ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant:	ASUSTeK COMPUTER INC. 1F., No. 15, Lide Rd., Beitou Dist., Taipei City 112, Taiwan
Product Name:	ASUS Phone (Mobile Phone)
Brand Name:	ASUS
Model No.:	ASUS_I003D
Model Difference:	N/A
Report Number:	ER/2020/30081
FCC ID:	MSQI003D
IC:	3568A-I003D
FCC Rule Part:	§15.407, Cat: NII
ISED RSS:	RSS-247 issue 2 Feb. 2017
Issue Date:	Aug. 18, 2020
Date of Test:	May 06, 2020 ~ Jun. 29, 2020, Aug. 18, 2020
Date of EUT Received:	May 06, 2020

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Approved By: Jazz Huang

Jazz Huang / Asst. Supervisor

Testing Laboratory
3702

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Revision History				
Report Number	**Revision**	**Description**	**Issue Date**	**Remark**
ER/2020/30081	Rev.00	Original.	Aug. 18, 2020	Revised By: Karen Huang

Note:

1、Disclaimer

Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	ASUS Phone (Mobile Phone)	
Brand Name:	ASUS	
Model No.:	ASUS_I003D	
Model Difference:	N/A	
Hardware Version:	R2.0B	
Software Version:	Android Q	
AJ dongle:	Model No.: F370002, Supplier: MEILU	
Fan Dongle:	Model No.: I003, Supplier: ASUS	
USB Cable:	Model No.: LA9U2015-CS-R, Supplier: ASAP	
Power Supply:	3.85Vdc from Rechargeable Li-polymer Battery or 5V / 9V / 12V / 15V / 20V from AC/DC Adapter	
	Battery:	Model No.: C11P1903, Supplier: SCUD
	Adapter:	Model No.: A299-200150U-US, Supplier: AOHAI
Modulation type	64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 802.11ac only 1024QAM for OFDMA in 802.11ax only	
Transition Rate:	802.11 a: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 144.4Mbps 802.11 n_40MHz: 13.5 – 300.0Mbps	802.11 ac_20MHz: 6.5 –173.3Mbps 802.11 ac_40MHz: 13.5 –400.0Mbps 802.11 ac_80MHz: 29.3 – 866.7Mbps 802.11 ax_20MHz: 8.6 –286.8 Mbps 802.11 ax_40MHz: 17.2 -573.5 Mbps 802.11 ax_80MHz: 36.0 – 1201 Mbps

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1.2 Antenna Designation

Wi-Fi					
Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
PIFA	N/A	Ant4	5150~5725	1.6	
		Ant5		1.7	V
		Ant6		3.7	V
		Ant7		2.0	
Note: Pre-scanned was done on the above 4 antennas, the Ant6 results higher Emission at 5GHz. Therefore, the completed set of measurement was done on the antenna to be presented on this test report.					

1.3 FCC and ISED Frequency, Channels and Modulation

Wi-Fi 802.11	Frequency Range	Channels	Modulation Technology
a	5150~5250	4	OFDM
	5250~5350	4	
	5470~5725	12	
	5725-5850	5	
n_HT ac_VHT ax_HE 20M	5150~5250	4	OFDM OFDMA
	5250~5350	4	
	5470~5725	12	
	5725-5850	5	
n_HT ac_VHT ax_HE 40M	5150~5250	2	OFDM OFDMA
	5250~5350	2	
	5470~5725	5	
	5725-5850	2	
ac_VHT ax_HE 80M	5150~5250	1	OFDM OFDMA
	5250~5350	1	
	5470~5725	2	
	5725-5850	1	

Note: EUT serial number is L4AIGF000585XCH.

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1.4 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407

FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

FCC KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02

RSS-247 issue 2 Feb. 2017

1.5 Test Facility

SGS Taiwan Ltd. Central RF Lab (TAF code 3702)
No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803

FCC Designation number: TW0027

ISED CAB identifier: TW3702

1.6 Special Accessories

There are no special accessories used while test was conducted.

1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SUMMARY OF TEST RESULT

FCC / IC Rules	IC Rules	Description Of Test	Result
§15.407(h)	IC RSS-247 issue 1 §6.3	TPC and DFS Measure-ment	Compliant

3 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
TPC and DFS Measurement	+/- 123.36 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC=+/- 0.2%

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

The conformity assessment statement in this report is based solely on the test results, measure-ment uncertainty is excluded.

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4 DESCRIPTION OF TEST MODES

1. WiFi signals can be transmitted from 4 antennas with 4 different modes, only one mode is available at any given time.

2. Measurements are presented on Camera Mode while spot checks on other modes conclude no noticeable results.

Mode	Antenna
Calling Mode	Chain0 is adapted in Ant4 Chain1 is adapted in Ant6
Camera Mode	Chain0 is adapted in Ant6 Chain1 is adapted in Ant5
Normal Mode	Portrait: Chain0 is adapted in Ant4 Chain1 is adapted in Ant6 Landscape: Chain0 is adapted in Ant4 Chain1 is adapted in Ant5
Gaming Mode	Chain0 is adapted in Ant4 Chain1 is adapted in Ant7

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5 TPC AND DFS MEASUREMENT

5.1 TPC: Standard Applicable

According to §15.407(h)(1), Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

Result: N/A, The output power is less than 500mW.

5.2 DFS: Standard Applicable

According to §15.407(h)(2) and FCC KDB 905462 D02 , Radar Detection Function of Dynamic Frequency Selection (DFS).

Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. Operators shall only use equipment with a DFS mechanism that is turned on when operating in these bands. The device must sense for radar signals at 100 percent of its emission bandwidth. The minimum DFS detection threshold for devices with a maximum e.i.r.p. of 200 mW to 1 W is −64 dBm. For devices that operate with less than 200 mW e.i.r.p. and a power spectral density of less than 10 dBm in a 1 MHz band, the minimum detection threshold is −62 dBm. The detection threshold is the received power averaged over 1 microsecond referenced to a 0 dBi antenna. For the initial channel setting, the manufacturers shall be permitted to provide for either random channel selection or manual channel selection.

(i) Operational Modes. The DFS requirement applies to the following operational modes:

(a) The requirement for channel availability check time applies in the master operational mode.

(b) The requirement for channel move time applies in both the master and slave operational modes.

(ii) Channel Availability Check Time. A U-NII device shall check if there is a radar system already operating on the channel before it can initiate a transmission on a channel and when it has to move to a new channel. The U-NII device may start using the channel if no radar signal with a power level greater than the interference threshold values listed in paragraph (h)(2) of this section, is detected within 60 seconds.

(iii) Channel Move Time. After a radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.

(iv) Non-occupancy Period. A channel that has been flagged as containing a radar system, either by a channel availability check or in-service monitoring, is subject to a non-occupancy

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period of at least 30 minutes. The non-occupancy period starts at the time when the radar system is detected.

