
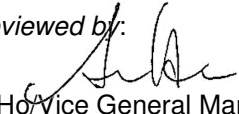


| | | | | |
|--|--|--|---|--|
| Prüfbericht-Nr.: <i>Test Report No.:</i> | 50141307 001 | Auftrags-Nr.: <i>Order No.:</i> | 114076042 | Seite 1 von 20 <i>Page 1 of 20</i> |
| Kunden-Referenz-Nr.: <i>Client Reference No.:</i> | N/A | Auftragsdatum: <i>Order date:</i> | 30-Mar-2018 | |
| Auftraggeber: <i>Client:</i> | Hon Hai Precision Industry Co., Ltd. No.151, Sec. 1, Nankan Rd., Lujhu Township, Taoyuan County, Taiwan | | | |
| Prüfgegenstand: <i>Test item:</i> | 802.11 a/b/g/n/ac module | | | |
| Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i> | WFU033 | | | |
| Auftrags-Inhalt: <i>Order content:</i> | DFS Test report | | | |
| Prüfgrundlage: <i>Test specification:</i> | FCC 47CFR Part 15: Subpart E Section 15.407 ISED RSS-247 Issue2 | | | |
| Wareneingangsdatum: <i>Date of receipt:</i> | 10-Apr-2018 | | | |
| Prüfmuster-Nr.: <i>Test sample No.:</i> | A000721430-001 | | | |
| Prüfzeitraum: <i>Testing period:</i> | 25-Apr-2018 | | | |
| Ort der Prüfung: <i>Place of testing:</i> | EMC Laboratory Taipei | | | |
| Prüflaboratorium: <i>Testing laboratory:</i> | TUV Rheinland Taiwan Ltd. | | | |
| Prüfergebnis*: <i>Test result*:</i> | Pass | | | |
| Report Date / tested by: | kontrolliert von / reviewed by: | | | |
| 2018-05-02 Sam C.J. Kuo/Project Engineer |  | 2018-05-02 Arvin Ho/Vice General Manager |  | |
| Datum <i>Date</i> | Name / Stellung <i>Name / Position</i> | Unterschrift <i>Signature</i> | Datum <i>Date</i> | Name / Stellung <i>Name / Position</i> |
| Sonstiges / Other: | | | | |
| Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i> | Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i> | | | |
| * Legende: | 1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n) | 2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n) | 3 = befriedigend N/A = nicht anwendbar | 4 = ausreichend N/T = nicht getestet |
| Legend: | 1 = very good P(ass) = passed a.m. test specification(s) | 2 = good F(ail) = failed a.m. test specification(s) | 3 = satisfactory N/A = not applicable | 4 = sufficient N/T = not tested |
| Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i> | | | | |

