

FCC Test Report

Product Name	Wireless module
Model No.	LBEE5ZZ1GV-893
FCC ID.	2AAD3JA0M0P0

Applicant	ABILITY ENTERPRISE CO., LTD.
Address	4 Fl., No.8, Lane7, Wuchiuan Rd, Wugu Dist.,
	New Taipei City 248, Taiwan, (R.O.C.)

Date of Receipt	Oct. 27, 2015
Issued Date	Dec. 03, 2015
Report No.	15B0029R-RFUSP01V00-D
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: Dec. 03, 2015 Report No.: 15B0029R-RFUSP01V00-D



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Applicant	ABILITY ENTERPRISE CO., LTD.		
Address	4 Fl., No.8, Lane7, Wuchiuan Rd, Wugu Dist., New Taipei City 248,		
	Taiwan, (R.O.C.)		
Manufacturer	ABILITY ENTERPRISE CO., LTD.		
Model No.	LBEE5ZZ1GV-893		
FCC ID.	2AAD3JA0M0P0		
EUT Rated Voltage	DC 3.3V		
EUT Test Voltage	DC 3.3V		
Trade Name	Nikon		
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2014		
	ANSI C63.4: 2014, ANSI C63.10: 2013		
Test Result	Complied		
Documented By	Joanne liv		
Tested By	(Senior Adm. Specialist / Joanne Lin) :		
	(Engineer / Eason Chen)		
Approved By	Honde		
	(Director / Vincent Lin)		

TABLE OF CONTENTS

Des	scription	Page
1.	GENERAL INFORMATION	5
1.1.	EUT Description	5
1.2.	Operational Description	7
1.3.	Tested System Details	
1.4.	Configuration of Tested System	8
1.5.	EUT Exercise Software	8
1.6.	Test Facility	9
2.	CONDUCTED EMISSION	10
2.1.	Test Equipment	10
2.2.	Test Setup	10
2.3.	Limits	
2.4.	Test Procedure	
2.5.	Uncertainty	
2.6.	Test Result of Conducted Emission	
3.	PEAK POWER OUTPUT	14
3.1.	Test Equipment	14
3.2.	Test Setup	14
3.3.	Limit	14
3.4.	Test Procedure	14
3.5.	Uncertainty	14
3.6.	Test Result of Peak Power Output	
4.	RADIATED EMISSION	
4.1.	Test Equipment	
4.2.	Test Setup	
4.3.	Limits	
4.4.	Test Procedure	19
4.5.	Uncertainty	19
4.6.	Test Result of Radiated Emission	
5.	RF ANTENNA CONDUCTED TEST	
5.1.	Test Equipment	
5.2.	Test Setup	
5.3.	Limits	
5.4.	Test Procedure	
5.5.	Uncertainty	
5.6.	Test Result of RF Antenna Conducted Test	
6.	BAND EDGE	
6.1.	Test Equipment	
6.2.	Test Setup	
6.3.	Limit	
6.4.	Test Procedure	
6.5.	Uncertainty	

6.6.	Test Result of Band Edge	
7.	CHANNEL NUMBER	41
7.1.	Test Equipment	41
7.2.	Test Setup	41
7.3.	Limit	41
7.4.	Test Procedure	41
7.5.	Uncertainty	41
7.6.	Test Result of Channel Number	
8.	CHANNEL SEPARATION	44
8.1.	Test Equipment	44
8.2.	Test Setup	44
8.3.	Limit	
8.4.	Test Procedure	44
8.5.	Uncertainty	44
8.6.	Test Result of Channel Separation	
9.	DWELL TIME	49
9.1.	Test Equipment	49
9.2.	Test Setup	
9.3.	Limit	
9.4.	Test Procedure	49
9.5.	Uncertainty	49
9.6.	Test Result of Dwell Time	
10.	OCCUPIED BANDWIDTH	54
10.1.	Test Equipment	54
10.2.	Test Setup	54
10.3.	Limits	54
10.4.	Test Procedure	54
10.5.	Uncertainty	54
10.6.	Test Result of Occupied Bandwidth	
11.	EMI REDUCTION METHOD DURING COMPLIANCE TESTING	59
Attach Attach	ment 1: EUT Test Photographsment 2: EUT Detailed Photographs	

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Wireless module	
Trade Name	Nikon	
Model No.	LBEE5ZZ1GV-893	
FCC ID.	2AAD3JA0M0P0	
Frequency Range	2402 – 2480MHz	
Channel Number	79	
Type of Modulation	FHSS: GFSK(1Mbps) / π /4DQPSK(2Mbps) / 8DPSK(3Mbps)	
Antenna Type	PCB Antenna	
Channel Control	Auto	
Antenna Gain	Refer to the table "Antenna List"	

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	Murata Manufacturing	Type1GV(LBEE5ZZ1GV)	РСВ	-0.1dBi for 2.4 GHz
	Co., Ltd.			

Note: The antenna of EUT conforms to FCC 15.203.

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 Wireless module with a built-in WLAN and 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.
- 5. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

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:

Produ	ıct	Manufacturer	Model No.	Serial No.	Power Cord
1	Notebook PC	DELL	Latitude E5440	FS9TK32	Non-Shielded, 0.8m
2	LCD Monitor	ASUS	VS229HA	F4LMQS135395	Non-Shielded, 1.8m
3	Test Fixture	ABILITY	N/A	N/A	N/A

Signal Cable Type		Signal cable Description	
А	USB Cable	Shielded, 1.8m, with one ferrite core bonded.	
В	HDMI Cable	Non-Shielded, 1.8m	

1.4. Configuration of Tested System



1.5. EUT Exercise Software

- 1. Setup the EUT as shown in Section 1.4.
- 2. Execute software "Sample_Project MFC Application V1.1.0.1" on the Notebook PC.
- 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			
Site Name:	Quietek Corporation			
Site Address:	No.5-22, Ruishukeng,			
	Linkou Dist. New Taipei City 24451,			
	Taiwan, R.O.C.			
	TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789			
	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
Х	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2015	
Х	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2015	Peripherals
Х	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2015	EUT
	DC LISN	Schwarzbeck	8226 / 176	Mar., 2015	EUT
Х	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



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

2.3. Limits

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

Product	:	Wireless module
Test Item	:	Conducted Emission Test
Power Line	:	Line 1
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK) (2441MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	dBµV	dB	dBµV
LINE 1					
Quasi-Peak					
0.209	9.755	43.240	52.995	-11.319	64.314
0.248	9.758	26.220	35.978	-27.222	63.200
0.314	9.764	32.140	41.904	-19.410	61.314
0.373	9.768	17.930	27.698	-31.931	59.629
0.455	9.774	16.110	25.884	-31.402	57.286
0.638	9.789	11.520	21.309	-34.691	56.000
Average					
0.209	9.755	34.220	43.975	-10.339	54.314
0.248	9.758	16.360	26.118	-27.082	53.200
0.314	9.764	27.030	36.794	-14.520	51.314
0.373	9.768	11.100	20.868	-28.761	49.629
0.455	9.774	8.180	17.954	-29.332	47.286
0.638	9.789	3.720	13.509	-32.491	46.000

Note:

- 1. All Reading Levels are Quasi-Peak and average value.
- 2. " " means the worst emission level.

