FCC Radio Test Report

FCC ID: 2ABHA0001

Original Grant

Report No.	:	TB-FCC144439
Applicant	:	NINGBO CSTAR IMP&EXP CO., LTD
Equipment Under Test (EUT)		
EUT Name	:	Voyager Bluetooth Keyboard and Case
Model No.	:	SL008
Series No.	:	7140-53
Brand Name	:	Cstar
Receipt Date	:	2015-06-02
Test Date	:	2015-06-02 to 2015-06-10
Issue Date	:	2015-06-11
Standards	:	FCC Part 15: 2014, Subpart C(15.247)
Test Method	:	ANSI C63.10:2013
Conclusions	:	**PASS**

In the configuration tested, the EUT complied with the standards specified above,
The EUT technically complies with the FCC requirements

Test/Witness Engineer : Lwan Su

Approved& Authorized :

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, China
Tel: +86 75526509301 Fax: +86 75526509195

Contents

1. General Information about EUT

1.1 Client Information

Applicant	:	NINGBO CSTAR IMP&EXP CO., LTD
Address	:	Floor 4, Building E, No. 655-90, Qiming Road, Yinzhou Investment & Innovation Center, Ningbo, China
Manufacturer	:	ShenZhen C-Star Electronic Tech. co., Ltd
Address	:	2, 3/F, Building B, No. 2 Bada Industrial Park, Yongfu Road, Heping Community, Fuyong Town, Baoan District, Shenzhen, China

1.2 General Description of EUT (Equipment Under Test)

EUT Name	:	Voyager Bluetooth Keyboard and Case	
Models No.	:	SL008, 7140-53	
Model Difference	:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is model name for commercial.	
Product Description	:	Operation Frequency: Bluetooth:2402~2480MHz	
		Number of Channel:	Bluetooth:79 Channels **see note (2)**
		Max Peak Output Power:	8-DPSK: 0.19 dBm
		Antenna Gain:	2 dBi PCB Antenna
		Modulation Type:	GFSK 1Mbps(1 Mbps) π/4-DQPSK(2 Mbps) 8-DPSK(3 Mbps)
Power Supply	:	DC Voltage supplied from Host System by USB cable. DC power by Li-ion Battery.	
Power Rating	:	DC 5.0V by USB cable. DC 3.7V 310mAh Li-ion Battery.	
Connecting I/O Port(S)	:	Please refer to the User's Manual	

Note:

(1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

(2) Channel List

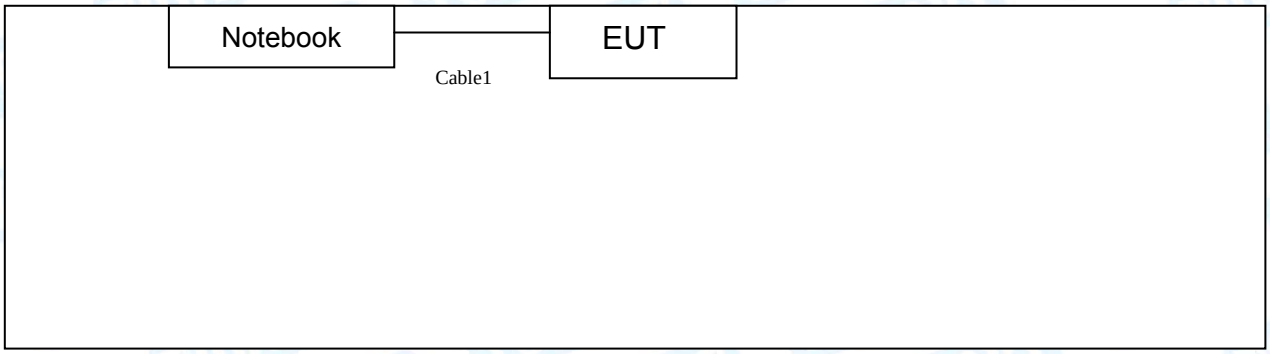
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	**2402**	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459

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

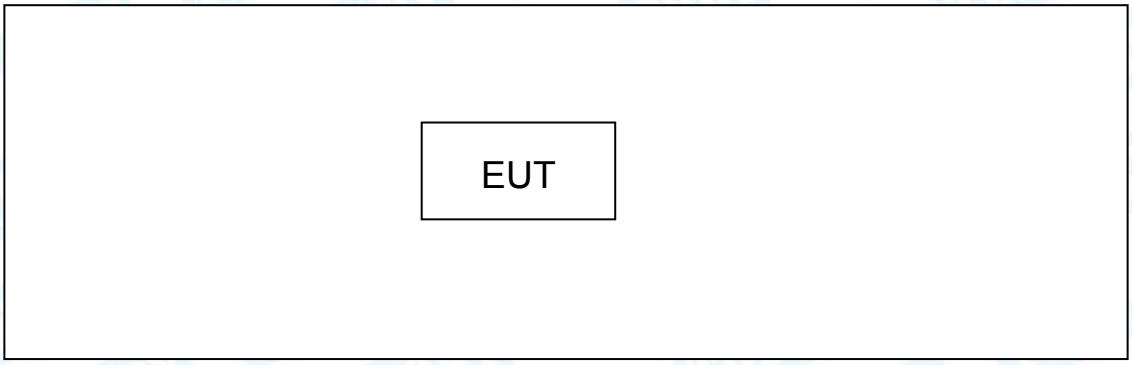
(3) The Antenna information about the equipment is provided by the applicant.

1.3 Block Diagram Showing the Configuration of System Tested

USB Charging with TX Mode



TX Mode



1.4 Description of Support Units

Equipment Information				
Name	**Model**	**FCC ID/DOC**	**Manufacturer**	**Used "√"**
Notebook	T60P	42W3244	Lenovo	√
Cable Information				
Number	**Shielded Type**	**Ferrite Core**	**Length**	**Note**
Cable 1	NO	NO	0.8M	Accessorise

1.5 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

For Conducted Test	
Final Test Mode	Description
Mode 1	USB Charging with TX GFSK Mode

For Radiated Test	
Final Test Mode	Description
Mode 1	USB Charging with TX GFSK Mode
Mode 2	TX Mode(GFSK) Channel 00/39/78
Mode 3	TX Mode(π /4-DQPSK) Channel 00/39/78

Mode 4	TX Mode(8-DPSK) Channel 00/39/78
Mode 5	Hopping Mode(GFSK)
Mode 6	Hopping Mode(π /4-DQPSK)
Mode 7	Hopping Mode(8-DPSK)

Note:

(1) For all test, we have verified the construction and function in typical operation. And all the test modes were carried out with the EUT in transmitting operation in maximum power with all kinds of data rate. We have pretested all the test mode above.
According to ANSI C63.10 standards, the measurements are performed at the highest, middle, lowest available channels, and the worst case data rate as follows:
TX Mode: GFSK (1 Mbps)
TX Mode: 8-DPSK (3 Mbps)

(2) The EUT is considered a portable unit; it was pre-tested on the positioned of each 3 axis, X-plane, Y-plane and Z-plane. The worst case was found positioned on X-plane as the normal use. Therefore only the test data of this X-plane was used for radiated emission measurement test.

1.6 Description of Test Software Setting

During testing channel& Power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of Bluetooth mode.

Test Software Version	**BlueTool**		
Frequency	2402 MHz	2441MHz	2480 MHz
GFSK	DEF	DEF	DEF
π /4-DQPSK	DEF	DEF	DEF
8-DPSK	DEF	DEF	DEF

1.7 Measurement Uncertainty

The reported uncertainty of measurement y ± U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %.

Test Item	Parameters	Expanded Uncertainty (U_{Lab})
Conducted Emission	Level Accuracy: 9kHz~150kHz 150kHz to 30MHz	 ±3.42 dB ±3.42 dB
Radiated Emission	Level Accuracy: 9kHz to 30 MHz	±4.60 dB
Radiated Emission	Level Accuracy: 30MHz to 1000 MHz	±4.40 dB
Radiated Emission	Level Accuracy: Above 1000MHz	±4.20 dB

1.8 Test Facility

The testing was performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at:

1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China.

At the time of testing, the following bodies accredited the Laboratory:

CNAS (L5813)

The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

FCC List No.: (811562)

The Laboratory is listed in the United States of American Federal Communications Commission (FCC), and the registration number is 811562.

IC Registration No.: (11950A-1)

The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A-1.

2. Test Summary

FCC Part 15 Subpart C(15.247)/ RSS 247 Issue 1				
Standard Section		Test Item	Judgment	Remark
FCC	IC			
15.203		Antenna Requirement	PASS	N/A
15.207	RSS-GEN 7.2.2	Conducted Emission	PASS	N/A
15.205	RSS-Gen 7.2.3	Restricted Bands	PASS	N/A
15.247(a)(1)	RSS 247 5.1 (2)	Hopping Channel Separation	PASS	N/A
15.247(a)(1)	RSS 247 5.1 (4)	Dwell Time	PASS	N/A
15.247(b)(1)	RSS 247 5.4 (2)	Peak Output Power	PASS	N/A
15.247(b)(1)	RSS 247 5.1 (4)	Number of Hopping Frequency	PASS	N/A
15.247(c)	RSS 247 5.5	Radiated Spurious Emission	PASS	N/A
15.247(a)	RSS 247 5.1 (1)	99% Occupied Bandwidth & 20dB Bandwidth	PASS	99%OBW GFSK:840.6225kHz π/4-DQPSK: 1151.20kHz 8-DPSK:1136.30kHz
Note: N/A is an abbreviation for Not Applicable.				

3. Test Equipment

AC Main Conducted Emission					
Description	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Cal. Due Date**
EMI Test Receiver	ROHDE& SCHWARZ	ESCI	100321	Aug. 08, 2014	Aug. 07, 2015
50ΩCoaxial Switch	Anritsu	MP59B	X10321	Aug. 08, 2014	Aug. 07, 2015
L.I.S.N	Rohde & Schwarz	ENV216	101131	Aug. 08, 2014	Aug. 07, 2015
L.I.S.N	SCHWARZBECK	NNBL 8226-2	8226-2/164	Aug. 08, 2014	Aug. 07, 2015
Radiation Spurious Emission					
Description	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Sep. 01, 2014	Aug. 31, 2015
Spectrum Analyzer	Rohde & Schwarz	FSP30	DE25181	Aug. 08, 2014	Aug.07, 2015
EMI Test Receiver	Rohde & Schwarz	ESCI	101165	Aug. 08, 2014	Aug.07, 2015
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar. 06, 2015	Mar.05, 2016
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar. 06, 2015	Mar.05, 2016
Pre-amplifier	HP	11909A	185903	Mar. 06, 2015	Mar.05, 2016
Pre-amplifier	HP	8447B	3008A00849	Mar. 06, 2015	Mar.05, 2016
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar. 06, 2015	Mar.05, 2016
Signal Generator	Rohde & Schwarz	SML03	IKW682-054	Mar. 28, 2015	Mar. 27, 2016
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A

4. Conducted Emission Test

4.1 Test Standard and Limit

4.1.1Test Standard

FCC 15.207

4.1.2 Test Limit

Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dBμV)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

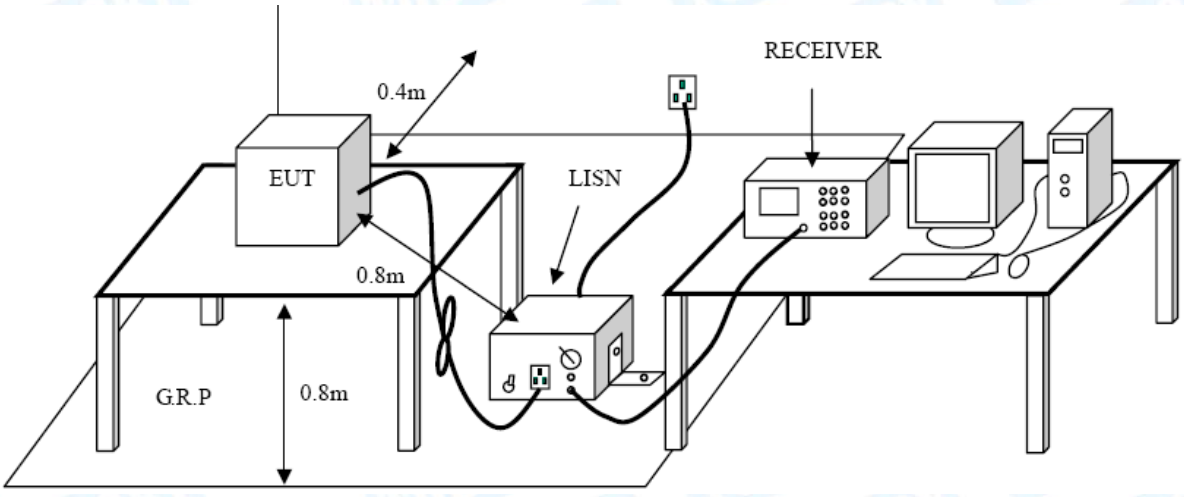
Notes:

(1) *Decreasing linearly with logarithm of the frequency.

(2) The lower limit shall apply at the transition frequencies.

(3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2 Test Setup



4.3 Test Procedure

The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

LISN at least 80 cm from nearest part of EUT chassis

The bandwidth of EMI test receiver is set at 9kHz, and the test frequency band is from 0.15MHz to 30MHz.

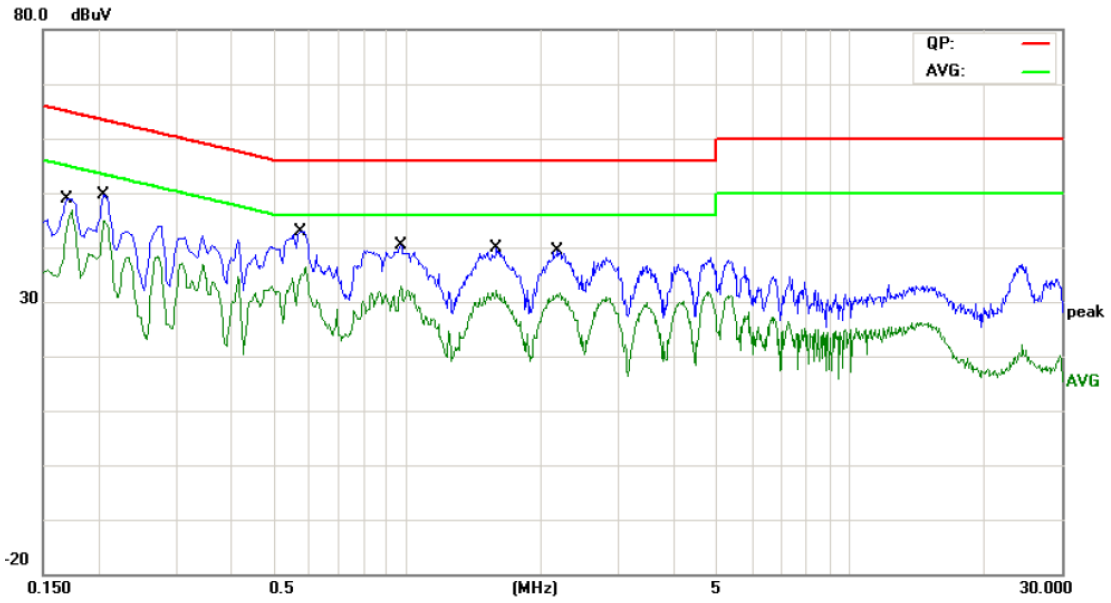
4.4 EUT Operating Mode

Please refer to the description of test mode.

4.5 Test Data

Please see the next page.

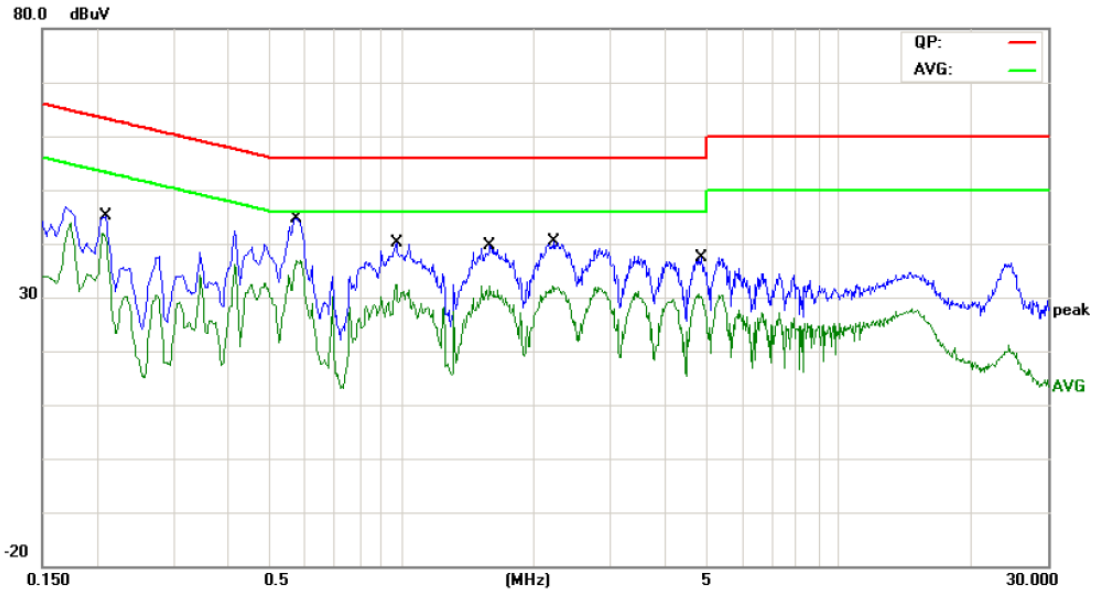
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60 Hz		
Terminal:	Line		
Test Mode:	USB Charging with TX GFSK Mode 2402 MHz		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1700	38.26	9.96	48.22	64.96	-16.74	QP
2		0.1700	34.98	9.96	44.94	54.96	-10.02	AVG
3		0.2060	37.58	10.02	47.60	63.36	-15.76	QP
4	*	0.2060	34.73	10.02	44.75	53.36	-8.61	AVG
5		0.5740	31.93	10.06	41.99	56.00	-14.01	QP
6		0.5740	24.53	10.06	34.59	46.00	-11.41	AVG
7		0.9660	28.14	10.07	38.21	56.00	-17.79	QP
8		0.9660	22.43	10.07	32.50	46.00	-13.50	AVG
9		1.5859	27.03	10.06	37.09	56.00	-18.91	QP
10		1.5859	22.05	10.06	32.11	46.00	-13.89	AVG
11		2.1820	25.31	10.05	35.36	56.00	-20.64	QP
12		2.1820	20.78	10.05	30.83	46.00	-15.17	AVG

Emission Level= Read Level+ Correct Factor

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60 Hz		
Terminal:	Neutral		
Test Mode:	USB Charging with TX GFSK Mode 2402 MHz		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.2100	33.41	10.02	43.43	63.20	-19.77	QP
2		0.2100	30.71	10.02	40.73	53.20	-12.47	AVG
3		0.5740	33.83	10.06	43.89	56.00	-12.11	QP
4	*	0.5740	26.44	10.06	36.50	46.00	-9.50	AVG
5		0.9700	28.15	10.07	38.22	56.00	-17.78	QP
6		0.9700	22.32	10.07	32.39	46.00	-13.61	AVG
7		1.5859	26.61	10.06	36.67	56.00	-19.33	QP
8		1.5859	21.78	10.06	31.84	46.00	-14.16	AVG
9		2.2260	25.18	10.05	35.23	56.00	-20.77	QP
10		2.2260	21.18	10.05	31.23	46.00	-14.77	AVG
11		4.8380	23.47	9.97	33.44	56.00	-22.56	QP
12		4.8380	19.94	9.97	29.91	46.00	-16.09	AVG

Emission Level= Read Level+ Correct Factor

5. Radiated Emission Test

5.1 Test Standard and Limit

5.1.1 Test Standard

FCC 15.209

5.1.2 Test Limit

Radiated Emission Limit (9 kHz~1000MHz)

Frequency (MHz	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Radiated Emission Limit (Above 1000MHz)

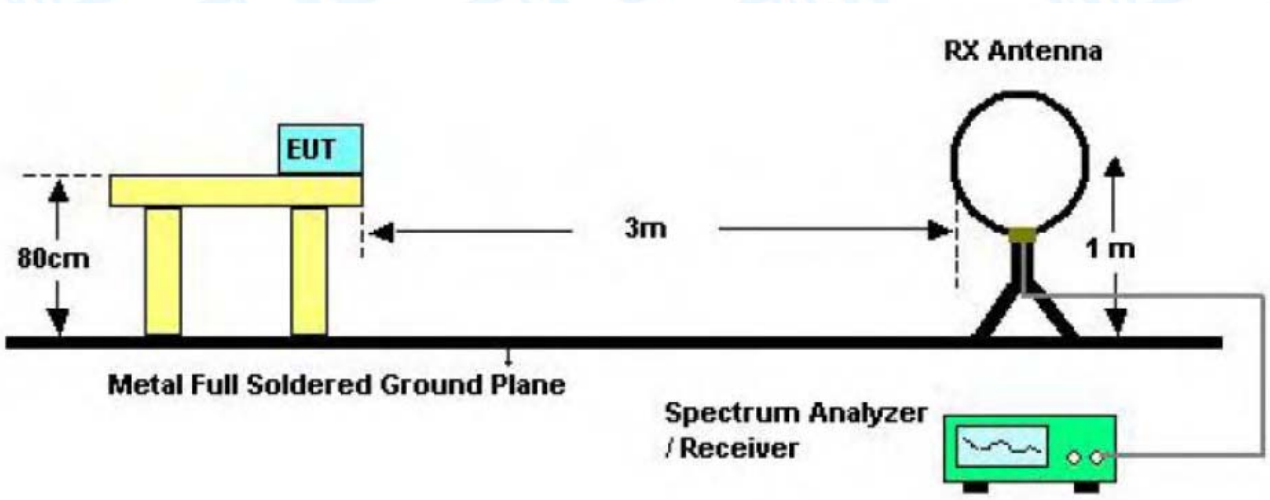
Frequency (MHz)	(dBuV/m)(at 3m)	
	Peak	Average
Above 1000	74	54

Note:

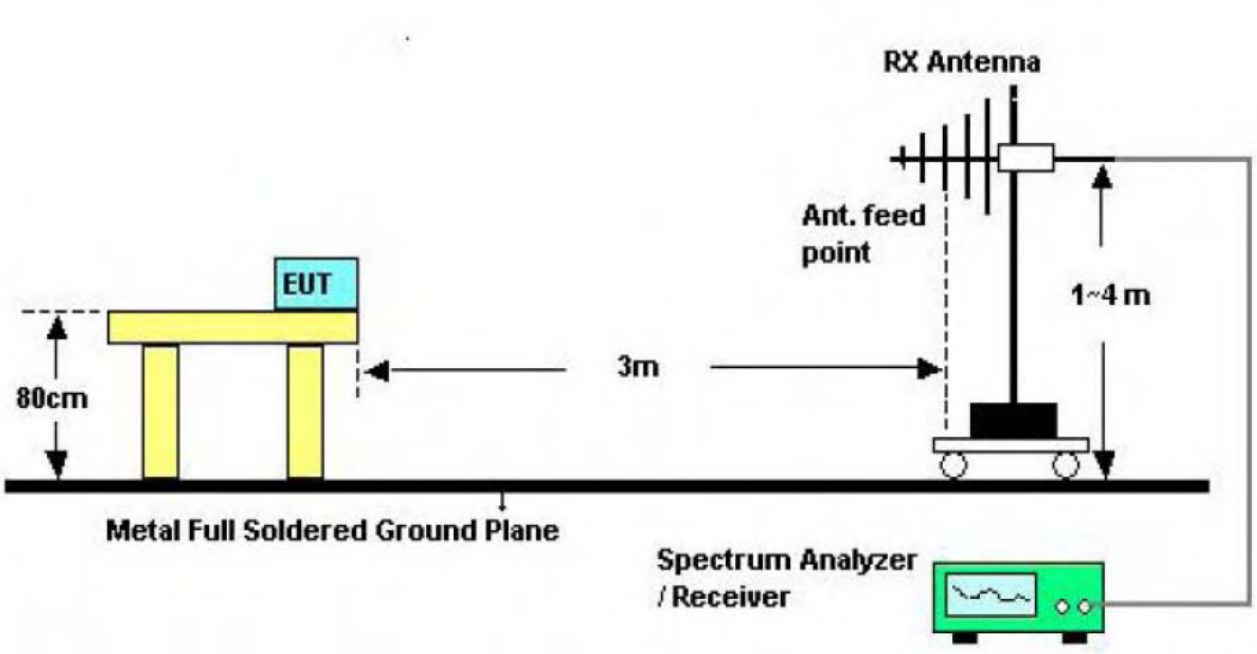
(1) The tighter limit applies at the band edges.

(2) Emission Level (dBuV/m)=20log Emission Level (uV/m)

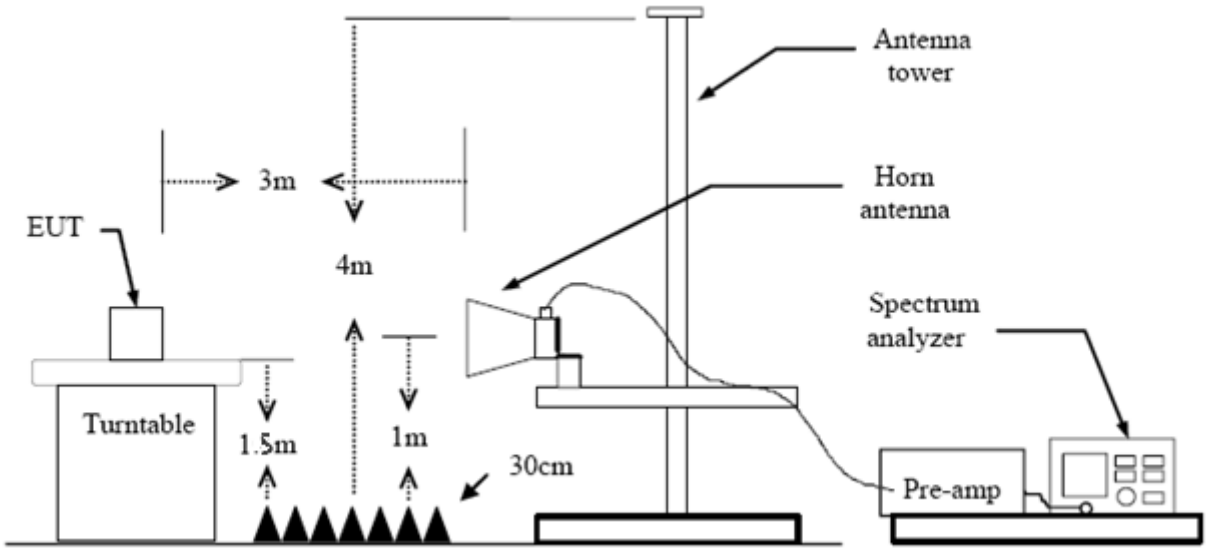
5.2 Test Setup



Bellow 30MHz Test Setup



Bellow 1000MHz Test Setup



Above 1GHz Test Setup

5.3 Test Procedure

(1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz. The EUT was placed on a rotating 0.8m high above the ground, the table was rotated 360 degrees to determine the position of the highest radiation.

