




TEST REPORT

<p>Eurofins KCTL Co.,Ltd. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-70-5008-1021 FAX: 82-505-299-8311 www.kctl.co.kr</p>	<p>Report No.: KR23-SRF0132 Page (1) of (69)</p>	 KCTL
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1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2023-03-23

2. Use of Report : Certification

3. Name of Product / Model : Smart wearable / SM-R945U (FCC), SM-R945F (ISED)

4. Manufacturer / Country of Origin : Samsung Electronics Co., Ltd. / Vietnam

5. FCC ID : A3LSMR945 (SM-R945U, SM-R945F)

6. IC Certificate No. : 649E-SMR945 (SM-R945F)

7. Date of Test : 2023-03-28 to 2023-05-17

8. Location of Test : Permanent Testing Lab On Site Testing
 (Address:65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)

9. Test method used : FCC Part 15 Subpart E, 15.407

RSS-247 Issue 2 February 2017

RSS-Gen Issue 5 February 2021


10. Test Result : Refer to the test result in the test report

Affirmation	Tested by	Technical Manager
	Name : Kwonse Kim (Signature)	Name : Harim Lee (Signature)

2023-05-19

Eurofins KCTL Co.,Ltd.

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REPORT REVISION HISTORY

Date	Revision	Page No
2023-05-19	Originally issued	-

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General remarks for test reports

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:

Procedure number, issue date and title:

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

Statement not required by the standard or client used for type testing

CONTENTS

1.	General information	4
2.	Device information	4
2.1.	Accessory information	5
2.2.	Frequency/channel operations.....	5
2.3.	Simultaneous Tx Condition	5
2.4.	Duty Cycle Factor	6
3.	Antenna requirement	7
4.	Summary of tests	8
5.	Measurement uncertainty	9
6.	Measurement results explanation example	10
7.	Test results	11
7.1.	Maximum conducted output power	11
7.2.	Maximum Power Spectral Density	16
7.3.	26 dB Bandwidth & 99% Bandwidth.....	20
7.4.	6 dB Bandwidth.....	26
7.5.	Straddle channel.....	29
7.6.	Spurious Emission, Band Edge and Restricted bands.....	33
7.7.	AC Conducted emission	67
8.	Measurement equipment	69

1. General information

Client	: Samsung Electronics Co., Ltd.
Address	: 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Manufacturer	: Samsung Electronics Co., Ltd.
Address	: 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Factory 1	: AG TECH CO.,LTD
Address	: Lot G3, Que Vo Industrial Park(Expanded Area), Nam son Ward, Bac Ninh Province, Vietnam
Factory 2	: ALMUS VINA
Address	: Lot CN07A, Phu Ha Industrial Park, Ha Thach Commune, Phu Tho Town, Phu Tho Province, Vietnam
Laboratory	: Eurofins KCTL Co.,Ltd.
Address	: 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations	: FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056 CAB Identifier: KR0040 ISED Number: 8035A KOLAS No.: KT231

2. Device information

Equipment under test	: Smart wearable
Model	: SM-R945U(FCC), SM-R945F(ISED)
Derivative model	: SM-R945F(FCC)
Modulation technique	: OFDM [WIFI(802.11a/n)]
Number of channels	: UNII-1 : 4 ch (20 MHz) UNII-2A : 4 ch (20 MHz) UNII-2C : 12 ch (20 MHz) UNII-3 : 5 ch (20 MHz)
Power source	: DC 3.88 V
Antenna specification	: LDS Antenna
Antenna gain	: UNII-1 : -3.00 dBi UNII-2A : -3.60 dBi UNII-2C : -5.30 dBi UNII-3 : -6.30 dBi
Frequency range	: UNII-1 : 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20) UNII-2A : 5 260 MHz ~ 5 320 MHz (802.11a/n_HT20) UNII-2C : 5 500 MHz ~ 5 720 MHz (802.11a/n_HT20) UNII-3 : 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20)
Software version	: SM-R945U_R945U.001, SM-R945F_R945F.001
Hardware version	: REV1.0
Test device serial No.	: Conducted : R3AW400RM2B Radiated : R3AW400R4DD, R3AW400R56J
Operation temperature	: -20 °C ~ 50 °C

Note.

1. Due to marketing purpose, the model SM-R945F will be filed for ISED approval and the test reports remain valid for Model SM-R945F ISED submission.
2. The product equality letter includes detailed information about the differences between SM-R945U and SM-R945F model.

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source	FCC ID & IC
Wireless charger	Samsung Electronics Co., Ltd.	EP-OR900	-	5.0 V, 2.0 A	FCC ID : A3LEPOR900 IC : 649E-EPOR900

2.2. Frequency/channel operations

This device contains the following capabilities:

WLAN (11a/b/g/n), Bluetooth (BDR/EDR/BLE), LTE B2/4/5/7/12/13/25/26/66/71, WCDMA 850/1700/1900

UNII-1		UNII-2A		UNII-2C		UNII-3	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
36	5 180	52	5 260	100	5 500	149	5 745
40	5 200	56	5 280	120	5 600	157	5 785
48	5 240	64	5 320	140	5 700	165	5 825
				144	5 720		

Table 2.2.1. 802.11a/n HT20 mode

2.3. Simultaneous Tx Condition

The device supports simultaneous transmission operation, which allows for two channels to operate independent of one another in the Bluetooth, 5 GHz bands simultaneously.

Simultaneous Tx condition – not RSDB

Mode	# of TX	WLAN 5 GHz	Bluetooth
Bluetooth + 5G WLAN	2	O	O

Notes.

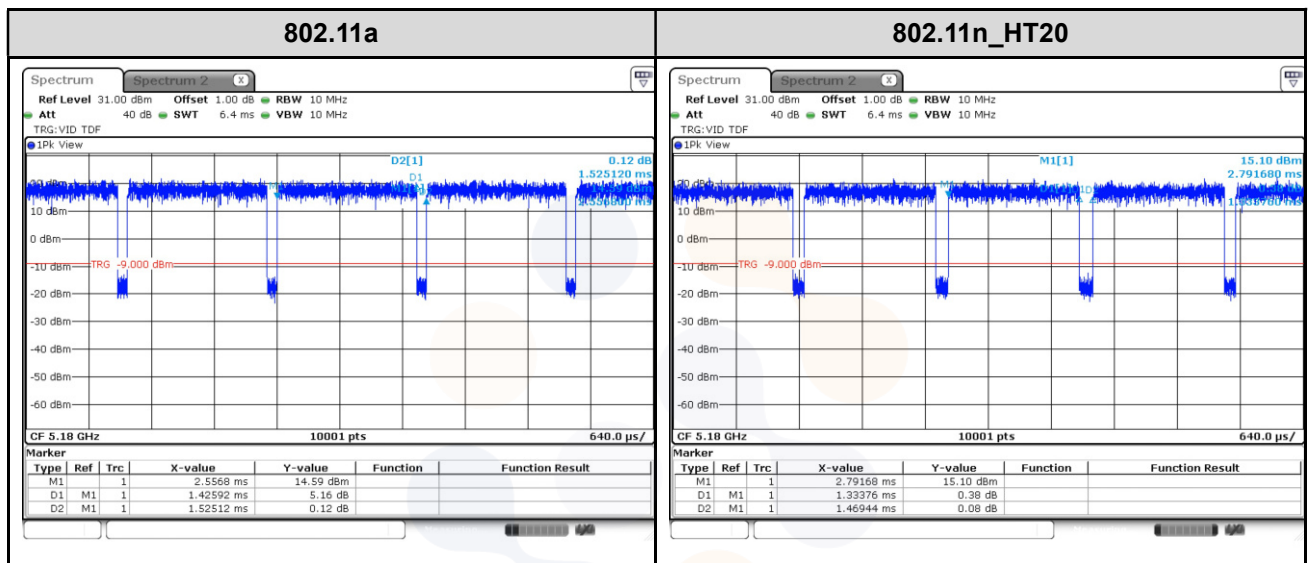
Simultaneous condition was performed as a worst case which is configured as a combination of lowest margin for each mode during radiated spurious emission.



2.4. Duty Cycle Factor

Test mode	Period (ms)	T _{on} time (ms)	Duty cycle		Duty cycle factor (dB)
			(Linear)	(%)	
802.11a	1.525	1.426	0.935 1	93.51	0.29
802.11n_HT20	1.469	1.334	0.908 1	90.81	0.42

Notes.

1. Duty cycle (Linear) = T_{on} time / Period
2. DCF(Duty cycle factor) = 10log(1/duty cycle)
3. DCF is not compensated to average result if duty cycle is more than 98%



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3. Antenna requirement

Requirement of FCC part section 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Requirement of RSS-Gen Section 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

- The transmitter has permanently attached LDS Antenna (Internal antenna) on board.
- The E.U.T Complies with the requirement of §15.203, §15.247, §15.407.

