ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

EUT Description	Sparrow Wi-Fi Module
Applicant:	BOTS UNLIMITED LLC 5817 La Colonia, San Antonio, Texas 78218, USA
Manufacturer:	BOTS UNLIMITED LLC 5817 La Colonia, San Antonio, Texas 78218, USA
Brand Name:	Bots Unlimited
Model No.:	SP-01-100
Report Number:	TERF2506001931ER
FCC ID	2BPPF-SP01
Date of EUT Received:	June 6, 2025
Date of Test:	June 9, 2025～August 19, 2025
Issue Date:	September 5, 2025

Approved By _____

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 C63.10:2020 and the energy emitted by the sample EUT comply with FCC rule part §15.407.

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

Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TERF2506001931ER	00	Original	Aug. 27, 2025	Candice Li	
TERF2506001931ER	01	Modify the index on page 3; Section 3, 4.1, 5.1, 6.1,6.5	Sep. 5, 2025	Candice Li	*

Note:

1、 The remark "*" indicates modification of the report upon requests from certification body.

Contents

1 GENERAL INFORMATION

1.1 Product Description

EUT Description	Sparrow Wi-Fi Module
Brand Name:	Bots Unlimited
Model No.:	SP-01-100
Hardware Version:	1
Firmware Version:	W16.88.10.p173-16.26.10.p173-C4X16698_V4
EUT Series No.:	254WSP-01-EVKAAAA101000001
Power Supply:	3.3 Vdc, 1.8 Vdc
Test Software (Name/Version)	N/A

1.2 DFS Firmware version

1.3 Modulation & Data Rate

Modulation type:	64QAM, 16QAM, QPSK, BPSK for OFDM in 802.11a,11n
	256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM in 802.11ac
Transition Rate:	802.11 n_HT20: up to 144.4 Mbps
	802.11 n_HT40: up to 300 Mbps
	802.11 ac_VHT80: up to 866.6 Mbps

Wi-Fi	Frequency Range	Channels	EIRP/Avg	Modulation Technology
802.11a	5180~5240	4	Avg	OFDM
	5260~5320	4	Avg	OFDM
	5500~5700	12	Avg	OFDM
	5745-5825	5	Avg	OFDM
	5845~5885	3	EIRP	OFDM
802.11n_HT20	5180~5240	4	Avg	OFDM
	5260~5320	4	Avg	OFDM
	5500~5720	12	Avg	OFDM
	5745-5825	5	Avg	OFDM
	5845~5885	3	EIRP	OFDM
802.11n_HT40	5190~5230	2	Avg	OFDM
	5270~5310	2	Avg	OFDM
	5510~5710	6	Avg	OFDM
	5755-5795	2	Avg	OFDM
	5835~5875	2	EIRP	OFDM
802.11ac_VHT80	5210	1	Avg	OFDM
	5290	1	Avg	OFDM
	5530~5690	3	Avg	OFDM
	5775	1	Avg	OFDM
	5855	1	EIRP	OFDM

1.4 Antenna Designation

Antenna Type	Supplier	Antenna Model No.	Ant No.	Freq. (MHz)	Peak Antenna Gain (dBi)
Flexible Printed Circuit	ABRACON	AFG4507W2	Ant0	5150 – 5250	7.68
				5250 – 5350	8.12
				5470 – 5725	8.12
				5725 – 5850	6.91
				5850 – 5895	6.91
Flexible Printed Circuit	ABRACON	AFG4507W2	Ant1	5150 – 5250	7.68
				5250 – 5350	8.12
				5470 – 5725	8.12
				5725 – 5850	6.91
				5850 – 5895	6.91

Note:
1. Pre-scanned was done on the above antennas, measurements were demonstrated by using the antenna with the highest gain as the worst case scenarios.
2. The antenna information is provided by the applicant. The laboratory does not verify the accuracy of this information, and all test results related to antenna characteristics are based solely on the data supplied. Responsibility for the authenticity and accuracy of these specifications rests entirely with the party who provided the information.
3. The antenna complies with part 15.203 requirement and no consideration of replacement. Please see EUT photo for details.
4. The directional gain is calculated according to section F. 2). e). (ii) of FCC KDB 662911 D01.

