

# FCC Test Report

Product Name	Notebook PC
Model No.	E202S, L202S, R206S
FCC ID.	MSQE202S

Applicant	ASUSTeK COMPUTER INC.
Address	4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan

Date of Receipt	Apr. 27, 2015
Issued Date	Jun. 26, 2015
Report No.	1550007R-RFUSP23V00
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

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# Test Report

Issued Date: Jun. 26, 2015 Report No.: 1550007R-RFUSP23V00



Product Name	Notebook PC
Applicant	ASUSTeK COMPUTER INC.
Address	4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan
Manufacturer	1. Digitek(Chongqing) Limited
	2. Tech-Com(Shanghai) Computer Co. Ltd.
	3. Tech-Front (Chongqing) Computer Co., Ltd.
	4. WISTRON INFOCOMM(CHONGQING) CO., LTD.
Model No.	E202S, L202S, R206S
FCC ID.	MSQE202S
EUT Rated Voltage	AC 100-240V, 50/60Hz
EUT Test Voltage	AC 120V/60Hz
Trade Name	ASUS
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2014
	ANSI C63.4: 2014, ANSI C63.10: 2013
Test Result	Complied

Documented By :

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Tested By

:

1

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Approved By

(Director / Vincent Lin)

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# 1. GENERAL INFORMATION

# 1.1. EUT Description

Product Name	Notebook PC
Trade Name	ASUS
Model No.	E202S, L202S, R206S
FCC ID.	MSQE202S
Frequency Range	2402 – 2480MHz
Channel Number	79
Type of Modulation	FHSS: GFSK(1Mbps) / π /4DQPSK(2Mbps) / 8DPSK(3Mbps)
Antenna Type	PIFA Antenna
Channel Control	Auto
Antenna Gain	Refer to the table "Antenna List"
Power Adapter	MFR: PIE, M/N: AD890326
	Input: AC 100-240V~50/60Hz, 0.8A
	Output: 19V==1.75A
	Cable Out: Shielded, 1.8m

# Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	HongLin	260-26061	PIFA	0.93 dBi for 2.4 GHz
2	INPAQ	WA-P-LB-02-227	PIFA	0.47 dBi for 2.4 GHz

Note:

1. The antenna of EUT conforms to FCC 15.203.

2. Only the higher gain antenna was tested and recorded in this report.

Center Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 00:	2402 MHz	Channel 20:	2422 MHz	Channel 40:	2442 MHz	Channel 60:	2462 MHz
Channel 01:	2403 MHz	Channel 21:	2423 MHz	Channel 41:	2443 MHz	Channel 61:	2463 MHz
Channel 02:	2404 MHz	Channel 22:	2424 MHz	Channel 42:	2444 MHz	Channel 62:	2464 MHz
Channel 03:	2405 MHz	Channel 23:	2425 MHz	Channel 43:	2445 MHz	Channel 63:	2465 MHz
Channel 04:	2406 MHz	Channel 24:	2426 MHz	Channel 44:	2446 MHz	Channel 64:	2466 MHz
Channel 05:	2407 MHz	Channel 25:	2427 MHz	Channel 45:	2447 MHz	Channel 65:	2467 MHz
Channel 06:	2408 MHz	Channel 26:	2428 MHz	Channel 46:	2448 MHz	Channel 66:	2468 MHz
Channel 07:	2409 MHz	Channel 27:	2429 MHz	Channel 47:	2449 MHz	Channel 67:	2469 MHz
Channel 08:	2410 MHz	Channel 28:	2430 MHz	Channel 48:	2450 MHz	Channel 68:	2470 MHz
Channel 09:	2411 MHz	Channel 29:	2431 MHz	Channel 49:	2451 MHz	Channel 69:	2471 MHz
Channel 10:	2412 MHz	Channel 30:	2432 MHz	Channel 50:	2452 MHz	Channel 70:	2472 MHz
Channel 11:	2413 MHz	Channel 31:	2433 MHz	Channel 51:	2453 MHz	Channel 71:	2473 MHz
Channel 12:	2414 MHz	Channel 32:	2434 MHz	Channel 52:	2454 MHz	Channel 72:	2474 MHz
Channel 13:	2415 MHz	Channel 33:	2435 MHz	Channel 53:	2455 MHz	Channel 73:	2475 MHz
Channel 14:	2416 MHz	Channel 34:	2436 MHz	Channel 54:	2456 MHz	Channel 74:	2476 MHz
Channel 15:	2417 MHz	Channel 35:	2437 MHz	Channel 55:	2457 MHz	Channel 75:	2477 MHz
Channel 16:	2418 MHz	Channel 36:	2438 MHz	Channel 56:	2458 MHz	Channel 76:	2478 MHz
Channel 17:	2419 MHz	Channel 37:	2439 MHz	Channel 57:	2459 MHz	Channel 77:	2479 MHz
Channel 18:	2420 MHz	Channel 38:	2440 MHz	Channel 58:	2460 MHz	Channel 78:	2480 MHz
Channel 19:	2421 MHz	Channel 39:	2441 MHz	Channel 59:	2461 MHz		

- 1. The EUT is a Notebook PC with a built-in WLAN Bluetooth transceiver, this report for Bluetooth.
- 2. These tests were conducted on a sample for the purpose of demonstrating compliance of Bluetooth transmitter with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
- 3. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
- 4. Bluetooth operation was evaluated at both 1Mb/s and 3Mb/s data rates. 2Mb/s data rate was found, through pre-testing, to produce emissions similar to those for 3Mb/s.

Test Mode	Mode 1: Transmit - 1Mbps (GFSK)
	Mode 2: Transmit - 3Mbps (8DPSK)



# **1.3.** Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Prod	uct	Manufacturer	Model No.	Serial No.	Power Cord
1	Monitor	DELL	U2410	CN-0J257M-728-01I-038L	N/A
2	Keyboard	Logitech	Y-UR83	SY848UK	N/A
3	USB Mouse	Logitech	M-BE58	HCA30103299	N/A
4	Earphone	Ergotech	ET-E201	N/A	N/A
5	FLASH	Transcend	JetFlash110	155422-2931	N/A

Signal Cable Type		Signal cable Description
Α	HDMI Cable	Shielded, 1.8m
В	Keyboard Cable	Shielded, 1.2m
С	Mouse Cable	Shielded, 1.2m
D	Earphone Cable	Shielded, 1.8m
E	USB to USB Cable	Shielded, 1.5m

# **1.4.** Configuration of Tested System



# **1.5.** EUT Exercise Software

- 1. Setup the EUT as shown in Section 1.4.
- 2. Execute software "Raltek MP Tool" on the EUT.
- 3. Configure the test mode, the test channel, and the data rate.
- 4. Press "OK" to start the continuous Transmit.
- 5. Verify that the EUT works properly.

# 1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	30-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded

from QuieTek Corporation's Web Site: <u>http://www.quietek.com/chinese/about/certificates.aspx?bval=5</u> The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site: <u>http://www.quietek.com/</u>

Site Description:	File on			
	Federal Communications Commission FCC Engineering Laboratory			
	7435 Oakland Mills Road			
	Columbia, MD 21046			
	Registration Number: 92195			
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Site Address:	No.5-22, Ruishukeng,			
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	Taiwan, R.O.C.			
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	E-Mail · service@quietek com			

FCC Accreditation Number: TW1014

# 2. Conducted Emission

# 2.1. Test Equipment

	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
Χ	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2014	
X	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2015	Peripherals
Χ	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2015	EUT
	DC LISN	Schwarzbeck	8226 / 176	Mar., 2015	EUT
Χ	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2015	
	No.1 Shielded Room				

Note:

- 1. All equipments are calibrated every one year.
- 2. The test instruments marked by "X" are used to measure the final test results.

# 2.2. Test Setup



#### 2.3. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBµV) Limit			
Frequency MHz	Limits		
	QP	AV	
0.15 - 0.50	66-56	56-46	
0.50-5.0	56	46	
5.0 - 30	60	50	

Remarks: In the above table, the tighter limit applies at the band edges.

