

Shenzhen Toby Technology Co., Ltd.

Report No.: TB-FCC152205

1 of 44 Page:

FCC Radio Test Report FCC ID: 2AK5Q-VKB

Original Grant

Report No. TB-FCC152205

SHENZHEN MSD SCIENCE & TECHNOLOGY CO., LTD **Applicant**

Equipment Under Test (EUT)

Smart Bluetooth Bulb **EUT Name**

Model No. VKB-005-E14

Serial No. VKB-008-E12

Brand Name KASA

Receipt Date 2017-03-23

2017-03-24 to 2017-04-07 **Test Date**

Issue Date 2017-04-08

FCC Part 15: 2016, Subpart C(15.247) **Standards**

Test Method ANSI C63.10: 2013

Conclusions PASS

In the configuration tested, the EUT complied with the standards specified above,

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

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1. General Information about EUT

1.1 Client Information

Applicant : SHENZHEN MSD SCIENCE & TECHNOLOGY CO., LTD

Address R3009, BLOCK C, SUNNY NEW GANXIAN, GONGMEN S RD, LO

WU, SHENZHEN, CHINA

Manufacturer : SHENZHEN MSD SCIENCE & TECHNOLOGY CO., LTD

Address : R3009, BLOCK C, SUNNY NEW GANXIAN, GONGMEN S RD, LO

WU, SHENZHEN, CHINA

1.2 General Description of EUT (Equipment Under Test)

EUT Name	1	Smart Bluetooth Bulb				
Models No.	1	VKB-005-E14, VKB-008	/KB-005-E14, VKB-008-E12			
Model Difference	•	All these models are identical in the same PCB layout and electrical circuit, the only difference is model name for commercial.				
Milion	۰	Operation Frequency:	Bluetooth 4.0(BLE): 2402MHz~2480MHz			
33		Number of Channel:	Bluetooth 4.0(BLE): 40 channels see note(3)			
Product		RF Output Power:	2.92 dBm Conducted Power			
Description		Antenna Gain:	-1 dBi PCB Antenna			
2 6		Modulation Type:	GFSK			
0.07.77	0	Bit Rate of Transmitter:	1Mbps(GFSK)			
Power Rating		85-245VAC, 50/60Hz.				
Connecting I/O Port(S)	:	Please refer to the User's Manual				

Note:

This Test Report is FCC Part 15.247 for Bluetooth BLE, the test procedure follows the FCC KDB 558074 D01 DTS Means Guidance v04.

- (1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
- (2) Antenna information provided by the applicant.
- (3) Channel List:



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Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	14	2430	28	2458
01	2404	15	2432	29	2460
02	2406	16	2434	30	2462
03	2408	17	2436	31	2464
04	2410	18	2438	32	2466
05	2412	19	2440	33	2468
06	2414	20	2442	34	2470
07	2416	21	2444	35	2472
08	2418	22	2446	36	2474
09	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	39	2480
12	2426	26	2454		
13	2428	27	2456		

1.3 Block Diagram Showing the Configuration of System Tested

TX Mode

EUT

1.4 Description of Support Units

The EUT has been test as an independent unit.



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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	TX Mode				

For Radiated Test					
Final Test Mode	Description				
Mode 2	TX Mode				
Mode 3	TX Mode (Channel 00/20/39)				

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.

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:

BLE Mode: GFSK Modulation Transmitting mode.

- (2) During the testing procedure, the continuously transmitting with the maximum power mode was programmed by the customer.
- (3) The EUT is considered a fixed unit; in normal use it was positioned on X-plane. The worst case was found positioned on X-plane. 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 RF setting.

Test Software Version	Contract of the Contract of th	N/A	4000
Frequency	2402 MHz	2442MHz	2480 MHz
BLE GFSK	DEF	DEF	DEF



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1.7 Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, 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})	
THU THE	Level Accuracy:		
Conducted Emission	9kHz~150kHz	±3.42 dB	
	150kHz to 30MHz	±3.42 dB	
Dedicted Emission	Level Accuracy:	. 4 CO dD	
Radiated Emission	9kHz to 30 MHz	±4.60 dB	
Dedicted Emission	Level Accuracy:	. 4. 40 dD	
Radiated Emission	30MHz to 1000 MHz	±4.40 dB	
Padiated Emission	Level Accuracy:	±4.20 dB	
Radiated Emission	Above 1000MHz	±4.20 UD	

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.



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2. Test Summary

Standard S	ection	Tool Hom	ludana ant		
FCC	IC	Test Item	Judgment	Remark	
15.203		Antenna Requirement	PASS	N/A	
15.207(a)	RSS-GEN 7.2.4	Conducted Emission	PASS	N/A	
15.205&15.247(d)	RSS-GEN 7.2.2	Band-Edge & Unwanted Emissions into Restricted Frequency	PASS	N/A	
15.247(a)(2)	RSS 247 5.2 (1)	6dB Bandwidth	PASS	N/A	
15.247(b)(3)	RSS 247 5.4 (4)	Conducted Max Output Power	PASS	N/A	
15.247(e)	RSS 247 5.2 (2)	Power Spectral Density	PASS	N/A	
15.205, 15.209&15.247(d)	RSS 247 5.5	Transmitter Radiated Spurious &Unwanted Emissions into Restricted Frequency	PASS	N/A	

Note: N/A is an abbreviation for Not Applicable.



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3. Test Equipment

Conducte	d Emission Te	st			
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	100321	Jul. 22, 2016	Jul. 21, 2017
RF Switching Unit	Compliance Direction Systems Inc	RSU-A4	34403	Jul. 22, 2016	Jul. 21, 2017
AMN	SCHWARZBECK	NNBL 8226-2	8226-2/164	Jul. 22, 2016	Jul. 21, 2017
LISN	Rohde & Schwarz	ENV216	101131	Jul. 22, 2016	Jul. 21, 2017
Radiation	Emission Tes	t			
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 22, 2016	Jul. 21, 2017
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jul. 22, 2016	Jul. 21, 2017
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar. 25, 2017	Mar. 24, 2018
Bilog Antenna	ETS-LINDGREN	3142E	00117542	Mar. 25, 2017	Mar. 24, 2018
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar. 25, 2017	Mar. 24, 2018
Horn Antenna	ETS-LINDGREN	3117	00143209	Mar. 25, 2017	Mar. 24, 2018
Loop Antenna	Laplace instrument	RF300	0701	Mar. 25, 2017	Mar. 24, 2018
Pre-amplifier	Sonoma	310N	185903	Mar. 24, 2017	Mar. 23, 2018
Pre-amplifier	HP	8449B	3008A00849	Mar. 29, 2017	Mar. 28, 2018
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar. 29, 2017	Mar. 28, 2018
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A
Antenna C	Conducted Em	ission			
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 22, 2016	Jul. 21, 2017
Spectrum Analyzer	Rohde & Schwarz	ESCI	100010/007	Jul. 22, 2016	Jul. 21, 2017
Power Meter	Anritsu	ML2495A	25406005	Jul. 22, 2016	Jul. 21, 2017
Power Sensor	Anritsu	ML2411B	25406005	Jul. 22, 2016	Jul. 21, 2017



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4. Conducted Emission Test

4.1 Test Standard and Limit

4.1.1Test Standard FCC Part 15.207

4.1.2 Test Limit

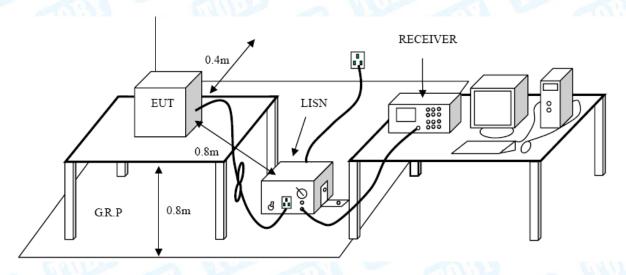
Conducted Emission Test Limit

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.

