

TEST REPORT DFS

FCC Standards : FCC 47CFR part 15 subpart E

Test Report No. : CTK-2016-00189
Date of Issue : 2016-02-18
FCC ID : RTQLPT200AR
Model/Type No. : LPT-200AR
Kind of Product : Tablet PC
Applicant : LG CNS CO.,LTD.
Applicant Address : FKI Tower, 24, Yeoui-daero, Yeongdeungpo-gu, Seoul, Korea, 07320
Manufacturer : ART&CORE Inc
Manufacturer Address : 44 Burim-ro 170beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
Factory #1 : ARTVIEW CO.,LTD.
Factory Address : 5F, 44, burim-ro 170beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
Contact Person : Jae hee Lee
Telephone : +82-2-2099-0167
Received Date : 2015-12-30
Test period : Start : 2016-02-16 End : 2016-02-17

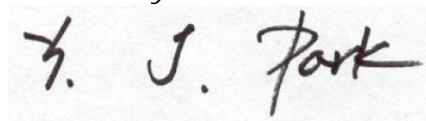
The test results presented in this report relate only to the object tested.

Tested by



Won-Jae, Hwang
Test Engineer
Date: 2016-02-18

Reviewed by



Young-Joon, Park
Technical Manager
Date: 2016-02-18



CTK Co., Ltd.
The Power Leader of Global Regulatory Compliance

CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970 Fax: +82-31-624-9501
www.e-ctk.com

REPORT REVISION HISTORY

Date	Revision	Page No
2016-02-18	Issued (CTK-2016-00189)	All

This report shall not be reproduced except in full, without the written approval of CTK Co., Ltd. This document may be altered or revised by CTK Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by CTK Co., Ltd. will constitute fraud and shall nullify the document.

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
1.0 General Product Description	4
1.1 Test mode	5
1.2 EUT Operation Test Setup	5
1.3 EUT Exercise of Software	5
1.4 Device Modifications	5
1.5 Peripheral Devices	5
1.6 Calibration Details of Equipment Used for Measurement	5
1.7 Test Facility	5
1.8 Laboratory Accreditations and Listings	6
1.9 Scope	6
2 Summary of tests	7
2.1 Description of Dynamic Frequency Selection Test	8
2.2 Measuring Systematic diagram	11
2.3 Description of EUT	12
2.4 Test Results	13
2.4.1 Test Channel	13
2.4.2 Radar waveform and Traffic	13
2.4.3 Channel move time and Channel closing Transmission time	16
2.4.4 Client beacon test	19
APPENDIX A – Test Equipment Used For Tests	20



CTK Co., Ltd.
The Power Leader of Global Regulatory Compliance

CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

1.0 General Product Description

Equipment model name	LPT-200AR				
Serial number	Prototype				
EUT condition	Pre-production, not damaged				
Frequency Range	UNII 1 : 5180 MHz – 5240 MHz (20 MHz_BW) 5190 MHz – 5230 MHz (40 MHz_BW) UNII 2A : 5260 MHz – 5320 MHz (20 MHz_BW) 5270 MHz – 5310 MHz (40 MHz_BW) UNII 2C : 5500 MHz – 5700 MHz (20 MHz_BW) 5510 MHz – 5670 MHz (40 MHz_BW) UNII 3 : 5745 MHz – 5825 MHz (20 MHz_BW) 5755 MHz – 5795 MHz (40 MHz_BW)				
RF output power :					
	Band	Mode	Channel Bandwidth (MHz)	Frequency Range (MHz)	ANT1 (SISO) RF output power (dBm)
UNII 1	802.11a		20	5180 – 5240	16.33
	802.11n		20	5180 - 5240	16.29
	802.11n		40	5190 – 5230	16.53
UNII 2A	802.11a		20	5260 – 5320	16.43
	802.11n		20	5260 – 5320	16.22
	802.11n		40	5270 – 5310	16.25
UNII 2C	802.11a		20	5500 – 5700	16.49
	802.11n		20	5500 – 5700	16.29
	802.11n		40	5510 – 5670	16.51
UNII 3	802.11a		20	5745 – 5825	16.10
	802.11n		20	5745 – 5825	16.03
	802.11n		40	5755 - 5795	16.12
Transfer Rate	802.11a : 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6 Mbps 802.11n : up to 150 Mbps				
Type of Modulation	OFDM				
Power Source	DC 22 V				
Duty Cycle	802.11a : 97.3 % 802.11n_HT20 : 97.3 % 802.11n_HT40 : 96.5 %				
Antenna Type	PCB antenna				
Antenna Gain	4.1 dBi @2.4GHz, 5.9 dBi @5GHz				
DFS Mode of Operation	Master Device			<input type="checkbox"/>	
	Client Device (No radar detection)			<input checked="" type="checkbox"/>	
	Client Device With Radar Detection			<input type="checkbox"/>	
Hardware Rev	DS2 (2015-11-30)				
Software Rev	ALPS.L1.MP8.V2.7_ANC8127.SB.BRS.L1 (2015-12-15)				
Firmware Rev	0x0104				

