

FCC REPORT

(LoRa WAN)

Applicant: Hangzhou Roombanker Technology Co., Ltd.

Address of Applicant: A#801 Wantong center, Hangzhou, China

Equipment Under Test (EUT)

Product Name: Indoor LoRaWAN Light Hotspot

Model No.: DSGW-090B

FCC ID: 2AUXBDSGW-090B

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

Date of sample receipt: 25 Apr., 2022

Date of Test: 26 Apr., to 17 May., 2022

Date of report issued: 18 May., 2022

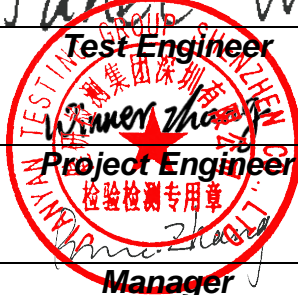
Test Result: PASS *

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

Tested by: Janet Wei **Date:** 18 May., 2022
Test Engineer

Reviewed by: Wenwen Zhang **Date:** 18 May., 2022
Project Engineer

Approved by: Wenwen Zhang **Date:** 18 May., 2022
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.

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2 Version

Version No.	Date	Description
00	18 May., 2022	Original

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4 Test Summary

Test Items	Section in CFR 47	Result
Antenna Requirement	15.203 & 15.247 (b)(4)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(2)	Pass
20dB Occupied Bandwidth	15.247 (a)(1) (i)	Pass
6dB Emission Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (f)	Pass
Carrier Frequencies Separation	15.247 (a)(1)	Pass
Hopping Channel Number	15.247 (a)(1) (i)	Pass
Dwell Time	15.247 (f)	Pass
Band Edge	15.247 (d)	Pass
Spurious Emission	15.205 & 15.209	Pass
<p>Remark:</p> <ol style="list-style-type: none"> 1. Pass: The EUT complies with the essential requirements in the standard. 2. N/A: Not Applicable. 3. The cable insertion loss used by "RF Output Power" and other conduction measurement items is 0.5dB (provided by the customer). 		
Test Method:	ANSI C63.4-2014 ANSI C63.10-2013 KDB 558074 D01 15.247 Meas Guidance v05r02	

5 General Information

5.1 Client Information

Applicant:	Hangzhou Roombanker Technology Co., Ltd.
Address:	A#801 Wantong center, Hangzhou, China
Manufacturer/Factory:	Hangzhou Roombanker Technology Co., Ltd.
Address:	A#801 Wantong center, Hangzhou, China

5.2 General Description of E.U.T.

Product Name:	Indoor LoRaWAN Light Hotspot
Model No.:	DSGW-090B
Operation Frequency:	902.3 MHz~914.9MHz
Number of channel:	64
Modulation type:	LoRa (hybrid system)
Antenna Type:	External antenna
Antenna gain:	2.44dBi
Power supply:	DC 5V
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	902.3MHz	17	905.5MHz	33	908.7MHz	49	911.9MHz
2	902.5MHz	18	905.7MHz	34	908.9MHz	50	912.1MHz
3	902.7MHz	19	905.9MHz	35	909.1MHz	51	912.3MHz
4	902.9MHz	20	906.1MHz	36	909.3MHz	52	912.5MHz
5	903.1MHz	21	906.3MHz	37	909.5MHz	53	912.7MHz
6	903.3MHz	22	906.5MHz	38	909.7MHz	54	912.9MHz
7	903.5MHz	23	906.7MHz	39	909.9MHz	55	913.1MHz
8	903.7MHz	24	906.9MHz	40	910.1MHz	56	913.3MHz
9	903.9MHz	25	904.1MHz	41	910.3MHz	57	913.5MHz
10	904.1MHz	26	907.3MHz	42	910.5MHz	58	913.7MHz
11	904.3MHz	27	907.5MHz	43	910.7MHz	59	913.9MHz
12	904.5MHz	28	907.7MHz	44	910.9MHz	60	914.1MHz
13	904.7MHz	29	907.9MHz	45	911.1MHz	61	914.3MHz
14	904.9MHz	30	908.1MHz	46	911.3MHz	62	914.5MHz
15	905.1MHz	31	908.3MHz	47	911.5MHz	63	914.7MHz
16	905.3MHz	32	908.5MHz	48	911.7MHz	64	914.9MHz

Remark: Channel 1, 32 & 64 were selected to test.

5.3 Test environment and mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test Modes:	
Non-hopping mode:	Keep the EUT in continuous transmitting mode with worst case data rate.
Hopping mode:	Keep the EUT in hopping mode.
<p>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 with a fresh battery, 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.</p>	

5.4 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
LENOVO	Laptop	SL510	2847A65	DoC

5.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
Conducted Emission (9kHz ~ 150KHz) for V-AMN	3.11 dB
Conducted Emission (150kHz ~ 30MHz) for V-AMN	2.62 dB
Conducted Emission (150kHz ~ 30MHz) for AAN	3.54 dB
Radiated Emission (30MHz ~ 1GHz) for 3m SAC	4.45 dB
Radiated Emission (1GHz ~ 18GHz) for 3m SAC	5.34 dB
Radiated Emission (18GHz ~ 40GHz) for 3m SAC	5.34 dB

5.6 Additions to, deviations, or exclusions from the method

No

5.7 Laboratory Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> ● FCC - Designation No.: CN1211 JianYan Testing Group Shenzhen 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 and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen 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 L15527 JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527. ● A2LA - Registration No.: 4346.01 This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 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
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5.8 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.

Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.

Tel: +86-755-23118282, Fax: +86-755-23116366

Email: info-JYTee@lets.com, Website: <http://jyt.lets.com>

5.9 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	ETS	RFD-100	Q1984	04-14-2021	04-13-2024
BiConiLog Antenna	SCHWARZBECK	VULB9163	9163-1246	02-17-2022	02-16-2023
Biconical Antenna	SCHWARZBECK	VUBA 9117	9117#359	06-17-2021	06-17-2022
Horn Antenna	SCHWARZBECK	BBHA9120D	912D-916	02-17-2022	02-16-2023
Broad-Band Horn Antenna	SCHWARZBECK	BBHA9170	1067	02-17-2022	02-16-2023
Broad-Band Horn Antenna	SCHWARZBECK	BBHA9170	1068	02-17-2022	02-16-2023
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	02-17-2022	02-16-2023
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	02-17-2022	02-16-2023
Spectrum analyzer	Keysight	N9010B	MY60240202	10-27-2021	10-26-2022
Low Pre-amplifier	SCHWARZBECK	BBV9743B	00305	02-17-2022	02-16-2023
High Pre-amplifier	SKET	LNPA_0118G-50	MF280208233	02-17-2022	02-16-2023
Cable	Qualwave	JYT3M-1G-NN-8M	JYT3M-1	02-17-2022	02-16-2023
Cable	Qualwave	JYT3M-18G-NN-8M	JYT3M-2	02-17-2022	02-16-2023
Cable	Qualwave	JYT3M-1G-BB-5M	JYT3M-3	02-17-2022	02-16-2023
Cable	Bost	JYT3M-40G-SS-8M	JYT3M-4	02-17-2022	02-16-2023
EMI Test Software	Tonscend	TS+	Version:3.0.0.1		

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 3	101189	02-17-2022	02-16-2023
LISN	Schwarzbeck	NSLK 8127	QCJ001-13	02-17-2022	02-16-2023
LISN	Rohde & Schwarz	ESH3-Z5	843862/010	06-18-2020	06-17-2022
ISN	Schwarzbeck	CAT3 8158	#96	02-17-2022	02-16-2023
ISN	Schwarzbeck	CAT5 8158	#166	02-17-2022	02-16-2023
ISN	Schwarzbeck	NTFM 8158	#126	02-17-2022	02-16-2023
RF Switch	TOP PRECISION	RSU0301	N/A	02-17-2022	02-16-2023
Cable	Bost	JYTCE-1G-NN-2M	JYTCE-1	02-17-2022	02-16-2023
Cable	Bost	JYTCE-1G-BN-3M	JYTCE-2	02-17-2022	02-16-2023
EMI Test Software	AUDIX	E3	Version: 6.110919b		