According to RSS 247 §6.2.3, Until further notice, devices subject to this section shall not be capable of transmitting in the band 5600-5650 MHz. This restriction is for the protection of Environment Canada's weather radars operating in this band.

According to RSS 247 §6.3,Devices operating in the bands 5250-5350 MHz, 5470-5600 MHz and 5650-5725 MHz band shall comply with the following:

(a) **DFS radar signal detection threshold**

Devices shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. The device must detect radar signals within its entire emission bandwidth. The minimum DFS radar signal detection threshold is described below.

Devices	**DFS Threshold**
Devices with an e.i.r.p. < 200 mW AND a Power Spectral Density < 10 dBm/MHz	-62 dBm
Devices with 200 mW ≤ e.i.r.p. ≤ 1 W	-64 dBm
Note: The detection threshold power is the received power, averaged over a 1-microsecond reference to a 0 dBi antenna.	

(b) **Operational requirements**

Devices shall comply with the following requirements, however, the requirement for in-service monitoring does not apply to slave devices without radar detection.

(i) In-service monitoring: an LE-LAN device shall be able to monitor the operating channel to check that a co-channel radar has not moved or started operation within range of the LE-LAN device. During in-service monitoring, the LE-LAN radar detection function continuously searches for radar signals between normal LE-LAN transmissions.

(ii) Channel availability check time: the device shall check whether there is a radar system already operating on the channel before it initiates a transmission on a channel and when it moves to a channel. The device may start using the channel if no radar signal with a power level greater than the interference threshold value specified in Section 6.3.1 above is detected within 60 seconds. This requirement only applies in the master operational mode.

(iii) Channel move time: after a radar signal is detected, the device shall cease all transmissions on the operating channel within 10 seconds.

(iv) Channel closing transmission time: is comprised of 200 ms 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 ms) over the remaining 10-second period of the channel move time.

(v) Non-occupancy period: a channel that has been flagged as containing a radar signal, either by

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a channel availability check or in-service monitoring, is subject to
a 30-minute non-occupancy period where the channel cannot be used by the LE-LAN device.
The non-occupancy period starts from the time that the radar signal is detected.

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5.2.1 Limit

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 Thresh-old	Yes	Not required	Yes
Channel Availability Check Time	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
Cannel Closing Transmission time	Yes	Yes
Channel Move time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

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Additional requirements for devices with multiple bandwidth mode	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 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
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. **Note3:** EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

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Table 4: 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.

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Table 5: Radar Test Waveforms

Short Pulse Radar

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	Roundup $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{PRI_{\mu sec}}\right)\right\}$	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.					

Long Pulse Radar

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

Frequency Hopping Radar

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

The applicant of this given application confirms that information regarding the parameters of the detected Radar Waveforms is not available to the end user.

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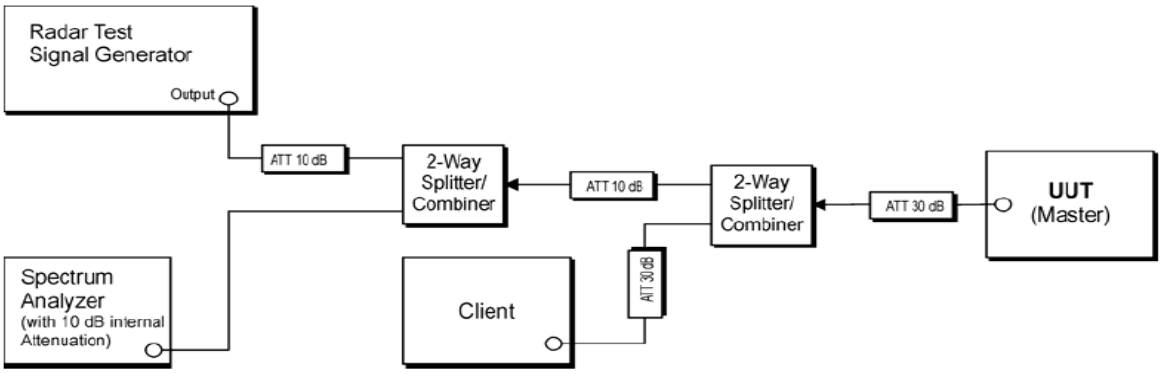
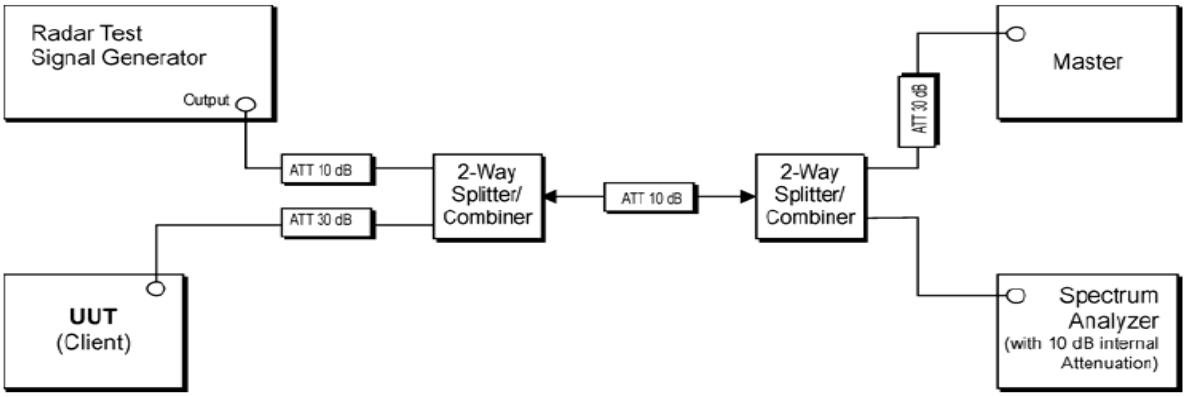
5.2.2 Test Setup

