

Shenzhen Toby Technology Co., Ltd.

Report No.: TB-FCC143532
Page: 1 of 85

FCC Radio Test Report FCC ID: 2AEEF-1440

Original Grant

Report No. : TB-FCC143532

Applicant: Sunstar Digi CO.,LTD.

Equipment Under Test (EUT)

EUT Name : Bluetooth Speaker Shutter

Model No. : 1440

Series Model No. : 1441, 1442, 1443, 1444, 1445, 1446, 1447, 1448, JTL-6

Brand Name: Groove Cube

Receipt Date : 2015-03-05

Test Date : 2015-03-06 to 2015-03-18

Issue Date : 2015-03-19

Standards : FCC Part 15: 2014, Subpart C(15.247)

Test Method : ANSI C63.4:2009, 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 :

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.

TB-RF-074-1.0



Contents

COI	NTENTS	2
1.	GENERAL INFORMATION ABOUT EUT	4
	1.1 Client Information	4
	1.2 General Description of EUT (Equipment Under Test)	4
	1.3 Block Diagram Showing the Configuration of System Tested	6
	1.4 Description of Support Units	6
	1.5 Description of Test Mode	7
	1.6 Description of Test Software Setting	
	1.7 Test Facility	8
2.	TEST SUMMARY	
3.	CONDUCTED EMISSION TEST	10
	3.1 Test Standard and Limit	10
	3.2 Test Setup	10
	3.3 Test Procedure	10
	3.4 Test Equipment Used	11
	3.5 EUT Operating Mode	
	3.6 Test Data	11
4.	RADIATED EMISSION TEST	14
	4.1 Test Standard and Limit	14
	4.2 Test Setup	15
	4.3 Test Procedure	16
	4.4 EUT Operating Condition	
	4.5 Test Equipment	
5.	RESTRICTED BANDS REQUIREMENT	32
	5.1 Test Standard and Limit	32
	5.2 Test Setup	32
	5.3 Test Procedure	
	5.4 EUT Operating Condition	
	5.5 Test Equipment	
6.	NUMBER OF HOPPING CHANNEL	46
	6.1 Test Standard and Limit	46
	6.2 Test Setup	
	6.3 Test Procedure	
	6.4 EUT Operating Condition	
	6.5 Test Equipment	
	6.6 Test Data	
7.	AVERAGE TIME OF OCCUPANCY	
	7.1 Test Standard and Limit	
	7.2 Test Setup	
	7.3 Test Procedure	48



Page: 3 of 85

	7.4 EUT Operating Condition	48
	7.5 Test Equipment	48
	7.6 Test Data	49
8.	CHANNEL SEPARATION AND BANDWIDTH TEST	67
	8.1 Test Standard and Limit	67
	8.2 Test Setup	
	8.3 Test Procedure	
	8.4 EUT Operating Condition	67
	8.5 Test Equipment	68
	8.6 Test Data	
9.	PEAK OUTPUT POWER TEST	78
	9.1 Test Standard and Limit	78
	9.2 Test Setup	78
	9.3 Test Procedure	78
	9.4 EUT Operating Condition	
	9.5 Test Equipment	78
	9.6 Test Data	78
10.	ANTENNA REQUIREMENT	85
	10.1 Standard Requirement	85
	10.2 Antenna Connected Construction	



Page: 4 of 85

1. General Information about EUT

1.1 Client Information

Applicant: Sunstar Digi CO.,LTD.

Address: 2-3 Floor, F Building, Guanlong 1st Industrial Zone, Xili Town,

Nanshan District, Shenzhen, China

Manufacturer : Sunstar Digi CO.,LTD.

Address: 2-3 Floor, F Building, Guanlong 1st Industrial Zone, Xili Town,

Nanshan District, Shenzhen, China

1.2 General Description of EUT (Equipment Under Test)

FUT Name					
EUT Name	:	Bluetooth Speaker Shutter			
Models No.	:	1440, 1441, 1442, 1443, 1444, 1445, 1446, 1447, 1448, JTL-6			
Brand Name	:	Groove Cube	Groove Cube		
Model	:	All models are identical in the	same PCB layout, interior structure and		
difference		electrical circuits, The only dif	ference is model name for commercial		
		purpose.			
		Operation Frequency:			
		Bluetooth:2402~2480MHz			
		Number of Channel:	Bluetooth:79 Channels see note (2)		
Product Description	:	Max Peak Output Power:	GFSK: -2.594dBm (Conducted Power)		
Bescription		Antenna Gain:	1.3 dBi PCB Antenna		
		Modulation Type:	GFSK 1Mbps(1 Mbps)		
			π /4-DQPSK(2 Mbps)		
			8-DPSK(3 Mbps)		
Dawer Cumple		DC power by USB cable form Host System			
Power Supply	:	DC power by Li-ion battery			
Power Rating	:				
		DC 3.7V by 180mAh Li-ion Battery.			
Connecting I/O	:	Please refer to the User's Manual			
Port(S)					

Note:

- (1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
- (2) This Test Report is FCC Part 15.247 for Bluetooth, and test procedure in accordance with Public Notice: DA 00-705.

(3) Channel List:

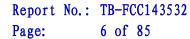
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456



Page: 5 of 85

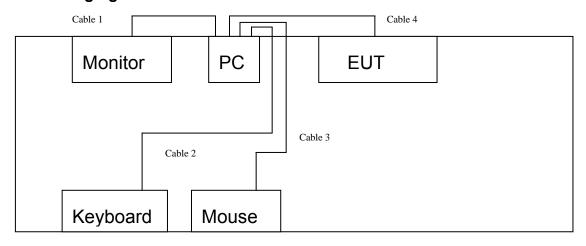
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	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		

⁽⁴⁾ The Antenna information about the equipment is provided by the applicant.

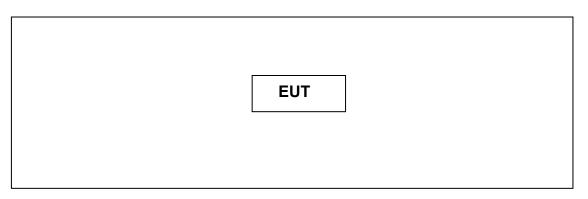




1.3 Block Diagram Showing the Configuration of System Tested USB Charging with TX Mode



TX Mode



1.4 Description of Support Units

Equipment Information							
Name	Model	FCC ID/DOC	Manufacturer	Used "√"			
LCD Monitor	E170Sc	DOC	DELL	√			
PC	OPTIPLEX380	DOC	DELL	√			
Keyboard	L100	DOC	DELL	√			
Mouse	M-UARDEL7	DOC	DELL	√			
	Cable Information						
Number	Number Shielded Type Ferrite Core Length Note						
Cable 1	YES	YES	1.5M				
Cable 2	YES	YES	1.5M				
Cable 3	YES	NO	1.5M				
Cable 4	YES	NO	0.3M	Accessories			



Page: 7 of 85

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(IT /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)			
Remark: Only showed the worst mode data of GFSK and 8-DPSK mode.			

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 C63.4 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.



Page: 8 of 85

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	AppoTech RF Control Kit V3.6		
Frequency	2402 MHz	2441MHz	2480 MHz
GFSK	DEF	DEF	DEF
π /4-DQPSK	DEF	DEF	DEF
8-DPSK	DEF	DEF	DEF

1.7 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.



Page: 9 of 85

2. Test Summary

FCC Part 15 Subpart C(15.247)				
Standard Section	Test Item	Judgment	Remark	
15.203	Antenna Requirement	PASS	N/A	
15.207	Conducted Emission	PASS	N/A	
15.205	Restricted Bands	PASS	N/A	
15.247(a)(1)	Hopping Channel Separation	PASS	N/A	
15.247(a)(1)	Dwell Time	PASS	N/A	
15.247(b)(1)	Peak Output Power	PASS	N/A	
15.247(b)(1)	Number of Hopping Frequency	PASS	N/A	
15.247(c)	Radiated Spurious Emission	PASS	N/A	
15.247(c)	Antenna Conducted Spurious Emission	PASS	N/A	
15.247(a)	20dB Bandwidth	PASS	N/A	
Note: N/A is an abbreviation for Not Applicable.				



Page: 10 of 85

3. Conducted Emission Test

3.1 Test Standard and Limit

3.1.1Test Standard FCC Part 15.207

3.1.2 Test Limit

Conducted Emission Test Limit

Eroguanov	Maximum RF Line Voltage (dBμV)		
Frequency	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.

3.2 Test Setup



3.3 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.



Report No.: TB-FCC143532 Page: 11 of 85

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.

3.4 Test Equipment Used

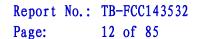
Description	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
EMI Test	ROHDE&		400224	Aug. 08, 2014	Aug.07, 2015
Receiver	SCHWARZ	ESCI	100321	Aug. 00, 2014	Aug.07, 2015
50ΩCoaxial	Anritsu	MP59B	X10321	Aug. 08, 2014	Aug.07, 2015
Switch	Aillitsu	MESSE	X10321	Aug. 08, 2014	Aug.07, 2015
L.I.S.N	Rohde & 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

3.5 EUT Operating Mode

Please refer to the description of test mode.

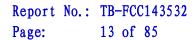
3.6 Test Data

Please see the next page.



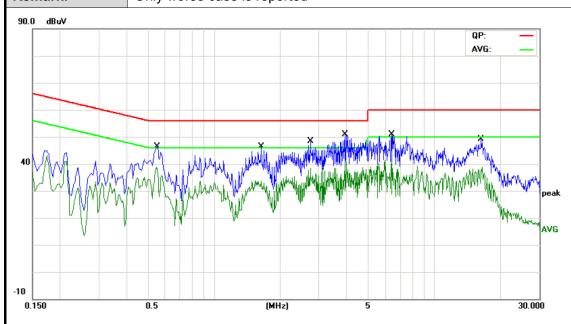


EUT: Bluetooth Speaker Shutter **Model Name:** 1440 25 ℃ Temperature: **Relative Humidity:** 55% **Test Voltage:** DC 5V Terminal: Line **Test Mode:** USB Charging with TX GFSK Mode 2402 MHz Remark: Only worse case is reported 90.0 dBuV QP: AVG: AVG -10 0.5 (MHz) 30.000 0.150 Reading Correct Measure-No. Mk. Limit Over Freq. Level Factor ment dBu∀ dΒ MHz dBuV dBuV dΒ Detector 0.5540 36.10 10.05 46.15 1 56.00 -9.85 QP 27.95 2 0.5540 10.05 38.00 46.00 -8.00 AVG 3 1.6380 31.44 10.06 41.50 56.00 -14.50 QΡ 1.6380 23.57 10.06 33.63 46.00 -12.37 AVG 4 5 2.6500 31.37 10.04 41.41 56.00 -14.59 QΡ 6 2.6500 25.22 10.04 35.26 46.00 -10.74 AVG 7 QΡ 3.9540 36.74 9.99 46.73 56.00 -9.27 8 3.9540 30.83 9.99 40.82 46.00 -5.18 AVG QΡ 9 6.4140 37.90 10.03 47.93 60.00 -12.07 50.00 10 6.4140 30.98 10.03 41.01 -8.99 AVG QΡ 11 16.3460 35.10 10.23 45.33 60.00 -14.67 12 16.3460 27.78 10.23 38.01 50.00 -11.99 AVG **Emission Level= Read Level+ Correct Factor**





