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-2019-00691

1. Client

◦ Name : Haier US Appliance Solutions, Inc.

◦ Address : Appliance Park AP2-226, Louisville, KY 40225, United States

◦ Date of Receipt : 2019-02-18

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 / WCATA007

5. Date of Test : 2019-02-19 to 2019-02-22

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

7. Testing Environment: Temp.: (24 ± 5) ℃, Humidity: (50 ± 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)

2019-02-26

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 REVISION HISTORY

Date	Revision	Page No
2019-02-26	Issued (CTK-2019-00691)	all

CONTENTS

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-WCATA007
ISED	10229A-WCATA007
Product Description	Wi-Fi Module
Model name	WCATA007
Variant Model name	-
Operating Frequency	2 412 MHz – 2 462 MHz
RF Output Power	802.11b : 19.85 dBm (96.61 mW) 802.11g : 14.35 dBm (27.23 mW) 802.11n : 14.26 dBm (26.67 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	1.0
Software Rev	3.5b

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253QPR
AC/DC Adapter	HP	HSTNN-LA40	-

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.

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
Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable			
Note 2: The data in this test report are traceable to the national or international standards.			
Note 3: The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013			
Note 4: 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
Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable			
Note 2: The data in this test report are traceable to the national or international standards.			
Note 3: The sample was tested according to the following specification: ISED RSS-247 Issue 2, RSS-GEN Issue 5, ANSI C63.10-2013			
Note 4: The tests were performed according to the method of measurements prescribed in KDB No.558074.			

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	100.0%	-
802.11g	OFDM	6 Mbps	100.0%	-
802.11n	OFDM	MCS 0	100.0%	-

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 ≤ 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	ESCI7, ESCI3 : 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 – Section 6.9.2
RSS-GEN Issue 5 – Section 6.7

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 – Section 6.9.3
RSS-GEN Issue 5 – Section 6.7

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 ≥ 3 x 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

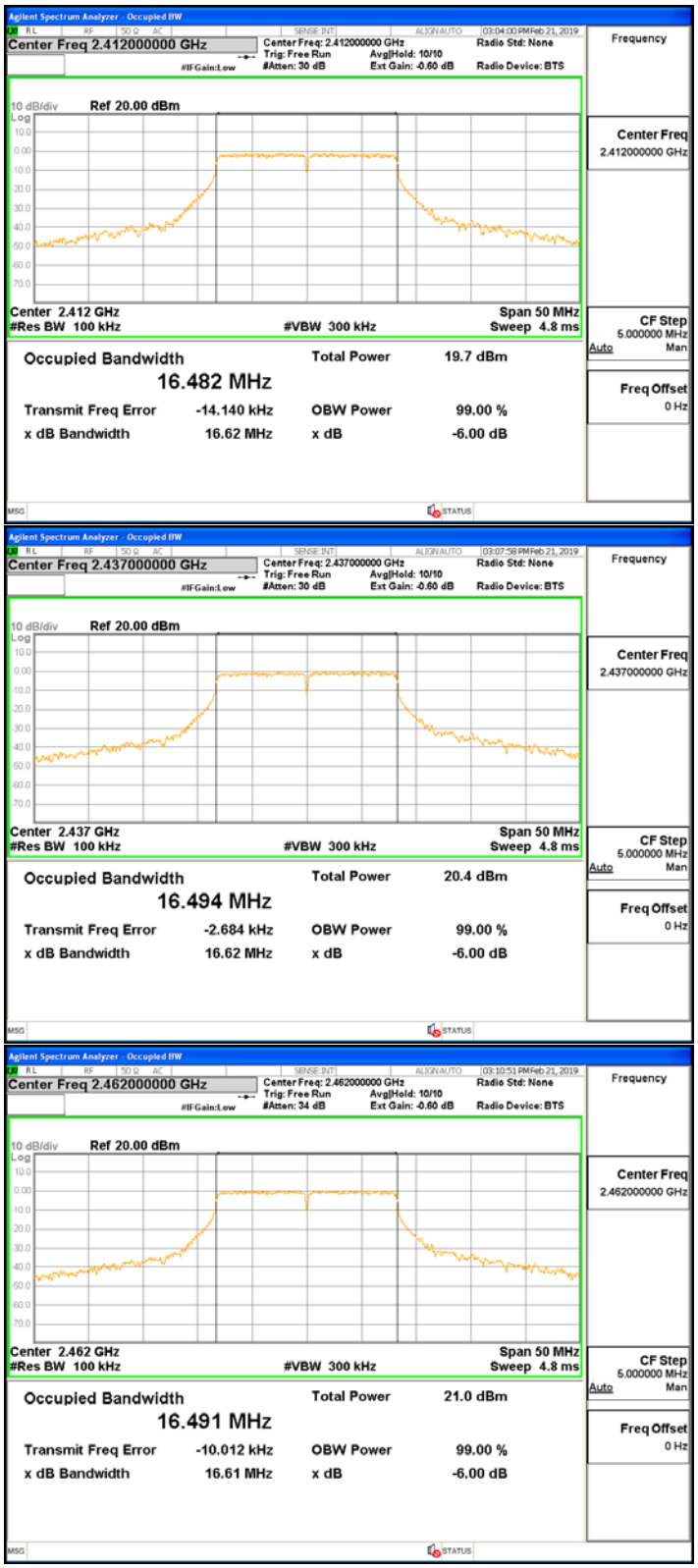
Test Data:

	6 dB Bandwidth and 99% Bandwidth (MHz)					
Mode	802.11b		802.11g		802.11n_HT20	
Frequency	6dB	99%	6dB	99%	6dB	99%
2 412 MHz	9.11	13.78	16.62	16.48	17.81	17.67
2 437 MHz	9.09	13.60	16.62	16.49	17.80	17.68
2 462 MHz	9.11	13.59	16.61	16.49	17.80	17.68

See next pages for actual measured spectrum plots.


Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.412000000 GHz
Center Freq: 2.412000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 34 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.412000000 GHz
Center 2.412 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
CF Step
5.000000 MHz
Auto
Man
Occupied Bandwidth
13.777 MHz
Total Power
27.4 dBm
Transmit Freq Error
-40.098 kHz
OBW Power
99.00 %
x dB Bandwidth
9.114 MHz
x dB
-6.00 dB
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.437000000 GHz
Center Freq: 2.437000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 34 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.437000000 GHz
Center 2.437 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
CF Step
5.000000 MHz
Auto
Man
Occupied Bandwidth
13.598 MHz
Total Power
26.4 dBm
Transmit Freq Error
38.544 kHz
OBW Power
99.00 %
x dB Bandwidth
9.089 MHz
x dB
-6.00 dB
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.462000000 GHz
Center Freq: 2.462000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 34 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.462000000 GHz
Center 2.462 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
CF Step
5.000000 MHz
Auto
Man
Occupied Bandwidth
13.589 MHz
Total Power
26.6 dBm
Transmit Freq Error
8.871 kHz
OBW Power
99.00 %
x dB Bandwidth
9.106 MHz
x dB
-6.00 dB
Freq Offset
0 Hz

802.11b


Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.412000000 GHz
Center Freq: 2.412000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 30 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.412000000 GHz
Center 2.412 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
CF Step
5.000000 MHz
Auto
Man
Occupied Bandwidth
16.482 MHz
Total Power
19.7 dBm
Transmit Freq Error
-14.140 kHz
OBW Power
99.00 %
x dB Bandwidth
16.62 MHz
x dB
-6.00 dB
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.437000000 GHz
Center Freq: 2.437000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 30 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.437000000 GHz
Center 2.437 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
CF Step
5.000000 MHz
Auto
Man
Occupied Bandwidth
16.494 MHz
Total Power
20.4 dBm
Transmit Freq Error
-2.684 kHz
OBW Power
99.00 %
x dB Bandwidth
16.62 MHz
x dB
-6.00 dB
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.462000000 GHz
Center Freq: 2.462000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 34 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.462000000 GHz
Center 2.462 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
CF Step
5.000000 MHz
Auto
Man
Occupied Bandwidth
16.491 MHz
Total Power
21.0 dBm
Transmit Freq Error
-10.012 kHz
OBW Power
99.00 %
x dB Bandwidth
16.61 MHz
x dB
-6.00 dB
Freq Offset
0 Hz

802.11g


Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.412000000 GHz
Center Freq: 2.412000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 30 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.412000000 GHz
Center 2.412 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
CF Step
5.000000 MHz
Auto
Man
Occupied Bandwidth
17.674 MHz
Total Power
20.1 dBm
Transmit Freq Error
7.389 kHz
OBW Power
99.00 %
x dB Bandwidth
17.81 MHz
x dB
-6.00 dB
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.437000000 GHz
Center Freq: 2.437000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 30 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.437000000 GHz
Center 2.437 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
CF Step
5.000000 MHz
Auto
Man
Occupied Bandwidth
17.683 MHz
Total Power
20.4 dBm
Transmit Freq Error
17.676 kHz
OBW Power
99.00 %
x dB Bandwidth
17.80 MHz
x dB
-6.00 dB
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.462000000 GHz
Center Freq: 2.462000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 32 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.462000000 GHz
Center 2.462 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
CF Step
5.000000 MHz
Auto
Man
Occupied Bandwidth
17.678 MHz
Total Power
20.9 dBm
Transmit Freq Error
8.586 kHz
OBW Power
99.00 %
x dB Bandwidth
17.80 MHz
x dB
-6.00 dB
Freq Offset
0 Hz

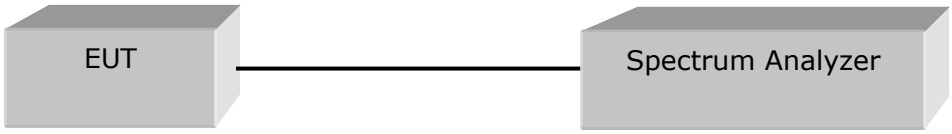
802.11n_HT20

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 5 – Section 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 ≥ 1.5 x OBW
b) RBW = 1 MHz
c) VBW ≥ 3 x RBW
d) Sweep time = auto
e) Detector = RMS
f) average at least 100
g) Duty cycle factor = 10log(1/x)
802.11b = 0 dB, 802.11g = 0 dB, 802.11n_HT20 = 0 dB

Limit

Operating Mode	Mode	ANT Gain (dBi)	Limit	
			FCC(dBm)	ISED(e.i.r.p)
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	19.85	0.00	19.85	30.00	10.15
2 437 MHz	19.11	0.00	19.11	30.00	10.89
2 462 MHz	19.32	0.00	19.32	30.00	10.68

802.11g

Frequency	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	13.15	0.00	13.15	30.00	16.85
2 437 MHz	13.82	0.00	13.82	30.00	16.18
2 462 MHz	14.35	0.00	14.35	30.00	15.65

802.11n_HT20

Frequency	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	13.52	0.00	13.52	30.00	16.48
2 437 MHz	13.76	0.00	13.76	30.00	16.24
2 462 MHz	14.26	0.00	14.26	30.00	15.74

See next pages for actual measured spectrum plots.