# 2.4. Test Procedure

The EUT and Peripherals are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

The EUT was setup to ANSI C63.4, 2014; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

# 2.5. Uncertainty

± 2.26 dB

# 2.6. Test Result of Conducted Emission

Notebook PC
Conducted Emission Test
Line 1
Mode 2: Transmit - 3Mbps (8DPSK) (2441MHz)

Frequency	Frequency Correct Read		Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	dBµV	dB	dBµV
LINE 1					
Quasi-Peak					
0.154	9.670	35.540	45.210	-20.676	65.886
0.185	9.661	31.400	41.061	-23.939	65.000
0.228	9.662	21.560	31.222	-32.549	63.771
0.298	9.666	18.770	28.436	-33.335	61.771
0.466	9.675	30.700	40.375	-16.596	56.971
0.677	9.686	19.770	29.456	-26.544	56.000
Average					
0.154	9.670	20.370	30.040	-25.846	55.886
0.185	9.661	19.970	29.631	-25.369	55.000
0.228	9.662	7.240	16.902	-36.869	53.771
0.298	9.666	3.420	13.086	-38.685	51.771
0.466	9.675	21.690	31.365	-15.606	46.971
0.677	9.686	11.170	20.856	-25.144	46.000

- 1. All Reading Levels are Quasi-Peak and average value.
- 2. " " means the worst emission level.
- 3. Measurement Level = Reading Level + Correct Factor

Product	:	Notebook PC
Test Item	:	Conducted Emission Test
Power Line	:	Line 2
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK) (2441MHz)

Frequency Correct		Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	dBµV	dB	dBµV
LINE 2					
Quasi-Peak					
0.150	9.671	37.880	47.551	-18.449	66.000
0.209	9.661	27.450	37.111	-27.203	64.314
0.283	9.665	23.280	32.945	-29.255	62.200
0.431	9.673	29.040	38.713	-19.258	57.971
0.502	9.677	28.910	38.587	-17.413	56.000
0.705	9.688	22.950	32.638	-23.362	56.000
Average					
0.150	9.671	23.180	32.851	-23.149	56.000
0.209	9.661	13.650	23.311	-31.003	54.314
0.283	9.665	12.540	22.205	-29.995	52.200
0.431	9.673	20.140	29.813	-18.158	47.971
0.502	9.677	19.360	29.037	-16.963	46.000
0.705	9.688	14.810	24.498	-21.502	46.000

- 1. All Reading Levels are Quasi-Peak and average value.
- 2. " means the worst emission level.
- 3. Measurement Level = Reading Level + Correct Factor

# 3. Peak Power Output

# **3.1. Test Equipment**

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Х	Power Meter	Anritsu	ML2495A/6K00003357	May, 2015
Х	Power Sensor	Anritsu	MA2411B/0738448	Jun., 2015

Note: 1. All equipments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

# 3.2. Test Setup



# **3.3.** Limit

The maximum peak power shall be less 1Watt.

# **3.4.** Test Procedure

The EUT was setup to ANSI C63.4, 2014; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

# 3.5. Uncertainty

 $\pm$  1.27 dB

# 3.6. Test Result of Peak Power Output

Product	:	Notebook PC
Test Item	:	Peak Power Output
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK)

Channel No.	Frequency	Measurement	Required Limit	Result
	(MHz)	(dBm)		
Channel 00	2402.00	3.49	1 Watt= 30 dBm	Pass
Channel 39	2441.00	3.74	1 Watt= 30 dBm	Pass
Channel 78	2480.00	3.43	1 Watt= 30 dBm	Pass



Product	:	Notebook PC
Test Item	:	Peak Power Output
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK)

Channel No.	Frequency	Measurement	Required Limit	Result
	(MHz)	(dBm)		
Channel 00	2402.00	5.41	1 Watt= 30 dBm	Pass
Channel 39	2441.00	5.69	1 Watt= 30 dBm	Pass
Channel 78	2480.00	5.43	1 Watt= 30 dBm	Pass



# 4. Radiated Emission

#### 4.1. Test Equipment

The following test equipments are used during the radiated emission test:

Test Site	Equipment		Manufacturer	Model No./Serial No.	Last Cal.
$\Box$ Site # 3	Х	Magnetic Loop Antenna	Teseq	HLA6121/ 37133	Sep, 2014
	Х	Bilog Antenna	Schaffner Chase	CBL6112B/ 2707	Jun., 2015
	Х	EMI Test Receiver	R&S	ESCS 30/838251/ 001	Jun., 2015
	Х	Coaxial Cable	QTK(Arnist)	RG 214/ LC003-RG	Jun., 2015
	Х	Coaxial signal switch	Arnist	MP59B/ 6200798682	Jun., 2015

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
CB # 8	Х	Spectrum Analyzer	R&S	FSP40/ 100339	Oct., 2014
	Х	Horn Antenna	ETS-Lindgren	3117/ 35205	Mar., 2015
	Х	Horn Antenna	Schwarzbeck	BBHA9170/209	Jan., 2015
	Х	Horn Antenna	TRC	AH-0801/95051	Aug., 2014
	Х	Pre-Amplifier	EMCI	EMC012630SE/980210	Jan., 2015
	Х	Pre-Amplifier	MITEQ	JS41-001040000-58-5P/153945	Jul., 2014
	Х	Pre-Amplifier	NARDA	DBL-1840N506/013	Jul., 2014

Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

2. The test instruments marked with "X" are used to measure the final test results.

# 4.2. Test Setup

sBelow 1GHz



Above 1GHz



# 4.3. Limits

#### **General Radiated Emission Limits**

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits					
Frequency MHz	uV/m @3m	dBµV/m@3m			
30-88	100	40			
88-216	150	43.5			
216-960	200	46			
Above 960	500	54			

Remarks: 1. RF Voltage  $(dB\mu V) = 20 \log RF$  Voltage (uV)

- 2. In the Above Table, the tighter limit applies at the band edges.
- 3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

#### 4.4. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested compliance to FCC 47CFR 15.249 requirements.

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground, when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna. The worst radiated emission is measured in the Open Area Test Site on the Final Measurement.

The measurement frequency range form 9kHz - 10th Harmonic of fundamental was investigated.

#### 4.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

Product	: Notebook PC					
Test Item	: Harmonic Radiated Emission					
Test Site	: No.3 OATS					
Test Mode	: Mode 1: T	ransmit - 1Mbp	s (GFSK)(2402MHz)			
<b>F</b> #2 <b>3 2 3</b>	Compost	Decding	Maagumantaat	Manain	T ::4	
riequency	Contect	Reading	Measurement	Margin	LIIIII	
	Factor	Level	Level			
MHz	dB	dBµV	dBµV/m	dB	dBµV/m	
Horizontal						
<b>Peak Detector:</b>						
4804.000	3.139	36.120	39.259	-34.741	74.000	
7206.000	10.038	35.040	45.078	-28.922	74.000	
9608.000	13.419	35.650	49.070	-24.930	74.000	
Average						
<b>Detector:</b>						
Vertical						
Peak Detector:						
4804.000	6.450	36.350	42.800	-31.200	74.000	
7206.000	10.907	35.040	45.947	-28.053	74.000	
9608.000	13.816	35.940	49.757	-24.243	74.000	
Average						
Detector:						

#### 4.6. Test Result of Radiated Emission

Note:

---

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	:	Notebook PC
Test Item	:	Harmonic Radiated Emission
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK)(2441MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	$dB\mu V/m$	dB	dBµV/m
Horizontal					
Peak Detector:					
4882.000	2.889	36.070	38.959	-35.041	74.000
7323.000	11.783	34.250	46.033	-27.967	74.000
9764.000	12.338	35.630	47.968	-26.032	74.000
Average					
<b>Detector:</b>					
Vertical					
Peak Detector:					
4882.000	5.601	36.390	41.992	-32.008	74.000
7323.000	12.664	34.150	46.815	-27.185	74.000
9764.000	12.803	37.020	49.823	-24.177	74.000
Average					
<b>Detector:</b>					

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- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	:	Notebook PC
Test Item	:	Harmonic Radiated Emission
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK)(2480MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	$dB\mu V/m$	dB	dBµV/m
Horizontal					
<b>Peak Detector:</b>					
4960.000	2.722	35.940	38.662	-35.338	74.000
7440.000	12.451	34.990	47.441	-26.559	74.000
9920.000	13.180	35.020	48.201	-25.799	74.000
Average					
<b>Detector:</b>					
Vertical					
<b>Peak Detector:</b>					
4960.000	5.519	36.820	42.339	-31.661	74.000
7440.000	13.310	34.630	47.940	-26.060	74.000
9920.000	13.682	35.360	49.043	-24.957	74.000
Average					
<b>Detector:</b>					

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- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.



Product	: Notebook PC					
Test Item	: Harmonic Radiated Emission					
Test Site	: No.3 OATS					
Test Mode	: Mode 2:	Transmit - 3Mbp	os (8DPSK)(2402MHz	z)		
Frequency	Correct	Reading	Measurement	Margin	Limit	
	Factor	Level	Level			
MHz	dB	dBµV	$dB\mu V/m$	dB	dBµV/m	
Horizontal						
Peak Detector:						
4804.000	3.139	36.980	40.119	-33.881	74.000	
7206.000	10.038	33.250	43.288	-30.712	74.000	
9608.000	13.419	33.050	46.470	-27.530	74.000	
Average						
Detector:						
Vertical						
Peak Detector:						
4804.000	6.450	34.810	41.260	-32.740	74.000	
7206.000	10.907	32.660	43.567	-30.433	74.000	
9608.000	13.816	34.190	48.007	-25.993	74.000	
Average						
Detector:						

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.



Product Test Item Test Site Test Mode	<ul> <li>Notebook PC</li> <li>Harmonic Radiated Emission</li> <li>No.3 OATS</li> <li>Mode 2: Transmit - 3Mbps (8DPSK) (2441MHz)</li> </ul>				
Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	$dB\mu V/m$	dB	dBµV/m
Horizontal					
Peak Detector:					
4882.000	2.889	37.000	39.889	-34.111	74.000
7323.000	11.783	34.660	46.443	-27.557	74.000
9764.000	12.338	35.150	47.488	-26.512	74.000
Average					
<b>Detector:</b>					
Vertical					
Peak Detector:					
4882.000	5.601	38.060	43.662	-30.338	74.000
7323.000	12.664	35.100	47.765	-26.235	74.000
9764.000	12.803	34.840	47.643	-26.357	74.000
Average					
Detector:					

=

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.



