



Test Report No. : 4789787917-JP-R0-V0

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Issued date : Mar. 9, 2021

RADIO TEST REPORT

Product : Terminal

Model Name : xCL_AT-170-17W

Test Regulation : Article 2 paragraph 1 item (19), MIC notice 88 Appendix 43

Received Date : Jan. 25, 2021

Test Date : Jan. 26, 2021 ~ Feb. 8, 2021

Issued Date : Mar. 9, 2021

Applicant : XAC Automation Corporation
4F., No. 30 Industry E. Road IX, Science-Based Industrial Park
Hsin-Chu, 300, Taiwan, ROC

Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd.,
Zhudong Township, Hsinchu County, Taiwan

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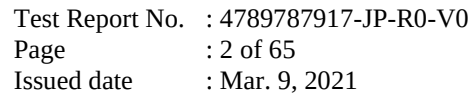
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Doc No: 17-EM-F0938 / 1.0



Original Test Report No.: 4789787917-JP-R0-V0

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1. Attestation of Test Results

APPLICANT: XAC Automation Corporation
4F., No. 30 Industry E. Road IX, Science-Based Industrial Park Hsin-Chu, 300, Taiwan, ROC

EUT DESCRIPTION: Terminal

BRAND: XAC

MODEL: xCL_AT-170-17W

SAMPLE STAGE: Mass-Production

DATE of TESTED: Jan. 26, 2021 ~ Feb. 8, 2021

APPLICABLE STANDARDS	
STANDARD	Test Results
Article 2 paragraph 1 item (19), MIC notice 88 Appendix 43	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Sally Lu Date : Mar. 9, 2021
Project Handler

Approved and Authorized By:

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2. Summary of Test Results

Summary of Test Results		
Test Items	MIC Notice	Test Result
Frequency Tolerance	MIC Notice No. 88 Appendix No. 43	PASS
Occupied Bandwidth (99% channel power bandwidth)		PASS
Spreading Bandwidth (90% channel power bandwidth)		PASS
Spurious Emission Transmitter		PASS
Antenna Power		PASS
Spurious Emission Receiver		PASS
Carrier Sense		PASS
Interference Prevention Function		PASS



3. Test Methodology

The tests documented in this report were performed in accordance with Article 2 paragraph 1 item (19), MIC notice 88 Appendix 43

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan



5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Test Item	Measurement Frequency Range	K	U(dB)
RF Conducted	9 kHz - 40GHz	2	1.0



6. General Information

6.1. General Description of EUT

Product	Terminal	
Brand	XAC	
Model Name	xCL_AT-170-17W	
Radio Technology	IEEE 802.11b/g/n Bluetooth LE	
Operating Frequency	IEEE 802.11b: 2412MHz-2472MHz IEEE 802.11g: 2412MHz-2472MHz IEEE 802.11n HT20: 2412MHz-2472MHz IEEE 802.11n HT40: 2422MHz-2462MHz Bluetooth: 2402 ~ 2480 MHz	
Modulation	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM GFSK for Bluetooth LE	
Transfer Rate	802.11b: 11/5.5/2/1 Mbps 802.11g: 54/48/36/24/18/12/9/6 Mbps 802.11n: up to MCS7 Bluetooth LE: 1Mbps	
Nominal Voltage	100-240 Vac	
Number of Channel	WLAN 2.4 GHz	802.11b: 13 802.11g/n (HT20): 13 802.11n (HT40): 9
	Bluetooth LE 4.2	40
Rated RF Output Power Density	Refer to Note	
Conducted RF Output Power Density	Refer to Note	
Radiated RF Output Power Density	Refer to Note	
Antenna Specification	Refer to item 6.4	



Note:

1. The EUT contains following accessory devices

Product	Brand	Model	Description	Remark
AC Adapter	Mass Power Electronic Limited	NBS10B050200VUU	Input: 110-240Vac, 300mA Output: 5Vdc, 2000mA	Optional
USB-Type C Cable	N/A	N/A	Length:1.2m	-
Battery	Shenzhen Rishengzhi Electronics	J601	3.8Vdc, 5200mAh	-

2. The EUT incorporates a SISO function. Physically, the EUT provides 1 completed transmitter and 1 receiver.

Modulation Mode	Transmit Function
802.11b	1TX (SISO mode)
802.11g	1TX (SISO mode)
802.11n (HT20)	1TX (SISO mode)
802.11n (HT40)	1TX (SISO mode)

1TX: Only 1 RF port transmits at the same time.

3. The power table as below:

	Rated Power (mW/MHz)	Total Conducted RF Output Power Density (mW/MHz)	Radiated RF Output Power Density (mW/MHz)
2.4 GHz			
802.11b	6.71	6.71	7.33
802.11g	2.24	2.24	2.44
802.11n (HT20)	1.79	1.79	1.95
802.11n (HT40)	0.81	0.81	0.88

	Rated Power (mW)	Total Conducted RF Output Power Density (mW)	Radiated RF Output Power Density (mW/MHz)
Bluetooth LE			
Bluetooth LE	3.15	2.79	3.04



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4. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual
5. Test Environment:
Measurement temperature : 24 °C ~ 26 °C
Measurement humidity : 55% ~ 65%
6. Test Personnel: Wayne Chen

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6.2. Description of test mode

WLAN 2.4 GHz

Modes	Channel	Frequency (MHz)
802.11b/g/n (HT20)	1	2412
	7	2442
	13	2472
802.11n (HT40)	3	2422
	7	2442
	11	2462

By means of test software provided by manufacture, the power levels during the tests were set according to the following codes:

802.11b		802.11g	
Channel	Power Setting	Channel	Power Setting
1	38	1	44
7	36	7	43
13	36	13	42
802.11n (HT20)		802.11n (HT40)	
Channel	Power Setting	Channel	Power Setting
1	43	3	42
7	41	7	41
13	41	11	41

**Bluetooth LE:**

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

NOTE 1: By means of test software provided by manufacture, the power levels during the tests were set according to the following codes:

Modulation type: GFSK	
Channel	Power Setting
0	20
19	20
39	20



6.3. Test Condition

Test Conditions	Voltage (Vdc)
Vnormal	3.8

Note: Since the input voltage to receiver RF circuit varies below $\pm 1\%$ when the input voltage from the external power supply to the receiver varies $\pm 10\%$, therefore only execute normal condition test.



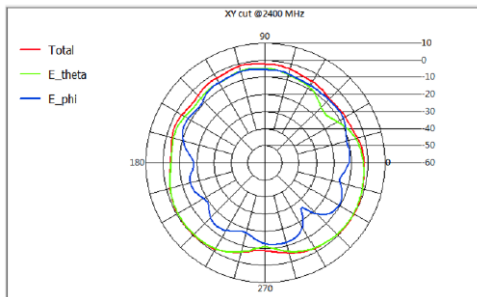
6.4. Description of Available Antennas

6.4.1. Antenna Specification

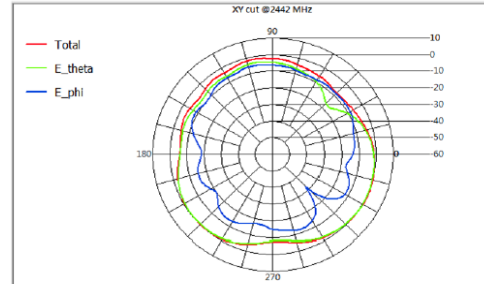
Ant. No.	Brand Name	Model Name	Antenna Type	Connector Type	Antenna Gain(dBi)
1	ACON	AEF6P-100001	Monopole	i-pex	0.38

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

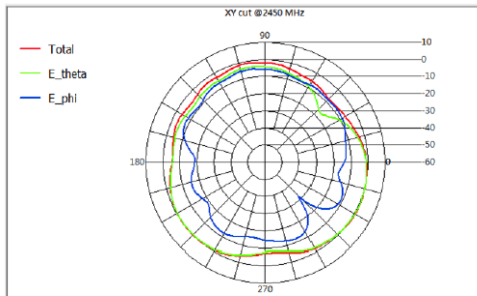
6.4.2 Antenna Pattern



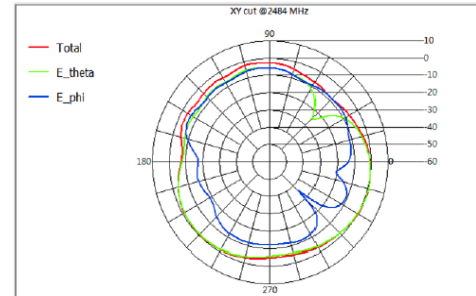
Center Frequency	2400 MHz
Horizontal (dBi) peak	-0.49
Vertical (dBi) peak	-4.63
H+V (dBi) peak	-0.09



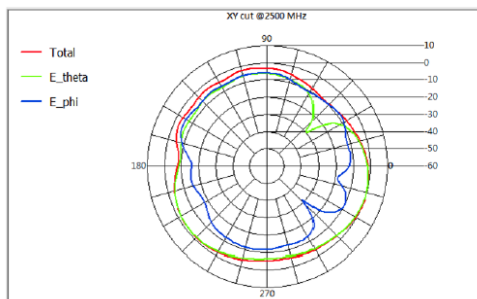
Center Frequency	2442MHz
Horizontal (dBi) peak	0.17
Vertical (dBi) peak	-5.53
H+V (dBi) peak	0.45



Center Frequency	2450MHz
Horizontal (dBi) peak	0.37
Vertical (dBi) peak	-5.07
H+V (dBi) peak	0.68



Center Frequency	2484MHz
Horizontal (dBi) peak	0.38
Vertical (dBi) peak	-5.57
H+V (dBi) peak	0.63



Center Frequency	2500MHz
Horizontal (dBi) peak	-0.36
Vertical (dBi) peak	-5.41
H+V (dBi) peak	-0.07



7. Test Instruments

Description	Manufacturer	Model No.	Serial No.	Calibration Authority	Cal. Method	Cal. Date	Expired date
Spectrum Analyzer	Keysight	N9010A	MY56070834	Electronics Testing Center	c)	2020/11/6	2021/11/5
Power meter	Anritsu	MA2411B	1531202	Electronics Testing Center	c)	2020/12/21	2021/12/20
Power sensor	Anritsu	ML2495A	1645002	Electronics Testing Center	c)	2020/12/21	2021/12/20
Signal Generator	Keysight	N5182B	MY56200244	Electronics Testing Center	c)	2021/1/15	2022/1/14

Note: Calibration Method

- a) : Calibration conducted by the National Institute of Information and Communications Technology ~ NICT ~ or a designated calibration agency under Article 102-18 paragraph (1) ~ TELEC Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc ~.
- b) : Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992) ~ Japan Calibration Service System ~
- c) : Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1) ~ TELEC Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc ~.
- d) : Calibration conducted by using other equipment that listed above from a) to c)



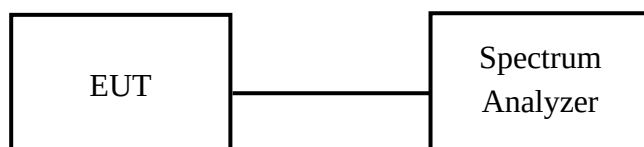
8. Test Results (WLAN 2.4GHz)

8.1. Frequency Tolerance

8.1.1 Requirements

The limitation of Frequency Tolerance is less than or equal to +/-50ppm.