1.1 Test mode

Test Item	Modulation	Data Rate
Channel Move Time	802.11a	6 Mbps
Channel Closing Transmission Time	802.11n_HT40	MCS 0
Client beacon test		

1.2 EUT Operation Test Setup

For WLAN function, the EUT was set to connect with the WLAN AP under Transmission.

1.3 EUT Exercise of Software

The EUT was operated in the normal mode. The software is using the android system to internal memory.

1.4 Device Modifications

The following modifications were necessary for compliance:

Not applicable

1.5 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	LG Electronics.	LGE-DMLGS1 (B)	703KIUP015110
AC ADAPTER	Dongguang Lite Power 2nd Plant	PA-1900-08	-




1.6 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.7 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.8 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Registration Number	Logo
USA	FCC	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	805871	
JAPAN	VCCI	VCCI V-3 EMI (Electromagnetic Interference / Emission)	C-986 T-1843 R-3627 G-387	
KOREA	MSIP	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	KR0025	

1.9 Scope

This report has been prepared to demonstrate compliance with the requirements for Dynamic Frequency Selection(DFS) as stated in KDB 905462 D02 v01r02 and Industry Canada RSS 247 specification. Testing was performed LPT-200AR in accordance with the measurement procedure described in Appendix B of FCC KDB 905462 D02 v01r02. As of July 20, 2007 all devices operating in the UNII 2A Band and/or the UNII 2C Bands must comply with the DFS requirements. AS the EUT does not have radar detection capability it was evaluated as a Client Only Device. All test results reports herein are applicable to the sample selected for testing. The unit used for testing was supplied by LG CNS CO.,LTD.



CTK Co., Ltd.
The First Leader of Global Regulatory Compliance

CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

2 Summary of tests

Parameter	Limit	Status (note 1)
Channel Move Time	10 seconds	C
Channel Closing Transmission Time	200ms + aggregate of 60ms over remaining 10 second period	C
Client beacon test	Monitored for 10 minutes with no client transmission	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable



2.1 Description of Dynamic Frequency Selection Test

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

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

Table 2: Applicability of DFS requirements during normal operation

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

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>U-NII Detection Bandwidth and Statistical Performance Check</i>	All BW modes must be tested	Not required
<i>Channel Move Time and Channel Closing Transmission Time</i>	Test using widest BW mode available	Test using the widest BW mode available for the link
<i>All other tests</i>	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		



Table 3: 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
<p>Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. Note 3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.</p>	

Table 4: DFS Response Requirement Values

Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
<p>Note 1: <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: The <i>Channel Closing Transmission Time</i> is comprised of 200 milliseconds starting at the beginning of the <i>Channel Move Time</i> plus any additional intermittent control signals required to facilitate a <i>Channel</i> 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 <i>U-NII Detection Bandwidth</i> 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.</p>	



