

RF PERFORMANCE TEST REPORT

Test Report No. : OT-203-RWD-075
AGR No. : A202A-298R
Applicant : SMC Corporation
Address : 4-2-2, Kinunodai, Tsukubamirai-shi, Ibaraki-ken, Japan
Manufacturer : SMC Corporation
Address : 4-2-2, Kinunodai, Tsukubamirai-shi, Ibaraki-ken, Japan
Type of Equipment : Wireless module
FCC ID. : 2AJE7SMC-WEX02
Model Name : P5740-133
Multiple Model Name: N/A
Serial number : N/A
Total page of Report : 54 pages (including this page)
Date of Incoming : February 26, 2020
Date of issue : March 27, 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.

Reviewed by:



Ha-Ram, Lee / Manager
ONETECH Corp.

Approved by:



Jae-Ho Lee / Chief Engineer
ONETECH Corp.

CONTENTS

PAGE

1. VERIFICATION OF COMPLIANCE	5
2. TEST SUMMARY	6
2.1 TEST ITEMS AND RESULTS	6
2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS	6
2.3 RELATED SUBMITTAL(S) / GRANT(S)	6
2.4 PURPOSE OF THE TEST	6
2.5 TEST METHODOLOGY	6
2.6 TEST FACILITY	7
3. GENERAL INFORMATION	8
3.1 PRODUCT DESCRIPTION	8
3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT	8
4. EUT MODIFICATIONS	8
5. SYSTEM TEST CONFIGURATION	9
5.1 JUSTIFICATION	9
5.2 PERIPHERAL EQUIPMENT	9
5.3 MODE OF OPERATION DURING THE TEST	10
5.4 CONFIGURATION OF TEST SYSTEM	10
5.5 ANTENNA REQUIREMENT	10
6. PRELIMINARY TEST	11
6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS	11
6.2 GENERAL RADIATED EMISSIONS TESTS	11
7. MINIMUM 20 DB BANDWIDTH	12
7.1 OPERATING ENVIRONMENT	12
7.2 TEST SET-UP	12
7.3 TEST EQUIPMENT USED	12
7.4 TEST DATA FOR 1 MBPS	13
7.5 TEST DATA FOR 250 KBPS	15
8. HOPPING FREQUENCY SEPARATION	17
8.1 OPERATING ENVIRONMENT	17
8.2 TEST SET-UP	17
8.3 TEST EQUIPMENT USED	17
8.4 TEST DATA FOR 1 MBPS	18

8.5 TEST DATA FOR 250 KBPS	19
9. NUMBER OF HOPPING CHANNELS	20
9.1 OPERATING ENVIRONMENT	20
9.2 TEST SET-UP	20
9.3 TEST EQUIPMENT USED	20
9.4 TEST DATA FOR 1 MBPS	21
9.5 TEST DATA FOR 250 KBPS	24
10. TIME OF OCCUPANCY	27
10.1 OPERATING ENVIRONMENT	27
10.2 TEST SET-UP	27
10.3 TEST EQUIPMENT USED	27
10.4 TEST DATA FOR 1 MBPS	28
10.5 TEST DATA FOR 250 KBPS	29
11. MAXIMUM PEAK OUTPUT POWER	30
11.1 OPERATING ENVIRONMENT	30
11.2 TEST SET-UP	30
11.3 TEST EQUIPMENT USED	30
11.4 TEST DATA FOR 1 MBPS	31
11.5 TEST DATA FOR 250 KBPS	33
12. 100 KHZ BANDWIDTH OUTSIDE THE FREQUENCY BAND	35
12.1 OPERATING ENVIRONMENT	35
12.2 TEST SET-UP FOR CONDUCTED MEASUREMENT	35
12.3 TEST SET-UP FOR RADIATED MEASUREMENT	35
12.4 TEST EQUIPMENT USED	35
12.5 TEST DATA FOR CONDUCTED EMISSION (1 MBPS)	36
12.6 TEST DATA FOR CONDUCTED EMISSION (250 KBPS)	41
12.7 TEST DATA FOR TRANSMITTING MODE RADIATED EMISSION	46
12.7.1 Radiated Emission which fall in the Restricted Band	46
12.7.2 Spurious & Harmonic Radiated Emission above 1 GHz	48
12.7.3 Spurious Radiated Emission	50
13. CONDUCTED EMISSION TEST	52
13.1 OPERATING ENVIRONMENT	52
13.2 TEST SET-UP	52
13.3 TEST EQUIPMENT USED	52
13.4 TEST DATA	53

Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
OT-203-RWD-075	March 27, 2020	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

APPLICANT : SMC Corporation
 ADDRESS : 4-2-2, Kinunodai, Tsukubamirai-shi, Ibaraki-ken, Japan
 CONTACT PERSON : Akira Nishigori / Assistant Manager
 TELEPHONE NO : +81-297-52-6665
 FCC ID : 2AJE7SMC-WEX02
 MODEL NAME : P5740-133
 SERIAL NUMBER : N/A
 DATE : March 27, 2020

EQUIPMENT CLASS	<i>DSS – PART 15 SPREAD SPECTRUM TRANSMITTER</i>
KIND OF EQUIPMENT	Wireless module
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
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	3 m Semi Anechoic Chamber

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

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247 (a) (1)	Carrier Frequency Separation	Met the Limit / PASS
15.247 (a) (1) (iii)	Minimum Number of Hopping Channels	Met the Limit / PASS
15.247 (a) (1) (iii)	Average Time of Occupancy	Met the Limit / PASS
15.247 (b) (1)	Maximum Peak Conducted Output Power	Met the Limit / PASS
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (d)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met requirement / PASS

2.2 Additions, deviations, exclusions from standards

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

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247

2.5 Test Methodology

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

2.6 Test Facility

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

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

-. Site Filing:

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

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

-. Site Accreditation:

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

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The SMC Corporation, Model P5740-133 (referred to as the EUT in this report) is a Wireless module. The product specification described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	Wireless module	
OPERATING FREQUENCY	2 403 MHz ~ 2 481 MHz (1 Mbps, 250 kbps)	
RF OUTPUT POWER	1 Mbps	12.30 dBm
	250 kbps	12.25 dBm
NUMBER OF CHANNEL	79 Channels	
MODULATION TYPE	GFSK	
ANTENNA TYPE	PCB Antenna	
ANTENNA GAIN	1.36 dBi	
LIST OF EACH OSC. OR CRYSTAL. FREQ.(FREQ.>=1 MHz)	38.4 MHz	
RATED SUPPLY VOLTAGE	DC 3.3 V	

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

-. None

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

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

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	N/A	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
SW60-24002500-W	SHENZHEN TOP-ASIA ELECTRONICS CO.,LTD	AC Adapter	EUT

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting and receiving mode is programmed. The EUT was set at Low Channel (2 403 MHz), Middle Channel (2 442 MHz), and High Channel (2 481 MHz). To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis, but the worst data was recorded in this test report.

5.4 Configuration of Test System

Line Conducted Test: The EUT was connected to LISN. All supporting equipment was 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: The EUT was tested in a Charging & Transmitting mode. Preliminary radiated emissions test was conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m 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 transmitter antenna of the EUT is a PCB Antenna, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Charging mode	X

6.2 General Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Charging & Transmitting mode.	X

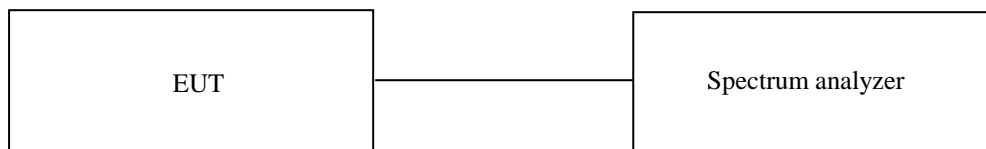
7. MINIMUM 20 dB BANDWIDTH

7.1 Operating environment

Temperature : 22 °C
 Relative humidity : 51 % 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 equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)

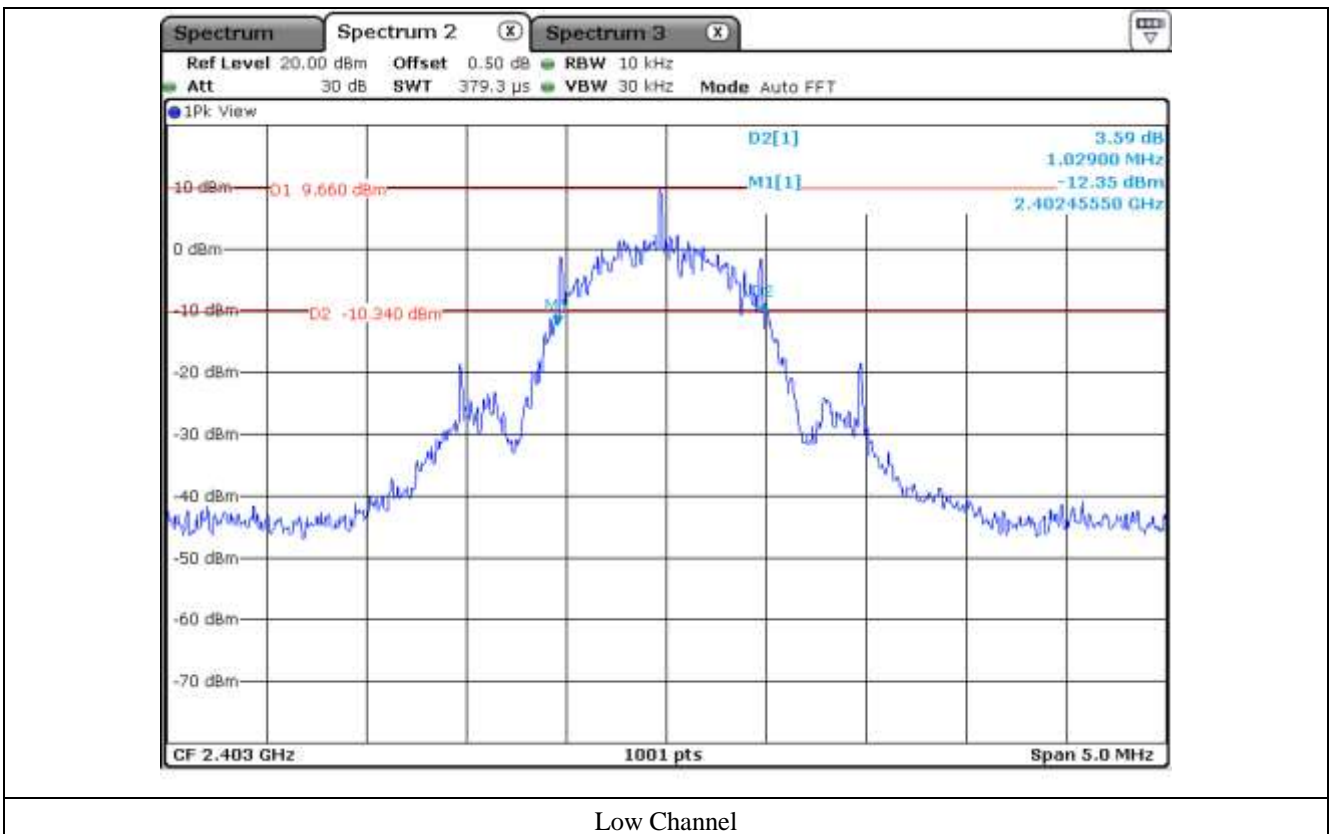
All test equipment used is calibrated on a regular basis.

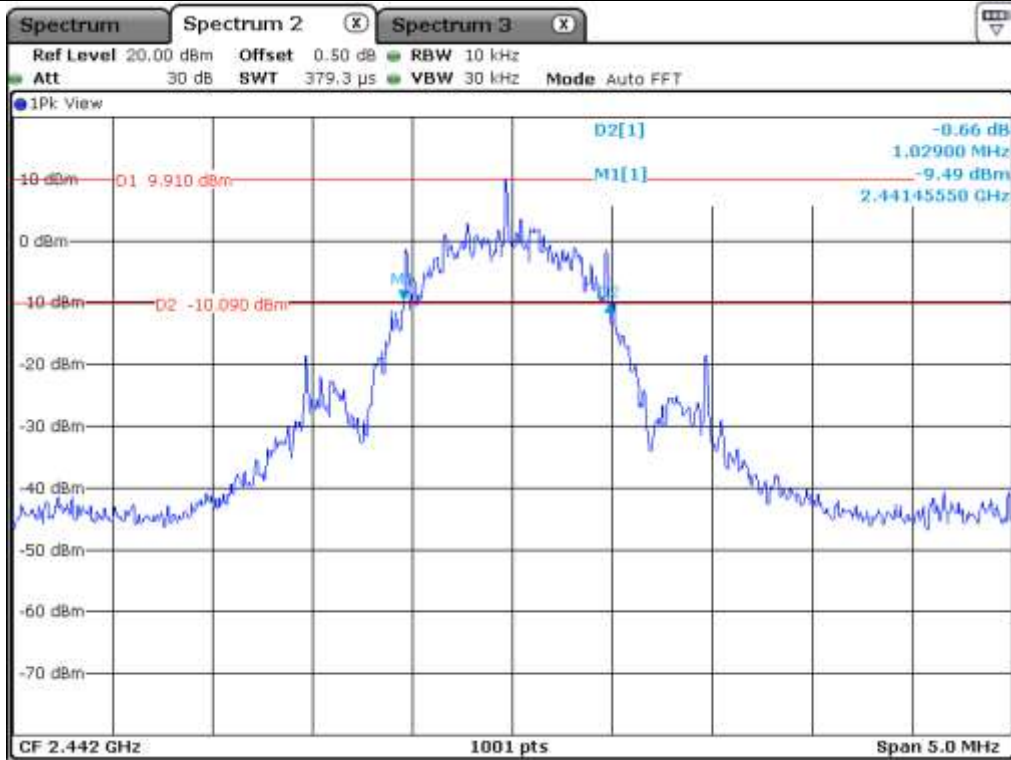
7.4 Test data for 1 Mbps

-. Test Date : March 05, 2020

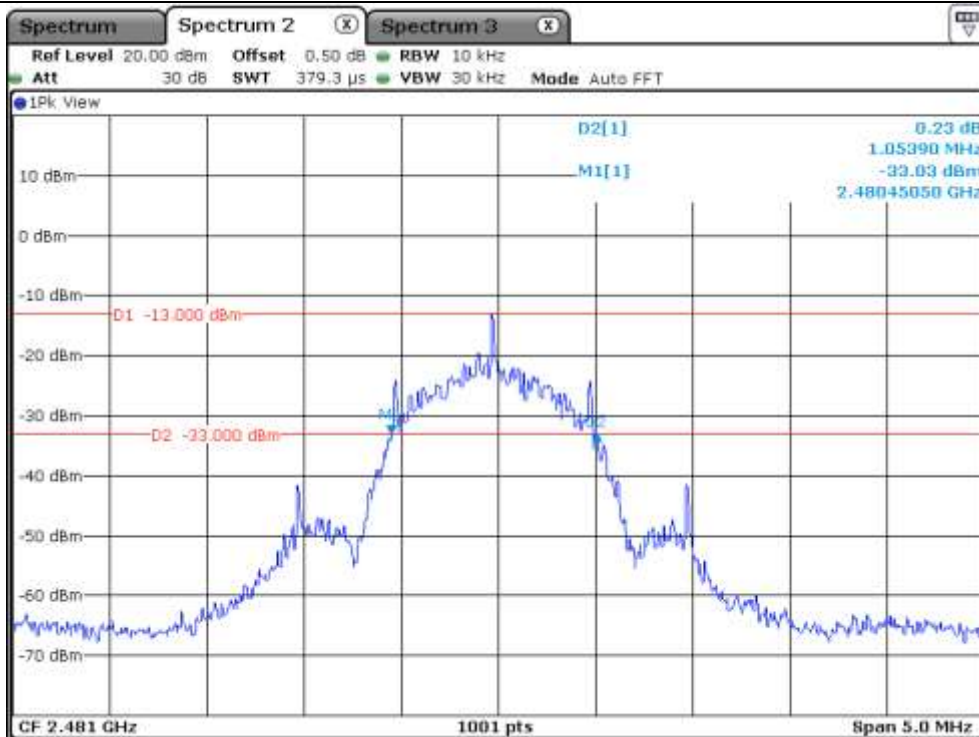
CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 403.00	1 029.00
Middle	2 442.00	1 029.00
High	2 481.00	1 053.90