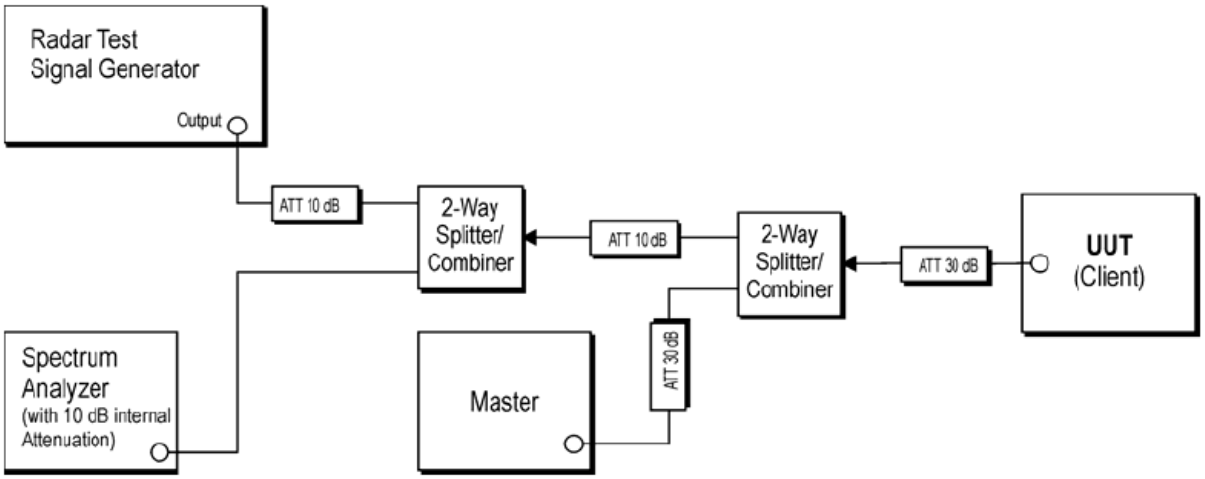
Setup for Master with injection at the Master



Setup for Client with injection at the Master



Setup for Client with injection at the Client



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5.2.3 Test Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
EMI Receiver	KEYSIGHT	N9038A	MY52260216	11/28/2019	11/27/2020
Signal Generator	Keysight	N5182B	MY56200007	08/11/2019	08/10/2020
Splitter	RF-LAMBAD	RFLT4W1G18G	SPCD10-004	01/02/2020	01/01/2021
Splitter	RF-LAMBAD	RFLT2W1G18G	11-JSPF412-020	01/02/2020	01/01/2021
Splitter	RF-LAMBAD	RFLT2W1G18G	11-JSPF412-017	01/02/2020	01/01/2021
Attenuator	Agilent	8495B	3308A22470	01/02/2020	01/01/2021
Attenuator	HP	8494B	2812A170605	01/02/2020	01/01/2021
Accece Ponit	ASUS	RT-AX88U	FCC ID :MSQ-RTAXHP00 IC : 3568A-RTAXHP00 CAN IC-ES-3(B)/NMB-3(B)	N/A	N/A

Note: The measurement was taken place with the long duration of the time, and additional equipment list as shown blow indicate those equipment of which has been subject to undertake the calibration in intermediate period of time of the measurement.

EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Signal Generator	Agilent	N5172B	MY53050661	04/01/2020	03/31/2021

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5.2.4 Description of EUT:

EUT operates over the 5250-5350MHz and 5470-5725MHz ranges and EUT is a slave device (client equipment) w/o radar detection and DFS capability.

EUT has no TPC mechanism implemented with no adjustment of lowest, and highest power, but the level of power emission stays at fixed level.

WLAN traffic is generated by streaming the mpeg file from the master to slave in full monitor video mode using the media player.

The rated output power of the master unit is >23dBm(EIRP).therefore the required interference threshold level is -64dBm.after correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is -64dBm.

While calibrate the path on antenna port of DFS test equipment (master), measurements equipments (spectrum) is ensured to be 50 Ohms, and therefore verification on antenna gain measurement can be ignored.

Conducted test was performed with appropriate adjustment, and calibration to ensure power from DFS simulator injects to antenna port of DFS test equipment (DFS) is -64dBm

Message or files that is used for communication between Master and Client:

IP based system:

For the required channel loading, the full motion, 30 frames per second MPEG video file from http://ntiacsd.ntia.doc.gov/dfs/ was streamed from a network on a test bench (server of the storage to download the mandatory format of Video file), via the DFS Master device, to the UE (mobile phone).

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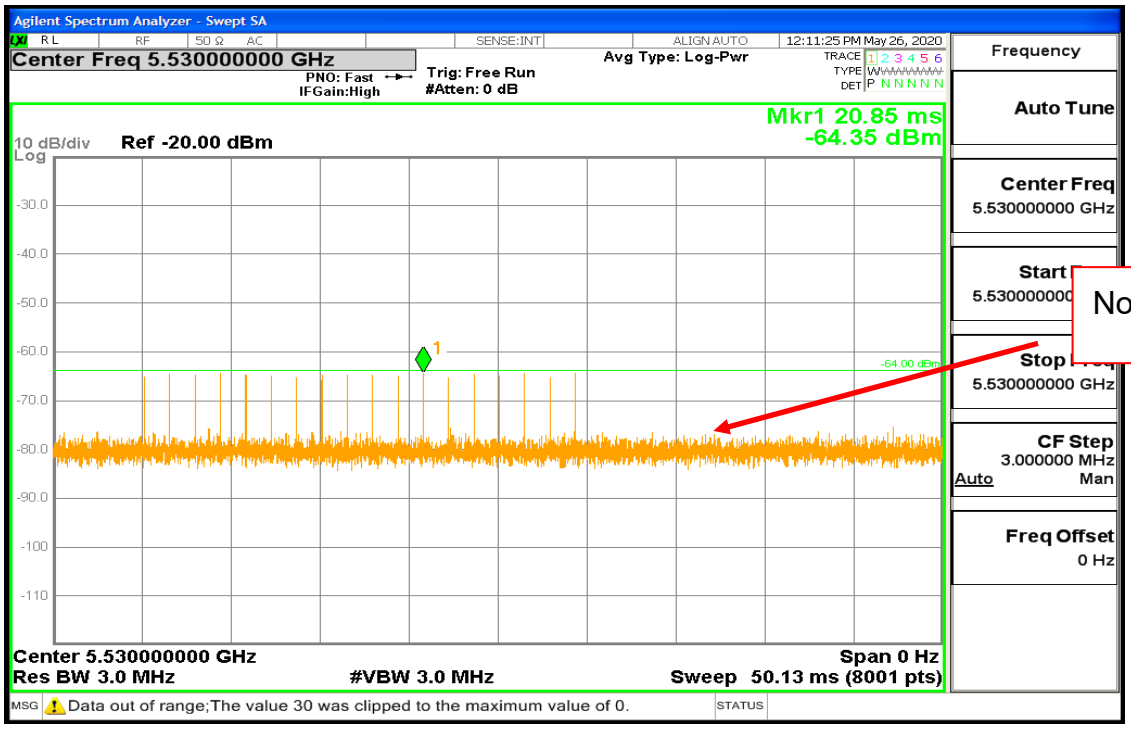
5.2.5 Test results