Agilent Spectrum Analyzer - Channel Power
Center Freq 2.412000000 GHz
Center Freq: 2.412000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 34 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.412000000 GHz
Center 2.412 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
CF Step
5.000000 MHz
Auto
Man
Channel Power
Power Spectral Density
19.85 dBm / 13.78 MHz
-51.55 dBm /Hz
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Channel Power
Center Freq 2.437000000 GHz
Center Freq: 2.437000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 32 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.437000000 GHz
Center 2.437 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
CF Step
5.000000 MHz
Auto
Man
Channel Power
Power Spectral Density
19.11 dBm / 13.6 MHz
-52.23 dBm /Hz
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Channel Power
Center Freq 2.462000000 GHz
Center Freq: 2.462000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 34 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.462000000 GHz
Center 2.462 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
CF Step
5.000000 MHz
Auto
Man
Channel Power
Power Spectral Density
19.32 dBm / 13.59 MHz
-52.01 dBm /Hz
Freq Offset
0 Hz

802.11b


Agilent Spectrum Analyzer - Channel Power
Center Freq 2.412000000 GHz
Center Freq: 2.412000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Log
Center Freq
2.412000000 GHz
Center 2.412 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
CF Step
5.000000 MHz
Auto
Man
Channel Power
Power Spectral Density
13.15 dBm / 16.48 MHz
-59.02 dBm /Hz
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Channel Power
Center Freq 2.437000000 GHz
Center Freq: 2.437000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Log
Center Freq
2.437000000 GHz
Center 2.437 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
CF Step
5.000000 MHz
Auto
Man
Channel Power
Power Spectral Density
13.82 dBm / 16.49 MHz
-58.35 dBm /Hz
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Channel Power
Center Freq 2.462000000 GHz
Center Freq: 2.462000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 32 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Log
Center Freq
2.462000000 GHz
Center 2.462 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
CF Step
5.000000 MHz
Auto
Man
Channel Power
Power Spectral Density
14.35 dBm / 16.49 MHz
-57.82 dBm /Hz
Freq Offset
0 Hz

802.11g


Agilent Spectrum Analyzer - Channel Power
Center Freq 2.412000000 GHz
Center Freq: 2.412000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.412000000 GHz
Center 2.412 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
CF Step
5.000000 MHz
Auto
Man
Channel Power
Power Spectral Density
13.52 dBm / 17.67 MHz
-58.96 dBm /Hz
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Channel Power
Center Freq 2.437000000 GHz
Center Freq: 2.437000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.437000000 GHz
Center 2.437 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
CF Step
5.000000 MHz
Auto
Man
Channel Power
Power Spectral Density
13.76 dBm / 17.68 MHz
-58.72 dBm /Hz
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Channel Power
Center Freq 2.462000000 GHz
Center Freq: 2.462000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 32 dB
Ext Gain: -0.60 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 20.00 dBm
Center Freq
2.462000000 GHz
Center 2.462 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
CF Step
5.000000 MHz
Auto
Man
Channel Power
Power Spectral Density
14.26 dBm / 17.68 MHz
-58.22 dBm /Hz
Freq Offset
0 Hz

802.11n_HT20

4.3 Power Spectral Density

Test Procedures

Procedure 10.2 in KDB 558074, Method Peak PSD
RSS-247 Issue 2 - Section 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 kHz ≤ RBW ≤ 100 kHz

b) VBW ≥ 3 x RBW

c) span ≥ 1.5 x DTS 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	ISED
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	-9.64	8.00	17.64
2 437 MHz	-10.25	8.00	18.25
2 462 MHz	-9.83	8.00	17.83

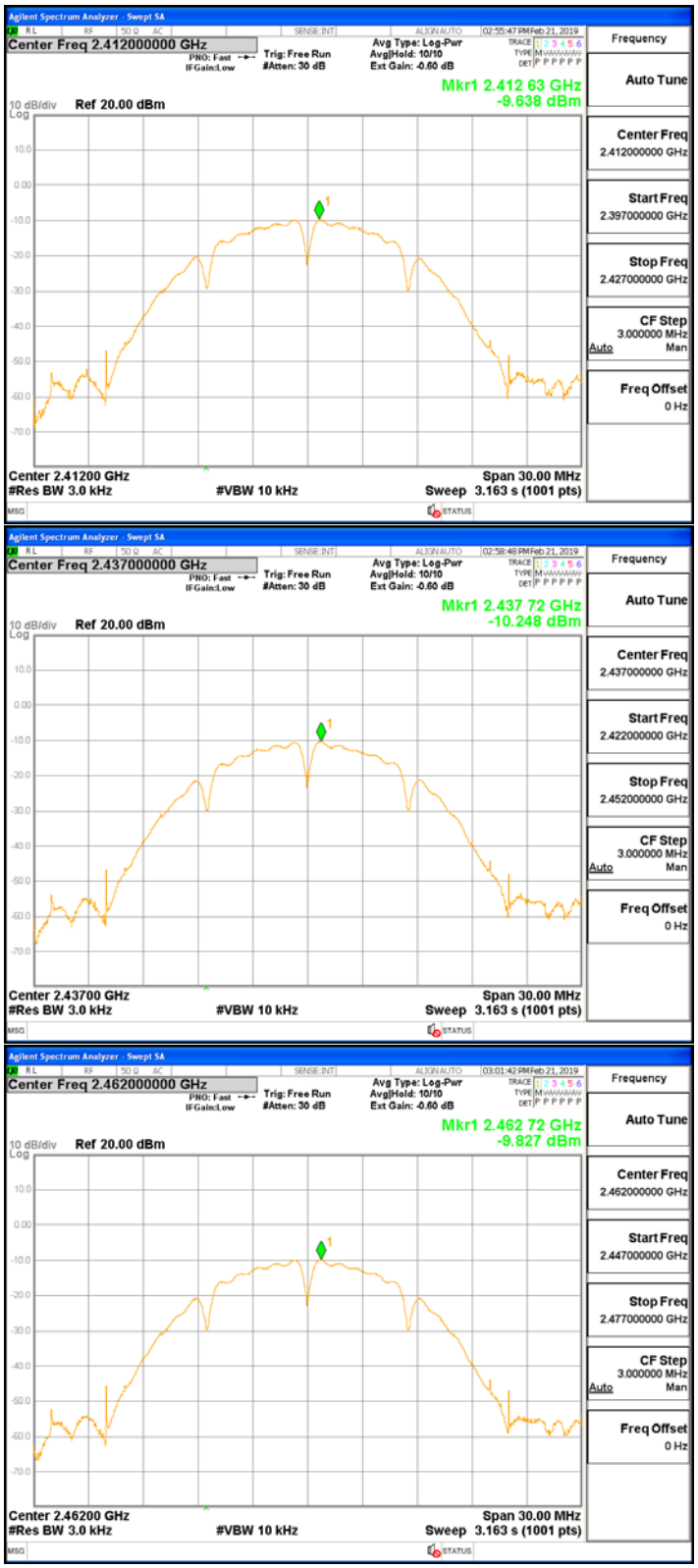
802.11g

Frequency	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	-15.05	8.00	23.05
2 437 MHz	-14.49	8.00	22.49
2 462 MHz	-13.90	8.00	21.90