2 SUMMARY OF TEST RESULT

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

2.1 Test Methodology of Applied Standards

1. FCC Part 15, Subpart E §15.407
2. FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02
3. FCC KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02

2.2 Measurement Uncertainty

Test Items	Uncertainty		
TPC and DFS Measurement	+/-	1.49	Hz
Temperature	+/-	0.6	°C
Humidity	+/-	3	%
DC / AC Power Source	+/-	1	%

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

2.3 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation Number / Registration Number	IC CAB identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1	TW0027 / 891563	TW3702
		SAC 2		
		SAC 3		
		Conduction 1		
		Conducted 1		
		Conducted 2		
		Conducted 3		
		Conducted 4		
		Conducted 5		
		Conducted 6		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C	TW0028 / 200037	
		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G		

Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

Temperature:	20-23	°C	Relative Humidity:	48-79	%
Test site	Conducted 2		Test Start:	07/11/2025	
Test Engineer:	Dannis Chen		Test Done:	08/10/2025	

3 TEST INSTRUMENT

Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
Attenuator	Mini-Circuits	BW-S10W2+	4	12/11/2024	12/10/2025
DC Block	Titan	T0610A00127A	SNK47008	12/11/2024	12/10/2025
Power Meter	Anritsu	ML2496A	2138003	10/09/2024	10/08/2025
Power Sensor	Anritsu	MA2411B	1911393	10/09/2024	10/08/2025
Power Sensor	Anritsu	MA2411B	1911394	10/09/2024	10/08/2025

Conducted Emission Test Site: Conducted 6					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
DC Block	Mini-Circuits	BLK-18-S+	31129	12/11/2024	12/10/2025
EXA Spectrum Analyzer	Agilent	N9010A	MY54200716	10/14/2024	10/13/2025
Manual Attenuator	Agilent	8496B + 8494B	MY42147434 + MY42152151	12/11/2024	12/10/2025
Signal Generator	KEYSIGHT	N5182B	MY61252553	09/24/2024	09/23/2025
Splitter	RF-Lambda	RFLT2W1G18G	21032900019	12/11/2024	12/10/2025
Splitter	RF-Lambda	RFLT4W1G18G	18090300133	12/11/2024	12/10/2025
Splitter	Titan	T0510E2W118Q	22015158	12/11/2024	12/10/2025
Splitter	RF-Lambda	RFLT2W1G18G	18112200209	2024/12/11	2025/12/10
Test Software	KEYSIGHT	N7607B Signal Stdio for DFS Radar profile	Ver. 3.2.0.0	N.C.R	N.C.R

Conducted Emission Test Site: Conducted 6					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
Access Point	ASUS	GT-AXE11000	LBIAJF200192	N/A	N/A
Notebook	Lenovo	T470	PF-0XLQGV 19/09	N/A	N/A
Notebook	Lenovo	X270	PC-0SWYQR 18/02	N/A	N/A

NOTE: *N.C.R refers to Not Calibrated Required*

4 REGULATORY REQUIREMENTS

4.1 Transmit Power Control (TPC)

According to Part 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.

4.2 Dynamic Frequency Selection (DFS)

4.2.1 FCC

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.

Applicability of DFS requirements during normal operation

Requirement	Operational Mode
	Client Without Radar Detection
DFS Detection Threshold	Not required
Channel Closing Transmission time	Yes
Channel Move time	Yes
U-NII Detection Bandwidth	Not required

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.

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.	

(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 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.

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.

Additional requirements for devices with multiple bandwidth mode	**Client Without Radar Detection**
U-NII Detection Bandwidth and Statistical Performance Check	Not required
Channel Move Time and Channel Closing Transmission Time	Test using the widest BW mode available for the link
All other tests	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.

4.3 Applicability of DFS requirements during normal operation

Requirement	**Operational Mode**
	Client Without Radar Detection
DFS Detection Threshold	Not required
Channel Closing Transmission time	Yes
Channel Move time	Yes
U-NII Detection Bandwidth	Not required

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.	

Additional requirements for devices with multiple bandwidth mode	Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	Not required
Channel Move Time and Channel Closing Transmission Time	Test using the widest BW mode available for the link
All other tests	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.	

4.4 Radar Test Waveforms

4.4.1 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.					

