

FCC Test Report

Product Name	Key programming device
Model No.	KeyReader Plus
FCC ID.	QLXKRP

Applicant	TeraTron GmbH
Address	Bunsenstr. 10, 51647 Gummersbach, Germany

Date of Receipt	Aug. 02, 2016
Issued Date	Jan. 06, 2017
Report No.	1680089R-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.

This report must not be used to claim product endorsement by TAF or any agency of the government.

The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.

Test Report

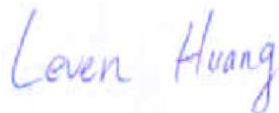
Issued Date: Jan. 06, 2017

Report No.: 1680089R-RFUSP23V00



Product Name	Key programming device
Applicant	TeraTron GmbH
Address	Bunsenstr. 10, 51647 Gummersbach, Germany
Manufacturer	TeraTron GmbH
Model No.	KeyReader Plus
FCC ID.	QLXKRP
EUT Rated Voltage	DC 3.6V (Power by Battery)
EUT Test Voltage	DC 3.6V (Power by Battery)
Trade Name	TeraTron
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2015 ANSI C63.4: 2014, ANSI C63.10: 2013
Test Result	Complied

Documented By :

A handwritten signature in blue ink, reading 'Leven Huang'.

(Senior Adm. Specialist / Leven Huang)

Tested By :

A handwritten signature in blue ink, reading 'Eason chen'.

(Engineer / Eason Chen)

Approved By :

A handwritten signature in blue ink, appearing to read 'Vincent Lin'.

(Director / Vincent Lin)

TABLE OF CONTENTS

Description	Page
1. GENERAL INFORMATION	5
1.1. EUT Description.....	5
1.2. Operational Description.....	7
1.3. Tested System Details.....	8
1.4. Configuration of Tested System	8
1.5. EUT Exercise Software	8
1.6. Test Facility	9
1.7. List of Test Equipment.....	10
2. CONDUCTED EMISSION	11
2.1. Test Setup	11
2.2. Limits.....	12
2.3. Test Procedure	12
2.4. Uncertainty	12
2.5. Test Result of Conducted Emission.....	13
3. PEAK POWER OUTPUT	15
3.1. Test Setup	15
3.2. Limit	15
3.3. Test Procedure	15
3.4. Uncertainty	15
3.5. Test Result of Peak Power Output.....	16
4. RADIATED EMISSION	18
4.1. Test Setup	18
4.2. Limits.....	19
4.3. Test Procedure	20
4.4. Uncertainty	20
4.5. Test Result of Radiated Emission.....	21
5. RF ANTENNA CONDUCTED TEST.....	29
5.1. Test Setup	29
5.2. Limits.....	29
5.3. Test Procedure	29
5.4. Uncertainty	29
5.5. Test Result of RF Antenna Conducted Test.....	30
6. BAND EDGE	32
6.1. Test Setup	32
6.2. Limit	32
6.3. Test Procedure	33
6.4. Uncertainty	33
6.5. Test Result of Band Edge	34
7. CHANNEL NUMBER.....	46
7.1. Test Setup	46
7.2. Limit	46
7.3. Test Procedure	46
7.4. Uncertainty	46
7.5. Test Result of Channel Number.....	47
8. CHANNEL SEPARATION.....	49
8.1. Test Setup	49
8.2. Limit	49
8.3. Test Procedure	49
8.4. Uncertainty	49
8.5. Test Result of Channel Separation.....	50
9. DWELL TIME.....	54
9.1. Test Setup	54
9.2. Limit	54
9.3. Test Procedure	54
9.4. Uncertainty	54
9.5. Test Result of Dwell Time.....	55
10. OCCUPIED BANDWIDTH	59
10.1. Test Setup	59

10.2.	Limits.....	59
10.3.	Test Procedure	59
10.4.	Uncertainty	59
10.5.	Test Result of Occupied Bandwidth	60
11.	EMI REDUCTION METHOD DURING COMPLIANCE TESTING	64
Attachment 1: EUT Test Photographs		
Attachment 2: EUT Detailed Photographs		

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Key programming device
Trade Name	TeraTron
Model No.	KeyReader Plus
FCC ID.	QLXKRP
Frequency Range	2402-2480MHz
Channel Number	79
Type of Modulation	FHSS: GFSK(1Mbps) / π /4DQPSK(2Mbps) / 8DPSK(3Mbps)
Antenna Type	Printed on PCB Antenna
Channel Control	Auto
Antenna Gain	Refer to the table “Antenna List”
USB Cable	Shielded, 2m
Contain Module	u-blox / ODIN-W16

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	PROANT AB	432	Printed on PCB Antenna	3.0dBi for 2.4 GHz

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		

Note:

1. The EUT is a Key programming device with a built-in WLAN 、Bluetooth V3.0, V2.1+EDR,V4.0 transceiver, this report for Bluetooth V3.0, V2.1+EDR.
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)

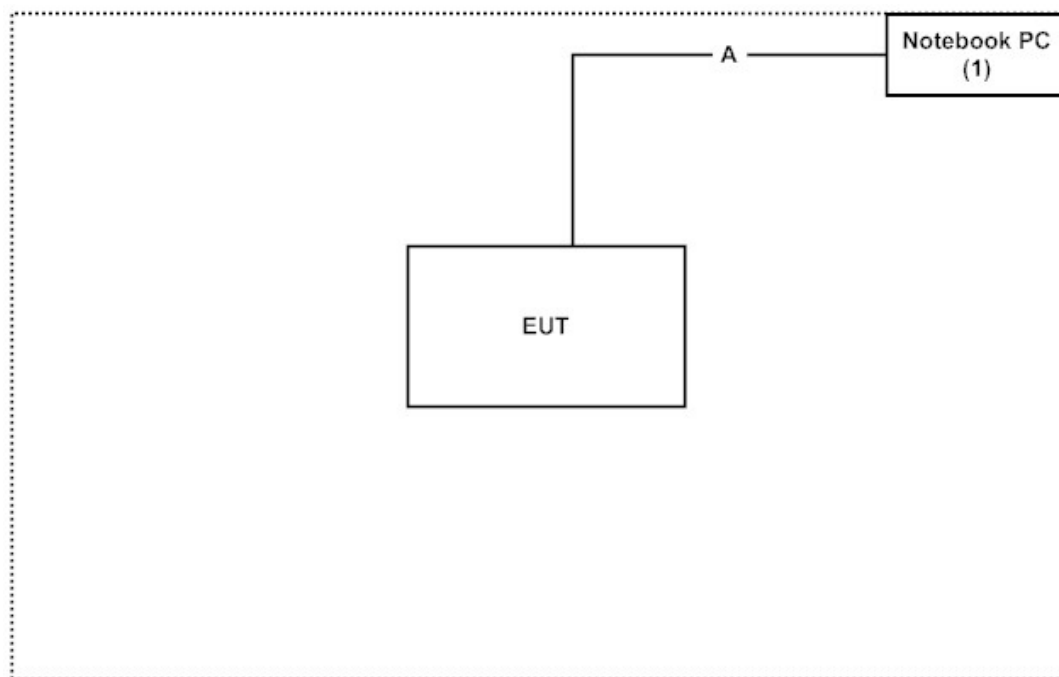
1.3. Tested System Details

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

	Product	Manufacturer	Model No.	Serial No.	Power Cord
1	Notebook PC	ASUS	X206H	X206HA	Non-Shielded, 1.8m

Signal Cable Type	Signal cable Description
A USB Cable	Shielded, 2m

1.4. Configuration of Tested System



1.5. EUT Exercise Software

1. Setup the EUT as shown in Section 1.4.
2. Execute software "Firefox for keyReaderPlus.lnk (Ver2015.08.1-21C /01.25)" 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	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

<http://www.dekra.com.tw/chinese/about/certificates.aspx?bval=5>

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: [http:// www.dekra.com.tw](http://www.dekra.com.tw)

Site Description: Accredited by TAF
Accredited Number: 3023

Site Name: DEKRA Testing and Certification Co., Ltd
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 : info.tw@dekra.com

FCC Accreditation Number: TW1014

1.7. List of Test Equipment

For Conducted measurements /CB3/SR8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Spectrum Analyzer	Agilent	N9010A	MY48030495	2016/7/22	2017/7/21
X	Power Meter	Anritsu	ML2495A	6K00003357	2016/6/23	2017/6/22
X	EMI Test Receiver	R&S	ESCS 30	100369	2016/10/13	2017/10/12
X	LISN	R&S	ESH3-Z5	836679/017	2017/1/7	2018/1/6
X	LISN	R&S	ENV216	100097	2017/1/7	2018/1/6
X	Coaxial Cable	QTK(Arnist)	RG 400	LC018-RG	2016/6/25	2017/6/24

For Radiated measurements /Site3/CB8

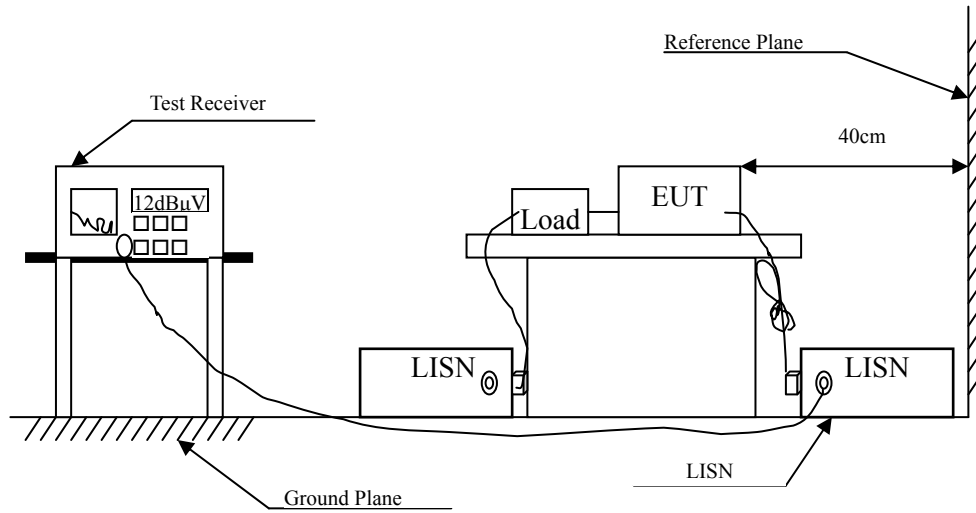
	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Spectrum Analyzer	R&S	FSP40	100170	2017/1/5	2018/1/4
X	Bi-Log Antenna	Schaffner Chase	CBL6112B	2707	2016/9/10	2017/9/9
X	Horn Antenna	ETS-Lindgren	3117	00135205	2016/4/6	2017/4/5
	Horn Antenna	Schwarzbeck	BBHA9170	9170430	2016/1/11	2017/1/10
X	Pre-Amplifier	QTK	AP/0100A	CHM/0901069	2016/6/28	2017/6/27
X	Pre-Amplifier	EMCI	EMC012630SE	980210	2016/1/27	2017/1/26
	Pre-Amplifier	NARDA WE	DBL-1840N506	013	2016/9/30	2017/9/29
X	Filter	MicroTRON	BRM50701	019	2016/10/20	2017/10/19
	Filter	Microwave Circuits	N0257881	36681	2016/12/7	2017/12/6
X	EMI Test Receiver	R&S	ESR26	101385	2016/9/29	2017/9/28
X	Coaxial Cable	QTK(Arnist)	SUCOFLEX 106	L1606-015C	2016/6/25	2017/6/24
X	EMI Test Receiver	R&S	ESCS 30	838251/001	2016/7/21	2017/7/20
X	Coaxial Cable	QTK(Arnist)	RG 214	LC003-RG	2016/6/21	2017/6/20
X	Coaxial signal switch	Anritsu	MP59B	6201415889	2016/6/16	2017/6/15

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek EMI 2.0 V2.1.113

2. Conducted Emission

2.1. Test Setup



2.2. 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.

2.3. 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 investigated 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.

2.4. Uncertainty

± 2.26 dB

2.5. Test Result of Conducted Emission

Product : Key programming device
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test date : 2016.08.31
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK) (2441MHz)

Frequency MHz	Correct Factor dB	Reading Level dB μ V	Measurement Level dB μ V	Margin dB	Limit dB μ V
LINE 1					
Quasi-Peak					
0.158	9.685	34.040	43.725	-22.046	65.771
0.170	9.681	33.010	42.692	-22.737	65.429
0.470	9.675	31.360	41.035	-15.822	56.857
1.775	9.736	14.970	24.706	-31.294	56.000
4.443	9.780	20.030	29.810	-26.190	56.000
7.189	9.838	15.650	25.488	-34.512	60.000
Average					
0.158	9.685	22.640	32.325	-23.446	55.771
0.170	9.681	26.020	35.702	-19.727	55.429
0.470	9.675	24.550	34.225	-12.632	46.857
1.775	9.736	9.910	19.646	-26.354	46.000
4.443	9.780	11.760	21.540	-24.460	46.000
7.189	9.838	10.130	19.968	-30.032	50.000

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 : Key programming device
 Test Item : Conducted Emission Test
 Power Line : Line 2
 Test date : 2016.08.31
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK) (2441MHz)

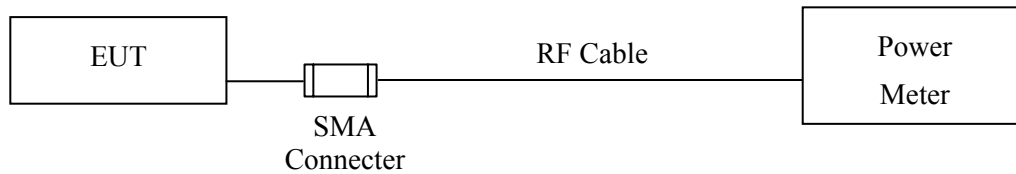
Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dB μ V	dB μ V	dB	dB μ V
LINE 2					
Quasi-Peak					
0.173	9.735	35.860	45.595	-19.748	65.343
0.216	9.737	25.660	35.397	-28.717	64.114
0.466	9.745	30.850	40.595	-16.376	56.971
1.087	9.764	12.310	22.074	-33.926	56.000
4.088	9.847	15.130	24.977	-31.023	56.000
25.392	10.310	11.870	22.180	-37.820	60.000
Average					
0.173	9.735	25.890	35.625	-19.718	55.343
0.216	9.737	12.690	22.427	-31.687	54.114
0.466	9.745	24.230	33.975	-12.996	46.971
1.087	9.764	6.350	16.114	-29.886	46.000
4.088	9.847	5.740	15.587	-30.413	46.000
25.392	10.310	6.650	16.960	-33.040	50.000

Note:

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

3. Peak Power Output

3.1. Test Setup



3.2. Limit

The maximum peak power shall be less 1Watt.

3.3. 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.

3.4. Uncertainty

± 1.19 dB

3.5. Test Result of Peak Power Output

Product : Key programming device
Test Item : Peak Power Output
Test Site : No.3 OATS
Test date : 2016.08.31
Test Mode : Mode 1: Transmit - 1Mbps (GFSK)

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
Channel 00	2402.00	9.13	1 Watt= 30 dBm	Pass
Channel 39	2441.00	9.34	1 Watt= 30 dBm	Pass
Channel 78	2480.00	9.47	1 Watt= 30 dBm	Pass

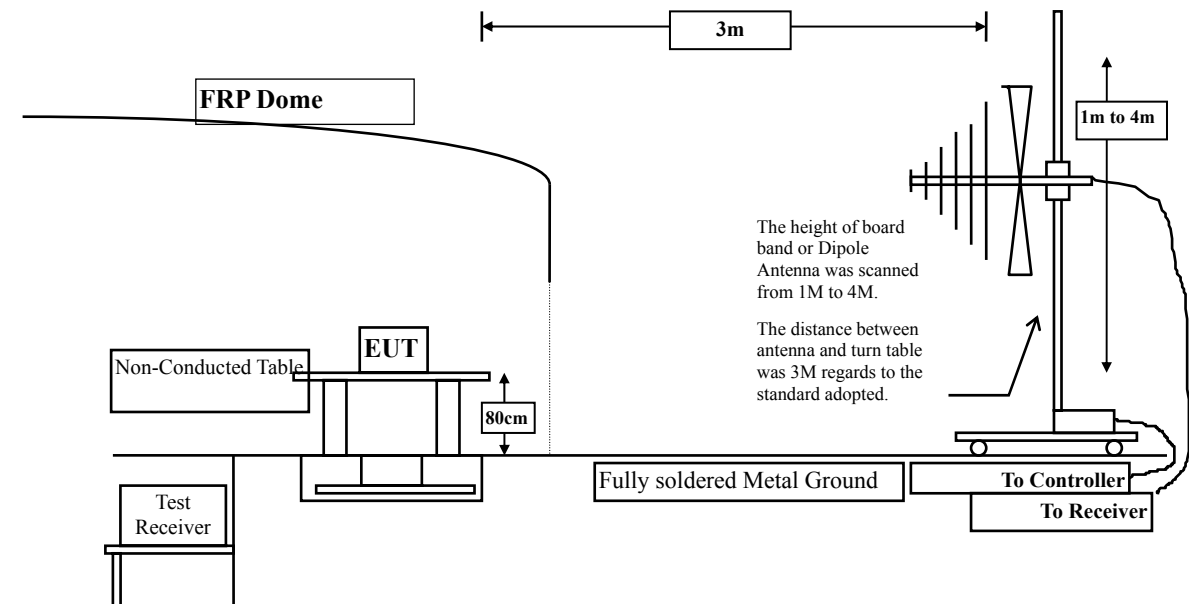
Product : Key programming device
Test Item : Peak Power Output
Test Site : No.3 OATS
Test date : 2016.08.31
Test Mode : Mode 2: Transmit - 3Mbps (8DPSK)

