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Dynamic Frequency Selection Test Report

EUT Name: Wireless Audio Headset

Model No.: Stealth 600X Gen 2

CFR 47 Part 15.407(h) 2020 and KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

Prepared for:

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Revisions

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0	06/12/2020	Original Document	N/A

Note: Latest revision report will replace all previous reports.

Statement of Compliance

Manufacturer:	Voyetra Turtle Beach, Inc. 100 Summit Lake Drive, Suite 100 Valhalla, New York 10595 USA (530) 277-3482
Requester / Applicant:	Tim Blaney
Name of Equipment:	Wireless Audio Headset
Model No.	Stealth 600X Gen 2 (TB300-2315-01)
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.407(h) 2020 and KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02
Test Dates:	May 26, 2020 to May 30, 2020

Guidance Documents:

Dynamic Frequency Selection: CFR47 Part 2 and 15.407(h), KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

Test Methods:

Dynamic Frequency Selection: CFR47 Part 2 and 15.407(h), KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

The Dynamic Frequency Selection test and documented data described in this report has been performed and recorded by TUV Rheinland, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that the equipment described above has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by A2LA or any agency of the U.S. Government. This report contains data that are not covered by A2LA accreditation. This report shall not be reproduced except in full, without the written authorization of TUV Rheinland of North America.

Jeremy Luong	June 12, 2020	Kerwinn Corpuz	June 12, 2020
Test Engineer	Date	Reviewer Signature	Date

Testing Cert #3331.02 **US1131** **2932M-1**

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1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15.407(h) 2020 and KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02 based on the results of testing performed on May 26, 2020 through May 30, 2020 on the Wireless Audio Headset Model Stealth 600X Gen 2 manufactured by Voyetra Turtle Beach, Inc.. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the dynamic frequency selection performance of the Wireless Audio Headset in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Summary of Test Results

Table 1: Summary of Test Results for Client Device Mode

Requirements	Test Method KDB 905462	Description	Test Parameters	Measured Value	Result
20 MHz Bandwidth					
Detection Threshold	Sect. 7.8.1	EUT Min. Detection Level	-64 dBm ≥ 200 mW -62 dBm <200 mW	Not Required*	**N/A**
Detection Bandwidth	Sect. 7.8.1	U-NII Detection Bandwidth	Min 100% of 99% BW.	Not Required*	**N/A**
Performance Requirements Check	Sect. 7.8.2.1	Initial Channel Check	CAC ≥ 60s	Not Required*	**N/A**
	Sect. 7.8.2.2	Burst Radar at the beginning	150s (2.5min)	Not Required*	**N/A**
	Sect. 7.8.2.3	Burst Radar at the End	150s (2.5min)	Not Required*	**N/A**
In-Service Monitoring	Sect. 7.8.3	Channel Moving Time	CMT ≤ 10s	162.2 ms	**Complied**
		Channel Closing Time Transmission	200 ms + an agg. Of 60 ms over remaining 10s.	60.9 ms	**Complied**
		Non-Occupancy Period	≥ 30 min.	> 30 min.	**Complied**
Radar Statistic Performance Check	Sect. 7.8.4	Waveform 1 - 4 Detections	60% in 30 trials 80% of Aggregate	Not Required*	**N/A**
		Waveform 5 Detections	80% in 30 trials	Not Required*	
		Waveform 6 Detections	70% in 30 trials	Not Required*	
Transmit Power Control	CFR47 15.407 (h)(1)		6 dB below 30 dBm EIRP or less than 500 mW.	Manufacturer's Statement	**Complied**
Uniform Spreading	CFR47 15.407 (h)(2)		Manufacturer's Statement		**Complied**

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

None.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 is recognized by the commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (US1131). The laboratory scope of accreditation includes: Title 47 CFR Parts 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 A2LA

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:2017 and ISO 9002 (Lab Code US1131). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada

TUV Rheinland of North America at the 1279 Quarry Ln, Pleasanton, CA 94566 address is accredited by Industry Canada for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by Industry Canada (File Number 2932M-1). This reference number is the indication to the Industry Canada Certification Officers that the site meets the requirements of RSS 212, Issue 1 (Provisional). The accreditation is updated every 3 years.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 has been assessed and approved in accordance with the Regulations for Voluntary Control Measures.

VCCI Registration No. for Pleasanton: A-0326

2.1.5 Acceptance by Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Lane, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory A2LA accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 1279 Quarry Lane, Pleasanton, California 94566, USA.

2.2.1 Emission Test Facility

The Semi-Anechoic chamber and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 and 5 meters. The site is listed with the FCC and accredited by A2LA (Lab Code US1131). The 3/5-meter semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 meter and 5 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7 m x 4.8 m x 3.175 mm thick aluminum floor connected to PE ground.

For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6 m x 0.8 m x 0.8 m high non-conductive table with a 3.175 mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50 cm x 50 cm x 3.175 mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors.

For EFT, Surge, PQF, the HCP and VCP are removed.

RF Field Immunity testing is performed in a 7.3m x 4.3m x 4.1m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.8m x 3.7m x 3.175mm thick aluminum ground plane.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st Edition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities; it is equal to the positive square root of the sum of the variances or co-variances of these other quantities, weighted according to how the measurement result varies with changes in these quantities. The term *standard uncertainty* is the result of a measurement expressed as a standard deviation.

2.3.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.3.2 Measurement Uncertainty

Per CISPR 16-4-2	**U_{lab}**	**U_{cispr}**
Radiated Disturbance @ 10 meters		
30 – 1,000 MHz	2.25 dB	4.51 dB
Radiated Disturbance @ 3 meters		
30 – 1,000 MHz	2.26 dB	4.52 dB
1 – 6 GHz	2.12 dB	4.25 dB
6 – 18 GHz	2.47 dB	4.93 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.09 dB	2.18 dB
Disturbance Power		
30 MHz – 300 MHz	3.92 dB	4.3 dB

Voltech PM6000A

The estimated combined standard uncertainty for harmonic current and flicker measurements is ± 5.0%.	Per CISPR 16-4-2 Methods

Measurement Uncertainty - EMC Immunity

The estimated combined standard uncertainty for ESD immunity measurements is ± 8.2%.	Per IEC 61000-4-2
The estimated combined standard uncertainty for radiated immunity measurements is ± 4.10 dB.	Per IEC 61000-4-3
The estimated combined standard uncertainty for conducted immunity measurements with CDN is ± 3.66 dB	Per IEC 61000-4-6
The estimated combined standard uncertainty for power frequency magnetic field immunity is ± 2.9%.	Per IEC 61000-4-8
The estimated combined standard uncertainty for EFT fast transient immunity measurements is ± 2.6%.	Per IEC 61000-4-4
The estimated combined standard uncertainty for surge immunity measurements is ± 2.6%.	Per IEC 61000-4-5
The estimated combined standard uncertainty for voltage variation and interruption measurements is ± 1.74%.	Per IEC 61000-4-11

Measurement Uncertainty – Radio Testing

The estimated combined standard uncertainty for frequency error measurements is ± 3.88 Hz
The estimated combined standard uncertainty for carrier power measurements is ± 0.70 dB.
The estimated combined standard uncertainty for adjacent channel power measurements is ± 1.47 dB.
The estimated combined standard uncertainty for modulation frequency response measurements is ± 0.46 dB.
The estimated combined standard uncertainty for transmitter conducted emission measurements is ± 2.06 dB

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2017. Equipment calibration records are kept on file at the test facility.

3 Product Information

3.1 Product Description

The Stealth 600X Gen 2 is a completely wireless Xbox One audio gaming headset. It wirelessly connects directly to the Xbox One and future Xbox consoles over either a 2.4 GHz or 5.0 GHz Wi-Fi link. The functionality in the headset consists of 50mm speaker drivers, a flip up non-removable microphone, microphone monitoring and game/chat mix controls on the headset. Additionally, it has a ProSpecs alternative glasses relief ear pad design. With the Microsoft integrated radio module, this headset is also capable of working with compatible Windows PCs in the future.

