# FCC DFS Test Report

| | | |
|---|---|---|
| **FCC ID** | : | **MXF-WRTM-331** |
| **Equipment** | : | **THINGS** |
| **Model No.** | : | **TH-GW10, VC-FLX1**<br>**(Marketing difference)** |
| **Brand Name** | : | **Toshiba, Onkyo**<br>**(Marketing difference)** |
| **Applicant** | : | **Gemtek Technology Co., Ltd.** |
| **Address** | : | **No. 15-1 Zhonghua Road, Hsinchu Industrial Park, Hukou, Hsinchu, Taiwan, 30352.** |
| **Standard** | : | **47 CFR FCC Part 15.407** |
| **Received Date** | : | **Mar. 09, 2018** |
| **Tested Date** | : | **Mar. 28, 2018** |
| **Operating Mode** | : | **Client Without Radar Detection** |

**We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.**

**Reviewed by:**
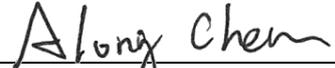
**Along Chen / Assistant Manager**

**Approved by:**

**Gary Chang / Manager**

Testing Laboratory 2732

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# Release Record

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| FZ741201-04 | Rev. 01 | Initial issue | Apr. 03, 2018 |

# Summary of Test Results

| FCC Rules | | Description of Test | Result |
|---|---|---|---|
| FCC 15.407 | KDB 905462 D02 | Non-Occupancy Period | Pass |
| FCC 15.407 | KDB 905462 D02 | Channel Closing Transmission Time | Pass |
| FCC 15.407 | KDB 905462 D02 | Channel Move Time | Pass |

# 1 General Description

## 1.1 Information

### 1.1.1 Specification of the Equipment under Test (EUT)

| Frequency Range (GHz) | 5.25~5.35, 5.47~5.725 |
|---|---|
| Wireless Function | 11a / HT20 / HT40/ VHT20 / VHT40 / VHT80 |
| Operating Mode at DFS Band | Client without radar detection and ad hoc function |
| Firmware / Software Version | 2.03a |

### 1.1.2 Antenna Details

| Ant. No. | Model | Type | Connector | Operating Frequencies (MHz) / Antenna Gain (dBi) | |
|---|---|---|---|---|---|
| | | | | 5250~5350MHz | 5470~5725MHz |
| 1 | A8-A006-00391 | Dipole | IPEX | 4.34 | 4.34 |
| 2 | A8-A006-00392 | Dipole | IPEX | 4.34 | 4.34 |

## 1.2 Support Equipment List

| Support Equipment List | | | | |
|---|---|---|---|---|
| No. | Equipment | Brand Name | Model Name | FCC ID |
| 1 | AP | Extreme Networks | WS-AP3805e | QXO-4200 |
| 2 | Notebook | DELL | LATITUDE-E6430 | 9ZFB4X1 |
| 3 | Notebook | DELL | LATITUDE-E5420 | B6FV9T1 |

## 1.3    The Equipment List

| Test Site | (DF01-WS) | | | | |
|---|---|---|---|---|---|
| **Instrument** | **Manufacturer** | **Model No.** | **Serial No.** | **Calibration Date** | **Calibration Until** |
| Spectrum Analyzer | R&S | FSV 7 | 101607 | Dec. 14, 2017 | Dec. 13, 2018 |
| RF Cable | HUBER+SUHNER | SUCOFLEX_104 | MY15686/4 | Dec. 07, 2017 | Dec. 06, 2018 |
| RF Cable | HUBER+SUHNER | SUCOFLEX_104 | 296081/4 | Dec. 07, 2017 | Dec. 06, 2018 |
| RF Cable | HUBER+SUHNER | SUCOFLEX_104 | 500199/4 | Dec. 07, 2017 | Dec. 06, 2018 |
| RF Cable | HUBER+SUHNER | SUCOFLEX_104 | 500202/4 | Dec. 07, 2017 | Dec. 06, 2018 |
| RF Cable | HUBER+SUHNER | SUCOFLEX_104 | 296088/4 | Dec. 07, 2017 | Dec. 06, 2018 |
| RF Cable | HUBER+SUHNER | SUCOFLEX_104 | 329023/4 | Dec. 07, 2017 | Dec. 06, 2018 |
| RF Cable | HUBER+SUHNER | SUCOFLEX_104 | 329021/4 | Dec. 07, 2017 | Dec. 06, 2018 |
| Vector signal generator | R&S | SMBV100A | 263146 | Jan. 02, 2018 | Jan. 01, 2019 |
| Note: Calibration Interval of instruments listed above is one year. | | | | | |

