TEST REPORT

CTK Co., Ltd.
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Tel: +82-31-339-9970
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Report No.: CTK-2017-02027

1. Client

◦ Name : Haier US Appliance Solutions, Inc.

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

◦ Date of Receipt : 2017-09-19

2. Manufacturer

◦ Name : Haier US Appliance Solutions, Inc.

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

3. Use of Report : For FCC / ISED Certification

4. Test Sample / Model: Wi-Fi Module / WCATB002

5. Date of Test : 2017-10-10 to 2017-10-23

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

7. Testing Environment: Temp.: (24 ± 5) ℃, Humidity: (48 ± 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)

2017-10-30

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

REPORT REVISION HISTORY

Date	Revision	Page No
2017-10-30	Issued (CTK-2017-02027)	all

CONTENTS

1.0 General Product Description

FCC ID	ZKJ-WCATB002
Certification Number ISED	10229A-WCATB002
Equipment model name	WCATB002
Serial number	Prototype
EUT condition	Pre-production, not damaged
Frequency Range	802.11b/g/n_HT20 : 2 412 MHz – 2 462 MHz

Frequency Range(MHz)	2 412 - 2 462		
Mode	802.11b	802.11g	802.11n_20
RF output power	16.83	14.95	14.10

Number of channels	802.11b/g/n_HT20 : 11
Transfer Rate	802.11b : 11 / 5.5 / 2 / 1 Mbps 802.11g : 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6 Mbps 802.11n : up to 72.2 Mbps
Type of Modulation	802.11b : DSSS 802.11g/n : OFDM
Power Source	DC 5 V
Duty Cycle	802.11b : 99 % 802.11g : 94 % 802.11n_HT20 : 94 %
Antenna Type	Chip Antenna
Antenna Gain	1.47 dBi
Hardware Rev	v1.1
Software Rev	V0.0.8.26

2.0 Facility and Accreditations

2.1 Test Facility

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

2.2 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Registration Number	Logo
USA	**FCC**	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	KR0025 (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.

3.0 Test Specifications

3.1 Standards

FCC Part Section(s)	Requirement(s)	Limit	Status (Note 1)	Test Condition
15.247(a)	6 dB Bandwidth	> 500 kHz	C	Conducted
15.247(b)	Maximum Output Power	< 1 Watt	C	
15.247(d)	Conducted Spurious emission	> 30 dBc	C	
15.247(d)	Band Edge	> 30 dBc	C	
15.247(e)	Transmitter Power Spectral Density	< 8 dBm @ 3 kHz	C	
15.209	Field Strength of Harmonics	15.209(a)	C	Radiated
15.207	AC Conducted Emissions	15.207(a)	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.				

ISED Part Section(s)	Requirement(s)	Limit	Status (Note 1)	Test Condition
RSS-Gen 4.6.1	6 dB Bandwidth	NA	C	Conducted
RSS-247 5.4(d)	Maximum Output Power	< 1 Watt	C	
RSS-Gen 6.13	Conducted Spurious emission	RSS-247 5.5	C	
RSS-Gen 6.13	Band Edge	RSS-247 5.5	C	
RSS-247 5.2(b)	Transmitter Power Spectral Density	< 8 dBm @ 3 kHz	C	
RSS-Gen 6.13	Field Strength of Harmonics	RSS-247 5.5	C	Radiated
RSS-Gen 5	Receiver Spurious Emissions	RSS-Gen 7.1.2	C	
RSS-Gen 8.8	AC Conducted Emissions	RSS-Gen 8.8	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.				

The sample was tested according to the following specification:
FCC Part 15.247, ANSI C63.10-2013, RSS-247 Issue 2

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.
For WLAN function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.
All modulation modes were tests. The results are only attached worst cases.

Test mode

Test Item	Modulation	Data Rate
6 dB Bandwidth Maximum Output Power Conducted Spurious emission Band Edge Power Spectral Density Radiated Emissions Above 1GHz	802.11b	1 Mbps
	802.11g	6 Mbps
	802.11n	MCS 0
AC Conducted Emissions	Nomal Mode	Auto

Test Frequency

- 802.11b, 802.11g, 802.11n_HT20

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

3.3 Device Modifications

The following modifications were necessary for compliance:

Not applicable

3.4 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	ProBook 650 G1	5CG5114KD2
AC/DC Adapter	HP	PPP012D-S	-

3.5 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

3.6 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

4.0 Technical Characteristic Test

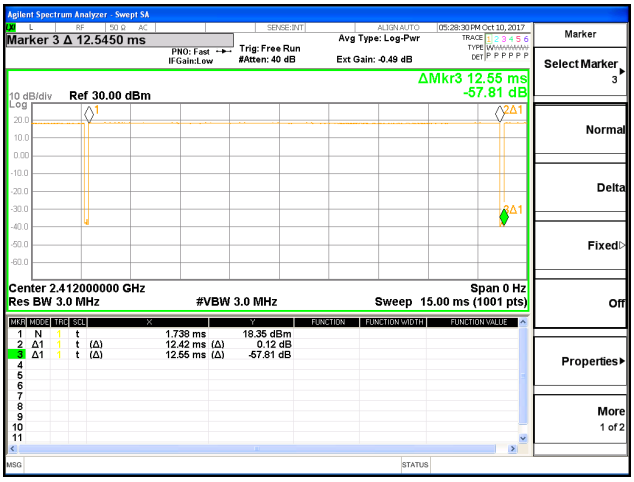
4.1 ON Time, Duty Cycle

Test Procedures

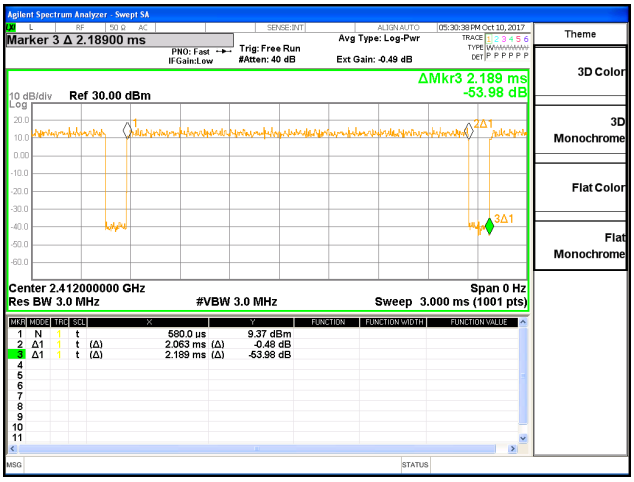
KDB 558074 Zero-Span Spectrum Analyzer Method.

Test Data:

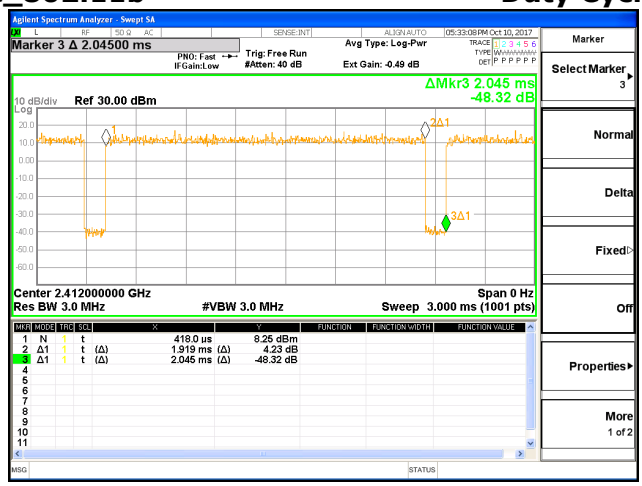
	ON Time (ms)	Period (ms)	TX OFF (ms)	Duty Cycle (linear)	Duty Cycle (%)
802.11b	12.420	12.550	0.130	0.99	99
802.11g	2.063	2.189	0.126	0.94	94
802.11n_HT20	1.919	2.045	0.126	0.94	94



Duty Cycle_802.11b



Duty Cycle_802.11g



Duty Cycle_802.11n_HT20

4.2 6dB Bandwidth

Test Procedures (ANSI C63.10-2013 6.9.2)

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)

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.

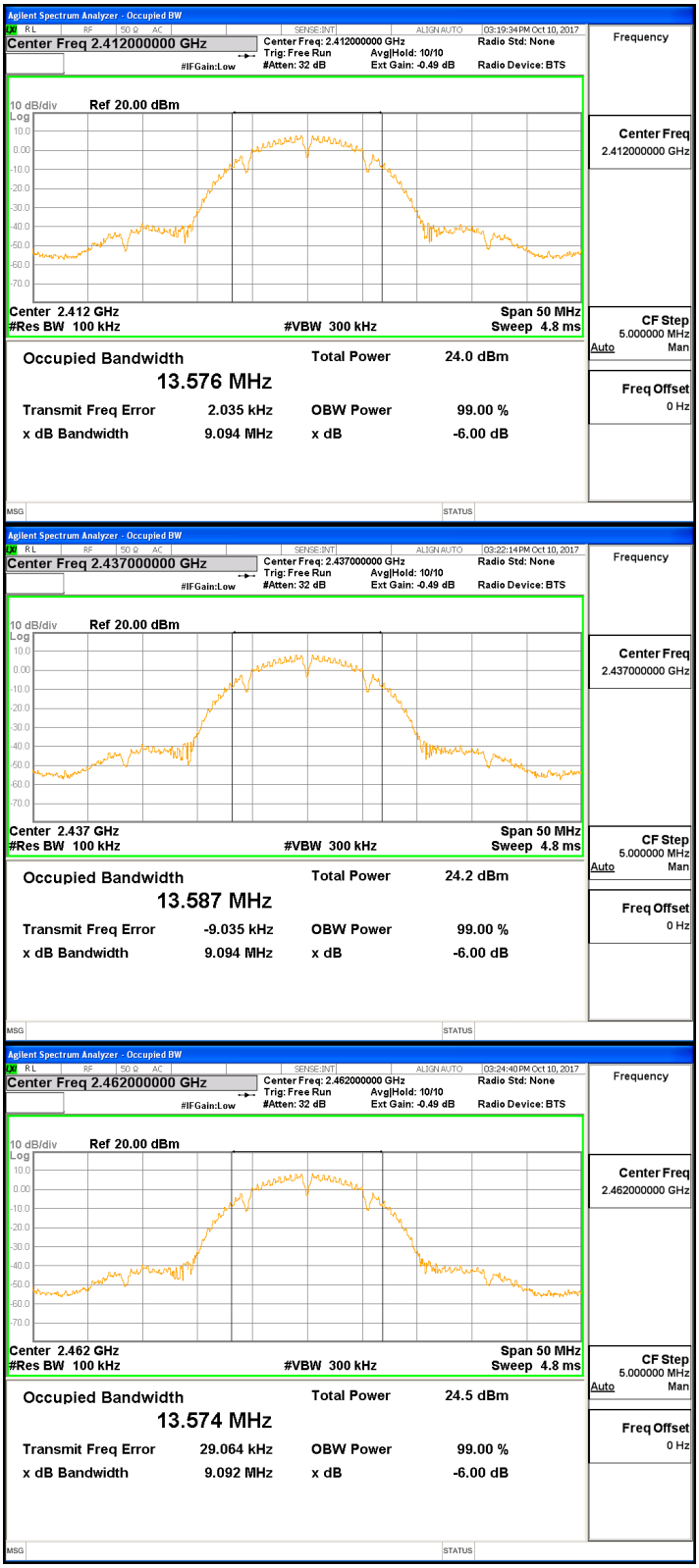
Minimum Standard:

