

Radio Test Report

According to

**FCC part 15E,
RSS-247, RSS-Gen**

DUT Name: PAN9019A
Model No. : ENWF9511C1KF
Customer: Panasonic Industrial Devices Europe GmbH
Address: Zeppelinstr. 19, 21337 Lüneburg, Germany
Summary IN COMPLIANCE
Date of Reception: 27.11.2023
Date(s) of Test(s): 08.02.2024 – 28.02.2024

Tested by Test Engineer



Arto Kuosmanen

Approved by Technical Manager



Jukka Rauma

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Document Version History	Date of issue	Comments	Approved by
v0.1	5.3.2024	Initial version	
v1.0	28.3.2024	Approved version	Jukka Rauma

General Information

Test Engineer(s): Arto Kuosmanen, Pekka Pulkkinen

Location:

Test Firm Name	Eurofins Electric & Electronics Finland Oy (EEEF)
Test Site	Yrttipellontie, Peltola
Address of Test Site	Yrttipellontie 6, 90230 Oulu, Finland
FCC Designation number	FI0008
FCC site registration number	771880
ISED number	29576
CAB Identifier	T290

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Climate Conditions: Temperature: 15 - 35 °C
Air pressure: 860 - 1060 hPa
Humidity: 30-60 rH%
These limits were not exceeded during testing.

1. Test Samples

General description:

The PAN9019 and PAN9019A are 2.4 GHz and 5 GHz ISM band Wi-Fi, Bluetooth, and 802.15.41 radio modules, which allow easy integration of Wi-Fi, Bluetooth, and 802.15.41 based technologies into various electronic devices.

Test sample (Conducted RF tests):

Sample number	Serial number	Manufacturer	DUT Type	Model	HW version	SW version
3938ER001	00000297	Panasonic	Wireless module	ENWF9511C1KF	03	01

Test sample (Conducted and radiated emission tests):

Sample number	Serial number	Manufacturer	DUT Type	Model	HW version	SW version
3938ER004	00000327	Panasonic	Wireless module + antenna 2JF1002P	ENWF9511C1KF + 2JF1002P	03	01
3938ER005	00000295	Panasonic	Wireless module + antenna GW.51.5153	ENWF9511C1KF + GW.51.5153	03	01

Auxiliary equipment:

Sample number	Serial number	Manufacturer	DUT Type	Model	Description
3938ER004	#7	Embedded Artists	Host Board	EAK00393	MX8M Mini Developer's Kit V3
3938ER005	#6	Embedded Artists	Host board	EAK00393	MX8M Mini Developer's Kit V3
3938ER001	#5	Embedded Artists	Host Board	EAK00393	MX8M Mini Developer's Kit V3
3938ER007	na	Phihong Technology Co. Ltd.	Switching Power Supply	PSAA30R-120	

3938ER008	na	Phihong Technology Co. Ltd.	Switching Power Supply	PSAA30R-120	
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Description	Information	
Additional model	ENWF9501C1KF, ENWF9511CMKF, ENWF9501CMKF, ENWF9511AMKF, ENWF9501AMKF	
Brand Names(s)	PAN9019, PAN9019A-M2E-EVD, PAN9019-M2E-EVD, PAN9019A-M2E-C-EVD, PAN9019-M2E-C-EVD	
PMN	PAN9019A	
HVIN	ENWF9511C1KF	
FVIN	n/a	
HMN	n/a	
FCC ID	T7V9019	
IC ID	216Q-9019	
Equipment type	Radio module	
Radio type	Transceiver	
- operating frequency range:	5150 – 5850 MHz	
Radio technology / type of equipment	IEEE 802.11a IEEE 802.11n (HT20, HT40) IEEE 802.11ac (VHT20, VHT40, VHT80) IEEE 802.11ax (HE-SU HE20, HE40, HE80; HE-TB 26-TONE RU, HE-TB 52-TONE RU, HE-TB 106-TONE RU, HE-TB 242-TONE RU, HE-TB 484-TONE RU, HE-TB 996-TONE RU)	
Modulation:	BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM	
Number of antenna ports	1	
Transmit power control	Yes	
Antenna 1	Type	2.4/5.0/6.0 GHz WIFI 6E / WIFI 7 ISM Flexible ultra-thin PCB Adhesive Antenna
	Model	2JF1002P
	Manufacturer	2J Antennas
	Gain	U-NII-1 = 6.6 dBi U-NII-2A = 7.3 dBi U-NII-2C = 8.0 dBi U-NII-3 = 6.6 dBi
Antenna 2	Type	Terminal Mount Dipole Antenna
	Model	GW.51.5153
	Manufacturer	Taoglas

	Gain	U-NII-1 = 3.9 dBi U-NII-2A = 4.5 dBi U-NII-2C = 5.5 dBi U-NII-3 = 3.8 dBi
Antenna 3	Type	TDK RF Ceramic Chip Antenna
	Model	ANT162442DT-2001A2
	Manufacturer	TDK
	Gain	U-NII-1 = 1.0 dBi U-NII-2A = 1.1 dBi U-NII-2C = 1.5 dBi U-NII-3 = 2.1 dBi
Supply voltage	1.8/3.3VDC	
Type of Power source	Host board / AC/DC adapter	
Operating Temperature	TNom = 25°C TMin = -40°C TMax = 85°C	
Manufacturer	Panasonic Industrial Devices Europe GmbH Zeppelinstr. 19, 21337 Lüneburg, Germany	

RF General information					
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq (MHz)	Channel Number	Transmit chains	MCS
5150 - 5850	a	5180 - 5825	36 - 165	1	6Mbps - 54 Mbps
5150 - 5850	n (HT20)	5180 - 5825	36 - 165	1	MCS0 - MCS7
5150 - 5850	ac (VHT20)	5180 - 5825	36 - 165	1	MCS0 - MCS8
5150 - 5850	ax (HE20)	5180 - 5825	36 - 165	1	MCS0 - MCS11
5150 - 5850	n (HT40)	5190 - 5795	38 - 159	1	MCS0 - MCS7
5150 - 5850	ac (VHT40)	5190 - 5795	38 - 159	1	MCS0 - MCS9
5150 - 5850	ax (HE40)	5190 - 5795	38 - 159	1	MCS0 - MCS11
5150 - 5850	ac (VHT80)	5210 - 5775	42 - 155	1	MCS0 - MCS9
5150 - 5850	ax (HE80)	5210 - 5775	42 - 155	1	MCS0 - MCS11

2. Test mode output power

Information

Test information	
Measurement method	KDB 789033 E

Test procedure
<ol style="list-style-type: none"> EUT set to test mode on the first supported channel for each modulation and data rate The power is measured with the wideband power sensor The power is measured for the all data rates/modulations supported by the EUT The data rate with the highest output power for each technology is selected for test mode

Results

U-NII-1

OFDM – 5220 MHz (ch 44)							
Output power [dBm]							
6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
13,2	14,5	14,4	13,9	13,9	12,3	13,1	15,3

HT20 – 5220 MHz (ch 44)							
Output power [dBm]							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
13,6	13,8	13,7	13,6	13,5	13,7	13,8	13,8

HT40 – 5230 MHz (ch46)							
Output power [dBm]							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
14,3	14,2	14,2	14,2	14	14,3	14,3	14,3

VHT20 – 5220 MHz (ch 44)								
Output power [dBm]								
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8
13,5	13,4	13,6	13,4	13,4	13,4	13,2	13,5	11,3

VHT40 – 5230 MHz (ch 46)									
Output power [dBm]									
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9
14,1	14,2	14,2	14,2	14	14,3	14,3	14,2	13,1	12,5

VHT80 – 5210 MHz (ch 42)									
Output power [dBm]									
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9
11	10,9	10,9	10,9	10,9	10,7	10,9	10,8	9,9	9,7

HE-SU20 – 5220 MHz (ch 44)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
12,9	13,2	13,3	12,9	13,2	13,2	13,1	13,1	10,9	11	7,8	7,7

HE-SU 40 – 5230 MHz (ch 46)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
14,6	14,7	14,5	14,6	14,7	14,6	14,5	14,5	13,5	13,5	10,4	10,2

HE-SU 80 – 5210 MHz (ch 42)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
10,3	10,3	10,3	10,3	10,3	10,3	10,2	10	9,1	9,1	7	7

HE-TB20 RU61 – 5220 MHz (ch 44)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
7,7	7,7	7,7	7,7	7,7	7,7	7,7	7,7	7,7	7,6	7,6	7,6

HE-TB 40 RU65 – 5230 MHz (ch 46)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5

HE-TB RU67 80 – 5210 MHz (ch 42)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
0,3	0,3	0,3	0,3	0,2	0,2	0,2	0,2	0,3	0,2	0,2	0,2

U-NII-2A

OFDM – 5260 MHz (ch 52)							
Output power [dBm]							
6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
13,9	13,8	13,7	13,7	13,6	13,7	13,6	13,8

HT20 – 5260 MHz (ch 52)							
Output power [dBm]							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
12,7	12,8	12,7	12,7	12,9	12,8	12,7	12,8

HT40 – 5270 MHz (ch54)							
Output power [dBm]							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
11,3	11,3	11,3	11,2	11,4	11,4	11,3	11,3

VHT20 – 5260 MHz (ch 52)								
Output power [dBm]								
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8
12,9	12,7	12,7	12,8	12,9	12,9	12,8	12,7	10,6

VHT40 – 5270 MHz (ch 54)									
Output power [dBm]									
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9
11,3	11,5	11,3	11,3	11,4	11,4	11,2	11,4	10,2	10,2

VHT80 – 5290 MHz (ch 58)									
Output power [dBm]									
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9
9,7	9,7	9,5	9,7	9,6	9,6	9,6	9,5	9,6	9,5

HE-SU 20 – 5260 MHz (ch 52)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
13,1	13,1	13,1	13,05	13	13	13	12,9	10,9	10,9	7,9	7,9

HE-SU 40 – 5270 MHz (ch 54)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
11,7	11,6	11,7	11,7	11,7	11,6	11,7	11,6	10,7	10,6	7,5	7,6

HE-SU 80 – 5290 MHz (ch 58)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
8,9	8,9	8,9	8,9	8,8	8,8	8,7	8,9	8,9	8,9	6,8	6,7

HE-TB RU61 20 – 5260 MHz (ch 52)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
7,4	7,4	7,3	7,2	7,2	7,2	7,2	7,2	7,2	7,2	7,3	7,4

HE-TB 40 RU65– 5270 MHz (ch 54)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
7,4	7,4	7,4	7,4	7,4	7,3	7,3	7,3	7,3	7,3	7,3	7,3

HE-TB RU 67 80 – 5290 MHz (ch 58)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,5	0,5

U-NII-2C

OFDM – 5600 MHz (ch 120)							
Output power [dBm]							
6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
15,4	15,4	15,4	15,3	15,4	15,2	15,3	15,3

HT20 – 5600 MHz (ch 120)							
Output power [dBm]							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
14,2	14,2	14,2	14,3	14,3	14,3	14,2	14

HT40 – 5710 MHz (ch 142)							
Output power [dBm]							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
11,8	11,7	11,8	11,7	11,7	11,8	11,7	11,6

VHT20 – 5590 MHz								
Output power [dBm]								
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8
14,3	14,3	14,3	14,1	14,3	14,3	14,2	14,3	12

VHT40 – 5710 MHz (ch 142)									
Output power [dBm]									
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9
11,8	11,6	11,7	11,7	11,8	11,8	11,6	11,7	10,6	10,6

VHT80 – 5690 MHz (ch 138)									
Output power [dBm]									
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9
13	12,9	12,8	12,9	12,9	12,8	12,7	12,8	11,8	11,7

HE-SU 20 – 5600 MHz (ch 120)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
14,6	14,5	14,5	14,5	14,5	14,6	13,3	14,5	12,3	12,1	9,1	9,1

HE-SU 40 – 5710 MHz (ch 142)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
12	11	12,1	12,1	12,1	12,1	12	12	10,9	11,0	8	8

HE-SU 80 – 5690 MHz (ch 138)											
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Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
13,1	13,1	13	12,9	13	13	13	12,9	11,7	11,8	8,9	8,9

HE-TB RU61 20 – 5600 MHz (ch 120)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
8,0	8,0	8,0	8,0	8,0	7,9	7,9	7,9	7,9	7,9	8,0	8,0

HE-TB RU65 40 – 5710 MHz (ch 142)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
8,0	7,9	7,9	7,9	7,9	7,9	7,9	7,9	7,9	7,9	7,9	7,9

HE-TB RU67 80 – 5690 MHz (ch 138)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
1,1	1,1	1,1	1,1	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0

UNII-3

OFDM – 5745 MHz (ch 149)							
Output power [dBm]							
6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
16,6	16,5	16,5	16,5	16,5	16,5	16,6	16,4

HT20 – 5745 MHz (ch149)							
Output power [dBm]							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
15,6	15,5	15,6	15,7	15,6	15,6	15,4	15,5

HT40 – 5795 MHz (ch 159)							
Output power [dBm]							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
14,1	13,8	13,7	13,8	13,7	13,8	13,9	13,7

VHT20 – 5745 MHz (ch 149)								
Output power [dBm]								
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8
15,9	15,6	15,4	15,6	15,7	15,4	15,6	15,6	13,5

VHT40 – 5795 MHz (ch 159)									
Output power [dBm]									
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9
14,1	13,8	13,7	13,8	13,7	13,8	13,9	13,7	12,8	12,7

VHT80 – 5775 MHz (ch 155)									
Output power [dBm]									
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9
14,5	14,3	14,3	14,2	14,2	14,3	14,3	14,1	13,1	13,2

HE-SU 20 – 5745 MHz (ch 149)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
15,9	15,7	15,7	15,7	15,6	15,8	15,6	15,6	13,6	13,6	10,6	10,4

HE-SU 40 – 5795 MHz (ch 159)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
14,4	14,2	14,3	14,2	14,3	14	14,1	14,1	13,1	13	9,9	9,9

HE-SU 80 – 5775 MHz (ch 155)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
13,7	13,7	13,7	13,5	13,7	13,7	13,6	13,7	12,7	12,6	9,5	9,4

HE-TB RU61 20 – 5745 MHz (ch 149)											
Output power [dBm]											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
9,1	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0

HE-TB RU65 40 – 5795 MHz (ch 159)

Output power [dBm]

MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
8,8	8,8	8,8	8,8	8,8	8,7	8,7	8,7	8,7	8,7	8,7	8,7

HE-TB RU67 80 – 5775 MHz (ch 155)

Output power [dBm]

MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
1,8	1,8	1,8	1,8	1,8	1,8	1,7	1,7	1,7	1,7	1,7	1,8

3. Test mode duty cycle evaluation

Test information	
Measurement Method	ANSI C63.10 12.2

Requirements	
Duty cycle	Duty cycle correction
≥ 98%	No correction required
< 98 %	Correction required ($10 \times \log_{10}(1/DC)$)

Test procedure	
<i>Describe procedure to measure DC with TS8997</i>	
<ol style="list-style-type: none"> 1. EUT set to test mode 2. Sweep time is set to long enough to capture at least 5 bursts 3. The maximum burst duration TON is measured 4. The minimum idle duration TOFF is measured 5. The duty cycle correction is calculated by $DC = -10 \times \log_{10}(T_{ON} / (T_{ON} + T_{OFF}))$ 	

Results

OFDM							
Duty Cycle %							
6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
95,9	95,4	95,1	94	93,4	91,6	90,2	89,7

HT20							
Duty Cycle %							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
95,8	94,8	93,9	93,1	93	90,4	89,7	89,3

HT40							
Duty Cycle %							
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7
96	94,8	93,8	93	92,8	90	89,5	90,3

VHT20								
Duty Cycle %								
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8
95,8	94,9	94	94,5	94,5	90,3	91,4	89,2	88,3

VHT40									
Duty Cycle %									
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9
95,8	94,8	93,9	93,2	91,5	91,5	91	89	88,2	88

VHT80									
Duty Cycle %									
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9
95,8	96,1	93,7	92,5	91,1	89,6	90,3	88,2	87,2	86,6

HE-SU (20)											
Duty Cycle %											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
95,5	95,8	93,3	92,4	90,8	89,5	89	89	87,6	88,4	86,8	87,6

HE-SU (40)											
Duty Cycle %											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
95,5	94,5	93,3	92,4	90,8	89,6	89	88,6	87,6	87,1	86,5	86,2

HE-SU (80)											
Duty Cycle %											
MCS 0	MCS 1	MCS 2	MCS 3	MCS 4	MCS 5	MCS 6	MCS 7	MCS 8	MCS 9	MCS10	MCS11
95,4	94,1	93	92	90,5	89	88,7	88,1	87,	86,5	86,2	85,5

4. Configuration and Operation Modes

Conducted RF test:

Mode	Description (worst case data rate selected per technology)
OFDM (IEEE 802.11a)	Mode = Transmit Modulation = OFDM Bandwidth = 20 MHz Duty cycle = 93,4% U-NII-1, 95,9% U-NII-2A, 95,9% U-NII-2C, 95,9% U-NII-3 Data rate = 24Mbps U-NII-1, 6Mbps U-NII-2A, 6Mbps U-NII-2C, 6Mbps U-NII-3 Packet length = 1024 Burst SIFS = 16 us
HT20 (IEEE 802.11n)	Mode = Transmit Modulation = OFDM Bandwidth = 20 MHz Duty cycle = 94,8% U-NII-1, 93% U-NII-2A, 93,1 U-NII-2C, 93,1% U-NII-3 Data rate = MCS1 U-NII-1, MCS4 U-NII-2A, MCS3 U-NII-2C, MCS3 U-NII-3 Packet length = 1024 Burst SIFS = 16 us
HT40 (IEEE 802.11n)	Mode = Transmit Modulation = OFDM/QPSK Bandwidth = 40 MHz Duty cycle = 96% U-NII-1, 92,8% U-NII-2A, 96% U-NII-2C, 96% U-NII-3 Data rate = MCS0 U-NII-1, MCS4 U-NII-2A, MCS0 U-NII-2C, MCS0 U-NII-3 Packet length = 2048 Burst SIFS = 16 us
VHT20 (IEEE802.11ac)	Mode = Transmit Modulation = OFDM Bandwidth = 20 MHz Duty cycle = 94% U-NII-1, 95,8% U-NII-2A, 95,8% U-NII-2C, 95,8% U-NII-3 Data rate = MCS2 U-NII-1, MCS0 U-NII-2A, MCS0 U-NII-2C, MCS0 U-NII-3 Packet length = 1024 Burst SIFS = 16 us
VHT40 (IEEE802.11ac)	Mode = Transmit Modulation = OFDM Bandwidth = 40 MHz Duty cycle = 91,5% U-NII-1, 94,8% U-NII-2A, 95,8% U-NII-2C, 95,8% U-NII-3 Data rate = MCS5 U-NII-1, MCS1 U-NII-2A, MCS0 U-NII-2C, MCS0 U-NII-3 Packet length = 1024 Burst SIFS = 16 us
VHT80 (IEEE802.11ac)	Mode = Transmit Modulation = OFDM Bandwidth = 80 MHz Duty cycle = 95,8% U-NII-1, 95,8% U-NII-2A, 95,8% U-NII-2C, 95,8% U-NII-3 Data rate = MCS0 U-NII-1, MCS0 U-NII-2A, MCS0 U-NII-2C, MCS0 U-NII-3 Packet length = 4098 Burst SIFS = 16 us
HE-SU20 (IEEE802.11ax)	Mode = Transmit Modulation = OFDM Bandwidth = 20 MHz Duty cycle = 93,3% U-NII-1, 95,8% U-NII-2A, 95,8% U-NII-2C, 95,8% U-NII-3 Data rate = MCS2 U-NII-1, MCS0 U-NII-2A, MCS0 U-NII-2C, MCS0 U-NII-3 Packet length = 1024 Burst SIFS = 16 us

HE-SU40 (IEEE802.11ax)	Mode = Transmit Modulation = OFDM Bandwidth = 40 MHz Duty cycle = 94,5% U-NII-1, 95,5% U-NII-2A, 93,3% U-NII-2C, 95,5% U-NII-3 Data rate = MCS2 U-NII-1, MCS0 U-NII-2A, MCS2 U-NII-2C, MCS0 U-NII-3 Packet length = 2048 Burst SIFS = 16 us
HE-SU80 (IEEE802.11ax)	Mode = Transmit Modulation = OFDM Bandwidth = 80 MHz Duty cycle = 95,4% U-NII-1, 95,4% U-NII-2A, 95,4% U-NII-2C, 95,4% U-NII-3 Data rate = MCS0 U-NII-1, MCS0 U-NII-2A, MCS0 U-NII-2C, MCS0 U-NII-3 Packet length = 4096 Burst SIFS = 16 us
HE-TB20 RU 61 (IEEE802.11ax)	Mode = Transmit Modulation = OFDMA Bandwidth = 20 MHz Duty cycle = 96,9% U-NII-1, U-NII-2A, U-NII-2C, U-NII-3 Data rate = MCS0 U-NII-1, U-NII-2A, U-NII-2C, U-NII-3 Packet length = 200 Burst SIFS = 16 us
HE-TB40 RU65 (IEEE802.11ax)	Mode = Transmit Modulation = OFDMA Bandwidth = 40 MHz Duty cycle = 96,9% U-NII-1, U-NII-2A, U-NII-2C, U-NII-3 Data rate = MCS0 U-NII-1, U-NII-2A, U-NII-2C, U-NII-3 Packet length = 200 Burst SIFS = 16 us
HE-TB80 RU67 (IEEE802.11ax)	Mode = Transmit Modulation = OFDMA Bandwidth = 80 MHz Duty cycle = 96,9% U-NII-1, U-NII-2A, U-NII-2C, U-NII-3 Data rate = MCS0 U-NII-1, U-NII-2A, U-NII-2C, U-NII-3 Packet length = 200 Burst SIFS = 16 us
Receive	Mode = Receive (scan)
Comment: The above settings were found as worst case during pre-tests. Conducted peak/average output power was evaluated to determine the worst case settings.	

