




TEST REPORT

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| Eurofins KCTL Co.,Ltd. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-70-5008-1021 FAX: 82-505-299-8311 www.kctl.co.kr | Report No.: KR23-SRF0133 Page (1) of (16) |  KCTL |
|---|---|---|

1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2023-03-23

2. Use of Report : Certification

3. Name of Product / Model : Smart wearable / SM-R945U (FCC), SM-R945F (ISED)

4. Manufacturer / Country of Origin : Samsung Electronics Co., Ltd. / Vietnam

5. FCC ID : A3LSMR945 (SM-R945U, SM-R945F)

6. IC Certificate No. : 649E-SMR945 (SM-R945F)

7. Date of Test : 2023-03-28 to 2023-05-17

8. Location of Test : Permanent Testing Lab On Site Testing
 (Address:65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)

9. Test method used : FCC Part 15 Subpart E, 15.407

RSS-247 Issue 2 February 2017

RSS-Gen Issue 5 February 2021

10. Test Result : Refer to the test result in the test report

| | | |
|-------------|-------------------------------|------------------------------|
| Affirmation | Tested by | Technical Manager |
| | Name : Kwonse Kim (Signature) | Name : Harim Lee (Signature) |

2023-05-19

Eurofins KCTL Co.,Ltd.

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REPORT REVISION HISTORY

| Date | Revision | Page No |
|------------|-------------------|---------|
| 2023-05-19 | Originally issued | - |
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General remarks for test reports

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:

Procedure number, issue date and title:

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

Statement not required by the standard or client used for type testing

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1. General information

Client : Samsung Electronics Co., Ltd.
 Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Manufacturer : Samsung Electronics Co., Ltd.
 Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Factory 1 : AG TECH CO.,LTD
 Address : Lot G3, Que Vo Industrial Park(Expanded Area), Nam son Ward, Bac Ninh Province, Vietnam

Factory 2 : ALMUS VINA
 Address : Lot CN07A, Phu Ha Industrial Park, Ha Thach Commune, Phu Tho Town, Phu Tho Province, Vietnam

Laboratory : Eurofins KCTL Co.,Ltd.
 Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea

Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132
 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056
 CAB Identifier: KR0040
 ISED Number: 8035A
 KOLAS No.: KT231

2. Device information

Equipment under test : Smart wearable
 Model : SM-R945U(FCC), SM-R945F(ISED)
 Derivative model : SM-R945F(FCC)
 Modulation technique : OFDM [WIFI(802.11a/n)]

Number of channels
 UNII-1 : 4 ch (20 MHz)
 UNII-2A : 4 ch (20 MHz)
 UNII-2C : 12 ch (20 MHz)
 UNII-3 : 5 ch (20 MHz)

Power source : DC 3.88 V
 Antenna specification : LDS Antenna
 Antenna gain
 UNII-1 : -3.00 dBi
 UNII-2A : -3.60 dBi
 UNII-2C : -5.30 dBi
 UNII-3 : -6.30 dBi

Frequency range
 UNII-1 : 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20)
 UNII-2A : 5 260 MHz ~ 5 320 MHz (802.11a/n_HT20)
 UNII-2C : 5 500 MHz ~ 5 720 MHz (802.11a/n_HT20)
 UNII-3 : 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20)

Software version : SM-R945U_R945U.001, SM-R945F_R945F.001
 Hardware version : REV1.0
 Test device serial No. : Conducted : R3AW400RM2B
 Operation temperature : -20 °C ~ 50 °C

Note.

1. Due to marketing purpose, the model SM-R945F will be filed for ISED approval and the test reports remain valid for Model SM-R945F ISED submission.
2. The product equality letter includes detailed information about the differences between SM-R945U and SM-R945F model.

2.1. Accessory information

| Equipment | Manufacturer | Model | Serial No. | Power source | FCC ID & IC |
|------------------|-------------------------------|----------|------------|--------------|--|
| Wireless charger | Samsung Electronics Co., Ltd. | EP-OR900 | - | 5.0 V, 2.0 A | FCC ID : A3LEPOR900 IC : 649E-EPOR900 |

2.2. Frequency/channel operations

This device contains the following capabilities:

WLAN (11a/b/g/n), Bluetooth (BDR/EDR/BLE), LTE B2/4/5/7/12/13/25/26/66/71,
WCDMA 850/1700/1900

| UNII-2A | | UNII-2C | |
|---------|-----------------|---------|-----------------|
| Ch. | Frequency (MHz) | Ch. | Frequency (MHz) |
| 52 | 5 260 | 100 | 5 500 |
| 56 | 5 280 | 120 | 5 600 |
| 64 | 5 320 | 140 | 5 700 |
| | | 144 | 5 720 |