Tested by: Sieon Lee / Assistant Manager





Middle Channel



High Channel

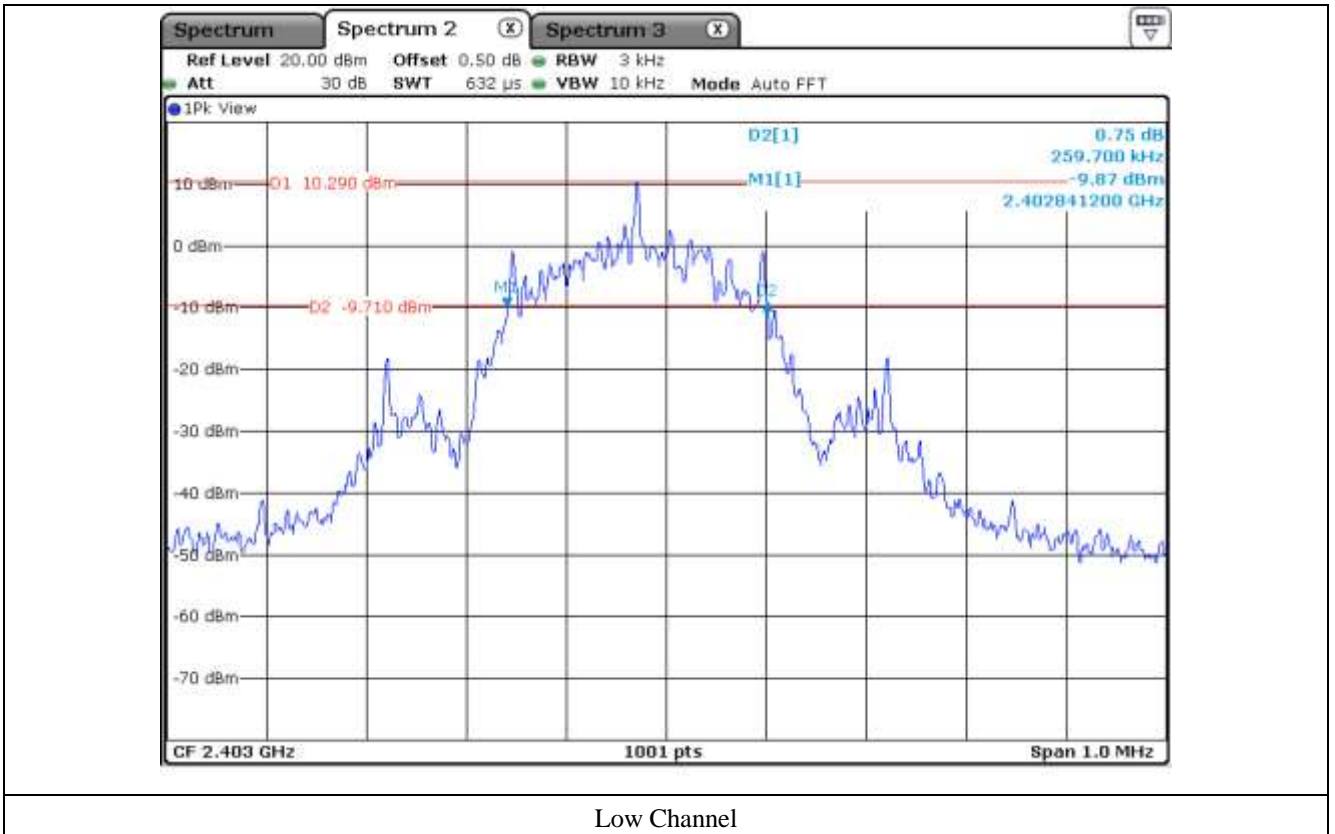
7.5 Test data for 250 kbps

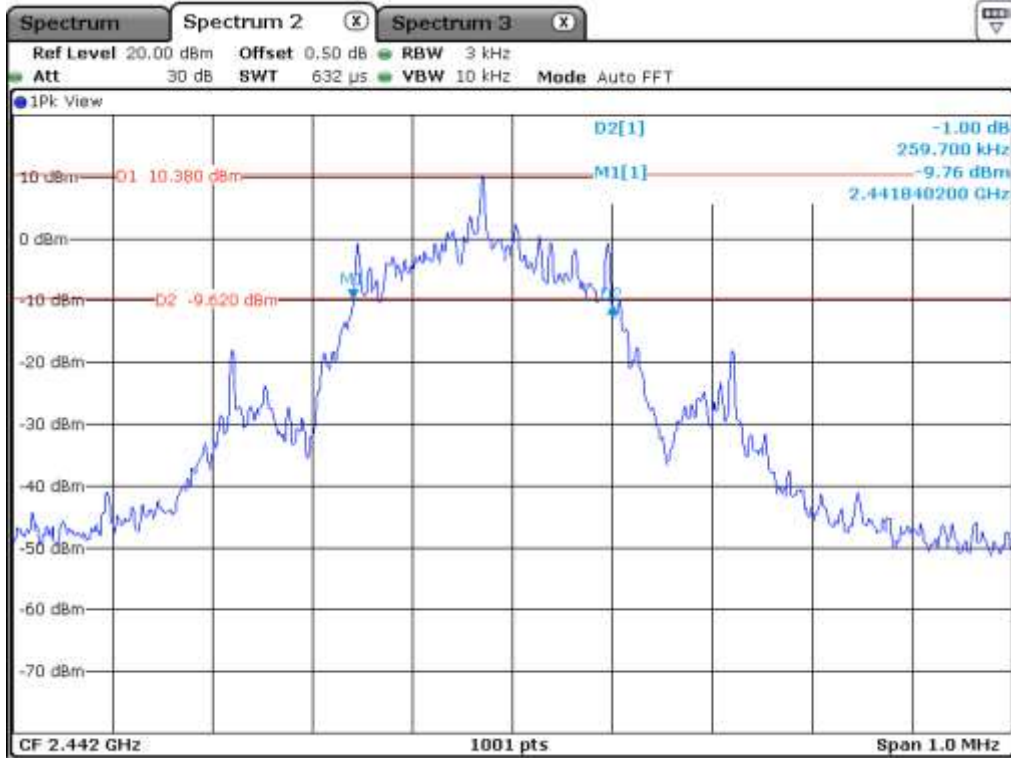
-. Test Date : March 05, 2020

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 403.00	259.70
Middle	2 442.00	259.70
High	2 481.00	258.70

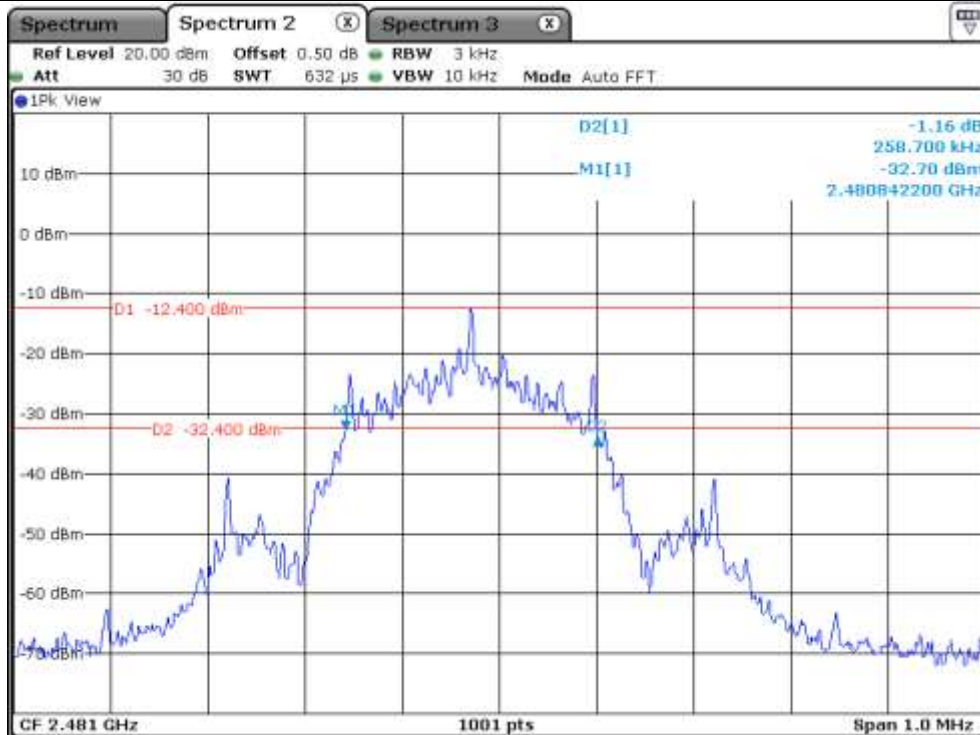


Tested by: Sieon Lee / Assistant Manager





Middle Channel



High Channel

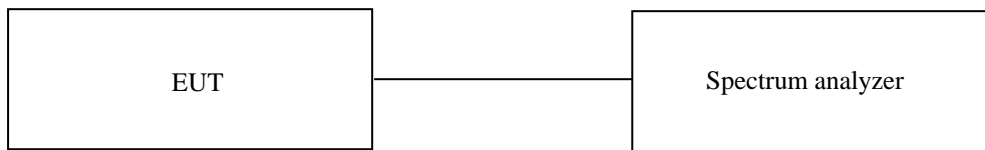
8. HOPPING FREQUENCY SEPARATION

8.1 Operating environment

Temperature : 22 °C
 Relative humidity : 51 % R.H.

8.2 Test set-up

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



8.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

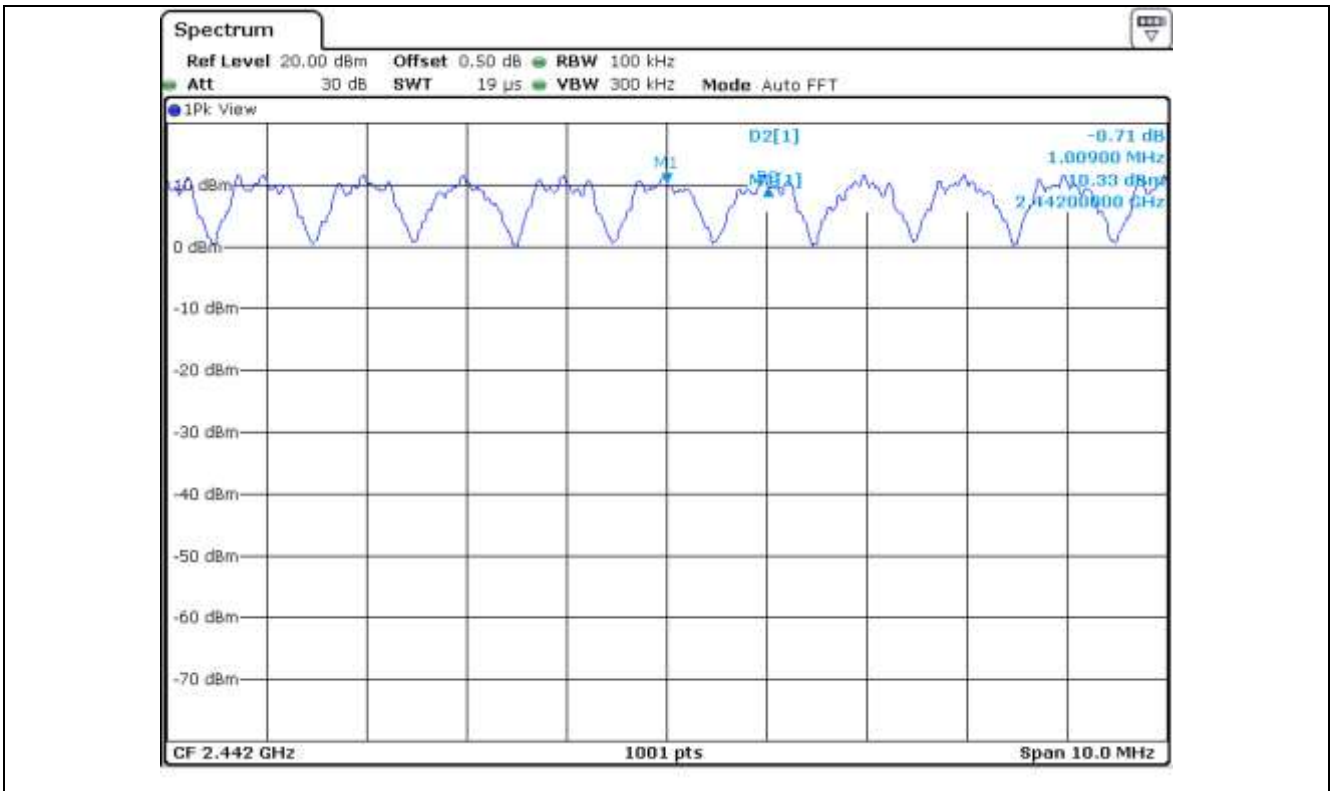
8.4 Test data for 1 Mbps

- Test Date : March 05, 2020

- Test Result : Pass

MEASURED VLAUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
1 009.00	686.00	Separated by a minimum of 25 kHz

Tested by: Sieon Lee / Assistant Manager



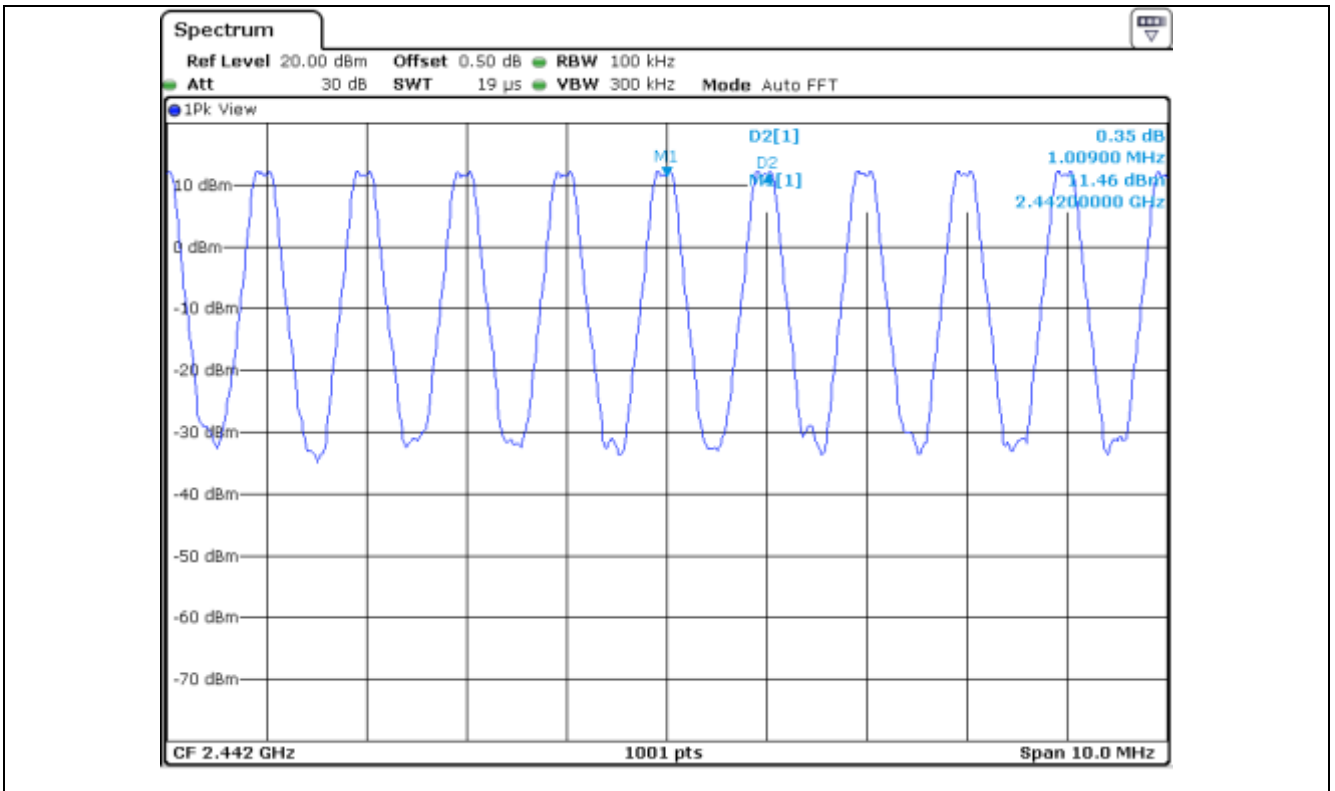
8.5 Test data for 250 kbps

-. Test Date : March 05, 2020

-. Test Result : Pass

MEASURED VLAUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
1 009.00	172.47	Separated by a minimum of 25 kHz

Tested by: Sieon Lee / Assistant Manager



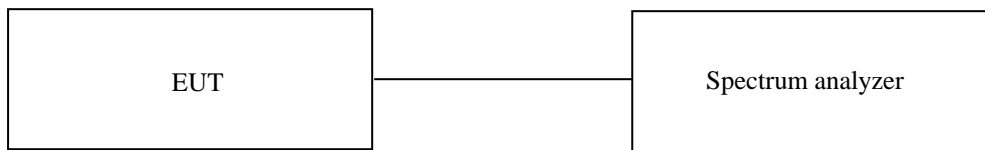
9. NUMBER OF HOPPING CHANNELS

9.1 Operating environment

Temperature : 22 °C
 Relative humidity : 51 % 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 frequency band of operation and the resolution bandwidth is set to 100 kHz. The analyzer is set to peak hold and then complete pseudo-random hopping sequence of the transmitter is captured.



9.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

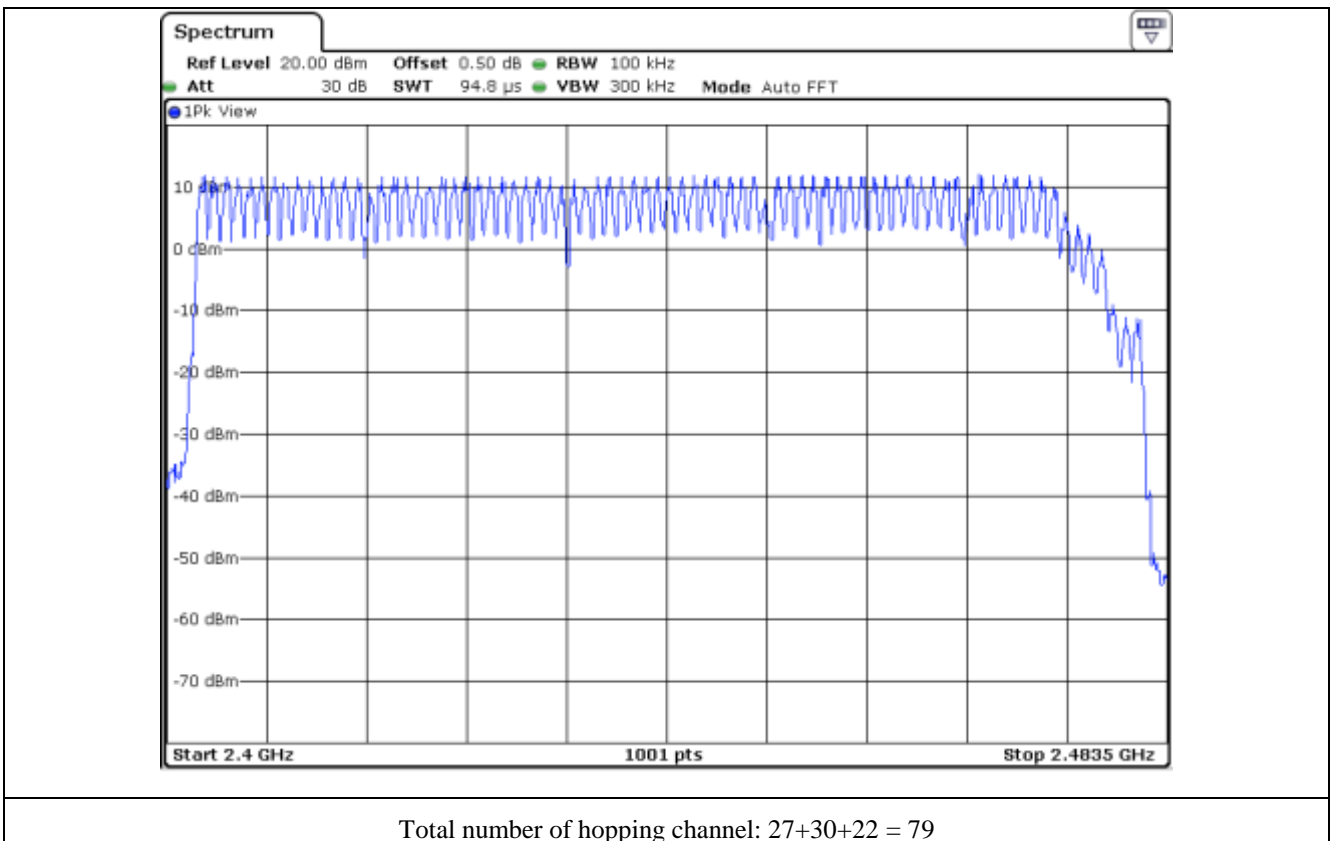
9.4 Test data for 1 Mbps

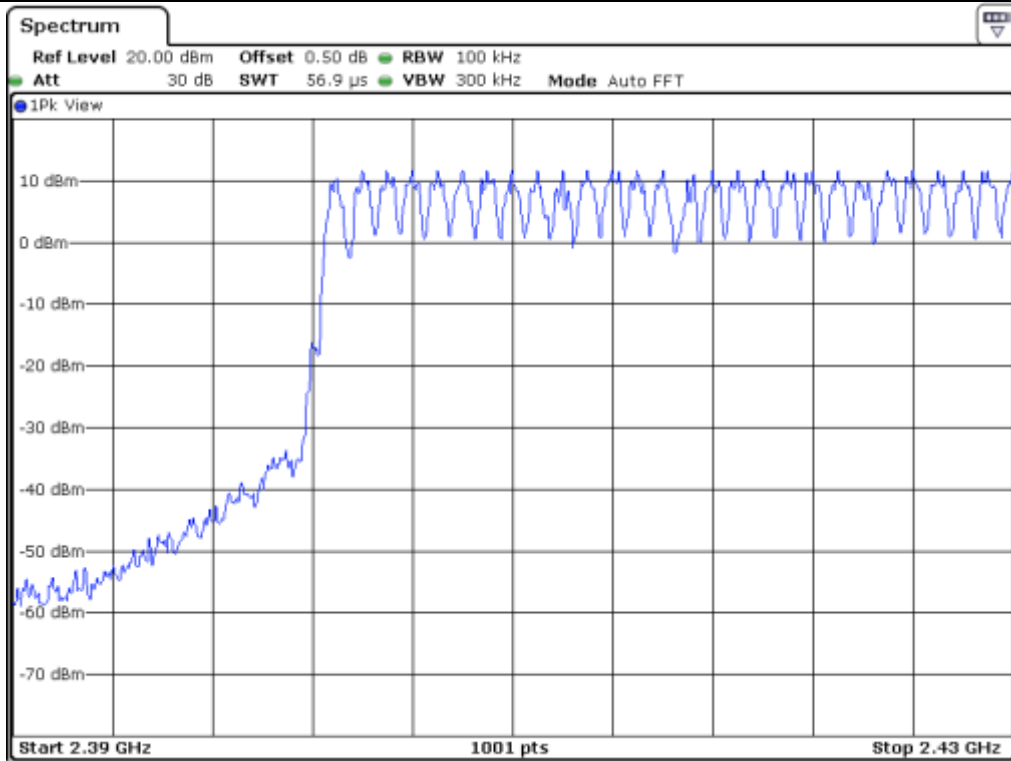
- Test Date : March 05, 2020
- Test Result : Pass

