

FCC DFS Test Report

FCC ID : SQG-SSD45N
Equipment : Radio Module
Model No. : SSD45N
Brand Name : Laird Technologies
Applicant : Laird Technologies
Address : 11160 Thompson Ave. / Lenexa, Kansas /
66219 / USA
Standard : 47 CFR FCC Part 15.407
Received Date : May 08, 2013
Tested Date : Jul. 04 ~ Jul. 05, 2013
Operating Mode : Client without ad hoc and radar detection

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Approved & Reviewed by:



Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FZ442904	Rev. 01	Initial issue	May 13, 2014

Summary of Test Results

FCC Rules	Description of Test	Result
15.407	Channel Closing Transmission Time	Pass
15.407	Channel Move Time	Pass
15.407	Non-occupancy	Pass

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

Frequency Range (GHz)	5.15~5.25, 5.25~5.35, 5.47~5.725,5.725~5.85
Wireless Function	11a / n HT20
Operating Mode at DFS Band	Client without radar detection and ad hoc function
Firmware / Software Version	3.4.0

1.1.2 Antenna Details

Ant. No.	Brand / Model	Type	Connector	Operating Frequencies (MHz) / Antenna Gain (dBi)				
				2400~2483.5	5150~5250	5250~5350	5470~5725	5725~5850
1	MAG.LAYERS EDA-1513-25GR 2-B2-CY	Dipole	SMA Jack Reverse	2	2	2	2	2
2	MAG.LAYERS PCA-4606-2G4C 1-A13-CY	PCB Dipole	UFL	2.21	2.21	2.21	2.21	2.21
3	Larid NanoBlade-IP04	PCB Dipole	UFL	2	3.9	3.9	4	4
4	Larid MAF95310 Mini NanoBlade Flex	PCB Dipole	UFL	2.79	3.38	3.38	3.38	3.38
5	Laird NanoBlue-IP04	PCB Dipole	UFL	2	---	---	---	-
6	Ethertronics WLAN_1000146	PIFA	UFL	2.5	3.5	3.5	3.5	3.5

1.2 Support Equipment List

Support Equipment List				
No.	Equipment	Brand Name	Model Name	FCC ID
1	AP (Master)	D-Link	DIR-826L	KA2IR826LMO1
2	Notebook	DELL	LATITUDE-E5420	B6FV9T1

1.3 The Equipment List

Test Site	DF01-WS				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV 7	101607	Dec. 19, 2012	Dec. 18, 2013
Horn Antenna 1G-18G	ETS-LINDGREN	3115	00149268	Oct. 05, 2012	Oct. 04, 2013
RF Cable	HUBER+SUHNER	SUCOFLEX_104	MY15686/4	Dec. 24, 2012	Dec. 23, 2013
RF Cable	HUBER+SUHNER	SUCOFLEX_104	296081/4	Dec. 24, 2012	Dec. 23, 2013
RF Cable	HUBER+SUHNER	SUCOFLEX_104	329023/4	Dec. 24, 2012	Dec. 23, 2013
RF Cable	HUBER+SUHNER	SUCOFLEX_104	329021/4	Dec. 24, 2012	Dec. 23, 2013
Vector signal generator	R&S	SMJ100A	100498	Dec. 13, 2012	Dec. 12, 2013

Note: Calibration Interval of instruments listed above is one year.

1.4 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
DFS	DF01-WS	26°C / 66%	Alex Huang

1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.407
FCC 06-96
KDB 848637

2 Technical Requirements for DFS

2.1 Applicability of DFS Requirements

2.1.1 Applicability of DFS Requirements Prior to use of a Channel

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

2.1.2 Applicability of DFS Requirements during Normal Operation

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

2.2 DFS Detection Thresholds and Response Requirement

Below table provides the DFS Detection Thresholds for Master Devices as well as Client Devices incorporating In-Service Monitoring.

DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection.

Maximum Transmit Power	Value (See Notes 1 and 2)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm

Note:

- 1) This is the level at the input of the receiver assuming a 0 dBi receive antenna.
- 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.

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 80% of the U- NII 99% transmission power bandwidth. (See Note 3.)