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

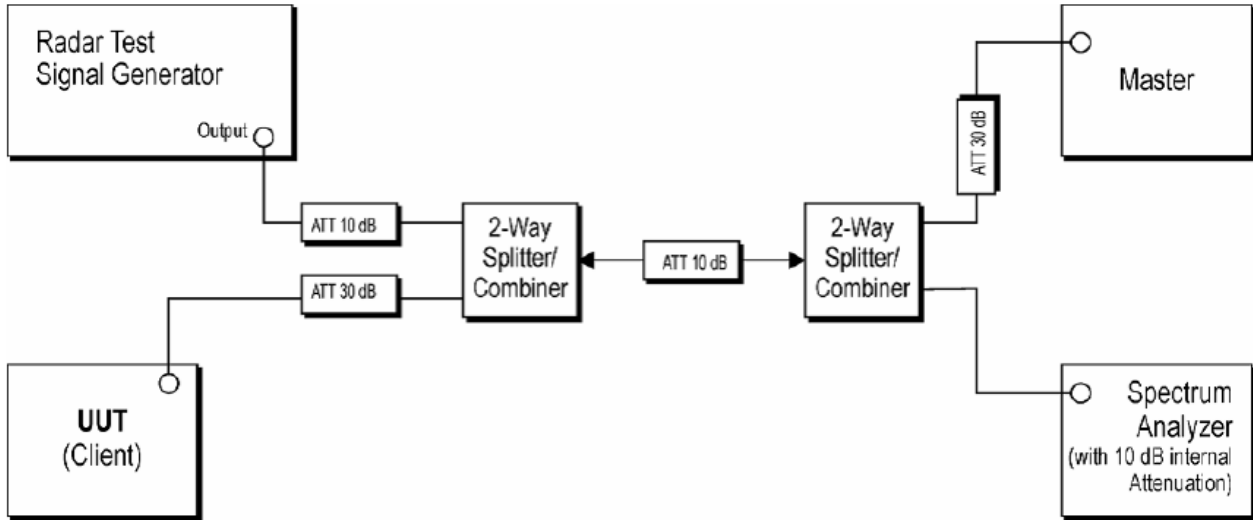
Table 6 – Long Pulse Radar Test Waveform

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

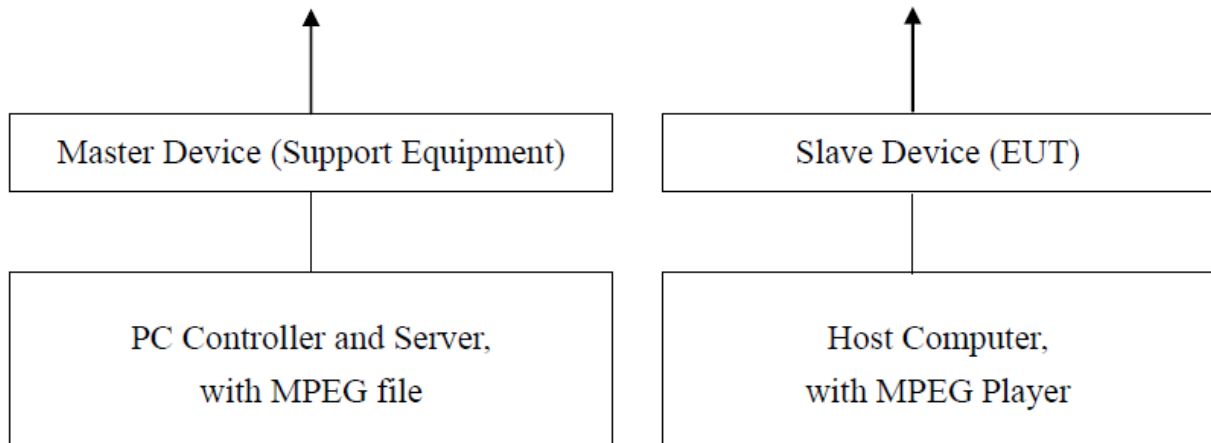
Table 7 – Frequency Hopping Radar Test Waveform

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 Measuring Systematic diagram



Antenna Port RF Connections to Test Instrument Setup



2.3 Description of EUT

Overview Of EUT With Respect To §15.407 (H) Requirements

The EUT operates over the 5250-5350 MHz and 5470-5725 MHz range.

