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ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART E REQUIREMENT DFS TEST REPORT

ASKEY COMPUTER CORP. Applicant:

10F, NO.119, JIANKANG RD., ZHONGHE DIST., NEW TAIPEI CITY

TAIWAN, R.O.C.

Product Name: Wireless module

Model No.: WLU5540B-D81(NB-RoHS)

Model Difference: N/A

FCC ID: H8N-WLU5540B-NB

Report Number: ER/2018/60112 **FCC Rule Part:** §15.407, Cat: NII

Issue Date: Sep. 18, 2018

Date of Test: Jun. 12, 2018~ Sep. 06, 2018

Date of EUT Received: Jun. 12, 2018

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory 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.

Tested By:

Louis Chen / Engineer

Approved By:

Blue Yang / Supervisor





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(R チカガ 乳切り) 近根音級大理対例(人) (R の) 異 「同可以後の理解報句人。 本格音を集めたなり音曲に行う。 This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <u>www.sqs.com/terms and conditions.htm</u> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <u>www.sqs.com/terms e-document.htm</u>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law



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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
ER/2018/60112	Rev.00	Initial creation of docu- ment	All	Sep. 18, 2018	Stefanie Yu / Clerk

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GENERAL INFORMATION

1.1 Product Description

General:

Wireless module
Panasonic
WLU5540B-D81(NB-RoHS)
N/A
REV2
N/A
Ubuntu 12.04.1
v.62132
v 0.0.4.26
v.1.0.1
5Vdc from USB Port

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WI AN 5GHz:

WLAN 5GF WLAN		Channels	Potod Dower (Ava.) (dPm)	Modulation
802.11	Frequency Range	Channels	Rated Power (Avg.) (dBm)	Technology
	5180~5240	4	21.28	
	5260~5320	4	21.07	OFDM
а	5500~5700	12	19.48	OFDIVI
	5745-5825	5	25.47	
	5180~5240	4	HT: 21.26 (Worst case)	
n_HT ac_VHT	5260~5320	4	HT: 21.01 (Worst case)	OFDM
20M	5500~5700	11	HT: 19.57 (Worst case)	OFDIVI
	5745-5825	5	HT: 25.43 (Worst case)	
	5190~5230	2	HT: 21.39 (Worst case)	OFDM
n_HT ac_VHT 40M	5270~5310	2	HT: 21.16 (Worst case)	
	5510~5670	5	HT: 19.68 (Worst case)	
	5755~5795	2	HT: 25.40 (Worst case)	
5210		1	13.01	
ac_VHT	5290	1	12.63	OFDM
80M	5530~5610	2	19.42	OFDIVI
	5775	1	18.15	
Modulation type		64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 802.11ac only		
Transition Rate:s		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		

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Modulation type	64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 802.11ac only
	PIFA Antenna, 5150~5250MHz Gain: 4.72dBi (Main) 5250~5350MHz Gain: 4.72dBi (Main)
Antenna Designation:	5470~5725MHz Gain: 6.42dBi (Main) 5725~5850MHz Gain: 4.46dBi (Main)
	5150~5250MHz Gain: 6.30dBi (Aux) 5250~5350MHz Gain: 6.30dBi (Aux) 5470~5725MHz Gain: 8.01dBi (Aux)
Transition Rate:	5725~5850MHz Gain: 5.86dBi (Aux) 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

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1.2 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 All test items have been performed and record as per the above standards.

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803 (TAF code 0513)

FCC Registration Number and Designation are: 509634 / TW0001.

1.4 Special Accessories

There are no special accessories used while test was conducted.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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SUMMARY OF TEST RESULT

FCC Rules	Description Of Test	Result
§15.407(h)	TPC and DFS Measurement	Compliant

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.

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TPC AND DFS MEASUREMENT

4.1. 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.