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.



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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 9 kHz, and the test frequency band is from 0.15MHz to 30MHz.

4.4 EUT Operating Mode

Please refer to the description of test mode.

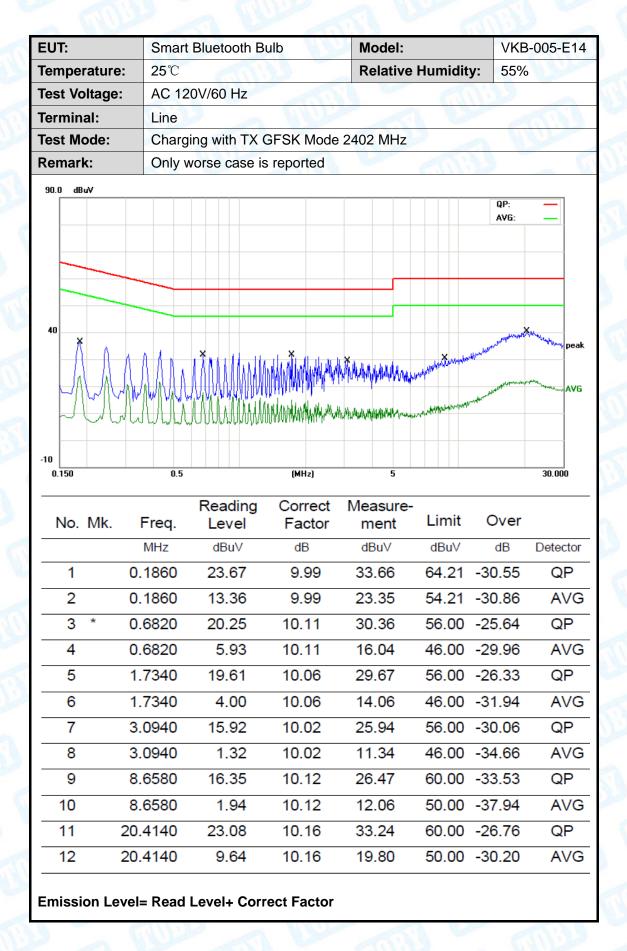
4.5 Test Da5ta

Test data please refer the following pages.



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MOLE	-	Value of the same	1000		2000	





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4	7		7
		К	Y
			-

EUT:	Smar	t Bluetooth	Bulb	Model:		VKE	3-005-E14
Temperature:	25℃			Relative	y: 55%	55%	
Test Voltage:	AC 12	20V/60 Hz	33	a little		-	A Brown
Terminal:	Neutr	al			GI	100	
Test Mode:	Char	ging with T	GFSK Mod	e 2402 MHz	<u>z</u>	0	MRL
Remark:	Only	worse case	is reported	MILL OF		2 1	
40 A A A A A A A A A A A A A A A A A A A	X X X X X X X X X X X X X X X X X X X				Address of the State of the Sta	QP: AVG:	pea
0.150	0.5		(MHz)	5			30.000
No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
	MHz	dBu∀	dB	dBu∀	dBu∀	dB	Detector
1 0	.1860	22.94	10.12	33.06	64.21	-31.15	QP
2 0	.1860	17.71	10.12	27.83	54.21	-26.38	AVG
3 0	.3100	25.95	10.08	36.03	59.97	-23.94	QP
4 0	.3100	16.68	10.08	26.76	49.97	-23.21	AVG
5 * 0	.4340	27.95	10.04	37.99	57.18	-19.19	QP
6 0	.4340	17.29	10.04	27.33	47.18	-19.85	AVG
	.6820	26.32	10.02	36.34	56.00		QP
	.6820	12.86	10.02	22.88	46.00		AVG
	.9900	25.71	10.16	35.87	56.00		QP
	.9900	13.05	10.16	23.21	46.00		AVG
	.7340	25.61	10.10	35.70	56.00		QP
11 1	.7340	9.43	10.09	19.52	46.00		AVG
12 1					/US ULL	- /M /DX	A \/(=