The EUT is a Client Device that does not have radar detection capability.

The antenna assembly utilized with the EUT has a gain of 5.9 dBi.

The Slave device associated with the EUT during these tests does not have radar detection +capability.

WLAN traffic is generated by streaming the video file TestFile.mp2 "6 ½ Magic Hours" from the Master to the Slave in full motion video mode using the media player with the V2.61 Codec package.

The EUT utilizes the 802.11a architecture, with a nominal channel bandwidth of 20/40 MHz.

The Master Device is a Samsung WEA463e 802.11a/b/g/n/ac WLAN Access Point, FCC ID: A3LWEA463E.

The rated output power of the Master unit is < 23dBm (EIRP). Therefore the required interference threshold level is -62 dBm. After correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is $-62 + 5 = -57$ dBm.

The calibrated conducted DFS Detection Threshold level is set to -57 dBm. The tested level is lower than the required level hence it provides margin to the limit.

2.4 Test Results

2.4.1 Test Channel

All test were performed at a channel center frequency of 5500 MHz for 20 MHz Bandwidth.
 All test were performed at a channel center frequency of 5510 MHz for 40 MHz Bandwidth.

2.4.2 Radar waveform and Traffic

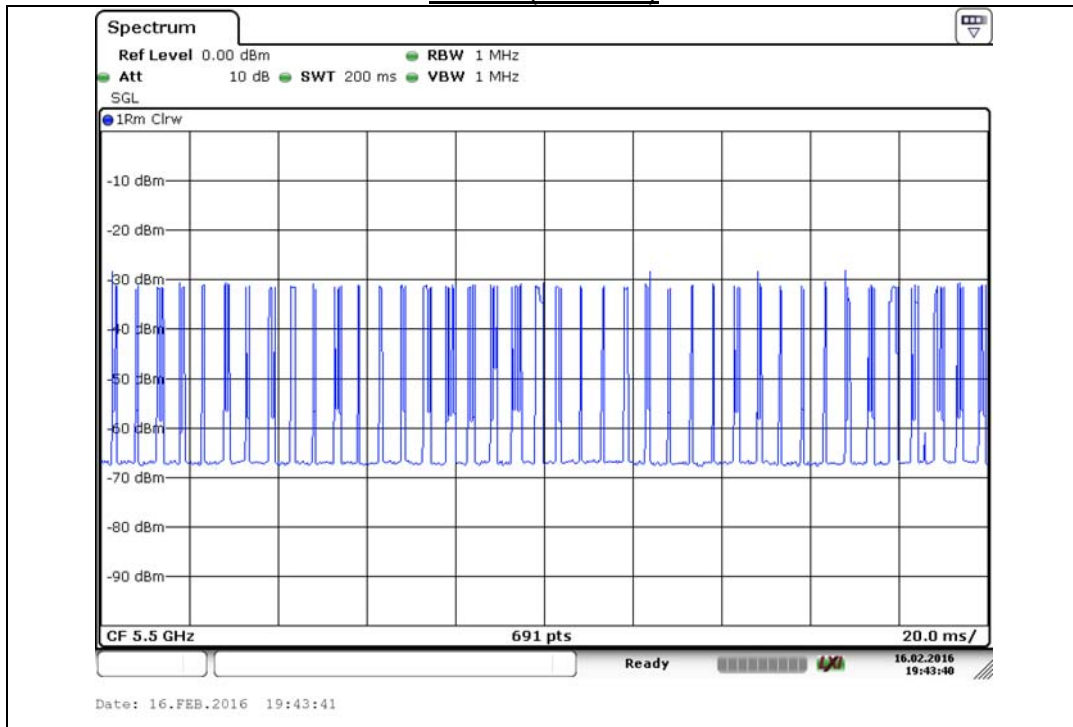
Radar Waveform (20 MHz)



