



TEST REPORT

| | | | | |
|---|---------------------|--|----------------------|--|
| KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr | | Report No.: KR21-SRF0059 Page (1) of (17) | | |
| 1. Client <ul style="list-style-type: none"> ◦ Name : Samsung Electronics Co., Ltd. ◦ Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea ◦ Date of Receipt : 2021-03-31 | | | | |
| 2. Use of Report : Certification | | | | |
| 3. Name of Product / Model : Mobile Phone / SM-A225M/DSN | | | | |
| 4. Manufacturer / Country of Origin : Samsung Electronics Co., Ltd. / Vietnam | | | | |
| 5. FCC ID : A3LSMA225M | | | | |
| 6. Date of Test : 2021-04-08 to 2021-04-26 | | | | |
| 7. Location of Test <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Permanent Testing Lab <input type="checkbox"/> On Site Testing (Address:65,Sinwon-roYeongtong-gu,Suwon-si,Gyeonggi-do,16677, Korea) | | | | |
| 8. Test method used : FCC Part 15 Subpart E, 15.407 | | | | |
| 9. Test Results : Refer to the test result in the test report | | | | |
| Affirmation | Tested by | | Technical Manager | |
| | Name : Taeyoung Kim | | Name : Seungyong Kim | |
| 2021-05-07 | | | | |
| <h2>KCTL Inc.</h2> | | | | |
| As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc. | | | | |

REPORT REVISION HISTORY

| Date | Revision | Page No |
|------------|-------------------|---------|
| 2021-05-07 | Originally issued | - |
| | | |
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General remarks for test reports

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

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 : SAMSUNG ELECTRONICS VIETNAM CO.,LTD.
Address : Yenphong 1 -I.P YenTrung Commune, Yenphong Dist., Bac Ninh Province,
Vietnam
Laboratory : KCTL Inc.
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 : Mobile Phone
Model : SM-A225M/DSN
Derivative model : SM-A225M/N
Modulation technique : Bluetooth(BDR/EDR)_GFSK, $\pi/4$ DQPSK, 8DPSK
Bluetooth(BLE)_GFSK
WIFI(802.11a/b/g/n/ac)_DSSS, OFDM
LTE_QPSK, 16QAM, 64QAM
WCDMA_QPSK
GSM_GMSK, 8-PSK
NFC_ASK
Number of channels : Bluetooth(BDR/EDR)_79 ch / Bluetooth(BLE)_40 ch
802.11b/g/n_HT20 : 13 ch
UNII-1: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
UNII-2A: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
UNII-2C: 12 ch (20 MHz), 6 ch (40 MHz), 3 ch (80 MHz)
UNII-3: 5 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
NFC: 1 ch
Power source : DC 3.86 V
Antenna specification : LTE/WCDMA/GSM_FPCB Antenna
WIFI/Bluetooth(BDR/EDR/BLE)_FPCB Antenna
NFC_FPCB Antenna

Antenna gain : WIFI/Bluetooth(BDR/EDR/BLE)_-2.10 dBi
UNII-1 : -2.80 dBi
UNII-2A : -3.60 dBi
UNII-2C : -2.70 dBi
UNII-3 : -2.70 dBi

