



# FCC PART 15C TEST REPORT No. I21Z61156-IOT01

for

**TCL Communication Ltd.**

**LINKHUB**

**HH42NK1**

**FCC ID : 2ACCJB160**

with

**Hardware Version: V02**

**Software Version: HH42LITENK1\_00\_02.00\_02**

**Issued Date: 2021-06-25**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

**Test Laboratory:**

**CTTL-Telecommunication Technology Labs, CAICT**

No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191.

Tel:+86(0)10-62304633-2512, Fax:+86(0)10-62304633-2504

Email: [ctl\\_terminals@caict.ac.cn](mailto:ctl_terminals@caict.ac.cn), website: [www.caict.ac.cn](http://www.caict.ac.cn)



## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
I21Z61156-IOT01	Rev.0	1st edition	2021-06-25
I21Z61156-IOT01	Rev.1	Add KDB-662911 D01 description P.8	2021-07-05

## **CONTENTS**

<b>1. TEST LABORATORY .....</b>	<b>5</b>
1.1. INTRODUCTION & ACCREDITATION .....	5
1.2. TESTING LOCATION .....	5
1.3. TESTING ENVIRONMENT.....	5
1.4. PROJECT DATE .....	5
1.5. SIGNATURE.....	5
<b>2. CLIENT INFORMATION.....</b>	<b>6</b>
2.1. APPLICANT INFORMATION .....	6
2.2. MANUFACTURER INFORMATION .....	6
<b>3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE) .....</b>	<b>7</b>
3.1. ABOUT EUT .....	7
3.2. INTERNAL IDENTIFICATION OF EUT .....	7
3.3. INTERNAL IDENTIFICATION OF AE.....	7
3.4. GENERAL DESCRIPTION.....	7
3.5. INTERPRETATION OF THE TEST ENVIRONMENT.....	7
<b>4. REFERENCE DOCUMENTS .....</b>	<b>8</b>
4.1. DOCUMENTS SUPPLIED BY APPLICANT .....	8
4.2. REFERENCE DOCUMENTS FOR TESTING.....	8
<b>5. TEST RESULTS .....</b>	<b>9</b>
5.1. SUMMARY OF TEST RESULTS .....	9
5.2. STATEMENTS.....	9
5.3. TEST CONDITIONS .....	9
<b>6. TEST FACILITIES UTILIZED .....</b>	<b>10</b>
<b>7. MEASUREMENT UNCERTAINTY .....</b>	<b>11</b>
7.1. MAXIMUM OUTPUT POWER.....	11
7.2. PEAK POWER SPECTRAL DENSITY.....	11
7.3. DTS 6-DB SIGNAL BANDWIDTH.....	11
7.4. BAND EDGES COMPLIANCE.....	11
7.5. TRANSMITTER SPURIOUS EMISSION .....	11
7.6. AC POWER-LINE CONDUCTED EMISSION .....	11
<b>ANNEX A: DETAILED TEST RESULTS.....</b>	<b>12</b>
<b>A.1. MEASUREMENT METHOD.....</b>	<b>12</b>
<b>A.2. MAXIMUM OUTPUT POWER.....</b>	<b>13</b>
A.2.1. PEAK OUTPUT POWER-CONDUCTED .....	13



**A.3. PEAK POWER SPECTRAL DENSITY..... 17**

**A.5. BAND EDGES COMPLIANCE..... 45**

**A.6. TRANSMITTER SPURIOUS EMISSION..... 55**

    A.6.1 TRANSMITTER SPURIOUS EMISSION – CONDUCTED ..... 55

    .6.2 TRANSMITTER SPURIOUS EMISSION - RADIATED..... 95

**A.7. AC POWER-LINE CONDUCTED EMISSION ..... 106**

**ANNEX B: ACCREDITATION CERTIFICATE..... 111**

## 1. Test Laboratory

### 1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2005 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (CN0066). The detail accreditation scope can be found on NVLAP website.

### 1.2. Testing Location

Location 1:CTTL(Huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing,  
P. R. China100191

### 1.3. Testing Environment

Normal Temperature: 15-35°C

Relative Humidity: 20-75%

### 1.4. Project date

Testing Start Date: 2021-06-12

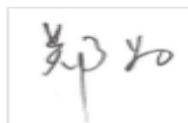
Testing End Date: 2021-06-25

### 1.5. Signature

封爱宇

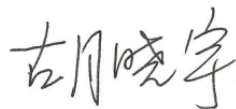
---

**Feng Aiyu**  
(Prepared this test report)



---

**Zheng Wei**  
(Reviewed this test report)



---

**Hu Xiaoyu**  
(Approved this test report)



## 2. Client Information

### 2.1. Applicant Information

Company Name: TCL Communication Ltd.  
Address: 5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong  
City: Hong Kong  
Postal Code: /  
Country: CHINA  
Contact: Gong Zhizhou  
Telephone: 0086-755-36611722  
E-mail: zhizhou.gong@tcl.com

