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-2018-02896

1. Client

◦ Name : Haier US Appliance Solutions, Inc.

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

◦ Date of Receipt : 2018-09-10

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 / WCATA006

5. Date of Test : 2018-09-11 to 2018-09-14

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

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

2018-09-14

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

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REPORT REVISION HISTORY

Date	Revision	Page No
2018-09-14	Issued (CTK-2018-02896)	all

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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-WCATA006
ISED	10229A-WCATA006
Product Description	Wi-Fi Module
Model name	WCATA006
Variant Model name	-
Operating Frequency	2 412 MHz – 2 462 MHz
RF Output Power	802.11b : 16.10 dBm (40.74 mW) 802.11g : 11.48 dBm (14.06 mW) 802.11n : 11.28 dBm (13.43 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	Rev 0
Software Rev	V3.5b-117987

1.3 Peripheral Devices

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

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 4, 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	99.0%	-
802.11g	OFDM	6 Mbps	94.2%	0.26 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 ≤ 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 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

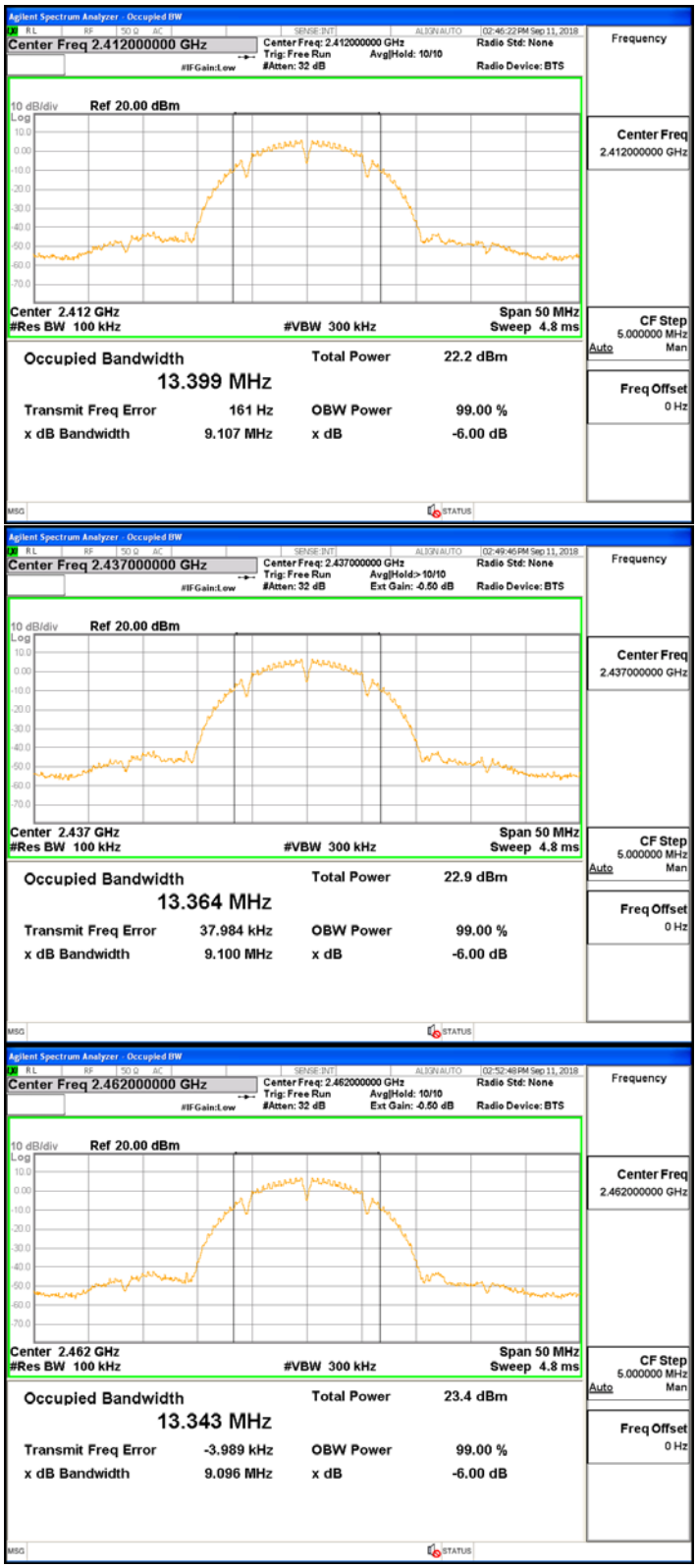
a) RBW = 100 kHz
b) VBW ≥ 3 x RBW
c) Detector = peak
d) Trace mode = Max hold
e) Sweep = auto couple
f) Allow trace to fully stabilize
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that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

Limit
6 dB Bandwidth > 500kHz

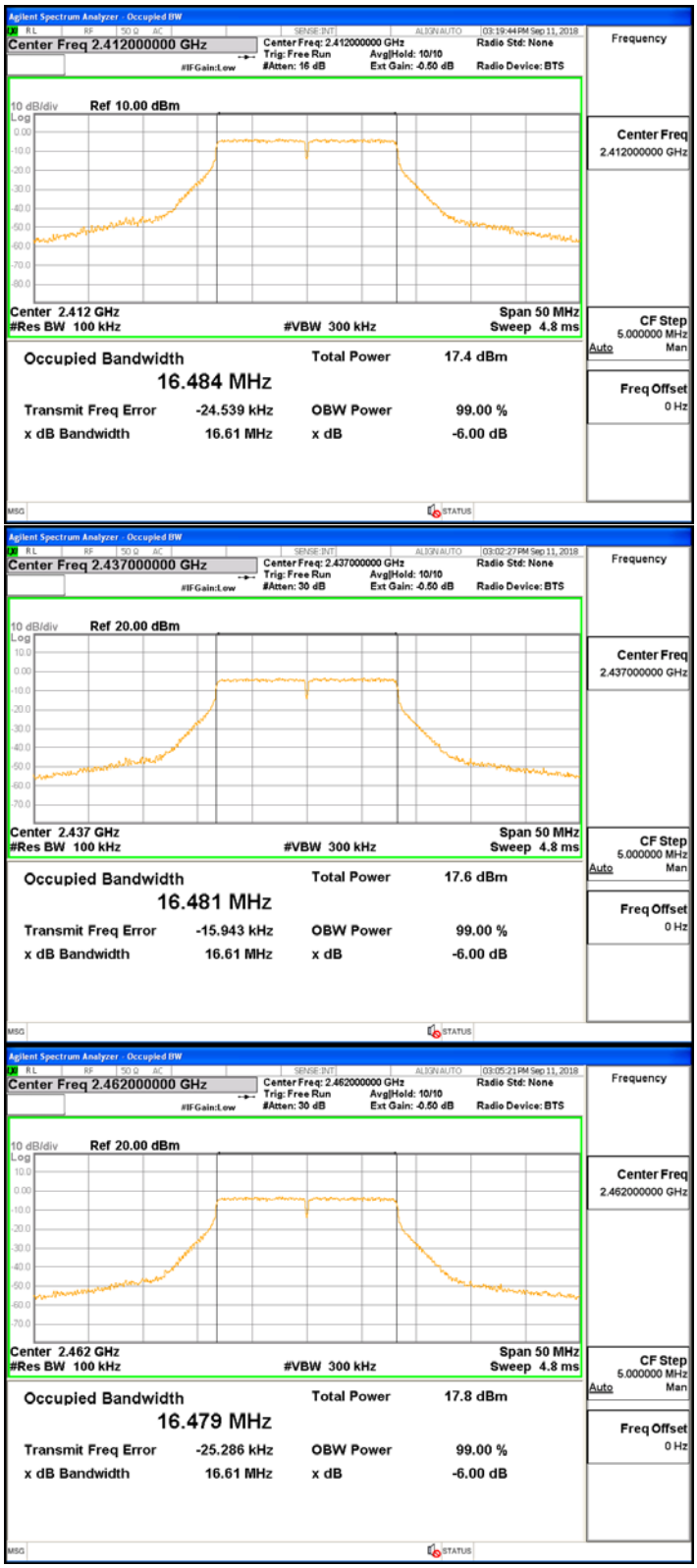
Test Data:

	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	13.40	16.61	16.48	17.83	17.68
2 437 MHz	9.10	13.36	16.61	16.48	17.81	17.67
2 462 MHz	9.10	13.34	16.61	16.48	17.80	17.67

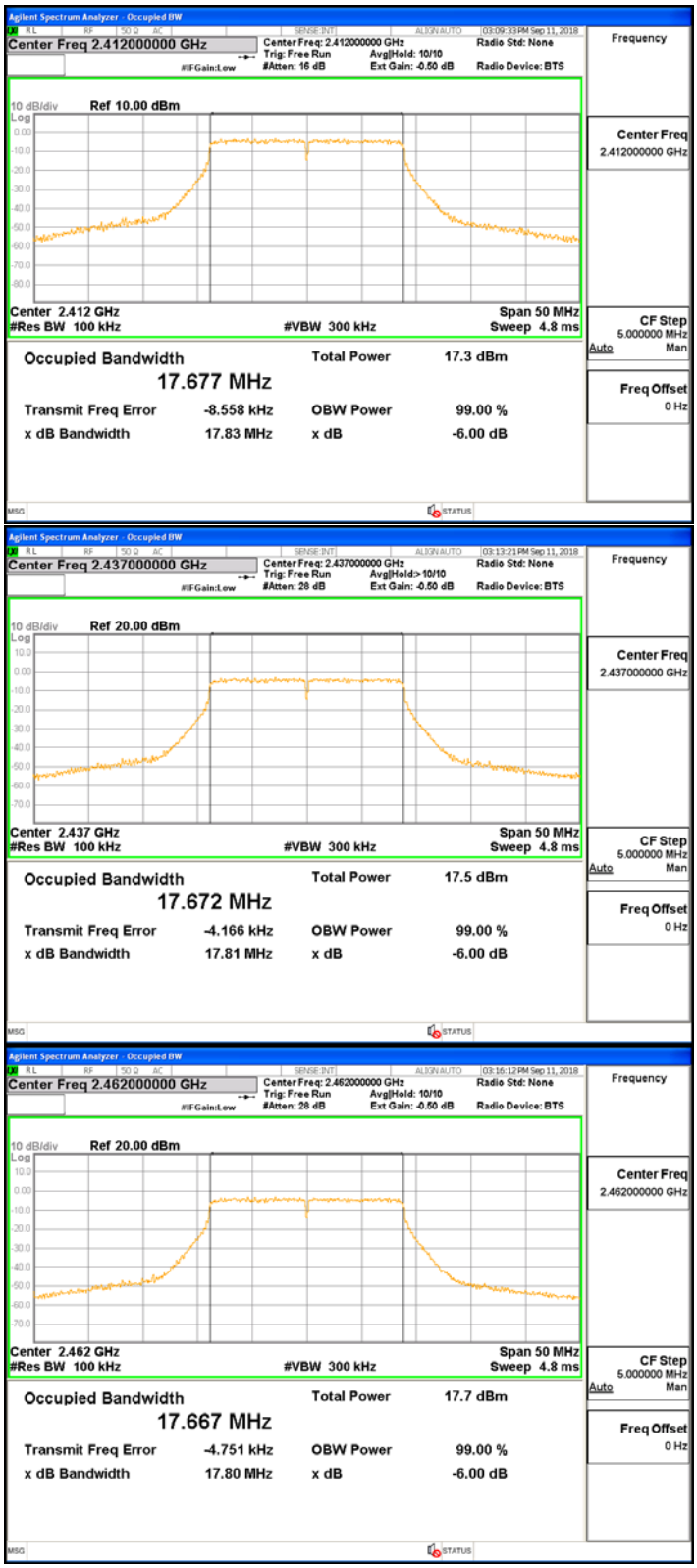
See next pages for actual measured spectrum plots.


Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.412000000 GHz
Center Freq: 2.412000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 32 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
13.399 MHz
Total Power
22.2 dBm
Transmit Freq Error
161 Hz
OBW Power
99.00 %
x dB Bandwidth
9.107 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: 32 dB
Ext Gain: -0.50 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
13.364 MHz
Total Power
22.9 dBm
Transmit Freq Error
37.984 kHz
OBW Power
99.00 %
x dB Bandwidth
9.100 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: -0.50 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
13.343 MHz
Total Power
23.4 dBm
Transmit Freq Error
-3.989 kHz
OBW Power
99.00 %
x dB Bandwidth
9.096 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: 16 dB
Ext Gain: -0.50 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Ref 10.00 dBm
Center 2.412 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
Occupied Bandwidth
16.484 MHz
Total Power 17.4 dBm
Transmit Freq Error -24.539 kHz
OBW Power 99.00 %
x dB Bandwidth 16.61 MHz
x dB -6.00 dB
Frequency
Center Freq
2.412000000 GHz
CF Step
5.000000 MHz
Auto
Man
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: -0.50 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Ref 20.00 dBm
Center 2.437 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
Occupied Bandwidth
16.481 MHz
Total Power 17.6 dBm
Transmit Freq Error -15.943 kHz
OBW Power 99.00 %
x dB Bandwidth 16.61 MHz
x dB -6.00 dB
Frequency
Center Freq
2.437000000 GHz
CF Step
5.000000 MHz
Auto
Man
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: 30 dB
Ext Gain: -0.50 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Ref 20.00 dBm
Center 2.462 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50 MHz
Sweep 4.8 ms
Occupied Bandwidth
16.479 MHz
Total Power 17.8 dBm
Transmit Freq Error -25.286 kHz
OBW Power 99.00 %
x dB Bandwidth 16.61 MHz
x dB -6.00 dB
Frequency
Center Freq
2.462000000 GHz
CF Step
5.000000 MHz
Auto
Man
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: 16 dB
Ext Gain: -0.50 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Ref 10.00 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
Freq Offset
0 Hz
Occupied Bandwidth
17.677 MHz
Total Power
17.3 dBm
Transmit Freq Error
-8.558 kHz
OBW Power
99.00 %
x dB Bandwidth
17.83 MHz
x dB
-6.00 dB
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.437000000 GHz
Center Freq: 2.437000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 28 dB
Ext Gain: -0.50 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
Freq Offset
0 Hz
Occupied Bandwidth
17.672 MHz
Total Power
17.5 dBm
Transmit Freq Error
-4.166 kHz
OBW Power
99.00 %
x dB Bandwidth
17.81 MHz
x dB
-6.00 dB
Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.462000000 GHz
Center Freq: 2.462000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 28 dB
Ext Gain: -0.50 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
Freq Offset
0 Hz
Occupied Bandwidth
17.667 MHz
Total Power
17.7 dBm
Transmit Freq Error
-4.751 kHz
OBW Power
99.00 %
x dB Bandwidth
17.80 MHz
x dB
-6.00 dB

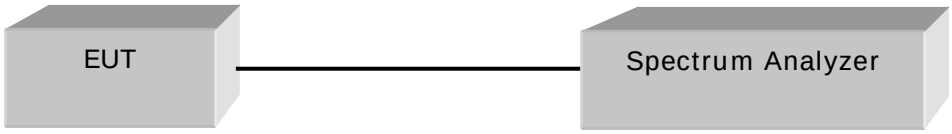
802.11n_HT20

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 ≥ 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 = 0.26 dB, 802.11n_HT20 = 0.27 dB

Limit

Operating Mode	Mode	ANT Gain (dBi)	Limit	
			FCC(dBm)	IC(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	15.52	0.00	15.52	30.00	14.48
2 437 MHz	15.63	0.00	15.63	30.00	14.37
2 462 MHz	16.10	0.00	16.10	30.00	13.90

802.11g

Frequency	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	10.58	0.26	10.84	30.00	19.16
2 437 MHz	10.93	0.26	11.19	30.00	18.81
2 462 MHz	11.22	0.26	11.48	30.00	18.52

802.11n_HT20

Frequency	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	10.78	0.27	11.05	30.00	18.95
2 437 MHz	10.84	0.27	11.11	30.00	18.89
2 462 MHz	11.01	0.27	11.28	30.00	18.72

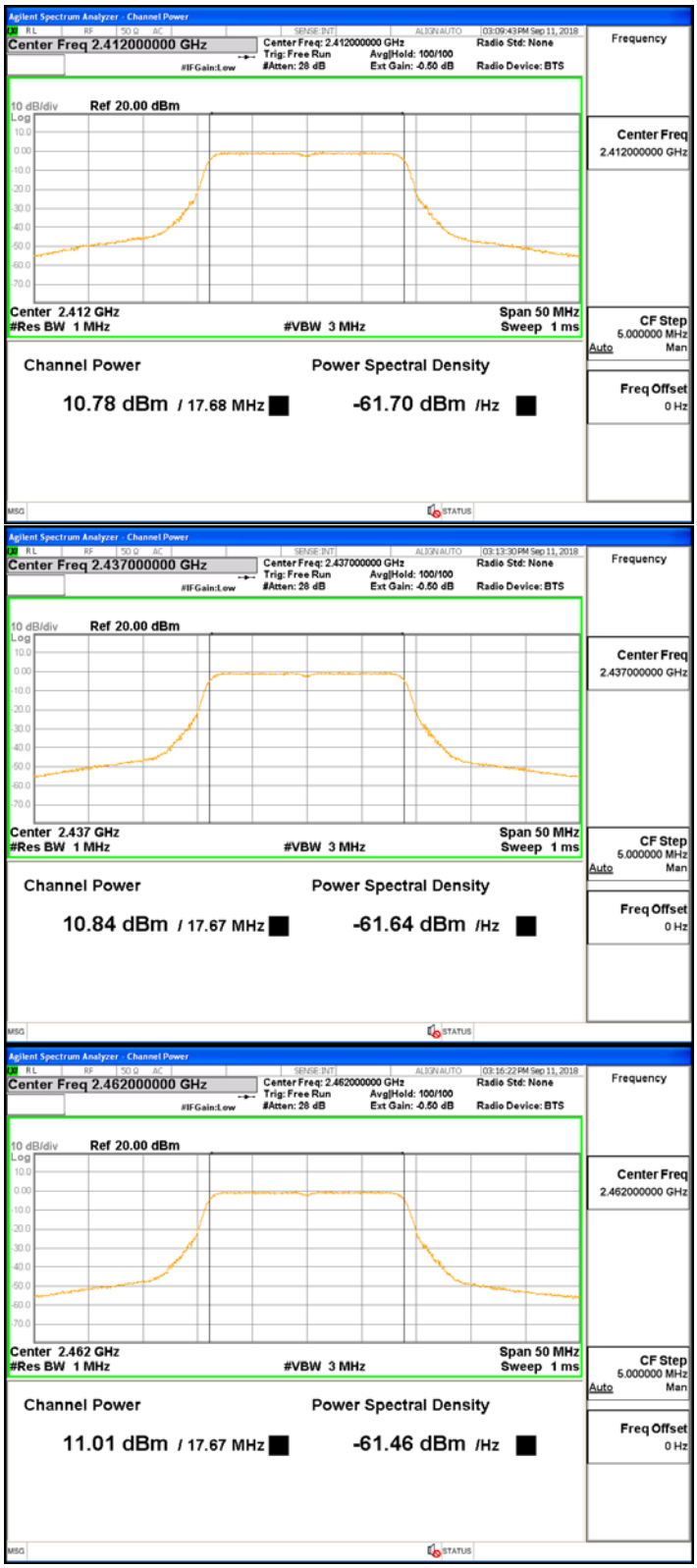
See next pages for actual measured spectrum plots.


Agilent Spectrum Analyzer - Channel Power
Center Freq 2.412000000 GHz
Center Freq: 2.412000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 32 dB
Ext Gain: -0.50 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
15.52 dBm / 13.4 MHz
Power Spectral Density
-55.75 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: -0.50 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
15.63 dBm / 13.36 MHz
Power Spectral Density
-55.63 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: -0.50 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
16.10 dBm / 13.34 MHz
Power Spectral Density
-55.15 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: -0.50 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
10.58 dBm / 16.49 MHz
-61.60 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: -0.50 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
10.93 dBm / 16.48 MHz
-61.24 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: 30 dB
Ext Gain: -0.50 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
11.22 dBm / 16.48 MHz
-60.95 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: 28 dB
Ext Gain: -0.50 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
10.78 dBm / 17.68 MHz
-61.70 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: 28 dB
Ext Gain: -0.50 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
10.84 dBm / 17.67 MHz
-61.64 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: 28 dB
Ext Gain: -0.50 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
11.01 dBm / 17.67 MHz
-61.46 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 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	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	-13.81	8.00	21.81
2 437 MHz	-13.49	8.00	21.49
2 462 MHz	-13.19	8.00	21.19