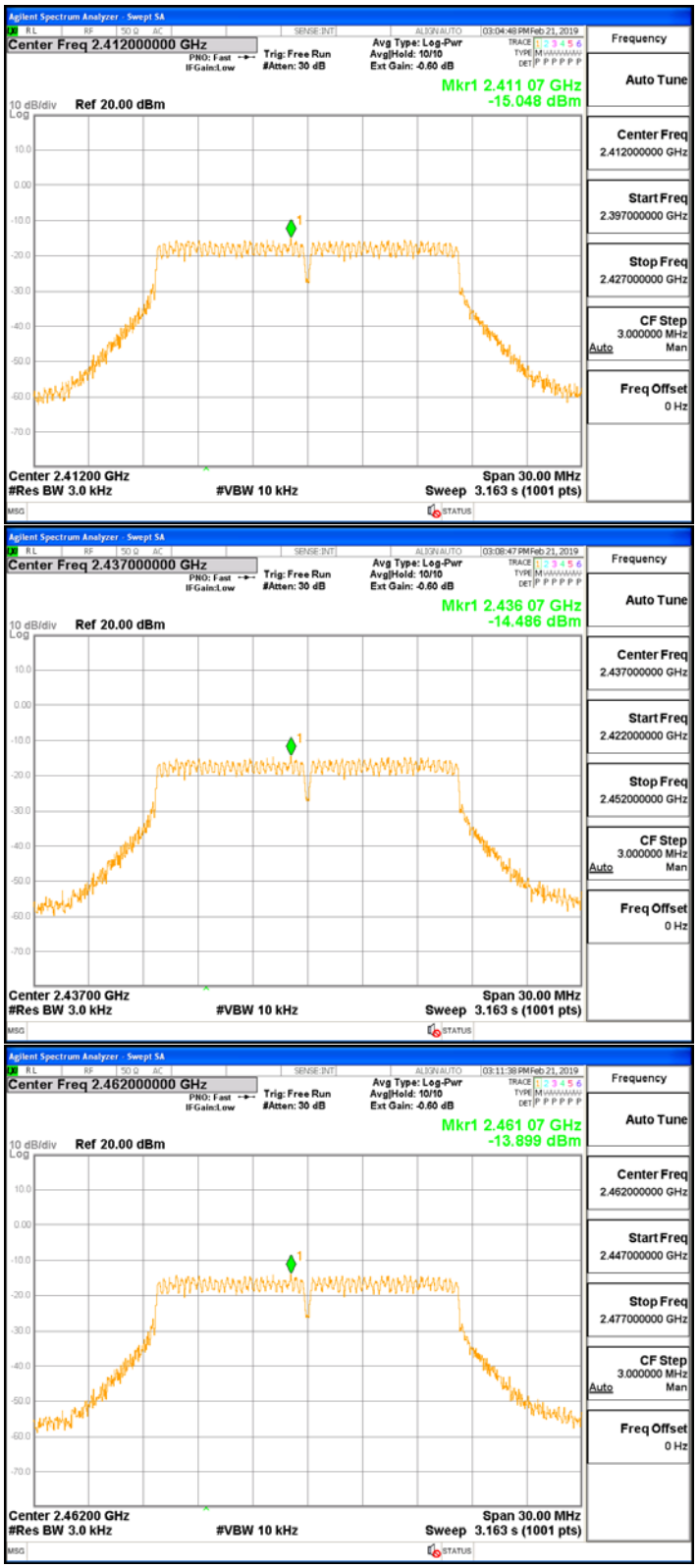
802.11n_HT20

Frequency	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	-14.02	8.00	22.02
2 437 MHz	-14.10	8.00	22.10
2 462 MHz	-13.37	8.00	21.37

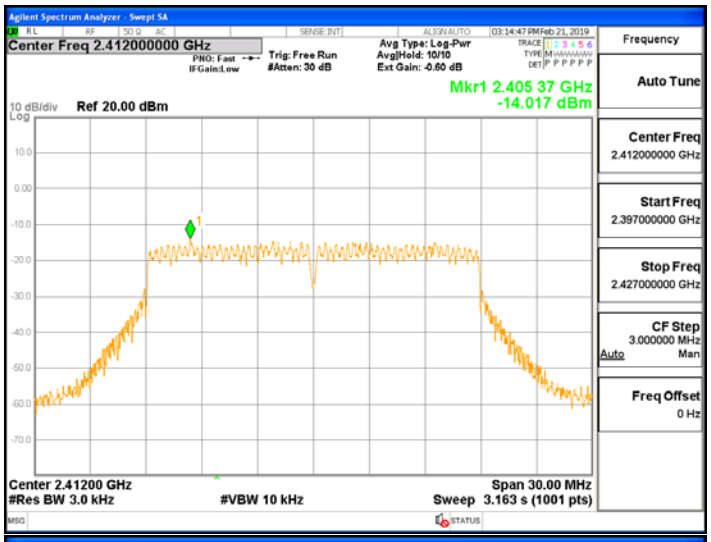
See next pages for actual measured spectrum plots.

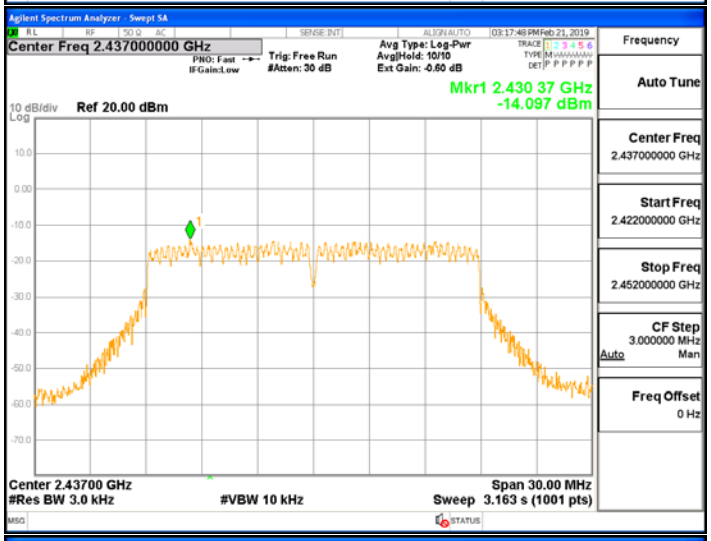

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.412000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.60 dB
02:55:47 PM Feb 21, 2019
Mkr1 2.412 63 GHz
-9.638 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.41200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 30.00 MHz
Sweep 3.163 s (1001 pts)
Frequency
Auto Tune
Center Freq
2.412000000 GHz
Start Freq
2.397000000 GHz
Stop Freq
2.427000000 GHz
CF Step
3.000000 MHz
Auto
Man
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.437000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.60 dB
02:58:48 PM Feb 21, 2019
Mkr1 2.437 72 GHz
-10.248 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.43700 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 30.00 MHz
Sweep 3.163 s (1001 pts)
Frequency
Auto Tune
Center Freq
2.437000000 GHz
Start Freq
2.422000000 GHz
Stop Freq
2.452000000 GHz
CF Step
3.000000 MHz
Auto
Man
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.462000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.60 dB
03:01:42 PM Feb 21, 2019
Mkr1 2.462 72 GHz
-9.827 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.46200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 30.00 MHz
Sweep 3.163 s (1001 pts)
Frequency
Auto Tune
Center Freq
2.462000000 GHz
Start Freq
2.447000000 GHz
Stop Freq
2.477000000 GHz
CF Step
3.000000 MHz
Auto
Man
Freq Offset
0 Hz

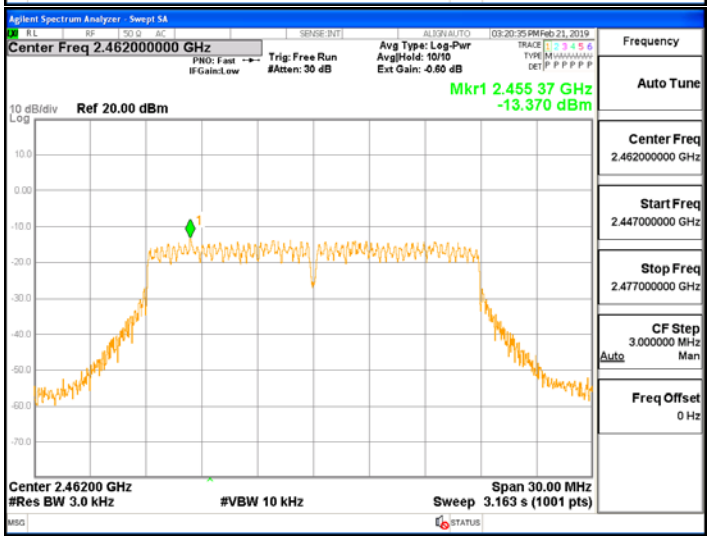
802.11b


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.412000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.60 dB
03:04:48 PM Feb 21, 2019
Mkr1 2.411 07 GHz
-15.048 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.41200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 30.00 MHz
Sweep 3.163 s (1001 pts)
Frequency
Auto Tune
Center Freq
2.412000000 GHz
Start Freq
2.397000000 GHz
Stop Freq
2.427000000 GHz
CF Step
3.000000 MHz
Auto
Man
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.437000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.60 dB
03:08:47 PM Feb 21, 2019
Mkr1 2.436 07 GHz
-14.486 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.43700 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 30.00 MHz
Sweep 3.163 s (1001 pts)
Frequency
Auto Tune
Center Freq
2.437000000 GHz
Start Freq
2.422000000 GHz
Stop Freq
2.452000000 GHz
CF Step
3.000000 MHz
Auto
Man
Freq Offset
0 Hz
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.462000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.60 dB
03:11:38 PM Feb 21, 2019
Mkr1 2.461 07 GHz
-13.899 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.46200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 30.00 MHz
Sweep 3.163 s (1001 pts)
Frequency
Auto Tune
Center Freq
2.462000000 GHz
Start Freq
2.447000000 GHz
Stop Freq
2.477000000 GHz
CF Step
3.000000 MHz
Auto
Man
Freq Offset
0 Hz

802.11g


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.412000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.60 dB
03:14:47 PM Feb 21, 2019
Mkr1 2.405 37 GHz
-14.017 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.41200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 30.00 MHz
Sweep 3.163 s (1001 pts)
Frequency
Auto Tune
Center Freq
2.412000000 GHz
Start Freq
2.397000000 GHz
Stop Freq
2.427000000 GHz
CF Step
3.000000 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.437000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.60 dB
03:17:48 PM Feb 21, 2019
Mkr1 2.430 37 GHz
-14.097 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.43700 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 30.00 MHz
Sweep 3.163 s (1001 pts)
Frequency
Auto Tune
Center Freq
2.437000000 GHz
Start Freq
2.422000000 GHz
Stop Freq
2.452000000 GHz
CF Step
3.000000 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.462000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.60 dB
03:20:35 PM Feb 21, 2019
Mkr1 2.455 37 GHz
-13.370 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.46200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 30.00 MHz
Sweep 3.163 s (1001 pts)
Frequency
Auto Tune
Center Freq
2.462000000 GHz
Start Freq
2.447000000 GHz
Stop Freq
2.477000000 GHz
CF Step
3.000000 MHz
Auto
Man
Freq Offset
0 Hz

