

# TEST REPORT

Report No.: SHE20040045-02GE

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**Applicant** : Shenzhen UniStrong Science & Technology Co.,Ltd.  
**Address of Applicant** : B,4-4Factory, Zhengcheng Road, Fuyong Baoan District, Shenzhen, China

**Product Name** : Rugged android tablet  
**Model No.** : UT56  
**Sample No.** : E20040045-01#01;  
E20040045-01#05  
**FCC ID** : 2AOPD-UT56  
**ISED Number** : 11546A-UT56

**Standards** : FCC CFR47 Part 15, Subpart C  
RSS-Gen (Issue 5, March 2019)  
RSS-247 (Issue 2, February 2017)

**Date of Receipt** : 2020-04-14  
**Date of Test** : 2020-04-27 ~ 2020-07-09  
**Date of Issue** : 2020-07-15

**Remark:**

*This report details the results of the testing carried out on one sample, the results contained in this report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.*

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Guoyou Chi  
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## Revision Record

Version	Date	Revisions	Revised By
1.0	2019-10-31	Original	--

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## 1 General Information

### 1.1 Testing Laboratory

Company Name	ICAS Testing Technology Services (Shanghai) Co., Ltd.
Address	155 Pingbei Rd, Minhang District, Shanghai, China
Telephone	0086 21-51682999
Fax	0086 21-54711112
Homepage	www.icasiso.com

### 1.2 Details of Application

Company Name	Shenzhen UniStrong Science & Technology Co.,Ltd.
Address	B,4-4Factory, Zhengcheng Road, Fuyong Baoan District, Shenzhen, China
Contact Person	Lili Zheng
Telephone	+86-21-54467182
Email	ll.zheng@unistrong.com

### 1.3 Details of EUT

Product Name	Rugged android Tablet
Brand Name	Unistrong
Model No.	UT56
FCC ID	2AOPD-UT56
ISED Number	11546A-UT56
Mode of Operation	WLAN 802.11b/g/n(HT20/40)
Frequency Range	2400MHz ~ 2483.5MHz
Channel Separation	5 MHz
Modulation Type	DSSS, OFDM
Antenna Type	Internal Antenna
Antenna Gain	-3.63 dBi
Extreme Temperature Range	-10°C ~ +55°C
Test Voltage	DC 3.8V

### 1.4 Test Methodology

47 CFR Part 15, Subpart C (10-1-16 Edition)	Miscellaneous Wireless Communications Services
KDB Publication 558074 D01 v05r02	15.247 Meas Guidance.
KDB Publication 662911 D01 v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g., MIMO, Smart Antenna, etc)
RSS-Gen	General Requirements for Compliance of Radio Apparatus

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(Issue 5, March 2019)	
RSS-247 (Issue 2, February 2017)	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

**Note(s):**

All test items were verified and recorded according to the standards and without any addition/deviation/exclusion during the test.

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## 2 Test Condition

### 2.1 Test Facility

### 2.2 Environmental conditions

Temperature (°C)	18-25
Humidity (%RH)	40-65
Barometric Pressure (mbar)	960-1060

### 2.3 Equipment List

Name of Equipment	Manufacturer	Model	Serial No.	Cal. Due Date
Spectrum Analyzer	Keysight	N9020B	MY59260184	2020-07-28
Spectrum Analyzer	Rohde & Schwarz	FSV40N	101450	2021-06-24
EMI Test Receiver	Rohde & Schwarz	ESPI3	100173	2021-06-19
EMI Test Receiver	Rohde & Schwarz	ESR 7	101911	2021-06-19
V-network	SCHWARZBECK	NSLK 8127	8127-902	2021-02-20
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	100687	2020-08-22
Broadband Antenna	SCHWARZBECK	VULB9163	9163-1037	2021-06-06
Horn Antenna-18G	SCHWARZBECK	BBHA9120D	9120D-1775	2021-06-06
Loop Antenna	SCHWARZBECK	FMZB 1513	N/A	2021-03-19
Horn Antenna-40G	YINGLIAN	LB-180400-KF	N/A	2020-07-26
EMC chamber 9*6*6 (L*W*H)	CHANGNING	966	N/A	2023-06-26
Shielded Enclosure 8*5*4 (L*W*H)	CHANGNING	854	N/A	2020-08-28
Test Software	BL	BL410_E	N/A	N/A

### 2.4 Measurement Uncertainty

Parameter	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	± 1.5 dB
	> 1GHz	± 1.5 dB
Radiated Emission	30 MHz – 1 GHz	± 3 dB
	> 1GHz	± 3 dB

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## 3 Test Set-up and Operation Modes

### 3.1 Details of Test Mode

Using test software was control EUT work in continuous transmitter and receiver mode. Select test channel as below:

For 802.11b/g/n (HT20)

Channel	Frequency
The lowest channel(CH1)	2412MHz
The middle channel(CH6)	2437MHz
The Highest channel(CH11)	2462MHz

For 802.11n(HT40)

Channel	Frequency
The lowest channel(CH3)	2422MHz
The middle channel(CH6)	2437MHz
The Highest channel(CH9)	2452MHz

Through Pre-scan under all rate at lowest channel, the data rate as below table described is the worst case, so we choose these data rate for test.

Type	Data rate
802.11b	5.5Mbps
802.11g	48Mbps
802.11n(20M)	MCS7
802.11n(40M)	MCS3

The basic operation modes are:

- A. On
  - 1. WLAN mode
    - a. Transmitting
      - i. Low Channel
      - ii. Middle Channel
      - iii. High Channel
    - b. Receiving
- B. Standby
- C. Off

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## 3.2 Special Accessories and Auxiliary Equipment

Description	Manufacturer	Model No.	Serial No.
N/A	N/A	N/A	N/A

## 3.3 Support Software

Description	Manufacturer	Software Name
N/A	N/A	N/A



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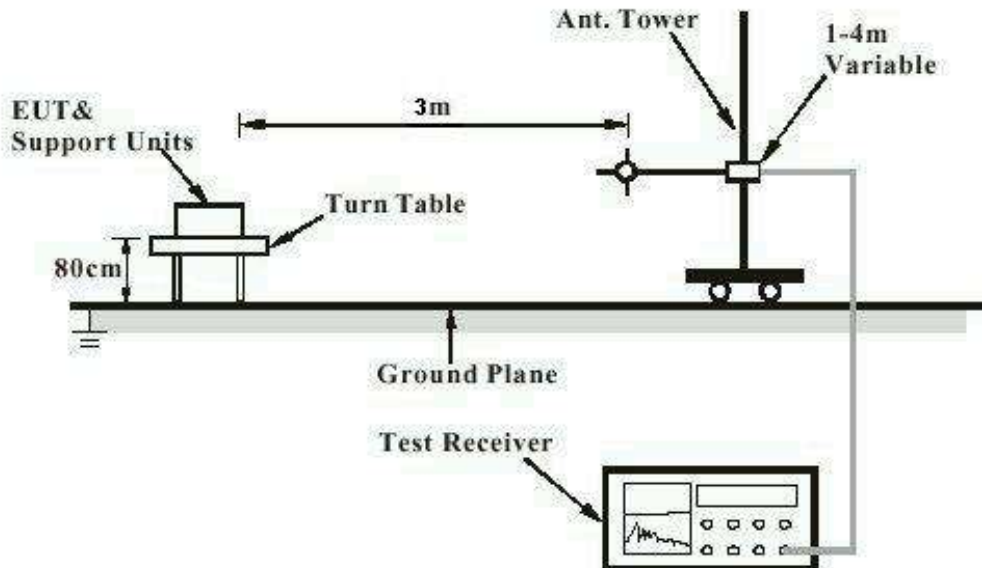
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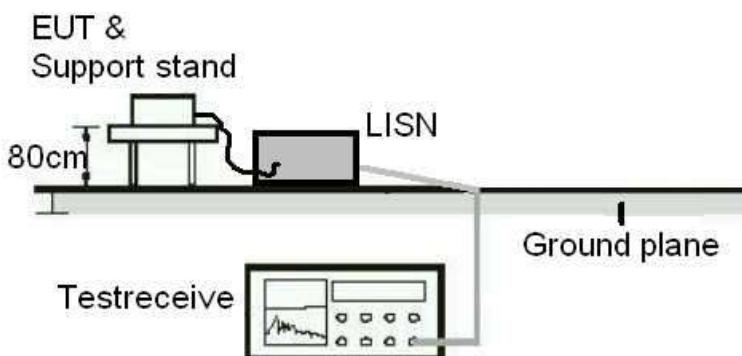
## 3.4 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Conduction Measurement



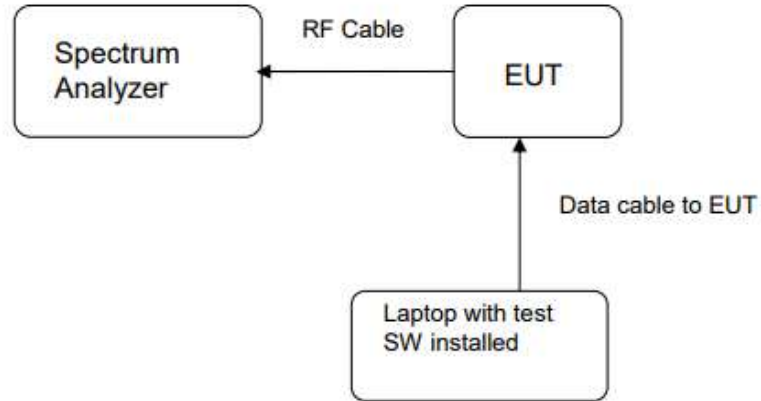
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## Diagram of Measurement Equipment Configuration for Transmitter Measurement



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## 4 Test Results

### 4.1 Transmitter Requirement & Test Suites

#### 4.1.1 Antenna Requirement

RESULT:

**PASS**

Test standard : FCC Part 15.247(b)(4), Part 15.203  
RSS-247 5.4(6)

Requirement : The use of approved antennas only with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of -3.63 dBi. The antenna is an internal antenna with no possibility of replacement with a non-approved antenna by the end-user.

Therefore, the EUT is considered to comply with this provision.