Measured value (Number)	Limit (Number)	Margin (Number)
79	Minimum of 15	64

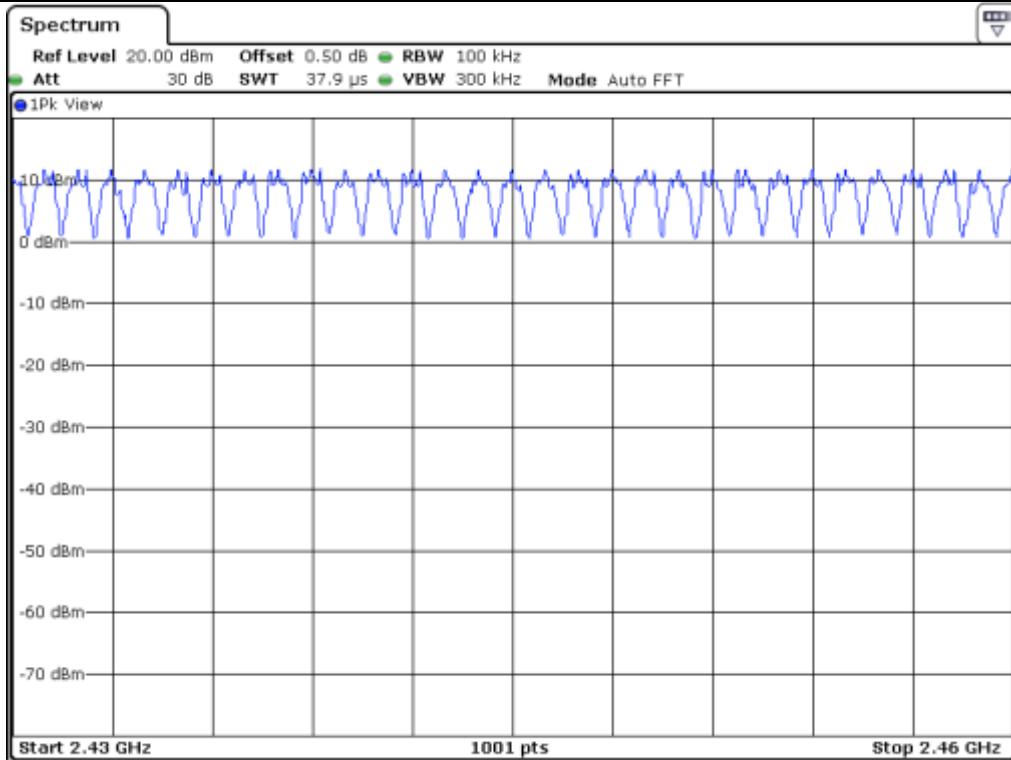


Tested by: Seon Lee / Assistant Manager

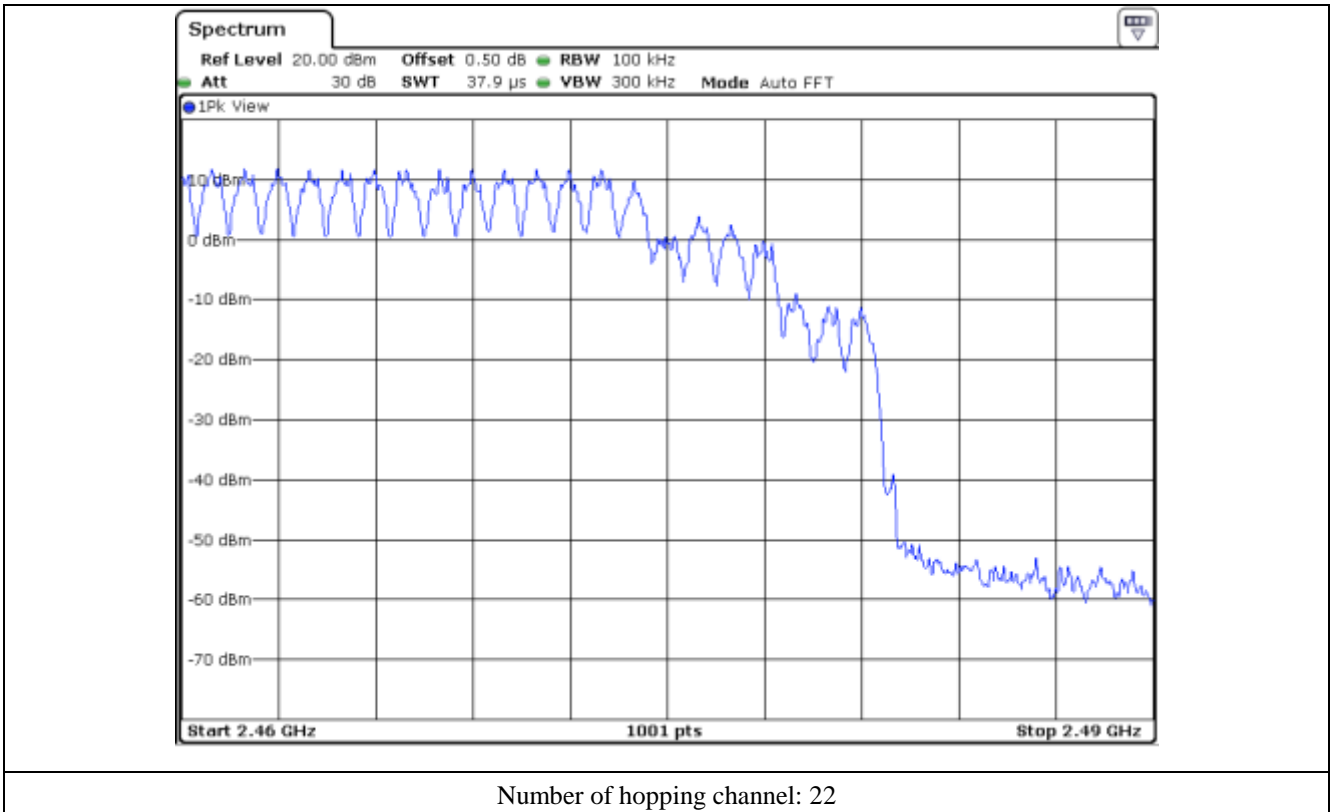




Number of hopping channel: 27



Number of hopping channel: 30



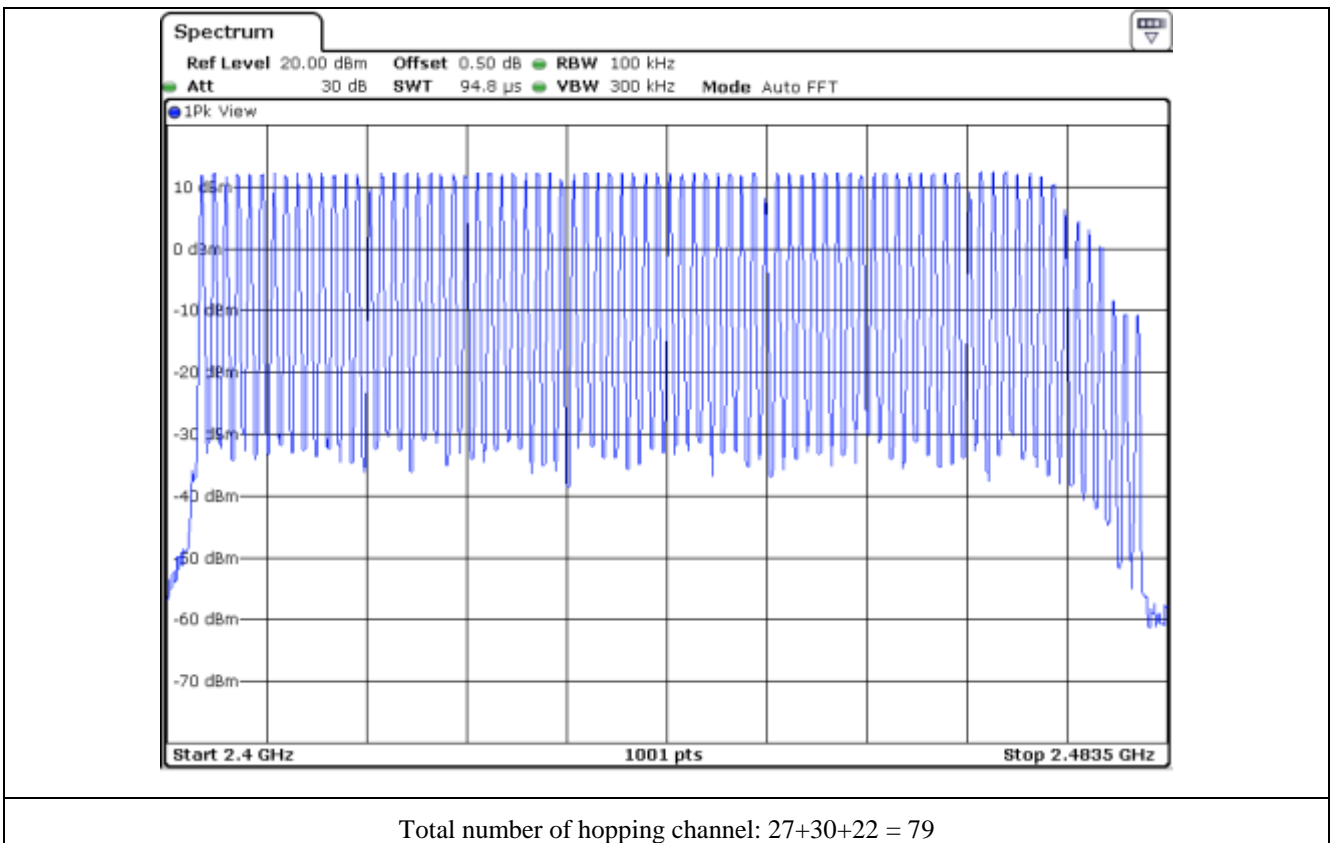
9.5 Test data for 250 kbps

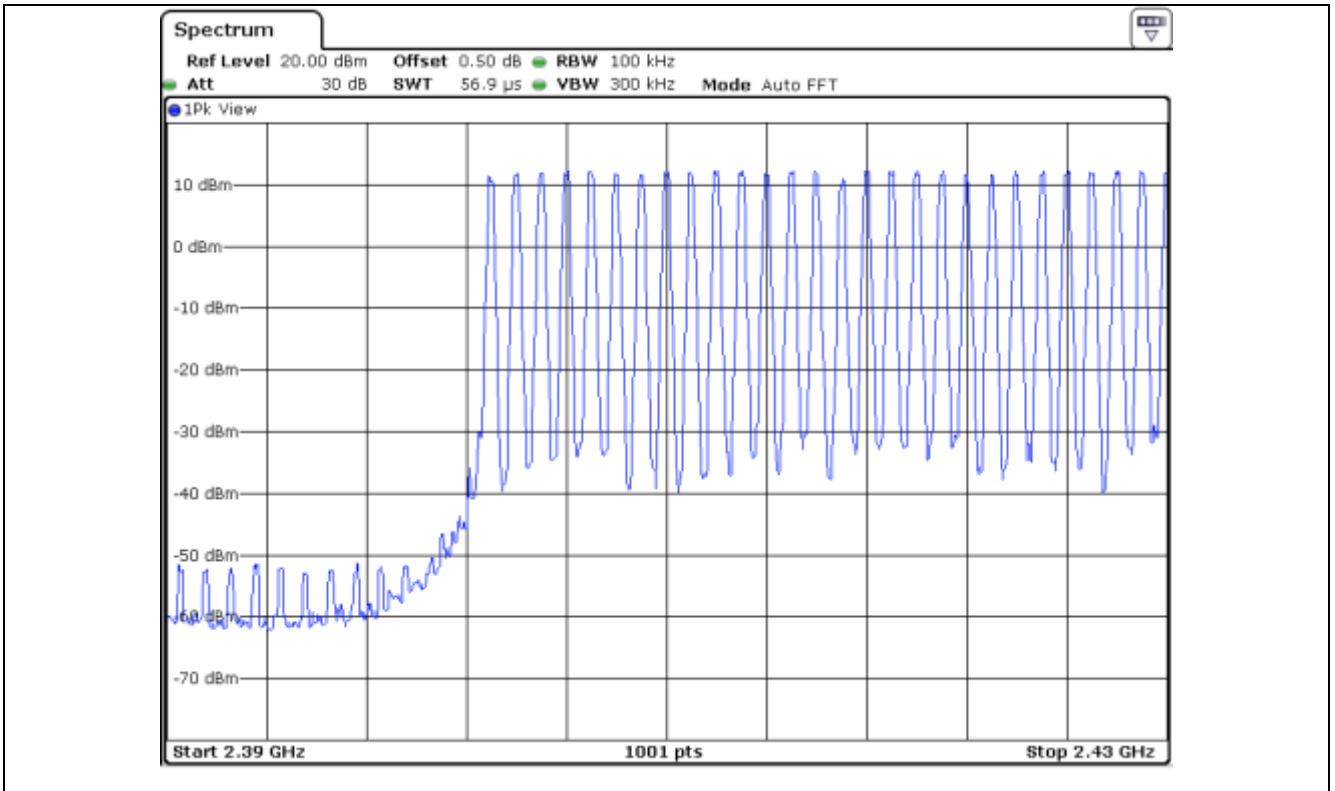
- Test Date : March 05, 2020
- Test Result : Pass

Measured value (Number)	Limit (Number)	Margin (Number)
79	Minimum of 15	64

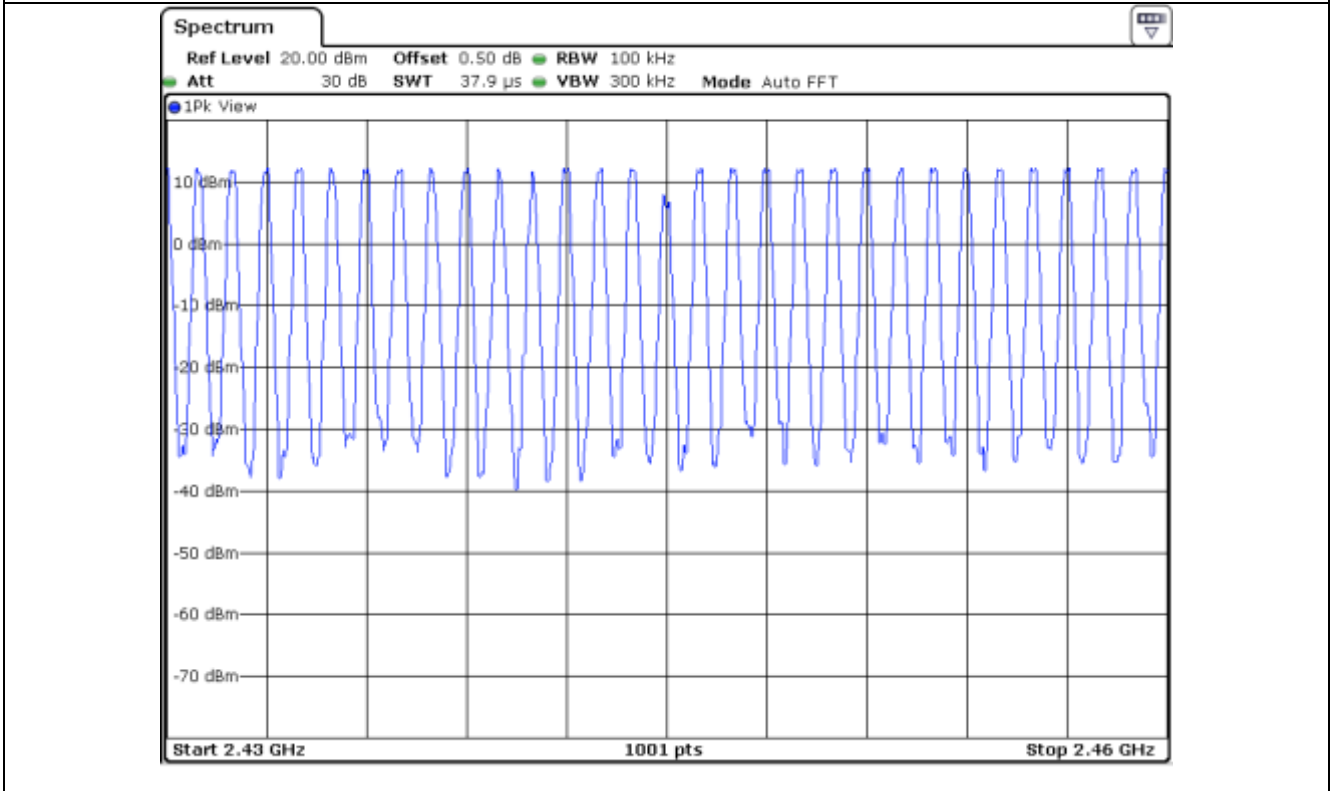


Tested by: Seon Lee / Assistant Manager

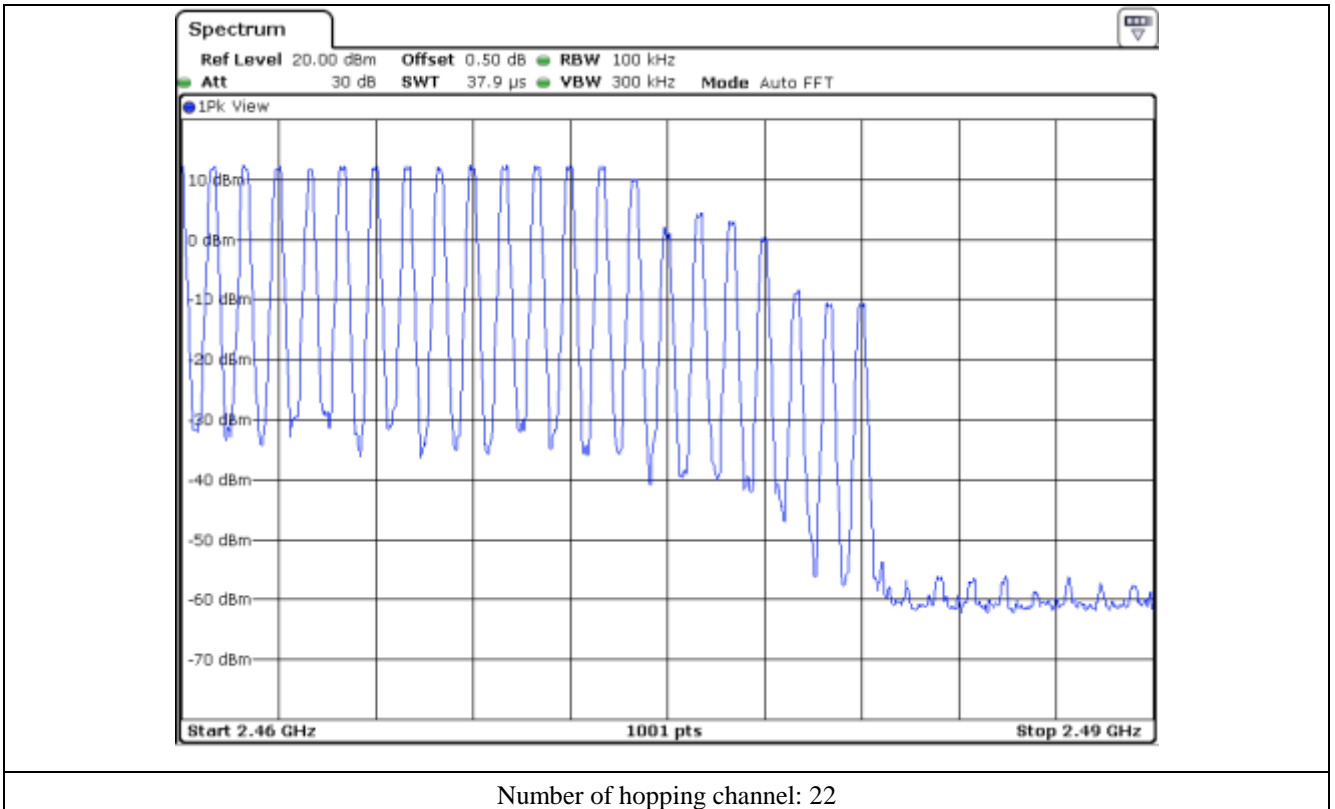




Number of hopping channel: 27



Number of hopping channel: 30



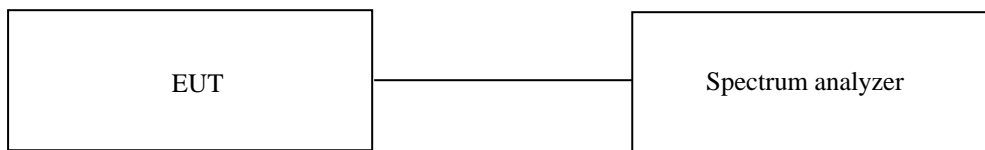
10. TIME OF OCCUPANCY

10.1 Operating environment

Temperature : 22 °C
 Relative humidity : 51 % 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 equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

