



**FCC PART 15C  
TEST REPORT  
No.I19Z61530-IOT05**

**for**

**LG Electronics Inc.**

**Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN**

**LM-X540BMW**

**with**

**FCC ID: ZNFX540HM**

**Hardware Version: Rev.1.0**

**Software Version: V09c-LAO-COM**

**Issued Date: 2019-09-17**



**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

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

**Test Laboratory:**

CTTL, Telecommunication Technology Labs, CAICT

No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191.

Tel: +86(0)10-62304633-2512, Fax: +86(0)10-62304633-2504

Email: [ctl\\_terminals@caict.ac.cn](mailto:ctl_terminals@caict.ac.cn), website: [www.caict.ac.cn](http://www.caict.ac.cn)



## **REPORT HISTORY**

| Report Number   | Revision | Description | Issue Date |
|-----------------|----------|-------------|------------|
| I19Z61530-IOT05 | Rev.0    | 1st edition | 2019-09-17 |

## **CONTENTS**

|                                                                        |           |
|------------------------------------------------------------------------|-----------|
| <b>CONTENTS .....</b>                                                  | <b>3</b>  |
| <b>1. TEST LATORATORY.....</b>                                         | <b>5</b>  |
| 1.1. INTRODUCTION & ACCREDITATION .....                                | 5         |
| 1.2. TESTING LOCATION .....                                            | 5         |
| 1.3. TESTINGENVIRONMENT .....                                          | 5         |
| 1.4. PROJECT DATA .....                                                | 5         |
| 1.5. SIGNATURE .....                                                   | 5         |
| <b>2. CLIENT INFORMATION.....</b>                                      | <b>5</b>  |
| 2.1. APPLICANT INFORMATION.....                                        | 6         |
| 2.2. MANUFACTURER INFORMATION.....                                     | 6         |
| <b>3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT(AE) .....</b> | <b>6</b>  |
| 3.1. ABOUT EUT .....                                                   | 7         |
| 3.2. INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST .....         | 7         |
| <b>3.3. INTERNAL IDENTIFICATION OF AE .....</b>                        | <b>7</b>  |
| 3.4. GENERAL DESCRIPTION.....                                          | 7         |
| <b>4. REFERENCE DOCUMENTS.....</b>                                     | <b>8</b>  |
| 4.1. DOCUMENTS SUPPLIED BY APPLICANT .....                             | 8         |
| 4.2. REFERENCE DOCUMENTS FOR TESTING.....                              | 8         |
| <b>5. LABORATORY ENVIRONMENT.....</b>                                  | <b>8</b>  |
| <b>6. SUMMARY OF TEST RESULTS .....</b>                                | <b>9</b>  |
| 6.1. SUMMARY OF TEST RESULTS.....                                      | 9         |
| 6.2. STATEMENTS.....                                                   | 9         |
| 6.3. TEST CONDITIONS .....                                             | 9         |
| <b>7. TEST EQUIPMENTS UTILIZED .....</b>                               | <b>10</b> |
| <b>8. MEASUREMENT UNCERTAINTY .....</b>                                | <b>11</b> |
| 8.1. TRANSMITTER OUTPUT POWER.....                                     | 11        |
| 8.2. PEAK POWER SPECTRAL DENSITY .....                                 | 11        |
| 8.3. OCCUPIED 6DB BANDWIDTH.....                                       | 11        |
| 8.4. BAND EDGES COMPLIANCE.....                                        | 11        |
| 8.5. SPURIOUS EMISSIONS .....                                          | 11        |
| 8.6. AC POWER-LINE CONDUCTED EMISSION .....                            | 11        |
| <b>ANNEX A: MEASUREMENT RESULTS.....</b>                               | <b>12</b> |
| A.1. MEASUREMENT METHOD .....                                          | 12        |
| A.2. MAXIMUM PEAK OUTPUT POWER .....                                   | 13        |
| A.2.1. MAXIMUM PEAK OUTPUT POWER-CONDUCTED .....                       | 13        |

|                                                       |           |
|-------------------------------------------------------|-----------|
| A.2.2. MAXIMUM AVERAGE OUTPUT POWER-CONDUCTED .....   | 16        |
| A.3. PEAK POWER SPECTRAL DENSITY .....                | 17        |
| A.4. OCCUPIED 6DB BANDWIDTH .....                     | 18        |
| A.5. TRANSMITTER SPURIOUS EMISSION .....              | 26        |
| A.5.1 TRANSMITTER SPURIOUS EMISSION - CONDUCTED ..... | 26        |
| A.5.2 TRANSMITTER SPURIOUS EMISSION - RADIATED .....  | 57        |
| A.6. BAND EDGES COMPLIANCE .....                      | 67        |
| A6.1 BAND EDGES - CONDUCTED.....                      | 67        |
| A6.2 BAND EDGES - RADIATED .....                      | 74        |
| FIG. 83 BAND EDGES (802.11A, 5745MHz) .....           | 75        |
| FIG. 84 BAND EDGES (802.11A, 5825MHz) .....           | 75        |
| FIG. 85 BAND EDGES (802.11N-HT20, 5745MHz).....       | 76        |
| FIG. 86 BAND EDGES (802.11N-HT20, 5825MHz).....       | 76        |
| FIG. 87 BAND EDGES (802.11N-HT40, 5755MHz).....       | 77        |
| FIG. 88 BAND EDGES (802.11N-HT40, 5795MHz).....       | 77        |
| FIG. 89 BAND EDGES (802.11AC-HT20, 5745MHz).....      | 78        |
| FIG. 90 BAND EDGES (802.11AC-HT20, 5825MHz).....      | 78        |
| FIG. 91 BAND EDGES (802.11AC-HT40, 5755MHz).....      | 79        |
| FIG. 92 BAND EDGES (802.11AC-HT40, 5795MHz).....      | 79        |
| FIG. 93 BAND EDGES (802.11AC-HT80, 5775MHz).....      | 80        |
| A.7. AC POWERLINE CONDUCTED EMISSION.....             | 81        |
| FIG. 94 AC POWERLINE CONDUCTED EMISSION-802.11A ..... | 82        |
| FIG. 95 AC POWERLINE CONDUCTED EMISSION-IDLE.....     | 83        |
| <b>ANNEX B: ACCREDITATION CERTIFICATE.....</b>        | <b>84</b> |

## **1. TEST LATORATORY**

### **1.1. Introduction & Accreditation**

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2005 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 (CN0066). The detail accreditation scope can be found on NVLAP website.

### **1.2. Testing Location**

Conducted testing Location: CTTL(huayuan North Road)

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

Radiated testing Location: CTTL(huayuan North Road)

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

Radiated testing Location: CTTL(BDA)

Address: No.18A, Kangding Street, Beijing Economic-Technology  
Development Area, Beijing, P. R. China 100176

### **1.3. TestingEnvironment**

Normal Temperature: 15-35°C

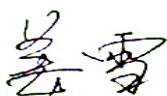
Relative Humidity: 20-75%

### **1.4. Project data**

Testing Start Date: 2019-08-19

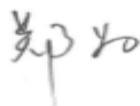
Testing End Date: 2019-09-16

### **1.5. Signature**



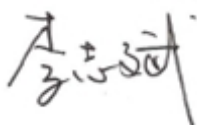
---

Jiang Xue  
(Prepared this test report)



---

Zheng Wei  
(Reviewed this test report)



---

Li Zhibin  
(Approved this test report)

## **2. CLIENT INFORMATION**

## **2.1. Applicant Information**

Company Name: LG Electronics Inc.  
Address: LG Twin Towers,128,Yeoui-daero,Yeongdeungpo-gu  
City: Seoul  
Postal Code: /  
Country: Korea  
Telephone: +82-2-6946-1675  
Fax: /

## **2.2. Manufacturer Information**

Company Name: LG Electronics Inc.  
Address: LG Twin Towers,128,Yeoui-daero,Yeongdeungpo-gu  
City: Seoul  
Postal Code: /  
Country: Korea  
Telephone: +82-2-6946-1675  
Fax: /

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

## **EQUIPMENT(AE)**

### **3.1. About EUT**

|                      |                                                     |
|----------------------|-----------------------------------------------------|
| Description          | Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN |
| Model name           | LM-X540BMW                                          |
| FCC ID               | ZNFX540HM                                           |
| WLAN Frequency Range | ISM Band: 5725MHz~5850MHz                           |
| Type of modulation   | OFDM                                                |
| Voltage              | 3.85V                                               |

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

| <b>EUT ID*</b> | <b>SN or IMEI</b>                   | <b>HW Version</b> | <b>SW Version</b> |
|----------------|-------------------------------------|-------------------|-------------------|
| EUT1           | 358619100026710/<br>358619100026728 | Rev.1.0           | V09c-LAO-COM      |
| EUT2           | 358619100026355/<br>358619100026363 | Rev.1.0           | V09c-LAO-COM      |
| EUT3           | 358619100027957/<br>358619100027965 | Rev.1.0           | V09c-LAO-COM      |

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

### **3.3. Internal Identification of AE**

| <b>AE ID*</b> | <b>Description</b> | <b>SN</b> | <b>Remarks</b> |
|---------------|--------------------|-----------|----------------|
| AE1           | Battery            | /         | /              |
| AE2           | Charger            | /         | /              |
| AE3           | USB Cable          | /         | /              |

#### **AE1**

|                 |                      |
|-----------------|----------------------|
| Model           | BL-T45 (EAC64578801) |
| Manufacturer    | Lishen               |
| Capacitance     | 4000mAh              |
| Nominal voltage | 3.85v                |

#### **AE2**

|                 |                        |
|-----------------|------------------------|
| Model           | MCS-V01WR(EAY65068902) |
| Manufacturer    | Sunlin Electrocnis     |
| Length of cable | /                      |

#### **AE3**

|                 |                        |
|-----------------|------------------------|
| Model           | DC15WB-G (EAD64746101) |
| Manufacturer    | Ningbo                 |
| Length of cable | /                      |

\*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 Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN 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 Part15              | FCC CFR 47, Part 15, Subpart C and E:                  |         |
|                         | 15.205 Restricted bands of operation;                  | 2018    |
|                         | 15.209 Radiated emission limits, general requirements; |         |
|                         | 15.407 General technical requirements                  |         |
| ANSI C63.10             | Methods of Measurement of Radio-Noise Emissions from   | 2013    |
|                         | Low-Voltage Electrical and Electronic Equipment in the |         |
|                         | Range of 9 kHz to 40 GHz                               |         |
| UNII: KDB 789033<br>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)             | /                | P       |
| Peak Power Spectral Density                      | 15.407 (a)             | /                | P       |
| Occupied 6dB Bandwidth                           | 15.407 (e)             | /                | P       |
| Band Edges Compliance                            | 15.407 (b)             | /                | P       |
| Transmitter Spurious Emission - Conducted        | 15.407                 | /                | P       |
| Transmitter Spurious Emission - Radiated         | 15.407, 15.205, 15.209 | /                | P       |
| AC Powerline Conducted Emission                  | 15.107, 15.207         | /                | P       |
| Transmitter Spurious Emission - Radiated < 30MHz | 15.407, 15.209         | /                | P       |

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/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     | 3.85V |
| 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             | 2020-05-15           |
| 2   | LISN                   | ENV216 | 101200        | Rohde & Schwarz | 1 year             | 2020-04-10           |
| 3   | Test Receiver          | ESCI   | 100344        | Rohde & Schwarz | 1 year             | 2020-03-20           |
| 4   | Shielding Room         | S81    | /             | ETS-Lindgren    | /                  | /                    |

### Radiated emission test system

| No. | Equipment              | Model    | Serial Number | Manufacturer    | Calibration Period | Calibration Due date |
|-----|------------------------|----------|---------------|-----------------|--------------------|----------------------|
| 1   | Test Receiver          | ESU26    | 100376        | Rohde & Schwarz | 1 year             | 2019-11-27           |
| 2   | Test Receiver          | ESU26    | 100235        | Rohde & Schwarz | 1 year             | 2020-03-01           |
| 3   | BiLog Antenna          | VULB9163 | 9163-514      | Schwarzbeck     | 1 year             | 2020-02-03           |
| 4   | BiLog Antenna          | VULB9163 | 9163-301      | Schwarzbeck     | 1 year             | 2020-02-29           |
| 5   | EMI Antenna            | 3117     | 00139065      | ETS-Lindgren    | 1 year             | 2019-10-15           |
| 6   | EMI Antenna            | 3115     | 6914          | ETS-Lindgren    | 1 year             | 2019-10-15           |
| 7   | EMI Antenna            | 3116     | 2663          | ETS-Lindgren    | 1 year             | 2019-11-19           |
| 8   | EMI Antenna            | 3116     | 2661          | ETS-Lindgren    | 1 year             | 2019-10-15           |
| 9   | Vector Signal Analyzer | FSV40    | 101047        | Rohde & Schwarz | 1 year             | 2020-05-16           |

## 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                              | /               |
| $30\text{MHz} \leq f \leq 1\text{GHz}$  | 5.40            |
| $1\text{GHz} \leq f \leq 18\text{GHz}$  | 4.32            |
| $18\text{GHz} \leq f \leq 40\text{GHz}$ | 5.26            |

### 8.6. AC Power-line Conducted Emission

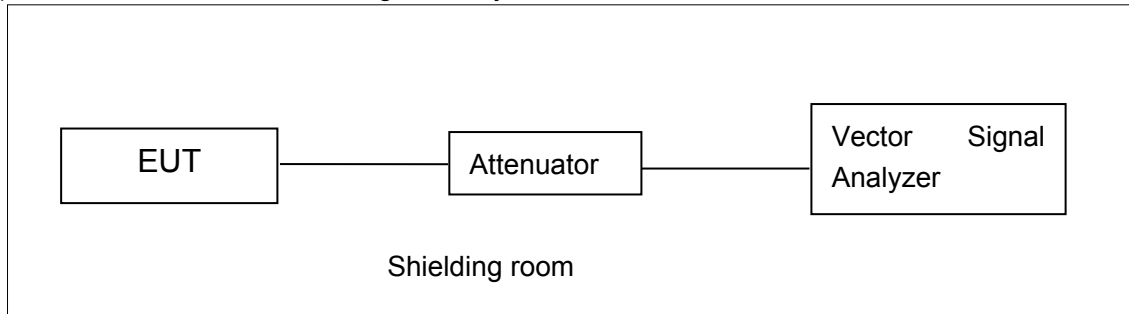
Measurement Uncertainty : 3.08dB,k=2

## 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

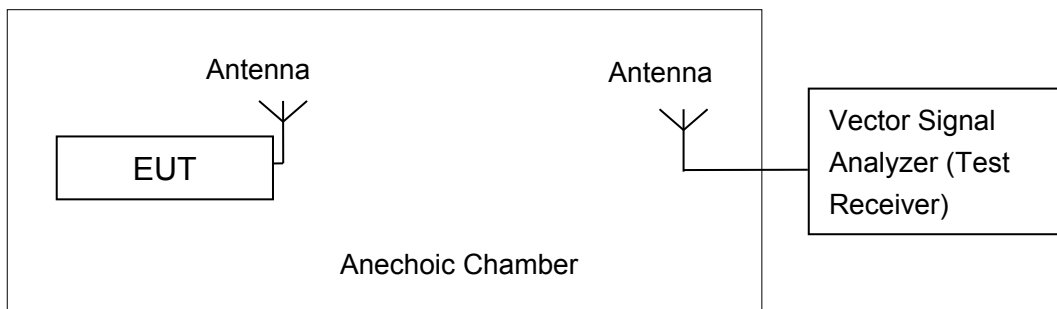


#### A.1.2. Radiated Emission Measurements

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. 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                | 22.54             | 22.29           | 21.75           |
|         | 9                | 22.26             | /               | /               |
|         | 12               | 21.98             | /               | /               |
|         | 18               | 21.97             | /               | /               |
|         | 24               | 22.47             | /               | /               |
|         | 36               | 21.66             | /               | /               |
|         | 48               | 20.76             | /               | /               |
|         | 54               | 21.01             | /               | /               |

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              | 22.21             | /               | /               |
|                 | MCS1              | 21.90             | /               | /               |
|                 | MCS2              | 21.90             | /               | /               |
|                 | MCS3              | 22.22             | /               | /               |
|                 | MCS4              | 22.36             | 21.71           | 20.74           |
|                 | MCS5              | 21.67             | /               | /               |
|                 | MCS6              | 20.83             | /               | /               |
|                 | MCS7              | 20.85             | /               | /               |

The data rate MCS4 is selected as worse condition, and the following cases are performed with this condition.