6 dB Bandwidth > 500kHz

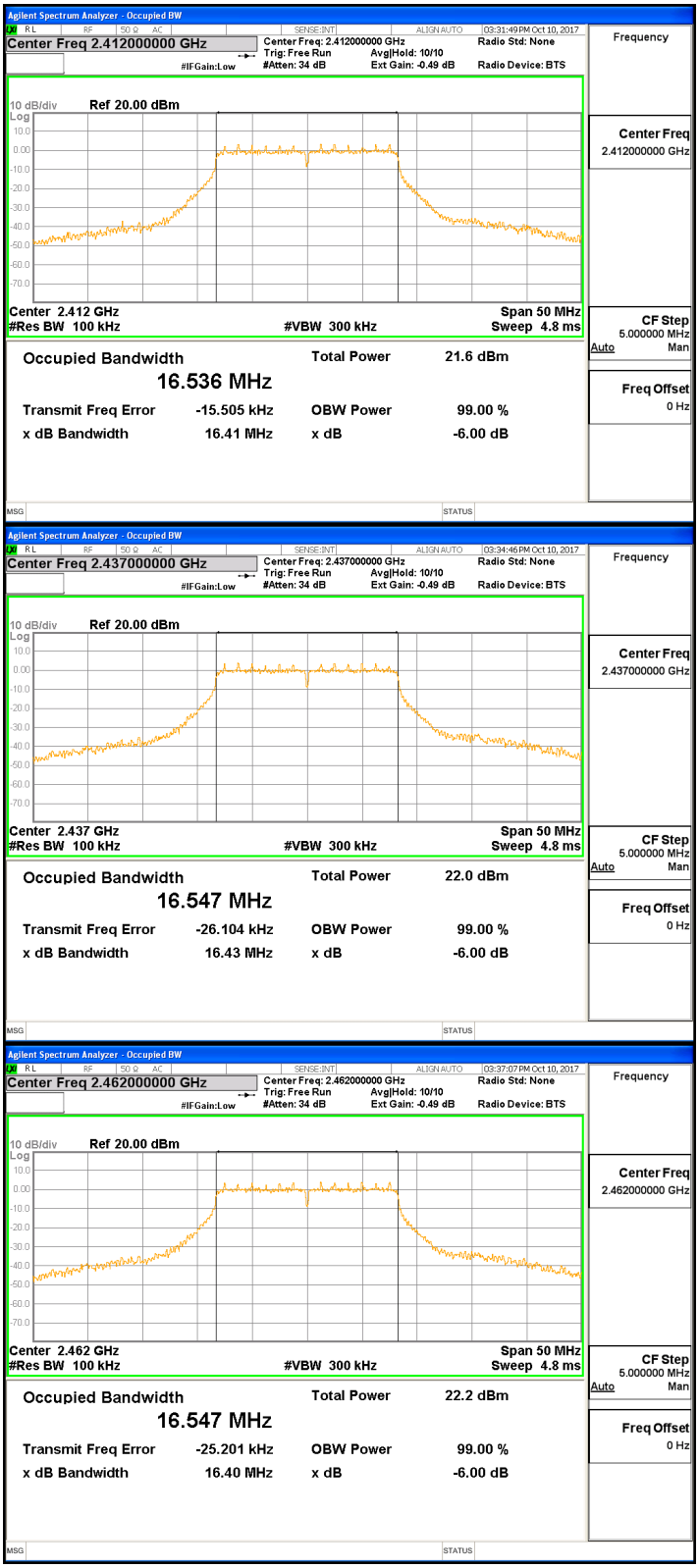
Test Data:

	6 dB Bandwidth and 99% Bandwidth (MHz)					
Frequency	2 412 MHz		2 437 MHz		2 462 MHz	
Mode	6dB	99%	6dB	99%	6dB	99%
802.11b	9.094	13.576	9.094	13.587	9.092	13.574
802.11g	16.410	16.536	16.430	16.547	16.400	16.547
802.11n HT20	17.560	17.642	17.570	17.656	17.600	17.656

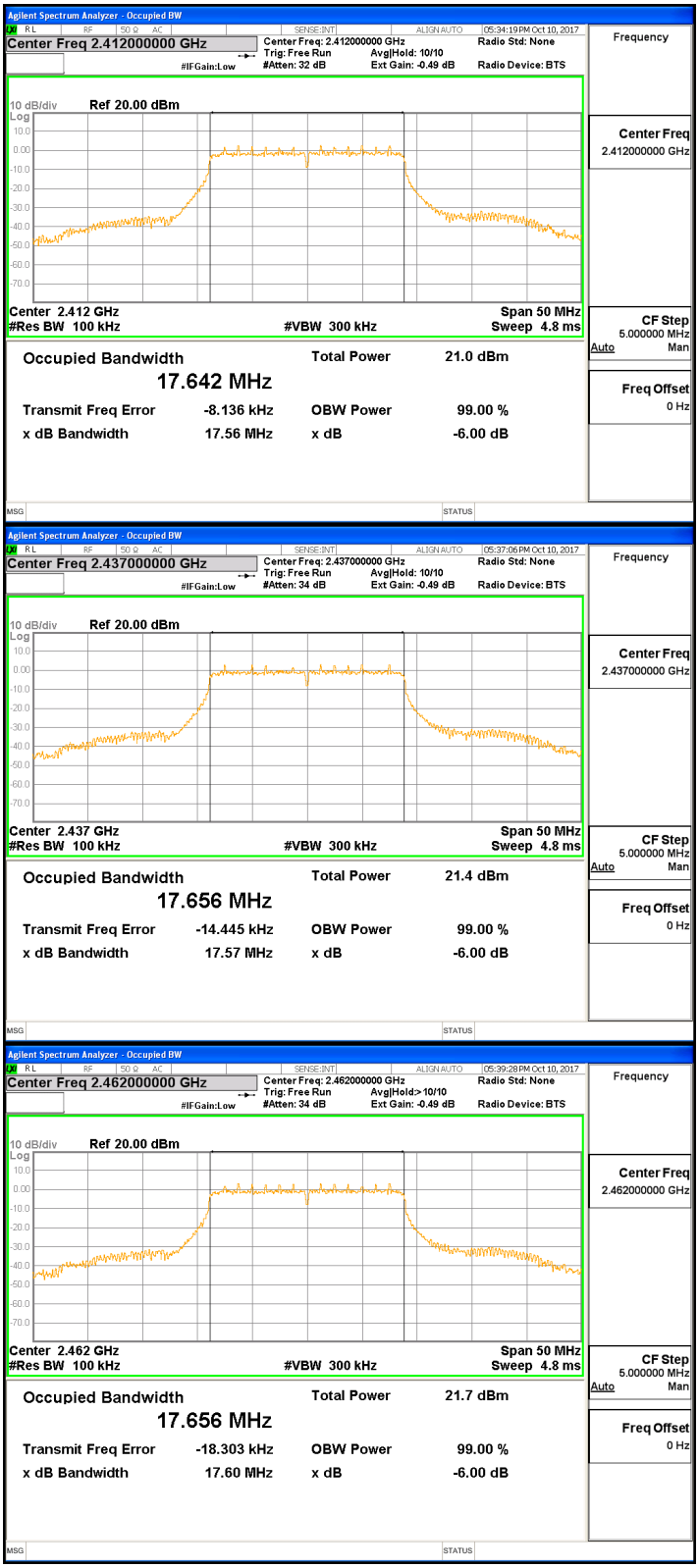
See next pages for actual measured spectrum plots.


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
Ext Gain: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
03:19:34 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Log
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
13.576 MHz
Total Power
24.0 dBm
Transmit Freq Error
2.035 kHz
OBW Power
99.00 %
x dB Bandwidth
9.094 MHz
x dB
-6.00 dB
MSG
STATUS
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: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
03:22:14 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Log
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
13.587 MHz
Total Power
24.2 dBm
Transmit Freq Error
-9.035 kHz
OBW Power
99.00 %
x dB Bandwidth
9.094 MHz
x dB
-6.00 dB
MSG
STATUS
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: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
03:24:40 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Log
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
13.574 MHz
Total Power
24.5 dBm
Transmit Freq Error
29.064 kHz
OBW Power
99.00 %
x dB Bandwidth
9.092 MHz
x dB
-6.00 dB
MSG
STATUS

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: 34 dB
Ext Gain: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
03:31:49 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Log
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
16.536 MHz
Total Power
21.6 dBm
Transmit Freq Error
-15.505 kHz
OBW Power
99.00 %
x dB Bandwidth
16.41 MHz
x dB
-6.00 dB
MSG
STATUS
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: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
03:34:46 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Log
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
16.547 MHz
Total Power
22.0 dBm
Transmit Freq Error
-26.104 kHz
OBW Power
99.00 %
x dB Bandwidth
16.43 MHz
x dB
-6.00 dB
MSG
STATUS
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: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
03:37:07 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Log
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
16.547 MHz
Total Power
22.2 dBm
Transmit Freq Error
-25.201 kHz
OBW Power
99.00 %
x dB Bandwidth
16.40 MHz
x dB
-6.00 dB
MSG
STATUS

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: 32 dB
Ext Gain: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
05:34:19 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Log
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
17.642 MHz
Total Power
21.0 dBm
Transmit Freq Error
-8.136 kHz
OBW Power
99.00 %
x dB Bandwidth
17.56 MHz
x dB
-6.00 dB
MSG
STATUS
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: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
05:37:06 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Log
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
17.656 MHz
Total Power
21.4 dBm
Transmit Freq Error
-14.445 kHz
OBW Power
99.00 %
x dB Bandwidth
17.57 MHz
x dB
-6.00 dB
MSG
STATUS
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: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
05:39:28 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Log
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
17.656 MHz
Total Power
21.7 dBm
Transmit Freq Error
-18.303 kHz
OBW Power
99.00 %
x dB Bandwidth
17.60 MHz
x dB
-6.00 dB
MSG
STATUS

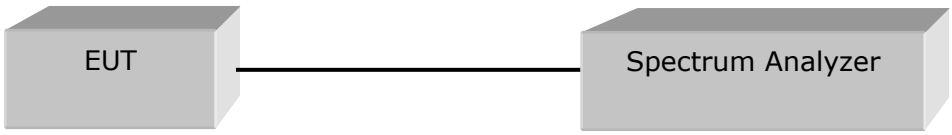
802.11n_HT20

4.3 OUTPUT POWER

Test Procedures

Average Power(Procedure 9.2.2.2 in KDB 558074, Method AVGSA-1)

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

Limit

< 1 W

Test Data

Test Mode : 802.11b

	Measured Output Power (dBm)		
Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)
2 412	16.42	30	13.58
2 437	16.58	30	13.42
2 462	16.83	30	13.17