EUT: Bluetooth Speaker Shutter **Model Name:** 1440 Temperature: 25 ℃ **Relative Humidity:** 55% DC 5V **Test Voltage:** 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		0.5540	36.12	10.05	46.17	56.00	-9.83	QP
2		0.5540	28.01	10.05	38.06	46.00	-7.94	AVG
3		1.6380	30.59	10.06	40.65	56.00	-15.35	QP
4		1.6380	23.01	10.06	33.07	46.00	-12.93	AVG
5		2.7500	32.94	10.04	42.98	56.00	-13.02	QP
6		2.7500	27.34	10.04	37.38	46.00	-8.62	AVG
7		3.9540	35.35	9.99	45.34	56.00	-10.66	QP
8	*	3.9540	29.32	9.99	39.31	46.00	-6.69	AVG
9		6.4140	36.50	10.03	46.53	60.00	-13.47	QP
10		6.4140	29.44	10.03	39.47	50.00	-10.53	AVG
11		16.3460	32.26	10.23	42.49	60.00	-17.51	QP
12		16.3460	24.71	10.23	34.94	50.00	-15.06	AVG



Page: 14 of 85

4. Radiated Emission Test

4.1 Test Standard and Limit

4.1.1 Test Standard FCC Part 15.209

4.1.2 Test Limit

Radiated Emission Limit (9 kHz~1000MHz)

readilated Emileoien Emile (e mile 1000mile)						
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	Class B (dBuV/m)(at 3m)				
(MHz)	Peak	Average			
Above 1000	74	54			

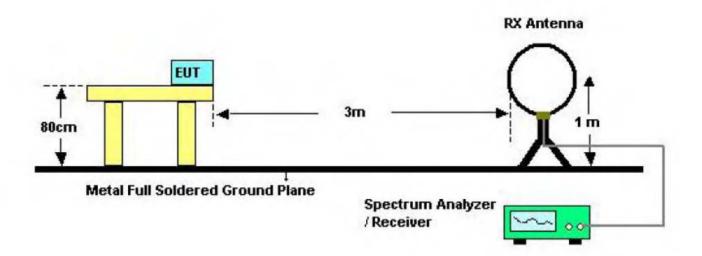
Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission Level (dBuV/m)=20log Emission Level (uV/m)

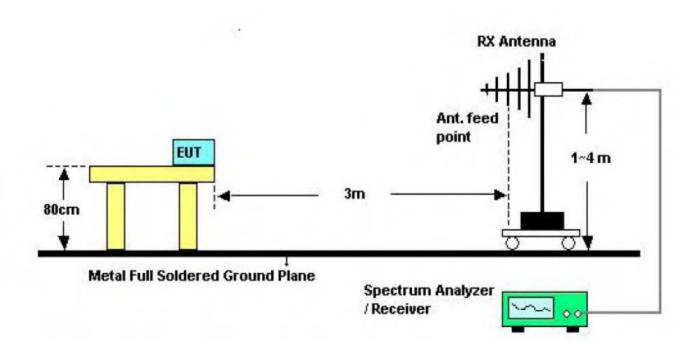


Page: 15 of 85

4.2 Test Setup

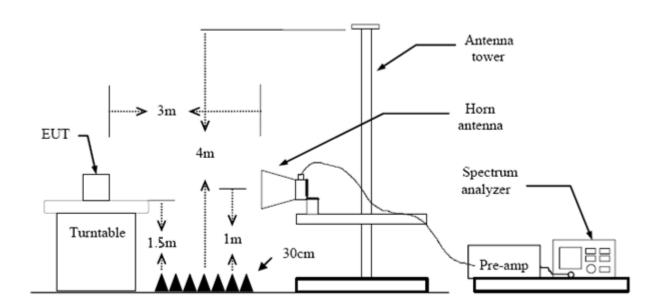


Bellow 30MHz Test Setup



Bellow 1000MHz Test Setup





Above 1GHz Test Setup

4.3 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.



Page: 17 of 85

4.4 EUT Operating Condition

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

4.5 Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Aug. 08, 2014	Aug.07, 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	Feb. 10, 2015	Feb.09, 2016
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A

4.6 Test Data

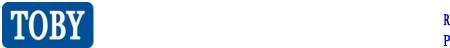
Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=1 kHz with Peak Detector for Average Values.

Test data please refer the following pages.



Report No.: TB-FCC143532 Page: 18 of 85

EUT:	Bluetooth Sp	eaker Shutter	Model Nan	ne :	1440				
Temperature:	25 ℃ Relative Humidity: 55%								
Test Voltage:	DC 5V	DC 5V							
Ant. Pol.	Horizontal								
Test Mode:	TX GFSK Mo	de 2402MHz							
Remark: Only worse case is reported									
80.0 dBuV/m									
-20	of the design of the later of t	2 X X X X X X X X X X X X X X X X X X X	\$ XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	(RF)FCC 15C	3M Radiation Margin -6	dB			
30.000 40 50	60 70 80	(MHz)	300	400 500	600 700	1000.000			
No. Mk. Fr	Readii eq. Leve	-	Measure- ment	Limit	Over				
M	Hz dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector			
1 31.8	31.60	0 -15.10	16.50	40.00	-23.50	peak			
2 122.4	4040 46.78	3 -22.43	24.35	43.50	-19.15	peak			
3 * 160.9	9089 54.69	9 -20.57	34.12	43.50	-9.38	peak			
4 227.0	6906 37.40	-19.18	18.22	46.00	-27.78	peak			
5 300.3	3672 38.8	3 -17.07	21.76	46.00	-24.24	peak			
6 375.9	9385 37.84	4 -14.40	23.44	46.00	-22.56	peak			
*:Maximum data x:C	Over limit !:over ma								



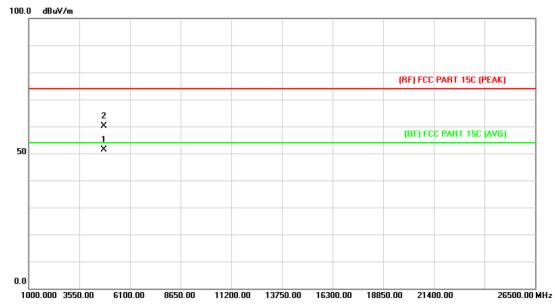
Report No.: TB-FCC143532 Page: 19 of 85

EUT:	Bluetooth Speak	er Shutter	Model Nam	e :	1440		
Temperature:	25 ℃	Relative Hu	Relative Humidity: 55%				
Test Voltage:	DC 5V						
Ant. Pol.	Vertical						
Test Mode:	TX GFSK Mode	2402MHz					
Remark:	Only worse case	e is reported					
80.0 dBuV/m							
30 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Reading Level	(MHz) Correct Factor	300 Measure- ment	Maril Marildon and	5C 3M Radiation Margin -6 00 600 700 Over		
MH	<u> </u>	dB/m	dBuV/m	dBuV/m	dB	Detector	
1 31.50		-14.89	23.46	40.00	-16.54	peak	
2 35.87	746 42.65	-17.60	25.05	40.00	-14.95	peak	
3 40.13	347 41.11	-20.22	20.89	40.00	-19.11	peak	
4 91.81	163 50.23	-22.53	27.70	43.50	-15.80	peak	
5 119.8	556 57.11	-22.50	34.61	43.50	-8.89	peak	
6 * 160.3	456 56.16	-20.53	35.63	43.50	-7.87	peak	
*:Maximum data x:0	ver limit !:over margin						



Page: 20 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440			
Temperature:	25 ℃	Relative Humidity:	55%			
Test Voltage:	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.						
prescribed liftit.						

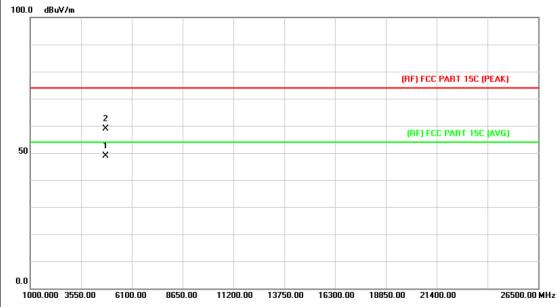


N	No.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
			MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		*	4804.012	37.96	13.44	51.40	54.00	-2.60	AVG
2			4804.084	46.63	13.44	60.07	74.00	-13.93	peak



Page: 21 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440		
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.					

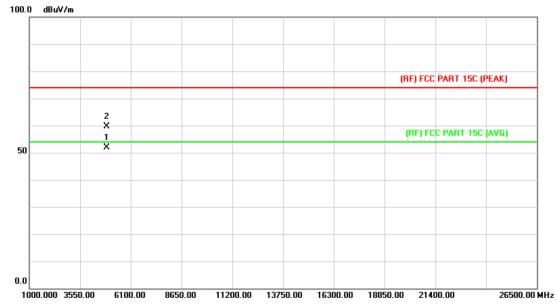


1	No.	Mk.	Freq.	_		Measure- ment	Limit	Over	
			MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		*	4803.979	35.41	13.44	48.85	54.00	-5.15	AVG
2			4804.144	45.49	13.44	58.93	74.00	-15.07	peak



Page: 22 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440		
Temperature: 25 ℃		Relative Humidity:	55%		
Test Voltage: DC 3.7V					
Ant. Pol.	Horizontal				
Test Mode:	TX GFSK Mode 2441MHz				
Remark:	elow the				

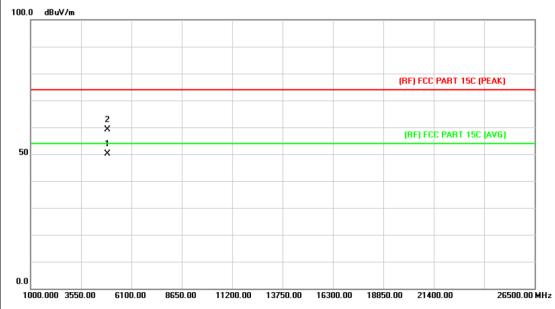


N	o. Mł	c. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4882.018	38.10	13.90	52.00	54.00	-2.00	AVG
2		4882.030	45.69	13.90	59.59	74.00	-14.41	peak



Page: 23 of 85

EUT:	Bluetooth Speaker Shutter	1440					
Temperature:	25 ℃	25 °C Relative Humidity:					
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						

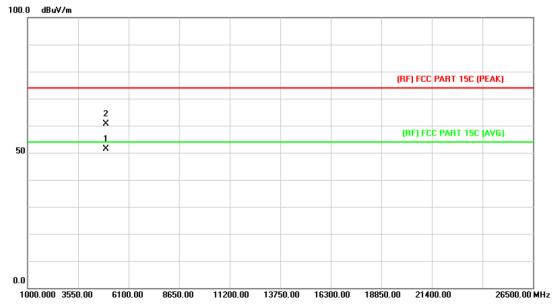


ı	No.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
			MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		*	4882.012	36.20	13.90	50.10	54.00	-3.90	AVG
2			4882.039	45.18	13.90	59.08	74.00	-14.92	peak



Page: 24 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440			
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.					
	1					



N	o. N	Иk.	Freq.	Reading Level		Measure- ment	Limit	Over	
			MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*		4960.015	36.92	14.36	51.28	54.00	-2.72	AVG
2			4960.192	46.21	14.36	60.57	74.00	-13.43	peak



Page: 25 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440				
Temperature:	25 ℃	°C Relative Humidity:					
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.						

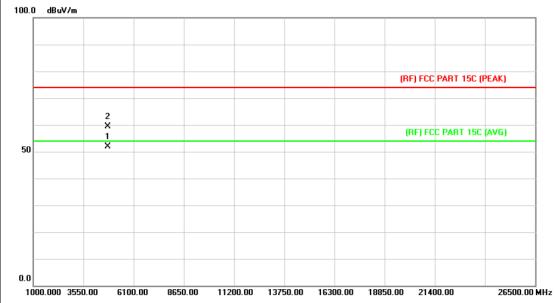


	No.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
			MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
•	1	*	4959.997	37.36	14.36	51.72	54.00	-2.28	AVG
2	2		4960.045	46.06	14.36	60.42	74.00	-13.58	peak



Page: 26 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440			
Temperature:	25 ℃	°C Relative Humidity:				
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.					

