DFS MEASUREMENT REPORT

FCC PART 15 Subpart E

FCC ID:	2ADZR4G0812WA
APPLICANT:	Nokia Shanghai Bell Co., Ltd
Application Type:	Certification
Product:	FastMile 4G Gateway
Model No.:	4G08-12W-A
Brand Name:	NOKIA
FCC Classification:	Unlicensed National Information Infrastructure (NII)
FCC Rule Part(s):	Part15 Subpart E (Section 15.407(h)(2))
Test Procedure(s):	KDB 905462 D02v02, KDB 905462 D04v01
Type of Device:	Master Device
Test Date:	February 15, 2020 ~ February 22, 2020

Reviewed By: Sunny Sun
(Sunny Sun)

Approved By: Robin Wu
(Robin Wu)

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

The test results relate only to the samples tested.
This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 905462 D02v02. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date	Note
1911RSU040-U7	Rev. 01	Initial Report	04-27-2020	Valid

CONTENTS

General Information

Applicant:	Nokia Shanghai Bell Co., Ltd
Applicant Address:	388#, Ningqiao Road, China (Shanghai) Pilot Free Trade Zone, Shanghai 201206, China
Manufacturer:	Nokia Shanghai Bell Co., Ltd
Manufacturer Address:	388#, Ningqiao Road, China (Shanghai) Pilot Free Trade Zone, Shanghai 201206, China
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- **MRT facility is a FCC accredited (MRT Designation No. CN1166) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.**
- **MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.**
- **MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.**
- **MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications, Radio and SAR testing.**

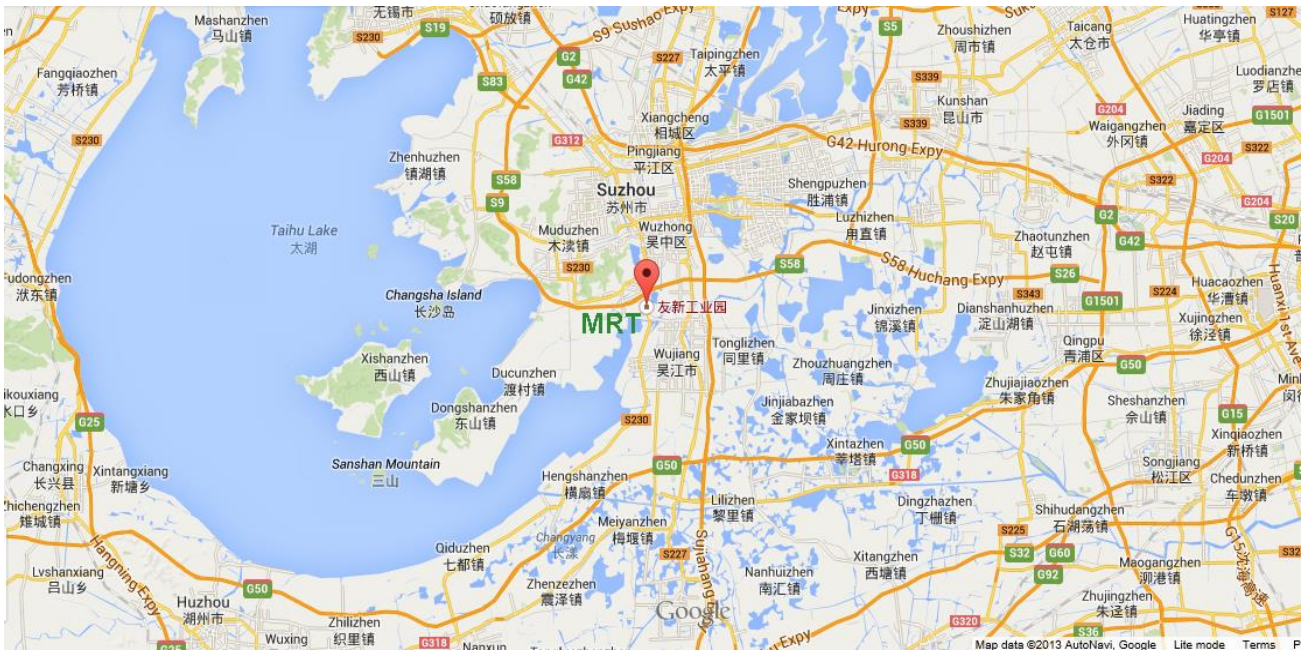
1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	FastMile 4G Gateway
Model No.:	4G08-12W-A
Brand Name:	NOKIA
Wi-Fi Specification:	802.11a/b/g/n/ac
LTE Specification:	Band 2, 4, 5, 7, 25, 38, 48, 66
Operating Temperature:	0 ~ 40 °C
Power Type:	AC adapter input

2.2. Product Specification Subjective to this Report

Frequency Range:	For 802.11a/n-HT20/ac-VHT20: 5180~5240MHz, 5260~5320MHz, 5500~5720MHz, 5745~5825MHz For 802.11n-HT40/ac-VHT40: 5190~5230MHz, 5270~5310MHz, 5510~5710MHz, 5755~5795MHz For 802.11ac-VHT80: 5210MHz, 5290MHz, 5530MHz, 5610 MHz, 5690MHz, 5775MHz
Type of Modulation:	802.11a/n/ac: OFDM
Data Rate:	802.11a: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.6Mbps
Power-on cycle:	Requires 51.2 seconds to complete its power-on cycle
Uniform Spreading (For DFS Frequency Band):	For the 5250-5350MHz, 5470-5725 MHz bands, the Master device provides, on aggregate, uniform loading of the spectrum across all devices by selecting an operating channel among the available channels using a random algorithm.

Note: For other features of this EUT, test report will be issued separately.

2.3. Description of Available Antennas

Technology	Frequency Range (MHz)	Antenna Type	Max Peak Gain (dBi)		Directional Gain (dBi)			
					CDD Mode		Beam-Forming Mode	
			Ant 8	Ant 9	For Power	For PSD	For Power	For PSD
2.4GHz Wi-Fi	2400 ~ 2483.5	PCB	3.81	3.95	3.95	6.96	6.96	6.96
5GHz Wi-Fi	5150 ~ 5350	Dipole	4.13	3.99	4.13	7.14	7.14	7.14
	5470 ~ 5725		4.42	4.65	4.65	7.66	7.66	7.66
	5725 ~ 5850		4.56	4.67	4.67	7.68	7.68	7.68

Technology	Frequency Range (MHz)	Antenna Type	Max Peak Gain (dBi)
LTE Band 2	1850 ~ 1910	PCB	4.27
LTE Band 4	1710 ~ 1755		4.49
LTE Band 5	824 ~ 849		0.10
LTE Band 7	2500 ~ 2570		4.70
LTE Band 25	1850 ~ 1915		4.27
LTE Band 38	2570 ~ 2620		4.70
LTE Band 48	3550 ~ 3700		4.80
LTE Band 66	1710 ~ 1780		4.49

Note 1: The EUT supports Cyclic Delay Diversity (CDD) with 802.11a/g/n/ac, CDD signals are correlated.

If all antennas have the same gain, G_{ANT}, Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

- For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log (N_{ANT}/ N_{SS}) dB = 3.01;

- For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB for $N_{ANT} \leq 4$;

If antenna gains are not equal, Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain.

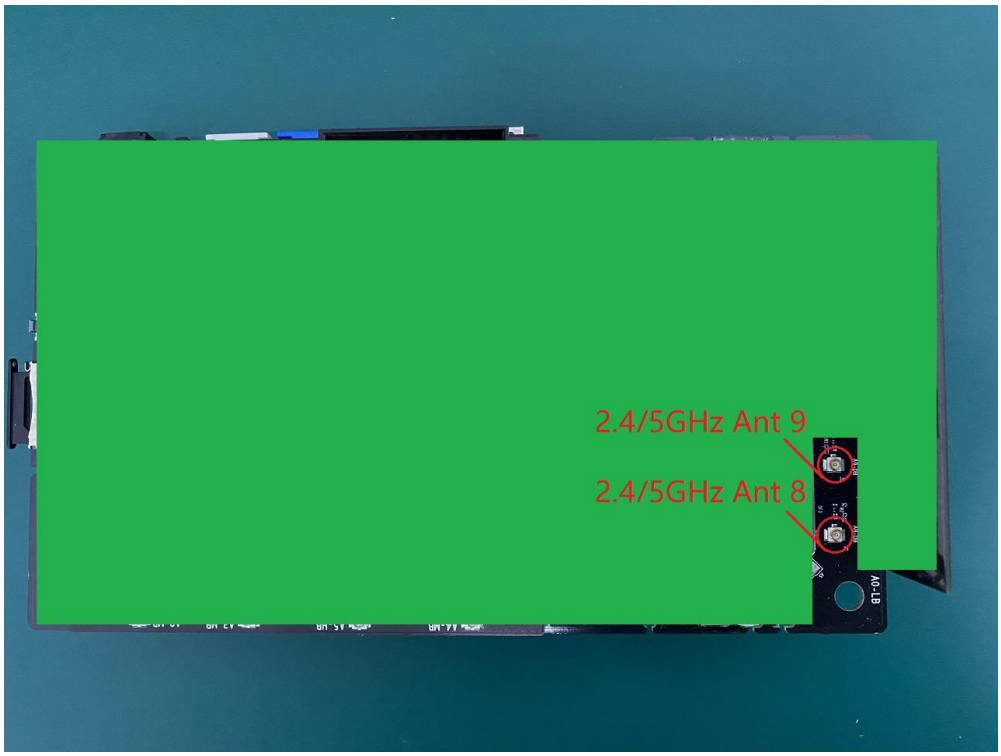
Note 2: The EUT supports Beam Forming mode with 802.11n/ac.