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4	DIT
det	KY
-	T T

UT:	Smart	Bluetooth Bu	dlu	Model:		VKB	8-005-E1	
emperature:	25℃		13	Relative Humidity:		55 %	55%	
est Voltage:	AC 24	0V/60 Hz		1	CIL	133		
erminal:	Line		MAG		63			
est Mode:	Chargi	ing with TX G	FSK Mode	2402 MHz		a W	A Libert	
emark:	Only w	orse case is	reported	Comment		13		
90.0 dBuV								
						QP: AVG:		
							\vdash	
40 ×	×	×	v				Mary Comments of the Comments	
	$\Lambda \Lambda_{\Lambda}$	للجياللا	A. A. A.	di di makara	MANAMAN	out the state of the talk of talk of the t	ре	
- 1/A\	AN AN AN AN	A KAMAMAA K		nd tite talicabilities	Miknolo		John Marine Marine	
	MJWJVJVJV			Mr. 186 . Ili. desiration	Marin Angelier	agrigitation of the second second second second	AV.	
PWW.			t it till Myklası atal Millian is Ma	i. In Maria and Maria Maria and a sa	Trai:			
0								
	0.5		(411-)				20,000	
0.150	0.5		(MHz)	5			30.000	
0.150		Reading	Correct	Measure-	l invit	Over	30.000	
	Freq.	Level	Correct Factor	Measure- ment	Limit	Over		
0.150 No. Mk.	Freq.	Level dBuV	Correct Factor	Measure- ment	dBu∀	dB	Detecto	
0.150 No. Mk.	Freq.	Level	Correct Factor	Measure- ment	dBu∀			
0.150 No. Mk.	Freq.	Level dBuV	Correct Factor	Measure- ment	dBu∀	dB -26.35	Detecto	
0.150 No. Mk.	Freq. MHz 0.1700	dBuV 28.65	Correct Factor dB 9.96	Measure- ment dBuV 38.61	dBu√ 64.96	dB -26.35 -27.61	Detecto	
0.150 No. Mk. 1 2 3	Freq. MHz 0.1700 0.1700	Level dBuV 28.65 17.39	Correct Factor dB 9.96 9.96	Measure- ment dBuV 38.61 27.35	dBuV 64.96 54.96 57.81	dB -26.35 -27.61	QP AV0	
0.150 No. Mk. 1 2 3 4	Freq. MHz 0.1700 0.1700 0.4020	Level dBuV 28.65 17.39 26.22	Correct Factor dB 9.96 9.96 10.02	Measure- ment dBuV 38.61 27.35 36.24	dBuV 64.96 54.96 57.81 47.81	dB -26.35 -27.61 -21.57 -22.62	Detecto QP AVC	
0.150 No. Mk. 1 2 3 4 5 *	Freq. MHz 0.1700 0.1700 0.4020 0.4020	Level dBuV 28.65 17.39 26.22 15.17	Correct Factor dB 9.96 9.96 10.02	Measure- ment dBuV 38.61 27.35 36.24 25.19	dBuV 64.96 54.96 57.81 47.81	dB -26.35 -27.61 -21.57 -22.62 -19.00	Detecto QP AVC QP AVC	
0.150 No. Mk. 1 2 3 4 5 * 6	Freq. MHz 0.1700 0.1700 0.4020 0.4020 0.8580 0.8580	Level dBuV 28.65 17.39 26.22 15.17 26.91 14.70	Correct Factor dB 9.96 9.96 10.02 10.02 10.09	Measure- ment dBuV 38.61 27.35 36.24 25.19 37.00 24.79	dBuV 64.96 54.96 57.81 47.81 56.00 46.00	dB -26.35 -27.61 -21.57 -22.62 -19.00 -21.21	Detecto QP AVC QP AVC	
0.150 No. Mk. 1 2 3 4 5 * 6 7	Freq. MHz 0.1700 0.1700 0.4020 0.4020 0.8580 0.8580 1.3740	Level dBuV 28.65 17.39 26.22 15.17 26.91 14.70 25.80	Correct Factor dB 9.96 9.96 10.02 10.02 10.09 10.09	Measure- ment dBuV 38.61 27.35 36.24 25.19 37.00 24.79 35.86	dBuV 64.96 54.96 57.81 47.81 56.00 46.00 56.00	dB -26.35 -27.61 -21.57 -22.62 -19.00 -21.21 -20.14	Detecto QP AVC QP AVC QP AVC	
0.150 No. Mk. 1 2 3 4 5 * 6 7 8	Freq. MHz 0.1700 0.1700 0.4020 0.4020 0.8580 0.8580 1.3740 1.3740	Level dBuV 28.65 17.39 26.22 15.17 26.91 14.70 25.80 11.60	Correct Factor dB 9.96 9.96 10.02 10.02 10.09 10.09 10.06	Measure- ment dBuV 38.61 27.35 36.24 25.19 37.00 24.79 35.86 21.66	dBuV 64.96 54.96 57.81 47.81 56.00 46.00 46.00	dB -26.35 -27.61 -21.57 -22.62 -19.00 -21.21 -20.14 -24.34	Detecto QP AVC QP AVC QP AVC	
0.150 No. Mk. 1 2 3 4 5 * 6 7 8 9	Freq. MHz 0.1700 0.1700 0.4020 0.4020 0.8580 0.8580 1.3740 1.3740 1.8300	Level dBuV 28.65 17.39 26.22 15.17 26.91 14.70 25.80 11.60 24.86	Correct Factor dB 9.96 9.96 10.02 10.09 10.09 10.06 10.06	Measure-ment dBuV 38.61 27.35 36.24 25.19 37.00 24.79 35.86 21.66 34.92	dBuV 64.96 54.96 57.81 47.81 56.00 46.00 56.00	dB -26.35 -27.61 -21.57 -22.62 -19.00 -21.21 -20.14 -24.34 -21.08	Detecto QP AVC QP AVC QP AVC QP	
0.150 No. Mk. 1 2 3 4 5 * 6 7 8 9 10	Freq. MHz 0.1700 0.1700 0.4020 0.4020 0.8580 0.8580 1.3740 1.3740 1.8300 1.8300	Level dBuV 28.65 17.39 26.22 15.17 26.91 14.70 25.80 11.60 24.86 11.05	Correct Factor dB 9.96 9.96 10.02 10.02 10.09 10.06 10.06 10.06	Measure-ment dBuV 38.61 27.35 36.24 25.19 37.00 24.79 35.86 21.66 34.92 21.11	dBuV 64.96 54.96 57.81 47.81 56.00 46.00 56.00 46.00	dB -26.35 -27.61 -21.57 -22.62 -19.00 -21.21 -20.14 -24.34 -21.08 -24.89	Detecto QP AVC QP AVC QP AVC	
0.150 No. Mk. 1 2 3 4 5 * 6 7 8 9 10	Freq. MHz 0.1700 0.1700 0.4020 0.4020 0.8580 0.8580 1.3740 1.3740 1.8300	Level dBuV 28.65 17.39 26.22 15.17 26.91 14.70 25.80 11.60 24.86	Correct Factor dB 9.96 9.96 10.02 10.09 10.09 10.06 10.06	Measure-ment dBuV 38.61 27.35 36.24 25.19 37.00 24.79 35.86 21.66 34.92	dBuV 64.96 54.96 57.81 47.81 56.00 46.00 56.00 46.00	dB -26.35 -27.61 -21.57 -22.62 -19.00 -21.21 -20.14 -24.34 -21.08 -24.89	Detecto QP AVC QP AVC QP AVC	



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S Y

EUT:		Smar	t Bluetooth	Bulb	Model:		VKE	3-005-E14	
Tempera	ture:	25℃	CIN'	N)	Relative	Humidit	y: 55%	, D	
Test Volt	age:	AC 2	40V/60 Hz	-		CIL	1133		
Terminal	:	Neuti	ral	DATE:		IN		MRI)	
Test Mod	5 5								
Remark:		Only	worse case	is reported		CITI!	13		
90.0 dBuV							QP:		
							AVG:		
-									
40 /i	<u> </u>	ζ ,		ř X X	مرين واسوال		later than	peak	
						MAYAMM	A LANGE BOOK		
7/\\.					Hilly the to three towns	4	and of his books and his way to be a few of the control of the con	AVG	
	1 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	PIVIVIN			ha Manakan	Managara			
7 W	MWW	MUUL	1/1/ՄՈՒ Ի Վ Խ ՈՐՈՈՒ	. Illi					
-10									
0.150		0.5		(MHz)	5			30.000	
			Reading	Correct	Measure-				
No. M	lk. Fr	eq.	Level	Factor	ment	Limit	Over		
	MI	Hz	dBu∨	dB	dBu∨	dBu∨	dB	Detector	
1	0.23	300	30.75	10.11	40.86	62.45	-21.59	QP	
2	0.23	300	23.88	10.11	33.99	52.45	-18.46	AVG	
3	0.40	020	30.11	10.05	40.16	57.81	-17.65	QP	
4	0.40	020	21.39	10.05	31.44	47.81	-16.37	AVG	
5	0.86	520	28.19	10.10	38.29	56.00	-17.71	QP	
6	0.86	320	14.96	10.10	25.06	46.00	-20.94	AVG	
7 *	1.37	740	29.66	10.12	39.78	56.00	-16.22	QP	
8	1.37	740	17.46	10.12	27.58	46.00	-18.42	AVG	
9	1.83	340	28.32	10.08	38.40	56.00	-17.60	QP	
10	1.83	340	13.62	10.08	23.70	46.00	-22.30	AVG	
11	2.40	060	27.92	10.06	37.98	56.00	-18.02	QP	
12	2.40	060	13.13	10.06	23.19	46.00	-22.81	AVG	
Emission	n Level=	Read	Level+ Corr	ect Factor					