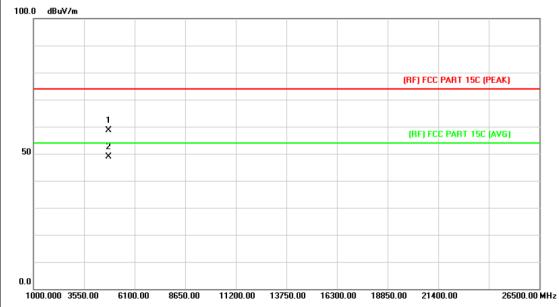


No	. Mk	. Freq.	Reading Level		Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4804.024	38.55	13.44	51.99	54.00	-2.01	AVG
2		4804.066	45.84	13.44	59.28	74.00	-14.72	peak



Page: 27 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440				
Temperature:	25 ℃	Relative Humidity:					
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.						

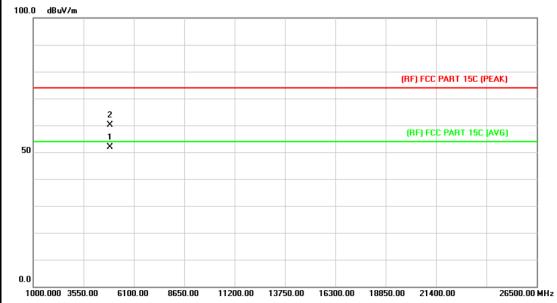


No	o. Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4803.925	45.26	13.44	58.70	74.00	-15.30	peak
2	*	4804.033	35.44	13.44	48.88	54.00	-5.12	AVG



Page: 28 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440			
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.					
	I					

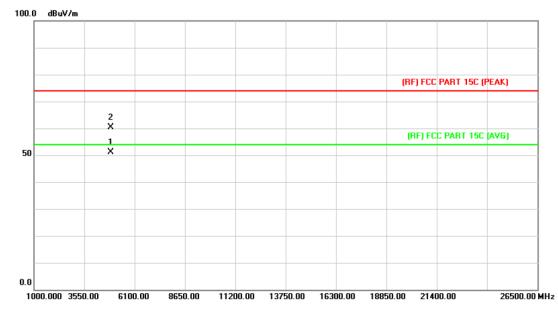


N	o. Mł	c. Freq.		Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4881.973	37.87	13.90	51.77	54.00	-2.23	AVG
2		4882.081	46.26	13.90	60.16	74.00	-13.84	peak



Page: 29 of 85

Bluetooth Speaker Shutter	Model Name :	1440					
25 ℃	55%						
DC 3.7V							
Vertical							
TX 8-DPSK Mode 2441MHz	2						
No report for the emission which more than 10 dB below the prescribed limit.							
	25 °C DC 3.7V Vertical TX 8-DPSK Mode 2441MHz	25 °C Relative Humidity: DC 3.7V Vertical TX 8-DPSK Mode 2441MHz No report for the emission which more than 10 dB I					

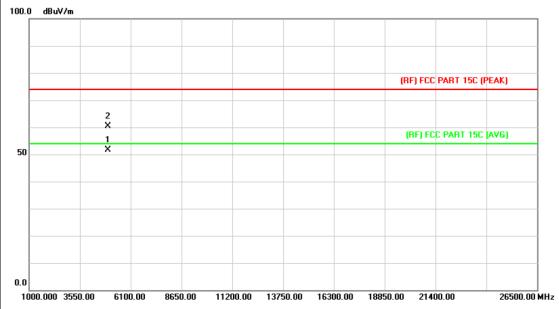


N	o.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
			MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	k	4882.009	37.27	13.90	51.17	54.00	-2.83	AVG
2			4882.084	46.46	13.90	60.36	74.00	-13.64	peak



Page: 30 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440					
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.							

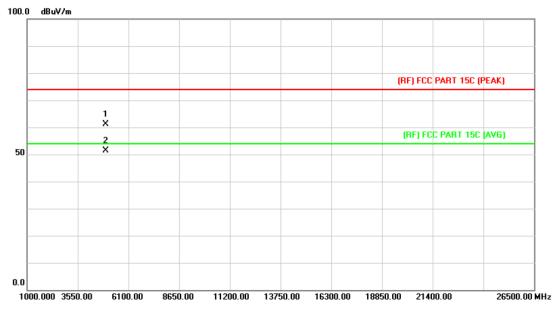


N	o. I	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
			MHz	dBu∀	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*		4960.003	37.23	14.36	51.59	54.00	-2.41	AVG
2			4960.036	46.06	14.36	60.42	74.00	-13.58	peak



Page: 31 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440				
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		Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4959.904	46.78	14.36	61.14	74.00	-12.86	peak
2	*	4959.994	36.96	14.36	51.32	54.00	-2.68	AVG



Page: 32 of 85

5. Restricted Bands Requirement

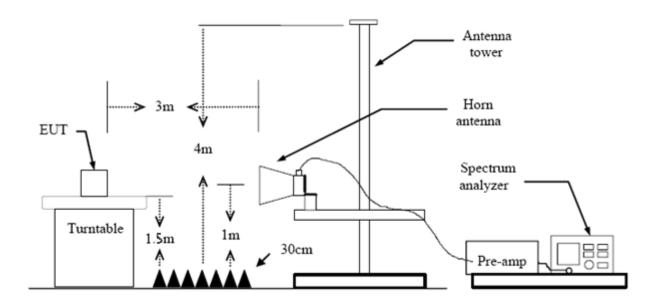
5.1 Test Standard and Limit

5.1.1 Test Standard FCC Part 15.209 FCC Part 15.205

5.1.2 Test Limit

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

5.2 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



Report No.: TB-FCC143532 Page: 33 of 85

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.

5.5 Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Aug. 08, 2014	Aug.07, 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+SUHNE R	100	SUCOFLEX	Mar. 06, 2015	Mar.05, 2016
Signal	Rohde & Schwarz	SML03	IKW682-054	Feb. 10, 2015	Feb.09, 2016
Generator	Tronde & Conwarz	ONIEGO	11.77002-007	1 00. 10, 2010	1 00.00, 2010
Positioning	ETS-LINDGREN	2090	N/A	N/A	N/A
Controller	2.5 EN ADOINEN	2000		14/1	13// 1

5.6 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.

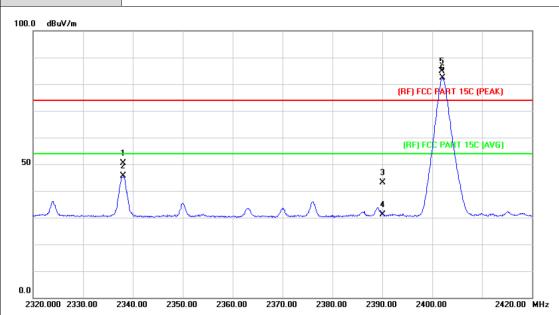
All restriction bands have been tested, only the worst case is reported.



34 of 85 Page:

(1) Radiation Test

EUT:	Bluetooth Speaker Shutter	Model Name :	1440					
Temperature:	25 ℃	Relative Humidity:	55%					
Test Voltage:	DC 3.7V							
Ant. Pol.	Horizontal							
Test Mode:	TX GFSK Mode 2402MHz							
Remark:	N/A							

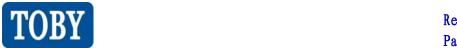


No.	. Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBu∀	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2338.100	49.89	0.56	50.45	74.00	-23.55	peak
2		2338.100	44.97	0.56	45.53	54.00	-8.47	AVG
3		2390.000	42.41	0.77	43.18	74.00	-30.82	peak
4		2390.000	30.41	0.77	31.18	54.00	-22.82	AVG
5	Χ	2401.900	84.16	0.82	84.98	Fundamenta	I Frequency	peak
6	*	2402.100	81.55	0.82	82.37	Fundamenta	I Frequency	AVG



Page: 35 of 85

EUT:			Blue	tooth	Spe	anei	Snut	ıcı	Mo	odel	Name) :		1440)		
Temp	peratur	e:	25 °	С					Re	lativ	e Hu	midit	y:	55%)		
Test '	Voltage	e:	DC 3	3.7V					•								
Ant.	Pol.		Verti	ical													
Test	Mode:		TX C	3FSK	Mod	de 24	102M	Ηz									
Rema	ark:		N/A														
100.0	dBuV/m																1
50	Λ	1 3		^				<u></u>	Λ		3 X			T 15C (F			
0.0																	
2320	0.000 2330 O Mk		340.00		adin	2360.0	Corre			asure		ımit	100.00	Over		420.00	
2320	0.000 2330 O. Mk.	Fre	eq.	Rea Le	adin evel		Corre Fac	ect tor	Mea m	asure ent	;- L	imit					
2320	o. Mk.		eq. Iz	Rea Le	adin	g	Corre	ect tor	Mea m	asure	;- L		m	Over	r	Detec	to
No	o. Mk.	Fr€	eq. Iz 800	Rea Le	adin evel BuV	g	Corre Fact	ect tor	Mea m dB	asure ent uV/m	e- L	.imit BuV/	m 0 ·	dB	r)1	Detec	ito
No.	o. Mk.	Fre M⊦ 2337.	eq. dz 800	Rea Le dl 51	adin evel BuV	g	Corre Fact dB/n	ect tor	Mea m dB	asure ent uV/m 2.09	- L	imit BuV/ 74.00	m 0 ·	dB - 21 .9	- 01 6	Detec pe a	ak G
No. 1	o. Mk.	Fre MH 2337.	eq. dz 800 000	Rea Le dl 51 47	adin evel BuV 1.54	g	Corre Fact dB/n 0.55	ect tor	Mea m dB 52 48	ent uv/m 2.09)- L	imit 18uV/ 74.00	m 0 ·	dB -21.9 -5.56	r 91 6	Detec pea	ak G
No. 1 2 3	o. Mk.	Fre MH 2337. 2338. 2390.	eq. dz 800 000 000	Rea Le 51 47 42	adin evel 3uV 1.54 7.89	g	Corre Fact dB/n 0.55 0.55	ect tor	Mea m dB 52 48 43	asure ent uV/m 2.09 3.44 3.53)- L	imit 74.00 54.00 74.00	m 0 · 0 ·	dB -21.9 -5.56 -30.4	6 17 21	Detection pea	itorak Gak



Report No.: TB-FCC143532 Page: 36 of 85

EUT:	Bluetooth Speaker	Shutter	Model Name :	1440				
Temperature:	25 ℃		Relative Humidity:	55%				
Test Voltage:	DC 3.7V	,						
Ant. Pol.	Horizontal							
Test Mode:	TX GFSK Mode 24	80 MHz						
Remark:	N/A							
100.0 dBuV/m								
***			(RF) FCC I	PART 15C (PEAK)				
3			(RF) FCC	PART 15C (AVG)				
50			6 8					
			` \					
Marine Marine		Munde		***************************************				
0.0 2466.000 2476.00 2	486.00 2496.00 2506.00	2516.00	2526.00 2536.00 2546.	00 2566.00 MHz				
No. Mk. Fr	Reading (eq. Level	Correct Factor	Measure- ment Limit	Over				
M	Hz dBuV	dB/m	dBuV/m dBuV/m	dB Detector				
1 X 2480	.000 84.59	1.15	85.74 Fundament	al Frequency peak				
2 * 2480	.000 81.92	1.15	83.07 Fundament	al Frequency AVG				
3 2483	.500 50.95	1.17	52.12 74.00	-21.88 peak				
4 2483	.500 42.04	1.17	43.21 54.00	-10.79 AVG				
5 2544	.000 41.37	1.49	42.86 54.00	-11.14 AVG				
6 2544	.100 47.03	1.49	48.52 74.00	-25.48 peak				
Emission Level=	Read Level+ Correc	ct Factor						