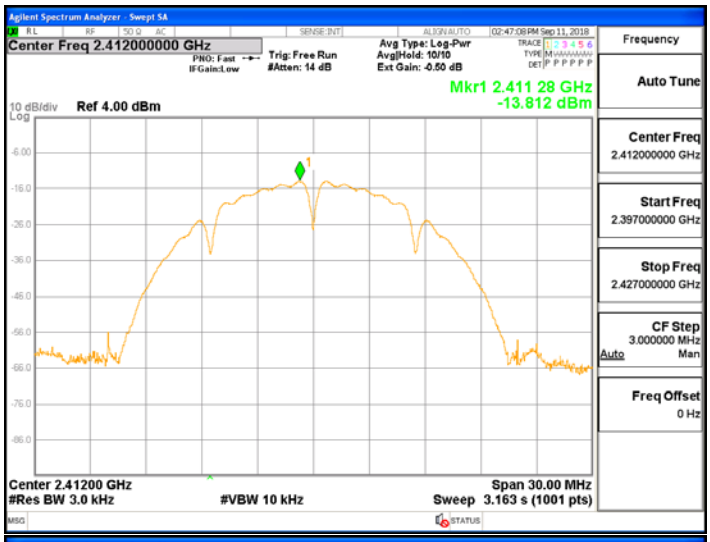
802.11g

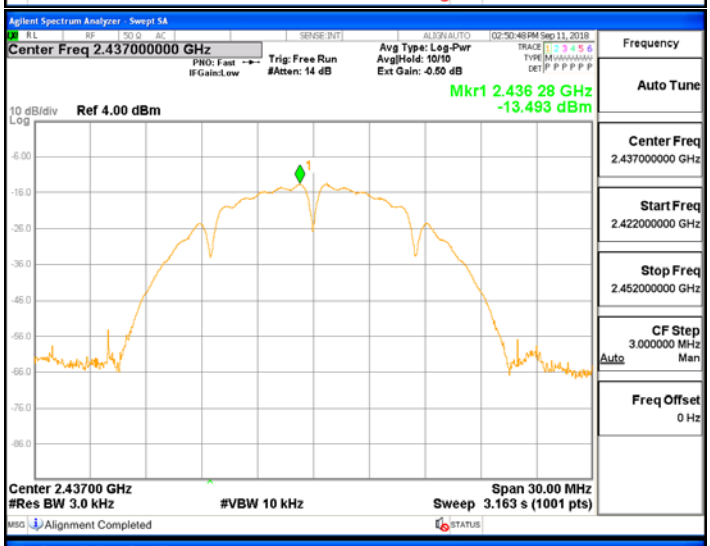
Frequency	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	-17.81	8.00	25.81
2 437 MHz	-17.40	8.00	25.40
2 462 MHz	-17.14	8.00	25.14

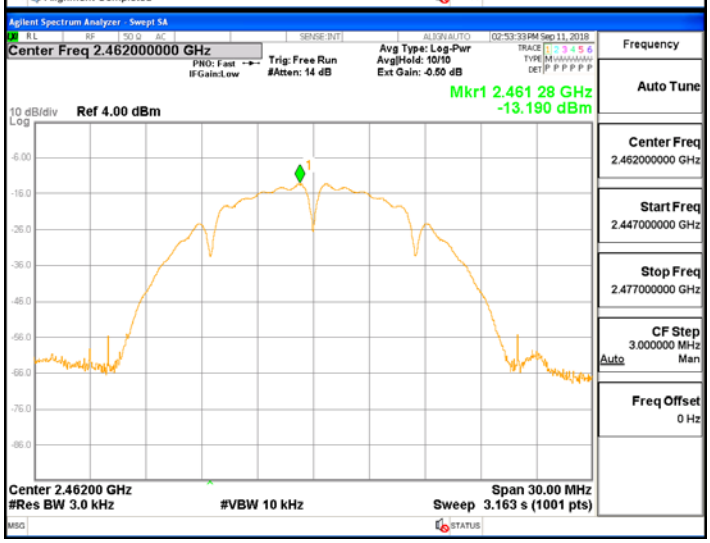
802.11n_HT20

Frequency	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
2 412 MHz	-17.19	8.00	25.19
2 437 MHz	-16.83	8.00	24.83
2 462 MHz	-16.54	8.00	24.54

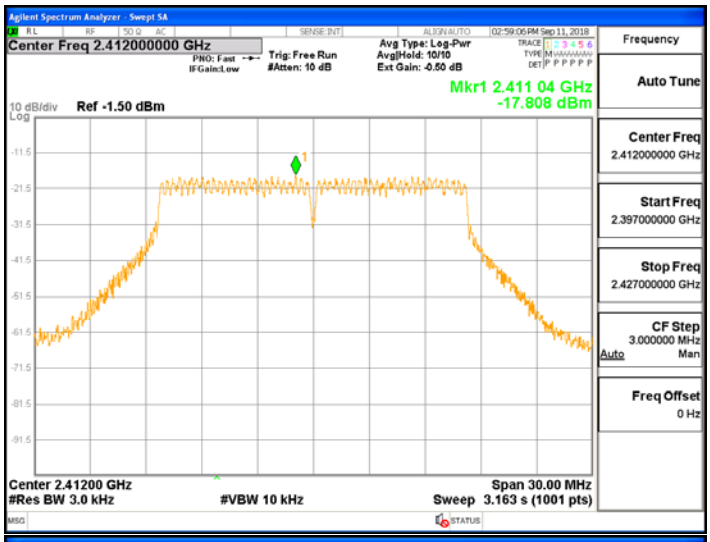
See next pages for actual measured spectrum plots.

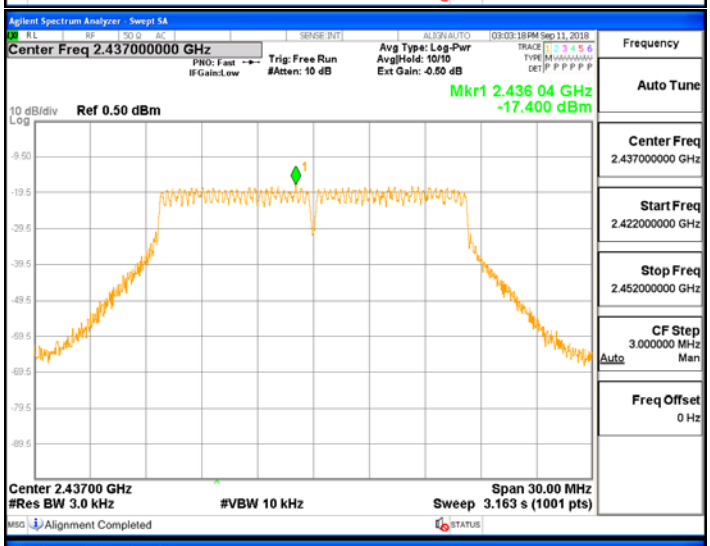

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.412000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.50 dB
02:47:08 PM Sep 11, 2018
Mkr1 2.411 28 GHz
-13.812 dBm
10 dB/div
Log
Ref 4.00 dBm
Center 2.41200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 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

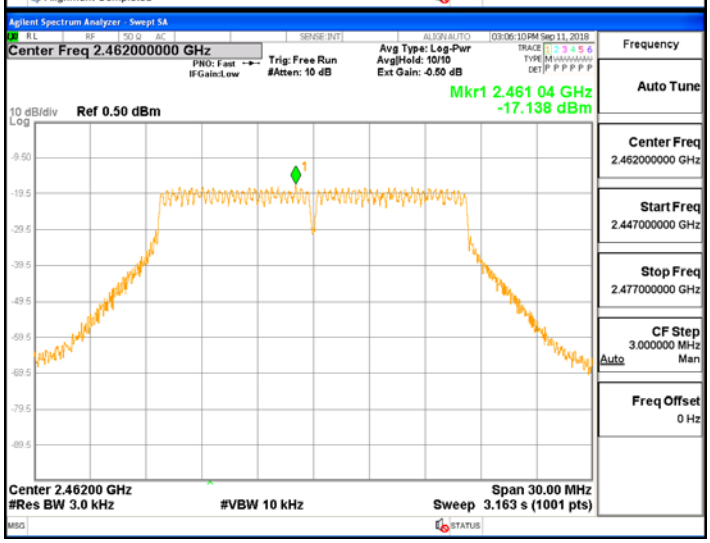

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.437000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.50 dB
02:50:48 PM Sep 11, 2018
Mkr1 2.436 28 GHz
-13.493 dBm
10 dB/div
Log
Ref 4.00 dBm
Center 2.43700 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 30.00 MHz
Sweep 3.163 s (1001 pts)
Alignment Completed
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: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.50 dB
02:53:33 PM Sep 11, 2018
Mkr1 2.461 28 GHz
-13.190 dBm
10 dB/div
Log
Ref 4.00 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

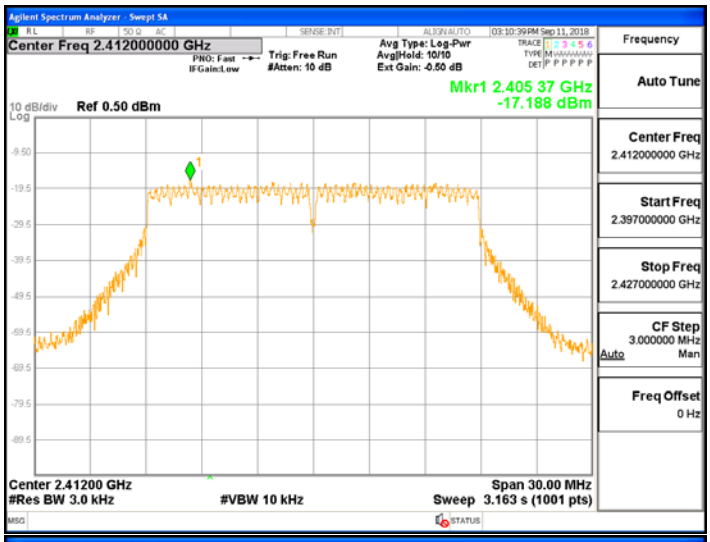
802.11b

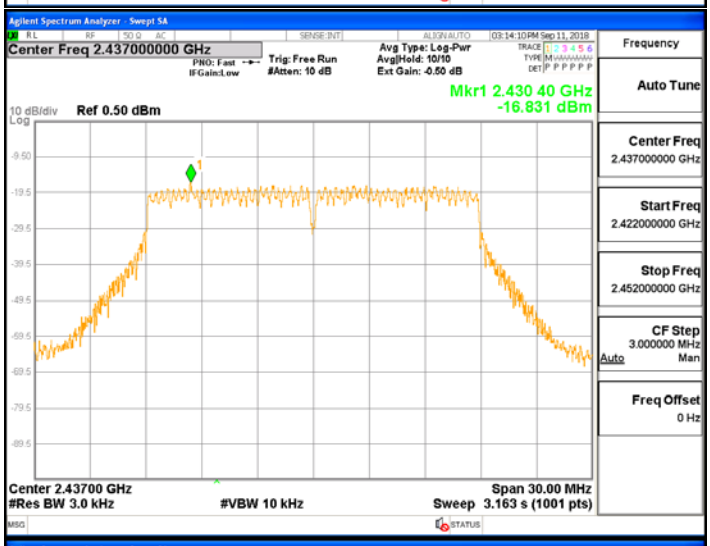

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.412000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.50 dB
02:59:06 PM Sep 11, 2018
Mkr1 2.411 04 GHz
-17.808 dBm
10 dB/div
Log
Ref -1.50 dBm
Center 2.41200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 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