3. Measurement Level = Reading Level + Correct Factor

Product	:	Wireless module
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					
0.181	9.756	22.610	32.366	-32.748	65.114
0.205	9.755	38.030	47.785	-16.644	64.429
0.220	9.756	26.770	36.526	-27.474	64.000
0.236	9.758	19.760	29.518	-34.025	63.543
0.310	9.763	25.070	34.833	-26.596	61.429
0.623	9.787	16.950	26.737	-29.263	56.000
Average					
0.181	9.756	11.490	21.246	-33.868	55.114
0.205	9.755	22.910	32.665	-21.764	54.429
0.220	9.756	6.670	16.426	-37.574	54.000
0.236	9.758	12.740	22.498	-31.045	53.543
0.310	9.763	19.050	28.813	-22.616	51.429
0.623	9.787	4.700	14.487	-31.513	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

± 1.27 dB

3.6. Test Result of Peak Power Output

Product	:	Wireless module
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	3.23	1 Watt= 30 dBm	Pass
Channel 39	2441.00	3.32	1 Watt= 30 dBm	Pass
Channel 78	2480.00	3.47	1 Watt= 30 dBm	Pass

Product	:	Wireless module	
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	1.70	1 Watt= 30 dBm	Pass
Channel 39	2441.00	2.08	1 Watt= 30 dBm	Pass
Channel 78	2480.00	1.78	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.
Site # 3	Х	Magnetic Loop Antenna	Teseq	HLA6121/ 37133	Sep., 2015
	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
	Χ	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., 2015
	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., 2015
	Х	Pre-Amplifier	EMCI	EMC012630SE/980210	Jan., 2015
	Х	Pre-Amplifier	MITEQ	JS41-001040000-58-5P/153945	Jul., 2015
	Х	Pre-Amplifier	NARDA	DBL-1840N506/013	Jul., 2015

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 Test Item Test Site Test Mode	 Wireless m Harmonic No.3 OATS Mode 1: Tr 	odule Radiated Emissi S ransmit - 1Mbps	ion s (GFSK) (2402MHz))	
Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	$dB\mu V/m$	dB	dBµV/m
Horizontal					
Peak Detector:					
4804.000	2.511	46.921	49.431	-24.569	74.000
7206.000	9.511	43.865	53.376	-20.624	74.000
9608.000	10.394	43.256	53.650	-20.350	74.000
Average					
Detector:					
Vertical					
Peak Detector:					
4804.000	2.923	44.469	47.391	-26.609	74.000
7206.000	9.988	43.535	53.524	-20.476	74.000
9608.000	10.848	42.983	53.831	-20.169	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.

Limit

Product	:	Wireless	module				
Test Item	:	Harmon	Harmonic Radiated Emission				
Test Site	:	No.3 OA	ATS				
Test Mode	:	Mode 1:	Mode 1: Transmit - 1Mbps (GFSK)(2441MHz)				
Frequency	Co	orrect	Reading	Measurement	Margin		
	Fa	etor	Level	Level			

	Factor	Level	Level		
MHz	dB	dBµV	dBµV/m	dB	$dB\mu V/m$
Horizontal					
Peak Detector:					
4882.000	2.025	45.250	47.275	-26.725	74.000
7323.000	9.762	43.195	52.956	-21.044	74.000
9764.000	9.682	43.296	52.977	-21.023	74.000
Average					
Detector:					
Vertical					
Peak Detector:					
4882.000	2.488	44.691	47.179	-26.821	74.000
7323.000	10.375	43.266	53.640	-20.360	74.000
9764.000	10.315	43.541	53.856	-20.144	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	:	Wireless module
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	dBµV/m	dB	$dB\mu V/m$
Horizontal					
Peak Detector:					
4960.000	2.582	46.089	48.671	-25.329	74.000
7440.000	10.555	42.920	53.475	-20.525	74.000
9920.000	10.206	43.130	53.336	-20.664	74.000
Average					
Detector:					
Vertical					
Peak Detector:					
4960.000	3.398	44.676	48.075	-25.925	74.000
7440.000	11.214	42.544	53.758	-20.242	74.000
9920.000	11.245	42.305	53.550	-20.450	74.000
Average					
Detector:					

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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 Test Item Test Site Test Mode	 Wireless m Harmonic I No.3 OATS Mode 2: Tr 	odule Radiated Emissi S ransmit - 3Mbps	on (8DPSK)(2402MHz	:)	
Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	dBµV/m	dB	dBµV/m
Horizontal					
Peak Detector:					
4804.000	2.511	44.776	47.286	-26.714	74.000
7206.000	9.511	43.872	53.383	-20.617	74.000
9608.000	10.394	43.290	53.684	-20.316	74.000
Average					
Detector:					
Vertical					
Peak Detector:					
4804.000	2.923	44.898	47.820	-26.180	74.000
7206.000	9.988	43.614	53.603	-20.397	74.000
9608.000	10.847	42.928	53.775	-20.225	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	: Wireles	s module				
Test Item	: Harmonic Radiated Emission					
Test Site	: No.3 OATS					
Test Mode	: Mode 2	: Transmit - 3Mbp	os (8DPSK) (2441MH	[z)		
Frequency	Correct	Reading	Measurement	Margin	Limit	
	Factor	Level	Level			
MHz	dB	dBµV	$dB\mu V/m$	dB	dBµV/m	
Horizontal						
Peak Detector:						
4882.000	2.025	44.274	46.299	-27.701	74.000	
7323.000	9.762	43.297	53.058	-20.942	74.000	
9764.000	9.682	43.204	52.885	-21.115	74.000	
Average						
Detector:						
Vertical						
Peak Detector:						
4882.000	2.488	44.239	46.727	-27.273	74.000	
7323.000	10.375	43.010	53.384	-20.616	74.000	
9764.000	10.315	43.426	53.741	-20.259	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	: Wireles	s module				
Test Item	: Harmonic Radiated Emission					
Test Site	: No.3 O	ATS				
Test Mode	: Mode 2	: Transmit - 3Mbr	os (8DPSK) (2480MH	[z)		
				,		
Frequency	Correct	Reading	Measurement	Margin	Limit	
	Factor	Level	Level			
MHz	dB	dBµV	$dB\mu V/m$	dB	dBµV/m	
Horizontal						
Peak Detector:						
4960.000	2.582	44.586	47.168	-26.832	74.000	
7440.000	10.555	43.142	53.697	-20.303	74.000	
9920.000	10.206	43.020	53.226	-20.774	74.000	
Average						
Detector:						
Vertical						
Peak Detector:						
4960.000	3.398	43.974	47.373	-26.627	74.000	
7440.000	11.214	42.058	53.272	-20.728	74.000	
9920.000	11.245	42.384	53.629	-20.371	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	:	Wireless module
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					
115.360	-7.390	27.501	20.112	-23.388	43.500
268.620	-5.522	24.938	19.416	-26.584	46.000
421.880	-0.260	27.903	27.643	-18.357	46.000
631.400	1.266	25.873	27.139	-18.861	46.000
757.500	5.107	21.071	26.178	-19.822	46.000
864.200	6.329	26.975	33.304	-12.696	46.000
Vertical					
119.240	-3.571	28.988	25.418	-18.082	43.500
237.580	-6.537	30.194	23.657	-22.343	46.000
371.440	-0.310	26.936	26.626	-19.374	46.000
540.220	2.169	22.162	24.331	-21.669	46.000
757.500	2.487	23.215	25.702	-20.298	46.000
968.960	3.936	20.125	24.061	-29.939	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.

