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-2018-02342

1. Client

◦ Name : Samsung Electronics Co., Ltd.

◦ Address : 129, Samsung-ro, Yeongtong-gu Suwon-si, Gyeonggi-do, 16677 Republic of Korea

◦ Date of Receipt : 2018-05-24

2. Manufacturer

◦ Name : Samsung Electronics Co., Ltd.

◦ Address : 129, Samsung-ro, Yeongtong-gu Suwon-si, Gyeonggi-do, 16677 Republic of Korea

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

4. Test Sample / Model: WLAN Access Point / WEA554i

5. Date of Test : 2018-06-07 to 2018-07-27

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)

2018-08-01

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

REPORT REVISION HISTORY

Date	Revision	Page No
2018-08-01	Issued (CTK-2018-02342)	all

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1. General Product Description

1.1 Client Information

Company	Samsung Electronics Co., Ltd.
Contact Point	129, Samsung-ro, Yeongtong-gu Suwon-si, Gyeonggi-do, 16677 Republic of Korea
Contact Person	Name : Kim, Jong-in E-mail : jered.kim@samsung.com Tel : +82-31-279-3096 Fax : -

1.2 Product Information

FCC ID	A3LWEA554
Certification Number ISED	649E-WEA554
Product Description	WLAN Access Point
Model name	WEA554i
Variant Model name	WEA554d
Operating Frequency	2 412 MHz – 2 462 MHz
RF Output Power	802.11b : 25.71 dBm (372.30 mW) 802.11g : 20.31 dBm (107.44 mW) 802.11n_HT20 : 19.48 dBm (88.70 mW)
Antenna Specification	Antenna type : OMNI Antenna <Antenna Gain> ANT0 : 2.49 dBi ANT1 : 3.57 dBi ANT2 : 3.16 dBi ANT3 : 2.43 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 288.8 Mbps
Power Source	DC 48 V(PoE)
Hardware Rev	PCS01C
Software Rev	4.10.16.R

1.3 Model Differences

WEA554i and WEA554d are no technical difference from each model only except for Model name and Antenna.

1.4 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253R6N
AC/DC Adapter	HP	HSTNN-CA40	-
PoE Injector	Shenzhen yichen technology development Co., Ltd.	NEXT-PEG4806JT	-

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)	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)	Unwanted Emission(Conducted)	> 30 dBc	C	
15.247(e)	Transmitter Power Spectral Density	< 8 dBm @ 3 kHz	C	
15.209	Radiated Emissions	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.				
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)	Limit	Status (Note 1)	Test Condition
RSS-Gen 6.6	6 dB Bandwidth	NA	C	Conducted
RSS-247 5.4(d)	Maximum Output Power	< 4 Watt (e.r.i.p)	C	
RSS-Gen 6.13	Conducted Spurious emission	RSS-247 5.5	C	
RSS-Gen 6.13	Unwanted Emission(Conducted)	RSS-247 5.5	C	
RSS-247 5.2(b)	Transmitter Power Spectral Density	< 8 dBm @ 3 kHz	C	
RSS-Gen 6.13	Radiated Emissions	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.				
Note 3: The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013, RSS-247 Issue 2, RSS-GEN Issue 4				
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.
For WLAN function, the engineering test program was provided and enabled to make EUT continuous transmit.
All modulation modes were tests. The results are only attached worst cases.

Test Frequency
- 802.11b, 802.11g, 802.11n_HT20

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	99.5%	0 dB (≥ 98%)
802.11g	OFDM	6 Mbps	96.9%	0.14 dB
802.11n_HT20	OFDM	MCS 0	99.0%	0 dB (≥ 98%)

3.3 Device Modifications

The following modifications were necessary for compliance:

Not applicable

3.4 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

3.5 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:

ANT0

	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	8.12	12.77	15.95	16.35	16.36	17.55
2 437 MHz	8.12	12.73	16.06	16.35	16.40	17.55
2 462 MHz	8.12	12.67	16.32	16.35	16.33	17.55

ANT1

	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	8.12	12.77	15.76	16.34	16.15	17.55
2 437 MHz	8.11	12.74	15.76	16.34	16.08	17.54
2 462 MHz	8.12	12.75	16.29	16.34	16.33	17.54

ANT2

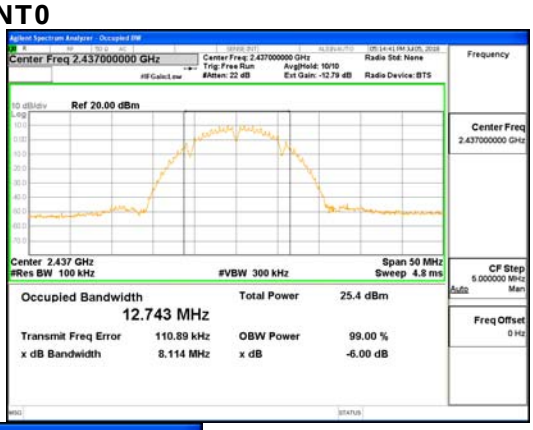
	6 dB Bandwidth and 99% Bandwidth (MHz)					
Mode	802.11b		802.11g		802.11n_HT20	
Frequency	6dB	99%	6dB	99%	6dB	99%
2 412 MHz	8.11	12.75	15.77	16.35	16.67	17.55
2 437 MHz	8.11	12.76	15.77	16.35	16.17	17.54
2 462 MHz	8.12	12.73	15.95	16.35	16.43	17.55

ANT3

	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	8.12	12.74	15.76	16.34	16.14	17.54
2 437 MHz	8.12	12.76	15.76	16.34	16.15	17.54
2 462 MHz	8.12	12.73	15.83	16.34	16.08	17.54

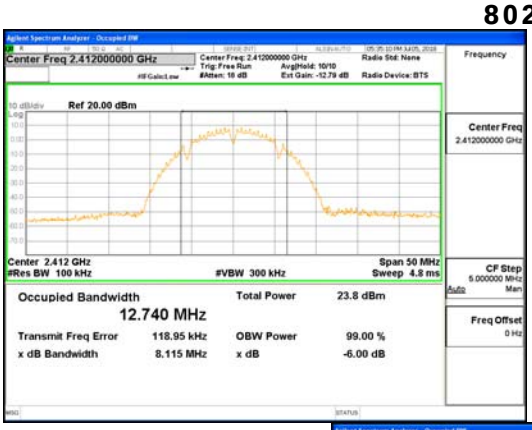
See next pages for actual measured spectrum plots.

