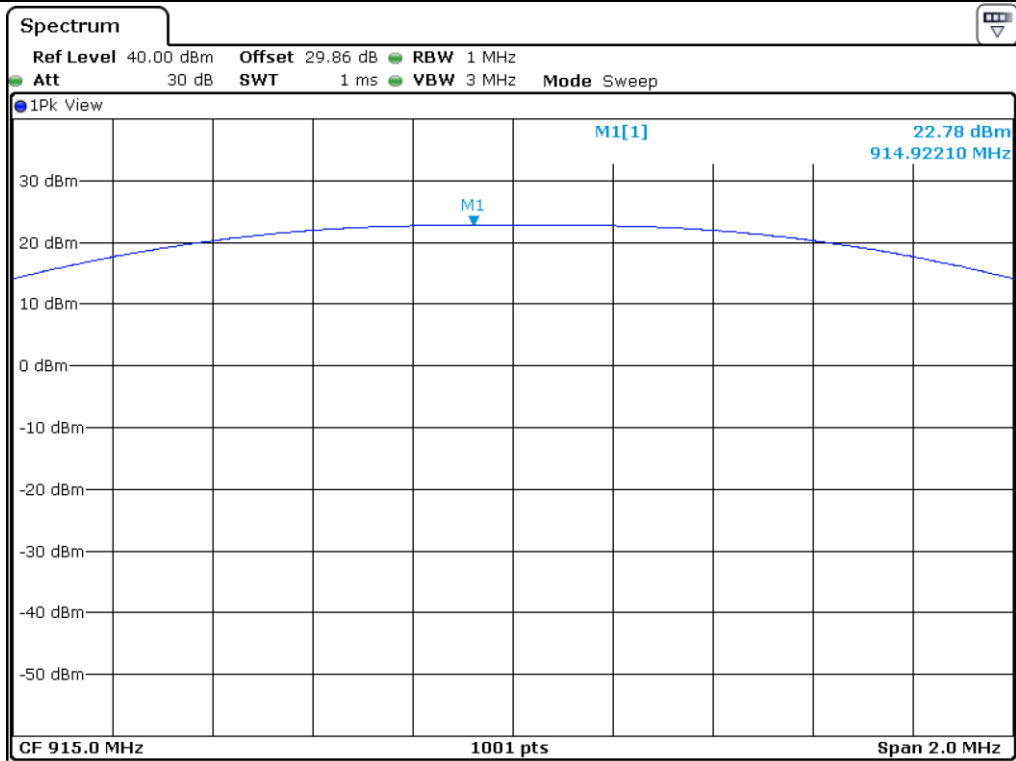
### 7.4 Test data for Mode 1\_Normal

-. Test Result : Pass

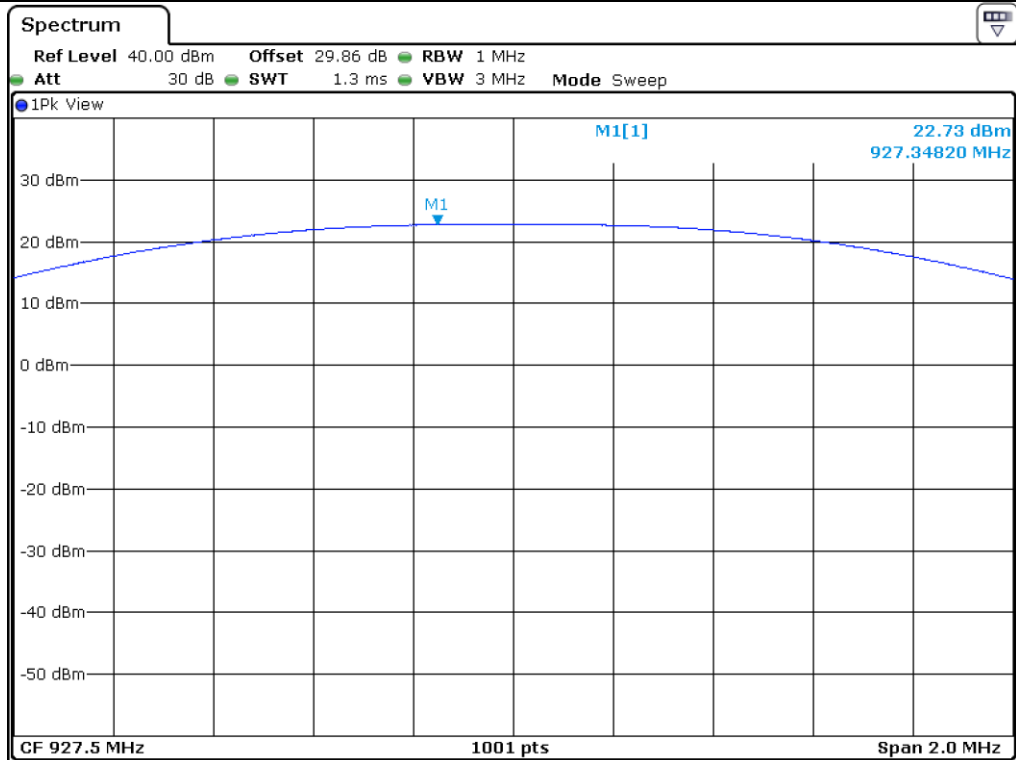
CHANNEL	FREQUENCY (MHz)	MEASURED VALUE		LIMIT (mW)	MARGIN (mW)
		(dBm)	(mW)		
LOW	902.5000	23.01	199.99	1 000	800.01
MIDDLE	915.0000	22.78	189.67	1 000	810.33
HIGH	927.5000	22.73	187.50	1 000	812.50



Low Channel



Middle Channel

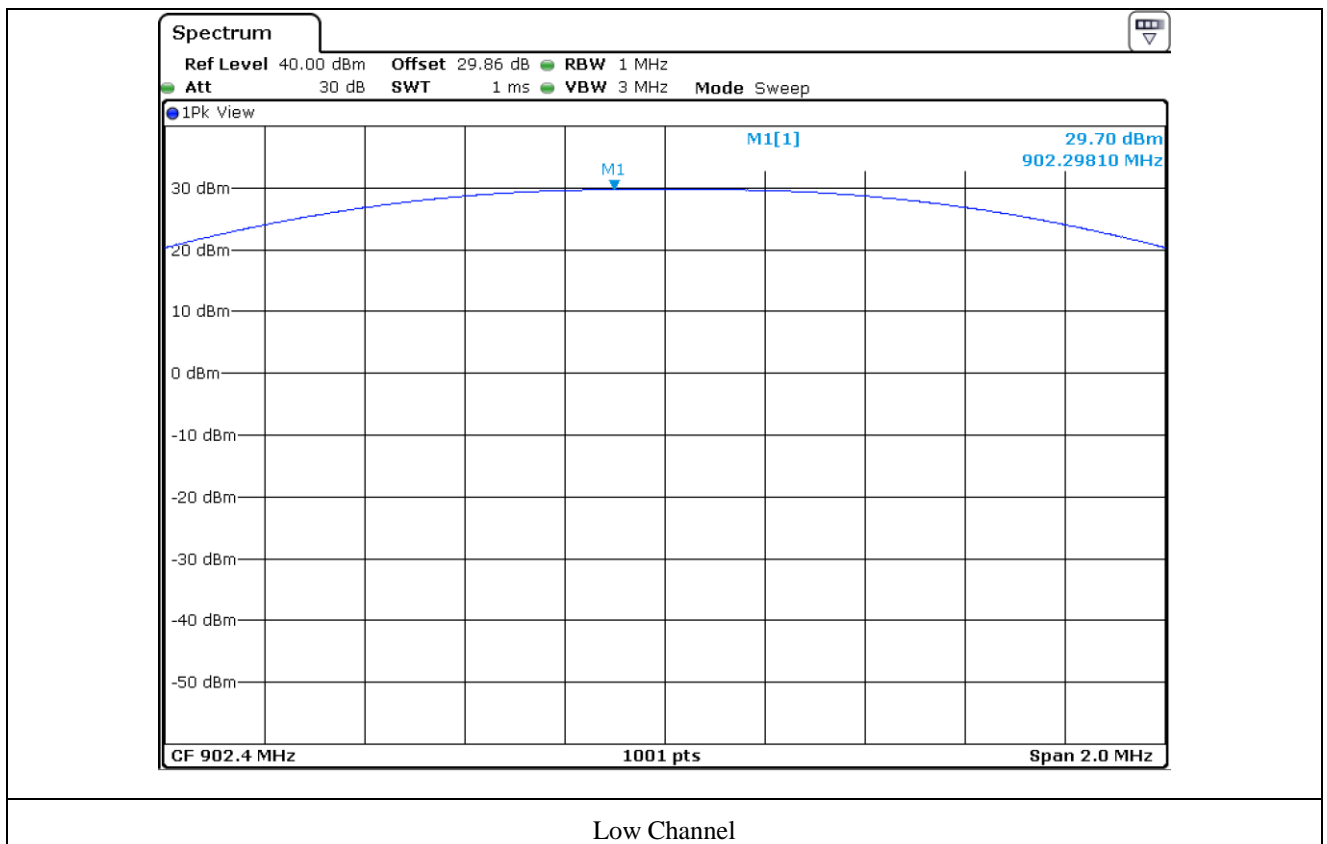


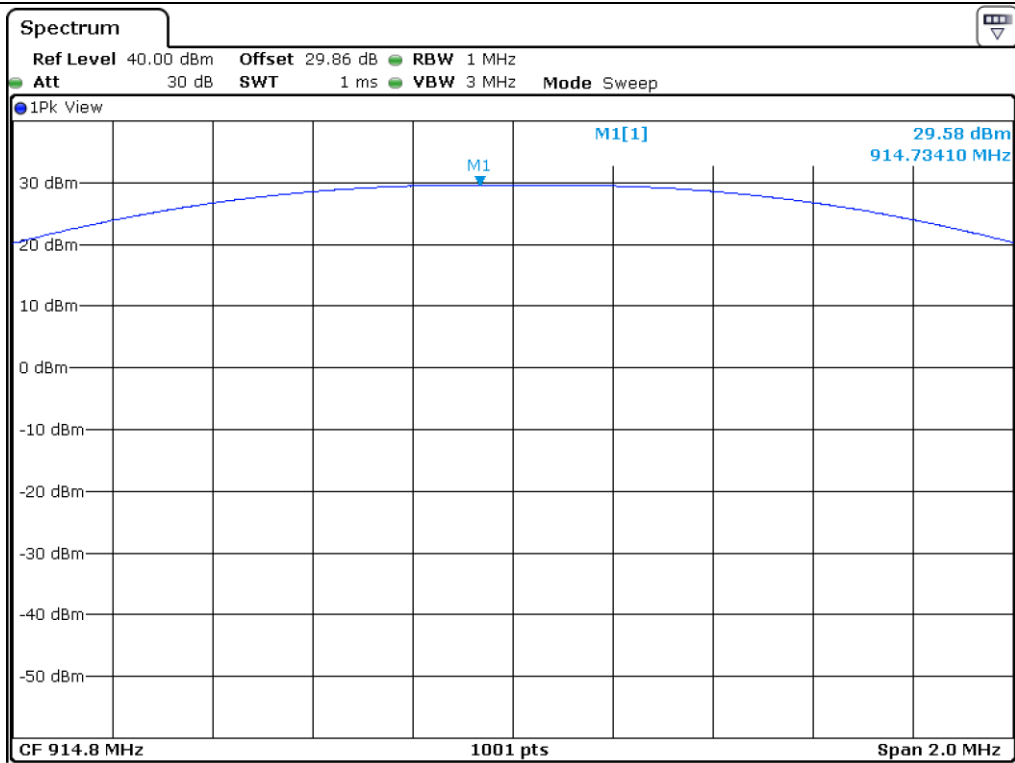
High Channel

### 7.5 Test data for Mode 2\_Long

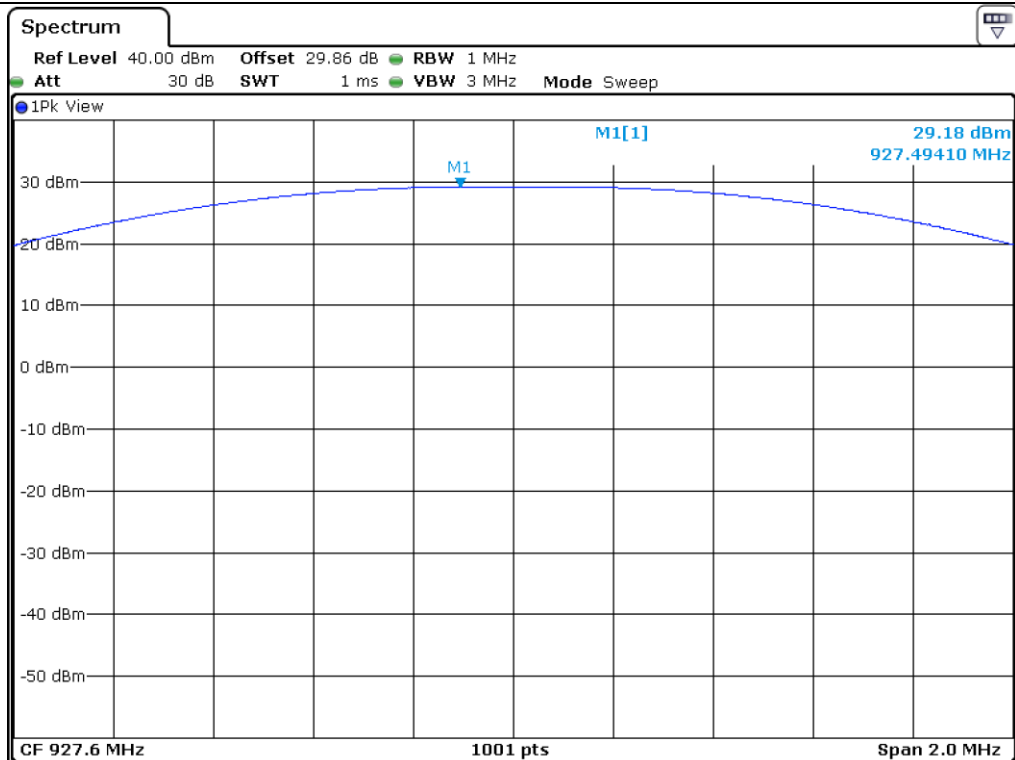
-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE		LIMIT (mW)	MARGIN (mW)
		(dBm)	(mW)		
LOW	902.4000	29.70	933.25	1 000.00	66.75
MIDDLE	914.8000	29.58	907.82	1 000.00	92.18
HIGH	927.6000	29.18	827.94	1 000.00	172.06





Middle Channel

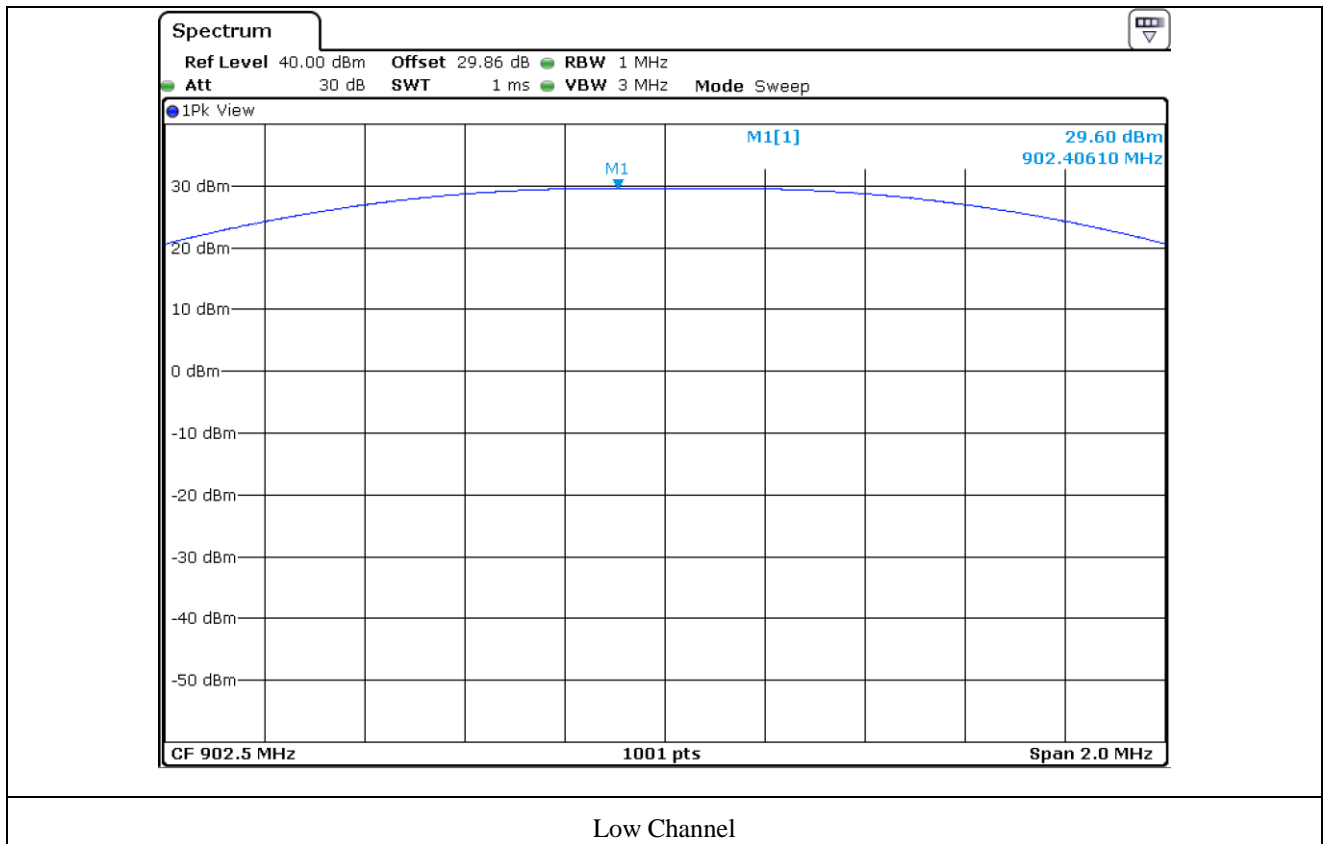


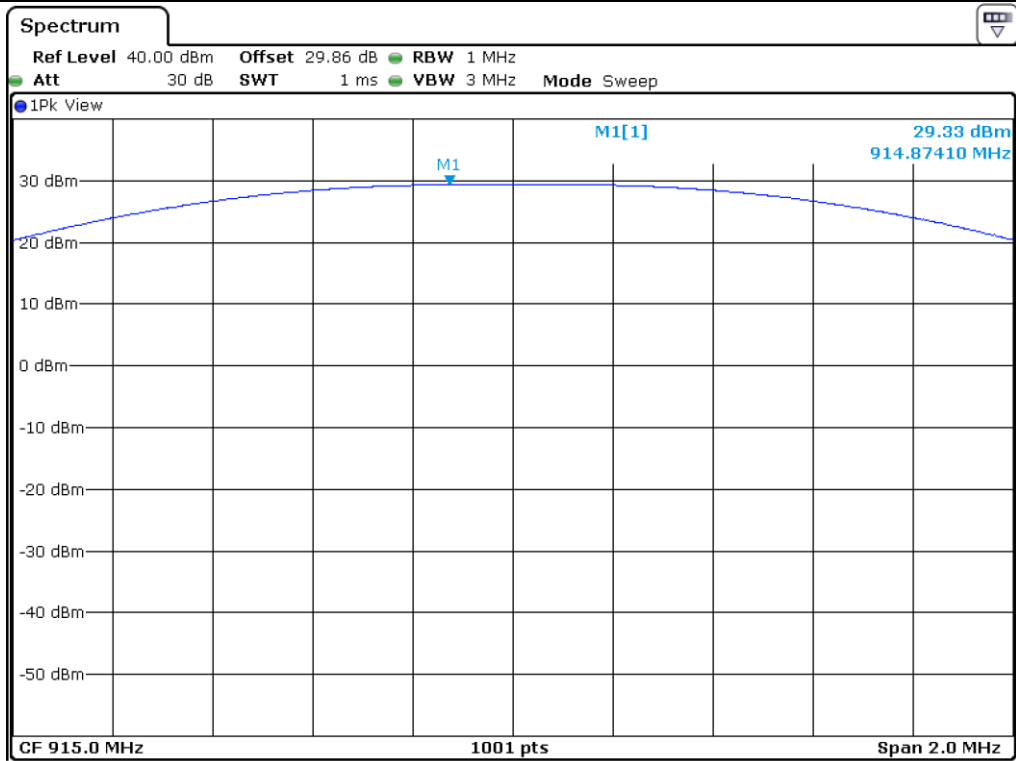
High Channel

### 7.6 Test data for Mode 3\_Repeat

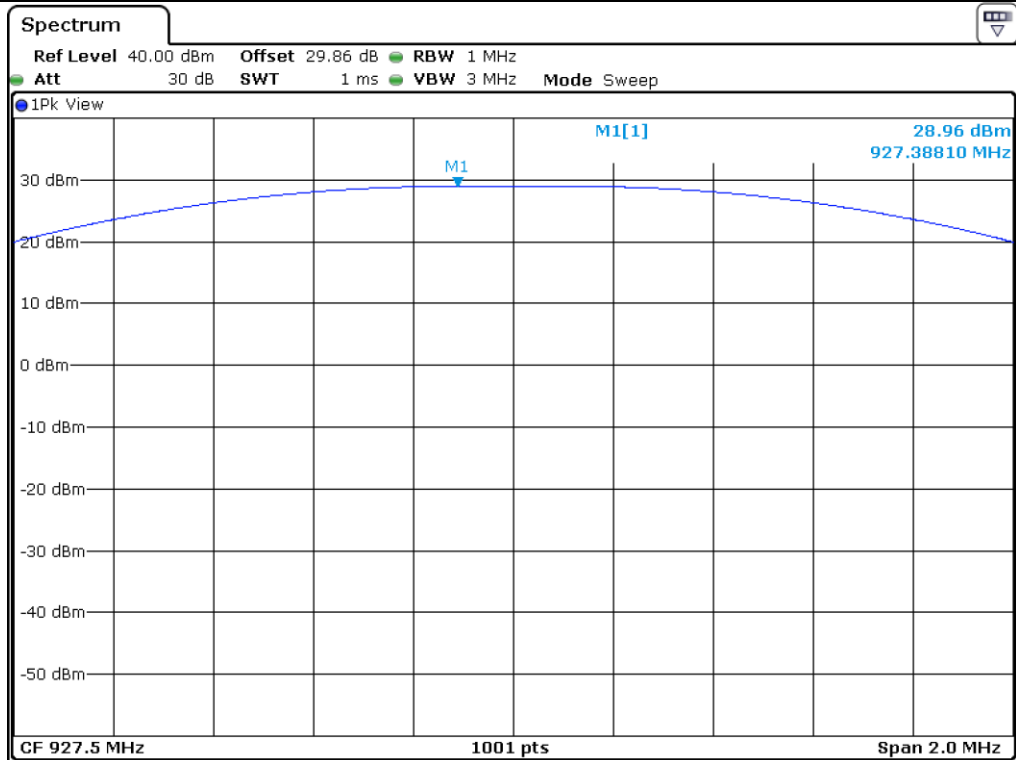
-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE		LIMIT (mW)	MARGIN (mW)
		(dBm)	(mW)		
LOW	902.5000	29.60	912.01	1 000.00	87.99
MIDDLE	915.0000	29.33	857.04	1 000.00	142.96
HIGH	927.5000	28.96	787.05	1 000.00	212.95





Middle Channel



High Channel

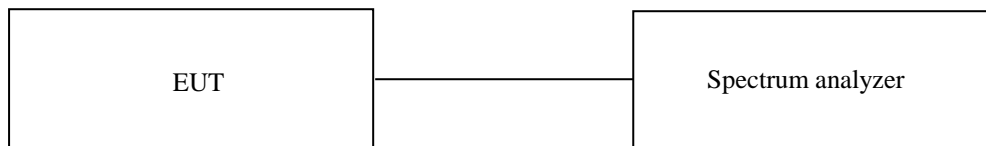
## 8. BAND EDGES

### 8.1 Operating environment

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

### 8.2 Test set-up

According to §15.247(d) in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.



### 8.3 Test Date

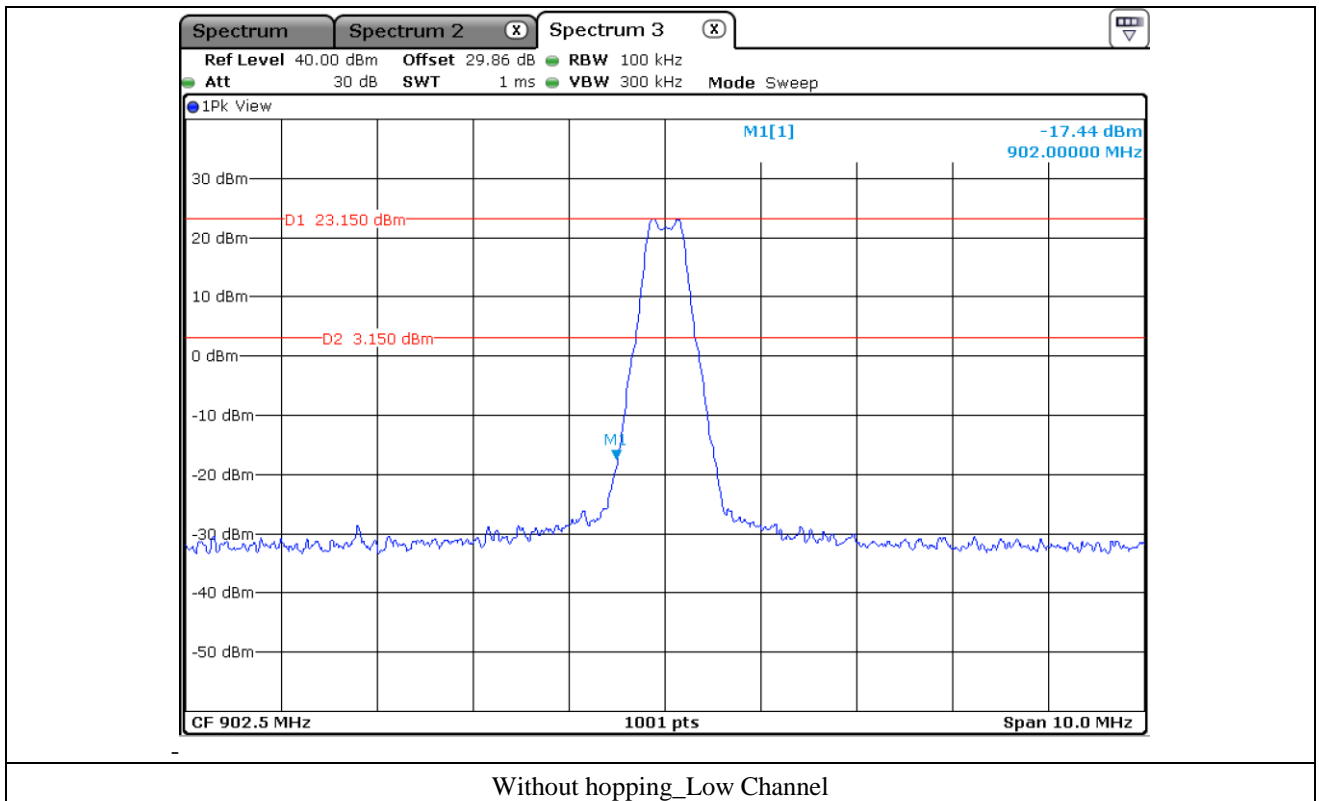
October 28, 2022 ~ January 18, 2023

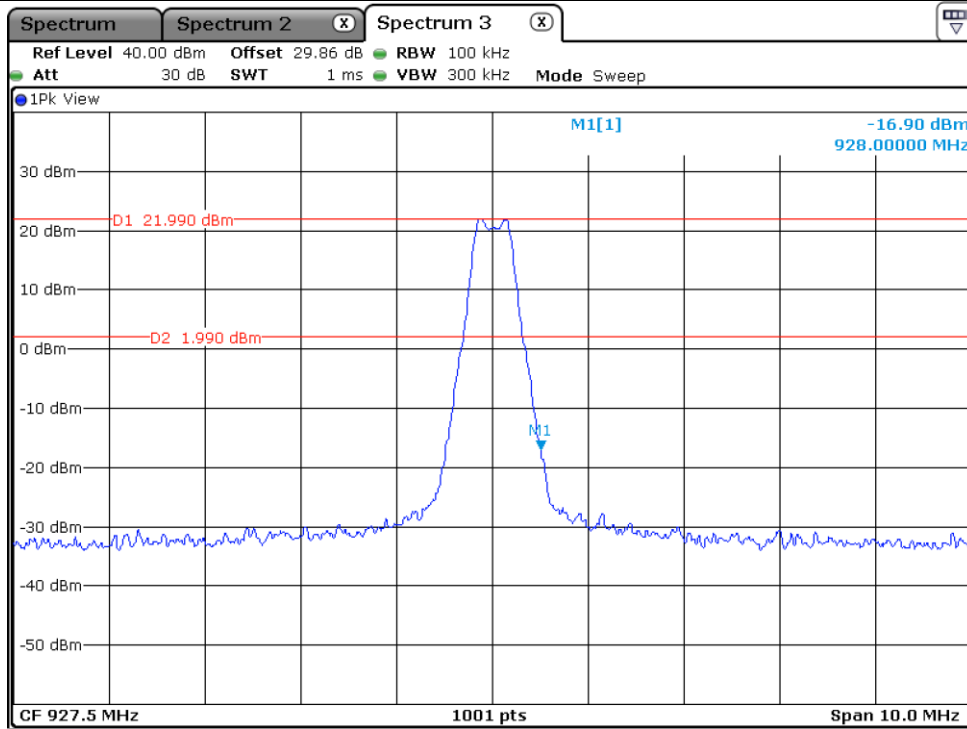


8.4 Test data for Mode 1\_Normal

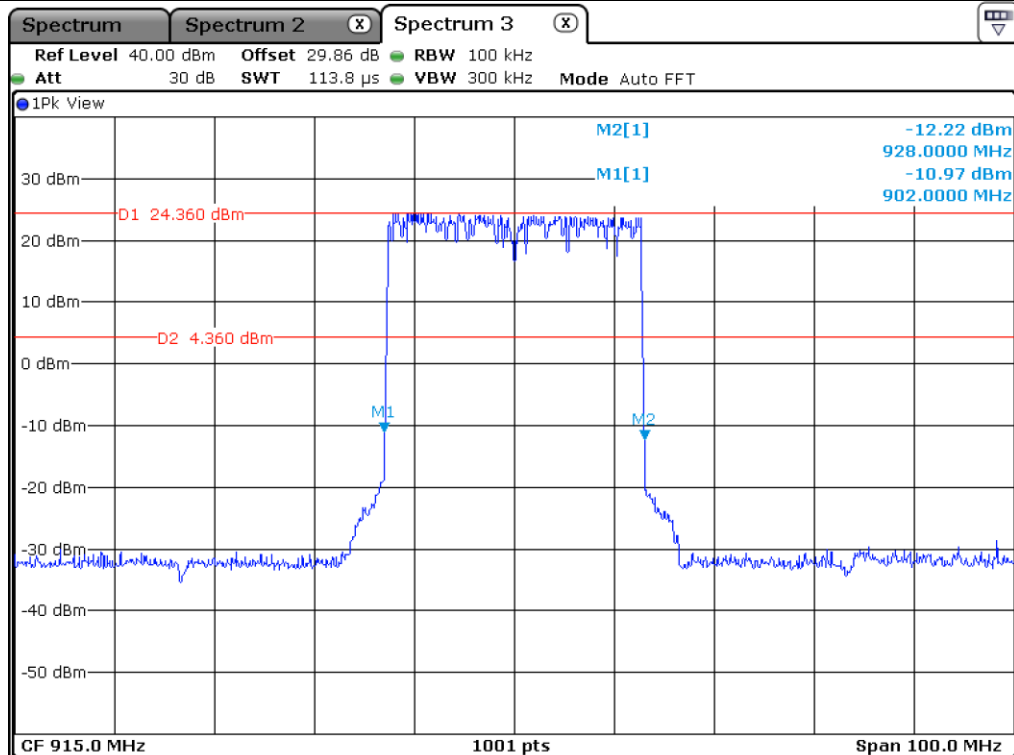
-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dB)	LIMIT (dBC)	MARGIN (dB)
<b>Without hopping</b>				
LOW	902.5000	40.59	20.00	20.59
HIGH	927.5000	38.89	20.00	18.89
<b>With Hopping</b>				
LOW	902.5000	35.33	20.00	15.33
HIGH	927.5000	36.58	20.00	16.58