802.11n_HT20

4.4 Band Edge & Conducted Spurious emission

Test Procedures

ANSI C63.10-2013 – Section 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 ≥ 3 x 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

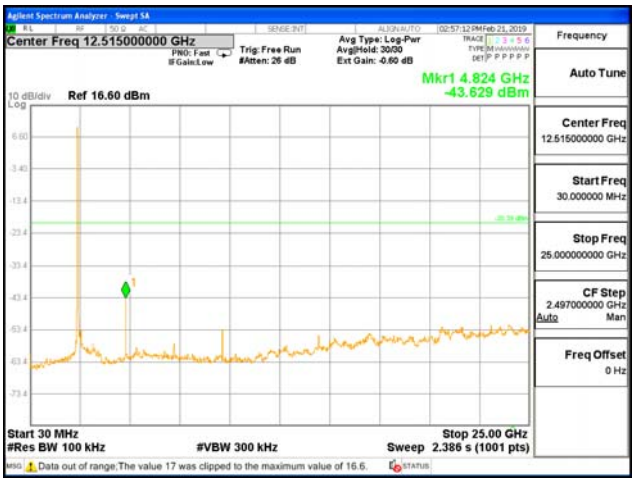
Test Data: Complies

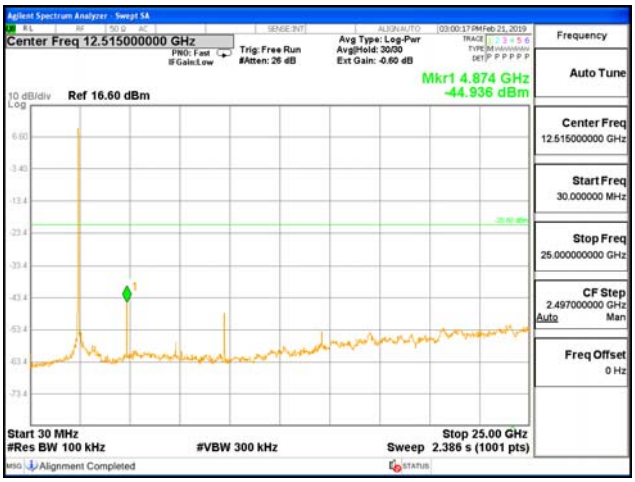
- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 30dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.

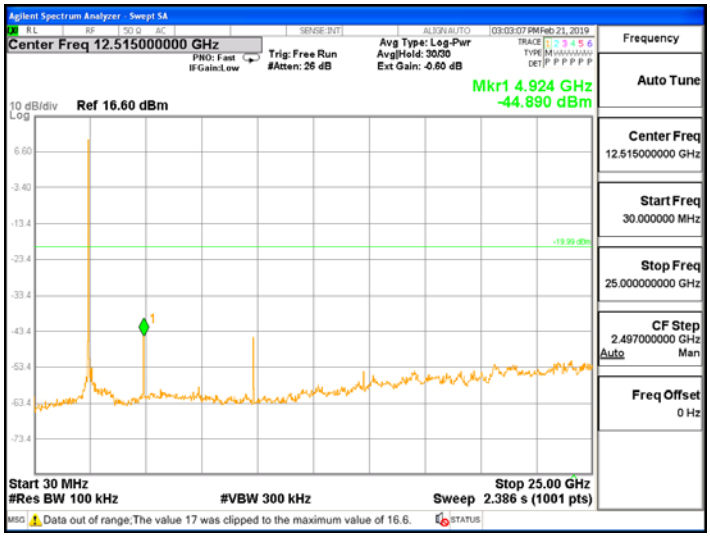
See next pages for actual measured spectrum plots.


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 24 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.60 dB
Mkr1 2.412 50 GHz
9.714 dBm
10 dB/div
Ref 14.00 dBm
Center 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.400000000 GHz
Start Freq
2.375000000 GHz
Stop Freq
2.425000000 GHz
CF Step
5.000000 MHz
Auto
Man
Freq Offset
0 Hz

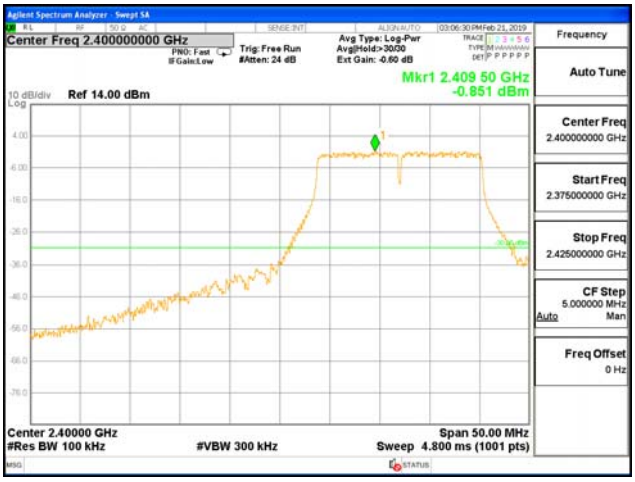

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 24 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.60 dB
Mkr1 2.462 50 GHz
9.971 dBm
10 dB/div
Ref 14.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.483500000 GHz
Start Freq
2.458500000 GHz
Stop Freq
2.508500000 GHz
CF Step
5.000000 MHz
Auto
Man
Freq Offset
0 Hz

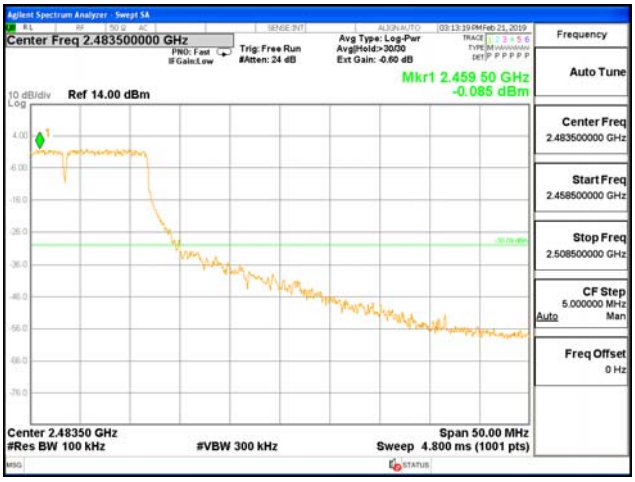

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -0.60 dB
Mkr1 4.824 GHz
-43.629 dBm
10 dB/div
Ref 16.60 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Data out of range;The value 17 was clipped to the maximum value of 16.6.
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -0.60 dB
Mkr1 4.874 GHz
-44.936 dBm
10 dB/div
Ref 16.60 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Alignment Completed
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz

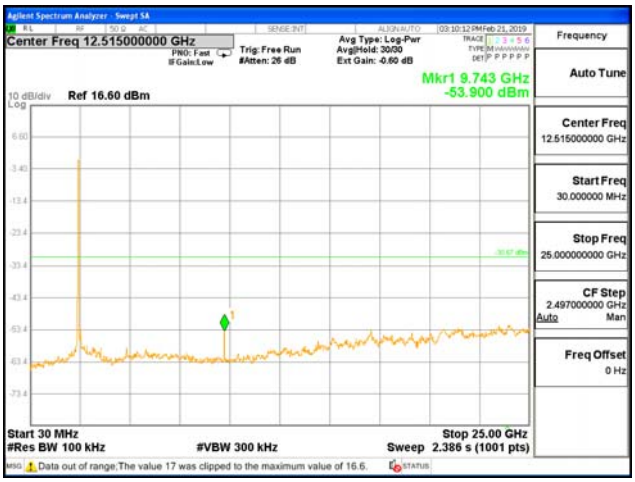

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -0.60 dB
Mkr1 4.924 GHz
-44.890 dBm
10 dB/div
Ref 16.60 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Data out of range;The value 17 was clipped to the maximum value of 16.6.
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz

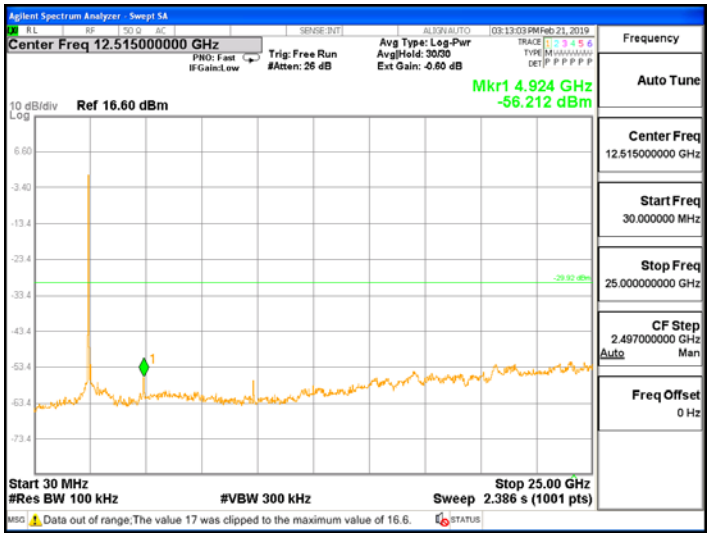
802.11b


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 24 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.60 dB
03:06:30 PM Feb 21, 2019
Mkr1 2.409 50 GHz
-0.851 dBm
10 dB/div
Log
Ref 14.00 dBm
Center 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.400000000 GHz
Start Freq
2.375000000 GHz
Stop Freq
2.425000000 GHz
CF Step
5.000000 MHz
Auto
Man
Freq Offset
0 Hz