802.11b_ANT0

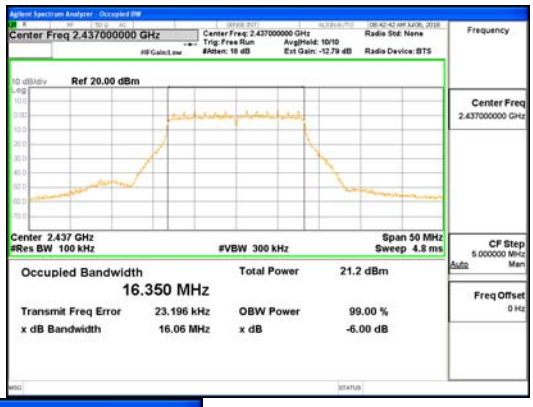


802.11b_ANT1

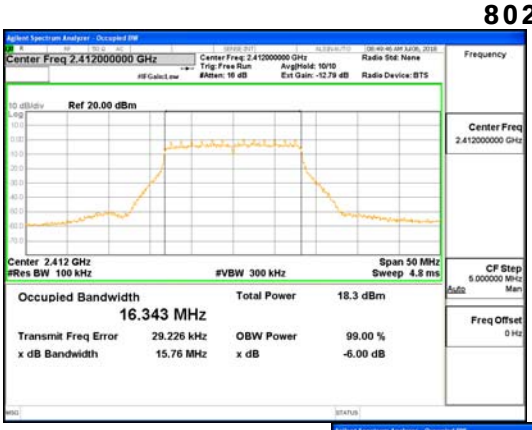
802.11b_ANT2

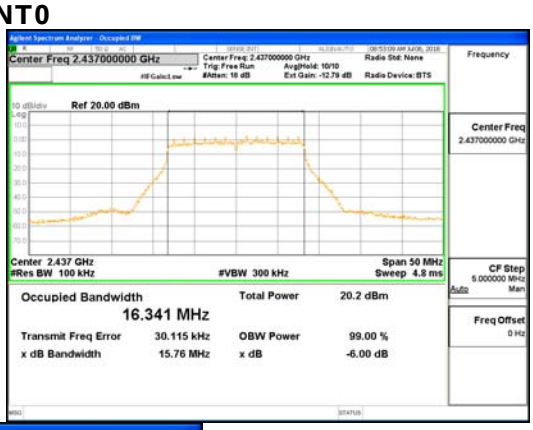


802.11b_ANT3



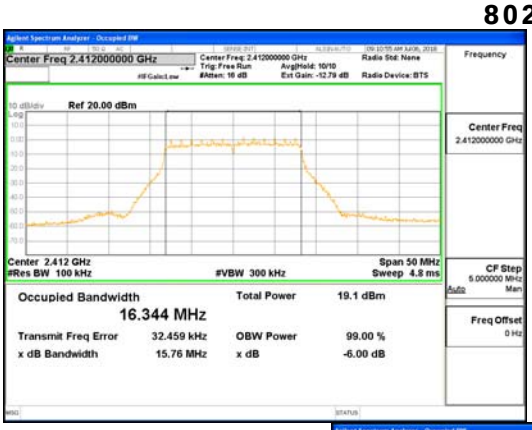
802.11g_ANT0





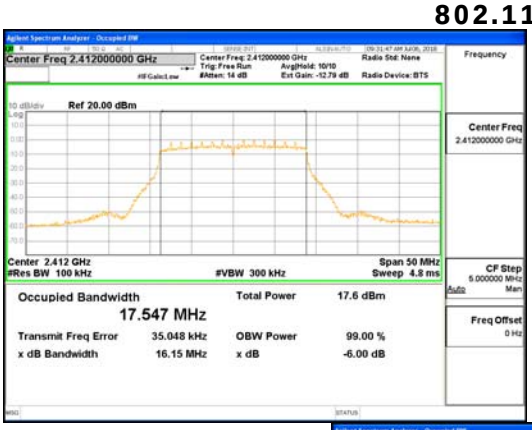
802.11g_ANT1

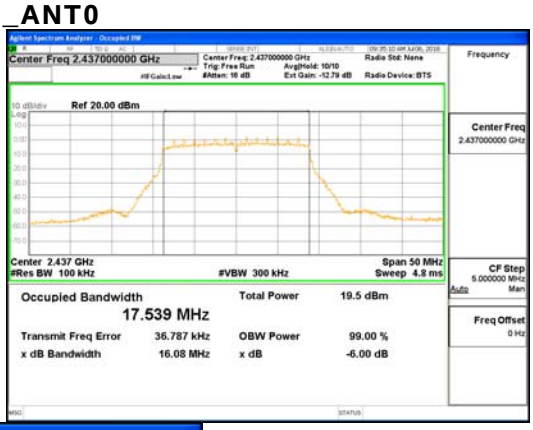
802.11g_ANT2



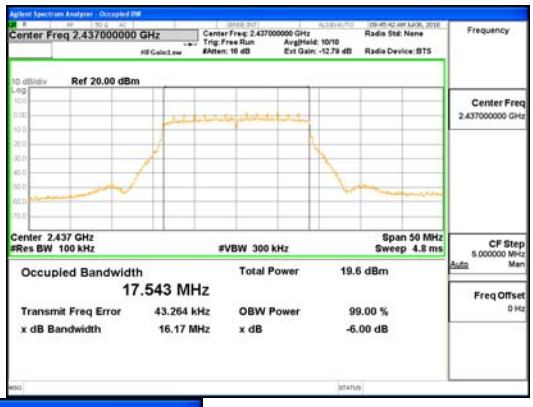
802.11g_ANT3

802.11n_HT20_ANT0

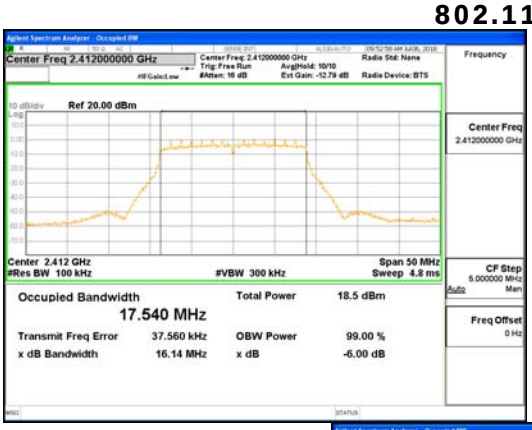




802.11n_HT20_ANT1



802.11n_HT20_ANT2



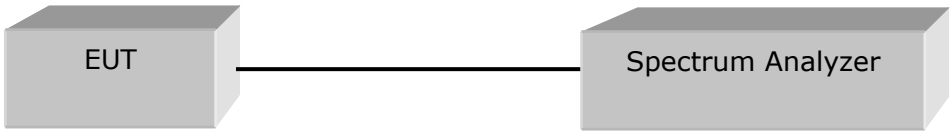
802.11n_HT20_ANT3

4.2 OUTPUT POWER

Test Procedures

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

Test mode	Duty Cycle Factor (dB)
802.11b	0 dB
802.11g	0.14 dB
802.11n_HT20	0 dB

Limit

Operating Mode	Mode	ANT Configuration	ANT Gain (dBi)	Limit (dBm)	
				FCC	ISED (e.i.r.p)
SISO	802.11b/g/n	ANT0	2.49	30.00	36.00
SISO	802.11b/g/n	ANT1	3.57	30.00	36.00
SISO	802.11b/g/n	ANT2	3.16	30.00	36.00
SISO	802.11b/g/n	ANT3	2.43	30.00	36.00
MIMO (2Tx)	802.11b/g/n	ANT0 + ANT1	6.06	29.94	36.00
MIMO (3Tx)	802.11b/g/n	ANT0 + ANT1 + ANT2	7.86	28.14	36.00
MIMO (4Tx)	802.11b/g/n	ANT0 + ANT1 + ANT2 + ANT3	8.95	27.05	36.00

Test Data

ANT0

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	2 412	16.77	0	16.77	30.00	13.23
	2 437	18.70	0	18.70	30.00	11.30
	2 462	19.94	0	19.94	30.00	10.06
802.11g	2 412	11.38	0.14	11.52	30.00	18.48
	2 437	13.25	0.14	13.39	30.00	16.61
	2 462	14.55	0.14	14.69	30.00	15.31
802.11n _HT20	2 412	10.70	0	10.70	30.00	19.30
	2 437	12.54	0	12.54	30.00	17.46
	2 462	13.83	0	13.83	30.00	16.17

ANT1

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	2 412	16.16	0	16.16	30.00	13.84
	2 437	18.06	0	18.06	30.00	11.94
	2 462	19.63	0	19.63	30.00	10.37
802.11g	2 412	10.42	0.14	10.56	30.00	19.44
	2 437	12.26	0.14	12.4	30.00	17.60
	2 462	13.82	0.14	13.96	30.00	16.04
802.11n _HT20	2 412	9.70	0	9.7	30.00	20.30
	2 437	11.61	0	11.61	30.00	18.39
	2 462	13.10	0	13.1	30.00	16.90

ANT2

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	2 412	15.84	0	15.84	30.00	14.16
	2 437	17.79	0	17.79	30.00	12.21
	2 462	19.47	0	19.47	30.00	10.53
802.11g	2 412	10.52	0.14	10.66	30.00	19.34
	2 437	12.39	0.14	12.53	30.00	17.47
	2 462	14.00	0.14	14.14	30.00	15.86
802.11n _HT20	2 412	9.81	0	9.81	30.00	20.19
	2 437	11.71	0	11.71	30.00	18.29
	2 462	13.32	0	13.32	30.00	16.68

ANT3

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	2 412	16.50	0	16.50	30.00	13.50
	2 437	18.47	0	18.47	30.00	11.53
	2 462	19.70	0	19.70	30.00	10.30
802.11g	2 412	11.15	0.14	11.29	30.00	18.71
	2 437	13.12	0.14	13.26	30.00	16.74
	2 462	14.20	0.14	14.34	30.00	15.66
802.11n _HT20	2 412	10.55	0	10.55	30.00	19.45
	2 437	12.42	0	12.42	30.00	17.58
	2 462	13.55	0	13.55	30.00	16.45

ANT0 + ANT1

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	2 412	19.49	0	19.49	29.94	10.45
	2 437	21.40	0	21.40	29.94	8.54
	2 462	22.80	0	22.80	29.94	7.14
802.11g	2 412	13.94	0.14	14.08	29.94	15.86
	2 437	15.79	0.14	15.93	29.94	14.01
	2 462	17.21	0.14	17.35	29.94	12.59
802.11n _HT20	2 412	13.24	0	13.24	29.94	16.70
	2 437	15.11	0	15.11	29.94	14.83
	2 462	16.49	0	16.49	29.94	13.45

ANT0 + ANT1 + ANT2

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	2 412	21.05	0	21.05	28.14	7.09
	2 437	22.97	0	22.97	28.14	5.17
	2 462	24.46	0	24.46	28.14	3.68
802.11g	2 412	15.57	0.14	15.71	28.14	12.43
	2 437	17.43	0.14	17.57	28.14	10.57
	2 462	18.91	0.14	19.05	28.14	9.09
802.11n _HT20	2 412	14.86	0	14.86	28.14	13.28
	2 437	16.74	0	16.74	28.14	11.40
	2 462	18.20	0	18.20	28.14	9.94

ANT0 + ANT1 + ANT2 + ANT3

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	2 412	22.35	0	22.35	27.05	4.70
	2 437	24.29	0	24.29	27.05	2.76
	2 462	25.71	0	25.71	27.05	1.34
802.11g	2 412	16.91	0.14	17.05	27.05	10.00
	2 437	18.80	0.14	18.94	27.05	8.11
	2 462	20.17	0.14	20.31	27.05	6.74
802.11n _HT20	2 412	16.23	0	16.23	27.05	10.82
	2 437	18.11	0	18.11	27.05	8.94
	2 462	19.48	0	19.48	27.05	7.57

See next pages for actual measured spectrum plots.

802.11b_ANT0

802.11b_ANT1

802.11b_ANT2

802.11b_ ANT3

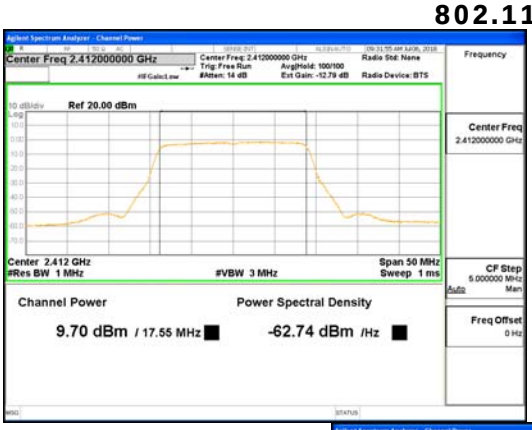
802.11g_ANT0

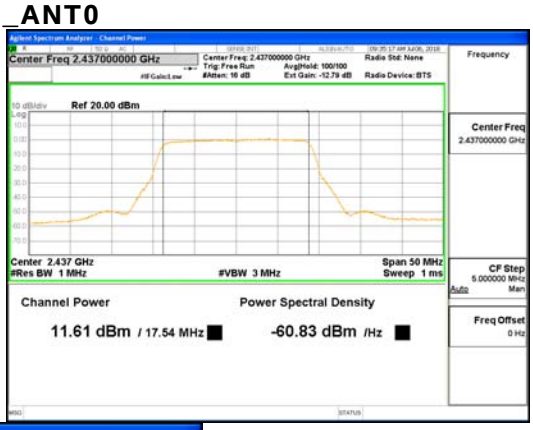
802.11g_ANT1

802.11g_ANT2

802.11g_ANT3

802.11n_HT20_ANT0





802.11n_HT20_ANT1

802.11n_HT20_ANT2

802.11n_HT20_ANT3

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 Configuration	ANT Gain (dBi)	Limit (dBm)	
				FCC	ISED
SISO	802.11b/g/n	ANT0	2.49	8.00	
SISO	802.11b/g/n	ANT1	3.57	8.00	
SISO	802.11b/g/n	ANT2	3.16	8.00	
SISO	802.11b/g/n	ANT3	2.43	8.00	
MIMO (2Tx)	802.11b/g/n	ANT0 + ANT1	6.06	7.94	
MIMO (3Tx)	802.11b/g/n	ANT0 + ANT1 + ANT2	7.86	6.14	
MIMO (4Tx)	802.11b/g/n	ANT0 + ANT1 + ANT2 + ANT3	8.95	5.05	

Test Data

ANT0

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
802.11b	2 412	-8.17	8.00	16.17
	2 437	-6.12	8.00	14.12
	2 462	-4.73	8.00	12.73
802.11g	2 412	-15.53	8.00	23.53
	2 437	-12.51	8.00	20.51
	2 462	-12.39	8.00	20.39
802.11n_HT20	2 412	-16.18	8.00	24.18
	2 437	-14.20	8.00	22.20
	2 462	-12.92	8.00	20.92

ANT1

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
802.11b	2 412	-8.15	8.00	16.15
	2 437	-5.25	8.00	13.25
	2 462	-4.55	8.00	12.55
802.11g	2 412	-15.46	8.00	23.46
	2 437	-13.64	8.00	21.64
	2 462	-12.43	8.00	20.43
802.11n_HT20	2 412	-16.41	8.00	24.41
	2 437	-14.96	8.00	22.96
	2 462	-13.98	8.00	21.98

ANT2

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
802.11b	2 412	-7.93	8.00	15.93
	2 437	-6.59	8.00	14.59
	2 462	-5.63	8.00	13.63
802.11g	2 412	-16.70	8.00	24.70
	2 437	-13.82	8.00	21.82
	2 462	-12.03	8.00	20.03
802.11n_HT20	2 412	-16.71	8.00	24.71
	2 437	-14.90	8.00	22.90
	2 462	-12.51	8.00	20.51

ANT3

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
802.11b	2 412	-6.85	8.00	14.85
	2 437	-6.67	8.00	14.67
	2 462	-4.89	8.00	12.89
802.11g	2 412	-14.30	8.00	22.30
	2 437	-14.25	8.00	22.25
	2 462	-11.28	8.00	19.28
802.11n_HT20	2 412	-14.29	8.00	22.29
	2 437	-14.44	8.00	22.44
	2 462	-12.40	8.00	20.40

ANT0 +ANT1

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
802.11b	2 412	-5.15	7.94	13.09
	2 437	-2.66	7.94	10.60
	2 462	-1.62	7.94	9.56
802.11g	2 412	-12.48	7.94	20.42
	2 437	-10.03	7.94	17.97
	2 462	-9.40	7.94	17.34
802.11n_HT20	2 412	-13.29	7.94	21.23
	2 437	-11.56	7.94	19.50
	2 462	-10.41	7.94	18.35

ANT0 + ANT1 + ANT2

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
802.11b	2 412	-3.31	6.14	9.45
	2 437	-1.18	6.14	7.32
	2 462	-0.17	6.14	6.31
802.11g	2 412	-11.09	6.14	17.23
	2 437	-8.51	6.14	14.65
	2 462	-7.51	6.14	13.65
802.11n_HT20	2 412	-11.66	6.14	17.80
	2 437	-9.90	6.14	16.04
	2 462	-8.32	6.14	14.46

ANT0 + ANT1 + ANT2 + ANT3

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Limit (dBm)	Margin(dB)
802.11b	2 412	-1.72	5.05	6.77
	2 437	-0.10	5.05	5.15
	2 462	1.09	5.05	3.96
802.11g	2 412	-9.40	5.05	14.45
	2 437	-7.48	5.05	12.53
	2 462	-5.99	5.05	11.04
802.11n_HT20	2 412	-9.77	5.05	14.82
	2 437	-8.59	5.05	13.64
	2 462	-6.89	5.05	11.94

See next pages for actual measured spectrum plots.