(2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.

(3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.

(4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

(5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.

(6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.

(7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

(8) For the actual test configuration, please see the test setup photo.

5.4 EUT Operating Condition

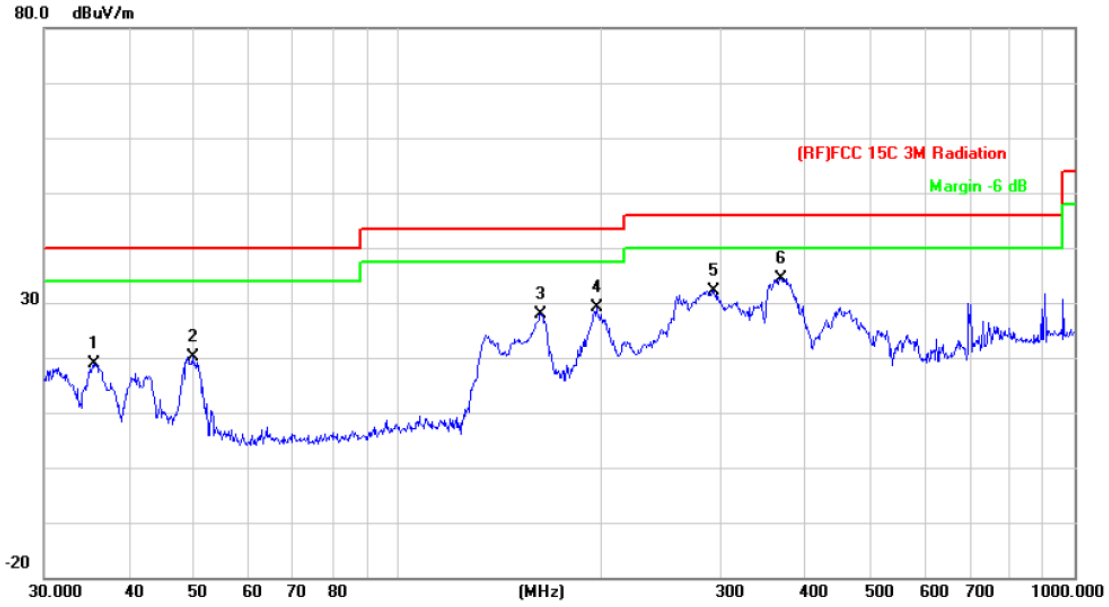
The Equipment Under Test was set to Continual Transmitting in maximum power in TX mode.

5.5 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=1 KHz with Peak Detector for Average Values.

Test data please refer the following pages.

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 5V		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2402MHz		
Remark:	Only worse case is reported		

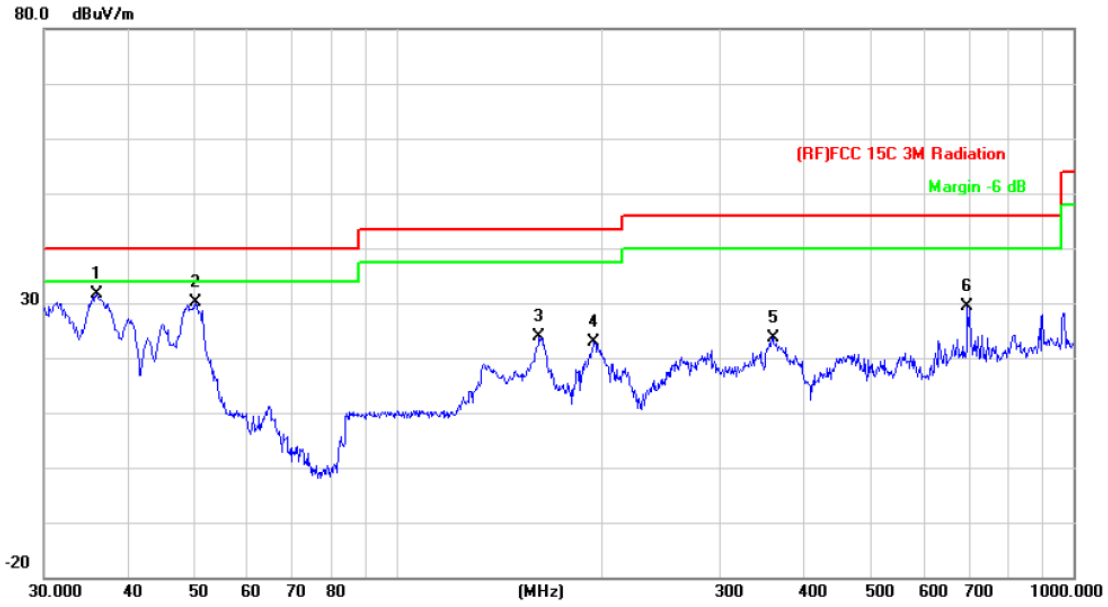


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		35.6240	36.39	-17.45	18.94	40.00	-21.06	peak
2		49.7068	44.44	-24.27	20.17	40.00	-19.83	peak
3		162.6106	48.53	-20.68	27.85	43.50	-15.65	peak
4		196.5098	49.66	-20.57	29.09	43.50	-14.41	peak
5		293.0842	49.42	-17.22	32.20	46.00	-13.80	peak
6	*	368.1116	48.89	-14.50	34.39	46.00	-11.61	peak

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 5V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2402MHz		
Remark:	Only worse case is reported		

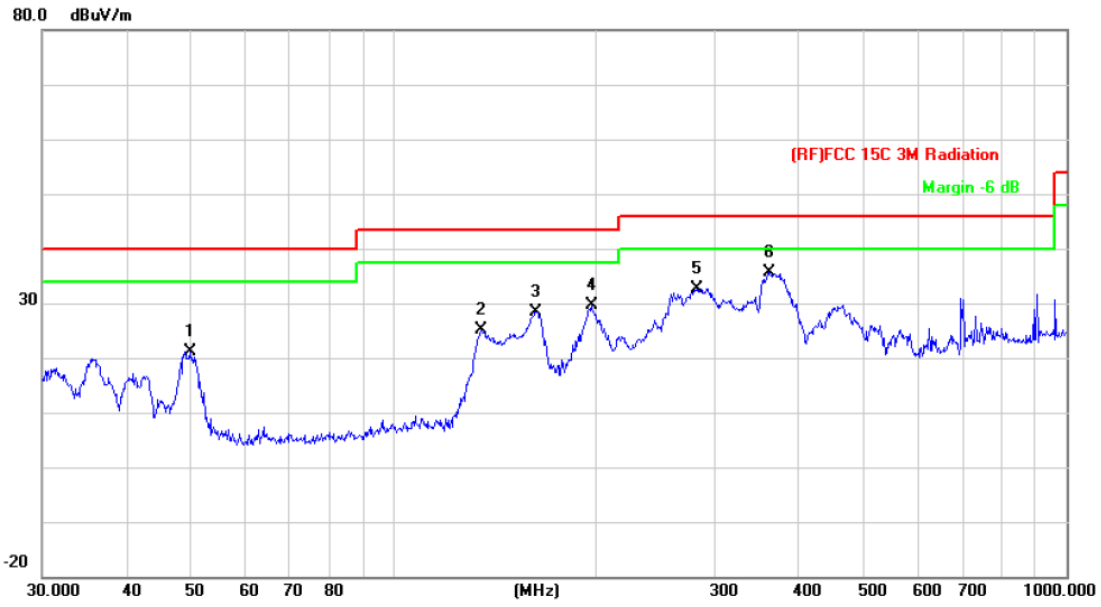


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	35.8746	49.27	-17.60	31.67	40.00	-8.33	peak
2		50.2324	54.42	-24.40	30.02	40.00	-9.98	peak
3		162.0414	44.63	-20.65	23.98	43.50	-19.52	peak
4		195.1365	43.42	-20.64	22.78	43.50	-20.72	peak
5		359.1859	38.26	-14.55	23.71	46.00	-22.29	peak
6		696.8567	36.24	-6.95	29.29	46.00	-16.71	peak

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 5V		
Ant. Pol.	Horizontal		
Test Mode:	TX π/4-DQPSK Mode 2402MHz		
Remark:	Only worse case is reported		

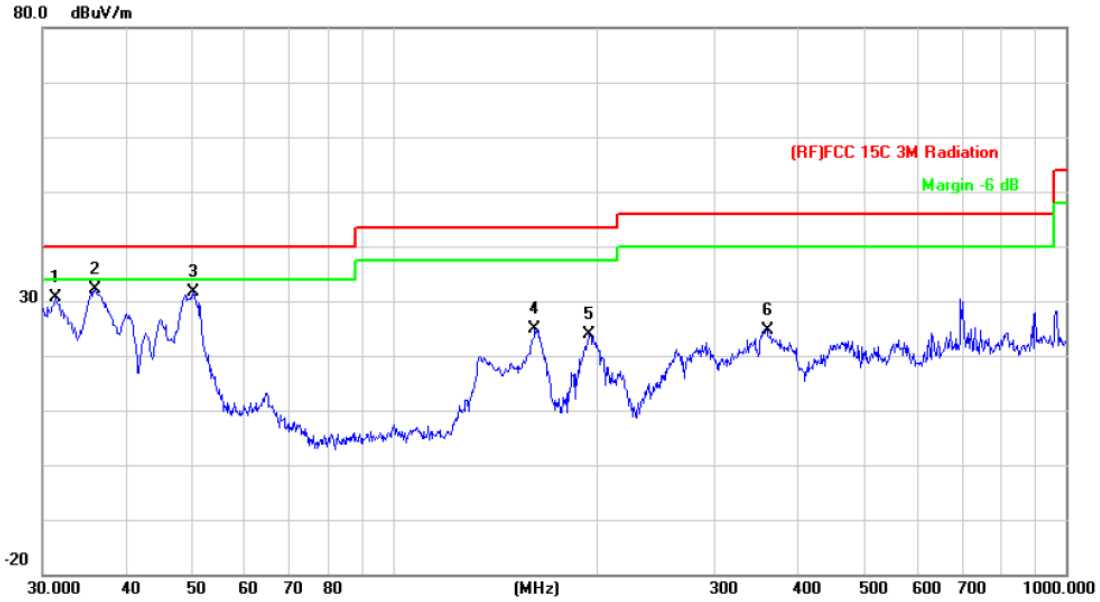


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		49.7068	45.44	-24.27	21.17	40.00	-18.83	peak
2		135.0319	47.32	-22.08	25.24	43.50	-18.26	peak
3		162.6106	49.03	-20.68	28.35	43.50	-15.15	peak
4		196.5098	50.16	-20.57	29.59	43.50	-13.91	peak
5		281.9946	50.18	-17.44	32.74	46.00	-13.26	peak
6	*	361.7139	50.28	-14.54	35.74	46.00	-10.26	peak

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 5V		
Ant. Pol.	Vertical		
Test Mode:	TX π /4-DQPSK Mode 2402MHz		
Remark:	Only worse case is reported		

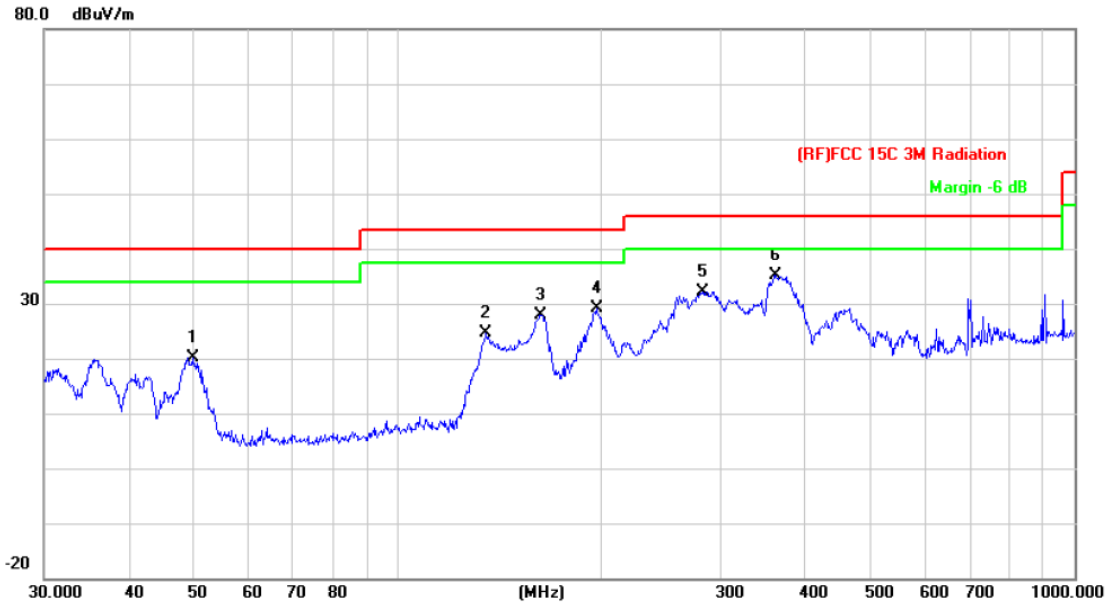


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		31.2893	45.27	-14.76	30.51	40.00	-9.49	peak
2	*	35.8746	49.77	-17.60	32.17	40.00	-7.83	peak
3		50.2324	55.92	-24.40	31.52	40.00	-8.48	peak
4		162.0414	45.63	-20.65	24.98	43.50	-18.52	peak
5		195.1365	44.42	-20.64	23.78	43.50	-19.72	peak
6		359.1860	39.26	-14.55	24.71	46.00	-21.29	peak

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 5V		
Ant. Pol.	Horizontal		
Test Mode:	TX 8-DPSK Mode 2402MHz		
Remark:	Only worse case is reported		

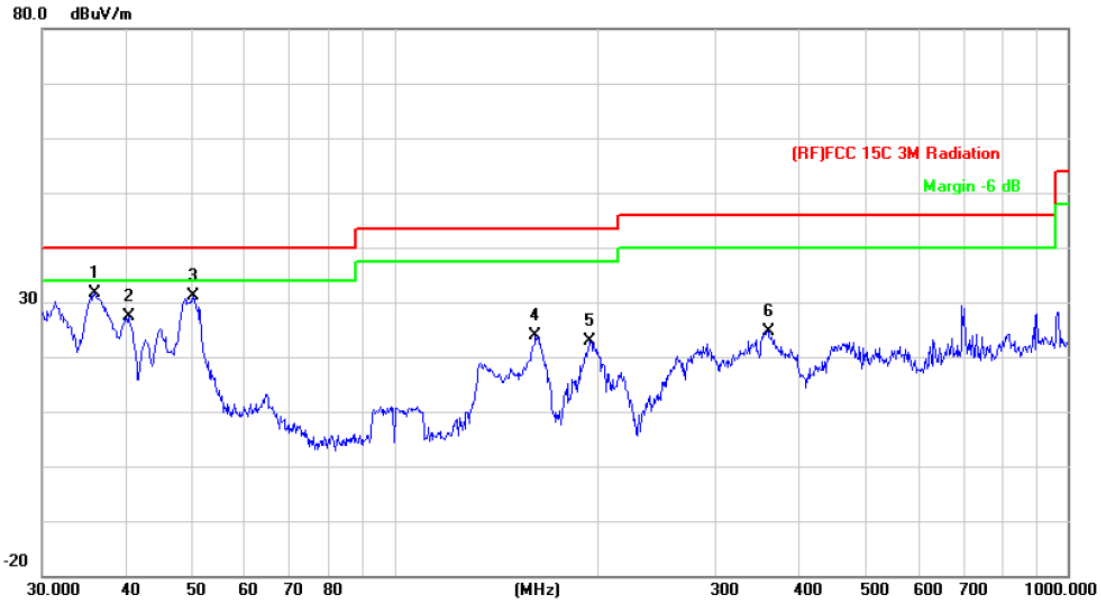


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		49.7068	44.44	-24.27	20.17	40.00	-19.83	peak
2		135.0319	46.82	-22.08	24.74	43.50	-18.76	peak
3		162.6106	48.53	-20.68	27.85	43.50	-15.65	peak
4		196.5098	49.66	-20.57	29.09	43.50	-14.41	peak
5		281.9945	49.68	-17.44	32.24	46.00	-13.76	peak
6	*	361.7139	49.78	-14.54	35.24	46.00	-10.76	peak

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 5V		
Ant. Pol.	Vertical		
Test Mode:	TX 8-DPSK Mode 2402MHz		
Remark:	Only worse case is reported		

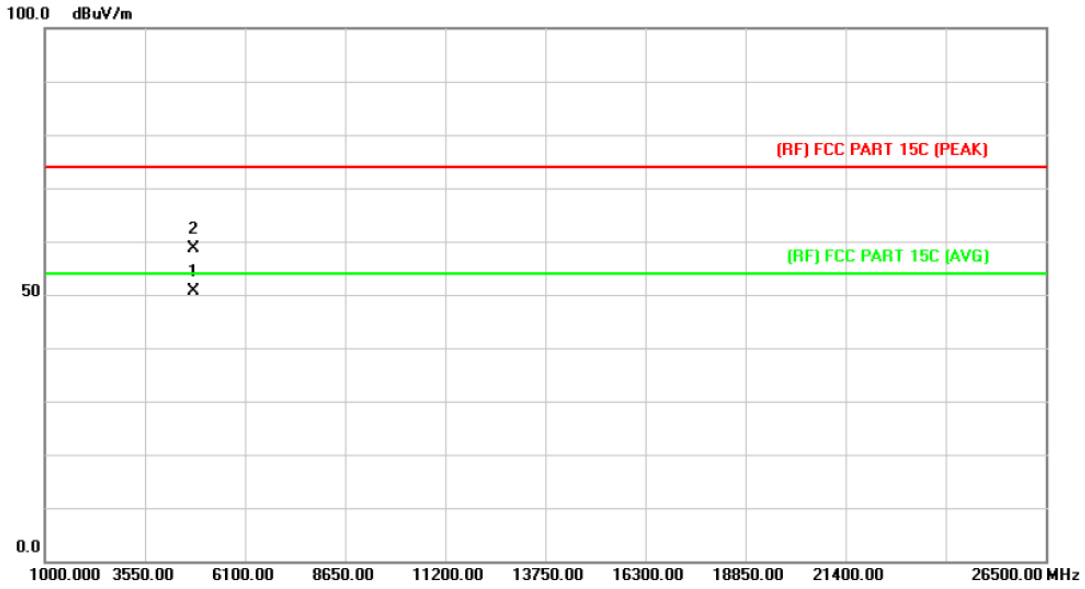


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	35.8746	49.27	-17.60	31.67	40.00	-8.33	peak
2		40.2757	47.53	-20.27	27.26	40.00	-12.74	peak
3		50.2324	55.42	-24.40	31.02	40.00	-8.98	peak
4		162.0414	44.63	-20.65	23.98	43.50	-19.52	peak
5		195.1365	43.42	-20.64	22.78	43.50	-20.72	peak
6		359.1859	39.26	-14.55	24.71	46.00	-21.29	peak

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

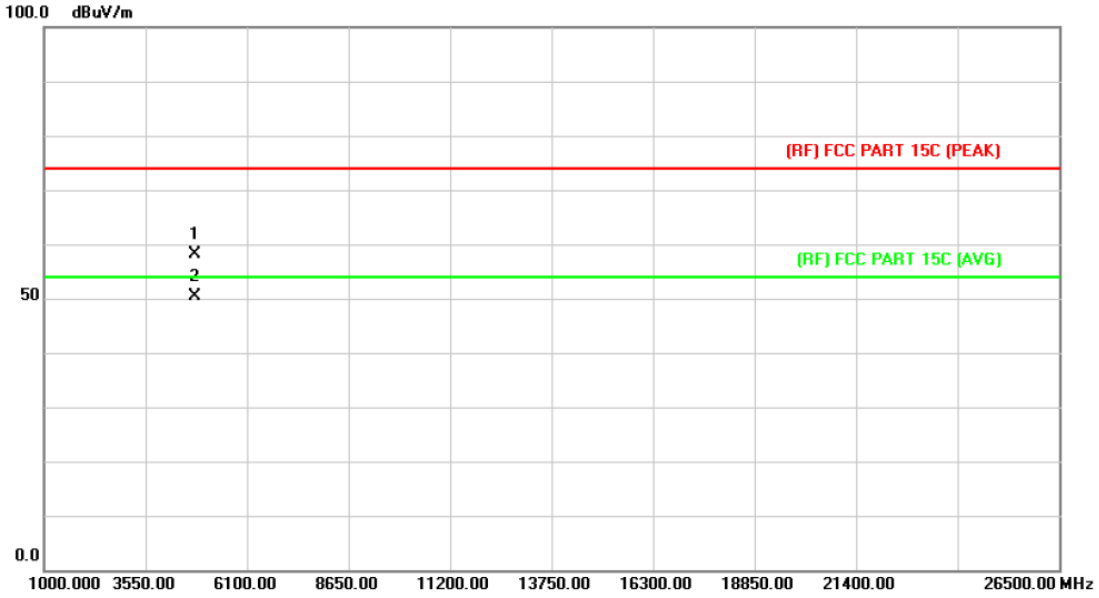
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2402MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4803.541	37.26	13.44	50.70	54.00	-3.30	AVG
2		4803.643	45.20	13.44	58.64	74.00	-15.36	peak

Emission Level= Read Level+ Correct Factor

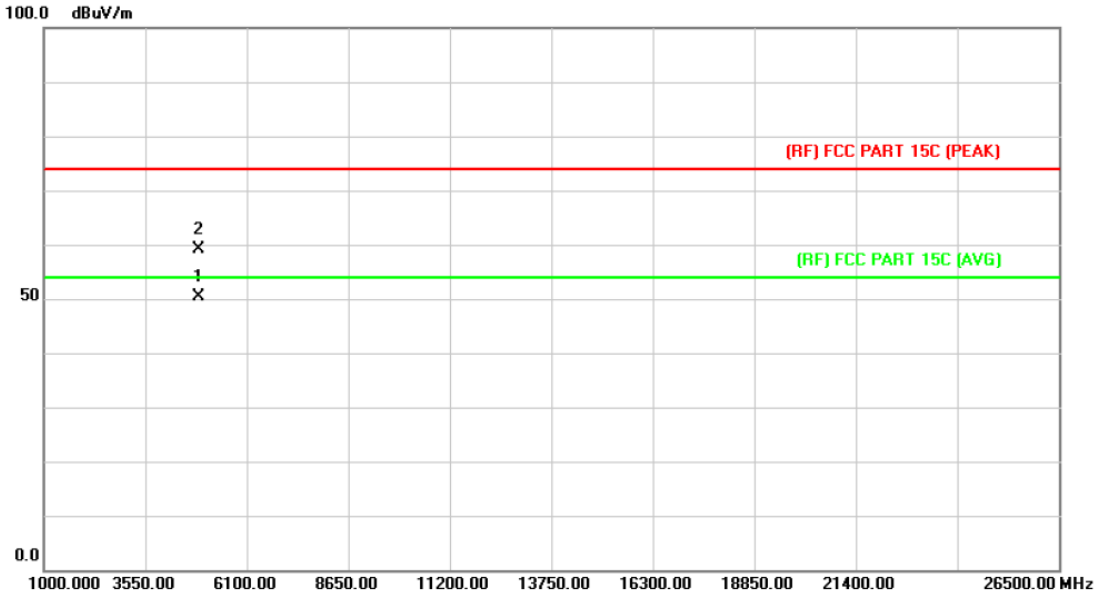
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2402MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4804.222	44.70	13.44	58.14	74.00	-15.86	peak
2	*	4804.234	37.00	13.44	50.44	54.00	-3.56	AVG

Emission Level= Read Level+ Correct Factor

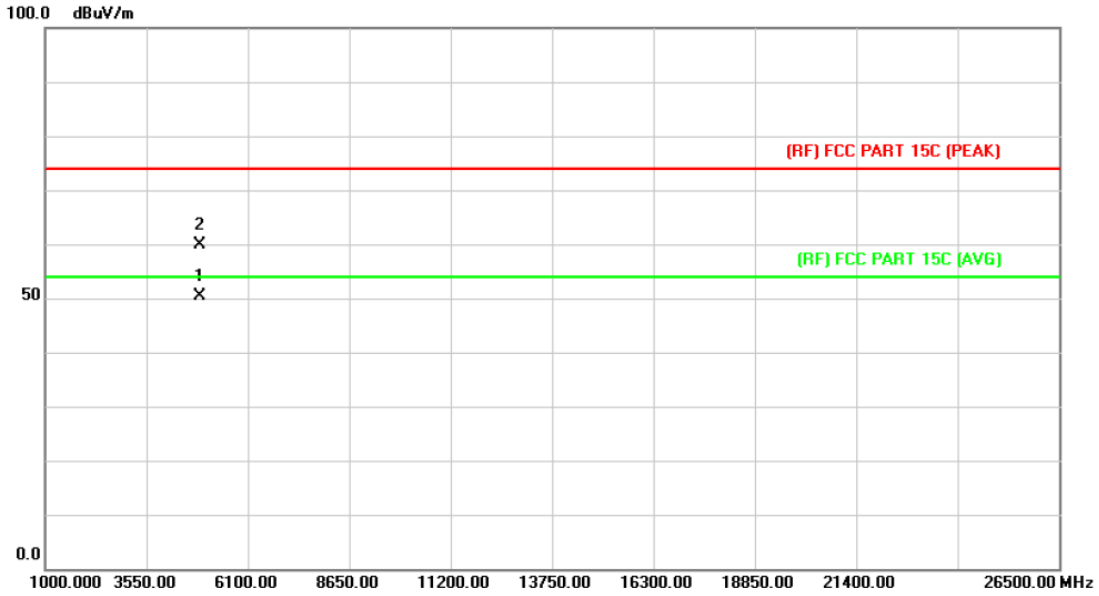
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2441MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4882.924	36.56	13.90	50.46	54.00	-3.54	AVG
2		4883.173	45.13	13.91	59.04	74.00	-14.96	peak