6 Test results and measurement data

6.1 Antenna Requirement

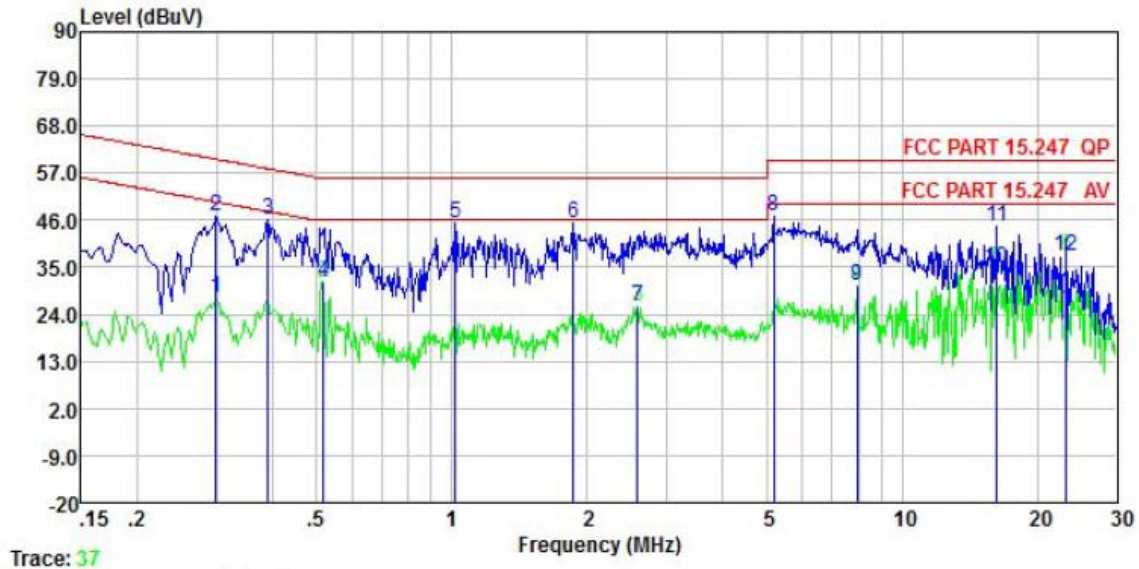
Standard requirement:	FCC Part 15 C Section 15.203 /247(c)
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses 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.</p> <p>15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.</p>	
E.U.T Antenna:	
<p>The LoRa antenna is an External antenna which cannot replace by end-user, the best-case gain of the antenna is 2.44 dBi.</p>	

6.2 Conducted Emissions

Test Requirement:	FCC Part 15 C Section 15.207		
Test Frequency Range:	150 kHz to 30 MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto		
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 setup:	<p><i>Remark</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>		
Test procedure:	<ol style="list-style-type: none"> 1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4-2014 on conducted measurement. 		
Test Instruments:	Refer to section 5.9 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Passed		

Measurement Data:

Product name:	Indoor LoRaWAN Light Hotspot	Product model:	DSGW-090B
Test by:	Janet	Test mode:	Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5°C Humi: 55%

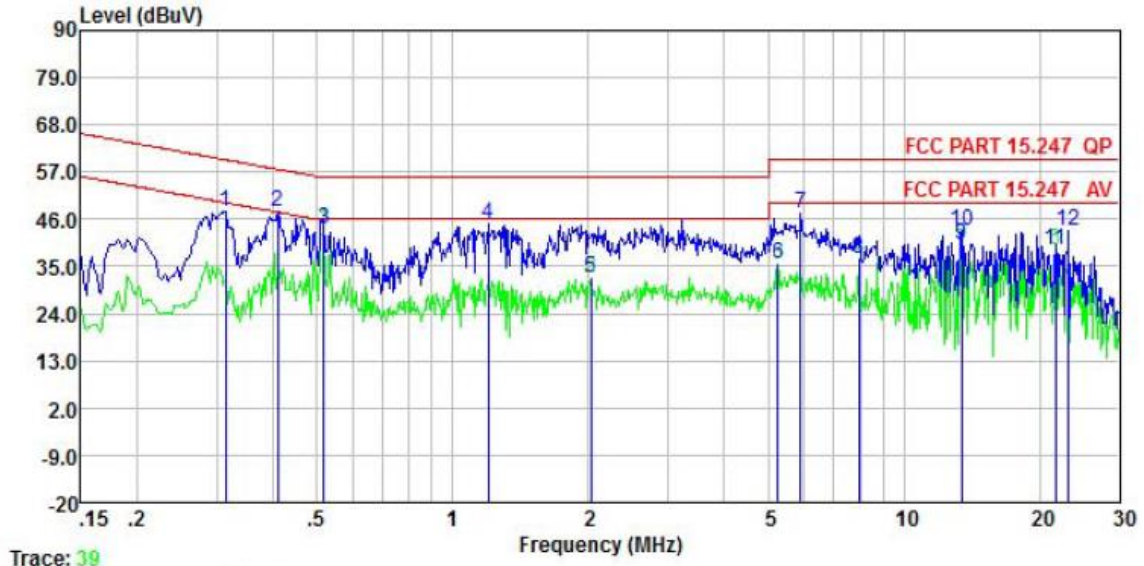


	Read	LISN	Cable	Limit	Over	Remark
Trace: 37	Level	Factor	Loss	Line	Limit	
MHz	dBuV	dB	dB	dBuV	dBuV	dB
1	27.74	0.04	0.03	27.81	50.28	-22.47 Average
2	46.74	0.04	0.03	46.81	60.28	-13.47 QP
3	46.15	0.04	0.04	46.23	58.08	-11.85 QP
4	31.41	0.04	0.03	31.48	46.00	-14.52 Average
5	45.37	0.05	0.05	45.47	56.00	-10.53 QP
6	45.07	0.07	0.19	45.33	56.00	-10.67 QP
7	25.86	0.08	0.12	26.06	46.00	-19.94 Average
8	46.89	0.12	0.09	47.10	60.00	-12.90 QP
9	30.60	0.17	0.10	30.87	50.00	-19.13 Average
10	34.44	0.28	0.16	34.88	50.00	-15.12 Average
11	44.01	0.28	0.16	44.45	60.00	-15.55 QP
12	37.11	0.35	0.17	37.63	50.00	-12.37 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:	Indoor LoRaWAN Light Hotspot	Product model:	DSGW-090B
Test by:	Janet	Test mode:	Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5°C Huni: 55%

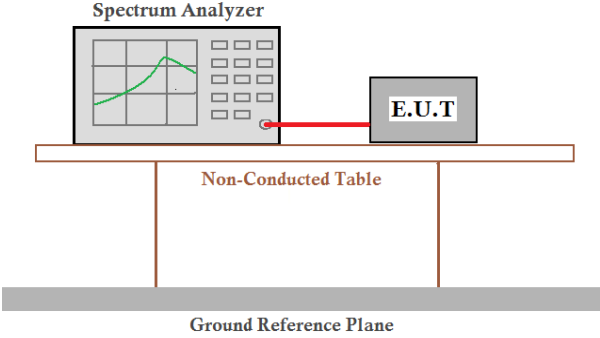


	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.313	47.65	0.04	0.03	47.72	59.88	-12.16	QP
2	0.410	47.56	0.04	0.04	47.64	57.64	-10.00	QP
3	0.518	43.62	0.04	0.03	43.69	46.00	-2.31	Average
4	1.197	44.77	0.05	0.09	44.91	56.00	-11.09	QP
5	2.023	31.96	0.06	0.20	32.22	46.00	-13.78	Average
6	5.249	35.59	0.11	0.09	35.79	50.00	-14.21	Average
7	5.898	47.19	0.12	0.09	47.40	60.00	-12.60	QP
8	7.935	36.44	0.16	0.10	36.70	50.00	-13.30	Average
9	13.408	39.72	0.23	0.11	40.06	50.00	-9.94	Average
10	13.408	42.78	0.23	0.11	43.12	60.00	-16.88	QP
11	21.715	38.26	0.32	0.16	38.74	50.00	-11.26	Average
12	23.140	42.77	0.34	0.17	43.28	60.00	-16.72	QP

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.