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
Channel 00	2402.00	7.11	1 Watt= 30 dBm	Pass
Channel 39	2441.00	7.34	1 Watt= 30 dBm	Pass
Channel 78	2480.00	7.47	1 Watt= 30 dBm	Pass

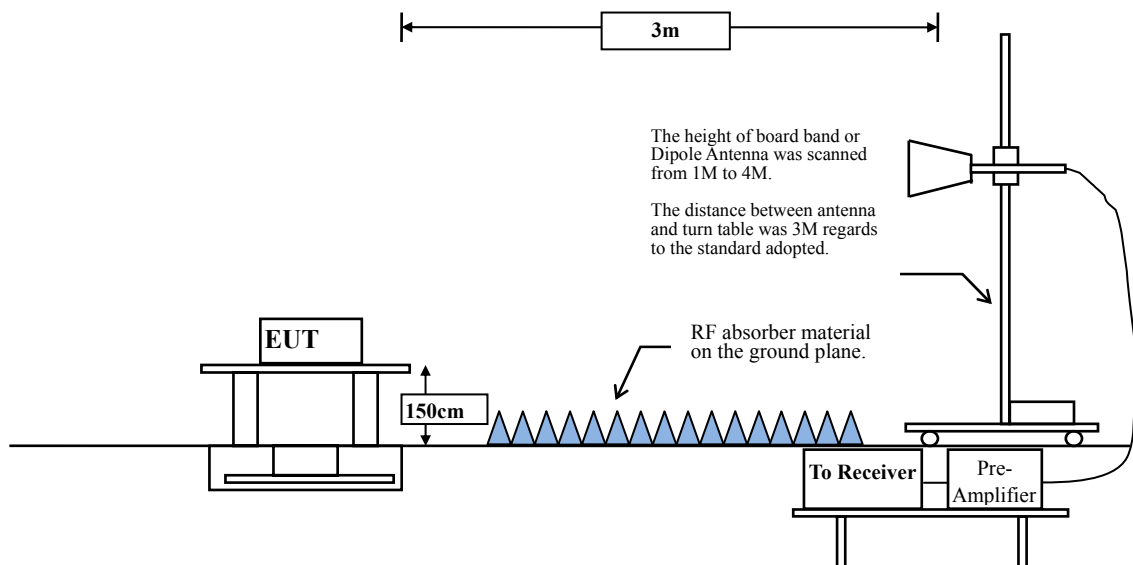
4. Radiated Emission

4.1. Test Setup

Below 1GHz



Above 1GHz



4.2. 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 (dBμV) = 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.

4.3. 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 from 9kHz - 10th Harmonic of fundamental was investigated.

4.4. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

4.5. Test Result of Radiated Emission

Product : Key programming device
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK)(2402MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dB μ V	dB μ V/m	dB	dB μ V/m
Horizontal					
Peak Detector:					
4804.000	2.511	51.210	53.720	-20.280	74.000
7206.000	9.511	41.230	50.741	-23.259	74.000
9608.000	10.394	38.660	49.054	-24.946	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
4804.000	2.923	46.820	49.742	-24.258	74.000
7206.000	9.988	39.510	49.499	-24.501	74.000
9608.000	10.847	38.430	49.277	-24.723	74.000
Average					
Detector:					
--					

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 : Key programming device
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK)(2441MHz)

Frequency MHz	Correct Factor dB	Reading Level dB μ V	Measurement Level dB μ V/m	Margin dB	Limit dB μ V/m
Horizontal					
Peak Detector:					
4882.000	2.025	51.390	53.415	-20.585	74.000
7323.000	9.762	39.600	49.361	-24.639	74.000
9764.000	9.682	38.340	48.021	-25.979	74.000
Average Detector:					
--					
Vertical					
Peak Detector:					
4882.000	2.488	50.560	53.048	-20.952	74.000
7323.000	10.375	39.110	49.484	-24.516	74.000
9764.000	10.315	38.280	48.595	-25.405	74.000
Average Detector:					
--					

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 : Key programming device
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK)(2480MHz)

Frequency MHz	Correct Factor dB	Reading Level dB μ V	Measurement Level dB μ V/m	Margin dB	Limit dB μ V/m
Horizontal					
Peak Detector:					
4960.000	2.582	51.169	53.751	-20.249	74.000
7440.000	11.214	38.960	50.174	-23.826	74.000
9920.000	11.245	38.740	49.985	-24.015	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
4960.000	3.398	50.170	53.569	-20.431	74.000
7440.000	11.214	39.530	50.744	-23.256	74.000
9920.000	11.245	39.060	50.305	-23.695	74.000
Average					
Detector:					
--					

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 : Key programming device
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.09.01
 Test Mode : Mode 2: Transmit - 3Mbps (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	51.350	53.860	-20.140	74.000
7206.000	9.511	40.985	50.496	-23.504	74.000
9608.000	10.394	38.735	49.129	-24.871	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
4804.000	2.923	46.830	49.752	-24.248	74.000
7206.000	9.988	39.863	49.852	-24.148	74.000
9608.000	10.847	38.742	49.589	-24.411	74.000
Average					
Detector:					
--					

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 : Key programming device
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.09.01
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK) (2441MHz)

Frequency MHz	Correct Factor dB	Reading Level dBμV	Measurement Level dBμV/m	Margin dB	Limit dBμV/m
Horizontal					
Peak Detector:					
4882.000	2.025	51.670	53.695	-20.305	74.000
7323.000	9.762	39.781	49.542	-24.458	74.000
9764.000	9.682	38.578	48.259	-25.741	74.000
Average Detector:					
--					
Vertical					
Peak Detector:					
4882.000	2.488	50.757	53.245	-20.755	74.000
7323.000	10.375	39.377	49.751	-24.249	74.000
9764.000	10.315	38.481	48.796	-25.204	74.000
Average Detector:					
--					

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 : Key programming device
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.09.01
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK) (2480MHz)

Frequency MHz	Correct Factor dB	Reading Level dBμV	Measurement Level dBμV/m	Margin dB	Limit dBμV/m
Horizontal					
Peak Detector:					
4960.000	2.582	51.269	53.851	-20.149	74.000
7440.000	10.555	39.704	50.259	-23.741	74.000
9920.000	10.206	39.817	50.023	-23.977	74.000
Average Detector:					
--					
Vertical					
Peak Detector:					
4960.000	3.398	50.393	53.792	-20.208	74.000
7440.000	11.214	39.738	50.952	-23.048	74.000
9920.000	11.245	39.346	50.591	-23.409	74.000
Average Detector:					
--					

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 : Key programming device
 Test Item : General Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK) (2441MHz)

Frequency MHz	Correct Factor dB	Reading Level dBμV	Measurement Level dBμV/m	Margin dB	Limit dBμV/m
Horizontal					
125.060	-9.946	39.388	29.442	-14.058	43.500
159.980	-11.775	45.038	33.263	-10.237	43.500
297.720	-3.633	36.807	33.175	-12.825	46.000
352.040	-2.403	33.060	30.657	-15.343	46.000
699.300	2.875	36.543	39.418	-6.582	46.000
819.580	5.789	30.211	36.001	-9.999	46.000
Vertical					
225.940	-8.598	38.818	30.219	-15.781	46.000
344.280	-3.171	37.600	34.430	-11.570	46.000
602.300	-2.333	31.845	29.512	-16.488	46.000
662.440	-2.026	37.852	35.826	-10.174	46.000
807.940	3.586	30.593	34.178	-11.822	46.000
968.960	8.191	21.699	29.890	-24.110	54.000

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 : Key programming device
 Test Item : General Radiated Emission
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK) (2441MHz)

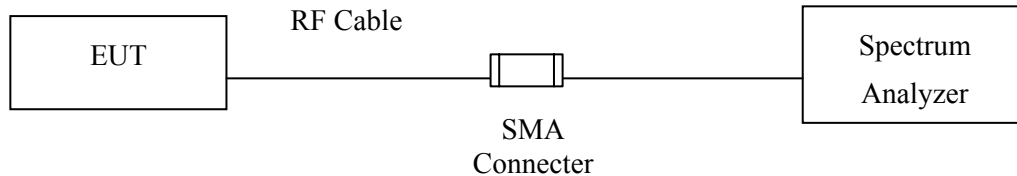
Frequency MHz	Correct Factor dB	Reading Level dBμV	Measurement Level dBμV/m	Margin dB	Limit dBμV/m
Horizontal					
297.720	-3.633	29.528	25.896	-20.104	46.000
352.040	-2.403	33.857	31.454	-14.546	46.000
544.100	3.512	24.100	27.612	-18.388	46.000
699.300	2.875	34.425	37.300	-8.700	46.000
827.340	6.302	22.266	28.568	-17.432	46.000
922.400	6.334	25.472	31.806	-14.194	46.000
Vertical					
150.280	-6.224	36.742	30.518	-12.982	43.500
274.440	-8.718	42.709	33.991	-12.009	46.000
381.140	-1.558	38.374	36.816	-9.184	46.000
573.200	-5.563	39.342	33.779	-12.221	46.000
695.420	1.878	29.639	31.517	-14.483	46.000
794.360	2.861	25.607	28.468	-17.532	46.000

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.
8. No emission found between lowest internal used/generated frequency to 30MHz.

5. RF Antenna Conducted Test

5.1. Test Setup



5.2. 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.

5.3. 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.

5.4. Uncertainty

$\pm 1.20\text{dB}$

5.5. Test Result of RF Antenna Conducted Test

Product : Key programming device
Test Item : RF Antenna Conducted Test
Test Site : No.3 OATS
Test date : 2016.08.31
Test Mode : Mode 1: Transmit - 1Mbps (GFSK)

Figure Channel 00:

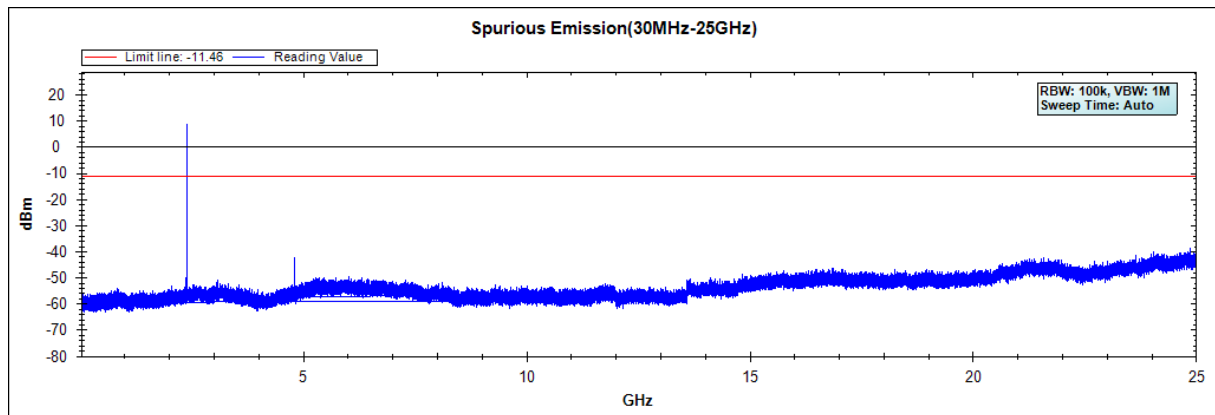


Figure Channel 39:

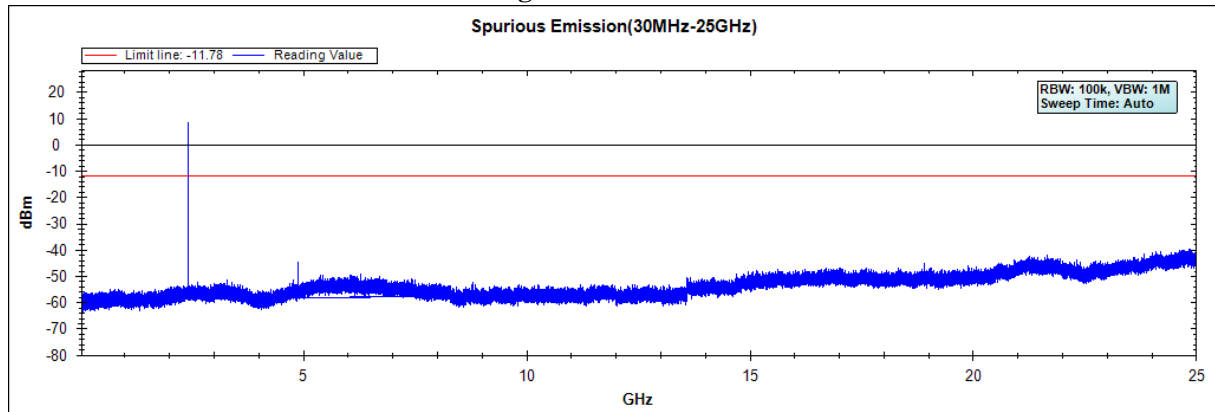
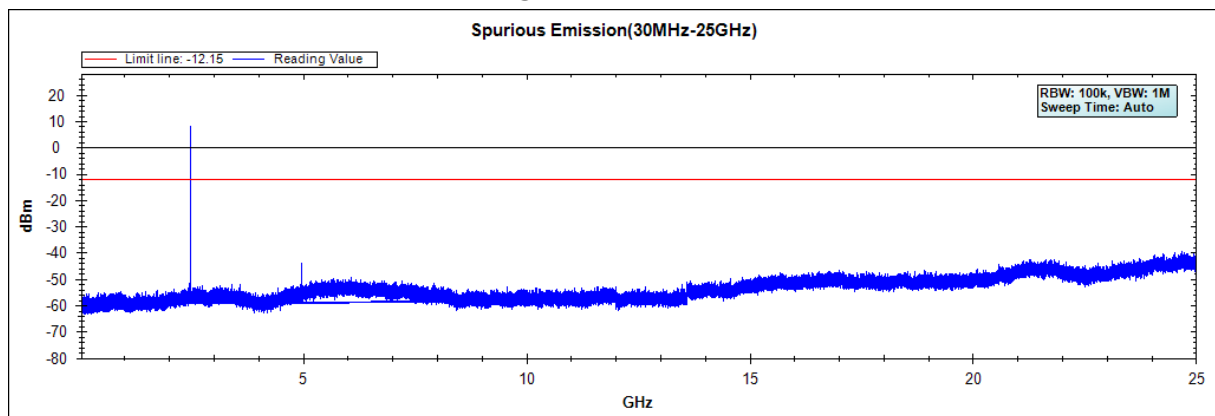
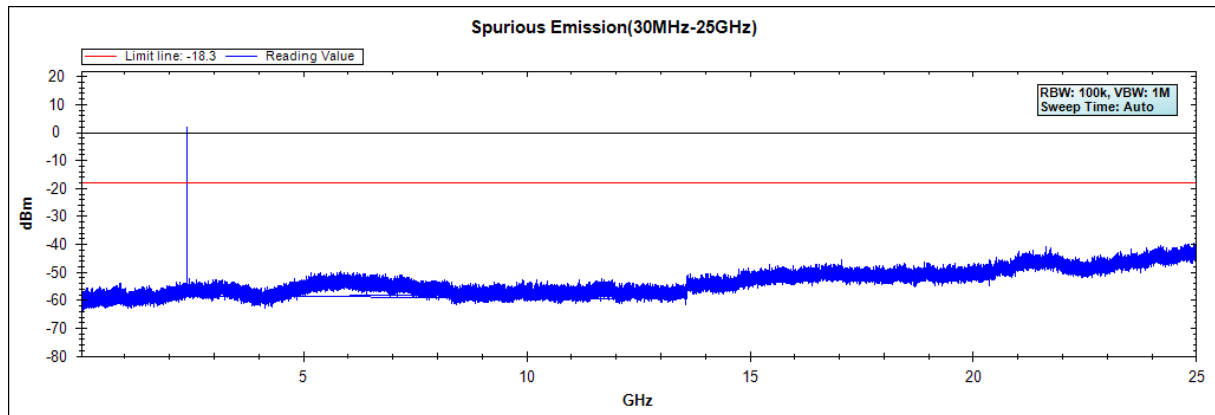
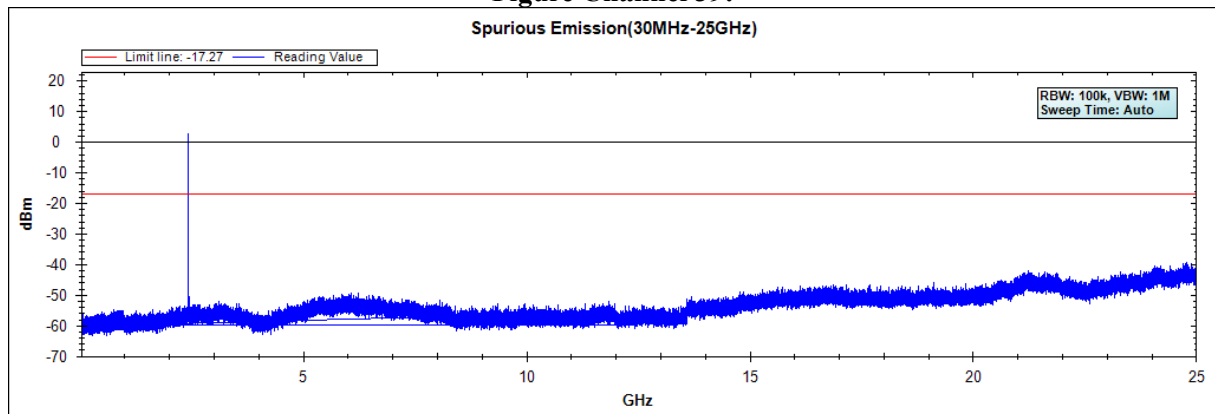
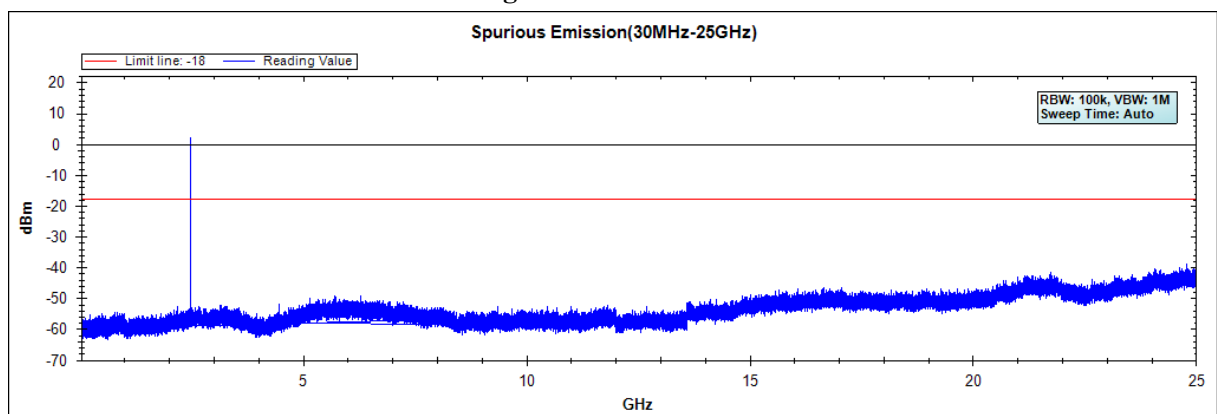