2544.000

Emission Level= Read Level+ Correct Factor

38.94

1.49

40.43

6

Report No.: TB-FCC143532 Page: 37 of 85

EUT:	Bluetooth Speake	er Shutter	Model Name :	1440		
Temperature:	25 ℃	25 °C Relative Humidity: 55%				
Test Voltage:	DC 3.7V					
Ant. Pol.	Vertical					
Test Mode:	TX GFSK Mode 2	2480 MHz				
Remark:	N/A					
100.0 dBuV/m						
0.0	2486.00 2496.00 2506	5.00 2516.00	(RF) F 5 X 6			
No. Mk. Fre	Reading eq. Level	Correct Factor	Measure- ment Limit	Over		
MH	Hz dBuV	dB/m	dBuV/m dBuV/	m dB Detector		
1 X 2479.	.900 84.41	1.15	85.56 Fundame	ntal Frequency peak		
2 * 2480.	.000 81.85	1.15	83.00 Fundame	ntal Frequency AVG		
3 2483.	500 51.73	1.17	52.90 74.00	0 -21.10 peak		
4 2483.	500 41.73	1.17	42.90 54.00	0 -11.10 AVG		
5 2544.	.000 45.45	1.49	46.94 74.00	0 -27.06 peak		

AVG

54.00 -13.57



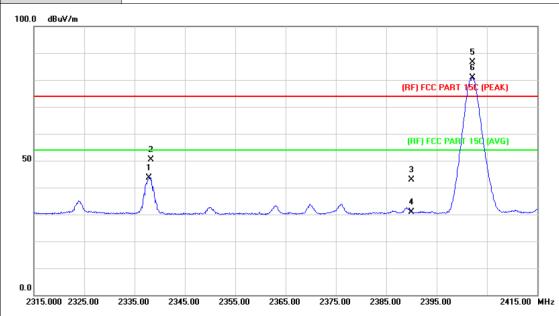
Page: 38 of 85

EUT	:		Blue	tooth Speal	ker Shutter	Model Na	del Name : 1440		
Tem	peratu	re:	25 °C	<u></u>		Relative H	lumidity:	55%	
Test	Voltag	e:	DC 3	3.7V					
Ant.	Pol.		Horiz	zontal					
Test	Mode:		TX 8	-DPSK Mod	de 2402MHz	<u>Z</u>			
Rem	nark:		N/A						
100.0) dBu∀/m								
								5	
								ቼ	
							(RF) FCC I	PART 150 (PEAK	9
							(BE) ECC	PART 150 (AVE	n
50			1 X				()		,
			2				3 X		
			$ \top / $			\wedge \wedge	4		
			-	-					
0.0	15.000 232	25 NN 2	335.00	2345.00 23	355.00 2365.00	2375.00 2	2385.00 2395.	nn 2	2415.00 MHz
	10.000 2	.5.00	000.00	2010.00	100.00	2010.00	200.00	.00	.410.00
N	lo. Mk.	Fr	eq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
	O. IVIIX.	. 110 MH		dBuV		dBuV/m	dBuV/m	dB	Detector
_					dB/m				
1		2337.		47.39	0.55	47.94	74.00	-26.06	peak
2		2338.	.100	39.61	0.56	40.17	54.00	-13.83	AVG
3		2390.	.000	41.61	0.77	42.38	74.00	-31.62	peak
4		2390.	.000	30.26	0.77	31.03	54.00	-22.97	AVG
5	Х	2401.	700	86.73	0.82	87.55	Fundamenta	al Frequency	peak
6	*	2402.	100	81.65	0.82	82.47	Fundamenta	al Frequency	AVG
Emi	ssion L	_evel=	Read	Level+ Co	rrect Factor	r			



Report No.: TB-FCC143532 Page: 39 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440			
Temperature:	25 ℃	Relative Humidity:	55%			
Test Voltage:	DC 3.7V	DC 3.7V				
Ant. Pol.	Vertical					
Test Mode:	TX 8-DPSK Mode 2402MHz					
Remark:	N/A					



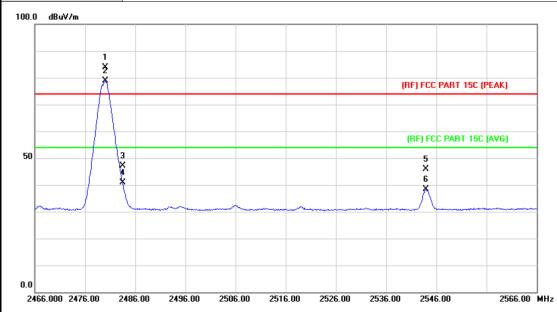
No	o. Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2337.900	43.08	0.55	43.63	54.00	-10.37	AVG
2		2338.300	49.90	0.56	50.46	74.00	-23.54	peak
3		2390.000	42.08	0.77	42.85	74.00	-31.15	peak
4		2390.000	30.00	0.77	30.77	54.00	-23.23	AVG
5	Χ	2402.100	85.85	0.82	86.67	Fundamenta	I Frequency	peak
6	*	2402.100	80.00	0.82	80.82	Fundamenta	I Frequency	AVG

Emission Level= Read Level+ Correct Factor



Page: 40 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440		
Temperature:	25 ℃	Relative Humidity:	55%		
Test Voltage:	DC 3.7V				
Ant. Pol.	Horizontal				
Test Mode:	TX 8-DPSK Mode 2480MHz				
Remark:	N/A				



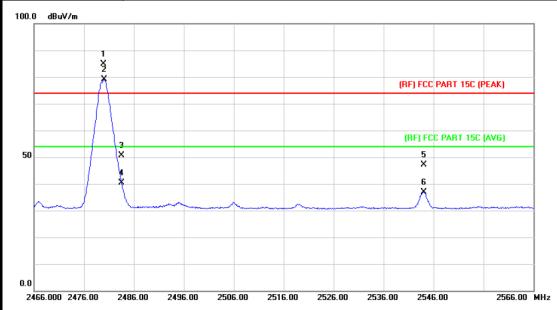
No	o. Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBu∀	dB/m	dBuV/m	dBuV/m	dB	Detector
1	Χ	2480.100	82.84	1.15	83.99	Fundamenta	l Frequency	peak
2	*	2480.100	77.72	1.15	78.87	Fundamenta	l Frequency	AVG
3		2483.500	46.00	1.17	47.17	74.00	-26.83	peak
4		2483.500	39.81	1.17	40.98	54.00	-13.02	AVG
5		2543.900	44.31	1.49	45.80	74.00	-28.20	peak
6		2543.900	36.83	1.49	38.32	54.00	-15.68	AVG

Emission Level= Read Level+ Correct Factor



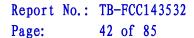
Page: 41 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440		
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	Χ	2479.900	83.65	1.15	84.80	Fundamenta	l Frequency	peak
2	*	2480.000	77.98	1.15	79.13	Fundamenta	l Frequency	AVG
3		2483.500	49.40	1.17	50.57	74.00	-23.43	peak
4		2483.500	39.22	1.17	40.39	54.00	-13.61	AVG
5		2544.000	45.74	1.49	47.23	74.00	-26.77	peak
6		2544.000	35.43	1.49	36.92	54.00	-17.08	AVG

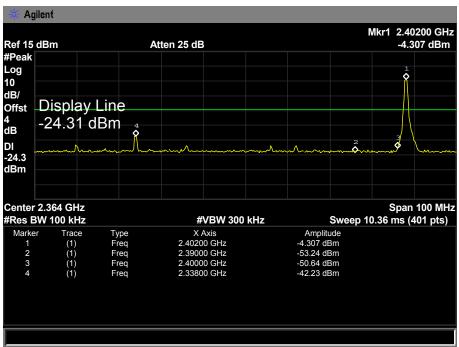
Emission Level= Read Level+ Correct Factor

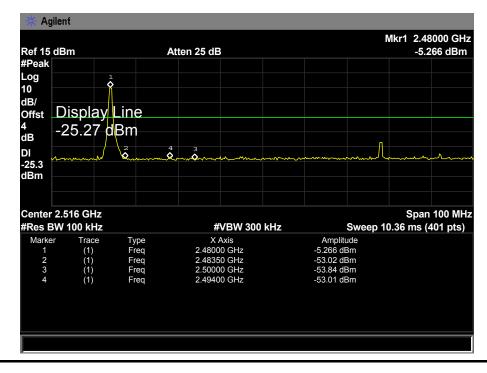


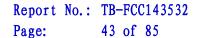


(1) Conducted Test

EUT:	Bluetooth Speaker Shutter	Model Name :	1440			
Temperature:	25 ℃ Relative Humidity: 55%					
Test Voltage:	DC 3.7V	DC 3.7V				
Test Mode:	TX GFSK Mode 2402MHz /	TX GFSK Mode 2402MHz / 2480 MHz				
Remark:	N/A					









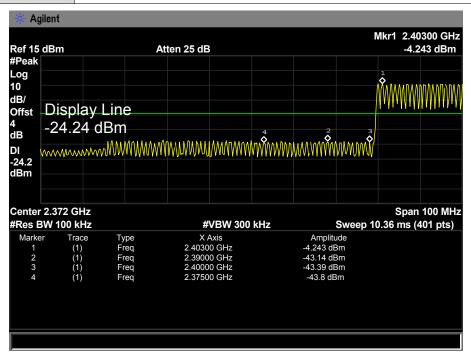
EUT: Bluetooth Speaker Shutter Model Name: 1440

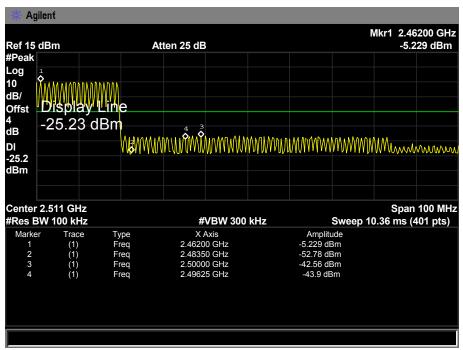
Temperature: 25 °C Relative Humidity: 55%

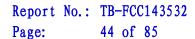
Test Voltage: DC 3.7V

Test Mode: GFSK Hopping Mode

Remark: N/A









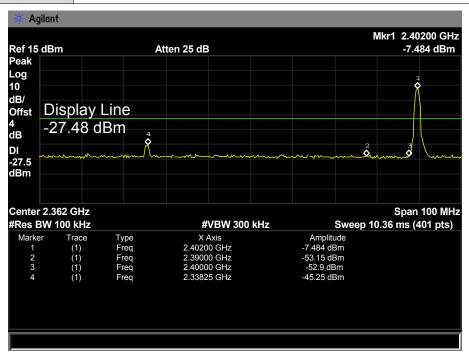
EUT: Bluetooth Speaker Shutter Model Name: 1440

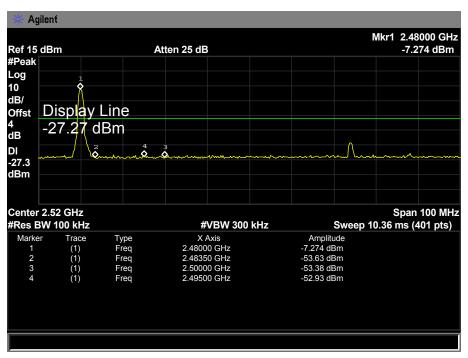
Temperature: 25 ℃ Relative Humidity: 55%

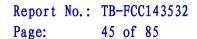
Test Voltage: DC 3.7V

Test Mode: TX 8-DPSK Mode 2402MHz / 2480 MHz

Remark: N/A









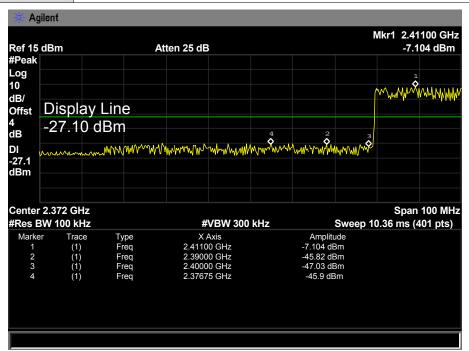
EUT: Bluetooth Speaker Shutter Model Name: 1440

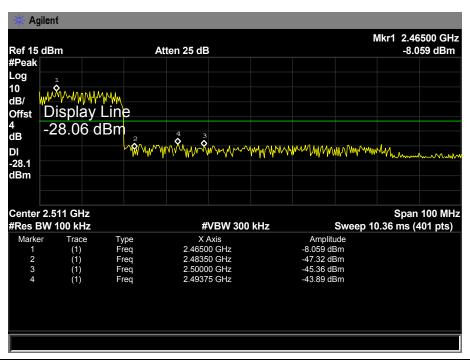
Temperature: 25 ℃ Relative Humidity: 55%

Test Voltage: DC 3.7V

Test Mode: 8-DPSK Hopping Mode

Remark: N/A







Page: 46 of 85

6. Number of Hopping Channel

6.1 Test Standard and Limit

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

6.1.2 Test Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

6.2 Test Setup



6.3 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.