TEST SUMMARY

6.2.1 CHANNEL CLOSING TRANSMISSION AND CHANNEL MOVE TIME

RESULT: Passed

6.2.2 NON-OCCUPANCY PERIOD

RESULT: Passed

Contents

| | | |
|------------|---|-----------|
| 1. | GENERAL REMARKS | 4 |
| 1.1 | COMPLEMENTARY MATERIALS..... | 4 |
| 2. | TEST SITES | 5 |
| 2.1 | TEST FACILITIES | 5 |
| 2.2 | LIST OF TEST AND MEASUREMENT INSTRUMENTS..... | 6 |
| 2.3 | TRACEABILITY | 7 |
| 2.4 | CALIBRATION | 7 |
| 2.5 | MEASUREMENT UNCERTAINTY | 7 |
| 3. | GENERAL PRODUCT INFORMATION..... | 8 |
| 3.1 | PRODUCT FUNCTION AND INTENDED USE | 8 |
| 3.2 | SYSTEM DETAILS AND RATINGS..... | 8 |
| 4. | TEST SET-UP AND OPERATION MODES..... | 9 |
| 4.1 | PRINCIPLE OF CONFIGURATION SELECTION | 9 |
| 4.2 | TEST OPERATION AND TEST SOFTWARE..... | 9 |
| 4.3 | SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT | 10 |
| 4.4 | TEST SETUP DIAGRAM | 10 |
| 4.5 | TEST ENVIRONMENT | 10 |
| 5. | UNII DFS RULE REQUIREMENT | 11 |
| 5.1 | WORKING MODES AND REQUIRED TEST ITEMS | 11 |
| 5.2 | TEST LIMITS AND RADAR SIGNAL PARAMETERS | 12 |
| 6. | TEST RESULTS | 14 |
| 6.1 | DFS DETECTION THRESHOLD LEVELS..... | 14 |
| 6.2 | DFS REQUIREMENT & TEST SUITES..... | 16 |
| 6.2.1 | <i>Channel Closing Transmission And Channel Move Time</i> | <i>16</i> |
| 6.2.2 | <i>Non-Occupancy Period.....</i> | <i>18</i> |
| 7. | PHOTOGRAPHS OF THE TEST SET-UP..... | 19 |
| 8. | LIST OF TABLES | 20 |
| 9. | LIST OF PHOTOGRAPHS..... | 20 |

1. General Remarks

1.1 Complementary Materials

The following attachments are integral parts of this test report:

Appendix P: Photo Documentation
(File Name: 50141307APPENDIXP)

Test Specifications

The following standards were applied (in bold: product standards, otherwise: basic standards).

Table 1: Applied Standard and Test Levels

| Radio |
|-----------------------------|
| FCC CFR47 Part 15 Subpart E |
| RSS-247 Issue 2 |
| FCC KDB 905462 D02 |
| FCC KDB 905462 D03 |

2. Test Sites

2.1 Test Facilities

TUV Rheinland Taiwan Ltd.
Taipei Office

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

FCC Registration No.: 340738
IC Canada Registration No.: 9465A-1
TAF Accredited NCC Test Lab. No.:0759
TAF ISO17025 Certification effective periods: 2016-Jul-1st to 2019-Jun-30th



Testing Laboratory
0759

2.2 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

| Kind of Equipment | Manufacturer | Type | S/N | Last Calibration | Next Calibration |
|----------------------------------|--------------|--------|------------|------------------|------------------|
| Spectrum Analyzer | Agilent | N9010A | MY53470241 | 2017/05/23 | 2018/05/22 |
| EXG-B RF Analog Signal Generator | Agilent | N5171B | MY53050377 | 2018/04/10 | 2020/04/10 |
| MXG-B RF Vector Signal Generator | Agilent | N5182B | MY53050524 | 2018/04/10 | 2020/04/10 |

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements are $\pm 3\text{dB}$.

Table 3: Emission Measurement Uncertainty

| Parameter | Uncertainty |
|---------------------|--------------------------------|
| Radio Frequency | $\pm 1 \times 10^{-7}$ |
| RF power, conducted | $\pm 1.5 \text{ dB}$ |
| Temperature | $\pm 2 \text{ }^\circ\text{C}$ |
| Humidity | $\pm 10 \%$ |

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a 802.11 a/b/g/n/ac module. It contains a WiFi compatible module enabling the user to communicate data through a Wireless interface.

For details refer to the User Guide, Data Sheet and Circuit Diagram.

The device is a Slave Device with DFS function.

For further details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Table 4: Technical Specification of EUT

| | |
|---------------------|--|
| Kind of Equipment | 802.11 a/b/g/n/ac module |
| Type Designation | WFU033 |
| Operating Frequency | 5150 ~ 5350MHz, 5470 ~ 5725MHz, 5725 ~ 5850MHz |
| Operation Voltage | 5V |
| Modulation | OFDM with BPSK, QPSK, QAM |
| Antenna gain | 2.5dBi for Ant1, 3.54dBi for Ant2 |
| Antenna Type | PCB Antenna |
| FCC ID | RX3-WFU033 |
| IC ID | 2878F-WFU033 |
| HVIN | WFU033 |

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

System testing will be performed with channel-loading using means appropriate to the data types that are used by the unlicensed device.

