DFS TEST REPORT

Part 15 Subpart E 15.407 & RSS-247 (Issue 2)

Equipment under test	Flat Panel Digital X-ray Detector
Model name	EVS 4343W
Derivative Model	EVS 3643W, EVS 4343WP, EVS 3643WP
FCC ID	RNH-EVS4343W
IC ID	29808-EVS4343W
Applicant	DRTECH Corporation
Manufacturer	DRTECH Corporation
Date of test(s)	2022.09.01 ~ 2022.09.30
Date of issue	2023.03.08

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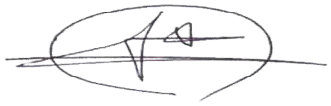	
Bong-Seok, Kim Test engineer	Yeong-Jun, Cho Technical manager

This test report is not related to KS Q ISO/IEC 17025 and KOLAS

Revision history

Revision	Date of issue	Test report No.	Description
-	2022.01.09	KES-RF-23T0011	Initial
R1	2023.03.08	KES-RF-23T0011-R1	Change applicant's address

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1. General information

Applicant:	DRTECH Corporation
Applicant address:	Suite No.2, 1Floor / Suite No.2, 3Floor, 29, Dunchon-daero 541 beon-gil, Jungwon-gu, Seongnam-si, Gyeonggi-do, 13216, Republic of Korea
Test site:	KES Co., Ltd.
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Test Facility	FCC Accreditation Designation No.: KR0100, Registration No.: 444148 ISED Registration No.: 23298
FCC,IC rule part(s):	FCC : 15.407 / IC : RSS-247
FCC ID:	RNH-EVS4343W
IC ID:	29808-EVS4343W
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	Flat Panel Digital X-ray Detector
Frequency range	2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20)
	2 422 ㎒ ~ 2 452 ㎒ (11n_HT40)
UNII-1	5 180 ㎒ ~ 5 240 ㎒ (11a/an_VHT20/ac_VHT20)
	5 190 ㎒ ~ 5 230 ㎒ (11an_VHT40/ac_VHT40)
	5 210 ㎒ (11ac_VHT80)
UNII-2A	5 260 ㎒ ~ 5 320 ㎒ (11a/an_VHT20/ac_VHT20)
	5 270 ㎒ ~ 5 310 ㎒ (11an_VHT40/ac_VHT40)
	5 290 ㎒ (11ac_VHT80)
UNII-2C	5 500 ㎒ ~ 5 700 ㎒ (11a/an_VHT20/ac_VHT20)
	5 510 ㎒ ~ 5 670 ㎒ (11an_VHT40/ac_VHT40)
	5 530 ㎒ ~ 5 610 ㎒ (11ac_VHT80)
UNII-3	5 745 ㎒ ~ 5 825 ㎒ (11a/an_VHT20/ac_VHT20)
	5 755 ㎒ ~ 5 795 ㎒ (11an_VHT40/ac_VHT40)
	5 775 ㎒ (11ac_VHT80)
Model	EVS 4343W
Modulation technique	OFDM

