



# FCC PART 15C TEST REPORT No.I22Z60845-IOT05

for

**HMD Global Oy**

**Smart Phone**

**TA-1481**

With

**FCC ID: 2AJOTTA-1481**

**Hardware Version: V1.0**

**Software Version: 00WW\_0\_043**

**Issued Date: 2022-08-01**

**Note:**

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## **REPORT HISTORY**

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I22Z60845-IOT05	Rev.0	1st edition	2022-07-15
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## 1. TEST LABORATORY

### 1.1. Introduction & Accreditation

**Telecommunication Technology Labs, CAICT** is an ISO/IEC 17025:2017 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (ISED#: 24849). The detail accreditation scope can be found on NVLAP website.

### 1.2. Testing Location

Testing Location: CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing,  
P. R. China100191

### 1.3. Testing Environment

Normal Temperature: 15-35°C

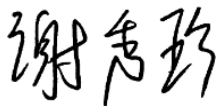
Relative Humidity: 20-75%

### 1.4. Project date

Testing Start Date: 2022-04-26

Testing End Date: 2022-06-25

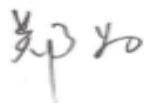
### 1.5. Signature



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Xie Xiuzhen

( Prepared this test report )



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Zheng Wei

(Reviewed this test report)



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Hu Xiaoyu

(Approved this test report)



## **2. CLIENT INFORMATION**

### **2.1. Applicant Information**

Company Name: HMD Global Oy  
Address: Bertel Jungin aukio 9, 02600 Espoo, Fin  
City: Espoo  
Postal Code: /  
Country: Fin  
Telephone: +886931279274  
Fax: /

### **2.2. Manufacturer Information**

Company Name: HMD Global Oy  
Address: Bertel Jungin aukio 9, 02600 Espoo, Fin  
City: Espoo  
Postal Code: /  
Country: Fin  
Telephone: +886931279274  
Fax: /

### **3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY**

#### **EQUIPMENT(AE)**

##### **3.1. About EUT**

Description	Smart Phone
Model name	TA-1481
FCC ID	2AJOTTA-1481
WLAN Frequency Band	ISM Band: 5725MHz~5850MHz
Type of modulation	OFDM
Voltage	3.7V

##### **3.2. Internal Identification of EUT used during the test**

<b>EUT ID*</b>	<b>IMEI</b>	<b>HW Version</b>	<b>SW Version</b>
UT33a	351816950004287/ 351816950029276	V1.0	00WW_0_043
UT02a	351816950001317/ 351816950026306	V1.0	00WW_0_043

\*EUT ID: is used to identify the test sample in the lab internally.

##### **3.3. Internal Identification of AE used during the test**

<b>AE ID*</b>	<b>Description</b>
AE1	Battery
AE2	USB Cable
AE3	Charger

AE1

Model	CN450
Manufacturer	Gaoyuan
Capacity	4500mAh
Nominal Voltage	3.87V

AE2

Model	SZN-A016A
Manufacturer	Saibao

AE3

Model	AD-020U
Manufacturer	Aohai

\*AE ID: is used to identify the test sample in the lab internally.

##### **3.4. General Description**

Equipment Under Test (EUT) is a model of Smart Phone with integrated antenna. It consists of normal options: Battery and Charger.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the Client.

## **4. REFERENCE DOCUMENTS**

### **4.1. Documents supplied by applicant**

EUT feature information is supplied by the applicant or manufacturer, which is the basis of testing.

### **4.2. Reference Documents for testing**

The following documents listed in this section are referred for testing.

	FCC CFR 47, Part 15, Subpart C and E:	
FCC Part15	15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements; 15.407 General technical requirements	2018
ANSI C63.10	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2013
UNII: KDB 789033 D02	General U-NII Test Procedures New Rules v02r01	2017-12

## **5. LABORATORY ENVIRONMENT**

Conducted RF performance testing is performed in shielding room.

EMC performance testing is performed in Semi-anechoic chamber.



## 6. SUMMARY OF TEST RESULTS

### 6.1. Summary of Test Results

SUMMARY OF MEASUREMENT RESULTS	Sub-clause of Part15C	Sub-clause of IC	Verdict
Maximum Peak Output Power	15.407 (a)	/	<b>P</b>
Peak Power Spectral Density	15.407 (a)	/	<b>P</b>
Occupied 6dB Bandwidth	15.407 (e)	/	<b>P</b>
Band Edges Compliance - Conducted& Radiated	15.407 (b)	/	<b>P</b>
Transmitter Spurious Emission - Conducted	15.407	/	<b>P</b>
Transmitter Spurious Emission - Radiated	15.407, 15.205, 15.209	/	<b>P</b>
AC Powerline Conducted Emission	15.107, 15.207	/	<b>P</b>

Please refer to **ANNEX A** for detail.

Terms used in Verdict column

P	Pass, The EUT complies with the essential requirements in the standard.
NM	Not measured, The test was not measured by CTTL
NA	Not Applicable, The test was not applicable
F	Fail, The EUT does not comply with the essential requirements in the standard

### 6.2. Statements

CTTL has evaluated the test cases requested by the client/matrix manufacturer as listed in section 6.1 of this report for the EUT specified in section 3 according to the standards or reference documents listed in section 4.1.

This report only deals with the WLAN function among the features described in section 3.

### 6.3. Test Conditions

For this report, all the test cases are tested under normal temperature and normal voltage, and also under norm humidity, the specific condition is shown as follows:

Temperature	26°C
Voltage	3.7V
Humidity	44%

## 7. TEST EQUIPMENTS UTILIZED

### Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Vector Signal Analyzer	FSQ40	200089	Rohde & Schwarz	1 year	2023-05-15
2	Test Receiver	ESCI	100766	R&S	1 year	2023-03-21
3	LISN	ENV216	101200	R&S	1 year	2023-05-30
4	Shielding Room	S81	/	ETS-Lindgren	/	/

### Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Test Receiver	ESW44	103023	R&S	1 year	2022-10-28
2	EMI Antenna	VULB 9163	302	SCHWARZBECK	1 year	2022-12-28
3	EMI Antenna	3115	6914	ETS-Lindgren	1 year	2023-01-19

## 8. Measurement Uncertainty

### 8.1. Transmitter Output Power

Measurement Uncertainty: 0.387dB,k=1.96

### 8.2. Peak Power Spectral Density

Measurement Uncertainty: 0.705dB,k=1.96

### 8.3. Occupied 6dB Bandwidth

Measurement Uncertainty: 60.80Hz,k=1.96

### 8.4. Band Edges Compliance

Measurement Uncertainty : 0.62dB,k=1.96

### 8.5. Spurious Emissions

#### Conducted (k=1.96)

Frequency Range	Uncertainty(dB)
$30\text{MHz} \leq f \leq 2\text{GHz}$	1.22
$2\text{GHz} \leq f \leq 3.6\text{GHz}$	1.22
$3.6\text{GHz} \leq f \leq 8\text{GHz}$	1.22
$8\text{GHz} \leq f \leq 12.75\text{GHz}$	1.51
$12.75\text{GHz} \leq f \leq 26\text{GHz}$	1.51
$26\text{GHz} \leq f \leq 40\text{GHz}$	1.59

#### Radiated (k=2)

Frequency Range	Uncertainty(dB)
9kHz-30MHz	/
$30\text{MHz} \leq f \leq 1\text{GHz}$	5.15
$1\text{GHz} \leq f \leq 18\text{GHz}$	5.54
$18\text{GHz} \leq f \leq 40\text{GHz}$	5.26

### 8.6. AC Power-line Conducted Emission

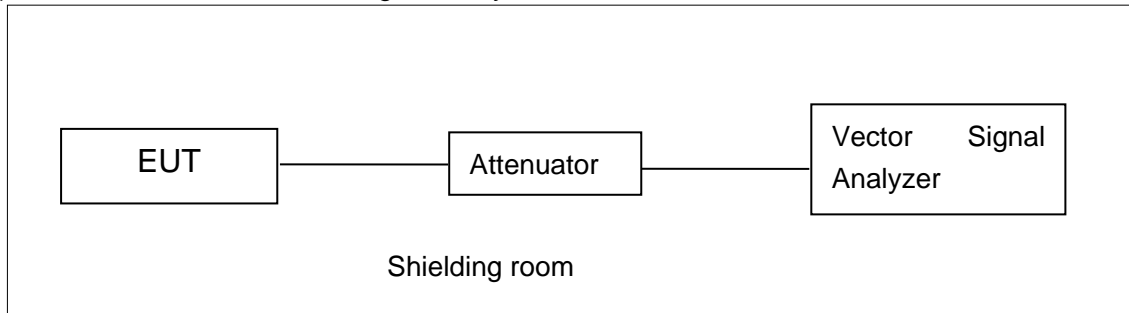
Measurement Uncertainty : 3.08dB,k=2

## ANNEX A: MEASUREMENT RESULTS

### A.1. Measurement Method

#### A.1.1. Conducted Measurements

- 1). Connect the EUT to the test system correctly.
- 2). Set the EUT to the required work mode.
- 3). Set the EUT to the required channel.
- 4). Set the spectrum analyzer to start measurement.
- 5). Record the values. Vector Signal Analyzer

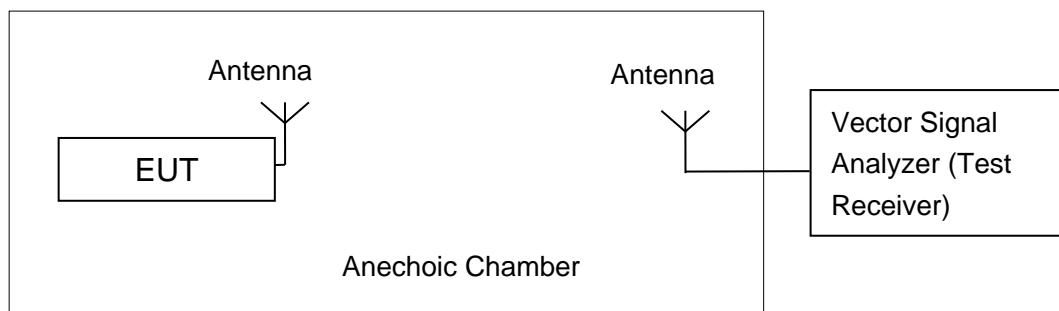


#### A.1.2. Radiated Emission Measurements

In the case of radiated emission, the used settings are as follows,

Sweep frequency from 30 MHz to 1GHz, RBW = 100 kHz, VBW = 300 kHz;

Sweep frequency from 1 GHz to 26GHz, RBW = 1MHz, VBW = 10Hz;



The measurement is made according to ANSI C63.10.

The radiated emission test is performed in semi-anechoic chamber. The distance from the EUT to the reference point of measurement antenna is 3m. The test is carried out on both vertical and horizontal polarization and only maximization result of both polarizations is kept. During the test, the turntable is rotated 360° and the measurement antenna is moved from 1m to 4m to get the maximization result.

## A.2. Maximum Peak Output Power

### Measurement Limit and Method:

Standard	Limit (dBm)
FCC CRF Part 15.407(a)	< 30

### A.2.1 Antenna Gain

Antenna gain is -0.9dBi and the value is supplied by the applicant or manufacturer.

### A.2.2. Maximum Peak Output Power-conducted

#### Measurement Results:

#### 802.11a mode

Mode	Data Rate (Mbps)	Test Result (dBm)		
		5745MHz (Ch149)	5785MHz (Ch157)	5825MHz (Ch165)
802.11a	6	16.18	16.74	16.05

The data rate 6Mbps is selected as worse condition, and the following cases are performed with this condition.

