FCC Part 15C
Measurement and Test Report

For

Shenzhen Dolphin Electronic Co., Ltd

FCC ID: 2AAK2-JVASWI00033

FCC Rule(s):	FCC Part 15.247
Product Description:	SWITCH GC WIRELESS CONTROLLER
Tested Model:	JVASWI00033
Report No.:	BSL011891601RF
Tested Date:	September 30-October 15, 2018
Issued Date:	October 15, 2018
Tested By:	Messi Wang / Engineer
Reviewed By:	Lisa. Li / EMC Manager
Approved & Authorized By:	Mike mo / PSQ Manager

Prepared By:

BSL Testing Co.,LTD.
NO. 24, ZH Park, Nantou, Shenzhen, 518000 China
Tel: 400-882-9628 Fax: 86- 755-26508703

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	Shenzhen Dolphin Electronic Co., Ltd
Address of applicant:	Building1, FuQiao NO.1 Industrial Zone, Fuyong, BaoAn District, ShenZhen, China
Manufacturer:	Shenzhen Dolphin Electronic Co., Ltd
Address of manufacturer:	Building1, FuQiao NO.1 Industrial Zone, Fuyong, BaoAn District, ShenZhen, China
Product Name:	SWITCH GC WIRELESS CONTROLLER
Model No.:	JVASWI00033, GG00102, GG00103, JVASWI00032
Test Model No:	JVASWI00033
Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The different is only model name for commercial purpose.	
Quantity of tested samples	1
Serial No.:	N/A
Hardware Version:	DFL-002 V1.1 2018.09.06
Software Version:	20180917-SW-DFL-002-A4.bin
Operation Frequency:	2402MHz~2480MHz
Channel numbers:	79
Channel separation:	1MHz
Modulation type:	GFSK, Pi/4 QPSK, 8DPSK
Antenna Type:	PCB antenna
Antenna gain:	1.05dBi
Power supply:	DC 3.7V by battery

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	21	2422MHz	41	2442MHz	61	2462MHz
2	2403MHz	22	2423MHz	42	2443MHz	62	2463MHz
3	2404MHz	23	2424MHz	43	2444MHz	63	2464MHz
4	2405MHz	24	2425MHz	44	2445MHz	64	2465MHz
5	2406MHz	25	2426MHz	45	2446MHz	65	2466MHz
6	2407MHz	26	2427MHz	46	2447MHz	66	2467MHz
7	2408MHz	27	2428MHz	47	2448MHz	67	2468MHz
8	2409MHz	28	2429MHz	48	2449MHz	68	2469MHz
9	2410MHz	29	2430MHz	49	2450MHz	69	2470MHz
10	2411MHz	30	2431MHz	50	2451MHz	70	2471MHz
11	2412MHz	31	2432MHz	51	2452MHz	71	2472MHz
12	2413MHz	32	2433MHz	52	2453MHz	72	2473MHz
13	2414MHz	33	2434MHz	53	2454MHz	73	2474MHz
14	2415MHz	34	2435MHz	54	2455MHz	74	2475MHz
15	2416MHz	35	2436MHz	55	2456MHz	75	2476MHz
16	2417MHz	36	2437MHz	56	2457MHz	76	2477MHz
17	2418MHz	37	2438MHz	57	2458MHz	77	2478MHz
18	2419MHz	38	2439MHz	58	2459MHz	78	2479MHz
19	2420MHz	39	2440MHz	59	2460MHz	79	2480MHz
20	2421MHz	40	2441MHz	60	2461MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test.

EUT Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
USB cable	1.0	Unshielded	Without Ferrite

Auxiliary Equipment List and Details

Description	Manufacturer	Model	Serial Number
Adapter	JINFULIN	BST01	/
USB cable			

Special Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
/	/	/	/

1.2 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List			
Test Mode	Description	Channel	Frequency (MHz)
1	GFSK,	CH1	2402
		CH40	2441
		CH79	2480
2	Pi/4 QPSK	CH1	2402
		CH40	2441
		CH79	2480
3	8DPSK	CH1	2402
		CH40	2441
		CH79	2480

1.3 Test Standards

The following report accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.5 Test Facility

BSL Testing Co.,LTD.
NO. 24, ZH Park, Nantou, Shenzhen, 518000 China
Test Firm Registration Number: 866035
Designation Number: CN1217

Tel: 400-882-9628
Fax: 86-755-26508703

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	±0.42dB
Occupied Bandwidth	Conducted	±1.5%
Power Spectral Density	Conducted	±1.8dB
Conducted Spurious Emission	Conducted	±2.17dB
Conducted Emissions	Conducted	±2.88dB
Transmitter Spurious Emissions	Radiated	±5.1dB