Note:

- 1) The instant that the Channel Move Time and the Channel Closing Transmission Time begins is as follows:
 - For the Short Pulse Radar Test Signals this instant is the end of the Burst.
 - For the Frequency Hopping radar Test Signal, this instant is the end of the last radar Burst generated.
 - For the Long Pulse Radar Test Signal this instant is the end of the 12 second period defining the Radar Waveform.
- 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.
- 3) During the U-NII Detection Bandwidth detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

2.3 Radar Test Waveforms

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.

2.3.1 Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
1	1	1428	18	60%	30
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

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. For Short Pulse Radar Type 1, the same waveform is used a minimum of 30 times. 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. The aggregate is the average of the percentage of successful detections of Short Pulse Radar Types 1-4.

2.3.2 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

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.

2.3.3 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

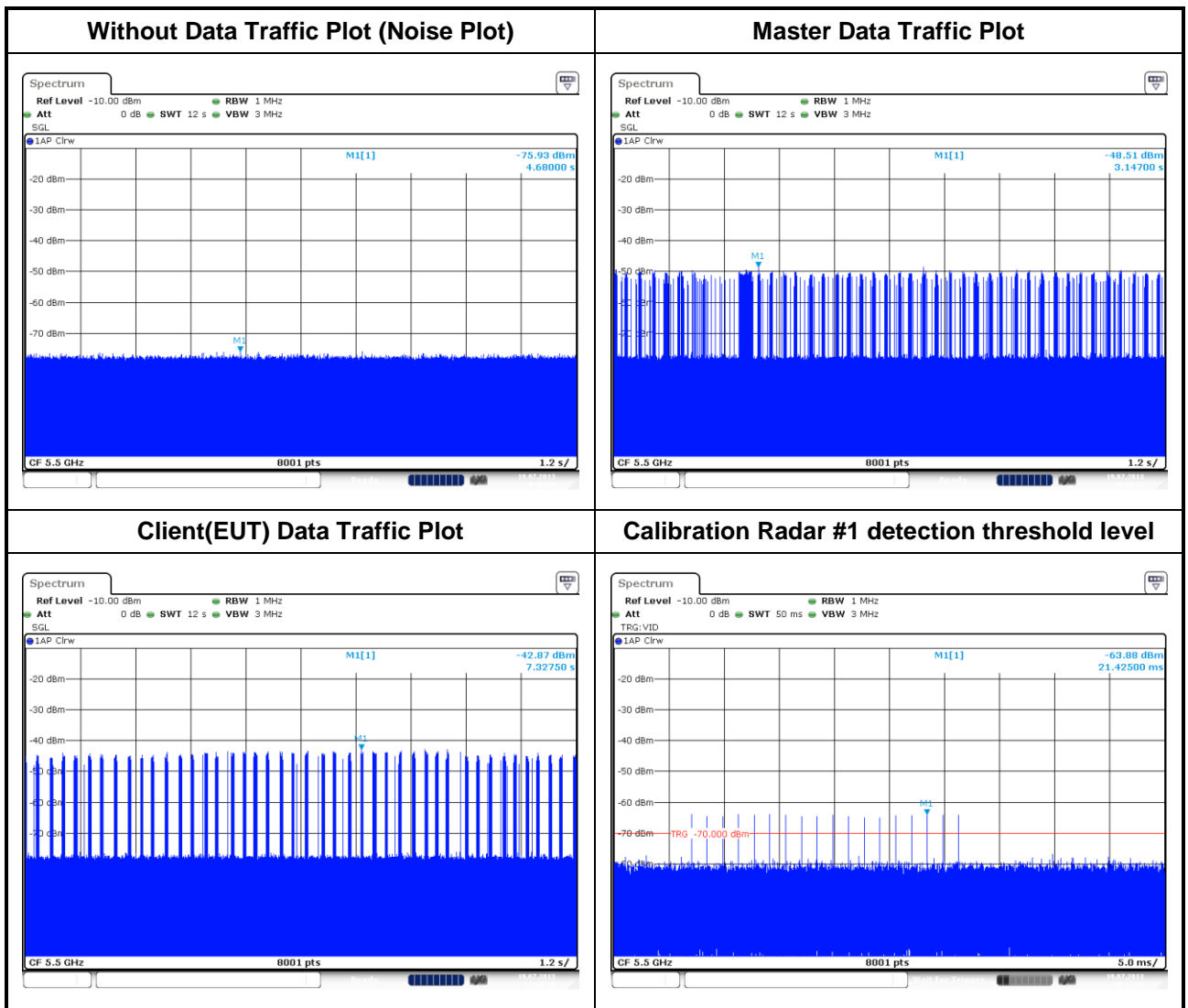
For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm

2.3.4 Radar waveform generation

A single R&S SMJ100A Vector Signal Generator is used for the DFS signal generation. This instrument is capable of generating all the above waveforms with Pulse Sequencer Software. The R&S Pulse Sequencer Software comes as a stand-alone PC based software with preconfigured project files for DFS. It simplifies the generation of all required waveforms and offers a one box solution

2.3.5 Verify DFS Detection Threshold levels

Master DFS Threshold Level	
DFS Threshold level: -63 dBm	<input checked="" type="checkbox"/> at the antenna connector(-63 dBm conducted)
	<input type="checkbox"/> in front of the antenna(-63 dBm e.i.r.p.)
The Interference Radar Detection Threshold Level is $(-64\text{dBm}) + (0 [\text{dBi}]) + \{1 \text{ dB}\} = -63 \text{ dBm}$. That had been taken into account the master output power range and antenna gain.	

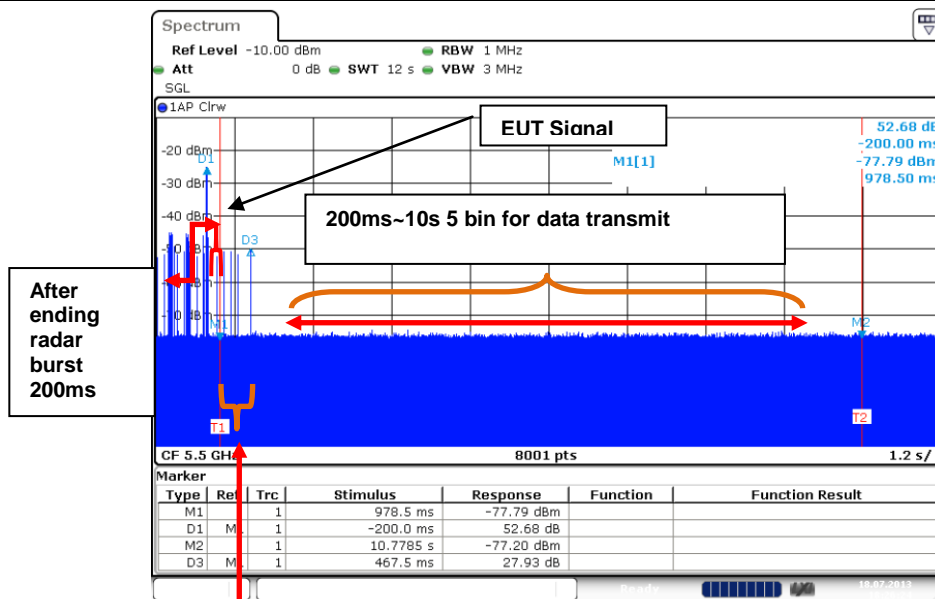


3 Test Result

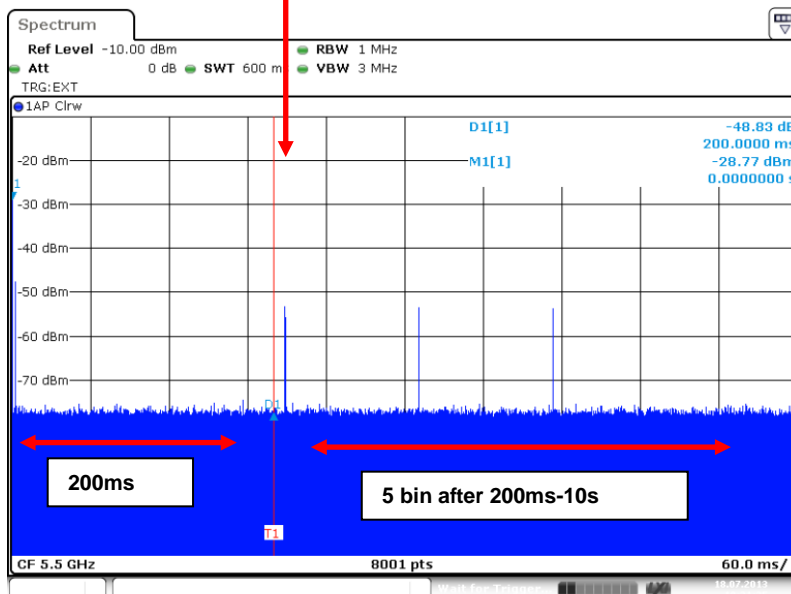
3.1 Channel Closing Transmission and Channel Move Time