### 2.2. Manufacturer Information

Company Name: TCL Communication Ltd.  
Address: 5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong  
City: Hong Kong  
Postal Code: /  
Country: CHINA  
Contact: Gong Zhizhou  
Telephone: 0086-755-36611722  
E-mail: zhizhou.gong@tcl.com

### 3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

#### 3.1. About EUT

Description	LINKHUB
Model name	HH42NK1
FCC ID	2ACCJB160
With WLAN Function	Yes
Frequency Range	ISM 2400MHz~2483.5MHz
Type of Modulation	DSSS/CCK/OFDM
Number of Channels	11
Antenna	Integral Antenna
MAX Conducted Power	24.37dBm
Power Supply	12V

#### 3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version
UT07a	350969640000131	V02	HH42LITENK1_00_02.00_02
UT02a	350969640000107	V02	HH42LITENK1_00_02.00_02

\*EUT ID: is used to identify the test sample in the lab internally.

#### 3.3. Internal Identification of AE

AE ID*	Description	SN
AE1	Charger	---

AE1

Model	S012CDU1200100
Manufacturer	Tenpao

\*AE ID: is used to identify the test sample in the lab internally.

#### 3.4. General Description

The Equipment under Test (EUT) is a model of CPE with WLAN with integrated antenna and inbuilt battery.

It consists of normal options: travel charger, USB cable.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the client.

#### 3.5. Interpretation of the Test Environment

For the test methods, the test environment uncertainty figures correspond to an expansion factor  $k=2$ .

## Measurement Uncertainty

Parameter	Uncertainty
temperature	0.48°C
humidity	2 %
DC voltages	0.003V

## 4. Reference Documents

### 4.1. Documents supplied by applicant

EUT feature information is supplied by the applicant or manufacturer, which is the basis of testing.

### 4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part15	FCC CFR 47, Part 15, Subpart C: 15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements; 15.247 Operation within the bands 902-928MHz, 2400-2483.5 MHz, and 5725-5850 MHz.	2018
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices Federal Communications Commission Office of Engineering and Technology Laboratory Division GUIDANCE FOR COMPLIANCE MEASUREMENTS ON	2013
KDB 558074 D01	DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES	2019
KDB-662911 D01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g. MIMO Smart Antenna etc)	2013



## 5. Test Results

### 5.1. Summary of Test Results

SUMMARY OF MEASUREMENT RESULTS	Sub-clause of Part15C	Sub-clause of IC	Verdict
Maximum Peak Output Power	15.247 (b)	/	P
Peak Power Spectral Density	15.247 (e)	/	P
Occupied 6dB Bandwidth	15.247 (a)	/	P
Band Edges Compliance	15.247 (d)	/	P
Transmitter Spurious Emission - Conducted	15.247 (d)	/	P
Transmitter Spurious Emission - Radiated	15.247, 15.205, 15.209	/	P
AC Powerline Conducted Emission	15.107, 15.207	/	P

Please refer to **ANNEX A** for detail.

Terms used in Verdict column

P	Pass, The EUT complies with the essential requirements in the standard.
NP	Not Perform, The test was not performed by CTTL
NA	Not Applicable, The test was not applicable
F	Fail, The EUT does not comply with the essential requirements in the standard

### 5.2. Statements

The test cases as listed in section 5.1 of this report for the EUT specified in section 3 was performed by CTTL and according to the standards or reference documents listed in section 4.2. The EUT met all requirements of the standards or reference documents, and only the WLAN function was tested in this report.

### 5.3. Test Conditions

T nom	Normal Temperature
T min	Low Temperature
T max	High Temperature
V nom	Normal Voltage

For this report, if the test cases listed above are tested under normal temperature and normal voltage, and also under norm humidity, the specific condition is shown as follows:

Temperature	T nom	26°C
Voltage	V nom	12V
Humidity	H nom	20-75%

## 6. Test Facilities Utilized

### Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Vector Signal Analyzer	FSQ40	200089	Rohde & Schwarz	1 year	2022-05-15
2	LISN	ENV216	101459	R&S	1 year	2022-04-10
3	Test Receiver	ESCI7	100948	R&S	1 year	2021-07-17
4	Shielding Room	S81	/	ETS-Lindgren	/	/

### Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Test Receiver	ESU26	100235	R&S	1 year	2022-02-23
2	BiLog Antenna	VULB9163	483	Schwarzbeck	1 year	2021-08-27
3	Dual-Ridge Waveguide Horn Antenna	3115	6914	ETS-Lindgren	1 year	2022-02-03
4	Loop Antenna	HFH2-Z2	829324/007	R&S	1 year	2021-12-10
5	EMI Antenna	3116	2661	ETS-Lindgren	1 year	2022-01-05