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## 4.1.2 Peak Output Power and E.I.R.P

RESULT:

**PASS**

Test standard : FCC Part 15.247(b)(3)  
 RSS-247 5.4(4)  
 Requirement : ANSI C63.10-2013, KDB 558074  
 Kind of test site : Shielded room

### Test setup

Test Channel : Low/Middle/High  
 Operation Mode : A.1.a  
 Ambient temperature : 25°C  
 Relative humidity : 52%

**Table 1: Peak Output Power**

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(mW)	
802.11b	2412	13.27	21.23	< 1
	2437	14.66	29.24	
	2462	14.59	28.77	
802.11g	2412	13.02	20.04	
	2437	14.36	27.29	
	2462	14.26	26.67	
802.11n(HT20)	2412	12.81	19.10	
	2437	14.13	25.88	
	2462	13.93	24.72	
802.11n(HT40)	2422	13.28	21.28	
	2437	14.24	26.55	
	2452	13.76	23.77	

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Table 2: E.I.R.P

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(mW)	
802.11b	2412	9.64	9.20	< 4
	2437	11.03	12.68	
	2462	10.96	12.47	
802.11g	2412	9.39	8.69	
	2437	10.73	11.83	
	2462	10.63	11.56	
802.11n(HT20)	2412	9.18	8.28	
	2437	10.50	11.22	
	2462	10.30	10.72	
802.11n(HT40)	2422	9.65	9.23	
	2437	10.61	11.51	
	2452	10.13	10.30	

Duty cycle factor =  $10 \cdot \log(1/\text{duty cycle})$

802.11b > 98%



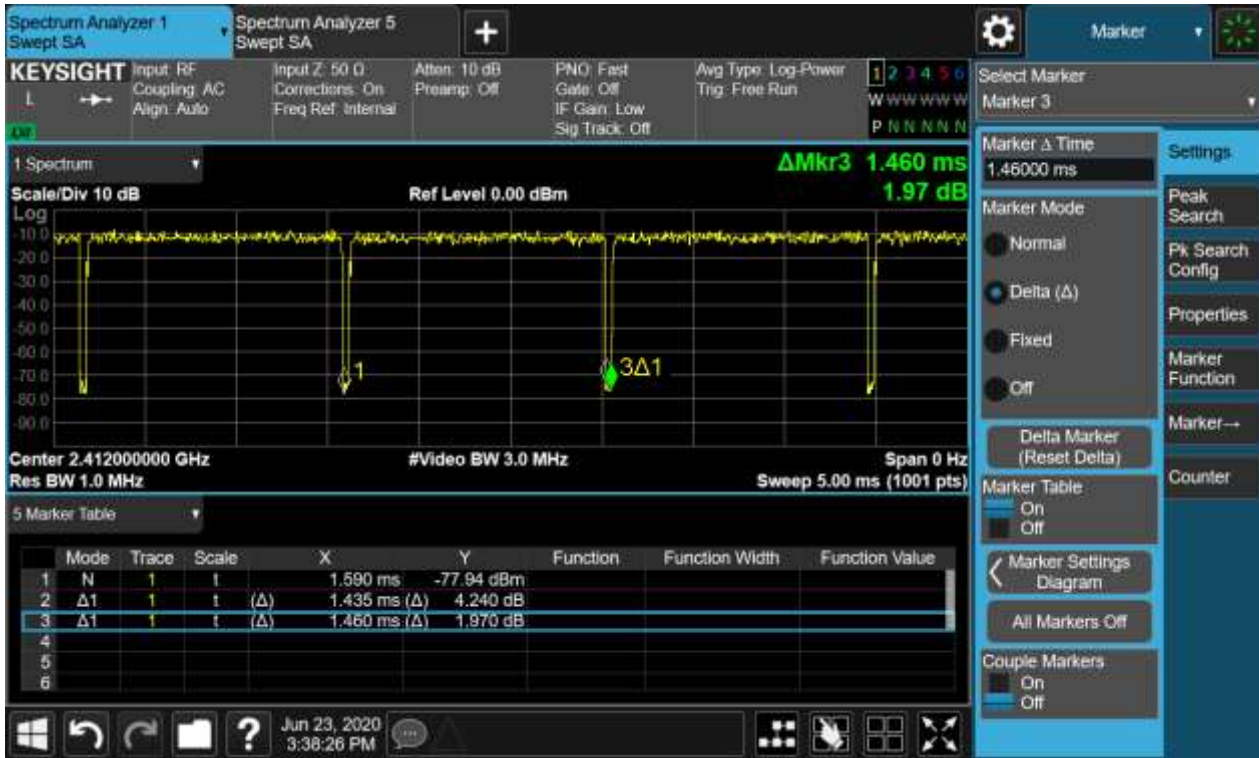
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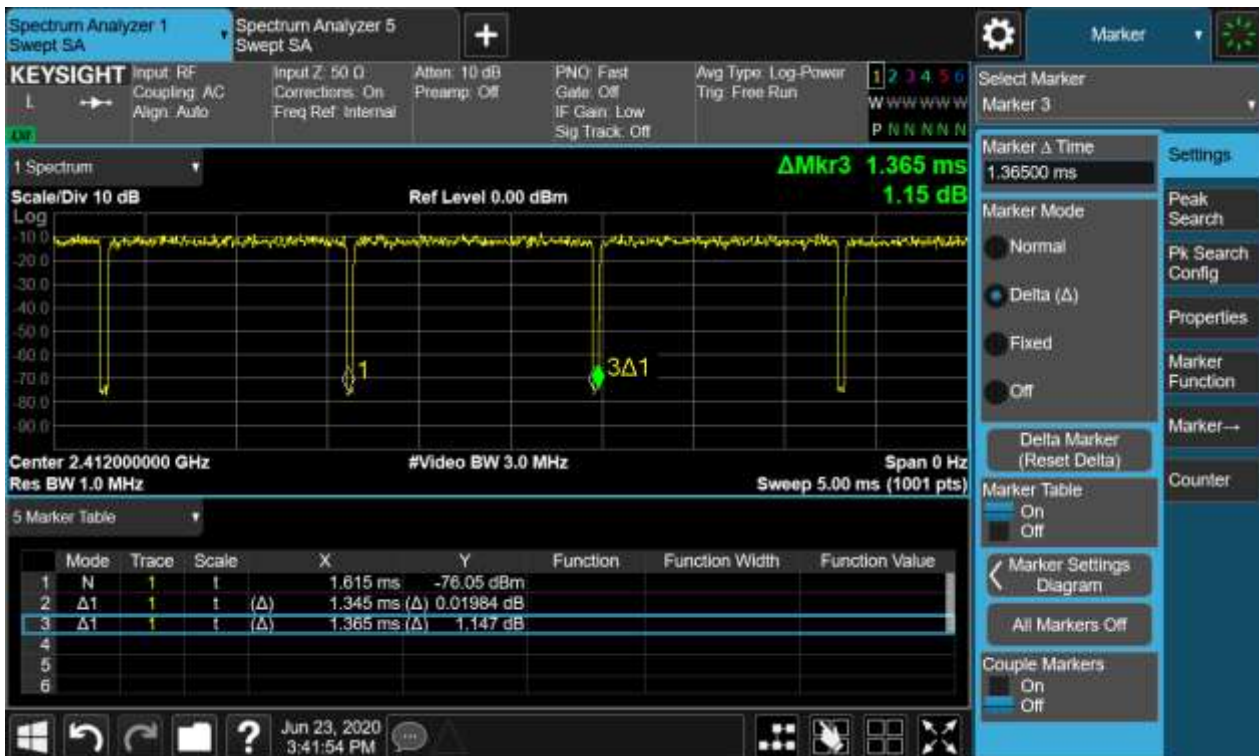
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802.11g > 98%



802.11n20 > 98%



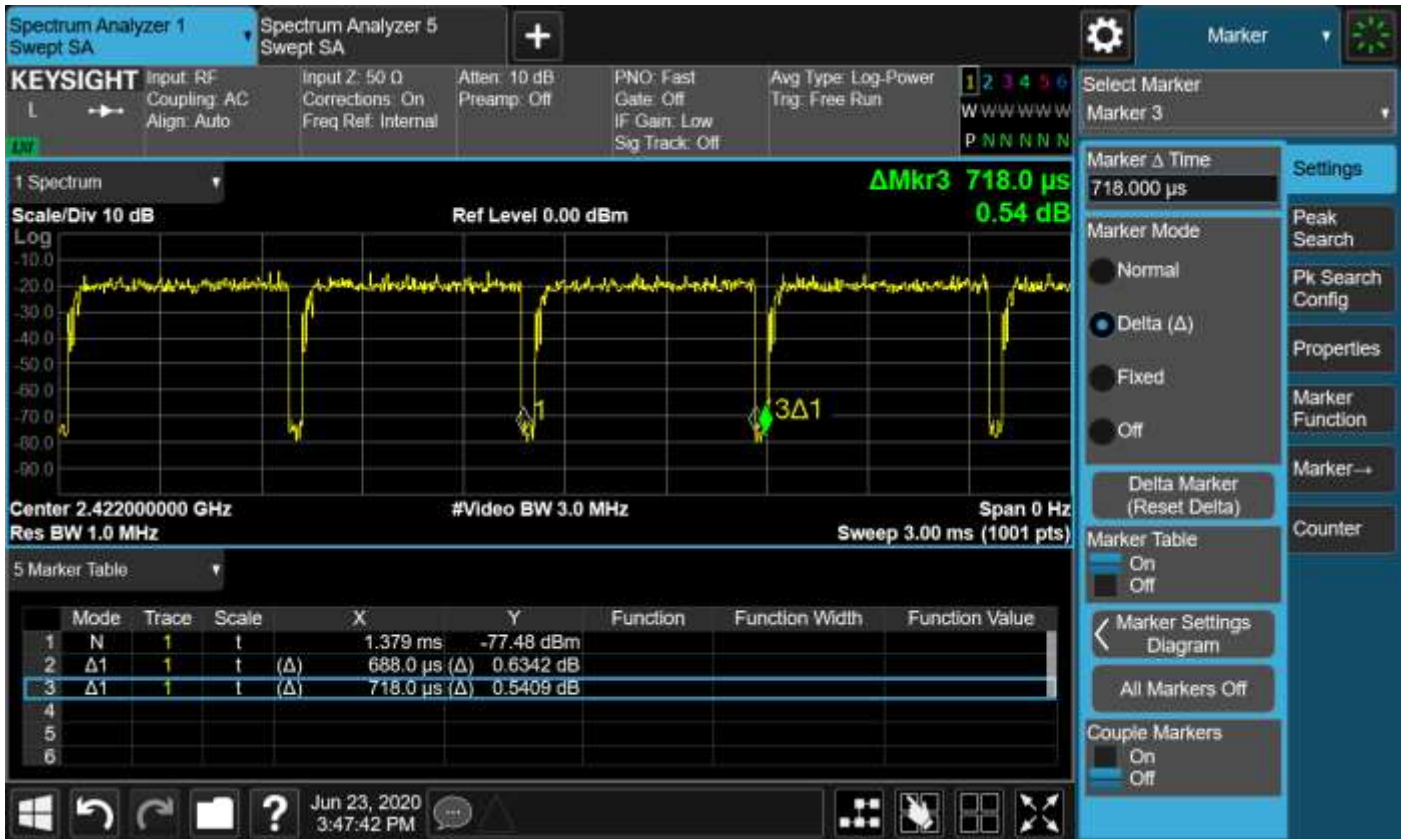
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$$802.11n40=10*\log(1/(688.4/7))=0.186$$



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## 4.1.3 6dB Bandwidth and 99% Bandwidth

RESULT:

**PASS**

Test standard : FCC Part 15.247(a)(2)  
 RSS-247 5.2(1)  
 RSS-Gen 6.6

Requirement : ANSI C63.10-2013, KDB 558074

Kind of test site : Shielded room

### Test setup

Test Channel : Low/Middle/High

Operation Mode : A.1.a

Ambient temperature : 25°C

Relative humidity : 52%

**Table 3: 6dB Bandwidth and 99% Bandwidth**

Test Mode	Test Channel (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth Limit (MHz)
802.11b	2412	8.104	12.429	0.5
	2437	7.331	11.987	
	2462	7.615	12.567	
802.11g	2412	14.216	16.243	
	2437	14.496	16.215	
	2462	15.742	16.286	
802.11n(HT20)	2412	15.684	17.512	
	2437	15.068	17.352	
	2462	15.111	17.519	
802.11n(HT40)	2422	33.399	36.094	
	2437	20.180	35.218	
	2452	35.761	36.123	



