

DFS TEST REPORT FOR CERTIFICATION  
On Behalf of

Acer Incorporated

Halo Smart Speaker

Model Number: HSP3100G

FCC ID: HLZSP3100

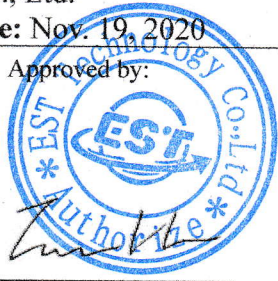
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|---------------|---------------------------------------------------------------------|
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|                 |                  |
|-----------------|------------------|
| Report Number:  | ESTE-R2011158    |
| Date of Test:   | Nov. 04~16, 2020 |
| Date of Report: | Nov. 19, 2020    |

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## EST Technology Co., Ltd.

|                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                       |                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------|
| <b>Applicant:</b>                                                                                                                                                                                 | Acer Incorporated                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                       |                       |
| <b>Address:</b>                                                                                                                                                                                   | 8F, 88, Sec 1, Hsin Tai Wu Rd, Hsichih, Taipei Hsien, 221, Taiwan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                       |                       |
| <b>Manufacturer:</b>                                                                                                                                                                              | Acer Incorporated                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                       |                       |
| <b>Address:</b>                                                                                                                                                                                   | 8F, 88, Sec 1, Hsin Tai Wu Rd, Hsichih, Taipei Hsien, 221, Taiwan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                       |                       |
| <b>E.U.T:</b>                                                                                                                                                                                     | Halo Smart Speaker                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                       |                       |
| <b>Model Number:</b>                                                                                                                                                                              | HSP3100G                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                       |                       |
| <b>Power Supply:</b>                                                                                                                                                                              | DC 16V From Adapter Input AC 100-240V, 50/60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                       |                       |
| <b>Trade Name:</b>                                                                                                                                                                                |  or ACER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Serial No.:</b>                                                                    | -----                 |
| <b>Date of Receipt:</b>                                                                                                                                                                           | Nov. 04, 2020                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Date of Test:</b>                                                                  | Nov. 04~Nov. 16, 2020 |
| <b>Test Specification:</b>                                                                                                                                                                        | FCC Part 15 Subpart E 15.407<br>KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02<br>KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                       |                       |
| <b>Test Result:</b>                                                                                                                                                                               | <p>The device described above is tested by EST Technology Co., Ltd. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the Dynamic Frequency Selection (DFS) tests under FCC Rules and Regulations Part 15 Subpart E requirements.</p> <p>This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd.</p> <p style="text-align: right;"><b>Date:</b> Nov. 19, 2020</p> |                                                                                       |                       |
| <b>Prepared by:</b>                                                                                                                                                                               | <b>Reviewed by:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Approved by:</b>                                                                   |                       |
|                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                       |
| Ring Yang / Assistant                                                                                                                                                                             | Seven Wang / Engineer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Iceman Hu / Manager                                                                   |                       |
| <b>Other Aspects:</b>                                                                                                                                                                             | None.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                       |                       |
| Abbreviations: OK/P=passed    fail/F=failed    n.a/N=not applicable    E.U.T=equipment under tested                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                       |                       |
| This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                       |                       |

## 1. GENERAL INFORMATION

### 1.1. Description Of Device (EUT)

|                    |   |                                                                                                                                                                             |
|--------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC ID             | : | HLZSP3100                                                                                                                                                                   |
| Product Name       | : | Halo Smart Speaker                                                                                                                                                          |
| Model Number       | : | HSP3100G                                                                                                                                                                    |
| Software Version   | : | 1.44.0.0.12                                                                                                                                                                 |
| Hardware Version   | : | VER-03                                                                                                                                                                      |
| Number of channel  | : | U-NII-2C(5600 MHz~5650 MHz):<br>IEEE 802.11a / n HT20 / ac VHT20: 3 Channels;<br>IEEE 802.11n HT40 / ac VHT40: 2 Channels;<br>IEEE 802.11ac VHT80: 1 Channel.               |
| Modulation         | : | OFDM(QPSK, BPSK, 16-QAM, 64-QAM, 256-QAM)                                                                                                                                   |
| Transmit Data Rate | : | IEEE 802.11a: 54, 48, 36, 24, 18, 12, 9, 6Mbps;<br>IEEE 802.11n: up to 150Mbps;<br>IEEE 802.11ac: up to 433.3Mbps;                                                          |
| Channels Spacing   | : | IEEE 802.11a: 20MHz;<br>IEEE 802.11n HT20: 20MHz;<br>IEEE 802.11n HT40: 40MHz;<br>IEEE 802.11ac VHT20: 20MHz;<br>IEEE 802.11ac VHT40: 40MHz;<br>IEEE 802.11ac VHT80: 80MHz; |
| TPC Function       | : | <input checked="" type="checkbox"/> Without TPC <input type="checkbox"/> With TPC                                                                                           |
| DFS Mode(s)        | : | <input type="checkbox"/> Master<br><input type="checkbox"/> Slave with radar detection<br><input checked="" type="checkbox"/> Slave without radar detection                 |
| Other Function     | : | <input type="checkbox"/> Ad-hoc <input type="checkbox"/> Hotspot                                                                                                            |
| Sample Type        | : | Prototype production                                                                                                                                                        |