4. Summary of tests

FCC Part section(s)	IC Rule Reference	Parameter	Test Condition	Test results
15.407(a)	RSS-247 Issue 2, 6.2	Maximum conducted output power	Conducted	Pass
15.407(a)	RSS-247 Issue 2, 6.2	Maximum power spectral density		Pass
15.407(a)	RSS-Gen Issue 5, 6.7	26 dB Channel Bandwidth		Pass
15.407(e)	RSS-247 Issue 2, 6.2.4	6 dB Channel Bandwidth		Pass
-	RSS-Gen Issue 5, 6.7	Occupied Bandwidth		Pass
15.207(a)	RSS-Gen Issue 5, 8.8	AC Conducted Emissions		Pass
15.407(b), 15.205(a), 15.209(a)	RSS-Gen Issue 5, 8.9, 8.10 RSS-247 Issue 2, 6.2,	Spurious emission	Radiated	Pass

Notes:

- All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- According to exploratory test no any obvious emission were detected from 9 kHz to 30 MHz. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
- The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z and all of the radiated tests have been performed with the accessories as below. It was determined that below orientation was worst case orientation for each band.

Band	Strap	With charger	Without charger		
		X-axis	X-axis	Y-axis	Z-axis
UNII-1	With strap	O	-	-	-
	Without strap	-	-	-	-
UNII-2A	With strap	-	-	-	-
	Without strap	-	-	-	O
UNII-2C	With strap	-	-	-	O
	Without strap	-	-	-	-
UNII-3	With strap	-	-	-	-
	Without strap	-	-	-	O

- The test procedure(s) in this report were performed in accordance as following.
 - ANSI C63.10-2013
 - KDB 789033 D02 v02r01
- Based on the baseline scan, the worst-case data rates were:
 - 802.11a mode: 6Mbps
 - 802.11n HT20 mode: MCS0

5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicated a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty (\pm)	
Conducted RF power	0.9 dB	
Conducted spurious emissions	1.3 dB	
Radiated spurious emissions	Below 30 MHz:	2.3 dB
	30 MHz ~ 1 000 MHz	2.5 dB
	1 000 MHz ~ 18 000 MHz	4.7 dB
	Above 18 000 MHz	4.8 dB
Conducted emissions	9 kHz ~ 150 kHz	2.7 dB
	150 kHz ~ 30 MHz	2.7 dB

6. Measurement results explanation example

The offset level is set in the spectrum analyzer to compensate the RF cable loss factor between EUT conducted output port and spectrum analyzer.

With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Frequency (MHz)	Factor(dB)	Frequency (MHz)	Factor(dB)
30	10.07	9 000	12.62
50	10.08	10 000	12.66
100	10.11	11 000	12.56
200	10.24	12 000	12.67
300	10.31	13 000	13.22
400	10.35	14 000	12.88
500	10.48	15 000	13.02
600	10.46	16 000	13.17
700	10.54	17 000	13.49
800	10.58	18 000	13.22
900	10.58	19 000	13.54
1 000	10.66	20 000	13.53
2 000	10.99	21 000	13.80
3 000	11.19	22 000	13.54
4 000	11.38	23 000	13.63
5 000	11.65	24 000	13.56
6 000	11.89	25 000	13.92
7 000	11.99	26 000	14.00
8 000	12.26	26 500	14.07

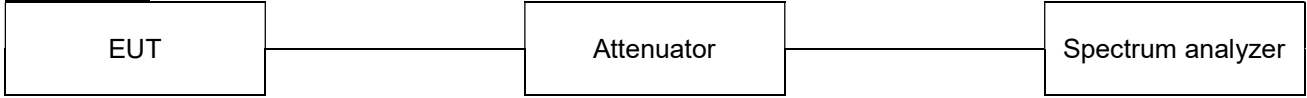
Notes:

Offset(dB) = RF cable loss(dB) + Attenuator(dB)

7. Test results

7.1. Maximum conducted output power

Test setup



Limit

According to §15.407(a), RSS-247(6.2)

FCC

Band	EUT category	Conducted output power limit
UNII-1	Outdoor access point	1 W (30 dBm)
	Indoor access point	
	Fixed point-to-point access point	
	√ Client device	250 mW (23.98 dBm)
UNII-2A	√	250 mW or 11 dBm + 10logB ¹⁾
UNII-2C	√	250 mW or 11 dBm + 10logB ¹⁾
UNII-3	√	1 W (30 dBm)

IC

Band	Maximum e.i.r.p. limit
UNII-1	200 mW or 10 + 10 log ₁₀ B ²⁾ , dBm
UNII-2A	1 W or 17 dBm + 10logB ²⁾
UNII-2C	1 W or 17 dBm + 10logB ²⁾
UNII-3	1 W (30 dBm)

Note:

- 1) Conducted output power limit B is the 26 dB emission bandwidth.
- 2) Maximum e.i.r.p. limit B is the 99% emission bandwidth.

Test procedure

ANSI C63.10-2013-Section 12.3.2.4 or 12.3.3.1
 KDB 789033 D02 v02r01 - Section E.2.d) or E.3.a)

Test settings

Used test method is Section E.2.d)

◆ KDB 789033 D02 v02r01

Section E.2.d)

Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction):

- (i) Measure the duty cycle, x , of the transmitter output signal as described in II.B.
- (ii) Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- (iii) Set RBW = 1 MHz
- (iv) Set RBW \geq 3 MHz
- (v) Number of points in sweep \geq $2 \times \text{span}/\text{RBW}$. (This ensures that bin-to-bin spacing is \leq RBW/2, so that narrowband signals are not lost between frequency bins.)
- (vi) Sweep time = auto.
- (vii) Detector = power averaging (rms), if available. Otherwise use sample detector mode.
- (viii) Do not use sweep triggering. Allow the sweep to “free run.”
- (ix) Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.
- (x) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- (xi) Add $10 \log (1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add $10 \log (1/0.25) = 6 \text{ dB}$ if the duty cycle is 25%.

Section E.3.a)

Method PM (Measurement using an RF average power meter):

- (i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied:
 - The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
 - At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
 - The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five
- (ii) If the transmitter does not transmit continuously, measure the duty cycle, x , of the transmitter output signal as described in II
- (iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
- (iv) Adjust the measurement in dBm by adding $10 \log (1/x)$ where x is the duty cycle (e.g., $10 \log (1/0.25)$ if the duty cycle is 25%).

Test results

Conducted output power

Test mode	Band	Frequency (MHz)	Measured output power			Limit (dBm)
			Reading (dBm)	DCF (dB)	Result (dBm)	
802.11a	UNII-1	5 180	16.11	0.29	16.40	23.98
		5 200	16.45		16.74	
		5 240	16.64		16.93	
	UNII-2A	5 260	15.87		16.16	23.98
		5 280	15.74		16.03	
		5 320	16.07		16.36	
	UNII-2C	5 500	14.84		15.13	23.98
		5 600	15.24		15.53	
		5 700	15.25		15.54	
	UNII-3	5 745	15.60		15.89	30.00
		5 785	15.83		16.12	
		5 825	15.94		16.23	
802.11n HT20	UNII-1	5 180	15.87	0.42	16.29	23.98
		5 200	15.71		16.13	
		5 240	16.07		16.49	
	UNII-2A	5 260	15.09		15.51	23.98
		5 280	15.16		15.58	
		5 320	15.50		15.92	
	UNII-2C	5 500	15.17		15.59	23.98
		5 600	15.06		15.48	
		5 700	15.05		15.47	
	UNII-3	5 745	15.39		15.81	30.00
		5 785	15.59		16.01	
		5 825	15.70		16.12	

Notes:

1. Average result(dB m) = Average Reading (dB m) + DCF(dB)

e.i.r.p

Test mode	Band	Frequency (MHz)	Measured output power			MAX. e.i.r.p Limit (dBm)
			Conducted output power (dBm)	ANT gain (dBi)	MAX. e.i.r.p (dBm)	
802.11a	UNII-1	5 180	16.40	-3.00	13.40	22.61
		5 200	16.74		13.74	
		5 240	16.93		13.93	
	UNII-2A	5 260	16.16	-3.60	12.56	29.62
		5 280	16.03		12.43	
		5 320	16.36		12.76	
	UNII-2C	5 500	15.13	-5.30	9.83	29.61
		5 600	15.53		10.23	
		5 700	15.54		10.24	
	UNII-3	5 745	15.89	-6.30	9.59	30.00
		5 785	16.12		9.82	
		5 825	16.23		9.93	
802.11n HT20	UNII-1	5 180	16.29	-3.00	13.29	23.01
		5 200	16.13		13.13	
		5 240	16.49		13.49	
	UNII-2A	5 260	15.51	-3.60	11.91	30.00
		5 280	15.58		11.98	
		5 320	15.92		12.32	
	UNII-2C	5 500	15.59	-5.30	10.29	30.00
		5 600	15.48		10.18	
		5 700	15.47		10.17	
	UNII-3	5 745	15.81	-6.30	9.51	30.00
		5 785	16.01		9.71	
		5 825	16.12		9.82	

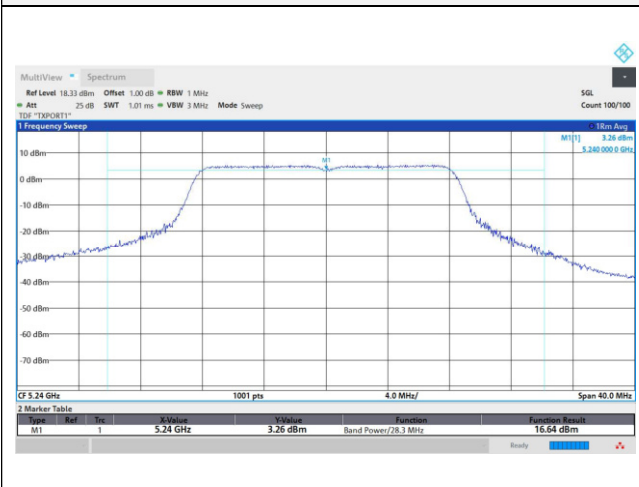
Notes:

1. e.i.r.p. Calculation:

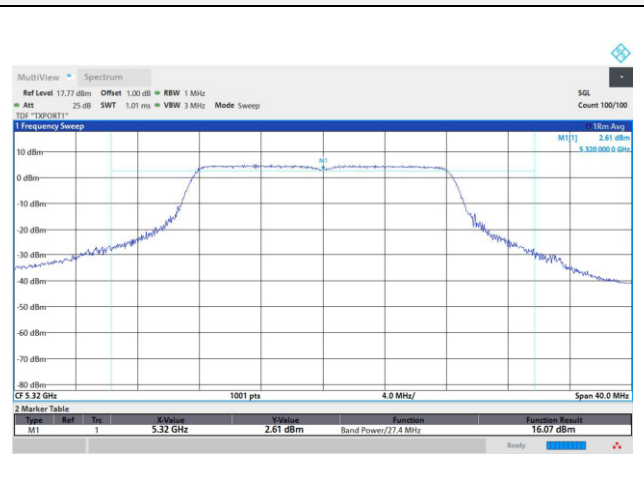
$$\text{e.i.r.p. (dB m)} = \text{Conducted output power (dB m)} + \text{Antenna gain (dB i)}$$

In order to simplify the report, attached plots were only worst bandwidth

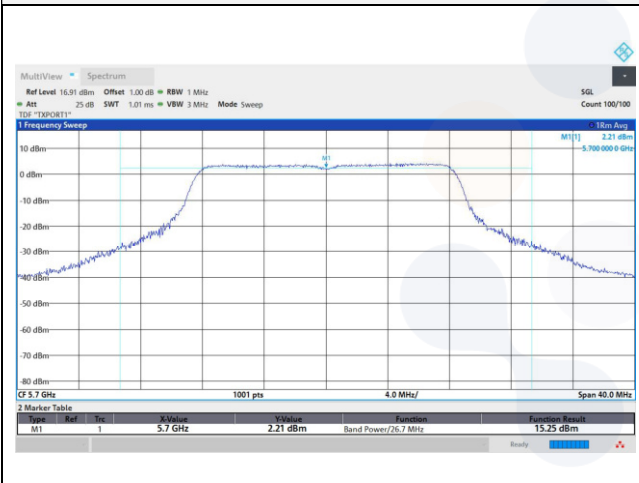
UNII-1 / 802.11a / High ch.



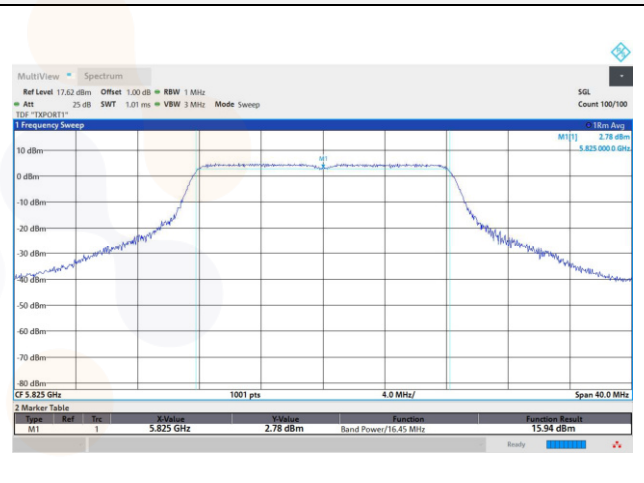
UNII-2A / 802.11a / High ch.



UNII-2C / 802.11a / High ch.

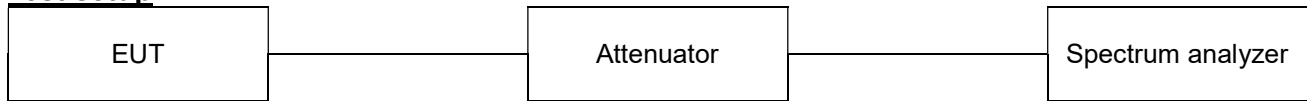


UNII-3 / 802.11a / High ch.



7.2. Maximum Power Spectral Density

Test setup



Limit

According to §15.407(a), RSS-247(6.2)

Band	EUT category	Limit
UNII-1	Outdoor access point	17 dBm/MHz
	Indoor access point	
	Fixed point-to-point access point	
	√ Client device	11 dBm /MHz
UNII-2A	√	11 dBm /MHz
UNII-2C	√	11 dBm /MHz
UNII-3	√	30 dBm /500 kHz

Notes:

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain if the antenna exceed 6 dBi

Test procedure

ANSI C63.10-2013 Section 12.3.2.2, 14.3.2.2
 KDB 789033 D02 v02r01 - Section F

Test settings

Section F

The rules requires “maximum power spectral density” measurements where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission. Refer to III.A for additional guidance for devices that use channel aggregation.

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power....” (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
2. Search function on the instrument to find the peak of the spectrum and record its value.
3. Adjustments to the peak value of the spectrum, if applicable:
 - a) If Method SA-2 or SA-2 Alternative was used, add $10 \log(1/x)$, where x is the duty cycle, to the peak of the spectrum.
 - b) If Method SA-3 Alternative was used and the linear mode was used in II.E.2.g) (viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
4. The result is the Maximum PSD over 1MHz reference bandwidth
5. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the preceding procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference

bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth(i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

- a) Set $RBW \geq 1/T$, where T is defined in II.B.I.a).
- b) Set $VBW \geq 3 RBW$.
- c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log (500 \text{ kHz} / RBW)$ to the measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
- d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10 \log (1\text{MHz}/RBW)$ to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
- e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the II.F.5.c) and II.F.5.d), since RBW=100 kHz is available on nearly all spectrum analyzers.

Test results

Test mode	Band	Frequency (MHz)	Measured PSD (dBm/MHz)	DCF (dB)	Maximum PSD (dB m/MHz)	Limit (dBm/MHz)
802.11a	UNII 1	5 180	5.24	0.29	5.53	11.00
		5 200	5.54		5.83	
		5 240	5.38		5.67	
	UNII 2A	5 260	5.01		5.30	11.00
		5 280	5.01		5.30	
		5 320	4.42		4.71	
	UNII 2C	5 500	4.36		4.65	11.00
		5 600	4.42		4.71	
		5 700	5.05		5.34	
802.11n HT20	UNII 1	5 180	4.53	0.42	4.95	11.00
		5 200	4.36		4.78	
		5 240	4.81		5.23	
	UNII 2A	5 260	3.94		4.36	11.00
		5 280	4.16		4.58	
		5 320	3.84		4.26	
	UNII 2C	5 500	3.88		4.30	11.00
		5 600	3.78		4.20	
		5 700	4.01		4.43	

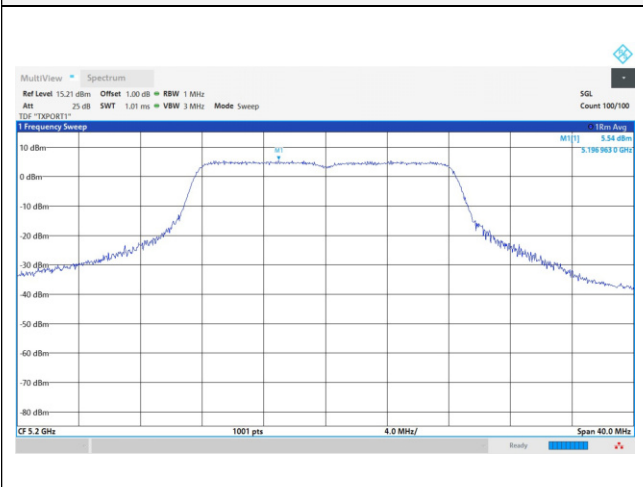
Test mode	Band	Frequency (MHz)	Measured PSD (dBm /500 kHz)	DCF (dB)	Maximum PSD (dBm /500 kHz)	Limit (dBm /500 kHz)
802.11a	UNII 3	5 745	1.69	0.29	1.98	30.00
		5 785	1.68		1.97	
		5 825	0.71		1.00	
802.11n HT20		5 745	1.33	0.42	1.75	
		5 785	0.92		1.34	
		5 825	0.80		1.22	

Notes:

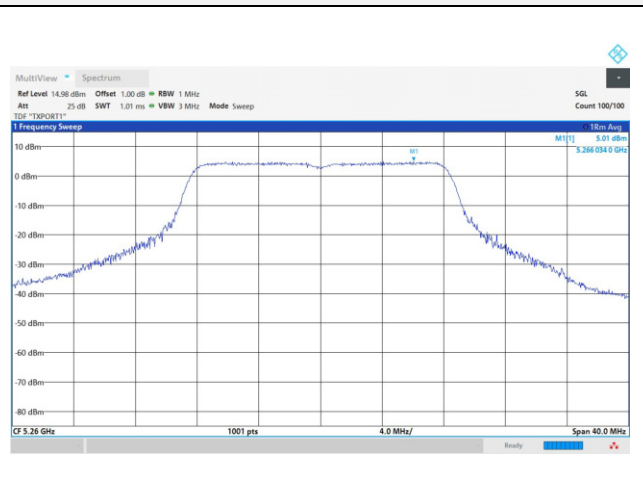
1. Maximum PSD calculation
- Maximum PSD = Measured PSD + D.C.F