8.1.2 Test Setup



8.1.3 Test Results

802.11b / 802.11g / 802.11n (HT20)

Mode	Voltage (Vdc)	Freq. (MHz)	Carrier Frequency (MHz)	Frequency Tolerance (ppm)	Limits (ppm)
Wi-Fi	Normal	2412	2411.9826	-7.2014925	+/- 50ppm
		2442	2441.9826	-7.113022	+/- 50ppm
		2472	2471.9826	-7.026699	+/- 50ppm

802.11n (HT40)

Mode	Voltage (Vdc)	Freq. (MHz)	Carrier Frequency (MHz)	Frequency Tolerance (ppm)	Limits (ppm)
Wi-Fi	Normal	2422	2421.9835	-6.812552	+/- 50ppm
		2442	2441.9848	-6.224406	+/- 50ppm
		2462	2461.9831	-6.876523	+/- 50ppm

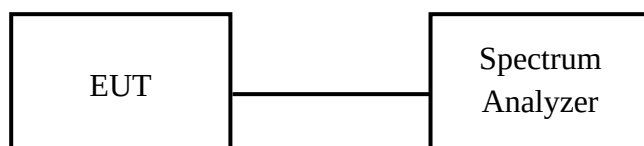


8.2. Occupied Bandwidth (99% Channel Power Bandwidth)

8.2.1 Requirements

Item	Limits
Occupied Bandwidth	FH, FH+DS, FH+OFDM: $\leq 83.5\text{MHz}$ Others: $\leq 26\text{MHz}$ OFDM1: $\leq 26\text{MHz}$ OFDM2: $26\text{MHz} < \text{BW} \leq 38\text{MHz}$

8.2.2 Test Setup

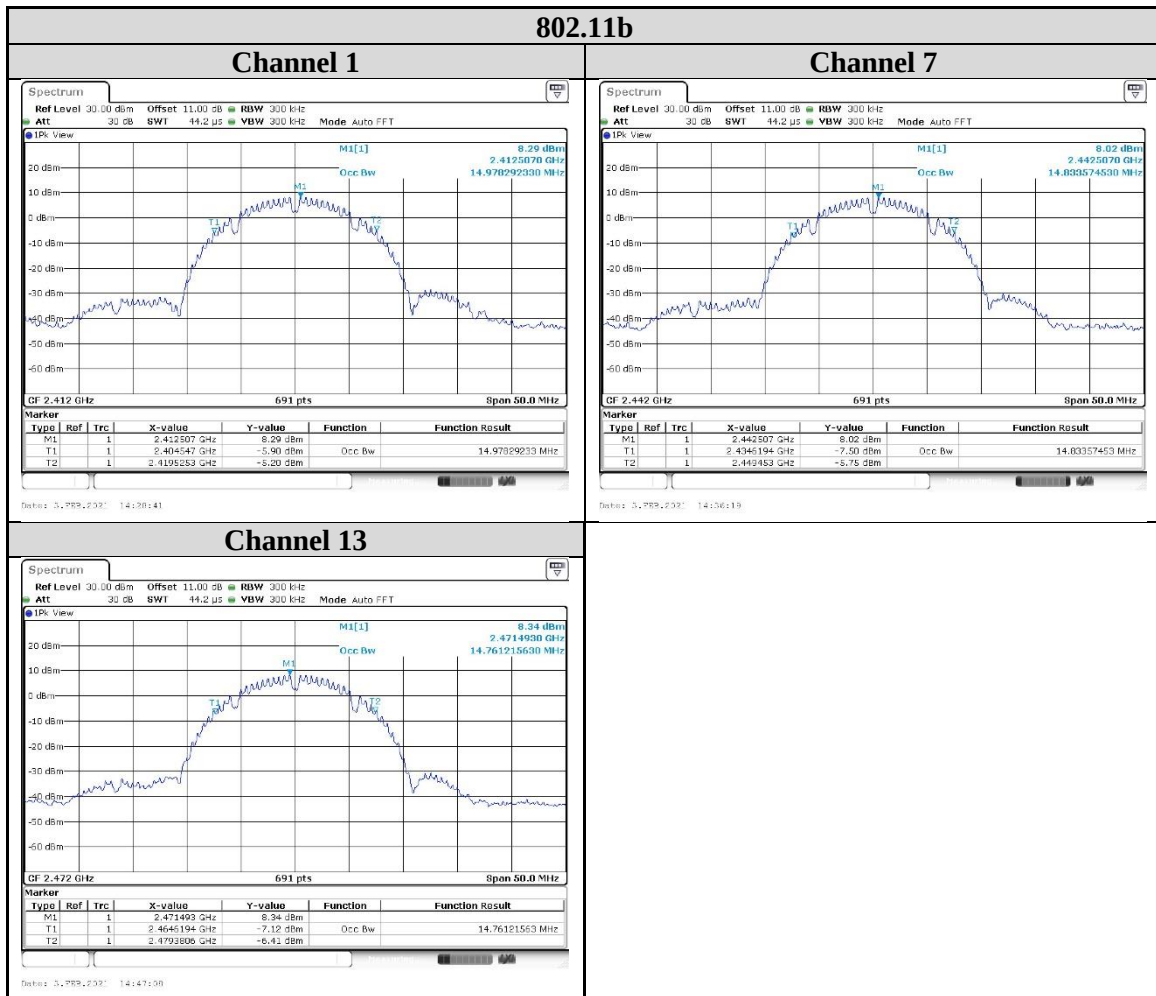




8.2.3 Test Results

802.11b

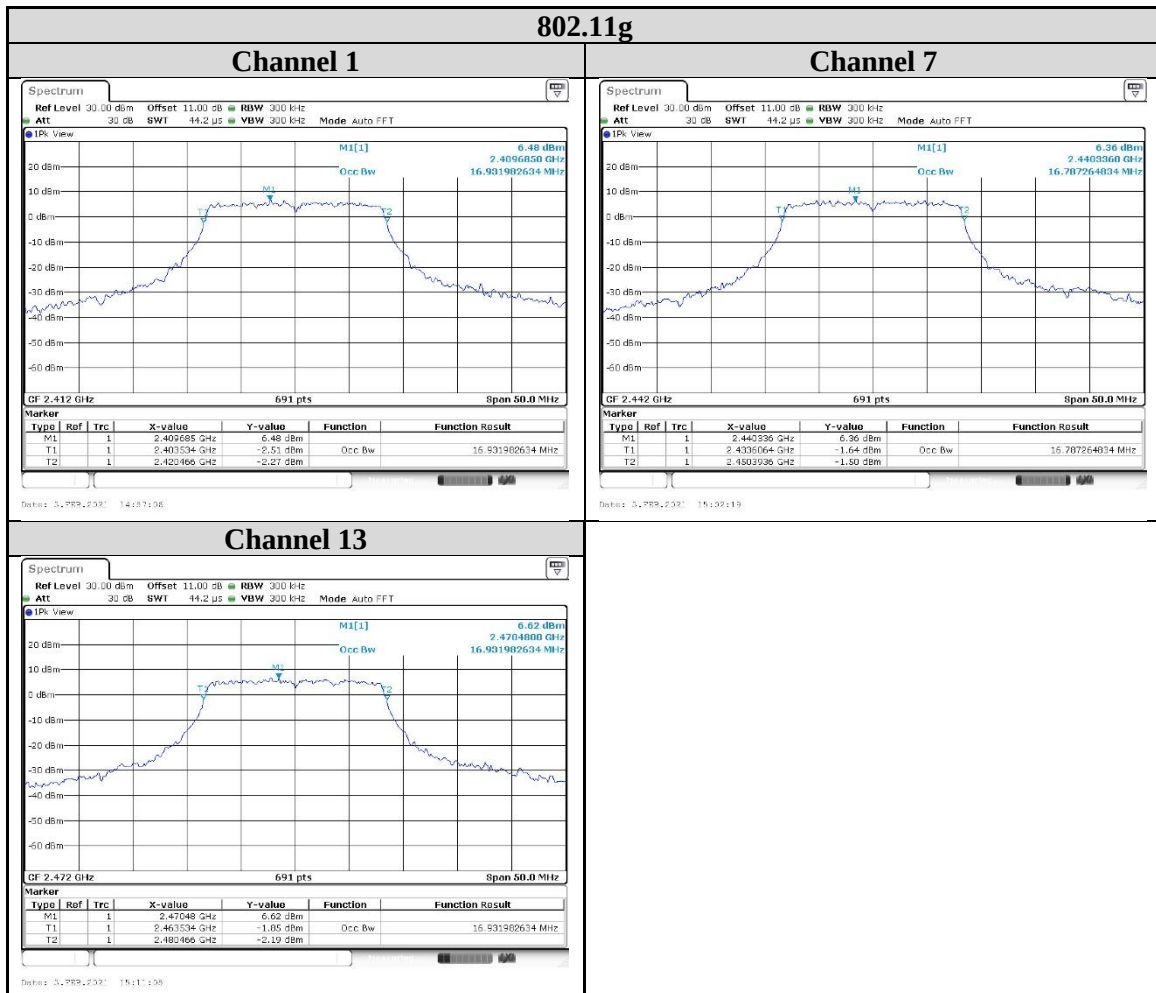
Mode	Voltage	Frequency (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Pass/Fail
802.11b	Vnormal	2412	14.98	≤ 26	Pass
		2442	14.83	≤ 26	Pass
		2472	14.76	≤ 26	Pass





802.11g

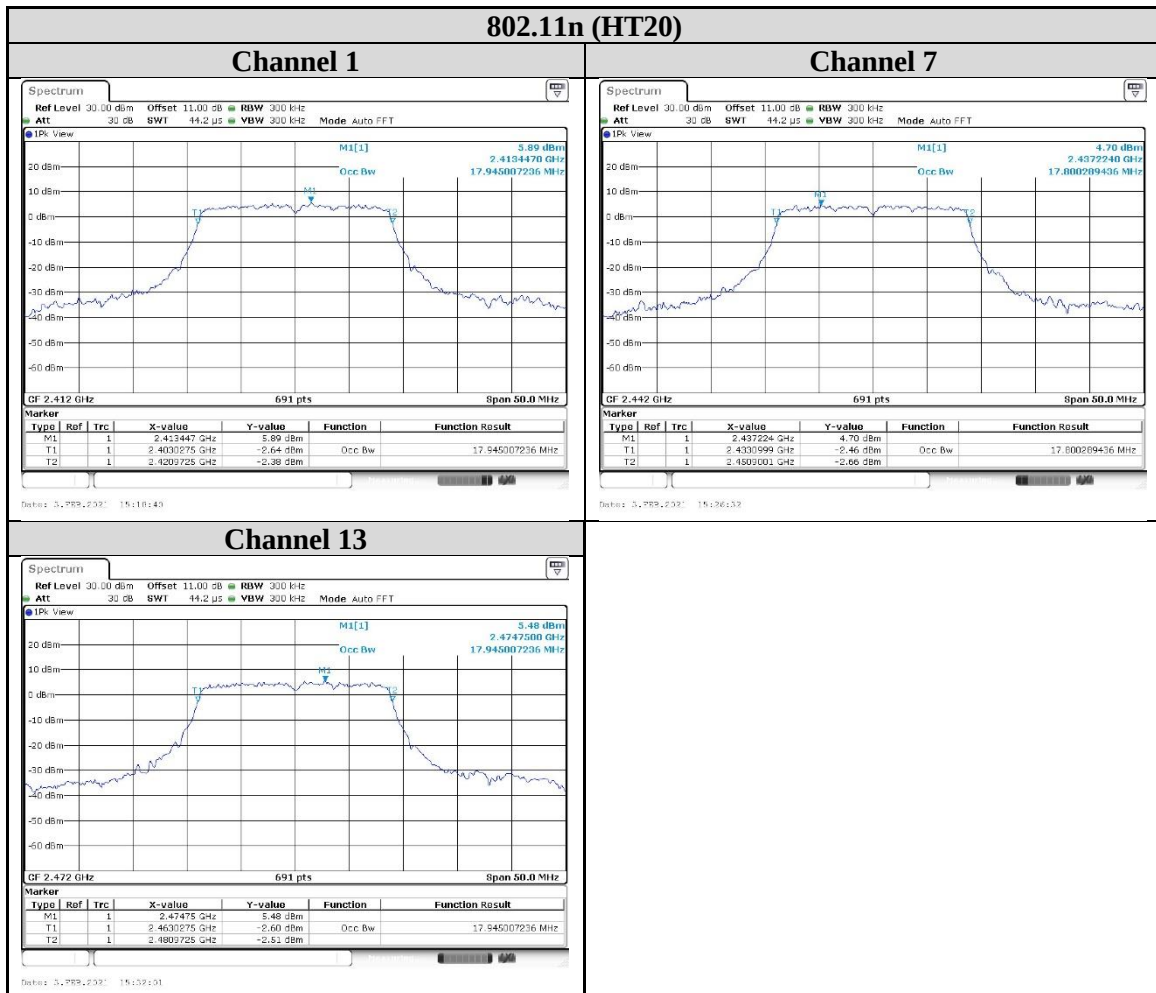
Mode	Voltage	Frequency (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Pass/Fail
802.11g	Vnormal	2412	16.93	≤ 26	Pass
		2442	16.79	≤ 26	Pass
		2472	16.93	≤ 26	Pass





802.11n (HT20)

