



TEST REPORT

Reference No...... : WTF20F03014698W001
FCC ID : 2AXYV-C5140A
Applicant..... : Foshan Rayven lighting Co.,Ltd
Address..... : A1 New Lighting Source Industry Zone,Luocun, Nanhai District,
Foshan, Guangdong, China
Manufacturer : The same as above
Address..... : The same as above
Product Name..... : LED downlight
Model No...... : SD.C5140A, SD.C5140C
Standards..... : FCC CFR47 Part 15 Subpart C (Section 15.247): 2019
Date of Receipt sample : 2020-03-31
Date of Test : 2020-10-22
Date of Issue..... : 2021-03-24
Test Result..... : Pass

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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1 Revision History

Test Report No.	Date of Issue	Description	Status
WTF20F03014698W001	2021-03-24	Original	Valid

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2 Contents

	Page
1 REVISION HISTORY	2
2 CONTENTS	3
3 GENERAL INFORMATION	4
3.1 GENERAL DESCRIPTION OF E.U.T	4
3.2 TECHNICAL CHARACTERISTICS OF EUT	4
3.3 STANDARDS APPLICABLE FOR TESTING	4
3.4 TEST FACILITY	5
3.5 SUBCONTRACTED	5
3.6 ABNORMALITIES FROM STANDARD CONDITIONS	5
4 EUT SETUP AND TEST MODE	6
5 EQUIPMENT USED DURING TEST	7
5.1 EQUIPMENT LIST	7
5.2 SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	8
5.3 MEASUREMENT UNCERTAINTY	8
6 SUMMARY OF TEST RESULT	9
6.1 ANTENNA REQUIREMENT	10
6.2 RF EXPOSURE REQUIREMENT	11
6.3 RADIATED SPURIOUS EMISSIONS	12
6.4 POWER SPECTRAL DENSITY	21
6.5 DTS BANDWIDTH	29
6.6 RF OUTPUT POWER	36
6.7 OUT OF BAND EMISSIONS	44
6.8 CONDUCTED EMISSIONS	51
7 PHOTOGRAPHS TEST SETUP	55
7.1 PHOTOGRAPHS - RADIATED EMISSION TEST SETUP	55
7.2 PHOTOGRAPHS - CONDUCTED EMISSION TEST SETUP	56
8 PHOTOGRAPHS - CONSTRUCTIONAL DETAILS	57
8.1 EUT - EXTERNAL VIEW	57
8.2 EUT - INTERNAL VIEW	60



3 General Information

3.1 General Description of E.U.T

Product Name	LED downlight
Model No.	SD.C5140A, SD.C5140C
Model Description	Two models are identical except the appearance. Therefore the full tests were performed on model SD.C5140A.
Rated Voltage.....	AC 120V, 60Hz, 12W
Battery Capacity	---
Power Adapter	---

3.2 Technical Characteristics of EUT

Support Standards	802.11b, 802.11g, 802.11n
Frequency Range	2412-2462MHz for 802.11b/g/n(HT20) 2422-2452MHz for 802.11n(HT40)
RF Output Power	14.67dBm (Conducted)
Modulation	802.11b: DSSS(DBPSK/DQPSK/CCK) 802.11g/n: OFDM (BPSK/QPSK/16QAM/64QAM)
Data Rate	1Mbps for 802.11b; 6Mbps for 802.11g;MCS0 for 802.11n
Quantity of Channels	11 for 802.11b/g/n(HT20); 8 for 802.11n(HT40)
Channel Separation.....	5MHz
Type of Antenna	PCB Printed Antenna
Antenna Gain	1.0dBi
Lowest Oscillation.....	26MHz

3.3 Standards Applicable for Testing

The tests were performed according to following standards:

FCC Rules Part 15.247	Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz
558074 D01 15.247 Meas Guidance v05r02	Guidance For Compliance Measurements On Digital Transmission System, Frequency Hopping Spread Spectrum System, And Hybrid System Devices Operating Under Section 15.247 Of The FCC Rules
662911 D01 Multiple Transmitter Output v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices



3.4 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 21895-1**

Waltek Testing Group (Foshan) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration IC number: 21895-1, Nov. 14, 2016.

- **FCC – Registration No.: 820106**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 820106, August 16, 2018

- **FCC – Designation No.: CN5034**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation No. CN5034.

- **NVLAP – Lab Code: 600191-0**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 600191-0.

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

3.5 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test items: ---

Lab information: ---

3.6 Abnormalities from Standard Conditions

None.



4 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, with a duty cycle equal to 100%, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List

Test Mode	Description	Remark
TM1	802.11b	Low:2412MHz, Middle:2437MHz, High:2462MHz
TM2	802.11g	Low:2412MHz, Middle:2437MHz, High:2462MHz
TM3	802.11n-HT20	Low:2412MHz, Middle:2437MHz, High:2462MHz
TM4	802.11n-HT40	Low:2422MHz, Middle:2437MHz, High:2452MHz

Test Conditions

Temperature:	22~25°C
Relative Humidity:	50~55%
Atmospheric pressure:	101.9kPa



5 Equipment Used during Test

5.1 Equipment List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal Date	Cal Due Date
1.	EMI Test Receiver	RS	ESCI	101178	2021-01-09	2022-01-08
2.	LISN	RS	ENV216	101215	2021-01-09	2022-01-08
3.	Cable	HUBER+SUHNER	CBL2-NN-3M	223NN322	2021-01-09	2022-01-08
4.	Test Software	FARATRONIC	EZ-EMC CON-03A1	-	-	-
3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	RS	ESR7	101566	2021-01-09	2022-01-08
2.	EMC Analyzer	Agilent	N9020A	MY48011796	2021-01-09	2022-01-08
3.	Active Loop Antenna	SCHWARZBECK	FMZB1519B	00004	2021-01-09	2022-01-08
4.	Trilog Broadband Antenna	SCHWARZBECK	VULB 9162	9162-117	2021-01-09	2022-01-08
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2021-01-09	2022-01-08
6.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2021-01-09	2022-01-08
7.	Amplifier	Lunar E M	LNA1G18-40	20160501002	2021-01-09	2022-01-08
8.	Coaxial Cable (below 1GHz)	H+S	CBL3-NN-12+3 m	214NN320	2021-01-09	2022-01-08
9.	Coaxial Cable (above 1GHz)	Times-Microwave	CBL5-NN	-	2021-01-09	2022-01-08
10.	Test Software	FARATRONIC	EZ-EMC RA-03A1-1	-	-	-
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	Spectrum Analyzer	Agilent	N9020A	MY48011796	2021-01-09	2022-01-08
2.	Spectrum Analyzer	R&S	FSP40	100501	2021-01-09	2022-01-08
3.	Vector Signal Generator	Agilent	N5182A	MY50141533	2021-01-09	2022-01-08
4.	Analog Signal Generator	Agilent	N5181A	MY48180720	2021-01-09	2022-01-08
5.	Environmental Chamber	KSON	THS-D4C-100	5244K	2021-01-09	2022-01-08
6.	RF Control Unit	CHANGCHUANG	JS0806-2	-	2021-01-09	2022-01-08



5.2 Special Accessories and Auxiliary Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.
1.	/	/	/	/

5.3 Measurement Uncertainty

Parameter	Uncertainty
RF Output Power	±0.95dB
Occupied Bandwidth	±1.5%
Conducted Spurious Emission	±2.7dB
Conducted Emission	±2.7dB
Transmitter Spurious Emission	±3.8dB (for 25MHz-1GHz)
	±5.0dB (for 1GHz-18GHz)

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6 Summary of Test Result

Test Items	FCC Rules	Result
Antenna Requirement	§15.203; §15.247(b)(4)(i)	Compliance
Restricted Band of Operation	§15.205	Compliance
Conducted Emissions	§15.207(a)	Compliance
Radiated Spurious Emissions	§15.209(a)	Compliance
Power Spectral Density	§15.247(e)	Compliance
DTS Bandwidth	§ 15.247(a)(2)	Compliance
RF Output Power	§15.247(b)(3)	Compliance
Band edge (Out of Band Emissions)	§15.247(d)	Compliance
RF Exposure	§2.1093	Compliance

Remark:

Pass Test item meets the requirement

Fail Test item does not meet the requirement

N/A Test case does not apply to the test object

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6.1 Antenna Requirement

6.1.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

6.1.2 Evaluation Information

The EUT has an PCB Printed Antenna, the gain is 1.0dBi, fulfil the requirement of this section.





6.2 RF Exposure Requirement

6.2.1 Standard Applicable

According to §1.1307 and §2.1093, the portable transmitter must comply the RF exposure requirements.

6.2.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report WTF20F03014698W002.

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6.3 Radiated Spurious Emissions

6.3.1 Standard Applicable

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

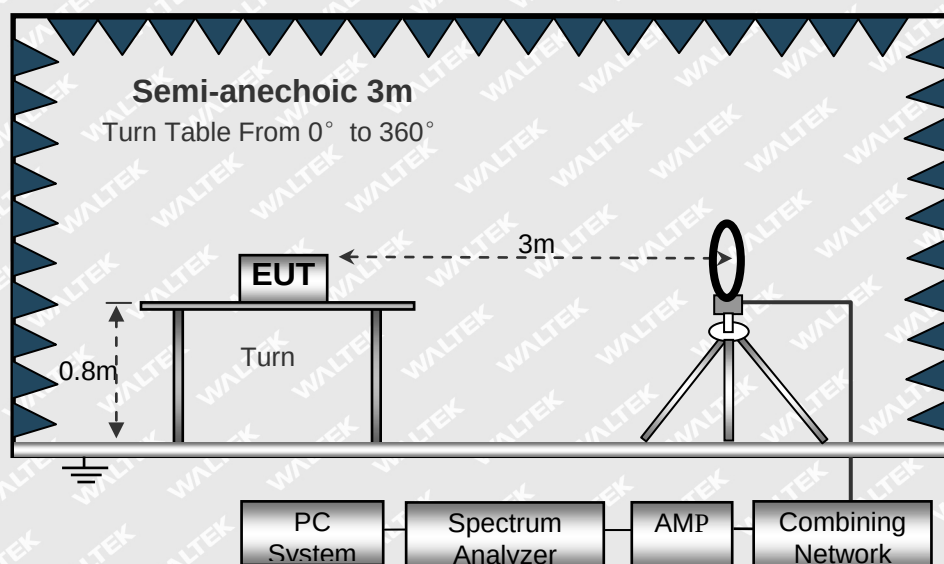
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

6.3.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.

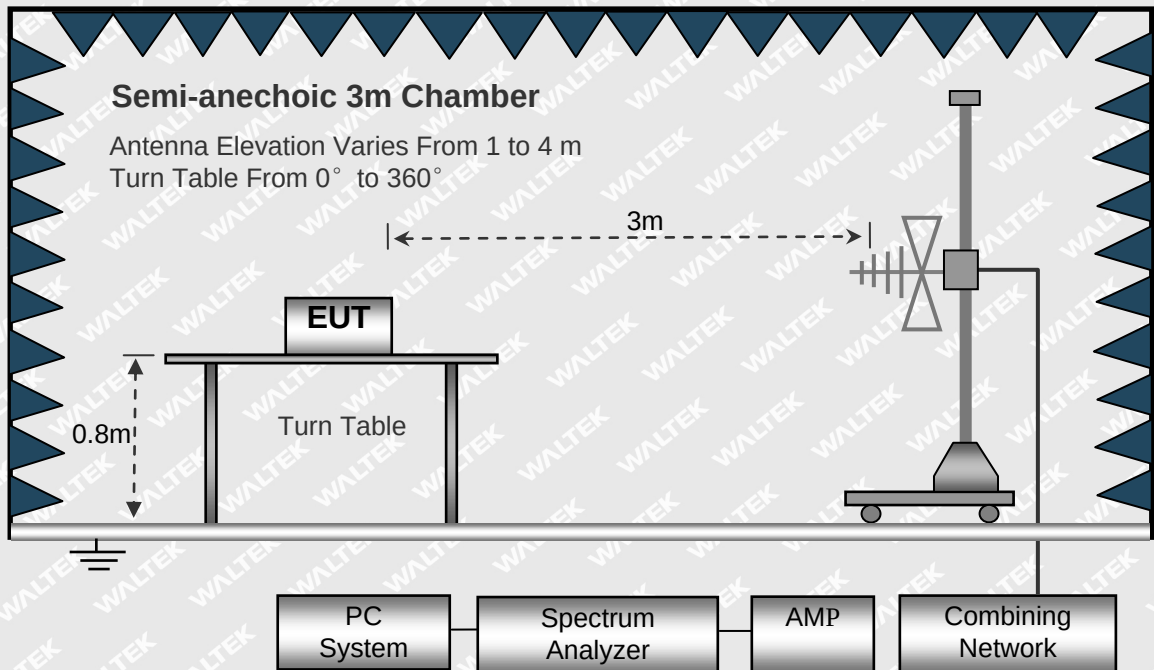
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

The test setup for emission measurement below 30MHz.

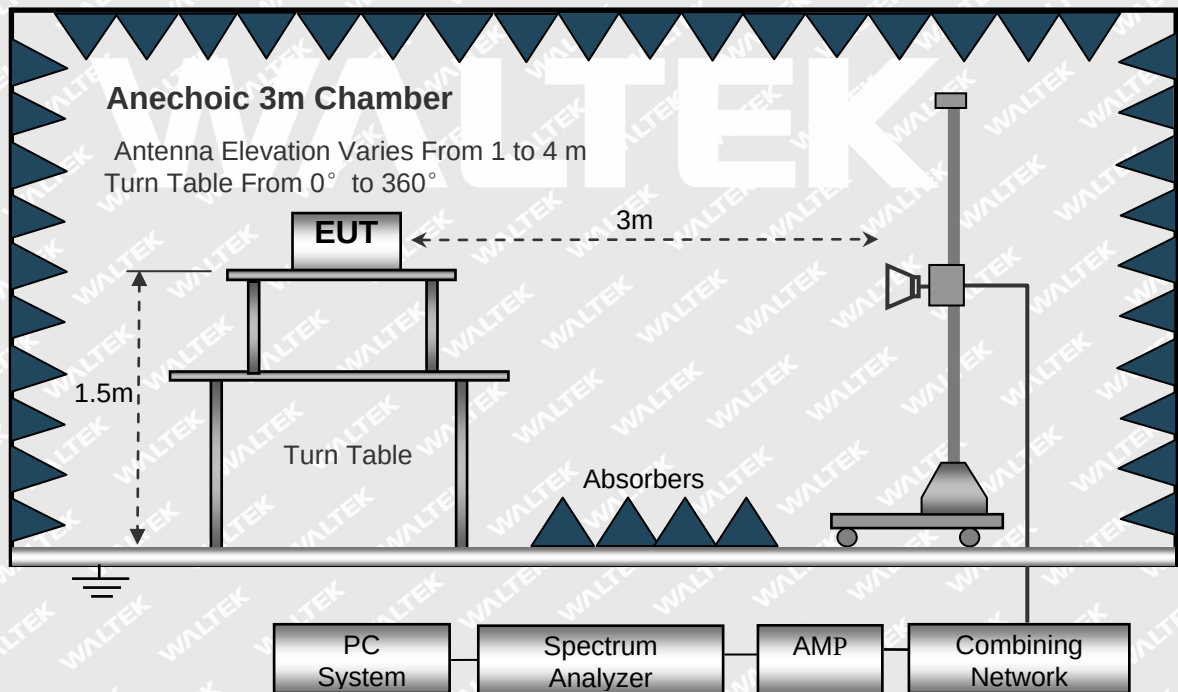




The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.





6.3.3 Spectrum Analyzer Setup

9KHz-30MHz

RBW=10kHz

VBW=30kHz

Sweep time=Auto

Trace=Max hold

Detector function=peak

30MHz-1GHz

RBW=120kHz

VBW=300kHz

Sweep time=Auto

Trace=Max hold

Detector function=peak, QP

Above 1GHz

RBW=1MHz

VBW=3MHz(Peak), 10MHz(AV)

Sweep time=Auto

Trace=Max hold

Detector function=peak, AV

6.3.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Corr. Factor}$$

$$\text{Corr. Factor} = \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$



6.3.5 Test Results

Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.

Test Frequency: 30MHz ~ 18GHz

Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11b_Low Channel									
282.09	26.43	QP	223	1.1	H	15.72	42.15	46	-3.85
282.09	24.57	QP	240	1.1	V	15.72	40.29	46	-5.71
4818.75	52.82	PK	256	2.0	H	-3.56	49.26	74	-24.74
4818.75	41.31	AVG	138	1.4	H	-3.56	37.75	54	-16.25
5711.75	46.06	PK	219	1.5	V	-1.46	44.60	74	-29.40
5711.75	35.33	AVG	106	2.0	V	-1.46	33.87	54	-20.13
6358.00	45.62	PK	123	1.9	H	-0.06	45.56	74	-28.44
6358.00	35.08	AVG	102	1.7	H	-0.06	35.02	54	-18.98
7121.75	46.11	PK	108	1.0	V	2.83	48.94	74	-25.06
7121.75	34.77	AVG	126	1.4	V	2.83	37.60	54	-16.40
9037.00	45.98	PK	239	1.6	H	5.75	51.73	74	-22.27
9037.00	34.21	AVG	161	1.9	H	5.75	39.96	54	-14.04

Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11b_Middle Channel									
278.65	27.15	QP	126	1.8	H	15.63	42.78	46	-3.22
278.65	22.21	QP	275	1.2	V	15.63	37.84	46	-8.16
4865.75	51.14	PK	281	2.0	H	-3.45	47.69	74	-26.31
4865.75	42.72	AVG	231	1.7	H	-3.45	39.27	54	-14.73
6616.50	44.94	PK	115	1.5	V	1.36	46.30	74	-27.70
6616.50	35.18	AVG	290	1.3	V	1.36	36.54	54	-17.46
7309.75	47.32	PK	150	1.4	H	3.20	50.52	74	-23.48
7309.75	33.50	AVG	215	1.3	H	3.20	36.70	54	-17.30
8731.50	45.89	PK	286	2.0	V	4.66	50.55	74	-23.45
8731.50	35.36	AVG	234	1.9	V	4.66	40.02	54	-13.98
9742.00	46.90	PK	235	1.3	H	7.13	54.03	74	-19.97
9742.00	34.14	AVG	289	1.9	H	7.13	41.27	54	-12.73



Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11b_High Channel									
278.85	26.84	QP	176	1.4	H	15.63	42.47	46	-3.53
278.85	22.26	QP	137	1.0	V	15.63	37.89	46	-8.11
4924.50	54.29	PK	214	1.9	H	-3.31	50.98	74	-23.02
4924.50	42.95	AVG	145	1.5	H	-3.31	39.64	54	-14.36
6076.00	44.25	PK	138	1.5	V	-0.40	43.85	74	-30.15
6076.00	36.76	AVG	110	1.1	V	-0.40	36.36	54	-17.64
6546.00	44.59	PK	142	1.2	H	0.59	45.18	74	-28.82
6546.00	35.72	AVG	161	1.2	H	0.59	36.31	54	-17.69
7462.50	43.91	PK	276	1.6	V	3.33	47.24	74	-26.76
7462.50	36.55	AVG	226	1.2	V	3.33	39.88	54	-14.12
9201.50	44.09	PK	106	1.9	H	6.13	50.22	74	-23.78
9201.50	34.22	AVG	170	1.2	H	6.13	40.35	54	-13.65

Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11g Low Channel									
275.45	26.57	QP	175	2.0	H	15.62	42.19	46	-3.81
275.45	21.71	QP	200	1.9	V	15.62	37.33	46	-8.67
4818.75	54.18	PK	238	1.3	H	-3.56	50.62	74	-23.38
4818.75	45.92	AVG	119	1.2	H	-3.56	42.36	54	-11.64
6757.50	45.02	PK	140	1.5	V	1.83	46.85	74	-27.15
6757.50	35.09	AVG	270	1.2	V	1.83	36.92	54	-17.08
7309.75	48.45	PK	265	1.4	H	3.20	51.65	74	-22.35
7309.75	33.45	AVG	238	1.9	H	3.20	36.65	54	-17.35
8085.25	45.71	PK	266	2.0	V	4.03	49.74	74	-24.26
8085.25	34.88	AVG	220	2.0	V	4.03	38.91	54	-15.09
8943.00	46.78	PK	259	2.0	H	5.49	52.27	74	-21.73
8943.00	34.20	AVG	119	1.1	H	5.49	39.69	54	-14.31



Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11g_Middle Channel									
285.28	25.41	QP	138	1.5	H	15.87	41.28	46	-4.72
285.28	22.12	QP	229	1.4	V	15.87	37.99	46	-8.01
4865.75	53.06	PK	271	1.6	H	-3.45	49.61	74	-24.39
4865.75	42.43	AVG	230	1.7	H	-3.45	38.98	54	-15.02
6346.25	44.34	PK	120	1.1	V	0.48	44.82	74	-29.18
6346.25	34.64	AVG	105	1.2	V	0.48	35.12	54	-18.88
7215.75	46.08	PK	105	1.9	H	3.07	49.15	74	-24.85
7215.75	34.23	AVG	234	1.1	H	3.07	37.30	54	-16.70
7450.75	46.48	PK	239	1.7	V	3.32	49.80	74	-24.20
7450.75	36.12	AVG	173	1.5	V	3.32	39.44	54	-14.56
9436.50	46.96	PK	138	1.7	H	6.68	53.64	74	-20.36
9436.50	34.35	AVG	244	1.9	H	6.68	41.03	54	-12.97

Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11g_High Channel									
279.73	26.11	QP	201	1.6	H	15.63	41.74	46	-4.26
279.73	21.98	QP	104	1.9	V	15.63	37.61	46	-8.39
4924.50	54.78	PK	106	1.6	H	-3.31	51.47	74	-22.53
4924.50	45.84	AVG	135	1.1	H	-3.31	42.53	54	-11.47
5864.50	44.66	PK	305	1.3	V	-1.02	43.64	74	-30.36
5864.50	35.28	AVG	281	1.5	V	-1.02	34.26	54	-19.74
7239.25	46.27	PK	163	1.8	H	3.10	49.37	74	-24.63
7239.25	39.84	AVG	215	1.4	H	3.10	42.94	54	-11.06
8802.00	45.34	PK	228	1.6	V	4.79	50.13	74	-23.87
8802.00	34.65	AVG	216	1.2	V	4.79	39.44	54	-14.56
8837.25	45.31	PK	261	1.6	H	5.19	50.50	74	-23.50
8837.25	34.43	AVG	173	1.5	H	5.19	39.62	54	-14.38



Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11n20_Low Channel									
278.85	26.47	QP	189	1.1	H	15.63	42.10	46	-3.90
278.85	21.13	QP	247	1.6	V	15.63	36.76	46	-9.24
4818.75	54.12	PK	107	1.5	H	-3.56	50.56	74	-23.44
4818.75	45.15	AVG	170	2.0	H	-3.56	41.59	54	-12.41
6687.00	45.54	PK	277	1.3	V	1.60	47.14	74	-26.86
6687.00	37.25	AVG	253	1.5	V	1.60	38.85	54	-15.15
6170.00	45.05	PK	264	1.3	H	-0.63	44.42	74	-29.58
6170.00	35.25	AVG	212	1.2	H	-0.63	34.62	54	-19.38
8978.25	45.56	PK	309	1.2	V	5.12	50.68	74	-23.32
8978.25	36.16	AVG	267	2.0	V	5.12	41.28	54	-12.72
9377.75	45.88	PK	181	1.3	H	6.54	52.42	74	-21.58
9377.75	34.06	AVG	168	2.0	H	6.54	40.60	54	-13.40

Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11n20_Middle Channel									
215.80	26.35	QP	135	2.0	H	13.69	40.04	46	-5.96
215.80	28.62	QP	186	1.8	V	13.69	42.31	46	-3.69
4865.70	52.92	PK	117	2.0	H	-3.45	49.47	74	-24.53
4865.70	40.89	AVG	307	1.1	H	-3.45	37.44	54	-16.56
6134.75	45.78	PK	106	2.0	V	-0.20	45.58	74	-28.42
6134.75	36.47	AVG	203	1.1	V	-0.20	36.27	54	-17.73
6264.00	46.08	PK	202	1.5	H	-0.35	45.73	74	-28.27
6264.00	36.48	AVG	248	1.3	H	-0.35	36.13	54	-17.87
7944.25	45.29	PK	306	2.0	V	3.91	49.20	74	-24.80
7944.25	37.04	AVG	117	1.6	V	3.91	40.95	54	-13.05
9354.25	45.16	PK	276	1.5	H	6.49	51.65	74	-22.35
9354.25	34.92	AVG	318	1.8	H	6.49	41.41	54	-12.59



Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11n20_High Channel									
279.04	25.36	QP	249	1.4	H	15.63	40.99	46	-5.01
279.04	21.90	QP	272	1.9	V	15.63	37.53	46	-8.47
4924.50	55.77	PK	161	1.7	H	-3.31	52.46	74	-21.54
4924.50	46.11	AVG	290	1.3	H	-3.31	42.80	54	-11.20
6557.75	45.67	PK	273	1.6	V	1.16	46.83	74	-27.17
6557.75	34.95	AVG	109	1.6	V	1.16	36.11	54	-17.89
6181.75	44.90	PK	194	1.0	H	-0.59	44.31	74	-29.69
6181.75	35.48	AVG	315	1.4	H	-0.59	34.89	54	-19.11
8813.75	44.75	PK	263	1.7	V	4.82	49.57	74	-24.43
8813.75	34.88	AVG	303	1.5	V	4.82	39.70	54	-14.30
9095.75	45.68	PK	274	1.3	H	5.88	51.56	74	-22.44
9095.75	34.44	AVG	225	1.1	H	5.88	40.32	54	-13.68

Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11n40_Low Channel									
219.08	27.32	QP	180	1.0	H	13.76	41.08	46	-4.92
219.08	22.82	QP	151	1.5	V	13.76	36.58	46	-9.42
4818.75	56.74	PK	293	1.1	H	-3.56	53.18	74	-20.82
4818.75	45.94	AVG	218	1.4	H	-3.56	42.38	54	-11.62
6287.50	45.49	PK	219	1.1	V	0.29	45.78	74	-28.22
6287.50	34.93	AVG	252	1.3	V	0.29	35.22	54	-18.78
5758.75	46.11	PK	218	1.5	H	-1.68	44.43	74	-29.57
5758.75	35.51	AVG	258	1.5	H	-1.68	33.83	54	-20.17
7815.00	45.99	PK	251	1.3	V	3.76	49.75	74	-24.25
7815.00	36.23	AVG	299	1.5	V	3.76	39.99	54	-14.01
8661.00	45.94	PK	302	1.4	H	4.70	50.64	74	-23.36
8661.00	34.70	AVG	212	1.7	H	4.70	39.40	54	-14.60



Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11n40_Middle Channel									
223.42	25.98	QP	310	1.5	H	13.87	39.85	46	-6.15
223.42	25.55	QP	260	1.8	V	13.87	39.42	46	-6.58
4865.75	54.88	PK	270	1.8	H	-3.45	51.43	74	-22.57
4865.75	46.10	AVG	255	1.8	H	-3.45	42.65	54	-11.35
6557.75	45.18	PK	233	1.0	V	1.16	46.34	74	-27.66
6557.75	35.38	AVG	109	1.5	V	1.16	36.54	54	-17.46
6886.75	45.18	PK	288	1.0	H	2.21	47.39	74	-26.61
6886.75	35.33	AVG	318	1.0	H	2.21	37.54	54	-16.46
7803.25	46.31	PK	159	1.8	V	3.75	50.06	74	-23.94
7803.25	35.10	AVG	231	1.6	V	3.75	38.85	54	-15.15
9448.25	46.47	PK	299	1.8	H	6.70	53.17	74	-20.83
9448.25	35.20	AVG	295	1.7	H	6.70	41.90	54	-12.10

Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11n40_High Channel									
219.00	26.18	QP	305	1.7	H	13.76	39.94	46	-6.06
219.00	25.15	QP	228	1.1	V	13.76	38.91	46	-7.09
4924.50	52.25	PK	142	1.1	H	-3.31	48.94	74	-25.06
4924.50	40.77	AVG	147	1.8	H	-3.31	37.46	54	-16.54
6240.50	45.32	PK	238	1.3	V	0.14	45.46	74	-28.54
6240.50	34.64	AVG	189	1.9	V	0.14	34.78	54	-19.22
6040.75	45.37	PK	294	1.4	H	-1.01	44.36	74	-29.64
6040.75	35.14	AVG	236	1.1	H	-1.01	34.13	54	-19.87
7826.75	46.08	PK	159	1.4	V	3.77	49.85	74	-24.15
7826.75	35.71	AVG	294	1.0	V	3.77	39.48	54	-14.52
9001.75	44.50	PK	308	1.1	H	5.66	50.16	74	-23.84
9001.75	34.13	AVG	264	1.2	H	5.66	39.79	54	-14.21

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.



6.4 Power Spectral Density

6.4.1 Standard Applicable

According to 15.247(a)(1)(iii), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

6.4.2 Test Procedure

According to the KDB 558074 D01 v05r02 Subclause 8.4 and ANSI C63.10-2013 Subclause 11.10.3, such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. The test method of power spectral density as below:

- a) Set instrument center frequency to DTS channel center frequency.
- b) Set span to at least 1.5 times the OBW.
- c) Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set VBW $\geq 3 \times \text{RBW}$.
- e) Detector = power averaging (RMS) or sample detector (when RMS not available).
- f) Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span/RBW}$.
- g) Sweep time = auto couple.
- h) Employ trace averaging (RMS) mode over a minimum of 100 traces.
- i) Use the peak marker function to determine the maximum amplitude level.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).

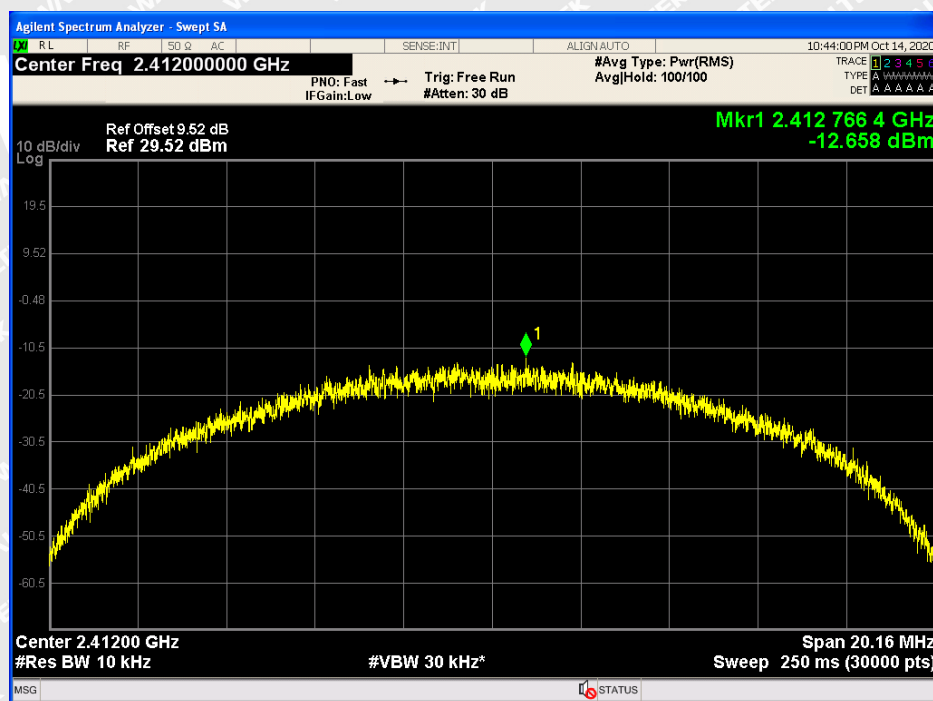


6.4.3 Test Result

Test Mode	Test Channel(MHz)	Test Result (dBm/10kHz)	Limit (dBm/3kHz)
802.11b	2412	-12.66	8
	2437	-10.72	8
	2462	-10.48	8
802.11g	2412	-14.79	8
	2437	-12.73	8
	2462	-12.44	8
802.11n-HT20	2412	-11.22	8
	2437	-9.24	8
	2462	-8.41	8
802.11n-HT40	2422	-14.94	8
	2437	-13.90	8
	2452	-12.94	8

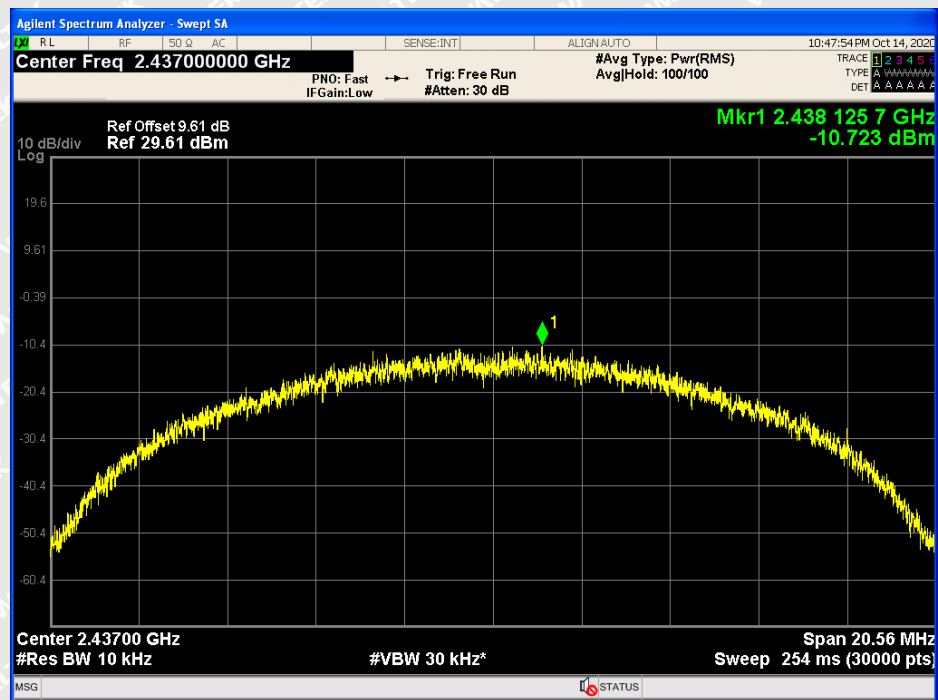
Test plots:

