

FCC REPORT

(ZIGBEE)

Applicant: AZTECH TECHNOLOGIES PTE LTD

Address of Applicant: 31 Ubi Road 1, #01-05, Singapore 408694

Equipment Under Test (EUT)

Product Name: Smart Wall Switch

Model No.: KSWs-223-ZB, KSWs-222-ZB, KSWs-221-ZB

Trade mark: KylaS

FCC ID: I38SMARTSWITCH

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Date of sample receipt: 17 Jan., 2019

Date of Test: 17 Jan., to 22 Feb., 2019

Date of report issued: 16 Jul., 2019

Test Result: PASS *

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

Authorized Signature:



Bruce Zhang
Laboratory Manager

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 and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

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2 Version

Version No.	Date	Description
00	16 Jul., 2019	Original

Tested by:

YT Yang

Test Engineer

Date:

16 Jul., 2019

Reviewed by:

Wimer Zhang

Project Engineer

Date:

16 Jul., 2019

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4 Test Summary

Test Items	Section in CFR 47	Result
Antenna requirement	15.203 & 15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(3)	Pass
6dB Emission Bandwidth 99% Occupied Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247 (d)	Pass
Spurious Emission	15.205 & 15.209	Pass
<i>Pass: The EUT complies with the essential requirements in the standard.</i> <i>N/A: The EUT not applicable of the test item.</i>		

5 General Information

5.1 Client Information

Applicant:	AZTECH TECHNOLOGIES PTE LTD
Address:	31 Ubi Road 1, #01-05, Singapore 408694
Manufacturer:	AZTECH TECHNOLOGIES PTE LTD
Address:	31 Ubi Road 1, #01-05, Singapore 408694
Factory:	Aztech Communication Device (DG) LTD
Address:	Jiu Jiang Shui Village, Chang Ping Town, Dong Guan City, Guang Dong Province, China.

5.2 General Description of E.U.T.

Product Name:	Smart Wall Switch
Model No.:	KWS-223-ZB, KWS-222-ZB, KWS-221-ZB
Operation Frequency:	2405MHz~2480MHz (IEEE 802.15.4)
Channel numbers:	16 for (IEEE 802.15.4)
Channel separation:	5 MHz
Modulation technology: (IEEE 802.15.4)	OQPSK
Data speed(IEEE 802.15.4):	250kbps
Antenna Type:	PCB antenna
Antenna gain:	1.5 dBi
Power supply:	AC 120V/60Hz
Test Sample Condition:	The applicant provided engineering samples for staying in continuously transmitting for testing.
Remark:	The No.: KWS-223-ZB, KWS-222-ZB, KWS-221-ZB internal same, circuit design, layout, internal wiring, the only difference is: KWS-223-ZB has 3 relays KWS-222-ZB has 2 relays KWS-221-ZB has 1 relay

Operation Frequency each of channel for IEEE 802.15.4							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2405MHz	5	2425MHz	9	2445MHz	13	2465MHz
2	2410MHz	6	2430MHz	10	2450MHz	14	2470MHz
3	2415MHz	7	2435MHz	11	2455MHz	15	2475MHz
4	2420MHz	8	2440MHz	12	2460MHz	16	2480MHz
Note:							
1. Channel 1, 8 & 16 selected for IEEE 802.15.4 as Lowest, Middle and Highest channel.							

5.3 Test environment and test mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test mode:	
Transmitting mode	Keep the EUT in continuous transmitting with modulation
The sample was placed 0.8m (below 1GHz)/1.5m (above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. Duty cycle setting during the transmission is 100% with maximum power setting for all modulations.	

5.4 Description of Support Units

The EUT has been tested as an independent unit.

5.5 Measurement Uncertainty

Parameters	Expanded Uncertainty
Conducted Emission (9kHz ~ 30MHz)	±2.22 dB (k=2)
Radiated Emission (9kHz ~ 30MHz)	±2.76 dB (k=2)
Radiated Emission (30MHz ~ 1000MHz)	±4.28 dB (k=2)
Radiated Emission (1GHz ~ 18GHz)	±5.72 dB (k=2)
Radiated Emission (18GHz ~ 40GHz)	±2.88 dB (k=2)

5.6 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Designation No.: CN1211**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber of Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L6048**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6048.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: <https://portal.a2la.org/scopepdf/4346-01.pdf>

5.7 Laboratory Location

Shenzhen Zhongjian Nanfang Testing Co., Ltd.
 Address: No. B-C, 1/F., Building 2, Laodong No.2 Industrial Park, Xixiang Road,
 Bao'an District, Shenzhen, Guangdong, China
 Tel: +86-755-23118282, Fax: +86-755-23116366
 Email: info@ccis-cb.com, Website: http://www.ccis-cb.com

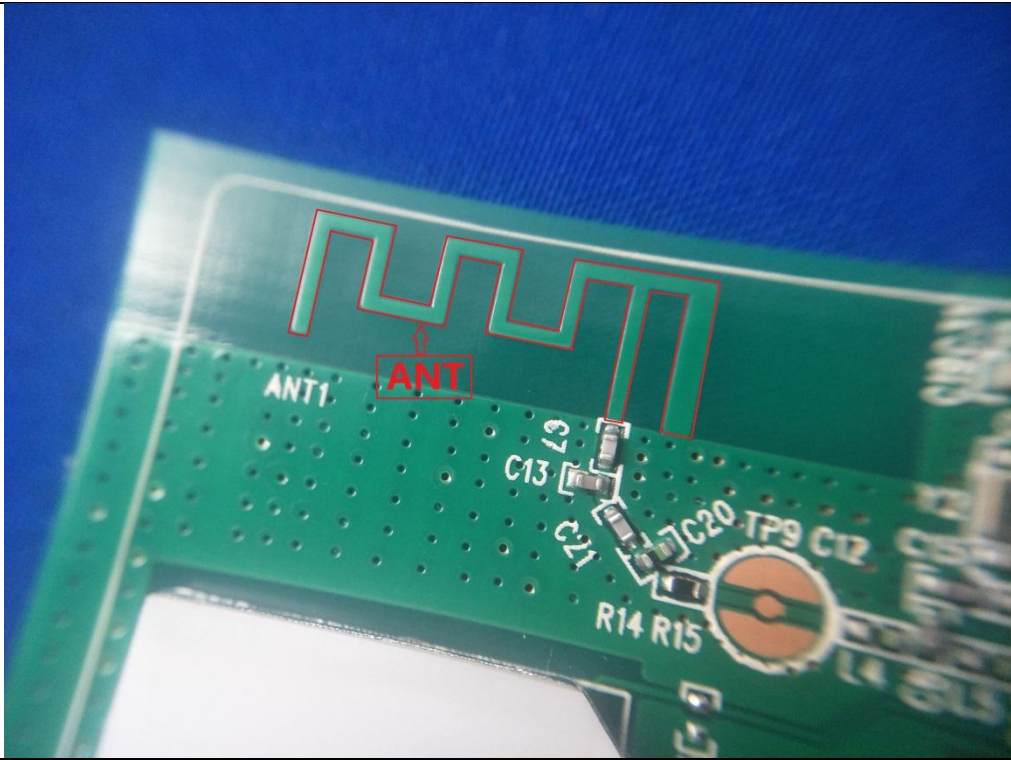
5.8 Test Instruments list

Radiated Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	SAEMC	9m*6m*6m	966	07-22-2017	07-21-2020
Loop Antenna	SCHWARZBECK	FMZB1519B	00044	03-16-2018	03-15-2019
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-16-2018	03-15-2019
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-16-2018	03-15-2019
Horn Antenna	SCHWARZBECK	BBHA9120D	1805	06-22-2017	06-21-2020
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170582	11-21-2018	11-20-2019
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-07-2018	03-06-2019
Pre-amplifier	CD	PAP-1G18	11804	03-07-2018	03-06-2019
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-07-2018	03-06-2019
Spectrum analyzer	Rohde & Schwarz	FSP40	100363	11-21-2018	11-20-2019
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-07-2018	03-06-2019
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-07-2018	03-06-2019
Cable	MICRO-COAX	MFR64639	K10742-5	03-07-2018	03-06-2019
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-07-2018	03-06-2019
RF Switch Unit	MWRFTTEST	MW200	N/A	N/A	N/A
Test Software	MWRFTTEST	MTS8200	Version: 2.0.0.0		