Without hopping\_High Channel

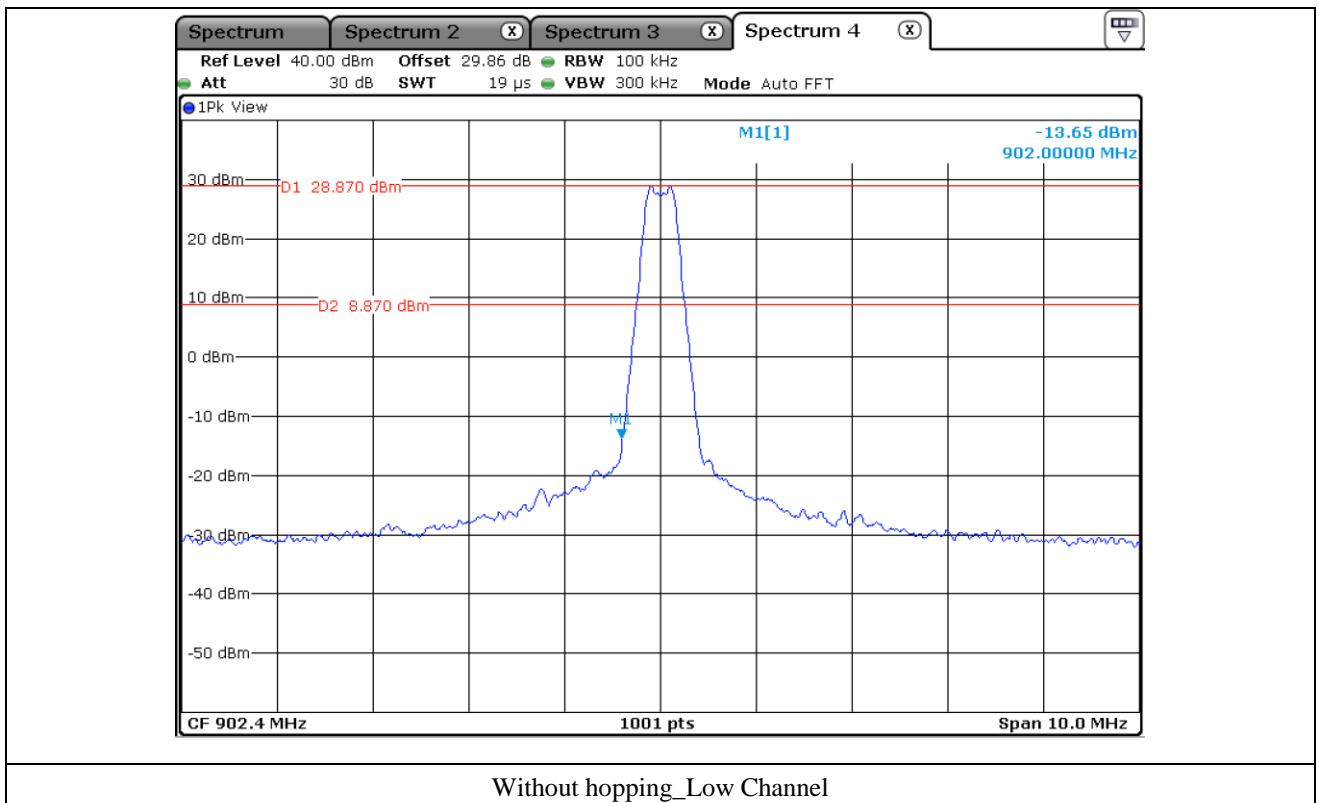


With Hopping

### 8.5 Test data for Mode 2\_Long

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dB)	LIMIT (dBC)	MARGIN (dB)
<b>Without hopping</b>				
LOW	902.4000	42.52	20.00	22.52
HIGH	927.6000	41.42	20.00	21.42
<b>With Hopping</b>				
LOW	902.4000	37.65	20.00	17.65
HIGH	927.6000	34.77	20.00	14.77

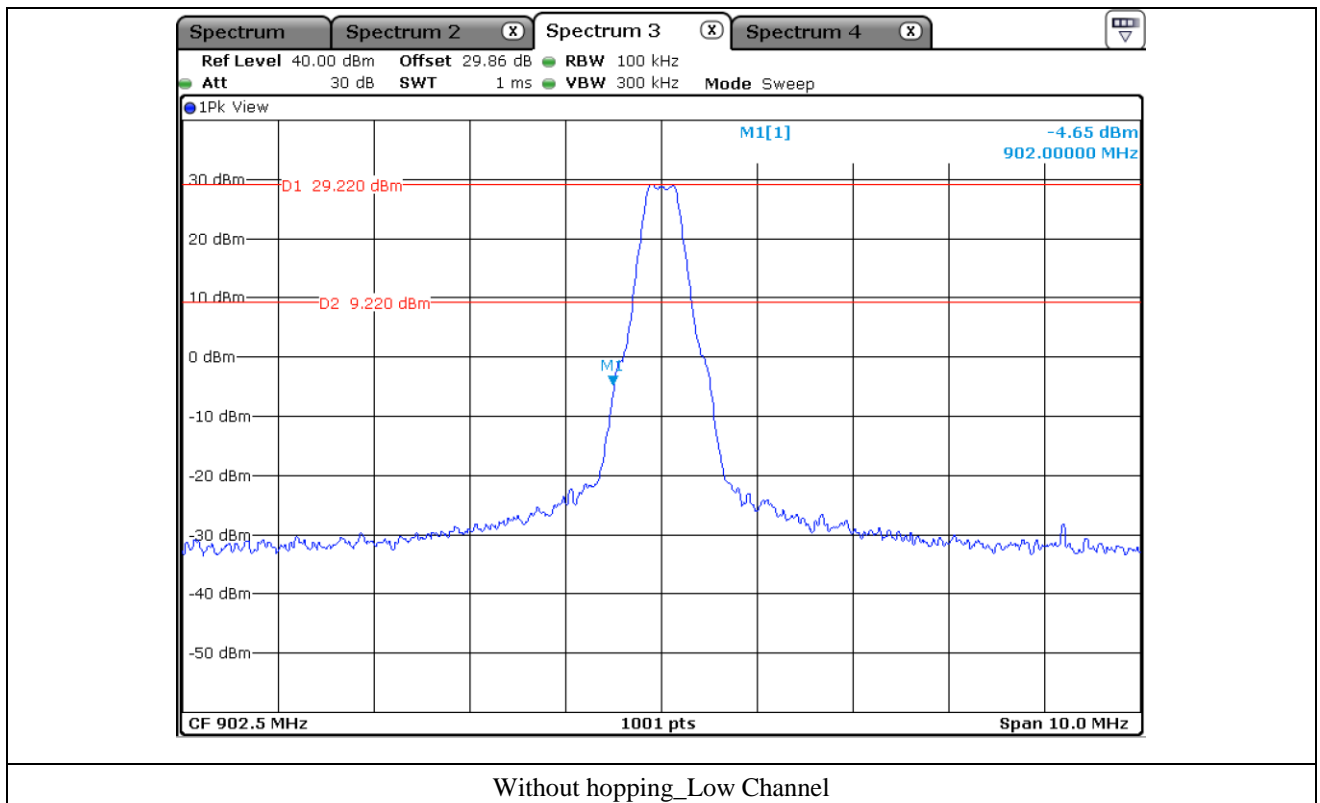




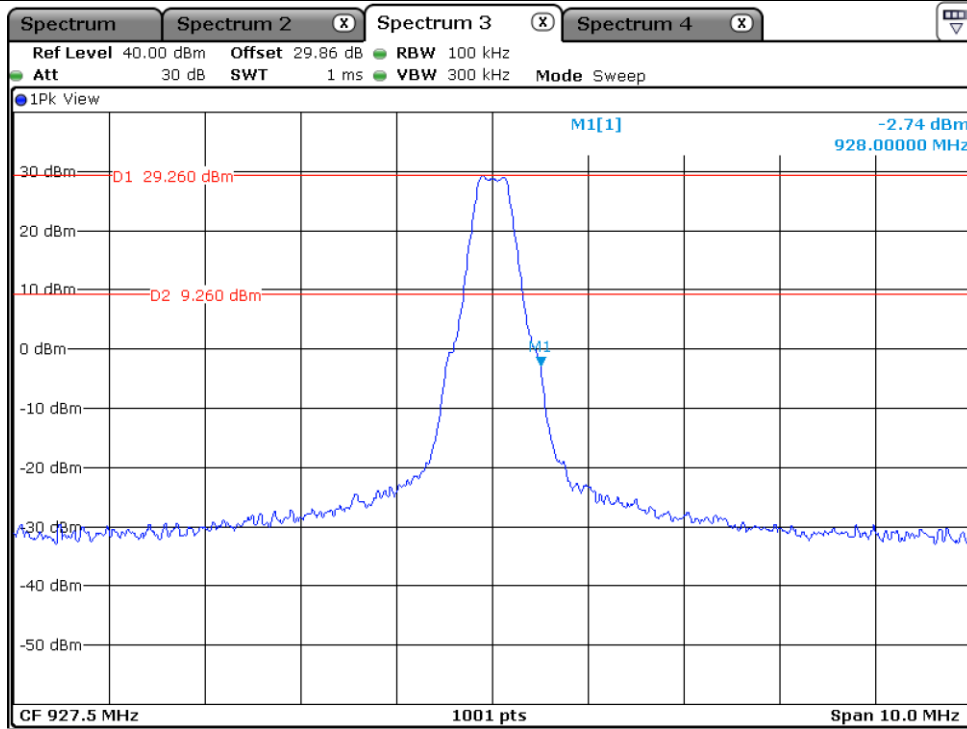
### 8.6 Test data for Mode 3\_Repeat

-. Test Result : Pass

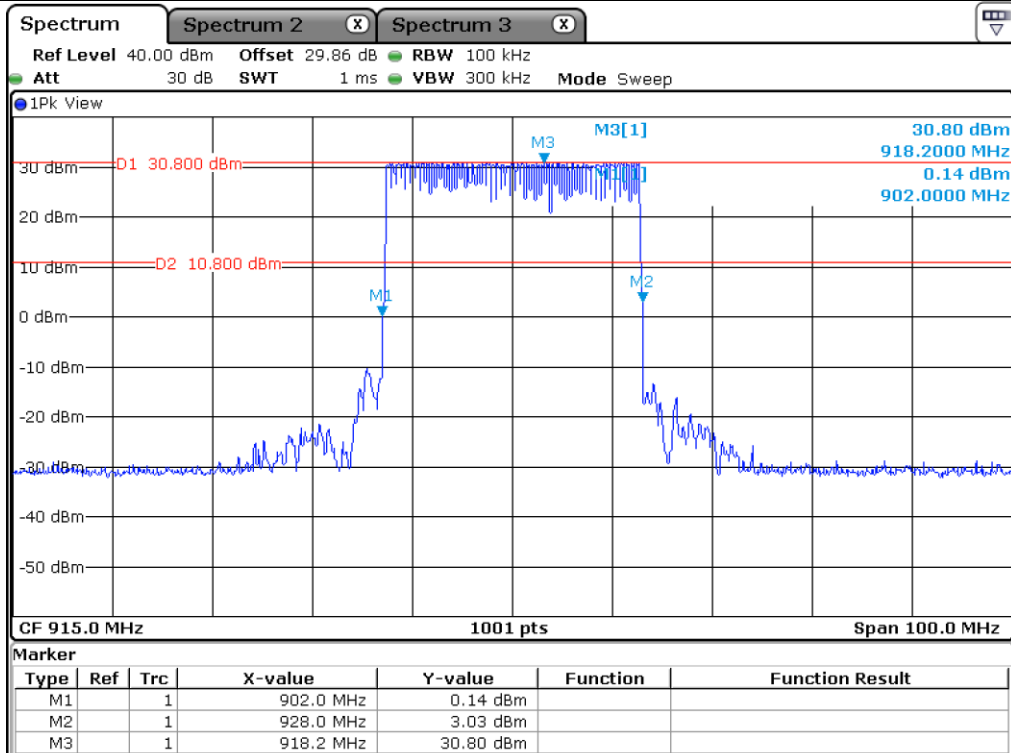
CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dB)	LIMIT (dBc)	MARGIN (dB)
<b>Without hopping</b>				
LOW	902.5000	33.87	20.00	13.87
HIGH	927.5000	32.00	20.00	12.00
<b>With Hopping</b>				
LOW	902.5000	30.66	20.00	10.66
HIGH	927.5000	27.77	20.00	7.77



Without hopping\_Low Channel



Without hopping\_High Channel



With Hopping

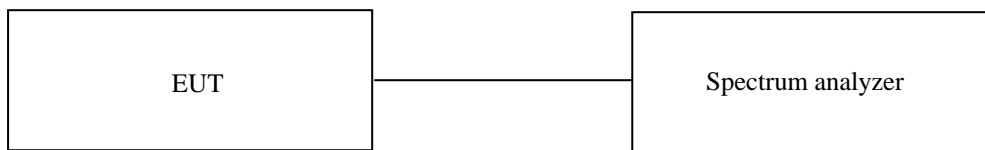
## 9. FREQUENCY SEPARATION / OCCUPIED BANDWIDTH (20 dB BANDWIDTH)

### 9.1 Operating environment

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

### 9.2 Test set-up

According to §15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.



### 9.3 Test Date

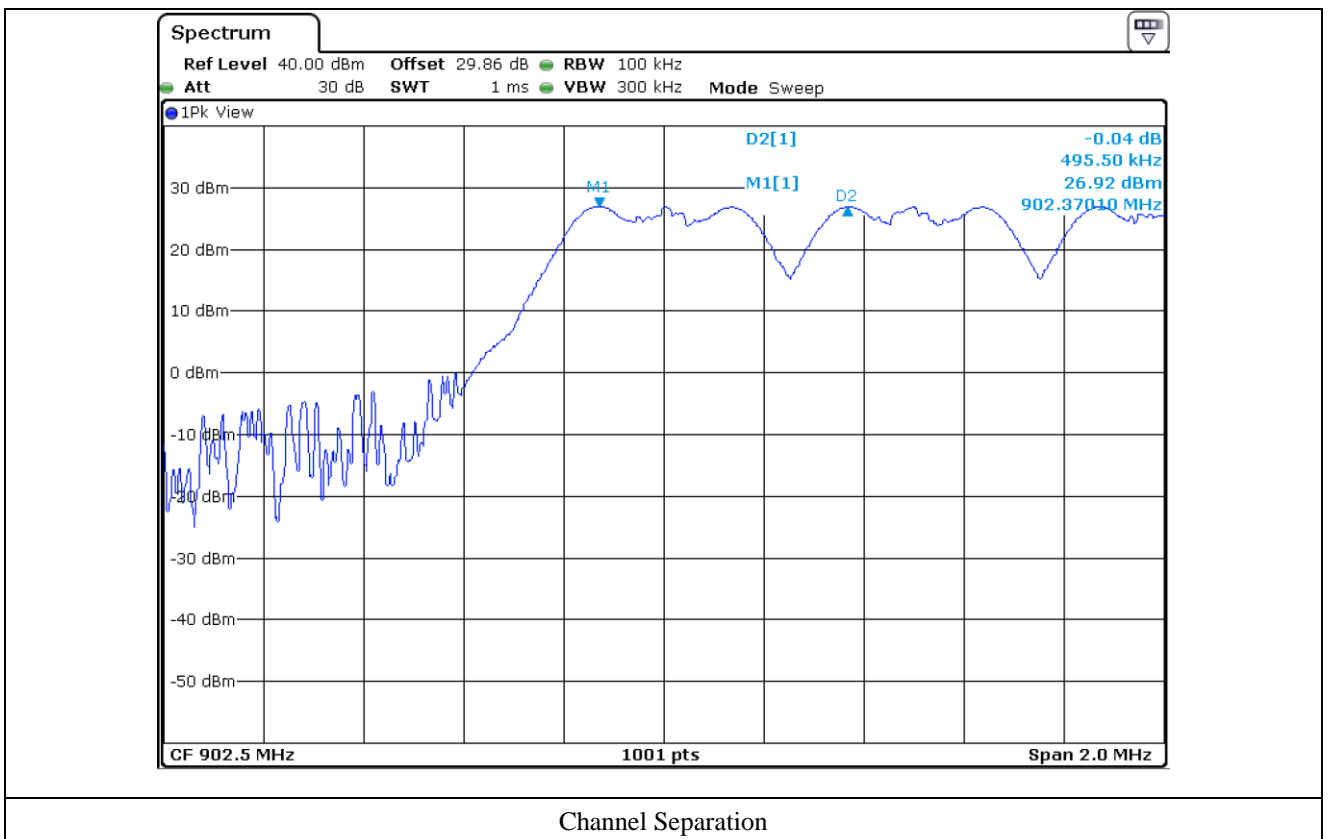
October 28, 2022 ~ January 18, 2023

9.4 Test data for Mode 1\_Normal

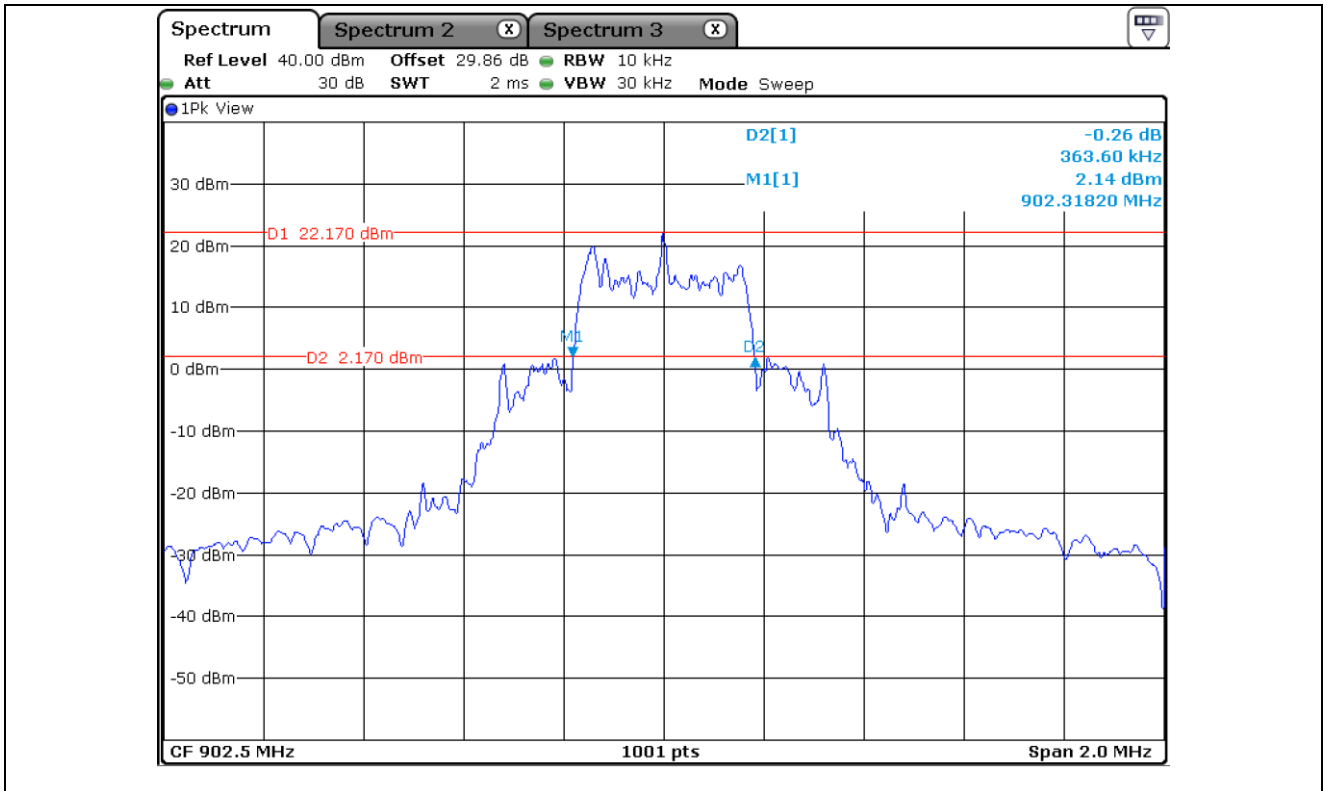
9.4.1 Carrier Frequency / 20 dB Bandwidth

- Test Result : Pass

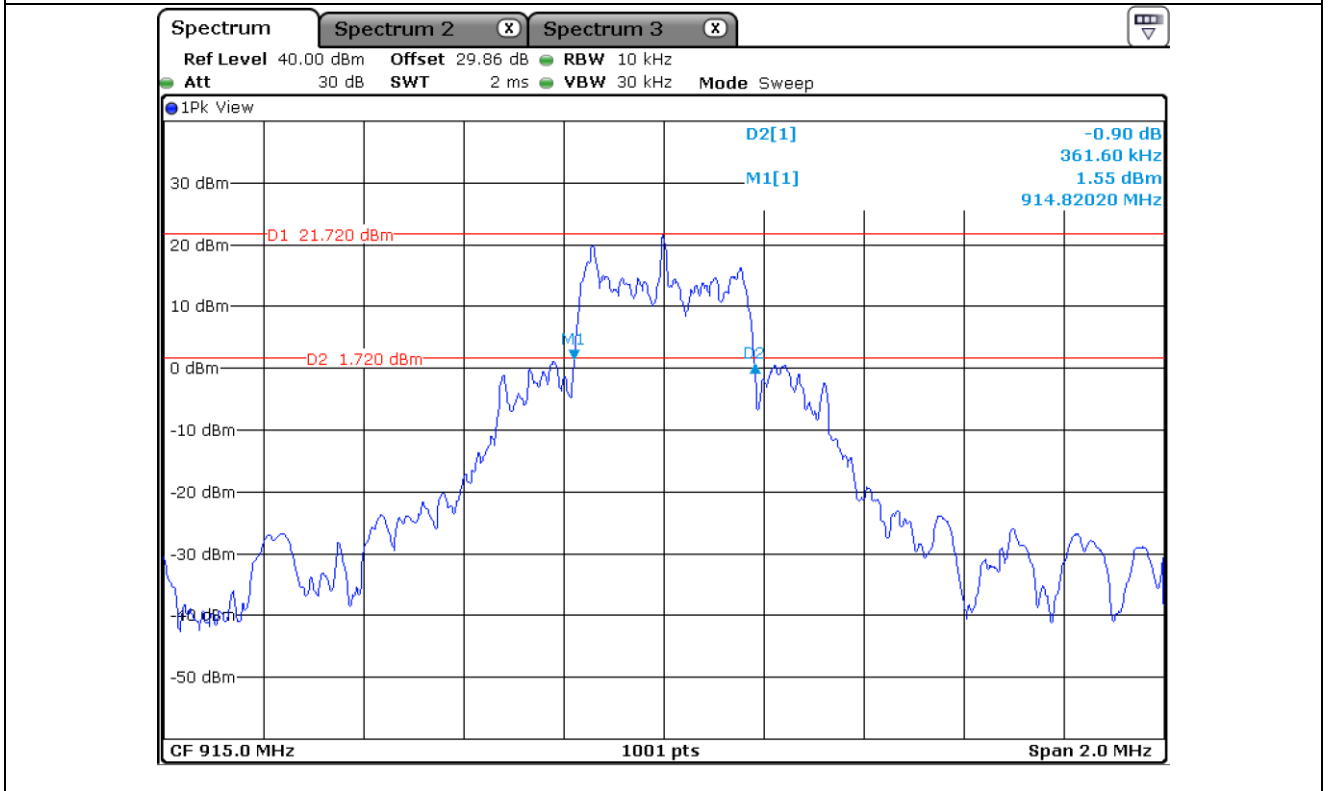
Channel Separation (kHz)	20 dB Bandwidth		Limit (kHz)	Result
	Channel	Measured Value (kHz)		
500.00	LOW	363.60	> 25 Or > 20 dB B.W. of Hopping Channel	Pass
	MIDDLE	361.60		
	HIGH	357.60		



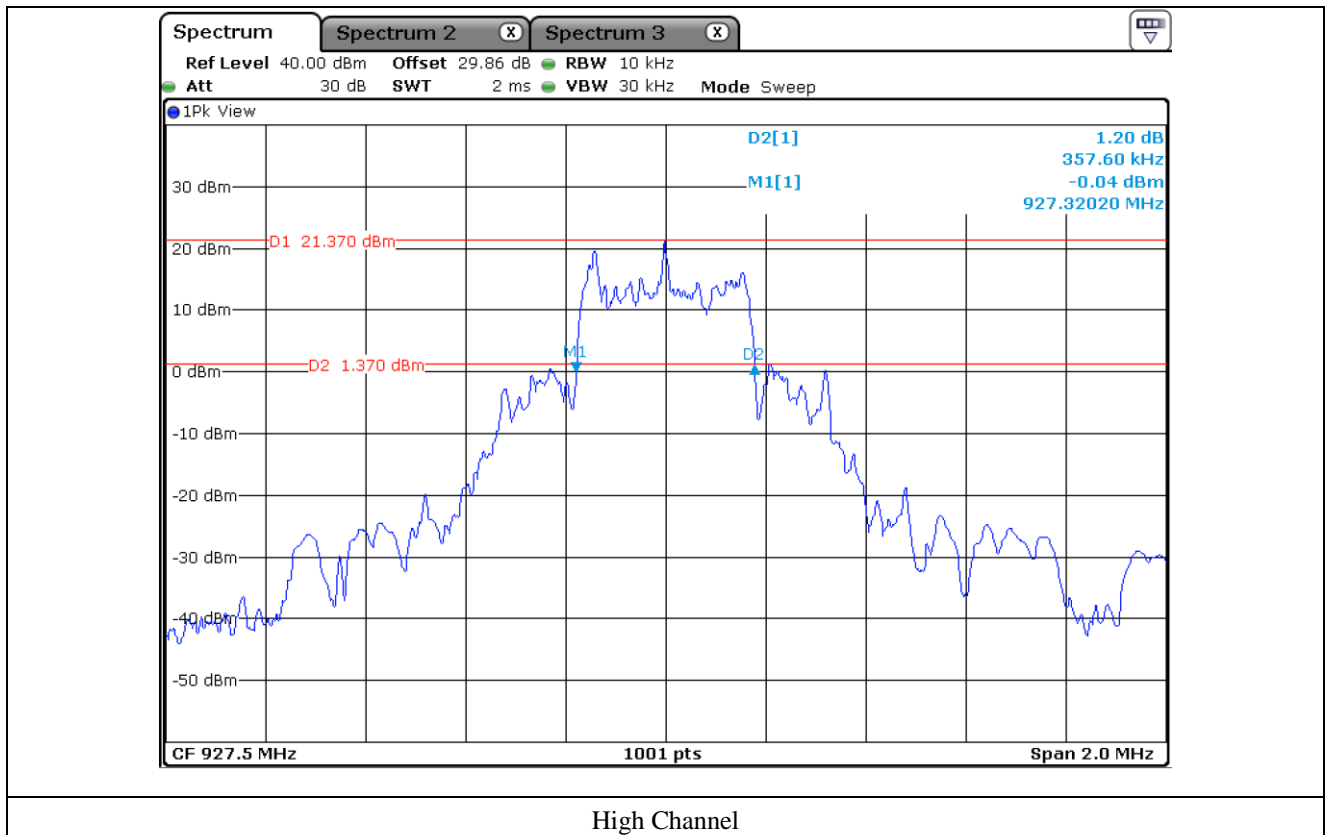




Low Channel



Middle Channel



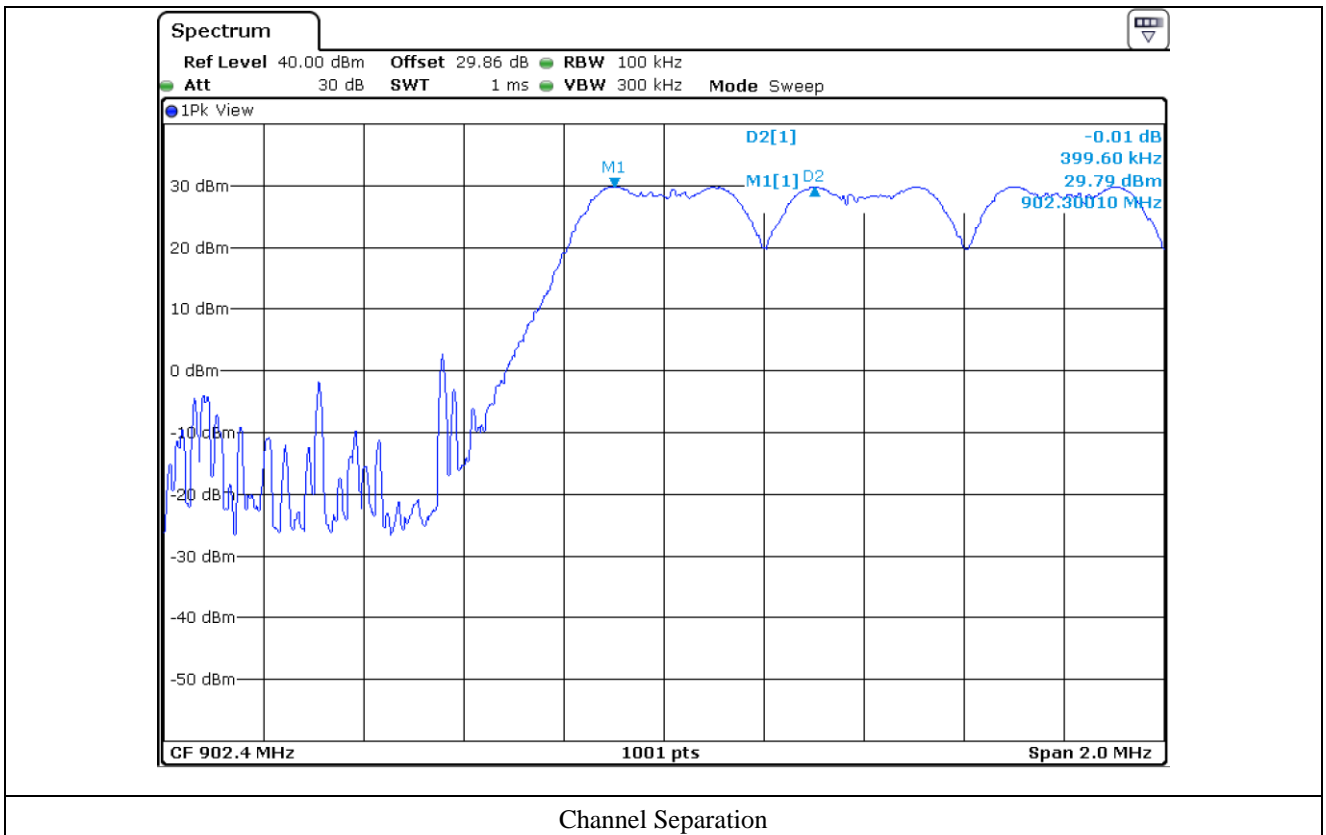
High Channel

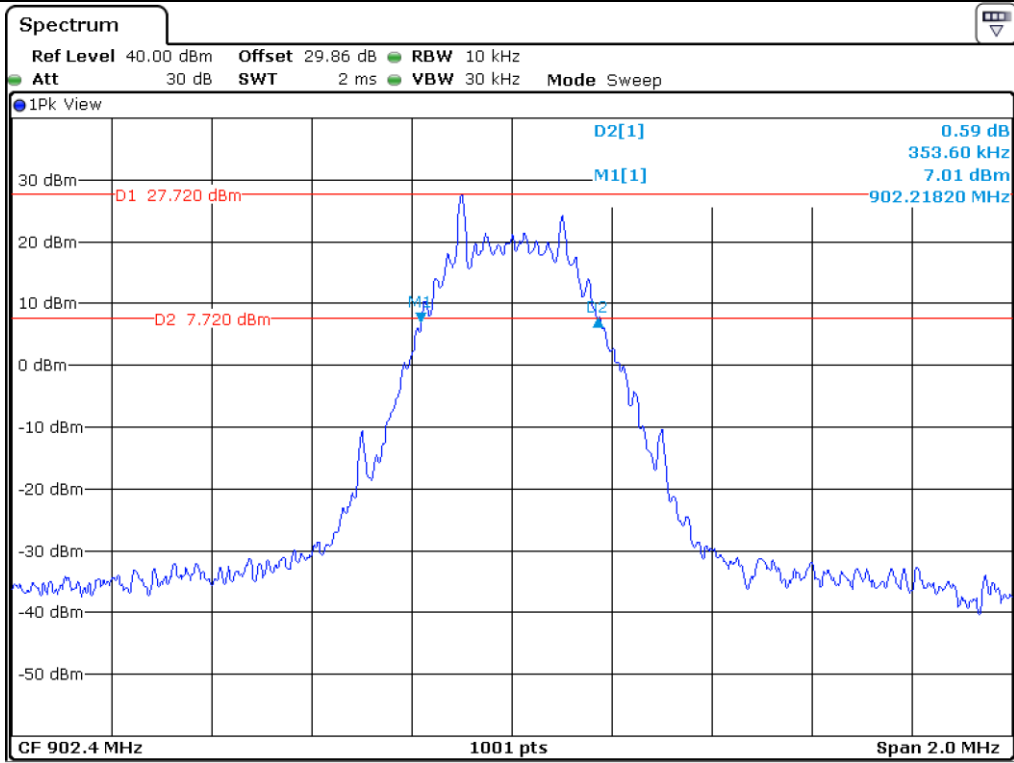
9.5 Test data for Mode 2\_Long

9.5.1 Carrier Frequency Separation / 20 dB Bandwidth

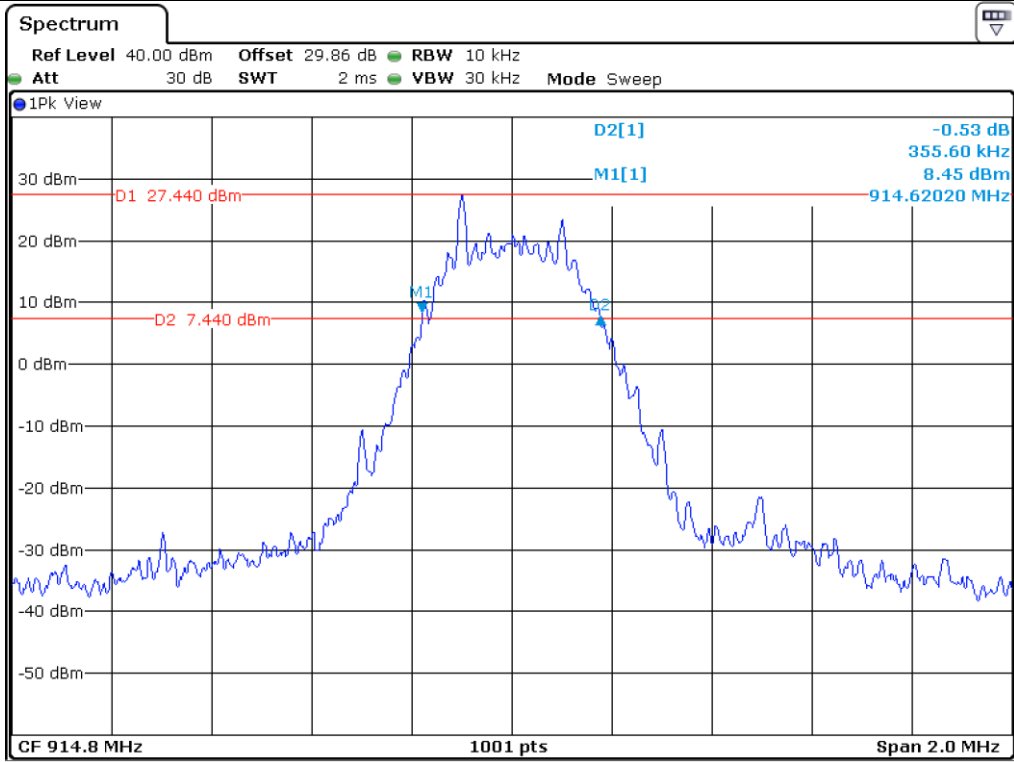
-. Test Result : Pass

Channel Separation (kHz)	20 dB Bandwidth		Limit (kHz)	Result
	Channel	Measured Value (kHz)		
500.00	LOW	353.60	> 25 Or > 20 dB B.W. of Hopping Channel	Pass
	MIDDLE	355.60		
	HIGH	357.60		

