

TEST REPORT



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

Report No.:
CTK-2018-00242
Page (1) / (41) Pages

1. Client

- Name : Haier US Appliance Solutions, Inc.
- Address : Appliance Park AP2-226, Louisville, KY 40225, United States
- Date of Receipt : 2018-01-16

2. Manufacturer

- Name : Haier US Appliance Solutions, Inc.
- Address : Appliance Park AP2-226, Louisville, KY 40225, United States

3. Use of Report : For FCC Certification / ISED Certification

4. Test Sample / Model: Wi-Fi Module / WCATB004

5. Date of Test : 2018-01-24 to 2018-01-26

6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.247
ISED RSS-247

7. Testing Environment: Temp.: (24 ± 5) °C, Humidity: (49 ± 3) % R.H.

8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by  Ji-Hye, Kim: (Signature)	Technical Manager  Won-Jae, Hwang: (Signature)
-------------	--	---

2018-01-26

Republic of KOREA **CTK Co., Ltd.**



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

Report No.:
CTK-2018-00242
Page (2) / (41)Pages

REPORT REVISION HISTORY

Date	Revision	Page No
2018-01-26	Issued (CTK-2018-00242)	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.



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

Report No.:
CTK-2018-00242
Page (3) / (41)Pages

CONTENTS

1. General Product Description	4
1.1 Client Information	4
1.2 Product Information.....	4
1.3 Peripheral Devices	4
2. Facility and Accreditations.....	5
2.1 Test Facility.....	5
2.2 Laboratory Accreditations and Listings	5
2.3 Calibration Details of Equipment Used for Measurement	5
3. Test Specifications	6
3.1 Standards.....	6
3.2 Mode of operation during the test	7
3.3 Maximum Measurement Uncertainty	7
3.4 Test Software.....	7
4. Technical Characteristic Test.....	8
4.1 6dB Bandwidth.....	8
4.2 OUTPUT POWER	13
4.3 Power Spectral Density	18
4.4 Band Edge & Conducted Spurious emission.....	23
4.5 Radiated Emission	27
4.6 AC Power Line Conducted Emissions	38
APPENDIX A – Test Equipment Used For Tests	41



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

Report No.:
CTK-2018-00242
Page (4) / (41)Pages

1. General Product Description

1.1 Client Information


Company	Haier US Appliance Solutions, Inc.
Contact Point	Appliance Park AP2-226, Louisville, KY 40225, United States
Contact Person	Name : Park, Hansung E-mail : hansung.park@geappliances.com Tel : +82-31-8094-6732

1.2 Product Information

FCC ID	ZKJ-WCATB004
ISED	10229A-WCATB004
Product Description	Wi-Fi Module
Model name	WCATB004
Variant Model name	-
Operating Frequency	2 412 MHz – 2 462 MHz
RF Output Power	802.11b : 22.31 dBm (170.22 mW) 802.11g : 17.30 dBm (53.70 mW) 802.11n : 16.84 dBm (48.31 mW)
Antenna Specification	Antenna type : Chip Antenna Peak Gain : 1.47 dBi
Number of channels	11
Type of Modulation	802.11b : DSSS 802.11g/n : OFDM
Data Rate	802.11b : 11 / 5.5 / 2 / 1 Mbps 802.11g : 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6 Mbps 802.11n: MCS0-7, up to 72.2 Mbps
Power Source	DC 5 V
Hardware Rev	v1.1
Software Rev	V0.0.7.36

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253R6N
AC/DC Adapter	HP	HSTNN-CA40	-





	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	Report No.: CTK-2018-00242 Page (5) / (41)Pages	
---	---	---	--

2. Facility and Accreditations

2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea.

2.2 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Registration Number	Logo
USA	FCC	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	805871	
CANADA	ISED	ISED EMI (3/10m test site)	8737A-2	
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	

2.3 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.



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

Report No.:
 CTK-2018-00242
 Page (6) / (41)Pages

3. Test Specifications

3.1 Standards

FCC Part Section(s)	Requirement(s)	Status (Note 1)	Test Condition
15.247(a)	6 dB Bandwidth	C	Conducted
15.247(b)	Maximum Output Power	C	
15.247(d)	Conducted Spurious emission	C	
15.247(d)	Unwanted Emission(Conducted)	C	
15.247(e)	Power Spectral Density	C	
15.209	Radiated Emissions	C	Radiated
15.207	AC Conducted Emission	C	Line Conducted
<i>Note 1:</i> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable			
<i>Note 2:</i> The data in this test report are traceable to the national or international standards.			
<i>Note 3:</i> The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013			
<i>Note 4:</i> The tests were performed according to the method of measurements prescribed in KDB No.558074.			

ISED Part Section(s)	Requirement(s)	Status (Note 1)	Test Condition
RSS-Gen 6.6	6 dB Bandwidth	C	Conducted
RSS-247 5.4(d)	Maximum Output Power	C	
RSS-Gen 6.13	Conducted Spurious emission	C	
RSS-Gen 6.13	Unwanted Emission(Conducted)	C	
RSS-247 5.2(b)	Power Spectral Density	C	
RSS-Gen 6.13	Radiated Emissions	C	Radiated
RSS-Gen 5	Receiver Spurious Emissions	C	
RSS-Gen 8.8	AC Conducted Emission	C	Line Conducted
<i>Note 1:</i> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable			
<i>Note 2:</i> The data in this test report are traceable to the national or international standards.			
<i>Note 3:</i> The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013			
<i>Note 4:</i> The tests were performed according to the method of measurements prescribed in KDB No.558074.			



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

Report No.:
 CTK-2018-00242
 Page (7) / (41)Pages

3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments.
 During at testing, system components were manipulated within the confines of typical usage to maximize each emission. All modulation modes were tests.
 The results are only attached worst cases.

Test Frequency

Lowest channel	Middle channel	Highest channel
2 412 MHz	2 437 MHz	2 462 MHz

Test mode

Test mode	Modulation	Data rate	Duty Cycle	Duty Cycle Factor
802.11b	DSSS	1 Mbps	99.2%	-
802.11g	OFDM	6 Mbps	94.5%	0.25 dB
802.11n	OFDM	MCS 0	93.9%	0.27 dB

3.3 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.
 Coverage factor $k = 2$, Confidence levels of 95 %

Description	Uncertainty
Conducted RF Output Power	± 1.5 dB
Power Spectral Density	± 1.5 dB
Occupied Bandwidth	± 0.1 MHz
Unwanted Emission(conducted)	± 3.0 dB
Radiated Emissions ($f \leq 1$ GHz)	± 4.0 dB
Radiated Emissions ($f > 1$ GHz)	± 5.0 dB

3.4 Test Software

Conducted Test	Ics Pro Ver. 6.0.3
Radiated Test	TOYO EMI software EP5RE Ver. 5.1.0
Line Conducted Test	ESC17, ESC13 : EMC32 Ver. 8.50.0 ESR7 : EMC32 Ver. 8.53.0



4. Technical Characteristic Test

4.1 6dB Bandwidth

Test Procedures

ANSI C63.10-2013 6.9.2
RSS-GEN Issue 4 6.6

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Procedures

ANSI C63.10-2013 6.9.3
RSS-GEN Issue 4 6.6

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = 100 kHz
- b) VBW $\geq 3 \times$ RBW
- c) Detector = peak
- d) Trace mode = Max hold
- e) Sweep = auto couple
- f) Allow trace to fully stabilize
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Limit

6 dB Bandwidth > 500kHz



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

Report No.:
CTK-2018-00242
Page (9) / (41)Pages

Test Data:

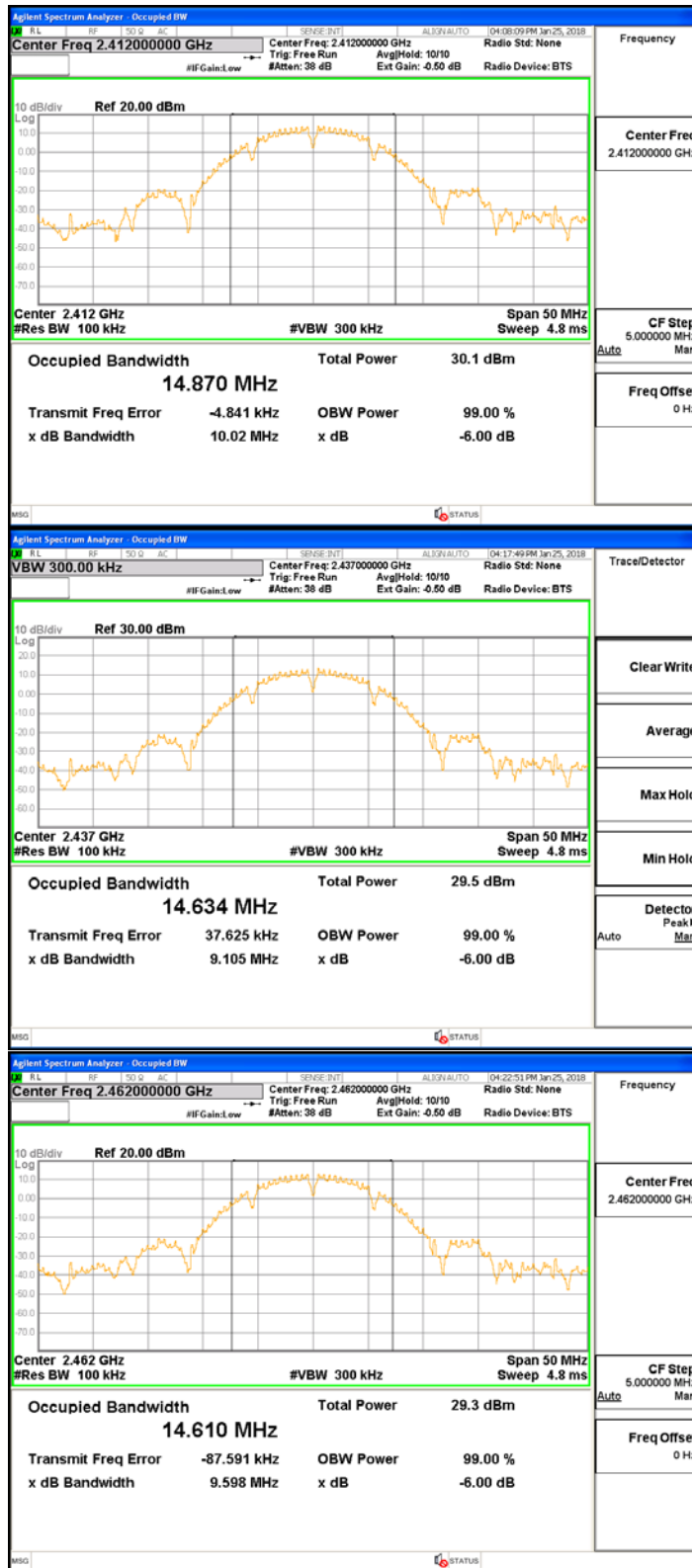
Mode	6 dB Bandwidth and 99% Bandwidth (MHz)					
	802.11b		802.11g		802.11n_HT20	
Frequency	6dB	99%	6dB	99%	6dB	99%
2 412 MHz	10.02	14.87	16.41	16.53	17.58	17.66
2 437 MHz	9.11	14.63	16.40	16.54	17.37	17.66
2 462 MHz	9.60	14.61	16.41	16.54	17.39	17.65

See next pages for actual measured spectrum plots.