## 1.4    Testing Condition

| Test Item | Test Site | Ambient Condition | Tested By |
|---|---|---|---|
| DFS | DF01-WS | 20°C / 65% | Jack Li |

## 1.5    Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.407
FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02
FCC KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02
FCC KDB 905462 D06 802 11 Channel Plans v02

# 2 Technical Requirements for DFS

## 2.1 Applicability of DFS Requirements

### 2.1.1 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 |

### 2.1.2 Applicability of DFS Requirements during Normal Operation

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

| Additional requirements for devices with multiple bandwidth modes | Operational Mode | |
|---|---|---|
| | Master 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 |
| Note: Frequencies selected for statistical performance check 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 all 20 MHz channel blocks and a null frequencies between the bonded 20 MHz channel blocks. | | |

## 2.2 DFS Detection Thresholds and Response Requirement

Below table provides the DFS Detection Thresholds for Master Devices as well as Client Devices incorporating In-Service Monitoring.

**DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection.**

| Maximum Transmit Power | Value (See Notes 1 , 2 and 3) |
|---|---|
| EIRP ≥ 200 milliwatt | -64 dBm |
| EIRP < 200 milliwatt and power spectral density < 10 dBm / MHz | -62 dBm |
| EIRP < 200 milliwatt and that do not meet the power spectral density requirement | -64 dBm |
| Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.<br>Note 2: 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.<br>Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01. | |

**DFS Response Requirement Values**

| Parameter | Value |
|---|---|
| Non-occupancy period | Minimum 30 minutes. |
| Channel Availability Check Time | 60 seconds. |
| Channel Move Time | 10 seconds. (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.) |
| **Note 1:** Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.<br>**Note 2:** The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel 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.<br>**Note 3:** During the U-NII Detection Bandwidth 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. | |

## 2.3    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.

### 2.3.1    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 Note1 | See Note1 |
| 1 | | Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a | $\text{Roundup}\left\{\dfrac{\left(\dfrac{1}{360}\right)\cdot}{\left(\dfrac{19\cdot10^6}{PRI_{\mu sec}}\right)}\right\}$ | 60% | 30 |
| | | Test B: 15 unique PRI values randomly selected within the range of 518-3066 $\mu$ sec, 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 |
| Note 1: 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.

## Pulse Repetition Intervals Values for Test A

| Pulse Repetition Frequency Number | Pulse Repetition Frequency (Pulses Per Second) | Pulse Repetition Interval (Microseconds) |
|:---:|:---:|:---:|
| 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 |

## 2.3.2 Long Pulse Radar Test Waveform

| Radar Type | Pulse Width (µsec) | Chirp Width (MHz) | PRI (µsec) | Number of Pulses per Burst | Number of Bursts | Minimum Percentage of Successful Detection | Minimum Number of Trials |
|---|---|---|---|---|---|---|---|
| 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.

## 2.3.3 Frequency Hopping Radar Test Waveform

| Radar Type | Pulse Width (µsec) | PRI (µsec) | Pulses per Hop | Hopping Rate (kHz) | Hopping Sequence Length (msec) | Minimum Percentage of Successful Detection | Minimum Number of Trials |
|---|---|---|---|---|---|---|---|
| 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