4.4.2 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

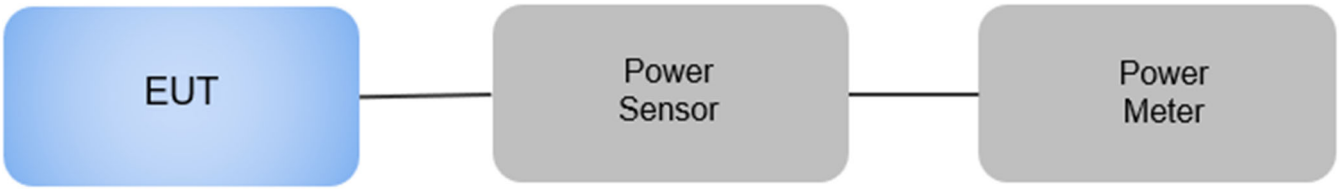
4.4.3 Frequency Hopping Radar

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.

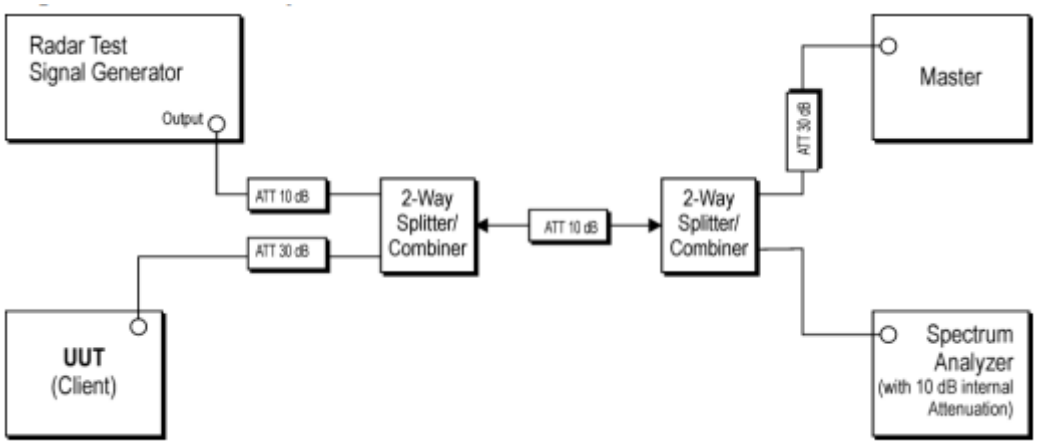
5 TEST CONFIGURATION

5.1 Transmitter Power Control (TPC)



5.2 Dynamic Frequency Selection (DFS)

Setup for Client with injection at the Master



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.

WLAN traffic is generated by streaming the mpeg file from the master to slave in full monitor video mode using the media player or transmit the data with the minimum channel loading of approximately 17%.

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

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

IP based system:

For the required channel loading, send packets via software to reach the applicable pay load via the UE to the slave.

6 TEST RESULTS

6.1 Transmit Power Control (TPC)

Yes, The EUT equipped with TPC function.

802.11a_Ch0

CH	Frequency (MHz)	TOTAL POWER (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)
52	5260	12.76	8.12	20.88	122.462
60	5300	12.88	8.12	21.00	125.893
64	5320	12.99	8.12	**21.11**	**129.122**
100	5500	11.49	8.12	19.61	91.411
116	5580	12.34	8.12	**20.46**	**111.173**
140	5700	3.98	8.12	12.10	16.218
144	5720	**15.25**	8.12	**23.37**	**217.270**

802.11a_Ch1

CH	Frequency (MHz)	TOTAL POWER (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)
52	5260	12.75	8.12	20.87	122.180
60	5300	12.83	8.12	20.95	124.451
64	5320	12.95	8.12	**21.07**	**127.938**
100	5500	11.19	8.12	19.31	85.310
116	5580	12.25	8.12	**20.37**	**108.893**
140	5700	3.96	8.12	12.08	16.144
144	5720	**15.10**	8.12	**23.22**	**209.894**

802.11n_HT20_2TX

CH	Frequency (MHz)	TOTAL POWER (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)
52	5260	12.08	8.12	20.20	104.713
60	5300	12.27	8.12	**20.39**	**109.396**
64	5320	12.27	8.12	**20.39**	**109.396**
100	5500	12.15	8.12	**20.27**	**106.414**
116	5580	11.64	8.12	19.76	94.624
140	5700	6.67	8.12	14.79	30.130
144	5720	**15.62**	8.12	**23.74**	**236.592**