Test Frequencies

Designator	Mode	Channel	Frequency [MHz]	Comment
F1	Tx / Rx	36	5180	U-NII-1, 20 MHz
F2	Tx / Rx	44	5220	U-NII-1, 20 MHz
F3	Tx / Rx	48	5240	U-NII-1, 20 MHz
F4	Tx / Rx	38=36+40	5190	U-NII-1, 40 MHz
F5	Tx / Rx	46=44+48	5230	U-NII-1, 40 MHz
F6	Tx / Rx	42=36+40+44+48	5210	U-NII-1, 80 MHz
F7	Tx / Rx	52	5260	U-NII-2A, 20 MHz
F8	Tx / Rx	60	5300	U-NII-2A, 20 MHz
F9	Tx / Rx	64	5320	U-NII-2A, 20 MHz
F10	Tx / Rx	54=52+56	5270	U-NII-2A, 40 MHz
F11	Tx / Rx	62=60+64	5310	U-NII-2A, 40 MHz
F12	Tx / Rx	58=52+56+60+64	5290	U-NII-2A, 80 MHz
F13	Tx / Rx	100	5500	U-NII-2C, 20 MHz
F15	Tx / Rx	120	5600	U-NII-2C, 20 MHz
F16	Tx / Rx	140	5700	U-NII-2C, 20 MHz
F17	Tx / Rx	144	5720	U-NII-2C, 20 MHz
F18	Tx / Rx	102=100+104	5510	U-NII-2C, 40 MHz
F19	Tx / Rx	118=116+120	5590	U-NII-2C, 40 MHz
F20	Tx / Rx	142=140+144	5710	U-NII-2C, 40 MHz
F21	Tx / Rx	106=100+104+108+112	5530	U-NII-2C, 80 MHz
F22	Tx / Rx	122=116+120+124+128	5610	U-NII-2C, 80 MHz
F23	Tx / Rx	138=132+136+140+144	5690	U-NII-2C, 80 MHz
F24	Tx / Rx	149	5745	U-NII-3, 20 MHz
F25	Tx / Rx	157	5785	U-NII-3, 20 MHz
F26	Tx / Rx	165	5825	U-NII-3, 20 MHz
F27	Tx / Rx	151=149+153	5755	U-NII-3, 40 MHz
F28	Tx / Rx	159=157+161	5795	U-NII-3, 40 MHz
F29	Tx / Rx	155=149+153+157+161	5775	U-NII-3, 80 MHz

5. Test equipment

Conducted RF tests

R&S TS8997 Test System equipment list:

Equipment	Certification-No.	Calibration Date	Next calibration
SMW200A	1035089-D-K-15195-01-00-2022-03	26.06.2023	25.06.2026
SMB100A	1041326-D-K-15195-01-00-2022-03	26.06.2023	25.06.2026
OSP-B157WX+OSP220	300642762-D-K-15195-01-00-2022-03	26.06.2023	25.06.2024
OSP-B157W8plus+OSP150	300639878-D-K-15195-01-00-2022-03	26.06.2023	25.06.2024
ESW	1039208-D-K-15195-01-00-2022-03	05.07.2023	04.07.2024
CMW500	300693633-D-K-15195-01-00-2023-04	25.04.2023	24.04.2024

Radiated emission

New ID	Manufacturer	Equipment type	Description	Serial	Calibration information	Next calibration
G4C265	Rohde & Schwarz	ESW26	EMI test receiver	101324	29.6.2023	29.6.2024
G4C273	Frankonia	ALX-4000E	Broadband Antenna, 25MHz-4GHz with 6dB (50-A-MFN-06) att.	00816+1531	22.1.2024	22.1.2027
G4C292	Rohde & Schwarz	TS-LNA 1840	RF Preamplifier 18 to 40 GHz	100841	9.6.2022	9.6.2024
G4C469	Rohde & Schwarz	TS_PRE2	RF Preamplifier	101541	9.6.2022	9.6.2024
G4C294	Rohde & Schwarz	Antenna	Horn Antenna -> 40GHz	101067	4.11.2022	4.11.2025
G4C576	Rohde & Schwarz	HF907	Double-Ridged Waveguide Horn Antenna 800MHz-18GHz	100163	9.8.2022	9.8.2025

6. Uncertainties

Description	Expanded Uncertainty (k=2)
RF Output Power	0,99
Peak Power	0,80
Power Spectral Density	0,99
Accumulated Transmit Time	0,01%
Minimum Frequency Occupation Time	0,01%
Hopping Frequency Separation	0,60%
Occupied Channel Bandwidth	2,08 %
Out-of-band emissions	0,89
Transmitter unwanted emissions in the spurious domain	1,76
AC conducted emission	2,24
Radiated emission ≤ 1 GHz	4,62
Radiated emission > 1 GHz	5,72
Frequence stability	<5ppm

7. Sample emission level calculation

The following is a description of term and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dBuV.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strength to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. RF path losses, including RF cables and preamplifiers, have been included with the A.F to simplify the calculations. The antenna factor is used in calculations as follows:

$$\text{Reading on Analyzer (dBuV)} + \text{A.F. (dB/m)} = \text{Net field strength (dBuV/m)}$$

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBuV/m). The FCC limits are given in units of uV/m. The following formula is used to convert the units of uV/m to dbuV/m:

$$\text{Limit (dBuV/m)} = 20 * \log(\text{uV/m})$$

Margin :

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading + AF	= Net Reading :	Net reading – FCC limit	= Margin
+ 21.5 dBuV + 26 dB/m	= 47.5 dBuV/m :	47.5 dBuV/m – 57.0 dBuV/m	= -9.5 dB

8. Test conditions

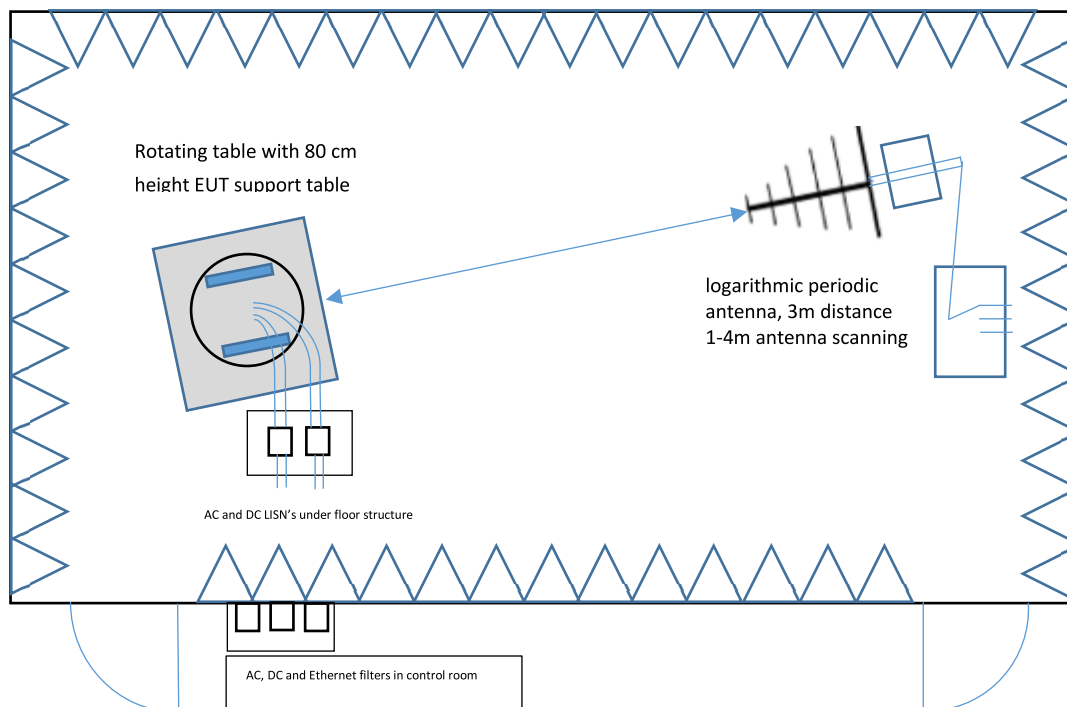
All radiated tests were performed in a semi-anechoic chamber, where the measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz, 1 GHz-18 GHz Double-ridged horn antenna and 18 GHz-40 GHz horn antenna) is located at a distance of 3 m.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (all antennas) was varied from 1 to 4 meters to find the maximum radiated emission.

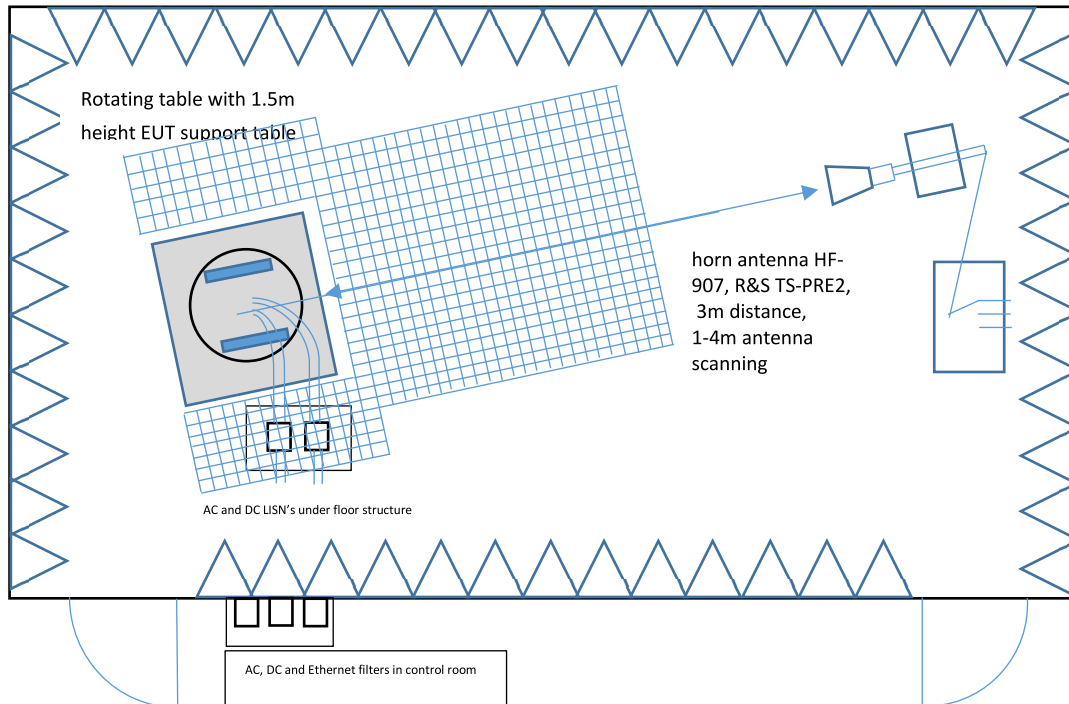
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth / video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

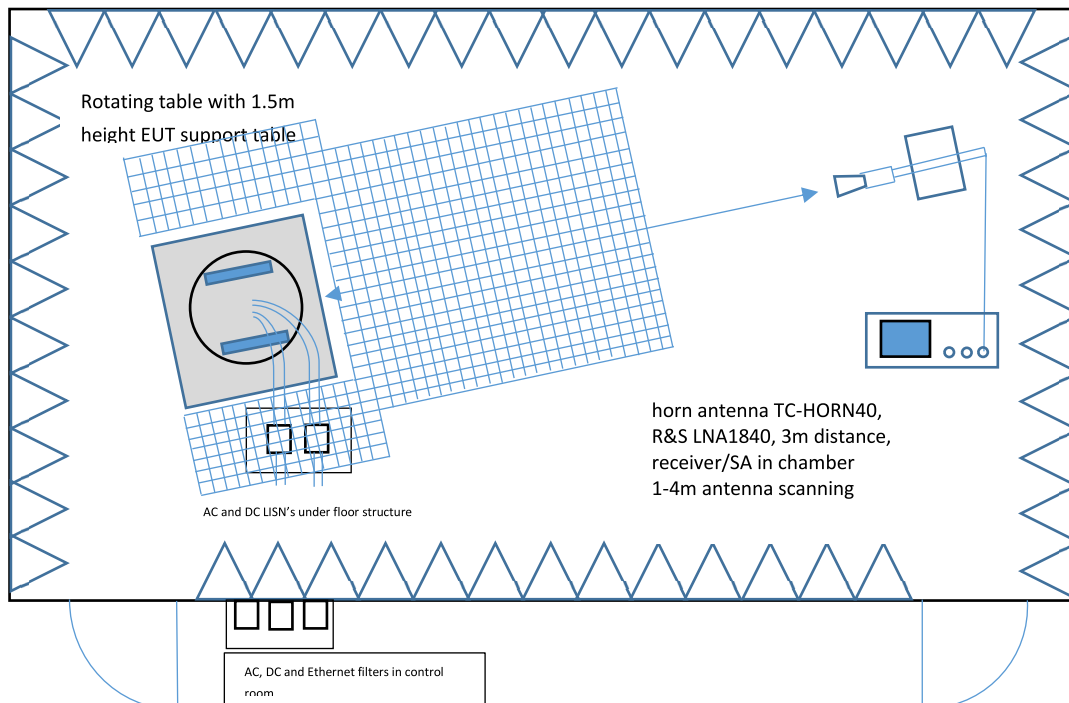
Radiated measurements setup from 30 MHz to 1 GHz:



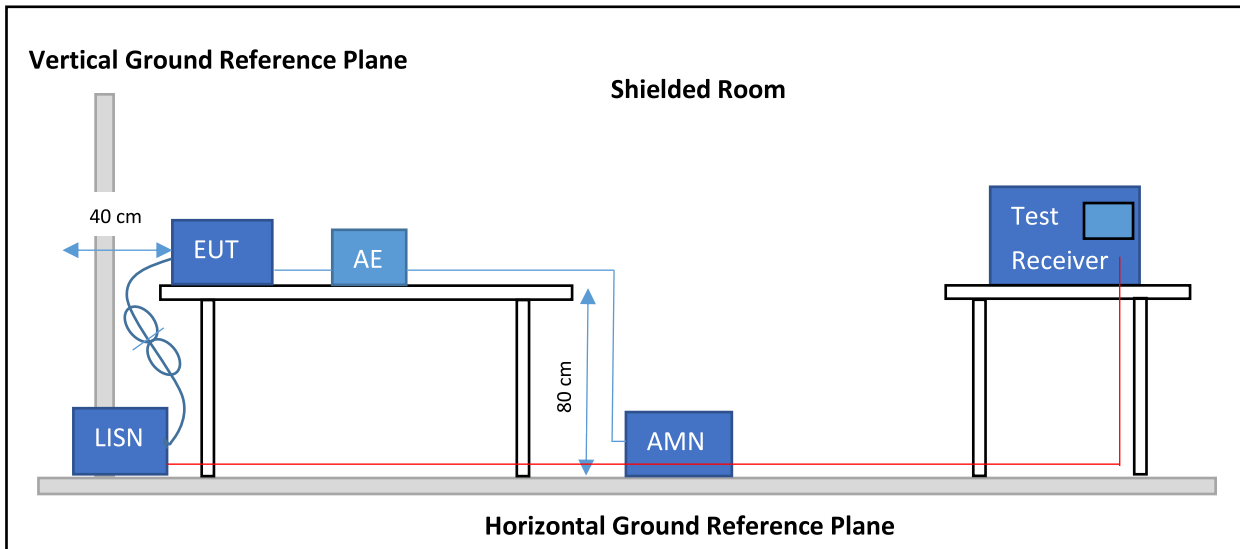
Radiated measurements setup from 1 GHz to 18 GHz:



Radiated measurements setup from 18 GHz to 26 / 40 GHz:



Conducted emission setup



Conducted RF measurement system:



9. Summary

FCC/ISED Requirement (15.247 / RSS-247)		Reference method	Result	Remark
6 dB Bandwidth	FCC §15.407 (e) / RSS-247, Issue 3 (section 6.2.4.2)	KDB 789033 C.2	PASS	Only required in 5725 – 5850 MHz band
26 dB bandwidth	FCC §15.407 (a)(2), (a)(5), (h)(2) / RSS-247, Issue 3 (section 6.2)	KDB 789033 C.1	PASS	No limit. Basis for other measurements.
Occupied Channel Bandwidth 99%	RSS-Gen, 6.7	ANSI C63.10, 6.9.3	PASS	
Maximum conducted output power	FCC §15.407 (a) / RSS-247, Issue 3 (section 6.2)	KDB 789033 C.1	PASS	
Transmit power control	FCC §15.407 (a) / RSS-247 Issue 3 (section 6.2)	KDB 789033 E	N/A	Required in 5250-5350 and 5470-5725 MHz bands. Not required for EIRP < 500 mW
Maximum power spectral density	FCC §15.407 (a) / RSS-247, Issue 3 (section 6.2)	KDB 789033 F	PASS	
Frequency stability	FCC §15.407 (g) / RSS-Gen, 6.11/8.11	ANSI C63.10, 6.8	PASS	
AC power line conducted emissions	FCC §15.407 (b) (6) / RSS-247, Issue 3 (section 3.1)	ANSI C63.10, 6.2	PASS	
Band edge emissions compliance (transmitter)	FCC §15.407 (b), RSS-247, Issue 3 (section 6.2.1.1)	KDB 789033 G	PASS	
Tx spurious emissions, conducted	FCC §15.407 (b), RSS-247, Issue 3 (section 6.2)	ANSI C63.10, 6.2	PASS	
Emissions in restricted frequency bands (peak)	FCC §15.407 (b), RSS-247, Issue 3 (section 6.2)	ANSI C63.10, 6.2	PASS	
Transmitter radiated spurious emissions	FCC §15.407 (b) /RSS-247, Issue 3, (section 6.2)	KDB 789033 G	PASS	
Receiver spurious emissions, radiated	ISED RSS-247, Issue 3 (section 3.1)	ANSI C63.4, 8.1-8.3	PASS	
Radiation pattern	FCC §15.407(a)	KDB 789033 H	N/A	Outdoor access points in the 5150-5250 MHz band with EIRP >21 dBm only
Possible test case verdicts: PASS = Tested device meets the requirements FAIL = Tested device does not meet the requirements N/A = Test requirement not applicable for tested device N/T = Test requirement applicable for tested device, but not tested				
Applicable FCC KDB(s): KDB 789033, reference: KDB 789033 D02 v02r01 KDB 905462, reference: KDB 905462 D02 v02				

10. 6 dB bandwidth

Reference: FCC title 47 part 15 §15.407(e), ISED RSS-247, Issue 3 (section 6.2.4.1)

Test method: KDB 789033 C.2 and ANSI C63.10-2013 (11.8.1, Option 1)

Limits
The minimum 6 dB bandwidth shall be at least 500 kHz.