## 2.3.4 Radar waveform generation

A single R&S SMU200A Vector Signal Generator is used for the DFS signal generation. This instrument is capable of generating all the above waveforms with Pulse Sequencer Software. The R&S Pulse Sequencer Software comes as a stand-alone PC based software with preconfigured project files for DFS. It simplifies the generation of all required waveforms and offers a one box solution
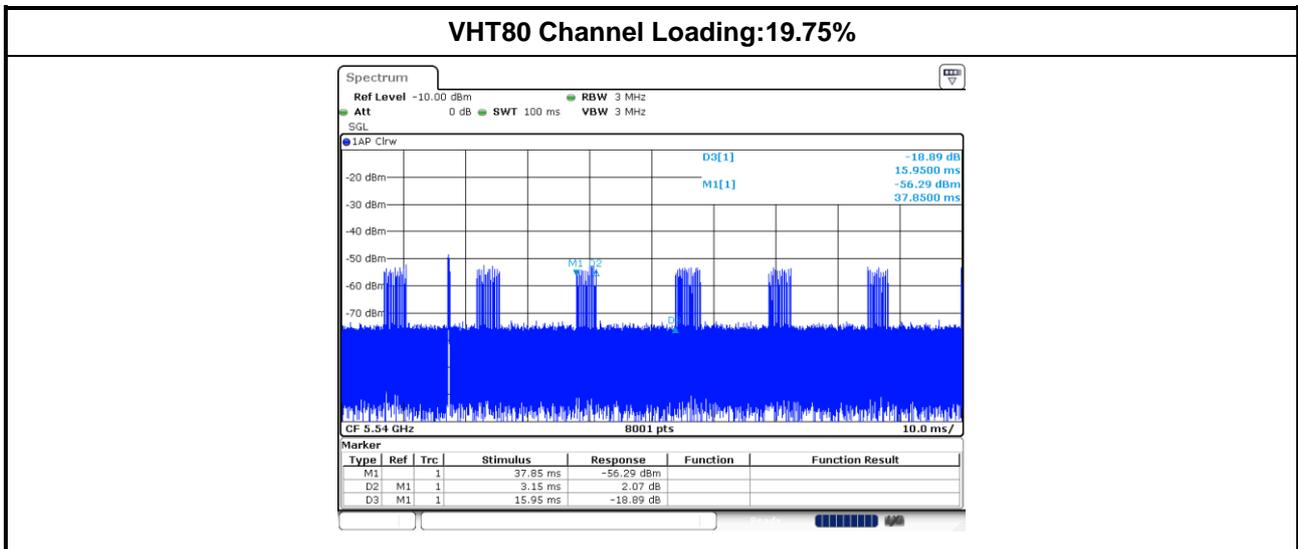
## 2.3.5 DFS Test Setup
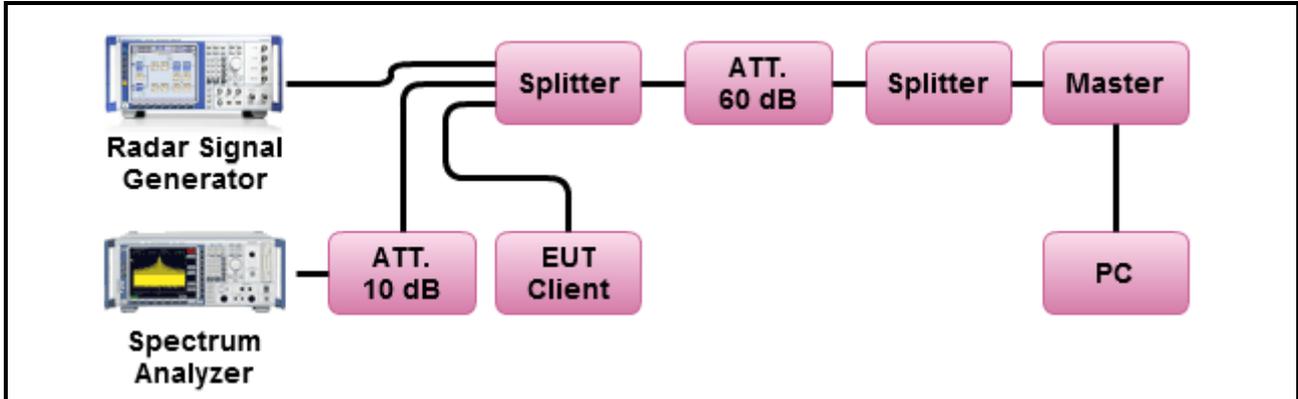


