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

Test Report No. : **W15OR-D004**

AGR No. : **A158A-013**

Applicant : **BLUEBIRD INC.**

Address : **(Dogok-dong, SEI Tower 13,14)39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea**

Manufacturer : **BLUEBIRD INC.**

Address : **(Dogok-dong, SEI Tower 13,14)39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea**

Type of Equipment : **Mobile Payment Terminal**

FCC ID. : **SS4MT280**

Model Name : **MT280**

Multiple Model Name: **N/A**

Serial number : **N/A**

Total page of Report : **88 pages (including this page)**

Date of Incoming : **August 03, 2015**

Date of issue : **October 02, 2015**

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: Sung-ik, Han/ Managing Director
ONETECH Corp.

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(TEL: +82-31-746-8500 FAX: +82-31-746-8700)

EMC Testing Div : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
W15OR-D004	October 02, 2015	Initial Issue	All

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1. VERIFICATION OF COMPLIANCE

APPLICANT	: BLUEBIRD INC.
ADDRESS	: (Dogok-dong, SEI Tower 13,14)39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea
CONTACT PERSON	: Jae-ho, Lee / Senior engineer
TELEPHONE NO	: +82-70-7730-8210
FCC ID	: SS4MT280
MODEL NAME	: MT280
SERIAL NUMBER	: N/A
DATE	: October 02, 2015

EQUIPMENT CLASS	***DSS – PART 15 SPREAD SPECTRUM TRANSMITTER***
KIND OF EQUIPMENT	Mobile Payment Terminal
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.

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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.

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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 301-14, Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862 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# 3736-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation No. 85

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. GENERAL INFORMATION

3.1 Product Description

The BLUEBIRD INC., Model MT280 (referred to as the EUT in this report) is a Mobile Payment Terminal. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Mobile Payment Terminal	
OPERATING FREQUENCY	2 402 MHz ~ 2 480 MHz	
RF OUTPUT POWER	1 Mbps	7.57 dBm
	2 Mbps	4.07dBm
	3 Mbps	4.16 dBm
NUMBER OF CHANNEL	79 Channels	
MODULATION TYPE	GFSK for 1 Mbps, DQPSK for 2 Mbps, 8-DPSK for 3 Mbps	
ANTENNA TYPE	Chip Antenna	
ANTENNA GAIN	3.6 dBi	
LIST OF EACH OSC. OR CRYSTAL. FREQ.(FREQ.>=1 MHz)	24 MHz, 2.5 MHz, 1.25 MHz, 32.768 kHz	
RATED SUPPLY VOLTAGE	DC 7.4 V	

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

-. None

4. EUT MODIFICATIONS

-. None

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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
KEY BOARD	N/A	PCB-MT280-KEY-REV0.2	N/A
MAIN BOARD	N/A	PCB-MT280-MAIN-REV0.2	N/A
TERMINAL BOARD	N/A	PCB-MT280-TERMINAL-REV0.2	N/A
LCD	N/A	N/A	N/A
LOWER BOARD	N/A	N/A	N/A
UPPER BOARD	N/A	N/A	N/A
Battery	N/A	N/A	N/A
Print	N/A	P2VS41504401136	N/A
BT Antenna	N/A	N/A	N/A
GSM Module	N/A	N/A	N/A
MSR	N/A	N/A	N/A
NFC Antenna	N/A	N/A	N/A
WCDMA Antenna	N/A	MT760_main antenna_GSM/WCDMA	N/A
WLAN Antenna	N/A	MT280_WLAN ant_FPCB_Rev.01	N/A

5.2 Peripheral equipment

Model	Manufacturer	Description	Connected to
MT280	BLUEBIRD INC.	Mobile Payment Terminal (EUT)	Adapter
PSAC30U-090	Phihong(Dong guan) Electronics Co.,Ltd.	Adapter	EUT

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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. 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 C63.4: 2009 7.3.3 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 C63.4: 2009 8.3.1.1 and 13.1.4.1 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m open area test site.

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.

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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 Chip 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

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7. MINIMUM 20 dB BANDWIDTH

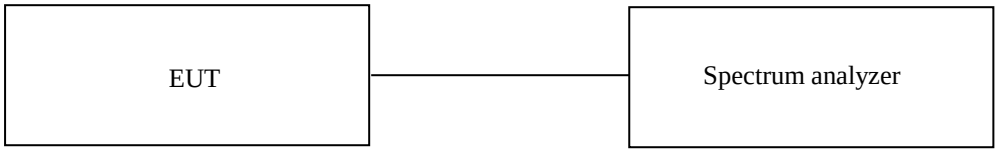
7.1 Operating environment

Temperature : 23.0 ℃

Relative humidity : 54.3 % 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. (Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 29, 2015 (1Y)

All test equipment used is calibrated on a regular basis.

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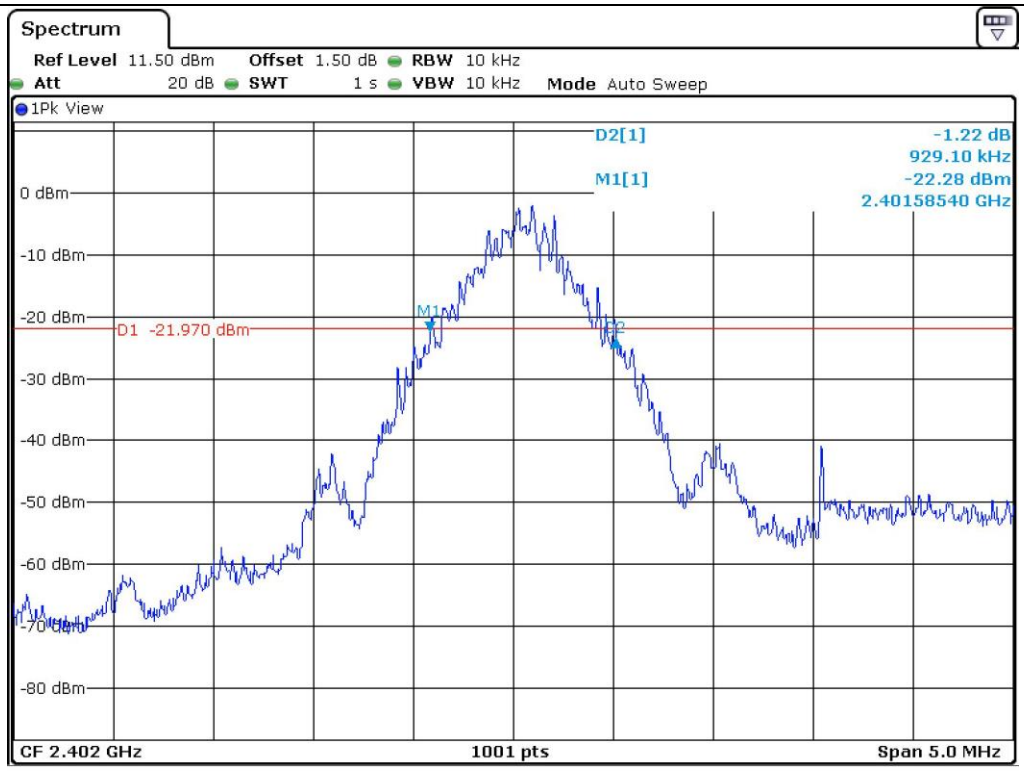
7.4 Test data for 1 Mbps

-. Test Date : September 30, 2015

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402	929.10
Middle	2 441	929.10
High	2 480	929.10

Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel

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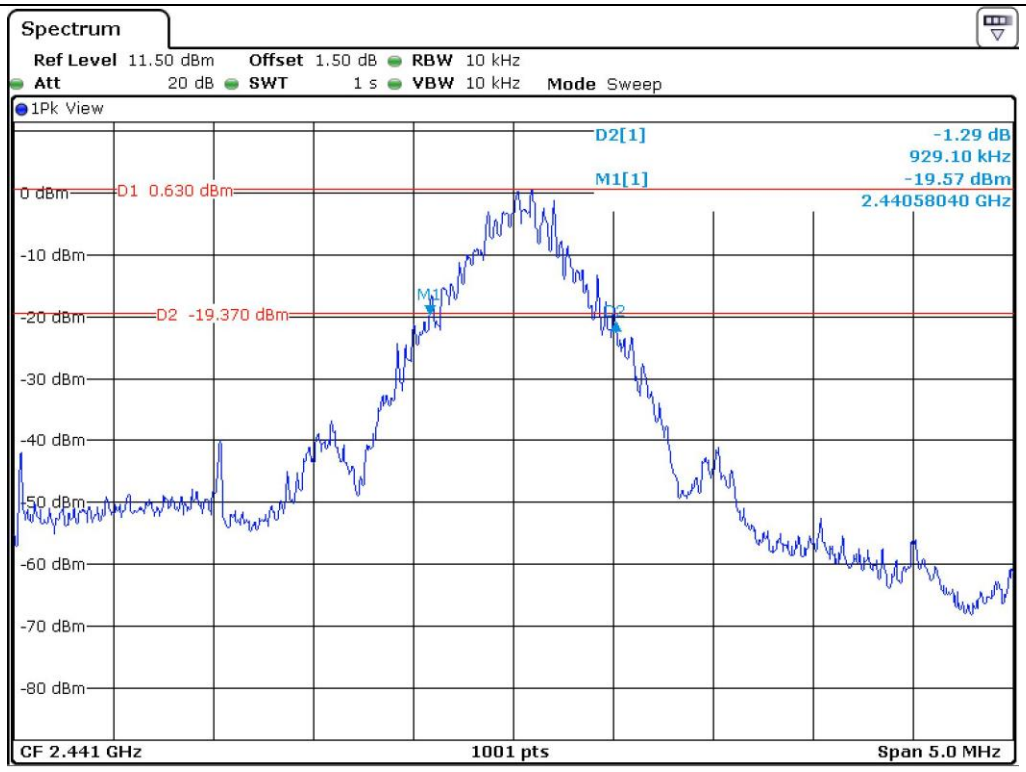
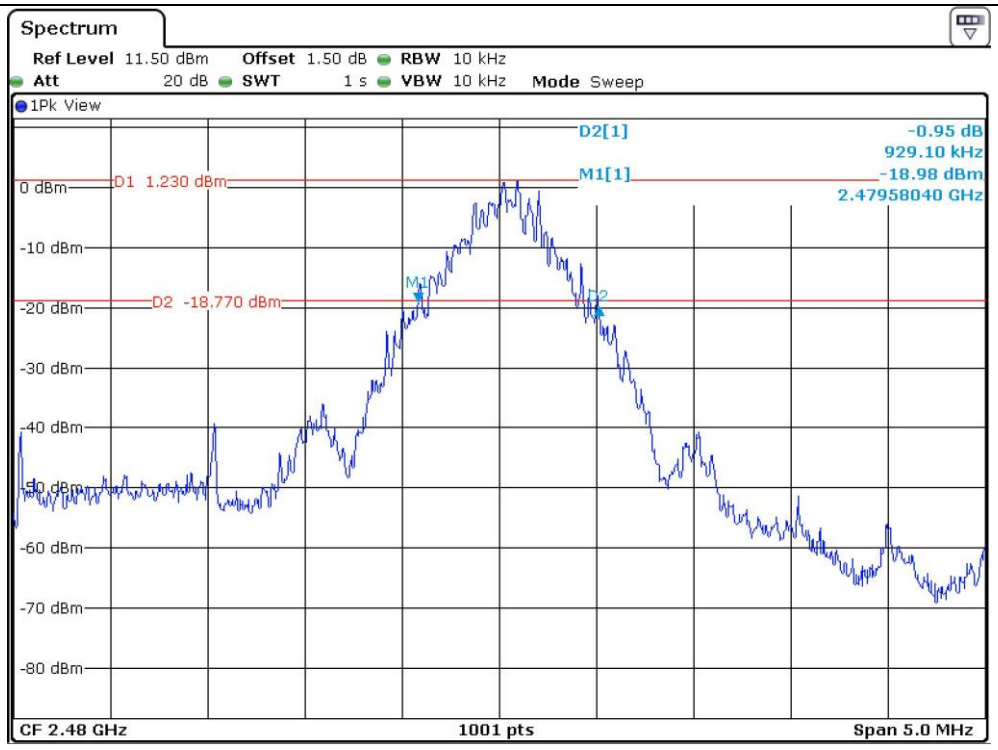