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Figure 1: 6dB Bandwidth and 99% Bandwidth, 802.11b, 2412MHz



Figure 2: 6dB Bandwidth and 99% Bandwidth, 802.11b, 2437MHz



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Figure 3: 6dB Bandwidth and 99% Bandwidth, 802.11b, 2462MHz



Figure 4: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2412MHz



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Figure 5: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2437MHz



Figure 6: 6dB Bandwidth and 99% Bandwidth, 802.11g, 2462MHz



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Figure 7: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2412MHz

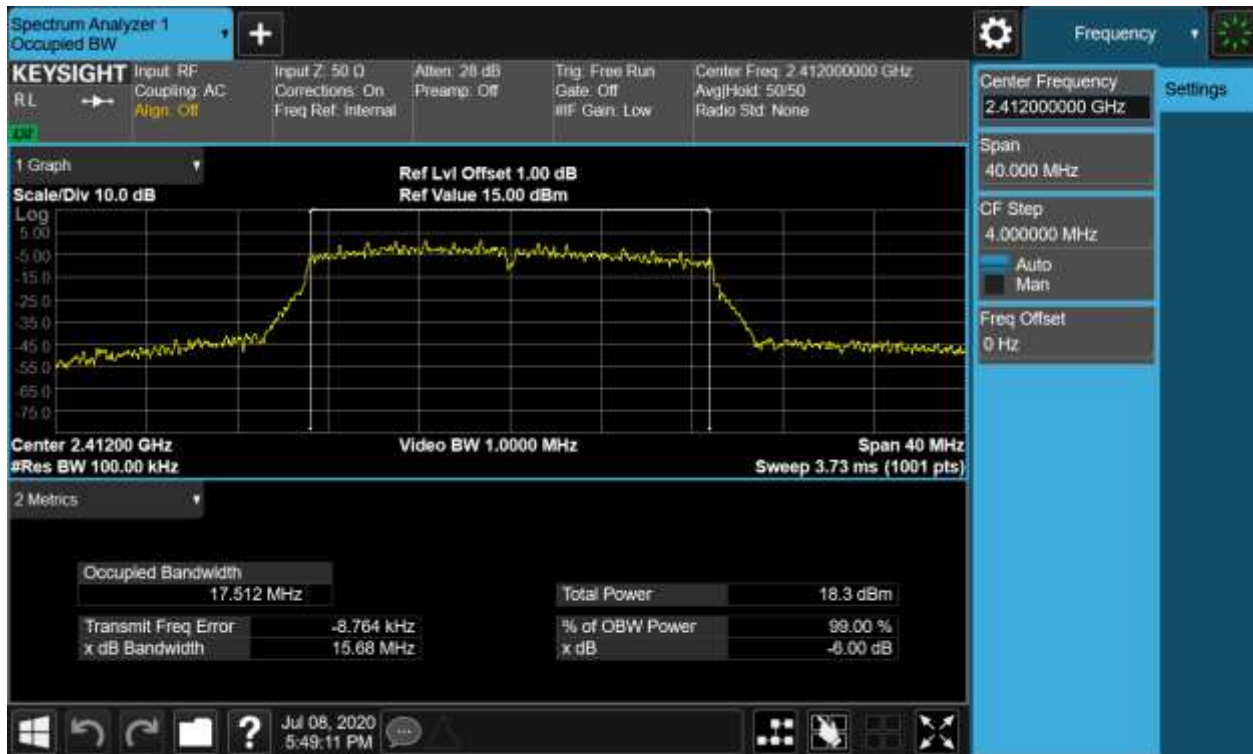


Figure 8: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2437MHz





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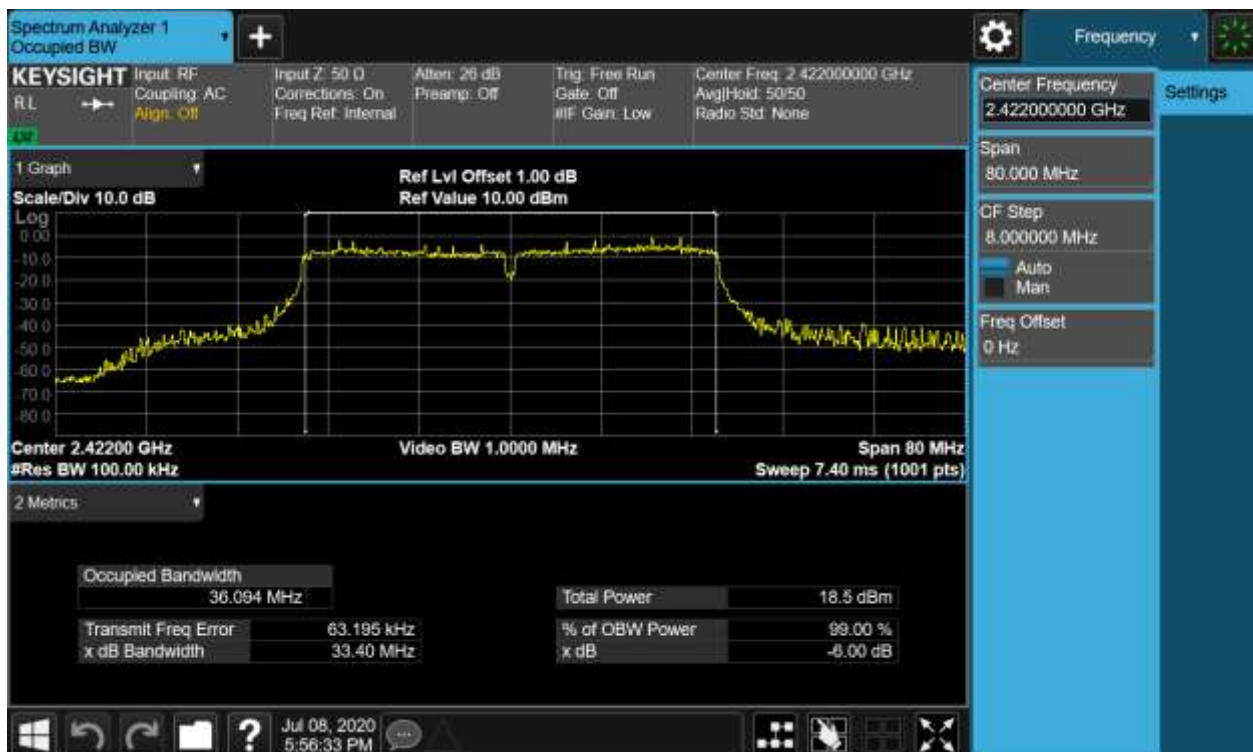
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Figure 9: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT20), 2462MHz



Figure 10: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2422MHz



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Figure 11: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2437MHz

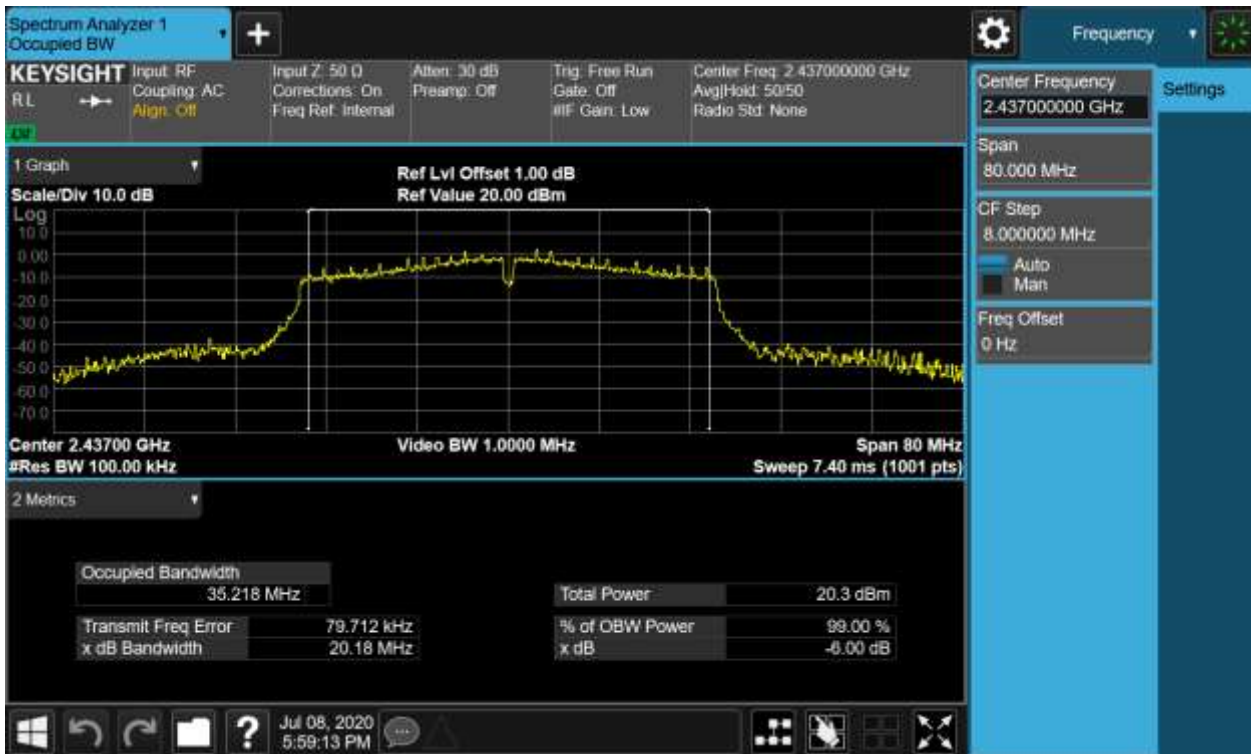
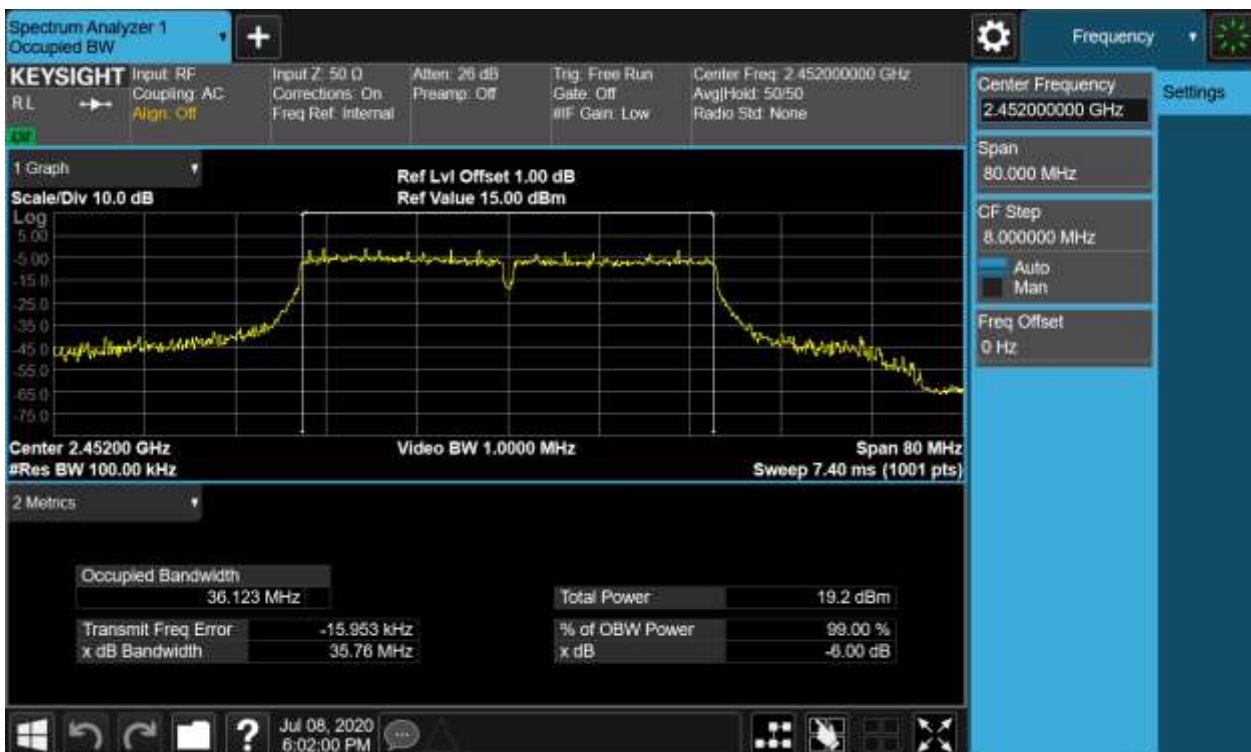