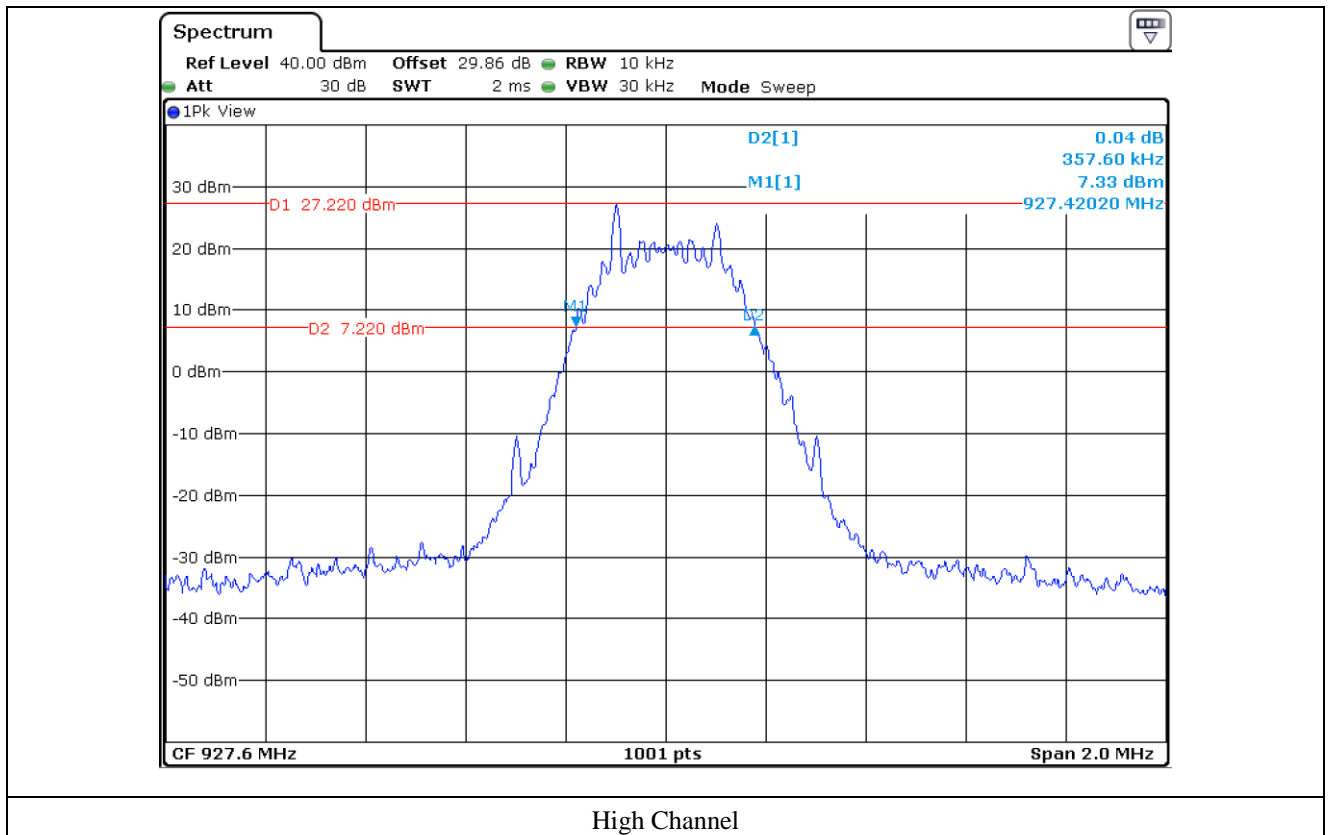




Low Channel



Middle Channel

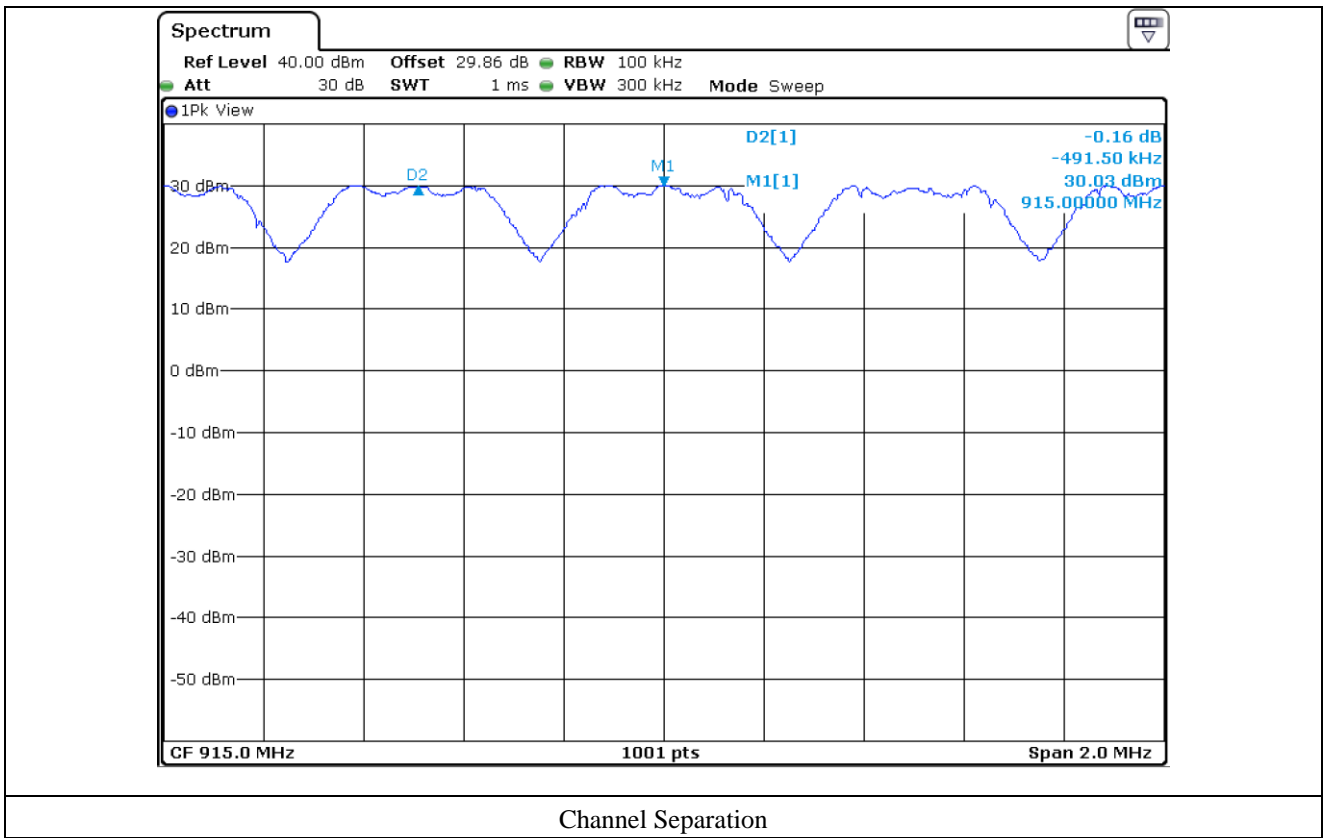


9.6 Test data for Mode 3\_Repeat

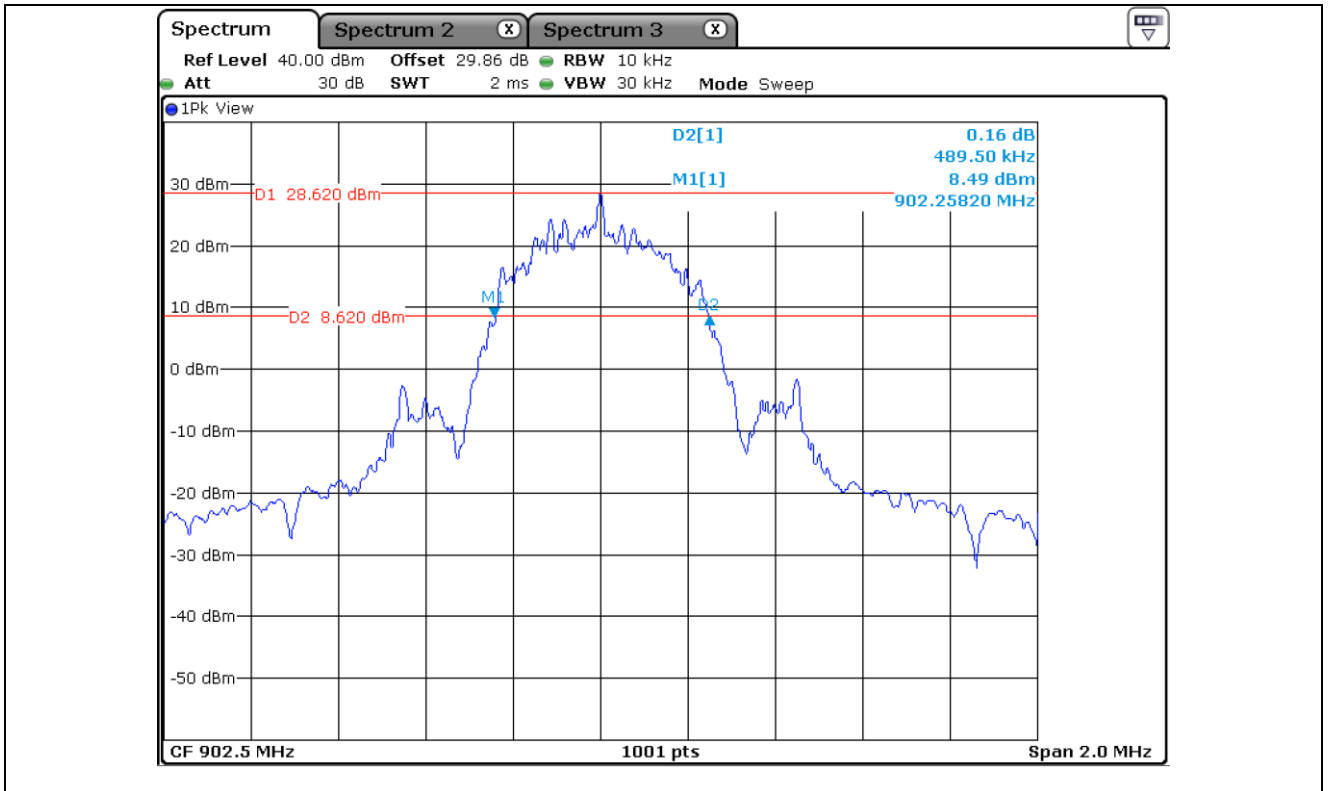
9.6.1 Carrier Frequency / 20 dB Bandwidth

- Test Result : Pass

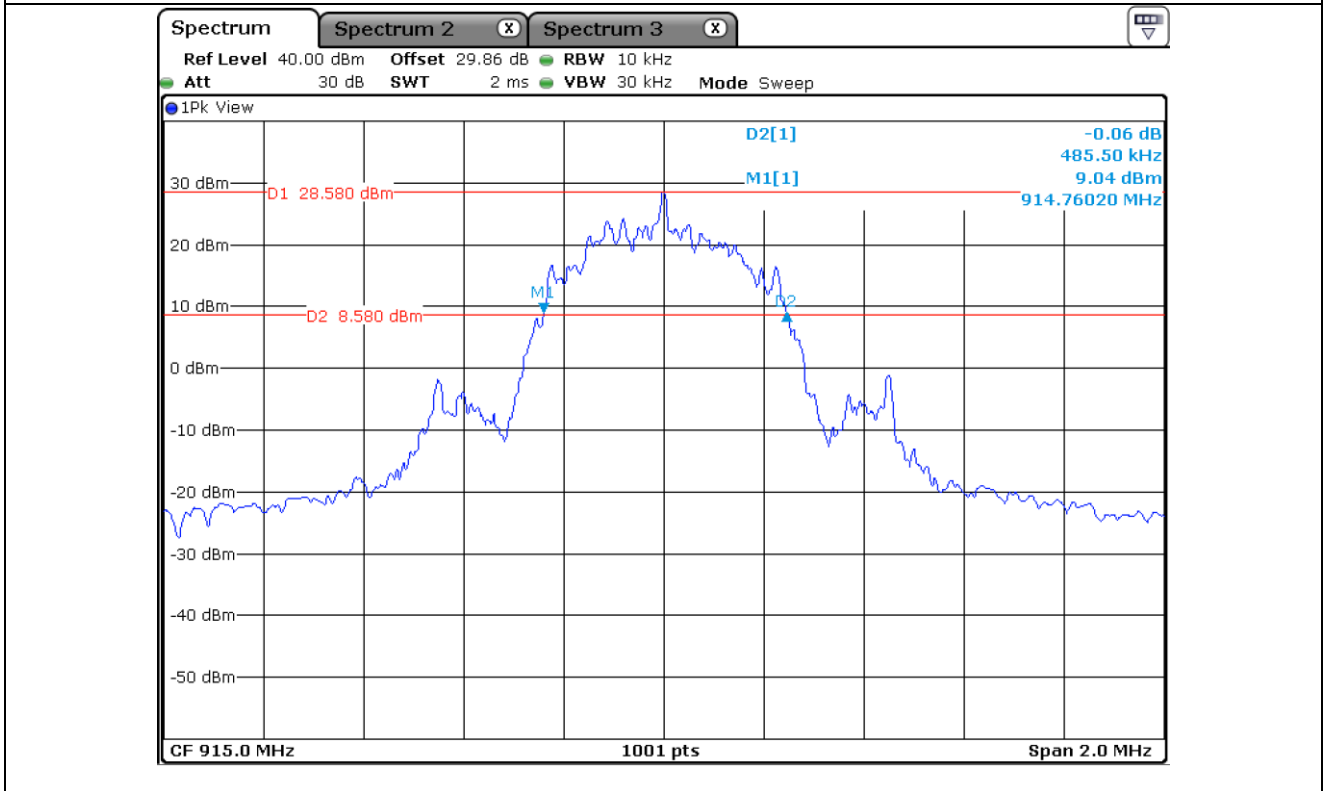
Channel Separation (kHz)	20 dB Bandwidth		Limit (kHz)	Result
	Channel	Measured Value (kHz)		
500.00	LOW	489.50	> 25 Or > 20 dB B.W. of Hopping Channel	Pass
	MIDDLE	485.50		
	HIGH	489.50		



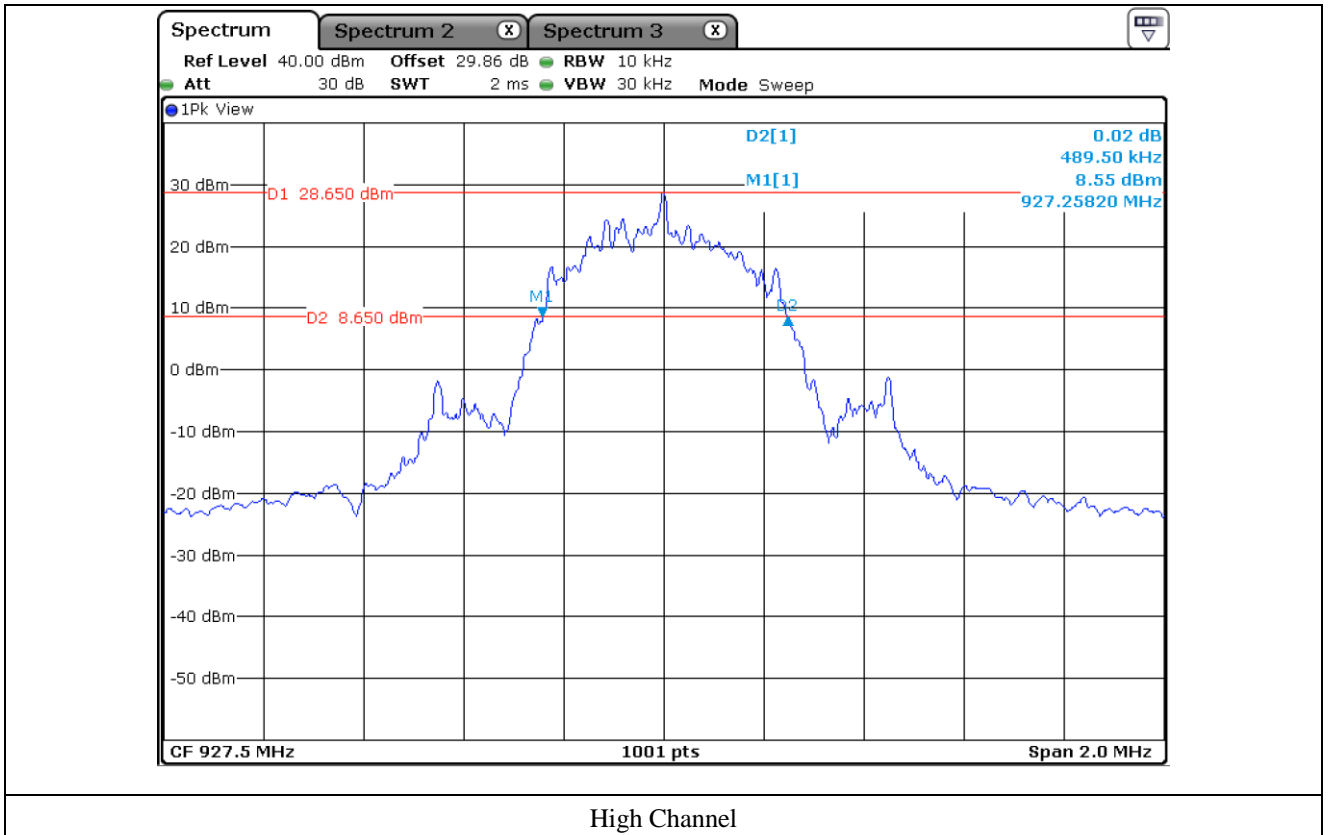
Channel Separation



Low Channel



Middle Channel





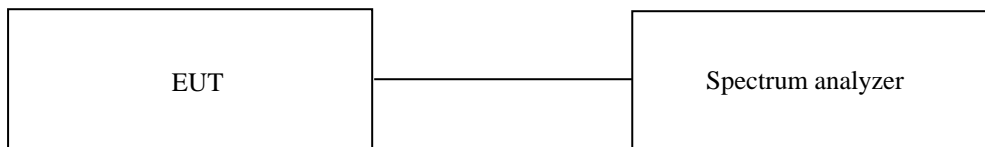
## 10. NUMBER OF HOPPING FREQUENCY

### 10.1 Operating environment

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

### 10.2 Test set-up

According to §15.247(a)(1)(i) if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.



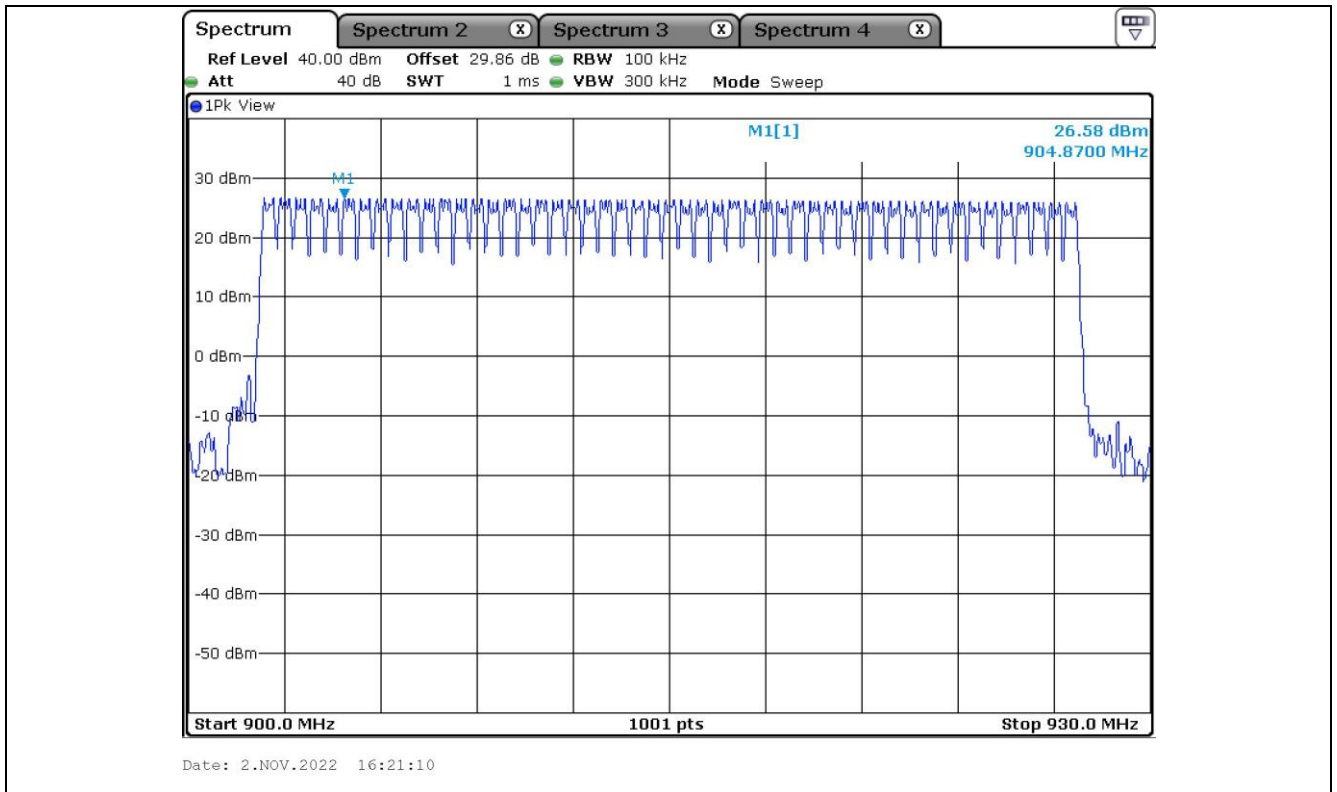
### 10.3 Test Date

October 28, 2022 ~ January 18, 2023

10.4 Test data for Mode 1\_Normal

-. Test Result : Pass

Number of Hopping Frequencies	Limit (EA)
51	25 ≤

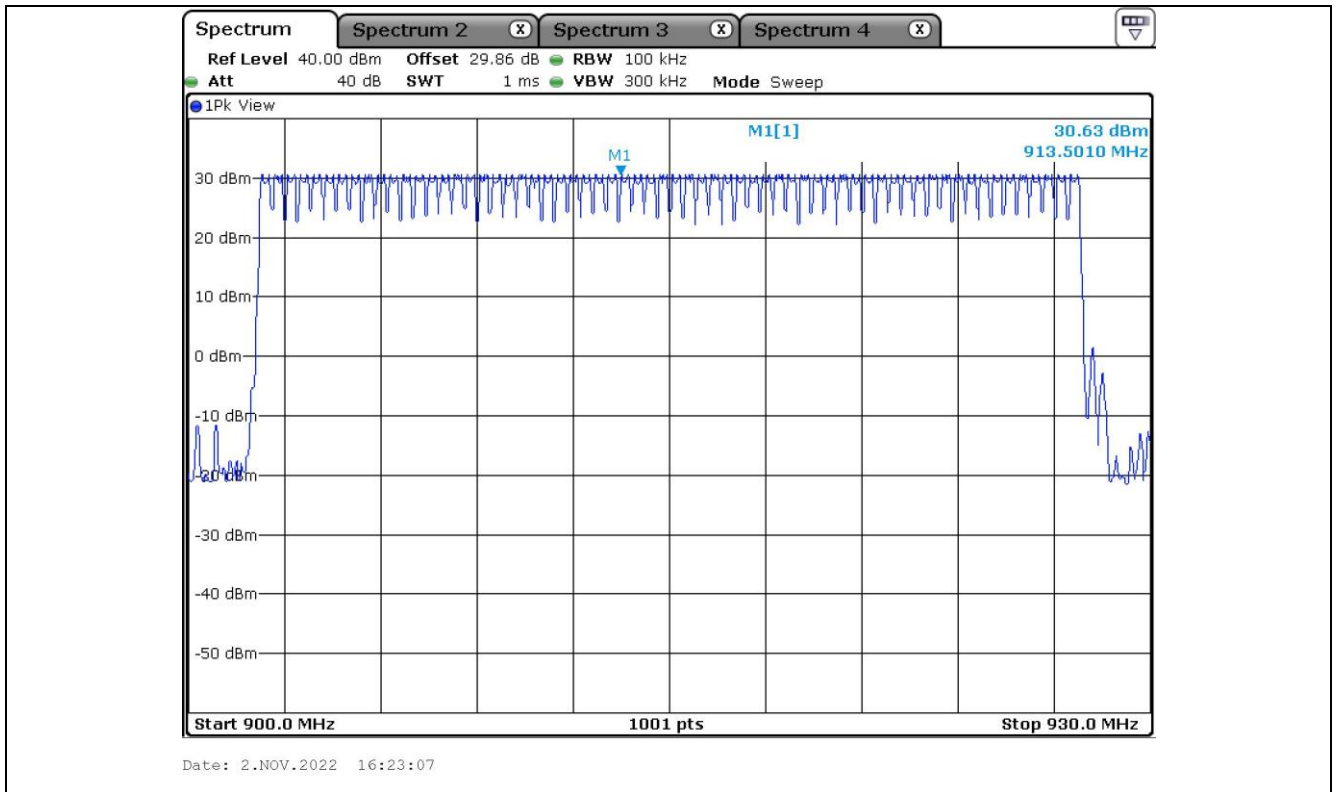


Number of Hopping Channels
----------------------------

10.5 Test data for Mode 2\_Long

-. Test Result : Pass

Number of Hopping Frequencies	Limit (EA)
64	25 ≤

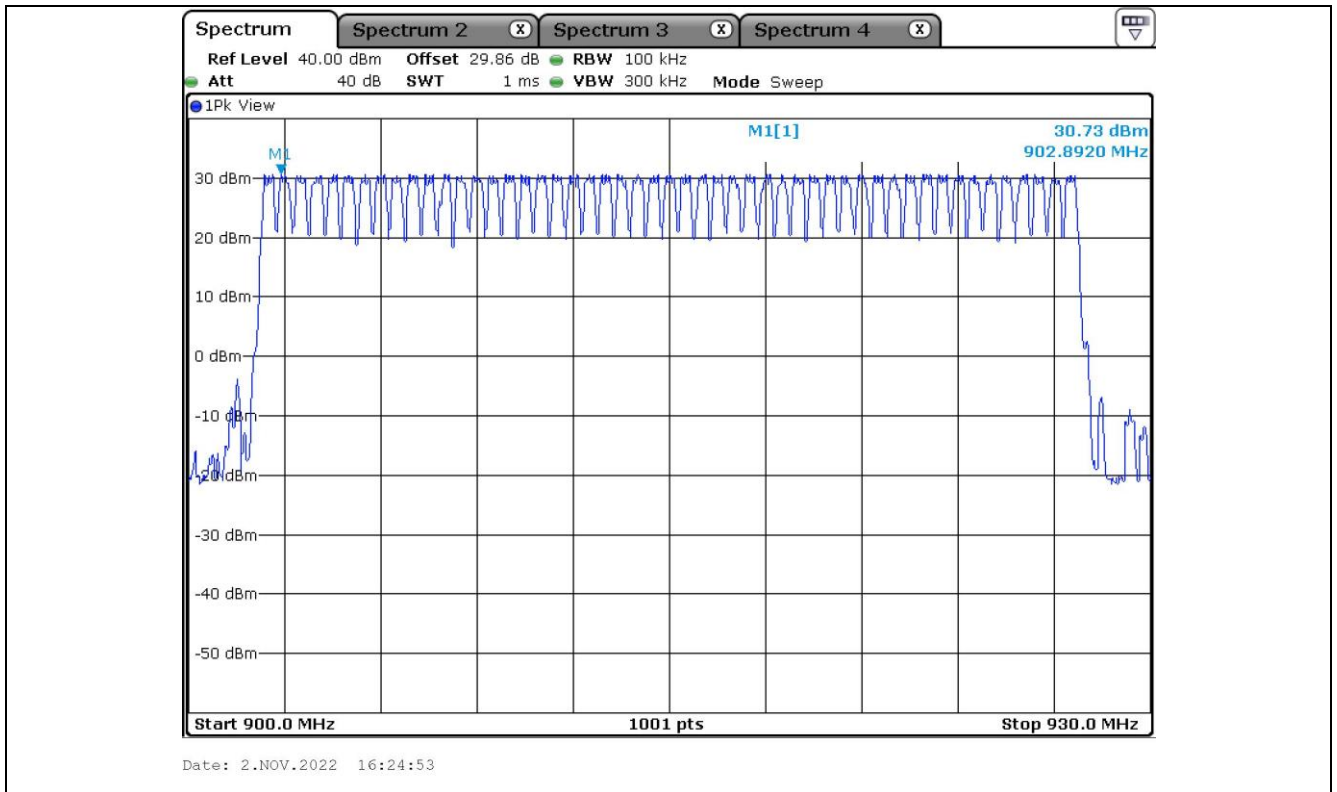


Number of Hopping Channels

10.6 Test data for Mode 3\_Repeat

-. Test Result : Pass

Number of Hopping Frequencies	Limit (EA)
51	25 ≤



Number of Hopping Channels
----------------------------

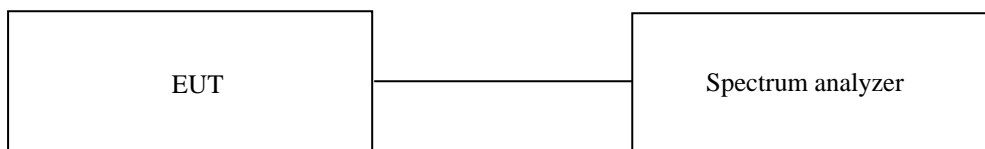
## 11. TIME OF OCCUPANCY (DWELL TIME)

### 11.1 Operating environment

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

### 11.2 Test set-up

According to §15.247(a)(1)(i) / RSS-247 5.1.3, Frequency hopping systems operating in the 902 MHz ~ 928 MHz bands. if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.