802.11b_Low Channel

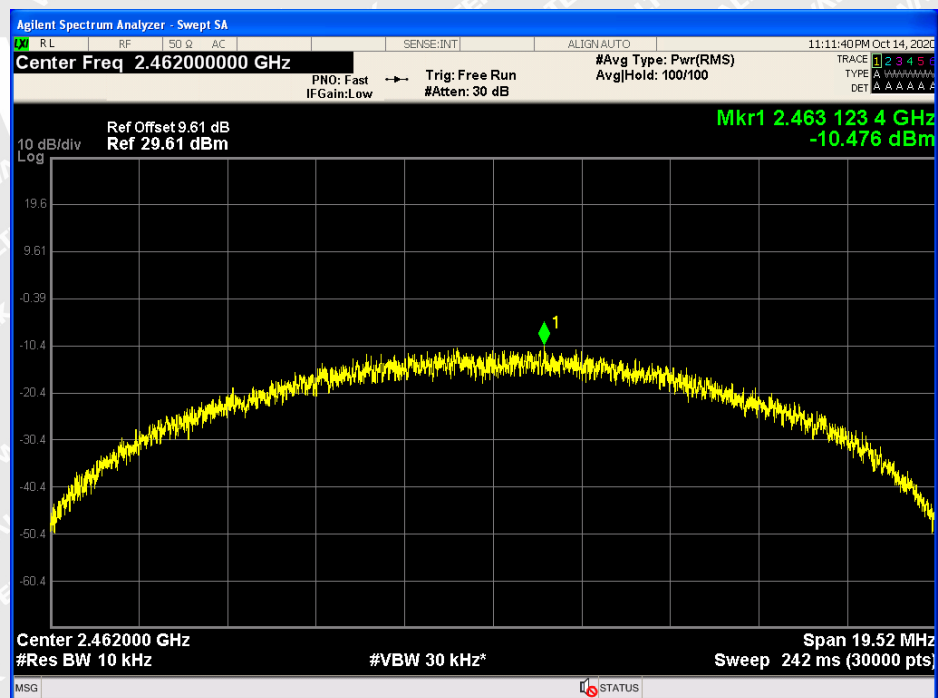




802.11b_Middle Channel

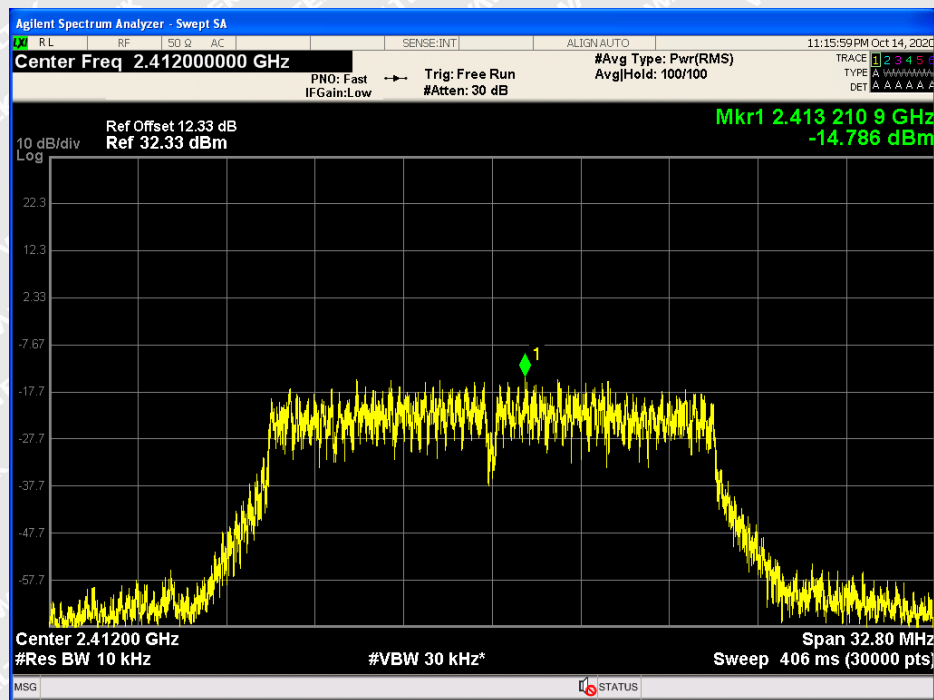


802.11b_High Channel

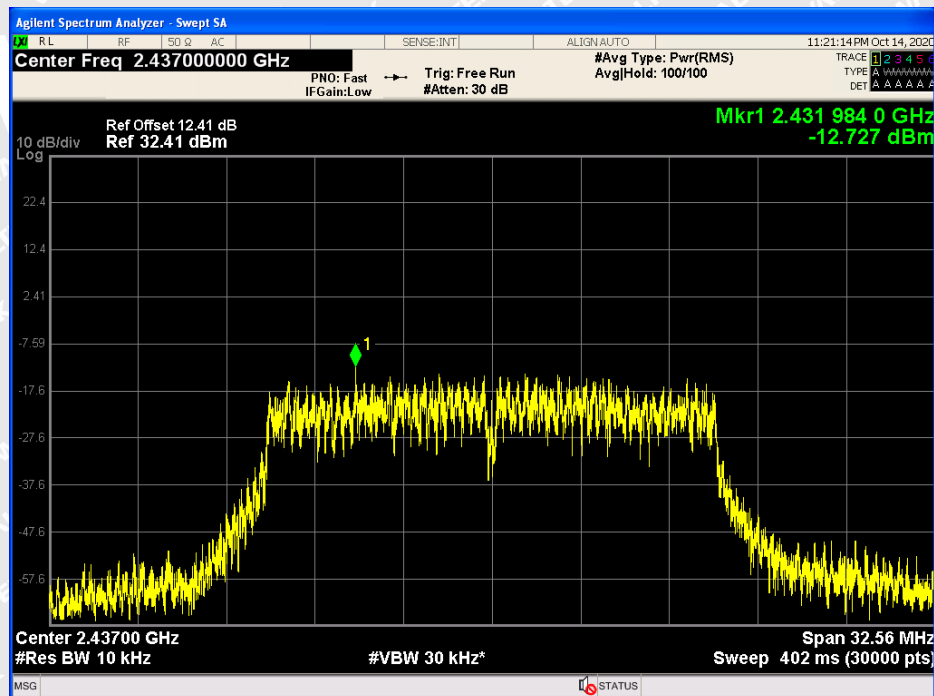




802.11g_Low Channel

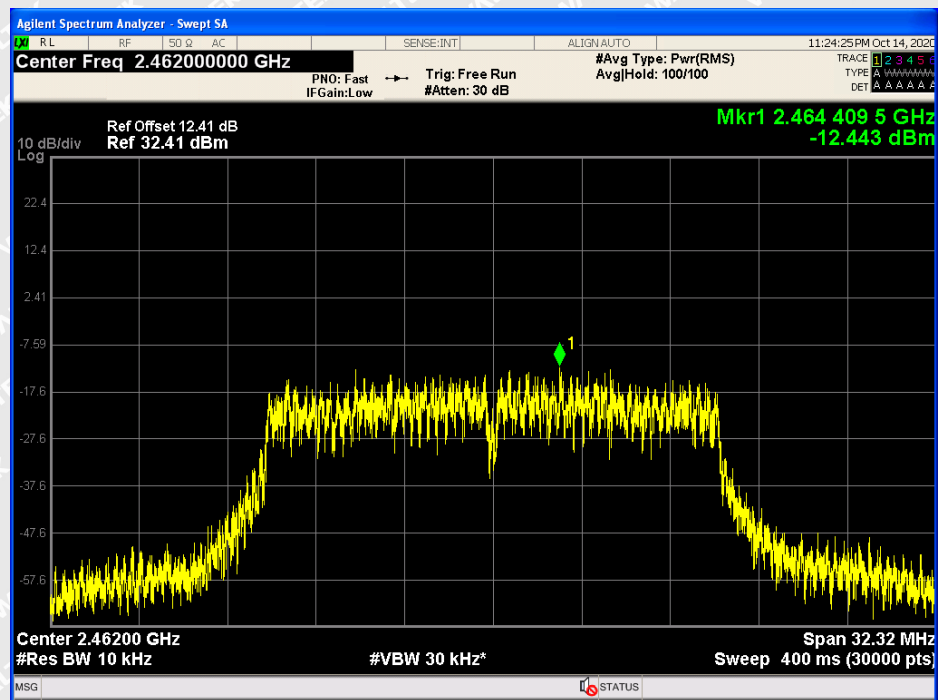


802.11g_Middle Channel

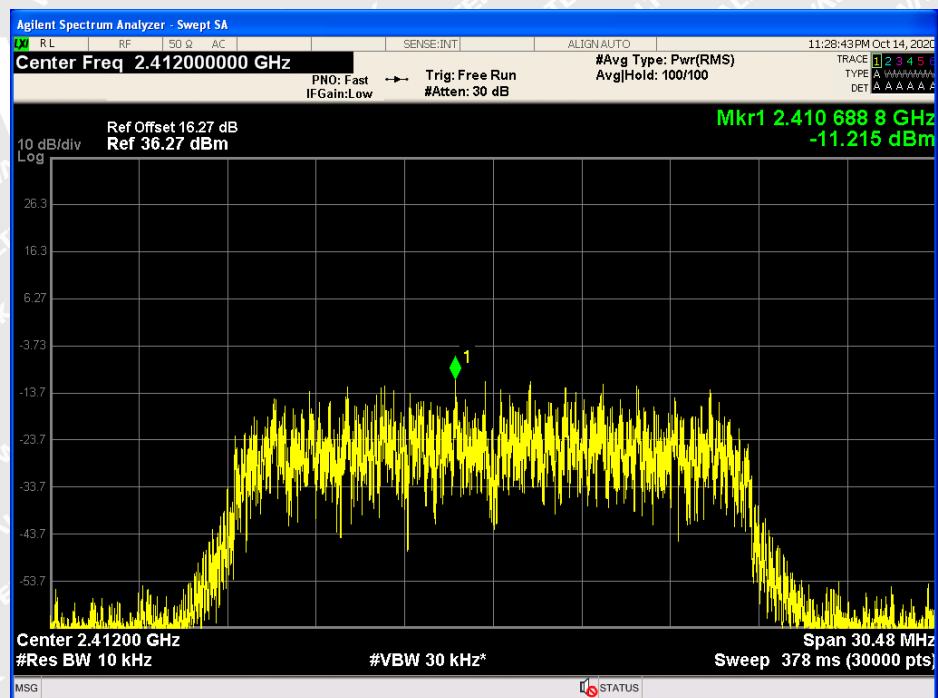




802.11g_High Channel

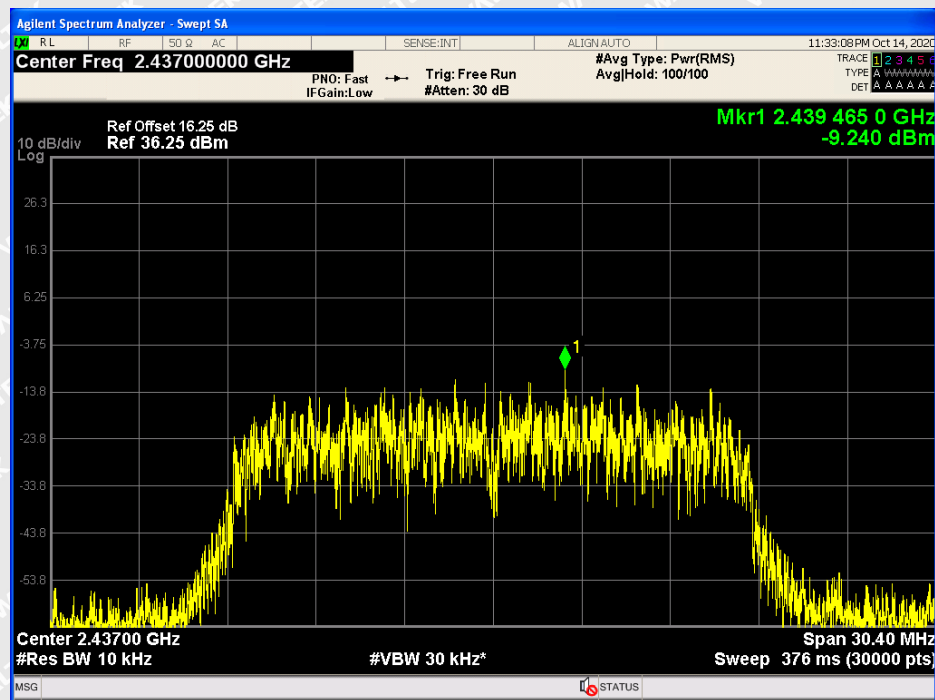


802.11n-HT20_Low Channel

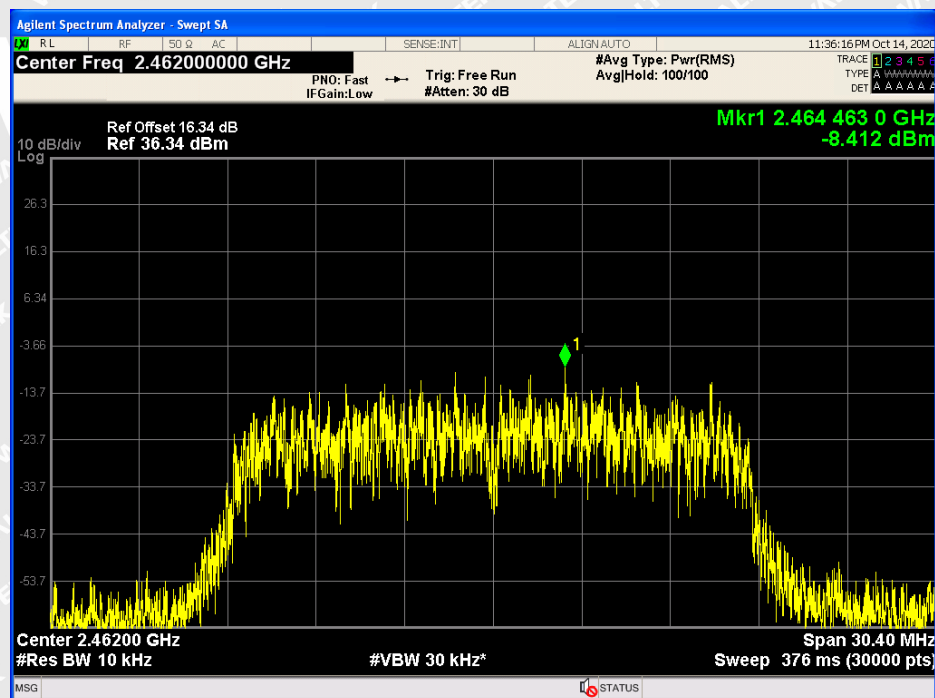




802.11n-HT20_Middle Channel

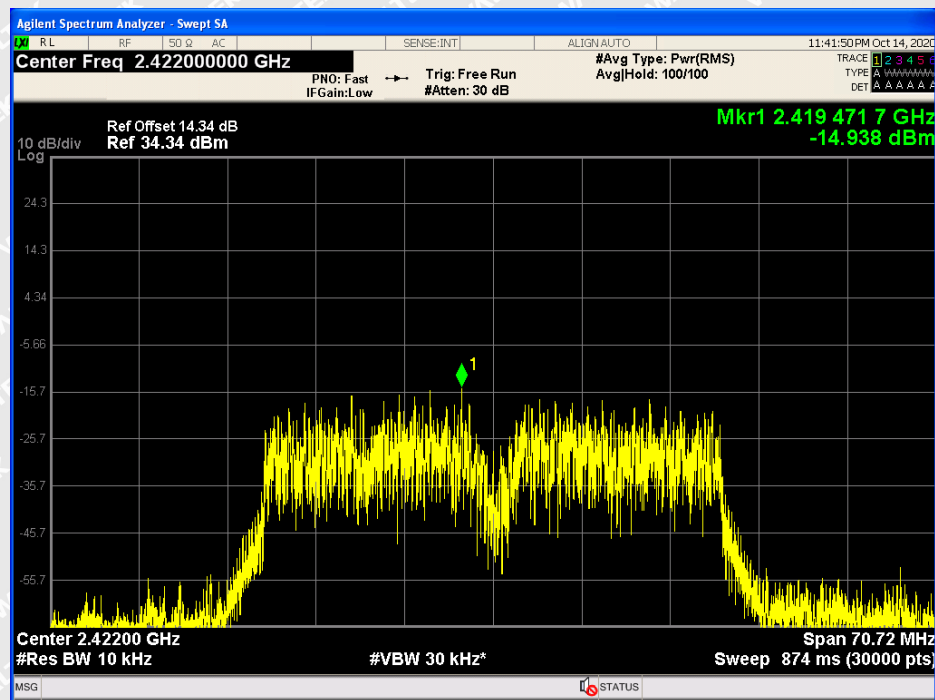


802.11n-HT20_High Channel

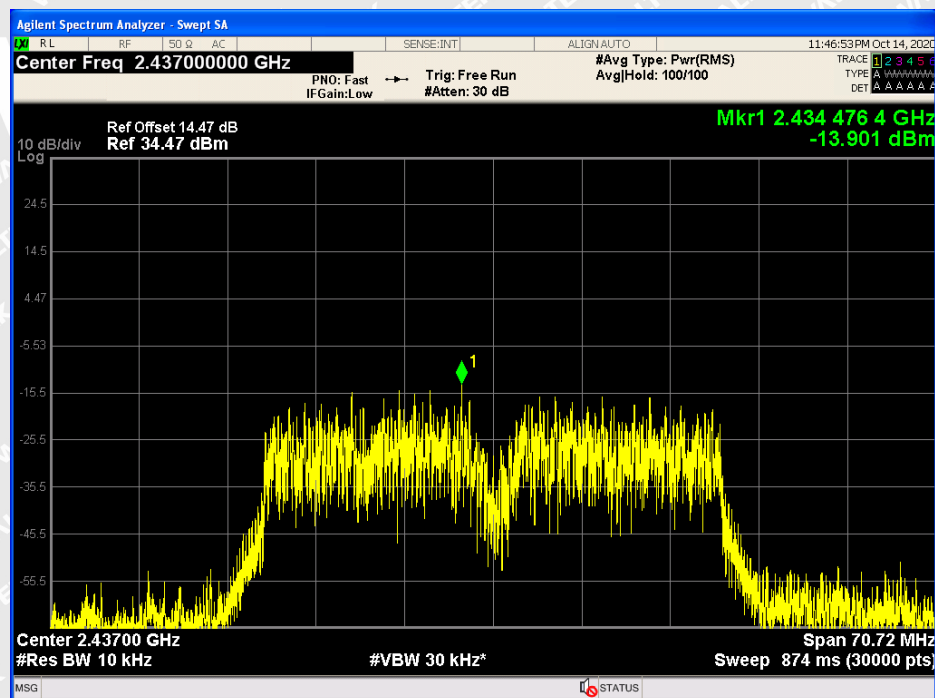




802.11n-HT40_Low Channel

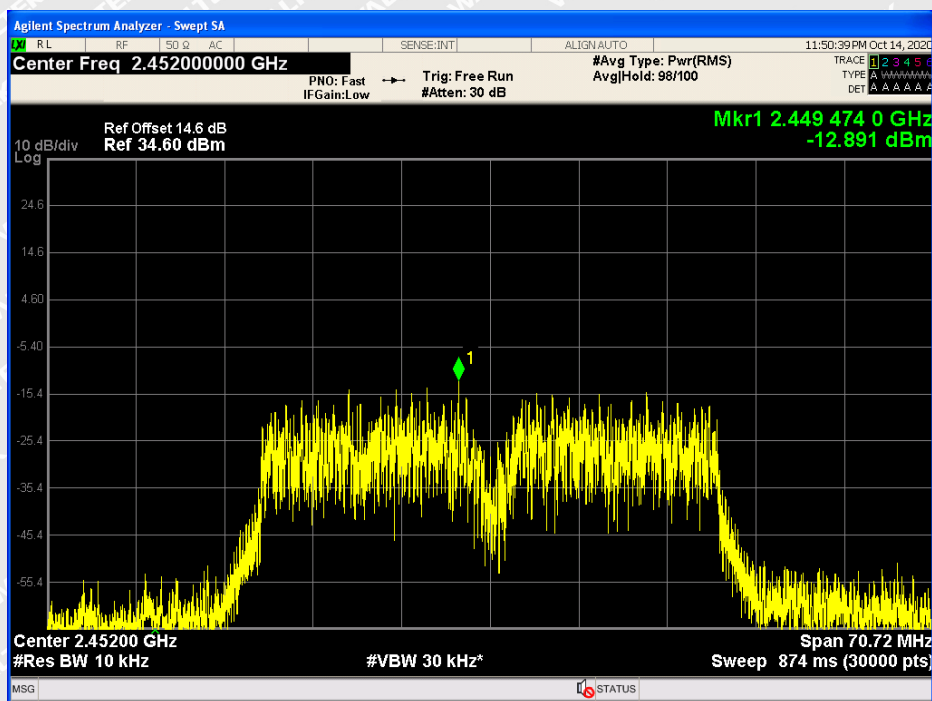


802.11n-HT40_Middle Channel





802.11n-HT40_High Channel



WALTEK



6.5 DTS Bandwidth

6.5.1 Standard Applicable

According to 15.247(a)(2). Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

6.5.2 Test Procedure

According to the KDB 558074 D01 v05r02 Subclause 8.2 and ANSI C63.10-2013 Subclause 11.8.1, the test method of DTS Bandwidth as below:

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.5.3 Test Result

Test Mode	Test Channel(MHz)	Test Result (MHz)	Limit kHz
802.11b	2412	10.080	≥ 500
	2437	10.280	≥ 500
	2462	9.760	≥ 500
802.11g	2412	16.400	≥ 500
	2437	16.280	≥ 500
	2462	16.160	≥ 500
802.11n-HT20	2412	15.240	≥ 500
	2437	15.200	≥ 500
	2462	15.200	≥ 500
802.11n-HT40	2422	35.360	≥ 500
	2437	35.360	≥ 500
	2452	35.360	≥ 500



Test plots:

802.11b_Low Channel

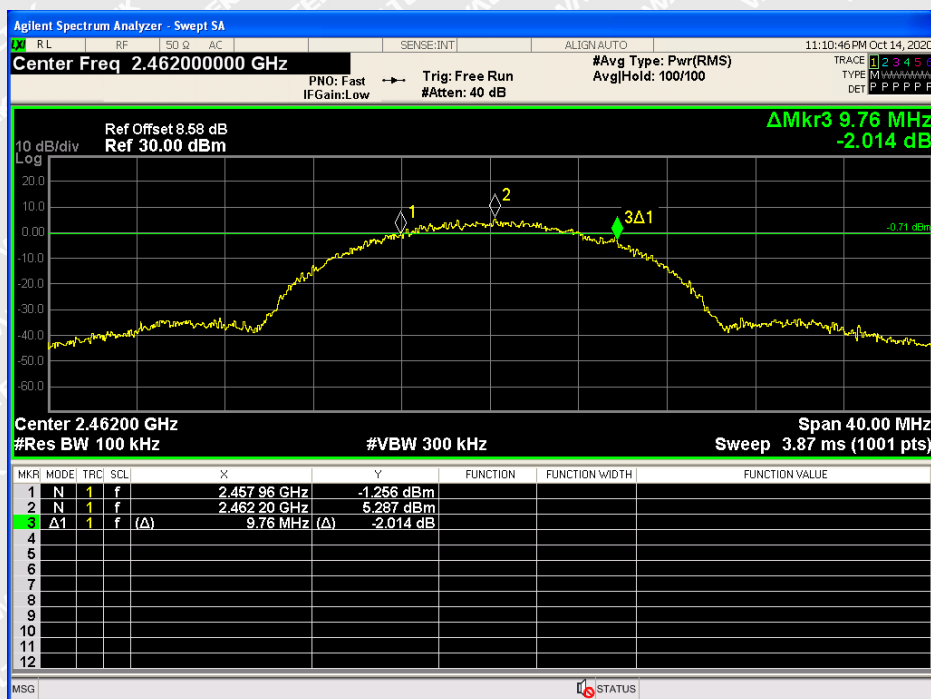


802.11b_Middle Channel

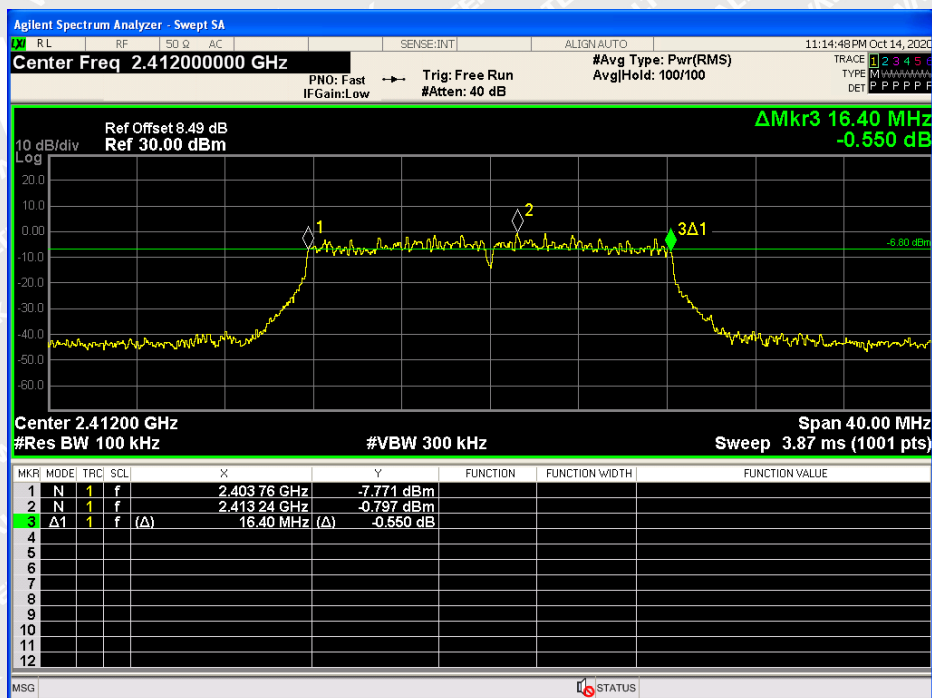




802.11b_High Channel



802.11g_Low Channel

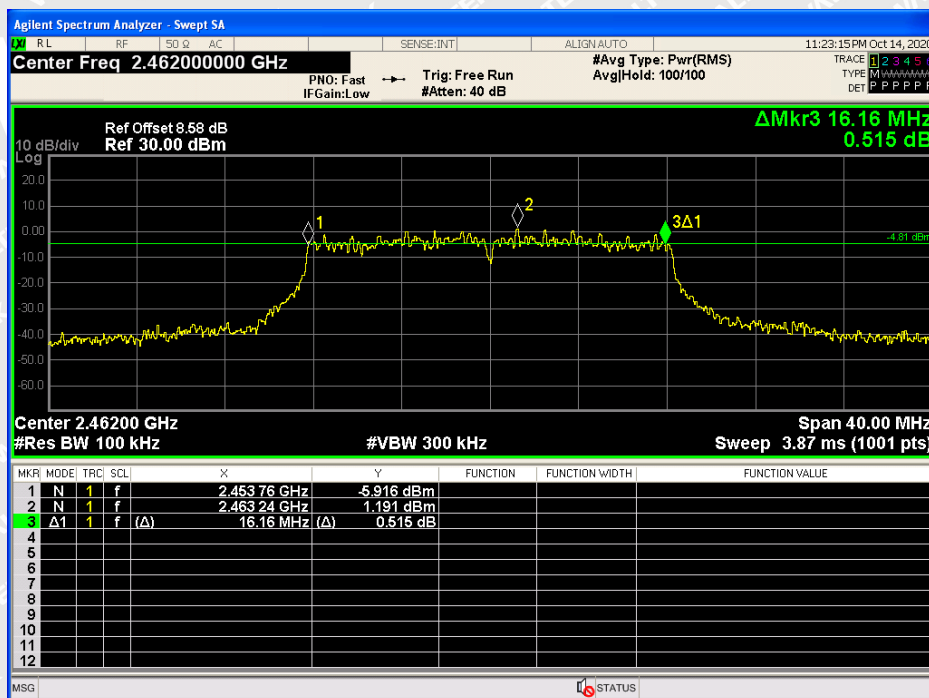




802.11g_Middle Channel

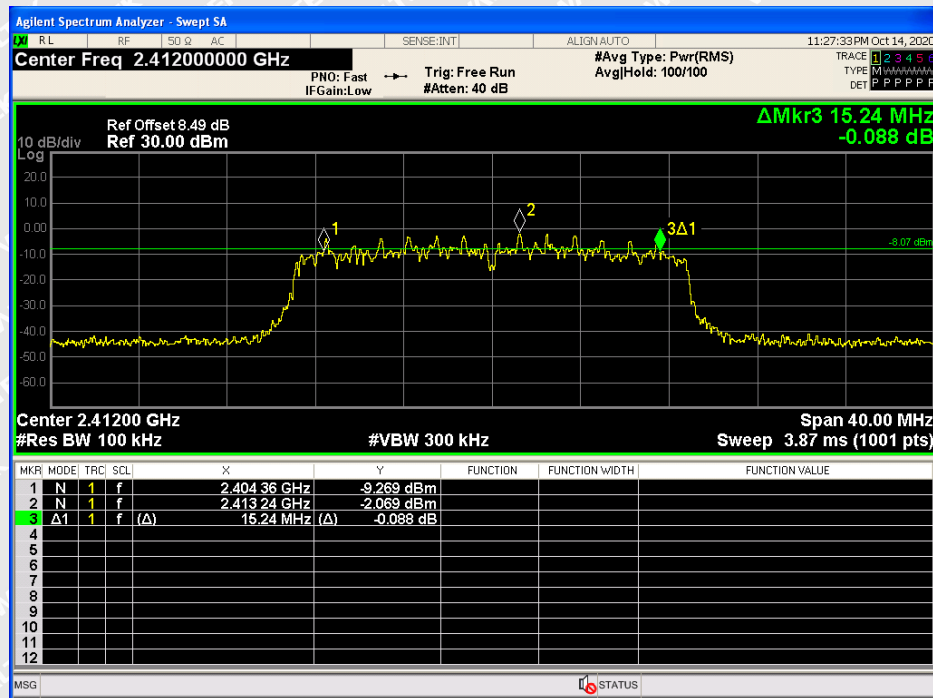


802.11g_High Channel

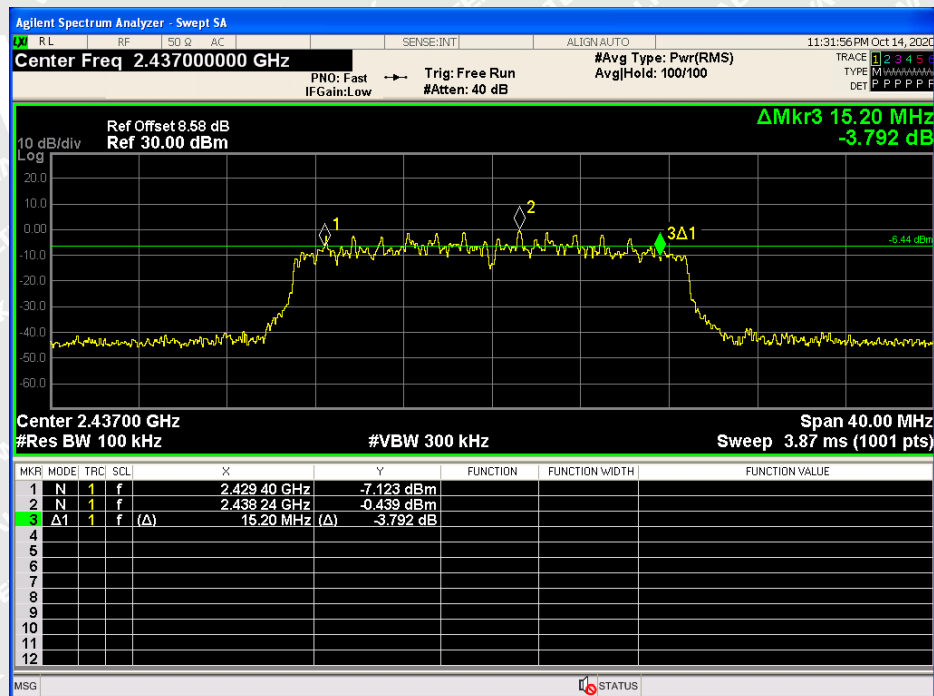




802.11n-HT20_Low Channel



802.11n-HT20_Middle Channel

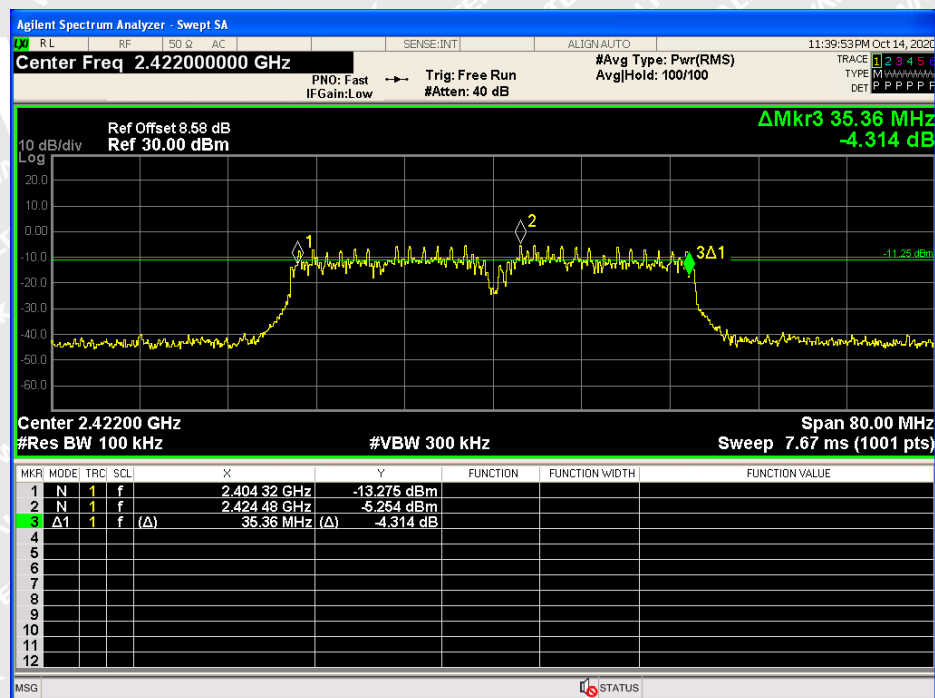




802.11n-HT20_High Channel

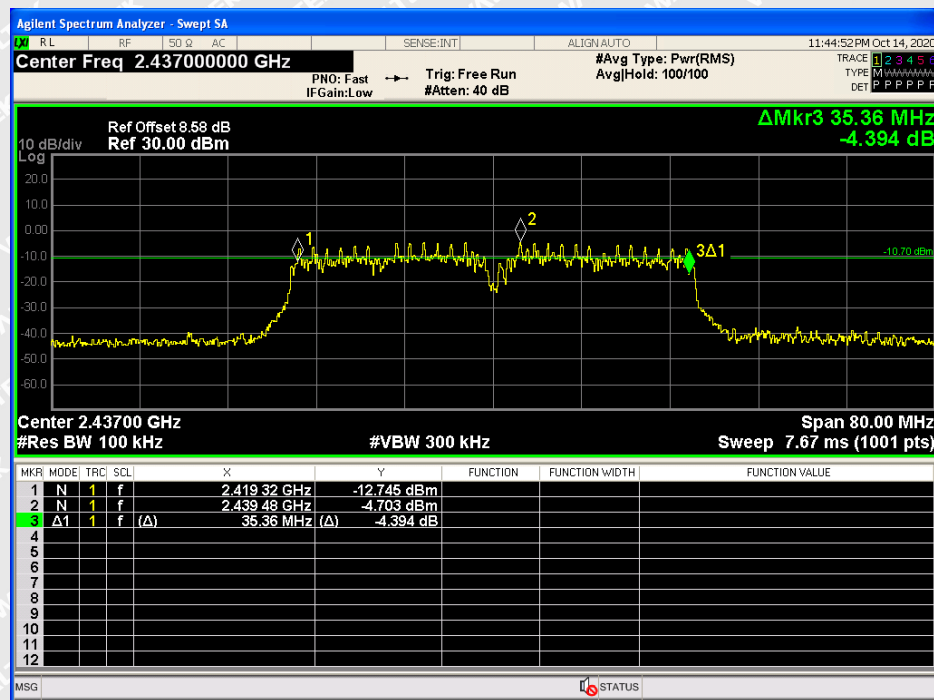


802.11n-HT40_Low Channel

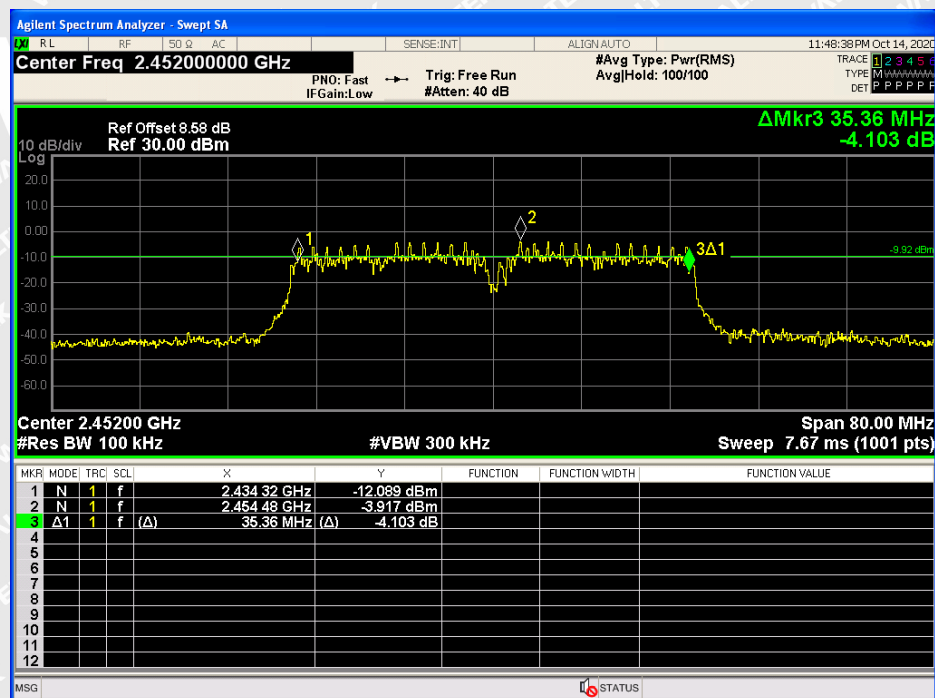




802.11n-HT40_Middle Channel



802.11n-HT40_High Channel





6.6 RF Output Power

6.6.1 Standard Applicable

According to 15.247(b)(3). For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

6.6.2 Test Procedure

According to the KDB-558074 D01 v05r02 Subclause 8.3.2.2 and ANSI C63.10-2013 Subclause 11.9.2.2, when this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth

- a) Set span to at least 1.5 times the OBW.
- b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
- c) Set VBW $\geq 3 \times$ RBW.
- d) Number of points in sweep $\geq 2 \times$ span / RBW. (This gives bin-to-bin spacing $\geq$ RBW/2, so that narrowband signals are not lost between frequency bins.)
- e) Sweep time = auto.
- f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- g) If transmit duty cycle < 98 %, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.
- h) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- i) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.