#### 802.11ac-HT20 mode

| Mode                | Data Rate<br>(Index) | Test Result (dBm)  |                    |                    |
|---------------------|----------------------|--------------------|--------------------|--------------------|
|                     |                      | 5745MHz<br>(Ch149) | 5785MHz<br>(Ch157) | 5825MHz<br>(Ch165) |
| 802.11ac<br>(20MHz) | MCS0                 | 21.40              | /                  | /                  |
|                     | MCS1                 | 21.10              | /                  | /                  |
|                     | MCS2                 | 21.16              | /                  | /                  |
|                     | MCS3                 | 21.69              | /                  | /                  |
|                     | MCS4                 | 21.66              | /                  | /                  |
|                     | MCS5                 | 21.64              | /                  | /                  |
|                     | MCS6                 | 21.57              | /                  | /                  |
|                     | MCS7                 | 21.75              | 21.55              | 21.09              |
|                     | MCS8                 | 20.60              | /                  | /                  |

The data rate MCS7 is selected as worse condition, and the following cases are performed with this condition.

#### 802.11n-HT40 mode

| Mode               | Data Rate<br>(Index) | Test Result (dBm)  |                    |
|--------------------|----------------------|--------------------|--------------------|
|                    |                      | 5755MHz<br>(Ch151) | 5795MHz<br>(Ch159) |
| 802.11n<br>(40MHz) | MCS0                 | 22.33              | /                  |
|                    | MCS1                 | 21.78              | /                  |
|                    | MCS2                 | 21.89              | /                  |
|                    | MCS3                 | 22.14              | /                  |
|                    | MCS4                 | 22.35              | 22.25              |
|                    | MCS5                 | 20.71              | /                  |
|                    | MCS6                 | 20.73              | /                  |
|                    | MCS7                 | 20.71              | /                  |

The data rate MCS4 is selected as worse condition, and the following cases are performed with this condition.

#### 802.11ac-HT40 mode

| Mode                | Data Rate<br>(Index) | Test Result (dBm)  |                    |
|---------------------|----------------------|--------------------|--------------------|
|                     |                      | 5755MHz<br>(Ch151) | 5795MHz<br>(Ch159) |
| 802.11ac<br>(40MHz) | MCS0                 | 20.59              | /                  |
|                     | MCS1                 | 20.23              | /                  |
|                     | MCS2                 | 20.20              | /                  |
|                     | MCS3                 | 20.65              | 20.85              |
|                     | MCS4                 | 20.48              | /                  |
|                     | MCS5                 | 20.53              | /                  |
|                     | MCS6                 | 20.50              | /                  |
|                     | MCS7                 | 20.55              | /                  |

|  |      |       |   |
|--|------|-------|---|
|  | MCS8 | 19.77 | / |
|  | MCS9 | 17.63 | / |

The data rate MCS3 is selected as worse condition, and the following cases are performed with this condition.

**802.11ac-HT80 mode**

| Mode                | Data Rate<br>(Index) | Test Result (dBm)  |
|---------------------|----------------------|--------------------|
|                     |                      | 5775MHz<br>(Ch155) |
| 802.11ac<br>(80MHz) | MCS0                 | 20.02              |
|                     | MCS1                 | 19.97              |
|                     | MCS2                 | 20.04              |
|                     | MCS3                 | 20.30              |
|                     | MCS4                 | 20.16              |
|                     | MCS5                 | 20.27              |
|                     | MCS6                 | 20.20              |
|                     | MCS7                 | 20.17              |
|                     | MCS8                 | 16.56              |
|                     | MCS9                 | 16.39              |

The data rate MCS5 is selected as worse condition, and the following cases are performed with this condition.

**Conclusion: PASS**

## A.2.2. Maximum Average Output Power-Conducted

Method of Measurement: See ANSI C63.10-clause 12.3.2.2 Method SA-1

### 802.11a mode

| Mode    | Test Result (dBm) |                 |                 |
|---------|-------------------|-----------------|-----------------|
|         | 5745MHz (Ch149)   | 5785MHz (Ch157) | 5825MHz (Ch165) |
| 802.11a | 14.58             | 15.54           | 15.54           |

### 802.11n-HT20 mode

| Mode           | Test Result (dBm) |                 |                |
|----------------|-------------------|-----------------|----------------|
|                | 5745MHz (Ch149)   | 5785MHz (Ch157) | 5825MHz(Ch165) |
| 802.11n(20MHz) | 13.98             | 13.65           | 12.18          |

### 802.11ac-HT20 mode

| Mode            | Test Result (dBm) |                 |                |
|-----------------|-------------------|-----------------|----------------|
|                 | 5745MHz (Ch149)   | 5785MHz (Ch157) | 5825MHz(Ch165) |
| 802.11ac(20MHz) | 12.53             | 11.94           | 12.35          |

### 802.11n-HT40 mode

| Mode           | Test Result (dBm) |                |
|----------------|-------------------|----------------|
|                | 5755MHz (Ch151)   | 5795MHz(Ch159) |
| 802.11n(40MHz) | 13.89             | 13.60          |

### 802.11ac-HT40 mode

| Mode            | Test Result (dBm) |                |
|-----------------|-------------------|----------------|
|                 | 5755MHz (Ch151)   | 5795MHz(Ch159) |
| 802.11ac(40MHz) | 10.98             | 10.85          |

### 802.11ac-HT80 mode

| Mode            | Test Result (dBm) |
|-----------------|-------------------|
|                 | 5775MHz (Ch155)   |
| 802.11ac(80MHz) | 11.05             |

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 |
|-------------------------|--------|

**Measurement Results:**

| Mode             | Channel | Power Spectral Density<br>( dBm/500kHz ) | Conclusion |
|------------------|---------|------------------------------------------|------------|
| 802.11a          | 149     | 2.34                                     | P          |
|                  | 157     | 1.47                                     | P          |
|                  | 165     | 1.64                                     | P          |
| 802.11n<br>HT20  | 149     | 1.94                                     | P          |
|                  | 157     | 1.69                                     | P          |
|                  | 165     | 0.16                                     | P          |
| 802.11ac<br>HT20 | 149     | 2.55                                     | P          |
|                  | 157     | 2.82                                     | P          |
|                  | 165     | 2.56                                     | P          |
| 802.11n<br>HT40  | 151     | -0.81                                    | P          |
|                  | 159     | -0.90                                    | P          |
| 802.11ac<br>HT40 | 151     | -1.31                                    | P          |
|                  | 159     | -1.57                                    | P          |
| 802.11ac HT80    | 155     | -4.52                                    | P          |

**Conclusion: PASS**

#### A.4. Occupied 6dB Bandwidth

##### Measurement Limit:

| Standard                   | Limit (kHz) |
|----------------------------|-------------|
| FCC 47 CFR Part 15.407 (e) | $\geq 500$  |

The measurement is made according to KDB789033 D02 .

##### Measurement Uncertainty:

|                         |         |
|-------------------------|---------|
| Measurement Uncertainty | 60.80Hz |
|-------------------------|---------|

##### Measurement Result:

| Mode             | Channel | Occupied 6dB Bandwidth<br>( MHz) |       | conclusion |
|------------------|---------|----------------------------------|-------|------------|
| 802.11a          | 149     | Fig.1                            | 16.30 | P          |
|                  | 157     | Fig.2                            | 16.30 | P          |
|                  | 165     | Fig.3                            | 16.30 | P          |
| 802.11n<br>HT20  | 149     | Fig.4                            | 17.60 | P          |
|                  | 157     | Fig.5                            | 17.60 | P          |
|                  | 165     | Fig.6                            | 17.60 | P          |
| 802.11ac<br>HT20 | 149     | Fig.7                            | 17.05 | P          |
|                  | 157     | Fig.8                            | 17.30 | P          |
|                  | 165     | Fig.9                            | 16.85 | P          |
| 802.11n<br>HT40  | 151     | Fig.10                           | 36.32 | P          |
|                  | 159     | Fig.11                           | 36.32 | P          |
| 802.11ac<br>HT40 | 151     | Fig.12                           | 35.12 | P          |
|                  | 159     | Fig.13                           | 35.20 | P          |
| 802.11ac HT80    | 155     | Fig.14                           | 75.52 | P          |

**Conclusion: PASS**

**Test graphs as below:**

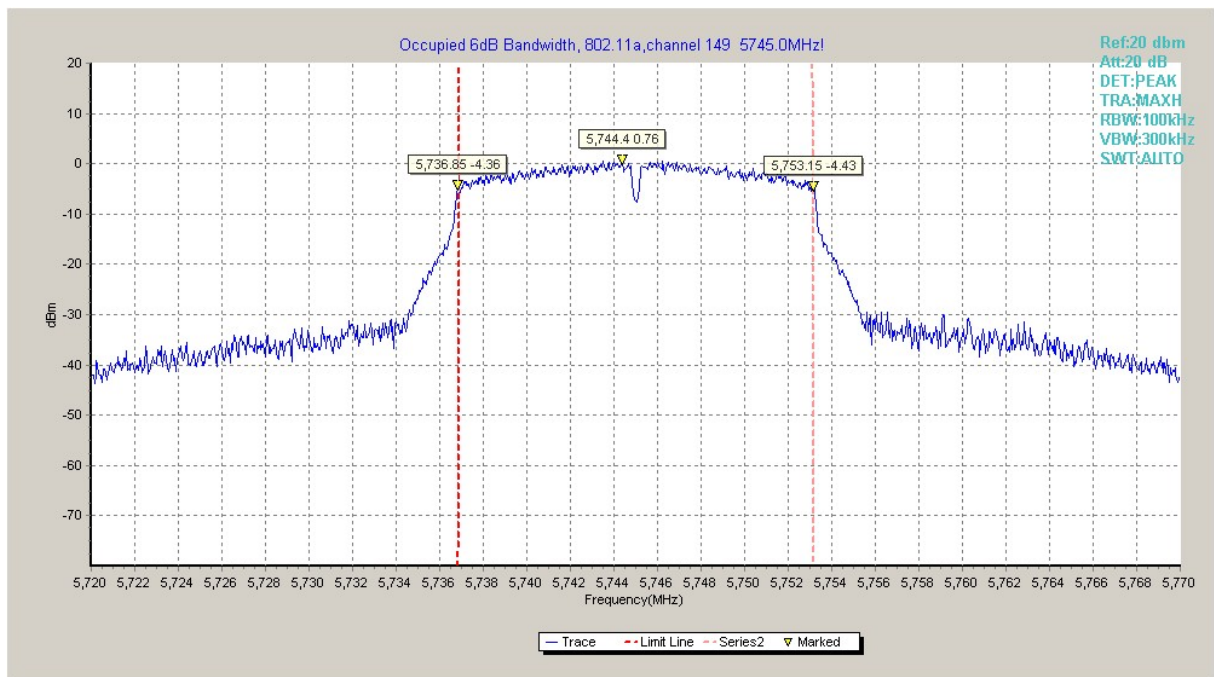


Fig. 1 Occupied 6dB Bandwidth (802.11a, Ch 149)

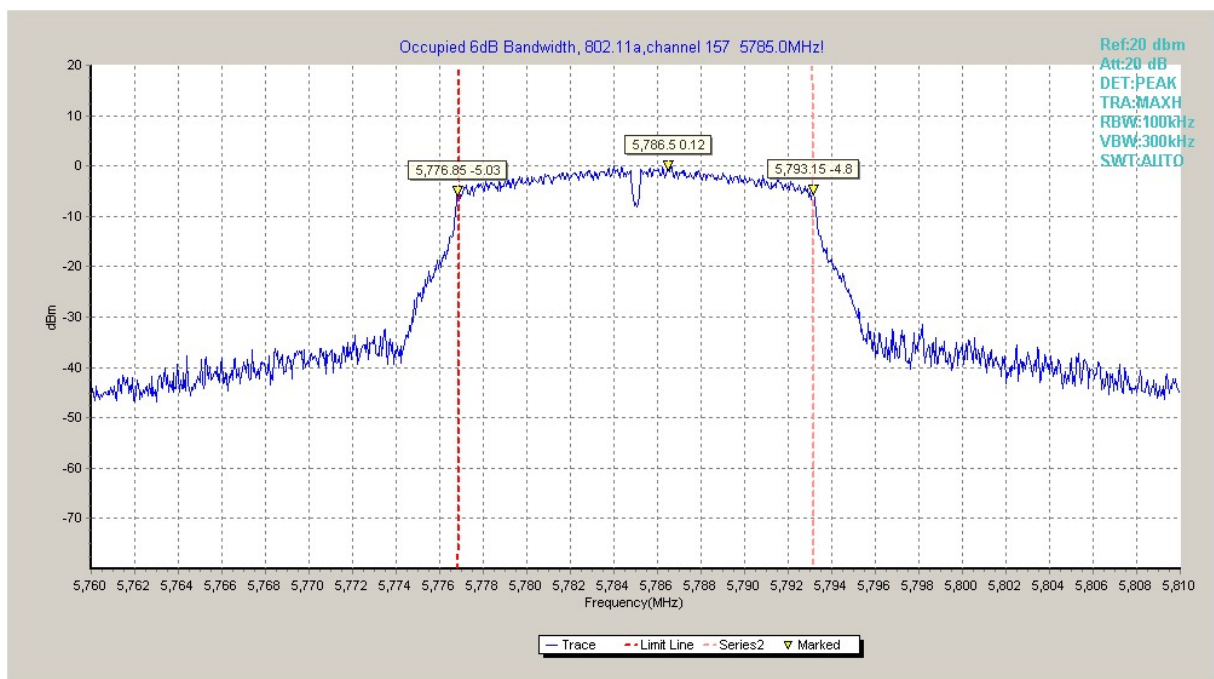


Fig. 2 Occupied 6dB Bandwidth (802.11a, Ch 157)

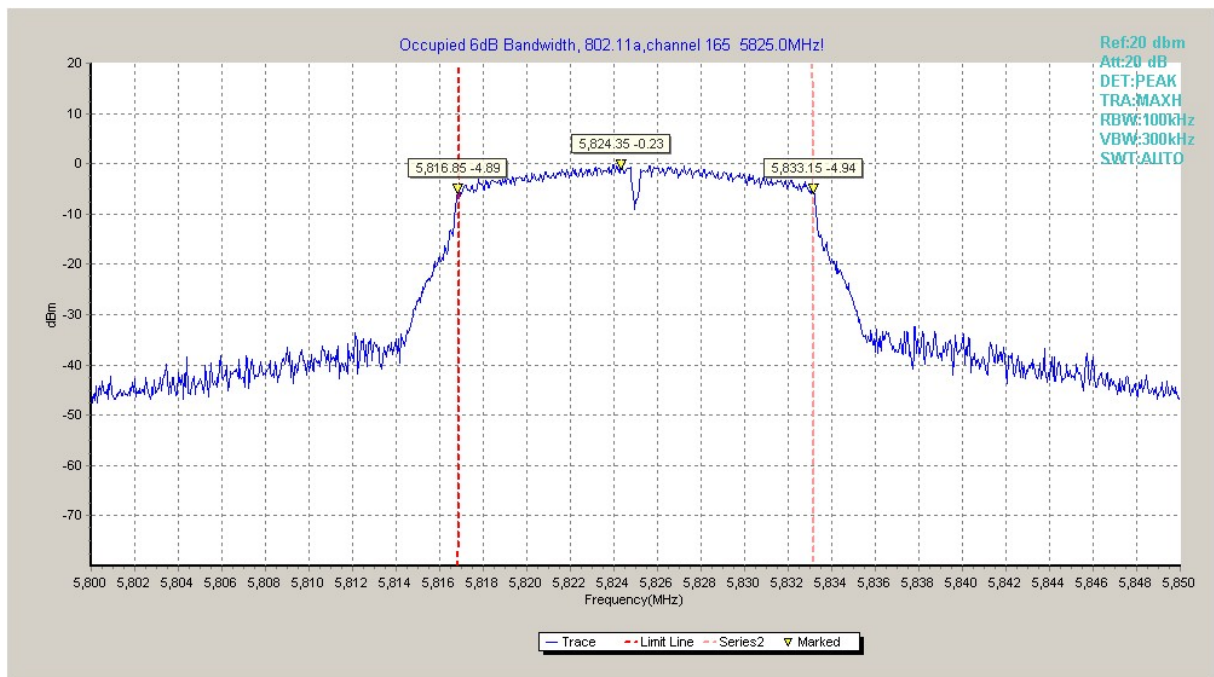


Fig. 3 Occupied 6dB Bandwidth (802.11a, Ch 165)

