

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

Test Report No. : W167R-D049

AGR No. : A166A-080

Applicant : BLUEBIRD INC.

Address : (Dogok-dong, SEI Tower13,14)39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea

Manufacturer : BLUEBIRD INC.

Address : (Dogok-dong, SEI Tower13,14)39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea

Type of Equipment : Handheld Mobile Computer

FCC ID. : SS4RFR900

Model Name : RFR900

Multiple Model Name: N/A

Serial number : N/A

Total page of Report : 83 pages (including this page)

Date of Incoming : June 02, 2016

Date of issue : July 12, 2016

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:



Jae-Ho, Lee / Chief Engineer
ONETECH Corp.

Approved by:



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ONETECH Corp.

CONTENTS

	PAGE
1. VERIFICATION OF COMPLIANCE	6
2. TEST SUMMARY	7
2.1 TEST ITEMS AND RESULTS.....	7
2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS	7
2.3 RELATED SUBMITTAL(S) / GRANT(S)	7
2.4 PURPOSE OF THE TEST.....	7
2.5 TEST METHODOLOGY	7
2.6 TEST FACILITY.....	8
3. GENERAL INFORMATION	9
3.1 PRODUCT DESCRIPTION	9
3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT.	9
4. EUT MODIFICATIONS.....	9
5. SYSTEM TEST CONFIGURATION.....	10
5.1 JUSTIFICATION	10
5.2 PERIPHERAL EQUIPMENT	10
5.3 MODE OF OPERATION DURING THE TEST	11
5.4 CONFIGURATION OF TEST SYSTEM.....	11
5.5 ANTENNA REQUIREMENT	11
6. PRELIMINARY TEST	12
6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS	12
6.2 GENERAL RADIATED EMISSIONS TESTS.....	12
7. MINIMUM 20 DB BANDWIDTH	13
7.1 OPERATING ENVIRONMENT	13
7.2 TEST SET-UP	13
7.3 TEST EQUIPMENT USED.....	13
7.4 TEST DATA FOR 1 MBPS.....	14
7.5 TEST DATA FOR 2 MBPS.....	16
7.6 TEST DATA FOR 3 MBPS.....	18
8. HOPPING FREQUENCY SEPARATION	20
8.1 OPERATING ENVIRONMENT	20
8.2 TEST SET-UP	20
8.3 TEST EQUIPMENT USED.....	20

8.4 TEST DATA FOR 1 MBPS.....	21
8.5 TEST DATA FOR 2 MBPS.....	22
8.6 TEST DATA FOR 3 MBPS.....	23
9. NUMBER OF HOPPING CHANNELS	24
9.1 OPERATING ENVIRONMENT	24
9.2 TEST SET-UP	24
9.3 TEST EQUIPMENT USED.....	24
9.4 TEST DATA FOR 1 MBPS.....	25
9.5 TEST DATA FOR 2 MBPS.....	28
9.6 TEST DATA FOR 3 MBPS.....	31
10. TIME OF OCCUPANCY	34
10.1 OPERATING ENVIRONMENT	34
10.2 TEST SET-UP	34
10.3 TEST EQUIPMENT USED.....	34
10.4 TEST DATA FOR 1 MBPS.....	35
10.5 TEST DATA FOR 2 MBPS	38
10.6 TEST DATA FOR 3 MBPS.....	41
11. MAXIMUM PEAK OUTPUT POWER.....	44
11.1 OPERATING ENVIRONMENT	44
11.2 TEST SET-UP	44
11.3 TEST EQUIPMENT USED.....	44
11.4 TEST DATA FOR 1 MBPS	45
11.5 TEST DATA FOR 2 MBPS	48
11.6 TEST DATA FOR 3 MBPS	51
12. 100 KHZ BANDWIDTH OUTSIDE THE FREQUENCY BAND	54
12.1 OPERATING ENVIRONMENT	54
12.2 TEST SET-UP FOR CONDUCTED MEASUREMENT	54
12.3 TEST SET-UP FOR RADIATED MEASUREMENT	54
12.4 TEST EQUIPMENT USED.....	54
12.5 TEST DATA FOR CONDUCTED EMISSION	55
12.5.1 Test data for 1 Mbps	55
12.5.2 Test data for 2 Mbps	61
12.5.3 Test data for 3 Mbps	67
12.6 TEST DATA FOR CHARGING & TRANSMITTING MODE RADIATED EMISSION	73
12.6.1 Radiated Emission which fall in the Restricted Band	73
12.6.2 Spurious & Harmonic Radiated Emission above 1 GHz.....	76

12.6.3 Spurious Radiated Emission	79
13. CONDUCTED EMISSION TEST	81
13.1 OPERATING ENVIRONMENT	81
13.2 TEST SET-UP	81
13.3 TEST EQUIPMENT USED.....	81
13.4 TEST DATA FOR CHARGING & TRANSMITTING MODE.....	82

Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
W167R-D049	July 12, 2016	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

APPLICANT : BLUEBIRD INC.
ADDRESS : (Dogok-dong, SEI Tower13,14)39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea
CONTACT PERSON : Jae-ho, Lee / Assistant Manager
TELEPHONE NO : +82-70-7730-8210
FCC ID : SS4RFR900
MODEL NAME : RFR900
SERIAL NUMBER : N/A
DATE : July 12, 2016

EQUIPMENT CLASS	DSS – PART 15 SPREAD SPECTRUM TRANSMITTER
KIND OF EQUIPMENT	Handheld Mobile Computer
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-4617/ G-666/ T-1842

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

- . Site Accreditation:

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

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The BLUEBIRD INC., Model RFR900 (referred to as the EUT in this report) is a Handheld Mobile Computer. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Handheld Mobile Computer				
OPERATING FREQUENCY	Bluetooth	2 402 MHz ~ 2 480 MHz			
	RFID	902.75 MHz ~ 927.25 MHz			
RF OUTPUT POWER	Bluetooth	1 Mbps	1.40 dBm		
		2 Mbps	2.98 dBm		
		3 Mbps	3.02 dBm		
	RFID	29.37 dBm (0.865 W)			
NUMBER OF CHANNEL	Bluetooth	79 Channels			
	RFID	50 Channels			
MODULATION TYPE	Bluetooth	GFSK for 1 Mbps, $\pi/4$ -DQPSK for 2 Mbps, 8DPSK for 3 Mbps			
	RFID	ASK			
ANTENNA TYPE	PCB Antenna				
ANTENNA GAIN	Bluetooth	4.535 dBi			
	RFID	3.72 dBi			
LIST OF EACH OSC. OR CRYSTAL. FREQ.(FREQ.>=1 MHz)	12 MHz				
RATED SUPPLY VOLTAGE	DC 3.635 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	
Switch Board	FPCB-RFR900-BATTERY-REV0.2	N/A	
RFID Module	IDRO900MI	N/A	
RFID Antenna	SANGSHIN 6015_V2.0	N/A	
Connect Board	EF400	N/A	
Battery	BAT-RFR900	GSP	

5.2 Peripheral equipment

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

Model	Manufacturer	Description	Connected to
RFR900	BLUEBIRD INC.	Handheld Mobile Computer	Adapter
ETA-U90KWK	RF Tech (Tianjin) Electronics Co., Ltd.	Adapter	EUT

5.3 Mode of operation during the test

For Bluetooth function testing, software used to control the EUT for staying in continuous transmitting and receiving mode is programmed. The EUT was set at Low Channel (2 402 MHz), Middle Channel (2 441 MHz), and High Channel (2 480 MHz) with each data transfer rate, 1 Mbps, 2 Mbps, and 3 Mbps. To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XZ” axis, but the worst data was recorded in this test report.

5.4 Configuration of Test System

- Line Conducted Test:** The EUT was tested in a charging mode and transmitting mode. The EUT was connected to USB and the power of USB was connected to Adapter. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.
- Radiated Emission Test:** The EUT was tested in a charging mode and transmitter mode. 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 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 Tests, the following operating mode was investigated

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

7. MINIMUM 20 dB BANDWIDTH

7.1 Operating environment

Temperature : 24 °C
Relative humidity : 57 % 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.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	May. 31, 2016 (1Y)

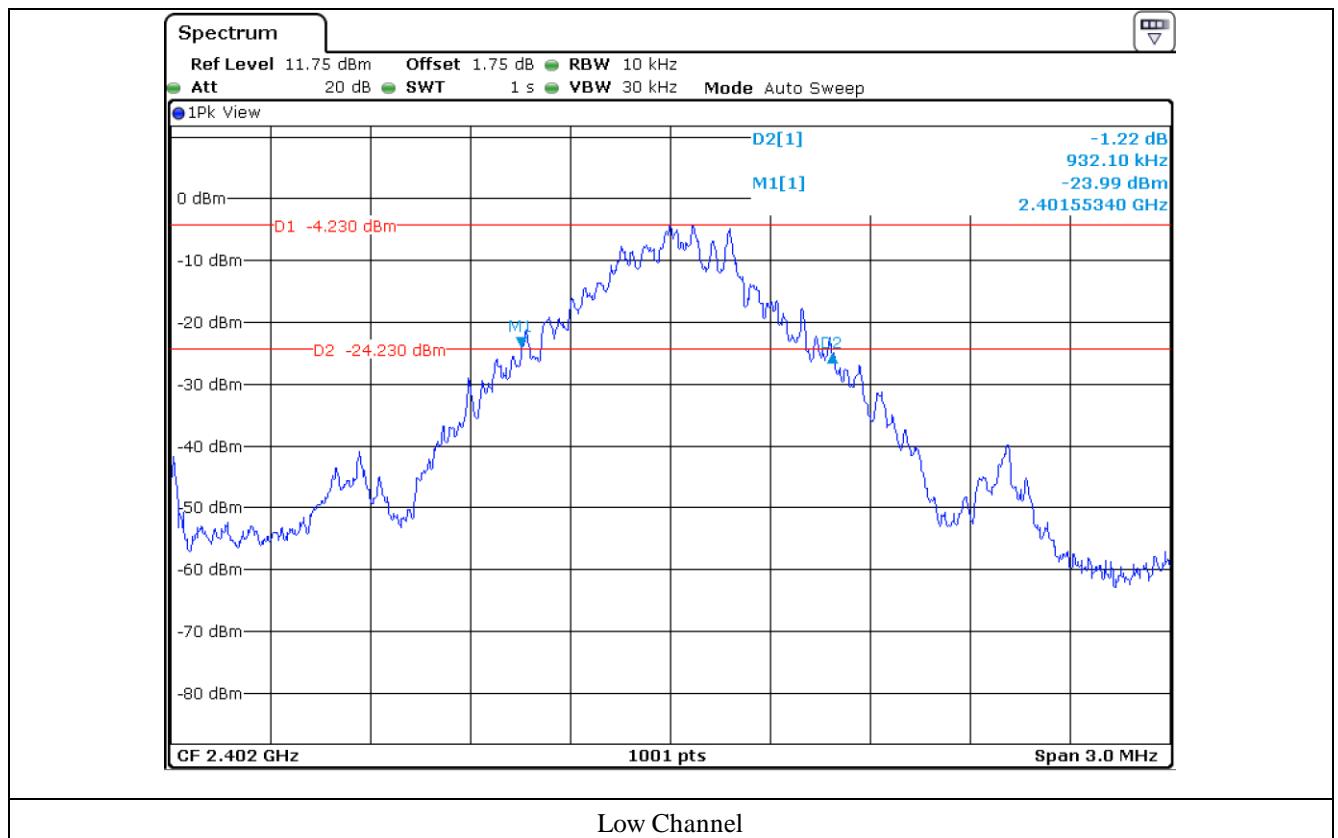
All test equipment used is calibrated on a regular basis.

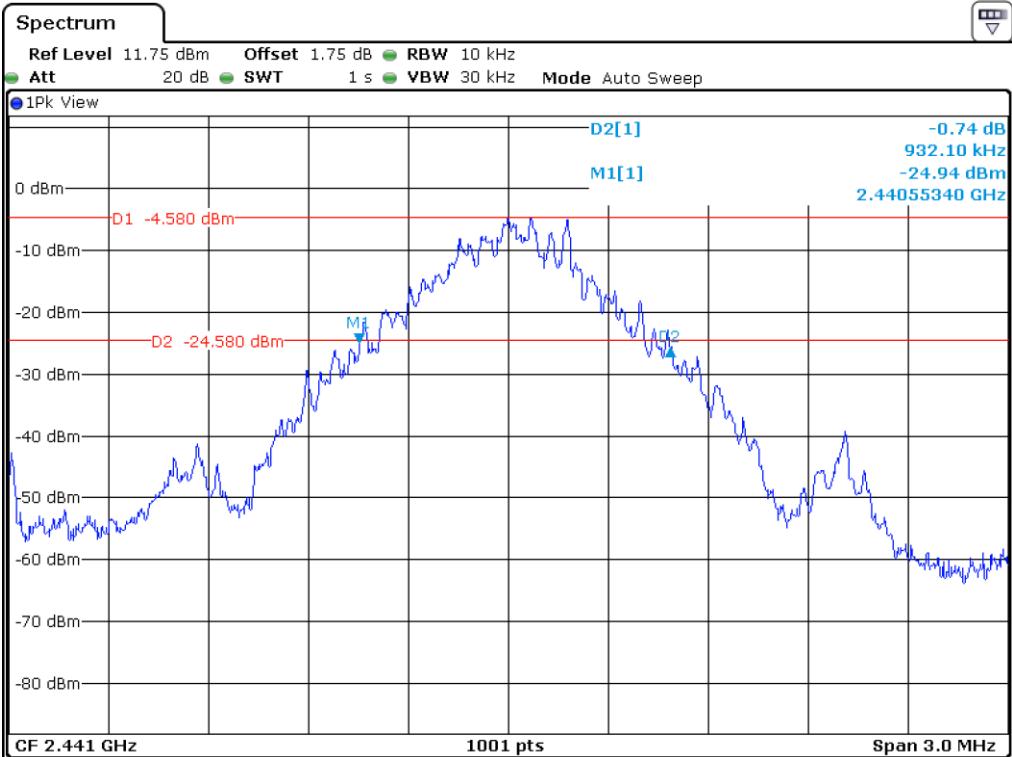
7.4 Test data for 1 Mbps

- Test Date : June 12, 2016

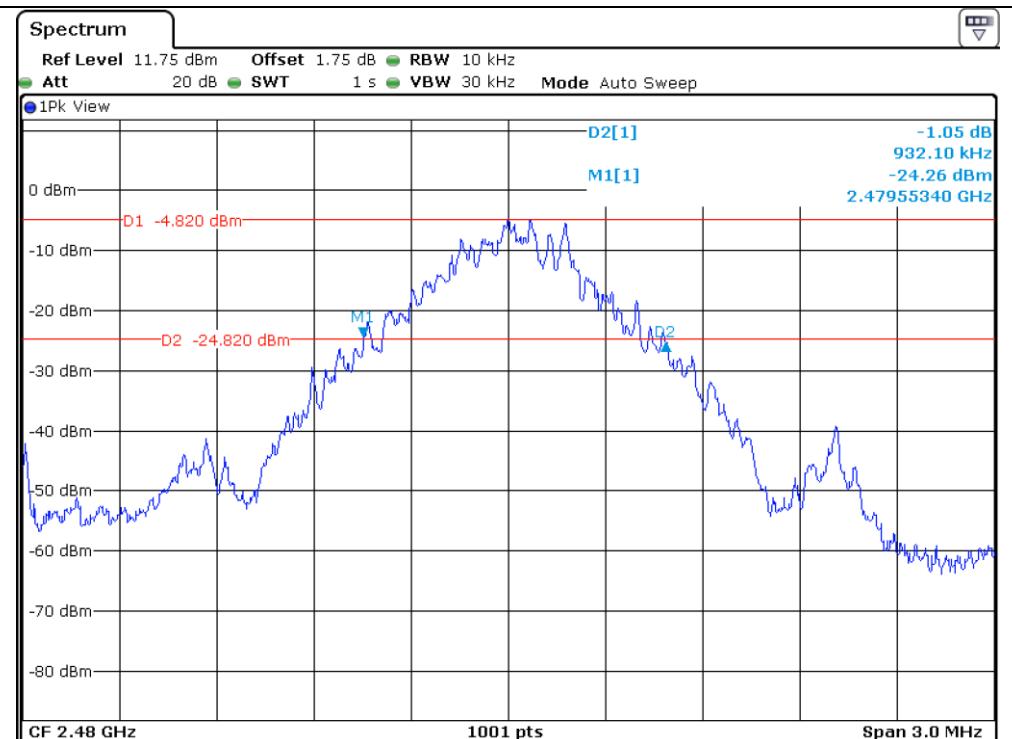
CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402	932.10
Middle	2 441	932.10
High	2 480	932.10


Tested by: Jun-Hui, Lee / Senior Engineer





Middle Channel

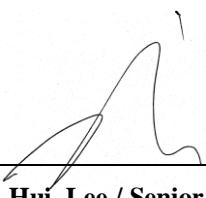


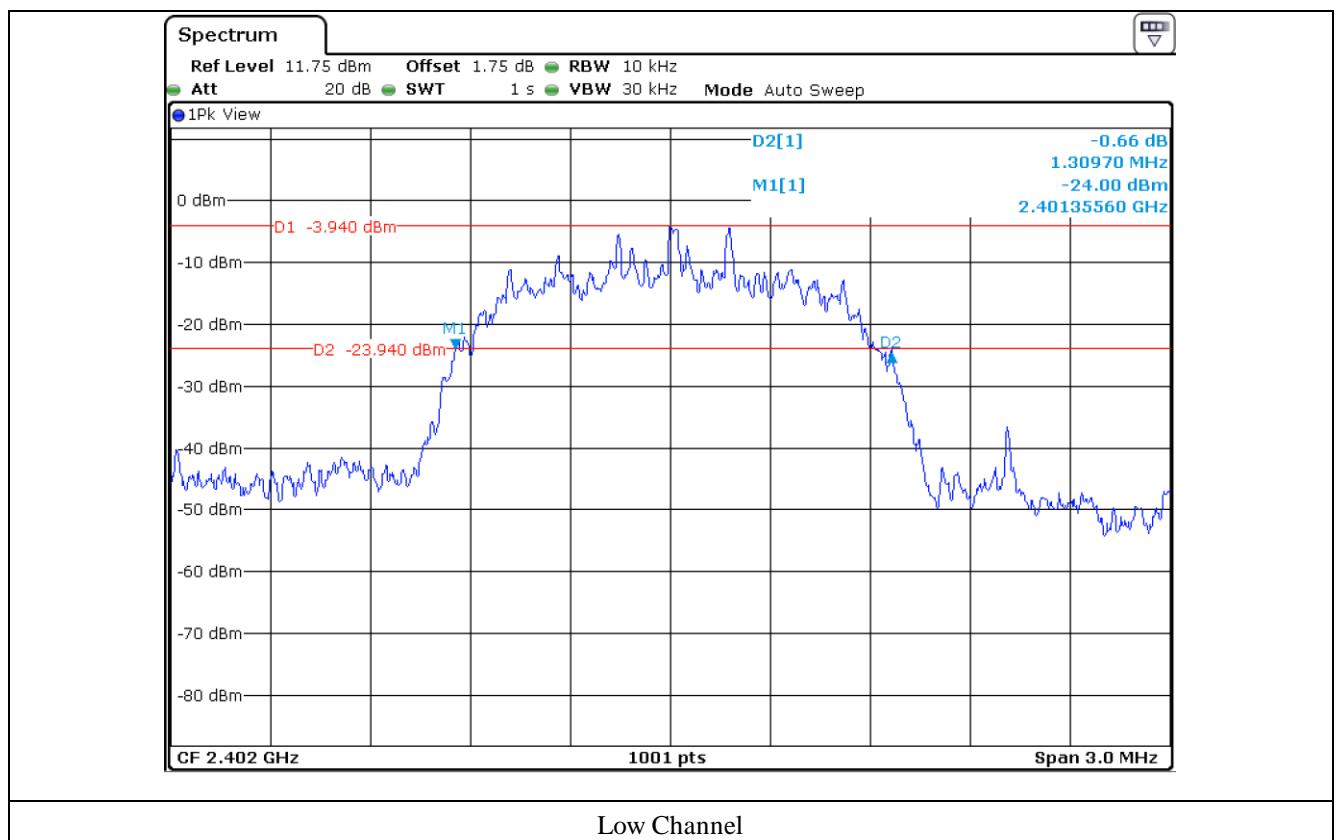
High Channel

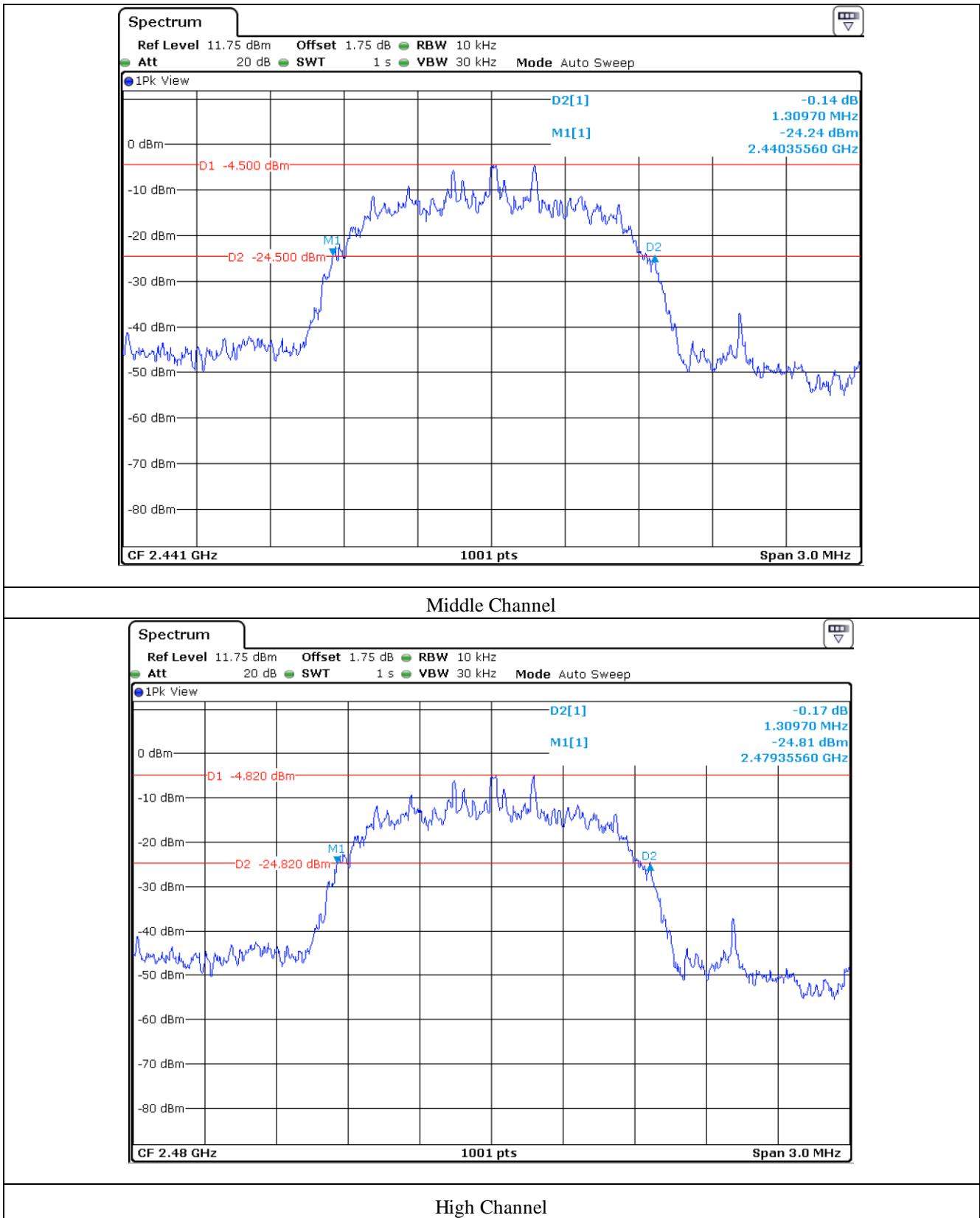
7.5 Test data for 2 Mbps

- Test Date : June 12, 2016

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402	1 309.70
Middle	2 441	1 309.70
High	2 480	1 309.70


Tested by: Jun-Hui, Lee / Senior Engineer

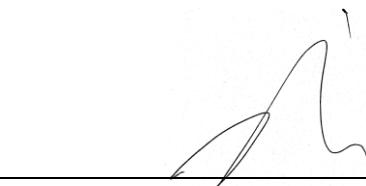




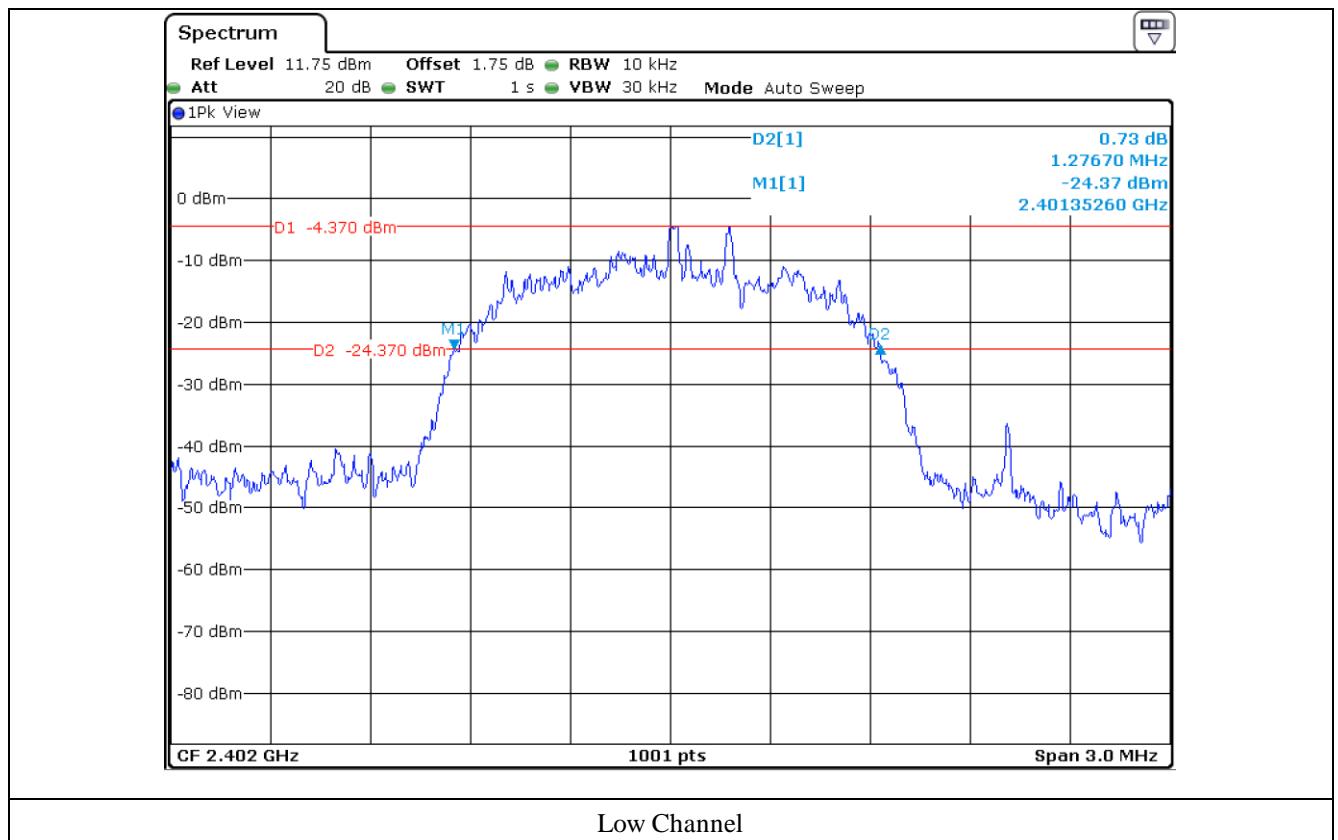
7.6 Test data for 3 Mbps

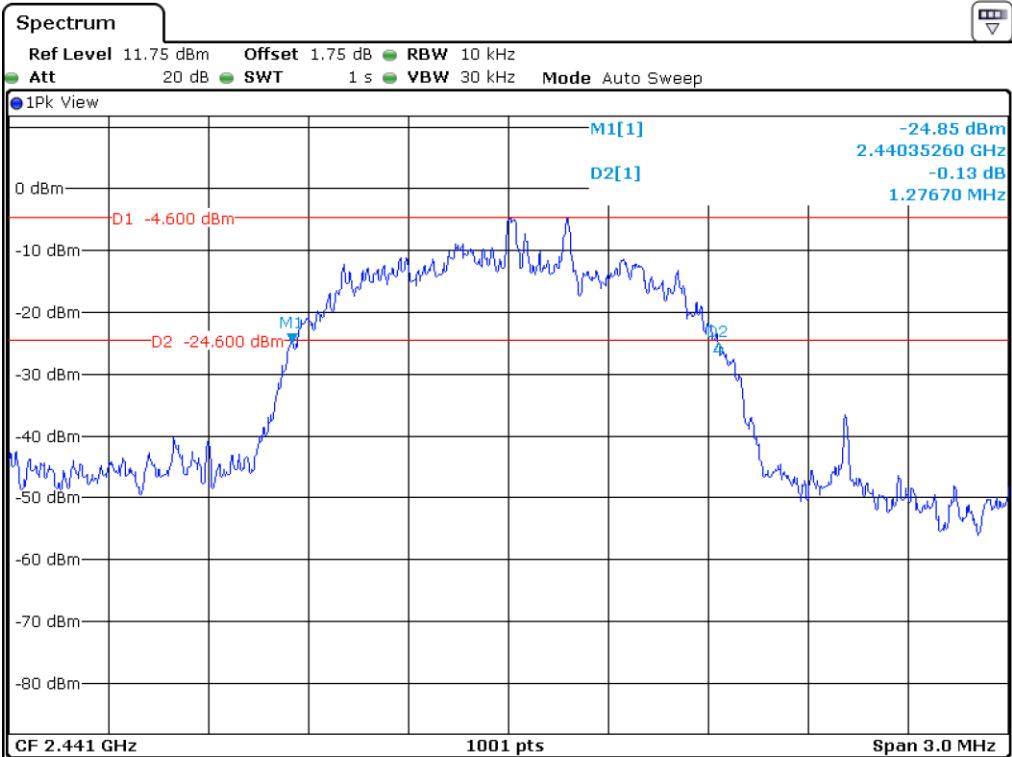
- Test Date : June 12, 2016

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402	1 276.70
Middle	2 441	1 276.70
High	2 480	1 276.70