2441MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	$dB\mu V/m$	dB	dBµV/m
Horizontal					
39.700	-3.625	28.245	24.620	-15.380	40.000
210.420	-10.427	30.015	19.588	-23.912	43.500
369.500	0.787	27.994	28.781	-17.219	46.000
474.260	2.294	25.904	28.198	-17.802	46.000
631.400	1.266	24.370	25.636	-20.364	46.000
864.200	6.329	28.744	35.073	-10.927	46.000
Vertical					
179.380	-0.824	27.716	26.892	-16.608	43.500
375.320	0.388	27.136	27.524	-18.476	46.000
530.520	1.192	22.011	23.203	-22.797	46.000
633.340	-1.450	24.843	23.393	-22.607	46.000
864.200	-0.291	29.181	28.890	-17.110	46.000
965.080	3.832	19.935	23.767	-30.233	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	:	Wireless module
Test Item	:	RF Antenna Conducted Test
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK)

Figure Channel 00:



Figure Channel 39:



Figure Channel 78:



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



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





Figure Channel 78:



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., 2015
	Х	Horn Antenna	ETS-Lindgren	3117/ 35205	Mar., 2015
	X Horn Antenna		Schwarzbeck	BBHA9170/209	Jan., 2015
	Х	Horn Antenna	TRC	AH-0801/95051	Aug., 2015
	Х	Pre-Amplifier	EMCI	EMC012630SE/980210	Jan., 2015
	Х	Pre-Amplifier	MITEQ	JS41-001040000-58-5P/153945	Jul., 2015
	Χ	Pre-Amplifier	NARDA	DBL-1840N506/013	Jul., 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.

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	:	Wireless module
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)	2386.900	-2.701	44.451	41.750	74.00	54.00	Pass
00 (Peak)	2390.000	-2.687	43.872	41.185	74.00	54.00	Pass
00 (Peak)	2400.000	-2.660	69.863	67.203			
00 (Peak)	2402.000	-2.657	103.612	100.955			
00 (Average)	2364.600	-2.800	31.310	28.511	74.00	54.00	Pass
00 (Average)	2390.000	-2.687	31.028	28.341	74.00	54.00	Pass
00 (Average)	2400.000	-2.660	48.770	46.110			
00 (Average)	2402.000	-2.657	88.522	85.865			

Figure Channel 00:



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. ', means this data is the worst emission level.
- 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	:	Wireless module
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK) (2402MHz)

RF Radiated Measurement (VERTICAL):

Channel Ma	Frequency	Correct Factor	Reading Level	Emission Level	Peak Limit	Arerage Limit	Dogult
Channel No.	(MHz)	(dB)	(dBµV)	(dBµV/m)	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
00 (Peak)	2376.800	-4.115	44.870	40.755	74.00	54.00	Pass
00 (Peak)	2390.000	-4.159	43.542	39.383	74.00	54.00	Pass
00 (Peak)	2400.000	-4.171	68.723	64.552			
00 (Peak)	2401.800	-4.171	100.915	96.744			
00 (Average)	2390.000	-4.159	30.738	26.579	74.00	54.00	Pass
00 (Average)	2400.000	-4.171	46.579	42.408			
00 (Average)	2402.000	-4.171	86.255	82.084			

Figure Channel 00:

VERTICAL (Peak)



Figure Channel 00:

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.
- ', means this data is the worst emission level.
- 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	:	Wireless module
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	Arerage Limit	Result
Chamber 100.	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	(dBµV/m)	(dBµV/m)	neosun
78 (Peak)	2480.000	-2.605	102.868	100.263			Pass
78 (Peak)	2483.500	-2.601	48.862	46.260	74.00	54.00	Pass
78 (Peak)	2484.000	-2.602	50.368	47.767	74.00	54.00	Pass
78 (Average)	2480.000	-2.605	87.725	85.120			Pass
78 (Average)	2483.500	-2.601	35.017	32.415	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.
- 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	:	Wireless module
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	Emission Level	Peak Limit	Arerage Limit	Dogult
	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
78 (Peak)	2480.000	-3.978	100.083	96.105			Pass
78 (Peak)	2483.500	-3.966	48.095	44.128	74.00	54.00	Pass
78 (Average)	2480.000	-3.978	85.393	81.415			Pass
78 (Average)	2483.500	-3.966	33.374	29.407	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.
- 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	:	Wireless module
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK) (2402MHz)

RF Radiated Measurement (Horizontal):

Channel No.	Frequency	Correct Factor	Reading Level	Emission Level	Peak Limit	Arerage Limit	Dogult
	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
00 (Peak)	2386.400	-2.703	44.612	41.909	74.00	54.00	Pass
00 (Peak)	2390.000	-2.687	42.750	40.063	74.00	54.00	Pass
00 (Peak)	2400.000	-2.660	70.937	68.277			
00 (Peak)	2402.000	-2.657	101.793	99.136			
00 (Average)	2390.000	-2.687	30.798	28.111	74.00	54.00	Pass
00 (Average)	2400.000	-2.660	53.596	50.936			
00 (Average)	2402.100	-2.657	84.442	81.785			





- 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. Measurement Level = Reading Level + Correction Factor.
- 1. 2. 3. 4.
- 5.
- 6. The average measurement was not performed when the peak measured data is under the limit of average detection.

Product	:	Wireless module
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	Dogult
	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
00 (Peak)	2390.000	-4.159	44.100	39.941	74.00	54.00	Pass
00 (Peak)	2400.000	-4.171	68.450	64.279			
00 (Peak)	2402.000	-4.171	99.096	94.925			
00 (Average)	2390.000	-4.159	30.601	26.442	74.00	54.00	Pass
00 (Average)	2400.000	-4.171	51.412	47.241			
00 (Average)	2402.000	-4.171	82.234	78.063			

Figure Channel 00:

VERTICAL (Peak)



Figure Channel 00:

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	:	Wireless module
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	Dogult
	(MHz)	(dB)	(dBµV)	(dBµV/m)	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
78 (Peak)	2480.000	-2.605	100.598	97.993			Pass
78 (Peak)	2483.500	-2.601	46.952	44.350	74.00	54.00	Pass
78 (Peak)	2484.000	-2.602	49.649	47.048	74.00	54.00	Pass
78 (Average)	2480.000	-2.605	83.526	80.921			Pass
78 (Average)	2483.500	-2.601	33.504	30.902	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	:	Wireless module
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK) (2480MHz)

RF Radiated Measurement (VERTICAL):

Channel No.	Frequency	Correct Factor	Reading Level	Emission Level	Peak Limit	Arerage Limit	Regult
	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
78 (Peak)	2480.000	-3.978	97.798	93.820			Pass
78 (Peak)	2483.500	-3.966	45.668	41.701	74.00	54.00	Pass
78 (Peak)	2485.300	-3.961	46.288	42.327	74.00	54.00	Pass
78 (Average)	2480.000	-3.978	81.286	77.308			Pass
78 (Average)	2483.500	-3.966	32.263	28.296	74.00	54.00	Pass

Figure Channel 78:

VERTICAL (Peak)



Figure Channel 78:

VERTICAL (Average)



- 1. 2. 3.
- 4. 5.
- 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. Measurement Level = Reading Level + Correction Factor. The average measurement was not performed when the peak measured data is under the limit of average dataction 6. 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

Wireless module
Channel Number
No.3 OATS
Mode 1: Transmit - 1Mbps (GFSK)