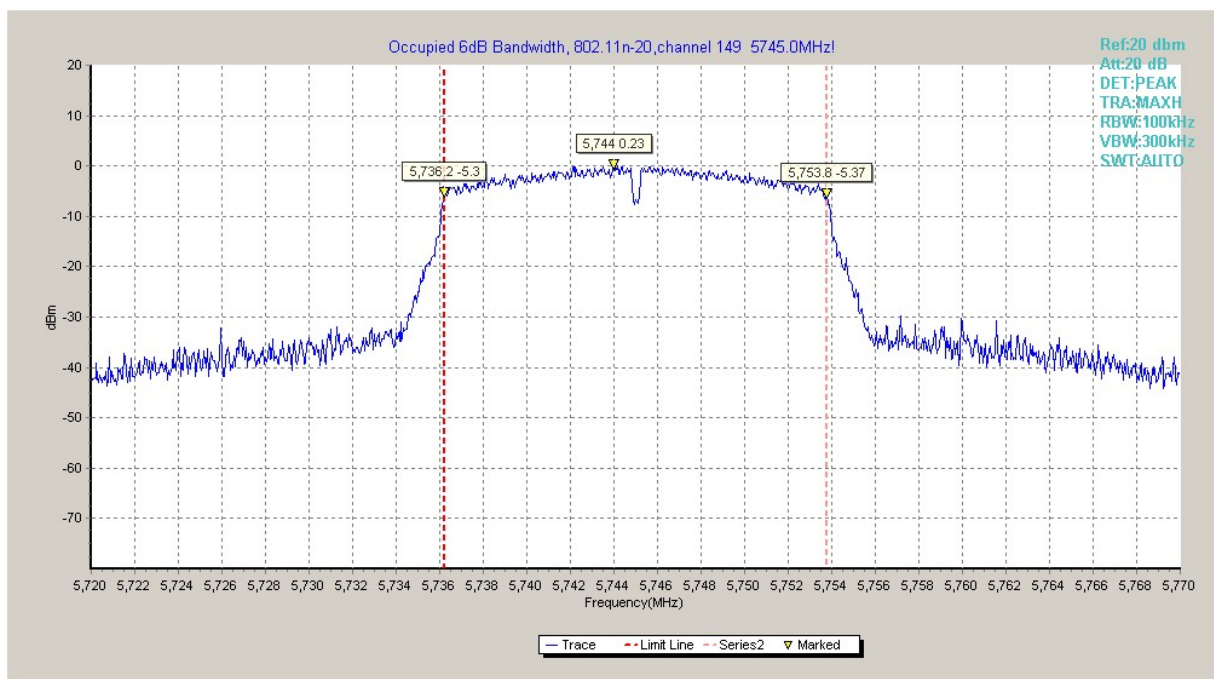


Fig. 4 Occupied 6dB Bandwidth (802.11n-HT20, Ch 149)

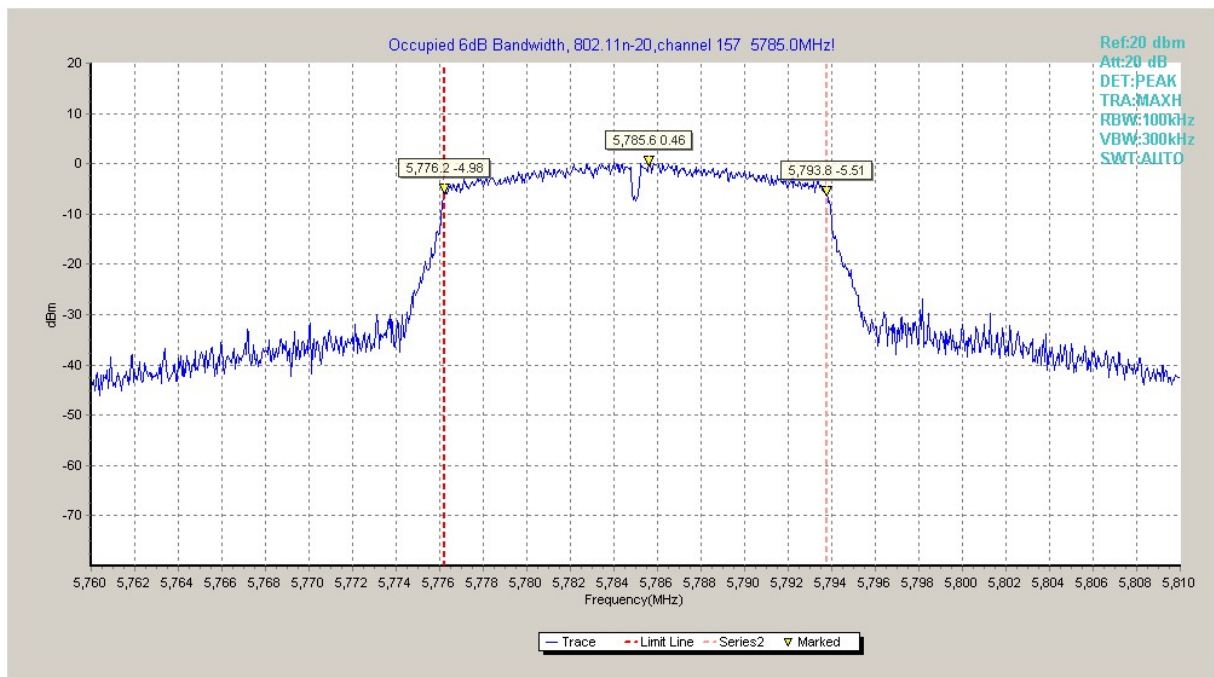


Fig. 5 Occupied 6dB Bandwidth (802.11n-HT20, Ch 157)

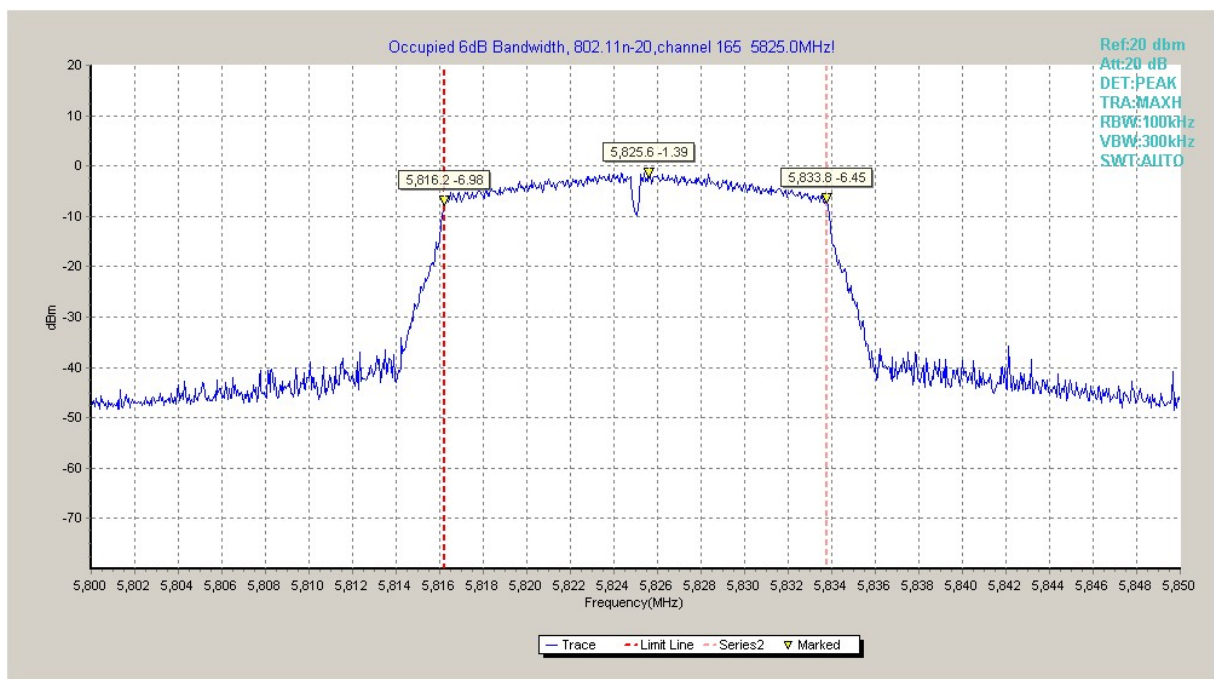


Fig. 6 Occupied 6dB Bandwidth (802.11n-HT20, Ch 165)



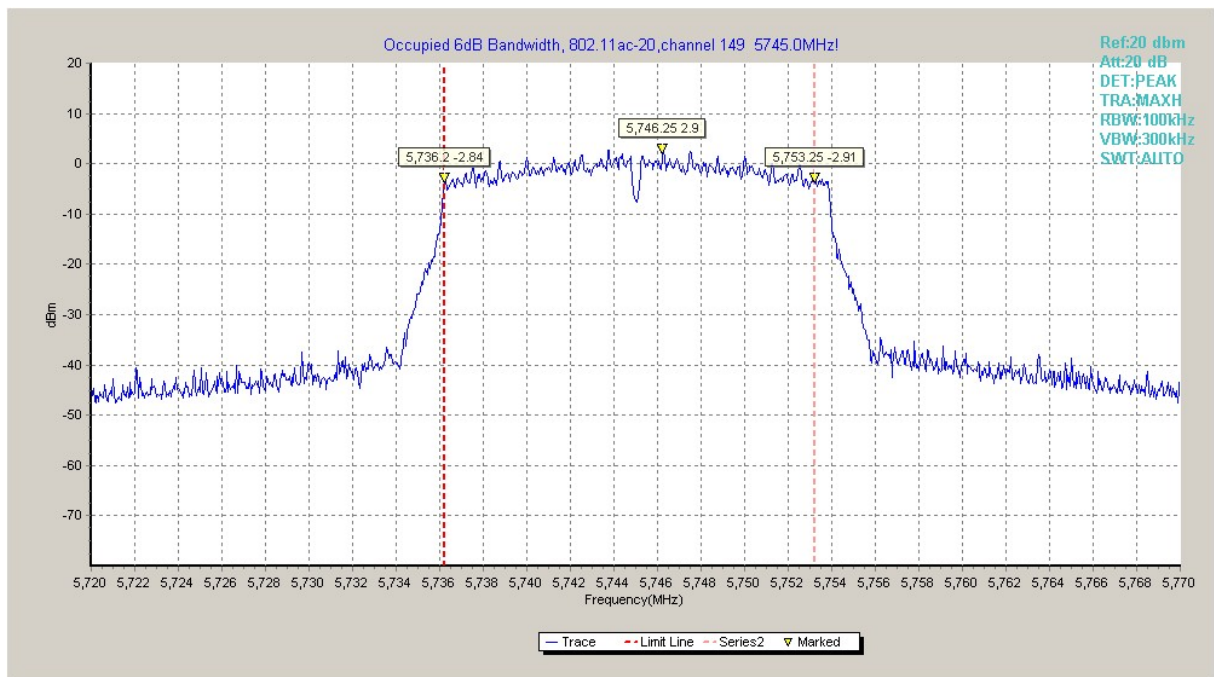


Fig. 7 Occupied 6dB Bandwidth (802.11ac-HT20, Ch 149)

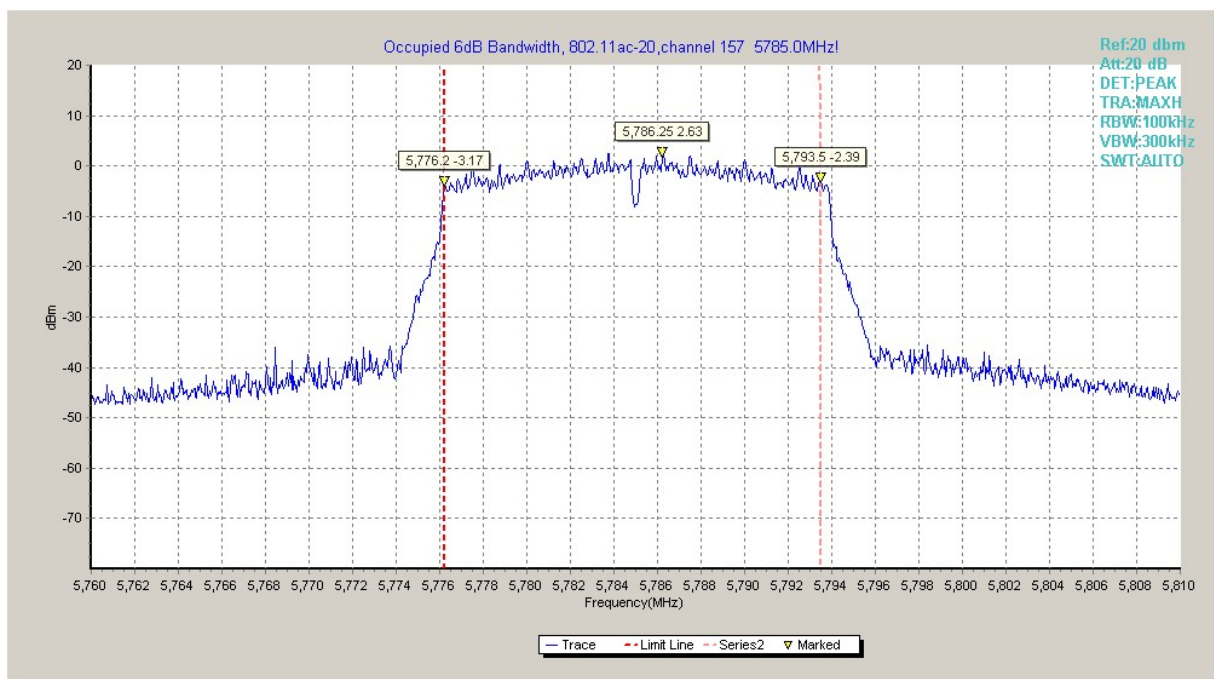


Fig. 8 Occupied 6dB Bandwidth (802.11ac-HT20, Ch 157)

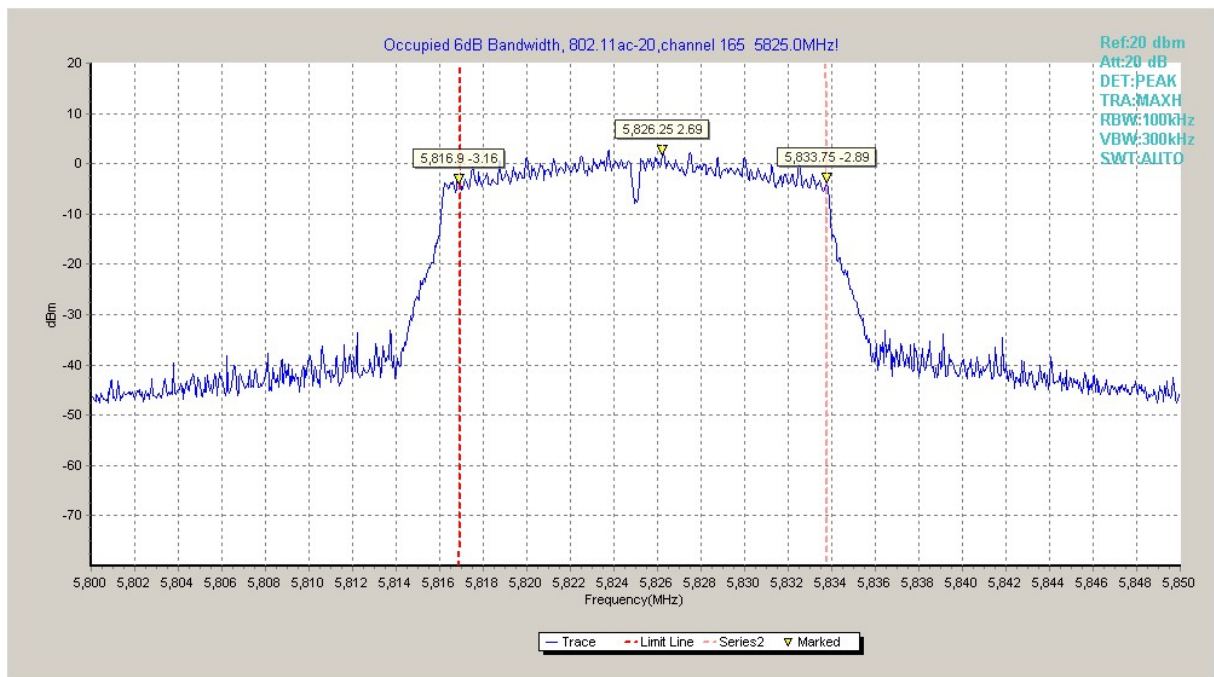


Fig. 9 Occupied 6dB Bandwidth (802.11ac-HT20, Ch 165)