Product	: Notebook PC					
Test Item	: Harmonic Radiated Emission					
Test Site	: No.3 OATS					
Test Mode	: Mode 2: Transmit - 3Mbps (8DPSK) (2480MHz)					
Frequency	Correct	Reading	Measurement	Margin	Limit	
	Factor	Level	Level			
MHz	dB	dBµV	$dB\mu V/m$	dB	$dB\mu V/m$	
Horizontal						
<b>Peak Detector:</b>						
4960.000	2.722	35.600	38.322	-35.678	74.000	
7440.000	12.451	34.540	46.991	-27.009	74.000	
9920.000	13.180	35.040	48.221	-25.779	74.000	
Average						
<b>Detector:</b>						
Vertical						
<b>Peak Detector:</b>						
4960.000	5.519	36.060	41.579	-32.421	74.000	
7440.000	13.310	34.580	47.890	-26.110	74.000	
9920.000	13.682	35.280	48.963	-25.037	74.000	
Average						
<b>Detector:</b>						

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	:	Notebook PC
Test Item	:	General Radiated Emission
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK) (2441MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	$dB\mu V/m$	dB	dBµV/m
Horizontal					
266.680	-4.963	36.381	31.418	-14.582	46.000
392.780	-2.096	33.151	31.055	-14.945	46.000
532.460	1.957	39.779	41.736	-4.264	46.000
598.420	3.991	35.490	39.481	-6.519	46.000
761.380	4.345	29.026	33.371	-12.629	46.000
928.220	6.893	26.033	32.926	-13.074	46.000
Vertical					
266.680	-8.213	36.381	28.168	-17.832	46.000
396.660	-4.356	34.198	29.842	-16.158	46.000
532.460	-0.563	42.947	42.384	-3.616	46.000
613.940	-1.687	34.926	33.239	-12.761	46.000
679.900	1.000	30.180	31.180	-14.820	46.000
782.720	4.325	27.294	31.619	-14.381	46.000

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	:	Notebook PC
Test Item	:	General Radiated Emission
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK) (2441MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	$dB\mu V/m$	dB	$dB\mu V/m$
Horizontal					
266.680	-4.963	34.780	29.817	-16.183	46.000
398.600	-2.268	37.942	35.674	-10.326	46.000
532.460	1.957	39.486	41.443	-4.557	46.000
598.420	3.991	35.854	39.845	-6.155	46.000
666.320	2.031	33.310	35.342	-10.658	46.000
800.180	5.141	33.161	38.302	-7.698	46.000
Vertical					
390.840	-3.099	37.981	34.882	-11.118	46.000
532.460	-0.563	37.599	37.036	-8.964	46.000
598.420	-2.979	35.266	32.287	-13.713	46.000
666.320	-1.809	29.734	27.926	-18.074	46.000
934.040	5.792	24.509	30.301	-15.699	46.000
968.960	8.191	23.340	31.531	-22.469	54.000

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.
- 8. No emission found between lowest internal used/generated frequency to 30MHz.

# 5. **RF Antenna Conducted Test**

### 5.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun., 2015
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun., 2015
Х	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015

Note: 1. All equipments are calibrated every one year.

2. The test instruments Marked "X" are used to measure the final test results.

#### 5.2. Test Setup



# 5.3. Limits

According to FCC Section 15.247(d). In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

# 5.4. Test Procedure

The EUT was setup to ANSI C63.4, 2014; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

#### 5.5. Uncertainty

± 150Hz



## 5.6. Test Result of RF Antenna Conducted Test

Product	:	Notebook PC
Test Item	:	RF Antenna Conducted Test
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK)

Figure Channel 00:









Note: The above test pattern is synthesized by multiple of the frequency range.

Product	:	Notebook PC
Test Item	:	RF Antenna Conducted Test
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK)







#### Note: The above test pattern is synthesized by multiple of the frequency range.

# 6. Band Edge

# 6.1. Test Equipment

#### **RF Radiated Measurement:**

The following test equipments are used during the band edge tests:

Test Site	Equipment		Manufacturer	Model No./Serial No.	Last Cal.
⊠CB # 8	Х	Spectrum Analyzer	R&S	FSP40/ 100339	Oct., 2014
	Х	Horn Antenna	ETS-Lindgren	3117/ 35205	Mar., 2015
	Х	Horn Antenna	Schwarzbeck	BBHA9170/209	Jan., 2015
	Х	Horn Antenna	TRC	AH-0801/95051	Aug., 2014
	Х	Pre-Amplifier	EMCI	EMC012630SE/980210	Jan., 2015
	Х	Pre-Amplifier	MITEQ	JS41-001040000-58-5P/153945	Jul., 2014
	Х	Pre-Amplifier	NARDA	DBL-1840N506/013	Jul., 2014

Note: 1. All equipments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

# 6.2. Test Setup

#### **RF Radiated Measurement:**

Above 1GHz



## 6.3. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

# 6.4. Test Procedure

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

The bandwidth setting below 1GHz and above 1GHz on the field strength meter is 120 kHz and 1MHz, respectively.

# 6.5. Uncertainty

- ± 3.9 dB above 1GHz
- ± 3.8 dB below 1GHz



#### 6.6. **Test Result of Band Edge**

Product	:	Notebook PC
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK) (2402MHz)

#### **RF Radiated Measurement (Horizontal):**

Channel No.	Frequency	Correct Factor	Reading Level	Emission Level	Peak Limit	Arerage Limit	Dogult
Channel No.	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
00 (Peak)	2377.300	-1.180	44.033	42.853	74.00	54.00	Pass
00 (Peak)	2390.000	-1.131	41.299	40.168	74.00	54.00	Pass
00 (Peak)	2400.000	-1.084	71.584	70.501			
00 (Peak)	2401.800	-1.074	99.819	98.745			
00 (Average)	2377.200	-1.180	34.454	33.273	74.00	54.00	Pass
00 (Average)	2390.000	-1.131	30.748	29.617	74.00	54.00	Pass
00 (Average)	2400.000	-1.084	55.662	54.579			
00 (Average)	2402.000	-1.073	99.115	98.043			

#### Figure Channel 00:





**Horizontal (Average)** 



- All readings above 1GHz are performed with peak and/or average measurements as necessary. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. "\*", means this data is the worst emission level 1.
- 1. 2. 3. 4.

- "\*", means this data is the worst emission level. Measurement Level = Reading Level + Correction Factor. 5.
- The average measurement was not performed when the peak measured data is under the limit of 6. average detection.



Product	:	Notebook PC
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK) (2402MHz)

#### **RF Radiated Measurement (VERTICAL):**

Channal Ma	Frequency	Correct Factor	Reading Level	Emission Level	Peak Limit	Arerage Limit	Dogult
Channel No.	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
00 (Peak)	2377.200	-1.665	44.041	42.376	74.00	54.00	Pass
00 (Peak)	2390.000	-1.725	42.705	40.980	74.00	54.00	Pass
00 (Peak)	2400.000	-1.733	70.228	68.496			
00 (Peak)	2401.900	-1.729	98.011	96.282			-
00 (Average)	2377.300	-1.665	33.309	31.643	74.00	54.00	Pass
00 (Average)	2390.000	-1.725	30.264	28.539	74.00	54.00	Pass
00 (Average)	2400.000	-1.733	53.811	52.079			
00 (Average)	2402.000	-1.729	97.143	95.414			



#### **VERTICAL** (Peak)





#### **VERTICAL** (Average)



- All readings above 1GHz are performed with peak and/or average measurements as necessary. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. "\*", means this data is the worst emission level.
- 1. 2. 3.
- 4. 5.
- Measurement Level = Reading Level + Correction Factor.
- The average measurement was not performed when the peak measured data is under the limit of 6. average detection.



Product	:	Notebook PC
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK) (2480MHz)

#### **RF Radiated Measurement (Horizontal):**

Channel No.	Frequency	Correct Factor	Reading Level	Emission Level	Peak Limit $(dBuV/m)$	Arerage Limit	Result
		(uD)	(αδμν)	(uDµ v/III)	(uDµ v/III)	(uDµ v/III)	_
78 (Peak)	2479.700	-0.581	99.157	98.575			Pass
78 (Peak)	2483.500	-0.558	62.413	61.855	74.00	54.00	Pass
78 (Average)	2480.000	-0.581	98.169	97.588			Pass
78 (Average)	2483.500	-0.558	43.232	42.674	74.00	54.00	Pass

#### Figure Channel 78:

#### Horizontal (Peak)



#### Figure Channel 78:

#### **Horizontal (Average)**



- All readings above 1GHz are performed with peak and/or average measurements as necessary. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. "\*", means this data is the worst emission level. 1.
- 2. 3. 4. 5. 6.

- Measurement Level = Reading Level + Correction Factor. The average measurement was not performed when the peak measured data is under the limit of average detection.



Product	:	Notebook PC
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK) (2480MHz)

#### **RF Radiated Measurement (VERTICAL):**

Channel No.	Frequency	Correct Factor	Reading Level	<b>Emission Level</b>	Peak Limit	Arerage Limit	Dogult
	(MHz)	(dB)	(dBµV)	(dBµV/m)	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
78 (Peak)	2479.900	-1.325	97.428	96.103			Pass
78 (Peak)	2483.500	-1.305	60.677	59.372	74.00	54.00	Pass
78 (Average)	2480.000	-1.324	96.480	95.156			Pass
78 (Average)	2483.500	-1.305	41.793	40.488	74.00	54.00	Pass

#### **Figure Channel 78:**

#### **VERTICAL** (Peak)



#### **Figure Channel 78:**

#### **VERTICAL** (Average)



- All readings above 1GHz are performed with peak and/or average measurements as necessary. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. "\*", means this data is the worst emission level. 1.
- 2. 3.
- 4.
- Measurement Level = Reading Level + Correction Factor. 5.
- The average measurement was not performed when the peak measured data is under the limit of 6. average detection.