10.4 Test data for 1 Mbps

-. Test Date : March 05, 2020

Frequency (MHz)	Pulse Time (ms)	Hops per second with channels	Period Time (s)	Total Dwell Time (ms)	Limit (ms)	Test Result
2.442	0.710	6.33	31.60	142.02	400	PASS

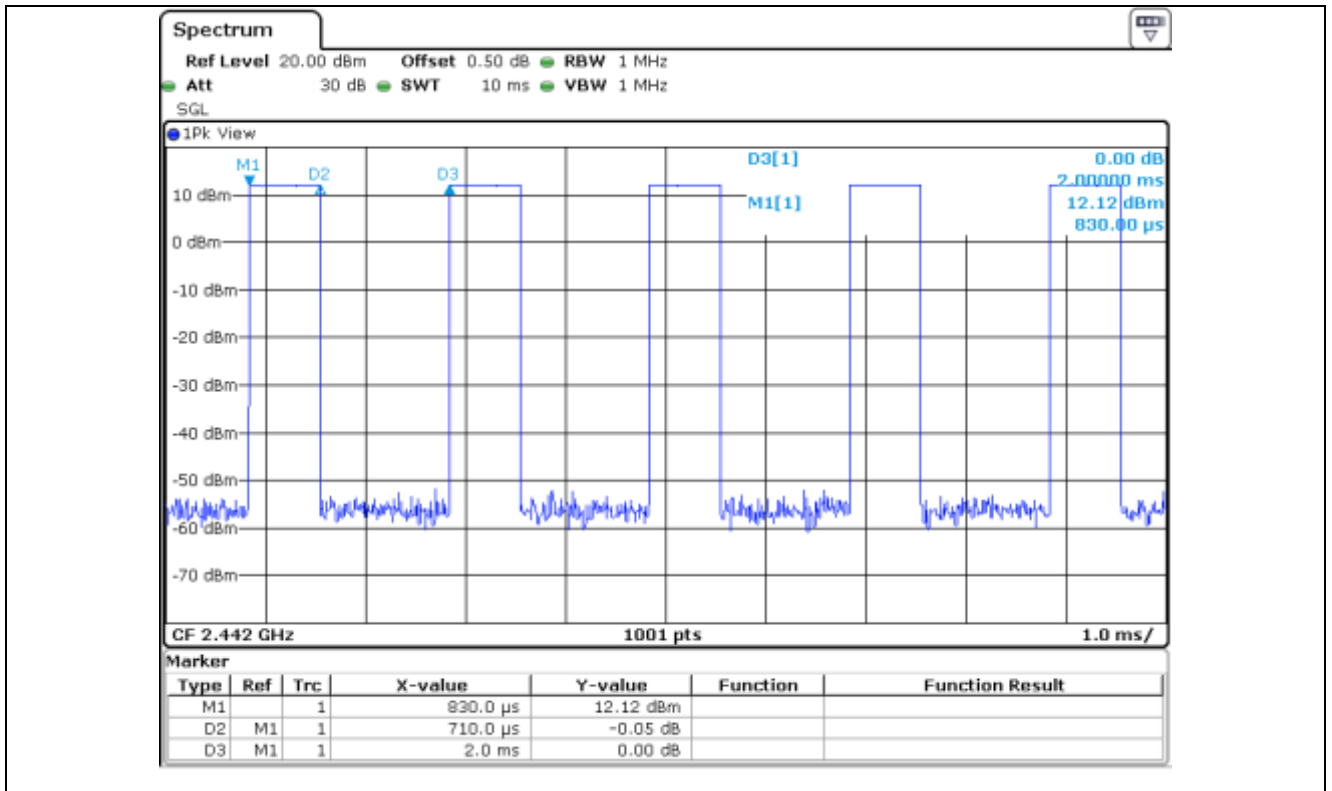
Total dwell time is calculated as following.

$$\text{Period Time} = 0.4 * 79 [\text{channel}]$$

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

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

Tested by: Sieon Lee / Assistant Manager



10.5 Test data for 250 kbps

-. Test Date : March 05, 2020

Frequency (MHz)	Pulse Time (ms)	Hops per second with channels	Period Time (s)	Total Dwell Time (ms)	Limit (ms)	Test Result
2 442	1.230	2.53	31.60	98.34	400	PASS

Total dwell time is calculated as following.

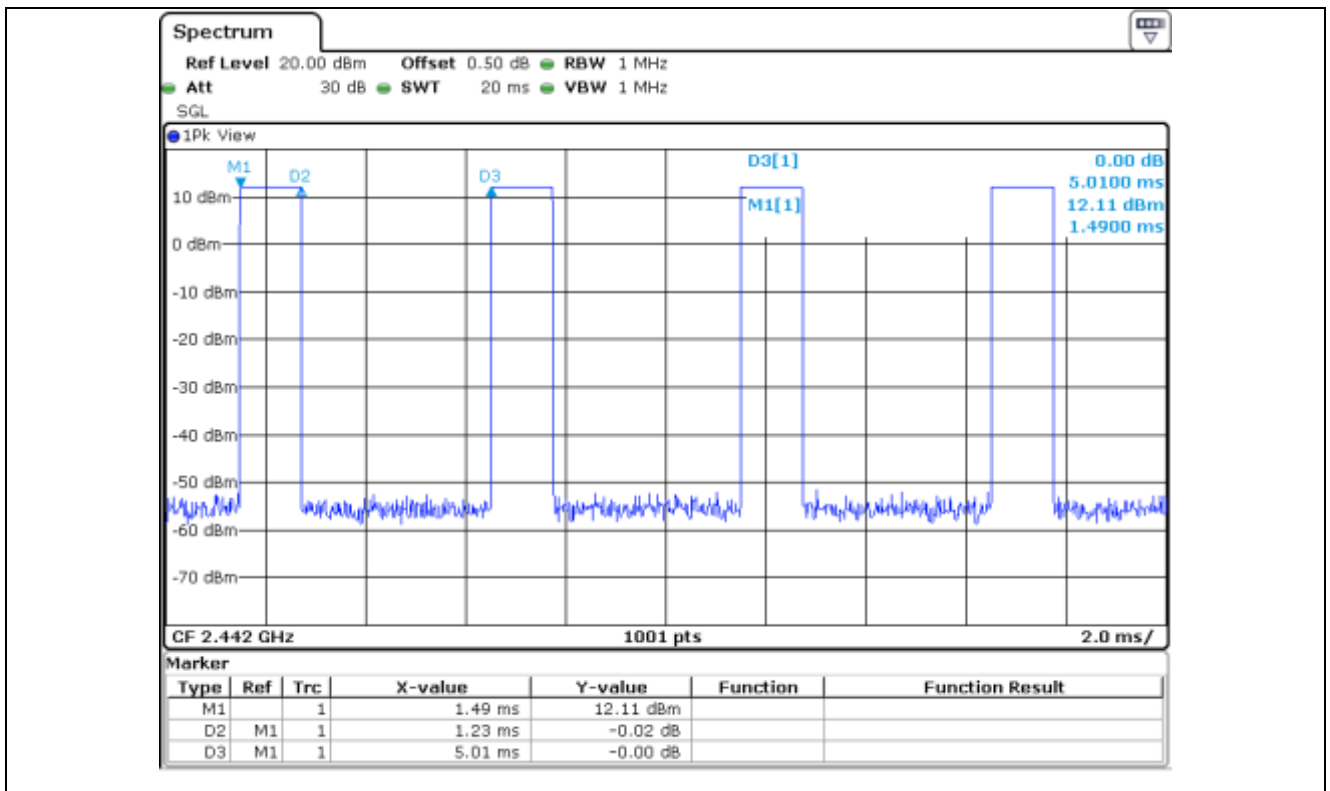
Period Time = 0.4 * 79 [channel]

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

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



Tested by: Seion Lee / Assistant Manager



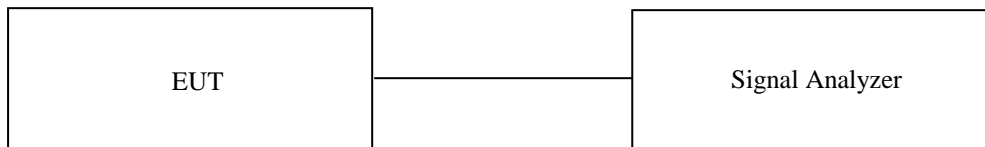
11. MAXIMUM PEAK OUTPUT POWER

11.1 Operating environment

Temperature : 22 °C
 Relative humidity : 51 % R.H

11.2 Test set-up

The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT. The EUT was operating in transmit mode at the appropriate center frequency.



11.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

11.4 Test data for 1 Mbps

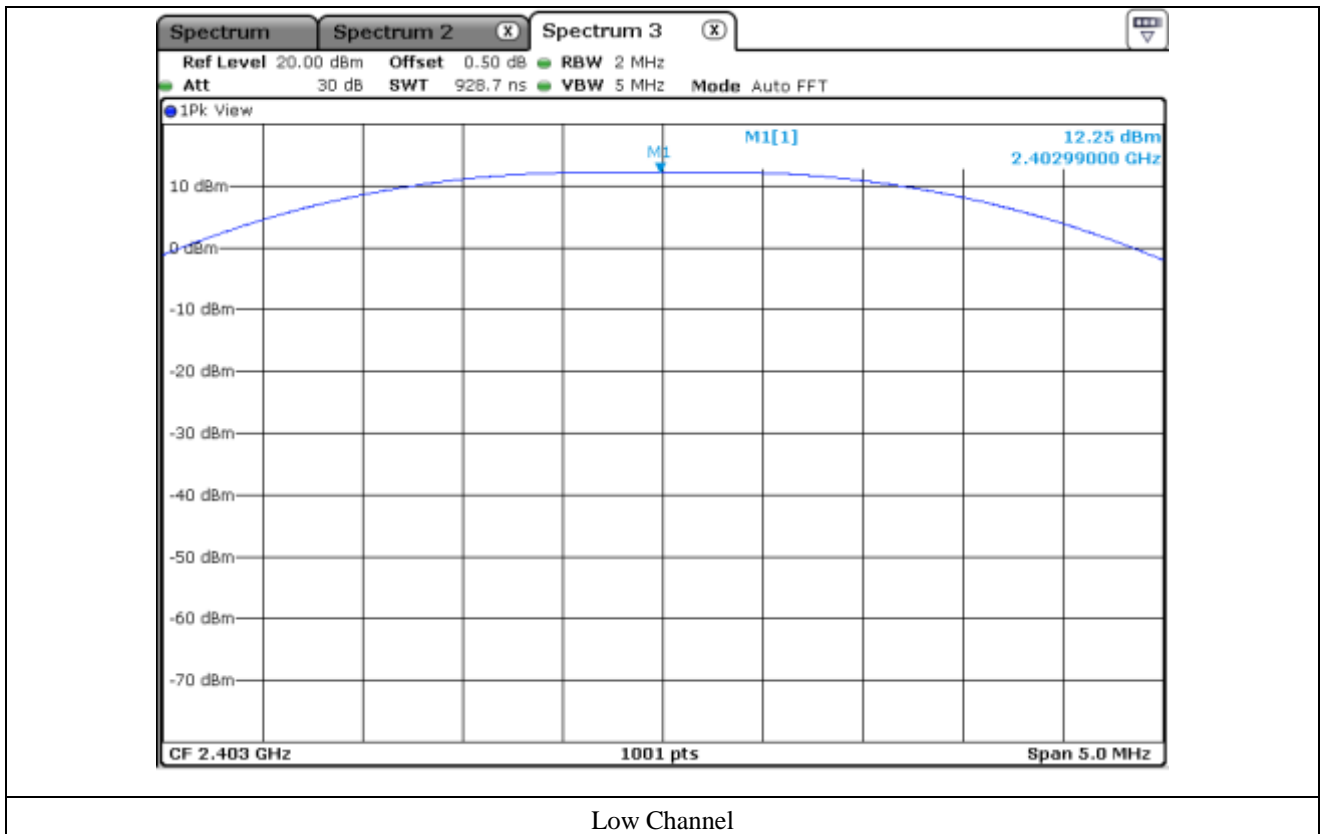
-. Test Date : March 05, 2020

-. Test Result : Pass

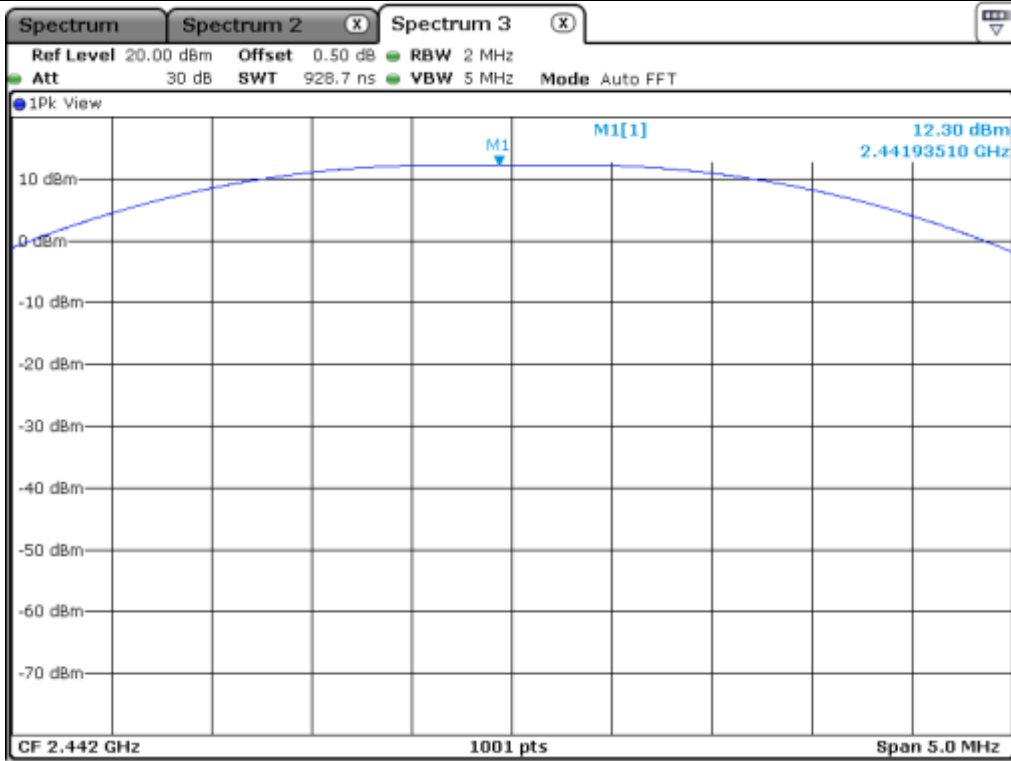
CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 403.00	12.25	21.00	8.75
MIDDLE	2 442.00	12.30	21.00	8.70
HIGH	2 481.00	-10.42	21.00	31.42

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

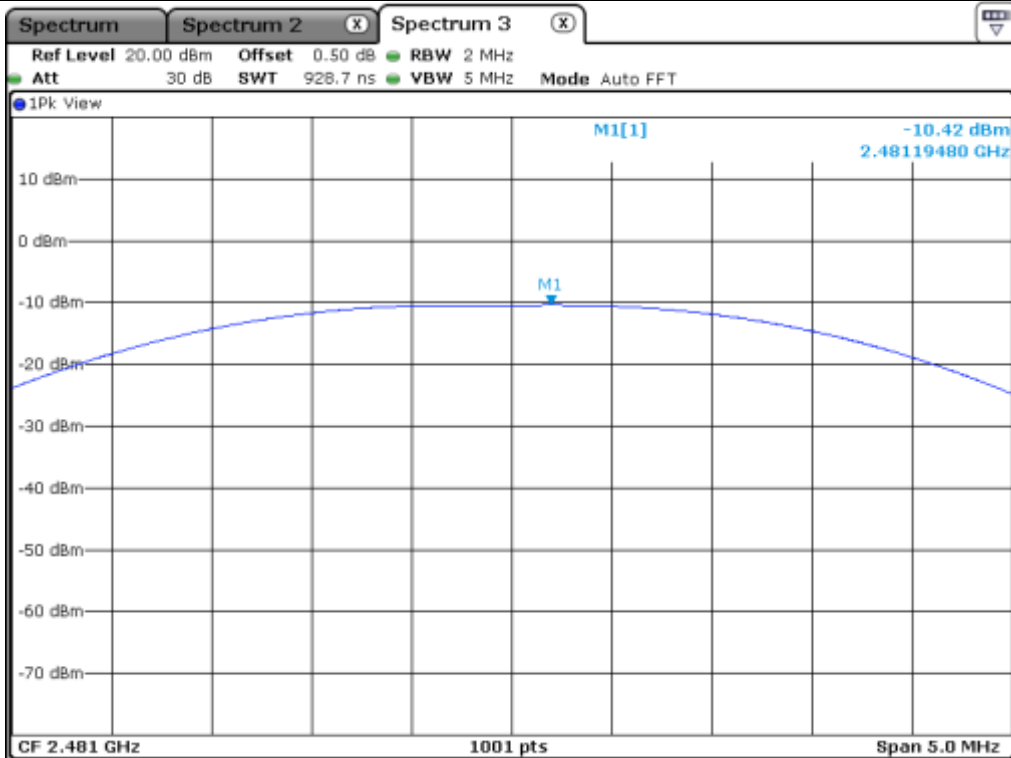
Tested by: Sieon Lee / Assistant Manager



