

DFS Test Report

Report No.: FCC_DFS_SL19062701-OTC-002

Test Model: KUM1000-MA0-03

Series Model: N/A

FCC ID: 2AU4Y-LAON-INTERCOM

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Applicant: LAON Technology

Address: #1212, Biz Center, SK-N Technopark. 124, Sagimakgol-ro, Jungwon-Gu,
Seongnam-Si, Gyeonggi-Do, Korea

Issued By: Bureau Veritas Consumer Products Services, Inc.

Lab Address: 775 Montague Expressway Milpitas, CA, 95035, USA

Test Location: 775 Montague Expressway Milpitas, CA, 95035, USA



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Table of Contents

Release Control Record	3
1 Certificate of Conformity	4
2 Dynamic Frequency Selection	5
2.1 Test Limits and Radar Signal Parameters	6
2.2 Test instruments	9
2.3 EUT Information	9
2.4 Description of support units	10
2.5 Test Procedure	11
2.1 DFS Measurement System	11
2.2 Calibration of DFS Detection Threshold Level	12
2.6 Deviation from Test Standard	12
2.7 Test Setup Configuration	13
2.8 List of Measurements	14
2.9 Test Results	15
Appendix A - Radar Type waveform characteristic	36
Appendix B – Information on the Testing Laboratories	49

Release Control Record

Issue No.	Description	Date Issued
FCC_DFS_SL19062701-OTC-002	Original Release	04/29/2020

1 Certificate of Conformity

Product: Wireless Audio RF Module

Brand: N/A

Test Model: KUM1000-MA0-03

Series Model: N/A

Sample Status: Engineer Sample

Applicant: LAON Technology

Test Date: 04/01/2020-04/28/2020

Standards: FCC 15.407

Procedure: 905462 D02 UNII DFS Compliance Procedures New Rules v02

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc., Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Deon, **Date:** 04/29/2020
Deon Dai / Test Engineer

Approved by : Chen, **Date:** 04/29/2020
Chen Ge / Engineer Reviewer

2 Dynamic Frequency Selection

The manufacturer shall state whether the UUT is capable of operating as a Master and/or a Slave. If the UUT is capable of operating in more than one operating mode then each operating mode shall be tested separately. See tables A and B for the applicability of DFS requirements prior to use a channel (Channel Availability Check) and during normal operation (In-Service Monitoring) for each of the operational modes.

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

Requirement	Operational Mode
	Master
Interference Detection Threshold	✓
Channel Availability Check Time	✓
Non-Occupancy Period	✓

Table B: Applicability of DFS requirements during normal operation

Requirement	Operational Mode
	Master
Interference Detection Threshold	✓
Channel Closing Transmission Time	✓
Channel Move Time	✓
Non-Occupancy Period	✓

2.1 Test Limits and Radar Signal Parameters

Detection Threshold Values

Table 8: DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP $\geq$ 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.

Table 9: 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.

Parameters of DFS Test Signals

Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

Table 10: Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	$\text{Roundup} \left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{\text{PRI}_{\text{in sec}}} \right) \right\}$	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066μ sec, with a minimum increment of 1μsec, excluding PRI values selected in Test A			
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

Table 11: 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

Three subsets of trials will be performed with a minimum of ten trials per subset. The subset of trials differ in where the Long Pulse Type 5 Signal is tuned in frequency.

a) the Channel center frequency
b) tuned frequencies such that 90% of the Long Pulse Type 5 frequency modulation is within the low edge of the UUT Occupied Bandwidth
c) tuned frequencies such that 90% of the Long Pulse Type 5 frequency modulation is within the high edge of the UUT Occupied Bandwidth

It include 10 trails for every subset, the formula as below,

For subset case 1: the center frequency of the signal generator will remain fixed at the center of the UUT Channel.

For subset case 2: to retain 90% frequency overlap between the radar signal and the UUT Occupied Bandwidth, the center frequency of the signal generator will vary for each of the ten trials in subset case 2. The center frequency of the signal generator for each trial is calculated by:

$FL + (0.4 * \text{Chirp Width [in MHz]})$

For subset case 3: to retain 90% frequency overlap between the radar signal and the UUT Occupied Bandwidth, the center frequency of the signal generator will vary for each of the ten trials in subset case 3. The center frequency of the signal generator for each trial is calculated by:

$FH - (0.4 * \text{Chirp Width [in MHz]})$

Table 12: 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

2.2 Test instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Keysight Signal Analyzer	N9010A	MY51440112	11/08/2019	11/08/2020
Splitter/Combiner (Mini-Circuit)	ZFSC-2-9G+	S F030000719	N/A	N/A
Splitter/Combiner (Mini-Circuit)	ZFSC-2-9G+	S F030000718	N/A	N/A
Agilent Signal Generator	MXG N5182A	MY47071065	09/28/2019	09/28/2020

2.3 EUT Information

Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency Range	
	5250~5350MHz	5470~5725MHz
Master	✓	✓

EUT Software and Firmware Version

No.	Product	Model No.	Software/Firmware Version
1	N/A	N/A	N/A

Description of Available Antennas to the EUT

The highest antenna gain is 6.134dBi for band 5250-5350MHz and 7.044dBi for band 5470-5725MHz.

2.4 Description of support units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	Acer	Aspire A315-51	N/A	N/A	N/A
B.	12V Power supply	Liteon	PA-1041-81	N/A	N/A	N/A

Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Switching power adapter	1	1.5m	No	0	Connect from EUT to Switch
2.						

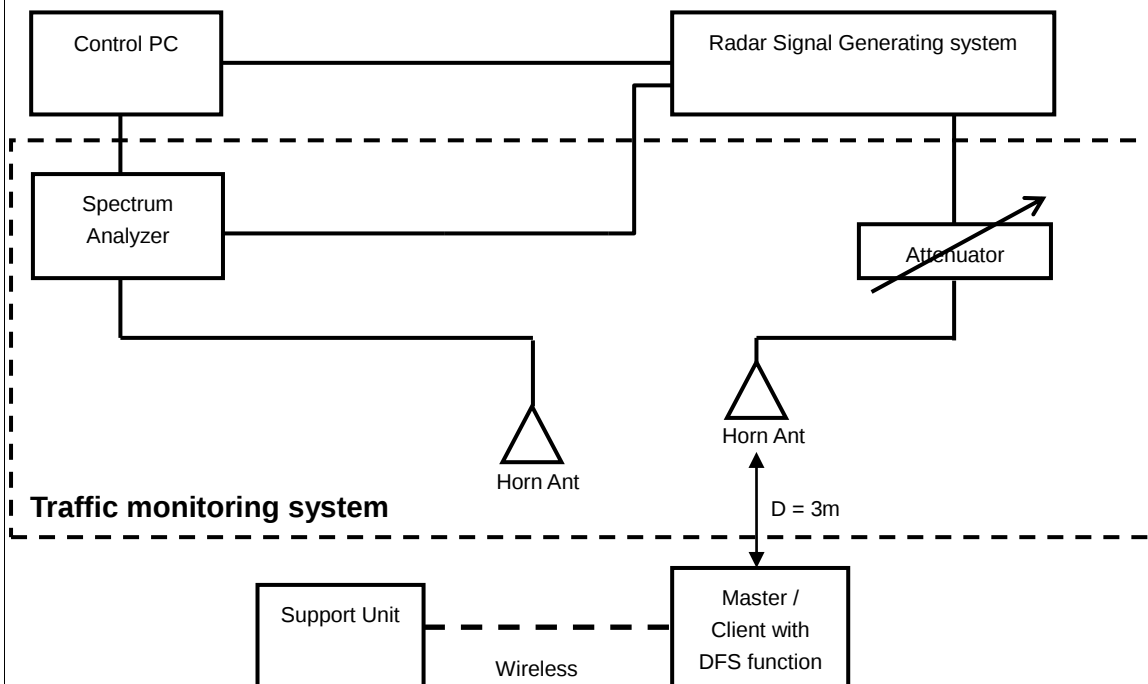
Note: The core(s) is(are) originally attached to the cable(s).

2.5 Test Procedure

2.1 DFS Measurement System

A complete DFS Measurement System consists of two subsystems: (1) the Radar Signal Generating system and (2) the Traffic Monitoring system. The control PC is necessary for generating the Radar waveforms in Table 10, 11 and 12. The traffic monitoring subsystem is specified to the type of unit under test (UUT).

Radiated Setup Configuration of DFS Measurement System



Channel Loading

System testing will be performed with channel-loading using means appropriate to the data types that are used by the unlicensed device. The following requirements apply:

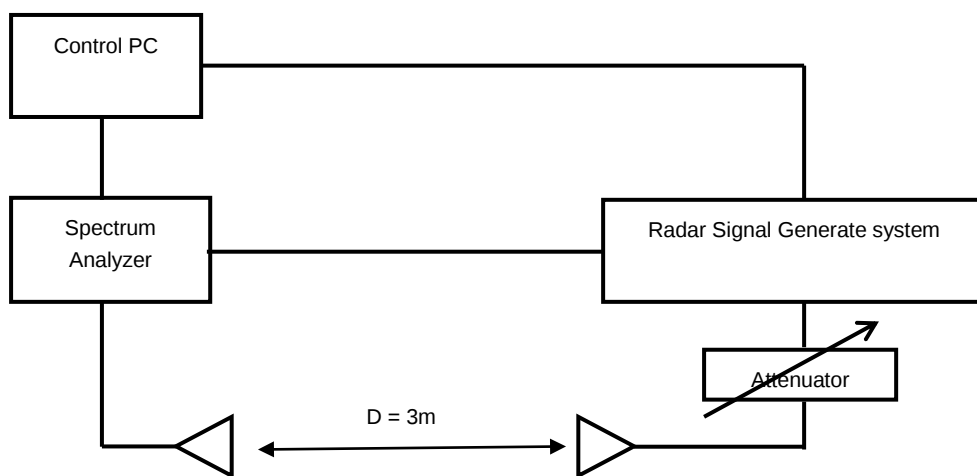
a)	The data file must be of a type that is typical for the device (i.e., MPEG-2, MPEG-4, WAV, MP3, MP4, AVI, etc.) and must generally be transmitting in a streaming mode.	
b)	Software to ping the client is permitted to simulate data transfer but must have random ping intervals.	
c)	Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater.	✓
d)	Unicast or Multicast protocols are preferable but other protocols may be used. The appropriate protocol used must be described in the test procedures.	