Product	:	Notebook PC
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK) (2402MHz)

#### **RF Radiated Measurement (Horizontal):**

Channal Ma	Frequency	Correct Factor	Reading Level	<b>Emission Level</b>	Peak Limit	Arerage Limit	Dogult
Channel No.	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
00 (Peak)	2377.600	-1.179	44.455	43.276	74.00	54.00	Pass
00 (Peak)	2390.000	-1.131	42.326	41.195	74.00	54.00	Pass
00 (Peak)	2400.000	-1.084	73.264	72.181			
00 (Peak)	2402.000	-1.073	101.115	100.043			
00 (Average)	2377.100	-1.181	33.528	32.347	74.00	54.00	Pass
00 (Average)	2390.000	-1.131	30.731	29.600	74.00	54.00	Pass
00 (Average)	2400.000	-1.084	61.168	60.085			
00 (Average)	2402.000	-1.073	97.049	95.977			

**Figure Channel 00:** 

Horizontal (Peak)





**Horizontal (Average)** 



- All readings above 1GHz are performed with peak and/or average measurements as necessary. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. "\*", means this data is the worst emission level.
- 1. 2. 3. 4. 5. 6.

- Measurement Level = Reading Level + Correction Factor.
- The average measurement was not performed when the peak measured data is under the limit of average detection.



Product	:	Notebook PC
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK) (2402MHz)

#### **RF Radiated Measurement (VERTICAL):**

Channel No	Frequency	Correct Factor	Reading Level	Emission Level	Peak Limit	Arerage Limit	Result
Chamier 100.	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	(dBµV/m)	(dBµV/m)	11050110
00 (Peak)	2388.300	-1.717	45.030	43.313	74.00	54.00	Pass
00 (Peak)	2390.000	-1.725	43.269	41.544	74.00	54.00	Pass
00 (Peak)	2400.000	-1.733	71.552	69.820			
00 (Peak)	2401.900	-1.729	99.199	97.470			
00 (Average)	2377.300	-1.665	33.096	31.430	74.00	54.00	Pass
00 (Average)	2390.000	-1.725	30.889	29.164	74.00	54.00	Pass
00 (Average)	2400.000	-1.733	59.301	57.569			
00 (Average)	2402.000	-1.729	95.189	93.460			

**Figure Channel 00:** 

#### **VERTICAL** (Peak)





#### VERTICAL (Average)



- All readings above 1GHz are performed with peak and/or average measurements as necessary. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. "\*", means this data is the worst emission level.
- 1. 2. 3. 4. 5. 6.
- Measurement Level = Reading Level + Correction Factor.
- The average measurement was not performed when the peak measured data is under the limit of average detection.



Product	:	Notebook PC
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK) (2480MHz)

#### **RF Radiated Measurement (Horizontal):**

Channel No	Frequency	Correct Factor	Reading Level	Emission Level	Peak Limit	Arerage Limit	Result
Chamler 100.	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	(dBµV/m)	(dBµV/m)	11050110
78 (Peak)	2479.900	-0.581	100.440	99.859			Pass
78 (Peak)	2483.500	-0.558	62.074	61.516	74.00	54.00	Pass
78 (Average)	2480.000	-0.581	96.425	95.844			Pass
78 (Average)	2483.500	-0.558	41.582	41.024	74.00	54.00	Pass

#### **Figure Channel 00:**

#### Horizontal (Peak)



#### **Figure Channel 00:**

#### **Horizontal (Average)**



- All readings above 1GHz are performed with peak and/or average measurements as necessary. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. "\*", means this data is the worst emission level.
- 1. 2. 3. 4. 5.

- Measurement Level = Reading Level + Correction Factor.
- 6. The average measurement was not performed when the peak measured data is under the limit of average detection.



Product	:	Notebook PC
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK) (2480MHz)

#### **RF Radiated Measurement (VERTICAL):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBµV)	Emission Level (dBµV/m)	Peak Limit (dBµV/m)	Arerage Limit (dBµV/m)	Result
78 (Peak)	2480.000	-1.324	98.547	97.223			Pass
78 (Peak)	2483.500	-1.305	60.367	59.062	74.00	54.00	Pass
78 (Average)	2480.000	-1.324	94.532	93.208			Pass
78 (Average)	2483.500	-1.305	40.138	38.833	74.00	54.00	Pass

#### **Figure Channel 78:**

#### **VERTICAL** (Peak)



#### Figure Channel 78:

#### **VERTICAL** (Average)



- All readings above 1GHz are performed with peak and/or average measurements as necessary. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. "\*", means this data is the worst emission level. 1.
- 2. 3. 4. 5. 6.
- Measurement Level = Reading Level + Correction Factor.
- The average measurement was not performed when the peak measured data is under the limit of average detection.



# 7. Channel Number

# 7.1. Test Equipment

_	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun., 2015
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun., 2015
Х	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015

Note: 1. All equipments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

# 7.2. Test Setup



#### 7.3. Limit

Frequency hopping systems operating in the 2400-2483.5 MHz bands shall use at least 75 hopping frequencies.

# 7.4. Test Procedure

The EUT was setup to ANSI C63.4, 2014; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

# 7.5. Uncertainty

N/A

# 7.6. Test Result of Channel Number

Product	:	Notebook PC
Test Item	:	Channel Number
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK)

Frequency Range	Measurement	Required Limit	Result	
(MHz)	(Hopping Channel)	(Hopping Channel)		
2402 ~ 2480 79		>75	Pass	

#### 2402-2421MHz

#### 2422-2441MHz

🗱 Keysight Spectrum Analyzer - Swept SA		00	BE Keysight Spectrum Analyzer - Swept SA	0 0 0
Center Freq 2.411000000 GHz Trig: Free Run Avg Type: Log-Pwr	05:12:45 PM May 05, 2015 TRACE 1 2 3 4 5 6	Frequency	RL         RF         SO 0         AC         SENSE (MT)         ALIGN AUTO         OS:14:15 PM May 05, 2015           Center Freq 2.431500000 GHz         Avg Type: Log-Pwr         TracE[1:2:3:4:5:6         TracE[1:2:3:4:5:6	Frequency
IFGainLow #Atten: 20 dB	2 421 000 GHZ	Auto Tune	PRO: Fast _ The row con IFGainLow #Atten: 20 dB	Auto Tune
10 dB/div Ref 10.00 dBm	1.69 dBm		10 dB/div Ref 10.00 dBm 1.79 dBm	
	VVVV	Center Freq 2.411000000 GHz		Center Freq 431500000 GHz
-300 -400 -400		Start Freq 2.400500000 GHz	400 21	Start Freq 421500000 GHz
40.0		Stop Freq 2.421500000 GHz	400 700 000	Stop Freq 441500000 GHz
Start 2.40050 GHz #Res BW 100 kHz #VBW 100 kHz Sweep 2	Stop 2.42150 GHz 2.533 ms (1001 pts)	CF Step 2.100000 MHz	Start 2.42150 GHz Stop 2.44150 GHz #Res BW 100 kHz #VBW 100 kHz Sweep 2.467 ms (1001 pts)	CF Step 2.000000 MHz
Model Model Find Sec.         X         Y         Europhon Function         Function	FUNCTION VALUE	CUTA Mast	Visit Model Free Sol.         X         Y         Function         Function	
3 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5		Freq Offset 0 Hz		Freq Offset 0 Hz
MSG STATU	s]		MSG STATUS	

#### 2442-2461MHz

#### 2462-2480MHz

SENSE INT Avg T	ALIGN AUTO	05:17:48 PM May 05, 2015 TRACE [1 2 3 4 5 6 TYPE HAMMAN DET P NNNN N 2.461 00 GHz 1.60 dBm	Frequency Auto Tune	Center Freq 2.4715	00000 GHz PNO: Fast IFGain:Low	Trig: Free Run #Atten: 20 dB	Avg Type: Log-Pwr	05:20:38 PH May 05, 2015 TRACE 1 2 3 4 5 6 TYPE HWWWWW DET P NNNN 2.2,480 00 GHZ	Frequency Auto Tune
#Atten: 20 dB	Mkr2 2	2.461 00 GHz 1.60 dBm	Auto Tune	10 dB/div Ref 10.00	PNO: Fast G	#Atten: 20 dB	Mkr2	2.480 00 GHz	Auto Tune
mm	2000	1.00 0.011		10 dB/div Ref 10.00				1 66 dBm	
	V V V	AAA	Center Freq 2.451500000 GHz	1000 -1000		NVN	WW		Center Freq 2.471500000 GHz
			Start Freq 2.441500000 GHz	-40.0					Start Free 2.461500000 GH
			Stop Freq 2.461500000 GHz	-60.0 -70.0 -80.0					Stop Free 2.481500000 GH
/ 100 kHz	Sto Sweep 2.46	op 2.46150 GHz i7 ms (1001 pts)	CF Step 2.000000 MHz Auto Man	Start 2.46150 GHz #Res BW 100 kHz	#VBW	100 kHz	Sweep 2.	Stop 2.48150 GHz 467 ms (1001 pts)	CF Step 2.000000 MH Auto Ma
1.77 dBm 1.60 dBm			Freq Offset 0 Hz	1 N 1 1 2 N 1 1 3 4 5	2.462 00 GHz 2.480 00 GHz	1.68 dBm 1.66 dBm		FUNCTION WALKE	Freq Offse 0 H
				7 8 9 10 11					
	100 kHz	100 kHz Ste 100 kHz Sweep 2.46	Stop 2.46150 GHz           100 kHz         Stop 2.467 ms (1001 pts)           177 dBm         1.90 eX100 M0071           1.50 dBm         1.90 eX100 M0071	100 kHz         Stop 2.46150 GHz         CF 5top 2.46150 GHz           100 kHz         Sweep 2.467 ms (1001 pts)         CF 5top 2.0000 MHz           1.00 dBm         Factor Model         Factor Model	100 kHz         Stop 2.46150 GHz         2.44150000 GHz         30 0         40 0	Start Freq         300         300           Start Freq         300         400           Start Freq         300         1           Start Freq         300         1           Start Freq         1         1           Start Freq         1         1	100 kHz         Stop Z.46150 GHz           100 kHz         Freq Offset           1100 kHz         Kerrer           1100 kHz         Kerrer	100 kHz         Stop 2.46150 GHz         CF 5top 2.46150 GHz         CF 5top 2.46150 GHz         240150000 GHz         2000         100	300         300