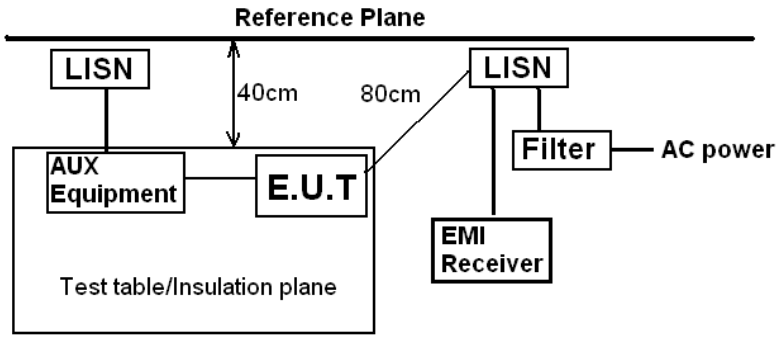
Conducted Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESCI	101189	03-07-2018	03-06-2019
Pulse Limiter	SCHWARZBECK	OSRAM 2306	9731	03-07-2018	03-06-2019
LISN	CHASE	MN2050D	1447	03-19-2018	03-18-2019
LISN	Rohde & Schwarz	ESH3-Z5	8438621/010	07-21-2018	07-20-2019
Cable	HP	10503A	N/A	03-07-2018	03-06-2019
EMI Test Software	AUDIX	E3	Version: 6.110919b		

6 Test results and Measurement Data

6.1 Antenna requirement:

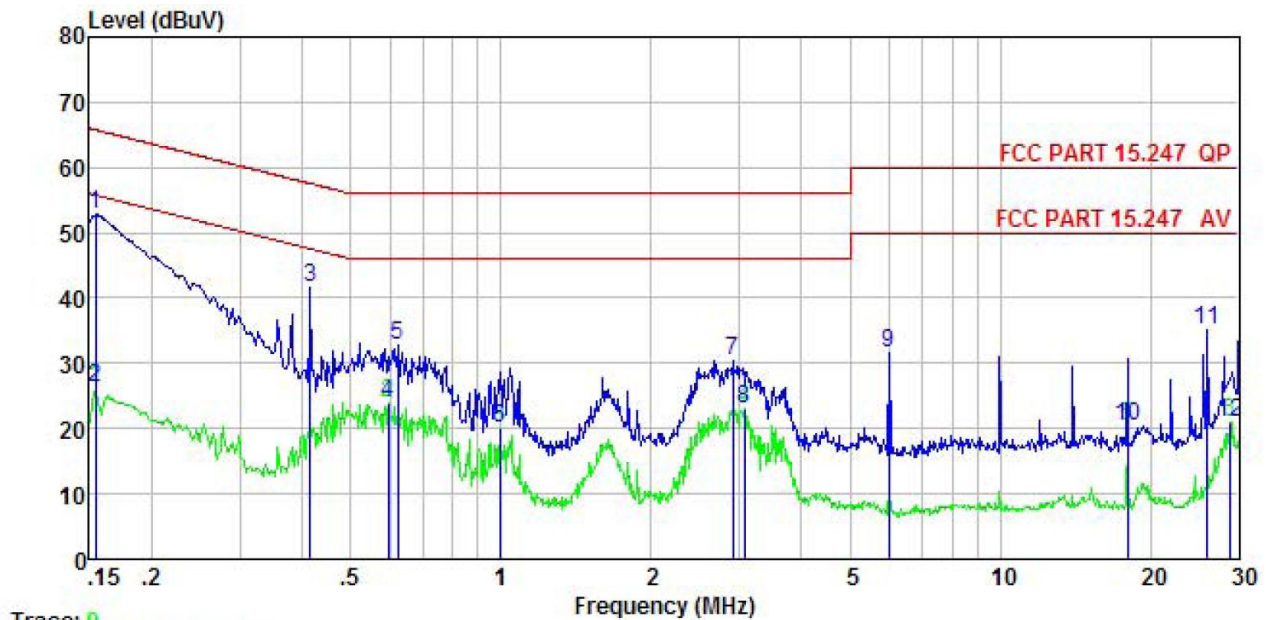
Standard requirement:	FCC Part 15 C Section 15.203 /247(b)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, 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. 15.247(b) (4) requirement: (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
E.U.T Antenna:	
The BLE antenna is an PCB antenna which cannot replace by end-user, the best-case gain of the antenna is 1.5 dBi.	
	

6.2 Conducted Emission

Test Requirement:	FCC Part 15 C Section 15.207		
Test Frequency Range:	150 kHz to 30 MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9kHz, VBW=30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test procedure	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.), which provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.		
Test setup:	 Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m		
Test Instruments:	Refer to section 5.8 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Passed		

Measurement Data:

Product name:	Smart Wall Switch	Product model:	KSWs-223-ZB
Test by:	Mike	Test mode:	ZIGBEE Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5℃ Humi: 55%

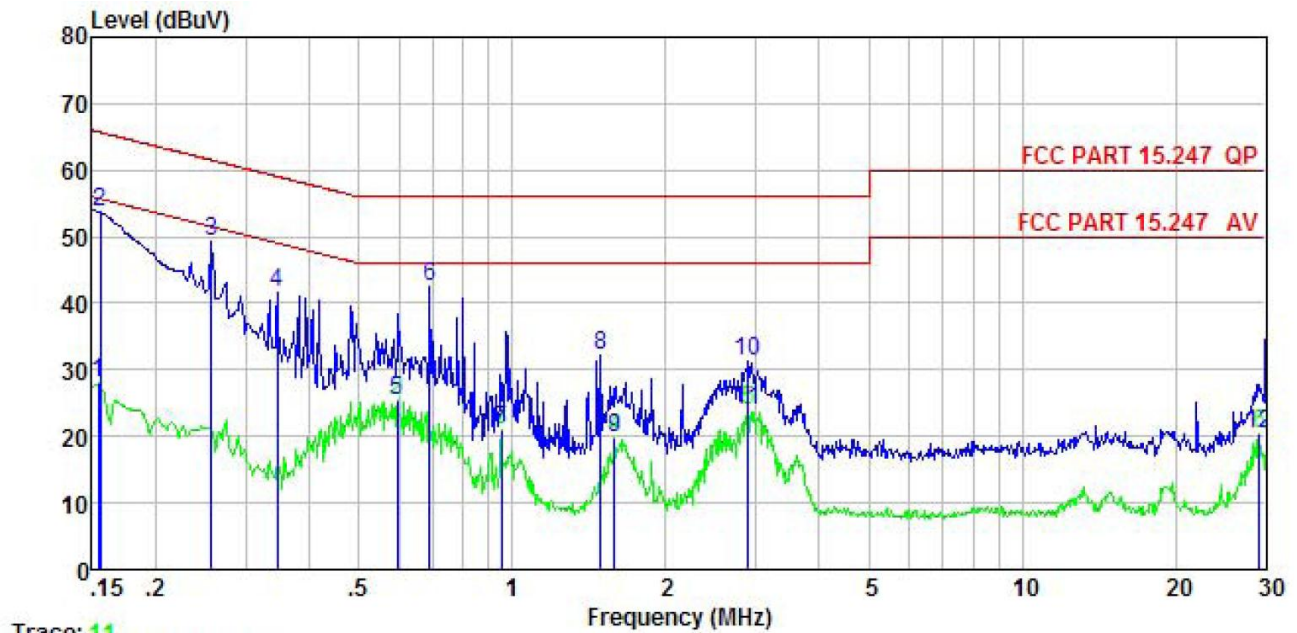


	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.154	41.91	0.18	10.78	52.87	65.78	-12.91	QP
2	0.154	15.20	0.18	10.78	26.16	55.78	-29.62	Average
3	0.415	30.68	0.12	10.73	41.53	57.55	-16.02	QP
4	0.595	13.11	0.13	10.77	24.01	46.00	-21.99	Average
5	0.621	21.84	0.13	10.77	32.74	56.00	-23.26	QP
6	0.994	9.03	0.13	10.87	20.03	46.00	-25.97	Average
7	2.915	19.35	0.16	10.92	30.43	56.00	-25.57	QP
8	3.074	11.97	0.16	10.92	23.05	46.00	-22.95	Average
9	5.993	20.53	0.23	10.82	31.58	60.00	-28.42	QP
10	17.944	9.03	0.29	10.92	20.24	50.00	-29.76	Average
11	26.001	23.84	0.35	10.87	35.06	60.00	-24.94	QP
12	28.755	9.81	0.39	10.87	21.07	50.00	-28.93	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss.