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5. Radiated Emission Test

5.1 Test Standard and Limit

5.1.1 Test Standard FCC Part 15.247(d)

5.1.2 Test Limit

Radiated Emission Limits (9kHz~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	Distance Meters(at 3m)				
(MHz)	Peak (dBuV/m)	Average (dBuV/m)			
Above 1000	74	54			

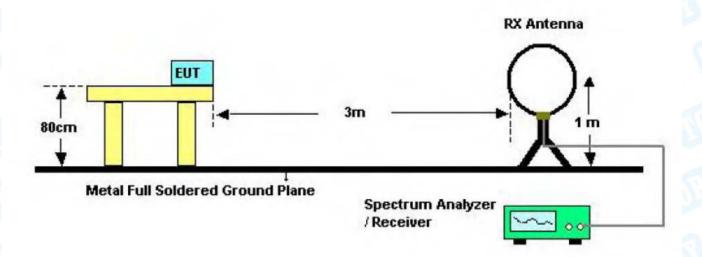
Note:

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

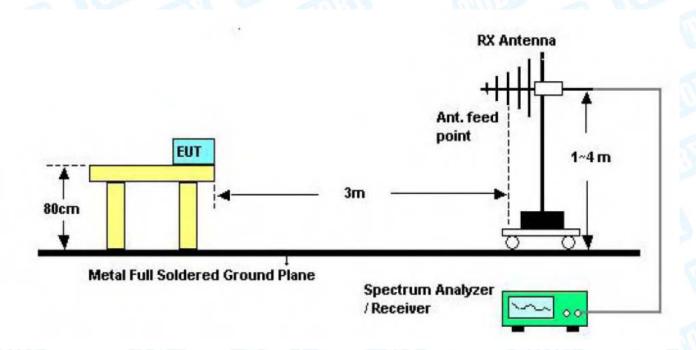


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5.2 Test Setup



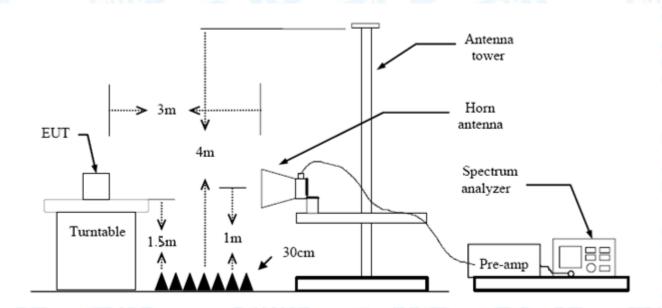
Below 30MHz Test Setup



Below 1000MHz Test Setup



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Above 1GHz Test Setup

5.3 Test Procedure

- (1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above 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.



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5.4 EUT Operating Condition

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

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=10 Hz with Peak Detector for Average Values.

Test data please refer the following pages.



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9 KHz~30 MHz

From 9 KHz to 30 MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB

below the permissible value has no need to be reported.

30MHz~1GHz

UT:	Smart	Bluetooth Bu	ulb M e	odel:	VK	(B-005-E1	4
emperature:	: 25 ℃	25℃ Relative Humidity			dity: 55	%	. 1
est Voltage:	AC 12	0V/60 Hz	A HILL		1300		
Ant. Pol.	Horizo	Horizontal					
Test Mode:	BLE T	BLE TX 2402 Mode					
Remark:	Only v	vorse case is	reported	1			
80.0 dBuV/m							
					(RF)FCC 15	C 3M Radiation Margin -6	
						Margin -0	
30						6 Wingston with the Terr	Luma
			3 ¥	*	5 	Whipson Boundary Washington	dia Maria
who work have for the or		2 X	Mary and the second	Manual house	AND DESIGNATION OF THE PARTY OF		
1 /	many Massacramings		Modern and				
-20							
30.000 40	50 60 7	0 80	(MHz)	300	400 500	0 600 700	1000.00
		Reading	Correct	Measure-			
No. Mk.	Freq.	Level	Factor	ment	Limit	Over	
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detecto
1 4	11.5670	31.71	-20.96	10.75	40.00	-29.25	peal
2 1	07.8877	30.74	-21.86	8.88	43.50	-34.62	peal
3 1	91.7450	38.18	-20.45	17.73	43.50	-25.77	peal
	90.0172	36.76	-16.85	19.91	46.00	-26.09	peal
-		30.39	-12.07	18.32	46.00	-27.68	peal
5 4	44 851/1	30.33	12.01	10.32	40.00	-27.00	pear
	44.8514		F 70	05.04	40.00	00.00	
	66.0571	30.73	-5.72	25.01	46.00	-20.99	peal
		30.73	-5.72	25.01	46.00	-20.99	peal



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EUT:	Smart Bluetooth B	Bulb	Model:	VKB-005-E14		
Temperature:	25℃ Relative Humidity:			55%		
Test Voltage:	AC 120V/60 Hz	The second				
Ant. Pol.	Vertical	Vertical				
Test Mode:	BLE TX 2402 Mod	le	MIDS	THE PARTY OF THE P		
Remark:	Only worse case i	s reported		33		
80.0 dBuV/m						
30	1 2 3 X	5	6 X	15C 3M Radiation Margin -6 dB		
-20 30.000 40 50	0 60 70 80	(MHz)	300 400 !	500 600 700 1000.000		
	Reading Freq. Level		Measure- ment Limit	Over		
	MHz dBuV	dB/m	dBuV/m dBuV/m	n dB Detecto		
1 * 54.				00.04		
1 34.	.2610 44.23	-24.54	19.69 40.00	-20.31 peak		
	.2610 44.23 .5617 41.01	-24.54 -24.46	19.69 40.00 16.55 40.00	<u>'</u>		
2 61.				-23.45 peak		

43.50

46.00

18.17

23.98

-25.33

-22.02

peak

peak

191.0738

290.0172

5

6

Emission Level= Read Level+ Correct Factor

38.67

40.83

-20.50

-16.85

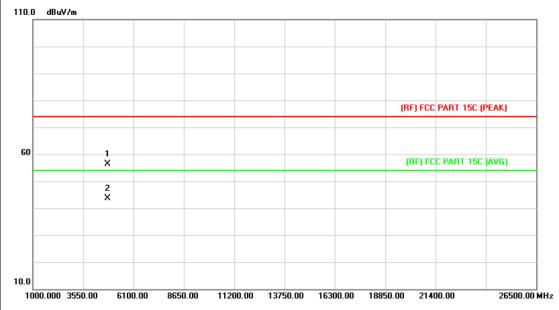
^{*:}Maximum data x:Over limit !:over margin