The directional gain = $10*\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2/N_{ANT}]$dBi.

Note 3: For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

2.4. Description of Antenna RF Port

Antenna RF Port				
--	2.4GHz RF Port		5GHz RF Port	
Software Control Port	Ant 8	Ant 9	Ant 8	Ant 9



2.5. DFS Band Carrier Frequencies Operation

802.11a/n/ac-VHT20

Channel	Frequency	Channel	Frequency	Channel	Frequency
52	5260 MHz	56	5280 MHz	60	5300 MHz
64	5320 MHz	100	5500 MHz	104	5520 MHz
108	5540 MHz	112	5560 MHz	116	5580 MHz
120	5600 MHz	124	5620 MHz	128	5640 MHz
132	5660 MHz	136	5680 MHz	140	5700 MHz
144	5720 MHz	--	--	--	--

802.11n-HT40/ac-VHT40

Channel	Frequency	Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz	102	5510 MHz
110	5550 MHz	118	5590 MHz	126	5630 MHz
134	5670 MHz	142	5710 MHz	--	--

802.11ac-VHT80

Channel	Frequency	Channel	Frequency	Channel	Frequency
58	5290 MHz	106	5530 MHz	122	5610 MHz
138	5690 MHz	--	--	--	--

2.6. Test Mode

Test Mode	Mode 1: Make the EUT communicate with client device at DFS channel

3. DFS DETECTION THRESHOLDS AND RADAR TEST WAVEFORMS

3.1. Applicability

The following table from FCC KDB 905462 D02 NII DFS Compliance Procedures New Rules v02 lists the applicable requirements for the DFS testing.

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 3-1: Applicability of DFS Requirements Prior to Use of a Channel

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

Additional requirements for devices 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 available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

Table 3-2: Applicability of DFS Requirements during normal operation

3.2. DFS Devices Requirements

Per FCC KDB 905462 D02 NII DFS Compliance Procedures New Rules v02 the following are the requirements for Master Devices:

(a) The Master Device will use DFS in order to detect Radar Waveforms with received signal strength above the DFS Detection Threshold in the 5250 ~ 5350 MHz and 5470 ~ 5725 MHz bands. DFS is not required in the 5150 ~ 5250 MHz or 5725 ~ 5825 MHz bands.

(b) Before initiating a network on a Channel, the Master Device will perform a Channel Availability Check for specified time duration (Channel Availability Check Time) to ensure that there is no radar system operating on the Channel, using DFS described under subsection a) above.

(c) The Master Device initiates a U-NII network by transmitting control signals that will enable other U-NII devices to Associate with the Master Device.

(d) During normal operation, the Master Device will monitor the Channel (In-Service Monitoring) to ensure that there is no radar system operating on the Channel, using DFS described under a).

(e) If the Master Device has detected a Radar Waveform during In-Service Monitoring as described under d), the Operating Channel of the U-NII network is no longer an Available Channel. The Master Device will instruct all associated Client Device(s) to stop transmitting on this Channel within the Channel Move Time. The transmissions during the Channel Move Time will be limited to the Channel Closing Transmission Time.

(f) Once the Master Device has detected a Radar Waveform it will not utilize the Channel for the duration of the Non-Occupancy Period.

(g) If the Master Device delegates the In-Service Monitoring to a Client Device, then the combination will be tested to the requirements described under d) through f) above.

Channel Move Time and Channel Closing Transmission Time requirements are listed in the following table.

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.

Table 3-3: DFS Response Requirements

3.3. DFS Detection Threshold Values

The DFS detection thresholds are defined for Master devices and Client Devices with In-service monitoring. These detection thresholds are listed in the following table.

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.	

Table 3-4: Detection Thresholds for Master Devices and Client Devices with Radar Detection

3.4. Parameters of DFS Test Signals

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. 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.

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 3-6	Roundup $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{PRI_{usec}}\right)\right\}$	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.					

Table 3-5: Parameters for Short Pulse Radar Waveforms

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms.

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses 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 3-6: Pulse Repetition Intervals Values for Test A

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 3-7: Parameters for Long Pulse Radar Waveforms

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse Radar Type waveforms. If more than 30 waveforms are used for the Long Pulse Radar Type waveforms, then each additional waveform must also be unique and not repeated from the previous waveforms.

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

Table 3-8: Parameters for Frequency Hopping Radar Waveforms

For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

3.5. Test Setup

The FCC KDB 905462 D02 NII DFS Compliance Procedures New Rules v02 describes a radiated test setup and a conducted test setup. The Radiated test setup was used for this testing. Figure 3-1 shows the typical test setup.

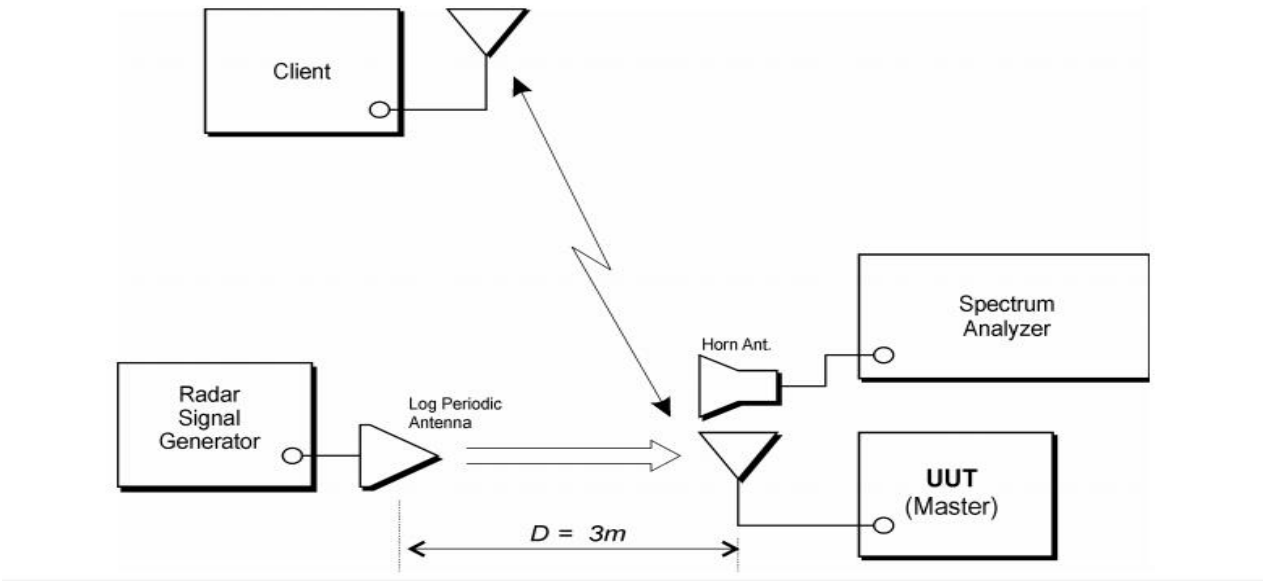


Figure 3-1: Radiated Test Setup where UUT is a Master and Radar Test Waveforms are injected into the Masters

4. TEST EQUIPMENT CALIBRATION DATE

Dynamic Frequency Selection (DFS) – SR4

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2020/04/15
Vector Signal Generator	Agilent	E4438C	MRTSUE06026	1 year	2020/11/07
Thermohygrometer	Testo	608-H1	MRTSUE06222	1 year	2020/11/10

Client Information

Instrument	Manufacturer	Type No.
Wireless Network Adapter	Intel	7260HMW

Software	Version	Manufacturer	Function
Pulse Building	N/A	Agilent	Radar Signal Generation Software
DFS Tool	V 6.9.2	Agilent	DFS Test Software
R&S Pulse Sequencer DFS	V 1.4	R&S	DFS Test Software

5. TEST RESULT

5.1. Summary

Parameter	Limit	Test Result	Reference
NII Detection Bandwidth Measurement	Refer Table 3-3	Pass	Section 5.4
Initial Channel Availability Check Time	Refer Table 3-3	Pass	Section 5.5
Radar Burst at the Beginning of the Channel Availability Check Time	Refer Table 3-3	Pass	Section 5.6
Radar Burst at the End of the Channel Availability Check Time	Refer Table 3-3	Pass	Section 5.7
In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time	Refer Table 3-3	Pass	Section 5.8
Non-Occupancy Period	Refer Table 3-3	Pass	Section 5.8
Statistical Performance Check	Refer Table 3-3	Pass	Section 5.9

5.2. Radar Waveform Calibration

5.2.1. Calibration Setup

The conducted test setup was used for this calibration testing. Figure 3-2 shows the typical test setup.