Notebook PC
Channel Number
No.3 OATS
Mode 2: Transmit - 3Mbps (8DPSK)

Frequency Range	Measurement	Required Limit	Result	
(MHz)	(Hopping Channel)	(Hopping Channel)		
$2402 \sim 2480$	2402 ~ 2480 79		Pass	

#### 2402-2421MHz

## 2422-2441MHz

III Keysight Spectrum Analyzer - Swept SA		10 P	III. Keysight Spectrum Analyzer - Swept SA			0 0 4
Center Freq 2.411000000 GHz	Aug Type: Log-Pwr TRACE 1 2 3 4 5	Frequency	Center Freq 2.431500000 GHz	SENSE (IVT) Avg Typ	ALIGN AUTO 06:23:05 PM May 05, 2015 e: Log-Pwr TRACE 1 2 3 4 5 6 Type: Humanian	Frequency
IFGainLow #Atten: 20 dB	Mkr2 2.421 000 GH	Z Auto Tune	PNO: IFGain	Low #Atten: 20 dB	Mkr2 2.441 00 GHz	Auto Tune
10 dB/div Ref 10.00 dBm		Center Freq 2.411000000 GHz	10 dB/div Ref 10.00 dBm			Center Freq 2.431500000 GHz
400		Start Freq 2.400500000 GHz	-30.0 -40.0 -50.0			Start Freq 2.421500000 GHz
40 0 -70 0 -80 0		Stop Freq 2.421500000 GHz	-60 0 -70 0 -80 0			Stop Freq 2.441500000 GHz
Start 2.40050 GHz #Res BW 100 kHz #VBW 100 kHz	Stop 2.42150 GH Sweep 2.533 ms (1001 pt	z s) CF Step 2.100000 MHz Auto Man	Start 2.42150 GHz #Res BW 100 kHz	#VBW 100 kHz	Stop 2.44150 GHz Sweep 2.467 ms (1001 pts)	CF Step 2.000000 MHz Auto Man
1 N 1 F 2402000 GHz 123 dBm 2 N 1 F 2421000 GHz 1.82 dBm 3 4 5 6		Freq Offset 0 Hz	1 N 1 f 2.422 00 G 2 N 1 f 2.441 00 G 3 4 5 6	Hz 1.64 dBm Hz 0.14 dBm		Freq Offset 0 Hz
7		-	7 8 9 10 11			
MSG	STATUS		MSG		STATUS	

#### 2442-2461MHz

#### 2462-2480MHz

III. Keysight Spectrum Analyzer - Swept SA	00	🗴 Keysight Spectrum Analyzer - Swept SA
RL         IP         30 G         42         SENSE: INT         ALLIN: AUTO         00e2752 PMMay 65, 2015           Center Freq 2.451500000 GHz         Trig: Free Run         Avg Type: Log-Pwr         TRACE [1 2 3 4 5]           PN0: Fast         Trig: Free Run         Trig: Free Run         Trig: Free Run	Frequency	RL         RF         Store         Store         Autowarro         Geoded/Semmar 05,2015         Frequency           Center Freq 2.471500000 GHz         Trig: Free Run         Avg Type: Log-Pwr         Trig: 2.4 5,5         Frequency
FGalm.Low         SAtten: 20 dB         Satten: 20 dB           10 dB/div         Ref 10.00 dBm         Mkr2 2.461 00 GHz	Auto Tune	IF GainLow & Atten: 20 dB Erry Annua Mkr2 2.480 00 GHz Auto Tune 10 dB/div Ref 10.00 dBm 1.24 dBm
	Center Freq 2.451500000 GHz	Log (1) 000
40	Start Freq 2.441500000 GHz	400 Start Free 400 400 2.461500000 GH
400	Stop Freq 2.461500000 GHz	600
Start 2.44150 GHz Stop 2.46150 GHz #Res BW 100 kHz #VBW 100 kHz Sweep 2.467 ms (1001 pts)	CF Step 2.000000 MHz Auto Man	Start 2.46150 GHz Stop 2.48150 GHz CF Step 2.48150 GHz CF Step 2.48150 GHz #VBW 100 kHz Sweep 2.467 ms (1001 pts) Autonomous Methew Sweep 2.467 ms (1001 pts) Compared to the start of the
Mode BackEg Rind (Sci.)         X         Y         FERCETION         FERCETION	Freq Offset 0 Hz	Vice (EDG) EIIC (SG)         X         Y         FUNCTION         FUNCTION MODE         FUNCTION MODE <th< td=""></th<>
6         -		
MSG STATUS		MSG STATUS



# 8. Channel Separation

# 8.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun., 2015
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun., 2015
Х	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015

Note: 1. All equipments are calibrated every one year.

2. The test instruments mark by "X" are used to measure the final test results.

## 8.2. Test Setup



# 8.3. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

#### 8.4. Test Procedure

The EUT was setup to ANSI C63.4, 2014; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

#### 8.5. Uncertainty

 $\pm$  150Hz

# 8.6. Test Result of Channel Separation

Product	:	Notebook PC
Test Item	:	Channel Separation
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK)

	Eroquanav	Measurement	Limit	Limit of (2/3)*20dB	
Channel No.	(MHz)	Level	(1-11-2)	Danderridth (1-11-)	Result
		(kHz)	(кпz)	Bandwidun (KFIZ)	
00	2402	1000	>25 kHz	740.0	Pass
39	2441	1000	>25 kHz	740.0	Pass
78	2480	1000	>25 kHz	753.3	Pass

NOTE: The 20dB Bandwidth is refer to section 10.

🊺 Ke	ysight S	Spectr	um A	nalyzer - Swe	ept SA								
Cen	ter	Fre	RF q 2	50 Ω .40200	AC	z	SE		Avg Type	ALIGN AUTO : Log-Pwr	04:44:36 P	May 05, 2015	Frequency
					PN IFC	lO:Wide ⊂ Gain:Low	#Atten: 2	0 dB			Di		Auto Tune
10 d	B/div	I	Ref	10.00 c	dBm					MKr	2 2.403 2.*	00 GHZ 19 dBm	
Log 0.00									2				Center Freq
-10.0			_					$  \lor$					2.402000000 GHz
-20.0													
-40.0													Start Freq 2.397000000 GHz
-50.0			-		wer	and the second s				- mark	man and a second	~	
-60.0	pette	Lager p	and and	and a star of the								harropport.	Stop Freq
-80.0													2.407000000 GHz
Cen	ter 2	2.40	200	00 GHz							Span 1	0.00 MHz	CF Step
#Re	sBV	N 1	00	(Hz		#VB	N 100 kHz		#	Sweep 5	00.0 ms (	1001 pts)	1.000000 MHz <u>Auto</u> Man
1 1	N	1	f		× 2.402 0	0 GHz	2.17 d	Bm	CTION FUI	ICTION WIDTH	FUNCTION		
3	N	-	-		2.403 0		2.19 u						Freq Offset
5 6												=	
7													
10 11													
•	1						III		1		1	F .	
MSG										STATUS			

# Channel 00 (2402MHz)



							Chuim	01 57	(2111	11112)			
🊺 Ke	ysight !	Spectru	um A	nalyzer - Swe	ept SA								
Cer	L Iter	Fre	RF q 2	<u>50 Ω</u>	AC 0000 GH	łz	SI	ENSE:INT	Avg T	ALIGN AUTO	05:24:40 P TRAC	M May 05, 2015 CE 1 2 3 4 5 6	Frequency
					P IF	NO: Wide Gain:Low	#Atten:	e Run 20 dB			Di		Auto Turo
10.1			7.05	10.00	Bna					Mkr	2 2.442 1	00 GHz 19 dBm	Auto Tune
10 d Log	Bidiv		Ref	10.00 0	ıвm			71\1	<b>A</b> 2				
0.00								¥'	<u> </u>				Center Freg
-10.0								$\downarrow$	<u> </u>				2.441000000 GHz
-20.0								$\sim$					2.111000000 0112
-30.0										_			
40.0													Start Freq
-40.0													2.436000000 GHz
-50.0					- Annapart	-					and a second and the second		
-6U.U	er wo	No.Mr	-18-70	where the same								m may have	Stop Freq
-70.0			+										2.446000000 GHz
-80.0			+										
Cer	ter	2.44	10	00 GHz	1			1			Span 1	0.00 MHz	CF Step
#Re	s B∖	N 10	00 I	kHz		#VE	3W 100 kH:	z		#Sweep 5	00.0 ms (	1001 pts)	1.000000 MHz
MKR	MODE	TRC	SCL		Х		Y	FL	JNCTION	FUNCTION WIDTH	FUNCTI	ON VALUE	<u>Auto</u> Man
1	N	1	f		2.441 0	0 GHz	1.19 c	Bm					
3	IN		-		2.442 0	UGHZ	1.190	ып					Freq Offset
4			_										0 Hz
6												=	
7		_	_										
9													
10		_	_										
•		-	_				III						
MSG										STATUS	s		<u> </u>

