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-2024-00714

1. Applicant

◦ Name : SOLUM CO.,LTD.

◦ Address : 4,5,6th F, 357, Guseong-ro, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea (Zip 16914)

◦ Date of Receipt : 2023-12-26

2. Manufacturer

◦ Name : SOLUM CO.,LTD.

◦ Address : 4,5,6th F, 357, Guseong-ro, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea (Zip 16914)

3. Factory

◦ Name : SOLUM VINA CO., LTD

◦ Address : Plot B3, Ba Thien 2 Industrial park, Thien Ke Ward, Binh Xuyen District, Vinh Phuc Province, 281200.,Peple's Republic of Vietnam

4. Use of Report : For FCC Conformance

5. Test Sample / Model: WiFi BLE Gateway / CG01WTS01W

6. Date of Test : 2024-02-20 to 2024-02-28

7. Test Standard(method) used : FCC 47 CFR part 15 subpart E 15.407
ISED RSS-247 & RSS-Gen

8. Testing Environment: Temp.: (22 ± 1) ℃, Humidity: (32 ± 3) % R.H.

9. Test Results : Compliance

10. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing
(Address : (Unhak-Dong) 5, Dongbu-ro 221beon-gil, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea)

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

Remark. This report is not related to KOLAS accreditation and relevant regulation.

2024-03-08

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REPORT REVISION HISTORY

Date	Revision	Page No
2024-03-08	Issued (CTK-2024-00714)	all

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1. General Product Description

1.1 Applicant Information

Company	SOLUM CO.,LTD.
Contact Point	4,5,6th F, 357, Guseong-ro, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea (Zip 16914)
Contact Person	Name : Ki Dong Lee E-mail : kdlee007@solu-m.com Tel : +82-31-8006-7677

1.2 Product Information

FCC ID	2AFWN-CG01WTS01W	
Product Description	WiFi BLE Gateway	
Model name	CG01WTS01W	
Variant Model name	-	
Operating Frequency	UNII 1	20 MHz_BW : 5 180 MHz – 5 240 MHz
	UNII 2A	20 MHz_BW : 5 260 MHz – 5 320 MHz
	UNII 2C	20 MHz_BW : 5 500 MHz – 5 720 MHz
	UNII 3	20 MHz_BW : 5 745 MHz – 5 825 MHz
RF Output Power	802.11a : 18.78 dBm (75.51 mW) 802.11n_HT20 : 18.05 dBm (63.83 mW)	
Antenna Specification	Antenna type : PCB Antenna	
	UNII 1, UNII 2A	Peak Gain : 2.99 dBi
	UNII 2C, UNII 3	Peak Gain : 3.81 dBi
Antenna Configurations	802.11a : SISO 802.11n : SISO	
Type of Modulation	802.11a/n : OFDM	
Data Rate	802.11a : 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6 Mbps 802.11n : up to 72.2 Mbps	
Power Source	DC 5 V	
Hardware Rev	1.00	
Software Rev	1.00	
Dynamic Frequency Selection	Slave without radar detection	

RF Power setting in Test SW

Mode	Frequency Band	Power Setting Value
802.11a	UNII 1	107
	UNII 2A	117
	UNII 2C	117
	UNII 3	117
802.11n_HT20	UNII 1	108
	UNII 2A	114
	UNII 2C	114
	UNII 3	114

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253R6N
AC/DC Adapter	HP	HSTNN-LA40	-

1.4 Model Differences

Not applicable

2. Accreditations

2.1 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	CN : 8737A CAB ID : KR0025
KOREA	NRRA	KR0025

2.2 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
15.407 (e)	6 dB Bandwidth	> 500 kHz (5 725 – 5 850 MHz)	C	Conducted
15.407 (a)	26 dB Bandwidth and 99% Bandwidth	NA	C	
15.407 (a)(1),(2),(3)	Conducted Output Power	< 250 mW (5 150 – 5 250 MHz) < 250 mW (5 250 – 5 350 MHz, 5 470 – 5 725 MHz) < 1 W (5 725 – 5 850 MHz)	C	
15.407 (a)(1),(2),(3)	Power Spectral Density	< 11 dBm/MHz (5 150 – 5 250 MHz) < 11 dBm/MHz (5 250 – 5 350 MHz, 5 470 – 5 725 MHz) < 30 dBm/500 kHz (5 725 – 5 850 MHz)	C	
15.407 (g)	Frequency Stability	NA	C	
15.407 (b)	Undesirable emission	< -27 dBm/MHz EIRP (5 150 – 5 250 MHz, 5 250 – 5 350 MHz, 5 470 – 5 725 MHz) < -27 dBm/MHz EIRP < 10 dBm/MHz EIRP < 15.6 dBm/MHz EIRP < 27 dBm/MHz EIRP (5 725 – 5 850 MHz)	C	Radiated
15.205, 15.407 (b)(9),(10)	Radiated Spurious Emission	15.209(a)	C	
15.407 (b)(9)	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 15.407, ANSI C63.10-2013				
Note 4: The tests were performed according to the method of measurements prescribed in KDB No.789033				

ISED Part Section(s)	Requirement(s)	Limit	Status (Note 1)	Test Condition
RSS-Gen 6.7	6 dB Bandwidth	> 500 kHz (5 725 – 5 850 MHz)	C	Conducted
RSS-Gen 6.7	26 dB Bandwidth and 99% Bandwidth	NA	C	
RSS-247 6.2.1.1, 6.2.2.1, 6.2.3.1, 6.2.4.2	Conducted Output Power	< 200 mW EIRP (5 150 – 5 250 MHz) < 250 mW (5 250 – 5 350 MHz, 5 470 – 5 725 MHz) < 1 W (5 725 – 5 850 MHz)	C	
RSS-247 6.2.1.1, 6.2.2.1, 6.2.3.1, 6.2.4.2	Power Spectral Density	< 10 dBm/MHz EIRP (5 150 – 5 250 MHz) < 11 dBm/MHz (5 250 – 5 350 MHz, 5 470 – 5 725 MHz) < 30 dBm/500 kHz (5 725 – 5 850 MHz)	C	
RSS-Gen 6.11	Frequency Stability	NA	C	
RSS-247 6.2.1.2, 6.2.2.2, 6.2.3.2, 6.2.4.3	Undesirable emission	< -27 dBm/MHz EIRP (5 150 – 5 250 MHz, 5 250 – 5 350 MHz, 5 470 – 5 725 MHz) < -27 dBm/MHz EIRP < 10 dBm/MHz EIRP < 15.6 dBm/MHz EIRP < 27 dBm/MHz EIRP (5 725 – 5 850 MHz)	C	Radiated
RSS-Gen 6.13, 7.3, 8.9, 8.10	Radiated Spurious Emission	RSS-Gen 7.3 8.9, 8.10	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: RSS-247, RSS-GEN				
Note 4: The tests were performed according to the method of measurements prescribed in KDB No.789033, ANSI C63.10-2013				

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 & Bandwidth

- 802.11a, 802.11n_HT20

	Lowest channel	Middle channel	Highest channel
UNII 1	5 180 MHz	5 200 MHz	5 240 MHz
UNII 2A	5 260 MHz	5 300 MHz	5 320 MHz
UNII 2C	5 500 MHz	5 600 MHz	5 700 MHz, 5 720 MHz
UNII 3	5 745 MHz	5 785 MHz	5 825 MHz

Test mode & Worst case

Test mode	Modulation	Data rate	Duty Cycle	Duty Cycle Factor
802.11a	OFDM	6 Mbps	94.4 %	0.25 dB
802.11n_HT20	OFDM	MCS 0	94.0 %	0.27 dB

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 (C.L.: Approx. 95 %, k = 2)
Power Spectral Density	1.5 dB (C.L.: Approx. 95 %, k = 2)
Occupied Bandwidth	0.1 MHz (C.L.: Approx. 95 %, k = 2)
Unwanted Emission(conducted)	3.0 dB (C.L.: Approx. 95 %, k = 2)
Radiated Emissions (f ≤ 1 GHz)	3.88 dB (C.L.: Approx. 95 %, k = 2)
Radiated Emissions (f > 1 GHz)	4.50 dB (C.L.: Approx. 95 %, k = 2)
Line Conducted Emission	2.08 dB (C.L.: Approx. 95 %, k = 2)

3.5 Test Software

Conducted Test	Ics Pro Ver. 6.0.3
Radiated Test	EP5RE Ver. 6.0.10, ES10 Ver. 2022.04.000
Line Conducted Test	EMC32 Ver. 10.50.00

4. Technical Characteristic Test

4.1 6dB Bandwidth

Test Procedures

KDB 789033 – Section C.2
ANSI C63.10-2013 - Section 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 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.

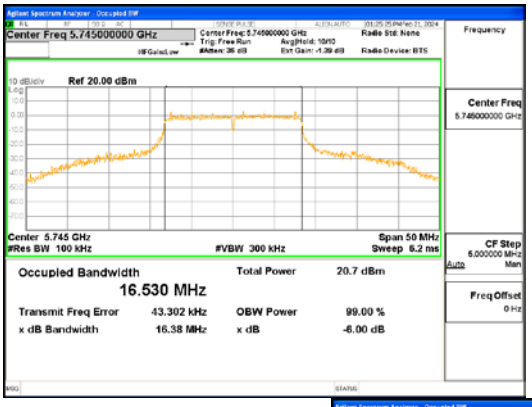
Minimum Standard:

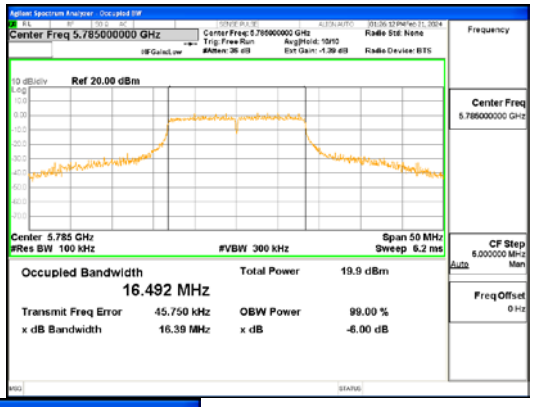
6 dB Bandwidth > 500 kHz

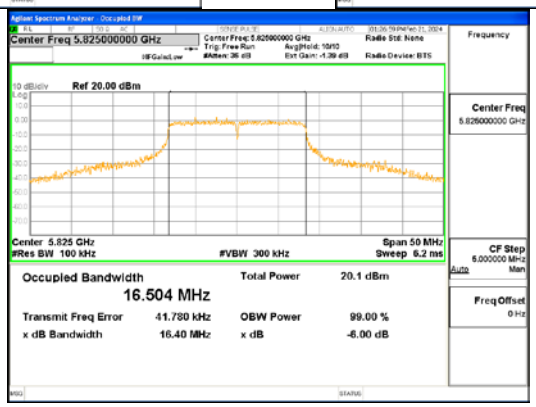
Test Data:

	6 dB Bandwidth (MHz)	
Mode / Frequency	802.11a	802.11n_HT20
5 745 MHz	16.38	17.30
5 785 MHz	16.39	17.58
5 825 MHz	16.40	17.31
Measurement uncertainty	± 0.1 MHz	

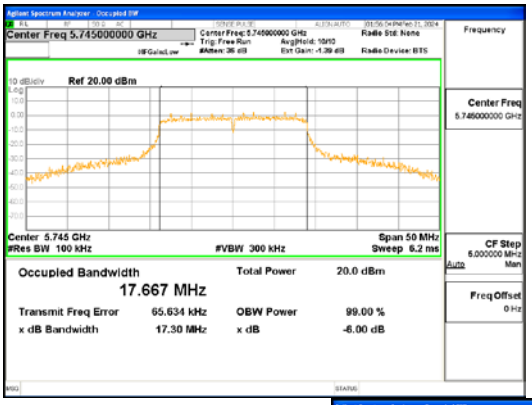
See next pages for actual measured spectrum plots.

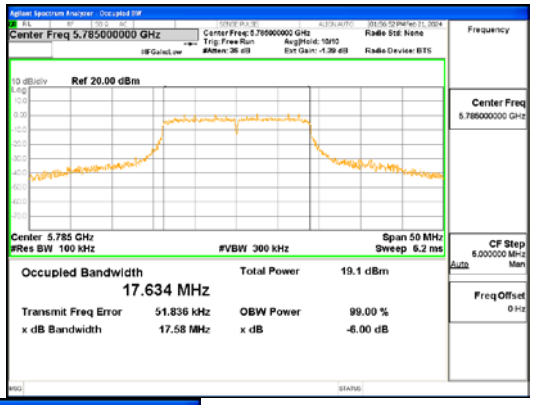


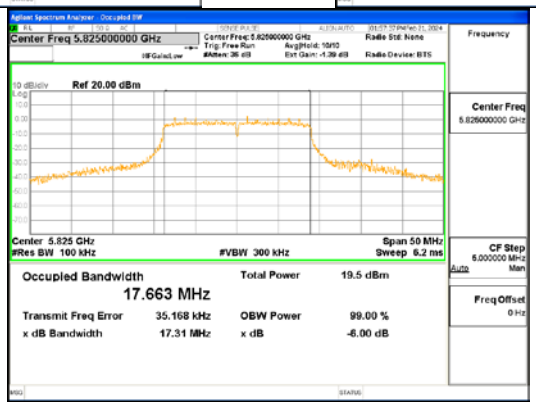




802.11a_UNII 3







802.11n_HT20_UNII 3

4.2 26 dB Bandwidth and 99% Bandwidth

Test Procedures

KDB 789033 – Section C.1
ANSI C63.10-2013 - Section 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 26 dB relative to the maximum level measured in the fundamental emission.

Test Procedures

KDB 789033 – Section C.1
ANSI C63.10-2013 - Section 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 = approximately 1 % of the emission bandwidth

b) VBW ≥ RBW

c) Detector = peak

d) Trace mode = Max hold

e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

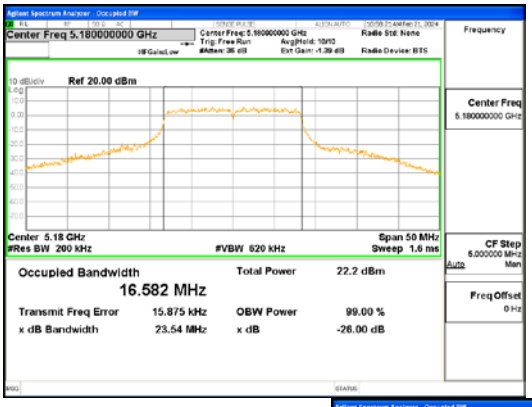
Minimum Standard:

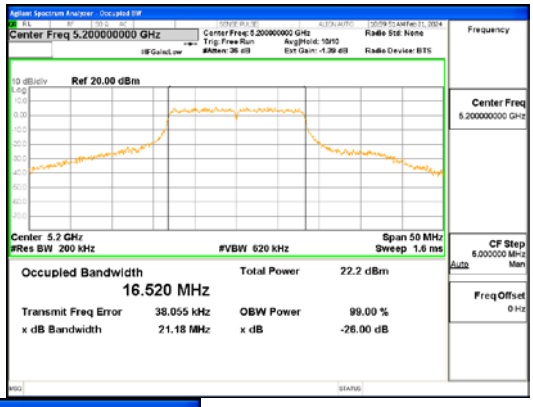
NA

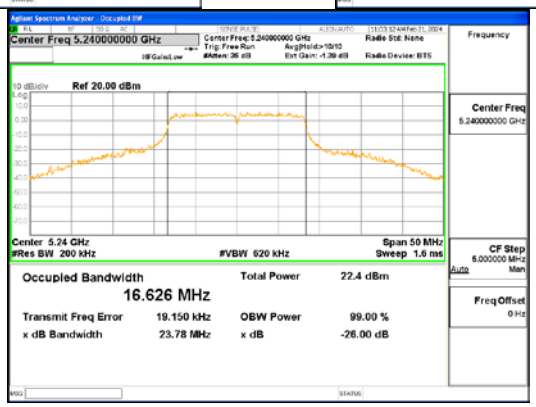
Test Data:

	26 dB Bandwidth and 99 % Bandwidth (MHz)			
Mode	802.11a		802.11n_HT20	
Frequency	26 dB	99 %	26 dB	99 %
5 180 MHz	23.54	16.58	21.47	17.72
5 200 MHz	21.18	16.52	24.48	17.75
5 240 MHz	23.78	16.63	26.04	17.78
5 260 MHz	33.58	17.45	31.90	17.91
5 300 MHz	31.41	17.02	31.60	17.92
5 320 MHz	33.23	17.05	32.93	17.95
5 500 MHz	33.40	17.00	25.43	17.83
5 600 MHz	27.94	16.61	24.28	17.77
5 700 MHz	28.61	16.78	27.51	17.78
5 720 MHz	27.97	16.68	22.87	17.70
5 745 MHz	32.13	17.67	28.91	18.49
5 785 MHz	24.56	17.29	23.13	18.31
5 825 MHz	30.57	17.58	27.34	18.38
Measurement uncertainty	± 0.1 MHz			

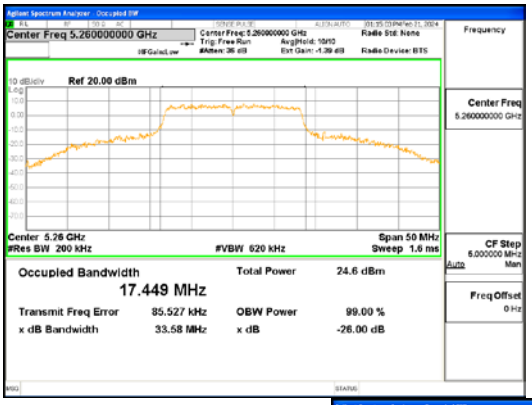
See next pages for actual measured spectrum plots.