#### 802.11n-HT20 mode

Mode	Data Rate (Index)	Test Result (dBm)		
		5745MHz (Ch149)	5785MHz (Ch157)	5825MHz (Ch165)
802.11n(20MHz)	MCS0	13.86	13.47	13.03

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

#### 802.11ac-HT20 mode

Mode	Data Rate (Index)	Test Result (dBm)		
		5745MHz (Ch149)	5785MHz (Ch157)	5825MHz (Ch165)
802.11ac(20MHz)	MCS0	13.80	13.50	13.06

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

#### 802.11n-HT40 mode

Mode	Data Rate (Index)	Test Result (dBm)	
		5755MHz (Ch151)	5795MHz (Ch159)
802.11n(40MHz)	MCS0	13.28	12.81

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

**802.11ac-HT40 mode**

Mode	Data Rate (Index)	Test Result (dBm)	
		5755MHz (Ch151)	5795MHz (Ch159)
802.11ac(40MHz)	MCS0	13.36	12.97

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

**802.11ac-HT80 mode**

Mode	Data Rate (Index)	Test Result (dBm)
		5775MHz (Ch155)
802.11ac(80MHz)	MCS0	12.03

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

The duty cycle of all mode are meet the 98% requirement.

**Conclusion: PASS**

### A.3. Peak Power Spectral Density

#### Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.407(a)	< 30 dBm/500 kHz

The measurement is made according to ANSI C63.10 and KDB789033 D02

#### Measurement Uncertainty:

Measurement Uncertainty	0.75dB
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#### Measurement Results:

Mode	Channel	Power Spectral Density ( dBm/500kHz )	Conclusion
802.11a	149	2.89	P
	157	1.91	P
	165	1.75	P
802.11n HT20	149	0.93	P
	157	0.07	P
	165	-0.14	P
802.11ac HT40	151	-2.63	P
	159	-3.60	P
802.11ac HT80	155	-7.31	P

**Conclusion: PASS**

### A.4. Occupied 6dB Bandwidth

#### Measurement Limit:

Standard	Limit (kHz)
FCC 47 CFR Part 15.407 (e)	≥ 500

The measurement is made according to KDB789033 D02 .

#### Measurement Uncertainty:

Measurement Uncertainty	60.80Hz
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#### Measurement Result:

Mode	Channel	Occupied 6dB Bandwidth ( MHz)		conclusion
802.11a	149	Fig.1	15.10	P
	157	Fig.2	15.35	P
	165	Fig.3	15.35	P
802.11n HT20	149	Fig.4	15.90	P
	157	Fig.5	16.80	P
	165	Fig.6	15.90	P
802.11ac HT40	151	Fig.7	35.04	P
	159	Fig.8	35.36	P
802.11ac HT80	155	Fig.9	75.20	P

#### Conclusion: PASS

#### Test graphs as below:

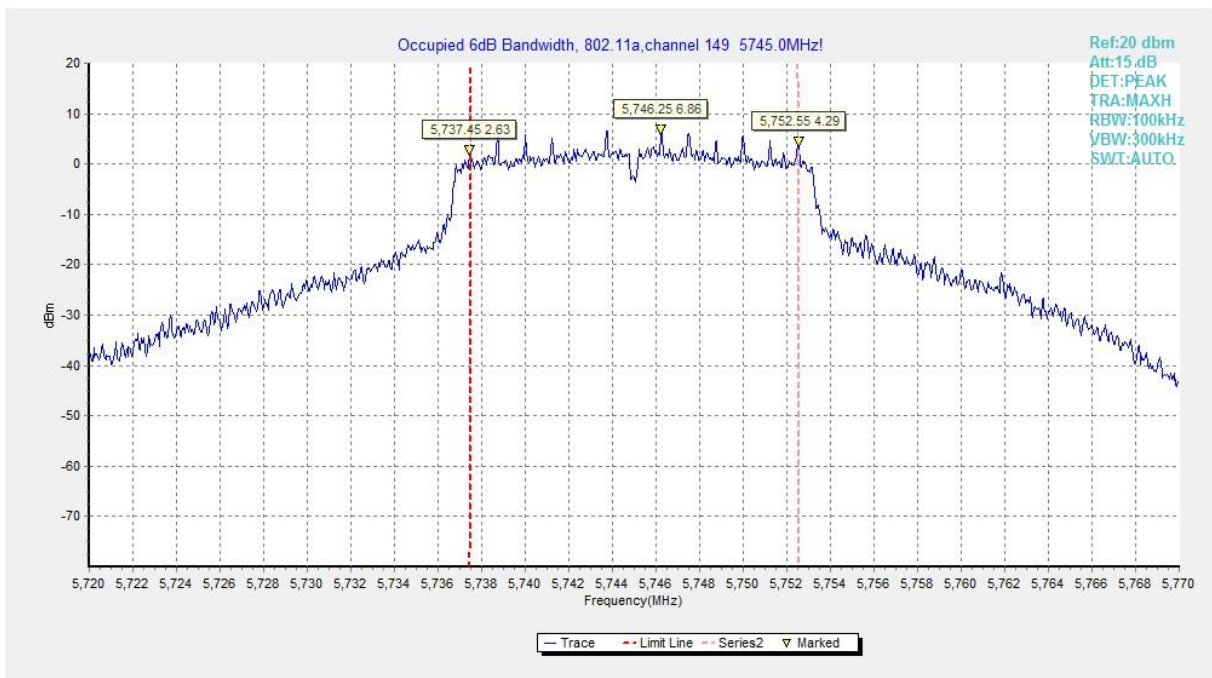
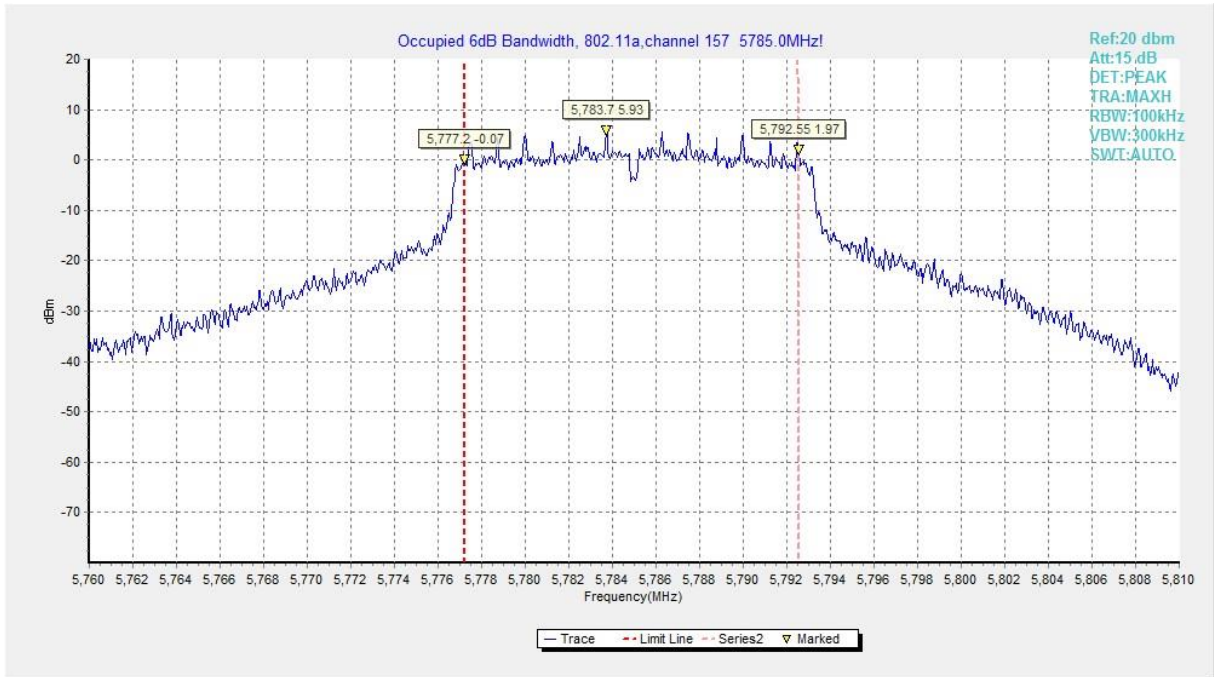
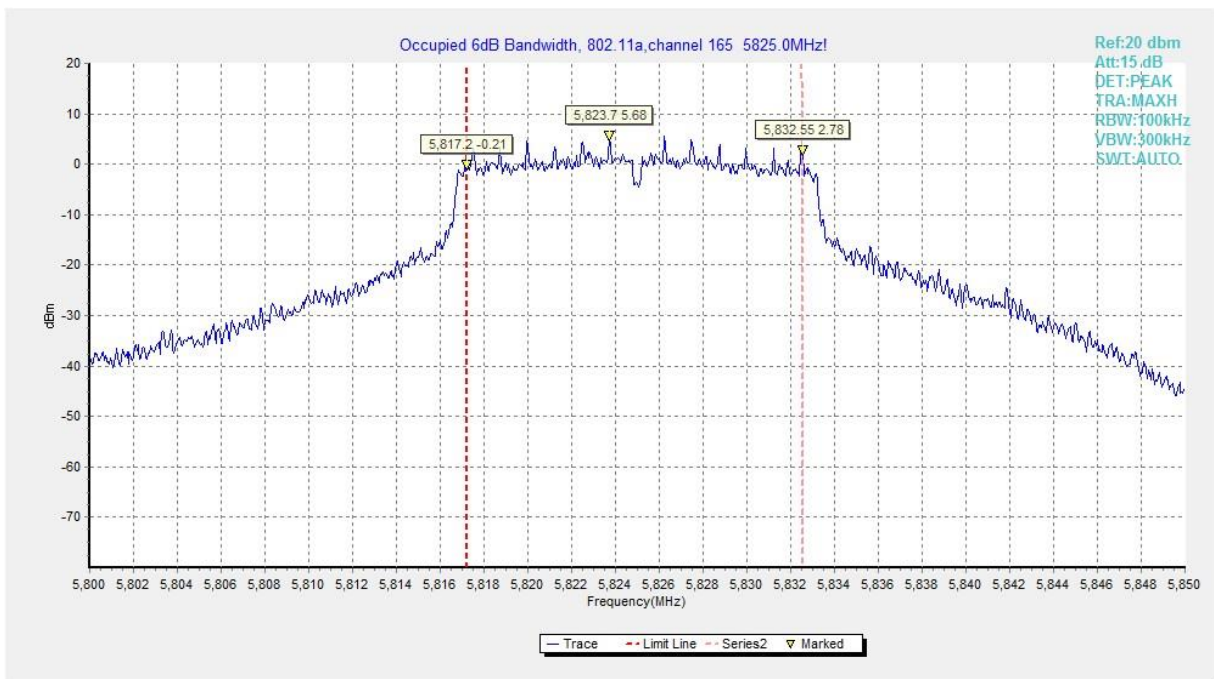


Fig. 1 Occupied 6dB Bandwidth (802.11a, Ch 149)