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Above 1GHz

Smart Bluetooth Bulb	Model:	VKB-005-E14			
25℃	Relative Humidity:	55%			
AC 120V/60 Hz					
Horizontal					
BLE Mode TX 2402 MHz					
No report for the emission which more than 10 dB below the prescribed limit.					
	25°C AC 120V/60 Hz Horizontal BLE Mode TX 2402 MHz No report for the emission w	25°C Relative Humidity: AC 120V/60 Hz Horizontal BLE Mode TX 2402 MHz No report for the emission which more than 10 dB			

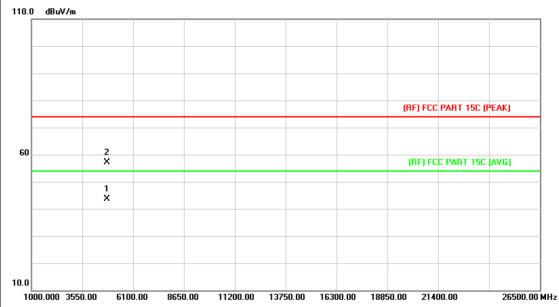


No	o. Mk	. Freq.	Reading Level		Measure- ment	Limit	Over	
		MHz	dBu∨	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4803.094	43.03	13.44	56.47	74.00	-17.53	peak
2	*	4805.161	30.30	13.45	43.75	54.00	-10.25	AVG



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EUT:	Smart Bluetooth Bulb	Model:	VKB-005-E14		
Temperature:	25℃	Relative Humidity:	55%		
Test Voltage:	AC 120V/60 Hz	The Dist			
Ant. Pol.	Vertical				
Test Mode:	BLE Mode TX 2402 MHz	WILD S	J. Hills		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.				

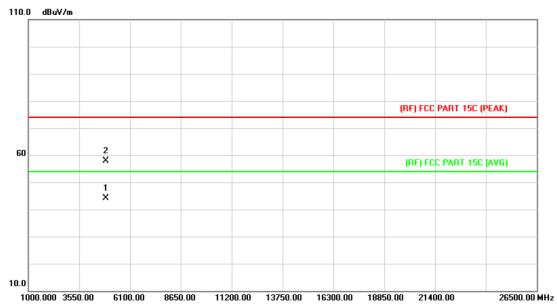


N	No.	Mk.	Freq.	_	Correct Factor	Measure- ment	Limit	Over	
			MHz	dBu∨	dB/m	dBuV/m	dBuV/m	dB	Detector
1		*	4803.295	30.22	13.44	43.66	54.00	-10.34	AVG
2			4804.339	43.62	13.44	57.06	74.00	-16.94	peak



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	0 151 1 5 11		\((\text{U}\)(\text{D}\) 007 544			
EUT:	Smart Bluetooth Bulb	Model:	VKB-005-E14			
Temperature:	25℃	Relative Humidity:	55%			
Test Voltage:	AC 120V/60 Hz	The state of the s	133			
Ant. Pol.	Horizontal					
Test Mode:	BLE Mode TX 2442 MHz		A Million			
Remark:	No report for the emission which more than 10 dB below the					
	prescribed limit.					
i						

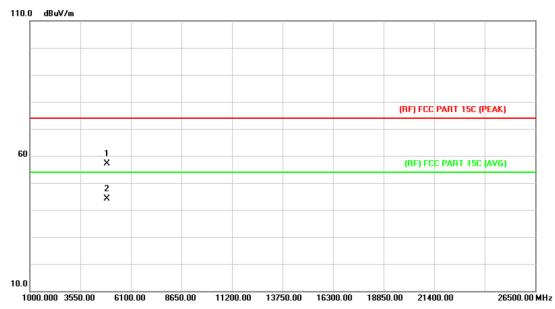


	No.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
			MHz	dBu∨	dB/m	dBuV/m	dBuV/m	dB	Detector
1		*	4882.746	30.11	13.90	44.01	54.00	-9.99	AVG
2			4884.612	44.04	13.92	57.96	74.00	-16.04	peak



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EUT:	Smart Bluetooth Bulb	Model:	VKB-005-E14			
Temperature:	25℃	25℃ Relative Humidity: 55%				
Test Voltage:	AC 120V/60 Hz		1133			
Ant. Pol.	Vertical	O				
Test Mode:	BLE Mode TX 2442 MHz		A HILL			
Remark:	No report for the emission v	No report for the emission which more than 10 dB below the				
	prescribed limit.					

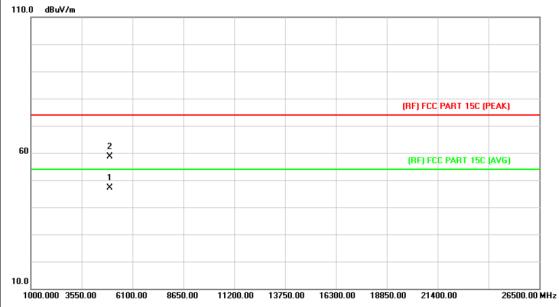


N	o. Mi	k. Freq.	Reading Level		Measure- ment	Limit	Over	
		MHz	dBu∀	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4884.591	43.25	13.92	57.17	74.00	-16.83	peak
2	*	4885.092	30.23	13.93	44.16	54.00	-9.84	AVG



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EUT:	Smart Bluetooth Bulb	Model:	VKB-005-E14		
Temperature:	25℃	Relative Humidity:	55%		
Test Voltage:	AC 120V/60 Hz	31	133		
Ant. Pol.	Horizontal	U			
Test Mode:	BLE Mode TX 2480 MHz	WIII DE	a little		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.				
	·	·			

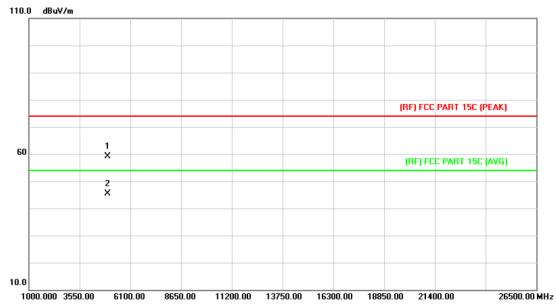


1	No.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
			MHz	dBu∨	dB/m	dBuV/m	dBuV/m	dB	Detector
1		*	4960.612	32.88	14.36	47.24	54.00	-6.76	AVG
2			4961.476	44.35	14.38	58.73	74.00	-15.27	peak



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EUT:	Smart Bluetooth Bulb	Model:	VKB-005-E14		
Temperature:	25℃	Relative Humidity:	55%		
Test Voltage:	AC 120V/60 Hz	110	133		
Ant. Pol.	Vertical	U			
Test Mode:	BLE Mode TX 2480 MHz	MIDS	J. Hilliam		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.				