In order to simplify the report, attached plots were only worst bandwidth

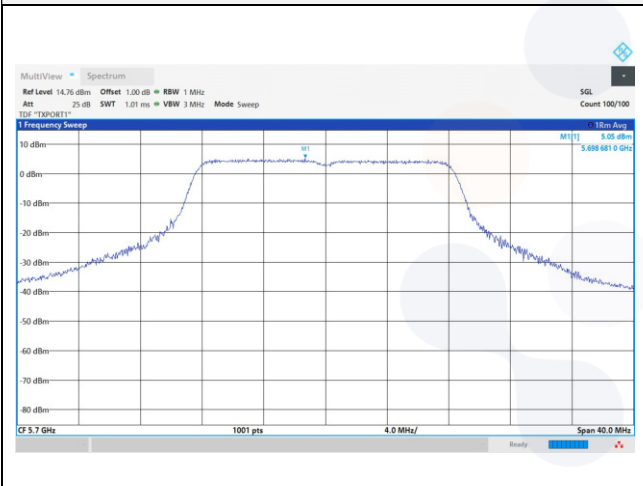
UNII-1 / 802.11a / Mid ch.



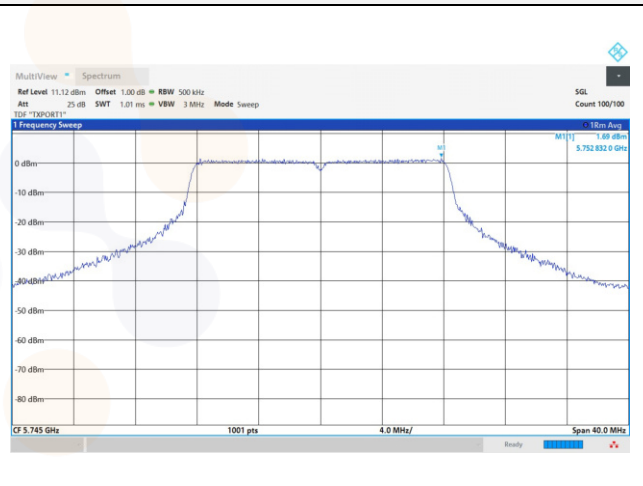
UNII-2A / 802.11a / Low ch.



UNII-2C / 802.11a / High ch.

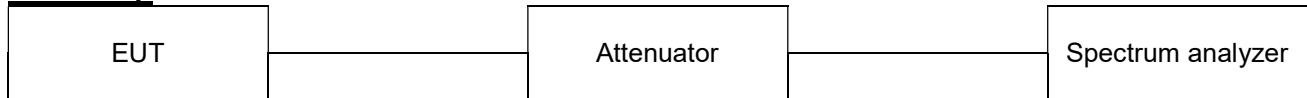


UNII-3 / 802.11a / Low ch.



7.3. 26 dB Bandwidth & 99% Bandwidth

Test setup



Limit

N/A

Test procedure

ANSI C63.10-2013 Section 12.4

KDB 789033 D02 v02r01 - Section C.1 (26dB bandwidth)

KDB 789033 D02 v02r01 - Section D (99% bandwidth)

Test settings

1. 26 dB Bandwidth

- a. Set RBW = approximately 1% of the emission bandwidth.
- b. Set the 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%.

2. 99% Occupied Bandwidth

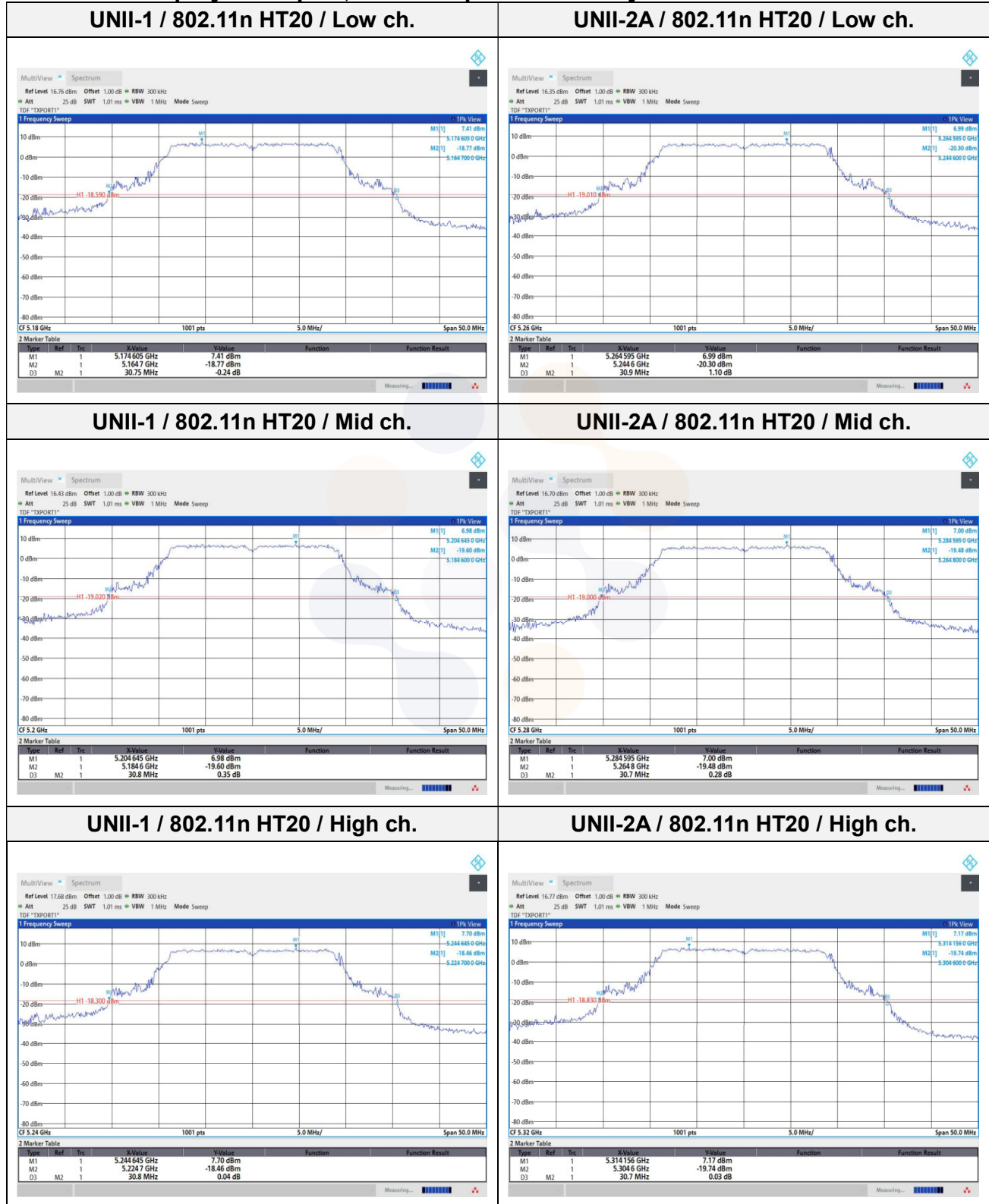
- a. Set center frequency to the nominal EUT channel center frequency.
- b. Set span = 1.5 times to 5.0 times the OBW.
- c. Set RBW = 1% to 5% of the OBW
- d. Set VBW $\geq 3 \times$ RBW
- e. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- f. Use the 99% power bandwidth function of the instrument (if available).
- g. If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

Test results

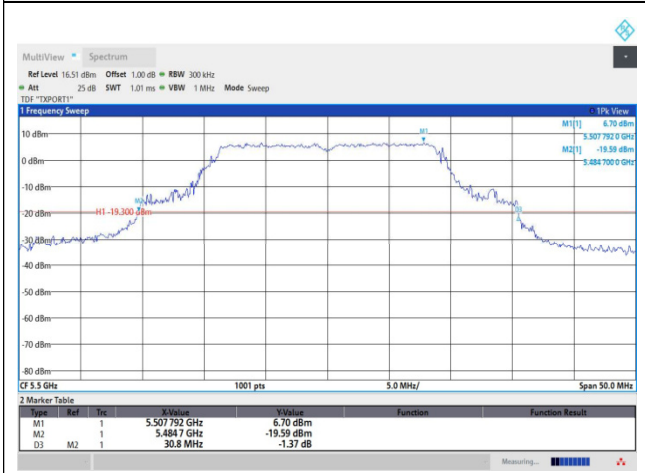
Test mode	Band	Frequency(MHz)	26 dB bandwidth (MHz)	99% bandwidth (MHz)
802.11a	UNII-1	5 180	28.65	18.29
		5 200	26.90	18.27
		5 240	28.30	18.19
	UNII-2A	5 260	27.50	18.23
		5 280	27.50	18.24
		5 320	27.40	18.24
	UNII-2C	5 500	26.95	18.25
		5 600	26.65	18.27
		5 700	26.70	18.24
802.11n HT20	UNII-1	5 180	30.75	20.17
		5 200	30.80	20.26
		5 240	30.80	20.39
	UNII-2A	5 260	30.90	20.20
		5 280	30.70	20.20
		5 320	30.70	20.36
	UNII-2C	5 500	30.80	20.27
		5 600	30.85	20.37
		5 700	30.90	20.28