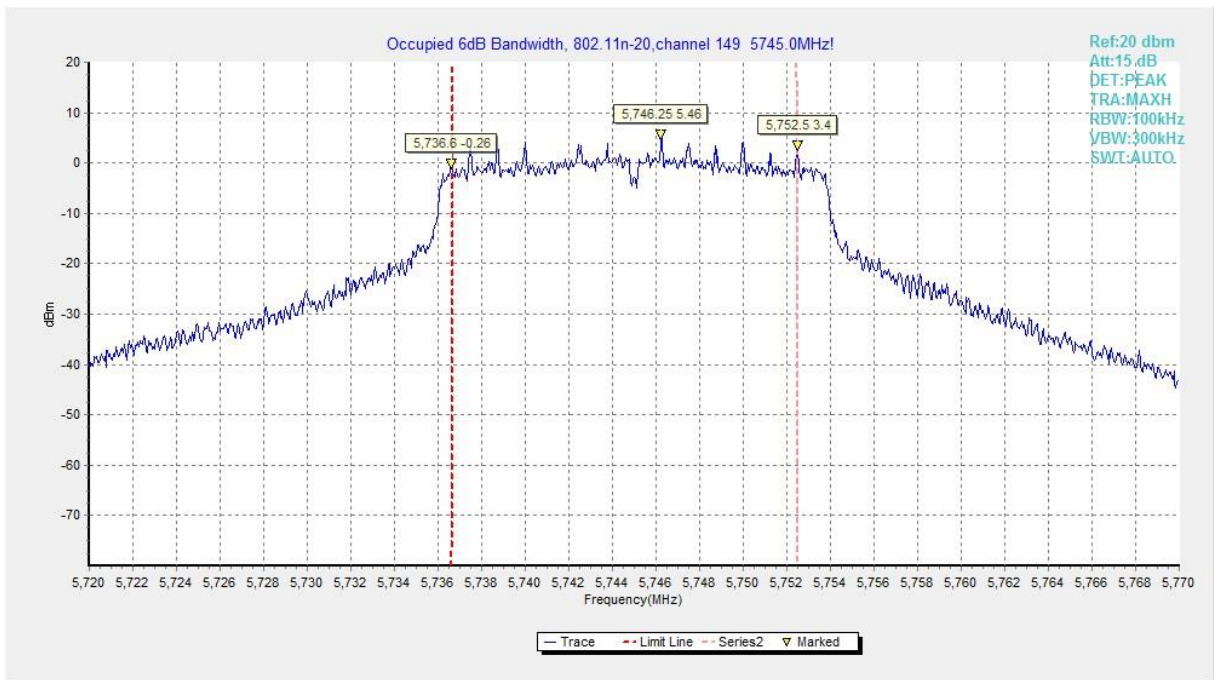




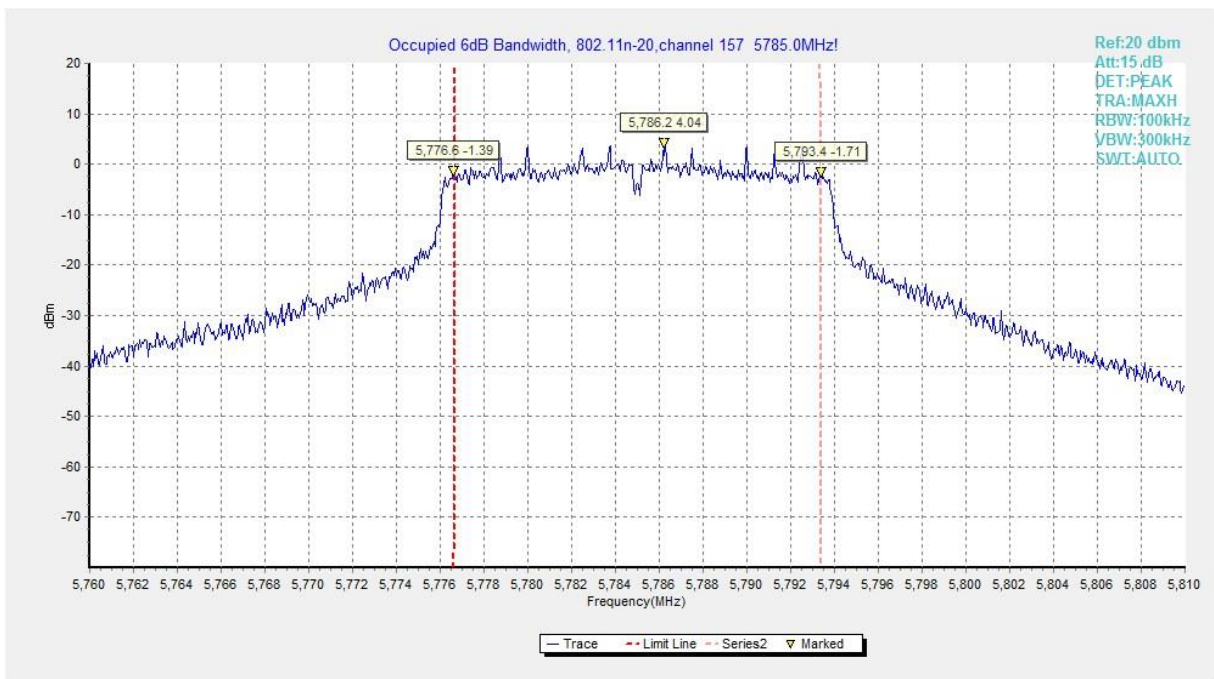
**Fig. 2 Occupied 6dB Bandwidth (802.11a, Ch 157)**



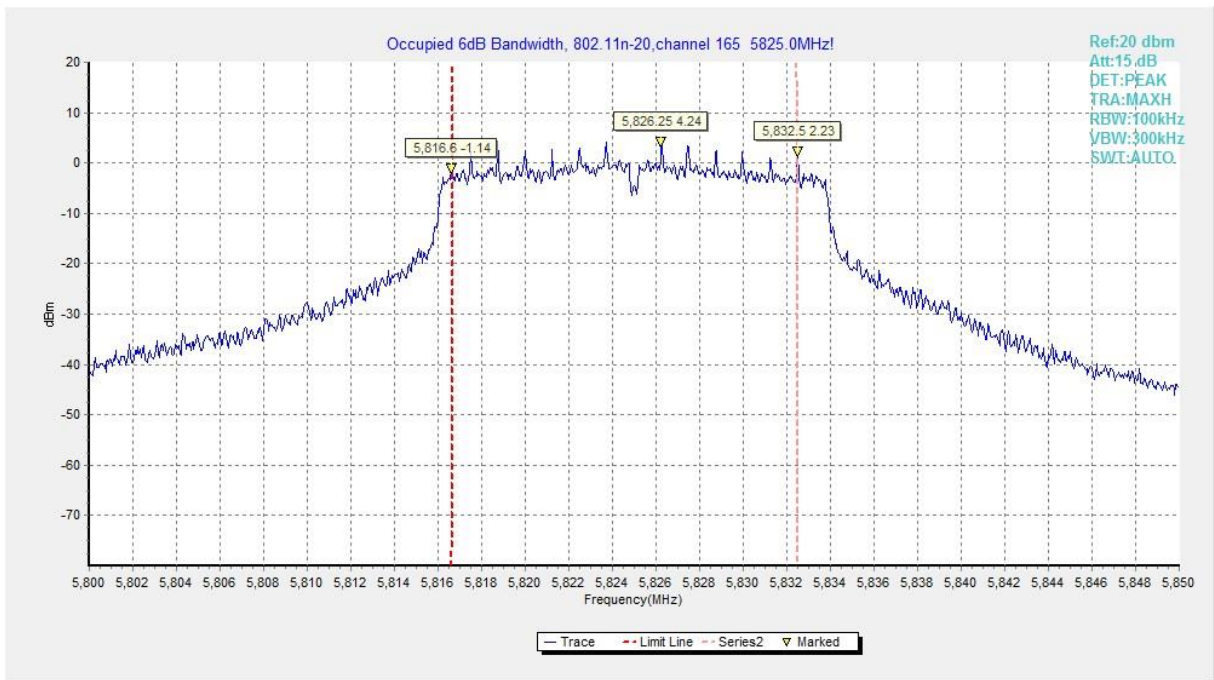
**Fig. 3 Occupied 6dB Bandwidth (802.11a, Ch 165)**



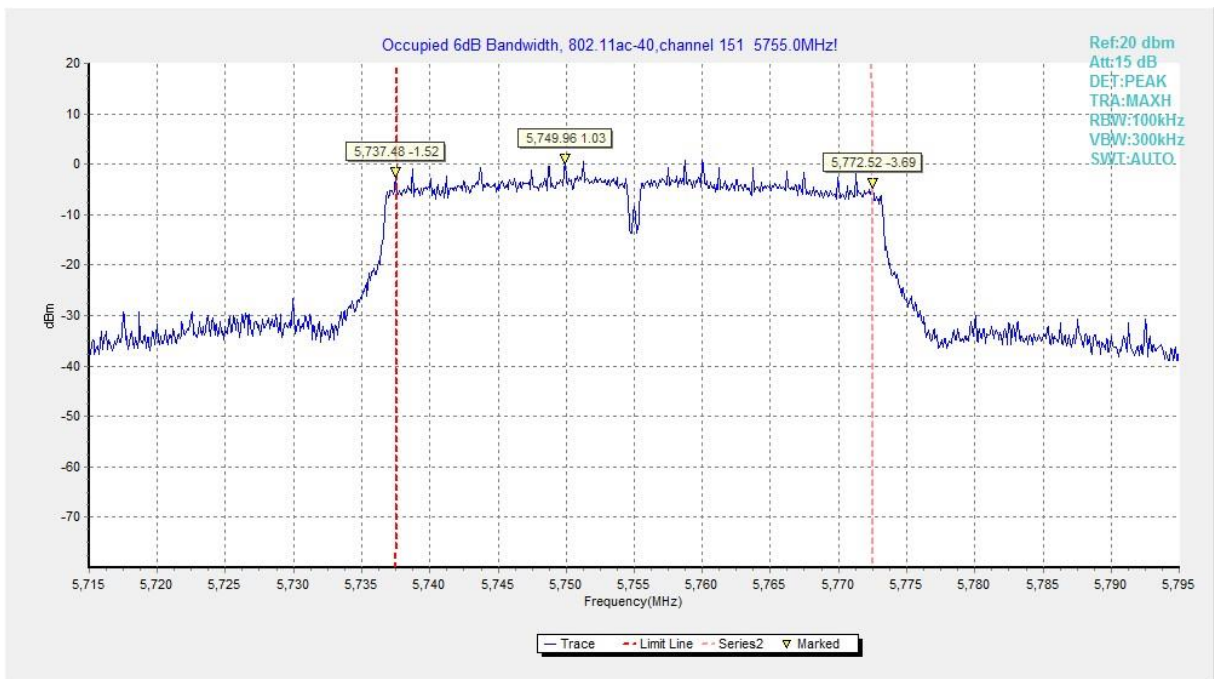
**Fig. 4 Occupied 6dB Bandwidth (802.11n-HT20, Ch 149)**