## 7. Measurement Uncertainty

### 7.1. Maximum Output Power

Measurement Uncertainty: 0.387dB,k=1.96

### 7.2. Peak Power Spectral Density

Measurement Uncertainty: 0.705dB,k=1.96

### 7.3. DTS 6-dB Signal Bandwidth

Measurement Uncertainty: 60.80Hz,k=1.96

### 7.4. Band Edges Compliance

Measurement Uncertainty : 0.62dB,k=1.96

### 7.5. Transmitter Spurious Emission

#### Conducted (k=1.96)

Frequency Range	Uncertainty(dB)
$30\text{MHz} \leq f \leq 2\text{GHz}$	1.22
$2\text{GHz} \leq f \leq 3.6\text{GHz}$	1.22
$3.6\text{GHz} \leq f \leq 8\text{GHz}$	1.22
$8\text{GHz} \leq f \leq 12.75\text{GHz}$	1.51
$12.75\text{GHz} \leq f \leq 26\text{GHz}$	1.51
$26\text{GHz} \leq f \leq 40\text{GHz}$	1.59

#### Radiated (k=2)

Frequency Range	Uncertainty(dB)
9kHz-30MHz	/
$30\text{MHz} \leq f \leq 1\text{GHz}$	5.40
$1\text{GHz} \leq f \leq 18\text{GHz}$	4.32
$18\text{GHz} \leq f \leq 40\text{GHz}$	5.26

### 7.6. AC Power-line Conducted Emission

Measurement Uncertainty : 3.08dB,k=2

## **ANNEX A: Detailed Test Results**

### **A.1. Measurement Method**

#### **A.1.1. Conducted Measurements**

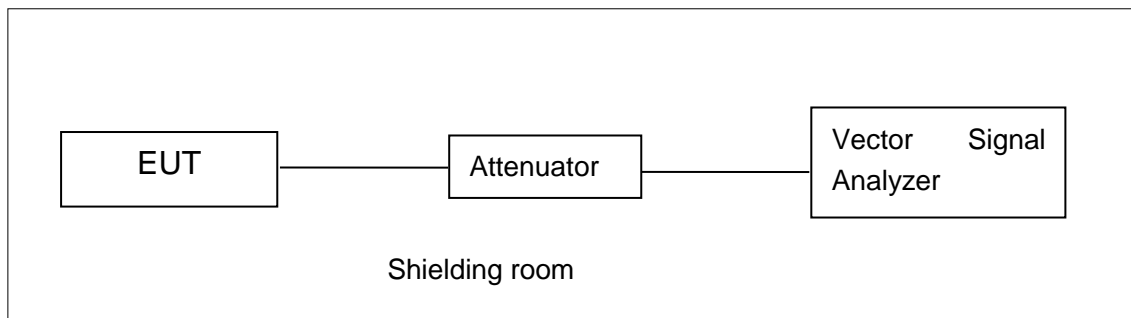
Connect the EUT to the test system as Fig.A.1.1.1 shows.

Set the EUT to the required work mode.

Set the EUT to the required channel.

Set the Vector Signal Analyzer and start measurement.

Record the values. Vector Signal Analyzer



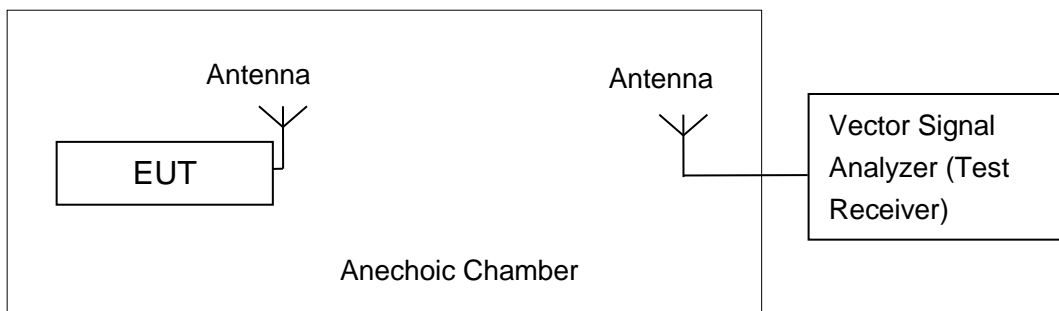
**Fig.A.1.1.1: Test Setup Diagram for Conducted Measurements**

#### **A.1.2. Radiated Emission Measurements**

In the case of radiated emission, the used settings are as follows,

Sweep frequency from 30 MHz to 1GHz, RBW = 100 kHz, VBW = 300 kHz;

Sweep frequency from 1 GHz to 26GHz, RBW = 1MHz, VBW = 10Hz;



**Fig.A.1.2.1: Test Setup Diagram for Radiated Measurements**

## A.2. Maximum Output Power

**Method of Measurement:** See ANSI C63.10-2013-clause 11.9.1.2

- a) Set the RBW = 1 MHz.
- b) Set the VBW = 3 MHz.
- c) Set the span  $\geq [1.5 \times \text{DTS bandwidth}]$ .
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select the peak detector).