Calibration plots for each of the required radar waveforms
Radar type 0



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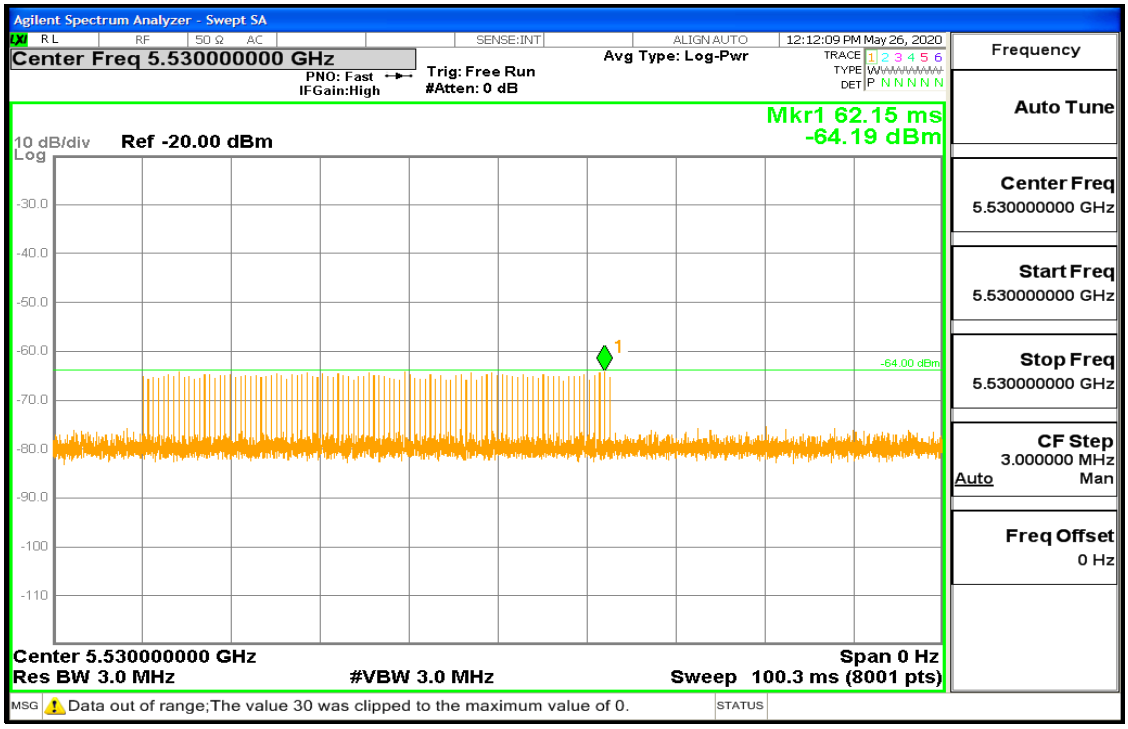
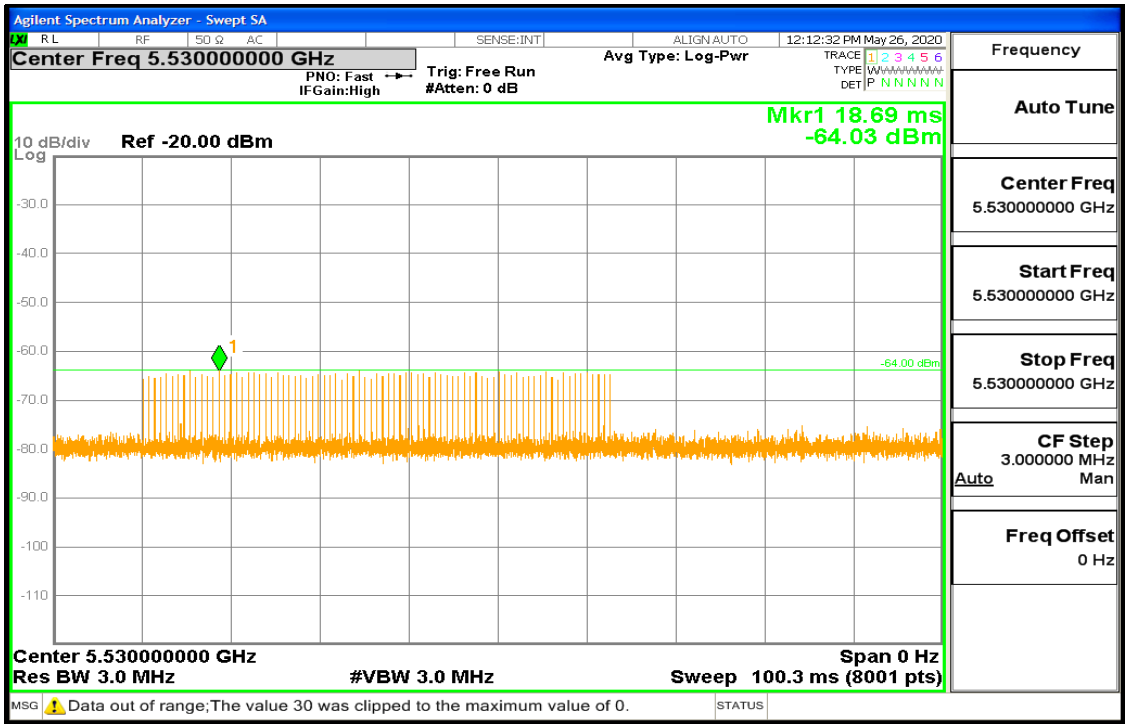
Radar type 1 A