**Fig. 5 Occupied 6dB Bandwidth (802.11n-HT20, Ch 157)**

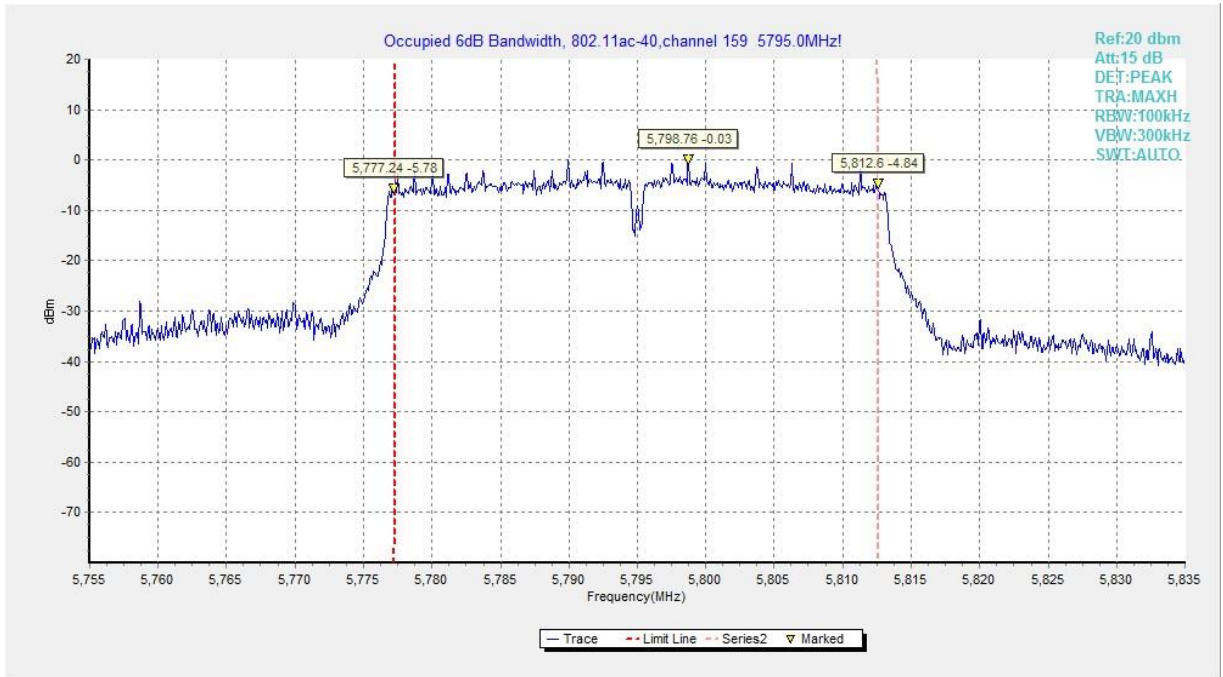


**Fig. 6 Occupied 6dB Bandwidth (802.11n-HT20, Ch 165)**

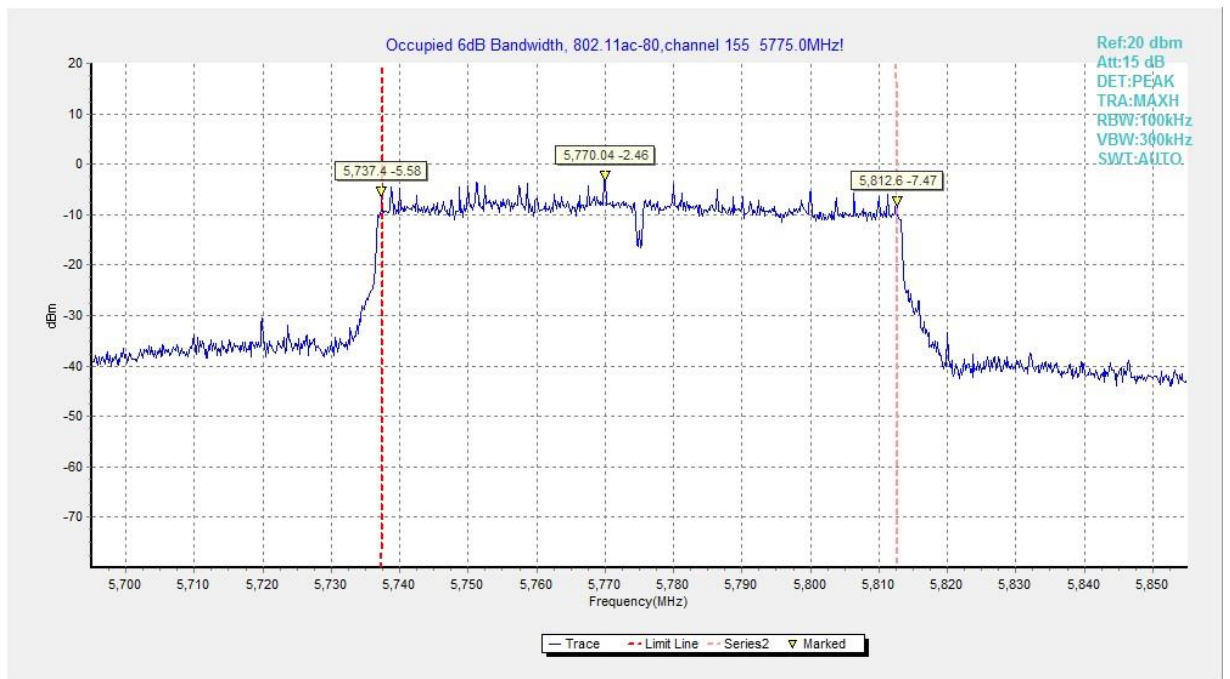


**Fig. 7 Occupied 6dB Bandwidth (802.11ac-HT40, Ch 151)**





**Fig. 8 Occupied 6dB Bandwidth (802.11ac-HT40, Ch 159)**



**Fig. 9 Occupied 6dB Bandwidth (802.11ac-HT80, Ch 155)**

## A.5. Transmitter Spurious Emission

### A.5.1 Transmitter Spurious Emission - Radiated

#### Measurement Limit:

Standard	Limit (dBm/MHz)	
FCC 47 CFR Part 15.407	at the band edge	27
	at 5 MHz above or below the band edge	15.6
	at 25 MHz above or below the band edge	10
	at 75 MHz or more above or below the band edge	-27
	Note: Increasing linearly from point to point.	

The measurement is made according to KDB 789033

#### Measurement Results:

##### 802.11a mode

Mode	Channel	Frequency Range	Test Results	Conclusion
802.11a	149	1 GHz ~ 3 GHz	---	P
		3 GHz ~ 7 GHz	---	P
		7 GHz ~ 18 GHz	---	P
	157	30 MHz ~1 GHz	---	P
		1 GHz ~ 3 GHz	---	P
		3 GHz ~ 7 GHz	---	P
		7 GHz ~ 18 GHz	---	P
		18 GHz ~ 26.5 GHz	---	P
	165	26.5 GHz~ 40 GHz	---	P
		1 GHz ~ 3 GHz	---	P
		3 GHz ~ 7 GHz	---	P
		7 GHz ~ 18 GHz	---	P

##### 802.11n-HT20 mode

Mode	Channel	Frequency Range	Test Results	Conclusion
802.11n (HT20)	149	1 GHz ~ 3 GHz	---	P
		3 GHz ~ 7 GHz	---	P
		7 GHz ~ 18 GHz	---	P
	157	30 MHz ~1 GHz	---	P
		1 GHz ~ 3 GHz	---	P
		3 GHz ~ 7 GHz	---	P
		7 GHz ~ 18 GHz	---	P
		18 GHz ~ 26.5 GHz	---	P
	165	26.5 GHz~ 40 GHz	---	P
		1 GHz ~ 3 GHz	---	P
		3 GHz ~ 7 GHz	---	P
		7 GHz ~ 18 GHz	---	P

**802.11n-HT40 mode**

Mode	Channel	Frequency Range	Test Results	Conclusion
802.11n (HT40)	151	30 MHz ~1 GHz	---	P
		1 GHz ~ 3 GHz	---	P
		3 GHz ~ 7 GHz	---	P
		7 GHz ~ 18 GHz	---	P
		18 GHz ~ 26.5 GHz	---	P
		26.5 GHz~ 40 GHz	---	P
	159	1 GHz ~ 3 GHz	---	P
		3 GHz ~ 7 GHz	---	P
		7 GHz ~ 18 GHz	---	P

**802.11ac-HT20 mode**

Mode	Channel	Frequency Range	Test Results	Conclusion	
802.11ac (HT20)	149	1 GHz ~ 3 GHz	---	P	
		3 GHz ~ 7 GHz	---	P	
		7 GHz ~ 18 GHz	---	P	
	157	30 MHz ~1 GHz	---	P	
		1 GHz ~ 3 GHz	---	P	
		3 GHz ~ 7 GHz	---	P	
		7 GHz ~ 18 GHz	---	P	
		18 GHz ~ 26.5 GHz	---	P	
		26.5 GHz~ 40 GHz	---	P	
		165	1 GHz ~ 3 GHz	---	P
			3 GHz ~ 7 GHz	---	P
	7 GHz ~ 18 GHz		---	P	

**802.11ac-HT40 mode**

Mode	Channel	Frequency Range	Test Results	Conclusion
802.11ac (HT40)	151	30 MHz ~1 GHz	---	P
		1 GHz ~ 3 GHz	---	P
		3 GHz ~ 7 GHz	---	P
		7 GHz ~ 18 GHz	---	P
		18 GHz ~ 26.5 GHz	---	P
		26.5 GHz~ 40 GHz	---	P
	159	1 GHz ~ 3 GHz	---	P
		3 GHz ~ 7 GHz	---	P
		7 GHz ~ 18 GHz	---	P

**802.11ac-HT80 mode**

Mode	Channel	Frequency Range	Test Results	Conclusion
802.11ac (HT80)	155	30 MHz ~1 GHz	---	P
		1 GHz ~ 3 GHz	---	P

		3 GHz ~ 7 GHz	---	P
		7 GHz ~ 18 GHz	---	P
		18 GHz ~ 26.5 GHz	---	P
		26.5 GHz~ 40 GHz	---	P

**Conclusion: PASS**

**Note:**

A "reference path loss" is established and the  $A_{Rpl}$  is the attenuation of "reference path loss", and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

$P_{Mea}$  is the field strength recorded from the instrument.

**Average Results:**

**802.11a**

Channel 149

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17959.300	43.16	-25.50	46.66	22.00	54.00	10.84	H
11489.650	43.11	-32.26	38.84	36.54	54.00	10.89	H
17839.400	42.94	-25.50	46.66	21.78	54.00	11.06	H
11490.200	42.40	-32.26	38.84	35.83	54.00	11.60	V
15963.350	42.25	-27.35	38.54	31.06	54.00	11.75	H
16043.650	41.88	-27.35	38.54	30.69	54.00	12.12	V

Channel 157

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11569.950	44.04	-32.31	38.91	37.45	54.00	9.96	H
17957.650	42.72	-25.50	46.66	21.56	54.00	11.28	V
17964.250	42.58	-25.50	46.66	21.42	54.00	11.42	V
15931.450	42.03	-27.35	38.54	30.84	54.00	11.97	H
15989.750	41.91	-27.35	38.54	30.72	54.00	12.09	H
11569.400	39.41	-32.31	38.91	32.82	54.00	14.59	H

Channel 165

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11649.700	44.35	-32.31	38.91	37.76	54.00	9.65	H
11650.250	44.15	-32.31	38.91	37.56	54.00	9.85	H
17974.150	42.86	-25.50	46.66	21.70	54.00	11.14	H
17871.300	42.85	-25.50	46.66	21.69	54.00	11.15	V
15981.500	41.97	-27.35	38.54	30.78	54.00	12.03	V

15931.450	41.91	-27.35	38.54	30.72	54.00	12.09	V
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**802.11n-HT20**

## Channel 149

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11490.200	42.91	-32.26	38.84	36.34	54.00	11.09	H
17957.650	42.90	-25.50	46.66	21.74	54.00	11.10	V
11489.650	42.73	-32.26	38.84	36.16	54.00	11.27	H
17896.050	42.57	-25.50	46.66	21.41	54.00	11.43	H
15936.950	42.08	-27.35	38.54	30.89	54.00	11.92	V
15954.000	41.59	-27.35	38.54	30.40	54.00	12.41	H

## Channel 157

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11569.950	44.26	-32.31	38.91	37.67	54.00	9.74	V
17946.650	42.82	-25.50	46.66	21.66	54.00	11.18	H
17924.650	42.70	-25.50	46.66	21.54	54.00	11.30	V
15965.550	41.87	-27.35	38.54	30.68	54.00	12.13	V
15940.250	41.85	-27.35	38.54	30.66	54.00	12.15	H
11569.400	38.90	-32.31	38.91	32.31	54.00	15.10	H

## Channel 165

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11650.250	44.25	-32.31	38.91	37.66	54.00	9.75	V
11649.700	44.07	-32.31	38.91	37.48	54.00	9.93	V
17853.150	42.70	-25.50	46.66	21.54	54.00	11.30	V
17936.750	42.68	-25.50	46.66	21.52	54.00	11.32	V
15966.650	41.93	-27.35	38.54	30.74	54.00	12.07	V
15965.550	41.58	-27.35	38.54	30.39	54.00	12.42	V



**802.11n-HT40**

## Channel 151

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11510.000	44.87	-32.26	38.84	38.30	54.00	9.13	H
17825.100	42.68	-25.50	46.66	21.52	54.00	11.32	V
17956.550	42.66	-25.50	46.66	21.50	54.00	11.34	V
15956.200	42.11	-27.35	38.54	30.92	54.00	11.89	V
15988.650	41.82	-27.35	38.54	30.63	54.00	12.18	V
11509.450	40.56	-32.26	38.84	33.99	54.00	13.44	H

## Channel 159

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11589.750	44.40	-32.31	38.91	37.81	54.00	9.60	H
11590.300	43.04	-32.31	38.91	36.45	54.00	10.96	H
17920.250	42.64	-25.50	46.66	21.48	54.00	11.36	H
17904.300	42.56	-25.50	46.66	21.40	54.00	11.44	H
15948.500	42.10	-27.35	38.54	30.91	54.00	11.90	H
16004.050	41.77	-27.35	38.54	30.58	54.00	12.23	V

**802.11ac-HT20**

## Channel 149

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11489.650	43.76	-32.26	38.84	37.19	54.00	10.24	H
11490.200	43.55	-32.26	38.84	36.98	54.00	10.45	H
17886.150	42.88	-25.50	46.66	21.72	54.00	11.12	V
17924.100	42.72	-25.50	46.66	21.56	54.00	11.28	V
16007.350	41.91	-27.35	38.54	30.72	54.00	12.09	H
15925.400	41.86	-27.35	38.54	30.67	54.00	12.14	V