802.11n_HT40_2TX

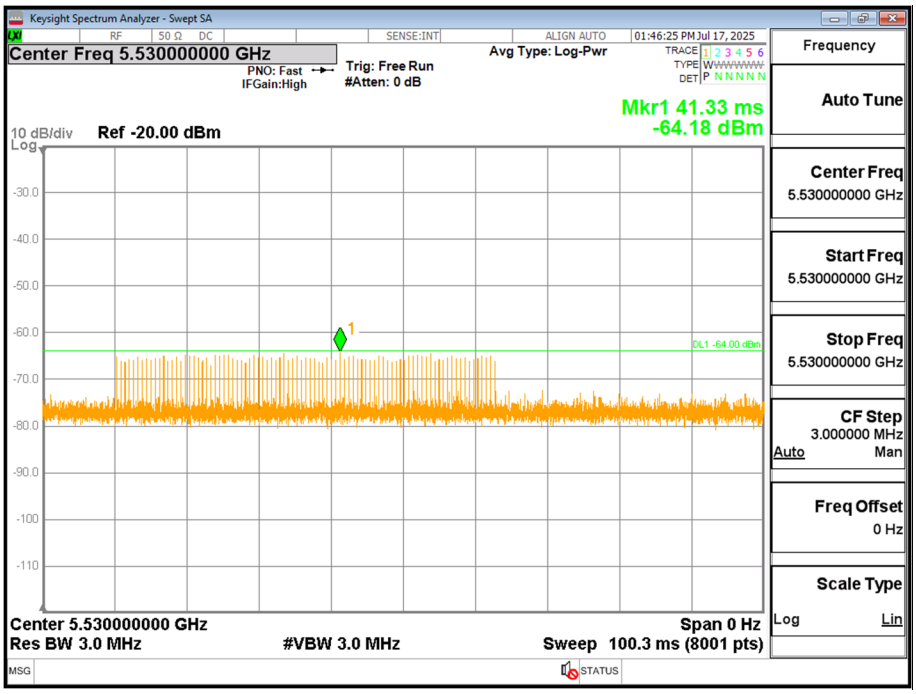
CH	Frequency (MHz)	TOTAL POWER (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)
54	5270	**15.14**	8.12	**23.26**	**211.836**
62	5310	6.35	8.12	14.47	27.990
102	5510	7.49	8.12	15.61	36.392
110	5550	14.80	8.12	**22.92**	**195.884**
134	5670	13.93	8.12	**22.05**	**160.325**
142	5710	12.87	8.12	20.99	125.603

802.11ac_VHT80_2TX

CH	Frequency (MHz)	TOTAL POWER (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)
58	5290	4.18	8.12	**12.30**	**16.982**
106	5530	9.12	8.12	17.24	52.966
122	5610	11.52	8.12	19.64	92.045
138	5690	**15.71**	8.12	**23.83**	**241.546**