### 11.3 Test Date

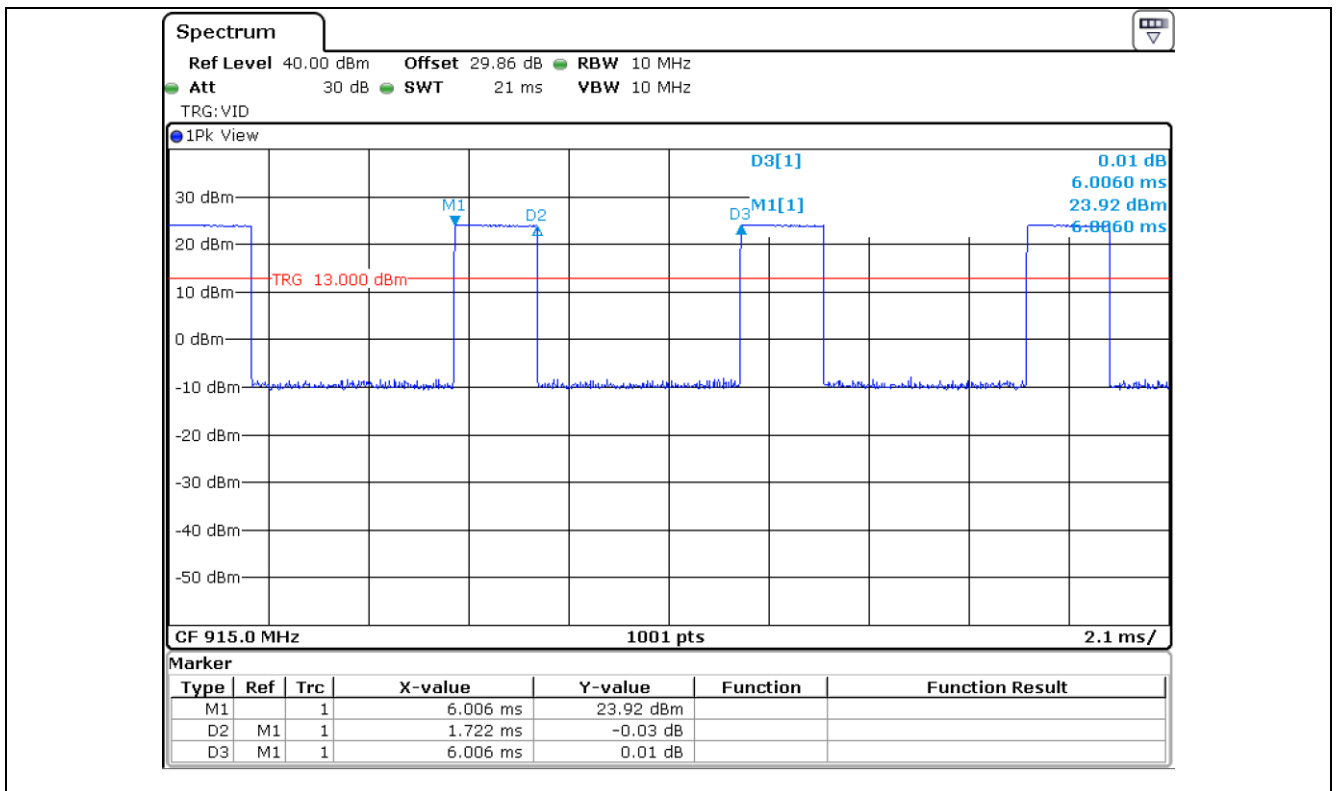
October 28, 2022 ~ January 18, 2023

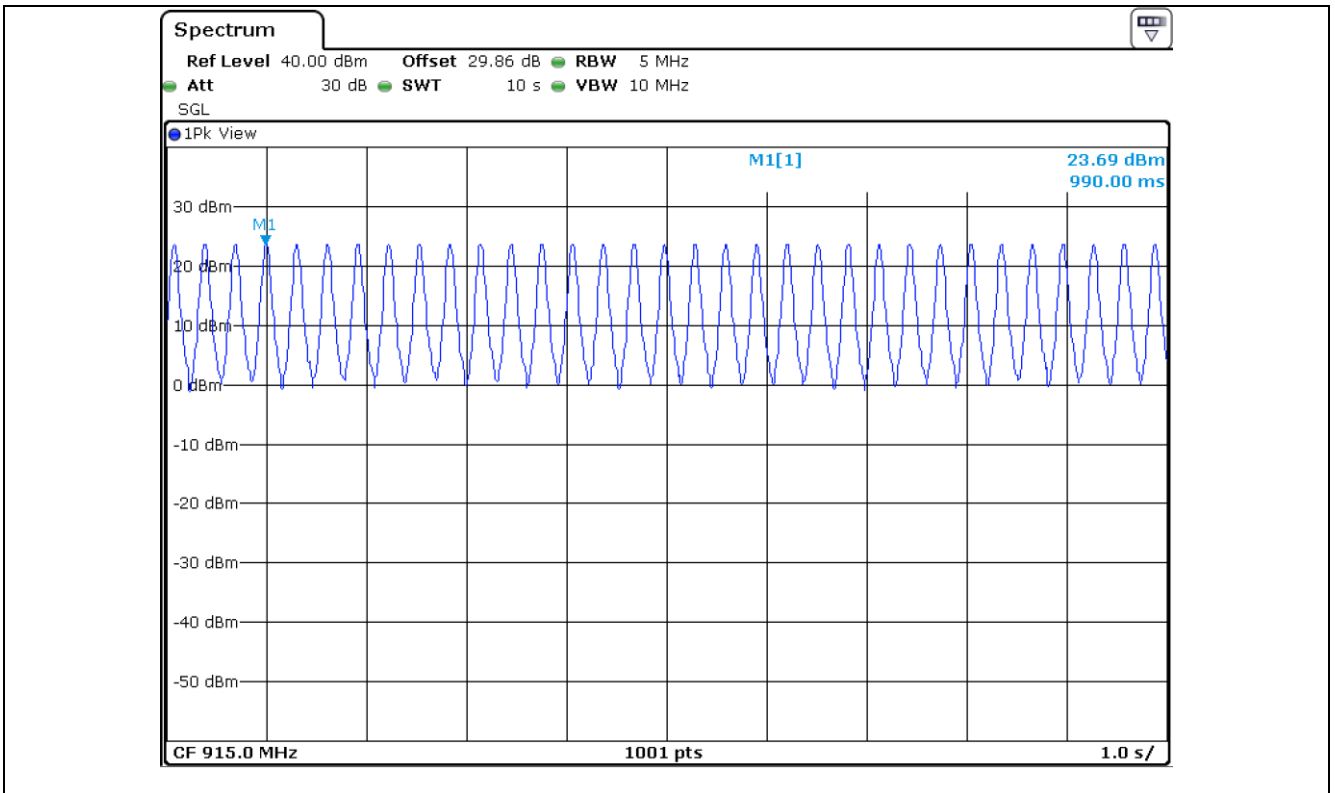
### 11.4 Test data for Mode 1\_Normal

-. Test Result : Pass

Channel	Average Time of Occupancy(ms)	Number of Pulse in 10 seconds	Total(ms)	Limit(ms)
MIDDLE	1.722	33	56.826	400.00

Note : Total : Average Time of Occupancy \* Number of Pulse in 10 seconds.



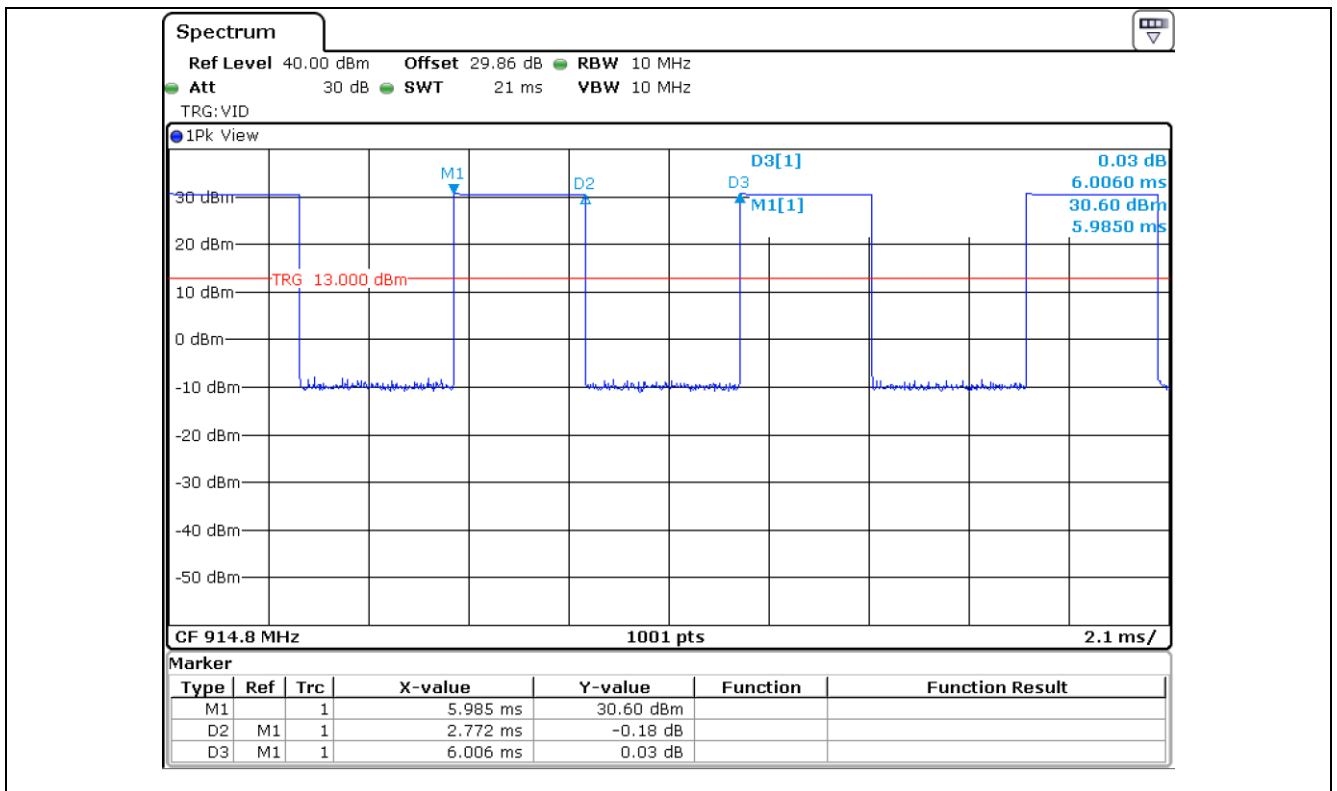


### 11.5 Test data for Mode 2\_Long

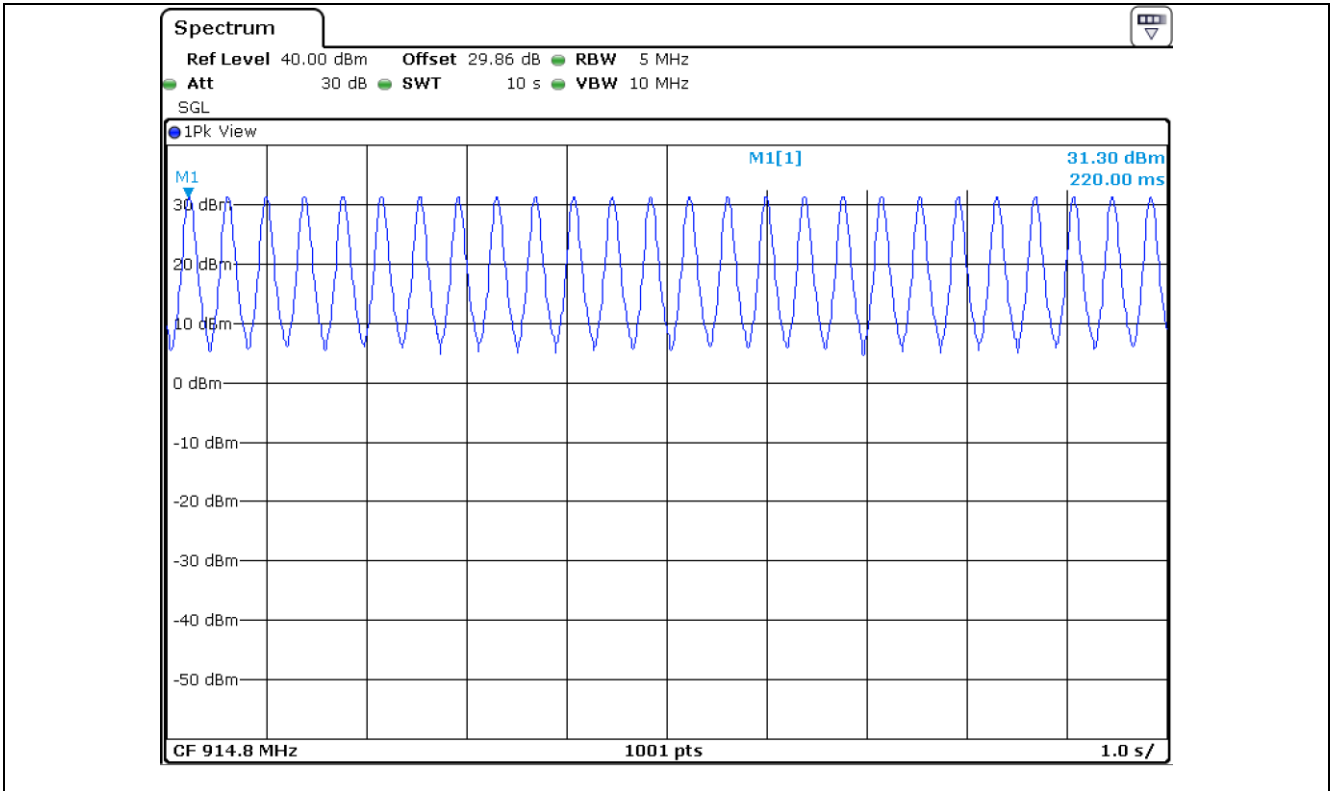
-. Test Result : Pass

Channel	Average Time of Occupancy(ms)	Number of Pulse in 10 seconds	Total(ms)	Limit(ms)
MIDDLE	2.772	26	72.072	400.00

Note : Total : Average Time of Occupancy \* Number of Pulse in 10 seconds.





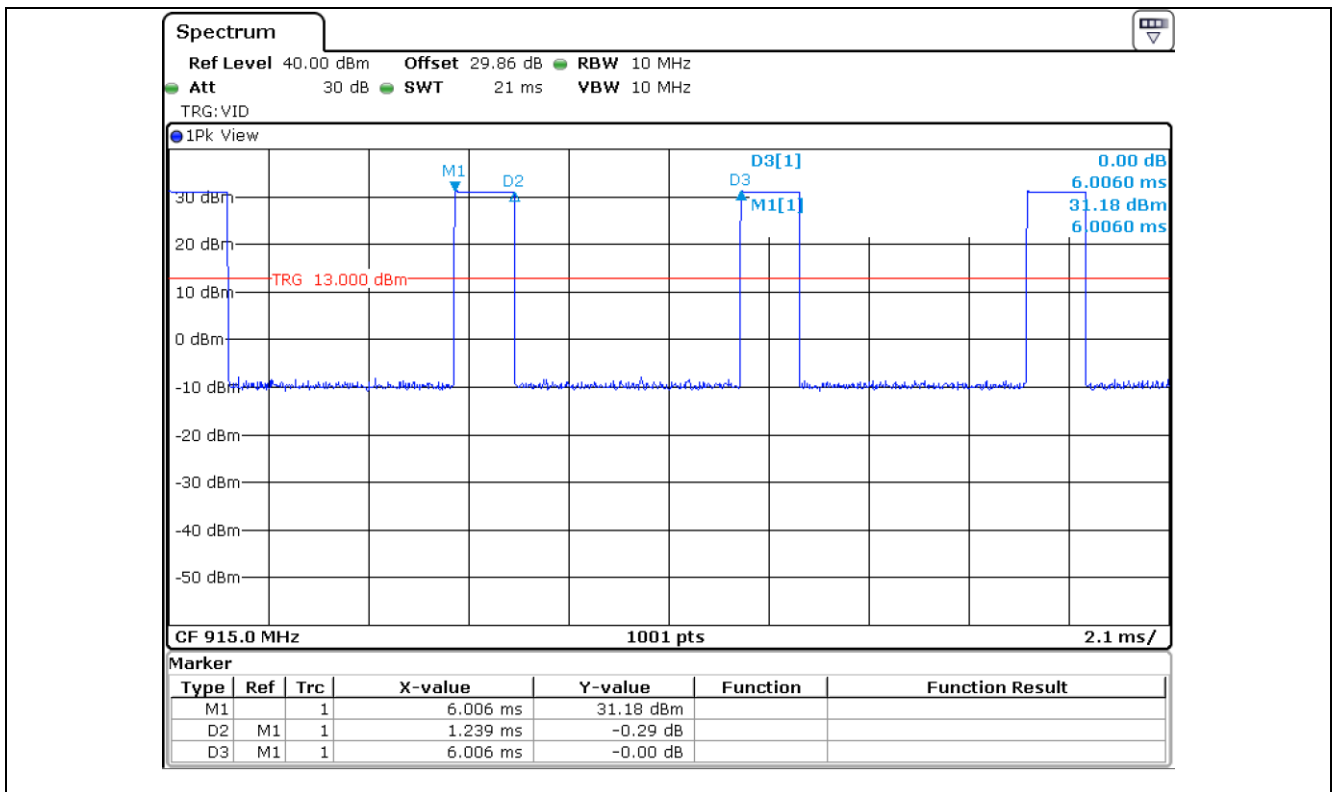


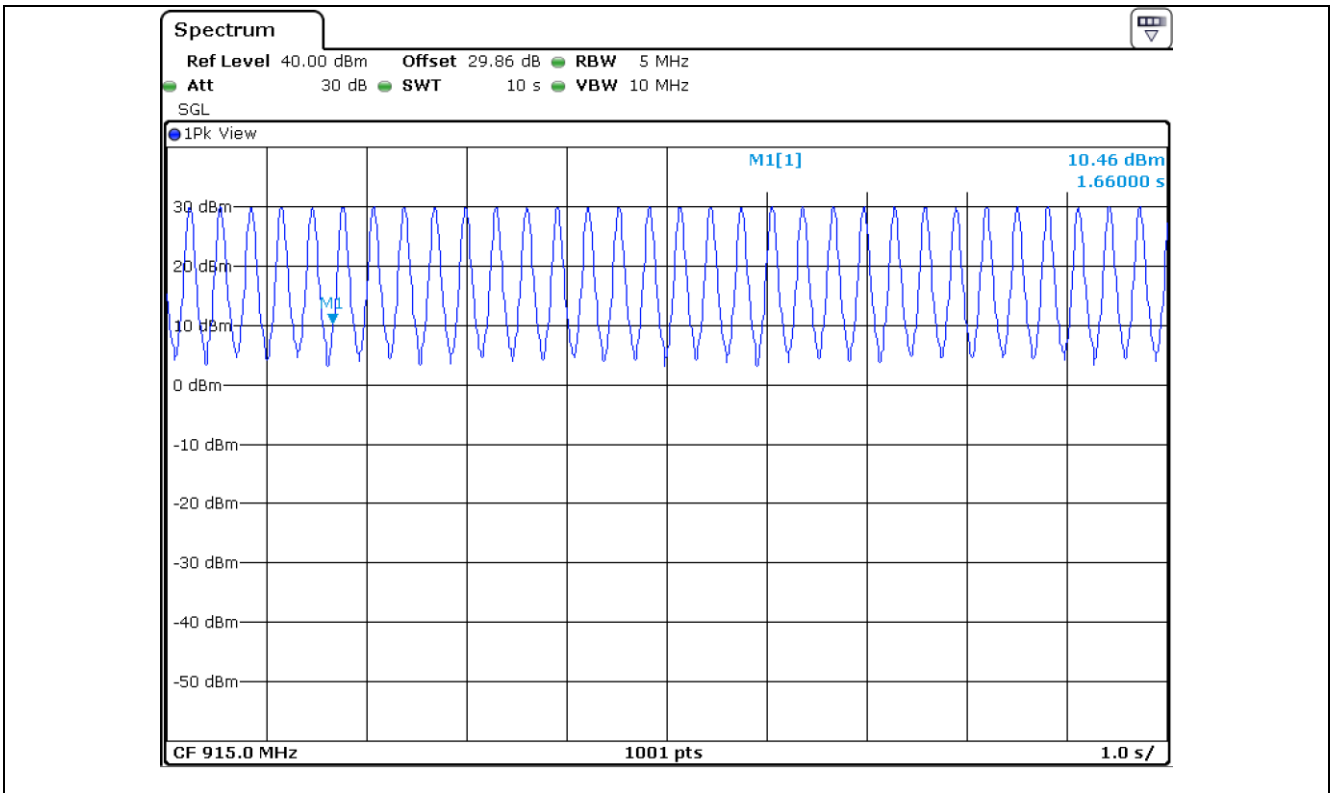
### 11.6 Test data for Mode 3\_Repeat

-. Test Result : Pass

Channel	Average Time of Occupancy(ms)	Number of Pulse in 10 seconds	Total(ms)	Limit(ms)
MIDDLE	1.239	33	40.887	400.00

Note : Total : Average Time of Occupancy \* Number of Pulse in 10 seconds.





**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 / radiated measurement**

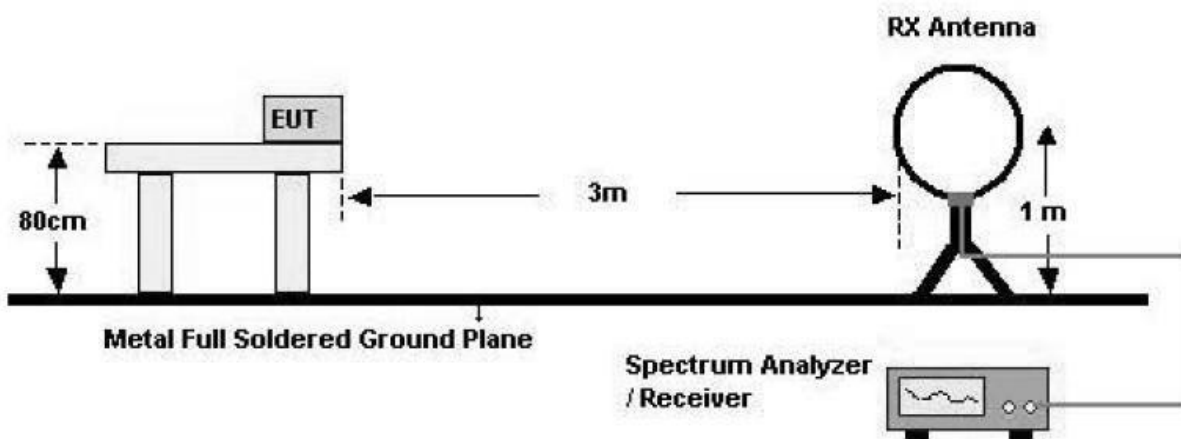
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

**- Conducted Configuration**

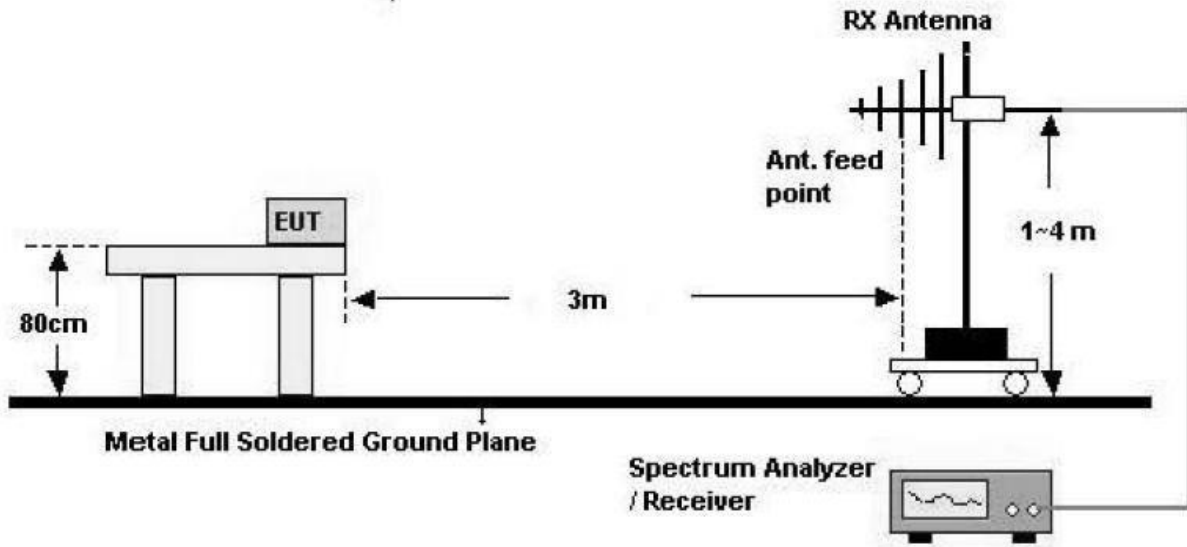


**- Radiated Configuration**

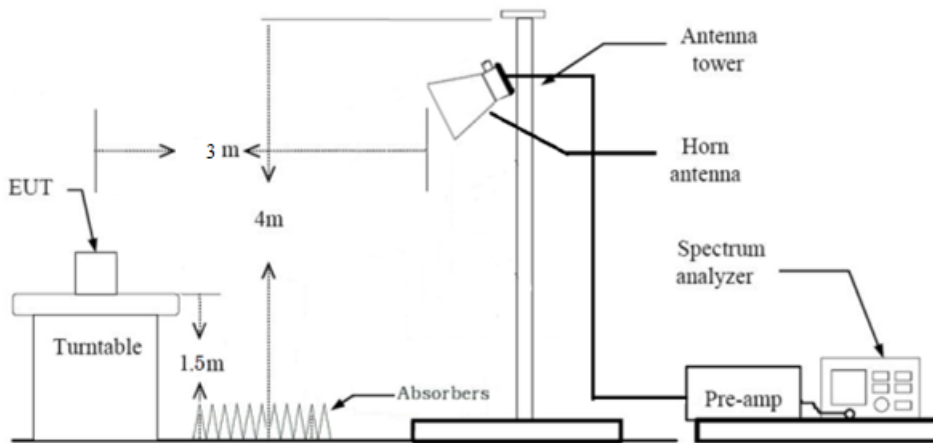
1. Below 30 MHz



2. 30 MHz - 1 GHz



3. Above 1 GHz



12.3 Test Date

October 28, 2022 ~ January 18, 2023

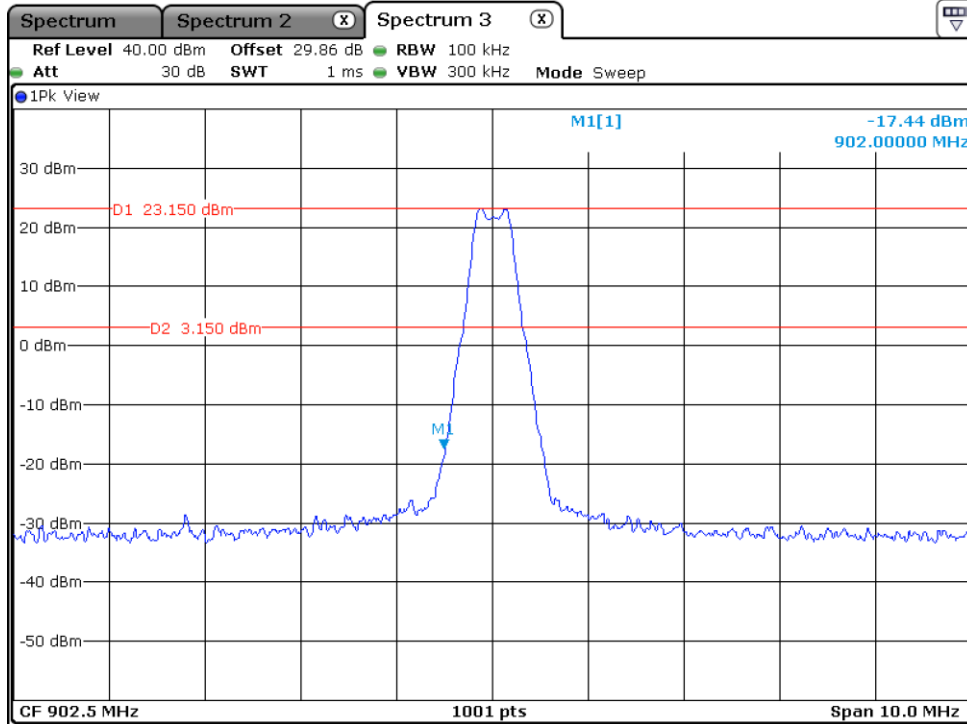
**12.4 Test data for conducted emission**

**12.4.1 Test data for Mode 1\_Normal**

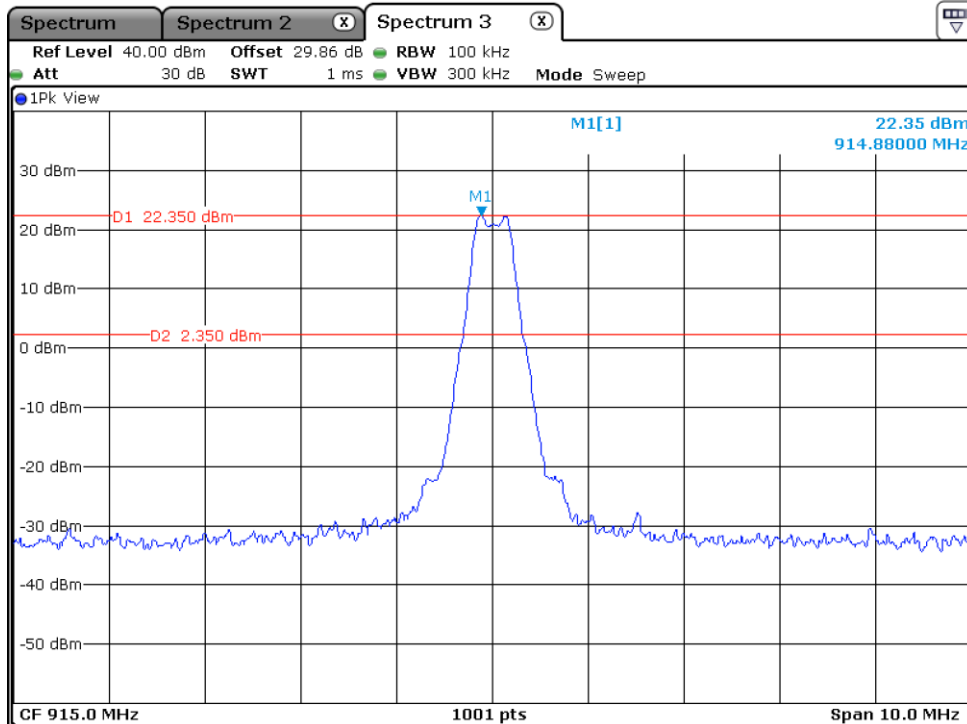
- . Resolution bandwidth : 100 kHz
- . Video bandwidth : 300 kHz
- . Detector : Peak
- . Result : PASS