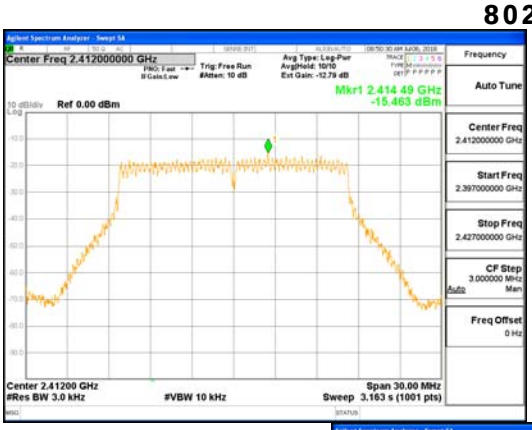
802.11b_ANT0

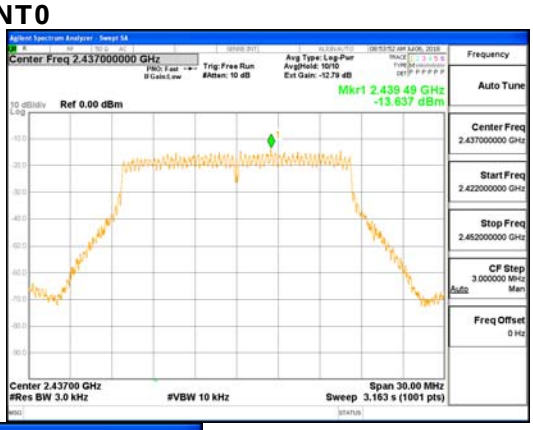
802.11b_ANT1

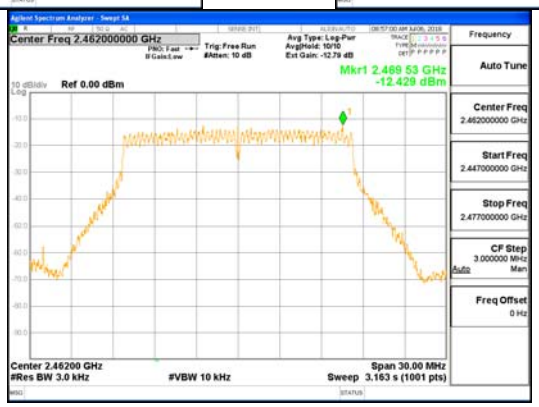
802.11b_ANT2

802.11b_ANT3

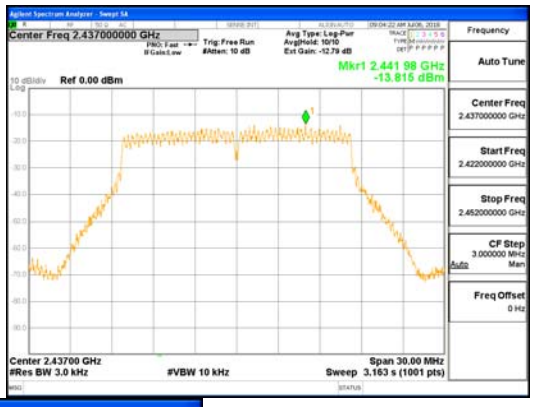
802.11g_ANT0

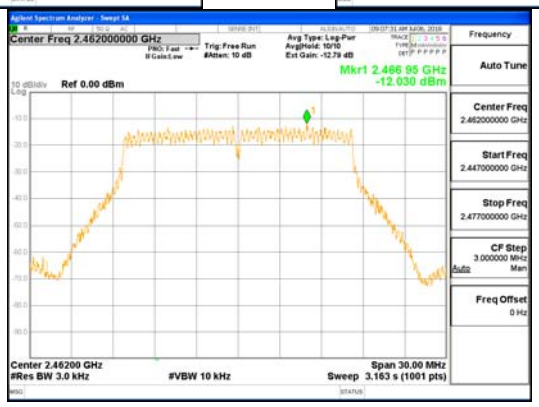




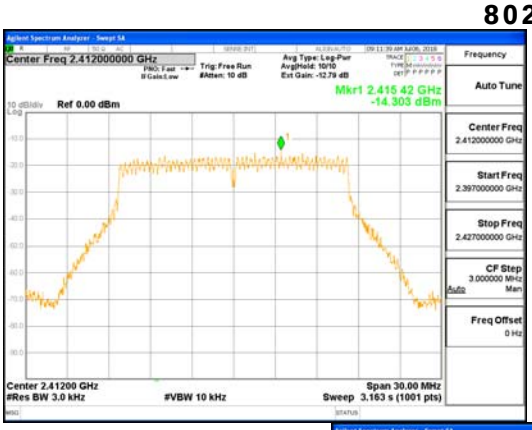


802.11g_ANT1

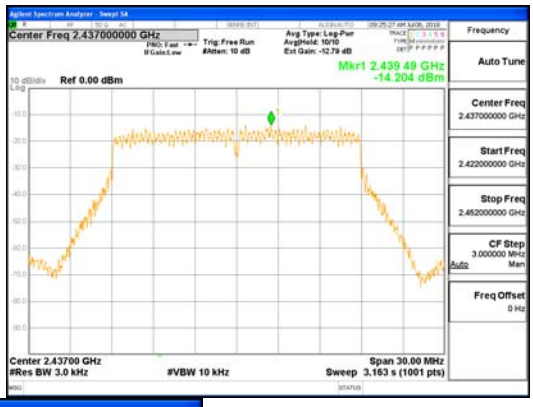




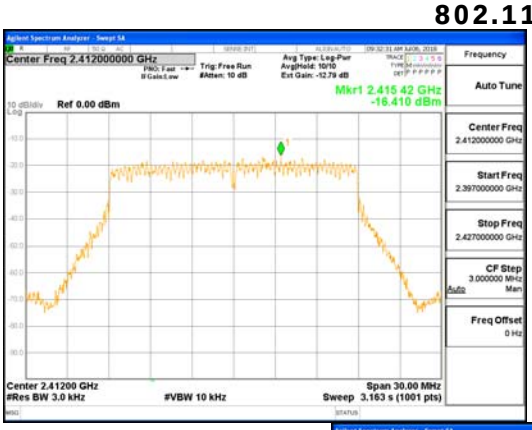
802.11g_ANT2

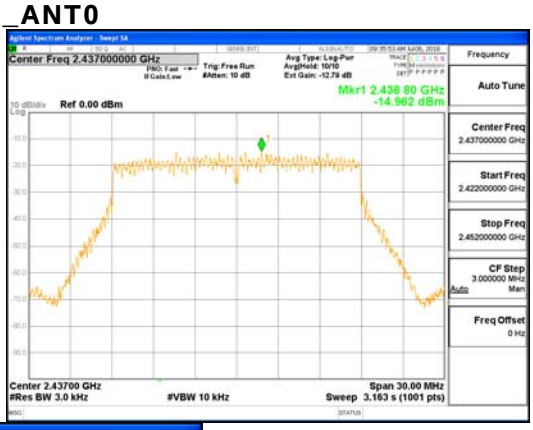


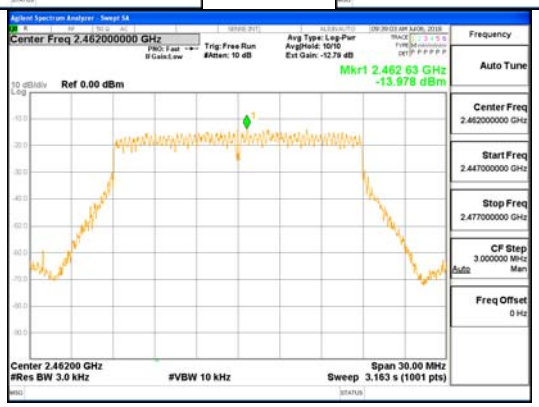
802.11g_ANT3



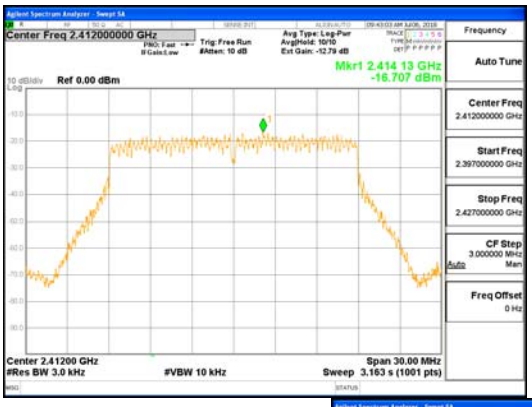
802.11n_HT20_ANT0

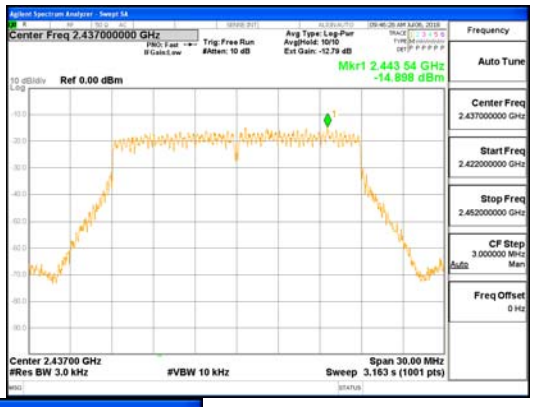


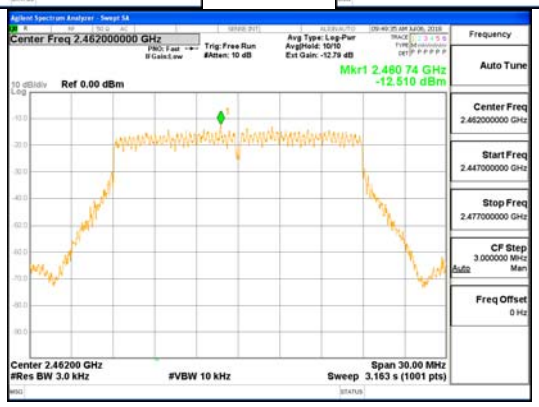




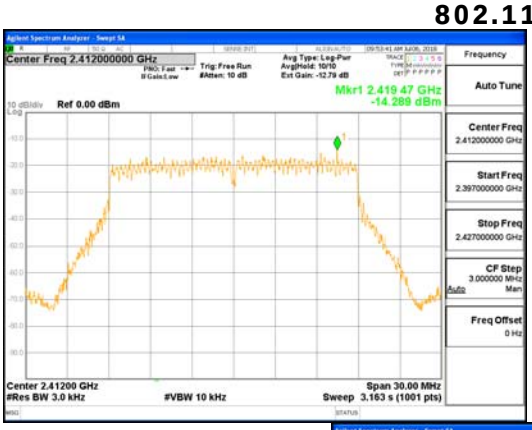
802.11n_HT20_ANT1

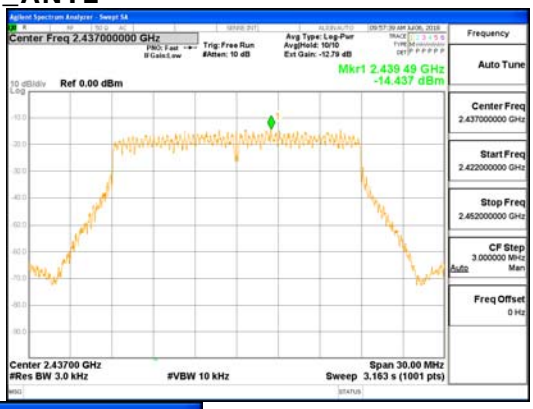


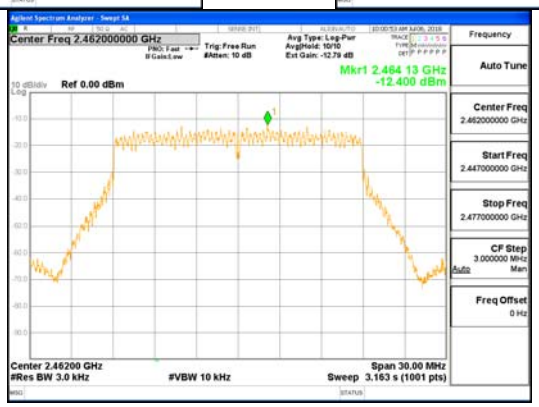




802.11n_HT20_ANT2







802.11n_HT20_ANT3

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 :