## Channel 157

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11569.950	44.26	-32.31	38.91	37.67	54.00	9.74	H
17944.450	42.82	-25.50	46.66	21.66	54.00	11.18	H
17931.800	42.77	-25.50	46.66	21.61	54.00	11.23	V
15966.650	41.80	-27.35	38.54	30.61	54.00	12.20	V
16045.850	41.66	-27.35	38.54	30.47	54.00	12.34	V
11569.400	39.40	-32.31	38.91	32.81	54.00	14.60	H

## Channel 165

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11649.700	43.95	-32.31	38.91	37.36	54.00	10.05	H
11650.250	43.65	-32.31	38.91	37.06	54.00	10.35	H
17996.150	42.77	-25.50	46.66	21.61	54.00	11.23	H
17857.000	42.60	-25.50	46.66	21.44	54.00	11.40	V
15973.800	41.94	-27.35	38.54	30.75	54.00	12.06	H
15946.850	41.86	-27.35	38.54	30.67	54.00	12.14	H

**802.11ac-HT40**

## Channel 151

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11510.000	45.11	-32.26	38.84	38.54	54.00	8.89	H
17938.400	42.66	-25.50	46.66	21.50	54.00	11.34	H
17975.250	42.64	-25.50	46.66	21.48	54.00	11.36	H
15957.300	41.81	-27.35	38.54	30.62	54.00	12.19	H
16035.400	41.64	-27.35	38.54	30.45	54.00	12.36	H
11509.450	40.72	-32.26	38.84	34.15	54.00	13.28	H

## Channel 159

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11589.750	44.77	-32.31	38.91	38.18	54.00	9.23	H
11590.300	43.40	-32.31	38.91	36.81	54.00	10.60	V
17847.100	42.72	-25.50	46.66	21.56	54.00	11.28	H
17937.850	42.58	-25.50	46.66	21.42	54.00	11.42	V
15963.350	42.17	-27.35	38.54	30.98	54.00	11.83	H
16005.150	41.91	-27.35	38.54	30.72	54.00	12.09	V

**802.11ac-HT80**

## Channel 155

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
11550.150	43.69	-32.26	38.84	37.12	54.00	10.31	H
17890.550	43.09	-25.50	46.66	21.93	54.00	10.91	V
17947.750	43.07	-25.50	46.66	21.91	54.00	10.93	H
11549.600	42.01	-32.26	38.84	35.44	54.00	11.99	H
15955.100	41.89	-27.35	38.54	30.70	54.00	12.11	H
16000.200	41.74	-27.35	38.54	30.55	54.00	12.26	H

**Peak Results:**
**802.11a**

## Channel 149

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17930.700	52.06	-25.50	46.66	30.90	74.00	21.94	H
17941.700	51.91	-25.50	46.66	30.75	74.00	22.09	H
16962.150	51.58	-26.32	42.36	35.53	68.20	16.62	V
16835.650	51.55	-26.62	41.49	36.68	68.20	16.65	V
11489.650	48.48	-32.26	38.84	41.91	74.00	25.52	V
11490.200	48.07	-32.26	38.84	41.50	74.00	25.93	H

## Channel 157

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17931.250	52.26	-25.50	46.66	31.10	74.00	21.74	H
17880.100	51.81	-25.50	46.66	30.65	74.00	22.19	V
15971.600	51.50	-27.35	38.54	40.31	74.00	22.50	V
15956.750	51.40	-27.35	38.54	40.21	74.00	22.60	V
11569.950	48.72	-32.31	38.91	42.13	74.00	25.28	H
11569.400	47.22	-32.31	38.91	40.63	74.00	26.78	H

## Channel 165

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17827.300	52.62	-25.50	46.66	31.46	74.00	21.38	V
17965.900	52.22	-25.50	46.66	31.06	74.00	21.78	H
15959.500	51.28	-27.35	38.54	40.09	74.00	22.72	H
16031.550	51.04	-27.35	38.54	39.85	74.00	22.96	V
11650.250	48.46	-32.31	38.91	41.87	74.00	25.54	H
11649.700	48.05	-32.31	38.91	41.46	74.00	25.95	H

**802.11n-HT20**

## Channel 149

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17924.650	52.41	-25.50	46.66	31.25	74.00	21.59	V
17945.000	52.40	-25.50	46.66	31.24	74.00	21.60	H
16994.600	52.03	-26.32	42.36	35.98	68.20	16.17	V
16977.000	51.72	-26.32	42.36	35.67	68.20	16.48	V
11490.200	49.04	-32.26	38.84	42.47	74.00	24.96	H
11489.650	46.95	-32.26	38.84	40.38	74.00	27.05	V

## Channel 157

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17120.550	52.69	-26.60	43.36	35.93	68.20	15.51	V
17825.650	52.29	-25.50	46.66	31.13	74.00	21.71	V
16848.300	51.64	-26.62	41.49	36.77	68.20	16.56	V
16422.600	51.55	-26.96	39.82	38.69	68.20	16.65	V
11569.950	47.60	-32.31	38.91	41.01	74.00	26.40	V
11569.400	46.78	-32.31	38.91	40.19	74.00	27.22	H

## Channel 165

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17941.700	51.91	-25.50	46.66	30.75	74.00	22.09	V
17974.150	51.87	-25.50	46.66	30.71	74.00	22.13	H
16003.500	51.44	-27.35	38.54	40.25	74.00	22.56	H
16963.800	51.28	-26.32	42.36	35.23	68.20	16.92	V
11650.250	48.98	-32.31	38.91	42.39	74.00	25.02	V
11649.700	48.26	-32.31	38.91	41.67	74.00	25.74	V

**802.11n-HT40**

## Channel 151

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
16560.100	52.63	-26.87	40.65	38.85	68.20	15.57	H
17946.100	52.12	-25.50	46.66	30.96	74.00	21.88	H
17964.800	51.94	-25.50	46.66	30.78	74.00	22.06	H
16497.950	51.21	-26.96	39.82	38.35	68.20	16.99	H
11510.000	48.72	-32.26	38.84	42.15	74.00	25.28	H
11509.450	47.49	-32.26	38.84	40.92	74.00	26.51	H

## Channel 159

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17918.600	53.06	-25.50	46.66	31.90	74.00	20.94	V
17975.800	52.83	-25.50	46.66	31.67	74.00	21.17	H
15972.150	51.75	-27.35	38.54	40.56	74.00	22.25	V
15999.100	51.17	-27.35	38.54	39.98	74.00	22.83	H
11589.750	48.85	-32.31	38.91	42.26	74.00	25.15	H
11590.300	47.89	-32.31	38.91	41.30	74.00	26.11	H

**802.11ac-HT20**

## Channel 149

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
15961.150	52.26	-27.35	38.54	41.07	74.00	21.74	H
17836.650	52.11	-25.50	46.66	30.95	74.00	21.89	V
17856.450	52.02	-25.50	46.66	30.86	74.00	21.98	V
16407.200	51.72	-26.96	39.82	38.86	68.20	16.48	V
11489.650	49.57	-32.26	38.84	43.00	74.00	24.43	H
11490.200	47.80	-32.26	38.84	41.23	74.00	26.20	H

## Channel 157

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17131.550	51.95	-26.60	43.36	35.19	68.20	16.25	V
17880.650	51.82	-25.50	46.66	30.66	74.00	22.18	H
16527.100	51.44	-26.96	39.82	38.58	68.20	16.76	H
16972.600	51.44	-26.32	42.36	35.39	68.20	16.76	H
11569.950	47.71	-32.31	38.91	41.12	74.00	26.29	H
11770.700	47.00	-31.99	38.98	40.01	74.00	27.00	V

## Channel 165

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17841.600	52.22	-25.50	46.66	31.06	74.00	21.78	H
17952.150	52.22	-25.50	46.66	31.06	74.00	21.78	V
16841.700	51.86	-26.62	41.49	36.99	68.20	16.34	V
16838.950	51.79	-26.62	41.49	36.92	68.20	16.41	V
11649.700	49.53	-32.31	38.91	42.94	74.00	24.47	V
11650.250	47.62	-32.31	38.91	41.03	74.00	26.38	H

**802.11ac-HT40**

## Channel 151

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17928.500	52.53	-25.50	46.66	31.37	74.00	21.47	V
17942.250	52.24	-25.50	46.66	31.08	74.00	21.76	H
16550.200	51.50	-26.87	40.65	37.72	68.20	16.70	H
16626.650	51.39	-26.87	40.65	37.61	68.20	16.81	H
11510.000	47.95	-32.26	38.84	41.38	74.00	26.05	H
11509.450	47.39	-32.26	38.84	40.82	74.00	26.61	H

## Channel 159

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17947.200	52.27	-25.50	46.66	31.11	74.00	21.73	V
17935.650	52.23	-25.50	46.66	31.07	74.00	21.77	V
15967.200	51.62	-27.35	38.54	40.43	74.00	22.38	V
16636.550	51.44	-26.87	40.65	37.66	68.20	16.76	V
11590.300	49.05	-32.31	38.91	42.46	74.00	24.95	H
11589.750	48.50	-32.31	38.91	41.91	74.00	25.50	H

**802.11ac-HT80**

## Channel 155

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17849.300	52.57	-25.50	46.66	31.41	74.00	21.43	V
17855.900	52.48	-25.50	46.66	31.32	74.00	21.52	V
16914.850	51.54	-26.32	42.36	35.49	68.20	16.66	V
16007.900	51.36	-27.35	38.54	40.17	74.00	22.64	V
11550.150	49.11	-32.26	38.84	42.54	74.00	24.89	H
11549.600	47.66	-32.26	38.84	41.09	74.00	26.34	H



## A.6. Band Edges Compliance

### A6.1 Band Edges - Radiated

#### Measurement Limit:

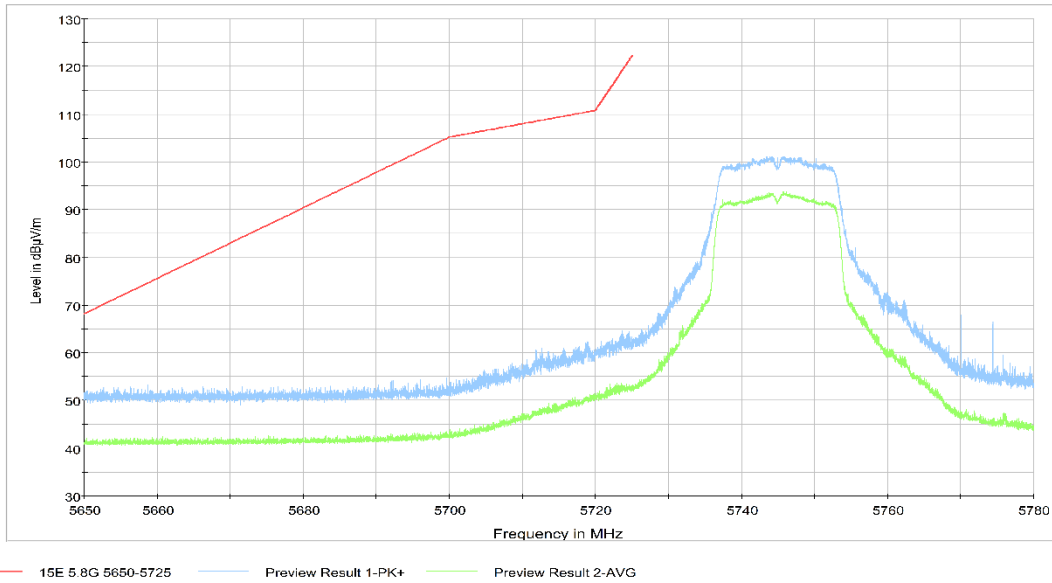
Standard	Limit (dBm/MHz)	
FCC 47 CFR Part 15.407	at the band edge	27
	at 5 MHz above or below the band edge	15.6
	at 25 MHz above or below the band edge	10
	at 75 MHz or more above or below the band edge	-27
Note: increasing linearly from point to point.		