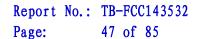
6.4 EUT Operating Condition

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

6.5 Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Aug. 08, 2014	Aug.07, 2015

6.6 Test Data



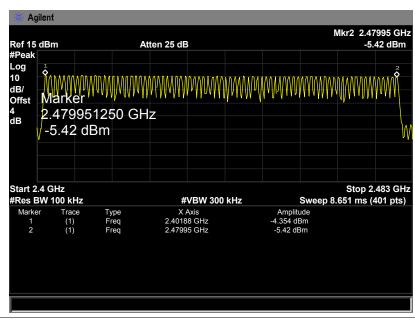


EUT:Bluetooth Speaker ShutterModel Name :1440Temperature:25 °CRelative Humidity:55%Test Voltage:DC 3.7V

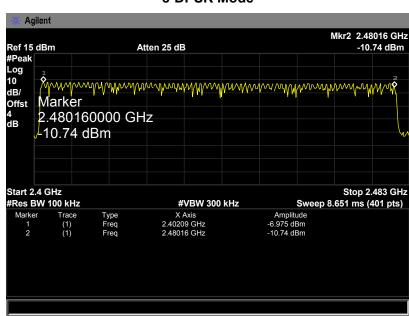
Test Mode: Hopping Mode (GFSK/ 8-DPSK)

Frequency Range	Quantity of Hopping Channel	Limit
2402011724900117	79	>15
2402MHz~2480MHz	79	>15

GFSK Mode



8-DPSK Mode





Page: 48 of 85

7. Average Time of OcCupancy

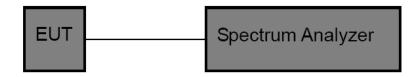
7.1 Test Standard and Limit

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

5.1.2 Test Limit

Section	Test Item	Limit
15.247(a)(1)/ RSS-210	Average Time of	0.4.000
Annex 8(A8.1d)	OcCupancy	0.4 sec

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=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.

7.4 EUT Operating Condition

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

7.5 Test Equipment

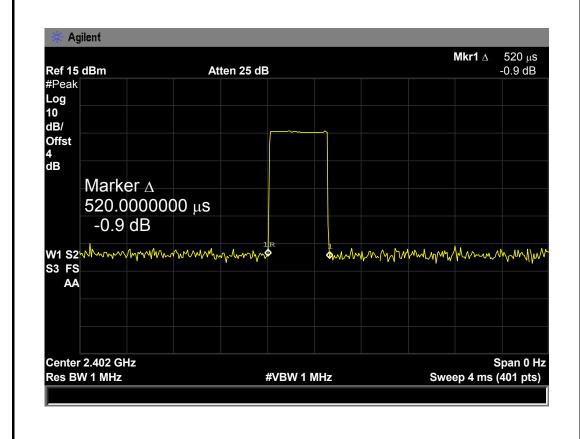
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Aug. 08, 2014	Aug.07, 2015

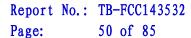


Page: 49 of 85

7.6 Test Data

EUT:		Bluetooth Speaker Shutter		Model Name :		1440
Temperature:		25 ℃		Relative Hum	idity:	55%
Test Voltage:		DC 3.7V				
Test Mode:		Hopping I	Mode (GFSK DH1))		
Channel	Pu	lse Time	Total of Dwell	Period Time	Limit	Result
(MHz)		(ms)	(ms)	(s)	(ms)	Result
2402		0.520	166.40			
2441		0.530	169.60	31.60	400	PASS
2480		0.510	163.20			
GFSK Hopping Mode DH1						







S3 FS AA

Center 2.48 GHz

Res BW 1 MHz

GFSK Hopping Mode DH1 2441 MHz Agilent Mkr1 Δ 530 μs 0.829 dB Ref 15 dBm Atten 25 dB #Peak Log 10 dB/ Offst dΒ Marker ∆ **5**30.0000000 μs 0.829 dB W1 S2 **№** & graph when we have he was reference when when we have the form S3 FS AA Center 2.441 GHz Span 0 Hz Res BW 1 MHz #VBW 1 MHz Sweep 4 ms (401 pts) **GFSK Hopping Mode DH1** 2480 MHz Agilent **Mkr1** Δ 510 μ s Ref 15 dBm Atten 25 dB -2.571 dB #Peak Log 10 dB/ Offst 4 dB Marker ∆ 510.0000000 μs -2.571 dB W1 S2 MAN MANAMANAMAN my Manufry hammen many many many

#VBW 1 MHz

Span 0 Hz

Sweep 4 ms (401 pts)

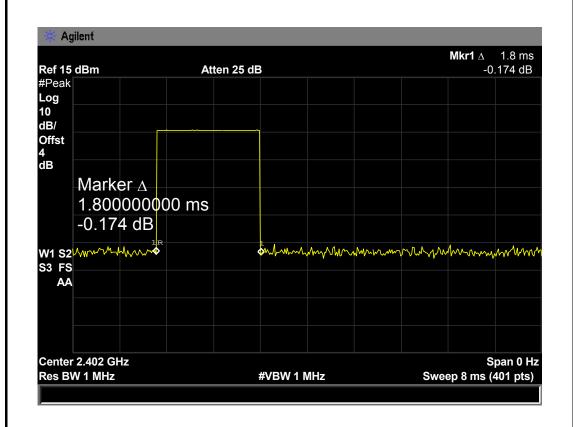


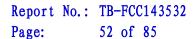
Page: 51 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440				
Temperature:	25 ℃	Relative Humidity:	55%				
Test Voltage:	DC 3.7V	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	1.800	288.00			
2441	1.820	291.20	31.60	400	PASS
2480	1.780	284.80			

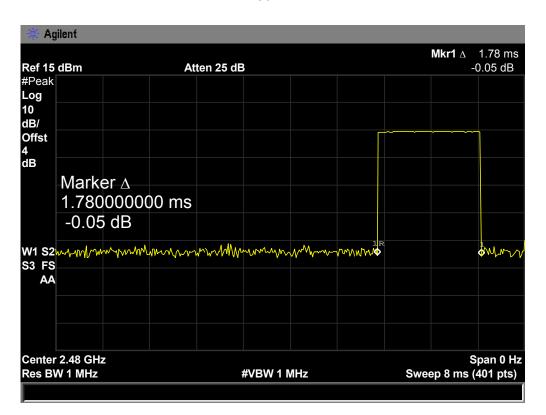
GFSK Hopping Mode DH3







GFSK Hopping Mode DH3 2441 MHz Agilent **Mkr1** Δ 1.82 ms -1.019 dB Ref 15 dBm Atten 25 dB #Peak Log 10 dB/ Offst 4 dB Marker ∆ 1.820000000 ms -1.019 dB S3 FS AA Center 2.441 GHz Span 0 Hz Res BW 1 MHz #VBW 1 MHz Sweep 8 ms (401 pts) **GFSK Hopping Mode DH3** 2480 MHz Agilent **Mkr1** Δ 1.78 ms



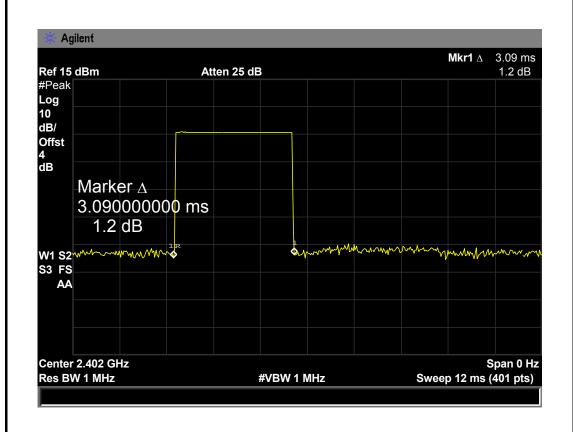


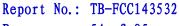
Page: 53 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (GFSK DH5)		

Channel (MHz)	Pulse Time (ms) Total of Dwell Time (s)		Limit (ms)	Result			
2402	3.090	329.60					
2441	3.120	332.80	31.60	400	PASS		
2480	3.030	323.20					

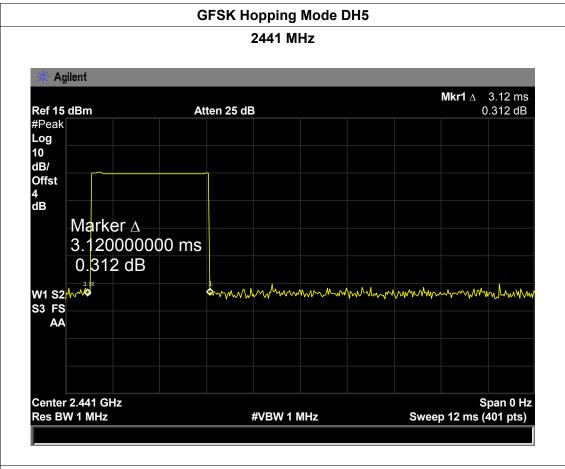
GFSK Hopping Mode DH5

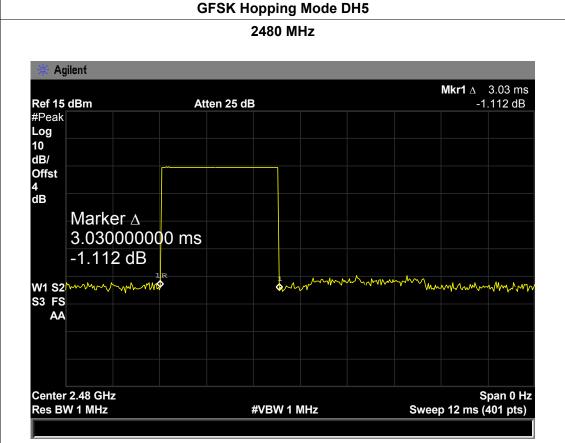






Page: 54 of 85







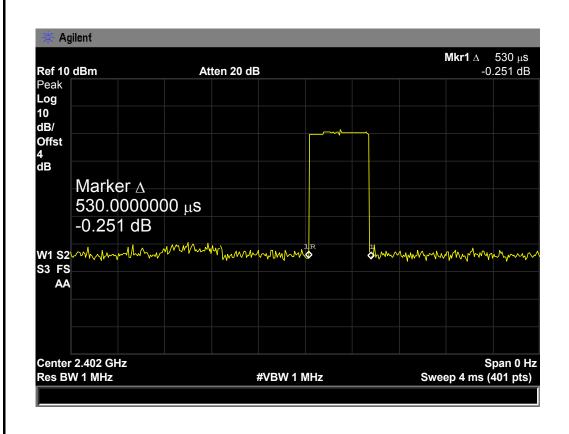
Page: 55 of 85

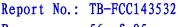
EUT:	Bluetooth Speaker Shutter	Model Name :	1440		
Temperature:	25 ℃	Relative Humidity:	55%		
Test Voltage:	DC 3.7V				
Toot Model	Hanning Mode (= /4 DODSK DH1)				