Middle Channel



High Channel

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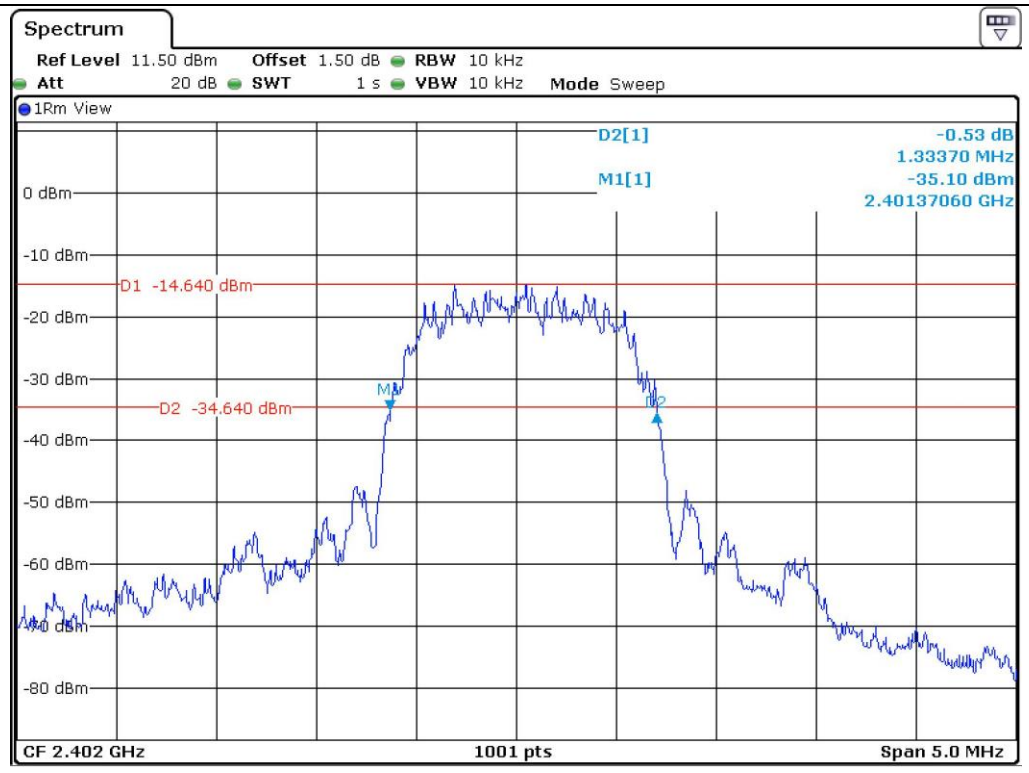
7.5 Test data for 2 Mbps

-. Test Date : September 30, 2015

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402	1 333.70
Middle	2 441	1 333.70
High	2 480	1 328.70

Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel

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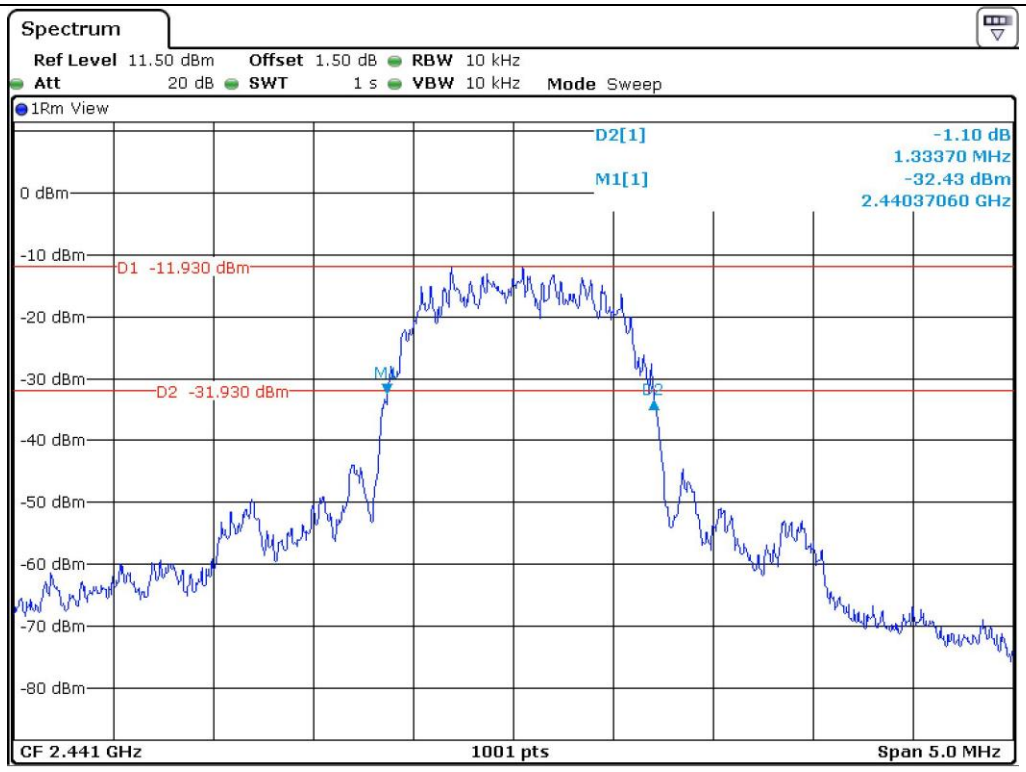
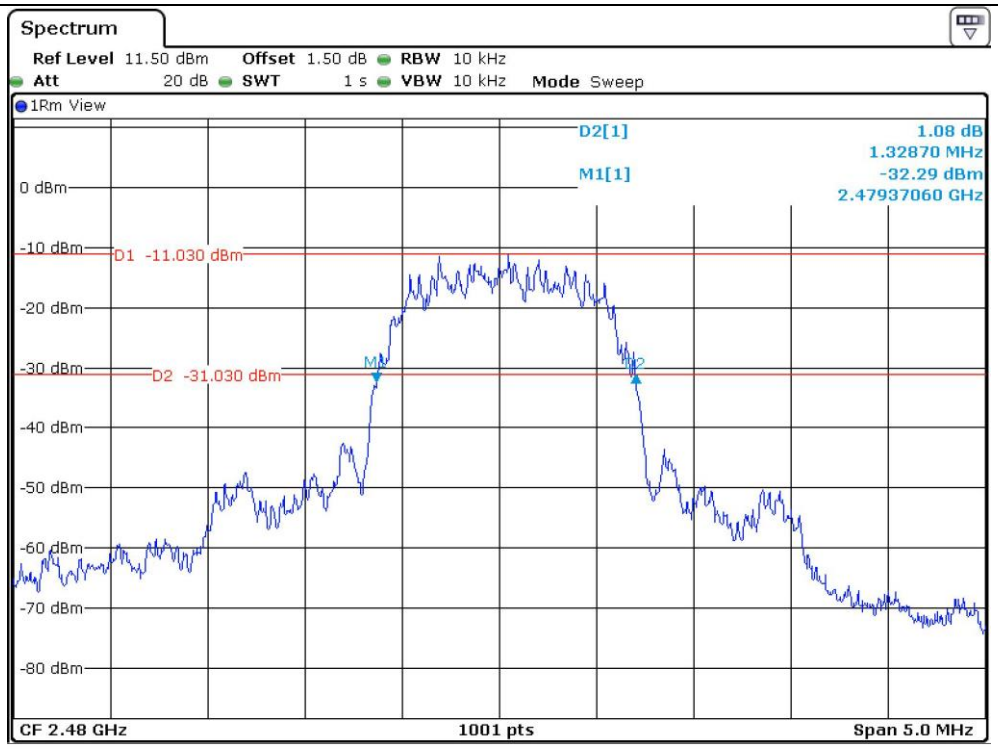


Middle Channel



High Channel

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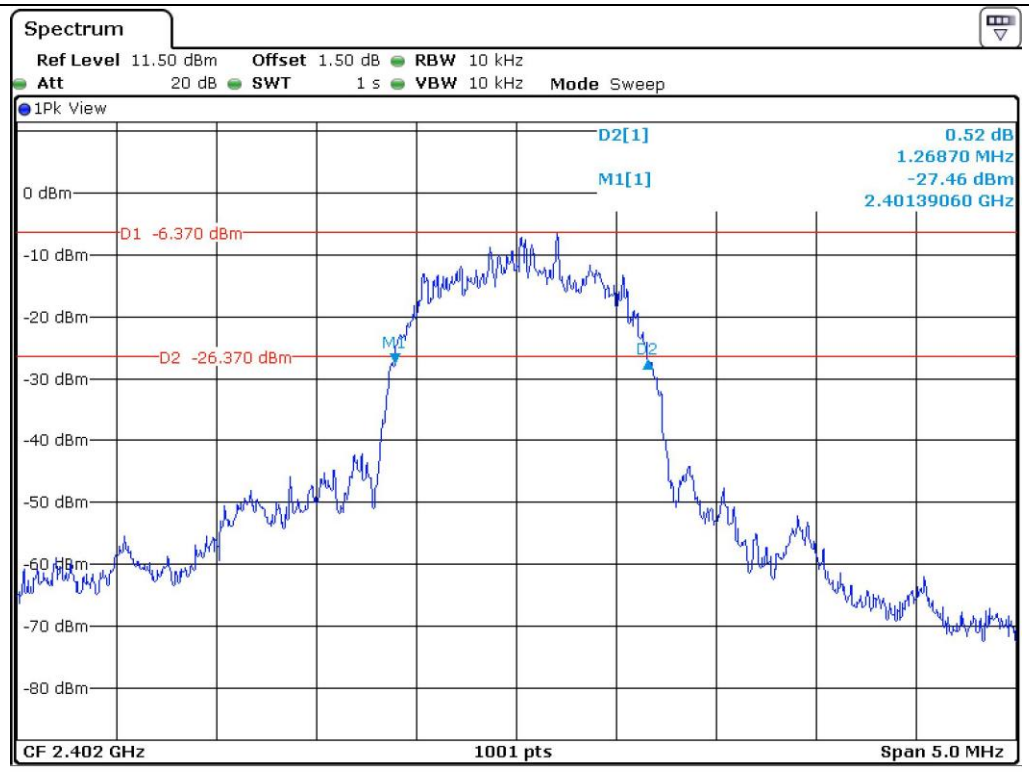
7.6 Test data for 3 Mbps

-. Test Date : September 30, 2015

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)
Low	2 402	1 268.70
Middle	2 441	1 268.70
High	2 480	1 268.70

Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel

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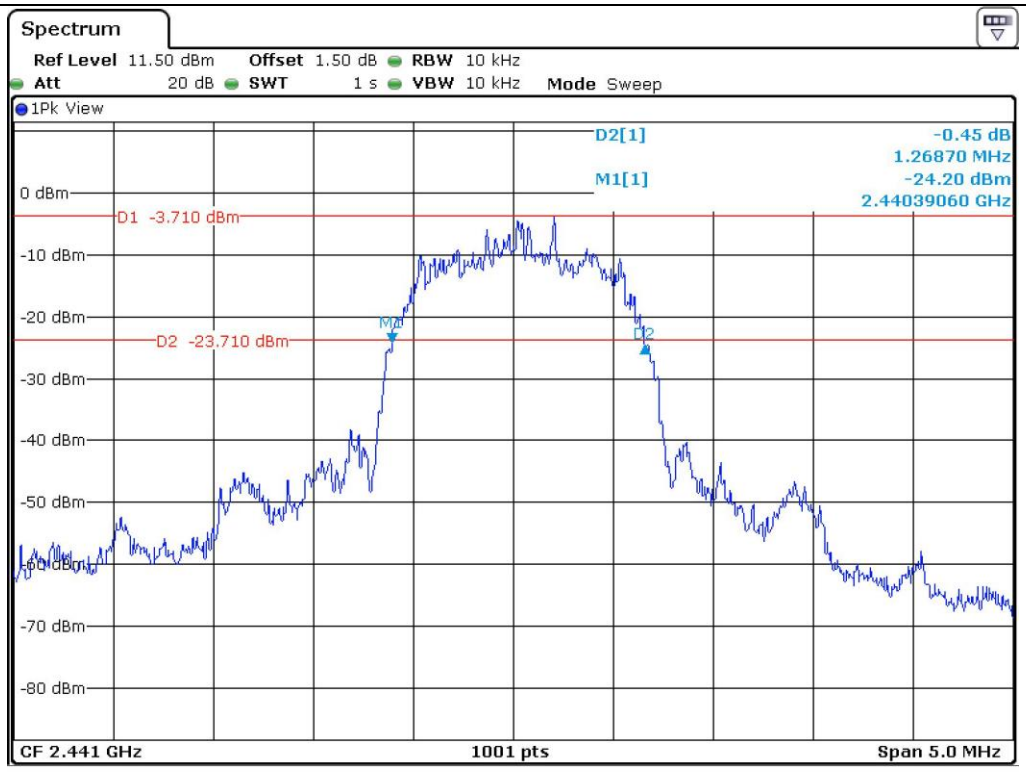
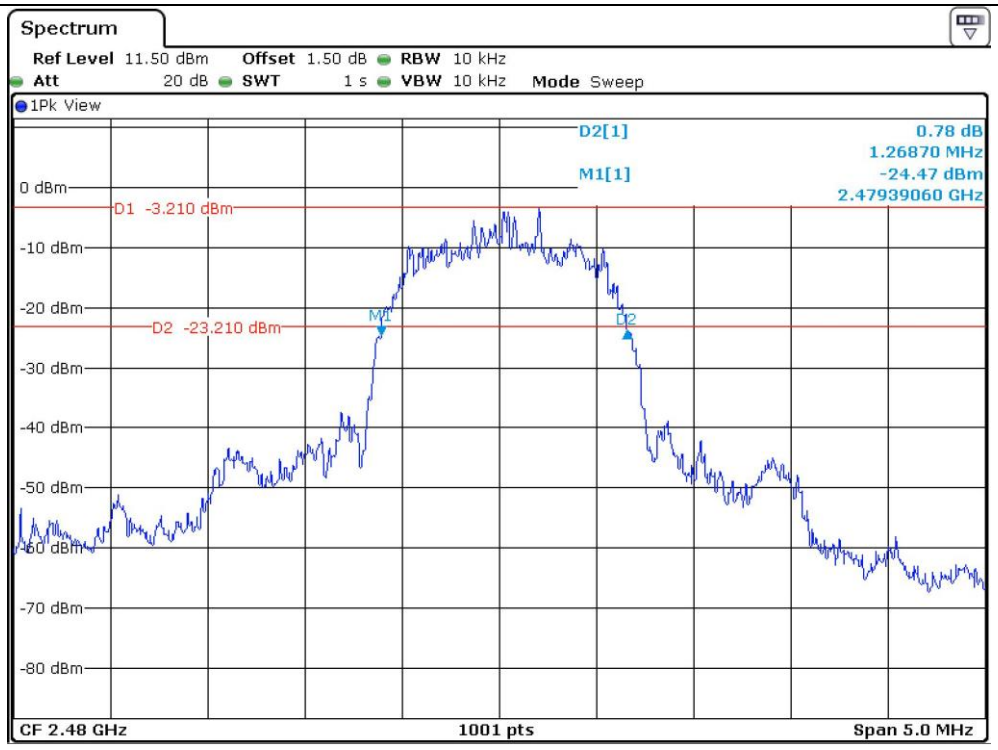


Middle Channel



High Channel

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8. HOPPING FREQUENCY SEPARATION

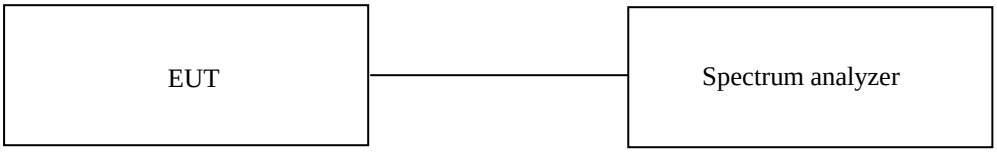
8.1 Operating environment

Temperature : 23.0 ℃

Relative humidity : 54.3 % 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. (Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 29, 2015 (1Y)

All test equipment used is calibrated on a regular basis.

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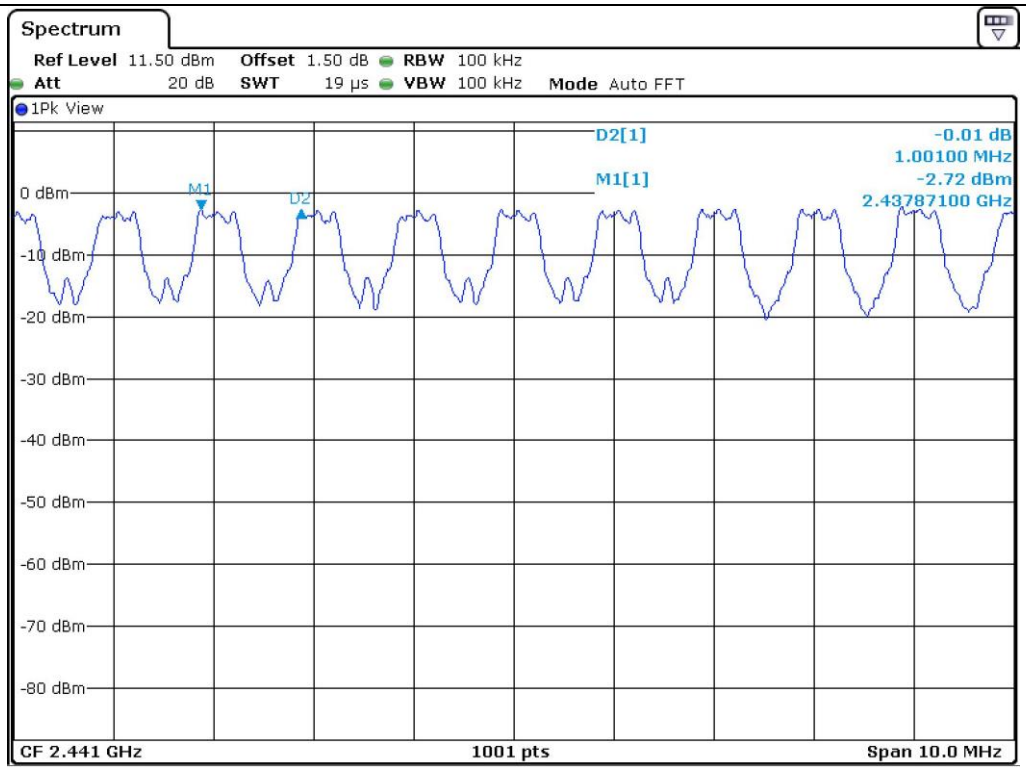
8.4 Test data for 1 Mbps

-. Test Date : September 30, 2015

-. Test Result : Pass

MEASURED VLAUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
1001.00	619.40	Separated by a minimum of 25 kHz

Tested by: Jun-Hui, Lee / Senior Engineer



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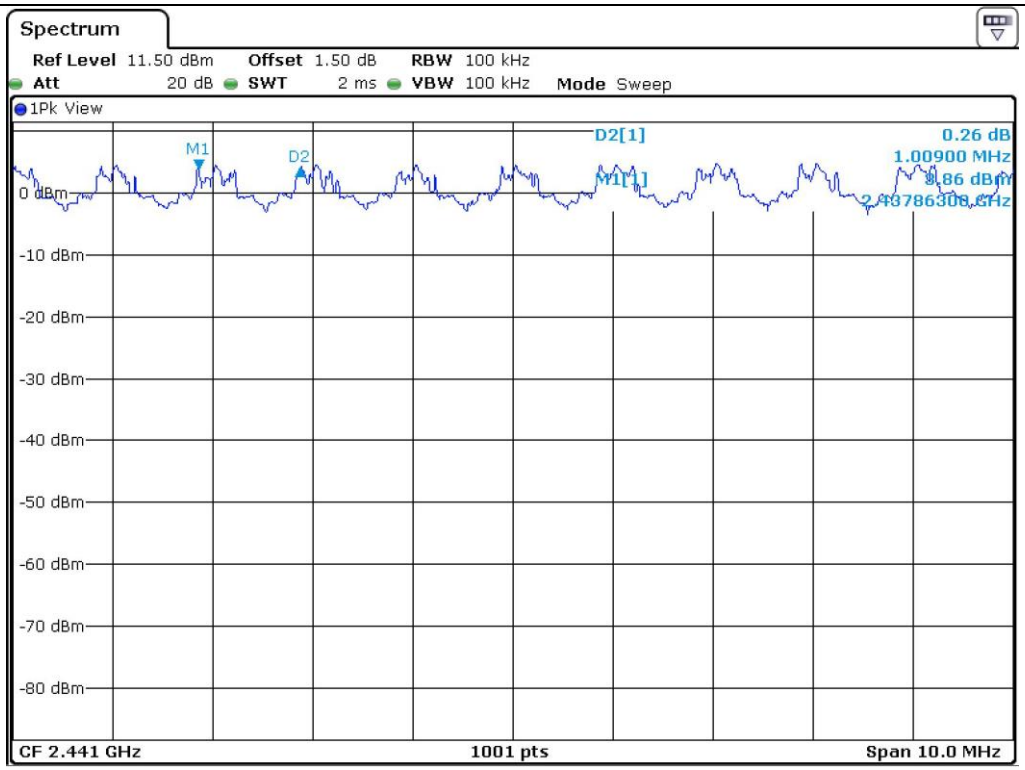
8.5 Test data for 2 Mbps

-. Test Date : September 30, 2015

-. Test Result : Pass

MEASURED VLAUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
1001.00	889.13	Separated by a minimum of 25 kHz