No	. Mk.	Freq.	_	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBu∨	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4958.914	44.72	14.35	59.07	74.00	-14.93	peak
2	*	4960.852	31.02	14.36	45.38	54.00	-8.62	AVG



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6. Restricted Bands Requirement

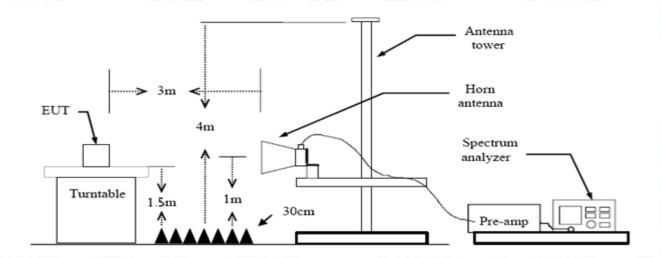
6.1 Test Standard and Limit

6.1.1 Test Standard FCC Part 15.247(d) FCC Part 15.205

6.1.2 Test Limit

Restricted Frequency	Distance Me	eters(at 3m)
Band (MHz)	Peak (dBuV/m)	Average (dBuV/m)
2310 ~2390	74	54
2483.5 ~2500	74	54

6.2 Test Setup



6.3 Test Procedure

- (1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above 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



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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=10 Hz with Peak Detector for Average Values.

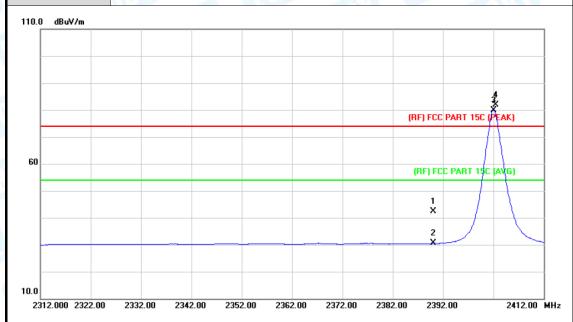
Test data please refer the following pages.



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(1) Radiation Test

EUT:	Smart Bluetooth Bulb	Model:	VKB-005-E14
Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60 Hz		
Ant. Pol.	Horizontal		A VIII
Test Mode:	BLE Mode TX 2402 MHz		3.9
Remark:	N/A		

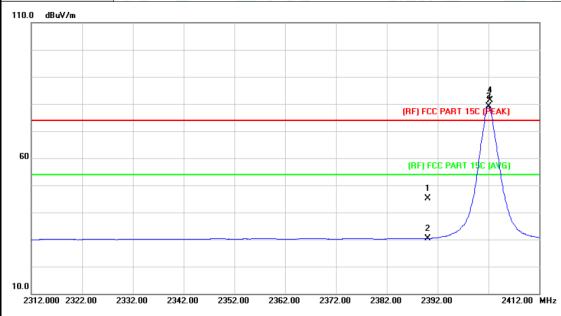


No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBu∀	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	41.67	0.77	42.44	74.00	-31.56	peak
2		2390.000	29.75	0.77	30.52	54.00	-23.48	AVG
3	*	2402.000	79.17	0.82	79.99	Fundamental	Frequency	AVG
4	X	2402.500	81.06	0.82	81.88	– Fundamental	Frequency	peak



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EUT:	Smart Bluetooth Bulb	Model:	VKB-005-E14
Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60 Hz		
Ant. Pol.	Vertical		
Test Mode:	BLE Mode TX 2402 MHz	MILLER	THE PARTY OF THE P
Remark:	N/A		133

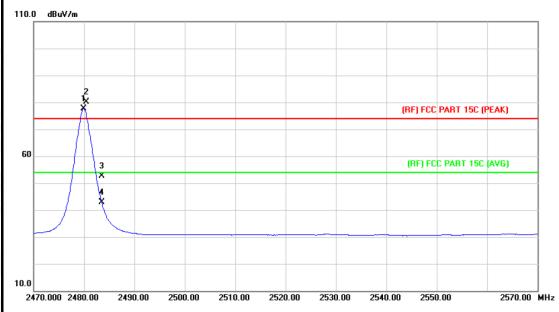


No	o. Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBu∀	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	44.45	0.77	45.22	74.00	-28.78	peak
2		2390.000	29.54	0.77	30.31	54.00	-23.69	AVG
3	*	2402.000	78.33	0.82	79.15	Fundamental	Frequency	AVG
4	X	2402.300	80.54	0.82	81.36	Fundamental	Frequency	peak



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EUT:	Smart Bluetooth Bulb	Model:	VKB-005-E14
Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60 Hz		133
Ant. Pol.	Horizontal	0	
Test Mode:	BLE Mode TX 2480 MHz		a little
Remark:	N/A		

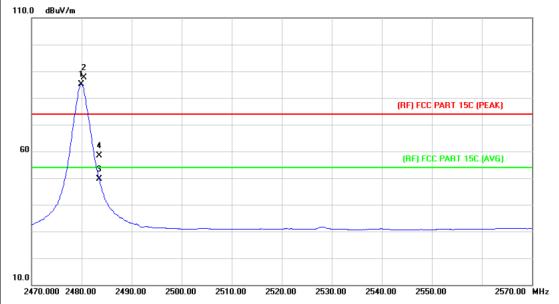


No	. Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBu∀	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	2479.900	76.49	1.15	77.64	Fundamental	Frequency	AVG
2	Χ	2480.400	79.04	1.15	80.19	Fundamental	Frequency	peak
3		2483.500	51.37	1.17	52.54	74.00	-21.46	peak
4		2483.500	41.67	1.17	42.84	54.00	-11.16	AVG



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EUT:	Smart Bluetooth Bulb	Model:	VKB-005-E14
Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60 Hz	01 - 0	
Ant. Pol.	Vertical		
Test Mode:	BLE Mode TX 2480 MHz	MILLER	THE PARTY OF THE P
Remark:	N/A		



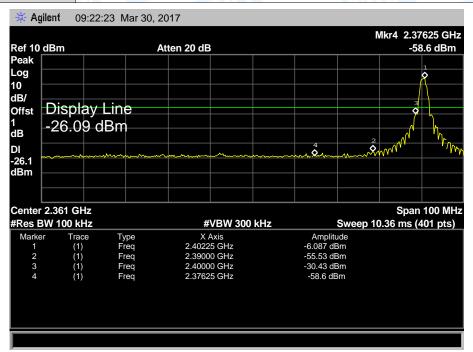
No	. Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBu∀	dB/m	dBuV/m	dBuV/m	dB	Detector
1	X	2479.900	84.01	1.15	85.16	Fundamental F	requency	peak
2	*	2480.400	86.43	1.15	87.58	Fundamental F	requency	peak
3		2483.500	48.43	1.17	49.60	74.00	-24.40	peak
4		2483.500	57.24	1.17	58.41	74.00	-15.59	peak