Test Mode: Hopping Mode (π /4-DQPSK DH1)

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	0.530	169.60			
2441	0.520	166.40	31.60 400	400	PASS
2480	0.520	166.40			

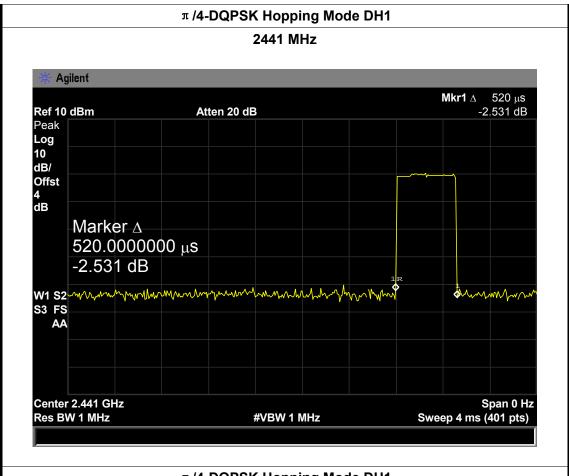
$\pi\,\text{/4-DQPSK}$ Hopping Mode DH1

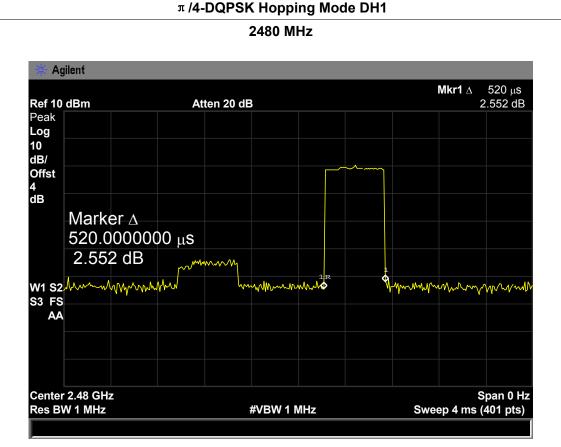






Page: 56 of 85





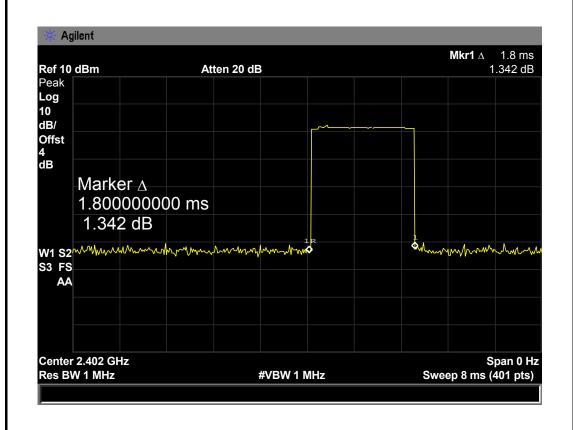


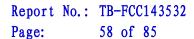
Page: 57 of 85

EUT:		Bluetooth	Speaker Shutter	Model Name	1440		
Temperature:		25 ℃		Relative Hum	55%		
Test Voltage:		DC 3.7V	DC 3.7V				
Test Mode: Hopping Mode (π /4-DQPSK DH3)							
Channel	Pu	lse Time	Total of Dwell	Period Time	Limit	Pocult	

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	1.800	288.00			
2441	1.800	288.00	31.60	400	PASS
2480	1.800	288.00			

 π /4-DQPSK Hopping Mode DH3







 π /4-DQPSK Hopping Mode DH3 2441 MHz Agilent Mkr1 Δ 1.8 ms Ref 10 dBm Atten 20 dB $0.873\,\mathrm{dB}$ Peak Log 10 dB/ Offst 4 dB Marker ∆ 1.800000000 ms 0.873 dB W1 S2¹ S3 FS AA Center 2.441 GHz Span 0 Hz Res BW 1 MHz #VBW 1 MHz Sweep 8 ms (401 pts) π/4-DQPSK Hopping Mode DH3

2480 MHz Agilent **Mkr1** Δ 1.8 ms Ref 10 dBm Atten 20 dB 1.975 dB Peak Log 10 dB/ Offst 4 dB Marker ∆ 1.800000000 ms 1.975 dB W1 S2 Why Who have many how why S3 FS AΑ Center 2.48 GHz Span 0 Hz Res BW 1 MHz #VBW 1 MHz Sweep 8 ms (401 pts)



2480

3.060

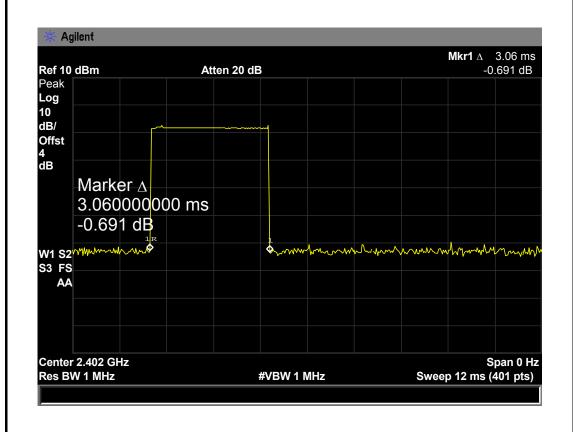
Report No.: TB-FCC143532

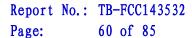
Page: 59 of 85

EUT:		Bluetooth	Speaker Shutter	Model Name :		1440
Temperature:		25 ℃		Relative Humidity:		55%
Test Voltage:		DC 3.7V				
Test Mode:	t Mode: Hopping Mode (π /4-DQPSK DH5)					
Channel	Pu	lse Time	Total of Dwell	Period Time	Limit	Result
(MHz)		(ms)	(ms)	(s)	(ms)	Nesuit
2402		3.060	326.40			
2441		3.060	326.40	31.60	400	PASS

 $\pi\,\text{/4-DQPSK}$ Hopping Mode DH5

326.40







S3 FS AA

Center 2.48 GHz

Res BW 1 MHz

 π /4-DQPSK Hopping Mode DH5 2441 MHz Agilent **Mkr1** Δ 3.06 ms -0.109 dB Ref 10 dBm Atten 20 dB Peak Log 10 dB/ Offst 4 dB Marker ∆ 3.0600000000 ms -0.109 dB W1 S2 Mmmmmmm S3 FS AA Center 2.441 GHz Span 0 Hz Res BW 1 MHz #VBW 1 MHz Sweep 12 ms (401 pts) π /4-DQPSK Hopping Mode DH5 2480 MHz Agilent **Mkr1** Δ 3.06 ms Ref 10 dBm Atten 20 dB -1.774 dB Peak Log 10 dB/ Offst 4 dB Marker ∆ 3.060000000 ms -1.774 dB W1 S2

#VBW 1 MHz

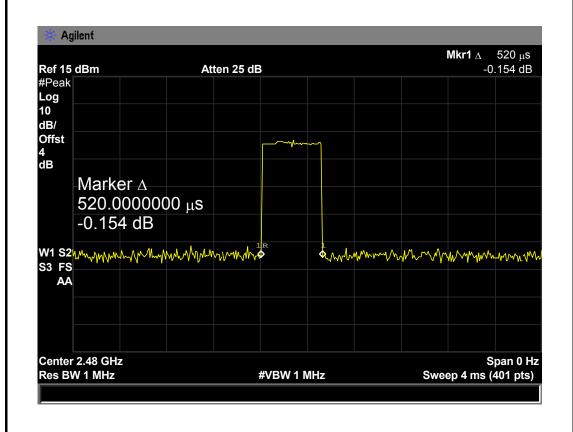
Span 0 Hz

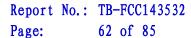
Sweep 12 ms (401 pts)



Page: 61 of 85

EUT:		Bluetooth Speaker Shutter		Model Name :		1440
Temperature:	ı	25 ℃		Relative Humidity:		55%
Test Voltage:	est Voltage: DC 3.7V					
Test Mode:	Dide: Hopping Mode (8-DPSK DH1)					
Channel	Pu	Ise Time	Total of Dwell	Period Time	Limit	Result
(MHz)		(ms)	(ms)	(s)	(ms)	Result
2402		0.520	166.40			
2441		0.530	169.60	31.60	400	PASS
2480 0.540 172.8						
	8-DPSK Hopping Mode DH1					







AA

Center 2.48 GHz

Res BW 1 MHz

8-DPSK Hopping Mode DH1 2441 MHz Agilent Mkr1 Δ 530 μ s -0.407 dB Ref 15 dBm Atten 25 dB #Peak Log 10 dB/ Offst 4 dB Marker ∆ $530.0000000 \, \mu s$ -0.407 dB S3 FS AA Center 2.441 GHz Span 0 Hz Res BW 1 MHz #VBW 1 MHz Sweep 4 ms (401 pts) 8-DPSK Hopping Mode DH1 2480 MHz Agilent **Mkr1** Δ 540 μs -2.306 dB Ref 15 dBm Atten 25 dB #Peak Log 10 dB/ Offst 4 dB Marker ∆ 540.0000000 μs -2.306 dB S3 FS

#VBW 1 MHz

Span 0 Hz

Sweep 4 ms (401 pts)



2480

1.840

Report No.: TB-FCC143532

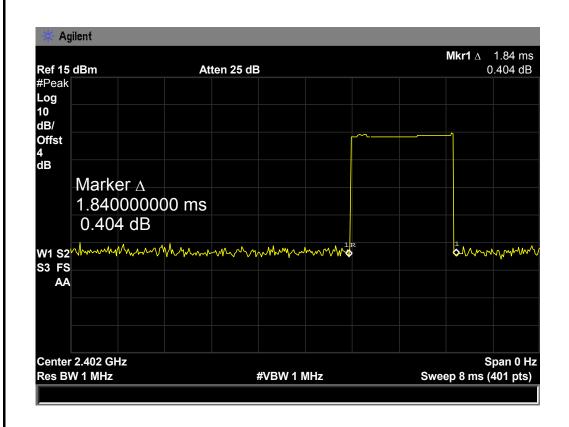
Page: 63 of 85

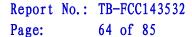
EUT:	Bluetooth Speaker Shutter	Model Name :	1440
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode (8-DPSK DH3)		

Tropping index (6 Dr Six Drie)					
Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	1.840	294.40			
2441	1.800	288.00	31.60	400	PASS

8-DPSK Hopping Mode DH3

294.40







W1 S2

Center 2.48 GHz

Res BW 1 MHz

S3 FS AA

8-DPSK Hopping Mode DH3 2441 MHz Agilent Mkr1 Δ 1.8 ms 0.678 dB Ref 15 dBm Atten 25 dB #Peak Log 10 dB/ Offst 4 dB Marker ∆ 1.800000000 ms 0.678 dB W1 S2 MM ~ mmhynnyll ML Mhyll Mark Mynnyll Mynnyll Market S3 FS AA Center 2.441 GHz Span 0 Hz Res BW 1 MHz #VBW 1 MHz Sweep 8 ms (401 pts) 8-DPSK Hopping Mode DH3 2480 MHz Agilent **Mkr1** Δ 1.84 ms 0.19 dB Ref 15 dBm Atten 25 dB #Peak Log 10 dB/ Offst 4 dB Marker ∆ 1.8400<mark>00000 ms</mark> 0.19 dB

#VBW 1 MHz

Span 0 Hz

Sweep 8 ms (401 pts)