**Note:**

For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

### 1.2. The Antenna Information For EUT

| Ant No. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) |
|---------|-------|------------|--------------|-----------|------------|
| 1       | N/A   | N/A        | Internal     | N/A       | 3.4        |
| 2       | N/A   | N/A        | Internal     | N/A       | 2.8        |

## 2. SUMMARY OF TEST

### 2.1. Summary Of Test Result

| Description of Test Item          | Test Mode                      | FCC Standard Section | Results |
|-----------------------------------|--------------------------------|----------------------|---------|
| Channel Closing Transmission Time | IEEE 802.11ac VHT80<br>5610MHz | 15.407(h)            | PASS    |
| Channel Move Time                 | IEEE 802.11ac VHT80<br>5610MHz | 15.407(h)            | PASS    |
| Non-Occupancy Period              | IEEE 802.11ac VHT80<br>5610MHz | 15.407(h)            | PASS    |

## 2.2. Test Facilities

### EMC Lab

: Certificated by CNAS, CHINA  
Registration No.: L5288  
This Certificate is valid until: November 12, 2023

Certificated by FCC, USA  
Designation Number: CN1215  
This Certificate is valid until: January 31, 2022

Certificated by A2LA, USA  
Registration No.: 4366.01  
This Certificate is valid until: January 31, 2022

Certificated by Industry Canada  
CAB identifier No.: CN0035  
This Certificate is valid until: January 31, 2022

Certificated by VCCI, Japan  
Registration No.: C-14103; T-20073; R-13663;  
R-20103; G-20097  
Date of registration: Apr. 20, 2020  
This Certificate is valid until: Apr. 19, 2023

Certificated by TUV Rheinland, Germany  
Registration No.: UA 50413872 0001  
Date of registration: July 31, 2018

Certificated by Intertek  
Registration No.: 2011-RTL-L2-64  
Date of registration: November 08, 2018

Name of Firm : EST Technology Co., Ltd.

Site Location : Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China

## 2.3.Measurement Uncertainty For EST Technology Co., Ltd.

| Test Item                                                   | Uncertainty               |
|-------------------------------------------------------------|---------------------------|
| Uncertainty for Conduction emission test                    | 2.54dB                    |
| Uncertainty for Radiation Emission test<br>(30MHz-1GHz)     | 3.62                      |
| Uncertainty for Radiation Emission test<br>(1GHz to 18GHz)  | 4.86                      |
| Uncertainty for spurious emissions test<br>(18GHz to 40GHz) | 4.67                      |
| Uncertainty for radio frequency                             | $7 \times 10^{-8}$        |
| Uncertainty for conducted RF Power                          | 0.20dB                    |
| Uncertainty for Power density test                          | 0.26dB                    |
| Temperature                                                 | $\pm 0.6^{\circ}\text{C}$ |
| Humidity                                                    | $\pm 4.0\%$               |
| Volatage DC                                                 | $\pm 1.0\%$               |
| Volatage (AC, <10KHz)                                       | $\pm 1.5\%$               |

Note:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

## 2.4. Test Equipment List

| Equipment                    | Manufacturer   | Model No.       | Serial No.         | Calibration Body | Last Cal.  | Next Cal. |
|------------------------------|----------------|-----------------|--------------------|------------------|------------|-----------|
| TS 8997                      | Rohde &Schwarz | /               | /                  | /                | /          | /         |
| Open Switch and Control Unit | Rohde &Schwarz | OSP-B157WB      | EST-E036           | LISAI            | June 13,20 | 1 Year    |
| Signal and Spectrum Analyzer | Rohde &Schwarz | FSV             | EST-E037           | LISAI            | June 13,20 | 1 Year    |
| Signal Generator             | Rohde &Schwarz | SMB100A         | EST-E038           | LISAI            | June 13,20 | 1 Year    |
| Vector Signal Generator      | Rohde &Schwarz | SMBV100A        | EST-E039           | LISAI            | June 13,20 | 1 Year    |
| Test Software                | Rohde &Schwarz | WMS32           | V10.50.00          | N/A              | N/A        | N/A       |
| Master AP                    | LINKSYS        | WRT3200ACM      | 1981060A6<br>21419 | N/A              | N/A        | N/A       |
| Notebook                     | DELL           | Laititude E6420 | N/A                | N/A              | N/A        | N/A       |

Note:

The FCC ID of Master AP is Q87-WRT3200ACM.