## 2.3.6 Channel Loading/Data Streaming

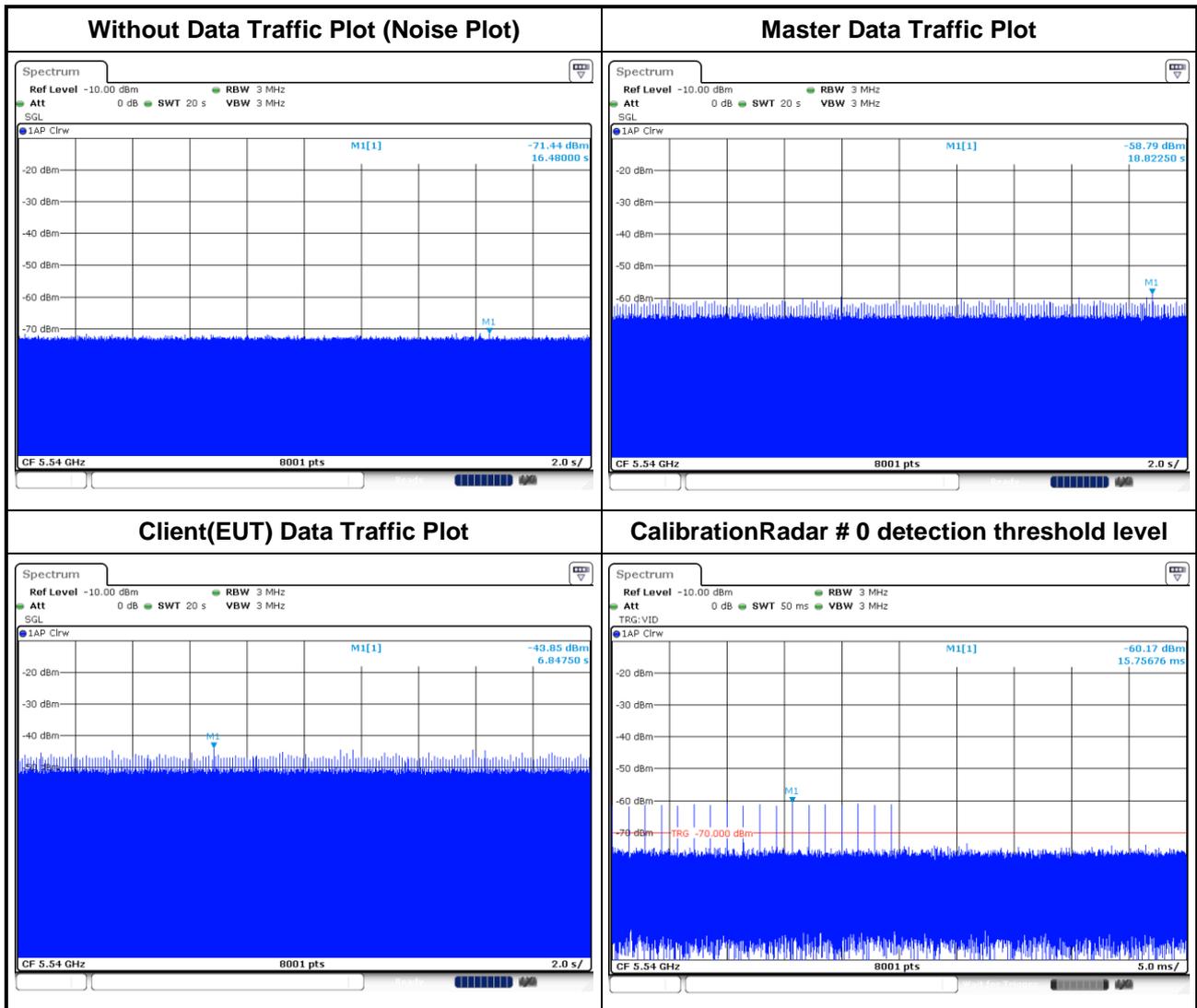| | |
|---|---|
| ☒ | IP Based (Load Based) - stream the test file from the Master to the Client. |
| | ☐ The data file must be of a type that is typical for the device (i.e., MPEG-2, MPEG-4, WAV, MP3, MP4, AVI, etc.) and must generally be transmitting in a streaming mode. |
| ☒ | Minimum channel loading of approximately 17 % |

| VHT80 Channel Loading:19.75% |
|---|
|  |

# 3 DFS test result

## 3.1 DFS Detection Threshold levels

| Master DFS Threshold Level |
|---|
| DFS Threshold level: -60.05dBm |
| The Interference **Radar Detection Threshold Level** is (-64dBm) + ([2.95dBi] ) + {1 dB}= -60.05 dBm. That had been taken into account the master output power range and antenna gain. |

| Without Data Traffic Plot (Noise Plot) | Master Data Traffic Plot |
|---|---|
|  |  |

| Client(EUT) Data Traffic Plot | CalibrationRadar # 0 detection threshold level |
|---|---|
|  |  |