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

Report No.:
 CTK-2018-00242
 Page (10) / (41)Pages

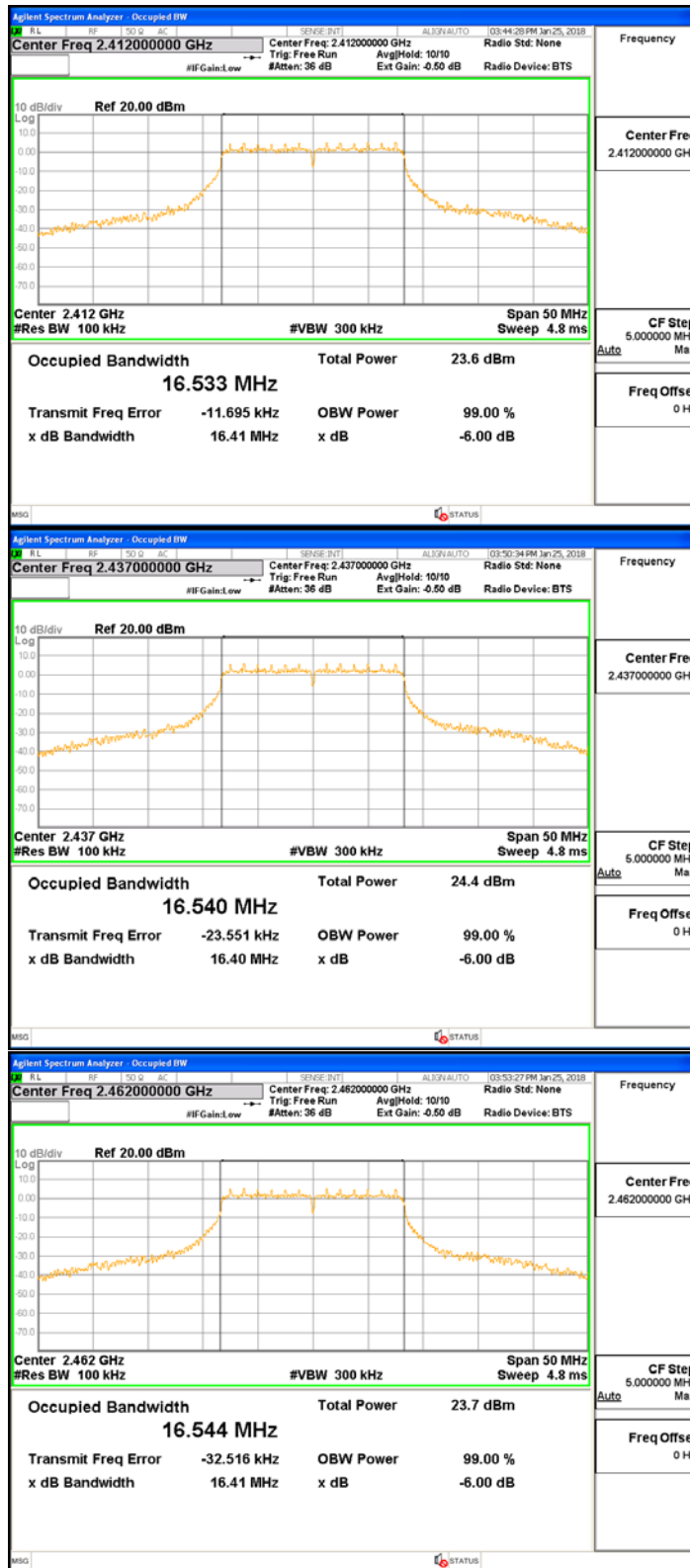


802.11b



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

Report No.:
 CTK-2018-00242
 Page (11) / (41)Pages

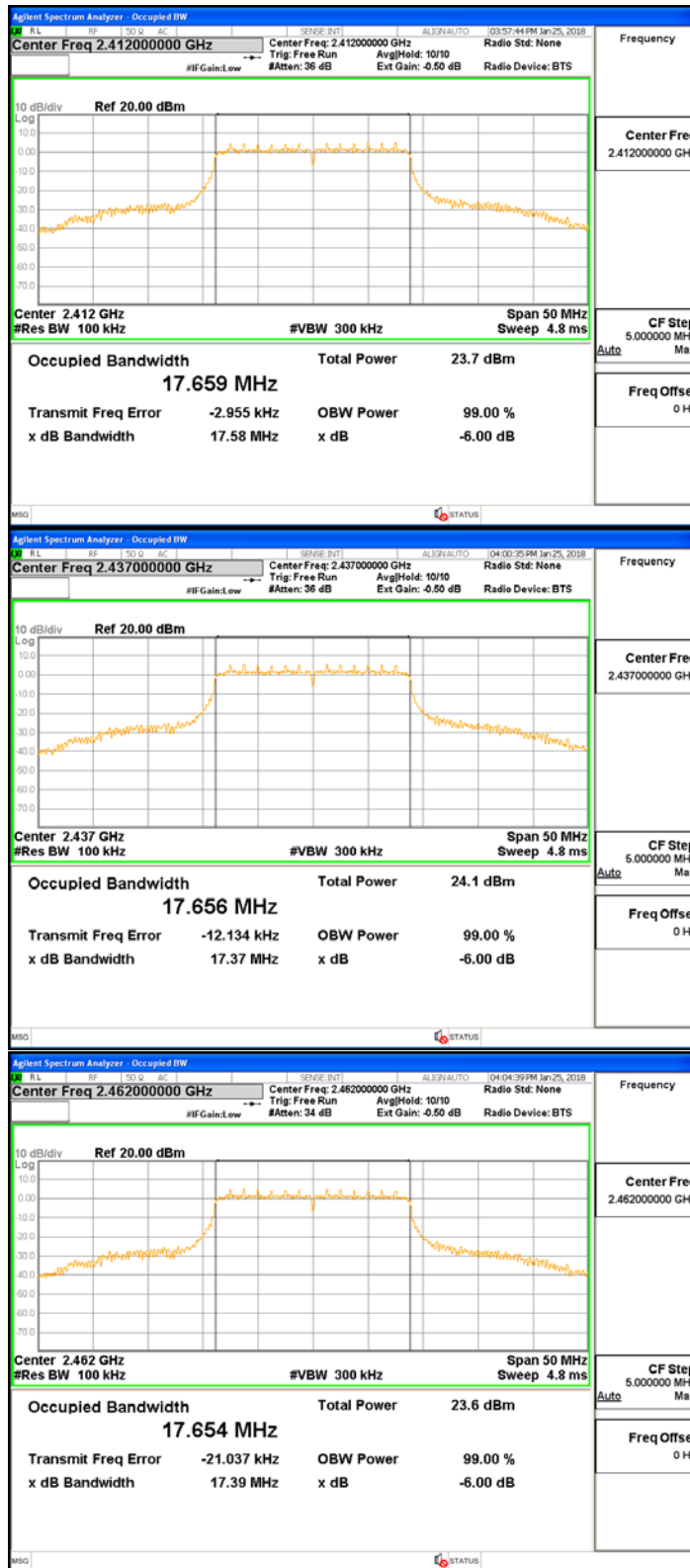


802.11g



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

Report No.:
 CTK-2018-00242
 Page (12) / (41)Pages



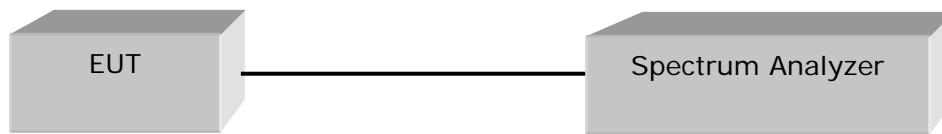
802.11n_HT20

4.2 OUTPUT POWER

Test Procedures

Average Power(Procedure 9.2.2.2 in KDB 558074, Method AVGSA-1, Method AVGSA-2)
RSS-GEN Issue 4 6.12

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.



Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) span $\geq 1.5 \times \text{OBW}$
- b) RBW = 1 MHz
- c) VBW $\geq 3 \times \text{RBW}$
- d) Sweep time = auto
- e) Detector = RMS
- f) average at least 100
- g) Duty cycle factor = $10\log(1/x)$

802.11b = 0 dB, 802.11g = 0.25 dB, 802.11n_HT20 = 0.27 dB

Limit

Operating Mode	Mode	ANT Gain (dBi)	Limit (dBm)	
			FCC	IC
SISO	802.11b/g/n	1.47	30	36



Test Data

802.11b

Frequency	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	22.31	0	22.31	30	7.69
2 437 MHz	22.06	0	22.06	30	7.94
2 462 MHz	21.67	0	21.67	30	8.33

802.11g

Frequency	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	16.32	0.25	16.57	30	13.43
2 437 MHz	17.05	0.25	17.30	30	12.70
2 462 MHz	16.40	0.25	16.65	30	13.35

802.11n_HT20

Frequency	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	16.04	0.27	16.31	30	13.69
2 437 MHz	16.57	0.27	16.84	30	13.16
2 462 MHz	16.04	0.27	16.31	30	13.69

See next pages for actual measured spectrum plots.



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

Report No.:
 CTK-2018-00242
 Page (15) / (41)Pages



802.11b



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

Report No.:
 CTK-2018-00242
 Page (16) / (41)Pages



802.11g



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

Report No.:
 CTK-2018-00242
 Page (17) / (41)Pages



802.11n_HT20



4.3 Power Spectral Density

Test Procedures

Procedure 10.2 in KDB 558074, Method Peak PSD
RSS-247 Issue 2 5.2(b)

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) $RBW : 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$
- b) $VBW \geq 3 \times RBW$
- c) $span \geq 1.5 \times DTS \text{ bandwidth}$
- d) Sweep time = auto couple
- e) Detector = peak
- f) Trace mode = max hold
- g) Allow trace to fully stabilize
- h) Use the peak marker function to determine the maximum amplitude level within the RBW.

Limit

Operating Mode	Mode	ANT Gain (dBi)	Limit (dBm)	
			FCC	IC
SISO	802.11b/g/n	1.47	8	8



Test Data

802.11b

Frequency	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	-1.71	8	9.71
2 437 MHz	-0.20	8	8.20
2 462 MHz	-4.08	8	12.08

802.11g

Frequency	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	-10.80	8	18.80
2 437 MHz	-10.72	8	18.72
2 462 MHz	-10.57	8	18.57

802.11n_HT20

Frequency	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	-10.56	8	18.56
2 437 MHz	-9.94	8	17.94
2 462 MHz	-10.29	8	18.29

See next pages for actual measured spectrum plots.

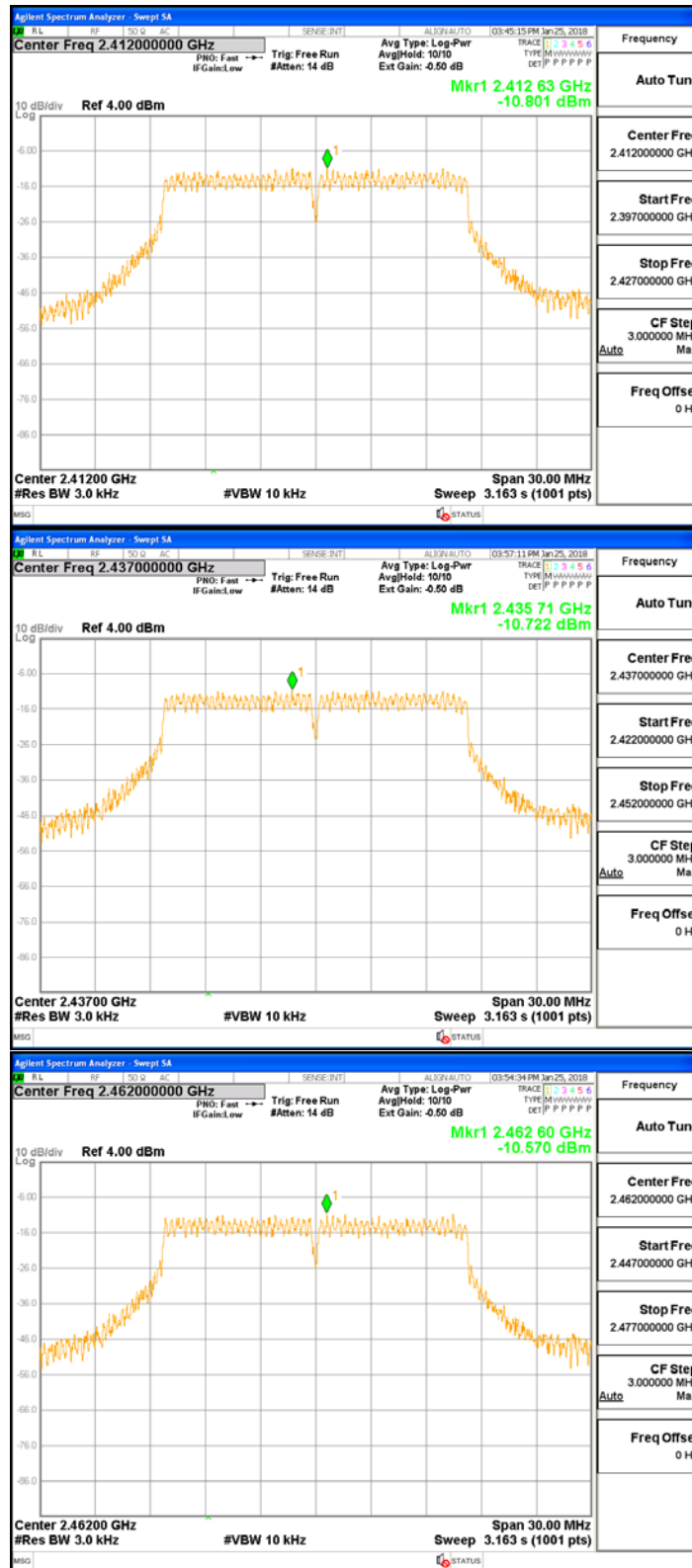


CTK Co., Ltd.
 (Ho-dong), 113, Yejik-ro, Cheoin-gu,
 Yongin-si, Gyeonggi-do, Korea
 Tel: +82-31-339-9970
 Fax: +82-31-624-9501