Low Channel



Middle Channel



High Channel

11.5 Test data for 250 kbps

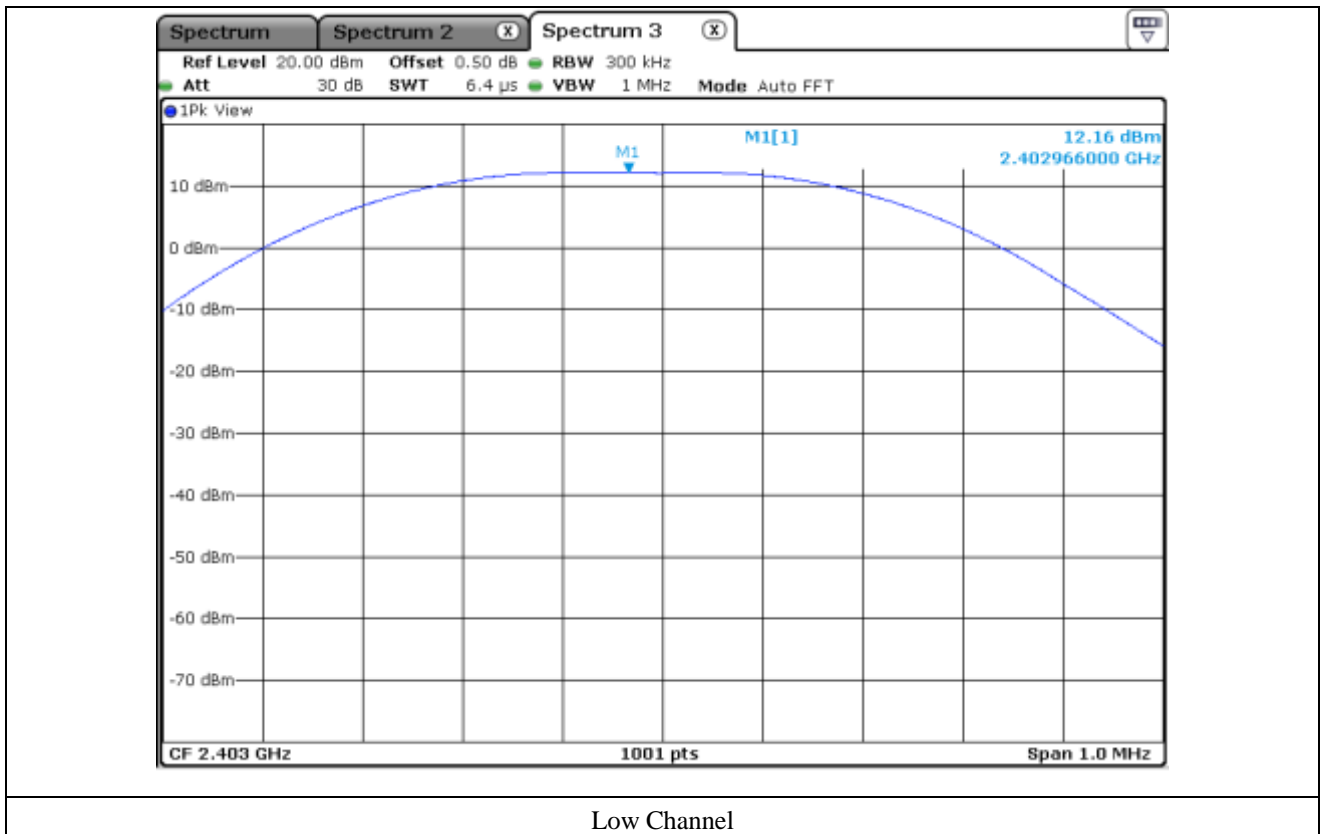
-. Test Date : March 05, 2020

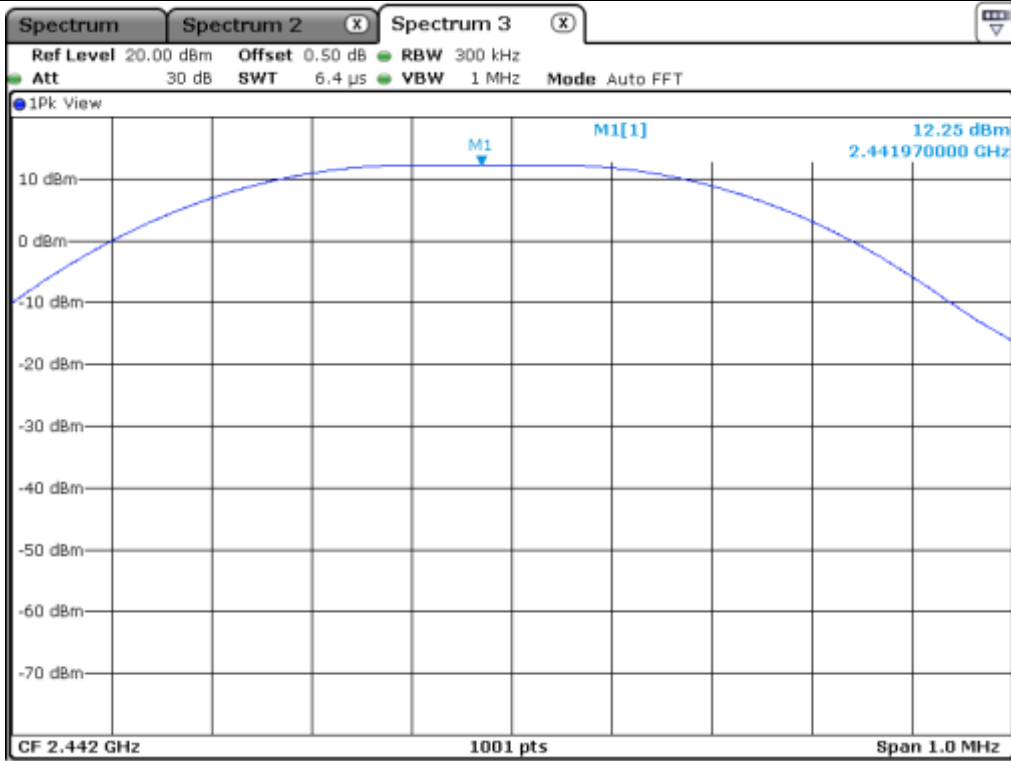
-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 403.00	12.16	21.00	8.84
MIDDLE	2 442.00	12.25	21.00	8.75
HIGH	2 481.00	-10.50	21.00	31.50

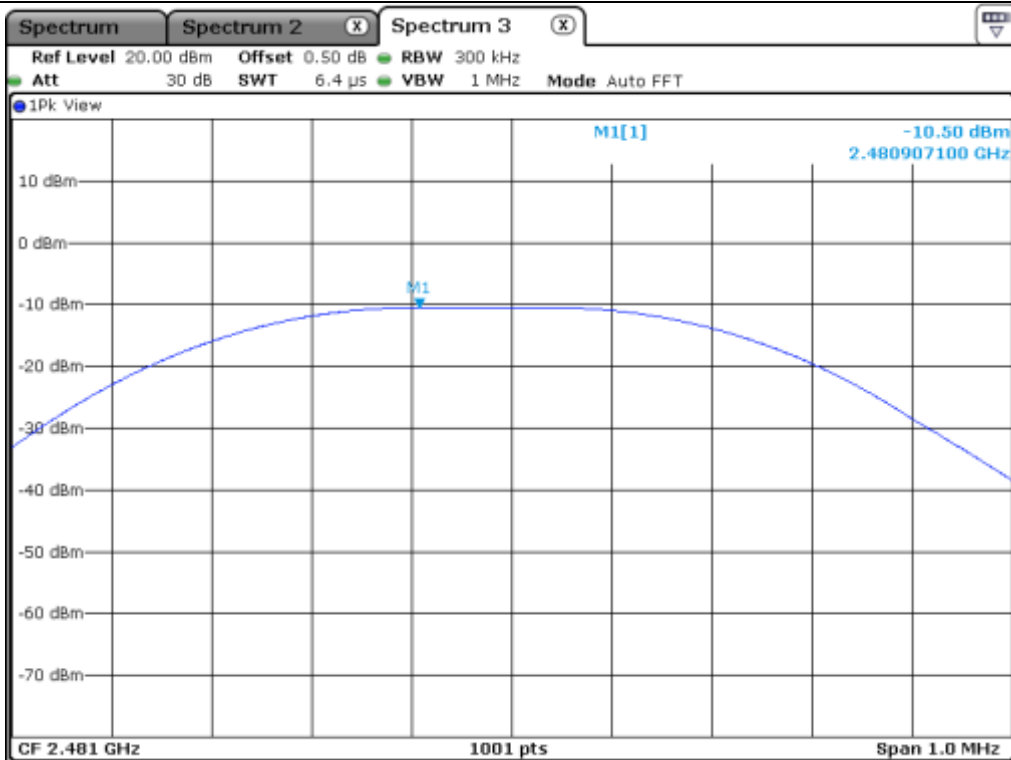
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Tested by: Sieon Lee / Assistant Manager





Middle Channel



High Channel

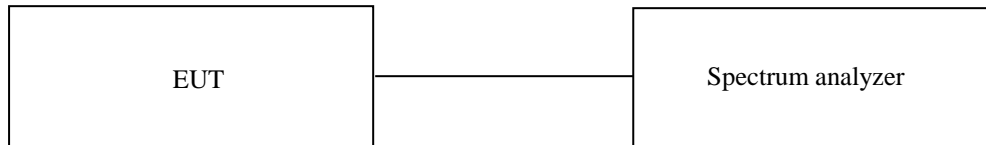
12. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

12.1 Operating environment

Temperature : 22 °C
 Relative humidity : 51 % 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, open-field test site. The EUT was placed on a non-conductive turntable approximately 0.8 m above the ground plane.

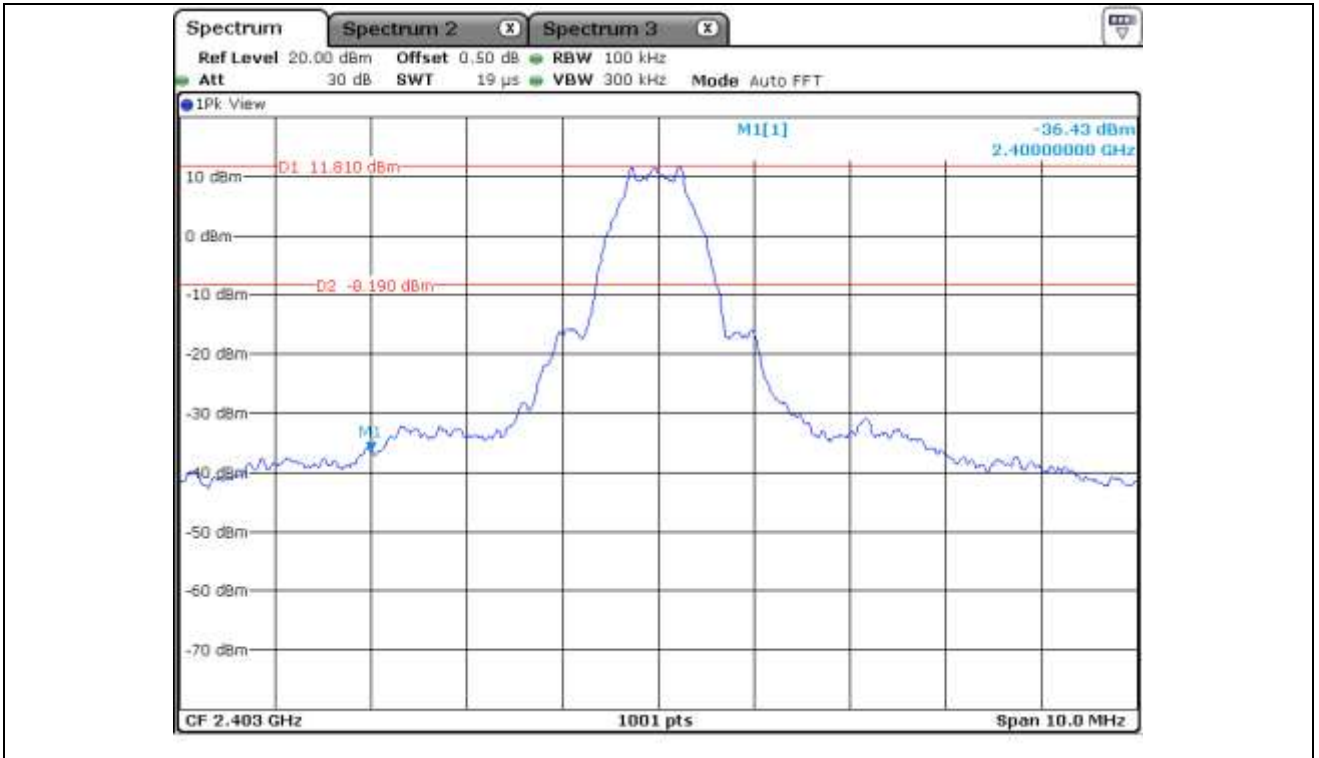
The frequency spectrum from 30 kHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 ms in order to determine the maximum emission levels. This procedure was performed for horizontal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

12.4 Test equipment used

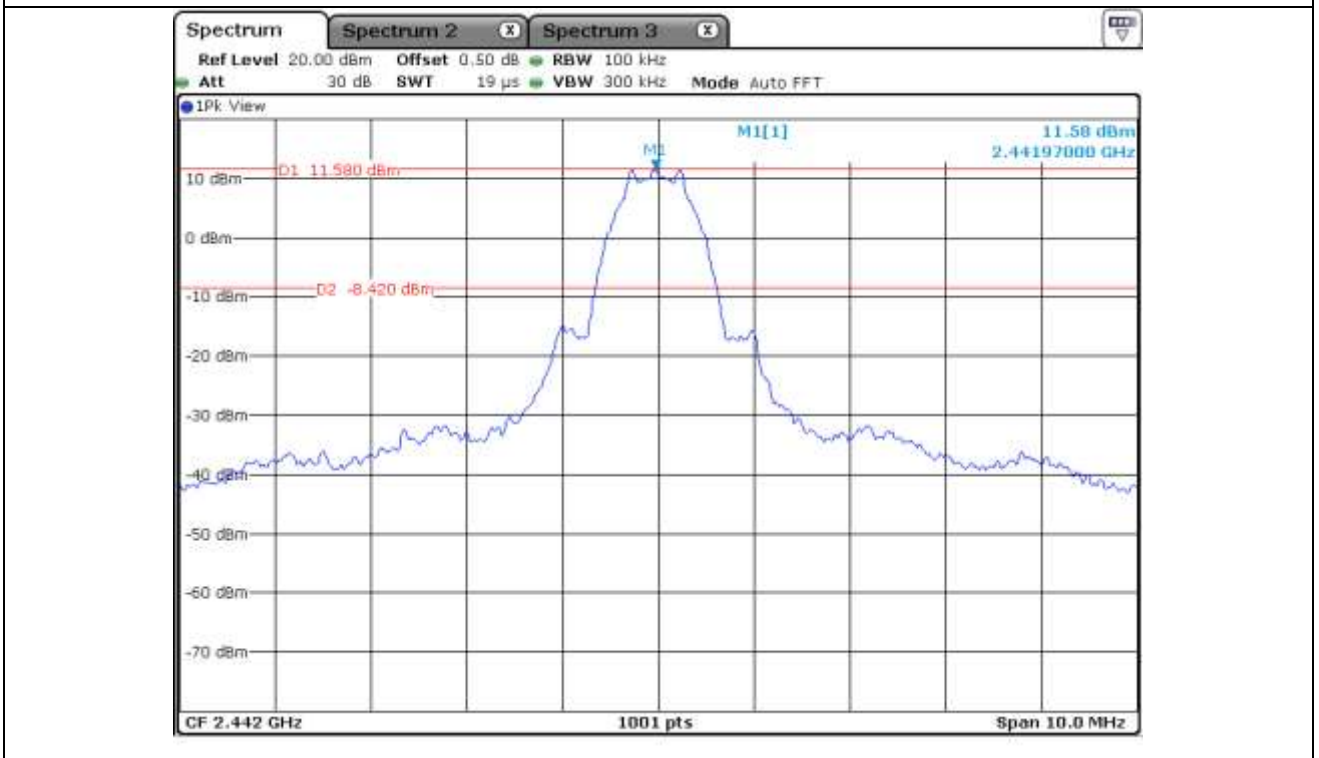
Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ - ESR	Rohde & Schwarz	EMI Test Receiver	102190	Oct. 16, 2019 (1Y)
■ - 310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 18, 2019 (1Y)
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)
■ - SCU18	Rohde & Schwarz	Pre-Amplifier	102266	Jul. 24, 2019 (1Y)
■ - MA-4640-XPET	Innco Systems GmbH	Antenna Master	MA4640/652	N/A
■ - HD100	HD GmbH	Position Controller	N/A	N/A
■ - DT2000-2t	Innco Systems GmbH	Turn Table	N/A	N/A
■ - FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)
■ - HLP-2008	TDK	Hybrid Antenna	131316	Feb. 27, 2020 (2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	1349	Nov. 25, 2019 (1Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA91700179	Jan. 20, 2020 (1Y)
■ - SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Feb. 20, 2020 (1Y)

All test equipment used is calibrated on a regular basis.