#### Channel 39 (2441MHz)

## Channel 78 (2480MHz)





Product	:	Notebook PC
Test Item	:	Channel Separation
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK)

	Fraguanay	Measurement	Limit	Limit of (2/3)*20dB	mit of (2/3)*20dB Bandwidth (kHz) 926.7 926.7 Pass 926.7 Pass	
Channel No.	(MHz)	Level	(1-11-2)	Dondwidth (kUz)	Result	
	(WITZ)	(kHz)	(кпz)	Bandwidtii (KHZ)		
00	2402	1000	>25 kHz	926.7	Pass	
39	2441	1000	>25 kHz	926.7	Pass	
78	2480	1000	>25 kHz	926.7	Pass	

NOTE: The 20dB Bandwidth is refer to section 10.

🂓 k	leysigh	t Spect	trum /	Analyzer - Swe	ept SA								- d <u>×</u>
ι×ν Ce	RL nter	Fre	RF ea 2	50 Ω 2.40200	AC	z	SE	NSE:INT	Avg Ty	ALIGN AUTO	05:51:23 P	May 05, 2015	Frequency
					PN IFC	IO: Wide Gain:Low	Trig: Fre #Atten: 2	e Run 20 dB		Mkı	r2 2.403		Auto Tune
10	dB/di	٧	Ref	f 10.00 c	1Bm			-			0.	84 aBM	
-10. -20.								1	2				Center Freq 2.402000000 GHz
-30. -40. -50.						and the second				And			<b>Start Freq</b> 2.397000000 GHz
-60. -70. -80.		waan		and the second secon							Replementer .	New Provinsion	<b>Stop Freq</b> 2.407000000 GHz
Ce #R	nter es B	2.4 W 1	020	00 GHz kHz		#VB	W 100 kHz	:		#Sweep {	Span 1 500.0 ms (	0.00 MHz 1001 pts)	CF Step 1.000000 MHz Auto Man
MK 1 2 3 4 5 6 7 8 9 10 11 <	MOD N N		f f		X 2.402 0 2.403 0	0 GHz 0 GHz	¥ 0.81 d 0.84 d		UNCTION F	UNCTION WIDTH			Freq Offset 0 Hz
MSG										STATU	IS		<u>,                                    </u>

# Channel 00 (2402MHz)



							Cildini		(2111	(1112)			
🇾 Ke	ysight	Spect	rum A	nalyzer - Swe	ept SA								
LXI R	L		RF	50 Ω	AC		SE	NSE:INT		ALIGN AUTO	06:35:37 PI	4 May 05, 2015	Frequency
Cen	ter	Fre	eq 2	2.44100	00000 GH	z	Tribus Free		Avg Ty	be: Log-Pwr	TRAC	E 1 2 3 4 5 6	riequency
					PN	O: Wide (	Trig: Fre	e Run o JB			DE		
					IFG	ain:Low	#Atten: 2	U U D					Auto Tupo
										Mki	2 2.442	00 GHz	Auto Tune
10 4	Didiu	,	Dof	10.00 /	IBm						1.3	26 dBm	
Log	Biuliv	· · · ·	Rei	10.00 (				1	<b>A</b> 2		1		
0.00								<u> </u>	A 2				Contor From
0.00								- mu	and and				Center Freq
-10.0	-		-							-			2.441000000 GHz
-20.0													
20.0													
-30.0			-							×			Start Fred
-40 O							/			March 1			
						~~~				man			2.436000000 GHZ
-50.0					and the						The second		
-60.0					and a layout						"The palle		
	whether	not the second		Marchael Marchael								THUR HAND	Stop Freq
-70.0			-						-	-			2 446000000 CH7
-80.0													2.44000000 0112
Cen	ter	2 44	110								Snan 1	0.00 MHz	CE Stop
#DA	e Bi	A 1	00			#\/P	1AK 100 KHZ		-	Cwoon 4	00 0 me (	1001 ntc)	1 000000 MHz
mr.c	3 11		00	NHZ		#¥⊔			,	Jameeh a		1001 pts)	Auto Man
MKR	MODE	TRC	SCL		X		Y	FU	INCTION FI	JNCTION WIDTH	FUNCTION	DN VALUE	Auto Man
1	Ν	1	f		2.441 0	) GHz	1.28 d	Bm					
2	Ν	1	f		2.442 00	GHz	1.26 d	Bm					Erog Offect
3													Frequise
4													0 Hz
6													
7													
8													
9													
10													
											I		
			-								1		
MSG										STATU	S		

#### Channel 39 (2441MHz)

# Channel 78 (2480MHz)



# 9. Dwell Time

#### 9.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun., 2015
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun., 2015
Х	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015

Note: 1. All equipments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

# 9.2. Test Setup



#### **9.3.** Limit

The dwell time shall be the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

# 9.4. Test Procedure

The EUT was setup to ANSI C63.4, 2014; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

# 9.5. Uncertainty

± 25msec

# 9.6. Test Result of Dwell Time

Product	:	Notebook PC
Test Item	:	Dwell Time
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK) (Channel 00,39,78 –DH5)

Frequency (MHz)	Time slot length (ms)	Hopping of Number	Sweep time (ms)	Duty cycle	Dwell Time (Sec)	Limit (Sec)	Result
2402	2.867	16	50	0.92	0.367	0.4	Pass
2441	2.867	16	50	0.92	0.367	0.4	Pass
2480	2.867	16	50	0.92	0.367	0.4	Pass

Duty cycle = ((Time slot length(ms)\*Hopping of Number) / Sweep time (ms)

Dwell time = (Duty cycle /79) \* (79\*0.4)

#### CH 00 Time Interval between hops

CH 00 Transmission Time

🗱 Keysight Spectrum Analyzer - Swept SA		00	🕼 Keysight Spectrum Analyzer - Swept SA 👘 📿 🖉 🔜
AL RF 50.0 AC SENSE.INT ALIGN AUTO 05.0;     Center Freq 2.402000000 GHz     Avg Type: Log-Pwr     Trig: Video	12:36 PH May 05, 2015 TRACE 1 2 3 4 5 6 TYPE WWWWWW	Frequency	R L         RF         SERIE UTT         ALLOR AUTO         05.02.47 PMMay 05, 2015         Frequency           Center Freq 2.402000000 GHz         Avg Type: Log-Pwr         TRACE[123456         Frequency
IFGainLow Atten: 30 dB	DET P NNNNN	Auto Tune	BrainLow Atten: 30 dB Der P NNNNN Mkr3 5.904 ms Auto Tune
10 dB/div Ref 20.00 dBm			10 dB/div Ref 20.00 dBm 2.12 dBm
10.0		Center Freq 2.40200000 GHz	100 2 3 Center Freq 0.00 2 2
0.00		Start Freq 2.40200000 GHz	300         mouth         mouth         Start Freq         2.40200000 GHz           300         mouth         mouth         mouth         2.40200000 GHz
		Stop Freq 2.40200000 GHz	600 Stop Freq 600 Stop Cherrer 700 Z40200000 CHz
40.0		CF Step 1.000000 MHz Auto Man	Center 2.402000000 GHz Res BW 1.0 MHz #VBW 1.0 MHz Sweep 10.00 ms (1001 pts) uto Mhz
60.0		Freq Offset 0 Hz	No         L         A         Foundation         Found
300			
Center 2.402000000 GHz Res BW 1.0 MHz #VBW 1.0 MHz Sweep 50.00 r	Span 0 Hz ms (1001 pts)		
MSG STATUS			MSG STATUS