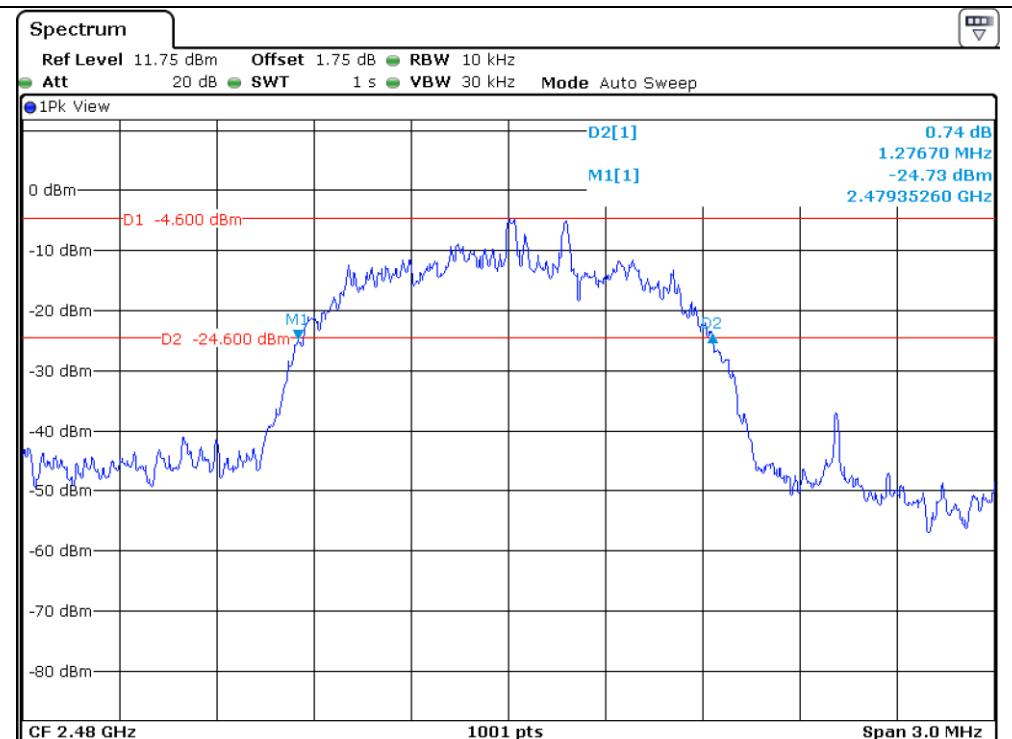


Tested by: Jun-Hui, Lee / Senior Engineer





Middle Channel



High Channel

8. HOPPING FREQUENCY SEPARATION

8.1 Operating environment

Temperature : 24 °C

Relative humidity : 57 % 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 10 MHz. The analyzer is set to peak hold then a pseudo-random hopping sequence of the transmitter is captured. The mark delta function was used to measure the frequency separation between two adjacent hopping channels.



8.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	May. 31, 2016 (1Y)

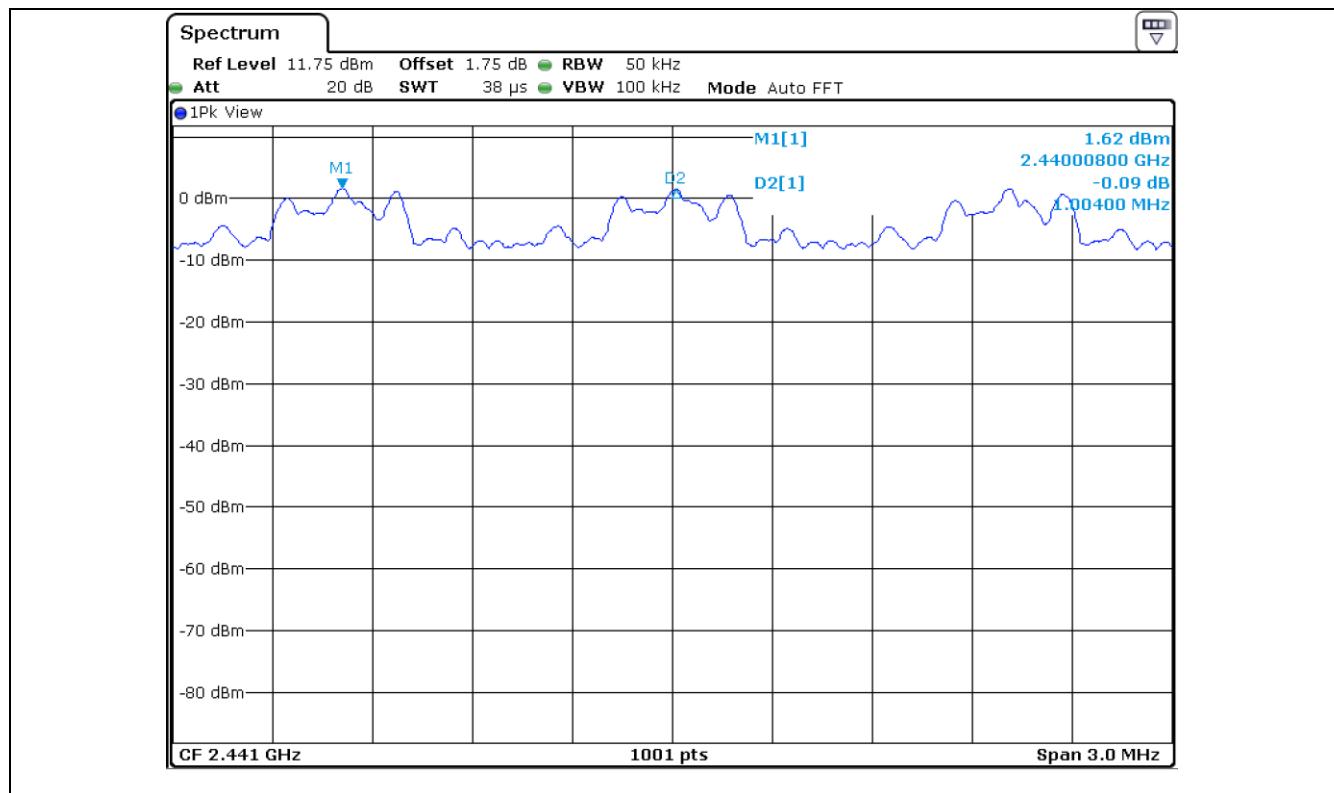
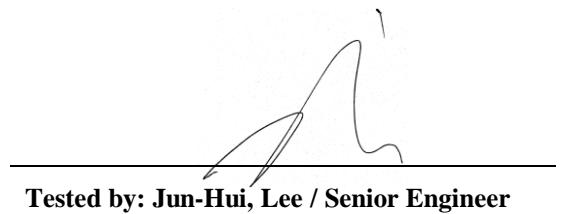
All test equipment used is calibrated on a regular basis.

8.4 Test data for 1 Mbps

- Test Date : June 12, 2016

- Test Result : Pass

MEASURED VALUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
1 004.00	621.40	Separated by a minimum of 25 kHz

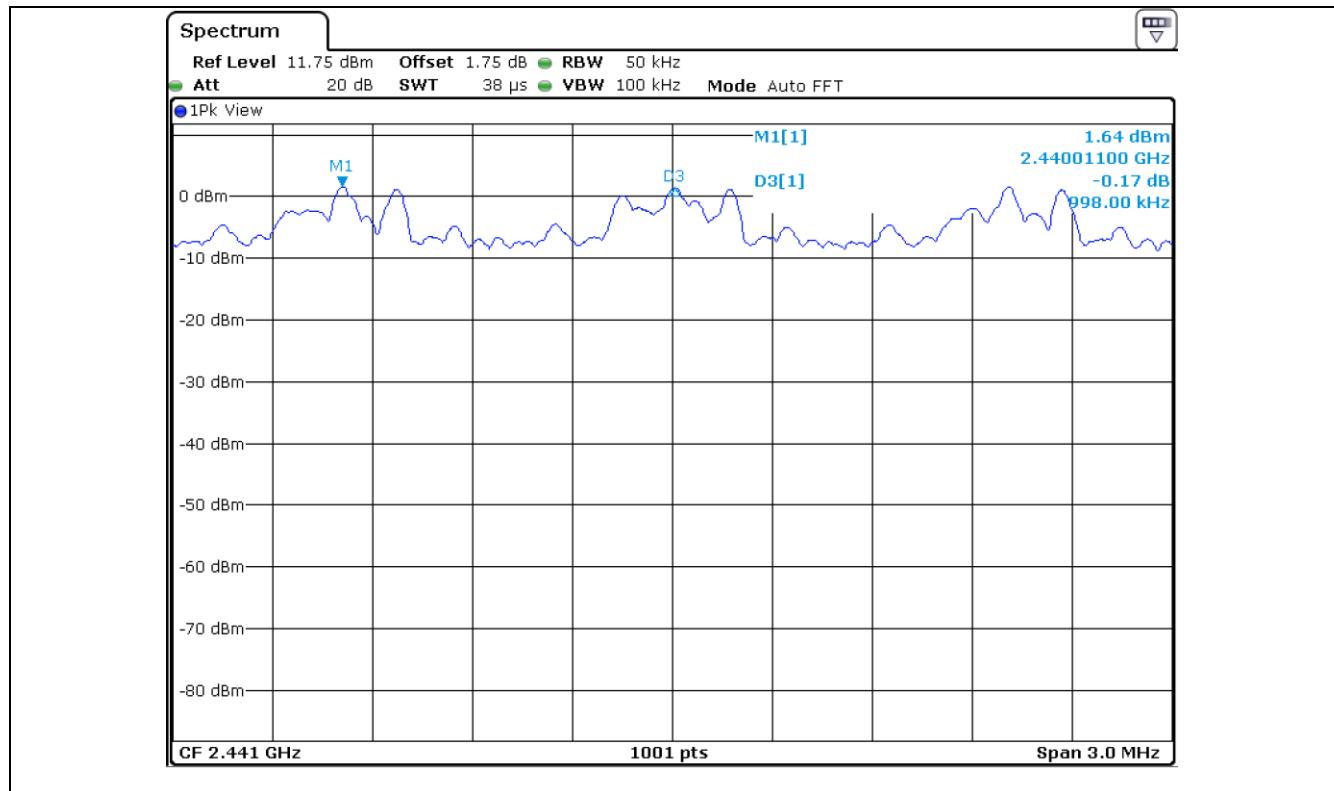
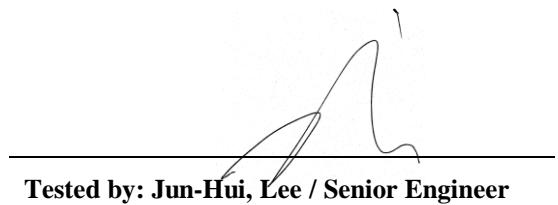


8.5 Test data for 2 Mbps

- Test Date : June 12, 2016

- Test Result : Pass

MEASURED VALUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
998.00	873.13	Separated by a minimum of 25 kHz

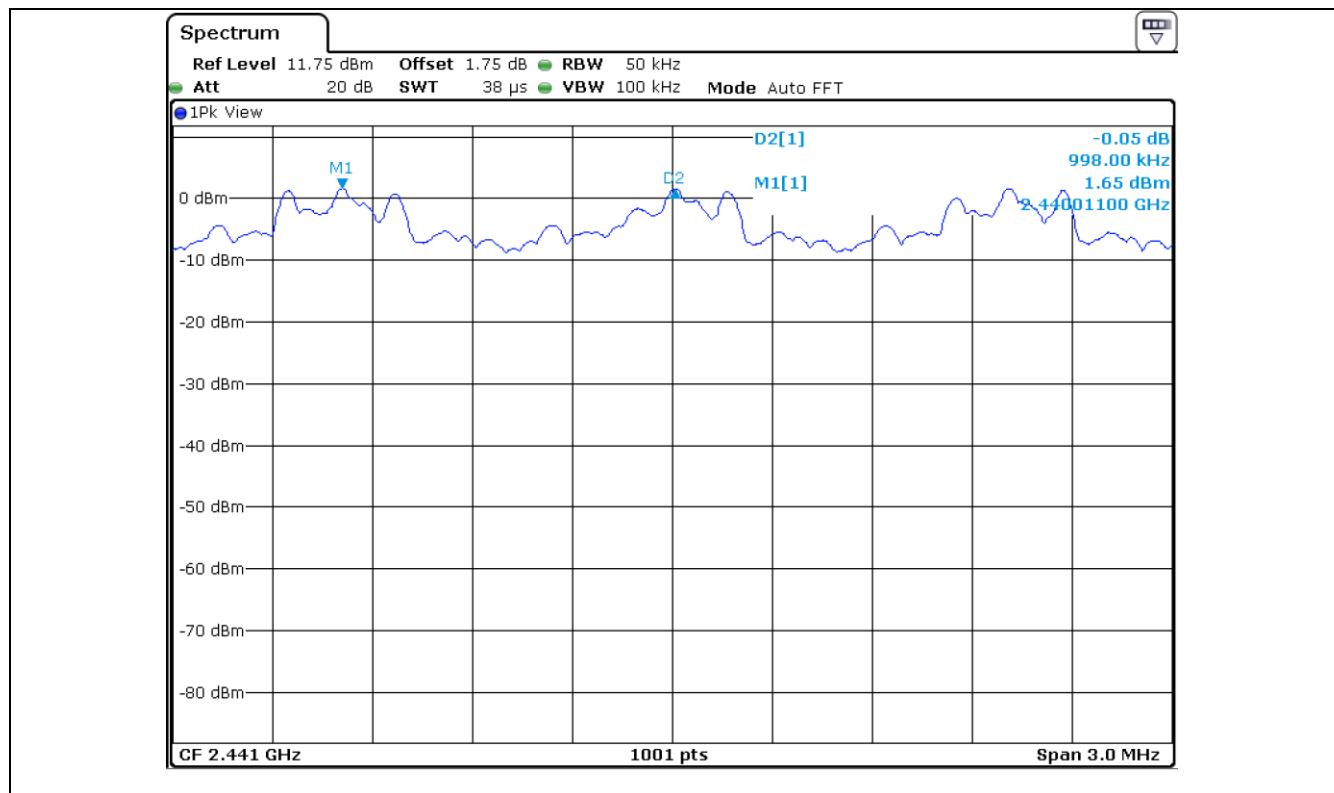
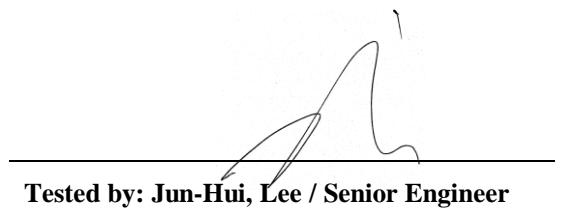


8.6 Test data for 3 Mbps

- Test Date : June 12, 2016

- Test Result : Pass

MEASURED VALUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
998.00	851.13	Separated by a minimum of 25 kHz



9. NUMBER OF HOPPING CHANNELS

9.1 Operating environment

Temperature : 24 °C

Relative humidity : 57 % R.H.

9.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The frequency span is set to 100 MHz and the resolution bandwidth is set to 1 MHz. The analyzer is set to peak hold and then complete pseudo-random hopping sequence of the transmitter is captured.



9.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	May. 31, 2016 (1Y)

All test equipment used is calibrated on a regular basis.