**Measurement Limit:**

Standard	Limit (dBm)
FCC CRF Part 15.247(b)	< 30

**EUT ID:** EUT1

### A.2.1. Peak Output Power-conducted

**Measurement Results:**

**802.11b/g mode SISO ANT0:**

Mode	Data Rate (Mbps)	Test Result (dBm)		
		2412MHz (Ch1)	2437MHz (Ch6)	2462 MHz (Ch11)
802.11b	1	20.69	19.89	20.28
	2	/	/	/
	5.5	/	/	/
	11	/	/	/
802.11g	6	23.93	23.18	23.73
	9	/	/	/
	12	/	/	/
	18	/	/	/
	24	/	/	/
	36	/	/	/
	48	/	/	/
	54	/	/	/

**802.11n-HT20 mode SISO ANT0:**

Mode	Data Rate (Index)	Test Result (dBm)		
		2412MHz	2437MHz	2462 MHz

		(Ch1)	(Ch6)	(Ch11)
802.11n (20MHz)	MCS0	23.73	21.49	22.28
	MCS1	/	/	/
	MCS2	/	/	/
	MCS3	/	/	/
	MCS4	/	/	/
	MCS5	/	/	/
	MCS6	/	/	/
	MCS7	/	/	/

The data rate MCS0 are selected as worse condition, and the following cases are performed with this condition.

#### 802.11n-HT40 mode SISO ANT0:

Mode	Data Rate (Index)	Test Result (dBm)		
		2422MHz (Ch3)	2437MHz (Ch6)	2452 MHz (Ch9)
802.11n (40MHz)	MCS0	22.20	21.93	22.23
	MCS1	/	/	/
	MCS2	/	/	/
	MCS3	/	/	/
	MCS4	/	/	/
	MCS5	/	/	/
	MCS6	/	/	/
	MCS7	/	/	/

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

#### 802.11n-HT20 mode SISO ANT1:

Mode	Data Rate (Index)	Test Result (dBm)		
		2412MHz (Ch1)	2437MHz (Ch6)	2462 MHz (Ch11)
802.11n (20MHz)	MCS0	21.35	19.97	23.08
	MCS1	/	/	/
	MCS2	/	/	/
	MCS3	/	/	/
	MCS4	/	/	/
	MCS5	/	/	/
	MCS6	/	/	/
	MCS7	/	/	/

The data rate MCS0 are selected as worse condition, and the following cases are performed with this condition.

**802.11n-HT40 mode SISO ANT1:**

Mode	Data Rate (Index)	Test Result (dBm)		
		2422MHz (Ch3)	2437MHz (Ch6)	2452 MHz (Ch9)
802.11n (40MHz)	MCS0	21.91	18.86	20.95
	MCS1	/	/	/
	MCS2	/	/	/
	MCS3	/	/	/
	MCS4	/	/	/
	MCS5	/	/	/
	MCS6	/	/	/
	MCS7	/	/	/

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

**802.11n-HT20 mode MIMO**

Mode	Data Rate (Index)	Test Result (dBm)					
		2412MHz (Ch1) ANT0/ANT1		2437MHz (Ch6) ANT0/ANT1		2462 MHz (Ch11) ANT0/ANT1	
802.11n (20MHz)	MCS0	21.66	20.51	20.37	20.06	21.11	21.59
	MCS1	/	/	/	/	/	/
	MCS2	/	/	/	/	/	/
	MCS3	/	/	/	/	/	/
	MCS4	/	/	/	/	/	/
	MCS5	/	/	/	/	/	/
	MCS6	/	/	/	/	/	/
	MCS7	/	/	/	/	/	/

**802.11n-HT20 mode MIMO**

Mode	Data Rate (Index)	Test Result (dBm)		
		2412MHz (Ch1)	2437MHz (Ch6)	2462 MHz (Ch11)
802.11n (20MHz)	MCS0	24.14	23.23	24.37
	MCS1	/	/	/
	MCS2	/	/	/
	MCS3	/	/	/
	MCS4	/	/	/
	MCS5	/	/	/

	MCS6	/	/	/
	MCS7	/	/	/

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

#### 802.11n-HT40 mode

Mode	Data Rate (Index)	Test Result (dBm)					
		2422MHz (Ch3) ANT0/ANT1		2437MHz (Ch6) ANT0/ANT1		2452 MHz (Ch9) ANT0/ANT1	
802.11n (40MHz)	MCS0	21.43	21.19	20.65	20.54	21.27	20.17
	MCS1	/	/	/	/	/	/
	MCS2	/	/	/	/	/	/
	MCS3	/	/	/	/	/	/
	MCS4	/	/	/	/	/	/
	MCS5	/	/	/	/	/	/
	MCS6	/	/	/	/	/	/
	MCS7	/	/	/	/	/	/

#### 802.11n-HT40 mode MIMO

Mode	Data Rate (Index)	Test Result (dBm)		
		2422MHz (Ch3)	2437MHz (Ch6)	2452 MHz (Ch9)
802.11n (40MHz)	MCS0	24.32	23.61	23.77
	MCS1	/	/	/
	MCS2	/	/	/
	MCS3	/	/	/
	MCS4	/	/	/
	MCS5	/	/	/
	MCS6	/	/	/
	MCS7	/	/	/

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

Note: The duty cycle of the EUT is 100%.