Frequency range : Bluetooth(BDR/EDR/BLE)_2 402 MHz ~ 2 480 MHz
2 412 MHz ~ 2 472 MHz (802.11b/g/n_HT20)
UNII-1: 5 180 MHz ~ 5 240 MHz (802.11a/n/ac_HT20/VHT20)
UNII-1: 5 190 MHz ~ 5 230 MHz (802.11n/ac_HT40/VHT40)
UNII-1: 5 210 MHz (802.11ac_VHT80)
UNII-2A: 5 260 MHz ~ 5 320 MHz (802.11a/n/ac_HT20/VHT20)
UNII-2A: 5 270 MHz ~ 5 310 MHz (802.11n/ac_HT40/VHT40)
UNII-2A: 5 290 MHz (802.11ac_VHT80)
UNII-2C: 5 500 MHz ~ 5 720 MHz (802.11a/n/ac_HT20/VHT20)
UNII-2C: 5 510 MHz ~ 5 710 MHz (802.11n/ac_HT40/VHT40)
UNII-2C: 5 530 MHz ~ 5 690 MHz (802.11ac_VHT80)
UNII-3: 5 745 MHz ~ 5 825 MHz (802.11a/n/ac_HT20/VHT20)
UNII-3: 5 755 MHz ~ 5 795 MHz (802.11n/ac_HT40/VHT40)
UNII-3: 5 775 MHz (802.11ac_VHT80)
LTE Band 2_1 850.7 MHz ~ 1 909.3 MHz
LTE Band 4_1 710.7 MHz ~ 1 754.3 MHz
LTE Band 5_824.7 MHz ~ 848.3 MHz
LTE Band 12_699.7 MHz ~ 715.3 MHz
LTE Band 17_706.5 MHz ~ 713.5 MHz
LTE Band 26_824.7 MHz ~ 848.3 MHz, 814.7 MHz ~ 823.3 MHz
LTE Band 41_2 498.5 MHz ~ 2 687.5 MHz
LTE Band 66_1 710.7 MHz ~ 1 779.3 MHz
GSM 850_824.2 MHz ~ 848.8 MHz
GSM 1900_1 850.2 MHz ~ 1 909.8 MHz
WCDMA 850_826.4 MHz ~ 846.6 MHz
WCDMA 1700_1 712.4 MHz ~ 1 752.6 MHz
WCDMA 1900_1 852.4 MHz ~ 1 907.6 MHz
NFC_13.56 MHz

Software version : A225M.001
Hardware version : REV1.0
Test device serial No. : Conducted(R38R302HD6T, R38T302HC2B)
Radiated(42003705cefec775, R38R302HDEF)

Operation temperature : -30 °C ~ 50 °C

Note. The Product equality letter includes detailed information about the differences between basic and derivative model.

2.1. Frequency/channel operations

This device contains the following capabilities:

WiFi (802.11a/b/g/n/ac), Bluetooth (BDR/EDR/BLE), NFC

LTE Band 2, LTE Band 4, LTE Band 5, LTE Band 12, LTE Band 17, LTE Band 26, LTE Band 41,
LTE Band 66, GSM 850, GSM 1900, WCDMA 850, WCDMA 1700, WCDMA 1900

UNII-2A

| Ch. | Frequency (MHz) |
|-----|--------------------|
| 52 | 5 260 |
| 56 | 5 280 |
| 64 | 5 320 |

UNII-2C

| Ch. | Frequency (MHz) |
|-----|--------------------|
| 100 | 5 500 |
| 120 | 5 600 |
| 140 | 5 700 |
| 144 | 5 720 |

Table 2.1-1. 802.11a/n/ac_HT20/VHT20 mode

UNII-2A

| Ch. | Frequency (MHz) |
|-----|--------------------|
| 54 | 5 270 |
| 62 | 5 310 |

UNII-2C

| Ch. | Frequency (MHz) |
|-----|--------------------|
| 102 | 5 510 |
| 118 | 5 590 |
| 134 | 5 670 |
| 142 | 5 710 |

Table 2.1-2. 802.11n/ac_HT40/VHT40 mode

UNII-2A

| Ch. | Frequency (MHz) |
|-----|--------------------|
| 58 | 5 290 |

UNII-2C

| Ch. | Frequency (MHz) |
|-----|--------------------|
| 106 | 5 530 |
| 122 | 5 610 |
| 138 | 5 690 |

Table 2.1-3 802.11ac_VHT80 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) | Parameter | Test results |
|---------------------|---|--------------|
| 15.407(h) | 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.

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- 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. |

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.

- 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 (μsec) | PRI (μsec) | 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 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 |