Test Mode : 802.11g

	Measured Output Power (dBm)		
Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)
2 412	14.33	30	15.67
2 437	14.80	30	15.20
2 462	14.95	30	15.05

Test Mode : 802.11n_HT20

	Measured Output Power (dBm)		
Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)
2 412	13.54	30	16.46
2 437	13.91	30	16.09
2 462	14.10	30	15.90


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: -0.49 dB
Radio Std: None
Radio Device: BTS
03:19:38 PM Oct 10, 2017
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
16.42 dBm / 13.58 MHz
Power Spectral Density
-54.91 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: -0.49 dB
Radio Std: None
Radio Device: BTS
03:22:18 PM Oct 10, 2017
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
16.58 dBm / 13.59 MHz
Power Spectral Density
-54.75 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: -0.49 dB
Radio Std: None
Radio Device: BTS
03:24:44 PM Oct 10, 2017
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
16.83 dBm / 13.57 MHz
Power Spectral Density
-54.49 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: 34 dB
Ext Gain: -0.49 dB
Radio Std: None
Radio Device: BTS
03:31:53 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Center 2.412 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
Channel Power
14.33 dBm / 16.54 MHz
Power Spectral Density
-57.85 dBm /Hz
Center Freq
2.412000000 GHz
CF Step
5.000000 MHz
Auto
Man
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: 34 dB
Ext Gain: -0.49 dB
Radio Std: None
Radio Device: BTS
03:34:50 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Center 2.437 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
Channel Power
14.80 dBm / 16.55 MHz
Power Spectral Density
-57.39 dBm /Hz
Center Freq
2.437000000 GHz
CF Step
5.000000 MHz
Auto
Man
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: -0.49 dB
Radio Std: None
Radio Device: BTS
03:37:11 PM Oct 10, 2017
Frequency
10 dB/div
Ref 20.00 dBm
Center 2.462 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
Channel Power
14.95 dBm / 16.55 MHz
Power Spectral Density
-57.23 dBm /Hz
Center Freq
2.462000000 GHz
CF Step
5.000000 MHz
Auto
Man
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: 32 dB
Ext Gain: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
10 dB/div
Ref 20.00 dBm
Center 2.412 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
Channel Power
13.54 dBm / 17.64 MHz
Power Spectral Density
-58.92 dBm /Hz
Frequency
Center Freq
2.412000000 GHz
CF Step
5.000000 MHz
Auto
Man
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: 34 dB
Ext Gain: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
10 dB/div
Ref 20.00 dBm
Center 2.437 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
Channel Power
13.91 dBm / 17.66 MHz
Power Spectral Density
-58.56 dBm /Hz
Frequency
Center Freq
2.437000000 GHz
CF Step
5.000000 MHz
Auto
Man
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: -0.49 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
10 dB/div
Ref 20.00 dBm
Center 2.462 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 50 MHz
Sweep 1 ms
Channel Power
14.10 dBm / 17.66 MHz
Power Spectral Density
-58.37 dBm /Hz
Frequency
Center Freq
2.462000000 GHz
CF Step
5.000000 MHz
Auto
Man
Freq Offset
0 Hz

802.11n_HT20

4.4 Power Spectral Density

Test Procedures

Procedure 10.2 in KDB 558074, Method Peak PSD

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

Power Spectral Density	< 8dBm @ 3 kHz BW

Test Data

Test Mode : 802.11b

	Measured Power Density (dBm/3kHz)		
Frequency (MHz)	Result (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
2 412	-0.796	8	8.796
2 437	0.895	8	7.105
2 462	-0.316	8	8.316

Test Mode : 802.11g

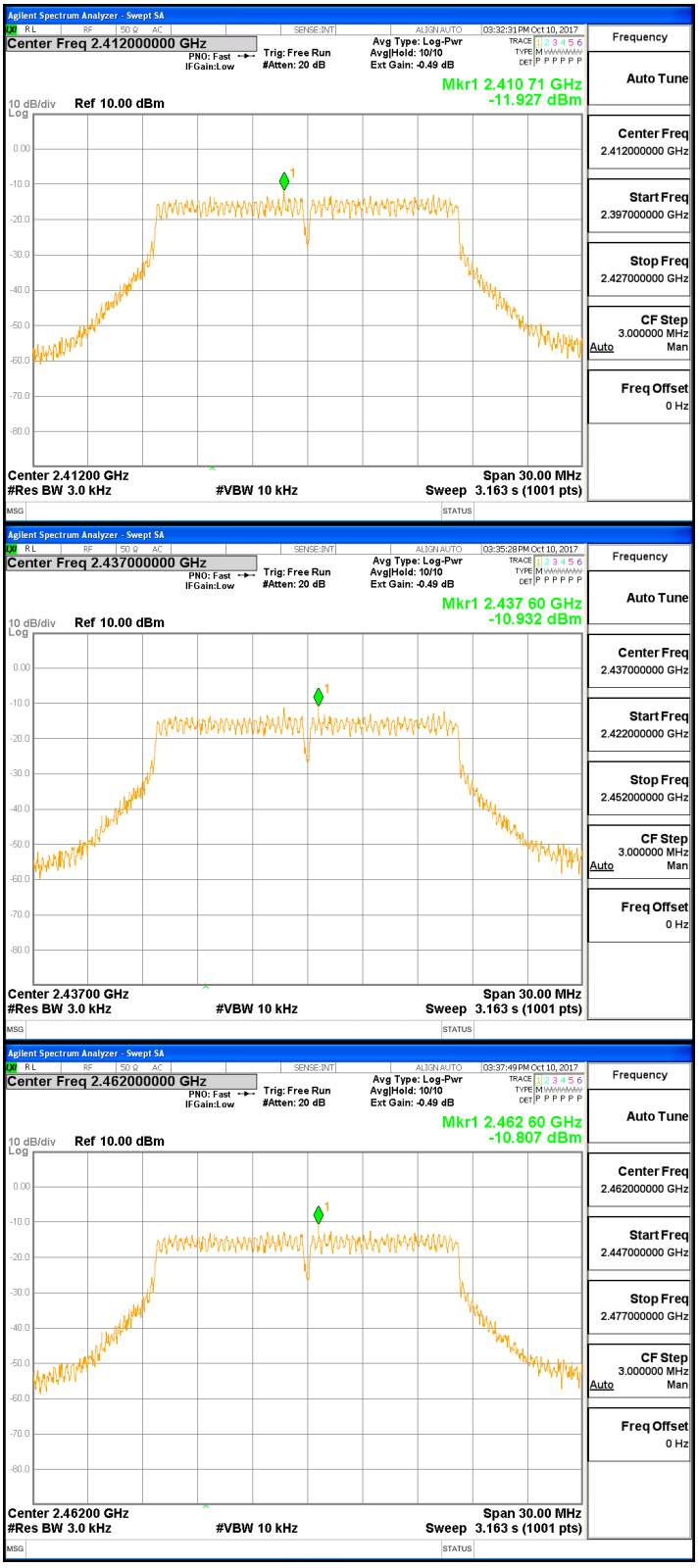
	Measured Power Density (dBm/3kHz)		
Frequency (MHz)	Result (dBm/3kHz)	Frequency (MHz)	Margin (dB)
2 412	-11.927	8	19.927
2 437	-10.932	8	18.932
2 462	-10.807	8	18.807

Test Mode : 802.11n_HT20

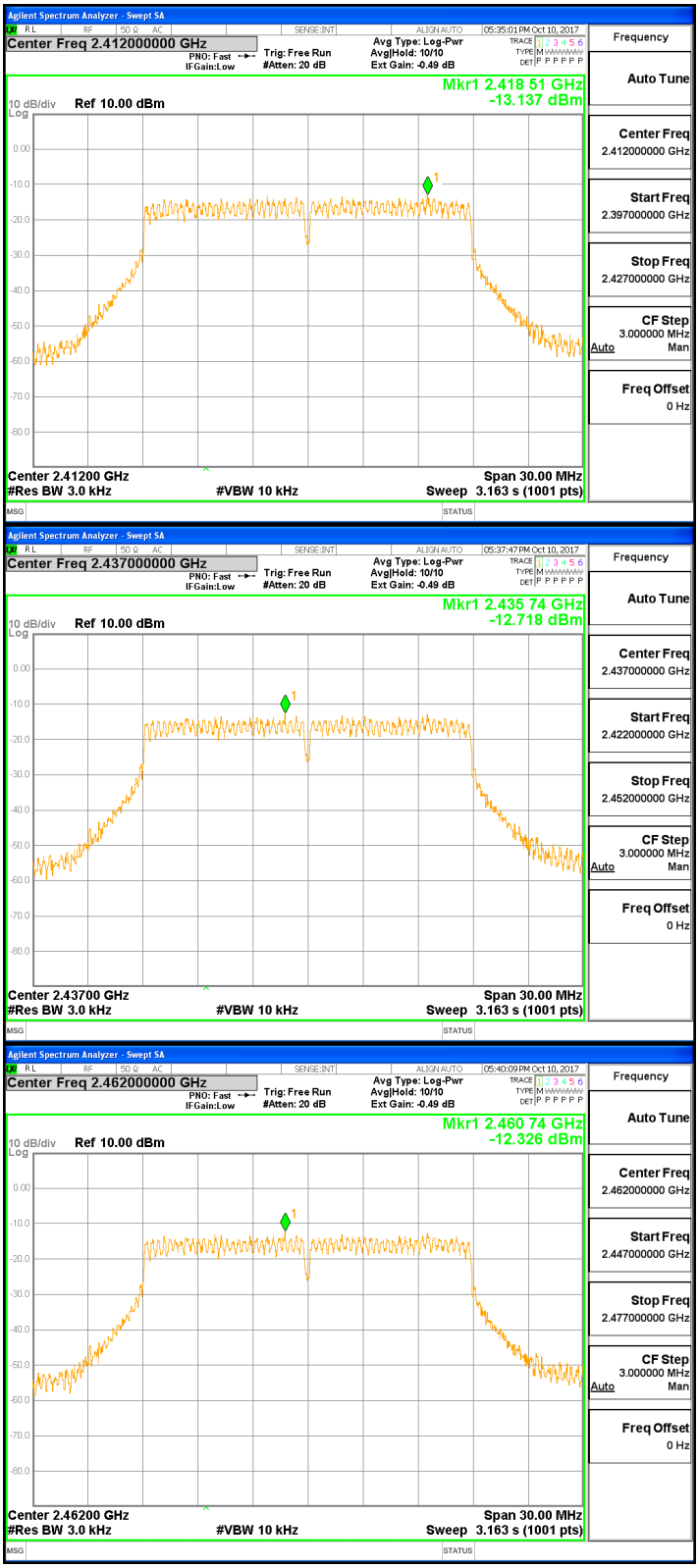
	Measured Power Density (dBm/3kHz)		
Frequency (MHz)	Result (dBm/3kHz)	Frequency (MHz)	Margin (dB)
2 412	-13.137	8	21.137
2 437	-12.718	8	20.718
2 462	-12.326	8	20.326


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.412000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.49 dB
03:20:15 PM Oct 10, 2017
Mkr1 2.415 72 GHz
-0.796 dBm
10 dB/div
Log
Ref 10.00 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: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.49 dB
03:22:55 PM Oct 10, 2017
Mkr1 2.439 73 GHz
0.895 dBm
10 dB/div
Log
Ref 10.00 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: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.49 dB
03:25:21 PM Oct 10, 2017
Mkr1 2.465 24 GHz
-0.316 dBm
10 dB/div
Log
Ref 10.00 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: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.49 dB
03:32:31 PM Oct 10, 2017
Mkr1 2.410 71 GHz
-11.927 dBm
10 dB/div
Log
Ref 10.00 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: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.49 dB
03:35:28 PM Oct 10, 2017
Mkr1 2.437 60 GHz
-10.932 dBm
10 dB/div
Log
Ref 10.00 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: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.49 dB
03:37:49 PM Oct 10, 2017
Mkr1 2.462 60 GHz
-10.807 dBm
10 dB/div
Log
Ref 10.00 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: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.49 dB
05:35:01 PM Oct 10, 2017
Mkr1 2.418 51 GHz
-13.137 dBm
10 dB/div
Log
Ref 10.00 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: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.49 dB
05:37:47 PM Oct 10, 2017
Mkr1 2.435 74 GHz
-12.718 dBm
10 dB/div
Log
Ref 10.00 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: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -0.49 dB
05:40:09 PM Oct 10, 2017
Mkr1 2.460 74 GHz
-12.326 dBm
10 dB/div
Log
Ref 10.00 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

4.5 Band - edge

Test Procedures

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.