#### CH39 Time Interval between hops

#### CH 39Transmission Time

💷 Keysight Spectrum Analyzer - Swept SA		0 0 0	🗱 Keysight Spectrum Analyzer - Swept SA 👘 🔁 🚾
RL         RF         S0 R         AC         SERVED INT         ALLSN AUTO         05:25:3           Center Freq 2.441000000 GHz         Avg Type: Log-Pwr         T	58 PH May 05, 2015 TRACE 1 2 3 4 5 6	Frequency	RL         RF         SQ:0         ACC         SENSE (NT)         ALLOW AUTO         (05:26:10 PM May 05, 2015)         Frequency           Center Freq 2.441000000 GHz         Avg Type: Log-Pwr         TRACE [ 2:3 4.5 6         Frequency
PNO: Fast Trg: Video IFGain:Low Atten: 30 dB	DETPNNNNN	Auto Tuno	PNO: Fast Ing. Video IFGainLow Atten: 30 dB
10 dB/div Ref 20.00 dBm		Auto Tune	10 dB/div Ref 20.00 dBm Auto Tune 2.25 dBm
100		Center Freq 2.441000000 GHz	22 3 Center Freq 2.44100000 GHz 2.4100000 GHz
0.00		Start Freq 2.441000000 GHz	100 100 100 100 100 100 100 100 100 100
200	100 (04	Stop Freq 2.441000000 GHz	600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600         600
40.0		CF Step 1.000000 MHz Auto Man	Center 2.44 1000000 GHz Res BW 1.0 MHz #VBW 1.0 MHz Sweep 10.00 ms (1001 pts) Man
40.0		Freq Offset 0 Hz	N         t         2.837 ms         2.01 dBm         200000 model           2         N         t         3.037 ms         1.87 dBm         Freq Offset           3         N         t         5.904 ms         225 dBm         Freq Offset           4         5           0 Hz         10 Hz
170.0			
Center 2.441000000 GHz Res BW 1.0 MHz #VBW 1.0 MHz Sweep 50.00 m	Span 0 Hz ns (1001 pts)		
MSG STATUS			MSG STATUS



# CH 78 Time Interval between hops

# CH 78 Transmission Time

Keysight Spectrum Analyzer - Swept SA		00	III. Keysight Spectrum Analyzer - Swept SA	0.00
Center Freq 2.480000000 GHz	ALIGN AUTO 05:41:14 PM May 05, 2015 Avg Type: Log-Pwr TRACE 1 2 3 4 5 6 Type: VWWWWW	Frequency	AL         AF         SO 0, AC         SENSE (INT)         ALIGN AUTO         (05-41-23 FM May 05, 2015)         Frequent           Center Freq 2.480000000 GHz         Trio: Video         Avg Type: Log-Pwr         Trace [1 2 3 4 5 6         Frequent	ncy
IFGein:Low Atten: 30 dB	DET P NNNN	Auto Tune	Microsoft Atten: 30 dB Configuration Microsoft Atten: 30 dB Auto	o Tune
		Center Freq 2.48000000 GHz	1.00 CBM 100 CBM 100 CBM 100 CBM 1.00 CBM 1.00 CBM 2.4800000 2.4800000	er Fred X00 GH;
0.00		Start Freq 2.48000000 GHz	300 300 300 300 300 300 300 300 300 300	rtFreq X00 GH;
20.0		Stop Freq 2.480000000 GHz	40.0	p Freq 300 GH:
40.0		CF Step 1.000000 MHz Auto Man	Center 2.48000000 GHz Res BW 1.0 MHz WBW 1.0 MHz Sweep 10.00 ms (100 1pt) 1.0000 Set Excerting Fox1 x V Public Res BW 1.0 MHz	F Step 100 MH: Mar
600		Freq Offset 0 Hz	1         N         1         2.837ms         1.710Bm           2         N         1         1.3037ms         1.570Bm           3         N         1         5.904ms         1.90dBm           4         5         5         5         5           6         5         5         5         5	Offse 0 Ha
Center 2.480000000 GHz Res BW 1.0 MHz #VBW 1.0 MHz	Span 0 Hz Sweep 50.00 ms (1001 pts)			

Note:

The dwell times of the packet type of DH1, DH3, and DH5 are tested. Only the worst case is shown on the report.

Product	:	Notebook PC
Test Item	:	Dwell Time
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK) (Channel 00,39,78 –DH5)

Frequency (MHz)	Time slot length (ms)	Hopping of Number	Sweep time (ms)	Duty cycle	Dwell Time (Sec)	Limit (Sec)	Result
2402	2.877	16	50	0.92	0.368	0.4	Pass
2441	2.877	16	50	0.92	0.368	0.4	Pass
2480	2.877	16	50	0.92	0.368	0.4	Pass

Duty cycle =((Time slot length(ms)\*Hopping of Number) / Sweep time (ms)

Dwell time = (Duty cycle /79) \* (79\*0.4)

#### CH 00 Time Interval between hops

#### Center Freq 2.402000000 GHZ Figure 1 State 1 S er Freq 2.402000000 GHz PN0: Fast PN0: Fast PN0: Fast Atten: 30 d Atten: 30 d 54 PM May 05, 2015 TRACE 1 2 3 4 5 TYPE WWWWWW DET P NNNN Frequency Auton Auto Frequency Avg Type: Log-Pw Auto Tur Mkr3 4.226 ms 2.42 dBn Auto Tu Ref 20.00 dBm Ref 20.00 dB 12 ●<sup>3</sup> Center Fre Center Fre 2.402000000 G ŧ U Start Fre Start Fre 2000000 G 2.40 Stop Fre Stop Fre 000000 G 24 CF Step 1.000000 MHz Mar CF Ste Center 2.402000000 GHz Res BW 1.0 MHz Span 0 F Sweep 10.00 ms (1001 pt #VBW 1.0 MHz Ma 1.149 ms 1.349 ms 4.226 ms 1 N N 2.41 dBm 1.72 dBm 2.42 dBm Freq Offs Freq Offse 01 OH Span 0 Hz Sweep 50.00 ms (1001 pts) 00000 GH2 BW 1.0 MHz #VBW 1.0 MHz

#### CH39 Time Interval between hops

# CH 39Transmission Time

BE Keys	phe Spe	ective	Analyzer	- Swep	RSA			-		وستبترك					and the second second	(Laborator	-	12220	and the second	000	E BE Ke	eysight S	Spectrum	Analyzer	- Swept SA	1. J.	- 14		مەربىيە ئۇر	//469/2		والمراجع والمرجع والمرجع	and strange from			000
Cent	er Fi	req	2.44	50 G 1000	0000	GH	z		],	rio: Vie	ENSE 1	NT]	Av	vg Typ	e: Log-	Pwr	06:37	TRACE TVP	Aay 05, 20	Frequency	Cer	nter	Freq	2.441	00000	00 GH	z		sens	E:INT]	Avg Ty	pe: Log-Pw	) {06:3 r	17:58 PM N TRACE TVPE	1 2 3 4 5 6	Frequency
10 dB	div	Re	f 20.0	00 dE	Bm	IFG	ain:Lo	w	A	tten: 3	30 dB						_	DET	PNNN	Auto Tune	10 d	dB/div	R	ef 20.0	00 dBn	iFG n	ain:Low	A	ten: 30 c	dB			Mkr	r3 4.5 2.6	45 ms 5 dBm	Auto Tune
10.0 -											-		-	_	_					Center Free 2.441000000 GH	10.0 0.00			_Ŷ	2			****	<b>∮</b> <sup>3</sup>			*****				Center Freq 2.441000000 GHz
-10.0	1			Ť	Ĩ		-	Ĩ	Ĩ		Ē	-		1	1		P	Ē	P	Start Free 2.441000000 GH	-10.0								U				-			Start Freq 2.441000000 GHz
-20.0				ł					+			ŧ	t	ŧ	Ħ		Ē	F	1905 L	Stop Fred 2.441000000 GH	-50.0 -60.0 -70.0				+			-				-	+	=		Stop Free 2.441000000 GH
-40.0				-		-			-		+		+		$\vdash$		$\vdash$	+		CF Step 1.000000 MH Auto Mar	Cen	nter 2 s BW	2.4410 / 1.0 h	000000 MHz	0 GHz	_	#VB	3W 1.0	MHz	EIN	cton 1	Sweep	10.00	Sp ms (10	an 0 Hz 001 pts)	CF Step 1.000000 MH Auto Mar
-50.0 -		_		_					F	_	Ŧ	_	F	_	F	_	-	-		Freq Offse	123456	NNN				1.45 1.65 4.54	9 ms 8 ms 15 ms		2.62 dBr 1.98 dBr 2.65 dBr	m						Freq Offse 0 H
-70.0 Cente	r 2.4	4410	00000	10 GH	łz		#1	/BW	410	MH					Swe	en f		S	pan 0 H	iz s)	7 8 9 10 11			Ē												
MSG		1.0 1	1112	-	_	_		1011	1.0	· Wirtz	-		_	_	Swee	STATU	0.001	.115 (1	ourpu	20	MSG	_	_	_	_				A			STA'	rus	_		