#### Measurement Result:

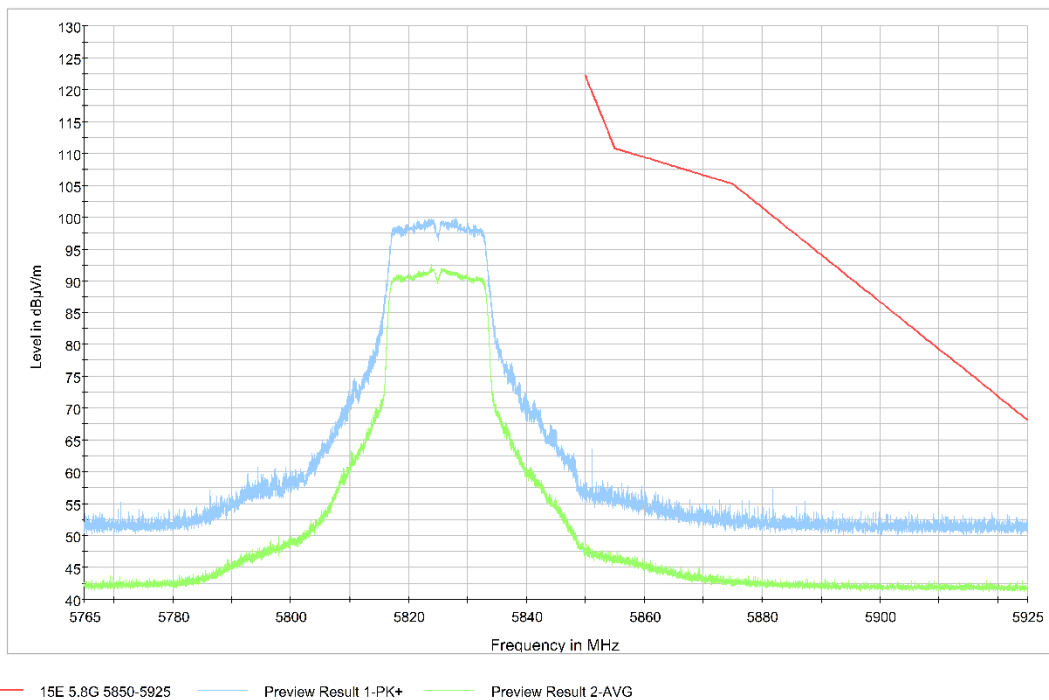
Mode	Channel	Test Results	Conclusion
802.11a	5745 MHz	Fig.10	P
	5825 MHz	Fig.11	P
802.11n HT20	5745 MHz	Fig.12	P
	5825 MHz	Fig.13	P
802.11n HT40	5755 MHz	Fig.14	P
	5795 MHz	Fig.15	P
802.11ac HT20	5745 MHz	Fig.16	P
	5825 MHz	Fig.17	P
802.11ac HT40	5755 MHz	Fig.18	P
	5795 MHz	Fig.19	P
802.11ac HT80	5775 MHz	Fig.20 Fig.21	P

**Conclusion: PASS**

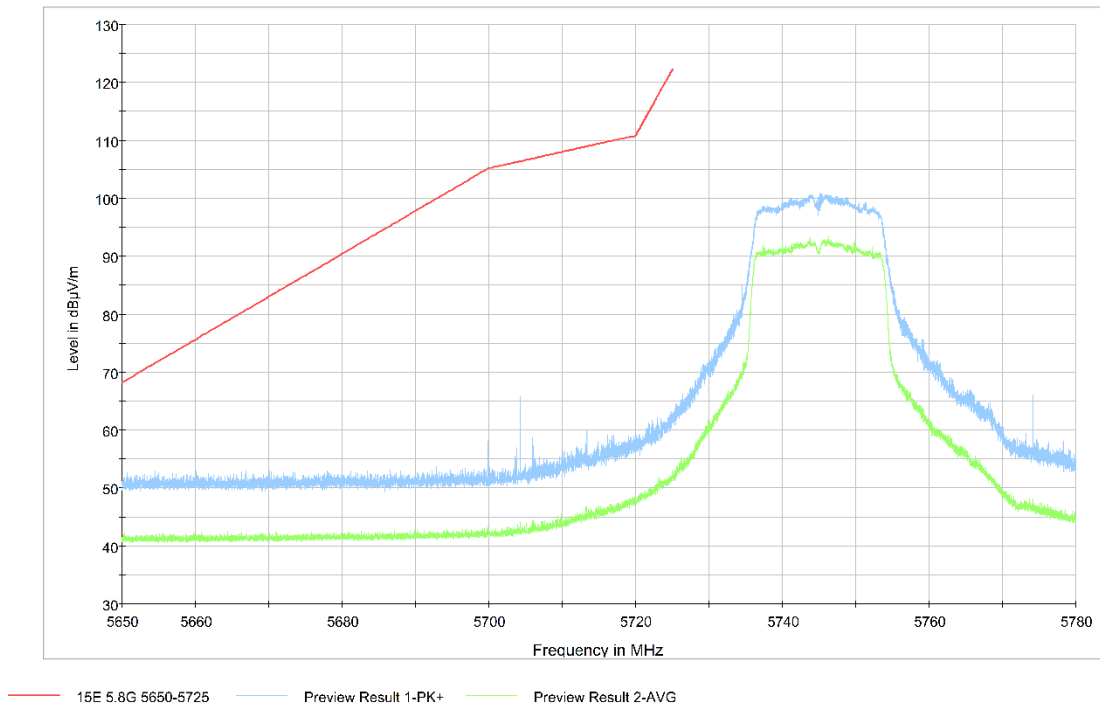
**Test graphs as below:**



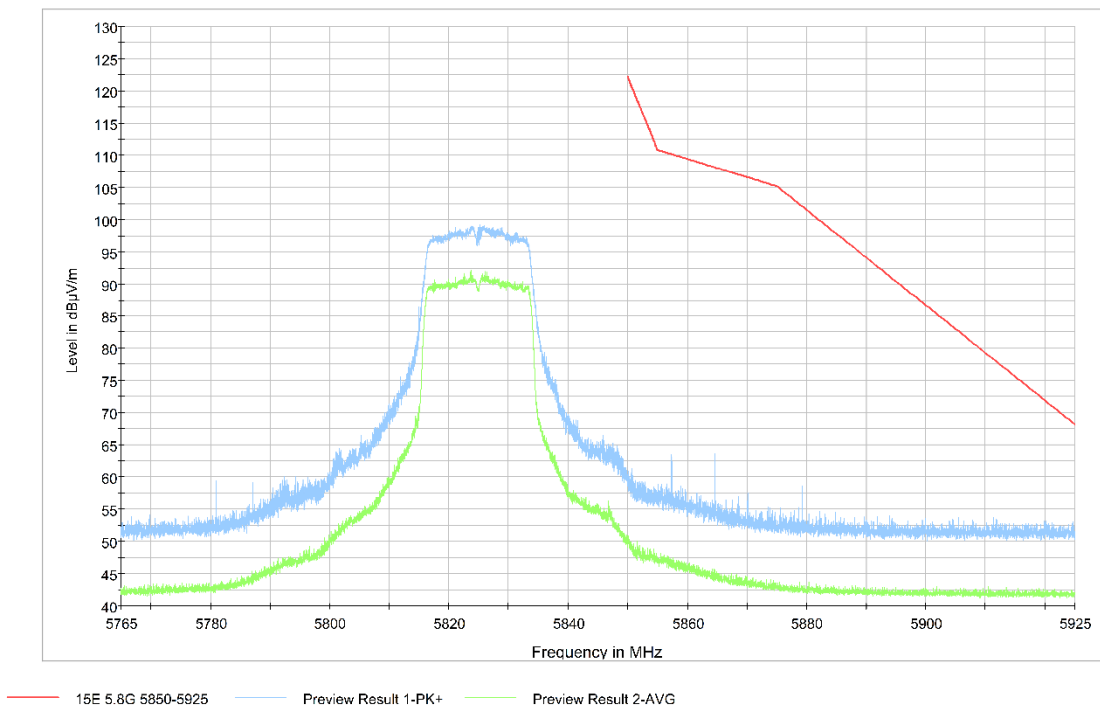
**Fig. 10 Band Edges (802.11a Ch149,5745MHz)**



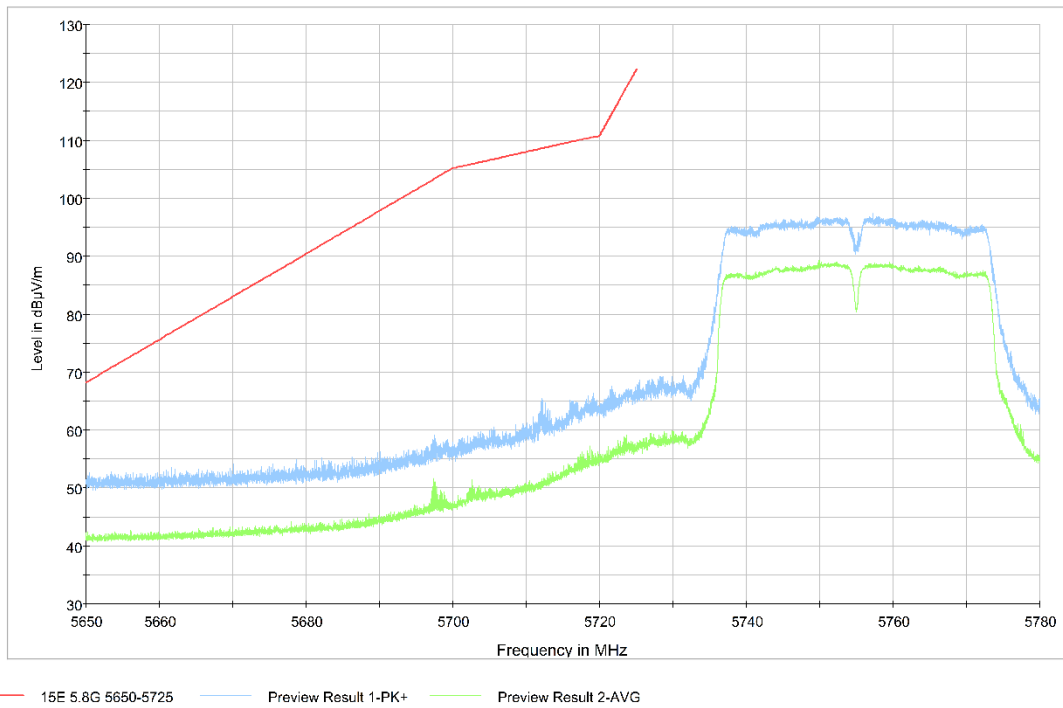
**Fig. 11 Band Edges (802.11a Ch165, 5825MHz)**



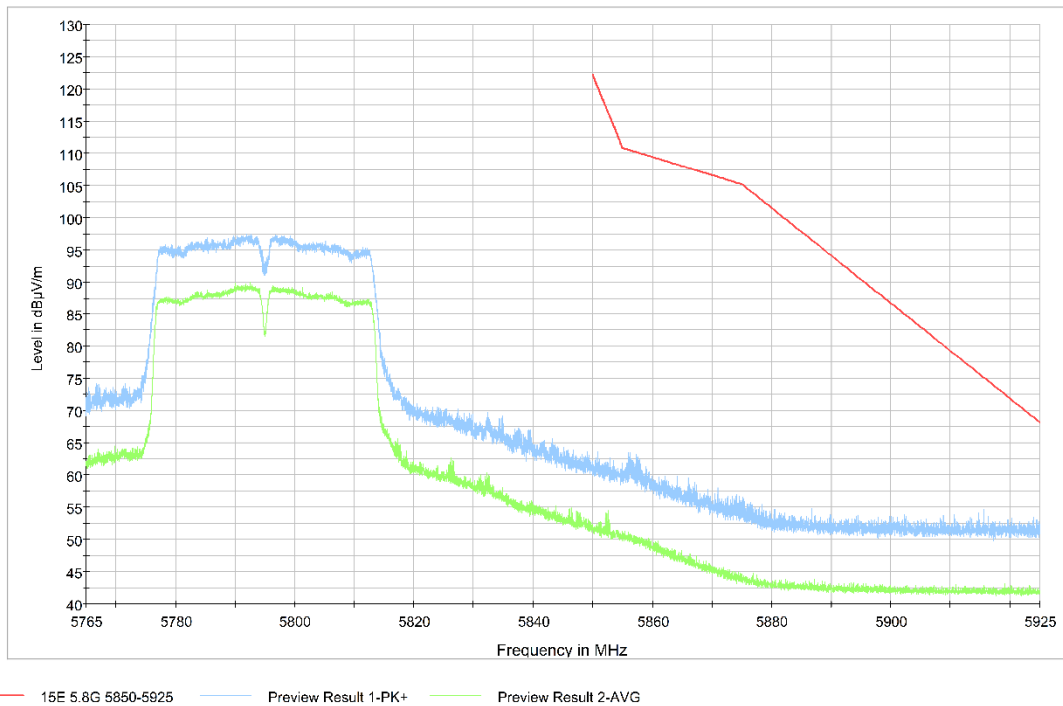
**Fig. 12 Band Edges (802.11n-HT20 Ch149, 5745MHz)**