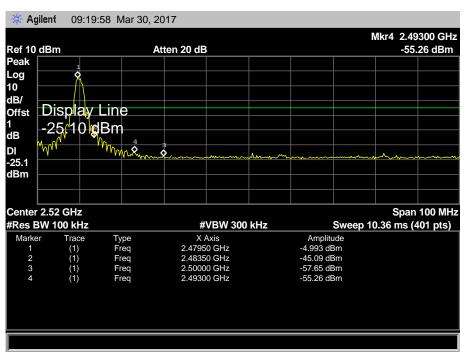


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(2) Conducted Test

EUT:	Smart Bluetooth Bulb	Model:	VKB-005-E14
Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60 Hz	0	
Test Mode:	BLE Mode TX 2402MHz / B	LE Mode TX 2480MHz	2 Millian
Remark:	The EUT is programed in co	entinuously transmitting	mode







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7. Bandwidth Test

7.1 Test Standard and Limit

7.1.1 Test Standard FCC Part 15.247 (a)(2)

7.1.2 Test Limit

FCC P	art 15 Subpart C(15.247)/	RSS-247
Test Item	Limit	Frequency Range(MHz)
Bandwidth	>=500 KHz (6dB bandwidth)	2400~2483.5

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) The bandwidth is measured at an amplitude level reduced 6dB 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.
- (3)Measure the channel separation the spectrum analyzer was set to Resolution Bandwidth:100 kHz, and Video Bandwidth:300 kHz, Detector: Peak, Sweep Time set auto.

7.4 EUT Operating Condition

The EUT was set to continuously transmitting in each mode and low, middle and high channel for the test.



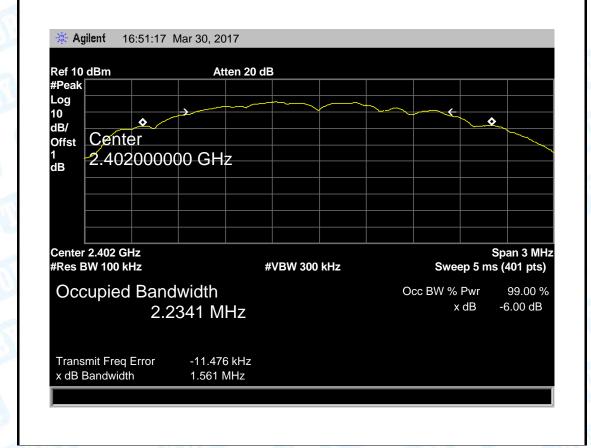
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7.5 Test Data

EUT:	Smart Bluetooth Bulb	Model:	VKB-005-E14
Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60 Hz	THUE	
Test Mode:	BLE TX Mode		1373
Channel frequence	cy 6dB Bandwidth	99% Bandwidth	Limit
(MHz)	(kHz)	(kHz)	(kHz)
2402	1561.0	2234.10	
2442	1561.0	2241.20	>=500
2480	1661.0	2251.30	
	DI E I		

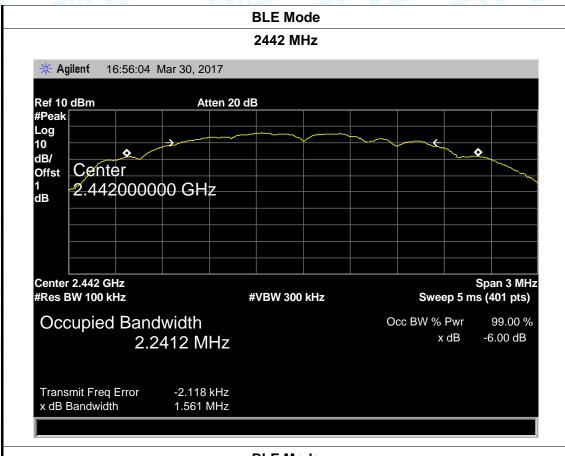
BLE Mode

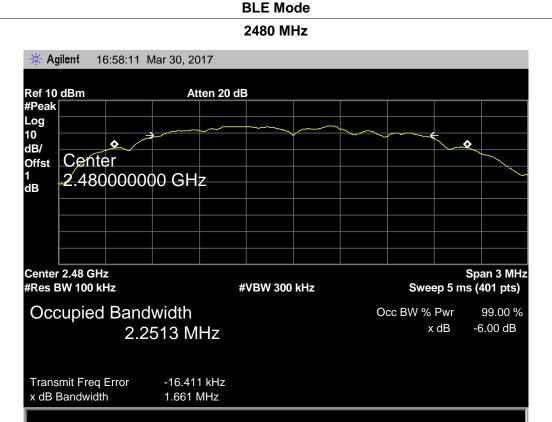
2402 MHz





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8. Peak Output Power Test

8.1 Test Standard and Limit

8.1.1 Test Standard FCC Part 15.247 (b)(3)

8.1.2 Test Limit

FCC Par	t 15 Subpart C(15.247)/RS	S-247
Test Item	Limit	Frequency Range(MHz)
Peak Output Power	1 Watt or 30 dBm	2400~2483.5

8.2 Test Setup



8.3 Test Procedure

The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement is according to section 9.1.1 of KDB 558074 D01 DTS Meas Guidance v04.

- (1) Set the RBW≥DTS Bandwidth
- (2) Set VBW≥3*RBW
- (3) Set Span≥3*RBW
- (4) Sweep time=auto
- (5) Detector= peak
- (6) Trace mode= maxhold.
- (7) Allow trace to fully stabilize, and then use peak marker function to determine the peak amplitude level.

8.4 EUT Operating Condition

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



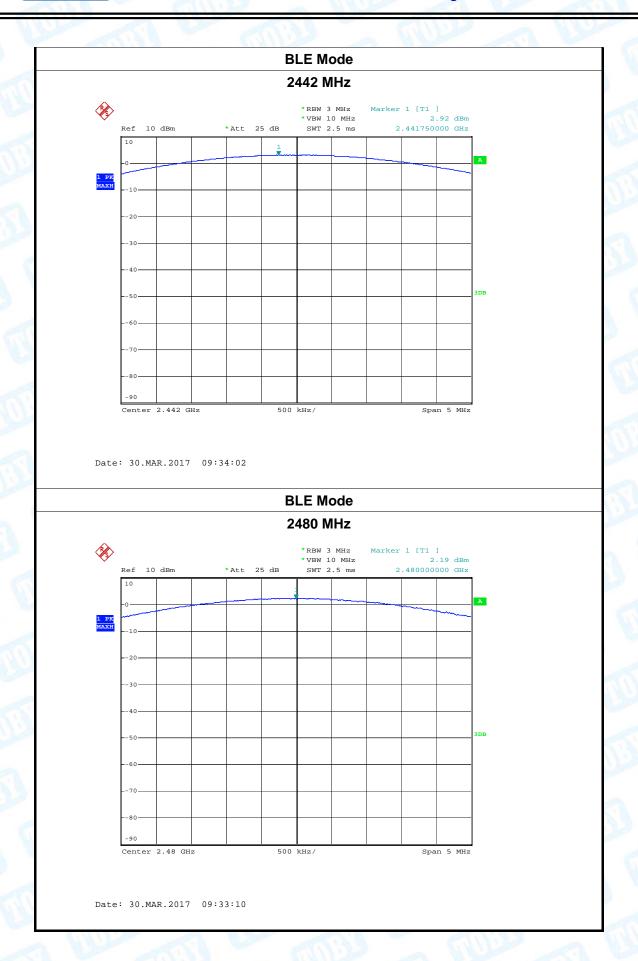
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8.5 Test Data

