FCC
RF Test Report

Product Name: Smart Phone

Model Number: MAR-LX2J

Report No.: SYBH(Z-RF)20190219010002-2006

FCC ID：QISMAR-LX2J

Authorized	APPROVED (Lab Manager)	PREPARED (Test Engineer)
BY	He Hao	Tao Ming
DATE	2019-03-26	2019-03-26

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※ ※ Notice ※ ※

1. The laboratory has passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01.

2. The laboratory has been recognized by the US Federal Communications Commission (FCC) to perform compliance testing subject to the Commission's Certification rules. The Designation Number is CN1173, and the Test Firm Registration Number is 294140.

3. The laboratory has been recognized by the Innovation, Science and Economic Development Canada (ISED) to test to Canadian radio equipment requirements. The CAB identifier is CN0003, an d the ISED# is 21741.

4. The laboratory (Reliability Lab of Huawei Technologies Co., Ltd) is also named “Global Compliance and Testing Center of Huawei Technologies Co., Ltd”, the both names have coexisted since 2009.

5. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.

6. The test report is invalid if there is any evidence of erasure and/or falsification.

7. The test report is only valid for the test samples.

8. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

9. If any question about this report, please contact the laboratory (PublicGCTC@huawei.com).

MODIFICATION RECORD

No.	Report No	Modification Description
1	SYBH(Z-RF)20190219010002-2006	First release.

DECLARATION

Type	Description
Multiple Models Applications	☒ The present report applies to single model. ☐ The present report applies to several models. The practical measurements are performed with the model. The present report only presents the worst test case of all modes, see relevant test results for detailed.

CONTENT

1 General Information

1.1 Test standard/s

Applied Rules :	47 CFR FCC Part 2, Subpart J 47 CFR FCC Part 15, Subpart E
Test Method :	FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02 FCC KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02 ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices

1.2 Test Environment

Temperature :	TN	15 to 30	°C during room temperature tests
Ambient Relative Humidity:	20 to 85 %		
Atmospheric Pressure:	Not applicable		
Power supply :	VN	3.8	V DC by Battery

NOTE 1: 1) VN= nominal voltage, VL= low extreme test voltage, VH= High extreme test voltage;

TN= normal temperature, TL= low extreme test temperature, TH= High extreme test temperature.

NOTE 2: The values used in the test report may be stringent than the declared.

1.3 Test Laboratories

Test Location 1 :	RELIABILITY LABORATORY OF HUAWEI TECHNOLOGIES CO., LTD.
Address of Test Location 1 :	No.2, New City Avenue, Songshan Lake Sci. & Tech. Industry Park, Dongguan, 523808, P.R.C

1.4 Applicant and Manufacturer

Company Name :	HUAWEI TECHNOLOGIES CO., LTD
Address :	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

1.5 Application details

Date of Receipt Sample:	2019-02-24
Start of test:	2019-03-01
End of test:	2019-03-26

2 Description of the Equipment under Test (EUT)

2.1 General Description

MAR-LX2J is subscriber equipment in the GSM/WCDMA/LTE system. The GSM frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900. The UMTS frequency band is B1 and B2 and B5 and B6 and B8 and B19. The LTE frequency band is B1 and B3 and B5 and B7 and B8 and B18 and B19 and B26 and B28 and B41. The Mobile Phone implements such functions as RF signal receiving/transmitting, GSM/WCDMA/LTE protocol processing, voice, video MMS service, GPS and WIFI etc. Externally it provides one micro SD card interface (it can also used as SIM card interface), earphone port (to provide voice service) and one SIM card interface. MAR-LX2J are dual SIM and single SIM smart phones, Single SIM delete SIM only by software. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

Note: Only 5G WIFI DFS test data included in this report.

2.2 EUT Identity

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

2.2.1 Board

Board		
Description	Software Version	Hardware Version
Main Board	9.0.1.120(SP1C900E120R1P16)	HL2MARLM

2.2.2 Sub-Assembly

Sub-Assembly			
Sub-Assembly Name	Model	Manufacturer	Description
Adapter	HW-090200EH0	Huawei Technologies Co., Ltd.	Input voltage: 100-240V ~50/60Hz 0.5A Output voltage: 5V ⎓ 2A OR 9V ⎓ 2A
Adapter	HW-090200BH0	Huawei Technologies Co., Ltd.	Input voltage: 100-240V ~50/60Hz 0.5A Output voltage: 5V ⎓ 2A OR 9V ⎓ 2A
Adapter	HW-090200JH0	Huawei Technologies Co., Ltd.	Input voltage: 100-240V ~50/60Hz 0.5A Output voltage: 5V ⎓ 2A OR 9V ⎓ 2A
Adapter	HW-090200UH0	Huawei Technologies Co., Ltd.	Input voltage: 100-240V ~50/60Hz 0.5A Output voltage: 5V ⎓ 2A OR 9V ⎓ 2A
Adapter	HW-059200EHQ	Huawei Technologies Co., Ltd.	Input voltage: 100-240V ~50/60Hz 0.5A Output voltage: 5V ⎓ 2A OR 9V ⎓ 2A

Sub-Assembly			
Sub-Assembly Name	Model	Manufacturer	Description
Battery	HB356687ECW	Huawei Technologies Co., Ltd.	Rated capacity: 3240mAh Nominal Voltage: ⎓ +3.82V Charging Voltage: ⎓ +4.40V

3 General Test Conditions / Configurations

3.1 Mode of Operation:

Characteristics	Description
TX/RX Operating Band	5250 MHz to 5350 MHz, 5470 MHz to 5725 MHz
Operation Mode	☐ Master, ☒ Slave without radar detection, ☐ Slave with radar detection
IEEE 802.11 WLAN Mode Supported	802.11A: Supported 802.11N: Supported 802.11AC: Supported
Channel Bandwidth	20 MHz, 40 MHz, 80 MHz
Modulation Type	BPSK/QPSK/16QAM/64QAM (OFDM).

3.2 Antenna Assembles Profiles

NOTE: When the EUT is put into service, the Antenna Gain should NOT exceed the value used in following table.

Characteristics	Description
Antenna Type	☒Integrated, ☐External
Antenna Ports	1
Smart Antenna Systems	SISO
Antenna Gain (dBi)	2
Remark	---

3.3 Power Supply

Specification	Description
Power Supply Type	AC/DC Adapter
Input to EUT	DC Voltage Nominal: ⎓ 3.8 V DC Voltage Range: ⎓ 3.6 V to 4.35 V

4 U-NII DFS RULE REQUIREMENTS

4.1 WORKING MODES ANF 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.

Table 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
Uniform Spreading	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 2. 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	Yes
Channel Move Time	Yes	Yes
U-NII Detection 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	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 each of the bonded 20 MHz channels and the channel center frequency.		

4.2 Requirements

Per FCC KDB 905462 D02 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.

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 shut down (rather than moving channels), no beacons should appear.

4.3 DFS Detection Thresholds

Table 3 below provides the *DFS Detection Thresholds* for *Master Devices* as well as *Client Devices* incorporating *In-Service Monitoring*.

Table3: DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	**Value (See Notes 1 and 2)**
EIRP ≥ 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. Note 3:EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

4.4 Response Requirements

Table 4 provides the response requirements for *Master* and *Client Devices* incorporating DFS.

Table4. 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 UNII 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.	

4.5 Parameters of DFS Test Signals

As the EUT is a Client Device with no Radar Detection only one 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. Table 5 lists the parameters for the Short Pulse Radar Waveforms. A plot of the Radar Pulse Type 0 used for testing is included in this report.