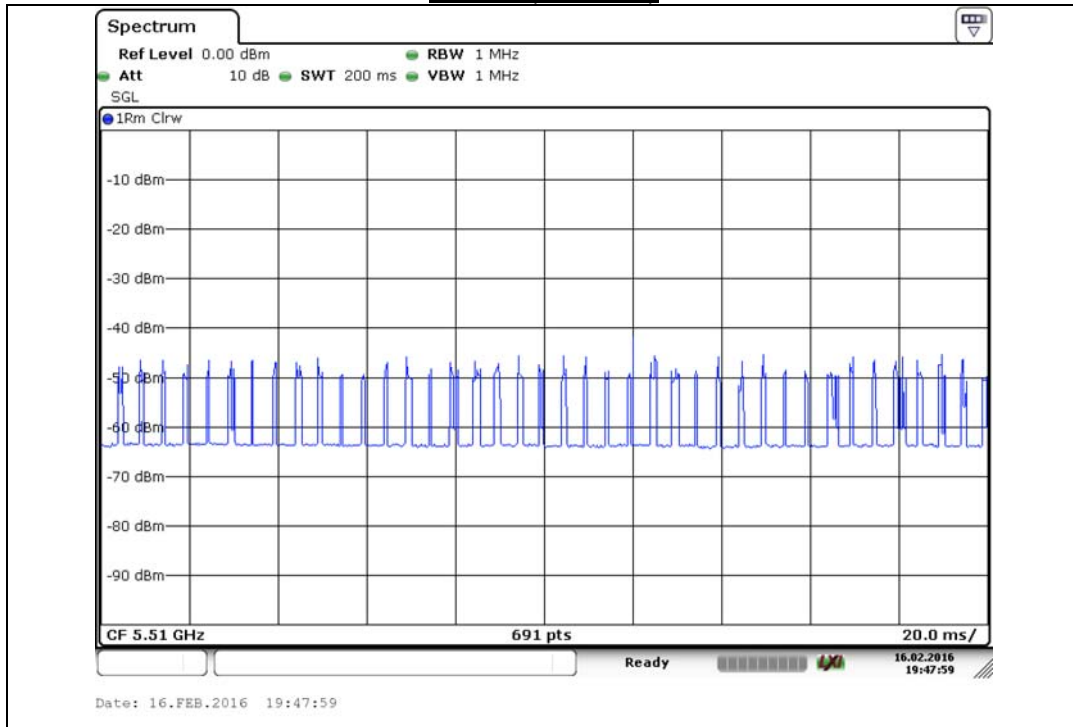
Radar Waveform (40 MHz)



Traffic (20 MHz)



Traffic (40 MHz)



2.4.3 Channel move time and Channel closing Transmission time

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse.
This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