Test procedure
<ol style="list-style-type: none"> 1. The testing follows FCC KDB 789033 D02 general UNII test procedures new rules v02r01 section C) Emission bandwidth for the band 5725 – 5850 MHz 2. Set RBW 100kHz 3. Set VBW $\geq 3 \times$ RBW 4. Detector = Peak 5. Trace mode = max hold 6. Measure the maximum width of the emission that is 6dB down from the peak of the emission. 7. Measure and record the result in the test report

Summary:

Mode / modulation	DUT Frequency (MHz)	Result
U-NII-3, 802.11a, ch149, 20 MHz, 6 Mbps	5745.000000	PASS
U-NII-3, 802.11a, ch157, 20 MHz, 6 Mbps	5785.000000	PASS
U-NII-3, 802.11a, ch165, 20 MHz, 6 Mbps	5825.000000	PASS
U-NII-3, 802.11n, ch149, 20 MHz, MCS3	5745.000000	PASS
U-NII-3, 802.11n, ch157, 20 MHz, MCS3	5785.000000	PASS
U-NII-3, 802.11n, ch165, 20 MHz, MCS3	5825.000000	PASS
U-NII-3, 802.11n, ch151, 40 MHz, MCS0	5755.000000	PASS
U-NII-3, 802.11n, ch159, 40 MHz, MCS0	5795.000000	PASS
U-NII-3, 802.11ac, ch149, 20 MHz, MCS0	5745.000000	PASS
U-NII-3, 802.11ac, ch157, 20 MHz, MCS0	5785.000000	PASS
U-NII-3, 802.11ac, ch165, 20 MHz, MCS0	5825.000000	PASS
U-NII-3, 802.11ac, ch151, 40 MHz, MCS0	5755.000000	PASS
U-NII-3, 802.11ac, ch159, 40 MHz, MCS0	5795.000000	PASS
U-NII-3, 802.11ac, ch155, 80 MHz, MCS0	5775.000000	PASS
U-NII-3, 802.11ax HE-SU, ch149, 20 MHz, MCS0	5745.000000	PASS
U-NII-3, 802.11ax HE-SU, ch157, 20 MHz, MCS0	5785.000000	PASS
U-NII-3, 802.11ax HE-SU, ch165, 20 MHz, MCS0	5825.000000	PASS
U-NII-3, 802.11ax HE-SU, ch151, 40 MHz, MCS0	5755.000000	PASS
U-NII-3, 802.11ax HE-SU, ch159, 40 MHz, MCS0	5795.000000	PASS
U-NII-3, 802.11ax HE-SU, ch155, 80 MHz, MCS0	5775.000000	PASS
U-NII-3, 802.11ax HE-TB Full RU, ch149, 20 MHz, MCS0	5745.000000	PASS
U-NII-3, 802.11ax HE-TB Full RU, ch157, 20 MHz, MCS0	5785.000000	PASS
U-NII-3, 802.11ax HE-TB Full RU, ch165, 20 MHz, MCS0	5825.000000	PASS
U-NII-3, 802.11ax HE-TB Full RU, ch151, 40 MHz, MCS0	5755.000000	PASS

Mode / modulation	DUT Frequency (MHz)	Result
U-NII-3, 802.11ax HE-TB Full RU, ch159, 40 MHz, MCS0	5795.000000	PASS
U-NII-3, 802.11ax HE-TB Full RU, ch155, 80 MHz, MCS0	5775.000000	PASS

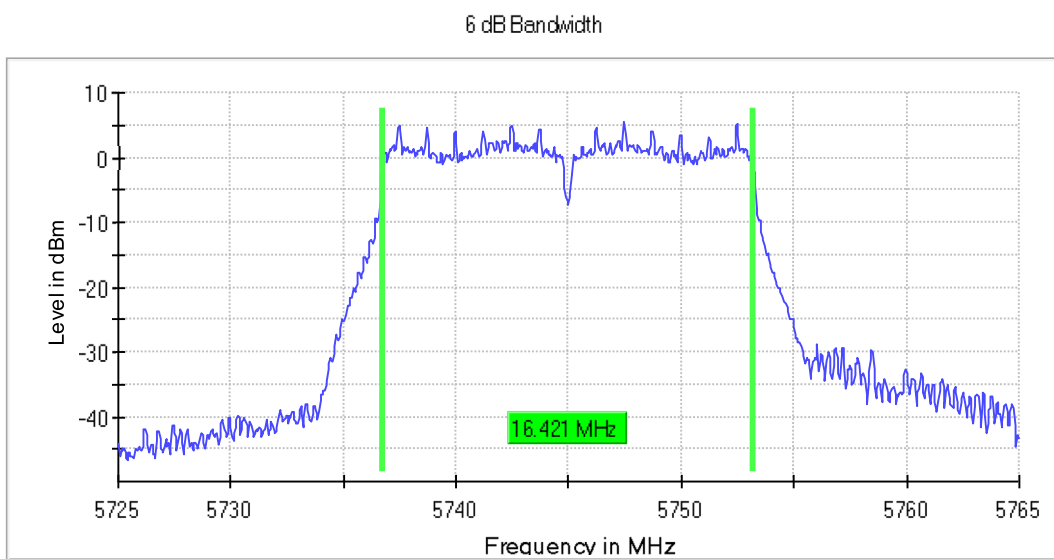
U-NII-3

Test results, 5725 – 5850 MHz

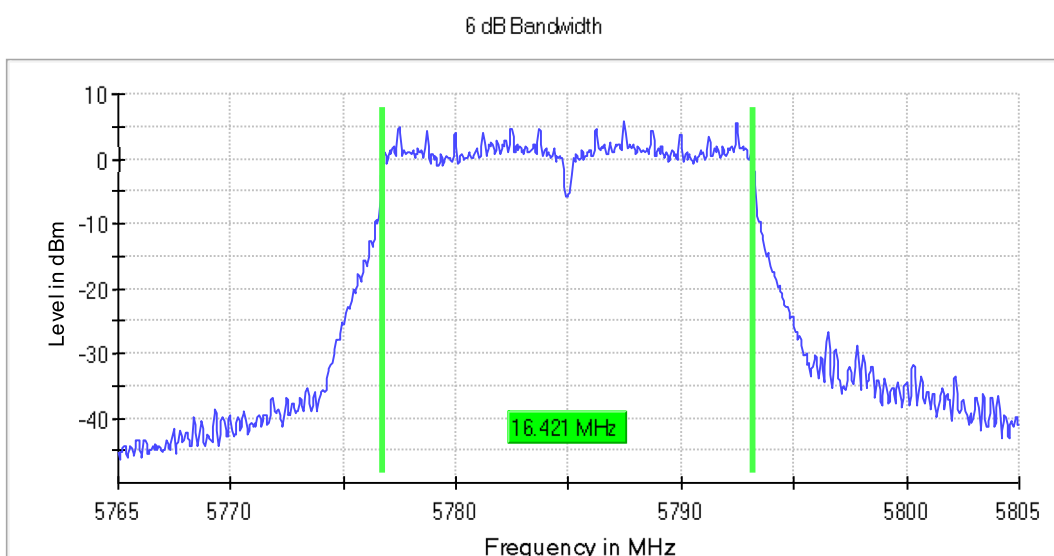
Mode / modulation	Channel	DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
OFDM	149	5745	16.420526	0.500000	---	5736.764706	5753.185232	5.6	PASS
OFDM	157	5785	16.420526	0.500000	---	5776.764706	5793.185232	5.9	PASS
OFDM	165	5825	16.470589	0.500000	---	5816.714643	5833.185232	5.2	PASS
HT20	149	5745	17.772215	0.500000	---	5736.063830	5753.836045	4.7	PASS
HT20	157	5785	17.722153	0.500000	---	5776.113892	5793.836045	4.9	PASS
HT20	165	5825	17.772215	0.500000	---	5816.063830	5833.836045	4.3	PASS
HT40	149+153	5755	35.922451	0.500000	---	5737.013759	5772.936210	0.0	PASS
HT40	157+161	5795	35.872420	0.500000	---	5777.013759	5812.886179	0.1	PASS
VHT20	149	5745	17.371715	0.500000	---	5736.163955	5753.535670	4.9	PASS
VHT20	157	5785	17.421777	0.500000	---	5776.364205	5793.785982	4.9	PASS
VHT20	165	5825	17.672090	0.500000	---	5816.113892	5833.785982	4.4	PASS
VHT40	149+153	5755	35.672295	0.500000	---	5737.113821	5772.786116	0.2	PASS
VHT40	157+161	5795	35.872420	0.500000	---	5777.013759	5812.886179	0.1	PASS
VHT80	149+153+157+161	5775	76.423882	0.500000	---	5736.763051	5813.186933	-1.8	PASS
HE-SU20	149	5745	18.623279	0.500000	---	5735.713392	5754.336671	4.6	PASS
HE-SU20	157	5785	18.673342	0.500000	---	5775.663329	5794.336671	4.6	PASS
HE-SU20	165	5825	18.623279	0.500000	---	5815.663329	5834.286608	4.3	PASS
HE-SU40	149+153	5755	37.273296	0.500000	---	5736.363352	5773.636648	0.2	PASS
HE-SU40	157+161	5795	37.323327	0.500000	---	5776.313321	5813.636648	-0.1	PASS
HE-SU80	149+153+157+161	5775	78.224445	0.500000	---	5735.862770	5814.087215	-2.4	PASS
HE-TB20 full RU	149	5745	18.823530	0.500000	---	5735.513141	5754.336671	-1.9	PASS
HE-TB20 full RU	157	5785	18.723404	0.500000	---	5775.613267	5794.336671	-1.9	PASS
HE-TB20 full RU	165	5825	19.023780	0.500000	---	5815.663329	5834.687109	-2.3	PASS

Mode / modulation	Channel	DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
HE-TB40 full RU	149+153	5755	37.973734	0.500000	---	5735.963102	5773.936836	-6.1	PASS
HE-TB40 full RU	157+161	5795	37.623515	0.500000	---	5776.063164	5813.686679	-5.4	PASS
HE-TB80 full RU	149+153+157+161	5775	78.174429	0.500000	---	5735.862770	5814.037199	-15.4	PASS

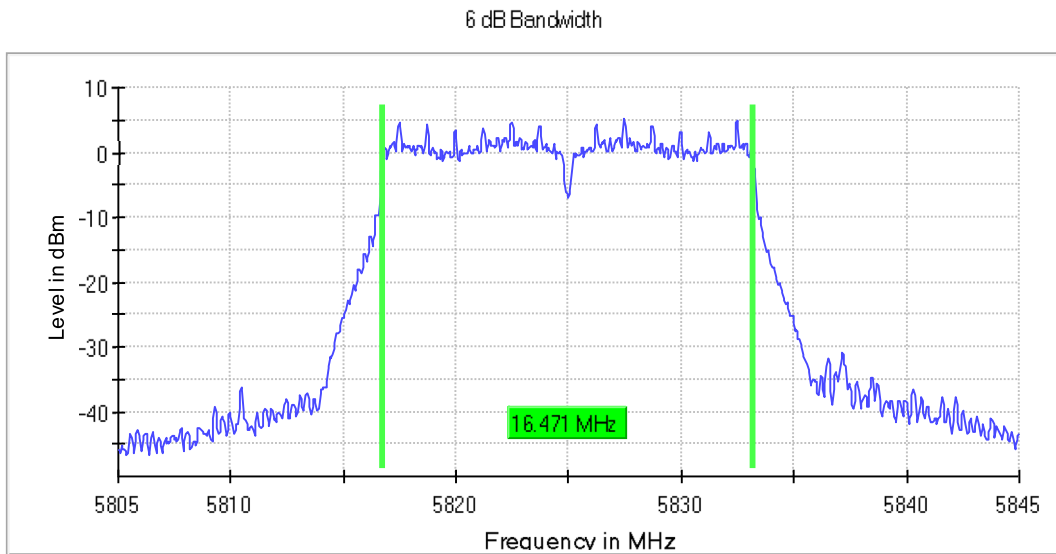
6 dB Bandwidth, low channel OFDM:



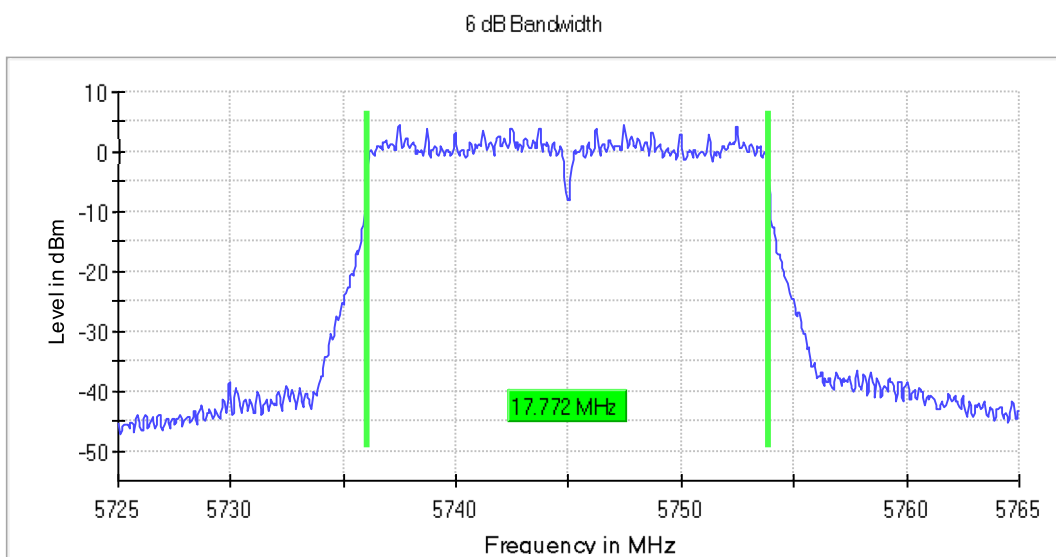
6 dB Bandwidth, middle channel OFDM:



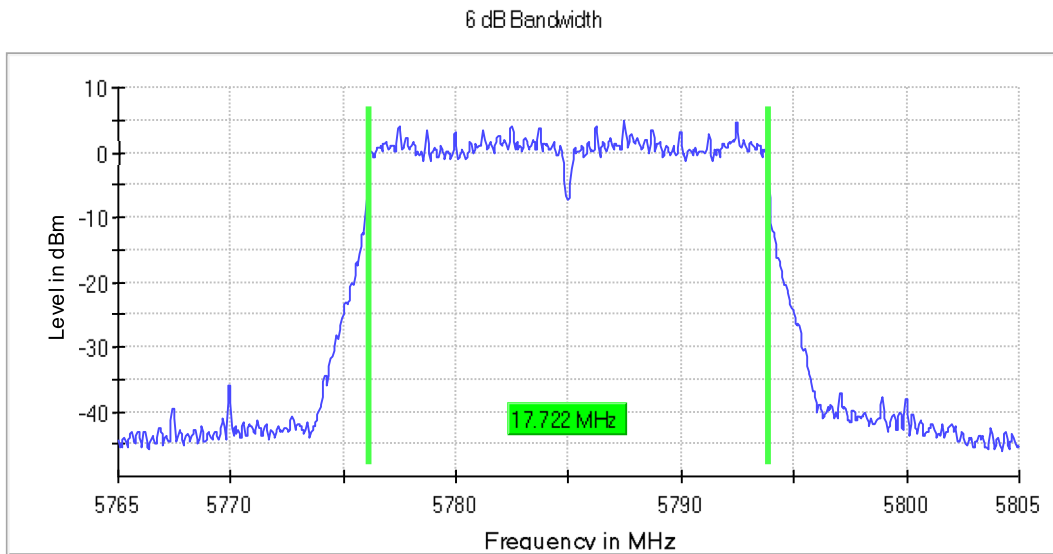
6 dB Bandwidth, high channel OFDM:



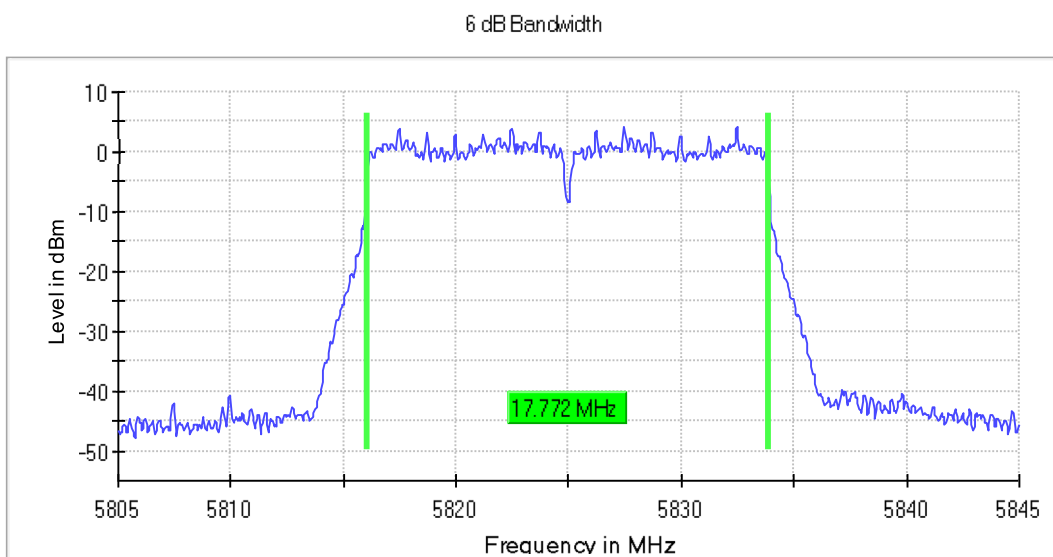
6 dB Bandwidth, low channel HT20:



6 dB Bandwidth, middle channel HT20:

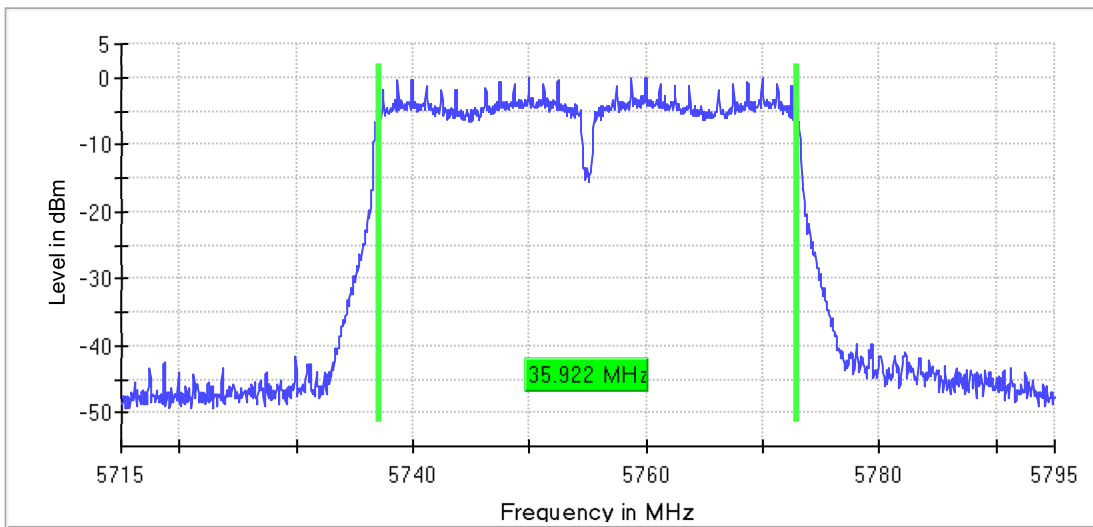


6 dB Bandwidth, high channel HT20:



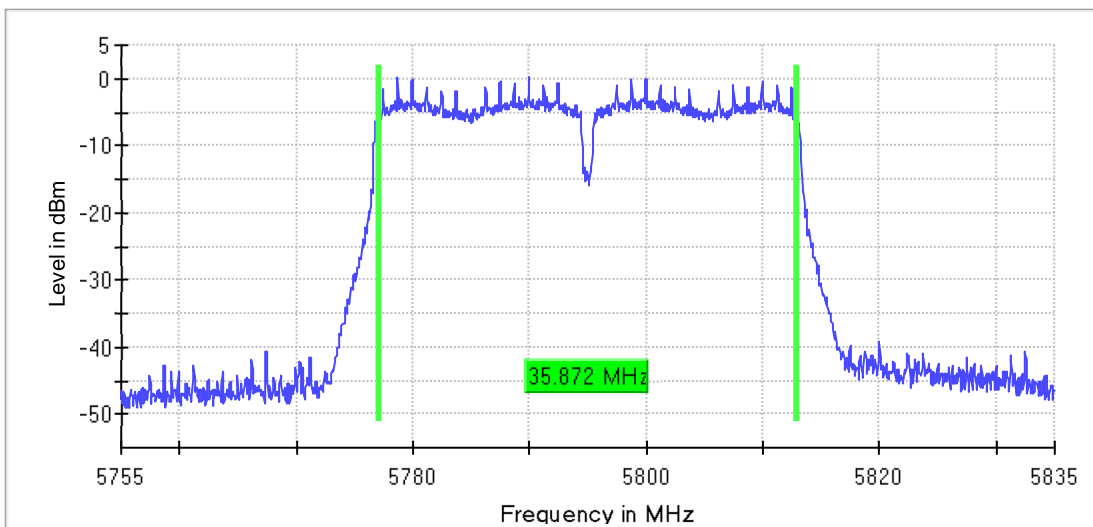
6 dB Bandwidth, low channel HT40:

6 dB Bandwidth

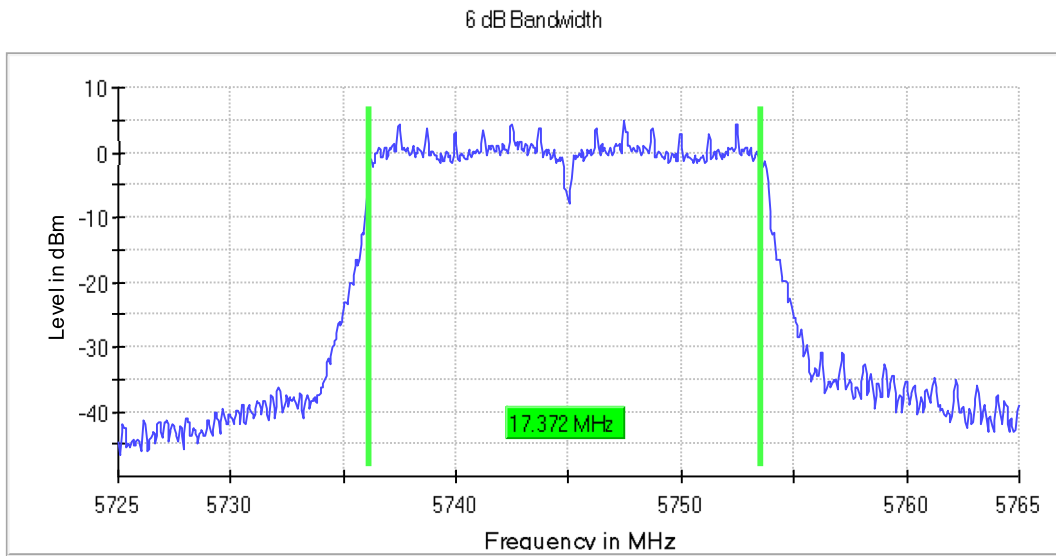


6 dB Bandwidth, high channel HT40:

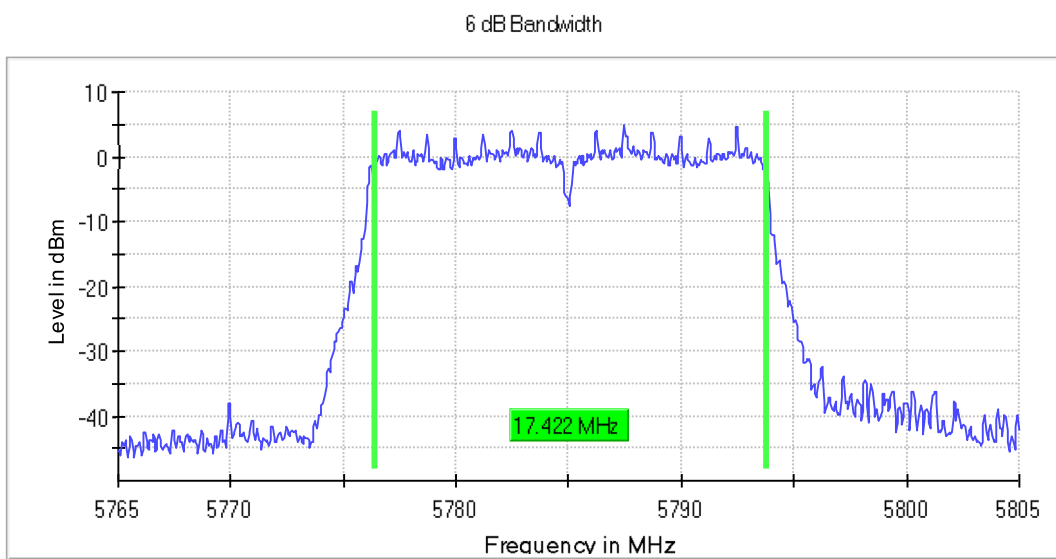
6 dB Bandwidth



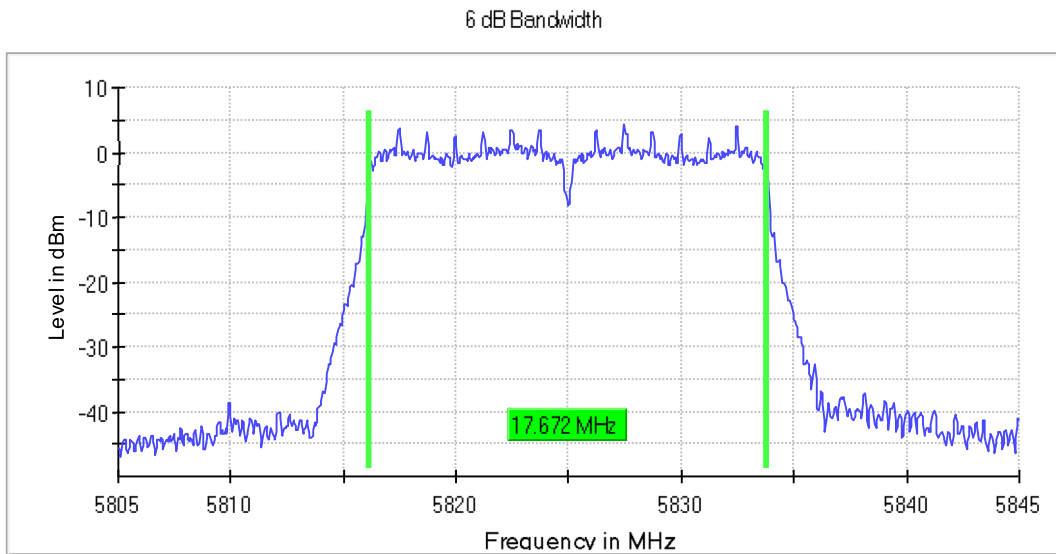
6 dB Bandwidth, low channel VHT20:



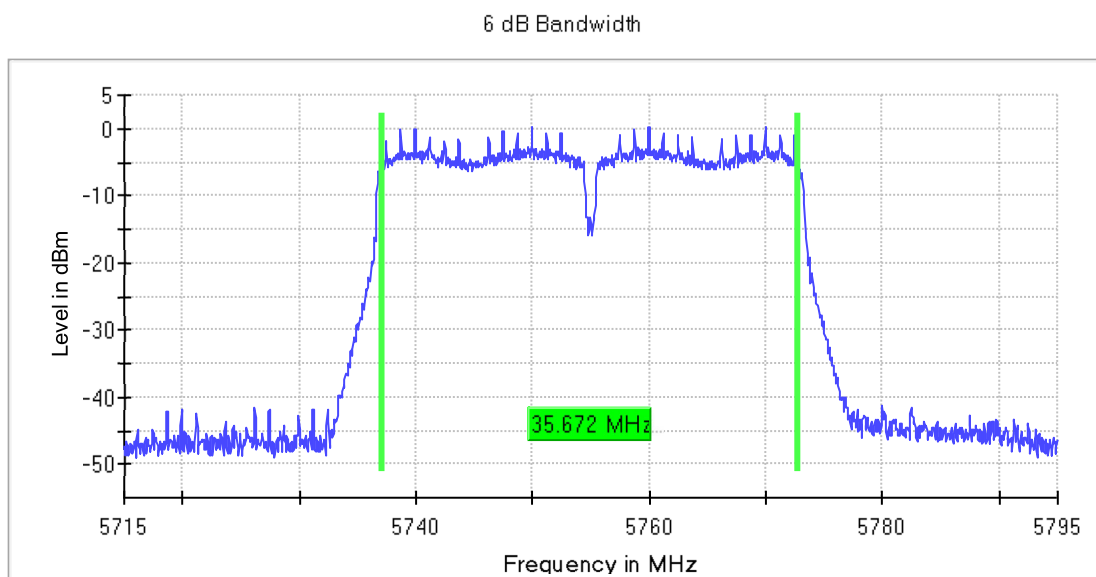
6 dB Bandwidth, middle channel VHT20:



6 dB Bandwidth, high channel VHT20:

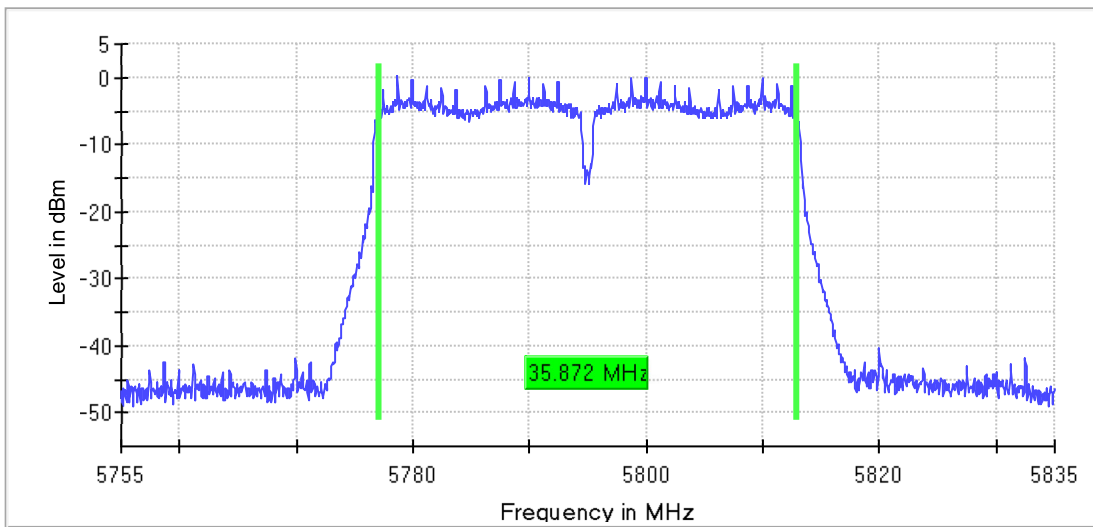


6 dB Bandwidth, low channel VHT40:



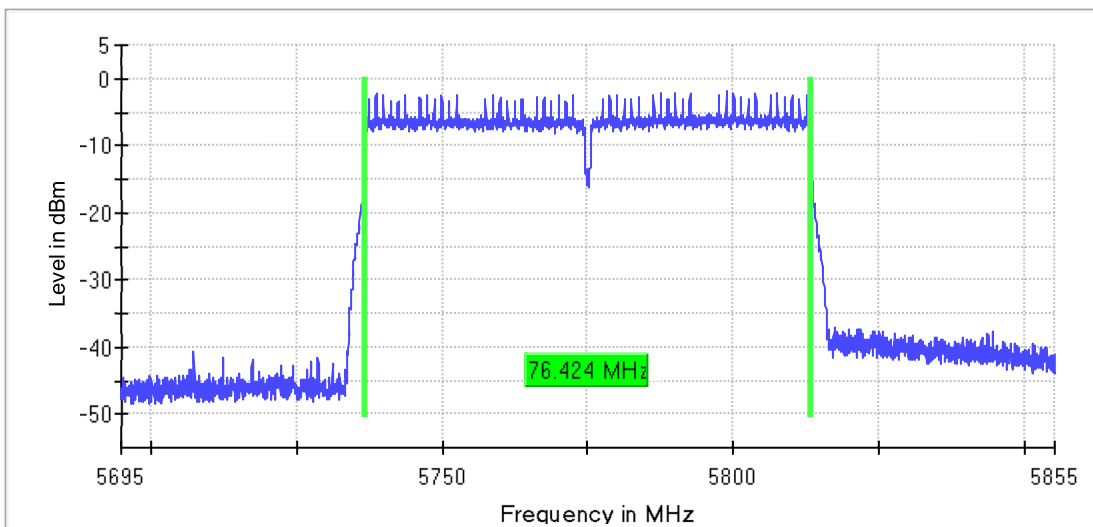
6 dB Bandwidth, high channel VHT40

6 dB Bandwidth

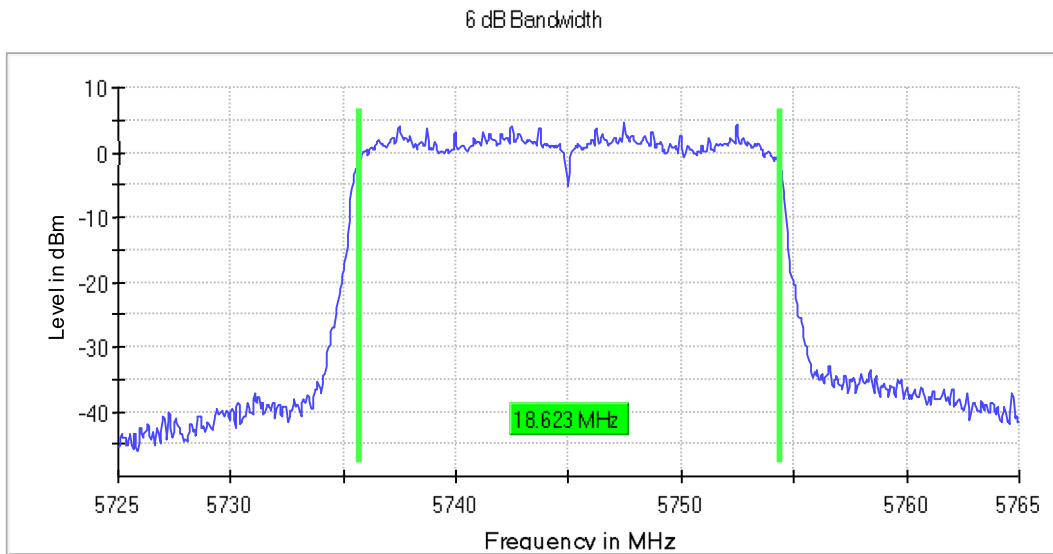


6 dB Bandwidth, middle VHT80

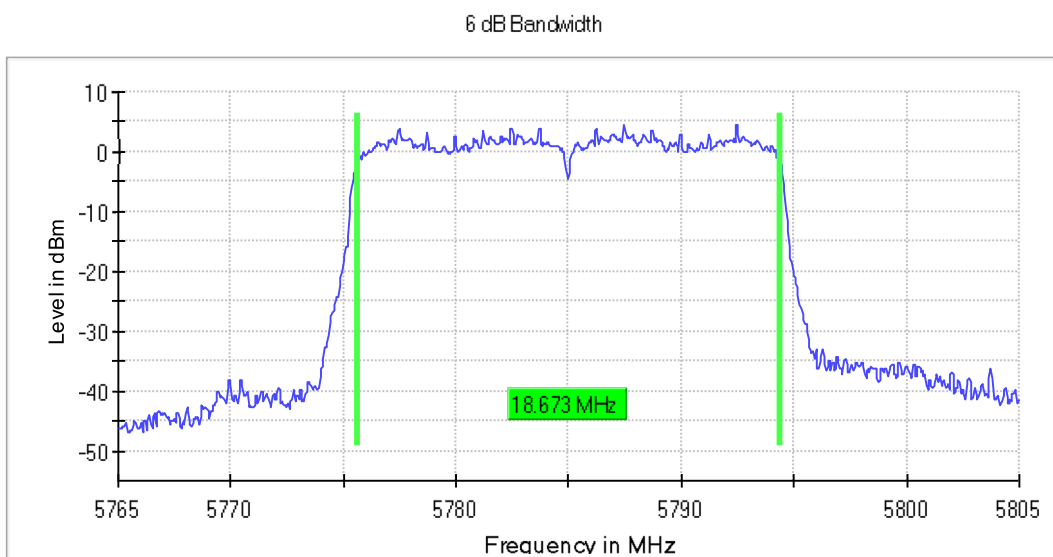
6 dB Bandwidth



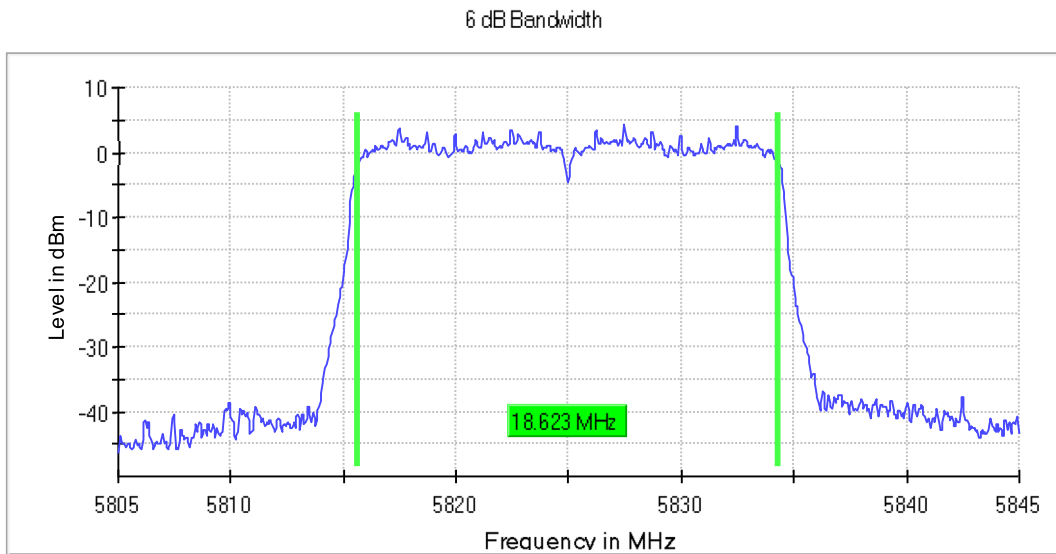
6 dB Bandwidth, low channel HE-SU 20:



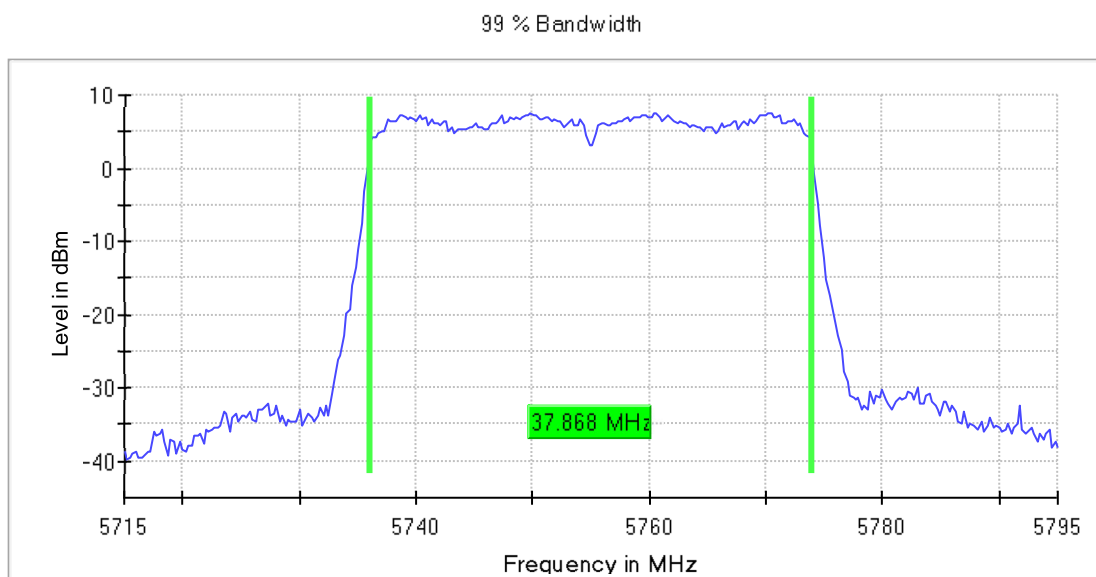
6 dB Bandwidth, middle channel HE-SU 20:



6 dB Bandwidth, high channel HE-SU 20:

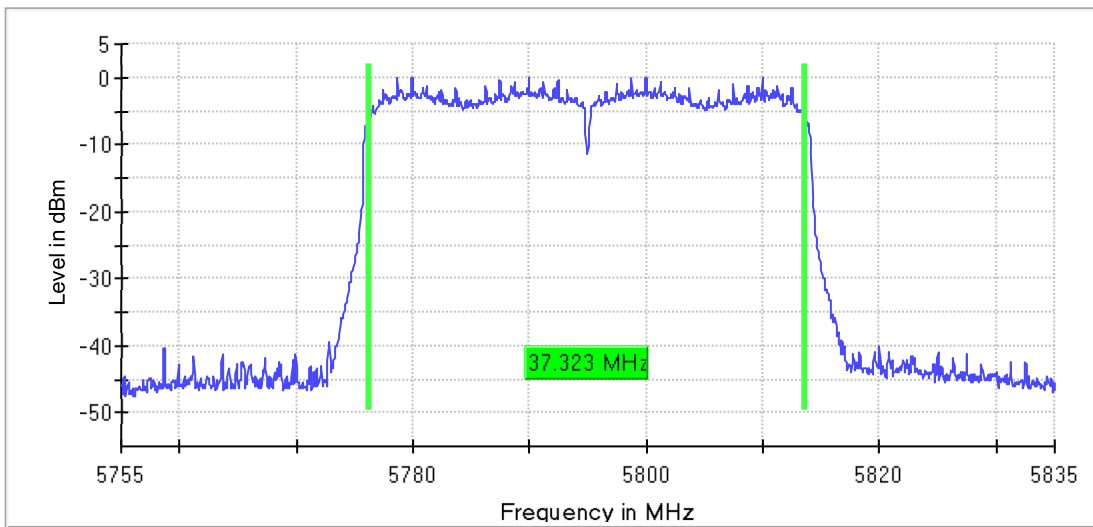


6 dB Bandwidth, low channel HE-SU 40:



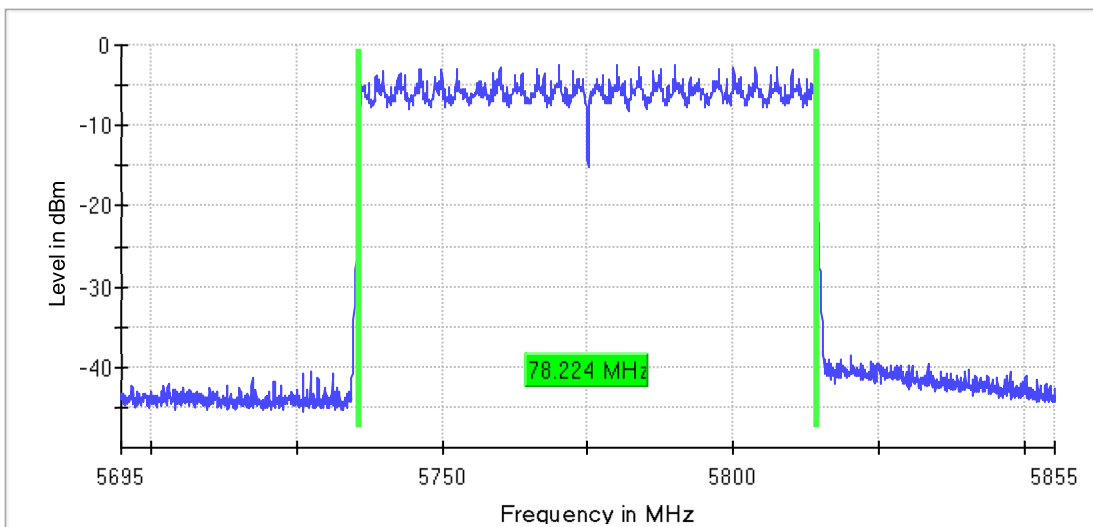
6 dB Bandwidth, high channel HE-SU 40:

6 dB Bandwidth

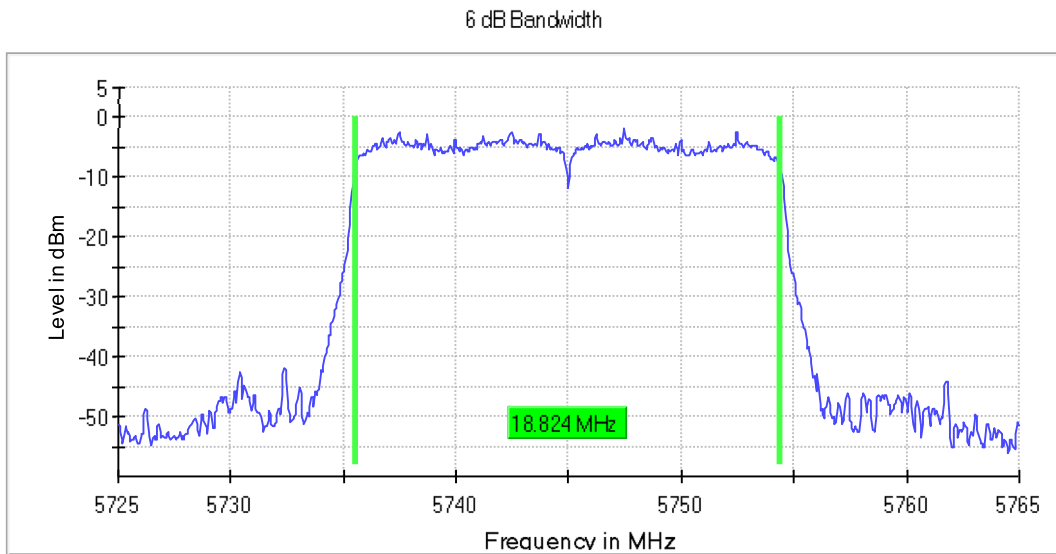


6 dB Bandwidth, middle channel HE-SU 80:

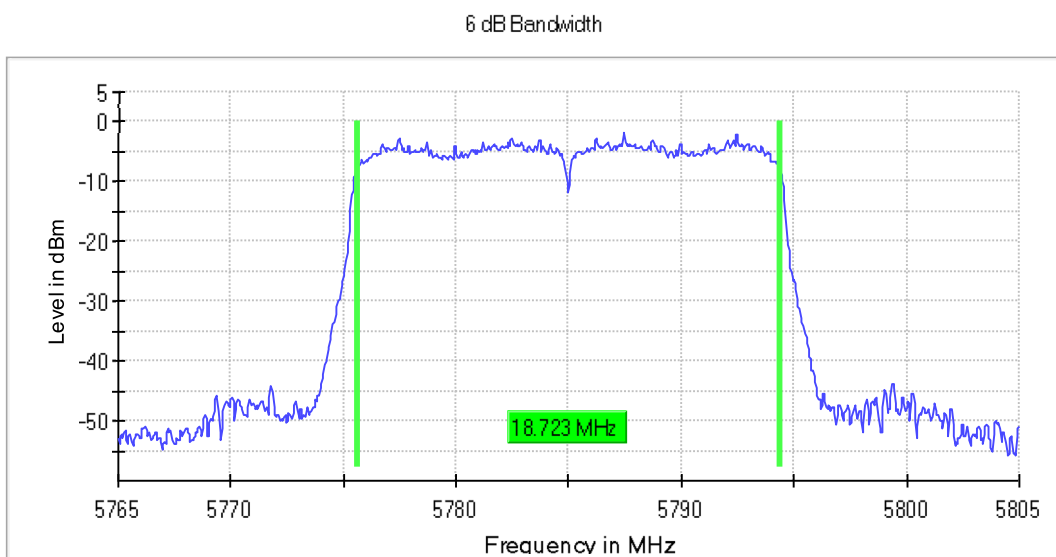
6 dB Bandwidth



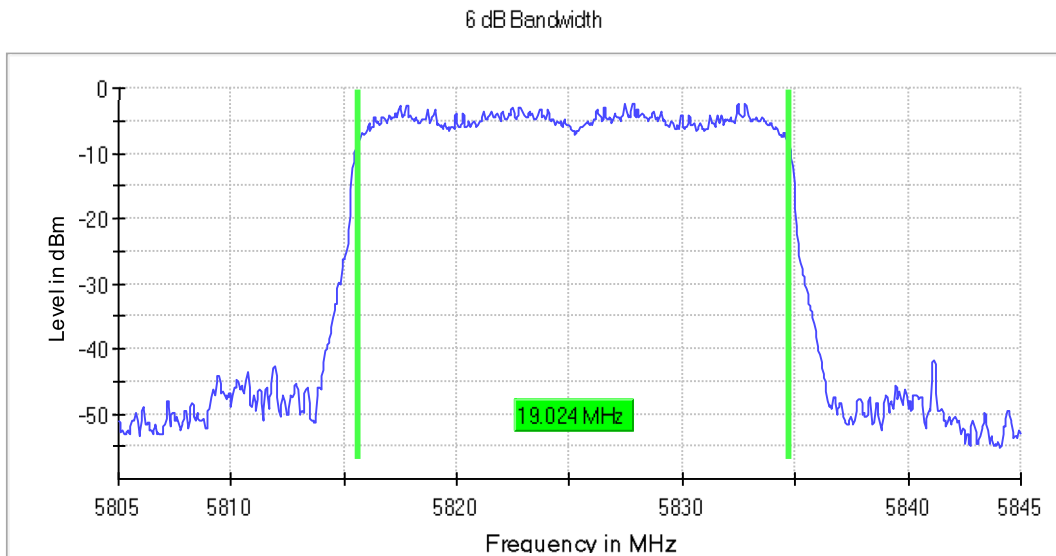
6 dB Bandwidth, low channel: HE-TB 20 full RU



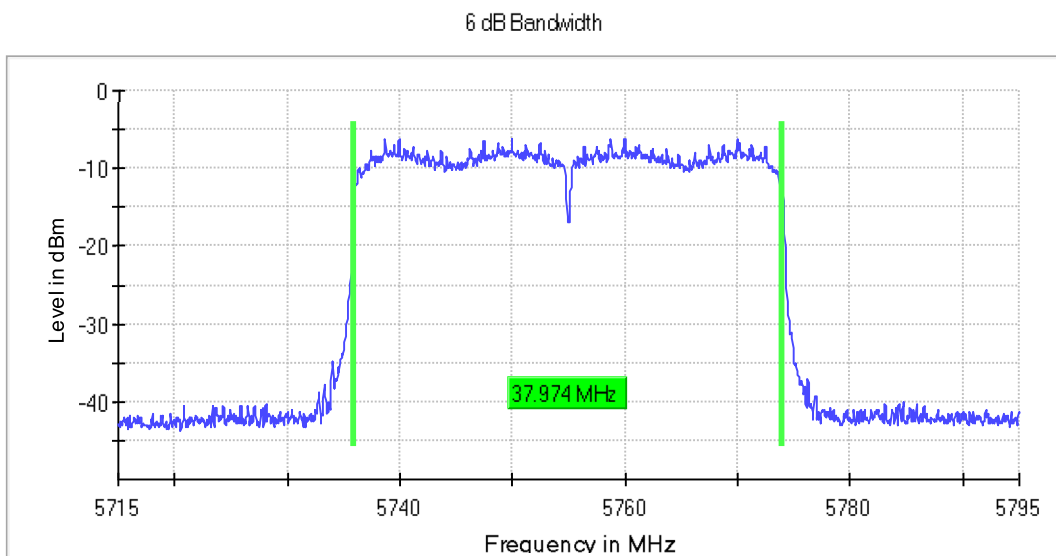
6 dB Bandwidth, middle channel HE-TB 20 full RU:



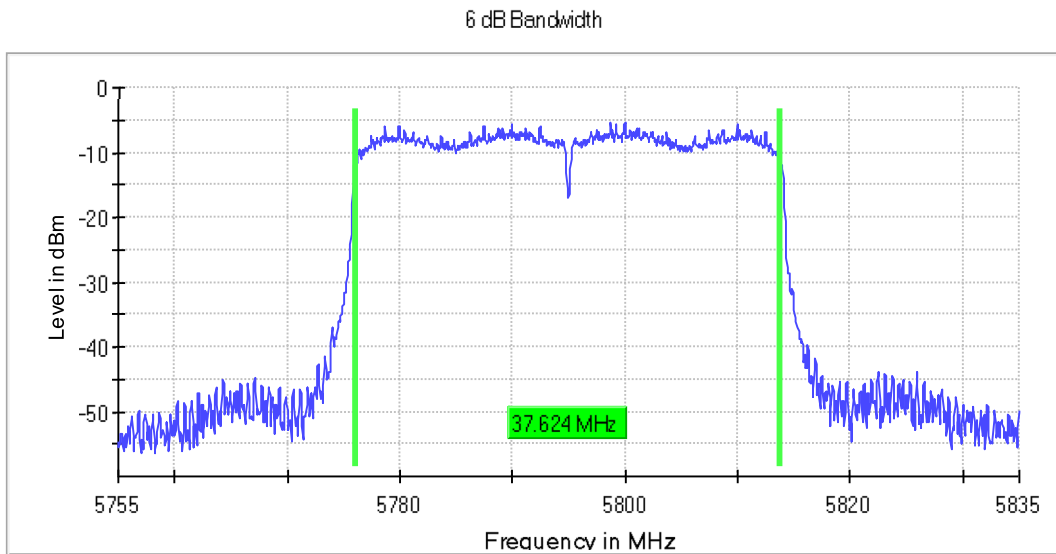
6 dB Bandwidth, high channel HE-TB 20 full RU:



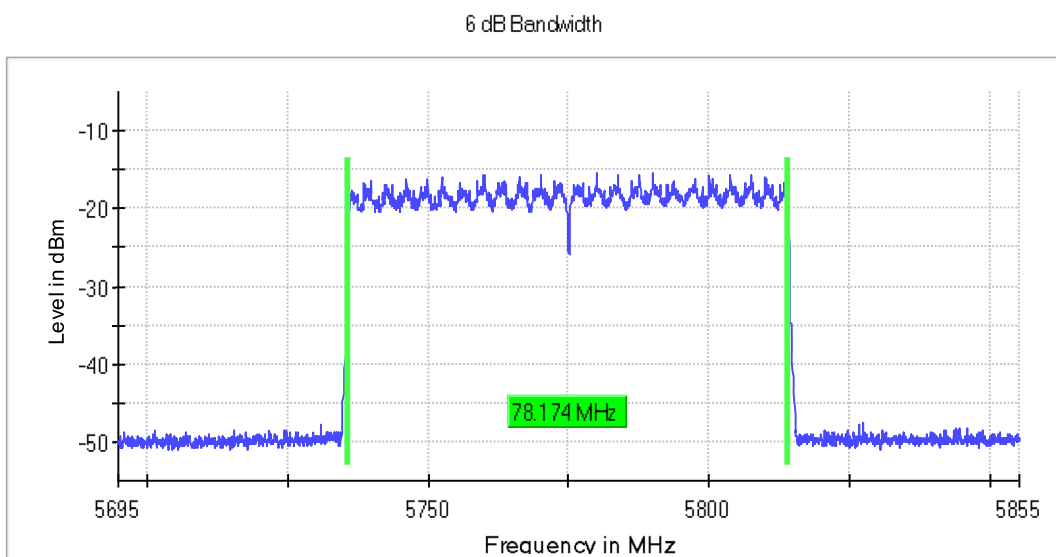
6 dB Bandwidth, low channel HE-TB 40 full RU:



6 dB Bandwidth, high channel HE-TB 40 full RU:



6 dB Bandwidth, middle channel HE-TB 80 full RU:



11. 26 dB bandwidth

Reference: FCC title 47 part 15 §15.407(a)(2), (a)(5), h (2), ISED RSS-247, Issue 3 (section 6.2)

Test method: 26 dB Bandwidth: KDB 789033 C.1 and ANSI C63.10-2013 (11.8.1 Option 1)

Occupied bandwidth (99% BW): ANSI C63.10-2013, Section 6.9.3

Test procedure
<ol style="list-style-type: none"> 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 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%.

Summary:

Mode / modulation	DUT Frequency (MHz)	Result
U-NII-1, 802.11a, ch36, 20 MHz, 24 Mbps	5180.000000	PASS
U-NII-1, 802.11a, ch44, 20 MHz, 24 Mbps	5220.000000	PASS
U-NII-1, 802.11a, ch48, 20 MHz, 24 Mbps	5240.000000	PASS
U-NII-1, 802.11n, ch36, 20 MHz, MCS1	5180.000000	PASS
U-NII-1, 802.11n, ch44, 20 MHz, MCS1	5220.000000	PASS
U-NII-1, 802.11n, ch48, 20 MHz, MCS1	5240.000000	PASS
U-NII-1, 802.11n, ch38, 40 MHz, MCS0	5190.000000	PASS
U-NII-1, 802.11n, ch46, 40 MHz, MCS0	5230.000000	PASS
U-NII-1, 802.11ac, ch36, 20 MHz, MCS2	5180.000000	PASS
U-NII-1, 802.11ac, ch44, 20 MHz, MCS2	5220.000000	PASS
U-NII-1, 802.11ac, ch48, 20 MHz, MCS2	5240.000000	PASS
U-NII-1, 802.11ac, ch38, 40 MHz, MCS5	5190.000000	PASS
U-NII-1, 802.11ac, ch46, 40 MHz, MCS5	5230.000000	PASS
U-NII-1, 802.11ac, ch42, 80 MHz, MCS0	5210.000000	PASS
U-NII-1, 802.11ax HE-SU, ch36, 20 MHz, MCS2	5180.000000	PASS
U-NII-1, 802.11ax HE-SU, ch44, 20 MHz, MCS2	5220.000000	PASS
U-NII-1, 802.11ax HE-SU, ch48, 20 MHz, MCS2	5240.000000	PASS
U-NII-1, 802.11ax HE-SU, ch38, 40 MHz, MCS1	5190.000000	PASS
U-NII-1, 802.11ax HE-SU, ch46, 40 MHz, MCS1	5230.000000	PASS
U-NII-1, 802.11ax HE-SU, ch42, 80 MHz, MCS0	5210.000000	PASS
U-NII-1, 802.11ax HE-TB Full RU, ch36, 20 MHz, MCS0	5180.000000	PASS
U-NII-1, 802.11ax HE-TB Full RU, ch44, 20 MHz, MCS0	5220.000000	PASS
U-NII-1, 802.11ax HE-TB Full RU, ch48, 20 MHz, MCS0	5240.000000	PASS
U-NII-1, 802.11ax HE-TB Full RU, ch38, 40 MHz, MCS0	5190.000000	PASS
U-NII-1, 802.11ax HE-TB Full RU, ch46, 40 MHz, MCS0	5230.000000	PASS
U-NII-1, 802.11ax HE-TB Full RU, ch42, 80 MHz, MCS0	5210.000000	PASS

Mode / modulation	DUT Frequency (MHz)	Result
U-NII-2A, 802.11a, ch52, 20 MHz, 6 Mbps	5260.000000	PASS
U-NII-2A, 802.11a, ch56, 20 MHz, 6 Mbps	5280.000000	PASS
U-NII-2A, 802.11a, ch64, 20 MHz, 6 Mbps	5320.000000	PASS
U-NII-2A, 802.11n, ch52, 20 MHz, MCS4	5260.000000	PASS
U-NII-2A, 802.11n, ch56, 20 MHz, MCS4	5280.000000	PASS
U-NII-2A, 802.11n, ch64, 20 MHz, MCS4	5320.000000	PASS
U-NII-2A, 802.11n, ch54, 40 MHz, MCS4	5270.000000	PASS
U-NII-2A, 802.11n, ch62, 40 MHz, MCS4	5310.000000	PASS
U-NII-2A, 802.11ac, ch52, 20 MHz, MCS0	5260.000000	PASS
U-NII-2A, 802.11ac, ch56, 20 MHz, MCS0	5280.000000	PASS
U-NII-2A, 802.11ac, ch64, 20 MHz, MCS0	5320.000000	PASS
U-NII-2A, 802.11ac, ch54, 40 MHz, MCS1	5270.000000	PASS
U-NII-2A, 802.11ac, ch62, 40 MHz, MCS1	5310.000000	PASS
U-NII-2A, 802.11ac, ch58, 80 MHz, MCS0	5290.000000	PASS
U-NII-2A, 802.11ax HE-SU, ch52, 20 MHz, MCS0	5260.000000	PASS
U-NII-2A, 802.11ax HE-SU, ch56, 20 MHz, MCS0	5280.000000	PASS
U-NII-2A, 802.11ax HE-SU, ch64, 20 MHz, MCS0	5320.000000	PASS
U-NII-2A, 802.11ax HE-SU, ch54, 40 MHz, MCS0	5270.000000	PASS
U-NII-2A, 802.11ax HE-SU, ch62, 40 MHz, MCS0	5310.000000	PASS
U-NII-2A, 802.11ax HE-SU, ch58, 80 MHz, MCS0	5290.000000	PASS
U-NII-2A, 802.11ax HE-TB Full RU, ch52, 20 MHz, MCS0	5260.000000	PASS
U-NII-2A, 802.11ax HE-TB Full RU, ch56, 20 MHz, MCS0	5280.000000	PASS
U-NII-2A, 802.11ax HE-TB Full RU, ch64, 20 MHz, MCS0	5320.000000	PASS
U-NII-2A, 802.11ax HE-TB Full RU, ch54, 40 MHz, MCS0	5270.000000	PASS
U-NII-2A, 802.11ax HE-TB Full RU, ch62, 40 MHz, MCS0	5310.000000	PASS
U-NII-2A, 802.11ax HE-TB Full RU, ch58, 80 MHz, MCS0	5290.000000	PASS