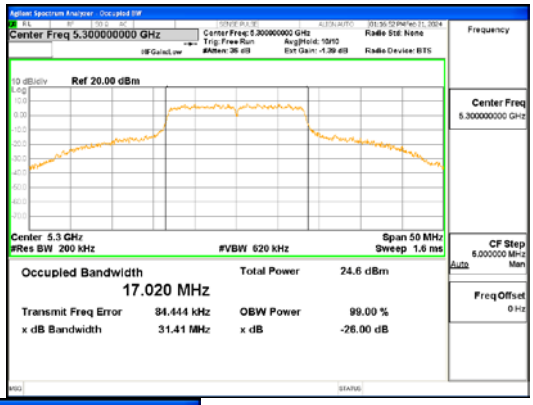


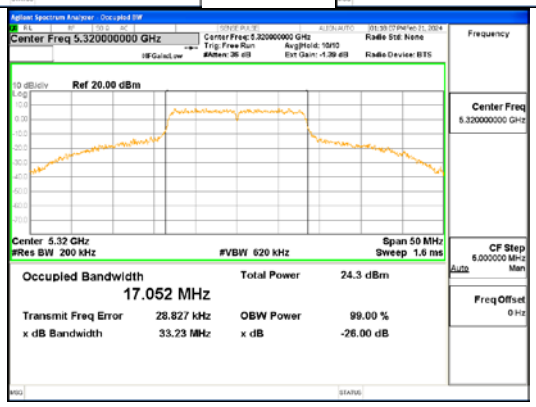




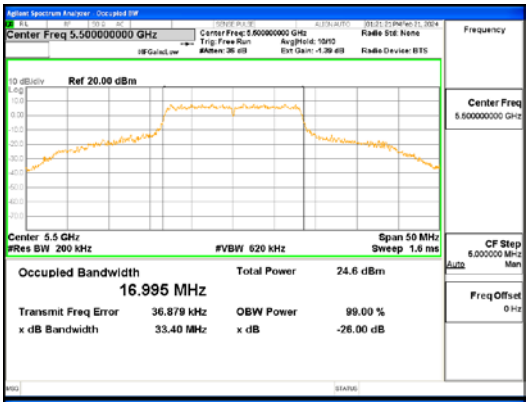
802.11a_UNII 1

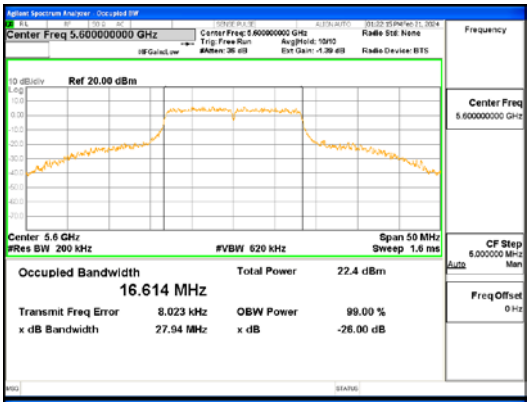


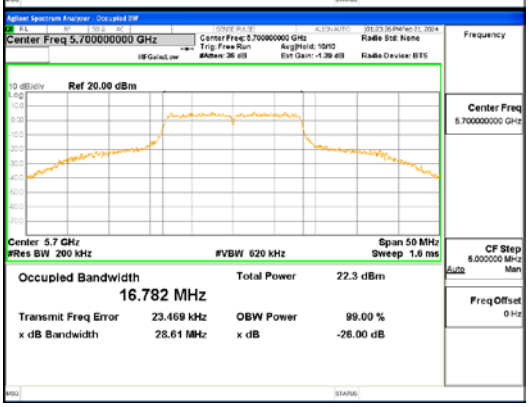


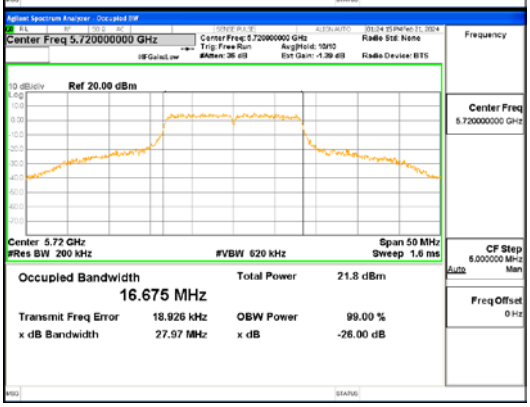


802.11a_UNII 2A









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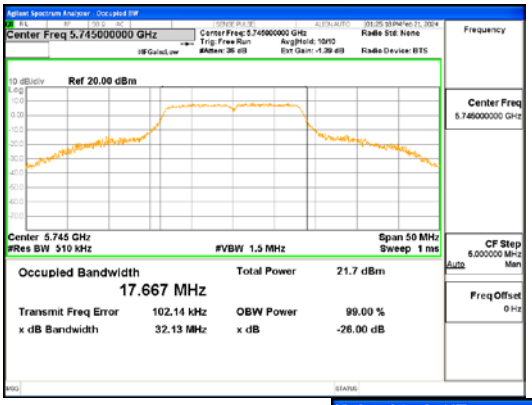

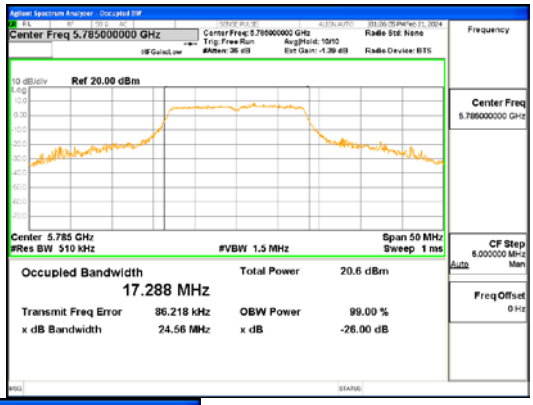

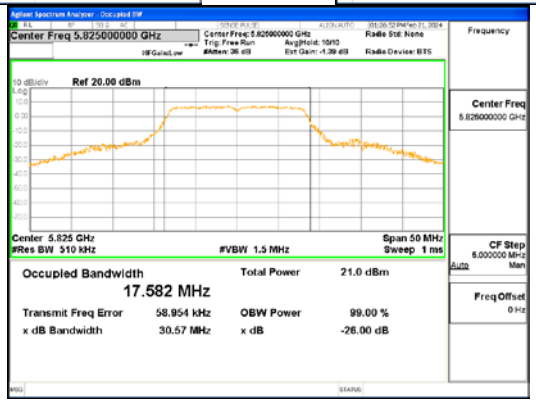

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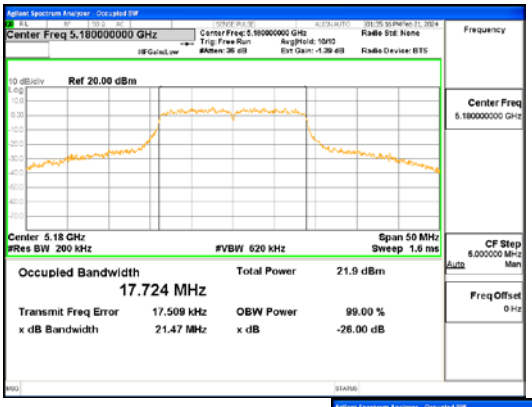

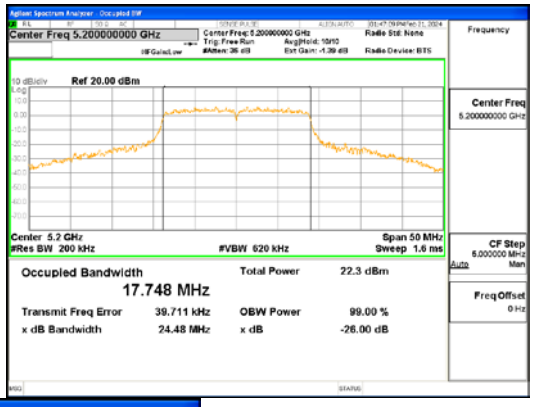

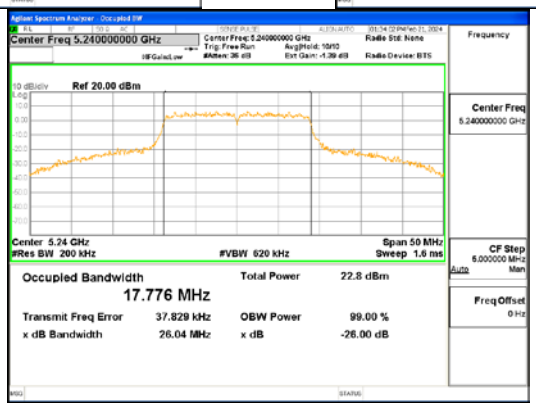

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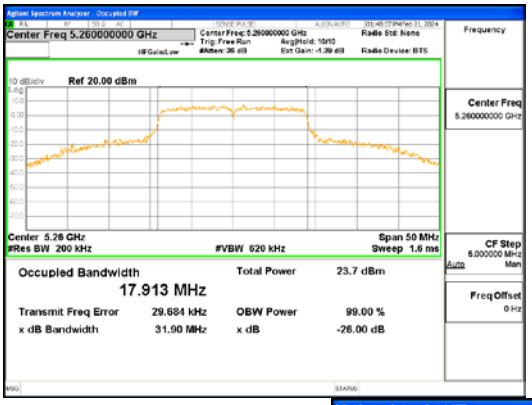

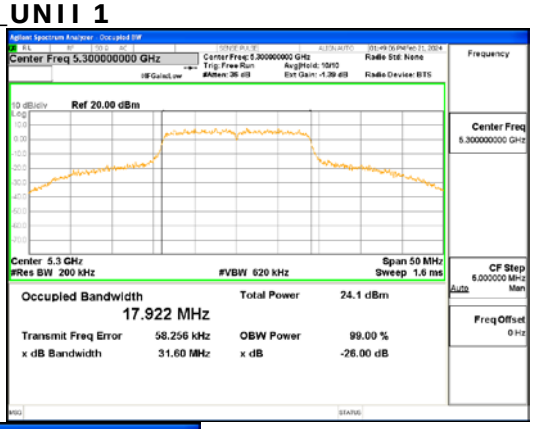

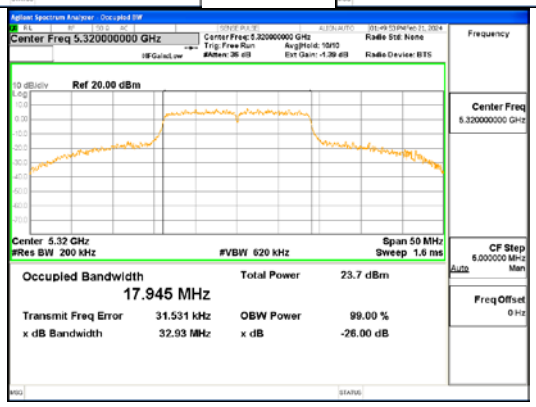

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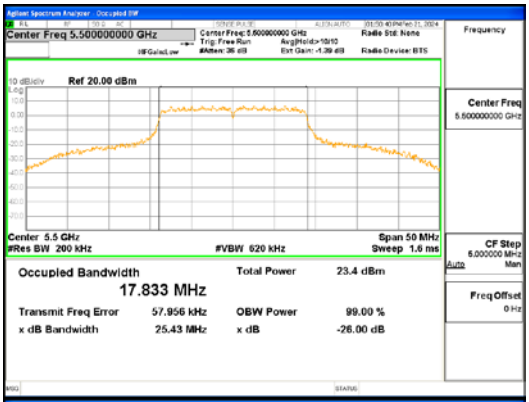

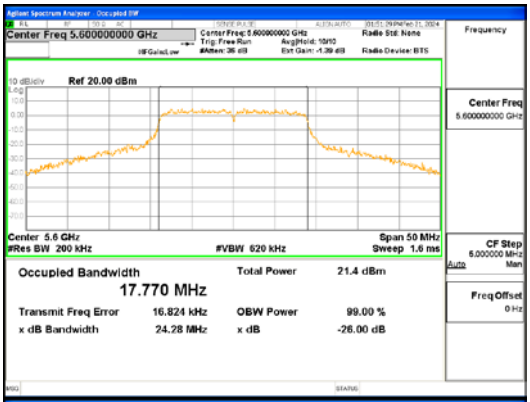

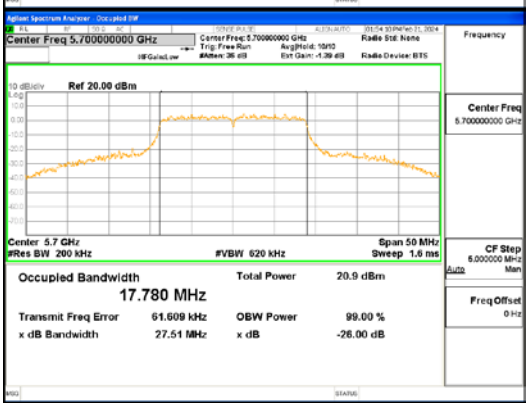

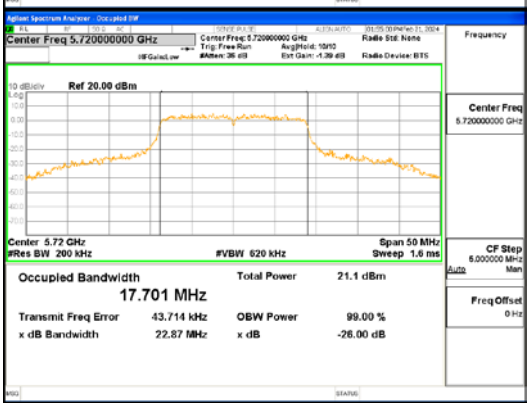

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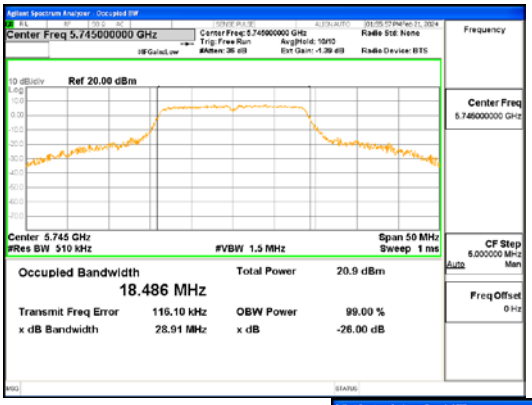
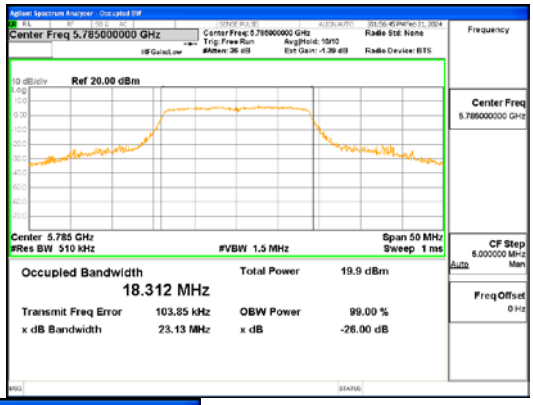
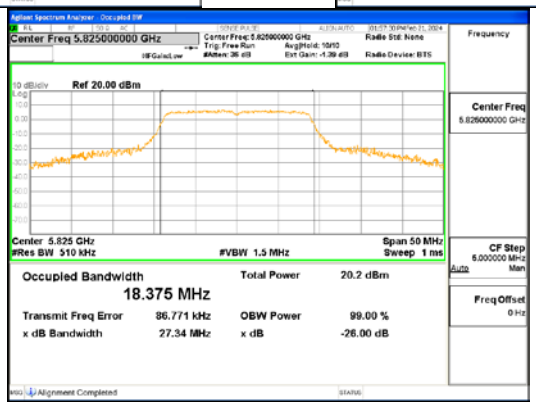






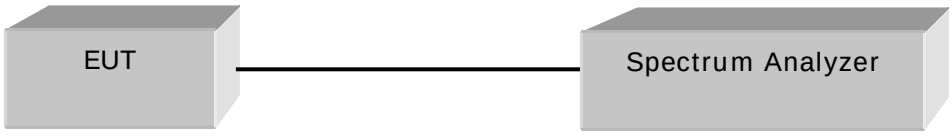
802.11n_HT20_UNII 3

4.3 OUTPUT POWER

Test Procedures

KDB 789033 – Section E.2.d (Method SA-2, Maximum Conducted Output Power)
ANSI C63.10-2013 – Section 12.3.2.4

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) RBW = 1 MHz

b) VBW ≥ 3 x RBW

c) Sweep time = auto

d) Detector = power averaging (rms)

e) Trace mode = Average at least 100

f) Duty cycle factor = 10log(1/x)

Test mode	Duty Cycle Factor (dB)
802.11a	0.25
802.11n_HT20	0.27

Limit

Operating Mode	Mode	ANT Gain (dBi)	Band	FCC Limit (dBm)	ISED Limit (dBm)
SISO	802.11a/n	2.99	UNII 1	24.00	Note
			UNII 2A	24.00	Note
		3.81	UNII 2C	24.00	Note
			UNII 3	30.00	Note

Note :

Band	Limit (dBm)
UNII 1	the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 $\log_{10}$B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz.
UNII 2A	The maximum conducted output power shall not exceed 250 mW or 11 + 10 $\log_{10}$B, dBm, whichever is less. The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 $\log_{10}$B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.
UNII 2C	The maximum conducted output power shall not exceed 250 mW or 11 + 10 $\log_{10}$B, dBm, whichever is less. The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 $\log_{10}$B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.
UNII 3	The maximum conducted output power shall not exceed 1 W.