Report No.:
 CTK-2018-00242
 Page (20) / (41)Pages



802.11b

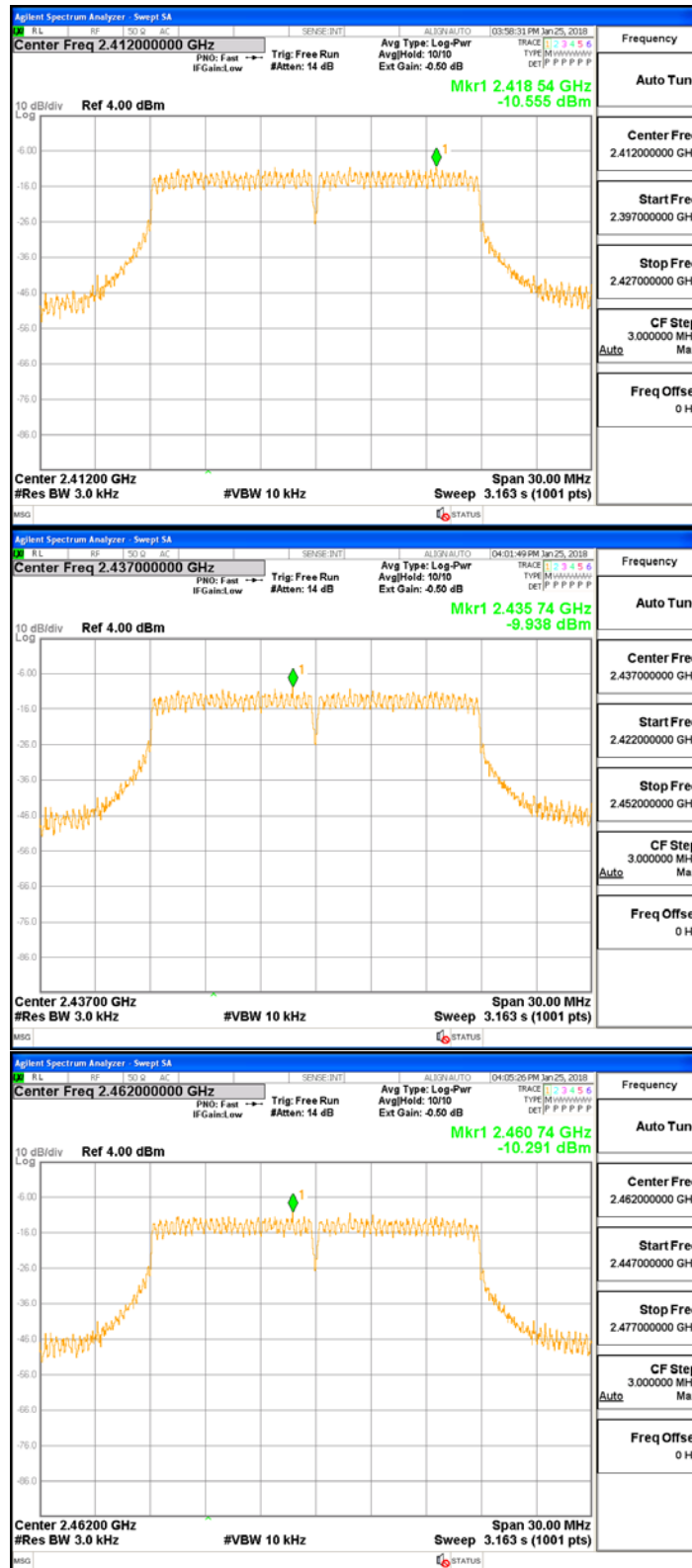


802.11g



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

Report No.:
 CTK-2018-00242
 Page (22) / (41)Pages



802.11n_HT20



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

Report No.:
CTK-2018-00242
Page (23) / (41)Pages

4.4 Band Edge & Conducted Spurious emission

Test Procedures

ANSI C63.10-2013 11.11.3

The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) RBW = 100 kHz
- b) VBW $\geq 3 \times$ RBW
- c) Detector = peak
- d) Sweep time = auto couple
- e) Trace mode= max hold
- f) Allow trace to fully stabilize
- g) Use the peak marker function to determine the maximum amplitude level.

Limit :

Emission level < 30 dBc

Test Data: Complies

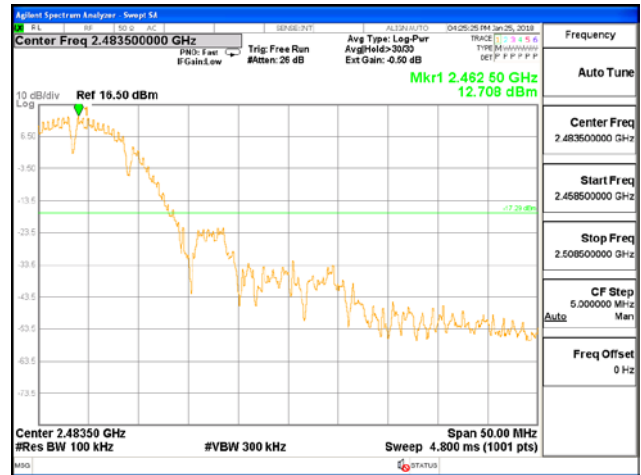
- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 30dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.

See next pages for actual measured spectrum plots.



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

Report No.:
CTK-2018-00242
Page (24) / (41)Pages

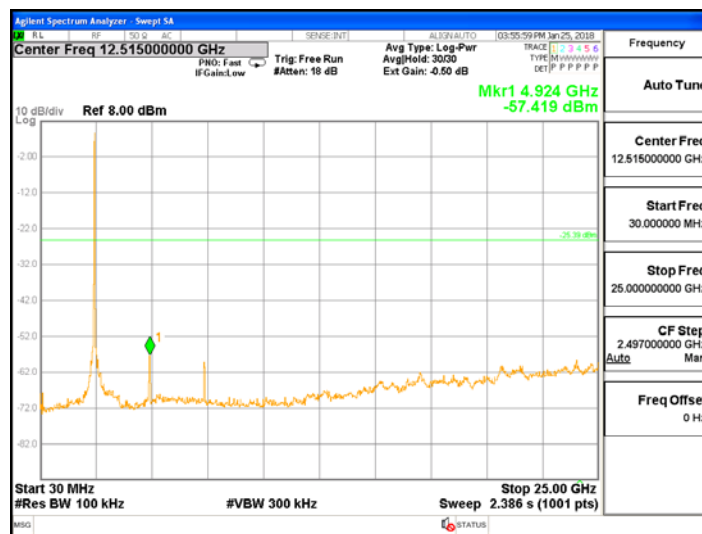
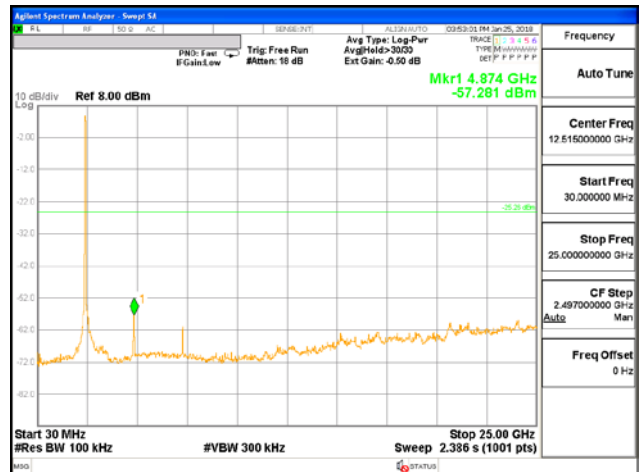
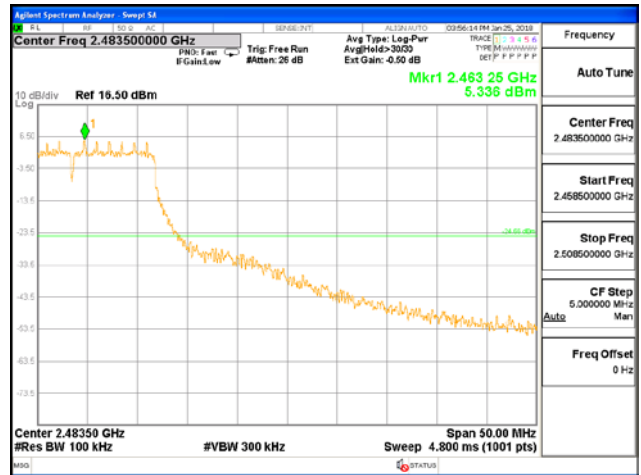
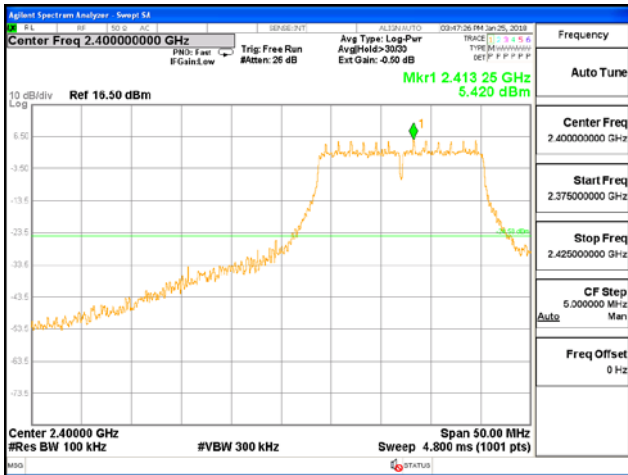