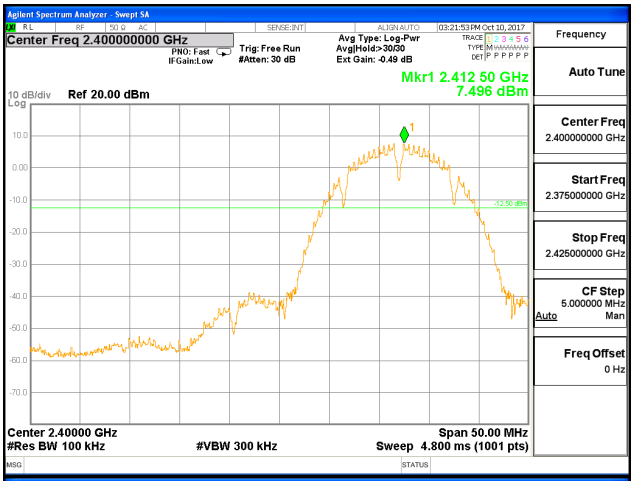
Limit :

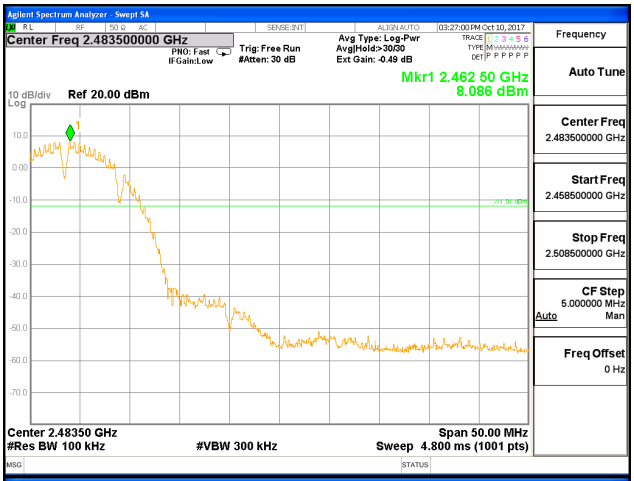
Emission level	<	30 dBc

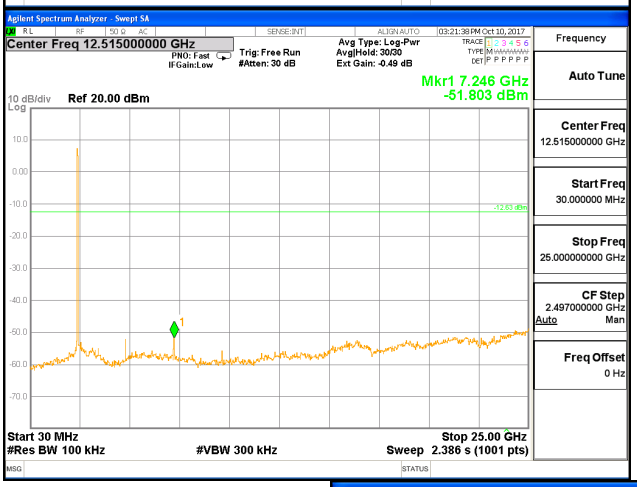
Test Data: Complies

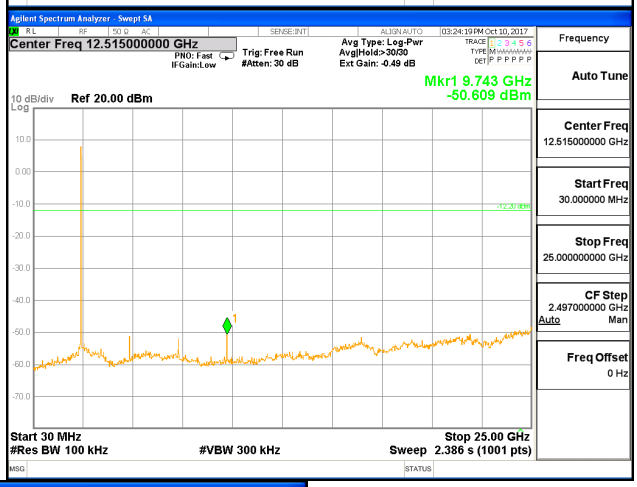
- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 30dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.

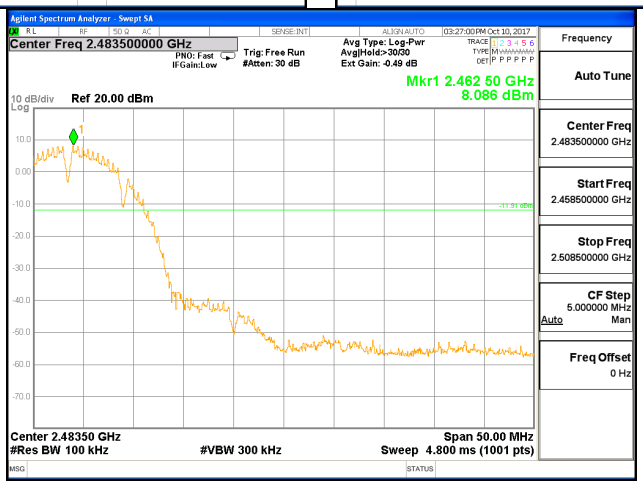
See next pages for actual measured spectrum plots.


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
03:21:53 PM Oct 10, 2017
Mkr1 2.412 50 GHz
7.496 dBm
10 dB/div
Log
Ref 20.00 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

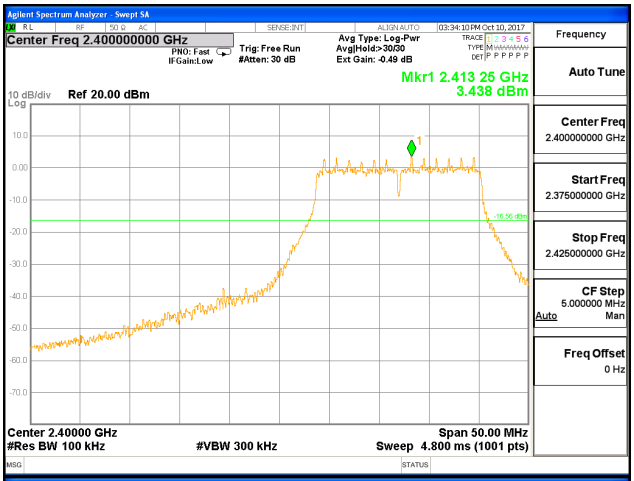

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
03:27:00 PM Oct 10, 2017
Mkr1 2.462 50 GHz
8.086 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 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

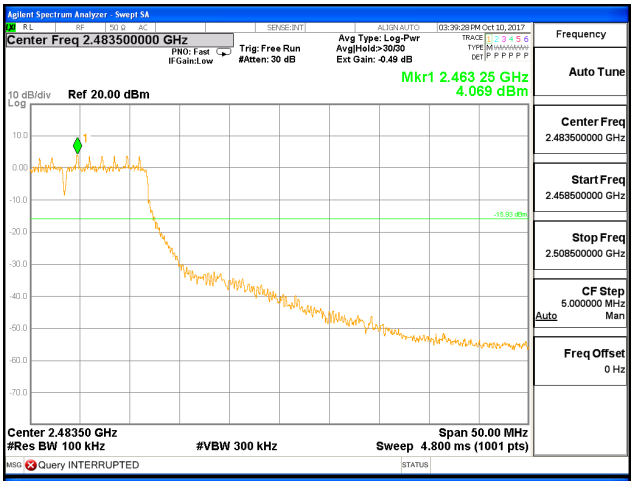

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -0.49 dB
03:21:39 PM Oct 10, 2017
Mkr1 7.246 GHz
-51.803 dBm
10 dB/div
Log
Ref 20.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 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

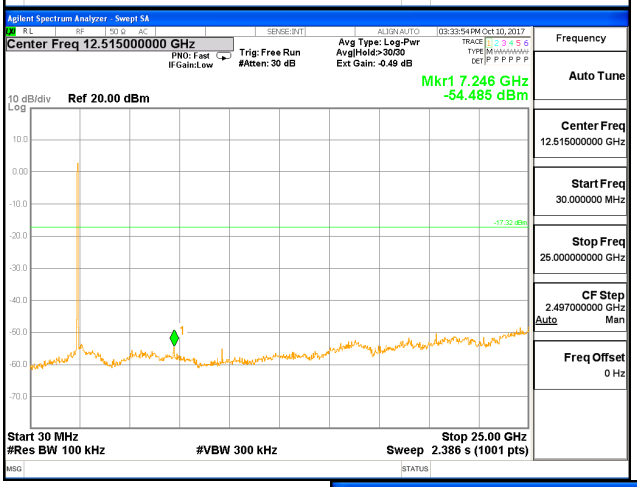

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
03:24:19 PM Oct 10, 2017
Mkr1 9.743 GHz
-50.609 dBm
10 dB/div
Log
Ref 20.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 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

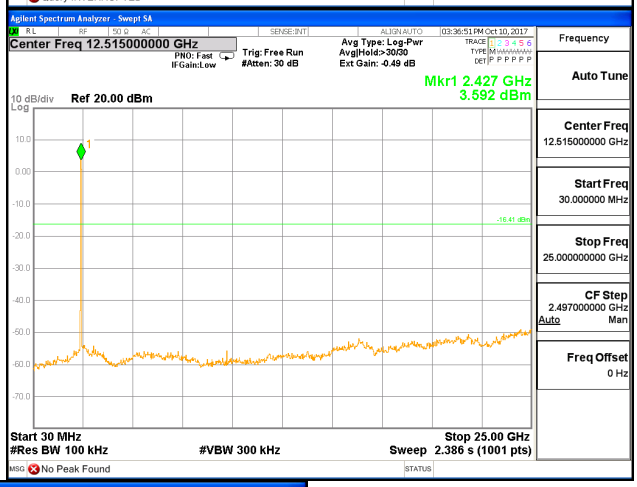

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
03:27:00 PM Oct 10, 2017
Mkr1 2.462 50 GHz
8.086 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 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