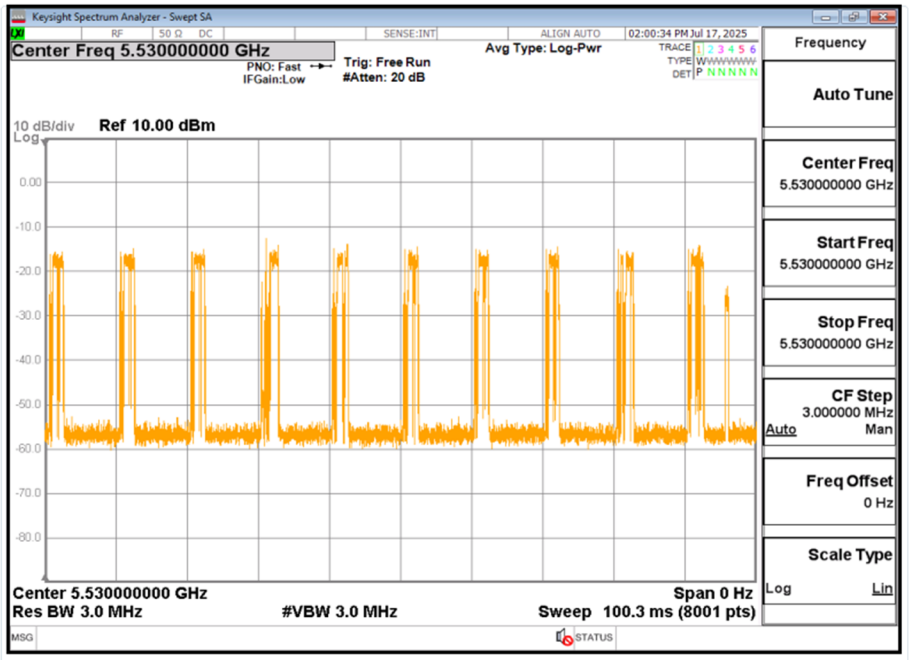
6.2 Radar waveforms

802.11ac_VHT80 5530MHz Radar type 0



6.3 WLAN traffic

802.11ac_VHT80 5530MHz



Duty Cycle: 17.67279 %

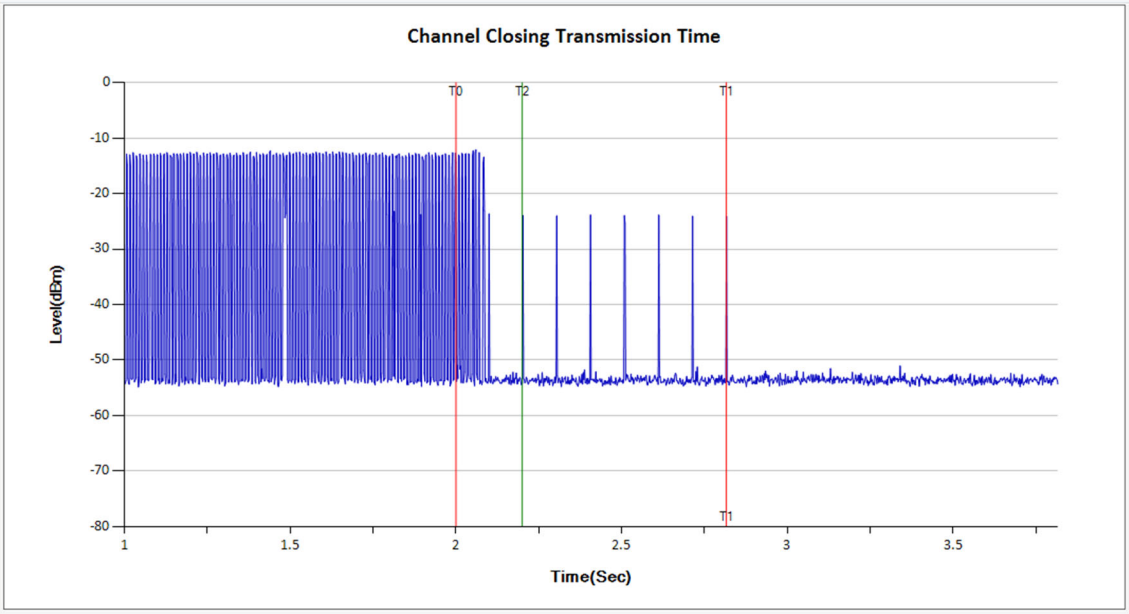
**The Channel Loading must be more than 17%*

6.4 Channel closing transmission and 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)
VHT80	5530	Type 0	16	0.816
Limit			60 ms	10 sec
Result			Complied	