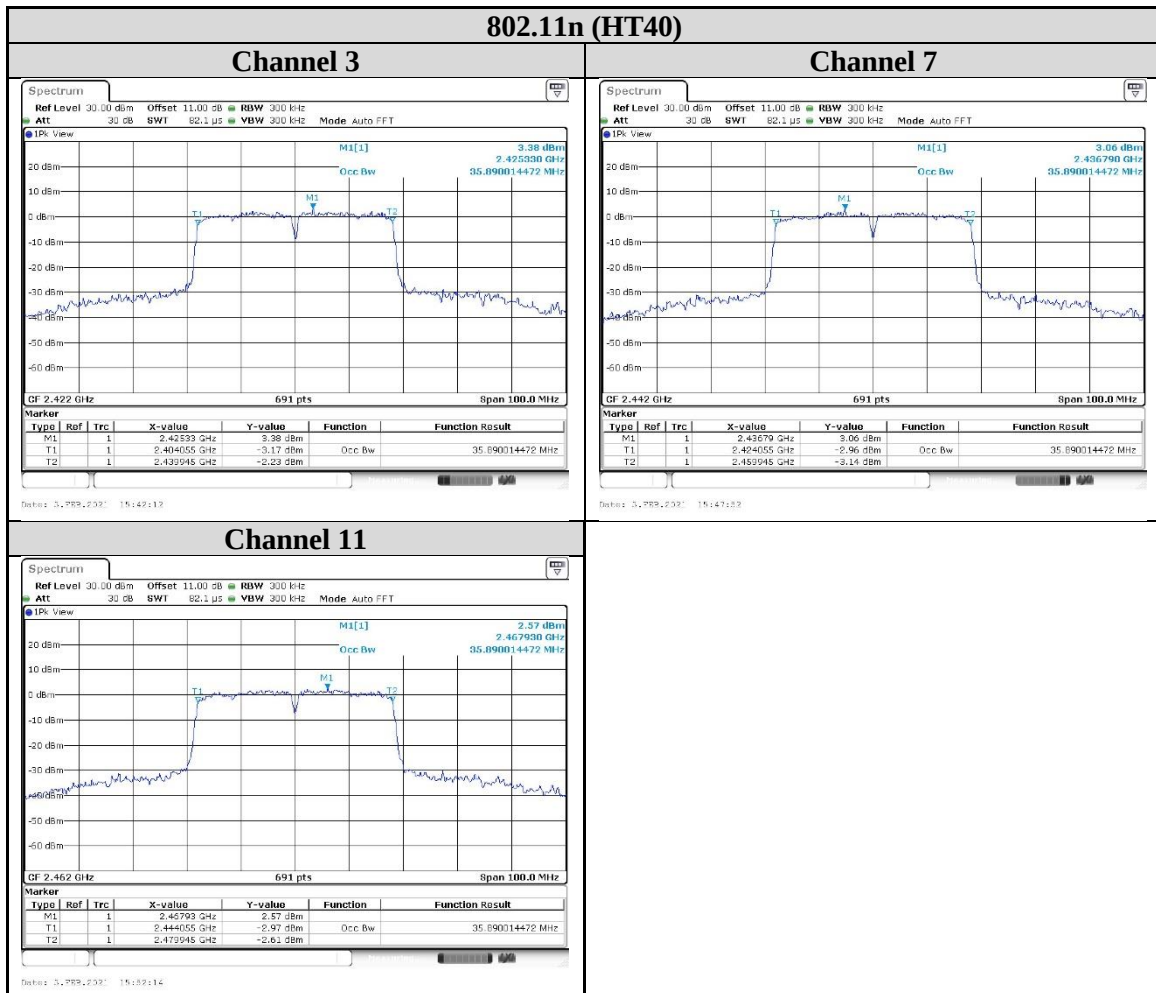
Mode	Voltage	Frequency (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Pass/Fail
802.11n	Vnormal	2412	17.95	≤ 26	Pass
		2442	17.80	≤ 26	Pass
		2472	17.95	≤ 26	Pass





802.11n (HT40)

Mode	Voltage	Frequency (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Pass/Fail
802.11n	Vnormal	2422	35.89	≤ 36	Pass
		2442	35.89	≤ 36	Pass
		2462	35.89	≤ 36	Pass



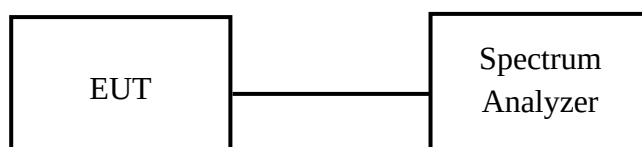


8.3. Spreading Bandwidth (90% Channel Power Bandwidth)

8.3.1 Requirements

Item	Limit	Remark
Spreading Bandwidth	≥ 500 kHz	(For DSSS, FHSS)
Spreading Factor	≥ 5	Operating frequency 2400 to 2483.5 MHz

8.3.2 Test Setup





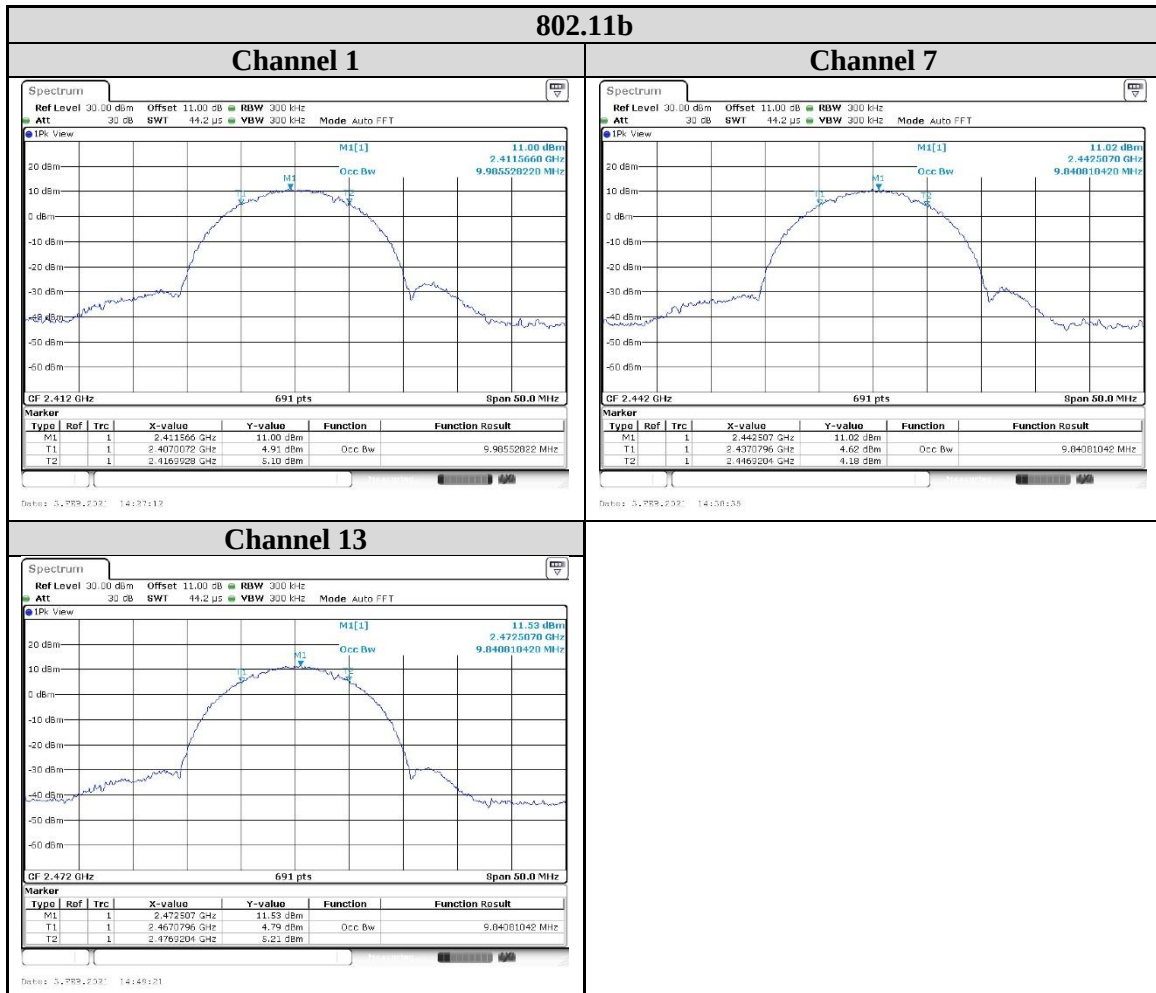
8.3.3 Test Results

802.11b

Mode	Voltage	Frequency (MHz)	Occupied Bandwidth (MHz)	Spreading Factor	Limit	Pass/Fail
11b	Vnormal	2412	9.99	7.26	≥ 5	Pass
		2442	9.84	7.16	≥ 5	Pass
		2472	9.84	7.16	≥ 5	Pass

Note: 1. For the test plots please refer to the below pages.

2. Spreading Factor: 90 % channel power bandwidth / 1.375.



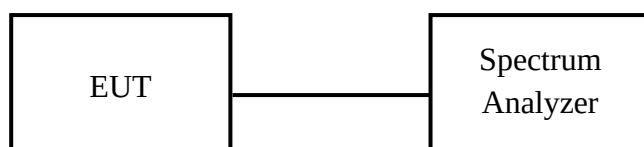


8.4. Spurious Emissions for Transmitter

8.4.1 Requirements

Frequencies(MHz)	Limits
30MHz-1GHz	$\leq 0.25 \mu\text{W}/100\text{kHz}$
1GHz-2.387GHz	$\leq 2.5 \mu\text{W}/\text{MHz}$
2.387GHz-2.4GHz	$\leq 25 \mu\text{W}/\text{MHz}$
2.4835GHz-2.4965GHz	$\leq 25 \mu\text{W}/\text{MHz}$
2.4965GHz -13GHz	$\leq 2.5 \mu\text{W}/\text{MHz}$

8.4.2 Test Setup



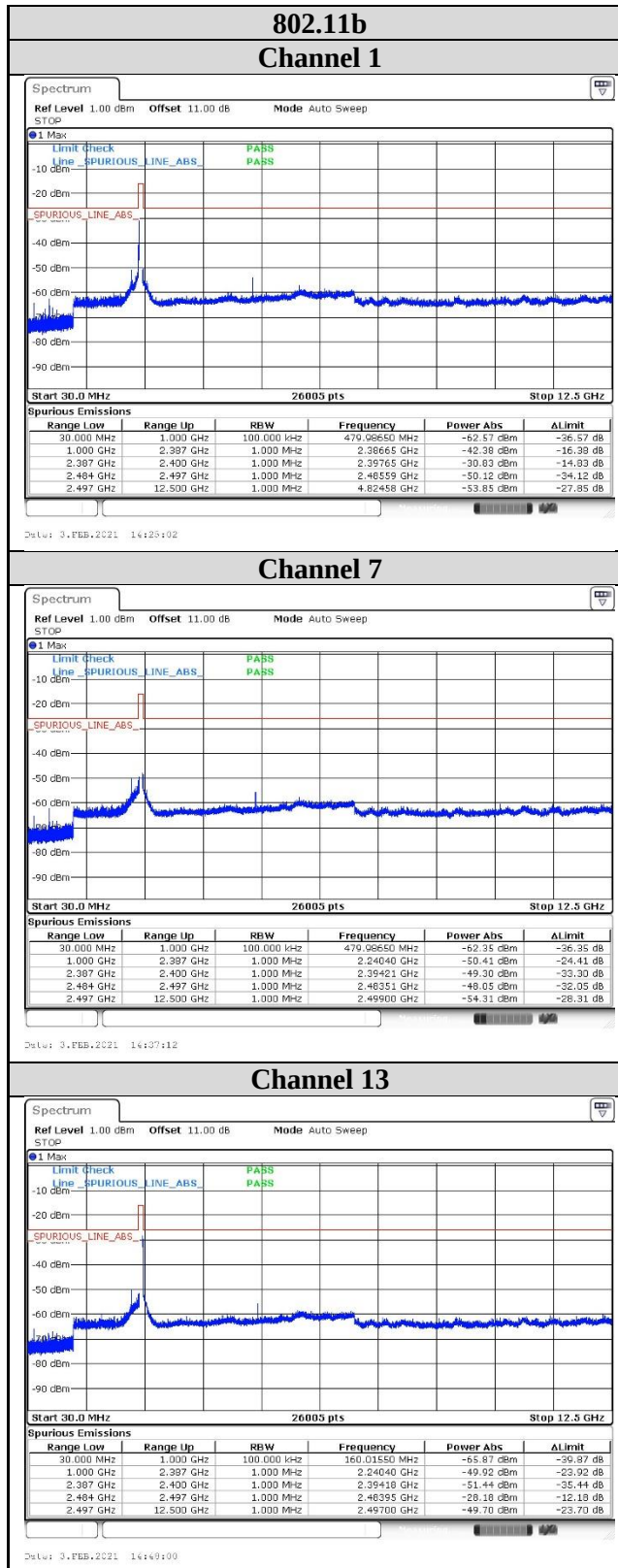


8.4.3 Test Results

802.11b

Test Channel		Ch 1 (2412 MHz)		CH7 (2442 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	479.9865	0.000553	479.9865	0.000582	0.25uW/100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2386.65	0.057810	2240.4	0.009099	2.5 uW/MHz	Pass
	2387.0 MHz to 2400.0 MHz	2397.65	0.826038	2394.21	0.011749	25 uW/MHz	Pass
	2483.5 MHz to 2496.5 MHz	2485.59	0.009727	2483.51	0.015668	25 uW/MHz	Pass
	2496.5 MHz to 12500.0 MHz	4824.58	0.004121	2499	0.003707	2.5 uW/MHz	Pass