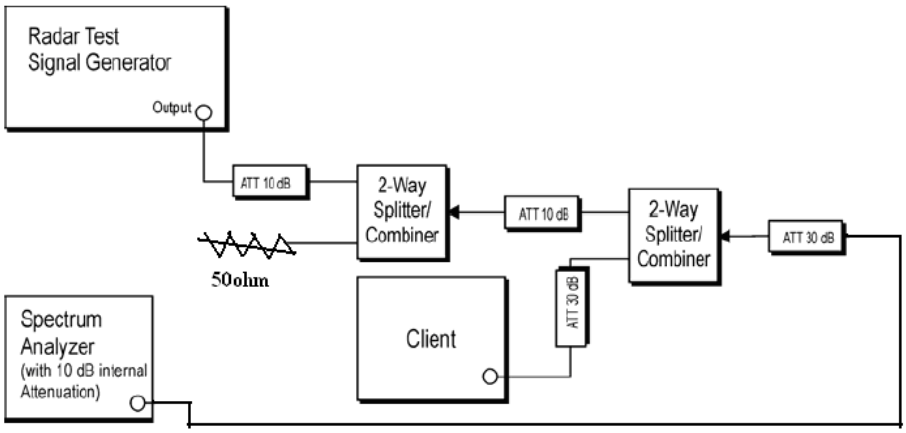


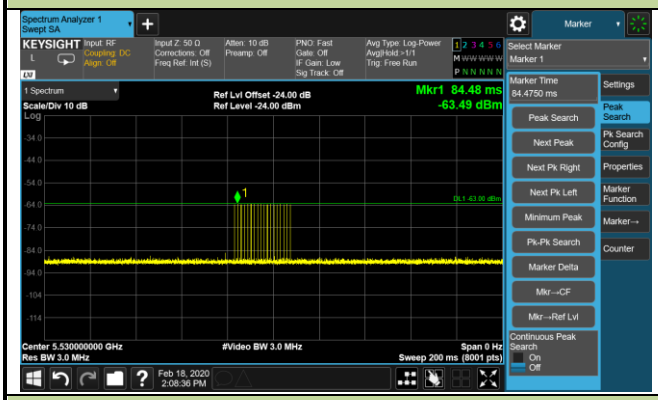
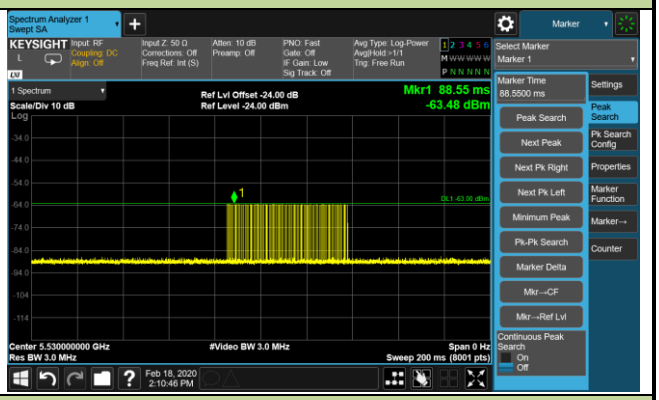
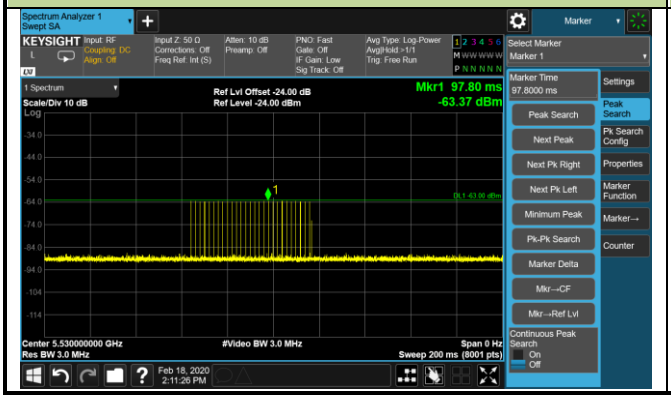
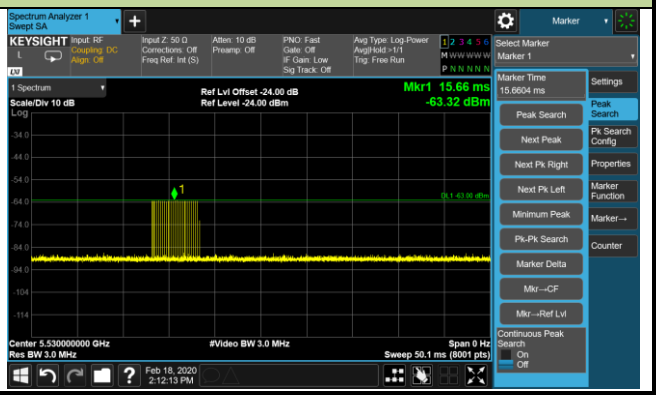
Figure 3-2: Conducted Test Setup

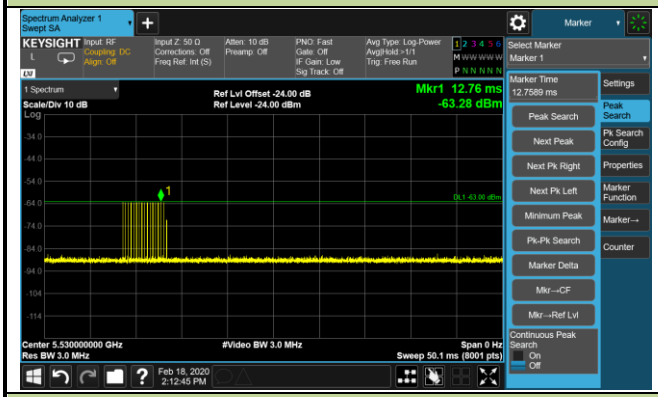
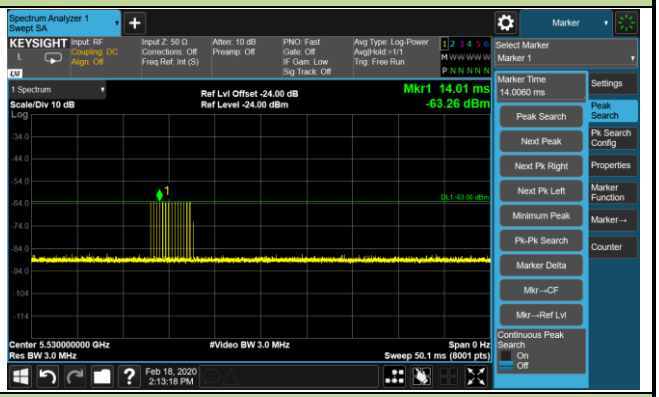
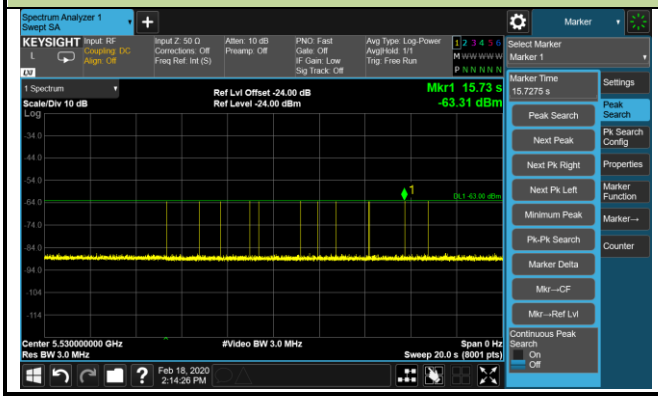
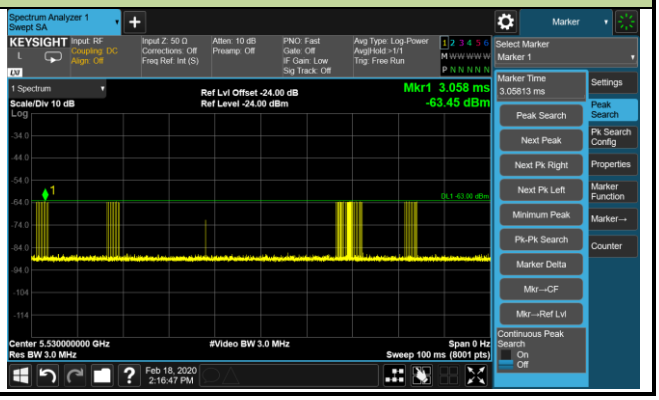
5.2.2. Calibration Procedure

The Interference Radar Detection Threshold Level is (-64dBm) + (0) [dBi] + 1 dB= -63 dBm that had been taken into account the output power range and antenna gain. The above equipment setup was used to calibrate the conducted Radar Waveform. A vector signal generator was utilized to establish the test signal level for each radar type. During this process there were replace 50ohm terminal form Master and Client device and no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero span (Time Domain) at the frequency of the Radar Waveform generator. Peak detection was used. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to at least 3MHz. The vector signal generator amplitude was set so that the power level measured at the spectrum analyzer was (-64dBm) + (0) [dBi] + 1 dB= -63dBm. Capture the spectrum analyzer plots on short pulse radar types, long pulse radar type and hopping radar waveform.