Table 5: 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 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	6 sec 1 360 Roundup 19 10 PRI	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 6. Parameters for Long Pulse Radar Waveforms

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

Table 7. Parameters for Frequency Hopping Radar Waveforms

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

4.6 Procedure

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

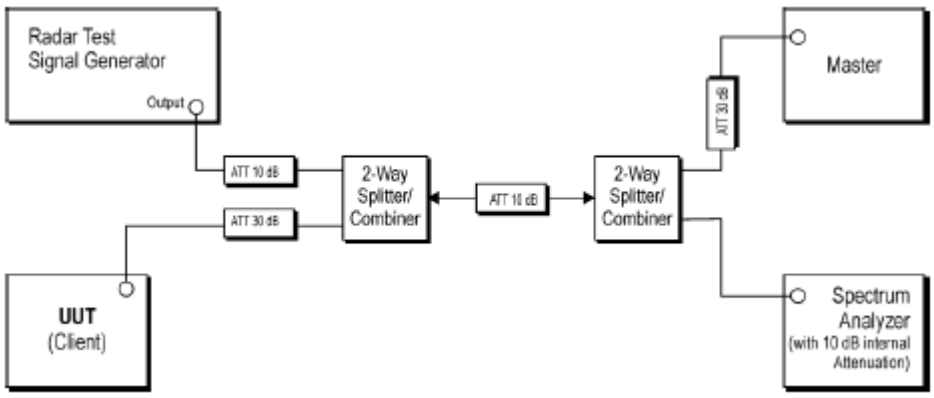


Figure 1. Test Setup for DFS

1. The radar pulse generator is setup to provide a pulse at the frequency that the Master and Client are operating. A Type 0 radar pulse with a 1us pulse width and a 1428us PRI is used for the testing.

2. The vector signal generator is adjusted to provide the radar burst (18 pulses) at a level of approximately -64dBm at the antenna of the Master device.

3. A trigger is provided from the pulse generator to the DFS monitoring system in order to capture the Traffic and the occurrence of the radar pulse.

4. The Client Device (EUT) is set up per the diagram in Figure 1 and communications between the Master device and the Client is established.

5. The data file specified by the FCC which the timing plots minimum channel loading of approximately 17% or greater is streamed from the “file computer” through the Master to the Slave Device.

6. The real time spectrum analyzer is set to record a 13sec window to any transmissions occurring up to and after 10sec.

7. The system is again setup and the monitoring time is shortened in order to capture the Channel Closing Transmission Time. This time is measured to insure that the Client ceases transmission within 200ms and the aggregate of emissions occurring after 200ms up to 10 sec do not exceed 60ms.
(Note: the channel may be different since the Master and Client have changed channels due to the detection of the initial radar pulse.)

8. Monitor the UUT for more than 30 minutes following Channel Closing Transmission Time if radar detection occurs to verify that the UUT does not resume any transmissions on this Channel.

5 Test Equipment

Equipment	Model	Manufacturer	S/N	Cal Date	Cal- Due
Vector Signal Generator	R&S	SMW200A	103447	2018/05/31	2019/05/31
Spectrum Analyzer	Agilent	N9030A	MY49431698	2018/7/23	2019/7/23
Notebook Computer	Hewlett Packard	Elite Book 840	5CG53648N9	unshielded	unshielded
AP	Netgear	R7000P（FCC ID :PY316200351）	52917474A0653	unshielded	unshielded

6 TEST RESULTS

6.1 SUMMARY OF TEST RESULT

FCC Rule No.	Test Parameter	Remarks	Pass/Fail
15.407(h)	DFS Detection Threshold	No Applicable	N/A
15.407(h)	Channel Availability Check time	No Applicable	N/A
15.407(h)	Channel Move time	Applicable	Pass
15.407(h)	Channel Closing Transmission Time	Applicable	Pass
15.407(h)	Non-Occupancy Period	Applicable	Pass
15.407(h)	Uniform Spreading	No Applicable	N/A
15.407(h)	U-NII Detection Bandwidth	No Applicable	N/A

6.1.1 TEST MODE: DEVICE OPERATING IN MASTER MODE

The EUT is slave equipment, it need a master device when testing.

Master with injection at the Master. (Radar Test Waveforms are injected into the Master)

6.1.2 DFS DETECTION THRESHOLD

The radar signal was the same as the transmitted channels, and injected into the antenna port of AP(master) for measuring the channel closing transmission time and channel move time.

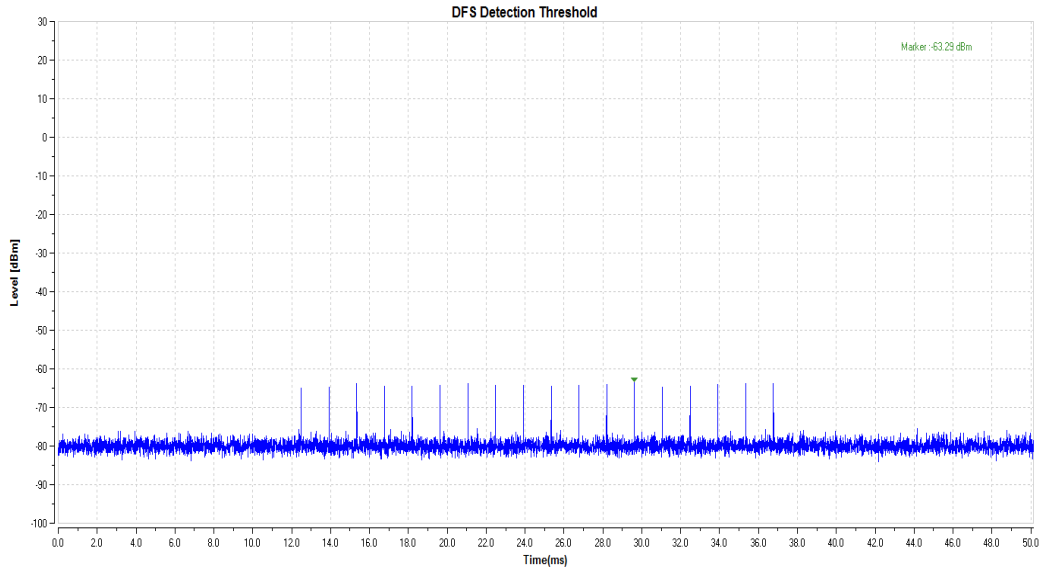
For the EIRP of the master is more than 200 milliwatt, the detection threshold level at the input of the receiver of master is -64dBm for conducted test, and the test level is lower than required level for 1dB. So required interference level is -63dBm(=-64+1).

6.1.2.1 Test Result

TestMode	Channel	Radar Type	Result	Limit[dbm]	Verdict
11A	5320	Type0	-63.29	-63	PASS
	5700	Type0	-64.23	-63	PASS
11N40SISO	5310	Type0	-64.28	-63	PASS
	5670	Type0	-64.07	-63	PASS
11AC80SISO	5290	Type0	-63.41	-63	PASS
	5530	Type0	-63.78	-63	PASS