Test Channel		Ch 13 (2472 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	160.0155	0.000259	0.25uW/100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2240.4	0.010186	2.5 uW/MHz	Pass
	2387.0 MHz to 2400.0 MHz	2394.18	0.007178	25 uW/MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.95	1.520548	25 uW/MHz	Pass
	2496.5 MHz to 12500.0 MHz	2497	0.010715	2.5 uW/MHz	Pass

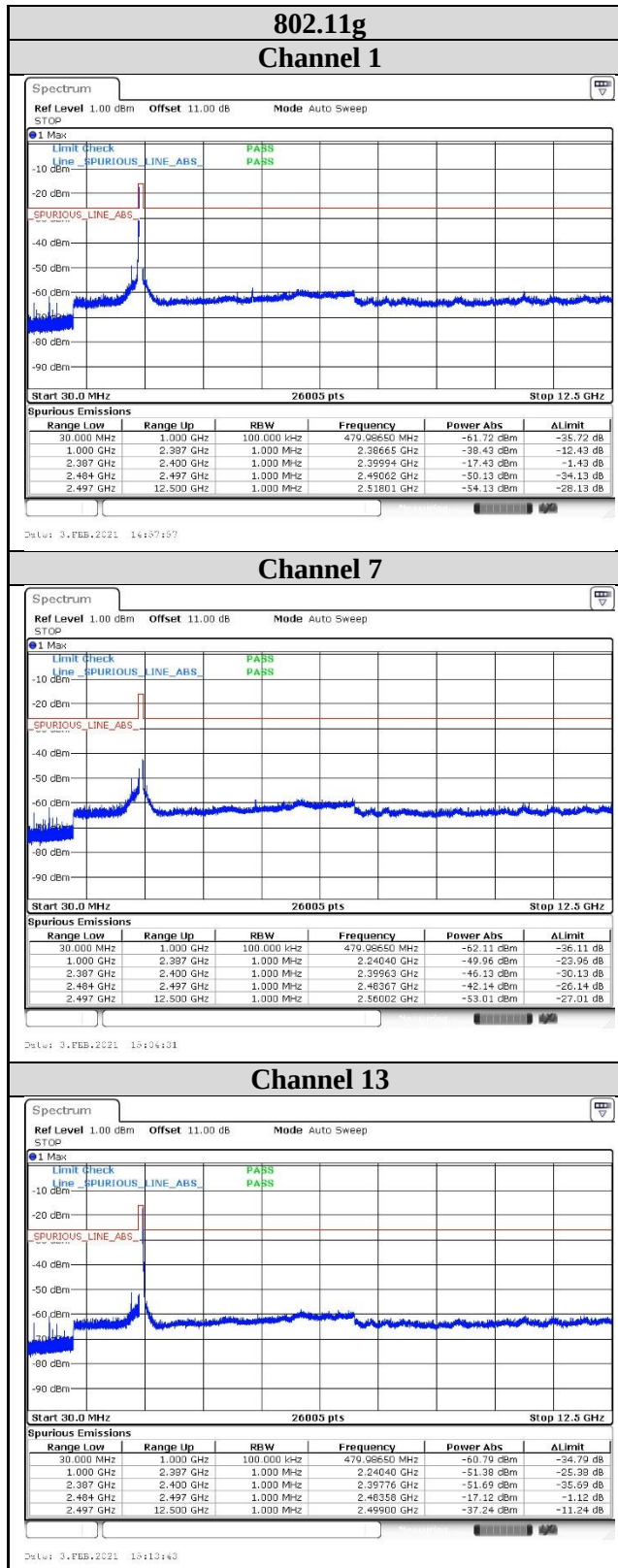




802.11g

Test Channel		Ch 1 (2412 MHz)		CH7 (2442MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	479.9865	0.000673	479.9865	0.000615	0.25uW/100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2386.65	0.143549	2240.4	0.010093	2.5 uW/MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.94	18.071741	2399.63	0.024378	25 uW/MHz	Pass
	2483.5 MHz to 2496.5 MHz	2490.62	0.009705	2483.67	0.061094	25 uW/MHz	Pass
	2496.5 MHz to 12500.0 MHz	2518.01	0.003864	2560.02	0.005000	2.5 uW/MHz	Pass

Test Channel		Ch 13 (2472 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	479.9865	0.000834	0.25uW/100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2240.4	0.007278	2.5 uW/MHz	Pass
	2387.0 MHz to 2400.0 MHz	2397.76	0.006776	25 uW/MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.58	19.408859	25 uW/MHz	Pass
	2496.5 MHz to 12500.0 MHz	2499	0.188799	2.5 uW/MHz	Pass



**802.11n (HT20)**

Test Channel		Ch 1 (2412 MHz)		CH7 (2442MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V_{normal}	30.0 MHz to 1000.0 MHz	479.9865	0.000532	479.9865	0.000661	0.25uW/100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2385.96	0.173780	2240.4	0.010471	2.5 uW/MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.81	17.179084	2399.93	0.025061	25 uW/MHz	Pass
	2483.5 MHz to 2496.5 MHz	2488.36	0.010328	2484	0.057810	25 uW/MHz	Pass
	2496.5 MHz to 12500.0 MHz	2560.02	0.003451	2560.02	0.004009	2.5 uW/MHz	Pass

Test Channel		Ch 13 (2472 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V_{normal}	30.0 MHz to 1000.0 MHz	479.9865	0.000820	0.25uW/100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2240.4	0.011940	2.5 uW/MHz	Pass
	2387.0 MHz to 2400.0 MHz	2390.88	0.005741	25 uW/MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.6	18.030177	25 uW/MHz	Pass
	2496.5 MHz to 12500.0 MHz	2497	0.173780	2.5 uW/MHz	Pass

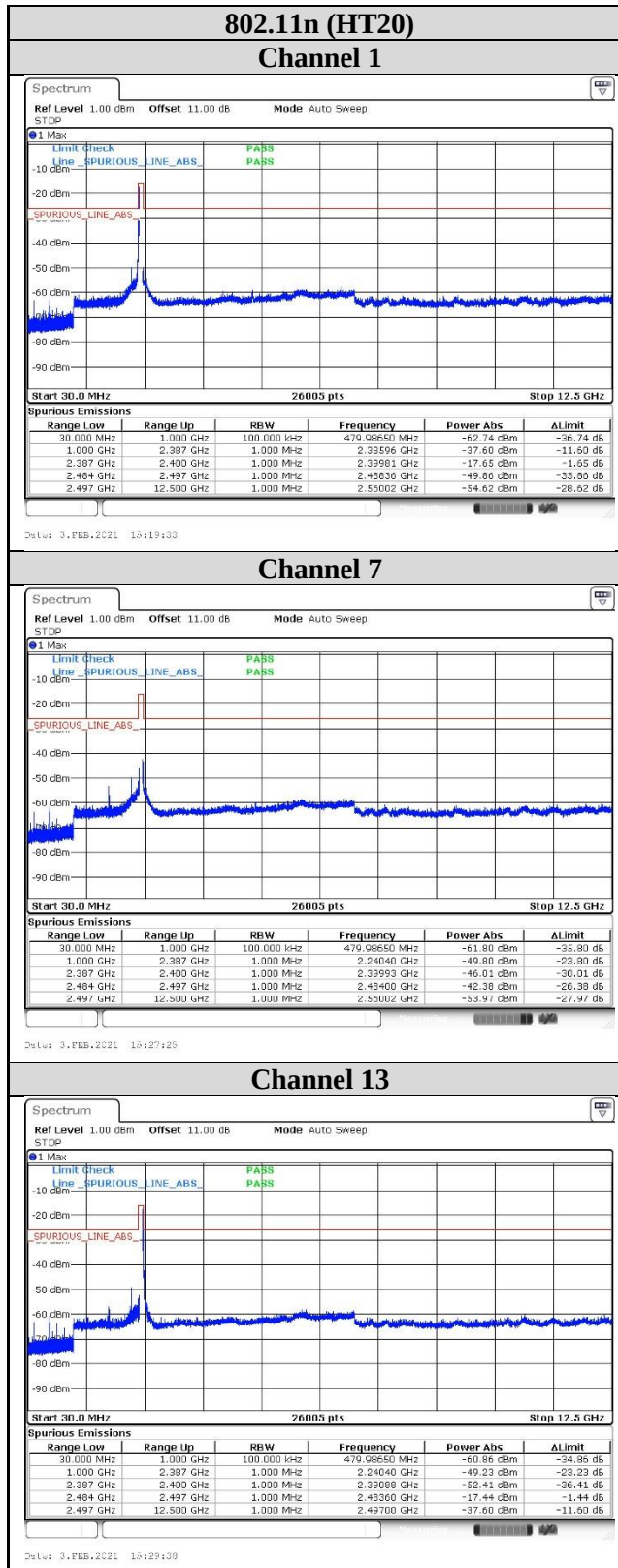
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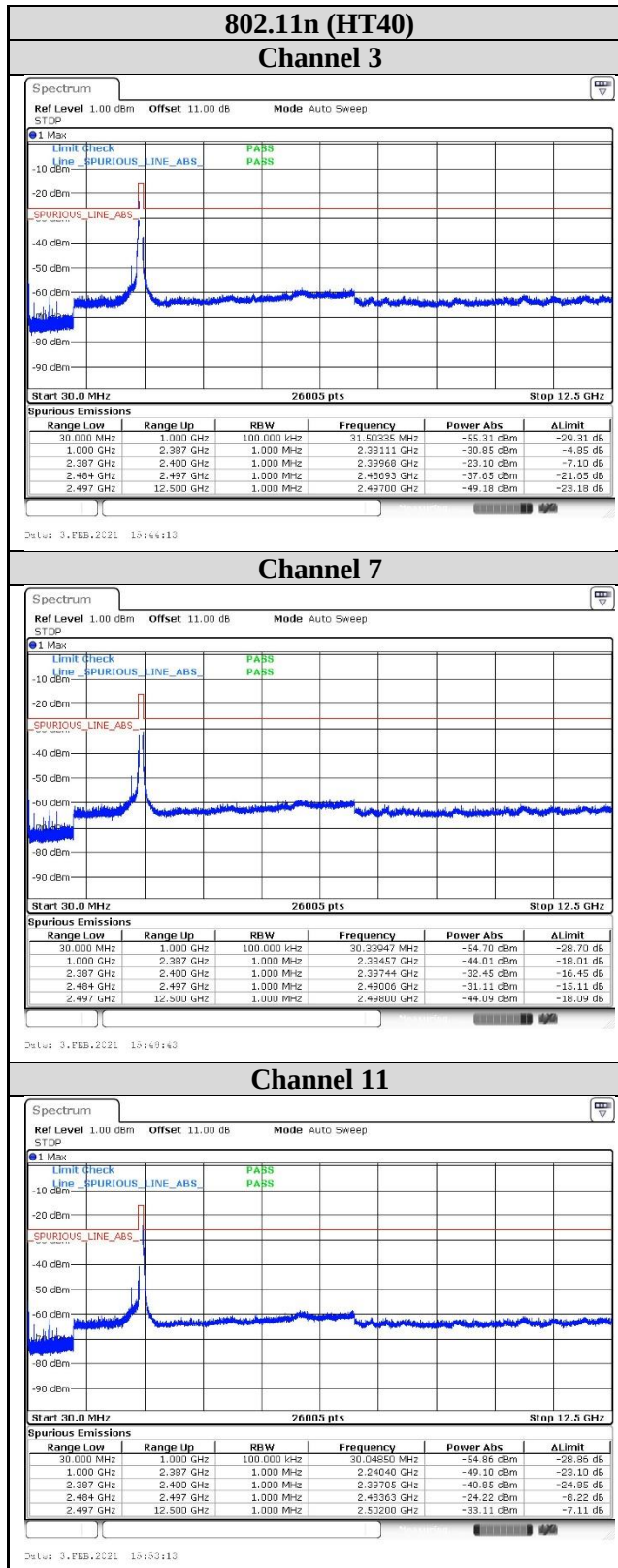