## 3.2 In-Service Monitoring

### 3.2.1 In-service Monitoring Limit

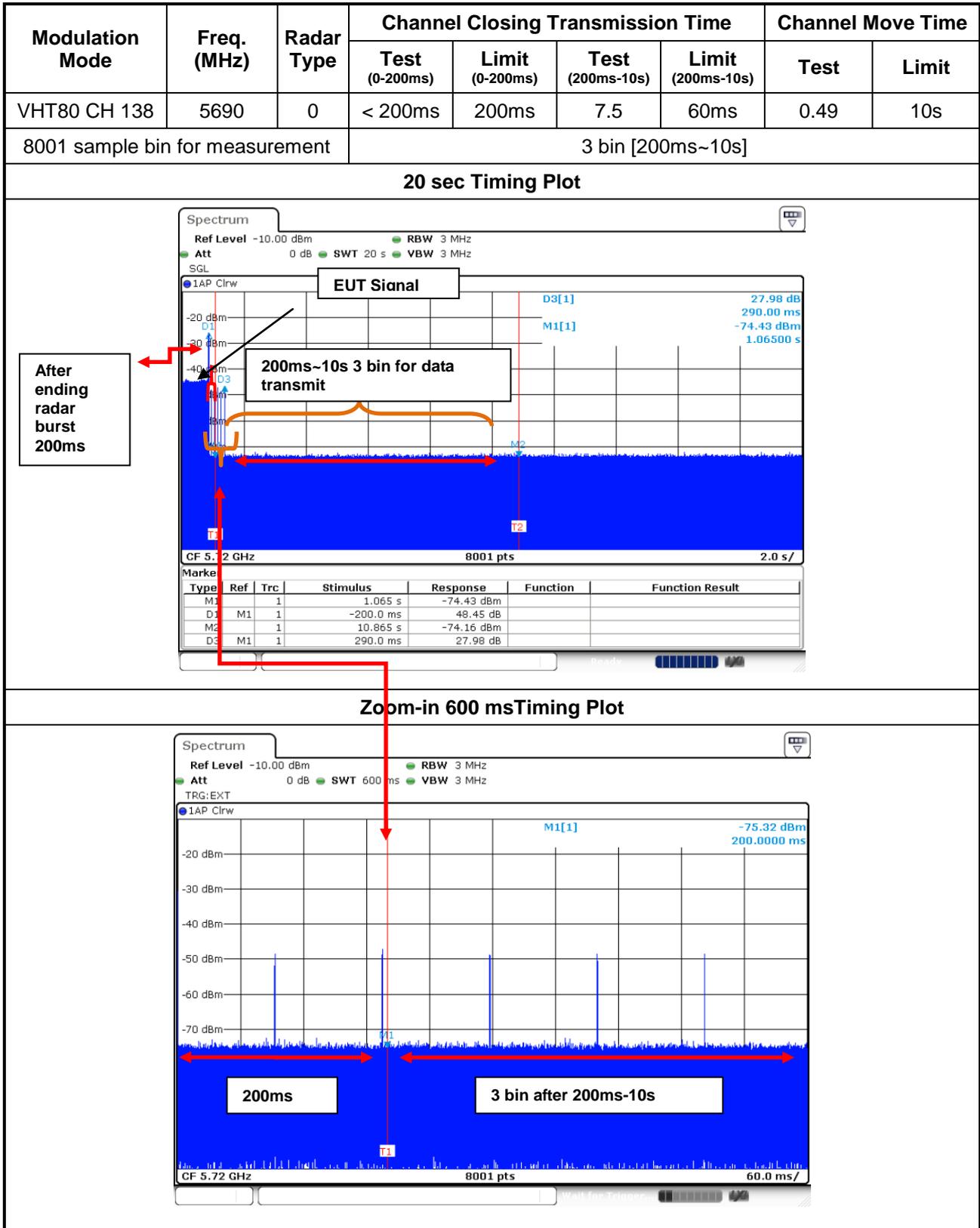| In-service Monitoring Limit | |
|---|---|
| Channel Move Time | 10 sec |
| Channel Closing Transmission Time | 200 ms + an aggregate of 60 ms over remaining 10 sec periods. |
| Non-occupancy period | Minimum 30 minutes |

### 3.2.2 Test Procedures

| Test Method |
|---|
| ☒ Refer as FCC KDB 905642 D02, clause 7.8.3 verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time. Client Device will associate with the EUT. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the EUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time limits. |
| ☒ Refer as FCC KDB 905642 D02, clause 7.8.3 verified during In-Service Monitoring; Non-Occupancy Period. Client Device will associate with the EUT. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the EUT during the observation time (Non-Occupancy Period). Compare the Non-Occupancy Period limits. |