3.2 Equipment Configuration

A description of the equipment configuration is given in the Test Plan Section. The EUT was tested as called for in the test standard and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to reach intended operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

3.3 DFS Operating Mode

DFS Mode	DFS Operating Range	
	5250 – 5350 MHz	5470 – 5725 MHz
Client without radar detection and ad hoc capability	Yes	Yes

3.4 EUT Transmit Power

Freq. Band (MHz)	Ant. Gain (dBi)	802.11a Mode		802.11n HT20 Mode	
		Output Pwr (dBm)	EIRP (dBm)	Output Pwr (dBm)	EIRP (dBm)
5250-5350	+1.3	+5.09	+6.39	+5.18	+6.48
5470-5725	+3.7	+5.18	+8.88	+5.07	+8.77

3.5 EUT Operating Channels

Band 1 (5150-5250 MHz)		Band 2 (5250-5350 MHz)		Band 3 (5470-5725 MHz)		Band 4 (5725-5850 MHz)	
No.	**Channel Freq. (MHz)**	**No.**	**Channel Freq. (MHz)**	**No.**	**Channel Freq. (MHz)**	**No.**	**Channel Freq. (MHz)**
36	5180	52	5260	100	5500	149	5745
40	5200	56	5280	104	5520	153	5765
44	5220	60	5300	108	5540	157	5785
48	5240	64	5320	112	5560	161	5805
				116	5580	165	5825
				132	5660		
				136	5680		
				140	5700		

Note: EUT supports only 20 MHz bandwidth in 802.11a and 802.11n HT20 modes.

3.6 Duty Cycle During DFS

Mode	Duty Cycle	
	5300 MHz	**5500 MHz**
Streaming Audio	26.4%	29.1%

4 Dynamic Frequency Selection

Testing was performed in accordance with CFR47 Part 2 and 15.407(h), KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures and verifies the characteristics and probability of EUT to switch to different operating channel, once the radar signal is detected. Procedures described in KDB 905462 D02 UNII DFS Compliance Procedure New Rules v02 were used.

4.1 DFS Applicability

All devices operated in the frequency range of 5250 MHz-5350 MHz and 5470 MHz-5725MHz must equip with the DFS mechanism. The Wireless Audio Headset *Mode* Stealth 600X Gen 2 *is a client device without radar detection capability, only channel closing transmission and channel move time requirements shall apply per KDB 905462 D02 procedures.*

Table 2: 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
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 3: Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	**Master Device or Client With Radar Detection**	**Client Without Radar Detection**
DFS Detection Threshold	Yes	Yes	Not required
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Yes	Not required

Additional Requirements for device 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	Testing 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 frequencies.		

4.2 DFS Requirements

Based on the applicability of Voyetra Turtle Beach, Inc., *Model* Stealth 600X Gen 2, *the following parameters and probability must be tested for conformance.*

Table 4: DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	Value
EIRP ≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet 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. Note 4: Stealth 600X Gen 2 *is a client device without radar detection. These requirements do not apply.*	

Table 5: 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 should be performed with Radar Type 0. The measurement timing begin 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 is used and for each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

Table 6: 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	60%	30
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI Values in Table 5a	Roundup{(1/360)*(19*10^6/PRI_{usec})}	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 uSec, with a minimum increment of 1 uSec, excluding PRI values selected in Test 1A			
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, channel move time and channel closing time tests.					

Table 7: Pulse Repetition Intervals Value for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulse per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678

10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

Table 8: Long Pulse Radar Test Waveform

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

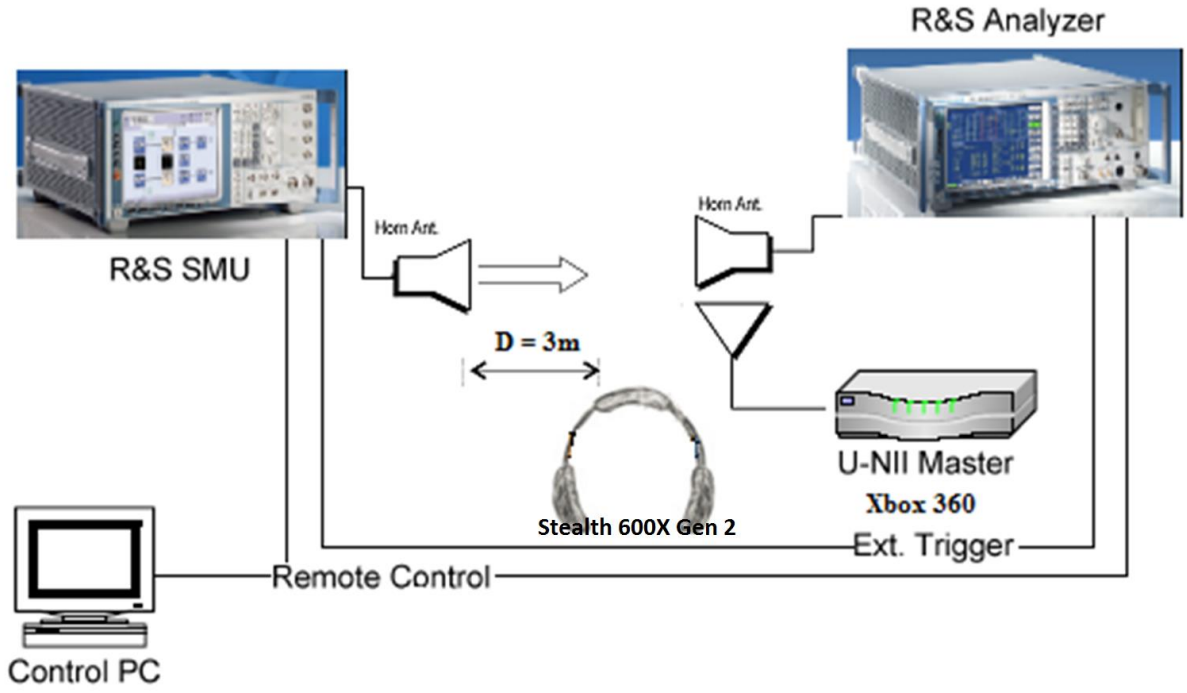
Table 9: Frequency Hopping Radar Test Waveform

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

4.3 Test Setup Protocol

The following test setup was used to evaluate the Wireless Audio Headset *Model* Stealth 600X Gen 2 *for DFS conformance.*

Dynamic Frequency Selection in Block Diagram: Radiated Setup



4.4 Radar Waveform Calibration Plot

The radar signal level must be -64 dBm applying to the master device; Xbox 360.

Note: These waveforms were compensated for the path loss as offset on spectrum analyzer.

Type 0 radar waveform verified at the 5300 MHz,, and 5500 MHz, center frequency using radiated method. . These waveforms were compensated for the path loss and antenna gain as offset on spectrum analyzer.

The radar signal levels below are calibrated to be less than -64.00 dBm for EUT threshold detection.