Channel	Frequency Range	Measured Value(dBm)	Limit(dBm)	Margin(dB)
Low	30 M ~ 1 GHz	-28.82	3.15	31.97
	1 GHz ~ 10 GHz	-21.18	3.15	24.33
Middle	30 M ~ 1 GHz	-30.14	2.35	32.49
	1 GHz ~ 10 GHz	-21.58	2.35	23.93
High	30 M ~ 1 GHz	-28.27	1.99	30.26
	1 GHz ~ 10 GHz	-21.33	1.99	23.32

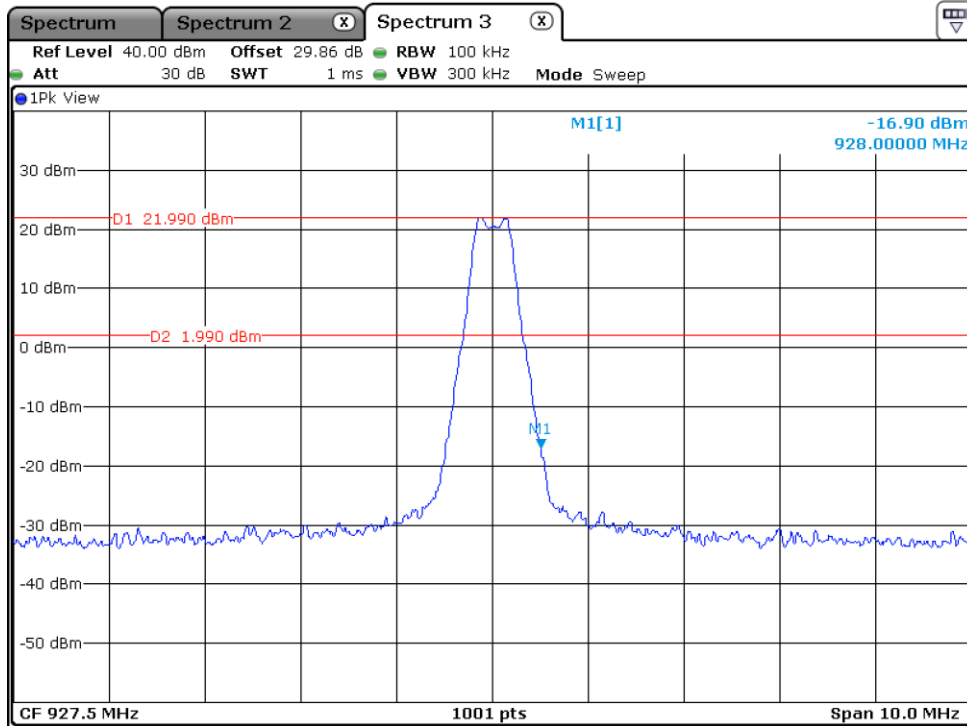
Tabulated test data for Restricted Band



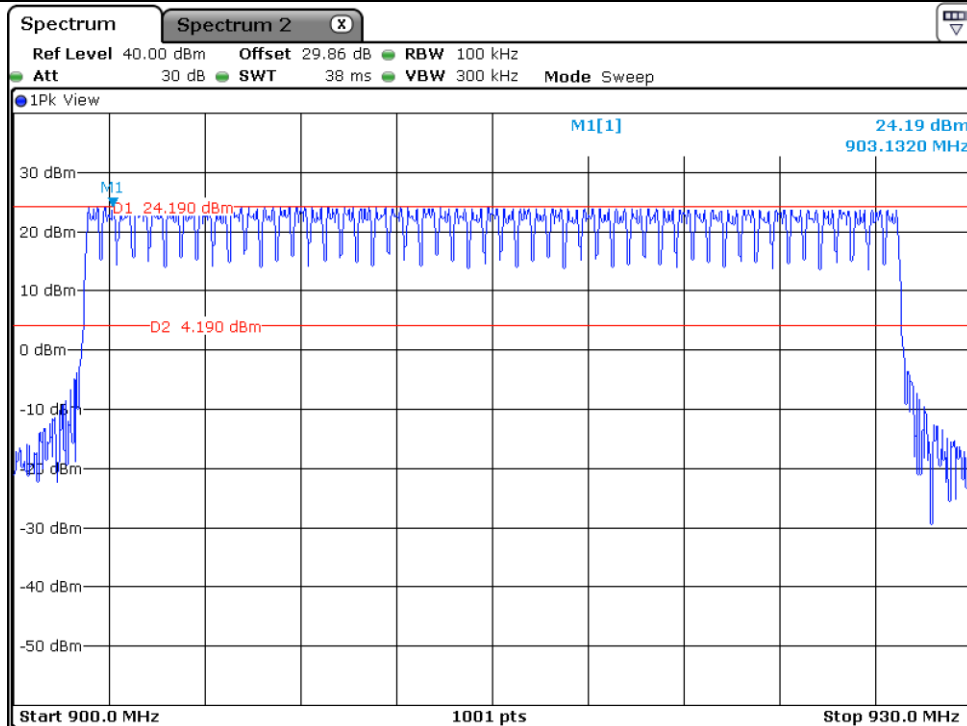
Low Channel



Middle Channel

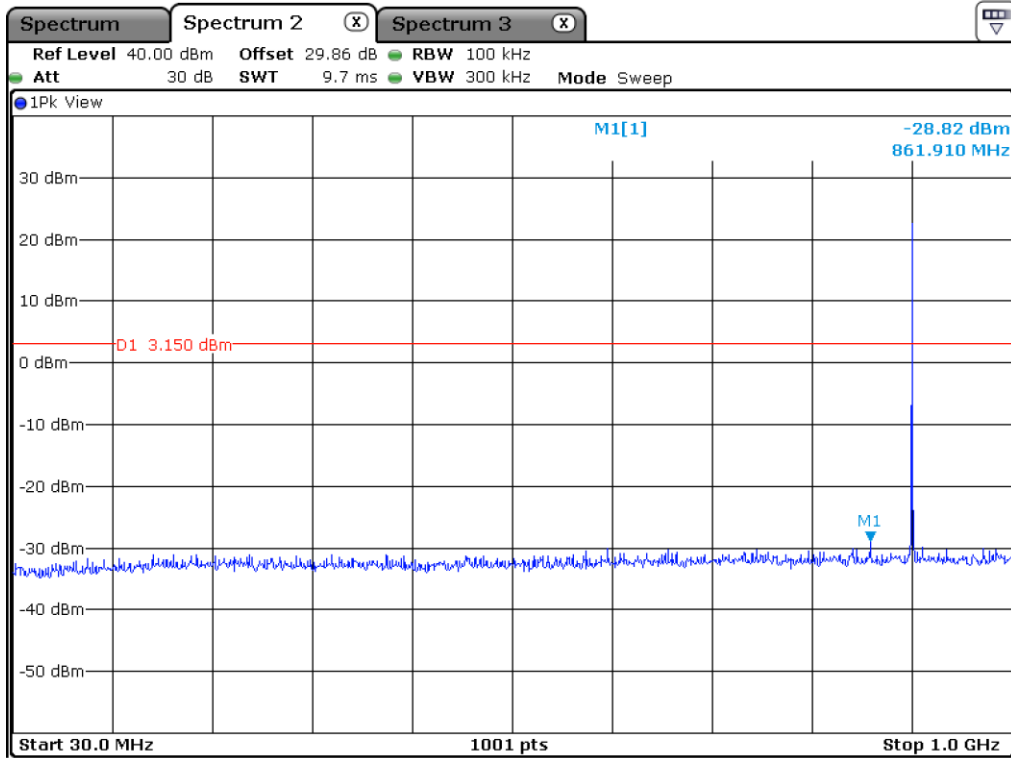


High Channel

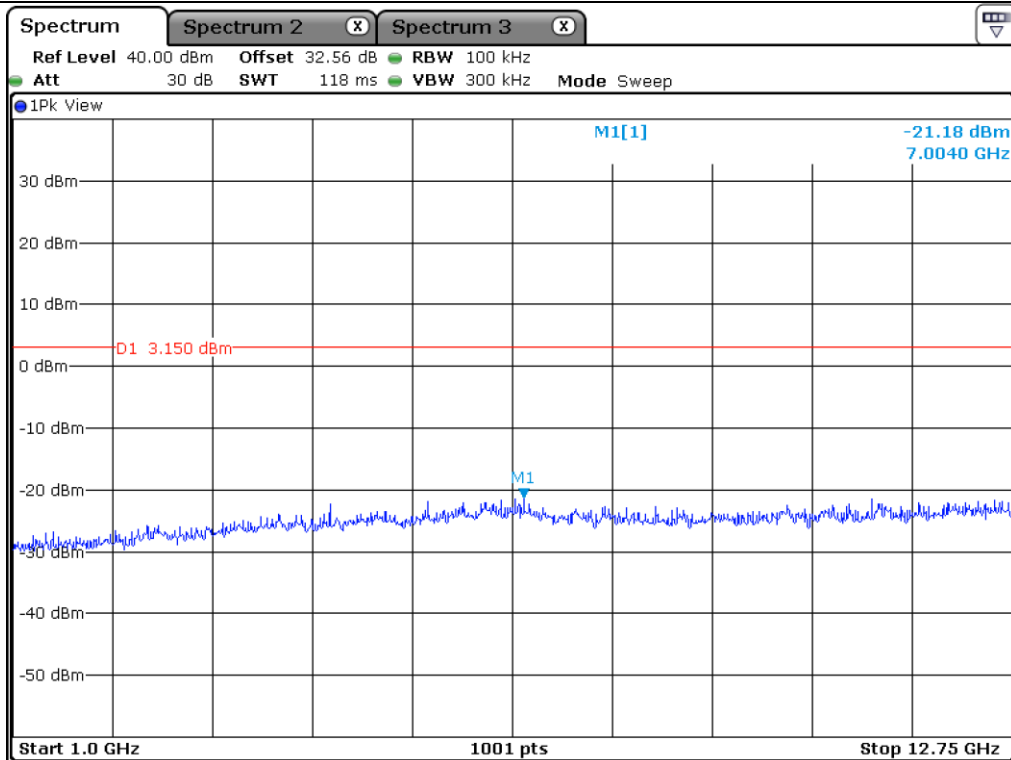


Hopping Channel

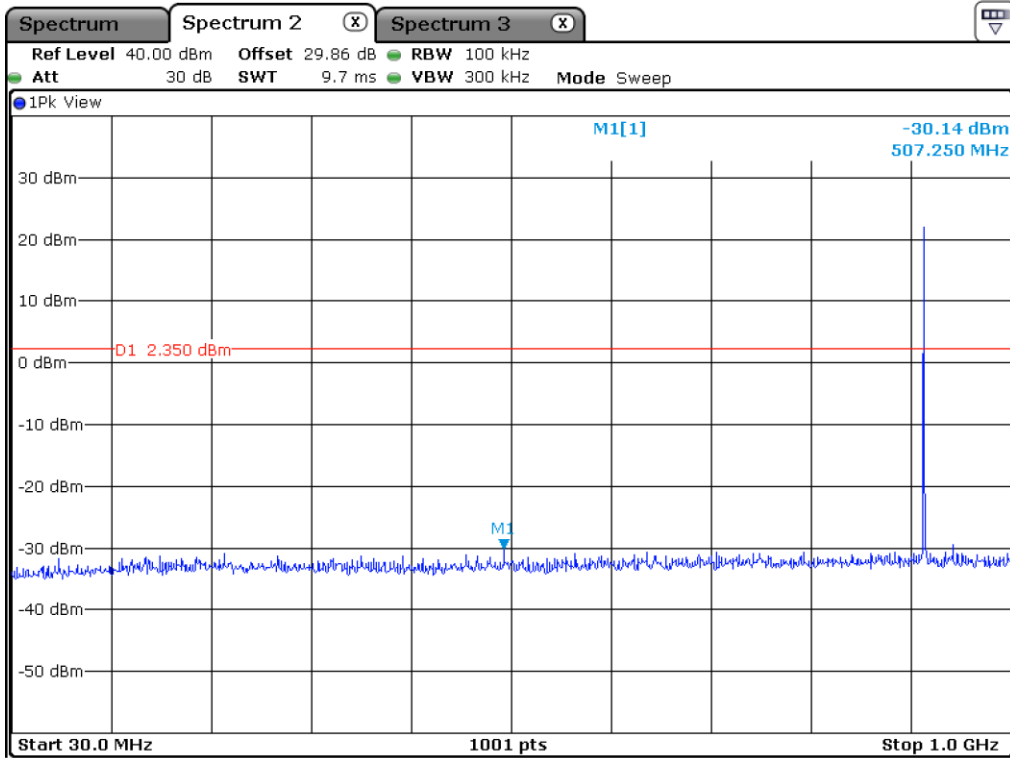




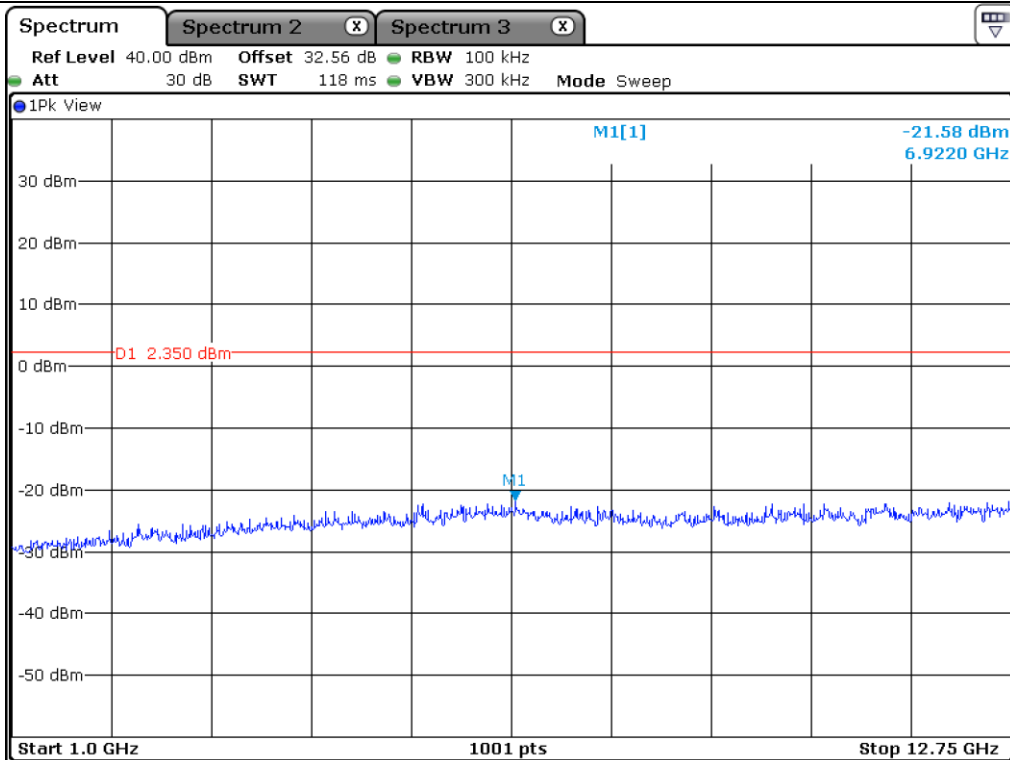
Low Channel



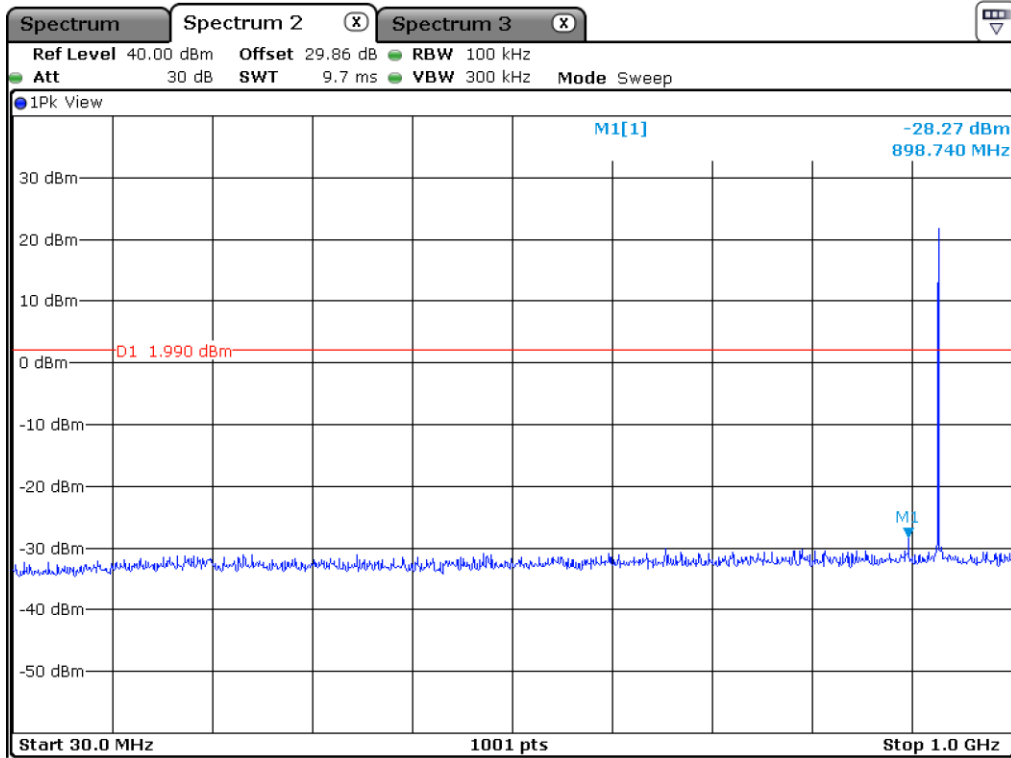
Low Channel



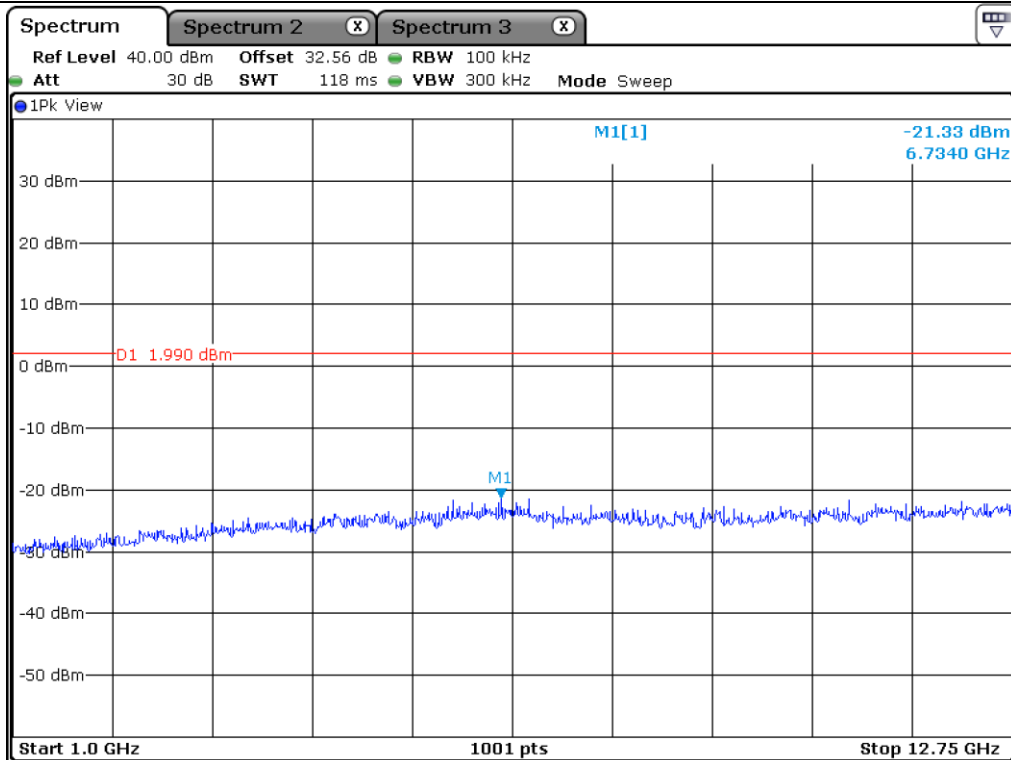
Middle Channel



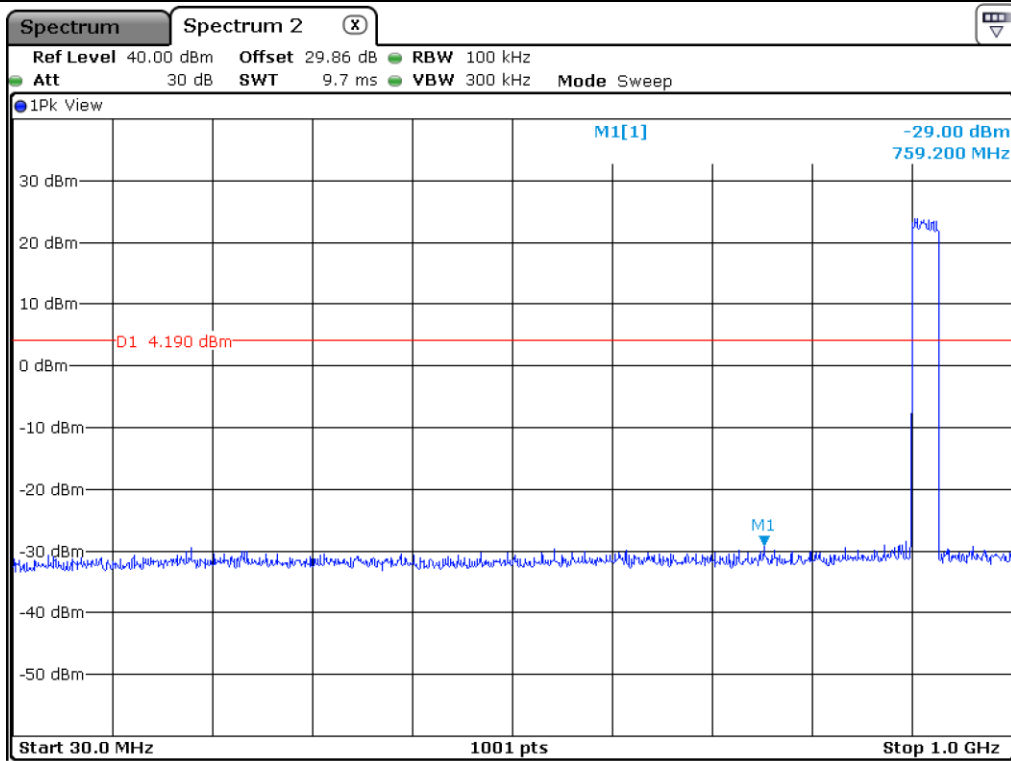
Middle Channel



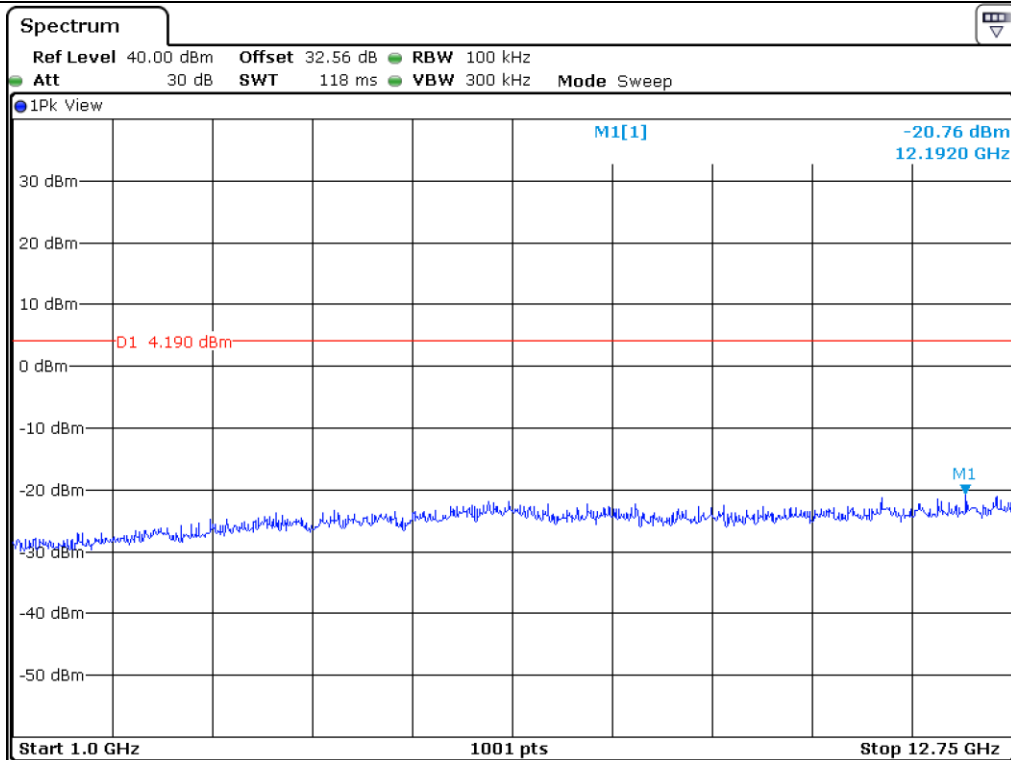
High Channel



High Channel



Hopping Channel



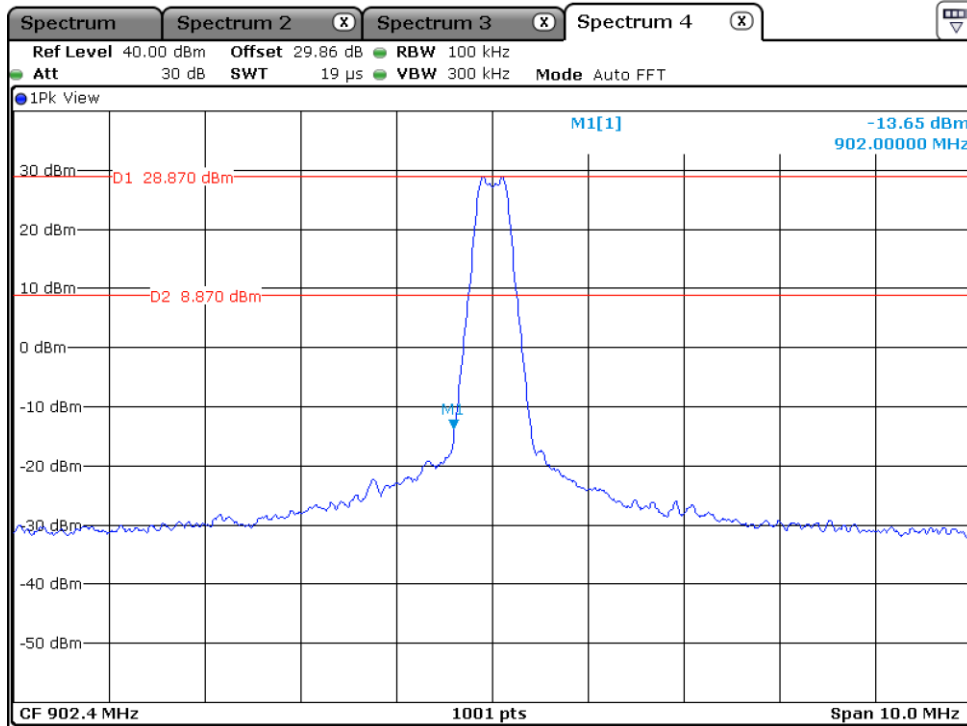
Hopping Channel

**12.4.2 Test data for Mode 2\_Long**

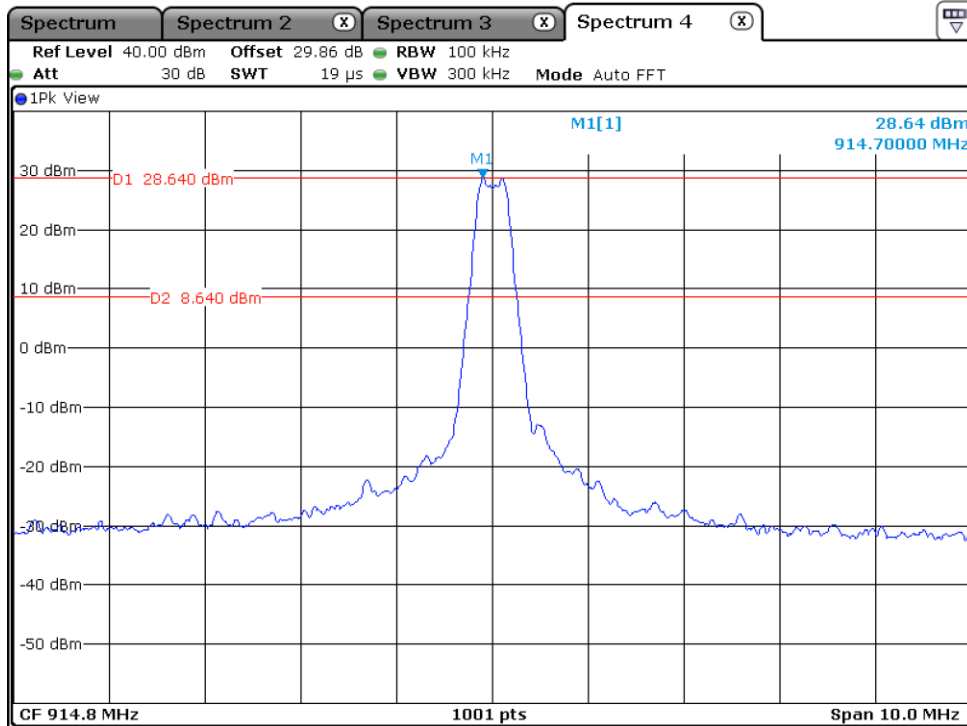
- . Resolution bandwidth : 100 kHz
- . Video bandwidth : 300 kHz
- . Detector : Peak
- . Result : PASS

Channel	Frequency Range	Measured Value(dBm)	Limit(dBm)	Margin(dB)
Low	30 M ~ 1 GHz	-29.86	8.87	38.73
	1 GHz ~ 10 GHz	-21.11	8.87	29.98
Middle	30 M ~ 1 GHz	-30.09	8.64	38.73
	1 GHz ~ 10 GHz	-21.75	8.64	30.39
High	30 M ~ 1 GHz	-29.90	10.51	40.41
	1 GHz ~ 10 GHz	-21.18	10.51	31.69