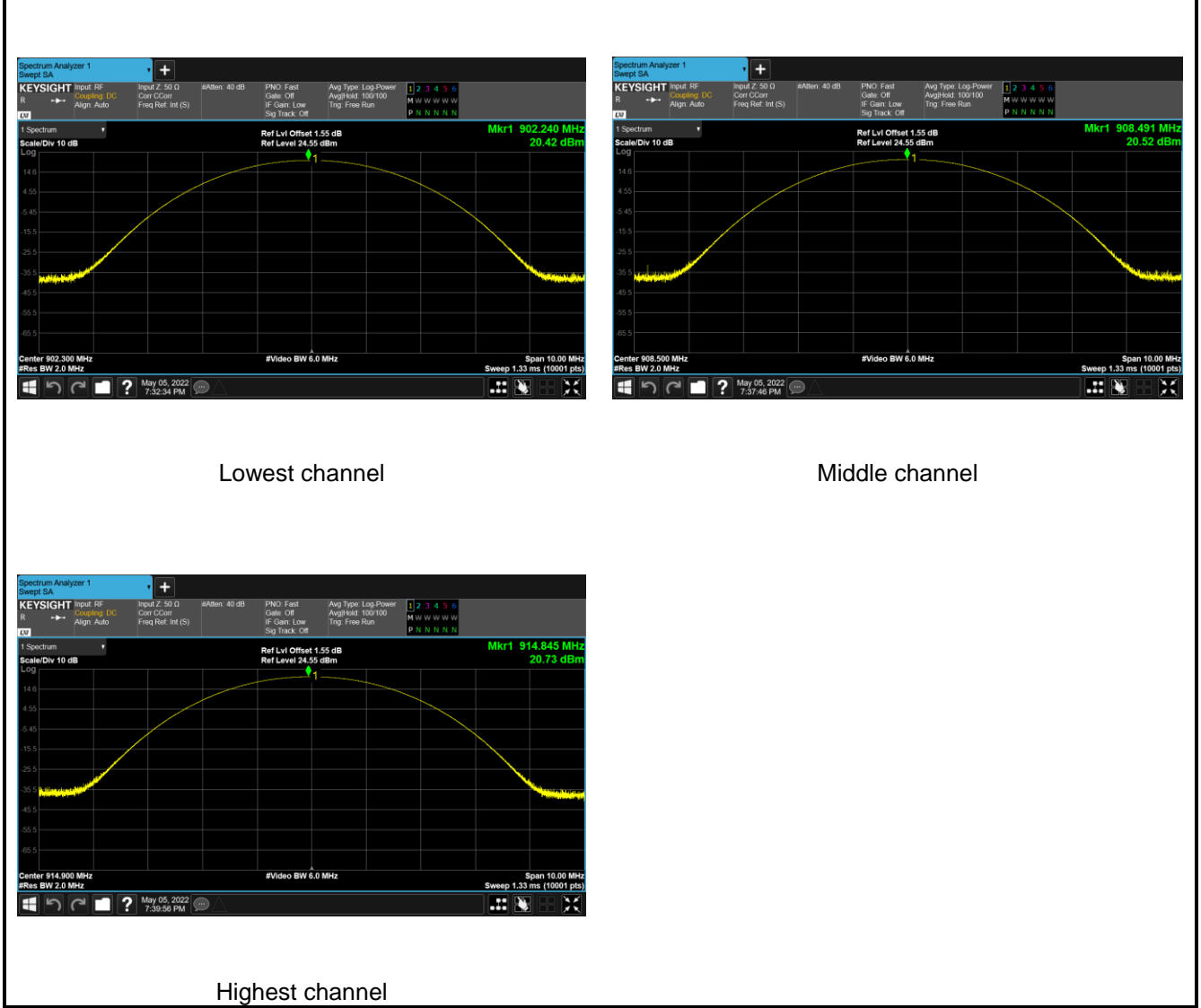
6.3 Conducted Output Power

Test Requirement:	FCC Part 15 C Section 15.247 (b)(1)
Receiver setup:	RBW=1MHz, VBW=3MHz, Detector=Peak (If 20dB BW ≤1 MHz) RBW=3MHz, VBW=10MHz, Detector=Peak (If 20dB BW > 1 MHz and < 3MHz)
Limit:	For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Test setup:	 <p>The diagram illustrates the test setup. 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. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.9 for details
Test mode:	Non-hopping mode
Test results:	Pass

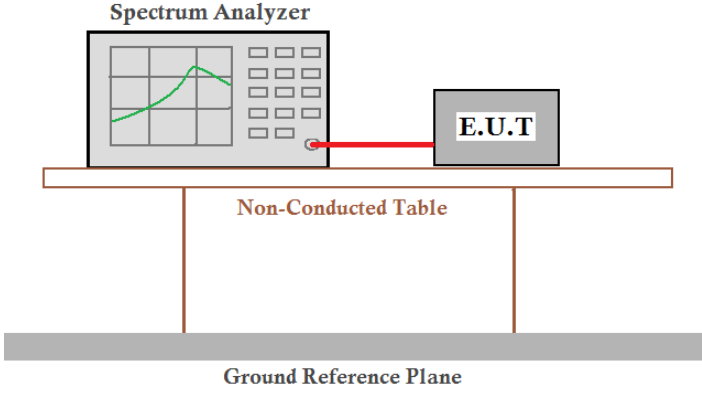
Measurement Data:

Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest channel	20.42	30.00	Pass
Middle channel	20.52	30.00	Pass
Highest channel	20.73	30.00	Pass

Test plot as follows:



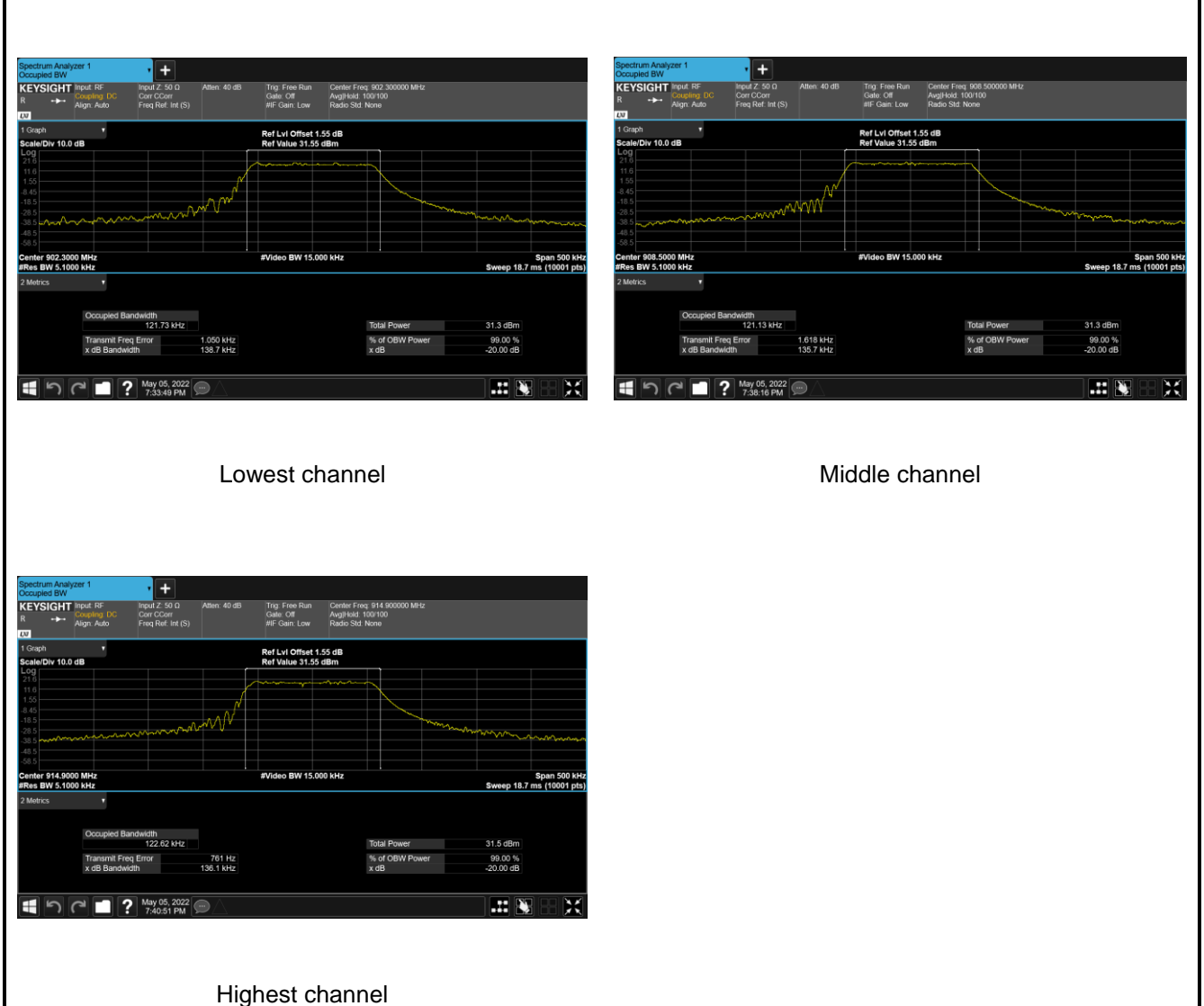
6.4 20dB Occupy Bandwidth

Test Requirement:	FCC Part 15 C Section 15.247 (a)(1)
Receiver setup:	RBW=30 kHz, VBW=100 kHz, detector=Peak
Limit:	N/A
Test setup:	 <p>The diagram illustrates the test setup. 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. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.9 for details
Test mode:	Non-hopping mode
Test results:	Pass

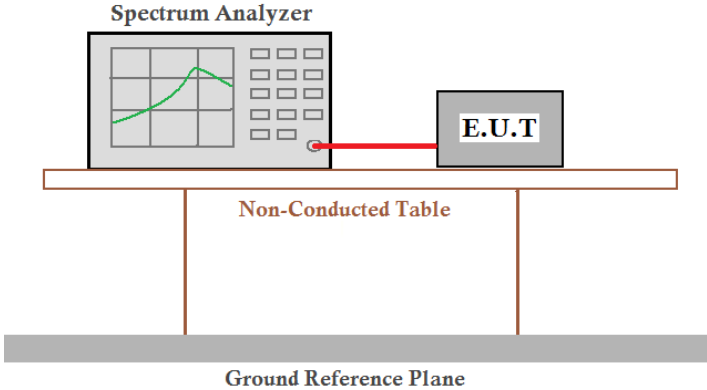
Measurement Data:

Test channel	20dB Occupy Bandwidth (kHz)
Lowest	121.73
Middle	121.13
Highest	122.62

Test plot as follows:



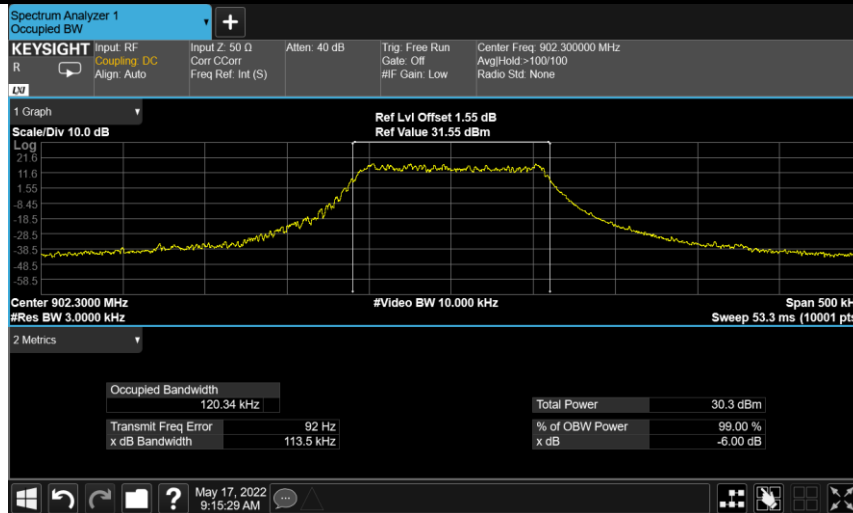
6.5 Occupy Bandwidth

Test Requirement:	FCC Part 15 C Section 15.247 (a)(2)
Limit:	>500kHz
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

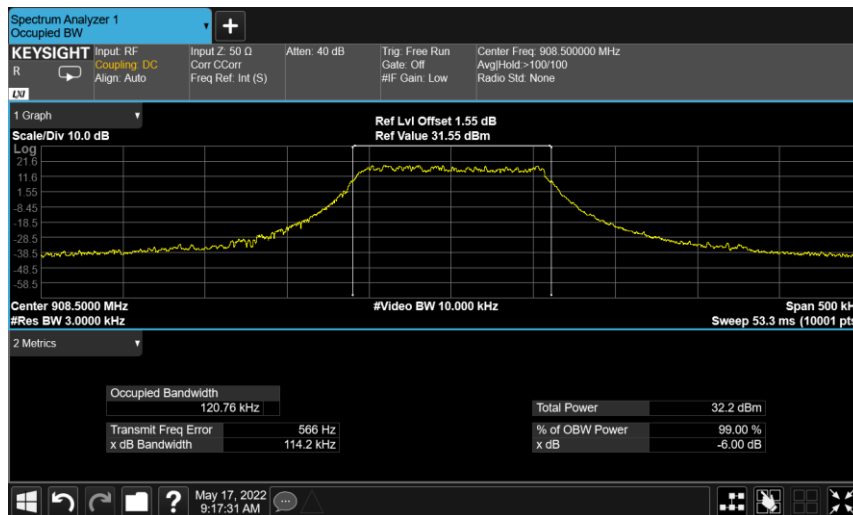
Measurement Data:

Test CH	-6dB Emission Bandwidth (KHz)	Limit(kHz)	Result
Lowest	113.50	N/A	Pass
Middle	114.20		
Highest	112.70		
Test CH	99% Occupy Bandwidth (KHz)	Limit(kHz)	Result
Lowest	120.34	N/A	N/A
Middle	120.76		
Highest	120.32		

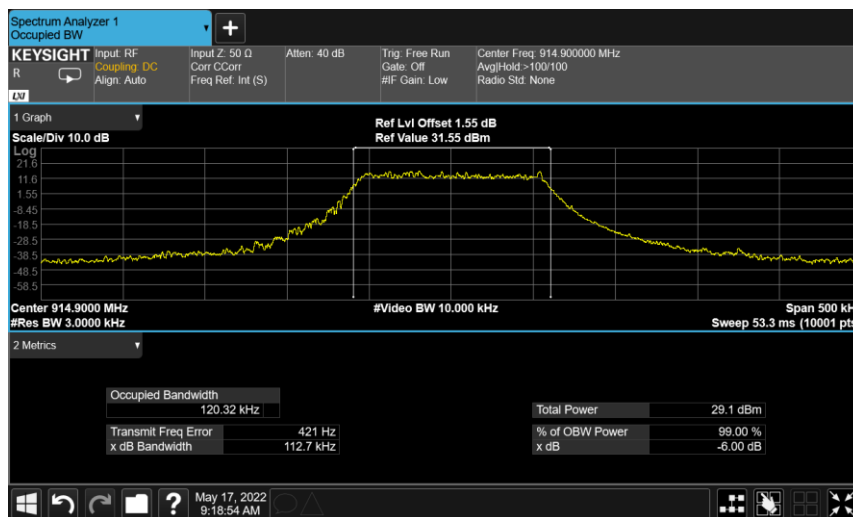
Test plot as follows:



Lowest channel

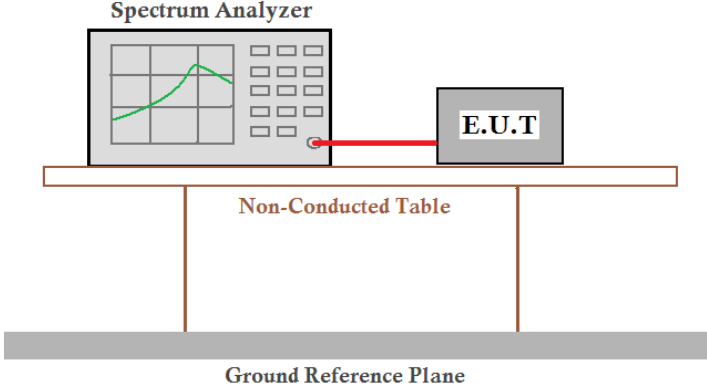


Middle channel



Highest channel

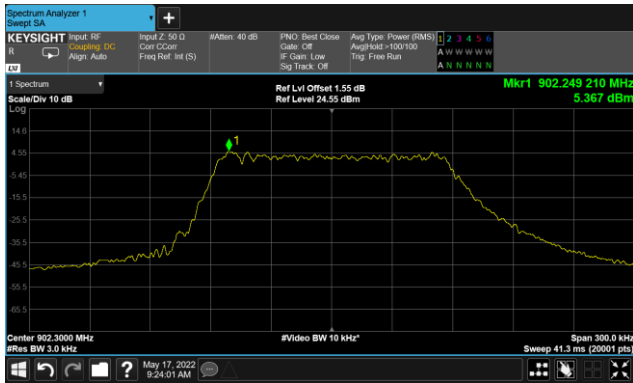
6.6 Power Spectral Density

Test Requirement:	FCC Part 15 C Section 15.247 (e)
Limit:	8 dBm/3kHz
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

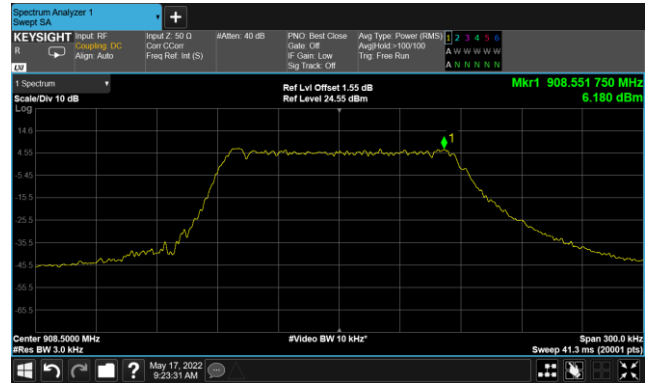
Measurement Data:

Test CH	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Lowest	5.367	8.00	Pass
Middle	6.180		
Highest	5.441		

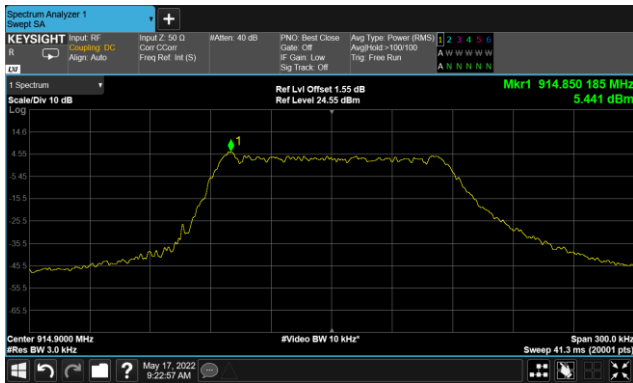
Test plots as follow:



Lowest channel

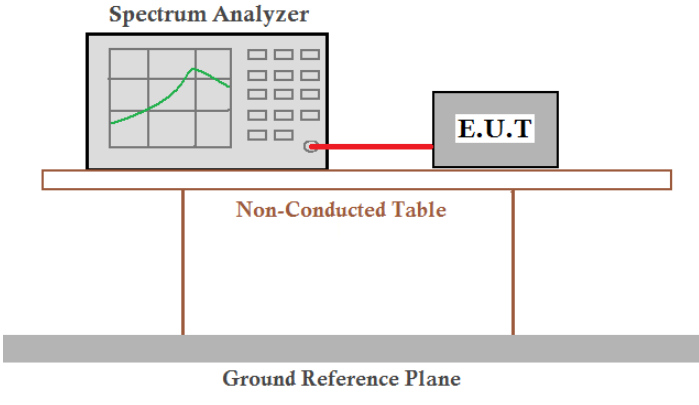


Middle channel



Highest channel

6.7 Carrier Frequencies Separation

Test Requirement:	FCC Part 15 C Section 15.247 (a)(1)
Receiver setup:	RBW=100 kHz, VBW=300 kHz, detector=Peak
Limit:	a) 0.025MHz or the 20dB bandwidth (whichever is greater) b) 0.025MHz or two-thirds of the 20dB bandwidth (whichever is greater)
Test setup:	 <p>The diagram illustrates the test setup. 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. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.9 for details
Test mode:	Hopping mode
Test results:	Pass

Measurement Data:

Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	208.60	121.73	Pass
Middle	207.20	121.13	Pass
Highest	121.80	122.62	Pass

Test plot as follows:



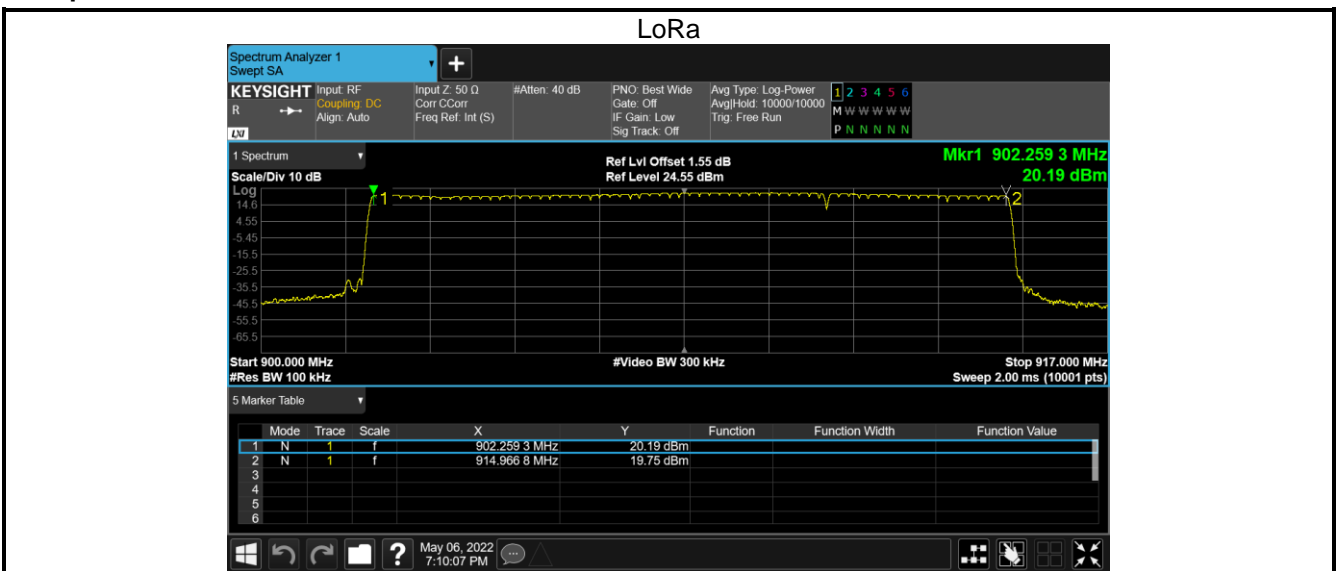
6.8 Hopping Channel Number

Test Requirement:	FCC Part 15 C Section 15.247 (a)(1)
Receiver setup:	RBW=100 kHz, VBW=300 kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Hopping mode
Test results:	Pass

Measurement Data:

Mode	Hopping channel numbers	Limit	Result
LoRa	64	15	Pass

Test plot as follows:



6.9 Dwell Time

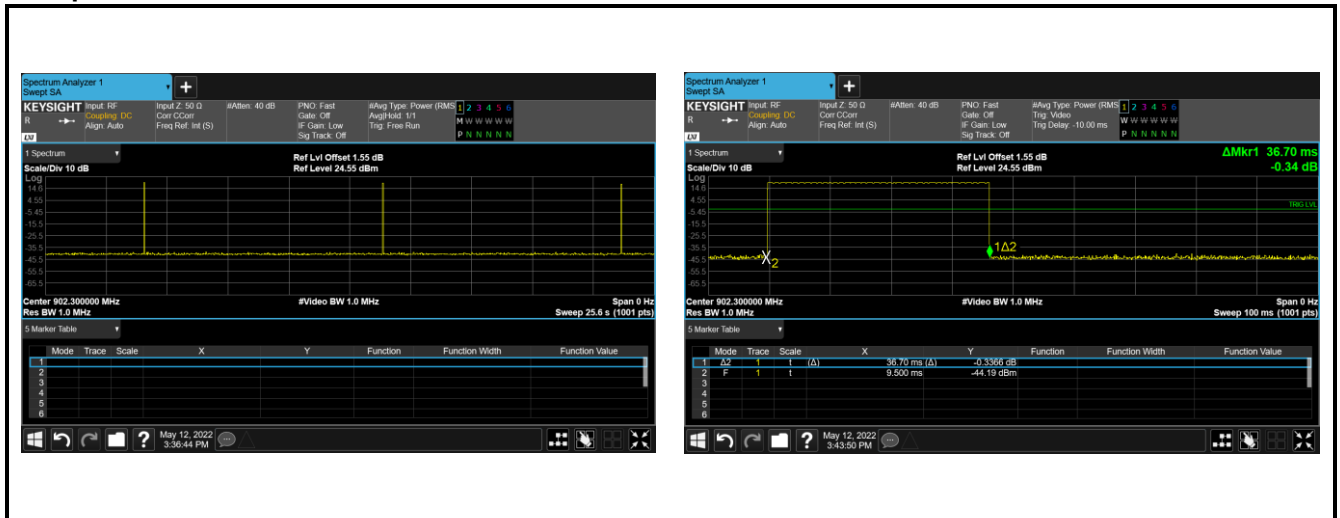
Test Requirement:	FCC Part 15 C Section 15.247 (f)
Receiver setup:	RBW=1 MHz, VBW=1 MHz, Span=0 Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Hopping mode
Test results:	Pass

Measurement Data (Worse case):

Mode	Dwell time (second)	Limit (second)	Result
LoRa	0.1101	0.4	Pass

Note:
 The test period = 0.4 Second/Channel x 64 Channel = 25.6 s
 Calculation Formula: Dwell time = Ton time per hop * Hopping numbers * Period

Test plot as follows:

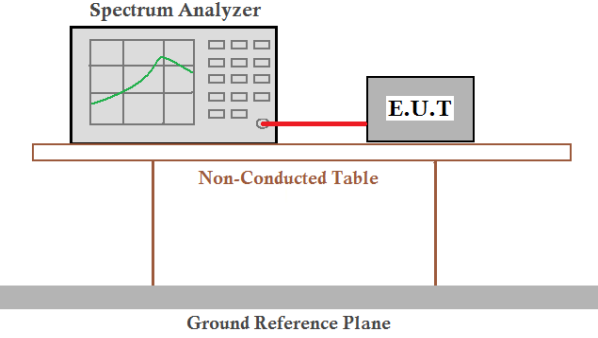


6.10 Pseudorandom Frequency Hopping Sequence

Test Requirement:	FCC Part 15 C Section 15.247 (a)(1) requirement:
<p>Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.</p> <p>Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.</p>	
EUT Pseudorandom Frequency Hopping Sequence	
<p>The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.</p> <ul style="list-style-type: none"> • Number of shift register stages: 9 • Length of pseudo-random sequence: $2^9 - 1 = 511$ bits • Longest sequence of zeros: 8 (non-inverted signal) 	
<p><i>Linear Feedback Shift Register for Generation of the PRBS sequence</i></p>	
<p>An example of Pseudorandom Frequency Hopping Sequence as follow:</p>	
<p>Each frequency used equally on the average by each transmitter.</p> <p>The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.</p>	

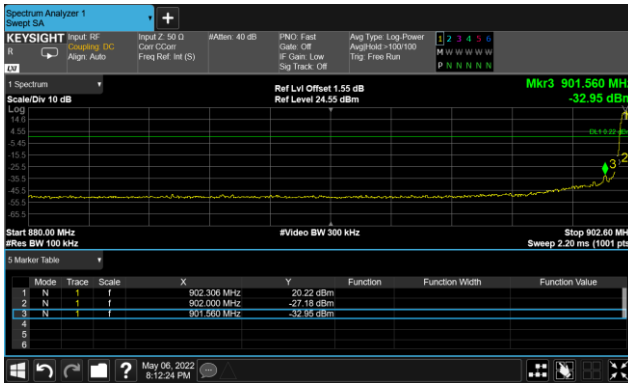
6.11 Band Edge

6.11.1 Conducted Emission Method

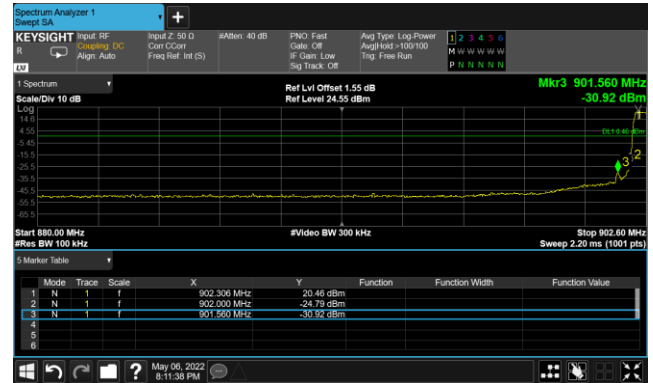
Test Requirement:	FCC Part 15 C Section 15.247 (d)
Receiver setup:	RBW=100 kHz, VBW=300 kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 <p>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.</p>
Test Instruments:	Refer to section 5.9 for details
Test mode:	Non-hopping mode and hopping mode
Test results:	Pass

Test plot as follows:

Lowest Channel



No-hopping mode

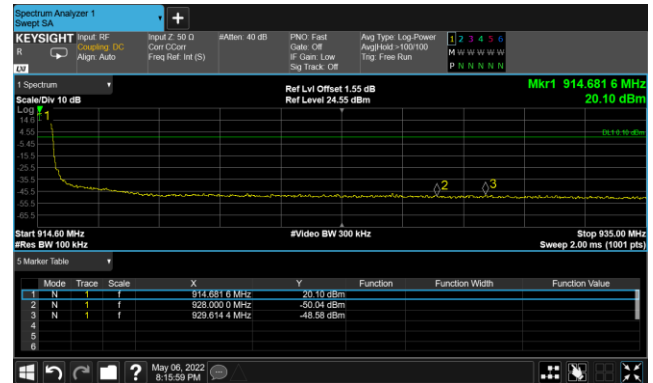


Hopping mode

Highest Channel



No-hopping mode



Hopping mode

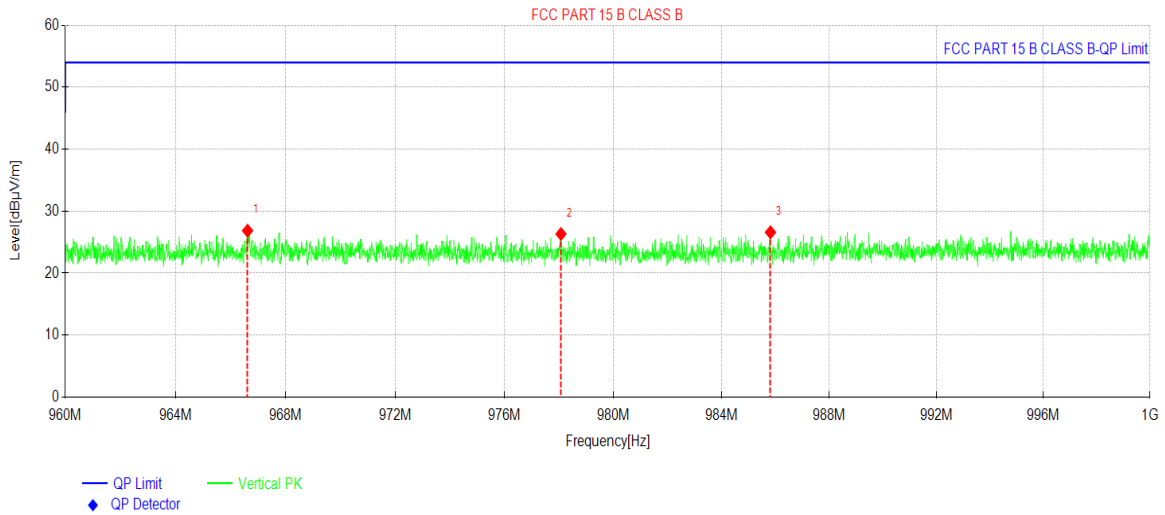
6.12 Restricted bands

6.12.1 Radiated Emission Method

Test Requirement:	FCC Part 15 C Section 15.209 and 15.205				
Test Frequency Range:	960MHz to1240MHz				
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 setup:					
Test Procedure:	<ol style="list-style-type: none"> 1. The EUT was placed on the top of a rotating table 1.5meters 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 10dB 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 10dB 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 Instruments:	Refer to section 5.9 for details				
Test mode:	Non-hopping mode				
Test results:	Passed				