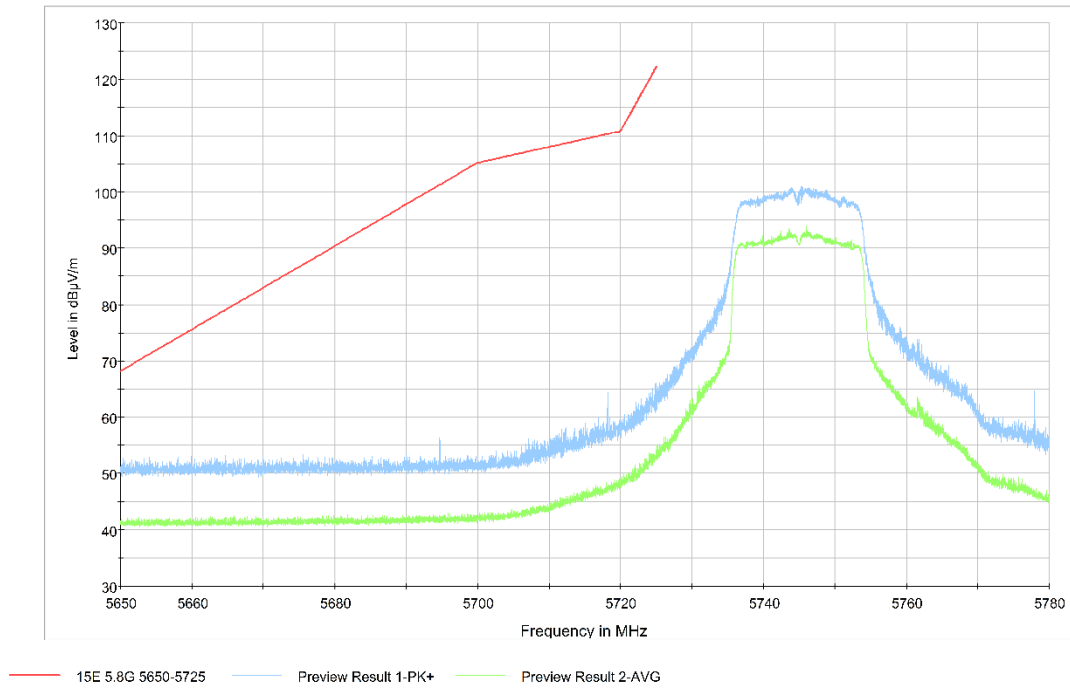
**Fig. 13 Band Edges (802.11n-HT20 Ch165, 5825MHz)**



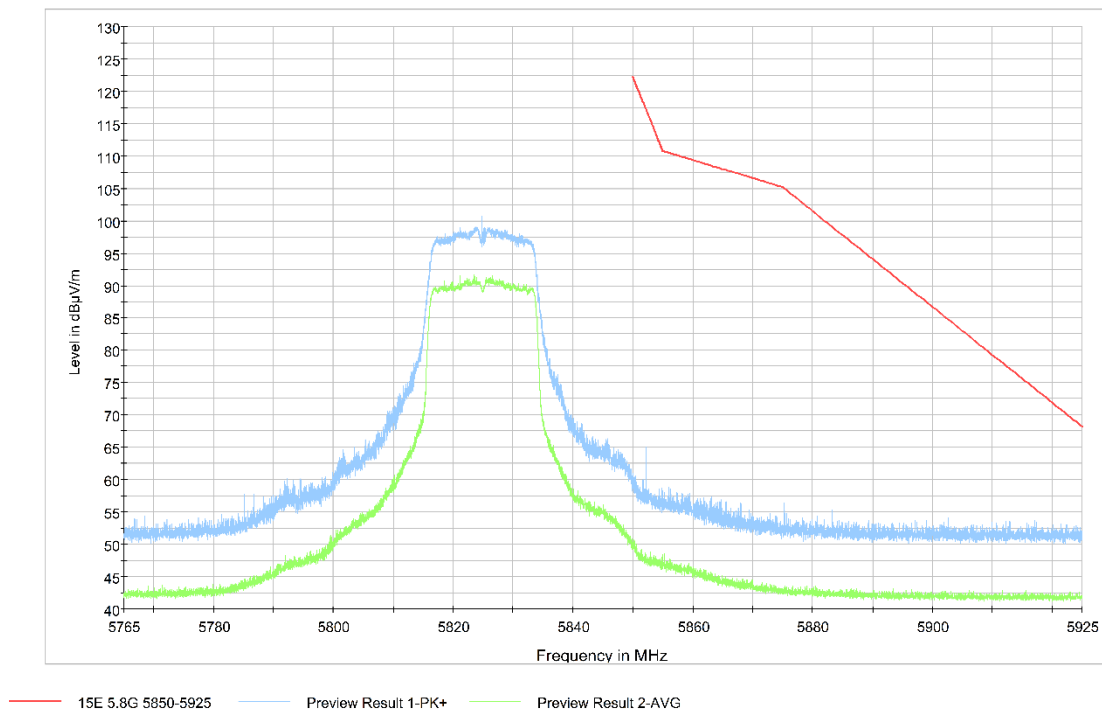
**Fig. 14 Band Edges (802.11n-HT40 Ch151, 5755MHz)**



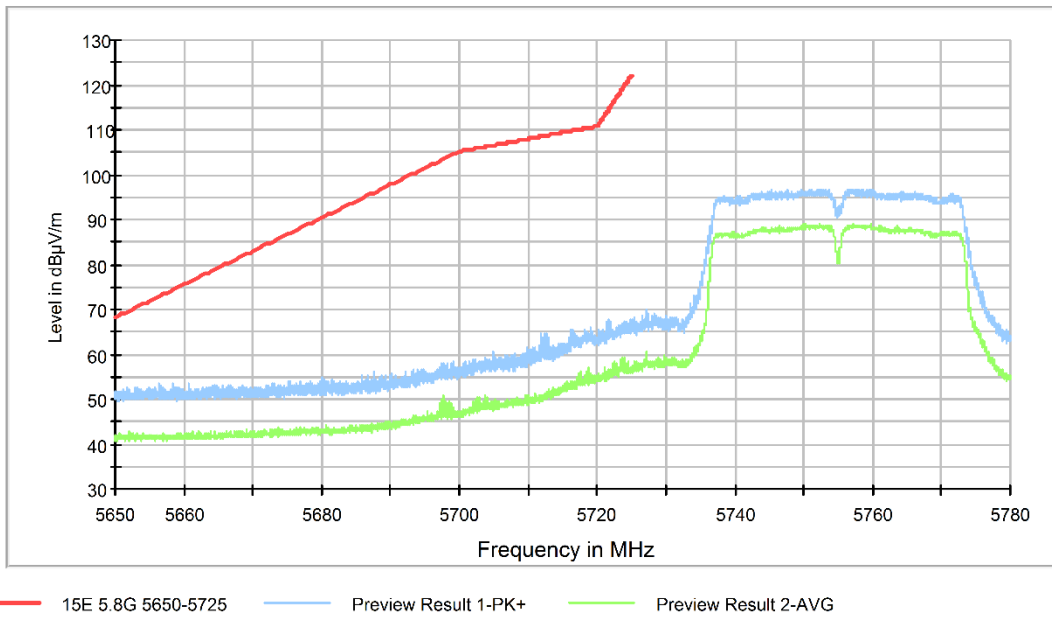
**Fig. 15 Band Edges (802.11n-HT40 Ch159, 5795MHz)**



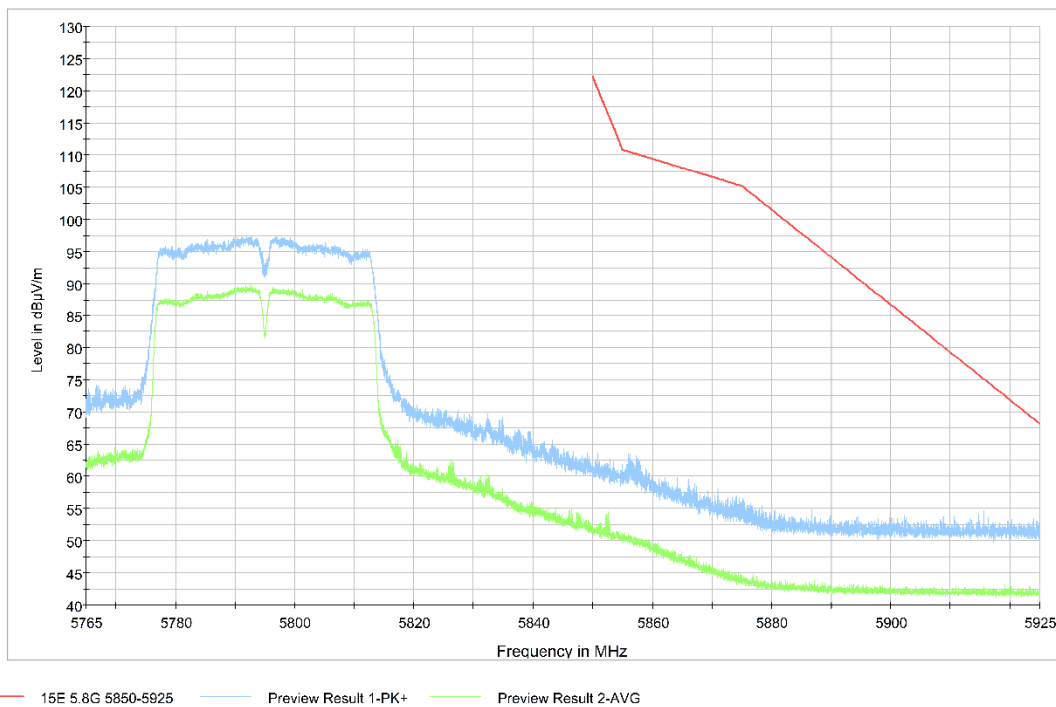
**Fig. 16 Band Edges (802.11ac-HT20 Ch149, 5745MHz)**