### 3. EIRP POWER

| Band                           | Test Mode           | Maximum Conducted Power (dBm) |       | Antenna Gain (dBi) |      | Total EIRP Power (mW) |
|--------------------------------|---------------------|-------------------------------|-------|--------------------|------|-----------------------|
|                                |                     | Ant 1                         | Ant 2 | Ant 1              | Ant2 |                       |
| UNII-2C<br>(5600 MHz~5650 MHz) | IEEE 802.11 a       | 11.71                         | 11.85 | 3.4                | 2.8  | 15.11                 |
|                                | IEEE 802.11n HT20   | 10.89                         | 10.92 |                    |      | 17.02                 |
|                                | IEEE 802.11ac VHT20 | 11.93                         | 11.97 |                    |      | 18.07                 |
|                                | IEEE 802.11n HT40   | 11.85                         | 11.79 |                    |      | 17.94                 |
|                                | IEEE 802.11ac VHT40 | 11.97                         | 11.86 |                    |      | 18.04                 |
|                                | IEEE 802.11ac VHT80 | 12.02                         | 11.99 |                    |      | 18.13                 |

## 4. DYNAMIC FREQUENCY SELECTION REQUIREMENTS

### 4.1.DFS Overview

**Table 1: Applicability of DFS Requirements Prior to Use of a Channel**

| Requirement                     | Operational Mode |                                |                             |
|---------------------------------|------------------|--------------------------------|-----------------------------|
|                                 | Master           | Client Without Radar Detection | Client With Radar Detection |
| Non-Occupancy Period            | Yes              | Not required                   | Yes                         |
| DFS Detection Threshold         | Yes              | Not required                   | Yes                         |
| Channel Availability Check Time | Yes              | Not required                   | Not required                |
| U-NII Detection Bandwidth       | Yes              | Not required                   | Yes                         |

**Table 2: Applicability of DFS requirements during normal operation**

| Requirement                       | Operational Mode                             |                                |
|-----------------------------------|----------------------------------------------|--------------------------------|
|                                   | Master Device or Client with Radar Detection | Client Without Radar Detection |
| DFS Detection Threshold           | Yes                                          | Not required                   |
| Channel Closing Transmission Time | Yes                                          | Not required                   |
| Channel Move Time                 | Yes                                          | Not required                   |
| U-NII Detection Bandwidth         | Yes                                          | Not required                   |

| Additional requirements for devices with multiple bandwidth modes                                                                                                                                                                                                                                                                                            | Master Device or Client with Radar Detection | Client Without Radar Detection                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------|
| U-NII Detection Bandwidth and Statistical Performance Check                                                                                                                                                                                                                                                                                                  | All BW modes must be tested                  | Not required                                         |
| Channel Move Time and Channel Closing Transmission Time                                                                                                                                                                                                                                                                                                      | Test using widest BW mode available          | Test using the widest BW mode available for the link |
| All other tests                                                                                                                                                                                                                                                                                                                                              | Any single BW mode                           | Not required                                         |
| <b>Note:</b> Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency. |                                              |                                                      |

## 4.2. DFS Detection Thresholds

**Table 3: DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection**

| Maximum Transmit Power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Value<br>(See Notes 1, 2, and 3) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| EIRP $\geq$ 200 milliwatt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -64 dBm                          |
| EIRP < 200 milliwatt and<br>power spectral density < 10 dBm/MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -62 dBm                          |
| EIRP < 200 milliwatt that do not meet the<br>power spectral density requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -64 dBm                          |
| <p><b>Note 1:</b> This is the level at the input of the receiver assuming a 0 dBi receive antenna.</p> <p><b>Note 2:</b> Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.</p> <p><b>Note 3:</b> EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.</p> |                                  |

## 4.3. Response Requirements

**Table 4: DFS Response Requirement Values**

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Value                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Non-occupancy period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Minimum 30 minutes                                                                                        |
| Channel Availability Check Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 60 seconds                                                                                                |
| Channel Move Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 10 seconds<br>See Note 1.                                                                                 |
| Channel Closing Transmission Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period.<br>See Notes 1 and 2. |
| U-NII Detection Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.                                   |
| <p><b>Note 1:</b> <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.</p> <p><b>Note 2:</b> The <i>Channel Closing Transmission Time</i> is comprised of 200 milliseconds starting at the beginning of the <i>Channel Move Time</i> plus any additional intermittent control signals required to facilitate a <i>Channel</i> move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.</p> <p><b>Note 3:</b> During the <i>U-NII Detection Bandwidth</i> detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic</p> |                                                                                                           |