26 dB bandwidth

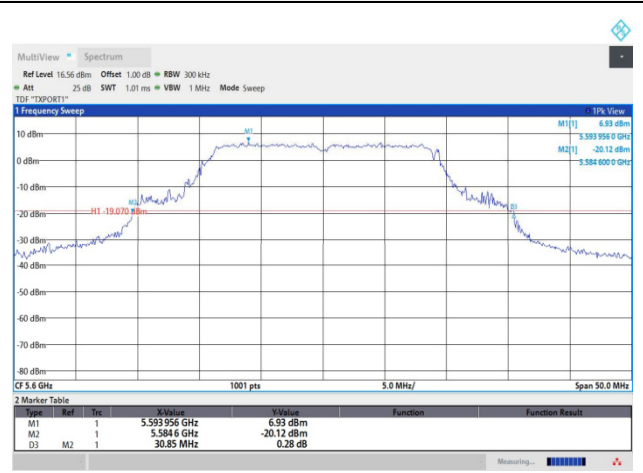
In order to simplify the report, attached plots were only worst bandwidth



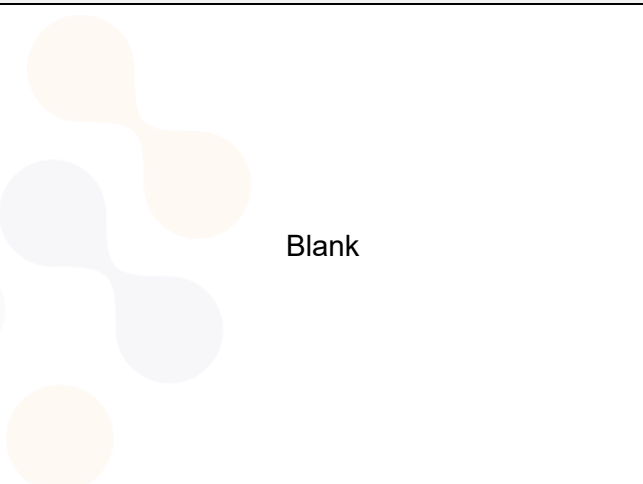
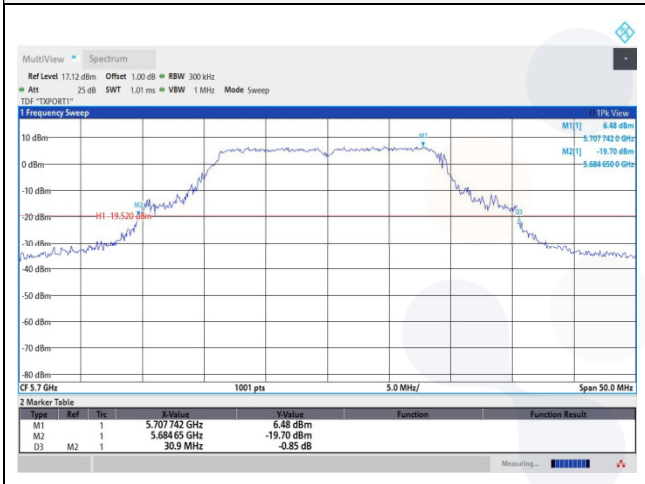
UNII-2C / 802.11n HT20 / Low ch.



UNII-2C / 802.11n HT20 / Mid ch.

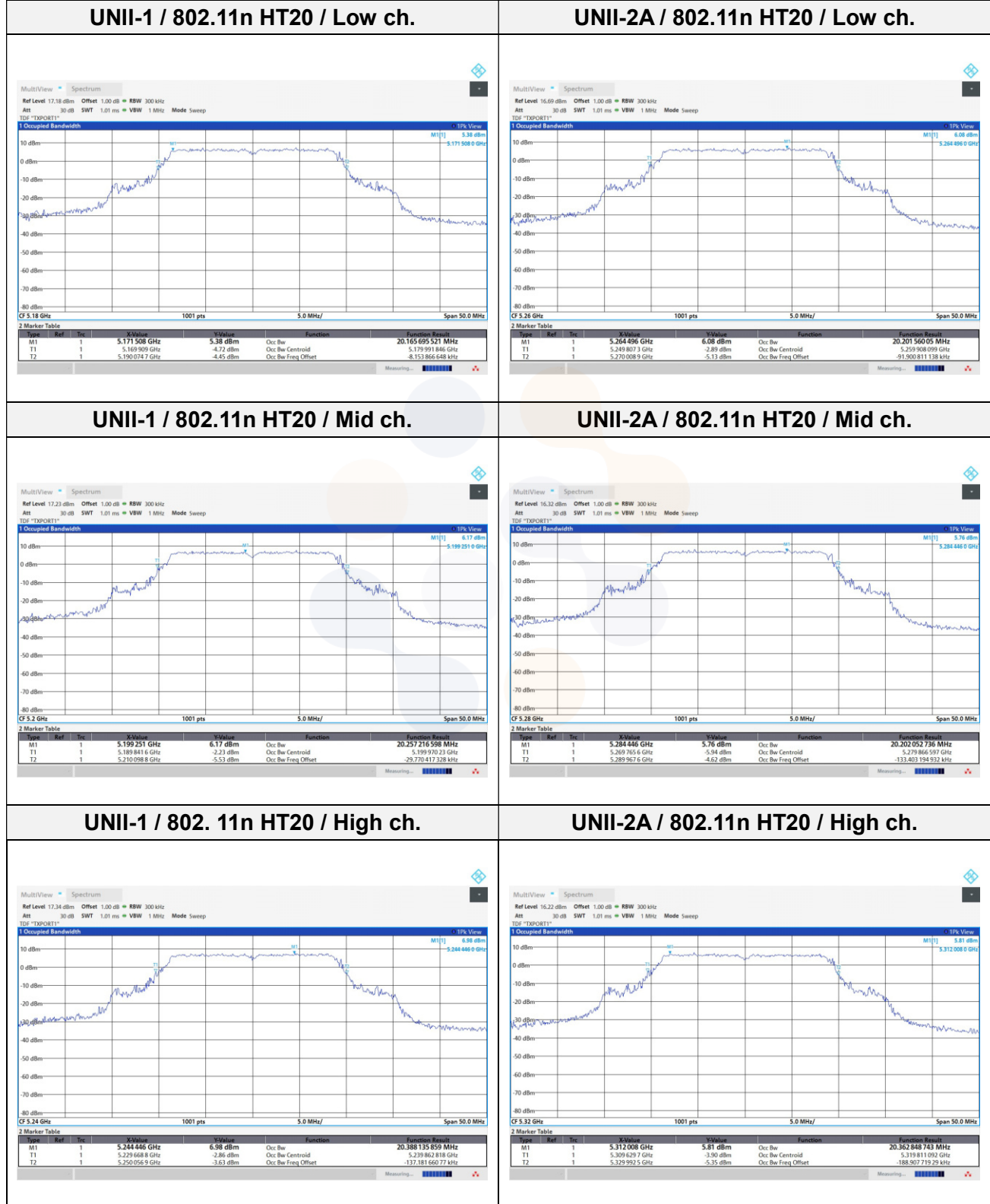


UNII-2C / 802.11n HT20 / High ch.

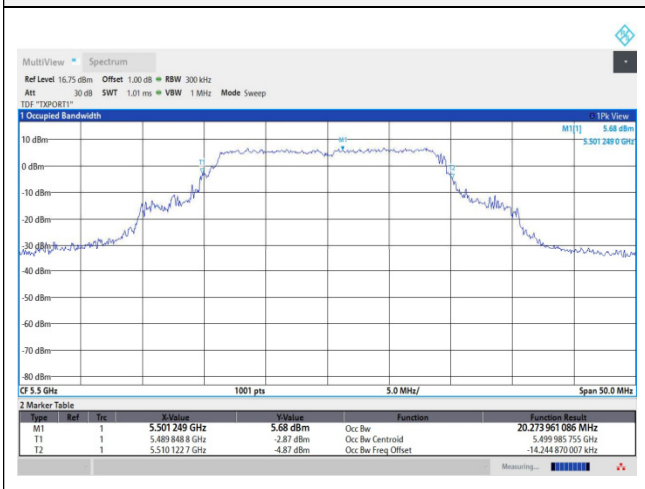


99% Bandwidth

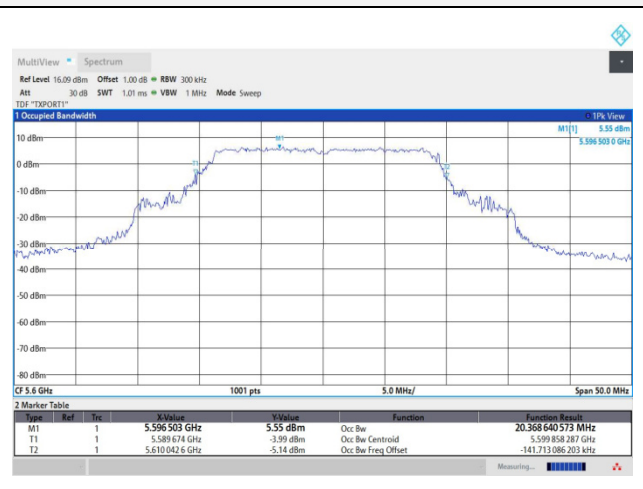
In order to simplify the report, attached plots were only worst bandwidth