1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
Communication Tester	Rohde & Schwarz	CMW500	100358	2017-10-21	2018-10-20
Spectrum Analyzer	R&S	FSP40	100550	2017-10-21	2018-10-20
Test Receiver	R&S	ESCI7	US47140102	2017-10-21	2018-10-20
Signal Generator	HP	83630B	3844A01028	2017-10-22	2018-10-21
Test Receiver	R&S	ESPI-3	100180	2017-10-21	2018-10-20
Amplifier	Agilent	8449B	4035A00116	2017-10-22	2018-10-21
Amplifier	HP	8447E	2945A02770	2017-10-22	2018-10-21
Signal Generator	IFR	2023A	202307/242	2017-10-22	2018-10-21
Broadband Antenna	SCHAFFNER	2774	2774	2017-10-17	2018-10-16
Biconical and log periodic antennas	ELECTRO-METRICS	EM-6917B-1	171	2017-10-17	2018-10-16
Horn Antenna	R&S	HF906	100253	2017-10-17	2018-10-16
Horn Antenna	EM	EM-6961	6462	2017-10-17	2018-10-16
LISN	R&S	ESH3-Z5	100196	2017-10-17	2018-10-16
LISN	COM-POWER	LI-115	02027	2017-10-17	2018-10-16
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	2017-10-21	2018-10-20
Horn Antenna	A-INFOMW	LB-180400KF	BSL088	2017-10-21	2018-10-20
20dB Attenuator	ICPROBING	IATS1	BSL1003	2017-10-21	2018-10-20
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2017-10-21	2018-10-20
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2017-10-21	2018-10-20
Loop Antenna	Schwarz beck	FMZB 1516	9773	2018-06-16	2019-06-15

2. SUMMARY OF TEST RESULTS

Test Item	Section in CFR 47	Result
RF Exposure (SAR)	Part 1.1307 Part 2.1093	Pass* (Please refer to SAR Report)
Antenna Requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(1)	Pass
20dB Occupied Bandwidth	15.247 (a)(1)	Pass
Carrier Frequencies Separation	15.247 (a)(1)	Pass
Hopping Channel Number	15.247 (a)(1)	Pass
Dwell Time	15.247 (a)(1)	Pass
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	Pass
Radiated Emission	15.205/15.209	Pass
Band Edge	15.247(d)	Pass

Pass: The EUT complies with the essential requirements in the standard.

Remark: Test according to ANSI C63.10:2013

3. RF Exposure

3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

4. Antenna Requirement

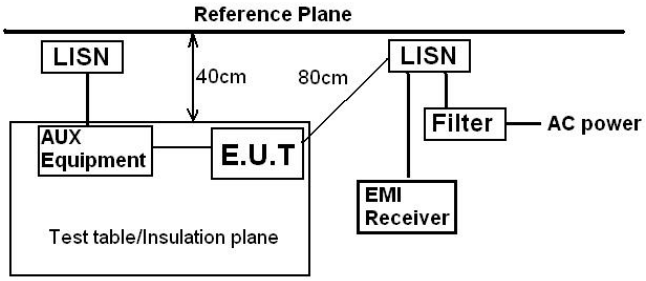
4.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

4.2 Evaluation Information

This product has a internal PCB antenna(1.05dBi), fulfill the requirement of this section.

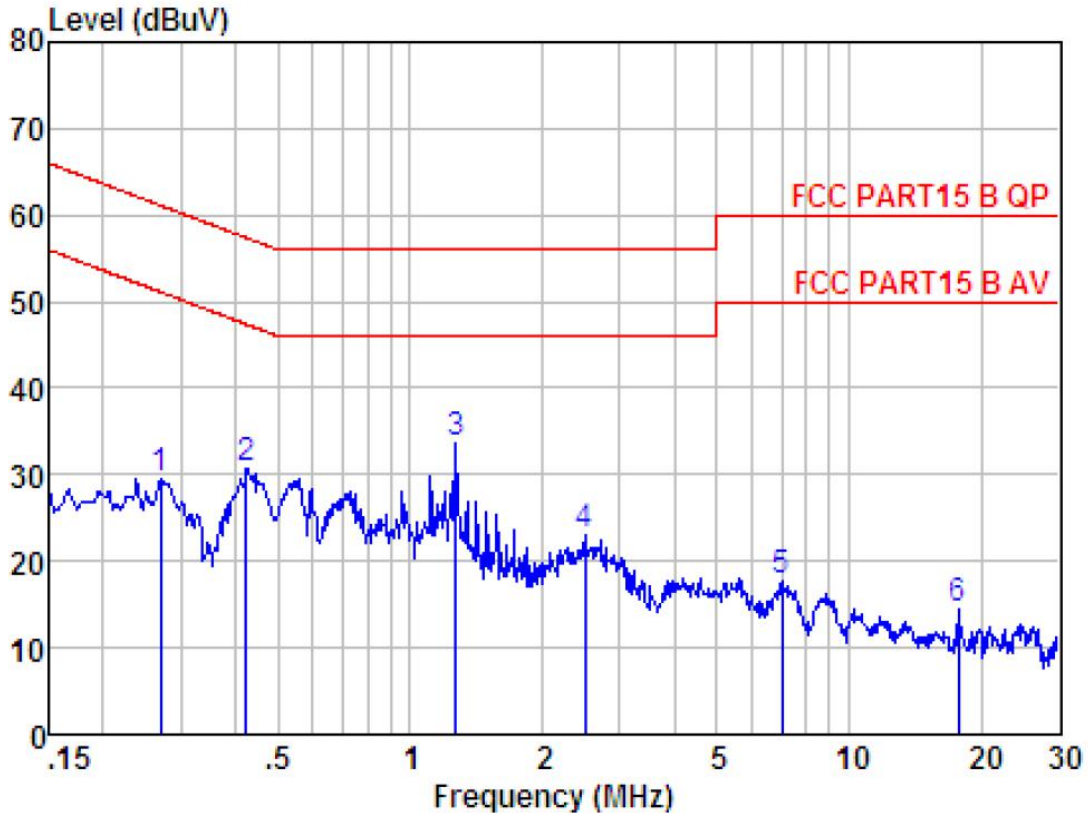
5. Conducted Emissions

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.207</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>150KHz to 30MHz</td></tr>
<tr><td>Class / Severity:</td><td>Class B</td></tr>
<tr><td>Receiver setup:</td><td>RBW=9KHz, VBW=30KHz, Sweep time=auto</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
* Decreases with the logarithm of the frequency.
</td></tr>
<tr><td>Test setup:</td><td>


Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m
</td></tr>
<tr><td>Test procedure:</td><td>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.
2. 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).
3. 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 of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.</td></tr>
<tr><td>Test Instruments:</td><td>Refer to section 1.7 for details</td></tr>
<tr><td>Test mode:</td><td>Refer to section 1.2 for details</td></tr>
<tr><td>Test results:</td><td>Pass</td></tr>
</table>

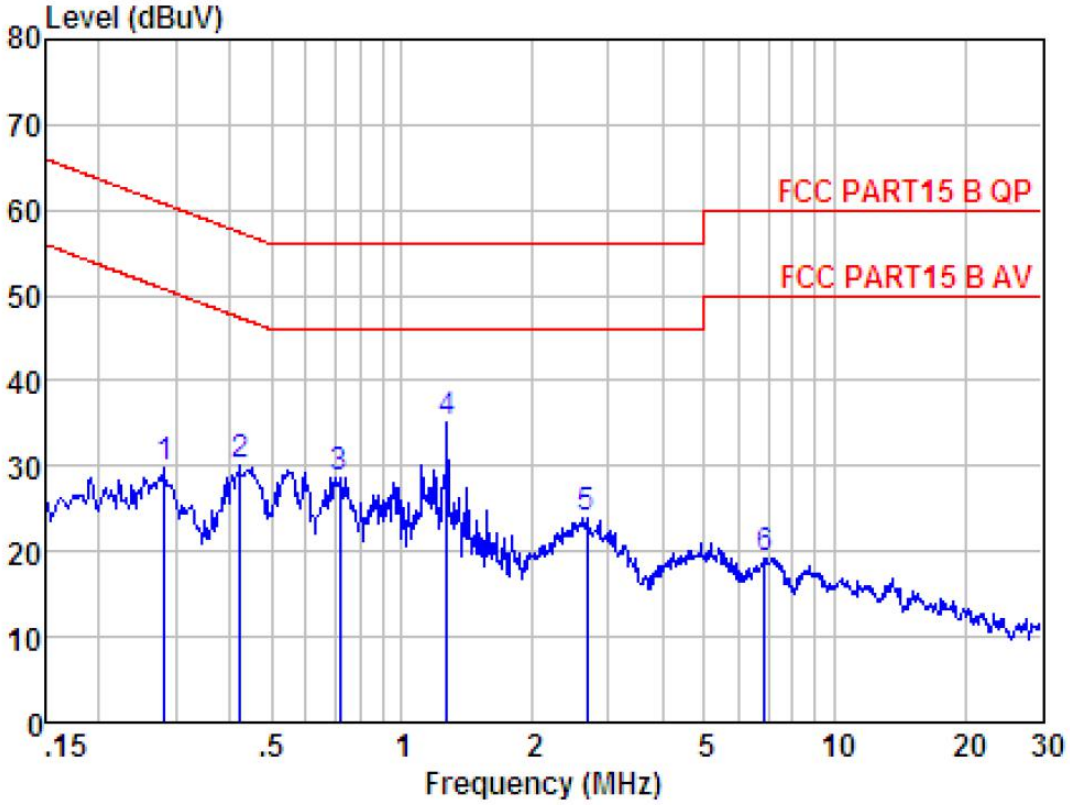
Measurement data:

Line:



	Freq	Pol/Phase	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz		dBuV	dB	dB	dBuV	dBuV	dB	
1	0.27	LINE	28.93	0.40	0.09	29.42	61.12	-31.70	Peak
2	0.42	LINE	30.17	0.37	0.11	30.65	57.42	-26.77	Peak
3 max	1.27	LINE	32.98	0.47	0.19	33.64	56.00	-22.36	Peak
4	2.50	LINE	22.14	0.47	0.28	22.89	56.00	-33.11	Peak
5	7.02	LINE	16.75	0.48	0.42	17.65	60.00	-42.35	Peak
6	17.75	LINE	13.41	0.44	0.49	14.34	60.00	-45.66	Peak

Neutral:

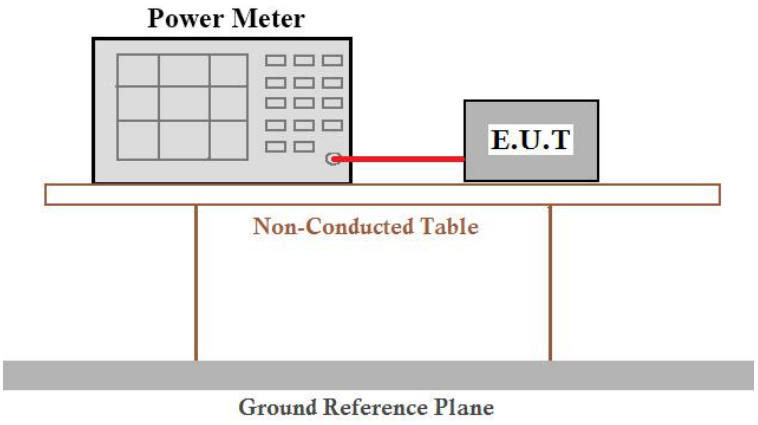


	Freq	Pol/Phase	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz		dBuV	dB	dB	dBuV	dBuV	dB	
1	0.28	NEUTRAL	29.10	0.52	0.10	29.72	60.76	-31.04	Peak
2	0.42	NEUTRAL	29.33	0.53	0.11	29.97	57.42	-27.45	Peak
3	0.72	NEUTRAL	27.97	0.50	0.18	28.65	56.00	-27.35	Peak
4 max	1.27	NEUTRAL	34.46	0.51	0.19	35.16	56.00	-20.84	Peak
5	2.68	NEUTRAL	23.14	0.52	0.29	23.95	56.00	-32.05	Peak
6	6.88	NEUTRAL	18.29	0.52	0.42	19.23	60.00	-40.77	Peak