Tested by: Jun-Hui, Lee / Senior Engineer



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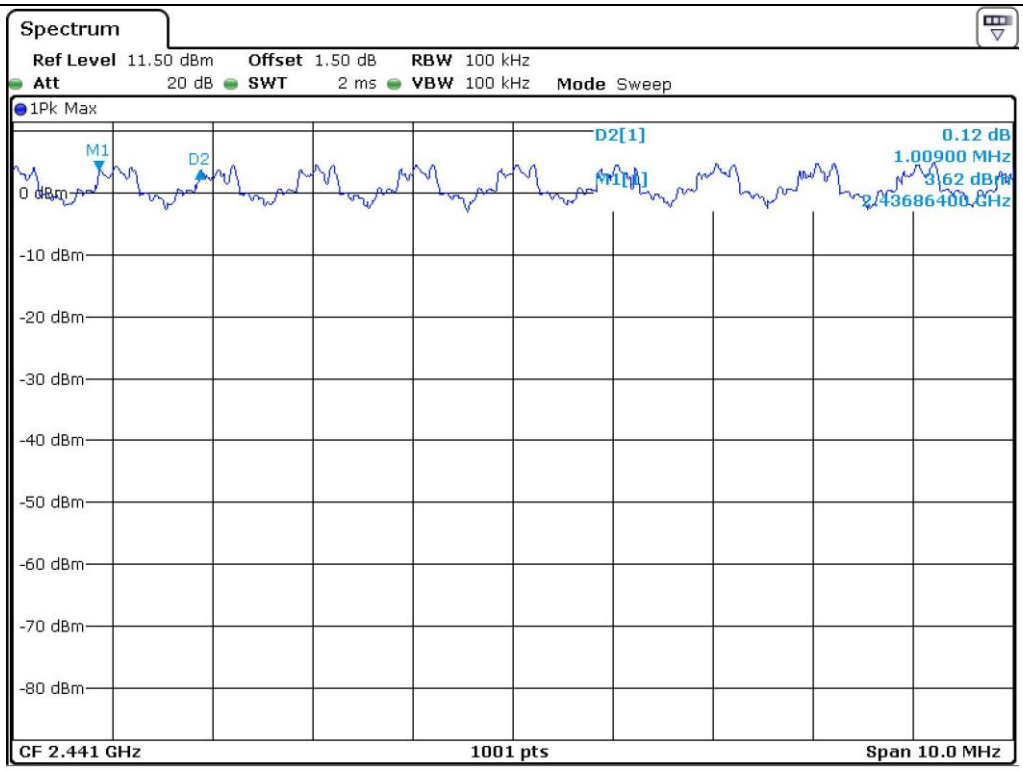
8.6 Test data for 3 Mbps

-. Test Date : September 30, 2015

-. Test Result : Pass

MEASURED VLAUE (kHz)	Two-third of 20 dB Bandwidth (kHz)	LIMIT
1001.00	845.80	Separated by a minimum of 25 kHz

Tested by: Jun-Hui, Lee / Senior Engineer



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9. NUMBER OF HOPPING CHANNELS

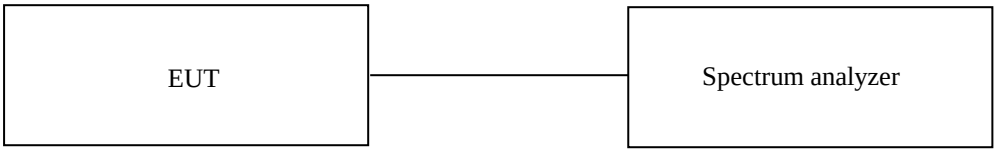
9.1 Operating environment

Temperature : 23.0 ℃

Relative humidity : 54.3 % 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. (Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 29, 2015 (1Y)

All test equipment used is calibrated on a regular basis.

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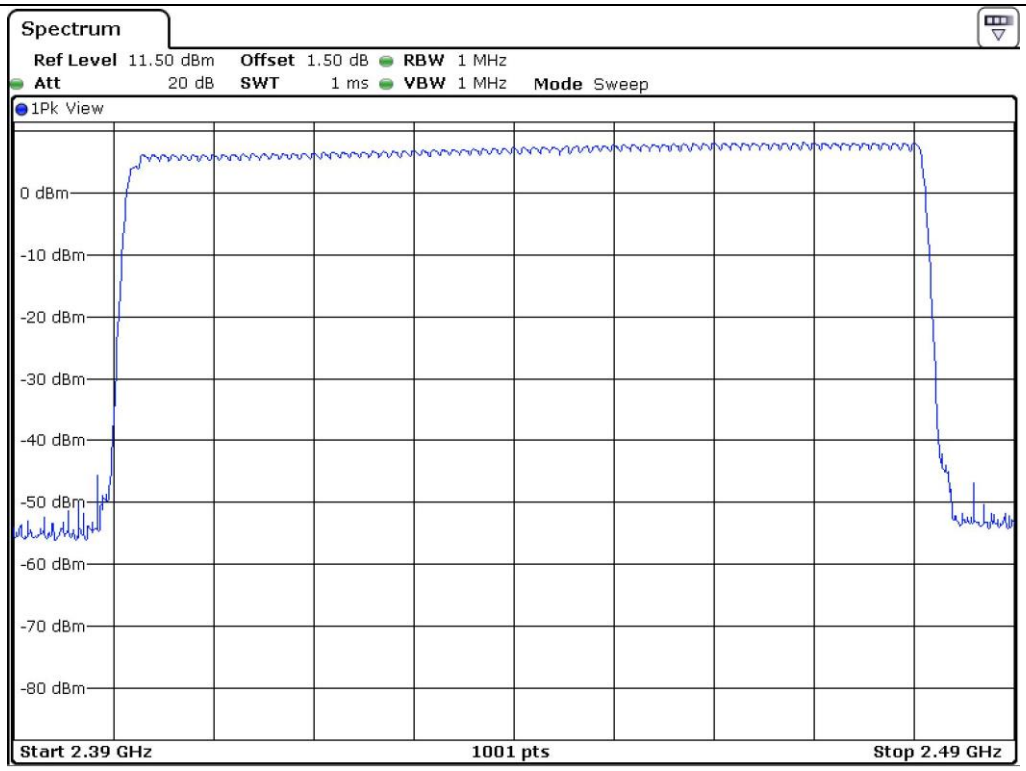
9.4 Test data for 1 Mbps

-. Test Date : September 30, 2015

-. 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



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

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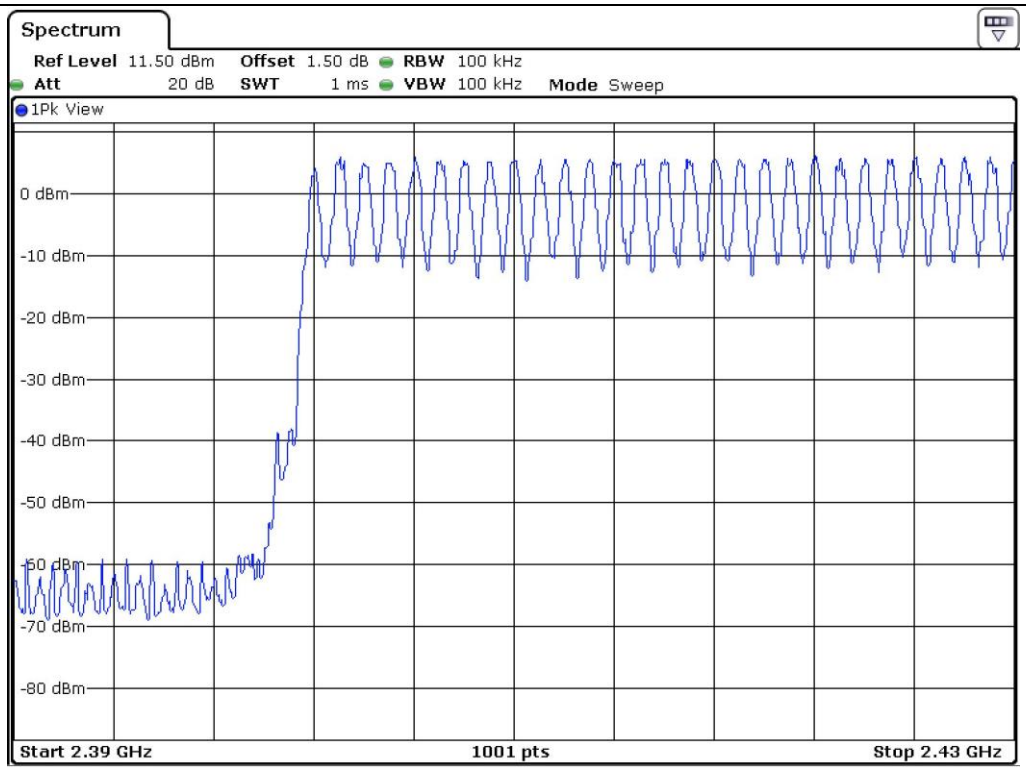
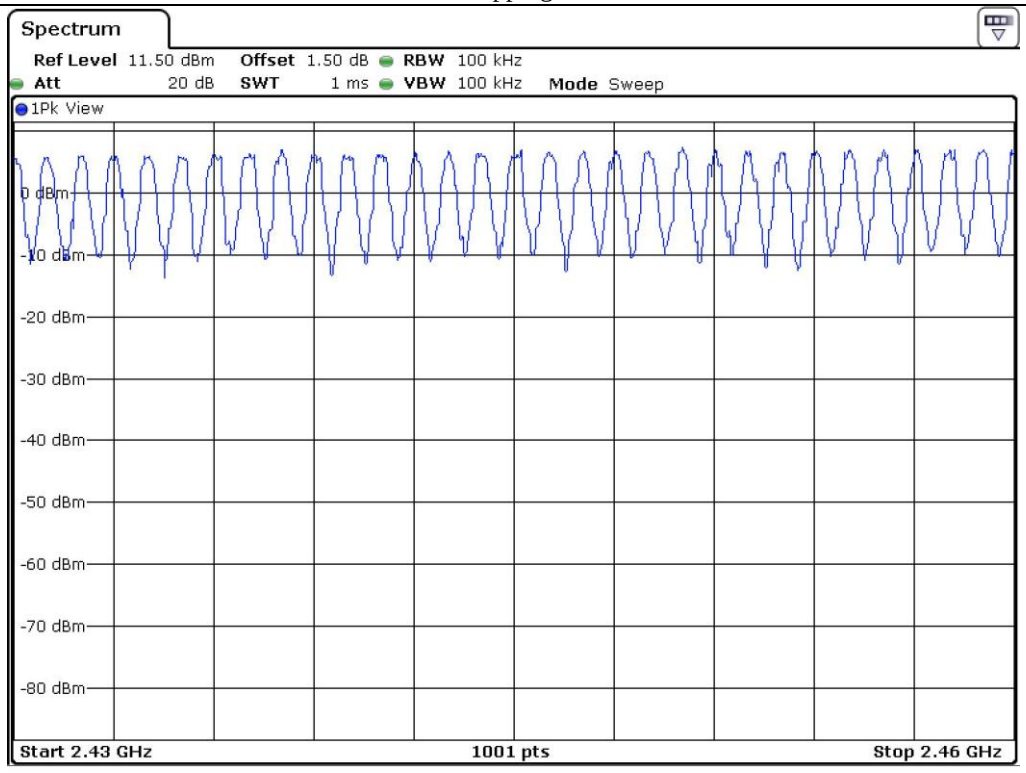


Number of hopping channel: 28



Number of hopping channel: 30

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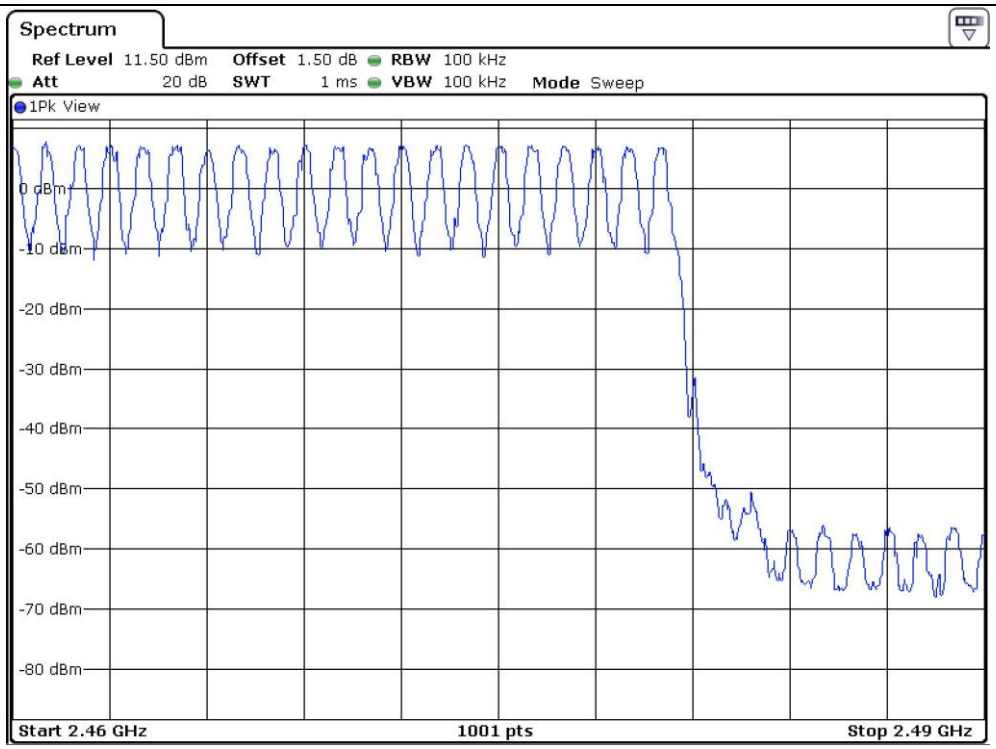