6.1.2.2 Test Graphs

11A_5320_Type0



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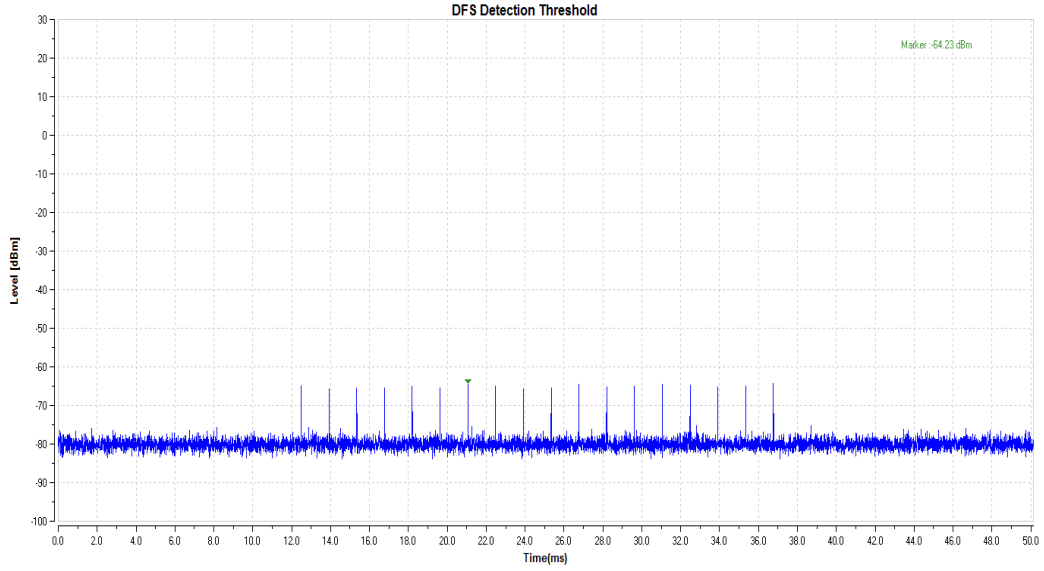
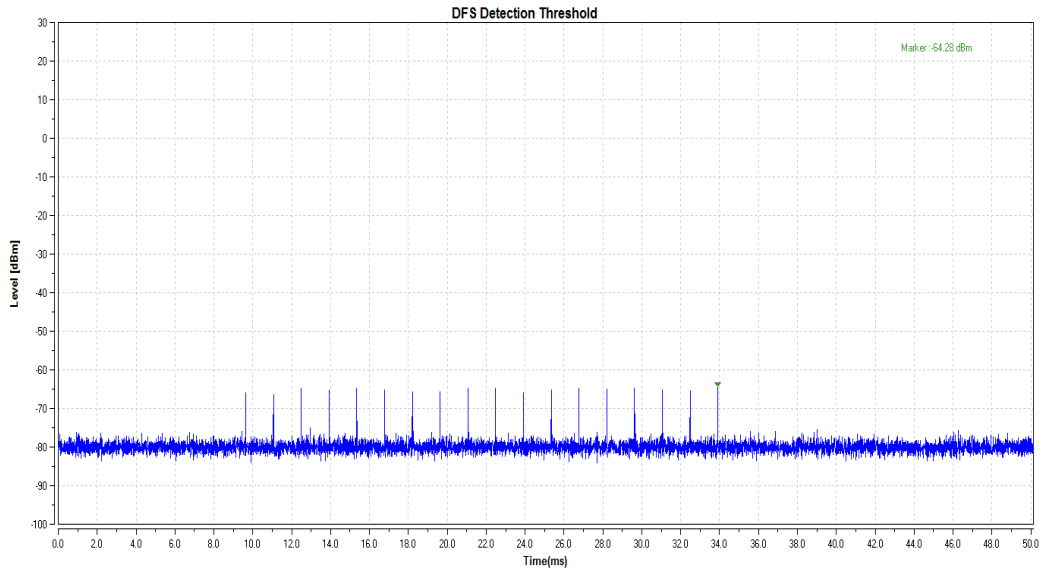


11N40SISO_5310_Type0



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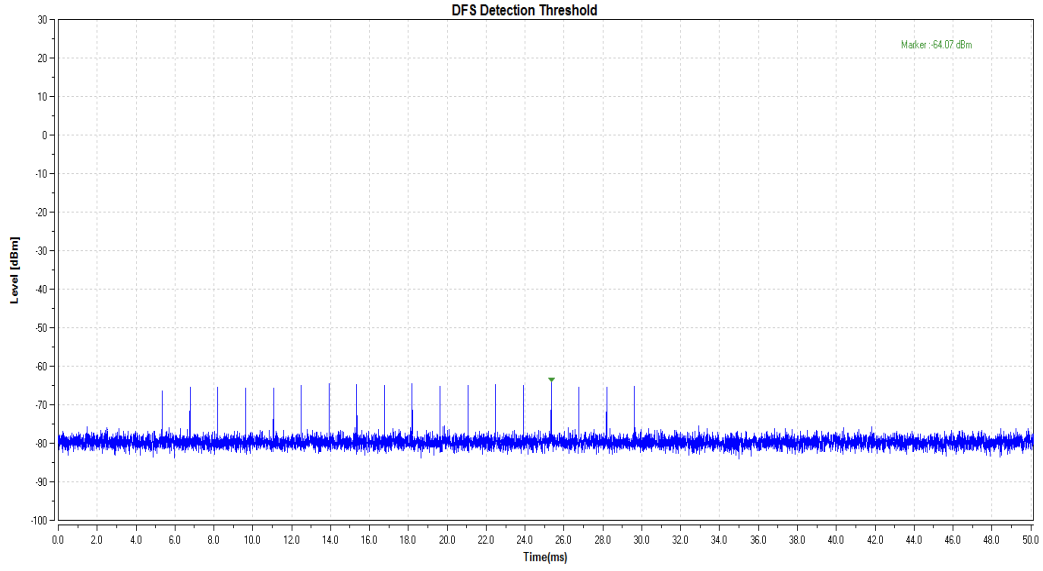

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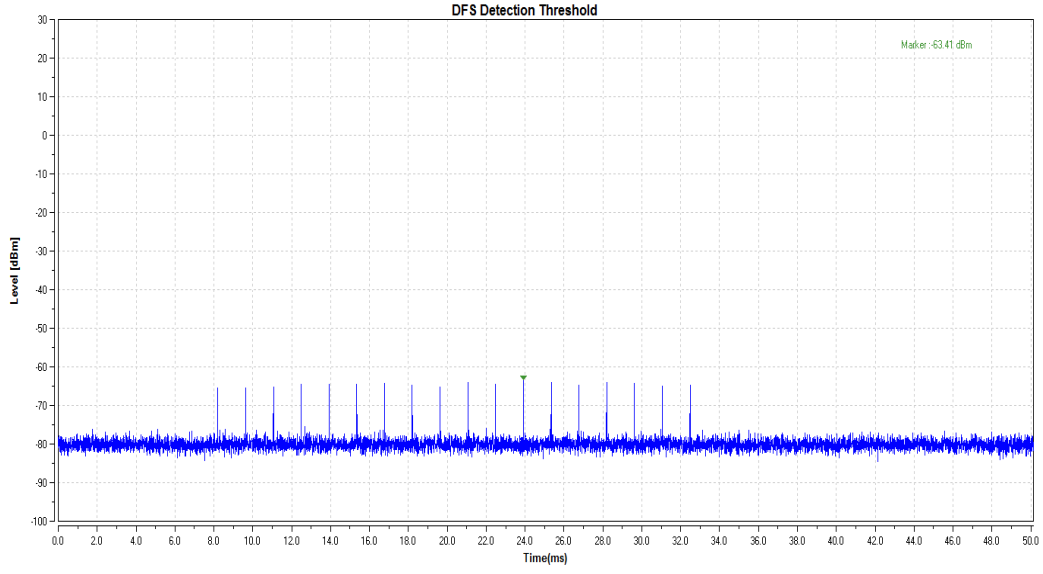

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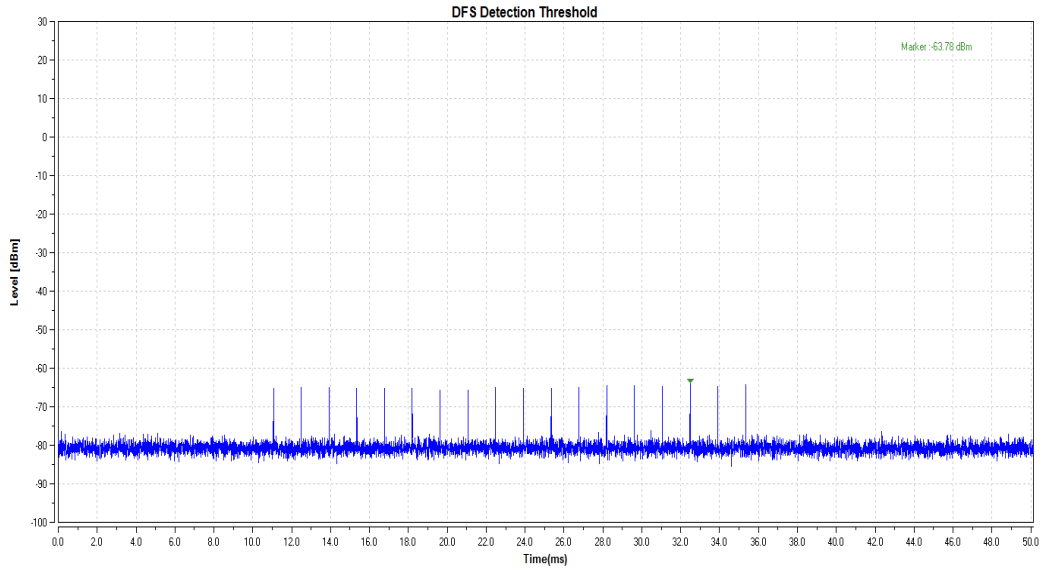