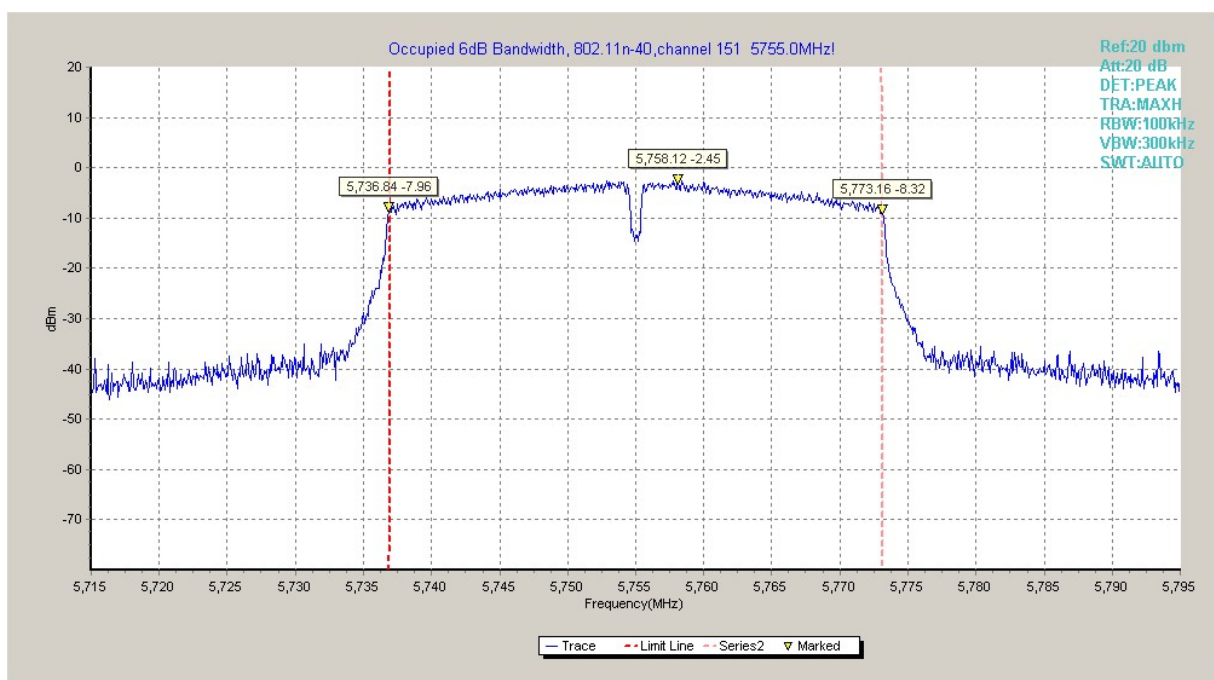


Fig. 10 Occupied 6dB Bandwidth (802.11n-HT40, Ch 151)

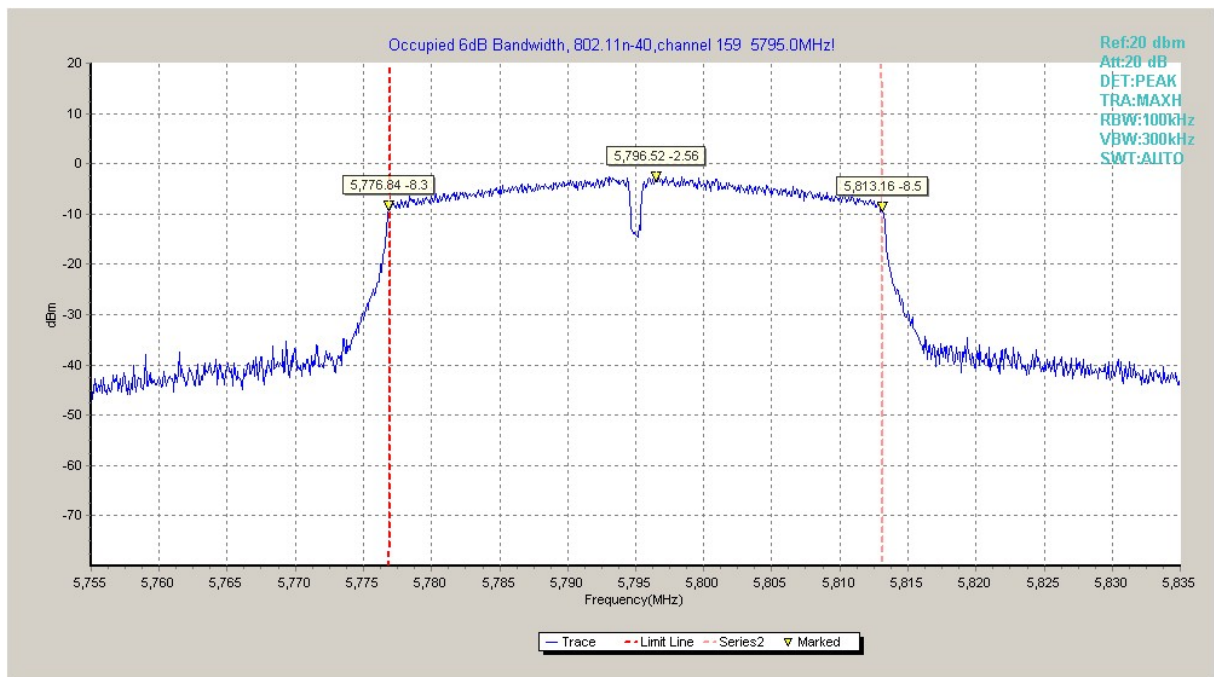


Fig. 11 Occupied 6dB Bandwidth (802.11n-HT40, Ch 159)

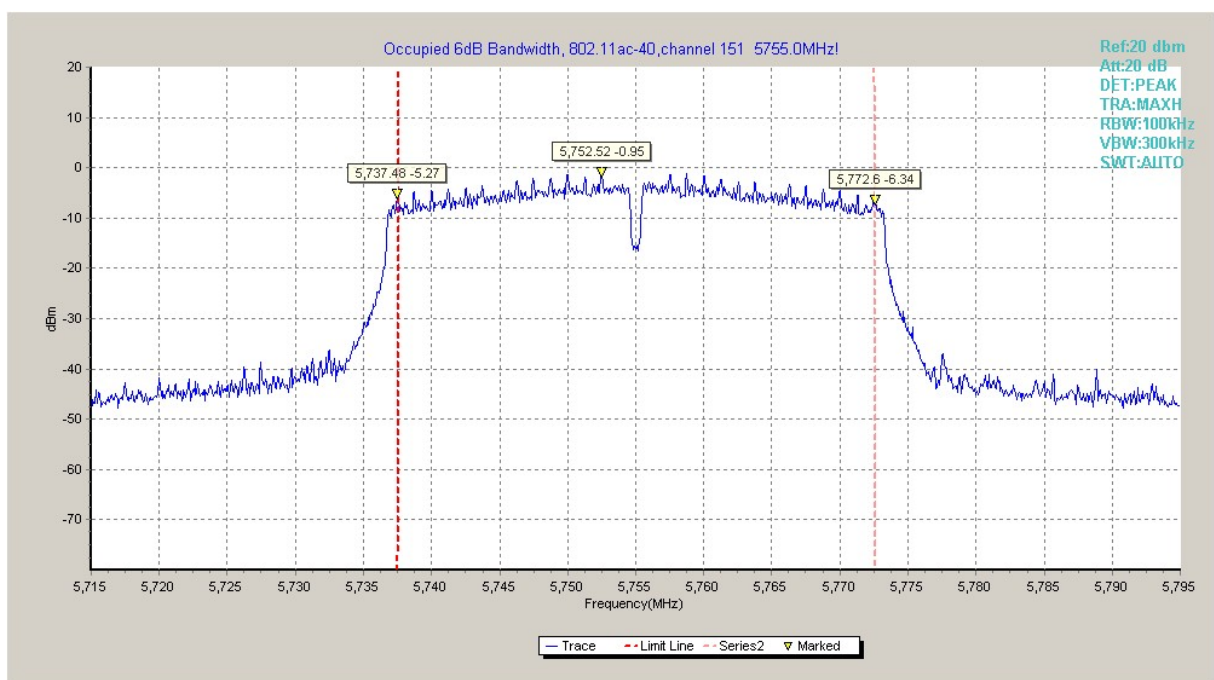


Fig. 12 Occupied 6dB Bandwidth (802.11ac-HT40, Ch 151)



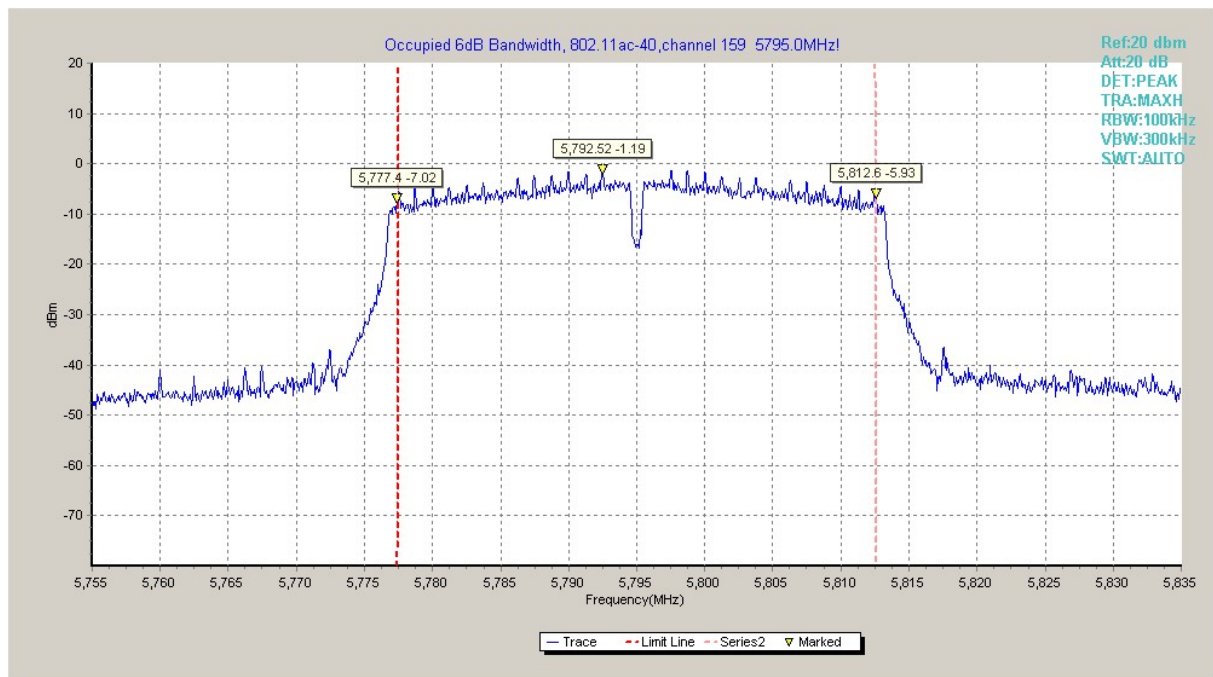


Fig. 13 Occupied 6dB Bandwidth (802.11ac-HT40, Ch 159)

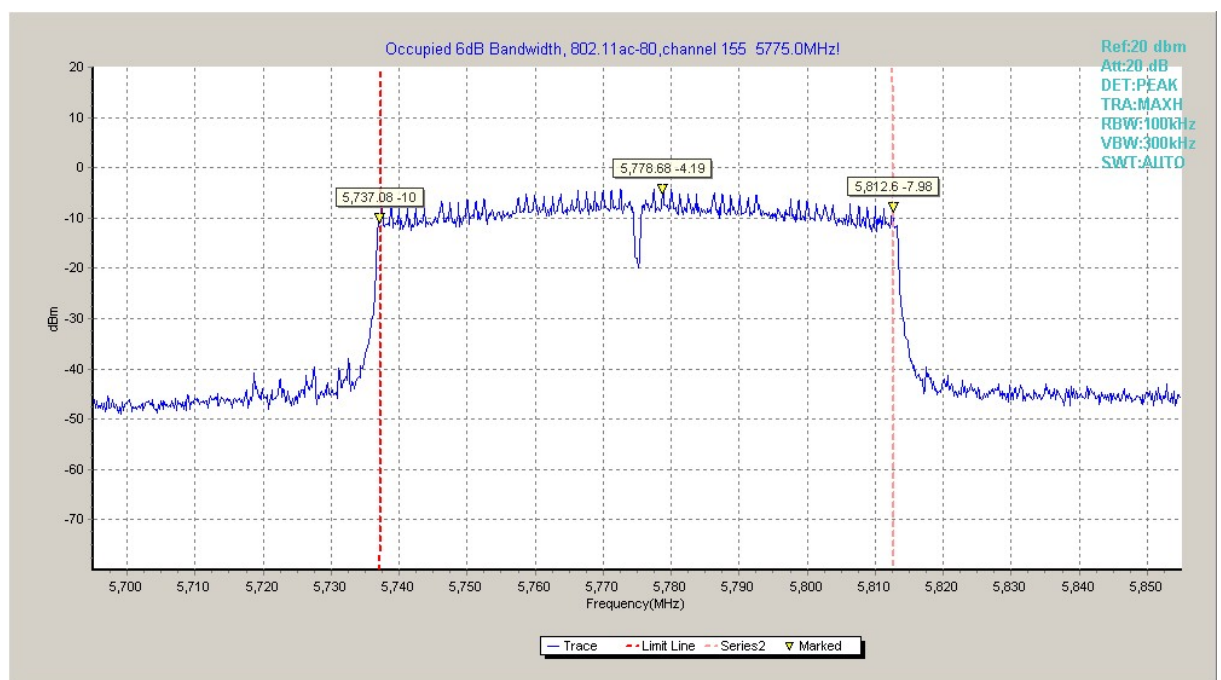


Fig. 14 Occupied 6dB Bandwidth (802.11ac-HT80, Ch 155)

## A.5. Transmitter Spurious Emission

### Measurement Limit:

| Standard               | Frequency (MHz) | Limit (dBm/MHz) |
|------------------------|-----------------|-----------------|
| FCC 47 CFR Part 15.407 | 5725MHz~5850MHz | < -27           |

The measurement is made according to ANSI C63.10 .

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) (see § 15.205(c)).

| Frequency of emission (MHz) | Field strength(uV/m) | Field strength(dBuV/m) |
|-----------------------------|----------------------|------------------------|
| 30-88                       | 100                  | 40                     |
| 88-216                      | 150                  | 43.5                   |
| 216-960                     | 200                  | 46                     |
| Above 960                   | 500                  | 54                     |

### Measurement Uncertainty:

| Frequency Range   | Uncertainty(dB) |
|-------------------|-----------------|
| 30MHz ≤ f ≤ 2GHz  | 0.63            |
| 2GHz ≤ f ≤ 3.6GHz | 0.82            |
| 3.6GHz ≤ f ≤ 8GHz | 1.55            |
| 8GHz ≤ f ≤ 20GHz  | 1.86            |
| 20GHz ≤ f ≤ 22GHz | 1.90            |
| 22GHz ≤ f ≤ 26GHz | 2.20            |

### A.5.1 Transmitter Spurious Emission - Conducted

#### Measurement Results:

#### 802.11a mode

| MODE    | Channel | Frequency Range | Test Results | Conclusion |
|---------|---------|-----------------|--------------|------------|
| 802.11a | 149     | 30 MHz ~ 1 GHz  | Fig.15       | P          |
|         |         | 1 GHz ~ 12 GHz  | Fig.16       | P          |
|         |         | 12 GHz ~ 25 GHz | Fig.17       | P          |
|         |         | 25 GHz ~ 40 GHz | Fig.18       | P          |
|         | 157     | 30 MHz ~ 1 GHz  | Fig.19       | P          |
|         |         | 1 GHz ~ 12 GHz  | Fig.20       | P          |
|         |         | 12 GHz ~ 25 GHz | Fig.21       | P          |
|         |         | 25 GHz ~ 40 GHz | Fig.22       | P          |
|         | 165     | 30 MHz ~ 1 GHz  | Fig.23       | P          |
|         |         | 1 GHz ~ 12 GHz  | Fig.24       | P          |
|         |         | 12 GHz ~ 25 GHz | Fig.25       | P          |
|         |         | 25 GHz ~ 40 GHz | Fig.26       | P          |

#### 802.11n-HT20 mode

| MODE            | Channel | Frequency Range | Test Results | Conclusion |
|-----------------|---------|-----------------|--------------|------------|
| 802.11n<br>HT20 | 149     | 30 MHz ~ 1 GHz  | Fig.27       | P          |
|                 |         | 1 GHz ~ 12 GHz  | Fig.28       | P          |
|                 |         | 12 GHz ~ 25 GHz | Fig.29       | P          |
|                 |         | 25 GHz ~ 40 GHz | Fig.30       | P          |
|                 | 157     | 30 MHz ~ 1 GHz  | Fig.31       | P          |
|                 |         | 1 GHz ~ 12 GHz  | Fig.32       | P          |
|                 |         | 12 GHz ~ 25 GHz | Fig.33       | P          |
|                 |         | 25 GHz ~ 40 GHz | Fig.34       | P          |
|                 | 165     | 30 MHz ~ 1 GHz  | Fig.35       | P          |
|                 |         | 1 GHz ~ 12 GHz  | Fig.36       | P          |
|                 |         | 12 GHz ~ 25 GHz | Fig.37       | P          |
|                 |         | 25 GHz ~ 40 GHz | Fig.38       | P          |