#### 4.4. Radar Test Waveforms

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

##### 4.4.1. Short Pulse Radar Test Waveforms

**Table 5 – Short Pulse Radar Test Waveforms**

| Radar Type                                                                                                                                  | Pulse Width (μsec) | PRI (μsec)                                                                                                                                                    | Number of Pulses                                                                                                                     | Minimum Percentage of Successful Detection | Minimum Number of Trials |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------------|
| 0                                                                                                                                           | 1                  | 1428                                                                                                                                                          | 18                                                                                                                                   | See Note 1                                 | See Note 1               |
| 1                                                                                                                                           | 1                  | Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a                                                                     | $\text{Roundup} \left\{ \left( \frac{1}{360} \right) \cdot \left( \frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{sec}}} \right) \right\}$ | 60%                                        | 30                       |
|                                                                                                                                             |                    | Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A |                                                                                                                                      |                                            |                          |
| 2                                                                                                                                           | 1-5                | 150-230                                                                                                                                                       | 23-29                                                                                                                                | 60%                                        | 30                       |
| 3                                                                                                                                           | 6-10               | 200-500                                                                                                                                                       | 16-18                                                                                                                                | 60%                                        | 30                       |
| 4                                                                                                                                           | 11-20              | 200-500                                                                                                                                                       | 12-16                                                                                                                                | 60%                                        | 30                       |
| Aggregate (Radar Types 1-4)                                                                                                                 |                    |                                                                                                                                                               |                                                                                                                                      | 80%                                        | 120                      |
| <b>Note 1:</b> Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests. |                    |                                                                                                                                                               |                                                                                                                                      |                                            |                          |

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B.

For example if in Short Pulse Radar Type 1 Test B a PRI of 3066 μsec is selected, the number of pulses would be  $\text{Roundup} \{ (1/360)(19 \times 10^6 / 3066) \} = \text{Round up} \{ 17.2 \} = 18$ .

**Table 5a - Pulse Repetition Intervals Values for Test A**

| <b>Repetition Frequency Number</b> | <b>Pulse Repetition Frequency (Pulses Per Second)</b> | <b>Pulse Repetition Interval (Microseconds)</b> |
|------------------------------------|-------------------------------------------------------|-------------------------------------------------|
| 1                                  | 1930.5                                                | 518                                             |
| 2                                  | 1858.7                                                | 538                                             |
| 3                                  | 1792.1                                                | 558                                             |
| 4                                  | 1730.1                                                | 578                                             |
| 5                                  | 1672.2                                                | 598                                             |
| 6                                  | 1618.1                                                | 618                                             |
| 7                                  | 1567.4                                                | 638                                             |
| 8                                  | 1519.8                                                | 658                                             |
| 9                                  | 1474.9                                                | 678                                             |
| 10                                 | 1432.7                                                | 698                                             |
| 11                                 | 1392.8                                                | 718                                             |
| 12                                 | 1355                                                  | 738                                             |
| 13                                 | 1319.3                                                | 758                                             |
| 14                                 | 1285.3                                                | 778                                             |
| 15                                 | 1253.1                                                | 798                                             |
| 16                                 | 1222.5                                                | 818                                             |
| 17                                 | 1193.3                                                | 838                                             |
| 18                                 | 1165.6                                                | 858                                             |
| 19                                 | 1139                                                  | 878                                             |
| 20                                 | 1113.6                                                | 898                                             |
| 21                                 | 1089.3                                                | 918                                             |
| 22                                 | 1066.1                                                | 938                                             |
| 23                                 | 326.2                                                 | 3066                                            |

The aggregate is the average of the percentage of successful detections of Short Pulse Radar Types 1-4. For example, the following table indicates how to compute the aggregate of percentage of successful detections.

| <b>Radar Type</b>                                    | <b>Number of Trials</b> | <b>Number of Successful Detections</b> | <b>Minimum Percentage of Successful Detection</b> |
|------------------------------------------------------|-------------------------|----------------------------------------|---------------------------------------------------|
| 1                                                    | 35                      | 29                                     | 82.9%                                             |
| 2                                                    | 30                      | 18                                     | 60%                                               |
| 3                                                    | 30                      | 27                                     | 90%                                               |
| 4                                                    | 50                      | 44                                     | 88%                                               |
| Aggregate $(82.9\% + 60\% + 90\% + 88\%)/4 = 80.2\%$ |                         |                                        |                                                   |

## 4.4.2. Long Pulse Radar Test Waveform

**Table 6 – Long Pulse Radar Test Waveform**

| <b>Radar Type</b> | <b>Pulse Width (μsec)</b> | <b>Chirp Width (MHz)</b> | <b>PRI (μsec)</b> | <b>Number of Pulses per Burst</b> | <b>Number of Bursts</b> | <b>Minimum Percentage of Successful Detection</b> | <b>Minimum Number of Trials</b> |
|-------------------|---------------------------|--------------------------|-------------------|-----------------------------------|-------------------------|---------------------------------------------------|---------------------------------|
| 5                 | 50-100                    | 5-20                     | 1000-2000         | 1-3                               | 8-20                    | 80%                                               | 30                              |

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse Radar Type waveforms. If more than 30 waveforms are used for the Long Pulse Radar Type waveforms, then each additional waveform must also be unique and not repeated from the previous waveforms.