**Conclusion: Pass**



### A.3. Peak Power Spectral Density

**Method of Measurement: See ANSI C63.10-2013-clause 11.10.2**

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to RBW = 3 kHz.
- d) Set the VBW = 10 kHz.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.

**Measurement Limit:**

Standard	Limit
FCC CRF Part 15.247(e)	< 8 dBm/3 kHz

**Measurement Results:**

**SISO**

Mode	Channel	Power Spectral Density ( dBm/3 kHz )	Power Spectral Density ( dBm/3 kHz )
		ANT0	ANT1
802.11b	1	-13.84	/
	6	-14.33	/
	11	-14.12	/
802.11g	1	-11.52	/
	6	-12.48	/
	11	-11.95	/
802.11n (HT20)	1	-12.50	-13.07
	6	-13.36	-13.99
	11	-13.06	-12.07
802.11n (HT40)	3	-13.38	-12.17
	6	-14.29	-13.83
	9	-12.50	-14.50

**MIMO**

Mode	Channel	Power Spectral Density ( dBm/3 kHz )	Power Spectral Density ( dBm/3 kHz )
		ANT0	ANT1
802.11b	1	/	/
	6	/	/
	11	/	/
802.11g	1	/	/
	6	/	/

	11	/	/
802.11n (HT20)	1	-13.86	-14.44
	6	-14.83	-15.46
	11	-14.44	-13.38
802.11n (HT40)	3	-14.51	-13.64
	6	-15.91	-15.30
	9	-14.13	-16.19

**802.11n-HT20 mode MIMO ANT0+ANT1**

Mode	Channel	Power Spectral Density ( dBm/3 kHz )		Conclusion
		Fig.A.3.1	Fig.A.3.2	
802.11n (HT20)	1	Fig.A.3.1	-11.13	<b>P</b>
	6	Fig.A.3.2	-12.12	<b>P</b>
	11	Fig.A.3.3	-10.86	<b>P</b>

**802.11n-HT40 mode MIMO ANT0+ANT1**

Mode	Channel	Power Spectral Density ( dBm/3 kHz )		Conclusion
		Fig.A.3.4	Fig.A.3.5	
802.11n (HT40)	3	Fig.A.3.4	-11.04	<b>P</b>
	6	Fig.A.3.5	-12.58	<b>P</b>
	9	Fig.A.3.6	-12.02	<b>P</b>

**Conclusion: Pass**

**Test graphs as below:**

SISO ANT0:

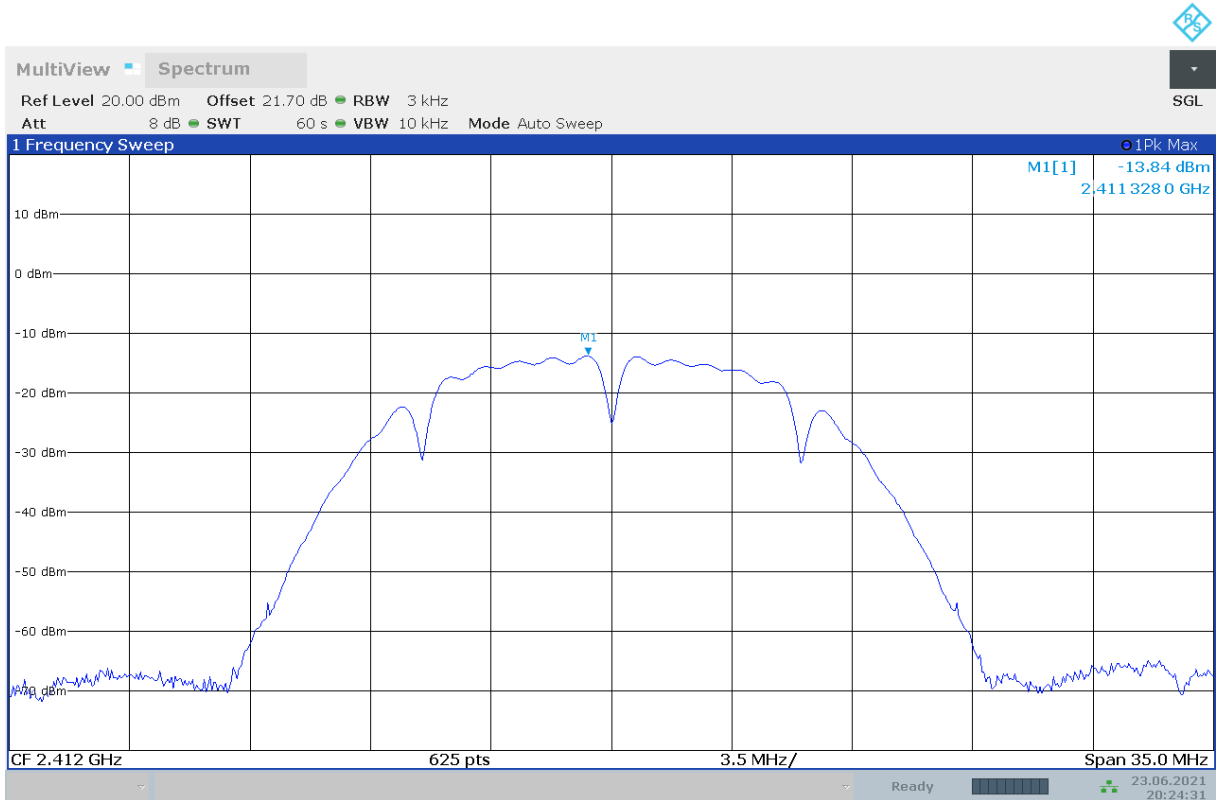


Fig.A.3.1 Power Spectral Density(802.11b,Ch1)