5.2.3. Cablibration Result

Product	FastMile 4G Gateway	Temperature	27°C
Test Engineer	Amy Zhang	Relative Humidity	65%
Test Site	SR5	Test Date	2020/02/18
Test Item	Radar Waveform Calibration		

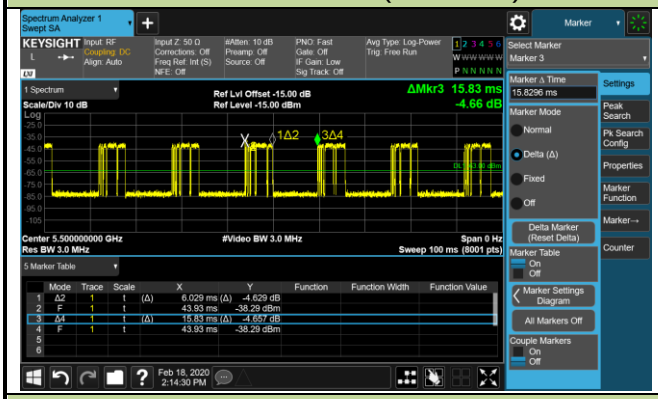
Radar #0	Radar #1 (Test A) PRI = 558us and the number of pulses = 95
	
Radar #1 (Test B) PRI = 1.956ms and the number of pulses = 27	Radar #2
	

Radar #3	Radar #4
	
Radar #5	**Radar #6**
	

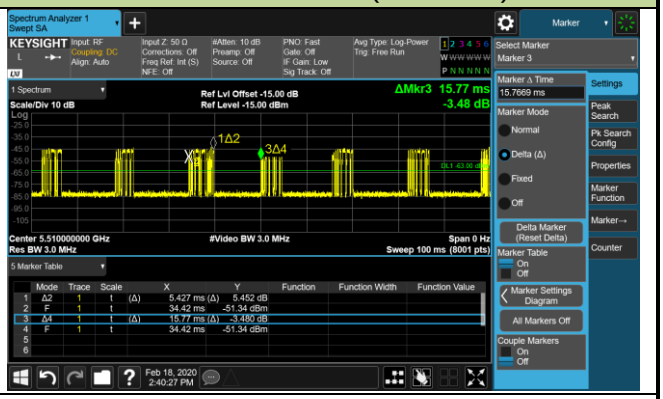
5.2.4. Channel Loading Test Result

Product	FastMile 4G Gateway	Temperature	23 ~ 25°C
Test Engineer	Amy Zhang	Relative Humidity	46 ~ 55%
Test Site	SR4	Test Date	2020/02/18
Test Item	Channel Loading		

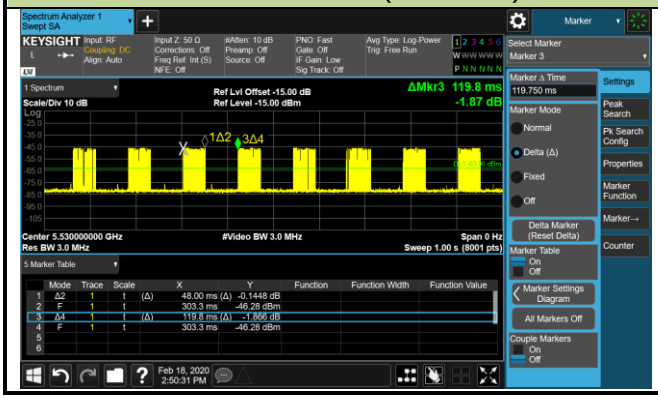
802.11ac-VHT20 (5500MHz)



802.11ac-VHT40 (5510MHz)



802.11ac-VHT80 (5530MHz)



Test Mode	Test Frequency	Packet ratio	Requirement ratio	Test Result
802.11ac-VHT20	5500 MHz	38.09%	≥ 17%	Pass
802.11ac-VHT40	5510 MHz	34.41%	≥ 17%	Pass
802.11ac-VHT80	5530 MHz	40.07%	≥ 17%	Pass

Note: System testing was performed with the designated iperf test file. This file is used by IP and Frame based systems for loading the test channel during the In-service compliance testing of the U-NII device. Packet ratio = Time On / (Time On + Off Time).

5.3. NII Detection Bandwidth Measurement

5.3.1. Test Limit

Minimum 100% of the NII 99% transmission power bandwidth. During the U-NII Detection Bandwidth detection test, each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

5.3.2. Test Procedure

1. Adjust the equipment to produce a single Burst of any one of the Short Pulse Radar Types 0-4 in Table 3-5 at the center frequency of the EUT Operating Channel at the specified DFS Detection Threshold level.
2. The generating equipment is configured as shown in the Conducted Test Setup above section 3.5.
3. The EUT is set up as a stand-alone device (no associated Client or Master, as appropriate) and no traffic. Frame based systems will be set to a talk/listen ratio reflecting the worst case (maximum) that is user configurable during this test.
4. Generate a single radar Burst and note the response of the EUT. Repeat for a minimum of 10 trials. The EUT must detect the Radar Waveform using the specified U-NII Detection Bandwidth criterion shown in Table 3-5. In cases where the channel bandwidth may exceed past the DFS band edge on specific channels (i.e., 802.11ac or wideband frame based systems) select a channel that has the entire emission bandwidth within the DFS band. If this is not possible, test the detection BW to the DFS band edge.
5. 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 in Table 3-3. 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.
6. Starting at the center frequency of the EUT operating Channel, decrease the radar frequency in 1 MHz steps, repeating the above item 4 test sequence, until the detection rate falls below the U-NII Detection Bandwidth criterion. 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.

7. The U-NII Detection Bandwidth is calculated as follows: U-NII Detection Bandwidth = FH – FL

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

5.3.3. Test Result

Product	FastMile 4G Gateway	Temperature	23 ~ 25°C
Test Engineer	Amy Zhang	Relative Humidity	46 ~ 60%
Test Site	SR4	Test Date	2020/02/18
Test Item	Detection Bandwidth (802.11ac-VHT20 mode - 5500MHz)		

Radar Frequency (MHz)	DFS Detection Trials (1=Detection, 0= No Detection)										
	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
5490	0	0	0	0	0	0	0	0	0	0	0%
5491 FL	1	1	1	1	1	1	1	1	1	1	100%
5492	1	1	1	1	1	1	1	1	1	1	100%
5493	1	1	1	1	1	1	1	1	1	1	100%
5494	1	1	1	1	1	1	1	1	1	1	100%
5495	1	1	1	1	1	1	1	1	1	1	100%
5500	1	1	1	1	1	1	1	1	1	1	100%
5505	1	1	1	1	1	1	1	1	1	1	100%
5506	1	1	1	1	1	1	1	1	1	1	100%
5507	1	1	1	1	1	1	1	1	1	1	100%
5508	1	1	1	1	1	1	1	1	1	1	100%
5509 FH	1	1	1	1	1	1	1	1	1	1	100%
5510	0	0	0	0	0	0	0	0	0	0	0%

Note 1: All NII channels for this device have identical Channel bandwidths. Therefore, all DFS testing was done at 5500MHz. The 99% channel bandwidth is 17.77MHz. (See the 99% BW section of the RF report for further measurement details).

Note 2: Detection Bandwidth = F_H - F_L = 5509MHz - 5491MHz = 18MHz.

Note 3: NII Detection Bandwidth Min. Limit (MHz): 17.77MHz x 100% = 17.77MHz.

Product	FastMile 4G Gateway	Temperature	23 ~ 25°C
Test Engineer	Amy Zhang	Relative Humidity	46 ~ 60%
Test Site	SR4	Test Date	2020/02/18
Test Item	Detection Bandwidth (802.11ac-VHT40 mode - 5510MHz)		

Radar Frequency (MHz)	DFS Detection Trials (1=Detection, 0= No Detection)										
	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
5490	0	0	0	0	0	0	0	0	0	0	0%
5491 FL	1	1	1	1	1	1	1	1	1	1	100%
5492	1	1	1	1	1	1	1	1	1	1	100%
5493	1	1	1	1	1	1	1	1	1	1	100%
5494	1	1	1	1	1	1	1	1	1	1	100%
5495	1	1	1	1	1	1	1	1	1	1	100%
5500	1	1	1	1	1	1	1	1	1	1	100%
5505	1	1	1	1	1	1	1	1	1	1	100%
5510	1	1	1	1	1	1	1	1	1	1	100%
5515	1	1	1	1	1	1	1	1	1	1	100%
5520	1	1	1	1	1	1	1	1	1	1	100%
5525	1	1	1	1	1	1	1	1	1	1	100%
5526	1	1	1	1	1	1	1	1	1	1	100%
5527	1	1	1	1	1	1	1	1	1	1	100%
5528	1	1	1	1	1	1	1	1	1	1	100%
5529 FH	1	1	1	1	1	1	1	1	1	1	100%
5530	0	0	0	0	0	0	0	0	0	0	0%

Note 1: All NII channels for this device have identical Channel bandwidths. Therefore, all DFS testing was done at 5510MHz. The 99% channel bandwidth is 36.28MHz. (See the 99% BW section of the RF report for further measurement details).

Note 2: Detection Bandwidth = F_H - F_L = 5529MHz - 5491MHz = 38MHz.

Note 3: NII Detection Bandwidth Min. Limit (MHz): 36.28MHz x 100% = 36.28MHz.