Each waveform is defined as follows:

- 1) The transmission period for the Long Pulse Radar test signal is 12 seconds.
- 2) There are a total of 8 to 20 *Bursts* in the 12 second period, with the number of *Bursts* being randomly chosen. This number is *Burst Count*.
- 3) Each *Burst* consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each *Burst* within the 12 second sequence may have a different number of pulses.
- 4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a *Burst* will have the same pulse width. Pulses in different *Bursts* may have different pulse widths.
- 5) Each pulse has a linear frequency modulated chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a *transmission period* will have the same chirp width. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.
- 6) If more than one pulse is present in a *Burst*, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a *Burst*, the random time interval between the first and second pulses is chosen independently of the random time interval between the second and third pulses.
- 7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to *Burst Count*. Each interval is of length  $(12,000,000 / \text{Burst Count})$  microseconds. Each interval contains one *Burst*. The start time for the *Burst*, relative to the beginning of the interval, is between 1 and  $[(12,000,000 / \text{Burst Count}) - (\text{Total Burst Length}) + (\text{One Random PRI Interval})]$  microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each *Burst* is chosen randomly.

**A representative example of a Long Pulse Radar Type waveform:**

- 1) The total test waveform length is 12 seconds.
- 2) Eight (8) *Bursts* are randomly generated for the *Burst Count*.
- 3) *Burst 1* has 2 randomly generated pulses.
- 4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.
- 5) The PRI is randomly selected to be at 1213 microseconds.
- 6) *Bursts 2* through 8 are generated using steps 3 – 5.
- 7) Each *Burst* is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, *Burst 1* is randomly generated (1 to 1,500,000 minus the total *Burst 1* length + 1 random PRI interval) at the 325,001 microsecond step. *Bursts 2* through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. *Burst 2* falls in the 1,500,001 – 3,000,000 microsecond range).

#### 4.4.3 Frequency Hopping Radar Test Waveform

**Table 7 – Frequency Hopping Radar Test Waveform**

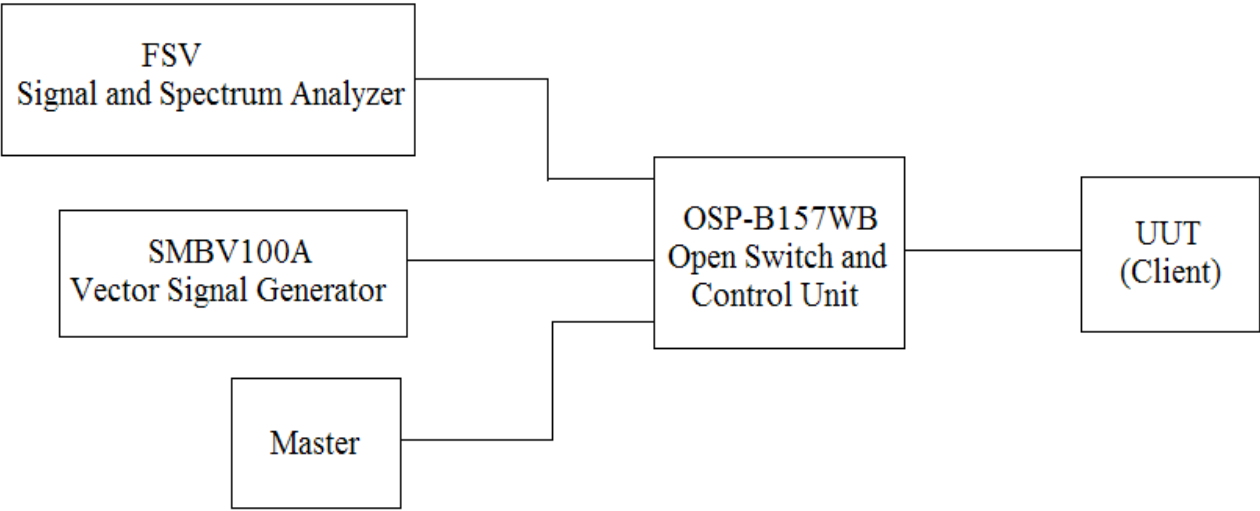
| <b>Radar Type</b> | <b>Pulse Width (μsec)</b> | <b>PRI (μsec)</b> | <b>Pulses per Hop</b> | <b>Hopping Rate (kHz)</b> | <b>Hopping Sequence Length (msec)</b> | <b>Minimum Percentage of Successful Detection</b> | <b>Minimum Number of Trials</b> |
|-------------------|---------------------------|-------------------|-----------------------|---------------------------|---------------------------------------|---------------------------------------------------|---------------------------------|
| 6                 | 1                         | 333               | 9                     | 0.333                     | 300                                   | 70%                                               | 30                              |

For the Frequency Hopping Radar Type, the same *Burst* parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