Radar type 1 B



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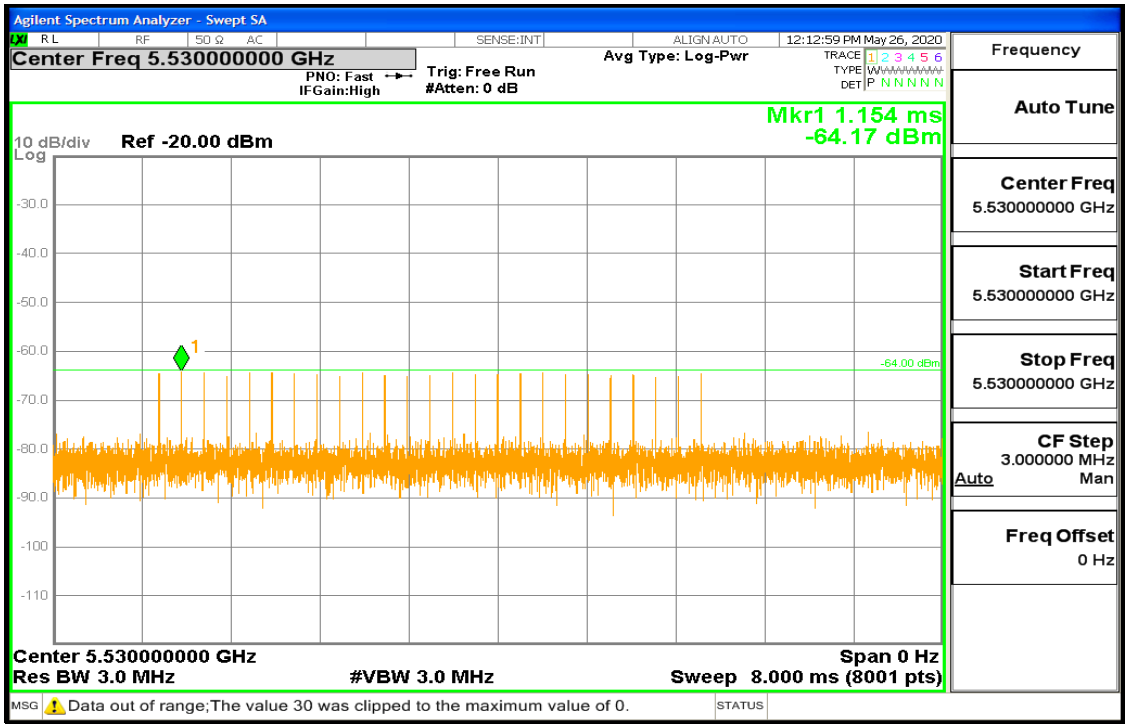
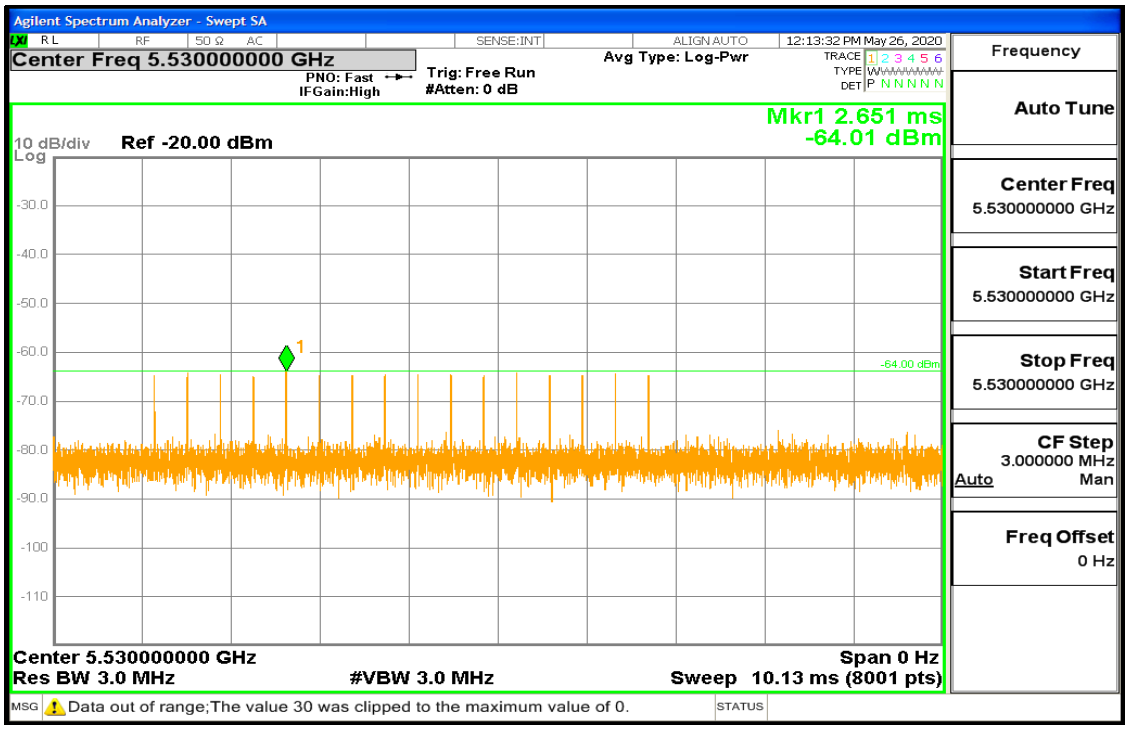
Radar type 2



Radar type 3



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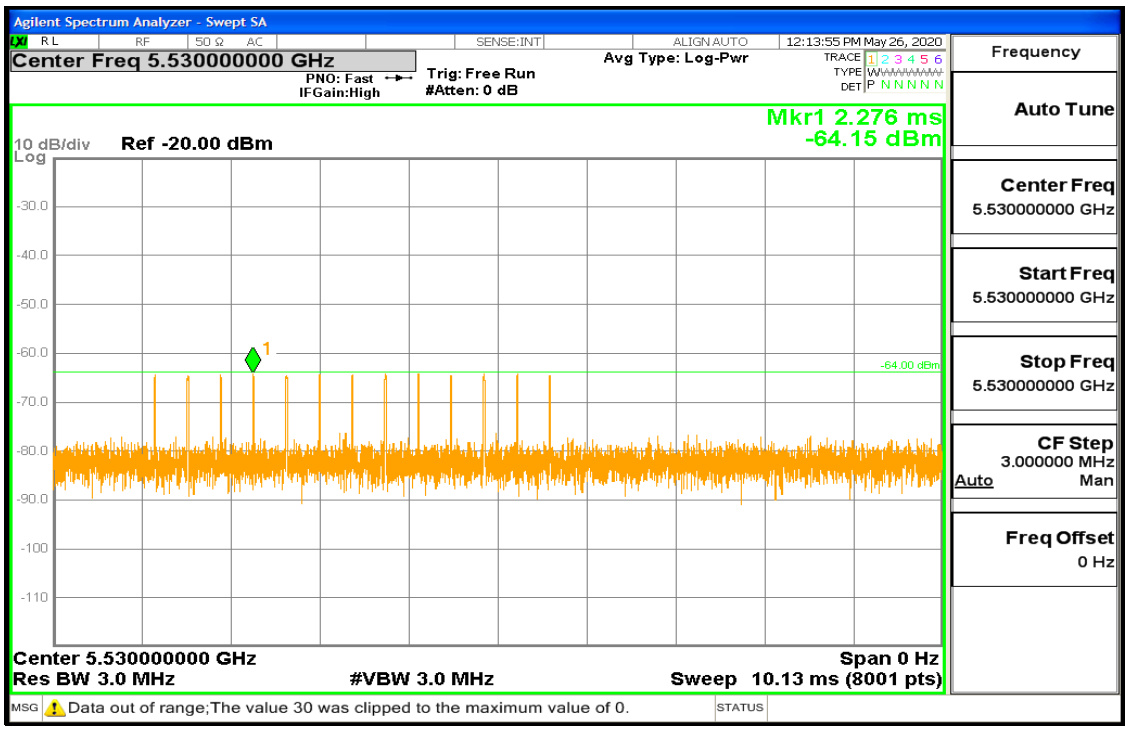
Radar type 4