Product	FastMile 4G Gateway	Temperature	23 ~ 25°C
Test Engineer	Amy Zhang	Relative Humidity	46 ~ 60%
Test Site	SR4	Test Date	2020/02/18
Test Item	Detection Bandwidth (802.11ac-VHT80 mode - 5530MHz)		

Radar Frequency (MHz)	DFS Detection Trials (1=Detection, 0= No Detection)										
	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
5490	0	0	0	0	0	0	0	0	0	0	0%
5491 FL	1	1	1	1	1	1	1	1	1	1	100%
5492	1	1	1	1	1	1	1	1	1	1	100%
5493	1	1	1	1	1	1	1	1	1	1	100%
5494	1	1	1	1	1	1	1	1	1	1	100%
5495	1	1	1	1	1	1	1	1	1	1	100%
5500	1	1	1	1	1	1	1	1	1	1	100%
5505	1	1	1	1	1	1	1	1	1	1	100%
5510	1	1	1	1	1	1	1	1	1	1	100%
5515	1	1	1	1	1	1	1	1	1	1	100%
5520	1	1	1	1	1	1	1	1	1	1	100%
5525	1	1	1	1	1	1	1	1	1	1	100%
5530	1	1	1	1	1	1	1	1	1	1	100%
5535	1	1	1	1	1	1	1	1	1	1	100%
5540	1	1	1	1	1	1	1	1	1	1	100%
5545	1	1	1	1	1	1	1	1	1	1	100%
5550	1	1	1	1	1	1	1	1	1	1	100%
5555	1	1	1	1	1	1	1	1	1	1	100%
5560	1	1	1	1	1	1	1	1	1	1	100%
5565	1	1	1	1	1	1	1	1	1	1	100%
5566	1	1	1	1	1	1	1	1	1	1	100%
5567	1	1	1	1	1	1	1	1	1	1	100%
5568	1	1	1	1	1	1	1	1	1	1	100%
5569 FH	1	1	1	1	1	1	1	1	1	1	100%
5570	0	0	0	0	0	0	0	0	0	0	0%

Note 1: All NII channels for this device have identical Channel bandwidths. Therefore, all DFS testing was done at 5530MHz. The 99% channel bandwidth is 75.69MHz. (See the 99% BW section of the RF report for further measurement details).

Note 2: Detection Bandwidth = F_H - F_L = 5569MHz - 5491MHz = 78MHz.

Note 3: NII Detection Bandwidth Min. Limit (MHz): 75.69MHz x 100% = 75.69MHz.

5.4. Initial Channel Availability Check Time Measurement

5.4.1. Test Limit

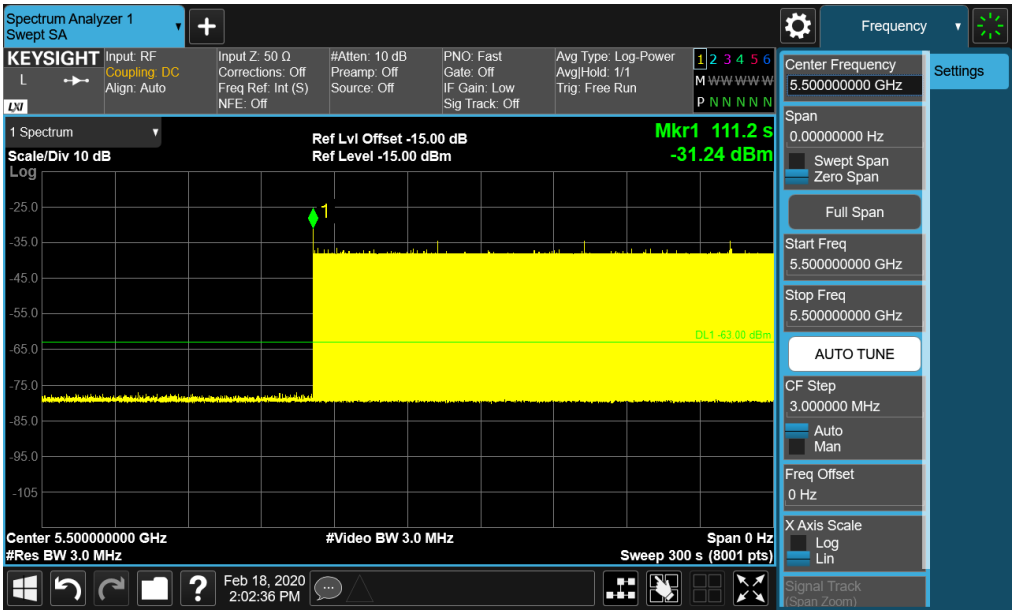
The EUT shall perform a Channel Availability Check to ensure that there is no radar operating on the channel. After power-up sequence, receive at least 1 minute on the intended operating frequency.

5.4.2. Test Procedure

1. The U-NII devices will be powered on and be instructed to operate on the appropriate U-NII Channel that must incorporate DFS functions. At the same time the EUT is powered on, the spectrum analyzer will be set to zero span mode with a 3 MHz RBW and 3 MHz VBW on the Channel occupied by the radar (Chr) with a 2.5 minute sweep time. The spectrum analyzer's sweep will be started at the same time power is applied to the U-NII device.
2. The EUT should not transmit any beacon or data transmissions until at least 1 minute after the completion of the power-on cycle.
3. Confirm that the EUT initiates transmission on the channel. Measurement system showing its nominal noise floor is marker1.

5.4.3. Test Result

Product	FastMile 4G Gateway	Temperature	25°C
Test Engineer	Amy Zhang	Relative Humidity	54%
Test Site	SR5	Test Date	2020/02/18
Test Item	Initial Channel Availability Check Time (802.11ac-VHT20 mode - 5500MHz)		

Initial Channel Availability Check Time

Note: The EUT does not transmit any beacon or data transmissions until at least 1 minute after the completion of the power-on cycle (51.2 sec). Initial beacons/data transmissions are indicated by marker 1 (111.2 sec).

5.5. Radar Burst at the Beginning of the Channel Availability Check Time Measurement

5.5.1. Test Limit

In beginning of the Channel Availability Check (CAC) Time, radar is detected on this channel, select another intended channel and perform a CAC on that channel.

5.5.2. Test Procedure

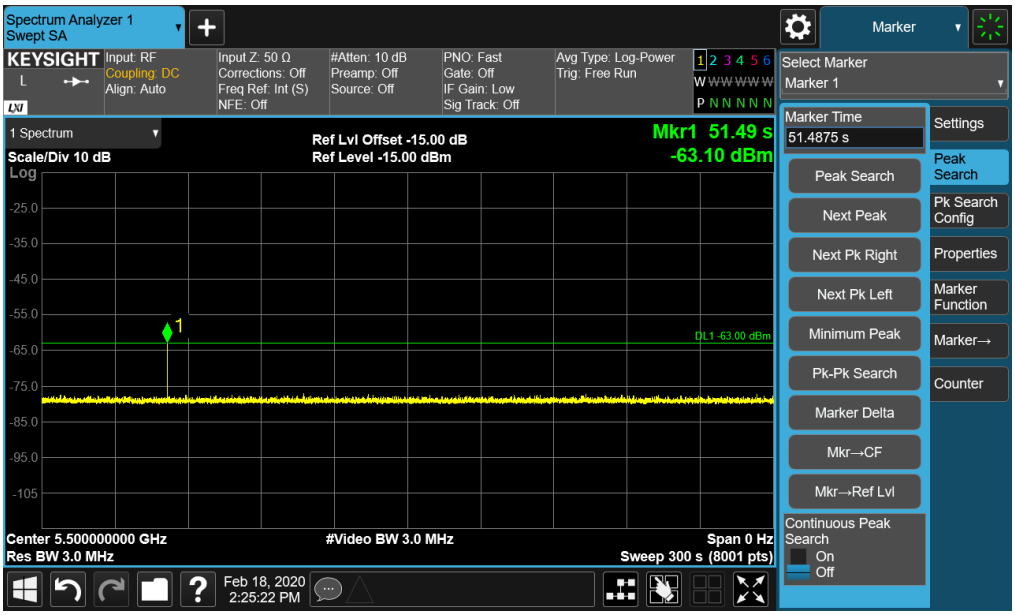
1. The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB occurs at the beginning of the Channel Availability Check Time.

2. The EUT is in completion power-up cycle (from T0 to T1). T1 denotes the instant when the EUT has completed its power-up sequence. The Channel Availability Check Time commences at instant T1 and will end no sooner than T1 + 60 seconds. A single Burst of one of Short Pulse Radar Types 0-4 at DFS Detection Threshold + 1 dB will commence within a 6 second window starting at T1.

3. Visual indication on the EUT of successful detection of the radar Burst will be recorded and reported. Observation of emissions will continue for 2.5 minutes after the radar Burst has been generated. Verify that during the 2.5 minutes measurement window no EUT transmissions occurred.

5.5.3. Test Result

Product	FastMile 4G Gateway	Temperature	25°C
Test Engineer	Amy Zhang	Relative Humidity	54%
Test Site	SR4	Test Date	2020/02/18
Test Item	Beginning of the Channel Availability Check Time (802.11ac-VHT20 mode - 5500MHz)		

Beginning of the Channel Availability Check Time


5.6. Radar Burst at the End of the Channel Availability Check Time Measurement

5.6.1. Test Limit

In the end of Channel Availability Check (CAC) Time, radar is detected on this channel, select another intended channel and perform a CAC on that channel.

5.6.2. Test Procedure

1. The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB occurs at the beginning of the Channel Availability Check Time.