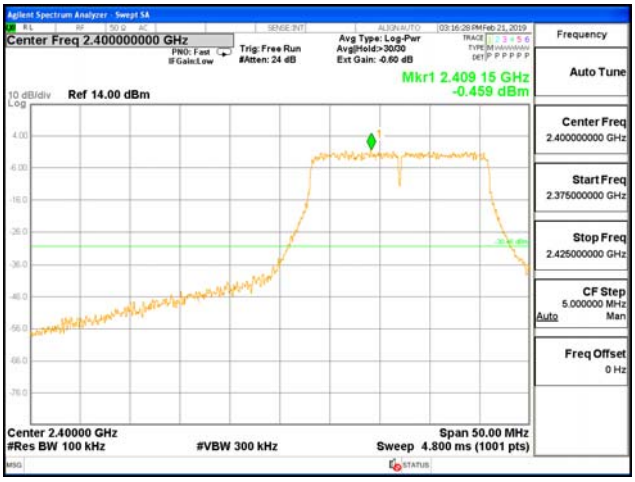

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 24 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.60 dB
03:13:19 PM Feb 21, 2019
Mkr1 2.459 50 GHz
-0.085 dBm
10 dB/div
Log
Ref 14.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.483500000 GHz
Start Freq
2.458500000 GHz
Stop Freq
2.508500000 GHz
CF Step
5.000000 MHz
Auto
Man
Freq Offset
0 Hz

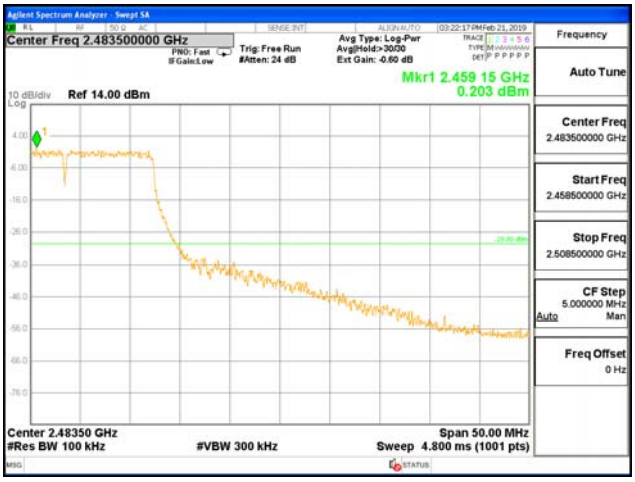

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -0.60 dB
03:06:13 PM Feb 21, 2019
Mkr1 9.643 GHz
-55.887 dBm
10 dB/div
Log
Ref 16.60 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Data out of range;The value 17 was clipped to the maximum value of 16.6.
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -0.60 dB
03:10:12 PM Feb 21, 2019
Mkr1 9.743 GHz
-53.900 dBm
10 dB/div
Log
Ref 16.60 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Data out of range;The value 17 was clipped to the maximum value of 16.6.
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -0.60 dB
03:13:03 PM Feb 21, 2019
Mkr1 4.924 GHz
-56.212 dBm
10 dB/div
Log
Ref 16.60 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Data out of range;The value 17 was clipped to the maximum value of 16.6.
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz

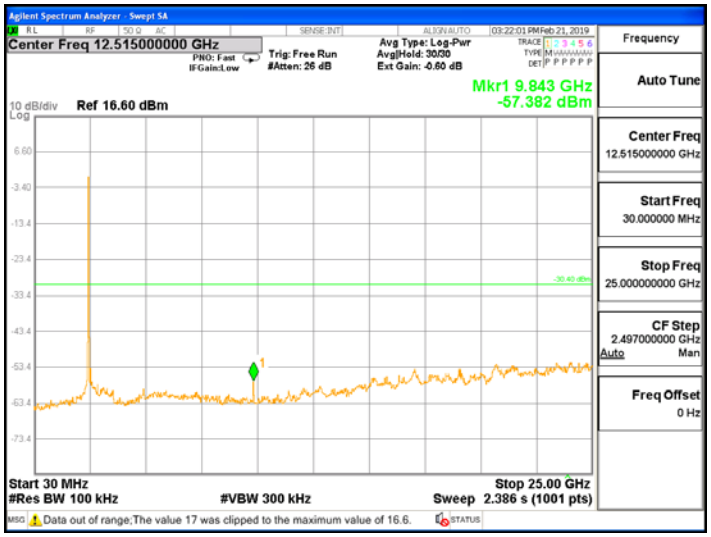
802.11g


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 24 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.60 dB
Mkr1 2.409 15 GHz
-0.459 dBm
10 dB/div
Ref 14.00 dBm
Log
Center 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.400000000 GHz
Start Freq
2.375000000 GHz
Stop Freq
2.425000000 GHz
CF Step
5.000000 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 24 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.60 dB
Mkr1 2.459 15 GHz
0.203 dBm
10 dB/div
Ref 14.00 dBm
Log
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.483500000 GHz
Start Freq
2.458500000 GHz
Stop Freq
2.508500000 GHz
CF Step
5.000000 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -0.60 dB
Mkr1 9.643 GHz
-55.562 dBm
10 dB/div
Ref 16.60 dBm
Log
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Data out of range;The value 17 was clipped to the maximum value of 16.6.
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -0.60 dB
Mkr1 9.743 GHz
-53.253 dBm
10 dB/div
Ref 16.60 dBm
Log
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Data out of range;The value 17 was clipped to the maximum value of 16.6.
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -0.60 dB
Mkr1 9.843 GHz
-57.382 dBm
10 dB/div
Ref 16.60 dBm
Log
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Data out of range;The value 17 was clipped to the maximum value of 16.6.
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz

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 rage 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 ≥ RBW

c) Detector = CISPR Quasi-peak

d) Sweep time = auto couple

- Peak

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

a) RBW = 1 MHz

b) VBW ≥ 3 x RBW

c) Detector = Peak

d) Sweep time = auto

e) Trace mode = max hold

- Average (duty cycle ≥ 98%)

Frequency Range = 1 GHz ~ 25 GHz (2.4 GHz 10^{th} 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)

- 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 dB, 802.11n_HT20 = 0 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 is 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.

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

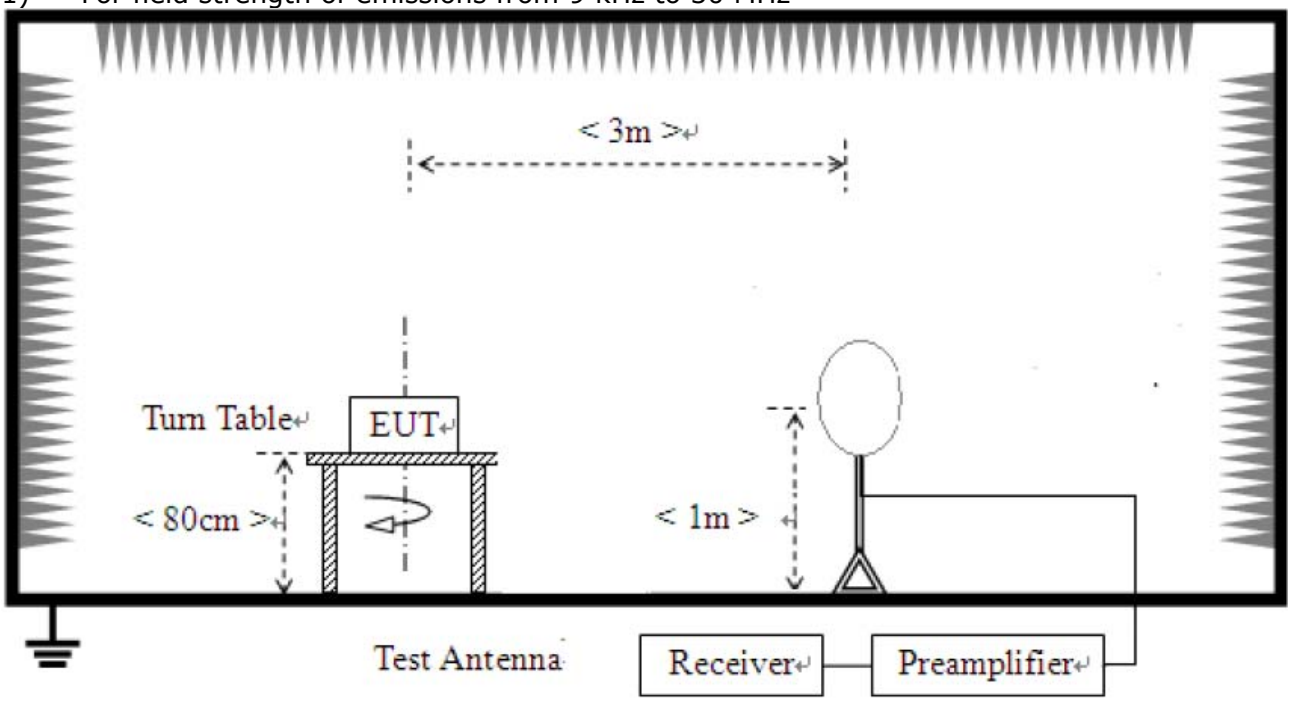
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231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

Note :