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + LISN Factor + Cable Loss
4. 9k~30MHz radiated emission all test results are below 20dB.

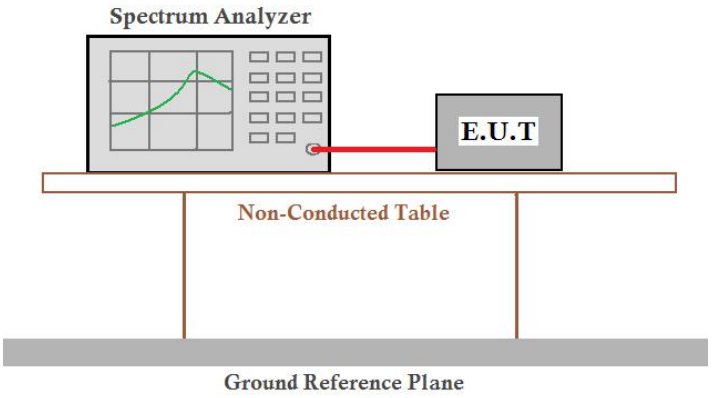
6. Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013
Limit:	30dBm(for GFSK),20.97dBm(for EDR)
Test setup:	
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Measurement Data

Mode	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	Lowest	0.025	30.00	Pass
	Middle	0.671		
	Highest	0.922		
Pi/4QPSK	Lowest	-0.102	20.97	Pass
	Middle	0.053		
	Highest	0.017		
8DPSK	Lowest	-0.314	20.97	Pass
	Middle	0.216		
	Highest	0.192		

7. 20dB Emission Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013
Limit:	N/A
Test setup:	
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Measurement Data

Mode	Test channel	20dB Emission Bandwidth (MHz)	Result
GFSK	Lowest	0.9108	Pass
	Middle	0.8851	
	Highest	0.8880	
Pi/4QPSK	Lowest	1.222	Pass
	Middle	1.224	
	Highest	1.224	
8DPSK	Lowest	1.209	Pass
	Middle	1.202	
	Highest	1.210	

Test plot as follows:

Test mode:	GFSK mode

Lowest channel

Middle channel

Highest channel

Test mode:	Pi/4QPSK mode

Lowest channel

Middle channel

Highest channel

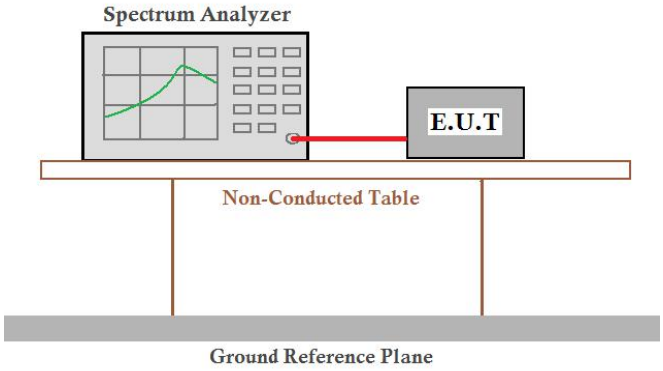
Test mode:	8DPSK mode

Lowest channel

Middle channel

Highest channel

8. Carrier Frequencies Separation

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=20KHz, VBW=62KHz, detector=Peak
Limit:	0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)
Test setup:	
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Measurement Data

Mode	Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
GFSK	Lowest	996	607	Pass
	Middle	998	607	Pass
	Highest	1000	607	Pass
Pi/4QPSK	Lowest	992	816	Pass
	Middle	996	816	Pass
	Highest	992	816	Pass
8DSK	Lowest	990	807	Pass
	Middle	998	807	Pass
	Highest	998	807	Pass

Note: According to section 7.4

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	910.8	607
Pi/4QPSK	1224.00	816
8DSK	1210.00	807

Test plot as follows:

Modulation mode:	GFSK

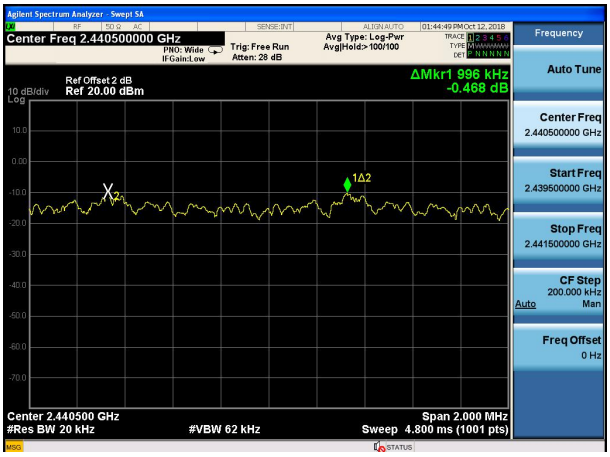
Lowest channel

Middle channel

Highest channel

Test mode:	Pi/4QPSK mode

Lowest channel

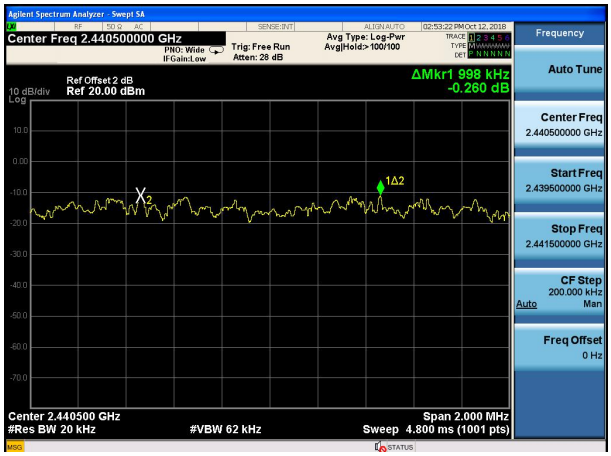


Middle channel

Highest channel

Test mode:	8DPSK mode

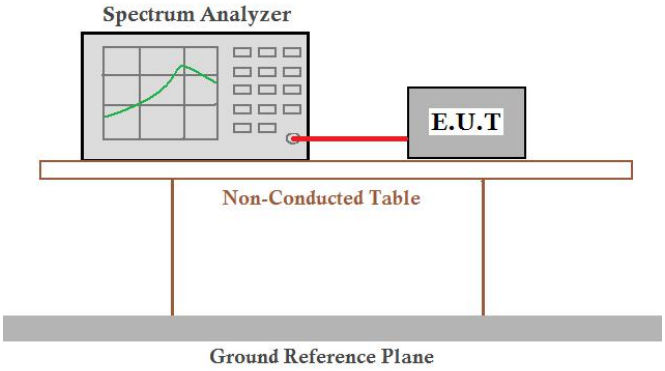
Lowest channel



Middle channel

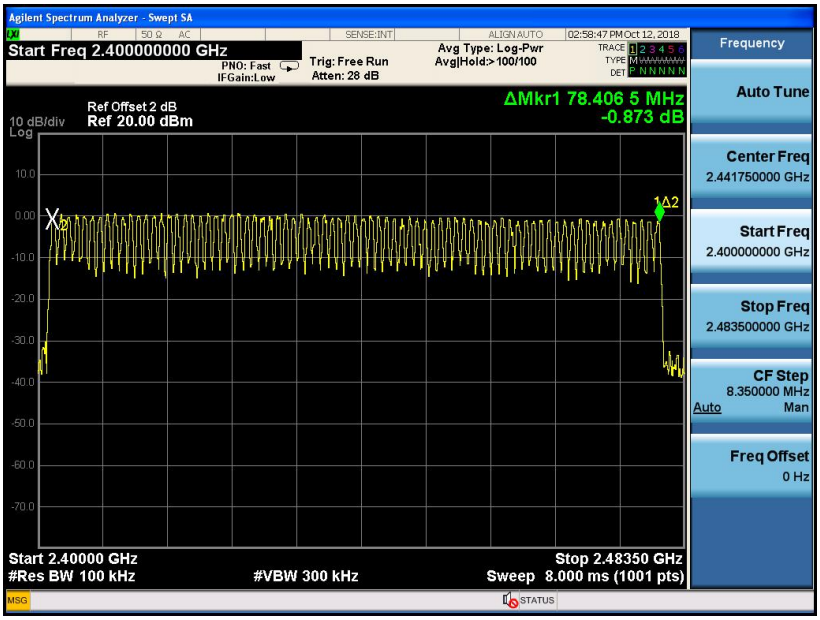
Highest channel

9. Hopping Channel Number

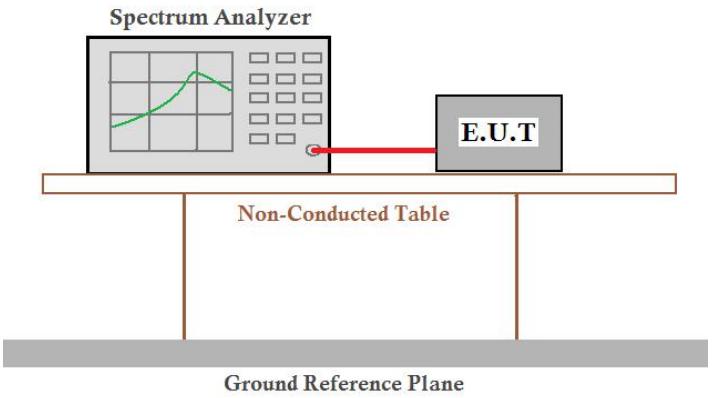
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Measurement Data:

Mode	Hopping channel numbers	Limit	Result
GFSK	79	15	Pass
Pi/4QPSK	79	15	Pass
8DPSK	79	15	Pass



10. Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Measurement Data

Mode	Frequency (MHz)	Burst Type	Pulse Width (ms)	Dwell Time (ms)	Limit (ms)	Verdict
GFSK	2441	DH1	0.385	123.20	400	PASS
		DH3	1.665	266.40		
		DH5	2.920	311.47		
π/4-DQPSK	2441	DH1	0.390	124.80	400	PASS
		DH3	1.610	257.60		
		DH5	2.910	310.40		
8DPSK	2441	DH1	0.390	124.80	400	PASS
		DH3	1.680	268.80		
		DH5	2.920	311.47		

