



TEST REPORT



Report No. : KES-RF240934
Page 1 / 111

KES Co., Ltd.
#3002, #3503, #3701, 40, Simin-daero365beon-gil, Dongan-gu,
Anyang-si, Gyeonggi-do, 14057, Republic of Korea
Tel : +82-31-425-6200, Fax : +82-31-341-3838

■ FCC TEST REPORT

1. Client

- Name : LINKFLOW Co., Ltd.
- Address : 3,4F, 54, Nonhyeon-ro 2-gil, Gangnam-gu, Seoul, South Korea

2. Sample Description

- Product item : P Series
- Model name : LF-P3000
- Derivative Model name : LF-P3300
- Manufacturer etc. : LINKFLOW Co., Ltd.

3. Date of test : 2024.12.11 ~ 2024.12.26

4. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing
○ Address : 473-21, Gayeo-ro, Yeosu-si, Gyeonggi-do, Korea

5. Test method used : Part 15 Subpart E 15.407

6. Test result : PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This laboratory is not accredited for the test results marked *.
This test report is not related to KOLAS accreditation.

Affirmation	Tested by	Technical Manager
	Name : Gu-Bong, Kang (Signature)	Name : Yeong-Jun Cho (Signature)

2025 . 01. 21.

KES Co., Ltd.

Accredited by KOLAS, Republic of KOREA



REPORT REVISION HISTORY

Date	Test Report No.	Revision History
2025.01.21	KES-RF240934	Initial

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd. This document may be altered or revised by KES Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by KES Co., Ltd. will constitute fraud and shall nullify the document.

Use of uncertainty of measurement for decisions on conformity (decision rule):

☒ No decision rule is specified by the standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty("simple acceptance" decision rule, previously known as "accuracy method").

☐ Other (to be specified, for example when required by the standard or client)



TABLE OF CONTENTS

1.	General information	4
1.1.	EUT description	4
1.2.	Test configuration.....	4
1.3.	Information about derivative model	5
1.4.	Accessory information	5
1.5.	Device modifications.....	5
1.6.	Sample calculation	5
1.7.	Measurement Uncertainty	5
1.8.	Worst case data rate.....	5
1.9.	Frequency/channel operations	6
2.	Summary of tests	8
3.	Test results.....	9
3.1.	26 dB bandwidth & 99% Occupied Bandwidth	9
3.2.	6 dB bandwidth	23
3.3.	Maximum conducted output power.....	28
3.4.	Power spectral density	31
3.5.	Frequency Stability	40
3.6.	Radiated restricted band and emissions	43
3.7.	AC conducted emissions	107
3.8.	Antenna Requirement.....	110
Appendix A.	Measurement equipment.....	111



1. General information

Applicant: LINKFLOW Co., Ltd.
Applicant address: 3,4F, 54, Nonhyeon-ro 2-gil, Gangnam-gu, Seoul, South Korea
Test site: KES Co., Ltd.
Test site address: ☐ #3002, #3503, #3701, 40, Simin-daero365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Republic of Korea
☒ 473-21, Gayeo-ro, Yeosu-si, Gyeonggi-do, Korea
Test Facility: FCC Accreditation Designation No.: KR0100, Registration No.: 444148
FCC rule part(s): 15.407
FCC ID: 2AVCKLFP3300
Test device serial No.: ☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test: P Series
Frequency range & Number of channels:
2 402 MHz ~ 2 480 MHz (BDR, EDR) : 79 ch
2 402 MHz ~ 2 480 MHz (LE 1/2 Mbps) : 40 ch
2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20) : 11 ch
2 422 MHz ~ 2 452 MHz (802.11n_HT40) : 7 ch
5 180 MHz ~ 5 240 MHz (802.11a/n_HT20/ac_VHT20) : 4 ch
UNII-1 5 190 MHz ~ 5 230 MHz (802.11n_HT40/ac_VHT40) : 2 ch
5 210 MHz (802.11ac_VHT80) : 1 ch
5 745 MHz ~ 5 825 MHz (802.11a/n_HT20/ac_VHT20) : 5 ch
UNII-3 5 755 MHz ~ 5 795 MHz (802.11n_HT40/ac_VHT40) : 2 ch
5 775 MHz (802.11ac_VHT80) : 1 ch
Model: LF-P3000
Derivative Model: LF-P3300
Modulation technique: GFSK, DSSS, OFDM
Antenna specification:
2.4 GHz band: FPCB Antenna // Peak gain: 1.58 dBi
UNII-1 band: FPCB Antenna // Peak gain: 3.70 dBi
UNII-3 band: FPCB Antenna // Peak gain: 3.49 dBi
Power source: DC 3.85 V (Battery)
H/W version: v1.0
S/W version: v1.0

1.2. Test configuration

The **LINKFLOW Co., Ltd. // P Series // LF-P3000 // FCC ID: 2AVCKLFP3300** was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.407
KDB 789033 D02 v02r01
ANSI C63.10-2013

**1.3. Information about derivative model**

Derivative model **LF-P3300** has no electrical, circuitry, appearance, or color differences from the basic model **LF-P3000**. It is simply a way to manage different names for different vendors.

1.4. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
-	-	-	-	-

1.5. Device modifications

N/A

1.6. Sample calculation

Where relevant, the following sample calculation is provided

For all conducted test items :

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator 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.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 1.23 + 10 = 11.23 \text{ (dB)}\end{aligned}$$

For Radiation test :

$$\text{Field strength level (dB}\mu\text{V/m)} = \text{Measured level (dB}\mu\text{V)} + \text{Antenna factor (dB)} + \text{Cable loss (dB)} - \text{Amplifier gain (dB)}$$

1.7. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.22 dB (SHIELD ROOM #6)
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1 GHz	4.04 dB (SAC #6)
	Above 1 GHz	5.32 dB (SAC #5)
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.		

1.8. Worst case data rate

1. Worst-case data rates were:

Mode	Data rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11ac VHT20	
802.11n HT40	
802.11ac VHT40	
802.11ac VHT80	



1.9. Frequency/channel operations

Ch.	Frequency (MHz)	Rate(Mbps)
00	2 402	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps
.	.	.
40	2 442	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps
.	.	.
78	2 480	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps

Ch.	Frequency (MHz)	Rate(Mbps)
00	2 402	LE 1 Mbps, LE 2 Mbps
.	.	.
20	2 442	LE 1 Mbps, LE 2 Mbps
.	.	.
39	2 480	LE 1 Mbps, LE 2 Mbps

Ch.	Frequency (MHz)	Mode
1	2 412	802.11b/g/n_HT20
.	.	.
6	2 437	802.11b/g/n_HT20
.	.	.
11	2 462	802.11b/g/n_HT20

Ch.	Frequency (MHz)	Mode
3	2 422	802.11n_HT40
.	.	.
6	2 437	802.11n_HT40
.	.	.
9	2 452	802.11n_HT40

**UNII-1**

Ch.	Frequency (MHz)
36	5 180
44	5 220
48	5 240

UNII-3

Ch.	Frequency (MHz)
149	5 745
157	5 785
165	5 825

802.11a/n_HT20/ac_VHT20 mode**UNII-1**

Ch.	Frequency (MHz)
38	5 190
46	5 230

UNII-3

Ch.	Frequency (MHz)
151	5 755
159	5 795

802.11n_HT40/ac_VHT40 mode**UNII-1**

Ch.	Frequency (MHz)
42	5 210

UNII-3

Ch.	Frequency (MHz)
155	5 775

802.11ac_VHT80 mode



2. Summary of tests

Section in FCC Part 15	Parameter	Test results
15.407(a)	26 dB bandwidth & 99 % bandwidth	Pass
15.407(a)	6 dB bandwidth	Pass
15.407(a)	Maximum conducted output power	Pass
15.407(a)	Power spectral density	Pass
15.407(g)	Frequency stability	Pass
15.205, 15.209, 15.407(b)	Radiated restricted band and emission	Pass
15.207(a)	AC power line conducted emissions	Pass
15.203	Antenna Requirement	Pass

Note.

1. The EUT does not support simultaneous operation of BT & WLAN.
2. By the request of applicant, test is performed with power setting value below :

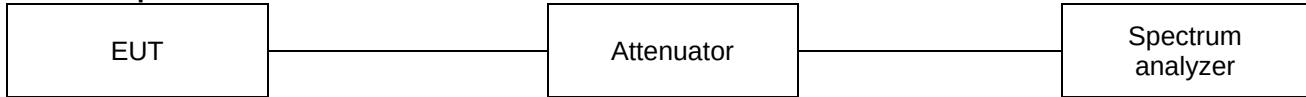
Mode	UNII-1		UNII-3	
	Frequency (Mhz)	Setting value	Frequency (Mhz)	Setting value
802.11a (6 Mbps)	5 180 ~ 5 240	F1 : 17 F2 : 17 F3 : 16	5 745 ~ 5 825	F1 : 18 F2 : 18 F3 : 17
802.11n_HT20 (MCS0)		17		F1 : 18 F2 : 18 F3 : 17
802.11ac_VHT20 (MCS0)		17		F1 : 18 F2 : 18 F3 : 17
802.11n_HT40 (MCS0)	5 190 ~ 5 230	17	5 755 ~ 5 795	17
802.11ac_VHT40 (MCS0)		17		17
802.11ac_VHT80 (MCS0)	5 210	17	5 775	18



3. Test results

3.1. 26 dB bandwidth & 99% Occupied Bandwidth

Test setup



Test procedure

26 dB bandwidth

KDB 789033 D02 v02r01– Section C.1

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak 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%.