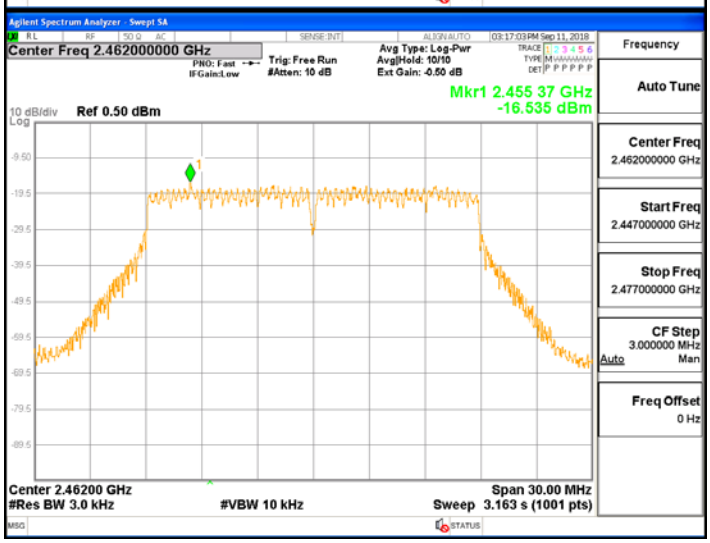

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.437000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.50 dB
03:03:18 PM Sep 11, 2018
Mkr1 2.436 04 GHz
-17.400 dBm
10 dB/div
Log
Ref 0.50 dBm
Center 2.43700 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 30.00 MHz
Sweep 3.163 s (1001 pts)
Alignment Completed
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: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.50 dB
03:06:10 PM Sep 11, 2018
Mkr1 2.461 04 GHz
-17.138 dBm
10 dB/div
Log
Ref 0.50 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: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.50 dB
03:10:39 PM Sep 11, 2018
Mkr1 2.405 37 GHz
-17.188 dBm
10 dB/div
Log
Ref 0.50 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: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.50 dB
03:14:10 PM Sep 11, 2018
Mkr1 2.430 40 GHz
-16.831 dBm
10 dB/div
Log
Ref 0.50 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: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.50 dB
03:17:03 PM Sep 11, 2018
Mkr1 2.455 37 GHz
-16.535 dBm
10 dB/div
Log
Ref 0.50 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 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.

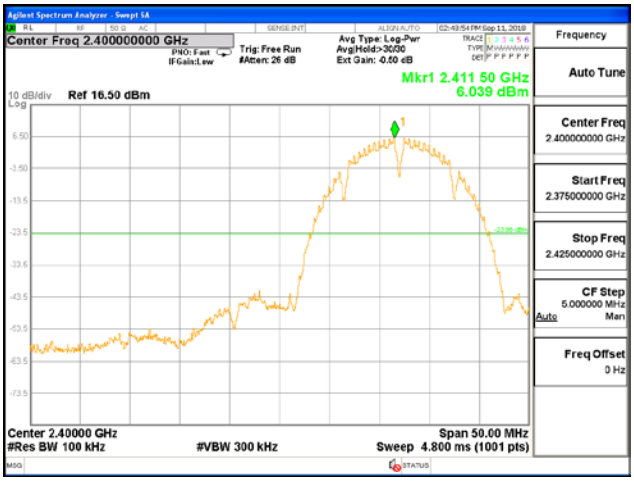
Limit :

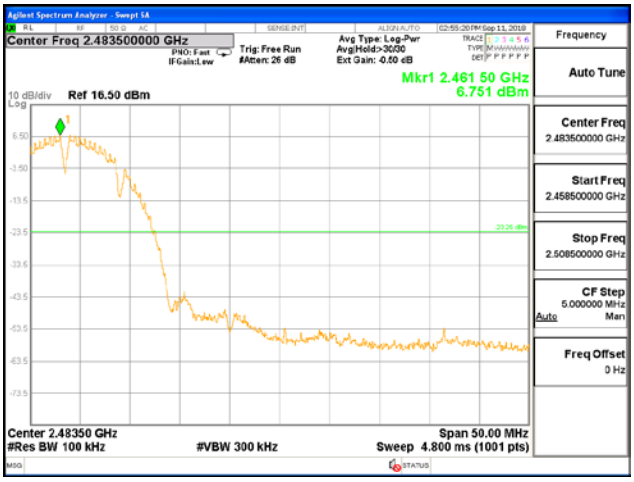
Emission level < 30 dBc

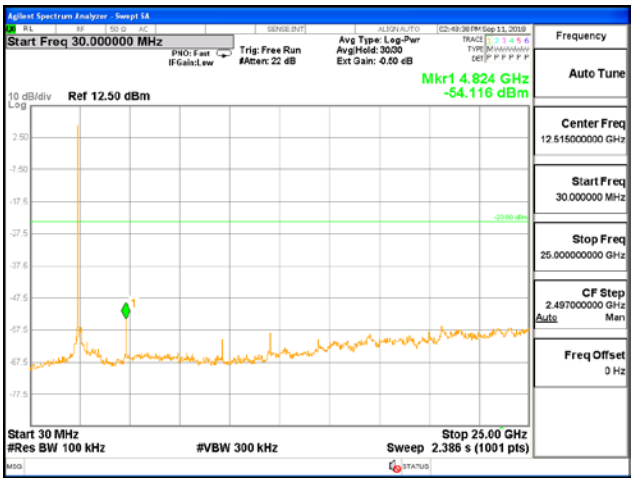
Test Data: Complies

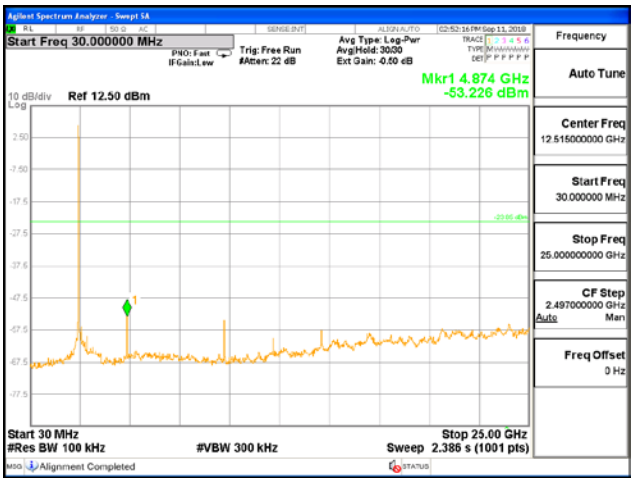
- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 30dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.

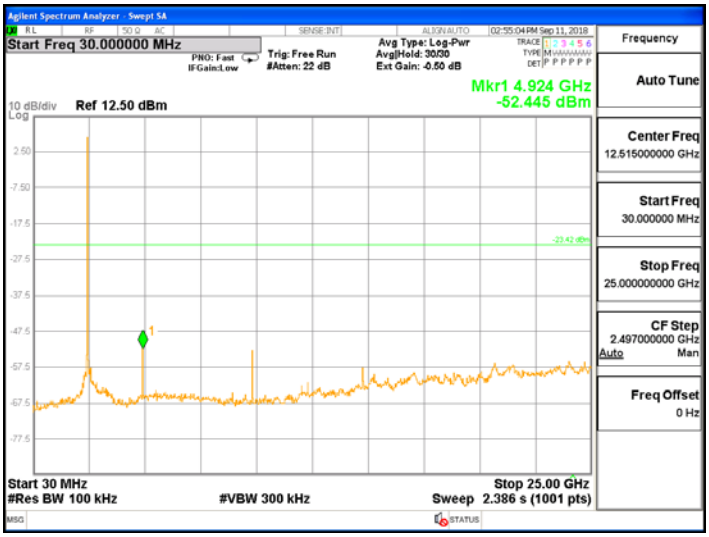
See next pages for actual measured spectrum plots.


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: 0.50 dB
Mkr1 2.411 50 GHz
6.039 dBm
10 dB/div
Ref 16.50 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

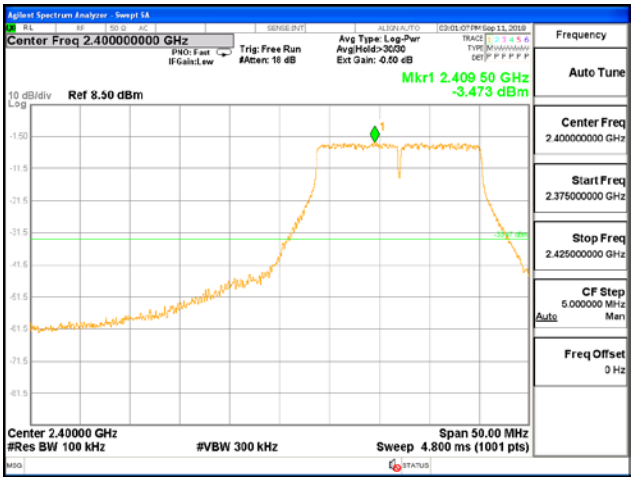

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
Trig: Free Run
#Atten: 26 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: 0.50 dB
Mkr1 2.461 50 GHz
6.751 dBm
10 dB/div
Ref 16.50 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
Frequency
Auto 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

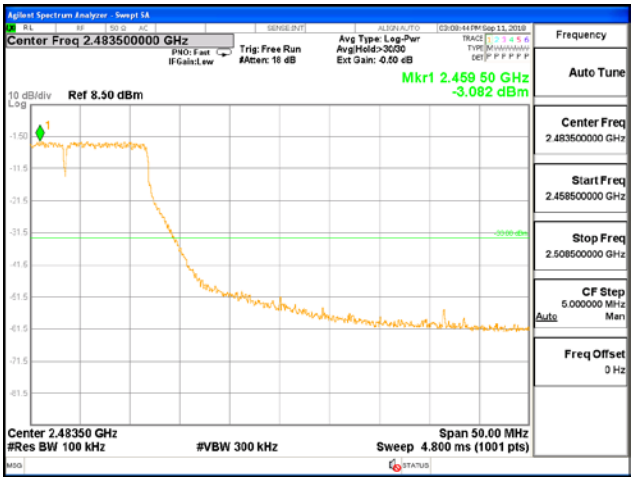

Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
Trig: Free Run
#Atten: 22 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: 0.50 dB
Mkr1 4.824 GHz
-54.116 dBm
10 dB/div
Ref 12.50 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Frequency
Auto Tune
Center 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