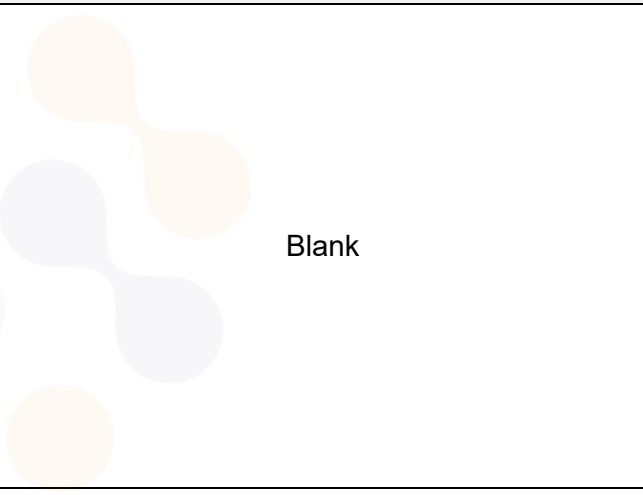
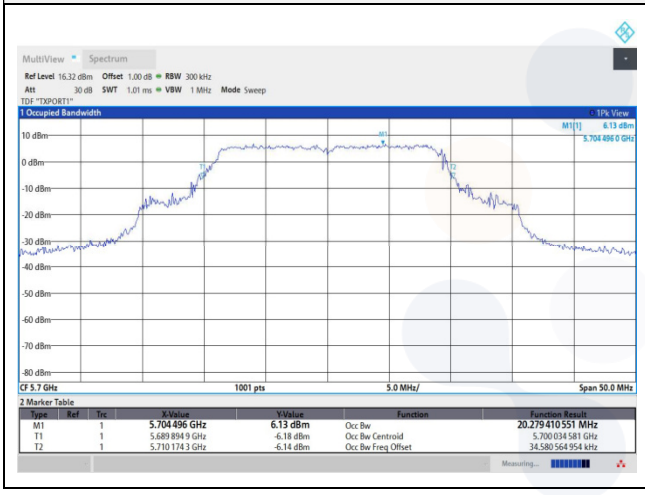
UNII-2C / 802.11n HT20 / Low ch.



UNII-2C / 802.11n HT20 / Mid ch.

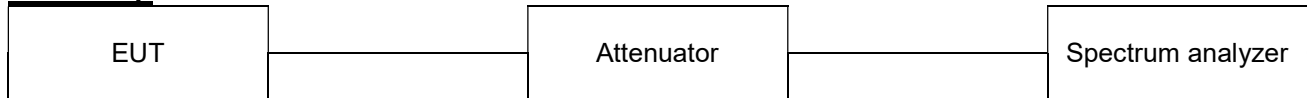


UNII-2C / 802.11n HT20 / High ch.



7.4. 6 dB Bandwidth

Test setup



Limit

According to §15.407(e), RSS-247(6.2.4), Within the 5.725-5.850 GHz bands, the minimum 6 dB bandwidth of U-NII devices shall be at least 500kHz.

Test procedure

ANSI C63.10-2013 Section 6.9.2
KDB 789033 D02 v02r01 - Section C.2

Test settings

Minimum Emission Bandwidth for the band 5.725–5.85 GHz

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 kHz for the band 5.725–5.85 GHz. The following procedure shall be used for measuring this Bandwidth:

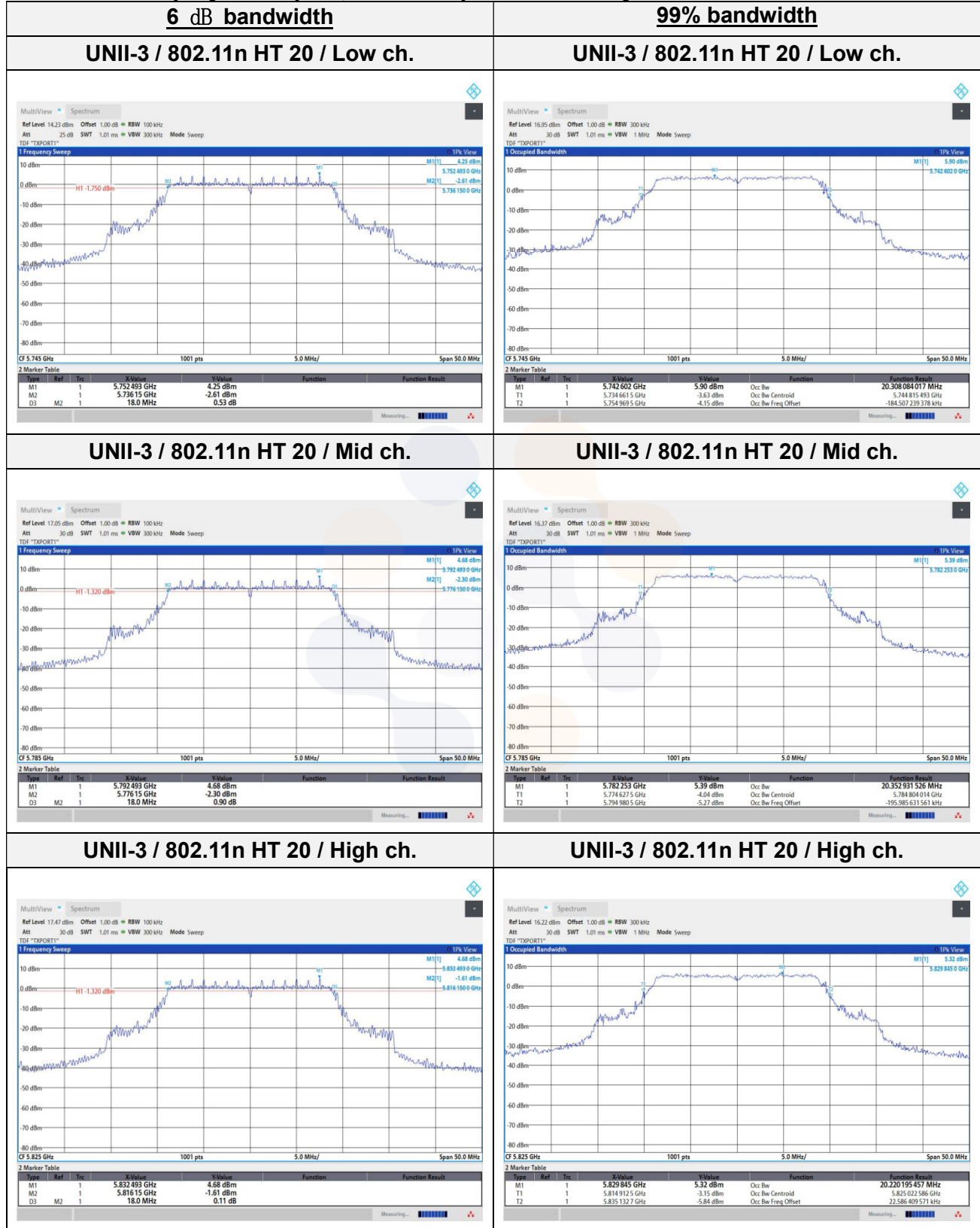
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test results

Test mode	Band	Frequency (MHz)	6dB bandwidth (MHz)	Limit (MHz)	99% bandwidth (MHz)
802.11a	UNII-3	5 745	16.50	0.50	18.22
		5 785	16.45	0.50	18.24
		5 825	16.45	0.50	18.17
802.11n HT20	UNII-3	5 745	18.00	0.50	20.31
		5 785	18.00	0.50	20.35
		5 825	18.00	0.50	20.22