99 % bandwidth

KDB 789033 D02 v02r01– Section D

1. Set span = 1.5 times to 5.0 times the OBW.
2. Set RBW = 1% to 5% of the OBW
3. Set the VBW > 3 x RBW.
4. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak bandwidth function of the instrument (if available).
5. Use the 99% power bandwidth function of the instrument (if available).
6. 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.

Limit

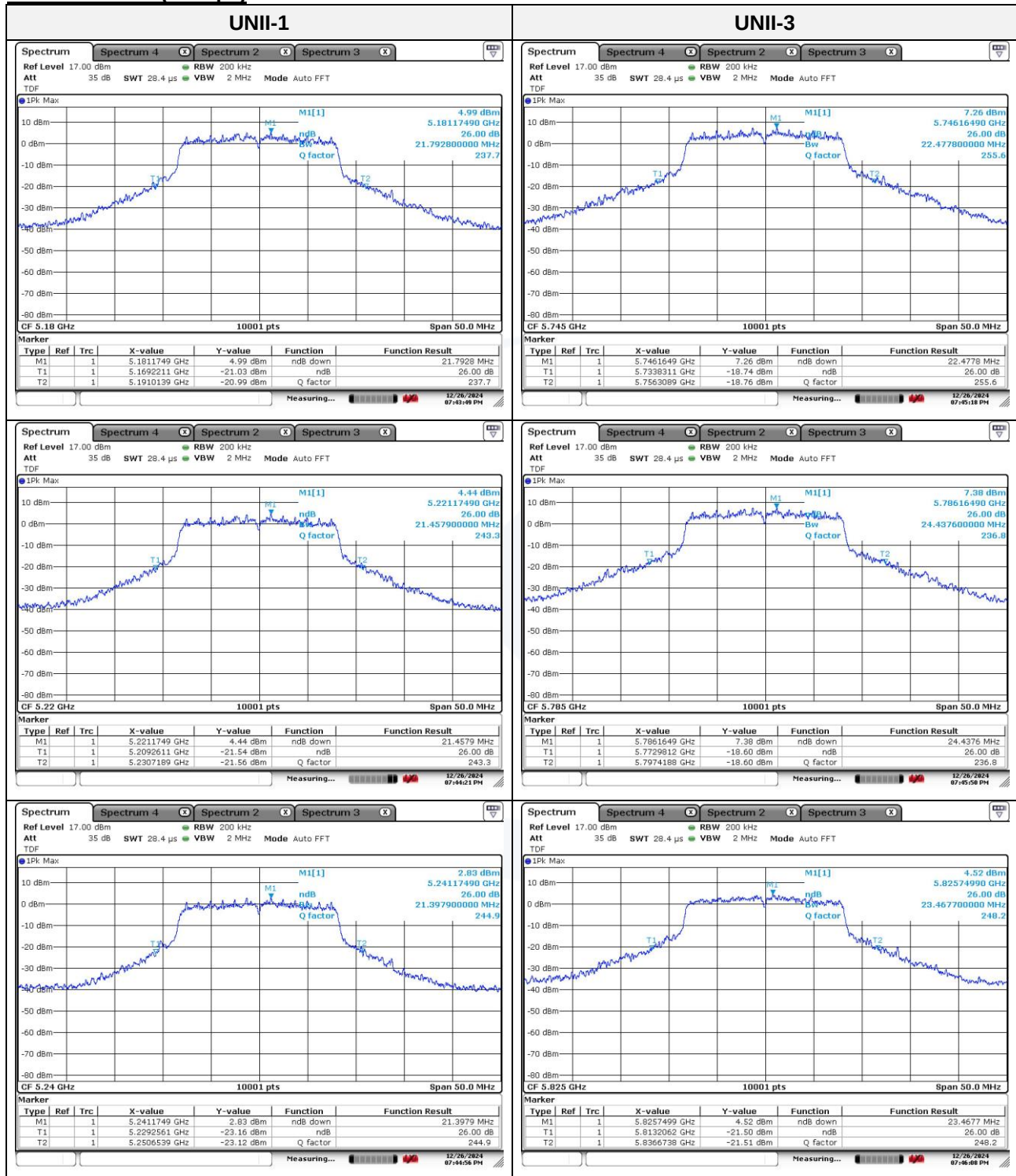
N/A

**Test results**

Band	Frequency(MHz)	Mode	26 dB bandwidth(MHz)	99 % bandwidth(MHz)
UNII-1	5 180	802.11a (6 Mbps)	21.79	16.61
	5 220		21.46	16.63
	5 240		21.40	16.51
UNII-3	5 745		22.48	16.83
	5 785		24.44	16.81
	5 825		23.47	16.83
UNII-1	5 180	802.11n_ HT20 (MCS0)	22.47	17.91
	5 220		21.88	17.97
	5 240		22.22	17.99
UNII-3	5 745		25.89	18.07
	5 785		24.36	18.25
	5 825		23.12	18.10
UNII-1	5 180	802.11ac_ VHT20 (MCS0)	22.49	17.90
	5 220		21.38	17.92
	5 240		21.59	17.97
UNII-3	5 745		22.88	18.07
	5 785		23.40	18.09
	5 825		24.23	18.02

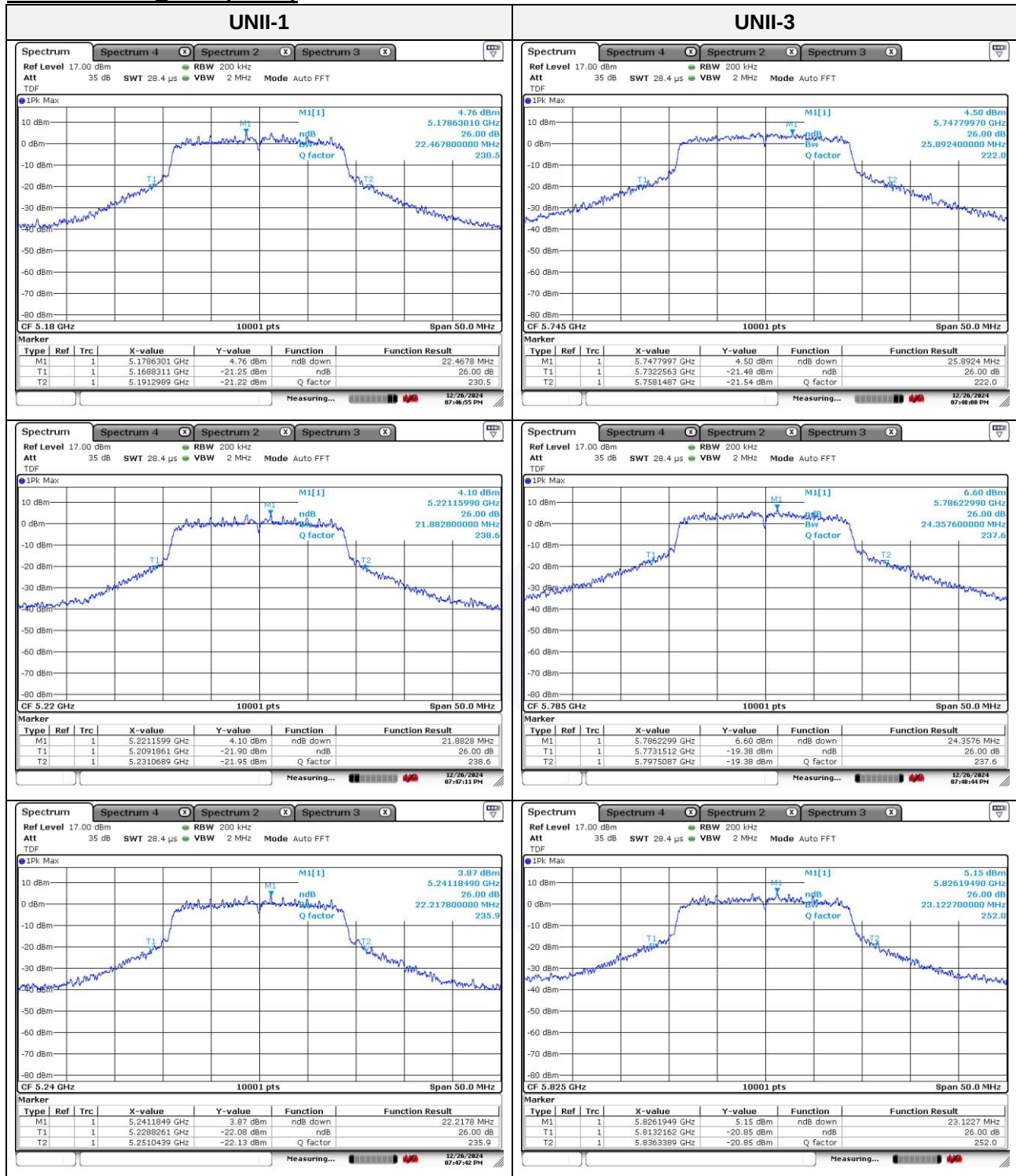
Band	Frequency(MHz)	Mode	26 dB bandwidth(MHz)	99 % bandwidth(MHz)
UNII-1	5 190	802.11n_ HT40 (MCS0)	41.63	36.48
	5 230		41.65	36.84
UNII-3	5 755		41.81	36.54
	5 795		41.28	36.55
UNII-1	5 190	802.11ac_ VHT40 (MCS0)	40.93	36.39
	5 230		41.54	36.43
UNII-3	5 755		41.36	36.61
	5 795		41.15	36.50