Test Data

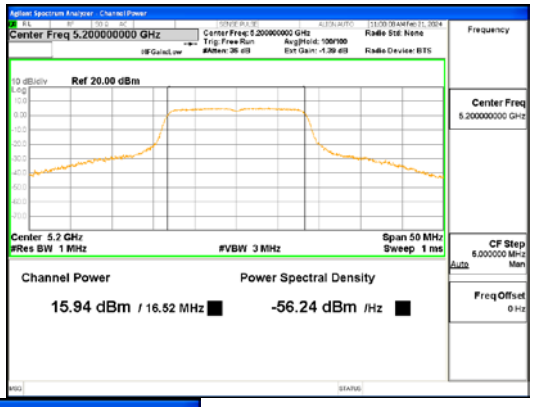
[FCC]

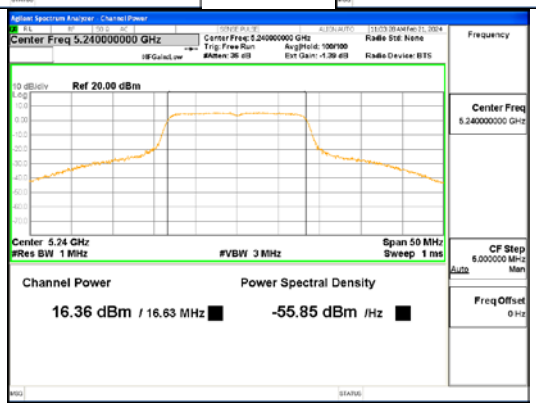
Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11a	5 180	16.03	0.25	16.28	24.00	7.72
	5 200	15.94	0.25	16.19	24.00	7.81
	5 240	16.36	0.25	16.61	24.00	7.39
	5 260	18.53	0.25	18.78	24.00	5.22
	5 300	18.34	0.25	18.59	24.00	5.41
	5 320	18.14	0.25	18.39	24.00	5.61
	5 500	18.12	0.25	18.37	24.00	5.63
	5 600	16.03	0.25	16.28	24.00	7.72
	5 700	16.06	0.25	16.31	24.00	7.69
	5 720	15.51	0.25	15.76	24.00	8.24
	5 745	15.57	0.25	15.82	30.00	14.18
	5 785	14.69	0.25	14.94	30.00	15.06
	5 825	14.96	0.25	15.21	30.00	14.79
802.11n _HT20	5 180	15.57	0.27	15.84	24.00	8.16
	5 200	16.06	0.27	16.33	24.00	7.67
	5 240	16.54	0.27	16.81	24.00	7.19
	5 260	17.61	0.27	17.88	24.00	6.12
	5 300	17.78	0.27	18.05	24.00	5.95
	5 320	17.45	0.27	17.72	24.00	6.28
	5 500	17.12	0.27	17.39	24.00	6.61
	5 600	15.02	0.27	15.29	24.00	8.71
	5 700	14.65	0.27	14.92	24.00	9.08
	5 720	14.88	0.27	15.15	24.00	8.85
	5 745	14.84	0.27	15.11	30.00	14.89
	5 785	13.87	0.27	14.14	30.00	15.86
	5 825	14.17	0.27	14.44	30.00	15.56
Measurement uncertainty		± 1.5 dB				

[ISED]

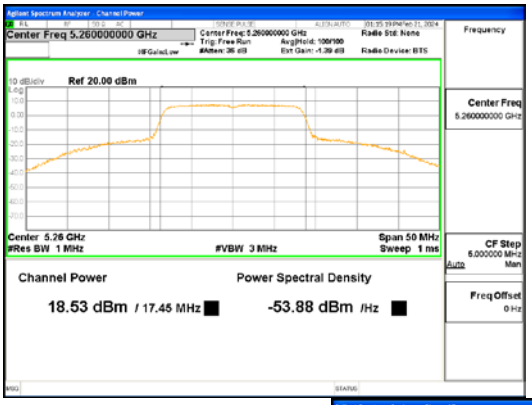
Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result (dBm)		Limit (dBm)		Margin (dB)	
				Conducted Output Power	EIRP	Conducted Output Power	EIRP	Conducted Output Power	EIRP
802.11a	5 180	16.03	0.25	16.28	19.27	-	22.20	-	2.93
	5 200	15.94	0.25	16.19	19.18	-	22.18	-	3.00
	5 240	16.36	0.25	16.61	19.60	-	22.21	-	2.61
	5 260	18.53	0.25	18.78	21.77	23.42	29.42	4.64	7.65
	5 300	18.34	0.25	18.59	21.58	23.31	29.31	4.72	7.73
	5 320	18.14	0.25	18.39	21.38	23.32	29.32	4.93	7.94
	5 500	18.12	0.25	18.37	22.18	23.30	29.30	4.93	7.12
	5 600	16.03	0.25	16.28	20.09	23.20	29.20	6.92	9.11
	5 700	16.06	0.25	16.31	20.12	23.25	29.25	6.94	9.13
	5 720	15.51	0.25	15.76	19.57	23.22	29.22	7.46	9.65
	5 745	15.57	0.25	15.82	-	30.00	-	14.18	-
	5 785	14.69	0.25	14.94	-	30.00	-	15.06	-
	5 825	14.96	0.25	15.21	-	30.00	-	14.79	-
802.11n _HT20	5 180	15.57	0.27	15.84	18.83	-	22.48	-	3.65
	5 200	16.06	0.27	16.33	19.32	-	22.49	-	3.17
	5 240	16.54	0.27	16.81	19.80	-	22.50	-	2.70
	5 260	17.61	0.27	17.88	20.87	23.53	29.53	5.65	8.66
	5 300	17.78	0.27	18.05	21.04	23.53	29.53	5.48	8.49
	5 320	17.45	0.27	17.72	20.71	23.54	29.54	5.82	8.83
	5 500	17.12	0.27	17.39	21.20	23.51	29.51	6.12	8.31
	5 600	15.02	0.27	15.29	19.10	23.50	29.50	8.21	10.40
	5 700	14.65	0.27	14.92	18.73	23.50	29.50	8.58	10.77
	5 720	14.88	0.27	15.15	18.96	23.48	29.48	8.33	10.52
	5 745	14.84	0.27	15.11	-	30.00	-	14.89	-
	5 785	13.87	0.27	14.14	-	30.00	-	15.86	-
	5 825	14.17	0.27	14.44	-	30.00	-	15.56	-
Measurement uncertainty		± 1.5 dB							

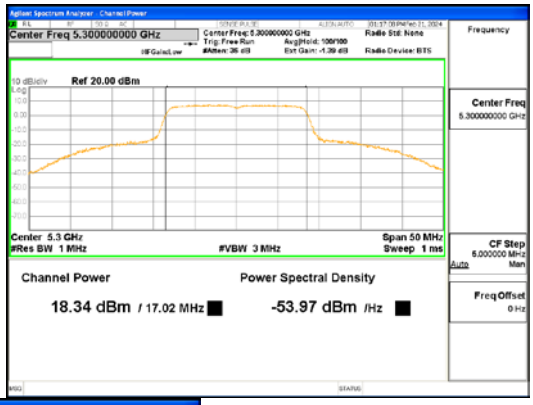
See next pages for actual measured spectrum plots.

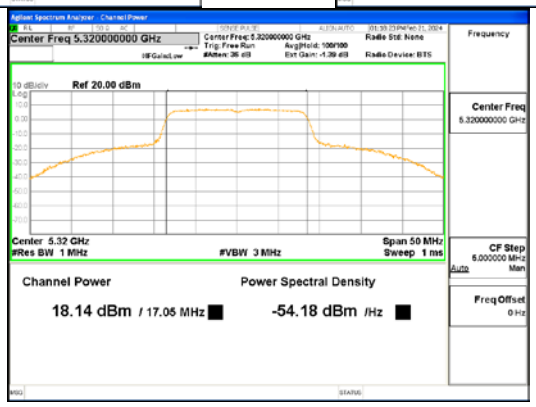




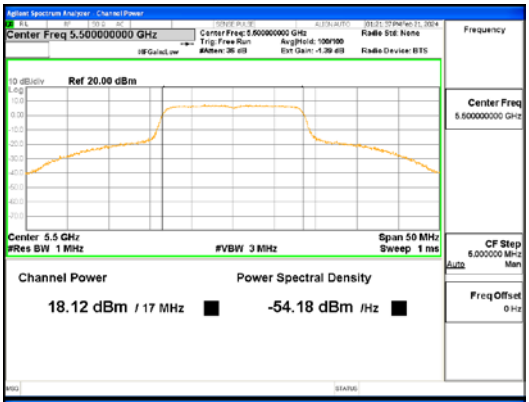
802.11a_UNII 1



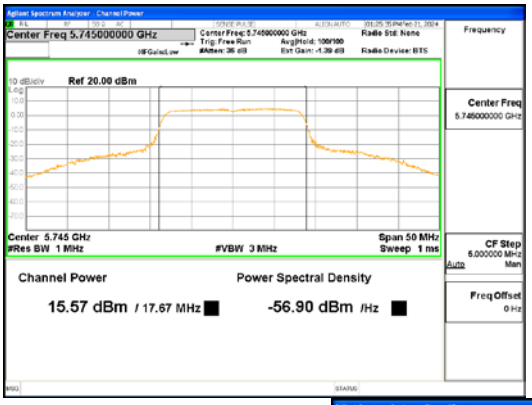


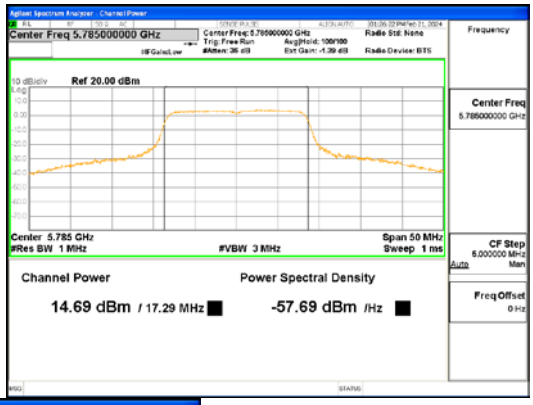


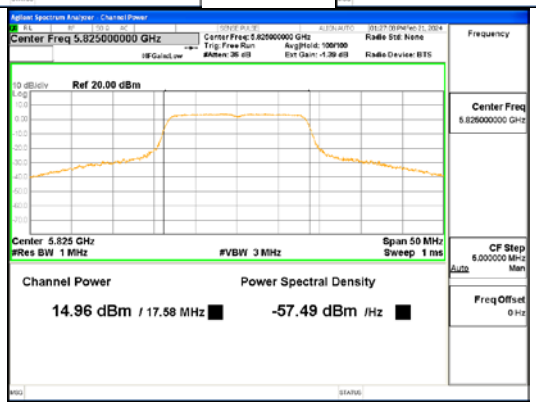
802.11a_UNII 2A



802.11a_UNII 2C

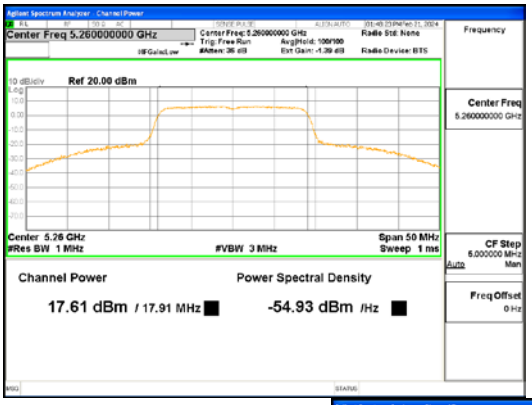


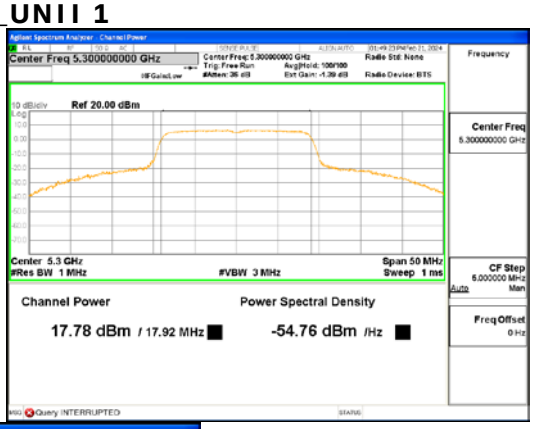


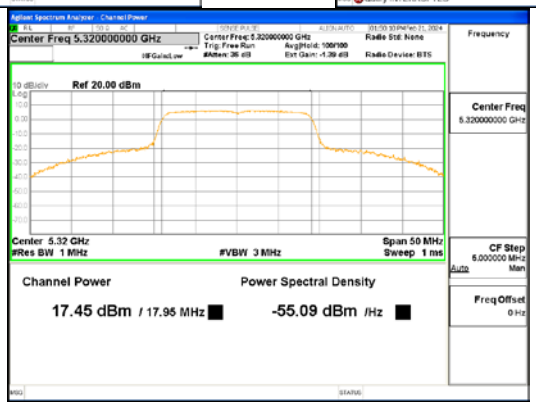


802.11a_UNII 3

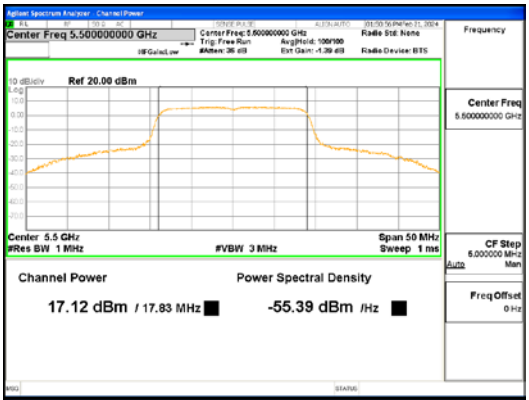
802.11n_HT20_UNII 1

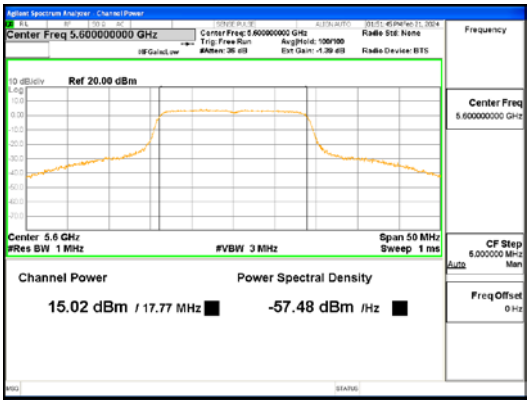


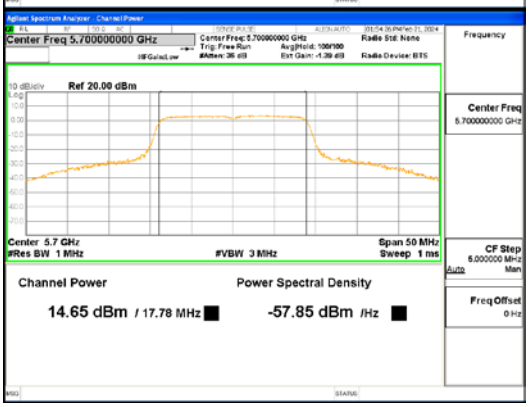




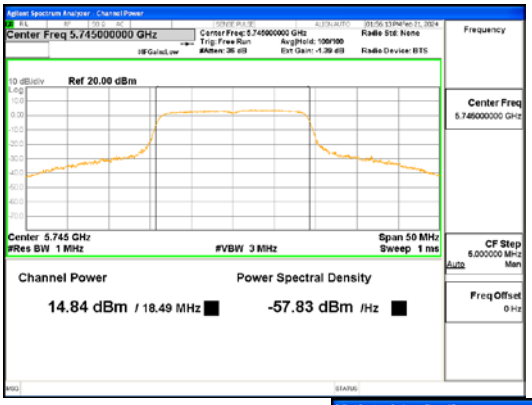
802.11n_HT20_UNII 2A

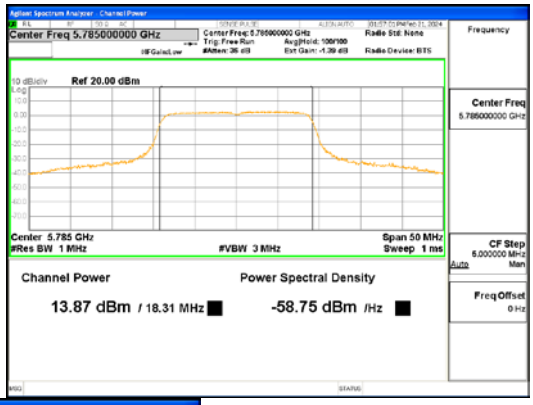


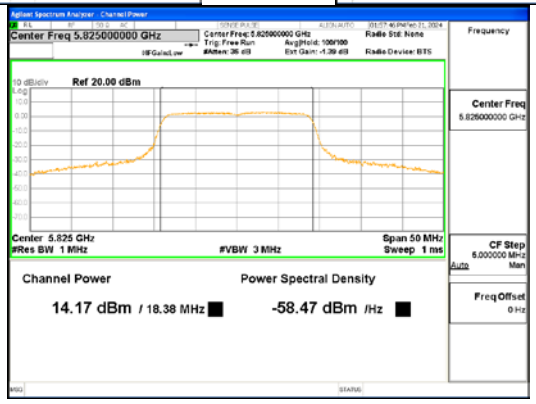




802.11n_HT20_UNII 2C







802.11n_HT20_UNII 3

4.4 Power Spectral Density

Test Procedures

KDB 789033 – Section F (Method SA-2, Maximum Power Spectral Density)
ANSI C63.10-2013 – Section 12.5

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 = 1 MHz, 500 kHz (UNII 3)

b) VBW = 3 MHz, 1.5 MHz (UNII 3)

c) Sweep time = auto

d) Detector = power averaging (rms)

e) Trace mode = Average at least 100

f) Duty cycle factor = 10log(1/x)

Test mode	Duty Cycle Factor (dB)
802.11a	0.25
802.11n_HT20	0.27

Limit

Operating Mode	Mode	ANT Gain (dBi)	Band	FCC Limit (dBm)	ISED Limit (dBm)
SISO	802.11a/n	2.99	UNII 1	11.00	10.00 (EIRP)
			UNII 2A	11.00	11.00
		3.81	UNII 2C	11.00	11.00
			UNII 3	30.00	30.00

Test Data

[FCC]

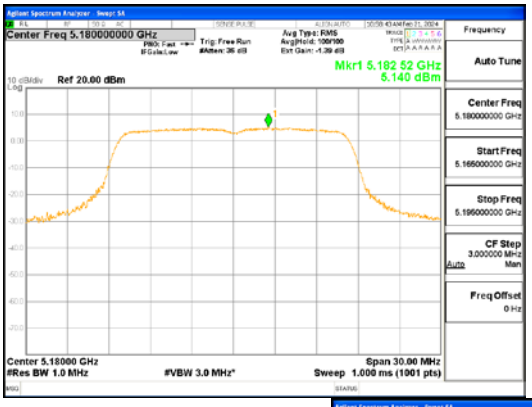
Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Duty cycle Factor (dB)	Result Power Density (dBm)	Limit (dBm)	Margin (dB)
802.11a	5 180	5.14	0.25	5.39	11.00	5.61
	5 200	4.91	0.25	5.16	11.00	5.84
	5 240	5.29	0.25	5.54	11.00	5.46
	5 260	7.54	0.25	7.79	11.00	3.21
	5 300	7.44	0.25	7.69	11.00	3.31
	5 320	7.12	0.25	7.37	11.00	3.63
	5 500	7.17	0.25	7.42	11.00	3.58
	5 600	5.14	0.25	5.39	11.00	5.61
	5 700	5.04	0.25	5.29	11.00	5.71
	5 720	4.76	0.25	5.01	11.00	5.99
	5 745	2.03	0.25	2.28	30.00	27.72
	5 785	0.93	0.25	1.18	30.00	28.82
	5 825	1.11	0.25	1.36	30.00	28.64
802.11n _HT20	5 180	4.64	0.27	4.91	11.00	6.09
	5 200	4.95	0.27	5.22	11.00	5.78
	5 240	5.29	0.27	5.56	11.00	5.44
	5 260	6.46	0.27	6.73	11.00	4.27
	5 300	6.56	0.27	6.83	11.00	4.17
	5 320	6.12	0.27	6.39	11.00	4.61
	5 500	5.79	0.27	6.06	11.00	4.94
	5 600	3.84	0.27	4.11	11.00	6.89
	5 700	3.44	0.27	3.71	11.00	7.29
	5 720	3.84	0.27	4.11	11.00	6.89
	5 745	1.02	0.27	1.29	30.00	28.71
	5 785	-0.1	0.27	0.17	30.00	29.83
	5 825	0.13	0.27	0.40	30.00	29.60
Measurement uncertainty		± 1.5 dB				