9.4 Test data for 1 Mbps

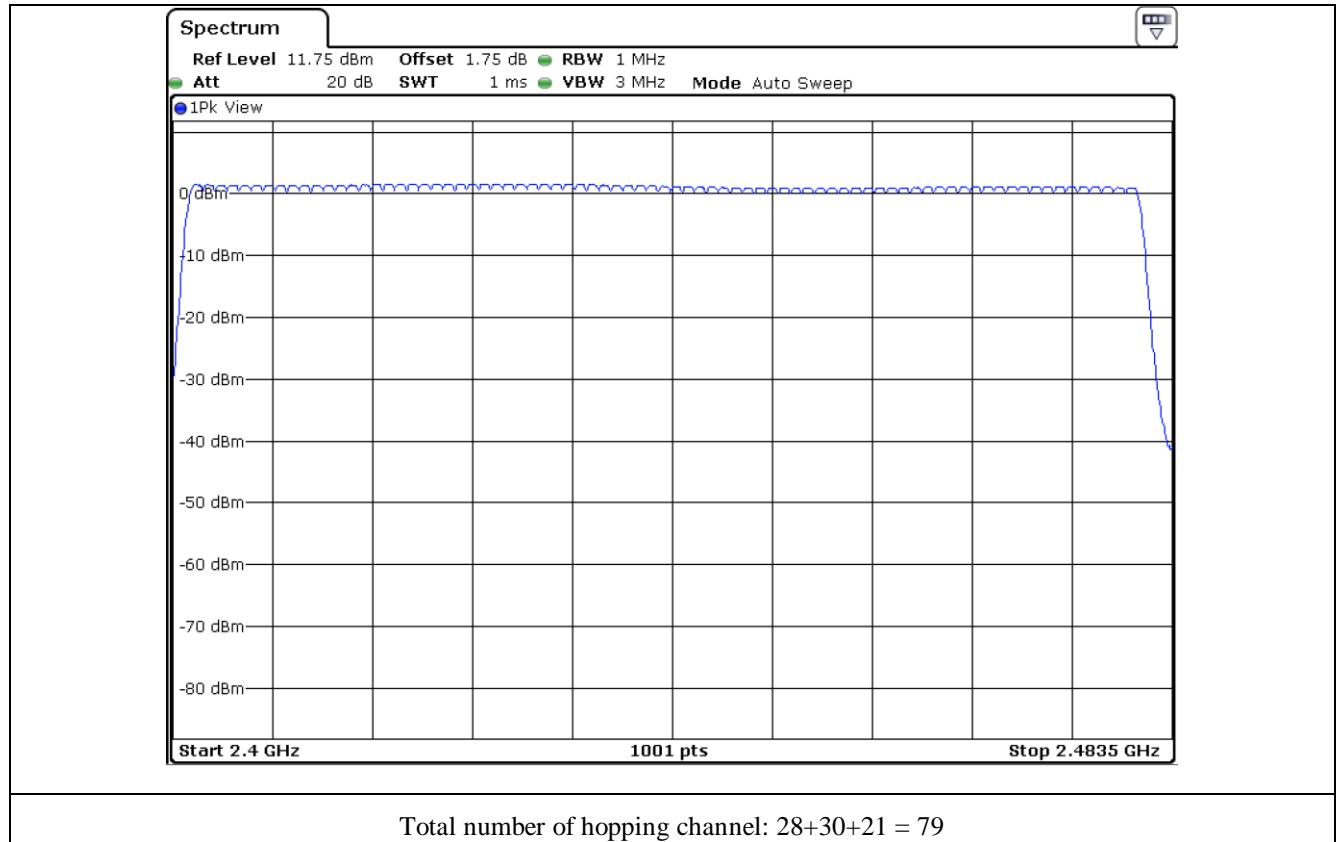
- Test Date : June 12, 2016

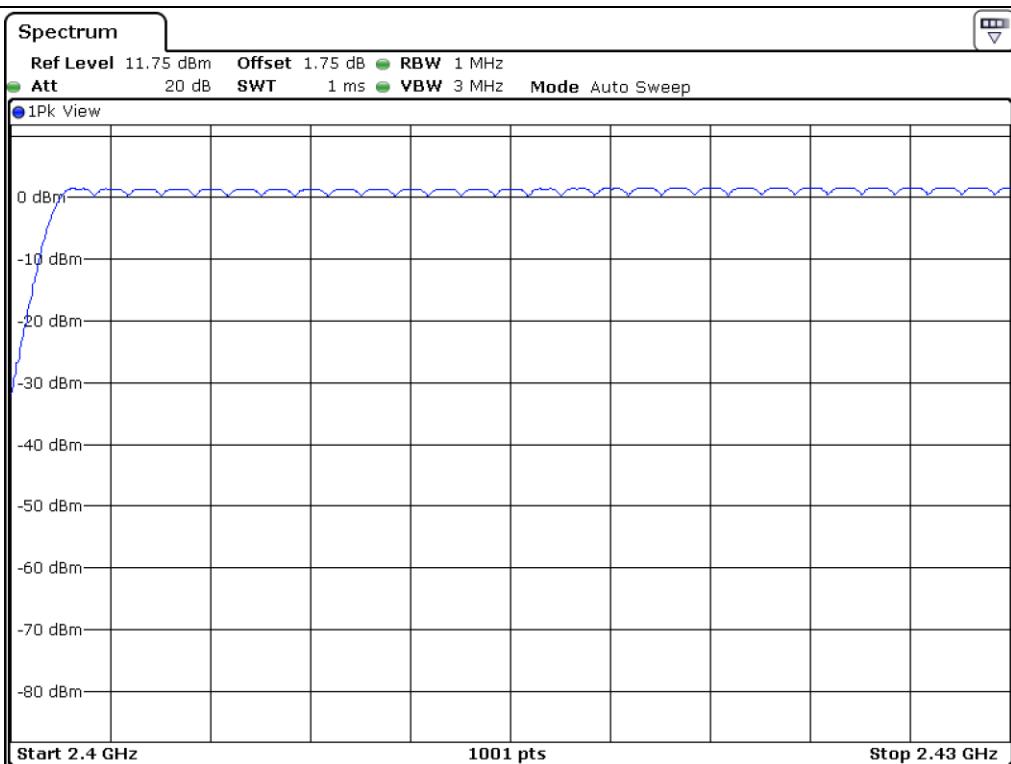
- Test Result : Pass

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

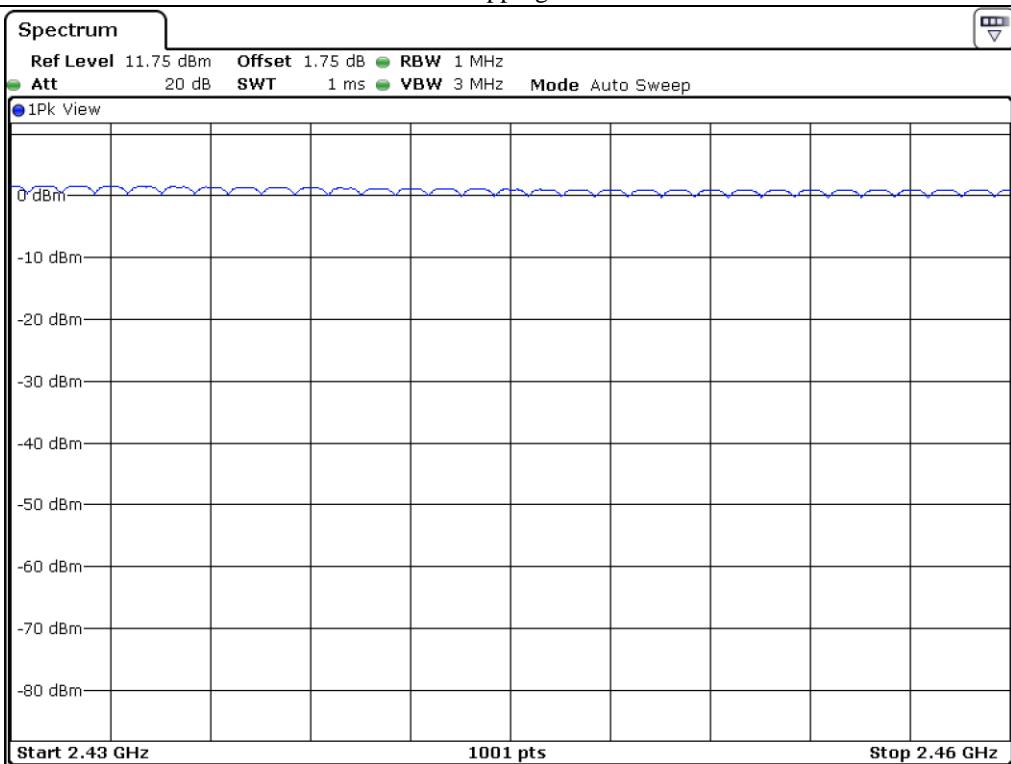


Tested by: Jun-Hui, Lee / Senior Engineer

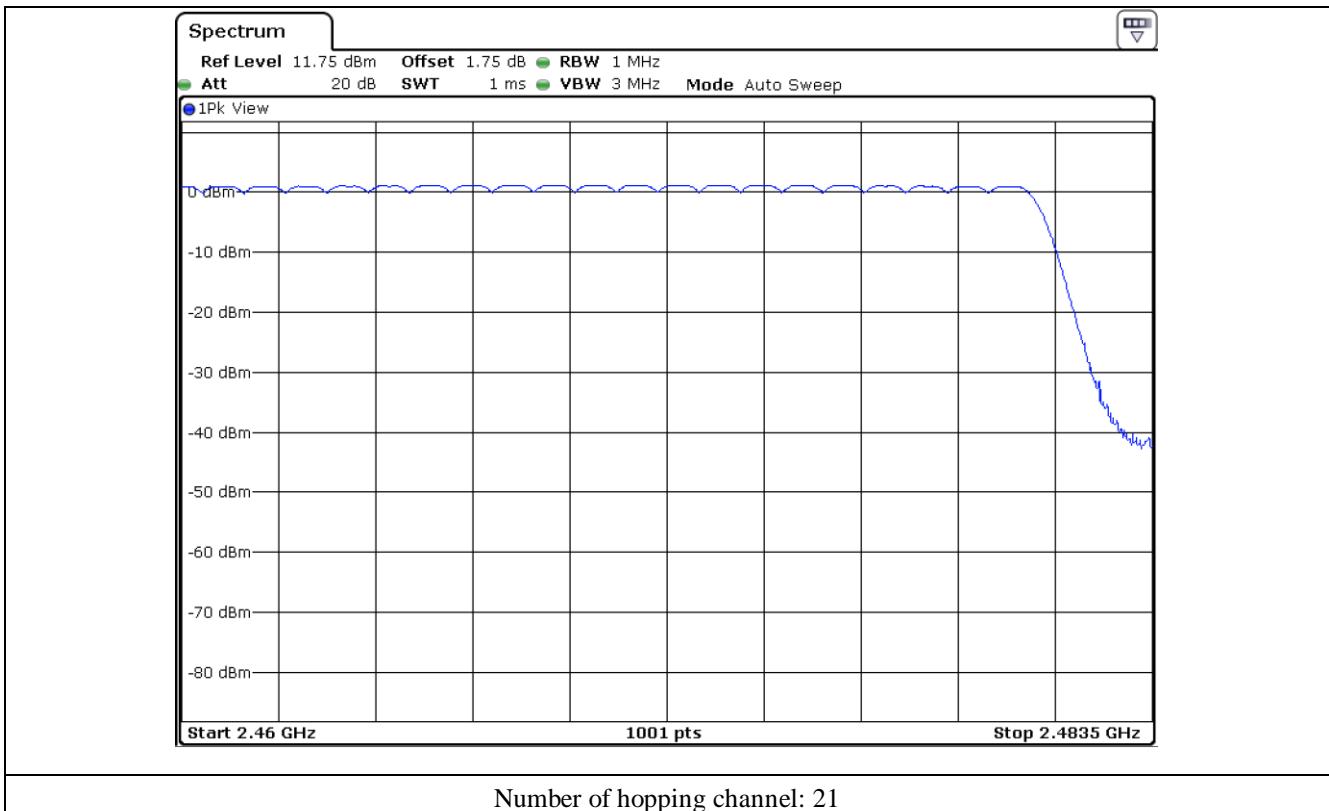




Number of hopping channel: 28



Number of hopping channel: 30



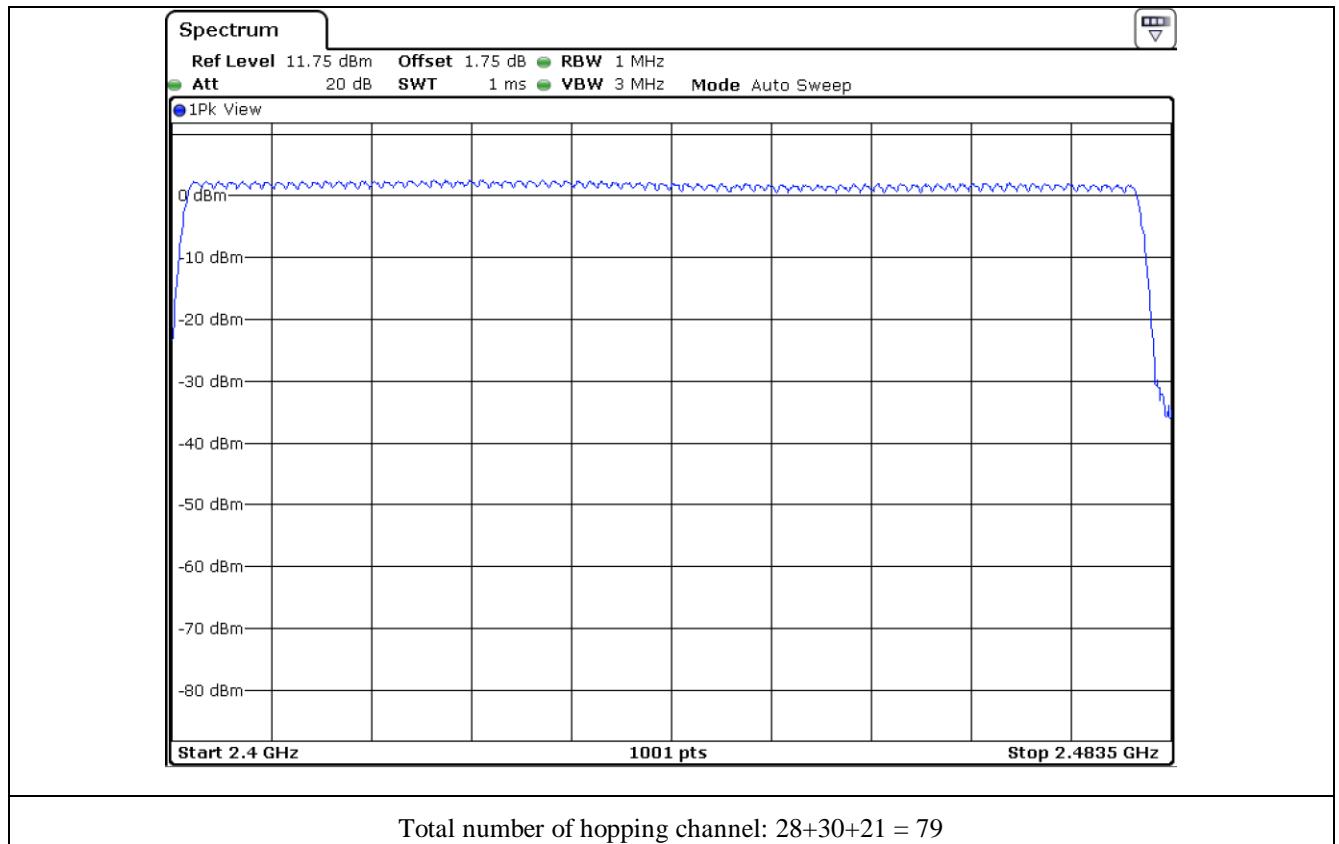
9.5 Test data for 2 Mbps

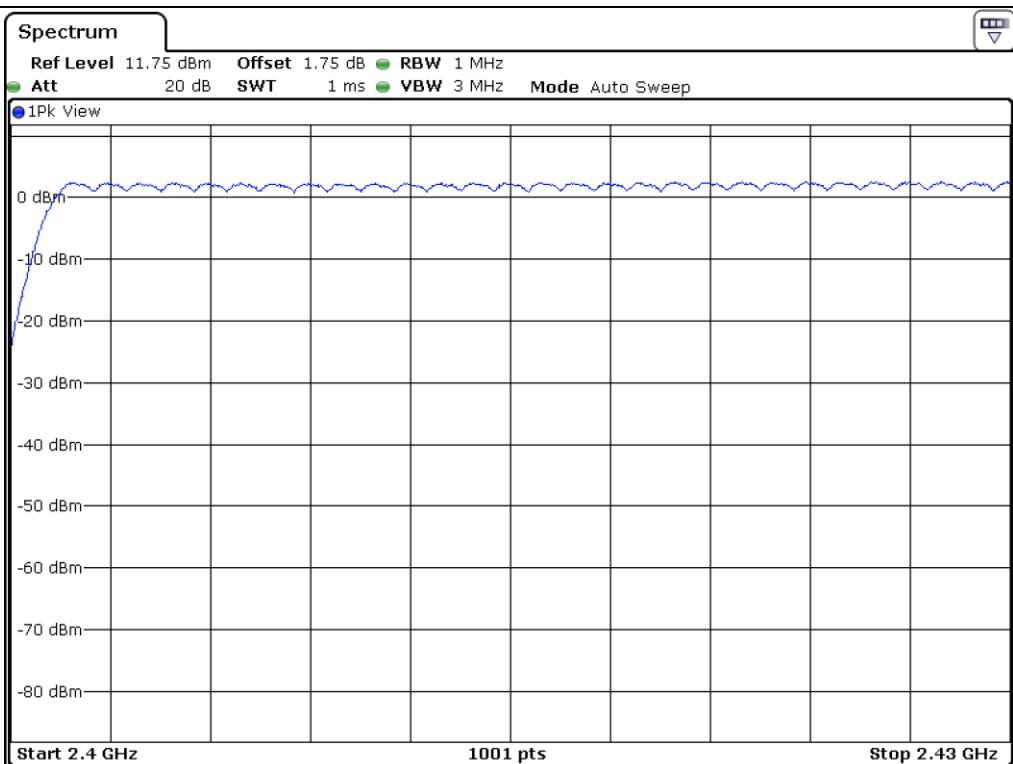
- Test Date : June 12, 2016

- Test Result : Pass

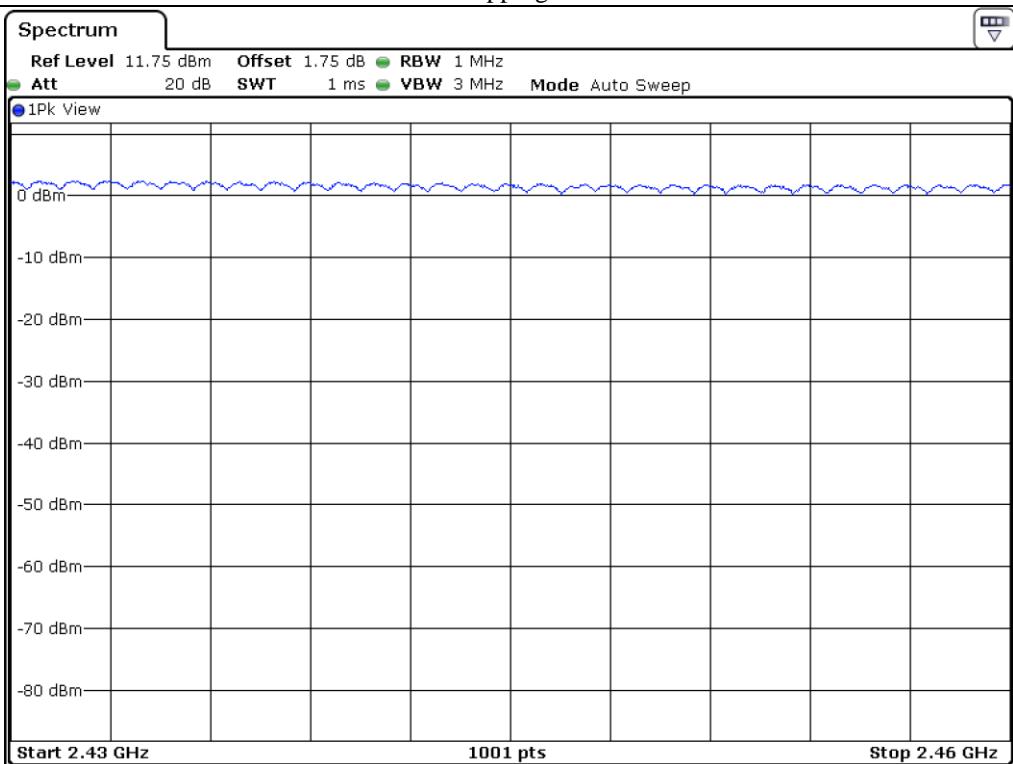
Data Transfer Rate	Measured value (Number)	Limit (Number)	Margin (Number)
2 Mbps	79	Minimum of 15	64


Tested by: Jun-Hui, Lee / Senior Engineer

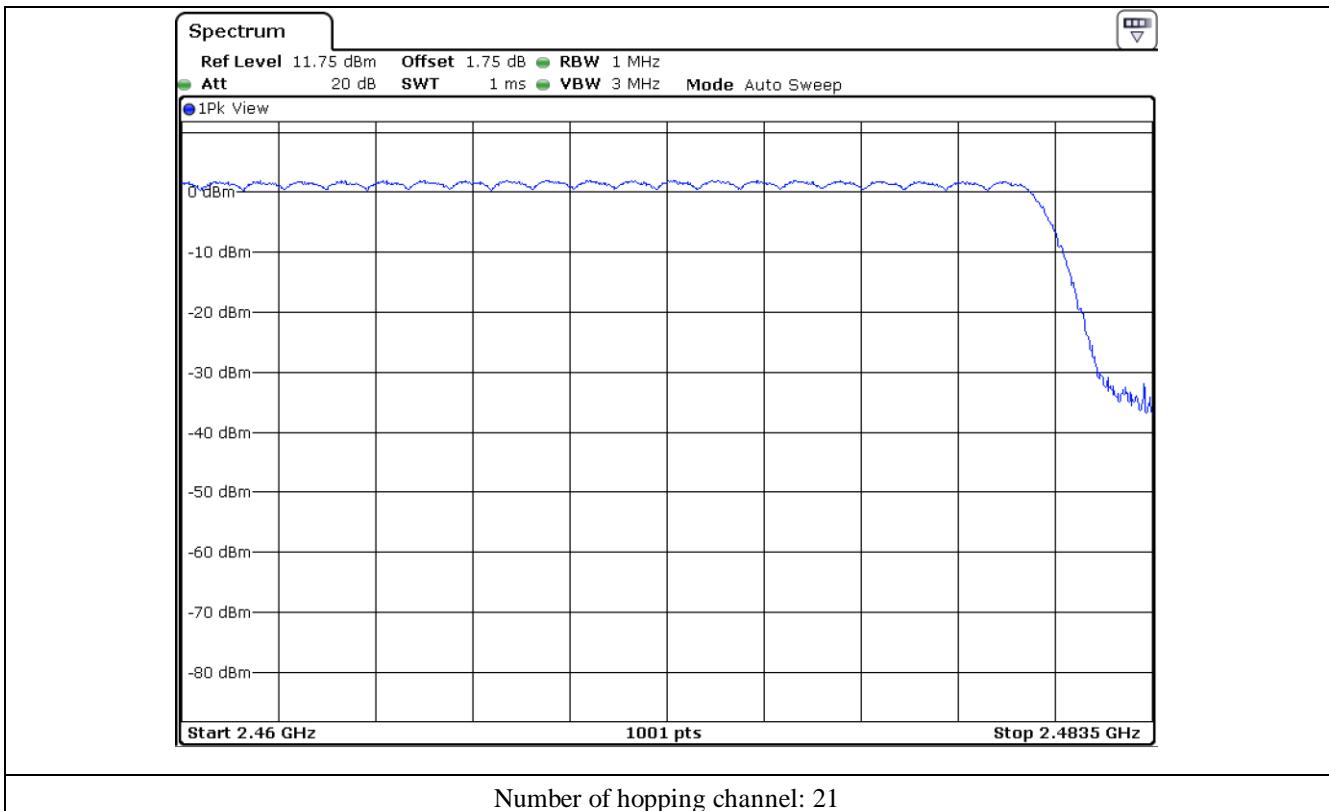




Number of hopping channel: 28



Number of hopping channel: 30

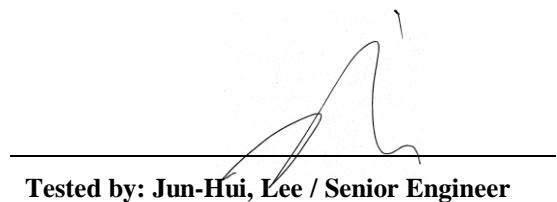


9.6 Test data for 3 Mbps

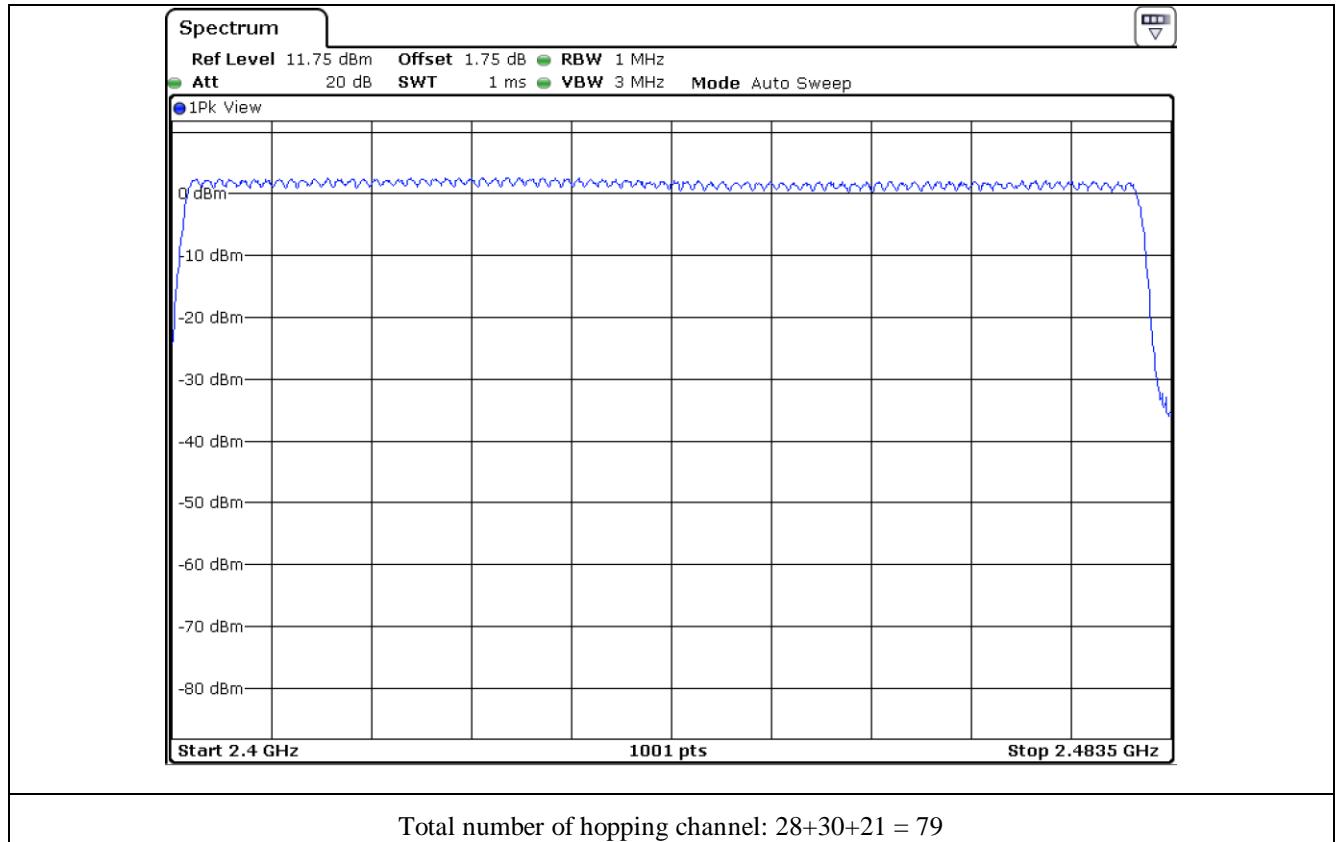
- Test Date : June 12, 2016

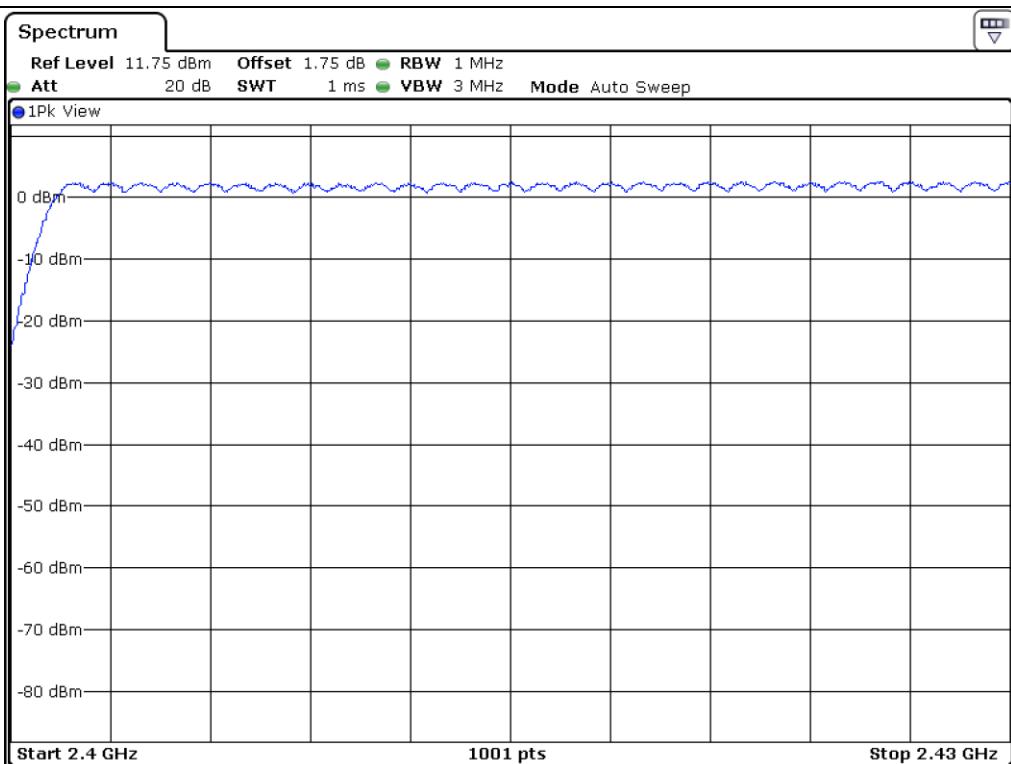
- Test Result : Pass

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

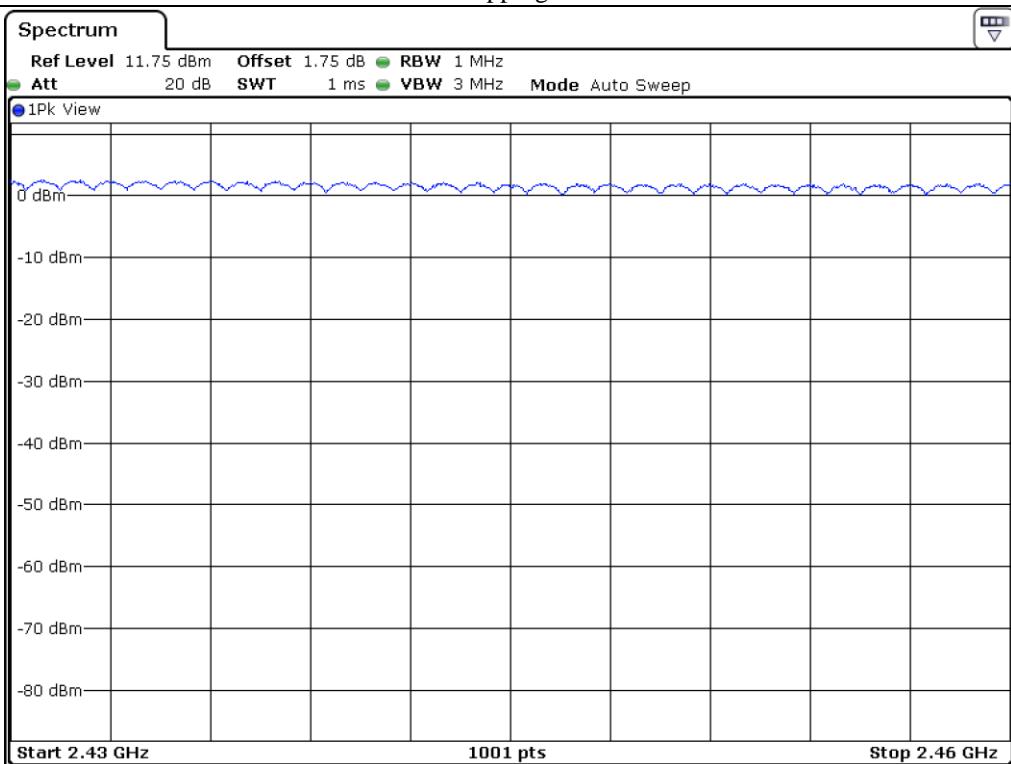


Tested by: Jun-Hui, Lee / Senior Engineer

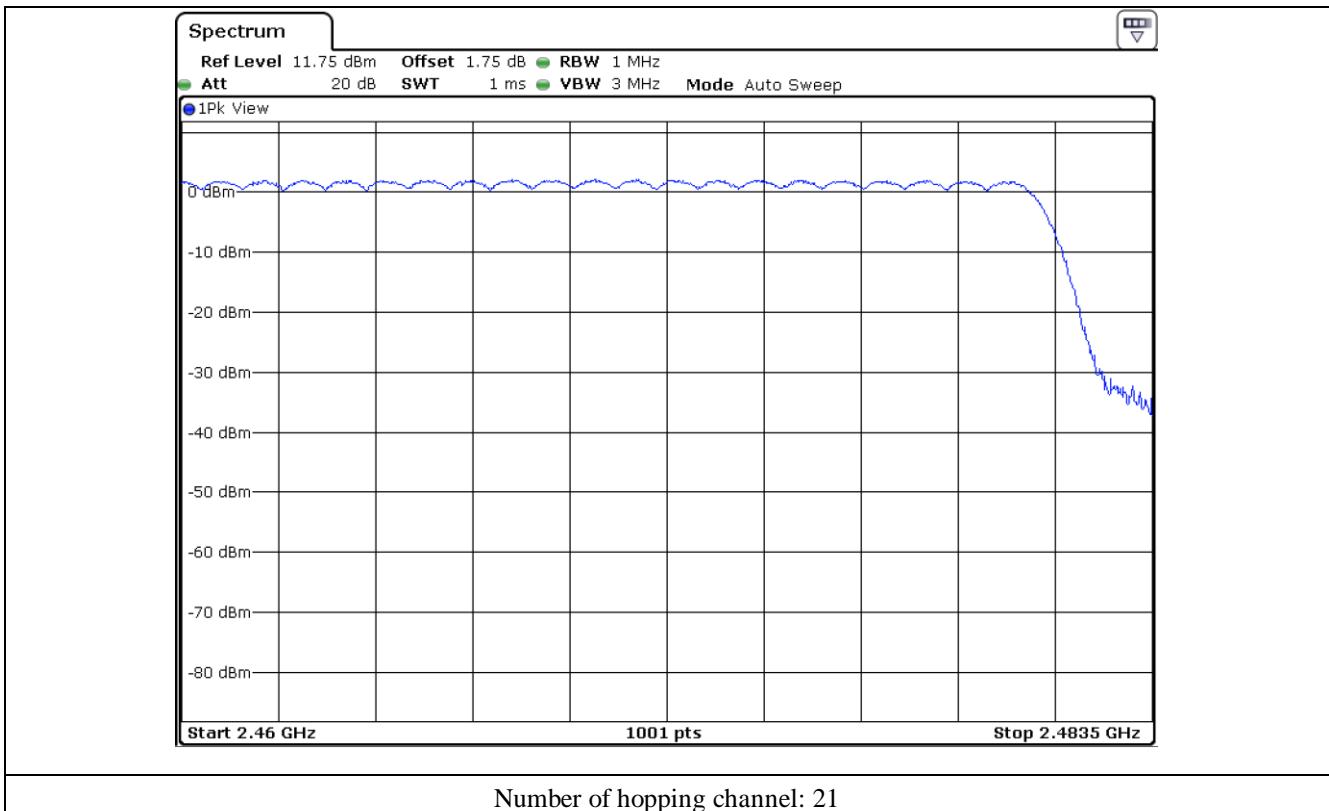




Number of hopping channel: 28



Number of hopping channel: 30



10. TIME OF OCCUPANCY

10.1 Operating environment

Temperature : 24 °C

Relative humidity : 57 % 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.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	May. 31, 2016 (1Y)

All test equipment used is calibrated on a regular basis.