Number of channels	2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20) : 11ch
	2 422 ㎒ ~ 2 452 ㎒ (11n_HT40) : 7ch
UNII-1	5 180 ㎒ ~ 5 240 ㎒ (11a/an_VHT20/ac_VHT20) : 4ch
	5 190 ㎒ ~ 5 230 ㎒ (11an_VHT40/ac_VHT40) : 2ch
	5 210 ㎒ (11ac_VHT80) : 1ch
UNII-2A	5 260 ㎒ ~ 5 320 ㎒ (11a/an_VHT20/ac_VHT20) : 4ch
	5 270 ㎒ ~ 5 310 ㎒ (11an_VHT40/ac_VHT40) : 2ch
	5 290 ㎒ (11ac_VHT80) : 1ch
UNII-2C	5 500 ㎒ ~ 5 700 ㎒ (11a/an_VHT20/ac_VHT20) : 11ch
	5 510 ㎒ ~ 5 670 ㎒ (11an_VHT40/ac_VHT40) : 5ch
	5 530 ㎒ ~ 5 610 ㎒ (11ac_VHT80) : 2ch
UNII-3	5 745 ㎒ ~ 5 825 ㎒ (11a/an_VHT20/ac_VHT20) : 5ch
	5 755 ㎒ ~ 5 795 ㎒ (11an_VHT40/ac_VHT40): 2ch
	5 775 ㎒ (11ac_VHT80) : 1ch
Antenna specification	ANT1/2 : PCB Antenna
Antenna Gain(SISO)	2.4 ㎓ band : -5.6 ㏈i 5 ㎓ band : UNII-1 ,UNII-2A : 0.7 ㏈i / UNII-2C, UNII-3 : 0.5 ㏈i
Antenna Gain(MIMO)	2.4 ㎓ band : -2.6 ㏈i 5 ㎓ band : UNII-1 ,UNII-2A : 3.7 ㏈i / UNII-2C, UNII-3 : 3.5 ㏈i
Power source	DC 7 V (Battery)
H/W version	0.3
S/W version	2207292b

1.2. Test configuration

The **DRTECH Corporation // Flat Panel Digital X-ray Detector // EVS 4343 W //**

FCC ID: RNH-EVS4343W // IC ID:29808-EVS4343W was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.407
ISED RSS-247 Issue 2 and RSS-Gen Issue 5
KDB 905462 D02 v02
ANSI C63.10-2013

1.3. Information about derivative model

Model name	Remark
EVS3643W	There is no difference in circuitry between the basic model and the multi-model. Addition of variant models for marketing purposes only.
EVS 4343WP	
EVS 3643WP	

1.4. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Battery Charger	DRETECH Corporation	EVS-BCS	HH220401935	DC 8.4 V
AC Adpater	XP Power	AHM85PS12	V21290190	AC 120 V

1.5. Sample calculation

Where relevant, the following sample calculation is provided
For all conducted test items :

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Offset(㏈) = RF cable loss(㏈) + attenuator factor(㏈).
= 1.52 + 10 = 11.52 (㏈)

For Radiation test :
Field strength level (㏈㎶/m) = Measured level (㏈㎶) + Antenna factor (㏈) + Cable loss (㏈) – Amplifier gain (㏈)

1.6. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.38 ㏈ (SHIELD ROOM #6)
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1 ㎓	4.50 ㏈ (SAC #6)
	Above 1 ㎓	4.90 ㏈ (SAC #5)
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

1.7. Application for Testing

Application Name	Version
REALTEK 11n 8188EUS USB WLAN NIC Massproduction kit	0.28.119.2010

1.8. Frequency/channel operations

Ch.	Frequency (㎒)	Mode
1	2 412	802.11b/g/n_HT20
. .	. .	. .
6	2 437	802.11b/g/n_HT20
. .	. .	. .
11	2 462	802.11b/g/n_HT20

Ch.	Frequency (㎒)	Mode
3	2 422	802.11n_HT40
. .	. .	. .
6	2 437	802.11n_HT40
. .	. .	. .
9	2 452	802.11n_HT40

UNII-1

Ch.	Frequency (㎒)
36	5 180
44	5 220
48	5 240

UNII-2A

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

UNII-2C

Ch.	Frequency (㎒)
100	5 500
120	5 600
140	5 700

UNII-3

Ch.	Frequency (㎒)
149	5 745
157	5 785
165	5 825

802.11a/an_VHT20/ac_VHT20 mode

UNII-1

Ch.	Frequency (㎒)
38	5 190
46	5 230

UNII-2A

Ch.	Frequency (㎒)
54	5 270
62	5 310

UNII-2C

Ch.	Frequency (㎒)
102	5 510
118	5 590
134	5 670

UNII-3

Ch.	Frequency (㎒)
151	5 755
159	5 795

802.11an_VHT40/ac_VHT40 mode

UNII-1

Ch.	Frequency (㎒)
42	5 210

UNII-2A

Ch.	Frequency (㎒)
58	5 290

UNII-2C

Ch.	Frequency (㎒)
106	5 530
122	5 610

UNII-3

Ch.	Frequency (㎒)
155	5 775

802.11ac_VHT80 mode

2. Summary of tests

Section in FCC Part 15	Section in RSS-247 & Gen	Parameter	Test results
15.407 (h)(iii)(iv)	RSS-247 6.3	Channel Move Time	Pass
		Channel Closing Transmission Time	Pass
		Non-Occupancy Period	Pass