Figure Channel 78:



Product : Key programming device
Test Item : RF Antenna Conducted Test
Test Site : No.3 OATS
Test date : 2016.08.31
Test Mode : Mode 2: Transmit - 3Mbps (8DPSK)

Figure Channel 00:**Figure Channel 39:****Figure Channel 78:**

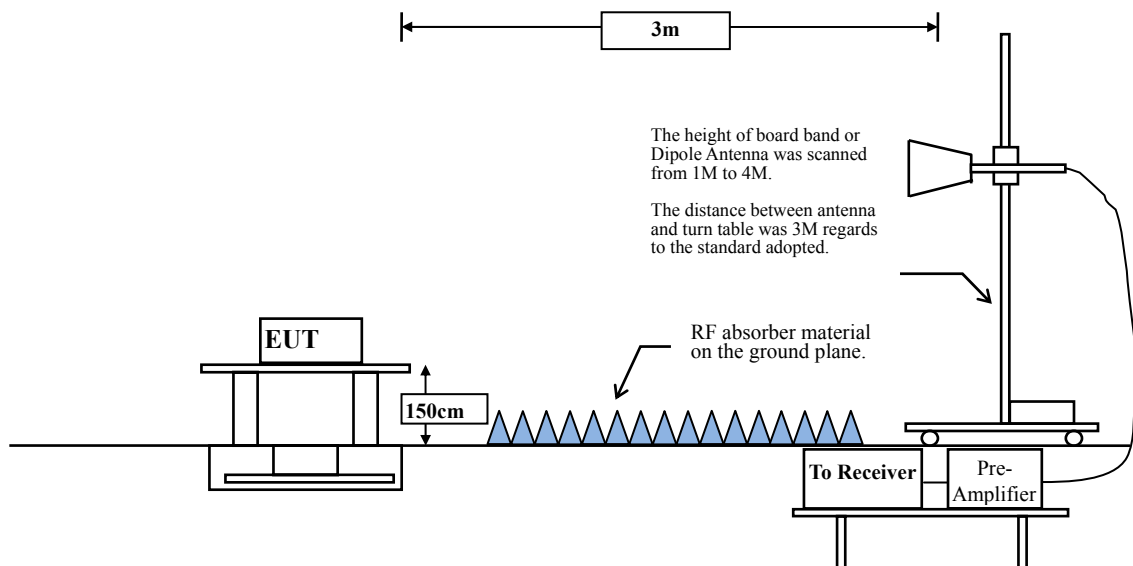
Note: The above test pattern is synthesized by multiple of the frequency range.

6. Band Edge

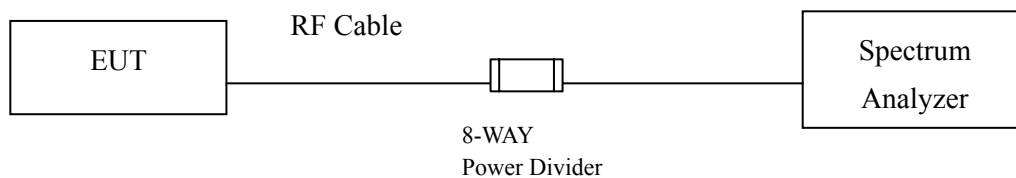
6.1. Test Setup

RF Radiated Measurement:

Above 1GHz



RF Conducted Measurement



6.2. 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)).

6.3. 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.

6.4. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

6.5. Test Result of Band Edge

Product : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK) (2402MHz)

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
00 (Peak)	2387.681	-2.697	65.939	63.242	74.00	54.00	Pass
00 (Peak)	2390.000	-2.687	50.811	48.124	74.00	54.00	Pass
00 (Peak)	2400.000	-2.660	73.097	70.437	--	--	--
00 (Peak)	2402.174	-2.657	108.773	106.116	--	--	--
00 (Average)	2388.116	-2.695	38.025	35.330	74.00	54.00	Pass
00 (Average)	2390.000	-2.687	35.644	32.957	74.00	54.00	Pass
00 (Average)	2400.000	-2.660	45.858	43.198	--	--	--
00 (Average)	2401.884	-2.658	72.914	70.256	--	--	--

Figure Channel 00: Horizontal (Peak)

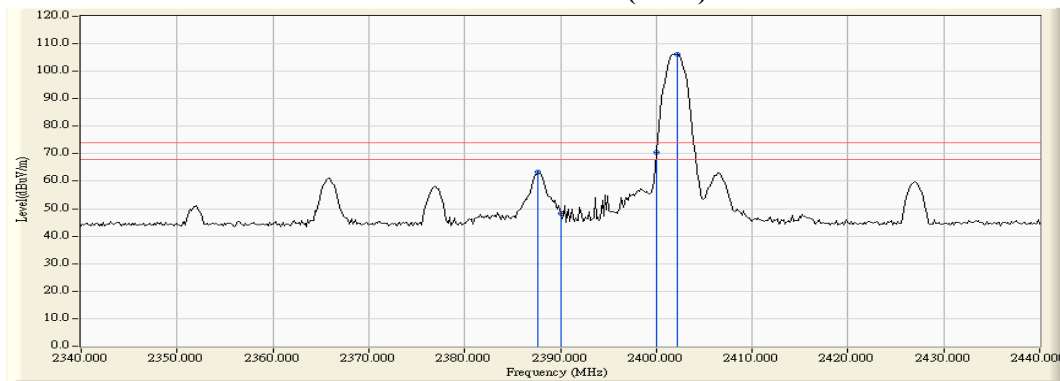
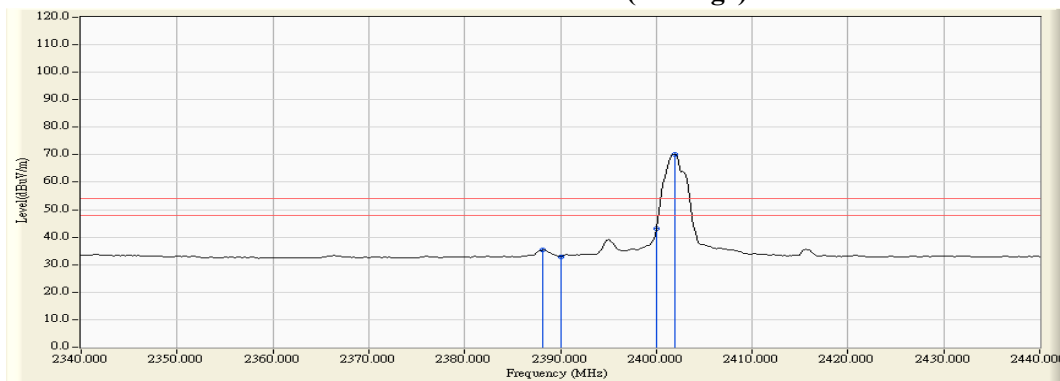


Figure Channel 00: Horizontal (Average)



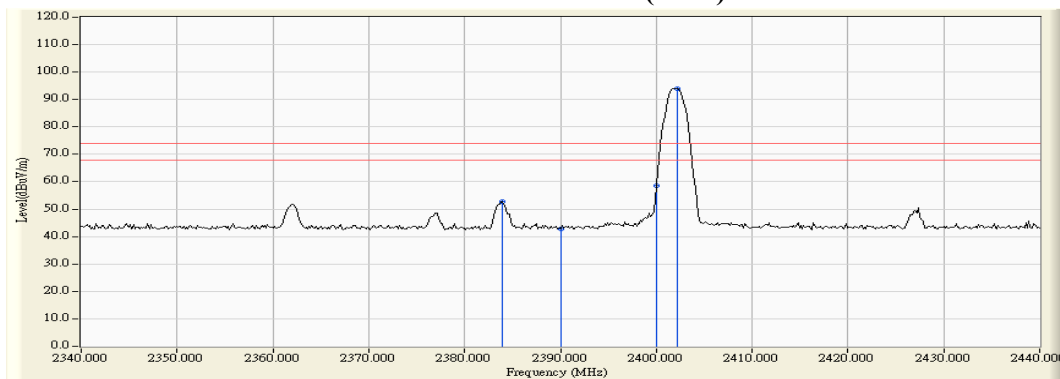
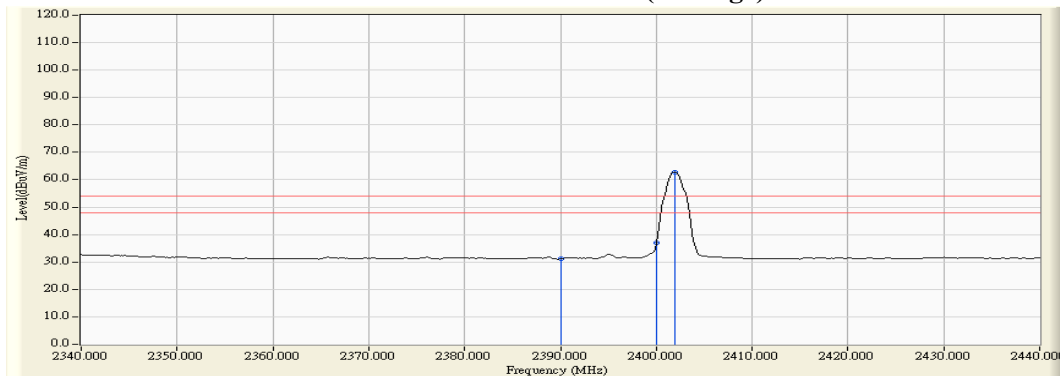
Note:

1. All readings 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. “ * ”, means this data is the worst emission level.
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 : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK) (2402MHz)

RF Radiated Measurement (VERTICAL):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dB μ V)	Emission Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Result
00 (Peak)	2383.913	-4.138	56.840	52.701	74.00	54.00	Pass
00 (Peak)	2390.000	-4.159	46.998	42.839	74.00	54.00	Pass
00 (Peak)	2400.000	-4.171	62.650	58.479	--	--	--
00 (Peak)	2402.174	-4.171	98.108	93.937	--	--	--
00 (Average)	2390.000	-4.159	35.226	31.067	74.00	54.00	Pass
00 (Average)	2400.000	-4.171	41.306	37.135	--	--	--
00 (Average)	2401.884	-4.171	67.056	62.885	--	--	--

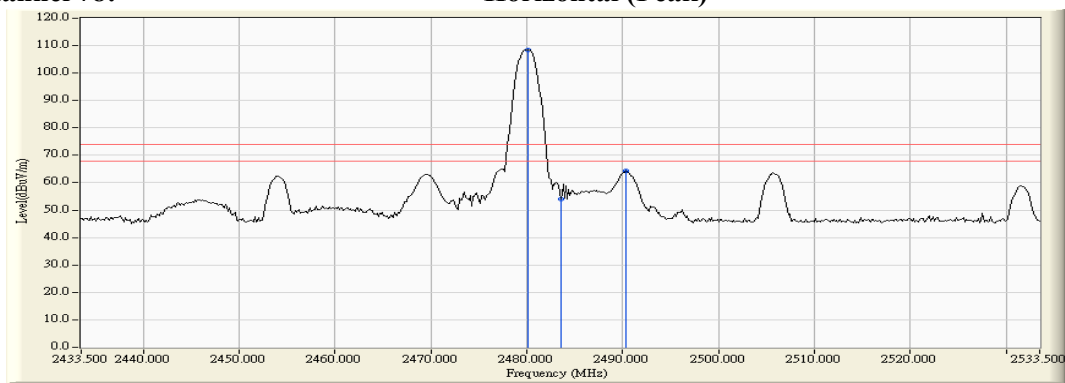
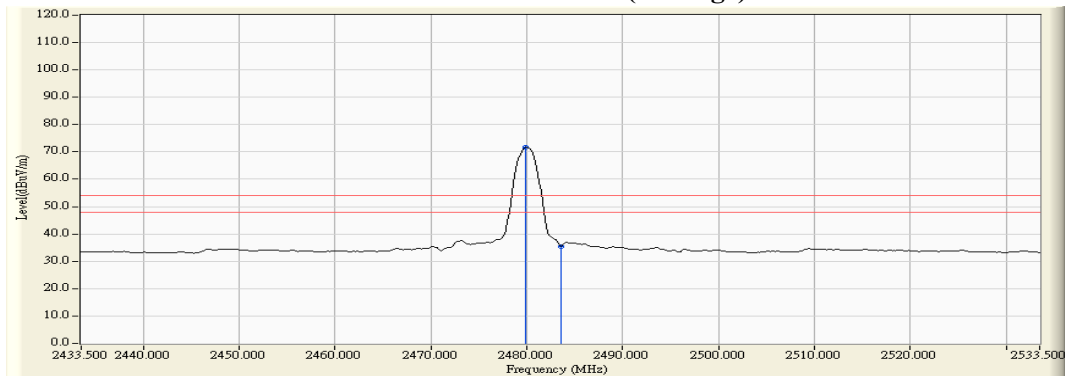
Figure Channel 00:**VERTICAL (Peak)****Figure Channel 00:****VERTICAL (Average)****Note:**

1. All readings 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. " * ", means this data is the worst emission level.
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 : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK) (2480MHz)

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
78 (Peak)	2480.167	-2.605	111.063	108.458	--	--	--
78 (Peak)	2483.500	-2.601	56.523	53.921	74.00	54.00	Pass
78 (Peak)	2490.312	-2.596	66.931	64.335	74.00	54.00	Pass
78 (Average)	2479.877	-2.605	74.354	71.749	--	--	--
78 (Average)	2483.500	-2.601	38.056	35.454	74.00	54.00	Pass