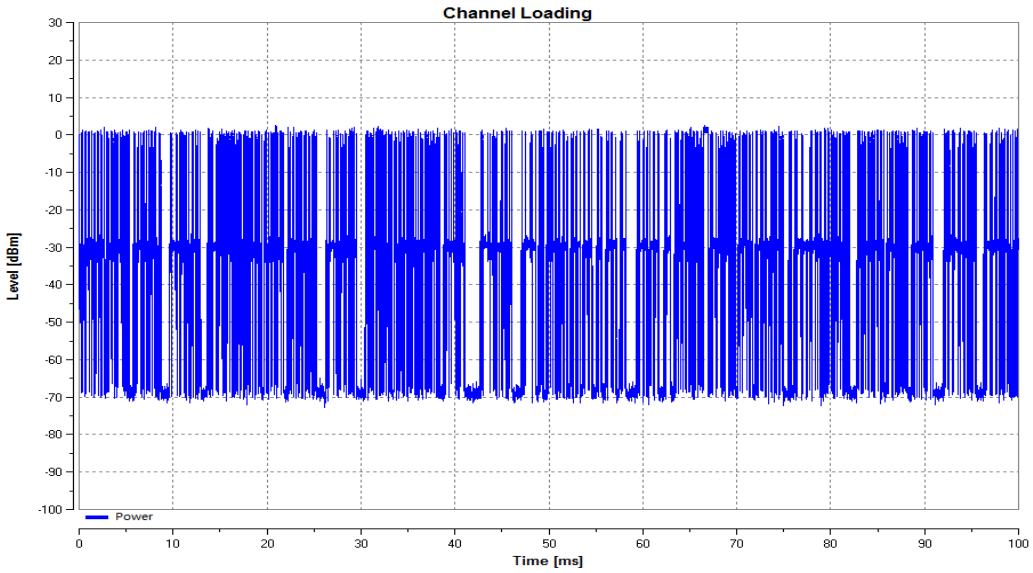
6.1.3 Channel Loading

6.1.3.1 Test Result

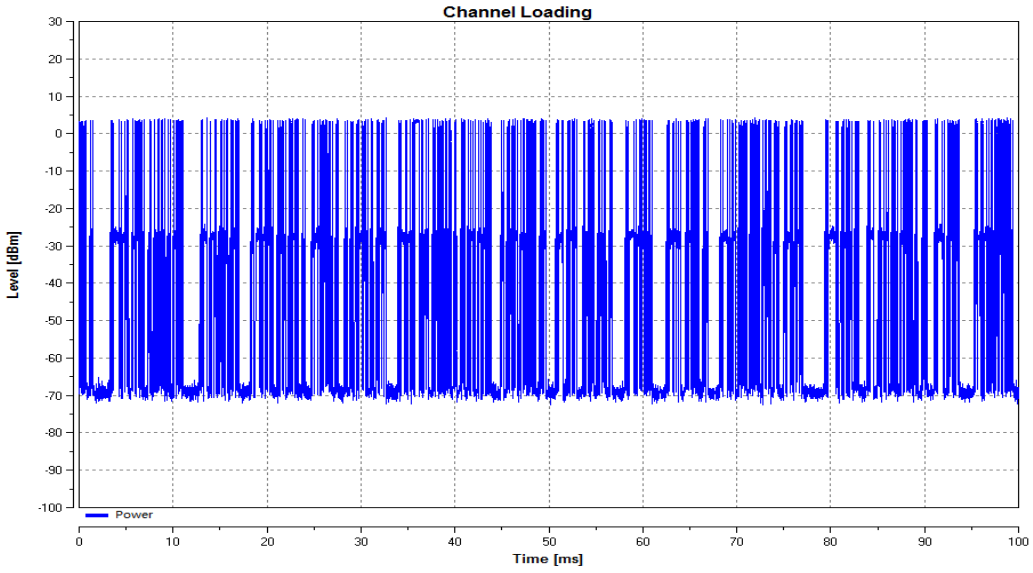
TestMode	Channel	Result	Limit [%]	Verdict
11A	5320	21.32	17	PASS
	5700	17.25	17	PASS
11N40SISO	5310	21.7	17	PASS
	5670	21.08	17	PASS
11AC80SISO	5290	19.61	17	PASS
	5530	27.39	17	PASS