#### 802.11ac-HT20 mode

| MODE             | Channel | Frequency Range | Test Results | Conclusion |
|------------------|---------|-----------------|--------------|------------|
| 802.11ac<br>HT20 | 149     | 30 MHz ~ 1 GHz  | Fig.39       | P          |
|                  |         | 1 GHz ~ 12 GHz  | Fig.40       | P          |
|                  |         | 12 GHz ~ 25 GHz | Fig.41       | P          |
|                  |         | 25 GHz ~ 40 GHz | Fig.42       | P          |
|                  | 157     | 30 MHz ~ 1 GHz  | Fig.43       | P          |
|                  |         | 1 GHz ~ 12 GHz  | Fig.44       | P          |
|                  |         | 12 GHz ~ 25 GHz | Fig.45       | P          |
|                  |         | 25 GHz ~ 40 GHz | Fig.46       | P          |
|                  | 165     | 30 MHz ~ 1 GHz  | Fig.47       | P          |
|                  |         | 1 GHz ~ 12 GHz  | Fig.48       | P          |
|                  |         | 12 GHz ~ 25 GHz | Fig.49       | P          |
|                  |         | 25 GHz ~ 40 GHz | Fig.50       | P          |

#### 802.11n-HT40 mode

| MODE            | Channel | Frequency Range | Test Results | Conclusion |
|-----------------|---------|-----------------|--------------|------------|
| 802.11n<br>HT40 | 151     | 30 MHz ~ 1 GHz  | Fig.51       | P          |
|                 |         | 1 GHz ~ 12 GHz  | Fig.52       | P          |
|                 |         | 12 GHz ~ 25 GHz | Fig.53       | P          |
|                 |         | 25 GHz ~ 40 GHz | Fig.54       | P          |
|                 | 159     | 30 MHz ~ 1 GHz  | Fig.55       | P          |
|                 |         | 1 GHz ~ 12 GHz  | Fig.56       | P          |
|                 |         | 12 GHz ~ 25 GHz | Fig.57       | P          |
|                 |         | 25 GHz ~ 40 GHz | Fig.58       | P          |

#### 802.11ac-HT40 mode

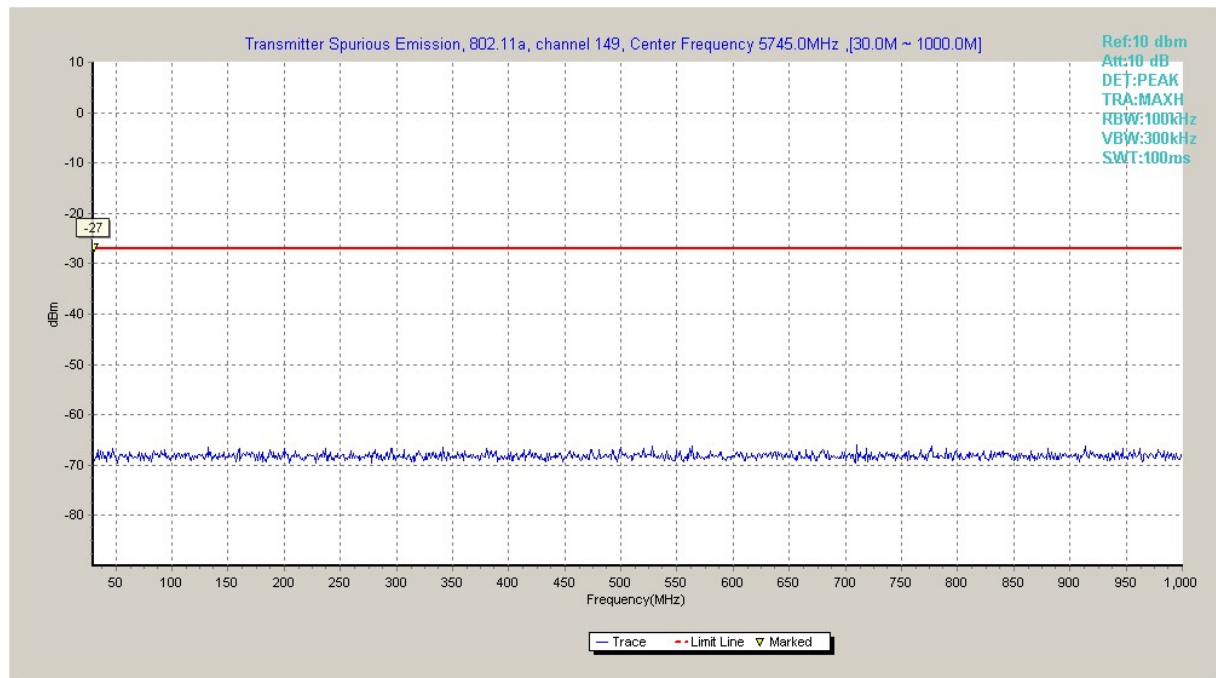
| MODE             | Channel | Frequency Range | Test Results | Conclusion |
|------------------|---------|-----------------|--------------|------------|
| 802.11ac<br>HT40 | 151     | 30 MHz ~ 1 GHz  | Fig.59       | P          |
|                  |         | 1 GHz ~ 12 GHz  | Fig.60       | P          |
|                  |         | 12 GHz ~ 25 GHz | Fig.61       | P          |
|                  |         | 25 GHz ~ 40 GHz | Fig.62       | P          |
|                  | 159     | 30 MHz ~ 1 GHz  | Fig.63       | P          |
|                  |         | 1 GHz ~ 12 GHz  | Fig.64       | P          |
|                  |         | 12 GHz ~ 25 GHz | Fig.65       | P          |
|                  |         | 25 GHz ~ 40 GHz | Fig.66       | P          |

#### 802.11ac-HT80 mode

| MODE             | Channel | Frequency Range | Test Results | Conclusion |
|------------------|---------|-----------------|--------------|------------|
| 802.11ac<br>HT80 | 155     | 30 MHz ~ 1 GHz  | Fig.67       | P          |
|                  |         | 1 GHz ~ 12 GHz  | Fig.68       | P          |
|                  |         | 12 GHz ~ 25 GHz | Fig.69       | P          |
|                  |         | 25 GHz ~ 40 GHz | Fig.70       | P          |

**Conclusion: PASS**

**Test graphs as below:**



**Fig. 15 Conducted Spurious Emission (802.11a, Ch149, 30 MHz-1 GHz)**

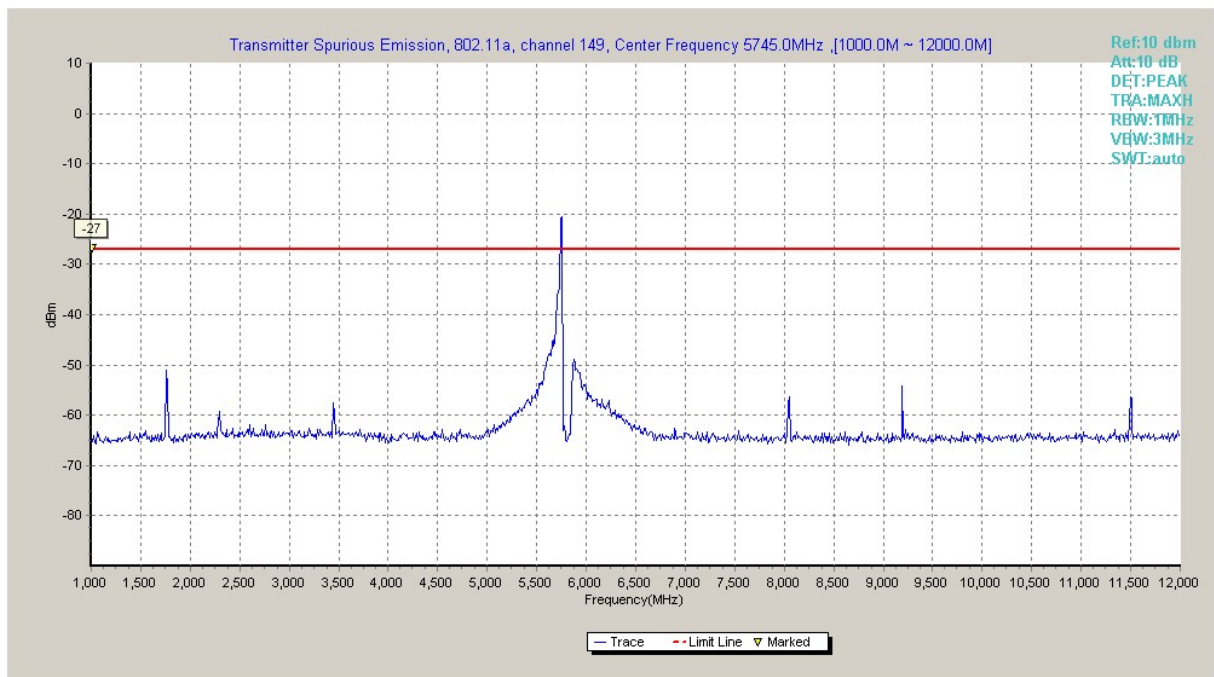


Fig. 16 Conducted Spurious Emission (802.11a, Ch149, 1 GHz -12 GHz)

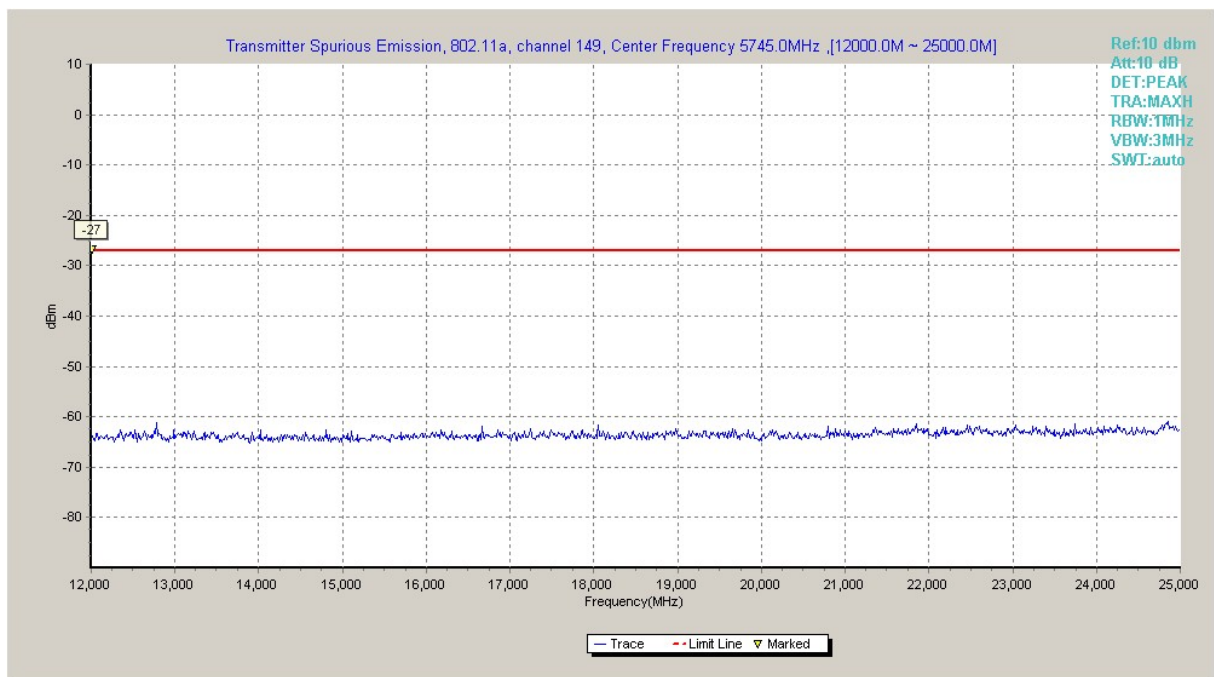


Fig. 17 Conducted Spurious Emission (802.11a, Ch149, 12 GHz-25 GHz)

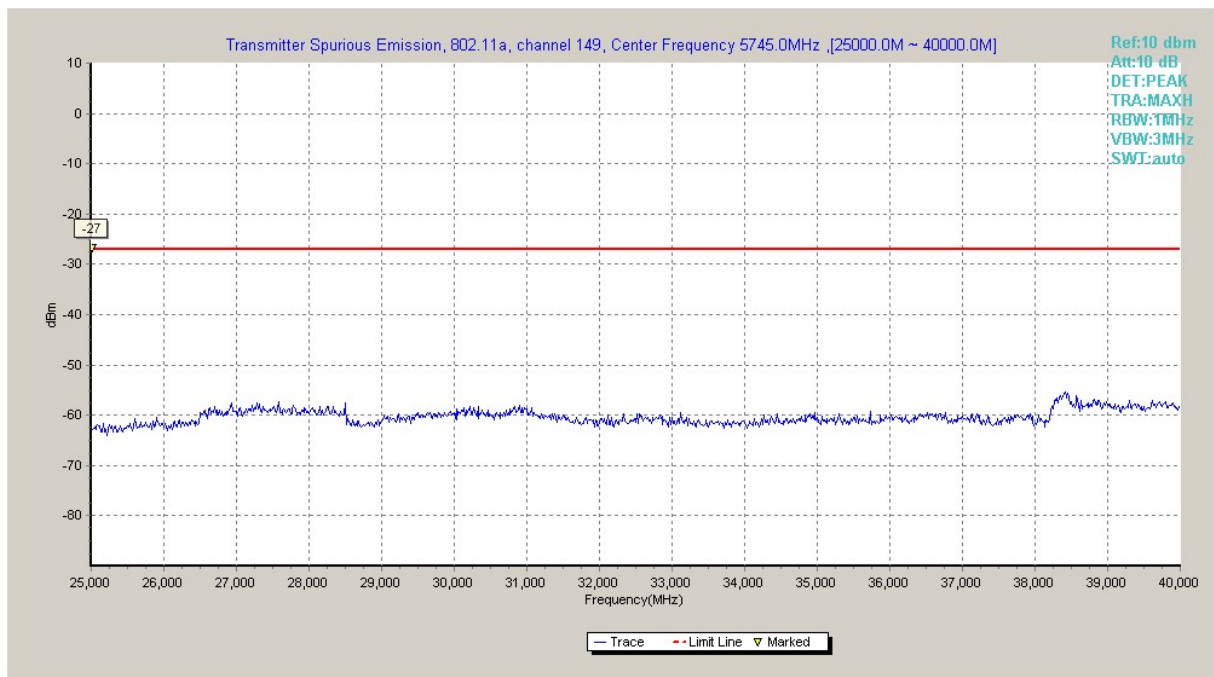


Fig. 18 Conducted Spurious Emission (802.11a, Ch149, 25 GHz-40 GHz)

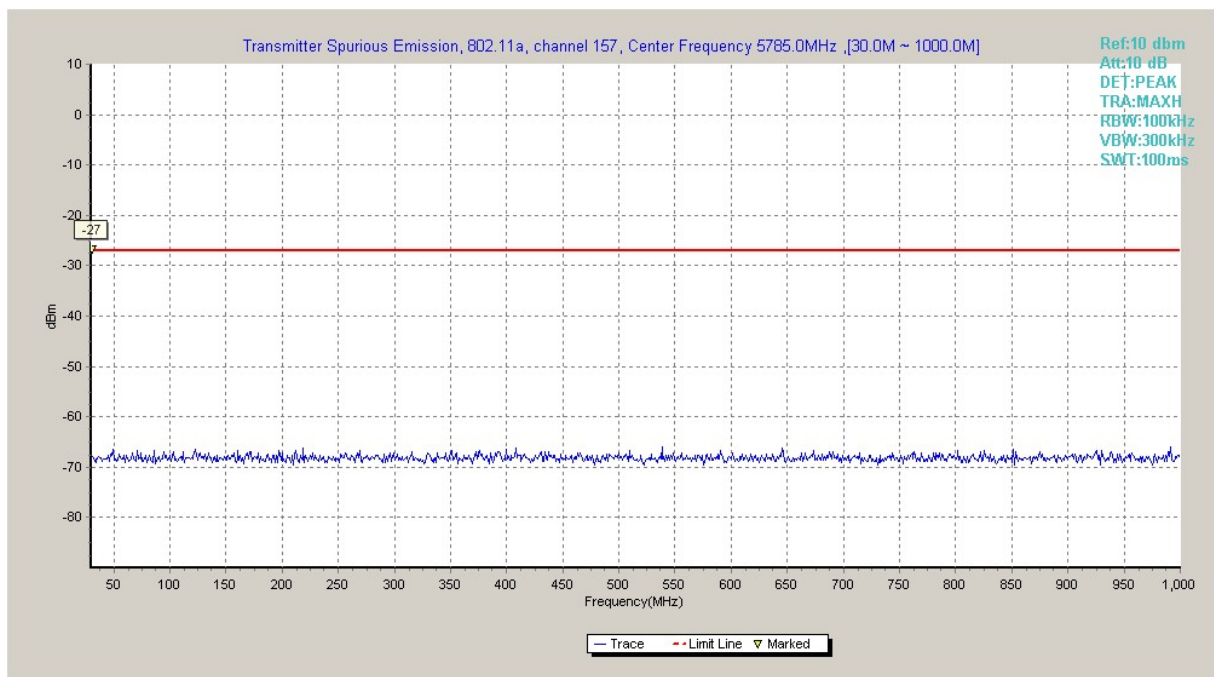


Fig. 19 Conducted Spurious Emission (802.11a, Ch157, 30 MHz-1 GHz)