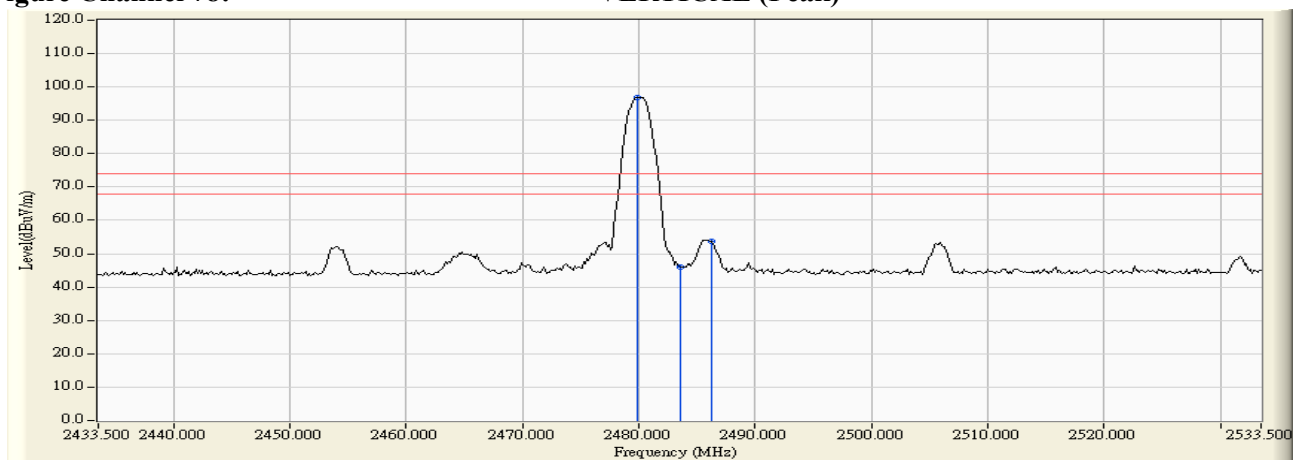
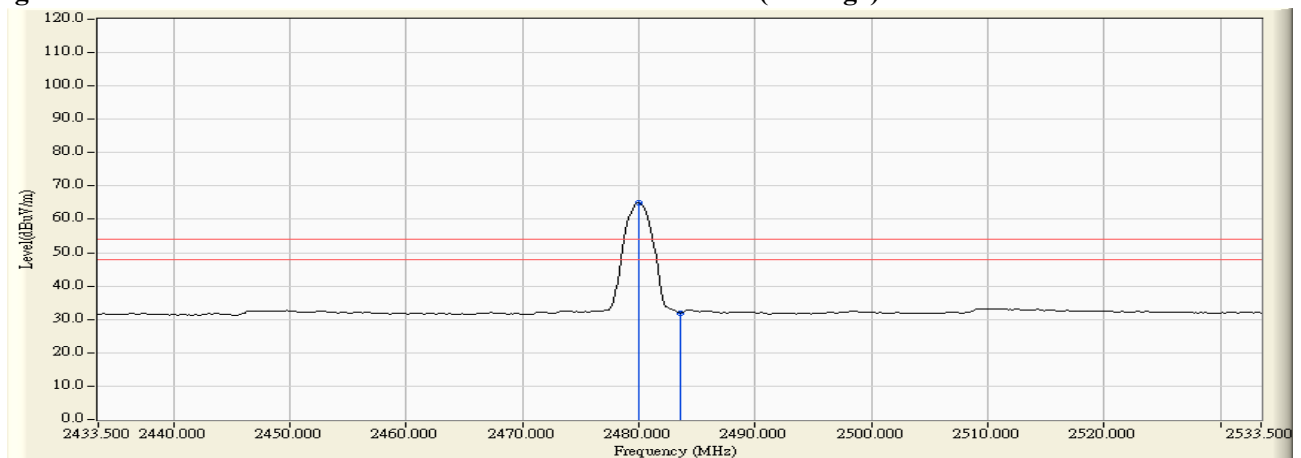
Figure Channel 78: Horizontal (Peak)

Figure Channel 78: Horizontal (Average)

Note:

1. All readings 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. “ * ”, means this data is the worst emission level.
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 : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK) (2480MHz)

RF Radiated Measurement (VERTICAL):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dB μ V)	Emission Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Result
78 (Peak)	2479.877	-3.978	100.802	96.824	--	--	--
78 (Peak)	2483.500	-3.966	50.046	46.079	74.00	54.00	Pass
78 (Peak)	2486.254	-3.958	57.767	53.809	74.00	54.00	Pass
78 (Average)	2480.022	-3.978	68.870	64.892	--	--	--
78 (Average)	2483.500	-3.966	35.827	31.860	74.00	54.00	Pass

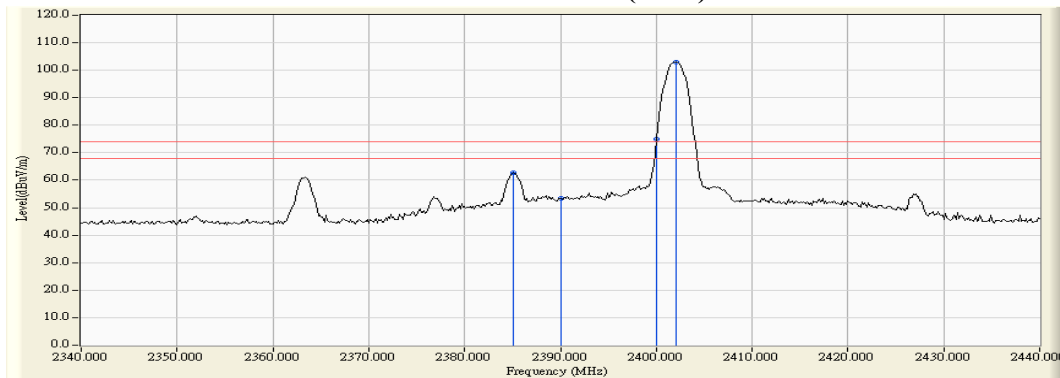
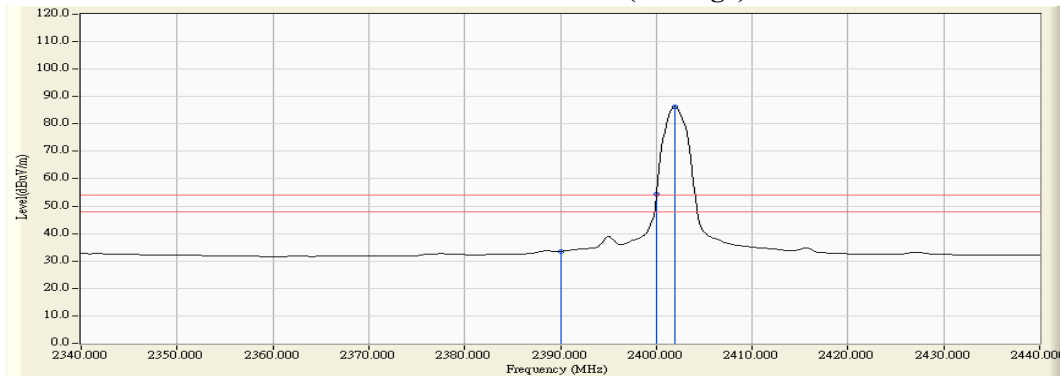
Figure Channel 78:**VERTICAL (Peak)****Figure Channel 78:****VERTICAL (Average)****Note:**

1. All readings 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. " * ", means this data is the worst emission level.
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 : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK) (2402MHz)

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
00 (Peak)	2385.072	-2.709	65.466	62.757	74.00	54.00	Pass
00 (Peak)	2390.000	-2.687	56.135	53.448	74.00	54.00	Pass
00 (Peak)	2400.000	-2.660	77.518	74.858	--	--	--
00 (Peak)	2402.029	-2.657	105.758	103.101	--	--	--
00 (Average)	2390.000	-2.687	36.200	33.513	74.00	54.00	Pass
00 (Average)	2400.000	-2.660	57.096	54.436	--	--	--
00 (Average)	2401.884	-2.658	88.756	86.098	--	--	--

Figure Channel 00: Horizontal (Peak)**Figure Channel 00: Horizontal (Average)**

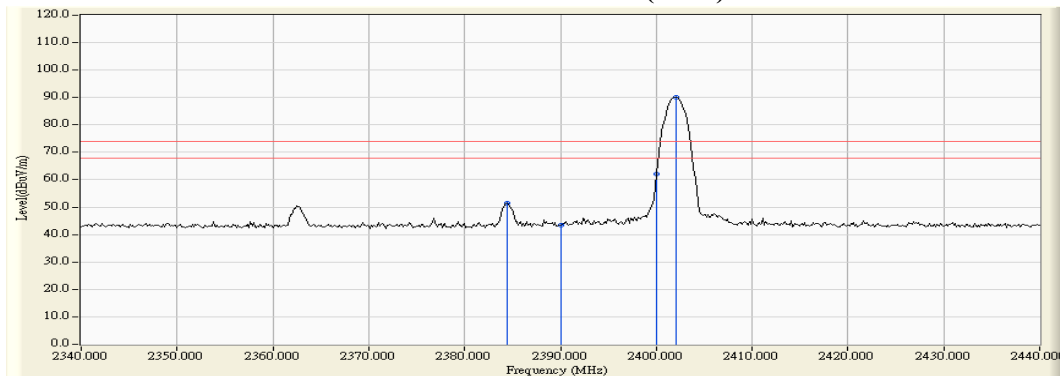
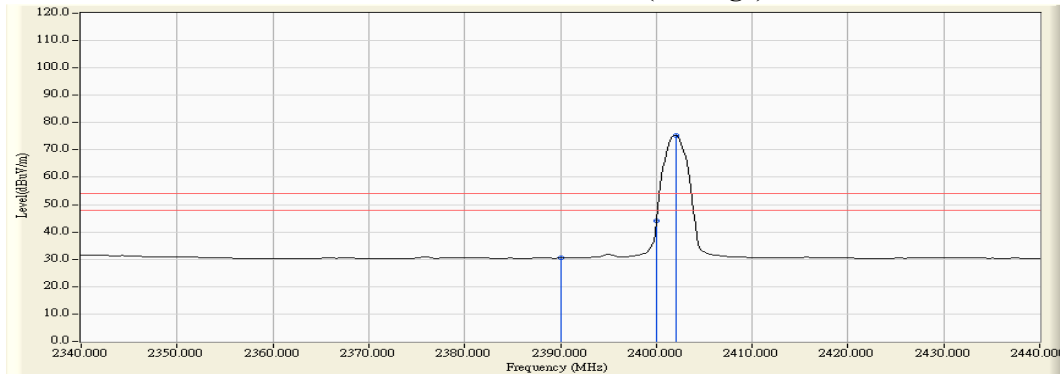
Note:

1. All readings 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. “ * ”, means this data is the worst emission level.
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 : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK) (2402MHz)

RF Radiated Measurement (VERTICAL):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
00 (Peak)	2384.493	-4.140	55.455	51.315	74.00	54.00	Pass
00 (Peak)	2390.000	-4.159	47.714	43.555	74.00	54.00	Pass
00 (Peak)	2400.000	-4.171	66.174	62.003	--	--	--
00 (Peak)	2402.029	-4.171	94.260	90.089	--	--	--
00 (Average)	2390.000	-4.159	34.689	30.530	74.00	54.00	Pass
00 (Average)	2400.000	-4.171	48.193	44.022	--	--	--
00 (Average)	2402.029	-4.171	79.605	75.434	--	--	--

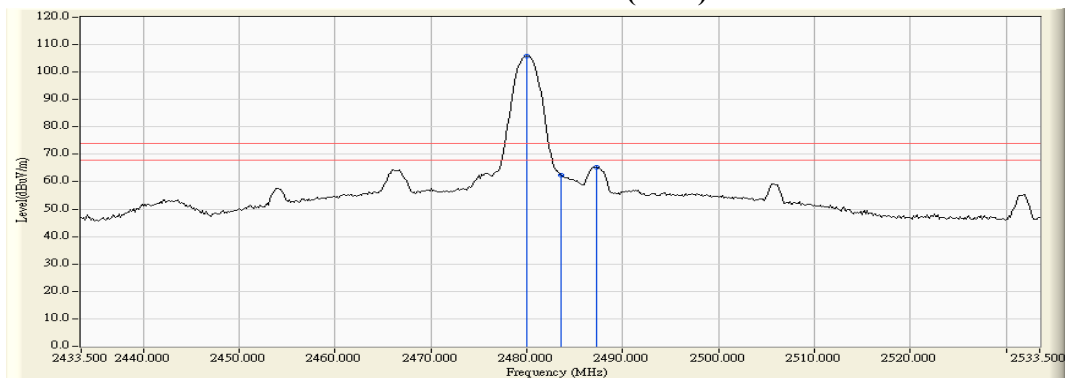
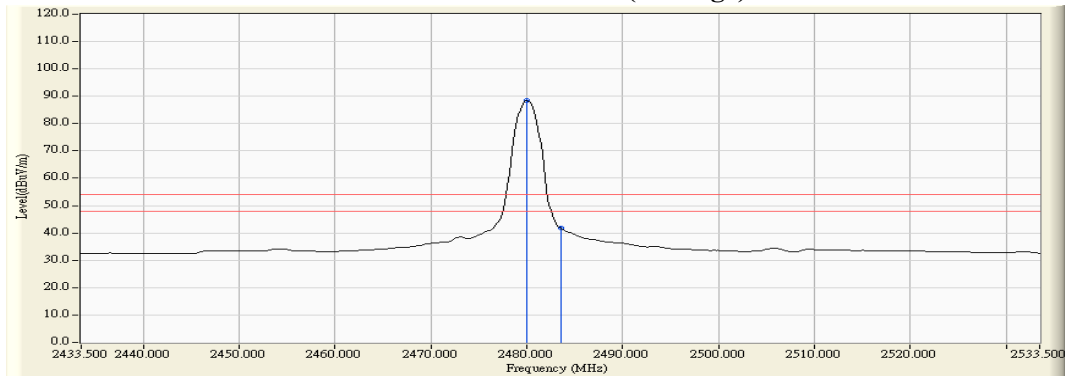
Figure Channel 00: VERTICAL (Peak)

Figure Channel 00: VERTICAL (Average)

Note:

1. All readings 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. " * ", means this data is the worst emission level.
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 : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK) (2480MHz)

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
78 (Peak)	2480.022	-2.605	108.410	105.805	--	--	--
78 (Peak)	2483.500	-2.601	65.009	62.407	74.00	54.00	Pass
78 (Peak)	2487.268	-2.599	67.874	65.276	74.00	54.00	Pass
78 (Average)	2480.022	-2.605	90.961	88.356	--	--	--
78 (Average)	2483.500	5.845	30.751	36.596	74.00	54.00	Pass

Figure Channel 00:**Horizontal (Peak)****Figure Channel 00:****Horizontal (Average)**

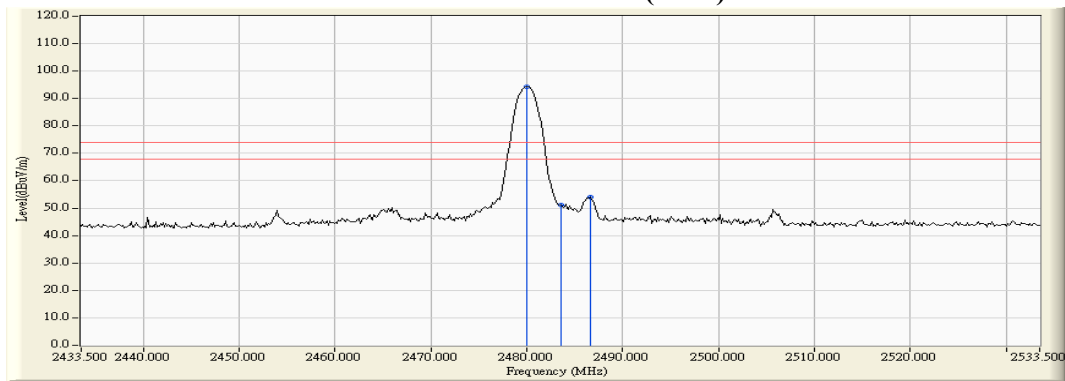
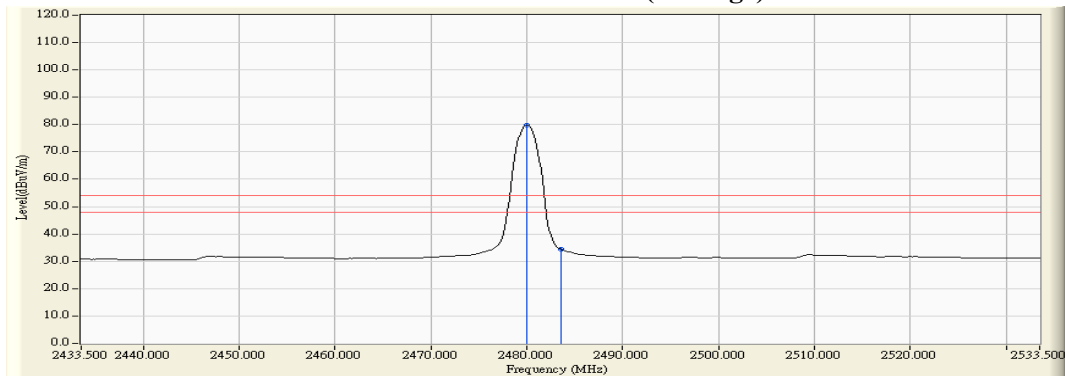
Note:

1. All readings 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. “ * ”, means this data is the worst emission level.
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 : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.30
 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)	Average Limit (dBμV/m)	Result
78 (Peak)	2480.022	-3.978	98.312	94.334	--	--	--
78 (Peak)	2483.500	-3.966	55.095	51.128	74.00	54.00	Pass
78 (Peak)	2486.688	-3.956	58.121	54.164	74.00	54.00	Pass
78 (Average)	2480.022	-3.978	83.772	79.794	--	--	--
78 (Average)	2483.500	-3.966	38.385	34.418	74.00	54.00	Pass

Figure Channel 78: VERTICAL (Peak)

Figure Channel 78: VERTICAL (Average)

Note:

1. All readings 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. “*”, means this data is the worst emission level.
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 : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK)(Hopping off)

Measurement Level	Result
Δ (dB)	
> 20	PASS

Figure Channel 00:

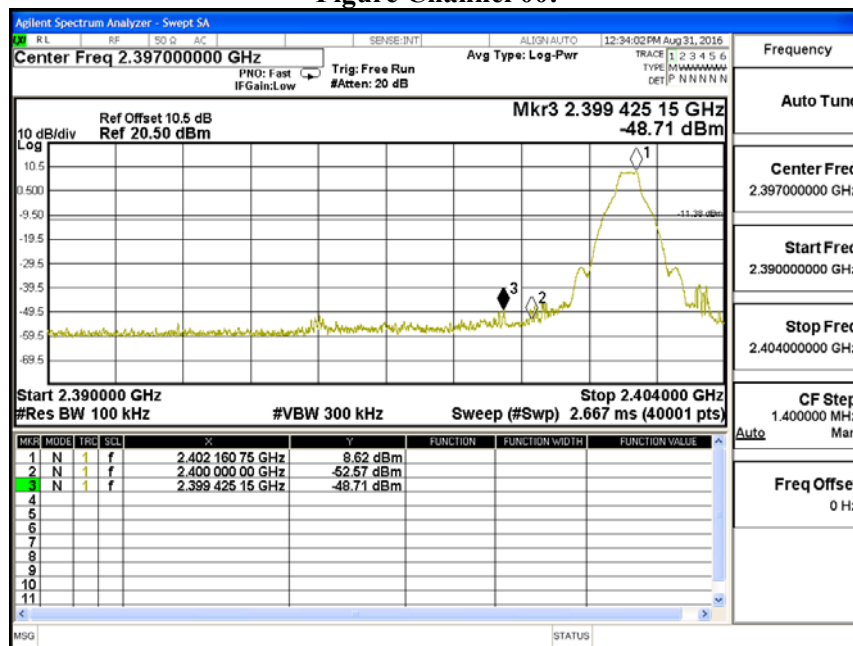
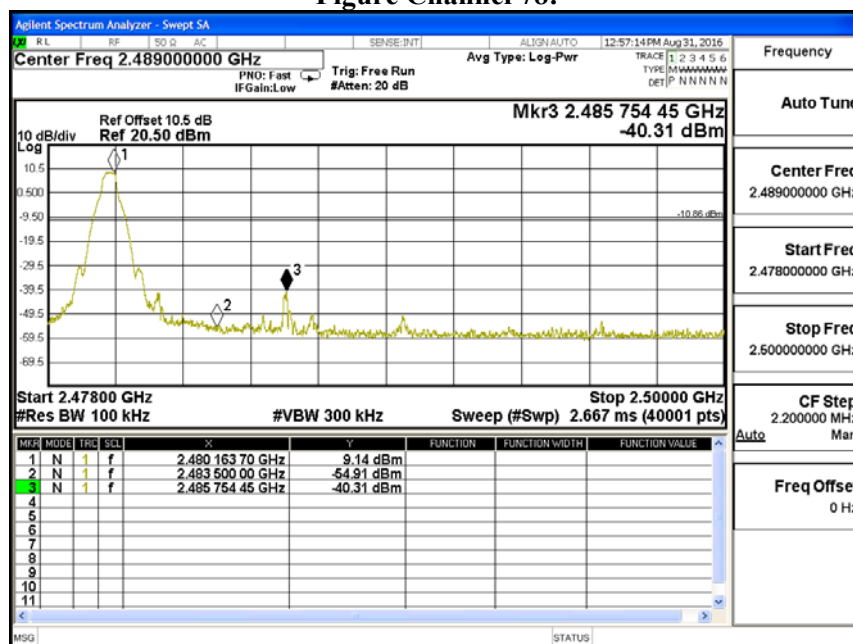


Figure Channel 78:



Product : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK) (Hopping off)

Measurement Level	Result
Δ (dB)	
> 20	PASS

Figure Channel 00:

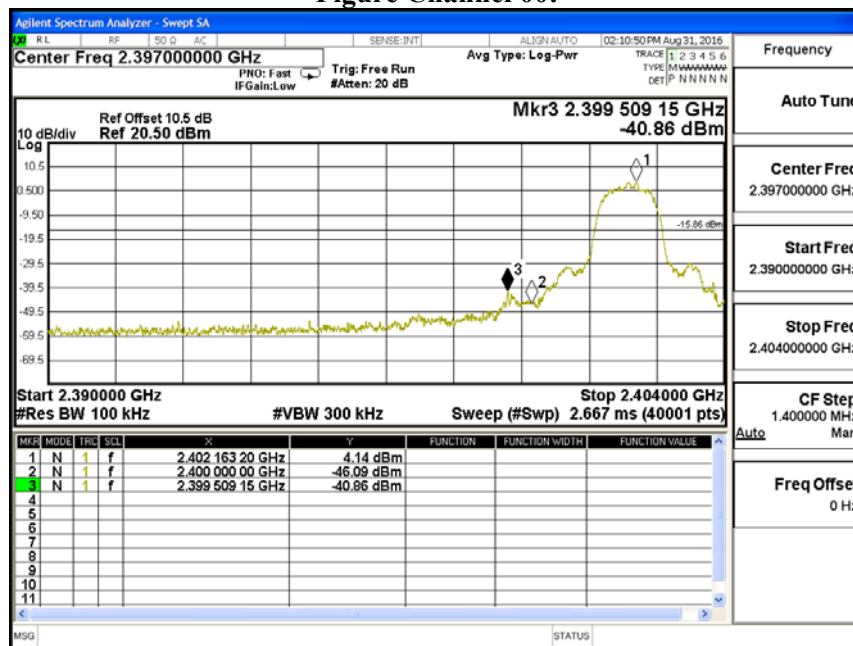
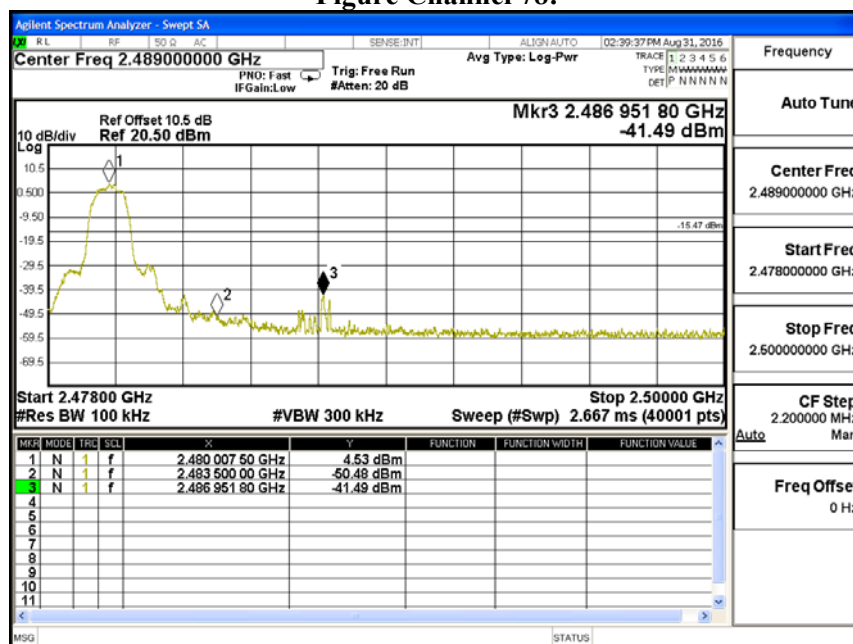


Figure Channel 78:



Product : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK)(Hopping on)

Measurement Level	Result
Δ (dB)	
> 20	PASS

Figure Channel Hopping:

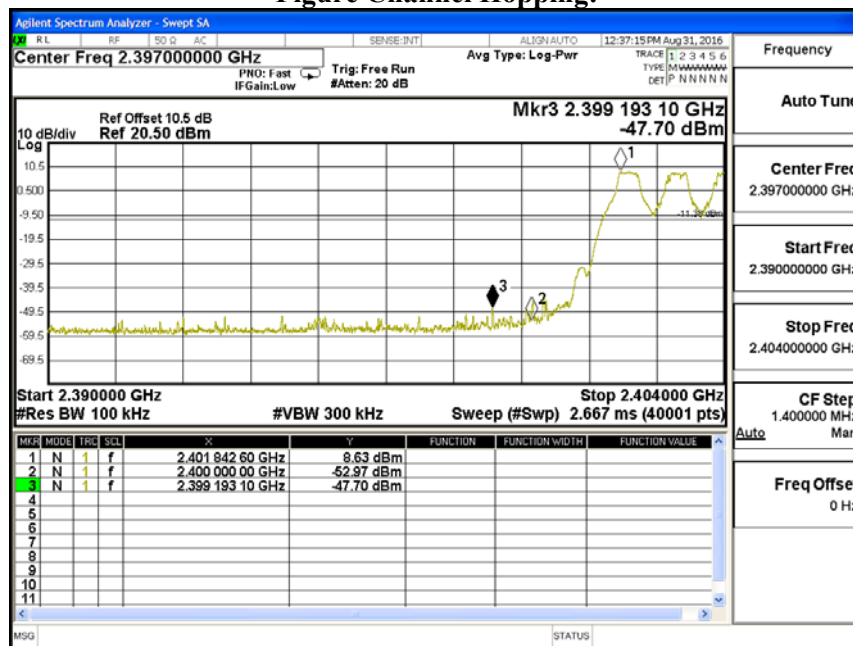
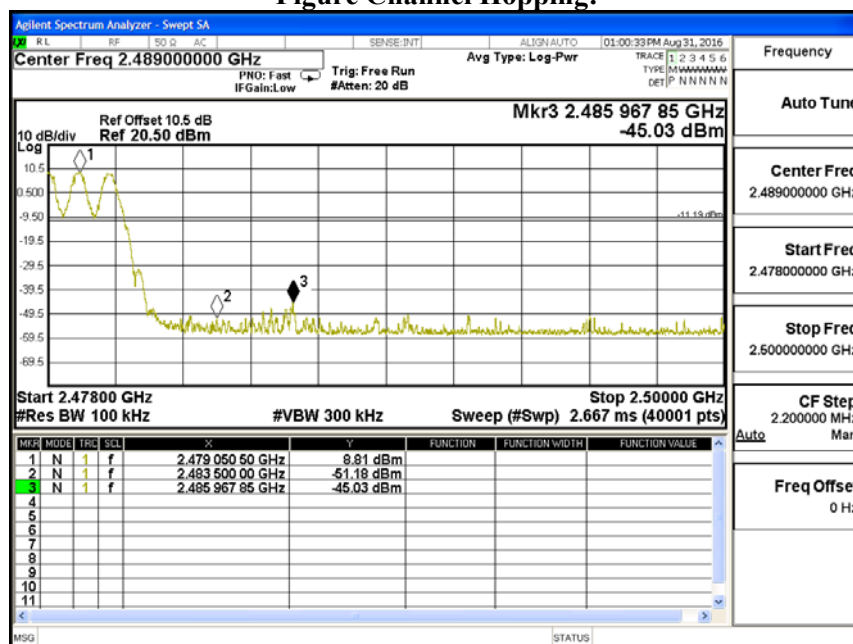


Figure Channel Hopping:



Product : Key programming device
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK) (Hopping on)

Measurement Level	Result
Δ (dB)	
> 20	PASS

Figure Channel Hopping:

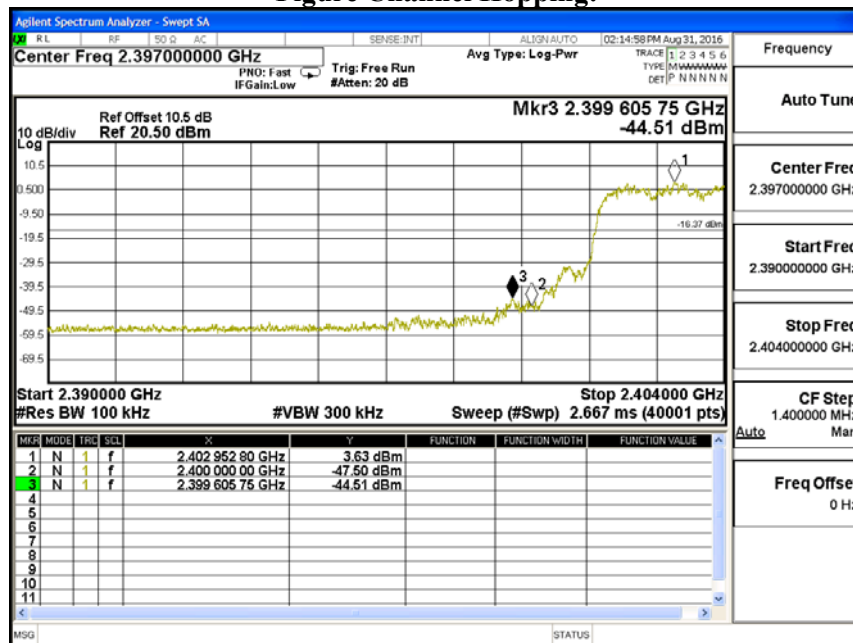
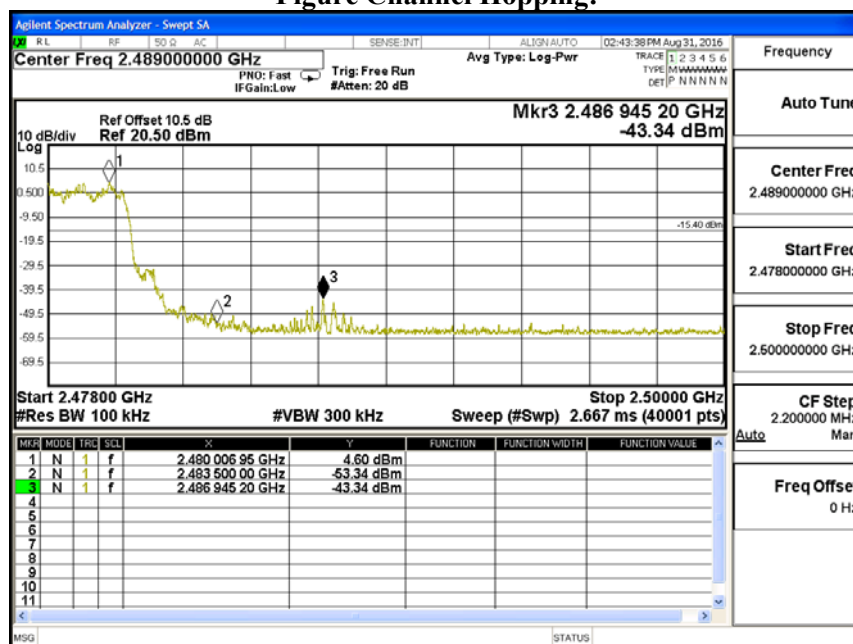
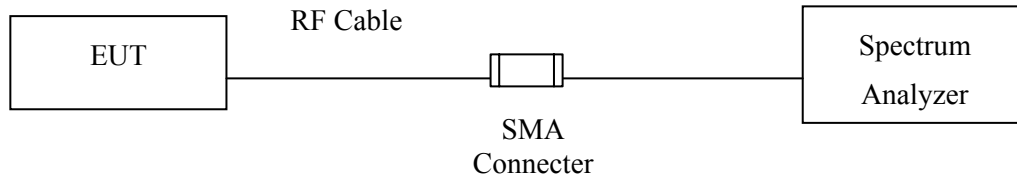


Figure Channel Hopping:



7. Channel Number

7.1. Test Setup



7.2. Limit

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

7.3. 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.

7.4. Uncertainty

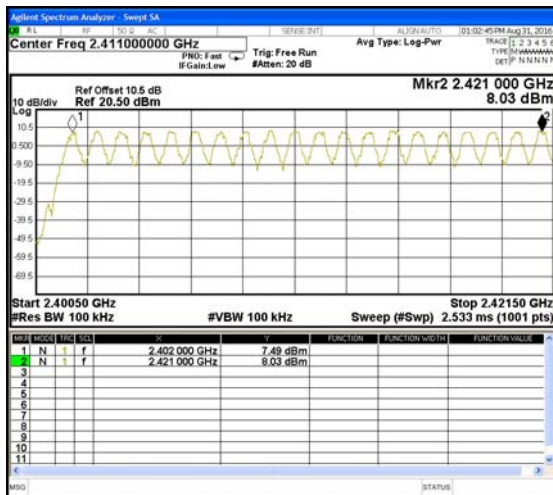
N/A

7.5. Test Result of Channel Number

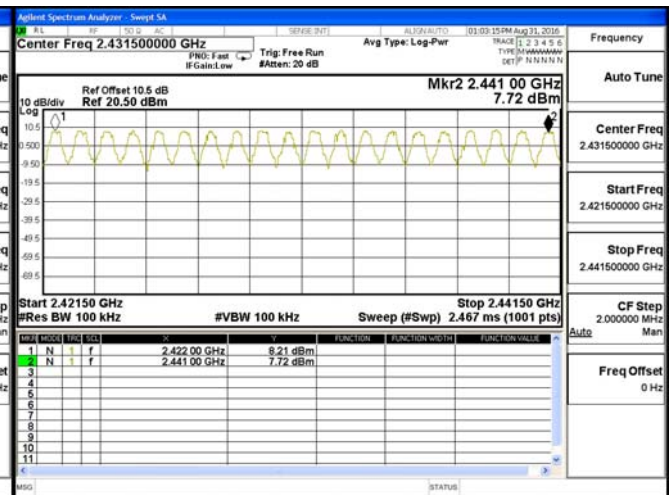
Product : Key programming device
 Test Item : Channel Number
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK)