10.4 Test data for 1 Mbps

- Test Date : June 12, 2016

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

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

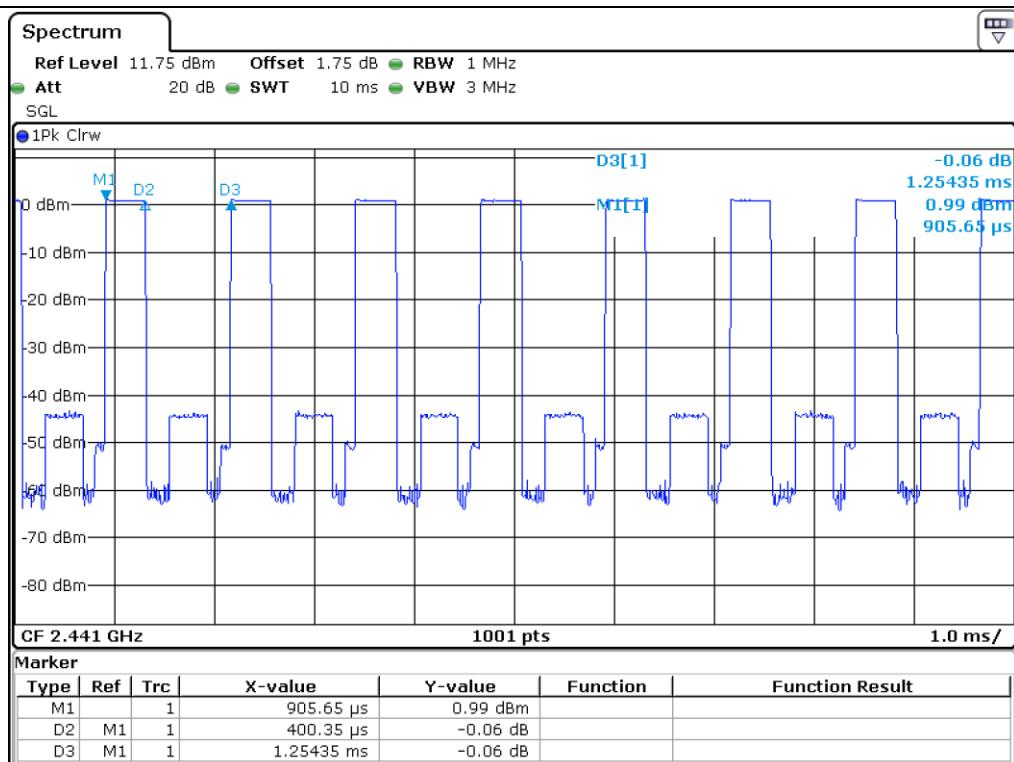
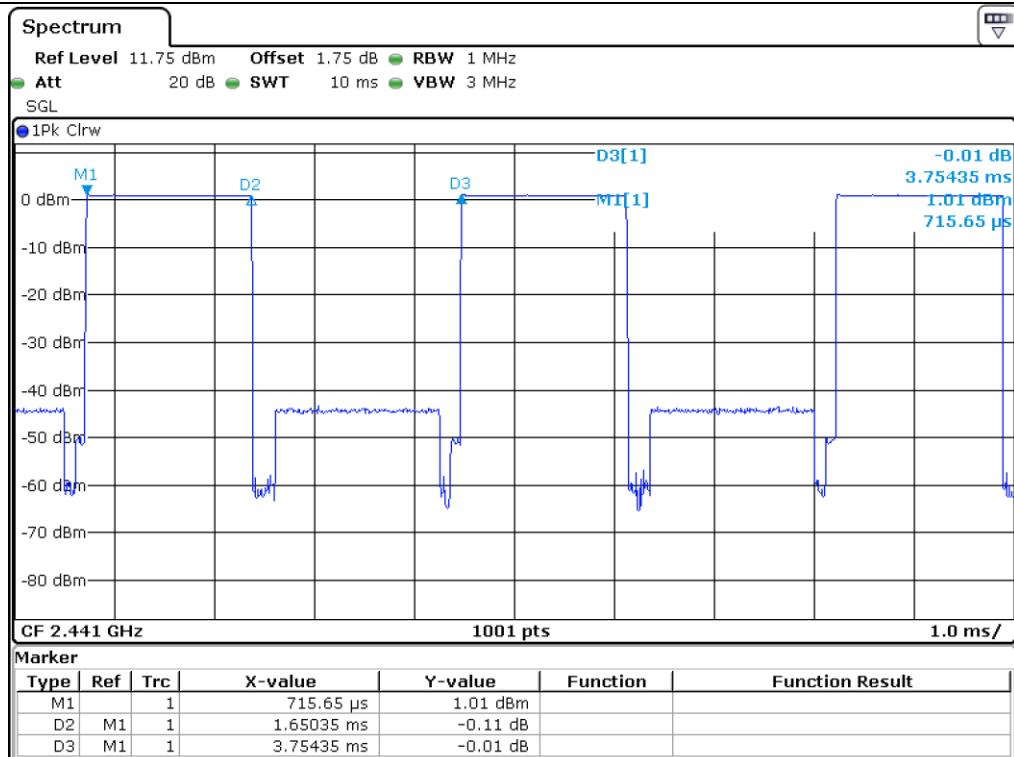
Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (s)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.400	10.13	31.6	128.04	400	PASS
DH3	1.650	5.06	31.6	263.83	400	
DH5	2.900	3.38	31.6	309.74	400	

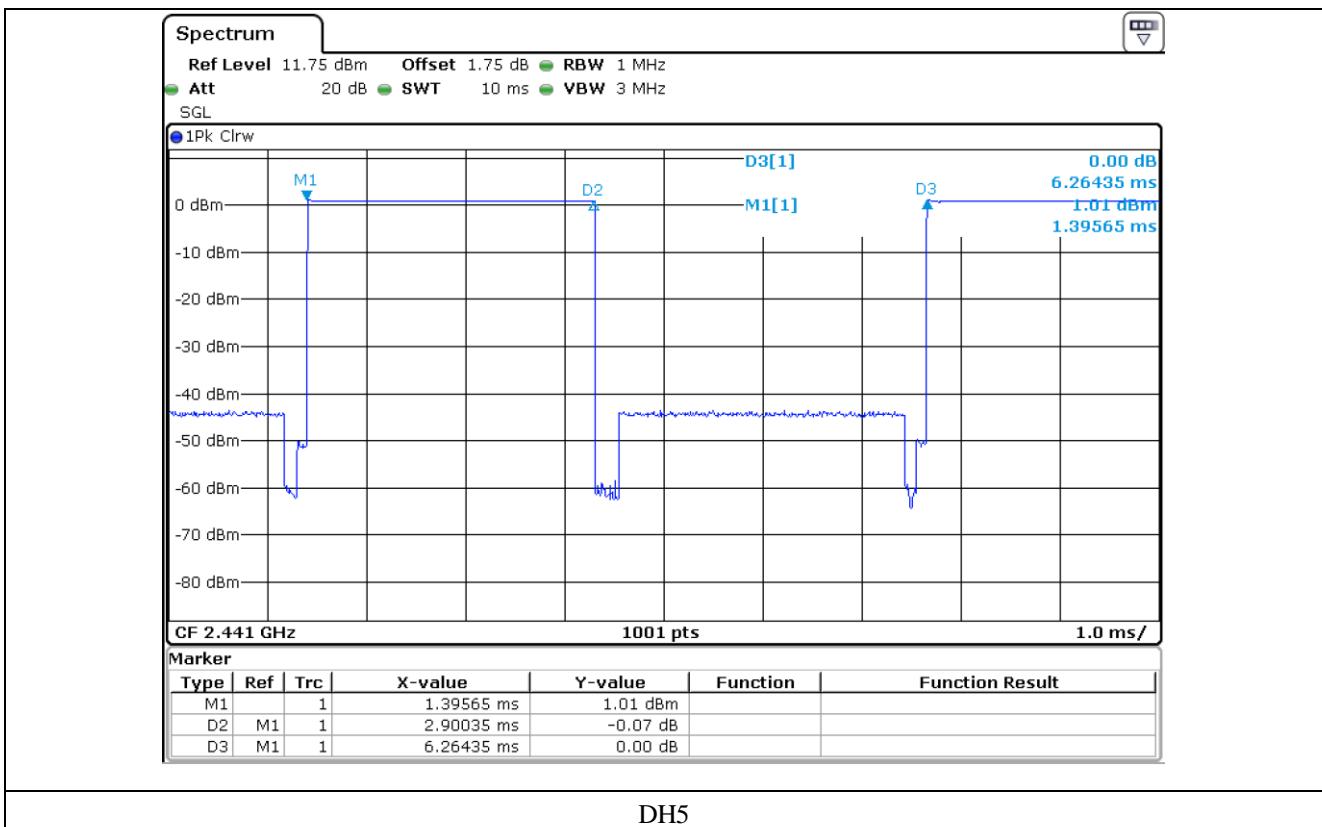
Total dwell time is calculated as following.

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

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

Tested by: Jun-Hui, Lee / Senior Engineer

**DH1****DH3**



10.5 Test data for 2 Mbps

- Test Date : June 12, 2016

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

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

Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (s)	Total Dwell Time (ms)	Limit (ms)	Test Result
2-DH1	0.400	10.13	31.6	128.04	400	PASS
2-DH3	1.650	5.06	31.6	263.83	400	
2-DH5	2.900	3.38	31.6	309.74	400	

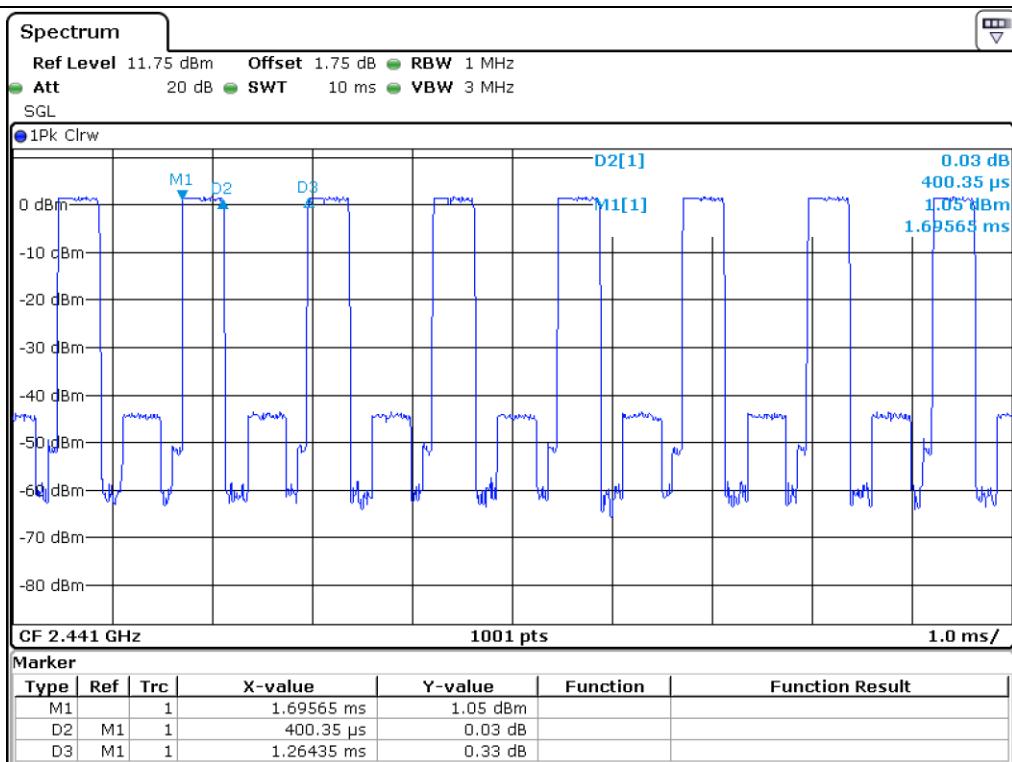
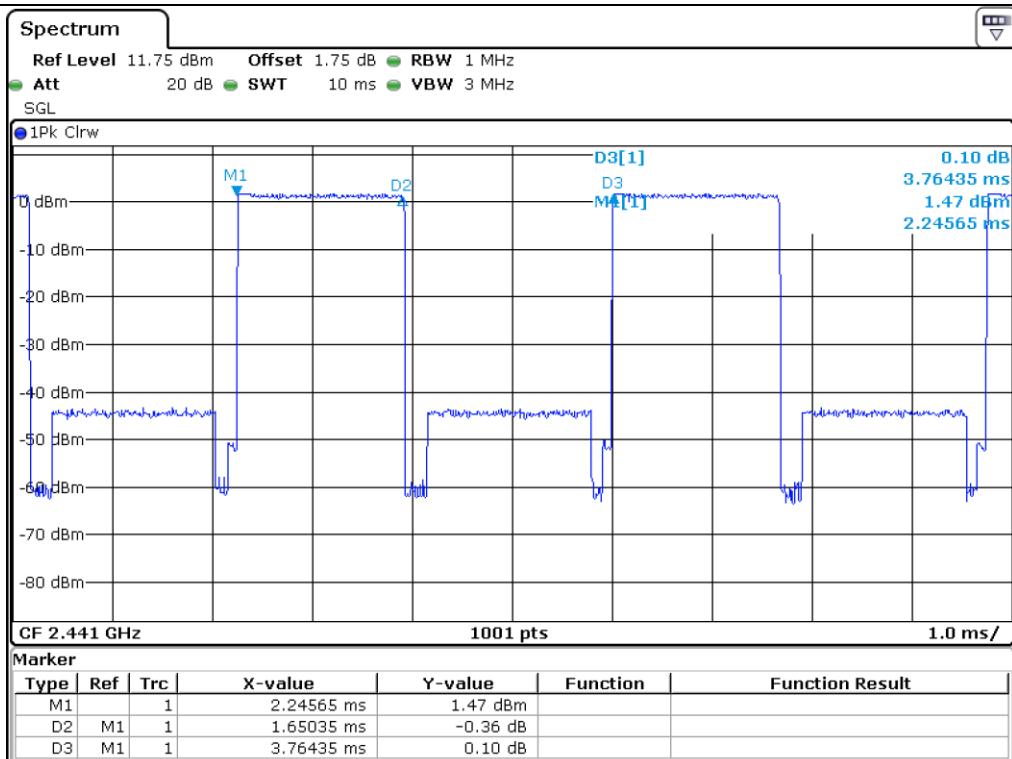
Total dwell time is calculated as following.

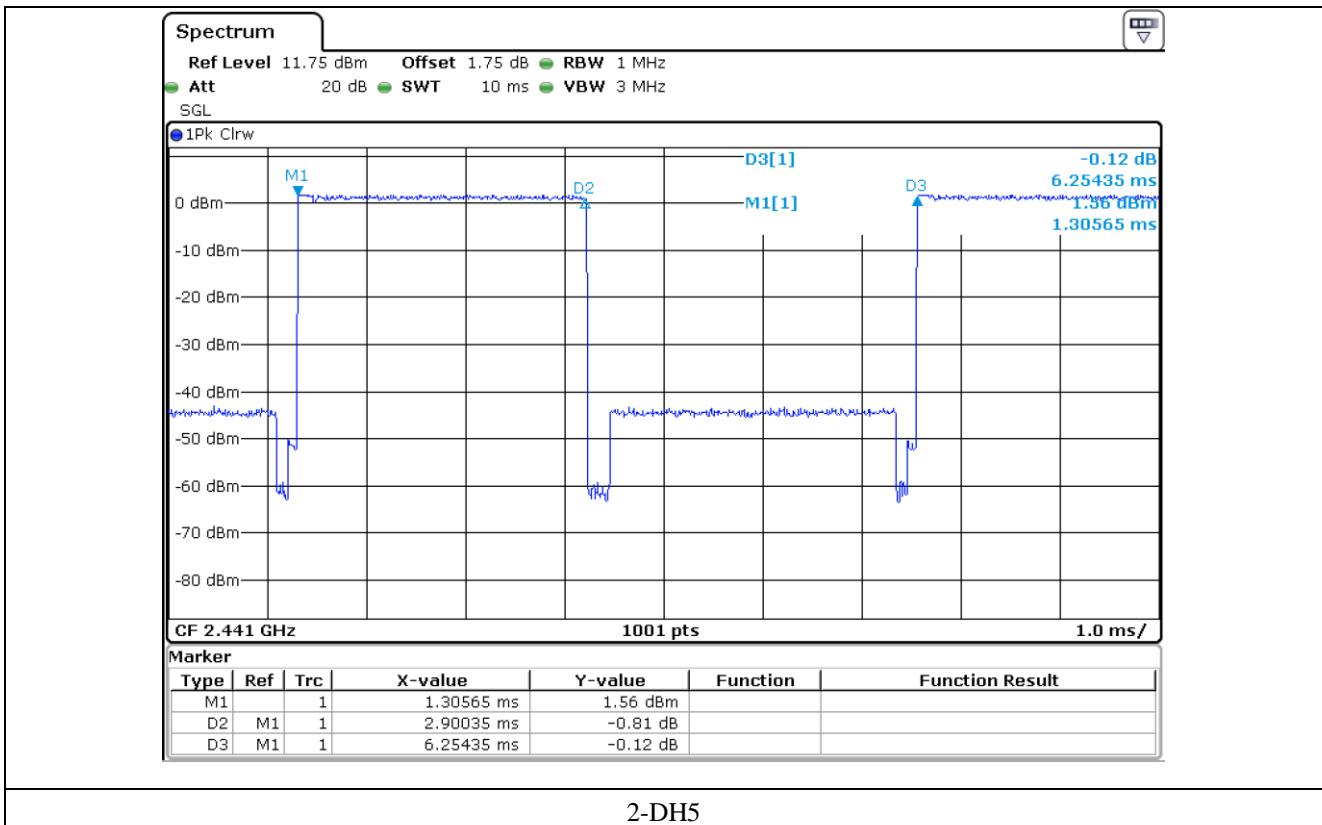
Total Dwell Time = Pulse time * Hops per second with channels * period time

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



Tested by: Jun-Hui, Lee / Senior Engineer

**2-DH1****2-DH3**



10.6 Test data for 3 Mbps

- Test Date : June 12, 2016

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

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

Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (s)	Total Dwell Time (ms)	Limit (ms)	Test Result
3-DH1	0.400	10.13	31.6	128.04	400	PASS
3-DH3	1.636	5.06	31.6	261.59	400	
3-DH5	2.886	3.38	31.6	308.25	400	

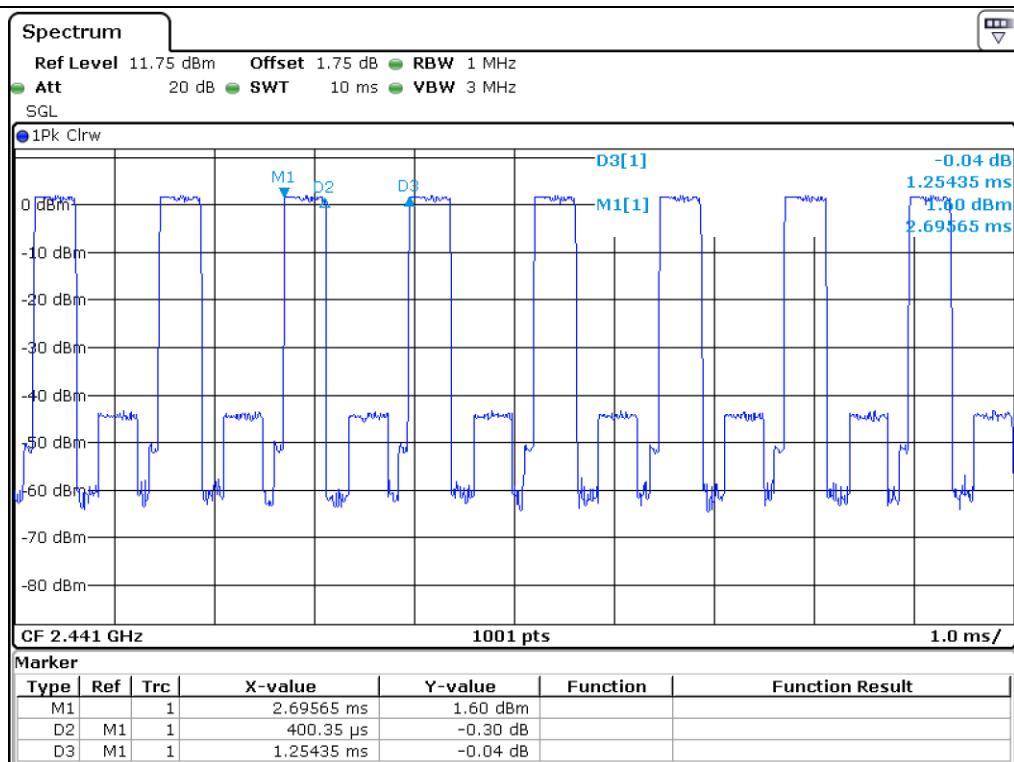
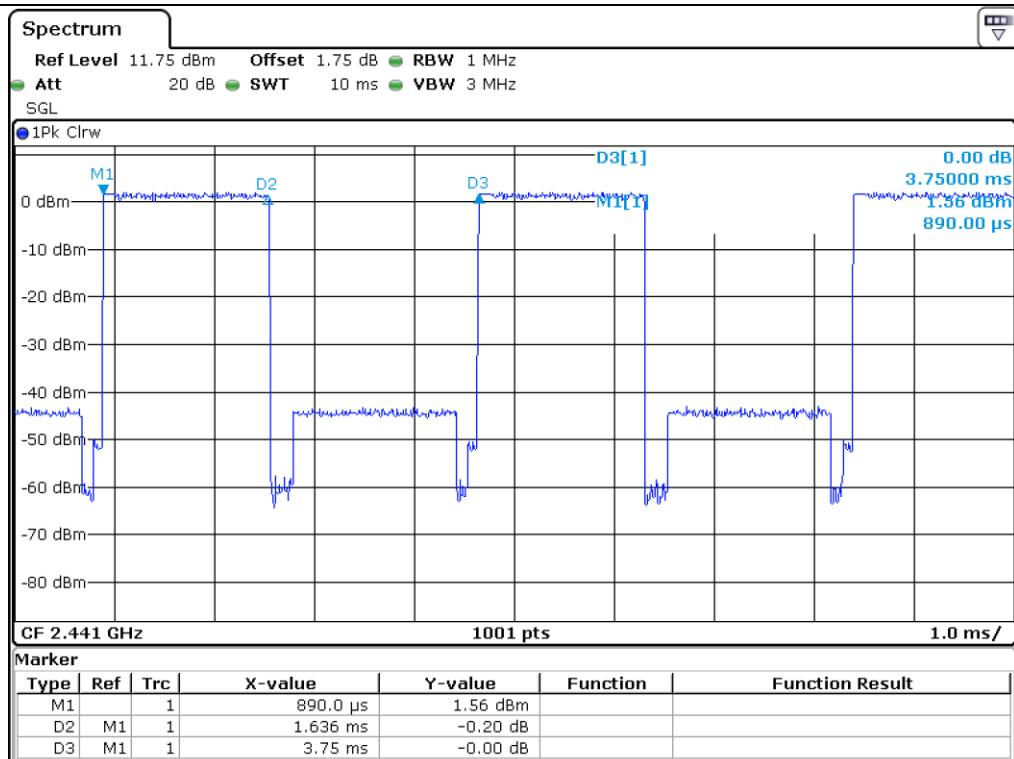
Total dwell time is calculated as following.

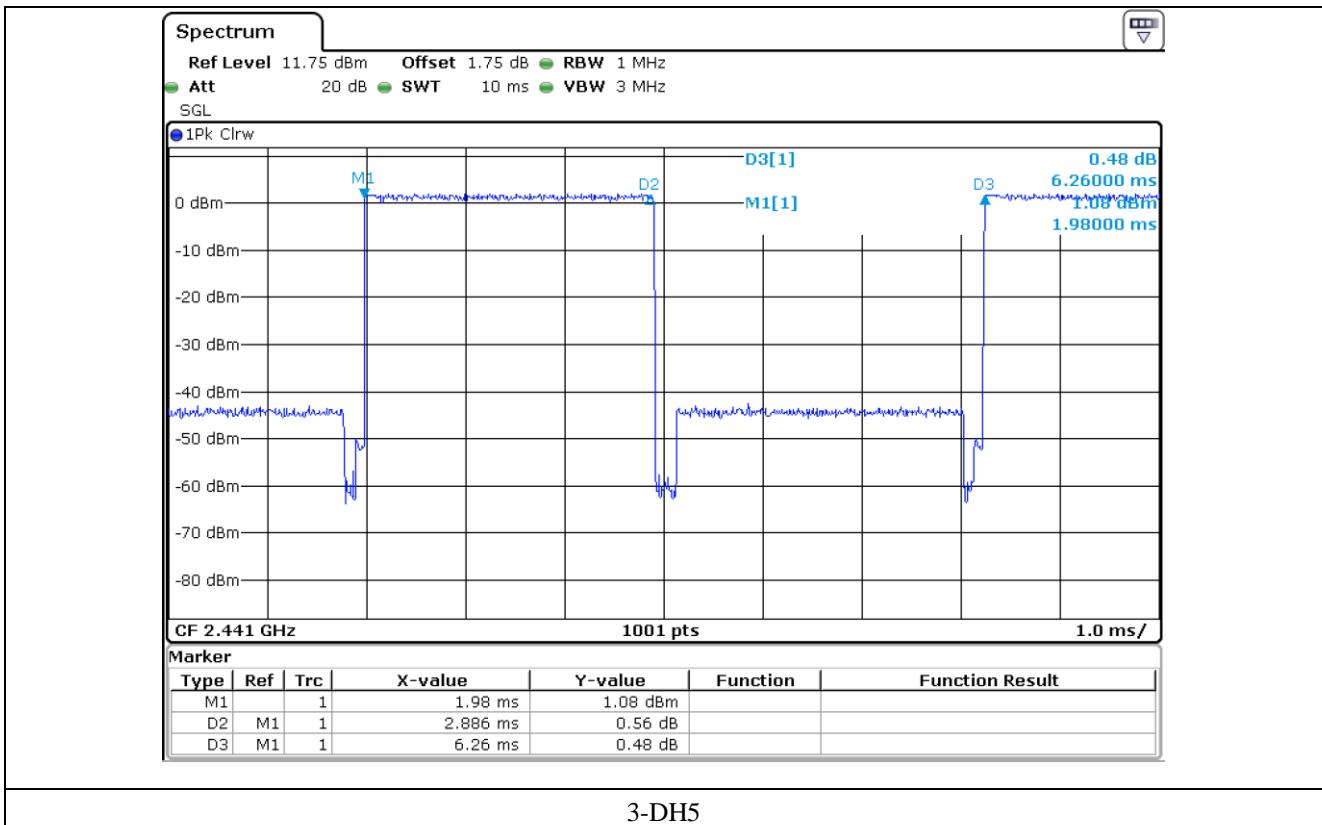
Total Dwell Time = Pulse time * Hops per second with channels * period time

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



Tested by: Jun-Hui, Lee / Senior Engineer

**3-DH1****3-DH3**



11. MAXIMUM PEAK OUTPUT POWER

11.1 Operating environment

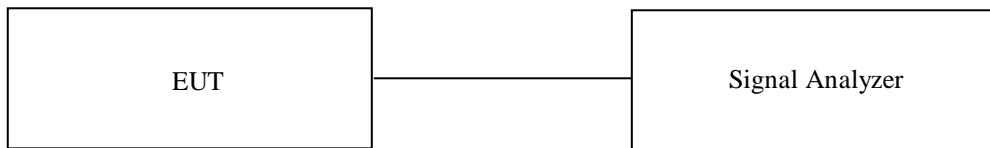
Temperature : 24 °C

Relative humidity : 57 % 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.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	May. 31, 2016 (1Y)

All test equipment used is calibrated on a regular basis.