Number of hopping channel: 21

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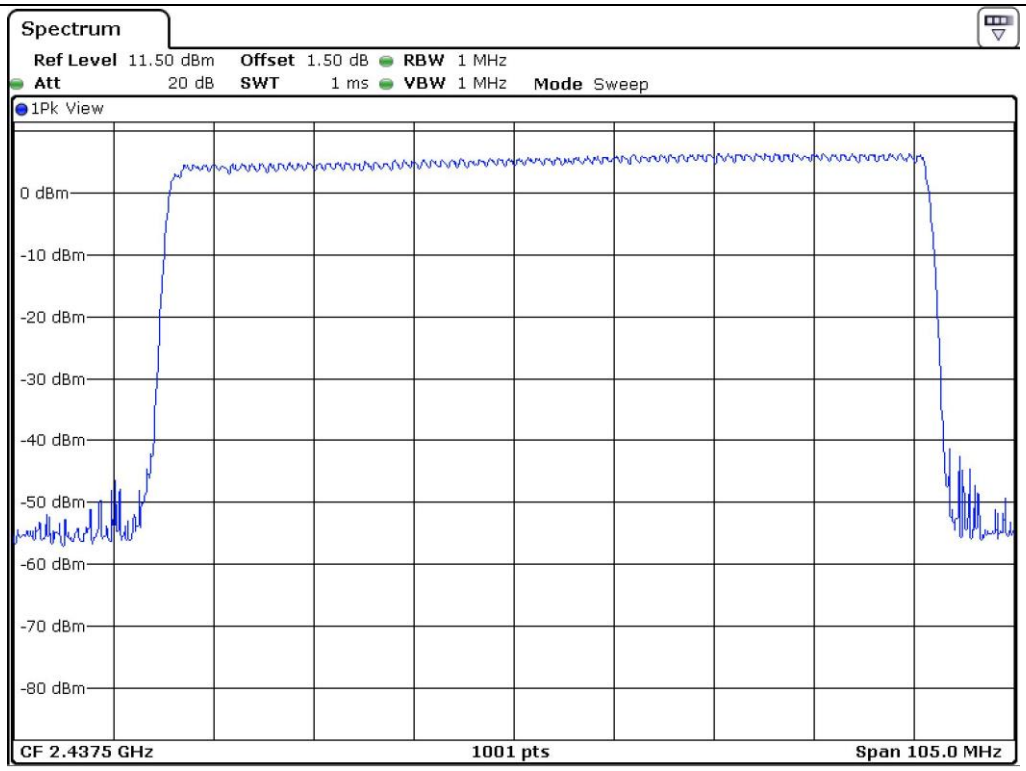
9.5 Test data for 2 Mbps

-. Test Date : September 30, 2015

-. 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



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

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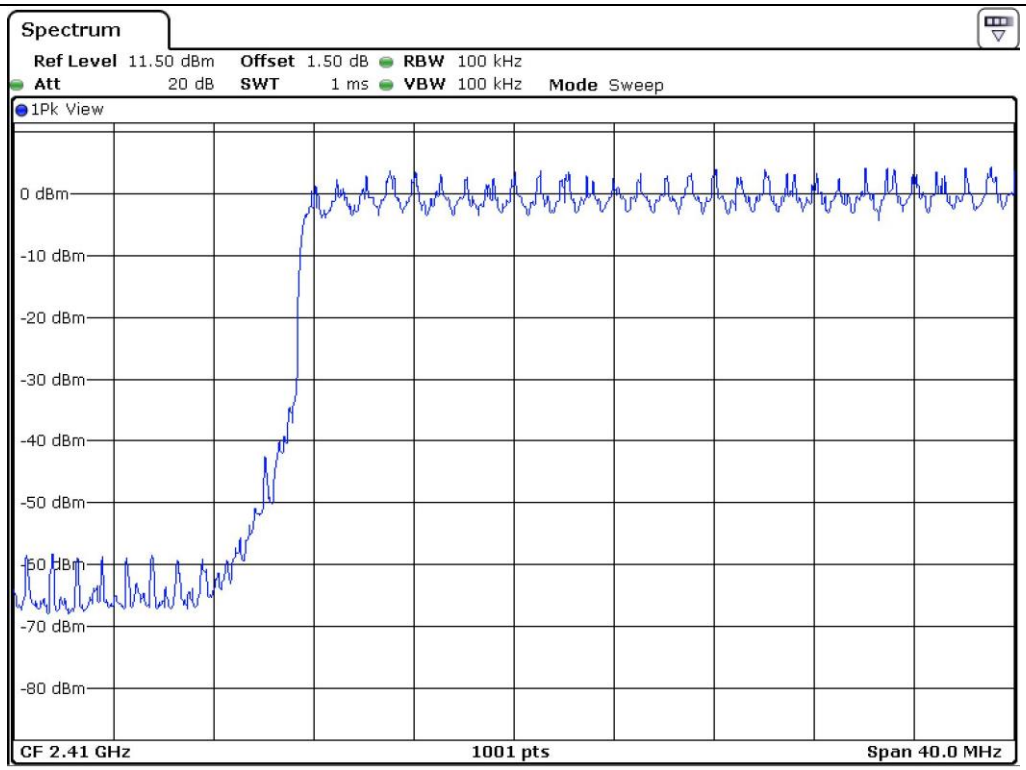
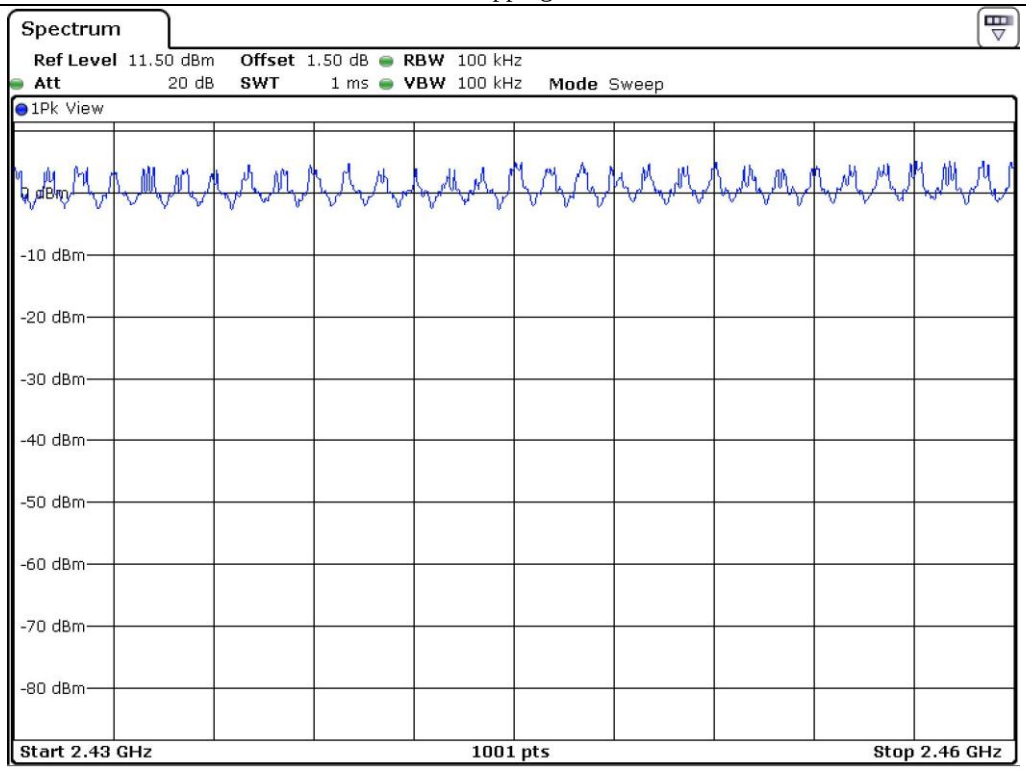


Number of hopping channel: 28



Number of hopping channel: 30

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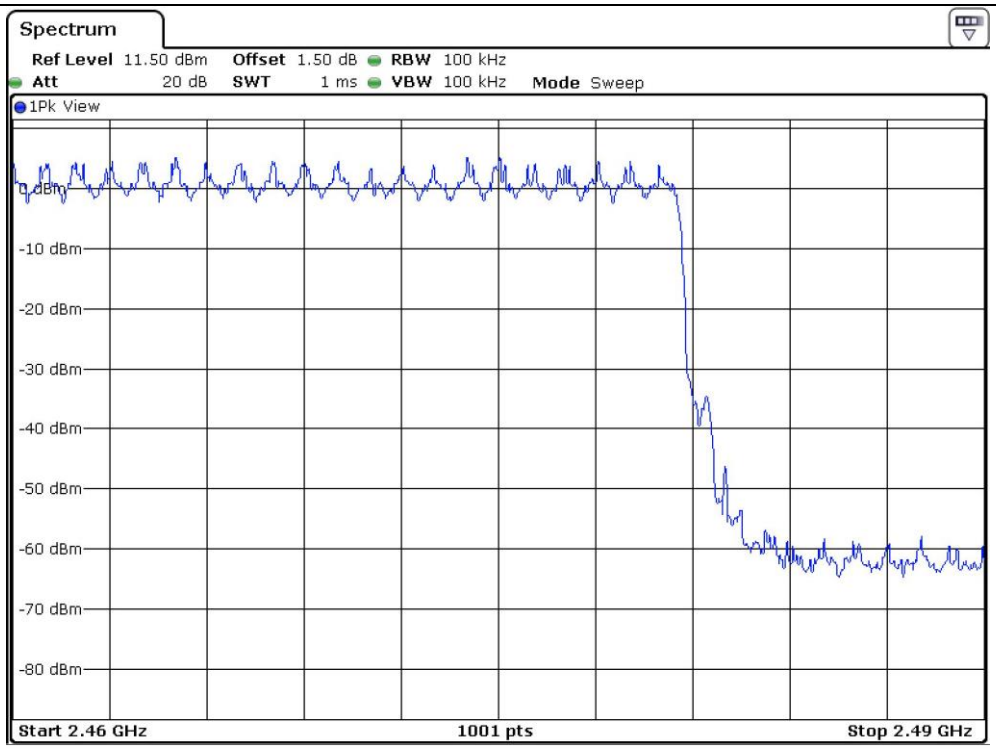