Table 2.2-1. 802.11a/n_HT20 mode

Notes:

1. The device supports DFS bands between UNII-2A and UNII-2C and operates as a slave device controlled by master.

3. Summary of tests

| FCC Part section(s) | IC Rule Reference | Parameter | Test results |
|---------------------|-------------------------|---|--------------|
| 15.407(h) | RSS-247 Issue 2, 6.3 | DFS -Channel closing transmission time -Channel move time -Non occupied period | Pass |

Notes:

1. The test procedure(s) in this report were performed in accordance as following.
 - ◆ KDB 905462 D02 UNII DFS compliance procedure new rules.
 - ◆ KDB 905462 D03 UNII client without radar detection new rules.
2. The device does not support radar detection feature.



4 Test results

4.1. DFS (Dynamic Frequency Selection)

Test description

- 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 |

- 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 | <u>Yes</u> |
| Channel Move Time | Yes | <u>Yes</u> |
| 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 | <u>Test using the widest BW mode available for the link</u> |
| 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 each of the bonded 20 MHz channels and the channel center frequency.

- Requirements of client devices

- a) A Client Device will not transmit before having received appropriate control signals from a Master Device.
- b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.
- c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.
- d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.
- e) The client test frequency must be monitored to ensure no transmission of any type has occurred for 30 minutes. Note: If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy

- 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. |
| <p>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.</p> <p>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.</p> | |

- Interference Threshold values, Master or Client incorporating In-Service Monitoring

| Maximum Transmit Power | Value (see note) |
|--|------------------|
| ≥ 200 milliwatt | -64 dBm |
| < 200 milliwatt 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.

- Radar test waveforms

| Type | Pulse Width (μ sec) | PRI (μ sec) | Number of Pulses | Minimum Percentage of Successful Detection | Minimum Number of Trials |
|-----------------------------|--------------------------|---|--|--|--------------------------|
| <u>0</u> | <u>1</u> | <u>1428</u> | <u>18</u> | <u>See Note 1</u> | <u>See Note 1</u> |
| 1 | 1 | Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a | $\text{Roundup}\left\{\left(\frac{1}{360}\right) \cdot \left(\frac{19 \cdot 10^6}{PRI_{\mu\text{sec}}}\right)\right\}$ | 60% | 30 |
| | | Test B: 15 unique PRI values randomly selected within the range of 518-3066 μ sec, with a minimum increment of 1 μ sec, 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.

Note 2: This report was applied Short Pulse Radar Type 0.

*Short Pulse Radar Test Waveforms

| Radar Type | Pulse Width (μ s) | Chirp Width (MHz) | PRI (μ s) | 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 |