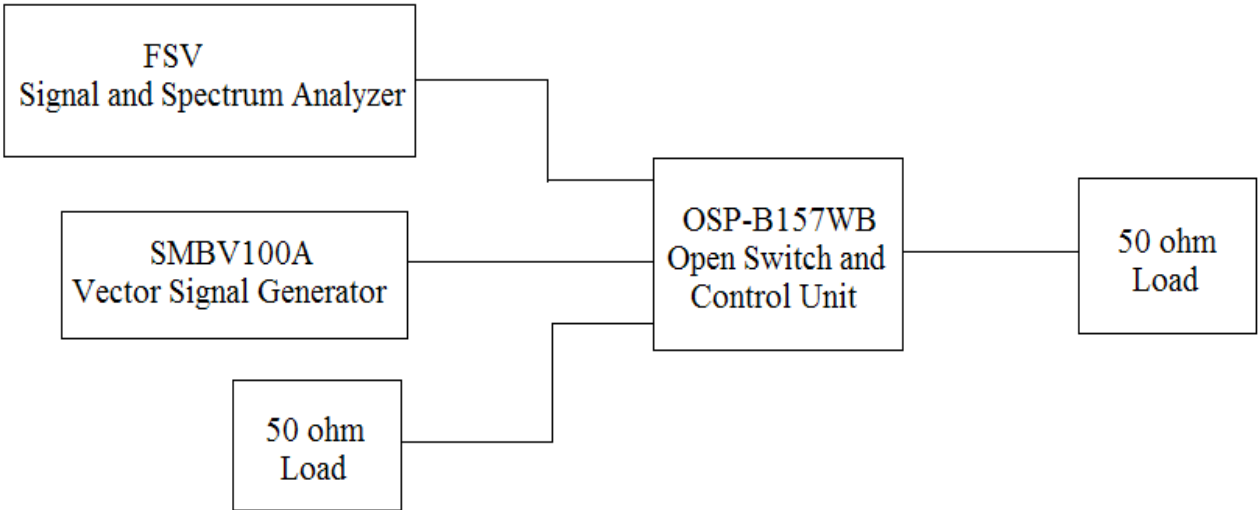
5. TEST SETUP

5.1.Setup Configuration of EUT and TS8997 System



5.2.Radar Waveform Calibration

The conducted radar waveform calibration diagram of TS8997 is shown below.



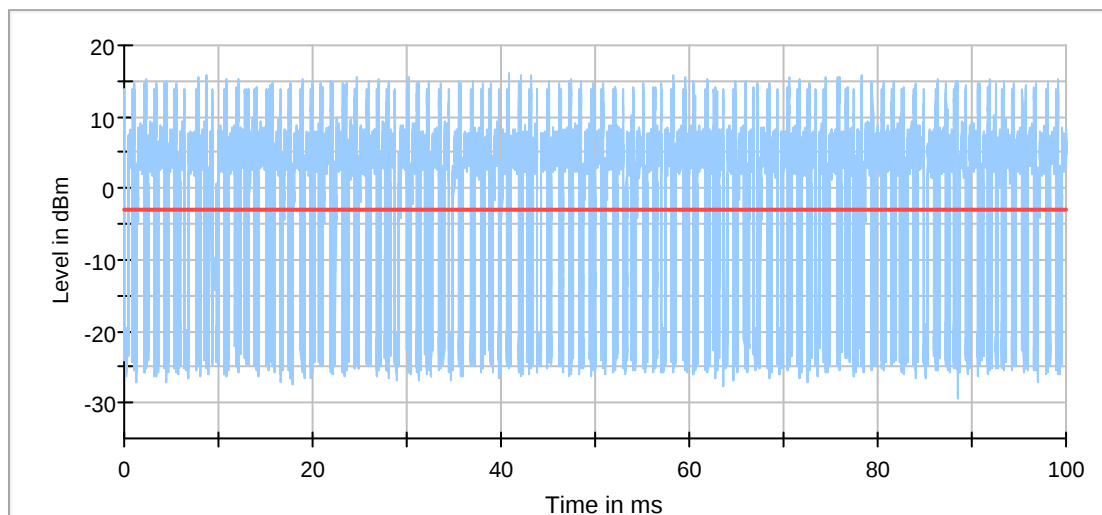
## 5.3.1 Radar Waveform Calibration Result

**Radar Waveform Type 0**

| Description                                                                                                                                                                                                                                                                                         | Value                                                                   | Unit    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|---------|
| IF((<br>{DFS Mode(0/1/2)}=0)or(<br>{DFS Mode(0/1/2)}=1) , IF((dBm2W(<br>{Nominal Power[dBm]}>0.2) , -64 , IF((<br>{Configured PSD[dBm]}<10) , -62 , -64))+<br>{Attenuation Vector Generator to DUT[dB]} , -50+<br>{Attenuation Vector Generator to COMP[dB]}))+<br>{Radar Signal Level Offset[dB]}) | Given setting /<br>formula<br>to calculate<br>Vector Generator<br>level | --      |
| Configured DUT EIRP:                                                                                                                                                                                                                                                                                | 31.62                                                                   | mW      |
| Configured DUT PSD:                                                                                                                                                                                                                                                                                 | 3.00                                                                    | dBm/MHz |
| Requirement of the Detection threshold value<br>for this given values acc. to FCC clause 5.2 / Table 3                                                                                                                                                                                              | -62                                                                     | dBm     |
| Vector Generator level setting                                                                                                                                                                                                                                                                      | 1.08                                                                    | dBm     |
| Configured overall pathloss from Vector Generator<br>RF out to DUT connector of 'DUT to OSP'-cable                                                                                                                                                                                                  | 59.90                                                                   | dB      |
| Given additional level added to the amplitude of<br>the waveform to account for variations in measurement                                                                                                                                                                                           | 1.00                                                                    | dB      |
| This results in the following radar signal<br>level at the DUT                                                                                                                                                                                                                                      | -58.81                                                                  | dBm     |