Emission Level= Read Level+ Correct Factor

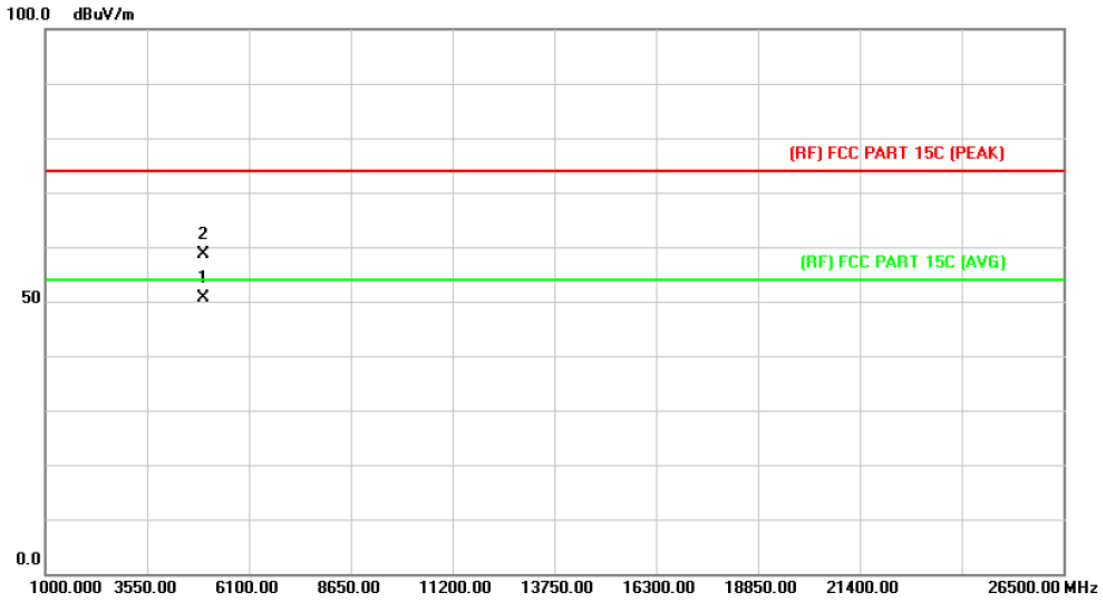
EUT:	Voyager Bluetooth Keyboard and Case	**Model Name :**	SL008
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2441MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4881.916	36.44	13.90	50.34	54.00	-3.66	AVG
2		4882.639	45.94	13.90	59.84	74.00	-14.16	peak

Emission Level= Read Level+ Correct Factor

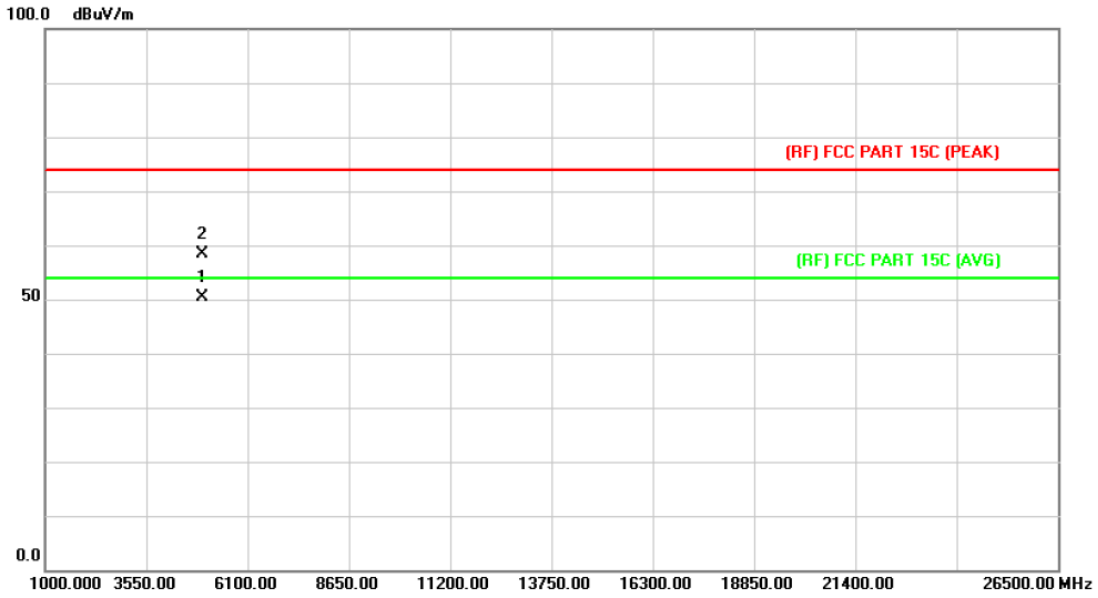
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2480MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4959.880	36.37	14.36	50.73	54.00	-3.27	AVG
2		4959.892	44.28	14.36	58.64	74.00	-15.36	peak

Emission Level= Read Level+ Correct Factor

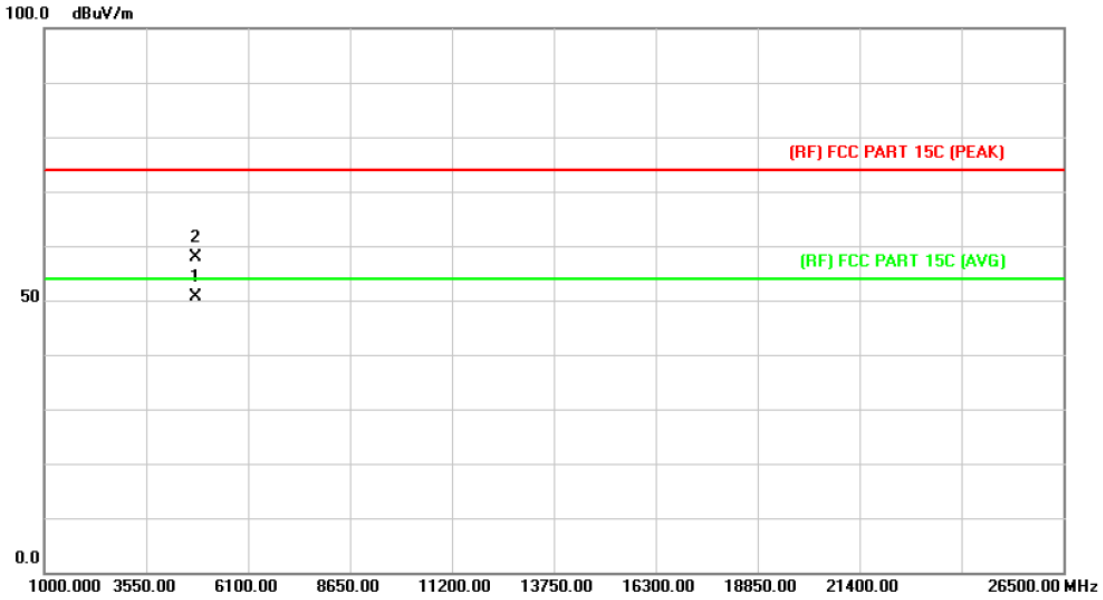
EUT:	Voyager Bluetooth Keyboard and Case	**Model Name :**	SL008
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2480MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4960.159	35.96	14.36	50.32	54.00	-3.68	AVG
2		4960.261	43.95	14.36	58.31	74.00	-15.69	peak

Emission Level= Read Level+ Correct Factor

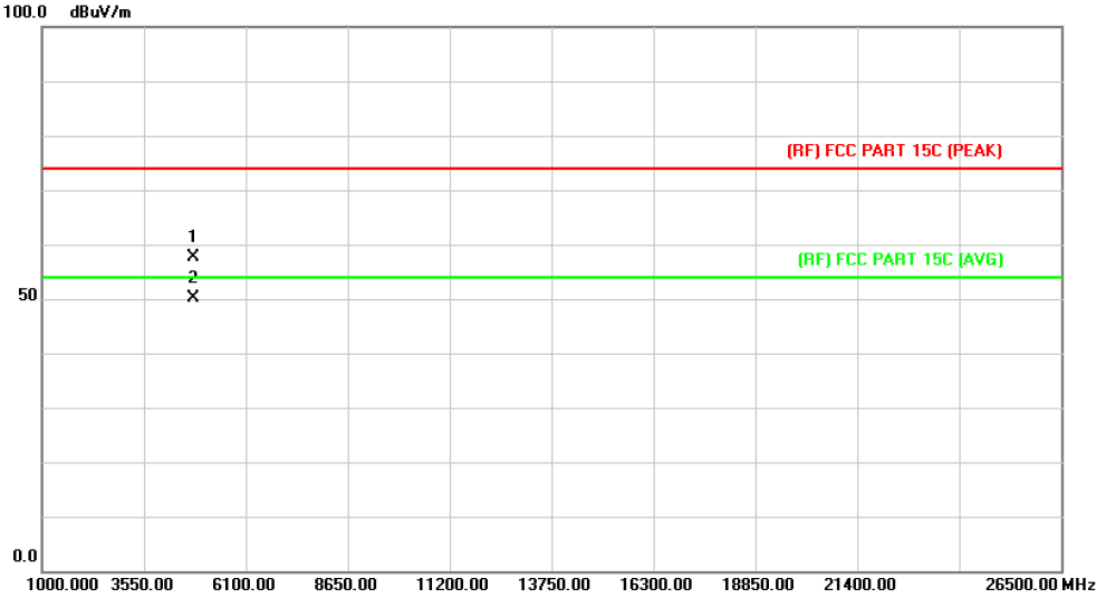
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX 8-DPSK Mode 2402MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4803.554	37.08	13.44	50.52	54.00	-3.48	AVG
2		4803.675	44.54	13.44	57.98	74.00	-16.02	peak

Emission Level= Read Level+ Correct Factor

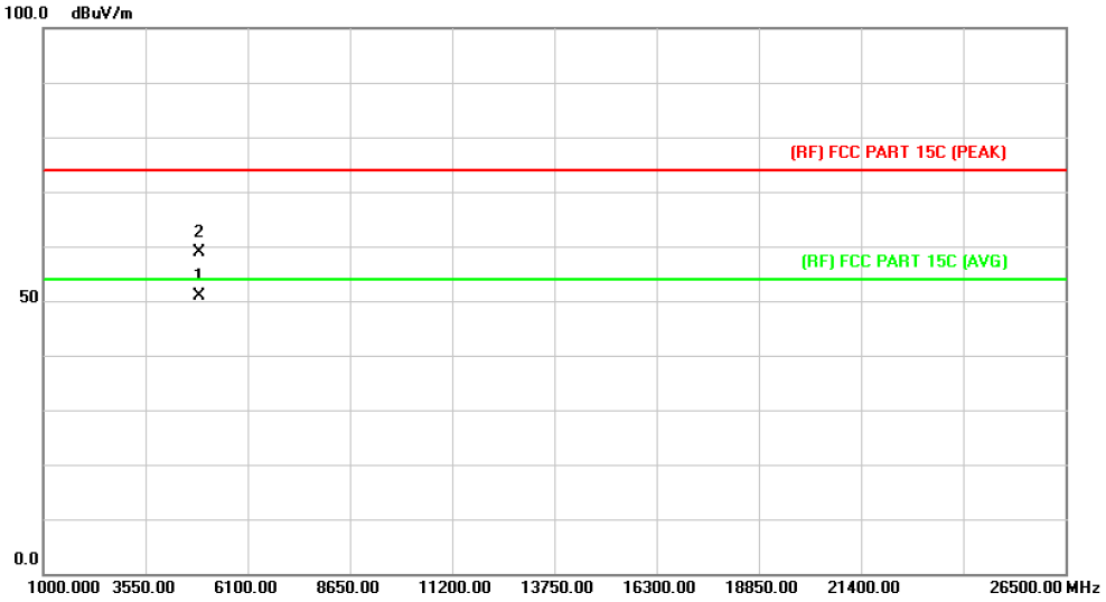
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX 8-DPSK Mode 2402MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4804.254	44.20	13.44	57.64	74.00	-16.36	peak
2	*	4804.261	36.63	13.44	50.07	54.00	-3.93	AVG

Emission Level= Read Level+ Correct Factor

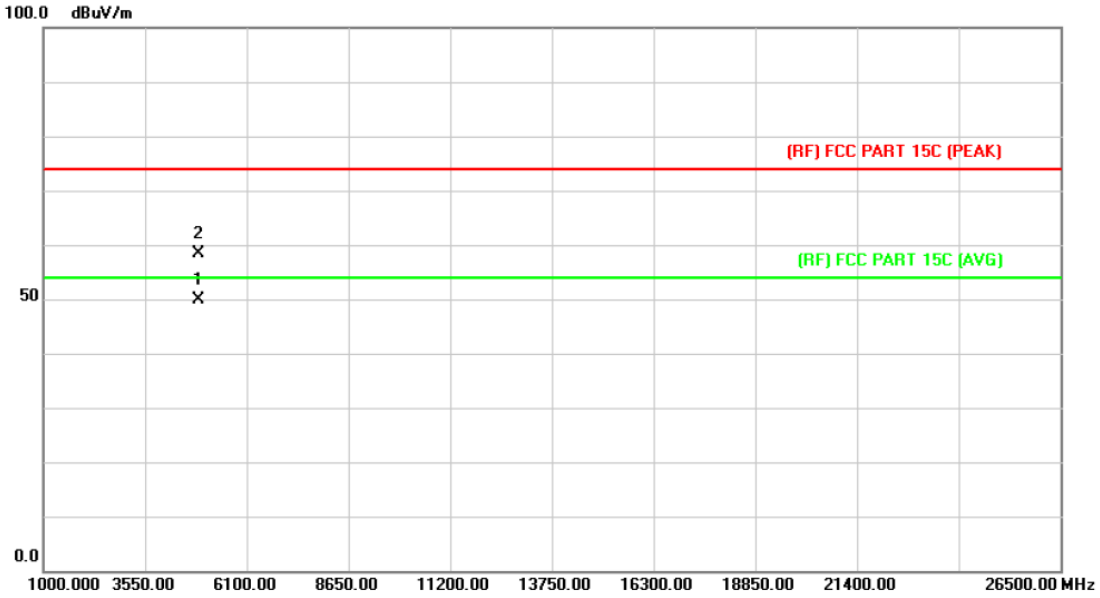
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX 8-DPSK Mode 2441MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4882.938	36.88	13.90	50.78	54.00	-3.22	AVG
2		4883.271	44.97	13.91	58.88	74.00	-15.12	peak

Emission Level= Read Level+ Correct Factor

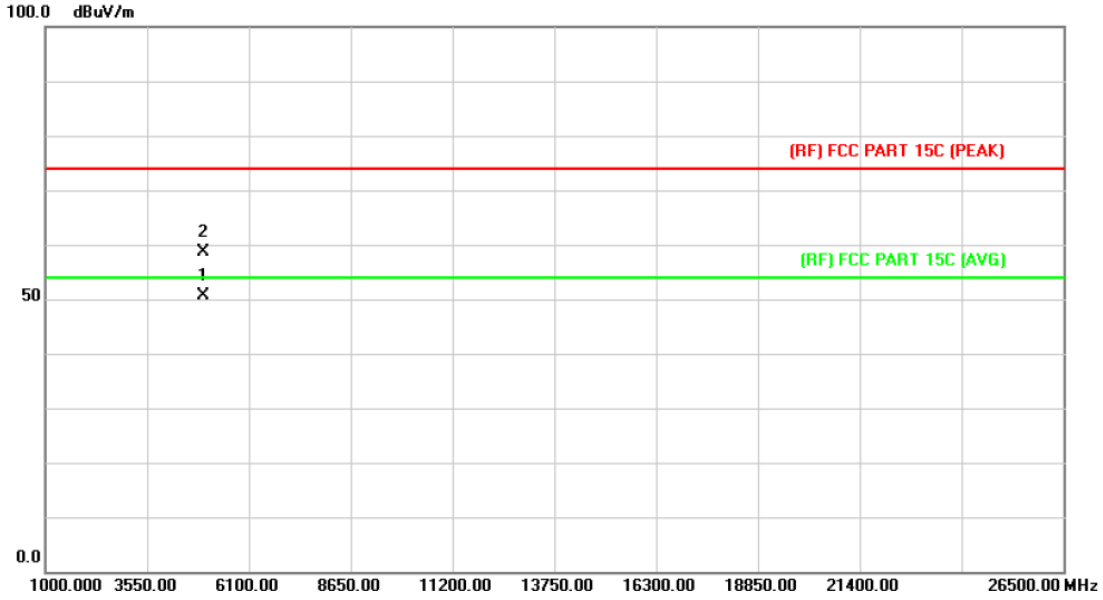
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX 8-DPSK Mode 2441MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4881.935	36.08	13.90	49.98	54.00	-4.02	AVG
2		4882.627	44.37	13.90	58.27	74.00	-15.73	peak

Emission Level= Read Level+ Correct Factor

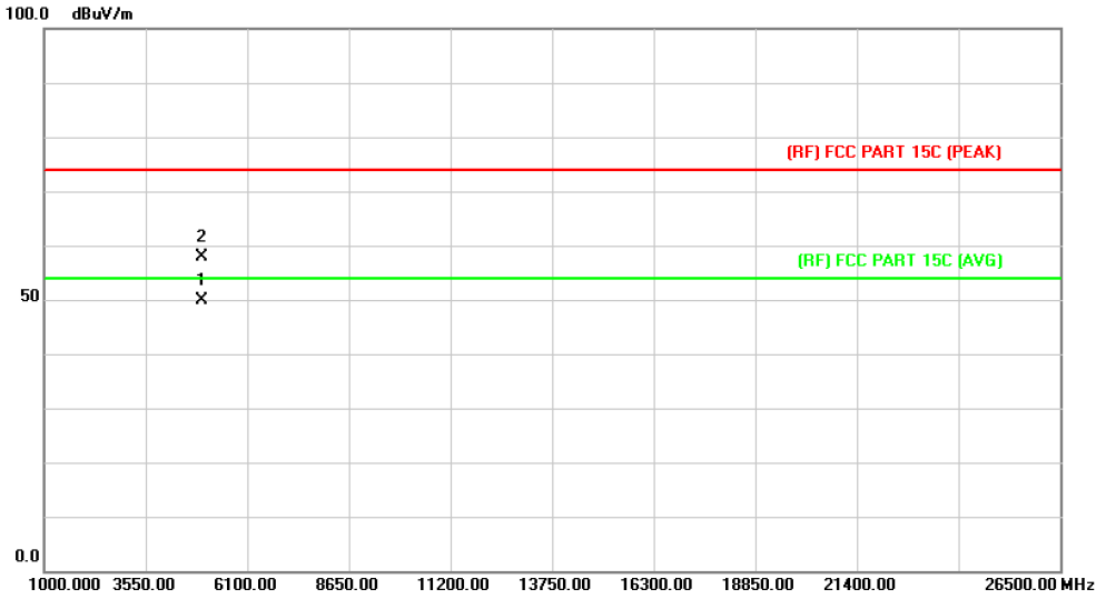
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX 8-DPSK Mode 2480MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4959.865	36.17	14.36	50.53	54.00	-3.47	AVG
2		4959.874	44.38	14.36	58.74	74.00	-15.26	peak

Emission Level= Read Level+ Correct Factor

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX 8-DPSK Mode 2480MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4960.167	35.54	14.36	49.90	54.00	-4.10	AVG
2		4960.354	43.62	14.36	57.98	74.00	-16.02	peak

Emission Level= Read Level+ Correct Factor

6. Restricted Bands Requirement

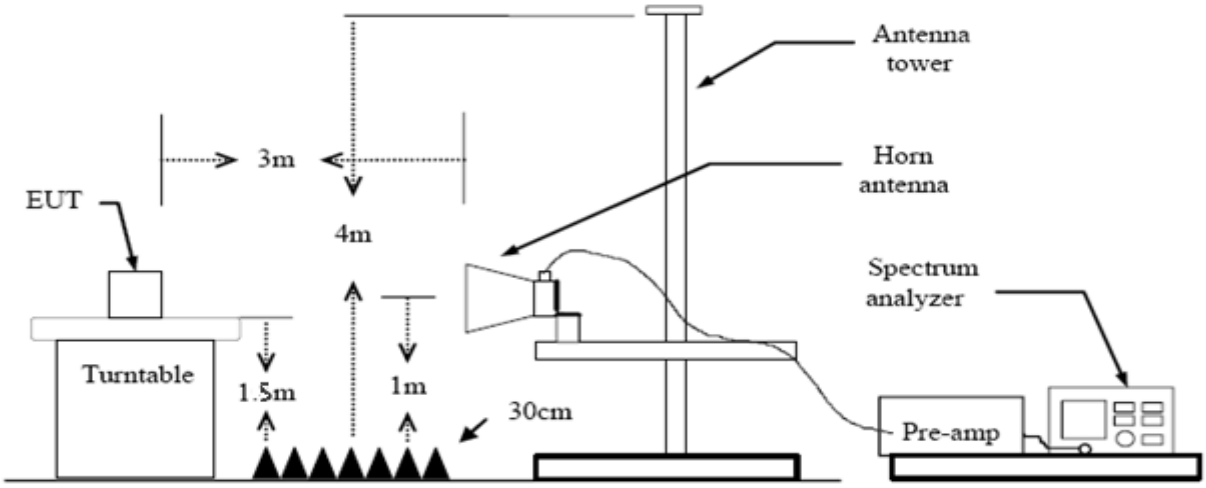
6.1 Test Standard and Limit

6.1.1 Test Standard
FCC Part 15.209
FCC Part 15.205

6.1.2 Test Limit

Restricted Frequency Band (MHz)	Class B (dBuV/m)(at 3m)	
	Peak	Average
2310 ~2390	74	54
2483.5 ~2500	74	54
Note: All restriction bands have been tested, only the worst case is reported.		

6.2 Test Setup



6.3 Test Procedure

(1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz. The EUT was placed on a rotating 0.8m high above the ground, the table was rotated 360 degrees to determine the position of the highest radiation.

(2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.

(3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.

(4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
(5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.
(6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.
(7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.
(8) For the actual test configuration, please see the test setup photo.

6.4 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

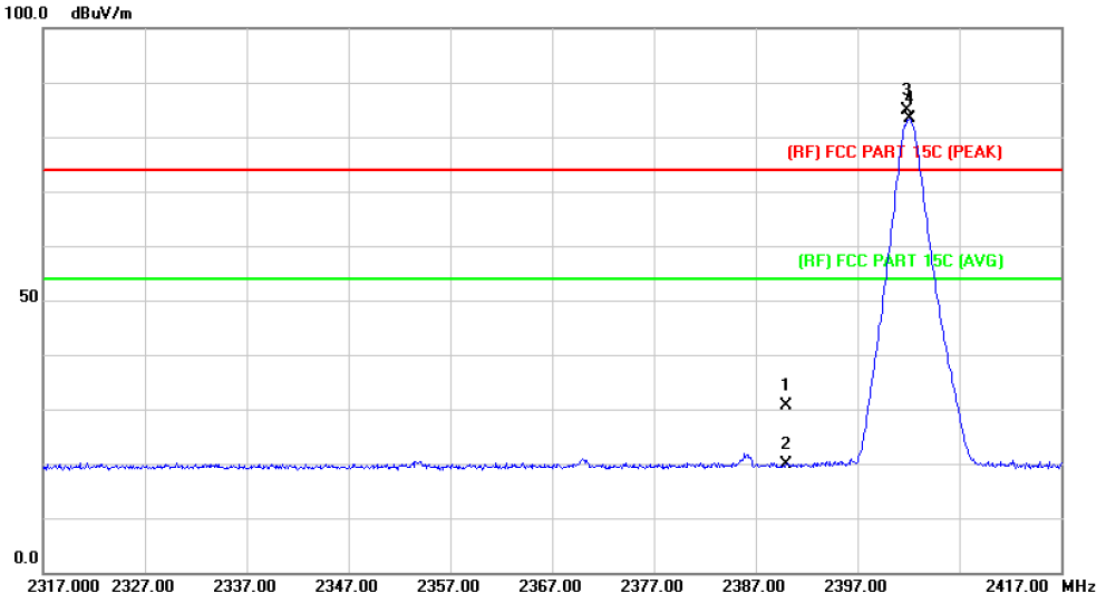
6.5 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=1 KHz with Peak Detector for Average Values.

All restriction bands have been tested, only the worst case is reported.