802.11b



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

Report No.:
 CTK-2018-00242
 Page (25) / (41)Pages

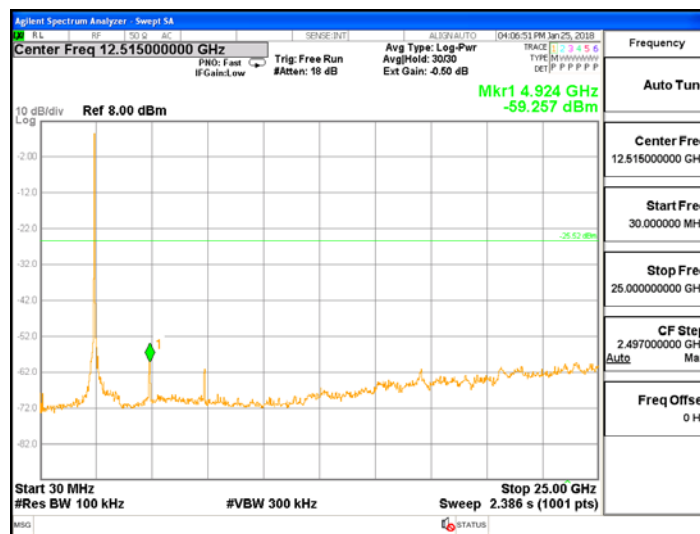
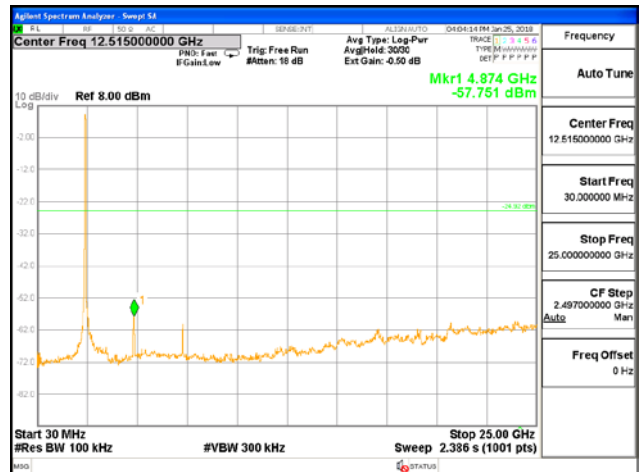
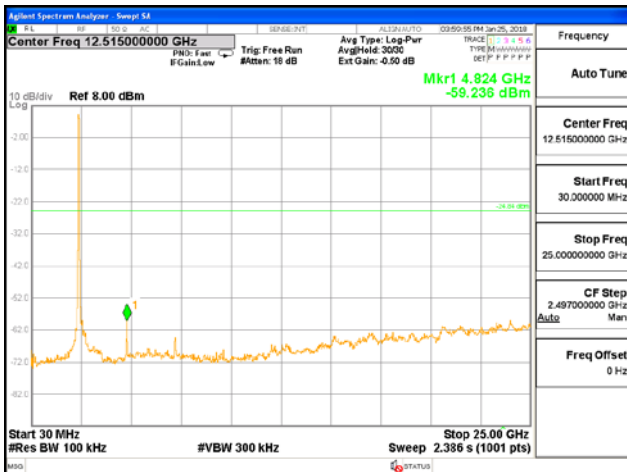
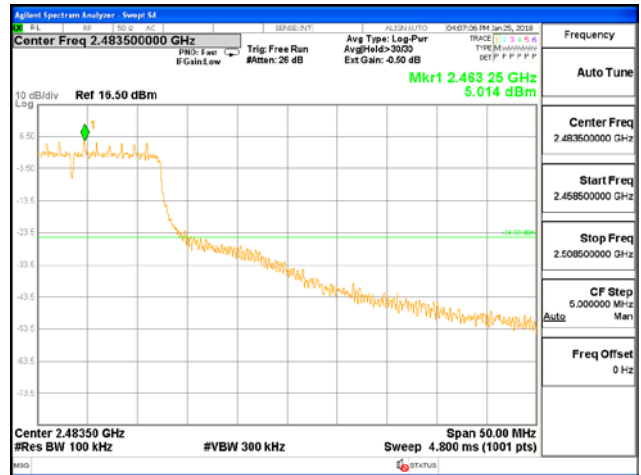
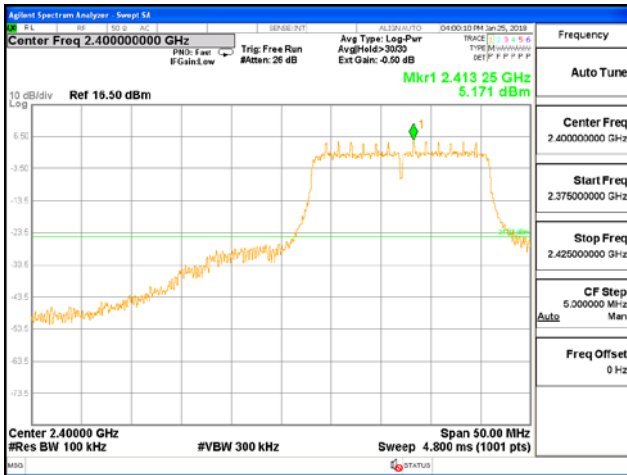


802.11g



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

Report No.:
 CTK-2018-00242
 Page (26) / (41)Pages



802.11n_HT20



4.5 Radiated Emission

Test Location

- 10 m SAC (test distance : 10 m, 3 m)
 3 m SAC (test distance : 3 m)

Test Procedures

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

Test Settings:

Frequency Range = 9 kHz ~ 1 GHz

- a) RBW = 100 kHz for $f < 1$ GHz, 9 kHz for $f < 30$ MHz
b) VBW \geq RBW
c) Detector = CISPR Quasi-peak
d) Sweep time = auto couple

- Peak

Frequency Range = 1 GHz ~ 25 GHz (2.4 GHz 10th harmonic)

- a) RBW = 1 MHz
b) VBW \geq 3 x RBW
c) Detector = Peak
d) Sweep time = auto
e) Trace mode = max hold

- Average (duty cycle \geq 98%)

Frequency Range = 1 GHz ~ 25 GHz (2.4 GHz 10th harmonic)

- a) RBW = 1 MHz
b) VBW \geq 3 x RBW
c) Detector = RMS
d) Sweep time = auto
e) Averaging type = power (i.e., RMS)
f) Trace mode = average (at least 100 traces)



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

Report No.:
 CTK-2018-00242
 Page (28) / (41)Pages

- Average (duty cycle < 98%, duty cycle variations are less than ±2%)

Frequency Range = 1 GHz ~ 25 GHz (2.4 GHz 10th harmonic)

a) RBW = 1 MHz

b) VBW ≥ 3 x RBW

c) Detector = RMS

d) Sweep time = auto

e) Averaging type = power (i.e., RMS)

f) Trace mode = average (at least 100 traces)

A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 % duty cycle.

If power averaging (RMS) mode, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.

802.11b = 0 dB, 802.11g = 0.25 dB, 802.11n_HT20 = 0.27 dB

Limit :

FCC Part 15 § 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	MHz	GHz
0.09-0.11	8.37626-8.38675	73-74.6	399.9-410	2690-2900	10.6-12.7
¹ 0.495-0.505	8.41425-8.41475	74.8-75.2	608-614	3260-3267	13.25-13.4
2.1735-2.1905	12.29-12.293	108-121.94	960-1240	3332-3339	14.47-14.5
4.125-4.128	12.51975-12.52025	123-138	1300-1427	3345.8-3358	15.35-16.2
4.17725-4.17775	12.57675-12.57725	149.9-150.05	1435-1626.5	3600-4400	17.7-21.4
4.20725-4.20775	13.36-13.41	156.52475-156.52525	1645.5-1646.5	4500-5150	22.01-23.12
6.215-6.218	16.42-16.423	156.7-156.9	1660-1710	5350-5460	23.6-24
6.26775-6.26825	16.69475-16.69525	162.0125-167.17	1718.8-1722.2	7250-7750	31.2-31.8
6.31175-6.31225	16.80425-16.80475	167.72-173.2	2200-2300	8025-8500	36.43-36.5
8.291-8.294	25.5-25.67	240-285	2310-2390	9000-9200	² Above 38.6
8.362-8.366	37.5-38.25	322-335.4	2483.5-2500	9300-9500	

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



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

Report No.:
CTK-2018-00242
Page (29) / (41)Pages

FCC Part 15 § 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Deasurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