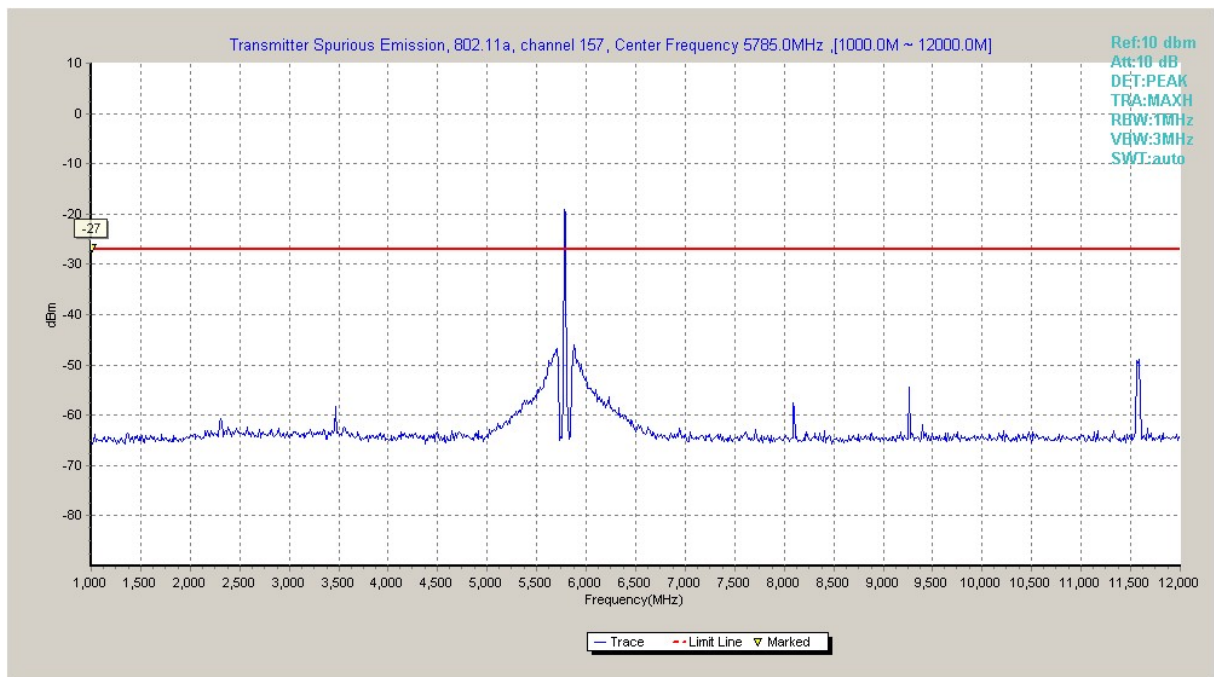


Fig. 20 Conducted Spurious Emission (802.11a, Ch157, 1 GHz -12 GHz)

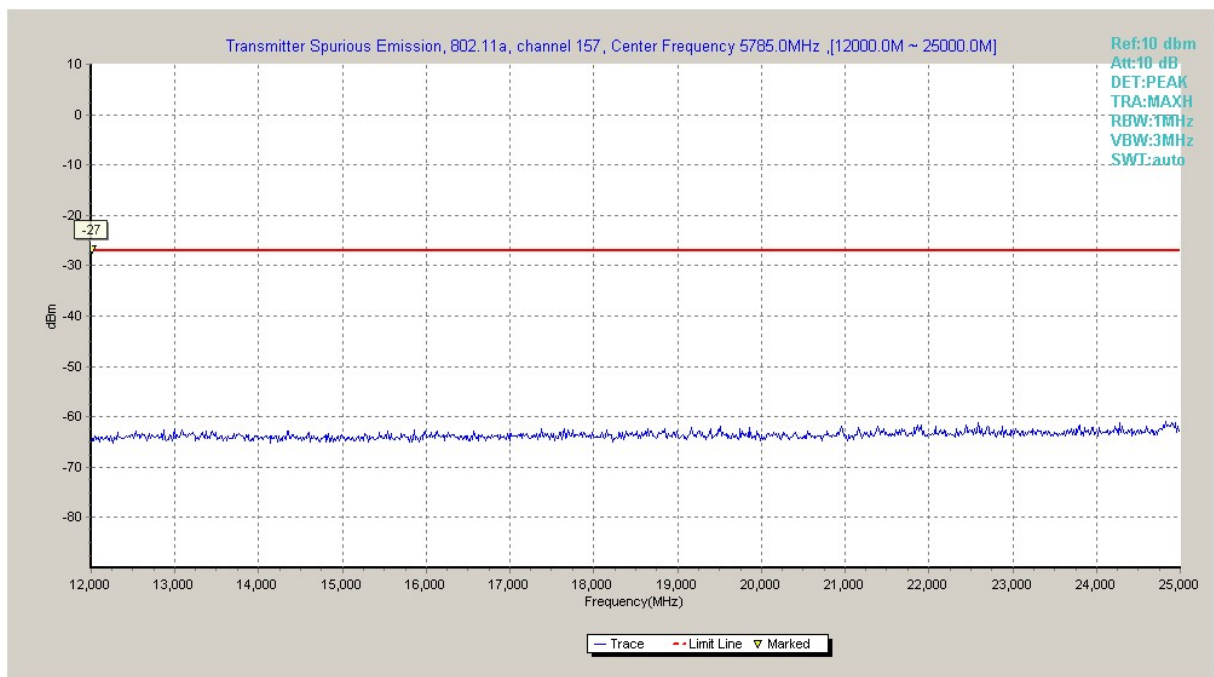


Fig. 21 Conducted Spurious Emission (802.11a, Ch157, 12 GHz-25 GHz)

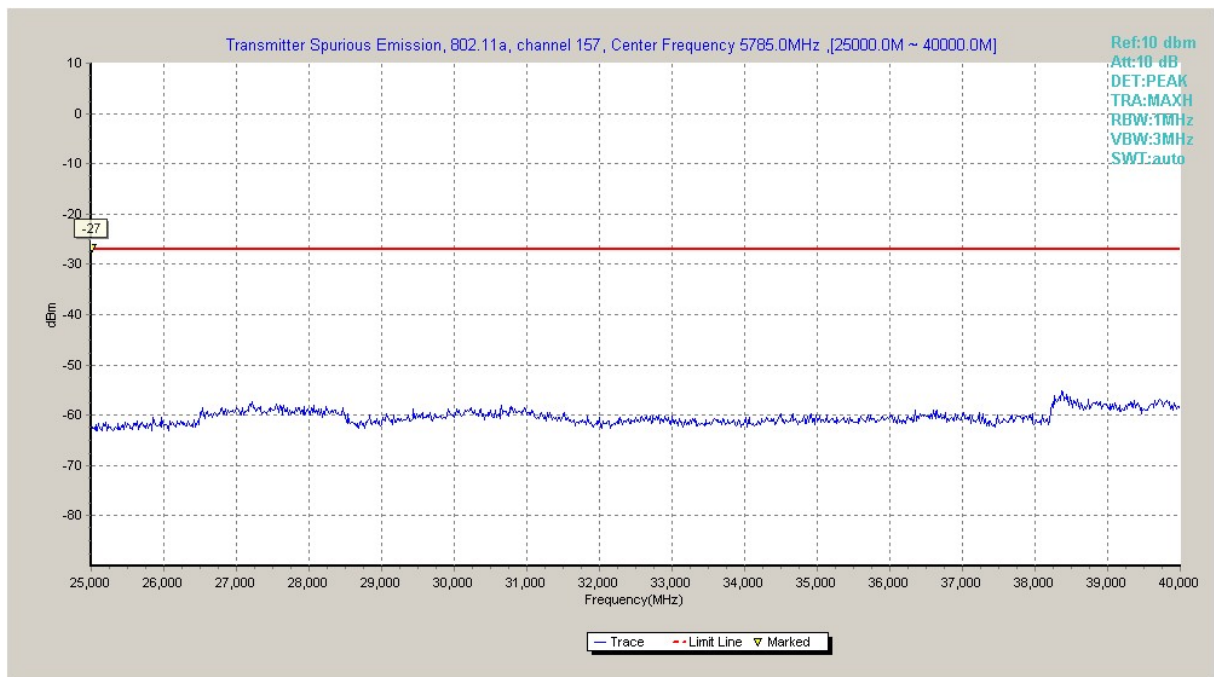


Fig. 22 Conducted Spurious Emission (802.11a, Ch157, 25 GHz-40 GHz)

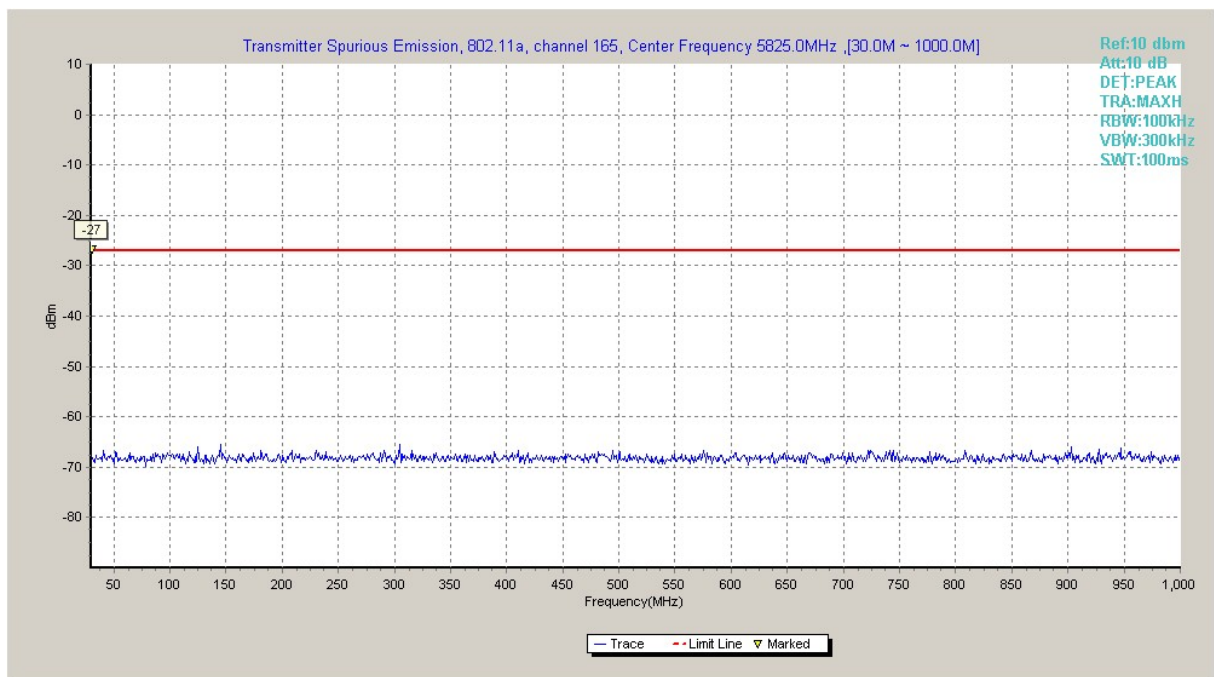


Fig. 23 Conducted Spurious Emission (802.11a, Ch165, 30 MHz-1 GHz)



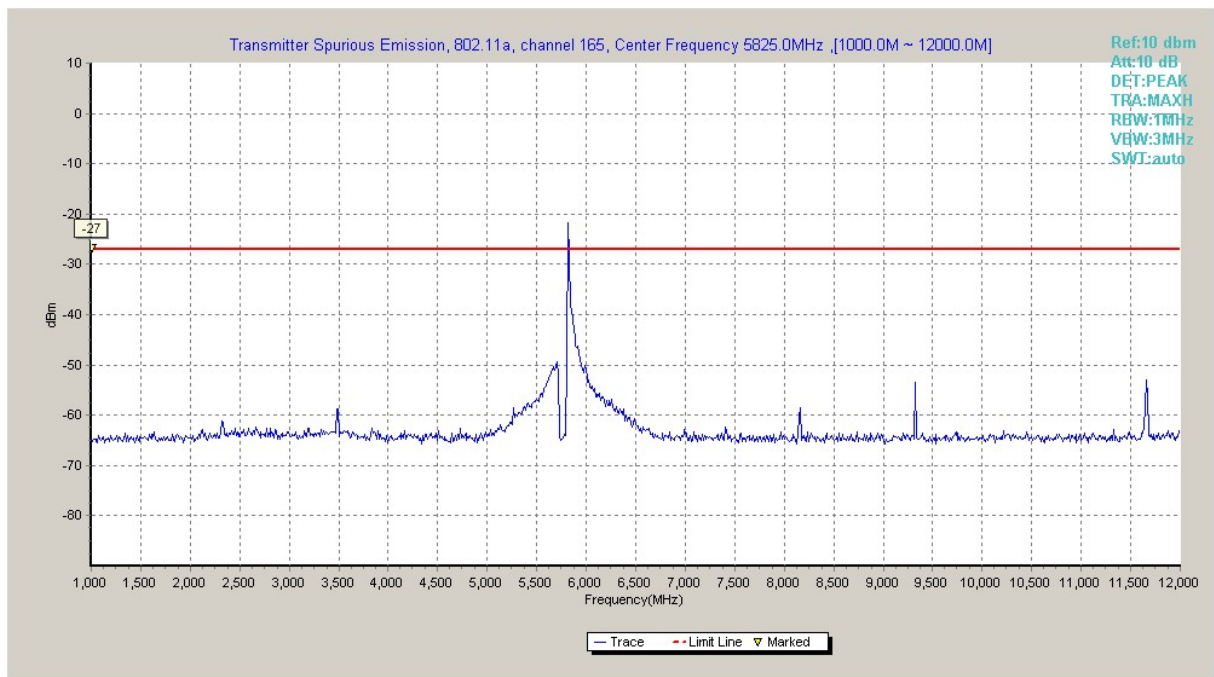


Fig. 24 Conducted Spurious Emission (802.11a, Ch165, 1 GHz -12 GHz)