(1) Radiation Test

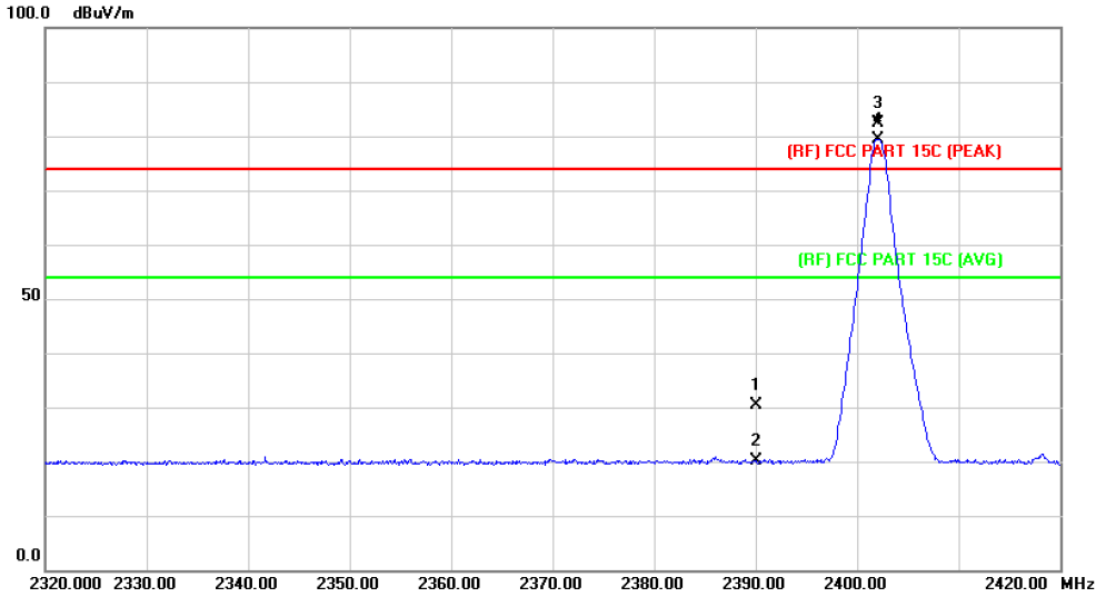
EUT:	Voyager Bluetooth Keyboard and Case	**Model Name :**	SL008
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2402MHz		
Remark:	N/A		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	29.91	0.77	30.68	74.00	-43.32	peak
2		2390.000	19.10	0.77	19.87	54.00	-34.13	AVG
3	X	2401.900	84.16	0.82	84.98	Fundamental Frequeny		peak
4	*	2402.100	82.44	0.82	83.26	Fundamental Frequeny		AVG

Emission Level= Read Level+ Correct Factor

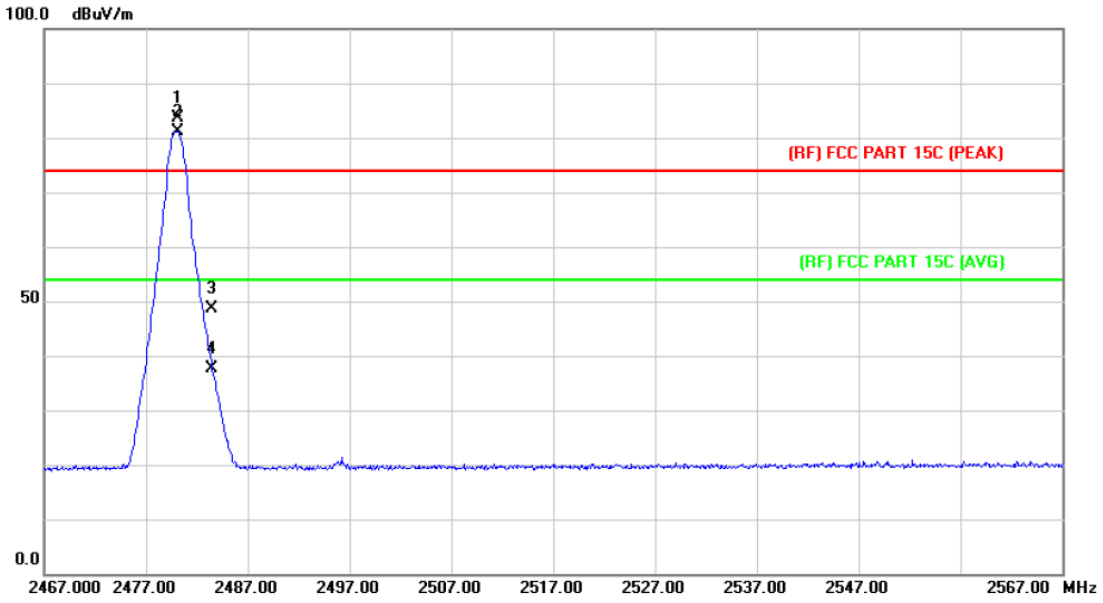
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2402MHz		
Remark:	N/A		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	29.68	0.77	30.45	74.00	-43.55	peak
2		2390.000	19.38	0.77	20.15	54.00	-33.85	AVG
3	X	2402.100	81.52	0.82	82.34	Fundamental Frequeny		peak
4	*	2402.100	78.66	0.82	79.48	Fundamental Frequeny		AVG

Emission Level= Read Level+ Correct Factor

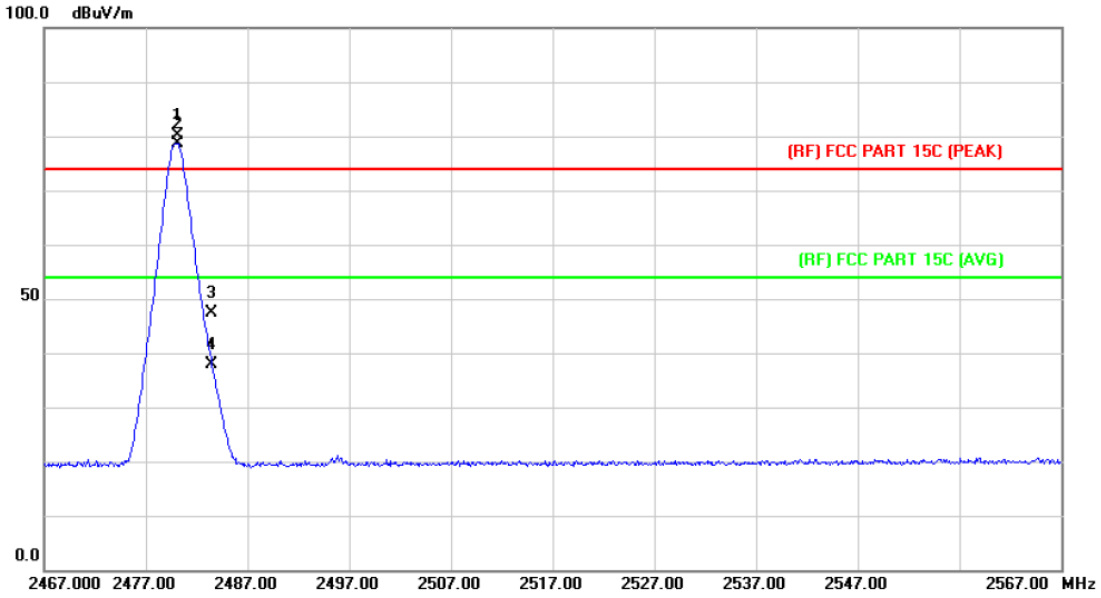
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2480 MHz		
Remark:	N/A		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	X	2480.100	82.50	1.15	83.65	Fundamental Frequeny		peak
2	*	2480.100	80.00	1.15	81.15	Fundamental Frequeny		AVG
3		2483.500	47.40	1.17	48.57	74.00	-25.43	peak
4		2483.500	36.49	1.17	37.66	54.00	-16.34	AVG

Emission Level= Read Level+ Correct Factor

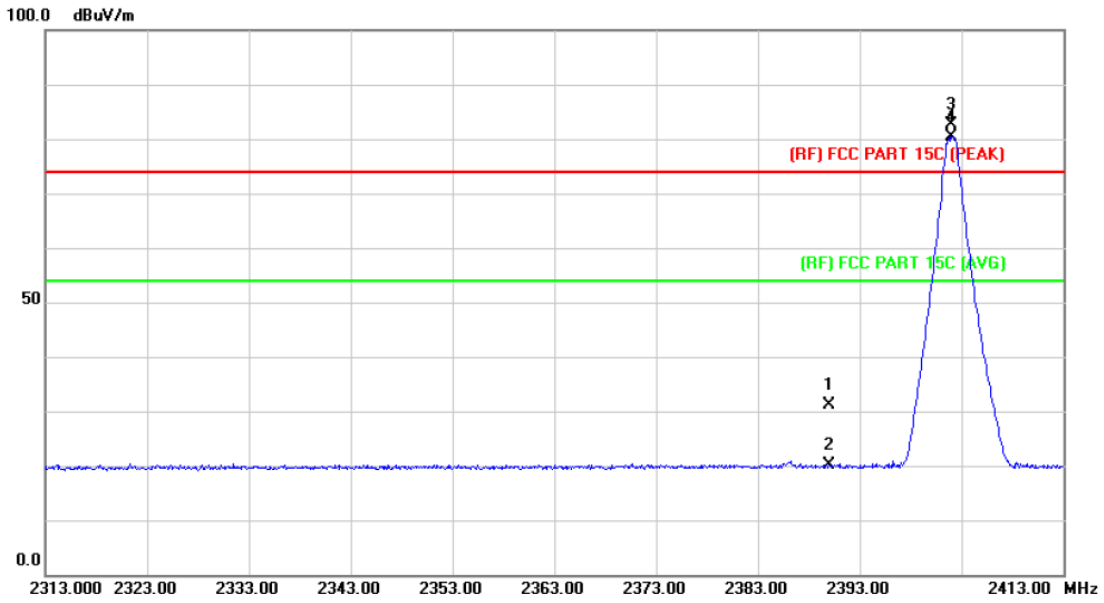
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2480 MHz		
Remark:	N/A		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	X	2480.100	79.09	1.15	80.24	Fundamental Frequeny		peak
2	*	2480.100	77.51	1.15	78.66	Fundamental Frequeny		AVG
3		2483.500	46.17	1.17	47.34	74.00	-26.66	peak
4		2483.500	36.59	1.17	37.76	54.00	-16.24	AVG

Emission Level= Read Level+ Correct Factor

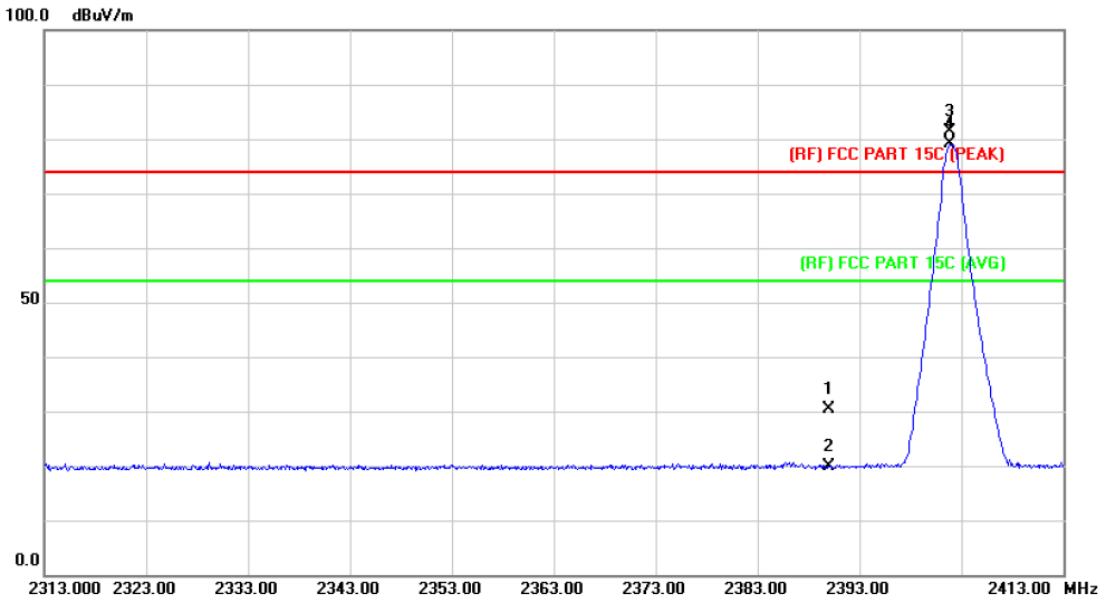
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX 8-DPSK Mode 2402MHz		
Remark:	N/A		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	30.47	0.77	31.24	74.00	-42.76	peak
2		2390.000	19.24	0.77	20.01	54.00	-33.99	AVG
3	X	2402.000	81.87	0.82	82.69	Fundamental Frequeny		peak
4	*	2402.000	79.65	0.82	80.47	Fundamental Frequeny		AVG

Emission Level= Read Level+ Correct Factor

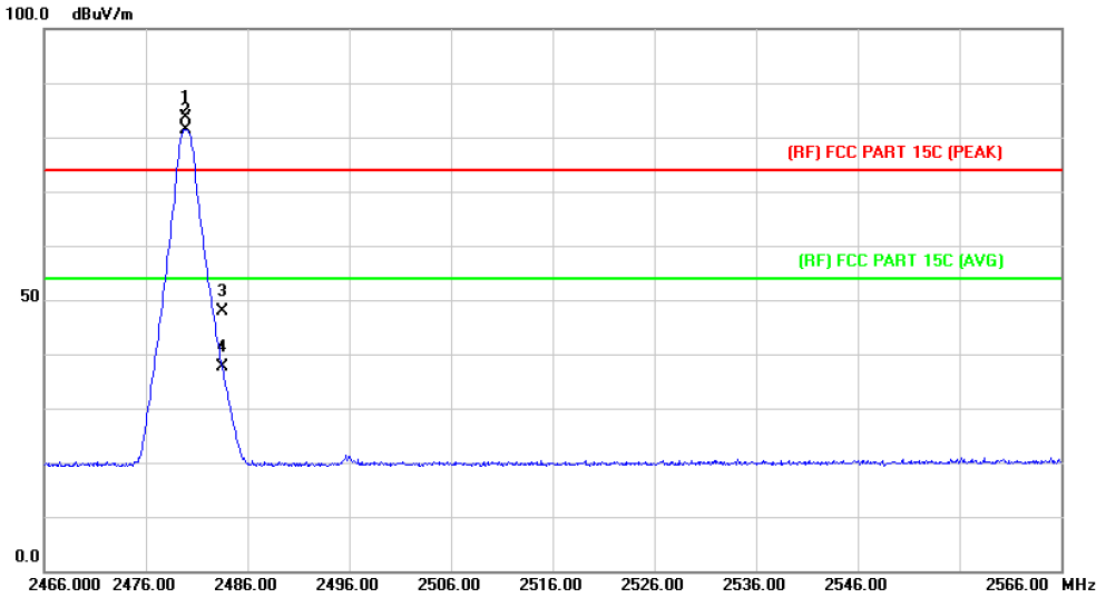
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX 8-DPSK Mode 2402MHz		
Remark:	N/A		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	29.68	0.77	30.45	74.00	-43.55	peak
2		2390.000	19.02	0.77	19.79	54.00	-34.21	AVG
3	X	2401.900	80.52	0.82	81.34	Fundamental Frequeny		peak
4	*	2401.900	78.21	0.82	79.03	Fundamental Frequeny		AVG

Emission Level= Read Level+ Correct Factor

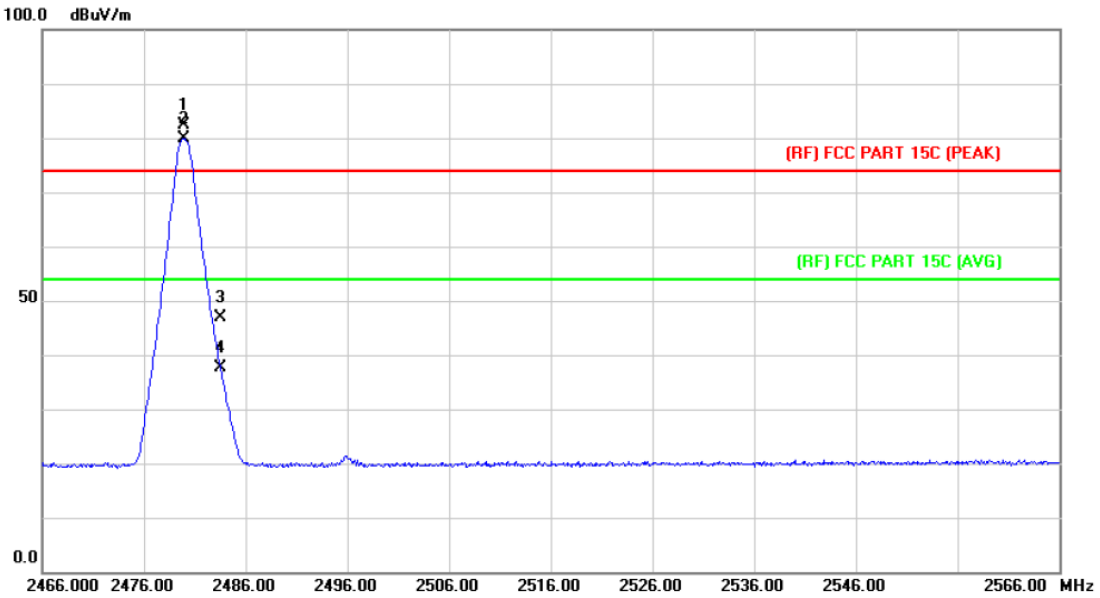
EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX 8-DPSK Mode 2480MHz		
Remark:	N/A		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	X	2479.900	82.44	1.15	83.59	Fundamental Frequeny		peak
2	*	2479.900	80.32	1.15	81.47	Fundamental Frequeny		AVG
3		2483.500	46.81	1.17	47.98	74.00	-26.02	peak
4		2483.500	36.55	1.17	37.72	54.00	-16.28	AVG

Emission Level= Read Level+ Correct Factor

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX 8-DPSK Mode 2480MHz		
Remark:	N/A		

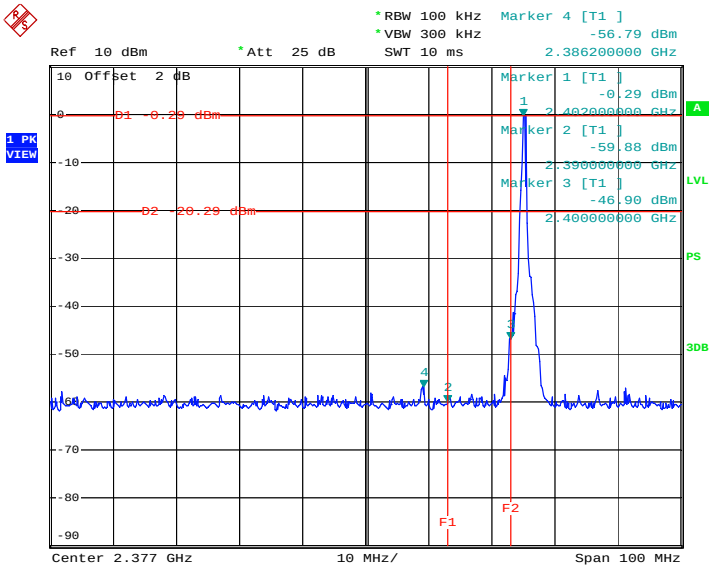


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	X	2479.900	81.19	1.15	82.34	Fundamental Frequeny		peak
2	*	2479.900	78.84	1.15	79.99	Fundamental Frequeny		AVG
3		2483.500	45.72	1.17	46.89	74.00	-27.11	peak
4		2483.500	36.36	1.17	37.53	54.00	-16.47	AVG

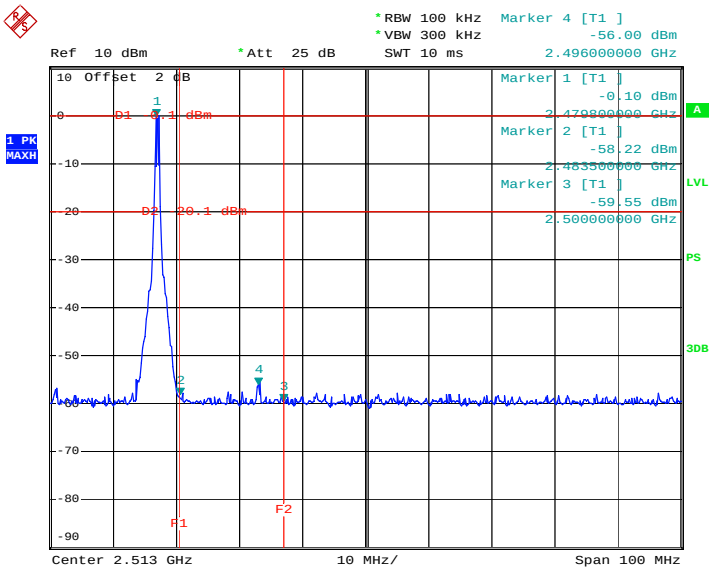
Emission Level= Read Level+ Correct Factor

(2) Conducted Test

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX GFSK Mode 2402MHz / 2480 MHz		
Remark:	N/A		

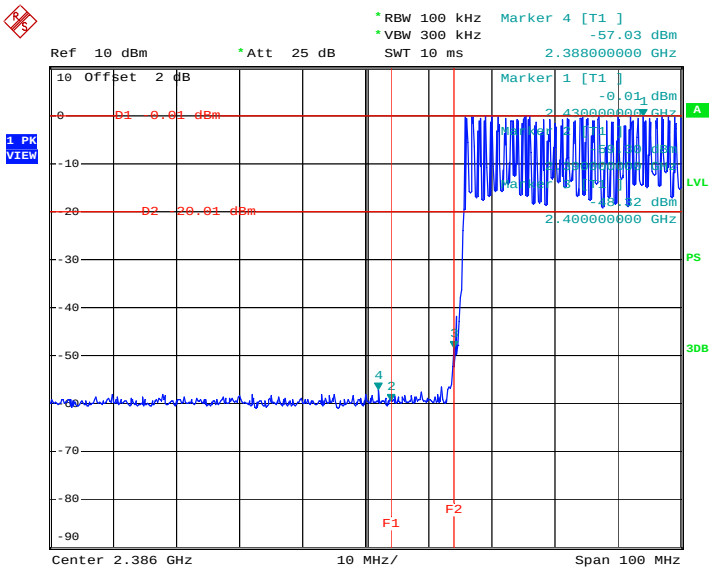


Date: 10.JUN.2015 10:39:06

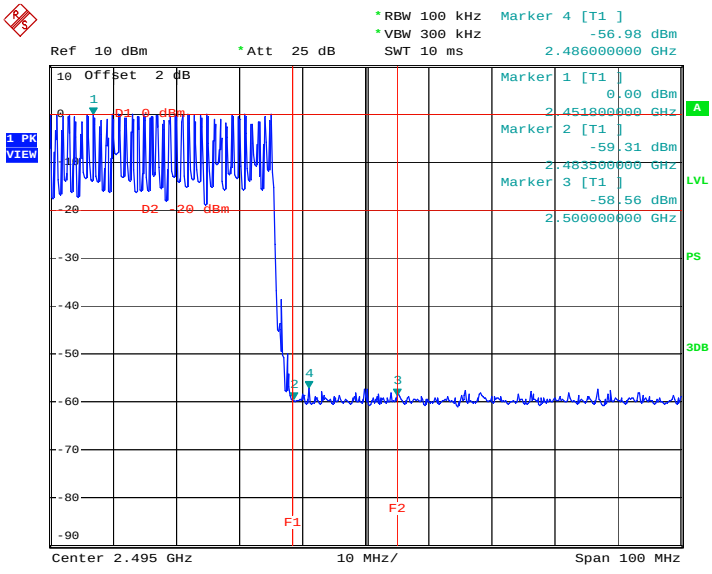


Date: 10.JUN.2015 10:37:42

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	GFSK Hopping Mode		
Remark:	N/A		

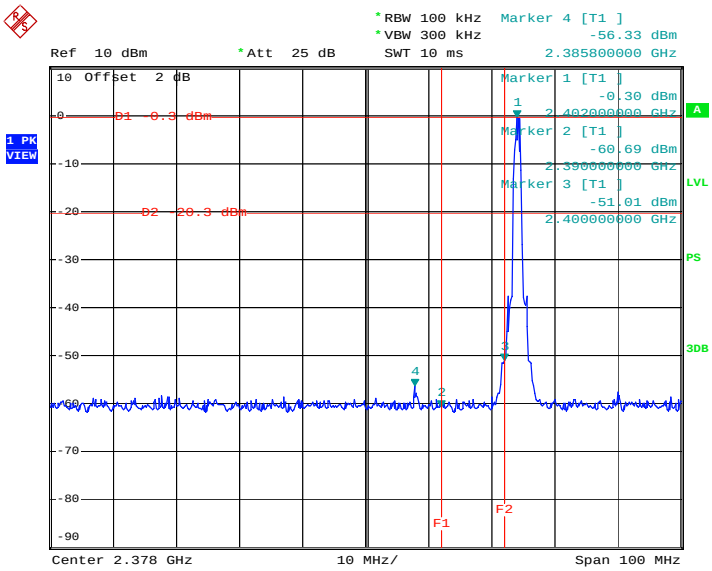


Date: 10.JUN.2015 10:46:57

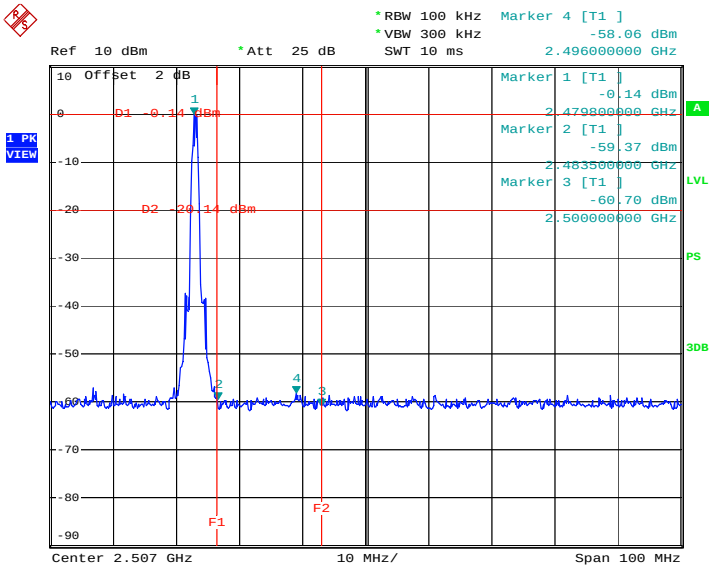


Date: 10.JUN.2015 10:49:13

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX 8-DPSK Mode 2402MHz / 2480 MHz		
Remark:	N/A		

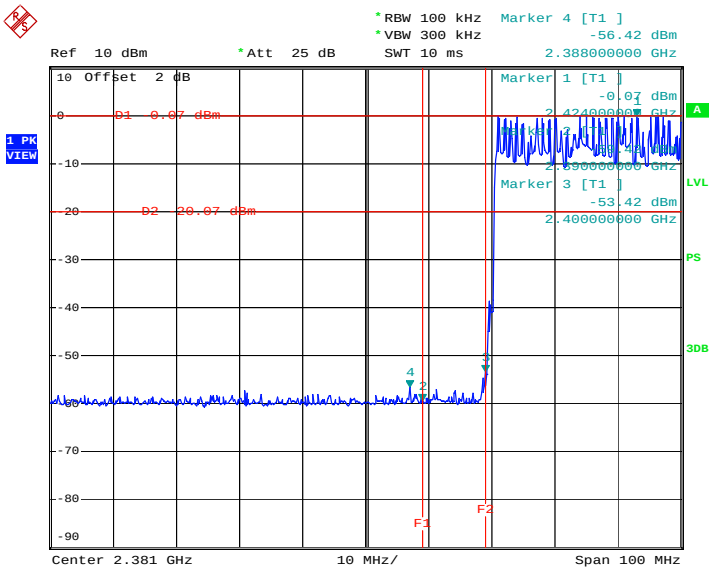


Date: 10.JUN.2015 10:40:19

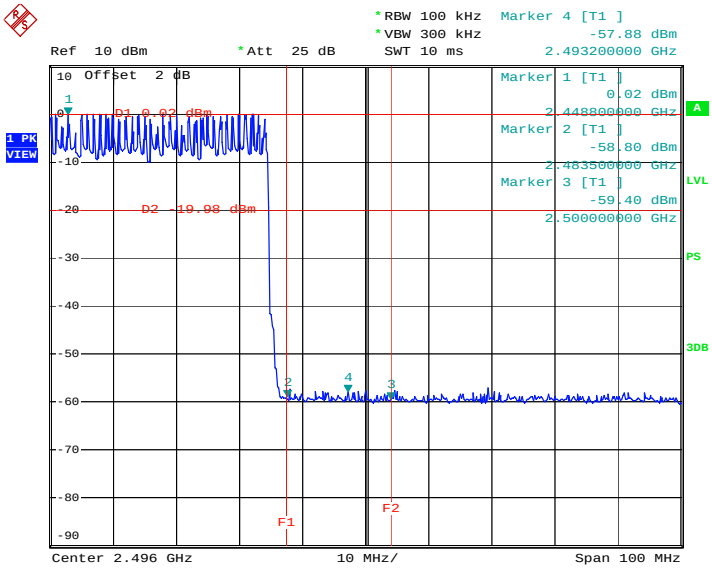


Date: 10.JUN.2015 10:41:31

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	8-DPSK Hopping Mode		
Remark:	N/A		



Date: 10.JUN.2015 10:54:53



Date: 10.JUN.2015 10:52:05

7. Number of Hopping Channel

7.1 Test Standard and Limit

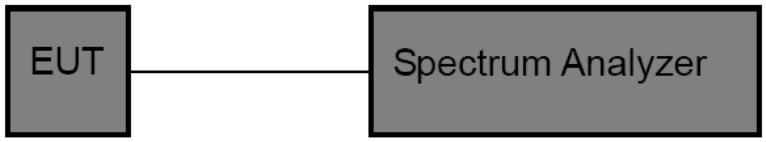
7.1.1 Test Standard

FCC Part 15.247 (a)(1)

7.1.2 Test Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

7.2 Test Setup



7.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
(2) Spectrum Setting: RBW=100 KHz, VBW=100 KHz, Sweep time= Auto.