Band	Frequency(MHz)	Mode	26 dB bandwidth(MHz)	99 % bandwidth(MHz)
UNII-1	5 210	802.11ac_ VHT80 (MCS0)	83.01	76.07
UNII-3	5 775		83.93	76.01

**26 dB bandwidth****Mode : 802.11a (6 Mbps)**

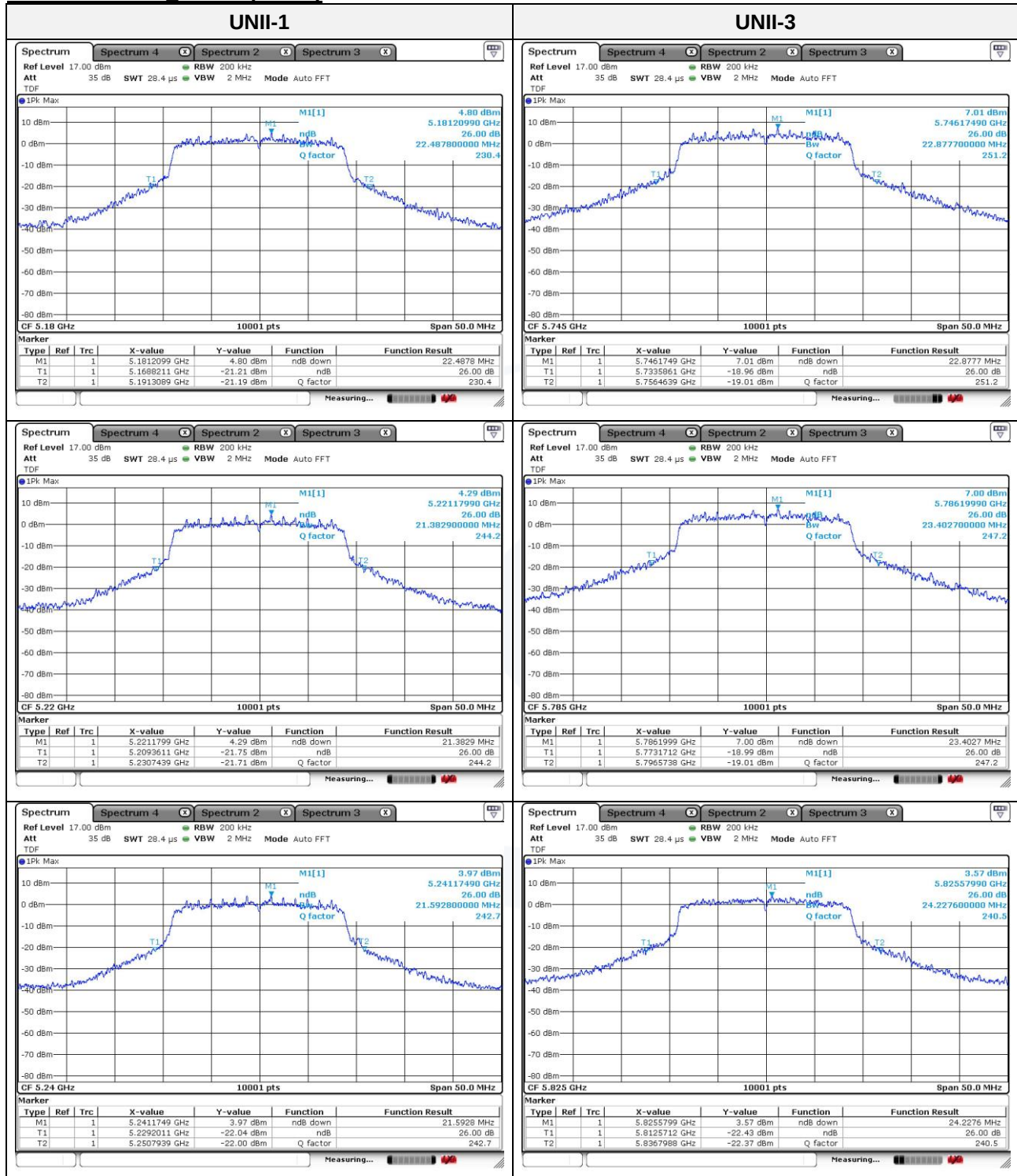


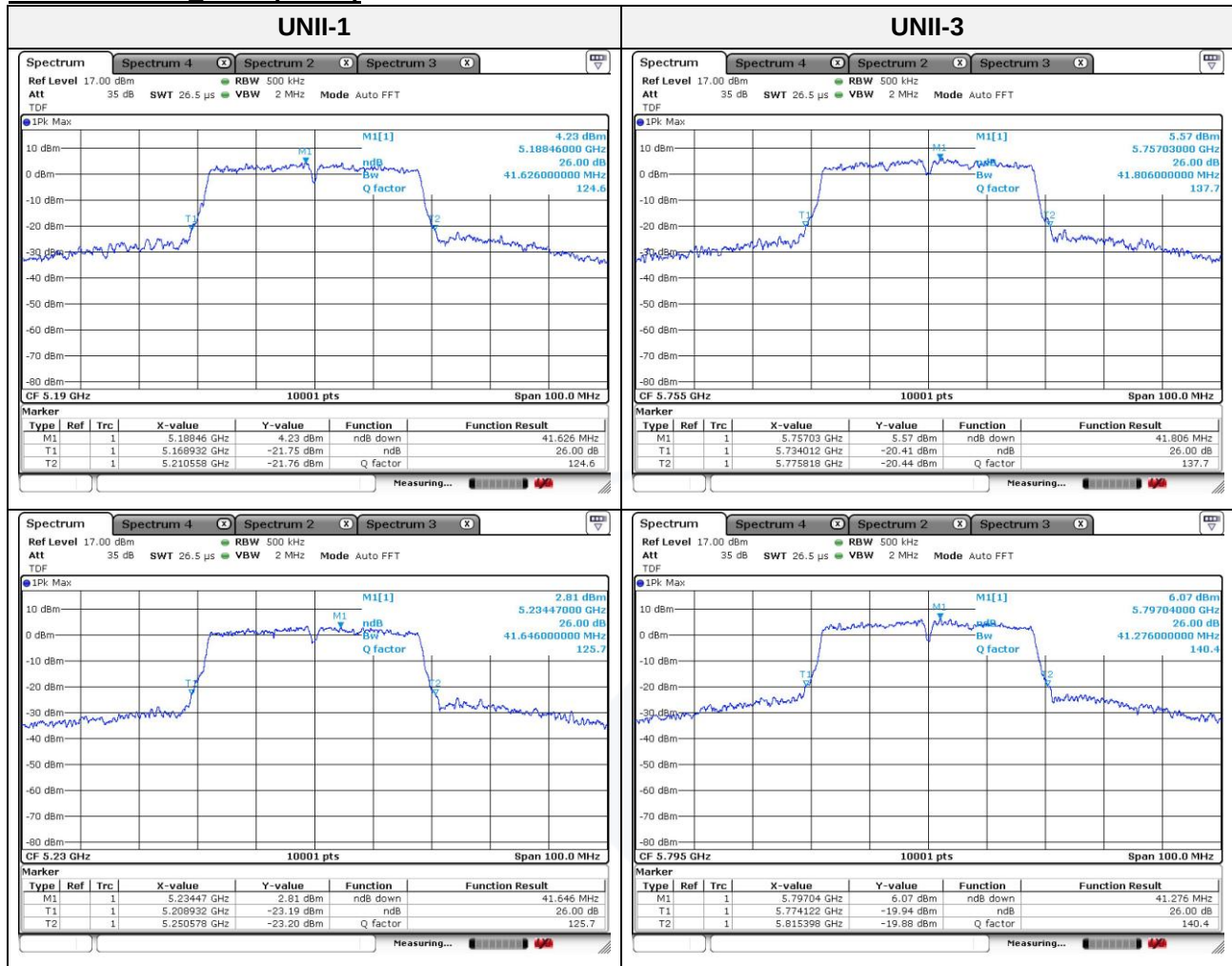
Mode : 802.11n HT20 (MCS0)