Radar type 5

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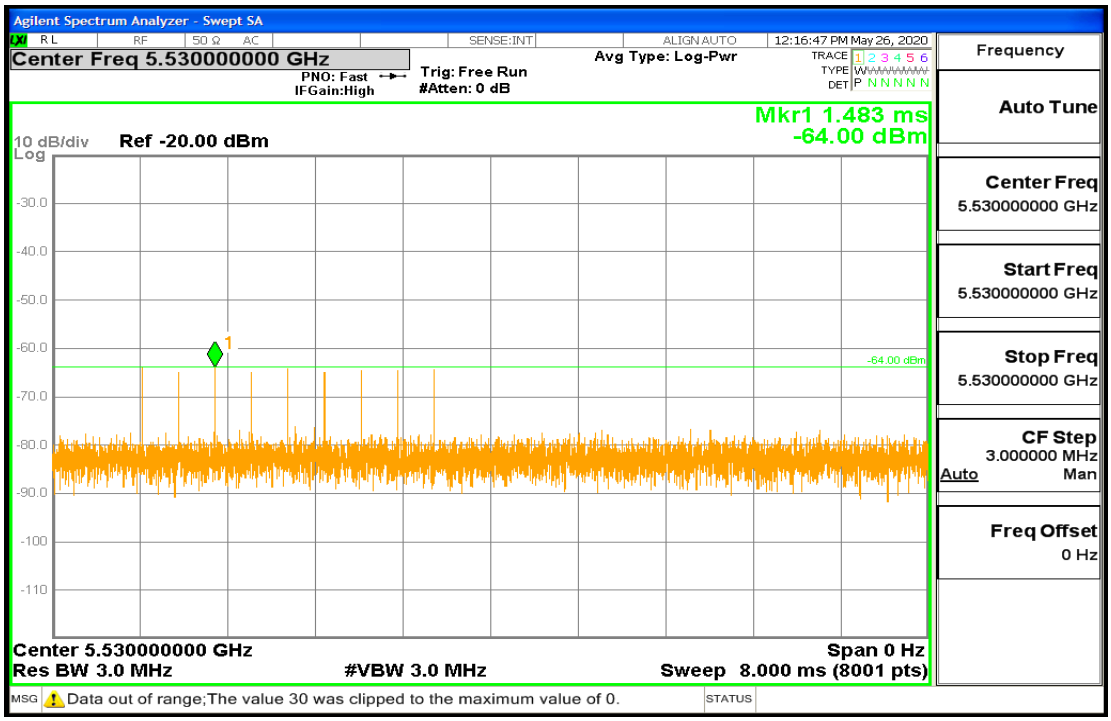
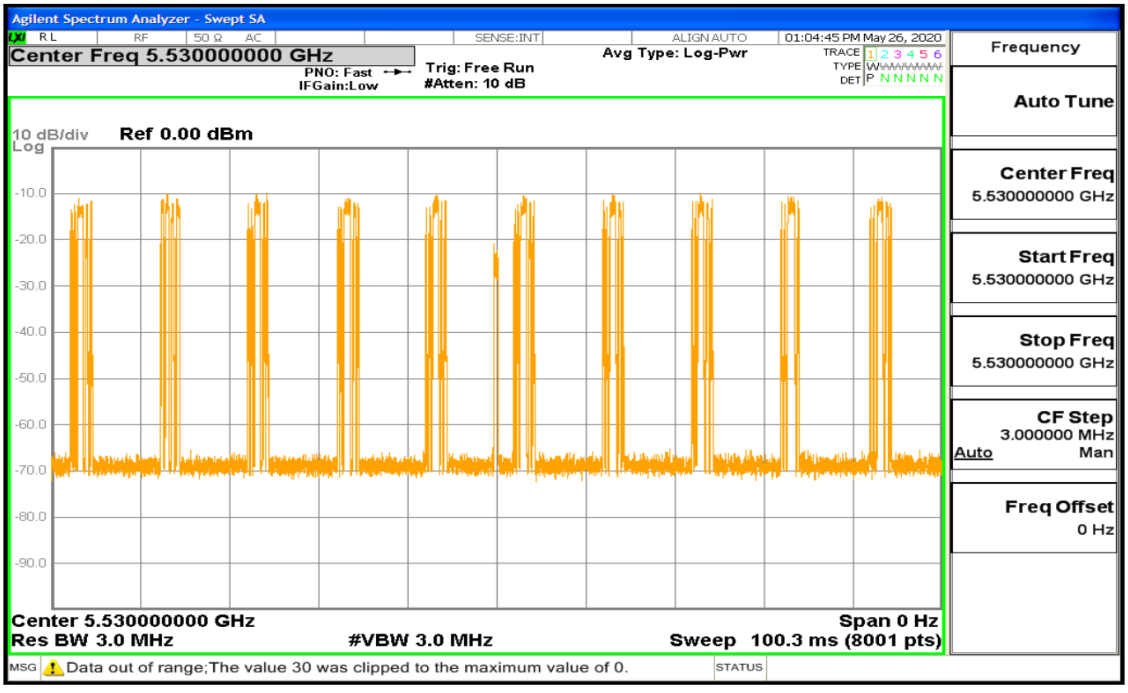
Radar type 6



WLAN traffic



Duty Cycle: 18.86014 %

** The Channel Loading must be more than 17%*

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Test Result of Channel closing Transmission Time and Channel Move Time

Channel Shutdown Result				
Detection Threshold Level (dBm)			-64	
Modulation Mode	**Freq. (MHz)**	**Radar Test Signal**	**Channel Closing Transmission Time(ms) 200ms~10sec**	**Channel Move Time(s)**
AX_HE80	5290	Type 0	20	0.928
AX_HE80	5530	Type 0	18	0.848
Limit			60 ms	10 sec
Result			**Complied**	