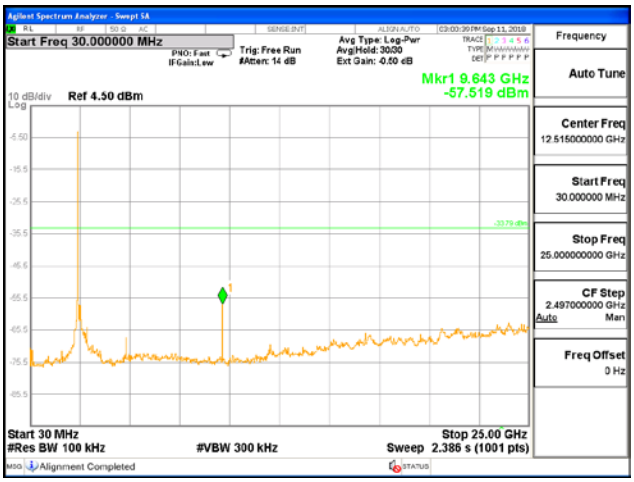

Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
Trig: Free Run
#Atten: 22 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: 0.50 dB
Mkr1 4.874 GHz
-53.226 dBm
10 dB/div
Ref 12.50 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Alignment Completed
Frequency
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

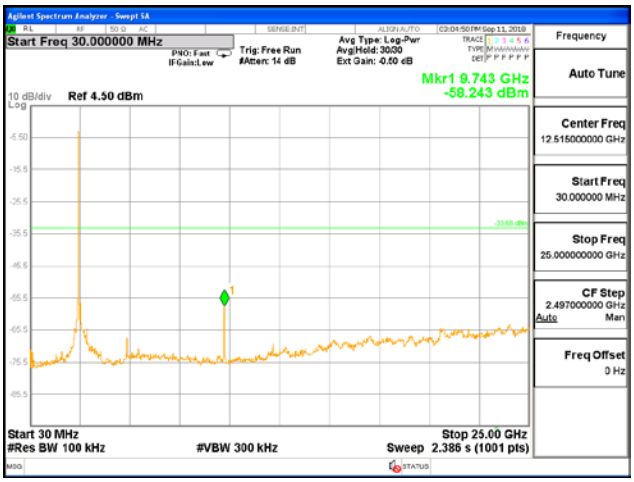

Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
Trig: Free Run
#Atten: 22 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: 0.50 dB
Mkr1 4.924 GHz
-52.445 dBm
10 dB/div
Ref 12.50 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Frequency
Auto Tune
Center 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

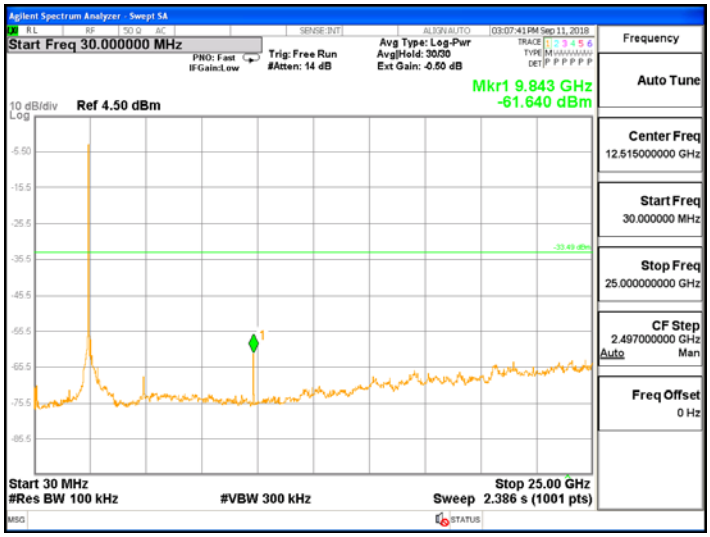
802.11b


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 18 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: 0.50 dB
Mkr1 2.409 50 GHz
-3.473 dBm
10 dB/div
Log
Ref 8.50 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

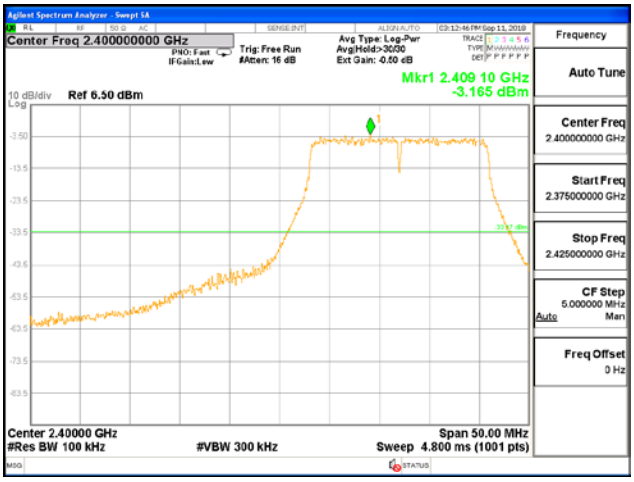

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 18 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: 0.50 dB
Mkr1 2.459 50 GHz
-3.082 dBm
10 dB/div
Log
Ref 8.50 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (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

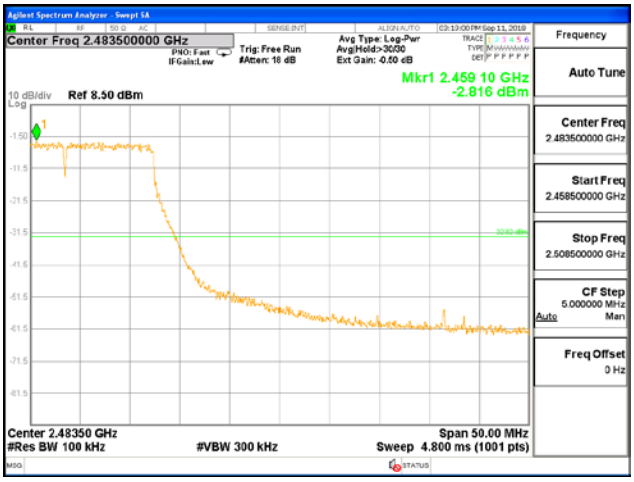

Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: 0.50 dB
Mkr1 9.643 GHz
-57.519 dBm
10 dB/div
Log
Ref 4.50 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Alignment 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

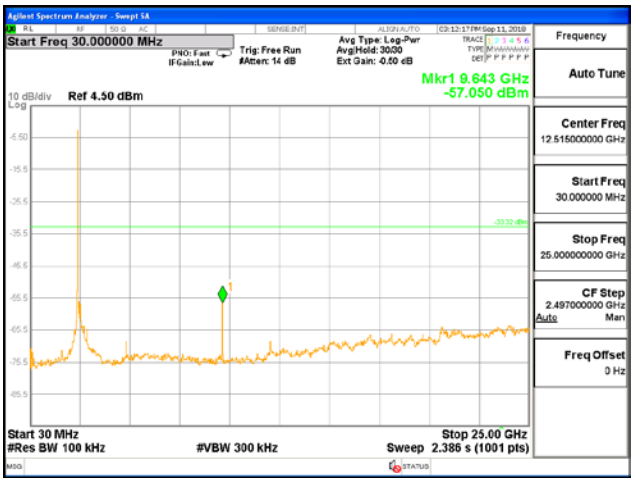

Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: 0.50 dB
Mkr1 9.743 GHz
-58.243 dBm
10 dB/div
Log
Ref 4.50 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Frequency
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

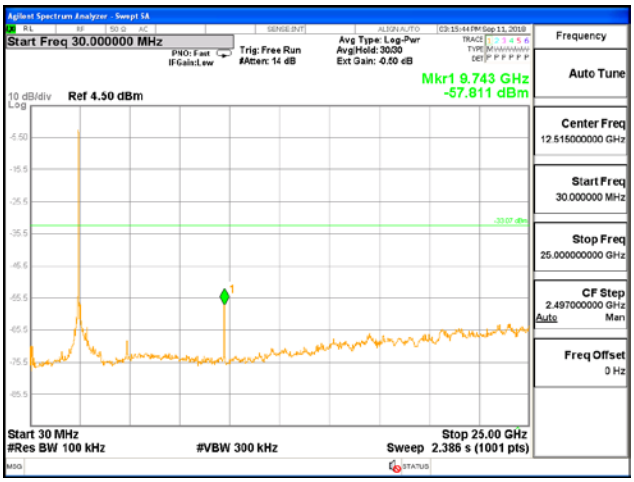

Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: 0.50 dB
Mkr1 9.843 GHz
-61.640 dBm
10 dB/div
Log
Ref 4.50 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Frequency
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

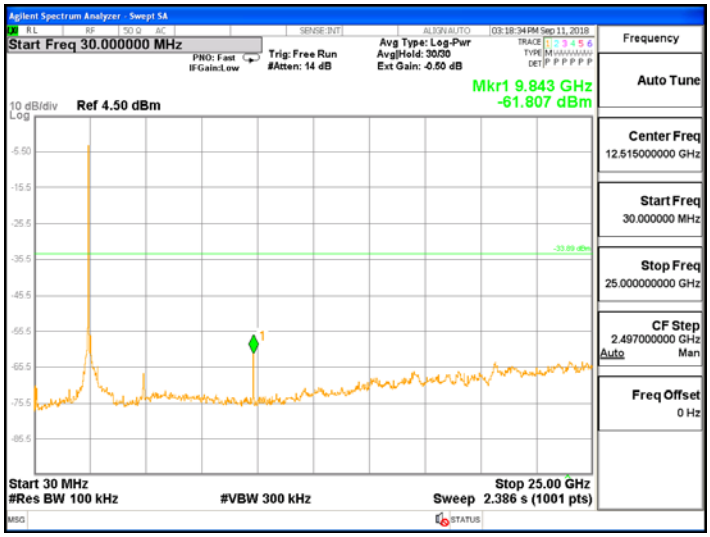
802.11g


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 16 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: 0.50 dB
Mkr1 2.409 10 GHz
-3.165 dBm
10 dB/div
Ref 6.50 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: 16 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: 0.50 dB
Mkr1 2.459 10 GHz
-2.816 dBm
10 dB/div
Ref 8.50 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
Start Freq 30.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: 0.50 dB
Mkr1 9.643 GHz
-57.050 dBm
10 dB/div
Ref 4.50 dBm
Log
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
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
Start Freq 30.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: 0.50 dB
Mkr1 9.743 GHz
-57.811 dBm
10 dB/div
Ref 4.50 dBm
Log
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
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
Start Freq 30.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: 0.50 dB
Mkr1 9.843 GHz
-61.807 dBm
10 dB/div
Ref 4.50 dBm
Log
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
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 = 0.26 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 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