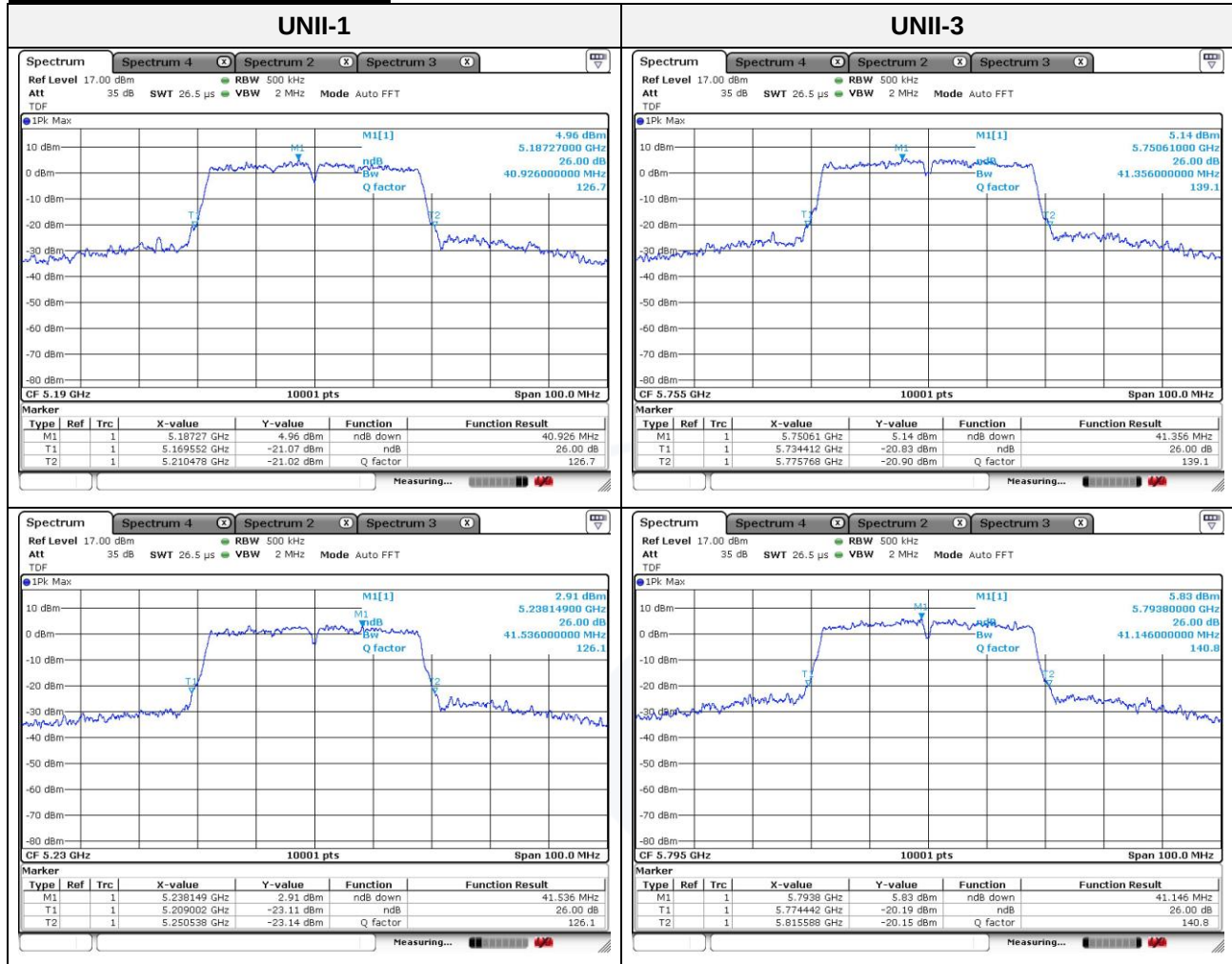
Mode : 802.11ac VHT20 (MCS0)



**Mode : 802.11n HT40 (MCS0)**

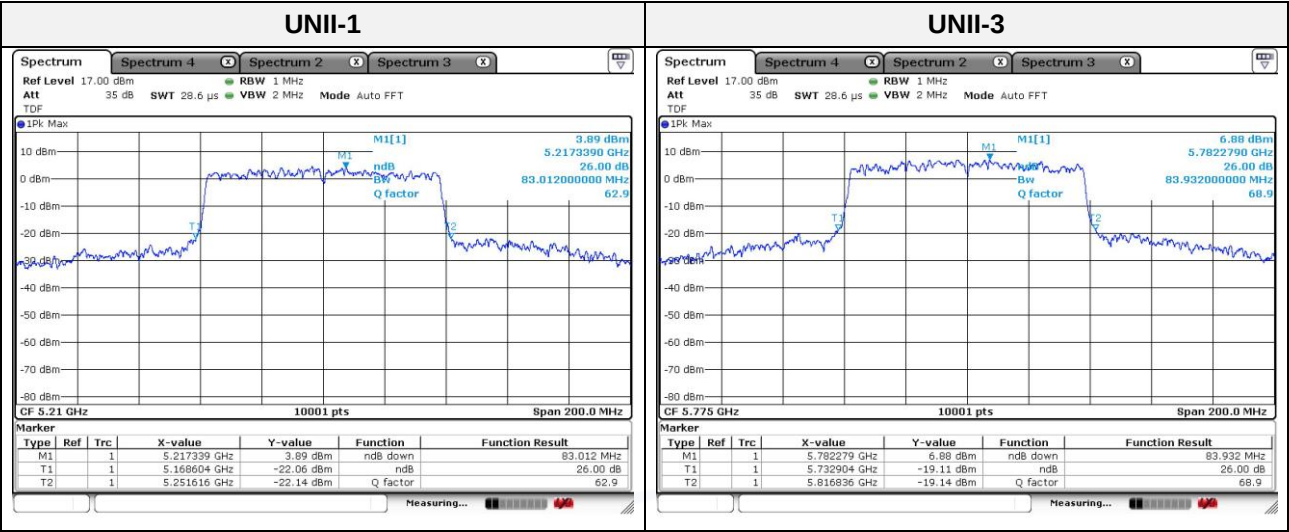


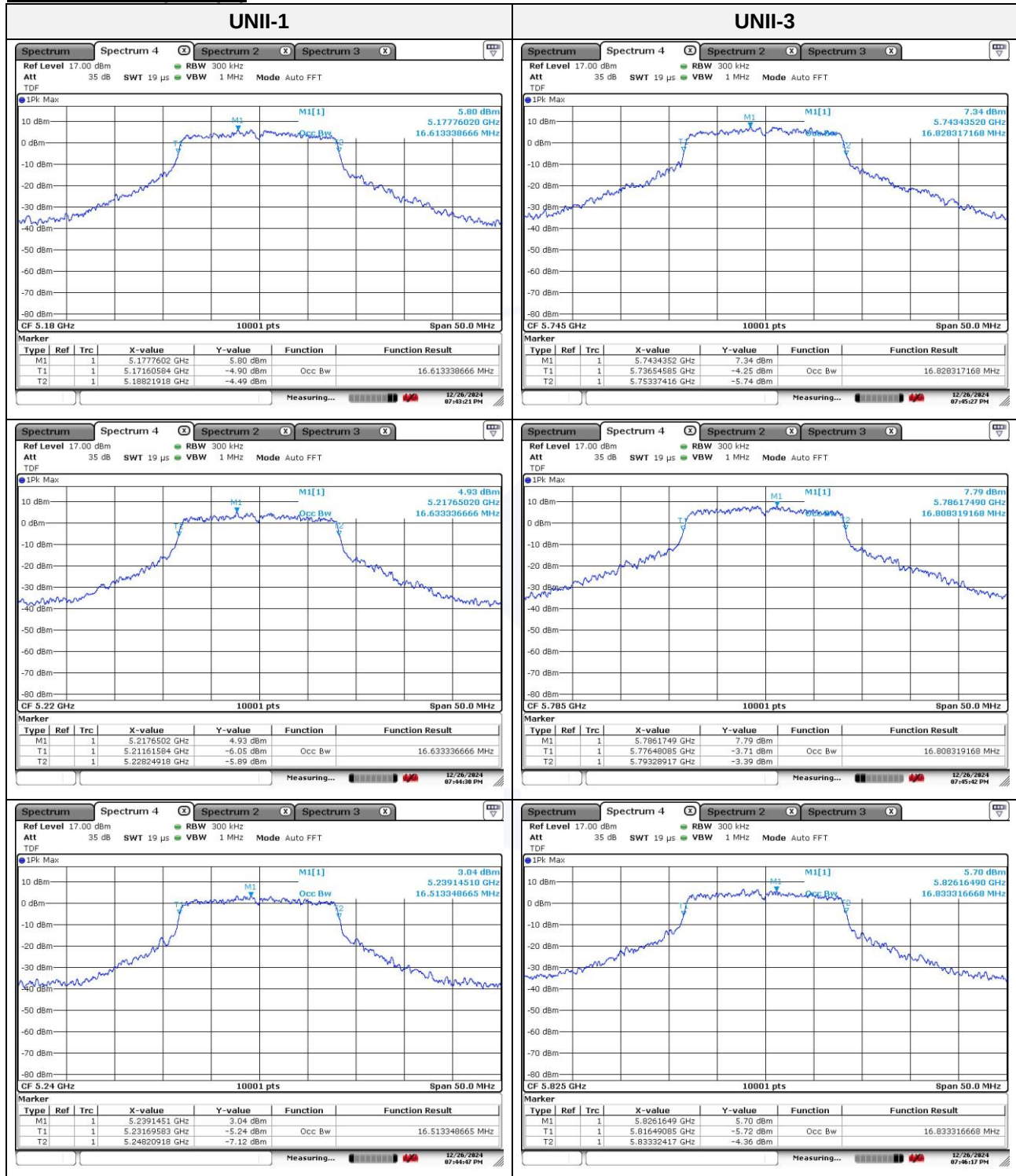
Mode : 802.11ac VHT40 (MCS0)