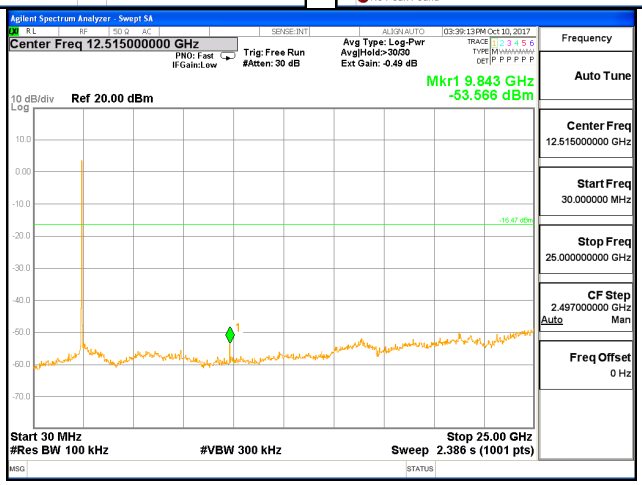
802.11b


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
03:34:10 PM Oct 10, 2017
Mkr1 2.413 25 GHz
3.438 dBm
10 dB/div
Log
Ref 20.00 dBm
-16.56 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

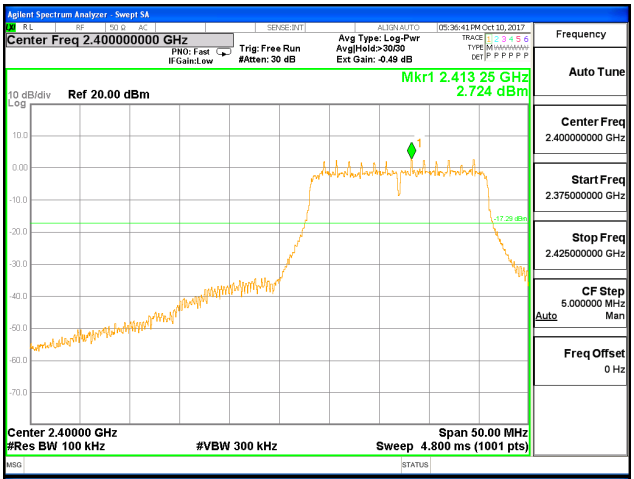

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
03:39:28 PM Oct 10, 2017
Mkr1 2.463 25 GHz
4.069 dBm
10 dB/div
Log
Ref 20.00 dBm
-15.93 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
Query INTERRUPTED
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

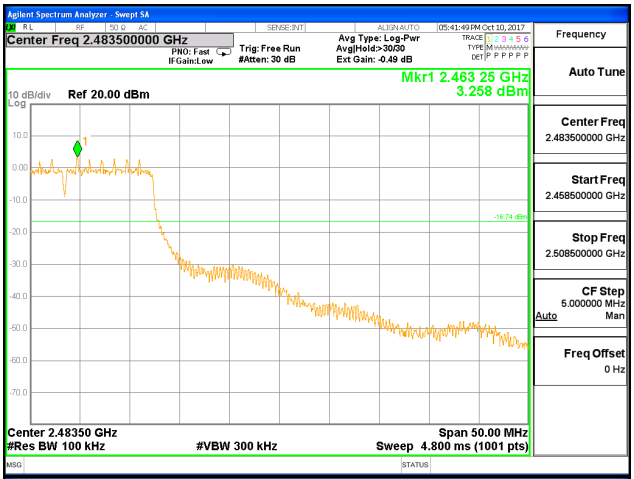

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
03:33:54 PM Oct 10, 2017
Mkr1 7.246 GHz
-54.485 dBm
10 dB/div
Log
Ref 20.00 dBm
-17.32 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
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

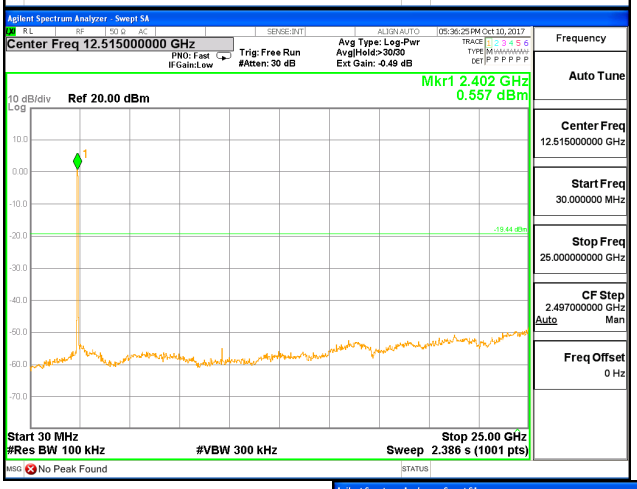

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
03:36:51 PM Oct 10, 2017
Mkr1 2.427 GHz
3.592 dBm
10 dB/div
Log
Ref 20.00 dBm
-16.41 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
No Peak Found
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

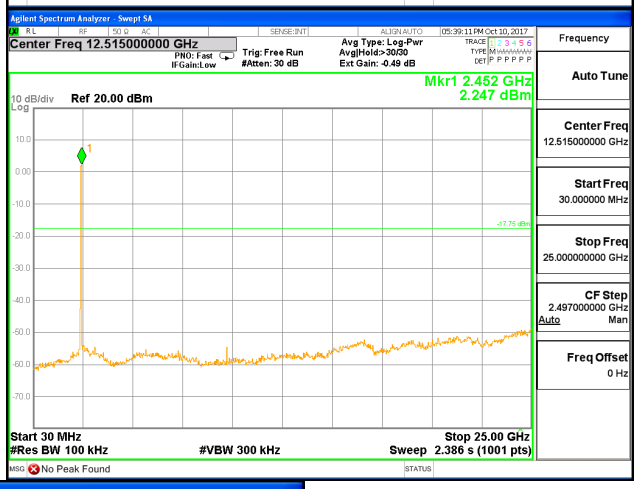

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
03:39:13 PM Oct 10, 2017
Mkr1 9.843 GHz
-53.566 dBm
10 dB/div
Log
Ref 20.00 dBm
-16.47 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
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

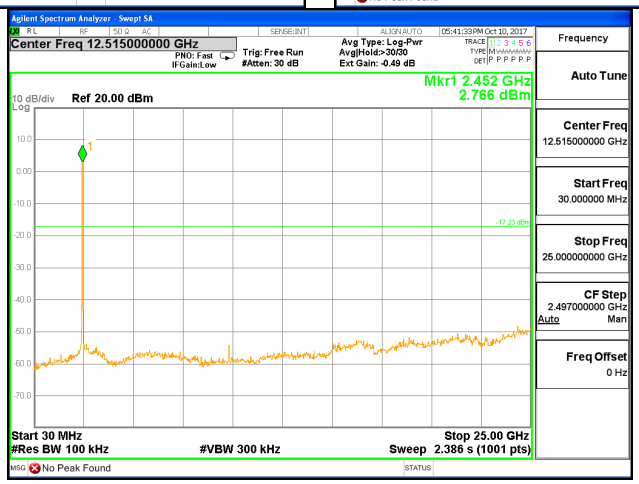
802.11g


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
05:36:41 PM Oct 10, 2017
Mkr1 2.413 25 GHz
2.724 dBm
10 dB/div
Ref 20.00 dBm
Log
-17.29 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
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
05:41:49 PM Oct 10, 2017
Mkr1 2.463 25 GHz
3.258 dBm
10 dB/div
Ref 20.00 dBm
Log
-16.74 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
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
05:36:25 PM Oct 10, 2017
Mkr1 2.402 GHz
0.557 dBm
10 dB/div
Ref 20.00 dBm
Log
-19.44 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
MSG
No Peak Found
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
05:39:11 PM Oct 10, 2017
Mkr1 2.452 GHz
2.247 dBm
10 dB/div
Ref 20.00 dBm
Log
-17.75 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
MSG
No Peak Found
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -0.49 dB
05:41:33 PM Oct 10, 2017
Mkr1 2.452 GHz
2.766 dBm
10 dB/div
Ref 20.00 dBm
Log
-17.23 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
MSG
No Peak Found
STATUS

802.11n_HT20

4.6 Field Strength of Emissions

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 Test Antenna is positioned with its plane vertical at 1m distance from the EUT. 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 ~ 25 GHz (2.4 GHz 10^{th} harmonic)

a) RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz, 9 kHz for f < 30 MHz

b) VBW ≥ RBW

c) Sweep time = auto couple

Limit

- **15.209(a)**

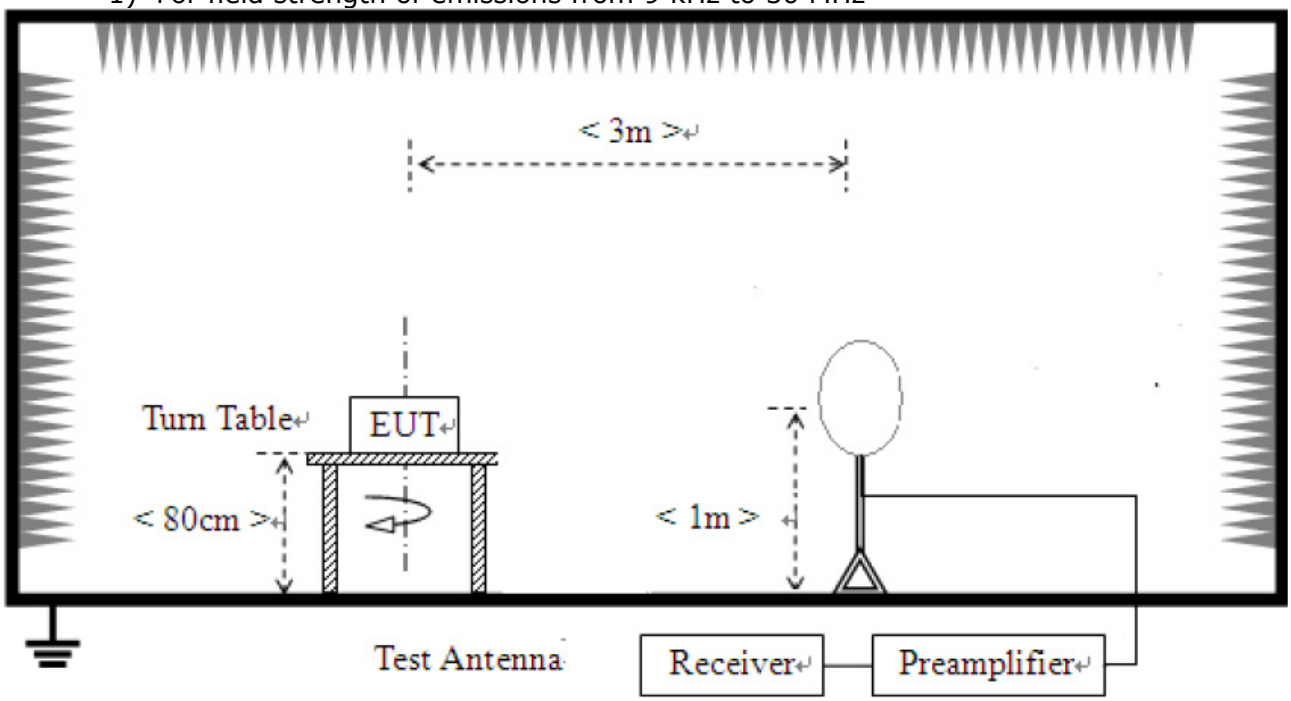
Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Deasurement Distance (meters)
0.009-0.490	2 400/F(kHz)	-	300
0.490-1.705	24 000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