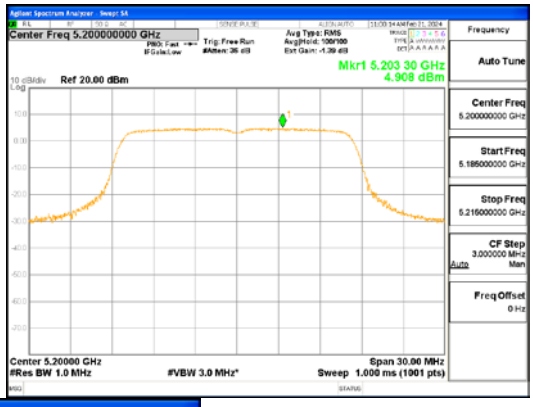
[ISED]

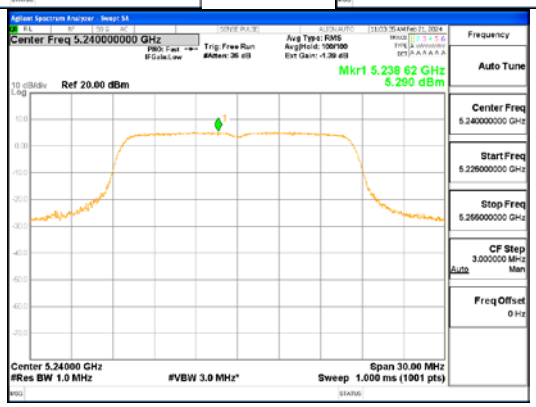
Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Duty cycle Factor (dB)	Result Power Density (dBm)	Limit (dBm)	Margin (dB)
802.11a	5 180	5.14	0.25	8.38*	10.00	1.62
	5 200	4.91	0.25	8.15*	10.00	1.85
	5 240	5.29	0.25	8.53*	10.00	1.47
	5 260	7.54	0.25	7.79	11.00	3.21
	5 300	7.44	0.25	7.69	11.00	3.31
	5 320	7.12	0.25	7.37	11.00	3.63
	5 500	7.17	0.25	7.42	11.00	3.58
	5 600	5.14	0.25	5.39	11.00	5.61
	5 700	5.04	0.25	5.29	11.00	5.71
	5 720	4.76	0.25	5.01	11.00	5.99
	5 745	2.03	0.25	2.28	30.00	27.72
	5 785	0.93	0.25	1.18	30.00	28.82
	5 825	1.11	0.25	1.36	30.00	28.64
802.11n _HT20	5 180	4.64	0.27	7.90*	10.00	2.10
	5 200	4.95	0.27	8.21*	10.00	1.79
	5 240	5.29	0.27	8.55*	10.00	1.45
	5 260	6.46	0.27	6.73	11.00	4.27
	5 300	6.56	0.27	6.83	11.00	4.17
	5 320	6.12	0.27	6.39	11.00	4.61
	5 500	5.79	0.27	6.06	11.00	4.94
	5 600	3.84	0.27	4.11	11.00	6.89
	5 700	3.44	0.27	3.71	11.00	7.29
	5 720	3.84	0.27	4.11	11.00	6.89
	5 745	1.02	0.27	1.29	30.00	28.71
	5 785	-0.1	0.27	0.17	30.00	29.83
	5 825	0.13	0.27	0.40	30.00	29.60
Measurement uncertainty		± 1.5 dB				

* Note :
UNII 1 Result Power Density = Measured Power Density + Duty cycle Factor + Antenna gain

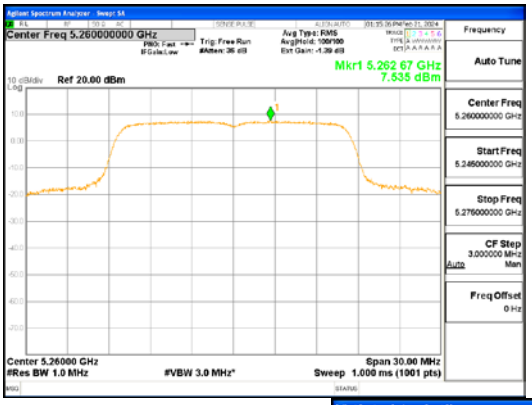
See next pages for actual measured spectrum plots.

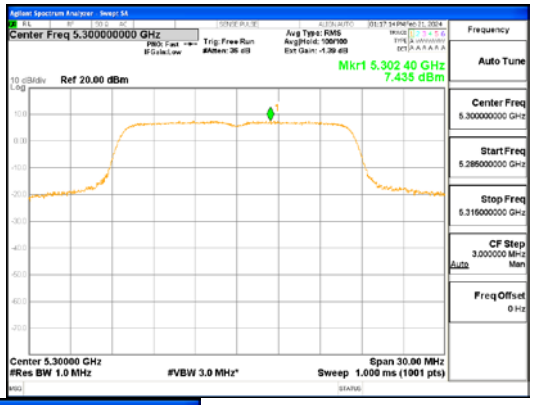


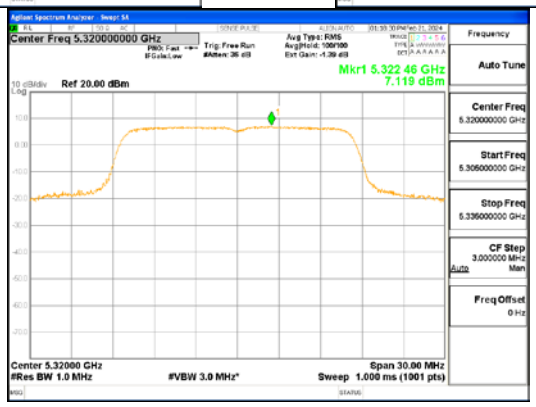




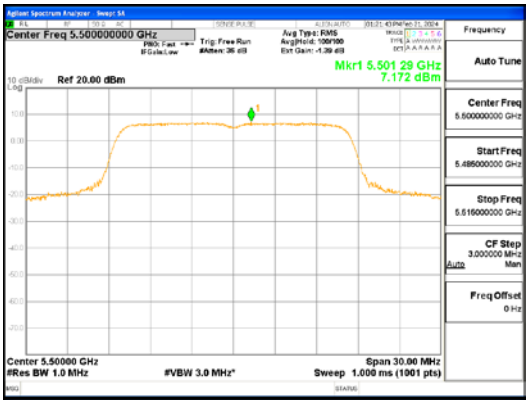
802.11a_UNII 1

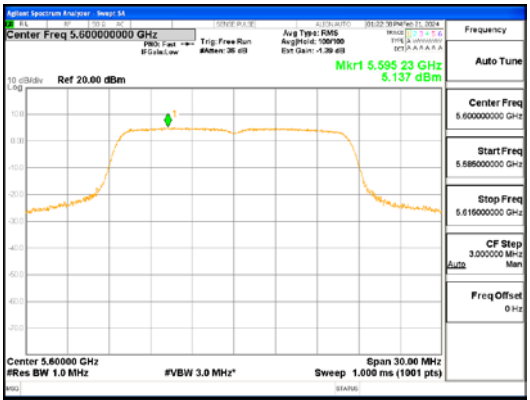


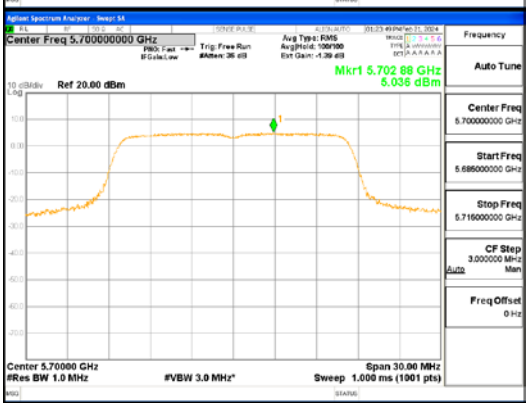


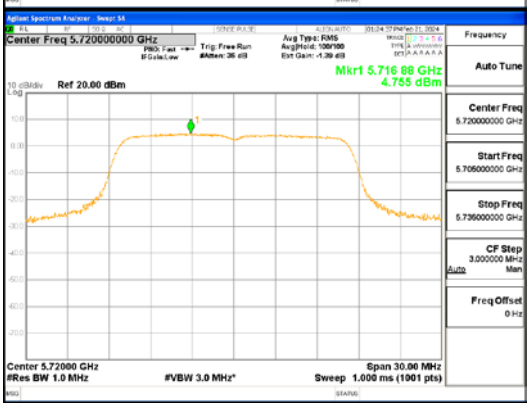


802.11a_UNII 2A

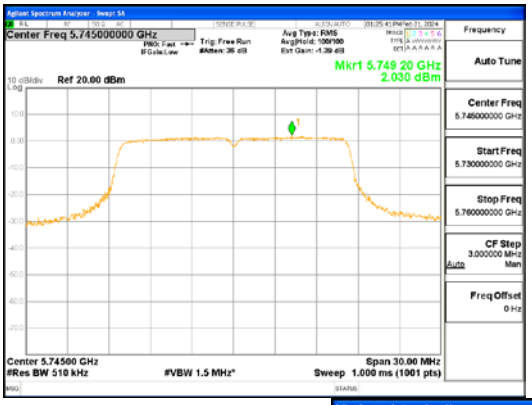


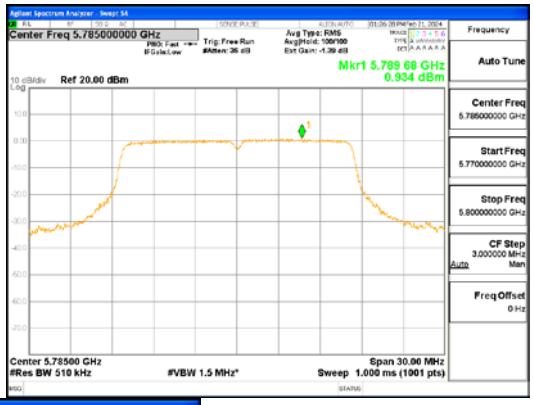


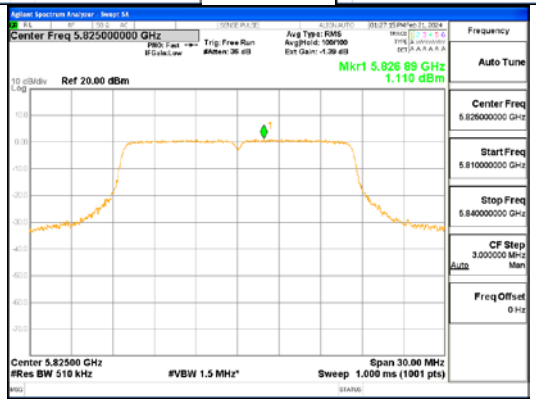




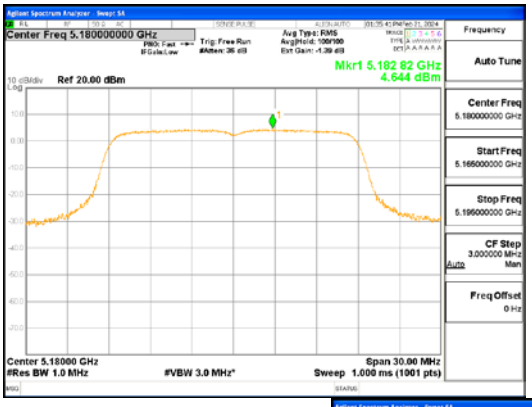
802.11a_UNII 2C

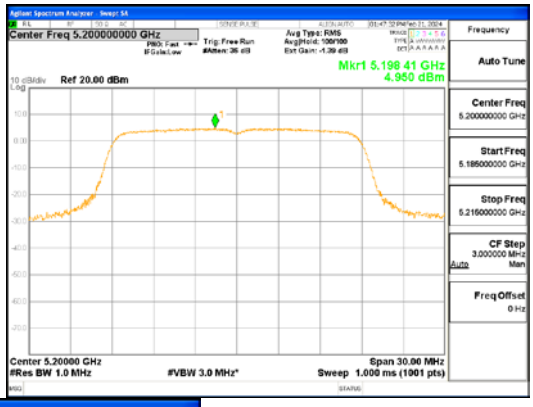


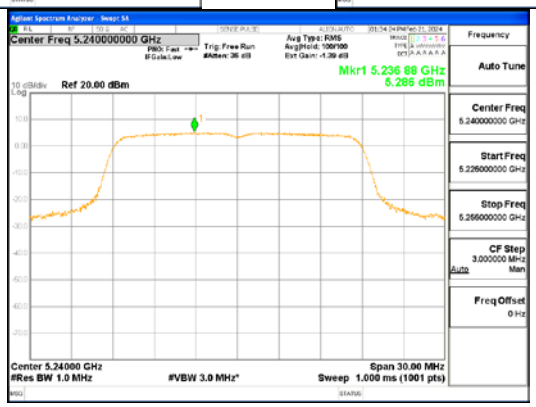




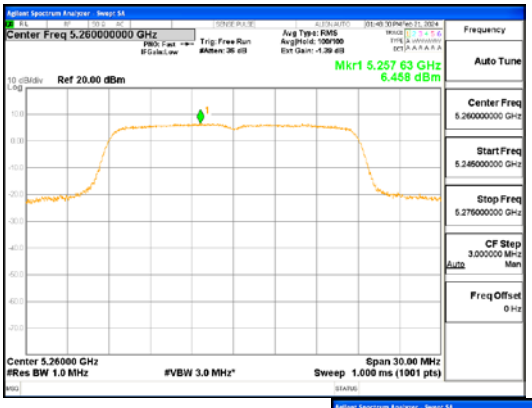
802.11a_UNII 3

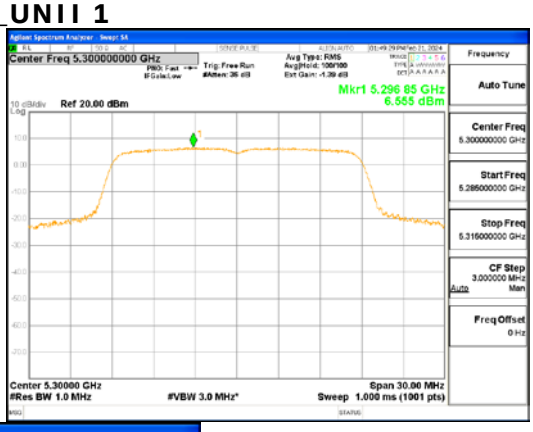


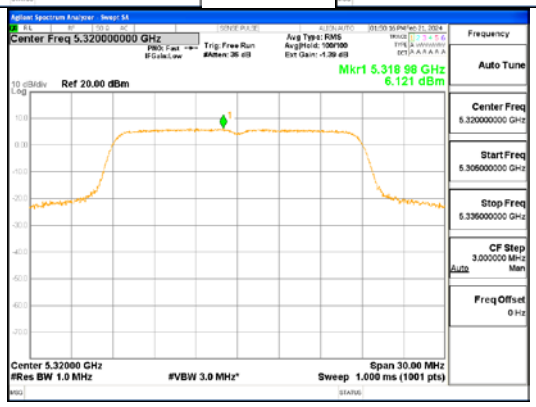




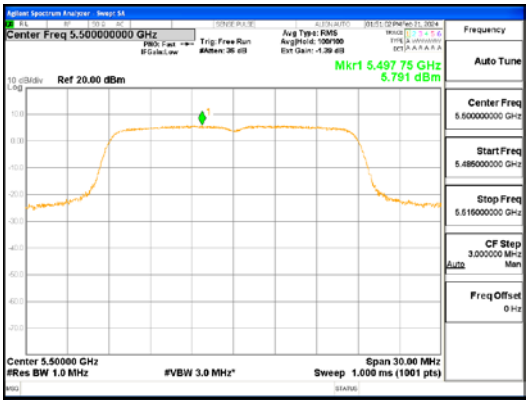
802.11n_HT20_UNII 1

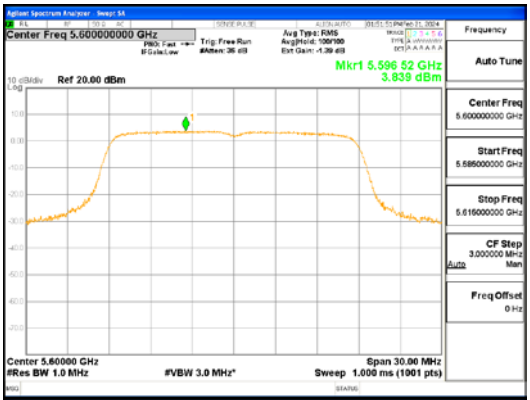


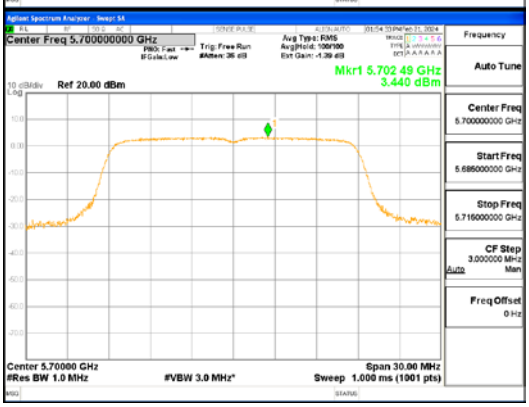


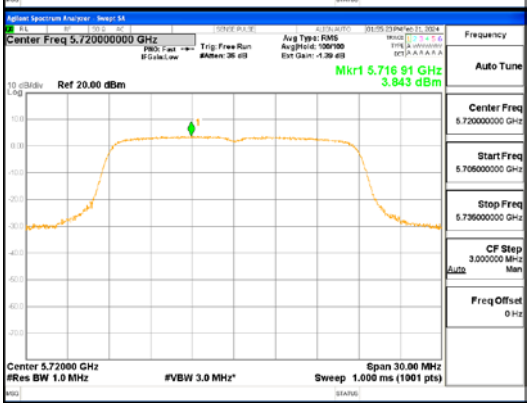


802.11n_HT20_UNII 2A









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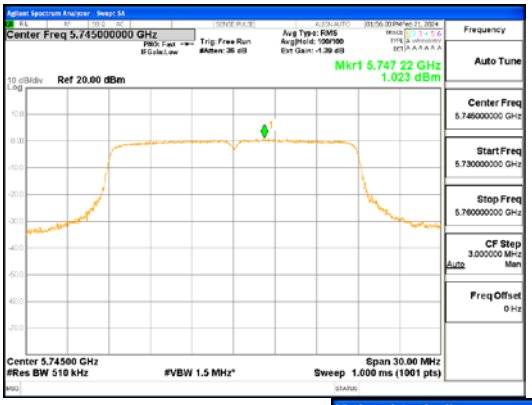
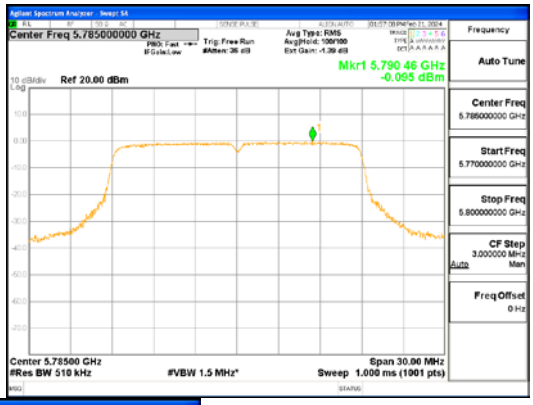
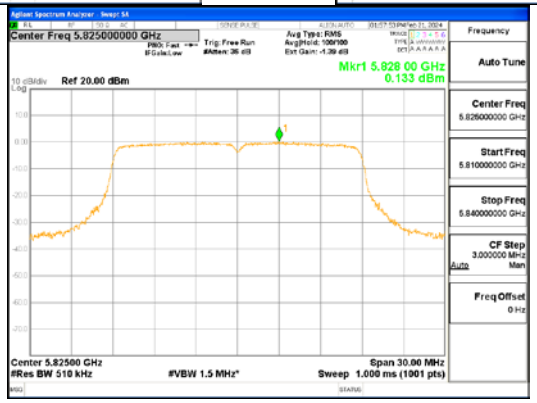






802.11n_HT20_UNII 3

4.5 Frequency Stability

Test Procedures

KDB 789033 – Section A.3

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between -20 ℃ and +85 ℃(Declaration by the Manufacturer). The temperature was incremented by 10 ℃ intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.