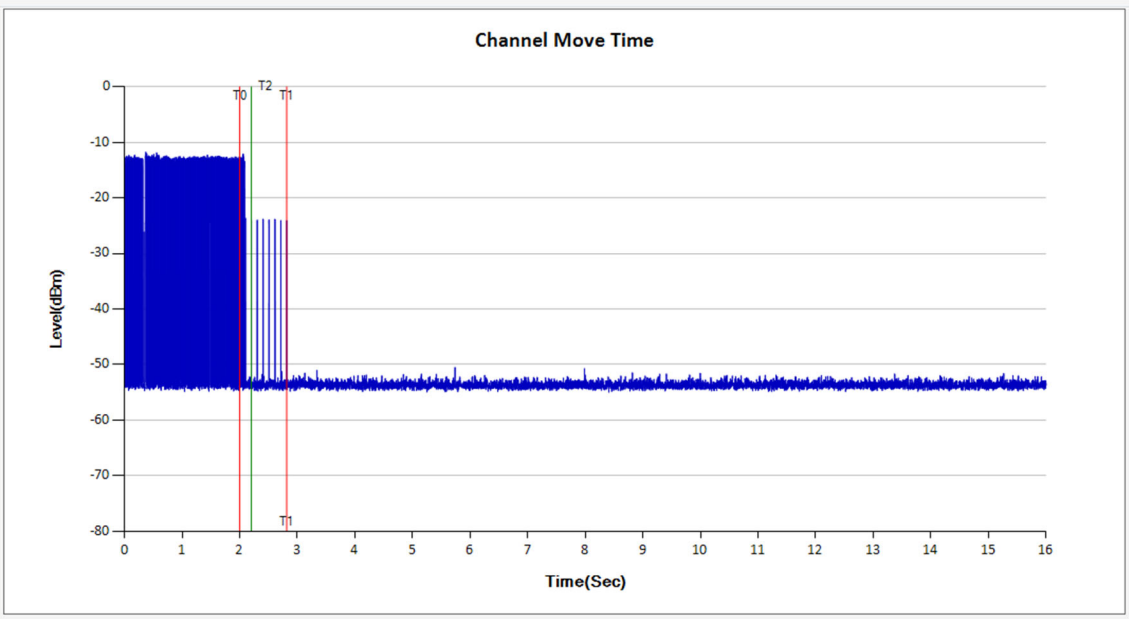
6.4.1 Channel Move and Closing Transmission Time

802.11ac_VHT80 5530MHz



T0: 2 Sec(Radar Injection)
T1: 2.816 Sec(Eut Move Time)
T2: 2.2 Sec(200ms Interval)

Channel Move Time: 0.816 Sec
Channel Closing Transmission Time: 0.016 Sec



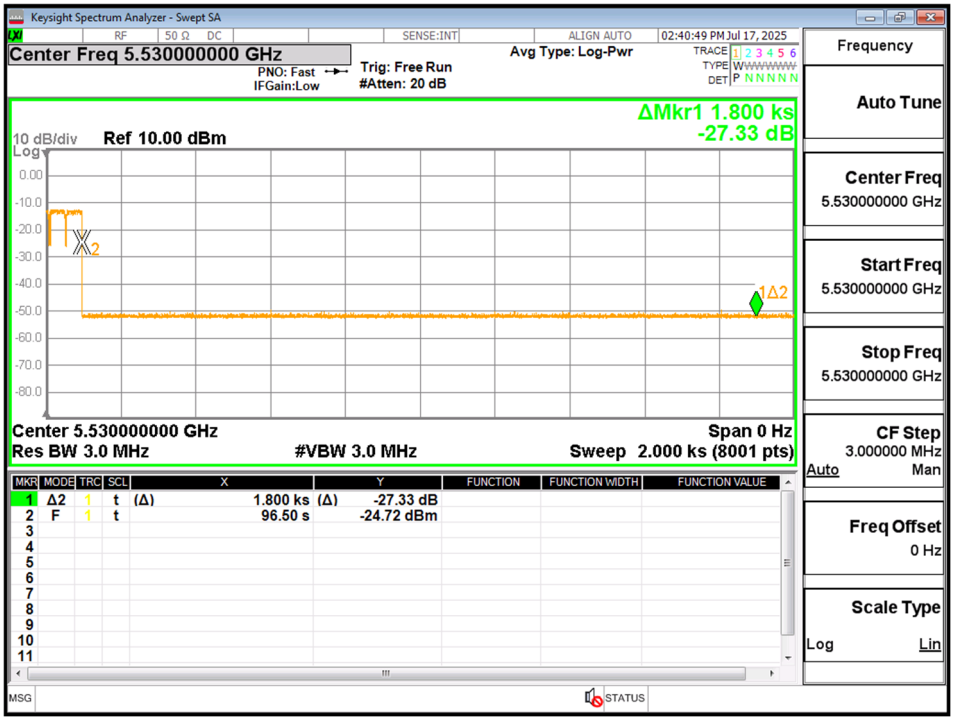
T0: 2 Sec(Radar Injection)
T1: 2.816 Sec(Eut Move Time)
T2: 2.2 Sec(200ms Interval)

Channel Move Time: 0.816 Sec
Channel Closing Transmission Time: 0.016 Sec

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

6.5 Non-occupancy Period (without radar detection)

802.11ac_VHT80 5530MHz



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

~ End of Report ~