6.6.3 Test Result

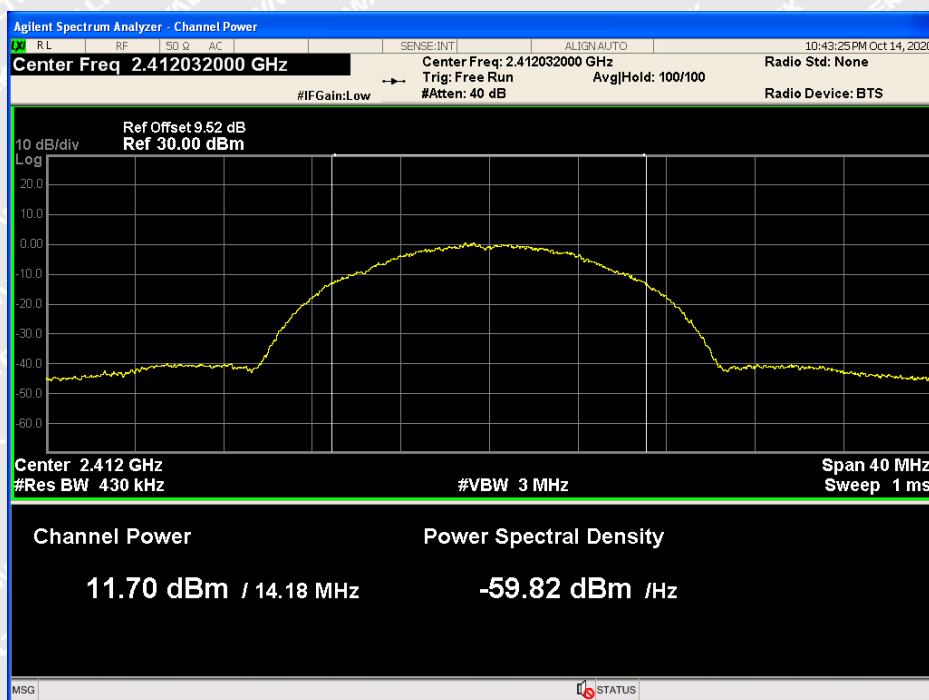
Modulation	Test Channel (MHz)	Reading (dBm)	Output Power (mW)	Limit (mW)
802.11b	2412	11.70	14.79	1000
	2437	14.18	26.18	1000
	2462	14.67	29.31	1000
802.11g	2412	9.93	9.84	1000
	2437	11.05	12.74	1000
	2462	11.63	14.55	1000
802.11n-HT20	2412	8.52	7.11	1000
	2437	9.92	9.82	1000
	2462	11.04	12.71	1000
802.11n-HT40	2422	8.19	6.59	1000
	2437	9.12	8.17	1000
	2452	9.88	9.73	1000

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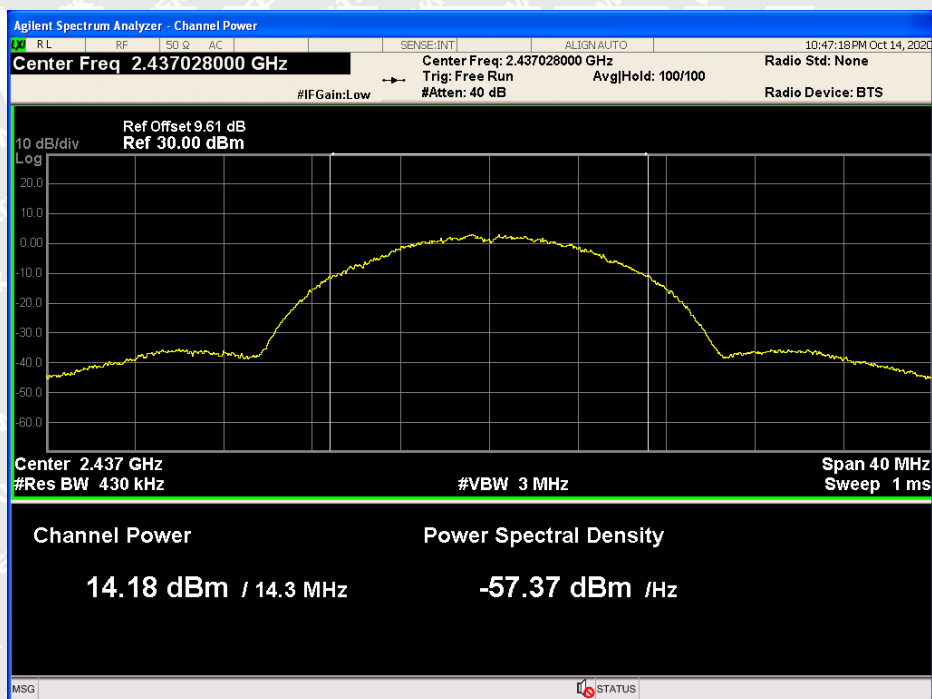


Test plots:

802.11b_Low Channel

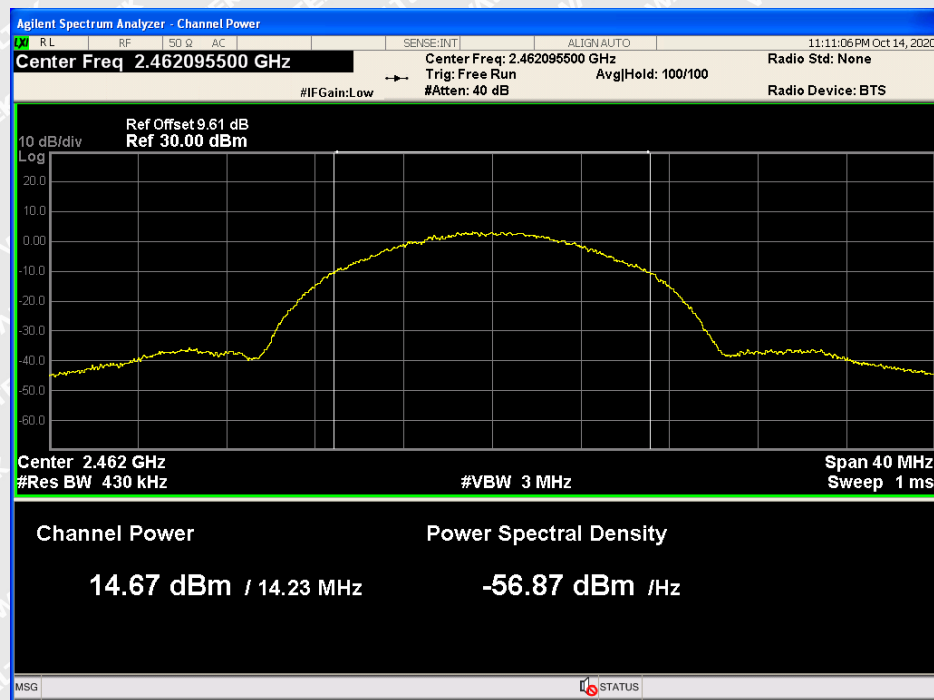


802.11b_Middle Channel

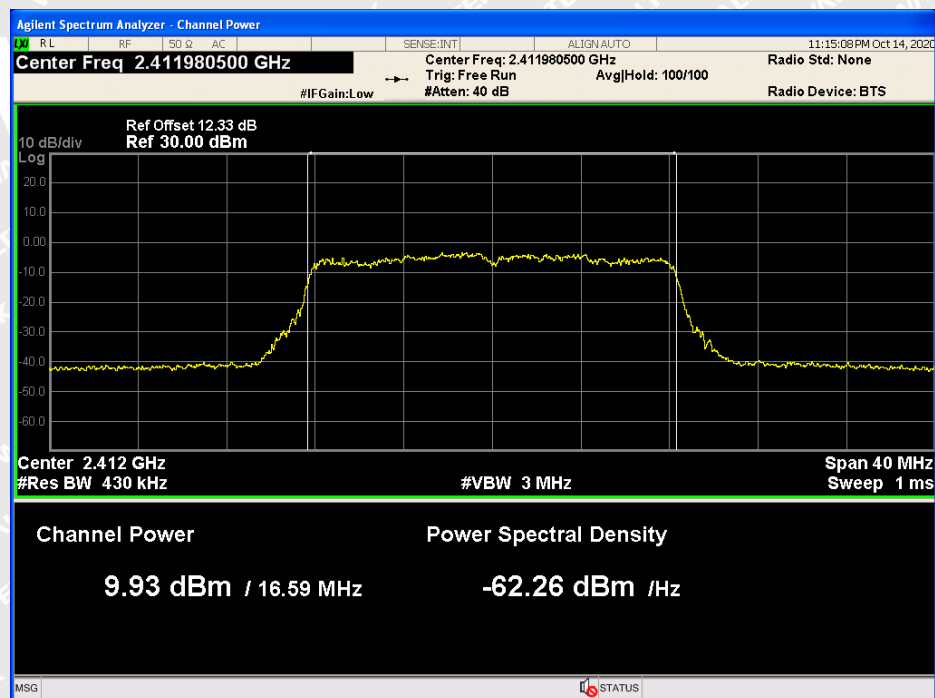




802.11b_High Channel

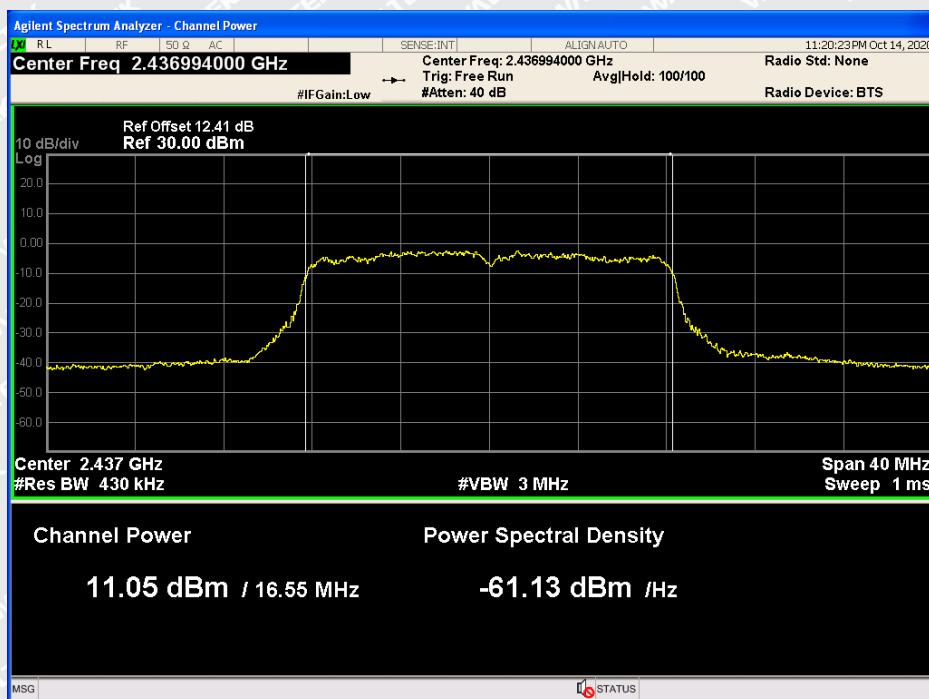


802.11g_Low Channel

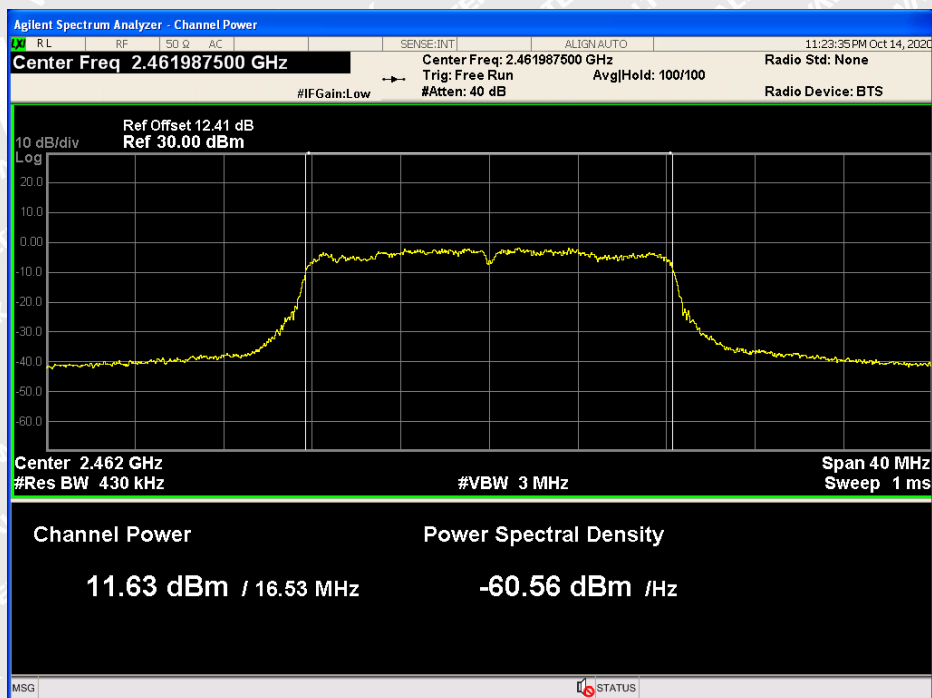




802.11g_Middle Channel

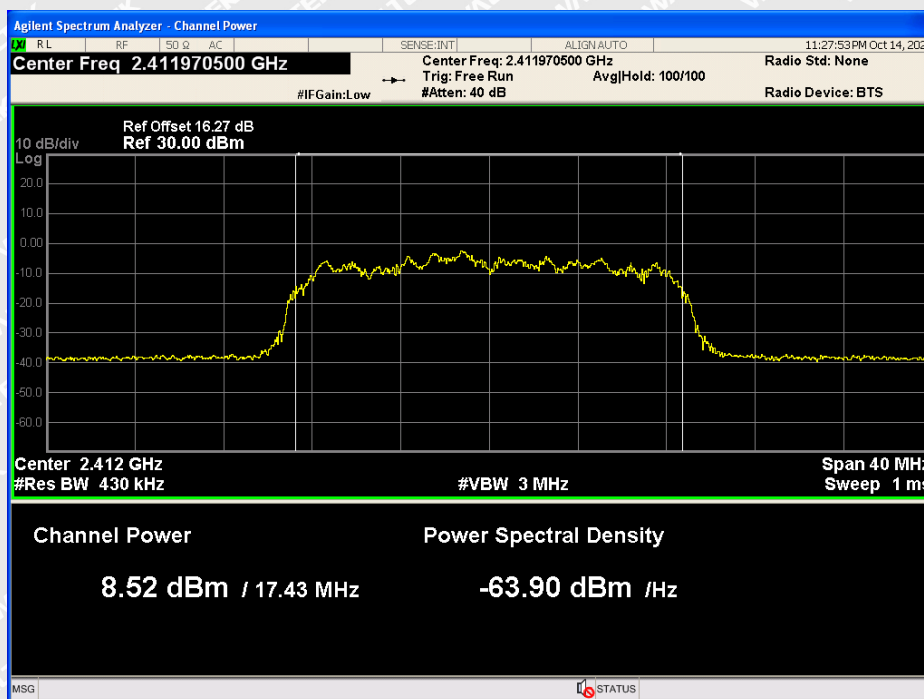


802.11g_High Channel

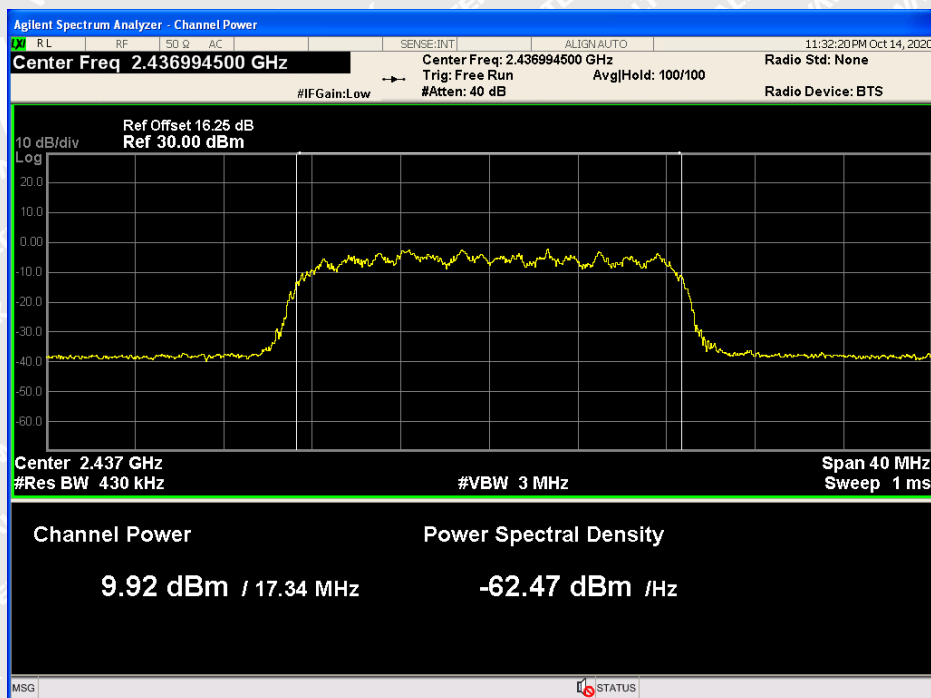




802.11n-HT20_Low Channel

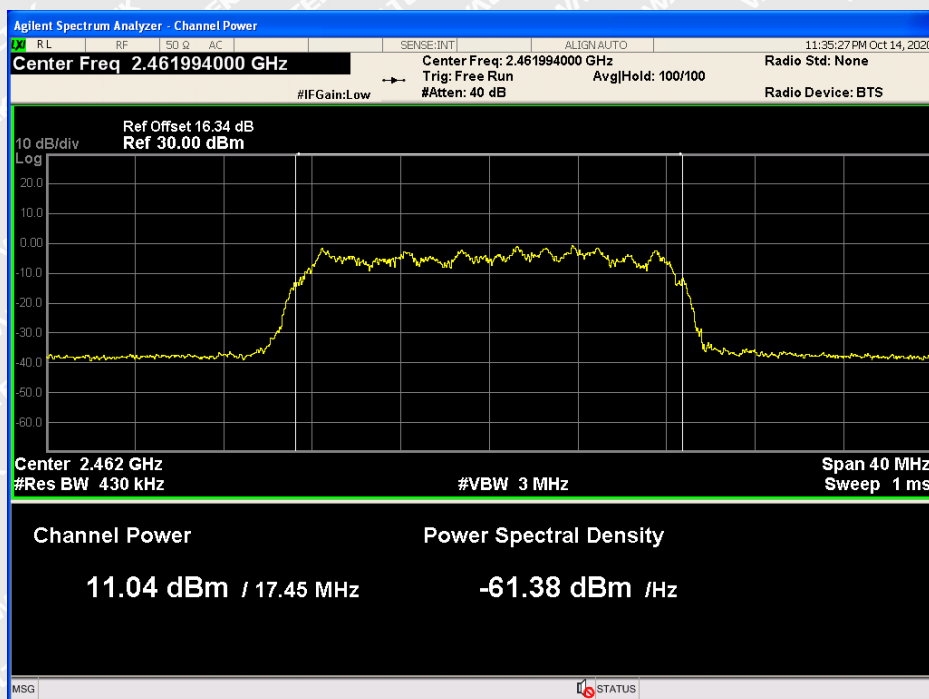


802.11n-HT20_Middle Channel

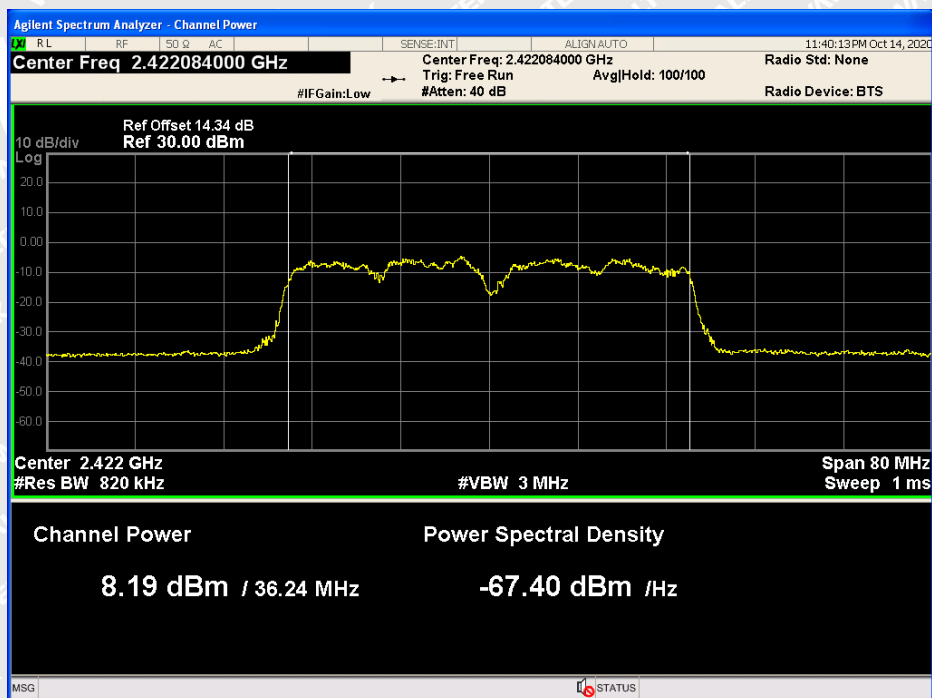




802.11n-HT20_High Channel

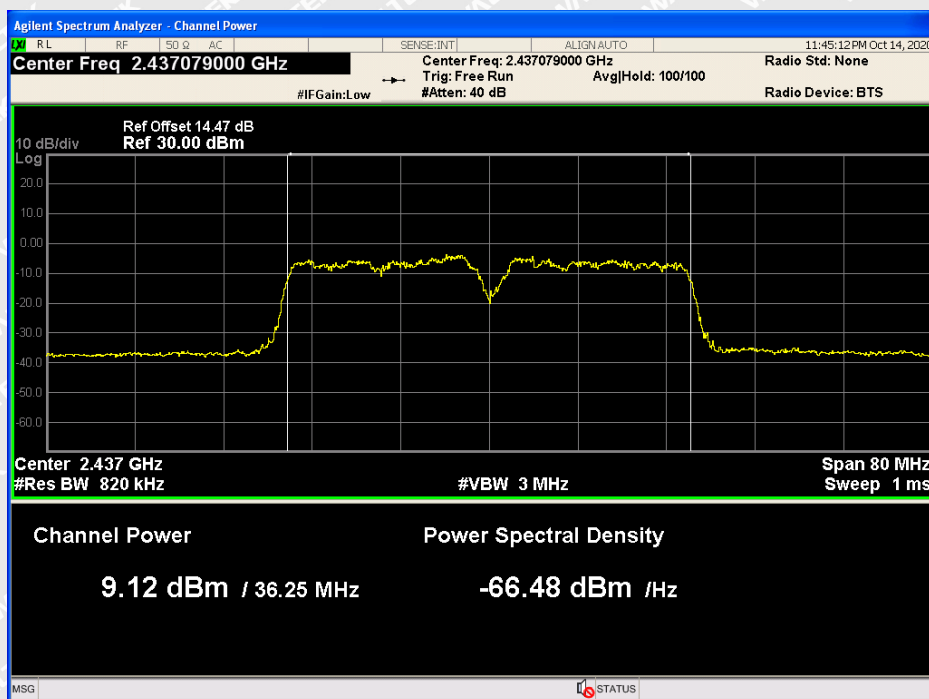


802.11n-HT40_Low Channel

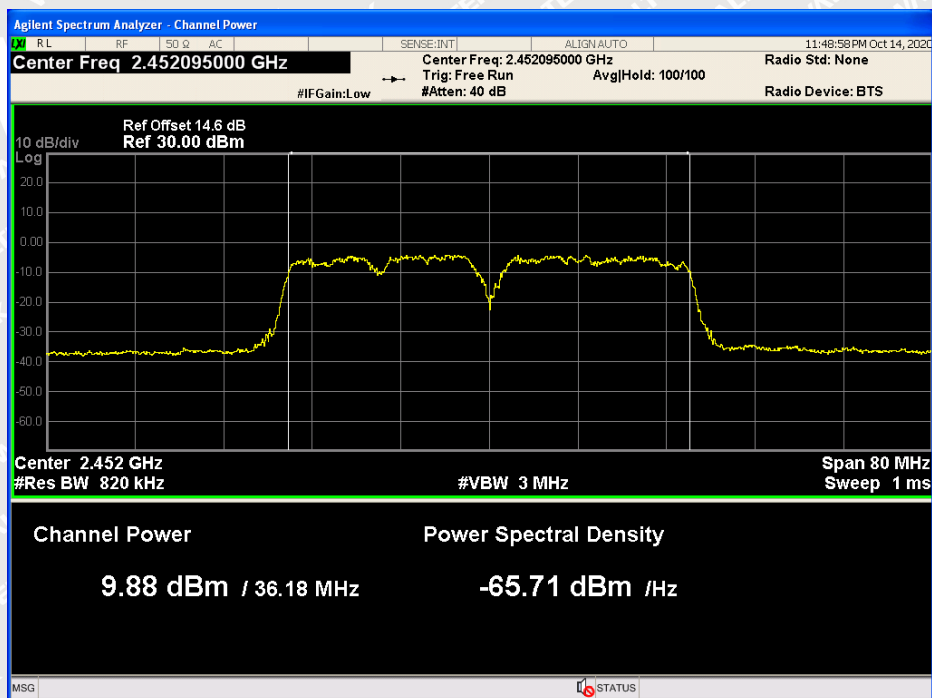




802.11n-HT40_Middle Channel



802.11n-HT40_High Channel





6.7 Out of Band Emissions

6.7.1 Standard Applicable

According to §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

6.7.2 Test Procedure

According to the KDB 558074 D01 v05r02 Subclause 8.4 and ANSI C63.10-2013 Subclause 11.11, the Emissions in nonrestricted frequency bands test method as follows:

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW $\geq [3 \times \text{RBW}]$.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.

According to the KDB 558074 D01 v05r02 Subclause 8.5 and ANSI C63.10-2013 Subclause 11.12, the Emissions in restricted frequency bands test method as follows:

A. Radiated emission measurements:

Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge,

as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2420MHz

for low bandedge, 2460MHz to 2500MHz for the high bandedge)

RBW = 1MHz, VBW = 1MHz for peak value measured

RBW = 1MHz, VBW = 10Hz for average value measured

Sweep = auto; Detector function = peak/average; Trace = max hold

All the trace to stabilize, set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.

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Those emissions must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205. Note that the method of measurement KDB publication number: 913591 may be used for the radiated band edge measurements.

B. Antenna-port conducted measurements

Peak emission levels are measured by setting the instrument as follows:

- a) RBW = as specified in Table 9/
- b) VBW $\geq [3 \times \text{RBW}]$.
- c) Detector = peak.
- d) Sweep time = auto.
- e) Trace mode = max hold.
- f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be lengthened for low-duty-cycle applications.)

Table 9—RBW as a function of frequency

Frequency	RBW
9 kHz to 150 kHz	200 Hz to 300 Hz
0.15 MHz to 30 MHz	9 kHz to 10 kHz
30 MHz to 1000 MHz	100 kHz to 120 kHz
>1000 MHz	1 MHz

If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1.

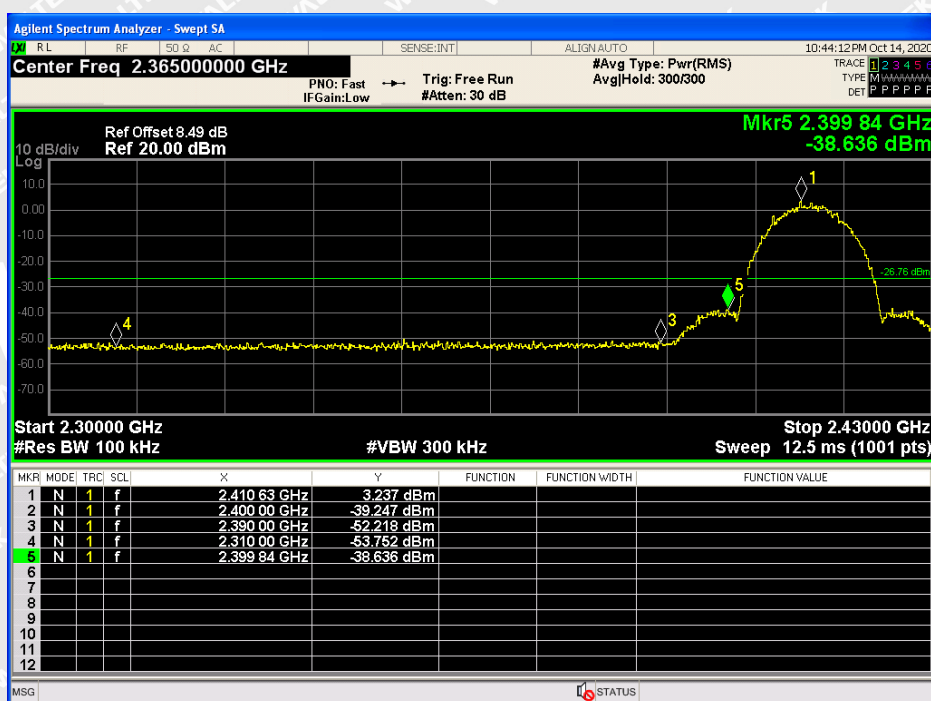


6.7.3 Test Result

Test Mode	Channel (MHz)	Ref Level (dBm)	Result (dBm)	Limit (dBm)	Verdict
802.11b	2412	3.24	-38.64	<=-26.76	Pass
	2462	5.76	-49.01	<=-24.24	Pass
802.11g	2412	-0.72	-42.82	<=-30.72	Pass
	2462	1.08	-46.22	<=-28.93	Pass
802.11n-HT20	2412	-2.17	-44.16	<=-32.17	Pass
	2462	0.56	-49.00	<=-29.44	Pass
802.11n-HT40	2422	-5.45	-42.48	<=-35.45	Pass
	2452	-3.99	-39.86	<=-33.99	Pass

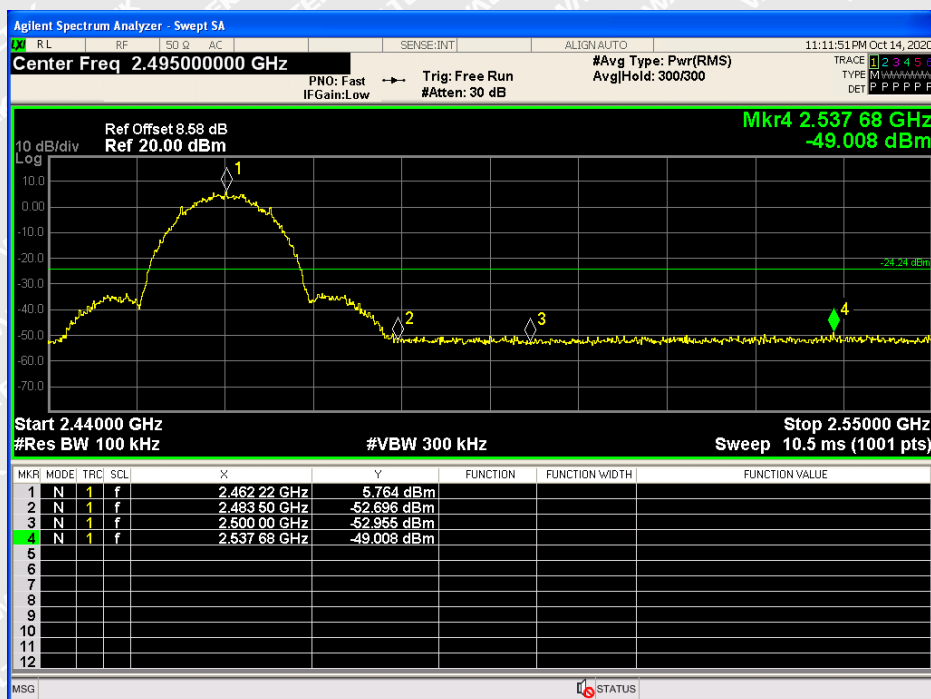
Test Plots:

802.11b_Low Channel

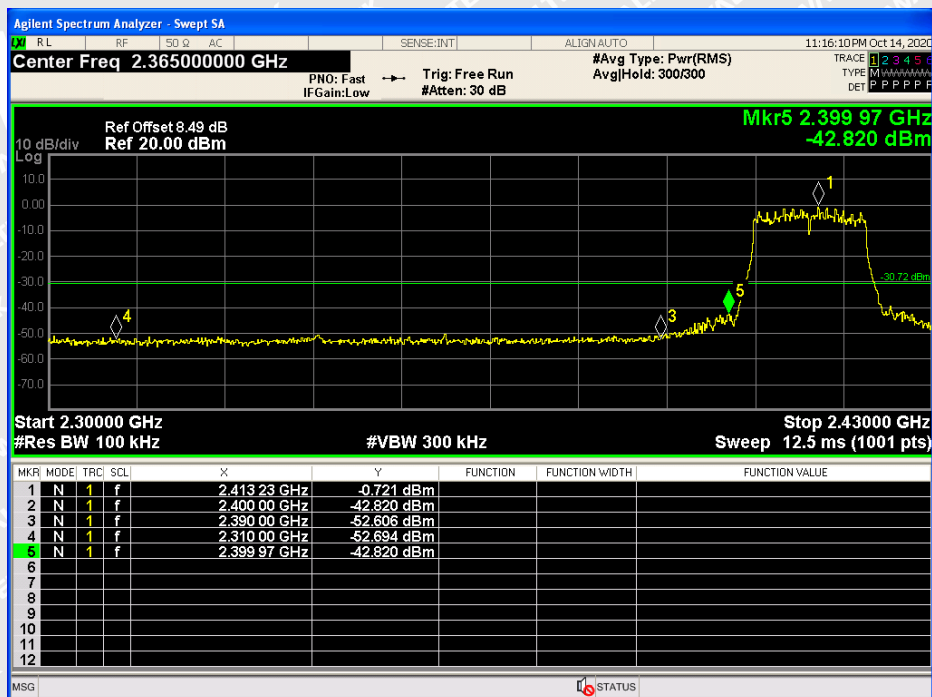




802.11b_High Channel

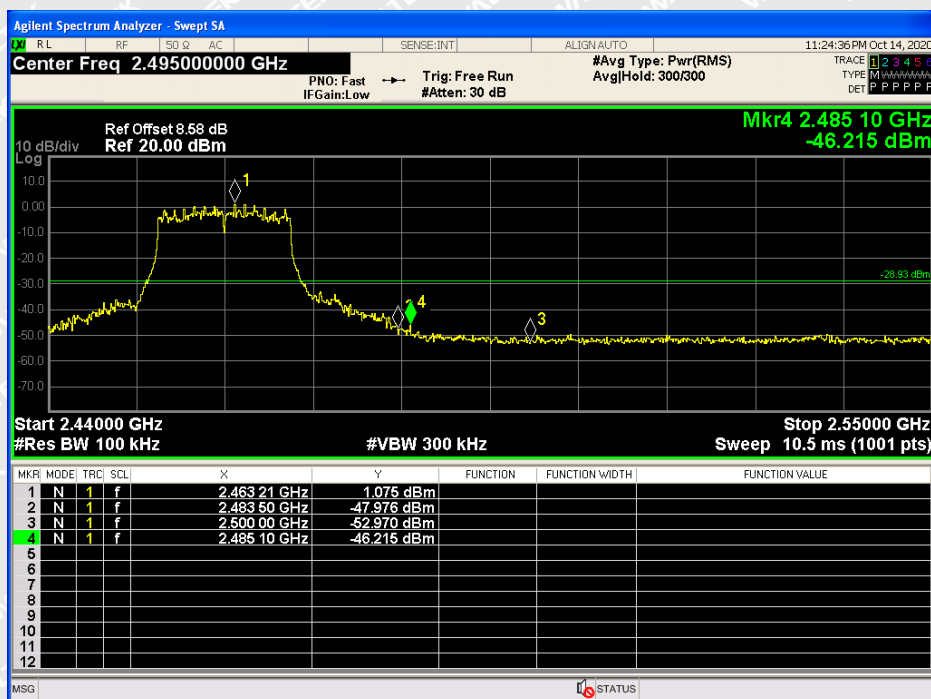


802.11g_Low Channel

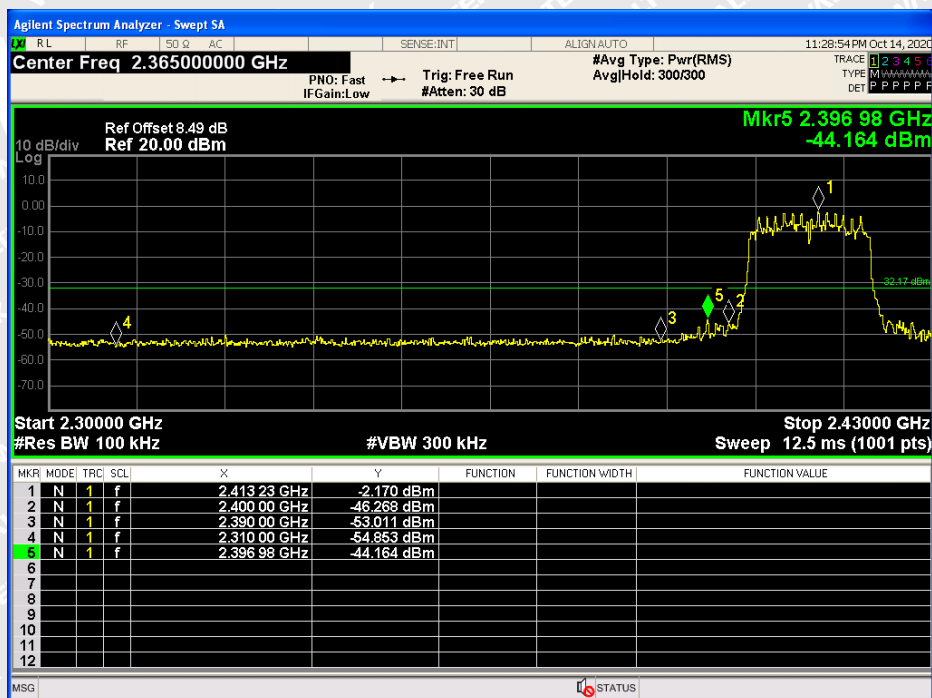




802.11g_High Channel

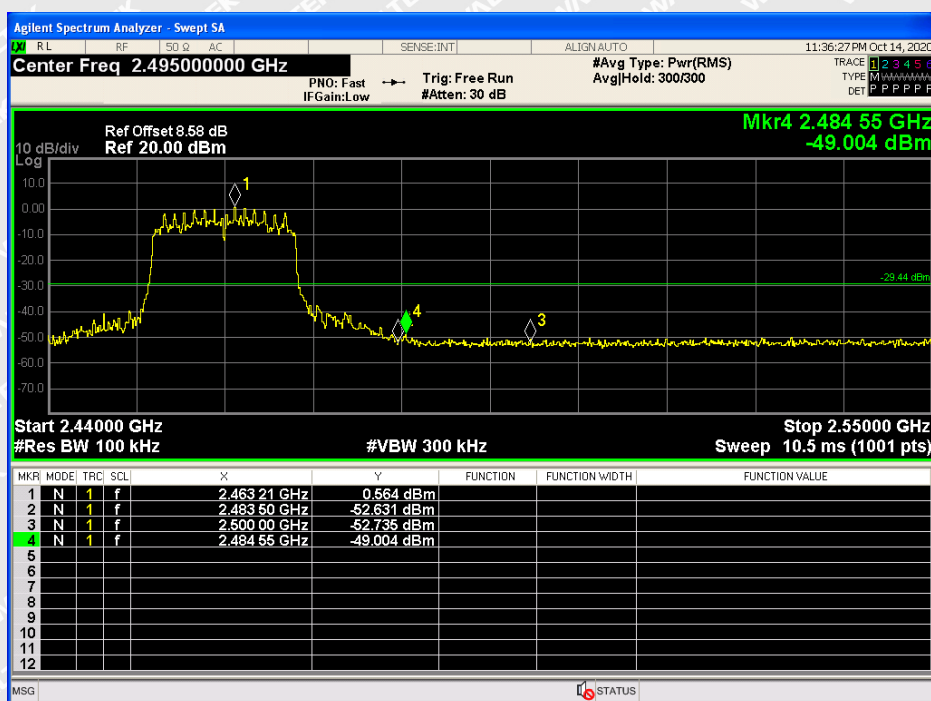


802.11n(HT20)_Low Channel

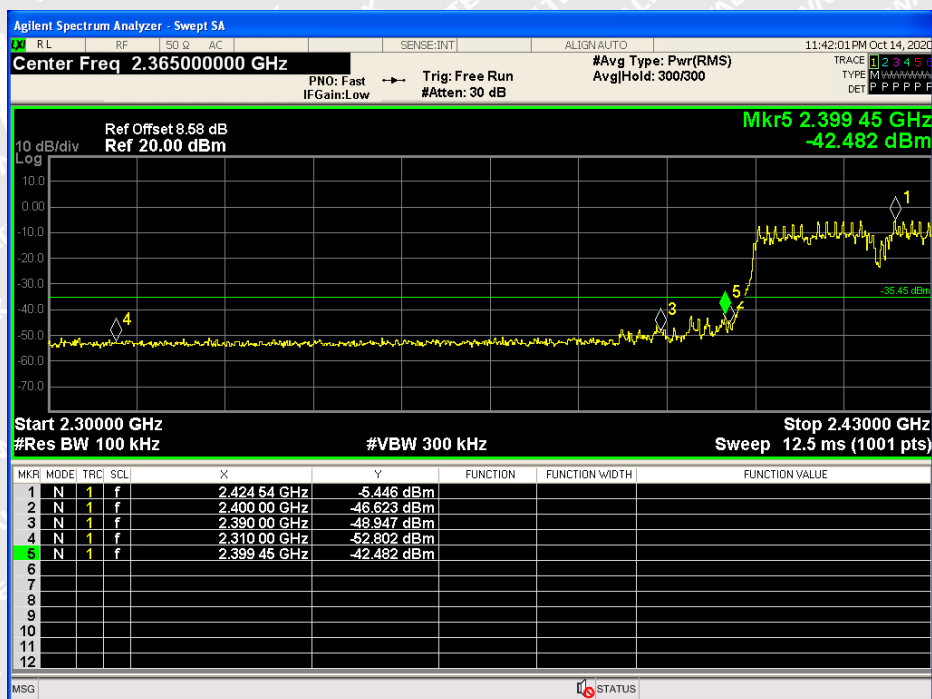




802.11n(HT20)_High Channel

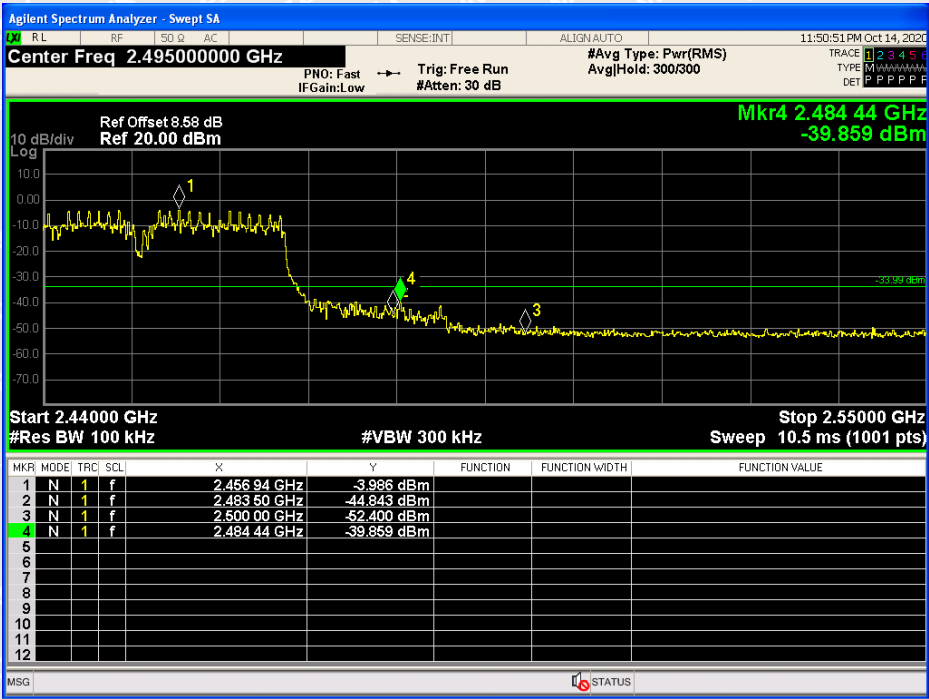


802.11n(HT40)_Low Channel





802.11n(HT40)_High Channel



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6.8 Conducted Emissions

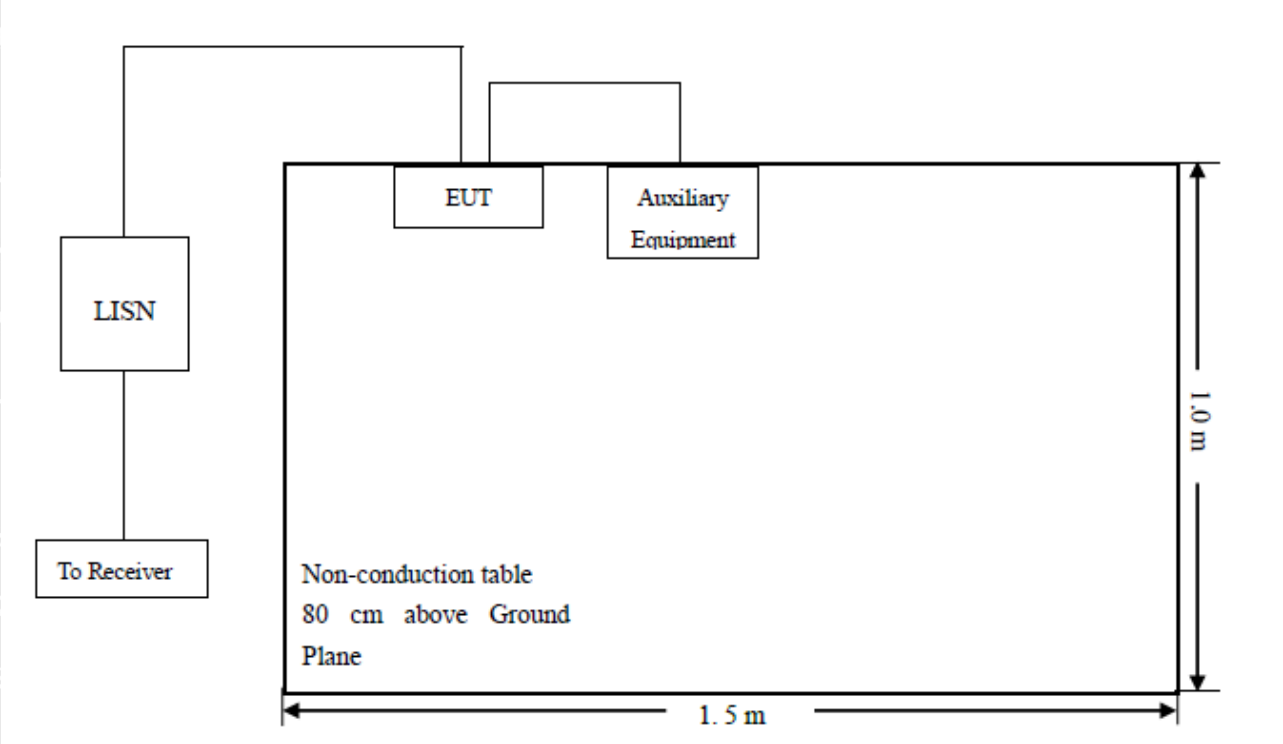
6.8.1 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

6.8.2 Basic Test Setup Block Diagram



6.8.3 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency.....150 kHz

Stop Frequency.....30 MHz

Sweep Speed.....Auto

IF Bandwidth.....10 kHz

Quasi-Peak Adapter Bandwidth.....9 kHz

Quasi-Peak Adapter Mode.....Normal



6.8.4 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.8.5 Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF(Voltage Division Facotr), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Measurement} = \text{Reading Level} + \text{Correct Factor}$$

$$\text{Correct Facotor} = \text{LISN VDF} + \text{Cable Loss}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Measurement}$$

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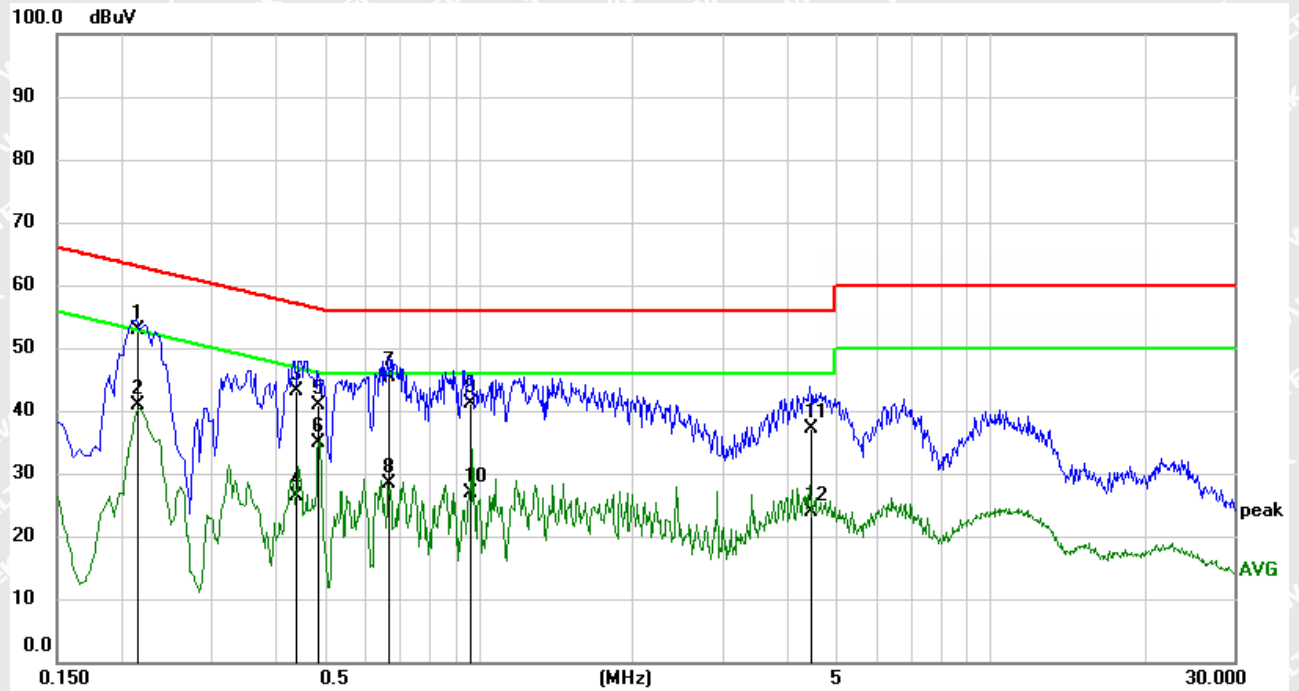
6.8.6 Test Result

Test Mode

Communication mode(AC 120V/60Hz)

Polarity

Line



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.2140	43.18	9.65	52.83	63.05	-10.22	QP	
2		0.2140	31.18	9.65	40.83	53.05	-12.22	AVG	
3		0.4380	33.59	9.66	43.25	57.10	-13.85	QP	
4		0.4380	16.71	9.66	26.37	47.10	-20.73	AVG	
5		0.4860	31.21	9.66	40.87	56.24	-15.37	QP	
6		0.4860	25.22	9.66	34.88	46.24	-11.36	AVG	
7		0.6660	35.75	9.66	45.41	56.00	-10.59	QP	
8		0.6660	18.73	9.66	28.39	46.00	-17.61	AVG	
9		0.9620	31.49	9.68	41.17	56.00	-14.83	QP	
10		0.9620	17.10	9.68	26.78	46.00	-19.22	AVG	
11		4.4420	27.29	9.75	37.04	56.00	-18.96	QP	
12		4.4420	14.18	9.75	23.93	46.00	-22.07	AVG	

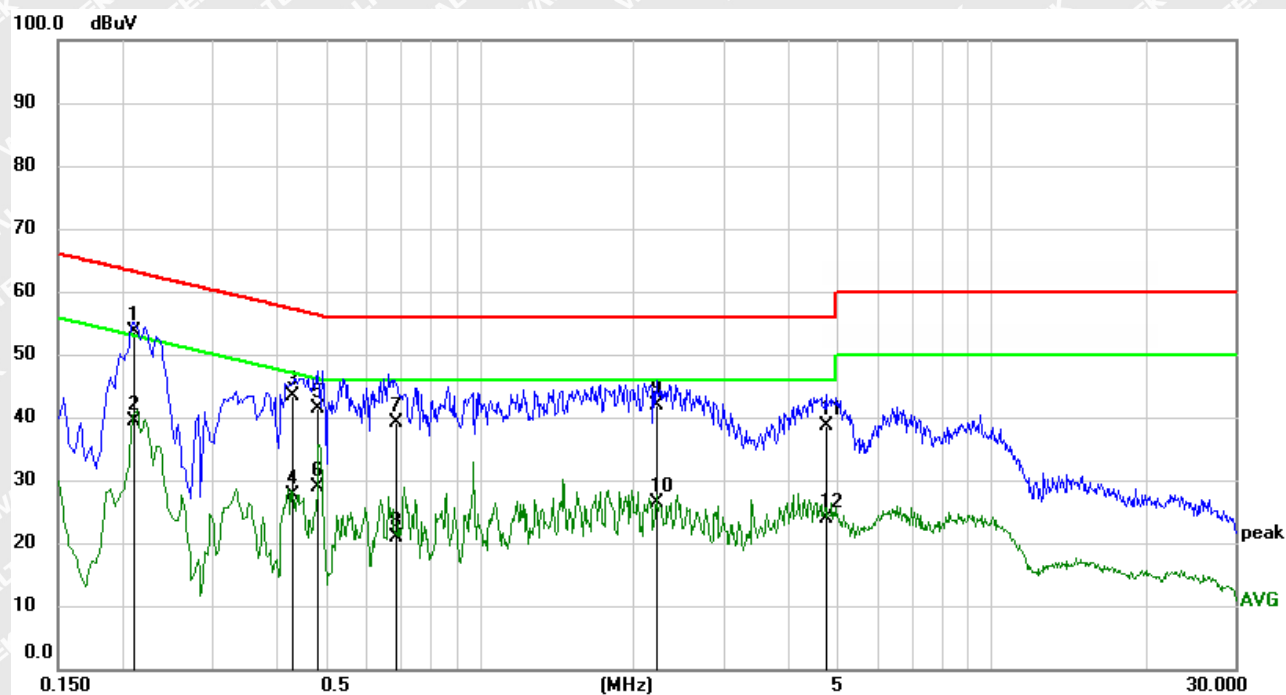


Test Mode

Communication mode(AC 120V/60Hz)

Polarity

Neutral



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.2100	43.91	9.65	53.56	63.21	-9.65	QP	
2		0.2100	29.75	9.65	39.40	53.21	-13.81	AVG	
3		0.4300	33.80	9.66	43.46	57.25	-13.79	QP	
4		0.4300	18.06	9.66	27.72	47.25	-19.53	AVG	
5		0.4820	31.74	9.66	41.40	56.30	-14.90	QP	
6		0.4820	19.34	9.66	29.00	46.30	-17.30	AVG	
7		0.6860	29.58	9.66	39.24	56.00	-16.76	QP	
8		0.6860	11.20	9.66	20.86	46.00	-25.14	AVG	
9		2.2139	32.20	9.73	41.93	56.00	-14.07	QP	
10		2.2139	16.56	9.73	26.29	46.00	-19.71	AVG	
11		4.7580	28.97	9.77	38.74	56.00	-17.26	QP	
12		4.7580	14.21	9.77	23.98	46.00	-22.02	AVG	



7 Photographs Test Setup

7.1 Photographs - Radiated Emission Test Setup

30MHz-1GHz



Above 1GHz





7.2 Photographs - Conducted Emission Test Setup

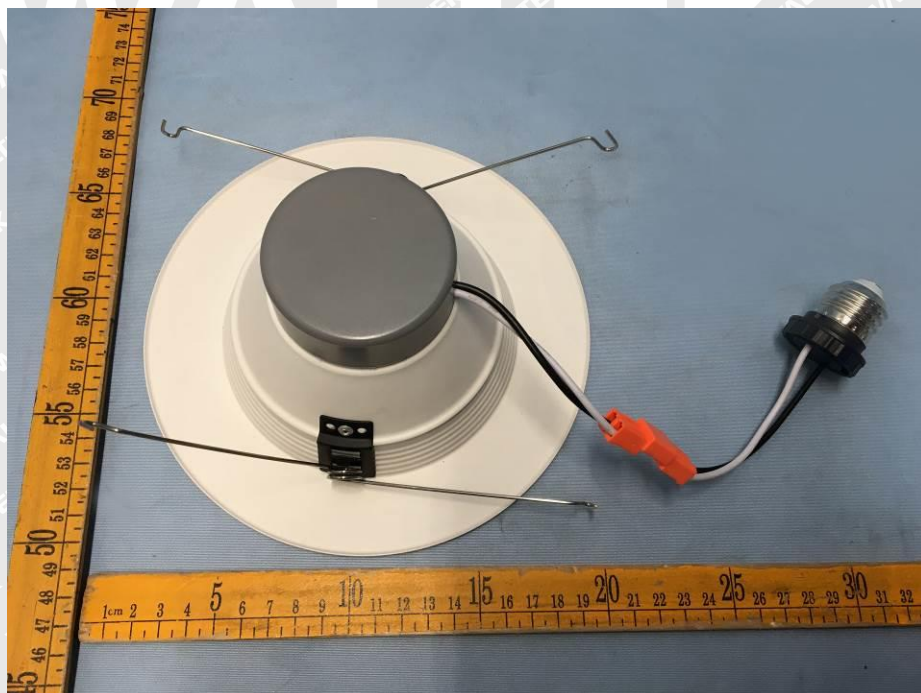
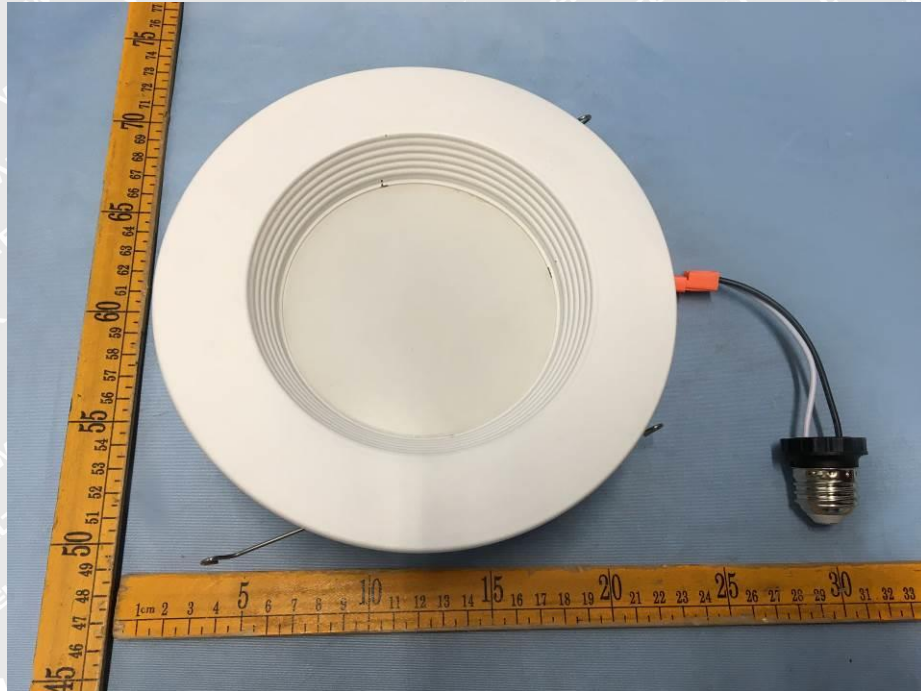