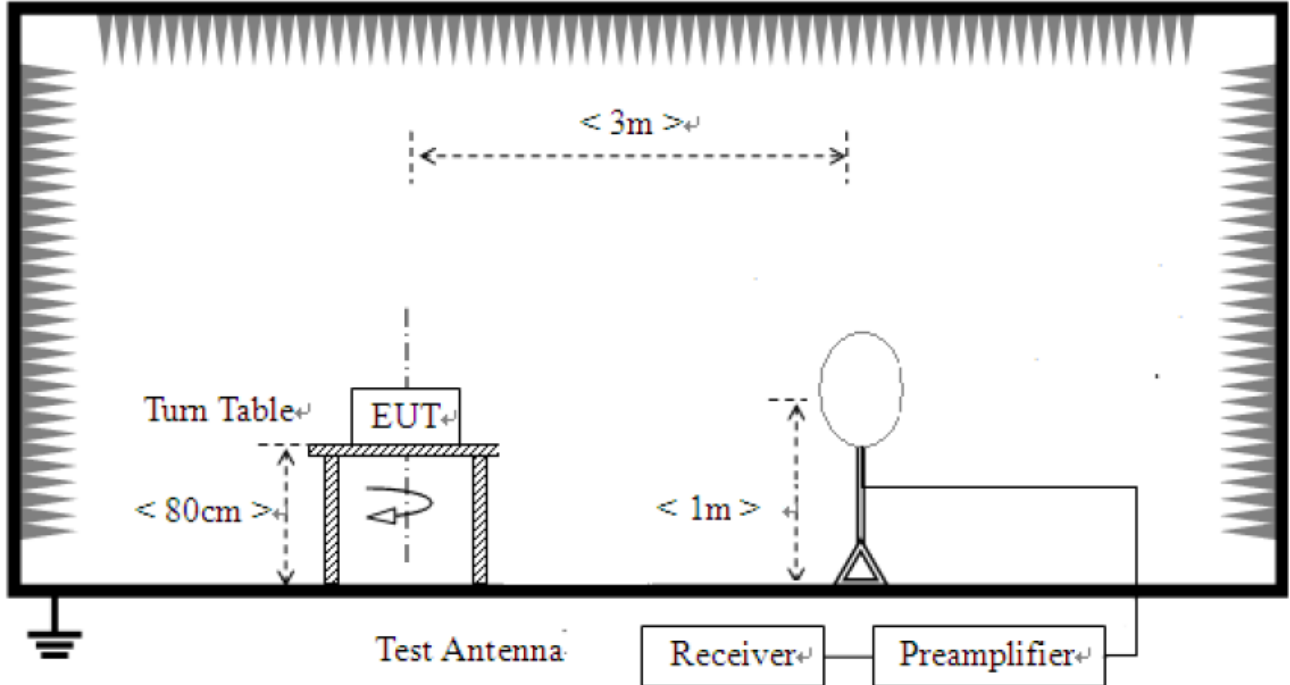
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note :

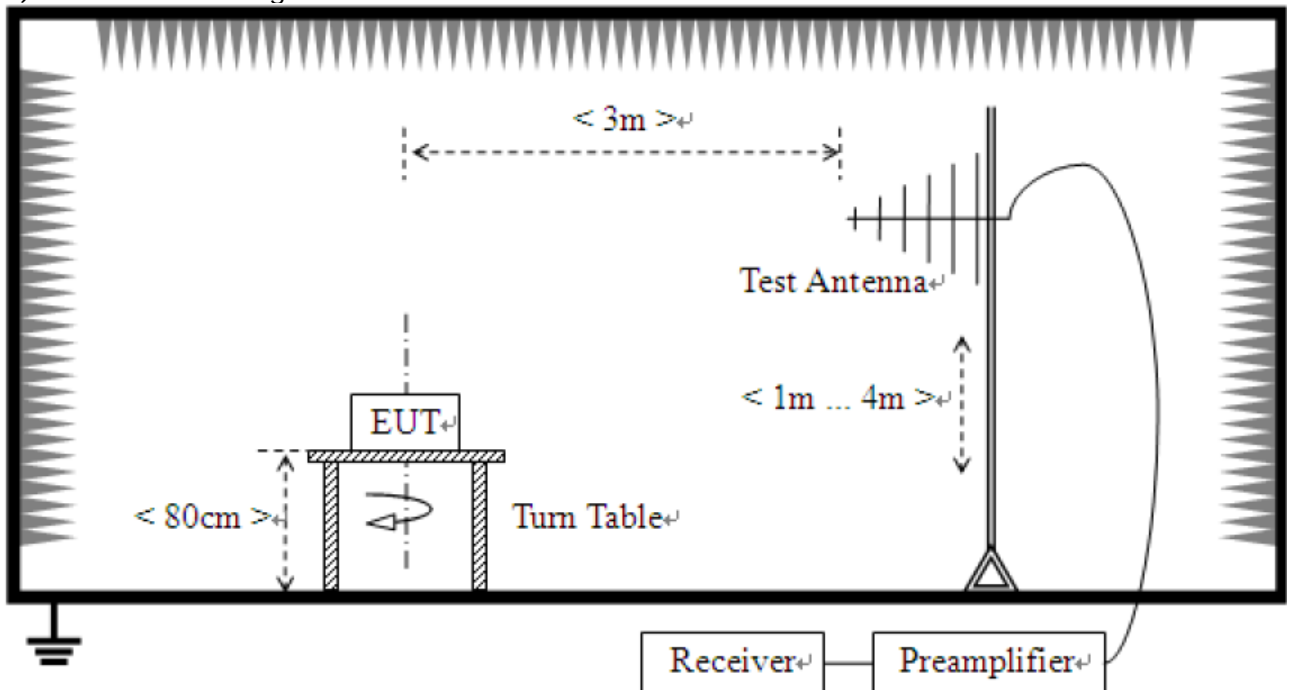
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)

Test Setup:

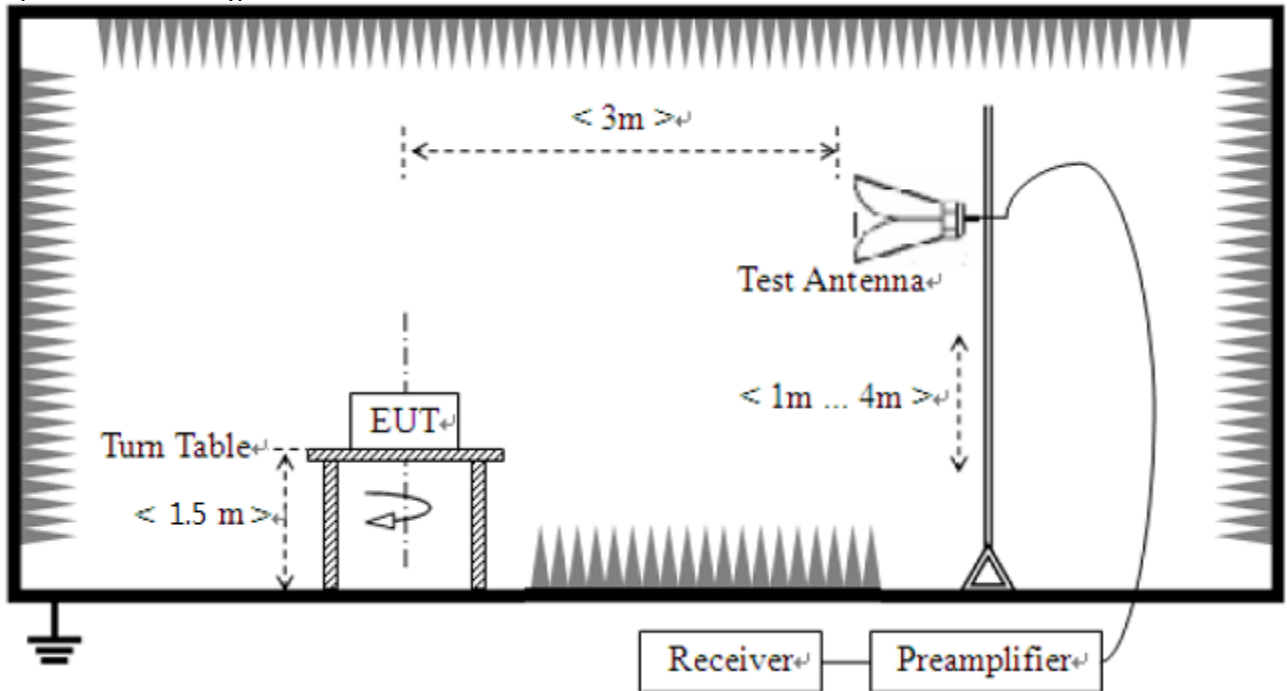
- 1) For field strength of emissions from 9 kHz to 30 MHz



- 2) For field strength of emissions from 30 MHz to 1 GHz



3) For field strength of emissions above 1 GHz



Test results

1) 9 kHz to 30 MHz

Test mode : 802.11b, 802.11g, 802.11n (Worst case)

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	See note

Note :

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB)