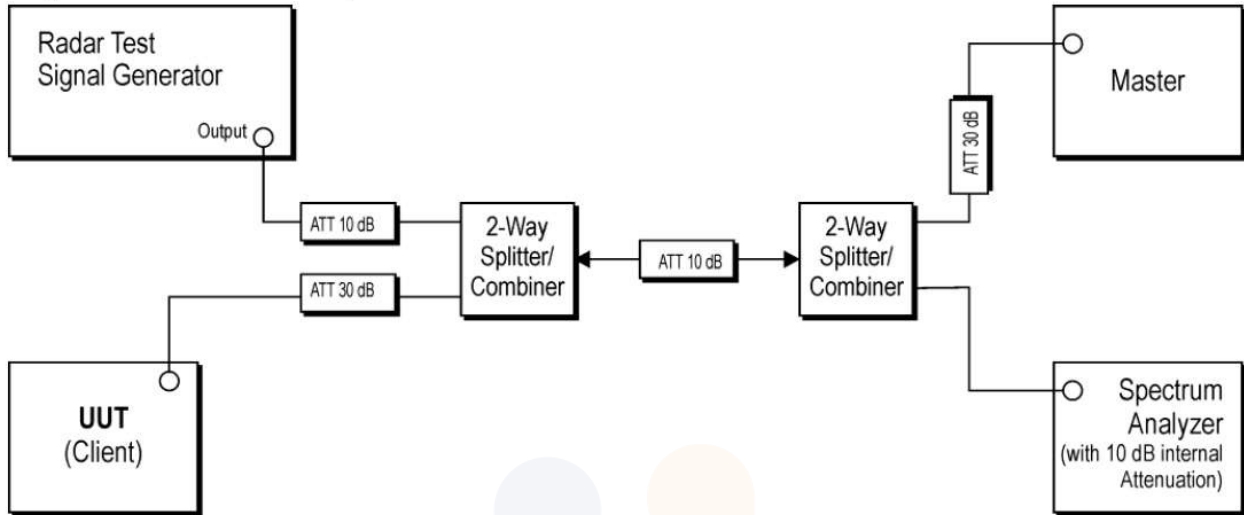
*Long Pulse Radar Test Waveform

| Radar Waveform | Pulse Width (μ sec) | PRI (μ sec) | Pulses per Hop | Hopping Rate (kHz) | Hopping Sequence Length (μ s) | Minimum Percentage of Successful Detection | Minimum Trials |
|----------------|--------------------------|------------------|----------------|--------------------|------------------------------------|--|----------------|
| 6 | 1 | 333 | 9 | 0.333 | 300 | 70% | 30 |

*Frequency Hopping Radar Test Waveform

Test setup

- Setup for Client with injection at the Master



- Spectrum analyzer setting parameter

This setting parameter is shown below and it according to the 905462 D02 UNII DFS Compliance Procedures New Rules.

- 1) RBW/VBW ≥ 3 MHz
- 2) Detector = peak
- 3) Span = zero span

- Conducted test procedure

- 1) One frequency will be chosen from the Operating Channels of the UUT within the 5 250-5 350 MHz or 5 470-5 725 MHz bands.
- 2) The Client Device (EUT) is set up the above diagram and communications between the Master device and the Client is established.
- 3) 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.
- 4) 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.
- 5) Observe the transmissions of the UUT at the end of the Burst on the Operating Channel for duration greater than 12 seconds for Radar Type 0 to ensure detection occurs.
- 6) After the initial radar burst the channel is monitored for 30 minutes to ensure no transmissions or beacons occur. A second monitoring setup is used to verify that the Master and Client have both moved to different channels.

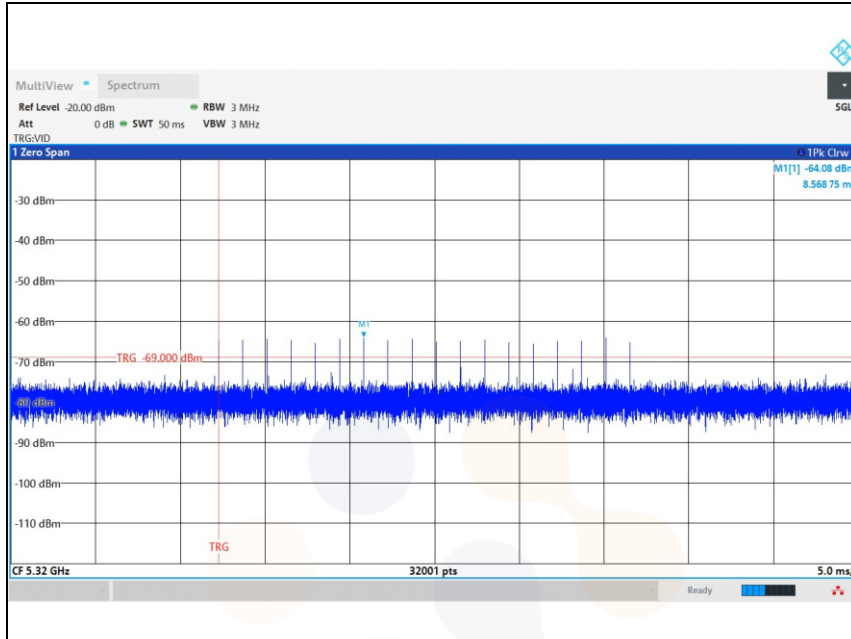
- Master device information

| Equipment Name | Manufacturer | Model No. | Serial No. | FCC ID |
|----------------|----------------------|-----------|--------------|--------------|
| Access Point | ASUSTeK Computer Inc | RT-AX88U | J9IAHP000993 | MSQ-RTAXHP00 |