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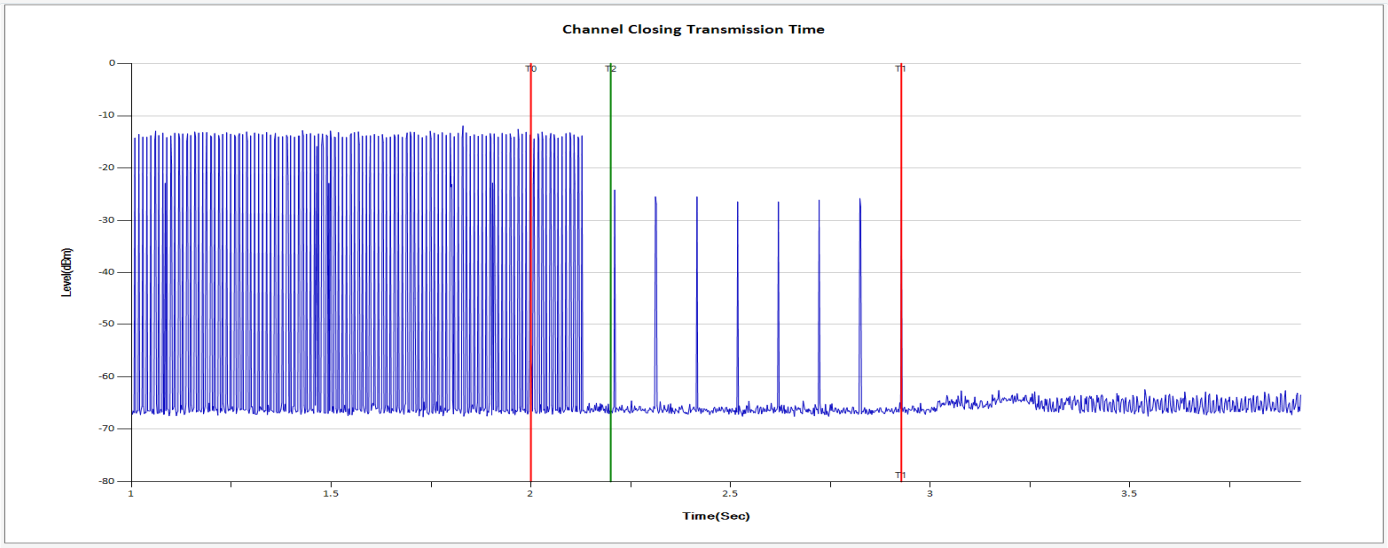
Radar Type 0 Channel Move and Closing Transmission Time – 1

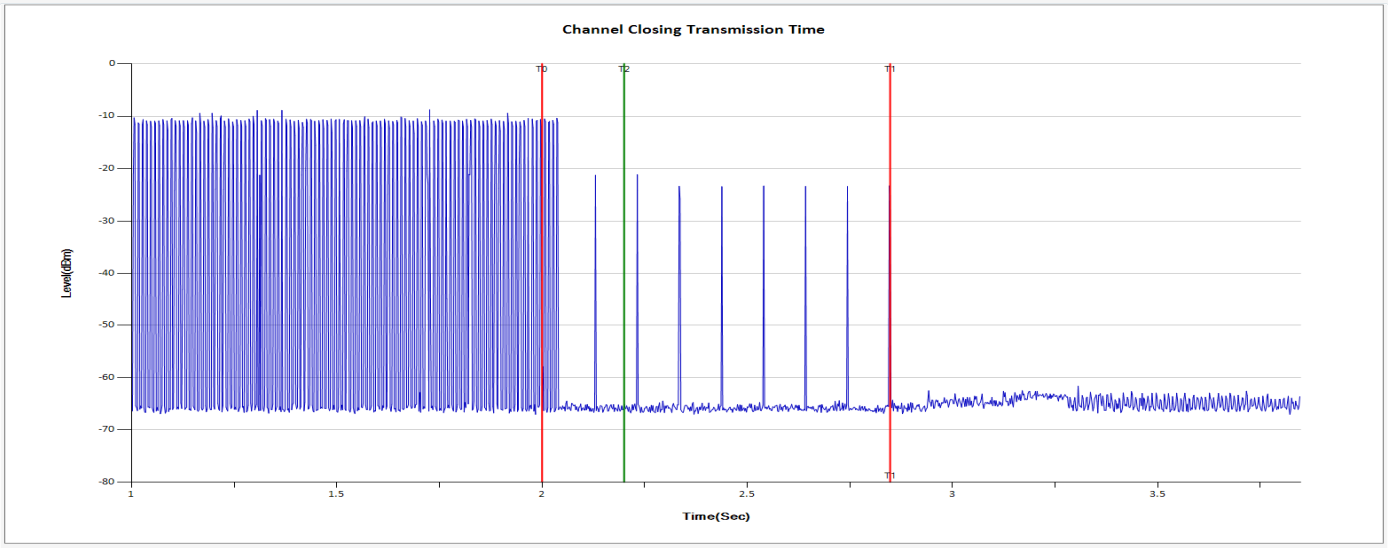
802.11 ax HE80 CH 5290



T0: 2 Sec(Radar Injection)
T1: 2.928 Sec(Eut Move Time)
T2: 2.2 Sec(200ms Interval)

Channel Move Time: 0.928 Sec
Channel Closing Transmission Time: 0.02 Sec

802.11 ax HE80 CH 5530



T0: 2 Sec(Radar Injection)
T1: 2.848 Sec(Eut Move Time)
T2: 2.2 Sec(200ms Interval)

Channel Move Time: 0.848 Sec
Channel Closing Transmission Time: 0.018 Sec

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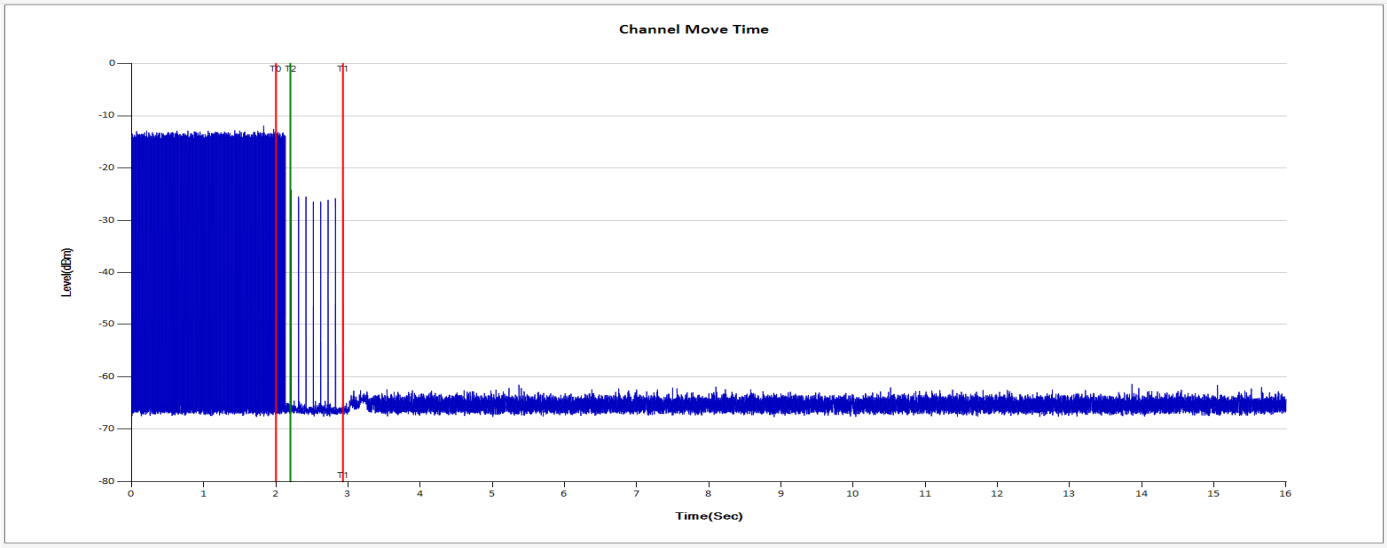
Radar Type 0 Channel Move and Closing Transmission Time - 2