In order to simplify the report, attached plots were only worst bandwidth



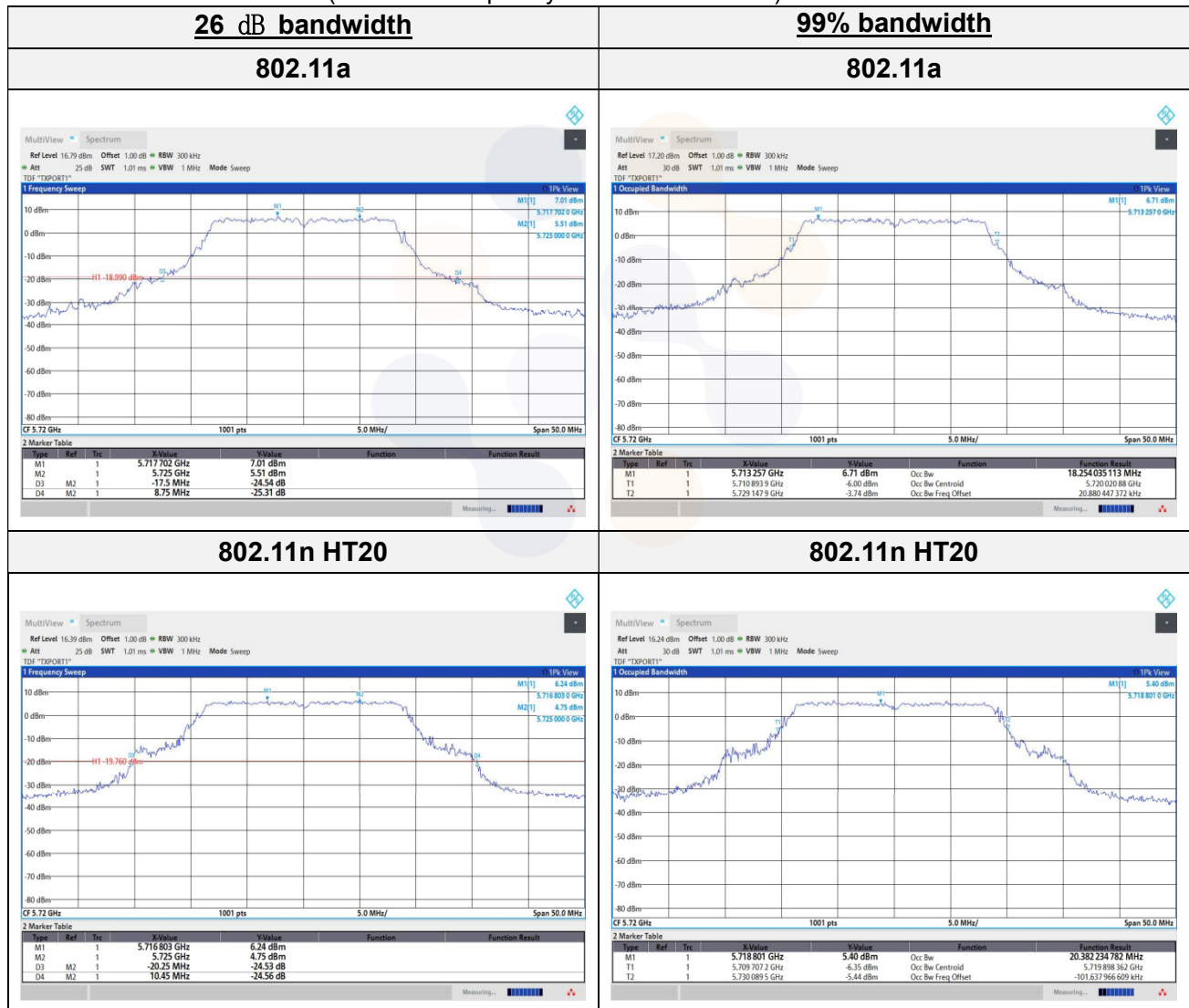
7.5. Straddle channel

26dB bandwidth & 99% Bandwidth

Test mode	Band	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	UNII-2C	5 720	17.5	14.11
802.11n HT20			20.25	15.29
802.11a	UNII-3	5 720	8.75	4.15
802.11n HT20			10.45	5.09

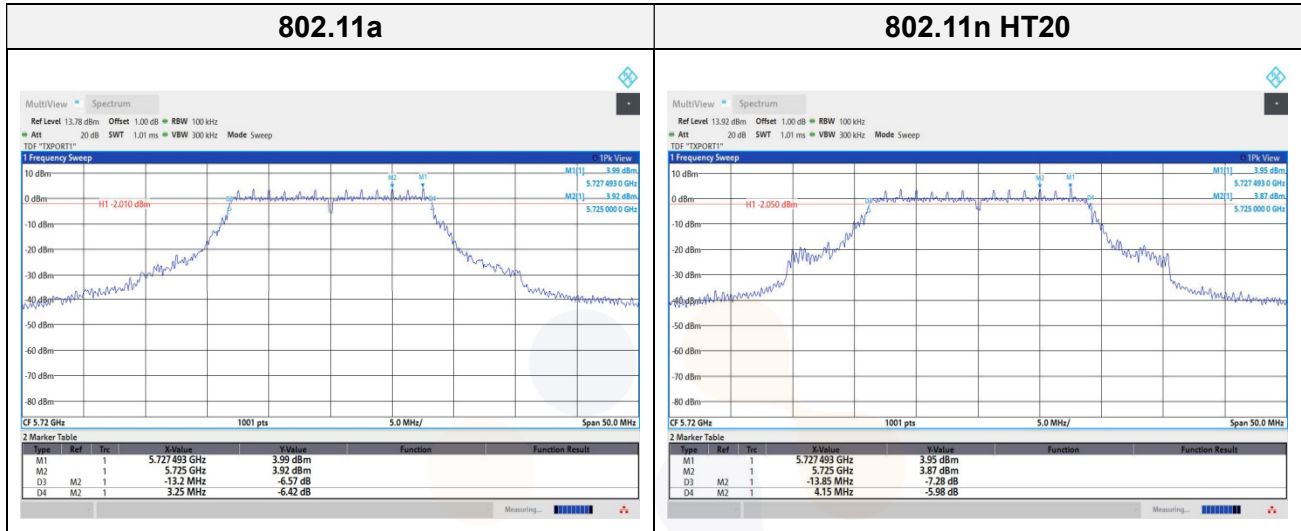
Notes: For 99% Bandwidth, measured 99% occupied bandwidth is separated as below

- For UNII band 2C = 5725 MHz – T1(measured frequency on the marker table)
- For UNII band 3 = T2(measured frequency on the marker table) – 5725 MHz



6dB bandwidth

Test mode	Band	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
802.11a	UNII-3	5 720	3.25	0.50
802.11n HT20			4.15	0.50



Conducted Output Power

Test mode	Band	Frequency (MHz)	Measured output power			Limit (dBm)
			Reading (dBm)	DCF (dB)	Result (dBm)	
802.11a	UNII-2C	5 720	14.16	0.29	14.45	23.43
	UNII-3		8.36		8.65	30.00
802.11n HT20	UNII-2C	5 720	13.92	0.42	14.34	23.98
	UNII-3		8.47		8.89	30.00

Notes:

1. Average result(dB m) = Average Reading (dB m) + DCF(dB)

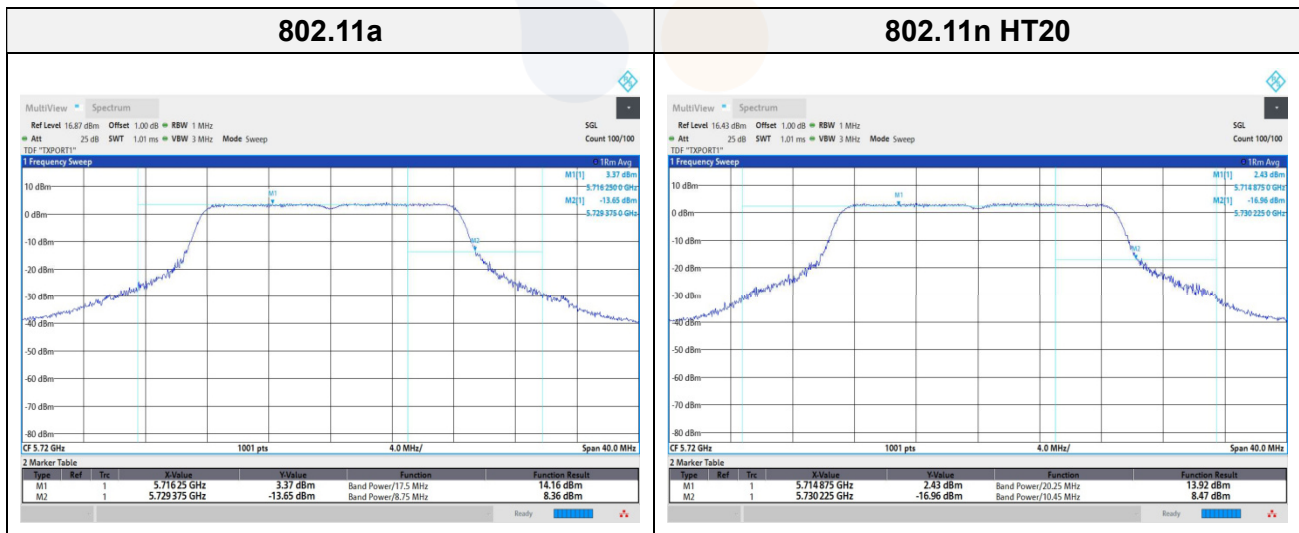
E.I.R.P

Test mode	Band	Frequency (MHz)	Measured output power			MAX. e.i.r.p Limit (dBm)
			Conducted output power (dBm)	ANT gain (dBi)	MAX. e.i.r.p (dBm)	
802.11a	UNII-2C	5 720	14.45	-5.30	9.15	28.50
	UNII-3		8.65	-6.30	3.35	30.00
802.11n HT20	UNII-2C	5 720	14.34	-5.30	9.04	28.84
	UNII-3		8.89	-6.30	3.59	30.00

Notes:

1. e.i.r.p. Calculation:

e.i.r.p. (dB m) = Conducted output power (dB m) + Antenna gain (dB i)