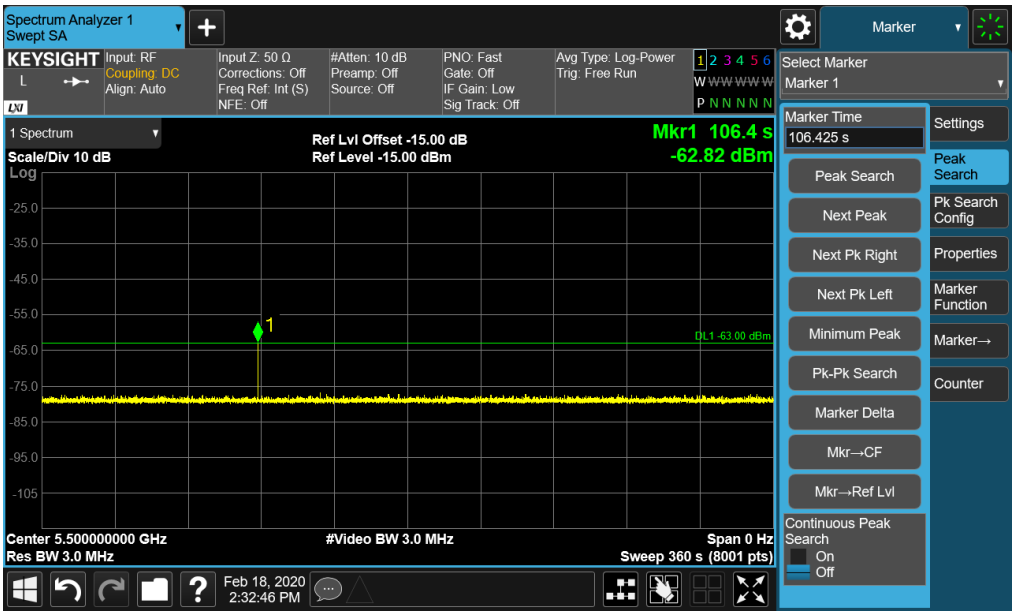
2. The EUT is powered on at T0. T1 denotes the instant when the EUT has completed its power-up sequence. The Channel Availability Check Time commences at instant T1 and will end no sooner thanT1 + 60 seconds. A single Burst of one of Short Pulse Radar Types 0-4 at DFS Detection Threshold + 1 dB will commence within a 6 second window starting at T1+ 54 seconds.

3. Visual indication on the EUT of successful detection of the radar Burst will be recorded and reported. Observation of emissions will continue for 2.5 minutes after the radar Burst has been generated. Verify that during the 2.5 minutes measurement window no EUT transmissions occurred.

5.6.3. Test Result

Product	FastMile 4G Gateway	Temperature	25°C
Test Engineer	Amy Zhang	Relative Humidity	54%
Test Site	SR5	Test Date	2020/02/18
Test Item	End of the Channel Availability Check Time (802.11ac-VHT20 mode - 5500MHz)		

End of the Channel Availability Check Time



5.7. In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period Measurement

5.7.1. Test Limit

The EUT has In-Service Monitoring function to continuously monitor the radar signals. If the radar is detected, must leave the channel (Shutdown). The Channel Move Time to cease all transmissions on the current channel upon detection of a Radar Waveform above the DFS Detection Threshold within 10 sec. The total duration of Channel Closing Transmission Time is 260ms, consisting of data signals and the aggregate of control signals, by a U-NII device during the Channel Move Time. The Non-Occupancy Period time is 30 minute during which a Channel will not be utilized after a Radar Waveform is detected on that Channel.

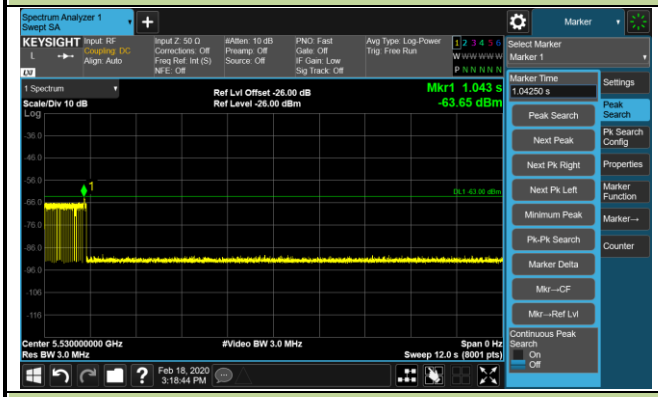
5.7.2. Test Procedure Used

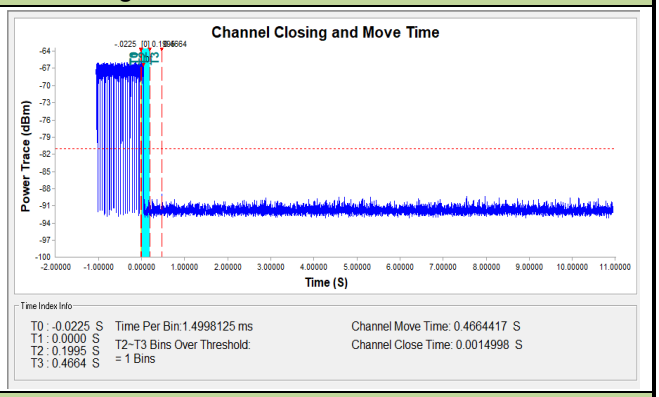
1. The test should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0.
2. When the radar burst with a level equal to the DFS Detection Threshold + 1dB is generated on the Operating Channel of the U-NII device. A U-NII device operating as a Master Device will associate with the Client Device at 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 Detection Threshold + 1dB.
3. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel. Measure and record the transmissions from the EUT during the observation time (Channel Move Time).
4. Measurement of the aggregate duration of the Channel Closing Transmission Time method. With the spectrum analyzer set to zero span tuned to the center frequency of the EUT operating channel at the radar simulated frequency, peak detection, and max hold, the dwell time per bin is given by: Dwell (1.5ms) = S (12 sec) / B (8000); 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. An upper bound of the aggregate duration of the intermittent control signals of Channel Closing Transmission Time is calculated by: C = N X Dwell; where 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.
5. Measure the EUT for more than 30 minutes following the channel close/move time to verify that the EUT does not resume any transmissions on this Channel.

5.7.3. Test Result

Product	FastMile 4G Gateway	Temperature	25°C
Test Engineer	Amy Zhang	Relative Humidity	52%
Test Site	SR4	Test Date	2020/02/18
Test Item	Channel Move Time and Channel Closing Transmission Time (802.11ac-VHT80 mode - 5530MHz)		

Channel Move Time and Channel Closing Transmission Time





Non-Occupancy Period

Parameter	Test Result	Limit
Channel Move Time (s)	0.466s	<10s
Channel Closing Transmission Time (ms) (Note)	1.5ms	< 60ms
Non-Occupancy Period (min)	≥ 30min	≥ 30 min
Note: 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 seconds period. The aggregate duration of control signals will not count quiet periods in between transmissions.		

5.8. Statistical Performance Check Measurement

5.8.1. Test Limit

The minimum percentage of successful detection requirements found in below table 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 (In- Service Monitoring).

Radar Type	Minimum Number of Trails	Detection Probability
0	30	Pd > 60%
1	30(15 of test A and 15 of test B)	Pd > 60%
2	30	Pd > 60%
3	30	Pd > 60%
4	30	Pd > 60%
Aggregate (Radar Types 1-4)	120	Pd > 80%
5	30	Pd > 80%
6	30	Pd > 70%
Note: The percentage of successful detection is calculated by: (Total Waveform Detections / Total Waveform Trails) * 100 = Probability of Detection Radar Waveform In addition an aggregate minimum percentage of successful detection across all Short Pulse Radar Types 1-4 is required and is calculated as follows: (Pd1 + Pd2 + Pd3 + Pd4) / 4.		

5.8.2. Test Procedure

1. Stream the MPEG test file from the Master Device to the Client Device on the test Channel for the entire period of the test.
2. At time T0 the Radar Waveform generator sends the individual waveform for each of the Radar Types 1-6, at levels equal to the DFS Detection Threshold + 1dB, on the Operating Channel.
3. Observe the transmissions of the EUT at the end of the Burst on the Operating Channel for duration greater than 10 seconds for Short Pulse Radar Types 0 to ensure detection occurs.
4. Observe the transmissions of the EUT at the end of the Burst on the Operating Channel for duration greater than 22 seconds for Long Pulse Radar Type 5 to ensure detection occurs.
5. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trial runs.
6. The Minimum number of trails, minimum percentage of successful detection and the average minimum percentage of successful detection are found in below table.

5.8.3. Test Result

Product	FastMile 4G Gateway	Temperature	23 ~ 25°C
Test Engineer	Amy Zhang	Relative Humidity	50 ~ 56%
Test Site	SR4	Test Date	2020/02/19
Test Item	Radar Statistical Performance Check (802.11ac-VHT20 mode - 5500MHz)		

Radar Type 1 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	1	778	68	1
2	5491	1	618	86	1
3	5491	1	738	72	1
4	5491	1	3066	18	1
5	5491	1	558	95	1
6	5491	1	758	70	1
7	5491	1	658	81	1
8	5491	1	798	67	1
9	5491	1	818	65	1
10	5491	1	578	92	1
11	5500	1	878	61	1
12	5500	1	718	74	1
13	5500	1	918	58	1
14	5500	1	698	76	1
15	5500	1	938	57	1
16	5500	1	2614	21	1
17	5500	1	1200	44	1
18	5500	1	2608	21	1
19	5500	1	1131	47	1
20	5500	1	1458	37	1
21	5509	1	2754	20	1
22	5509	1	2637	20	1
23	5509	1	2185	25	1
24	5509	1	2098	26	1
25	5509	1	2182	25	1
26	5509	1	1000	53	1
27	5509	1	1235	43	1
28	5509	1	891	60	1

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
29	5509	1	596	89	1
30	5509	1	2058	26	1
Detection Percentage (%)					100%