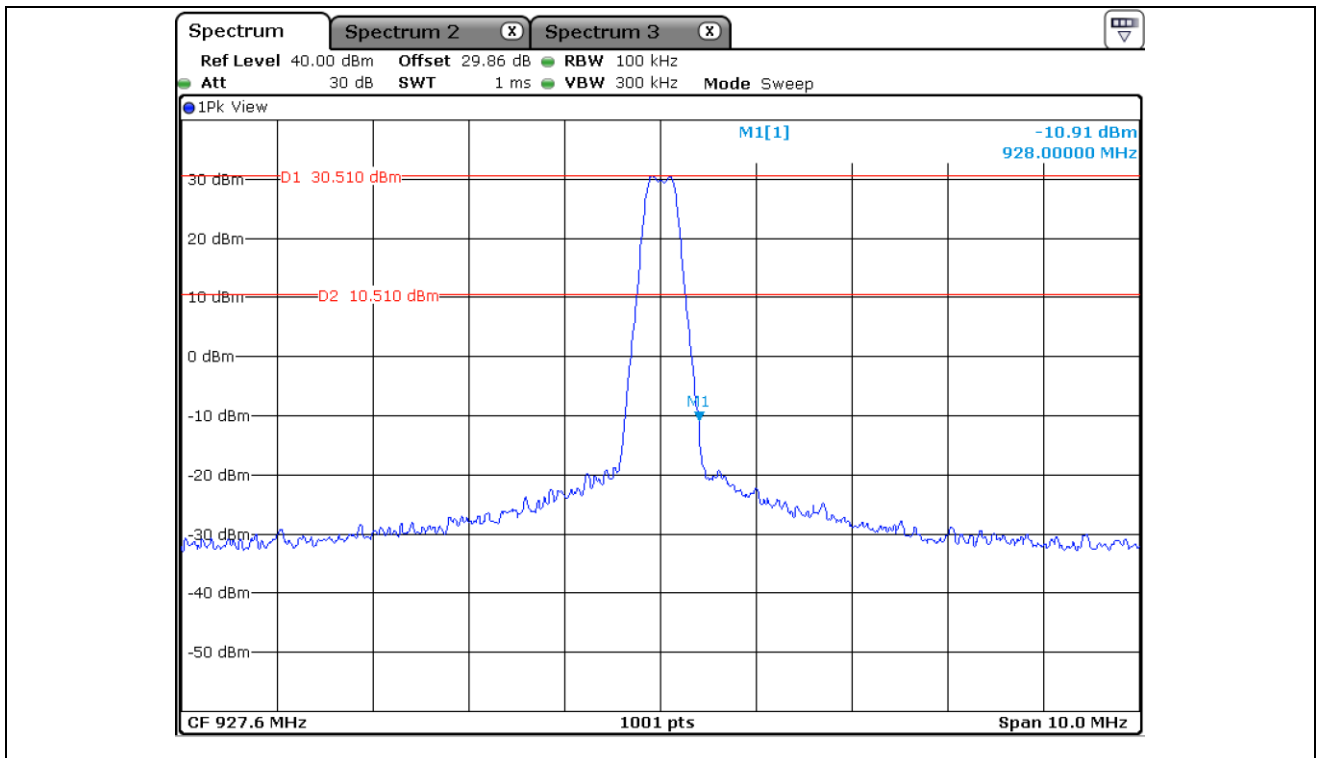
Tabulated test data for Restricted Band



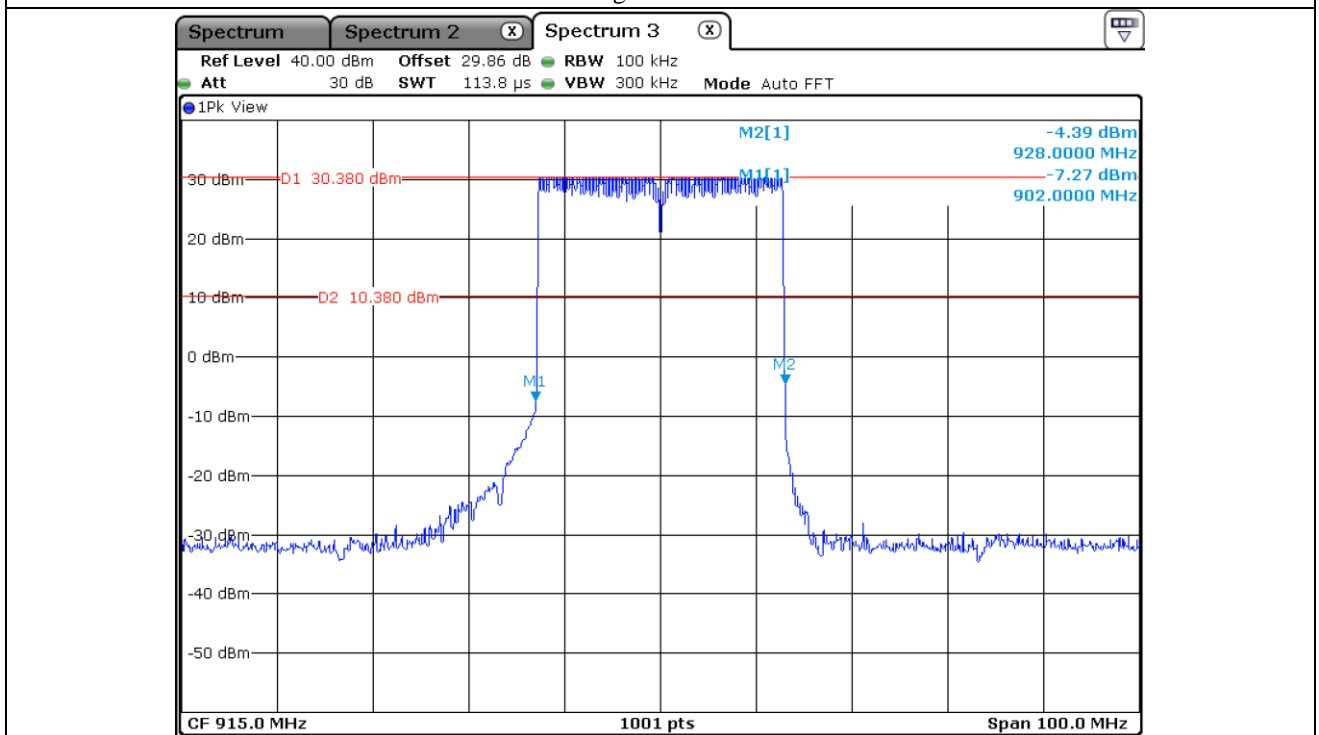
Low Channel



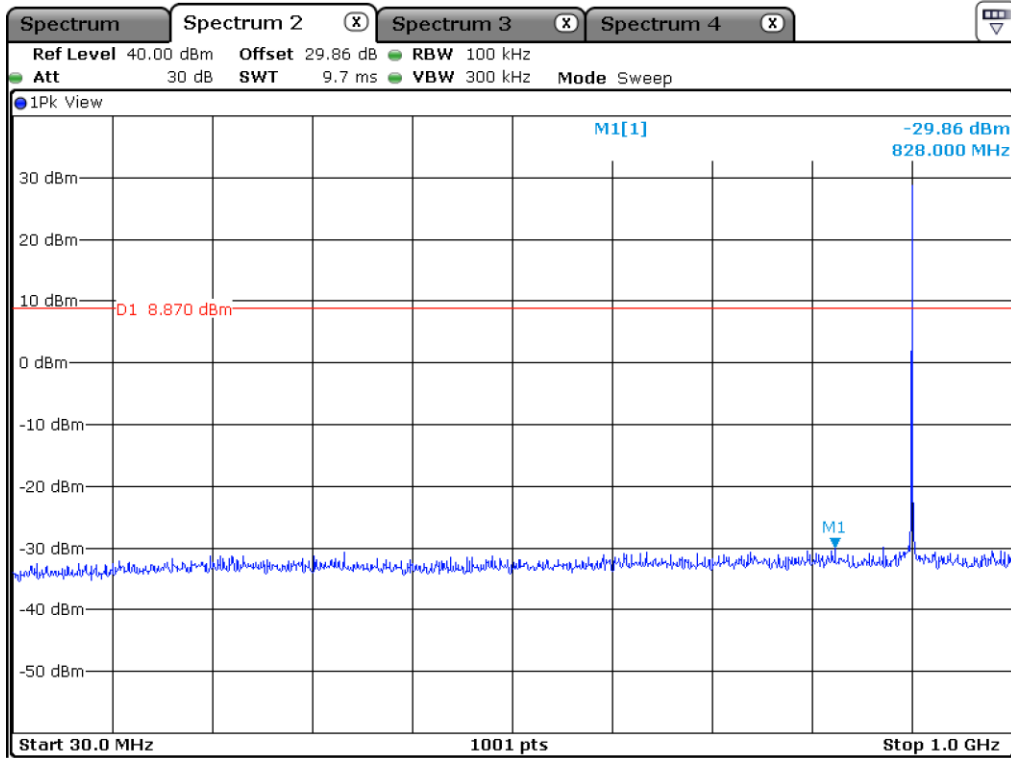
Middle Channel



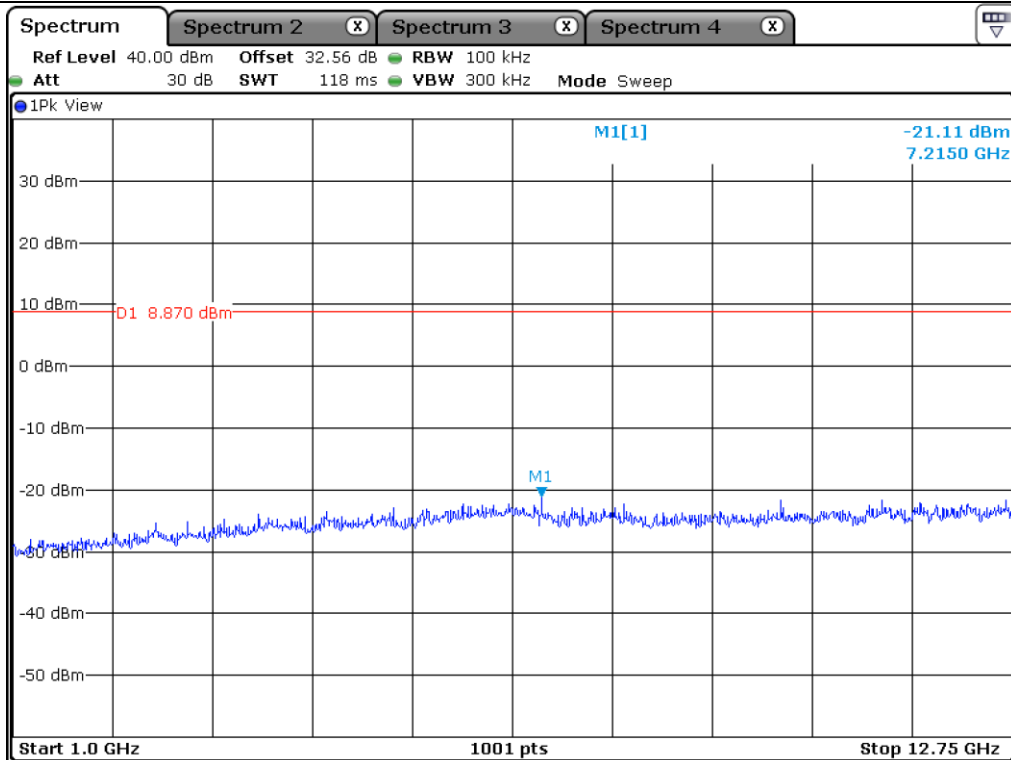
High Channel



Hopping Channel

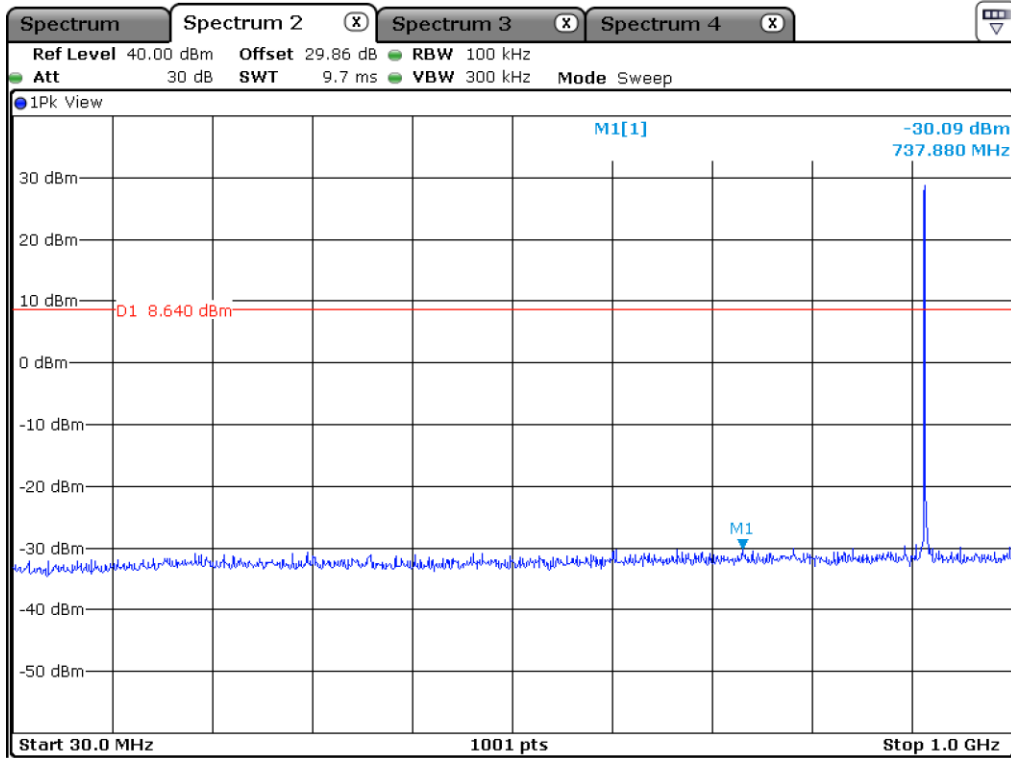


Low Channel

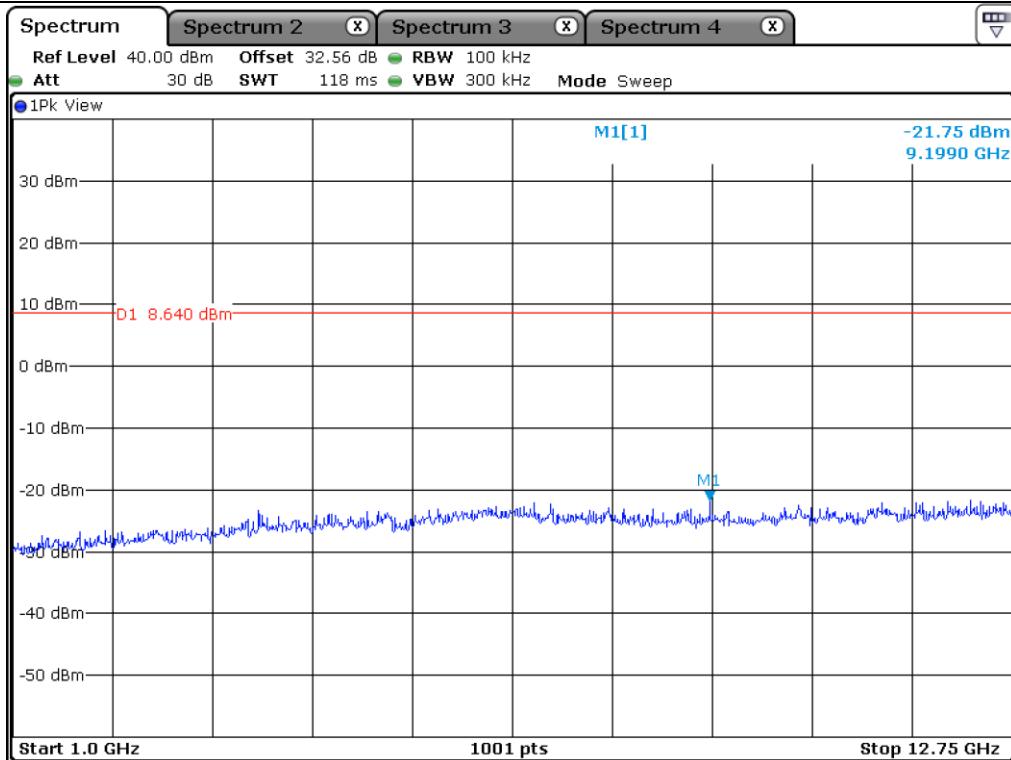


Low Channel

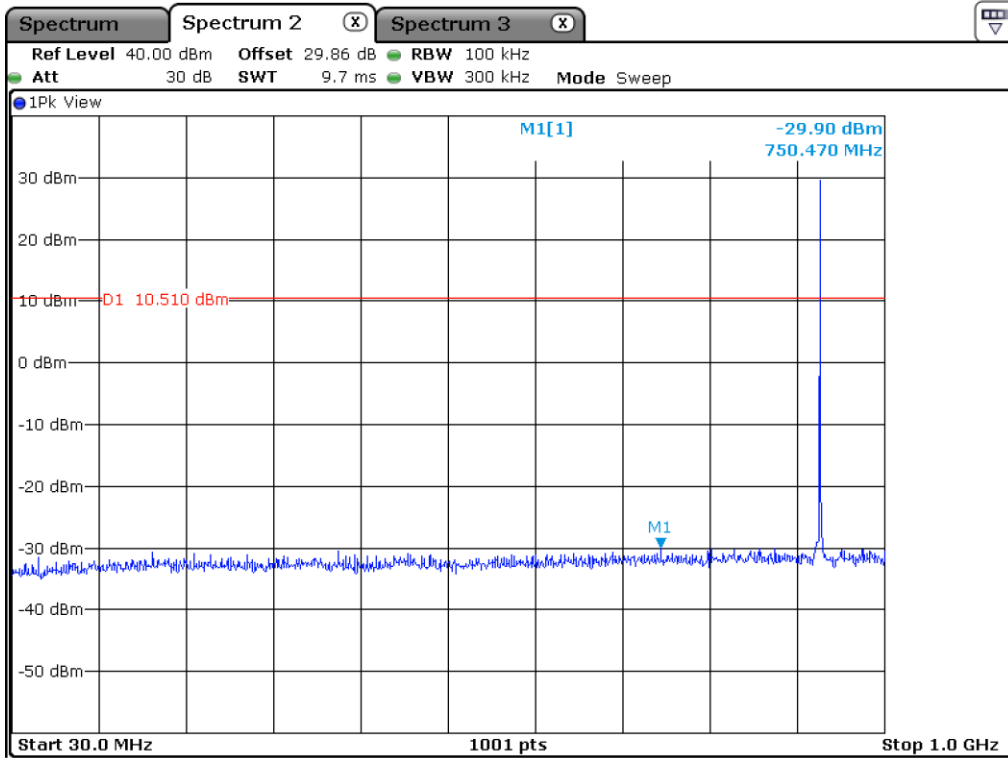




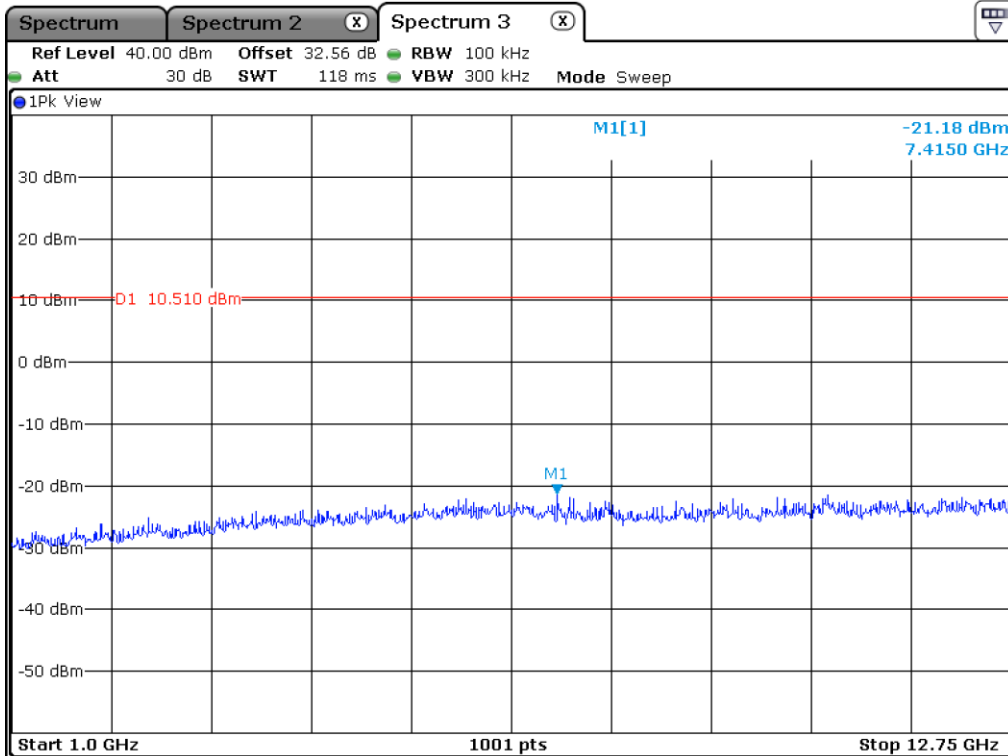
Middle Channel



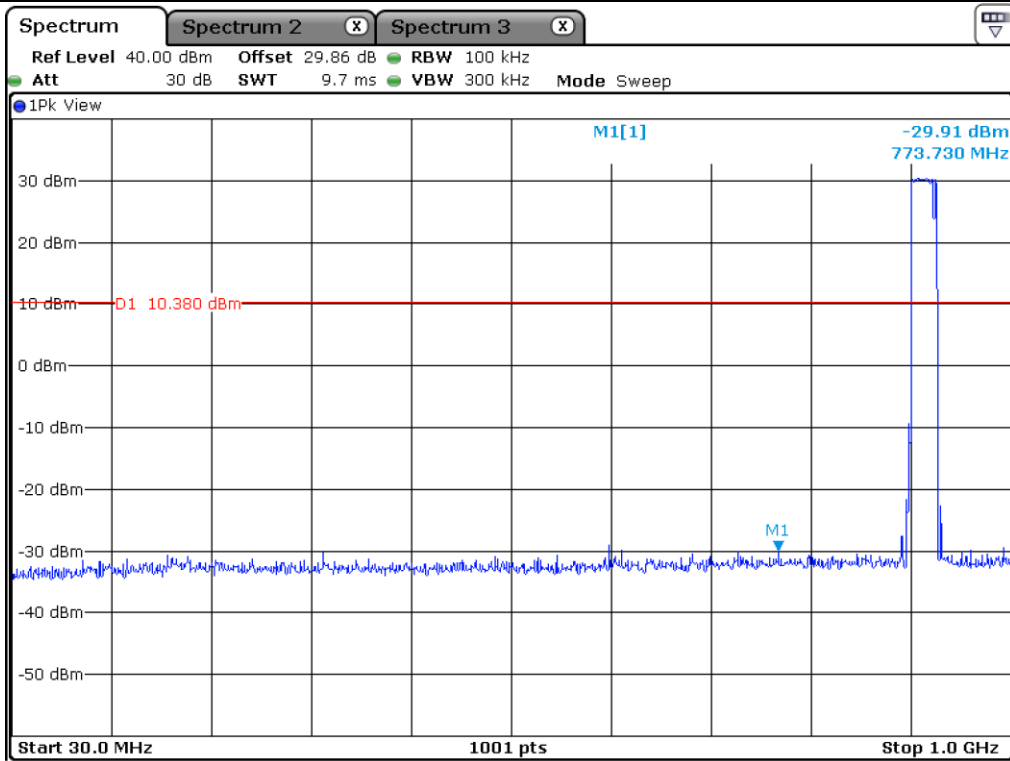
Middle Channel



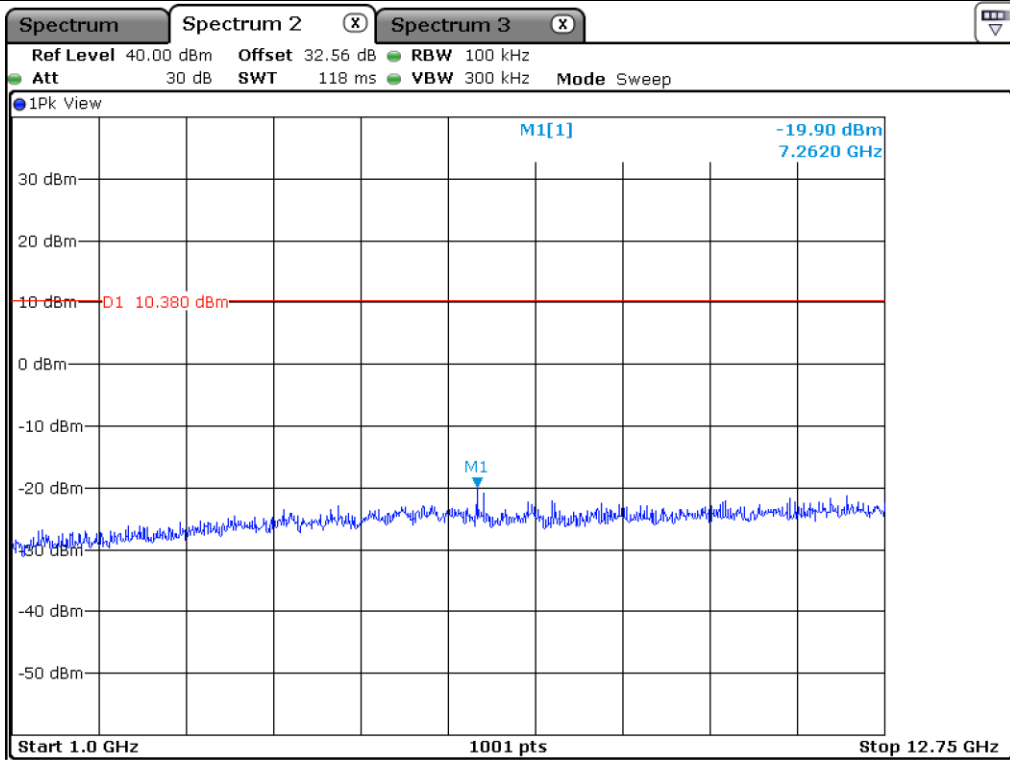
High Channel



High Channel



Hopping Channel



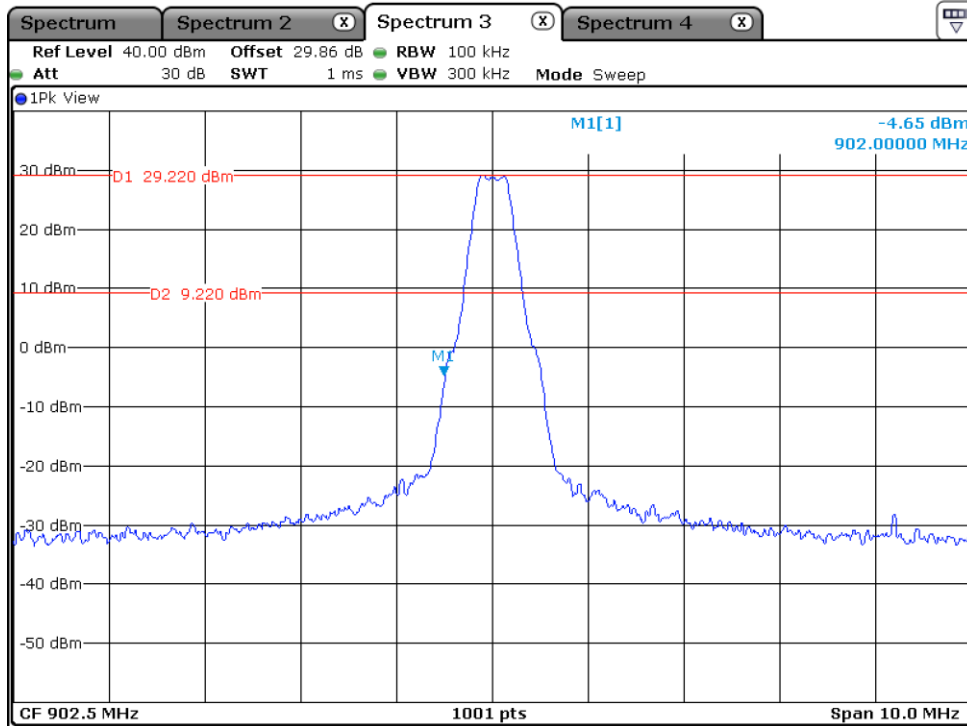
Hopping Channel

**12.4.3 Test data for Mode 3\_Repeat**

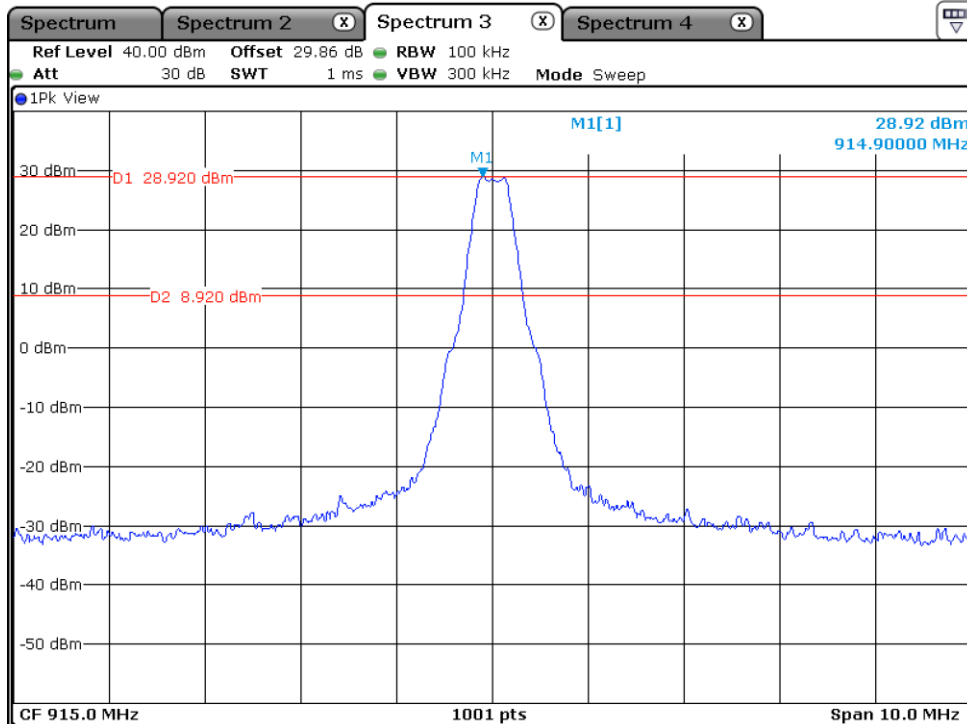
- . Resolution bandwidth : 100 kHz
- . Video bandwidth : 300 kHz
- . Detector : Peak
- . Result : PASS

Channel	Frequency Range	Measured Value(dBm)	Limit(dBm)	Margin(dB)
Low	30 M ~ 1 GHz	-29.76	9.22	38.98
	1 GHz ~ 10 GHz	-21.59	9.22	30.81
Middle	30 M ~ 1 GHz	-30.16	8.92	39.08
	1 GHz ~ 10 GHz	-20.89	8.92	29.81
High	30 M ~ 1 GHz	-28.68	9.26	37.94
	1 GHz ~ 10 GHz	-20.81	9.26	30.07