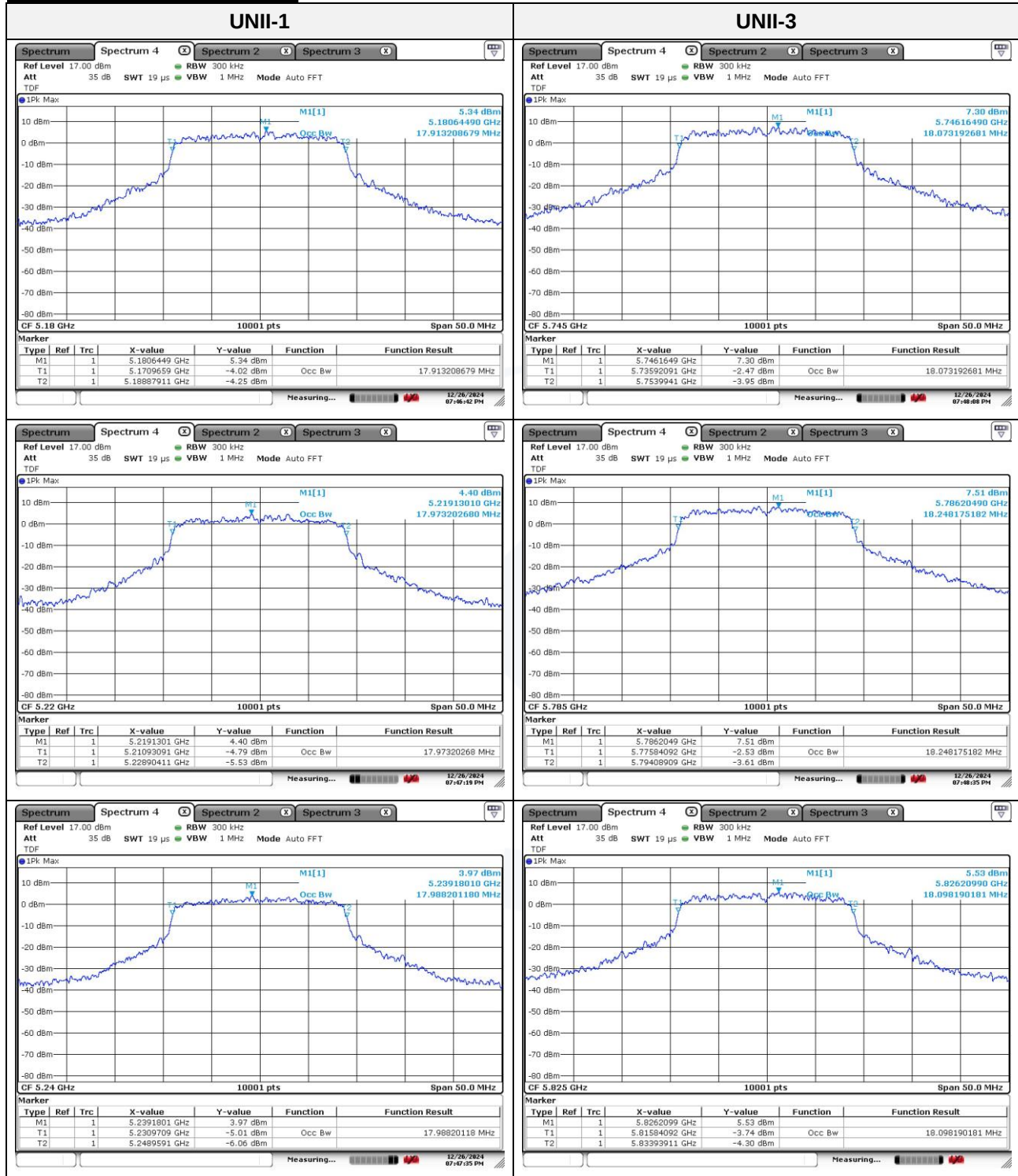
Mode : 802.11ac VHT80 (MCS0)



**99% bandwidth****Mode : 802.11a (6 Mbps)**

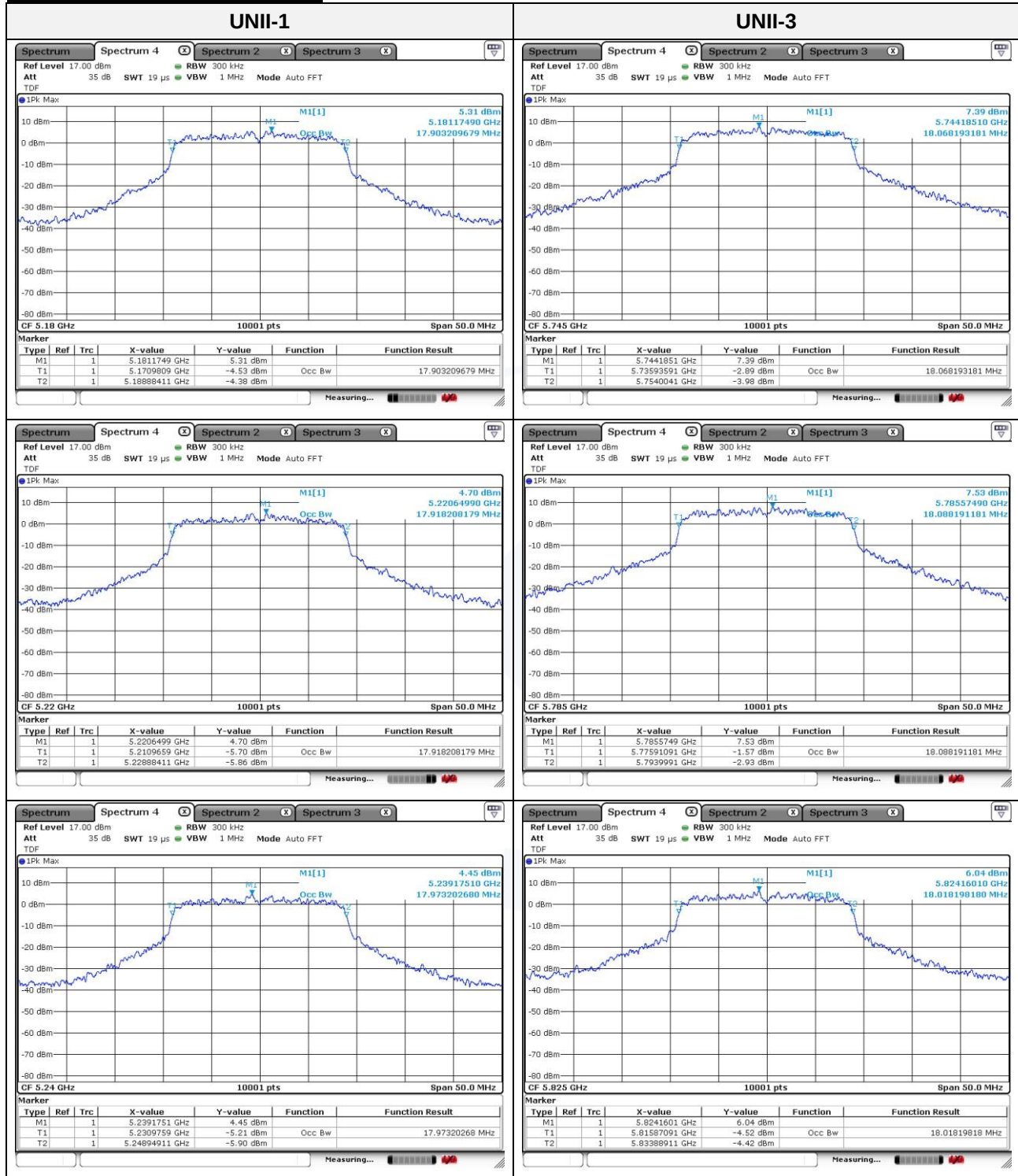


Mode : 802.11n HT20 (MCS0)