Data for the worst case channel is shown below.

Measured Frequency Error (kHz)						
Voltage (VDC)	Temperature (℃)	Test Frequency (MHz)				
		5 180	5 200	5 240	5 260	5 300
5.0	-20	39.784	37.400	34.571	37.810	33.734
5.0	-10	42.759	45.609	42.882	46.043	43.148
5.0	0	43.434	46.610	44.494	47.440	44.800
5.0	10	39.485	42.202	39.814	42.564	40.177
5.0	20(Ref)	24.449	26.735	25.519	27.294	25.350
5.0	30	31.311	33.158	31.286	33.280	31.160
5.0	40	28.944	31.043	29.574	31.372	29.708
5.0	50	33.288	35.381	34.434	38.319	35.533
5.0	60	52.625	55.246	54.168	57.456	55.058
5.0	70	78.971	84.361	83.219	87.810	85.390
5.0	80	130.169	133.307	133.160	134542	134.753
5.0	85	162.924	166.105	166.455	167.602	169.021
4.25	20(Ref)	25.149	27.371	25.893	28.153	26.591
5.75	20(Ref)	26.504	28.508	26.917	29.047	27.605

Measured Frequency Error (kHz)						
Voltage (VDC)	Temperature (℃)	Test Frequency (MHz)				
		5 320	5 500	5 600	5 700	5 720
5.0	-20	34.635	36.246	40.305	39.162	41.952
5.0	-10	42.863	45.451	49.078	47.523	49.498
5.0	0	44.914	46.785	50.407	47.856	50.900
5.0	10	41.249	42.249	45.598	43.191	44.589
5.0	20(Ref)	25.607	27.453	29.109	28.821	29.942
5.0	30	31.258	31.534	34.212	32.351	34.430
5.0	40	29.852	31.700	34.531	33.768	34.870
5.0	50	35.479	37.363	38.950	39.598	40.169
5.0	60	54.808	57.677	59.067	61.285	61.531
5.0	70	84.299	91.381	90.469	96.304	94.032
5.0	80	136.088	143.681	144.605	152.410	148.783
5.0	85	166.735	178.467	179.945	187.816	184.263
4.25	20(Ref)	26.987	28.047	30.447	30.447	31.451
5.75	20(Ref)	27.882	29.331	30.944	31.026	32.222

Voltage (VDC)	Temperature (℃)	Test Frequency (MHz)		
		5 745	5 785	5 825
5.0	-20	39.649	37.745	39.678
5.0	-10	47.268	46.005	46.802
5.0	0	48.443	47.954	48.464
5.0	10	42.450	42.319	44.180
5.0	20(Ref)	29.030	27.797	28.349
5.0	30	32.517	32.743	32.923
5.0	40	34.544	33.258	34.514
5.0	50	40.278	38.140	38.276
5.0	60	61.475	58.972	58.772
5.0	70	96.277	91.645	93.346
5.0	80	152.649	146.140	147.256
5.0	85	188.318	182.263	183.435
4.25	20(Ref)	30.611	29.100	29.718
5.75	20(Ref)	31.153	29.578	29.989

Note :

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature range as tested.

4.6 Unwanted Emissions

Test Location

☒ 10 m SAC (test distance : ☐ 10 m, ☒ 3 m)
☒ 3 m SAC (test distance : 3 m)

Test Procedures

KDB 789033 - Section G
ANSI C63.10-2013 – Section 12.7

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 range above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

Test Settings:

Frequency Range = 9 kHz ~ 1 GHz

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

b) VBW ≥ RBW

c) Detector = CISPR Quasi-peak

d) Sweep time = auto couple

- Peak

Frequency Range = 1 GHz ~ 40 GHz

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 ~ 40 GHz

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%)

Frequency Range = 1 GHz ~ 40 GHz

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)

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)
802.11a	0.25
802.11n_HT20	0.27

Limit

1. UNII 1, 2A : All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

2. UNII 2C : All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

3. UNII 3 : All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

* E.I.R.P -27 dBm/MHz
E[dBuV/m] = EIRP[dBm] + 95.2, for d = 3m

4. Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209.
- 15.209(a)

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.

5. 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

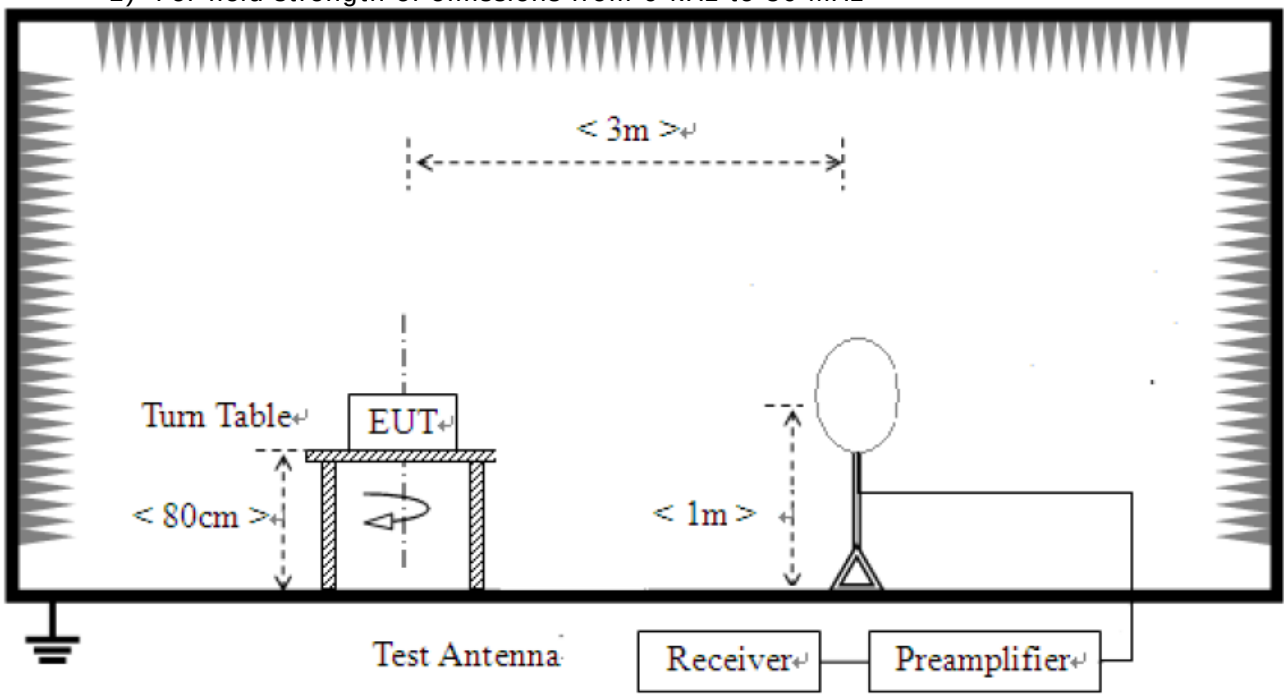
§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown is Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using 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.

Note :

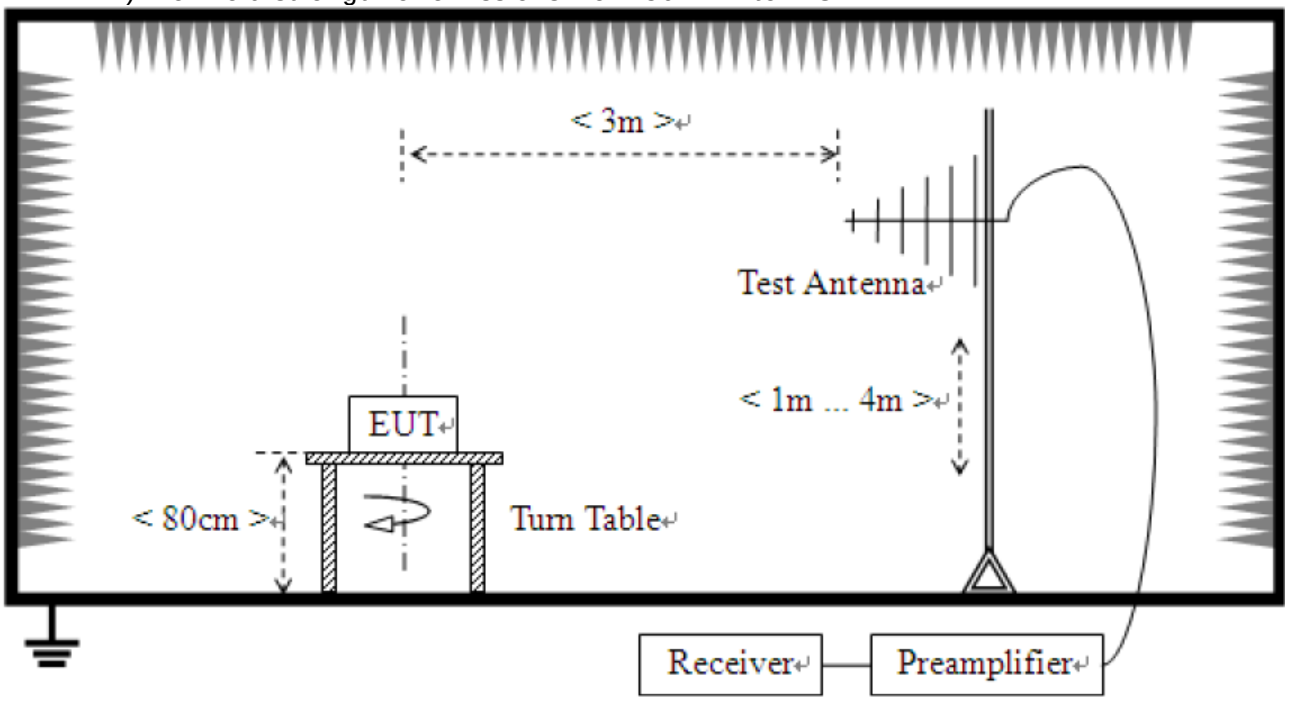
1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
2) For above 1 GHz, limit field strength of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

Test Setup:

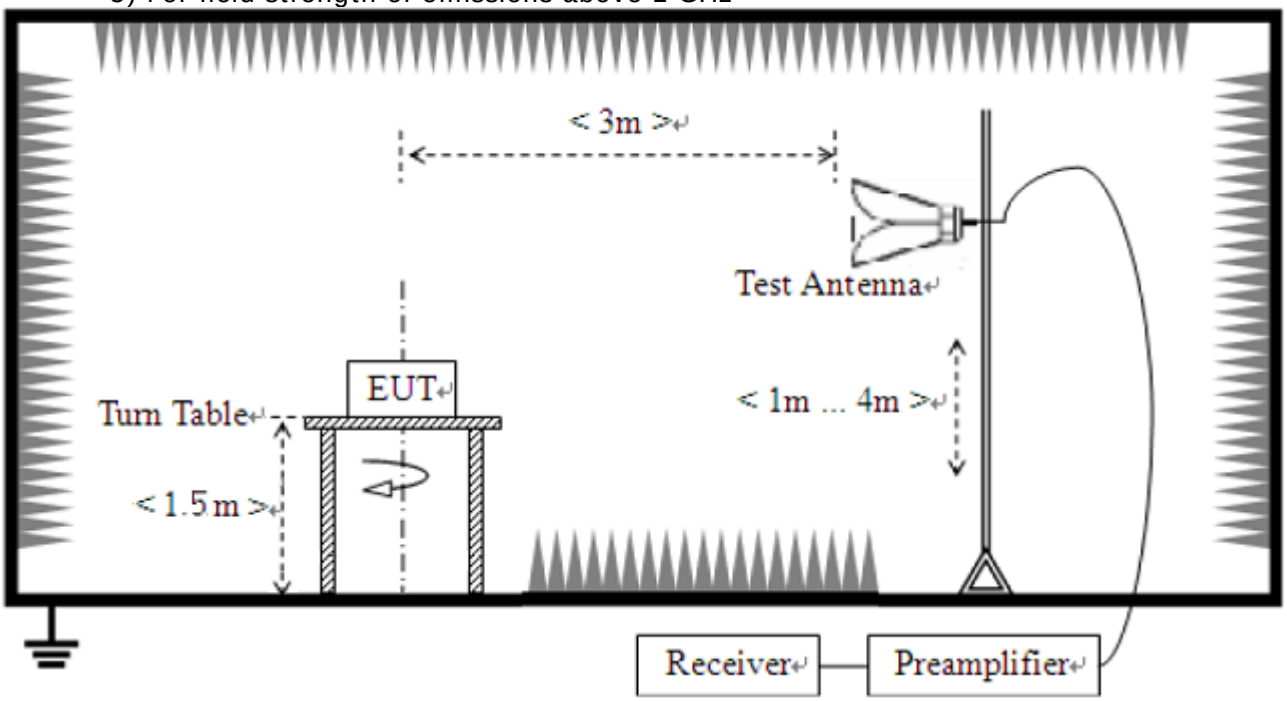
1) For field strength of emissions from 9 kHz to 30 MHz



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



3) For field strength of emissions above 1 GHz



Test Mode

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

So the results are only attached worst cases.

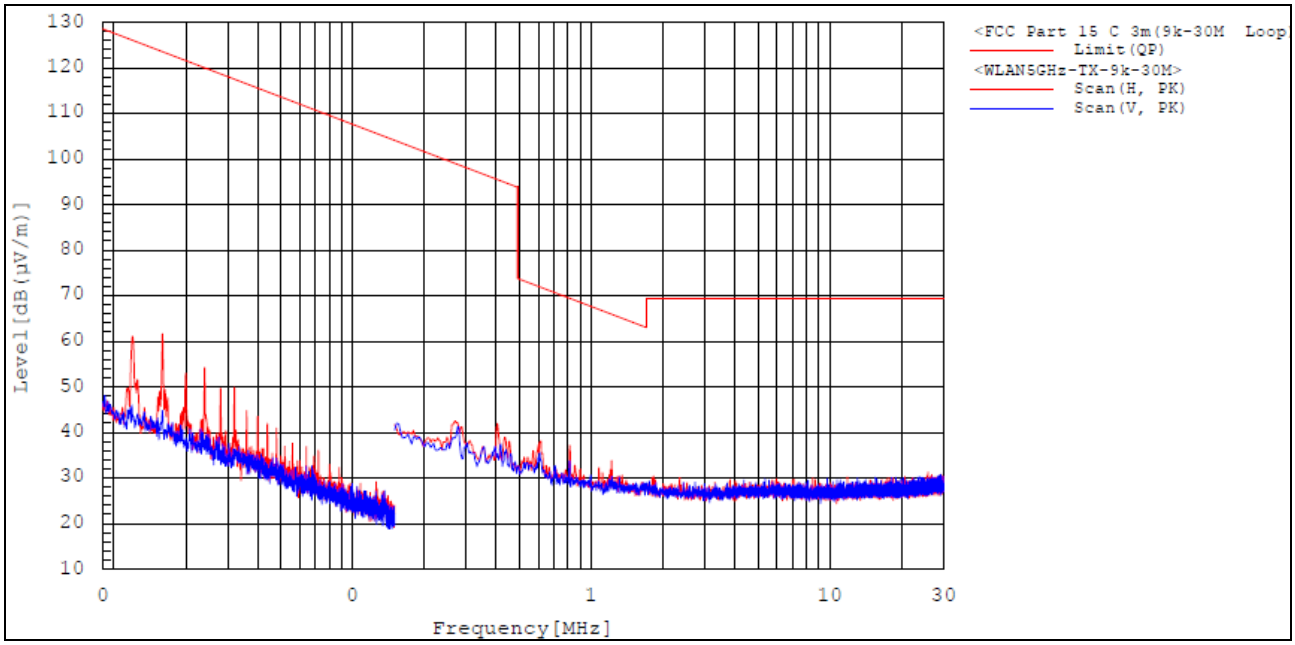
Test Results

1) 9 kHz to 30 MHz

Test mode : Transmitter (Worst Case)

The requirements are:
☒ Complies

Test Data



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Level [dB(uV/m)]	Limit [dB(uV/m)]	Margin [dB]

The emissions 9 kHz to 30 MHz were 20 dB lower than the limit.