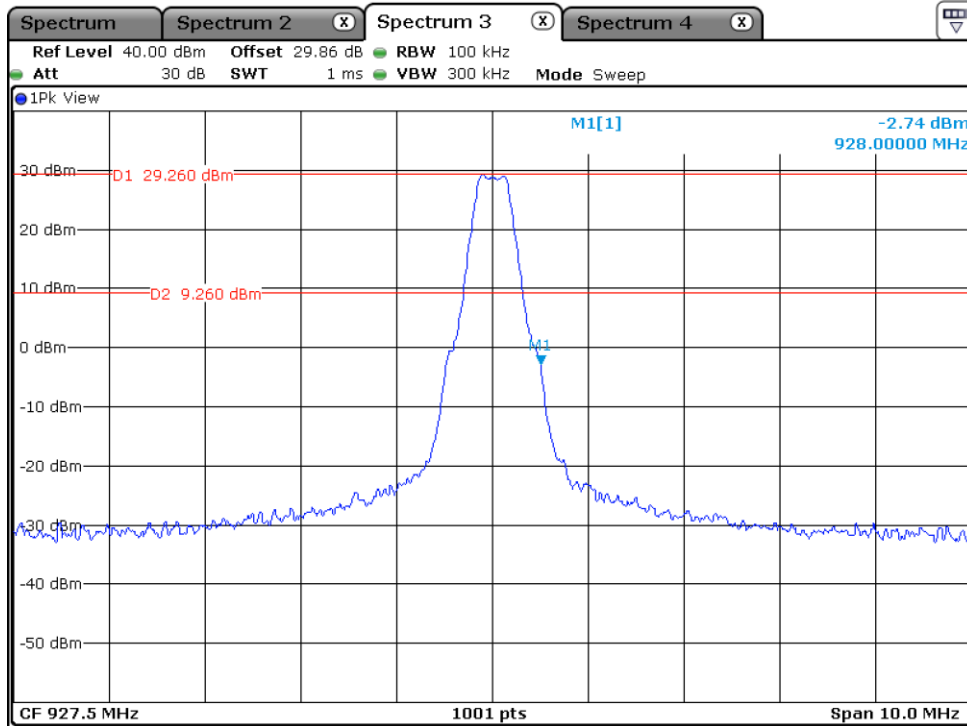
Tabulated test data for Restricted Band



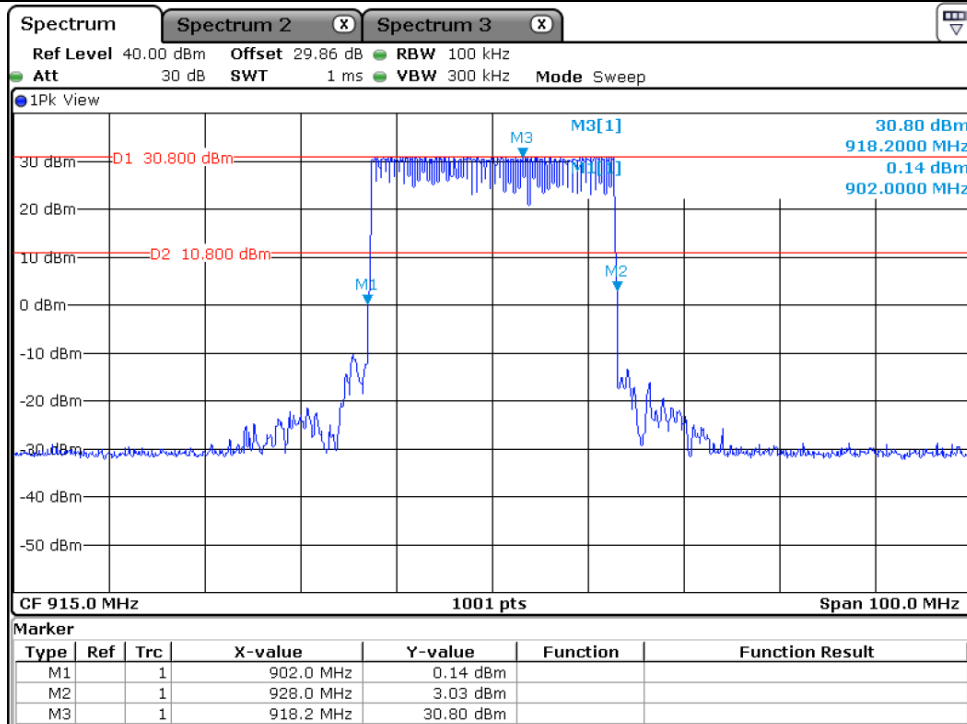
Low Channel



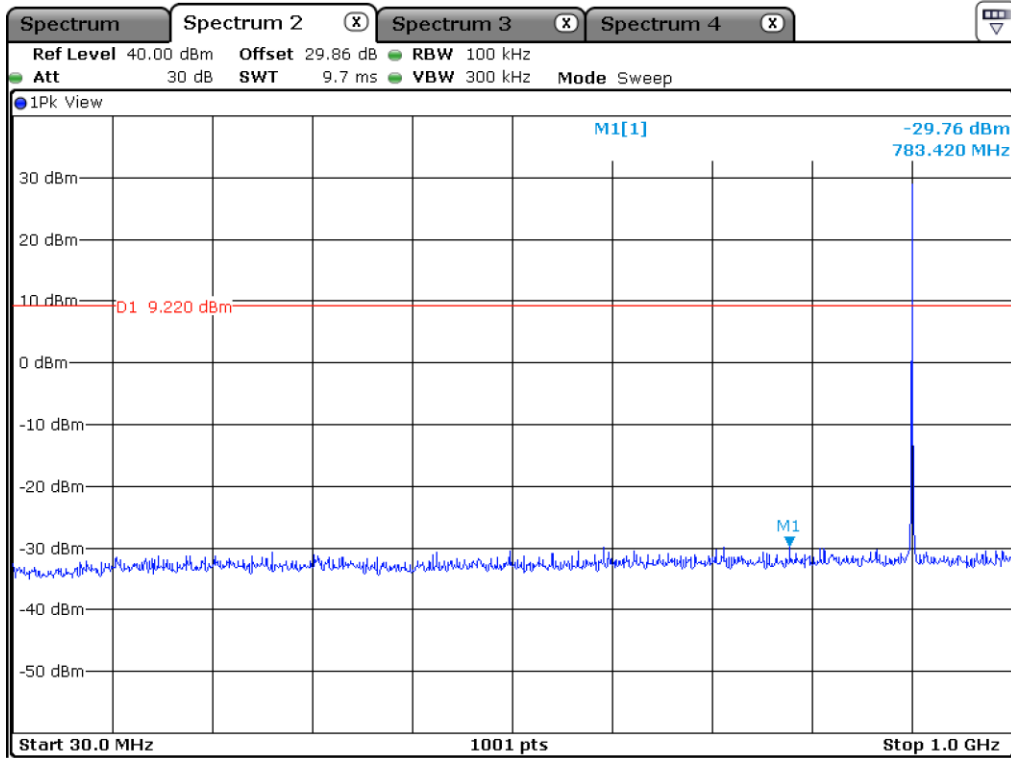
Middle Channel



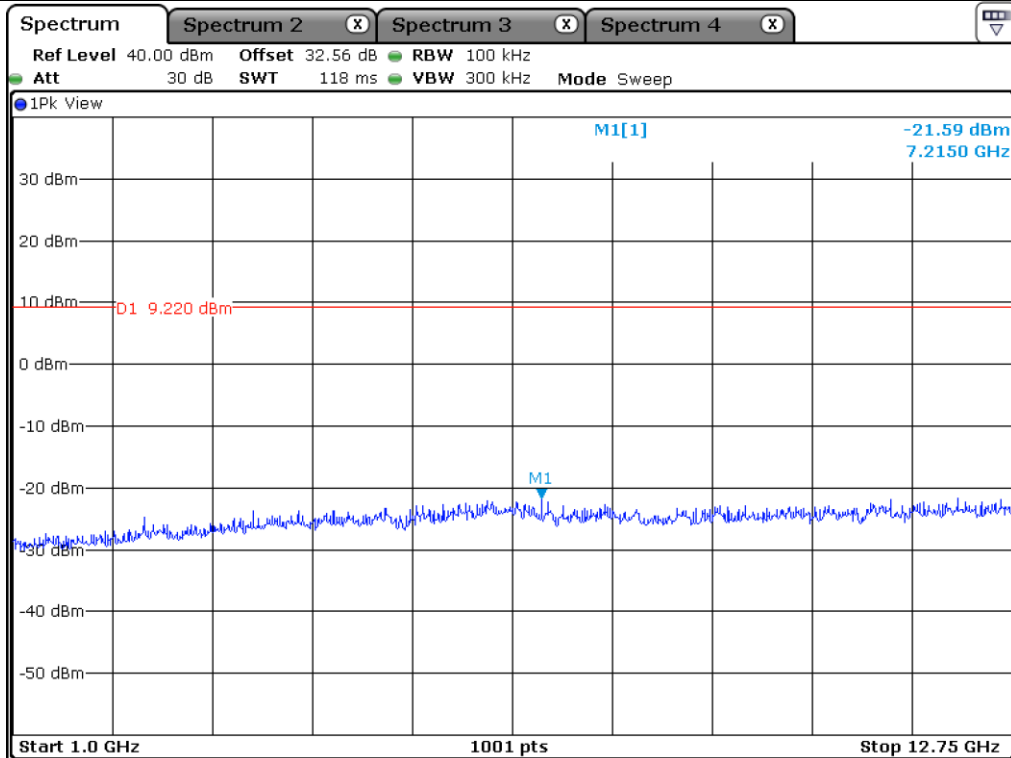
High Channel



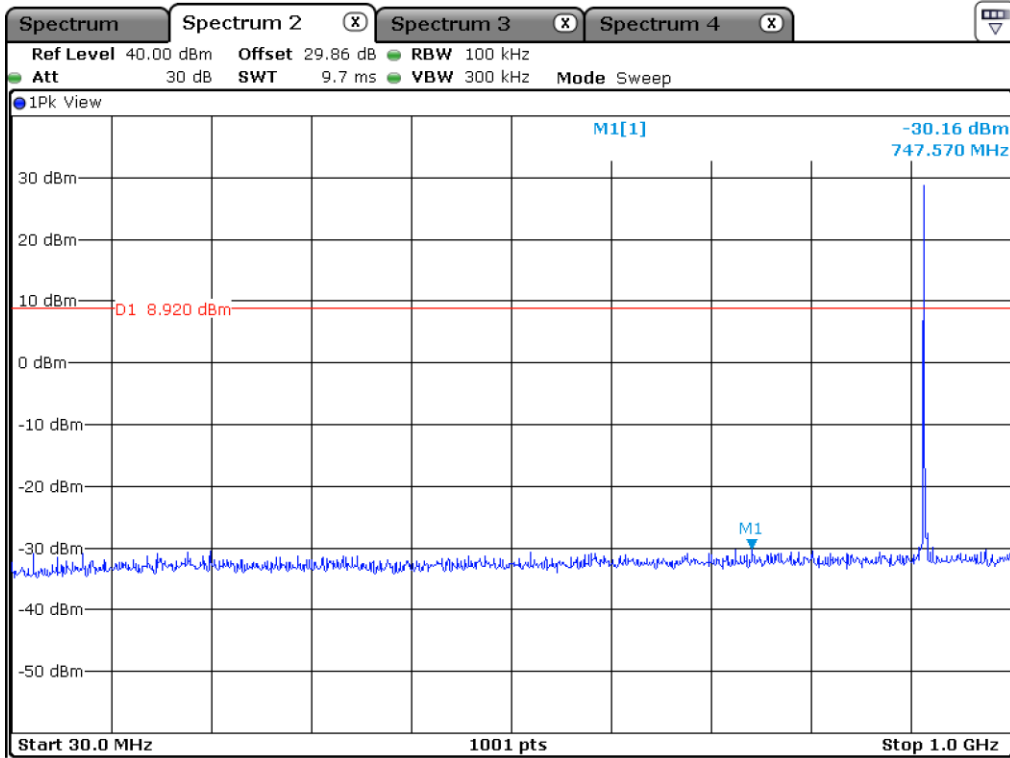
Hopping Channel



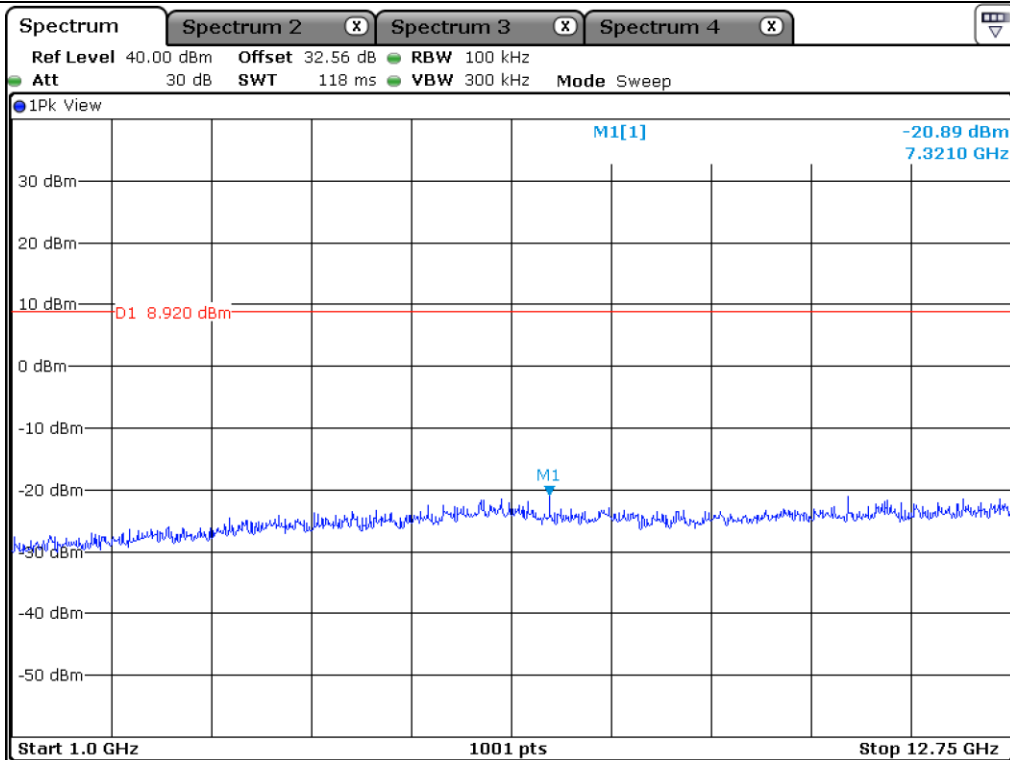
Low Channel



Low Channel

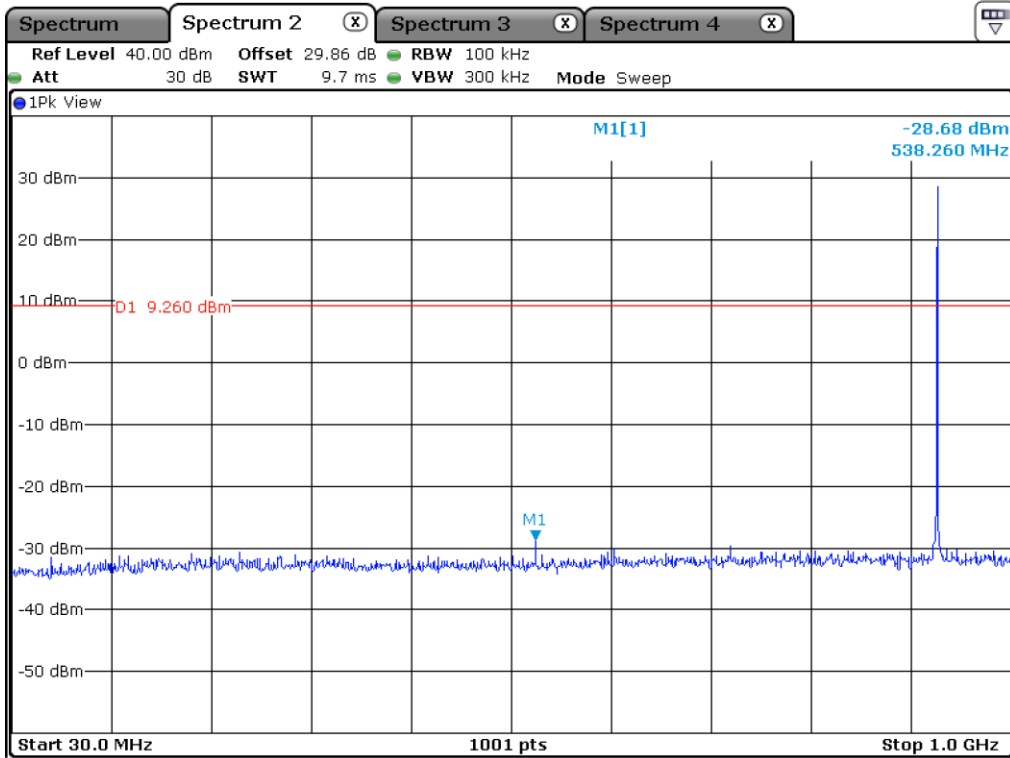


Middle Channel

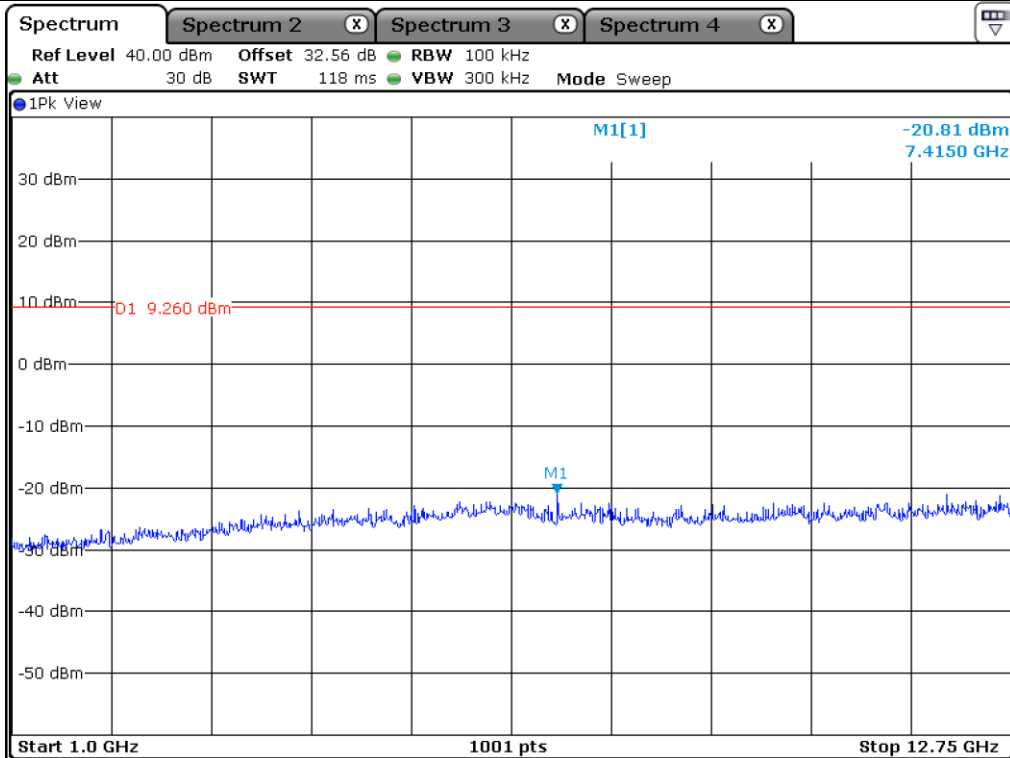


Middle Channel

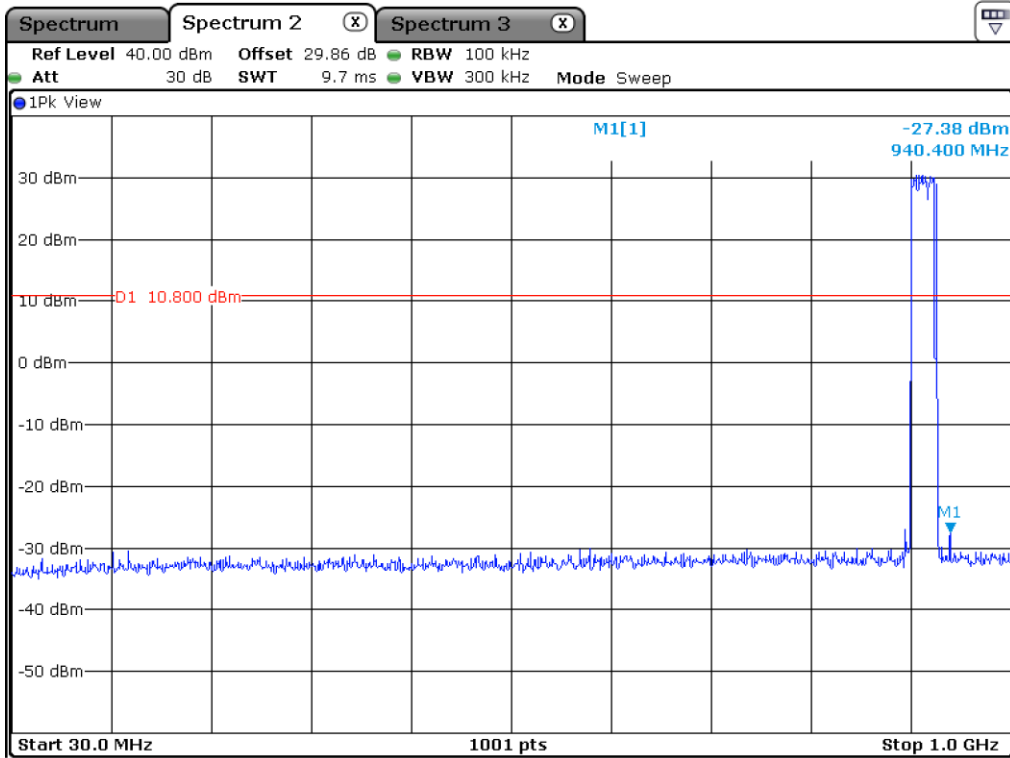




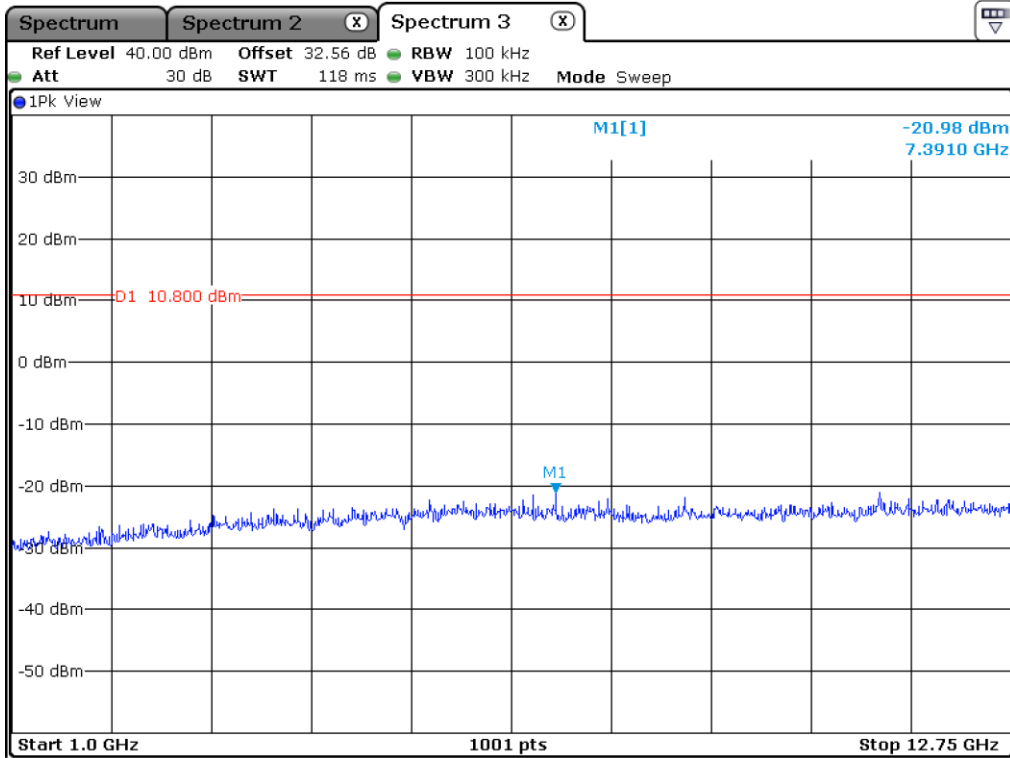
High Channel



High Channel



Hopping Channel



Hopping Channel

**12.5 Test data for Transmitting mode radiated emission (Transmitting Mode)**

**12.5.1 Spurious & Harmonic Radiated Emission above 1 GHz**

**12.5.1.1 Test data for Mode 1\_Normal**

- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak Mode(Peak Detector), 3 MHz for Average Mode(RMS Detector)
- Frequency range : 1 GHz ~ 10.0 GHz
- Measurement distance : 3 m
- Duty cycle : 100%
- Result : PASS

Channel	Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Low ch. Harmonic	1 805.00	53.31	Peak	H	25.10	8.50	45.10	41.81	74.00	32.19
		46.48	Average	H	25.10	8.50	45.10	34.98	54.00	19.02
		52.80	Peak	V	25.10	8.50	45.10	41.30	74.00	32.70
		45.83	Average	V	25.10	8.50	45.10	34.33	54.00	19.67
Middle ch. Harmonic	1 830.00	53.47	Peak	H	25.10	8.50	45.10	41.97	74.00	32.03
		46.81	Average	H	25.10	8.50	45.10	35.31	54.00	18.69
		56.20	Peak	V	25.10	8.50	45.10	44.70	74.00	29.30
		51.88	Average	V	25.10	8.50	45.10	40.38	54.00	13.62
High ch. Harmonic	1 855.00	53.05	Peak	H	25.30	8.50	45.10	41.75	74.00	32.25
		45.77	Average	H	25.30	8.50	45.10	34.47	54.00	19.53
		55.83	Peak	V	25.30	8.50	45.10	44.53	74.00	29.47
		51.38	Average	V	25.30	8.50	45.10	40.08	54.00	13.92

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "\*" Frequency fall in restricted band

**12.5.1.2 Test data for Mode 2\_Long**

- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak Mode(Peak Detector), 3 MHz for Average Mode(RMS Detector)
- Frequency range : 1 GHz ~ 10.0 GHz
- Measurement distance : 3 m
- Duty cycle : 100%
- Result : PASS

Channel	Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Low ch. Harmonic	1 804.80	59.11	Peak	H	25.10	8.50	45.10	47.61	74.00	26.39
		56.25	Average	H	25.10	8.50	45.10	44.75	54.00	9.25
		63.34	Peak	V	25.10	8.50	45.10	51.84	74.00	22.16
		61.45	Average	V	25.10	8.50	45.10	49.95	54.00	4.05
Middle ch. Harmonic	1 829.60	60.93	Peak	H	25.10	8.50	45.10	49.43	74.00	24.57
		58.40	Average	H	25.10	8.50	45.10	46.90	54.00	7.10
		63.50	Peak	V	25.10	8.50	45.10	52.00	74.00	22.00
		61.51	Average	V	25.10	8.50	45.10	50.01	54.00	3.99
High ch. Harmonic	1 855.20	62.64	Peak	H	25.30	8.50	45.10	51.34	74.00	22.66
		60.52	Average	H	25.30	8.50	45.10	49.22	54.00	4.78
		64.63	Peak	V	25.30	8.50	45.10	53.33	74.00	20.67
		62.92	Average	V	25.30	8.50	45.10	51.62	54.00	2.38

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "\*" Frequency fall in restricted band

**12.5.1.3 Test data for Mode 3\_Repeat**

- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak Mode(Peak Detector), 3 MHz for Average Mode(RMS Detector)
- Frequency range : 1 GHz ~ 10.0 GHz
- Measurement distance : 3 m
- Duty cycle : 100%
- Result : PASS

Channel	Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Low ch. Harmonic	1 805.00	59.15	Peak	H	25.10	8.50	45.10	47.65	74.00	26.35
		55.98	Average	H	25.10	8.50	45.10	44.48	54.00	9.52
		63.08	Peak	V	25.10	8.50	45.10	51.58	74.00	22.42
		61.05	Average	V	25.10	8.50	45.10	49.55	54.00	4.45
Middle ch. Harmonic	1 830.00	60.05	Peak	H	25.10	8.50	45.10	48.55	74.00	25.45
		57.17	Average	H	25.10	8.50	45.10	45.67	54.00	8.33
		63.29	Peak	V	25.10	8.50	45.10	51.79	74.00	22.21
		60.94	Average	V	25.10	8.50	45.10	49.44	54.00	4.56
High ch. Harmonic	1 855.00	60.56	Peak	H	25.30	8.50	45.10	49.26	74.00	24.74
		58.04	Average	H	25.30	8.50	45.10	46.74	54.00	7.26
		64.96	Peak	V	25.30	8.50	45.10	53.66	74.00	20.34
		63.31	Average	V	25.30	8.50	45.10	52.01	54.00	1.99

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "\*" Frequency fall in restricted band

## **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 9 kHz to 10.0 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**

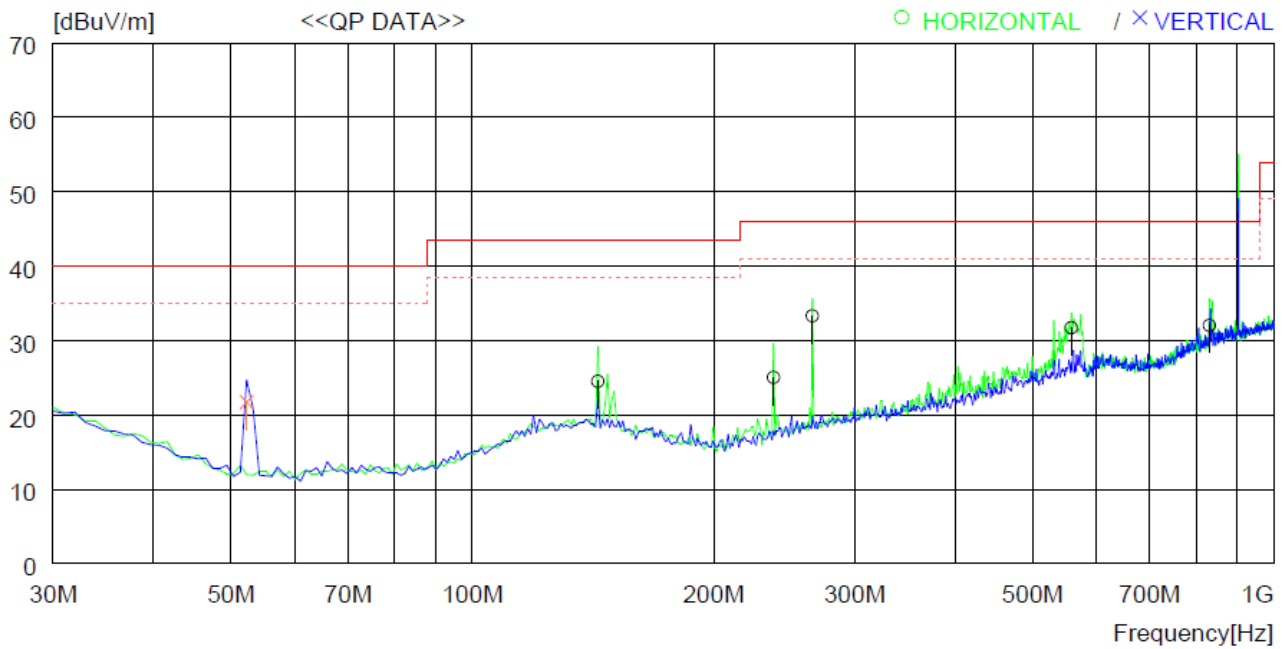
October 28, 2022 ~ January 18, 2023

13.4 Test data for Transmitting Mode

13.4.1 Test data for Mode 1\_Normal

13.4.1.1 Test data for 30 MHz ~ 1 000 MHz

- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 000 MHz
- Measurement distance : 3 m
- The highest value is the fundamental.



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	36.1	18.9	1.5	32.0	24.5	43.5	19.0	400	359
2	237.580	37.9	17.1	2.0	32.0	25.0	46.0	21.0	100	295
3	265.710	45.1	18.1	2.1	32.0	33.3	46.0	12.7	100	20
4	558.649	37.2	23.7	3.0	32.2	31.7	46.0	14.3	200	359
5	831.211	33.3	27.2	3.8	32.3	32.0	46.0	14.0	100	0
----- Vertical -----										
6	52.310	40.1	12.7	0.9	32.0	21.7	40.0	18.3	100	359

**13.4.1.2 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 (dB $\mu$ V)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.								

**13.4.1.3 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 ~ 10.0 GHz
- Measurement distance : 3 m

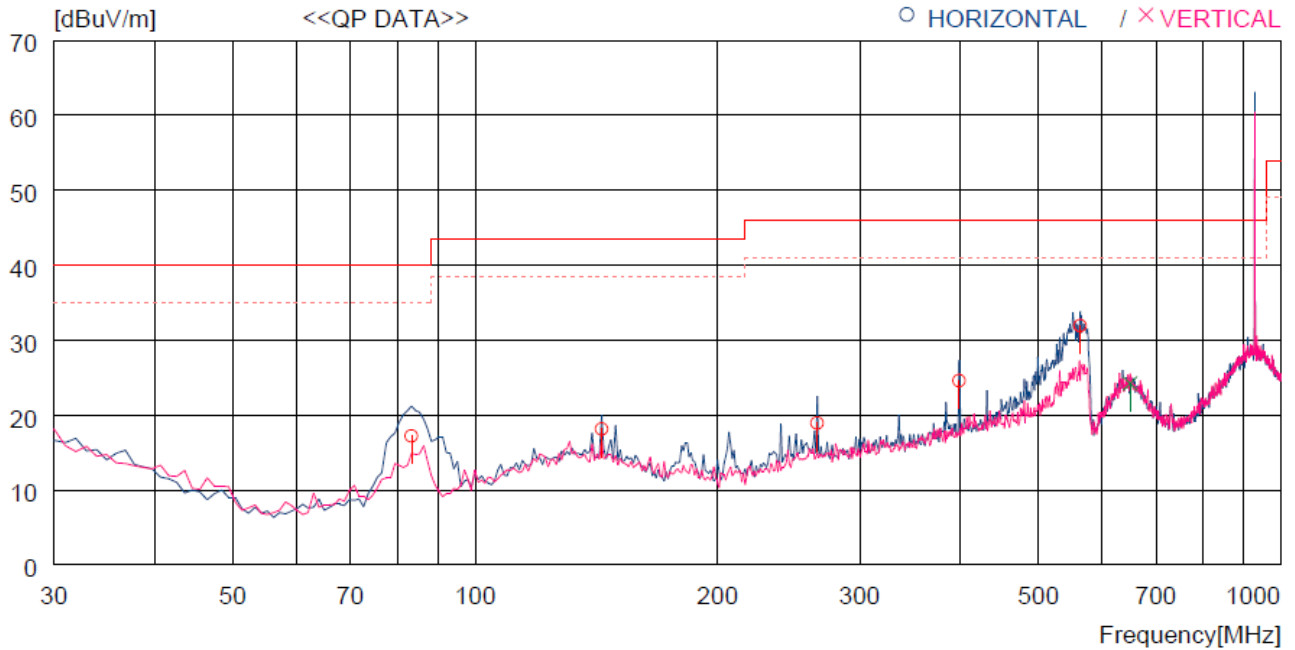
Frequency (MHz)	Reading (dB $\mu$ V)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.								