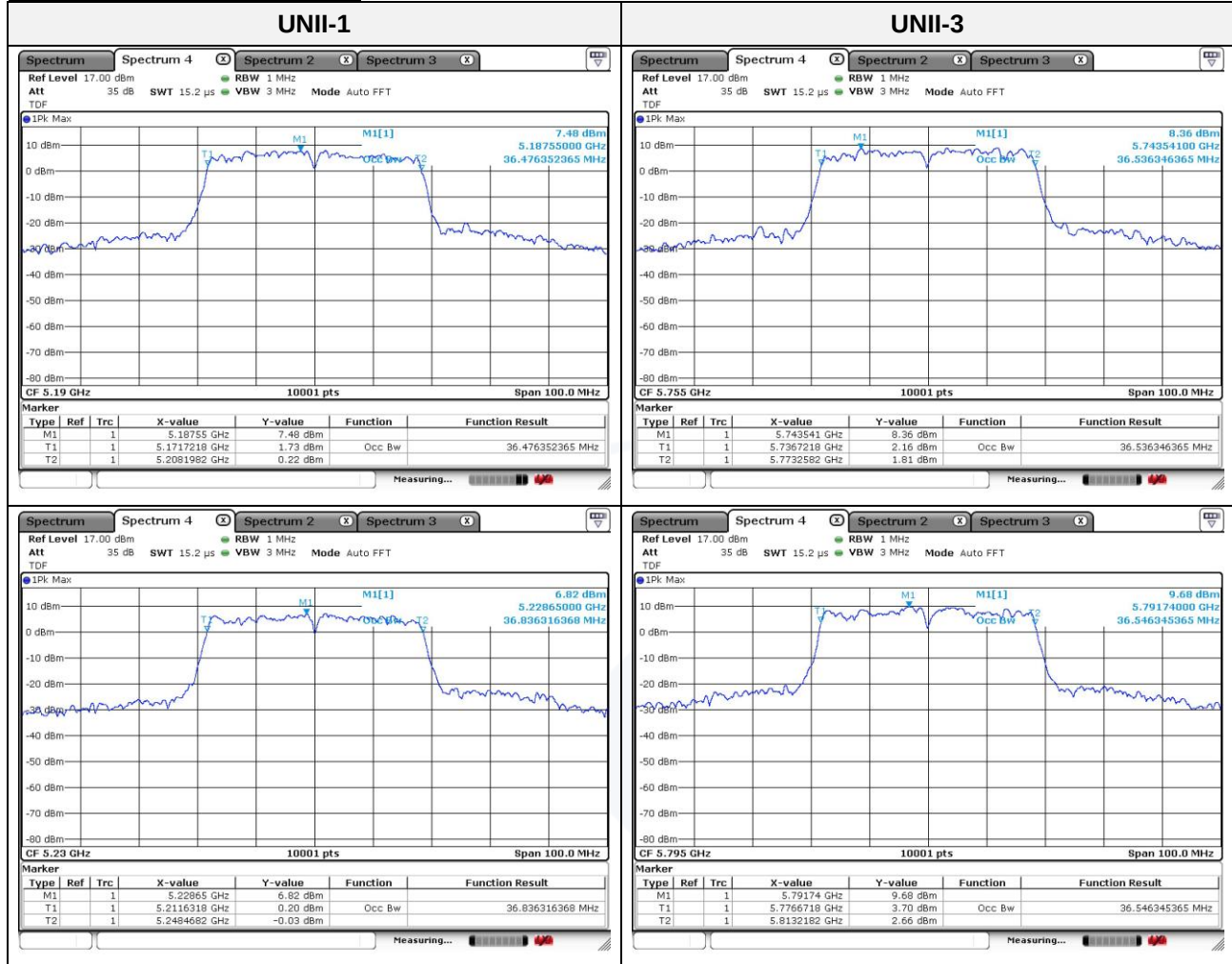


Mode : 802.11ac VHT20 (MCS0)



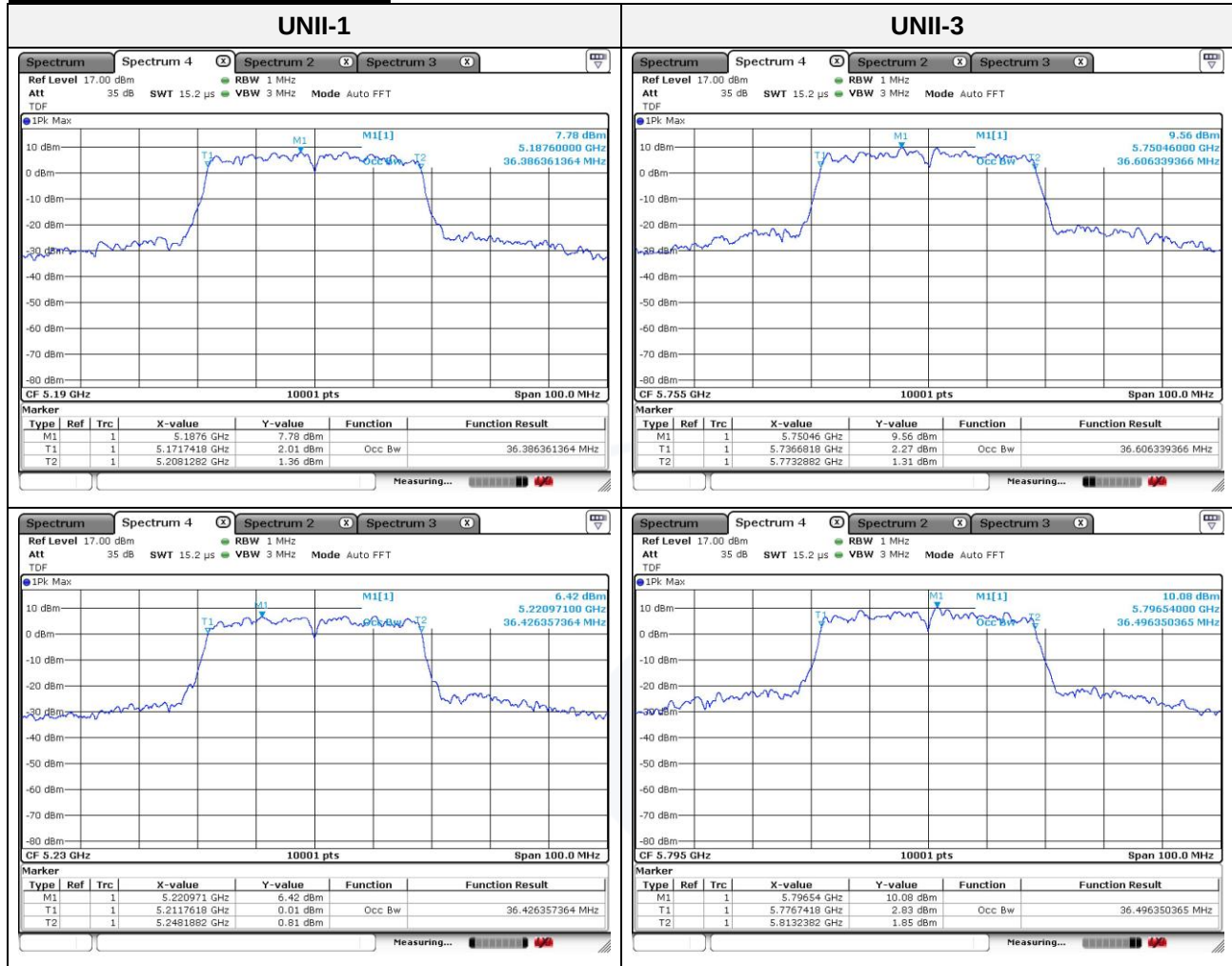


Mode : 802.11n HT40 (MCS0)