Mode / modulation	DUT Frequency (MHz)	Result
U-NII-2C, 802.11a, ch100, 20 MHz, 6 Mbps	5500.000000	PASS
U-NII-2C, 802.11a, ch120, 20 MHz, 6 Mbps	5600.000000	PASS
U-NII-2C, 802.11a, ch144, 20 MHz, 6 Mbps	5720.000000	PASS
U-NII-2C, 802.11n, ch100, 20 MHz, MCS3	5500.000000	PASS
U-NII-2C, 802.11n, ch120, 20 MHz, MCS3	5600.000000	PASS
U-NII-2C, 802.11n, ch144, 20 MHz, MCS3	5720.000000	PASS
U-NII-2C, 802.11n, ch102, 40 MHz, MCS0	5510.000000	PASS
U-NII-2C, 802.11n, ch126, 40 MHz, MCS0	5630.000000	PASS
U-NII-2C, 802.11n, ch142, 40 MHz, MCS0	5710.000000	PASS
U-NII-2C, 802.11ac, ch100, 20 MHz, MCS0	5500.000000	PASS
U-NII-2C, 802.11ac, ch120, 20 MHz, MCS0	5600.000000	PASS
U-NII-2C, 802.11ac, ch144, 20 MHz, MCS0	5720.000000	PASS
U-NII-2C, 802.11ac, ch102, 40 MHz, MCS0	5510.000000	PASS
U-NII-2C, 802.11ac, ch126, 40 MHz, MCS0	5630.000000	PASS
U-NII-2C, 802.11n, ch142, 40 MHz, MCS0	5710.000000	PASS
U-NII-2C, 802.11ac, ch106, 80 MHz, MCS0	5530.000000	PASS
U-NII-2C, 802.11ac, ch122, 80 MHz, MCS0	5610.000000	PASS
U-NII-2C, 802.11ac, ch138, 80 MHz, MCS0	5690.000000	PASS
U-NII-2C, 802.11ax HE-SU, ch100, 20 MHz, MCS0	5500.000000	PASS
U-NII-2C, 802.11ax HE-SU, ch120, 20 MHz, MCS0	5600.000000	PASS
U-NII-2C, 802.11ax HE-SU, ch144, 20 MHz, MCS0	5720.000000	PASS
U-NII-2C, 802.11ax HE-SU, ch102, 40 MHz, MCS2	5510.000000	PASS
U-NII-2C, 802.11ax HE-SU, ch126, 40 MHz, MCS2	5630.000000	PASS
U-NII-2C, 802.11ax HE-SU, ch142, 40 MHz, MCS2	5710.000000	PASS
U-NII-2C, 802.11ax HE-SU, ch106, 80 MHz, MCS0	5530.000000	PASS
U-NII-2C, 802.11ax HE-SU, ch122, 80 MHz, MCS0	5610.000000	PASS
U-NII-2C, 802.11ax HE-SU, ch138, 80 MHz, MCS0	5690.000000	PASS
U-NII-2C, 802.11ax HE-TB Full RU, ch100, 20 MHz, MCS0	5500.000000	PASS
U-NII-2C, 802.11ax HE-TB Full RU, ch120, 20 MHz, MCS0	5600.000000	PASS
U-NII-2C, 802.11ax HE-TB Full RU, ch144, 20 MHz, MCS0	5720.000000	PASS
U-NII-2C, 802.11ax HE-TB Full RU, ch102, 40 MHz, MCS0	5510.000000	PASS
U-NII-2C, 802.11ax HE-TB Full RU, ch126, 40 MHz, MCS0	5630.000000	PASS
U-NII-2C, 802.11ax HE-TB Full RU, ch142, 40 MHz, MCS0	5710.000000	PASS
U-NII-2C, 802.11ax HE-TB Full RU, ch106, 80 MHz, MCS0	5530.000000	PASS
U-NII-2C, 802.11ax HE-TB Full RU, ch122, 80 MHz, MCS0	5610.000000	PASS
U-NII-2C, 802.11ax HE-TB Full RU, ch138, 80 MHz, MCS0	5690.000000	PASS

U-NII-1

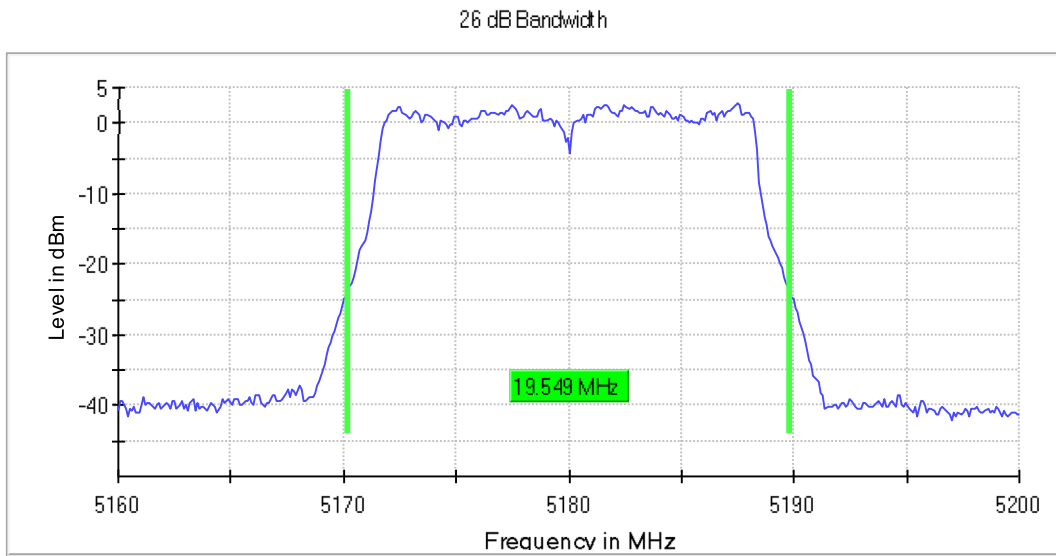
Test results 5150 – 5250 MHz – 26 dB BW

Mode / modulation	Channel	DUT Frequency (MHz)	Nominal Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
OFDM	36	5180	19.548872	---	---	5170.225564	5189.774436	2.8	PASS
OFDM	44	5220	19.649123	---	---	5210.125313	5229.774436	4.9	PASS
OFDM	48	5240	19.649123	---	---	5230.125313	5249.774436	4.5	PASS
HT20	36	5180	20.150376	---	---	5169.924812	5190.075188	1.9	PASS
HT20	44	5220	20.050125	---	---	5209.924812	5229.974937	3.9	PASS
HT20	48	5240	20.050125	---	---	5229.924812	5249.974937	3.5	PASS
HT40	36+40	5190	40.751880	---	---	5169.699248	5210.451128	0.6	PASS
HT40	44+48	5230	40.601504	---	---	5209.699248	5250.300752	1.7	PASS
VHT20	36	5180	20.050125	---	---	5170.025063	5190.075188	2.0	PASS
VHT20	44	5220	20.050125	---	---	5209.924812	5229.974937	4.1	PASS
VHT20	48	5240	20.150376	---	---	5229.924812	5250.075188	3.7	PASS
VHT40	36+40	5190	40.300752	---	---	5169.849624	5210.150376	1.3	PASS
VHT40	44+48	5230	40.451128	---	---	5209.699248	5250.150376	2.5	PASS
VHT80	36+40+44+48	5210	83.761756	---	---	5168.119122	5251.880878	3.2	PASS
HE-SU20	36	5180	20.551378	---	---	5169.724311	5190.275689	3.8	PASS
HE-SU 20	44	5220	20.651629	---	---	5209.624060	5230.275689	5.3	PASS
HE-SU 20	48	5240	20.651629	---	---	5229.624060	5250.275689	4.5	PASS
HE-SU 40	36+40	5190	40.601504	---	---	5169.699248	5210.300752	2.5	PASS
HE-SU 40	44+48	5230	40.751880	---	---	5209.548872	5250.300752	3.3	PASS
HE-SU 80	36+40+44+48	5210	82.758620	---	---	5168.620690	5251.379310	5.5	PASS
HE-TB 20 full RU	36	5180	20.651629	---	---	5169.624060	5190.275689	-1.8	PASS
HE-TB 20 full RU	44	5220	20.651629	---	---	5209.624060	5230.275689	-1.0	PASS
HE-TB 20 full RU	48	5240	21.152882	---	---	5229.122807	5250.275689	-1.1	PASS
HE-TB 40 full RU	36+40	5190	40.902256	---	---	5209.398496	5250.300752	-2.4	PASS
HE-TB 40 full RU	44+48	5230	41.052632	---	---	5169.398496	5210.451128	-3.8	PASS
HE-TB 80 full RU	36+40+44+48	5210	82.758620	---	---	5168.620690	5251.379310	-6.1	PASS

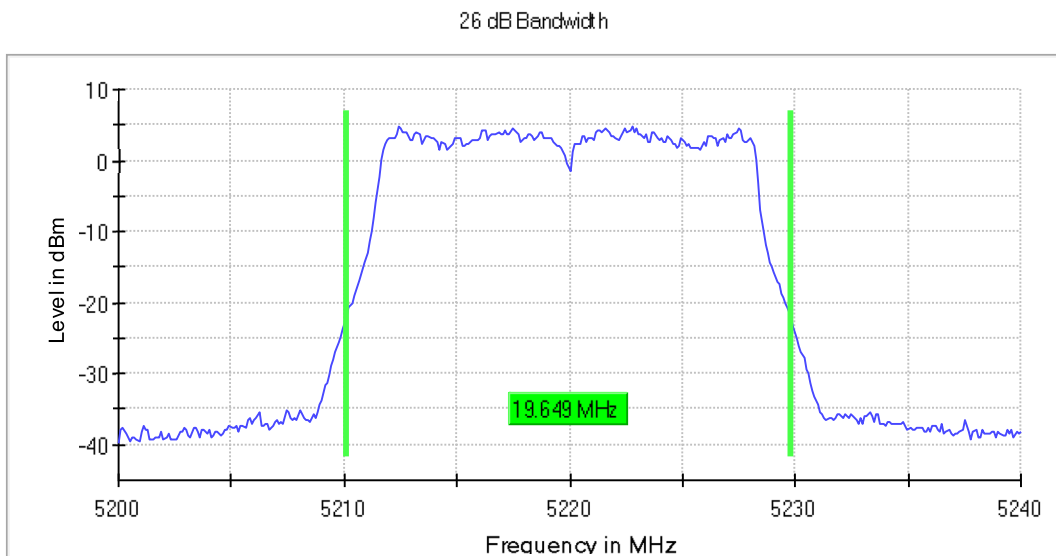
Test results 5150 – 5250 MHz – Occupied Channel Bandwidth 99%

Mode / modulation	DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
U-NII-1, 802.11a, ch48, 20 MHz, 24 Mbps	5240.000000	16.641604	---	---	5231.629073	5248.270677	PASS
U-NII-1, 802.11n, ch48, 20 MHz, MCS1	5240.000000	17.744360	---	---	5231.127820	5248.872180	PASS
U-NII-1, 802.11n, ch46, 40 MHz, MCS0	5230.000000	36.363636	---	---	5211.818182	5248.181818	PASS
U-NII-1, 802.11ac, ch48, 20 MHz, MCS2	5240.000000	17.644110	---	---	5231.127820	5248.771930	PASS
U-NII-1, 802.11ac, ch46, 40 MHz, MCS5	5230.000000	36.363636	---	---	5211.818182	5248.181818	PASS
U-NII-1, 802.11ac, ch42, 80 MHz, MCS0	5210.000000	77.241379	---	---	5171.630094	5248.871473	PASS
U-NII-1, 802.11ax HE-SU, ch48, 20 MHz, MCS2	5240.000000	18.847118	---	---	5230.526316	5249.373434	PASS
U-NII-1, 802.11ax HE-SU, ch46, 40 MHz, MCS1	5230.000000	37.868338	---	---	5211.065831	5248.934169	PASS
U-NII-1, 802.11ax HE-SU, ch42, 80 MHz, MCS0	5210.000000	77.742946	---	---	5171.128527	5248.871473	PASS
U-NII-1, 802.11ax HE-TB Full RU, ch48, 20 MHz, MCS0	5240.000000	19.448622	---	---	5229.924812	5249.373434	PASS
U-NII-1, 802.11ax HE-TB Full RU, ch46, 40 MHz, MCS0	5230.000000	37.868338	---	---	5211.065831	5248.934169	PASS
U-NII-1, 802.11ax HE-TB Full RU, ch42, 80 MHz, MCS0	5210.000000	77.742946	---	---	5171.128527	5248.871473	PASS

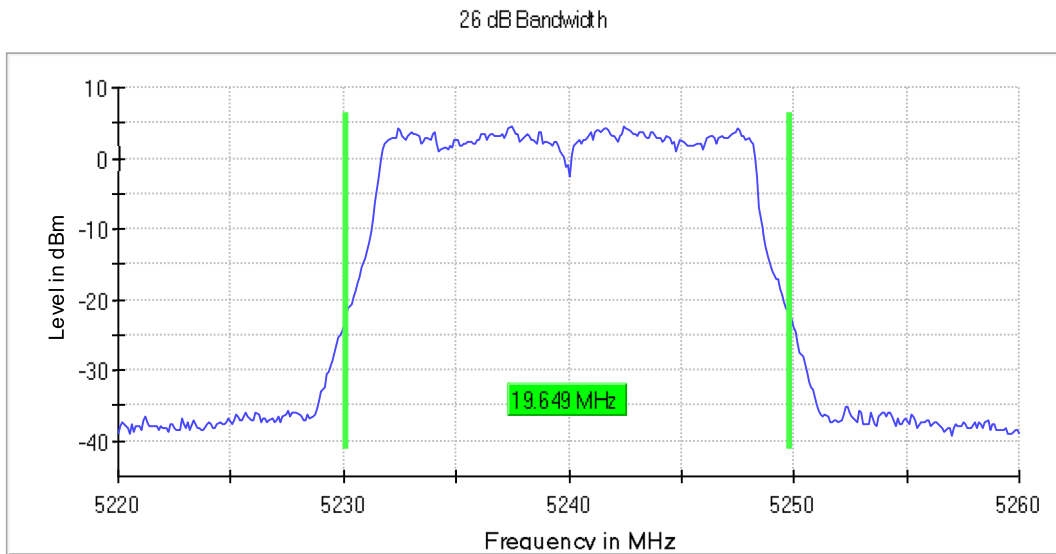
26 dB Bandwidth, low channel OFDM:



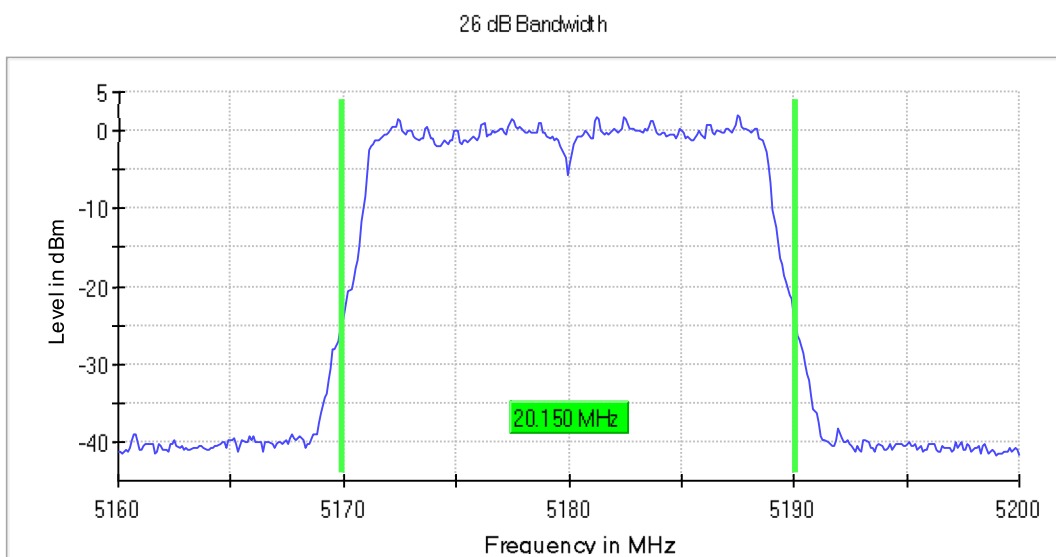
26 dB Bandwidth, middle channel OFDM:



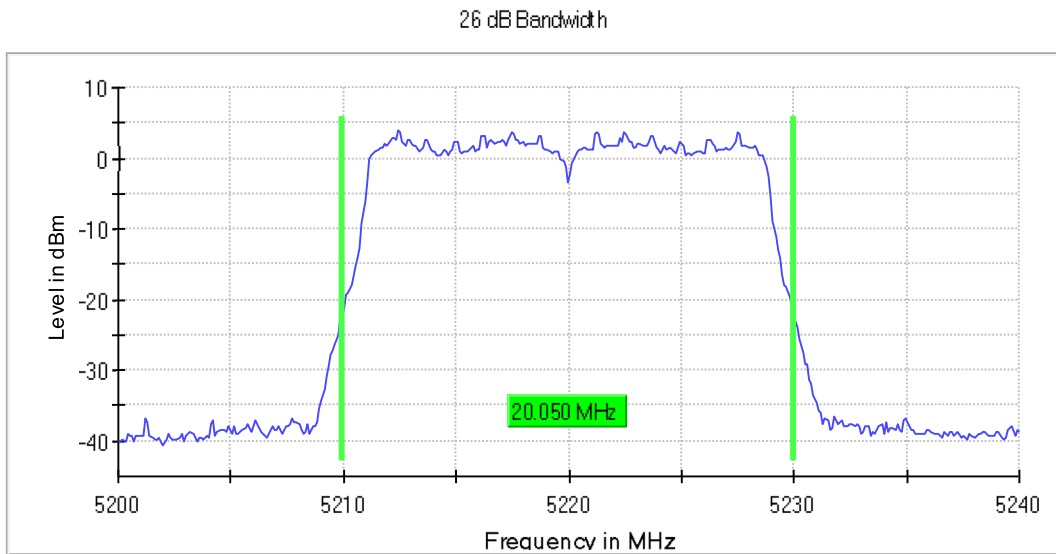
26 dB Bandwidth, high channel OFDM:



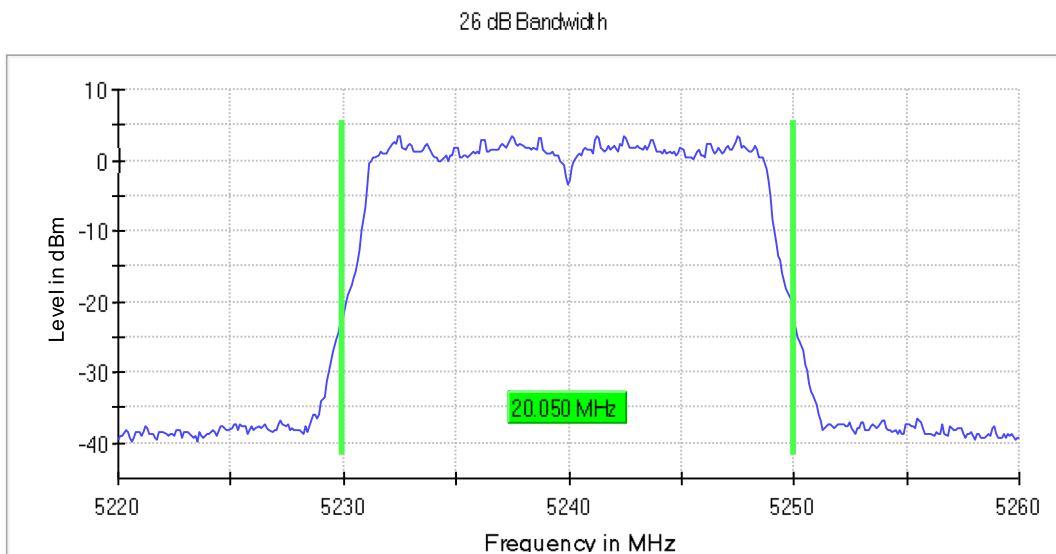
26 dB Bandwidth, low channel HT20:



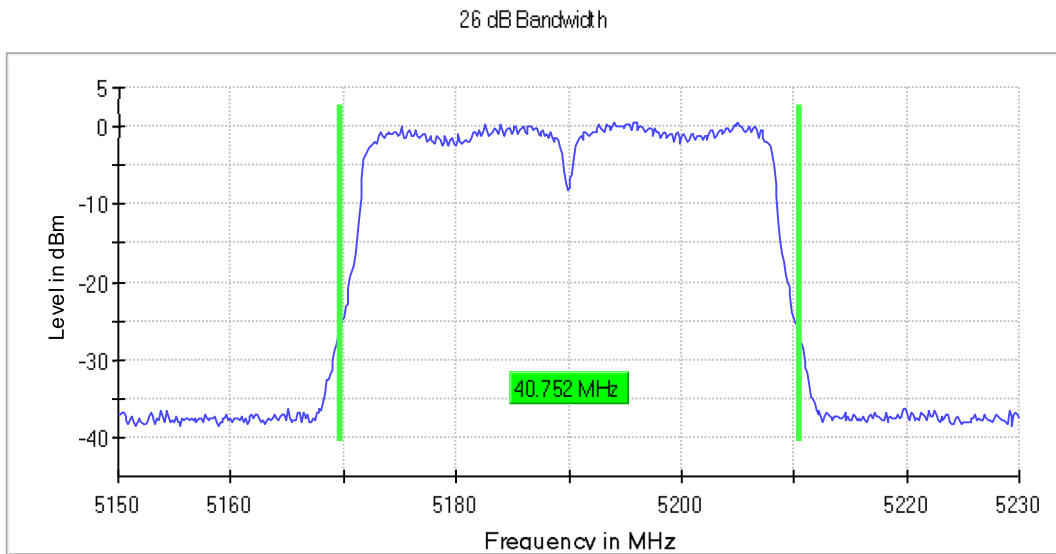
26 dB Bandwidth, middle channel HT20:



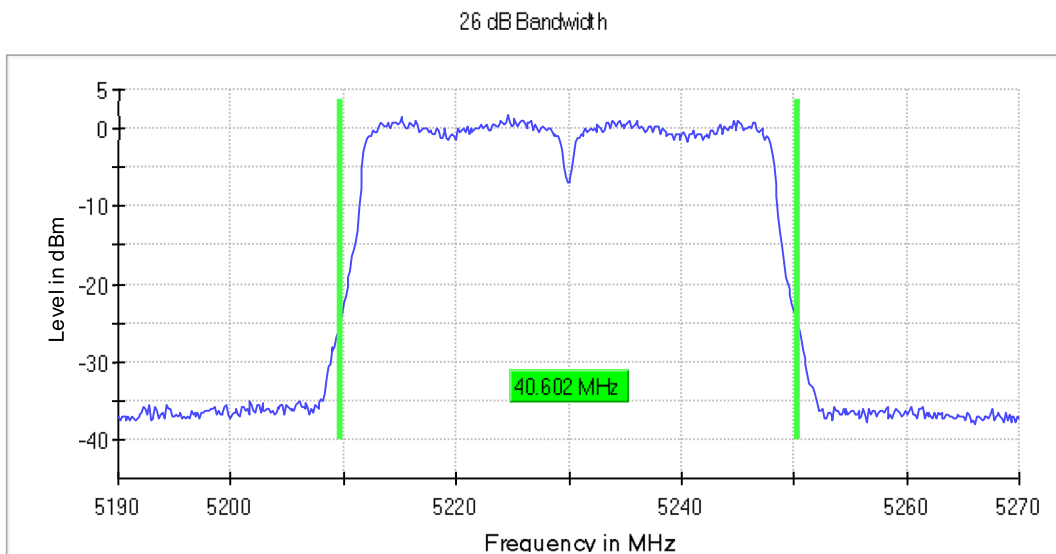
26 dB Bandwidth, high channel HT20:



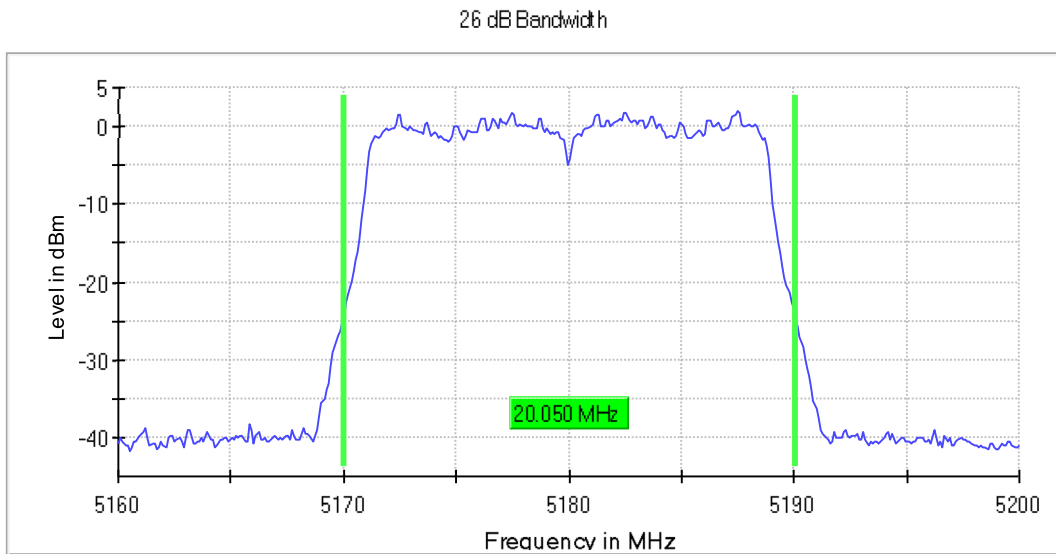
26 dB Bandwidth, low channel HT40:



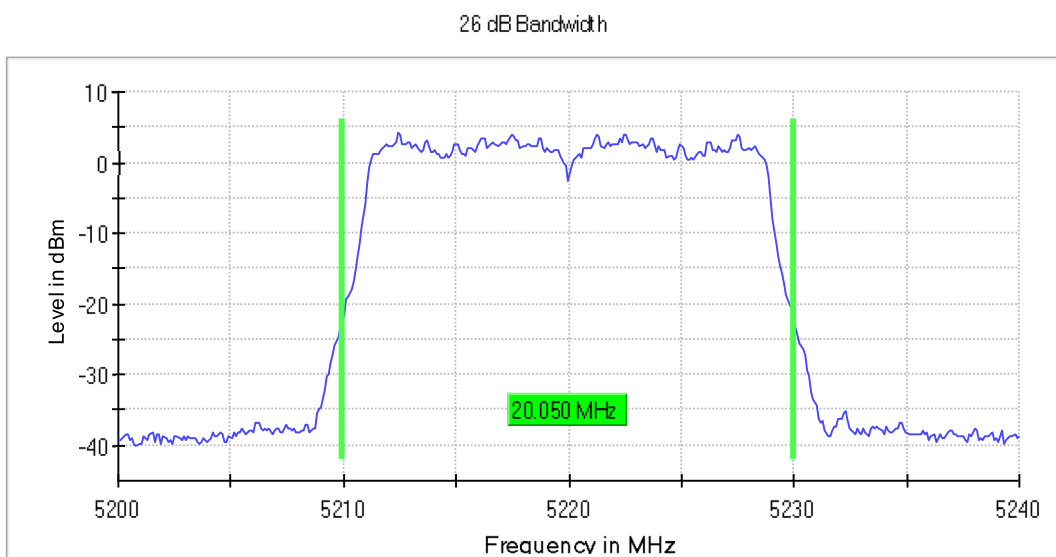
26 dB Bandwidth, high channel HT40:



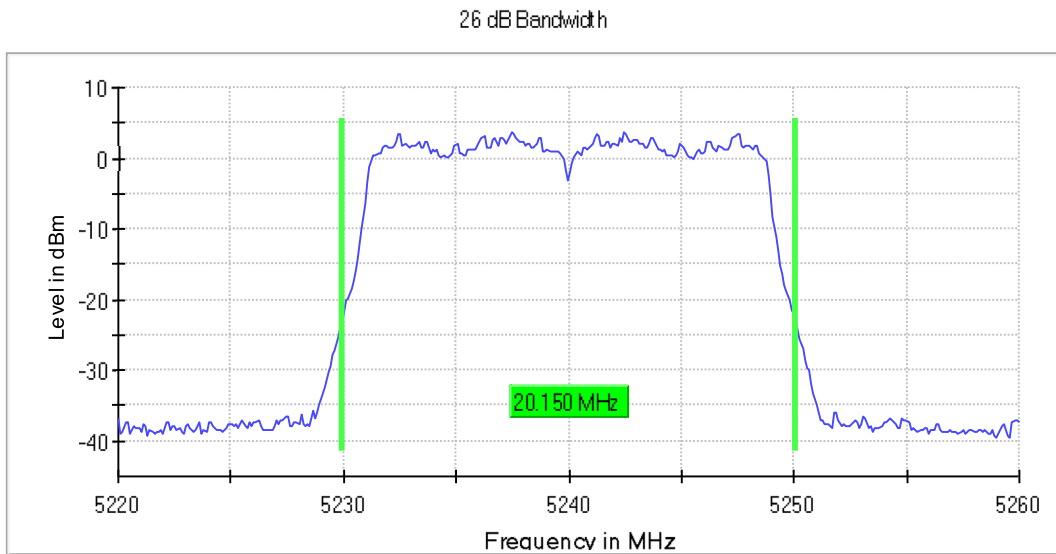
26 dB Bandwidth, low channel VHT20:



26 dB Bandwidth, middle channel VHT20:

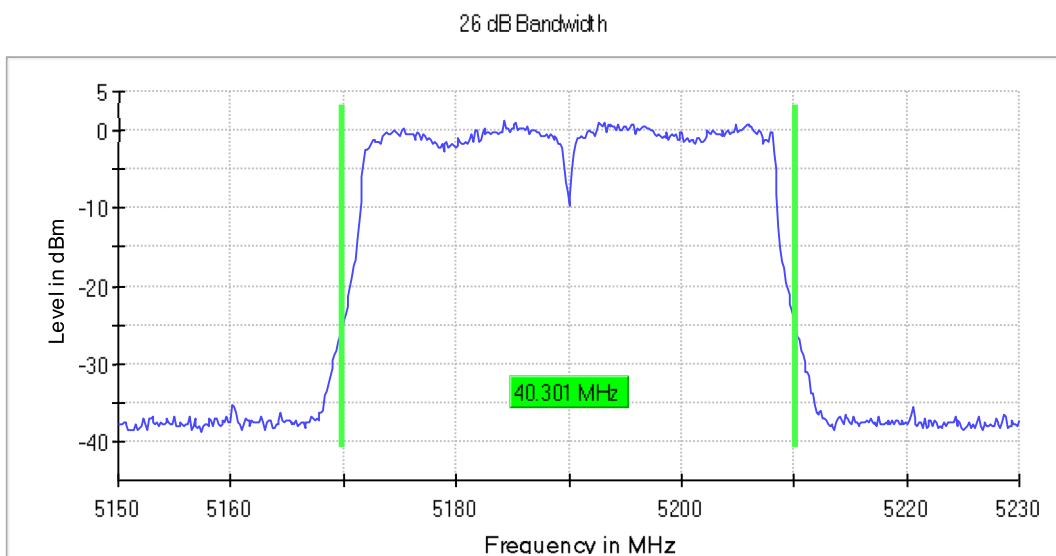


26 dB Bandwidth, high channel VHT20:

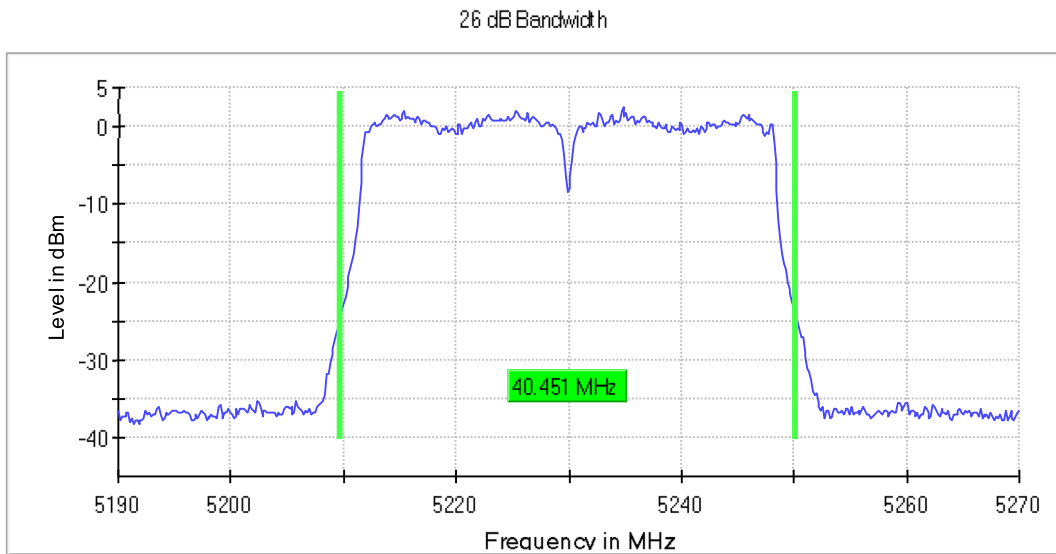


26 dB Bandwidth,

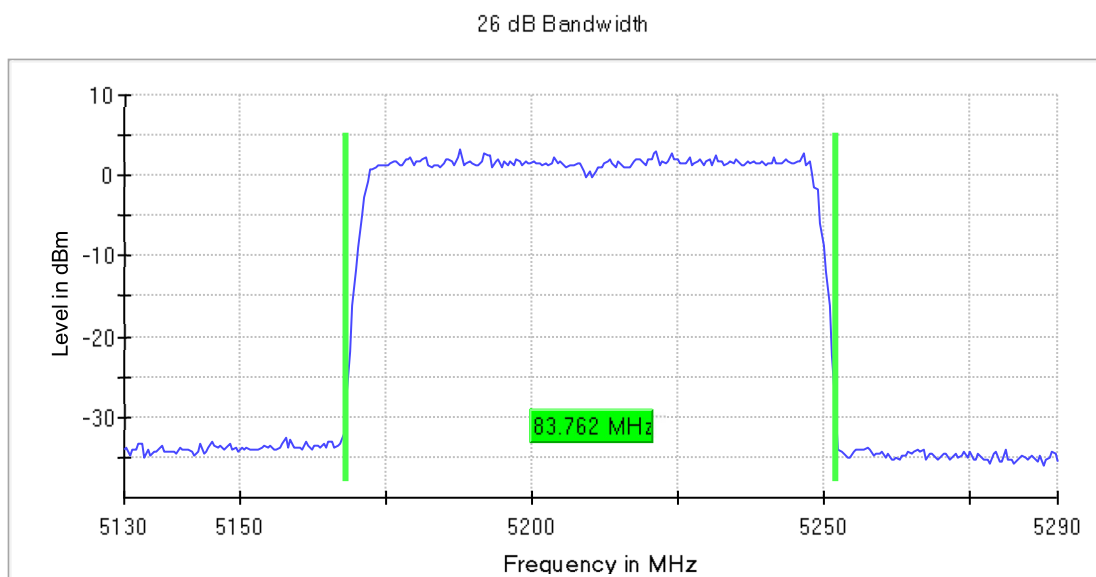
26 dB Bandwidth, low channel VHT40:



26 dB Bandwidth, high channel VHT40:

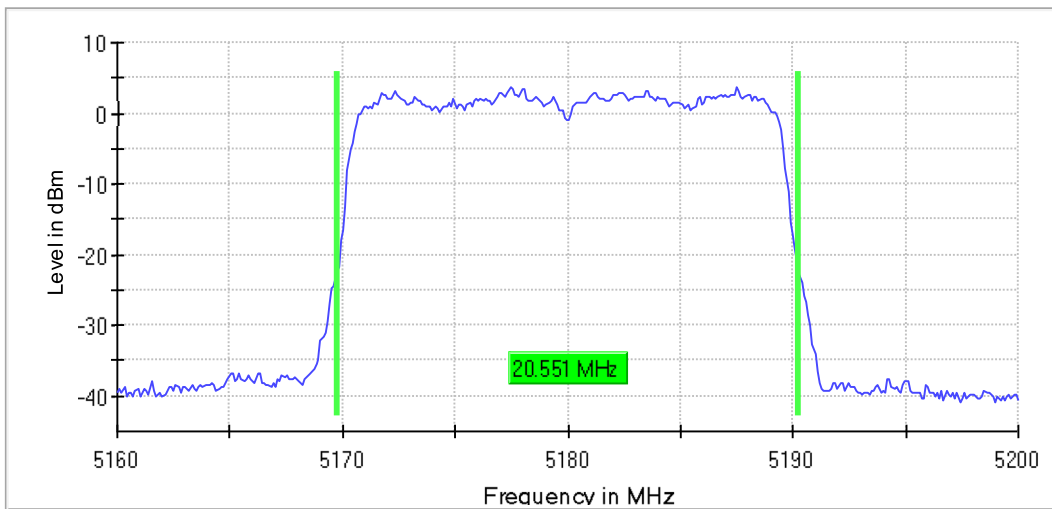


26 dB Bandwidth, middle channel VHT80:



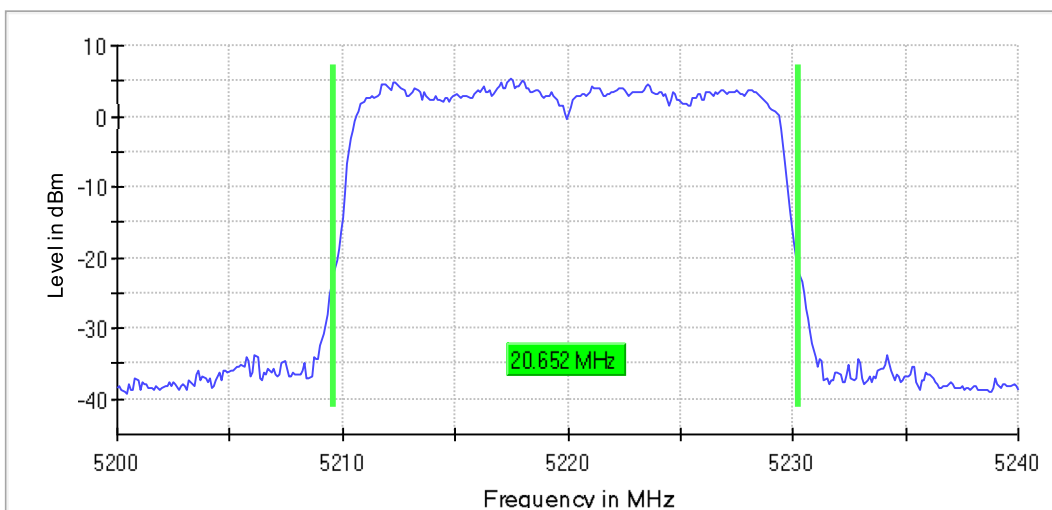
26 dB Bandwidth, low channel HE-SU20:

26 dB Bandwidth



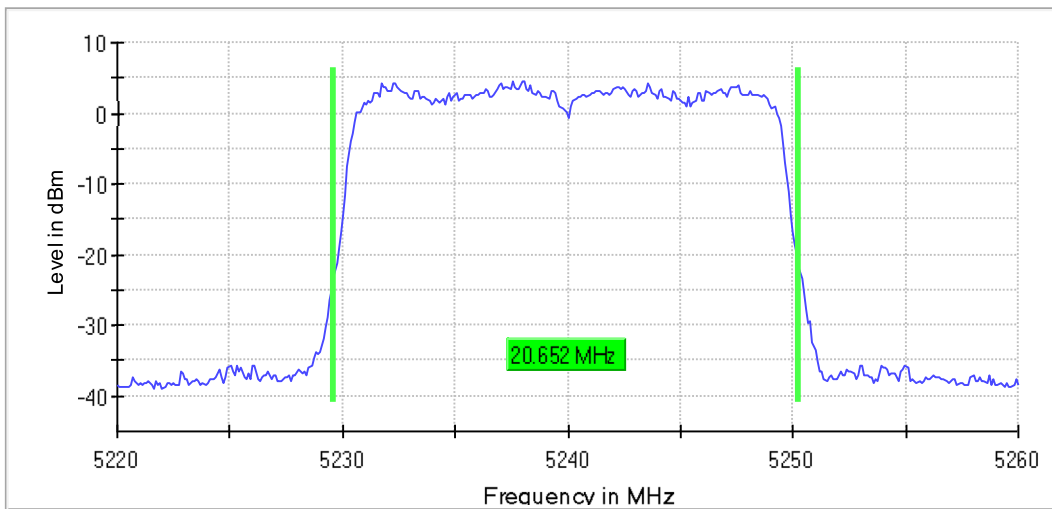
26 dB Bandwidth, middle channel HE-SU20:

26 dB Bandwidth



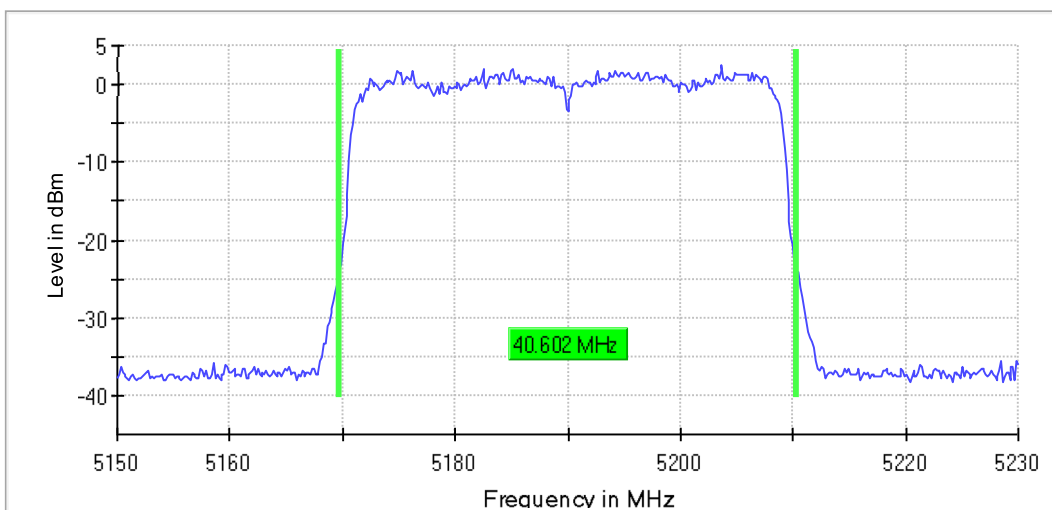
26 dB Bandwidth, high channel HE-SU20:

26 dB Bandwidth



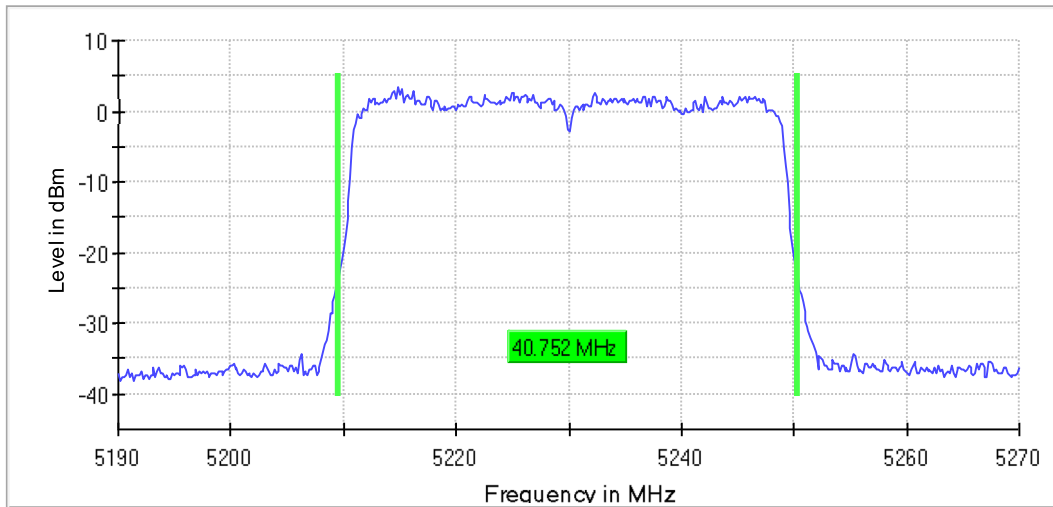
26 dB Bandwidth, low channel HE-SU40:

26 dB Bandwidth



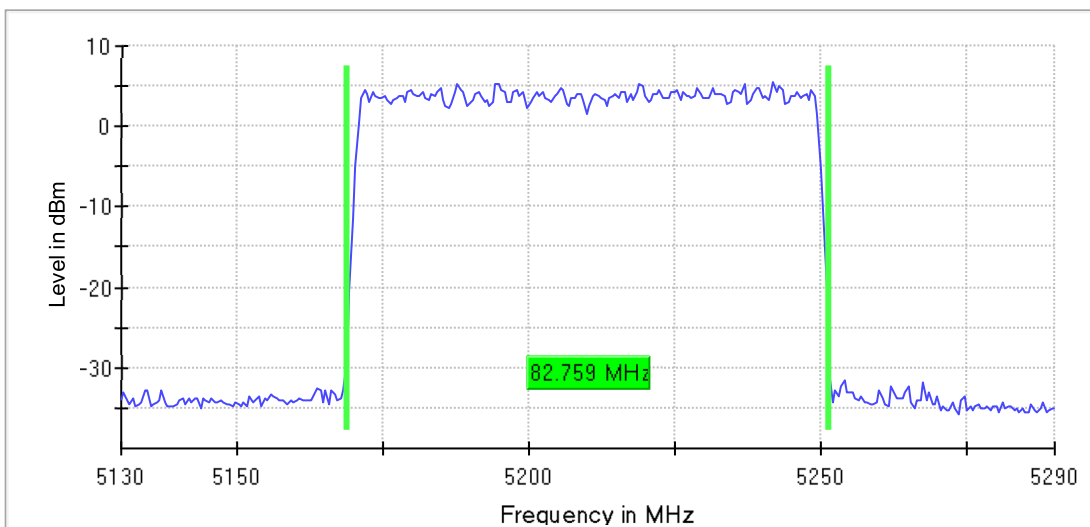
26 dB Bandwidth, high channel HE-SU40:

26 dB Bandwidth

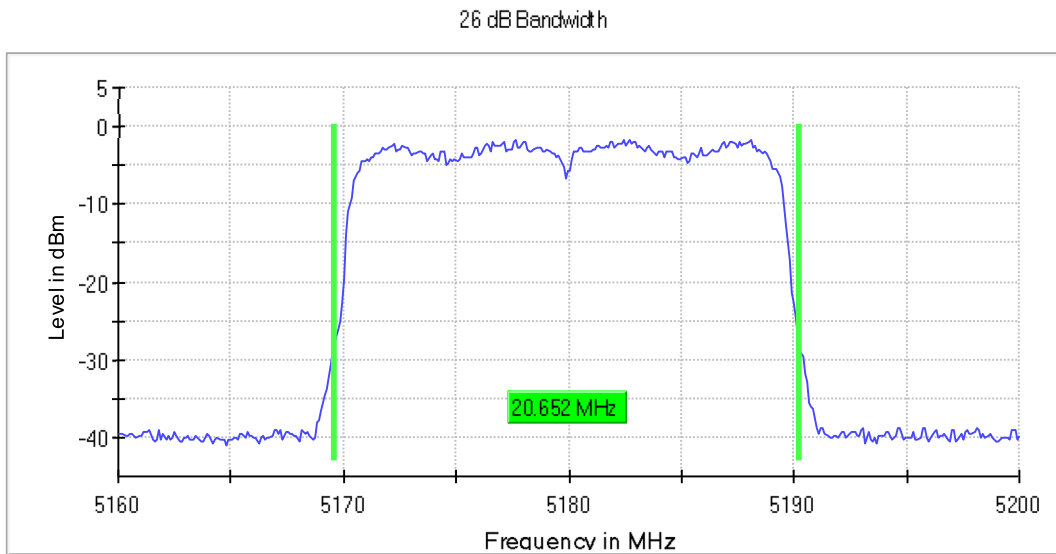


26 dB Bandwidth, high channel HE-SU80:

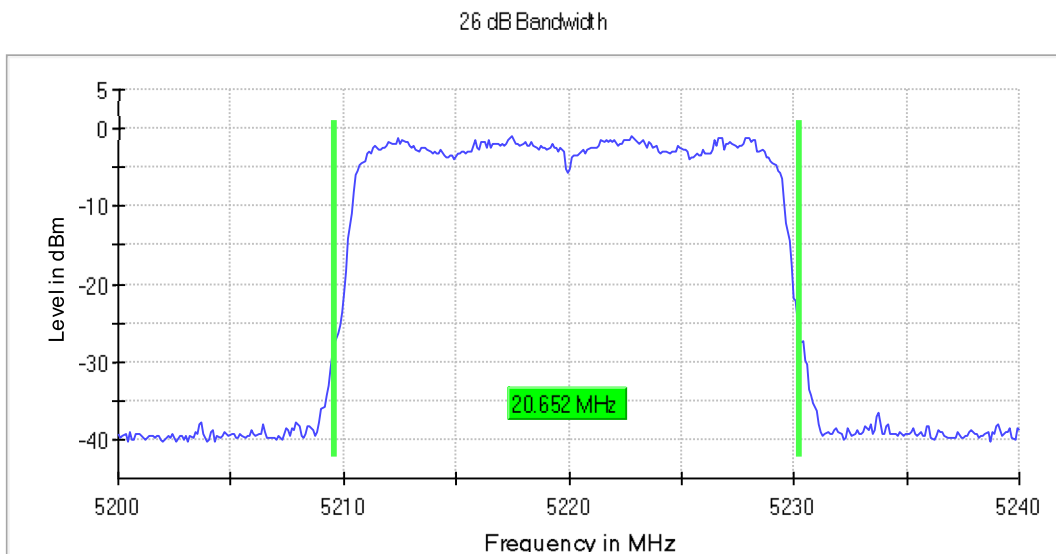
26 dB Bandwidth



26 dB Bandwidth, low channel HE-TB20 full RU:

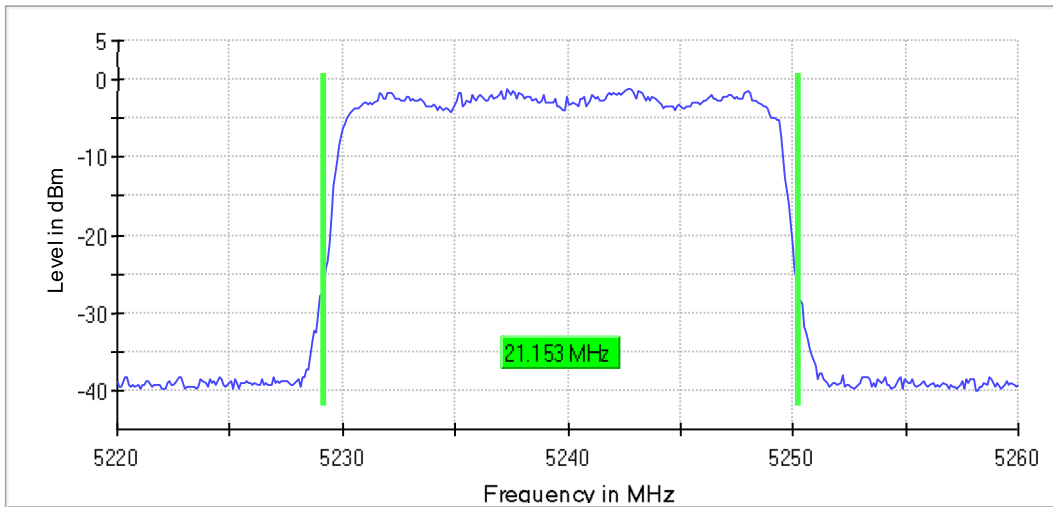


26 dB Bandwidth, middle channel HE-TB20 full RU:



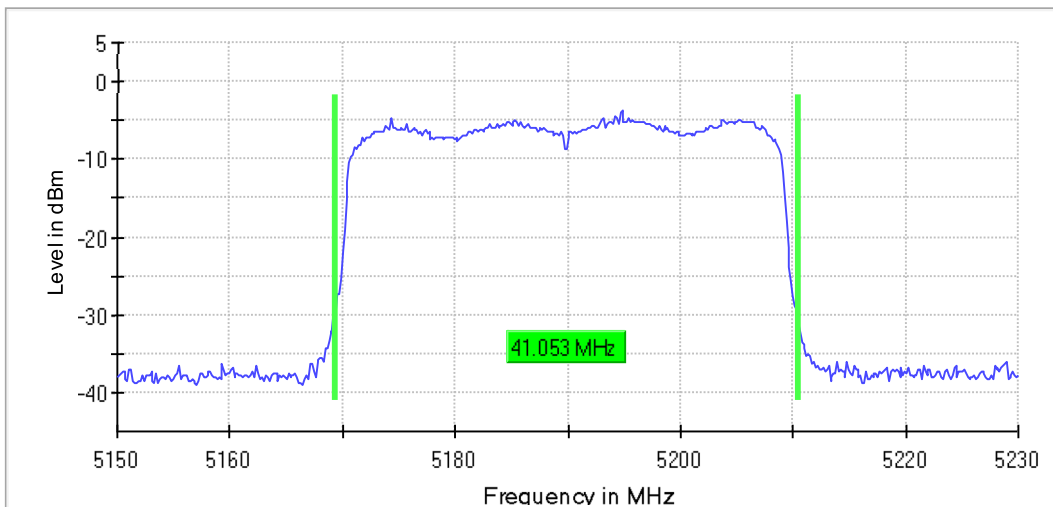
26 dB Bandwidth, high channel HE-TB20 full RU:

26 dB Bandwidth



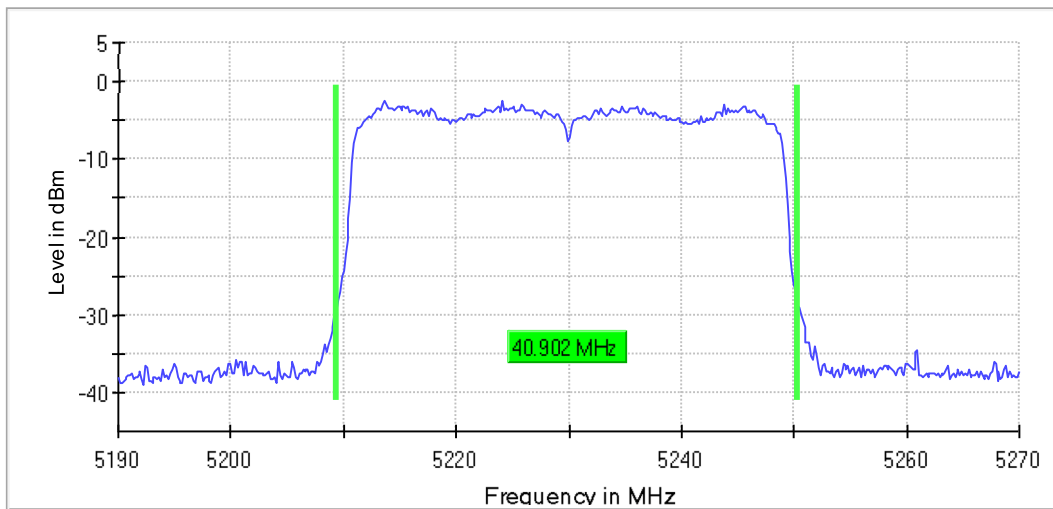
26 dB Bandwidth, low channel HE-TB40 full RU:

26 dB Bandwidth



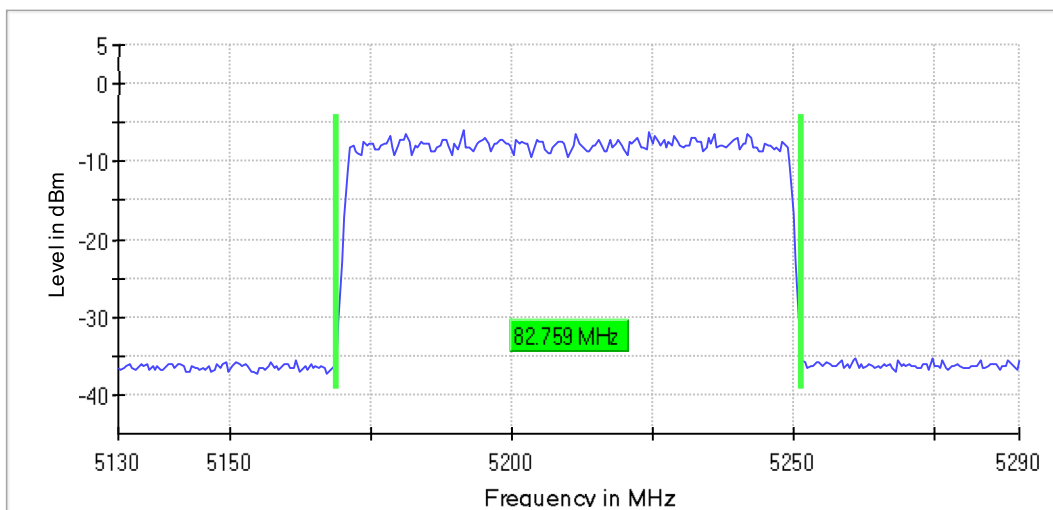
26 dB Bandwidth, high channel HE-TB40 full RU:

26 dB Bandwidth



26 dB Bandwidth, middle channel HE-TB80 full RU:

26 dB Bandwidth

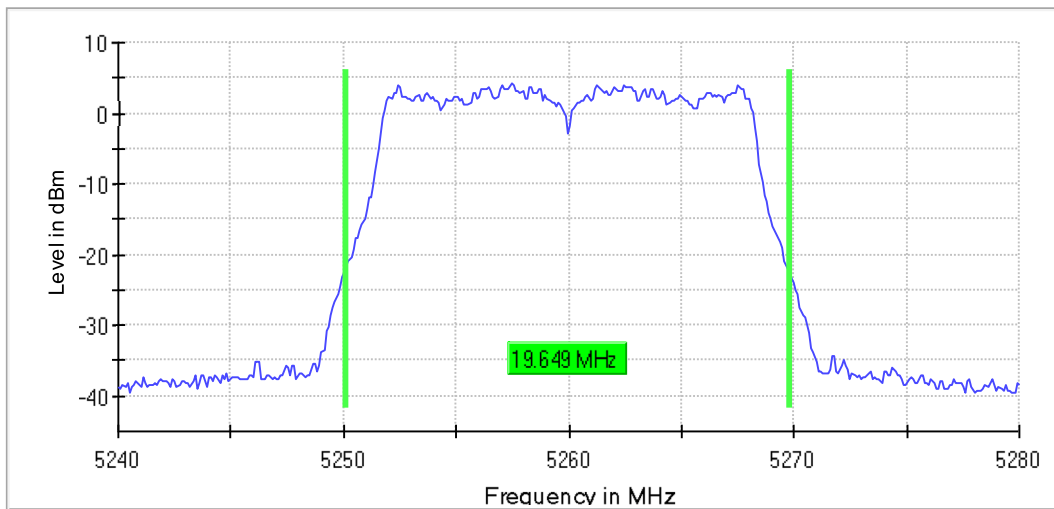


U-NII-2A

Mode / modulation	Channel	DUT Frequency (MHz)	Nominal Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
OFDM	52	5260.000000	19.649123	---	---	5250.125313	5269.774436	4.3	PASS
OFDM	56	5280.000000	20.150376	---	---	5269.924812	5290.075188	3.7	PASS
OFDM	62	5320.000000	20.751879	---	---	5309.523810	5330.275689	3.8	PASS
HT20	52	5260.000000	20.050125	---	---	5249.924812	5269.974937	3.5	PASS
HT20	56	5280.000000	20.150376	---	---	5269.824561	5289.974937	3.8	PASS
HT20	62	5320.000000	20.050125	---	---	5309.924812	5329.974937	2.7	PASS
HT40	52+56	5270.000000	40.000000	---	---	5250.000000	5290.000000	1.5	PASS
HT40	60+64	5310.000000	40.300752	---	---	5289.699248	5330.000000	-0.4	PASS
VHT20	52	5260.000000	20.150376	---	---	5249.824561	5269.974937	3.5	PASS
VHT20	56	5280.000000	20.150376	---	---	5269.924812	5290.075188	3.7	PASS
VHT20	62	5320.000000	20.250627	---	---	5309.824561	5330.075188	2.7	PASS
VHT40	52+56	5270.000000	40.000000	---	---	5250.000000	5290.000000	1.2	PASS
VHT40	60+64	5310.000000	40.451128	---	---	5289.699248	5330.150376	-0.9	PASS
VHT80	52+56+60+64	5290.000000	83.761756	---	---	5248.119122	5331.880878	1.9	PASS
HE-SU20	52	5260.000000	20.651629	---	---	5249.624060	5270.275689	4.8	PASS
HE-SU 20	56	5280.000000	20.651629	---	---	5269.624060	5290.275689	5.6	PASS
HE-SU 20	62	5320.000000	20.751879	---	---	5309.523810	5330.275689	3.8	PASS
HE-SU 40	52+56	5270.000000	40.601504	---	---	5249.699248	5290.300752	2.7	PASS
HE-SU 40	60+64	5310.000000	40.751880	---	---	5289.548872	5330.300752	1.4	PASS
HE-SU 80	52+56+60+64	5775.000000	78.224445	---	---	5735.862770	5814.087215	-2.8	PASS
HE-TB 20 full RU	52	5260.000000	20.751880	---	---	5249.624060	5270.375940	-0.7	PASS
HE-TB 20 full RU	56	5280.000000	20.751880	---	---	5269.624060	5290.375940	-0.8	PASS
HE-TB 20 full RU	62	5320.000000	20.651629	---	---	5309.624060	5330.275689	-1.0	PASS
HE-TB 40 full RU	52+56	5270.000000	41.203008	---	---	5249.398496	5290.601504	-3.2	PASS
HE-TB 40 full RU	60+64	5310.000000	41.052632	---	---	5289.398496	5330.451128	-4.0	PASS
HE-TB 80 full RU	52+56+60+64	5290.000000	82.257053	---	---	5249.122257	5331.379310	-5.5	PASS

26 dB Bandwidth, low channel OFDM

26 dB Bandwidth



26 dB Bandwidth, middle channel OFDM

26 dB Bandwidth