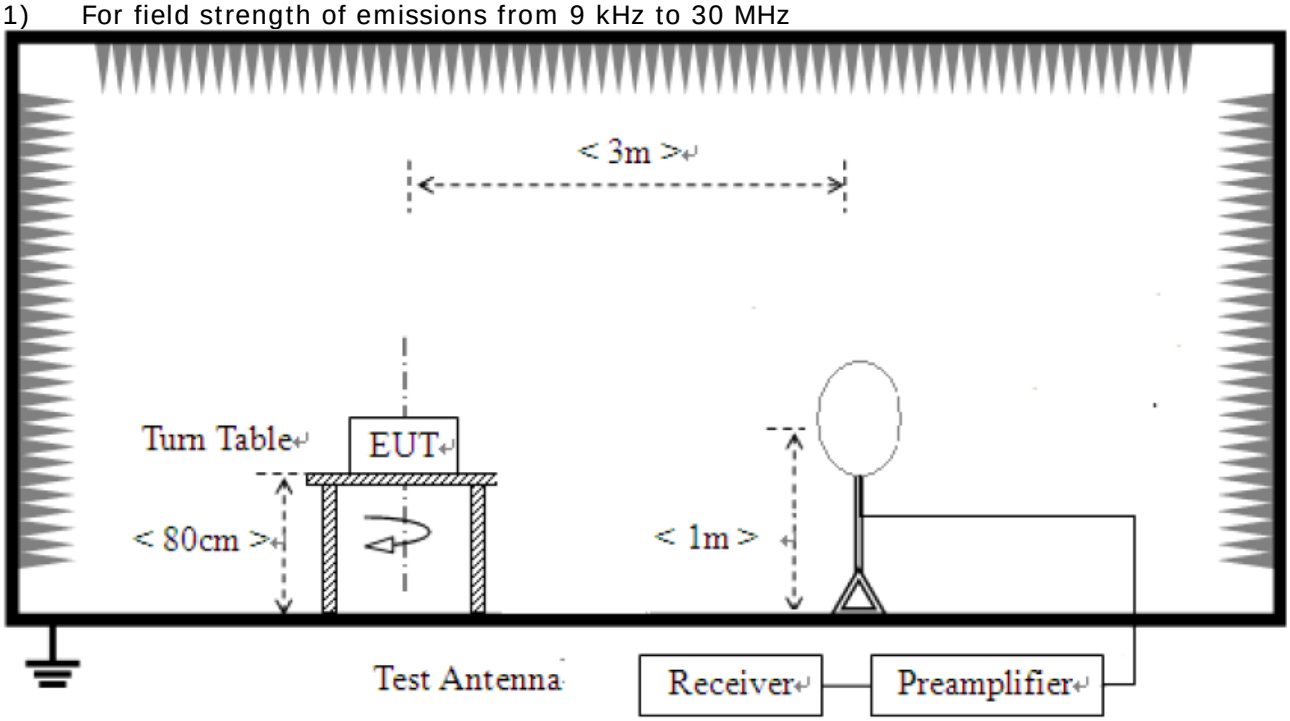
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231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

Note :

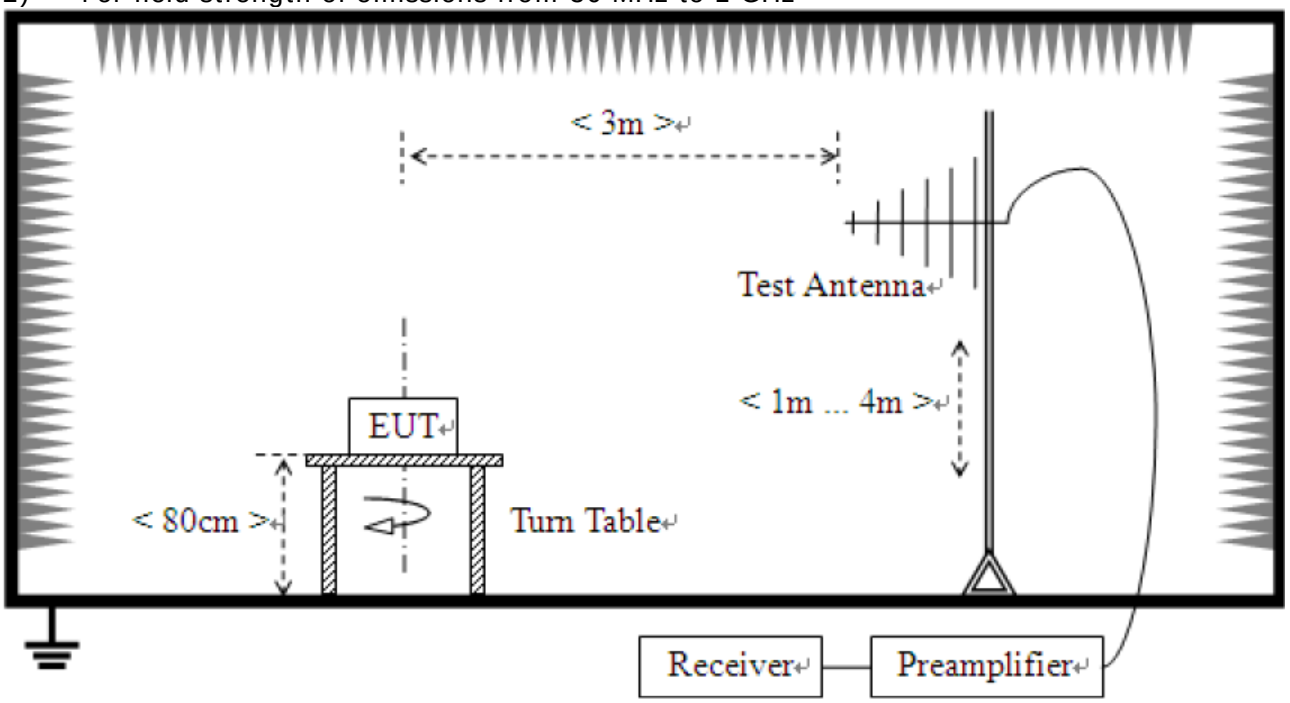
1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
2) For above 1 GHz, limit field strength of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

Test Setup:

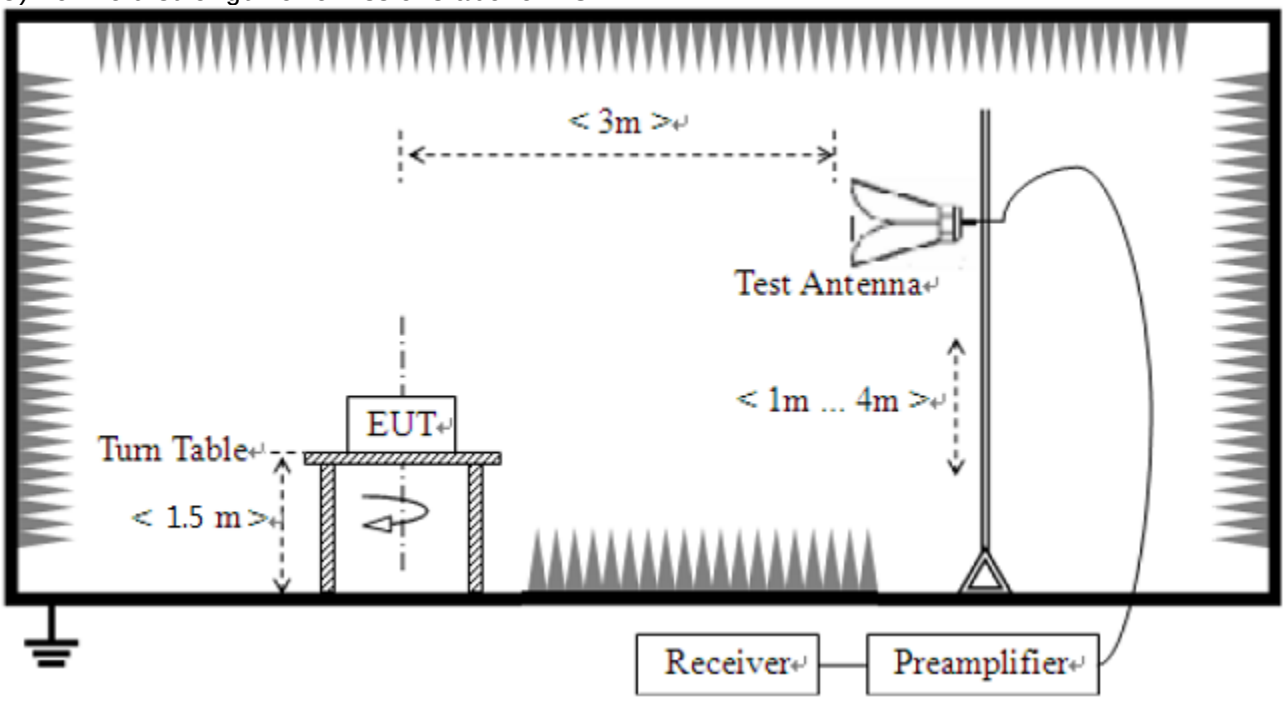
1) For field strength of emissions from 9 kHz to 30 MHz



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.