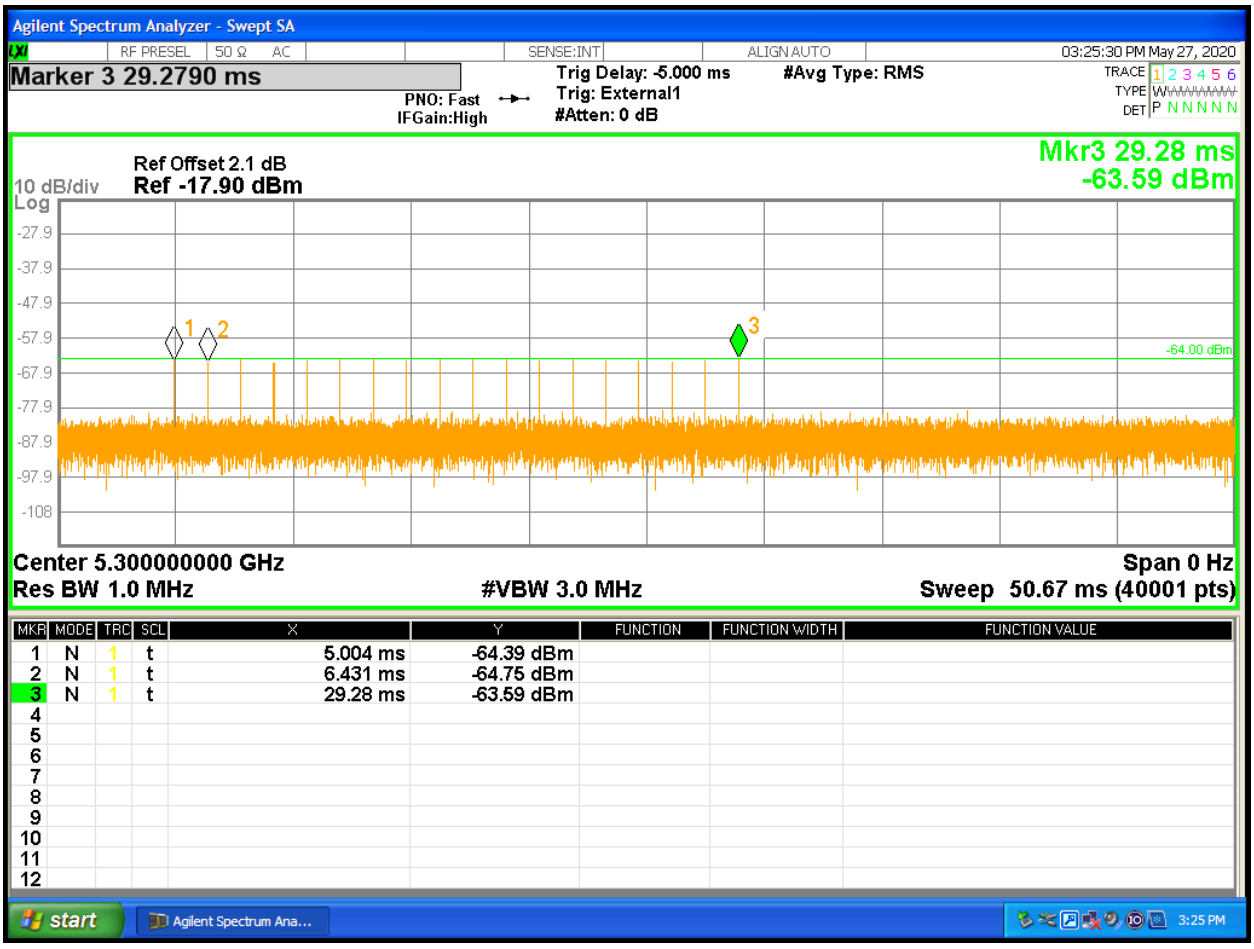


Figure 1: Radar Type 0 DFS Detection Threshold Level at 5300 MHz

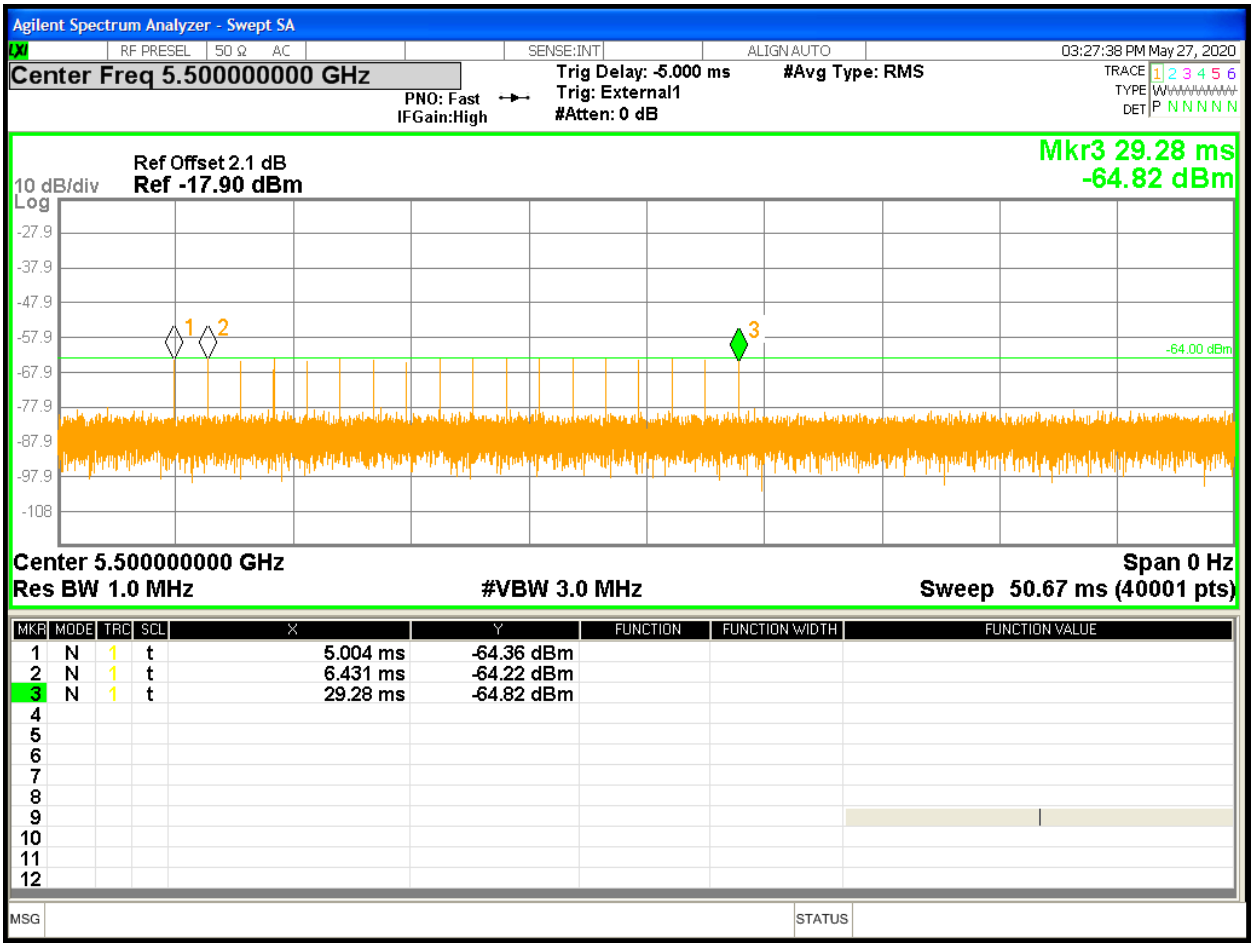


Figure 2: Radar Type 0 DFS Detection Threshold Level at 5500 MHz

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4.5 In-Service Monitoring

In-service monitoring performance checks consist of the channel move time, channel closing transmission time, and non-occupancy period. These parameters of the Wireless Audio Headset, Model Stealth 600X Gen 2 *are verified to give the radar system the priority of the frequency and minimize the interference with nearby radar systems when the Wireless Audio Headset, Model Stealth* 600X Gen 2 *is being used with Xbox 360 host system.*

The Stealth 600X Gen 2 *is a client device without any radar detection capability.*

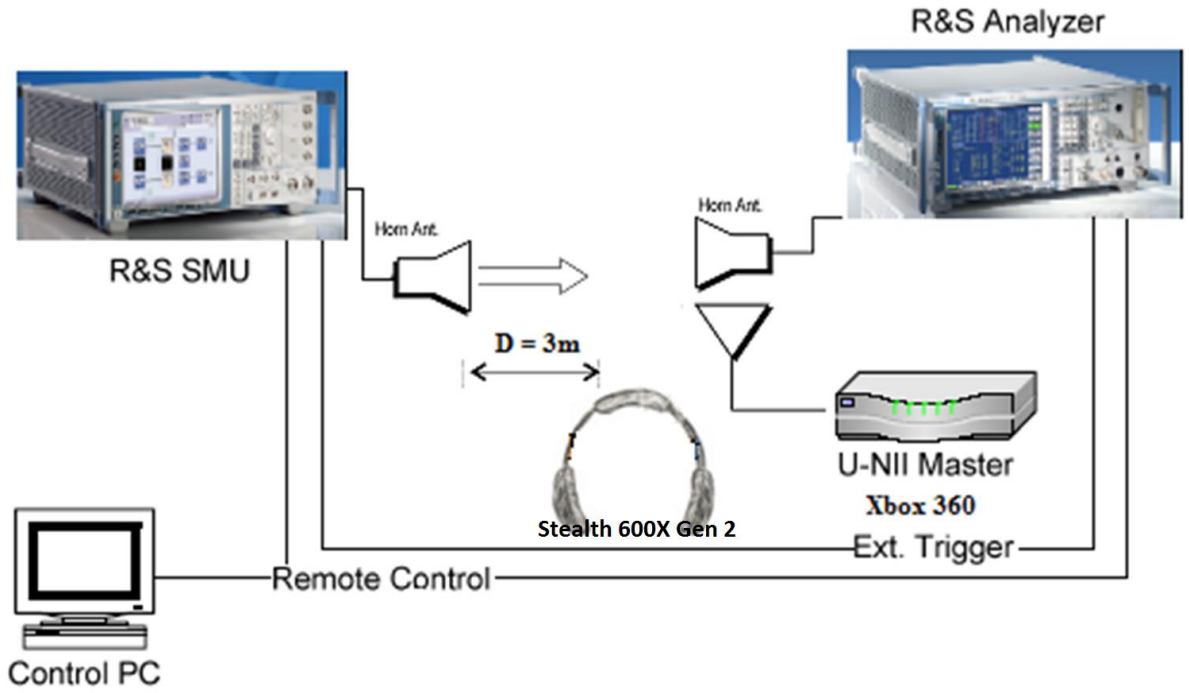
Upon the detection of radar signal on the operating channel, the Stealth 600X Gen 2 *with Xbox 360 gaming system must move to another operating channel with move time less than 10 seconds. The total channel closing transmission time must be 200 mS with an aggregate 60 mS over the remaining 10 second period. The radar detected channel must not have any transmission from EUT for the minimum of 30 minutes.*

4.8.1 Test Method

The KDB 905462 D02 UNII DFS Compliance Procedure New Rules v02 Section 7.8.3 Performance Requirements Check was used.