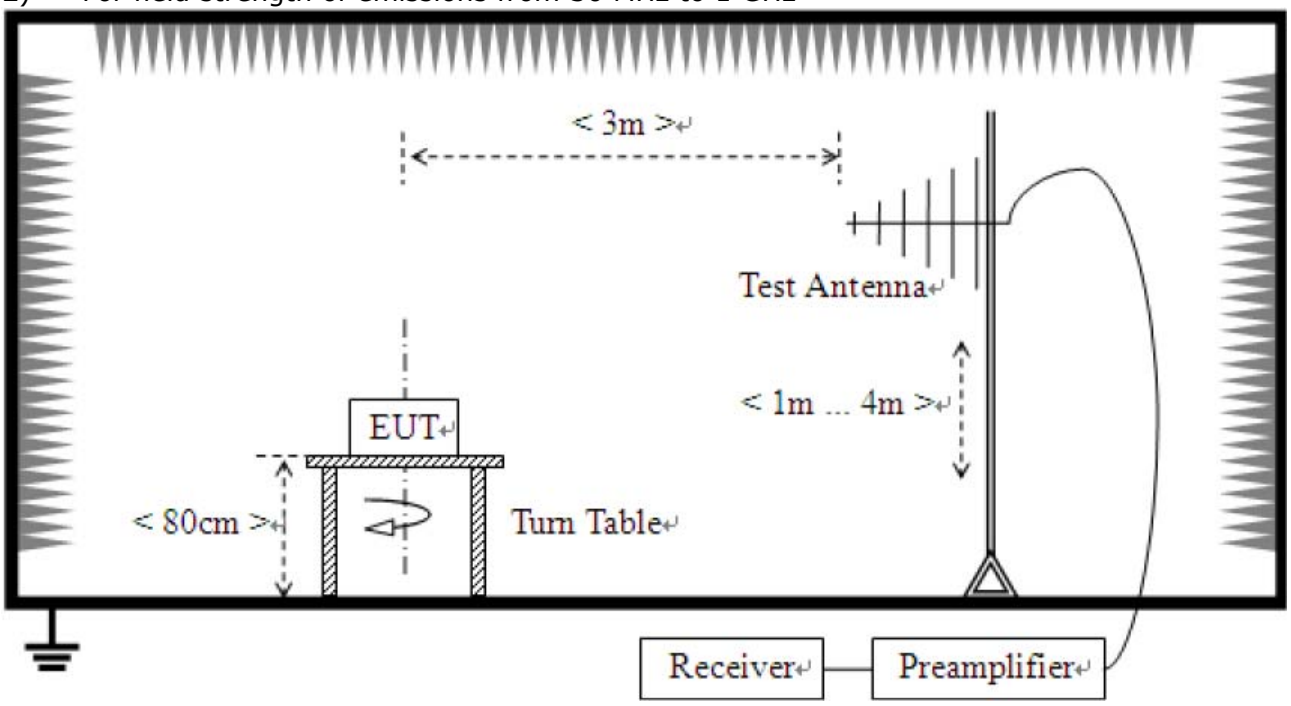
1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
2) For above 1 GHz, limit field strength of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

Test Setup:

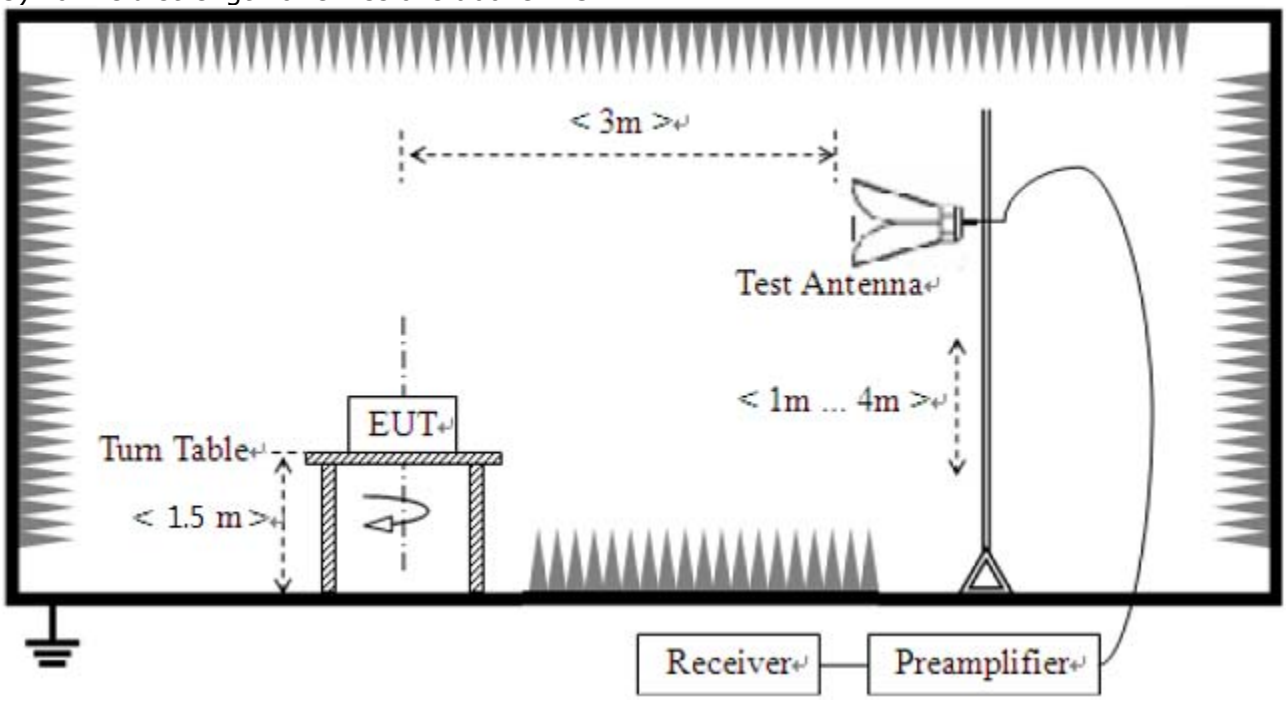
1) For field strength of emissions from 9 kHz to 30 MHz



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.

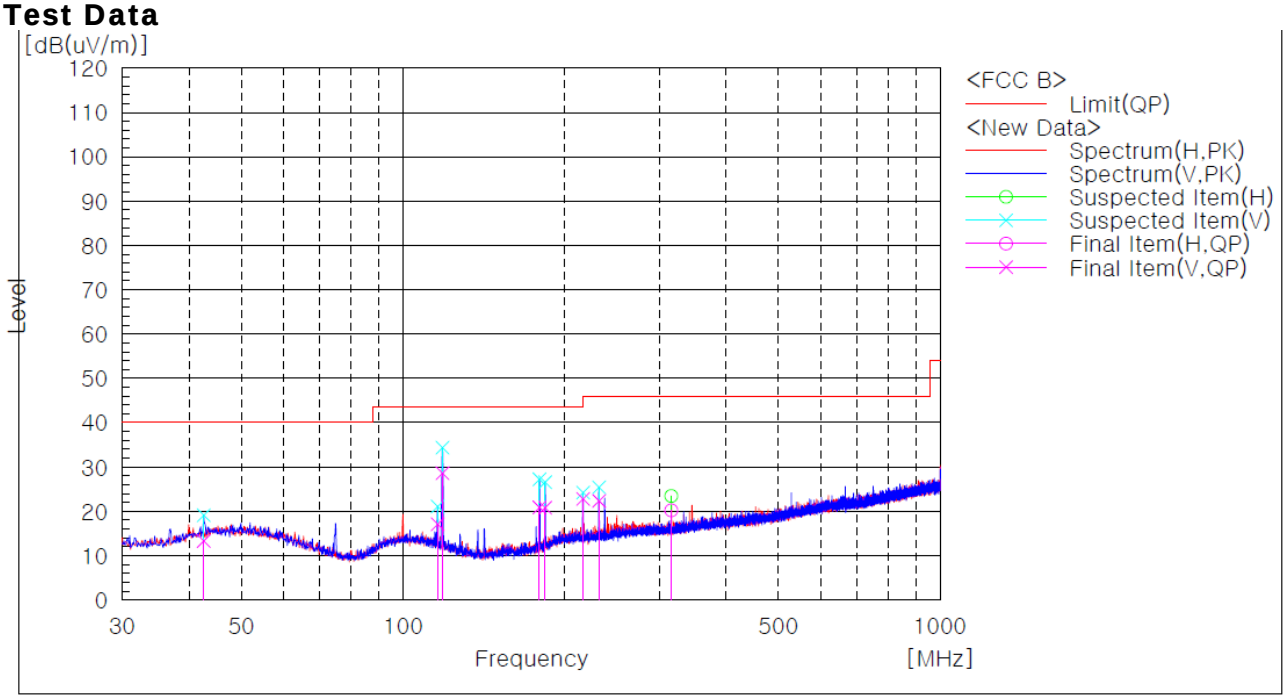
Distance extrapolation factor = 40 log (specific distance / test distance) (dB)