Product name:	Smart Wall Switch	Product model:	KSWS-223-ZB
Test by:	Mike	Test mode:	ZIGBEE Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5°C Humi: 55%

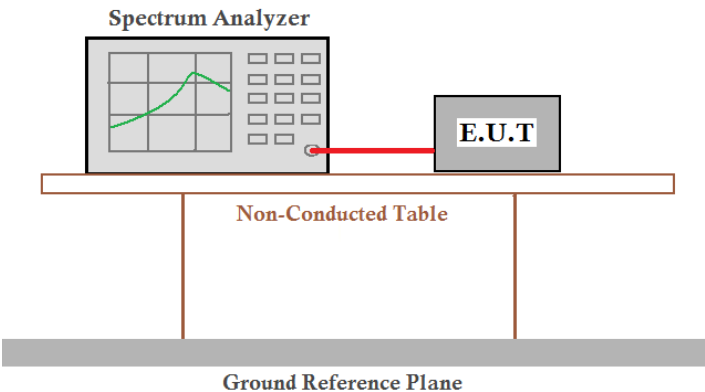


	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.154	16.22	0.98	10.78	27.98	55.78	-27.80	Average
2	0.156	41.92	0.98	10.77	53.67	65.69	-12.02	QP
3	0.258	37.45	0.95	10.75	49.15	61.51	-12.36	QP
4	0.346	29.84	0.97	10.73	41.54	59.05	-17.51	QP
5	0.595	13.77	0.97	10.77	25.51	46.00	-20.49	Average
6	0.690	30.64	0.97	10.77	42.38	56.00	-13.62	QP
7	0.953	9.17	0.97	10.86	21.00	46.00	-25.00	Average
8	1.487	20.29	0.98	10.92	32.19	56.00	-23.81	QP
9	1.585	7.76	0.98	10.93	19.67	46.00	-26.33	Average
10	2.900	19.46	0.99	10.92	31.37	56.00	-24.63	QP
11	2.900	12.01	0.99	10.92	23.92	46.00	-22.08	Average
12	29.216	8.33	1.17	10.87	20.37	50.00	-29.63	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss.

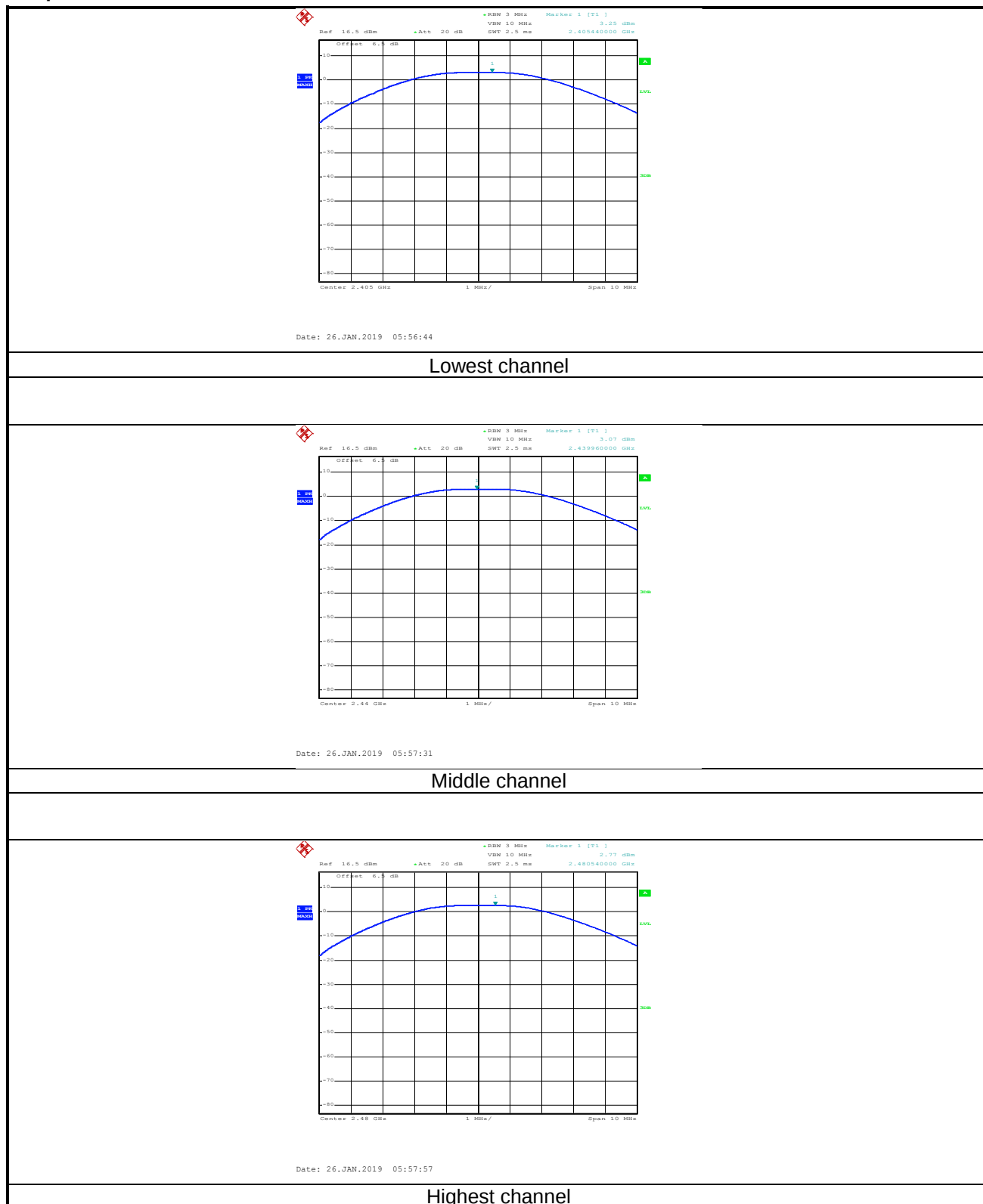
6.3 Conducted Output Power

Test Requirement:	FCC Part 15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013 and KDB 558074
Limit:	30dBm
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

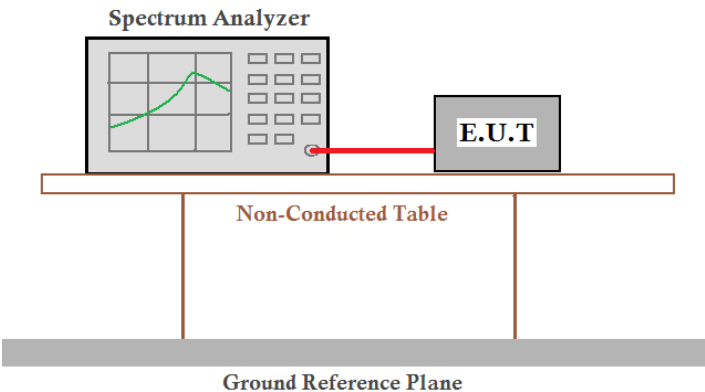
Measurement Data:

Test CH	Maximum Conducted Output Power (dBm)	Limit(dBm)	Result
Lowest	3.25	30.00	Pass
Middle	3.07		
Highest	2.77		

Test plot as follows:



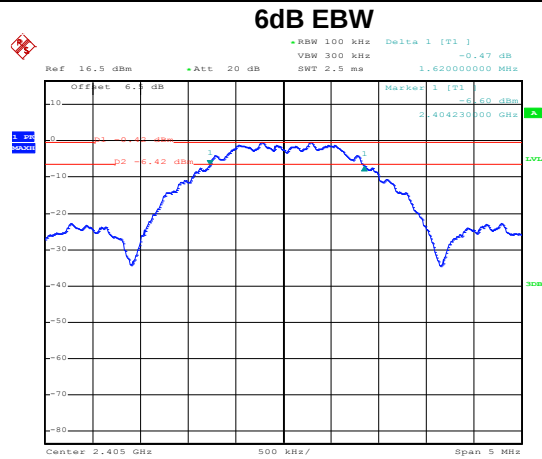
6.4 Occupy Bandwidth

Test Requirement:	FCC Part 15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013 and KDB 558074
Limit:	>500kHz
Test setup:	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