The *Stealth* 600X Gen 2 S/N PP#3 was used as slave device and configured to operate at 5300 MHz and 5500 MHz for 20 MHz bandwidth. The final results indicated below.

Test Setup:



4.8.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 10: In-Service Monitoring – Test Results

Test Date: May 27, 2020	**Test Method:** Radiated
Center Frequency: 5300 MHz and 5500 MHz	**EUT State:** Streaming Audio
Min. Antenna Gain: +3.7 dBi	**Max. Transmitted Power:** 5.22 dBm
Injection Radar Waveform Type: 0	**Detection Threshold:** -64 dBm
Ambient Temperature: 23°C	**Relative Humidity:** 34% RH

20 MHz Bandwidth

Frequency (MHz)	CCTT		CMT		Non-Occupancy		Plots	Results
	Meas.	Limit	Meas.	Limit	Meas.	Limit		
5300	60.9 ms	260 ms	162.2 ms	10s	>30min	30 min.	3,4,5	Complies
5500	17.1 ms	260 ms	156.4 ms	10s	>30min	30 min.	6,7,8	Complies

CCTT= Channel Closing Transmission Time.
CMT= Channel Move Time

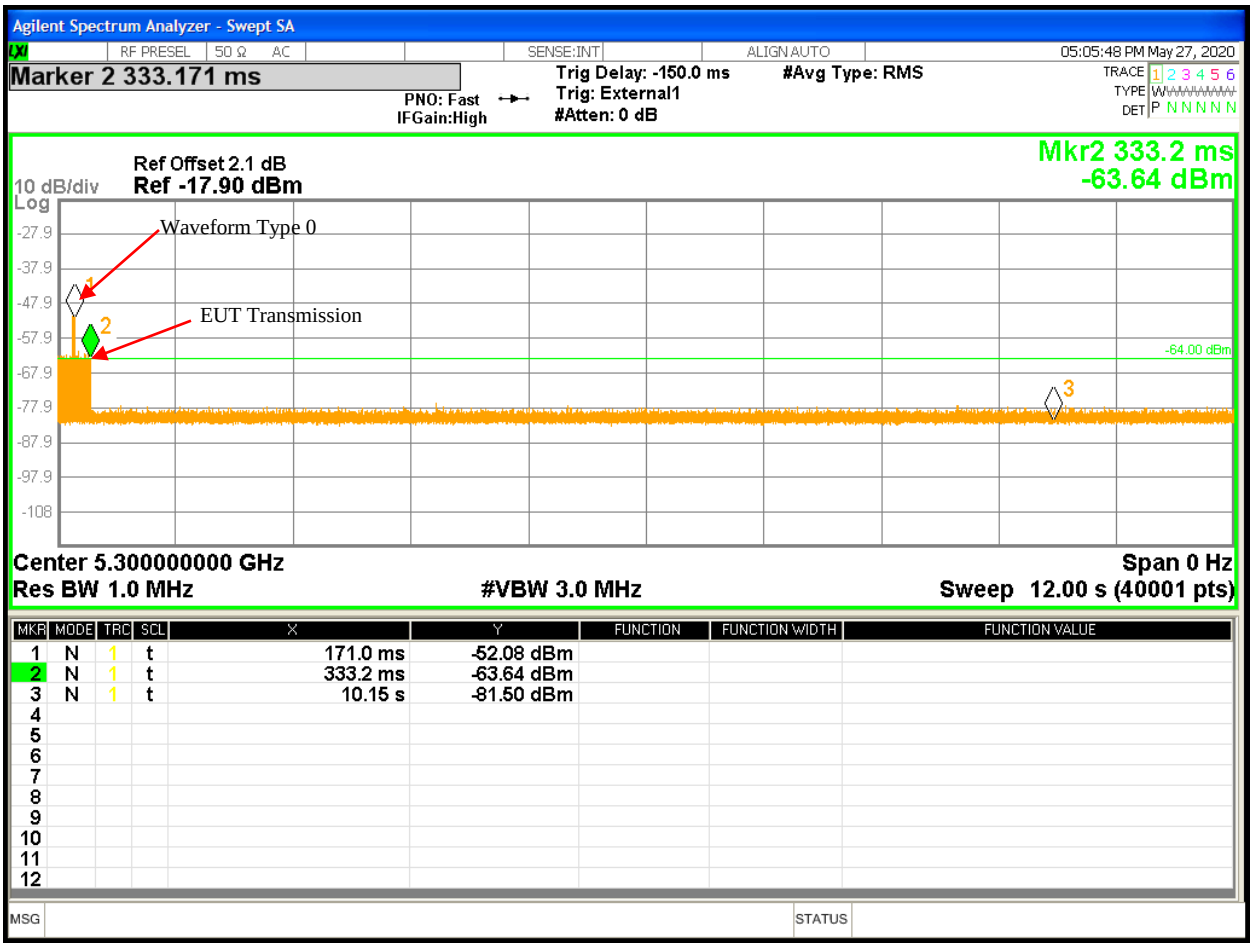


Figure 3: Channel Move Time and Channel Closing Transmission Time using Pulse Radar Waveform 0 at 5300 MHz, 20 MHz Bandwidth

Note: Spectrum Analyzer was triggered to capture Waveform Type 0 radar pulse and EUT transmission afterward. The Test Audio had a quick pause, and it resumed with the system operated at Non-DFS Channel 149, 5745 MHz.