2.2 Calibration of DFS Detection Threshold Level

The measured channel is 5300MHz and 5500MHz. The radar signal was the same as transmitted channels, and injected into the antenna of AP (master) or Client Device with Radar Detection, measured the channel closing transmission time and channel move time.

Radiated setup configuration of Calibration of DFS Detection Threshold Level

The radar signal generate system is generating waveform pattern of radar types. The amplitude of the radar signal generator system is adjusted to yield a level of -64 dBm as measured on the spectrum analyzer. The interference detection threshold level is lower than – 64dBm hence it provides margin to the limit.



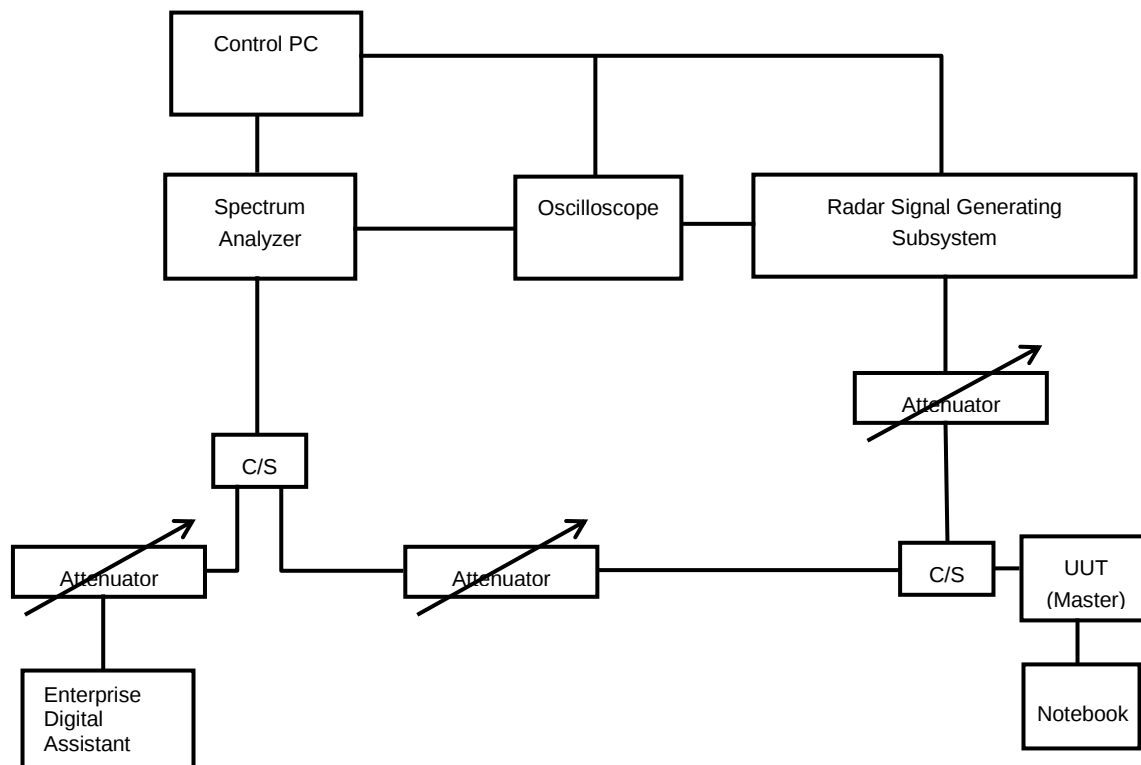
2.6 Deviation from Test Standard

No deviation.

2.7 Test Setup Configuration

Master mode

The EUT is a U-NII Device operating in Master mode. The radar test signals are injected into the Master Device.



The UUT is capable of operating as a Master mode. The radar test signals are injected into the Master Device.

2.8 List of Measurements

Clause	Test Parameter	Remarks	Pass/Fail
4.7.7.2	DFS Detection Threshold	Applicable	Pass
4.7.7.2	Channel Availability Check Time	Applicable	Pass
4.7.7.2	Channel Move Time	Applicable	Pass
4.7.7.2	Channel Closing Transmission Time	Applicable	Pass
4.7.7.2	Non- Occupancy Period	Applicable	Pass
4.7.7.2	U-NII Detection Bandwidth	Applicable	Pass

NOTE: This UUT is capable of operating as a master (with radar detection).

2.9 Test Results

UNII Detection Bandwidth

UNII Detection Bandwidth: All UNII channels for this device have identical Channel bandwidths and testing was performed on Mid Channel

The generating equipment is configured as shown in the Conducted Test Setup above. A single *Burst* of the short pulse radar type 0 is produced at Mid Channel at a -63 dBm level. The UUT is set up as a standalone device (no associated Client and no traffic).

A single radar Burst is generated for a minimum of 10 trials, and the response of the UUT is noted. The UUT must detect the Radar Waveform 90% or more of the time.

Starting at the center frequency of the UUT operating Channel, increase the radar frequency in 5 MHz steps, repeating the above test sequence, until the detection rate falls below the U-NII Detection Bandwidth criterion specified. Repeat this measurement in 1MHz steps at frequencies 5 MHz below where the detection rate begins to fall. Record the highest frequency (denote as FH) at which detection is greater than or equal to the U-NII Detection Bandwidth criterion. Recording the detection rate at frequencies above FH is not required to demonstrate compliance.

Starting at the center frequency of the UUT operating Channel, decrease the radar frequency in 5 MHz steps, repeating the above test sequence, until the detection rate falls below the U-NII Detection Bandwidth criterion specified in Table 4. Repeat this measurement in 1MHz steps at frequencies 5 MHz above where the detection rate begins to fall. Record the lowest frequency (denote as FL) at which detection is greater than or equal to the U-NII Detection Bandwidth criterion. Recording the detection rate at frequencies below FL is not required to demonstrate compliance.

The U-NII Detection Bandwidth is calculated as follows:

$$\text{U-NII Detection Bandwidth} = \text{FH} - \text{FL}$$

The U-NII Detection Bandwidth must be at least 100% of the UUT transmitter 99% power, otherwise, the UUT does not comply with DFS requirements.

Test Result

EUT Frequency = 5300MHz (11a mode)

Frequency (MHz)	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10	Detection Rate %
5289	No	No	No	No	No	No	No	No	No	No	0.00%
5290	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.00%
5295	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.00%
5300	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.00%
5305	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.00%
5310	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.00%
5311	No	No	No	No	No	No	No	No	No	No	0.00%
Detection Bandwidth: 20 MHz											
Specification: at least 100% of 99% of EUT bandwidth= 16.423 MHz											

EUT Frequency = 5500MHz (11a mode)

Frequency (MHz)	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10	Detection Rate %
5489	No	No	No	No	No	No	No	No	No	No	0.00%
5490	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.00%
5495	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.00%
5500	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.00%
5505	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.00%
5510	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100.00%
5511	No	No	No	No	No	No	No	No	No	No	0.00%
Detection Bandwidth: 20 MHz											
Specification: at least 100% of 99% of EUT bandwidth= 16.543 MHz											

Channel Availability Check Time

If the UUT successfully detected the radar burst, it should be observed as the UUT has no transmissions occurred until the UUT starts transmitting on another channel.

Timing of Radar Signal	Observation	
	UUT	Spectrum Analyzer
Within 1 to 6 second	Detected	No transmissions
Within 54 to 60 second	Detected	No transmissions

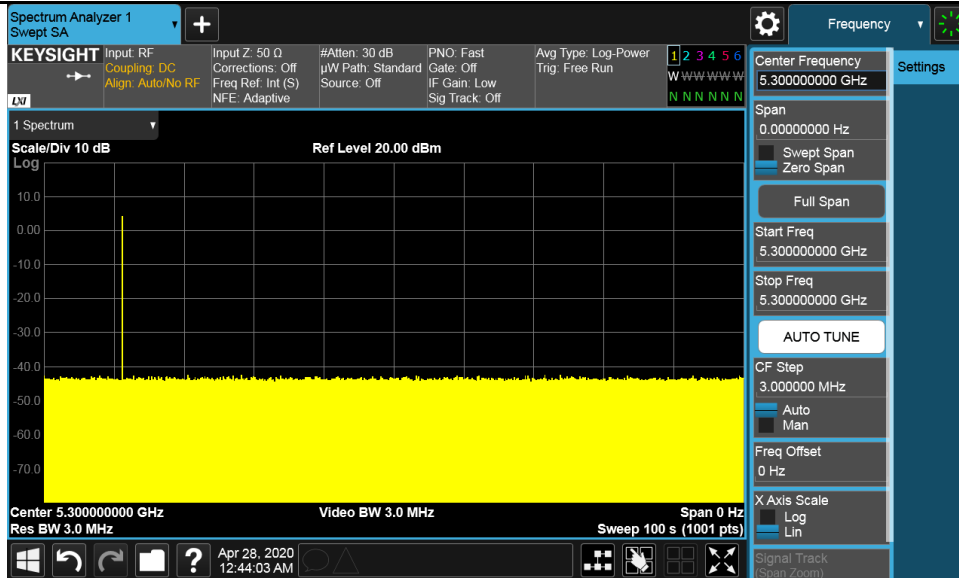
Initial Channel Availability Check Time

When switch channel, there is a timer on EUT screen showing the CAC time of 60 seconds.

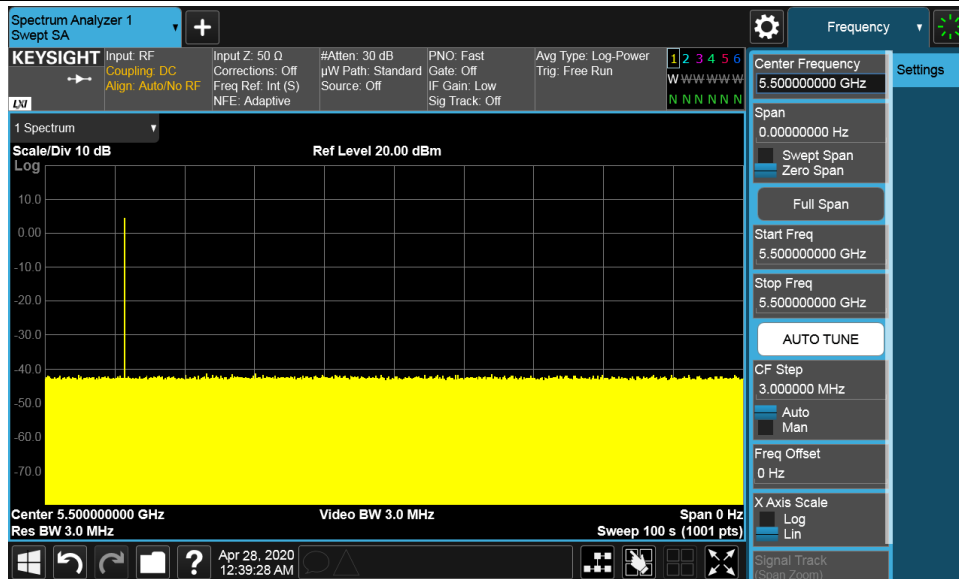
For CAC at the beginning, the radar signal was injected within 6 sec after CAC starts.
For CAC at the end, the radar signal was injected within 6 sec before CAC ends.