802.11n (HT40)

Test Channel		Ch 3 (2422 MHz)		CH7 (2442MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	31.50335	0.002944	30.33947	0.003388	0.25uW/100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2381.11	0.822243	2384.57	0.039719	2.5 uW/MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.68	4.897788	2397.44	0.568853	25 uW/MHz	Pass
	2483.5 MHz to 2496.5 MHz	2486.93	0.171791	2490.06	0.774462	25 uW/MHz	Pass
	2496.5 MHz to 12500.0 MHz	2497	0.012078	2498	0.038994	2.5 uW/MHz	Pass

Test Channel		Ch 11 (2462 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	30.0485	0.003266	0.25uW/100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2240.4	0.012303	2.5 uW/MHz	Pass
	2387.0 MHz to 2400.0 MHz	2397.05	0.082224	25 uW/MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.63	3.784426	25 uW/MHz	Pass
	2496.5 MHz to 12500.0 MHz	2502	0.488652	2.5 uW/MHz	Pass



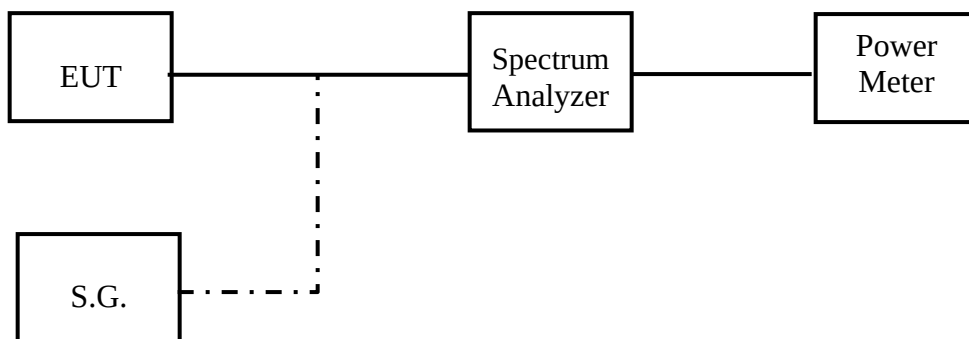


8.5. Antenna Power

8.5.1 Requirements

Item	Limits
Antenna Power Density	$\leq 3 \text{ mW/MHz}$ (2427~2470.75MHz)
	DS: $\leq 10 \text{ mW/MHz}$
	OFDM: $\leq 10 \text{ mW/MHz}$ (Bandwidth $\leq 26\text{MHz}$)
	OFDM: $\leq 5 \text{ mW/MHz}$ ($26\text{MHz} < \text{Bandwidth} \leq 38\text{MHz}$)
	Others: $\leq 10 \text{ mW}$

8.5.2 Test Setup





8.5.3 Test Results

802.11b

Test Condition	Conducted RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	6.28	6.21	6.71	10
Rated Power	6.71			
Tolerance of Antenna Power	1.34 ~ 8.06			

Note:

1. Highest output power tolerance (%) = $((6.71-6.71)/6.71)*100 = 0(\%)$
2. Lowest output power tolerance (%) = $((6.21-6.71)/6.71)*100 = -7.45(\%)$

Dipole antenna with 0.38 dBi gain

Test Condition	Radiated RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	6.85	6.78	7.33	16.368

Note: Radiated RF output power density = Conducted RF output power density + Antenna Gain.

**802.11g**

Test Condition	Conducted RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	2.05	2.24	2.18	10
Rated Power	2.24			
Tolerance of Antenna Power	0.45 ~ 2.69			

Note:

1. Highest output power tolerance (%) = $((2.24-2.24)/2.24)*100 = 0(\%)$
2. Lowest output power tolerance (%) = $((2.05-2.24)/2.24)*100 = -8.48(\%)$

Dipole antenna with 0.38 dBi gain

Test Condition	Radiated RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	2.24	2.44	2.38	16.368

Note: Radiated RF output power density = Conducted RF output power density + Antenna Gain.

**802.11n (HT20)**

Test Condition	Conducted RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	1.79	1.65	1.78	10
Rated Power	1.79			
Tolerance of Antenna Power	0.36 ~ 2.14			

Note:

- Highest output power tolerance (%) = $((1.79-1.79)/1.79)*100 = 0(\%)$
- Lowest output power tolerance (%) = $((1.65-1.79)/1.79)*100 = -7.82(\%)$

Dipole antenna with 0.38 dBi gain

Test Condition	Radiated RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	1.95	1.80	1.94	16.368

Note: Radiated RF output power density = Conducted RF output power density + Antenna Gain.

**802.11n (HT40)**

Test Condition	Conducted RF Output Power Density (mW/MHz)			
	Channel 3 2422 MHz	Channel 7 2442 MHz	Channel 11 2462 MHz	Max. Limit (mW/MHz)
V _{normal}	0.81	0.72	0.80	5
Rated Power	0.81			
Tolerance of Antenna Power	0.16 ~ 0.97			

Note:

1. Highest output power tolerance (%) = $((0.81-0.81)/0.81)*100 = 6.83(\%)$
2. Lowest output power tolerance (%) = $((0.72-0.81)/0.81)*100 = -11.11(\%)$

Dipole antenna with 0.38 dBi gain

Test Condition	Radiated RF Output Power Density (mW/MHz)			
	Channel 3 2422 MHz	Channel 7 2442 MHz	Channel 11 2462 MHz	Max. Limit (mW/MHz)
V _{normal}	0.88	0.79	0.87	8.184

Note: Radiated RF output power density = Conducted RF output power density + Antenna Gain.

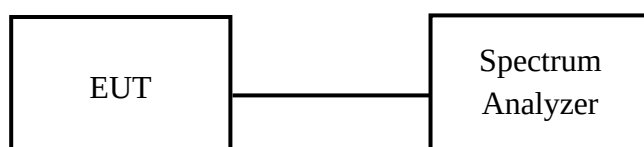


8.6 Spurious Emissions for Receiver

8.6.1 Requirements

Frequencies (MHz)	Limit
Below 1 GHz	≤ 4 nW (-54 dBm)
Above 1 GHz	≤ 20 nW (-47 dBm)

8.6.2 Test Setup

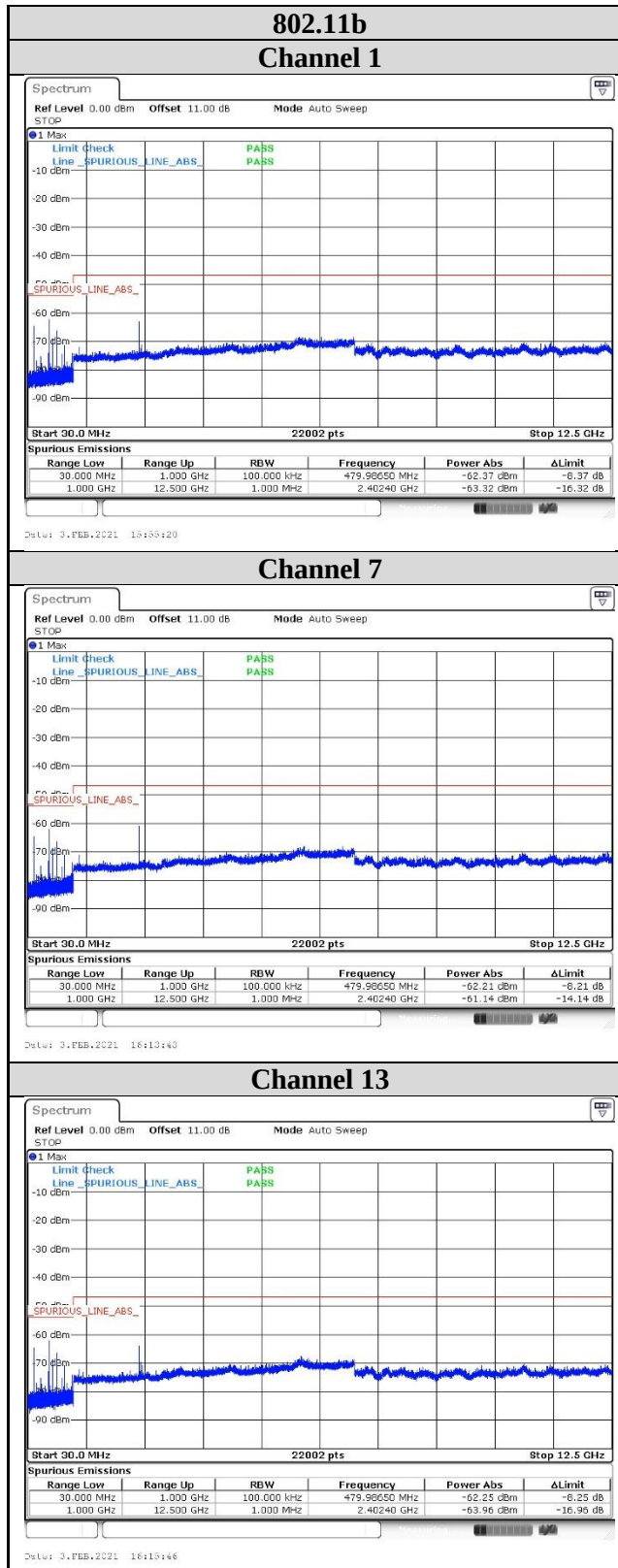




8.6.3 Test Results

802.11b

Test Channel		Channel 1 (2412 MHz)		Channel 7 (2442 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	Below 1 GHz	479.9865	0.579429	479.9865	0.601174	4 nW	Pass
	Above 1 GHz	2402.4	0.465586	2402.4	0.769130	20 nW	Pass
Test Channel		Channel 13 (2472 MHz)				Limit	Result
Test Condition	Frequency Range	Frequency (MHz)		Measured Value			
V _{normal}	Below 1 GHz	479.9865		0.595662		4 nW	Pass
	Above 1 GHz	2402.4		0.401791		20 nW	Pass



**802.11g**

Test Channel		Channel 1 (2412 MHz)		Channel 7 (2442 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	Below 1 GHz	479.9865	0.557186	479.9865	0.579429	4 nW	Pass
	Above 1 GHz	2402.4	0.292415	6180.8	0.154170	20 nW	Pass
Test Channel		Channel 13 (2472 MHz)				Limit	Result
Test Condition	Frequency Range	Frequency (MHz)		Measured Value			
V _{normal}	Below 1 GHz	479.9865		0.574116		4 nW	Pass
	Above 1 GHz	2402.4		0.229087		20 nW	Pass