** 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.

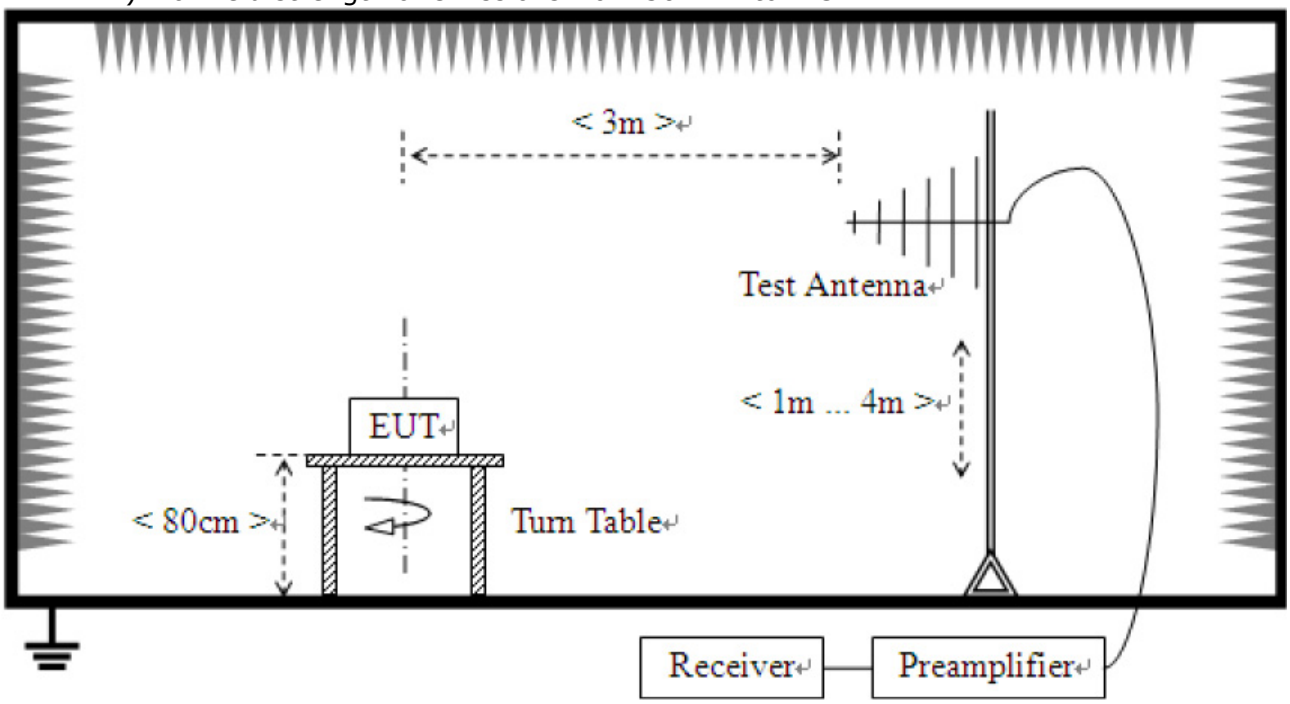
Note :
1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
2) For above 1 GHz, limit field strength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

Test Setup:

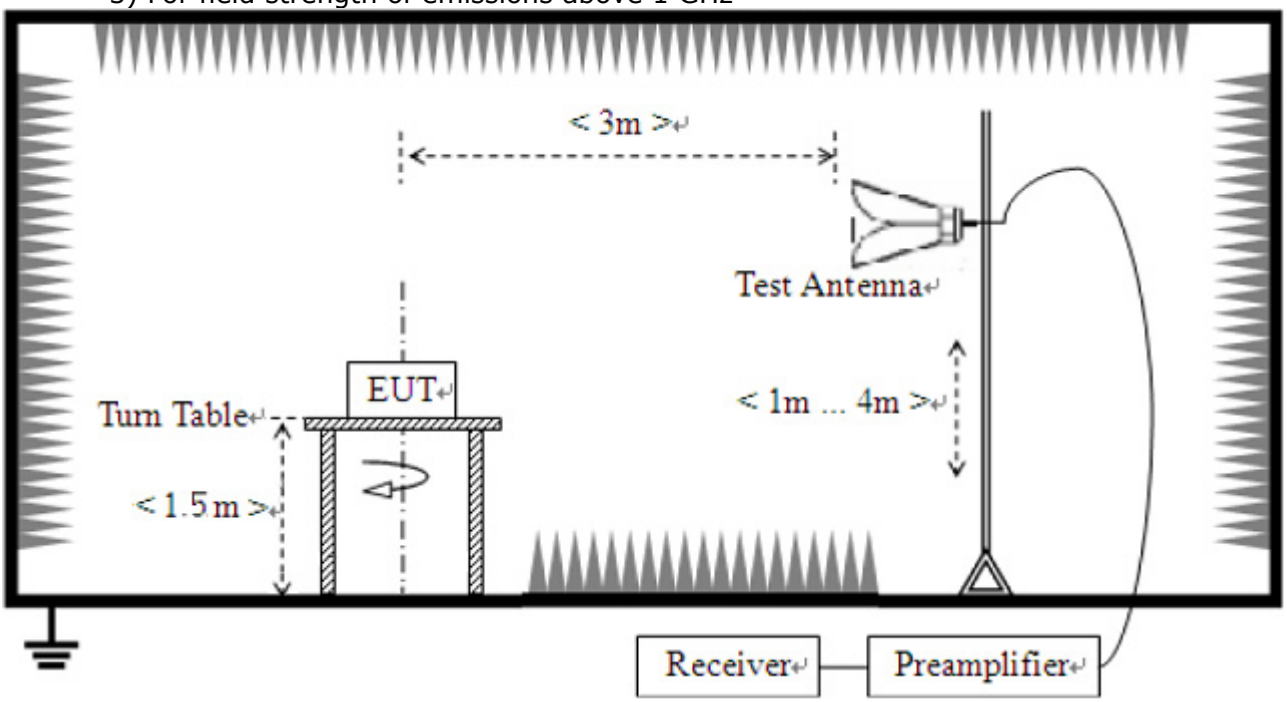
1) For field strength of emissions from 9 kHz to 30 MHz



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

EUT	Wi-Fi Module	Measurement Detail	
Model	WCATB002	Frequency Range	9 kHz – 30 MHz
Test mode	802.11b/g/n_HT20	Detector function	Quasi-Peak

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)

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(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea
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2) 30 MHz to 1 GHz

Test mode : 802.11b(Worst Case)

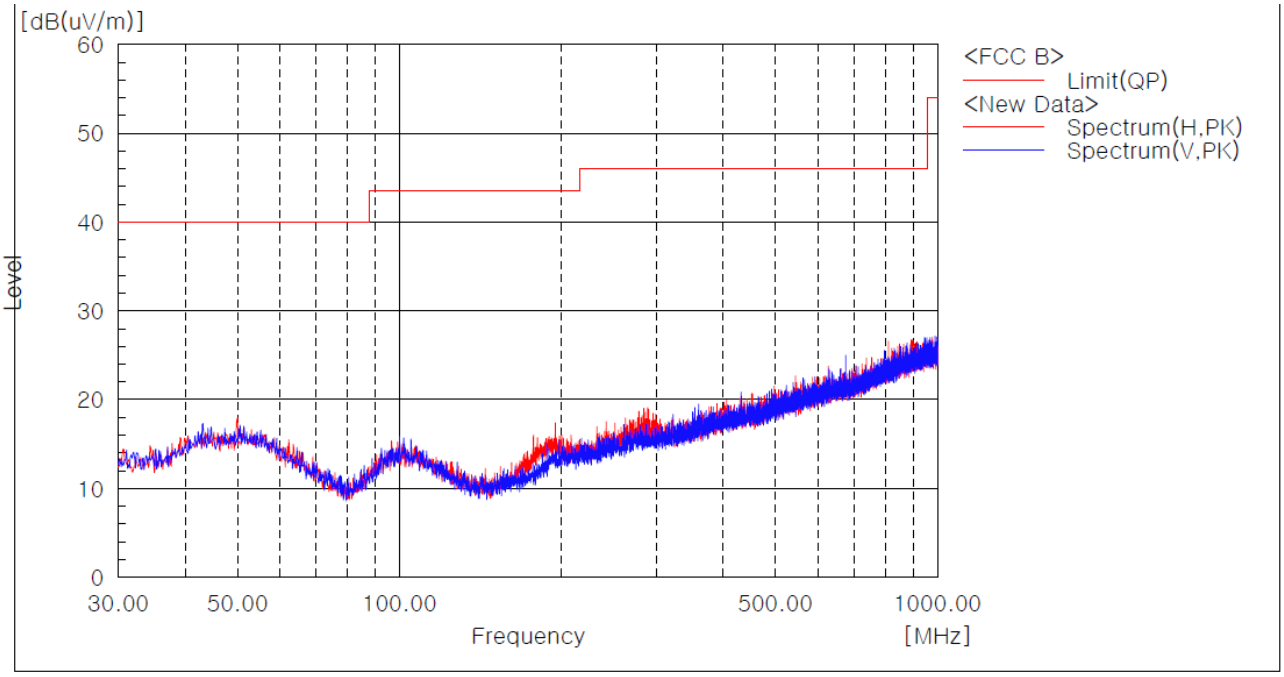
EUT	Wi-Fi Module	Measurement Detail	
Model	WCATB002	Frequency Range	Below 1 000 MHz
Configuration	802.11b	Detector function	Quasi-Peak

The requirements are:

☒ Complies

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

Test Data



Final Result

No.	Frequency [MHz]	(P)	c.f [dB(1/m)]	Angle [deg]	Remark

Remark :
1. The worst emission was found in li-down 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 : 802.11g(Worst Case)