Note: CAC starts at 10 seconds in the plots

Radar Burst at the Beginning of the Channel Availability Check Time

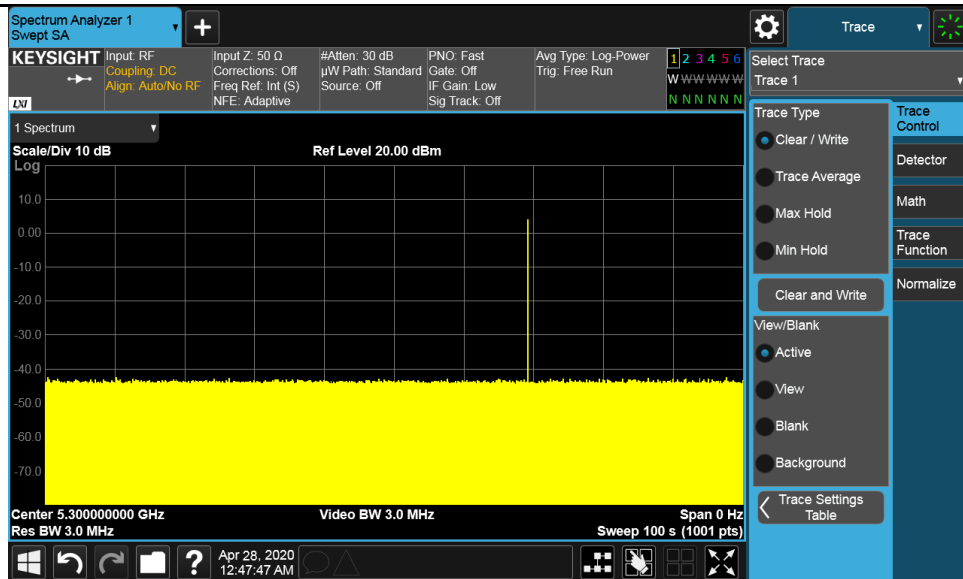


Radar at beginning of CAC – 802.11a–5300MHz

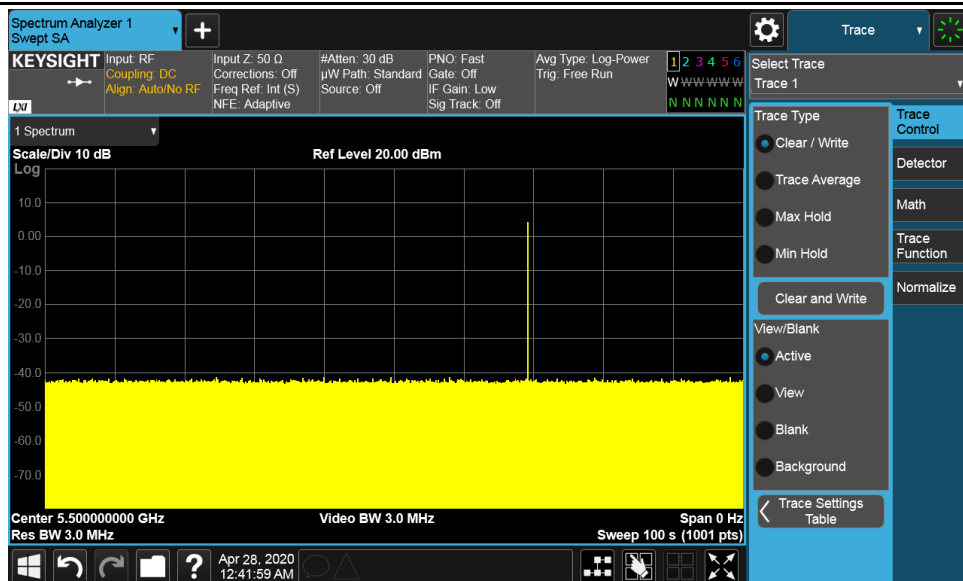


Radar at beginning of CAC – 802.11a–5500MHz

Radar Burst at the End of the Channel Availability Check Time



Radar at end of CAC – 802.11a–5300MHz



Radar at end of CAC – 802.11a–5500MHz

Channel Closing Transmission Time and Channel Move Time and Non-Occupancy Period

These tests define how the following DFS parameters are verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time, and Non-Occupancy Period.

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold + 1dB is generated on the Operating Channel of the U-NII device.

A U-NII device operating as a Client Device will associate with the UUT (Master) at Mid Channel. Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test.

At time T0 the Radar Waveform generator sends a Burst of pulses for each of the radar types at -64dBm.

Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time results to the limits defined in the DFS Response requirement values table.

Channel Closing Transmission Time- Measurement

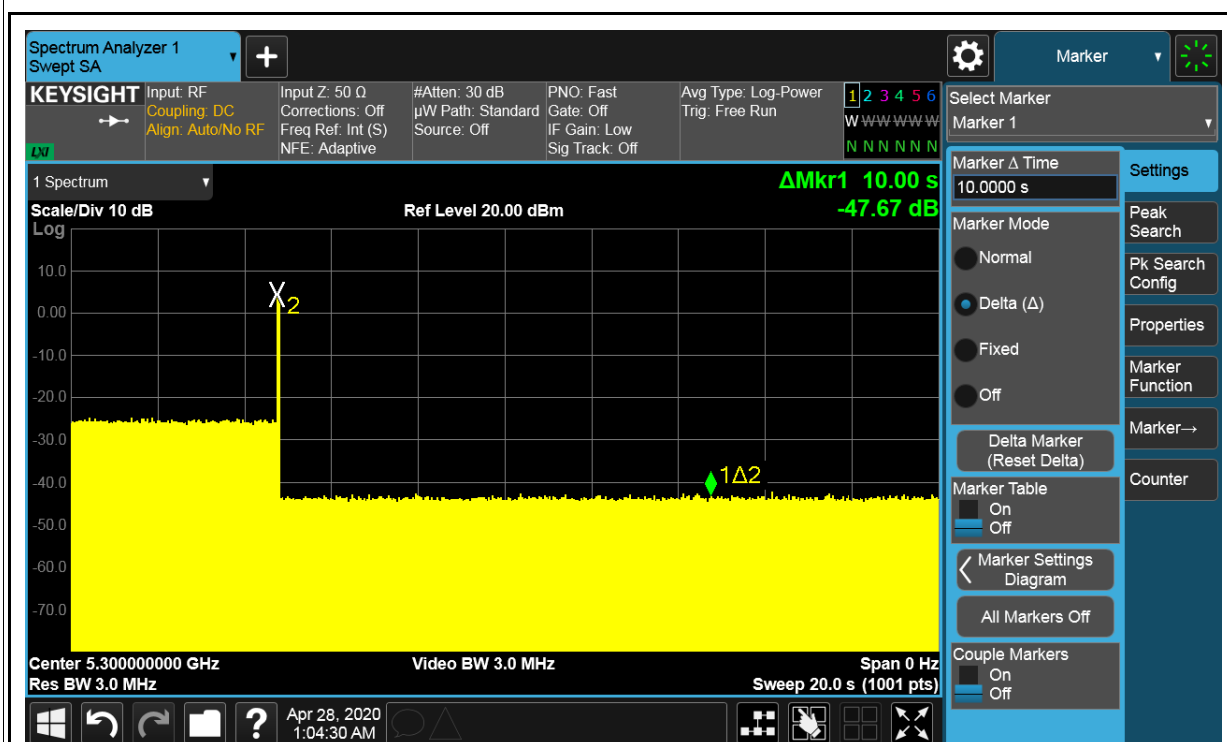
A type 1 waveform was introduced to the EUT and the Spectrum Analyzer sweep time was set to 1s for monitoring and capturing the plot. A LabView program was created to collect trace data and capturing the plot. The program will calculate the channel closing time base on the spectrum analyzer result. The result will be calculated base on FCC procedure.

$$C = N * D_{well}$$

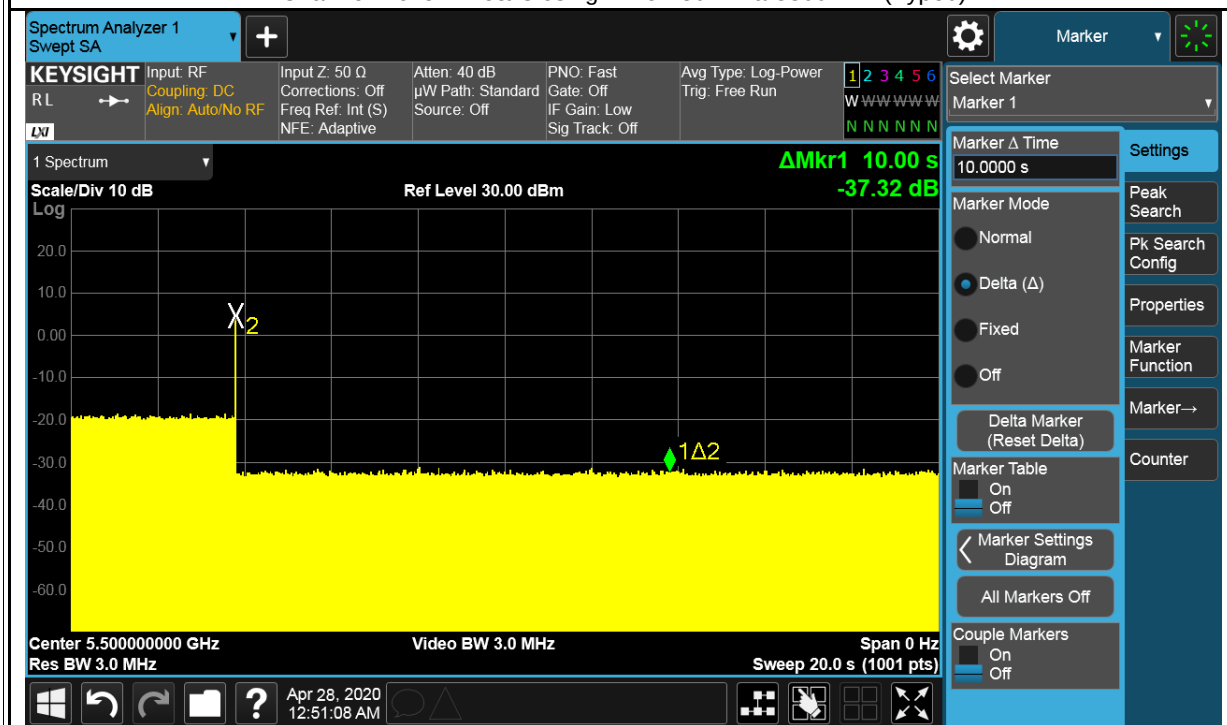
C is the closing time, N is the number of spectrum analyzer sampling bins showing a U-NII transmission and dwell is the dwell time per bin.