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

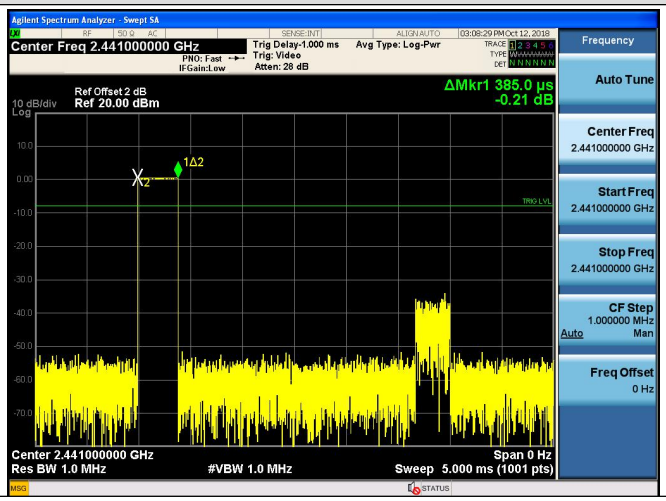
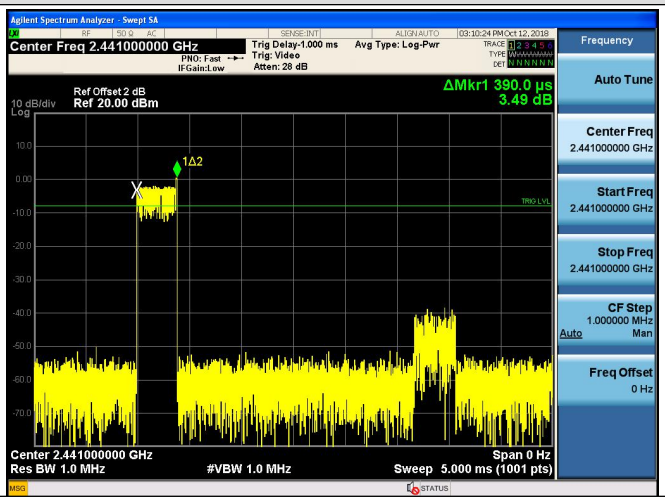
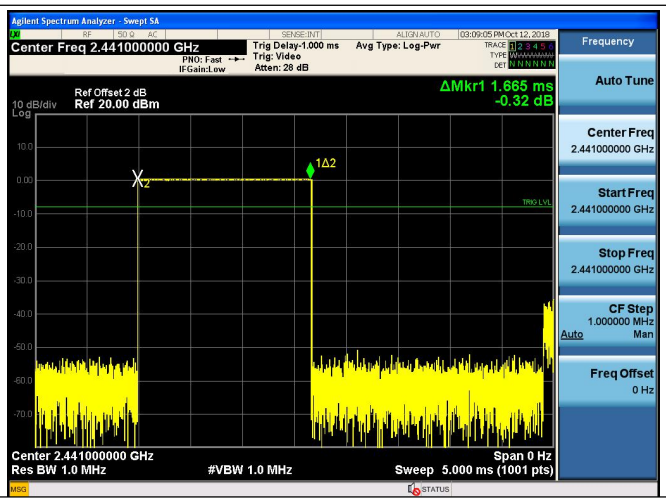
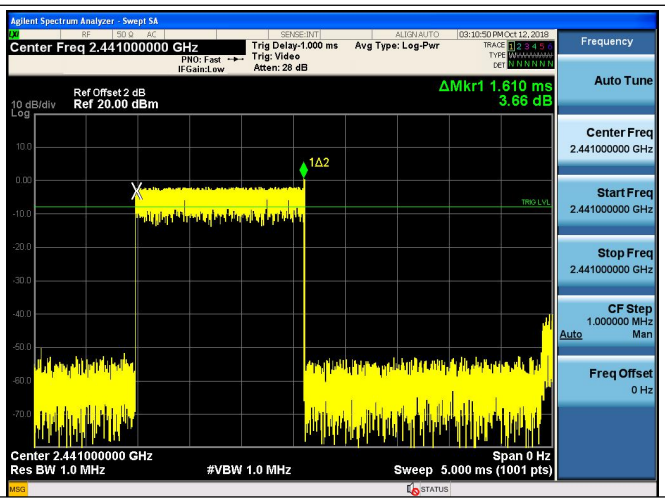
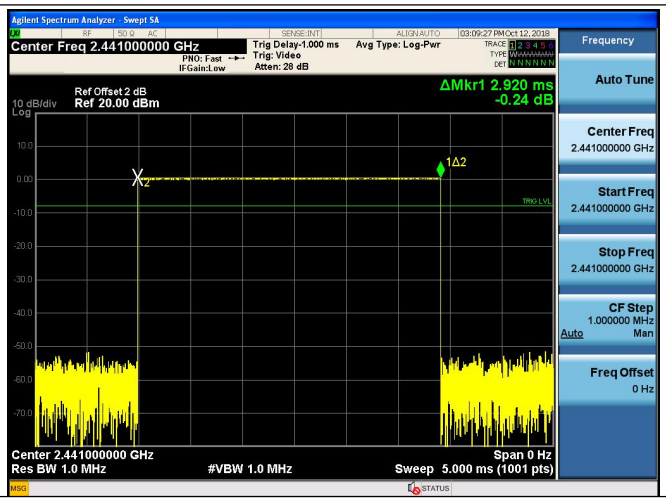
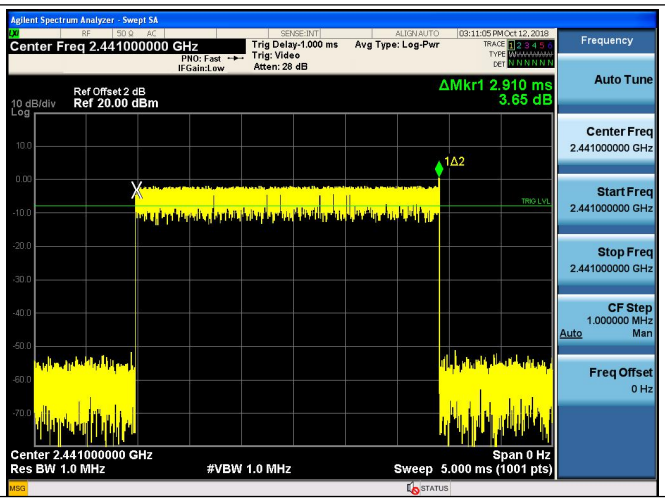
Test channel: 2402MHz/2441MHz/2480MHz as blow