3. DFS (Dynamic Frequency Selection) test description

3.1. Applicability

The following table from KDB 905462 D02 v02 lists the applicable requirements for the DFS testing.
The device evaluated in this report is considered a client device without radar detection capability.

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 2.1. DFS Applicability

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	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required
Non-Occupancy Period	NA/Yes	Yes

Additional requirements for devices with multiple	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
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.		

Table 2.2. DFS Applicability During normal operation

3.2. Requirements

KDB 905462 D02 v02 the following are the requirements for 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 period test. For devices that shutdown (rather than moving channels), no beacons should appear

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 Note3.
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 (and 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 the used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

Table 2.3. DFS Response Requirement Values

3.3. DFS Detection Thresholds

The DFS detection thresholds are defined for Master devices and Client Devices with In-service monitoring. These detection Thresholds are listed in the following table.

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP ≥ 200 milliwatt	-64 dBm
EIRP< 200 milliwatt and Power spectral density < 10 dBm/㎒	-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 respons. **Note 3:** EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01	

Table 2.4. DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

3.4. Parameters of DFS Test Signals

As the EUT is a Client Device with no Radar Detection only Zero type radar pulse is required for the testing.
Radar Pulse type 0 was used in the evaluation of the Client device for the purpose of measuring the channel Move Time and the Channel Closing Transmission Time.

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Mnimum 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	Roundup: {(1/360)*(19*10^6 PRI μsec)}	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.					

Table 2.5. Short Pulse Radar Test Waveforms

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

Table 2.6. Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Pulses Per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	0.333	300	70%	30