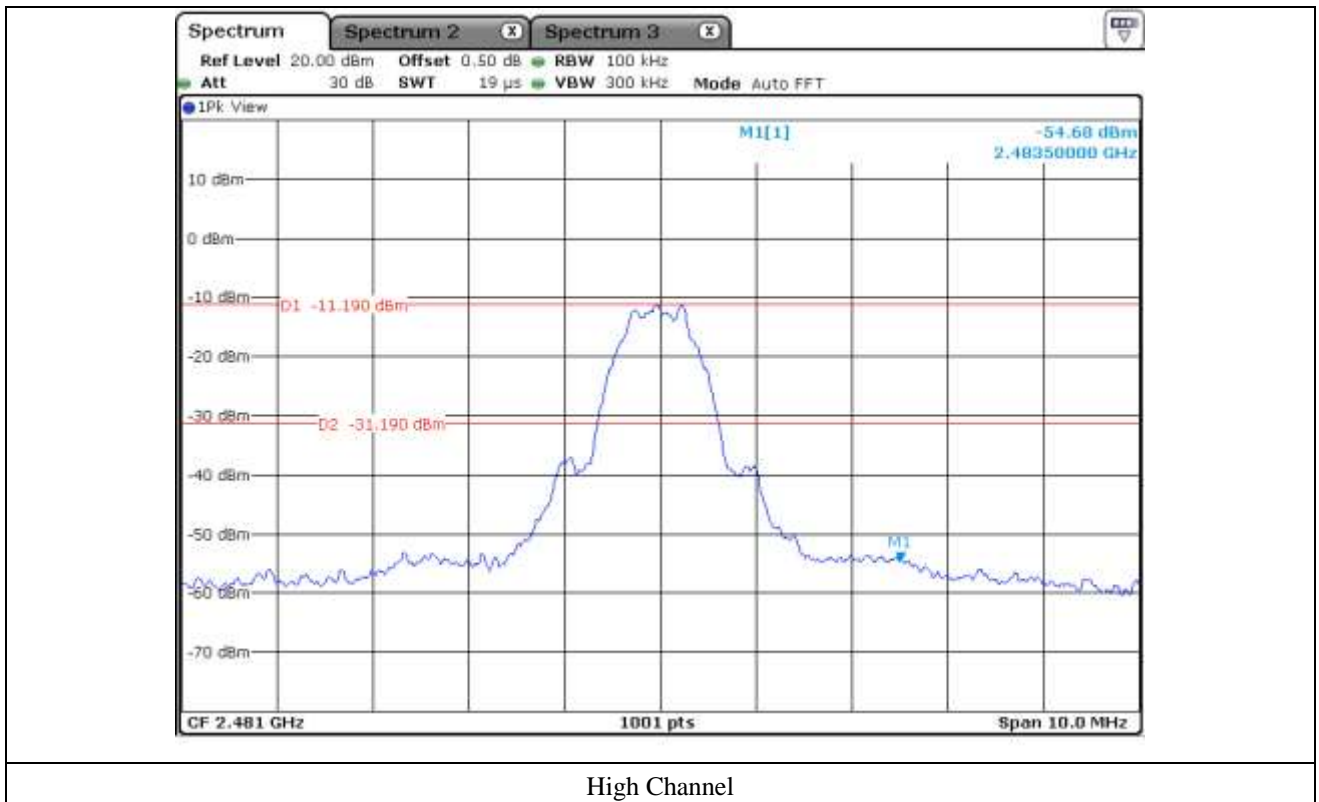
12.5 Test data for conducted emission (1 Mbps)