Figure 12: 6dB Bandwidth and 99% Bandwidth, 802.11n(HT40), 2452MHz



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## 4.1.4 Power Spectral Density

### RESULT:

**PASS**

Test standard : FCC Part 15.247(e)  
RSS-247 5.2(2)  
Requirement : ANSI C63.10-2013, KDB 558074  
Kind of test site : Shielded room

### Test setup

Test Channel : Low/Middle/High  
Operation Mode : A.1.a  
Ambient temperature : 25°C  
Relative humidity : 52%

**Table 4: Power Spectral Density**

Test Mode	Test Channel (MHz)	Measured Result (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	2412	-12.741	8
	2437	-11.742	
	2462	-12.445	
802.11g	2412	-14.918	
	2437	-13.405	
	2462	-13.842	
802.11n(HT20)	2412	-14.698	
	2437	-12.670	
	2462	-13.704	
802.11n(HT40)	2422	-16.866	
	2437	-13.865	
	2452	-16.937	

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Figure 13: Power Spectral Density, 802.11b, 2412MHz



Figure 14: Power Spectral Density, 802.11b, 2437MHz





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Figure 15: Power Spectral Density, 802.11b, 2462MHz



Figure 16: Power Spectral Density, 802.11g, 2412MHz



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Figure 17: Power Spectral Density, 802.11g, 2437MHz



Figure 18: Power Spectral Density, 802.11g, 2462MHz



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Figure 19: Power Spectral Density, 802.11n(HT20), 2412MHz

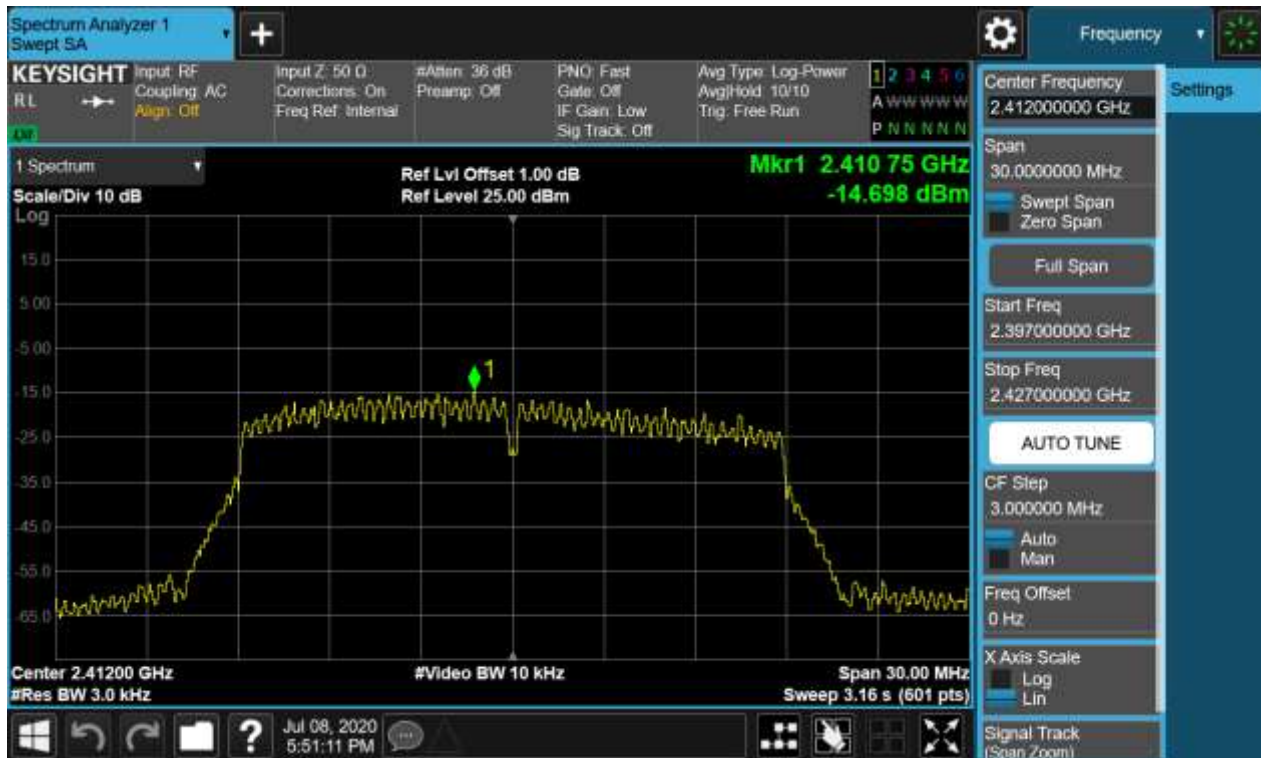


Figure 20: Power Spectral Density, 802.11n(HT20), 2437MHz





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Figure 21: Power Spectral Density, 802.11n(HT20), 2462MHz

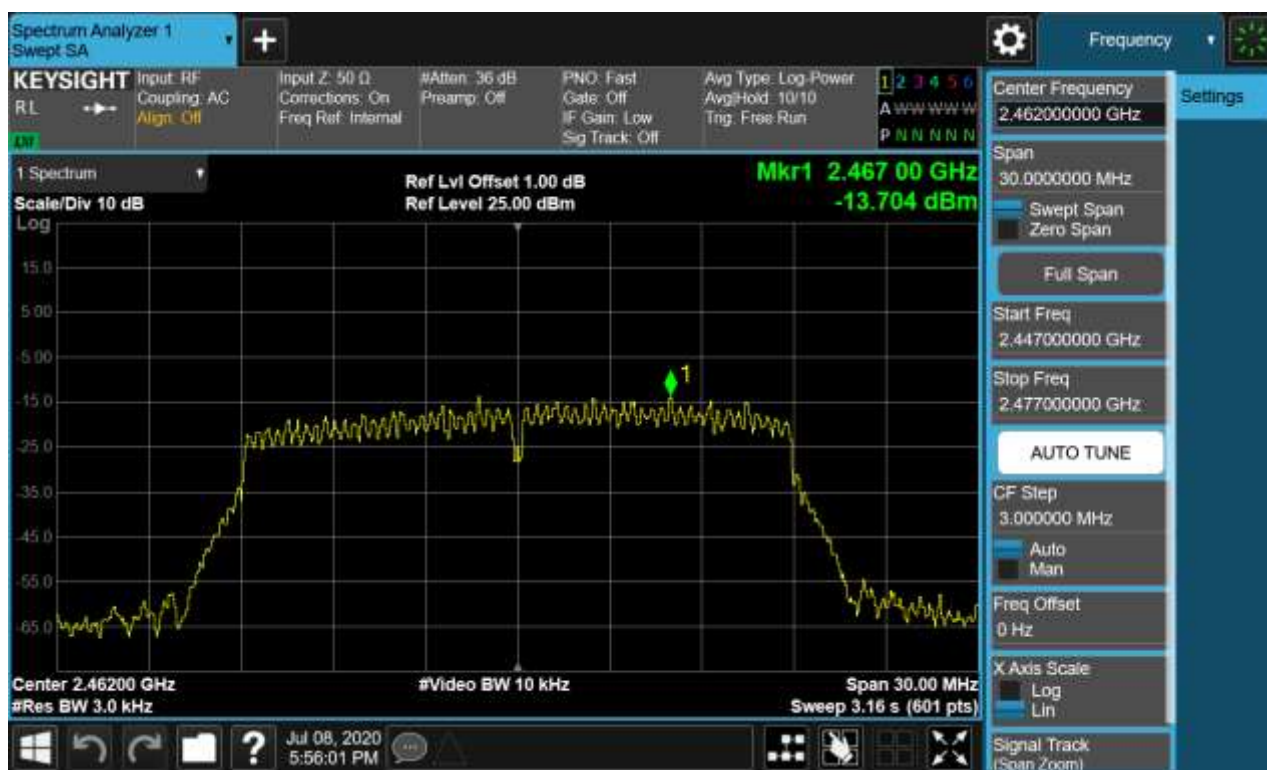


Figure 22: Power Spectral Density, 802.11n(HT40), 2422MHz



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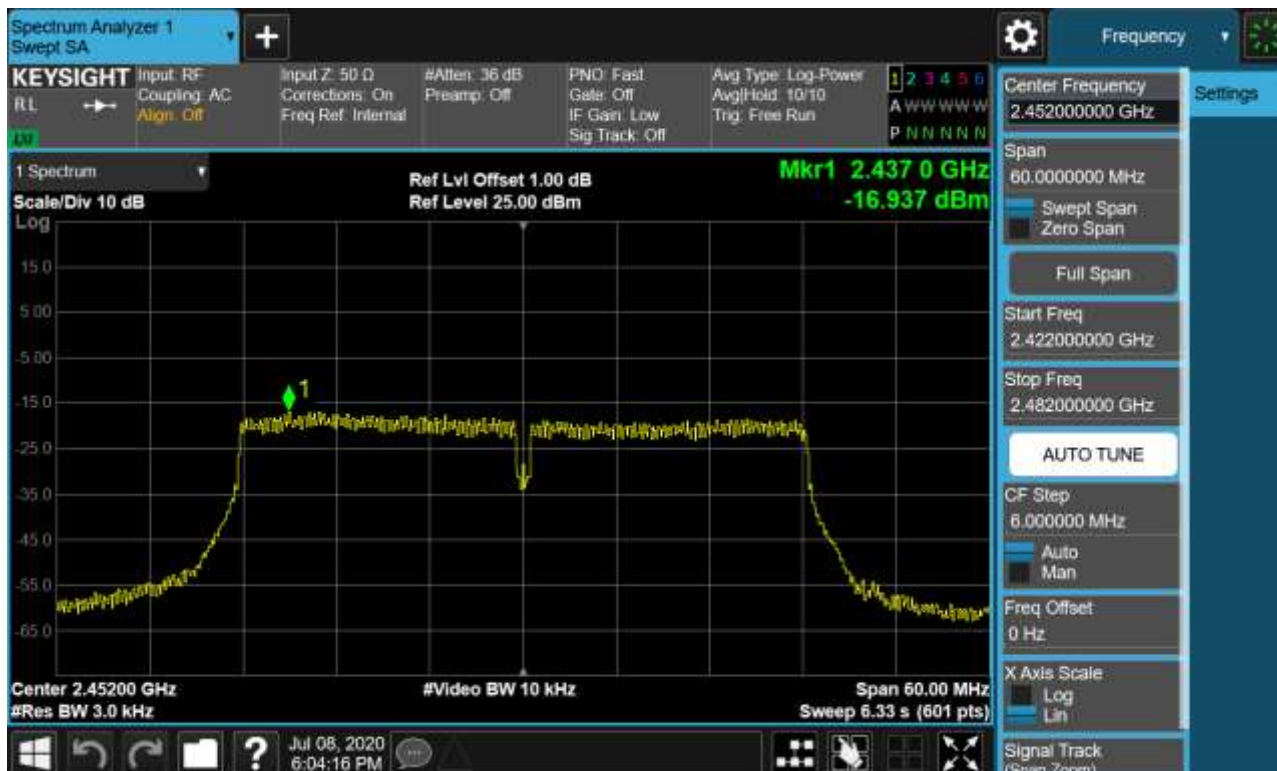
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Figure 23: Power Spectral Density, 802.11n(HT40), 2437MHz