The following requirements apply:

Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater.

The EUT operates over the 5250-5350 MHz and 5470-5725MHz range as a Client Device that does not have radar detection capability.

The samples were used as follows:
Conducted: A000721430-001

The device under test is 802.11 WiFi compliant.

The rated output power of the Master unit is < 23dBm (EIRP 200mW). Therefore the required interference threshold level is -62 dBm. After correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is $-64 + 2.5 = -61.5$ dBm.

The calibrated conducted DFS Detection Threshold level is set to -61.5 dBm. The tested level is lower than the required level hence it provides margin to the limit.

4.3 Special Accessories and Auxiliary Equipment

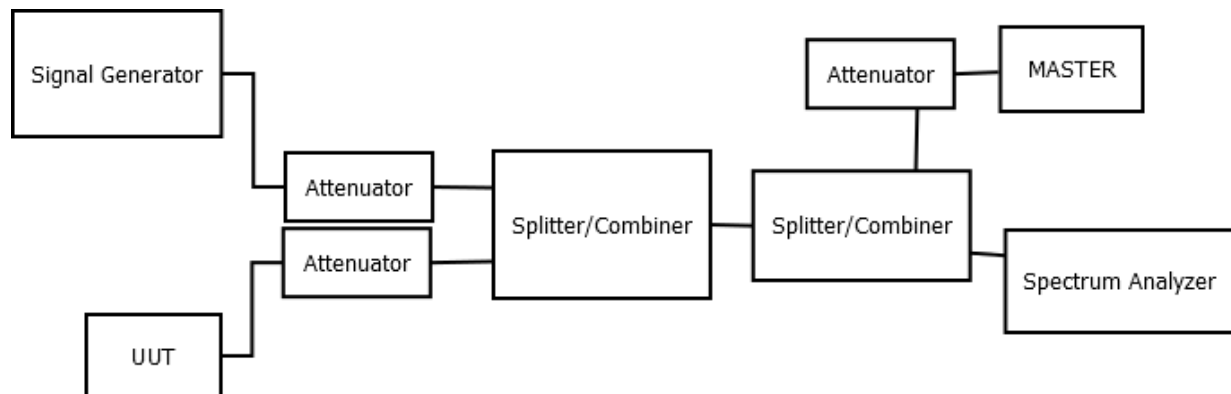
The product has been tested together with the following additional accessories:

| NO. | PRODUCT | BRAND | MODEL NO. |
|-----|--------------|---------|-----------|
| 1 | Access Point | NETGEAR | R7800 |

NOTE: This device was functioned as a Master Slave device during the DFS test.

4.4 Test Setup Diagram

Diagram of Measurement Equipment Configuration for Conducted DFS Measurement



4.5 Test Environment

| | |
|-------------|-----------|
| Temperature | 18 - 25°C |
| Humidity | 35 – 75% |

5. UNII DFS Rule Requirement

5.1 Working Modes And Required Test Items

The manufacturer shall state whether the UUT is capable of operating as a Master and/or a Client. If the UUT is capable of operating in more than one operating mode then each operating mode shall be tested separately. See tables 5 and 6 for the applicability of DFS requirements for each of the operational modes.