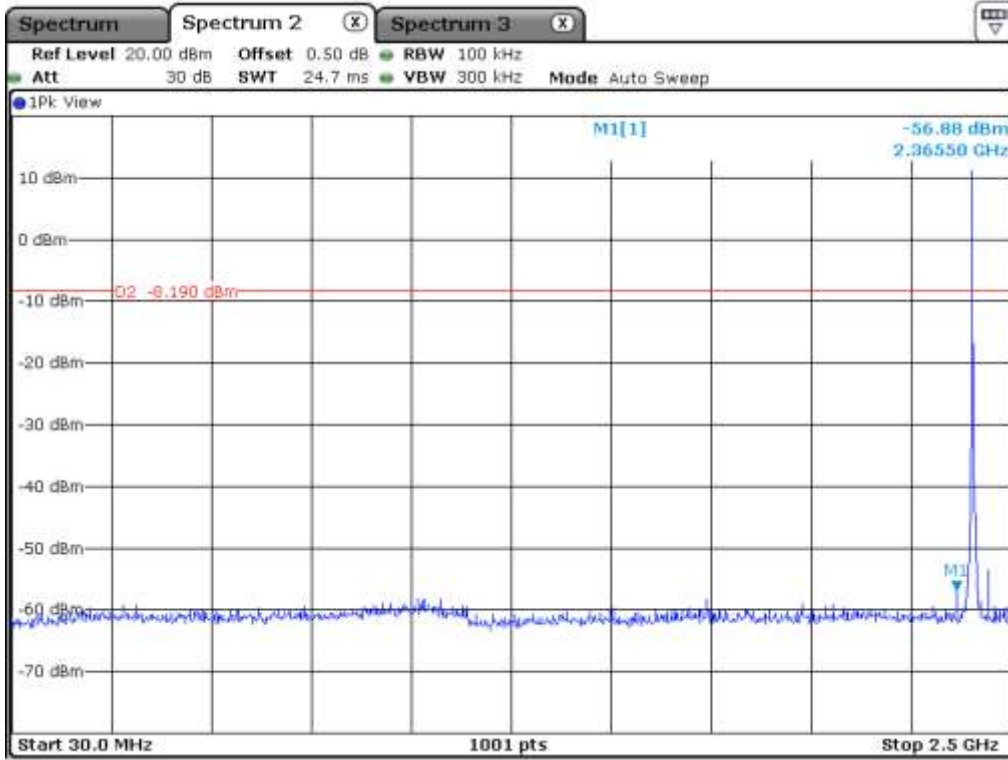


Low Channel

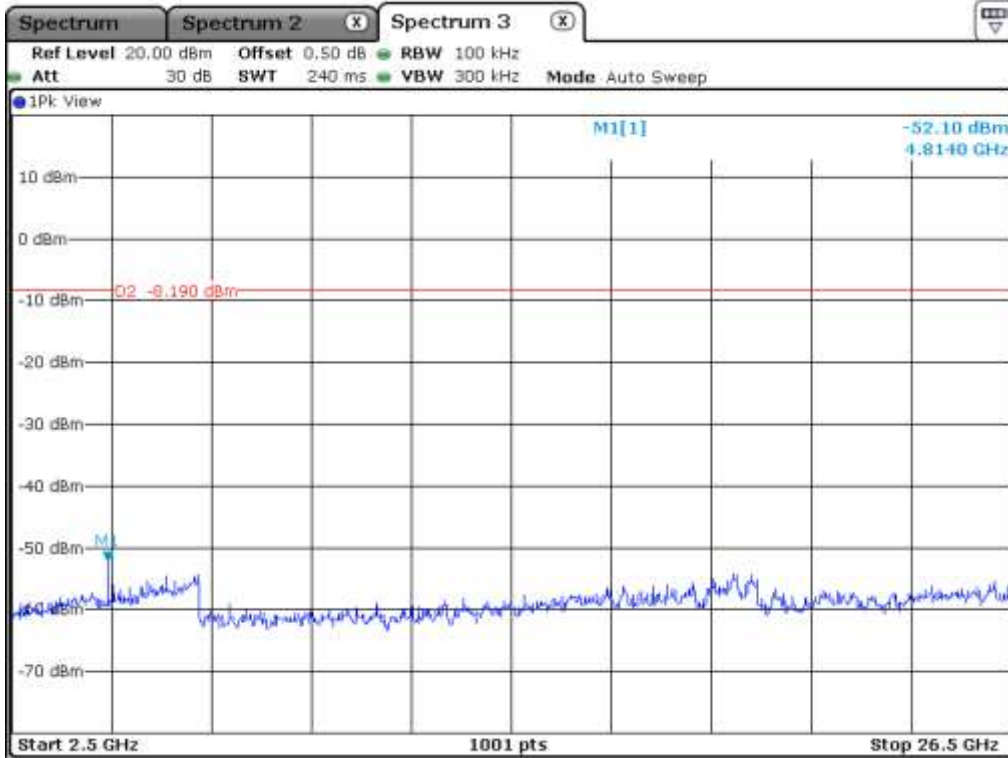


Middle Channel

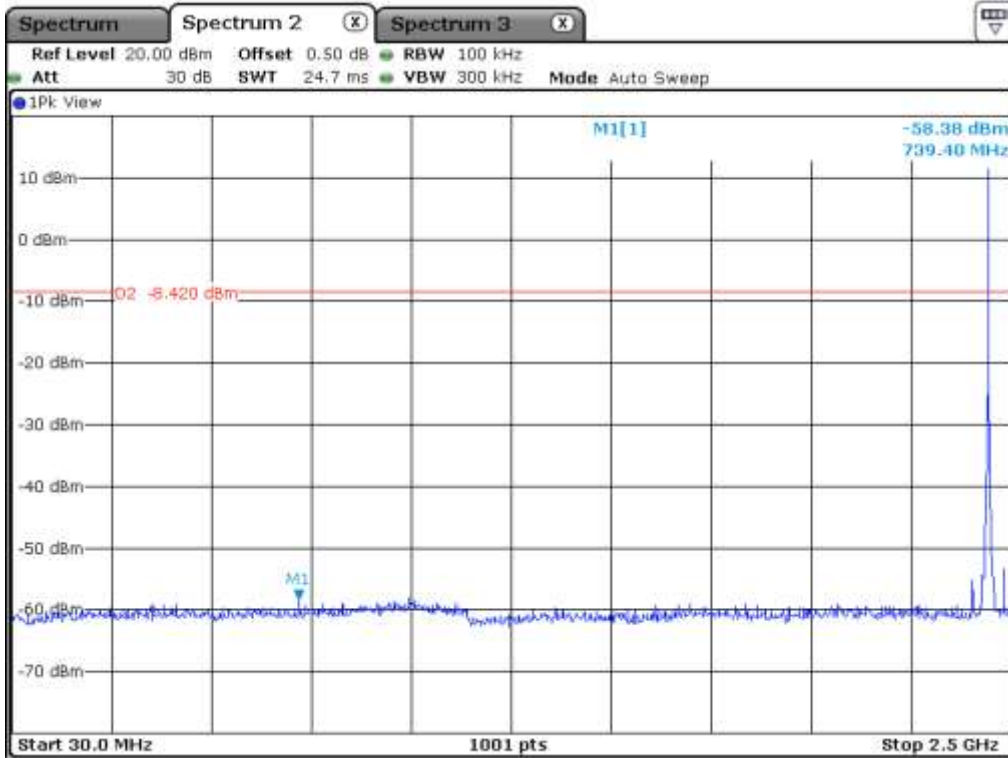




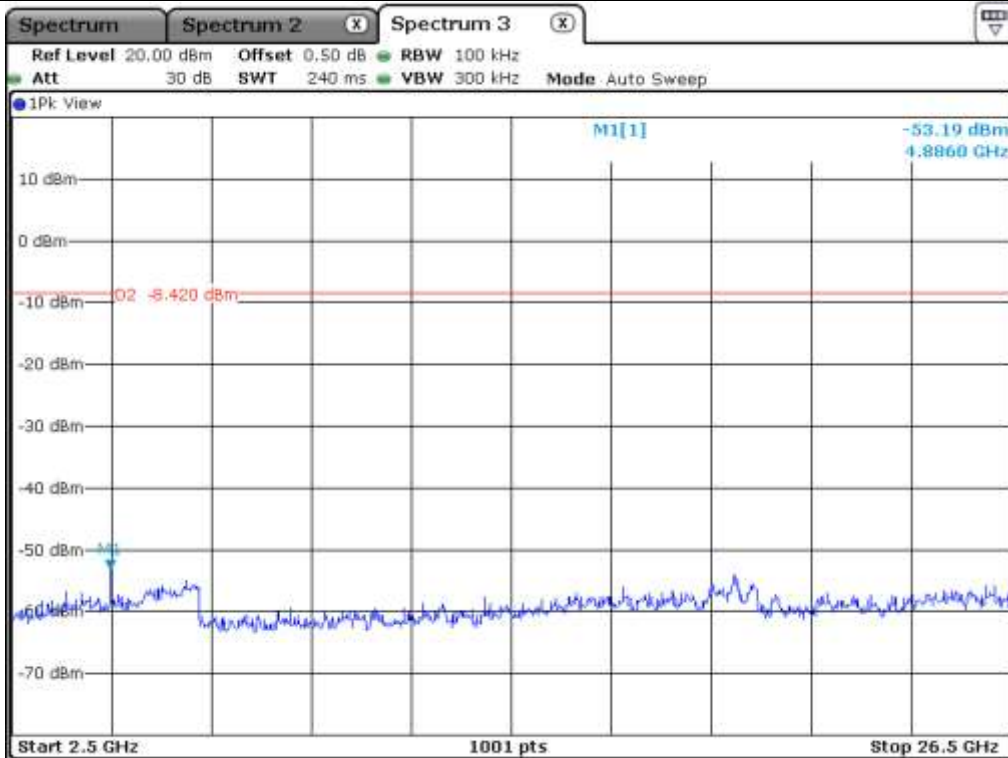
Low Channel



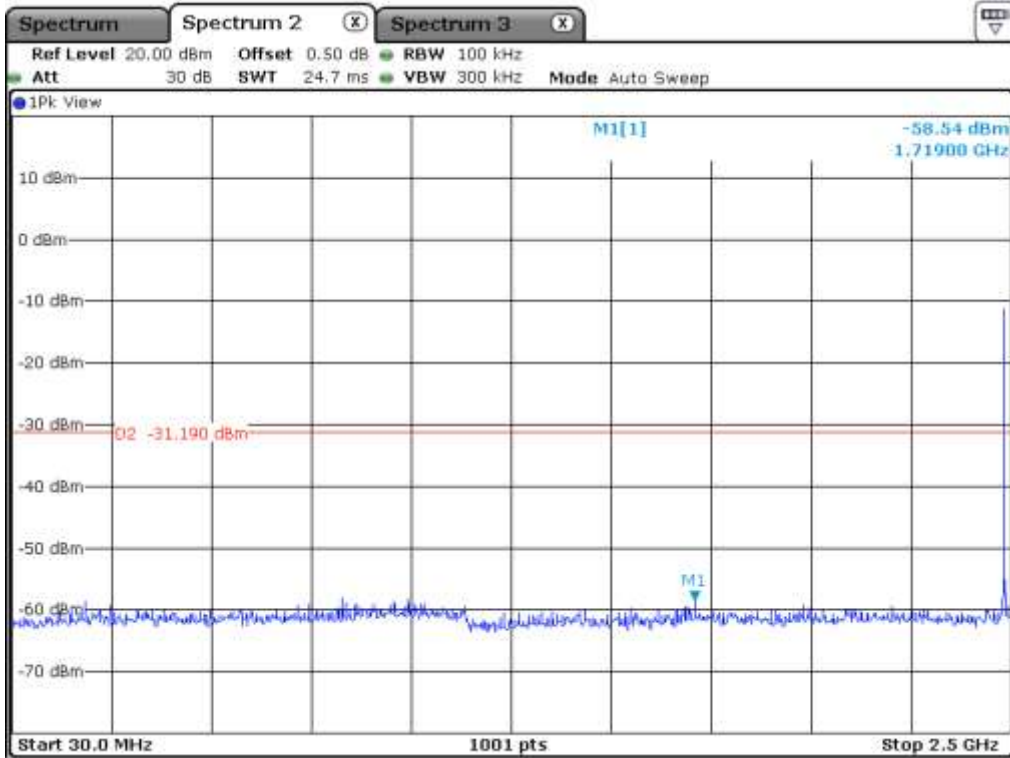
Low Channel



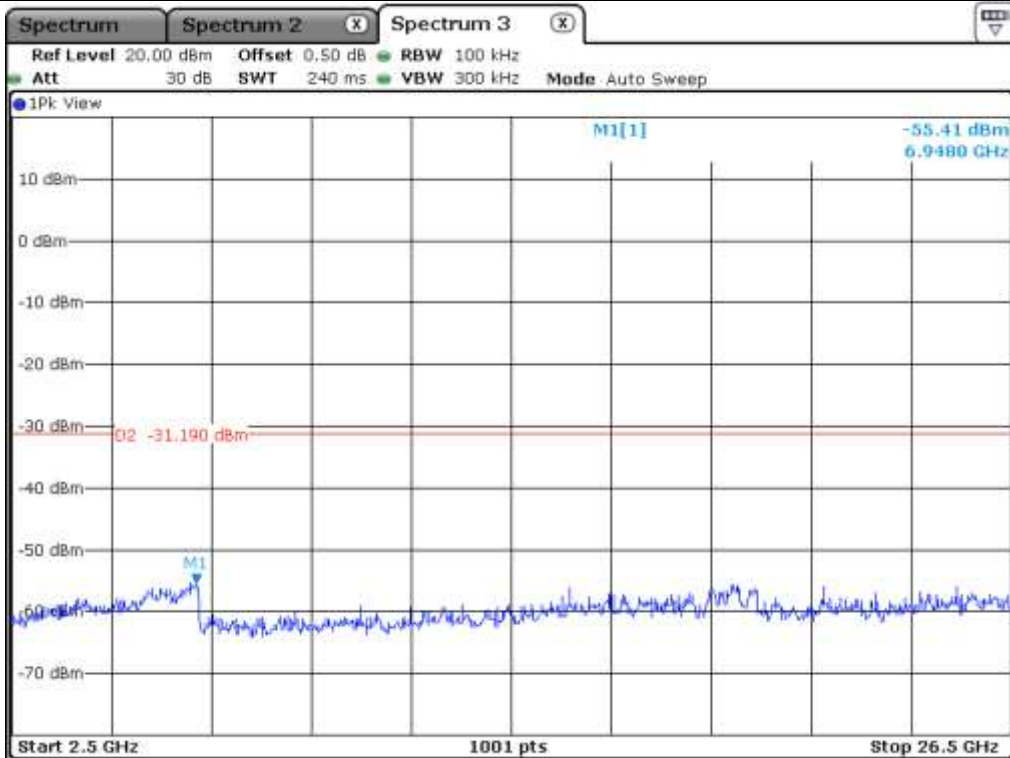
Middle Channel



Middle Channel

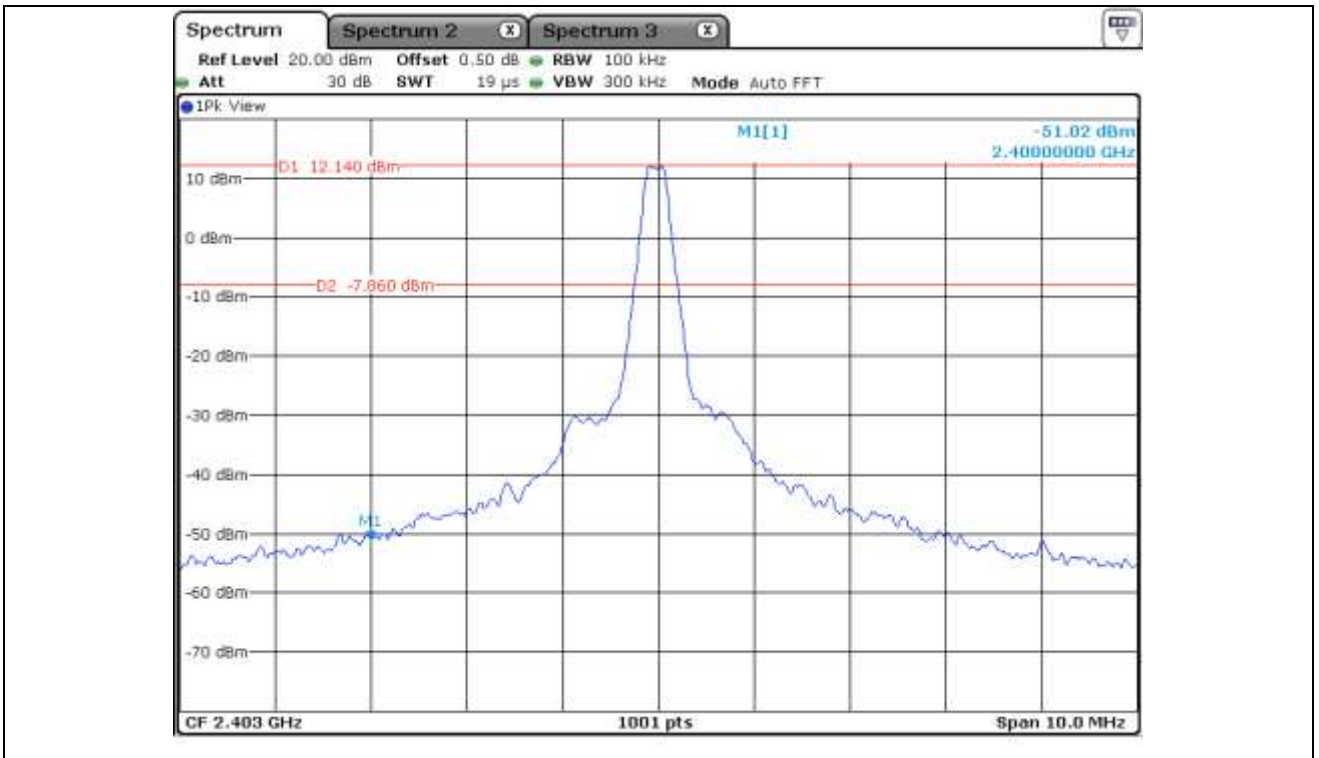


High Channel

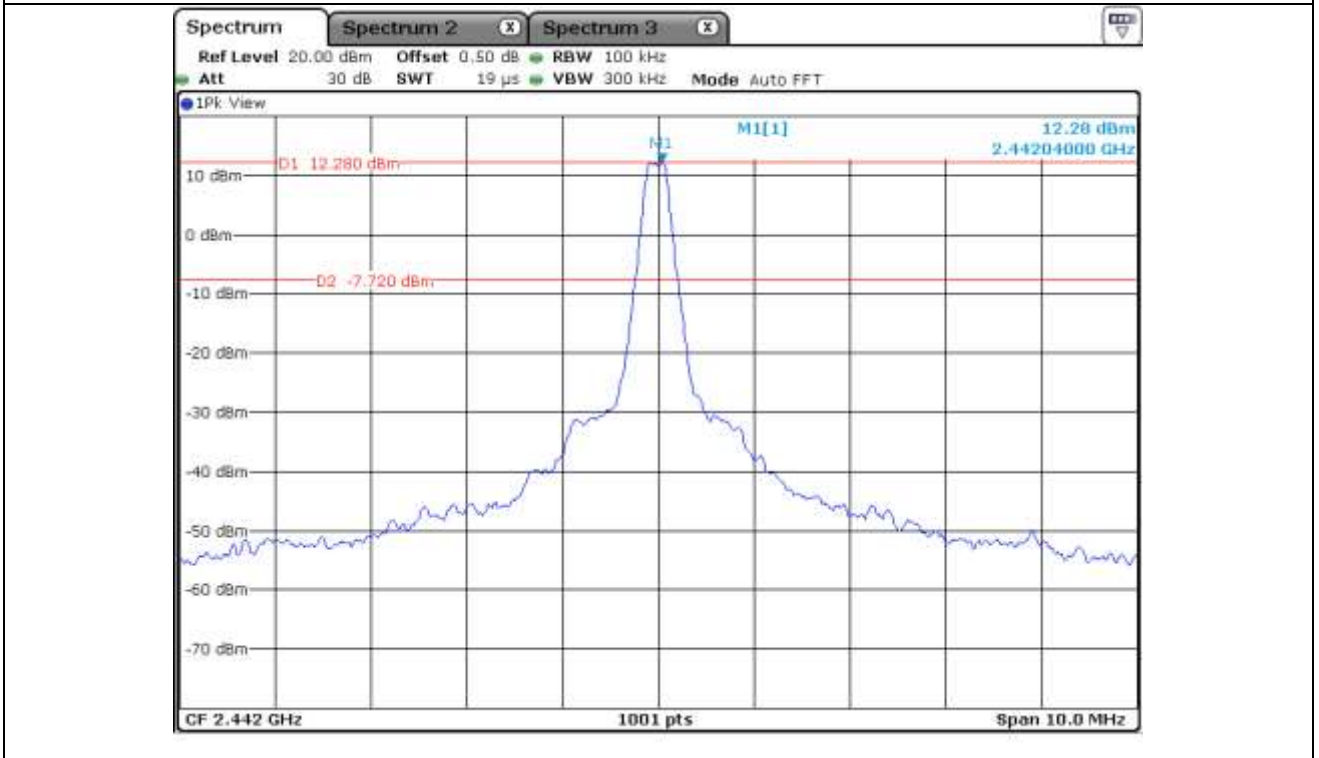


High Channel

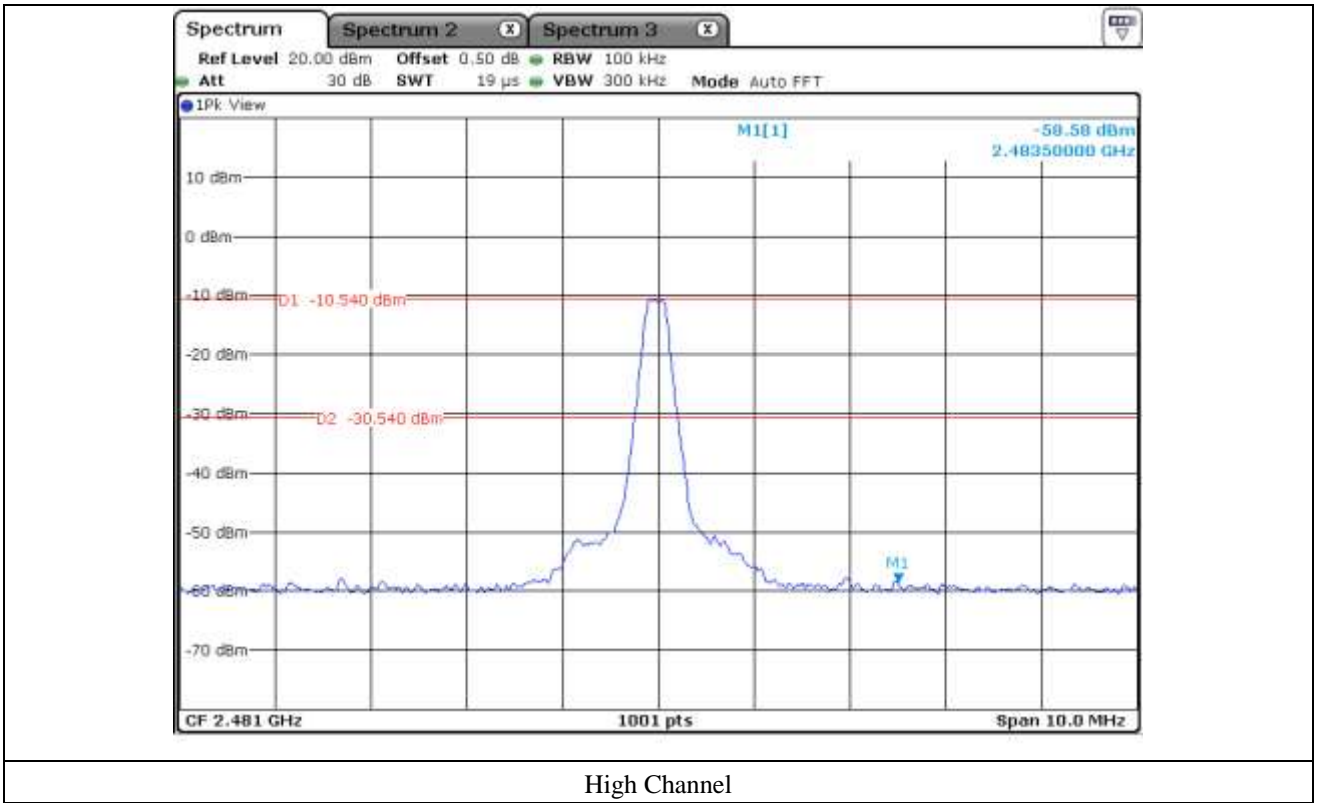
12.6 Test data for conducted emission (250 kbps)