7.4 EUT Operating Condition

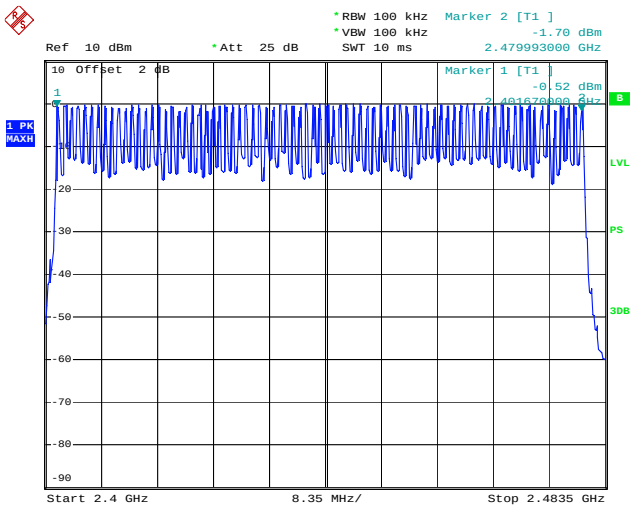
The EUT was set to the Hopping Mode by the Customer.

7.5 Test Data

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (GFSK/ 8-DPSK)		

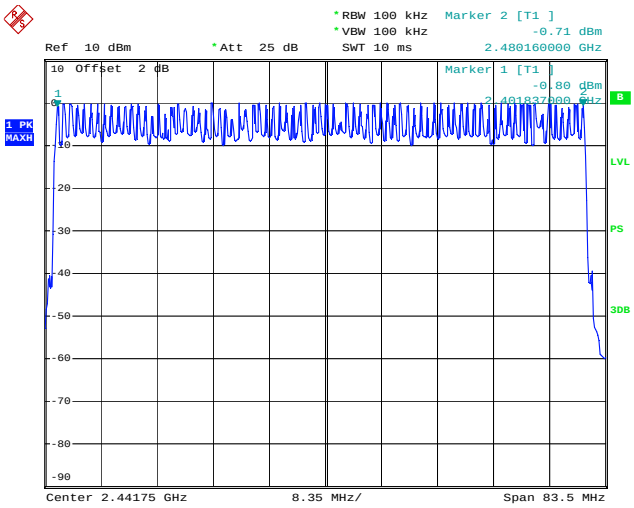
Frequency Range	Quantity of Hopping Channel	Limit
2402MHz~2480MHz	79	>15
	79	

GFSK Mode



Date: 10.JUN.2015 10:44:28

8-DPSK Mode



Date: 10.JUN.2015 10:56:57

8. Average Time of Occupancy

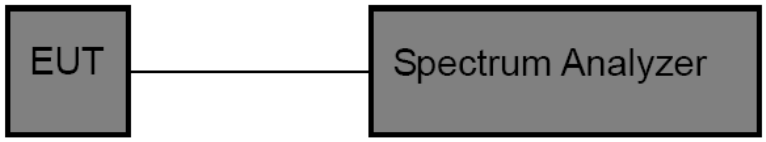
8.1 Test Standard and Limit

8.1.1 Test Standard
FCC Part 15.247 (a)(1)

8.1.2 Test Limit

Section	Test Item	Limit
15.247(a)(1)/ RSS-210 Annex 8(A8.1d)	Average Time of Occupancy	0.4 sec

8.2 Test Setup



8.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
(2) Spectrum Setting: RBW=1MHz, VBW=1MHz.
(3) Use video trigger with the trigger level set to enable triggering only on full pulses.
(4) Sweep Time is more than once pulse time.
(5) Set the center frequency on any frequency would be measure and set the frequency span to zero.
(6) Measure the maximum time duration of one single pulse.
(7) Set the EUT for packet transmitting.
(8) Measure the maximum time duration of one single pulse.

8.4 EUT Operating Condition

The EUT was set to the Hopping Mode by the Customer.

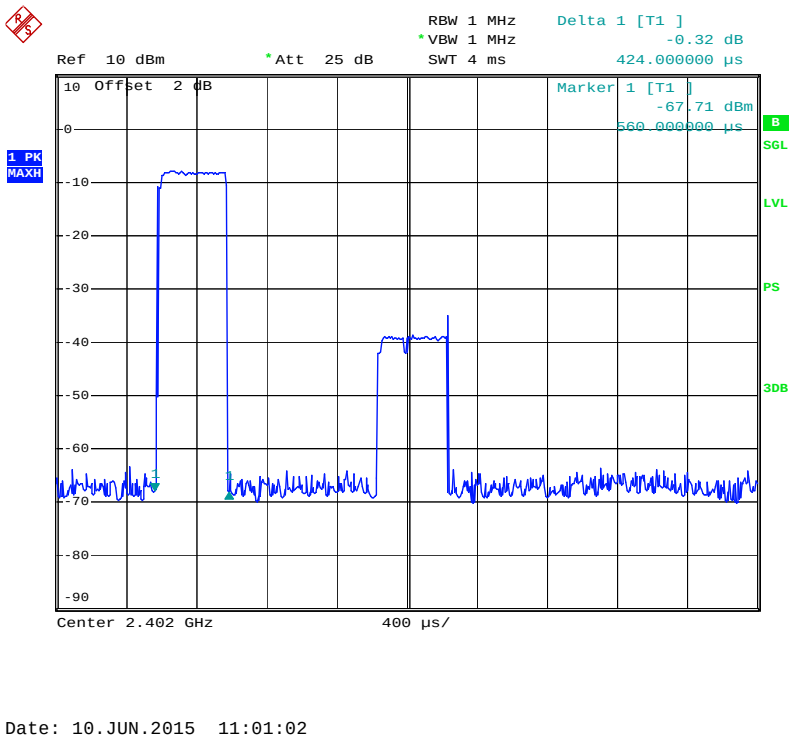
8.5 Test Data

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (GFSK DH1)		

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	0.424	135.68	31.60	400	PASS
2441	0.424	135.68			
2480	0.424	135.68			

GFSK Hopping Mode DH1

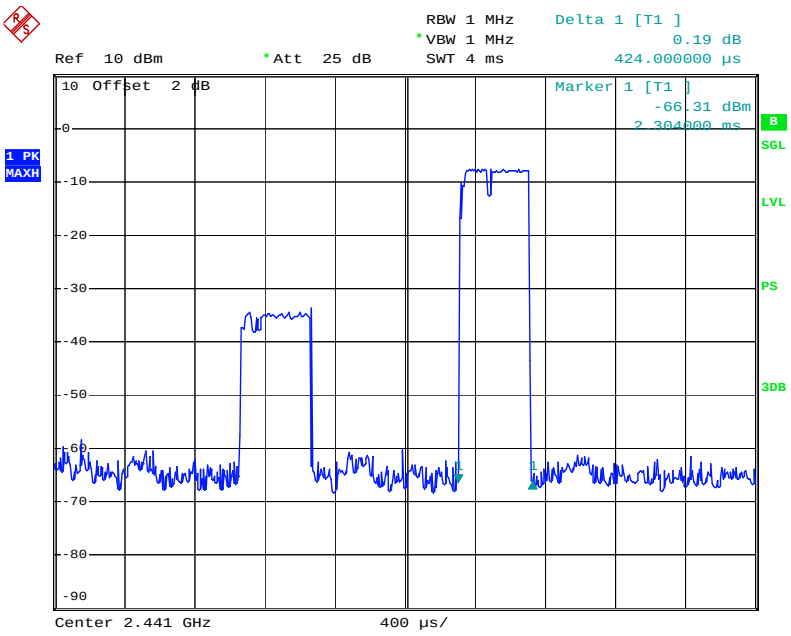
2402 MHz



Date: 10.JUN.2015 11:01:02

GFSK Hopping Mode DH1

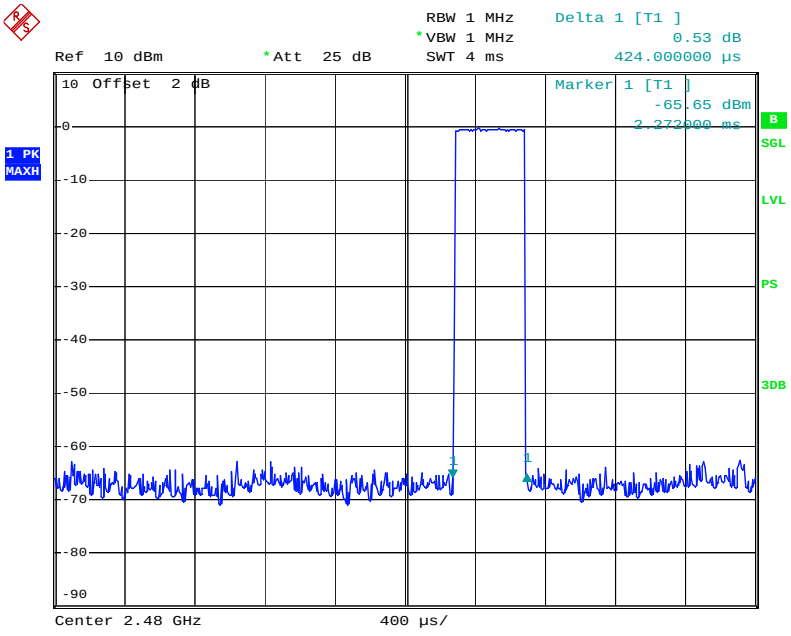
2441 MHz



Date: 10.JUN.2015 11:01:48

GFSK Hopping Mode DH1

2480 MHz



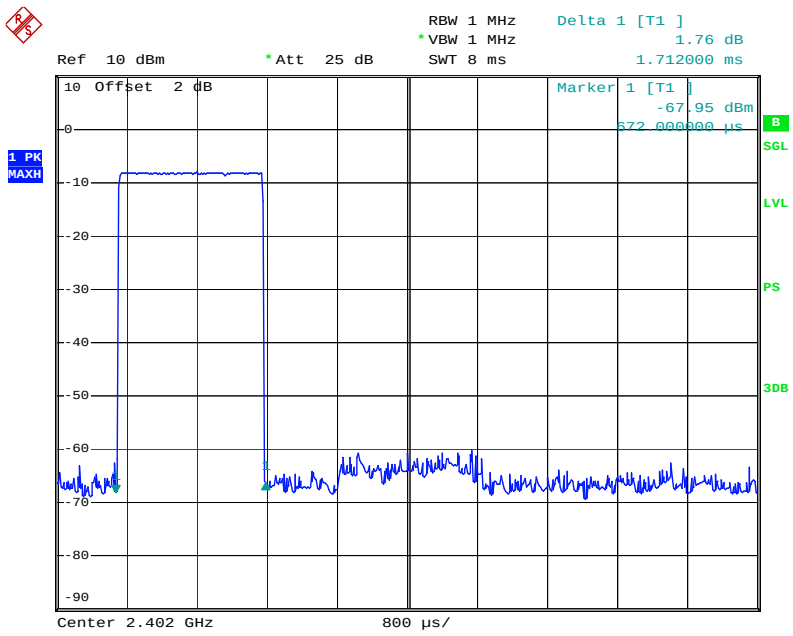
Date: 10.JUN.2015 11:02:11

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (GFSK DH3)		

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	1.712	273.92	31.60	400	PASS
2441	1.712	273.92			
2480	1.712	273.92			

GFSK Hopping Mode DH3

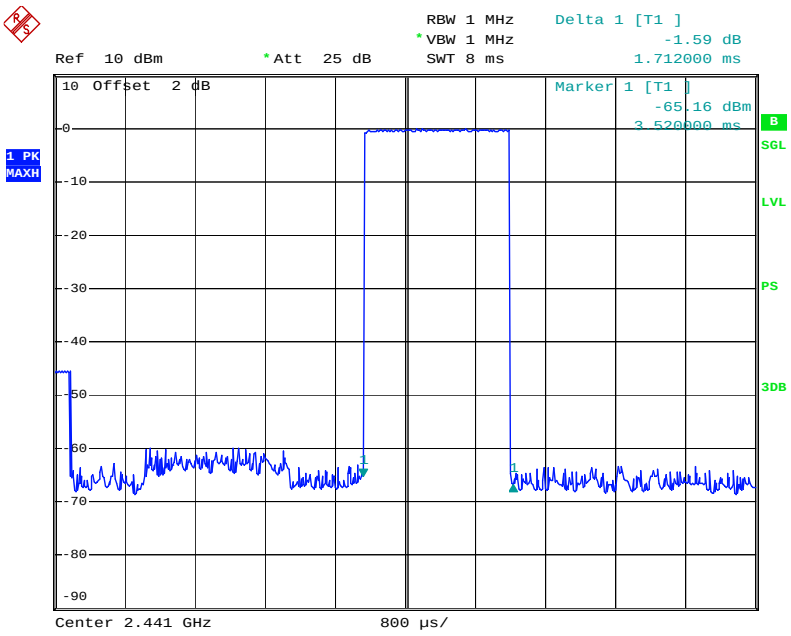
2402 MHz



Date: 10.JUN.2015 11:04:24

GFSK Hopping Mode DH3

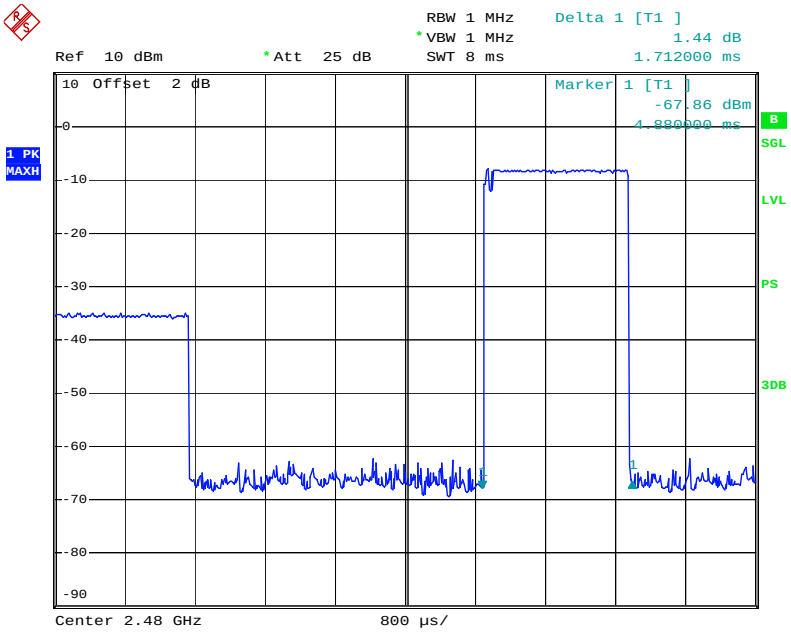
2441 MHz



Date: 10.JUN.2015 11:03:55

GFSK Hopping Mode DH3

2480 MHz



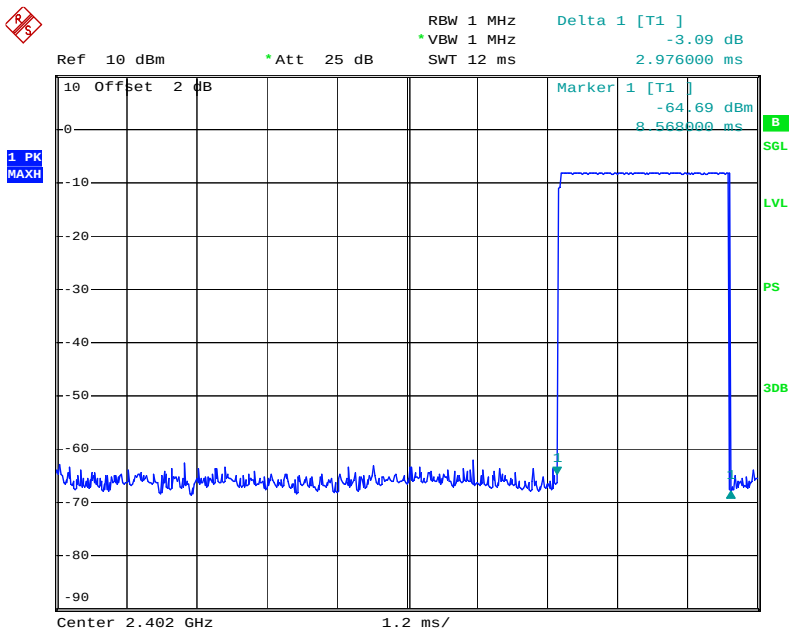
Date: 10.JUN.2015 11:03:06

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (GFSK DH5)		

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	2.976	317.44	31.60	400	PASS
2441	2.952	314.88			
2480	2.976	317.44			

GFSK Hopping Mode DH5

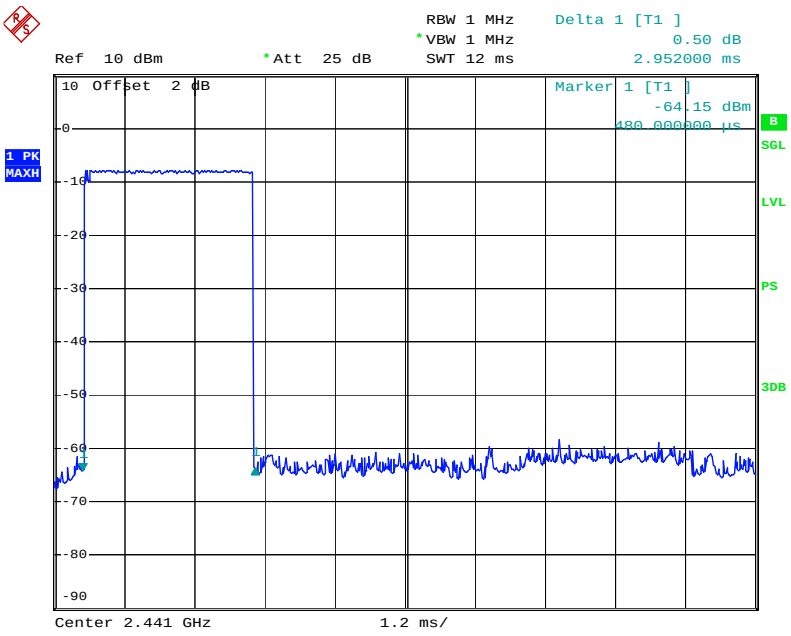
2402 MHz



Date: 10.JUN.2015 11:05:38

GFSK Hopping Mode DH5

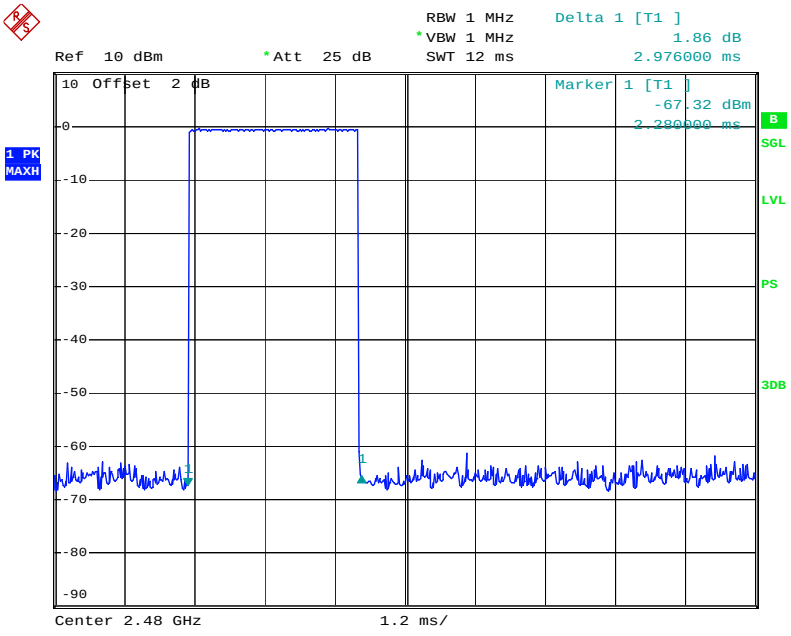
2441 MHz



Date: 10.JUN.2015 11:06:15

GFSK Hopping Mode DH5

2480 MHz



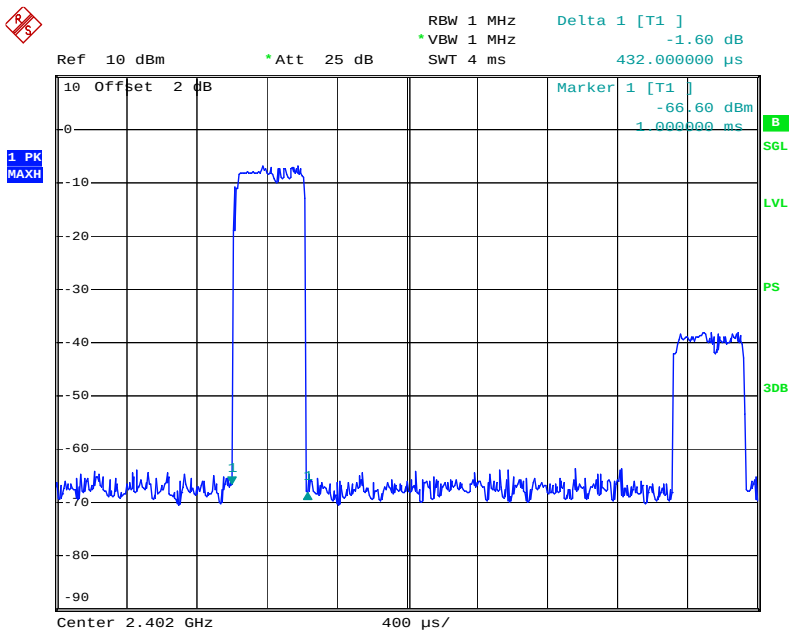
Date: 10.JUN.2015 11:06:54

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (π/4-DQPSK DH1)		

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	0.432	138.24	31.60	400	PASS
2441	0.440	140.80			
2480	0.440	140.80			