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

4.2. **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

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

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4.2.1. Limit

Table 1: Applicability of DFS requirements prior to use of a channel

	Operational Mode		
Requirement -	Master	Client(without radar detection)	Client(with radar detection)
Non-occupancy Period	Yes	Yes	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: Applicability of DFS requirements during normal operation

	Operational Mode		
Requirement	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 Band- width and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Trans- mission 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.

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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	-62 dBm
power spectral density < 10 dBm/MHz	
EIRP < 200 milliwatt that do not meet the power spectral	-64 dBm
density requirement	

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.

Devices	DFS Threshold
Devices with an e.i.r.p. < 200 mW AND a	-62 dBm
Power Spectral Density < 10 dBm/MHz	
Devices with	-64 dBm
$200 \text{ mW} \le \text{e.i.r.p.} \le 1 \text{ W}$	

Note: The detection threshold power is the received power, averaged over a 1-microsecond reference to a 0 dBi antenna.

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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	Pulse	PRI	Number of Pulses	Minimum	Minimum
Type	Width	(µsec)		Percentage of	Number
	(µsec)			Successful	of
				Detection	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 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	Roundup $ \left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{\text{PRI}_{\mu \text{sec}}} \right) \right\} $	60%	30
2	1.5	selected in Test A	22.20	600/	20
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

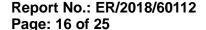
Frequency Hopping Radar

-	- <i>)</i>	P9 .						
	Radar	Pulse	PRI	Pulses	Hopping	Hopping	Minimum	Minimum
	Type	Width	(µsec)	per	Rate	Sequence	Percentage of	Number of
		(µsec)		Hop	(kHz)	Length	Successful	Trials
						(msec)	Detection	
	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.

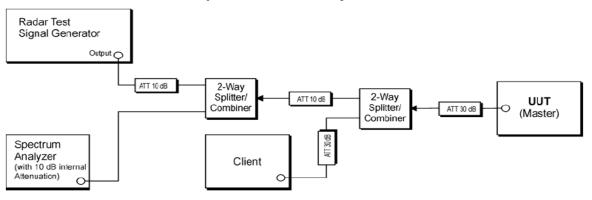
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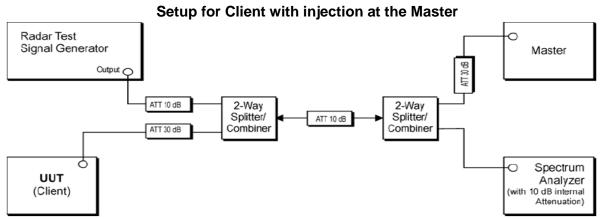
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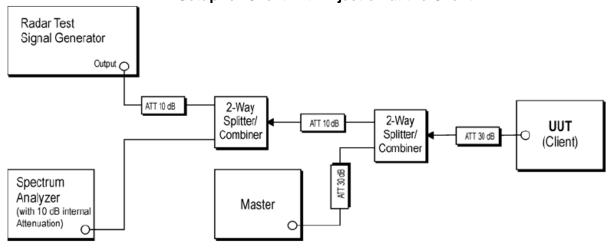
4.2.2. Test Setup

Setup for Master with injection at the Master





Setup for Client with injection at the Client



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4.2.3. Test Equipment Used:

Conducted Emission Test Site								
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.			
PXA Spectrum Ana- lyzer	Agilent	N9030A	MY53120760	2018/04/09	2019/04/08			
Signal Generator	Agilent	N5172B	MY53050661	2018/04/05	2019/04/04			
Power Splitter	Mini-Circuits	ZN2PD-9G-S+	N/A	2018/01/02	2019/01/01			
Power Splitter	Mini-Circuits	ZN2PD-9G-S+	N/A	2018/01/02	2019/01/01			
Attenuator	Agilent	8495B	3308A22470	2018/01/02	2019/01/01			
Attenuator	HP	8494B	2812A170605	2018/01/02	2019/01/01			
Notebook	Lenovo	T440P	P0000564	N/A	N/A			
Accece Ponit	Cisco	AIR-LAP1262 N-A-K9	FTX1605E1G1 FCC ID:LDK102073	N/A	N/A			

4.2.4. 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.