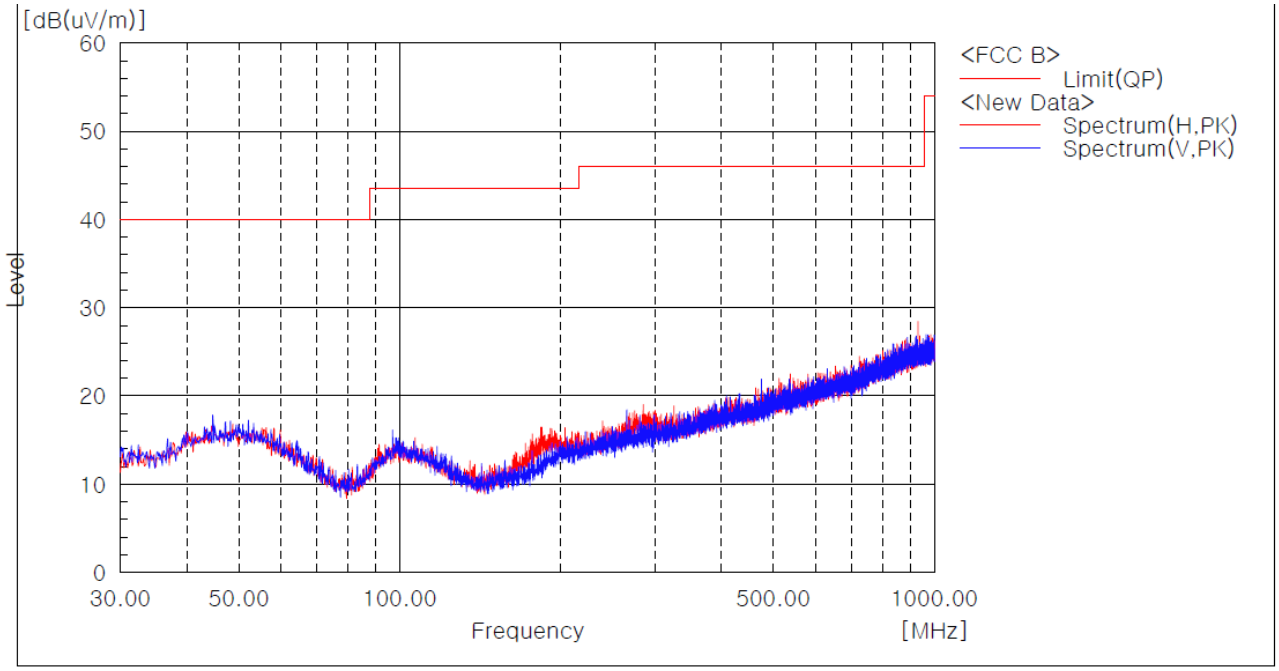
EUT	Wi-Fi Module	Measurement Detail	
Model	WCATB002	Frequency Range	Below 1 000 MHz
Configuration	802.11g	Detector function	Quasi-Peak

The requirements are:

☒ Complies

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

Test Data



Final Result

No.	Frequency [MHz]	(P)	c.f [dB(1/m)]	Angle [deg]	Remark

Remark :
1. The worst emission was found in li-down 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 : 802.11n_HT20(Worst Case)

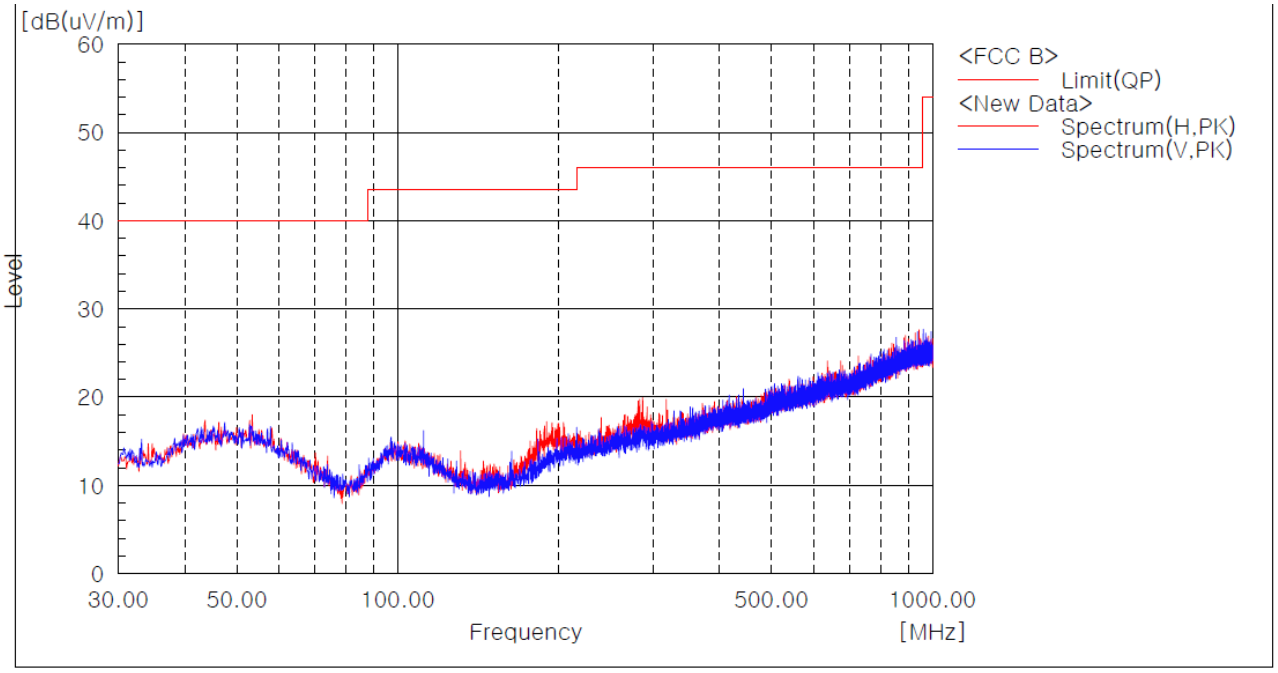
EUT	Wi-Fi Module	Measurement Detail	
Model	WCATB002	Frequency Range	Below 1 000 MHz
Configuration	802.11n_HT20	Detector function	Quasi-Peak

The requirements are:

☒ Complies

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

Test Data



Final Result

No.	Frequency [MHz]	(P)	c.f [dB(1/m)]	Angle [deg]	Remark

Remark :
1. The worst emission was found in li-down 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

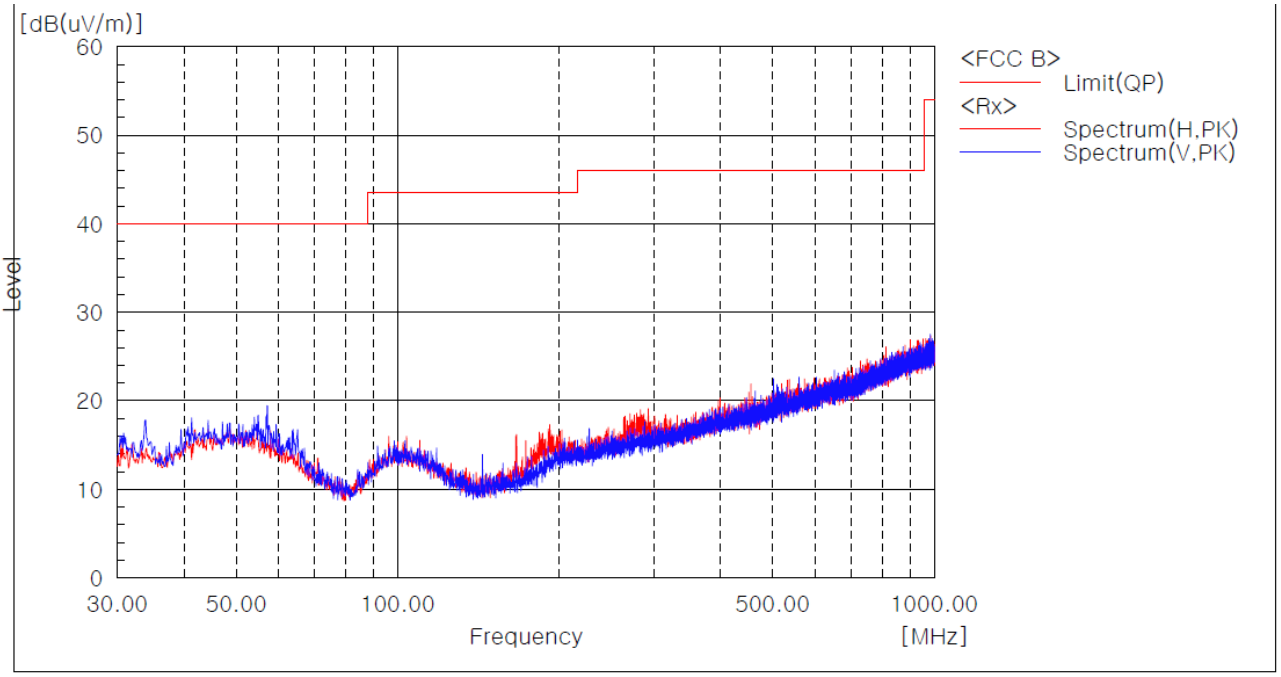
EUT	Wi-Fi Module	Measurement Detail	
Model	WCATB002	Frequency Range	Below 1 000 MHz
Configuration	Receiver	Detector function	Quasi-Peak

The requirements are:

☒ Complies

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

Test Data



Final Result

No.	Frequency [MHz]	(P)	c.f [dB(1/m)]	Angle [deg]	Remark

Remark :
1. The worst emission was found in li-down 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

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

3) above 1 GHz

Test mode : 802.11b

EUT	Wi-Fi Module	Measurement Detail	
Model	WCATB002	Frequency Range	1 - 25 GHz
Mode	802.11b	Detector function	Average / Peak

The requirements are:
☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4 824.00	42.45	11.55	Average

Ch.1(2 412 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4 824.00	H	54.00	74.00	42.45	46.55	11.55	27.45
4 824.00	V	54.00	74.00	36.83	44.61	17.17	29.39
7 236.00	H	54.00	74.00	37.70	48.85	16.30	25.15
7 236.00	V	54.00	74.00	38.30	49.45	15.70	24.55
2 390.00	H	54.00	74.00	38.61	50.75	15.39	23.25
2 390.00	V	54.00	74.00	34.66	48.25	19.34	25.75
2 483.50	H	54.00	74.00	34.77	48.13	19.23	25.87
2 483.50	V	54.00	74.00	32.67	46.54	21.33	27.46

Ch.6(2 437 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4 874.00	H	54.00	74.00	39.63	47.03	14.37	26.97
4 874.00	V	54.00	74.00	38.97	45.12	15.03	28.88
7 311.00	H	54.00	74.00	38.16	49.22	15.84	24.78
7 311.00	V	54.00	74.00	39.21	48.91	14.79	25.09
2 390.00	H	54.00	74.00	37.28	50.75	16.72	23.25
2 390.00	V	54.00	74.00	34.87	47.14	19.13	26.86

Ch.11(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
4 924.00	H	54.00	74.00	38.73	46.59	15.27	27.41
4 924.00	V	54.00	74.00	39.61	46.43	14.39	27.57
7 386.00	H	54.00	74.00	38.12	48.88	15.88	25.12
7 386.00	V	54.00	74.00	38.79	49.07	15.21	24.93
2 390.00	H	54.00	74.00	36.71	49.78	17.29	24.22
2 390.00	V	54.00	74.00	34.49	47.87	19.51	26.13
2 483.50	H	54.00	74.00	35.61	48.03	18.39	25.97
2 483.50	V	54.00	74.00	33.56	41.43	20.44	32.57