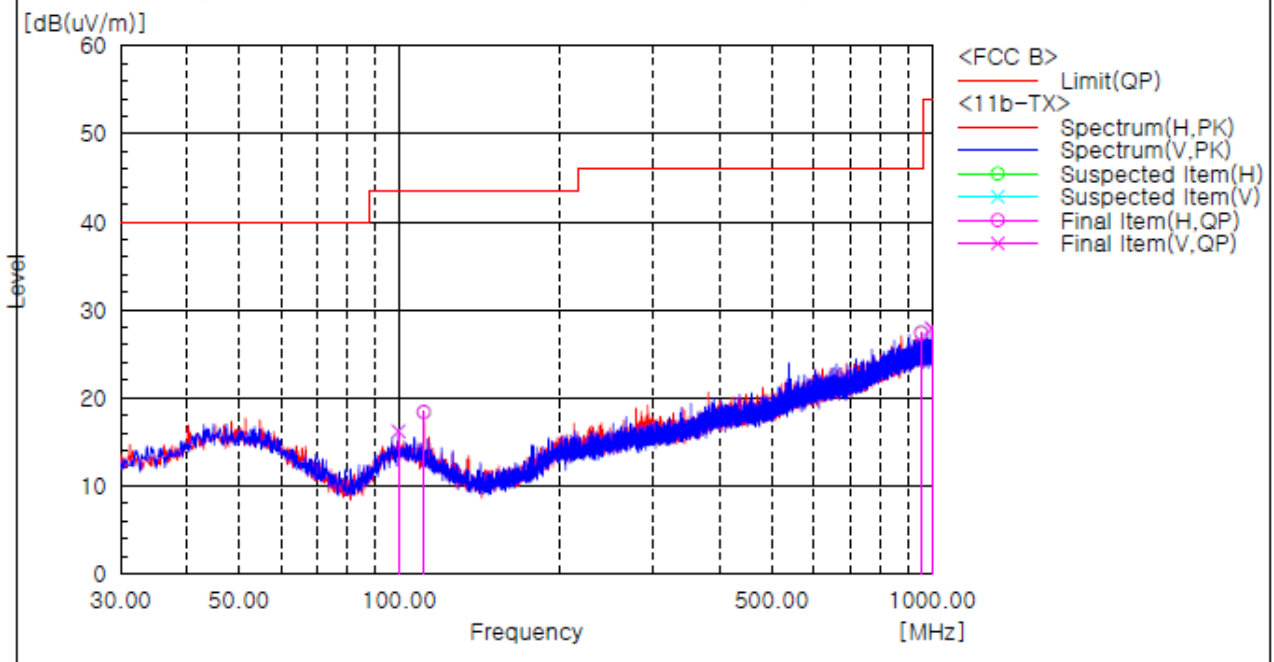
2) 30 MHz to 1 GHz

Test mode : 802.11b, Low Channel(Worst Case)

The requirements are:

Complies

Test Data



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Angle [deg]	Remark
1	99.606	V	30.3	-14.1	16.2	43.5	27.3	77.2	
2	111.126	H	33.1	-14.7	18.4	43.5	25.1	163.7	
3	953.555	H	30.9	-3.5	27.4	46.0	18.6	32.1	
4	997.817	V	31.0	-3.1	27.9	54.0	26.1	101.7	

Remark :

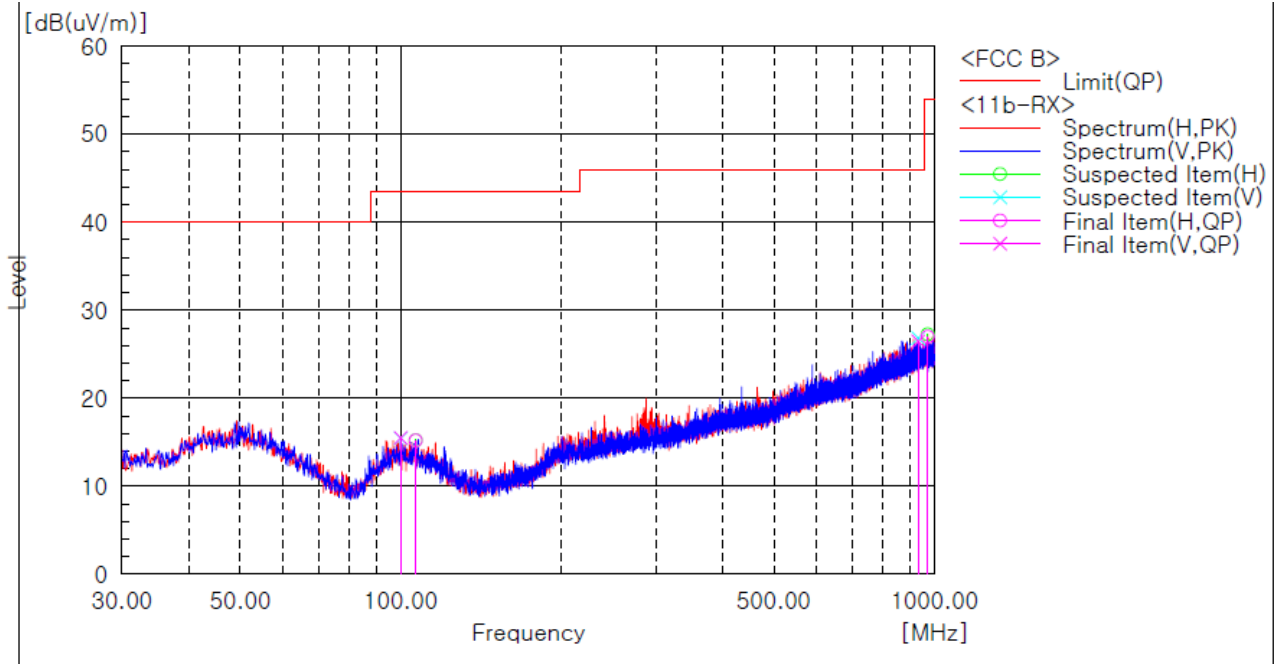
1. The worst emission was found in li-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain

Test mode : Receiver

The requirements are:

Complies

Test Data



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Angle [deg]	Remark
1	99.849	V	29.6	-14.1	15.5	43.5	28.0	18.0	
2	106.518	H	29.5	-14.3	15.2	43.5	28.3	355.4	
3	931.849	V	30.2	-3.7	26.5	46.0	19.5	1.5	
4	971.139	H	30.3	-3.3	27.0	54.0	27.0	131.1	

Remark :

1. The worst emission was found in li-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain



3) above 1 GHz

Test mode : 802.11b

The requirements are:

Complies

Test Data

Low(2 412 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
4 824.00	H	54.00	74.00	44.71	48.51	9.29	25.49
4 824.00	V	54.00	74.00	49.59	52.64	4.41	21.36
7 236.00	H	54.00	74.00	47.11	52.97	6.89	21.03
7 236.00	V	54.00	74.00	48.02	53.27	5.98	20.73
2 390.00	H	54.00	74.00	49.59	57.09	4.41	16.91
2 390.00	V	54.00	74.00	52.33	61.33	1.67	12.67

Mid(2 437 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
4 874.00	H	54.00	74.00	44.31	48.47	9.69	25.53
4 874.00	V	54.00	74.00	48.13	51.22	5.87	22.78
7 311.00	H	54.00	74.00	45.66	52.50	8.34	21.50
7 311.00	V	54.00	74.00	48.30	54.12	5.70	19.88

High(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
4 924.00	H	54.00	74.00	44.44	48.09	9.56	25.91
4 924.00	V	54.00	74.00	46.61	50.63	7.39	23.37
7 386.00	H	54.00	74.00	45.15	52.49	8.85	21.51
7 386.00	V	54.00	74.00	46.84	53.37	7.16	20.63
2 483.50	H	54.00	74.00	49.28	57.07	4.72	16.93
2 483.50	V	54.00	74.00	49.00	57.52	5.00	16.48

Remarks

1. The worst emission was found in li-down position(X axis) and the worst case was recorded.



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

Report No.:
CTK-2018-00242
Page (35) / (41)Pages

Test mode : 802.11g

The requirements are:

Complies

Test Data

Low(2 412 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2 390.00	H	54.00	74.00	50.04	64.78	3.96	9.22
2 390.00	V	54.00	74.00	52.30	66.69	1.70	7.31

Mid(2 437 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
-----------------	-----	-------------------	-------------------	--------------------	--------------------	----------------	----------------

The emissions above 1 GHz were 20 dB lower than the limit.

High(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2 483.50	H	54.00	74.00	50.40	63.82	3.60	10.18
2 483.50	V	54.00	74.00	49.73	63.84	4.27	10.16

Remarks

1. The worst emission was found in li-down position(X axis) and the worst case was recorded.



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

Report No.:
CTK-2018-00242
Page (36) / (41)Pages

Test mode : 802.11n

The requirements are:

Complies

Test Data

Low(2 412 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2 390.00	H	54.00	74.00	50.93	70.66	3.07	3.34
2 390.00	V	54.00	74.00	52.61	71.38	1.39	2.63

Mid(2 437 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
-----------------	-----	-------------------	-------------------	--------------------	--------------------	----------------	----------------

The emissions above 1 GHz were 20 dB lower than the limit.