Table 2.7. Frequency Hopping Radar Test Waveform

4. Test results
4.1. DFS (Dynamic Frequency Selection)

Test setup

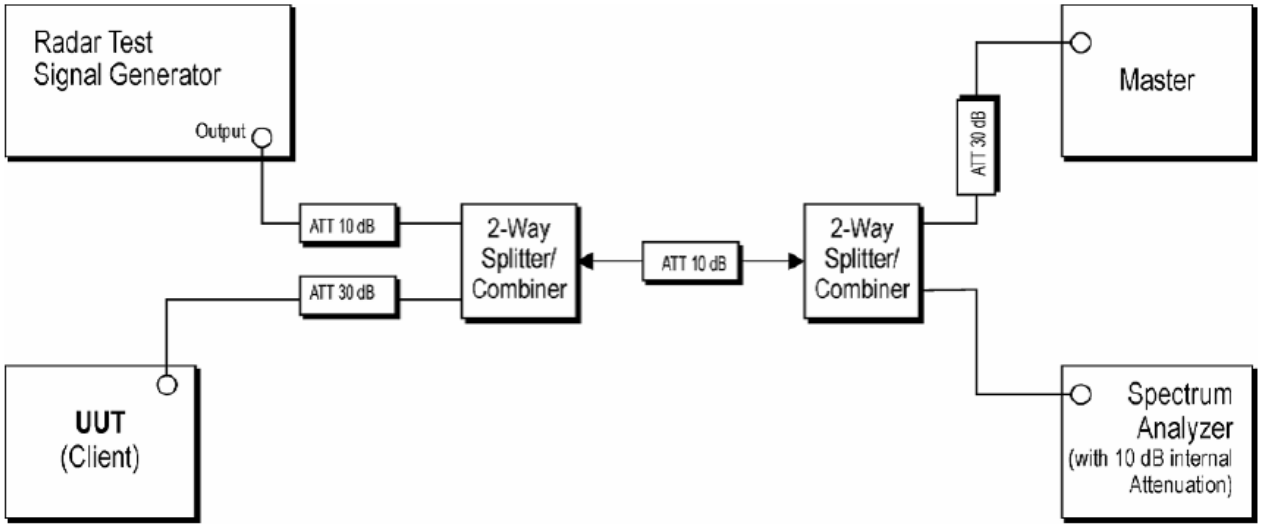


Figure 1: Conducted Test Setup for DFS

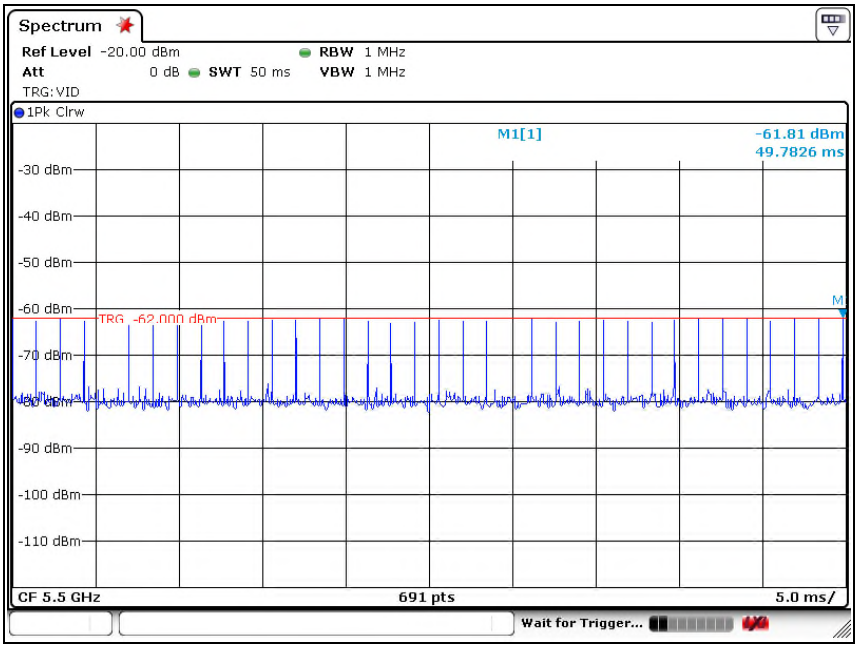
Test procedure
KDB 905462 D02 v02 describes a radiated test setup and a conducted test setup. The conducted test setup was used for this testing. Figure 1 shows the typical test setup.

1. One frequency will be chosen from the Operating Channels of the UUT within the 5250 ~5350 ㎒ or 5470 ~5725 ㎒ bands.
2. The Client Device (EUT) is setup per the diagram in Firure1 and communications between the Master device and the Client is established.
3. An MPEG or data file that is typical for the device is streamed from the Master to the Client to properly load the network.

4.1.1 Radar waveform

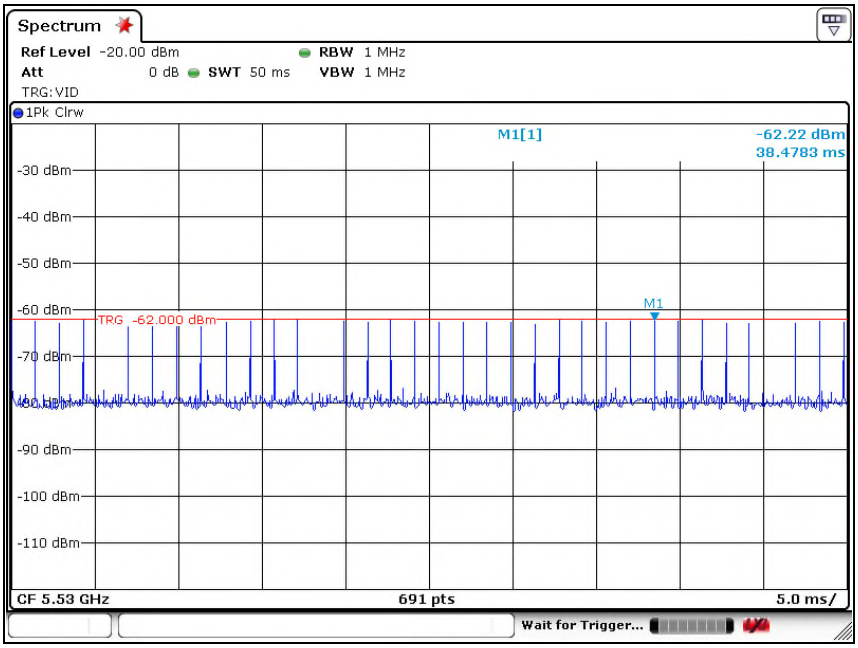
Mode: 802.11a (UNII-2C)