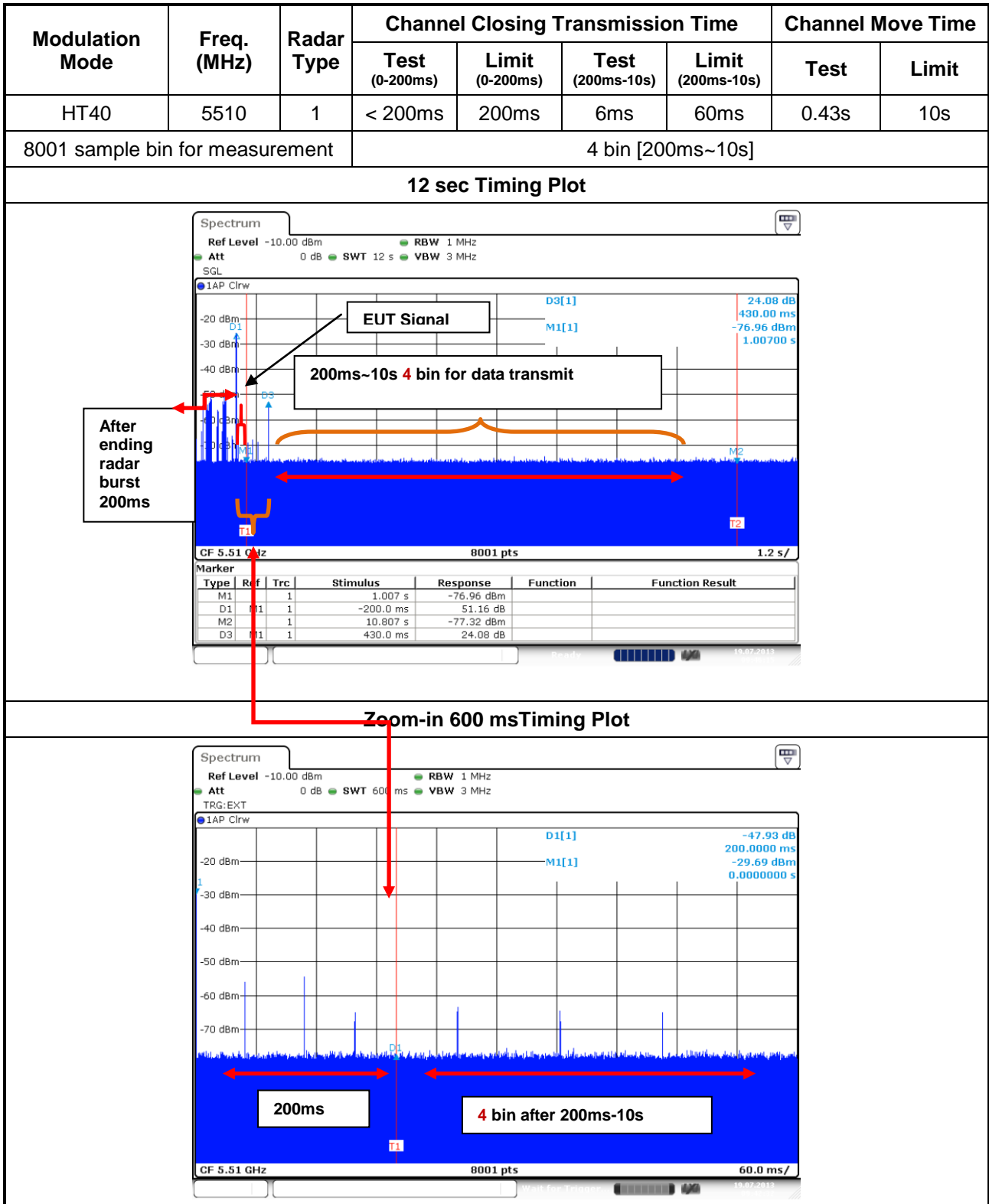
Modulation Mode	Freq. (MHz)	Radar Type	Channel Closing Transmission Time				Channel Move Time	
			Test (0-200ms)	Limit (0-200ms)	Test (200ms-10s)	Limit (200ms-10s)	Test	Limit
HT20	5500	1	< 200ms	200ms	7.5ms	60ms	0.467s	10 s
8001 sample bin for measurement			5 bin [200ms~10s]					