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

2402-2421MHz

2422-2441MHz

Keysight Sp	pectrum Analyzer - Swept	n SA	- 12	10000	10	and the second second			000	BE K	eysight S	petium	n Analyzer - S	Swept SA		22 - 53	100	11	10000	10000000		00
Center F	Freq 2.411000	0000 GHz	Trig: Fr	ree Run	Avg Type	Log-Pwr	04:12:32 F TRA TV	CE 1 2 3 4 5 6	Frequency	Cer	nter l	Freq	2.431	500000 G	Hz	Trig: Free	Run	Avg Typ	ALIGN AUTO	04:13:27 P TRAI TV	#Nov 09, 2015 E 1 2 3 4 5 6 PE MWWWWW	Frequency
10 dB/div	Ref Offset 0.5 (Ref 20.50 dB	IFGain:Lo dB Bm	#Atten:	30 dB		Mkr2	2.421 (000 GHz 78 dBm	Auto Tune	10 d	1B/div	Re	ef Offset (ef 20.50	0.5 dB 0 dBm	Gein:Low	#Atten: 3	0 d8		Mkr	2 2.441 2.	00 GHz 81 dBm	Auto Tune
10.5 0.500	Ânn	ww	w	w	w	w	w	VA.	Center Freq 2.411000000 GHz	10.5 0.500	Â	Λ	N	w	w	M	ΛΛ	N	INA	ΛÂ	∧Â	Center Freq 2.431500000 GHz
-195									Start Freq 2.400500000 GHz	-19.5 -29.5 -39.5	5				-							Start Freq 2.421500000 GHz
-49.5 -59.5 -69.5									Stop Freq 2.421500000 GHz	-49.5 -59.5 -69.5	5											Stop Freq 2.441500000 GHz
Start 2.4 #Res BW	0050 GHz / 100 kHz	#1	/BW 100 kH	z	-	Sweep 2	Stop 2.4 .533 ms	2150 GHz (1001 pts)	CF Step 2.100000 MHz Auto Man	Sta #Re	rt 2.4 es BV	2150 V 100) GHz) kHz		#VB\	V 100 kHz			Sweep 2	Stop 2.4 .467 ms (150 GHz 1001 pts)	CF Step 2.000000 MHz Auto Man
1 N 2 N 3 4		2.402 000 GHz 2.421 000 GHz	2.63	dBm dBm	CTION FUN	CTION WOTH	FUNCT		Freq Offset 0 Hz	1 2 3 4 5	N	THC 50		2.422 2.441	00 GHz 00 GHz	3.46 dE 2.81 dE	Bm Bm	CTION	INCTION WOTH	FUNCTI		Freq Offset 0 Hz
6 7 8 9 10 11								_		6 7 8 9 10												
MSG			1.5.1	. 1.		to STATU	s]			* L									to status	1. 1		

2442-2461MHz

2462-2480MHz

Keysight Spectrum Analyzer - Swept SA				🗱 Keysight Spectrum Analyzer - Swept SA	0 0 0
Center Freq 2.451500000 GHz	SENSE:INT ALIGN AUT Avg Type: Log-Pv	10 04:14:28 PM Nov 09, 2015 WY TRACE 1 2 3 4 5 6	Frequency	Int RF 50 02 AC SENSE:INT ALIGN AUTO 04:15:07 PM No. Center Freq 2.471500000 GHz Avg Type: Log-Pwr TMACE 1 TmacE 1 TmacE 1	09, 2015 2 3 4 5 6 Frequency
PNO: Faat C	#Atten: 30 dB	kr2 2.461 00 GHz 2.51 dBm	Auto Tune	PRO Frat Drug PR	GHZ Auto Tune
	MAMAA	1	Center Freq 2.451500000 GHz		2 Center Freq 2.471500000 GHz
.195 .295 .305			Start Freq 2.441500000 GHz	eq .195	Start Freq 2.461500000 GHz
49.5			Stop Freq 2.461500000 GHz	485	Stop Freq 2.4B1500000 GHz
Start 2.44150 GHz #Res BW 100 kHz #VBW	100 kHz Sweep	Stop 2.46150 GHz 2.467 ms (1001 pts)	CF Step 2.000000 MHz Auto Man	p Start 2.46150 GHz Stop 2.4815 Hz #Res BW 100 kHz #VBW 100 kHz Sweep 2.467 ms (100	0 GHz 1 pts) CF Step 2.000000 MHz Auto Man
L002 (0006) Trial Scitt X 1 N 1 f 2.442 00 GHz 2 N 1 2.461 00 GHz 3 1 2.461 00 GHz 4 5 5	2.92 dBm 2.51 dBm		Freq Offset 0 Hz	Line 1 1 7 2.480,000 GHz 2.82 dBm 1 1 7 2.480,000 GHz 2.82 dBm 1 3 1 2.480,000 GHz 1.69 dBm 14z 4 - - -	Freq Offset 0 Hz
8 9 10 11				9 1 1 1 9 1 1 1 1 10 1 1 1 1	
MSG	= (0) 51/	ATUS		MSG GSTATUS	

Wireless module
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

Keysight Spectrum Analyzer - Swept SA		0	III Keysight Spectrum Analyzer - Swept SA	00
RL RF S0 Ω AC SENSE INT] Center Freq 2.411000000 GHz Tala: Free Pue	ALISN AUTO 04:25:25 PM Nov 09, 2015 Avg Type: Log-Pwr TRACE 1 2 3 4 5 6 Type: Log-Pwr	Frequency	RL RF S0 0: AL SENSE:INT] ALIGN AUTO 04:26:21 PM Nov 09, 2015 Center Freq 2.431500000 GHz Avg Type: Log-Pwr TRACE[1: 23 4 5 6 Trace[1: 23 4 5 6	Frequency
PRO: Fast #Atten: 30 dB	Mkr2 2.421 000 GHz	Auto Tune	PROTAGE OF THE CONTROL OF THE CONTRO	Auto Tune
	-	Center Freq 2.411000000 GHz		Center Freq 2.431500000 GHz
-195 -295 -395		Start Freq 2.400500000 GHz	-195 	Start Freq 2.421500000 GHz
40.5		Stop Freq 2.421500000 GHz	405	Stop Freq 2.441500000 GHz
Start 2.40050 GHz #Res BW 100 kHz #VBW 100 kHz	Stop 2.42150 GHz Sweep 2.533 ms (1001 pts)	CF Step 2.100000 MHz Auto Man	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 Auto Man
N I		Freq Offset 0 Hz	IN I 2.422 00 GHz -0.55 dBm =0.05 dBm	Freq Offset 0 Hz
	Chistatus -			