Number of hopping channel: 21

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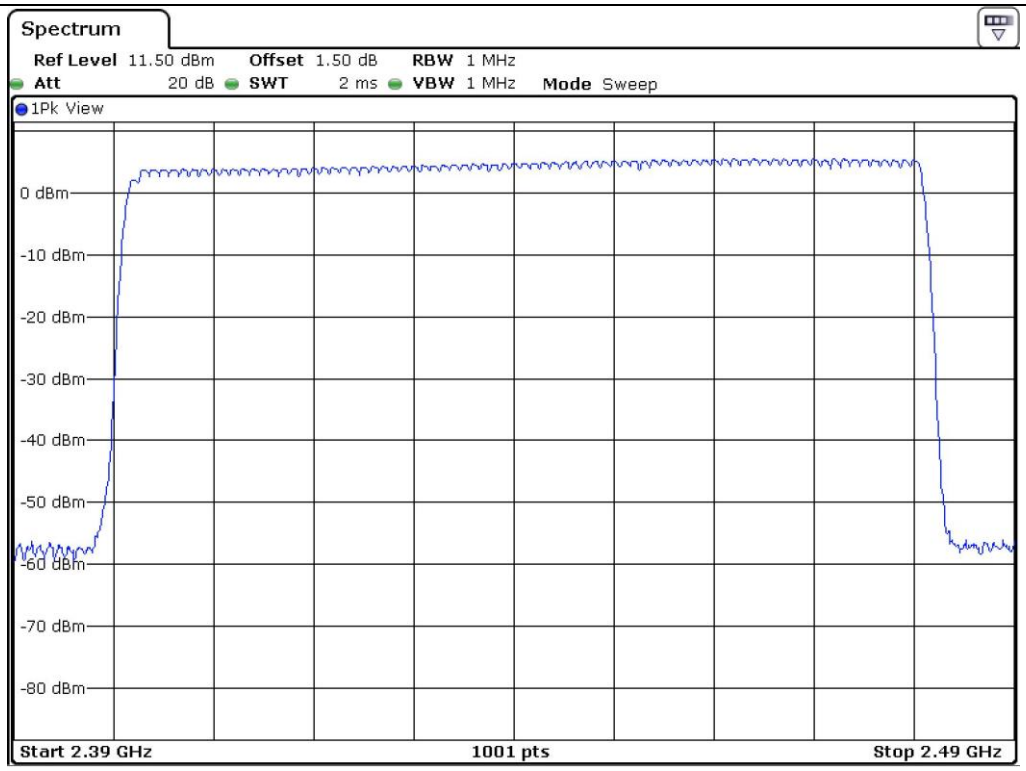
9.6 Test data for 3 Mbps

-. Test Date : September 30, 2015

-. 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



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

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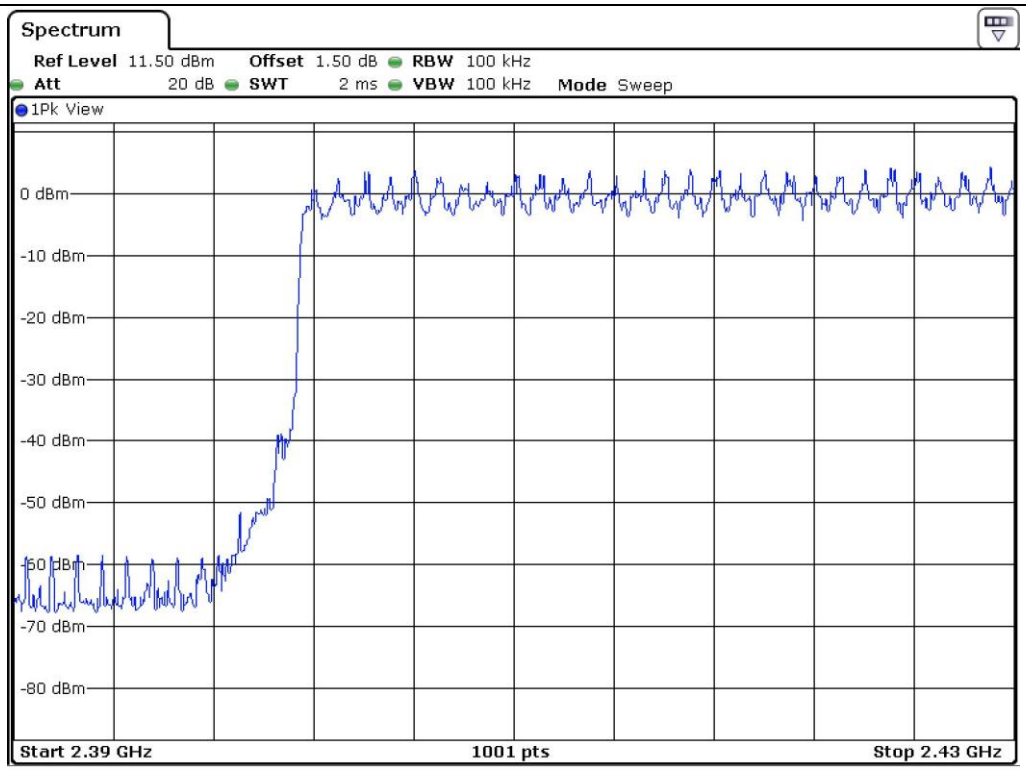
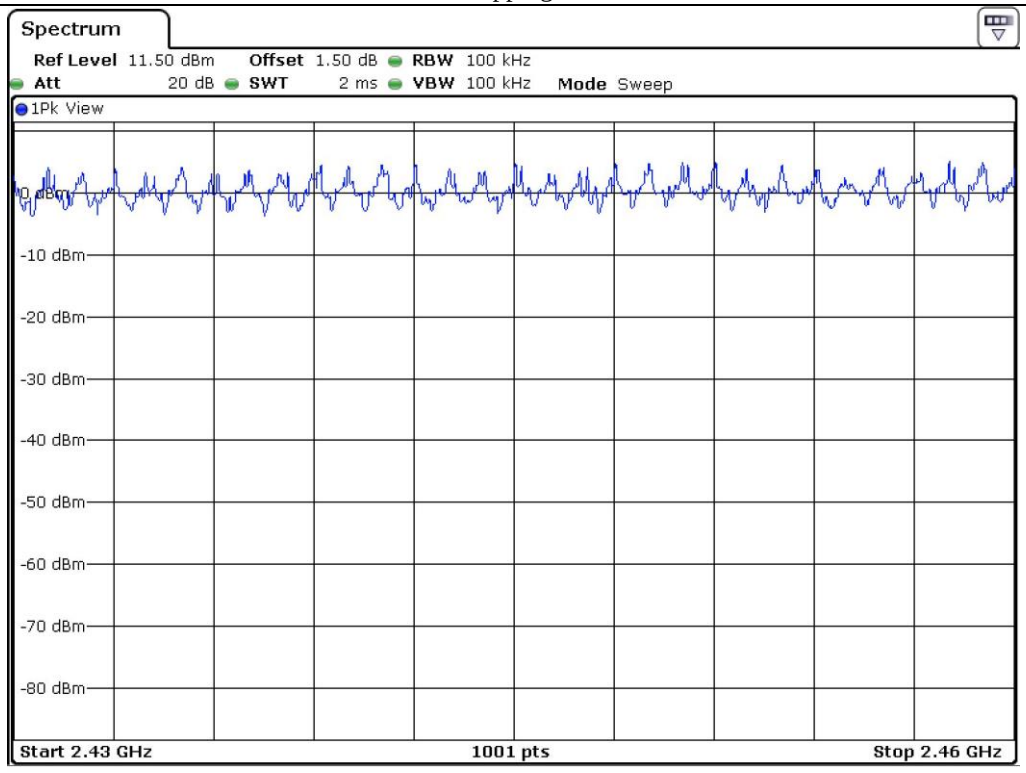


Number of hopping channel: 28



Number of hopping channel: 30

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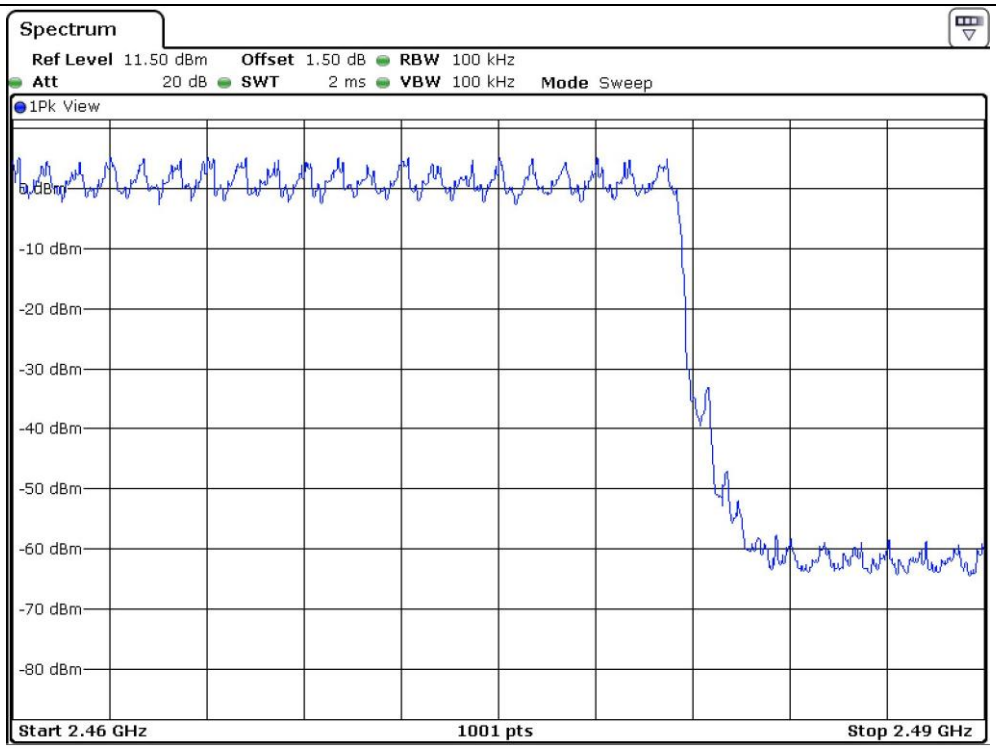

Number of hopping channel: 21

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10. TIME OF OCCUPANCY

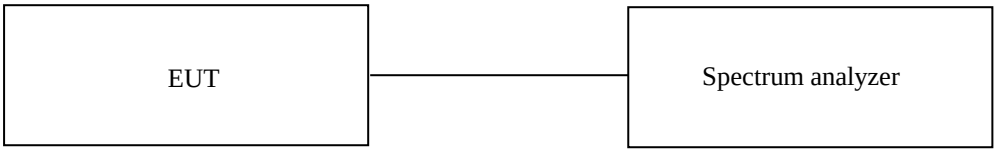
10.1 Operating environment

Temperature : 23.0 ℃

Relative humidity : 54.3 % 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. (Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 29, 2015 (1Y)

All test equipment used is calibrated on a regular basis.