6.1.3.2 Test Graphs

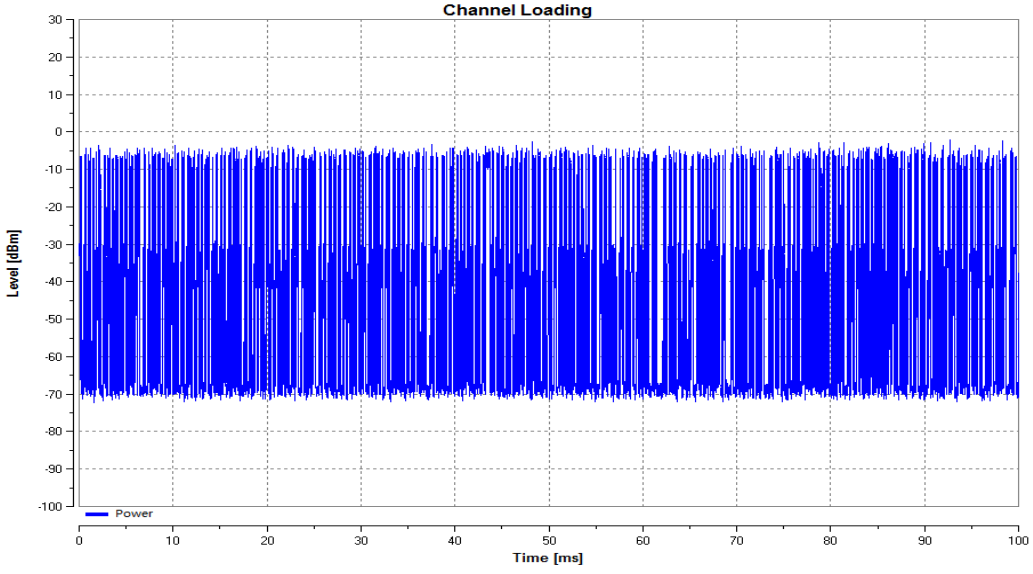
11A_5320



11A_5700



11N40SISO_5310



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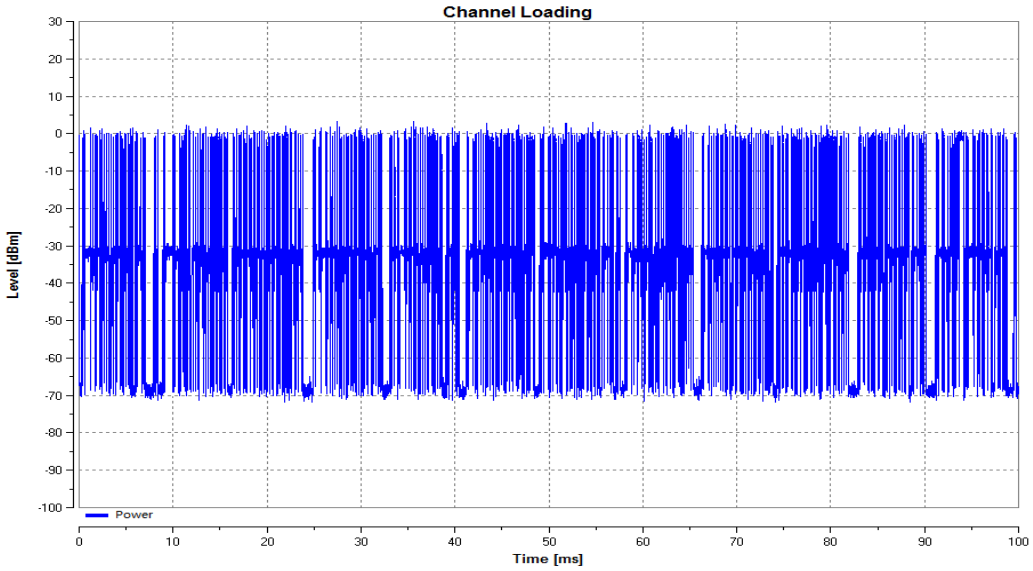
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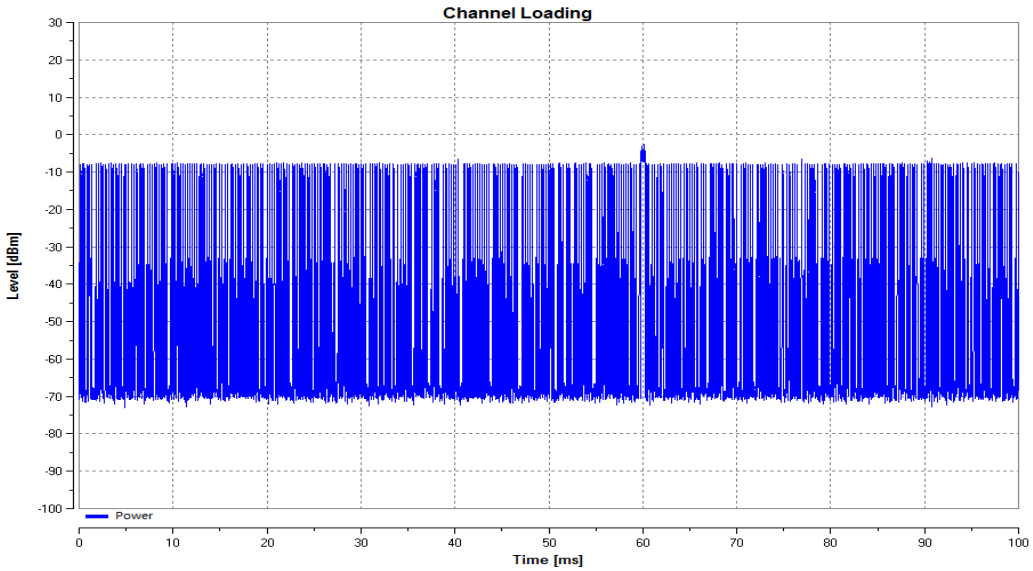
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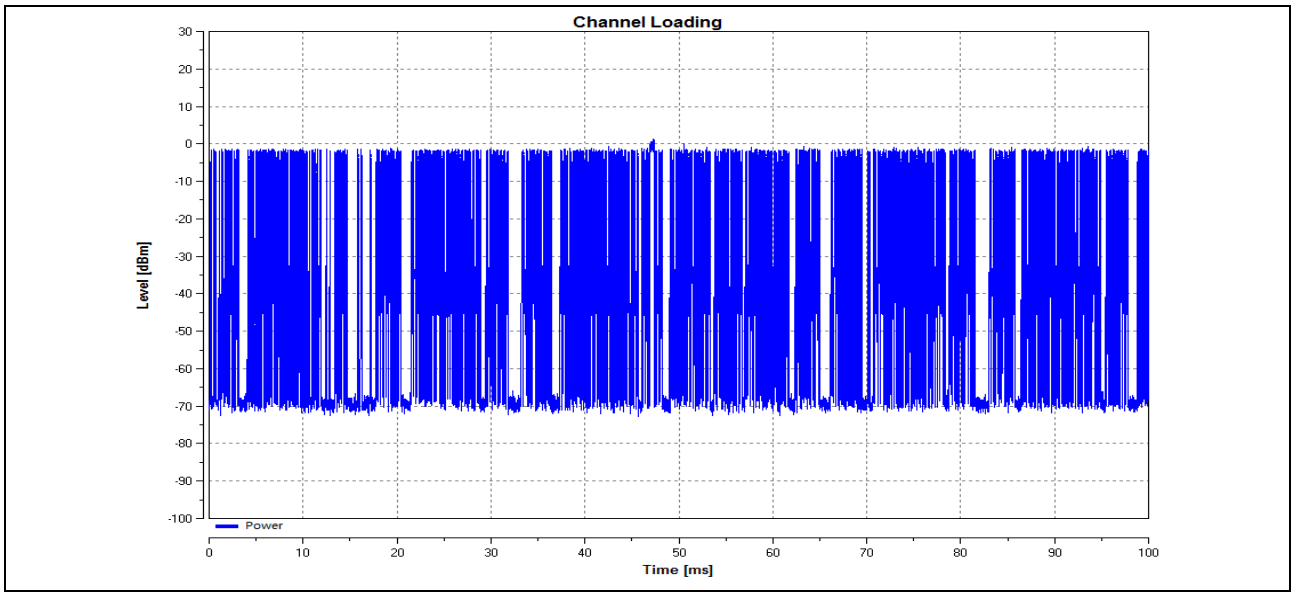


6.1.4 CHANNEL CLOSING TRANSMISSION AND CHANNEL MOVE TIME WLAN TRAFFIC

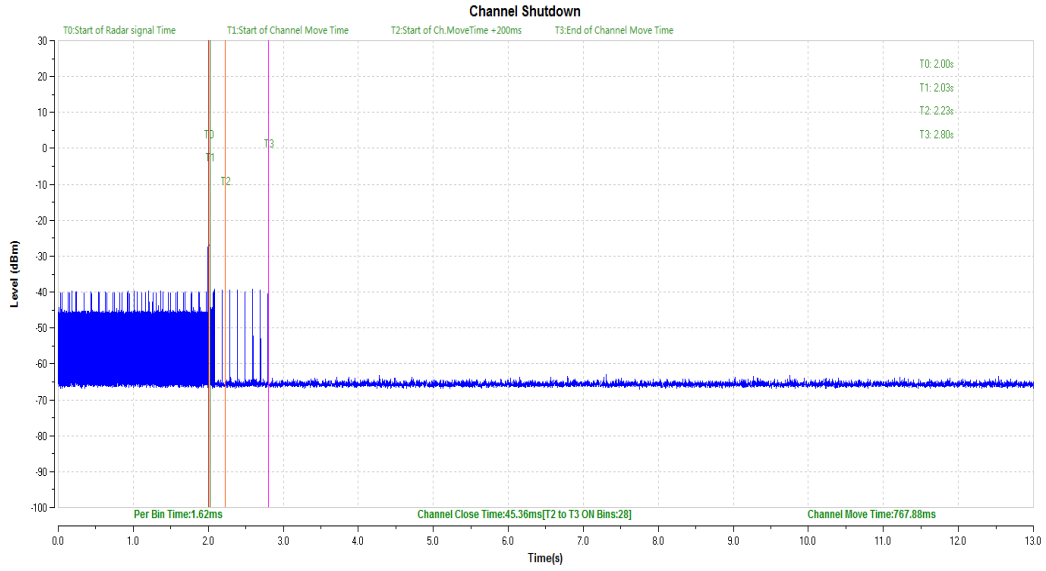
6.1.4.1 Test Result

TestMode	Channel	CCT[ms]	Limit[ms]	CMT[ms]	Limit[ms]	Verdict
11A	5320	45.36	60	767.88	10000	PASS
	5700	45.36	60	835.92	10000	PASS
11N40SISO	5310	25.92	60	811.62	10000	PASS
	5670	30.78	60	751.68	10000	PASS
11AC80SISO	5290	24.3	60	811.62	10000	PASS
	5530	32.4	60	858.6	10000	PASS