11.4 Test data for 1 Mbps

- . Test Date : June 12, 2016

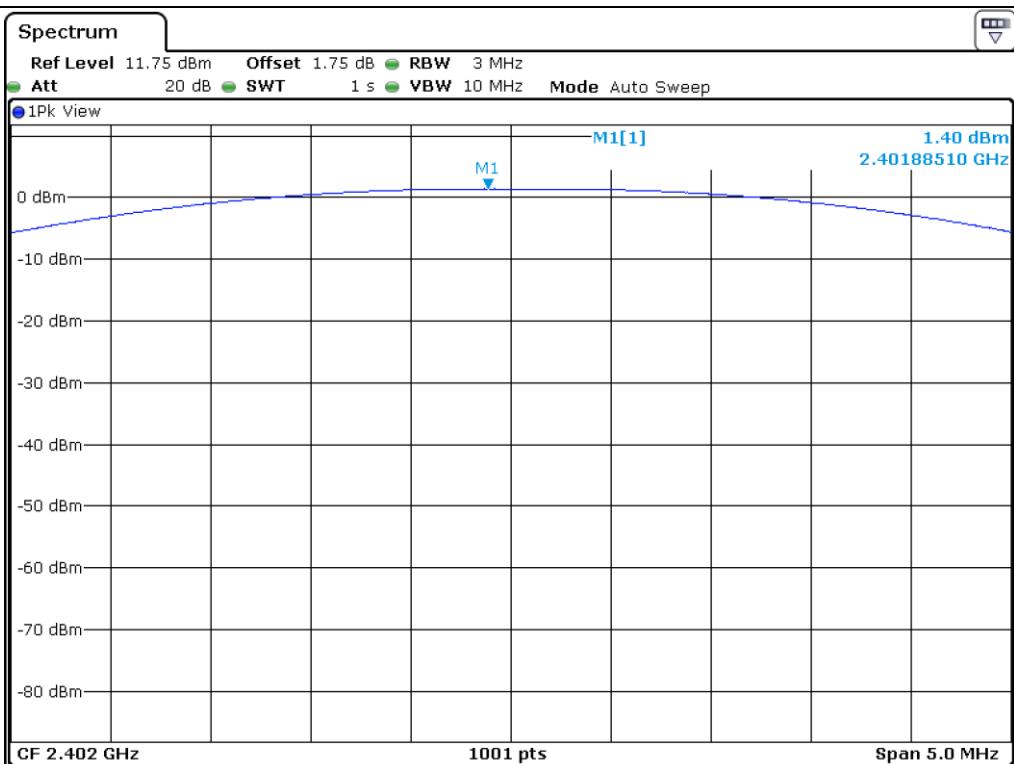
- . Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402	1.40	21.00	19.60
MIDDLE	2 441	1.32	21.00	19.68
HIGH	2 480	0.92	21.00	20.08

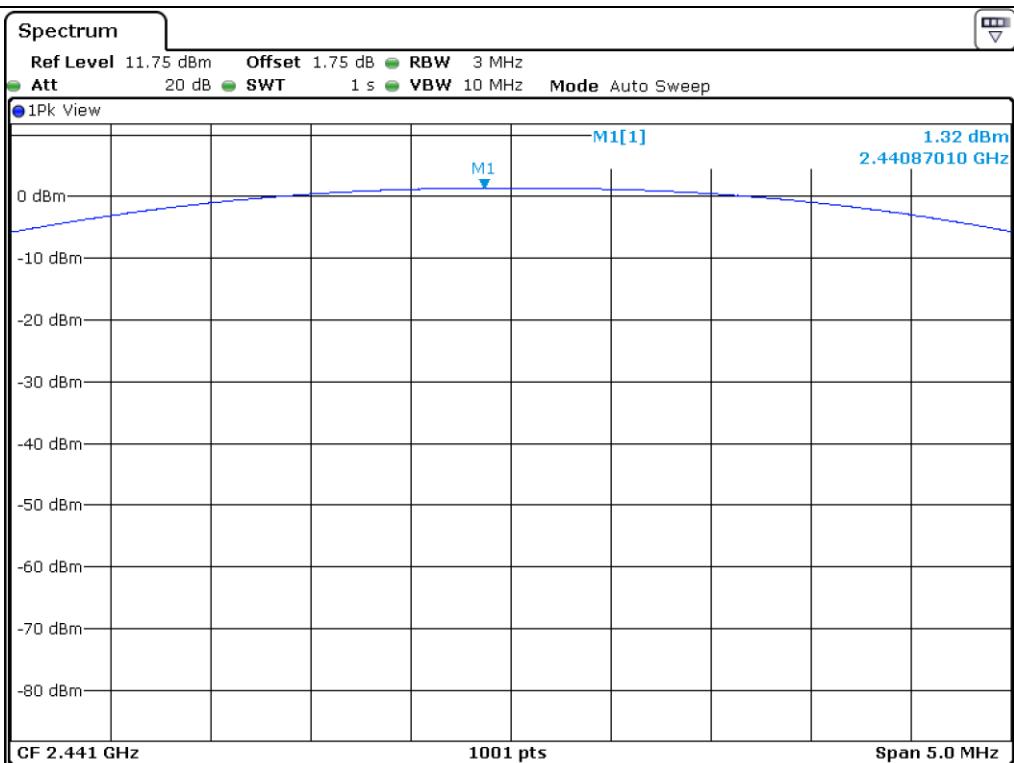
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)



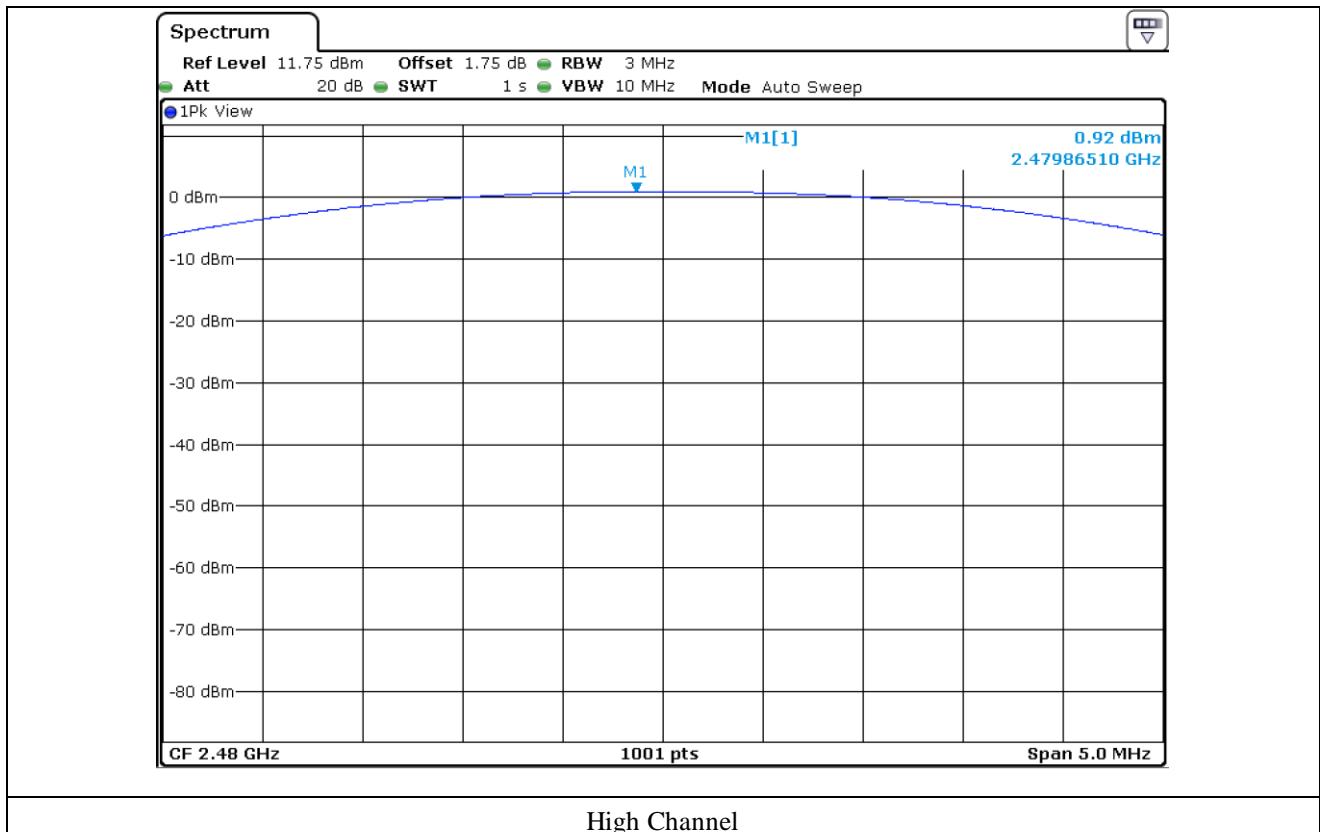
Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel



Middle Channel



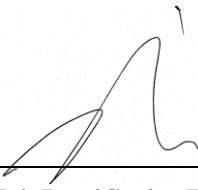
11.5 Test data for 2 Mbps

- . Test Date : June 12, 2016

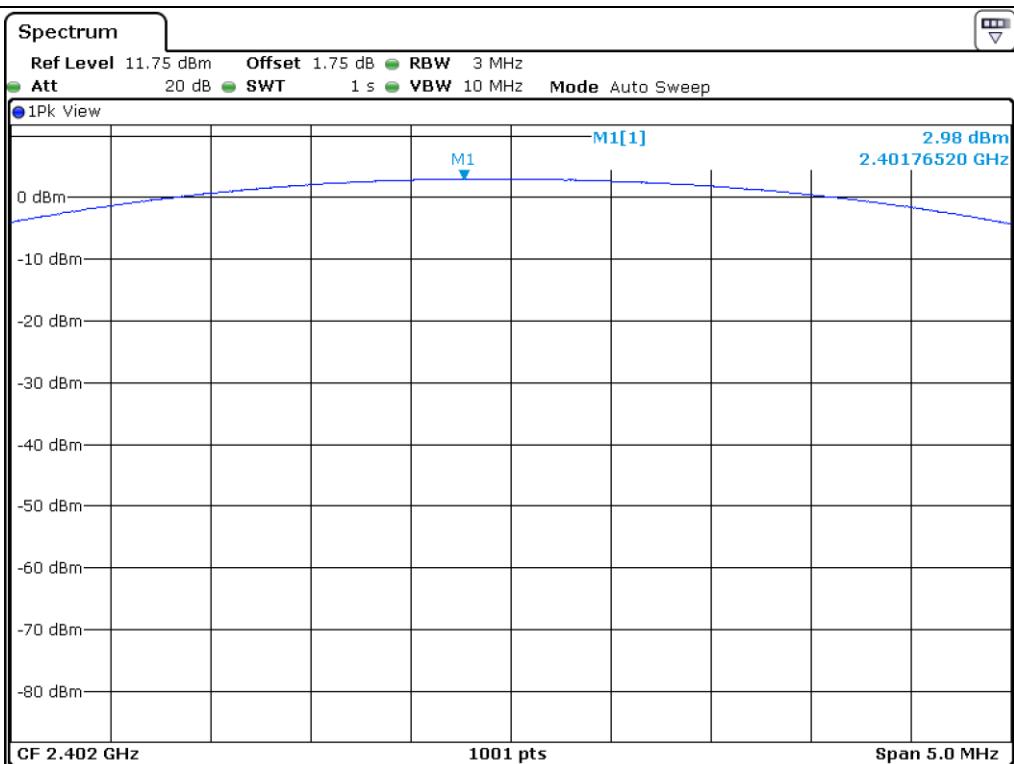
- . Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402	2.98	21.00	18.02
MIDDLE	2 441	2.66	21.00	18.34
HIGH	2 480	2.28	21.00	18.72

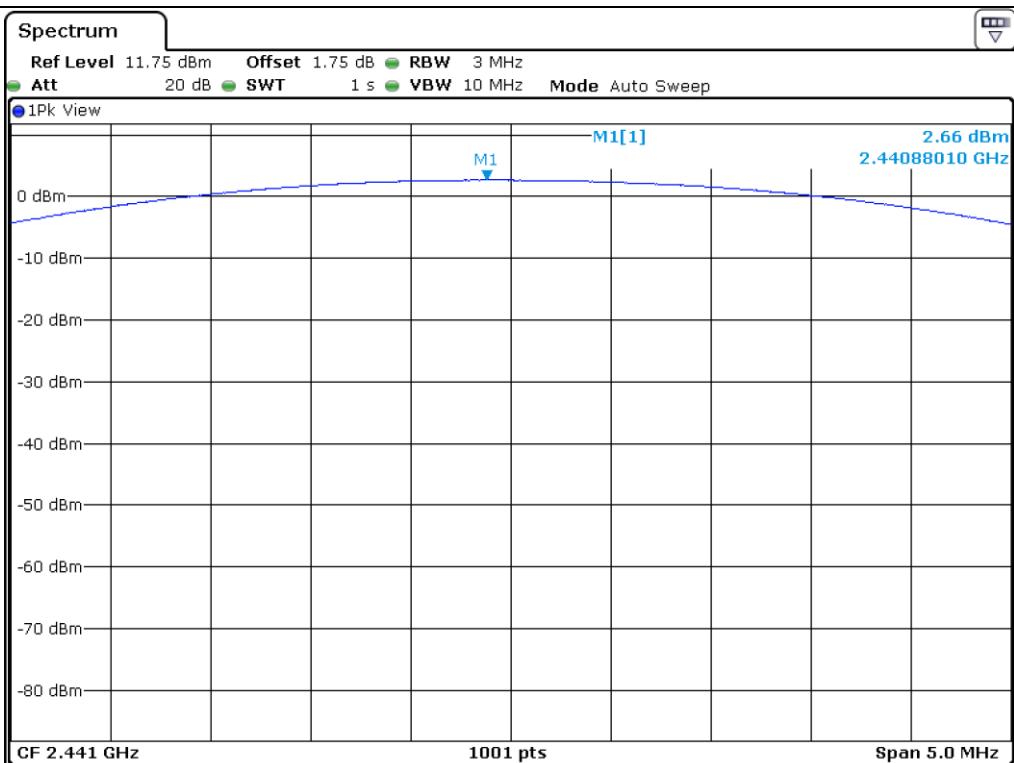
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)



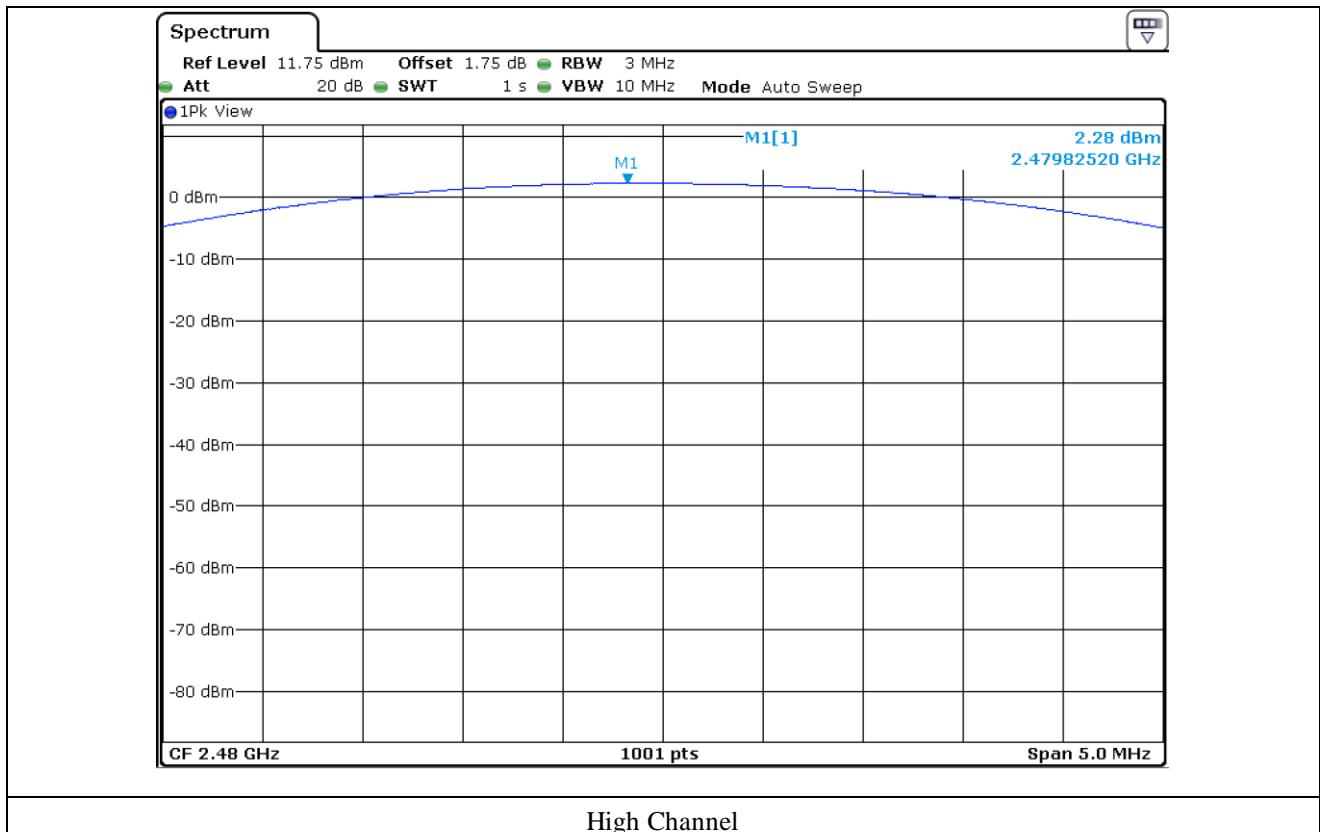
Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel



Middle Channel



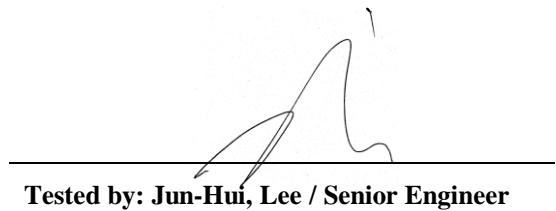
11.6 Test data for 3 Mbps

- . Test Date : June 12, 2016

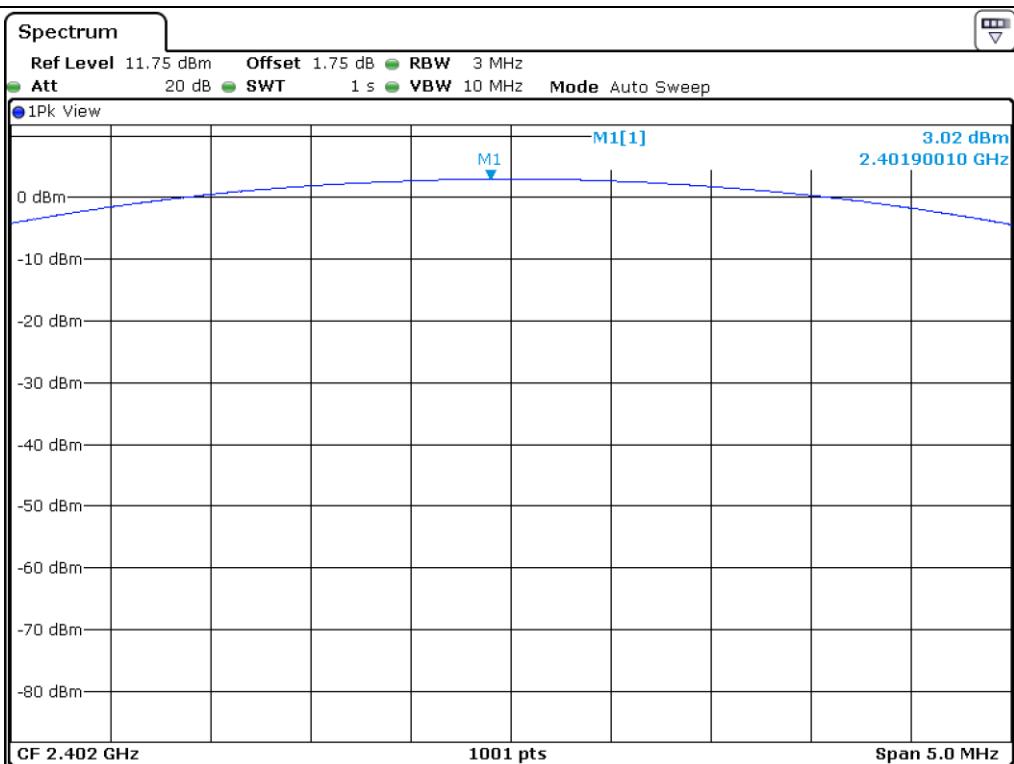
- . Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402	3.02	21.00	17.98
MIDDLE	2 441	2.75	21.00	18.25
HIGH	2 480	2.41	21.00	18.59

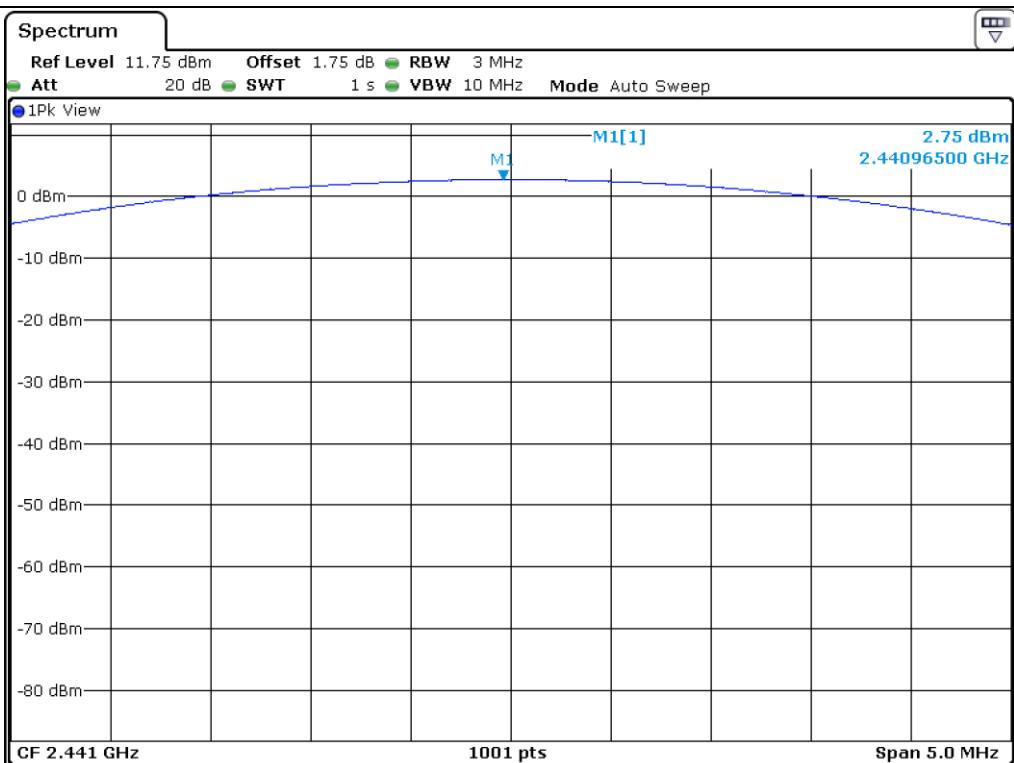
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)



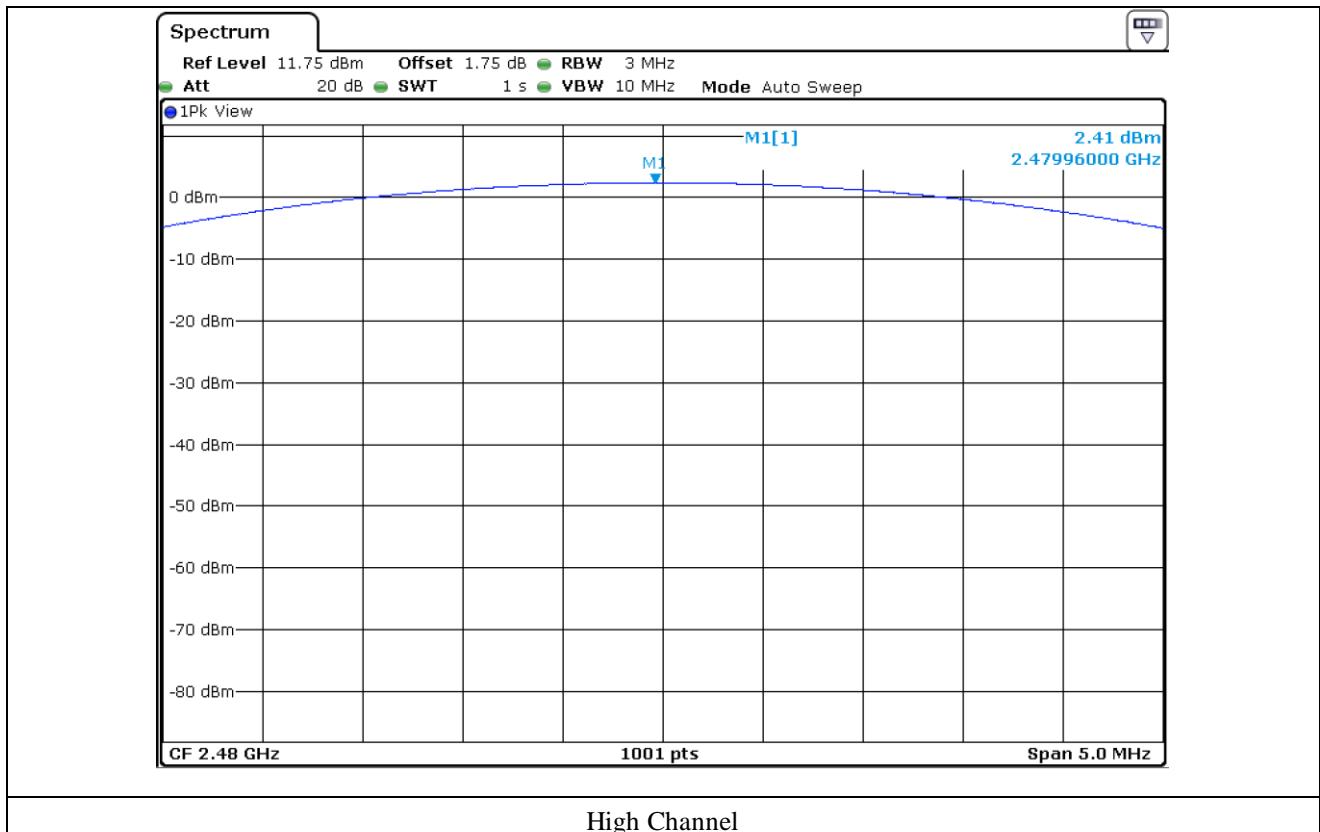
Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel



Middle Channel



12. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

12.1 Operating environment

Temperature : 24 °C

Relative humidity : 57 % 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.

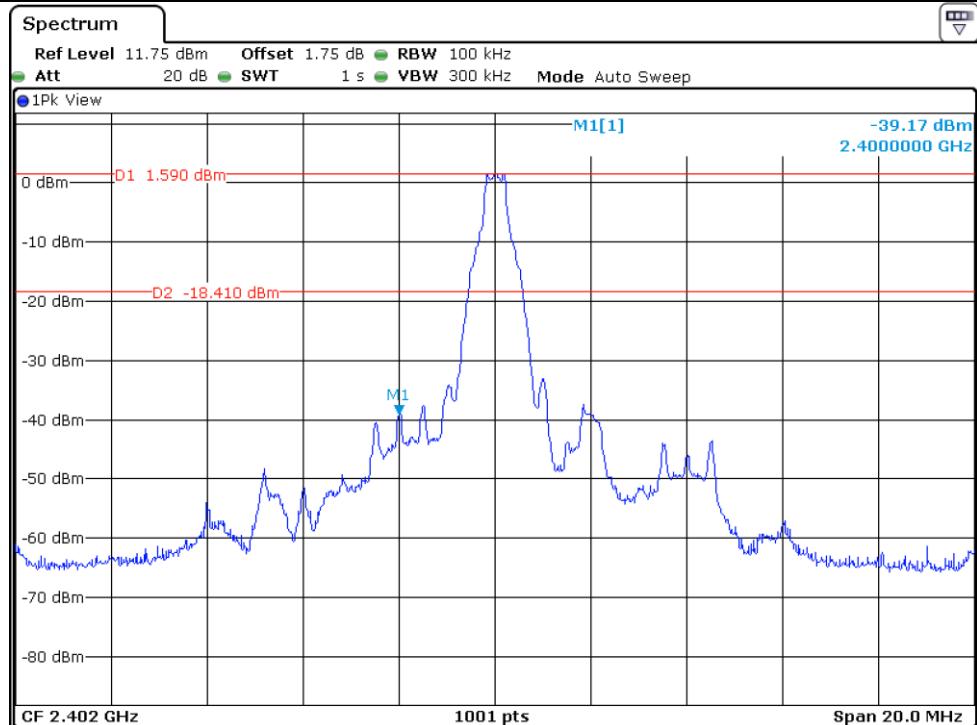
12.4 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
□ - ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Nov. 02, 2015 (1Y)
■ - ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 06, 2016 (1Y)
□ - 8564E	HP	Spectrum Analyzer	3650A00756	Apr. 11, 2016 (1Y)
□ - FSP	Rohde & Schwarz	Spectrum Analyzer	100017	Oct. 07, 2015 (1Y)
■ - 310N	Sonoma Instrument	AMPLIFIER	312544	Apr. 05, 2016 (1Y)
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101372	Jun. 15, 2016 (1Y)
■ - SCU-18	Rohde & Schwarz	PRE-AMPLIFIER	102209	May. 31, 2016 (1Y)
■ - MA240	HD GmbH	Antenna Master	N/A	N/A
■ - HD100	HD GmbH	Position Controller	N/A	N/A
■ - DS420S	HD GmbH	Turn Table	N/A	N/A
■ - HFH2-Z2	Rohde & Schwarz	Loop Antenna	879 285/26	Dec. 09, 2014 (2Y)
■ - VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	May. 20, 2016 (2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 31, 2015 (2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Aug. 31, 2015 (2Y)
■ - 83051A	Agilent	Microwave System Preamplifier	3950M00201	Apr. 15, 2016 (1Y)

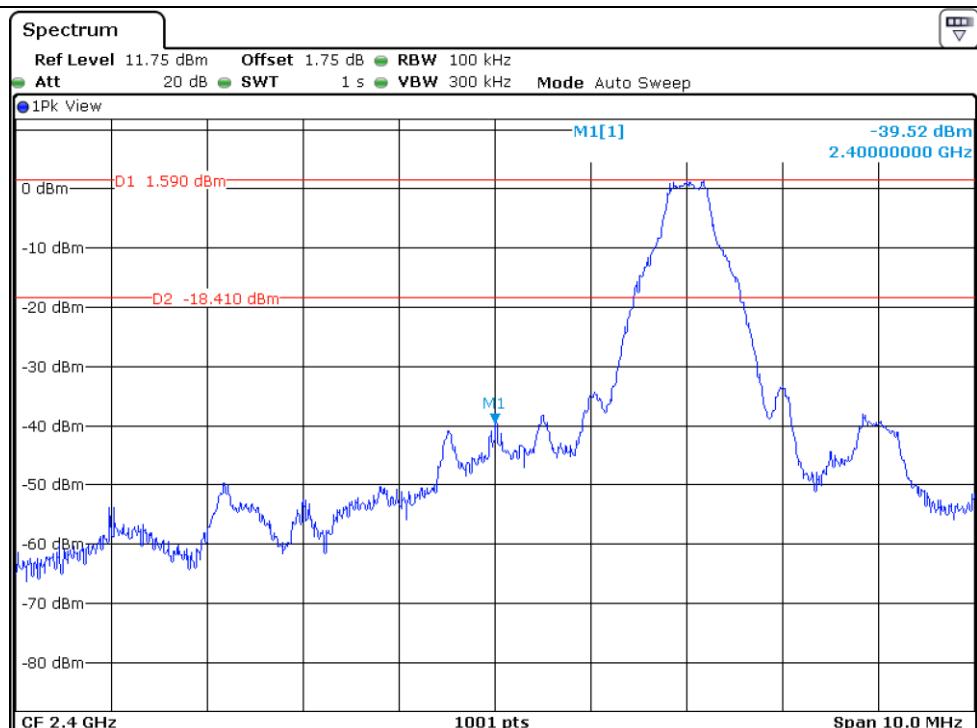
All test equipment used is calibrated on a regular basis.