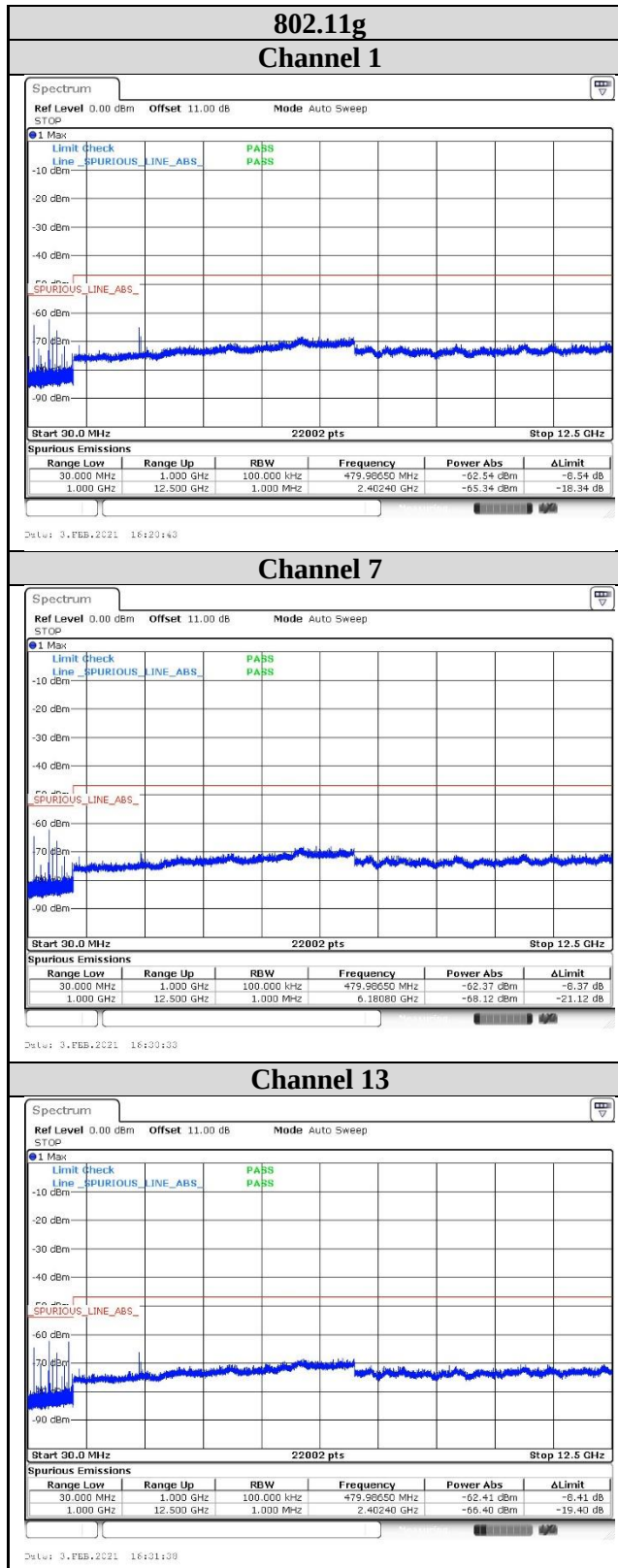
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**802.11 (HT20)**

Test Channel		Channel 1 (2412 MHz)		Channel 7 (2442 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	Below 1 GHz	479.9865	0.580764	479.9865	0.555904	4 nW	Pass
	Above 1 GHz	2426.36	0.176198	2480.02	0.142233	20 nW	Pass
Test Channel		Channel 13 (2472 MHz)				Limit	Result
Test Condition	Frequency Range	Frequency (MHz)		Measured Value			
V _{normal}	Below 1 GHz	479.9865		0.603949		4 nW	Pass
	Above 1 GHz	2426.36		0.376704		20 nW	Pass

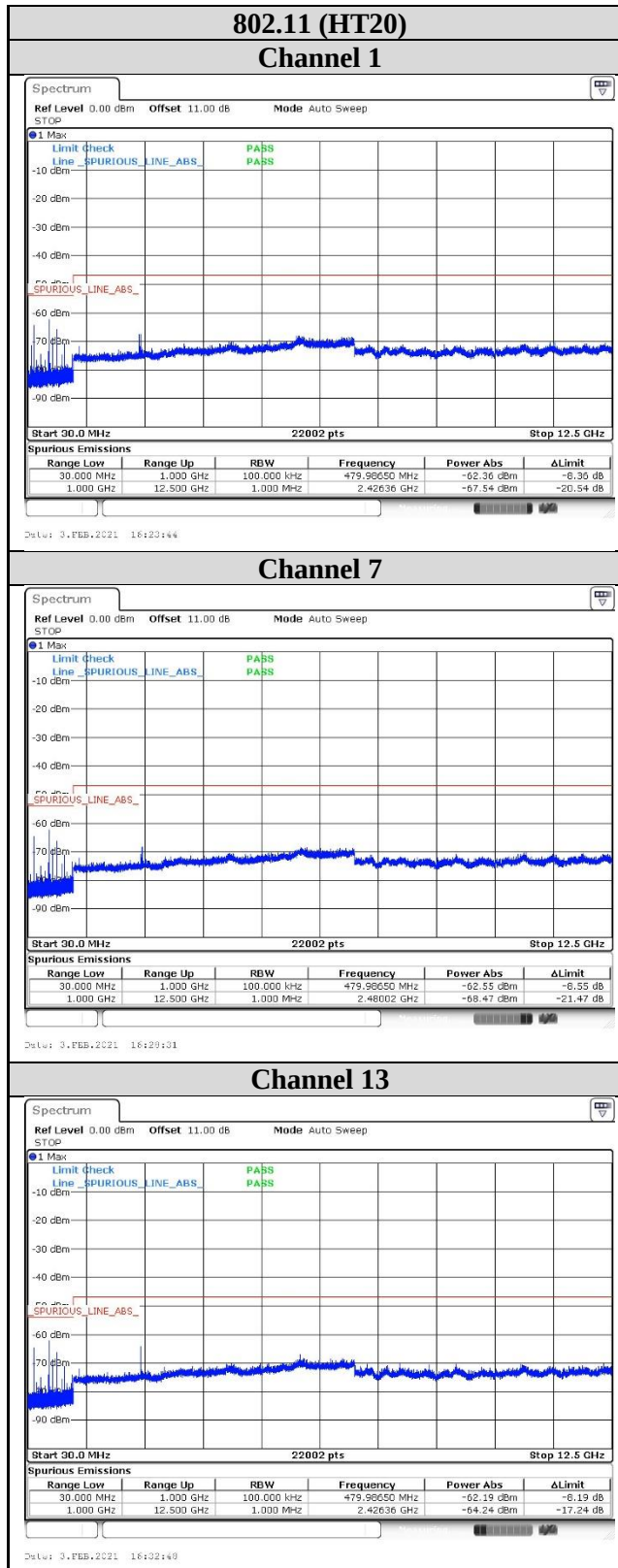
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**802.11n (HT40)**

Test Channel		Channel 3 (2422 MHz)		Channel 7 (2442 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	Below 1 GHz	479.9865	0.580764	479.9865	0.563638	4 nW	Pass
	Above 1 GHz	2402.4	0.150661	2402.4	0.189671	20 nW	Pass
Test Channel		Channel 11 (2462 MHz)				Limit	Result
Test Condition	Frequency Range	Frequency (MHz)		Measured Value			
V _{normal}	Below 1 GHz	479.9865		0.562341		4 nW	Pass
	Above 1 GHz	5872.24		0.143880		20 nW	Pass

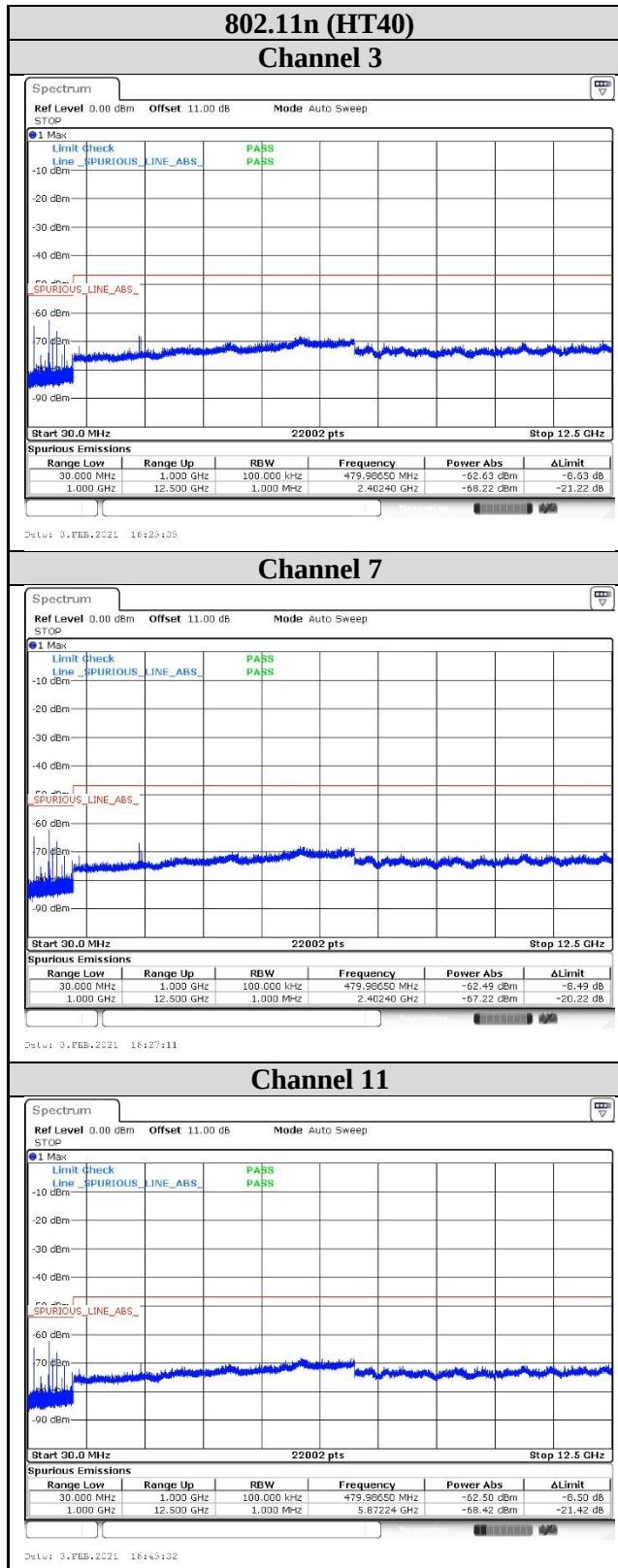
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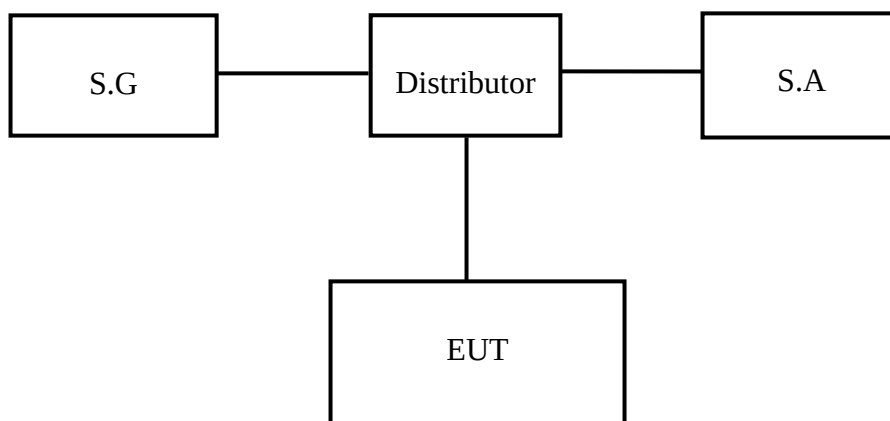
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8.7 Carrier Sense Capability

8.7.1 Measuring System Block Diagram



8.7.2 Measurement Procedures

- Turn the standard signal generator output OFF. Leave the equipment under test to be ready for transmission and verify the transmission with the spectrum analyzer.
- Set the equipment under test to the receiving state.
- Turn the standard signal generator ON and leave the equipment under test to be ready for transmission and verify with the spectrum analyzer that no transmission is being made.



8.7.3 Level of Ambient Carrier

802.11n (HT40)

Frequency (MHz)	Pcs (dBm)	C.F (dB)	S.G Level
2422	-44.51	27.81	-16.7
2442	-44.58	27.68	-16.9
2462	-44.66	27.66	-17

Note:

 $Pcs (dBm) = 22.79 + Gr - 20\log(F)$.

Gr: Antenna gain (0.38 dBi).

F: Transmission frequency (MHz).

C.F = Distributor loss + cable loss.

8.7.4 Test Result

Pass



8.8 Interference Prevention Function

8.8.1 Requirements

Radio equipment used mainly on the same premises and automatically transmits or receives identification code.

8.8.2 Test Setup



8.8.3 Test Results

Link Mode	Test Result
Normal	Pass



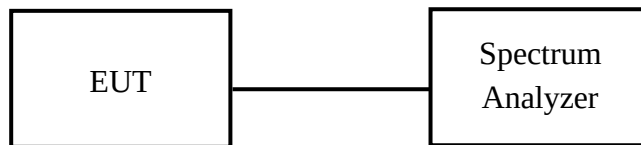
9. Test Results (Bluetooth LE)

9.1. Frequency Tolerance

9.1.1 Requirements

The limitation of Frequency Tolerance is less than or equal to +/-50ppm.