Figure 24: Power Spectral Density, 802.11n(HT40), 2452MHz



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## 4.1.5 Conducted Spurious Emission & Authorized-band band-edge

RESULT:

**PASS**

Test standard : FCC Part 15.247(d), 15.209  
RSS-247 5.5  
RSS-Gen 8.9  
Requirement : ANSI C63.10-2013, KDB 558074  
Kind of test site : Shielded room

### Test setup

Test Channel : Low/Middle/High for spurious, Low/High for Band  
Edge  
Operation Mode : A.1.a  
Ambient temperature : 25°C  
Relative humidity : 52%

For details refer to following test plot.

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Figure 25: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2412MHz Carrier Level



## Band Edge





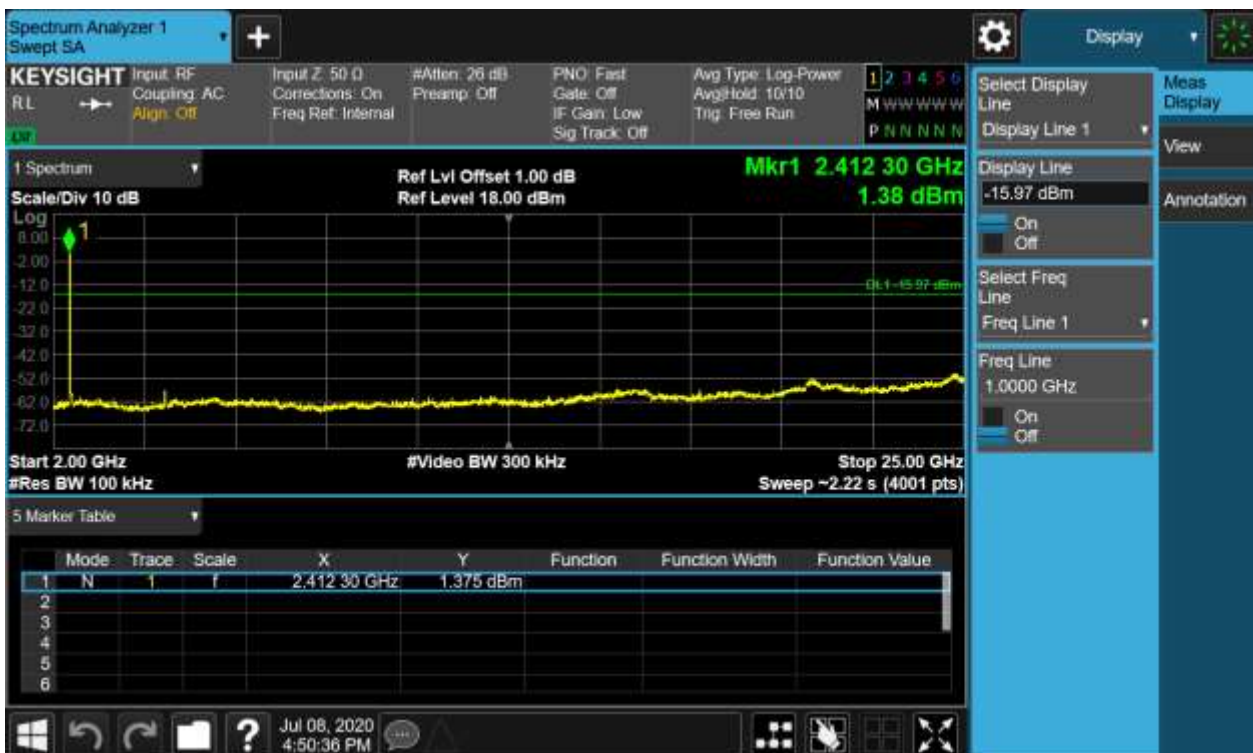
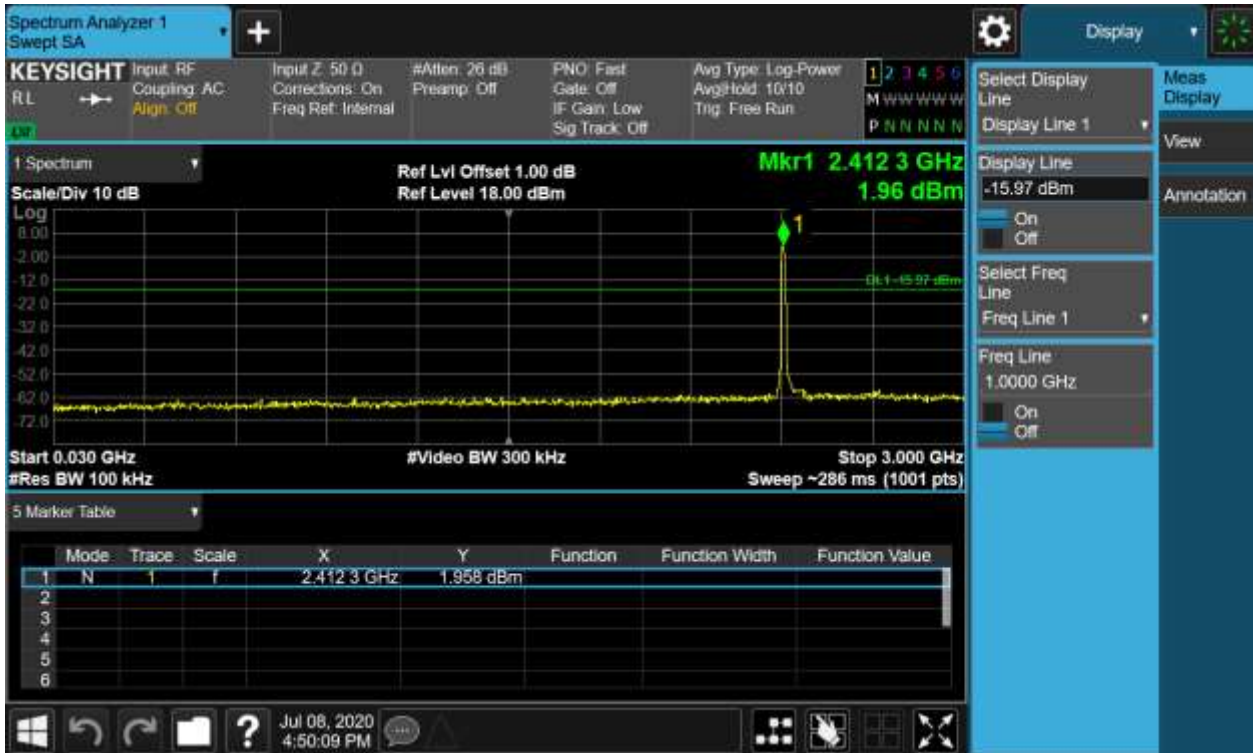
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## Conducted spurious emissions 30MHz-25GHz





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Figure 26: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2437MHz Carrier Level



Conducted spurious emissions 30MHz-25GHz

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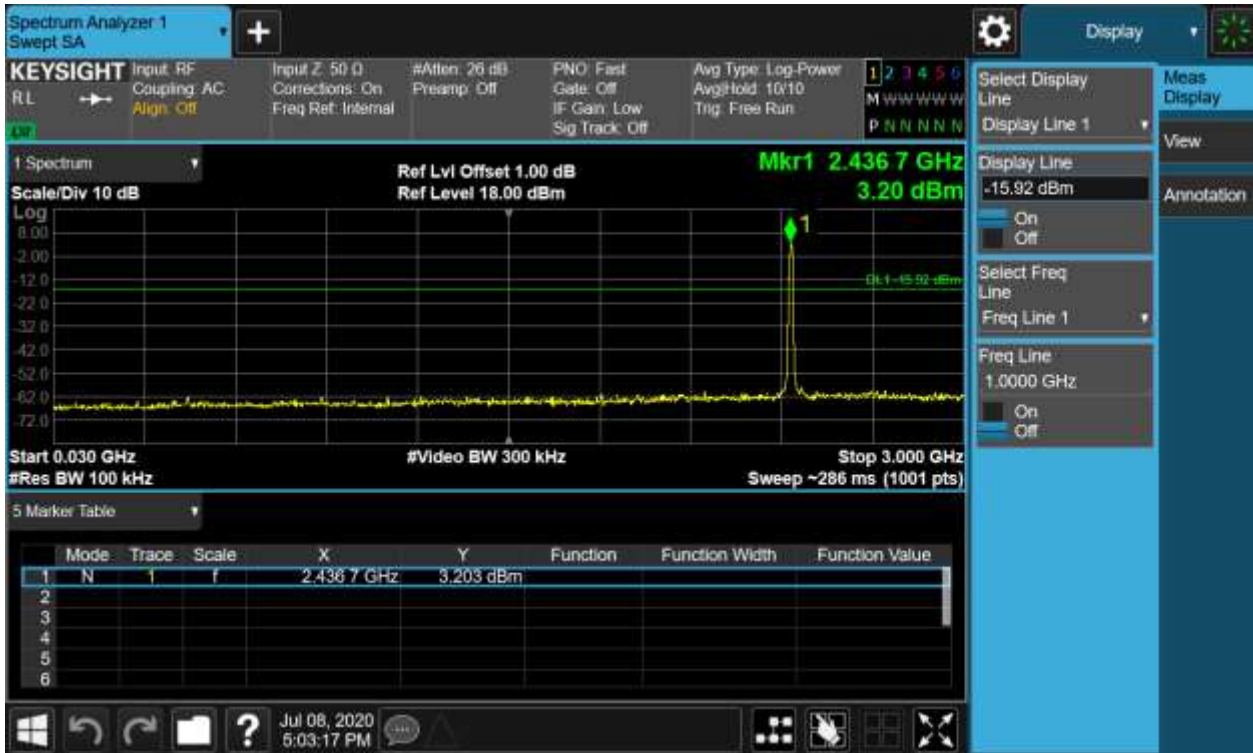