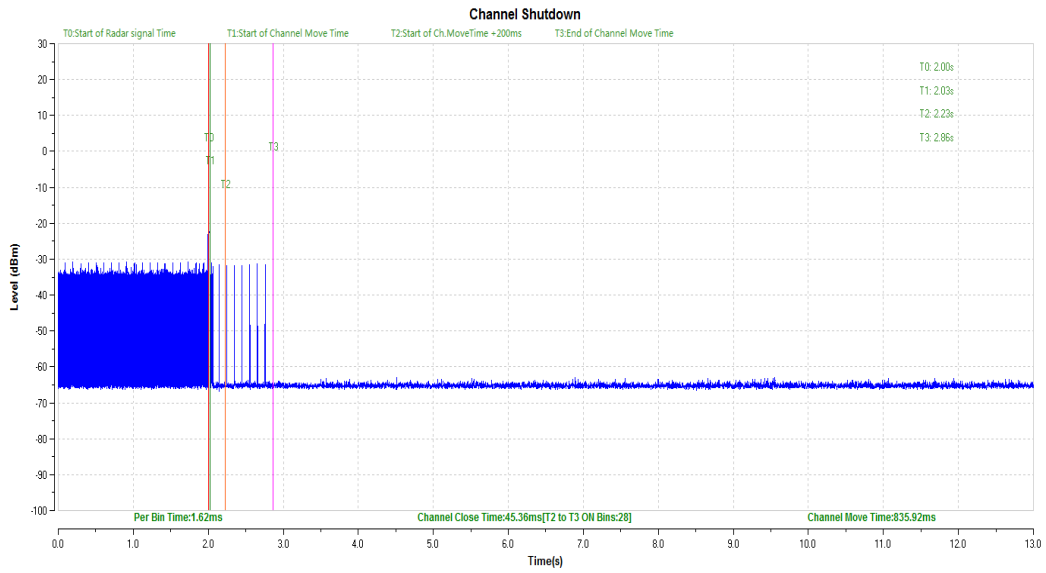
Note: The aggregate time in the 200 milliseconds starting at the beginning of the Channel Move Time is not calculated within the channel closing transmission time, so the limit is 60ms.

6.1.4.2 Test Graphs

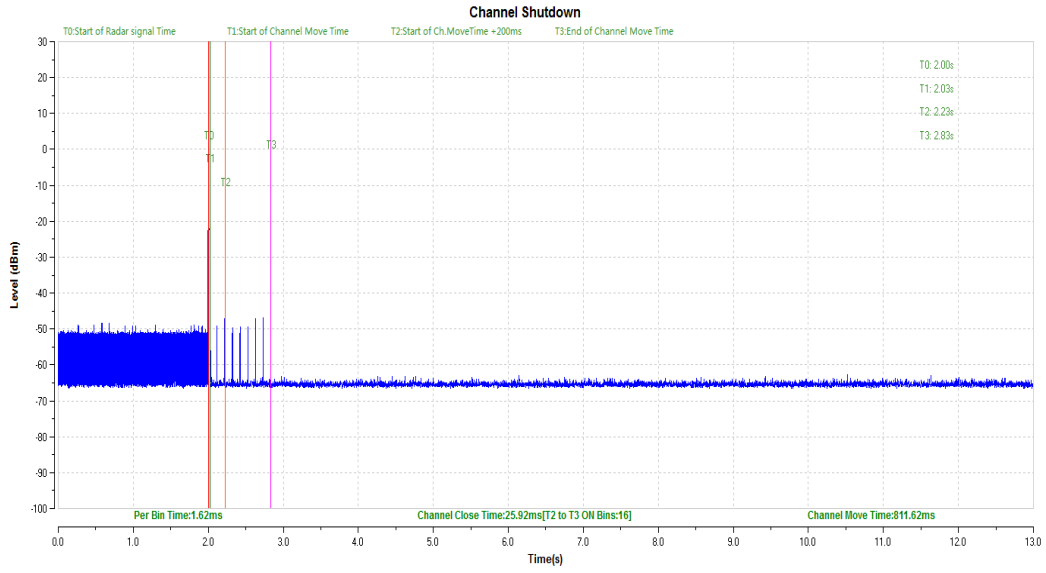
11A_5320



11A_5700



11N40SISO_5310



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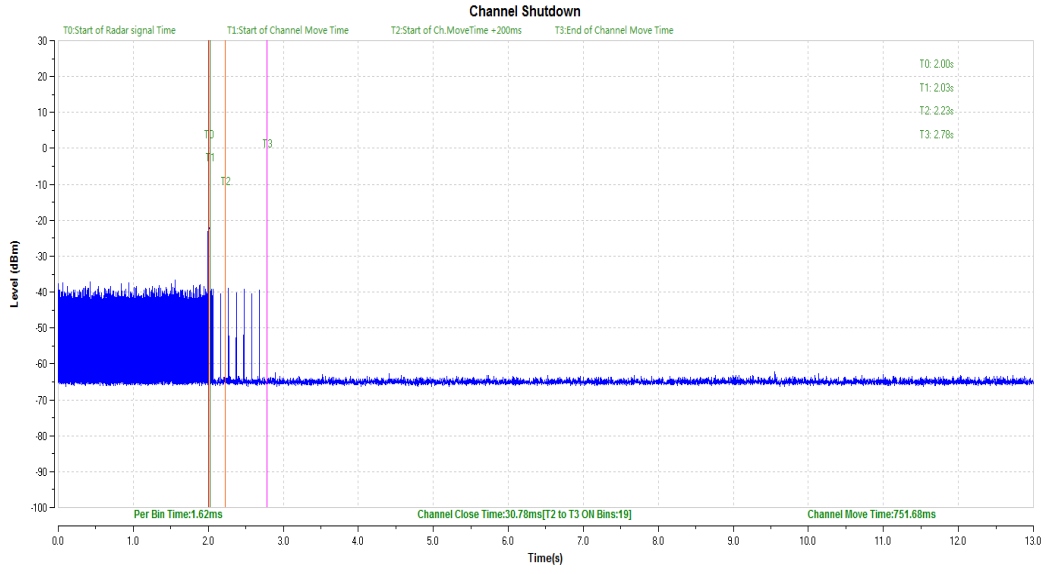

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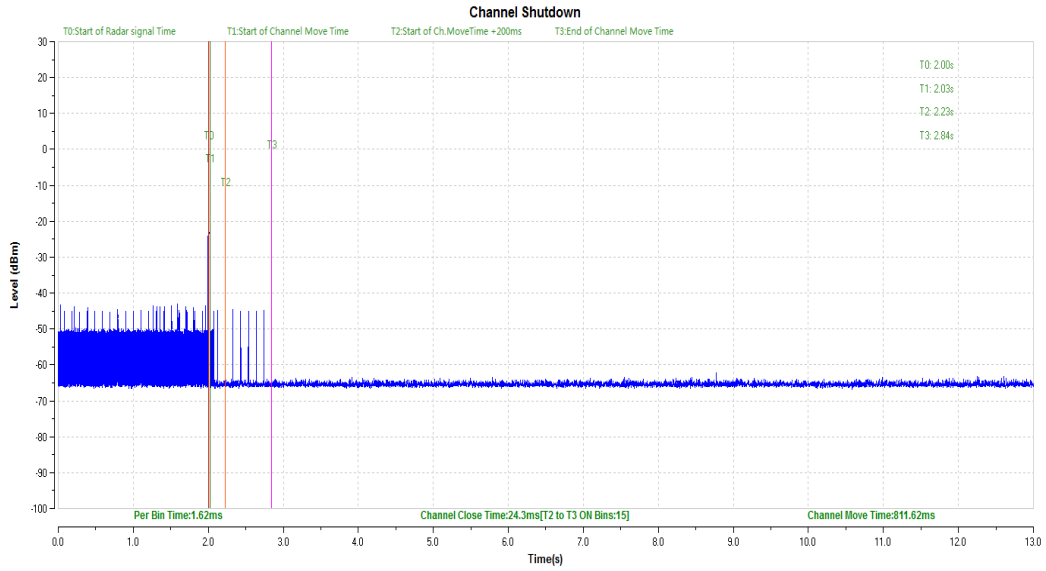