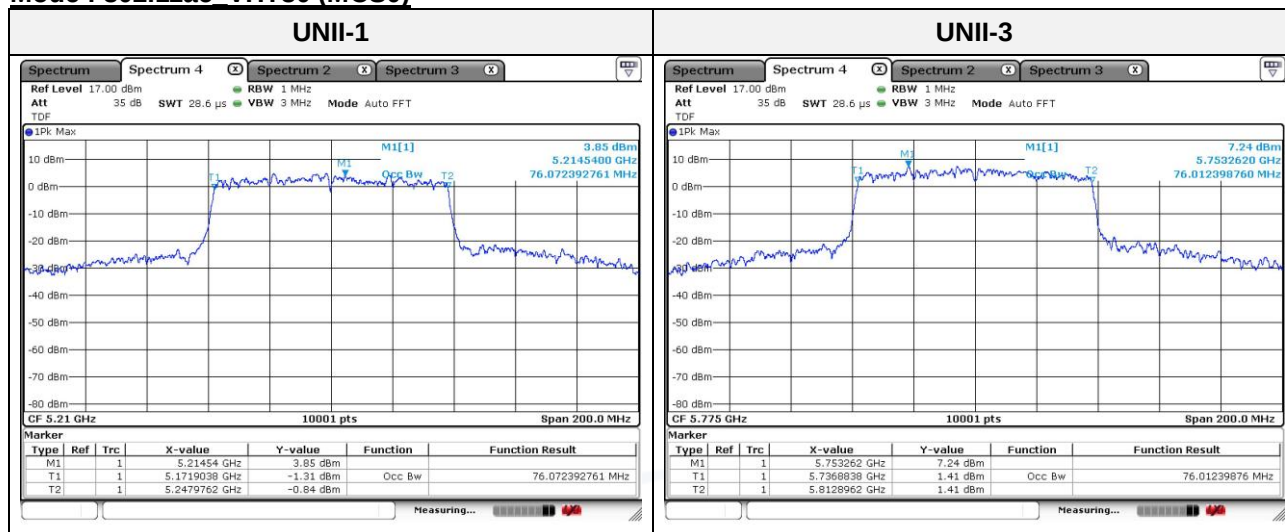


Mode : 802.11ac VHT40 (MCS0)





Mode : 802.11ac VHT80 (MCS0)



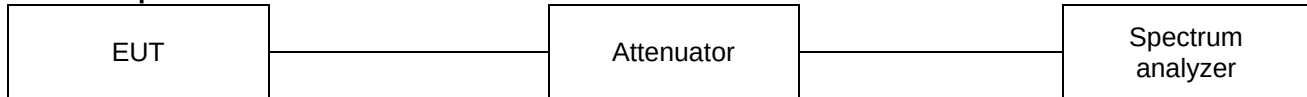


3.2. 6 dB bandwidth

Test procedure

KDB 789033 D02 v02r01– Section C.2

Test setup



Section C.2

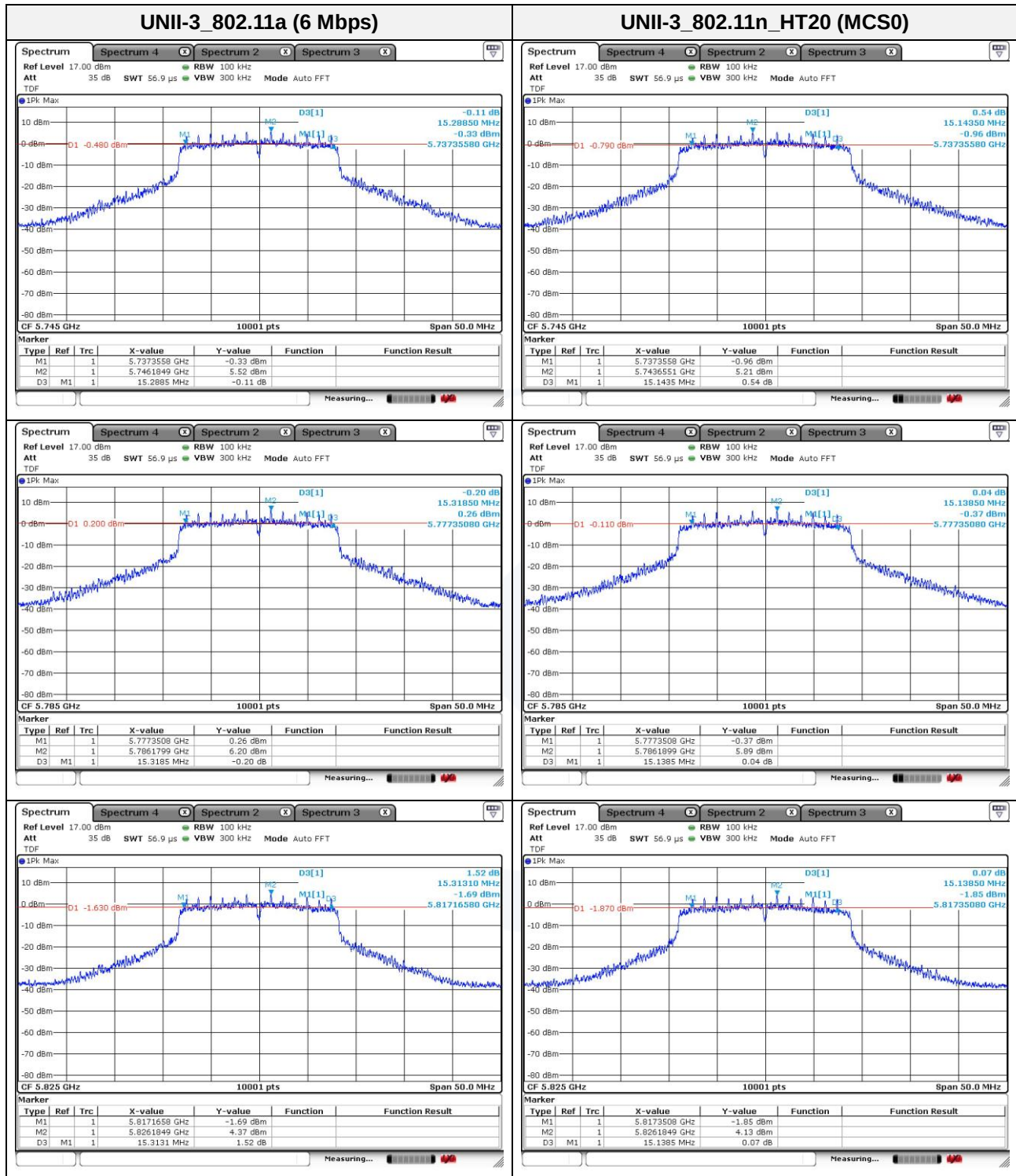
1. Set RBW = 100 kHz
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = peak.
4. Sweep = auto couple.
5. Allow the trace to stabilize
6. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower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