$$D_{well} = S / B$$

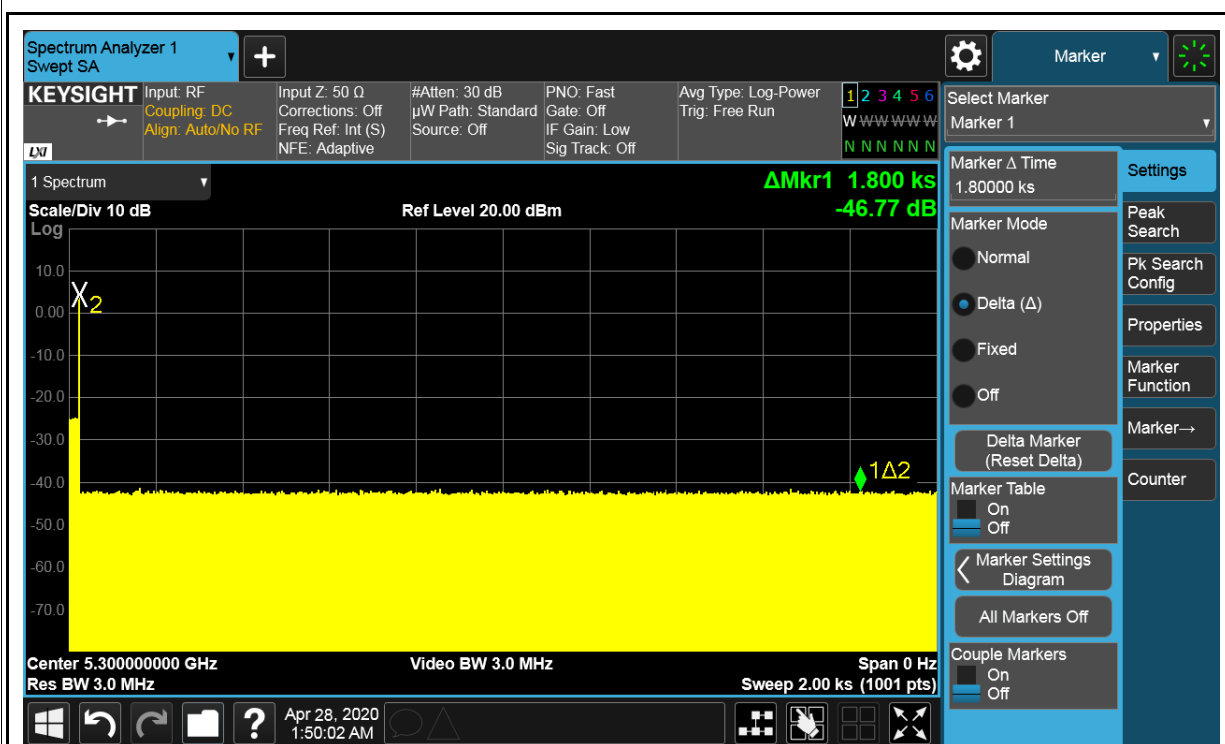
Where Dwell is the dwell time per spectrum analyzer sampling bin, S is the sweep time and B is the number of spectrum analyzer sampling bins.



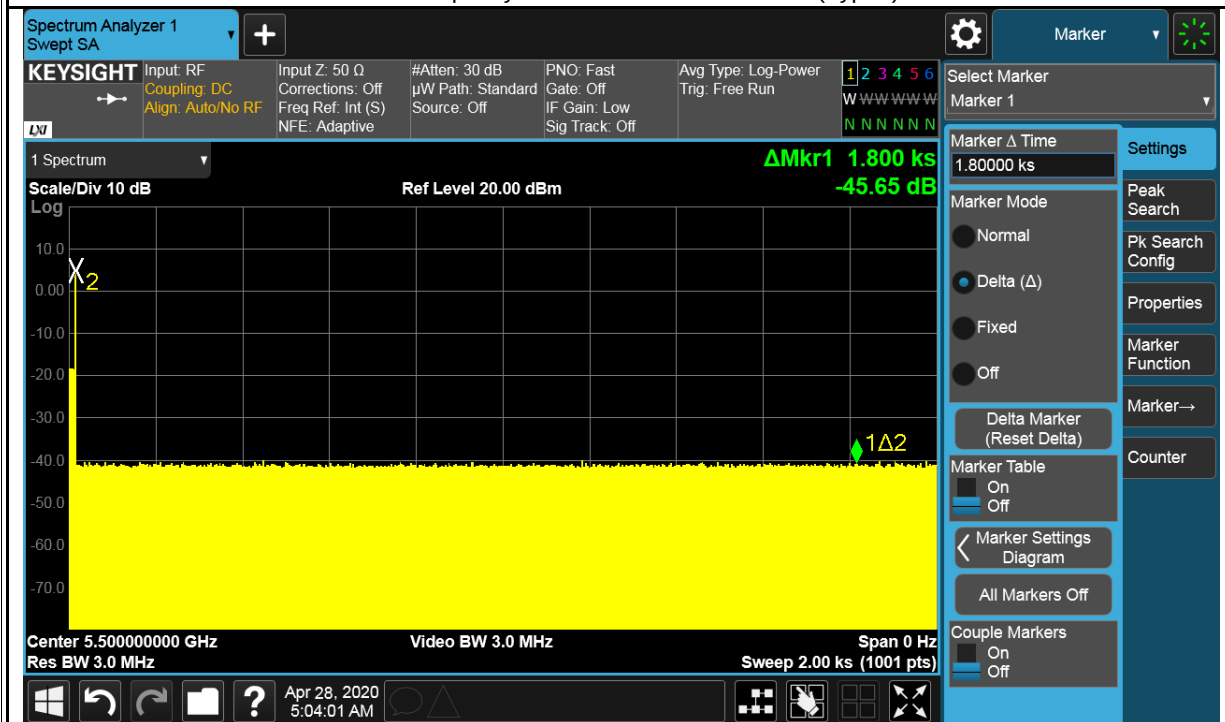
Channel Move Time& Closing Time - 802.11a-5300MHz (Type0)



Channel Move Time& Closing Time - 802.11a-5500MHz (Type0)



Non-Occupancy Period - 802.11a-5300MHz (Type0)



Non-Occupancy Period - 802.11a-5500MHz (Type0)

Statistical Performance Check

Statistical Performance Check, the steps below define the procedure to determine the minimum percentage of detection when a radar burst with a level equal to the DFS Detection Threshold + 1dB is generated on the Operating Channel of the U-NII device.

A U-NII device operating as a Client Device will associate with the UUT (Master) at Low, Mid and High Channel. Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test.

The Radar Waveform generator sends the individual waveform for each of the radar types 0-6 at -62dbm. Statistical data will be gathered to determine the ability of the device to detect the radar test waveforms. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device

$$\frac{TotalWaveformDetections}{TotalWaveformTrials} \times 100 = \text{Probability of Detection Radar Waveform calculated by:}$$

The Minimum number of trails, minimum percentage of successful detection and the average minimum percentage of successful detection are found in the Radar Test Waveforms section.

Test Result-5300MHz – 20MHz

Type 1

Trial Id	Pulse Width(us)	PRI(us)	Number of Pulses	Waveform Length(us)	Result
0	1	938	57	53466	Pass
1	1	698	76	53048	Pass
2	1	618	86	53148	Pass
3	1	538	99	53262	Pass
4	1	878	61	53558	Pass
5	1	3066	18	55188	Pass
6	1	638	83	52954	Pass
7	1	918	58	53244	Pass
8	1	838	63	52794	Pass
9	1	858	62	53196	Pass
10	1	798	67	53466	Pass
11	1	718	74	53132	Pass
12	1	578	92	53176	Pass
13	1	598	89	53222	Pass
14	1	558	95	53010	Pass
15	1	2536	21	53256	Pass
16	1	966	55	53130	Pass
17	1	827	64	52928	Pass
18	1	2501	22	55022	Pass
19	1	2595	21	54495	Pass
20	1	1114	48	53472	Pass
21	1	1302	41	53382	Pass
22	1	3045	18	54810	Pass
23	1	1624	33	53592	Pass
24	1	2878	19	54682	Pass
25	1	1027	52	53404	Pass
26	1	2485	22	54670	Pass
27	1	1600	33	52800	Pass
28	1	1172	46	53912	Pass
29	1	1177	45	52965	Pass

Test Result-5300MHz – 20MHz

Type 2

Trial Id	Pulse Width(us)	PRI(us)	Number of Pulses	Waveform Length(us)	Result
0	3.2	179	26	4654	Pass
1	1.1	207	23	4761	Pass
2	2.1	230	24	5520	Pass
3	4.8	200	29	5800	Pass
4	3.9	214	28	5992	Pass
5	2.9	222	26	5772	Pass
6	3.2	204	26	5304	Pass
7	2.5	192	25	4800	Pass
8	3.1	164	26	4264	Pass
9	1.2	156	23	3588	Pass
10	3.9	210	27	5670	Pass
11	4.6	201	29	5829	Pass
12	3.2	162	26	4212	Pass
13	2.2	197	25	4925	Pass
14	4.5	163	29	4727	Pass
15	3	203	26	5278	Pass
16	5	168	29	4872	Pass
17	2.4	217	25	5425	Pass
18	2.9	191	26	4966	Pass
19	2.3	166	25	4150	Pass
20	3.7	150	27	4050	Pass
21	2.2	176	25	4400	Pass
22	4.9	195	29	5655	Pass
23	2.9	202	26	5252	Pass
24	2.5	178	25	4450	Pass
25	1.1	206	23	4738	Pass
26	3.8	155	27	4185	Pass
27	4.7	157	29	4553	Pass
28	2.4	224	25	5600	Pass
29	4.2	159	28	4452	Pass