2) 30 MHz to 1 GHz

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

The requirements are:
☒ Complies

Test Data



Final Result

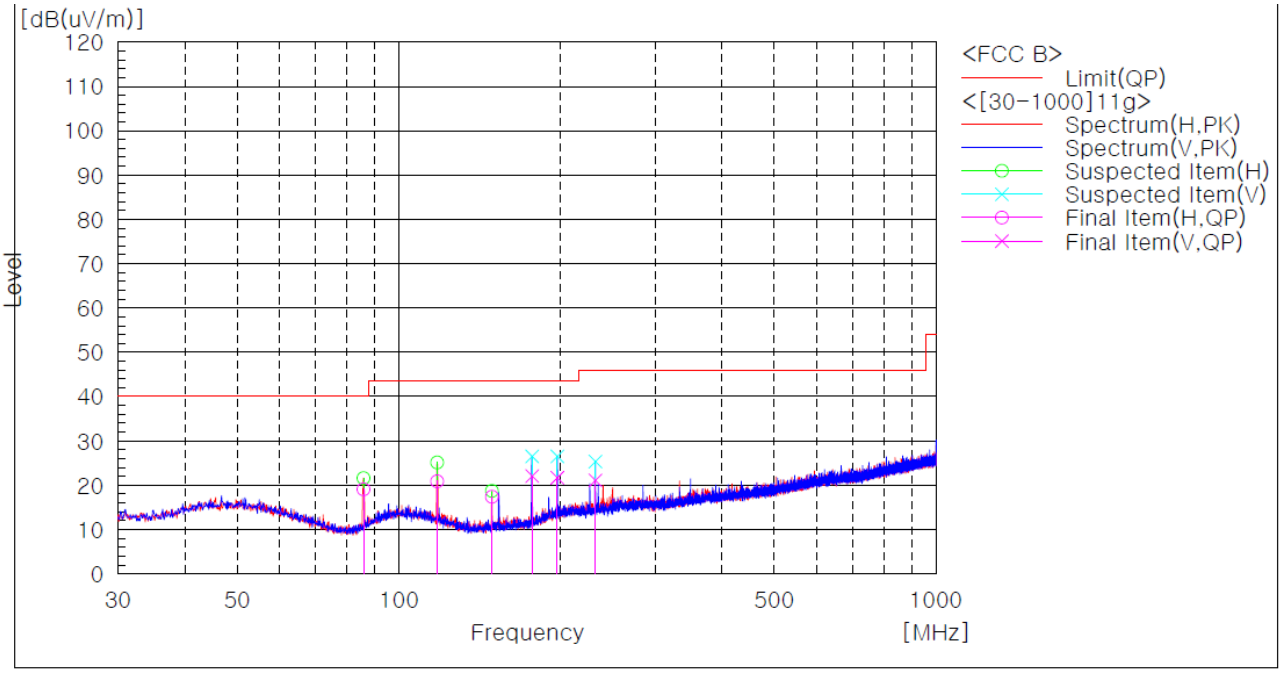
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Angle [deg]	Remark
1	42.520	V	25.9	-12.6	13.3	40.0	26.7	181.8	
2	116.005	V	32.4	-15.3	17.1	43.5	26.4	247.9	
3	118.401	V	44.2	-15.6	28.6	43.5	14.9	192.6	
4	179.475	V	37.0	-16.1	20.9	43.5	22.6	181.8	
5	183.830	V	36.4	-15.6	20.8	43.5	22.7	181.8	
6	216.381	V	36.6	-13.8	22.8	46.0	23.2	192.6	
7	231.623	V	35.8	-13.4	22.4	46.0	23.6	247.9	
8	315.778	H	31.9	-11.7	20.2	46.0	25.8	306.9	

Remark :
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z 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 : Transmitter, 802.11g, High Channel(Worst Case)

The requirements are:
☒ Complies

Test Data



Final Result

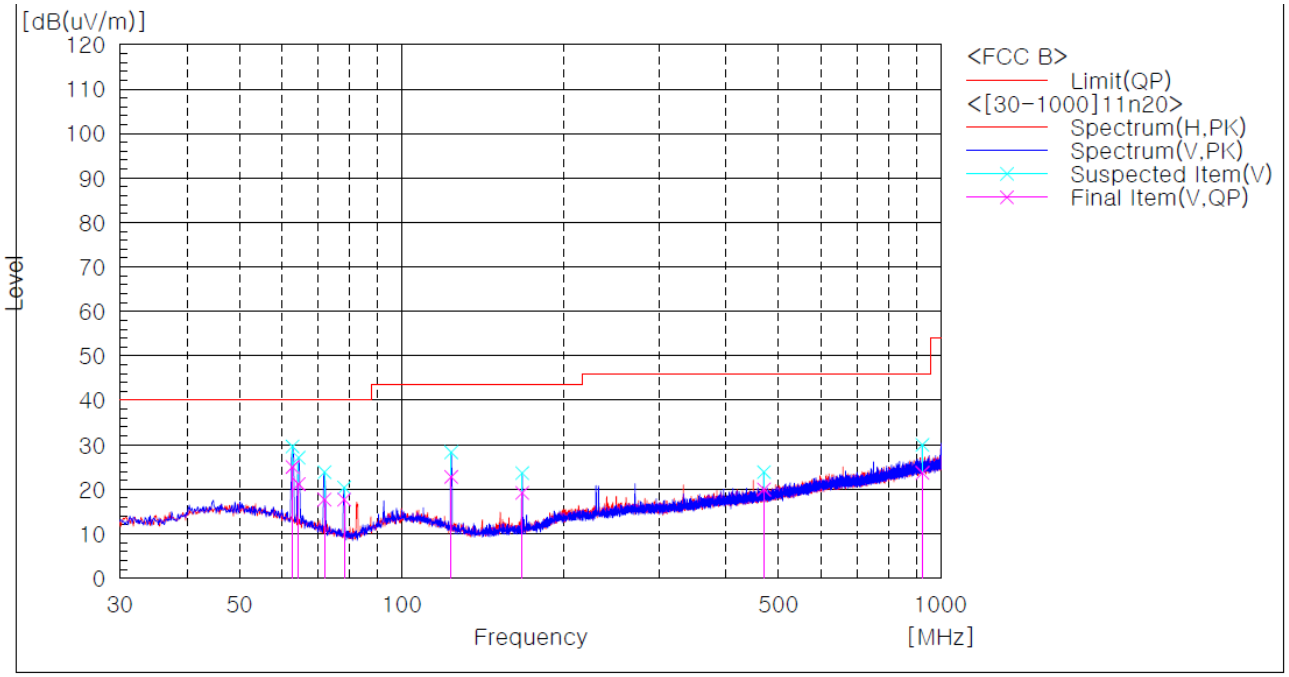
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Angle [deg]	Remark
1	85.958	H	36.2	-17.1	19.1	40.0	20.9	321.5	
2	117.856	H	36.4	-15.5	20.9	43.5	22.6	309.2	
3	148.992	H	34.9	-17.5	17.4	43.5	26.1	321.5	
4	176.971	V	38.4	-16.3	22.1	43.5	21.4	251.1	
5	197.221	V	35.9	-14.2	21.7	43.5	21.8	238.8	
6	232.058	V	34.5	-13.4	21.1	46.0	24.9	251.1	

Remark :
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z 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 : Transmitter, 802.11n_HT20, High Channel(Worst Case)

The requirements are:
☒ Complies

Test Data



Final Result

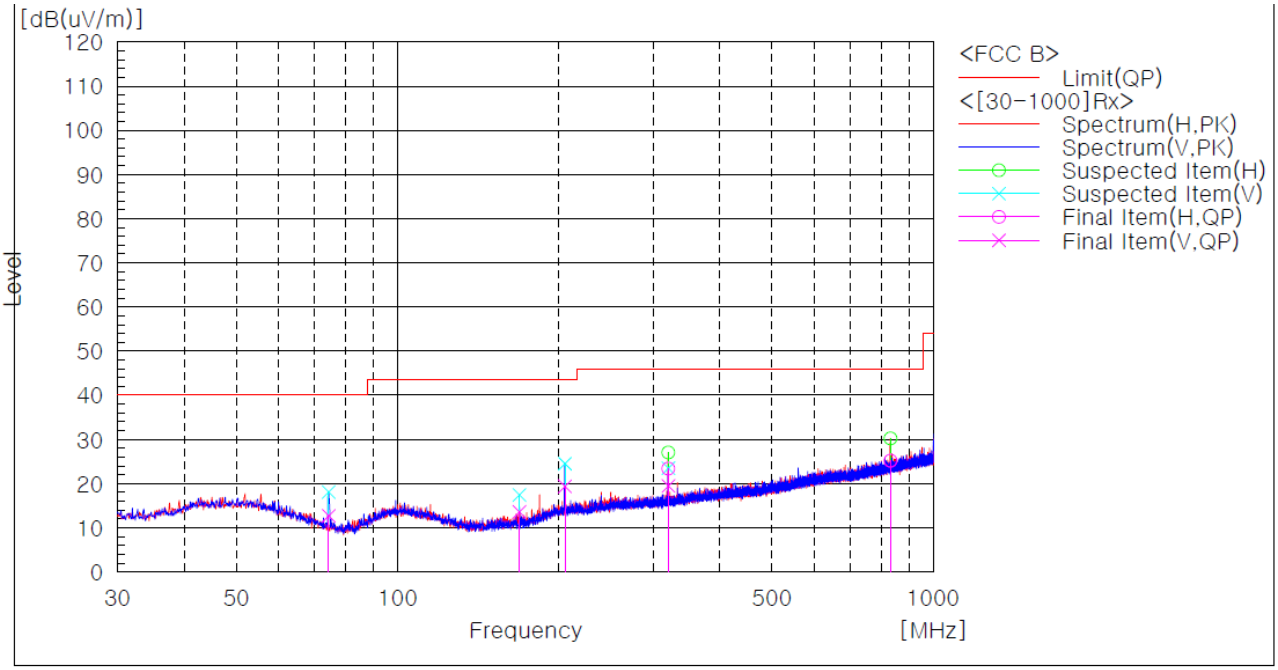
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Angle [deg]	Remark
1	62.660	V	39.5	-14.5	25.0	40.0	15.0	206.7	
2	64.293	V	36.1	-14.9	21.2	40.0	18.8	206.7	
3	71.805	V	34.6	-16.9	17.7	40.0	22.3	206.7	
4	78.120	V	35.9	-18.2	17.7	40.0	22.3	231.2	
5	123.517	V	39.1	-16.3	22.8	43.5	20.7	182.4	
6	167.173	V	36.1	-16.9	19.2	43.5	24.3	206.7	
7	469.716	V	30.0	-10.0	20.0	46.0	26.0	243.5	
8	924.783	V	27.4	-3.7	23.7	46.0	22.3	206.7	

Remark :
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z 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(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	74.309	V	30.2	-17.5	12.7	40.0	27.3	190.5	
2	168.697	V	30.4	-16.8	13.6	43.5	29.9	178.7	
3	205.168	V	33.5	-14.1	19.4	43.5	24.1	166.8	
4	320.023	H	35.1	-11.7	23.4	46.0	22.6	235.0	
5	320.023	V	31.2	-11.7	19.5	46.0	26.5	247.3	
6	832.572	H	30.1	-4.9	25.2	46.0	20.8	120.7	

Remark :
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z 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	40.80	46.10	13.20	27.90
4 824.00	V	54.00	74.00	44.50	48.80	9.50	25.20
7 236.00	H	54.00	74.00	42.90	50.40	11.10	23.60
7 236.00	V	54.00	74.00	37.60	47.10	16.40	26.90
2 387.08	H	54.00	74.00	52.10	58.00	1.90	16.00
2 387.29	V	54.00	74.00	51.30	57.90	2.70	16.10

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	40.80	45.80	13.20	28.20
4 874.00	V	54.00	74.00	42.80	46.80	11.20	27.20
7 311.00	H	54.00	74.00	44.90	48.50	9.10	25.50
7 311.00	V	54.00	74.00	44.90	47.80	9.10	26.20

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	42.90	46.00	11.10	28.00
4 924.00	V	54.00	74.00	42.00	46.70	12.00	27.30
7 386.00	H	54.00	74.00	43.60	47.70	10.40	26.30
7 386.00	V	54.00	74.00	37.10	48.00	16.90	26.00
2 483.94	H	54.00	74.00	46.70	54.10	7.30	19.90
2 483.50	V	54.00	74.00	45.90	54.50	8.10	19.50

Remarks

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z axis) and the worst case was recorded.