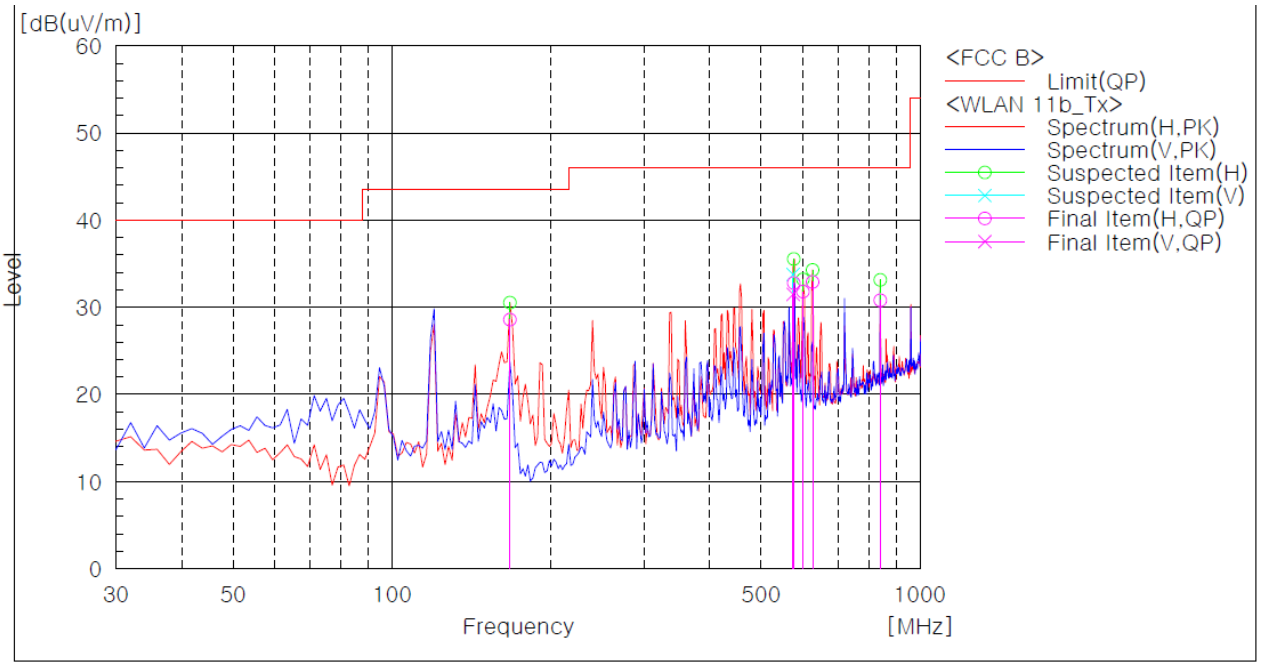
Distance extrapolation factor = 40 log (specific distance / test distance) (dB)

2) 30 MHz to 1 GHz

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

The requirements are:
☒ Complies

Test Data



Final Result

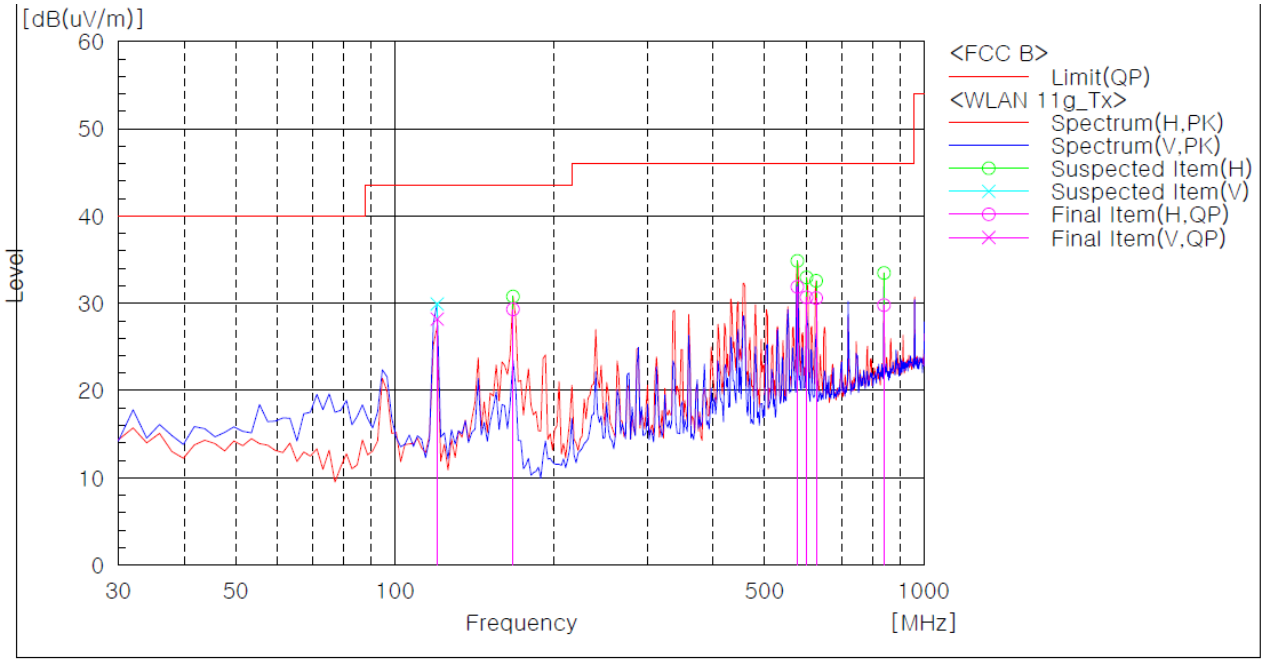
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	167.158	H	45.5	-16.9	28.6	43.5	14.9	99.8	64.5	
2	574.713	V	39.6	-8.1	31.5	46.0	14.5	99.8	199.8	
3	576.673	H	40.9	-8.1	32.8	46.0	13.2	99.8	19.3	
4	600.185	H	39.5	-7.7	31.8	46.0	14.2	99.8	247.0	
5	625.658	H	40.3	-7.4	32.9	46.0	13.1	99.8	88.8	
6	841.192	H	35.6	-4.8	30.8	46.0	15.2	99.8	283.3	

Remark :
1. The EUT was tested in three orientations in order to determine that "X axis" was the worst case.
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

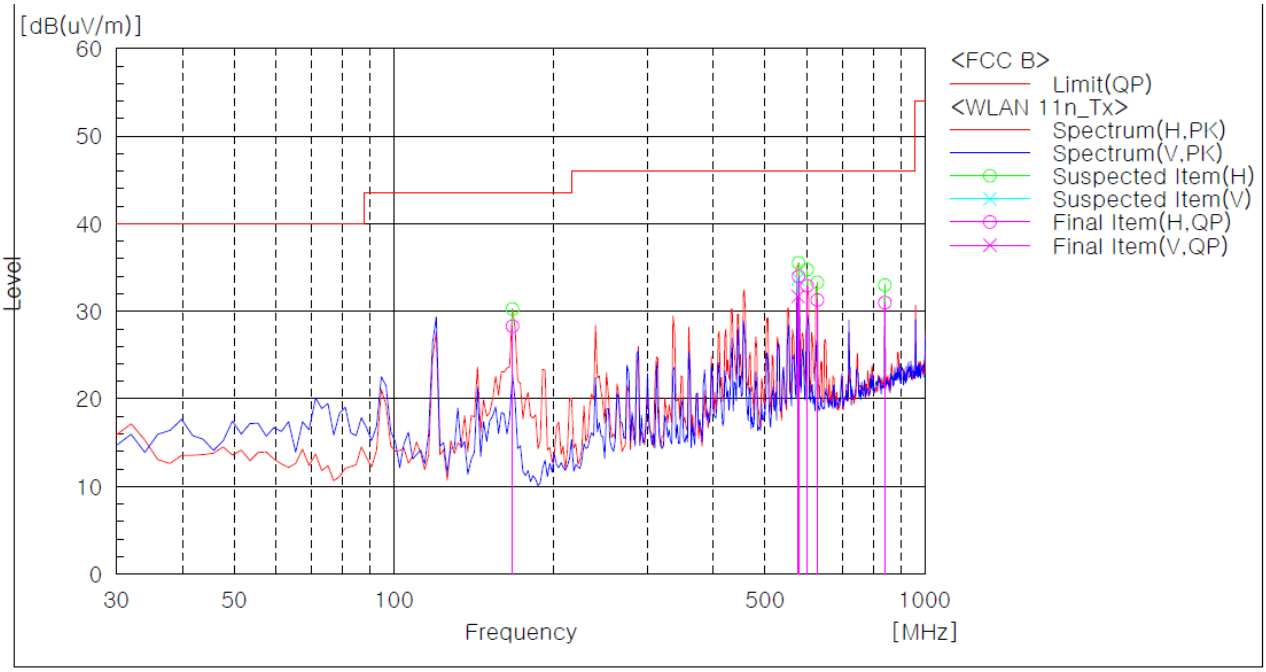
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	120.132	V	44.0	-15.8	28.2	43.5	15.3	99.8	2.2	
2	167.158	H	46.2	-16.9	29.3	43.5	14.2	99.8	74.0	
3	576.673	H	40.0	-8.1	31.9	46.0	14.1	99.8	19.6	
4	600.185	H	38.4	-7.7	30.7	46.0	15.3	99.8	19.6	
5	625.658	H	38.0	-7.4	30.6	46.0	15.4	99.8	19.6	
6	841.192	H	34.6	-4.8	29.8	46.0	16.2	99.8	291.4	

Remark :
1. The EUT was tested in three orientations in order to determine that "X axis" was the worst case.
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

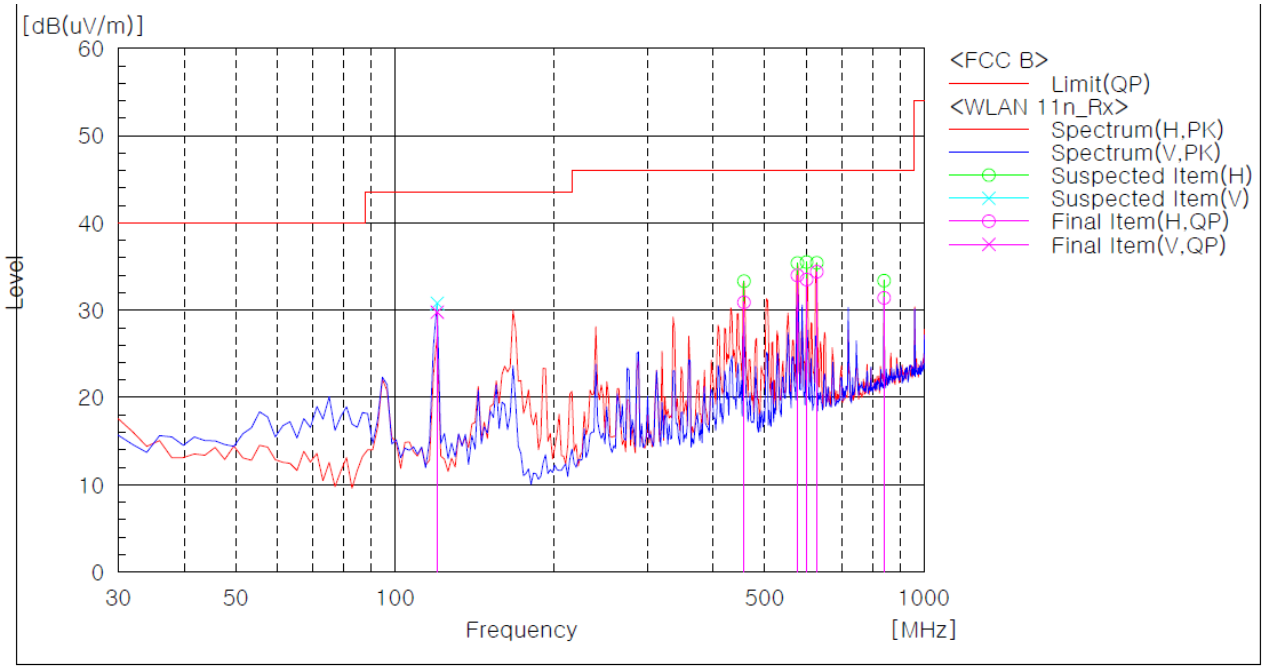
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	167.158	H	45.2	-16.9	28.3	43.5	15.2	99.8	64.3	
2	576.673	V	39.8	-8.1	31.7	46.0	14.3	99.8	207.0	
3	578.632	H	42.1	-8.1	34.0	46.0	12.0	99.8	19.0	
4	600.185	H	40.6	-7.7	32.9	46.0	13.1	99.8	359.6	
5	627.617	H	38.7	-7.4	31.3	46.0	14.7	99.8	88.6	
6	841.192	H	35.8	-4.8	31.0	46.0	15.0	99.8	112.9	