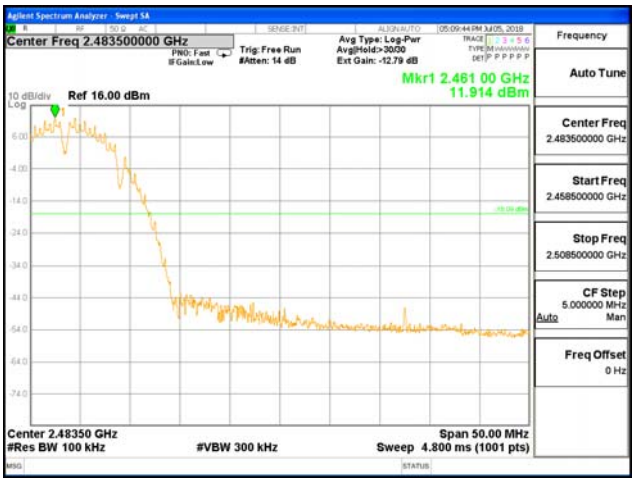
Emission level	<	30 dBc

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
Mkr1 2.413 00 GHz
8.786 dBm
Ref 16.00 dBm
Center 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
Mkr1 2.461 00 GHz
11.914 dBm
Ref 16.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)

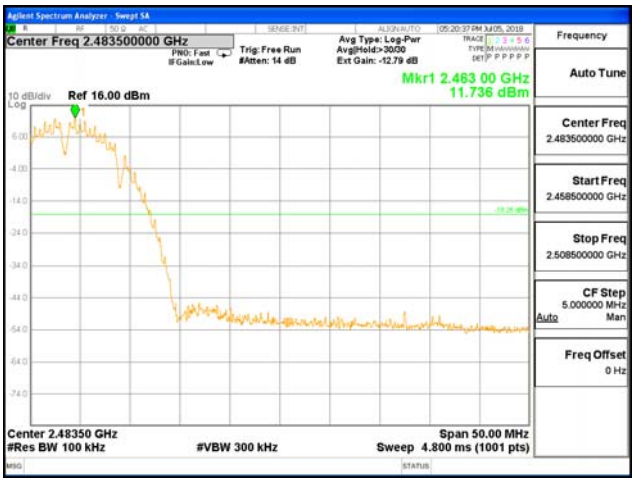
Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
Mkr1 2.252 GHz
-48.752 dBm
Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
Mkr1 2.252 GHz
-47.556 dBm
Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
Mkr1 2.302 GHz
-46.991 dBm
Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)

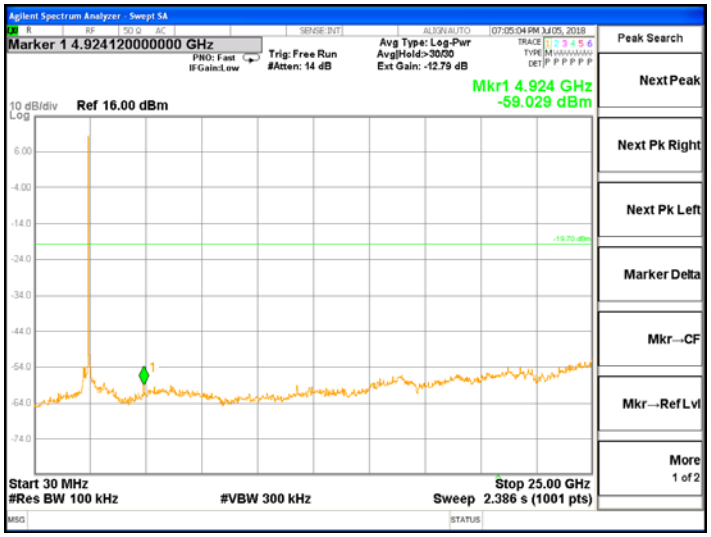
802.11b_ANT0

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
Mkr1 2.413 00 GHz
8.302 dBm
Ref 16.00 dBm
Center 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
Mkr1 2.463 00 GHz
11.736 dBm
Ref 16.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)

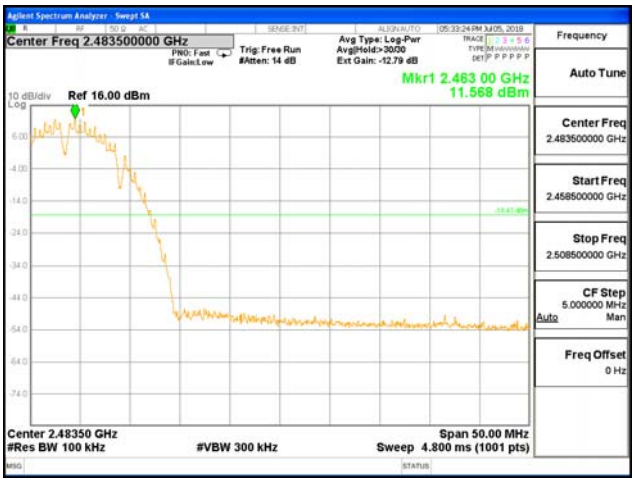
Agilent Spectrum Analyzer - Swept SA
Marker 1 2.252330000000 GHz
Mkr1 2.252 GHz
-50.044 dBm
Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)

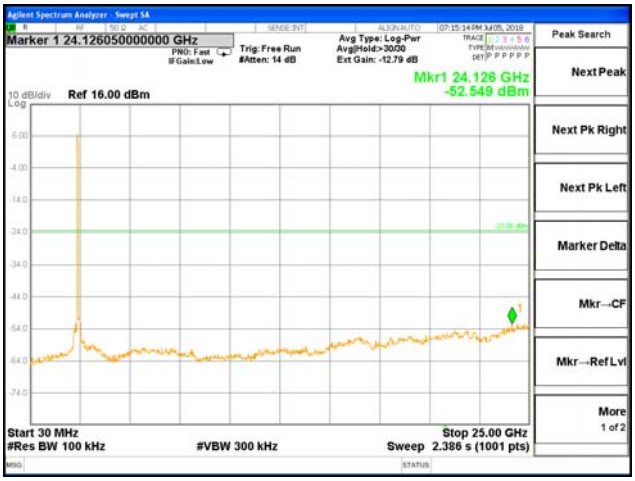
Agilent Spectrum Analyzer - Swept SA
Marker 1 2.302270000000 GHz
Mkr1 2.302 GHz
-53.920 dBm
Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)


Agilent Spectrum Analyzer - Swept SA
Marker 1 4.924120000000 GHz
Mkr1 4.924 GHz
-59.029 dBm
Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)

802.11b_ANT1

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
Mkr1 2.413 00 GHz
7.957 dBm
Ref 16.00 dBm
Center 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
Mkr1 2.463 00 GHz
11.568 dBm
Ref 16.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)


Agilent Spectrum Analyzer - Swept SA
Marker 1 24.126050000000 GHz
Mkr1 24.126 GHz
-52.549 dBm
Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)

Agilent Spectrum Analyzer - Swept SA
Marker 1 24.375750000000 GHz
Mkr1 24.376 GHz
-53.607 dBm
Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)

Agilent Spectrum Analyzer - Swept SA
Marker 1 24.675390000000 GHz
Mkr1 24.675 GHz
-51.581 dBm
Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)

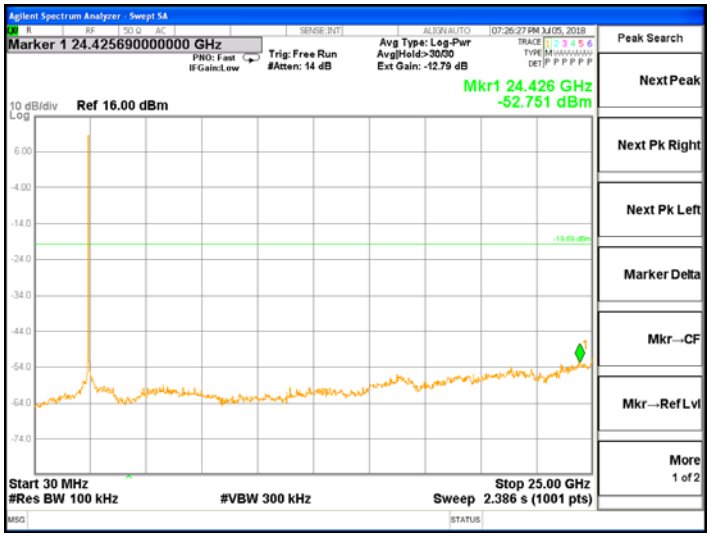
802.11b_ANT2

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
05:37:30 PM Jul 05, 2018
Mkr1 2.413 00 GHz
8.579 dBm
10 dB/div Ref 16.00 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

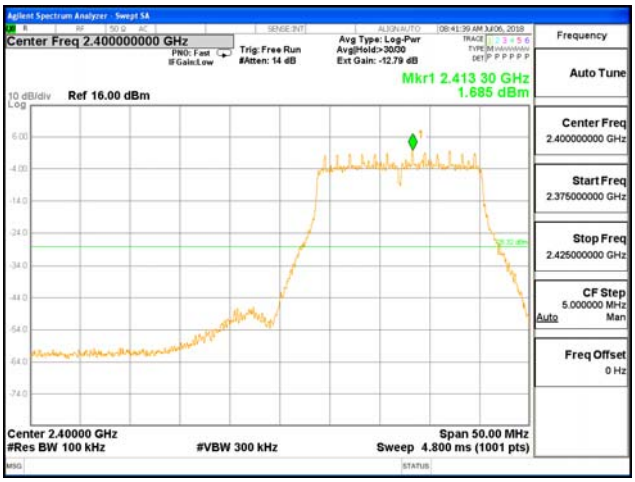
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
05:44:32 PM Jul 05, 2018
Mkr1 2.463 00 GHz
11.720 dBm
10 dB/div Ref 16.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 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

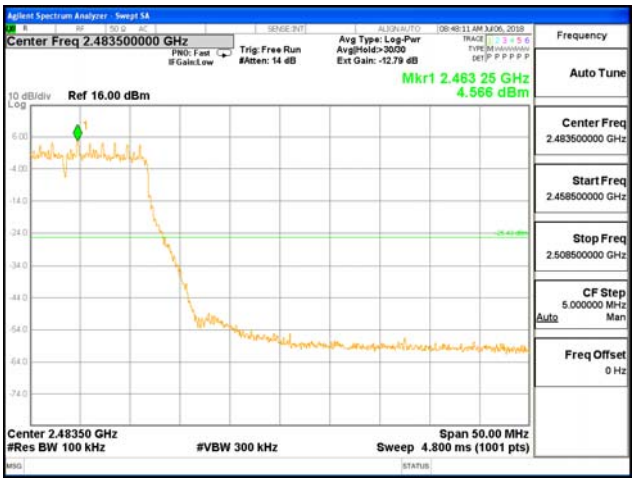
Agilent Spectrum Analyzer - Swept SA
Marker 1 24.400720000000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
07:21:37 PM Jul 05, 2018
Mkr1 24.401 GHz
-51.264 dBm
10 dB/div Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More 1 of 2

Agilent Spectrum Analyzer - Swept SA
Marker 1 24.001200000000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
07:24:47 PM Jul 05, 2018
Mkr1 24.001 GHz
-52.012 dBm
10 dB/div Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More 1 of 2


Agilent Spectrum Analyzer - Swept SA
Marker 1 24.425690000000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
07:26:27 PM Jul 05, 2018
Mkr1 24.426 GHz
-52.751 dBm
10 dB/div Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More 1 of 2

802.11b_ANT3


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
Mkr1 2.413 30 GHz
1.685 dBm
10 dB/div Ref 16.00 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

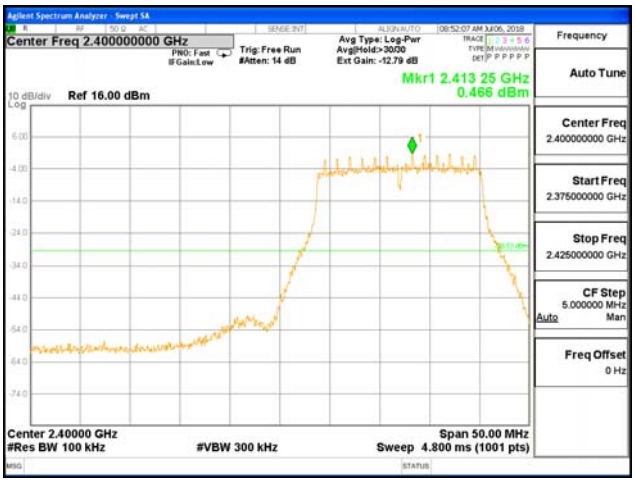

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
Mkr1 2.463 25 GHz
4.566 dBm
10 dB/div Ref 16.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
Frequency
Auto 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