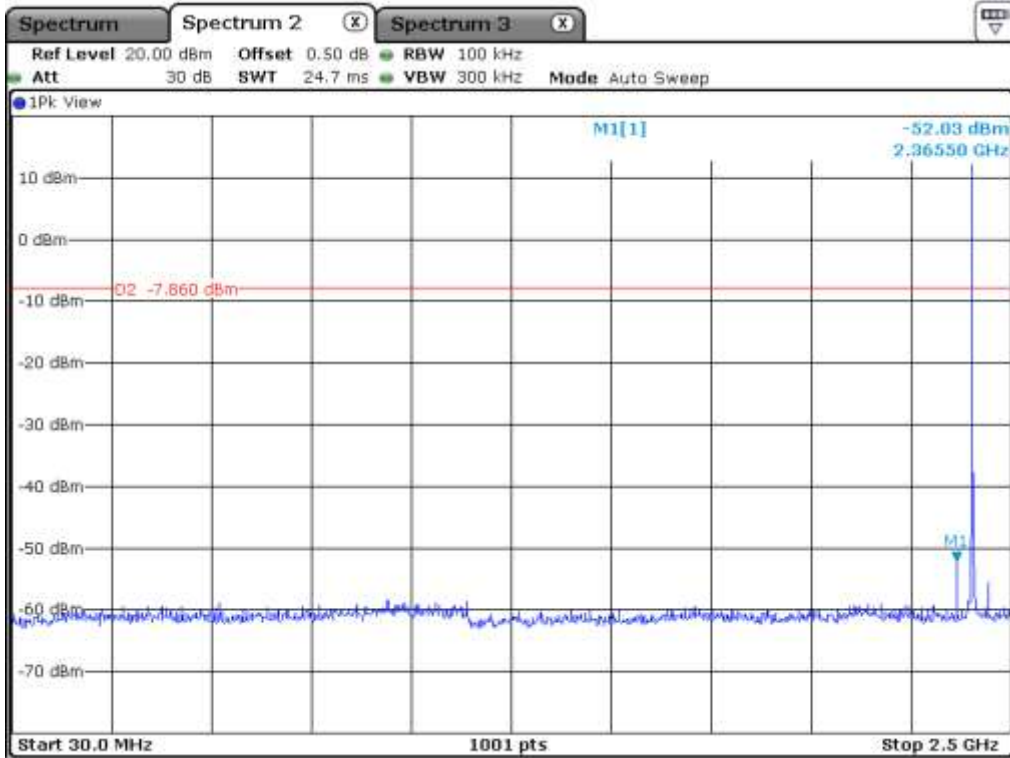


Low Channel

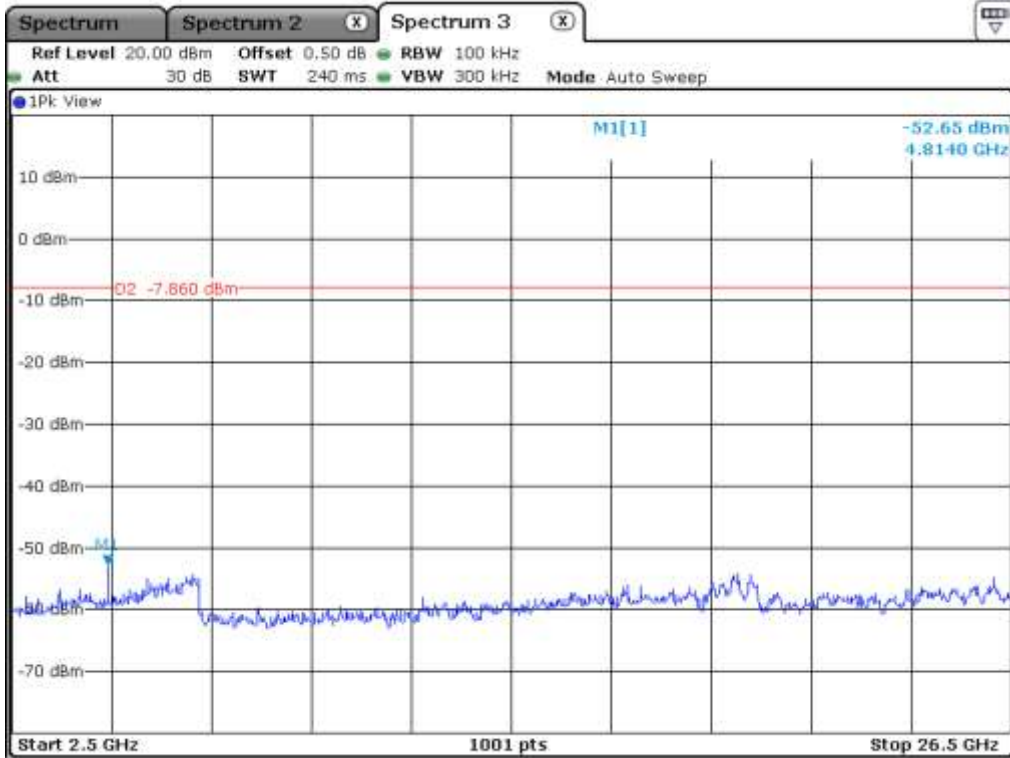


Middle Channel

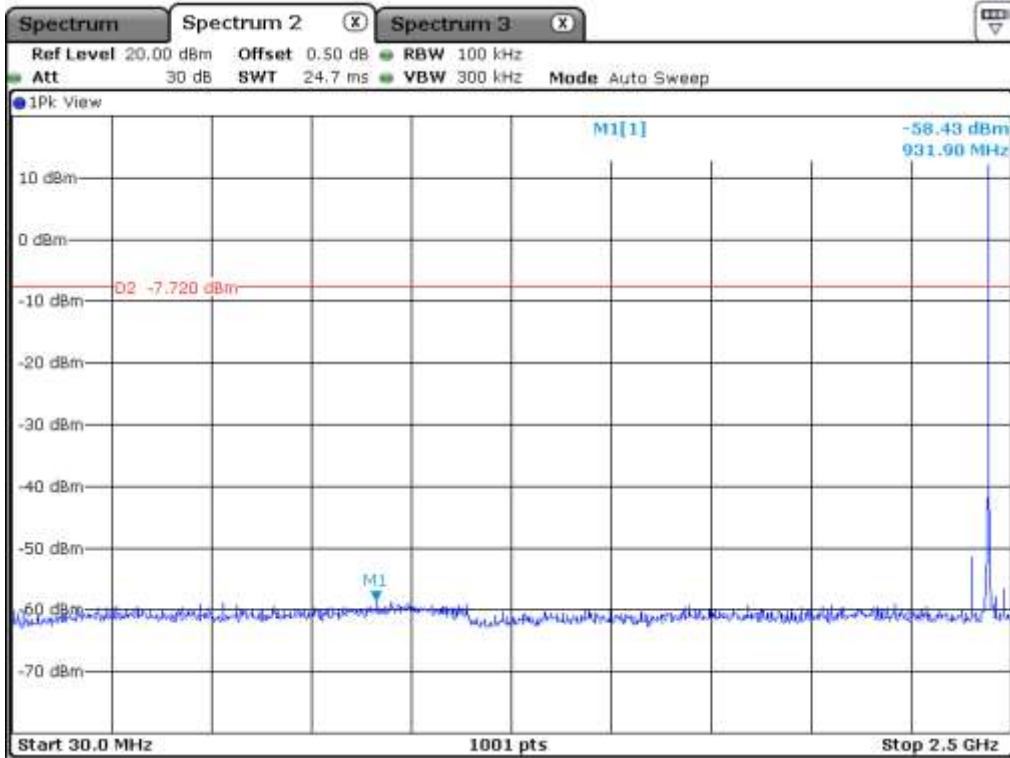




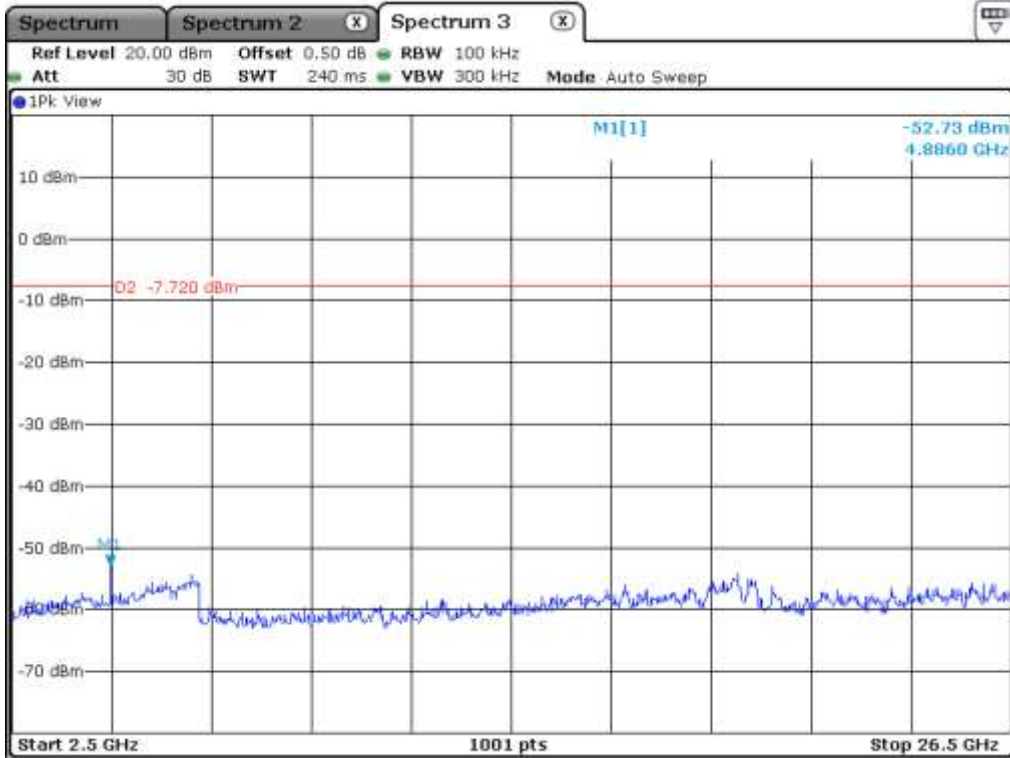
Low Channel



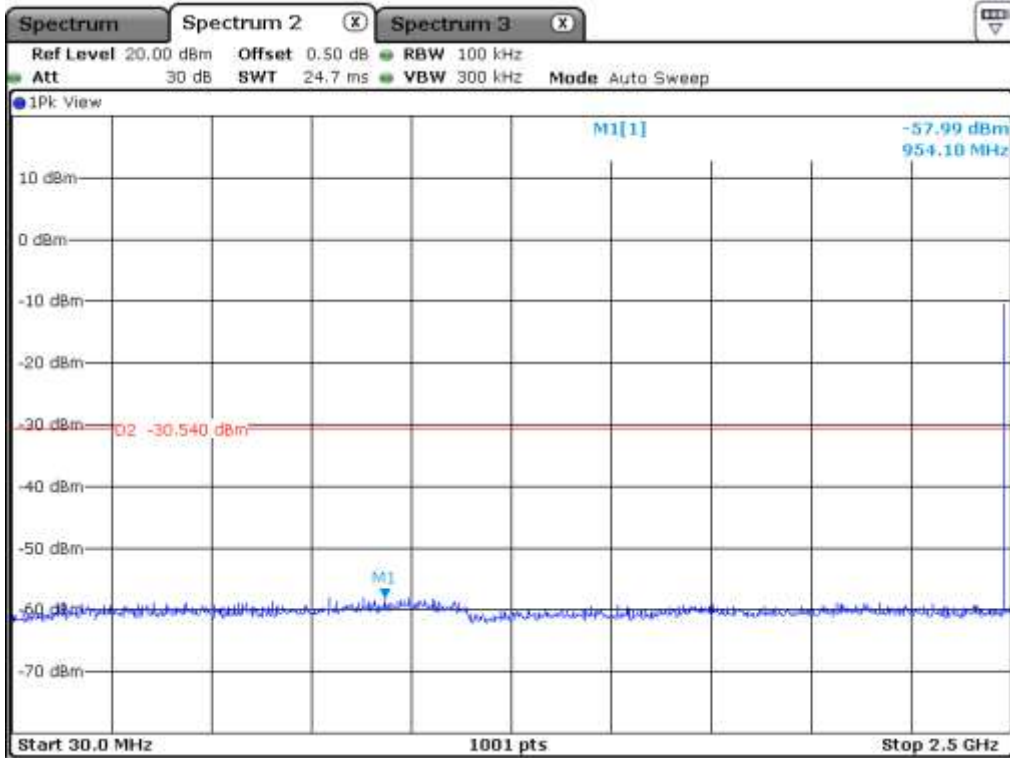
Low Channel



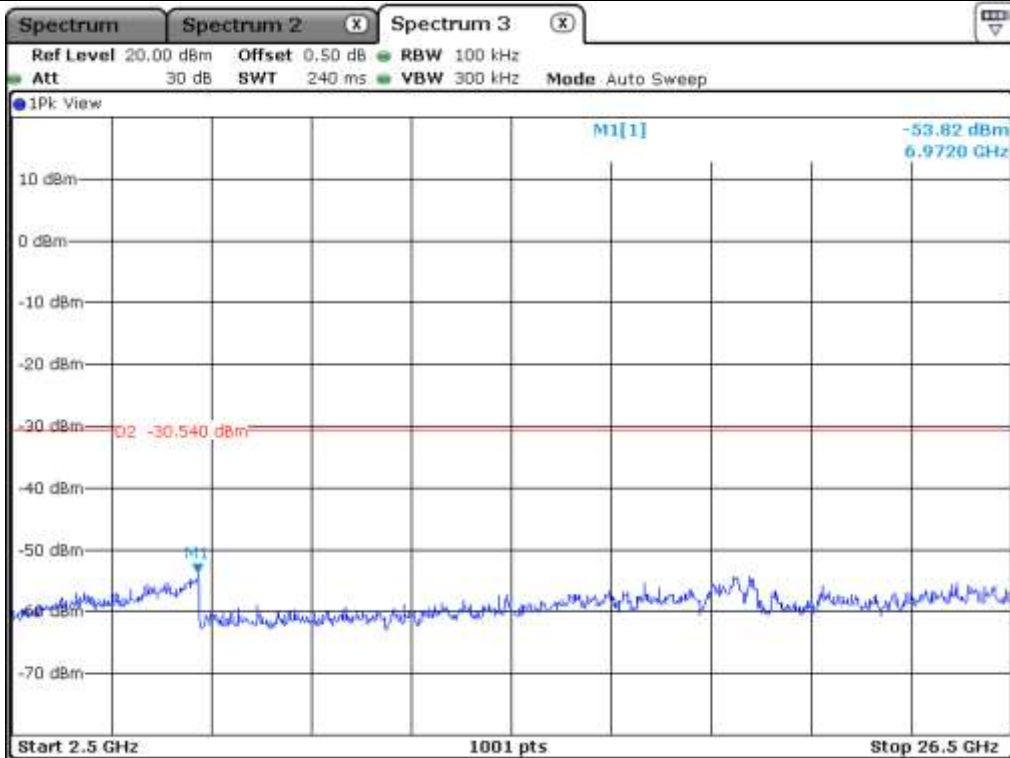
Middle Channel



Middle Channel



High Channel



High Channel

12.7 Test data for Transmitting Mode radiated emission

12.7.1 Radiated Emission which fall in the Restricted Band

12.7.1.1 Test data for 1Mbps

- . Test Date : March 04, 2020
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Detector : Peak Mode(Peak), Average Mode(RMS)
- . Measurement distance : 3 m
- . Operating Condition : Highest Output Power Transmitting Mode (Low Channel and High Channel)
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2 338.25	15.40	Peak	H	27.60	2.91	45.91	74.00	28.09
2 386.52	6.21	Average	H			41.22	54.00	12.78
2 317.55	15.22	Peak	V			45.73	74.00	28.27
2 344.40	6.06	Average	V			41.07	54.00	12.93
2 494.71	15.67	Peak	H	27.50	3.02	46.19	74.00	27.81
2 494.94	6.96	Average	H			41.98	54.00	12.02
2 484.54	15.12	Peak	V			45.64	74.00	28.36
2 494.94	6.38	Average	V			41.40	54.00	12.60

Tabulated test data for Restricted Band

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



Tested by: Sieon Lee / Assistant Manager

12.7.1.2 Test data for 250 kbps

- . Test Date : March 04, 2020
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Detector : Peak Mode(Peak), Average Mode(RMS)
- . Measurement distance : 3 m
- . Operating Condition : Highest Output Power Transmitting Mode (Low Channel and High Channel)
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2 364.70	15.72	Peak	H	27.60	2.91	46.23	74.00	27.77
2 332.25	6.80	Average	H			43.41	54.00	10.59
2 347.36	15.38	Peak	V			45.89	74.00	28.11
2 332.25	6.57	Average	V			43.18	54.00	10.82
2 495.16	15.25	Peak	H	27.50	3.02	45.77	74.00	28.23
2 494.98	6.67	Average	H			43.29	54.00	10.71
2 496.26	14.96	Peak	V			45.48	74.00	28.52
2 495.04	6.28	Average	V			42.90	54.00	11.10

Tabulated test data for Restricted Band

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



Tested by: Sieon Lee / Assistant Manager

12.7.2 Spurious & Harmonic Radiated Emission above 1 GHz

12.7.2.1 Test data for 1 Mbps

- Test Date : March 04, 2020
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Operating Condition : Highest Output Power Transmitting Mode
- Result : PASSED

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4 806.00	17.29	Peak	H	31.20	4.65	53.14	74.00	20.86
	7.41	Average	H			47.76	54.00	6.24
	17.10	Peak	V			52.95	74.00	21.05
	6.86	Average	V			47.21	54.00	6.79
4 884.00	17.24	Peak	H	31.40	4.72	53.36	74.00	20.64
	7.10	Average	H			47.72	54.00	6.28
	16.98	Peak	V			53.10	74.00	20.90
	6.81	Average	V			47.43	54.00	6.57
4 962.00	17.24	Peak	H	31.70	4.86	53.80	74.00	20.20
	6.91	Average	H			47.97	54.00	6.03
	16.94	Peak	V			53.50	74.00	20.50
	6.90	Average	V			47.96	54.00	6.04

Tabulated test data for Restricted Band

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



Tested by: Sieon Lee / Assistant Manager

12.7.2.2 Test data for 250 kbps

- Test Date : March 04, 2020
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Operating Condition : Highest Output Power Transmitting Mode
- Result : PASSED

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4 806.00	16.96	Peak	H	31.20	4.65	52.81	74.00	21.19
	7.23	Average	H			49.18	54.00	4.82
	16.45	Peak	V			52.30	74.00	21.70
	6.93	Average	V			48.88	54.00	5.12
4 884.00	17.36	Peak	H	31.40	4.72	53.48	74.00	20.52
	7.33	Average	H			49.55	54.00	4.45
	16.99	Peak	V			53.11	74.00	20.89
	6.81	Average	V			49.03	54.00	4.97
4 962.00	16.92	Peak	H	31.70	4.86	53.48	74.00	20.52
	7.23	Average	H			49.89	54.00	4.11
	16.79	Peak	V			53.35	74.00	20.65
	6.92	Average	V			49.58	54.00	4.42

Tabulated test data for Restricted Band

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



Tested by: Sieon Lee / Assistant Manager

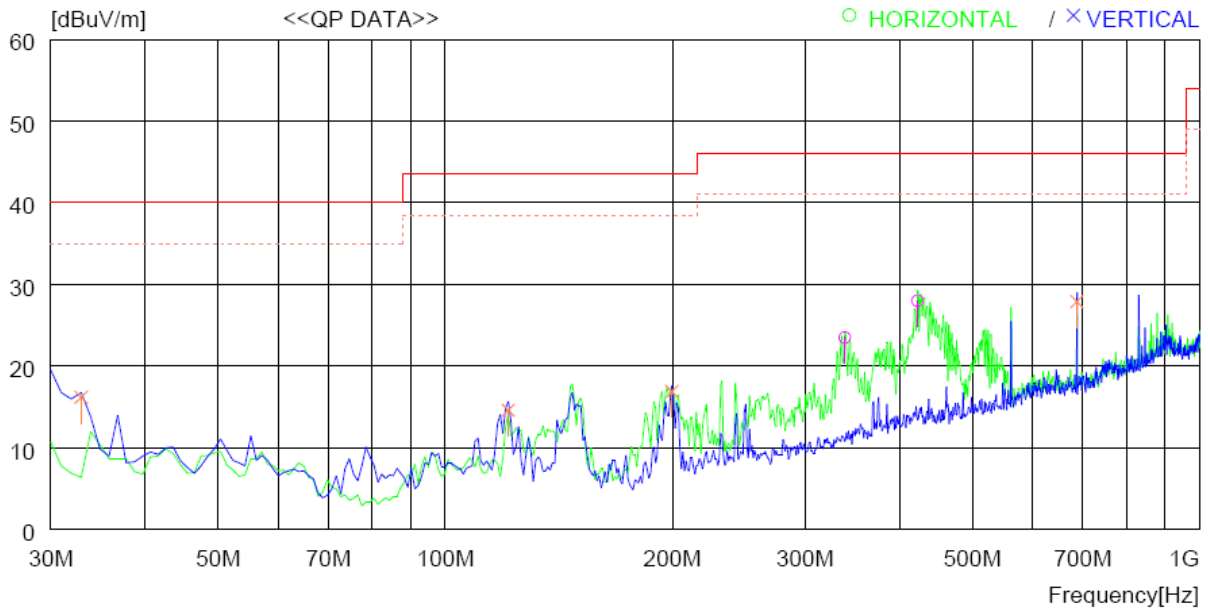
12.7.3 Spurious Radiated Emission

12.7.3.1 Test Data for 30 MHz ~ 1 GHz (Transmitting Mode)

Humidity Level : 50 % R.H. Temperature: 21 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : Wireless module Date: March 04, 2020

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	338.460	39.6	14.4	2.2	32.7	23.5	46.0	22.5	100	329
2	422.851	42.2	16.1	2.4	32.7	28.0	46.0	18.0	100	359
---- Vertical ----										
3	32.910	36.0	12.0	0.8	32.6	16.2	40.0	23.8	100	0
4	121.180	36.0	9.9	1.4	32.7	14.6	43.5	28.9	100	268
5	199.750	37.3	10.4	1.8	32.6	16.9	43.5	26.6	100	358
6	687.655	38.2	19.2	3.4	32.9	27.9	46.0	18.1	200	23

Tested by: Sieon Lee / Assistant Manager

12.7.3.2 Test Data for Below 30 MHz

- . Test Date : March 04, 2020
- . 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
- . Operating Condition : Highest Output Power Transmitting Mode
- . Result : PASSED

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)
Emissions observed were 20dB below the limit and thus not reported								

12.7.3.3 Test Data for above 1 GHz

- . Test Date : March 04, 2020
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Frequency range : 1 GHz ~ 26.5 GHz
- . Measurement distance : 3 m
- . Operating Condition : Highest Output Power Transmitting Mode
- . Result : PASSED

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)
Emissions observed were 20dB below the limit and thus not reported								



Tested by: Sieon Lee / Assistant Manager

13. CONDUCTED EMISSION TEST

13.1 Operating environment

Temperature : 21 °C
 Relative humidity : 50 % R.H

13.2 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 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

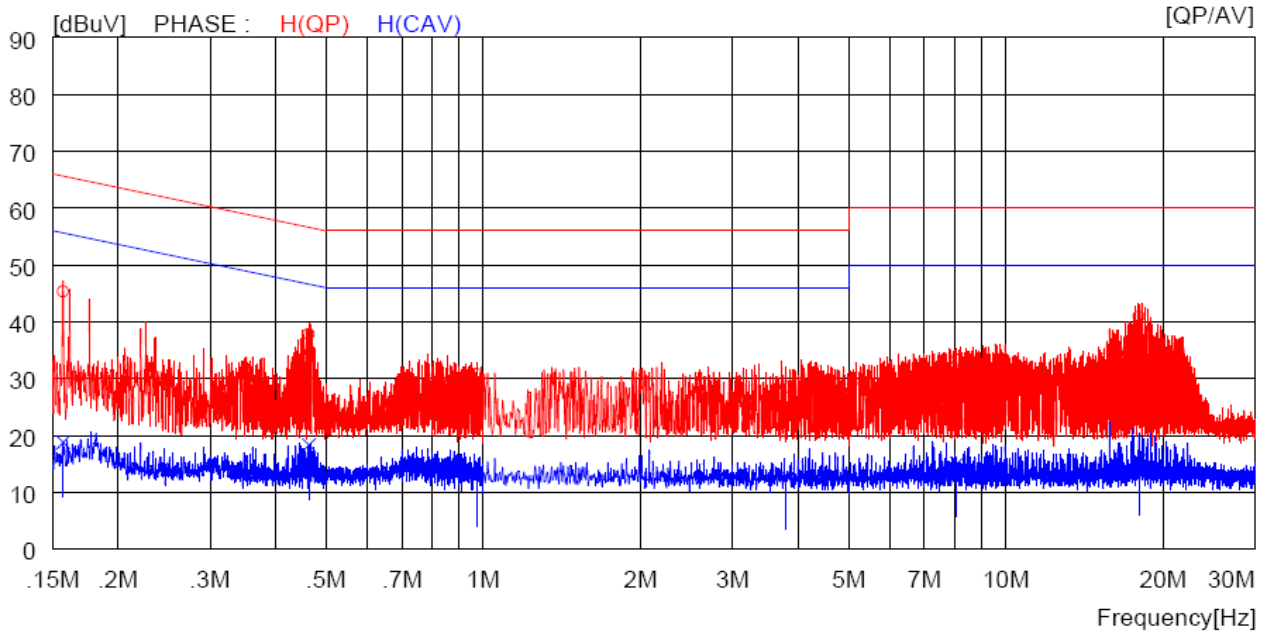
13.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ - ESCI	Rohde & Schwarz	Test Receiver	101420	Mar. 28, 2019 (1Y)
■ - 3825/2	EMCO	AMN	9109-1867	Mar. 27, 2019 (1Y)
■ - NSLK8126	Schwarzbeck	LISN	8126-480	Oct. 21, 2019 (1Y)
■ - 11947A	Hewlett Packard	Transient Limiter	3107A02762	Mar. 28, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

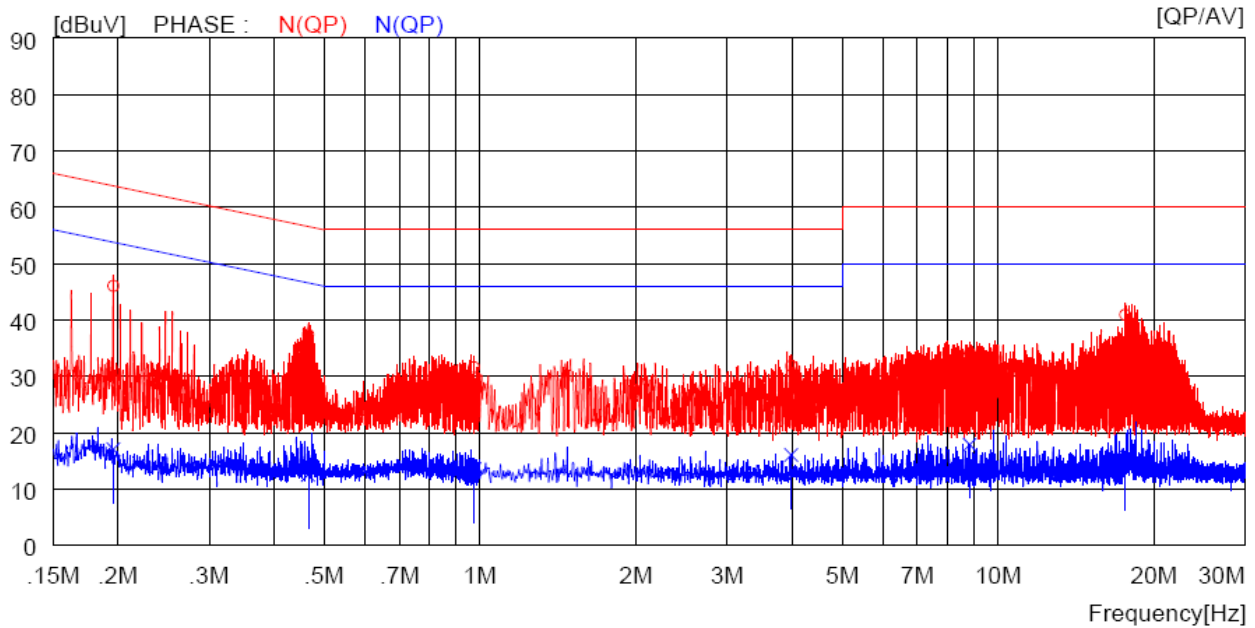
13.4 Test data

- Test Date : November 21, 2019
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT	MARGIN	PHASE		
		QP	AV		QP	AV					QP
1	0.15700	35.3	---	10.0	45.3	---	65.6	---	20.3	---	H(QP)
2	0.46400	27.8	---	10.0	37.8	---	56.6	---	18.8	---	H(QP)
3	0.97100	20.8	---	10.0	30.8	---	56.0	---	25.2	---	H(QP)
4	3.79200	18.4	---	10.1	28.5	---	56.0	---	27.5	---	H(QP)
5	8.07000	23.1	---	10.2	33.3	---	60.0	---	26.7	---	H(QP)
6	18.00000	30.6	---	10.3	40.9	---	60.0	---	19.1	---	H(QP)
7	0.15700	---	8.8	10.0	---	18.8	---	55.6	---	36.8	H(CAV)
8	0.46400	---	8.3	10.0	---	18.3	---	46.6	---	28.3	H(CAV)
9	0.97100	---	3.6	10.0	---	13.6	---	46.0	---	32.4	H(CAV)
10	3.79200	---	2.9	10.1	---	13.0	---	46.0	---	33.0	H(CAV)
11	8.07000	---	4.9	10.2	---	15.1	---	50.0	---	34.9	H(CAV)
12	18.00000	---	5.3	10.3	---	15.6	---	50.0	---	34.4	H(CAV)

- Test Line : NEUTRAL 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]	[dBuV]	[dBuV]	
1	0.19600	36.0	---	10.0	46.0	---	63.8	---	17.8	---	N(QP)	
2	0.46600	27.4	---	10.0	37.4	---	56.6	---	19.2	---	N(QP)	
3	0.97500	21.6	---	10.0	31.6	---	56.0	---	24.4	---	N(QP)	
4	3.98800	21.7	---	10.1	31.8	---	56.0	---	24.2	---	N(QP)	
5	8.83000	23.9	---	10.2	34.1	---	60.0	---	25.9	---	N(QP)	
6	17.66000	30.6	---	10.3	40.9	---	60.0	---	19.1	---	N(QP)	
7	0.19600	---	7.1	10.0	---	17.1	---	53.8	---	36.7	N(CAV)	
8	0.46600	---	2.6	10.0	---	12.6	---	46.6	---	34.0	N(CAV)	
9	0.97500	---	3.6	10.0	---	13.6	---	46.0	---	32.4	N(CAV)	
10	3.98800	---	6.0	10.1	---	16.1	---	46.0	---	29.9	N(CAV)	
11	8.83000	---	7.7	10.2	---	17.9	---	50.0	---	32.1	N(CAV)	
12	17.66000	---	5.4	10.3	---	15.7	---	50.0	---	34.3	N(CAV)	

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

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

Tested by: Seion Lee / Assistant Manager