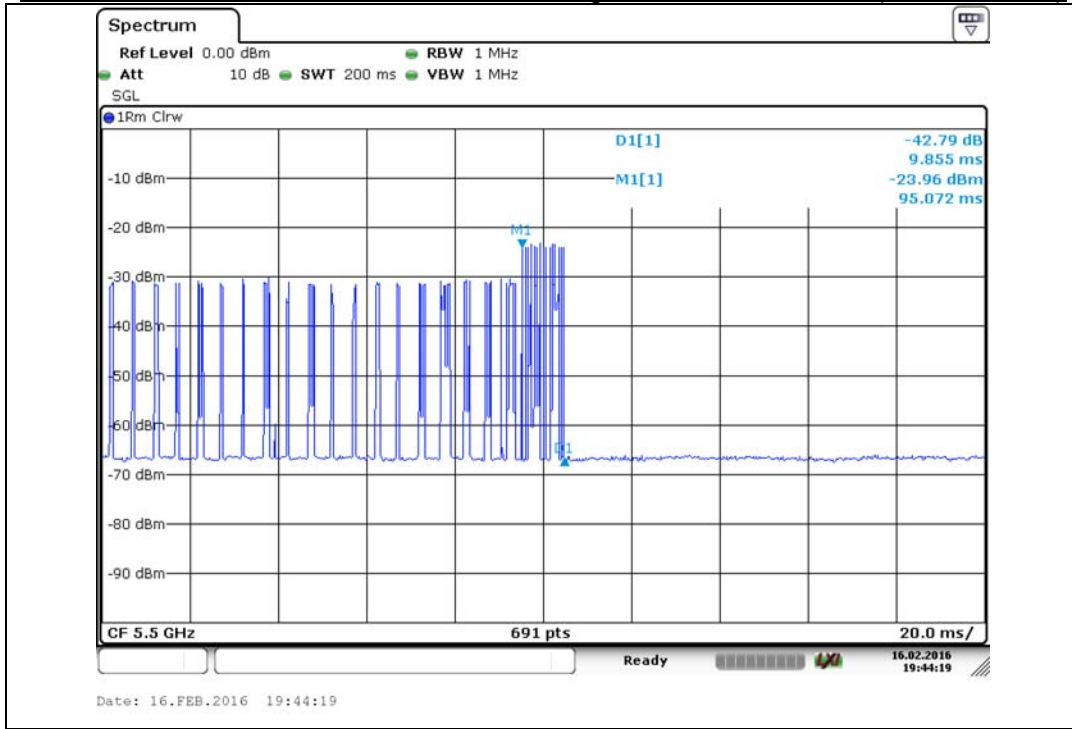
The observation period over which the aggregate time is calculated Begins at
(Reference Marker + 200 msec) and Ends no earlier than (Reference Marker + 10 sec).

Test Results

<Bandwidth 20 MHz Mode>

Channel Move Time (sec)	Limit (sec)
0.0099	10
Channel Closing Transmission Time (msec)	Limit (msec)
0	260

Channel Move Time and Channel closing Transmission time(20 MHz BW)



Channel Closing Transmission Time calculated	Test results
[S] Sweep time (sec)	0.2
[B] Sampling bins	691
[N] Number of sampling bins in 10	0
[C] Closing Transmission Time (msec)	0

Note : Dwell = S/B
 C = N * Dwell
 Closing Transmission Time[C] = 0 * (0.2/691)



CTK Co., Ltd.
The Power Leader of Global Regulatory Compliance

CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

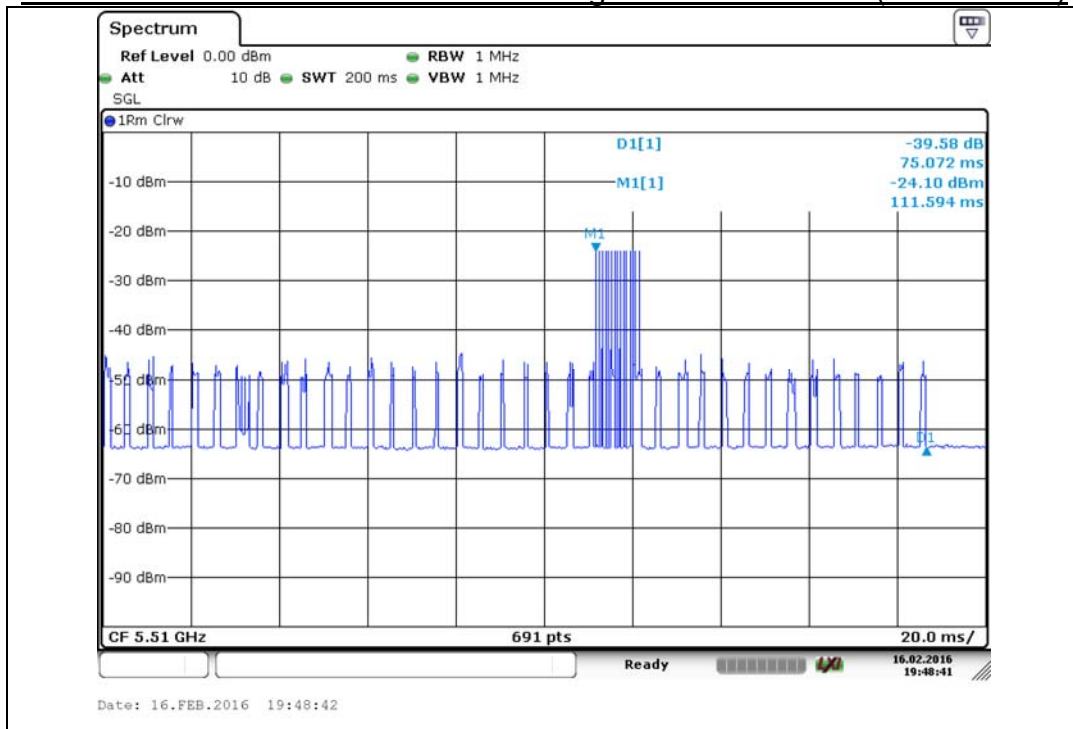
Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