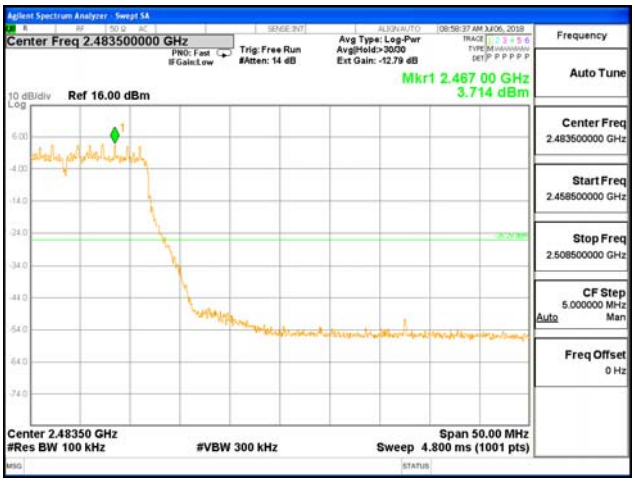
Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -12.79 dB
Mkr1 2.252 GHz
-52.955 dBm
10 dB/div Ref 16.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Frequency
Auto Tune
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
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -12.79 dB
Mkr1 2.252 GHz
-52.661 dBm
10 dB/div Ref 16.00 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
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -12.79 dB
Mkr1 2.252 GHz
-52.776 dBm
10 dB/div Ref 16.00 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

802.11g_ANT0


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
Mkr1 2.413 25 GHz
0.466 dBm
10 dB/div Ref 16.00 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

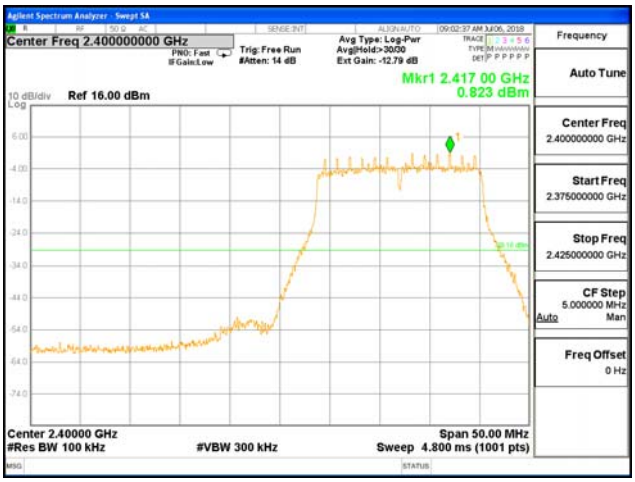

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
Mkr1 2.467 00 GHz
3.714 dBm
10 dB/div Ref 16.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
Frequency
Auto 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
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
Mkr1 2.252 GHz
-53.738 dBm
10 dB/div Ref 12.00 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
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -12.79 dB
Mkr1 6.273 GHz
-58.201 dBm
10 dB/div Ref 16.00 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

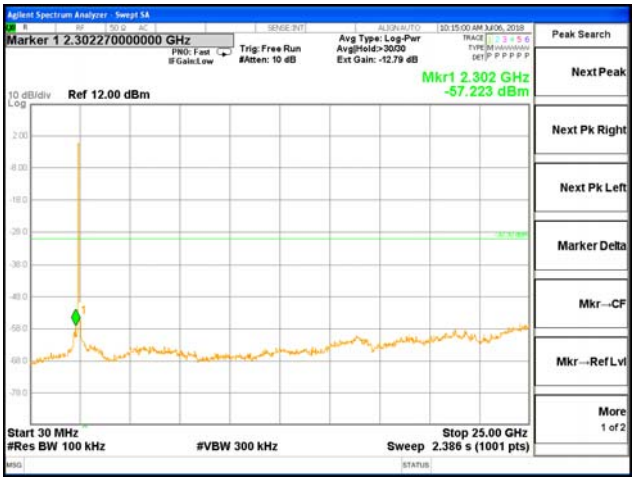
Agilent Spectrum Analyzer - Swept SA
Marker 1 2.302270000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
Mkr1 2.302 GHz
-55.610 dBm
10 dB/div Ref 12.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

802.11g_ANT1


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
Mkr1 2.417 00 GHz
0.823 dBm
10 dB/div Ref 16.00 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

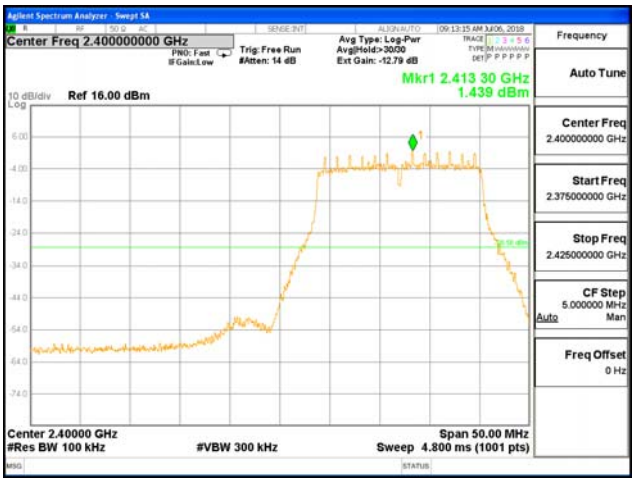
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
Mkr1 2.467 00 GHz
4.147 dBm
10 dB/div Ref 16.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
Frequency
Auto 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
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 30/30
Ext Gain: -12.79 dB
Mkr1 16.335 GHz
-54.698 dBm
10 dB/div Ref 16.00 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
Marker 1 2.302270000000 GHz
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
Mkr1 2.302 GHz
-57.223 dBm
10 dB/div Ref 12.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

Agilent Spectrum Analyzer - Swept SA
Marker 1 24.375750000000 GHz
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
Mkr1 24.376 GHz
-56.595 dBm
10 dB/div Ref 12.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

802.11g_ANT2


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.400000000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
09:13:15 AM Jul06, 2018
Mkr1 2.413 30 GHz
1.439 dBm
10 dB/div Ref 16.00 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

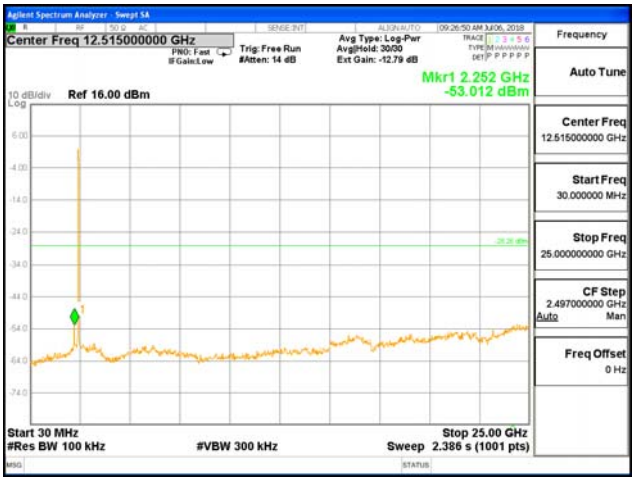
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
Trig: Free Run
#Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
09:19:49 AM Jul06, 2018
Mkr1 2.463 25 GHz
4.398 dBm
10 dB/div Ref 16.00 dBm
Center 2.48350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (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
Marker 1 24.400720000000 GHz
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
10:23:31 AM Jul06, 2018
Mkr1 24.401 GHz
-56.187 dBm
10 dB/div Ref 12.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More 1 of 2

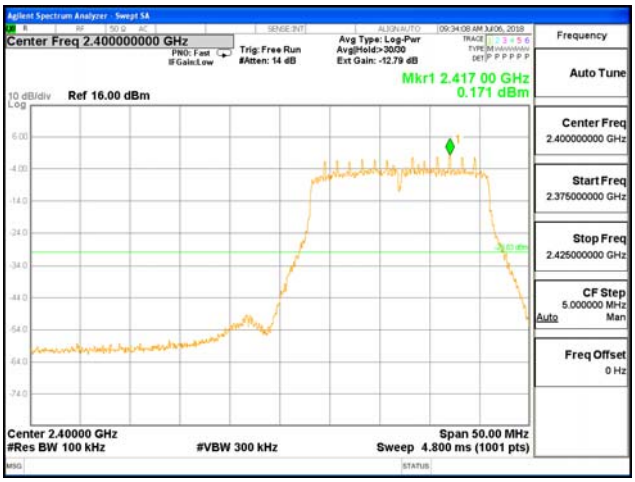
Agilent Spectrum Analyzer - Swept SA
Marker 1 24.600480000000 GHz
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
10:25:17 AM Jul06, 2018
Mkr1 24.600 GHz
-56.907 dBm
10 dB/div Ref 12.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More 1 of 2

Agilent Spectrum Analyzer - Swept SA
Marker 1 24.400720000000 GHz
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>30/30
Ext Gain: -12.79 dB
10:31:38 AM Jul06, 2018
Mkr1 24.401 GHz
-56.291 dBm
10 dB/div Ref 12.00 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More 1 of 2