The EUT utilizes the 802.11a/n 40M architecture, with a nominal channel bandwidth of 40MHz 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 -62dBm.after correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is -62dBm, and the master device as employed for the applicable DFS test is CISCO router whose FCC ID= LDK102073

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 -62dBm

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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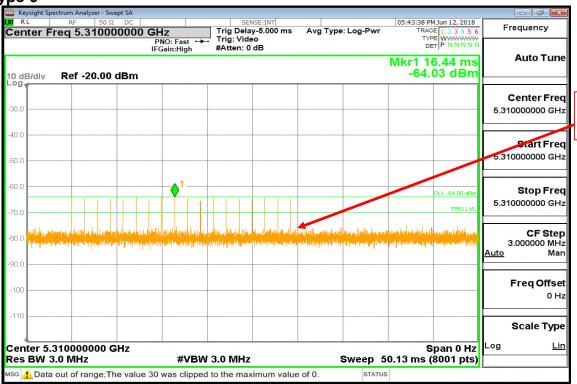
Noise Floor

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4.2.5. Test results

Calibration plots for each of the required radar waveforms

Radar type 0



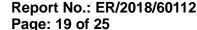
Radar type 1-A



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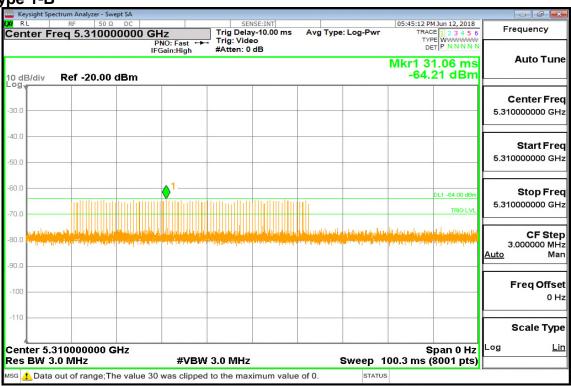
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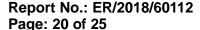
Radar type 1-B



Radar type 2



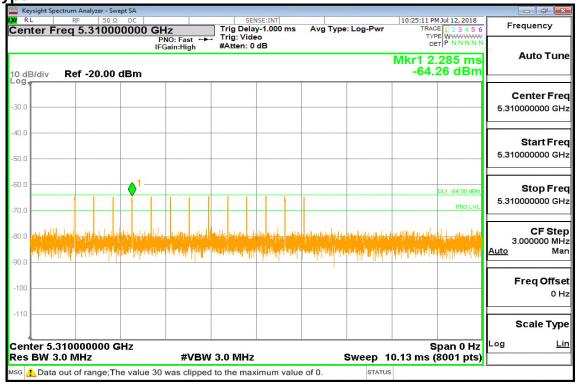
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Radar type 3



Radar type 4



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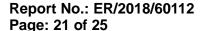
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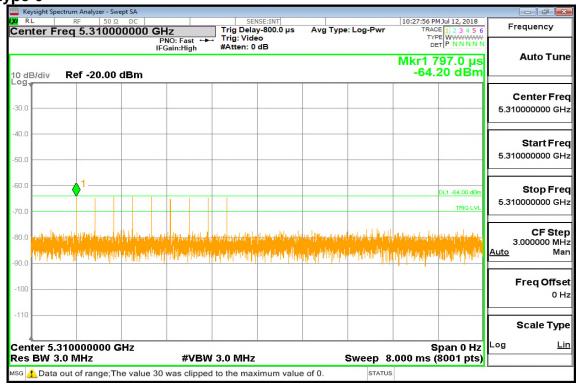
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Radar type 5