<Bandwidth 40 MHz Mode>

Channel Move Time (sec)	Limit (sec)
0.075	10
Channel Closing Transmission Time (msec)	Limit (msec)
0.0038	260

Channel Move Time and Channel closing Transmission time(40 MHz BW)

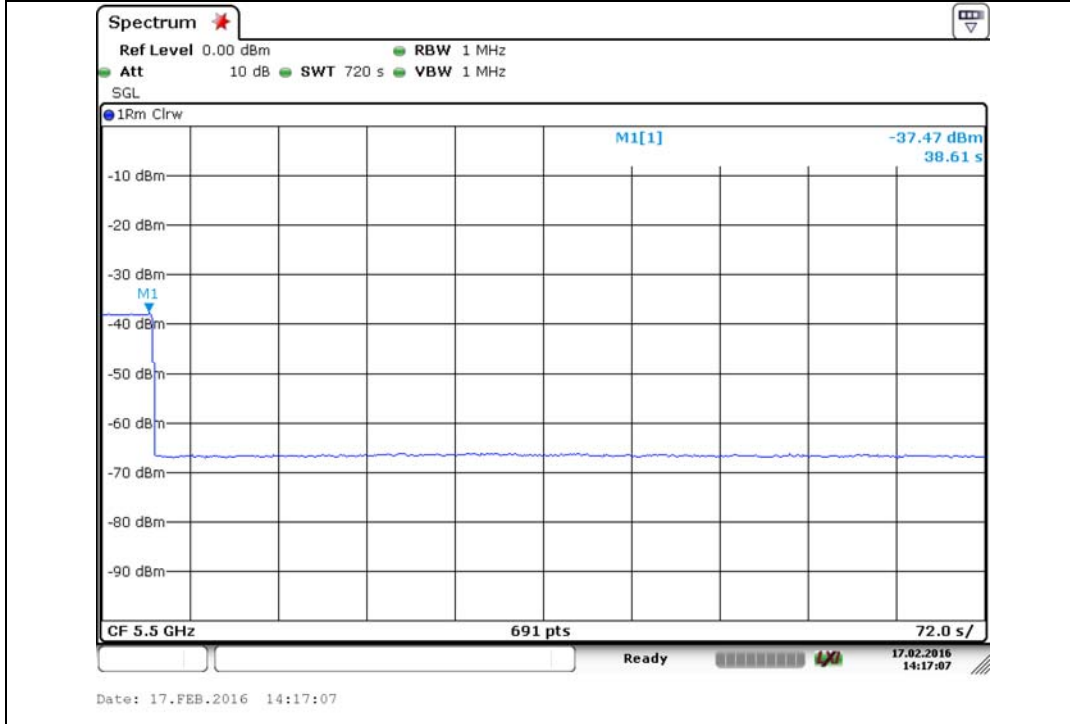


Channel Closing Transmission Time calculated	Test results
[S] Sweep time (sec)	0.2
[B] Sampling bins	691
[N] Number of sampling bins in 10	13
[C] Closing Transmission Time (msec)	0.0038