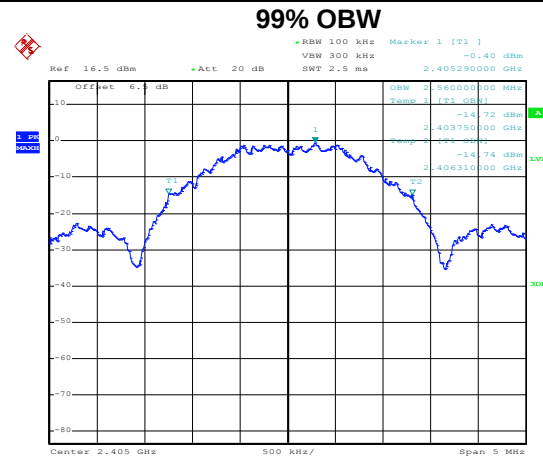
Measurement Data:

Test CH	6dB Emission Bandwidth (MHz)	Limit(kHz)	Result
Lowest	1.62	>500	Pass
Middle	1.64		
Highest	1.65		
Test CH	99% Occupy Bandwidth (MHz)	Limit(kHz)	Result
Lowest	2.56	N/A	N/A
Middle	2.57		
Highest	2.58		

Test plot as follows:



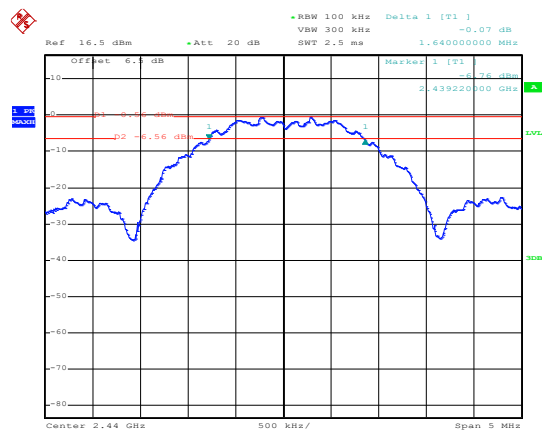
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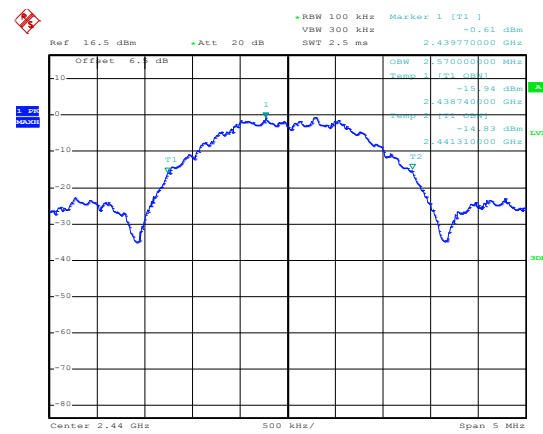
Date: 26.JAN.2019 05:59:41

Lowest channel

Lowest channel



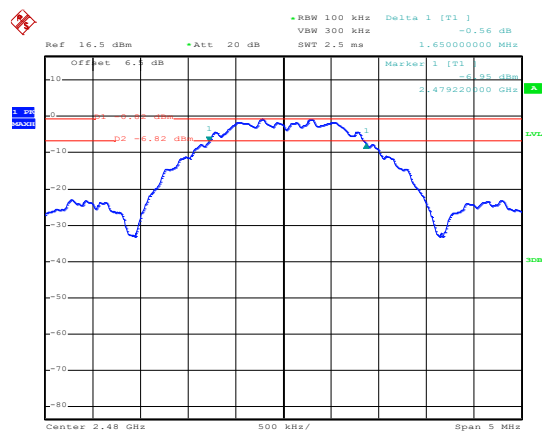
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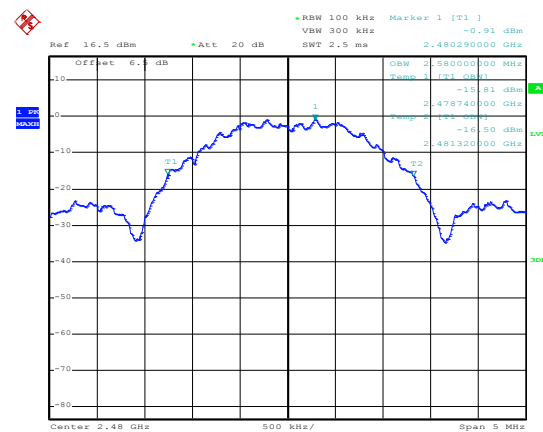
Date: 26.JAN.2019 05:59:11

Middle channel

Middle channel



Date: 26.JAN.2019 06:09:21

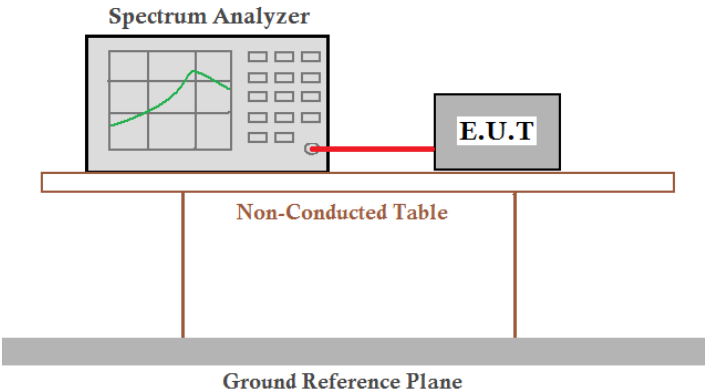


Date: 26.JAN.2019 05:58:45

Highest channel

Highest channel

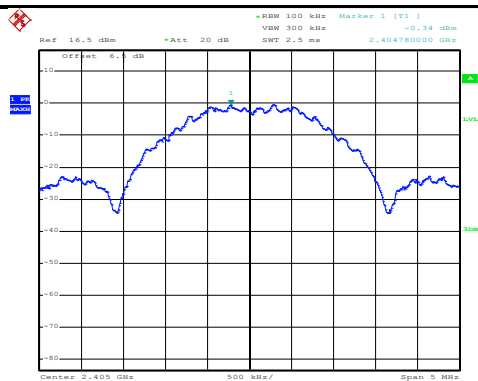
6.5 Power Spectral Density

Test Requirement:	FCC Part 15 C Section 15.247 (e)
Test Method:	ANSI C63.10:2013 and KDB 558074
Limit:	8 dBm
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two vertical legs. Below the table is a Ground Reference Plane.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

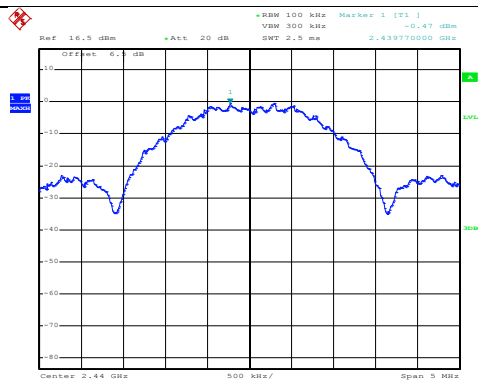
Test CH	Power Spectral Density (dBm)	Limit(dBm)	Result
Lowest	-0.34	8.00	Pass
Middle	-0.47		
Highest	-0.82		

Test plots as follow:



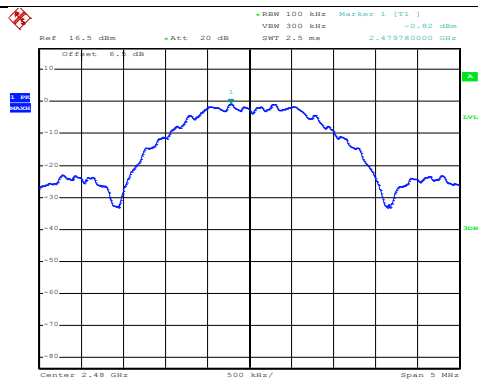
Date: 26.JAN.2019 06:19:27

Lowest channel



Date: 26.JAN.2019 06:18:54

Middle channel

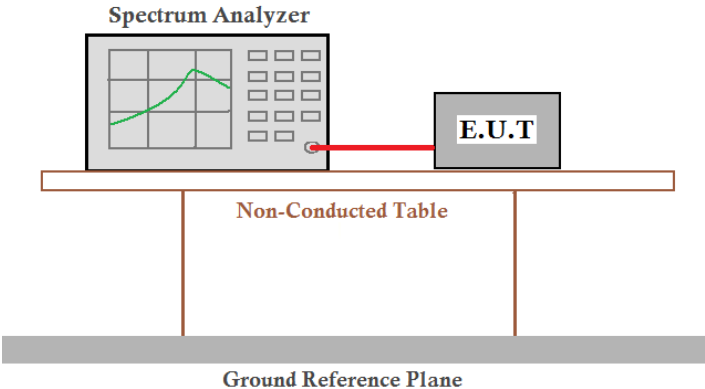


Date: 26.JAN.2019 06:18:33

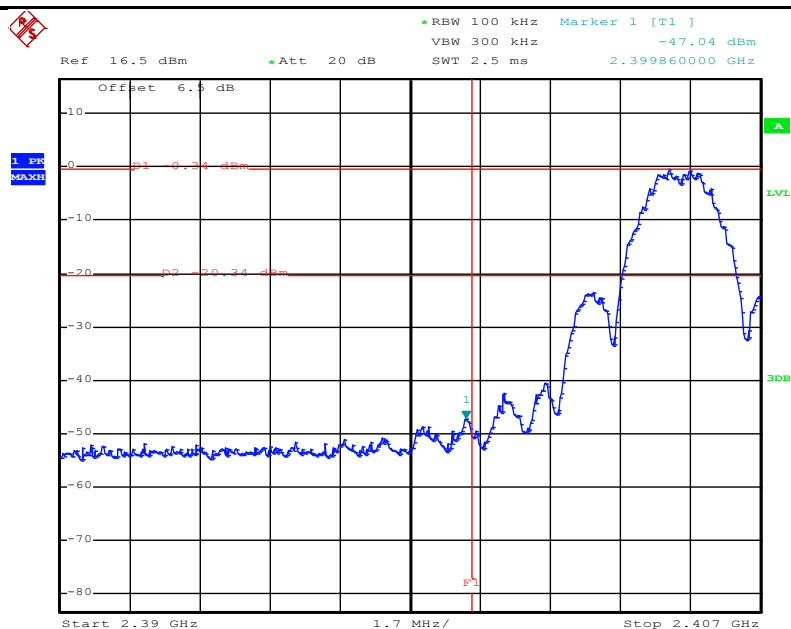
Highest channel

6.6 Band Edge

6.6.1 Conducted Emission Method

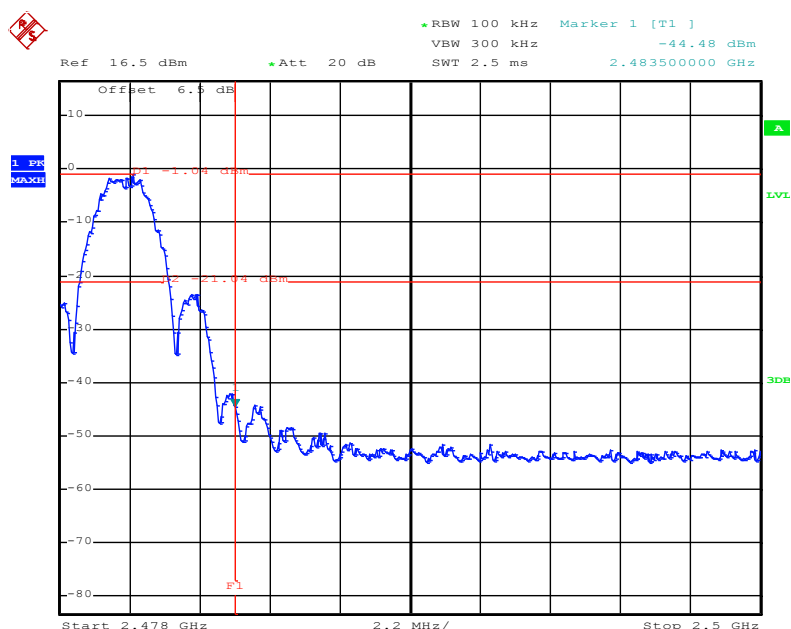
Test Requirement:	FCC Part 15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB 558074
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Test plots as follow:



Date: 26.JAN.2019 06:20:47

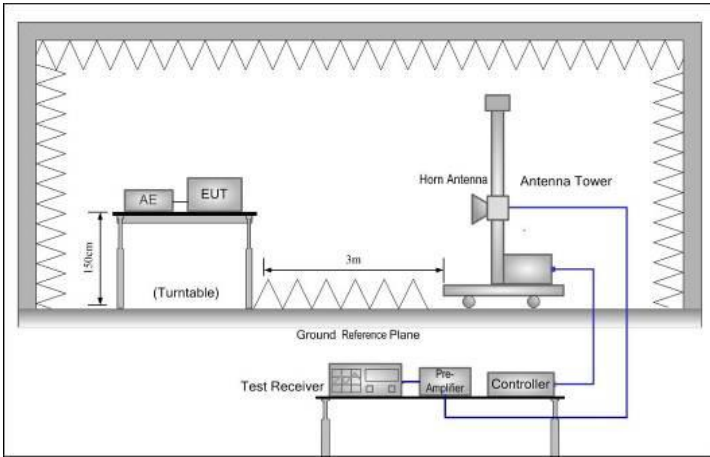
Lowest channel



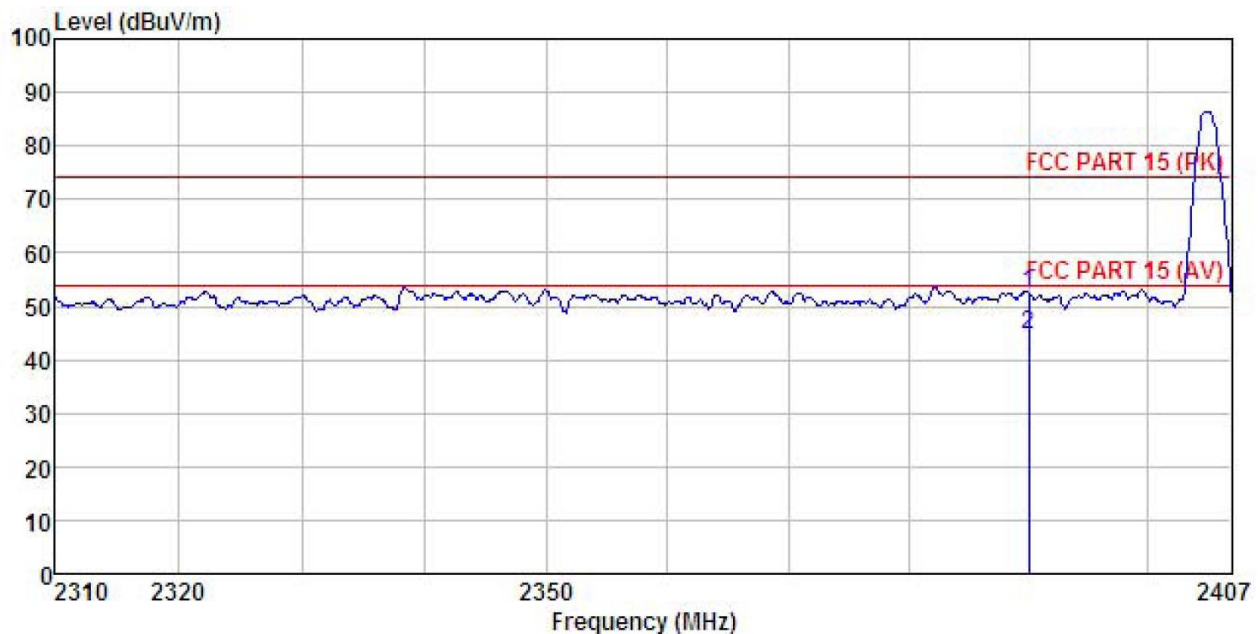
Date: 26.JAN.2019 06:21:57

Highest channel

6.6.2 Radiated Emission Method

Test Requirement:	FCC Part 15 C Section 15.205 and 15.209				
Test Method:	ANSI C63.10: 2013 and KDB 558074				
Test Frequency Range:	2.3GHz to 2.5GHz				
Test Distance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value
Limit:	Frequency		Limit (dBuV/m @3m)		Remark
	Above 1GHz		54.00		Average Value
			74.00		Peak Value
Test Procedure:	1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.				
Test setup:					
Test Instruments:	Refer to section 5.8 for details				
Test mode:	Refer to section 5.3 for details				
Test results:	Passed				

Product Name:	Smart Wall Switch	Product model:	KSWS-223-ZB
Test By:	Caffrey	Test mode:	ZIGBEE Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24°C Humi: 57%