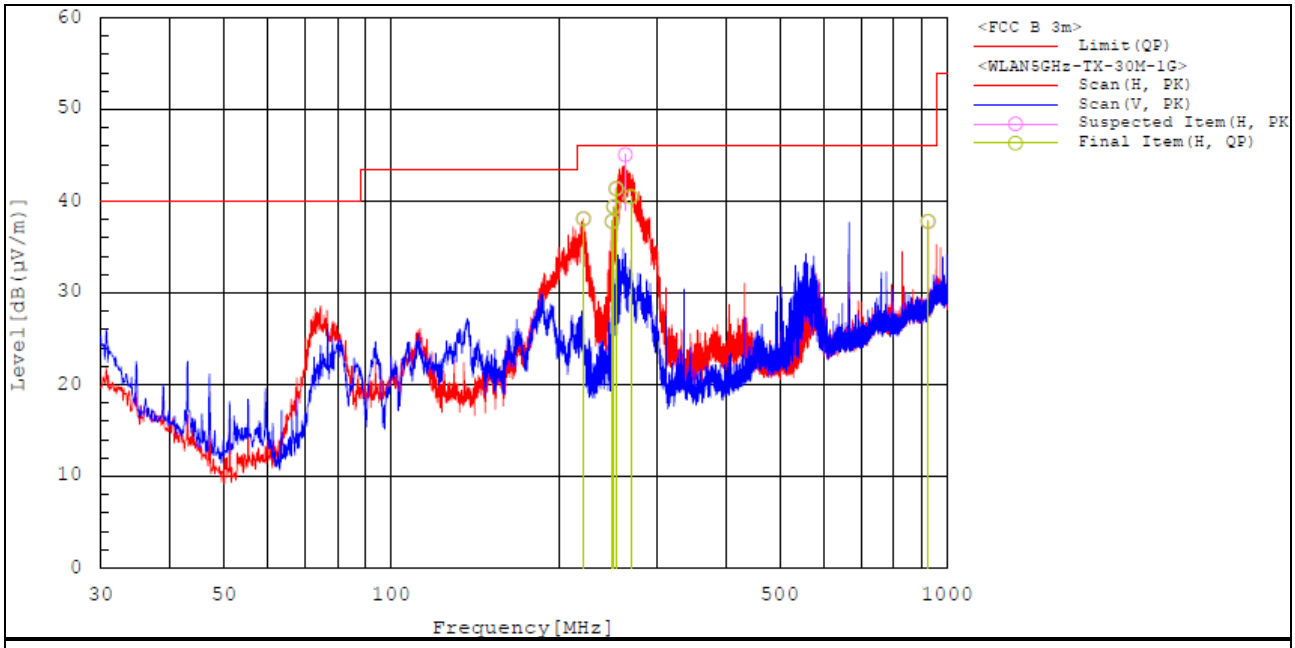
Remark :
1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down positon(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.

2) 30 MHz to 1 GHz

Test mode : Transmitter (Worst Case)

The requirements are:
☒ Complies

Test Data



Final Result

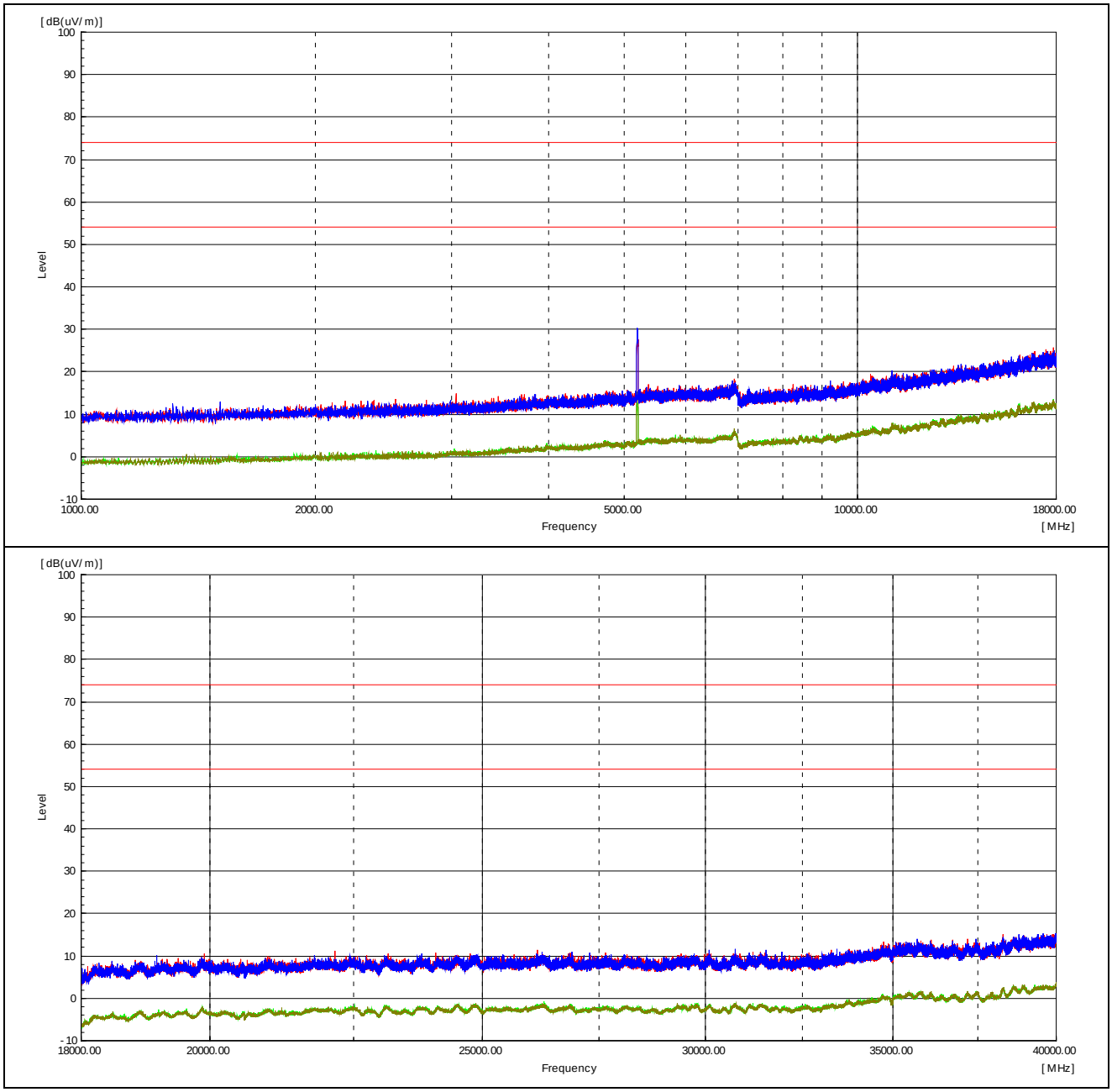
No.	Frequency [MHz]	Pol	Reading QP [dB(µV)]	c.f [dB(1/m)]	Result QP [dB(µV/m)]	Limit QP [dB(µV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	221.575	H	52.3	-14.2	38.1	46.0	7.9	99.9	0.7
2	249.511	H	49.0	-11.2	37.8	46.0	8.2	99.9	36.4
3	251.160	H	50.4	-11.0	39.4	46.0	6.6	99.9	36.4
4	253.682	H	52.1	-10.7	41.4	46.0	4.6	99.9	162.5
5	269.620	H	51.0	-10.5	40.5	46.0	5.5	99.9	131.2
6	923.758	H	33.9	3.9	37.8	46.0	8.2	199.9	249.9

Remark :
1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down positon(Y axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain

3) above 1 GHz

The requirements are:
☒ Complies

Test Data



Test mode : Transmitter, 802.11a

The requirements are:
☒ Complies

Test Data

Ch.36(5 180 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.40(5 200 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.48(5 240 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.5 2(5 260 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.60(5 300 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.64(5 320 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.100(5 500 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.120(5 600 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.140(5 700 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.144(5 720 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.149(5 745 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.157(5 785 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

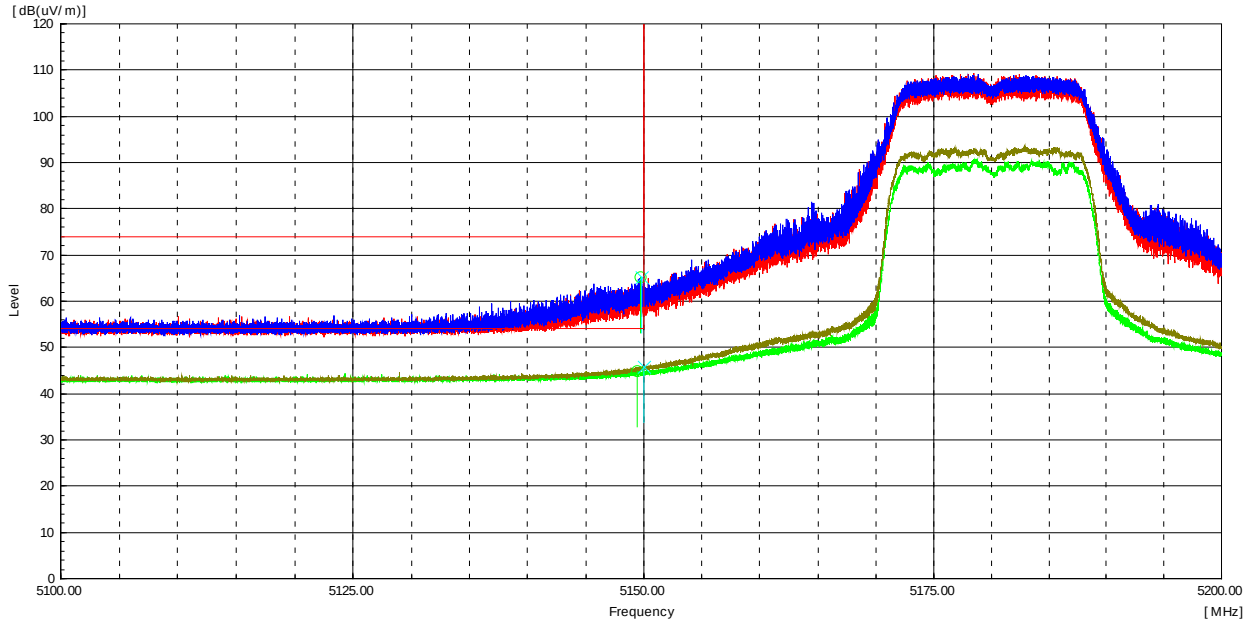
Ch.165(5 825 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Remarks

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down positon(Y axis) and the worst case was recorded.
2. Peak Result = Reading + c.f(Correction factor)
   Average Result = Reading + c.f(Correction factor) + Duty Cycle Factor
3. Correction factor = Antenna factor + Cable loss - Amp Gain

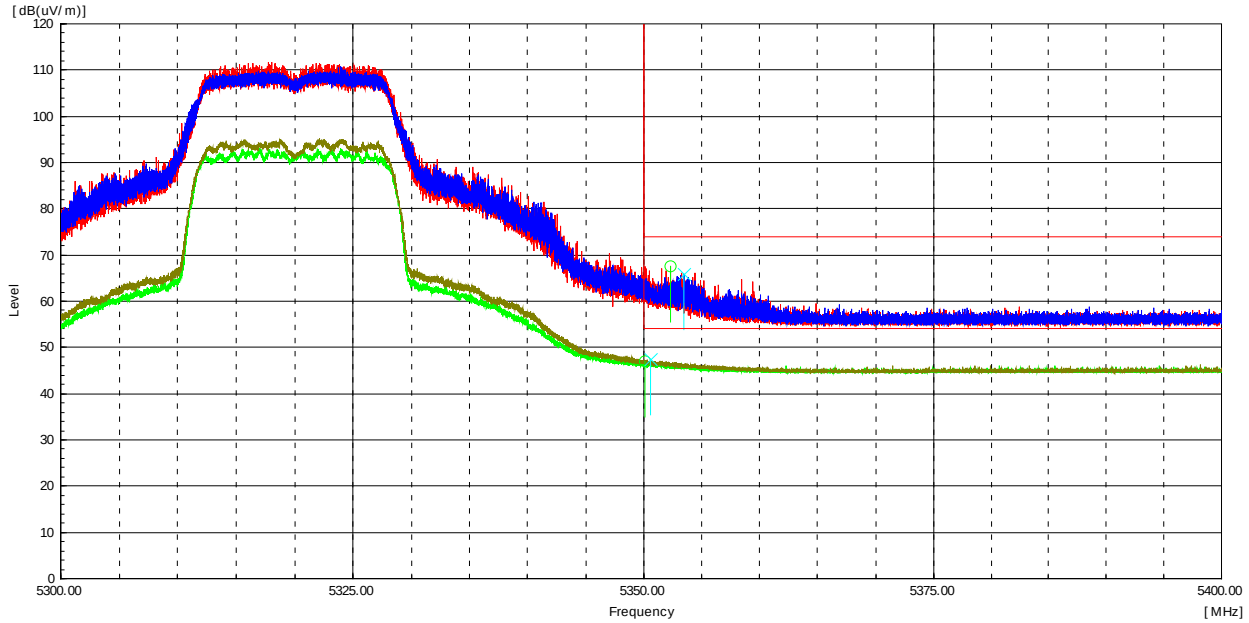
Worst Case Mode :	802.11a
Worst Case Transfer Rate :	6 Mbps
Distance of Measurements :	3 Meters
Operating Frequency :	5 180 MHz
Channel :	36



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
5 149.73	H	62.3	2.8	-----	65.1	-----	74.0	-----	8.9	-----	Peak
5 149.43	H	42.1	2.8	0.3	-----	45.2	-----	54.0	-----	8.8	Average
5 149.85	V	62.5	2.8	-----	65.3	-----	74.0	-----	8.7	-----	Peak
5 149.97	V	43.1	2.8	0.3	-----	46.2	-----	54.0	-----	7.8	Average

Radiated Restricted Band Edge Plot

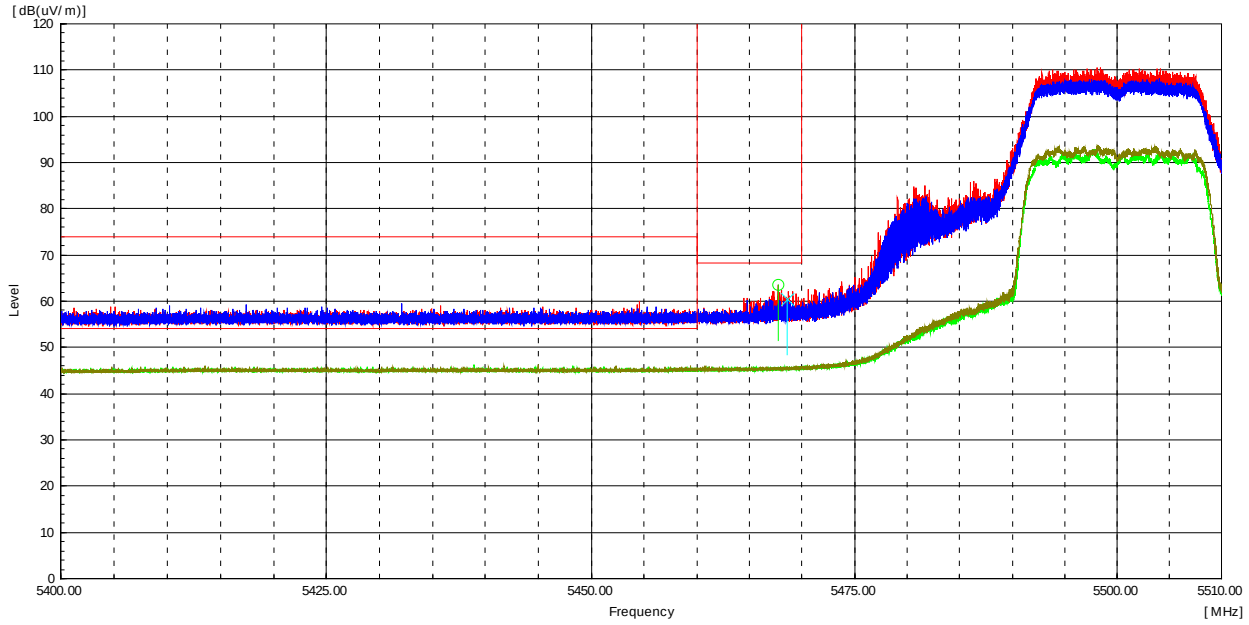
Worst Case Mode :	802.11a
Worst Case Transfer Rate :	6 Mbps
Distance of Measurements :	3 Meters
Operating Frequency :	5 320 MHz
Channel :	64



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
5 352.35	H	64.2	3.4	-----	67.6	-----	74.0	-----	6.4	-----	Peak
5 350.11	H	43.5	3.4	0.3	-----	47.2	-----	54.0	-----	6.8	Average
5 353.49	V	62.6	3.4	-----	66.0	-----	74.0	-----	8.0	-----	Peak
5 350.61	V	44.0	3.4	0.3	-----	47.7	-----	54.0	-----	6.3	Average