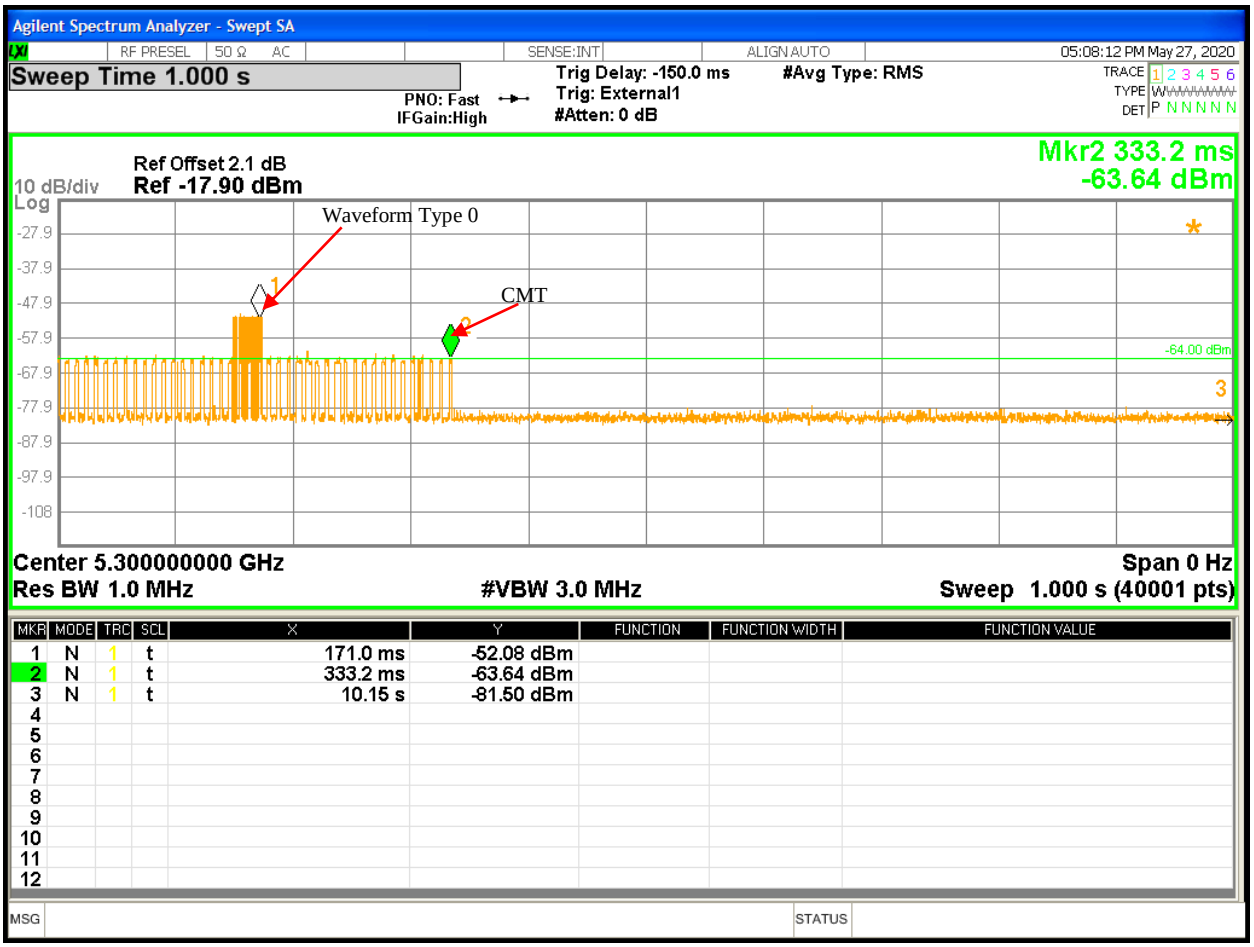


Figure 4: Channel Move Time and Channel Closing Transmission Time using Pulse Radar Waveform 0 at 5300 MHz, 20 MHz Bandwidth (Close-up)

Note: 1. Agilent Analyzer was triggered with 40000 single sweep points (Bins) Fig. 4 was a zoom-in plot from Fig. 3.

2. The last radar pulse of Waveform Type 0 was denoted by Marker 1 at 171.0 ms

3. There are total 43 spectrum analyzer bins above the noise floor level after 171.0 ms.

CCTT = # Bins * (12000 mS / 40000 Bins)
= 203 bins * (12000 mS/ 40000 Bins)
= 60.9 mS.

4. Channel Move Time (CMT) is defined as the delta of EUT's last transmission to the last pulse of radar burst.

Last Radar Pulse = 171.0 mS
Last Transmission = 333.2 mS
Channel Move Time = Last Transmission – Last Radar Pulse = 162.2 ms

5. No transmission happened after 200 mS, no aggregate.

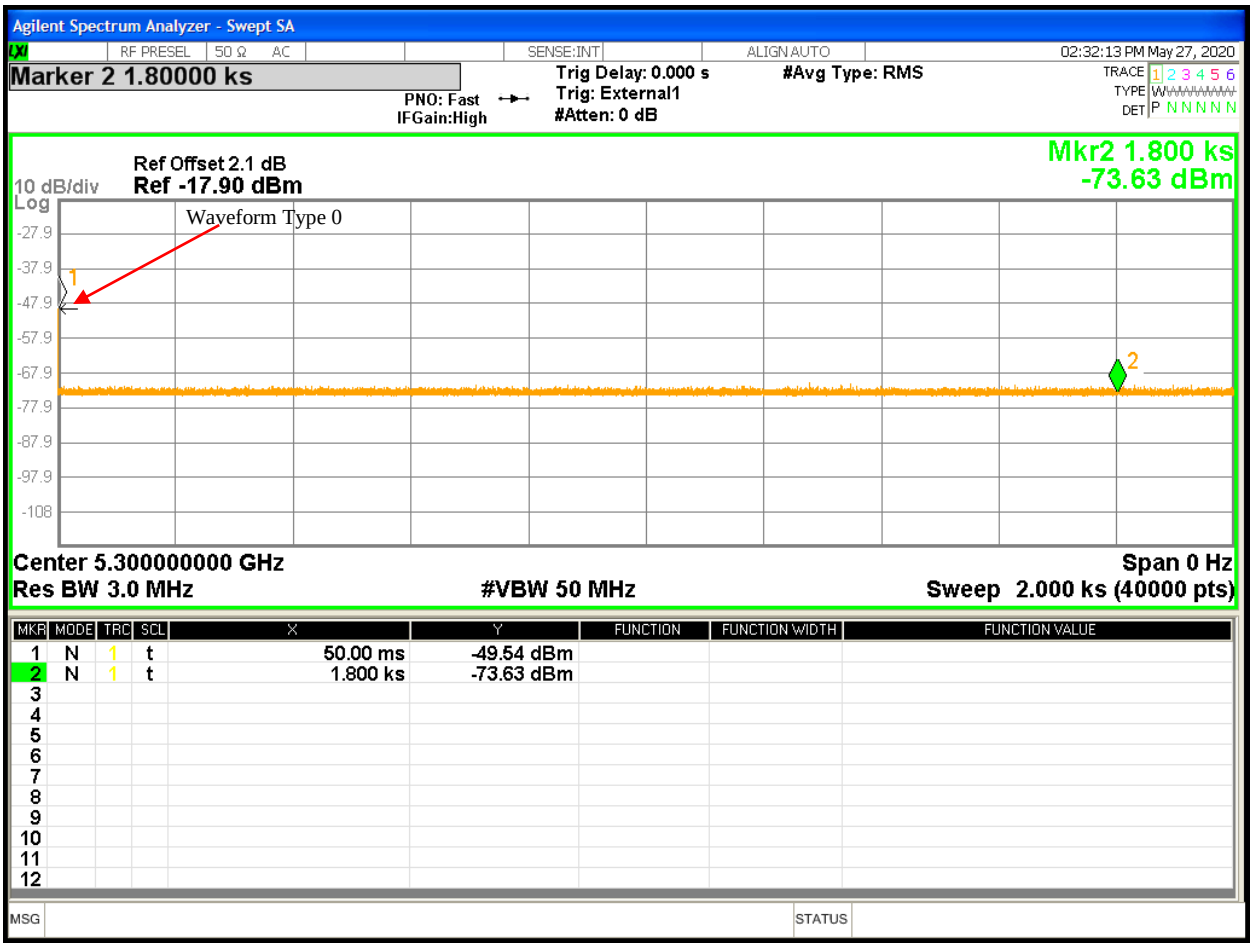


Figure 5: Non-Occupancy Period using Waveform Type 0 at 5300 MHz, 20 MHz Bandwidth

Note: 1. Marker #1 denotes the end of radar pulse.