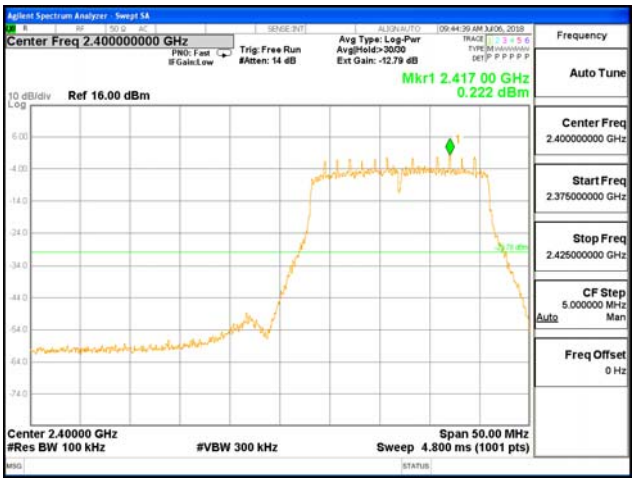
802.11g_ANT3

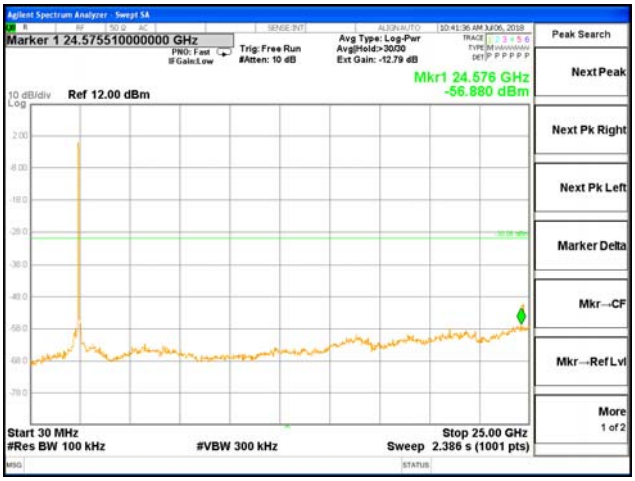


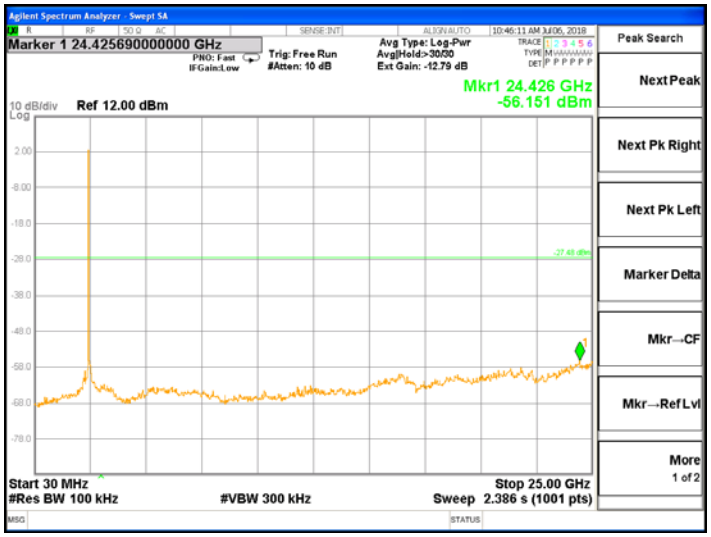
802.11n_HT20_ANT0



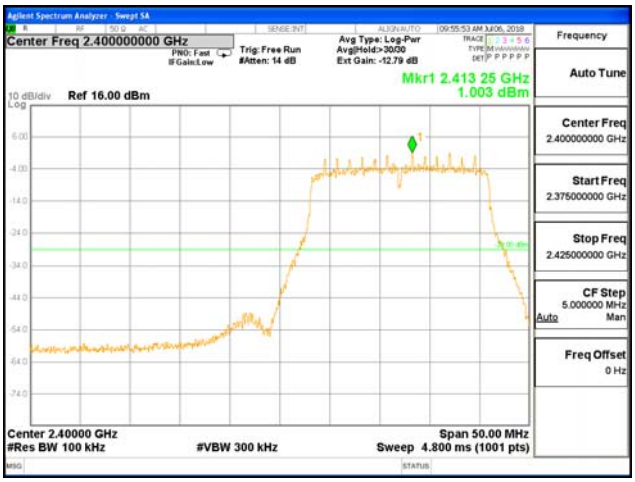
802.11n_HT20_ANT1

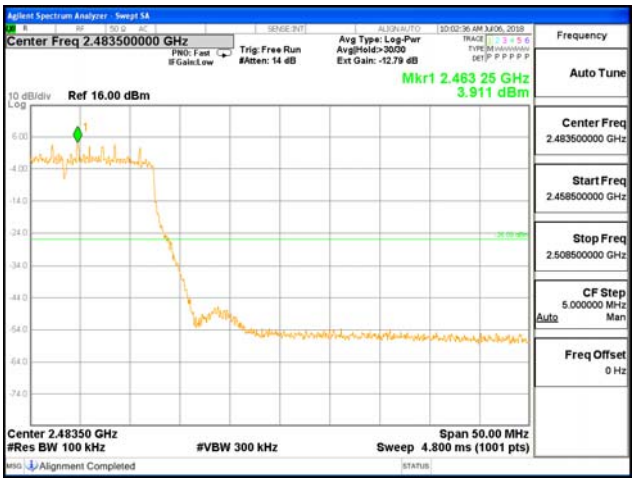






802.11n_HT20_ANT2





802.11n_HT20_ANT3

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 10th 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 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)

- 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.

Test mode	Duty Cycle Factor (dB)
802.11b	0 dB
802.11g	0.14 dB
802.11n_HT20	0 dB

Limit :

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

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

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

[2] Above 38.6

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

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

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

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

Note :

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

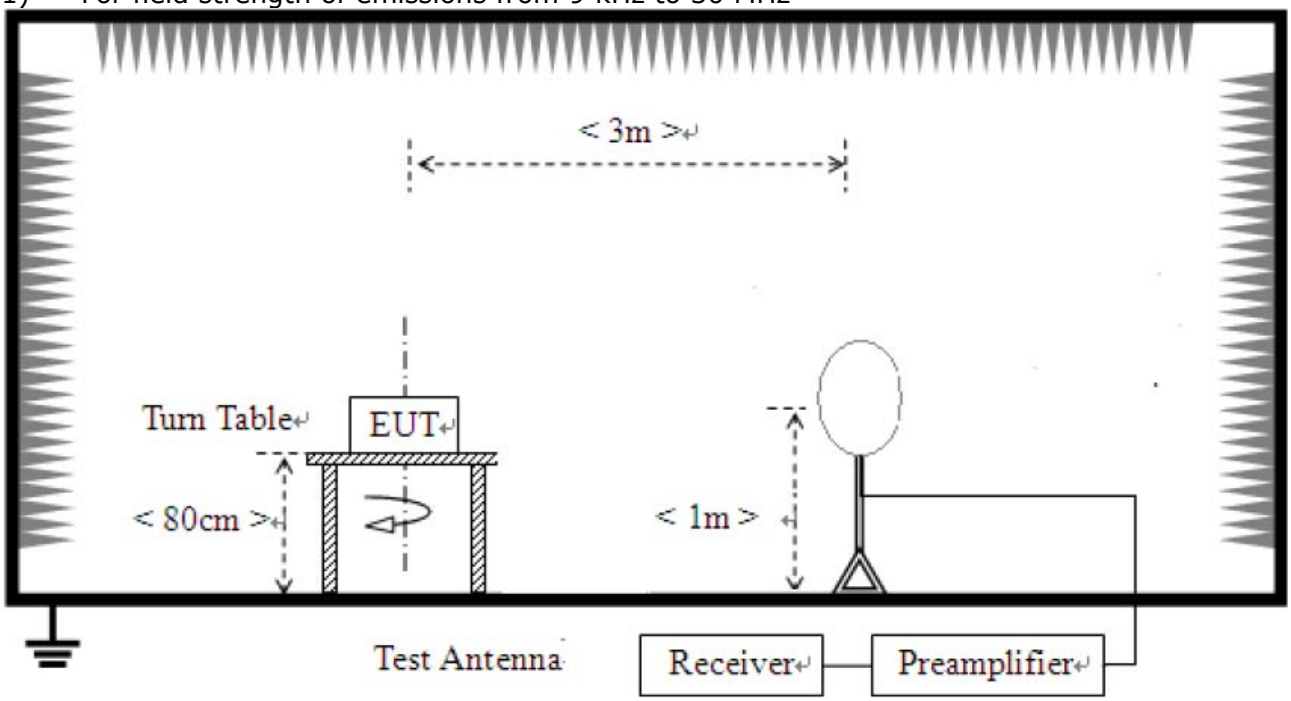
We have done all test mode.
The worst-case antenna configuration and Test mode are determined to be as follows.

802.11b mode : ANT0 + ANT1 + ANT2 + ANT3 (MIMO)
802.11g mode : ANT0 + ANT1 + ANT2 + ANT3 (MIMO)
802.11n_HT20 mode : ANT0 + ANT1 + ANT2 + ANT3 (MIMO)

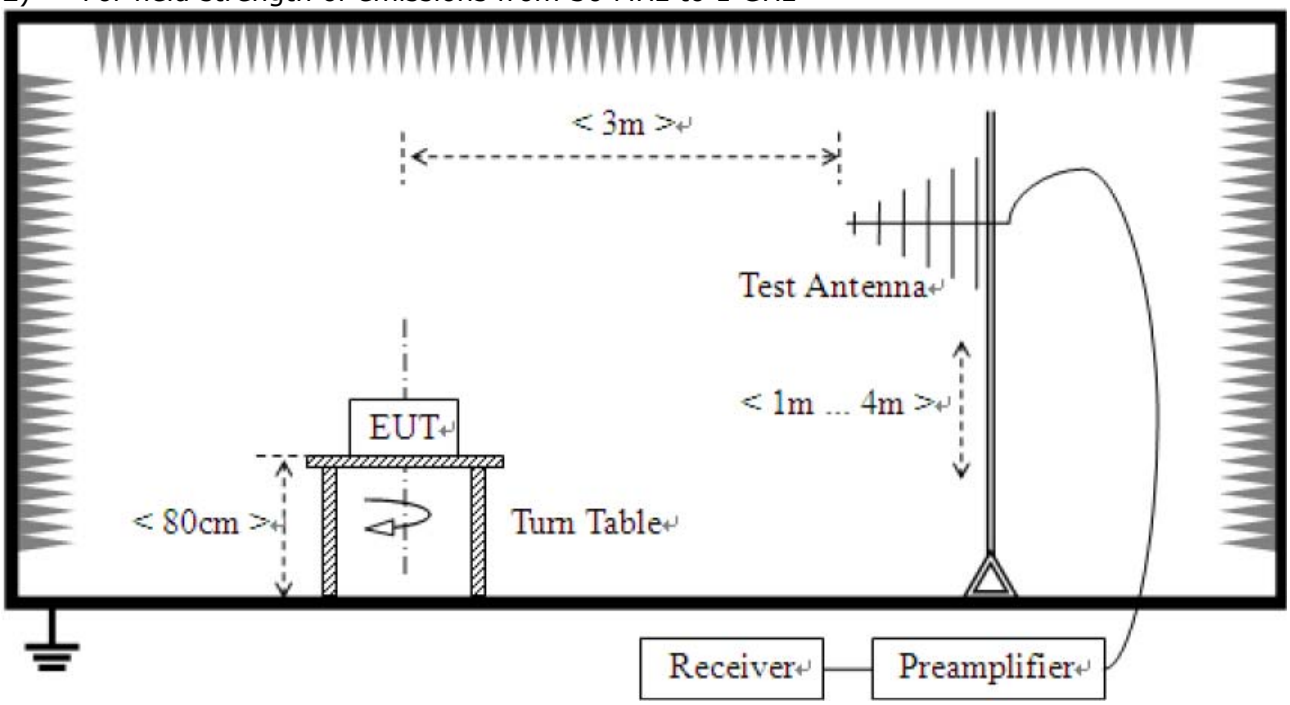
So the results are only attached worst cases.

Test Setup:

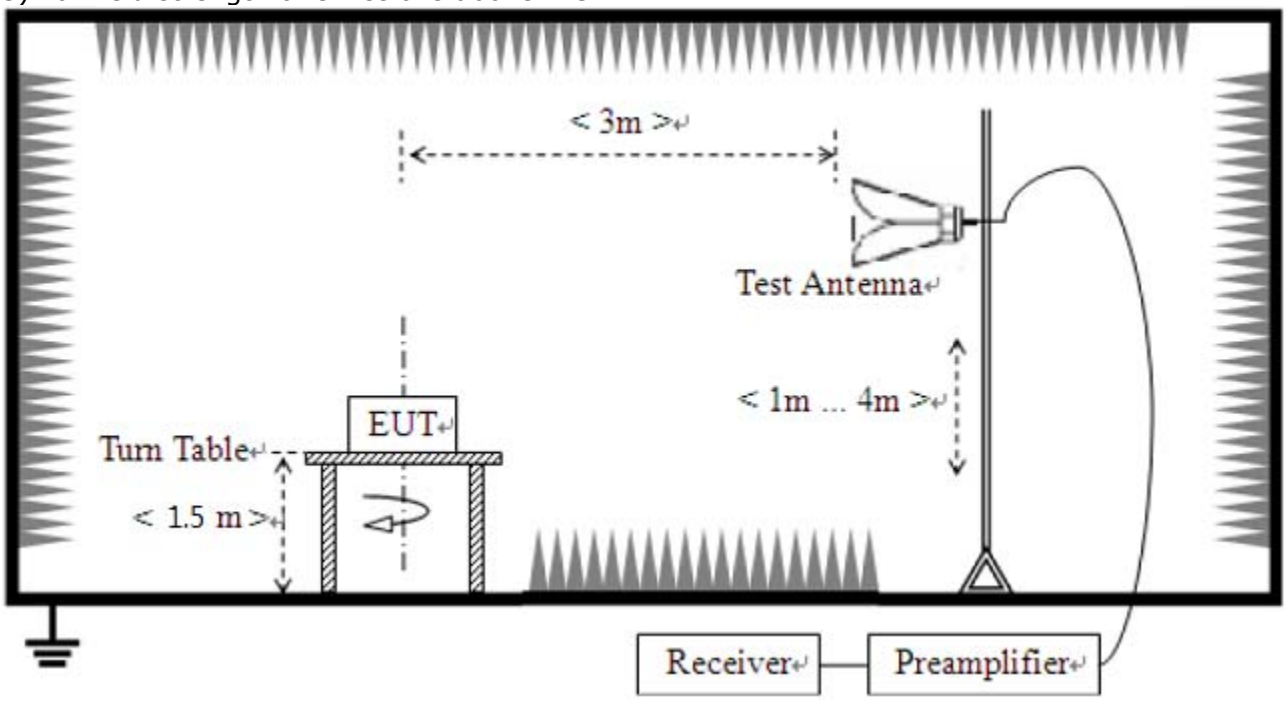
1) For field strength of emissions from 9 kHz to 30 MHz



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 : Transmitter, Receiver, 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.