13.4.2 Test data for Mode 2\_Long

13.4.2.1 Test data for 30 MHz ~ 1 000 MHz

- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 000 MHz
- Measurement distance : 3 m
- The highest value is the fundamental.



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	83.350	35.1	13.4	1.8	33.1	17.2	40.0	22.8	200	288
2	143.490	29.8	19.1	2.2	33.0	18.1	43.5	25.4	200	359
3	265.710	30.0	18.6	3.2	32.9	18.9	46.0	27.1	200	359
4	398.600	32.4	21.2	3.9	32.9	24.6	46.0	21.4	100	231
5	563.499	36.4	24.0	4.8	33.3	31.9	46.0	14.1	200	359
---- Vertical ----										
6	649.826	27.7	24.9	5.0	33.4	24.2	46.0	21.8	200	72

**13.4.2.2 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 (dB $\mu$ V)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.								

**13.4.2.3 Test data for above 1 GHz**

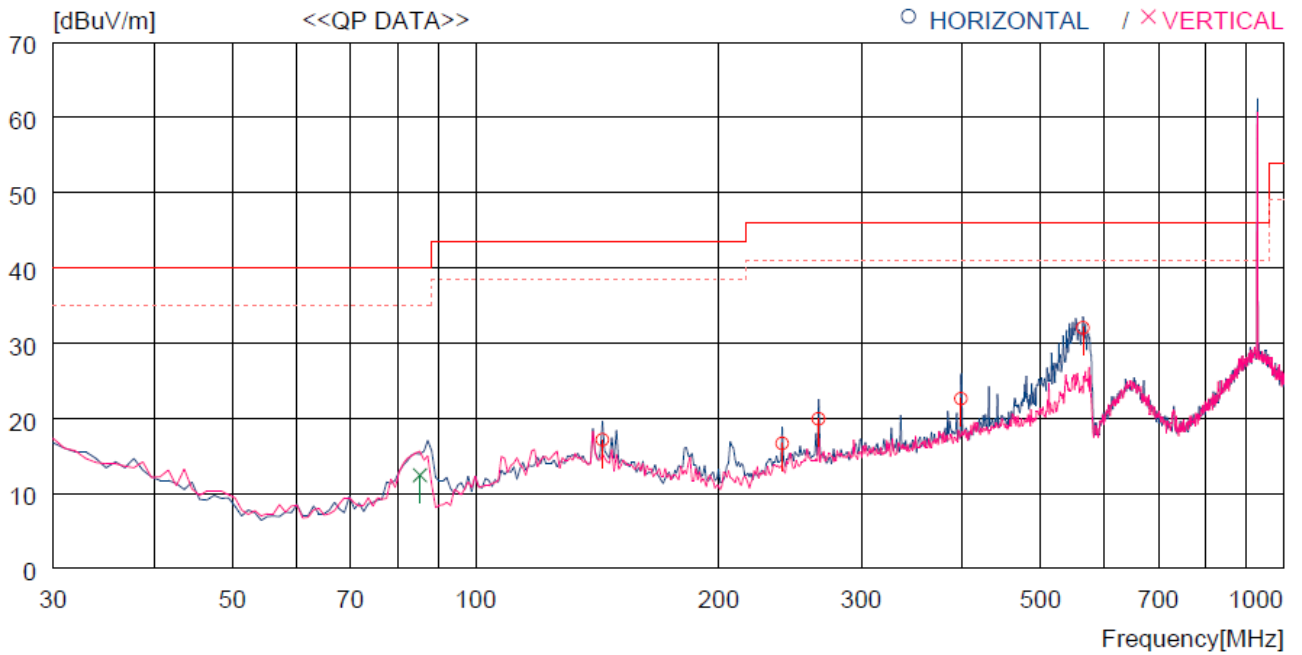
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 10.0 GHz
- Measurement distance : 3 m

Frequency (MHz)	Reading (dB $\mu$ V)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.								

**13.4.3 Test data for Mode 3\_Repeat**

**13.4.3.1 Test data for 30 MHz ~ 1 000 MHz**

- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 000 MHz
- Measurement distance : 3 m
- The highest value is the fundamental.



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	28.8	19.1	2.2	33.0	17.1	43.5	26.4	300	0
2	239.520	29.7	16.9	3.0	33.0	16.6	46.0	29.4	100	0
3	265.710	31.0	18.6	3.2	32.9	19.9	46.0	26.1	100	288
4	398.600	30.4	21.2	3.9	32.9	22.6	46.0	23.4	100	0
5	564.469	36.5	24.0	4.8	33.3	32.0	46.0	14.0	200	359
----- Vertical -----										
6	85.290	30.2	13.5	1.8	33.1	12.4	40.0	27.6	100	5

**13.4.3.2 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 (dB $\mu$ V)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.								

**13.4.3.3 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 ~ 10.0 GHz
- Measurement distance : 3 m

Frequency (MHz)	Reading (dB $\mu$ V)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dB $\mu$ V/m)	Limits (dB $\mu$ V/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 : 45 % 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

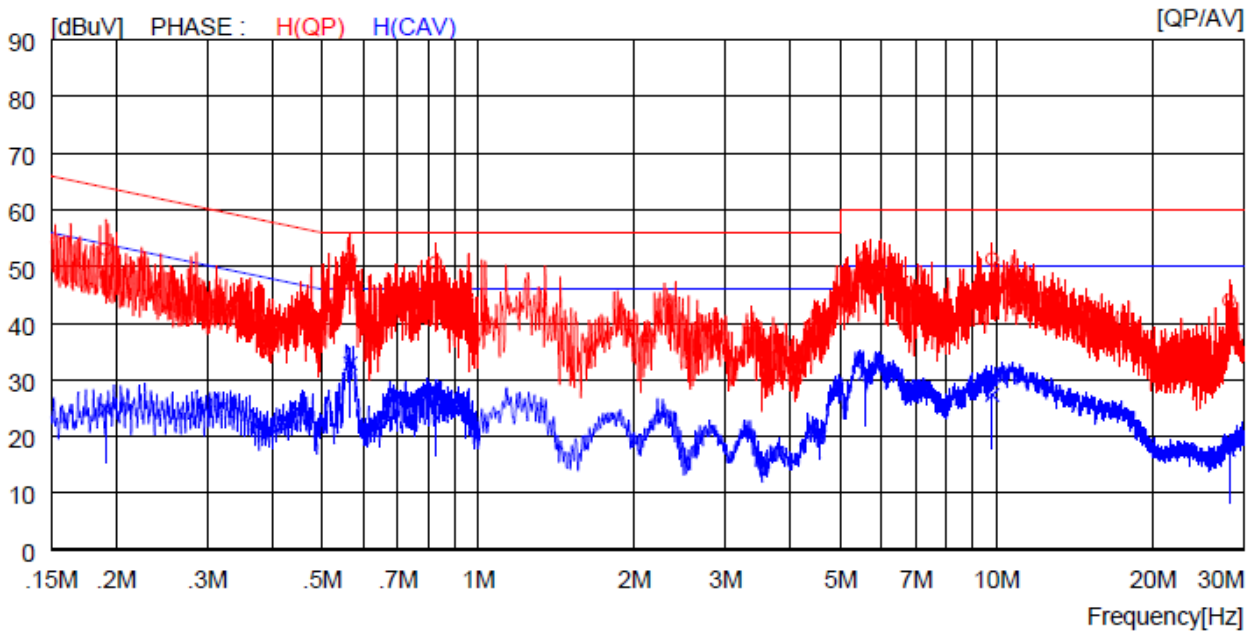
October 28, 2022 ~ January 18, 2023

14.4 Test Data for Trasmitting Mode

14.4.1 Test data for Mode 1\_Normal

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

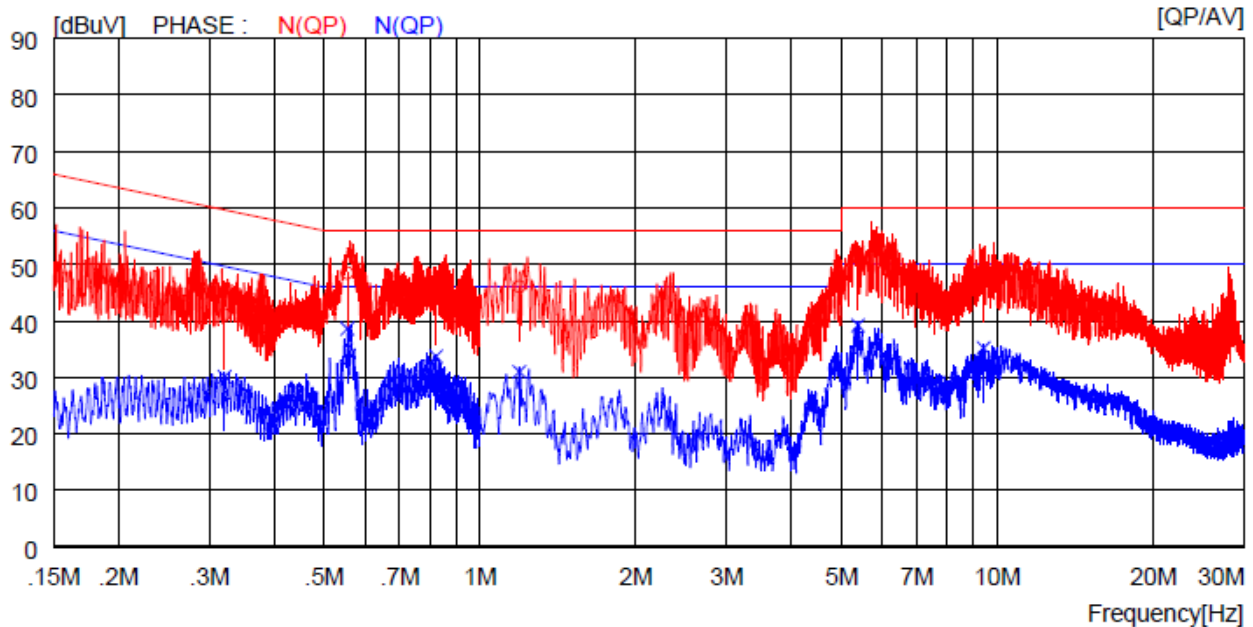
LIMIT : EN.KN.FCC.VCCI\_CISPR Pub.32 Class B, Quasi-Peak Limits (Mains Ports)  
 EN.KN.FCC.VCCI\_CISPR Pub.32 Class B, Average Limits (Mains Ports)



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	0.19100	43.1	----	10.0	53.1	----	64.0	----	10.9	----	H (QP)
2	0.56700	41.0	----	10.2	51.2	----	56.0	----	4.8	----	H (QP)
3	0.82700	40.5	----	10.2	50.7	----	56.0	----	5.3	----	H (QP)
4	5.58000	41.3	----	10.3	51.6	----	60.0	----	8.4	----	H (QP)
5	9.81000	40.8	----	10.5	51.3	----	60.0	----	8.7	----	H (QP)
6	28.08000	33.3	----	10.7	44.0	----	60.0	----	16.0	----	H (QP)
7	0.19100	----	14.8	10.0	----	24.8	----	54.0	----	29.2	H (CAV)
8	0.56700	----	22.7	10.2	----	32.9	----	46.0	----	13.1	H (CAV)
9	0.82700	----	15.9	10.2	----	26.1	----	46.0	----	19.9	H (CAV)
10	5.58000	----	21.0	10.3	----	31.3	----	50.0	----	18.7	H (CAV)
11	9.81000	----	16.8	10.5	----	27.3	----	50.0	----	22.7	H (CAV)
12	28.08000	----	6.9	10.7	----	17.6	----	50.0	----	32.4	H (CAV)

-. Tested Line : NEUTRAL LINE

LIMIT : EN.KN.FCC.VCCI\_CISPR Pub.32 Class B, Quasi-Peak Limits (Mains Ports)  
 EN.KN.FCC.VCCI\_CISPR Pub.32 Class B, Average Limits (Mains Ports)



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	0.32100	31.0	----	10.1	41.1	----	59.7	----	18.6	----	N (QP)
2	0.55500	38.4	----	10.1	48.5	----	56.0	----	7.5	----	N (QP)
3	0.82300	35.0	----	10.2	45.2	----	56.0	----	10.8	----	N (QP)
4	1.19200	35.8	----	10.3	46.1	----	56.0	----	9.9	----	N (QP)
5	5.38000	41.2	----	10.3	51.5	----	60.0	----	8.5	----	N (QP)
6	9.40500	38.7	----	10.5	49.2	----	60.0	----	10.8	----	N (QP)
7	0.32100	----	20.0	10.1	----	30.1	----	49.7	----	19.6	N (CAV)
8	0.55500	----	28.5	10.1	----	38.6	----	46.0	----	7.4	N (CAV)
9	0.82300	----	23.5	10.2	----	33.7	----	46.0	----	12.3	N (CAV)
10	1.19200	----	20.7	10.3	----	31.0	----	46.0	----	15.0	N (CAV)
11	5.38000	----	28.9	10.3	----	39.2	----	50.0	----	10.8	N (CAV)
12	9.40500	----	24.7	10.5	----	35.2	----	50.0	----	14.8	N (CAV)

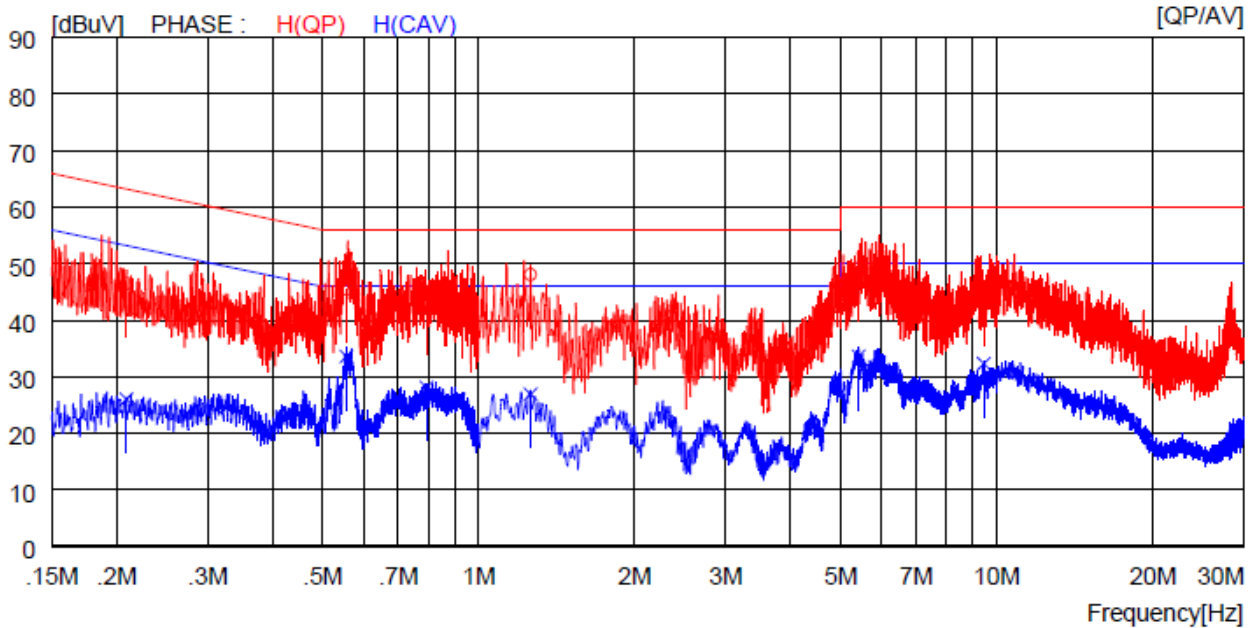
Remark: Margin (dB) = Limit – Level (Result)

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

14.4.2 Test data for Mode 2\_Long

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

LIMIT : EN.KN.FCC.VCCI CISPR Pub.32 Class B, Quasi-Peak Limits (Mains Ports)  
 EN.KN.FCC.VCCI\_CISPR Pub.32 Class B, Average Limits (Mains Ports)

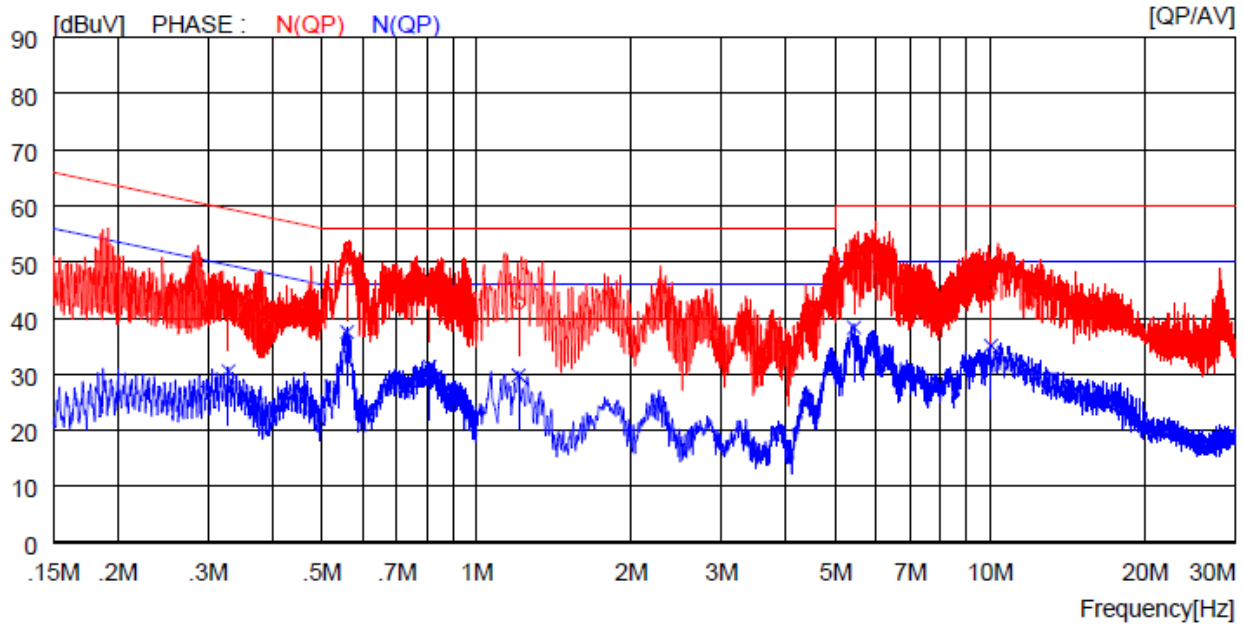


NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.20900	36.5	----	10.0	46.5	----	63.2	----	16.7	----	H (QP)
2	0.55600	35.4	----	10.1	45.5	----	56.0	----	10.5	----	H (QP)
3	0.79400	33.3	----	10.2	43.5	----	56.0	----	12.5	----	H (QP)
4	1.26000	37.8	----	10.3	48.1	----	56.0	----	7.9	----	H (QP)
5	5.42000	38.9	----	10.3	49.2	----	60.0	----	10.8	----	H (QP)
6	9.45000	34.6	----	10.5	45.1	----	60.0	----	14.9	----	H (QP)
7	0.20900	----	16.0	10.0	----	26.0	----	53.2	----	27.2	H (CAV)
8	0.55600	----	23.5	10.1	----	33.6	----	46.0	----	12.4	H (CAV)
9	0.79400	----	17.9	10.2	----	28.1	----	46.0	----	17.9	H (CAV)
10	1.26000	----	16.6	10.3	----	26.9	----	46.0	----	19.1	H (CAV)
11	5.42000	----	23.3	10.3	----	33.6	----	50.0	----	16.4	H (CAV)
12	9.45000	----	21.8	10.5	----	32.3	----	50.0	----	17.7	H (CAV)



-. Tested Line : NEUTRAL LINE

LIMIT : EN.KN.FCC.VCCI\_CISPR Pub.32 Class B, Quasi-Peak Limits (Mains Ports)  
 EN.KN.FCC.VCCI\_CISPR Pub.32 Class B, Average Limits (Mains Ports)



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	0.32900	33.5	----	10.1	43.6	----	59.5	----	15.9	----	N (QP)
2	0.56000	38.9	----	10.1	49.0	----	56.0	----	7.0	----	N (QP)
3	0.81000	35.0	----	10.2	45.2	----	56.0	----	10.8	----	N (QP)
4	1.20800	32.4	----	10.3	42.7	----	56.0	----	13.3	----	N (QP)
5	5.43000	40.0	----	10.3	50.3	----	60.0	----	9.7	----	N (QP)
6	10.03000	34.5	----	10.5	45.0	----	60.0	----	15.0	----	N (QP)
7	0.32900	----	20.4	10.1	----	30.5	----	49.5	----	19.0	N (CAV)
8	0.56000	----	27.4	10.1	----	37.5	----	46.0	----	8.5	N (CAV)
9	0.81000	----	21.2	10.2	----	31.4	----	46.0	----	14.6	N (CAV)
10	1.20800	----	19.5	10.3	----	29.8	----	46.0	----	16.2	N (CAV)
11	5.43000	----	28.0	10.3	----	38.3	----	50.0	----	11.7	N (CAV)
12	10.03000	----	24.6	10.5	----	35.1	----	50.0	----	14.9	N (CAV)

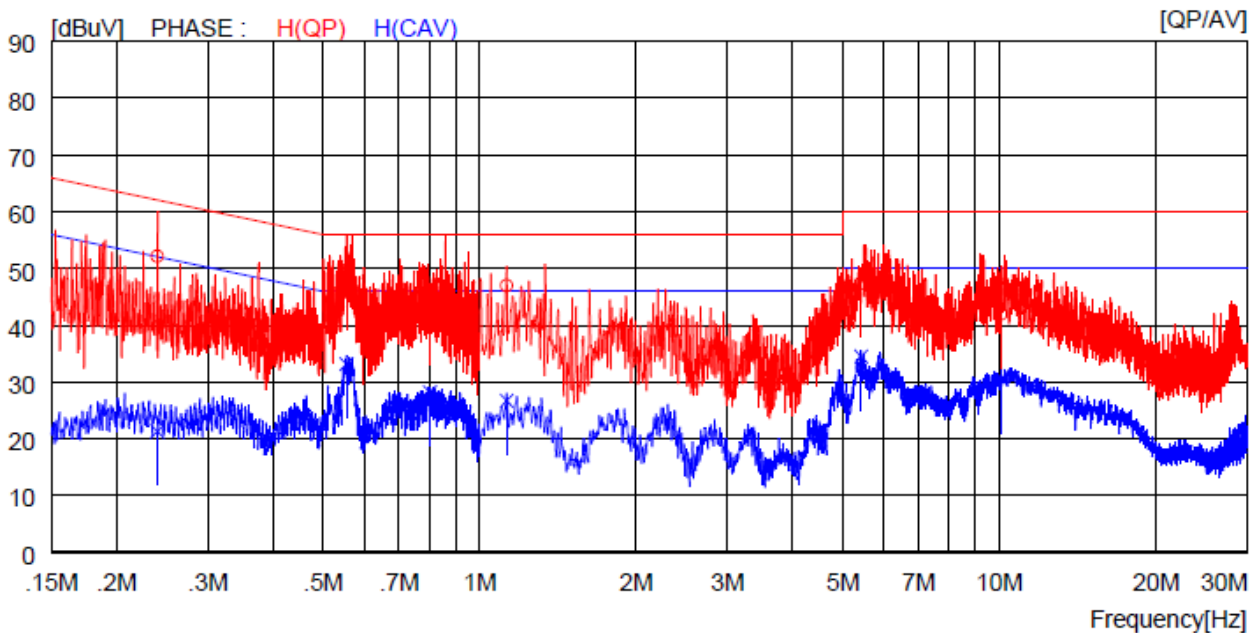
Remark: Margin (dB) = Limit – Level (Result)

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

14.4.3 Test data for Mode 3\_Repeat

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

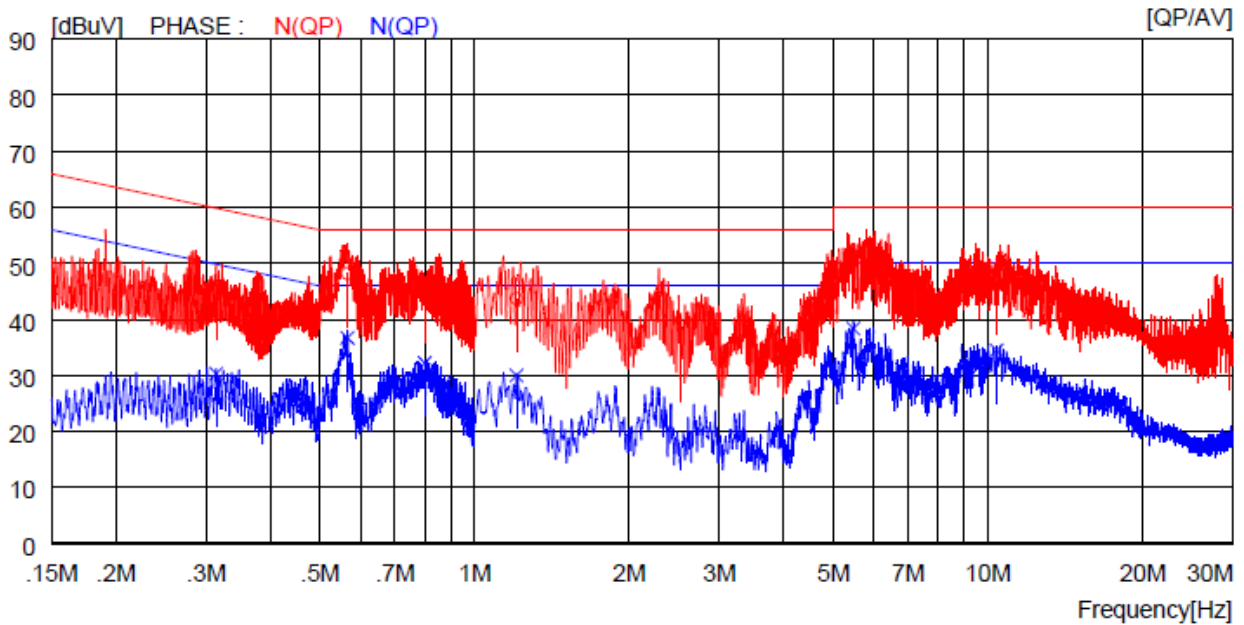
LIMIT : EN.KN.FCC.VCCI\_CISPR Pub.32 Class B, Quasi-Peak Limits (Mains Ports)  
 EN.KN.FCC.VCCI\_CISPR Pub.32 Class B, Average Limits (Mains Ports)



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	0.24000	42.1	----	10.1	52.2	----	62.1	----	9.9	----	H (QP)
2	0.55500	38.6	----	10.1	48.7	----	56.0	----	7.3	----	H (QP)
3	0.80300	32.4	----	10.2	42.6	----	56.0	----	13.4	----	H (QP)
4	1.12800	36.7	----	10.3	47.0	----	56.0	----	9.0	----	H (QP)
5	5.42500	37.1	----	10.3	47.4	----	60.0	----	12.6	----	H (QP)
6	10.09000	31.5	----	10.5	42.0	----	60.0	----	18.0	----	H (QP)
7	0.24000	----	11.2	10.1	----	21.3	----	52.1	----	30.8	H (CAV)
8	0.55500	----	23.1	10.1	----	33.2	----	46.0	----	12.8	H (CAV)
9	0.80300	----	18.0	10.2	----	28.2	----	46.0	----	17.8	H (CAV)
10	1.12800	----	16.4	10.3	----	26.7	----	46.0	----	19.3	H (CAV)
11	5.42500	----	24.2	10.3	----	34.5	----	50.0	----	15.5	H (CAV)
12	10.09000	----	20.0	10.5	----	30.5	----	50.0	----	19.5	H (CAV)

-. Tested Line : NEUTRAL LINE

LIMIT : EN.KN.FCC.VCCI\_CISPR Pub.32 Class B, Quasi-Peak Limits (Mains Ports)  
 EN.KN.FCC.VCCI\_CISPR Pub.32 Class B, Average Limits (Mains Ports)



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	0.31400	35.8	----	10.1	45.9	----	59.9	----	14.0	----	N (QP)
2	0.56600	38.1	----	10.1	48.2	----	56.0	----	7.8	----	N (QP)
3	0.80000	35.0	----	10.2	45.2	----	56.0	----	10.8	----	N (QP)
4	1.20800	33.4	----	10.3	43.7	----	56.0	----	12.3	----	N (QP)
5	5.47000	41.2	----	10.3	51.5	----	60.0	----	8.5	----	N (QP)
6	10.40000	36.3	----	10.5	46.8	----	60.0	----	13.2	----	N (QP)
7	0.31400	----	20.2	10.1	----	30.3	----	49.9	----	19.6	N (CAV)
8	0.56600	----	26.6	10.1	----	36.7	----	46.0	----	9.3	N (CAV)
9	0.80000	----	22.0	10.2	----	32.2	----	46.0	----	13.8	N (CAV)
10	1.20800	----	19.7	10.3	----	30.0	----	46.0	----	16.0	N (CAV)
11	5.47000	----	28.1	10.3	----	38.4	----	50.0	----	11.6	N (CAV)
12	10.40000	----	24.0	10.5	----	34.5	----	50.0	----	15.5	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**

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
FSVA40	Rohde & Schwarz	Signal Analyzer	101598	Apr. 21, 2022 (1Y)
ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 18, 2022 (1Y)
ESW 44	Rohde & Schwarz	EMI Test Receiver	101851	Mar. 08.2022 (1Y)
DT2000-2t	Innco System GmgH	Turn table	N/A	N/A
MA4000-EP	Innco System GmgH	Antenna Master	N/A	N/A
310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 15, 2022 (1Y)
310N	Sonoma Instrument	Pre-Amplifier	392756	Oct. 13, 2022 (1Y)
SCU18	Rohde & Schwarz	Signal Conditioning unit	102266	Jul. 12, 2022 (1Y)
DT2000-2t	Innco System	Turn Table	N/A	N/A
MA-4000XPET	Innco System	Tilt Antenna Master	MA4000/509/3 7211215/L	N/A
HLP-2008	TDK RF Solutions	Hybrid Antenna	131313	Fed. 21, 2022 (2Y)
HLP-2008	TDK RF Solutions	Hybrid Antenna	131316	Mar. 07, 2022 (2Y)
BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 05, 2022 (1Y)
89-30-11	WEINSCHTEL	Fixed Coaxial Attenuator(30 dB)	687	Jan. 04. 2023 (1Y)
10 dB Attenuator	Rohde & Schwarz	10 dB Attenuator	14100882-3	Jul. 14. 2022 (1Y)
HPF 1.5GHz	Rohde & Schwarz	High Pass Filter	N/A	Jan. 16. 2023 (1Y)
N/A	PHELCOM.CO	Band Reject Filter	N/A	Jan. 17. 2023 (1Y)
3825/2	EMCO	LISN(AMN)	9109-1869	Mar. 15, 2022 (1Y)
ESH3-Z2	Rohde & Schwarz	Pulse Limiter	100655	Mar. 14, 2022 (1Y)
ESCI	Rohde & Schwarz	Test Receiver	101012	Oct, 12, 2022 (1Y)
NSLK8128	SCHWARZ BECK	V - LISN ( 4*32/50A)	8128216	Mar. 14, 2022 (1Y)
SMB100A	Rohde & Schwarz	SIGNAL GENERATOR	177648	Jan. 18. 2023 (1Y)
FMZB 1513	Schwarzbeck	Loop Antenna	1513-235	Mar. 24, 2022 (1Y)