π/4-DQPSK Hopping Mode DH1

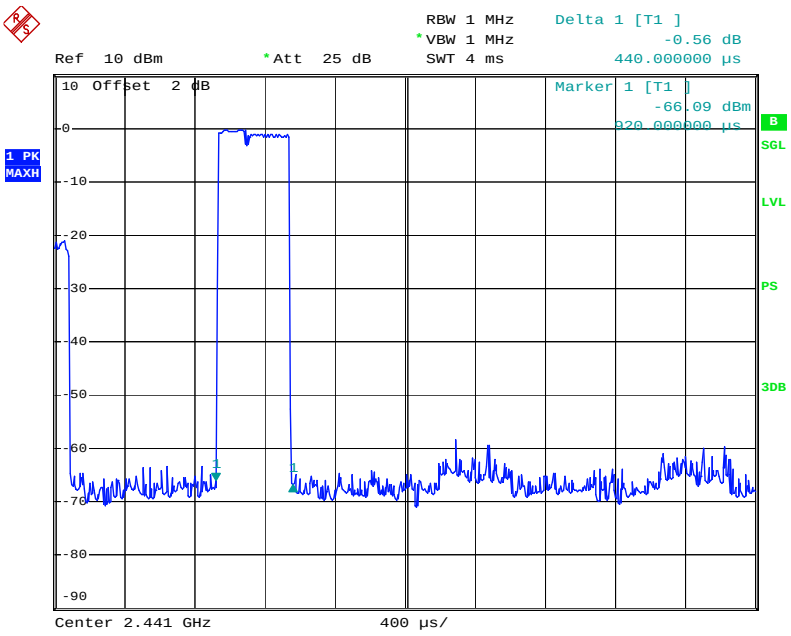
2402 MHz



Date: 10.JUN.2015 11:14:00

π/4-DQPSK Hopping Mode DH1

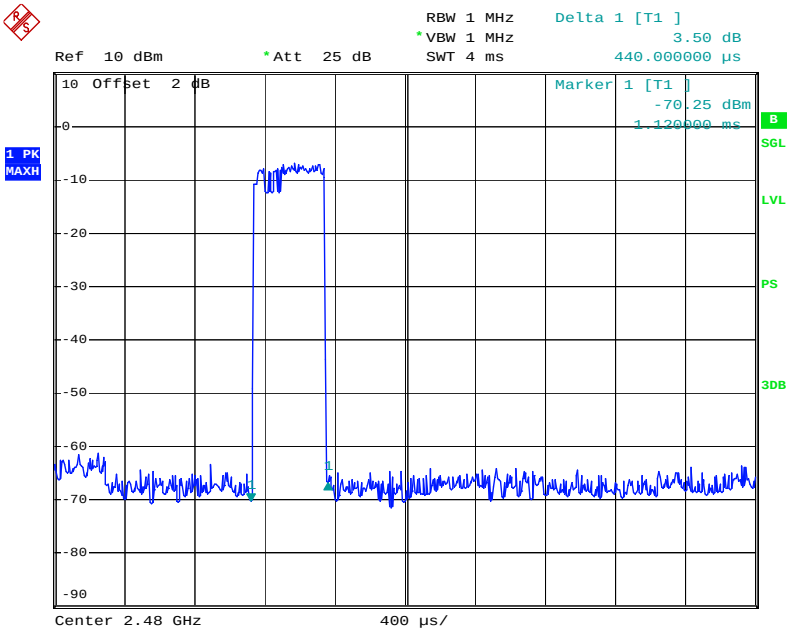
2441 MHz



Date: 10.JUN.2015 11:13:29

π/4-DQPSK Hopping Mode DH1

2480 MHz



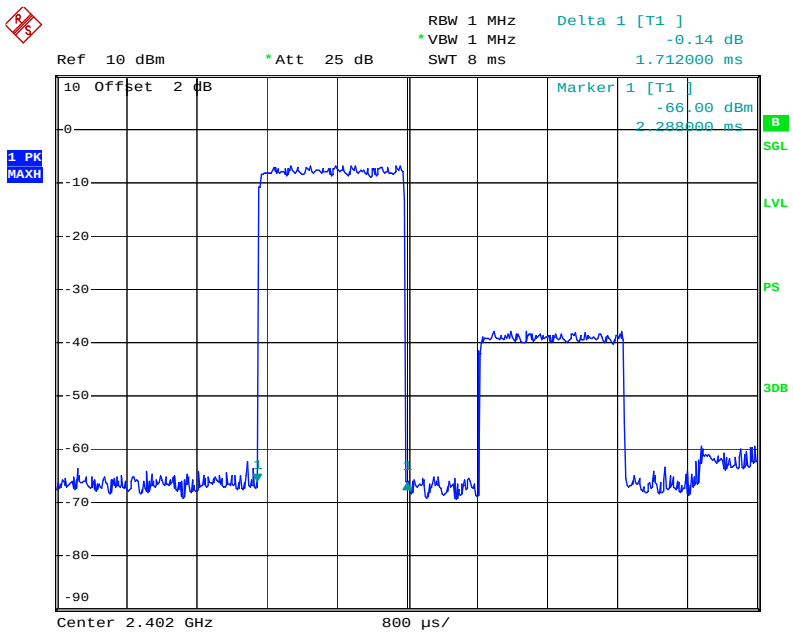
Date: 10.JUN.2015 11:12:48

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (π/4-DQPSK DH3)		

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	1.712	273.92	31.60	400	PASS
2441	1.712	273.92			
2480	1.712	273.92			

π/4-DQPSK Hopping Mode DH3

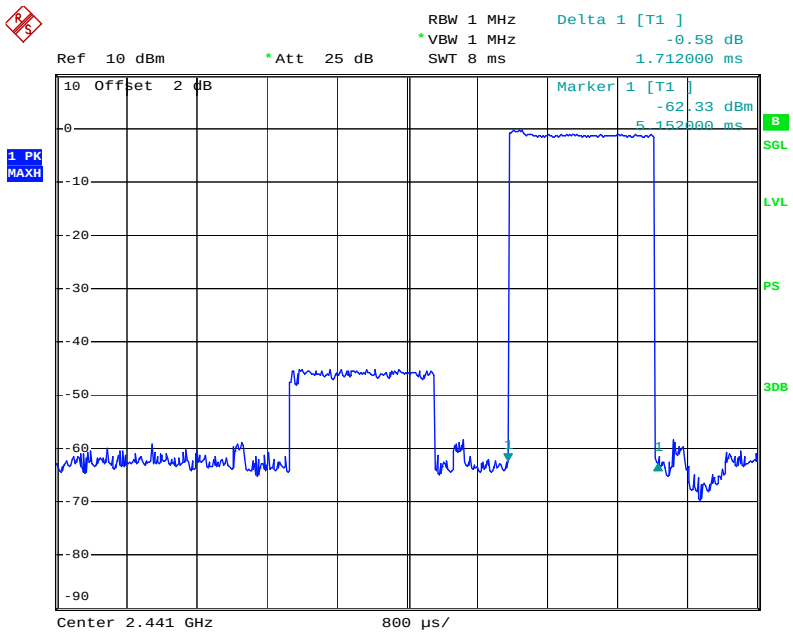
2402 MHz



Date: 10.JUN.2015 11:09:46

π/4-DQPSK Hopping Mode DH3

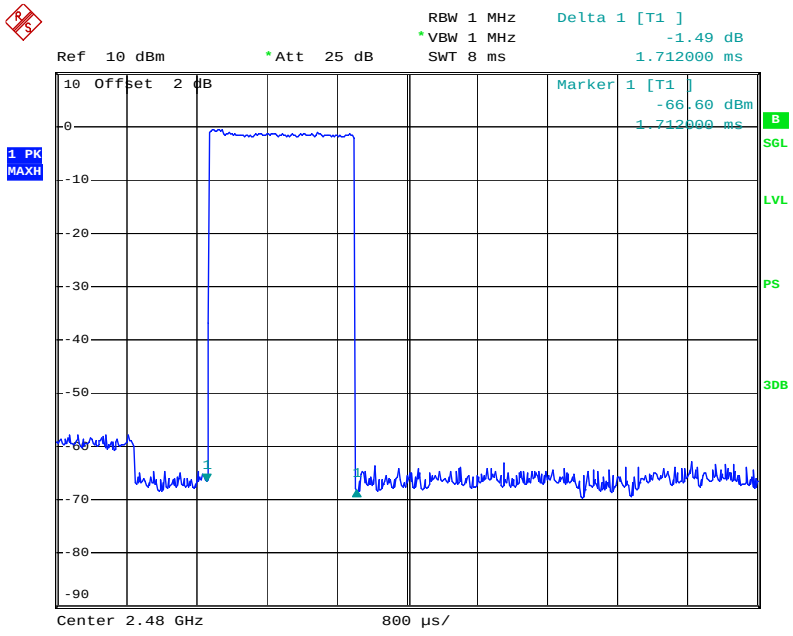
2441 MHz



Date: 10.JUN.2015 11:10:18

π/4-DQPSK Hopping Mode DH3

2480 MHz



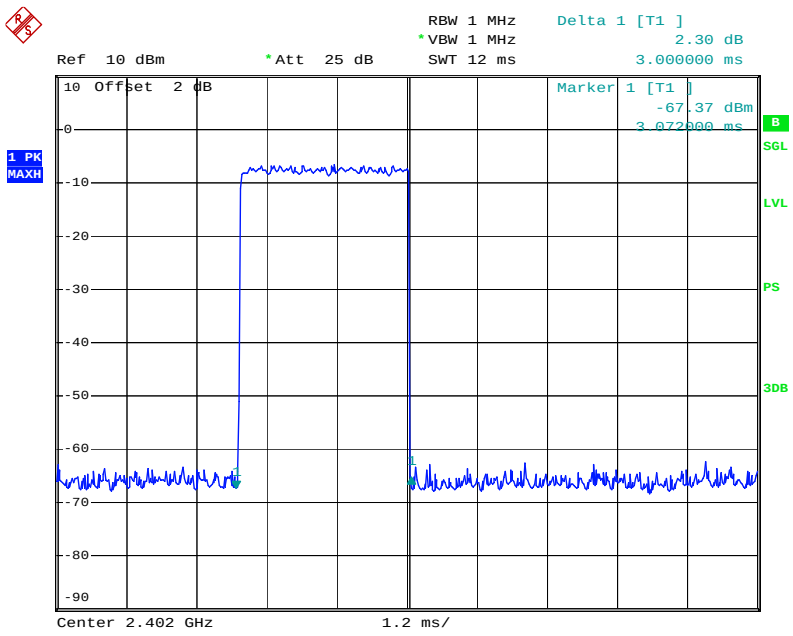
Date: 10.JUN.2015 11:10:58

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (π/4-DQPSK DH5)		

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	3.000	320.00	31.60	400	PASS
2441	3.000	320.00			
2480	2.976	317.44			

π/4-DQPSK Hopping Mode DH5

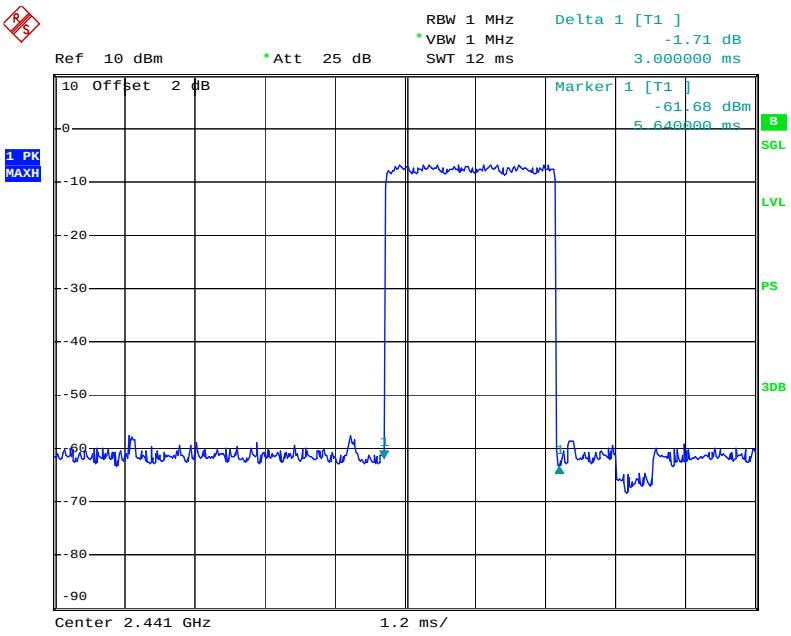
2402 MHz



Date: 10.JUN.2015 11:08:58

π/4-DQPSK Hopping Mode DH5

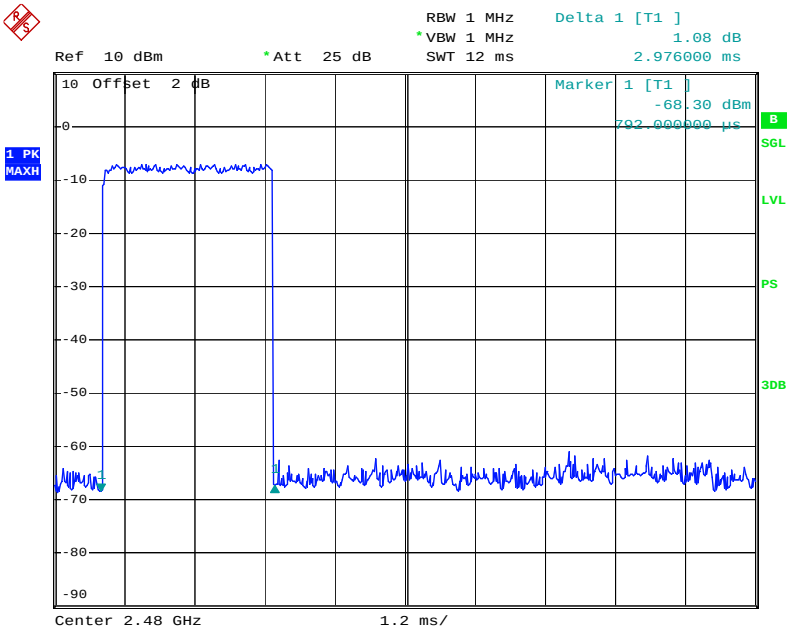
2441 MHz



Date: 10.JUN.2015 11:08:33

π/4-DQPSK Hopping Mode DH5

2480 MHz



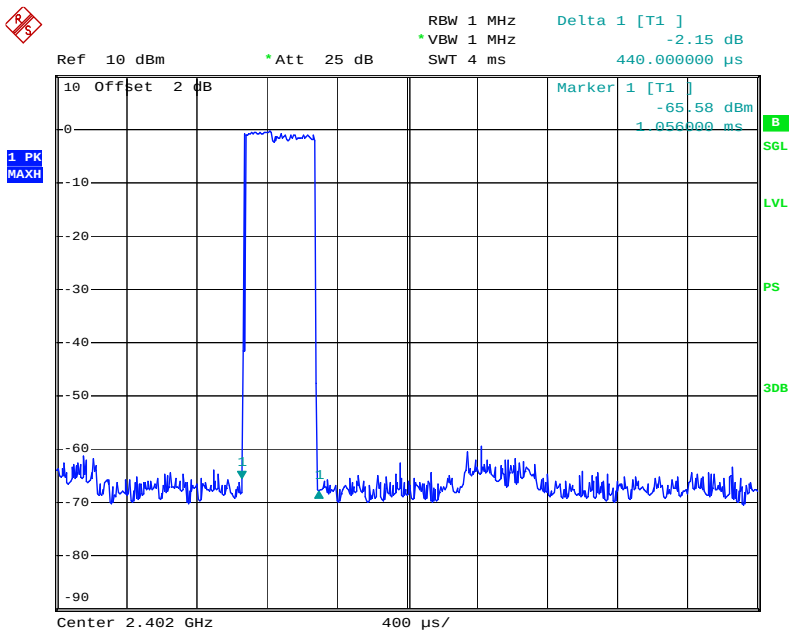
Date: 10.JUN.2015 11:07:43

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (8-DPSK DH1)		

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	0.440	140.80	31.60	400	PASS
2441	0.432	138.24			
2480	0.440	140.80			

8-DPSK Hopping Mode DH1

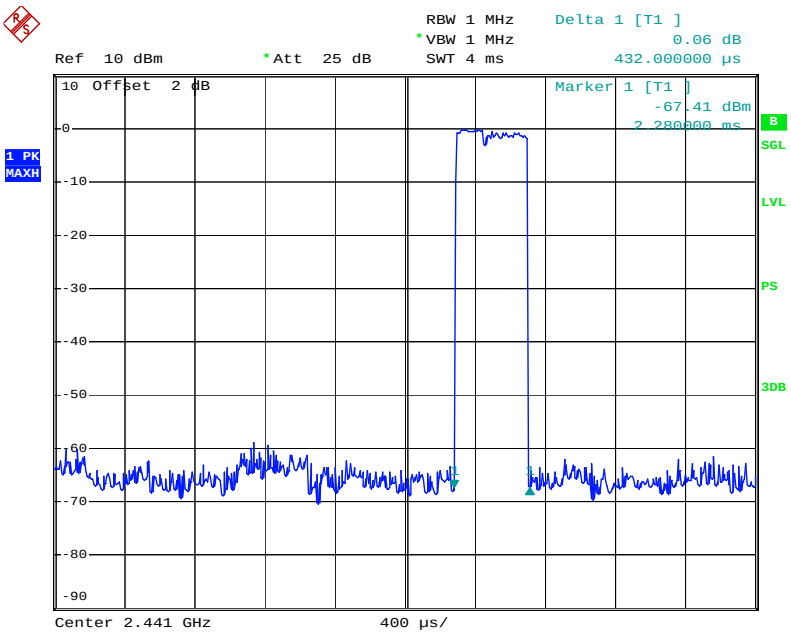
2402 MHz



Date: 10.JUN.2015 11:14:36

8-DPSK Hopping Mode DH1

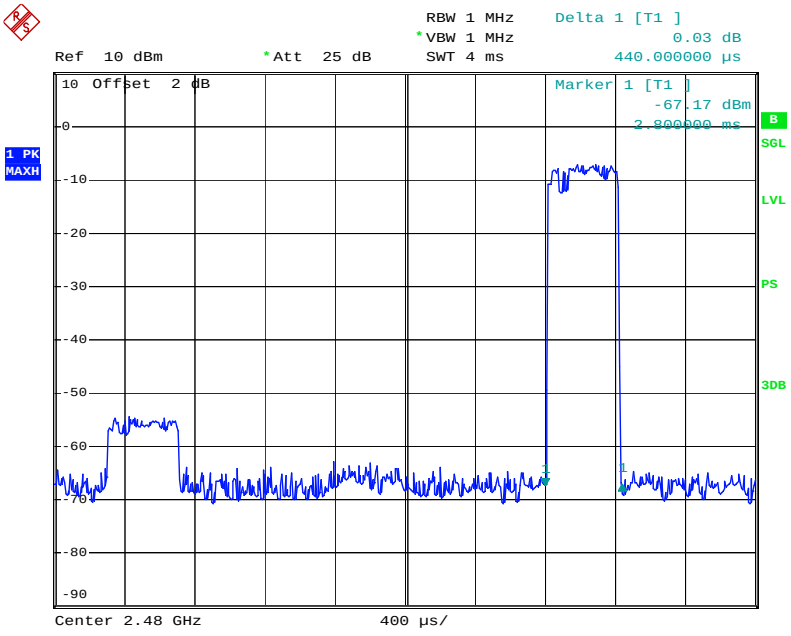
2441 MHz



Date: 10.JUN.2015 11:15:23

8-DPSK Hopping Mode DH1

2480 MHz



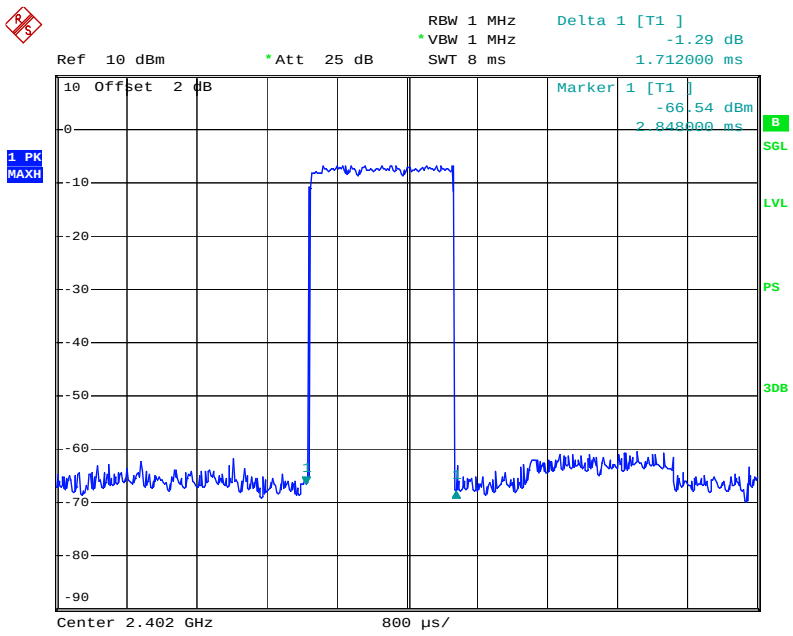
Date: 10.JUN.2015 11:18:24

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (8-DPSK DH3)		

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	1.712	273.92	31.60	400	PASS
2441	1.720	275.20			
2480	1.720	275.20			

8-DPSK Hopping Mode DH3

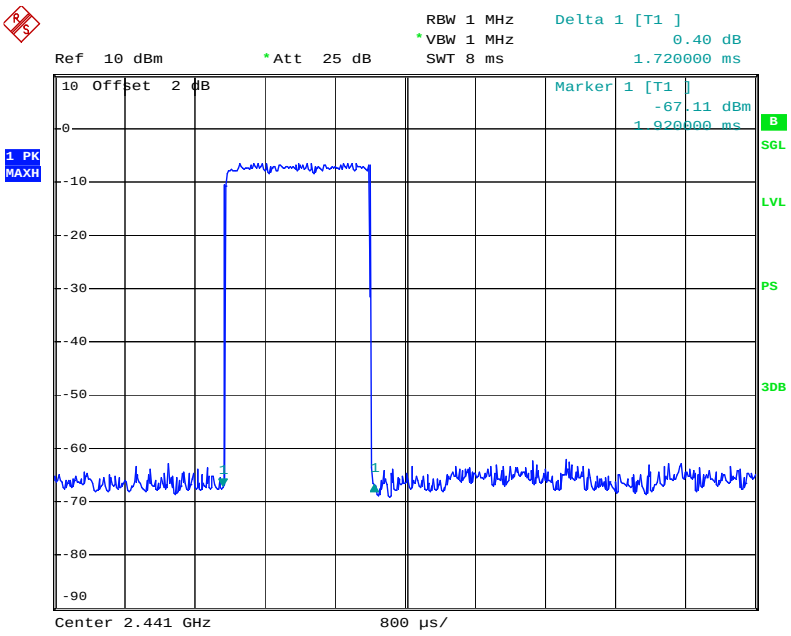
2402 MHz



Date: 10.JUN.2015 11:41:59

8-DPSK Hopping Mode DH3

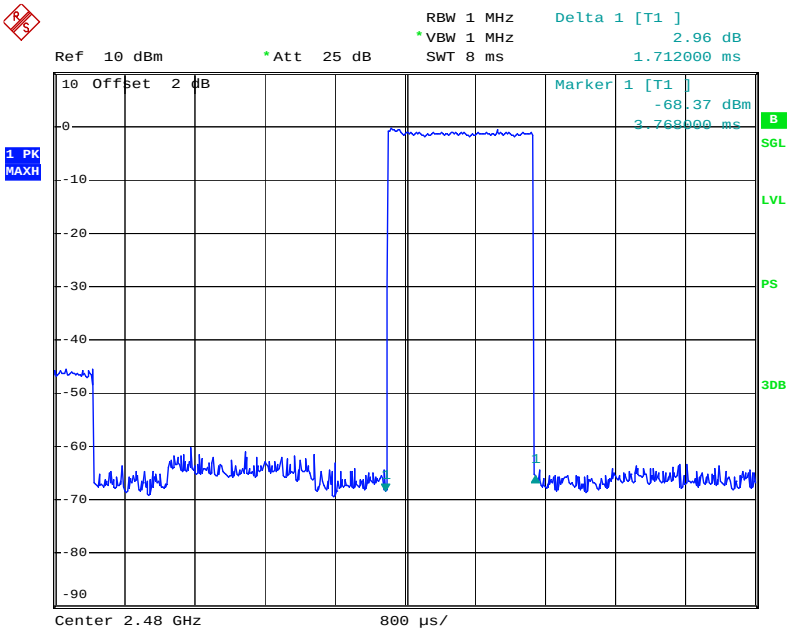
2441 MHz



Date: 10.JUN.2015 11:23:07

8-DPSK Hopping Mode DH3

2480 MHz



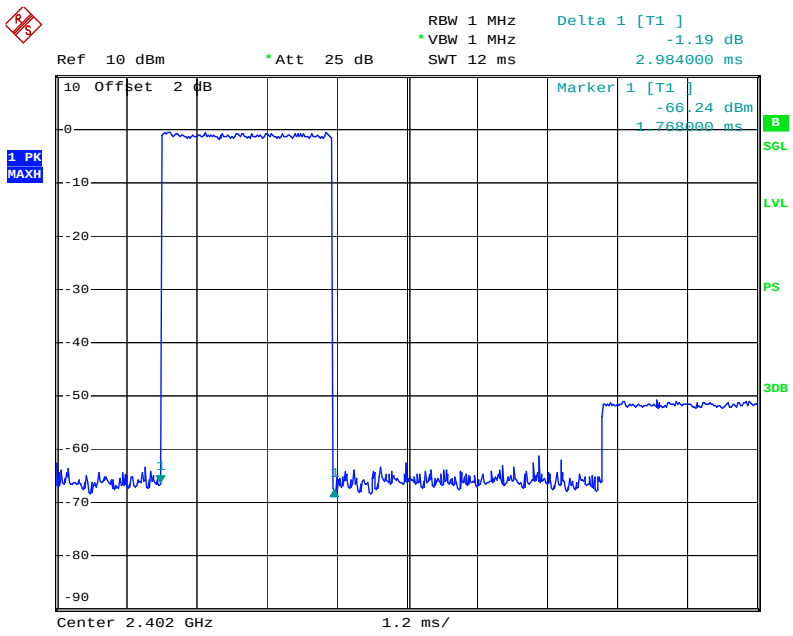
Date: 10.JUN.2015 11:48:22

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (8-DPSK DH5)		

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	2.984	318.29	31.60	400	PASS
2441	3.008	320.85			
2480	2.976	317.44			

8-DPSK Hopping Mode DH5

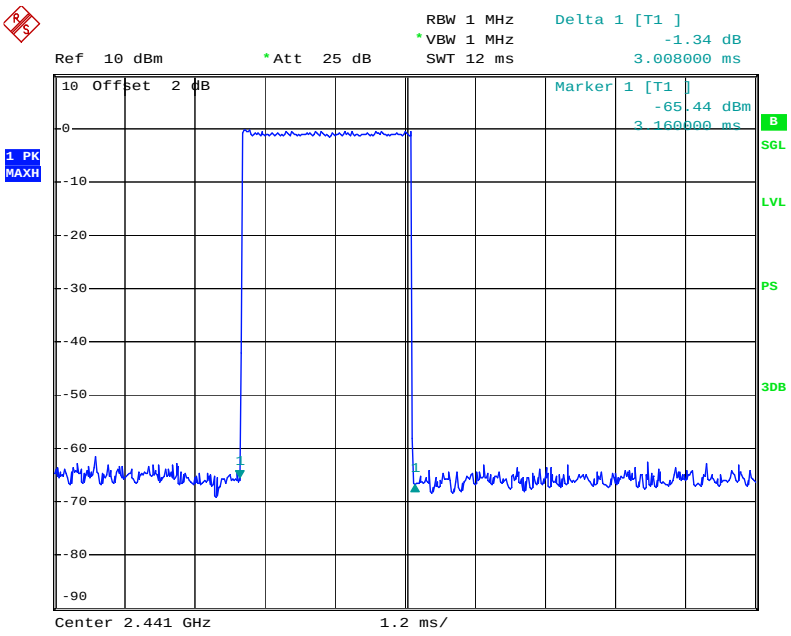
2402 MHz



Date: 10.JUN.2015 11:44:52

8-DPSK Hopping Mode DH5

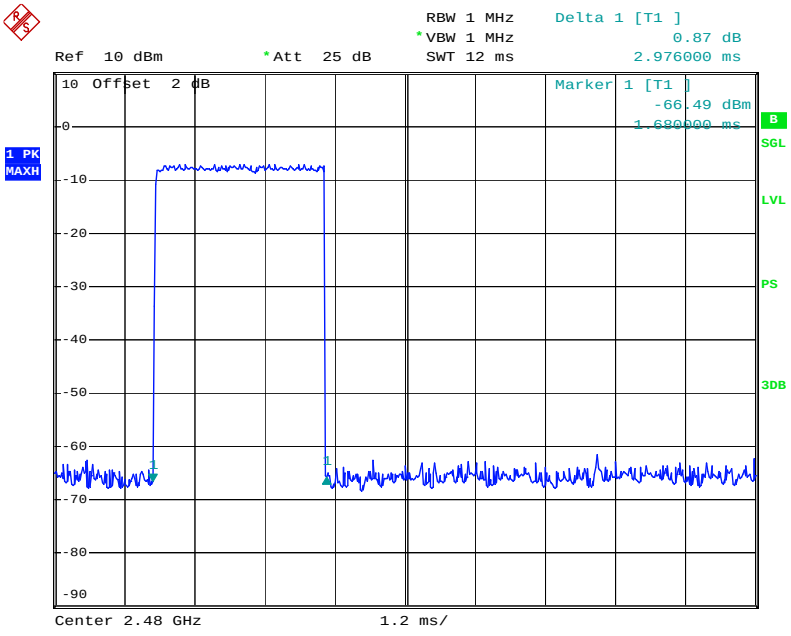
2441 MHz



Date: 10.JUN.2015 11:47:01

8-DPSK Hopping Mode DH5

2480 MHz



Date: 10.JUN.2015 11:24:56

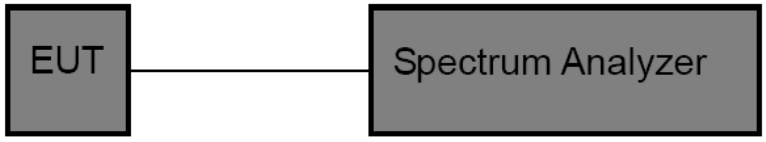
9. Channel Separation and Bandwidth Test

9.1 Test Standard and Limit

9.1.1 Test Standard
FCC Part 15.247
9.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Bandwidth	<=1 MHz (20dB bandwidth)	2400~2483.5
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

9.2 Test Setup



9.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
(2) Spectrum Setting:
Channel Separation: RBW=30 kHz, VBW=100 kHz.
Bandwidth: RBW=30 kHz, VBW=100 kHz.
(3) The bandwidth is measured at an amplitude level reduced 20dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst –case (i.e the widest) bandwidth.
(4) Measure the channel separation the spectrum analyzer was set to Resolution Bandwidth:30 kHz, and Video Bandwidth:100 kHz. Sweep Time set auto.