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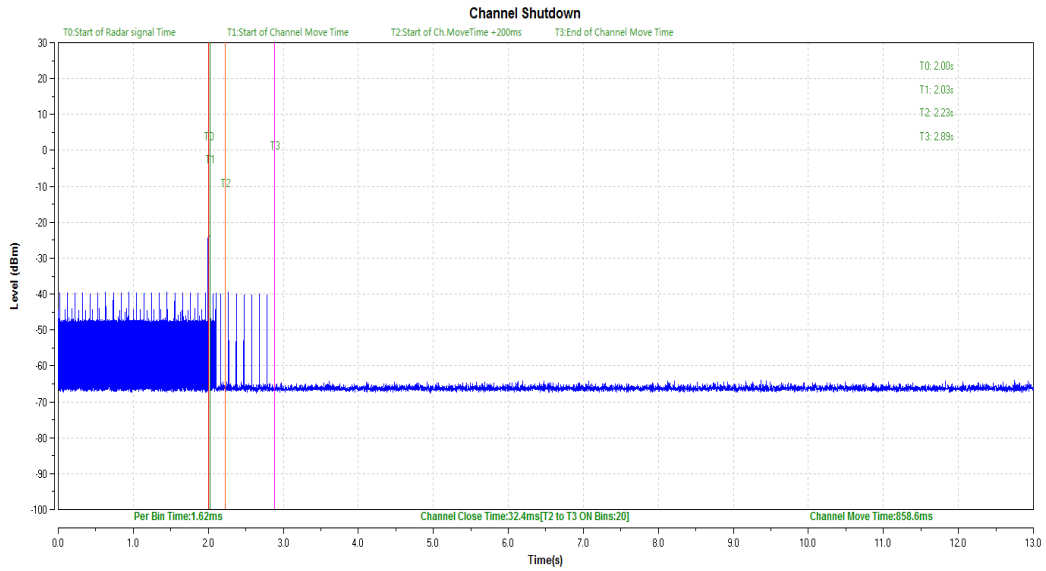


6.1.5 NON- OCCUPANCY PERIOD

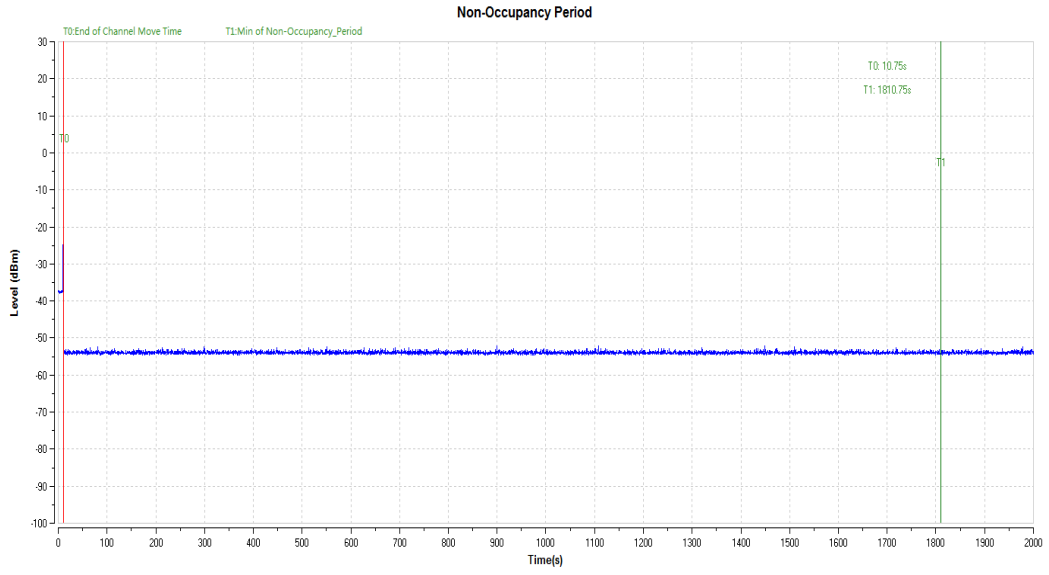
6.1.5.1 Test Result

During the 30 minutes observation time, UUT did not make any transmissions on a channel after a radar signal was detected on that channel by either the Channel Availability Check or the In-Service Monitoring.

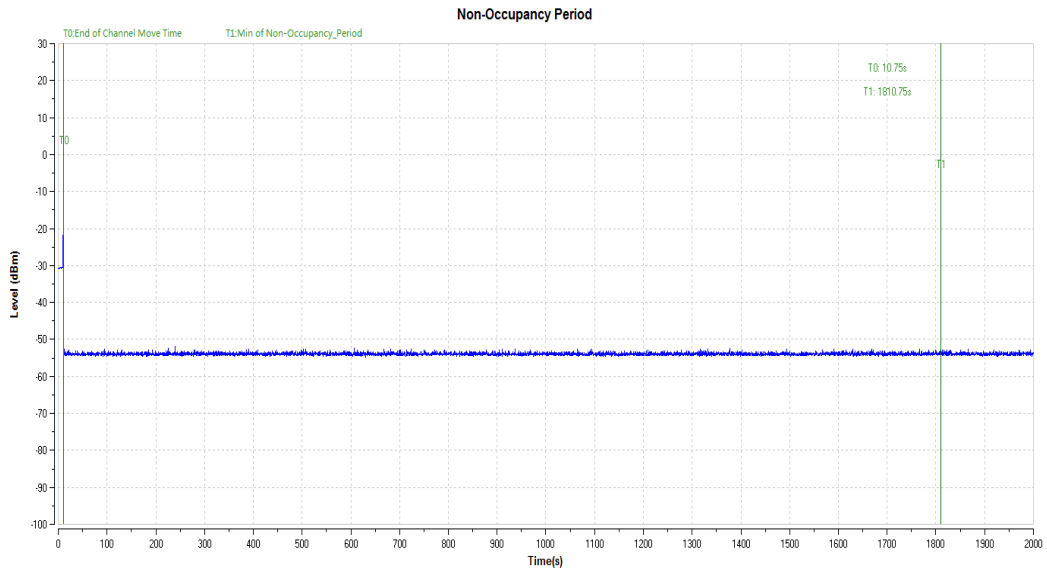
TestMode	Channel	Result	Limit[s]	Verdict
11A	5320	see test graph	>=1800	PASS
	5700	see test graph	>=1800	PASS
11N40SISO	5310	see test graph	>=1800	PASS
	5670	see test graph	>=1800	PASS
11AC80SISO	5290	see test graph	>=1800	PASS
	5530	see test graph	>=1800	PASS