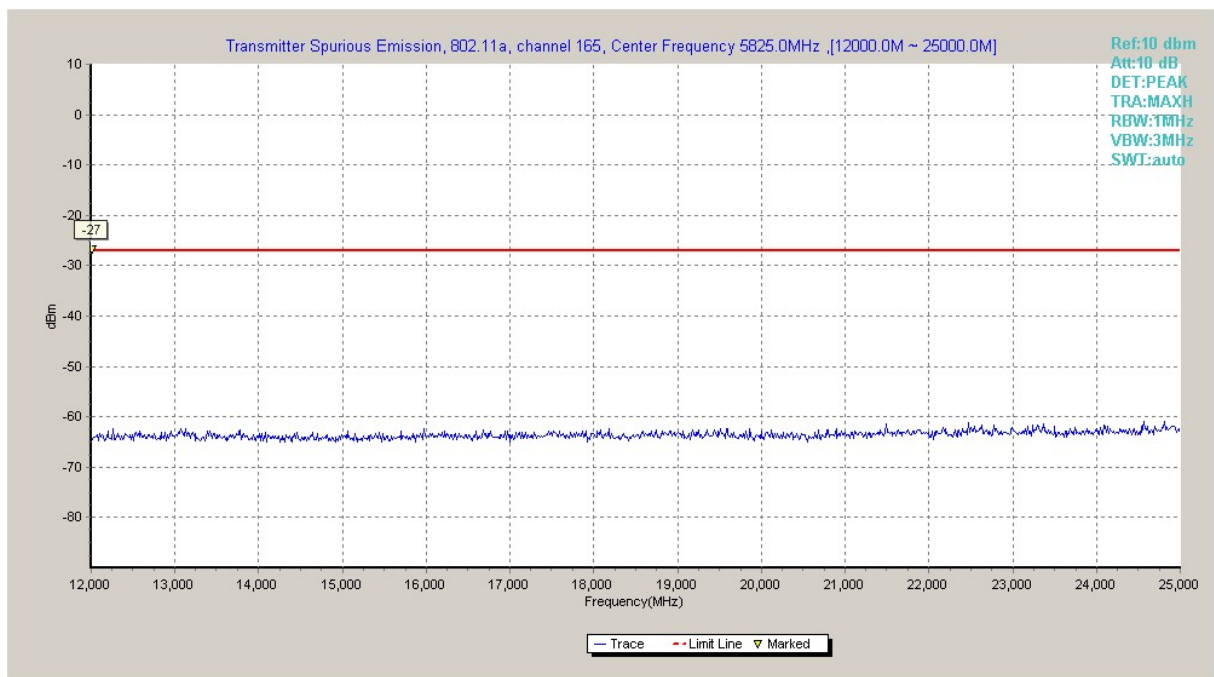
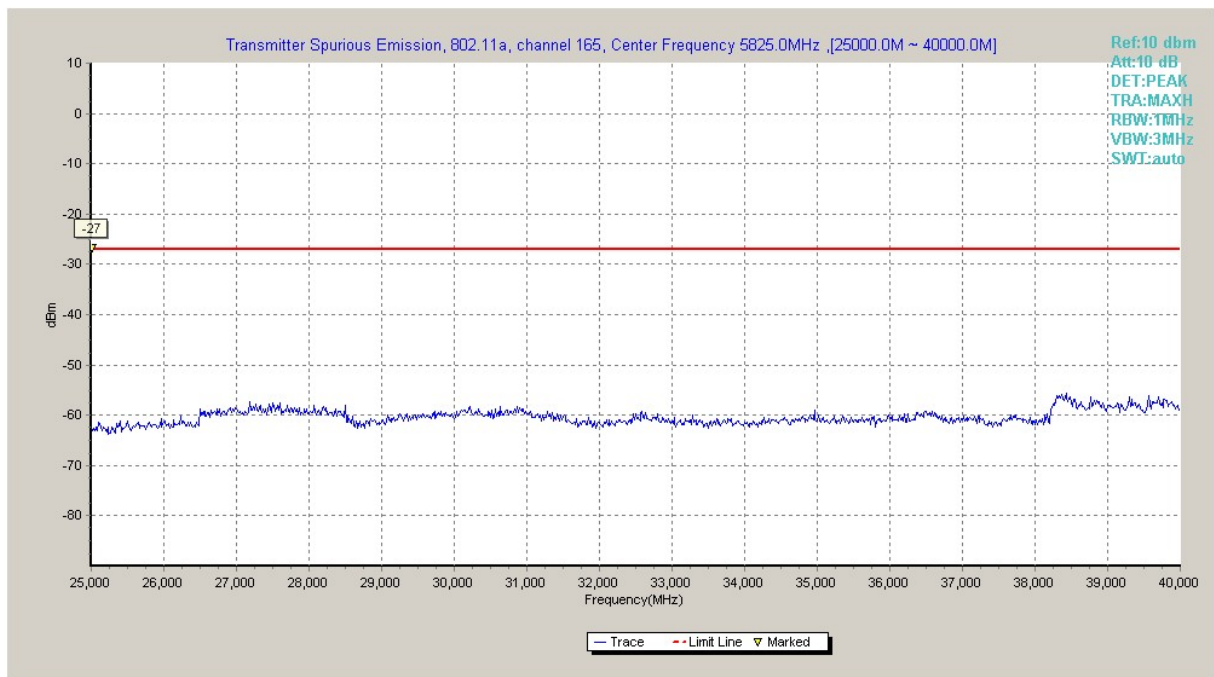
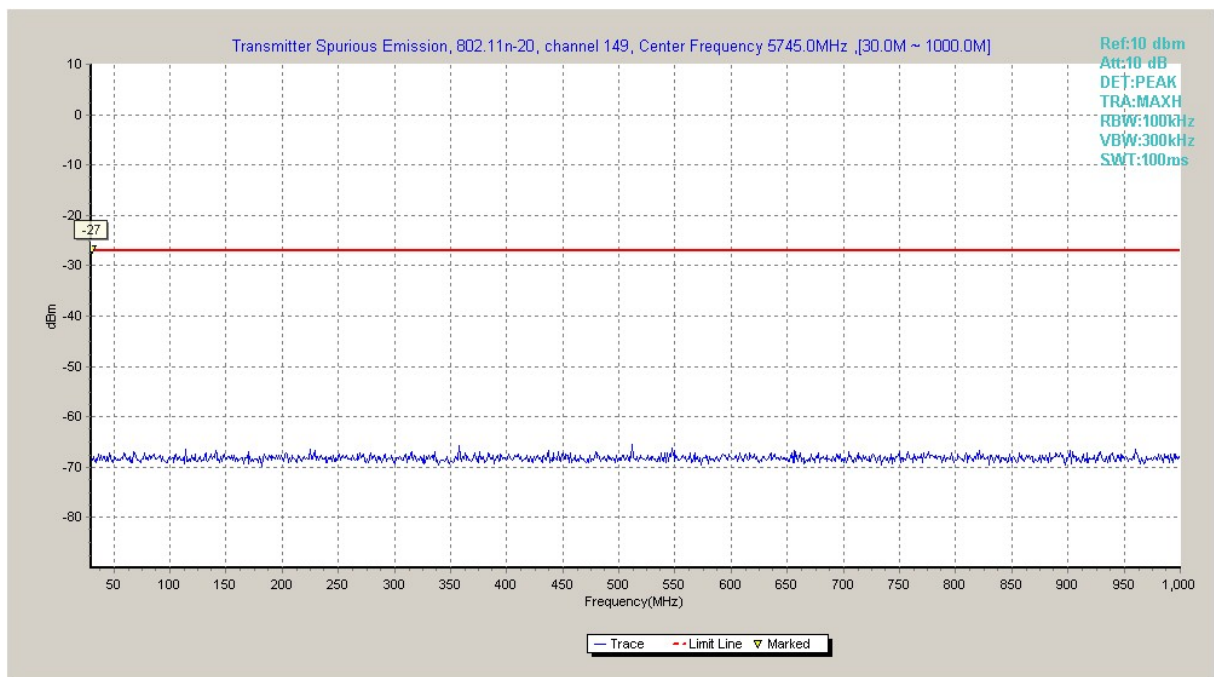


Fig. 25 Conducted Spurious Emission (802.11a, Ch165, 12 GHz-25 GHz)



**Fig. 26 Conducted Spurious Emission (802.11a, Ch165, 25 GHz-40 GHz)**



**Fig. 27 Conducted Spurious Emission (802.11n-HT20, Ch149, 30 MHz-1 GHz)**

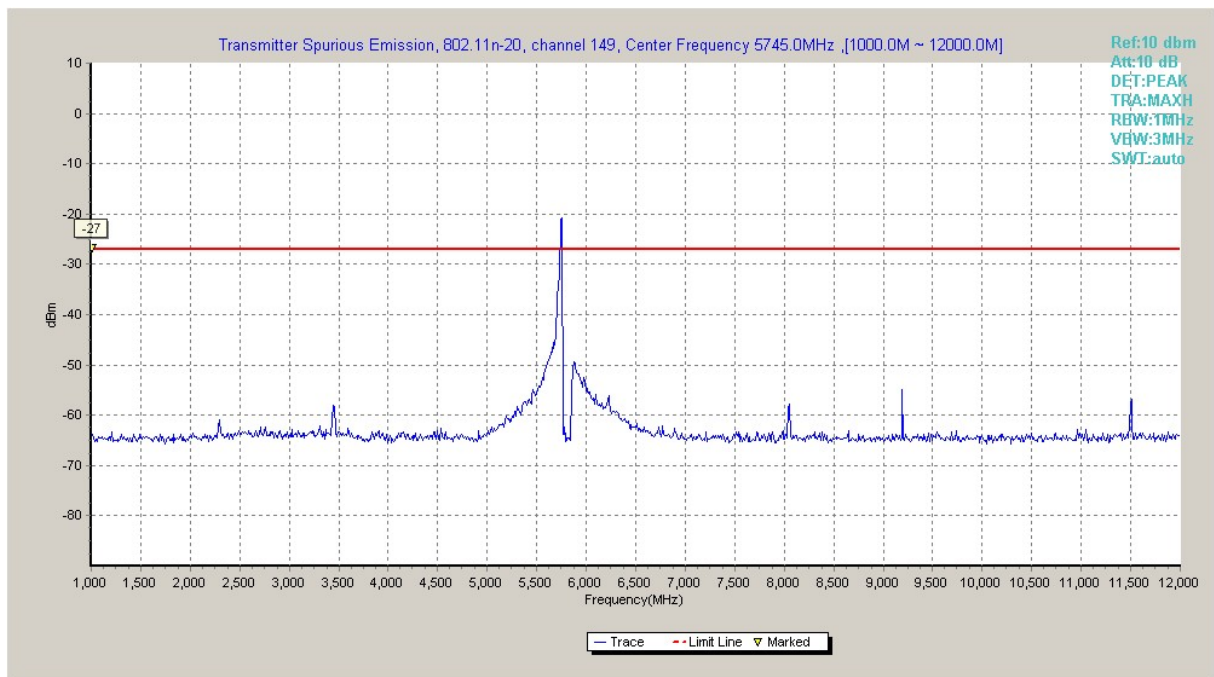


Fig. 28 Conducted Spurious Emission (802.11n-HT20, Ch149, 1 GHz -12 GHz)

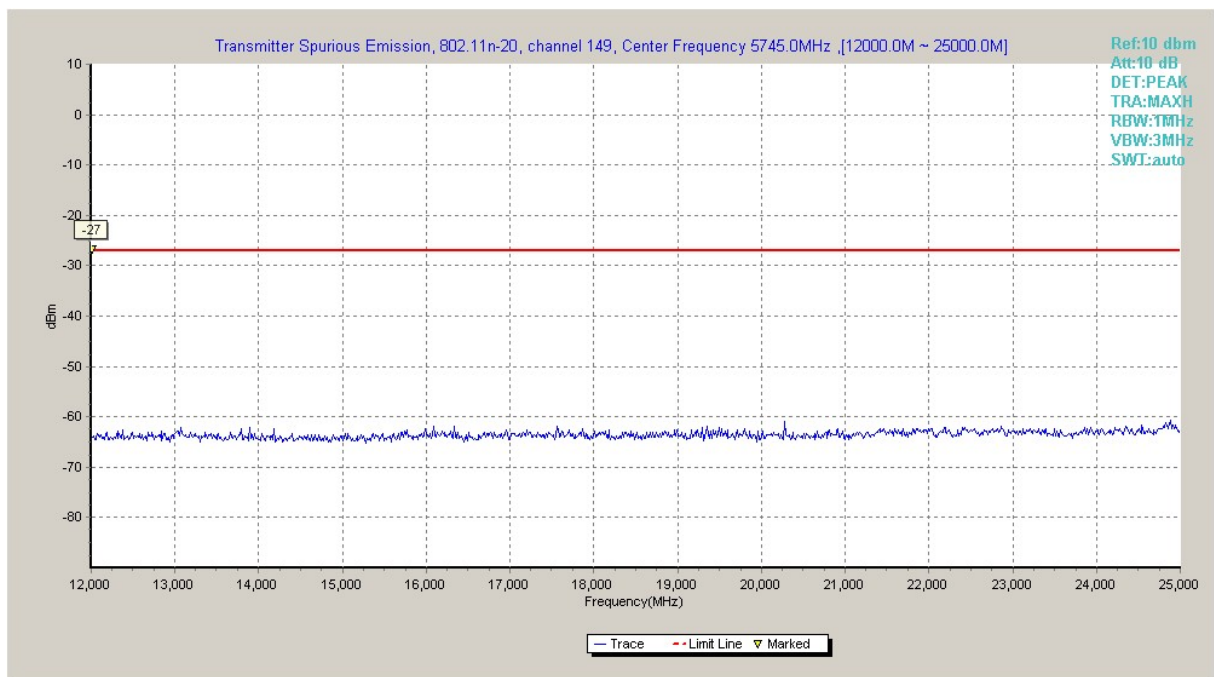
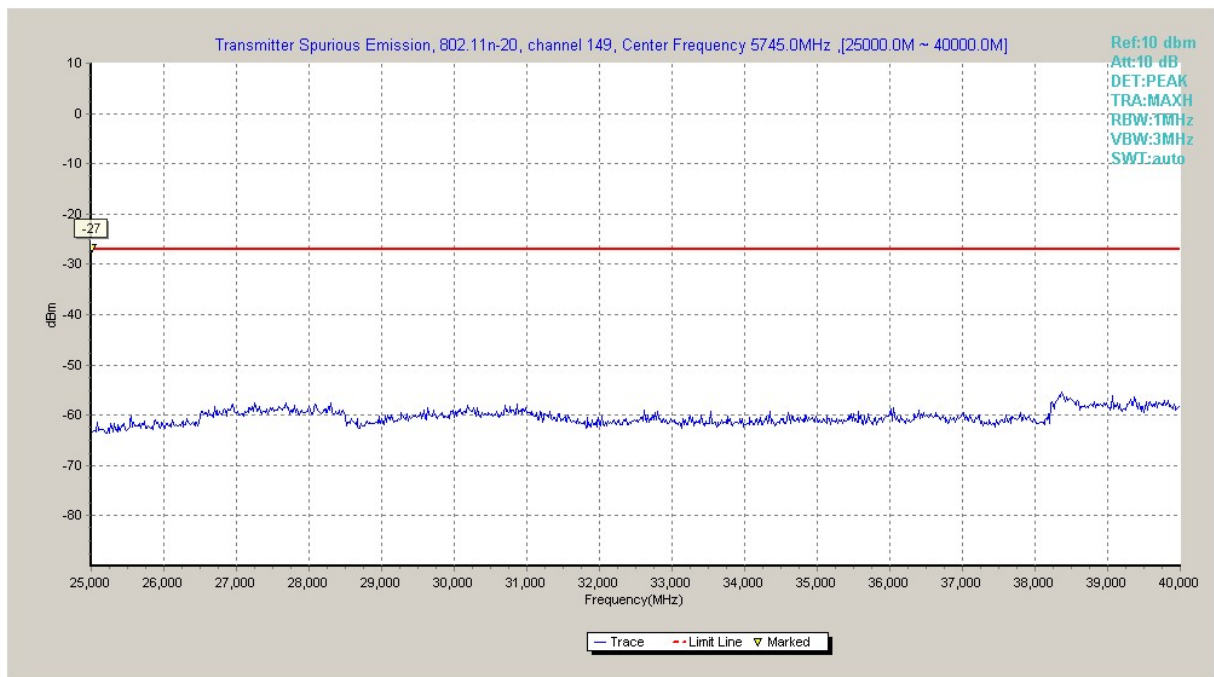
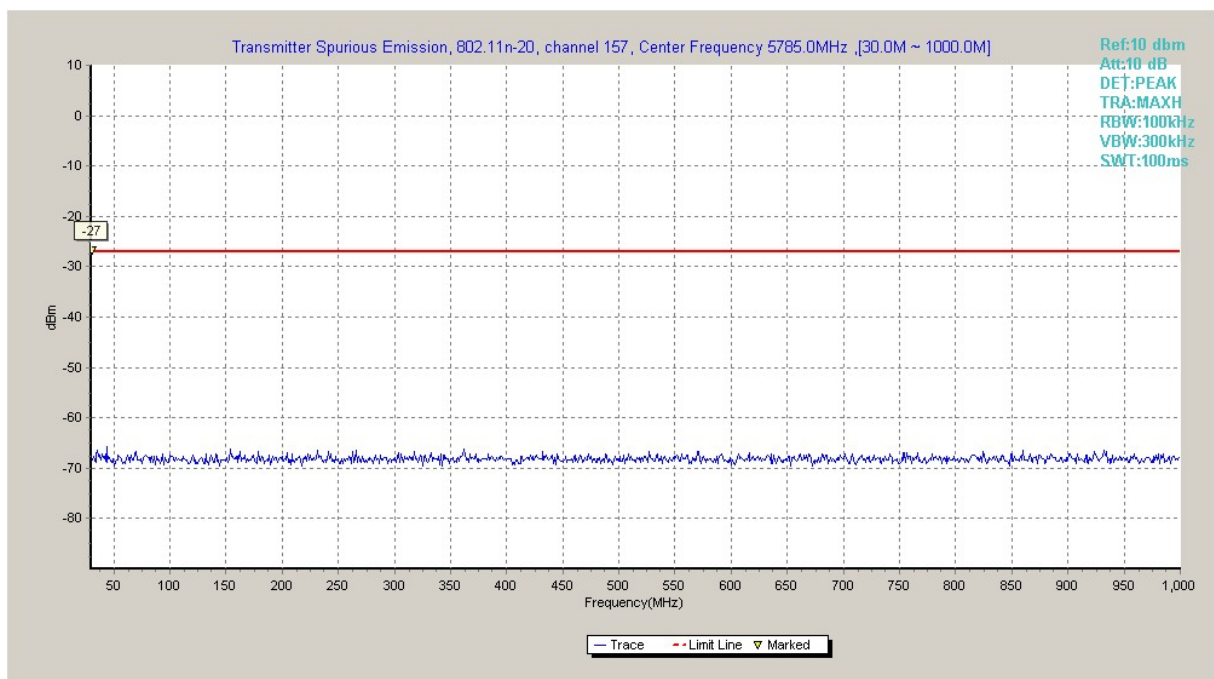


Fig. 29 Conducted Spurious Emission (802.11n-HT20, Ch149, 12 GHz-25 GHz)