2. Marker #2 denotes the 30 minutes limit on Channel 5300 MHz.

3. No transmission of 30 minutes after the last aggregates on the original channel.

4. The audio file was interrupted for 1 s.

5. EUT transmission moved to Non-DFS Channel 40 (5200 MHz).

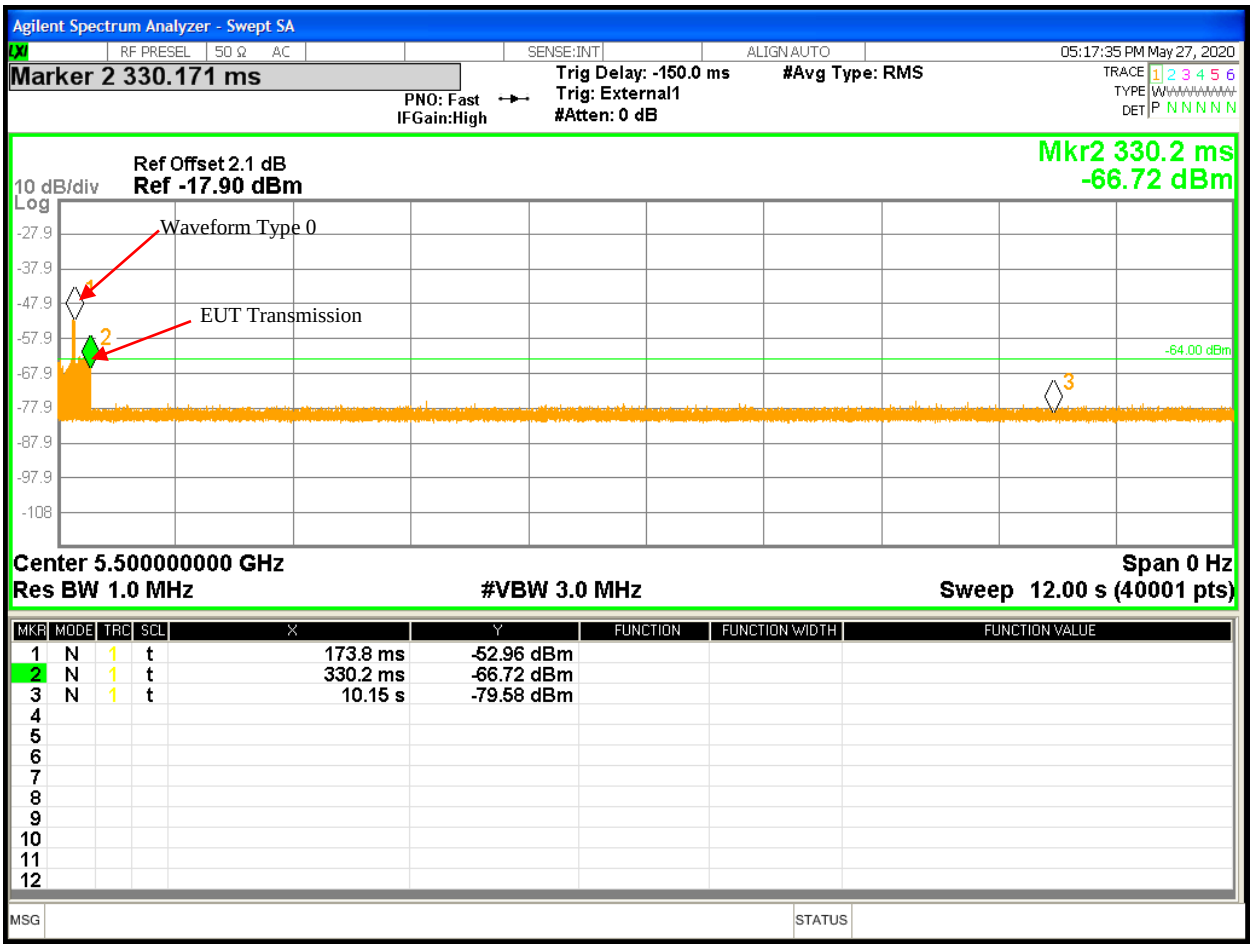


Figure 6: Channel Move Time and Channel Closing Transmission Time using Pulse Radar Waveform 0 at 5500 MHz, 20 MHz Bandwidth

Note: Spectrum Analyzer was triggered to capture Waveform Type 0 radar pulse and EUT transmission afterward. The Test Audio had a quick pause, and it resumed with the system operated at Non-DFS Channel 161, 5805 MHz.

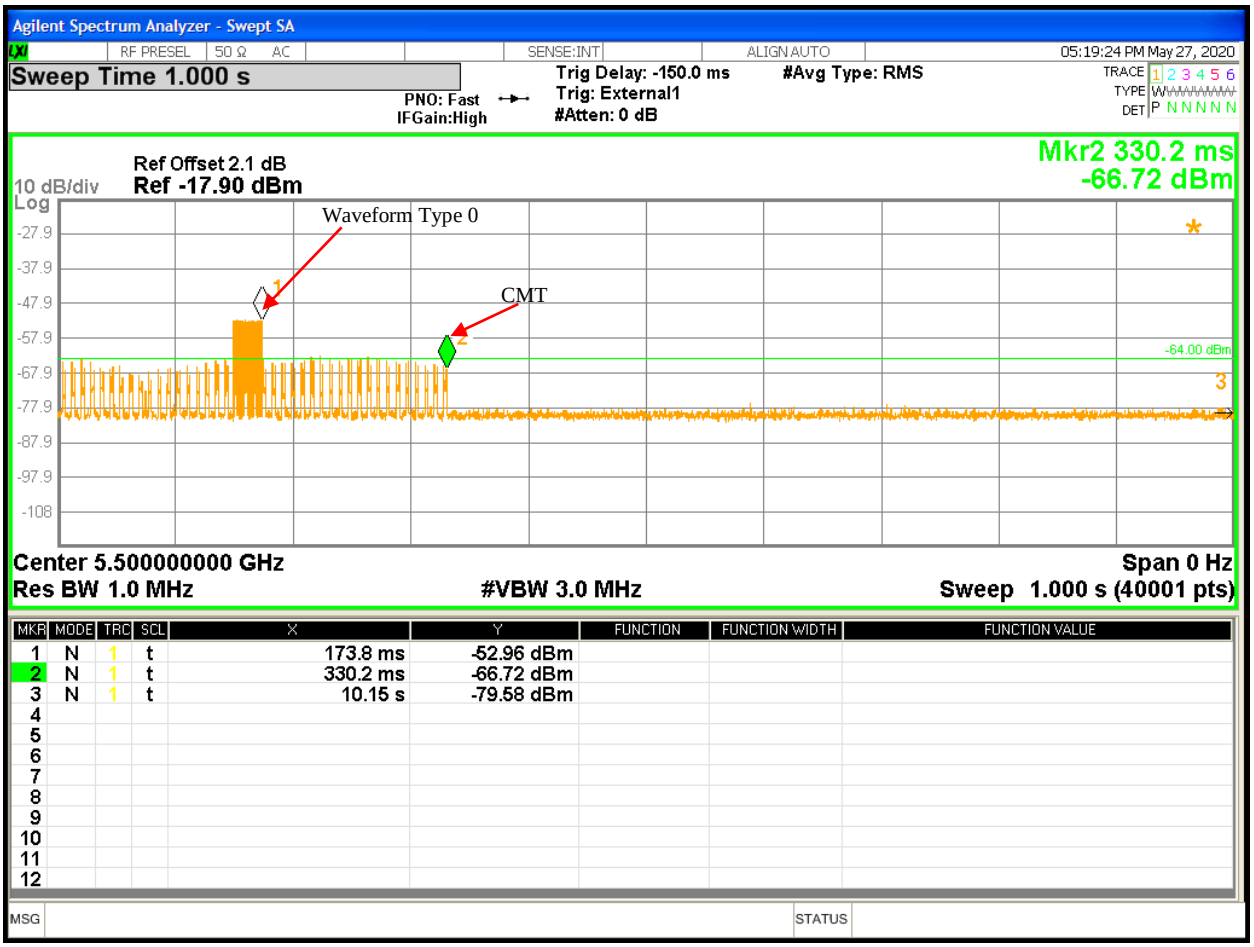


Figure 7: Channel Move Time and Channel Closing Transmission Time using Pulse Radar Waveform 0 at 5500 MHz, 20 MHz Bandwidth (Close-up)

Note: 1. Agilent Analyzer was triggered with 40000 single sweep points (Bins) Fig. 7 was a zoom-in plot from Fig. 6.

2. The last radar pulse of Waveform Type 0 was denoted by Marker 1 at 173.8 ms

3. There are total 51 spectrum analyzer bins above the noise floor level after 173.7 ms.

CCTT = # Bins * (12000 mS / 40000 Bins)
= 57 bins * (12000 mS/ 40000 Bins)
= 17.1 mS.

4. Channel Move Time (CMT) is defined as the delta of EUT's last transmission to the last pulse of radar burst.

Last Radar Pulse = 173.8 mS
Last Transmission = 330.2 mS
Channel Move Time = Last Transmission – Last Radar Pulse = 156.4 ms