9.1.2 Test Setup



9.1.3 Test Results

Bluetooth LE

Mode	Voltage (Vdc)	Freq. (MHz)	Carrier Frequency (MHz)	Frequency Tolerance (ppm)	Limits (ppm)
BLE	Normal	2402	2402	0.000000	+/- 50ppm
		2440	2440	0.000000	+/- 50ppm
		2480	2479.9971	-1.169355	+/- 50ppm

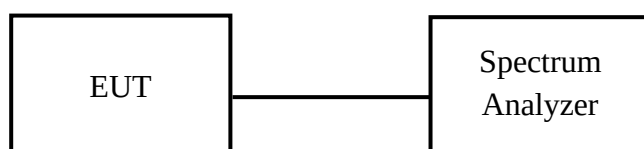


9.2. Occupied Bandwidth (99% Channel Power Bandwidth)

9.2.1 Requirements

Item	Limits
Occupied Bandwidth	FH, FH+DS, FH+OFDM: $\leq 83.5\text{MHz}$ Others: $\leq 26\text{MHz}$ OFDM1: $\leq 26\text{MHz}$ OFDM2: $26\text{MHz} < \text{BW} \leq 38\text{MHz}$

9.2.2 Test Setup

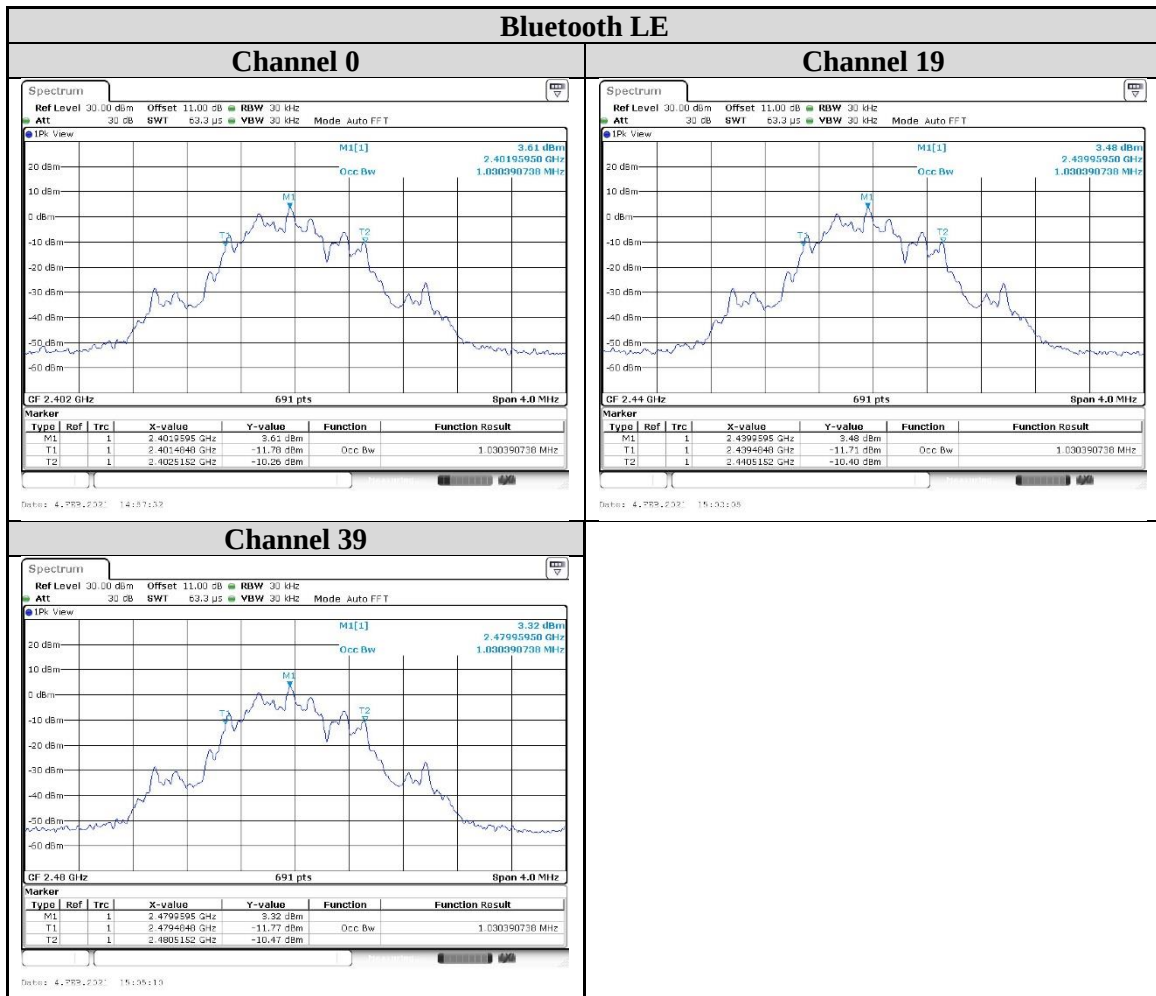




9.2.3 Test Results

Bluetooth LE

Mode	Voltage	Frequency (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Pass/Fail
BLE	Vnormal	2402	1.0304	≤ 26	Pass
		2440	1.0304	≤ 26	Pass
		2480	1.0304	≤ 26	Pass



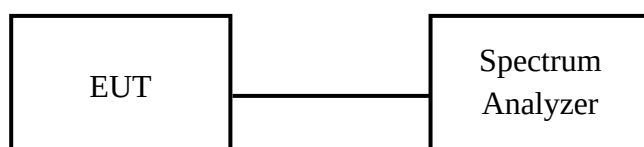


9.3. Spreading Bandwidth (90% Channel Power Bandwidth)

9.3.1 Requirements

Item	Limit	Remark
Spreading Bandwidth	≥ 500 kHz	(For DSSS, FHSS)
Spreading Factor	≥ 5	Operating frequency 2400 to 2483.5 MHz

9.3.2 Test Setup





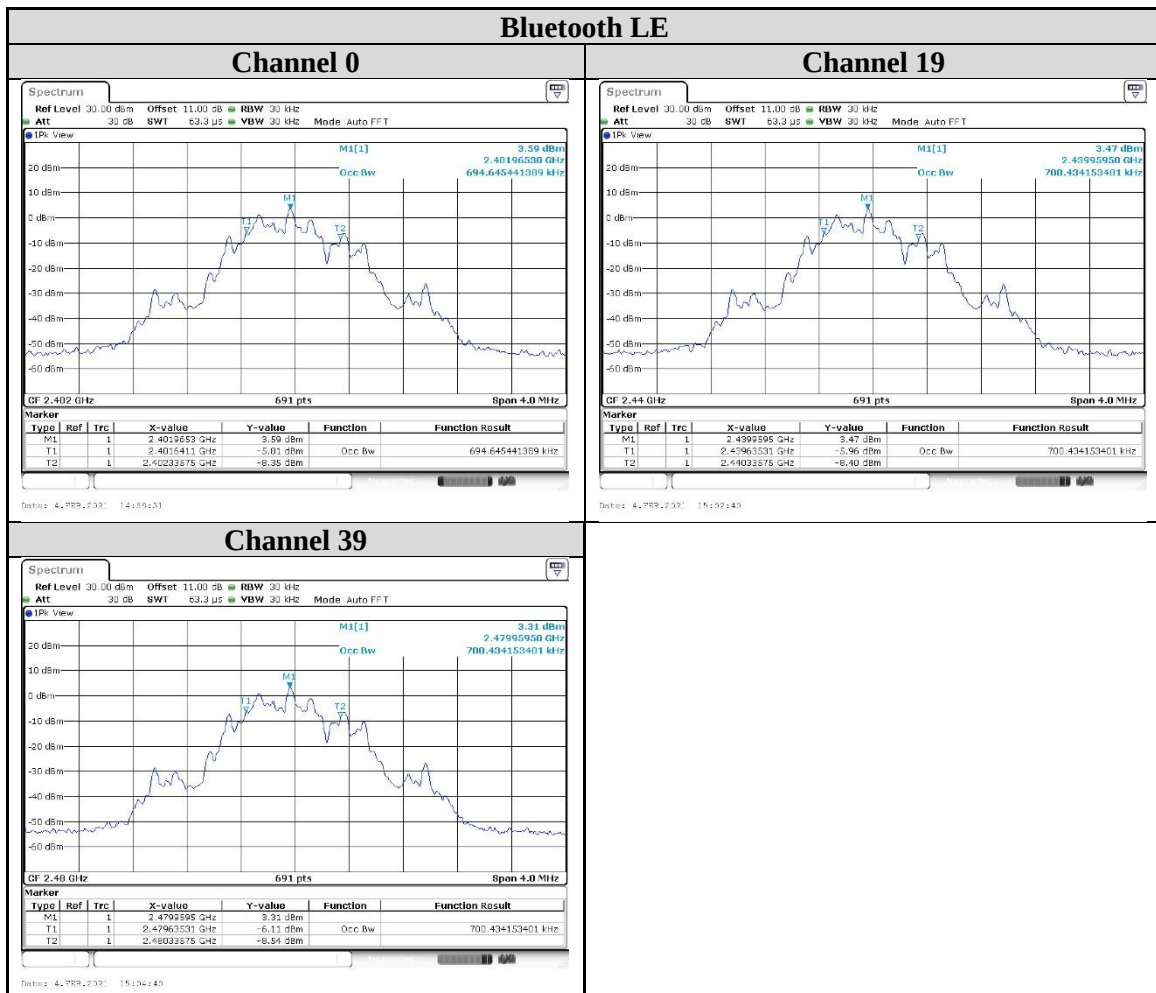
9.3.3 Test Results

Bluetooth LE

Mode	Voltage	Frequency (MHz)	Occupied Bandwidth (MHz)	Spreading Factor	Limit	Pass/Fail
BLE	Vnormal	2402	0.695	11.11	≥ 5	Pass
		2440	0.700	11.21	≥ 5	Pass
		2480	0.700	11.21	≥ 5	Pass

Note: 1. For the test plots please refer to the below pages.

2. Spreading Factor: 90 % channel power bandwidth / 0.0625.



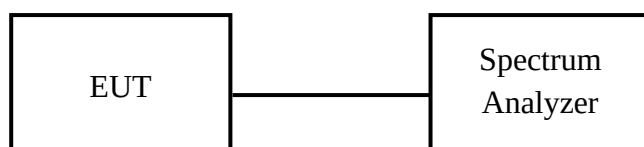


9.4. Spurious Emissions for Transmitter

9.4.1 Requirements

Frequencies(MHz)	Limits
30MHz-1GHz	$\leq 0.25 \mu\text{W}/100\text{kHz}$
1GHz-2.387GHz	$\leq 2.5 \mu\text{W}/\text{MHz}$
2.387GHz-2.4GHz	$\leq 25 \mu\text{W}/\text{MHz}$
2.4835GHz-2.4965GHz	$\leq 25 \mu\text{W}/\text{MHz}$
2.4965GHz -13GHz	$\leq 2.5 \mu\text{W}/\text{MHz}$