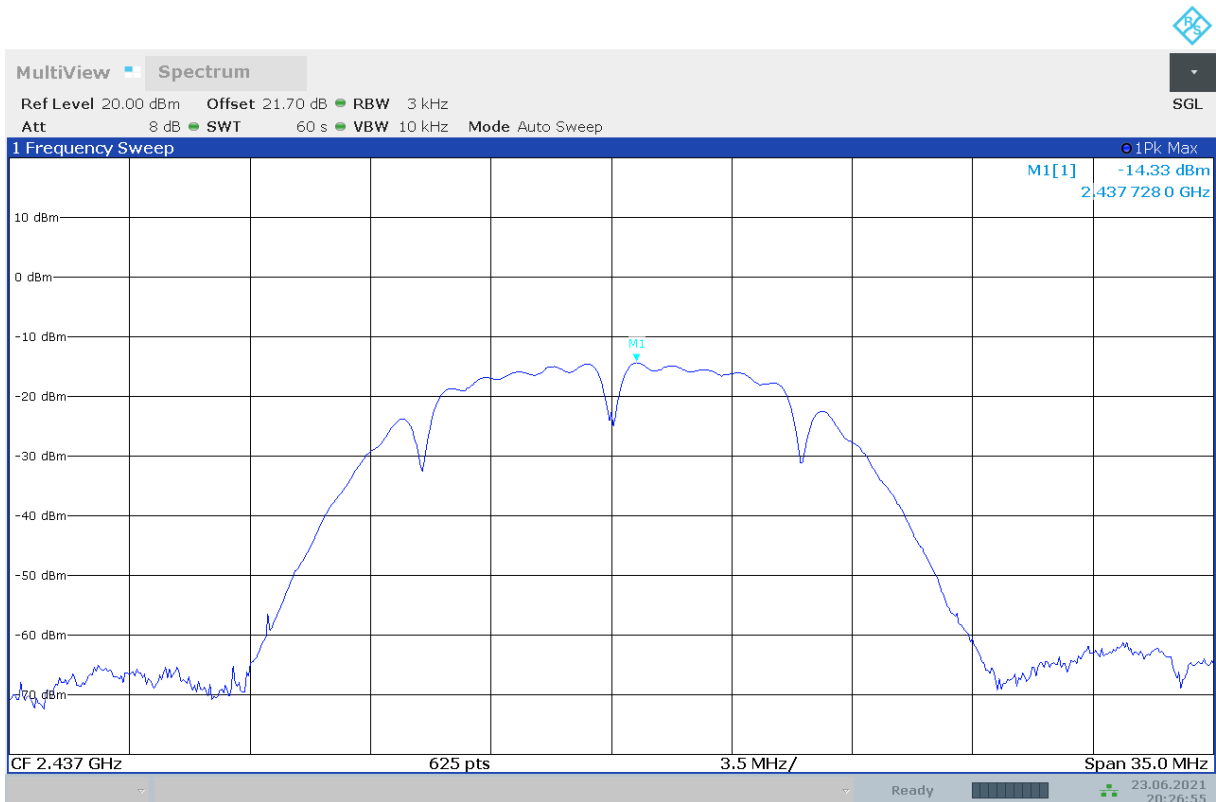
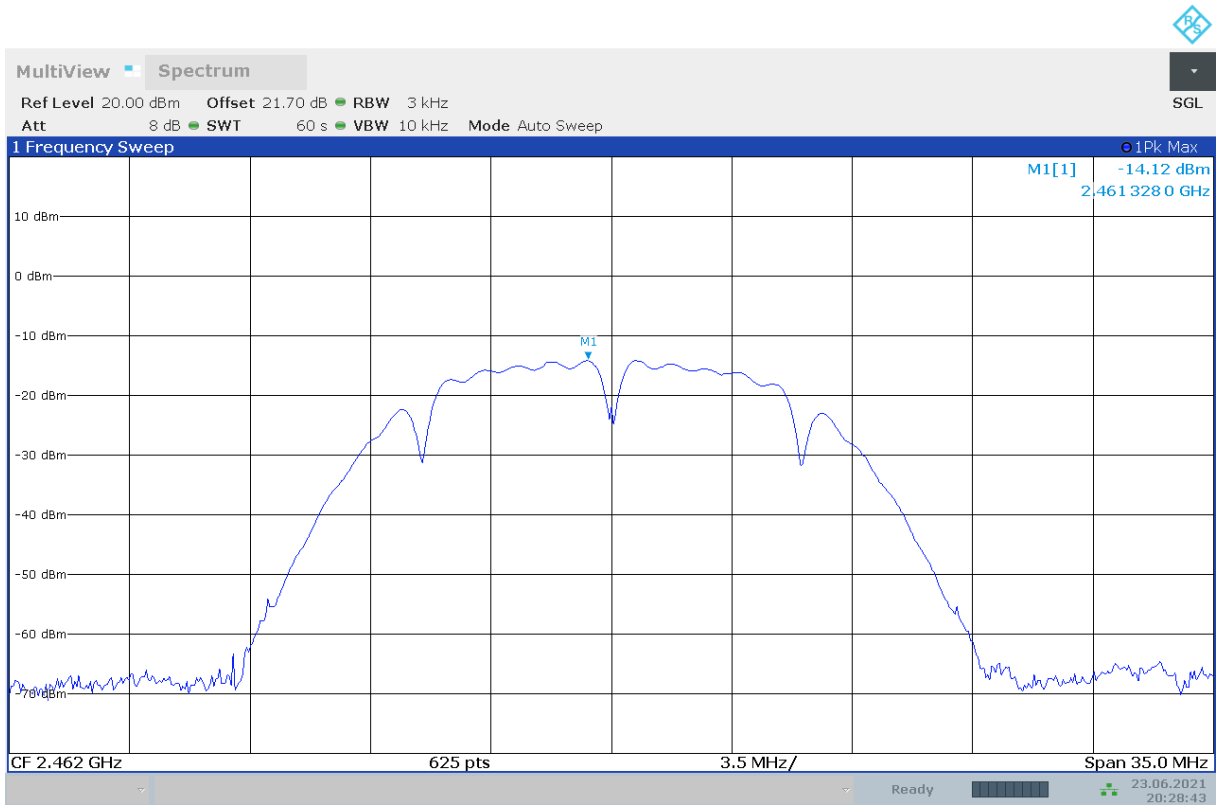
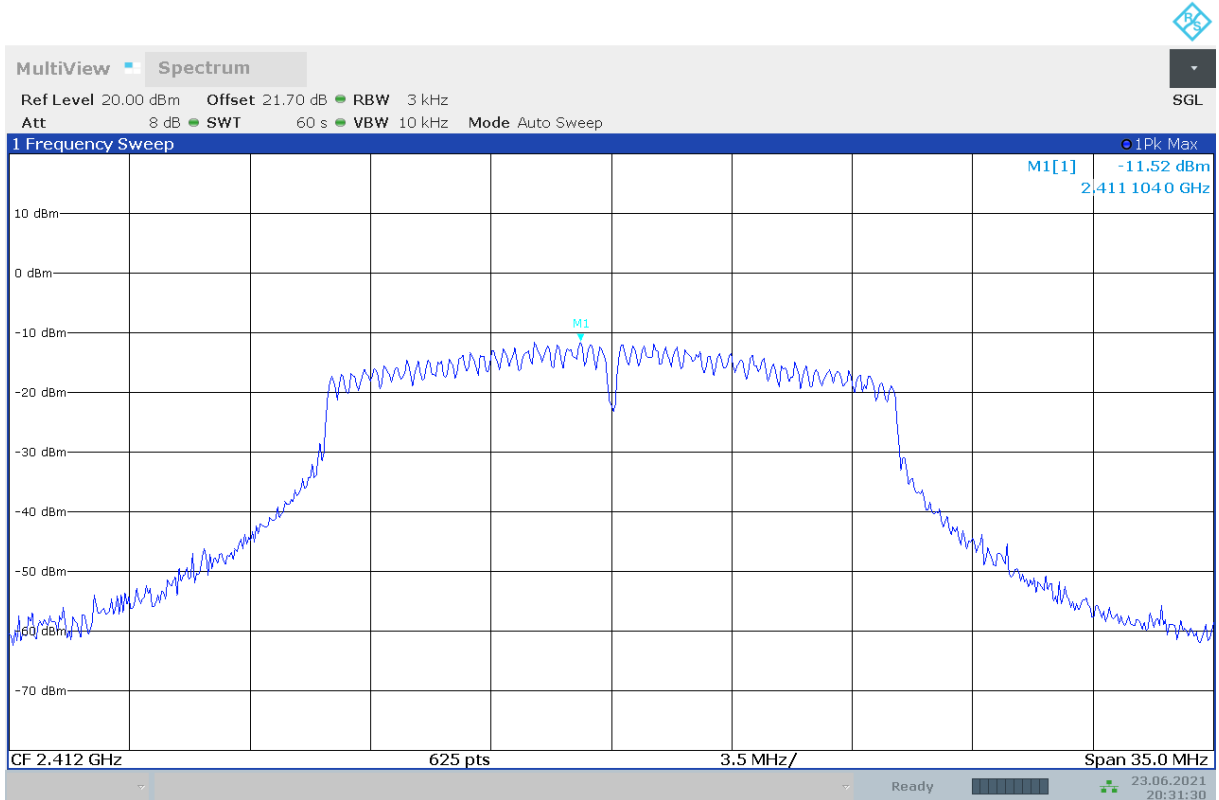