2442-2461MHz

2462-2480MHz

🚛 Keysight Spectrum Analyzer - Swept SA	000	🕼 Keysight Spectrum Analyzer - Swept SA 💦 👘 🔂 👘
RL RF S0.0 AC SENSE.DVT ALIGN AUTO 04-27-22 #MMor09.201 Center Freq 2.451500000 GHz Trig: Free Run Avg Type: Log-Pwr TRACE [2.3 4.5 Trig: Free Run	5 Frequency	RL RF Ising Acc Sense Intl Allow Arro (64283294Nac 49, 2015) Center Freq 2.471500000 GHz Avg Type: Log-Pwr RMACE[123456 Frequency
ICGinLow AAten: 30 dB Cert ANAMA B Cert Anama 10 dB/div Ref 20.50 dBm - 3.08 dBm - 3.08 dBm	Auto Tune	Series 30 dB Certer NMAR In Generation BAtten: 30 dB Mkr2 2.480 00 GHz 10 dB/div Ref 20.50 dBm -3.13 dBm
105 105 105 105 105 105 105 105	Center Freq 2.451500000 GHz	105 105 105 105 105 105 105 105
-195 -295 -395	Start Freq 2.441500000 GHz	.195. .095. .095. .095. .095. .005. .0
485	Stop Freq 2.461500000 GHz	405
Start 2.44150 GHz Stop 2.46150 GH; #Res BW 100 kHz #VBW 100 kHz Sweep 2.467 ms (1001 pts	Z CF Step 2.000000 MHz Auto Man	Start 2.46150 GHz #Res BW 100 kHz #VBW 100 kHz Sweep 2.467 ms (1001 pts) Autor Manual
With Deck Joint Deck Stort De	Freq Offset 0 Hz	Log Log Hull 2007 1 N 1 f 2.462 00 GHz -3.73 dBm 3 1 1 N 1 f 2.460 00 GHz -3.73 dBm 5 1 1 N 1 f 2.460 00 GHz -3.73 dBm 6 1 1 N 1 f 2.460 00 GHz -3.73 dBm 6 1 1 N 1 f 2.460 00 GHz -3.73 dBm 6 1 1 N 1 F 2.460 00 GHz -3.73 dBm 6 1 1 N 1 F 2.460 00 GHz -3.73 dBm 6 1 1 N 1 F 2.460 00 GHz -3.73 dBm 6 1 1 N 1 F 2.460 00 GHz -3.73 dBm 6 1 1 N 1 F 2.460 00 GHz -3.73 dBm 7 1 N 1 F 2.460 00 GHz -3.75 GHz -
MSG Destatus		MSG Gestatus

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

± 150Hz

8.6. Test Result of Channel Separation

:	Wireless module
:	Channel Separation
:	No.3 OATS
:	Mode 1: Transmit - 1Mbps (GFSK)
	: : : :

Channel No.	Fraguanau	Measurement	Limit	Limit of (2/3)*20dB	3	
	(MHz)	Level	(1,11,2)	Dondwidth (kUz)	Result	
	(MITZ)	(kHz)	(кпz)	Bandwidtii (KHZ)		
00	2402	1000	>25 kHz	766.7	Pass	
39	2441	1000	>25 kHz	766.7	Pass	
78	2480	1000	>25 kHz	766.7	Pass	

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

M RL RF 50 Ω AC SENSE:INT ALIGN AUTO 04:04:03 PM Nov 09, 2015 Center Freq 2.402000000 GHz Avg Type: Log-Pwr TRACE [1 2 3 4 5 6 Freque	ncy
Ref Offset 0.5 dB Mkr2 2.403 00 GHz 10 dB/div. Ref 20.50 dB 3.27 dBm 3.27 dBm	o Tune
Log 10.5 10.5 0.500 .9000 .900 .900 .900 .900 .900 .900 .900 .900	er Freq 000 GHz
19.5 -29.5 -39.5	irt Freq 000 GHz
49.5	o p Freq 000 GHz
Center 2.402000 GHz Span 10.00 MHz Span 10.00 MHz C #Res BW 100 kHz #VBW 100 kHz #Sweep 500.0 ms (1001 pts) 1.0000	F Step 000 MHz Man
I N I f 2.402.00 GHz 3.13 dBm Policition Policion Policition	Offset 0 Hz

Channel 00 (2402MHz)



1000 A		-	_						()			
鱦 Key	ysight	Spect	rum A	Analyzer - Swe	ept SA								
	L .	-	RF	50 Ω	AC OI	-	SE	NSE:INT	A	ALIGN AUTO	04:07:20 PI	M Nov 09, 2015	Frequency
Cen	ter	Fre	ed ≀	2.44100	0000 GF		Trig: Fre	Run	Avgiy	be. Log-Fwi	TYP		
					PI	VO: Wide 🕞	#Atten: 3	0 dB			DE	PNNNN	
						Jam.LOw							Auto Tune
			Ref	Offset 0 F	dB					Mkr	2 2.442	00 GHz	Auto Tunc
10 di	B /div	,	Ref	f 20.50 c	iBm						3.	00 dBm	
Log		-		20100 1							1		
10.5								Å 1	2				Center Fred
								V_{-}	9 .				CenterFreq
0.500							ſ	\sim /					2.441000000 GHz
-9.50													
0.00							1		2				
-19.5							1		- \				Start Fred
-29.5									\				
							F			-			2.436000000 GHZ
-39.5			-			-				1			
-49.5										Jan 1			
	ward		mar	mangender	بالمصربية	AN PROPERTY				and the second	mannen	manpuman	Stop Freq
-59.5													2 446000000 GHz
-69.5													2.440000000000112
Cen	ter	24	110								Snan 1	0 00 MHz	CE Stop
#PA		2.4* M/ 4	00			#\/D\/	(100 kHz		-	Cwoon 5	00.0 mc /	1001 ptc)	
#RC	3 D	VV I	00	NTIZ		#101			,	+aweeh 1	00.0 1115 (1001 ptsj	1.000000 Minz
MKR	MODE	TRC	SCL		Х		Y	FU	NCTION FL	JNCTION WIDTH	FUNCTION	DN VALUE	Auto Wan
1	Ν	1	f		2.441 0	0 GHz	3.04 d	Bm					
2	Ν	1	f		2.442 0	0 GHz	3.00 d	Bm					F Of
3													FreqOnset
4								_					0 Hz
5												=	
7													
8													
9													
10													
11		I											
•											1	•	
MSG										K STATUS	3		
										-			

Channel 39 (2441MHz)

Channel 78 (2480MHz)





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

	Fraguanay	Measurement	Limit	Limit of (2/3)*20dB	
Channel No.	(MHz)	Level	(1-11-)	Dondwidth (111-)	Result
	(MITZ)	(kHz)	(KHZ)	Bandwidtn (KHZ)	
00	2402	1000	>25 kHz	953.3	Pass
39	2441	1000	>25 kHz	953.3	Pass
78	2480	1000	>25 kHz	960.0	Pass

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

🊺 Keys	ight Sp	ectrum	Analyzer - Swe	ept SA									
Cent	er F	RF req	50 Ω 2.40200	AC 0000 GH	z	SE	NSE:INT	Avg T	ALIGN	AUTO J-Pwr	04:18:03 PI TRAC	MNov 09, 2015	Frequency
10 dB	(div	Re	f Offset 0.5	PN IFC dB	NO: Wide Gain:Low	➡ Trig: Fre #Atten: 3	e Run 0 dB			Mkr	2 2.403 -0.	00 GHz	Auto Tune
10.5 10.5 0.500						(1	2					Center Freq 2.402000000 GHz
-19.5 - -29.5 - -39.5 -					~				\	<u></u>			Start Freq 2.397000000 GHz
-49.5 - -59.5 - -69.5 -	querent	nnn	Veranter	leto-pation de la manuel	wa -					kw	Nolow ^{an (} Moradian	menter and	Stop Freq 2.407000000 GHz
Cent #Res	er 2. BW	4020 100	00 GHz kHz		#VB	W 100 kHz			#Swe	ep 5	Span 1 00.0 ms (0.00 MHz 1001 pts)	CF Step 1.000000 MHz <u>Auto</u> Man
Mick Mick 1 1 2 3 4 5 6 7 8 9 10 11 -				× 2.402 0 2.403 0	0 GHz 0 GHz	-0.77 di -0.77 di			FUNCTION		FUNCTION		Freq Offset 0 Hz
MSG									ų.	STATUS			

Channel 00 (2402MHz)