9.4.2 Test Setup



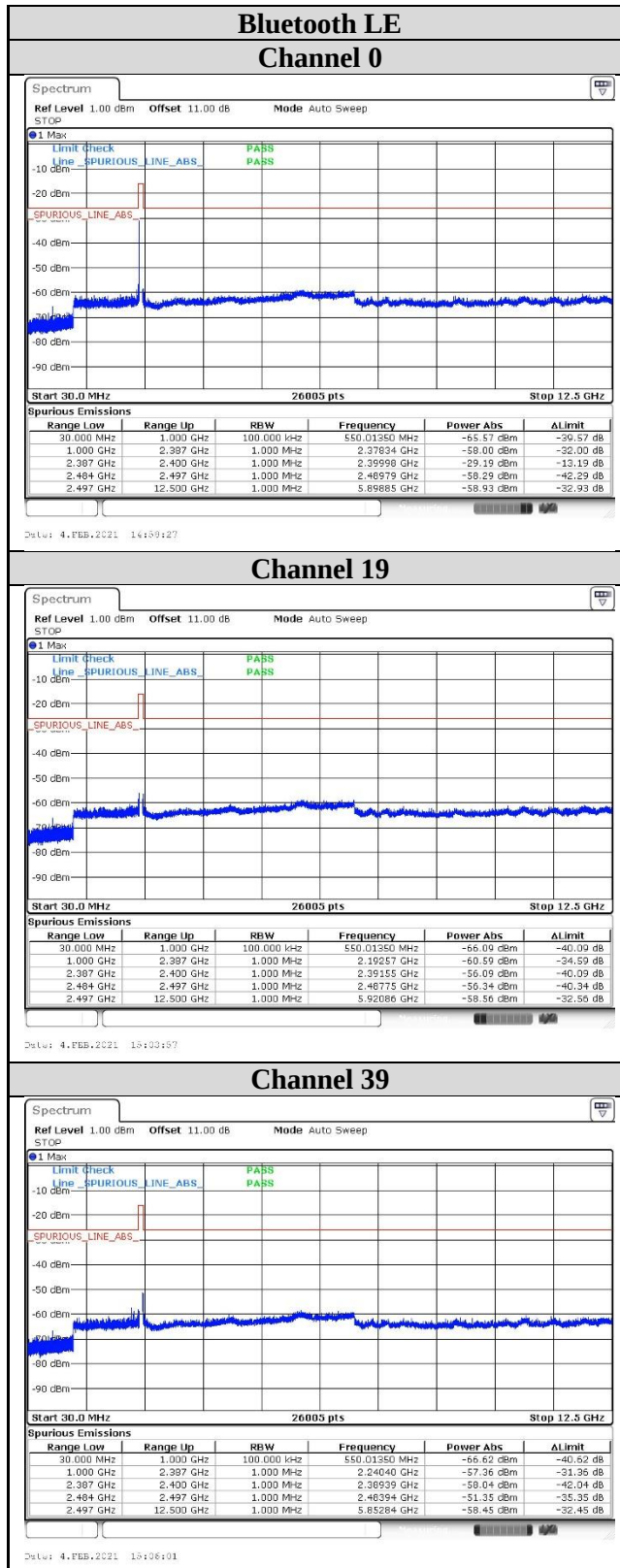


9.4.3 Test Results

Bluetooth LE

Test Channel		Ch 0 (2402 MHz)		CH19 (2440 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	550.0135	0.000271	550.0135	0.000246	0.25uW/100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2378.34	0.001585	2192.57	0.000873	2.5 uW/MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.98	1.205036	2391.55	0.002460	25 uW/MHz	Pass
	2483.5 MHz to 2496.5 MHz	2489.79	0.001483	2487.75	0.002323	25 uW/MHz	Pass
	2496.5 MHz to 12500.0 MHz	5898.85	0.001279	5920.86	0.001393	2.5 uW/MHz	Pass

Test Channel		Ch 39 (2480 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	550.0135	0.000218	0.25uW/100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2240.4	0.001837	2.5 uW/MHz	Pass
	2387.0 MHz to 2400.0 MHz	2389.39	0.001570	25 uW/MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.94	0.007328	25 uW/MHz	Pass
	2496.5 MHz to 12500.0 MHz	5852.84	0.001429	2.5 uW/MHz	Pass



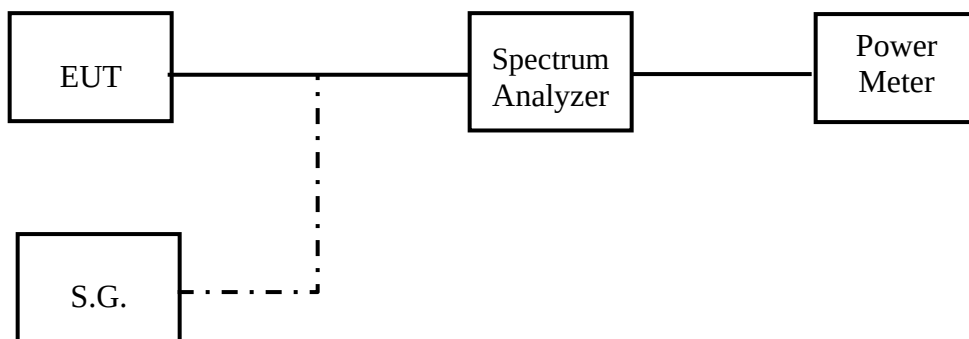


9.5. Antenna Power

9.5.1 Requirements

Item	Limits
Antenna Power Density	$\leq 3 \text{ mW/MHz}$ (2427~2470.75MHz)
	DS: $\leq 10 \text{ mW/MHz}$
	OFDM: $\leq 10 \text{ mW/MHz}$ (Bandwidth $\leq 26\text{MHz}$)
	OFDM: $\leq 5 \text{ mW/MHz}$ ($26\text{MHz} < \text{Bandwidth} \leq 38\text{MHz}$)
	Others: $\leq 10 \text{ mW}$

9.5.2 Test Setup





9.5.3 Test Results

Bluetooth LE

Test Condition	Conducted RF Output Power Density (mW/MHz)			
	Channel 0 2402 MHz	Channel 19 2440 MHz	Channel 39 2480 MHz	Max. Limit (mW/MHz)
V _{normal}	2.79	2.72	2.61	10
Rated Power	3.15			
Tolerance of Antenna Power	0.63 ~ 3.78			

Note:

1. Highest output power tolerance (%) = $((2.79-3.15)/3.15)*100 = 11.43(\%)$
2. Lowest output power tolerance (%) = $((2.61-3.15)/3.15)*100 = -15.43(\%)$

Dipole antenna with 0.38 dBi gain

Test Condition	Radiated RF Output Power Density (mW/MHz)			
	Channel 0 2402 MHz	Channel 19 2440 MHz	Channel 39 2480 MHz	Max. Limit (mW/MHz)
V _{normal}	3.04	2.97	2.84	16.368

Note: Radiated RF output power density = Conducted RF output power density + Antenna Gain.

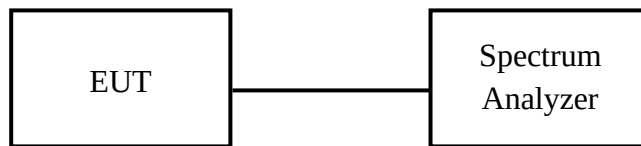


9.6 Spurious Emissions for Receiver

9.6.1 Requirements

Frequencies (MHz)	Limit
Below 1 GHz	≤ 4 nW (-54 dBm)
Above 1 GHz	≤ 20 nW (-47 dBm)

9.6.2 Test Setup



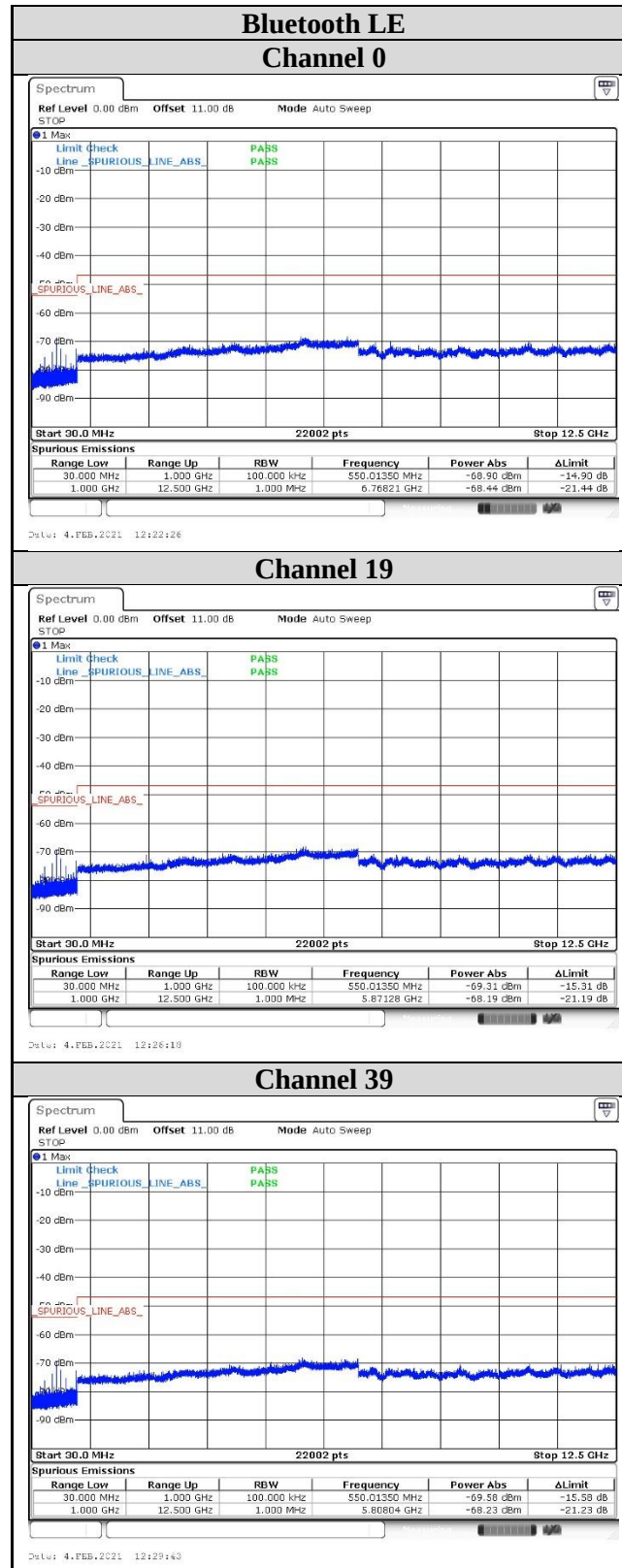


9.6.3 Test Results

Bluetooth LE

Table 10-10: Example of a Test Channel Table

Test Channel		Channel 0 (2402 MHz)		Channel 19 (2440 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	Below 1 GHz	550.0135	0.128825	550.0135	0.117220	4 nW	Pass
	Above 1 GHz	6768.21	0.143219	5871.28	0.151705	20 nW	Pass
Test Channel		Channel 39 (2480 MHz)				Limit	Result
Test Condition	Frequency Range	Frequency (MHz)		Measured Value			
V _{normal}	Below 1 GHz	550.0135		0.110154		4 nW	Pass
	Above 1 GHz	5808.04		0.150314		20 nW	Pass





9.7 Interference Prevention Function

9.7.1 Requirements

Radio equipment used mainly on the same premises and automatically transmits or receives identification code.

9.7.2 Test Setup

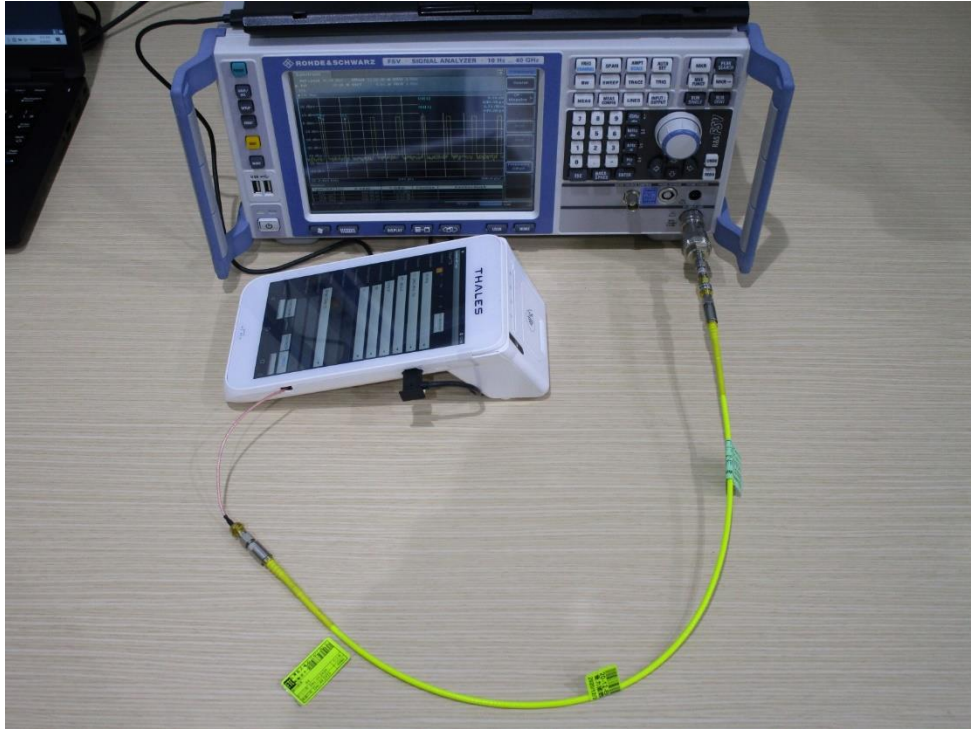


9.7.3 Test Results

Link Mode	Test Result
Bluetooth LE	Pass



10. Conducted Emission Measurement Setup Configurations



END OF REPORT

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