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

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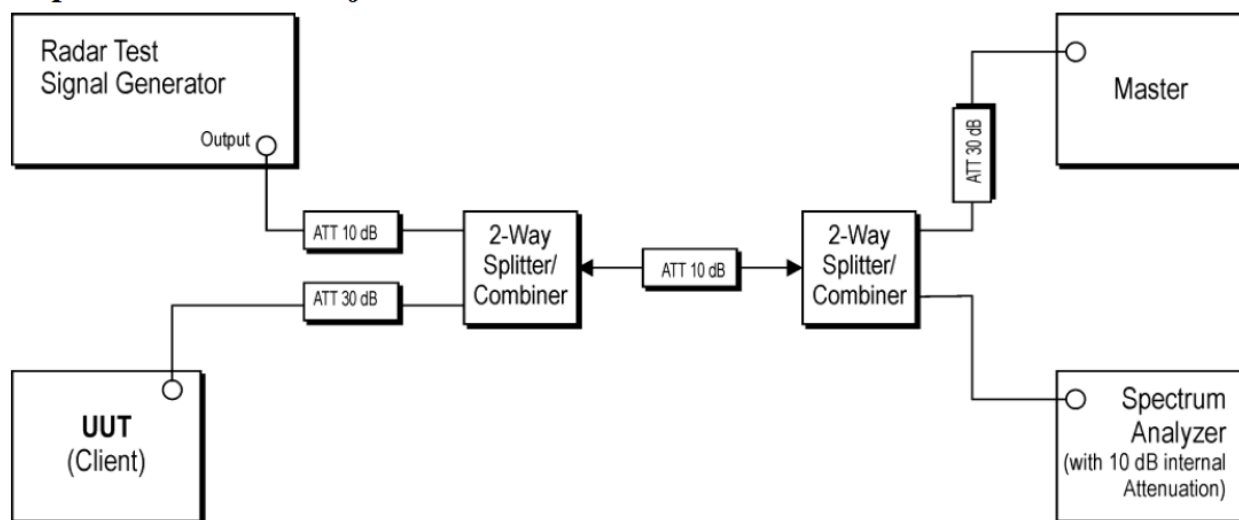


| Radar Type | Pulse Width (μs) | Chirp Width (MHz) | PRI (μs) | Number of Pulses per Burst | Number of Bursts | Minimum percentage of Successful Detection | Minimum Number of Trials |
|------------|------------------|-------------------|-----------|----------------------------|------------------|--|--------------------------|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

*Long Pulse Radar Test Waveform

| Radar Waveform | Pulse Width (μsec) | PRI (μsec) | Pulses per Hop | Hopping Rate (kHz) | Hopping Sequence Length (μs) | 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 |

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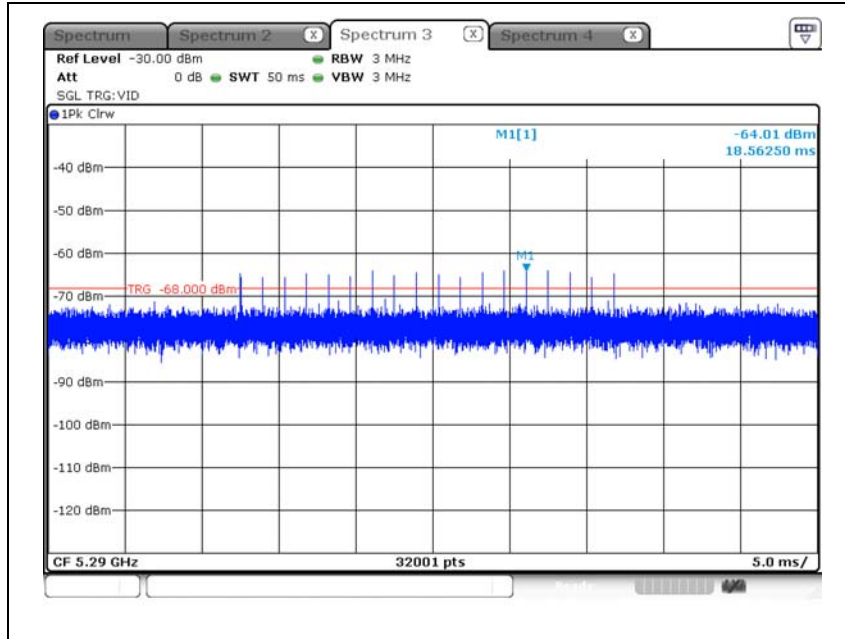
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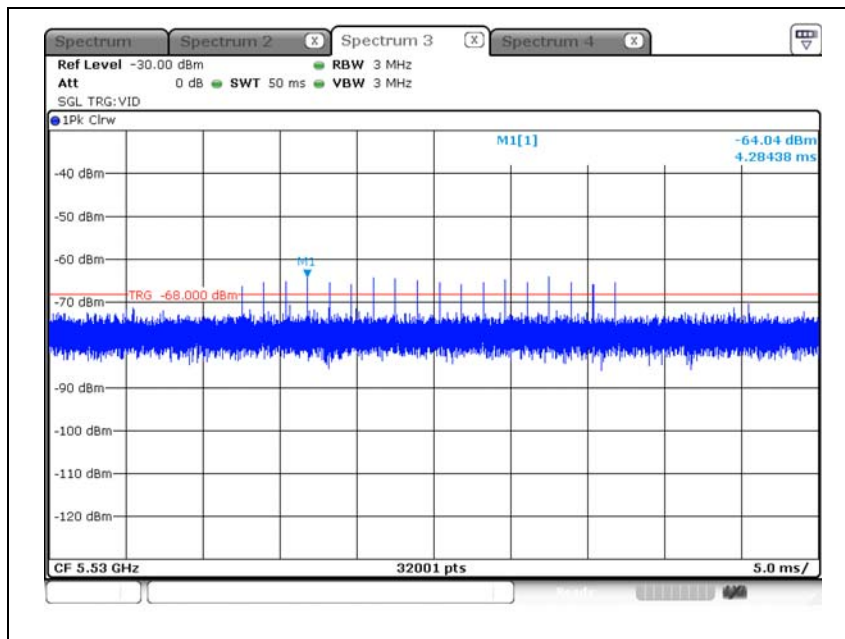
Test result