									(- · · ·					
🇾 Ke	ysight	Spect	rum /	Analyzer - Swe	ept SA									
lxi R	L		RF	50 Ω	AC		SE	NSE:INT		- 1	ALIGN AUTO	04:20:47 P	4 Nov 09, 2015	Frequency
Cen	ter	Fre	ed 1	2.44100	0000 GH	z	Trian Erro		Avg I	ype	: Log-Pwr	TYP	E 1 2 3 4 5 6	Trequency
					PN	lO:Wide ⊂	P Ing: Fre #∆tten: 3	0 dB				DE	PNNNN	
					IFC	sain:Low	#Atten. c	U UD					,	
			Dof		dD.						Mkr	2 2.442	00 GHz	Autorune
10 d	Bidis	,	Rei	F 20 50 c	1Bm							-0.9	95 dBm	
Log			RC	20.00				1						
10.5														Center Fred
10.0								∱1	▲ 2					Center Freq
0.500			-				(^	Kn -	-					2.441000000 GHz
-9.50								~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~						
0.00														
-19.5							1							Start Fred
-29.5														
										1	~			2.436000000 GHZ
-39.5						- m				~	back y			
-49.5						1								
	www	Anna		metrometers	- and and the second	al a					New York	Marial Marian	noturner	Stop Freq
-59.5														2 446000000 GHz
-69.5														2.440000000000112
Cen	ter	2 4/	110	00 GHz								Snan 1	0 00 MHz	CE Sten
#Do	e Bl	1 A/	00			#\/BI	M 100 KH2			#c	woon 5	00 0 me (1001 ptc)	1 000000 MHz
mr.c	3 01	** 1	00	KIIZ		#VD1				π.	aweeh a	00.0 1115 (roor pisj	Auto Man
MKR	MODE	TRC	SCL		x		Y	F	UNCTION	FUN	CTION WIDTH	FUNCTION	DN VALUE	Auto Man
1	Ν	1	f		2.441 0	0 GHz	-0.90 d	Bm						
2	N	1	f		2.442 0	0 GHz	-0.95 d	Bm						Eron Offect
3														Frequise
4														0 Hz
6													=	
7														
8														
9														
10														
11			_							_			*	
											_1	1		
MSG														

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

:	Wireless module
:	Dwell Time
:	No.3 OATS
:	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	2.887	13	50	0.75	0.300	0.4	Pass
2441	2.887	13	50	0.75	0.300	0.4	Pass
2480	2.887	13	50	0.75	0.300	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 Si	1.1. Sec. 1.1.				0 0 0	III Keysight Spectrum Analyzer - Sweg	# 5A				
Center Freq 2.4020000	00 GHz	SENSE:INT	Aug Type: Log-Pwr	04:04:44 PH Nov 09, 2015 TRACE 1 2 3 4 5 6	Frequency	Center Freq 2.40200	0000 GHz	Avg Type: Log-Pwr	14:04:59 PH Nov 09, 2015 TRACE 1 2 3 4 5 6	Frequency	
	PNO: Fast G	Atten: 30 dB		DET P NNNNN	Auto Tune		PRO: Fast Trg: Video IFGain:Low Atten: 30 dB Der/P NN				
10 dB/div Ref 20.50 dBr	'n					10 dB/div Ref 20.50 d	dB Bm	м	3.44 dBm		
10.5					Center Freq 2.402000000 GHz	10.5	¹ ⁽²	→ ³		Center Freq 2.402000000 GHz	
9.50					Start Freq 2.402000000 GHz	.19.5 .29.5			1780 LVL	Start Freq 2.402000000 GHz	
-19.5					Stop Freq 2.402000000 GHz	-49.5 -59.5 -69.5	youten	649479794		Stop Freq 2.40200000 GHz	
-39.5				1860 L.VL	CF Step 1.000000 MHz Auto Man	Center 2.402000000 G Res BW 1.0 MHz	Hz #VBW 1.0 MHz	Sweep 10.0	Span 0 Hz 10 ms (1001 pts)	CF Step 1.000000 MHz Auto Man	
-49.5 W W W		W	γ. • H	y # 0	Freq Offset 0 Hz	1 N 1 L 2 N 1 L 3 N 1 L 4 5	2.887 ms 3.43 dBm 3.746 ms 3.72 dBm 6.633 ms 3.44 dBm			Freq Offset 0 Hz	
69.5 Center 2.402000000 GHz				Span 0 Hz		5 7 8 9 10 11					
Nes BW 1.0 MHz	#VBW	1.0 MHZ	Sweep 5	0.00 ms (1001 pts)		+ MSG		STATUS			

CH39 Time Interval between hops

CH 39Transmission Time

III Keysight Spectrum Analyzer - Swept SA			00	III. Keysight Spectrum Analyzer - Swee	#SA	01. (CARDINE)	Contraction and the state	00
Center Freq 2.441000000 GHz Trig: Video	Aug Type: Log-Pwr TRAC TVP	MNov 09, 2015 CE 1 2 3 4 5 6 PE WWWWWW	Frequency	Center Freq 2.44100	AC SENSE INT	Avg Type: Log-Pwr	04:07:55 PH Nov 09, 2015 TRACE 1 2 3 4 5 6 TVPE WWWWWW	Frequency
Ref Offset 0.5 dB 10 dB/div Ref 20.50 dBm	DI	et P NNNNN	Auto Tune	Ref Offset 0.5 10 dB/div Ref 20,50 d	Mkr3 6.633 ms 3.21 dBm	Auto Tune		
10.5			Center Freq 2.441000000 GHz	10.5		→ ³		Center Freq 2.441000000 GHz
9.50			Start Freq 2.441000000 GHz	-19.5 -29.5 -39.5			1789 LVL	Start Freq 2.441000000 GHz
-19.5			Stop Freq 2.441000000 GHz	40.5 -50.5 -60.5	Man (help	elsormer:		Stop Freq 2.441000000 GHz
-30.5		1800	CF Step 1.000000 MHz Auto Man	Center 2.441000000 G Res BW 1.0 MHz	Hz #VBW 1.0 MHz	Sweep 10	Span 0 Hz 0.00 ms (1001 pts)	CF Step 1.000000 MHz Auto Man
49.5 4 1 1 1 1 1 1 1 1 1 1		W W	Freq Offset 0 Hz	1 N 1 t 2 N 1 t 3 N 1 t 4 5	2.887 ms 3.21 dBm 3.746 ms 3.53 dBm 6.633 ms 3.21 dBm			Freq Offset 0 Hz
©5 Center 2.441000000 GHz	S	Span 0 Hz		5 7 8 9 10 11				
Res BW 1.0 MHz #VBW 1.0 MHz	Sweep 50.00 ms ((1001 pts)		MSG		STATUS	1.1	