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

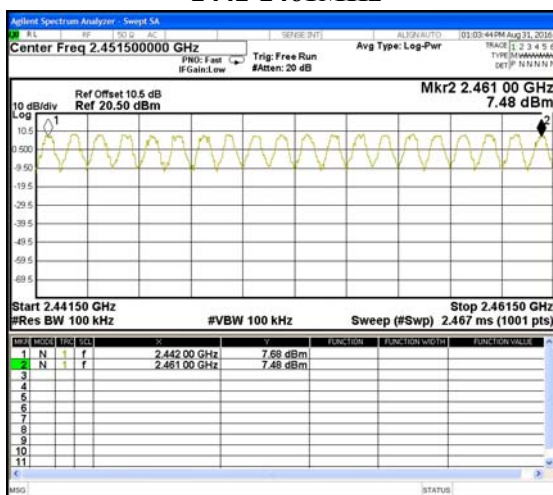
2402-2421MHz



2422-2441MHz



2442-2461MHz



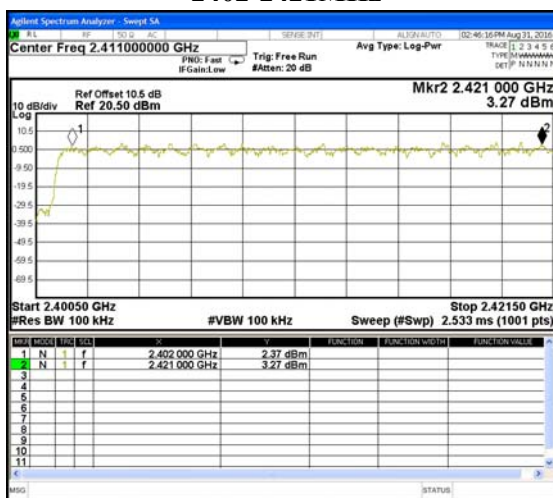
2462-2480MHz



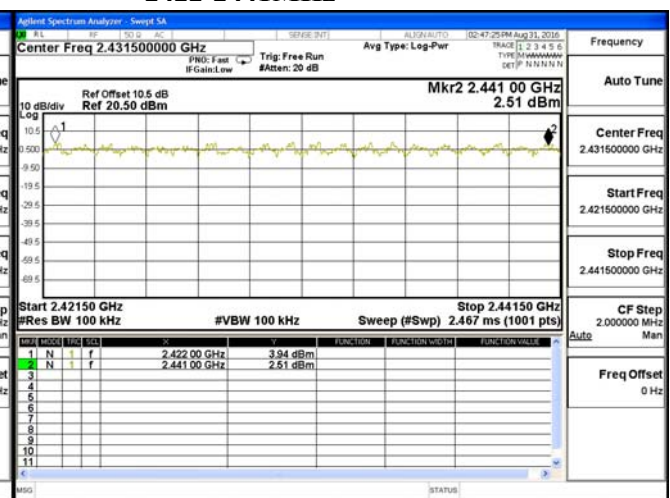
Product : Key programming device
 Test Item : Channel Number
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK)

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

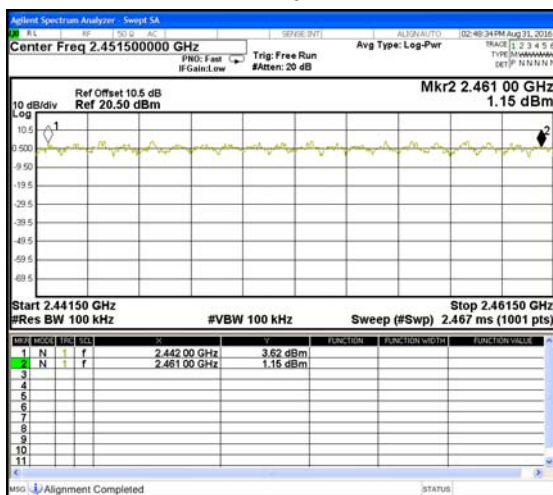
2402-2421MHz



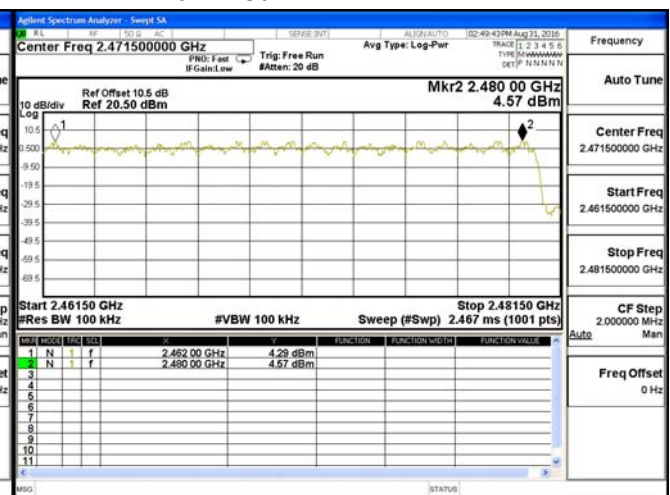
2422-2441MHz



2442-2461MHz

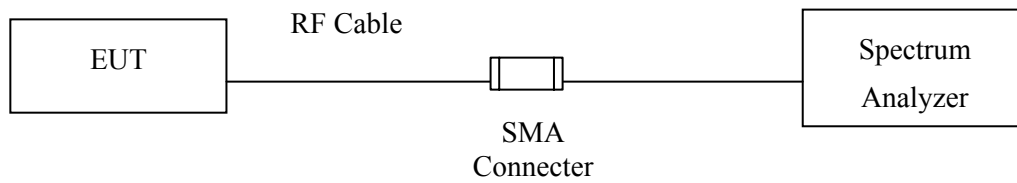


2462-2480MHz



8. Channel Separation

8.1. Test Setup



8.2. 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.

8.3. Test Procedure

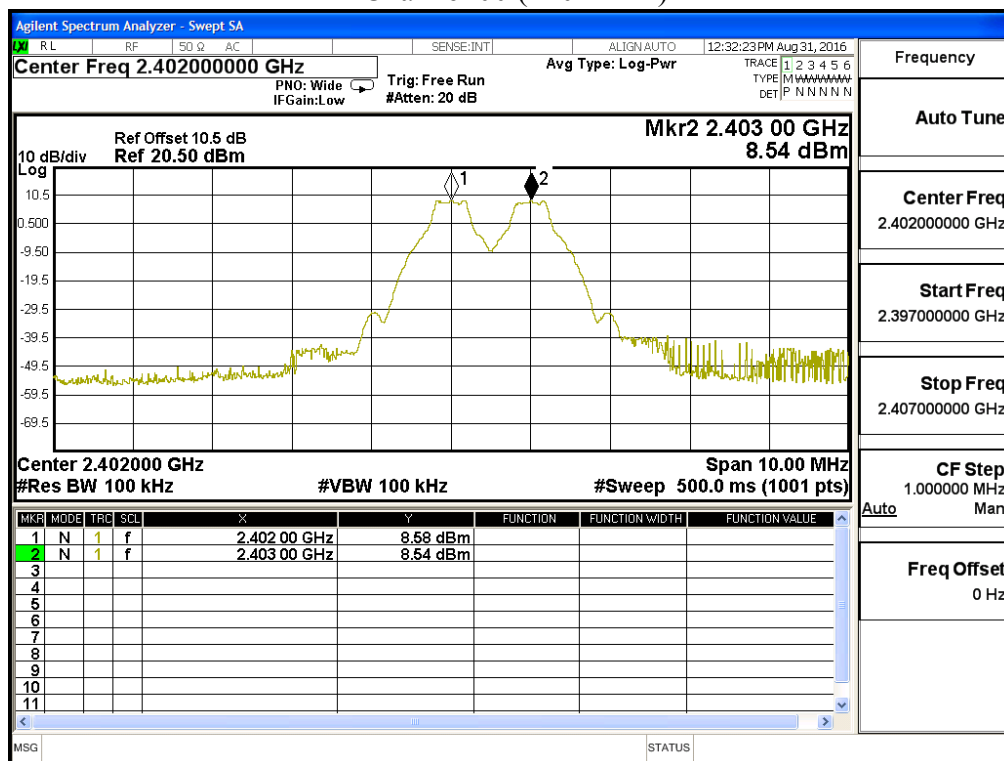
The EUT was setup to ANSI C63.4, 2014; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

8.4. Uncertainty

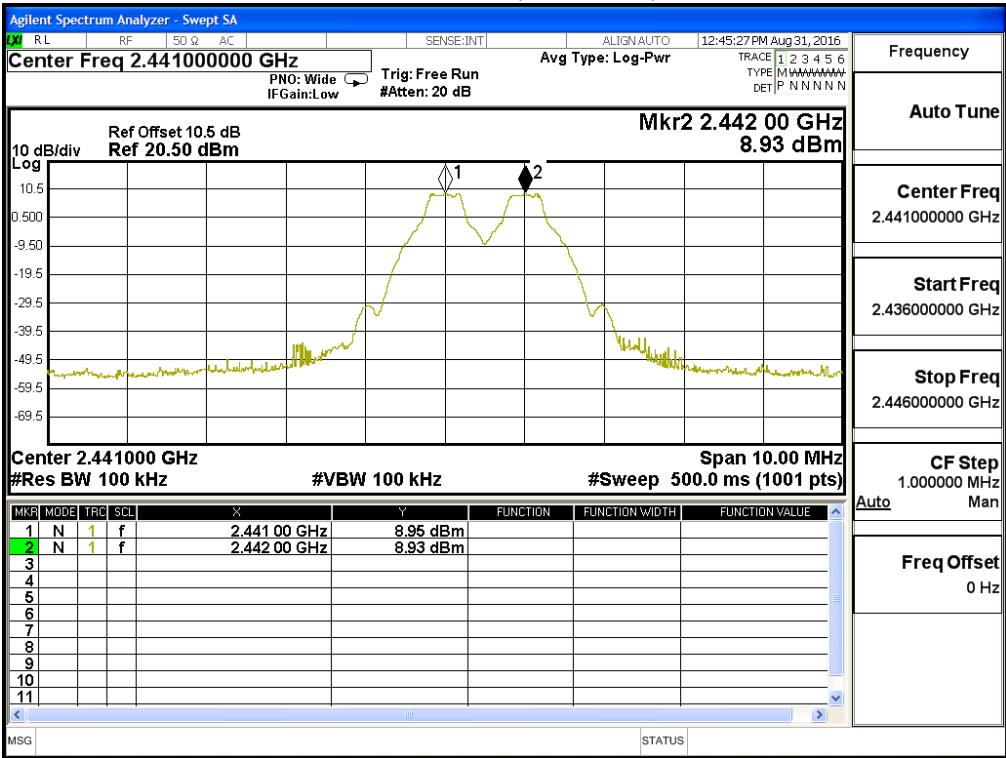
$\pm 283\text{Hz}$

Product	:	Key programming device
Test Item	:	Channel Separation
Test Site	:	No.3 OATS
Test date	:	2016.08.31
Test Mode	:	Mode 1: Transmit - 1Mbps (GFSK)

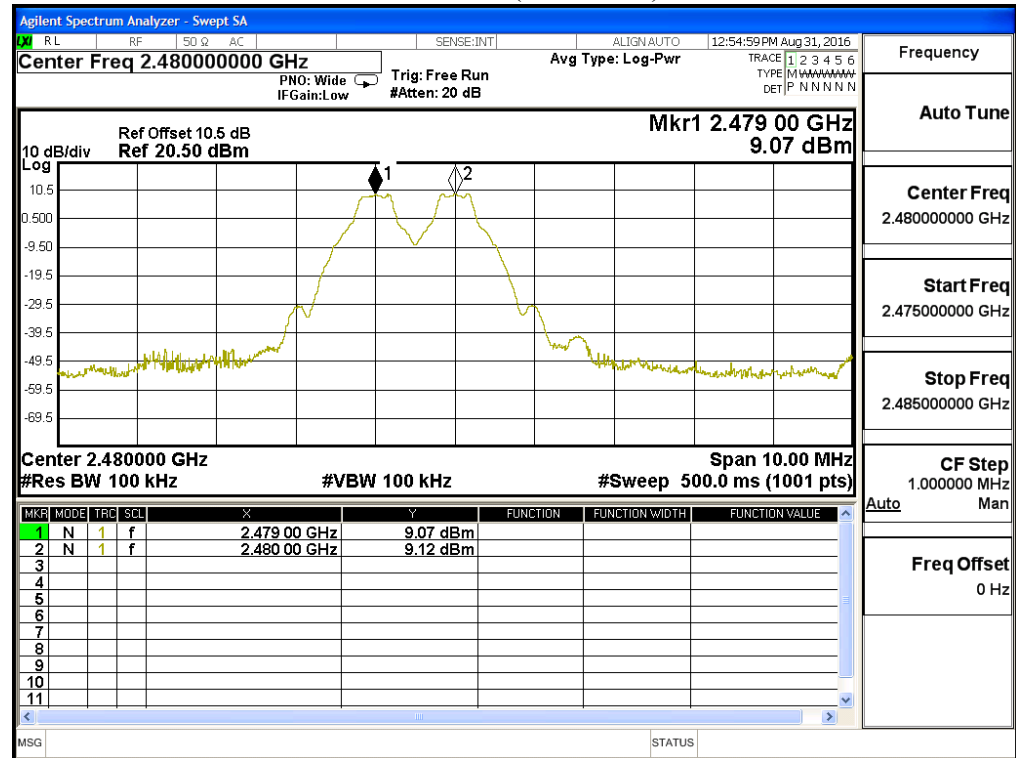
Channel No.	Frequency (MHz)	Measurement Level (kHz)	Limit (kHz)	Limit of (2/3)*20dB Bandwidth (kHz)	Result
00	2402	1000	>25 kHz	634.0	Pass
39	2441	1000	>25 kHz	634.0	Pass
78	2480	1000	>25 kHz	636.0	Pass



Channel 39 (2441MHz)



Channel 78 (2480MHz)

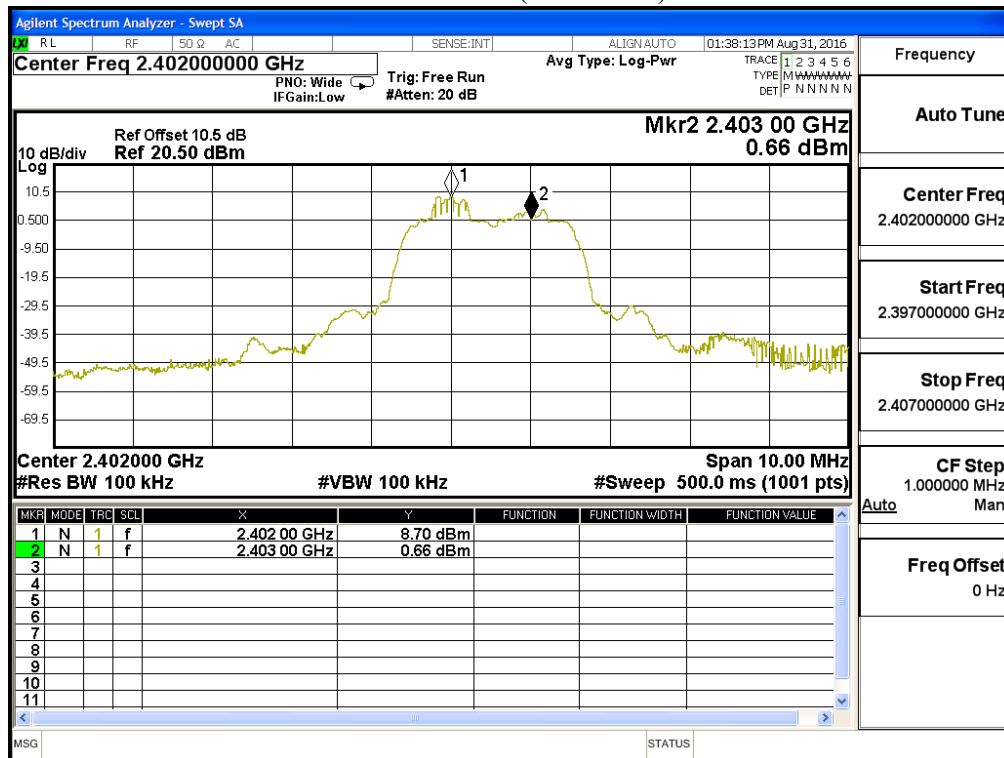


Product : Key programming device
 Test Item : Channel Separation
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK)

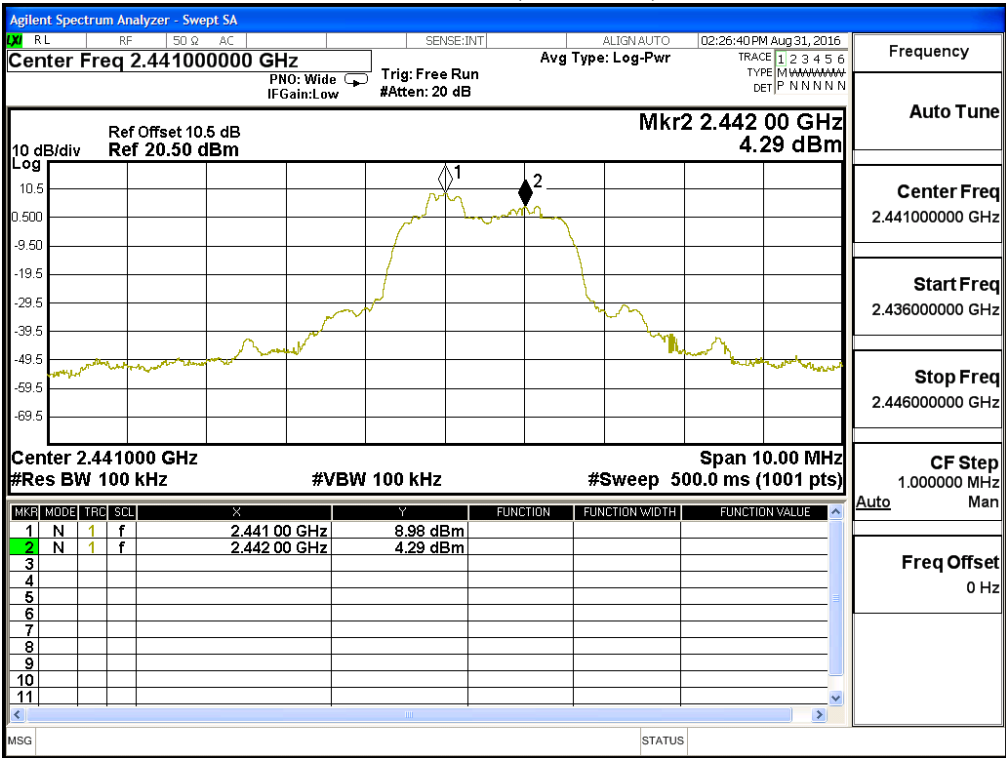
Channel No.	Frequency (MHz)	Measurement Level (kHz)	Limit (kHz)	Limit of (2/3)*20dB Bandwidth (kHz)	Result
00	2402	1000	>25 kHz	884.0	Pass
39	2441	1000	>25 kHz	880.0	Pass
78	2480	1000	>25 kHz	882.0	Pass