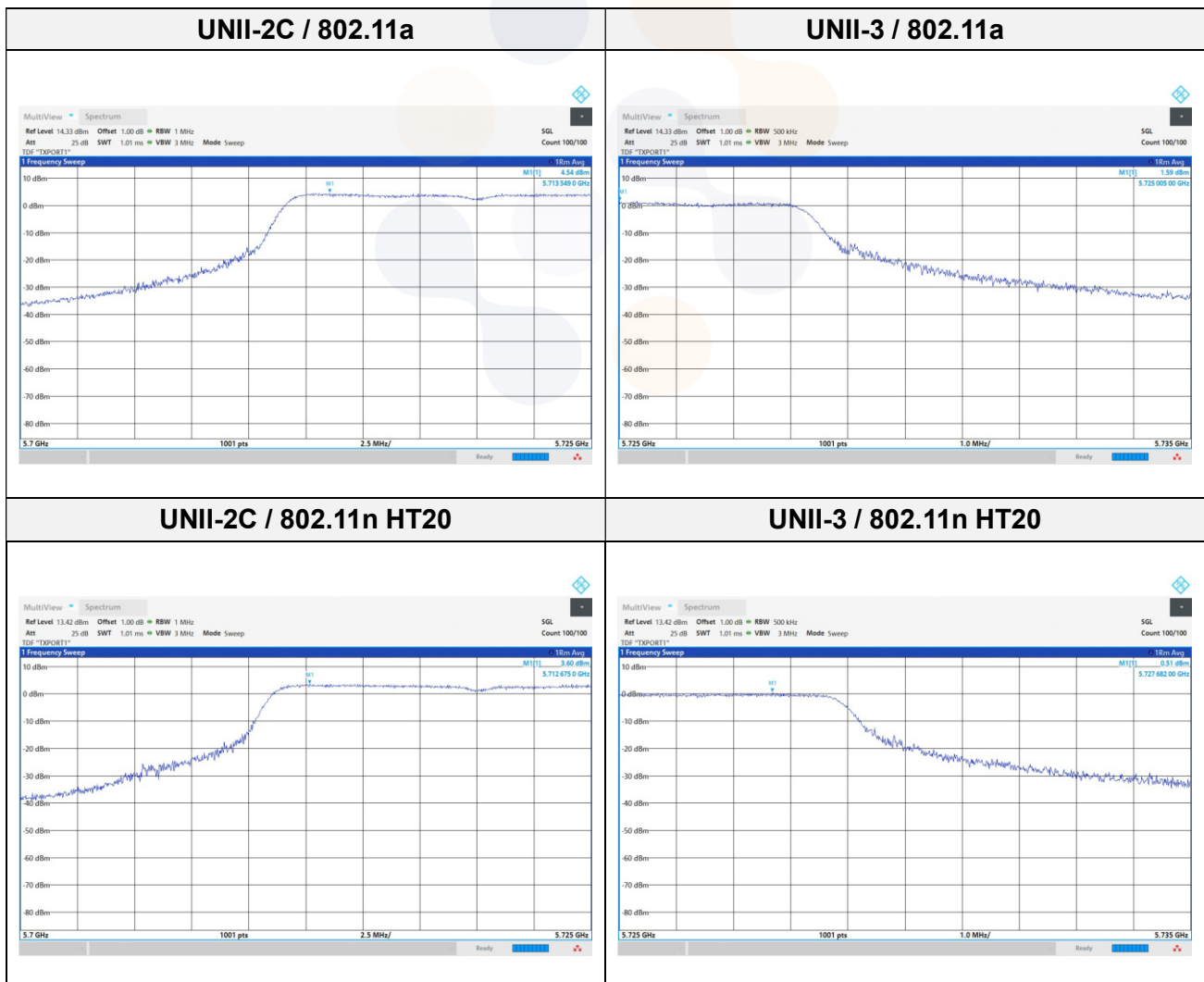
Power Spectral Density

Test mode	Band	Frequency (MHz)	Measured PSD (dBm/MHz)	DCF (dB)	Maximum PSD (dB m/MHz)	Limit (dBm/MHz)
802.11a	UNII-2C	5 720	4.54	0.29	4.83	11.00
802.11n HT20			3.60	0.42	4.02	

Test mode	Band	Frequency (MHz)	Measured PSD (dBm/ 500 kHz)	DCF (dB)	Maximum PSD (dBm/ 500 kHz)	Limit (dBm /500 kHz)
802.11a	UNII-3	5 720	1.59	0.29	1.88	30.00
802.11n HT20			0.51	0.42	0.93	

Notes:

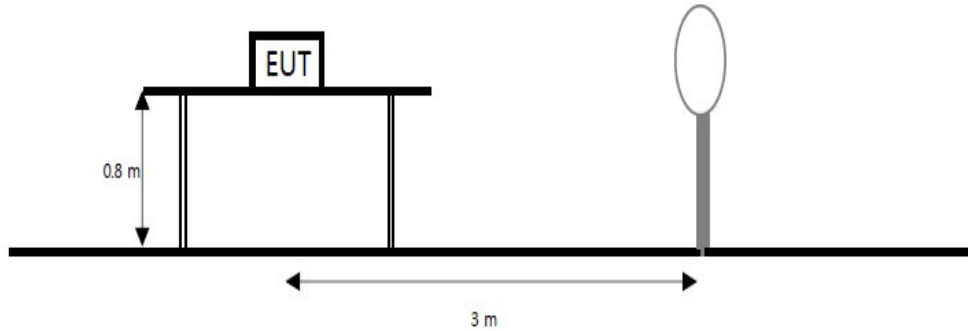
- Maximum PSD calculation
 - Maximum PSD = Measured PSD + D.C.F



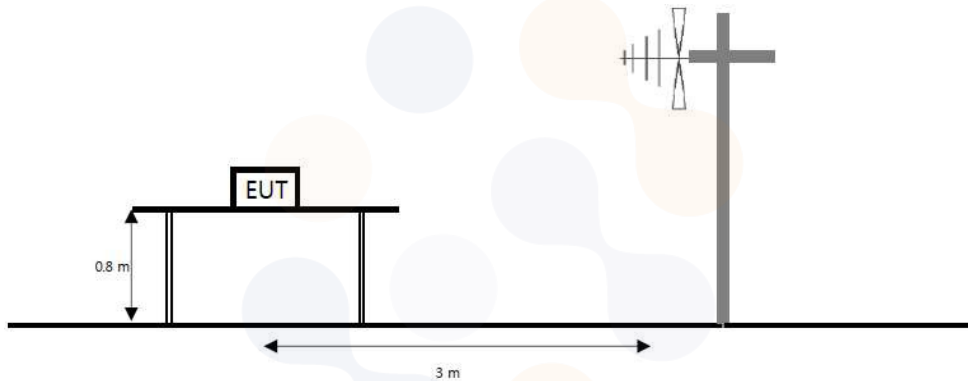
7.6. Spurious Emission, Band Edge and Restricted bands

Test setup

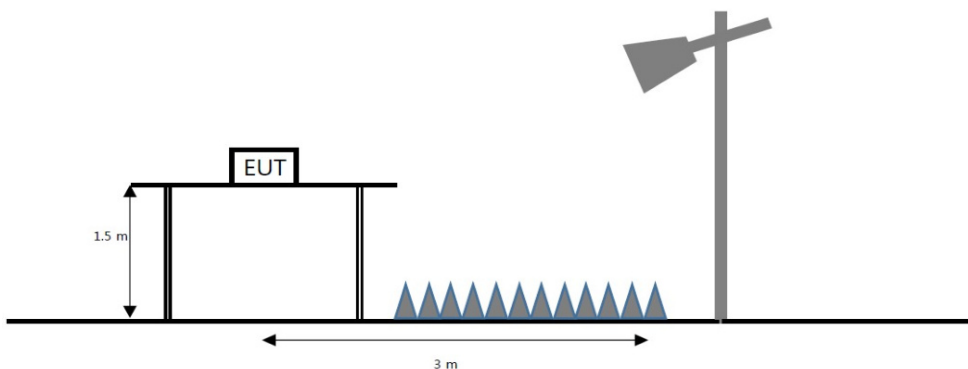
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz emissions, whichever is lower.



Limit

FCC

According to section 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 ($\mu\text{V}/\text{m}$)	Measurement distance (m)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/F(kHz)	30
1.705 - 30	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

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

According to section 15.205(a) and (b) only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 - 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 - 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 - 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 - 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 - 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 - 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 - 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 - 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525	2 483.5 - 2 500	17.7 - 21.4
8.376 25 - 8.386 75	25	2 690 - 2 900	22.01 - 23.12
8.414 25 - 8.414 75	156.7 - 156.9	3 260 - 3 267	23.6 - 24.0
12.29 - 12.293	162.012 5 - 167.17	3 332 - 3 339	31.2 - 31.8
12.519 75 - 12.520 25	167.72 - 173.2	3 345.8 - 3 358	36.43 - 36.5
12.576 75 - 12.577 25	240 - 285	3 600 - 4 400	Above 38.6
13.36 - 13.41	322 - 335.4		

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in section 15.209. At frequencies equal to or less than 1 000 MHz, compliance with the limits in section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 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.

<p>Eurofins KCTL Co.,Ltd. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-70-5008-1021 FAX: 82-505-299-8311 www.kctl.co.kr</p>	<p>Report No.: KR23-SRF0132 Page (35) of (69)</p>	<p> </p>
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According to section 15.407(b), undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz

For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: 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.