Operating frequency: 5 500 ㎒



Mode: 802.11ac_VHT80 (UNII-2C)

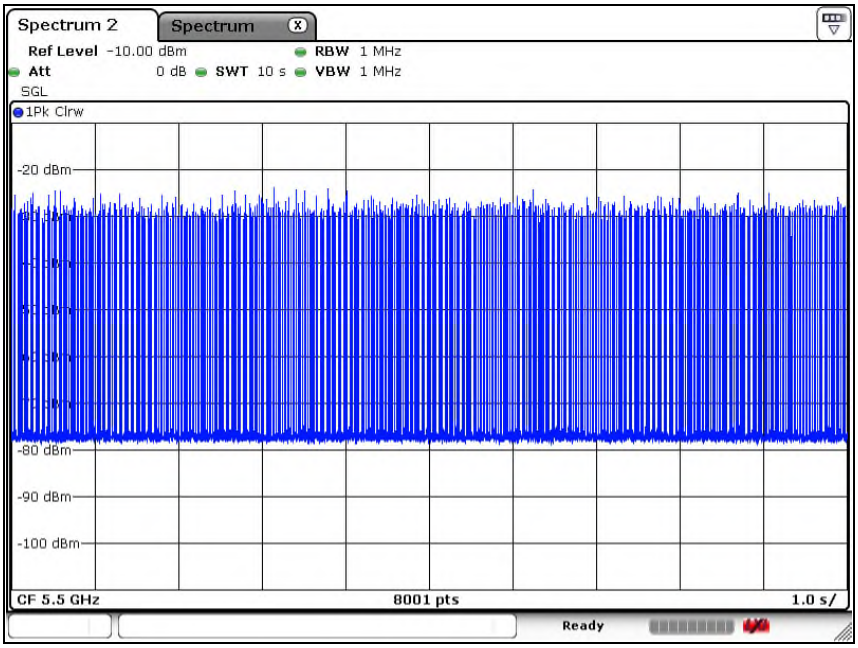
Operating frequency: 5 530 ㎒



4.1.2 LAN Traffic

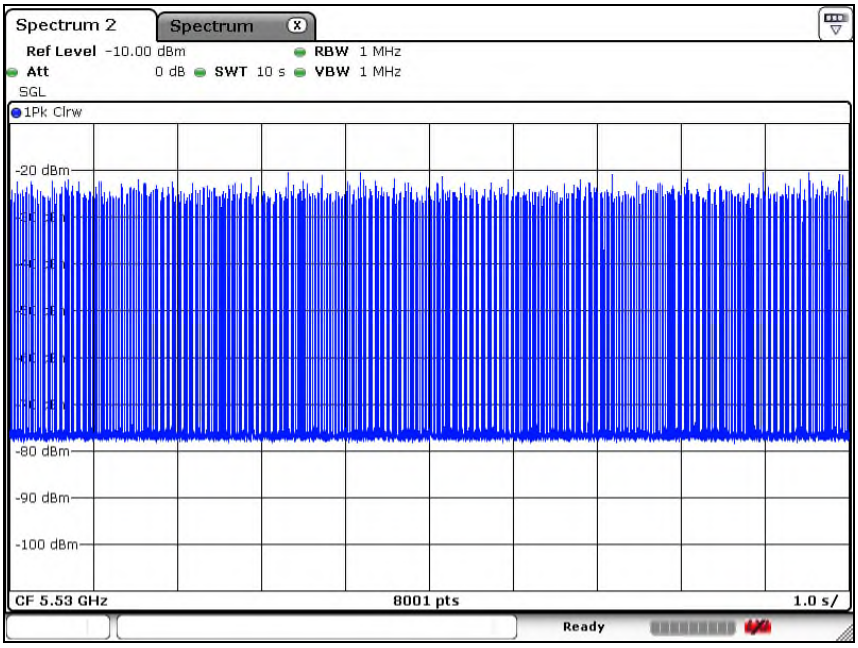
Mode: 802.11a (UNII-2C)