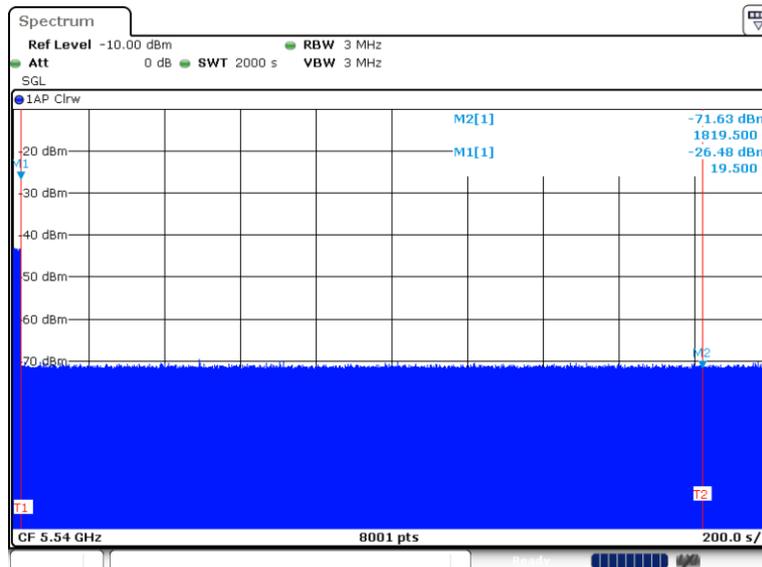## 3.2.3 Test Result of Channel Closing Transmission and Channel Move Time

| Modulation Mode | Freq. (MHz) | Radar Type | Channel Closing Transmission Time | | | | Channel Move Time | |
|---|---|---|---|---|---|---|---|---|
| | | | Test (0-200ms) | Limit (0-200ms) | Test (200ms-10s) | Limit (200ms-10s) | Test | Limit |
| VHT80 | 5530 | 0 | < 200ms | 200ms | 7.5 | 60ms | 0.425 | 10s |
| 8001 sample bin for measurement | | | 3 bin [200ms~10s] | | | | | |
| **20 sec Timing Plot** | | | | | | | | |



| **Zoom-in 600 msTiming Plot** |
|---|

| Modulation Mode | Freq. (MHz) | Radar Type | Channel Closing Transmission Time | | | | Channel Move Time | |
|---|---|---|---|---|---|---|---|---|
| | | | Test (0-200ms) | Limit (0-200ms) | Test (200ms-10s) | Limit (200ms-10s) | Test | Limit |
| VHT80 CH 138 | 5690 | 0 | < 200ms | 200ms | 7.5 | 60ms | 0.49 | 10s |
| 8001 sample bin for measurement | | | 3 bin [200ms~10s] | | | | | |

| 20 sec Timing Plot |
|---|



| Zoom-in 600 msTiming Plot |
|---|

## 3.2.4 Test Result of Non-Occupancy

| Non-Occupancy Period Result | | | | |
|---|---|---|---|---|
| **Modulation Mode** | **Freq. (MHz)** | **Non-Occupancy Period** | | |
| | | **Measured** | **Limit** | **Result** |
| VHT80 | 5530 | >30min | 30min | Complied |
| **2000 sec Timing Plot** | | | | |



| **Modulation Mode** | **Freq. (MHz)** | **Non-Occupancy Period** | | |
|---|---|---|---|---|
| | | **Measured** | **Limit** | **Result** |
| VHT80 CH 138 | 5690 | >30min | 30min | Complied |
| **2000 sec Timing Plot** | | | | |
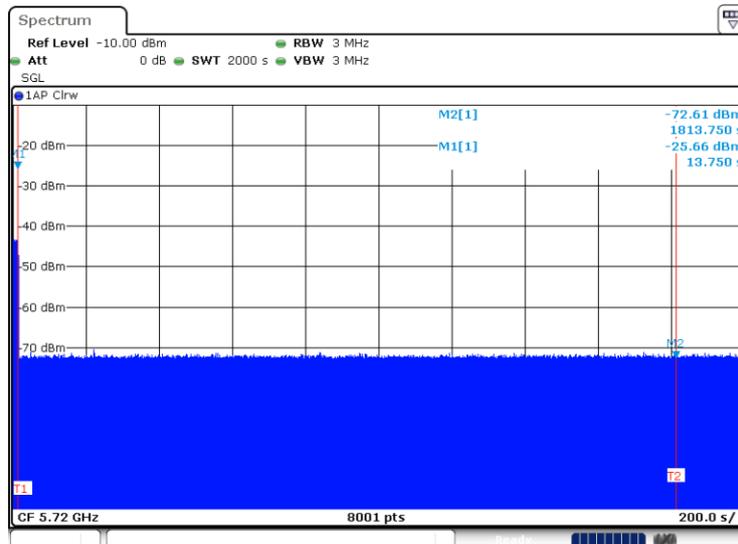
## 3.3 Non-Associated