12.5 Test data for conducted emission

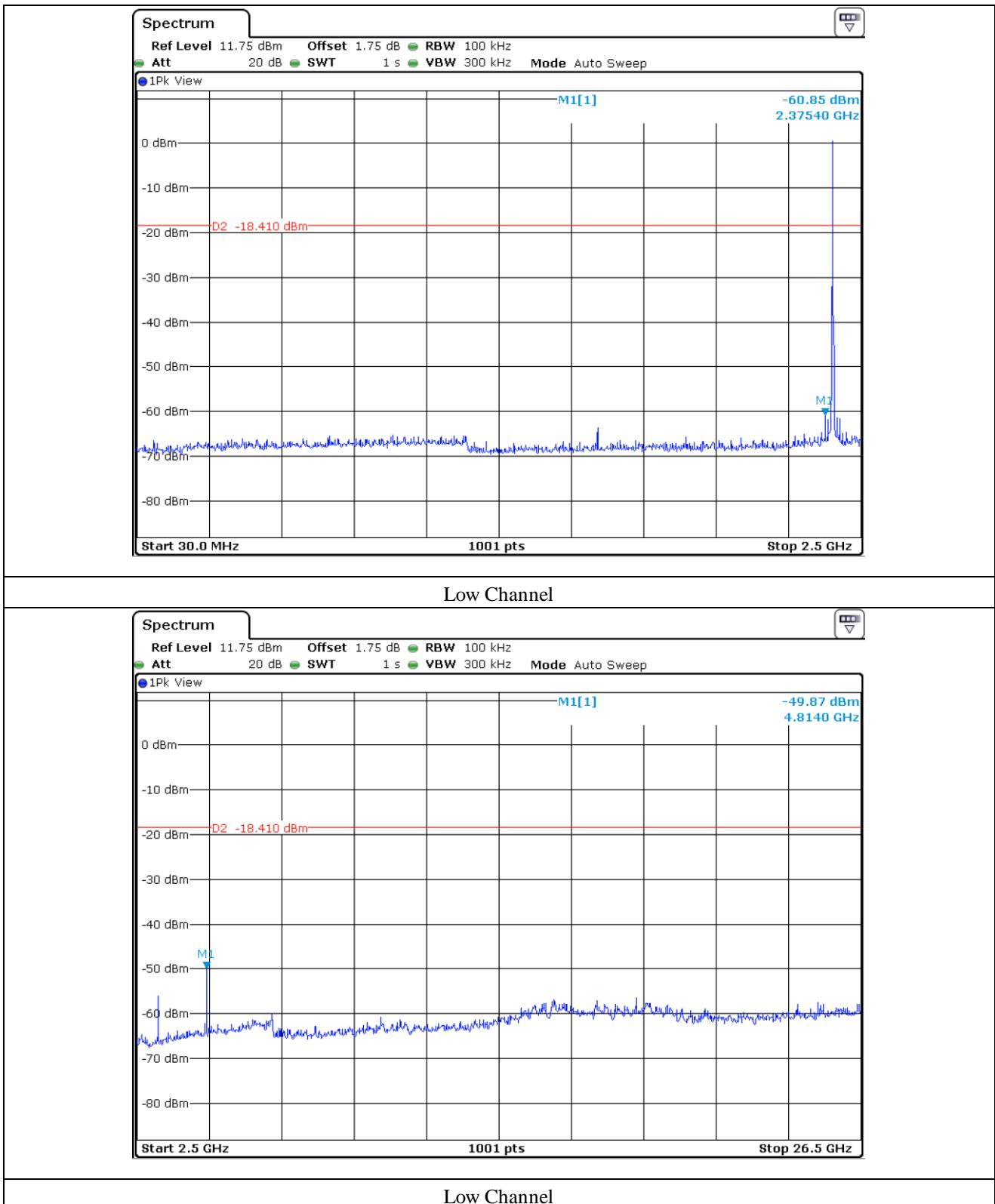
12.5.1 Test data for 1 Mbps

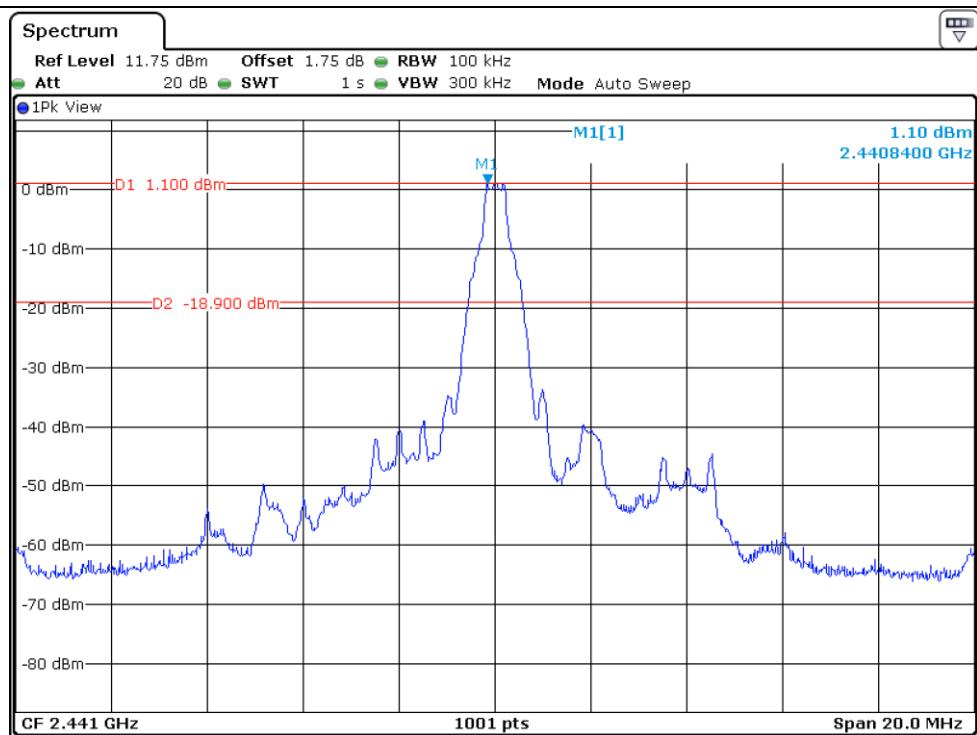
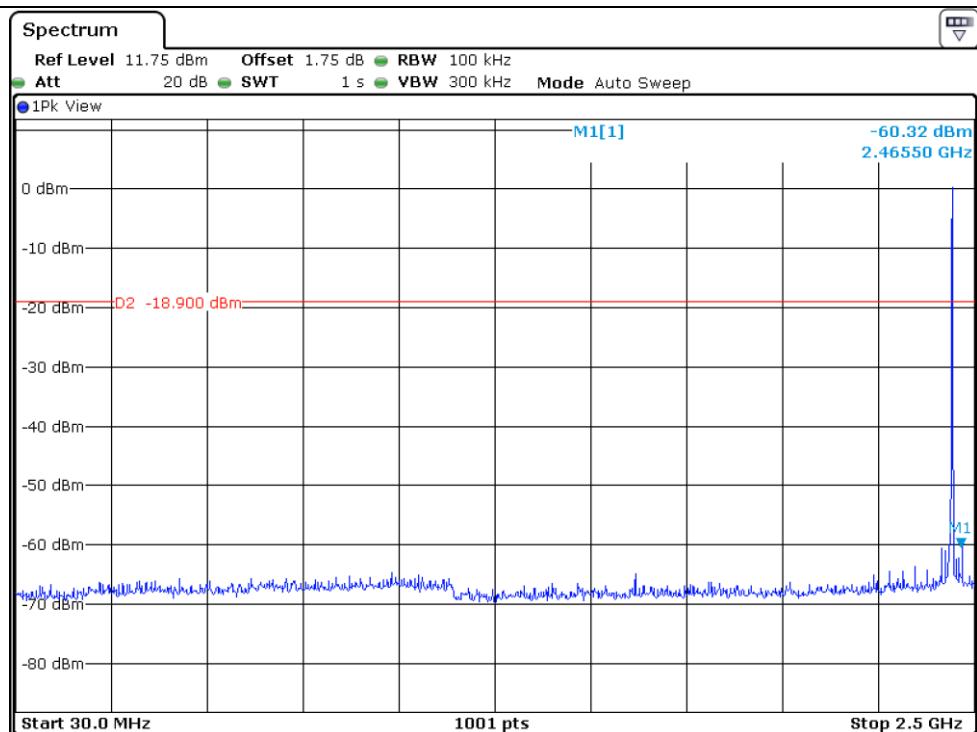