#### CH 00 Transmission Time



# CH 78 Time Interval between hops

CH 78 Transmission Time

BE Keyl	ght Spe	ctrum A	knalyzer -	Swept S	4		-									and along		000	BE K	leysight Sp	pectrum A	Analyzer -	Swept SA		12	44.55		11	CONTRACTOR -			000
Cent	er Fr	req 2	2.480	0000	000 0	SHz	-	$\Box_{n}$	rio: Vid	ENSE IN	<u></u>	Avg	Type:	Log-Pwr	06:47:4 Ti	RACE 1	23456	Frequency	Cer	nter F	req 3	2.480	000000	GHz		Trio: Vide	SE:INT]	Avg	ype: Log-Pwr	06:47:56 TRJ	CE 1 2 3 4 5 6	Frequency
10 48		Daf	20.0	dBr		PNO: F IFGain:	ast G		Atten: 3	30 dB						DET	NNNN	Auto Tune		-	Det		0.48-	PNO: IFGair	Fast C.	Atten: 30	dB			Mkr3 5	.934 ms	Auto Tune
10.05	div	Rei	20.00							-						T		Center Freq 2.480000000 GHz	10.0 10.0		~~~	r 20.0					****	3				Center Freq 2.48000000 GHz
-10.0	Ĩ		ſ	Y mina	ľ	T		Ĩ		Ē	1	Ĩ	T				Ĩ	Start Freq 2.480000000 GHz	-10.0 -20.0 -30.0	0											1801.41	Start Freq 2.48000000 GHz
-20.0		-				t	1	1			t	t	t	Ŧ	Ħ	+	1901.11	Stop Freq 2.480000000 GHz	-50.0 -60.0 -70.0	0												Stop Freq 2.48000000 GHz
-40.0		+		+		+		+		╞		╞	_			+		CF Step 1.000000 MHz Auto Man	Cer Res	nter 2 s BW	.4800 1.0 M	00000 IHz	) GHz		#VBW	/ 1.0 MHz			Sweep	0.00 ms	Span 0 Hz (1001 pts)	CF Step 1.000000 MH: Auto Mar
-60.0 -	_	-		+		-				F		F				-		Freq Offset 0 Hz	1 2 3 4 5	N N N				2.857 3.057 5.934	ms ms ms	1.86 dE 1.64 dE 1.97 dE	Bm Bm Bm	101104	FUNCTION WOTH	FUNC	2N V4232	Freq Offset 0 H;
-70.0 Cont	w 24	1900	00000		_											- Prov	0.41		6 7 8 9 10													
Res E	SW 1.	.0 M	Hz	GHZ			#VB\	W 1.0	0 MHz	z			S	weep 5	0.00 m	s (100	01 pts		11		-	-					+	-				
MSG														STATUS	6				MSG										STATU	s		

Note:

The dwell times of the packet type of DH1, DH3, and DH5 are tested. Only the worst case is shown on the report.



# 10. Occupied Bandwidth

# **10.1.** Test Equipment

_	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun., 2015
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun., 2015
Х	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015

Note: 1. All equipments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

# 10.2. Test Setup



# 10.3. Limits

N/A

# **10.4.** Test Procedure

The EUT was setup to ANSI C63.4, 2014; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

#### 10.5. Uncertainty

± 150Hz



# 10.6. Test Result of Occupied Bandwidth

Product	:	Notebook PC
Test Item	:	Occupied Bandwidth Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	1110		NA
39	2441	1110		NA
78	2480	1130		NA

📜 Keysight S	Spectrum A	Analyzer - Swe	pt SA								
Center	RF Freq 2	50 Ω 2.40200	AC 0000 GH	z	SEI	NSE:INT	Avg Ty	ALIGN AUTO	05:21:59 P TRAD	M May 05, 2015 CE 1 2 3 4 5 6	Frequency
			PN IFC	IO: Wide  ⊊ Gain:Low	∃ Trig: Fre #Atten: 2	e Run 0 dB		Mkr	2 2.401	45 GHz	Auto Tune
10 dB/div Log -10.0	Rel	f 10.00 d	Bm			3			-18.	-18.14 dBm	Center Freq 2.402000000 GHz
-30.0 -40.0 -50.0							And the second s				Start Freq 2.397000000 GHz
-60.0 -70.0 -80.0	samo	artu Vala Jaha	en and a second and a second a						Mary and	mhum	<b>Stop Freq</b> 2.407000000 GHz
Center 2 #Res BV	2.4020 V 100	00 GHz kHz		#VBV	/ 100 kHz	1		Sweep 1	Span 1 .267 ms (	0.00 MHz 1001 pts)	CF Step 1.000000 MHz Auto Man
MXX MODE 1 N 2 N 3 N 4 5 6 7 8 9 10 11	TRC         SCL           1         f           1         f           1         f		× 2.401 8: 2.401 4: 2.402 5:	5 GHz 5 GHz 6 GHz	1.86 dl -18.51 dl -18.21 dl	FUN Bm Bm Bm Bm		EUNCTION WIDTH	FUNCTI		Freq Offset 0 Hz
MSG					m			STATUS	3	F F	

#### Figure Channel 00:



							0						
🇾 Key	ysight !	Spectr	um A	nalyzer - Swe	ept SA								
Cen	ter	Fre	RF q 2	50 Ω 2.44100	AC	lz	SE	NSE:INT	Avg	ALIGN AUTO Type: Log-Pwr	05:33:07 P	M May 05, 2015	Frequency
					PI IFI	NO: Wide ( Gain:Low	#Atten: 2	e Run 20 dB			D		
10 d	Bidiv	. 1	Ref	10.00 d	iBm					Mki	2 2.440 r2 -18.	45 GHz 22 dBm	Auto Tune
Lõg				10.00 0				1					
0.00								.2					Center Freq
-10.0							<b>∳</b> <sup>2</sup>	V				-18.11 dBm	2.441000000 GHZ
-20.0													
-30.0							A	, ,					Start Freq
-40.0						- And a start of the start of t			- No.	m			2.436000000 GHz
-50.0					man					Chy Margan			
-70.0	~~~~	~~~	~~	-10							- about the	M. M. S. W. S.	Stop Freq
-20.0													2.446000000 GHz
-00.0													
Cen #Re	ter 1 s Bi	2.44 N 1	10 00	00 GHz kHz		#VP	3A/ 100 kHz	,		Sween 1	Span 1 267 ms (	0.00 MHz	CF Step
			00		~				CTION				Auto Man
1	N	1	f		2.440 8	4 GHz	1.89 d	Bm	ICTION	FUNCTION WIDTH	FUNCTI		
2	N N	1	f		<u>2.440 4</u> 2.441 5	<u>5 GHz</u> 6 GHz	<u>-18.22 d</u> -18.13 d	Bm Bm					Freq Offset
4												=	0 Hz
6													
8													
9 10													
11			_										
MSG										STATU	s		L
											1		

## Figure Channel 39:

#### Figure Channel 78:





Product	:	Notebook PC
Test Item	:	Occupied Bandwidth Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK) (2402MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	1390		NA
39	2441	1390		NA
78	2480	1390		NA

# Figure Channel 00:

🚺 К	eysight	Spect	rum A	Analyzer - Sw	ept SA								
⊮ <mark>الا</mark> Cer	nter	Fre	RF eq 2	50 Ω 2.40200	AC	z	SEI		Avg Typ	ALIGN AUTO	06:32:26 P TRA	M May 05, 2015	Frequency
10 0	Bidis	,	Ref	10.00		IO: Wide ⊆ ∋ain:Low	#Atten: 2	0 dB		Mkr	2 2.401 -19.	31 GHz 44 dBm	Auto Tune
0.00 -10.0 -20.0				10.00			2 <sup>2</sup>	3				-18.10 dBm	Center Freq 2.402000000 GHz
-30.0 -40.0 -50.0			_		- h- horr				and the second s	1			Start Freq 2.397000000 GHz
-60.0 -70.0 -80.0		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~	grow or							an and a second	Marana Marana Marana	<b>Stop Freq</b> 2.407000000 GHz
Cer #Re	nter : es Bi	2.40 N 1	020 00	00 GHz kHz		#VBV	V 100 kHz	500		Sweep 1	Span 1 .267 ms (	0.00 MHz 1001 pts)	CF Step 1.000000 MHz <u>Auto</u> Man
1 2 3 4 5 6 7 8 9 10 11		1 1 1	SCL f f		x 2.401 8 2.401 3 2.402 7	5 GHz 1 GHz 0 GHz	Y <u>1.90 di</u> -19.44 di -18.25 di	FUNC Bm Bm Bm Bm Bm		JNCTION WIDTH	FUNCT	E	Freq Offset
.∢ 📄 MSG							m		· ·	STATUS		Þ	



						-						
								ot SA	Analyzer - Swe	Spectrum /	ysight !	🊺 Ke
Frequency	May 05, 2015	06:39:21 PI	ALIGN AUTO		SE:INT	SEN	-		50 Ω	RF	L	XI R
Auto Tune	DET P N N N N		Avg Type. Log-t wi		Run dB	☐ Trig: Free Run #Atten: 20 dB		PNO: Wide IFGain:Low			Cen	
	Mkr2 2.440 31 GHz 10 dB/div Ref 10.00 dBm -18.88 dBm											
						$\langle \rangle$						∟og
Center Fre					and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~						0.00
2.441000000 GH	-17.95 dBm				<u>}</u>	2 <sup>2</sup>					-	10.0
	-17.55 dbm											20.0
Start Ere						<i>A</i>						30.0
2.436000000 GH				my	~							40.0
				- and the second			apart					50.0
			how was a					an all and and				10.0
Stop Fr	mann	Mr							s www.	m	area.	5U.U
2.446000000 GH												70.0
												30.0
05.01		Enon 1								0 4 4 4 0		
LF Step 1.000000 MH Auto Mar	BW 100 kHz #VBW 100 kHz Sween 1.267 ms (1001 nts)										s Bi	Re
	1001 pts/											
		FUNCTIO	ICTION WIDTH	TION FU	FUNC	2 05 dE		2 440 8/		TRC SCL	MODE	IKR 1
Ere # Offe					m	-18.88 dE	1 GHz	2.440 3		1 f	N	2
Frequis					m	-18.29 dE	) GHz	2.441 70		1 f	Ν	3
0	E											5
												6 7
												8
					-							9
	-											1
	E F	1				iii						
			STATUS									SG

## Figure Channel 39:

#### Figure Channel 78:





# 11. EMI Reduction Method During Compliance Testing

No modification was made during testing.



Attachment 1: EUT Test Photographs



Attachment 2: EUT Detailed Photographs