EUT:	Smart E	Bluetooth	Bulb	Мо	del:			VKB-005-E14
Temperature:	25℃		III	Re	lative	Humi	dity:	55%
Test Voltage:	AC 120	V/60 Hz	3	_ {	11/1/	115-0		a Millian
Test Mode:	BLE TX	Mode						33
Channel frequer	ncy (MHz) 1	Test Resu	ılt (dBı	n)		L	.imit (dBm)
2402			2.6	64				
2442			2.9	2				30
2480			2.1	9				
		•	BLE N	lode				
			2402	MHz				
				3 MHz 10 MHz			64 dBm	
	0 dBm	*Att 25	* VBW				64 dBm	
Ref 1	0 dBm	* Att 25	* VBW	10 MHz		2.	64 dBm	À.
10 -0	0 dBm	*Att 25	* VBW	10 MHz		2.	64 dBm	À.
10	0 dBm	*Att 25	* VBW	10 MHz		2.	64 dBm	A.
10 -0	0 dBm	*Att 25	* VBW	10 MHz		2.	64 dBm	Ā
10 PF MAXE 10	0 dBm	*Att 25	* VBW	10 MHz		2.	64 dBm	A
10 PE MANH10	0 dBm	*Att 25	* VBW	10 MHz		2.	64 dBm	Ä.
10 -0	0 dBm	*Att 25	* VBW	10 MHz		2.	64 dBm 00 GHz	À
10 -0	0 dBm	*Att 25	* VBW	10 MHz		2.	64 dBm 00 GHz	
10 -0	0 dBm	*Att 25	* VBW	10 MHz		2.	64 dBm 00 GHz	
10 -0	0 dBm	*Att 25	* VBW	10 MHz		2.	64 dBm 00 GHz	
10 -0	0 dBm	*Att 25	* VBW	10 MHz		2.	64 dBm 00 GHz	
10 PK MAXII10	0 dBm	*Att 25	* VBW	10 MHz		24019500	64 dBm 00 GHz	



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9. Power Spectral Density Test

9.1 Test Standard and Limit

9.1.1 Test Standard FCC Part 15.247 (e)

9.1.2 Test Limit

FCC Part 15 Subpart C(15.247)					
Test Item	Limit	Frequency Range(MHz)			
Power Spectral Density	8dBm(in any 3 kHz)	2400~2483.5			

9.2 Test Setup



9.3 Test Procedure

The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v04.

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Set analyser center frequency to DTS channel center frequenyc.
- (3) Set the span to 1.5 times the DTS bandwidth.
- (4) Set the RBW to: 3 kHz(5) Set the VBW to: 10 kHz
- (6) Detector: peak(7) Sweep time: auto
- (8) Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

9.4 EUT Operating Condition

The EUT was set to continuously transmitting in each mode and low, Midle and high channel for the test.



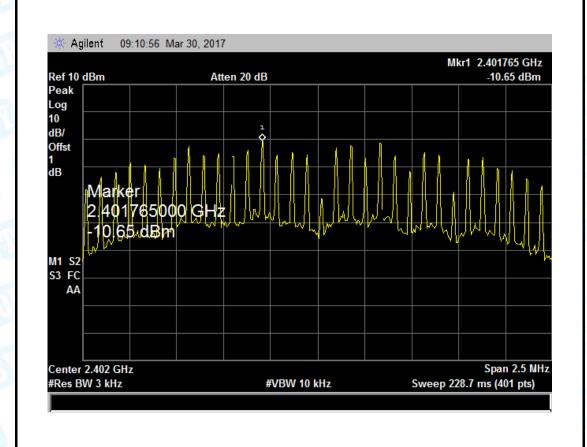
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9.5 Test Data

EUT:	Smart Bluetooth Bulb Mo		Model:		VKB-005-E14	
Temperature:	25℃		Relative Humidity:		55%	
Test Voltage:	AC 120V/60 Hz					
Test Mode:	BLE TX Mode					
Channel Frequency		Power Density		Lin	nit	Result
(MHz)		(dBm)		(dBm)		Result
2402		-10.6	65			PASS
2442		-8.0	57	8		
2480		-10.1	18			

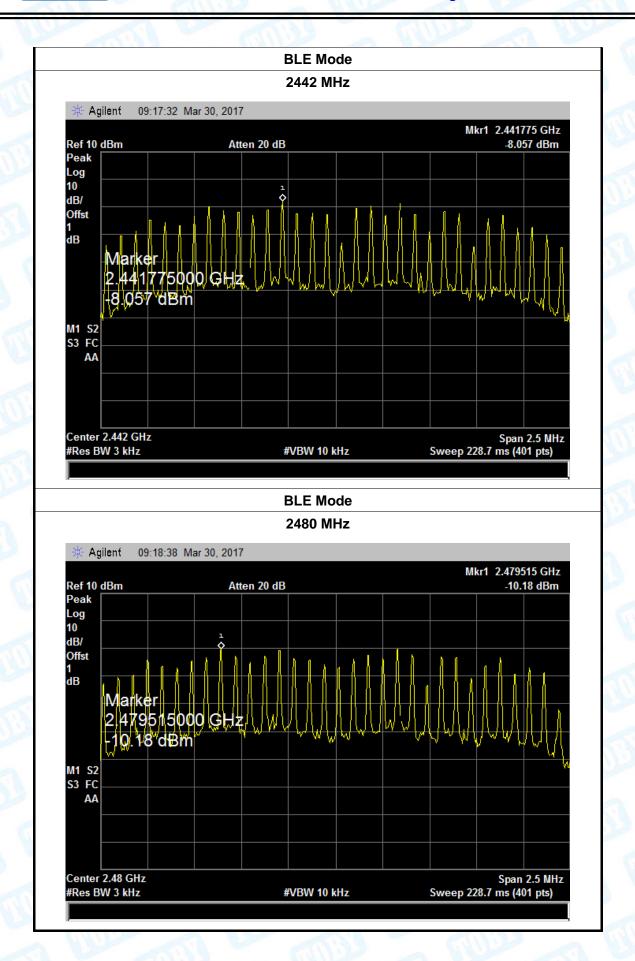
BLE Mode

2402 MHz





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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 gains of the antenna used for transmitting is -1dBi, and the antenna de-signed with permanent attachment and no consideration of replacement. Please see the EUT photo for details.

10.3 Result

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

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

----END OF REPORT-----