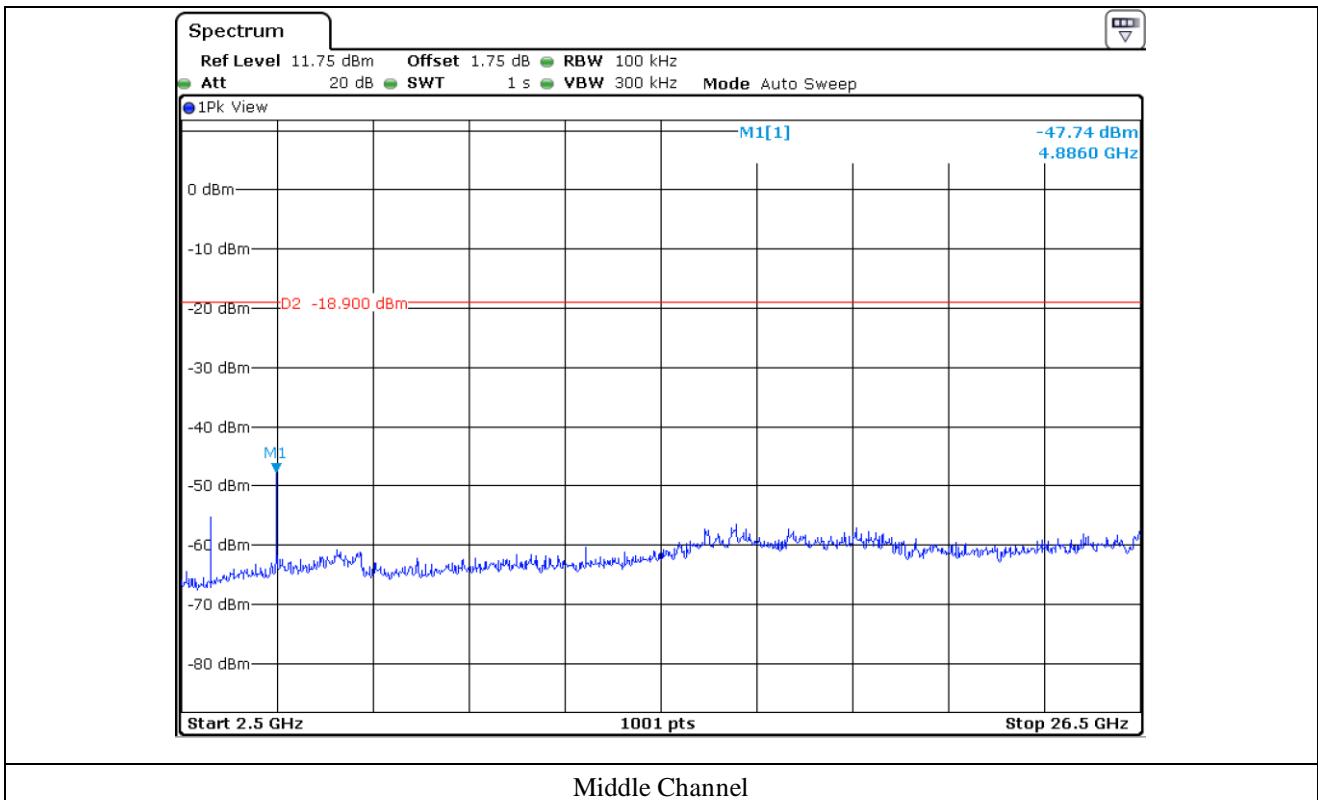
Low Channel

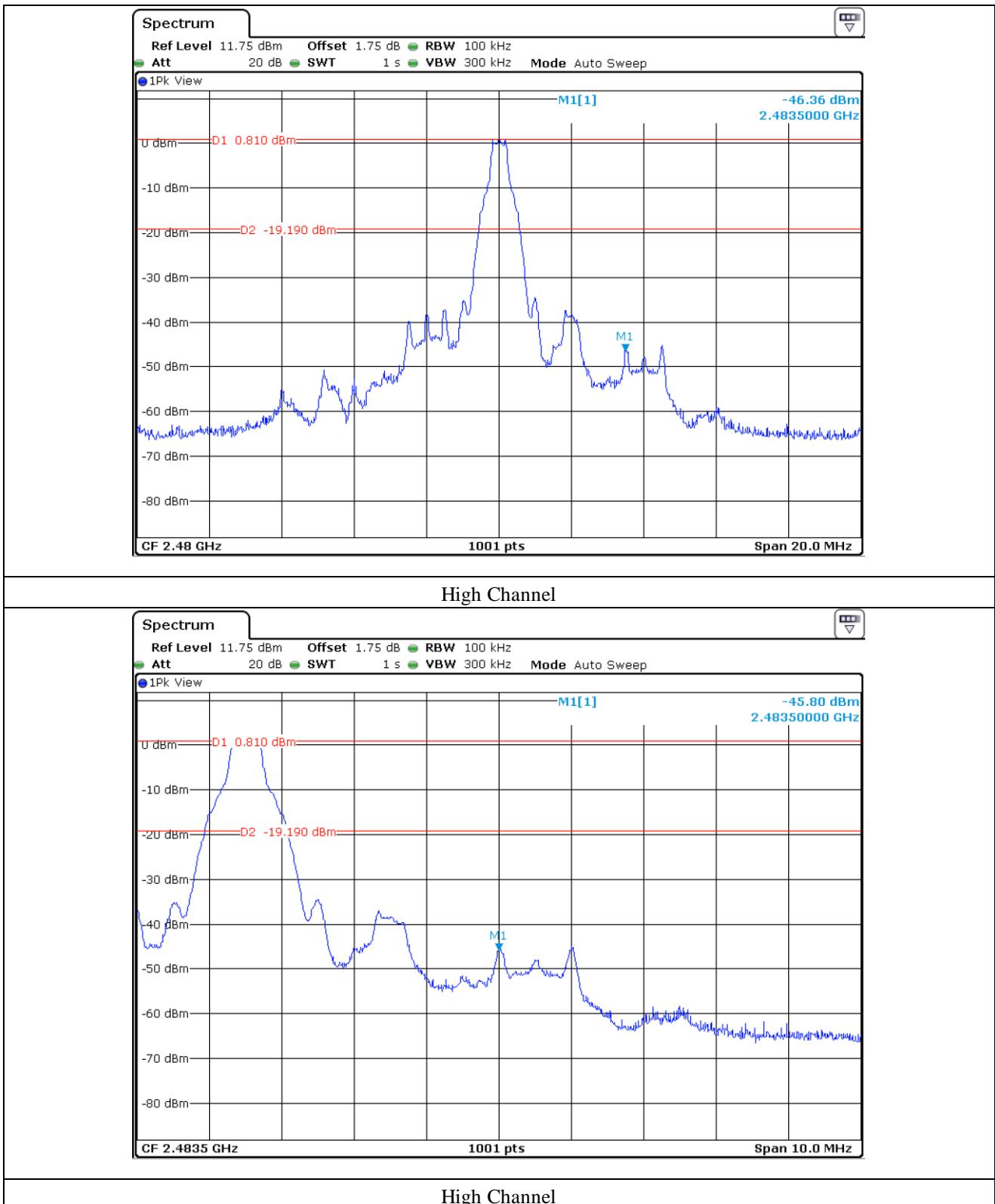


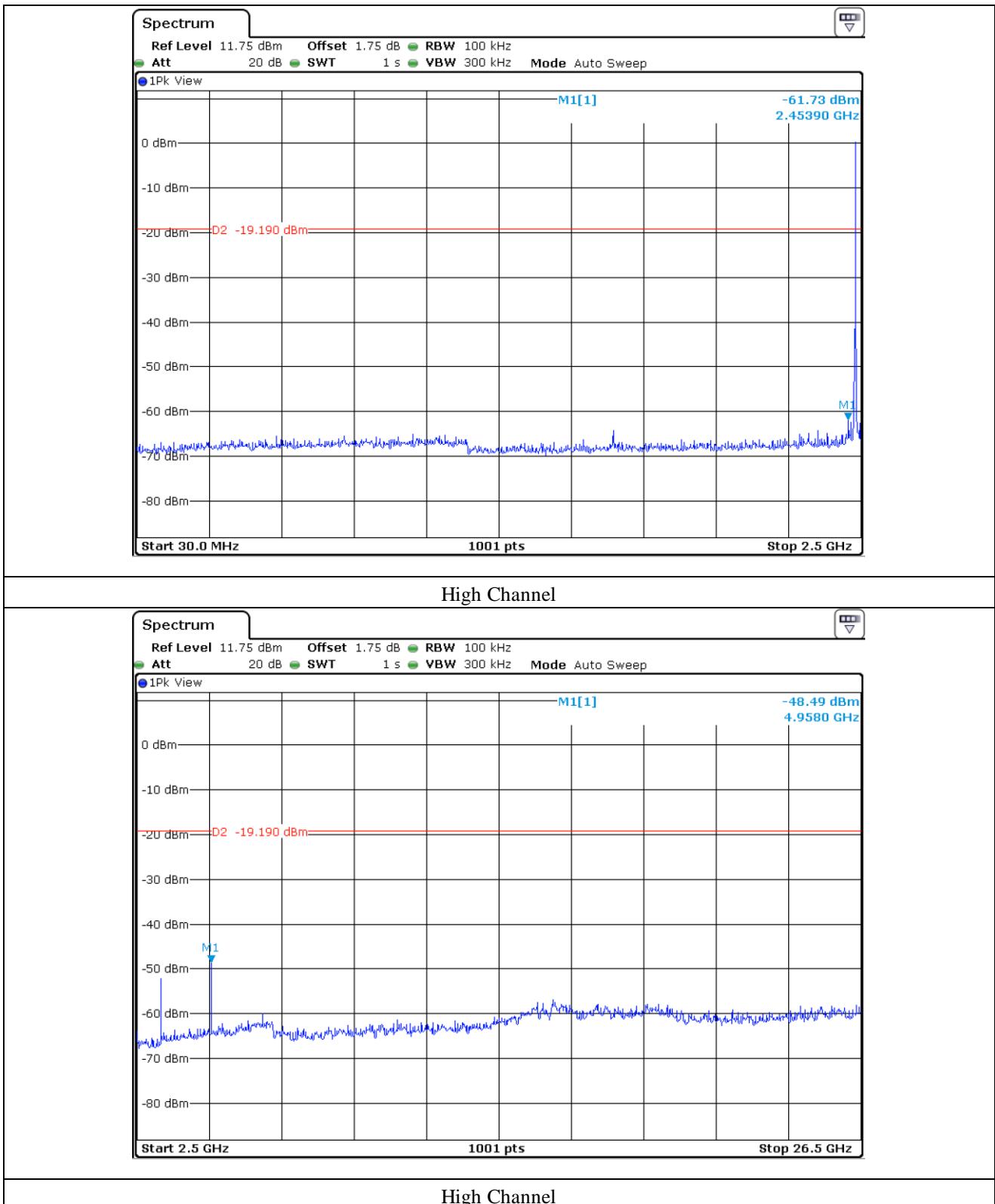
Low Channel



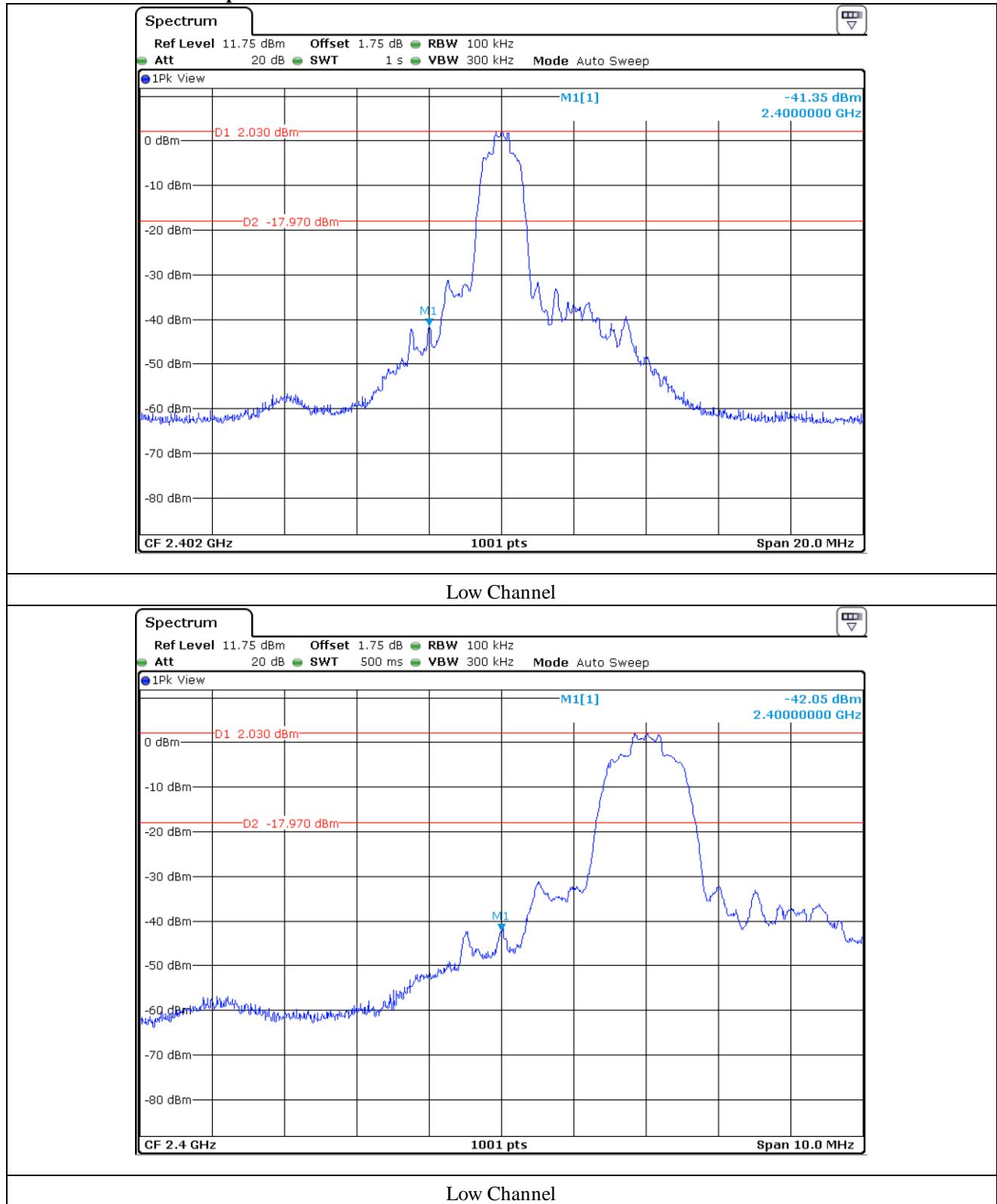
**Middle Channel****Middle Channel**

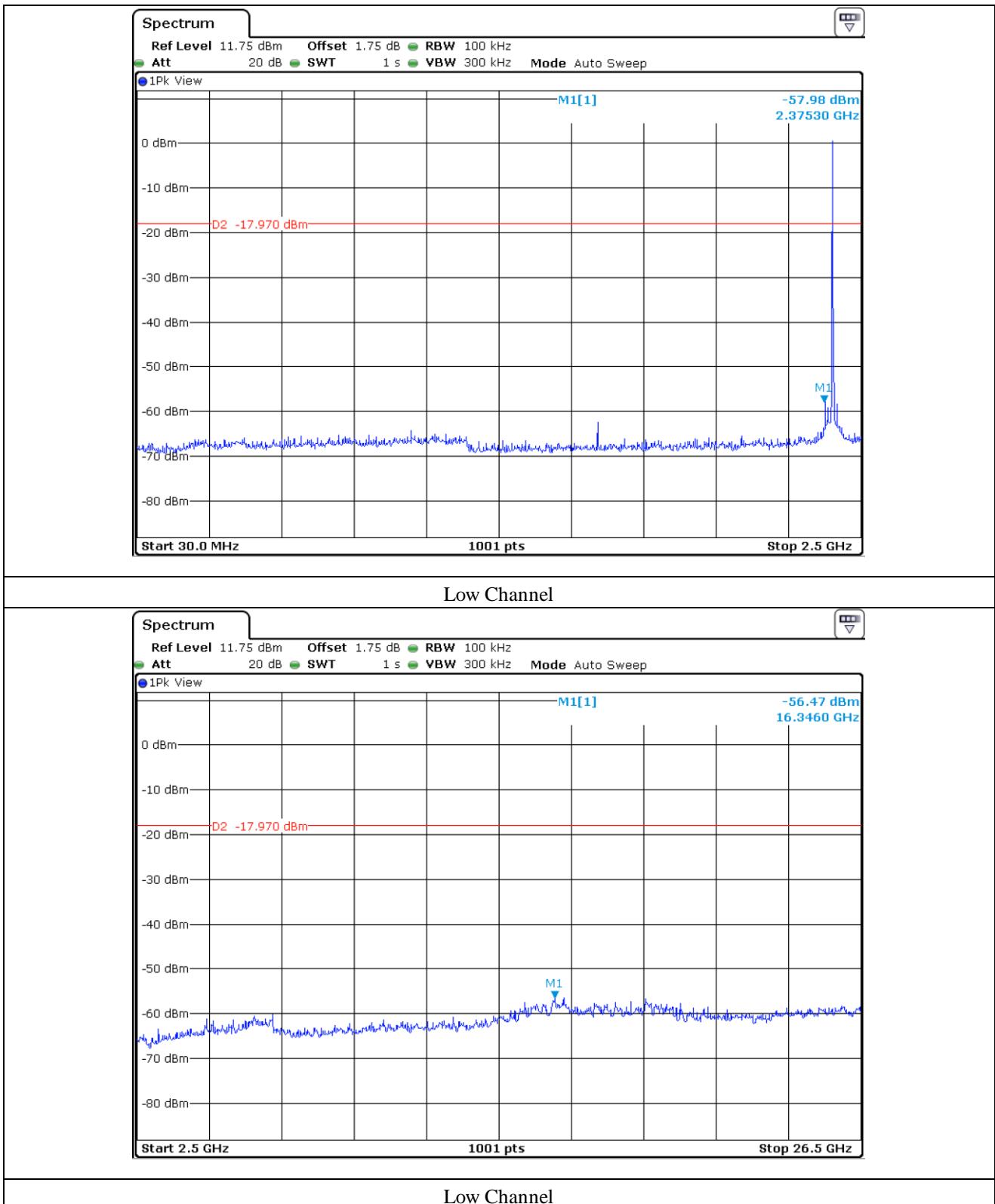


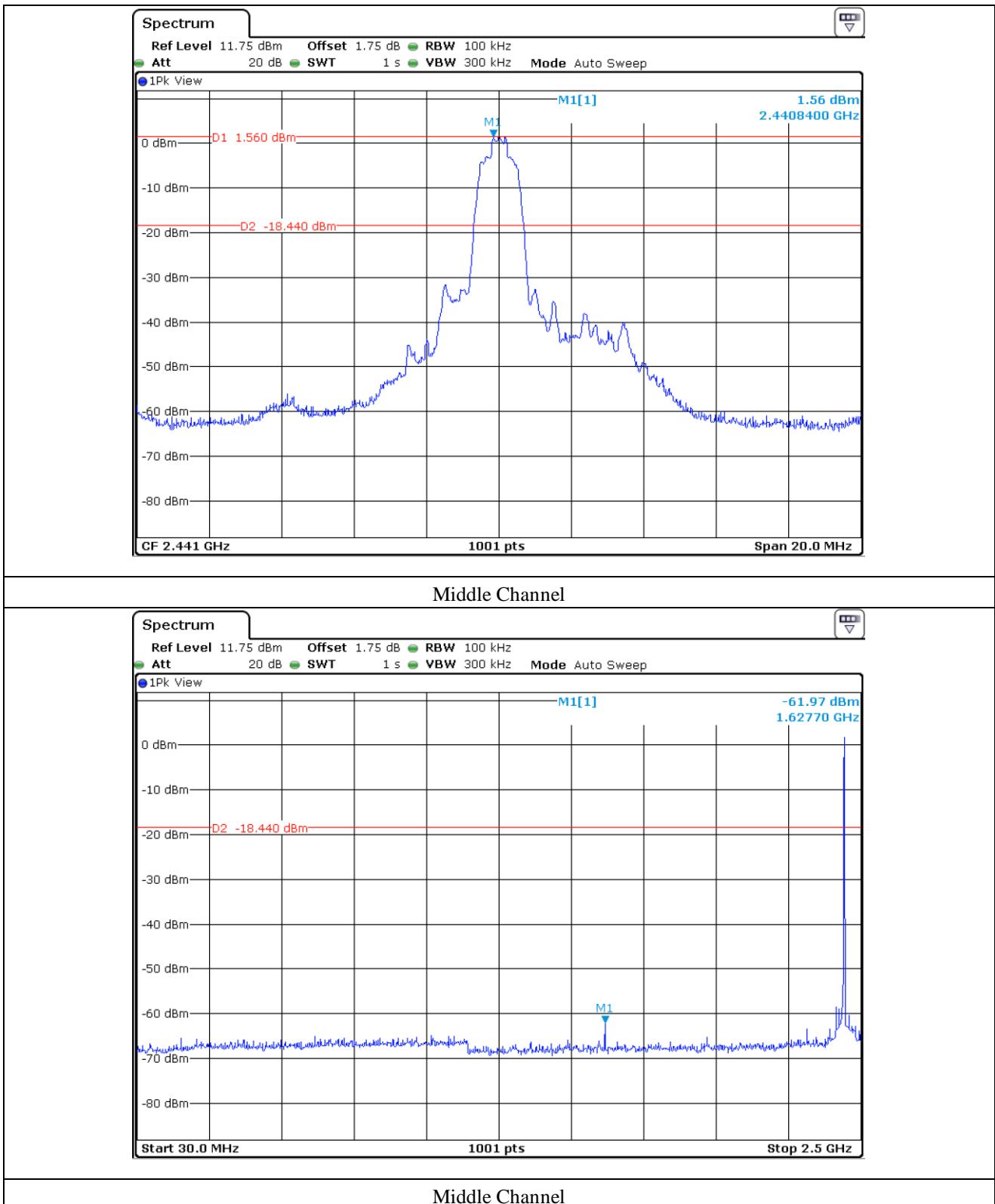


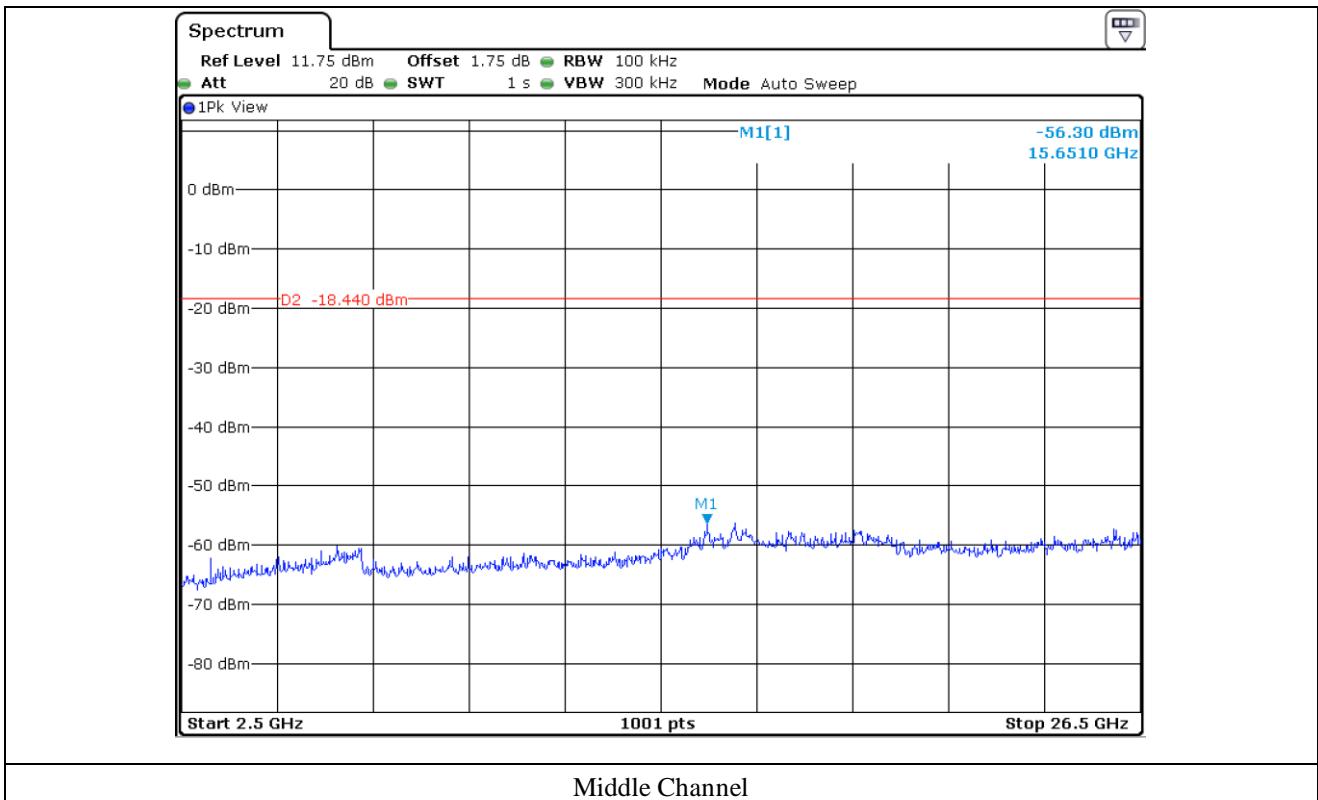


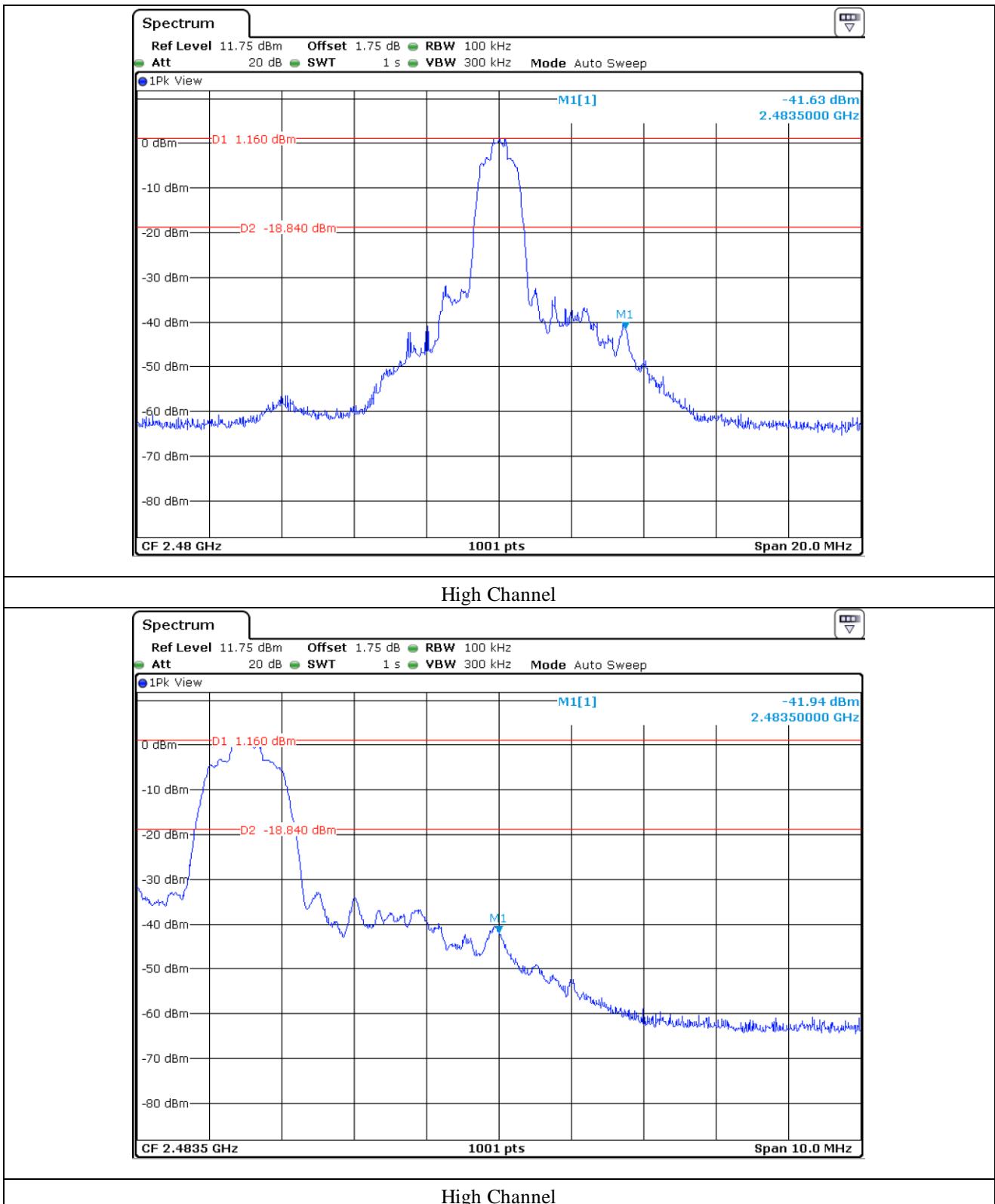
12.5.2 Test data for 2 Mbps

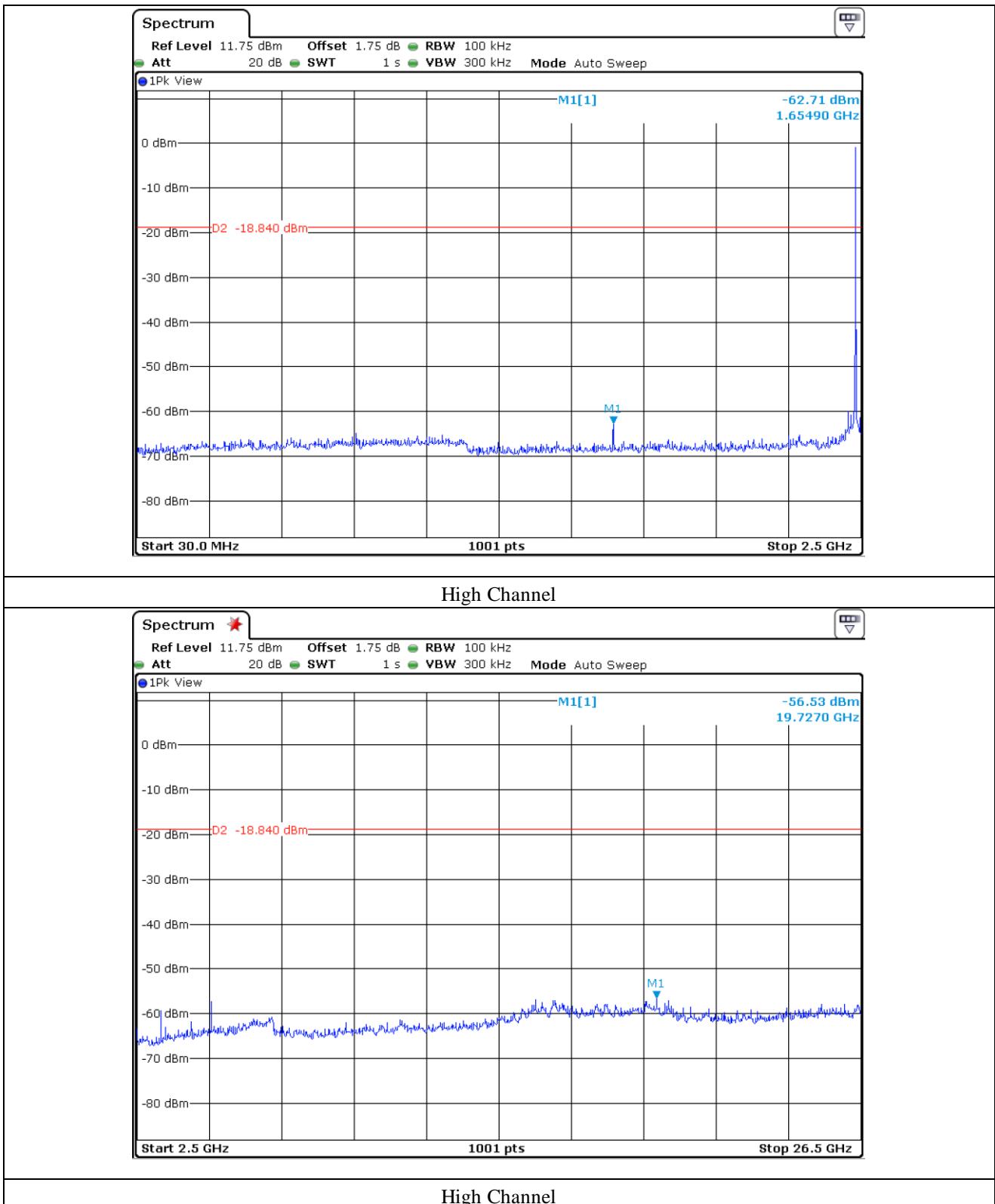




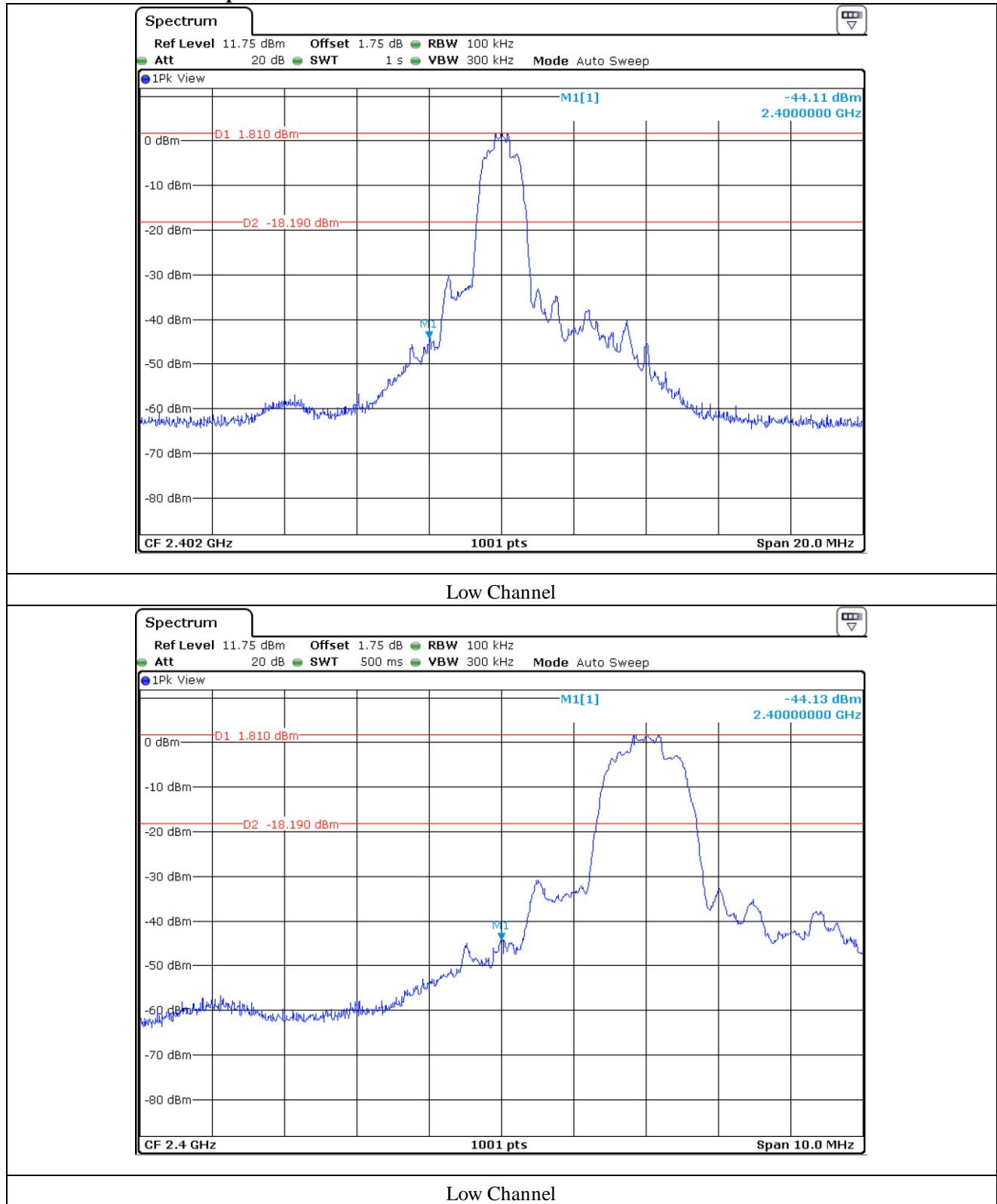


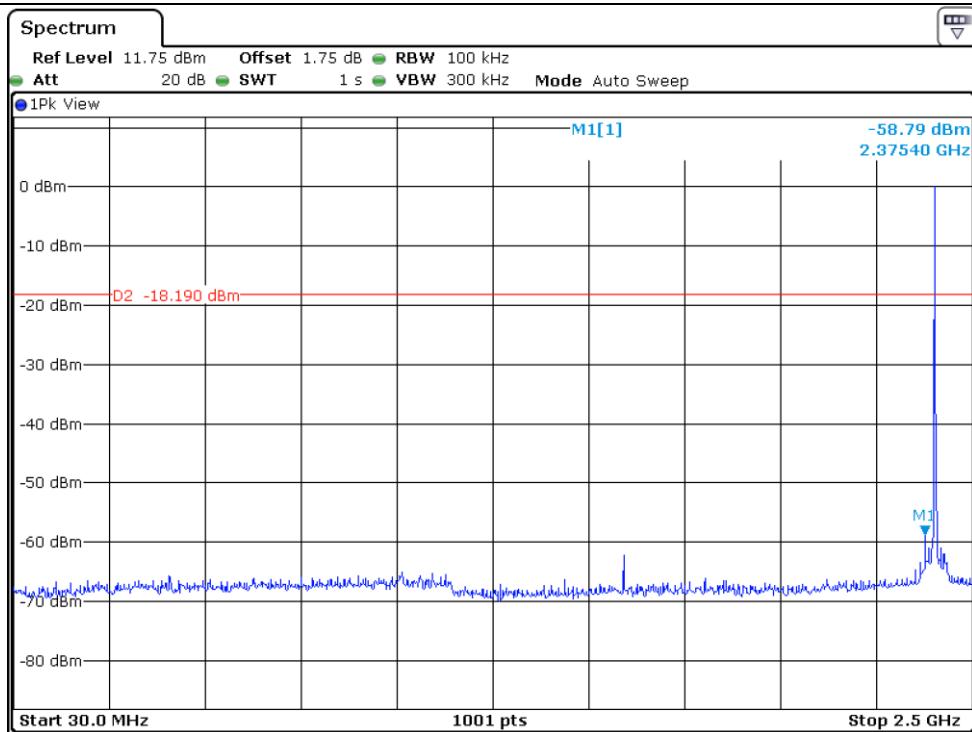




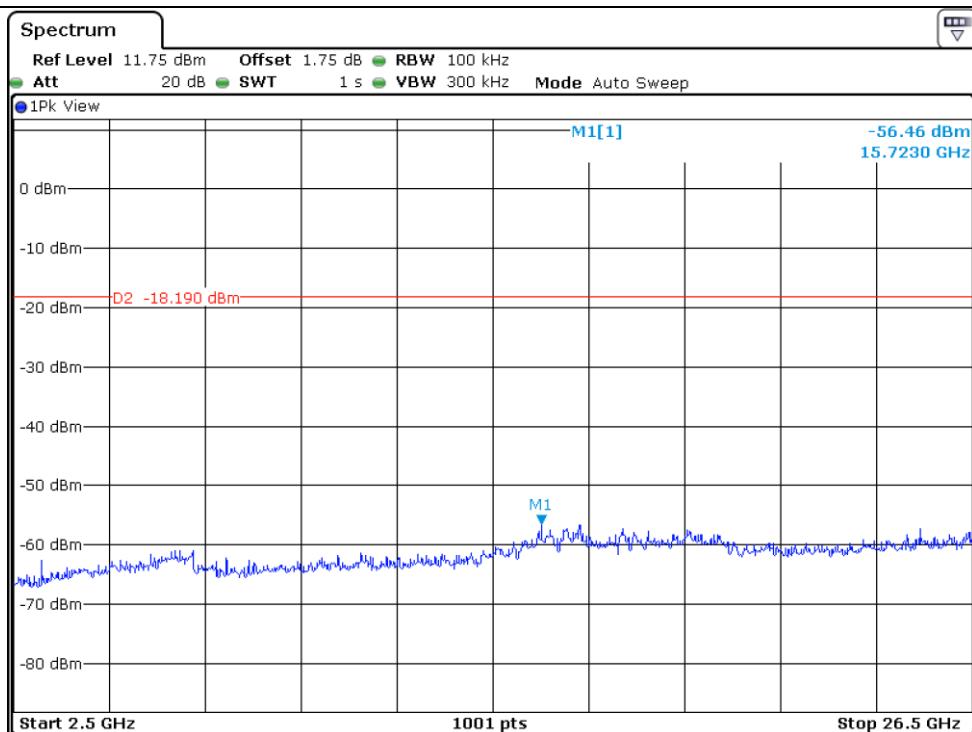


12.5.3 Test data for 3 Mbps

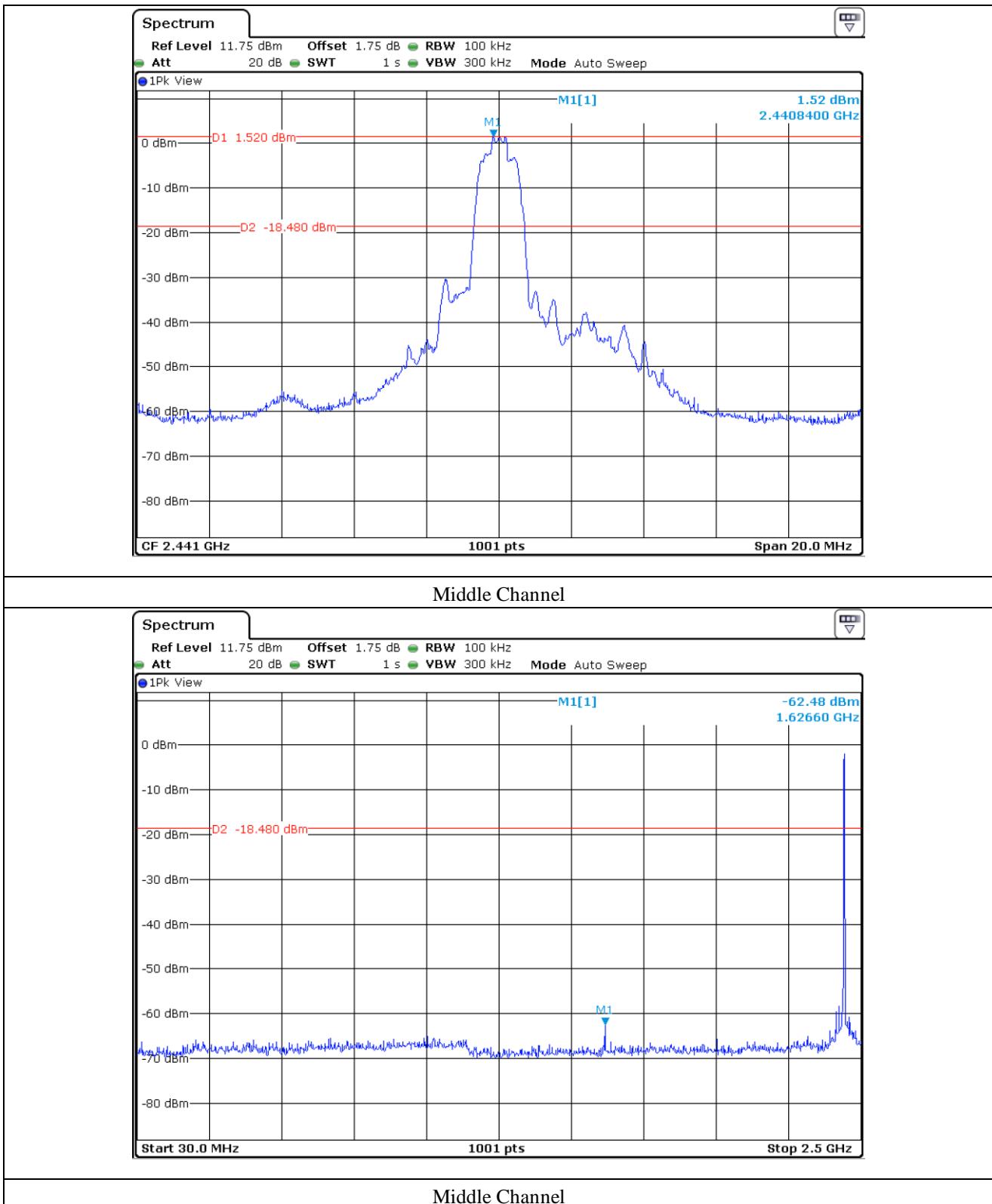


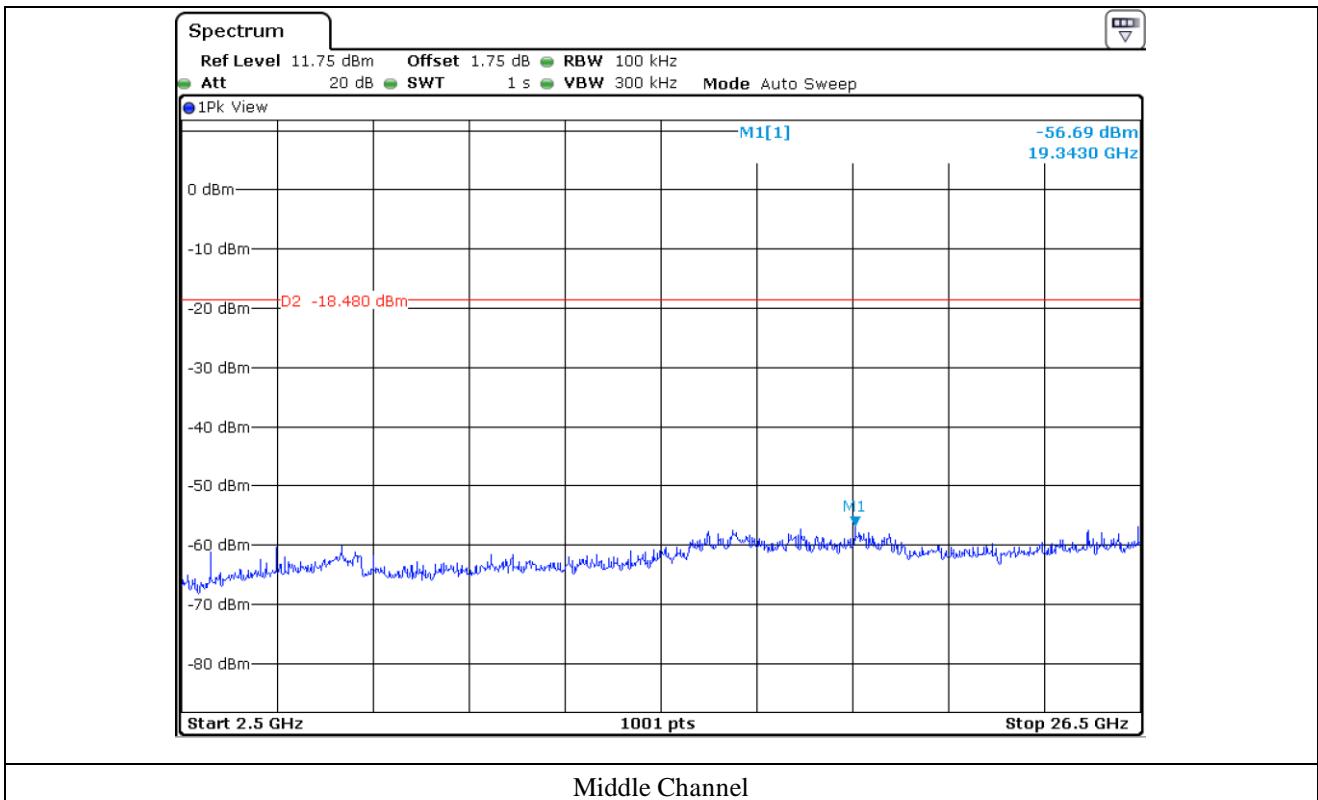


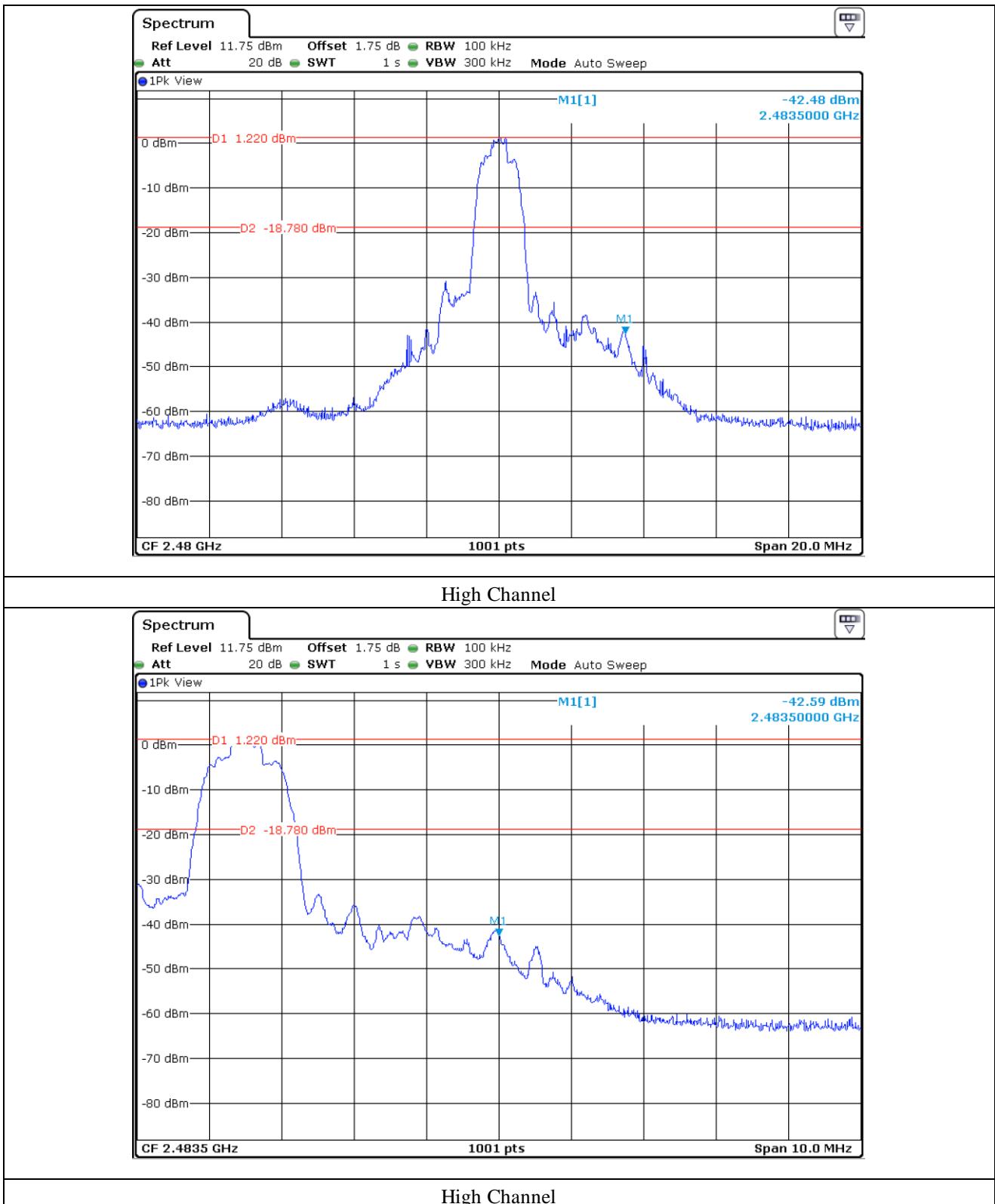
Low Channel

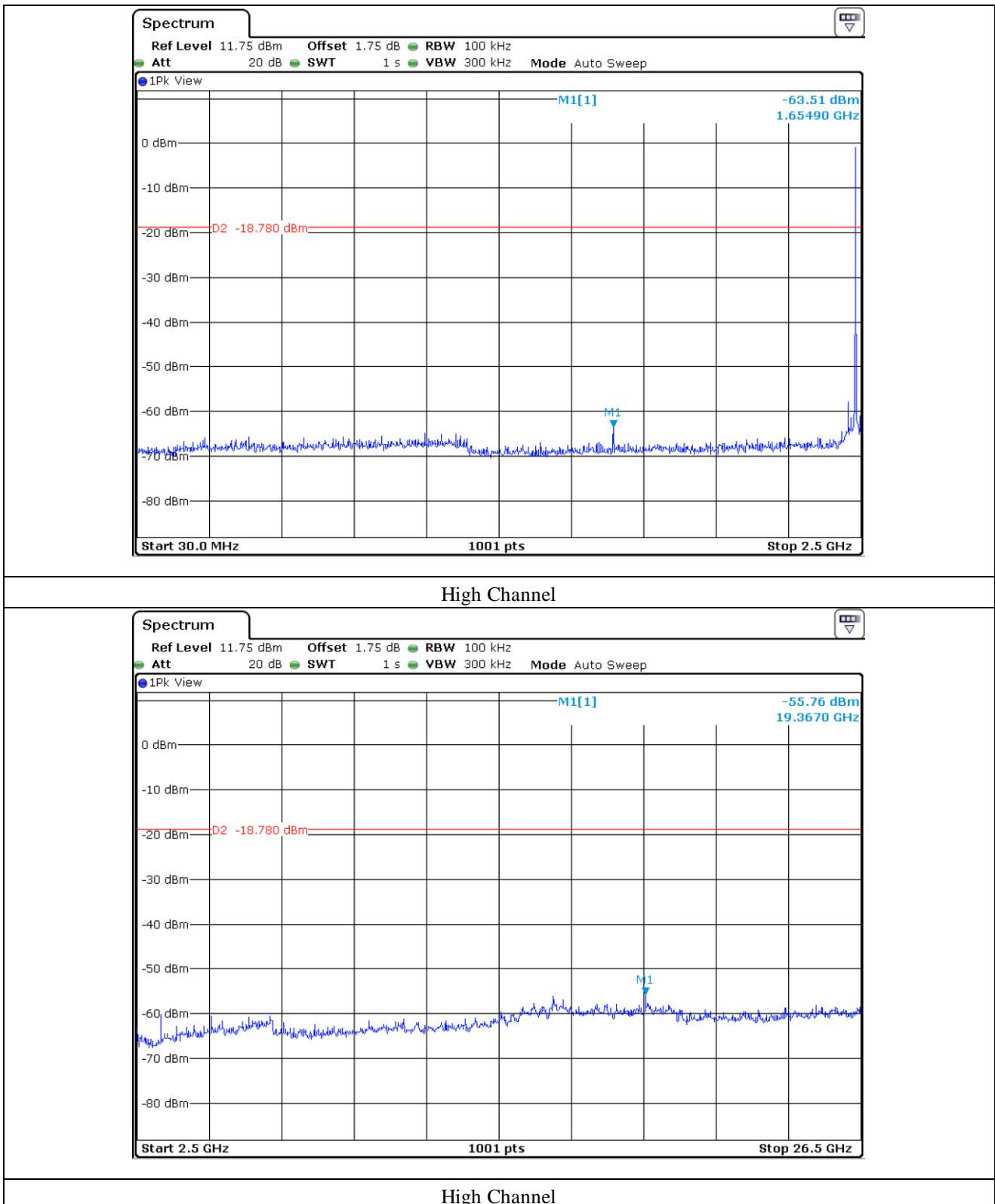


Low Channel









12.6 Test data for Charging & Transmitting Mode radiated emission

12.6.1 Radiated Emission which fall in the Restricted Band

12.6.1.1 Test data for 1 Mbps

- Test Date : July 10, 2016
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Operating Condition : Highest Output Power Charging & Transmitting Mode(Low Channel and High Channel)
- Result : PASSED

Frequency (MHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Test Data for Low Channel									
2 324.67	49.42	Peak	H	27.10	7.50	43.00	41.02	74.00	32.98
	35.12	Average	H				26.72	54.00	27.28
2 367.42	49.09	Peak	V				40.69	74.00	33.31
	34.85	Average	V				26.45	54.00	27.55
Test Data for High Channel									
2 483.56	54.21	Peak	H	27.10	7.50	43.00			
	40.21	Average	H						
2 484.15	52.41	Peak	V						
	38.68	Average	V						

Tabulated test data for Restricted Band

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



Tested by: Jun-Hui, Lee / Senior Engineer

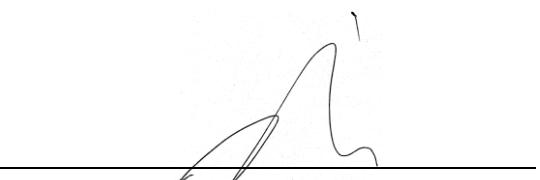
12.6.1.2 Test data for 2 Mbps

- Test Date : July 10, 2016
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Operating Condition : Highest Output Power Charging & Transmitting Mode(Low Channel and High Channel)
- Result : PASSED

Frequency (MHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Test Data for Low Channel									
2 375.73	49.93	Peak	H	27.10	7.50	43.00	41.53	74.00	32.47
	35.84	Average	H				27.44	54.00	26.56
2 347.76	49.17	Peak	V				40.77	74.00	33.23
	35.08	Average	V				26.68	54.00	27.32
Test Data for High Channel									
2 483.55	59.63	Peak	H	27.10	7.50	43.00	51.23	74.00	22.77
	44.98	Average	H				36.58	54.00	17.42
2 483.55	57.22	Peak	V				48.82	74.00	25.18
	39.47	Average	V				31.07	54.00	22.93

Tabulated test data for Restricted Band

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



Tested by: Jun-Hui, Lee / Senior Engineer

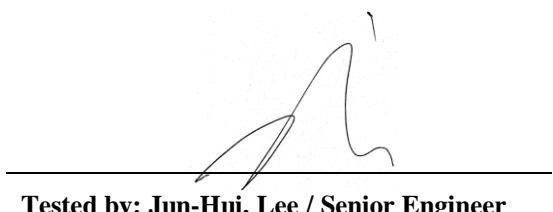
12.6.1.3 Test data for 3 Mbps

- . Test Date : March 07, 2016
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Measurement distance : 3 m
- . Operating Condition : Highest Output Power Charging & Transmitting Mode(Low Channel and High Channel)
- . Result : PASSED

Frequency (MHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Test Data for Low Channel									
2 311.88	50.15	Peak	H	27.10	7.50	43.00	41.75	74.00	32.25
	35.26	Average	H				26.86	54.00	27.14
2 337.69	49.46	Peak	V				41.06	74.00	32.94
	35.20	Average	V				26.80	54.00	27.20
Test Data for High Channel									
2 483.56	59.41	Peak	H	27.10	7.50	43.00	51.01	74.00	22.99
	40.90	Average	H				32.50	54.00	21.50
2 483.62	56.57	Peak	V				48.17	74.00	25.83
	39.41	Average	V				31.01	54.00	22.99

Tabulated test data for Restricted Band

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



Tested by: Jun-Hui, Lee / Senior Engineer

12.6.2 Spurious & Harmonic Radiated Emission above 1 GHz

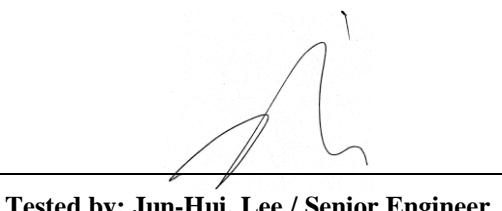
12.6.2.1 Test data for 1 Mbps

- Test Date : July 10, 2016
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Operating Condition : Highest Output Power Charging & Transmitting Mode
- Result : PASSED

Frequency (GHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Test Data for Low Channel									
4 804.00	57.62	Peak	H	30.60	11.10	42.50	56.82	74.00	17.18
	45.38	Average	H				44.58	54.00	9.42
	55.10	Peak	V				54.30	74.00	19.70
	41.64	Average	V				40.84	54.00	13.16
Test Data for Middle Channel									
4 882.00	53.85	Peak	H	30.70	11.20	42.50	53.25	74.00	20.75
	40.19	Average	H				39.59	54.00	14.41
	54.43	Peak	V				53.83	74.00	20.17
	41.13	Average	V				40.53	54.00	13.47
Test Data for High Channel									
4 960.00	55.84	Peak	H	30.80	11.30	42.50	55.44	74.00	18.56
	41.63	Average	H				41.23	54.00	12.77
	53.30	Peak	V				52.90	74.00	21.10
	39.44	Average	V				39.04	54.00	14.96

Tabulated test data for Restricted Band

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



Tested by: Jun-Hui, Lee / Senior Engineer

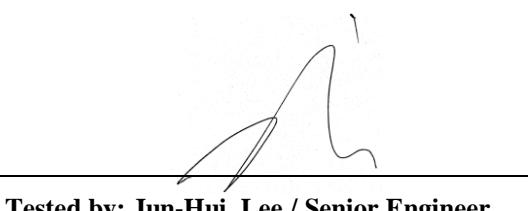
12.6.2.2 Test data for 2 Mbps

- Test Date : July 10, 2016
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Operating Condition : Highest Output Power Charging & Transmitting Mode
- Result : PASSED

Frequency (GHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Test Data for Low Channel									
4 804.00	57.25	Peak	H	30.60	11.10	42.50	56.45	74.00	17.55
	42.99	Average	H				42.19	54.00	11.81
	54.44	Peak	V				53.64	74.00	20.36
	30.30	Average	V				29.50	54.00	24.50
Test Data for Middle Channel									
4 882.00	55.17	Peak	H	30.70	11.20	42.50	54.57	74.00	19.43