Below 1GHz:

Product Name:	Indoor LoRaWAN Light Hotspot	Product Model:	DSGW-090B
Test By:	Janet	Test mode:	Tx mode
Test Channel:	960-1000MHz	Polarization:	Vertical
Test Voltage:	DC 5V	Environment:	Temp: 24°C Huni: 57%

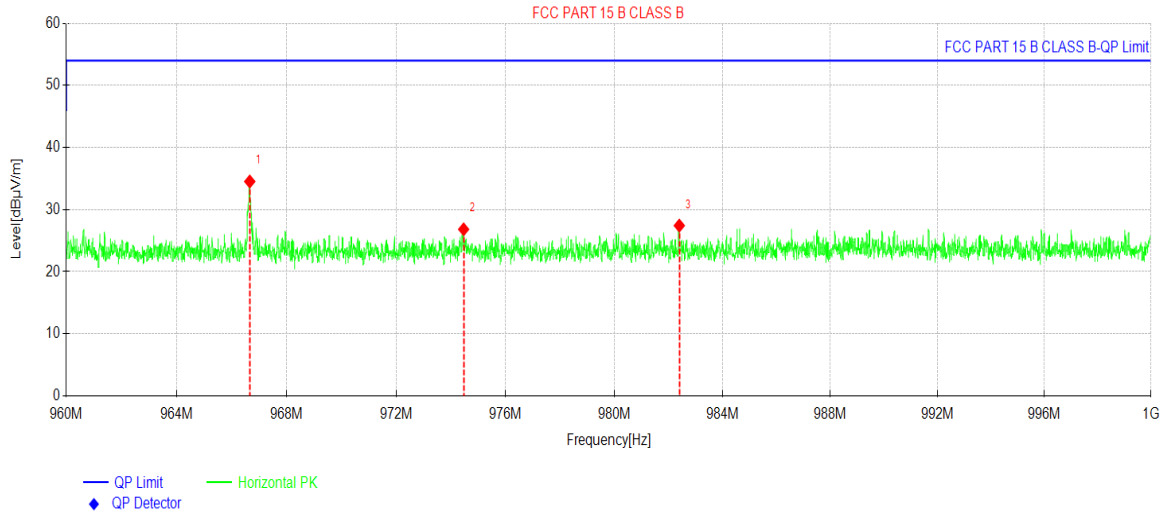


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	966.6087	27.72	26.85	-0.87	54.00	27.15	PK	Vertical
2	978.0778	27.23	26.32	-0.91	54.00	27.68	PK	Vertical
3	985.8186	27.37	26.59	-0.78	54.00	27.41	PK	Vertical

Remark:

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

Product Name:	Indoor LoRaWAN Light Hotspot	Product Model:	DSGW-090B
Test By:	Janet	Test mode:	Tx mode
Test Channel:	960-1000MHz	Polarization:	Horizontal
Test Voltage:	DC 5V	Environment:	Temp: 24°C Huni: 57%



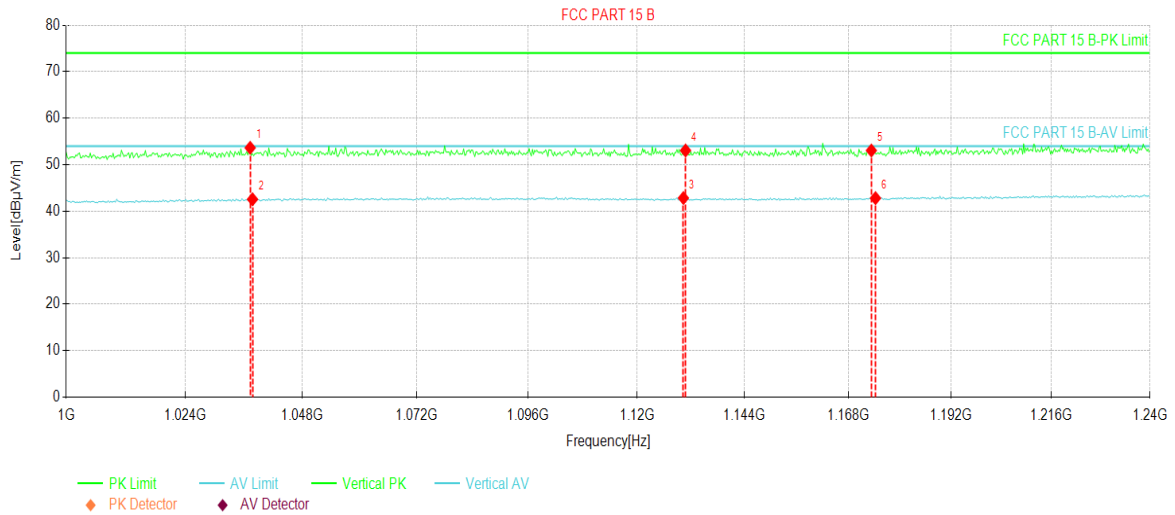
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	966.6527	35.39	34.52	-0.87	54.00	19.48	PK	Horizontal
2	974.4654	27.71	26.82	-0.89	54.00	27.18	PK	Horizontal
3	982.4062	28.28	27.42	-0.86	54.00	26.58	PK	Horizontal

Remark:

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

Above 1GHz:

Product Name:	Indoor LoRaWAN Light Hotspot	Product Model:	DSGW-090B
Test By:	Janet	Test mode:	Tx mode
Test Channel:	1000~1240MHz	Polarization:	Vertical
Test Voltage:	DC 5V	Environment:	Temp: 24°C Huni: 57%



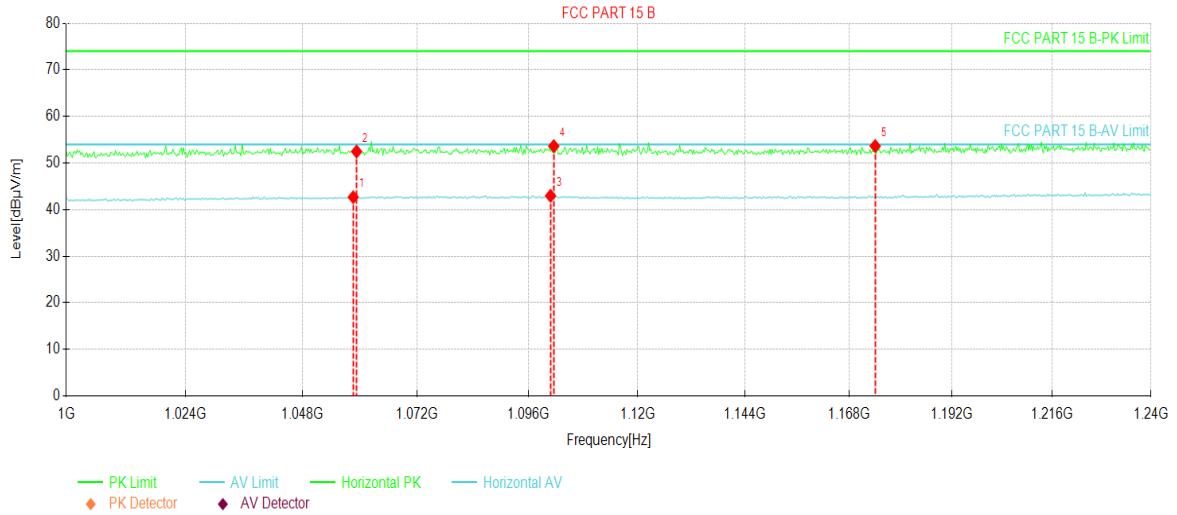
Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1037.2000	23.79	53.63	29.84	74.00	20.37	PK	Vertical
2	1037.6800	12.71	42.55	29.84	54.00	11.45	AV	Vertical
3	1130.3200	12.62	42.82	30.20	54.00	11.18	AV	Vertical
4	1130.8000	22.85	53.05	30.20	74.00	20.95	PK	Vertical
5	1173.2800	22.80	53.05	30.25	74.00	20.95	PK	Vertical
6	1174.2400	12.55	42.80	30.25	54.00	11.20	AV	Vertical