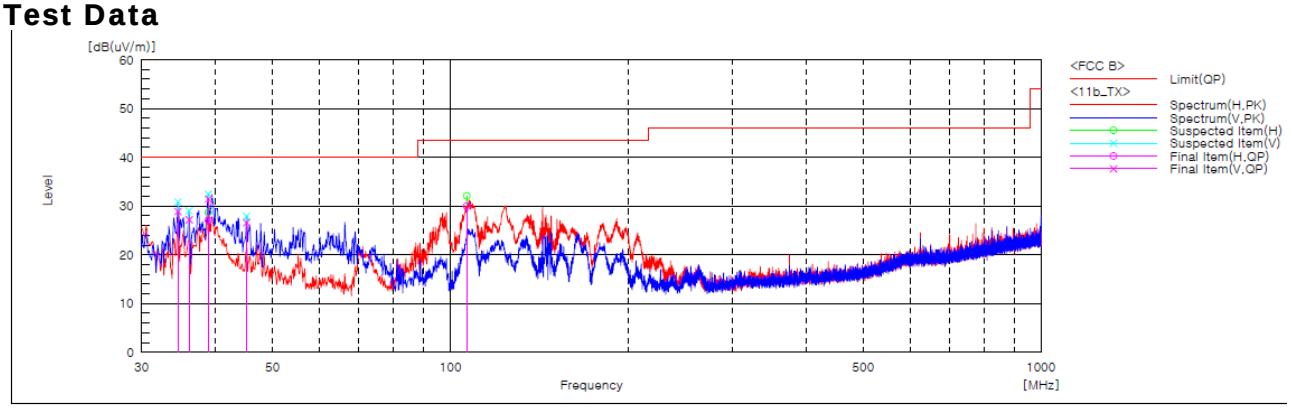
Distance extrapolation factor = 40 log (specific distance / test distance) (dB)

2) 30 MHz to 1 GHz

Test mode : Transmitter, 802.11b(Worst Case)

The requirements are:
☒ Complies

Test Data



Final Result

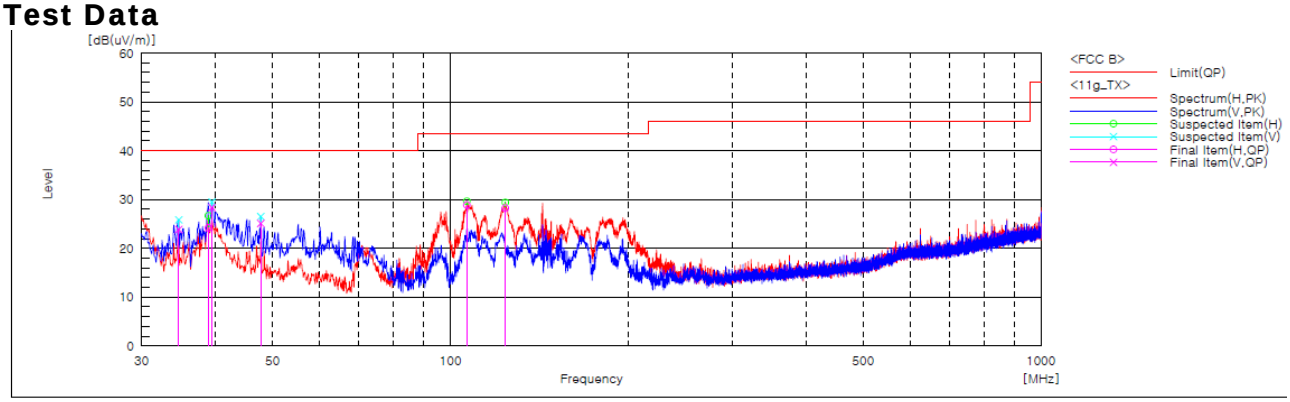
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	34.572	V	43.9	-15.0	28.9	40.0	11.1	99.8	185.3	
2	36.097	V	42.1	-14.9	27.2	40.0	12.8	99.8	197.5	
3	38.927	V	45.3	-13.8	31.5	40.0	8.5	99.8	185.3	
4	38.927	H	40.9	-13.8	27.1	40.0	12.9	99.8	55.0	
5	45.133	V	39.0	-12.4	26.6	40.0	13.4	99.8	126.2	
6	106.643	H	44.4	-14.4	30.0	43.5	13.5	99.8	90.5	

Remark :
1. The EUT was tested in three orientations in order to determine that "Z 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(Worst Case)

The requirements are:
☒ Complies

Test Data



Final Result

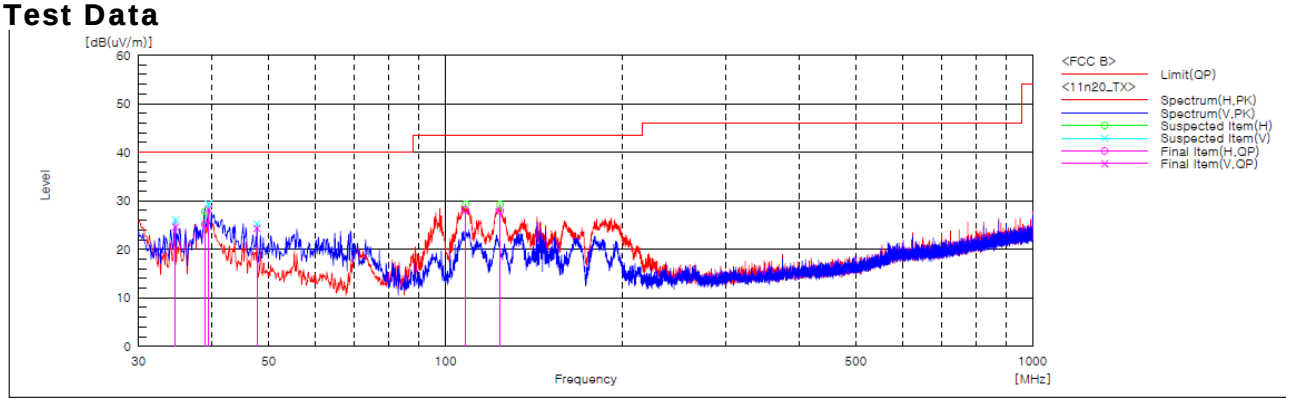
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	34.681	V	38.9	-15.0	23.9	40.0	16.1	99.8	233.8	
2	38.927	H	38.0	-13.8	24.2	40.0	15.8	99.8	45.2	
3	39.471	V	42.0	-13.6	28.4	40.0	11.6	99.8	166.8	
4	47.745	V	37.5	-12.4	25.1	40.0	14.9	99.8	2.6	
5	106.643	H	43.3	-14.4	28.9	43.5	14.6	99.8	276.8	
6	123.844	H	44.6	-16.4	28.2	43.5	15.3	99.8	45.2	

Remark :
1. The EUT was tested in three orientations in order to determine that "Z 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(Worst Case)

The requirements are:
☒ Complies

Test Data



Final Result

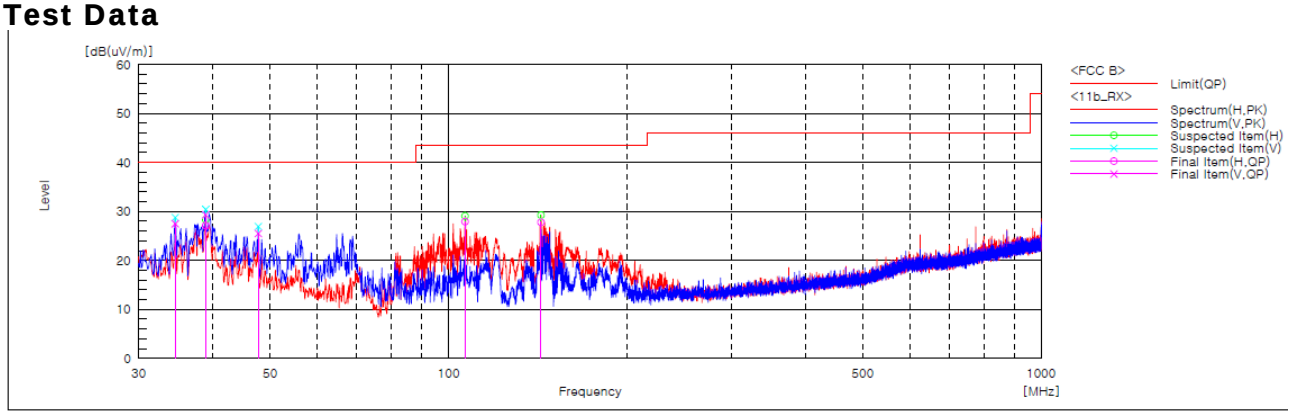
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	34.681	V	39.6	-15.0	24.6	40.0	15.4	99.8	338.5	
2	38.927	H	39.0	-13.8	25.2	40.0	14.8	99.8	64.1	
3	39.471	V	41.9	-13.6	28.3	40.0	11.7	99.8	210.9	
4	47.745	V	36.7	-12.4	24.3	40.0	15.7	99.8	317.0	
5	108.276	H	42.6	-14.5	28.1	43.5	15.4	99.8	95.6	
6	123.844	H	44.3	-16.4	27.9	43.5	15.6	99.8	52.4	

Remark :
1. The EUT was tested in three orientations in order to determine that "Z 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, 802.11b(Worst Case)

The requirements are:
☒ Complies

Test Data



Final Result

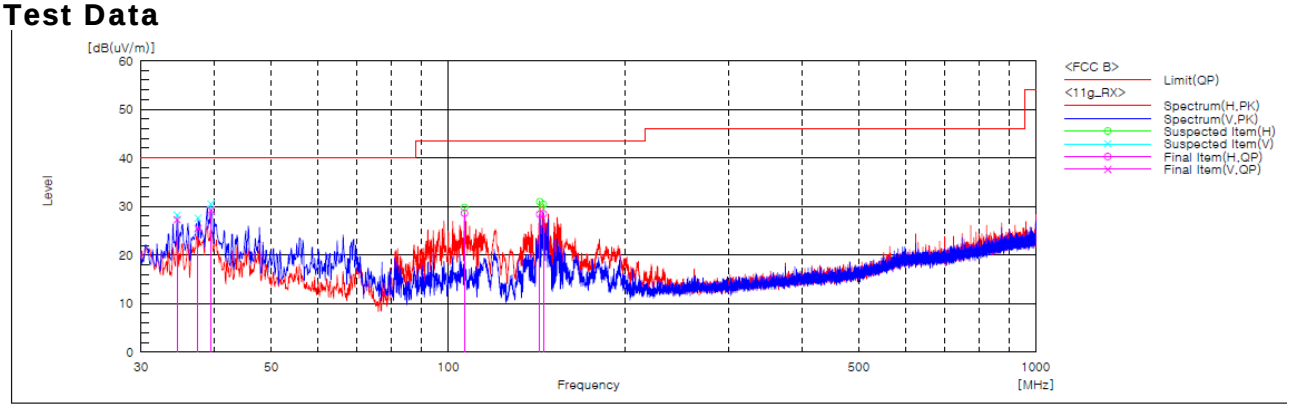
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	34.572	V	42.5	-15.0	27.5	40.0	12.5	99.8	314.3	
2	38.927	V	43.1	-13.8	29.3	40.0	10.7	99.8	302.5	
3	38.927	H	40.9	-13.8	27.1	40.0	12.9	99.8	67.0	
4	47.745	V	37.9	-12.4	25.5	40.0	14.5	99.8	338.1	
5	106.643	H	42.3	-14.4	27.9	43.5	15.6	99.8	126.7	
6	143.222	H	45.4	-17.6	27.8	43.5	15.7	99.8	114.9	

Remark :
1. The EUT was tested in three orientations in order to determine that "Z 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, 802.11g(Worst Case)