5. No transmission happened after 200 mS, no aggregate.

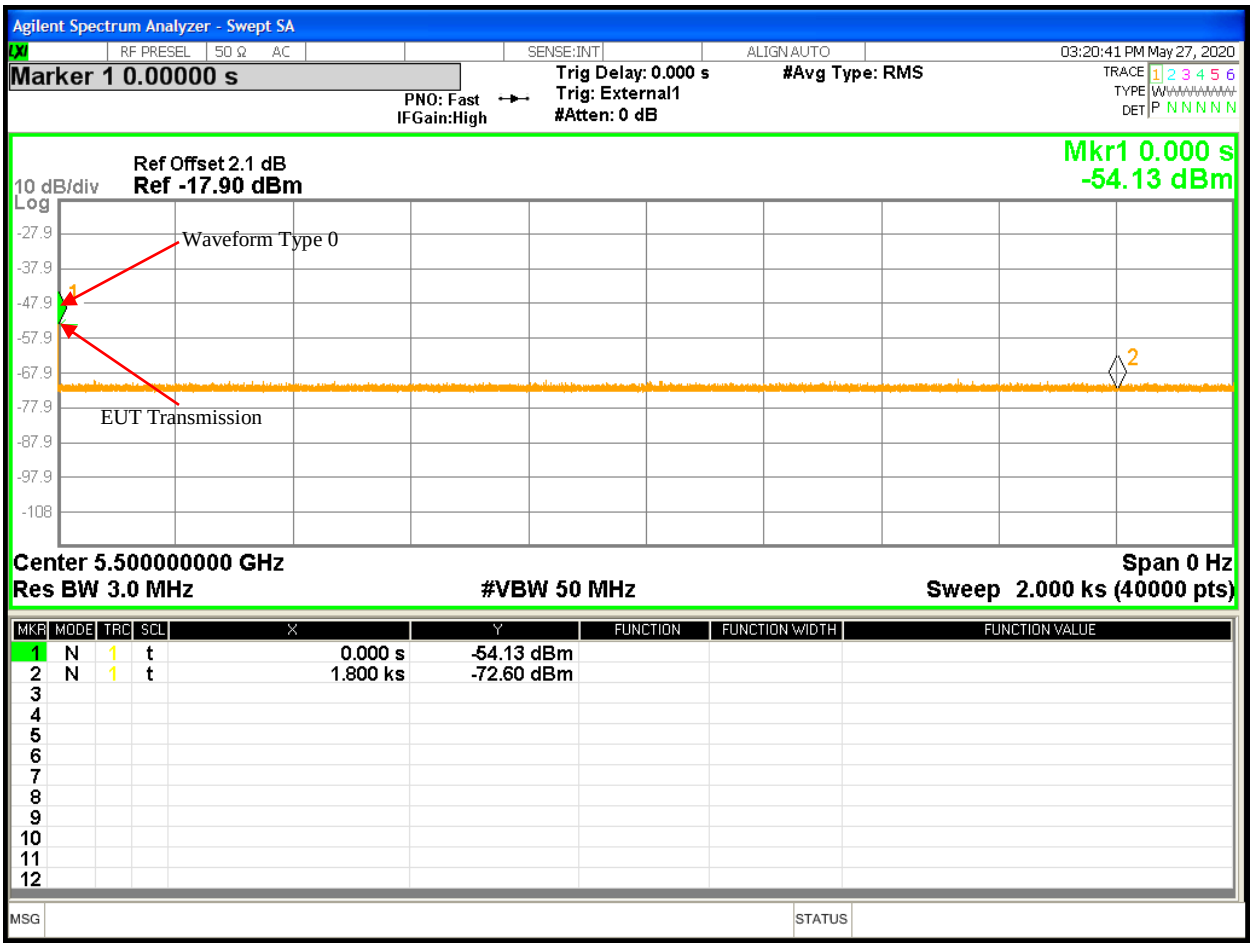


Figure 8: Non-Occupancy Period using Waveform Type 0 at 5500 MHz, 20 MHz Bandwidth

Note: 1. Marker #1 denotes the end of radar pulse.

2. Marker #2 denotes the 30 minutes limit on Channel 5500 MHz.

3. No transmission of 30 minutes after the last aggregates on the original channel.

4. The audio file was interrupted for 1 s.

5. EUT transmission moved to Non-DFS Channel 165 (5825 MHz).

5 Test Equipment Use List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal mm/dd/yyyy	Next Cal mm/dd/yyyy
Horn Antenna	EMCO	3115	9602-4676	03/04/2020	03/04/2022
Horn Antenna	EMCO	3115	9211-3969	06/20/2019	06/20/2021
RF Power Meter	Agilent	E4418A	MY45103902	02/13/2020	02/13/2021
Power Sensor	Agilent	8481A	US37295801	02/13/2020	02/13/2021
EMI Receiver	Agilent	N9038A	MY52260210	02/15/2020	02/15/2021
Vector Signal Generator	Rhode Schwarz	SMU 200A	1141.2005.02	07/24/2019	07/24/2020

* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.

6 Test Setup Photo

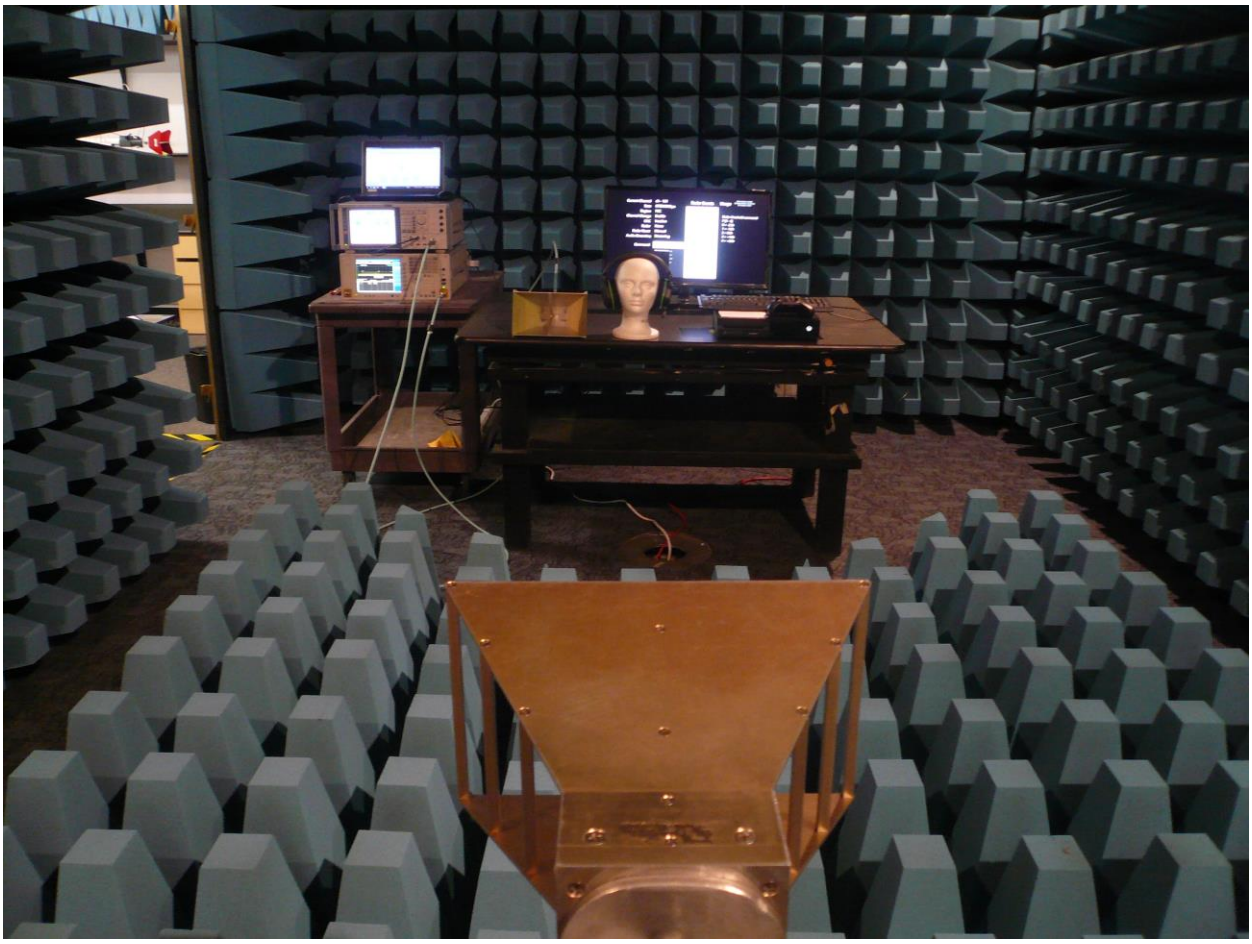


Figure 9: DFS Test Setup Photo (Rear)