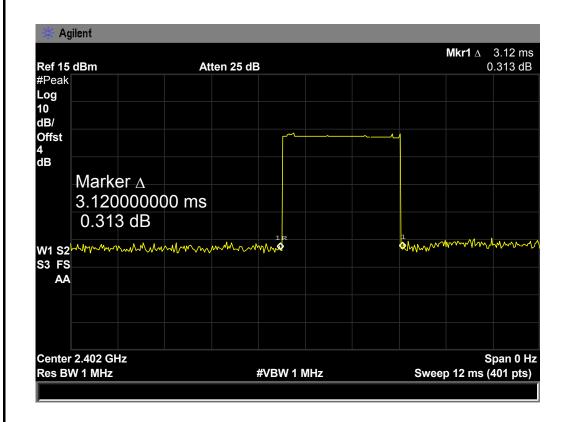


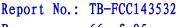
Page: 65 of 85

EUT:	Bluetooth	Speaker Shutter	Model Name	e :	1440
Temperature:	25 ℃		Relative Hu	midity:	55%
Test Voltage:	DC 3.7V				
Test Mode:	Hopping	Mode (8-DPSK DH5)			
			D		

Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2402	3.120	332.80			
2441	3.120	332.80	31.60	400	PASS
2480	3.060	326.40			

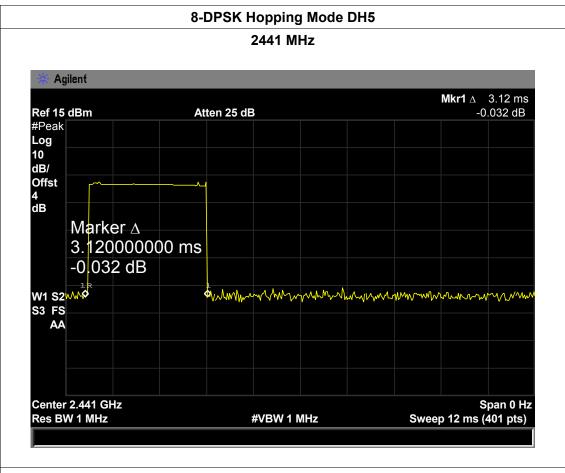
8-DPSK Hopping Mode DH5

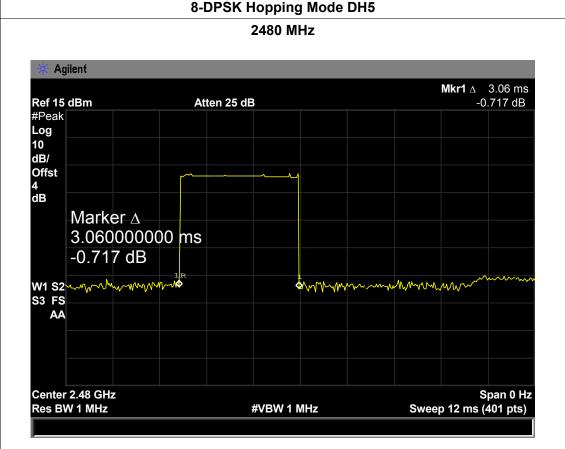






Page: 66 of 85







Report No.: TB-FCC143532 Page: 67 of 85

8. Channel Separation and Bandwidth Test

8.1 Test Standard and Limit

8.1.1 Test Standard FCC Part 15.247

8.1.2 Test Limit

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

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:

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.

8.4 EUT Operating Condition

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



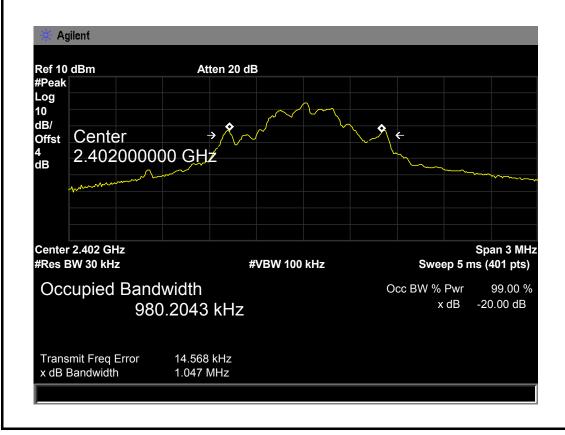


8.5 Test Equipment

Description	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Aug. 08, 2014	Aug.07, 2015

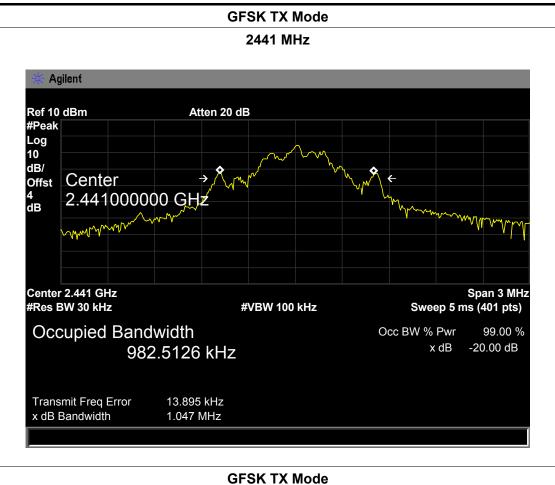
8.6 Test Data

EUT:	Bluetooth Speaker Shutter Model Name :		1440		
Temperature:	25 ℃	Relative Humidity:	55%		
Test Voltage:	DC 3.7V				
Test Mode:	TX Mode (GFSK)	TX Mode (GFSK)			
Channel frequence	cy 99% OBW	20dB Bandwidth	20dB		
(MHz)	(kHz)	(kHz)	Bandwidth		
			*2/3 (kHz)		
2402	980.2043	1047.00	698.00		
2441	982.5126	1047.00	698.00		
2480 987.5720		1046.00	697.33		
GFSK TX Mode					













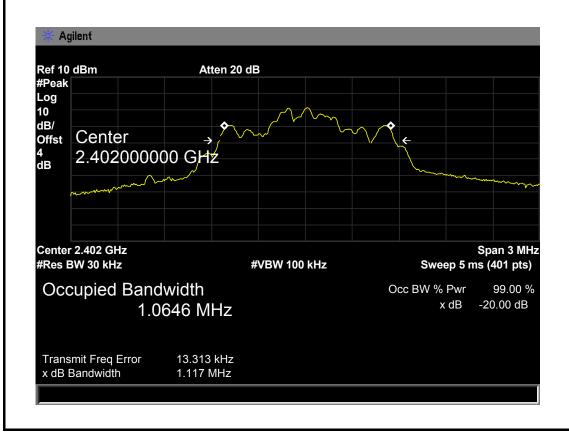
Page: 70 of 85

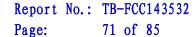
EUT:	Bluetooth Speaker Shutter	Model Name :	1440
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		

Test Mode: TX Mode (π /4-DQPSK)

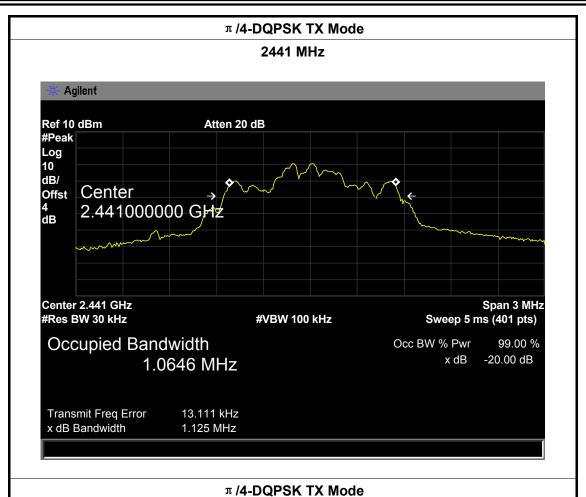
	,		
Channel frequency	99% OBW	20dB Bandwidth	20dB
(MHz)	(kHz)	(kHz)	Bandwidth
			*2/3 (kHz)
2402	1064.600	1117.00	744.67
2441	1064.600	1125.00	750.00
2480	1065.200	1124.00	749.33

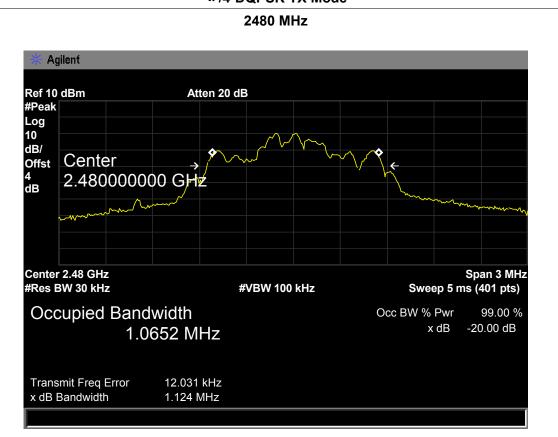
π /4-DQPSK TX Mode

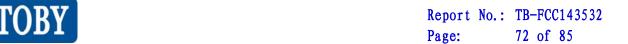








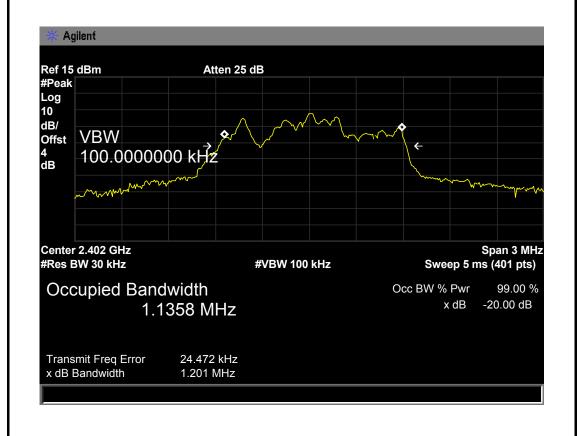


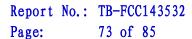


EUT:	Bluetooth Speaker Shutter	Model Name :	1440
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode (8-DPSK)		

rest widde.	TA Mode (6-DF3K)				
Channel frequenc	99% OBW	20dB Bandwidth	20dB		
(MHz)	(kHz)	(kHz)	Bandwidth		
			*2/3 (kHz)		
2402	1135.80	1201.00	800.67		
2441	1139.40	1201.00	800.67		
2480	1132.70	1183.00	788.67		
4					

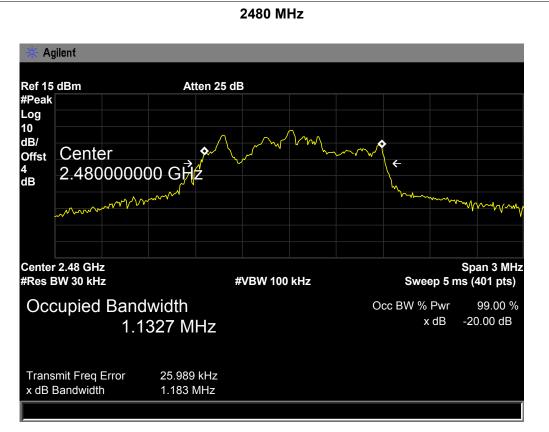
8-DPSK TX Mode 2402 MHz







8-DPSK TX Mode 2441 MHz Agilent Ref 15 dBm Atten 25 dB #Peak Log 10 dB/ Center Offst 4 dB 2.441000000 GHz Center 2.441 GHz Span 3 MHz #Res BW 30 kHz **#VBW 100 kHz** Sweep 5 ms (401 pts) Occupied Bandwidth 99.00 % Occ BW % Pwr x dB -20.00 dB 1.1394 MHz Transmit Freq Error 23.158 kHz x dB Bandwidth 1.201 MHz 8-DPSK TX Mode