Plot of radar waveform

5 290 MHz

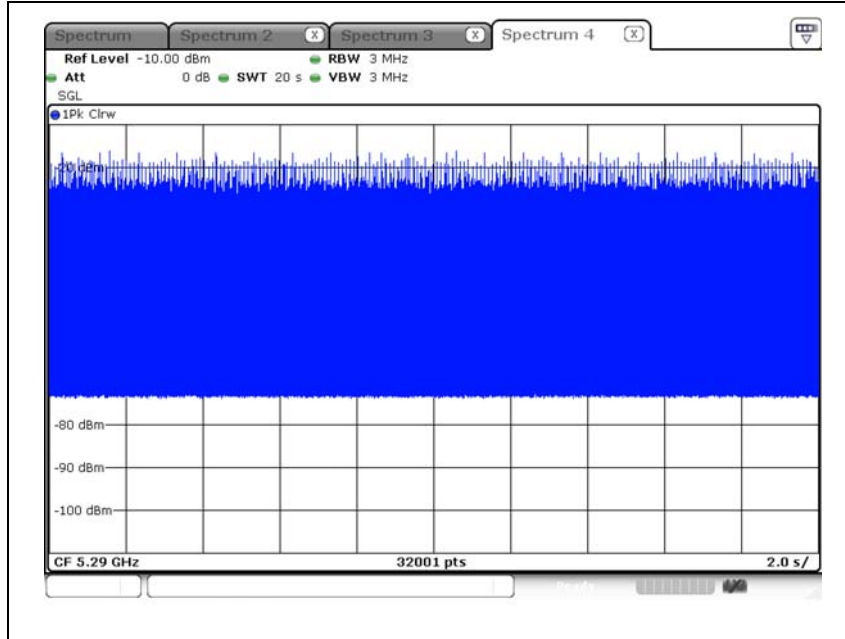


5 530 MHz

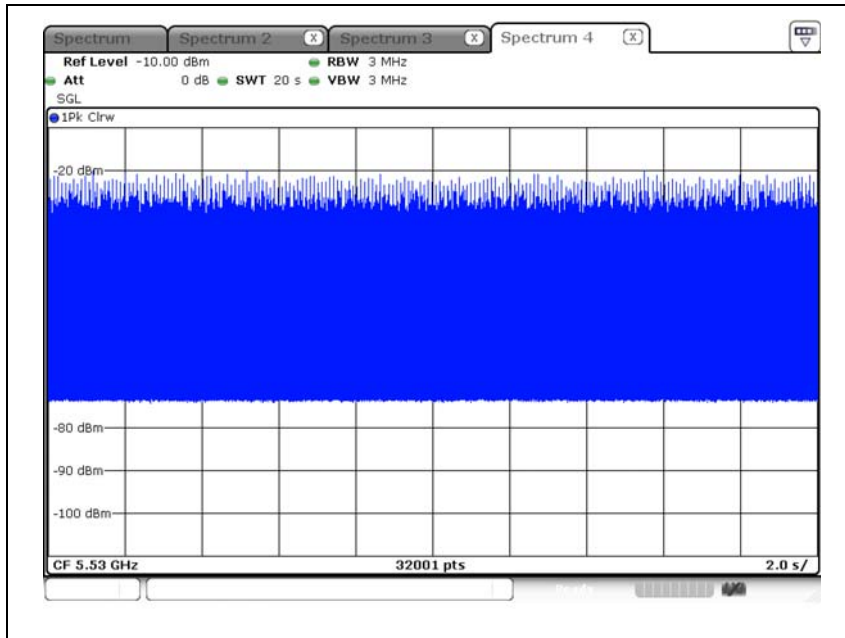


Plot of LAN traffic

5 290 MHz



5 530 MHz



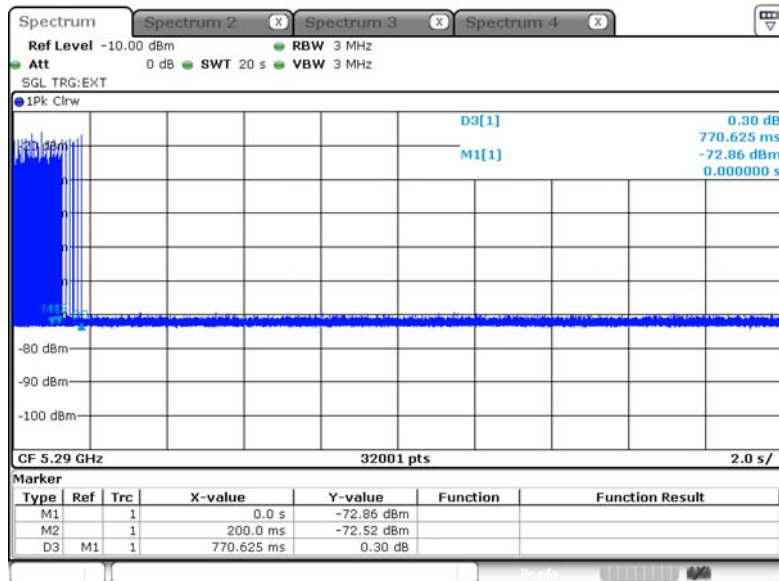
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Plot