Radiated Restricted Band Edge Plot

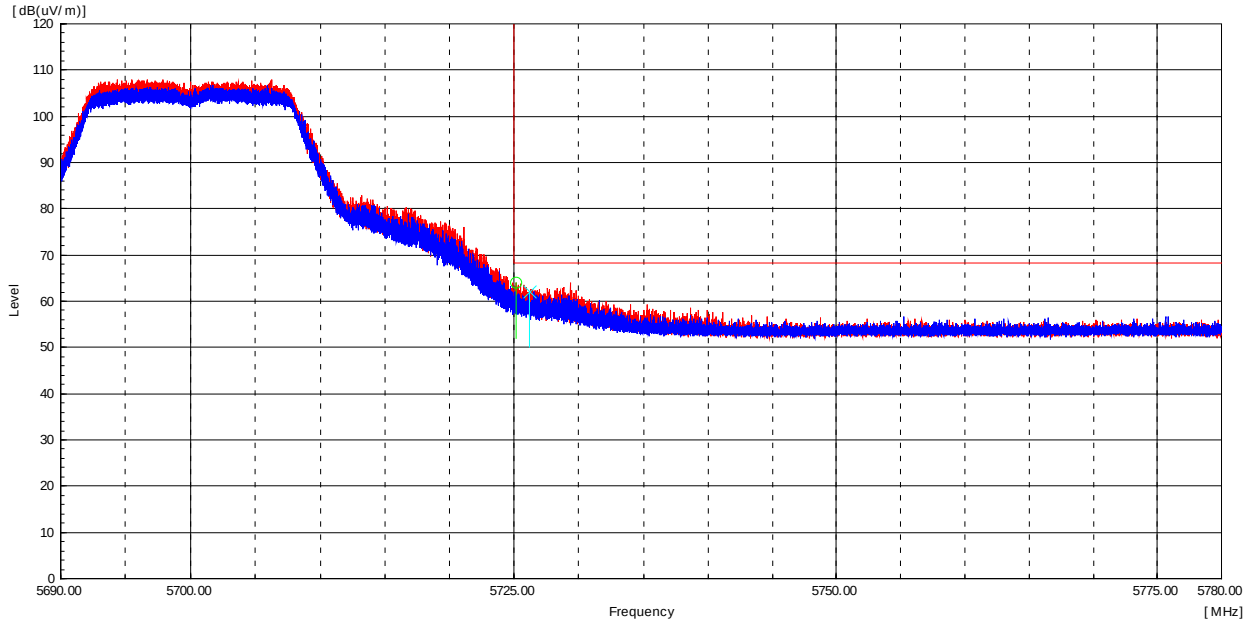
Worst Case Mode :	802.11a
Worst Case Transfer Rate :	6 Mbps
Distance of Measurements :	3 Meters
Operating Frequency :	5 500 MHz
Channel :	100



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
5 467.69	H	59.8	3.8	-----	63.6	-----	68.2	-----	4.6	-----	Peak
5 468.61	V	56.6	3.8	-----	60.4	-----	68.2	-----	7.8	-----	Peak

Radiated Restricted Band Edge Plot

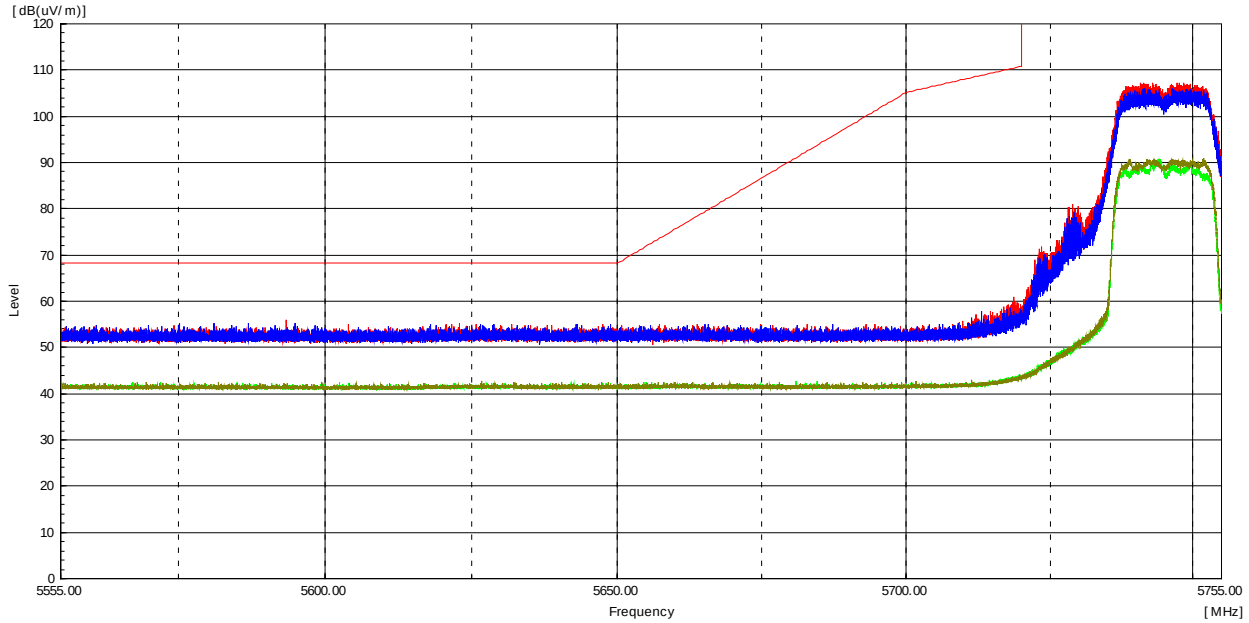
Worst Case Mode :	802.11a
Worst Case Transfer Rate :	6 Mbps
Distance of Measurements :	3 Meters
Operating Frequency :	5 700 MHz
Channel :	140



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
5 725.16	H	59.6	4.4	-----	64.0	-----	68.2	-----	4.2	-----	Peak
5 726.21	V	57.7	4.4	-----	62.1	-----	68.2	-----	6.1	-----	Peak

Radiated Restricted Band Edge Plot

Worst Case Mode :	802.11a
Worst Case Transfer Rate :	6 Mbps
Distance of Measurements :	3 Meters
Operating Frequency :	5 745 MHz
Channel :	149

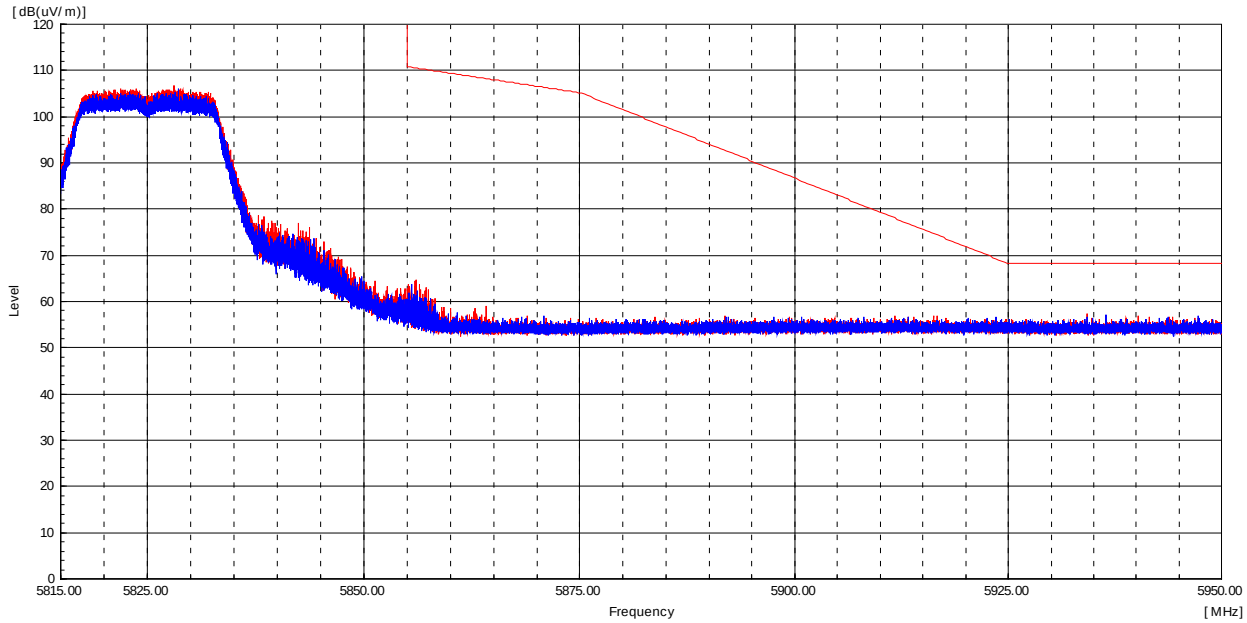


Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note

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

Radiated Restricted Band Edge Plot

Worst Case Mode :	802.11a
Worst Case Transfer Rate :	6 Mbps
Distance of Measurements :	3 Meters
Operating Frequency :	5 825 MHz
Channel :	165



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Radiated Restricted Band Edge Plot

Test mode : Transmitter, 802.11n_HT20

The requirements are:
☒ Complies

Test Data

Ch.36(5 180 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.40(5 200 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.48(5 240 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.5 2(5 260 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.60(5 300 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.64(5 320 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.100(5 500 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.120(5 600 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.140(5 700 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.144(5 720 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.149(5 745 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Ch.157(5 785 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

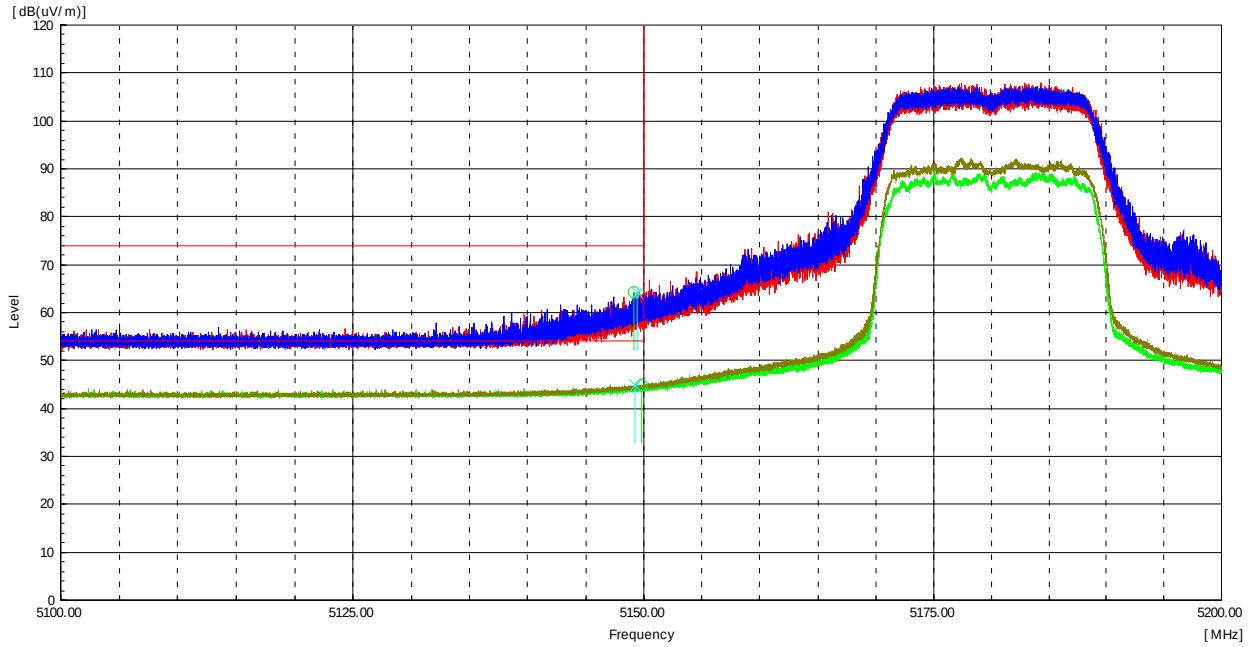
Ch.165(5 825 MHz)

Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Remarks

1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down positon(Y axis) and the worst case was recorded.
2. Peak Result = Reading + c.f(Correction factor)
   Average Result = Reading + c.f(Correction factor) + Duty Cycle Factor
3. Correction factor = Antenna factor + Cable loss - Amp Gain

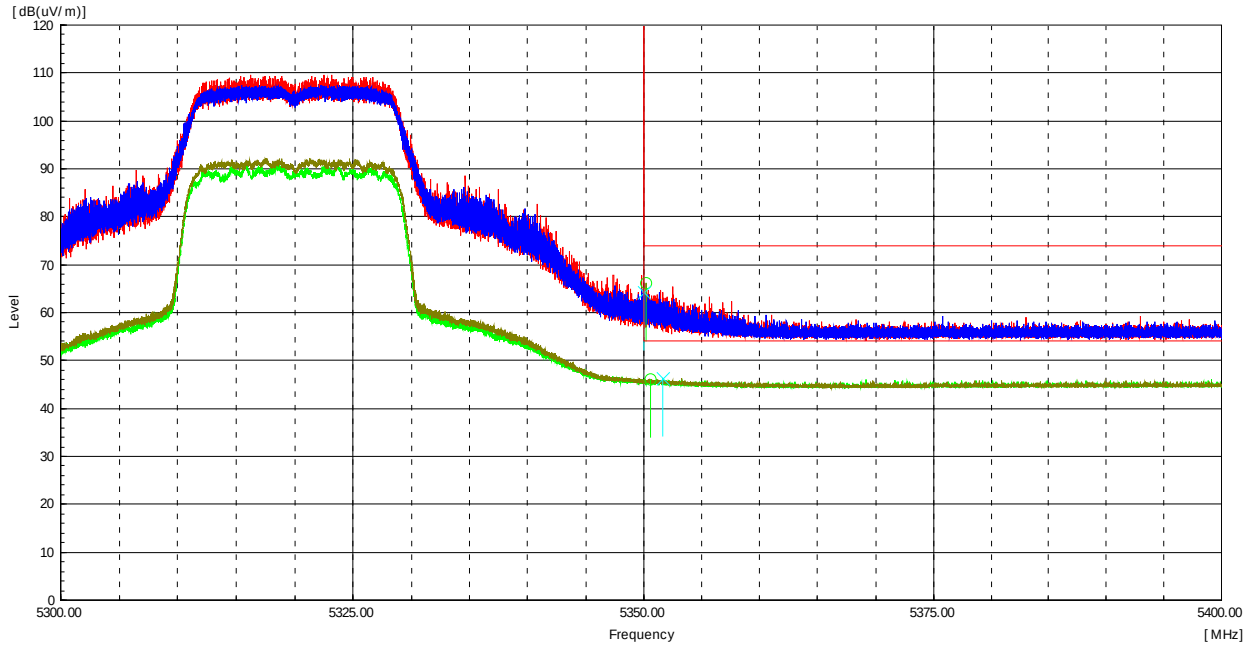
Worst Case Mode :	802.11n_HT20
Worst Case Transfer Rate :	MCS 0
Distance of Measurements :	3 Meters
Operating Frequency :	5 180 MHz
Channel :	36



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
5 149.15	H	61.5	2.8	-----	64.3	-----	74.0	-----	9.7	-----	Peak
5 149.83	H	42.0	2.8	0.3	-----	45.1	-----	54.0	-----	8.9	Average
5 149.44	V	61.5	2.8	-----	64.3	-----	74.0	-----	9.7	-----	Peak
5 149.26	V	42.2	2.8	0.3	-----	45.3	-----	54.0	-----	8.7	Average

Radiated Restricted Band Edge Plot

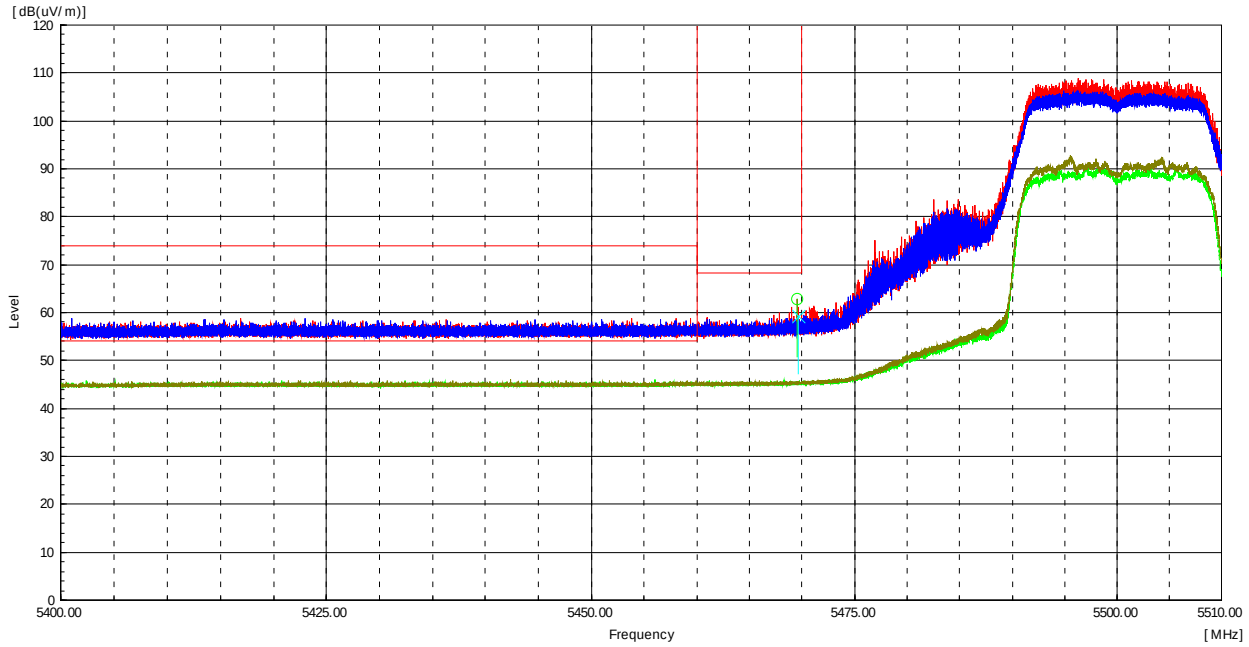
Worst Case Mode :	802.11n_HT20
Worst Case Transfer Rate :	MCS 0
Distance of Measurements :	3 Meters
Operating Frequency :	5 320 MHz
Channel :	64



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
5 350.22	H	62.8	3.4	-----	66.2	-----	74.0	-----	7.8	-----	Peak
5 350.55	H	42.7	3.4	0.3	-----	46.4	-----	54.0	-----	7.6	Average
5 350.02	V	60.9	3.4	-----	64.3	-----	74.0	-----	9.7	-----	Peak
5 351.61	V	42.9	3.4	0.3	-----	46.6	-----	54.0	-----	7.4	Average