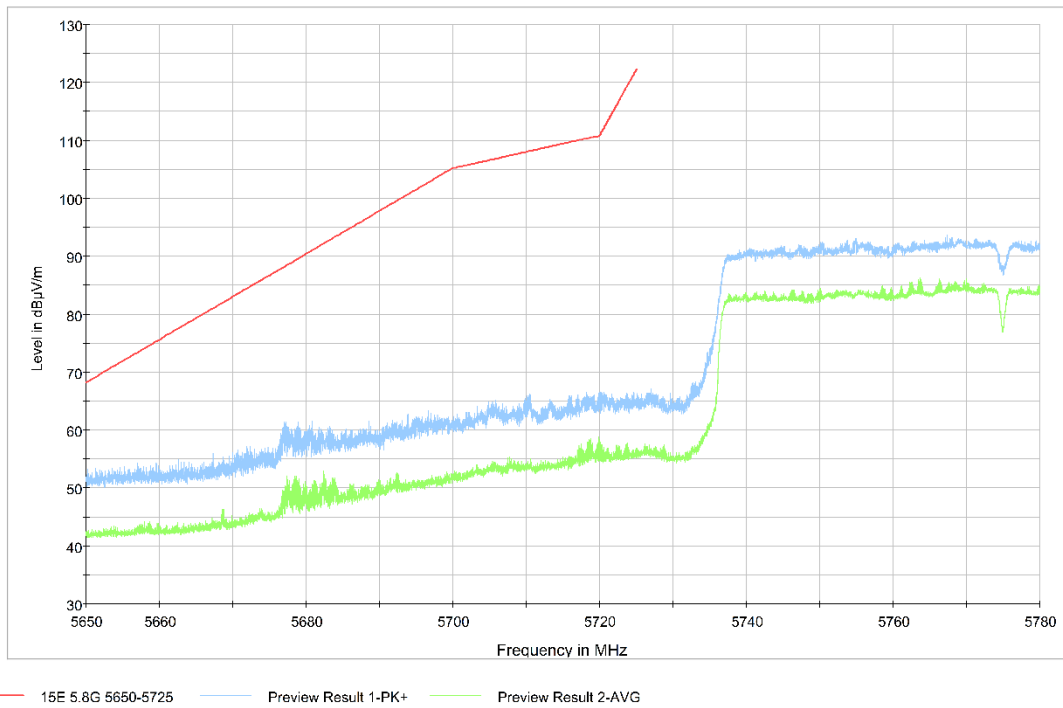
**Fig. 17 Band Edges (802.11ac-HT20 Ch165, 5825MHz)**



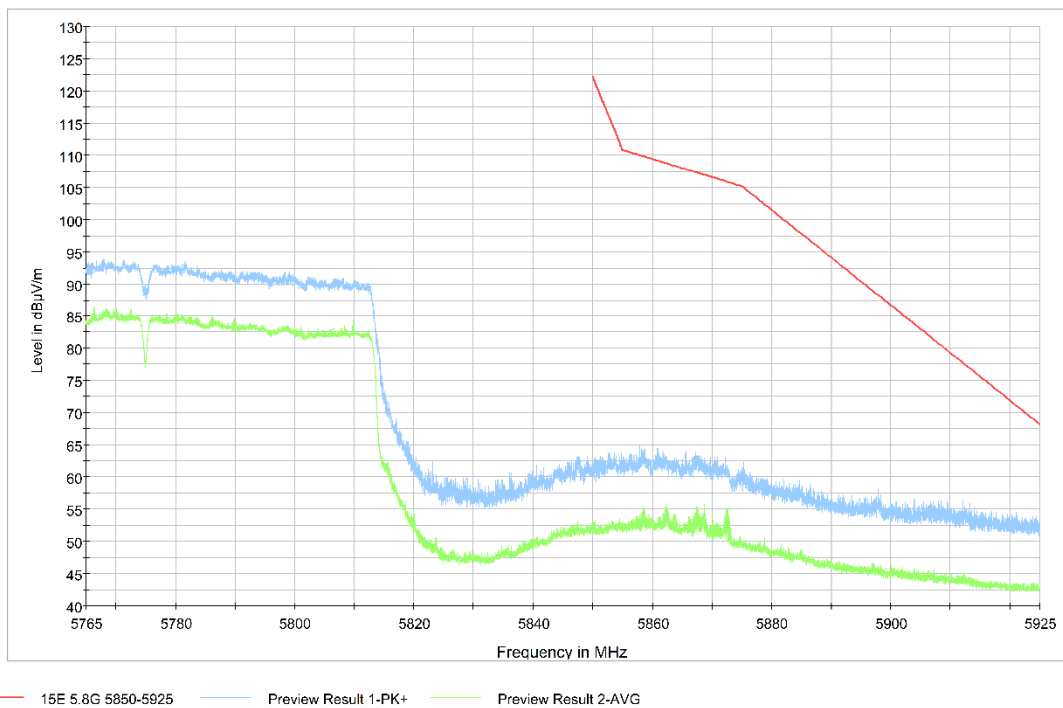
**Fig. 18 Band Edges (802.11ac-HT40 Ch151, 5755MHz)**



**Fig. 19 Band Edges (802.11ac-HT40 Ch159, 5795MHz)**



**Fig. 20 Band Edges (802.11ac-HT80 Ch155, 5775MHz)**



**Fig. 21 Band Edges (802.11ac-HT80, 5775MHz)**

## A.7. AC Powerline Conducted Emission

### Test Condition:

Voltage (V)	Frequency (Hz)
120	60

### Measurement uncertainty:

Expanded measurement uncertainty for this test item is  $U = 3.08\text{dB}$ ,  $k=2$ .

### Measurement Result and limit:

WLAN (Quasi-peak Limit)

Frequency range (MHz)	Quasi-peak Limit (dB $\mu$ V)	Result (dB $\mu$ V)		Conclusion
		With charger		
		802.11a	Idle	
0.15 to 0.5	66 to 56	Fig.22	Fig.23	P
0.5 to 5	56			
5 to 30	60			

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

WLAN (Average Limit)

Frequency range (MHz)	Average Limit (dB $\mu$ V)	Result (dB $\mu$ V)		Conclusion
		With charger		
		802.11a	Idle	
0.15 to 0.5	56 to 46	Fig.22	Fig.23	P
0.5 to 5	46			
5 to 30	50			

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

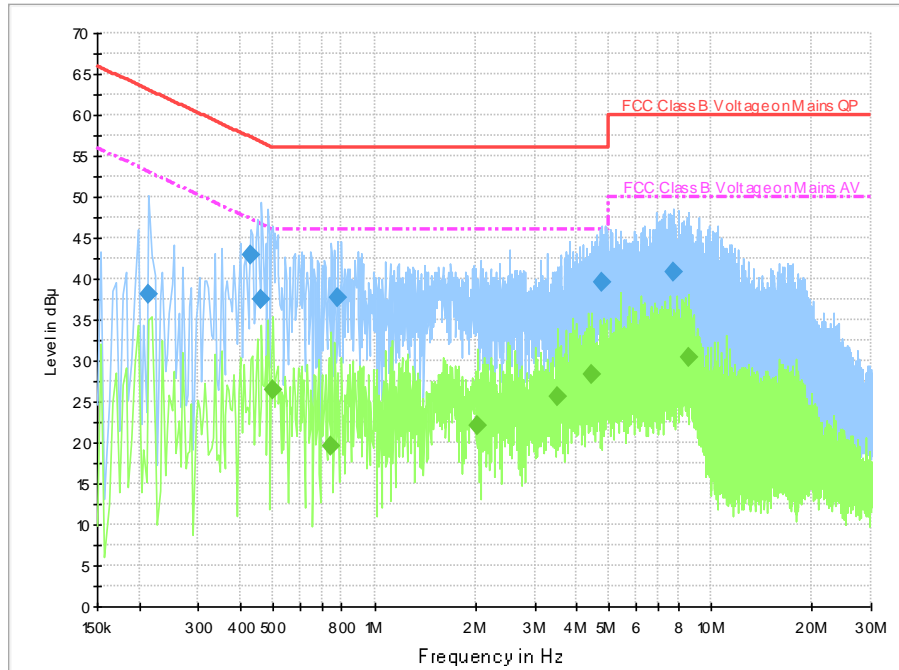
The measurement is made according to ANSI C63.10 .

**Conclusion: PASS**

**Test graphs as below:**



**Traffic:**



**Fig. 22 AC Power line Conducted Emission-802.11a**

Note1: The graphic result above is the maximum of the measurements for both phase line and neutral line.

**Final Result 1**

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.214000	38.0	5000.	9.000	On	N	19.7	25.0	63.0	
0.430000	43.0	5000.	9.000	On	L1	19.8	14.3	57.3	
0.462000	37.5	5000.	9.000	On	L1	19.8	19.2	56.7	
0.778000	37.7	5000.	9.000	On	L1	19.7	18.3	56.0	
4.766000	39.5	5000.	9.000	On	N	19.6	16.5	56.0	
7.782000	40.9	5000.	9.000	On	N	19.6	19.1	60.0	

**Final Result 2**

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.498000	26.4	5000.	9.000	On	L1	19.8	19.7	46.0	
0.746000	19.5	5000.	9.000	On	L1	19.6	26.5	46.0	
2.034000	22.1	5000.	9.000	On	L1	19.6	23.9	46.0	
3.522000	25.6	5000.	9.000	On	L1	19.6	20.4	46.0	
4.418000	28.4	5000.	9.000	On	L1	19.6	17.6	46.0	
8.630000	30.3	5000.	9.000	On	L1	19.7	19.7	50.0	

Note2: The measurement results showed here are worst cases of the combinations of different cables and chargers

Idle:

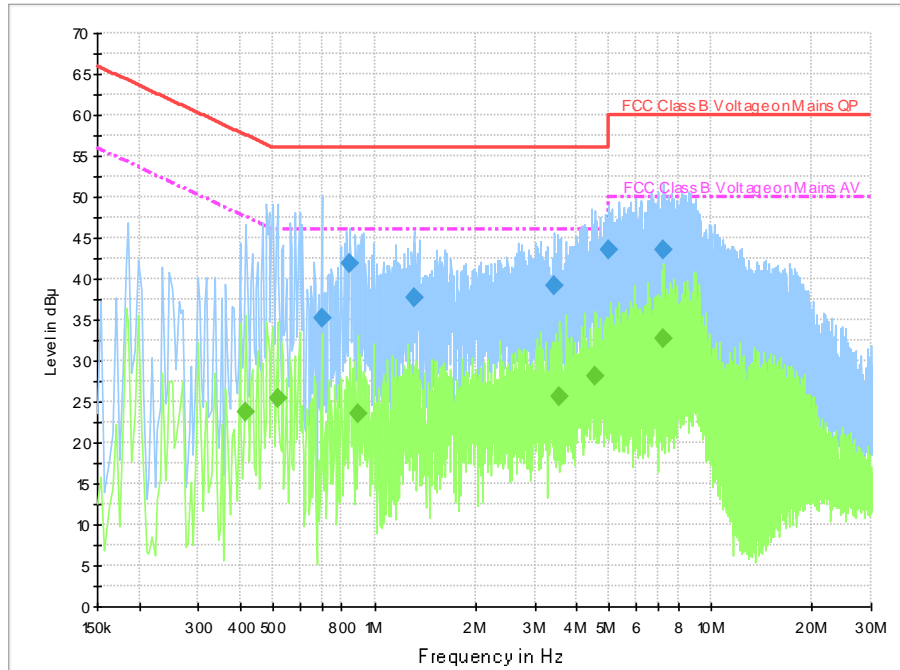


Fig. 23 AC Power line Conducted Emission-Idle

Note1: The graphic result above is the maximum of the measurements for both phase line and neutral line.

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.698000	35.3	5000.	9.000	On	N	19.6	20.7	56.0	
0.842000	41.9	5000.	9.000	On	L1	19.7	14.1	56.0	
1.310000	37.7	5000.	9.000	On	N	19.6	18.3	56.0	
3.418000	39.2	5000.	9.000	On	L1	19.6	16.8	56.0	
4.974000	43.6	5000.	9.000	On	L1	19.6	12.4	56.0	
7.226000	43.6	5000.	9.000	On	L1	19.8	16.4	60.0	

Final Result 2

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.414000	23.8	5000.0	9.000	On	L1	19.7	23.8	47.6	
0.514000	25.5	5000.0	9.000	On	L1	19.7	20.5	46.0	
0.894000	23.5	5000.0	9.000	On	L1	19.7	22.5	46.0	
3.550000	25.5	5000.0	9.000	On	L1	19.6	20.5	46.0	
4.534000	28.2	5000.0	9.000	On	L1	19.5	17.8	46.0	
7.242000	32.8	5000.0	9.000	On	L1	19.8	17.2	50.0	

Note2: The measurement results showed here are worst cases of the combinations of different cables and chargers

## ANNEX B: EUT parameters

Disclaimer: The antenna gain and worse case provided by the client may affect the validity of the measurement results in this report, and the client shall bear the impact and consequences arising therefrom.

## ANNEX C: Accreditation Certificate



\*\*\* END OF REPORT BODY \*\*\*