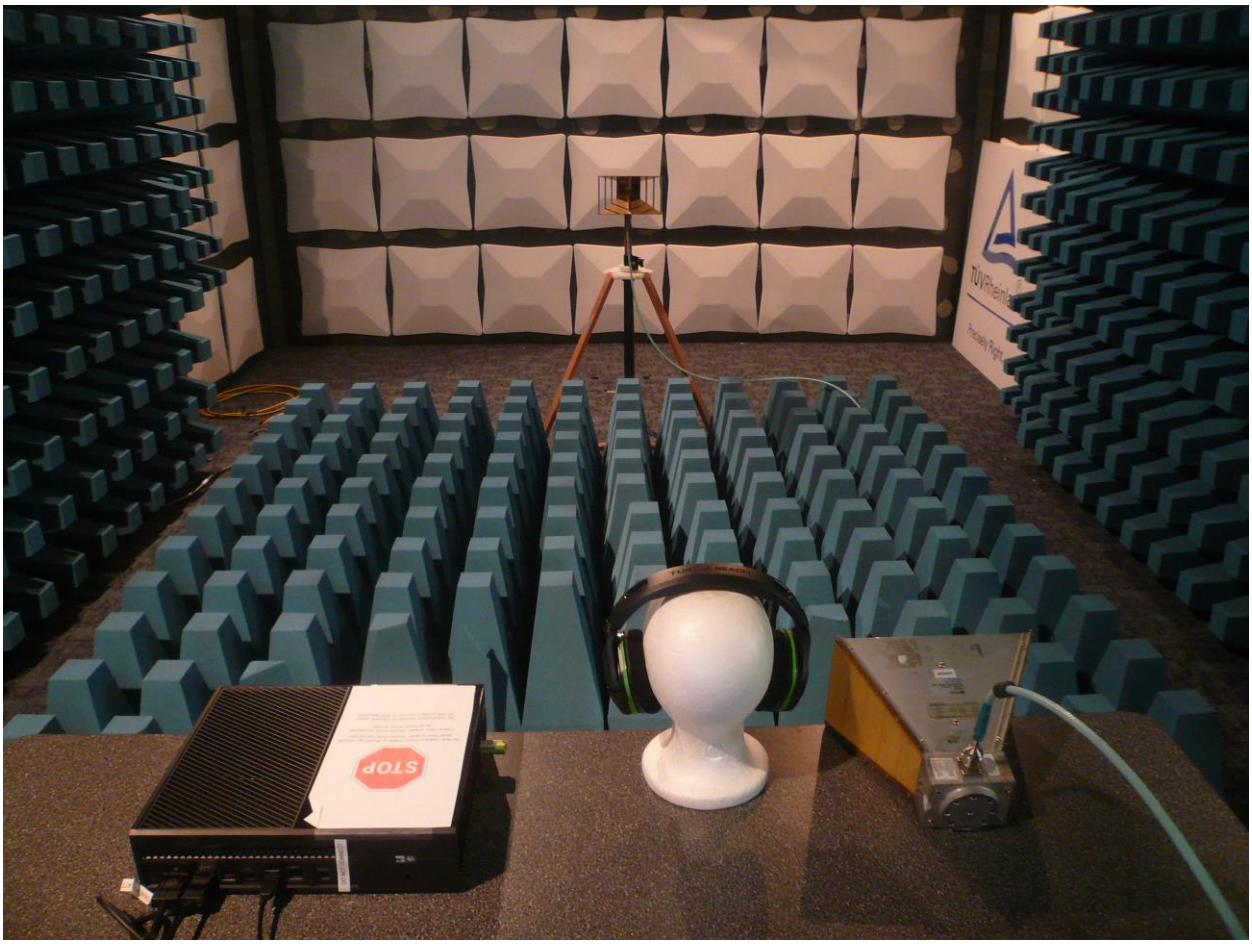


Figure 10: DFS Test Setup Photo for Master Mode (Front)

7 DFS Test Plan

7.1 Introduction

This section provides a description of the Equipment Under Test (EUT), configurations, operating conditions, and performance acceptance criteria. It is an overview of information provided by the manufacturer so that the test laboratory may perform the requested testing.

7.2 Customer

Table 11: Customer Information

Company Name	Voyetra Turtle Beach, Inc.
Address	100 Summit Lake Drive, Suite 100
City, State, Zip	Valhalla, New York 10595 USA
Country	U.S.A
Phone	(530) 277-3482
Fax	None

Table 12: Technical Contact Information

Name	Tim Blaney
E-mail	tim@commcepts.net
Phone	(530) 277-3482
Fax	(530) 478-5607

7.3 Equipment Under Test (EUT)

Table 13: EUT Specifications

EUT Specifications	
Dimensions	217 mm (8.5”) x 171 mm (6.75”) x 89 mm (3.5”)
DC Input	Headset Input Voltage: 3.7 Vdc (battery)
Environment	Indoor
Operating Temperature Range:	0 to 50 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Product Marketing Name (PMN)	Stealth 600X Gen 2
Hardware Version Identification Number (HVIN)	600X Gen 2
Firmware Version Identification Number (FVIN)	1.2.6
802.11-radio modules	
Operating Mode	802.11a, 802.11b, 802.11g, 802.11n HT20
Transmitter Frequency Band	2.4 GHz – 2.4835 GHz 5.15 GHz – 5.35 GHz 5.47 GHz – 5.75 GHz 5.725GHz – 5.85 GHz
Max. Rated Power Output	5.22 dBm
Power Setting @ Operating Channel	See Channel Planning Table.
Antenna Type	PCB Chip
Antenna Gain	+3.3 dBi at 2.4 GHz +3.7 dBi at 5 GHz
Modulation Type	☐ Thread (Zigbee) ☐ BLE ☒ DSSS ☒ OFDM ☒ Other describe: 16QAM
Data Rate	802.11b: 1, 2, 5.5, and 11 Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11a: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n HT20: 6.5, 13, 19.5, 26, 39, 52, 58.5, 65 Mbps
TX/RX Chain (s)	1
Directional Gain Type	☐ Correlated ☐ Beam-Forming ☒ Other describe: No beam-forming or correlated.
Type of Equipment	☐ Table Top ☐ Wall-mount ☐ Floor standing cabinet ☒ Other: Head wear device.

EUT Specifications
Note: The radio can only operate in one band and on one channel at a time. The Stealth 600X Gen 2 has two versions that are 100% identical electrically and mechanically except for the color of their exterior plastics. The two model color variations are black and white.

Table 14: EUT Channel Power Specifications

No.	Frequency (MHz)	Target Power Level in ART2					
		802.11b	802.11g	802.11a	802.11n HT20	802.11n HT40	
1	2412	6.0	5.5		5.5		
2	2417						
3	2422						
4	2427						
5	2432						
6	2437	7.0	7.0		7.0		
7	2442						
8	2447						
9	2452						
10	2457						
11	2462	7.5	7.0		7.0		
36	5180			9.0	9.0		
40	5200			8.5	8.5		
44	5220						
48	5240			7.5	7.5		
52	5260			7.5	7.5		
56	5280						
60	5300			6.5	6.5		
64	5320			5.5	6.0		
100	5500			6.0	5.5		
104	5520						
108	5540						
112	5560						
116	5580			6.5	6.5		
120	5600						
124	5620						
128	5640						
132	5660						
136	5680						
140	5700			9.0	9.5		
144	5720						
149	5745			9.0	9.5		
153	5765						
157	5785			9.0	9.5		
161	5805						
165	5825			7.5	8.0		
Note: The power outputs are set using TX Power Level in the ART2.							

Table 15: Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
None	--	☐ Yes	☐ Metric:3m	☐ M
Note: The EUT is powered by an internal 3.7 VDC battery. EUT can be charged externally using a standard USB port interface. EUT communicated with Xbox via wireless connection.				

Table 16: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Console	Microsoft	1540	057740543748	Configure as master device
Monitor	LG	27UD58-B	711NTTQAM425	Display the Xbox gaming console
Keyboard	Dell	SK-8120	CN-0C638N-71616-42M-1HUD-A00	Enter DFS command.
Controller	Microsoft	1537	02980119224432	Enter DFS command.
Note: None.				

Table 17: Description of Sample used for Testing

Device	Serial	KDB 905462	RF Connection
Slave	PP#3	Use for 20 MHz bandwidth DFS tests	Wireless via 5 GHz.

Table 18: Test Mode for DFS

Test	20 MHz BW	40 MHz BW	80 MHz BW	Comments
DFS Detection Threshold				
U-NII Detection Bandwidth				
Performance Requirements Checks				
In-Service Monitoring	5300 MHz, and 5500 MHz.			Stream/ play the audio on the Stealth 600X headset.

Test	20 MHz BW	40 MHz BW	80 MHz BW	Comments
Radar Statistic Performance Check				
Note: 5300 MHz and 5500 MHz were selected to represent 20 MHz bandwidth DFS characteristics of EUT.				

7.4 Test Specification

Table 19: Test Specifications

Dynamic Frequency Selection	
Regulation Rules / Standards	**Requirement**
CFR 47 Part 15.407(h) 2020 and KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02	All
RSS 247 Issue 2, 2017	All

END OF REPORT