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]
2 389.15	H	54.00	74.00	46.20	61.80	7.80	12.20
2 388.98	V	54.00	74.00	47.70	63.70	6.30	10.30

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]
2 485.06	H	54.00	74.00	42.90	60.00	11.10	14.00
2 483.50	V	54.00	74.00	42.70	61.60	11.30	12.40

Remarks

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z axis) and the worst case was recorded.

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	47.10	70.90	6.90	3.10
2 390.00	V	54.00	74.00	47.90	64.70	6.10	9.30

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]
2 483.92	H	54.00	74.00	43.90	61.10	10.10	12.90
2 483.55	V	54.00	74.00	42.80	62.80	11.20	11.20

Remarks

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z axis) and the worst case was recorded.

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

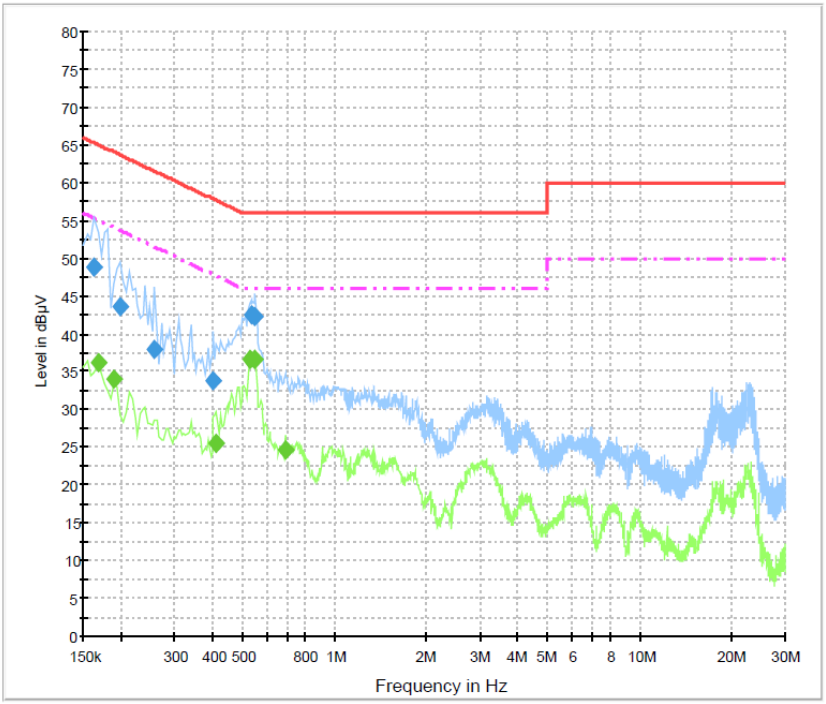
* The level decreases linearly with the logarithm of the frequency.
** A linear average detector is required.

Test Results

The requirements are:
☒ Complies

Test Data

[LINE]
Class B_L1



Final Result 1

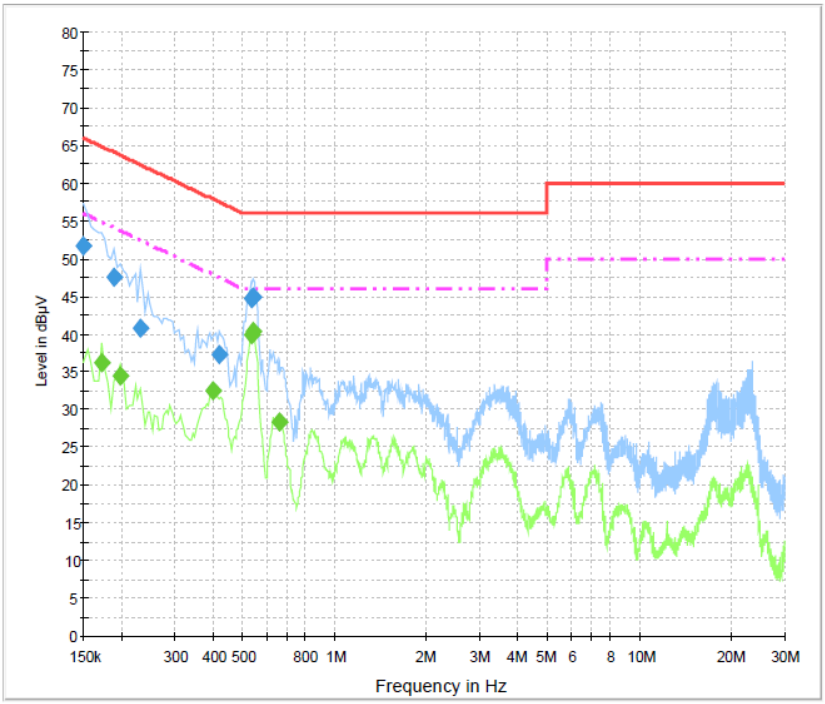
Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.163500	48.9	1000.0	9.000	On	L1	10.2	16.4	65.3
0.199500	43.7	1000.0	9.000	On	L1	10.1	20.0	63.6
0.258000	37.9	1000.0	9.000	On	L1	9.9	23.6	61.5
0.402000	33.9	1000.0	9.000	On	L1	10.1	23.9	57.8
0.532500	42.5	1000.0	9.000	On	L1	10.1	13.5	56.0
0.550500	42.2	1000.0	9.000	On	L1	10.1	13.8	56.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.168000	36.2	1000.0	9.000	On	L1	10.3	18.8	55.1
0.190500	34.0	1000.0	9.000	On	L1	10.2	20.0	54.0
0.411000	25.5	1000.0	9.000	On	L1	10.1	22.2	47.6
0.528000	36.7	1000.0	9.000	On	L1	10.1	9.3	46.0
0.546000	36.6	1000.0	9.000	On	L1	10.1	9.4	46.0
0.690000	24.6	1000.0	9.000	On	L1	10.1	21.4	46.0

[NEUTRAL]

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	51.6	1000.0	9.000	On	N	10.3	14.4	66.0
0.190500	47.4	1000.0	9.000	On	N	10.5	16.6	64.0
0.231000	40.8	1000.0	9.000	On	N	10.3	21.6	62.4
0.420000	37.2	1000.0	9.000	On	N	10.5	20.3	57.4
0.532500	44.6	1000.0	9.000	On	N	10.5	11.4	56.0
0.541500	45.0	1000.0	9.000	On	N	10.5	11.0	56.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.172500	36.3	1000.0	9.000	On	N	10.6	18.6	54.8
0.199500	34.4	1000.0	9.000	On	N	10.4	19.2	53.6
0.397500	32.5	1000.0	9.000	On	N	10.5	15.4	47.9
0.532500	39.8	1000.0	9.000	On	N	10.5	6.2	46.0
0.541500	40.3	1000.0	9.000	On	N	10.5	5.7	46.0
0.663000	28.3	1000.0	9.000	On	N	10.5	17.7	46.0

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	2018-10-25	2019-10-25
2	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2018-10-25	2019-10-25
3	Bilog Antenna	Schaffner	CBL6111C	2551	2018-05-10	2020-05-10
4	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2018-05-02	2020-05-02
5	6dB Attenuator	R&S	DNF	272.4110.50-2	2018-10-25	2019-10-25
6	AMPLIFIER	SONOMA	310	291721	2019-01-28	2020-01-28
7	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2019-01-29	2020-01-29
8	Preamplifier	Agilent	8449B	3008A02011	2018-12-03	2019-12-03
9	Horn Antenna	ETS-Lindgren	3115	00078894	2017-12-04	2019-12-04
10	Horn Antenna	ETS-Lindgren	3116	0062916	2017-04-25	2019-04-25
11	Band Reject Filter	Micro Tronics	BRM50702	G233	2019-01-28	2020-01-28
12	LISN	Rohde & Schwarz	ENV216	101760	2019-01-29	2020-01-29

	Cable	Manufacturer	Model No.	Serial No.	Check Date
1	RF Cable	Canare Corporation	L-5D2W	N/A	2018-12-19
2	RF Cable	Junkosha Inc.	MWX221	1510S085	2019-02-21
3	RF Cable	HUBER+SUHNER	SUCOFLEX 102	MY073/2	2018-12-19
4	RF Cable	HUBER+SUHNER	SUCOFLEX 102	MY4728/2	2018-12-19
5	RF Cable	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	2018-12-19
6	RF Cable	HUBER+SUHNER	SUCOFLEX 104	N/A	2018-12-19
7	RF Cable	HUBER+SUHNER	SUCOFLEX 104	MY27573/4	2018-12-19
8	RF Cable	HUBER+SUHNER	SUCOFLEX 106	N/A	2018-12-19