Remark :
1. The EUT was tested in three orientations in order to determine that "X axis" was the worst case.
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	(P)	Reading QP	c.f	Result QP	Limit QP	Margin QP	Height	Angle	Remark
	[MHz]		[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	[cm]	[deg]	
1	120.132	V	45.6	-15.8	29.8	43.5	13.7	99.8	24.4	
2	457.149	H	41.0	-10.1	30.9	46.0	15.1	99.8	112.6	
3	576.673	H	42.1	-8.1	34.0	46.0	12.0	99.8	32.2	
4	600.185	H	41.2	-7.7	33.5	46.0	12.5	99.8	21.5	
5	627.617	H	41.8	-7.4	34.4	46.0	11.6	99.8	76.3	
6	841.192	H	36.2	-4.8	31.4	46.0	14.6	99.8	281.8	

Remark :
1. The EUT was tested in three orientations in order to determine that "X axis" was the worst case.
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	39.00	44.70	15.00	29.30
4 824.00	V	54.00	74.00	38.10	44.20	15.90	29.80
2 387.25	H	54.00	74.00	39.20	47.70	14.80	26.30
2 386.98	V	54.00	74.00	38.00	47.90	16.00	26.10

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	37.00	43.80	17.00	30.20
4 874.00	V	54.00	74.00	35.00	43.70	19.00	30.30

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]
4 923.97	H	54.00	74.00	36.00	43.10	18.00	30.90
4 924.02	V	54.00	74.00	33.20	42.40	20.80	31.60
2 486.97	H	54.00	74.00	34.20	44.10	19.80	29.90
2 450.00	V	54.00	74.00	32.90	44.60	21.10	29.40

Remarks

1. The EUT was tested in three orientations in order to determine that "X axis" was the worst case.

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]
2 389.97	H	54.00	74.00	39.76	51.70	14.24	22.30
2 390.00	V	54.00	74.00	37.56	52.00	16.44	22.00

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]
2 483.95	H	54.00	74.00	34.36	45.80	19.64	28.20
2 483.56	V	54.00	74.00	33.06	44.20	20.94	29.80

Remarks

1. The EUT was tested in three orientations in order to determine that "X axis" was the worst case.

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]
2 389.74	H	54.00	74.00	40.27	55.90	13.73	18.10
2 387.84	V	54.00	74.00	39.77	54.60	14.23	19.40

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]
2 483.79	H	54.00	74.00	36.57	46.70	17.43	27.30
2 483.50	V	54.00	74.00	33.27	46.70	20.73	27.30

Remarks

1. The EUT was tested in three orientations in order to determine that "X axis" was the worst case.

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.

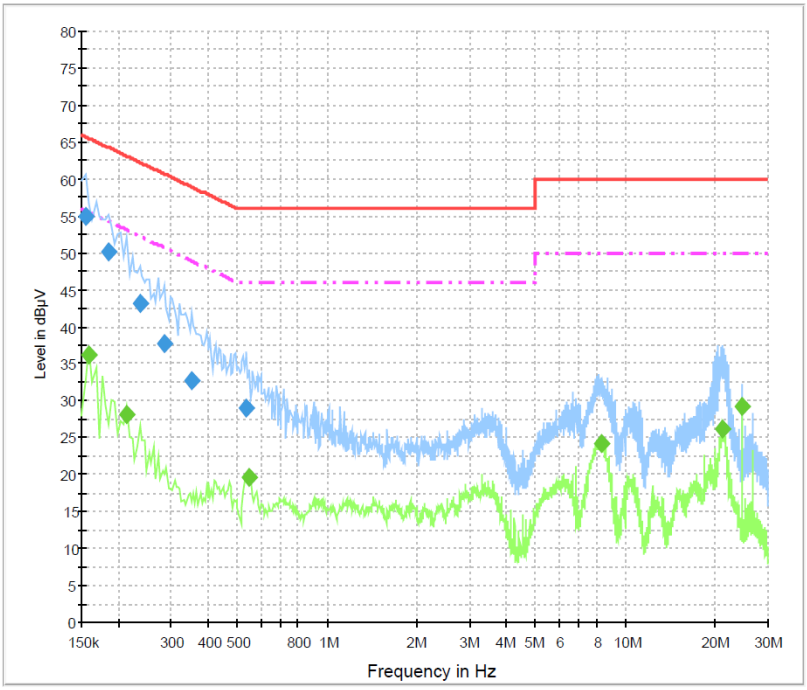
Test Results

The requirements are:
☒ Complies

Test Data

[LINE]

Class B_L1



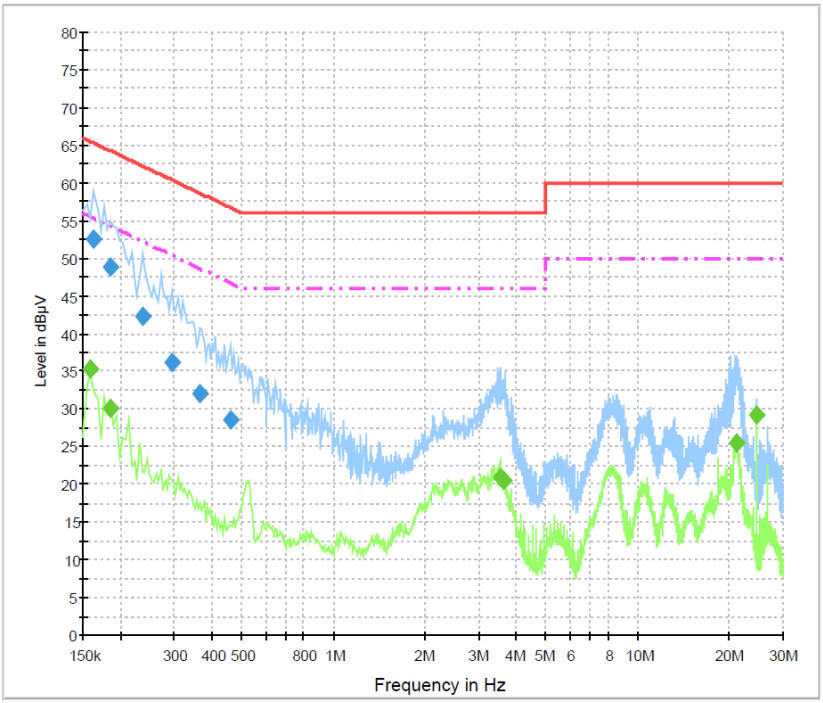
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.154500	55.0	1000.0	9.000	On	L1	9.8	10.8	65.8
0.186000	50.2	1000.0	9.000	On	L1	9.9	14.1	64.2
0.235500	43.2	1000.0	9.000	On	L1	9.8	19.1	62.3
0.285000	37.7	1000.0	9.000	On	L1	9.8	23.0	60.7
0.352500	32.7	1000.0	9.000	On	L1	9.9	26.2	58.9
0.537000	28.9	1000.0	9.000	On	L1	9.9	27.1	56.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.159000	36.2	1000.0	9.000	On	L1	9.8	19.3	55.5
0.213000	28.1	1000.0	9.000	On	L1	9.9	25.0	53.1
0.550500	19.6	1000.0	9.000	On	L1	9.9	26.4	46.0
8.295000	24.2	1000.0	9.000	On	L1	9.9	25.8	50.0
21.259500	26.1	1000.0	9.000	On	L1	10.0	23.9	50.0
24.576000	29.2	1000.0	9.000	On	L1	10.0	20.8	50.0

[NEUTRAL]
Class B_N



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.163500	52.5	1000.0	9.000	On	N	9.8	12.8	65.3
0.186000	48.9	1000.0	9.000	On	N	9.9	15.3	64.2
0.235500	42.4	1000.0	9.000	On	N	9.7	19.9	62.3
0.294000	36.3	1000.0	9.000	On	N	9.7	24.1	60.4
0.366000	32.0	1000.0	9.000	On	N	9.9	26.5	58.6
0.460500	28.6	1000.0	9.000	On	N	9.9	28.1	56.7

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.159000	35.2	1000.0	9.000	On	N	9.8	20.3	55.5
0.186000	30.2	1000.0	9.000	On	N	9.9	24.1	54.2
3.525000	21.0	1000.0	9.000	On	N	9.8	25.0	46.0
3.642000	20.5	1000.0	9.000	On	N	9.8	25.5	46.0
21.034500	25.5	1000.0	9.000	On	N	10.1	24.5	50.0
24.576000	29.2	1000.0	9.000	On	N	10.1	20.8	50.0

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	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	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	2017-10-25	2018-10-25
6	AMPLIFIER	SONOMA	310	291721	2018-02-02	2019-02-02
7	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2018-02-01	2019-02-01
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	2018-01-26	2019-01-26
12	LISN	Rohde & Schwarz	ENV216	101760	2018-01-31	2019-01-31
13	RF Cable	Canare Corporation	L-5D2W	N/A	-	-
14	RF Cable	Junkosha Inc.	MWX221	1510S085	-	-
15	RF Cable	HUBER+SUHNER	SUCOFLEX 102	MY073/2	-	-
16	RF Cable	HUBER+SUHNER	SUCOFLEX 102	MY4728/2	-	-
17	RF Cable	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	-	-
18	RF Cable	HUBER+SUHNER	SUCOFLEX 104	N/A	-	-
19	RF Cable	HUBER+SUHNER	SUCOFLEX 104	MY27573/4	-	-
20	RF Cable	HUBER+SUHNER	SUCOFLEX 106	N/A	-	-