Table 5: Applicability of DFS requirements prior to use a channel

| Requirement | Operational Mode | | |
|---------------------------------|------------------|--------------------------------|-----------------------------|
| | Master | Client without radar detection | Client with radar detection |
| Non-Occupancy Period | ✓ | Not required | ✓ |
| DFS Detection Threshold | ✓ | Not required | ✓ |
| Channel Availability Check Time | ✓ | Not required | Not required |
| U-NII Detection Bandwidth | ✓ | Not required | ✓ |

Table 6: Applicability of DFS requirements during normal operation

| Requirement | Operational Mode | |
|-----------------------------------|---------------------------------------|--------------------------------|
| | Master or Client with radar detection | Client without radar detection |
| DFS Detection Threshold | ✓ | Not required |
| Channel Closing Transmission Time | ✓ | ✓ |
| Channel Move Time | ✓ | ✓ |
| U-NII Detection Bandwidth | ✓ | Not required |

| Additional requirements for devices with multiple bandwidth modes | 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 |
| All other tests | Any single BW mode | Not required |

Note: 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 all 20 MHz channel blocks and a null frequencies between the bonded 20 MHz channel blocks.

5.2 Test Limits And Radar Signal Parameters

Table 7: DFS detection thresholds for Master devices and Client devices with Radar detection

| Maximum Transmit Power | Value (See Notes 1, 2, and 3) |
|--|--|
| EIRP \geq 200 milliwatt | -64 dBm |
| EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz | -62 dBm |
| EIRP < 200 milliwatt 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.

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.

Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

Table 8: 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. 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.

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.

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.

6. Test Results

6.1 DFS Detection Threshold levels

Test standard : FCC Part 15.407(i), RSS-247 6.3
Kind of test site : Shielded room

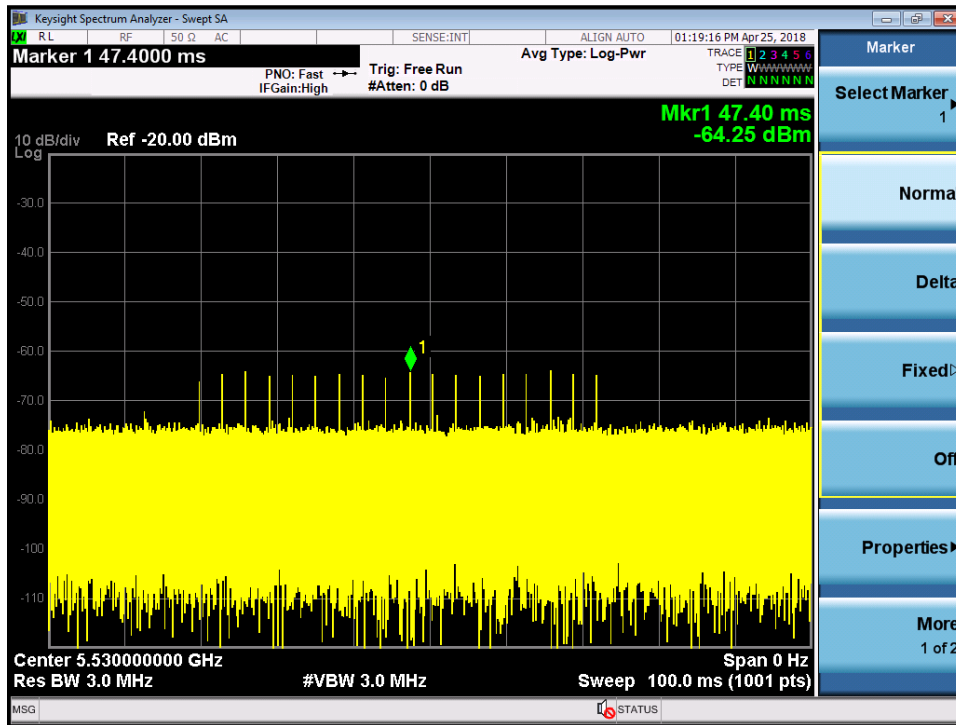
Test setup

Test Channel : 802.11 VHT80 5530MHz
Operation Mode : A

For a detection threshold level of -64dBm, the required signal strength at EUT antenna location is -64 dBm. The tested level is lower than required level hence it provides margin to the limit.