Radar Type 2 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	3.8	151	28	1
2	5491	3.1	162	24	1
3	5491	3.0	209	25	1
4	5491	4.1	186	25	1
5	5491	2.0	207	27	1
6	5491	4.8	212	26	1
7	5491	2.0	221	29	1
8	5491	1.7	159	29	1
9	5491	4.0	197	28	1
10	5491	2.3	165	27	1
11	5500	1.5	158	28	1
12	5500	3.9	205	26	1
13	5500	2.6	160	25	1
14	5500	2.0	208	25	1
15	5500	3.4	172	25	1
16	5500	2.8	173	24	1
17	5500	4.0	169	24	1
18	5500	4.7	182	27	1
19	5500	4.1	207	24	1
20	5500	4.9	172	25	1
21	5509	2.3	174	25	1
22	5509	2.3	155	27	1
23	5509	1.8	221	24	1
24	5509	4.8	162	29	1
25	5509	3.0	165	28	1
26	5509	3.5	155	26	1
27	5509	3.8	155	24	1
28	5509	2.8	174	23	1
29	5509	4.8	214	26	1
30	5509	1.2	181	24	1
Detection Percentage (%)					100%

Radar Type 3 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	9.3	290	18	1
2	5491	8.3	376	18	1
3	5491	7.9	320	17	1
4	5491	7.1	455	17	1
5	5491	9.9	233	18	1
6	5491	6.9	289	17	1
7	5491	7.0	488	17	1
8	5491	8.9	361	17	1
9	5491	7.4	348	18	1
10	5491	7.8	440	17	1
11	5500	7.7	362	16	1
12	5500	6.2	470	17	1
13	5500	6.5	347	17	1
14	5500	6.9	225	17	1
15	5500	7.2	494	16	1
16	5500	10.0	494	17	1
17	5500	6.8	223	16	1
18	5500	6.9	494	17	1
19	5500	7.1	232	17	1
20	5500	8.3	423	17	1
21	5509	6.3	430	16	1
22	5509	6.7	234	17	1
23	5509	6.9	491	17	1
24	5509	8.0	228	17	1
25	5509	6.2	496	17	1
26	5509	7.9	280	17	1
27	5509	7.9	254	16	1
28	5509	9.2	499	17	1
29	5509	8.3	351	18	1
30	5509	10.0	410	18	1
Detection Percentage (%)					100%

Radar Type 4 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	12.2	437	15	1
2	5491	19.7	220	16	1
3	5491	16.4	399	12	1
4	5491	13.5	461	12	1
5	5491	12.1	318	16	1
6	5491	18.4	437	15	1
7	5491	20.0	204	13	1
8	5491	18.2	328	13	1
9	5491	11.8	284	16	1
10	5491	19.4	279	15	1
11	5500	12.6	293	14	1
12	5500	15.2	360	14	1
13	5500	19.9	291	15	1
14	5500	16.5	214	14	1
15	5500	19.0	346	15	1
16	5500	13.3	441	16	1
17	5500	18.5	267	13	1
18	5500	12.5	363	13	1
19	5500	13.4	222	13	1
20	5500	16.8	337	15	1
21	5509	14.9	226	13	1
22	5509	14.8	334	15	1
23	5509	13.8	439	15	1
24	5509	17.4	433	12	1
25	5509	12.7	492	15	1
26	5509	17.4	340	14	1
27	5509	11.7	239	16	1
28	5509	16.1	369	13	1
29	5509	15.2	297	15	1
30	5509	13.2	331	15	1
Detection Percentage (%)					100%

Note: In addition an average minimum percentage of successful detection across all four Short pulse radar test waveforms is as follows: $\frac{P_d1+P_d2+P_d3+P_d4}{4}$ = (100%+100%+100%+100%)/4 = 100% (>80%)

Radar Type 5 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	1=Detection 0=No Detection	Trail #	Test Freq. (MHz)	1=Detection 0=No Detection
1	5500.0	1	16	5496.6	1
2	5500.0	1	17	5493.8	1
3	5500.0	1	18	5495.8	1
4	5500.0	1	19	5499.0	1
5	5500.0	1	20	5497.4	1
6	5500.0	1	21	5505.0	1
7	5500.0	1	22	5505.8	1
8	5500.0	1	23	5502.2	1
9	5500.0	1	24	5501.4	1
10	5500.0	1	25	5503.4	1
11	5497.0	1	26	5503.8	1
12	5493.8	1	27	5505.8	1
13	5496.6	1	28	5503.0	1
14	5493.0	1	29	5504.2	1
15	5494.2	1	30	5501.8	1
Detection Percentage (%)					100%

Radar Type 6 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	1=Detection 0=No Detection	Trail #	Test Freq. (MHz)	1=Detection 0=No Detection
1	5491	1	16	5500.	1
2	5491	1	17	5500.	1
3	5491	1	18	5500.	1
4	5491	1	19	5500.	1
5	5491	1	20	5500.	1
6	5491	1	21	5509	1
7	5491	1	22	5509	1
8	5491	1	23	5509	1
9	5491	1	24	5509	1
10	5491	1	25	5509	1
11	5500.	1	26	5509	1
12	5500.	1	27	5509	1
13	5500.	1	28	5509	1
14	5500.	1	29	5509	1
15	5500.	1	30	5509	1
Detection Percentage (%)					100%

Product	FastMile 4G Gateway	Temperature	23 ~ 25°C
Test Engineer	Amy Zhang	Relative Humidity	50 ~ 56%
Test Site	SR4	Test Date	2020/02/19
Test Item	Radar Statistical Performance Check (802.11ac-VHT40 mode - 5510MHz)		

Radar Type 1 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	1	858	62	1
2	5491	1	558	95	1
3	5491	1	918	58	1
4	5491	1	878	61	1
5	5500	1	598	89	1
6	5500	1	738	72	1
7	5500	1	718	74	1
8	5500	1	698	76	1
9	5509	1	838	63	1
10	5509	1	538	98	1
11	5509	1	638	83	1
12	5509	1	578	92	1
13	5510	1	658	81	1
14	5510	1	618	86	1
15	5510	1	678	78	1
16	5510	1	1607	33	1
17	5510	1	1403	38	1
18	5510	1	3017	18	1
19	5511	1	1834	29	1
20	5511	1	2769	20	1
21	5511	1	3015	18	1
22	5511	1	1258	42	1
23	5520	1	2126	25	1
24	5520	1	2095	26	1
25	5520	1	1777	30	1
26	5520	1	2690	20	1
27	5529	1	1067	50	1
28	5529	1	2619	21	1
29	5529	1	2140	25	1

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
30	5529	1	1480	36	1
Detection Percentage (%)					100%

Radar Type 2 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	4.5	192	25	1
2	5491	1.5	161	25	1
3	5491	3.6	171	29	1
4	5491	4.1	188	23	1
5	5500	5.0	167	27	1
6	5500	4.5	202	27	1
7	5500	3.4	167	26	1
8	5500	2.1	212	27	1
9	5509	2.7	199	29	1
10	5509	2.3	179	27	1
11	5509	4.4	164	24	1
12	5509	3.5	210	28	1
13	5510	2.8	174	27	1
14	5510	1.6	203	25	1
15	5510	2.2	195	28	1
16	5510	3.0	158	26	1
17	5510	5.0	221	28	1
18	5510	2.4	152	27	1
19	5511	2.7	158	23	1
20	5511	4.8	170	29	1
21	5511	3.5	150	27	1
22	5511	3.6	182	26	1
23	5520	3.3	191	26	1
24	5520	4.8	200	26	1
25	5520	4.0	193	25	1
26	5520	2.9	178	29	1
27	5529	2.4	168	26	1
28	5529	3.1	179	27	1
29	5529	1.9	189	28	1
30	5529	4.4	216	29	1
Detection Percentage (%)					100%

Radar Type 3 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	7.0	313	18	1
2	5491	9.5	385	18	1
3	5491	9.4	370	18	1
4	5491	6.6	317	17	1
5	5500	8.0	456	17	1
6	5500	8.1	334	16	1
7	5500	7.9	490	16	1
8	5500	7.2	212	16	1
9	5509	7.8	297	18	1
10	5509	6.1	439	17	1
11	5509	8.5	500	17	1
12	5509	9.6	229	16	1
13	5510	8.1	383	18	1
14	5510	6.1	334	17	1
15	5510	8.7	345	16	1
16	5510	8.1	374	17	1
17	5510	8.4	394	16	1
18	5510	9.5	405	17	1
19	5511	9.5	493	17	1
20	5511	9.3	281	17	1
21	5511	8.6	500	18	1
22	5511	9.1	311	18	1
23	5520	9.8	231	18	1
24	5520	7.1	314	17	1
25	5520	7.1	379	16	1
26	5520	6.0	450	18	1
27	5529	8.4	290	18	1
28	5529	8.7	241	18	1
29	5529	8.0	363	18	1
30	5529	7.8	489	17	1
Detection Percentage (%)					100%