CH 78 Time Interval between hops

CH 78 Transmission Time

Keysight Spectrum Analyzer - Swept SA			0 9 25	BE Keysight Spectrum Analyzer - Swept	SA		0 9 44
Center Freq 2.480000000 GHz	SENSE:INT Avg Typ	ALIGN AUTO 04:10:02 PH Nov 09, pe: Log-Pwr TRACE 1 2 3	Frequency	Center Freq 2.480000	AC SENSE.(INT)	ALISN AUTO 04:10:17 PH Nov 09, 2 Avg Type: Log-Pwr TRACE 1 2 3 4	Frequency
PNO: Fast G	5' Trig: Video Atten: 30 dB	DET P NN	NNN		PNO: Fast Trig: Video IFGain:Low Atten: 30 dB	DET P NNN	inn T
Ref Offset 0.5 dB 10 dB/div Ref 20.50 dBm			Auto Tune	10 dB/div Ref 20,50 dB	iB Jim	Mkr3 6.633 n 3.04 dB	ms Auto Tune
10.5			Center Freq 2.48000000 GHz	10.5 0.500	¹ ²	* ³	Center Freq 2.480000000 GHz
950			Start Freq 2.480000000 GHz	-9 50 -19 5 -29 5 -39 5			Start Freq 2.48000000 GHz
-19.5			Stop Freq 2.480000000 GHz	40.5 -50.5 -60.5	- Salitaria		Stop Freq 2.480000000 GHz
-30.5			CF Step 1.000000 MHz Auto Man	Center 2.480000000 GH Res BW 1.0 MHz	z #VBW 1.0 MHz	Span 0 Sweep 10.00 ms (1001 p	Hz CF Step 1.000000 MHz Auto Man
495 k² k	lat bit ted to	* w w w	Freq Offset 0 Hz	1 N 1 t 2 N 1 t 3 N 1 t 5	2.887 ms 2.99 dBm 3.746 ms 3.33 dBm 6.633 ms 3.04 dBm		Freq Offset
60 5 Center 2.480000000 GHz		Span 0	Hz	6 7 8 9 10 10			
Res BW 1.0 MHz #VBW	V 1.0 MHz	Sweep 50.00 ms (1001	pts)	MSG	1.5	Co STATUS	

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	:	Wireless module
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	2.887	13	50	0.75	0.300	0.4	Pass
2441	2.887	13	50	0.75	0.300	0.4	Pass
2480	2.887	13	50	0.75	0.300	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

te trystef spectral Adapter Status Registry Status Adapter Center Freq 2.4020000000 GHz PNO: Fast C+ IFGainLow Figure Adapter Figure Ad AL RF 500 AC enter Freq 2.402000000 GHz PNO: Fast C Historic dow Historic dow Historic dow 21 PH Nov 09, 2015 TRACE 1 2 3 4 5 1 TYPE WWWWWW DET P NNNN Frequency Aug Type: Log-Pw Frequ Avg Type: Log-Pw 6 PH Nov 09, 2 RACE 1 2 3 4 TYPE WWWW DET P N N N ncy Auto Tur Auto Tu Mkr3 6.633 ms 1.23 dBm Ref Offset 0.5 dB Ref 20.50 dBm Ref Offset 0.5 dB Ref 20.50 dBm Center Fre **♦**³ Center Fr 02000000 G 24 Start Fre Start Fr 2000000 G 24 WAR . A144.40 Stop Free Stop Fre 24 2.40 CF Step 1.000000 MH-CF Ste enter 2.402000000 GHz es BW 1.0 MHz Span 0 Hz Sweep 10.00 ms (1001 pts) #VBW 1.0 MHz MH M 1 N 2 N 3 N 2.887 ms 3.746 ms 6.633 ms 1.13 dBm -0.33 dBm 1.23 dBm 1 1 Freq Offs Freq Offse 01 OH Span 0 Hz Sweep 50.00 ms (1001 pts) 0000 GH2 BW 1.0 MHz #VBW 1.0 MHz r's

CH39 Time Interval between hops

CH 39Transmission Time

CH 00 Transmission Time

Keysight Spect	rum Analyzer - Swept SA	8 X.	12	1003140	11. ALC: N. A.	a catalana a	and the local state of the second	0 0 0	III Keysight Spectrum Analyzer - Swep	e SA	- contractor and statements	a taka mangan sa sanga sa kara sa sa sa	0 0 0
Center Fre	eq 2.441000000	GHz	Trig: Vide	NSE:(INT)	Avg Type: Log	AUTO PWr	04:21:10 PH Nov 09, 20 TRACE 1 2 3 4 TVPE WWWW	Frequency	Center Freq 2.44100	0000 GHz	SENSE INT ALIGN Avg Type: Log	AUTO 04:21:24 PM Nov 09, 2015 -Pwr TRACE 1 2 3 4 5 6 TVPE WWWWWW	Frequency
10 dB/div	IFGein.Low Atten: 30 dB DETP ANAL 10 dB/div Ref 20.50 dBn								Ref Offset 0.5 10 dB/div Ref 20,50 d	IFGain:Low Atte	m: 30 dB	Mkr3 6.633 ms 1.10 dBm	Auto Tune
10.5								Center Freq 2.441000000 GHz	10.5 0.500		***		Center Freq 2.441000000 GHz
0 500 - Jacobs -9 50								7 Start Freq 2.441000000 GHz	-19.5 -29.5 -39.5			, TRG LVL	Start Freq 2.441000000 GHz
-19.5								Stop Freq 2.441000000 GHz	40.5 -50.5 -60.5	opsykitelythe	hordeside	N	Stop Freq 2.441000000 GHz
-30.5						++	7/95	CF Step 1.000000 MHz Auto Man	Center 2.441000000 GI Res BW 1.0 MHz	Hz #VBW 1.0 N	MHz Swe	Span 0 Hz ep 10.00 ms (1001 pts)	CF Step 1.000000 MHz Auto Man
-49.5	* ~ 4		- W	M	W W	4		Freq Offset	1 N 1 t 2 N 1 t 3 N 1 t 5	2.887 ms 1. 3.746 ms 0. 6.633 ms 1.	00 dBm 44 dBm 10 dBm		Freq Offset 0 Hz
Center 2.44	1000000 GHz						Span 0 H	IZ	6 7 8 9 10 11				
Res BW 1.0) MHZ	#VBV	/ 1.0 MHz		Swe	status	00 ms (1001 pl	s)	MSG		4	STATUS	



CH 78 Time Interval between hops

CH 78 Transmission Time

BE Keysight	Spectrum	Analyzer - Si	wept SA			12		20	12			and the second	0 0 0	BK Keysig	pht Spectrum	Analyzer - Swept SA		10-0-00	20 GL 1	and the second	and the second states and the	00
Center	Freq	2.4800	00000	GHz		Trin	SENSE IN	ញ	Avg Typ	e: Log-Pwr	04:23:34 TR	PH Nov 09, 2015	Frequency	Cente	er Freq	2.4800000	00 GHz	SENSE IN	Avg Type	Log-Pwr	04:23:49 PH Nov 09, 2015 TRACE 1 2 3 4 5 6 Type UNIX	Frequency
10 dB/div	Re	Offset 0	.5 dB dBm	PNO: F IFGain:	Low	Atten	30 dB					DET P NNNN	Auto Tune	10 dB/	Re div Re	f Offset 0.5 dB f 20.50 dBn	IFGain:Low	Atten: 30 dB			Mkr3 6.633 ms 0.41 dBm	Auto Tune
10.5							-		1				Center Freq 2.48000000 GHz	10.5				2 ²	→ ³			Center Freq 2.480000000 GHz
0.500	1		1/	ļ,	1		T/				1		Start Freq 2.480000000 GHz	-19.5 -29.5 -39.5							178G LVL	Start Freq 2.480000000 GHz
-19.5													Stop Freq 2.480000000 GHz	-49.5 -59.5 -69.5			W usherby		**	NAME .		Stop Freq 2.48000000 GHz
-39.5		+		Ŧ							I.	TROLVL	CF Step 1.000000 MHz Auto Man	Cente Res B	r 2.4800 W 1.0 N	000000 GHz AHz	#V	BW 1.0 MHz	S FUNCTION FUN	weep 1	Span 0 Hz 0.00 ms (1001 pts)	CF Step 1.000000 MHz Auto Man
-49.5	Ň	٣	*	w	W	-	he	- 11	w.	w	VI	W M	Freq Offset 0 Hz	1 N 2 N 4 5			2.887 ms 3.746 ms 6.633 ms	0.38 dBm -1.11 dBm 0.41 dBm				Freq Offset 0 Hz
Center 2	2.4800	00000	GHz									Span 0 Hz		7 8 9 10								
Res BW	1.0 M	HZ		2	#VBW	1.0 M	12			Sweep :	s0.00 ms	s (1001 pts)	2	MSG						10 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	:	Wireless module
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	1150		NA
39	2441	1150		NA
78	2480	1150		NA