## 5.3.Chanel Loading

| DUT Frequency<br>(MHz) | Tx-Test<br>Duty Cycle<br>(%) | Tx-Test<br>Duty Cycle<br>Limit | Tx-Test No. of<br>Pulses found | Tx-Test<br>Result |
|------------------------|------------------------------|--------------------------------|--------------------------------|-------------------|
| 5610.000000            | 71.428                       | >=17 %                         | 297                            | PASS              |

**802.11ac VHT80 5610MHz**

— In-Service Monitoring Transmitt Test Sweep      — Threshold

## 6. IN-SERVICE MONITORING FOR CHANNEL MOVE TIME, CHANNEL CLOSING TRANSMISSION TIME AND NON-OCCUPANCY PERIOD

### 6.1. Test Procedure

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold + 1dB is generated on the Operating Channel of the U-NII device (In- Service Monitoring).

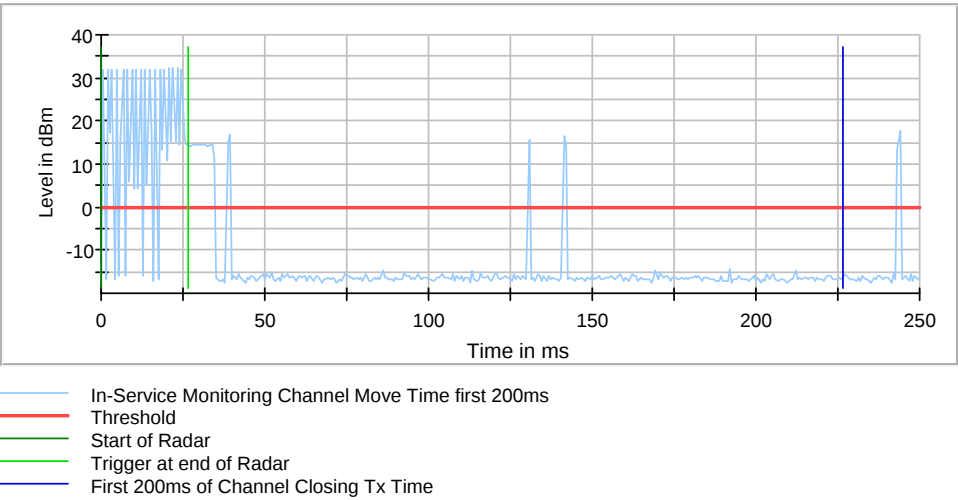
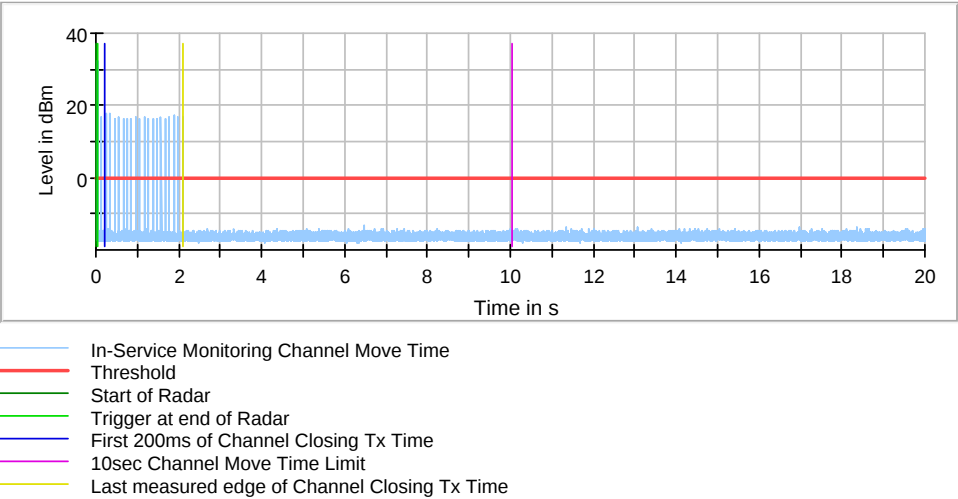
- a) One frequency will be chosen from the Operating Channels of the UUT within the 5250-5350 MHz or 5470-5725 MHz bands. For 802.11 devices, the test frequency must contain control signals. This can be verified by disabling channel loading and monitoring the spectrum analyzer. If no control signals are detected, another frequency must be selected within the emission bandwidth where control signals are detected.
- b) In case the UUT is a U-NII device operating as a Client Device (with or without DFS), a U-NII device operating as a Master Device will be used to allow the UUT (Client device) to Associate with the Master Device. In case the UUT is a Master Device, a U-NII device operating as a Client Device will be used and it is assumed that the Client will Associate with the UUT (Master). In both cases for conducted tests, the Radar Waveform generator will be connected to the Master Device. For radiated tests, the emissions of the Radar Waveform generator will be directed towards the Master Device. If the Master Device has antenna gain, the main beam of the antenna will be directed toward the radar emitter. Vertical polarization is used for testing.
- c) Stream the channel loading test file from the Master Device to the Client Device on the test Channel for the entire period of the test.
- d) At time T0 the Radar Waveform generator sends a Burst of pulses for one of the Radar Type 0 in **Table 5** at levels defined in **Table 3**, on the Operating Channel. An additional 1 dB is added to the radar test signal to ensure it is at or above the DFS Detection Threshold, accounting for equipment variations/errors.
- e) Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Measure and record the Channel Move Time and Channel Closing Transmission Time if radar detection occurs. f) When operating as a Master Device, monitor the UUT for more than 30 minutes following instant T2 to verify that the UUT does not resume any transmissions on this Channel. Perform this test once and record the measurement result.
- g) In case the UUT is a U-NII device operating as a Client Device with In-Service Monitoring, perform steps a) to f).