12 sec Timing Plot

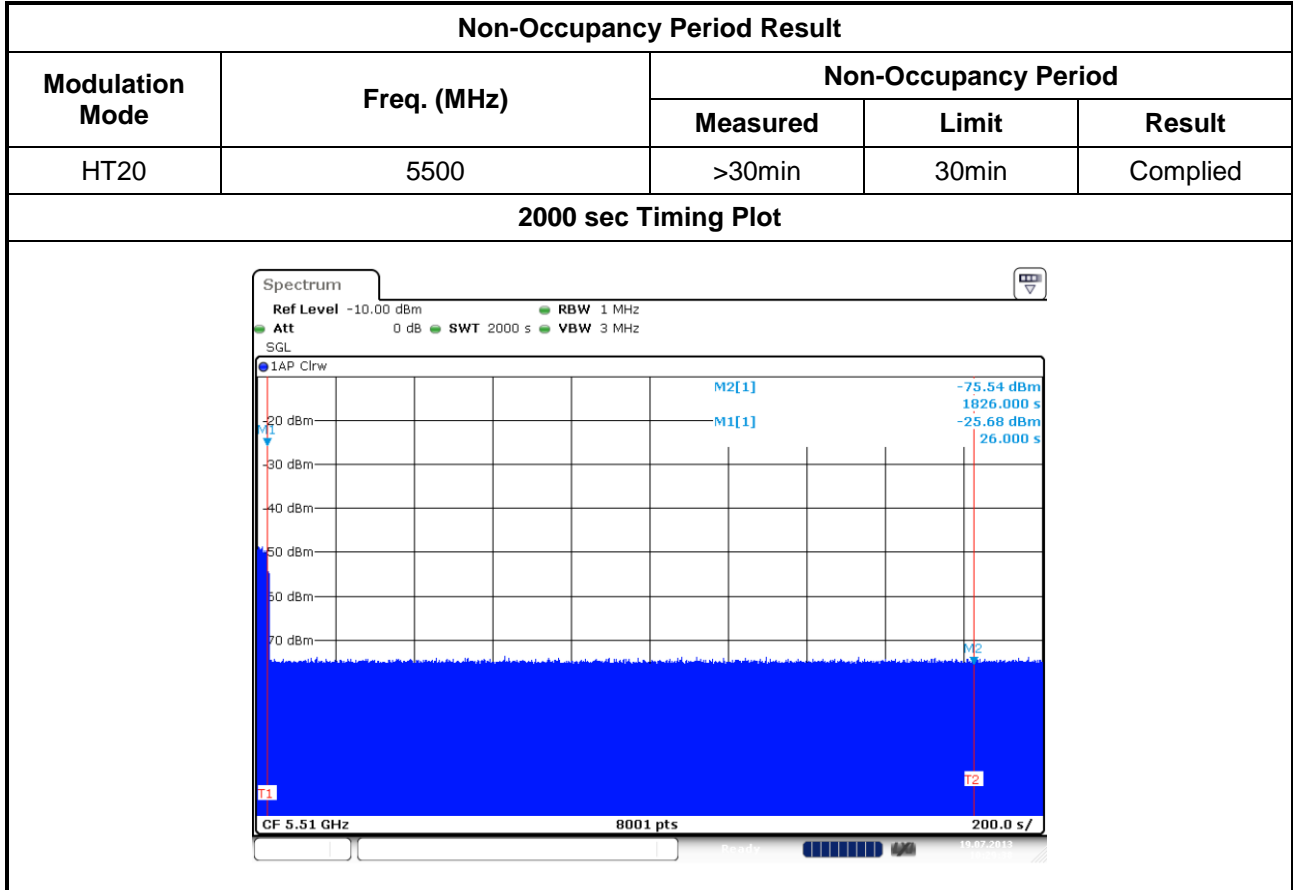


Zoom-in 600 ms Timing Plot





3.2 Non-Occupancy



4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp, it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan Hsiang. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

Tel: 886-2-2601-1640

No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.

Kwei Shan

Tel: 886-3-271-8666

No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsien 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666

Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

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