🊺 Key	/sight S	Spectrun	n Analyzer - S	wept SA								
Cent	ter	Freq	₹ <u>50</u>	Ω AC 00000 GI	Hz	SEI	NSE:INT	Avg Typ	ALIGN AUTO e: Log-Pwr	04:05:22 PI TRAC	HNov 09, 2015	Frequency
10 dF	3/div	R	ef Offset 0	P IF I.5 dB dBm	NO: Wide ⊆ Gain:Low	#Atten: 3	0 dB		Mkr	2 2.401 -16.0	44 GHz	Auto Tune
10.5 0.500						<u></u> 2	<u>∧</u> 1 ∧3					Center Freq 2.402000000 GHz
-19.5 -29.5 -39.5							,				-16.45 dBm	Start Freq 2.397000000 GHz
-49.5 -59.5 -69.5		ᢇᠬᡕᠬ	unn	, mar and a second	Nur N			- Corres	Langer Contract	-14940-49LA	∿Arm-numn	Stop Freq 2.407000000 GHz
Cent #Res	ter 2 s BV	2.402 V 100	000 GH:) kHz	z	#VBV	V 100 kHz	ELIN		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	N N N			2.402 2 2.401 4 2.402 5	17 GHz 14 GHz 59 GHz	3.55 dl -16.68 dl -16.93 dl	Bm Bm Bm Bm				E	Freq Offset 0 Hz
9 10 11 < MSG						III			K STATUS	\$		

Figure Channel 00:



						8						
🊺 Key	rsight Spe	ectrum /	Analyzer - Sw	ept SA								
LXI RL	-	RF	50 Ω	AC		SEI	NSE:INT		ALIGN AUTO	04:08:19 PI	4 Nov 09, 2015	Frequency
Cen	ter Fi	req	2.44100	10000 GF Pt IFC	IZ NO:Wide ⊂ Gain:Low	Trig: Free #Atten: 3	e Run 0 dB	Avgiyp	e: Log-Pwr	TYP	E NWWWWW PE NNNNN P NNNNN	
10 dE	3/div	Ref Ref	Offset 0.6 f 20.50 (dB dBm					Mkr	2 2.440 -17.:	44 GHz 21 dBm	Auto Tune
Log							<u>م1</u>					
10.5							\mathbb{O}					Center Fred
0.500						<pre></pre>	\sim					2.441000000 GHz
-9.50						^{2′}					16.65 dBm	
-19.5						7	<u> </u>				-10.03 0.011	Start Eron
-29.5												
20.7						p.	~					2.436000000 GH2
-39.5					- And			how				
-49.5				a a 10. abril	marriel			Mary				Ston Fred
-59.5	- Andrews	~~~~		~~~~							www.	2 44600000 GHz
-69.5												2.44000000000112
Cent #Res	ter 2.4 s BW	4410 100	00 GHz kHz		#VBV	V 100 kHz			Sweep 1	Span 1 .267 ms (0.00 MHz 1001 pts)	CF Step 1.000000 MHz
MKR N		RC SCL		Х		Y	FUNC	TION FU	NCTION WIDTH	FUNCTIO	DN VALUE	Auto Mar
1	N 1	f		2.441 1	7 GHz	3.35 d	Bm					
2	N 1	f		2.440 4	4 GHZ 9 GHZ	-17.21 di	3m 3m					Freq Offset
4												0 Hz
5 6		-					_				E	
7												
8		-										
10												
11												
									1 otota		,	
MSG									NO STATUS			

Figure Channel 39:

Figure Channel 78:





Product	:	Wireless module
Test Item	:	Occupied Bandwidth Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 2: Transmit - 3Mbps (8DPSK)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	1430		NA
39	2441	1430		NA
78	2480	1440		NA

Figure Channel 00:

🊺 Key	ysight S	Spectr	um A	nalyzer - Swe	ept SA								
Cen	ter	Fre	RF q 2	50 Ω 2.40200	AC	-lz	SE Tria: Fre	NSE:INT	Avg Type	ALIGN AUTO e: Log-Pwr	04:19:00 P TRAC	M Nov 09, 2015	Frequency
			Ref	Offset 0.5	P IF	NO: Wide Gain:Low	#Atten: 3	30 dB		Mkr	2 2.401	30 GHz	Auto Tune
10 di	B/div		Ref	20.50 c	1Bm						-20.	62 dBm	
10.5 0.500													Center Freq 2.402000000 GHz
-9.00							2	8	\$			-20.41 dBm	
-19.5								ľ					Start Freq 2.397000000 GHz
-39.5						1700	\sim	\					
-49.5 -59.5	~~~.	m	w	man	m					hundun	hard	www.	Stop Freq
-69.5							-						2.407000000 GHz
Cen #Re:	ter 2 s BV	2.40 N 1	20	00 GHz kHz		#VBV	↓ N 100 kHz	2 EUN		Sweep 1	Span 1 .267 ms (0.00 MHz 1001 pts)	CF Step 1.000000 MHz <u>Auto</u> Man
1	N	1	f		2.402 1	17 GHz	-0.41 d	Bm	STICK TO		FORCH	ON VALUE	
2 3 4 5	N N	1	f		2.401 3 2.402 7	O GHz 3 GHz	-20.62 d -21.63 d	Bm Bm				=	Freq Offset 0 Hz
6 7 8 9			_										
10								_					
•							III					- F	
MSG											5		



						0							
🊺 Keys	rsight Spe	ctrum /	Analyzer - Sw	ept SA									
LXI RL		RF	50 Ω	AC		SEI	NSE:INT	A T	ALIGN AUTO	04:21:49 P	Nov 09, 2015	Frequency	
Cent	ter Fr	eq	2.44100	00000 GI	HZ NO: Wide ⊂ Gain:Low	Trig: Fre #Atten: 3	e Run 0 dB	Avg Typ	e: Log-Pwr	TYP	E 1 2 3 4 5 6 E M WWWWW T P N N N N N		
10 dE	Ref Offset 0.5 dB 10 dB/div Ref 20.50 dBm								Mkr2 2.440 30 GHz -21.05 dBm				
Log 10.5 - 0.500 -						- cont	A 1					Center Freq 2.441000000 GHz	
-19.5 -29.5 -39.5						¢ ²					-20.52 dBm	Start Freq 2.436000000 GHz	
-49.5 -59.5 -69.5	~~~~	~~~~	ᡔᡀᡘᠰᡐᡒᡄᠬ	and the second s					www.www.	han and have	wy	Stop Fred 2.446000000 GHz	
Center 2.441000 GHz Span 10.00 MHz #Res BW 100 kHz #VBW 100 kHz Sweep 1.267 ms (1001 pts)											CF Step 1.000000 MH: <u>Auto</u> Mar		
1 2 3 4 5 6	N 1 N 1 N 1			2.441 1 2.440 3 2.441 7	17 GHz 30 GHz 73 GHz	<u>-0.51 dl</u> -21.05 dl -21.15 dl	Bm Bm Bm			FUNCTION		Freq Offset 0 Hz	
7 8 9 10 11						m							
MSG	SG Contraction Con												

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