High(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2 483.50	H	54.00	74.00	52.19	69.64	1.81	4.36
2 483.50	V	54.00	74.00	49.45	69.03	4.55	4.97

Remarks

1. The worst emission was found in li-down position(X axis) and the worst case was recorded.



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

Report No.:
CTK-2018-00242
Page (37) / (41)Pages

Test mode : Receiver

The requirements are:

Complies

Test Data

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
--------------------	-----	-------------------------	-------------------------	--------------------------	--------------------------	----------------------	----------------------

The emissions above 1 GHz were 20 dB lower than the limit.

4.6 AC Power Line Conducted Emissions

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits.

Instrument Settings

IF Band Width: 9 kHz

Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average**
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

* The level decreases linearly with the logarithm of the frequency.

** A linear average detector is required.

Test Results

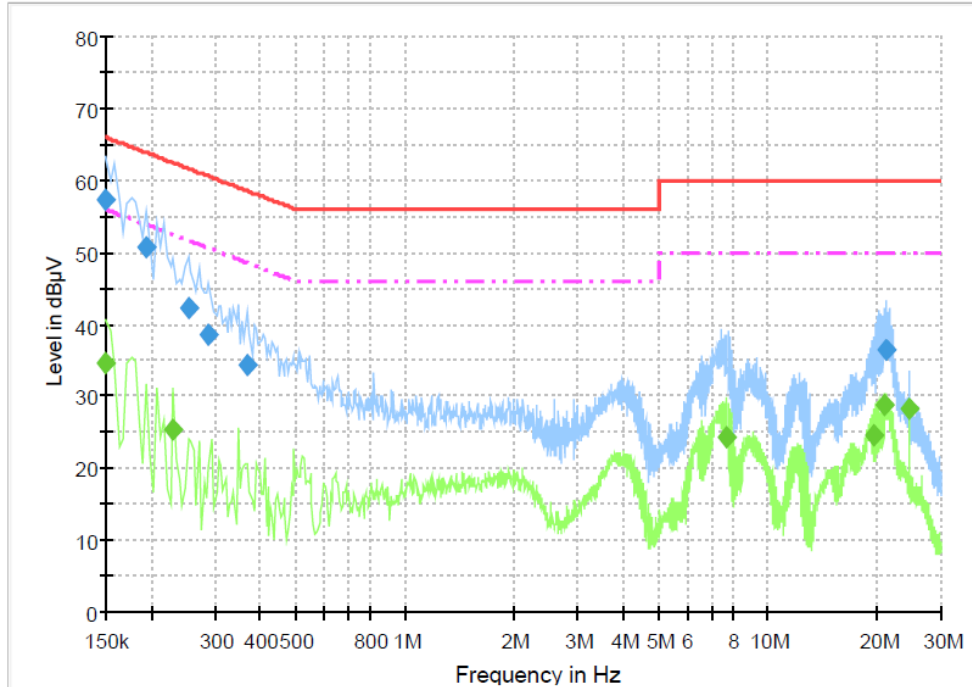
The requirements are:

Complies

Test Data

[LINE]

3CE_Class B_L1



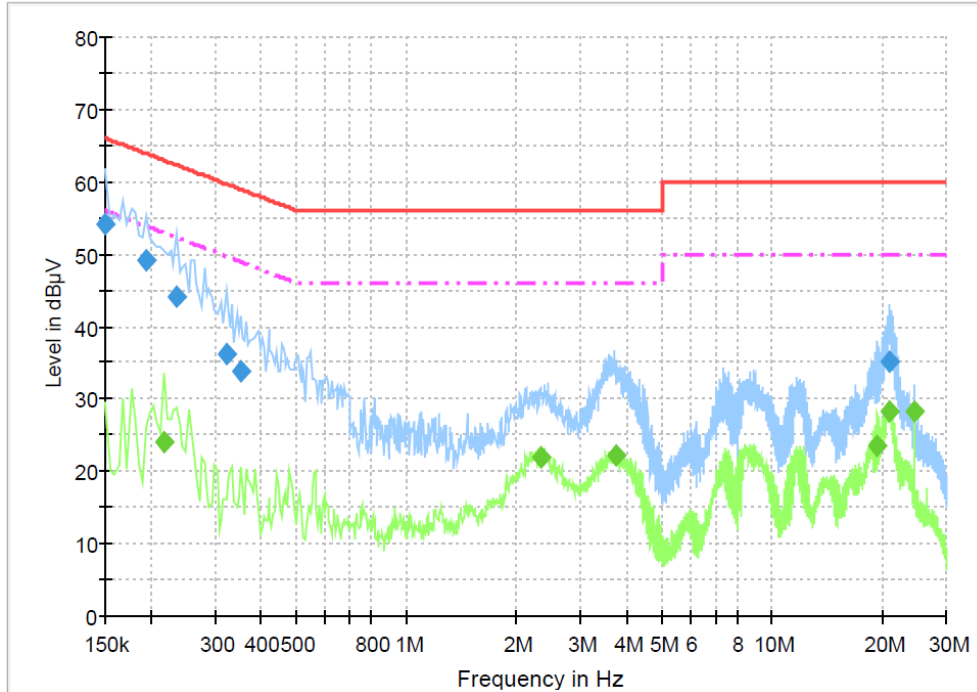
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	57.4	1000.0	9.000	On	L1	9.7	8.6	66.0
0.195000	50.6	1000.0	9.000	On	L1	9.8	13.2	63.8
0.253500	42.2	1000.0	9.000	On	L1	9.6	19.4	61.6
0.289500	38.5	1000.0	9.000	On	L1	9.7	22.0	60.5
0.370500	34.2	1000.0	9.000	On	L1	9.8	24.3	58.5
21.264000	36.5	1000.0	9.000	On	L1	10.0	23.5	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	34.6	1000.0	9.000	On	L1	9.7	21.4	56.0
0.231000	25.3	1000.0	9.000	On	L1	9.7	27.1	52.4
7.705500	24.2	1000.0	9.000	On	L1	9.8	25.8	50.0
19.563000	24.7	1000.0	9.000	On	L1	10.0	25.3	50.0
20.994000	28.7	1000.0	9.000	On	L1	10.0	21.3	50.0
24.576000	28.3	1000.0	9.000	On	L1	10.0	21.7	50.0

[NEUTRAL]
3CE_Class B_N



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	54.1	1000.0	9.000	On	N	9.8	11.9	66.0
0.195000	49.1	1000.0	9.000	On	N	9.9	14.7	63.8
0.235500	44.1	1000.0	9.000	On	N	9.8	18.2	62.3
0.321000	36.3	1000.0	9.000	On	N	9.9	23.4	59.7
0.352500	33.7	1000.0	9.000	On	N	9.9	25.2	58.9
20.899500	35.2	1000.0	9.000	On	N	10.0	24.8	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.217500	23.9	1000.0	9.000	On	N	9.8	29.0	52.9
2.337000	22.0	1000.0	9.000	On	N	9.7	24.0	46.0
3.727500	22.3	1000.0	9.000	On	N	9.8	23.7	46.0
19.455000	23.6	1000.0	9.000	On	N	10.0	26.4	50.0
21.034500	28.2	1000.0	9.000	On	N	10.0	21.8	50.0
24.576000	28.2	1000.0	9.000	On	N	10.1	21.8	50.0



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

Report No.:
CTK-2018-00242
Page (41) / (41)Pages

APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
1	Signal Analyzer	Agilent	N9020A	MY48011598	2017-11-01	2018-11-01
2	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2017-10-25	2018-10-25
3	Bilog Antenna	Schaffner	CBL6111C	2551	2016-05-13	2018-05-13
4	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2016-05-16	2018-05-16
5	6dB Attenuator	R&S	DNF	272.4110.50-2	2017-10-25	2018-10-25
6	AMPLIFIER	SONOMA	310	291721	2017-02-02	2018-02-02
7	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2017-05-12	2018-05-12
8	Preamplifier	Agilent	8449B	3008A02011	2017-11-30	2018-11-30
9	Horn Antenna	ETS-Lindgren	3116	00062504	2017-04-25	2019-04-25
10	Horn Antenna	ETS-Lindgren	3117	00154525	2017-09-14	2019-09-14
11	Band Reject Filter	Micro Tronics	BRM50702	G233	2017-02-03	2018-02-03
12	LISN	Rohde & Schwarz	ENV216	101760	2017-02-03	2018-02-03
13	Dual-Tracking DC Power Supply	Topward Electric Instruments	6303D	711196	2017-02-02	2018-02-02