Figure 27: Conducted Spurious Emission & Authorized-band band-edge, 802.11b, 2462MHz Carrier Level

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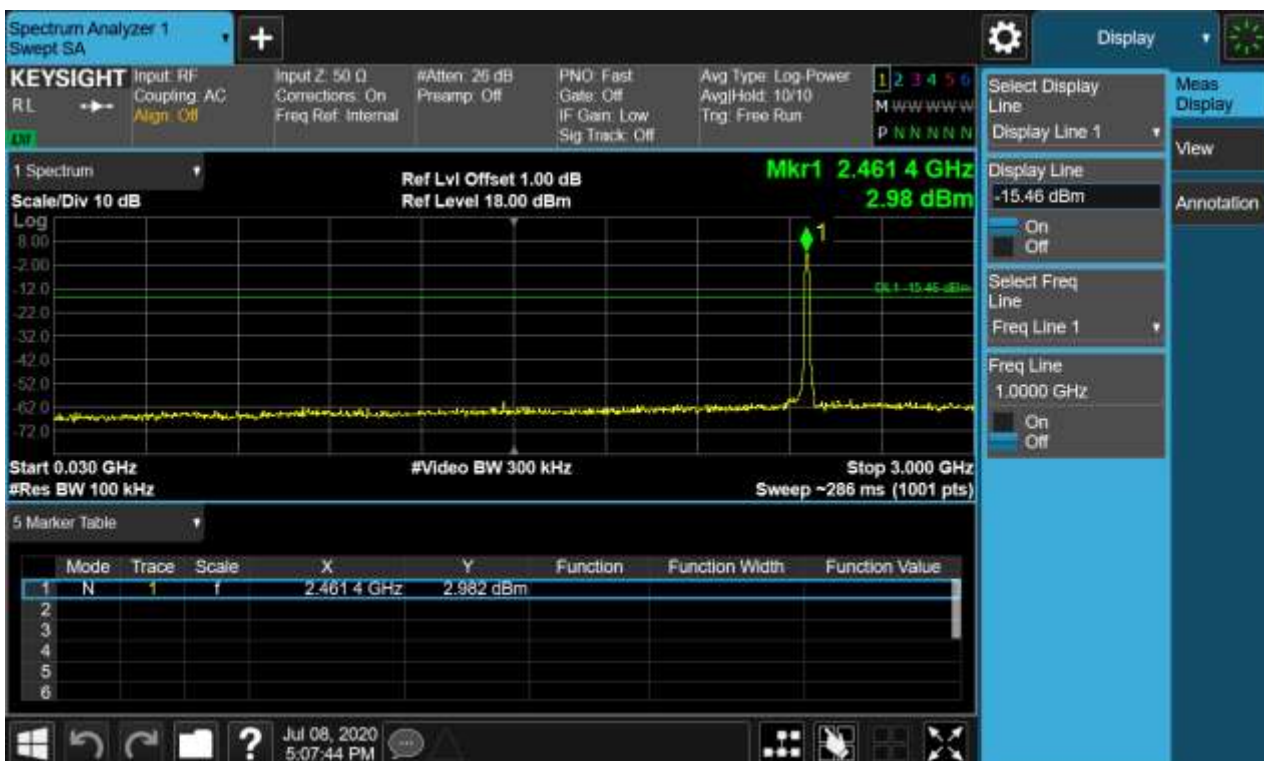
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## Band Edge



## Conducted spurious emissions 30MHz-25GHz





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Figure 28: Conducted Spurious Emission & Authorized-band band-edge, 802.11g, 2412MHz Carrier Level



## Band Edge



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## Conducted spurious emissions 30MHz-25GHz



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Figure 29: Conducted Spurious Emission & Authorized-band band-edge, 802.11g, 2437MHz Carrier Level



Conducted spurious emissions 30MHz-25GHz



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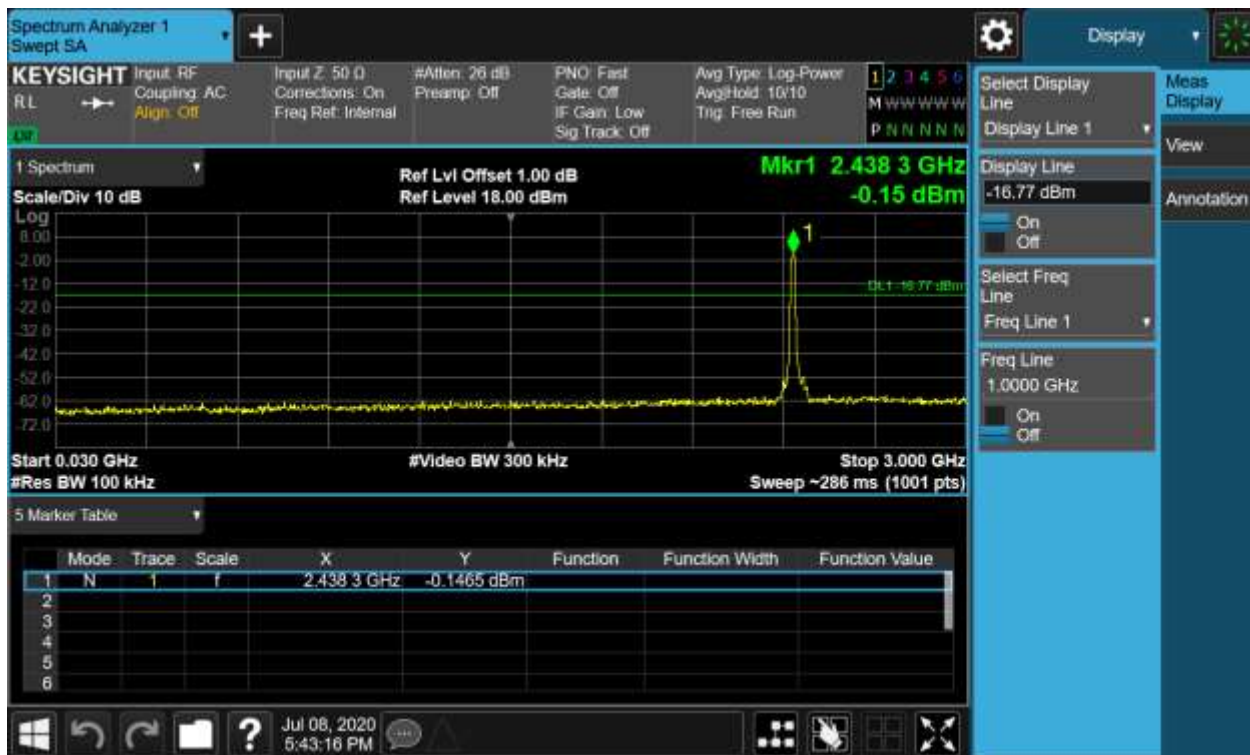


Figure 30: Conducted Spurious Emission & Authorized-band band-edge, 802.11g, 2462MHz Carrier Level

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## Band Edge



Conducted spurious emissions 30MHz-25GHz

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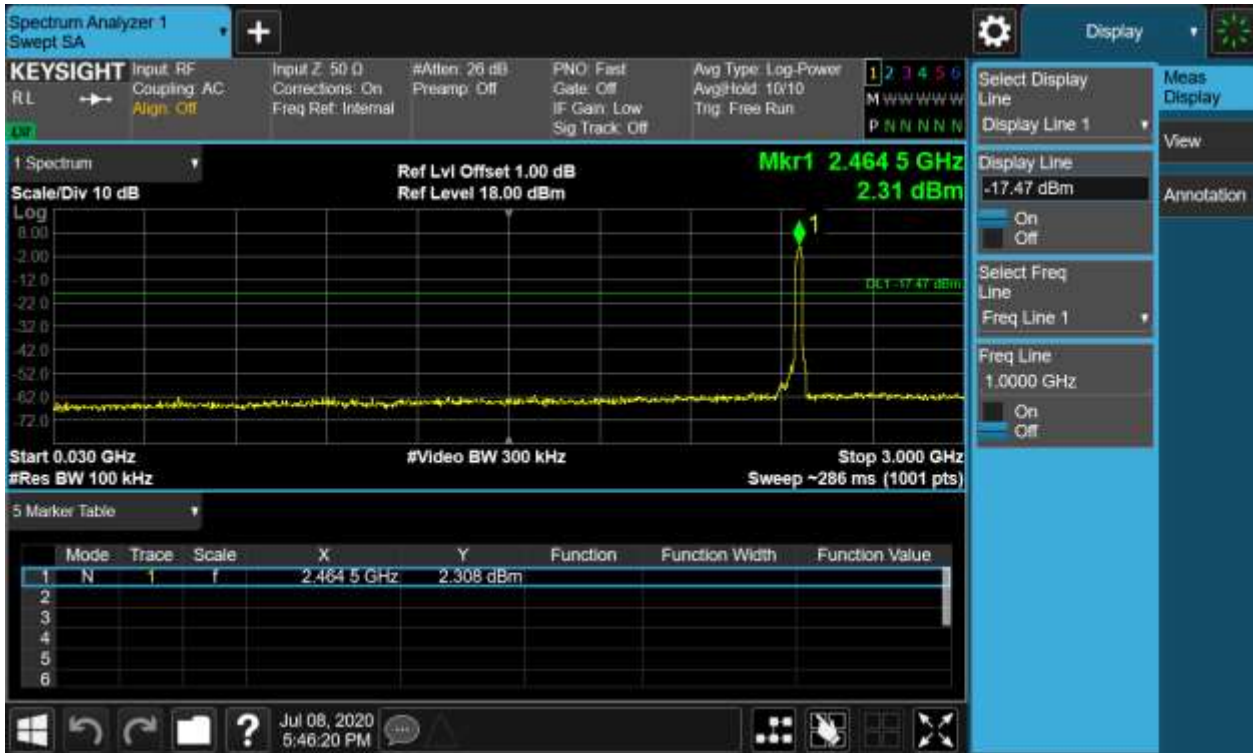


Figure 31: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT20), 2412MHz Carrier Level