Operating frequency: 5 500 ㎒



Mode: 802.11ac_VHT80 (UNII-2C)

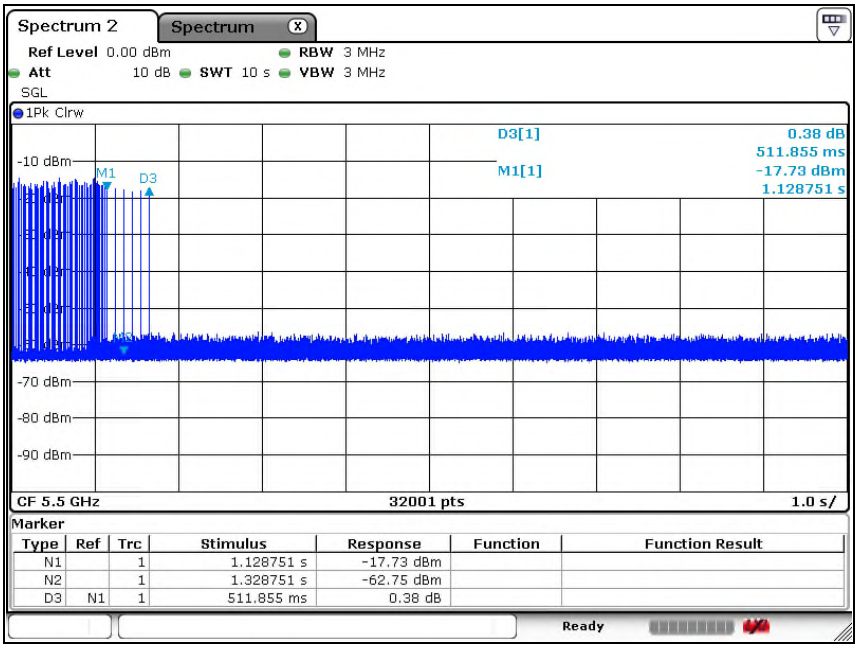
Operating frequency: 5 530 ㎒



4.1.3 Channel move time & aggregate channel closing transmission time

Mode: 802.11a (UNII-2C)

Operating frequency: 5 500 ㎒



Channel closing transmission time calculated	Test results
Sweep time[S] sec	10
Sampling bins[B]	32001
Number of sampling bins in 10 sec[N]	1
Closing transmission time [C] ms	0.312