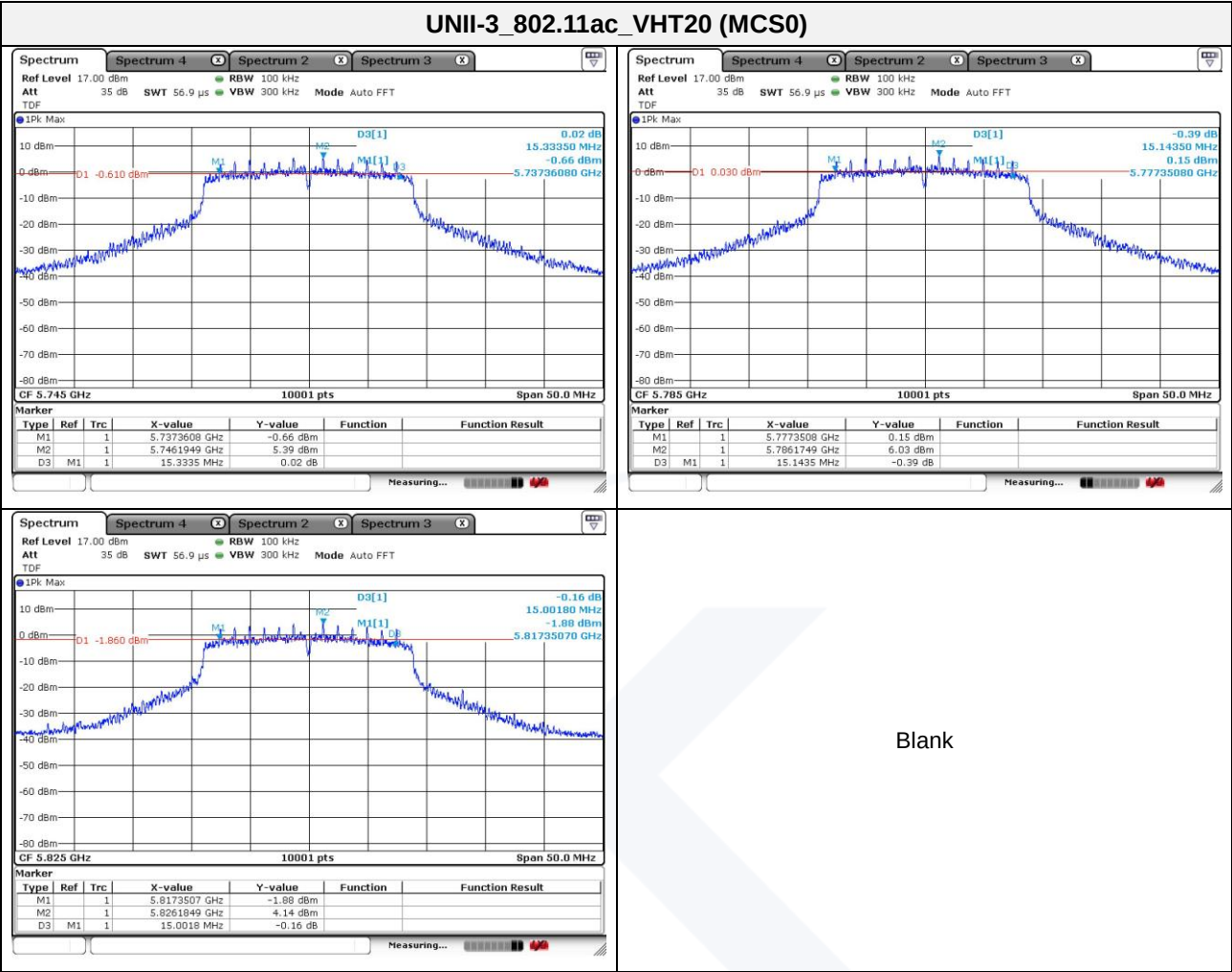
Limit

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

**Test results**

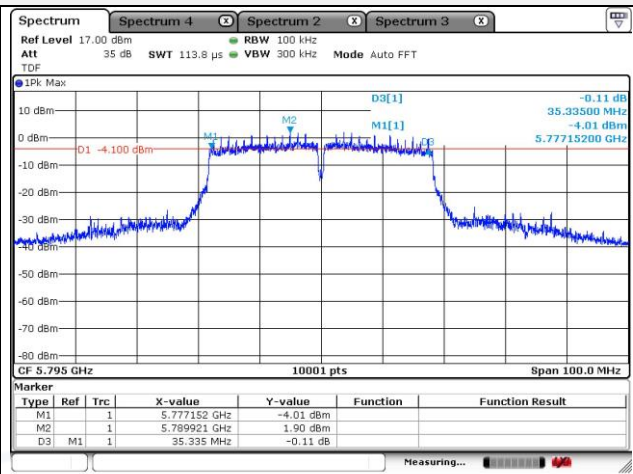
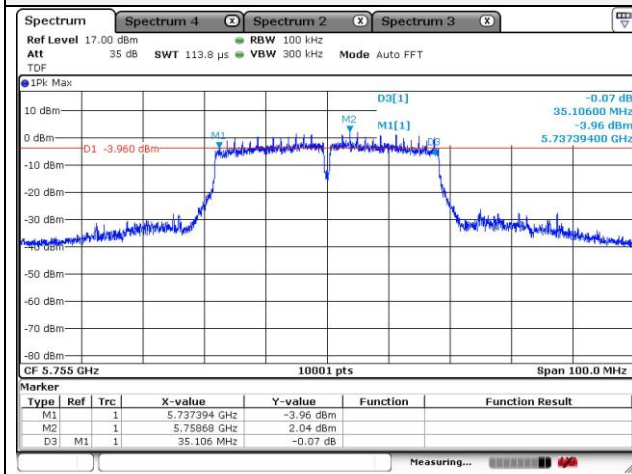
Band	Frequency(MHz)	Mode	6 dB bandwidth(MHz)
UNII-3	5 745	802.11a (6 Mbps)	15.29
	5 785		15.32
	5 825		15.31
	5 745	802.11n_HT20 (MCS0)	15.14
	5 785		15.14
	5 825		15.14
	5 745	802.11ac_VHT20 (MCS0)	15.33
	5 785		15.14
	5 825		15.00
	5 755	802.11n_HT40 (MCS0)	35.11
	5 795		35.34
	5 755	802.11ac_VHT40 (MCS0)	34.96
	5 795		35.27
	5 775	802.11ac_VHT80 (MCS0)	76.50



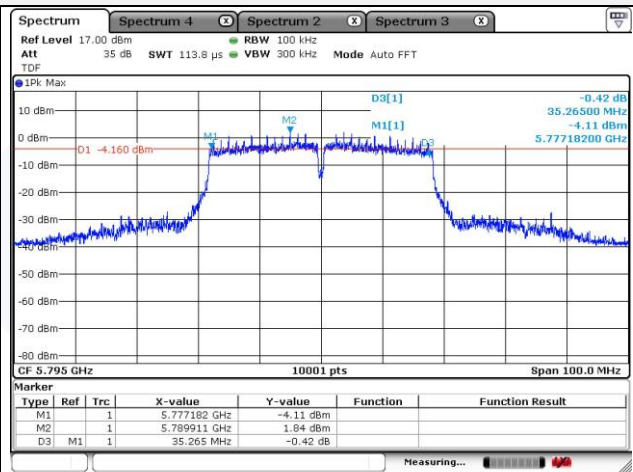
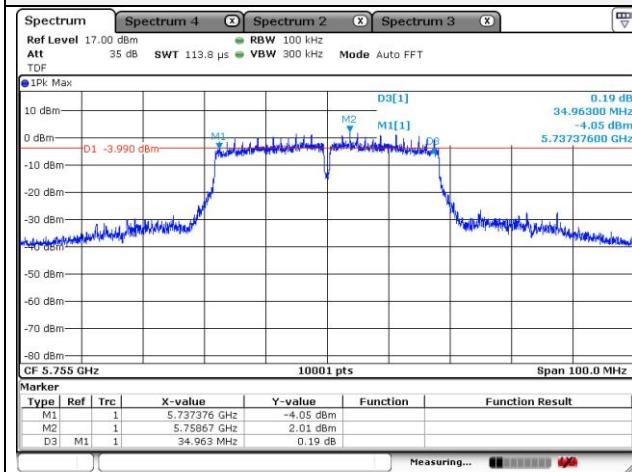




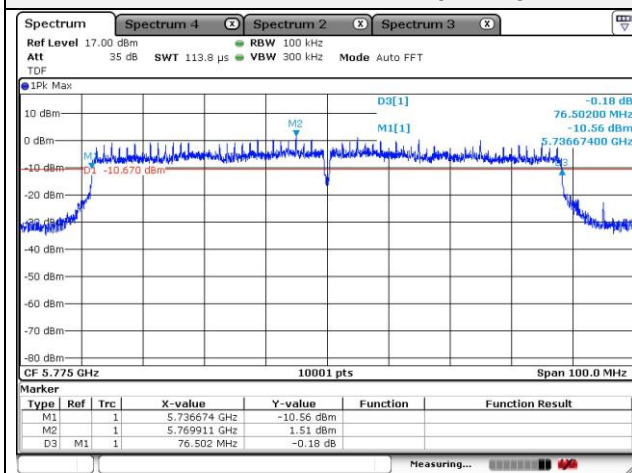
UNII-3_802.11n_HT40 (MCS0)



UNII-3_802.11ac_VHT40 (MCS0)



UNII-3_802.11ac_VHT80 (MCS0)



Blank



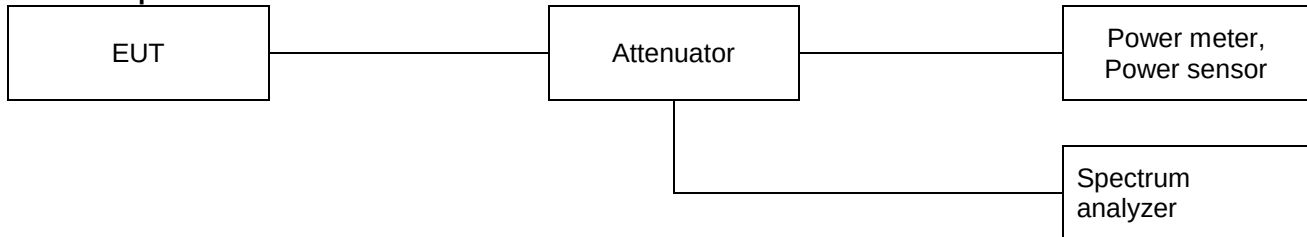
3.3. Maximum conducted output power

Test procedure

KDB 789033 D02 v02r01– Section E.3.a) or b)

Used test method is Section E.3.b)

Test setup



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 section II.B.
- 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 %).

Section E.3.b)

Method PM-G (Measurement using a gated RF average power meter):

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.