6.1.5.2 Test Graphs

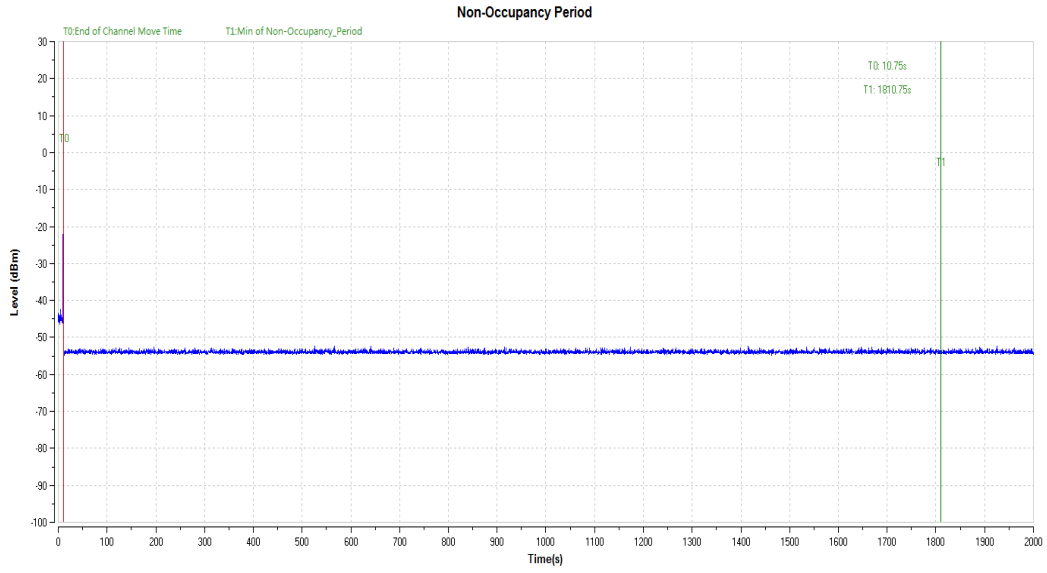
11A_5320



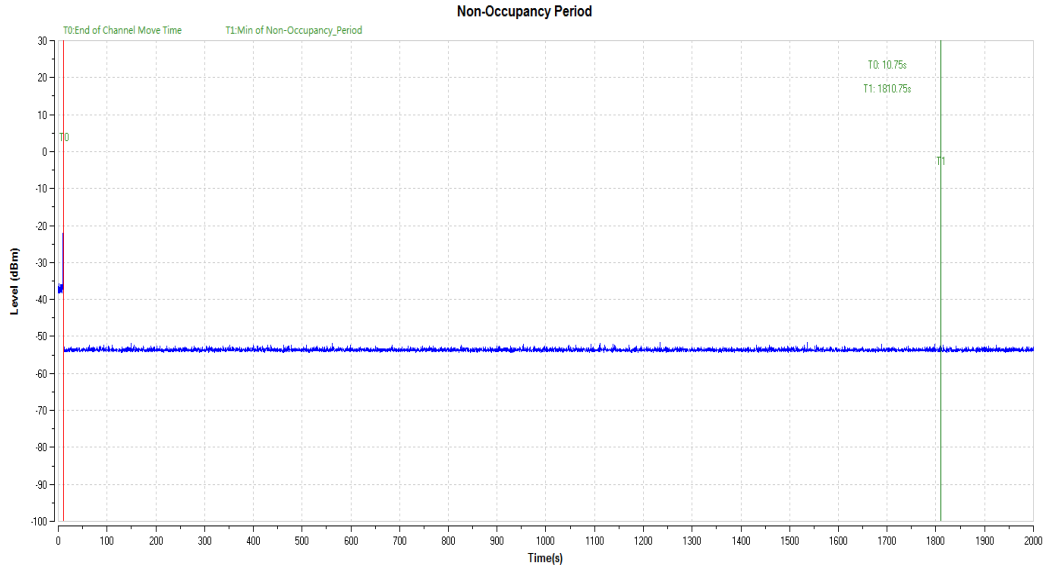
11A_5700



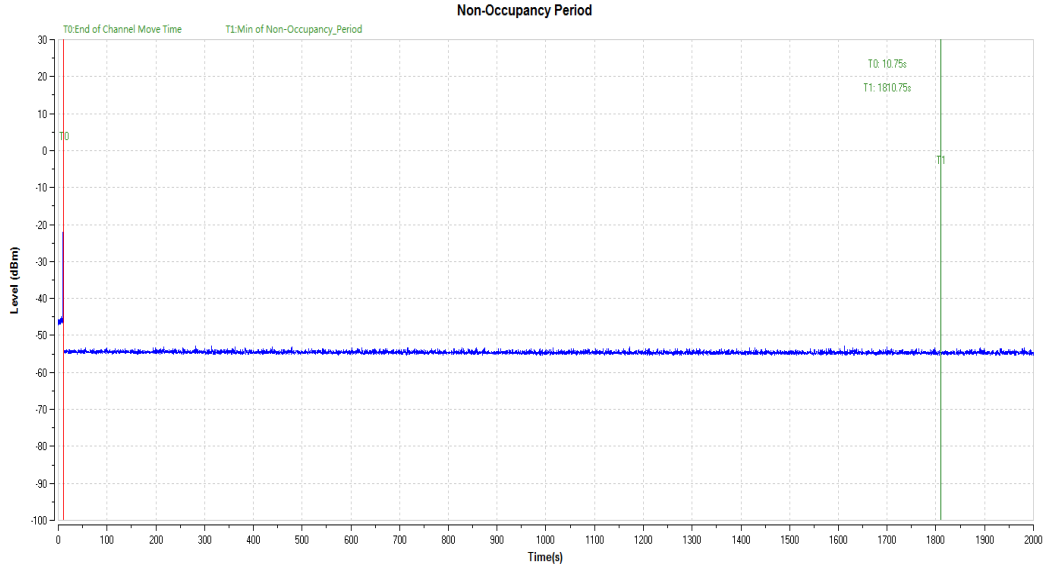
11N40SISO_5310



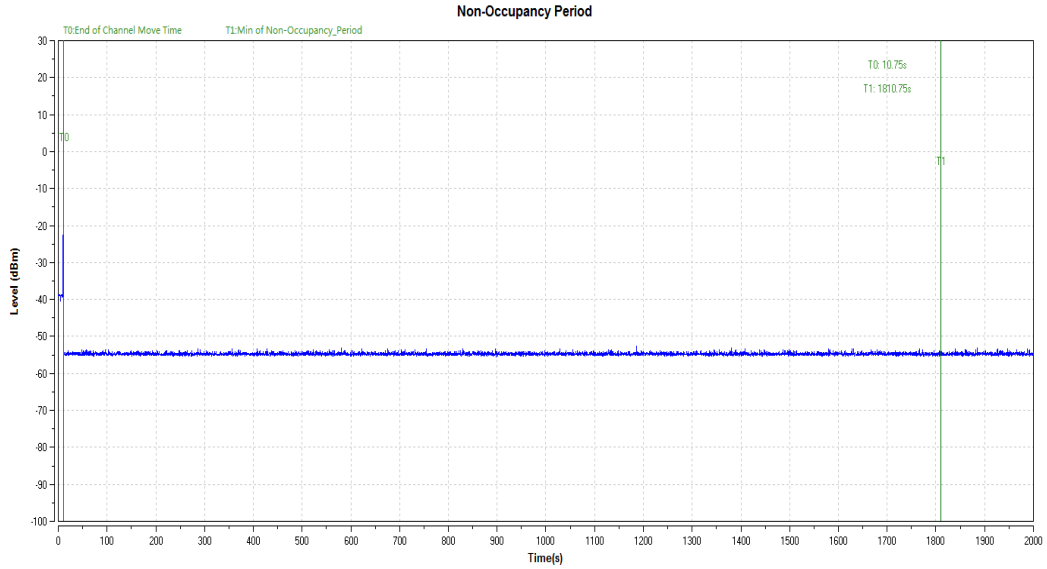
11N40SISO_5670



11AC80SISO_5290



11AC80SISO_5530



7 Measurement Uncertainty

For a 95% confidence level (k = 2), the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 as following:

Parameter	Measurement Uncertainty
DFS Threshold	0.96 dB

END