Test Result-5300MHz – 20MHz

Type 3

Trial Id	Pulse Width(us)	PRI(us)	Number of Pulses	Waveform Length(us)	Result
0	8.2	355	17	6035	Pass
1	6.1	487	16	7792	Pass
2	7.1	344	16	5504	Pass
3	9.8	288	18	5184	Pass
4	8.9	230	18	4140	Pass
5	7.9	432	17	7344	Pass
6	8.2	207	17	3519	Pass
7	7.5	443	17	7531	Pass
8	8.1	439	17	7463	Pass
9	6.2	223	16	3568	Pass
10	8.9	208	18	3744	Pass
11	9.6	463	18	8334	Pass
12	8.2	441	17	7497	Pass
13	7.2	323	16	5168	Pass
14	9.5	297	18	5346	Pass
15	8	412	17	7004	Pass
16	10	324	18	5832	Pass
17	7.4	271	17	4607	Pass
18	7.9	349	17	5933	Pass
19	7.3	409	16	6544	Pass
20	8.7	373	18	6714	Pass
21	7.2	254	16	4064	Pass
22	9.9	274	18	4932	Pass
23	7.9	278	17	4726	Pass
24	7.5	317	17	5389	Pass
25	6.1	260	16	4160	Pass
26	8.8	211	18	3798	Pass
27	9.7	272	18	4896	Pass
28	7.4	264	17	4488	Pass
29	9.2	284	18	5112	Pass

Test Result-5300MHz – 20MHz

Type 4

Trial Id	Pulse Width(us)	PRI(us)	Number of Pulses	Waveform Length(us)	Result
0	16	355	14	4970	Pass
1	11.3	487	12	5844	Pass
2	13.5	344	13	4472	Pass
3	19.4	288	16	4608	Pass
4	17.5	230	15	3450	Pass
5	15.3	432	14	6048	Pass
6	15.9	207	14	2898	Pass
7	14.3	443	13	5759	Pass
8	15.8	439	14	6146	Pass
9	11.5	223	12	2676	Pass
10	17.4	208	15	3120	Pass
11	19	463	16	7408	Pass
12	16	441	14	6174	Pass
13	13.8	323	13	4199	Pass
14	18.9	297	16	4752	Pass
15	15.5	412	14	5768	Pass
16	19.9	324	16	5184	Pass
17	14.1	271	13	3523	Pass
18	15.2	349	14	4886	Pass
19	13.8	409	13	5317	Pass
20	17.1	373	15	5595	Pass
21	13.8	254	13	3302	Pass
22	19.8	274	16	4384	Pass
23	15.3	278	14	3892	Pass
24	14.5	317	13	4121	Pass
25	11.3	260	12	3120	Pass
26	17.3	211	15	3165	Pass
27	19.2	272	16	4352	Pass
28	14.2	264	13	3432	Pass
29	18.2	284	15	4260	Pass

Test Result-5300MHz – 20MHz

Type 5

Trial Id	Number of Bursts	Burst Period(s)	Waveform Length(s)	Center Frequency(GHz)	Result
0	15	0.8	12	5.3	Pass
1	8	1.5	12	5.3	Pass
2	11	1.090909	12	5.3	Pass
3	20	0.6	12	5.3	Pass
4	17	0.705882	12	5.3	Pass
5	14	0.857143	12	5.3	Pass
6	15	0.8	12	5.3	Pass
7	12	1	12	5.3	Pass
8	14	0.857143	12	5.3	Pass
9	8	1.5	12	5.3	Pass
10	17	0.705882	12	5.3039	Pass
11	19	0.631579	12	5.3051	Pass
12	15	0.8	12	5.3027	Pass
13	12	1	12	5.3015	Pass
14	19	0.631579	12	5.3047	Pass
15	14	0.857143	12	5.3023	Pass
16	20	0.6	12	5.3055	Pass
17	12	1	12	5.3015	Pass
18	14	0.857143	12	5.3023	Pass
19	12	1	12	5.3015	Pass
20	16	0.75	12	5.2965	Pass
21	12	1	12	5.2989	Pass
22	20	0.6	12	5.2945	Pass
23	14	0.857143	12	5.2977	Pass
24	13	0.923077	12	5.2981	Pass
25	8	1.5	12	5.2005	Pass
26	17	0.705882	12	5.2961	Pass
27	19	0.631579	12	5.2949	Pass
28	12	1	12	5.2985	Pass
29	18	0.666667	12	5.2957	Pass

Note: Radar waveform center frequencies are selected based on section 7.8.4.2 Long Pulse Radar Test of 905462 D02 UNII DFS Compliance Procedures New Rules v02.
For each detail Radar waveform please refer Annex B.

Test Result-5300MHz – 20MHz

Type 6

Trial Id	Pulse Width(us)	PRI(us)	Pulses per Hop	Hopping Rate(kHz)	Hopping Sequence Length(ms)	Visible Frequency Number	Result
0	1	333.3	9	0.3333	300	32	Pass
1	1	333.3	9	0.3333	300	27	Pass
2	1	333.3	9	0.3333	300	25	Pass
3	1	333.3	9	0.3333	300	33	Pass
4	1	333.3	9	0.3333	300	37	Pass
5	1	333.3	9	0.3333	300	30	Pass
6	1	333.3	9	0.3333	300	33	Pass
7	1	333.3	9	0.3333	300	27	Pass
8	1	333.3	9	0.3333	300	33	Pass
9	1	333.3	9	0.3333	300	30	Pass
10	1	333.3	9	0.3333	300	37	Pass
11	1	333.3	9	0.3333	300	36	Pass
12	1	333.3	9	0.3333	300	38	Pass
13	1	333.3	9	0.3333	300	35	Pass
14	1	333.3	9	0.3333	300	28	Pass
15	1	333.3	9	0.3333	300	37	Pass
16	1	333.3	9	0.3333	300	35	Pass
17	1	333.3	9	0.3333	300	37	Pass
18	1	333.3	9	0.3333	300	27	Pass
19	1	333.3	9	0.3333	300	34	Pass
20	1	333.3	9	0.3333	300	35	Pass
21	1	333.3	9	0.3333	300	37	Pass
22	1	333.3	9	0.3333	300	41	Pass
23	1	333.3	9	0.3333	300	36	Pass
24	1	333.3	9	0.3333	300	29	Pass
25	1	333.3	9	0.3333	300	32	Pass
26	1	333.3	9	0.3333	300	30	Pass
27	1	333.3	9	0.3333	300	31	Pass
28	1	333.3	9	0.3333	300	31	Pass
29	1	333.3	9	0.3333	300	40	Pass

Test Result-5500MHz – 20MHz

Type 1

Trial Id	Pulse Width(us)	PRI(us)	Number of Pulses	Waveform Length(us)	Result
0	1	938	57	53466	Pass
1	1	698	76	53048	Pass
2	1	618	86	53148	Pass
3	1	538	99	53262	Pass
4	1	878	61	53558	Pass
5	1	3066	18	55188	Pass
6	1	638	83	52954	Pass
7	1	918	58	53244	Pass
8	1	838	63	52794	Pass
9	1	858	62	53196	Pass
10	1	798	67	53466	Pass
11	1	718	74	53132	Pass
12	1	578	92	53176	Pass
13	1	598	89	53222	Pass
14	1	558	95	53010	Pass
15	1	2536	21	53256	Pass
16	1	966	55	53130	Pass
17	1	827	64	52928	Pass
18	1	2501	22	55022	Pass
19	1	2595	21	54495	Pass
20	1	1114	48	53472	Pass
21	1	1302	41	53382	Pass
22	1	3045	18	54810	Pass
23	1	1624	33	53592	Pass
24	1	2878	19	54682	Pass
25	1	1027	52	53404	Pass
26	1	2485	22	54670	Pass
27	1	1600	33	52800	Pass
28	1	1172	46	53912	Pass
29	1	1177	45	52965	Pass

Test Result-5500MHz – 20MHz

Type 2

Trial Id	Pulse Width(us)	PRI(us)	Number of Pulses	Waveform Length(us)	Result
0	3.2	179	26	4654	Pass
1	1.1	207	23	4761	Pass
2	2.1	230	24	5520	Pass
3	4.8	200	29	5800	Pass
4	3.9	214	28	5992	Pass
5	2.9	222	26	5772	Pass
6	3.2	204	26	5304	Pass
7	2.5	192	25	4800	Pass
8	3.1	164	26	4264	Pass
9	1.2	156	23	3588	Pass
10	3.9	210	27	5670	Pass
11	4.6	201	29	5829	Pass
12	3.2	162	26	4212	Pass
13	2.2	197	25	4925	Pass
14	4.5	163	29	4727	Pass
15	3	203	26	5278	Pass
16	5	168	29	4872	Pass
17	2.4	217	25	5425	Pass
18	2.9	191	26	4966	Pass
19	2.3	166	25	4150	Pass
20	3.7	150	27	4050	Pass
21	2.2	176	25	4400	Pass
22	4.9	195	29	5655	Pass
23	2.9	202	26	5252	Pass
24	2.5	178	25	4450	Pass
25	1.1	206	23	4738	Pass
26	3.8	155	27	4185	Pass
27	4.7	157	29	4553	Pass
28	2.4	224	25	5600	Pass
29	4.2	159	28	4452	Pass

Test Result-5500MHz – 20MHz

Type 3

Trial Id	Pulse Width(us)	PRI(us)	Number of Pulses	Waveform Length(us)	Result
0	8.2	355	17	6035	Pass
1	6.1	487	16	7792	Pass
2	7.1	344	16	5504	Pass
3	9.8	288	18	5184	Pass
4	8.9	230	18	4140	Pass
5	7.9	432	17	7344	Pass
6	8.2	207	17	3519	Pass
7	7.5	443	17	7531	Pass
8	8.1	439	17	7463	Pass
9	6.2	223	16	3568	Pass
10	8.9	208	18	3744	Pass
11	9.6	463	18	8334	Pass
12	8.2	441	17	7497	Pass
13	7.2	323	16	5168	Pass
14	9.5	297	18	5346	Pass
15	8	412	17	7004	Pass
16	10	324	18	5832	Pass
17	7.4	271	17	4607	Pass
18	7.9	349	17	5933	Pass
19	7.3	409	16	6544	Pass
20	8.7	373	18	6714	Pass
21	7.2	254	16	4064	Pass
22	9.9	274	18	4932	Pass
23	7.9	278	17	4726	Pass
24	7.5	317	17	5389	Pass
25	6.1	260	16	4160	Pass
26	8.8	211	18	3798	Pass
27	9.7	272	18	4896	Pass
28	7.4	264	17	4488	Pass
29	9.2	284	18	5112	Pass