Radiated Restricted Band Edge Plot

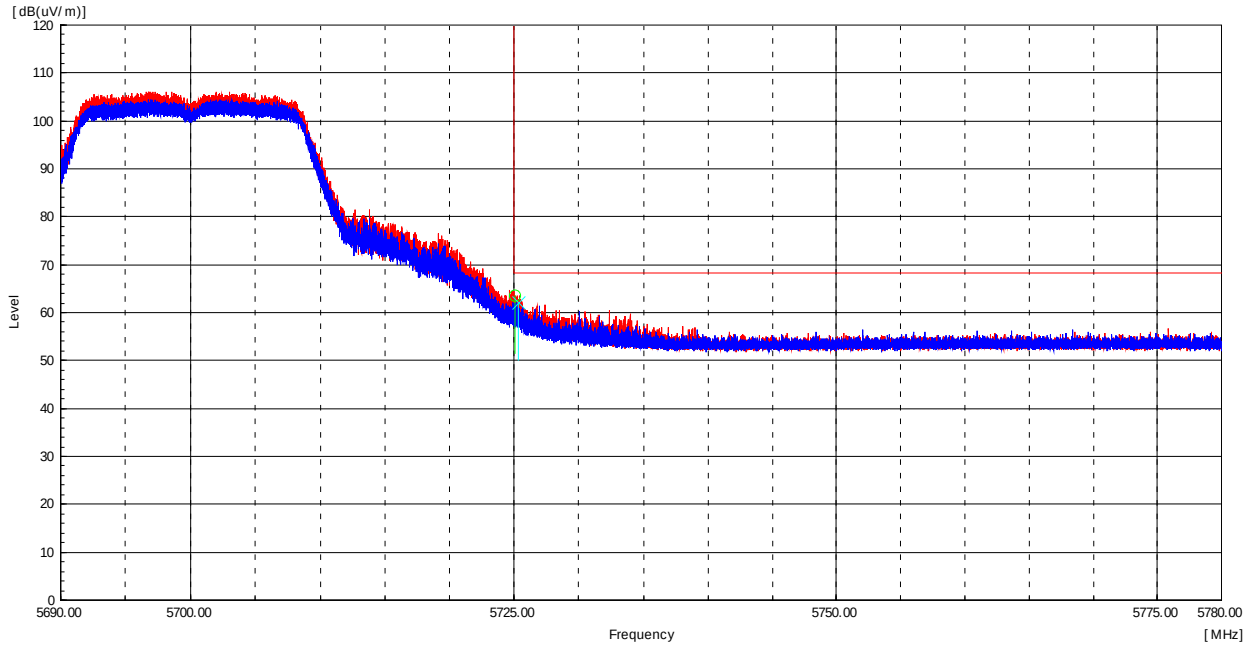
Worst Case Mode :	802.11n_HT20
Worst Case Transfer Rate :	MCS 0
Distance of Measurements :	3 Meters
Operating Frequency :	5 500 MHz
Channel :	100



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
5 469.58	H	59.1	3.8	-----	62.9	-----	68.2	-----	5.3	-----	Peak
5 469.65	V	55.6	3.8	-----	59.4	-----	68.2	-----	8.8	-----	Peak

Radiated Restricted Band Edge Plot

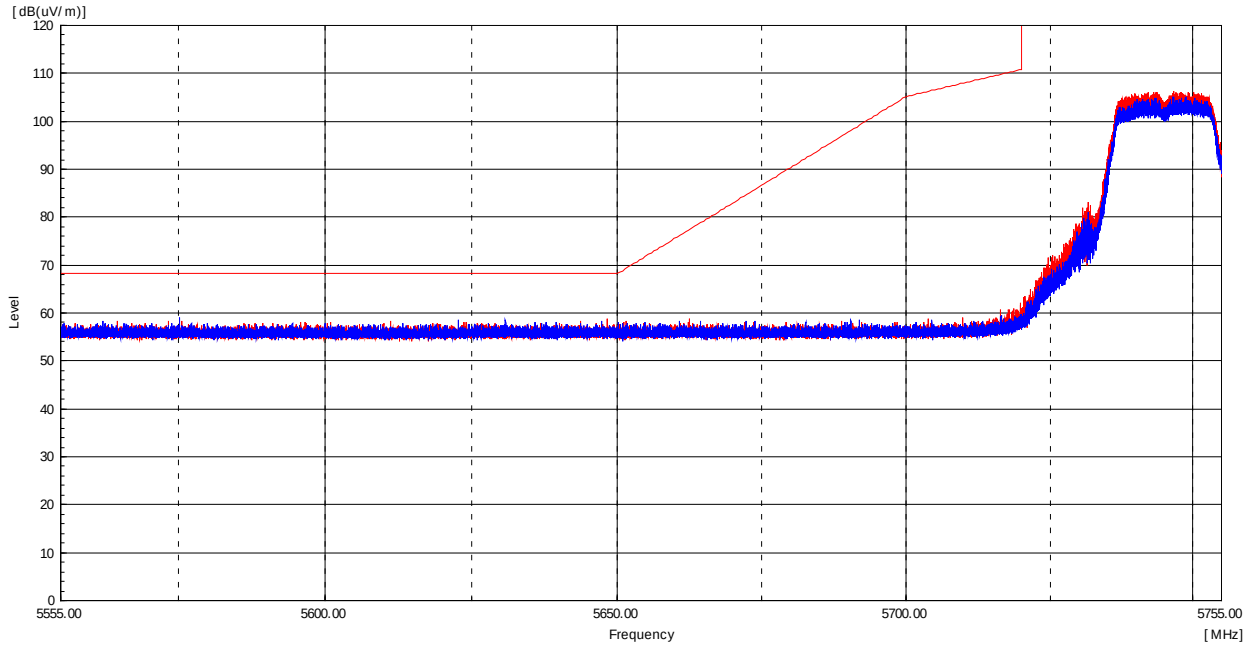
Worst Case Mode :	802.11n_HT20
Worst Case Transfer Rate :	MCS 0
Distance of Measurements :	3 Meters
Operating Frequency :	5 700 MHz
Channel :	140



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
5 725.06	H	59.2	4.4	-----	63.6	-----	68.2	-----	4.6	-----	Peak
5 725.34	V	57.8	4.4	-----	62.2	-----	68.2	-----	6.0	-----	Peak

Radiated Restricted Band Edge Plot

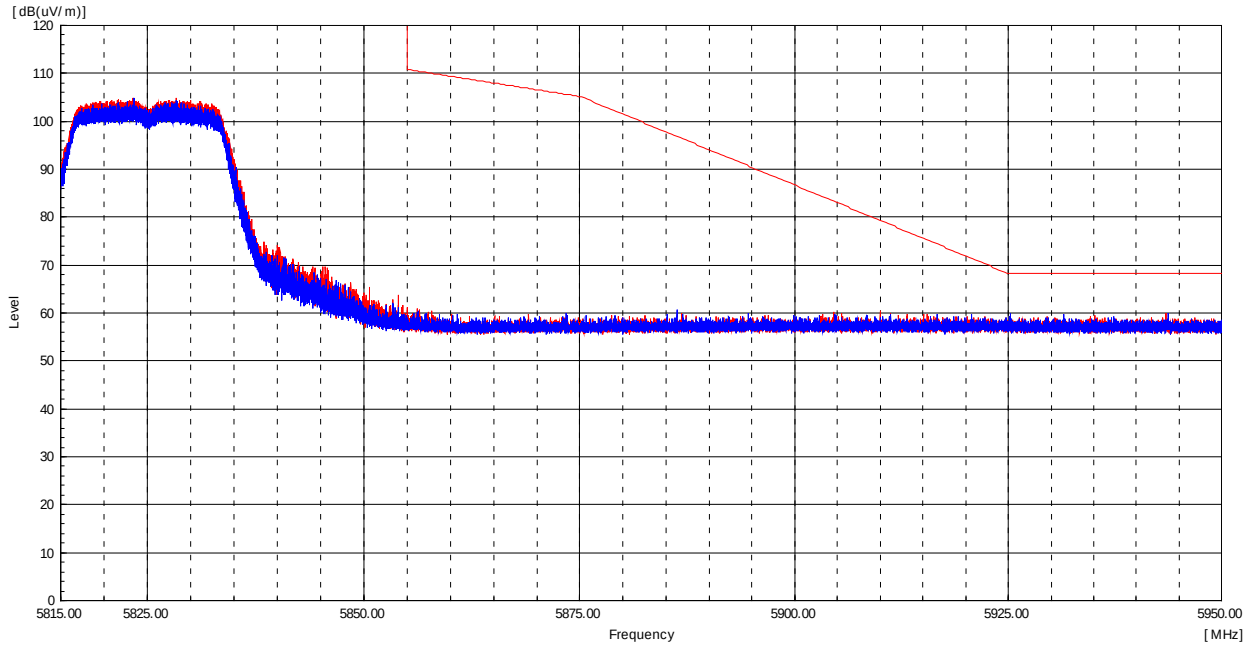
Worst Case Mode :	802.11n_HT20
Worst Case Transfer Rate :	MCS 0
Distance of Measurements :	3 Meters
Operating Frequency :	5 745 MHz
Channel :	149



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Radiated Restricted Band Edge Plot

Worst Case Mode :	802.11n_HT20
Worst Case Transfer Rate :	MCS 0
Distance of Measurements :	3 Meters
Operating Frequency :	5 825 MHz
Channel :	165



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Duty Cycle Factor [dB]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]	Note
The emissions above 1 GHz were 20 dB lower than the limit.											

Radiated Restricted Band Edge Plot

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

ANSI C63.10-2013 - Section 6.2
RSS-Gen - Section 8.8

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

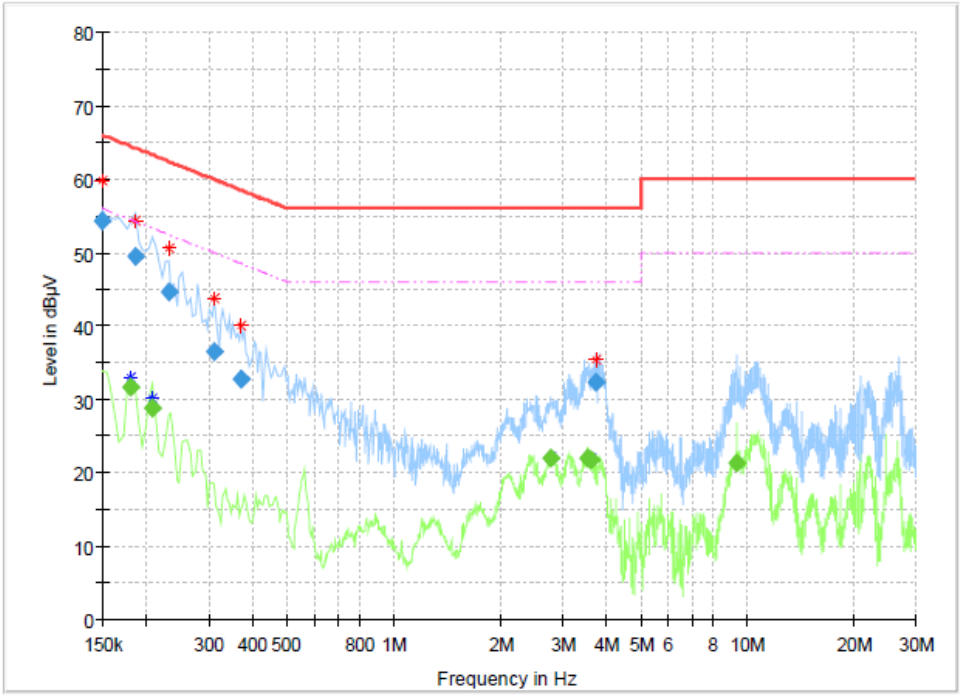
* The level decreases linearly with the logarithm of the frequency.
** A linear average detector is required.

Test Results

The requirements are:
☒ Complies

Test Data

[LINE]
Full Spectrum

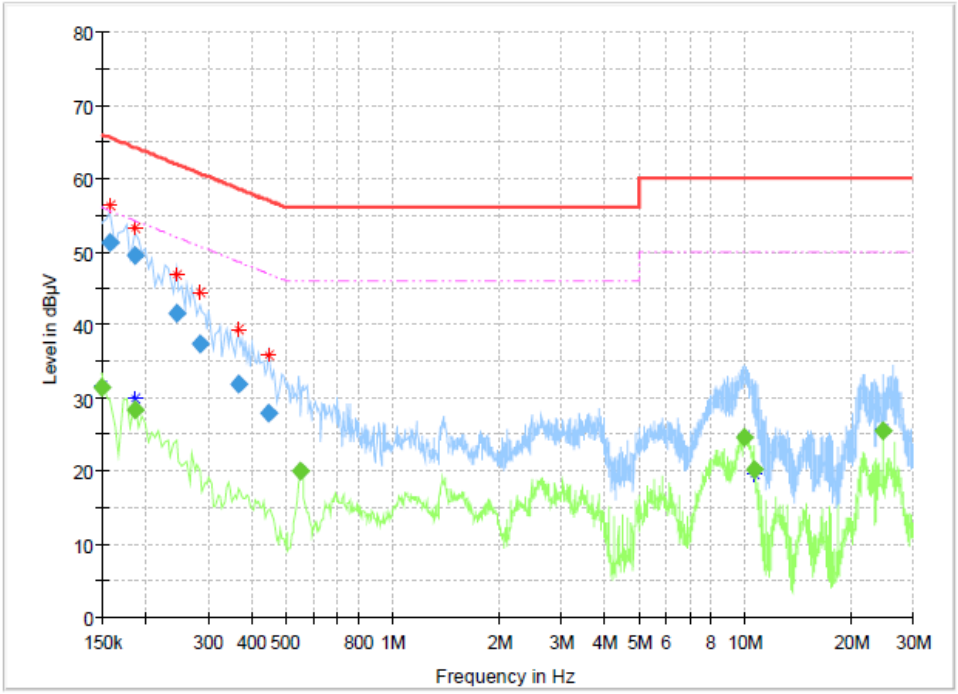


Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	54.23	---	66.00	11.77	15000.0	9.000	L1	ON	9.7
0.181500	---	31.64	54.42	22.78	15000.0	9.000	L1	ON	10.0
0.186000	49.52	---	64.21	14.70	15000.0	9.000	L1	ON	9.9
0.208500	---	28.84	53.27	24.43	15000.0	9.000	L1	ON	9.8
0.231000	44.72	---	62.41	17.70	15000.0	9.000	L1	ON	9.7
0.312000	36.51	---	59.92	23.41	15000.0	9.000	L1	ON	9.8
0.370500	32.86	---	58.49	25.63	15000.0	9.000	L1	ON	9.8
2.787000	---	21.96	46.00	24.04	15000.0	9.000	L1	ON	9.6
3.529500	---	21.97	46.00	24.03	15000.0	9.000	L1	ON	9.6
3.615000	---	21.68	46.00	24.32	15000.0	9.000	L1	ON	9.6
3.754500	32.36	---	56.00	23.64	15000.0	9.000	L1	ON	9.6
9.330000	---	21.38	50.00	28.62	15000.0	9.000	L1	ON	9.8

[NEUTRAL]

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	---	31.35	56.00	24.65	15000.0	9.000	N	ON	9.7
0.159000	51.26	---	65.52	14.26	15000.0	9.000	N	ON	9.8
0.186000	---	28.33	54.21	25.88	15000.0	9.000	N	ON	9.9
0.186000	49.41	---	64.21	14.81	15000.0	9.000	N	ON	9.9
0.244500	41.47	---	61.94	20.48	15000.0	9.000	N	ON	9.7
0.285000	37.42	---	60.67	23.25	15000.0	9.000	N	ON	9.7
0.366000	31.85	---	58.59	26.74	15000.0	9.000	N	ON	9.8
0.447000	27.83	---	56.93	29.10	15000.0	9.000	N	ON	9.8
0.550500	---	19.94	46.00	26.06	15000.0	9.000	N	ON	9.9
10.023000	---	24.60	50.00	25.40	15000.0	9.000	N	ON	9.9
10.680000	---	20.28	50.00	29.72	15000.0	9.000	N	ON	9.9
24.576000	---	25.52	50.00	24.48	15000.0	9.000	N	ON	10.0

APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
1	Signal Analyzer	Agilent	N9020A	MY49101016	2023-09-25	2024-09-25
2	Signal Generator	Rohde & Schwarz	SMB100A	175528	2023-03-22	2024-03-22
3	EMI TEST RECEIVER	Rohde & Schwarz	ESW44	102039	2023-05-03	2024-05-03
4	BILOG ANTENNA	TESEQ	CBL6111D	60654	2023-08-21	2025-08-21
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2022-04-15	2024-04-15
6	6dB Attenuator	PASTERNACK	PE7AP006-06	L20210504000023	2023-08-04	2024-08-04
7	AMPLIFIER	SONOMA INSTRUMENT	310N	411011	2023-08-04	2024-08-04
8	Spectrum Analyzer	Rohde & Schwarz	FSV40	101574	2024-01-15	2025-01-15
9	PRE AMPLIFIER	HP	8449B	3008A00620	2023-04-21	2024-04-21
10	Double Ridged Guide Antenna	ETS-Lindgren	3115	00078895	2023-04-13	2024-04-13
11	HORN ANTENNA	SCHWARZBECK	BBHA9170	1153	2023-10-19	2024-10-19
12	LOW NOISE AMPLIFIER	TESTEK	TK-PA1840H	210124-L	2023-10-23	2024-10-23
13	Band Reject Filter	Micro Tronics	BRM50716	G184	2023-12-01	2024-12-01
14	EMI Test Receiver	Rohde & Schwarz	ESR3	102826	2023-05-03	2024-05-03
15	LISN	Rohde & Schwarz	ENV216	102698	2023-05-03	2024-05-03
16	Temp&Humi Chamber	ESPEC CORP.	SH-242	93008423	2023-04-28	2024-04-28
17	Signal Analyzer	Agilent	N9020A	MY50510240	2023-07-05	2024-07-05
18	Dual-Tracking DC Power Supply	Topward Electric Instruments Co.,Ltd.	6303D	711196	2023-03-22	2024-03-22

	Cable	Manufacturer	Model No.	Serial No.	Check Date
1	RF Cable (Conducted)	Junkosha Inc.	MWX221	1512S151	2024-02-20
2	RF Cable (Line Conducted)	Canare Corporation	L-5D2W	N/A	2023-03-06
3	RF Cable (9 kHz - 1 GHz Radiated)	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	2023-03-06
4	RF Cable (9 kHz - 1 GHz Radiated)	HUBER+SUHNER	L-5D2W	N/A	2023-03-06
5	RF Cable (1 GHz - 18 GHz Radiated)	Junkosha Inc.	MWX221	2008S246	2023-06-28
6	RF Cable (1 GHz - 18 GHz Radiated)	Junkosha Inc.	MWX221	J0970749	2023-06-28
7	RF Cable (1 GHz - 18 GHz Radiated)	Sensorview Co., LTD	13A26	TPC2204060007	2023-06-28
8	RF Cable (18 GHz - 40 GHz Radiated)	Sensorview Co., LTD	9S40	TPC2204060009	2023-06-28
9	RF Cable (18 GHz - 40 GHz Radiated)	Sensorview Co., LTD	9A40	TP210713-001	2023-06-28

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