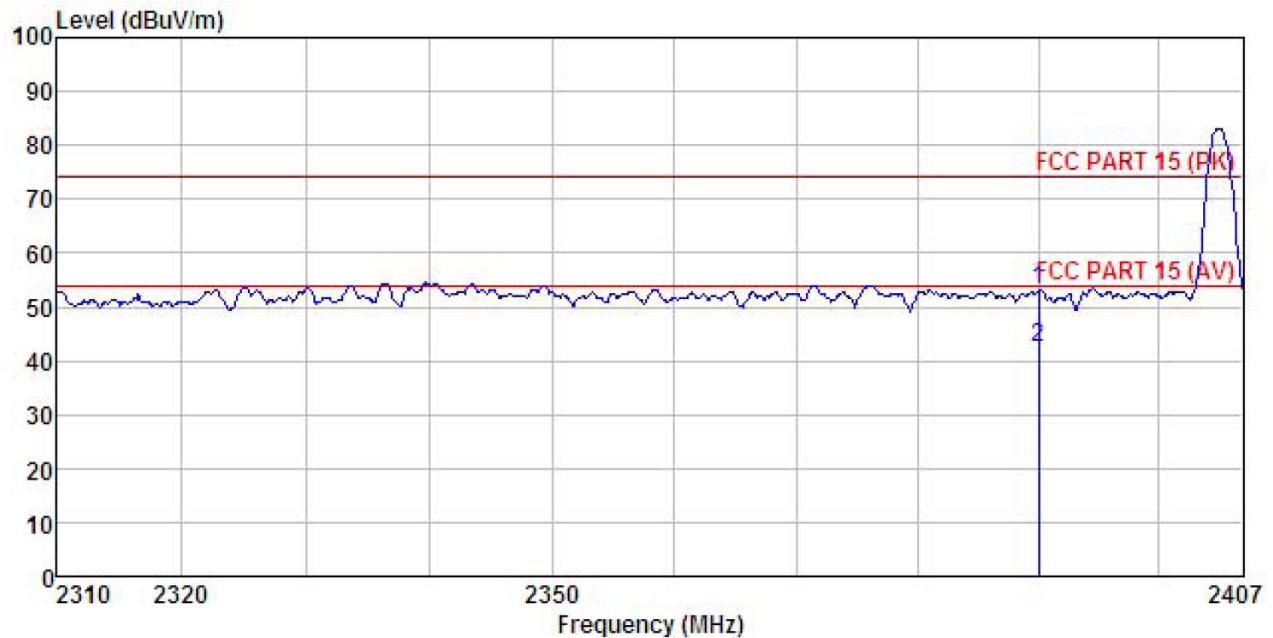


	Freq	ReadAntenna	Cable Preamp	Limit	Over	
	Level	Factor	Loss	Factor	Level	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m
1	2390.000	20.43	27.37	4.69	0.00	52.49
2	2390.000	12.67	27.37	4.69	0.00	44.73

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	Smart Wall Switch	Product model:	KSWS-223-ZB
Test By:	Caffrey	Test mode:	ZIGBEE Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24°C Humi: 57%

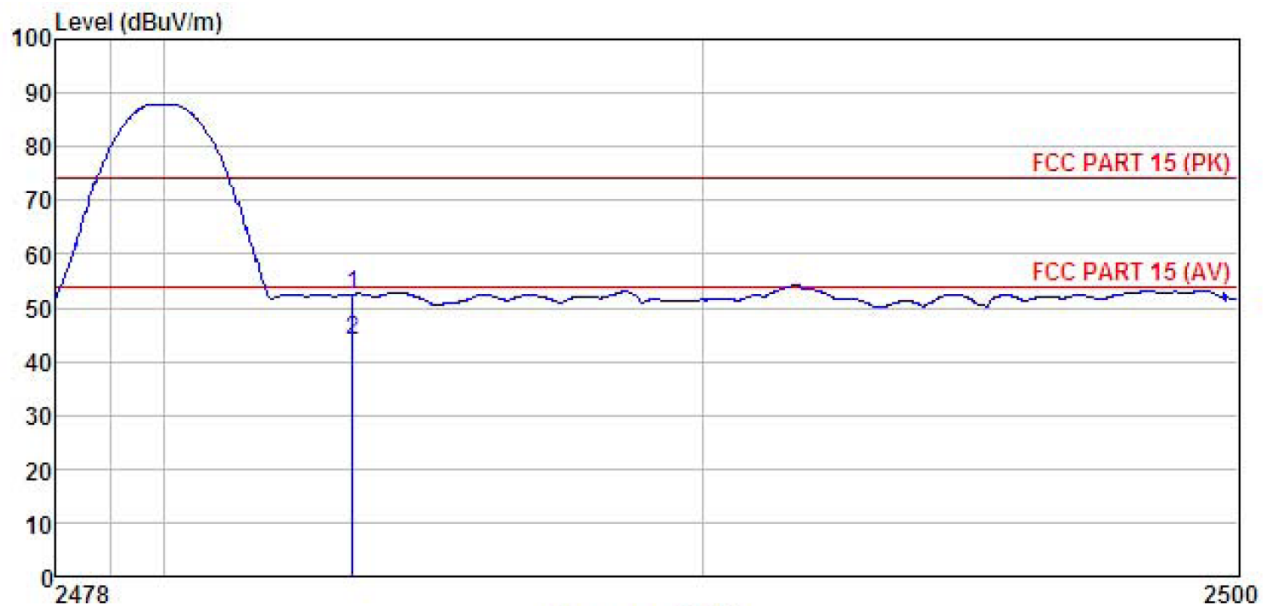


	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2390.000	20.96	27.37	4.69	0.00	53.02	74.00	-20.98	Peak
2	2390.000	10.24	27.37	4.69	0.00	42.30	54.00	-11.70	Average

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	Smart Wall Switch	Product model:	KSWs-223-ZB
Test By:	Caffrey	Test mode:	ZIGBEE Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24°C Humi: 57%

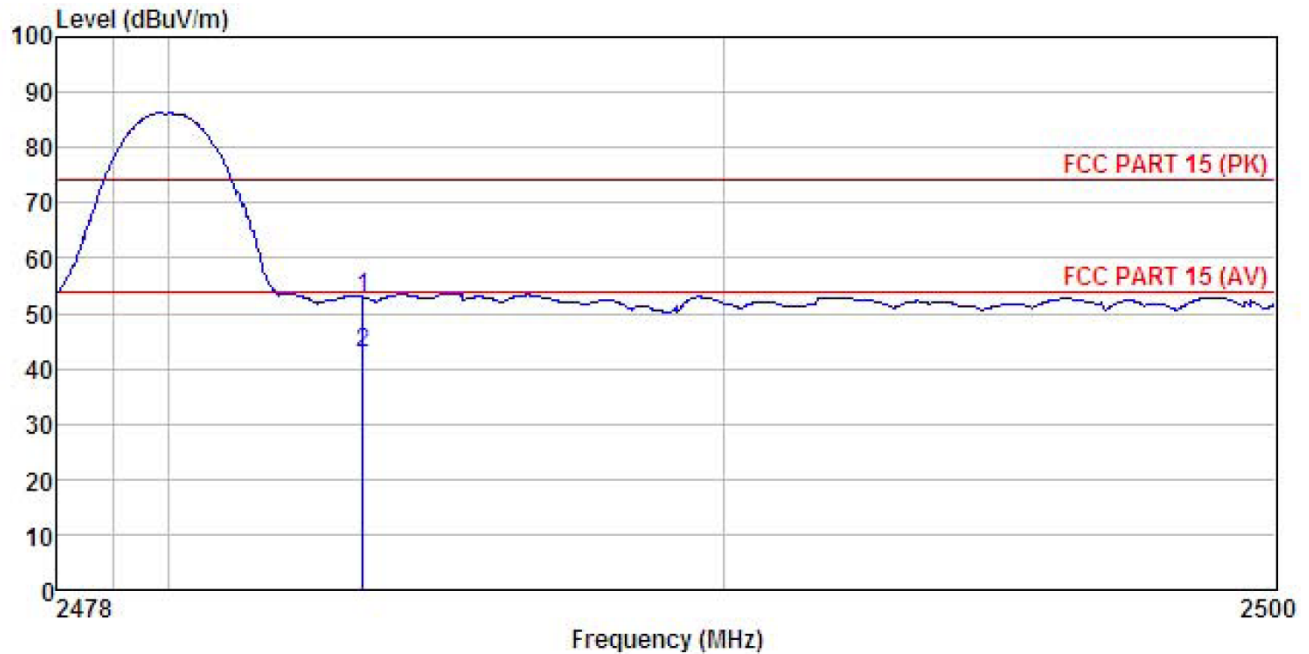


Frequency (MHz)								
	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Level	Limit	Over Limit
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	2483.500	20.13	27.57	4.81	0.00	52.51	74.00	-21.49 Peak
2	2483.500	11.47	27.57	4.81	0.00	43.85	54.00	-10.15 Average