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

Test mode : 802.11g

EUT	Wi-Fi Module	Measurement Detail	
Model	WCATB002	Frequency Range	1 - 25 GHz
Mode	802.11g	Detector function	Average / Peak

The requirements are:
☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
2 390.00	43.88	10.12	Average

Ch.1(2 412 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2 390.00	H	54.00	74.00	43.88	58.88	10.12	15.12
2 390.00	V	54.00	74.00	38.60	53.89	15.40	20.11

Ch.6(2 437 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2 390.00	H	54.00	74.00	35.23	50.39	18.77	23.61
2 390.00	V	54.00	74.00	35.39	47.26	18.61	26.74
2 483.50	H	54.00	74.00	35.26	48.35	18.74	25.65
2 483.50	V	54.00	74.00	33.31	46.26	20.69	27.74

Ch.11(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2 390.00	H	54.00	74.00	38.18	50.27	15.82	23.73
2 390.00	V	54.00	74.00	34.78	47.39	19.22	26.61
2 483.50	H	54.00	74.00	39.76	56.62	14.24	17.38
2 483.50	V	54.00	74.00	35.46	50.97	18.54	23.03

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

Test mode : 802.11n_HT20

EUT	Wi-Fi Module	Measurement Detail	
Model	WCATB002	Frequency Range	1 - 25 GHz
Mode	802.11n_HT20	Detector function	Average / Peak

The requirements are:
☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
2 390.00	43.09	10.91	Average

Ch.1(2 412 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2 390.00	H	54.00	74.00	43.09	61.82	10.91	12.18
2 390.00	V	54.00	74.00	37.80	56.89	16.20	17.11

Ch.6(2 437 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2 390.00	H	54.00	74.00	38.52	48.74	15.48	25.26
2 390.00	V	54.00	74.00	35.35	48.03	18.65	25.97

Ch.11(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2 390.00	H	54.00	74.00	38.04	50.17	15.96	23.83
2 390.00	V	54.00	74.00	34.83	47.69	19.17	26.31

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

Test mode : Receiver

EUT	Wi-Fi Module	Measurement Detail	
Model	WCATB002	Frequency Range	1 - 25 GHz
Mode	Receiver	Detector function	Average / Peak

The requirements are:
☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
No emissions were detected at a level greater than 20dB below limit.			

Ch.1(2 412 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
No emissions were detected at a level greater than 20dB below limit.							

Ch.6(2 437 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
No emissions were detected at a level greater than 20dB below limit.							

Ch.11(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
No emissions were detected at a level greater than 20dB below limit.							

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

4.7 AC Conducted Emissions

Test Location
Shielded Room

Frequency Range of Measurement
150 kHz to 30 MHz

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

- **15.207(a)**

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

* Decreases with the logarithm of the frequency.

Test Results
The requirements are:

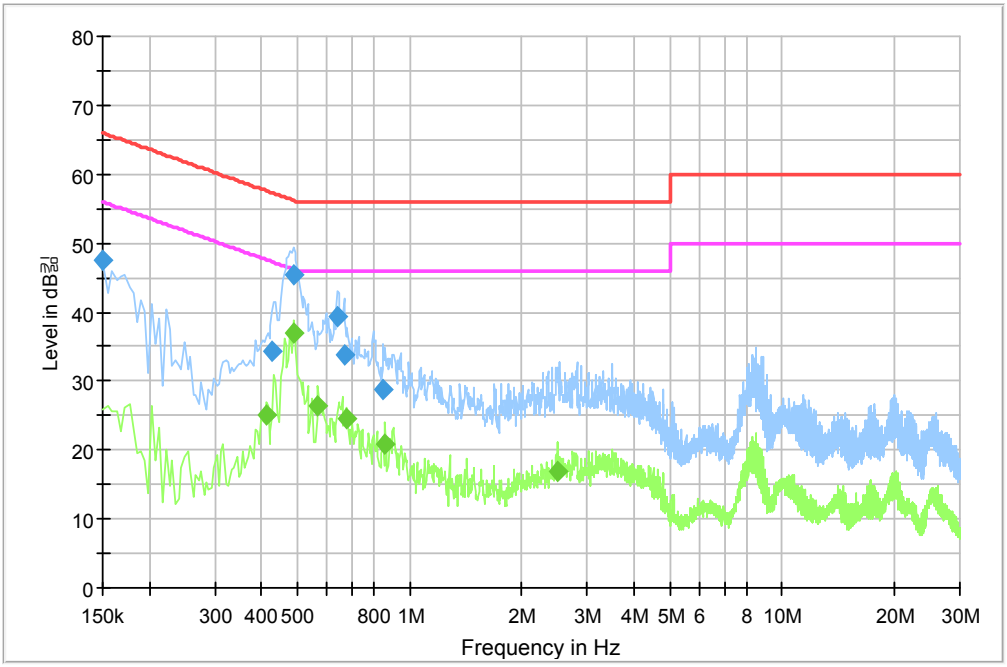
☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
0.492	37.9	8.2	Average

Test Data

[LINE]

3CE_Class B_L1



Final Result 1

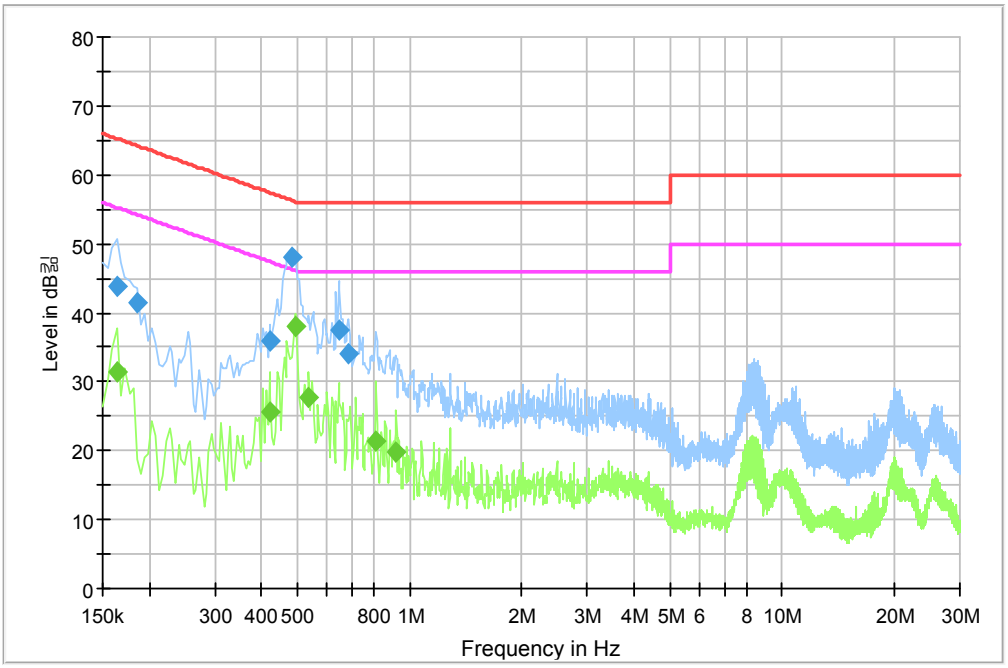
Frequency (MHz)	QuasiPeak (dBµ)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ)
0.150000	47.4	1000.0	9.000	On	L1	9.7	18.6	66.0
0.429000	34.4	1000.0	9.000	On	L1	9.8	22.9	57.3
0.487500	45.4	1000.0	9.000	On	L1	9.8	10.8	56.2
0.640500	39.2	1000.0	9.000	On	L1	9.8	16.8	56.0
0.667500	33.9	1000.0	9.000	On	L1	9.8	22.1	56.0
0.852000	28.8	1000.0	9.000	On	L1	9.7	27.2	56.0

Final Result 2

Frequency (MHz)	CAverage (dBµ)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ)
0.411000	25.0	1000.0	9.000	On	L1	9.8	22.6	47.6
0.487500	36.9	1000.0	9.000	On	L1	9.8	9.3	46.2
0.568500	26.4	1000.0	9.000	On	L1	9.8	19.6	46.0
0.676500	24.6	1000.0	9.000	On	L1	9.8	21.4	46.0
0.861000	20.8	1000.0	9.000	On	L1	9.7	25.2	46.0
2.503500	17.0	1000.0	9.000	On	L1	9.7	29.0	46.0

[NEUTRAL]

3CE_Class B_N



Final Result 1

Frequency (MHz)	QuasiPeak (dBµ)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ)
0.163500	44.0	1000.0	9.000	On	N	9.8	21.3	65.3
0.186000	41.4	1000.0	9.000	On	N	9.9	22.8	64.2
0.420000	35.8	1000.0	9.000	On	N	10.0	21.6	57.4
0.483000	48.0	1000.0	9.000	On	N	10.0	8.3	56.3
0.645000	37.4	1000.0	9.000	On	N	10.0	18.6	56.0
0.685500	33.9	1000.0	9.000	On	N	9.9	22.1	56.0

Final Result 2

Frequency (MHz)	CAverage (dBµ)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ)
0.163500	31.3	1000.0	9.000	On	N	9.8	24.0	55.3
0.420000	25.7	1000.0	9.000	On	N	10.0	21.7	47.4
0.492000	37.9	1000.0	9.000	On	N	10.0	8.2	46.1
0.537000	27.7	1000.0	9.000	On	N	10.0	18.3	46.0
0.811500	21.4	1000.0	9.000	On	N	9.9	24.6	46.0
0.919500	19.8	1000.0	9.000	On	N	9.8	26.2	46.0

APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Signal Analyzer	Agilent	N9020A	MY48011598	2016-11-01	2017-11-01
2	Signal Generator	Rohde & Schwarz	SMB100A	175528	2016-11-01	2017-11-01
3	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2016-11-01	2017-11-01
4	Bilog Antenna	Schaffner	CBL6111C	2551	2016-05-13	2018-05-13
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2016-05-16	2018-05-16
6	6dB Attenuator	R&S	DNF	272.4110.50-2	2016-11-01	2017-11-01
7	6dB Attenuator	R&S	DNF	272.4110.50-1	2017-02-03	2018-02-03
8	AMPLIFIER	SONOMA	310	291721	2017-02-02	2018-02-02
9	LISN	Rohde & Schwarz	ENV216	101235	2017-05-09	2018-05-09
10	Preamplifier	Agilent	8449B	3008A02011	2016-12-01	2017-12-01
11	Horn Antenna	ETS-Lindgren	3115	00078895	2017-04-25	2019-04-25
12	Horn Antenna	ETS-Lindgren	3116	00062916	2017-04-25	2019-04-25
13	Horn Antenna	ETS-Lindgren	3117	00154525	2015-09-02	2017-09-02
14	Band Reject Filter	Micro Tronics	BRM50702	G233	2017-02-03	2018-02-03