Test Result-5500MHz – 20MHz

Type 4

Trial Id	Pulse Width(us)	PRI(us)	Number of Pulses	Waveform Length(us)	Result
0	16	355	14	4970	Pass
1	11.3	487	12	5844	Pass
2	13.5	344	13	4472	Pass
3	19.4	288	16	4608	Pass
4	17.5	230	15	3450	Pass
5	15.3	432	14	6048	Pass
6	15.9	207	14	2898	Pass
7	14.3	443	13	5759	Pass
8	15.8	439	14	6146	Pass
9	11.5	223	12	2676	Pass
10	17.4	208	15	3120	Pass
11	19	463	16	7408	Pass
12	16	441	14	6174	Pass
13	13.8	323	13	4199	Pass
14	18.9	297	16	4752	Pass
15	15.5	412	14	5768	Pass
16	19.9	324	16	5184	Pass
17	14.1	271	13	3523	Pass
18	15.2	349	14	4886	Pass
19	13.8	409	13	5317	Pass
20	17.1	373	15	5595	Pass
21	13.8	254	13	3302	Pass
22	19.8	274	16	4384	Pass
23	15.3	278	14	3892	Pass
24	14.5	317	13	4121	Pass
25	11.3	260	12	3120	Pass
26	17.3	211	15	3165	Pass
27	19.2	272	16	4352	Pass
28	14.2	264	13	3432	Pass
29	18.2	284	15	4260	Pass

Test Result-5500MHz – 20MHz

Type 5

Trial Id	Number of Bursts	Burst Period(s)	Waveform Length(s)	Center Frequency(GHz)	Result
0	15	0.8	12	5.5	Pass
1	8	1.5	12	5.5	Pass
2	11	1.090909	12	5.5	Pass
3	20	0.6	12	5.5	Pass
4	17	0.705882	12	5.5	Pass
5	14	0.857143	12	5.5	Pass
6	15	0.8	12	5.5	Pass
7	12	1	12	5.5	Pass
8	14	0.857143	12	5.5	Pass
9	8	1.5	12	5.5	Pass
10	17	0.705882	12	5.5039	Pass
11	19	0.631579	12	5.5051	Pass
12	15	0.8	12	5.5027	Pass
13	12	1	12	5.5015	Pass
14	19	0.631579	12	5.5047	Pass
15	14	0.857143	12	5.5023	Pass
16	20	0.6	12	5.5055	Pass
17	12	1	12	5.5015	Pass
18	14	0.857143	12	5.5023	Pass
19	12	1	12	5.5015	Pass
20	16	0.75	12	5.4965	Pass
21	12	1	12	5.4989	Pass
22	20	0.6	12	5.4945	Pass
23	14	0.857143	12	5.4977	Pass
24	13	0.923077	12	5.4981	Pass
25	8	1.5	12	5.5005	Pass
26	17	0.705882	12	5.4961	Pass
27	19	0.631579	12	5.4949	Pass
28	12	1	12	5.4985	Pass
29	18	0.666667	12	5.4957	Pass

Note: Radar waveform center frequencies are selected based on section 7.8.4.2 Long Pulse Radar Test of 905462 D02 UNII DFS Compliance Procedures New Rules v02.
For each detail Radar waveform please refer Annex B.

Test Result-5500MHz – 20MHz

Type 6

Trial Id	Pulse Width(us)	PRI(us)	Pulses per Hop	Hopping Rate(kHz)	Hopping Sequence Length(ms)	Visible Frequency Number	Result
0	1	333.3	9	0.3333	300	32	Pass
1	1	333.3	9	0.3333	300	27	Pass
2	1	333.3	9	0.3333	300	25	Pass
3	1	333.3	9	0.3333	300	33	Pass
4	1	333.3	9	0.3333	300	37	Pass
5	1	333.3	9	0.3333	300	30	Pass
6	1	333.3	9	0.3333	300	33	Pass
7	1	333.3	9	0.3333	300	27	Pass
8	1	333.3	9	0.3333	300	33	Pass
9	1	333.3	9	0.3333	300	30	Pass
10	1	333.3	9	0.3333	300	37	Pass
11	1	333.3	9	0.3333	300	36	Pass
12	1	333.3	9	0.3333	300	38	Pass
13	1	333.3	9	0.3333	300	35	Pass
14	1	333.3	9	0.3333	300	28	Pass
15	1	333.3	9	0.3333	300	37	Pass
16	1	333.3	9	0.3333	300	35	Pass
17	1	333.3	9	0.3333	300	37	Pass
18	1	333.3	9	0.3333	300	27	Pass
19	1	333.3	9	0.3333	300	34	Pass
20	1	333.3	9	0.3333	300	35	Pass
21	1	333.3	9	0.3333	300	37	Pass
22	1	333.3	9	0.3333	300	41	Pass
23	1	333.3	9	0.3333	300	36	Pass
24	1	333.3	9	0.3333	300	29	Pass
25	1	333.3	9	0.3333	300	32	Pass
26	1	333.3	9	0.3333	300	30	Pass
27	1	333.3	9	0.3333	300	31	Pass
28	1	333.3	9	0.3333	300	31	Pass
29	1	333.3	9	0.3333	300	40	Pass

Appendix A - Radar Type waveform characteristic

Type 5:

Waveform 1

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.0 - 1.5	2	60	1728	0.51	20
2	1.5 - 3.0	3	76	1076, 1580	2.55	10
3	3.0 - 4.5	3	72	1872, 1208	3.96	20
4	4.5 - 6.0	2	76	1860	5.655	10
5	6.0 - 7.5	3	100	1400, 1860	6.825	20
6	7.5 - 9.0	1	52	/	7.89	10
7	9.0 - 10.5	3	92	1460, 1720	9.735	20
8	10.5 - 12.0	3	64	1704, 1240	10.98	10

Waveform 2

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.0 - 1.5	1	96	/	0.315	20
2	1.5 - 3.0	2	56	1784	1.68	10
3	3.0 - 4.5	3	100	1204, 1064	3.675	20
4	4.5 - 6.0	1	72	/	4.905	10
5	6.0 - 7.5	1	92	/	6.75	20
6	7.5 - 9.0	3	68	1060, 1808	7.71	10
7	9.0 - 10.5	3	72	1824, 1700	9.45	20
8	10.5 - 12.0	1	64	/	11.355	10

Waveform 3

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.0 - 1.5	1	76	/	0.705	20
2	1.5 - 3.0	2	88	1964	2.505	10
3	3.0 - 4.5	1	100	/	3.375	20
4	4.5 - 6.0	1	60	/	5.19	10
5	6.0 - 7.5	1	64	/	6.585	20
6	7.5 - 9.0	1	56	/	7.905	10
7	9.0 - 10.5	1	100	/	9.75	20
8	10.5 - 12.0	3	96	1256, 1104	11.04	10

Waveform 4

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.0 - 1.5	1	52	/	0.645	20
2	1.5 - 3.0	3	56	1836, 1788	1.845	10
3	3.0 - 4.5	2	52	1416	3.66	20
4	4.5 - 6.0	2	56	1812	5.52	10
5	6.0 - 7.5	1	80	/	6.6	20
6	7.5 - 9.0	3	92	1928, 1036	8.58	10
7	9.0 - 10.5	2	84	2000	9.24	20
8	10.5 - 12.0	2	88	1036	11.115	10

Waveform 5

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.0 - 1.5	2	56	1952	0.435	20
2	1.5 - 3.0	1	60	/	2.04	10
3	3.0 - 4.5	2	92	1064	3.99	20
4	4.5 - 6.0	2	64	1540	4.875	10
5	6.0 - 7.5	1	72	/	6.525	20
6	7.5 - 9.0	2	76	1692	7.785	10
7	9.0 - 10.5	3	80	1900, 1072	9.465	20
8	10.5 - 12.0	2	76	1136	10.74	10

Waveform 6

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.0 - 1.2	3	56	1484, 1292	0.252	20
2	1.2 - 2.4	3	68	1028, 1424	1.764	10
3	2.4 - 3.6	1	56	/	3.252	20
4	3.6 - 4.8	2	64	1956	3.9	10
5	4.8 - 6.0	2	100	1004	5.088	20
6	6.0 - 7.2	3	88	1368, 1652	6.672	10
7	7.2 - 8.4	3	52	1208, 1656	7.836	20
8	8.4 - 9.6	1	96	/	8.832	10
9	9.6 - 10.8	2	84	1288	9.972	20
10	10.8 - 12.0	1	100	/	11.16	10

Waveform 7

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.0 - 1.2	3	80	1656, 1788	0.852	20
2	1.2 - 2.4	1	96	/	1.404	10
3	2.4 - 3.6	1	84	/	3.108	20
4	3.6 - 4.8	3	56	1728, 1768	4.536	10
5	4.8 - 6.0	3	76	1596, 1656	5.496	20
6	6.0 - 7.2	3	64	1232, 1696	6.36	10
7	7.2 - 8.4	2	92	1924	7.848	20
8	8.4 - 9.6	1	96	/	8.544	10
9	9.6 - 10.8	1	60	/	9.78	20
10	10.8 - 12.0	1	76	/	10.992	10

Waveform 8

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.0 - 1.2	3	96	1940, 1260	0.636	20
2	1.2 - 2.4	1	72	/	1.368	10
3	2.4 - 3.6	3	60	1820, 1556	3.276	20
4	3.6 - 4.8	2	92	1416	3.72	10
5	4.8 - 6.0	3	96	1480, 1604	5.496	20
6	6.0 - 7.2	1	56	/	6.528	10
7	7.2 - 8.4	1	68	/	7.764	20
8	8.4 - 9.6	1	64	/	8.772	10
9	9.6 - 10.8	2	88	1232	10.08	20
10	10.8 - 12.0	2	76	1396	11.124	10

Waveform 9

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing (us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.0 - 1.2	1	76	/	0.588	20
2	1.2 - 2.4	1	56	/	1.86	10
3	2.4 - 3.6	3	92	1860, 1084	3.3	20
4	3.6 - 4.8	1	96	/	4.236	10
5	4.8 - 6.0	3	92	1432, 1860	5.28	20
6	6.0 - 7.2	1	100	/	6.264	10
7	7.2 - 8.4	3	64	1544, 1368	8.064	20
8	8.4 - 9.6	2	72	1248	8.724	10
9	9.6 - 10.8	1	76	/	9.828	20
10	10.8 - 12.0	3	84	1136, 1992	11.568	10