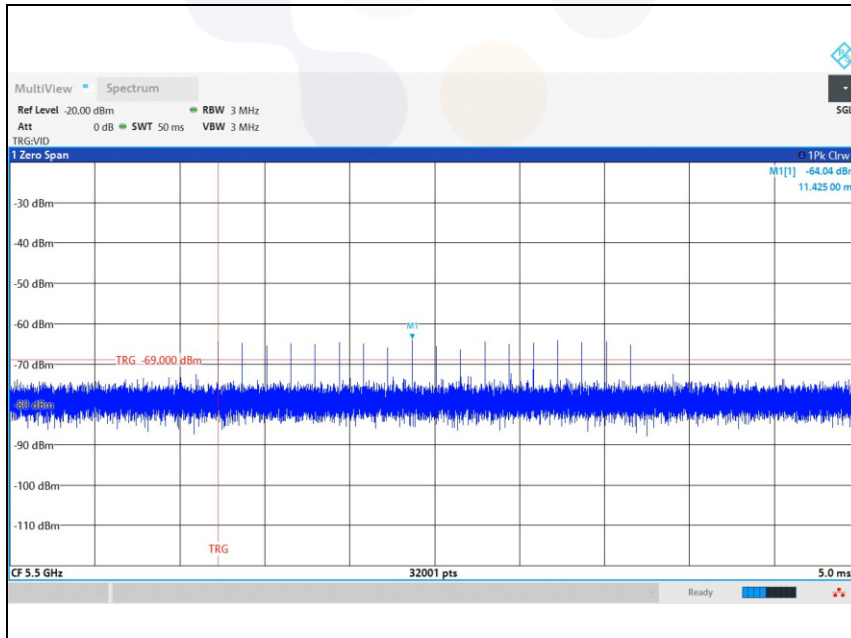
Test result

Plot of radar waveform

5 320 MHz

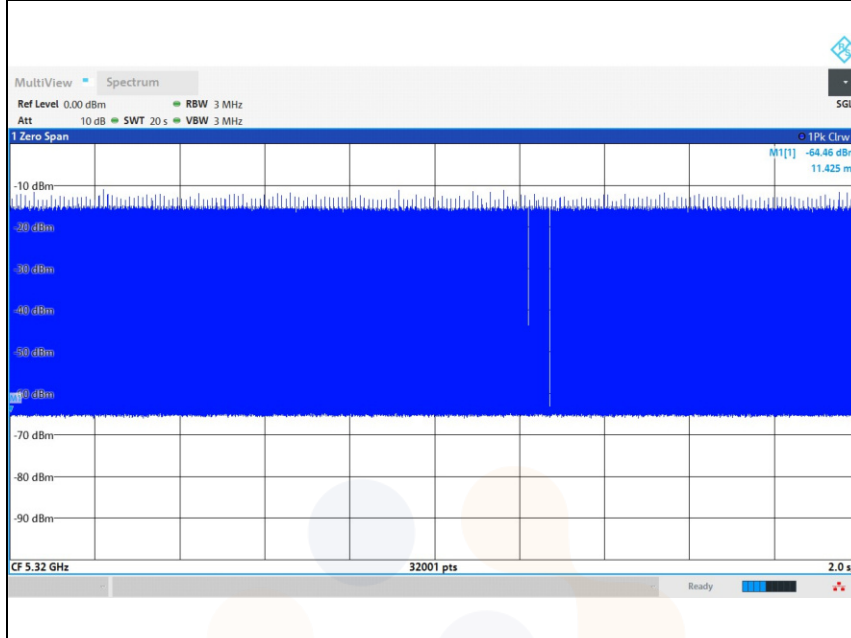


5 500 MHz

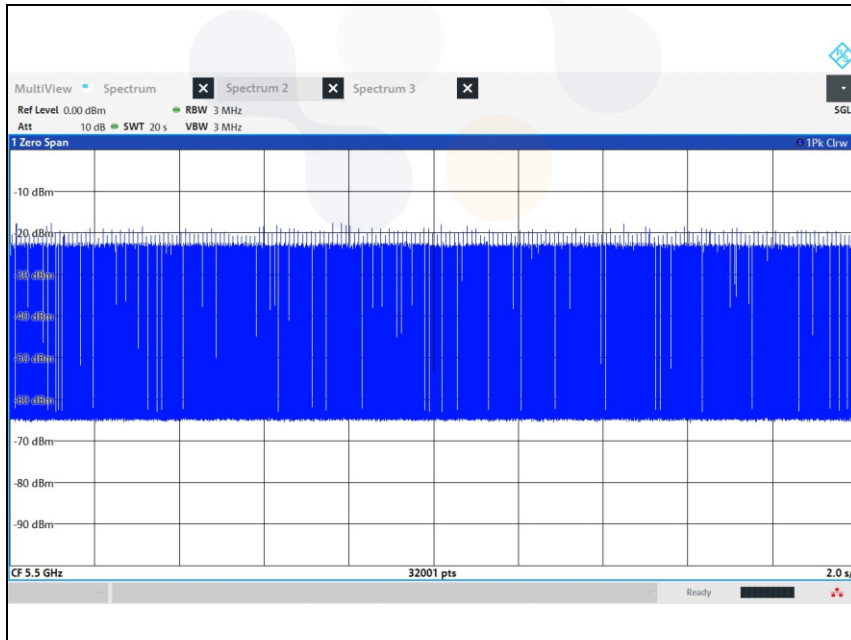


Plot of LAN traffic

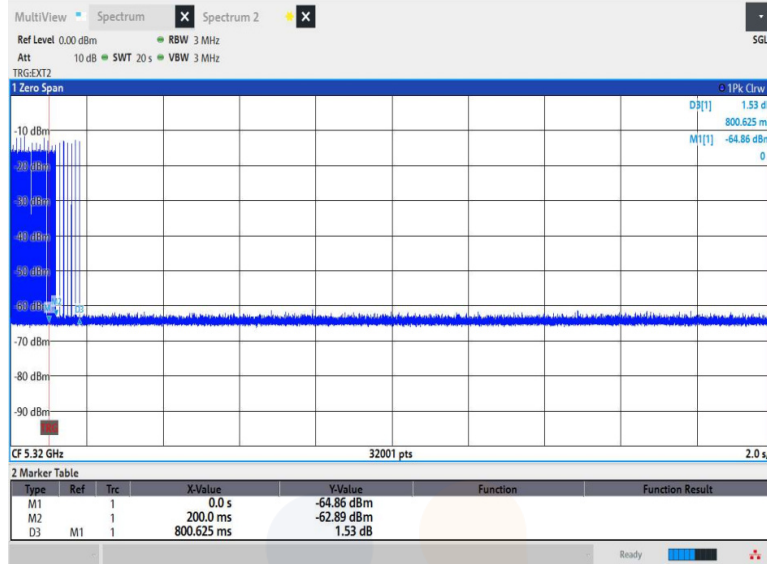
5 320 MHz



5 500 MHz