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## Band Edge



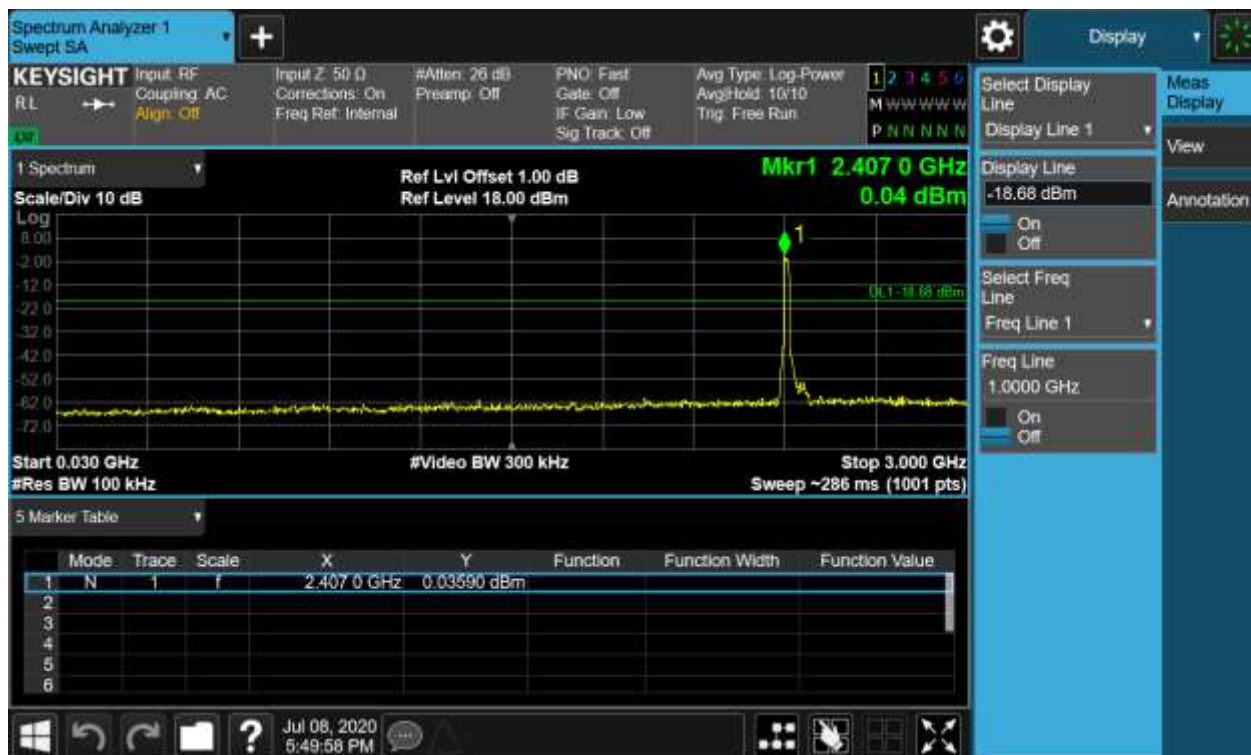
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## Conducted spurious emissions 30MHz-25GHz



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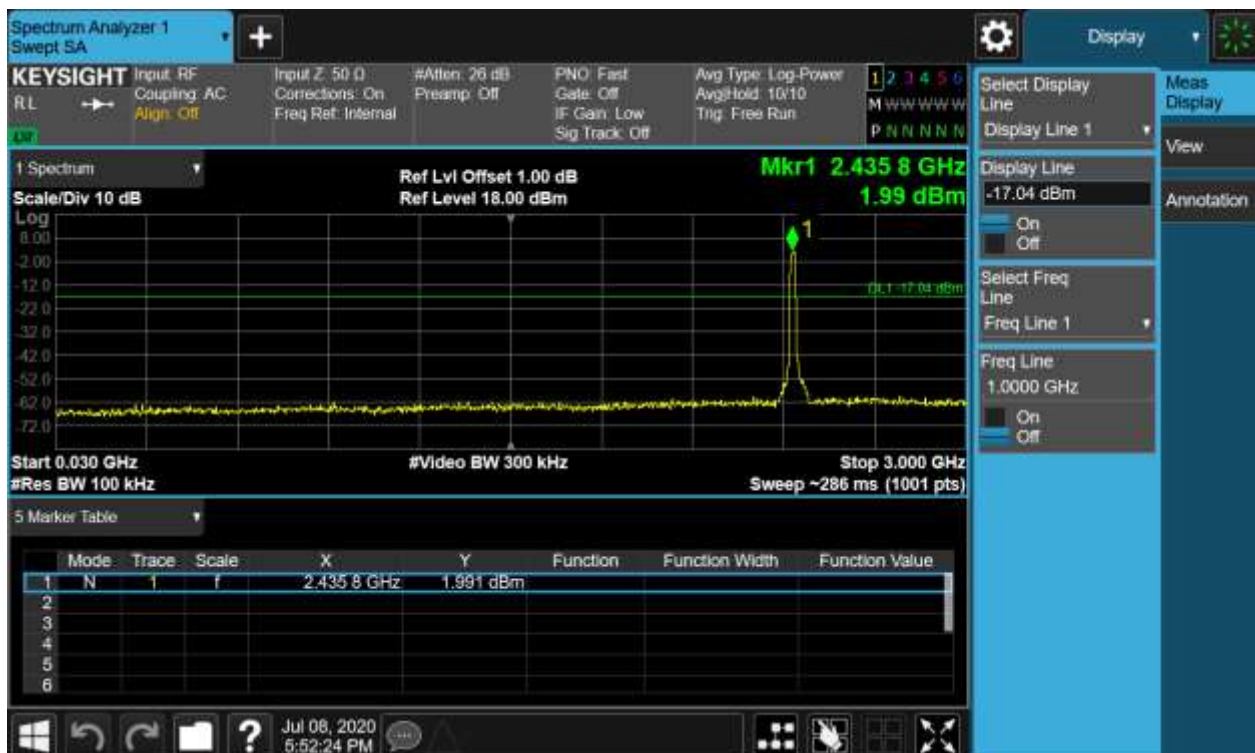
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Figure 32: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT20), 2437MHz Carrier Level



Conducted

spurious emissions 30MHz-25GHz





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Figure 33: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT20), 2462MHz Carrier Level



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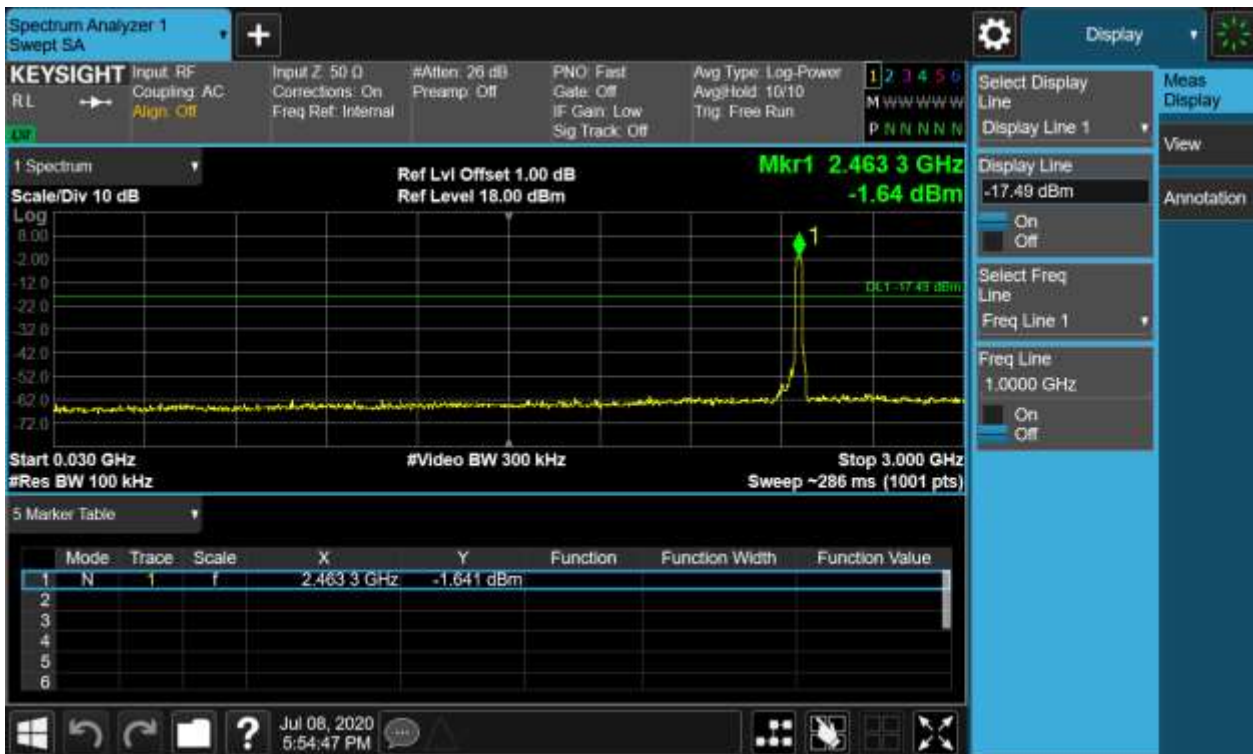
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## Band Edge



## Conducted spurious emissions 30MHz-25GHz



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Figure 34: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT40), 2422MHz Carrier Level





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## Band Edge



Conducted

## spurious emissions 30MHz-25GHz



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Figure 35: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT40), 2437MHz Carrier Level



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## Conducted spurious emissions 30MHz-25GHz





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Figure 36: Conducted Spurious Emission & Authorized-band band-edge, 802.11n(HT40), 2452MHz Carrier Level



Band Edge

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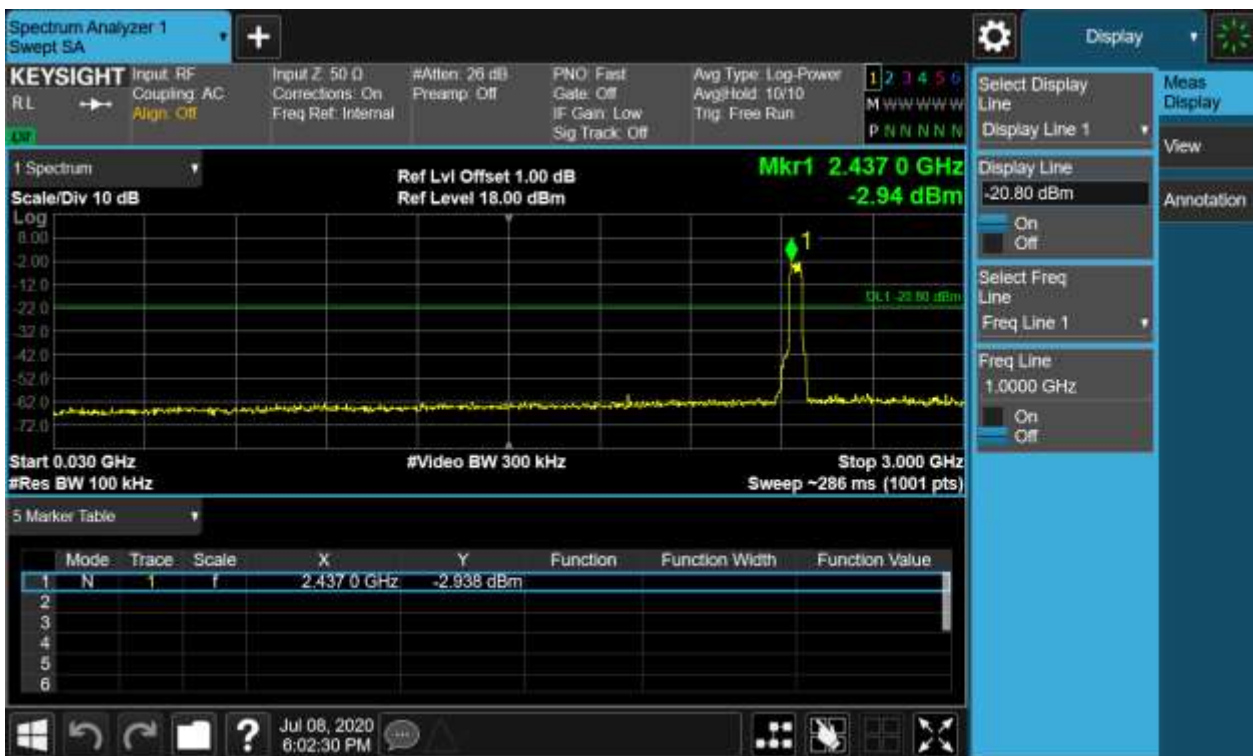
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## Conducted spurious emissions 30MHz-25GHz



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## 4.1.6 Spurious Emission

RESULT:

**PASS**

Test standard : FCC Part 15.247(d), 15.205, 15.209  
RSS-247 5.5  
Requirement : ANSI C63.10-2013, KDB 558074  
Kind of test site : 3m Semi-Anechoic Chamber

### Test setup

Test Channel : Low/Middle/High  
Operation Mode : A  
Ambient temperature : 25°C  
Relative humidity : 52%

### Notes

*Test plots please refer to the annex document "WLAN 2.4GHz-TX EXHIBIT A of SHE20040045-01GE".*

1. For 9 kHz ~ 30 MHz, the amplitude of spurious emissions that are attenuated by more than 20dB below the permissible. The value has no need to be reported.
2. The spurious above 18GHz is noise only and 20dB below the limit. The value has no need to be reported.
3. The EUT is working in the Normal link mode below 1 GHz.