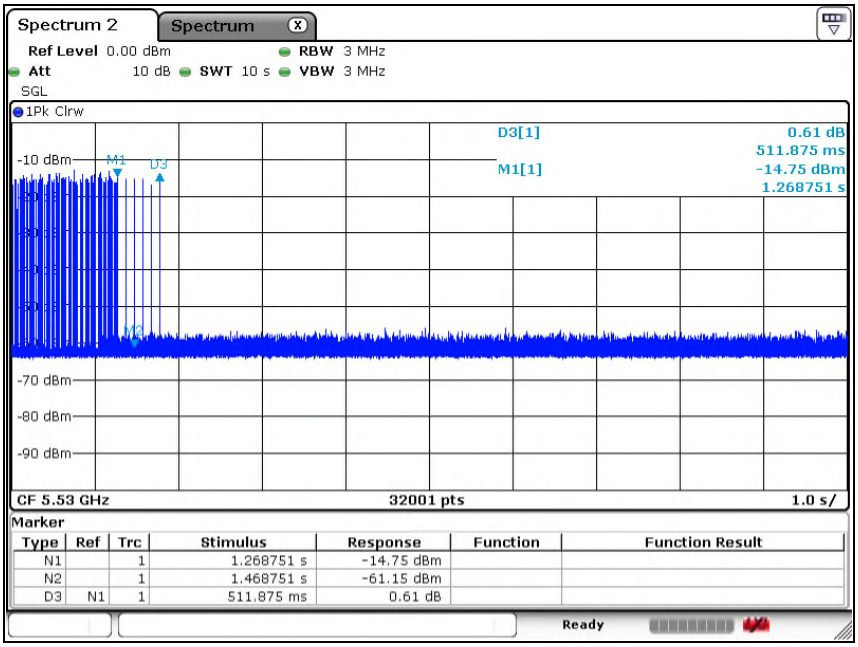
Channel move time (s)	Limit
0.512	≤ 10 s

Note:
Dwell = S/B;
Where **dwell** is the dwell time per spectrum analyzer sampling bin, **S** is the sweep time and **B** is the number of spectrum analyzer sampling bins.

An upper bound of the aggregate duration of the channel closing transmission time is calculated by:
C = N × Dwell;
Where **C** is the closing time, **N** is the number of spectrum analyzer sampling bins showing a U-NII transmission and dwell is the dwell time per bin.
Dwell = [S] / [B] = 10 / 32001 = 0.000312
Closing Transmission Time[C] = [N] × [Dwell] = 1 × 0.000312 = 0.000312 s = 0.312 ms

Mode: 802.11ac_VHT80 (UNII-2C)

Operating frequency: 5 530 ㎒



Channel closing transmission time calculated	Test results
Sweep time[S] sec	10
Sampling bins[B]	32001
Number of sampling bins in 10 sec[N]	1
Closing transmission time [C] ms	0.312

Channel move time (s)	Limit
0.512	≤ 10 s

Note:
Dwell = S/B;
Where **dwell** is the dwell time per spectrum analyzer sampling bin, **S** is the sweep time and **B** is the number of spectrum analyzer sampling bins.

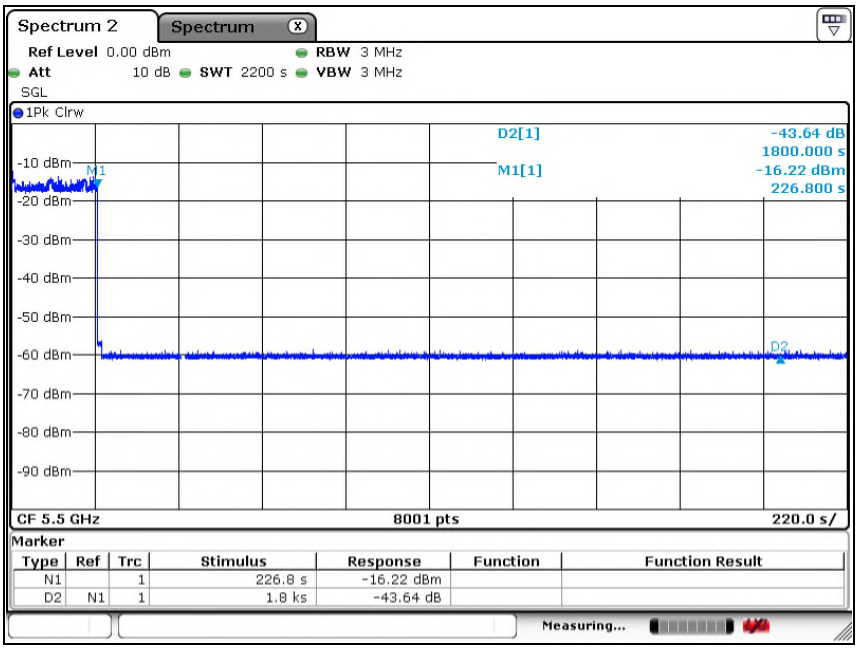
An upper bound of the aggregate duration of the channel closing transmission time is calculated by:
C = N × Dwell;
Where **C** is the closing time, **N** is the number of spectrum analyzer sampling bins showing a U-NII transmission and dwell is the dwell time per bin.