of channel move time and aggregate time

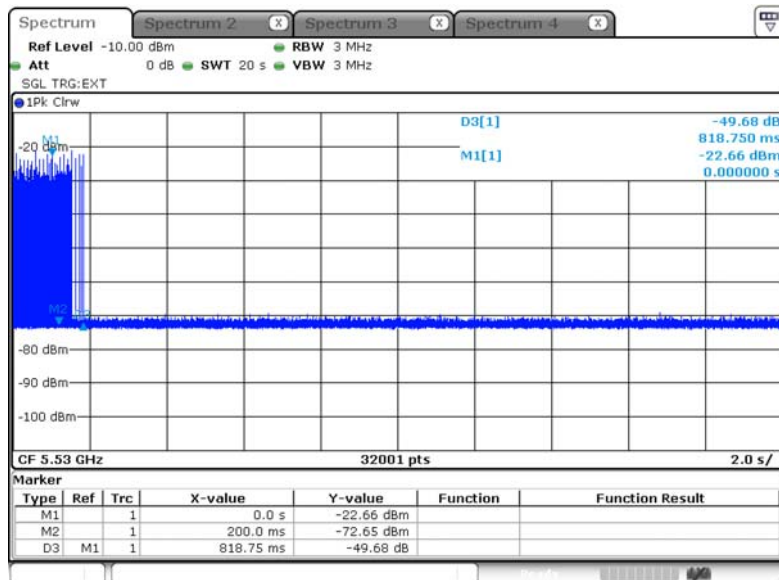


Channel move time = 0.770 625 s

Closing time = 0.000 625 s x 56 = 0.035 000 s

(Closing time : Burst unit time(20 s / 32 001 points) * Number of burst(between 2 markers))