Test Plot of Radar Waveform calibration

Radar Type 0 DFS detection threshold level _ 5530MHz / 80MHz



6.2 DFS Requirement & Test Suites

6.2.1 Channel Closing Transmission And Channel Move Time

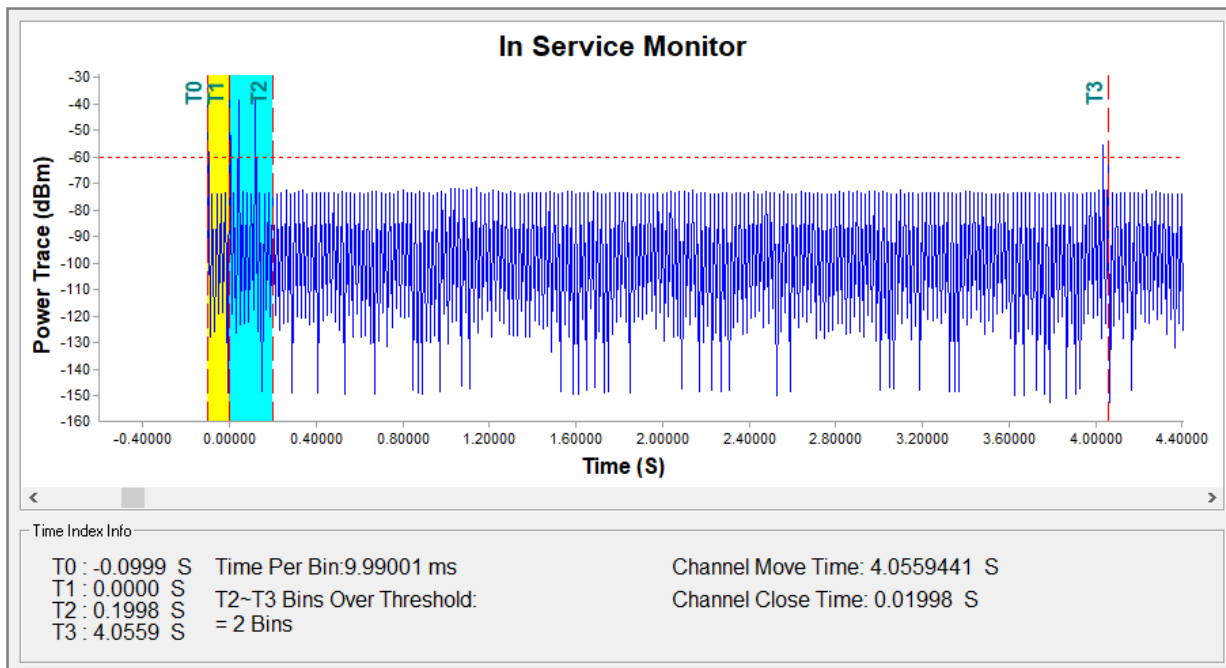
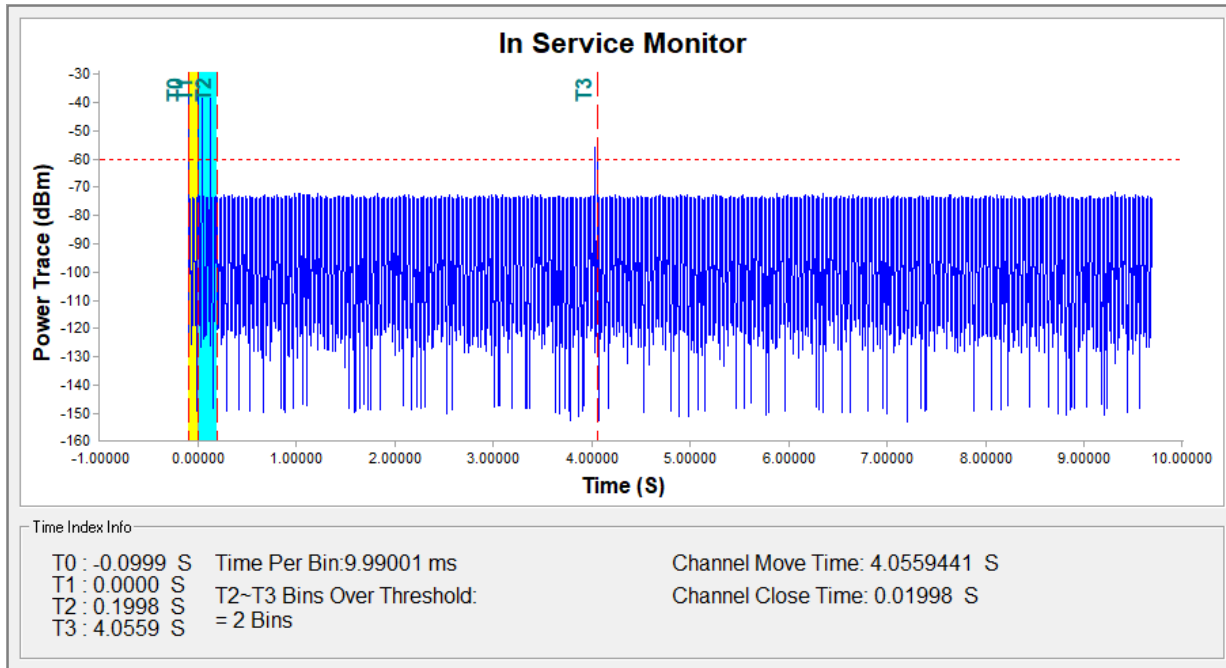
RESULT:**Passed**