The requirements are:
☒ Complies

Test Data



Final Result

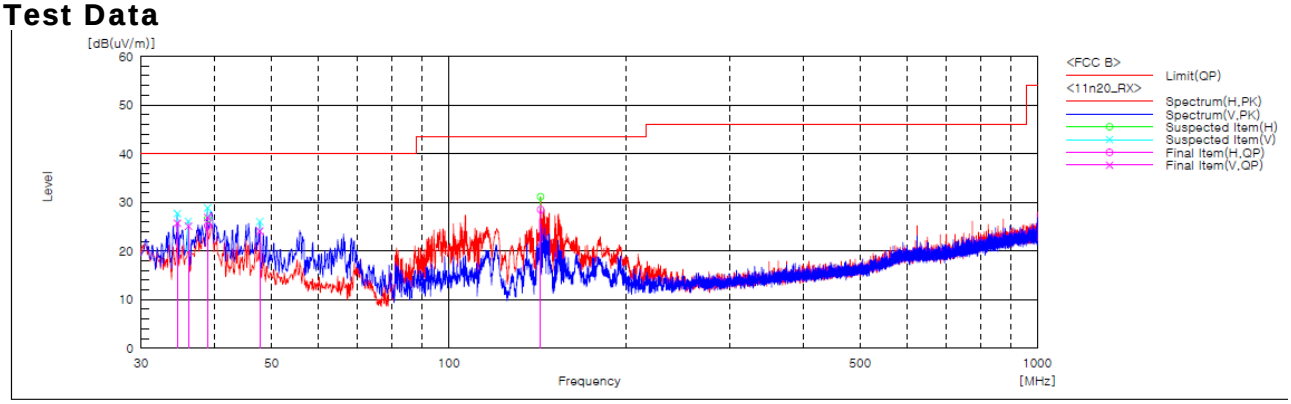
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	34.572	V	42.3	-15.0	27.3	40.0	12.7	99.8	185.1	
2	37.512	V	39.9	-14.4	25.5	40.0	14.5	99.8	258.9	
3	39.471	V	42.8	-13.6	29.2	40.0	10.8	99.8	271.3	
4	106.643	H	43.0	-14.4	28.6	43.5	14.9	99.8	108.5	
5	143.222	H	46.0	-17.6	28.4	43.5	15.1	99.8	108.5	
6	145.182	H	46.1	-17.6	28.5	43.5	15.0	99.8	96.6	

Remark :
1. The EUT was tested in three orientations in order to determine that "Z 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, 802.11n_HT20(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	34.572	V	40.7	-15.0	25.7	40.0	14.3	99.8	235.2	
2	36.097	V	40.0	-14.9	25.1	40.0	14.9	99.8	235.2	
3	38.927	V	40.7	-13.8	26.9	40.0	13.1	99.8	174.1	
4	38.927	H	39.0	-13.8	25.2	40.0	14.8	99.8	78.3	
5	47.745	V	36.5	-12.4	24.1	40.0	15.9	99.8	32.8	
6	143.222	H	46.1	-17.6	28.5	43.5	15.0	99.8	101.7	

Remark :
1. The EUT was tested in three orientations in order to determine that "Z 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 : Transmitter, 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]
3 216.00	H	54.00	74.00	39.90	44.60	14.10	29.40
3 216.00	V	54.00	74.00	32.90	42.90	21.10	31.10
4 976.00	H	54.00	74.00	38.70	44.60	15.30	29.40
4 976.00	V	54.00	74.00	36.20	43.50	17.80	30.50
2 390.00	H	54.00	74.00	47.20	59.60	6.80	14.40
2 390.00	V	54.00	74.00	42.00	54.60	12.00	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]
3 249.00	H	54.00	74.00	34.80	40.40	19.20	33.60
3 249.00	V	54.00	74.00	28.70	39.20	25.30	34.80
4 976.00	H	54.00	74.00	38.20	44.70	15.80	29.30
4 976.00	V	54.00	74.00	35.90	43.90	18.10	30.10

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]
4 976.00	H	54.00	74.00	37.20	45.50	8.50	28.50
4 976.00	V	54.00	74.00	35.60	43.50	10.50	30.50
2 483.50	H	54.00	74.00	46.20	57.00	7.80	17.00
2 483.50	V	54.00	74.00	42.10	53.20	11.90	20.80

Remarks

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

Test mode : Transmitter, 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]
3 216.00	H	54.00	74.00	36.94	44.70	17.06	29.30
3 216.00	V	54.00	74.00	39.64	45.10	14.36	28.90
2 390.00	H	54.00	74.00	47.64	68.60	6.36	5.40
2 390.00	V	54.00	74.00	42.44	55.40	11.56	18.60

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]
3 249.00	H	54.00	74.00	31.14	41.70	22.86	32.30
3 249.00	V	54.00	74.00	32.74	42.20	21.26	31.80

High(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2 483.50	H	54.00	74.00	51.44	70.20	2.56	3.80
2 483.50	V	54.00	74.00	43.64	57.60	10.36	16.40

Remarks

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

Test mode : Transmitter, 802.11n_HT20

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]
3 216.00	H	54.00	74.00	37.10	44.50	16.90	29.50
3 216.00	V	54.00	74.00	39.70	45.30	14.30	28.70
2 390.00	H	54.00	74.00	48.10	67.40	5.90	6.60
2 390.00	V	54.00	74.00	43.00	54.70	11.00	19.30

Mid(2 437 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
3 249.00	H	54.00	74.00	31.40	42.10	22.60	31.90
3 249.00	V	54.00	74.00	32.70	41.20	21.30	32.80

High(2 462 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2 483.50	H	54.00	74.00	51.20	70.80	2.80	3.20
2 483.50	V	54.00	74.00	43.40	57.40	10.60	16.60

Remarks

1. The EUT was tested in three orientations in order to determine that "Z 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]
No emissions were detected at a level greater than 20dB below limit.							

Remarks

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

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.

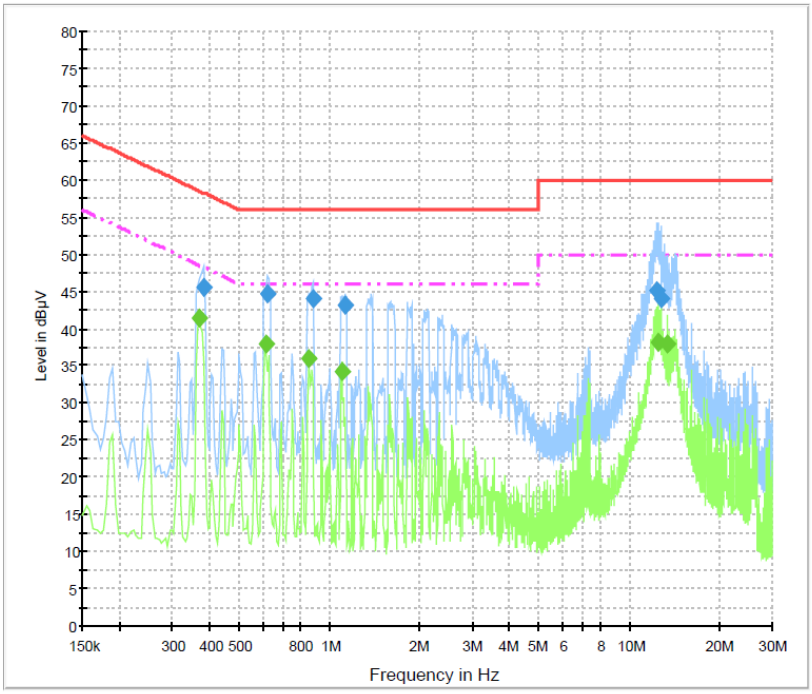
Test Results

The requirements are:
☒ Complies

Test Data

[LINE]

Class B_L1



Final Result 1

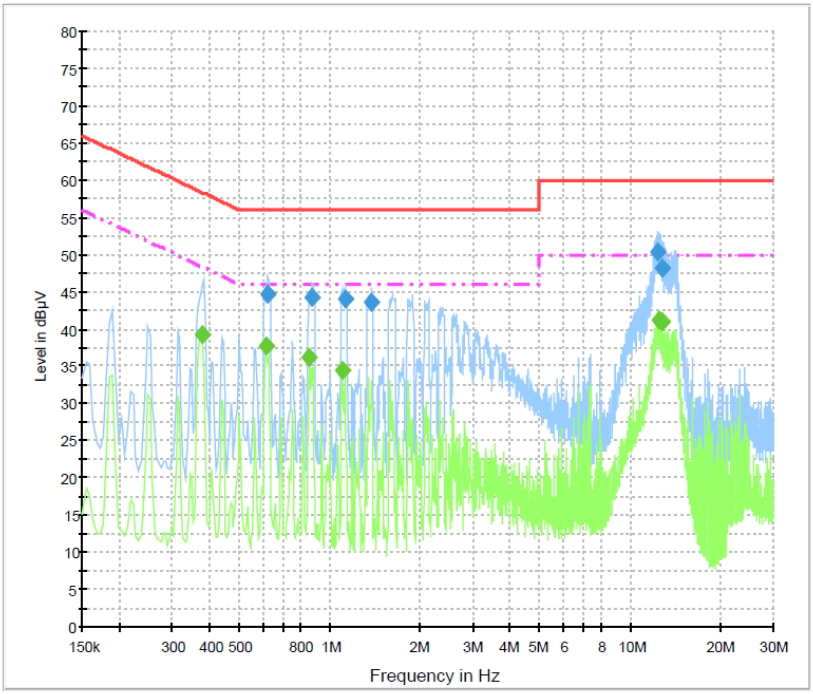
Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.379500	45.6	1000.0	9.000	On	L1	9.9	12.7	58.3
0.622500	44.8	1000.0	9.000	On	L1	9.9	11.2	56.0
0.879000	44.0	1000.0	9.000	On	L1	9.8	12.0	56.0
1.131000	43.2	1000.0	9.000	On	L1	9.8	12.8	56.0
12.300000	45.2	1000.0	9.000	On	L1	9.9	14.8	60.0
12.862500	44.0	1000.0	9.000	On	L1	9.9	16.0	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.370500	41.5	1000.0	9.000	On	L1	9.9	7.0	48.5
0.613500	38.0	1000.0	9.000	On	L1	9.9	8.0	46.0
0.856500	35.9	1000.0	9.000	On	L1	9.8	10.1	46.0
1.099500	34.2	1000.0	9.000	On	L1	9.8	11.8	46.0
12.484500	38.2	1000.0	9.000	On	L1	9.9	11.8	50.0
13.420500	38.0	1000.0	9.000	On	L1	10.0	12.0	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)
0.622500	44.7	1000.0	9.000	On	N	9.9	11.3	56.0
0.874500	44.4	1000.0	9.000	On	N	9.8	11.6	56.0
1.126500	44.1	1000.0	9.000	On	N	9.8	11.9	56.0
1.378500	43.5	1000.0	9.000	On	N	9.7	12.5	56.0
12.417000	50.4	1000.0	9.000	On	N	9.9	9.6	60.0
12.858000	48.1	1000.0	9.000	On	N	9.9	11.9	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.375000	39.3	1000.0	9.000	On	N	9.9	9.1	48.4
0.613500	37.7	1000.0	9.000	On	N	9.9	8.3	46.0
0.856500	36.2	1000.0	9.000	On	N	9.8	9.8	46.0
1.104000	34.5	1000.0	9.000	On	N	9.8	11.5	46.0
12.480000	41.2	1000.0	9.000	On	N	9.9	8.8	50.0
12.858000	40.9	1000.0	9.000	On	N	9.9	9.1	50.0

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	2017-11-01	2018-11-01
2	Signal Generator	Rohde & Schwarz	SMB100A	175528	2017-11-01	2018-11-01
3	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2017-10-25	2018-10-25
4	Bilog Antenna	Schaffner	CBL6111C	2551	2018-05-10	2020-05-10
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2018-05-02	2020-05-02
6	6dB Attenuator	R&S	DNF	272.4110.50-2	2017-10-25	2018-10-25
7	AMPLIFIER	SONOMA	310	291721	2018-02-02	2019-02-02
8	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2018-02-01	2019-02-01
9	Preamplifier	Agilent	8449B	3008A02011	2017-11-30	2018-11-30
10	Horn Antenna	ETS-Lindgren	3116	00062504	2017-12-04	2019-12-04
11	Horn Antenna	ETS-Lindgren	3117	00154525	2017-02-17	2019-02-17
12	Band Reject Filter	Micro Tronics	BRM50702	G233	2018-01-26	2019-01-26
13	LISN	Rohde & Schwarz	ENV216	101760	2018-01-31	2019-01-31
14	Singnal Canditioning Unit	R&S	SCU-40	10023	2017-11-01	2018-11-01
15	RF Cable	Canare Corporation	L-5D2W	N/A	-	-
16	RF Cable	Junkosha Inc.	MWX221	1510S085	-	-
17	RF Cable	HUBER+SUHNER	SUCOFLEX 102	MY073/2	-	-
18	RF Cable	HUBER+SUHNER	SUCOFLEX 102	MY4728/2	-	-
19	RF Cable	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	-	-
20	RF Cable	HUBER+SUHNER	SUCOFLEX 104	N/A	-	-
21	RF Cable	HUBER+SUHNER	SUCOFLEX 104	MY27573/4	-	-
22	RF Cable	HUBER+SUHNER	SUCOFLEX 106	N/A	-	-