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

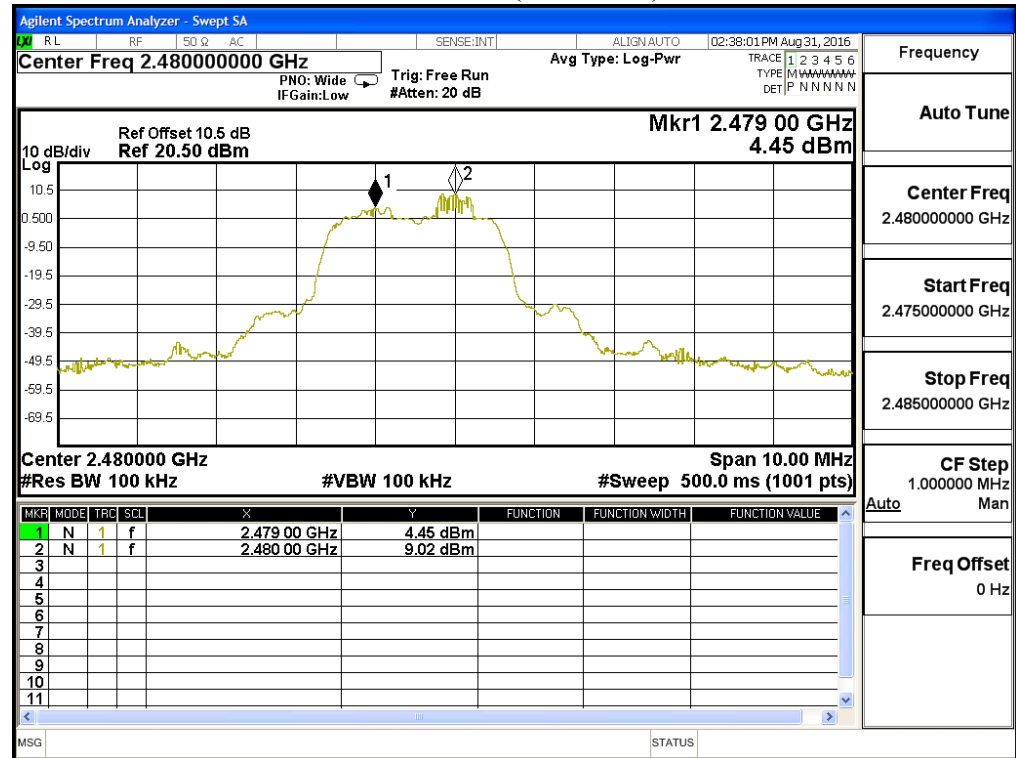
Channel 00 (2402MHz)



Channel 39 (2441MHz)

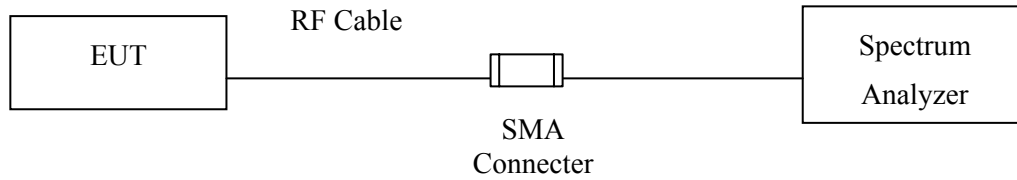


Channel 78 (2480MHz)



9. Dwell Time

9.1. Test Setup



9.2. 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.

9.3. 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.

9.4. Uncertainty

$\pm 25\text{msec}$

9.5. Test Result of Dwell Time

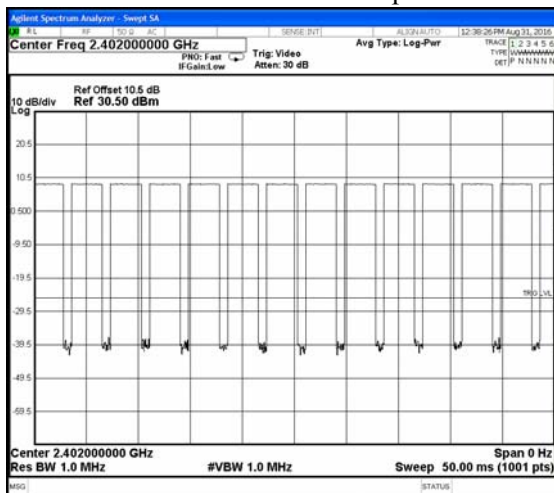
Product : Key programming device
 Test Item : Dwell Time
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK) (Channel 00,39,78 –DH5)

Frequency (MHz)	Time slot length (ms)	Hopping of Number	Sweep time (ms)	Duty cycle	Dwell Time (Sec)	Limit (Sec)	Result
2402	2.887	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

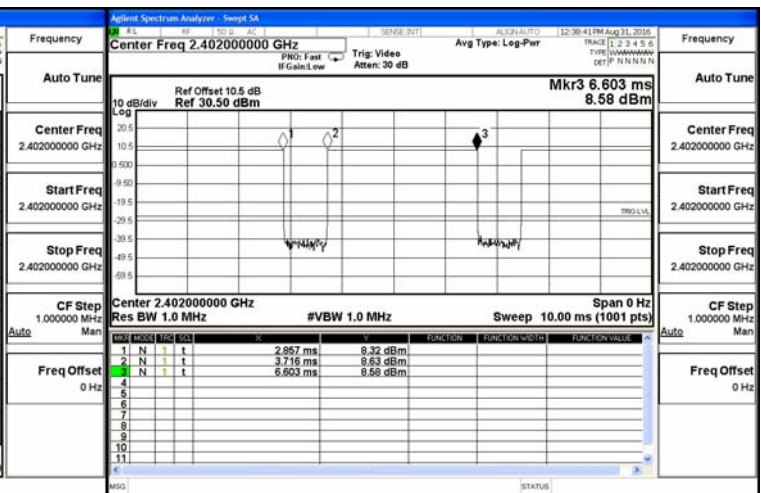
Duty cycle = ((Time slot length(ms)*Hopping of Number) / Sweep time (ms))

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

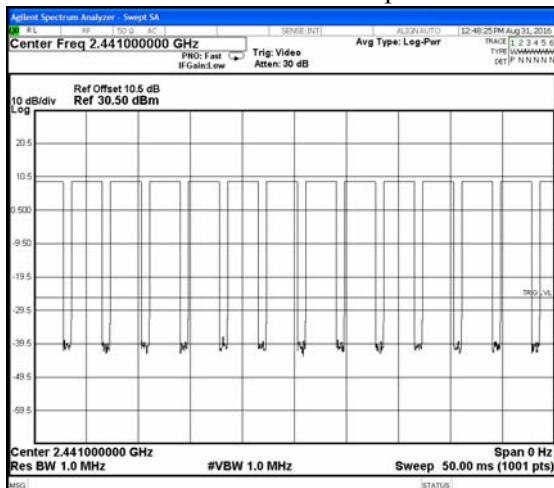
CH 00 Time Interval between hops



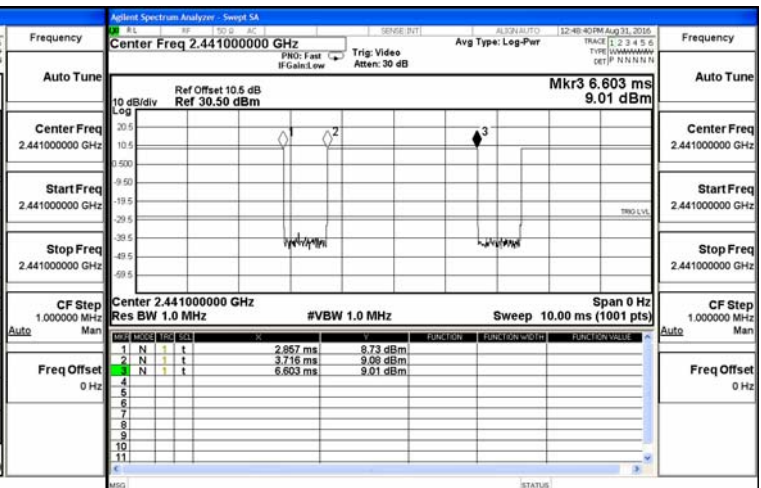
CH 00 Transmission Time



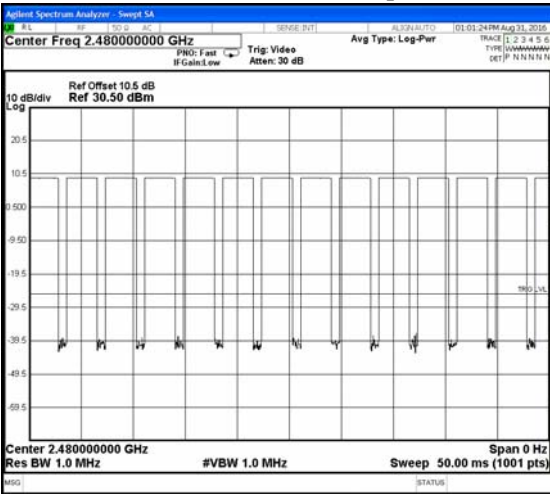
CH39 Time Interval between hops



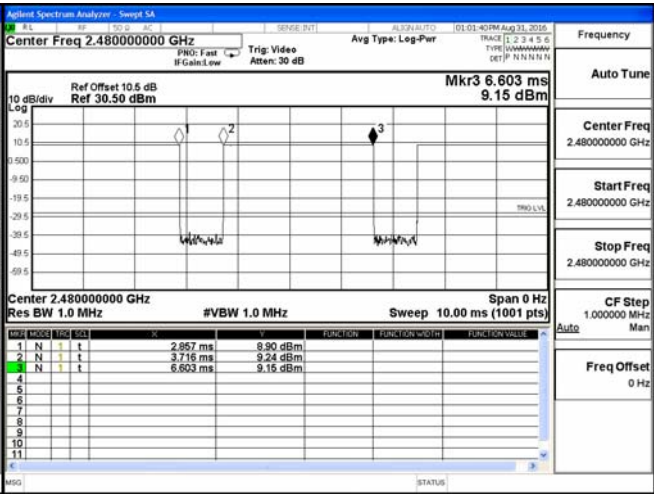
CH 39Transmission Time



CH 78 Time Interval between hops



CH 78 Transmission Time



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

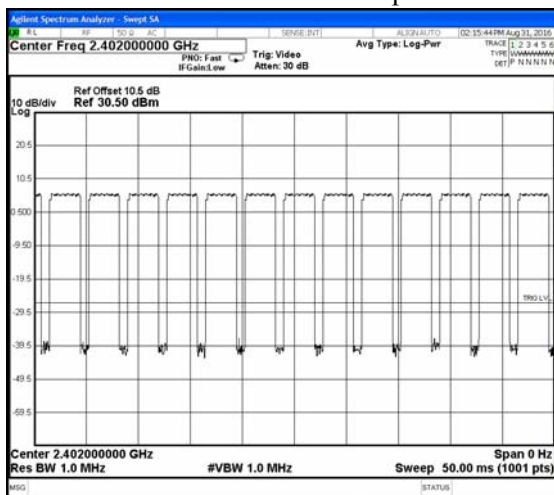
Product : Key programming device
 Test Item : Dwell Time
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK) (Channel 00,39,78 –DH5)

Frequency (MHz)	Time slot length (ms)	Hopping of Number	Sweep time (ms)	Duty cycle	Dwell Time (Sec)	Limit (Sec)	Result
2402	2.897	13	50	0.75	0.301	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

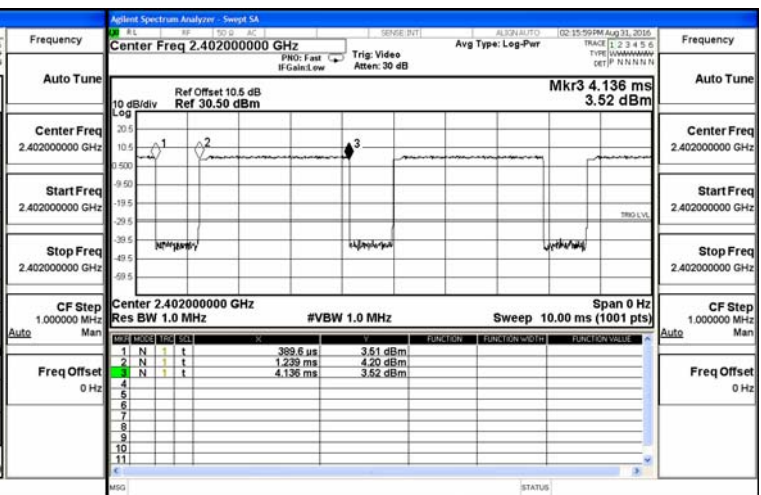
Duty cycle = ((Time slot length(ms)*Hopping of Number) / Sweep time (ms))

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

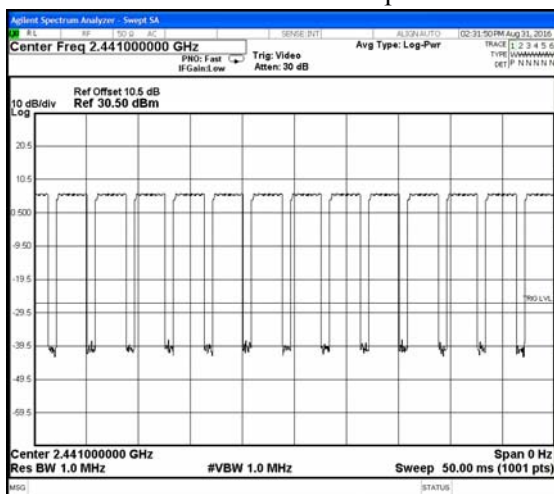
CH 00 Time Interval between hops



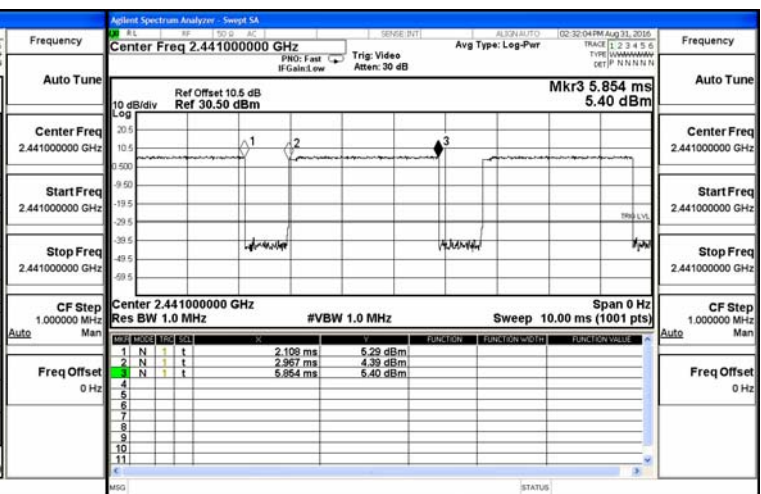
CH 00 Transmission Time



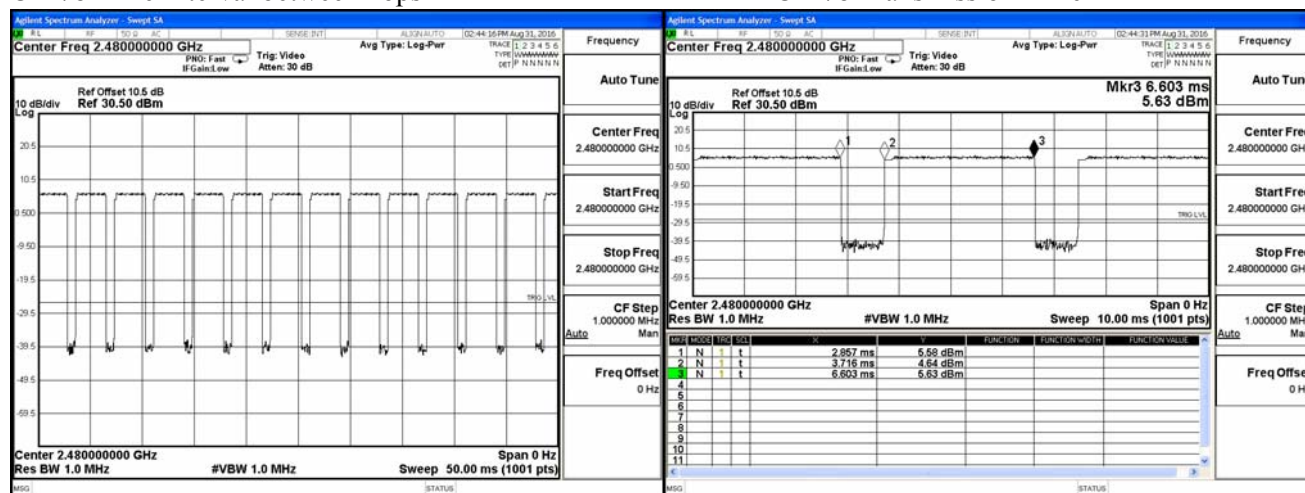
CH39 Time Interval between hops



CH 39 Transmission Time



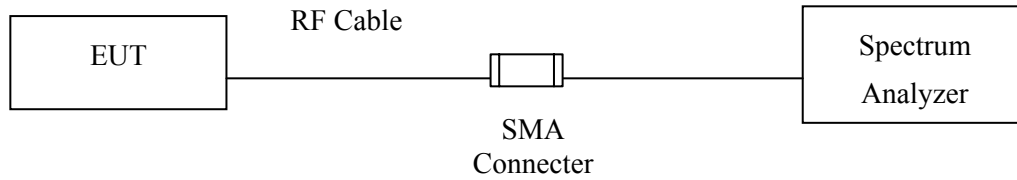
CH 78 Transmission Time



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 Setup



10.2. Limits

N/A

10.3. 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.