Remark:

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

Product Name:	Indoor LoRaWAN Light Hotspot	Product Model:	DSGW-090B
Test By:	Janet	Test mode:	Tx mode
Test Channel:	1000~1240MHz	Polarization:	Horizontal
Test Voltage:	DC 5V	Environment:	Temp: 24°C Huni: 57%



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1058.5600	12.72	42.67	29.95	54.00	11.33	AV	Horizontal
2	1059.2800	22.51	52.46	29.95	74.00	21.54	PK	Horizontal
3	1100.8000	12.78	42.95	30.17	54.00	11.05	AV	Horizontal
4	1101.5200	23.45	53.62	30.17	74.00	20.38	PK	Horizontal
5	1174.0000	23.39	53.64	30.25	74.00	20.36	PK	Horizontal

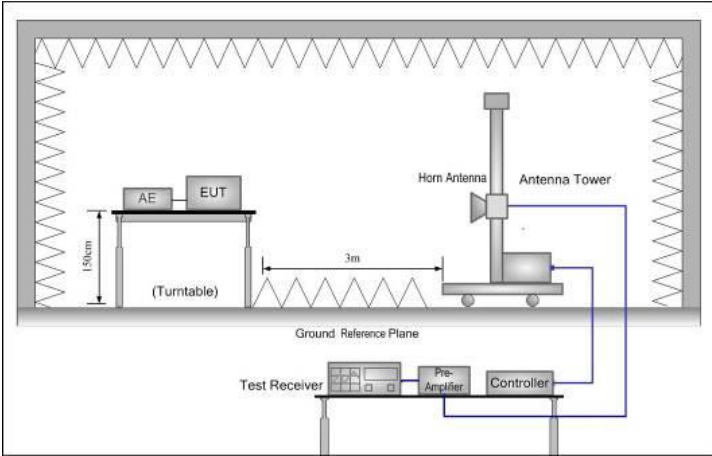
Remark:

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.

6.13 Spurious Emission

6.13.1 Radiated Emission Method

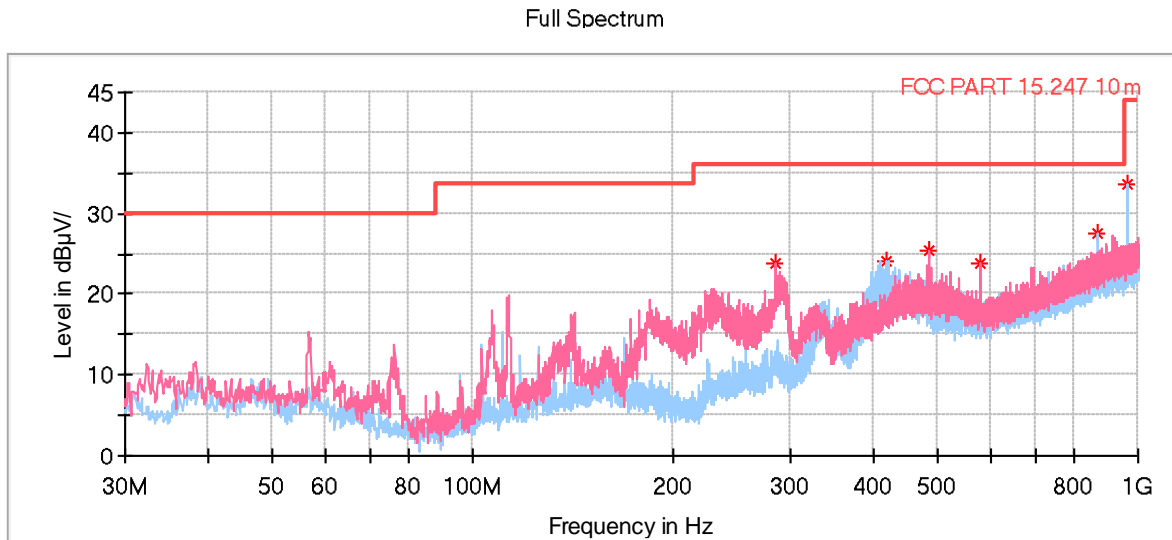
Test Requirement:	FCC Part 15 C Section 15.209				
Test Frequency Range:	9 kHz to 10 GHz				
Test Distance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
RMS		1MHz	3MHz	Average Value	
Limit:	Frequency	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	
	Above 1GHz	54.0		Average Value	
		74.0		Peak Value	
Test setup:	9kHz-30MHz				
	30MHz-1GHz				
Above 1GHz					

	
<p>Test Procedure:</p>	<ol style="list-style-type: none"> 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 chamber. 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 10dB 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 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
<p>Test Instruments:</p>	<p>Refer to section 5.9 for details</p>
<p>Test mode:</p>	<p>Non-hopping mode</p>
<p>Test results:</p>	<p>Pass</p>
<p>Remark:</p>	<ol style="list-style-type: none"> 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 30 MHz is noise floor, so only shows the data of above 30MHz in this report.

Measurement Data (worst case):

Below 1GHz:

Product Name:	Indoor LoRaWAN Light Hotspot	Product Model:	DSGW-090B
Test By:	Janet	Test mode:	Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical & Horizontal
Test Voltage:	AC 120/60Hz	Environment:	Temp: 24°C Huni: 57%



* Critical Freqs PK+ — FCC PART 15.247 10m ◆ Final Result QPK
 — Preview Result 1H-PK+ — Preview Result 1V-PK+

Frequency ↓ (MHz)	MaxPeak ↓ (dB μ V/m)	Limit ↓ (dB μ V/m)	Margin ↓ (dB)	Height ↓ (cm)	Pol.	Azimuth ↓ (deg)	Corr. ↓ (dB/m)
867.692000	27.48	36.00	8.52	100.0	H	3.0	-1.9
417.127000	24.15	36.00	11.85	100.0	H	236.0	-11.2
966.729000	33.64	44.00	10.36	100.0	H	334.0	-0.5
486.094000	25.48	36.00	10.52	100.0	V	20.0	-9.1
579.990000	23.74	36.00	12.26	100.0	V	169.0	-7.1
285.498000	23.84	36.00	12.16	100.0	V	216.0	-14.3

Remark:

1. Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).
2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

Above 1GHz:

Test channel: Lowest channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1804.60	65.18	-20.99	44.19	74.00	29.81	Vertical
1804.60	63.18	-20.99	42.19	74.00	31.81	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1804.60	56.29	-20.99	35.30	54.00	18.70	Vertical
1804.60	56.71	-20.99	35.72	54.00	18.28	Horizontal
Test channel: Middle channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1817.00	65.90	-20.92	44.98	74.00	29.02	Vertical
1817.00	62.74	-20.92	41.82	74.00	32.18	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1817.00	56.19	-20.92	35.27	54.00	18.73	Vertical
1817.00	56.27	-20.92	35.35	54.00	18.65	Horizontal
Test channel: Highest channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1829.80	65.89	-20.86	45.03	74.00	28.97	Vertical
1829.80	63.47	-20.86	42.61	74.00	31.39	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1829.80	55.18	-20.86	34.32	54.00	19.68	Vertical
1829.80	56.92	-20.86	36.06	54.00	17.94	Horizontal
<p>Remark:</p> <ol style="list-style-type: none"> Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor). The emission levels of other frequencies are lower than the limit 20dB and not show in test report. 						

-----End of report-----