Radar Type 4 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	19.4	447	15	1
2	5491	17.7	203	12	1
3	5491	11.4	245	13	1
4	5491	14.2	231	15	1
5	5500	13.7	288	15	1
6	5500	18.4	421	16	1
7	5500	17.7	263	13	1
8	5500	11.3	461	14	1
9	5509	19.3	287	15	1
10	5509	15.3	308	14	1
11	5509	18.3	321	14	1
12	5509	19.4	492	16	1
13	5510	19.4	438	15	1
14	5510	18.7	359	16	1
15	5510	18.7	323	14	1
16	5510	17.5	290	13	1
17	5510	13.2	419	16	1
18	5510	15.0	237	13	1
19	5511	11.6	378	14	1
20	5511	14.2	223	15	1
21	5511	15.4	236	14	1
22	5511	16.1	431	12	1
23	5520	12.4	261	15	1
24	5520	19.7	476	14	1
25	5520	11.2	221	12	1
26	5520	19.7	456	13	1
27	5529	11.0	358	14	1
28	5529	17.6	308	16	1
29	5529	15.2	251	14	1
30	5529	15.2	439	15	1
Detection Percentage (%)					100%

Note: In addition an average minimum percentage of successful detection across all four Short pulse radar test waveforms is as follows: $\frac{P_d1+P_d2+P_d3+P_d4}{4}$ = (100%+100%+100%+100%)/4 = 100% (>80%)

Radar Type 5 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	1=Detection 0=No Detection	Trail #	Test Freq. (MHz)	1=Detection 0=No Detection
1	5510.0	1	16	5496.6	1
2	5510.0	1	17	5495.4	1
3	5510.0	1	18	5497.4	1
4	5510.0	1	19	5497.0	1
5	5510.0	1	20	5497.4	1
6	5510.0	1	21	5525.8	1
7	5510.0	1	22	5521.4	1
8	5510.0	1	23	5523.4	1
9	5510.0	1	24	5524.2	1
10	5510.0	1	25	5523.0	1
11	5494.2	1	26	5525.8	1
12	5497.4	1	27	5522.2	1
13	5493.0	1	28	5523.4	1
14	5495.0	1	29	5523.8	1
15	5495.0	1	30	5527.0	1
Detection Percentage (%)					100%

Radar Type 6 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	1=Detection 0=No Detection	Trail #	Test Freq. (MHz)	1=Detection 0=No Detection
1	5491	1	16	5510	1
2	5491	1	17	5510	1
3	5491	1	18	5510	1
4	5491	1	19	5511	1
5	5500	1	20	5511	1
6	5500	1	21	5511	1
7	5500	1	22	5511	1
8	5500	1	23	5520	1
9	5509	1	24	5520	1
10	5509	1	25	5520	1
11	5509	1	26	5520	1
12	5509	1	27	5529	1
13	5510	1	28	5529	1
14	5510	1	29	5529	1
15	5510	1	30	5529	1
Detection Percentage (%)					100%

Product	FastMile 4G Gateway	Temperature	23 ~ 25°C
Test Engineer	Amy Zhang	Relative Humidity	50 ~ 56%
Test Site	SR4	Test Date	2020/02/19
Test Item	Radar Statistical Performance Check (802.11ac-VHT80 mode – 5530MHz)		

Radar Type 1 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	1	558	95	1
2	5491	1	578	92	1
3	5500	1	798	67	1
4	5500	1	918	58	1
5	5509	1	858	62	1
6	5509	1	618	86	1
7	5510	1	738	72	1
8	5510	1	538	98	1
9	5511	1	838	63	1
10	5511	1	938	57	1
11	5520	1	778	68	1
12	5520	1	878	61	1
13	5529	1	598	89	1
14	5529	1	3066	18	1
15	5530	1	718	74	1
16	5530	1	1131	47	1
17	5531	1	791	67	1
18	5531	1	1709	31	1
19	5540	1	934	57	1
20	5540	1	2796	19	1
21	5549	1	1397	38	1
22	5549	1	2816	19	1
23	5550	1	1327	40	1
24	5550	1	1508	35	1
25	5551	1	570	93	1
26	5551	1	2927	19	1
27	5560	1	2092	26	1
28	5560	1	2806	19	1
29	5569	1	2632	21	1

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
30	5569	1	1660	32	1
Detection Percentage (%)					100%

Radar Type 2 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	1.6	207	27	1
2	5491	3.3	220	25	1
3	5500	3.0	174	28	1
4	5500	2.7	166	28	1
5	5509	4.4	209	26	1
6	5509	2.1	168	23	1
7	5510	1.8	176	23	1
8	5510	3.1	202	24	1
9	5511	2.3	152	24	1
10	5511	3.6	171	29	1
11	5520	1.5	177	23	1
12	5520	2.3	174	23	1
13	5529	2.4	214	24	1
14	5529	4.8	185	29	1
15	5530	3.0	182	26	1
16	5530	1.1	164	23	1
17	5531	1.6	209	28	1
18	5531	2.4	205	25	1
19	5540	3.7	210	26	1
20	5540	3.2	157	26	1
21	5549	3.9	198	25	1
22	5549	3.3	209	27	1
23	5550	3.9	195	26	1
24	5550	1.0	173	27	1
25	5551	3.7	197	28	1
26	5551	2.2	226	24	1
27	5560	4.9	154	29	1
28	5560	1.8	224	24	1
29	5569	2.8	222	28	1
30	5569	2.2	151	28	1
Detection Percentage (%)					100%

Radar Type 3 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	7.5	398	18	1
2	5491	9.8	462	17	1
3	5500	7.2	241	17	1
4	5500	8.0	416	17	1
5	5509	8.0	401	17	1
6	5509	8.5	458	16	1
7	5510	6.1	386	17	1
8	5510	8.7	296	18	1
9	5511	7.6	377	18	1
10	5511	9.2	325	16	1
11	5520	6.3	346	17	1
12	5520	6.1	473	17	1
13	5529	6.4	395	17	1
14	5529	9.1	471	17	1
15	5530	8.2	282	17	1
16	5530	7.9	307	16	1
17	5531	9.1	348	17	1
18	5531	9.8	458	16	1
19	5540	7.2	371	17	1
20	5540	9.9	264	17	1
21	5549	9.1	459	17	1
22	5549	6.3	224	17	1
23	5550	9.4	345	17	1
24	5550	7.0	345	17	1
25	5551	6.4	337	16	1
26	5551	6.7	260	17	1
27	5560	7.8	447	16	1
28	5560	6.3	215	17	1
29	5569	8.9	404	17	1
30	5569	8.9	455	18	1
Detection Percentage (%)					100%

Radar Type 4 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	Pulse Width (us)	PRI (us)	Pulses / Burst	1=Detection 0=No Detection
1	5491	19.3	296	13	1
2	5491	13.1	424	12	1
3	5500	14.6	269	15	1
4	5500	13.1	253	13	1
5	5509	13.8	479	16	1
6	5509	17.4	231	15	1
7	5510	16.3	465	16	1
8	5510	13.0	311	12	1
9	5511	15.4	247	14	1
10	5511	16.3	395	15	1
11	5520	17.6	483	16	1
12	5520	20.0	222	15	1
13	5529	19.5	230	14	1
14	5529	17.5	222	14	1
15	5530	15.9	430	15	1
16	5530	19.3	215	13	1
17	5531	13.4	359	13	1
18	5531	11.6	458	16	1
19	5540	15.3	396	15	1
20	5540	13.5	355	16	1
21	5549	17.0	453	15	1
22	5549	19.4	397	15	1
23	5550	18.8	464	13	1
24	5550	14.3	449	15	1
25	5551	19.6	456	15	1
26	5551	11.1	216	14	1
27	5560	19.6	258	13	1
28	5560	15.9	416	15	1
29	5569	12.2	278	14	1
30	5569	13.1	294	15	1
Detection Percentage (%)					100%

Note: In addition an average minimum percentage of successful detection across all four Short pulse radar test waveforms is as follows: $\frac{P_d1+P_d2+P_d3+P_d4}{4}$ = (100%+100%+100%+100%)/4 = 100% (>80%)

Radar Type 5 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	1=Detection 0=No Detection	Trail #	Test Freq. (MHz)	1=Detection 0=No Detection
1	5530.0	1	16	5499.0	1
2	5530.0	1	17	5493.0	1
3	5530.0	1	18	5499.0	1
4	5530.0	1	19	5497.8	1
5	5530.0	1	20	5493.4	1
6	5530.0	1	21	5562.2	1
7	5530.0	1	22	5561.4	1
8	5530.0	1	23	5565.8	1
9	5530.0	1	24	5564.2	1
10	5530.0	1	25	5564.2	1
11	5497.0	1	26	5562.6	1
12	5493.4	1	27	5563.8	1
13	5495.8	1	28	5566.6	1
14	5496.6	1	29	5563.8	1
15	5493.4	1	30	5565.0	1
Detection Percentage (%)					100%

Radar Type 6 - Radar Statistical Performance

Trail #	Test Freq. (MHz)	1=Detection 0=No Detection	Trail #	Test Freq. (MHz)	1=Detection 0=No Detection
1	5491	1	16	5530	1
2	5491	1	17	5531	1
3	5500	1	18	5531	1
4	5500	1	19	5540	1
5	5509	1	20	5540	1
6	5509	1	21	5549	1
7	5510	1	22	5549	1
8	5510	1	23	5550	1
9	5511	1	24	5550	1
10	5511	1	25	5551	1
11	5520	1	26	5551	1
12	5520	1	27	5560	1
13	5529	1	28	5560	1
14	5529	1	29	5569	1
15	5530	1	30	5569	1
Detection Percentage (%)					100%

6. CONCLUSION

The data collected relate only the item(s) tested and show that the unit is compliance with FCC Rules Rule.

The End

Appendix A - Test Setup Photograph

Refer to “1911RSU040-UT” file.

Appendix B - EUT Photograph

Refer to “1911RSU040-UE” file.