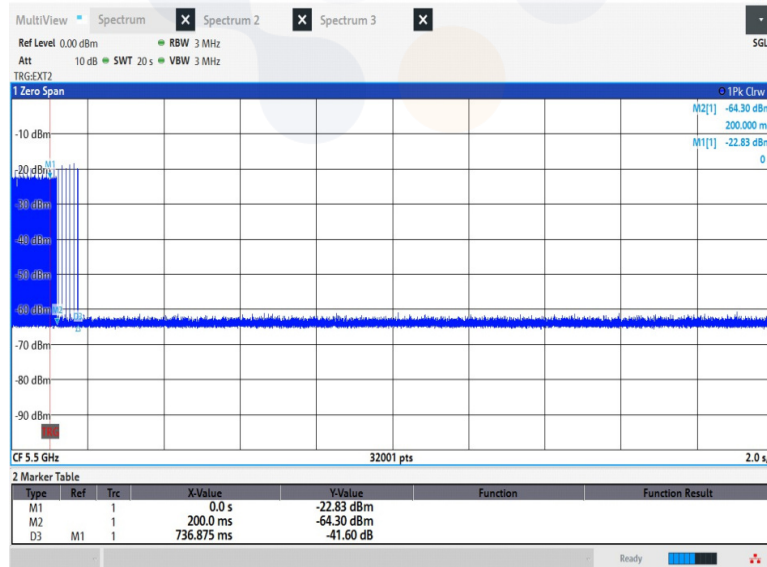


Plot of channel move time and aggregate time



Channel move time = 0.800 625 s
 Closing time = 0.000 625 s x 7 = 0.004 375 s
 (Closing time : Burst unit time(20 s / 32 001 points) * Number of burst(between 2 markers))