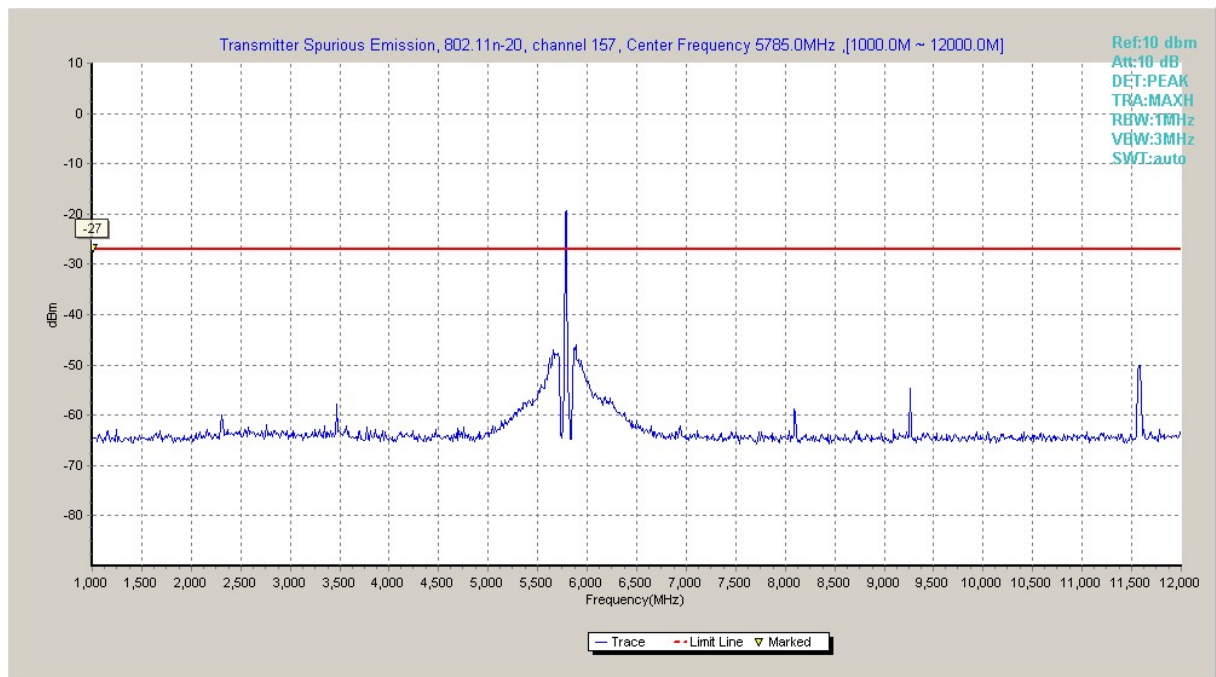


**Fig. 30 Conducted Spurious Emission (802.11n-HT20, Ch149, 25 GHz-40 GHz)**

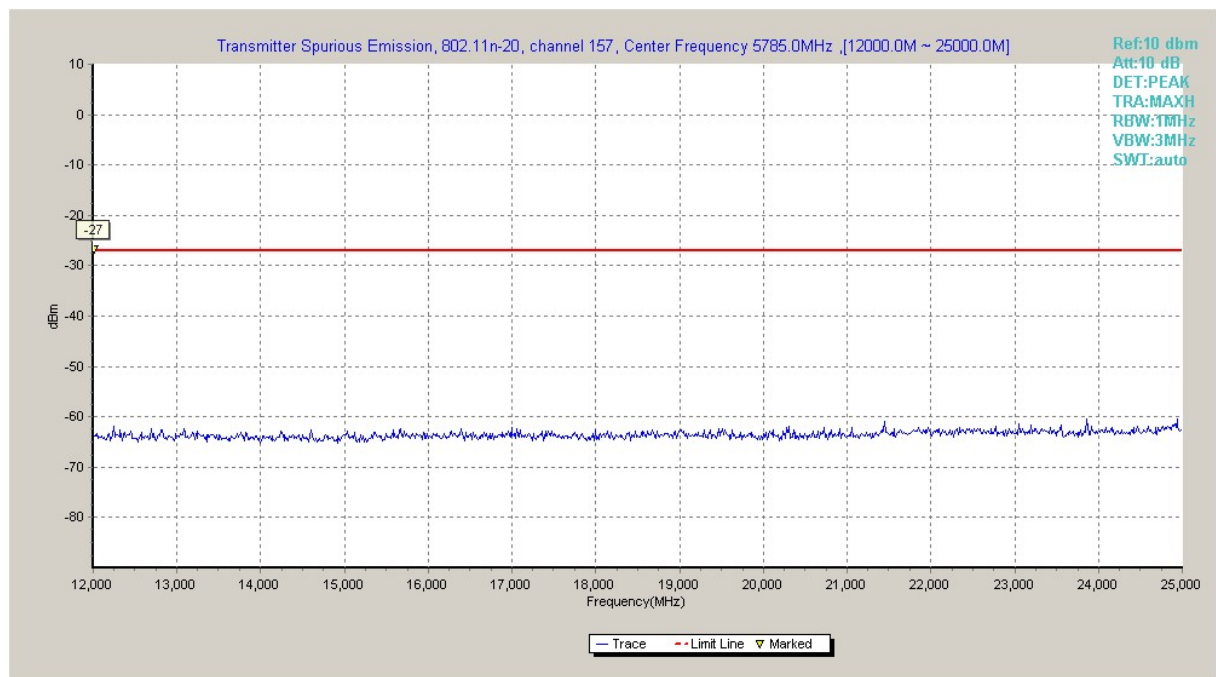


**Fig. 31 Conducted Spurious Emission (802.11n-HT20, Ch157, 30 MHz-1 GHz)**





**Fig. 32 Conducted Spurious Emission (802.11n-HT20, Ch157, 1 GHz -12 GHz)**



**Fig. 33 Conducted Spurious Emission (802.11n-HT20, Ch157, 12 GHz-25 GHz)**

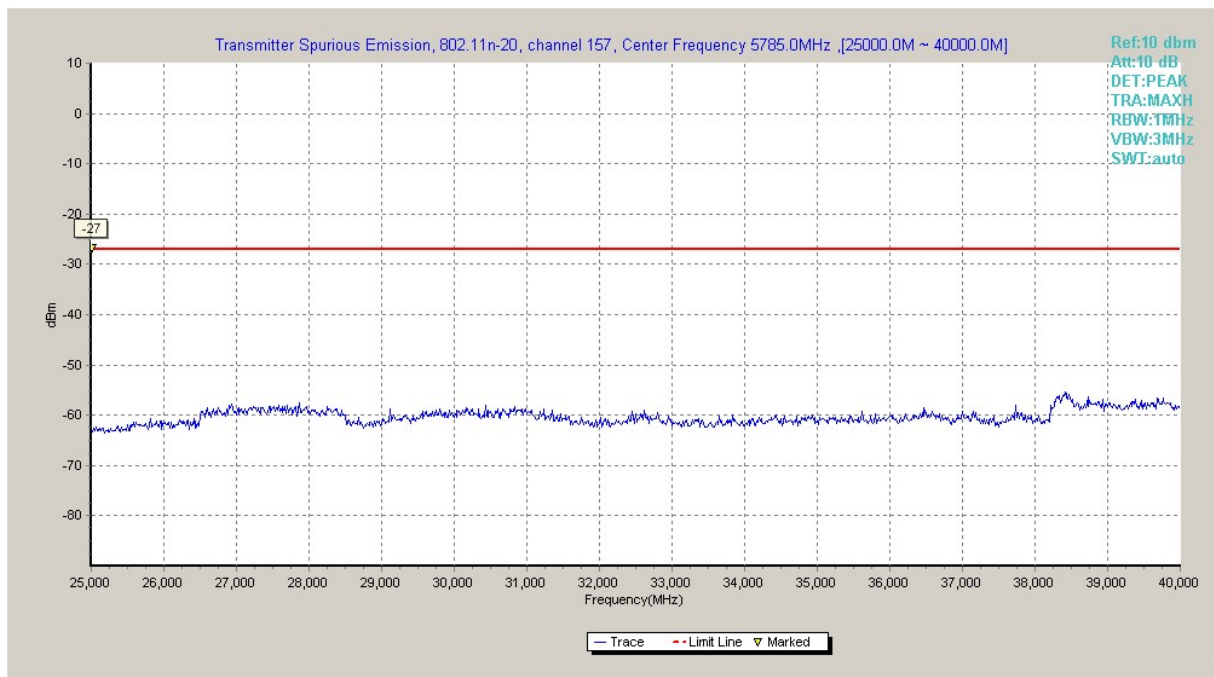


Fig. 34 Conducted Spurious Emission (802.11n-HT20, Ch157, 25 GHz-40 GHz)

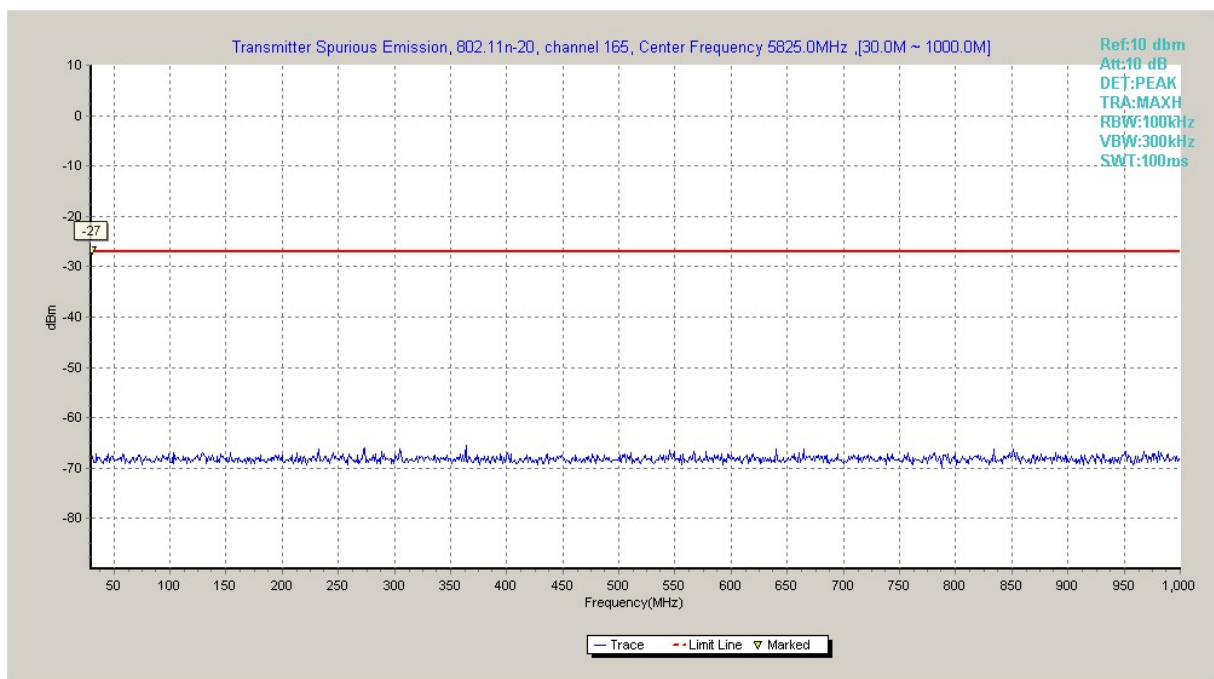


Fig. 35 Conducted Spurious Emission (802.11n-HT20, Ch165, 30 MHz-1 GHz)

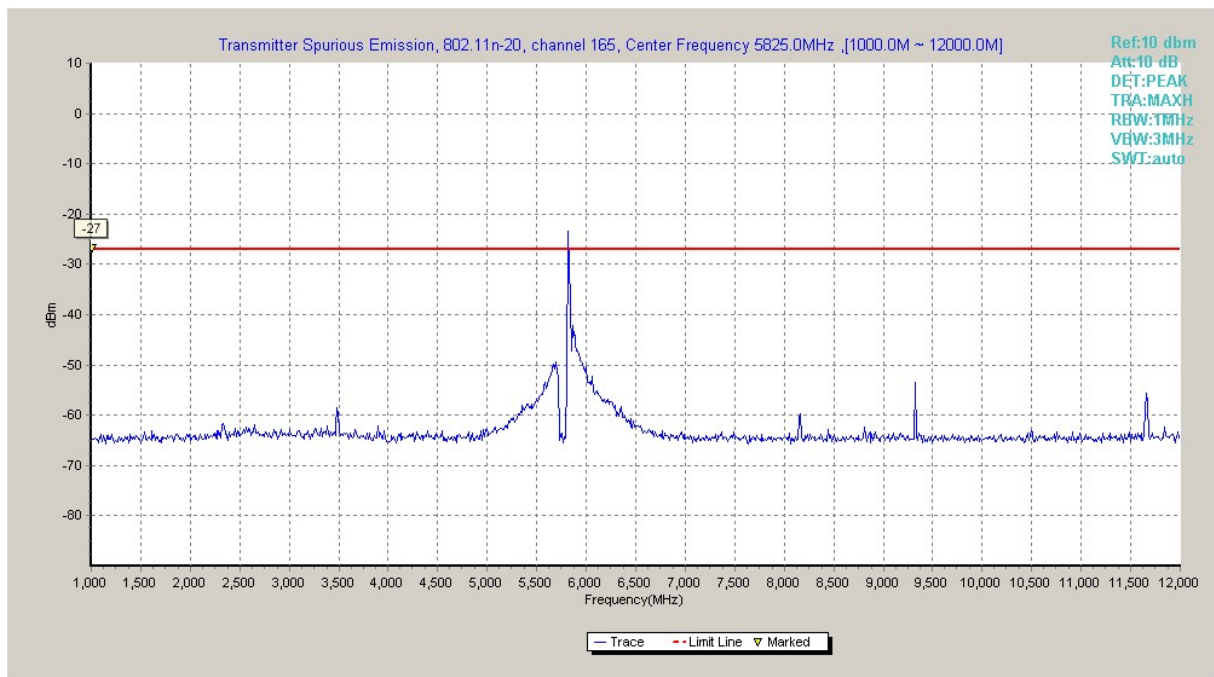


Fig. 36 Conducted Spurious Emission (802.11n-HT20, Ch165, 1 GHz -12 GHz)

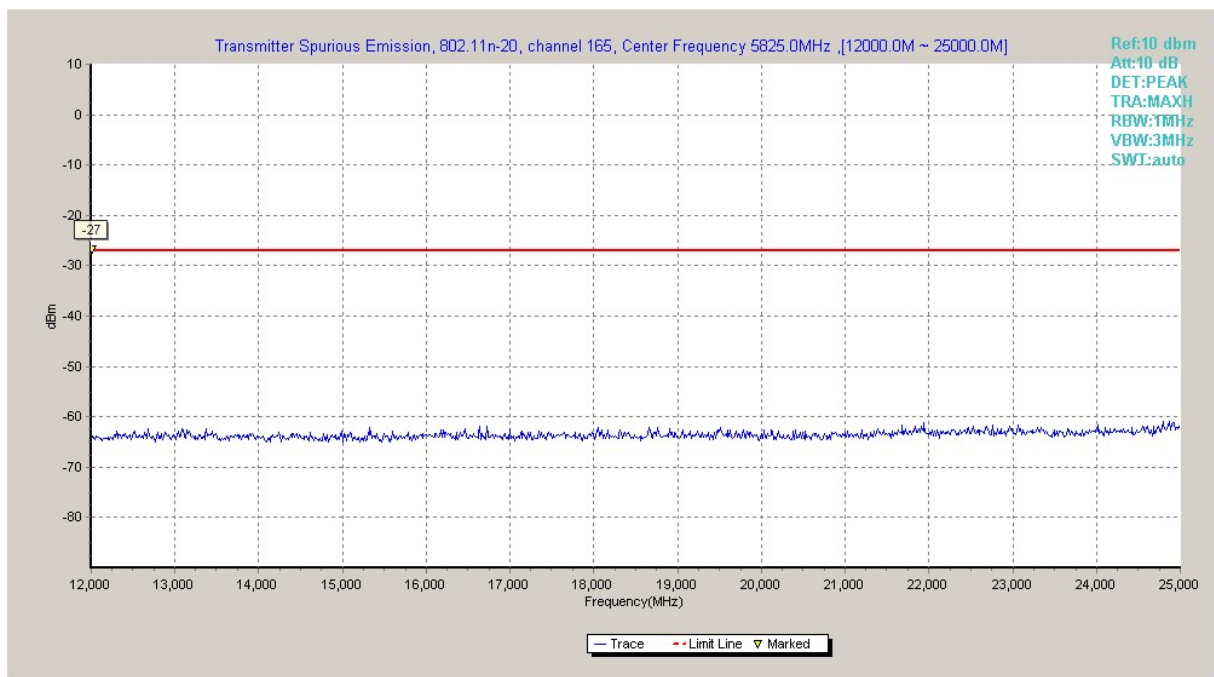


Fig. 37 Conducted Spurious Emission (802.11n-HT20, Ch165, 12 GHz-25 GHz)