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10.4 Test data for 1 Mbps

-. Test Date : September 30, 2015

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

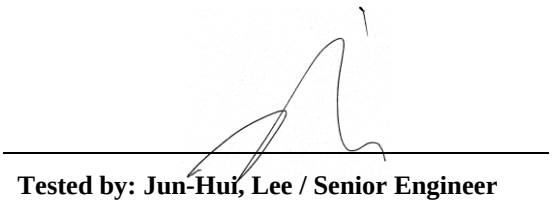
For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel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

Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.380	10.13	31.6	121.64	400	PASS
DH3	1.630	5.06	31.6	260.63	400	
DH5	2.880	3.38	31.6	307.61	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

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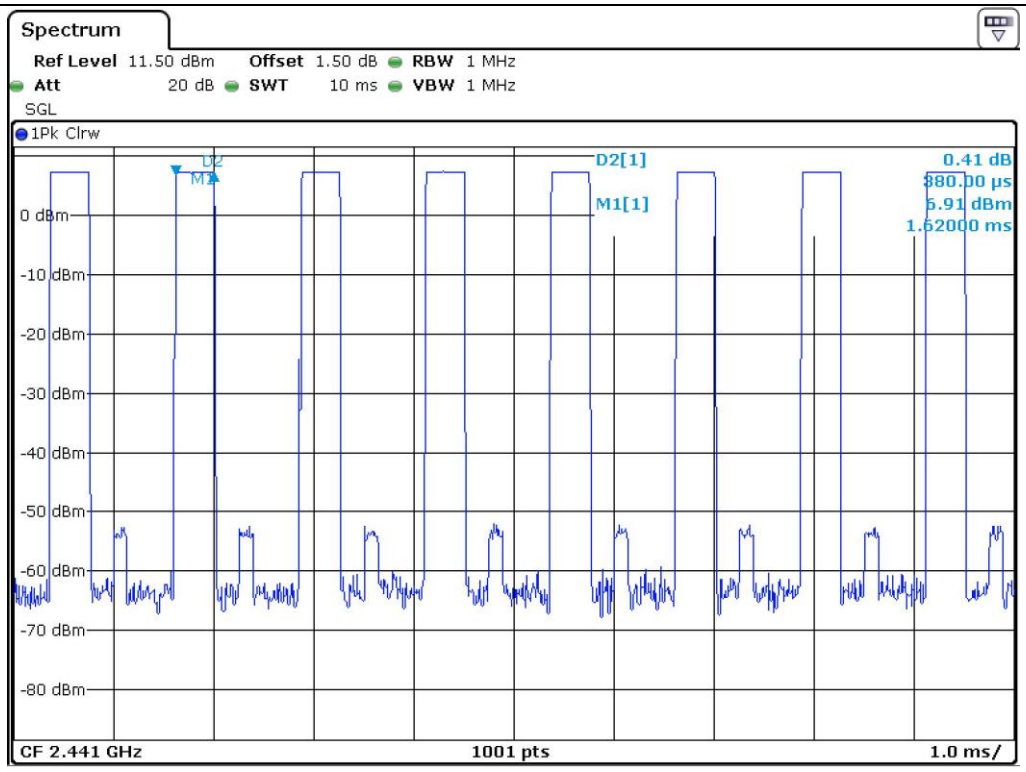
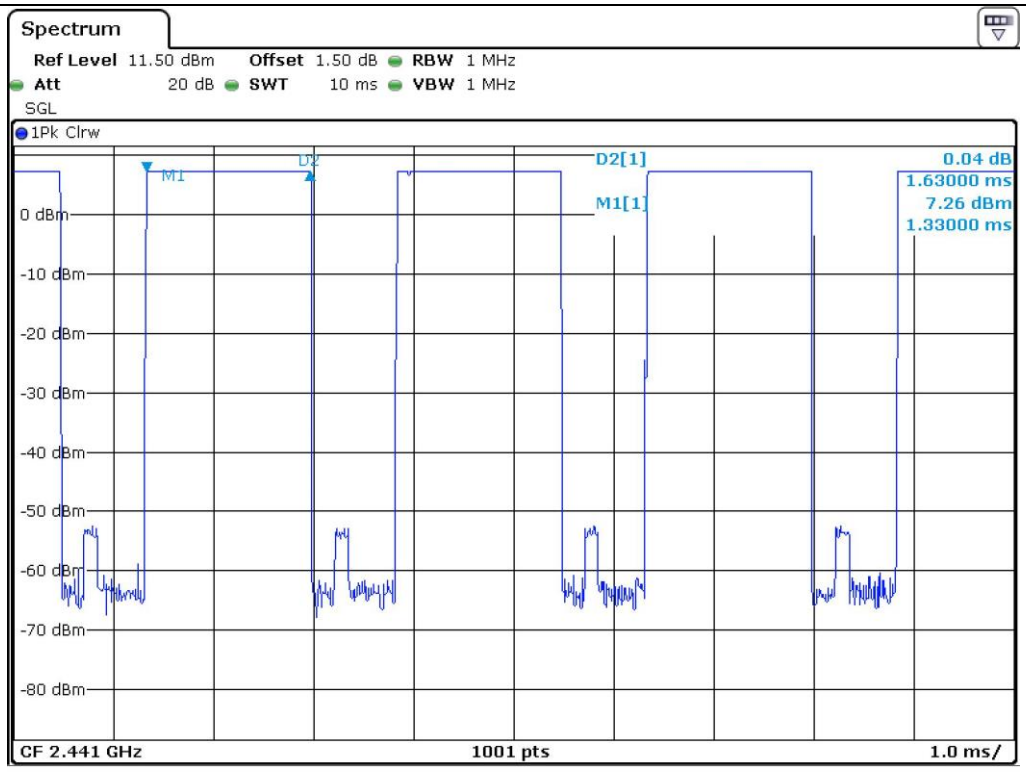


DH1



DH3

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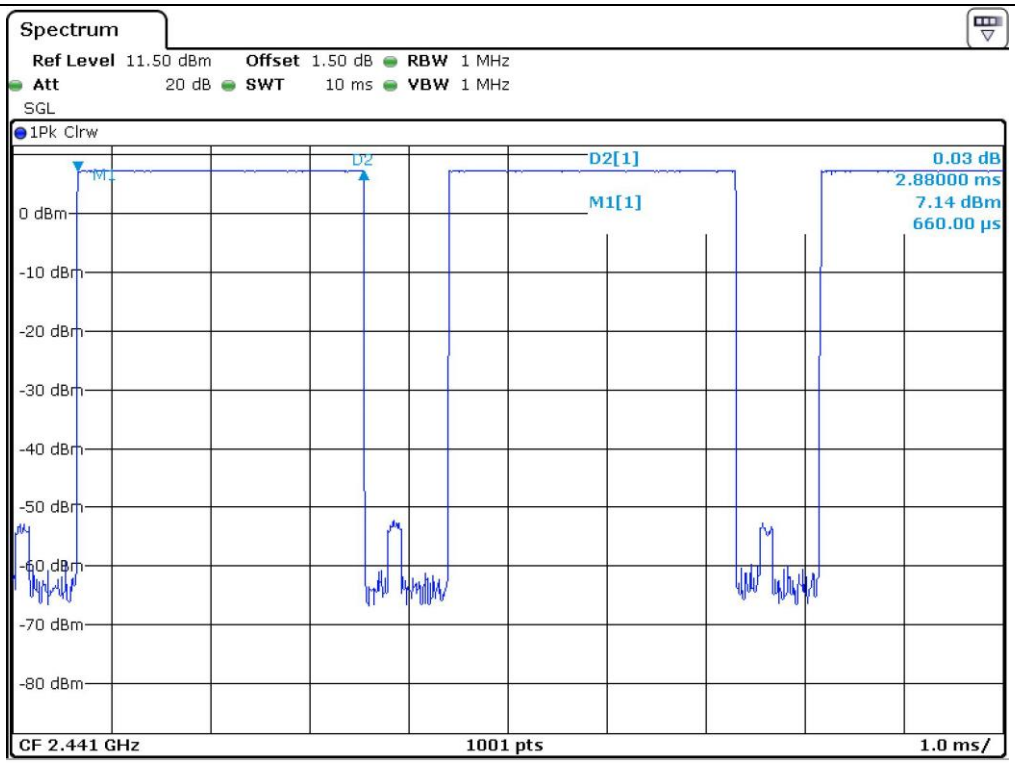

DH5

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10.5 Test data for 2 Mbps

-. Test Date : September 30, 2015

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

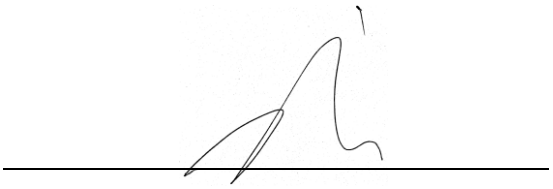
For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel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

Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.380	10.13	31.6	121.64	400	PASS
DH3	1.630	5.06	31.6	260.63	400	
DH5	2.880	3.38	31.6	307.61	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

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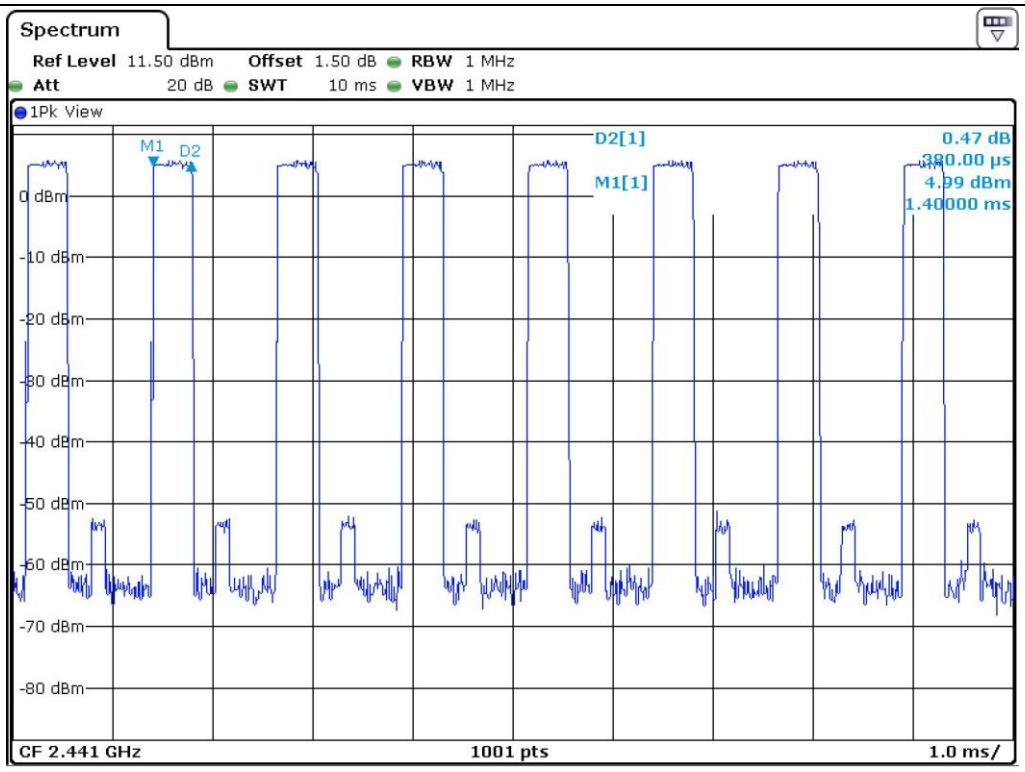
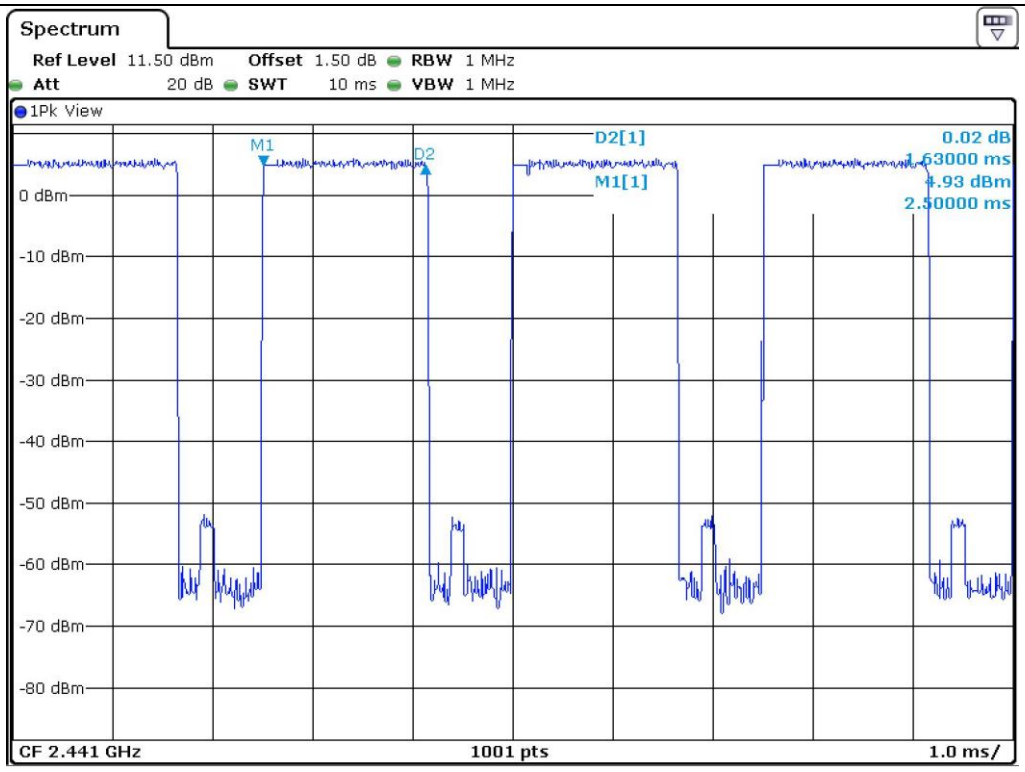