9.4 EUT Operating Condition

The EUT was set to the Hopping Mode for Channel Separation Test and continuously transmitting for the Bandwidth Test.

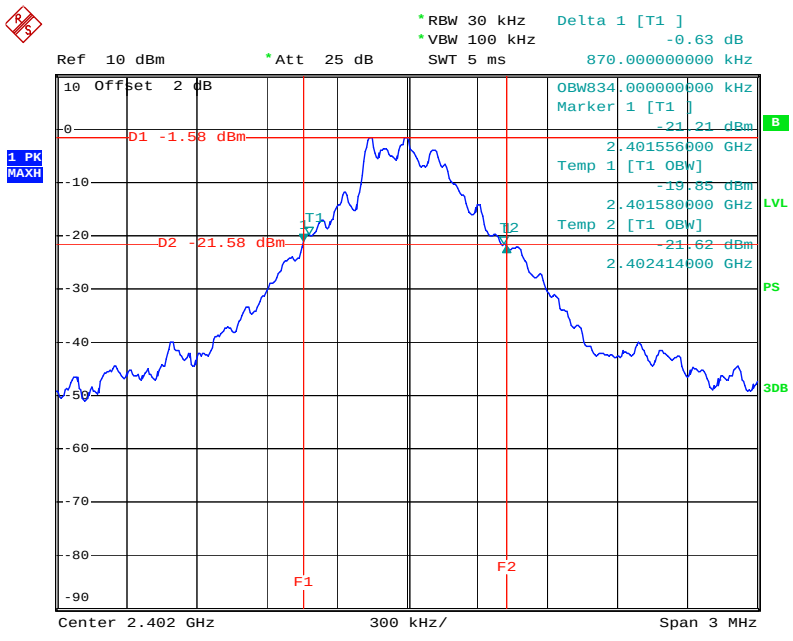
9.5 Test Data

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode (GFSK)		

Channel frequency (MHz)	99% OBW (kHz)	20dB Bandwidth (kHz)	20dB Bandwidth *2/3 (kHz)
2402	834.00	870.00	
2441	834.00	858.00	
2480	834.00	864.00	

GFSK TX Mode

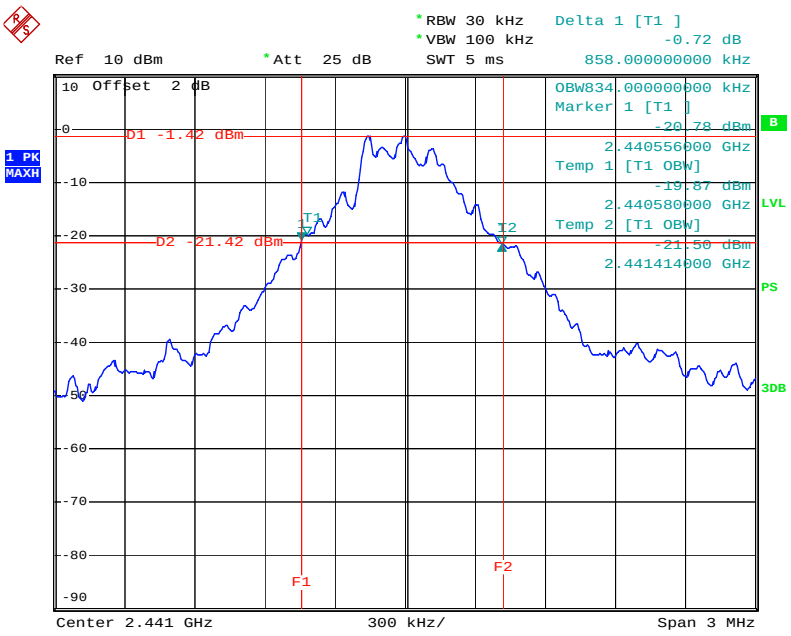
2402 MHz



Date: 10.JUN.2015 10:11:49

GFSK TX Mode

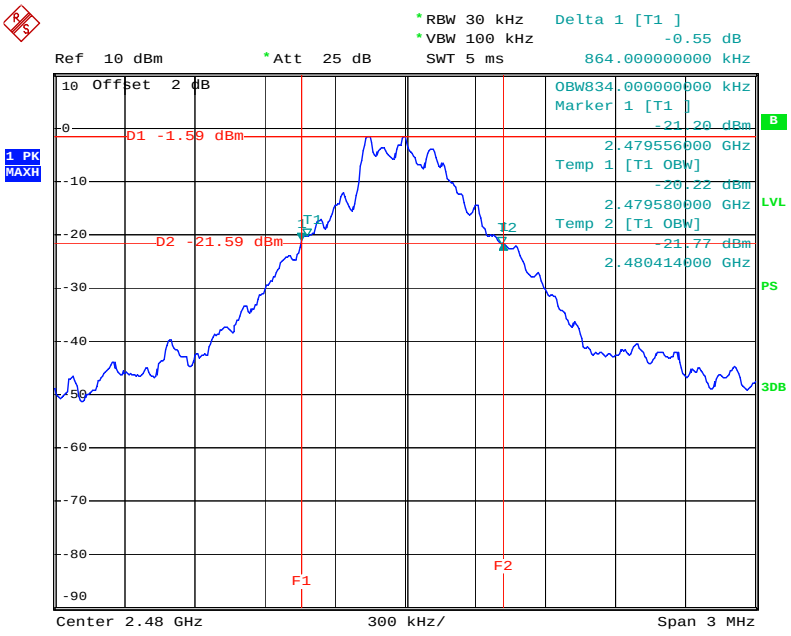
2441 MHz



Date: 10.JUN.2015 10:13:57

GFSK TX Mode

2480 MHz



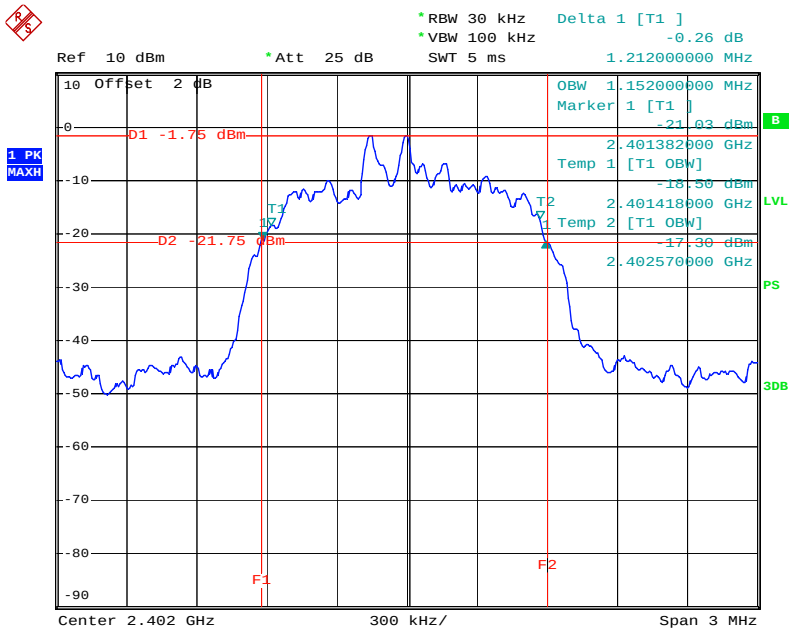
Date: 10.JUN.2015 10:21:19

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode (π /4-DQPSK)		

Channel frequency (MHz)	99% OBW (kHz)	20dB Bandwidth (kHz)	20dB Bandwidth *2/3 (kHz)
2402	1152.00	1212.00	808.00
2441	1152.00	1218.00	812.00
2480	1152.00	1218.00	812.00

π /4-DQPSK TX Mode

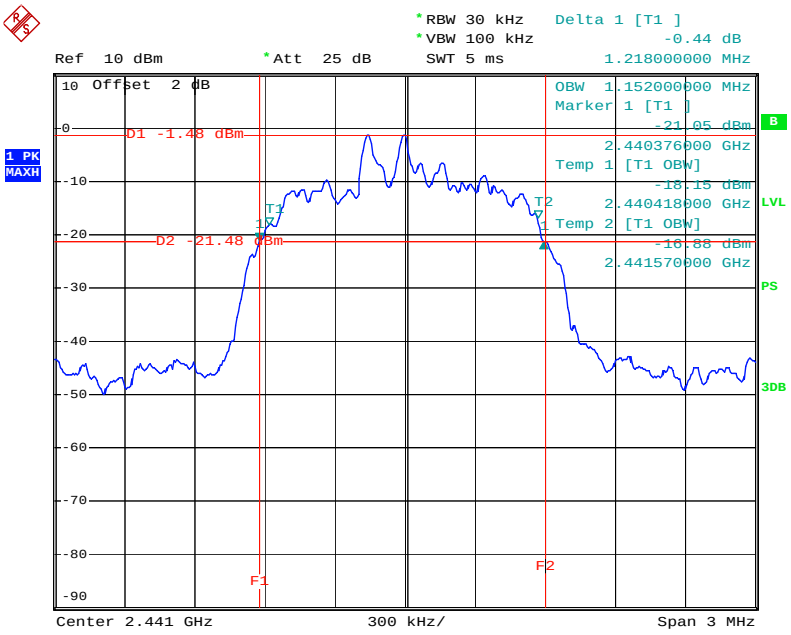
2402 MHz



Date: 10.JUN.2015 10:23:45

π/4-DQPSK TX Mode

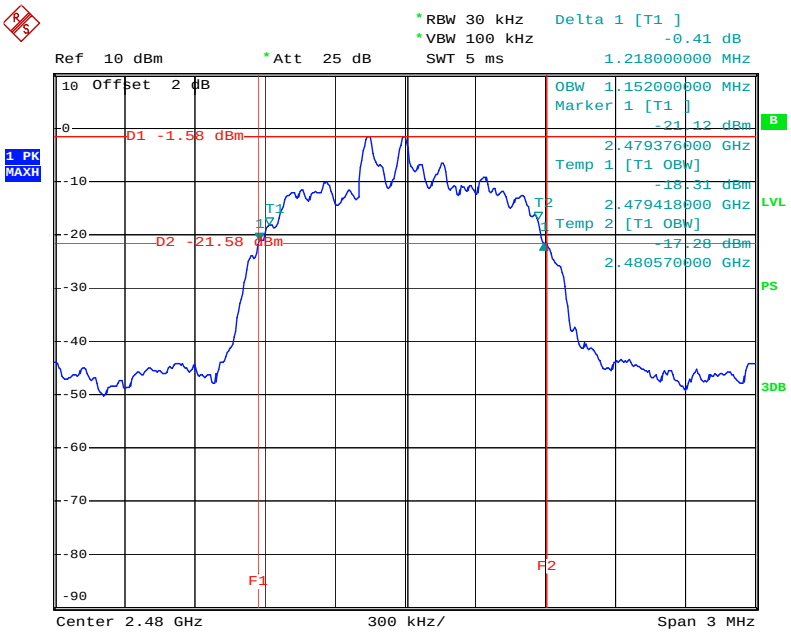
2441 MHz



Date: 10.JUN.2015 10:25:58

π/4-DQPSK TX Mode

2480 MHz



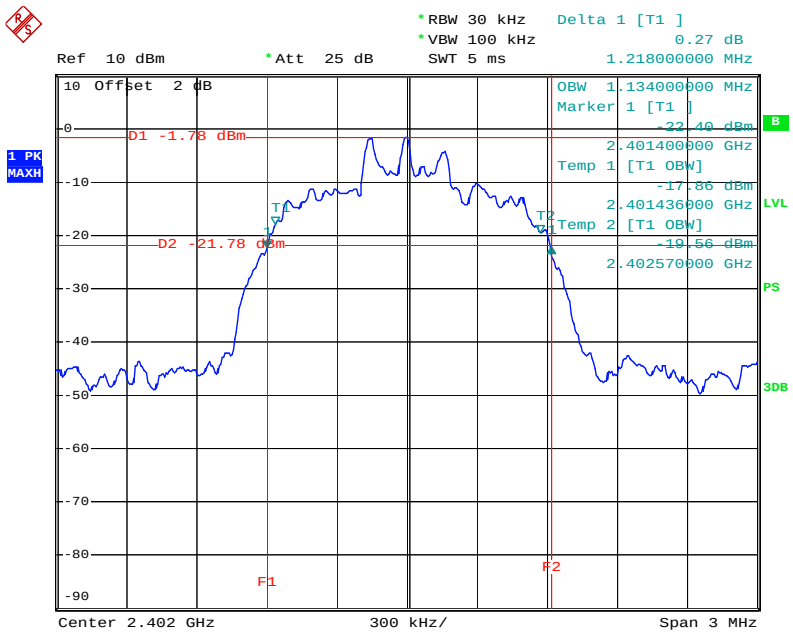
Date: 10.JUN.2015 10:27:45

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode (8-DPSK)		

Channel frequency (MHz)	99% OBW (kHz)	20dB Bandwidth (kHz)	20dB Bandwidth *2/3 (kHz)
2402	1134.00	1218.00	812.00
2441	1134.00	1212.00	808.00
2480	1134.00	1212.00	808.00

8-DPSK TX Mode

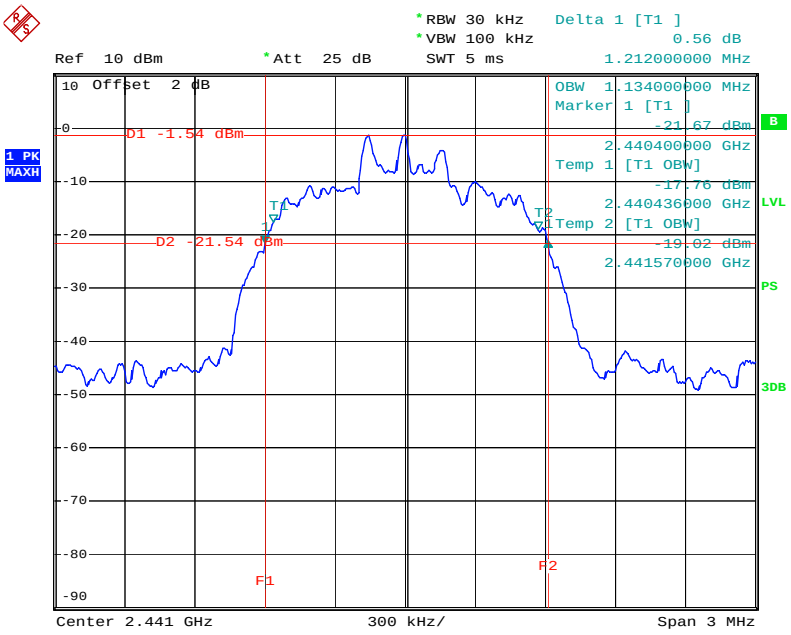
2402 MHz



Date: 10.JUN.2015 10:33:49

8-DPSK TX Mode

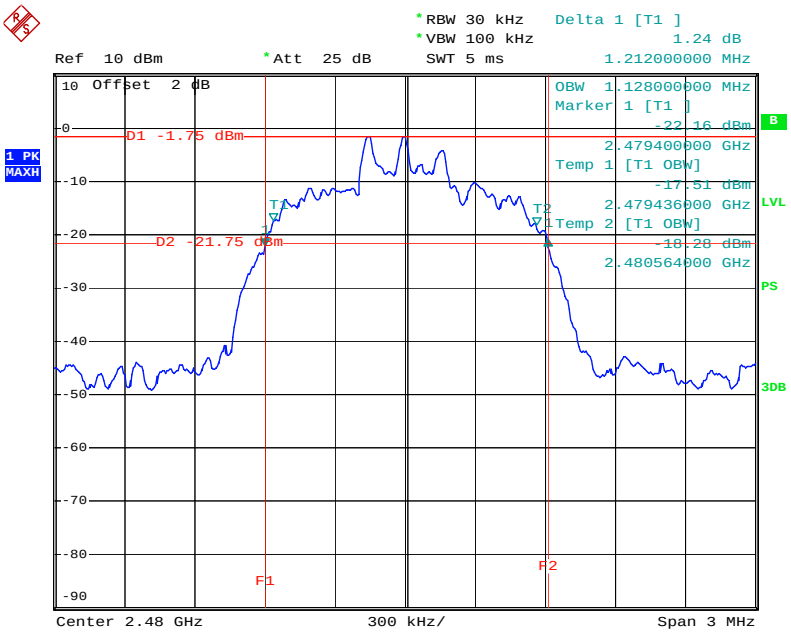
2441 MHz



Date: 10.JUN.2015 10:31:31

8-DPSK TX Mode

2480 MHz



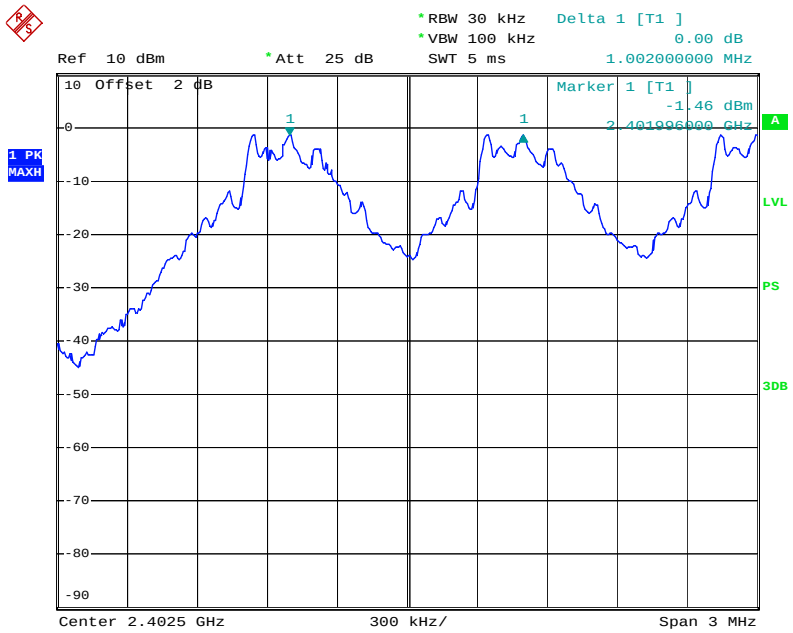
Date: 10.JUN.2015 10:29:52

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (GFSK)		

Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
2402	1002.00	870.00
2441	1002.00	858.00
2480	1002.00	864.00

GFSK Hopping Mode

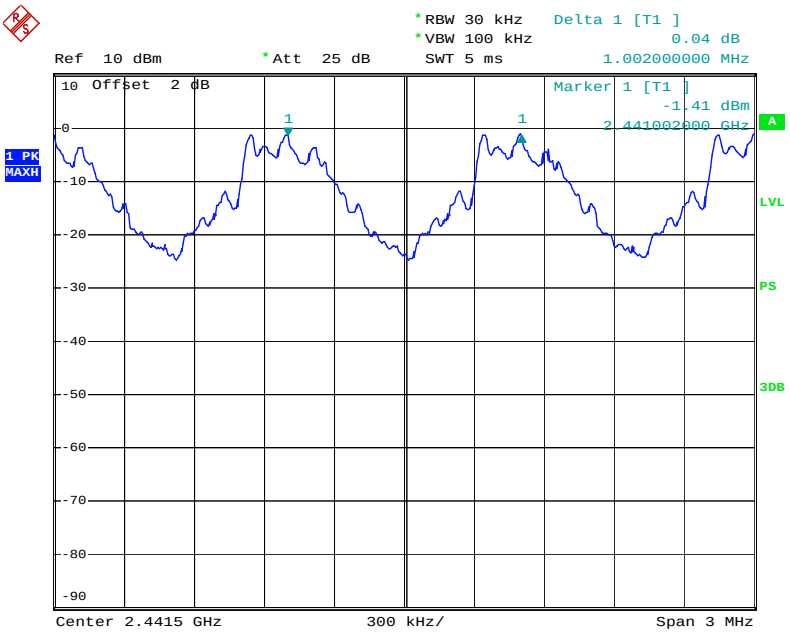
2402 MHz



Date: 11.JUN.2015 16:18:44

GFSK Hopping Mode

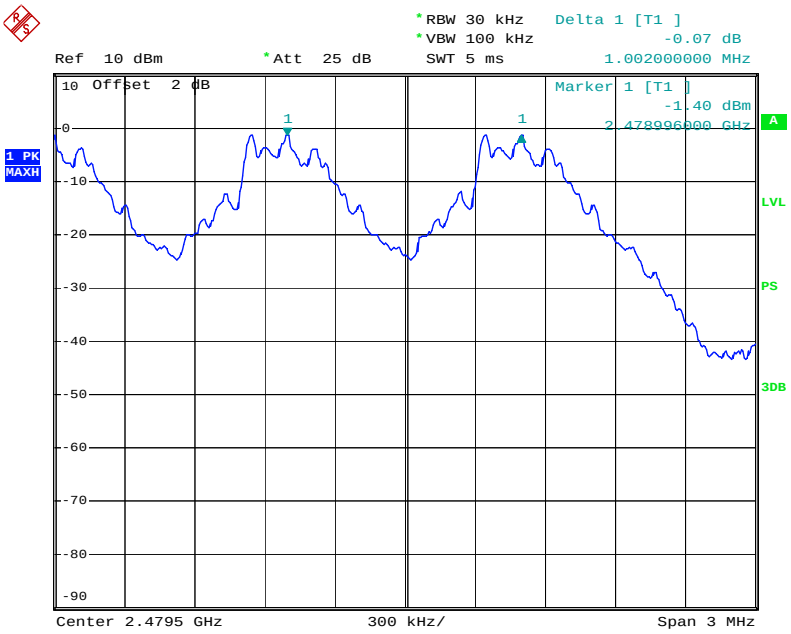
2441 MHz



Date: 11.JUN.2015 16:20:06

GFSK Hopping Mode

2480 MHz



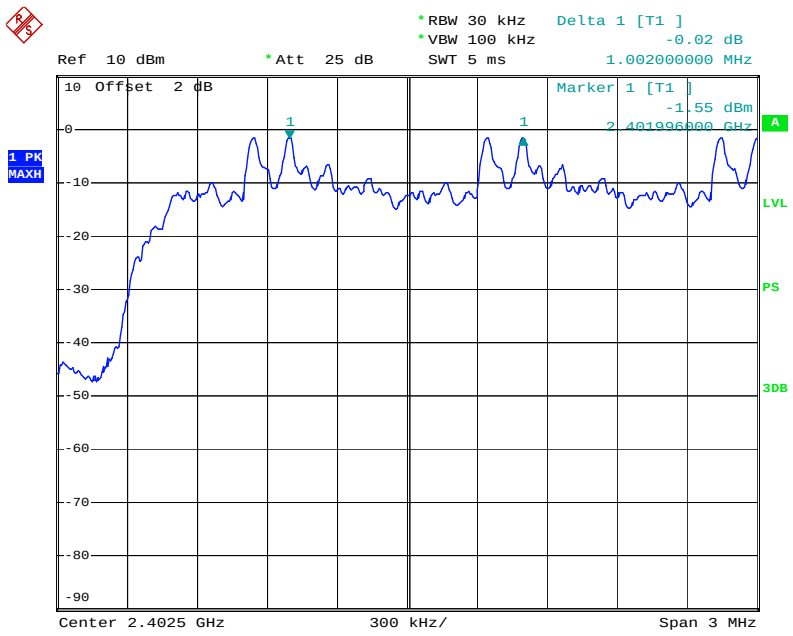
Date: 11.JUN.2015 16:21:27

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (π/4-DQPSK)		

Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
2402	1002.00	808.00
2441	1002.00	812.00
2480	1002.00	812.00