Dwell = [S] / [B] = 10 / 32001 = 0.000312
Closing Transmission Time[C] = [N] × [Dwell] = 1 × 0.000312 = 0.000312 s = 0.312 ms

4.1.4 Non-occupancy period

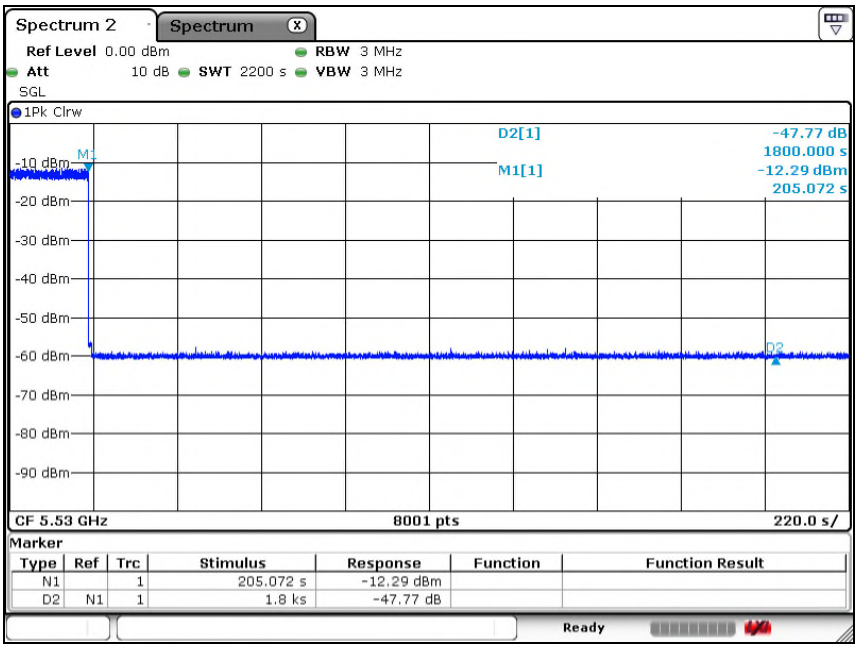
Mode: 802.11a (UNII-2C)

Operating frequency: 5 500 ㎒



Mode: 802.11ac_VHT80 (UNII-2C)

Operating frequency: 5 530 ㎒



Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum Analyzer	R&S	FSV3044	101272	1 year	2023.03.14
MXG Vector SIGNAL GENERATOR	AGILENT	N5182A	MY50143829	1 year	2023.01.14
Attenuator	HP	30dB ATTENUATOR	3318A05137	1 year	2023.01.14
Attenuator	SRT	F04-H930-01	17041002	1 year	2023.01.14
Attenuator	Mini-Circuits	BW-S10-2W263+	2	1 year	2023.01.17
Attenuator	Mini-Circuits	BW-S10-2W263+	3	1 year	2023.01.17
Splitter	MINI-CIRCUITS	ZFSC-2-10G+	FG63701930-1	1 year	2023.06.16
Splitter	MINI-CIRCUITS	ZFSC-2-10G+	FG63701930-2	1 year	2023.06.16

Peripheral devices

Device	Manufacturer	Model No.	Serial No.	Note.
Access Point (Master)	Cisco system Inc.	AIR-RM3000AC-A-K9	-	FCC ID: LDK102086
Notebook computer	LG Electronics Inc.,	LGS53	306QCZP560949	Notebook computer