| Non-Associated Test Result | | | |
|---|---|---|---|
| **Modulation Mode** | **Freq. (MHz)** | **Observation time** | **Result** |
| VHT80 | 5530 | 30 Minutes | Complied |
| **2000 sec Timing Plot** | | | |



| **Modulation Mode** | **Freq. (MHz)** | **Observation time** | **Result** |
|---|---|---|---|
| VHT80 CH 138 | 5690 | 30 Minutes | Complied |
| **2000 sec Timing Plot** | | | |
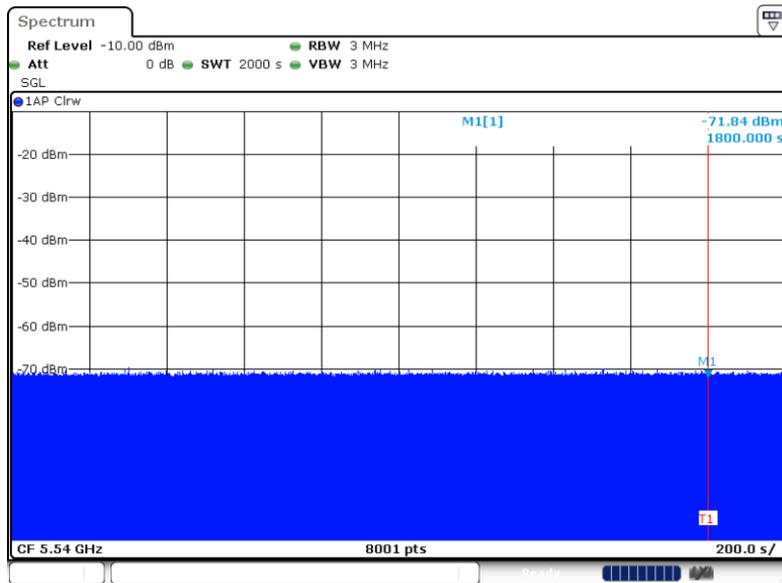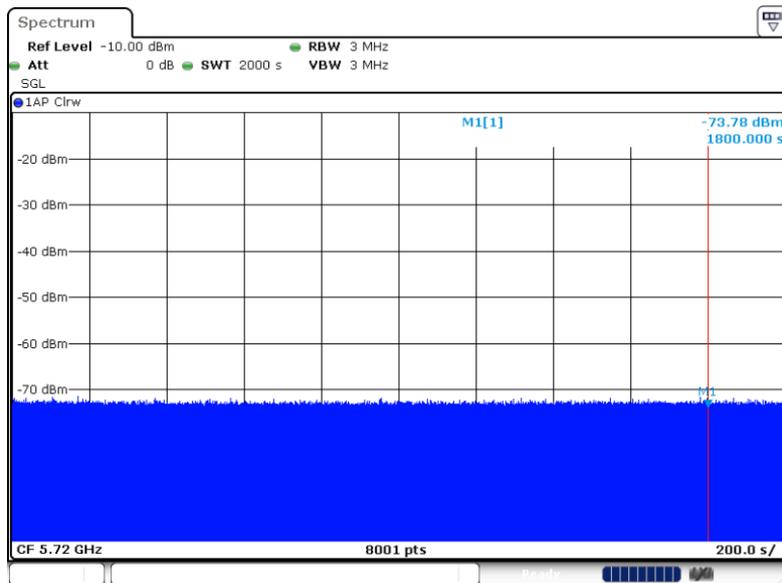
# 4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website http://www.icertifi.com.tw.

**Linkou**

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**Kwei Shan**

Tel: 886-3-271-8666

No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

**Kwei Shan Site II**

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information.

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