DH1



DH3

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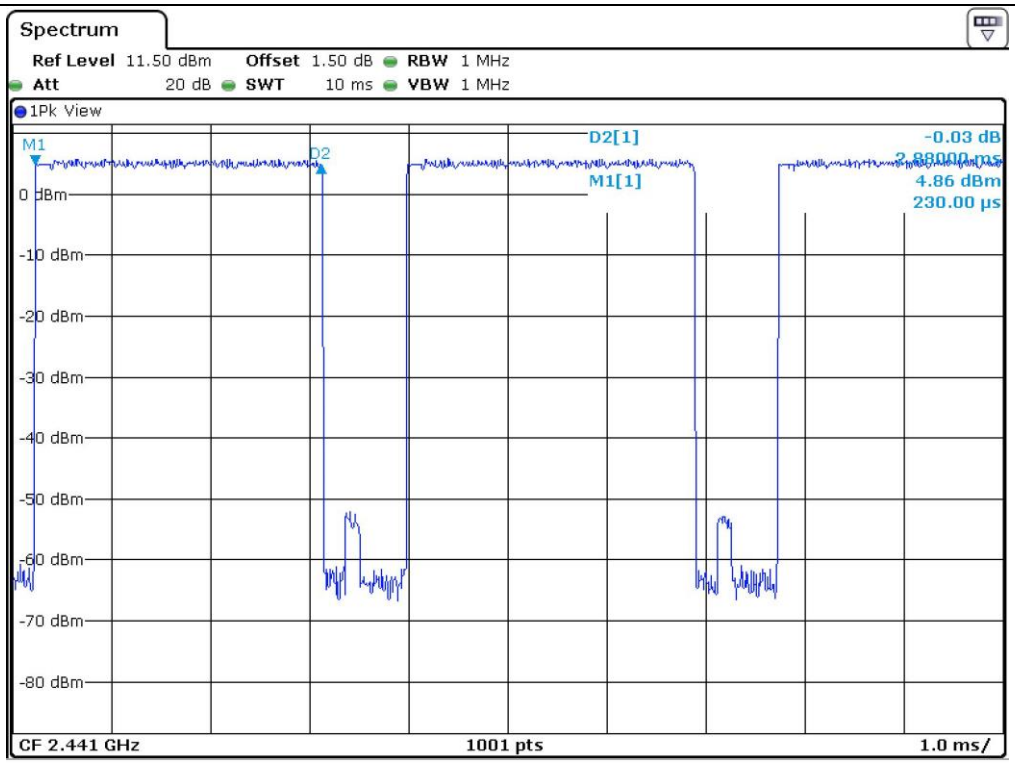

DH5

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10.6 Test data for 3 Mbps

-. Test Date : September 30, 2015

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

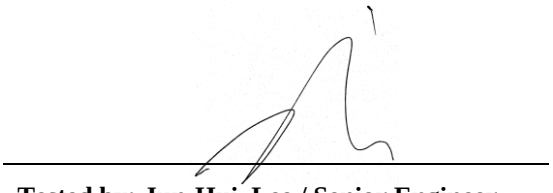
For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and for DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5 times slots for transmitting and 1 time slot for receiving. So The EUT has each channel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

Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.380	10.13	31.6	121.64	400	PASS
DH3	1.630	5.06	31.6	260.63	400	
DH5	2.880	3.38	31.6	307.61	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

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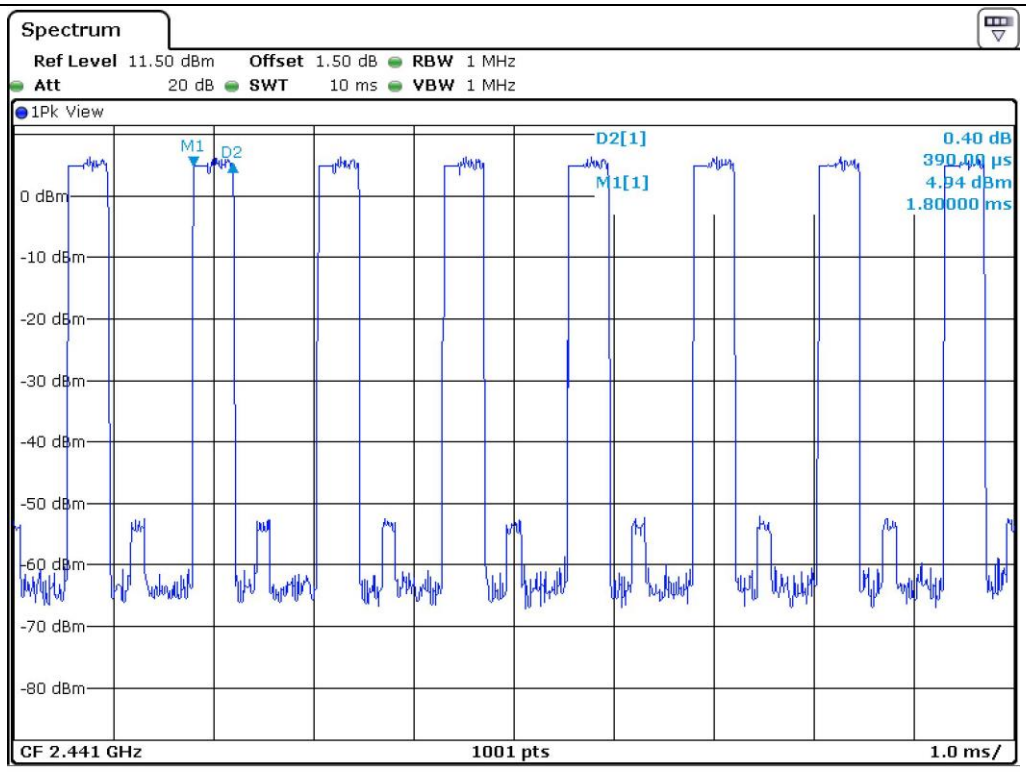
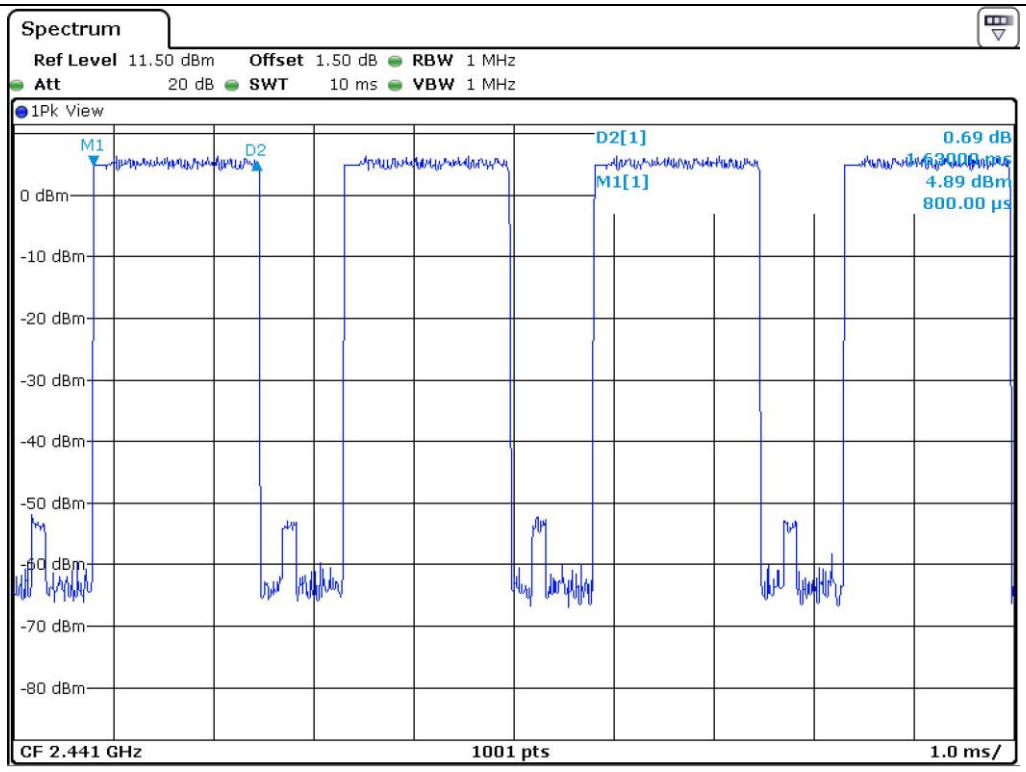


DH1



DH3

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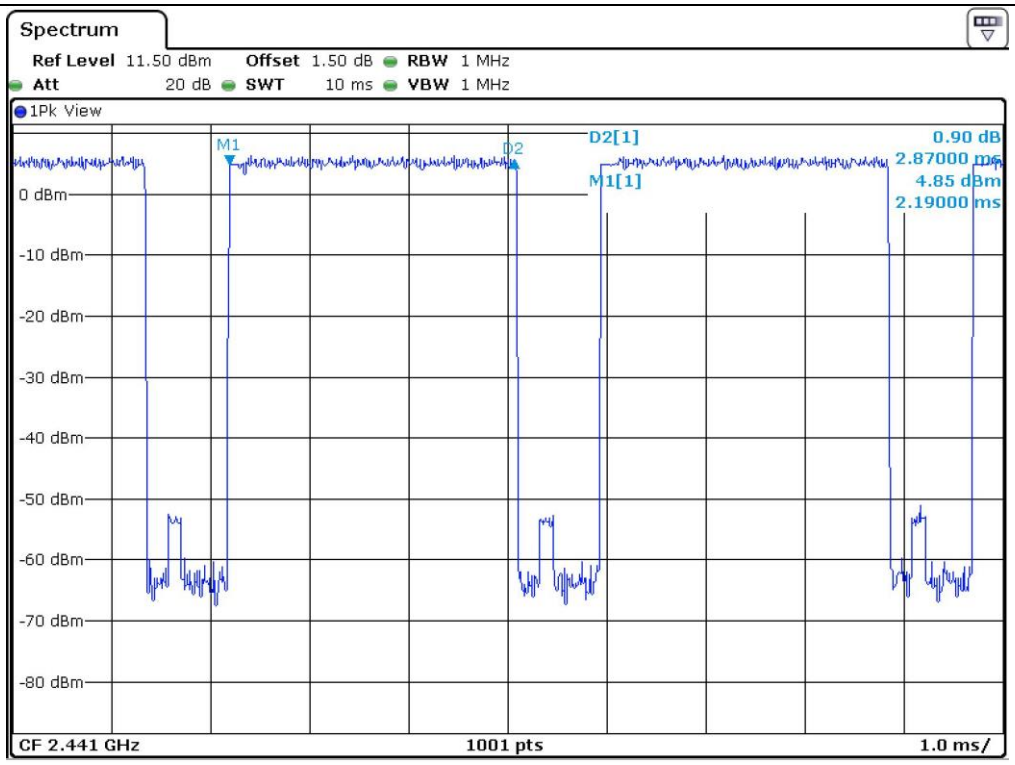

DH5

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