UNII-2A: 802.11ac VHT80, 5 290 MHz



Channel move time = 0.818 750 s

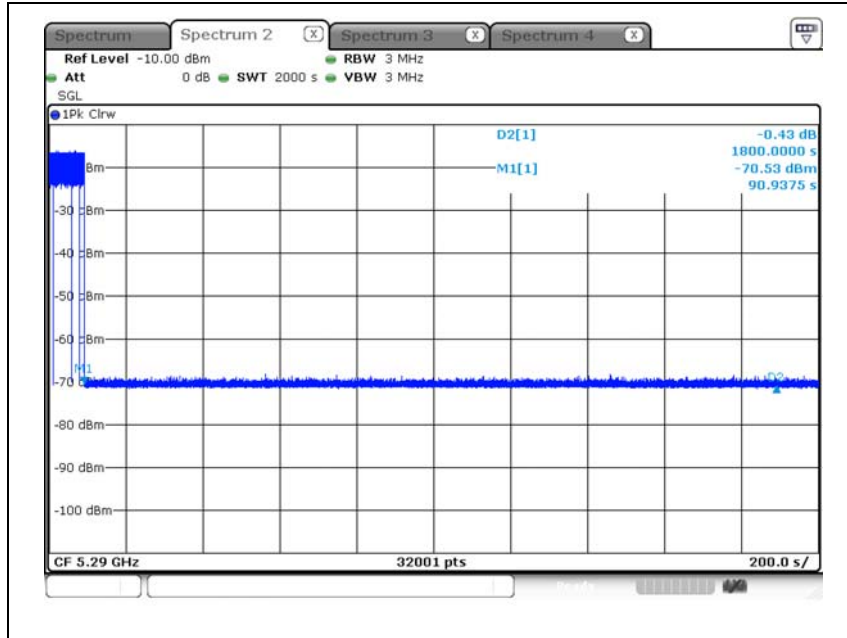
Closing time = 0.000 625 s x 83 = 0.051 875 s

(Closing time : Burst unit time(20 s / 32 001 points) * Number of burst(between 2 markers))

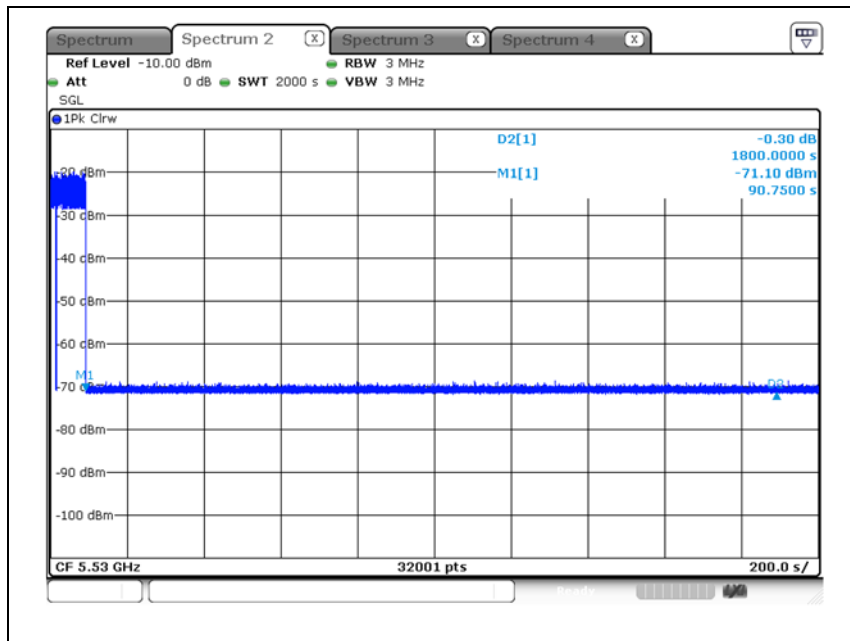
UNII-2C: 802.11ac VHT80, 5 530 MHz

Plot of Non-occupancy period

5 290 MHz



5 530 MHz



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**5. Measurement equipment**

| Equipment Name | Manufacturer | Model No. | Serial No. | Next Cal. Date |
|-------------------------|---------------|----------------|------------|----------------|
| Spectrum Analyzer | R&S | FSV30 | 100807 | 21.07.29 |
| SPLITTER | Mini-Circuits | ZX10-2-1252-S+ | 1633-1 | 22.01.20 |
| SPLITTER | Mini-Circuits | ZX10-2-1252-S+ | 1633-2 | 22.01.20 |
| Attenuator | API Inmet | 40AH2W-10 | 10 | 21.07.29 |
| Attenuator | API inmet | 40AH2W-10 | 16 | 21.05.12 |
| Step Attenuator | AGILENT | 8495D | MY42144296 | 22.02.17 |
| Step Attenuator | AGILENT | 8495D | MY42144300 | 22.01.21 |
| Signal Generator | R&S | SMB100A | 176206 | 22.01.20 |
| Vector Signal Generator | R&S | SMBV100A | 257566 | 21.07.13 |

End of test report