Waveform 10

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.0 - 1.2	1	68	/	0.576	20
2	1.2 - 2.4	1	84	/	1.44	10
3	2.4 - 3.6	3	64	1620, 1340	2.928	20
4	3.6 - 4.8	2	72	1552	4.2	10
5	4.8 - 6.0	3	64	1608, 1880	5.388	20
6	6.0 - 7.2	2	60	1672	6.192	10
7	7.2 - 8.4	3	52	1080, 1344	8.04	20
8	8.4 - 9.6	3	76	1828, 1868	8.568	10
9	9.6 - 10.8	2	56	1032	10.08	20
10	10.8 - 12.0	3	64	1728, 1256	11.088	10

Waveform 11

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	1	3	72	1440, 1968	0.14	20
2	2	1	64	/	1.42	10
3	3	2	60	1924	2.79	20
4	4	3	88	1188, 1956	3.17	10
5	5	3	52	1380, 1472	4.75	20
6	6	1	64	/	5.57	10
7	7	2	68	1856	6.76	20
8	8	1	100	/	7.59	10
9	9	1	72	/	8.7	20
10	10	3	60	1328, 1160	9.24	10
11	11	3	80	1740, 1248	10.72	20
12	12	2	88	1448	11.28	10

Waveform 12

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	1	1	100	/	0.61	20
2	2	3	92	1680, 1104	1.2	10
3	3	1	88	/	2.46	20
4	4	3	80	1628, 1052	3.22	10
5	5	2	68	1356	4.5	20
6	6	2	80	1532	5.15	10
7	7	1	52	/	6.33	20
8	8	2	60	1828	7.57	10
9	9	2	72	1492	8.74	20
10	10	2	80	1096	9.21	10
11	11	1	88	/	10.62	20
12	12	3	100	1744, 1860	11.65	10

Waveform13

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	1	3	84	1576, 1216	0.72	20
2	2	1	92	/	1.27	10
3	3	3	52	1356, 1236	2.68	20
4	4	3	80	1096, 1252	3.79	10
5	5	2	52	1224	4.7	20
6	6	3	76	1532, 1684	5.47	10
7	7	1	60	/	6.16	20
8	8	1	56	/	7.1	10
9	9	2	100	1572	8.44	20
10	10	1	72	/	9.41	10
11	11	2	80	1004	10.61	20
12	12	1	84	/	11.21	10

Waveform 14

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	1	1	80	/	0.48	20
2	2	1	92	/	1.66	10
3	3	1	88	/	2.51	20
4	4	2	96	1372	3.29	10
5	5	1	84	/	4.27	20
6	6	2	64	1396	5.28	10
7	7	2	80	1572	6.79	20
8	8	2	68	1932	7.21	10
9	9	1	60	/	8.11	20
10	10	1	68	/	9.15	10
11	11	1	84	/	10.2	20
12	12	3	100	1328, 1812	11.33	10

Waveform 15

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	1	1	80	/	0.71	20
2	2	3	96	1508, 1240	1.38	10
3	3	2	60	1072	2.7	20
4	4	2	64	1812	3.5	10
5	5	2	60	1672	4.57	20
6	6	2	92	1412	5.23	10
7	7	1	56	/	6.29	20
8	8	3	96	1812, 1336	7.3	10
9	9	2	88	1584	8.15	20
10	10	2	72	1700	9.49	10

11	11	1	76	/	10.37	20
12	12	2	68	1060	11.52	10

Waveform 16

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.80	3	92	1244, 1572	0.496	20
2	0.80 - 1.60	1	80	/	1.232	10
3	1.60 - 2.40	3	84	1432, 1632	1.688	20
4	2.40 - 3.20	3	60	1448, 1972	2.816	10
5	3.20 - 4.00	3	92	1080, 1184	3.32	20
6	4.00 - 4.80	3	96	1160, 1228	4.28	10
7	4.80 - 5.60	3	60	1036, 1736	4.936	20
8	5.60 - 6.40	2	56	1172	6.008	10
9	6.40 - 7.20	1	52	/	6.6	20
10	7.20 - 8.00	2	76	1980	7.512	10
11	8.00 - 8.80	3	80	1280, 1588	8.224	20
12	8.80 - 9.60	2	68	1664	9.008	10
13	9.60 - 10.40	2	92	1676	10.168	20
14	10.40 - 11.20	2	84	1332	10.728	10
15	11.20 - 12.00	2	60	1684	11.496	20

Waveform 17

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.80	1	72	/	0.632	20
2	0.80 - 1.60	3	92	1884, 1104	1.424	10
3	1.60 - 2.40	1	84	/	2.08	20
4	2.40 - 3.20	2	60	1912	2.912	10
5	3.20 - 4.00	3	72	1584, 1492	3.608	20
6	4.00 - 4.80	3	60	1588, 1752	4.272	10
7	4.80 - 5.60	2	64	1780	5.168	20
8	5.60 - 6.40	3	76	1588, 1744	5.808	10
9	6.40 - 7.20	1	56	/	6.888	20
10	7.20 - 8.00	2	76	1940	7.512	10
11	8.00 - 8.80	2	92	1444	8.592	20
12	8.80 - 9.60	3	60	1988, 1864	9.4	10
13	9.60 - 10.40	1	100	/	9.864	20
14	10.40 - 11.20	3	84	1284, 1748	10.728	10
15	11.20 - 12.00	2	100	1900	11.752	20

Waveform 18

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.80	1	56	/	0.504	20
2	0.80 - 1.60	3	76	1116, 1584	1.208	10
3	1.60 - 2.40	1	80	/	1.72	20
4	2.40 - 3.20	1	100	/	2.664	10
5	3.20 - 4.00	3	84	1264, 1140	3.568	20
6	4.00 - 4.80	1	72	/	4.544	10
7	4.80 - 5.60	3	56	1872, 1108	4.944	20
8	5.60 - 6.40	3	60	1320, 1920	6.208	10
9	6.40 - 7.20	2	76	1756	6.744	20
10	7.20 - 8.00	3	60	1596, 1400	7.776	10
11	8.00 - 8.80	1	56	/	8.36	20
12	8.80 - 9.60	3	88	1356, 1840	9.336	10
13	9.60 - 10.40	2	64	1712	9.896	20
14	10.40 - 11.20	1	100	/	10.984	10
15	11.20 - 12.00	3	76	1028, 1688	11.76	20

Waveform 19

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.80	1	84	/	0.408	20
2	0.80 - 1.60	3	64	1780, 1296	1.304	10
3	1.60 - 2.40	3	68	1400, 1292	1.824	20
4	2.40 - 3.20	1	92	/	2.944	10
5	3.20 - 4.00	1	64	/	3.352	20
6	4.00 - 4.80	2	56	1264	4.232	10
7	4.80 - 5.60	1	72	/	4.92	20
8	5.60 - 6.40	2	76	1460	5.992	10
9	6.40 - 7.20	1	84	/	6.528	20
10	7.20 - 8.00	2	68	1188	7.44	10
11	8.00 - 8.80	3	72	1576, 1536	8.456	20
12	8.80 - 9.60	2	64	1056	8.968	10
13	9.60 - 10.40	1	100	/	9.808	20
14	10.40 - 11.20	2	52	1092	10.616	10
15	11.20 - 12.00	3	68	1936, 1464	11.528	20

Waveform 20

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us))	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.80	1	88	/	0.2	20
2	0.80 - 1.60	1	68	/	1.376	10
3	1.60 - 2.40	2	88	1496	1.92	20
4	2.40 - 3.20	1	64	/	2.608	10
5	3.20 - 4.00	3	84	1768, 1184	3.584	20
6	4.00 - 4.80	3	52	1620, 1552	4.568	10
7	4.80 - 5.60	3	80	1908, 1884	5.432	20
8	5.60 - 6.40	3	92	1728, 1684	6.032	10
9	6.40 - 7.20	3	60	1536, 1496	6.928	20
10	7.20 - 8.00	3	76	1776, 1580	7.304	10
11	8.00 - 8.80	1	80	/	8.36	20
12	8.80 - 9.60	3	56	1020, 1292	9.072	10
13	9.60 - 10.40	2	60	1380	9.712	20
14	10.40 - 11.20	3	96	1324, 1664	10.992	10
15	11.20 - 12.00	2	72	1896	11.416	20

Waveform 21

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.75	3	52	1384, 1180	0.3225	20
2	0.75 - 1.50	2	60	1096	1.2525	10
3	1.50 - 2.25	3	72	1520, 1716	1.755	20
4	2.25 - 3.00	1	60	/	2.4675	10
5	3.00 - 3.75	2	56	1292	3.5475	20
6	3.75 - 4.50	2	64	1704	4.23	10
7	4.50 - 5.25	2	84	1708	4.9575	20
8	5.25 - 6.00	3	56	1008, 1624	5.565	10
9	6.00 - 6.75	3	80	1468, 1056	6.5325	20
10	6.75 - 7.50	2	88	1160	7.1325	10
11	7.50 - 8.25	3	56	1216, 1852	7.6575	20
12	8.25 - 9.00	1	52	/	8.37	10
13	9.00 - 9.75	1	80	/	9.45	20
14	9.75 - 10.50	3	60	1020, 1996	9.99	10
15	10.50 - 11.25	3	88	1960, 1620	10.6125	20
16	11.25 - 12.00	3	92	1760, 1496	11.46	10

Waveform 22

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.75	3	56	1704, 1692	0.3825	20
2	0.75 - 1.50	1	100	/	1.335	10
3	1.50 - 2.25	2	92	1068	2.025	20
4	2.25 - 3.00	2	84	1844	2.715	10
5	3.00 - 3.75	2	68	1896	3.0975	20
6	3.75 - 4.50	2	100	1656	3.8775	10
7	4.50 - 5.25	2	60	1960	5.0175	20
8	5.25 - 6.00	1	88	/	5.73	10
9	6.00 - 6.75	1	84	/	6.3975	20
10	6.75 - 7.50	3	56	1784, 1692	7.0125	10
11	7.50 - 8.25	3	52	1784, 1648	7.83	20
12	8.25 - 9.00	1	60	/	8.655	10
13	9.00 - 9.75	3	80	1460, 1564	9.195	20
14	9.75 - 10.50	2	68	1604	10.0875	10
15	10.50 - 11.25	1	76	/	10.77	20
16	11.25 - 12.00	2	96	1276	11.415	10