Page: 74 of 85

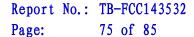
EUT:	Bluetooth Speaker Shutter	Model Name :	1440
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		

Test Mode: Hopping Mode (GFSK)

Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
2402	1005.00	698.00
2441	1005.00	698.00
2480	1005.00	697.33

GFSK Hopping Mode











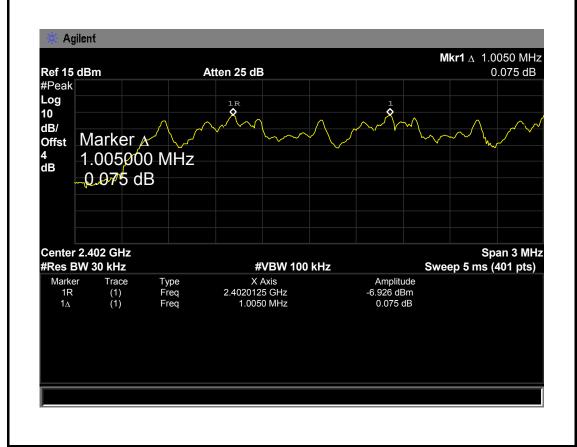


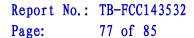
Page: 76 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Honning Mode (8-DPSK)		

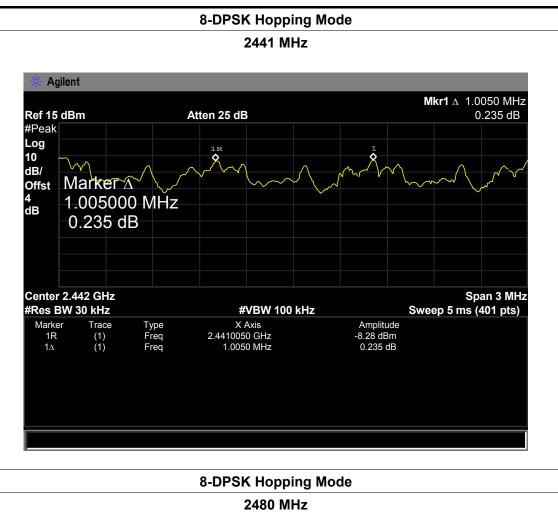
root mode.	Tropping Mode (6 B) Gity		
Channel frequency		Separation Read Value	Separation Limit
(MHz)		(kHz)	(kHz)
2402		1005.00	800.67
2441		1005.00	800.67
2480		1005.00	788.67

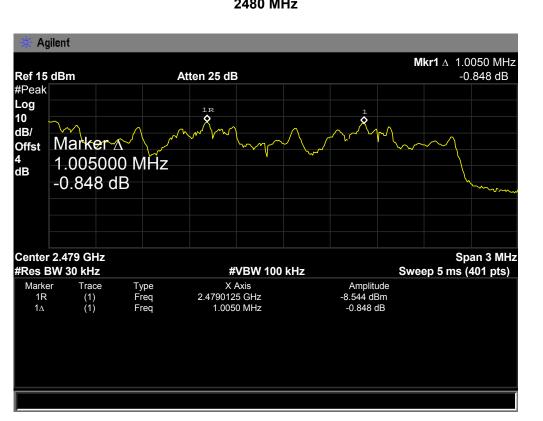
8-DPSK Hopping Mode













Page: 78 of 85

9. Peak Output Power Test

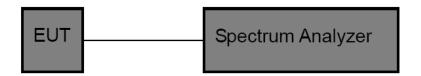
9.1 Test Standard and Limit

9.1.1 Test Standard FCC Part 15.247 (b) (1)

9.1.2 Test Limit

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

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:

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

9.4 EUT Operating Condition

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

9.5 Test Equipment

Description	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Aug. 08, 2014	Aug.07, 2015

9.6 Test Data

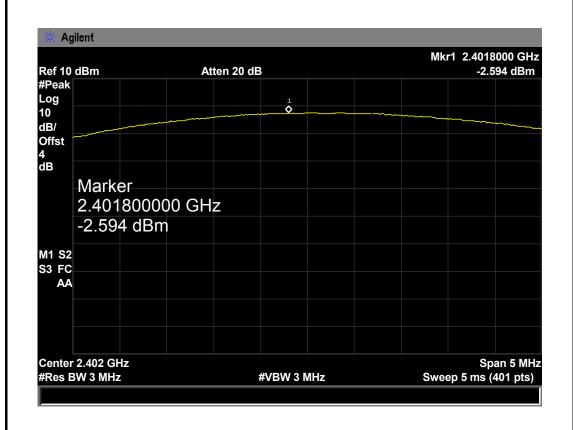


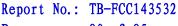
Page: 79 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode (GFSK)		

rest week.	17 WOOC	(Of Oit)	
Channel frequency (MHz)		Test Result (dBm)	Limit (dBm)
2402		-2.594	
2441		-3.257	21
2480		-4.732	

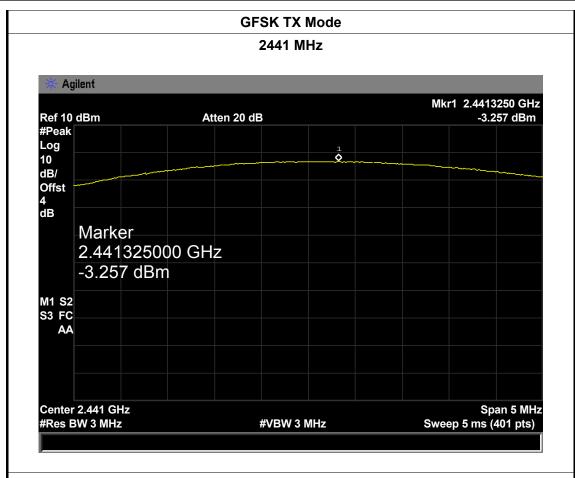
GFSK TX Mode



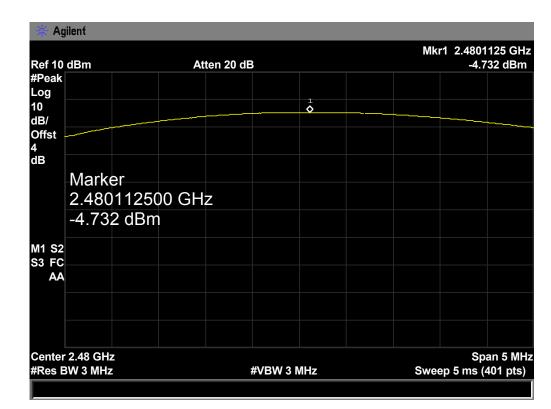




Page: 80 of 85



GFSK TX Mode





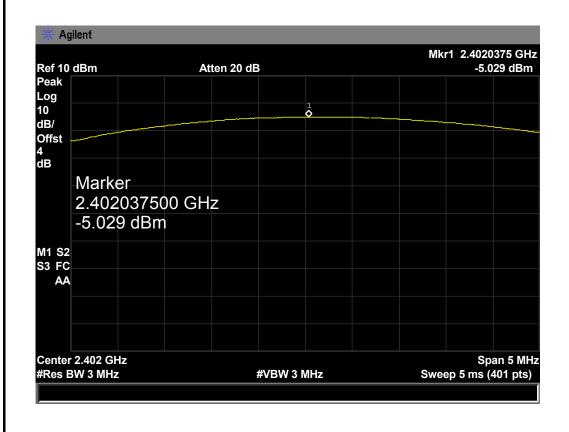
Page: 81 of 85

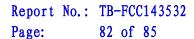
EUT:	Bluetooth Speaker Shutter	Model Name :	1440
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		

Test Mode: TX Mode (π /4-DQPSK)

Channel frequency (MHz)	Test Result (dBm)	Limit (dBm)
2402	-5.029	
2441	-4.285	21
2480	-4.383	

π /4-DQPSK TX Mode

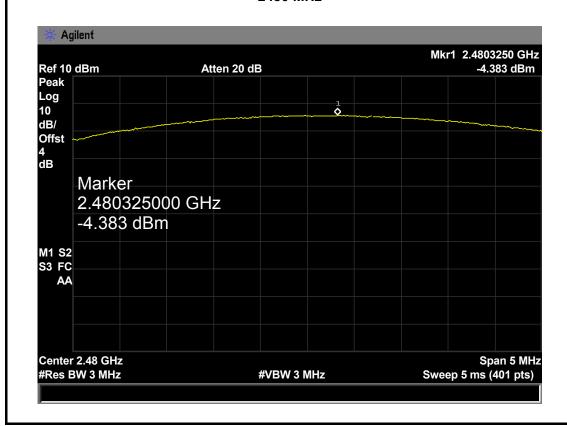






π /4-DQPSK TX Mode 2441 MHz Agilent Mkr1 2.4411625 GHz -4.285 dBm Ref 10 dBm Atten 20 dB Peak Log • 10 dB/ Offst 4 dB Marker 2.441162500 GHz -4.285 dBm M1 S2 S3 FC AA Center 2.441 GHz Span 5 MHz #Res BW 3 MHz #VBW 3 MHz Sweep 5 ms (401 pts)

π/4-DQPSK TX Mode



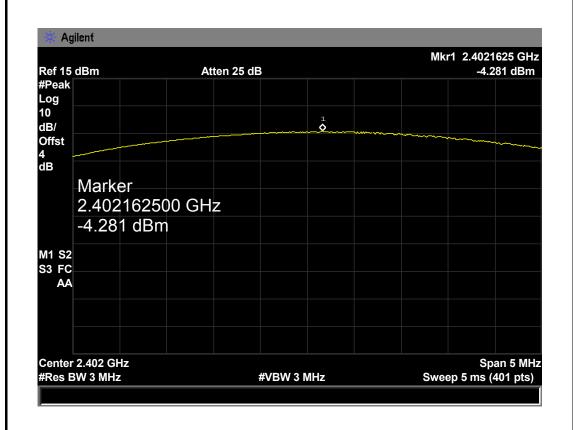


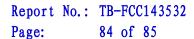
Page: 83 of 85

EUT:	Bluetooth Speaker Shutter	Model Name :	1440
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	-4.281	
2441	-4.958	21
2480	-5.537	

8-DPSK TX Mode







8-DPSK TX Mode

2441 MHz

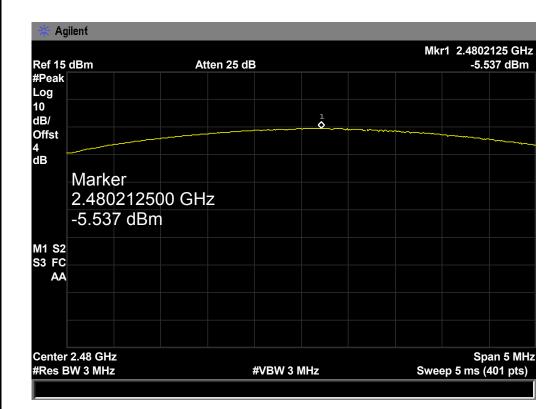
Mkr1 2.4411375 GHz

Ref 15 dBm Atten 25 dB -4.958 dBm

#Peak
Log
10
dB/

Mkr1 2.4411375 GHz Ref 15 dBm Atten 25 dB -4.958 dBm #Peak Log 10 dB/ Offst 4 dB Marker 2.441137500 GHz -4.958 dBm M1 S2 S3 FC AA Center 2.441 GHz #Res BW 3 MHz #VBW 3 MHz Mkr1 2.4411375 GHz -4.958 dBm Span 5 MHz Sweep 5 ms (401 pts)

8-DPSK TX Mode





Page: 85 of 85

10. 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 gain of the PCB antenna used for transmitting is 1.3 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 equipped a PCB Antenna. It complies with the standard requirement.

Antenna Type
✓ Permanent attached antenna
☐ Unique connector antenna
□ Professional installation antenna