UNII-2A: 802.11a, 5 320 MHz

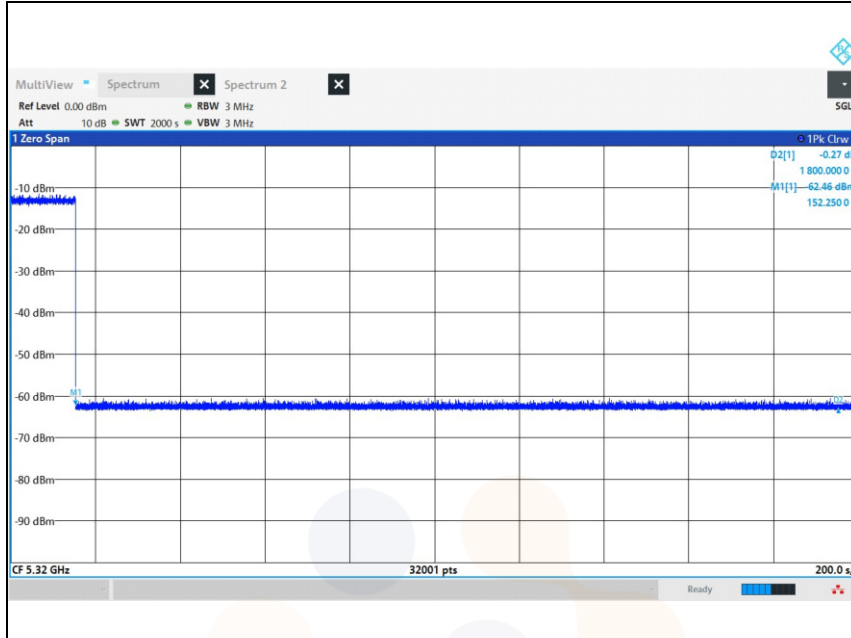


Channel move time = 0.736 875 s
 Closing time = 0.000 625 s x 8 = 0.005 000 s
 (Closing time : Burst unit time(20 s / 32 001 points) * Number of burst(between 2 markers))

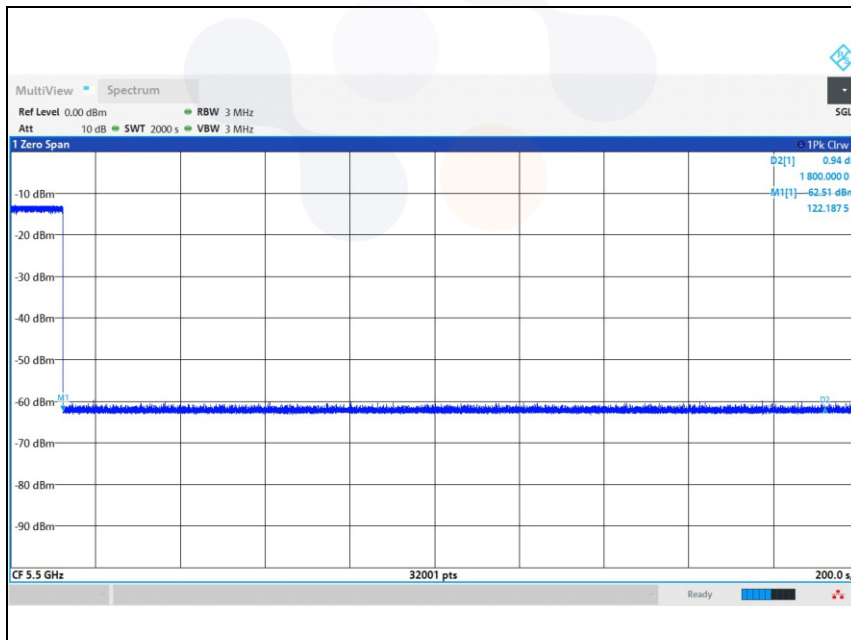
UNII-2C: 802.11a, 5 500 MHz

Plot of Non-occupancy period

5 320 MHz



5 500 MHz



5. Measurement equipment

| Equipment Name | Manufacturer | Model No. | Serial No. | Next Cal. Date |
|-------------------------|---------------|---------------------|--------------|----------------|
| Spectrum Analyzer | R&S | FSV3044 | 101427 | 24.03.28* |
| Attenuator | HUBER+SUHNER | 6610_SK-50-1/199_NE | ATT10 | 24.04.10* |
| DC Power Supply | AGILENT | E3632A | MY40000265 | 24.04.27* |
| Vector Signal Generator | R&S | SMBV100A | 1407.6004K02 | 23.07.11 |
| Step Attenuator | HP | 8496A | 3308A16640 | 23.07.11 |
| SPLITTER | Mini-Circuits | ZX10-2-98-S+ | 1635-1 | 24.01.19 |
| SPLITTER | Mini-Circuits | ZX10-2-98-S+ | 1635-2 | 24.01.19 |

* Tests related to this equipment were progressed after the calibration was completed.

End of test report