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## 4.1.7 Band Edge (Restricted-band band-edge)

RESULT:

**PASS**

Test standard : FCC Part 15.247(d), 15.205, 15.209  
RSS-247 5.5  
Requirement : ANSI C63.10-2013, KDB 558074  
Kind of test site : 3m Semi-Anechoic Chamber

### Test setup

Test Channel : Low/Middle/High  
Operation Mode : A.1  
Ambient temperature : 25°C  
Relative humidity : 52%

### Notes:

*Test plots please refer to the annex document "WLAN 2.4GHz-TX EXHIBIT A of SHE20040045-01GE".*

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## 4.2 Mains Emissions

### 4.2.1 Conducted Emission on AC Mains

RESULT:

**PASS**

Test standard : FCC Part 15.207(a)  
RSS-Gen 8.8  
Requirement : ANSI C63.10-2013  
Kind of test site : Shielded room

#### Test setup

Input Voltage : AC 120V, 60Hz; AC 240V, 50Hz  
Operation Mode : A  
Earthing : Not Connected  
Ambient temperature : 25°C  
Relative humidity : 52%

For details refer to following test plot.



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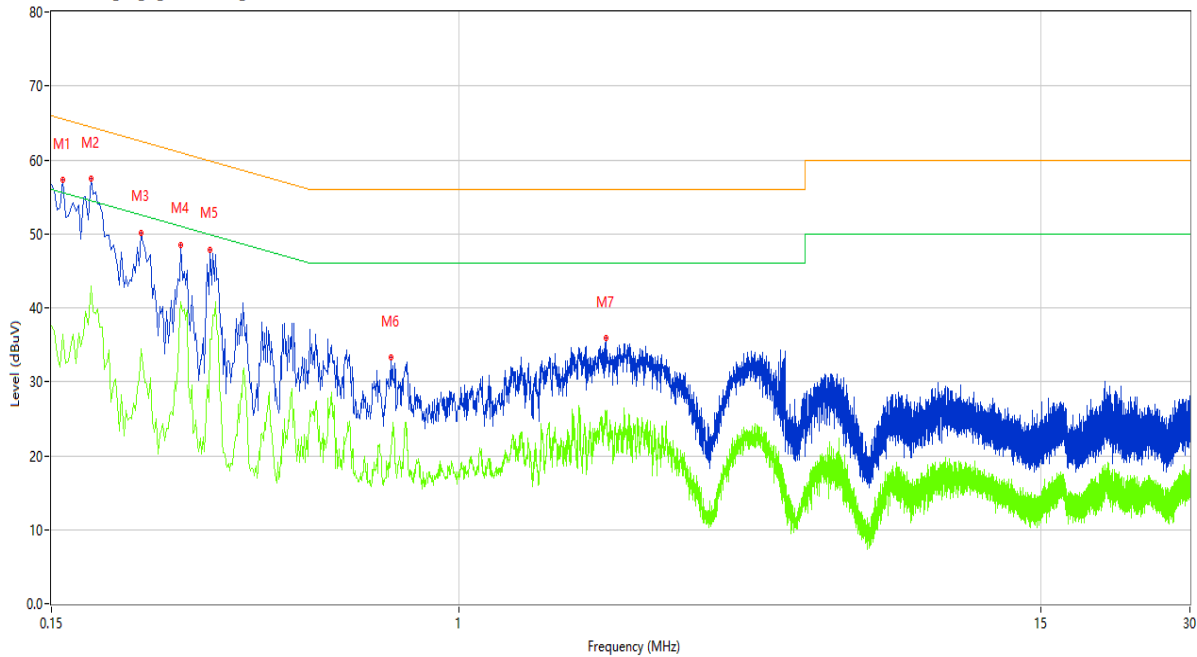
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**Note:**

The all configurations were tested respectively, but only the worst configuration shown here.

**Figure 37: Conducted Emission on AC Mains, L Phase**

C:Emission Test case\_FCC\_CE\_FCC PART 15B\_Class B



No.	Frequency(MHz)	Results (dBuV)	Factor(dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.166	57.61	10.15	65.16	-7.55	Peak	L	Pass
1*	0.166	50.59	10.15	65.16	-14.57	QP	L	Pass
1**	0.166	36.34	10.15	55.16	-18.82	AV	L	Pass
2	0.180	57.42	10.15	64.49	-7.07	Peak	L	Pass
2*	0.180	52.90	10.15	64.49	-11.59	QP	L	Pass
2**	0.180	42.91	10.15	54.49	-11.58	AV	L	Pass
3	0.228	50.39	10.14	62.52	-12.13	Peak	L	Pass
3*	0.228	46.62	10.14	62.52	-15.90	QP	L	Pass
3**	0.228	34.38	10.14	52.52	-18.14	AV	L	Pass
4	0.274	49.66	10.14	61.00	-11.34	Peak	L	Pass
4*	0.274	46.29	10.14	61.00	-14.71	QP	L	Pass
4**	0.274	40.77	10.14	51.00	-10.23	AV	L	Pass
5	0.314	48.01	10.14	59.86	-11.85	Peak	L	Pass
5*	0.314	43.42	10.14	59.86	-16.44	QP	L	Pass
5**	0.314	35.82	10.14	49.86	-14.04	AV	L	Pass
6	0.728	33.27	10.15	56.00	-22.73	Peak	L	Pass
6**	0.728	21.45	10.15	46.00	-24.55	AV	L	Pass
7	1.978	35.84	10.17	56.00	-20.16	Peak	L	Pass
7**	1.978	25.92	10.17	46.00	-20.08	AV	L	Pass

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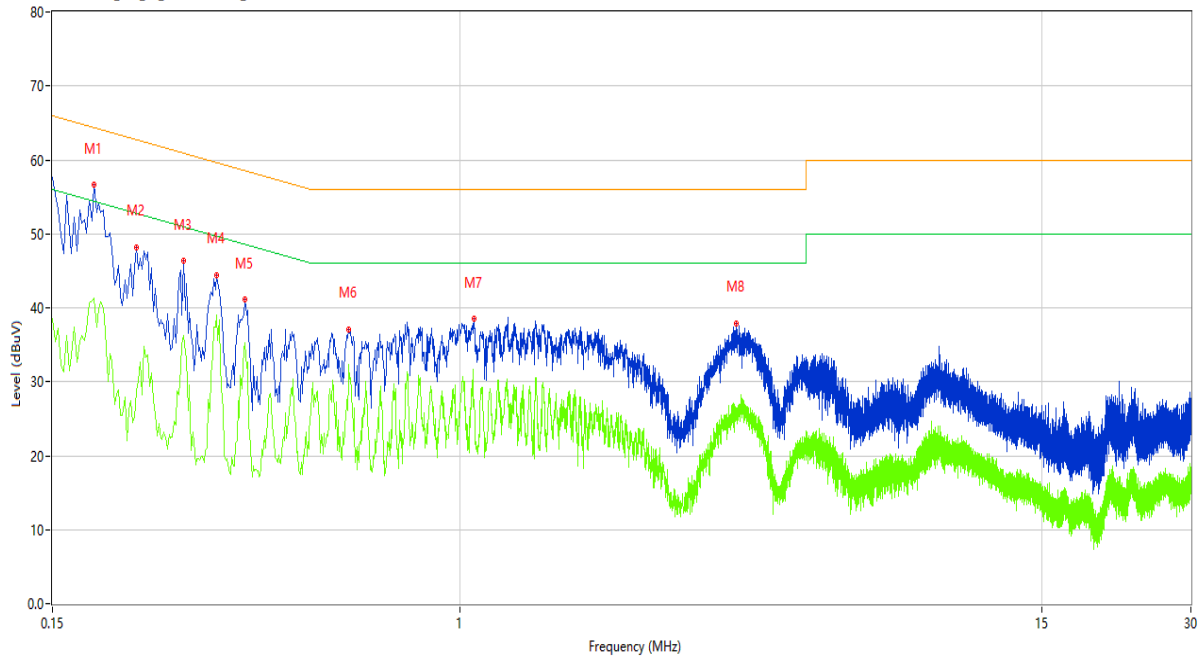
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Figure 26: Conducted Emission on AC Mains, N Phase

CEmission Test case\_FCC\_CE\_FCC PART 15B\_Class B



No.	Frequency(MHz)	Results (dBuV)	Factor(dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.182	57.58	10.15	64.39	-6.81	Peak	N	Pass
1*	0.182	54.05	10.15	64.39	-10.34	QP	N	Pass
1**	0.182	41.34	10.15	54.39	-13.05	AV	N	Pass
2	0.222	49.07	10.14	62.74	-13.67	Peak	N	Pass
2*	0.222	41.79	10.14	62.74	-20.95	QP	N	Pass
2**	0.222	28.68	10.14	52.74	-24.06	AV	N	Pass
3	0.276	46.99	10.14	60.94	-13.95	Peak	N	Pass
3*	0.276	43.26	10.14	60.94	-17.68	QP	N	Pass
3**	0.276	36.23	10.14	50.94	-14.71	AV	N	Pass
4	0.322	45.44	10.14	59.66	-14.22	Peak	N	Pass
4*	0.322	42.30	10.14	59.66	-17.36	QP	N	Pass
4**	0.322	38.94	10.14	49.66	-10.72	AV	N	Pass
5	0.368	42.82	10.14	58.55	-15.73	Peak	N	Pass
5*	0.368	39.25	10.14	58.55	-19.30	QP	N	Pass
5**	0.368	35.25	10.14	48.55	-13.30	AV	N	Pass
6	0.594	37.13	10.15	56.00	-18.87	Peak	N	Pass
6**	0.594	30.24	10.15	46.00	-15.76	AV	N	Pass
7	1.066	38.46	10.15	56.00	-17.54	Peak	N	Pass
7**	1.066	27.61	10.15	46.00	-18.39	AV	N	Pass
8	3.616	37.91	10.23	56.00	-18.09	Peak	N	Pass
8**	3.616	25.76	10.23	46.00	-20.24	AV	N	Pass

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\*\*\*End of the report\*\*\*