	40.88	Average	H				40.28	54.00	13.72
	54.10	Peak	V				53.50	74.00	20.50
	39.64	Average	V				39.04	54.00	14.96
Test Data for High Channel									
4 960.00	54.65	Peak	H	30.80	11.30	42.50	54.25	74.00	19.75
	41.41	Average	H				41.01	54.00	12.99
	53.13	Peak	V				52.73	74.00	21.27
	38.90	Average	V				38.50	54.00	15.50

Tabulated test data for Restricted Band

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



Tested by: Jun-Hui, Lee / Senior Engineer

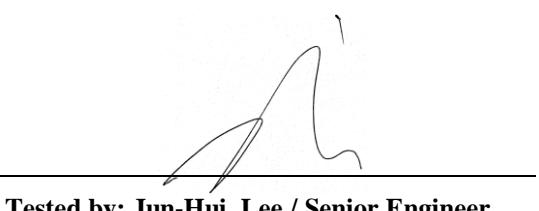
12.6.2.3 Test data for 3 Mbps

- Test Date : July 10, 2016
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Operating Condition : Highest Output Power Charging & Transmitting Mode
- Result : PASSED

Frequency (GHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Test Data for Low Channel									
4 804.00	58.28	Peak	H	30.60	11.10	42.50	57.48	74.00	16.52
	43.15	Average	H				42.35	54.00	11.65
	55.09	Peak	V				54.29	74.00	19.71
	40.32	Average	V				39.52	54.00	14.48
Test Data for Middle Channel									
4 882.00	56.46	Peak	H	30.70	11.20	42.50	55.86	74.00	18.14
	40.81	Average	H				40.21	54.00	13.79
	54.11	Peak	V				53.51	74.00	20.49
	39.66	Average	V				39.06	54.00	14.94
Test Data for High Channel									
4 960.00	54.34	Peak	H	30.80	11.30	42.50	53.94	74.00	20.06
	40.11	Average	H				39.71	54.00	14.29
	53.30	Peak	V				52.90	74.00	21.10
	38.93	Average	V				38.53	54.00	15.47

Tabulated test data for Restricted Band

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



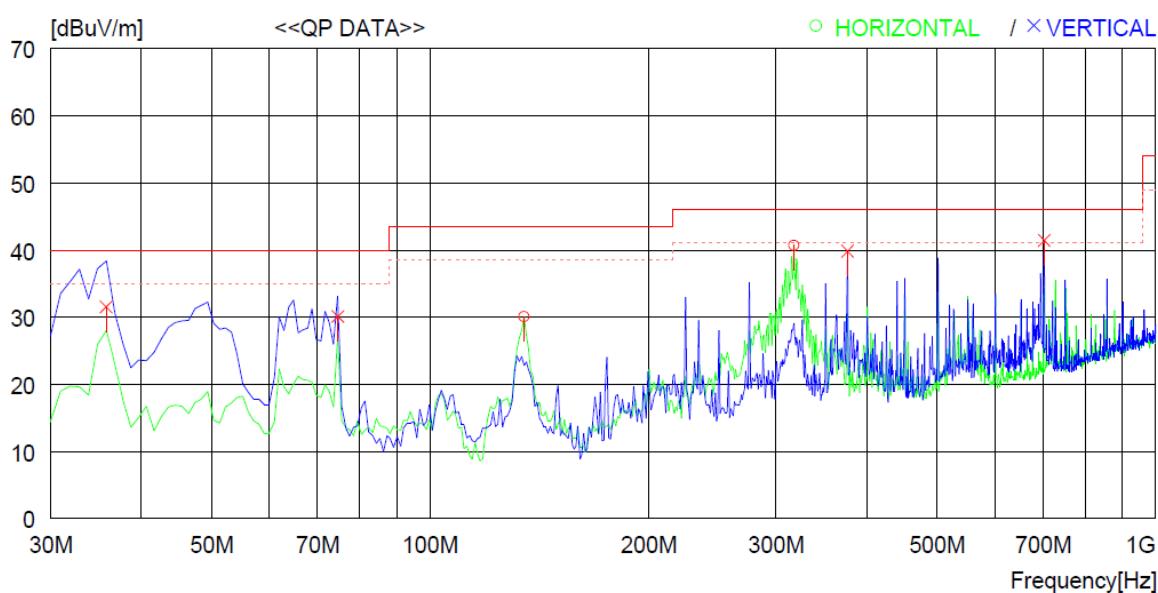
Tested by: Jun-Hui, Lee / Senior Engineer

12.6.3 Spurious Radiated Emission

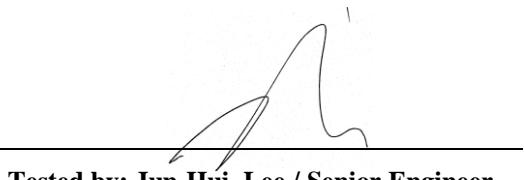
12.6.3.1 Test Data for 30 MHz ~ 1 000 MHz

Humidity Level : 50 % R.H. Temperature: 22 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : Handheld Mobile Computer Date: July 10, 2016
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



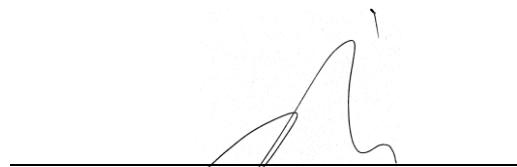
No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA TABLE	
									[dB]	[cm]
----- Horizontal -----										
1	134.760	51.5	8.6	3.1	33.1	30.1	43.5	13.4	300	0
2	317.120	55.2	13.8	4.7	33.0	40.7	46.0	5.3	100	0
----- Vertical -----										
3	35.820	50.2	12.5	1.8	33.0	31.5	40.0	8.5	100	2
4	74.620	52.2	8.7	2.3	33.1	30.1	40.0	9.9	400	30
5	376.290	52.3	15.4	5.2	33.1	39.8	46.0	6.2	100	114
6	702.205	48.2	19.4	7.2	33.4	41.4	46.0	4.6	100	318


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12.6.3.2 Test Data for Below 30 MHz

- . Test Date : July 10, 2016
- . 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 (dB μ V)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Any emissions were not observed from the EUT.								



Tested by: Jun-Hui, Lee / Senior Engineer

13. CONDUCTED EMISSION TEST

13.1 Operating environment

Temperature : 23 °C
Relative humidity : 53 % 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 $50 \Omega / 50 \mu\text{H} + 5 \Omega$ Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

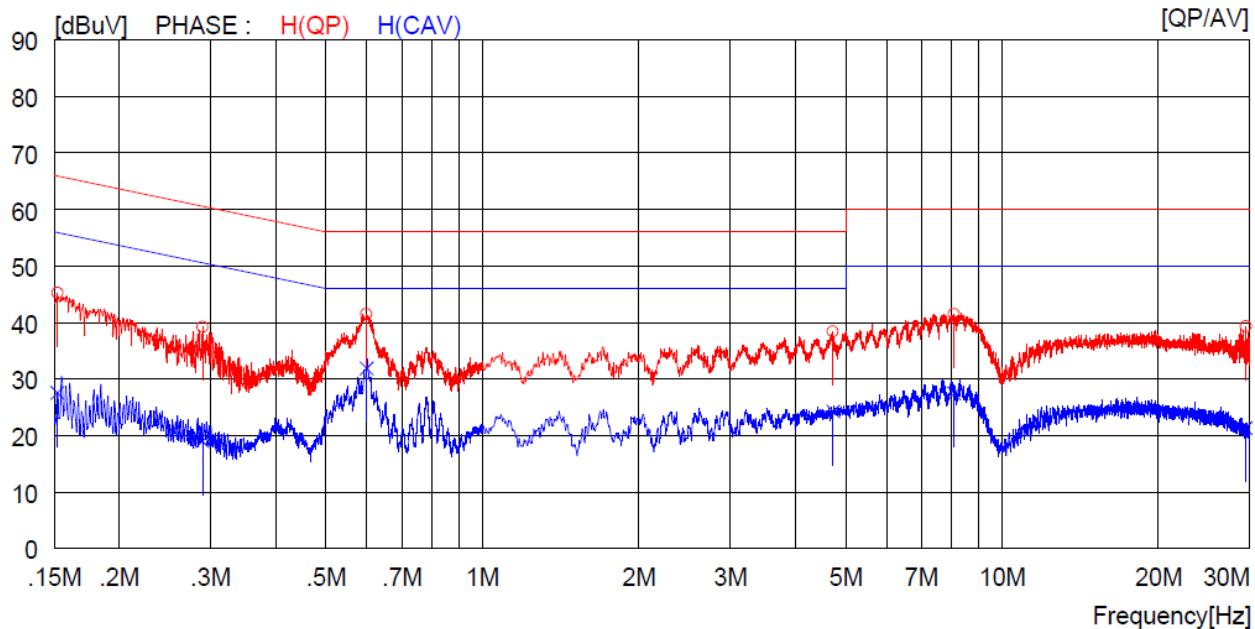
13.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ - ESPI	Rohde & Schwarz	EMI Test Receiver	101278	Nov. 02, 2015 (1Y)
□ - ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	Apr. 05, 2016 (1Y)
□ NSLK8128	Schwarzbeck	AMN	8128-216	Apr. 06, 2016 (1Y)
■ - NSLK8126	Schwarzbeck	AMN	8126-404	Apr. 05, 2016 (1Y)
□ - 3825/2	EMCO	AMN	9109-1869	Apr. 06, 2016 (1Y)
■ -- 3825/2	EMCO	AMN	9109-1867	Apr. 06, 2016 (1Y)

All test equipment used is calibrated on a regular basis.

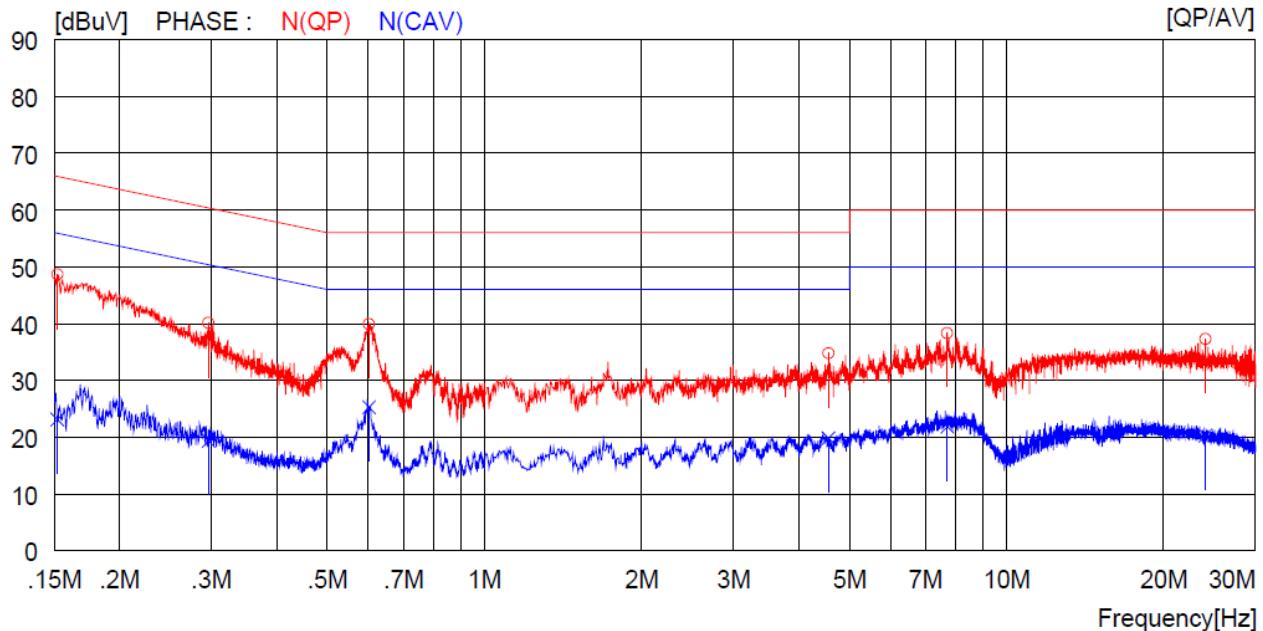
13.4 Test data for Charging & Transmitting Mode

- Test Date : July 09, 2016
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.15200	35.1	----	10.1	45.2	----	65.9	----	20.7	----	H (QP)
2	0.28900	29.1	----	10.1	39.2	----	60.6	----	21.4	----	H (QP)
3	0.59800	31.4	----	10.1	41.5	----	56.0	----	14.5	----	H (QP)
4	4.72800	28.2	----	10.2	38.4	----	56.0	----	17.6	----	H (QP)
5	8.09000	31.3	----	10.2	41.5	----	60.0	----	18.5	----	H (QP)
6	29.47000	28.6	----	10.7	39.3	----	60.0	----	20.7	----	H (QP)
7	0.15200	----	17.5	10.1	----	27.6	----	55.9	----	28.3	H (CAV)
8	0.28900	----	8.9	10.1	----	19.0	----	50.6	----	31.6	H (CAV)
9	0.59800	----	21.8	10.1	----	31.9	----	46.0	----	14.1	H (CAV)
10	4.72800	----	14.1	10.2	----	24.3	----	46.0	----	21.7	H (CAV)
11	8.09000	----	17.2	10.2	----	27.4	----	50.0	----	22.6	H (CAV)
12	29.47000	----	10.6	10.7	----	21.3	----	50.0	----	28.7	H (CAV)

- Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.15200	38.5	----	10.1	48.6	----	65.9	----	17.3	----	N (QP)
2	0.29600	30.0	----	10.1	40.1	----	60.4	----	20.3	----	N (QP)
3	0.60100	29.8	----	10.1	39.9	----	56.0	----	16.1	----	N (QP)
4	4.56400	24.6	----	10.2	34.8	----	56.0	----	21.2	----	N (QP)
5	7.70000	28.1	----	10.2	38.3	----	60.0	----	21.7	----	N (QP)
6	24.04000	26.7	----	10.6	37.3	----	60.0	----	22.7	----	N (QP)
7	0.15200	----	13.0	10.1	----	23.1	----	55.9	----	32.8	N (CAV)
8	0.29600	----	9.3	10.1	----	19.4	----	50.4	----	31.0	N (CAV)
9	0.60100	----	15.2	10.1	----	25.3	----	46.0	----	20.7	N (CAV)
10	4.56400	----	9.6	10.2	----	19.8	----	46.0	----	26.2	N (CAV)
11	7.70000	----	11.7	10.2	----	21.9	----	50.0	----	28.1	N (CAV)
12	24.04000	----	9.7	10.6	----	20.3	----	50.0	----	29.7	N (CAV)

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

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

Tested by: Jun-Hui Lee / Senior Engineer