10.4. Uncertainty

$\pm 283\text{Hz}$

10.5. Test Result of Occupied Bandwidth

Product : Key programming device
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 1: Transmit - 1Mbps (GFSK)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	951	--	NA
39	2441	951	--	NA
78	2480	954	--	NA

Figure Channel 00:

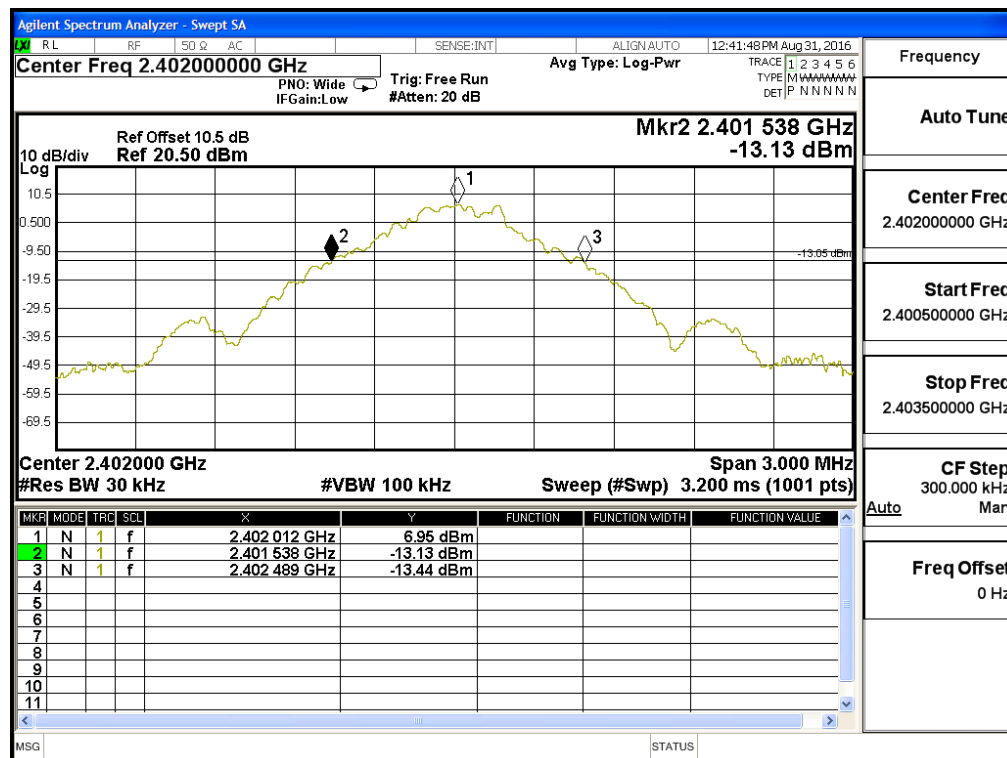


Figure Channel 39:

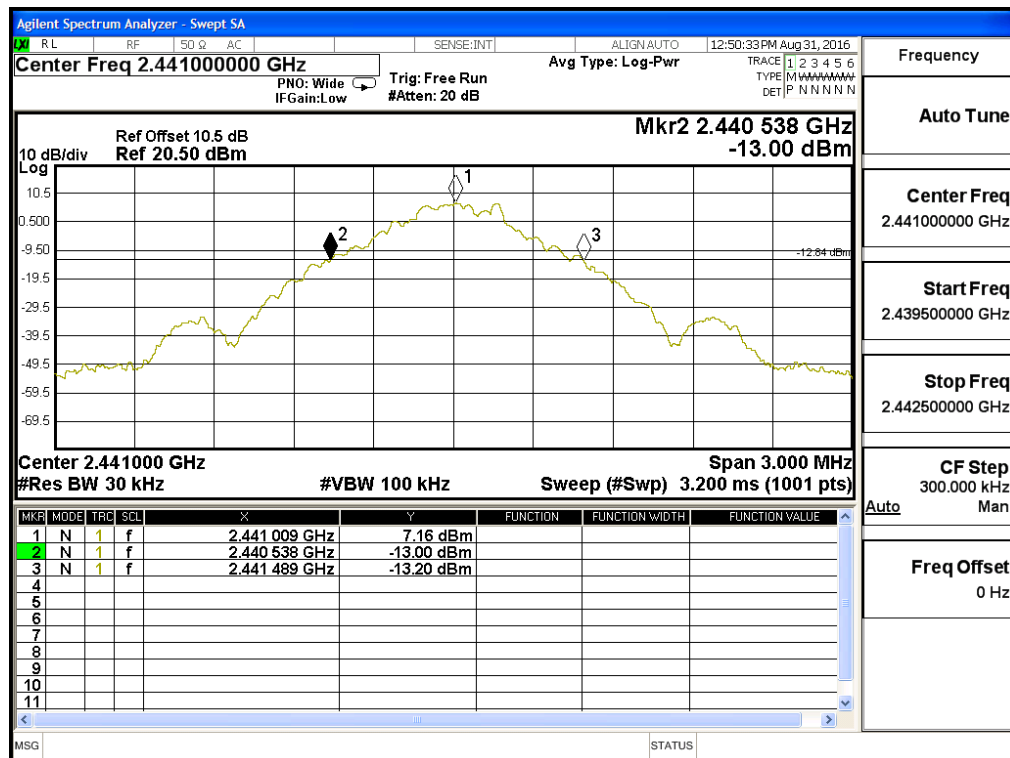
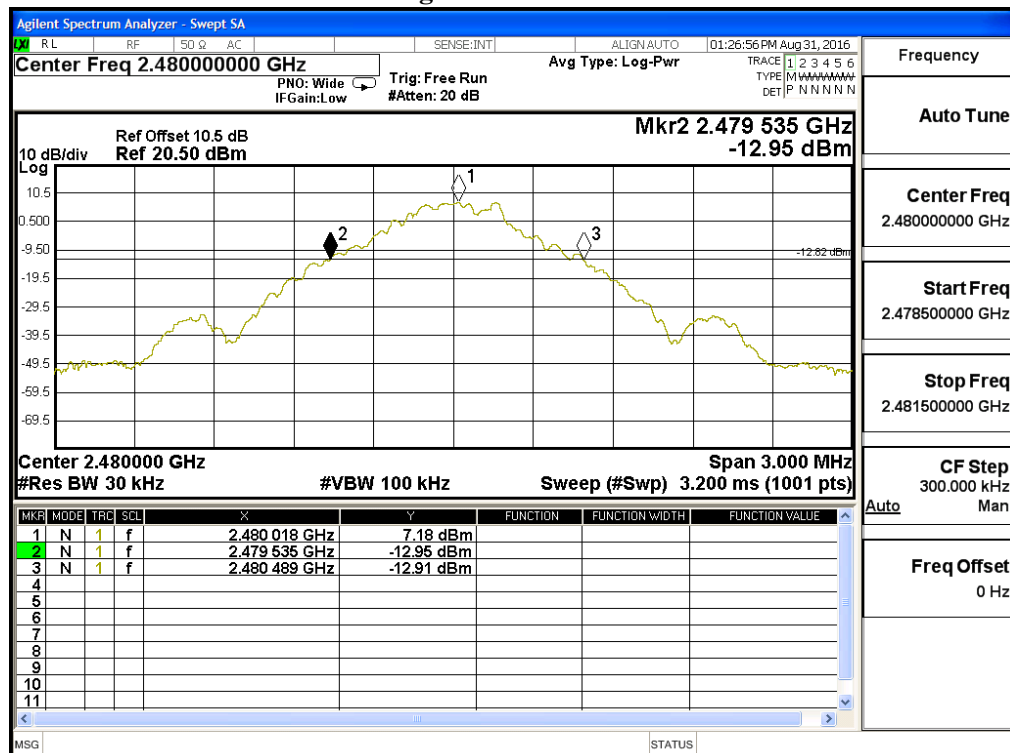


Figure Channel 78:



Product : Key programming device
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test date : 2016.08.31
 Test Mode : Mode 2: Transmit - 3Mbps (8DPSK)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	1326	--	NA
39	2441	1320	--	NA
78	2480	1323	--	NA

Figure Channel 00:

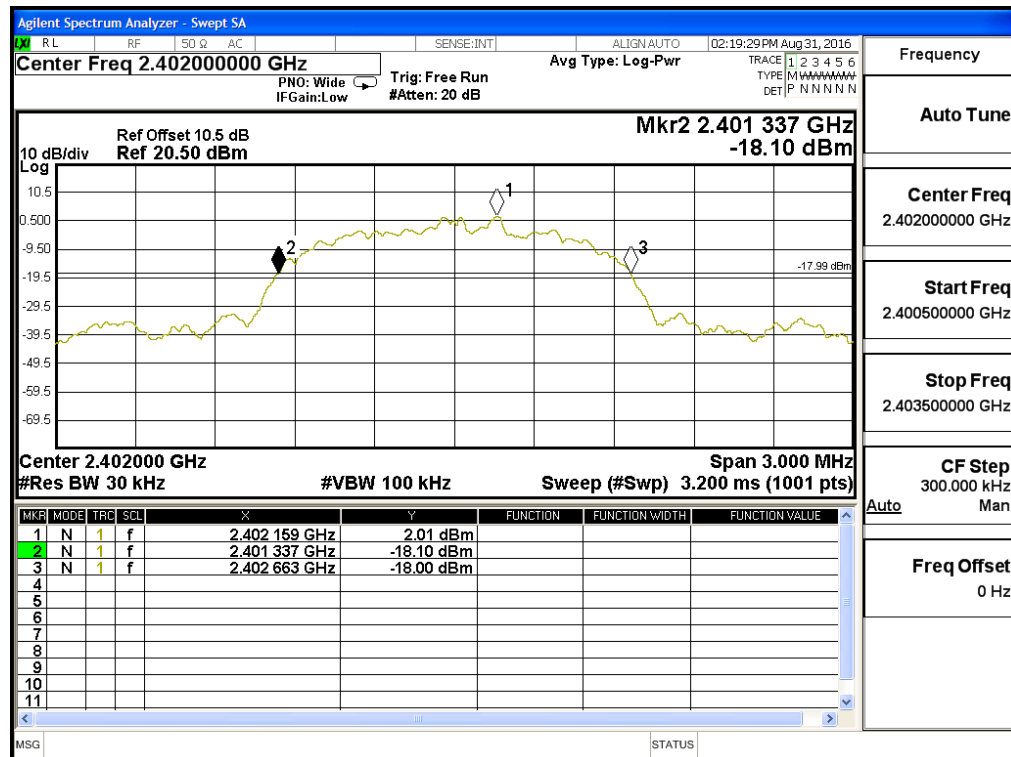


Figure Channel 39:

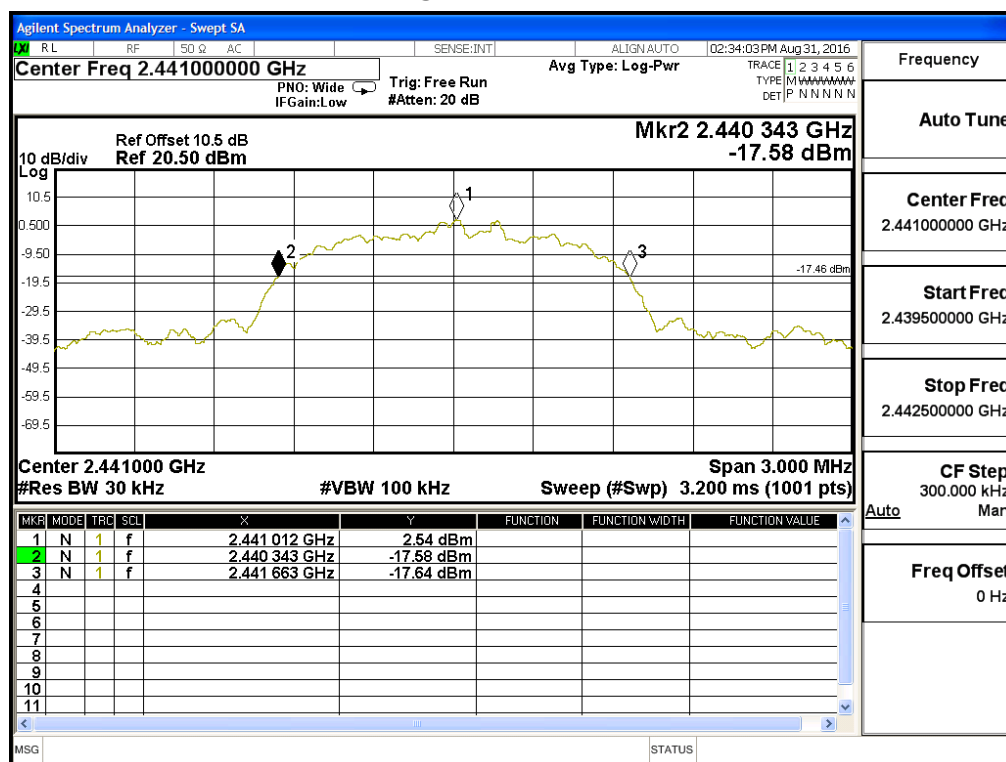
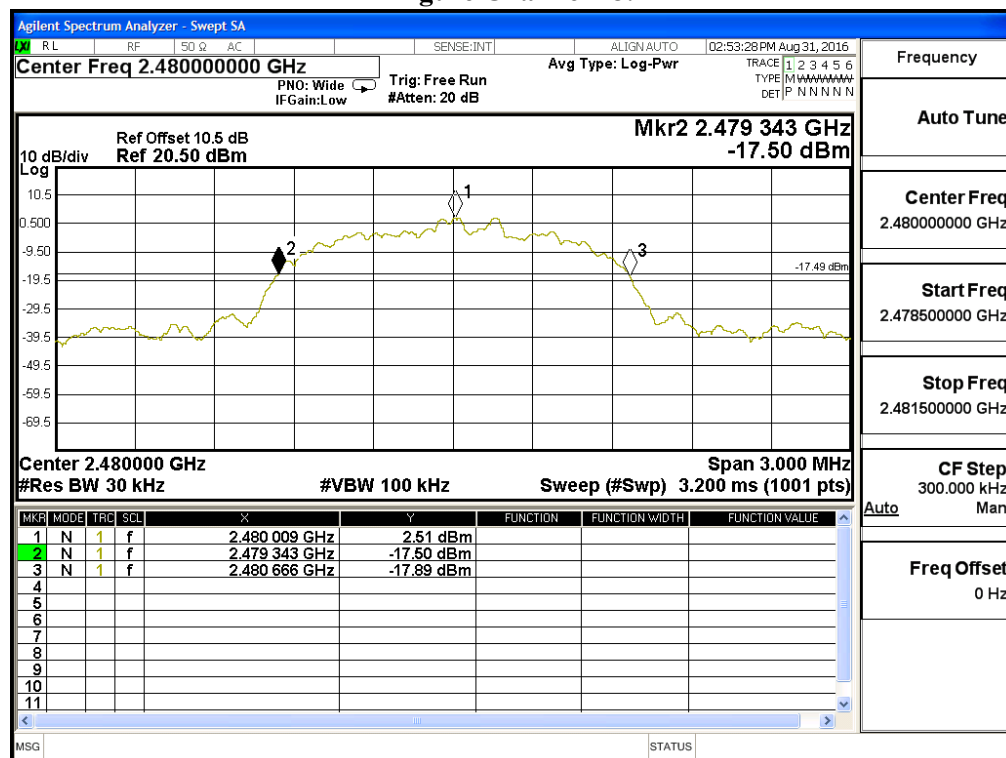


Figure Channel 78:



11. EMI Reduction Method During Compliance Testing

No modification was made during testing.