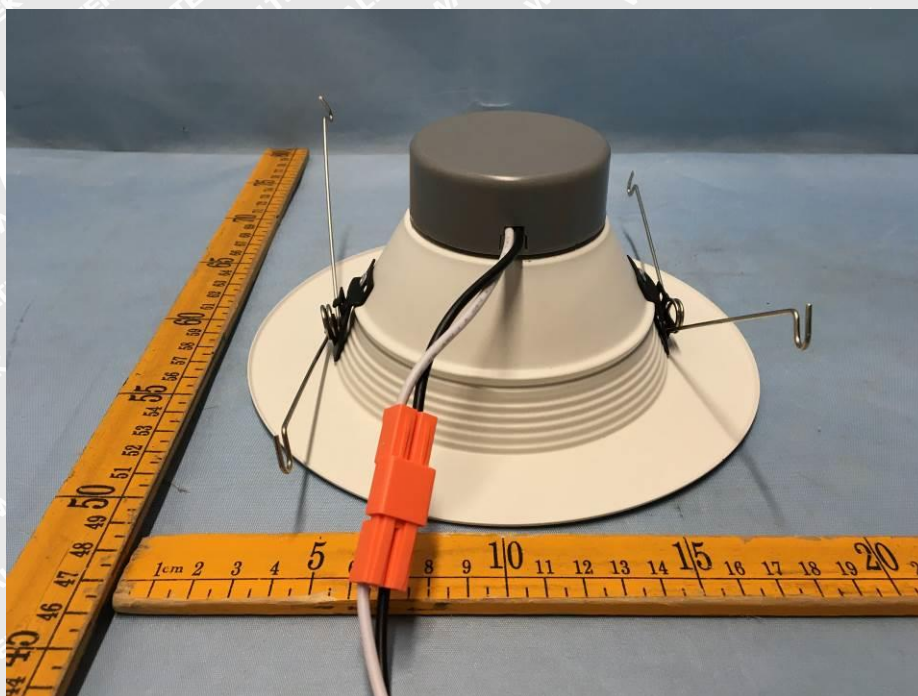
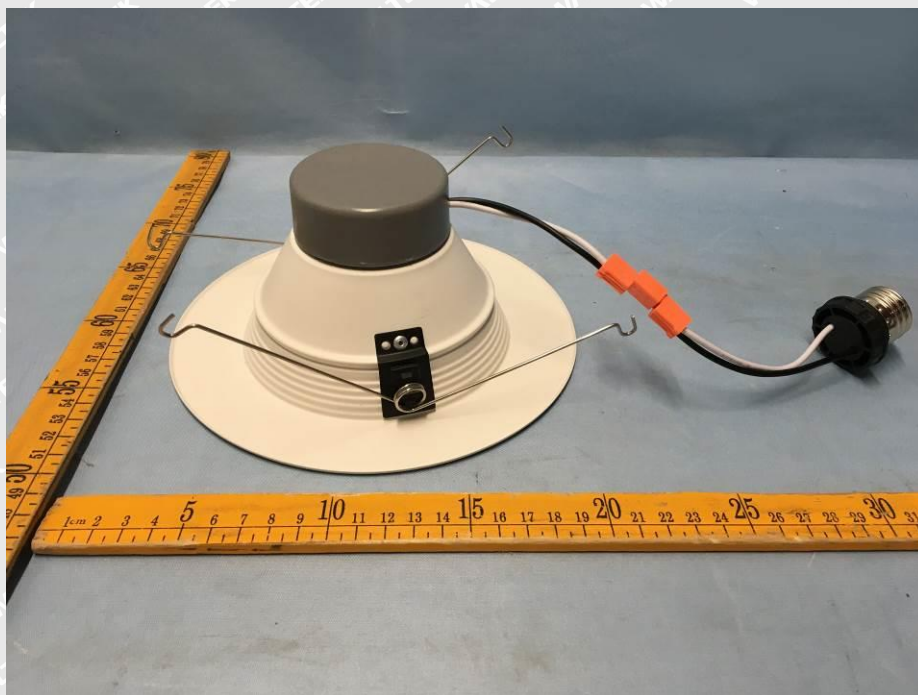
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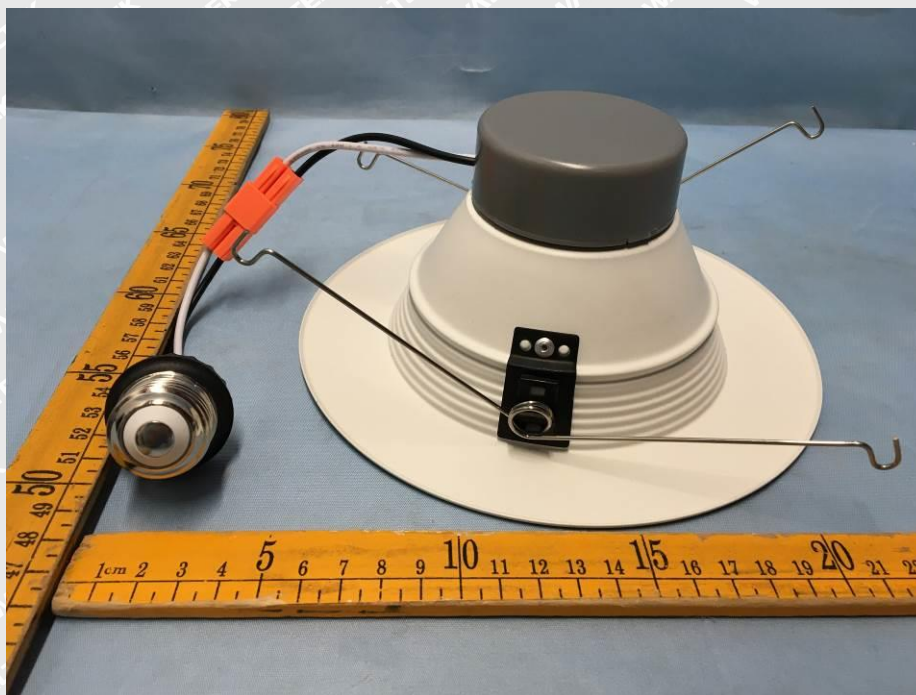


8 Photographs - Constructional Details

8.1 EUT - External View

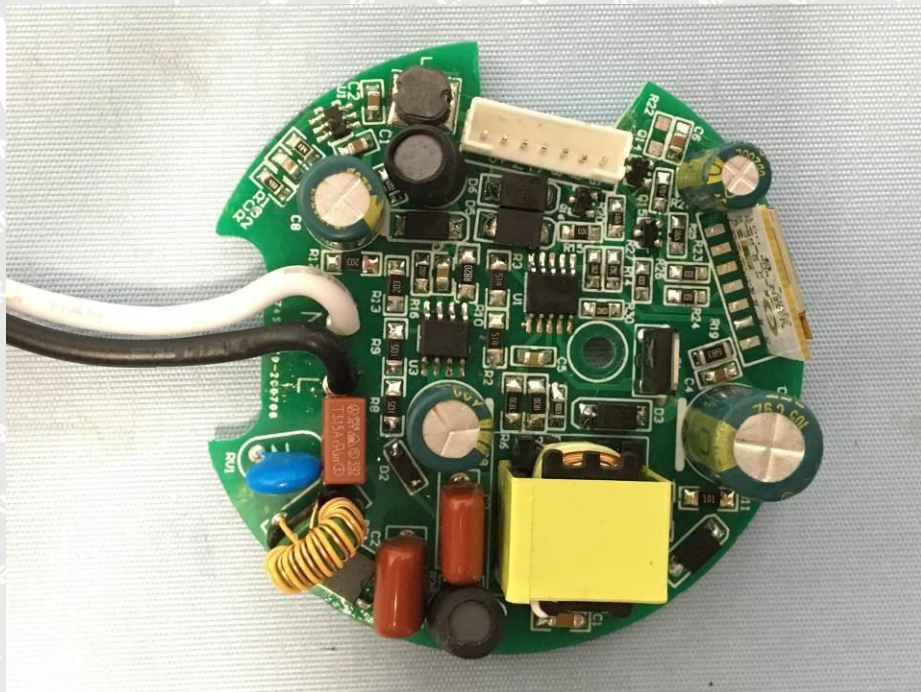
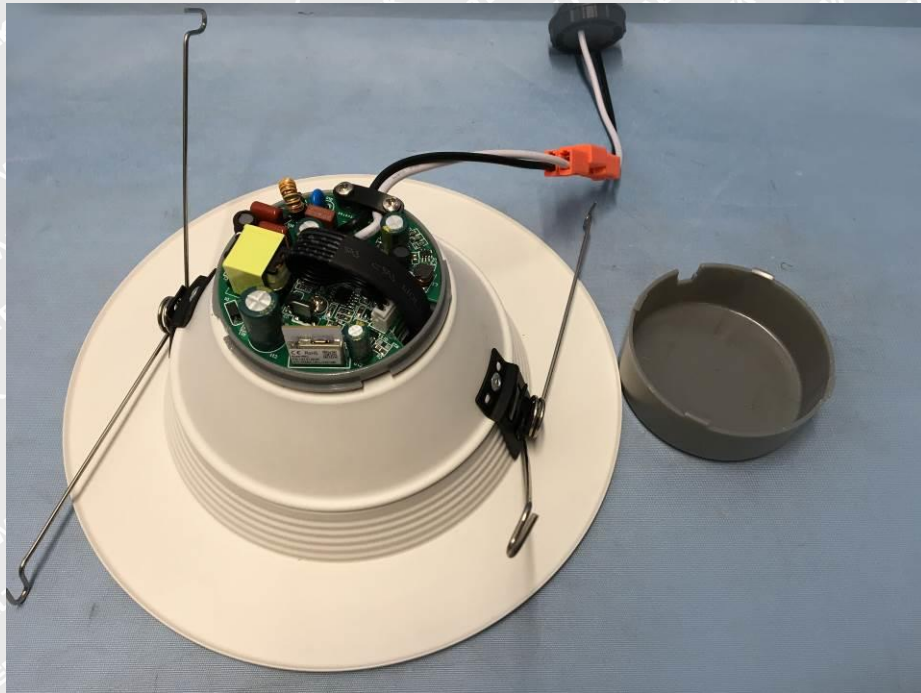


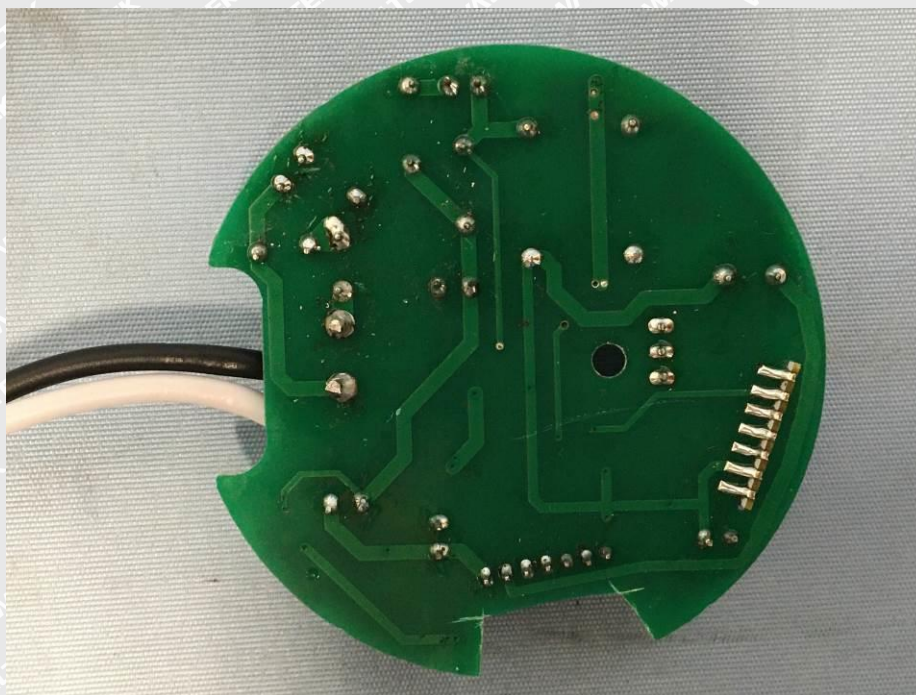


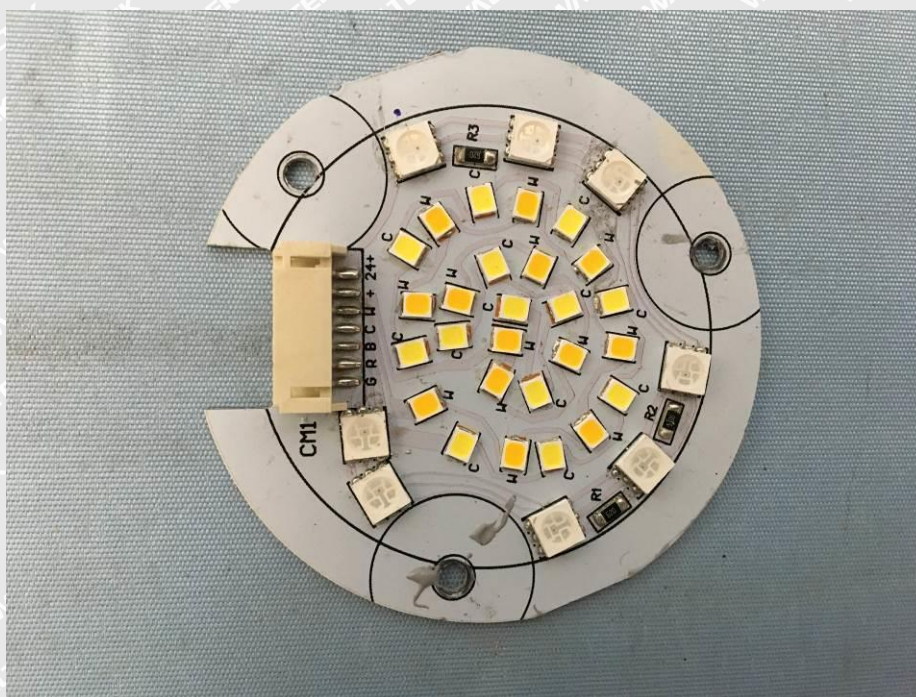


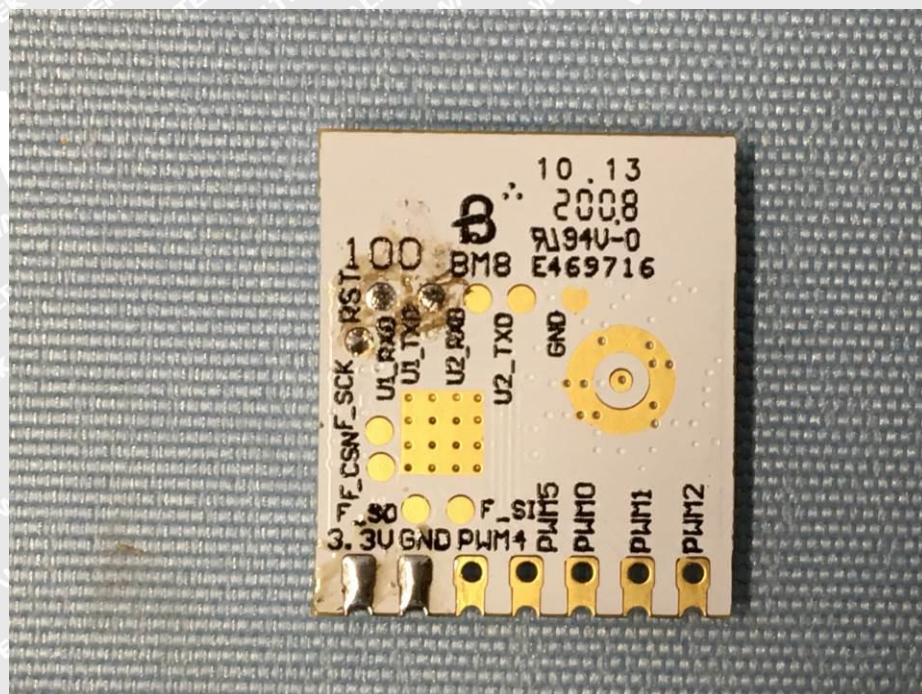


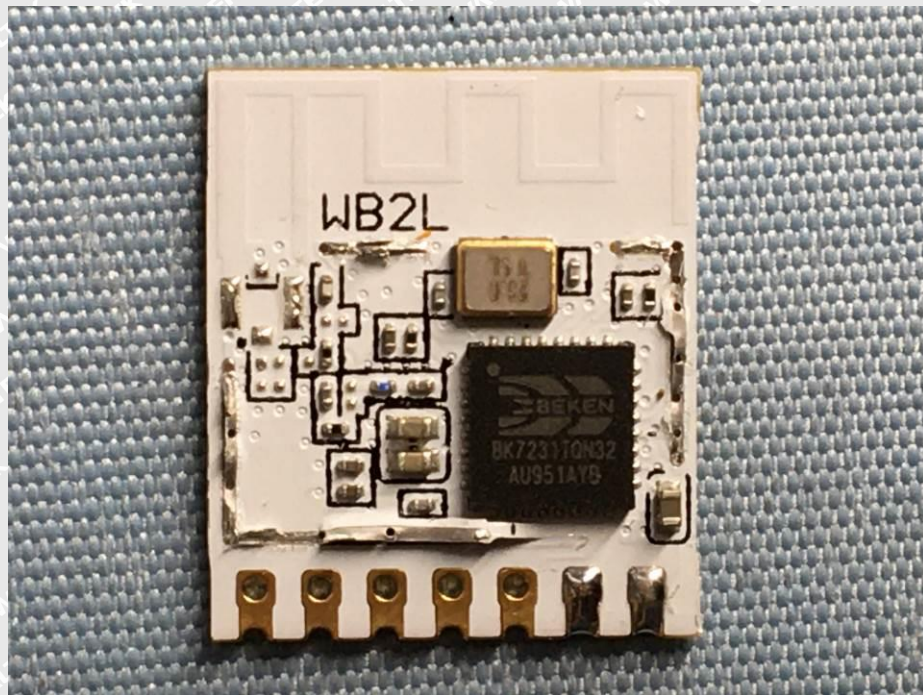
8.2 EUT - Internal View











=====End of Report=====

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