Waveform 23

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.75	3	52	1240, 1024	0.2025	20
2	0.75 - 1.50	2	100	1632	0.825	10
3	1.50 - 2.25	3	76	1112, 1156	1.6725	20
4	2.25 - 3.00	2	56	1808	2.43	10
5	3.00 - 3.75	1	64	/	3.585	20
6	3.75 - 4.50	3	68	1960, 1672	4.3425	10
7	4.50 - 5.25	2	52	1700	4.7625	20
8	5.25 - 6.00	1	100	/	5.385	10
9	6.00 - 6.75	3	60	1084, 1112	6.42	20
10	6.75 - 7.50	3	64	1972, 1164	7.0875	10
11	7.50 - 8.25	3	92	1752, 1168	7.845	20
12	8.25 - 9.00	3	80	1448, 1432	8.775	10
13	9.00 - 9.75	2	88	1744	9.39	20
14	9.75 - 10.50	2	92	1548	10.125	10
15	10.50 - 11.25	2	80	1812	11.0625	20
16	11.25 - 12.00	2	52	1508	11.3475	10

Waveform 24

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.75	2	56	1404	0.2775	20
2	0.75 - 1.50	3	64	1964, 1024	1.1625	10
3	1.50 - 2.25	3	84	1708, 1640	2.0475	20
4	2.25 - 3.00	2	88	1128	2.79	10
5	3.00 - 3.75	1	100	/	3.0825	20
6	3.75 - 4.50	1	60	/	3.885	10
7	4.50 - 5.25	2	96	1436	5.07	20
8	5.25 - 6.00	1	68	/	5.64	10
9	6.00 - 6.75	3	72	1496, 1800	6.3375	20
10	6.75 - 7.50	1	100	/	6.975	10
11	7.50 - 8.25	2	68	1752	8.0025	20
12	8.25 - 9.00	1	84	/	8.6025	10
13	9.00 - 9.75	1	72	/	9.3225	20
14	9.75 - 10.50	2	88	1552	10.215	10
15	10.50 - 11.25	3	52	1884, 1864	10.9425	20
16	11.25 - 12.00	3	60	1776, 1700	11.34	10

Waveform 25

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.75	1	88	/	0.105	20
2	0.75 - 1.50	1	96	/	1.0125	10
3	1.50 - 2.25	1	60	/	2.055	20
4	2.25 - 3.00	1	80	/	2.5875	10
5	3.00 - 3.75	3	76	1344, 1716	3.2475	20
6	3.75 - 4.50	2	64	1560	4.3275	10
7	4.50 - 5.25	2	84	1964	4.935	20
8	5.25 - 6.00	3	60	1760, 1532	5.7225	10
9	6.00 - 6.75	2	80	1432	6.375	20
10	6.75 - 7.50	1	96	/	7.1925	10
11	7.50 - 8.25	3	60	1904, 1676	7.6125	20
12	8.25 - 9.00	1	80	/	8.535	10
13	9.00 - 9.75	2	68	1724	9.465	20
14	9.75 - 10.50	3	76	1936, 1648	10.2	10
15	10.50 - 11.25	2	88	1728	10.92	20
16	11.25 - 12.00	3	84	1908, 1144	11.64	10

Waveform 26

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.60	1	96	/	0.36	20
2	0.60 - 1.20	3	80	1072, 1772	0.84	10
3	1.20 - 1.80	1	88	/	1.392	20
4	1.80 - 2.40	1	100	/	2.202	10
5	2.40 - 3.00	2	56	1692	2.718	20
6	3.00 - 3.60	3	84	1572, 1816	3.084	10
7	3.60 - 4.20	1	60	/	3.678	20
8	4.20 - 4.80	1	92	/	4.674	10
9	4.80 - 5.40	3	52	1628, 1704	5.13	20
10	5.40 - 6.00	3	84	1200, 1716	5.466	10
11	6.00 - 6.60	2	80	1580	6.432	20
12	6.60 - 7.20	3	68	1552, 1236	6.66	10
13	7.20 - 7.80	1	60	/	7.482	20
14	7.80 - 8.40	3	88	1192, 1516	8.094	10
15	8.40 - 9.00	3	56	1372, 1284	8.598	20
16	9.00 - 9.60	3	88	1824, 1280	9.354	10
17	9.60 - 10.20	1	60	/	10.014	20
18	10.20 - 10.80	3	84	1644, 1420	10.272	10
19	10.80 - 11.40	3	72	1348, 1724	11.226	20
20	11.40 - 12.00	1	88	/	11.742	10

Waveform 27

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.60	2	56	1976	0.192	20
2	0.60 - 1.20	2	100	1968	0.78	10
3	1.20 - 1.80	3	60	1892, 1628	1.476	20
4	1.80 - 2.40	3	64	1752, 1328	2.268	10
5	2.40 - 3.00	2	92	1664	2.484	20
6	3.00 - 3.60	2	84	1236	3.234	10
7	3.60 - 4.20	1	64	/	3.858	20
8	4.20 - 4.80	2	80	1280	4.572	10
9	4.80 - 5.40	3	76	1588, 1452	4.92	20
10	5.40 - 6.00	1	64	/	5.688	10
11	6.00 - 6.60	3	80	1464, 1924	6.204	20
12	6.60 - 7.20	1	76	/	6.996	10
13	7.20 - 7.80	1	72	/	7.65	20
14	7.80 - 8.40	1	60	/	8.01	10
15	8.40 - 9.00	2	76	1320	8.694	20
16	9.00 - 9.60	2	100	1684	9.408	10
17	9.60 - 10.20	2	56	1656	9.822	20
18	10.20 - 10.80	3	80	1064, 1868	10.374	10

19	10.80 - 11.40	1	60	/	10.866	20
20	11.40 - 12.00	3	88	1124, 1952	11.718	10

Waveform 28

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.60	2	68	1484	0.306	20
2	0.60 - 1.20	1	88	/	0.834	10
3	1.20 - 1.80	2	92	1832	1.398	20
4	1.80 - 2.40	2	72	1160	2.076	10
5	2.40 - 3.00	1	68	/	2.472	20
6	3.00 - 3.60	3	72	1320, 1844	3.18	10
7	3.60 - 4.20	1	92	/	3.768	20
8	4.20 - 4.80	2	72	1384	4.668	10
9	4.80 - 5.40	1	100	/	5.274	20
10	5.40 - 6.00	1	92	/	5.802	10
11	6.00 - 6.60	1	96	/	6.252	20
12	6.60 - 7.20	3	92	1364, 1348	6.732	10
13	7.20 - 7.80	3	72	1596, 1464	7.464	20
14	7.80 - 8.40	1	60	/	7.878	10
15	8.40 - 9.00	3	64	1444, 1224	8.508	20
16	9.00 - 9.60	1	100	/	9.438	10
17	9.60 - 10.20	3	72	1712, 1152	9.93	20
18	10.20 - 10.80	1	88	/	10.584	10
19	10.80 - 11.40	2	68	1368	11.022	20
20	11.40 - 12.00	1	88	/	11.544	10

Waveform29

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.60	1	72	/	0.348	20
2	0.60 - 1.20	1	92	/	1.068	10
3	1.20 - 1.80	2	60	1624	1.41	20
4	1.80 - 2.40	2	100	1336	2.082	10
5	2.40 - 3.00	3	72	1924, 1172	2.67	20
6	3.00 - 3.60	3	88	1488, 1396	3.438	10
7	3.60 - 4.20	1	76	/	4.008	20
8	4.20 - 4.80	1	72	/	4.674	10
9	4.80 - 5.40	2	92	1864	5.1	20
10	5.40 - 6.00	2	64	1748	5.604	10
11	6.00 - 6.60	2	84	1356	6.198	20
12	6.60 - 7.20	1	68	/	6.996	10
13	7.20 - 7.80	3	96	1236, 1988	7.542	20
14	7.80 - 8.40	3	56	1328, 1864	8.034	10
15	8.40 - 9.00	3	76	1160, 1264	8.538	20
16	9.00 - 9.60	2	96	1224	9.18	10
17	9.60 - 10.20	3	84	1136, 1364	10.002	20
18	10.20 - 10.80	1	56	/	10.302	10

19	10.80 - 11.40	2	64	1388	11.124	20
20	11.40 - 12.00	1	88	/	11.628	10

Waveform 30

Burst #	Burst Interval(s)	Number of Pulses	Pulse Width (us)	Pulse Spacing(us)	Pulse Start (s)	Chirp Width (MHZ)
1	0.00 - 0.60	2	52	1352	0.12	20
2	0.60 - 1.20	1	100	/	0.876	10
3	1.20 - 1.80	1	96	/	1.314	20
4	1.80 - 2.40	3	60	1220, 1504	1.974	10
5	2.40 - 3.00	1	92	/	2.46	20
6	3.00 - 3.60	2	100	1100	3.45	10
7	3.60 - 4.20	1	88	/	3.99	20
8	4.20 - 4.80	1	68	/	4.428	10
9	4.80 - 5.40	2	72	1396	5.154	20
10	5.40 - 6.00	3	92	1240, 1216	5.67	10
11	6.00 - 6.60	1	72	/	6.21	20
12	6.60 - 7.20	1	92	/	6.858	10
13	7.20 - 7.80	2	96	1896	7.602	20
14	7.80 - 8.40	2	68	1552	7.926	10
15	8.40 - 9.00	1	64	/	8.838	20
16	9.00 - 9.60	1	60	/	9.396	10
17	9.60 - 10.20	3	72	1996, 1516	9.978	20
18	10.20 - 10.80	2	68	1992	10.518	10
19	10.80 - 11.40	3	60	1448, 1792	11.148	20
20	11.40 - 12.00	2	68	1156	11.736	10

Appendix B – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

Milpitas EMC/RF/Safety/Telecom Lab

775 Montague Expressway, Milpitas, CA 95035

Tel: +1 408 526 1188

Sunnyvale OTA/Bluetooth Lab

1293 Anvilwood Avenue, Sunnyvale, CA

94089

Tel: +1 669 600 5293

Littleton EMC/RF/Safety/Environmental Lab

1 Distribution Center Cir #1, Littleton, MA 01460

Tel: +1 978 486 8880

Irvine OTA/PTCRB/Bluetooth/V2X Lab

15 Musick, Irvine, CA 92618

Tel: +1 949 716 6512

Email: sales.eaw@us.bureauveritas.com

Web Site: www.cpsusa-bureauveritas.com

The address and road map of all our labs can be found in our web site also.

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