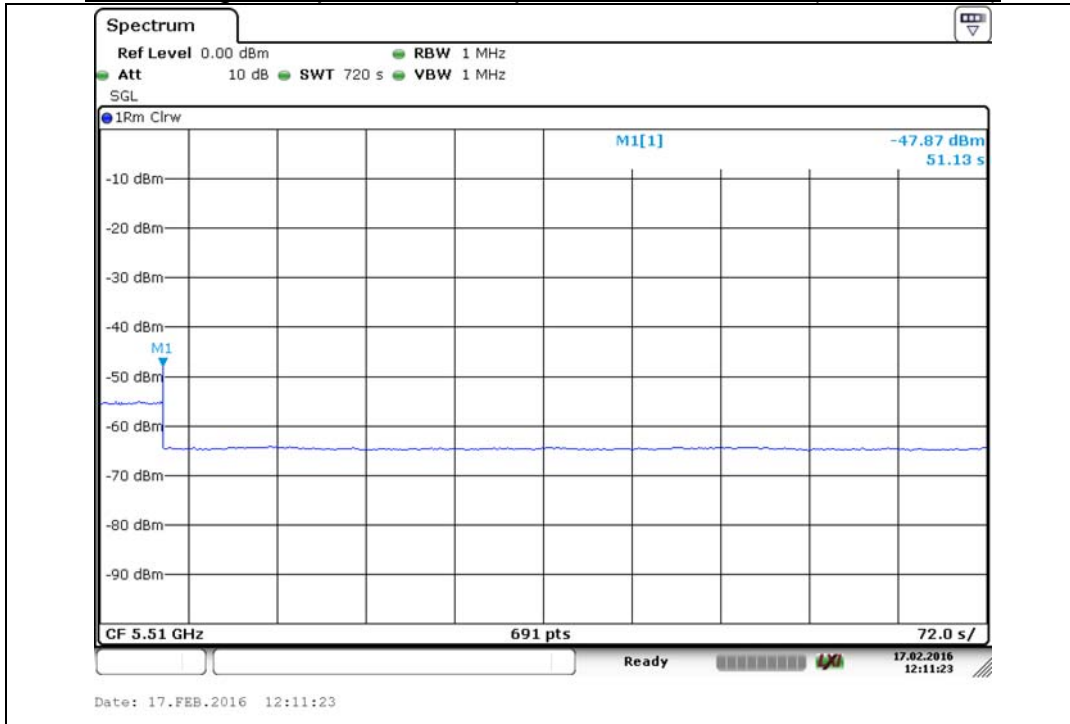
Note : Dwell = S/B
 C = N * Dwell
 Closing Transmission Time[C] = 13 * (0.2/691)

2.4.4 Client beacon test

Monitoring live spectrum – Elapse time 10 minutes (20 MHz BW)



Monitoring live spectrum – Elapse time 10 minutes (40 MHz BW)





CTK Co., Ltd.
The First Leader of Global Regulatory Compliance

CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Signal Generator	Rohde & Schwarz	SMB100A	175528	2016-01-20	2017-01-20
2	Signal Generator	Rohde & Schwarz	SMBV100A	258008	2015-05-13	2016-05-13
3	Combiner/Divider	Weinschel	1580-1	PE428	2015-11-03	2016-11-03
4	DUAL DIRECTIONAL COUPLER	HP	11692D	1212A03629	2015-11-23	2016-11-23
5	SPECTRUM ANALYZER	Rohde & Schwarz	FSV	101198	2015-07-16	2016-07-15