Radar type 6



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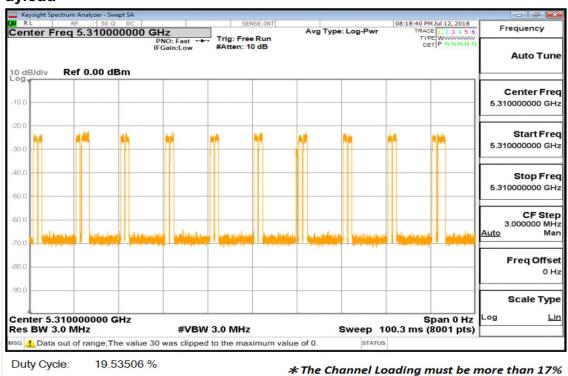
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WLAN Payload



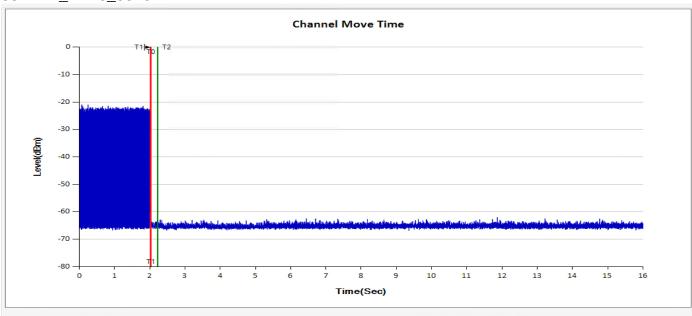
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Radar Type 1 Channel Move and Closing Transmission Time – 1 802.11n_HT40_5310MHz



T0: 2.02428 Sec(Radar Injection)

T1: 2.02428 Sec(Eut Move Time)

T2: 2.22428 Sec(200ms Interval)

Channel Move Time: 0 Sec

Channel Closing Transmission Time: 0 Sec



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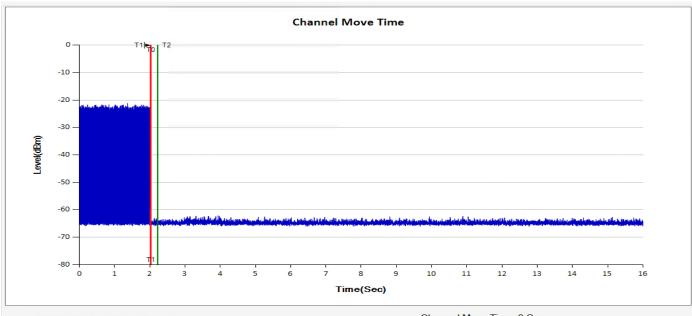
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Radar Type 1 Channel Move and Closing Transmission Time 802.11n_HT40_5510MHz



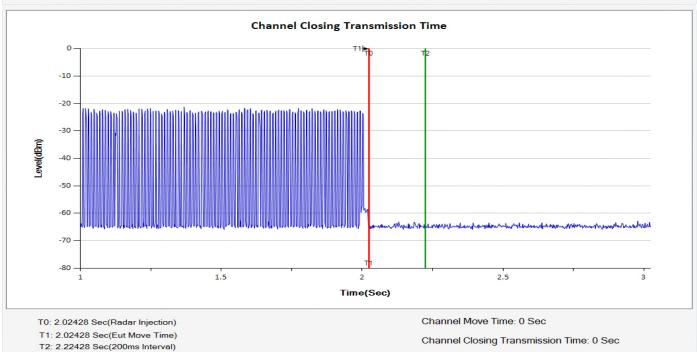
T0: 2.02428 Sec(Radar Injection)

T1: 2.02428 Sec(Eut Move Time)

T2: 2.22428 Sec(200ms Interval)

Channel Move Time: 0 Sec

Channel Closing Transmission Time: 0 Sec



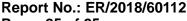
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Non-occupancy Period (without radar detection)



Verdict:

To verify whether channel is unavailable to be operated in 30 minutes. 1.8ks = 1800s = 1800 s /60 = 30minute

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				
HT40	5310	Type 0	0	0.000		
HT40	HT40 5510 Type 0		0	0.000		
	Limit		60 ms	s 10 sec		
	Result		С	omplied		

~ End of Report ~

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