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	Smart Wall Switch	Product model:	KSWS-223-ZB
Test By:	Caffrey	Test mode:	ZIGBEE Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24°C Humi: 57%



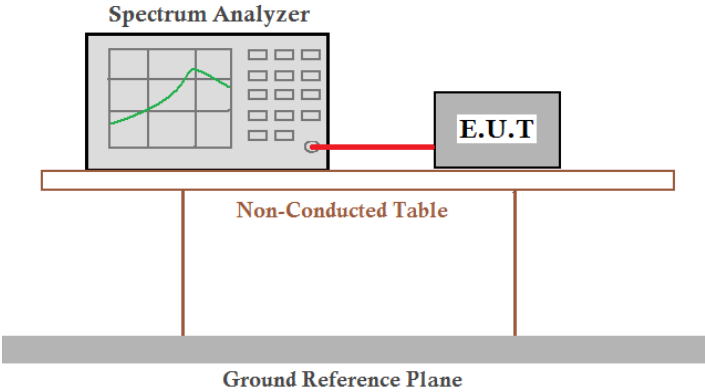
	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Level	Limit	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.500	20.49	27.57	4.81	0.00	52.87	74.00	-21.13	Peak
2	2483.500	10.58	27.57	4.81	0.00	42.96	54.00	-11.04	Average

Remark:

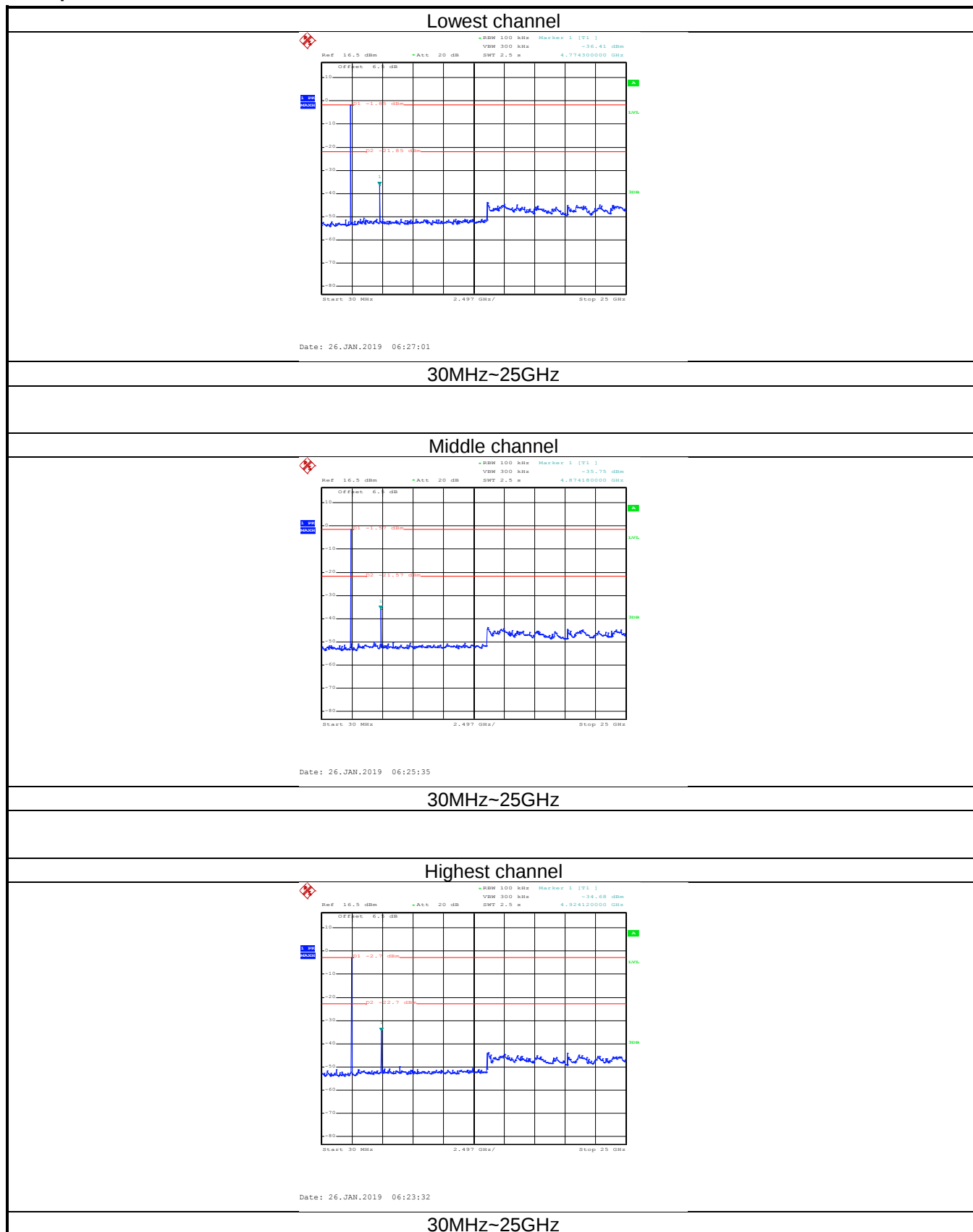
1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

6.7 Spurious Emission

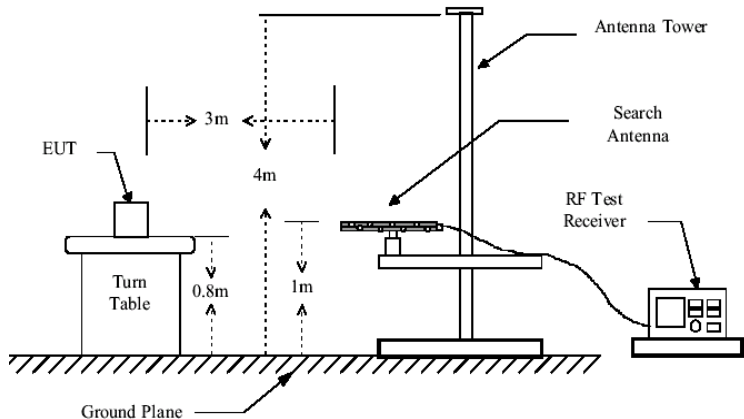
6.7.1 Conducted Emission Method

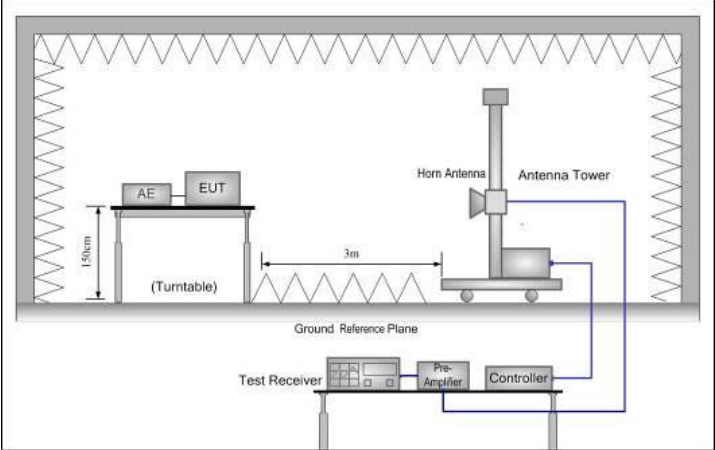
Test Requirement:	FCC Part 15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB 558074
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which sits on a Ground Reference Plane.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Test plot as follows:



6.7.2 Radiated Emission Method

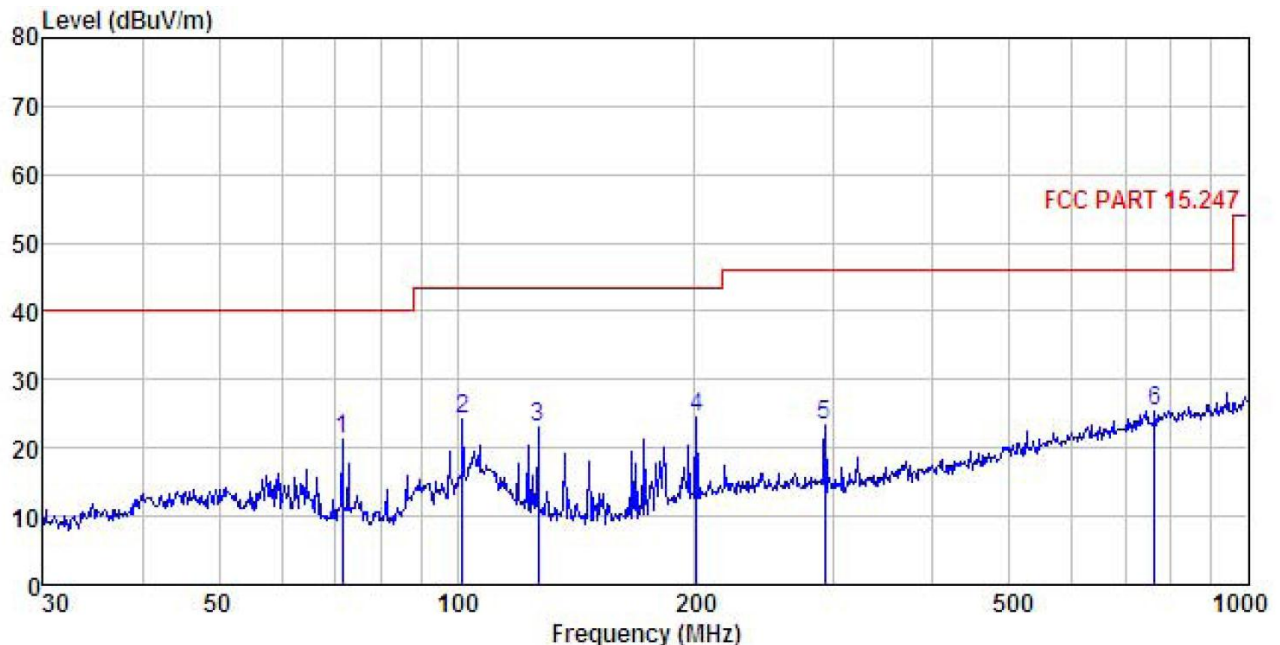
Test Requirement:	FCC Part 15 C Section 15.205 and 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 25GHz				
Test Distance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value
Limit:	Frequency		Limit (dBuV/m @3m)		Remark
	30MHz-88MHz		40.0		Quasi-peak Value
	88MHz-216MHz		43.5		Quasi-peak Value
	216MHz-960MHz		46.0		Quasi-peak Value
	960MHz-1GHz		54.0		Quasi-peak Value
	Above 1GHz		54.0		Average Value
			74.0		Peak Value
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8m(below 1GHz)/1.5m(above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.				
Test setup:	Below 1GHz  Above 1GHz				

	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed
Remark:	1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case. 2. 9 kHz to 30MHz is too low, so only shows the data of above 30MHz in this report.

Measurement Data (worst case):

Below 1GHz:

Product Name:	Smart Wall Switch	Product model:	KSWS-223-ZB
Test By:	Caffrey	Test mode:	ZIGBEE Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical
Test Voltage:	AC 12V/60Hz	Environment:	Temp: 24℃ Humi: 57%

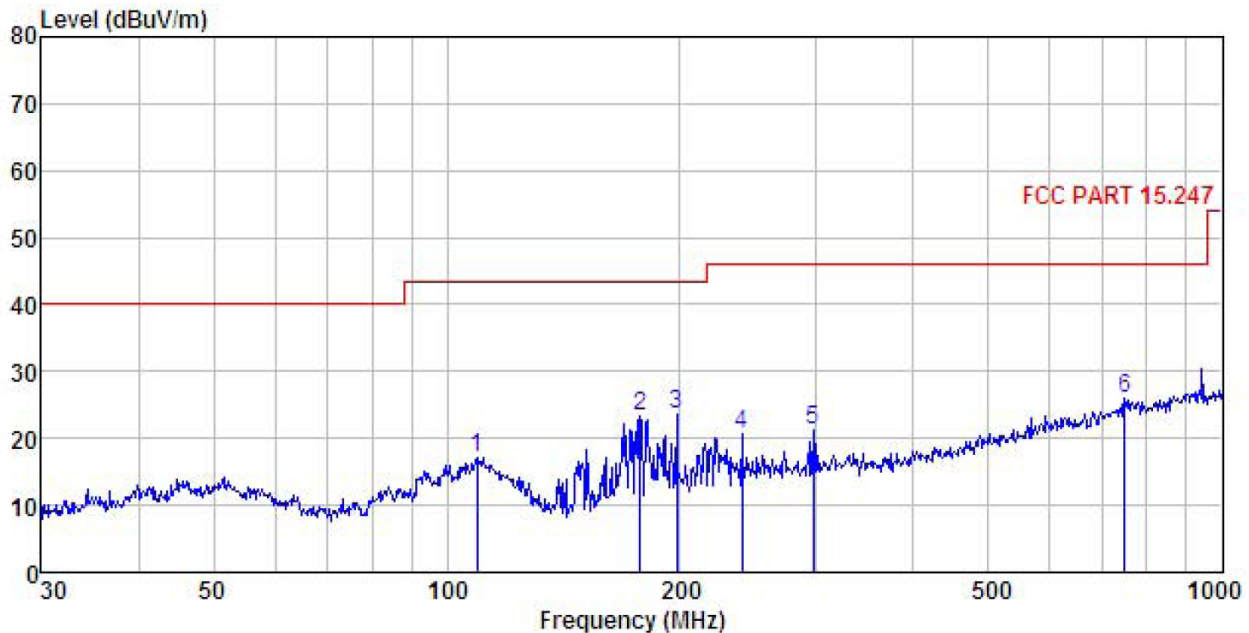


	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over	
	MHz	Level	Factor	Loss	Factor	Line	Limit	Remark
		dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	71.581	40.50	8.93	1.56	29.71	21.28	40.00	-18.72 QP
2	101.644	40.12	11.80	1.95	29.52	24.35	43.50	-19.15 QP
3	126.772	40.99	9.17	2.25	29.35	23.06	43.50	-20.44 QP
4	200.688	39.04	11.53	2.87	28.83	24.61	43.50	-18.89 QP
5	292.058	35.25	13.56	2.92	28.46	23.27	46.00	-22.73 QP
6	763.376	28.53	21.00	4.36	28.40	25.49	46.00	-20.51 QP

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	Smart Wall Switch	Product model:	KSWS-223-ZB
Test By:	Caffrey	Test mode:	ZIGBEE Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24℃ Humi: 57%



	Freq	ReadAntenna	Cable Preamp	Limit	Over	Remark			
	Level	Factor	Loss	Factor	Level	Line	Limit		
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	109.412	32.25	12.27	2.04	29.46	17.10	43.50	-26.40	QP
2	177.509	39.86	9.70	2.71	28.99	23.28	43.50	-20.22	QP
3	197.893	38.16	11.44	2.86	28.84	23.62	43.50	-19.88	QP
4	239.987	33.44	12.97	2.82	28.59	20.64	46.00	-25.36	QP
5	297.224	33.28	13.58	2.93	28.46	21.33	46.00	-24.67	QP
6	750.108	29.08	21.00	4.36	28.48	25.96	46.00	-20.04	QP

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Above 1GHz

Test channel: Lowest channel								
Detector: Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4810.00	47.25	30.85	6.80	41.81	43.09	74.00	-30.91	Vertical
4810.00	46.87	30.85	6.80	41.81	42.71	74.00	-31.29	Horizontal
Detector: Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4810.00	38.69	30.85	6.80	41.81	34.53	54.00	-19.47	Vertical
4810.00	37.44	30.85	6.80	41.81	33.28	54.00	-20.72	Horizontal
Test channel: Middle channel								
Detector: Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4880.00	47.51	31.20	6.86	41.84	43.73	74.00	-30.27	Vertical
4880.00	47.39	31.20	6.86	41.84	43.61	74.00	-30.39	Horizontal
Detector: Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4880.00	38.27	31.20	6.86	41.84	34.49	54.00	-19.51	Vertical
4880.00	38.42	31.20	6.86	41.84	34.64	54.00	-19.36	Horizontal
Test channel: Highest channel								
Detector: Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	46.93	31.63	6.91	41.87	43.60	74.00	-30.40	Vertical
4960.00	47.02	31.63	6.91	41.87	43.69	74.00	-30.31	Horizontal
Detector: Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	38.05	31.63	6.91	41.87	34.72	54.00	-19.28	Vertical
4960.00	38.41	31.63	6.91	41.87	35.08	54.00	-18.92	Horizontal
Remark: 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor. 2. The emission levels of other frequencies are very lower than the limit and not show in test report.								