π/4-DQPSK Hopping Mode

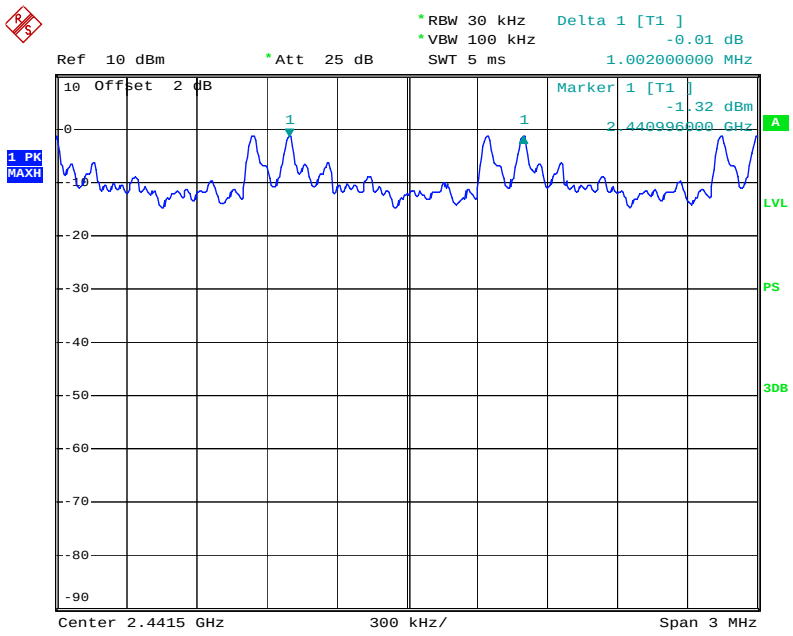
2402 MHz



Date: 11.JUN.2015 16:24:34

π/4-DQPSK Hopping Mode

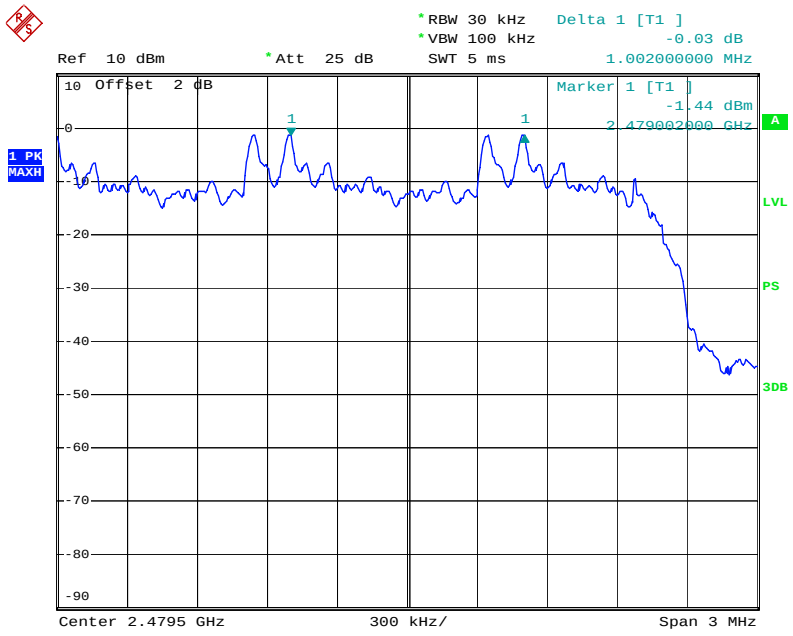
2441 MHz



Date: 11.JUN.2015 16:23:40

π/4-DQPSK Hopping Mode

2480 MHz



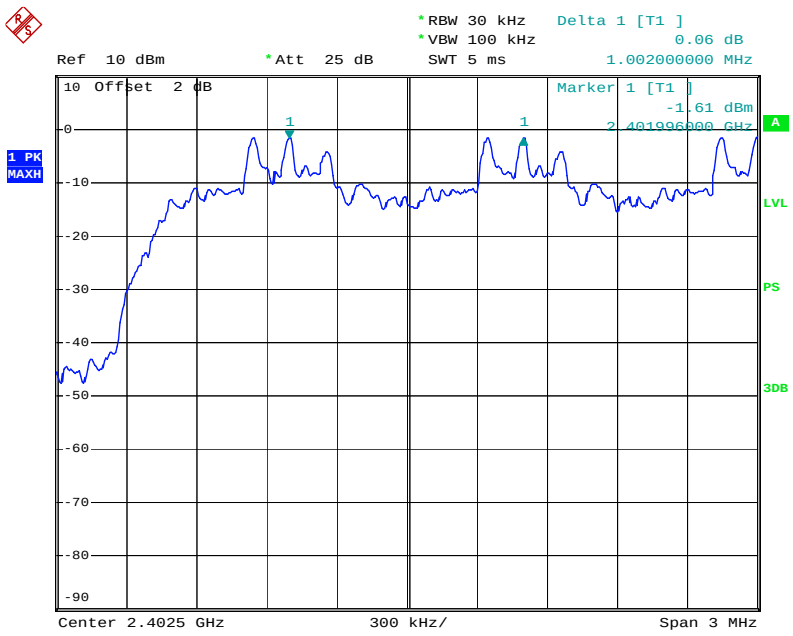
Date: 11.JUN.2015 16:22:24

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (8-DPSK)		

Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
2402	1002.00	812.00
2441	1002.00	808.00
2480	1002.00	808.00

8-DPSK Hopping Mode

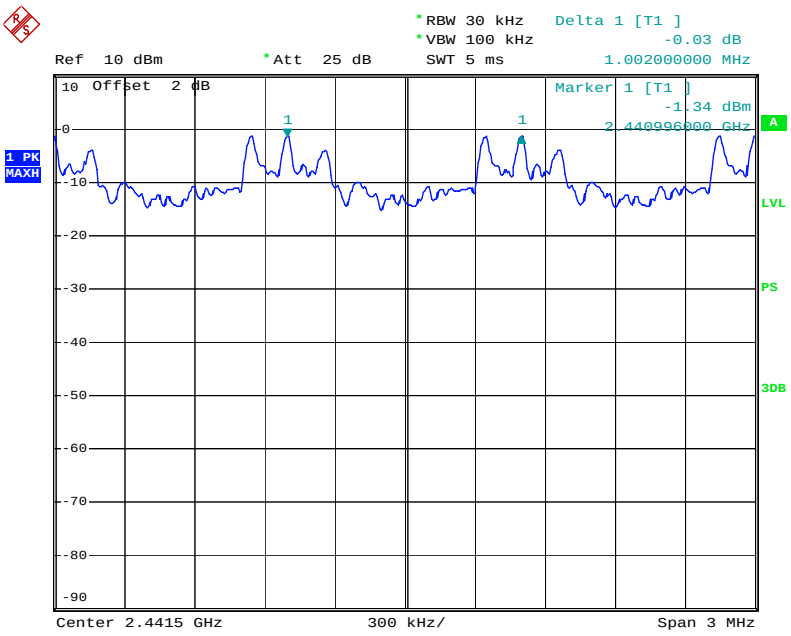
2402 MHz



Date: 11.JUN.2015 16:25:22

8-DPSK Hopping Mode

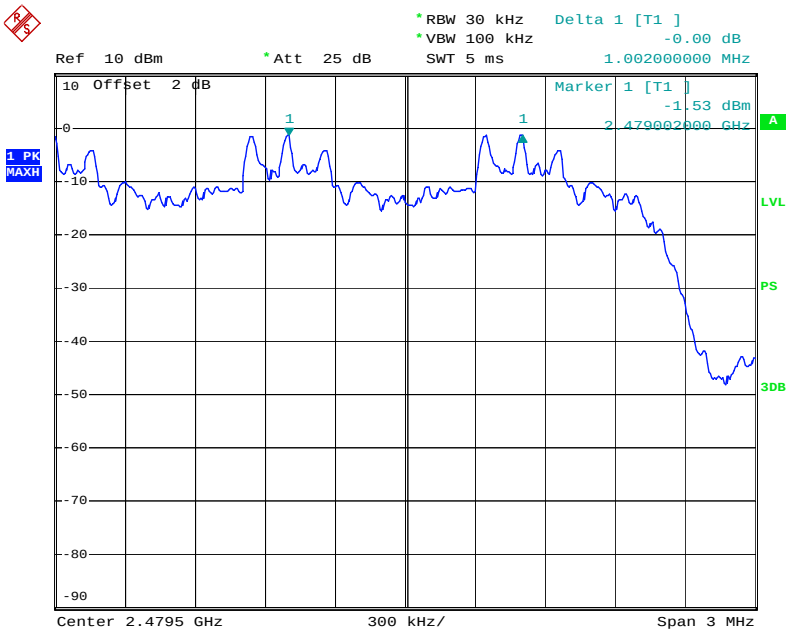
2441 MHz



Date: 11.JUN.2015 16:26:20

8-DPSK Hopping Mode

2480 MHz



Date: 11.JUN.2015 16:27:20

10. Peak Output Power Test

10.1 Test Standard and Limit

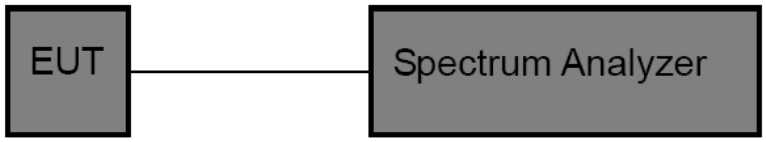
10.1.1 Test Standard

FCC Part 15.247 (b) (1)

10.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm) Other <125 mW(21dBm)	2400~2483.5

10.2 Test Setup



10.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2) Spectrum Setting:

Peak Detector: RBW=1 MHz, VBW=3 MHz for bandwidth less than 1MHz.

RBW=3 MHz, VBW=3 MHz for bandwidth more than 1MHz.

10.4 EUT Operating Condition

The EUT was set to continuously transmitting in the max power during the test.

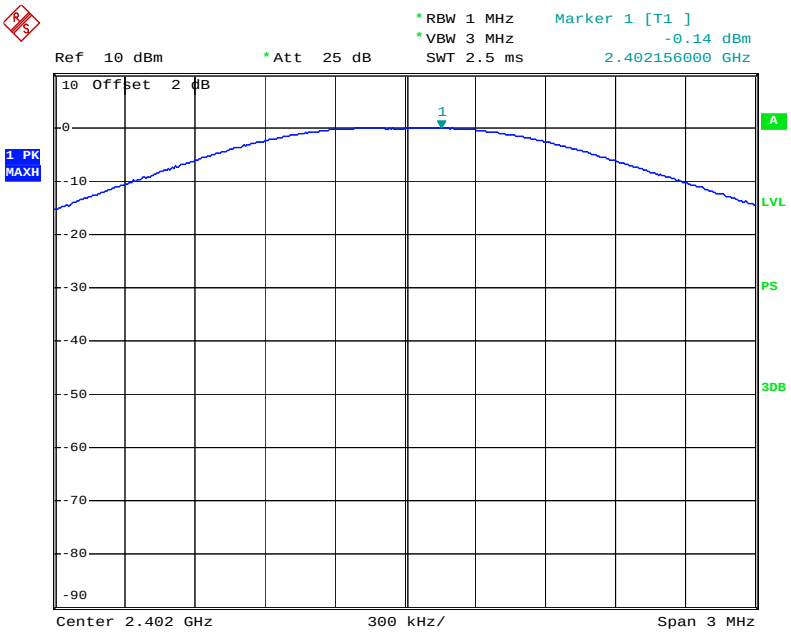
10.5 Test Data

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode (GFSK)		

Channel frequency (MHz)	Test Result (dBm)	Limit (dBm)
2402	-0.14	30
2441	0.10	
2480	-0.14	

GFSK TX Mode

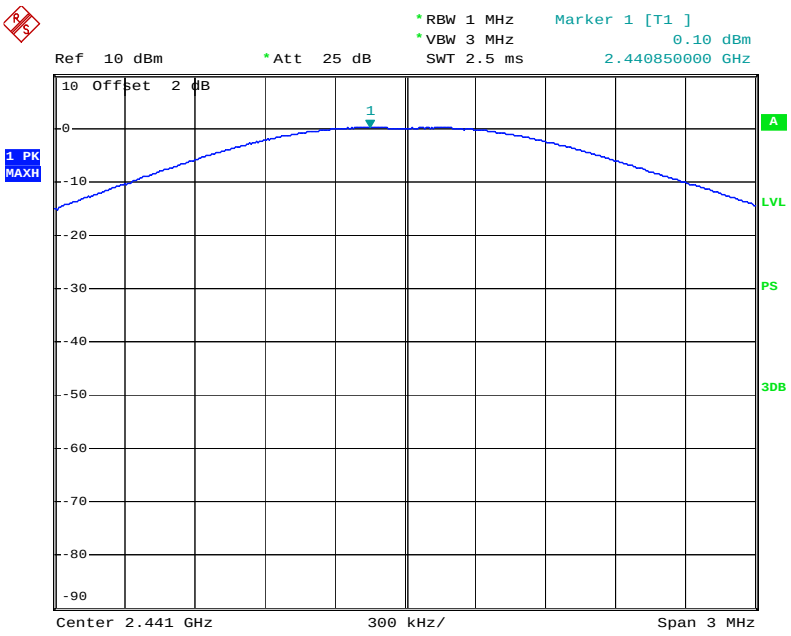
2402 MHz



Date: 10.JUN.2015 10:12:10

GFSK TX Mode

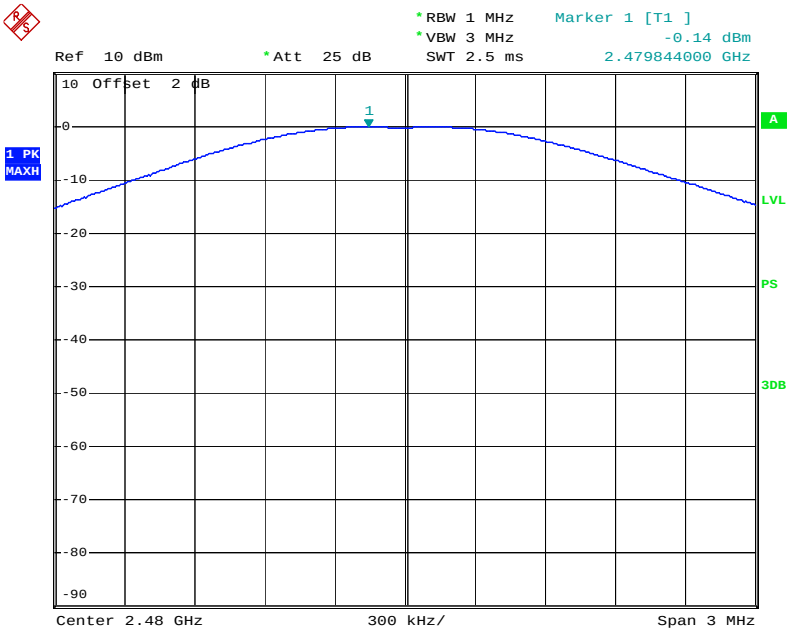
2441 MHz



Date: 10.JUN.2015 10:12:37

GFSK TX Mode

2480 MHz



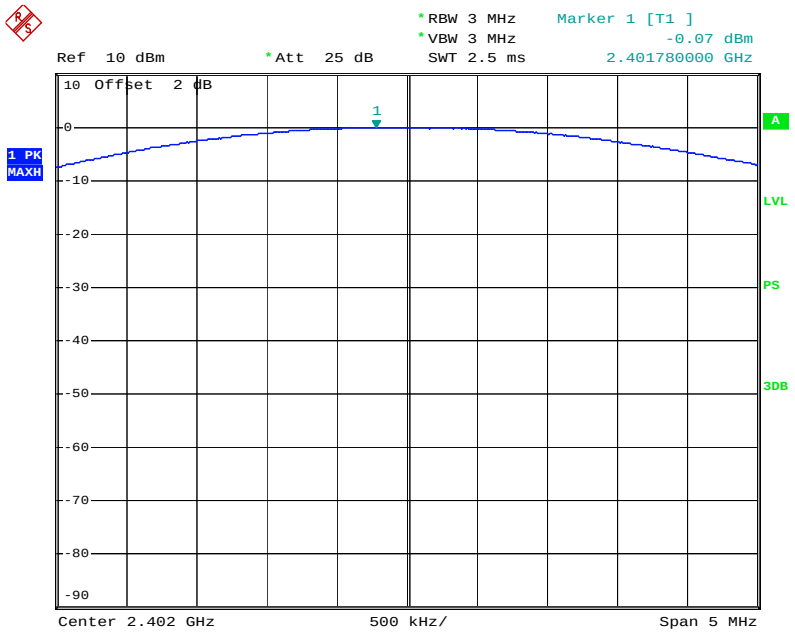
Date: 10.JUN.2015 10:20:18

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode (π /4-DQPSK)		

Channel frequency (MHz)	Test Result (dBm)	Limit (dBm)
2402	-0.07	21
2441	0.18	
2480	-0.09	

π /4-DQPSK TX Mode

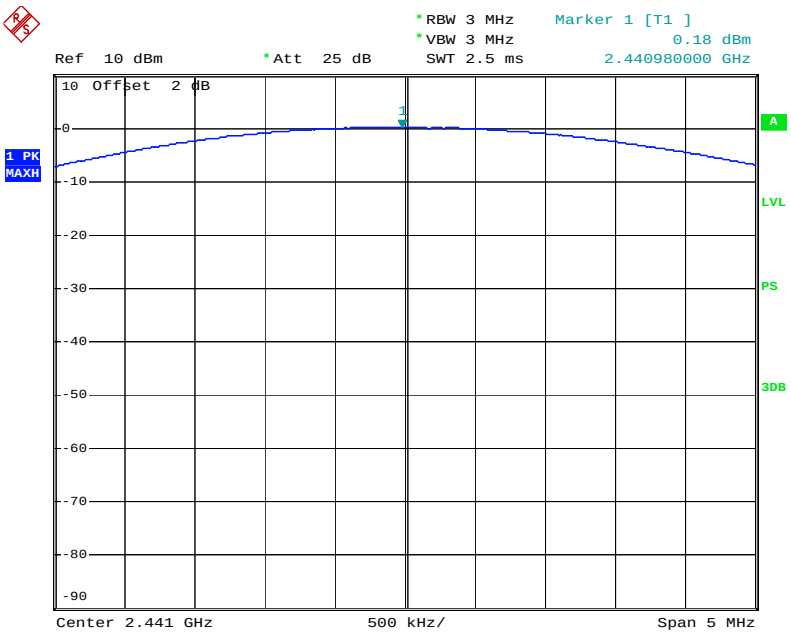
2402 MHz



Date: 10.JUN.2015 10:24:12

π/4-DQPSK TX Mode

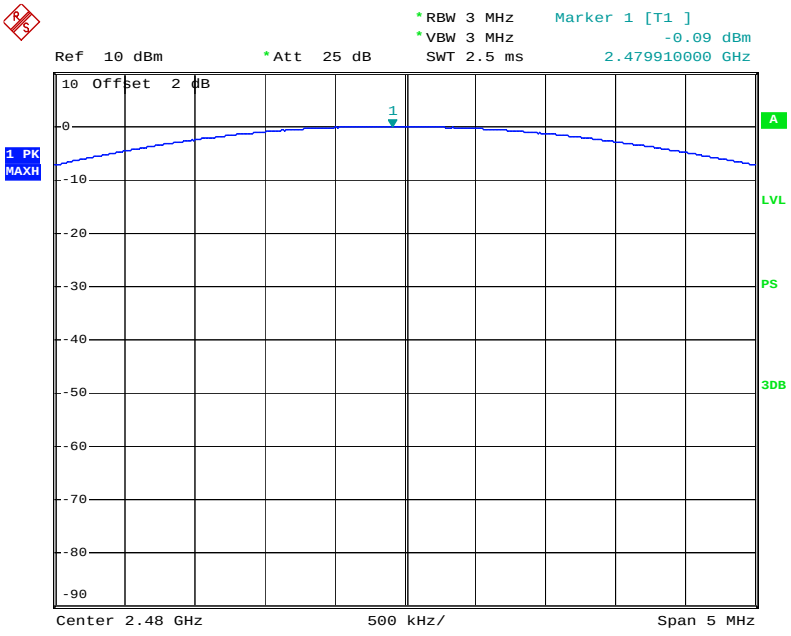
2441 MHz



Date: 10.JUN.2015 10:24:40

π/4-DQPSK TX Mode

2480 MHz



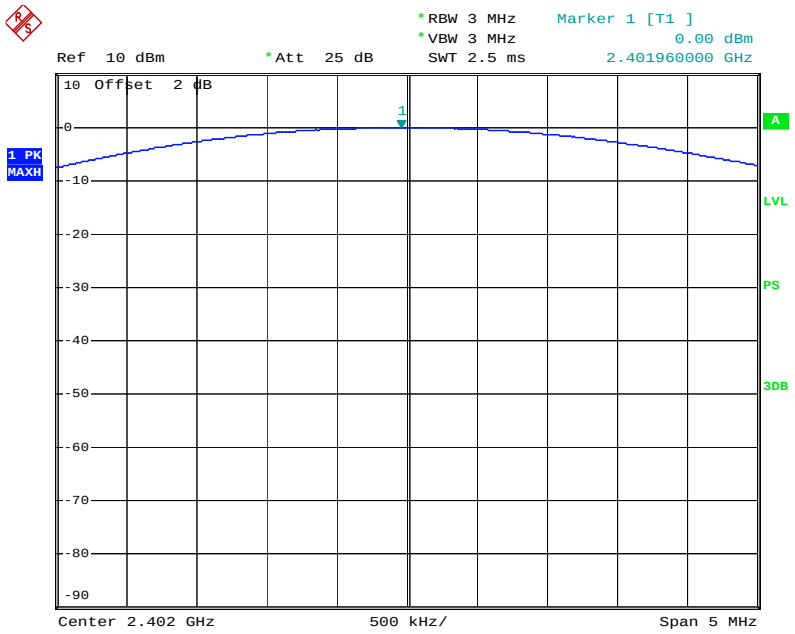
Date: 10.JUN.2015 10:28:11

EUT:	Voyager Bluetooth Keyboard and Case	Model Name :	SL008
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode (8-DPSK)		

Channel frequency (MHz)	Test Result (dBm)	Limit (dBm)
2402	0.00	21
2441	0.19	
2480	0.01	

8-DPSK TX Mode

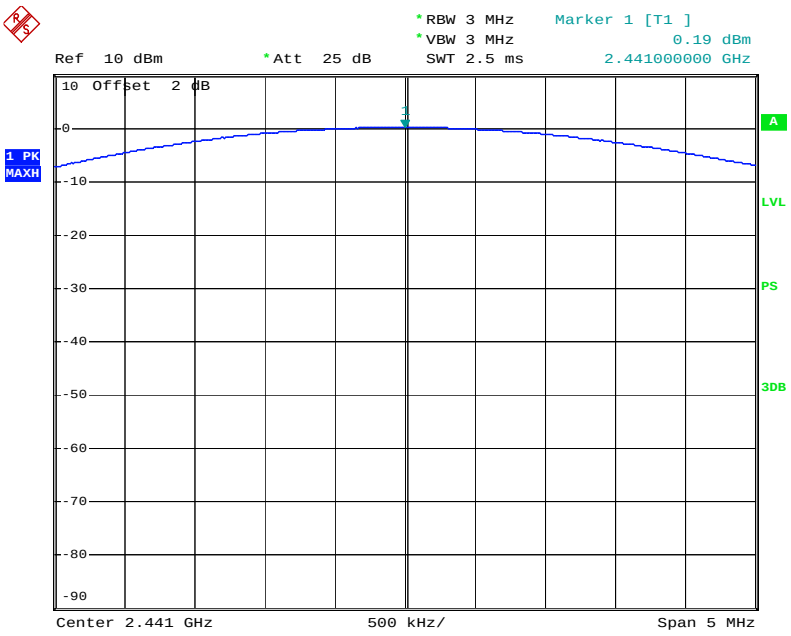
2402 MHz



Date: 10.JUN.2015 10:32:48

8-DPSK TX Mode

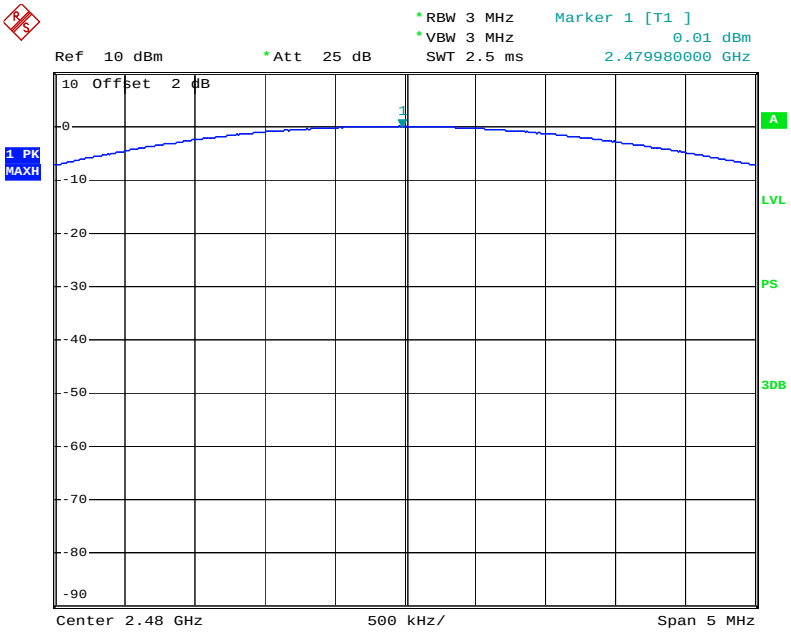
2441 MHz



Date: 10.JUN.2015 10:32:01

8-DPSK TX Mode

2480 MHz



Date: 10.JUN.2015 10:28:45

11. Antenna Requirement

10.1 Standard Requirement

10.1.1 Standard

FCC Part 15.203

10.1.2 Requirement

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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

10.2 Antenna Connected Construction

The directional gains of the antenna used for transmitting is 2 dBi, and the antenna connector is de-signed with permanent attachment and no consideration of replacement. Please see the EUT photo for details.

Result

The EUT antenna is a PCB Antenna. It complies with the standard requirement.

Antenna Type
☑ Permanent attached antenna
☐ Unique connector antenna
☐ Professional installation antenna