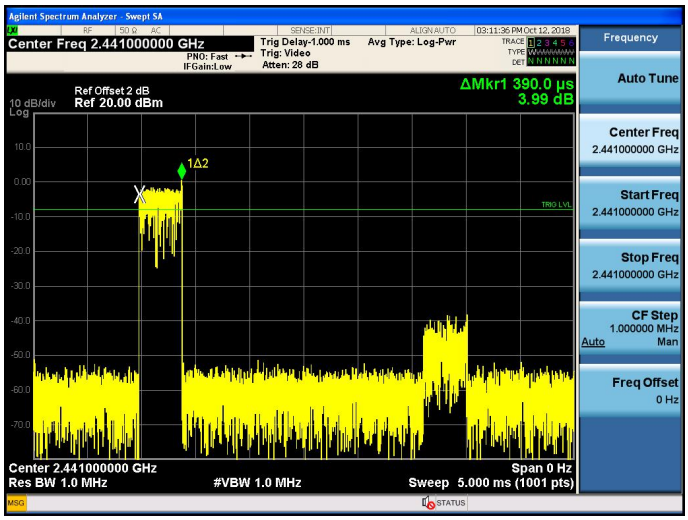
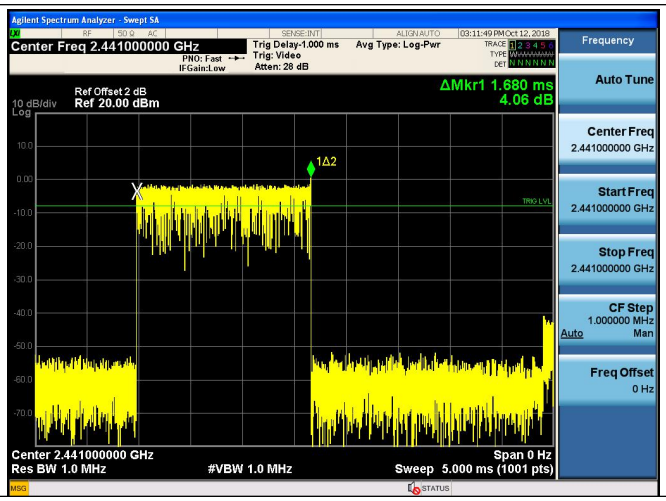
DH1 time slot= Pulse time (ms)*(1600/ (2*79))*31.6

DH3 time slot= Pulse time (ms)*(1600/ (4*79))*31.6

DH5 time slot= Pulse time (ms)*(1600/ (6*79))*31.6

Test plot as follows:

Dwell time	
GFSK	*π/4-DQPSK*
	
Channel 39 / 2441 MHz - DH1	*Channel 39 / 2441 MHz - 2DH1*
	
Channel 39 / 2441 MHz - DH3	*Channel 39 / 2441 MHz - 2DH3*
	
Channel 39 / 2441 MHz - DH5	*Channel 39 / 2441 MHz - 2DH5*

Dwell time	
8DPSK	
	
Channel 39 / 2441 MHz - 3DH1	
	
2 Channel 39 / 2441 MHz - 3DH3	
	
Channel 39 / 2441 MHz - 3DH5	

11. Pseudorandom Frequency Hopping Sequence

Test Requirement:	FCC Part15 C Section 15.247 (a)(1) requirement:

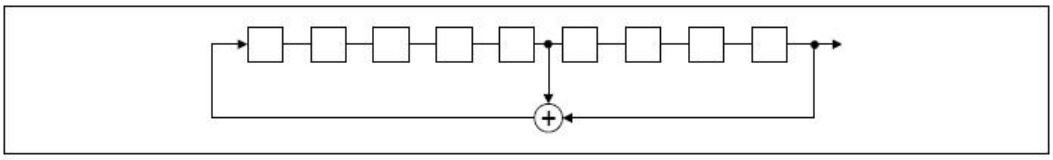
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence

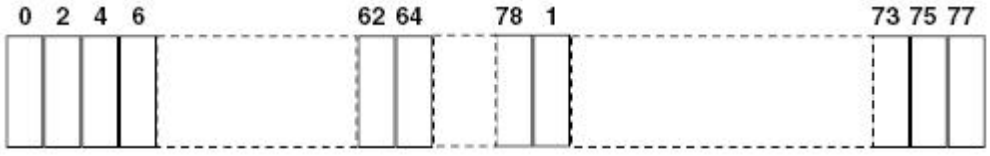
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- *Number of shift register stages: 9*
- *Length of pseudo-random sequence: 2^9 -1 = 511 bits*
- *Longest sequence of zeros: 8 (non-inverted signal)*



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:

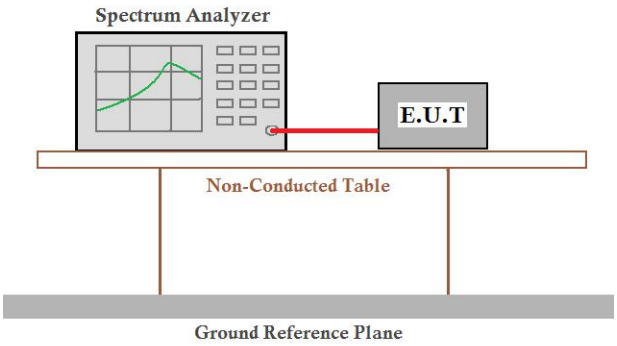


Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

12. Band Edge

Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak
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.
Test setup:	
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Test plot as follows:

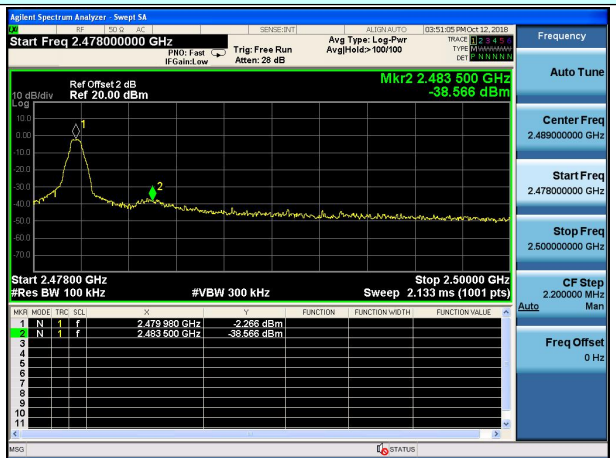
GFSK Mode:

Test channel:	Lowest channel

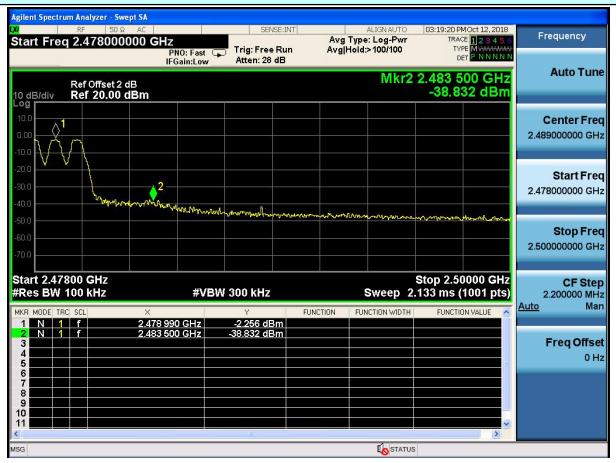
No-hopping mode

Hopping mode

Test channel:	Highest channel



No-hopping mode



Hopping mode

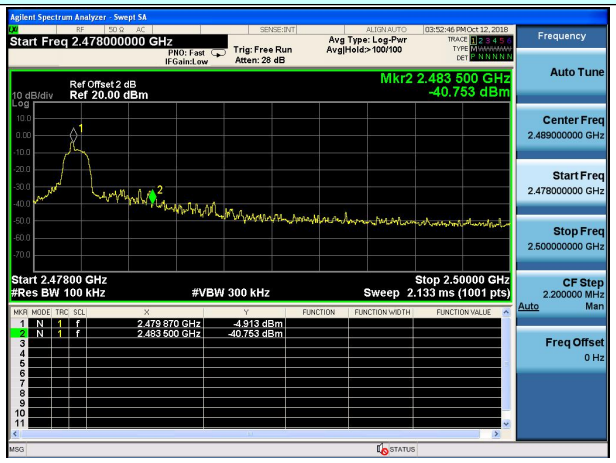
Pi/4QPSK Mode:

Test channel:	Lowest channel

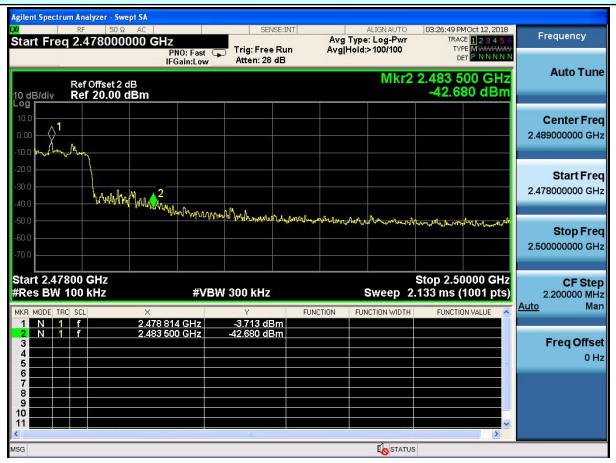
No-hopping mode

Hopping mode

Test channel:	Highest channel



No-hopping mode



Hopping mode