6.2.Channel Move Time&Channel Close Transmission Time Test Result

| Frequency (MHz) | Radar Type No. | CMT Tx Time (s) | CMT Limit (s) | Result |
|-----------------|----------------|-----------------|---------------|--------|
| 5610.000000     | 0              | 2.061           | 10.000        | PASS   |

| Frequency (MHz) | Radar Type No. | CCTT Type of Value              | CCTT No. of Pulses found | CCTT Tx Time (ms) | Limit (ms) | Result |
|-----------------|----------------|---------------------------------|--------------------------|-------------------|------------|--------|
| 5610.000000     | 0              | first 200 ms                    | 41                       | 6.472             | 200        | PASS   |
| 5610.000000     | 0              | remaining 10.0 second(s) period | 50                       | 9.412             | 60         | PASS   |

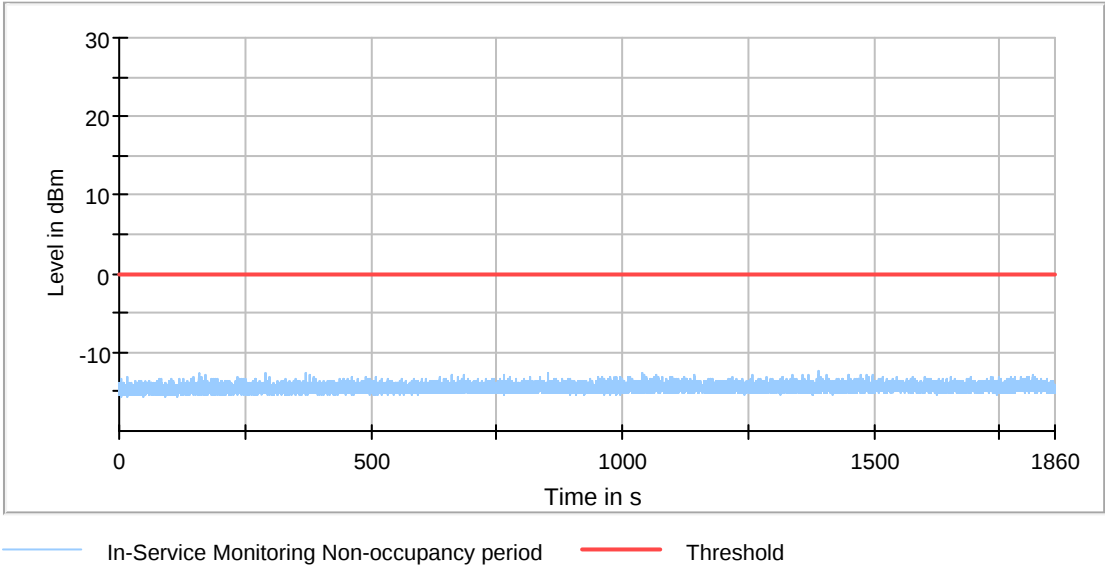
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6.3.Non-Occupancy Period Test Result

| Frequency<br>(MHz) | Radar<br>Type No. | NOP No.<br>of Pulses<br>found | NOP No. of<br>Pulses Limit | NOP Tx Time<br>(s) | NOP Tx<br>Time Limit<br>(s) | Result |
|--------------------|-------------------|-------------------------------|----------------------------|--------------------|-----------------------------|--------|
| 5610.000000        | 0                 | 0                             | 0                          | 0.000              | 30.000                      | PASS   |

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## 7. TEST SETUP PHOTO



**End of Test Report**