Test standard : FCC Part 15.407(i), RSS-247 6.3, LP0002(4.7.7.2)
Kind of test site : Shielded room

Test setup

Test Channel : 802.11 VHT80 5530MHz
Operation Mode : Normal

NOTE: T1 denotes the start of Channel Move Time upon the end of the last Radar burst. T2 denotes the data transmission time of 200ms from T1. T3 denotes the end of Channel Move Time.

Test Plot of Channel closing transmission and channel move time
802.11ac VHT80 5530MHz


6.2.2 Non-Occupancy Period

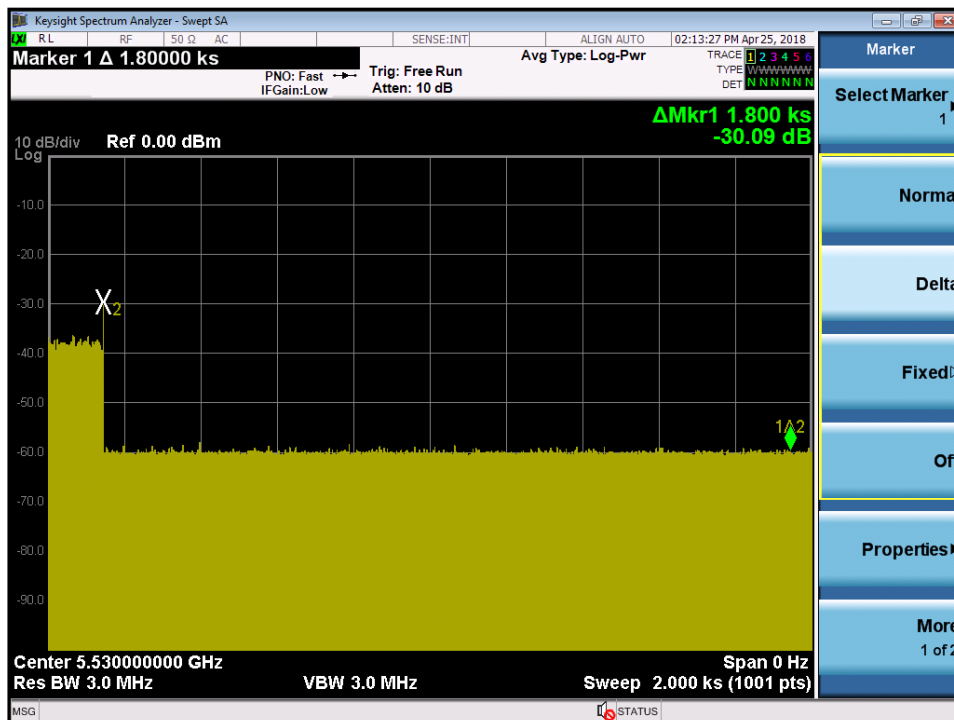
RESULT:
Passed

Test standard : FCC Part 15.407(i), RSS-247 6.3
 Kind of test site : Shielded room

Test setup

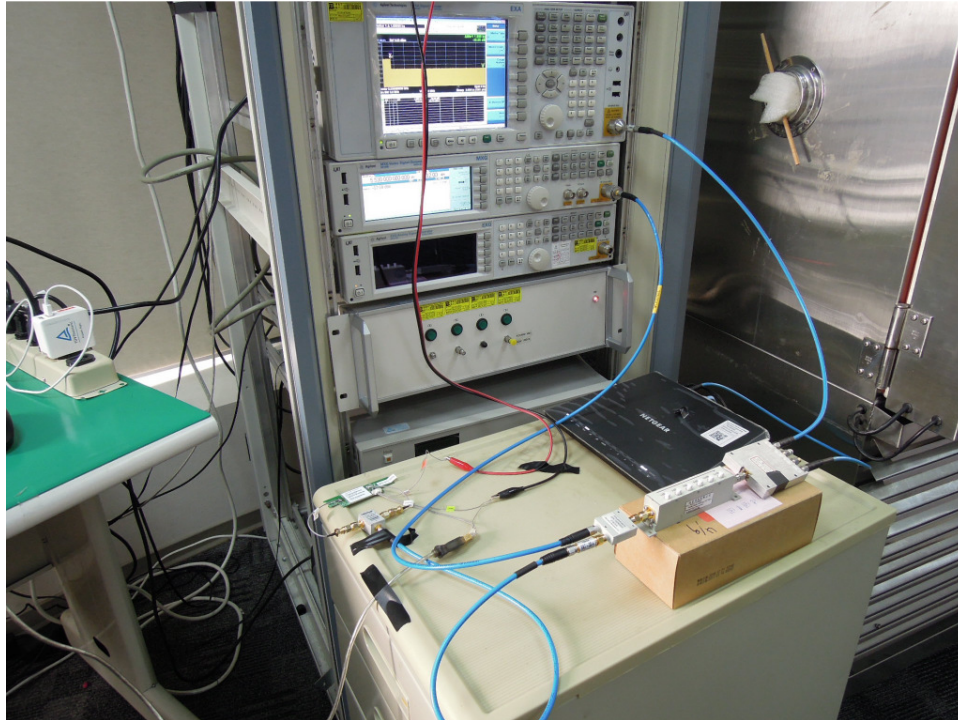
Test Channel : 802.11 VHT80 5530MHz
 Operation Mode : Normal

Test Plot of Non-Occupancy Period

802.11 VHT80


7. Photographs of the Test Set-Up

Photograph 1: Set-up for Conducted testing



8. List of Tables

| | |
|---|----|
| Table 1: Applied Standard and Test Levels | 4 |
| Table 2: List of Test and Measurement Equipment | 6 |
| Table 3: Emission Measurement Uncertainty..... | 7 |
| Table 4: Technical Specification of EUT | 8 |
| Table 5: Applicability of DFS requirements prior to use a channel | 11 |
| Table 6: Applicability of DFS requirements during normal operation | 11 |
| Table 7: DFS detection thresholds for Master devices and Client devices with Radar detection..... | 12 |
| Table 8: DFS response requirement values..... | 13 |

9. List of Photographs

| | |
|--|----|
| Photograph 1: Set-up for Conducted testing | 19 |
|--|----|