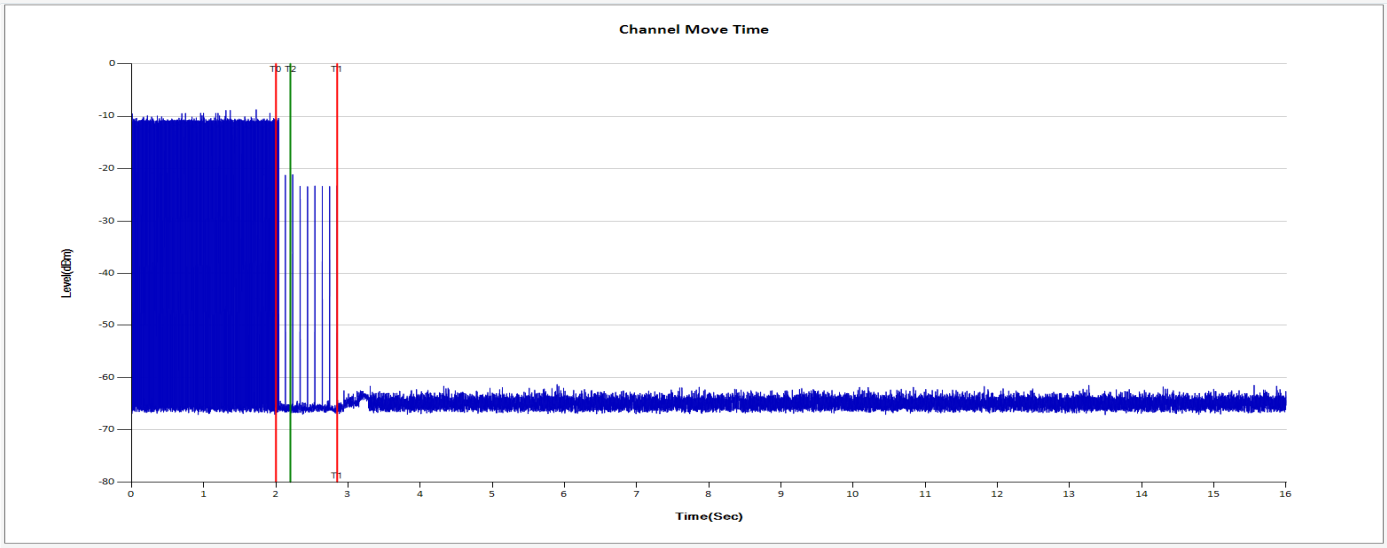
802.11 ax HE80 CH 5290



T0: 2 Sec(Radar Injection)
T1: 2.928 Sec(Eut Move Time)
T2: 2.2 Sec(200ms Interval)

Channel Move Time: 0.928 Sec
Channel Closing Transmission Time: 0.02 Sec

802.11 ax HE80 CH 5530



T0: 2 Sec(Radar Injection)
T1: 2.848 Sec(Eut Move Time)
T2: 2.2 Sec(200ms Interval)

Channel Move Time: 0.848 Sec
Channel Closing Transmission Time: 0.018 Sec

Verdict: *Note: narrowing the sweep time as the good engineering process for the verification of transmission closing in 200ms*

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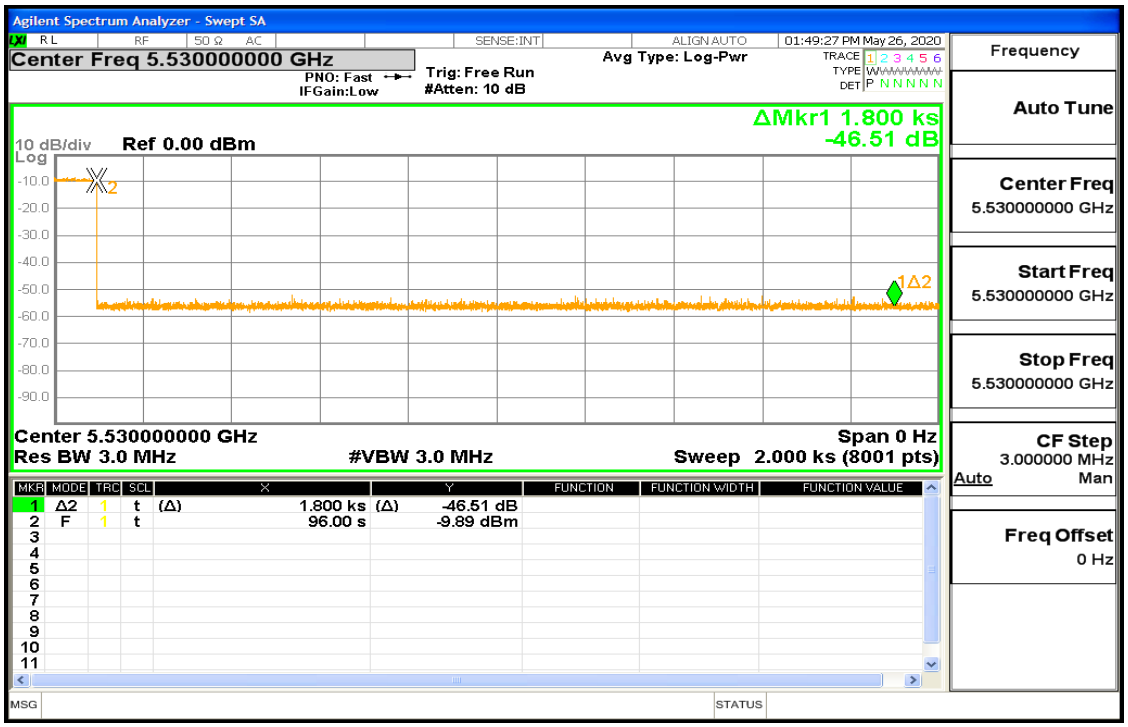
Non-occupancy Period (without radar detection)

CH5290

CH 5530



Verdict: *To verify whether channel is unavailable to be operated in 30 minutes.*

1.8ks = 1800s = 1800 s/min /60 = 30minute

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~ End of Report ~

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