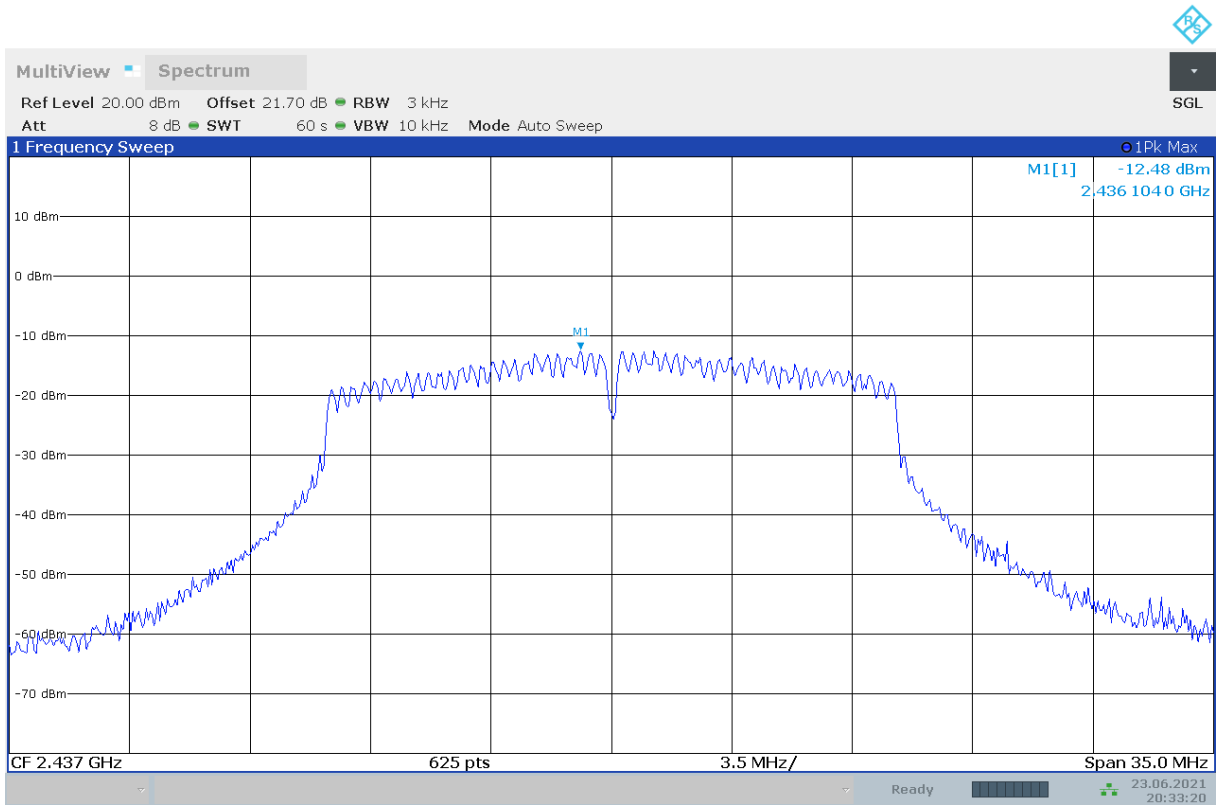
Fig.A.3.2 Power Spectral Density (802.11b, Ch 6)



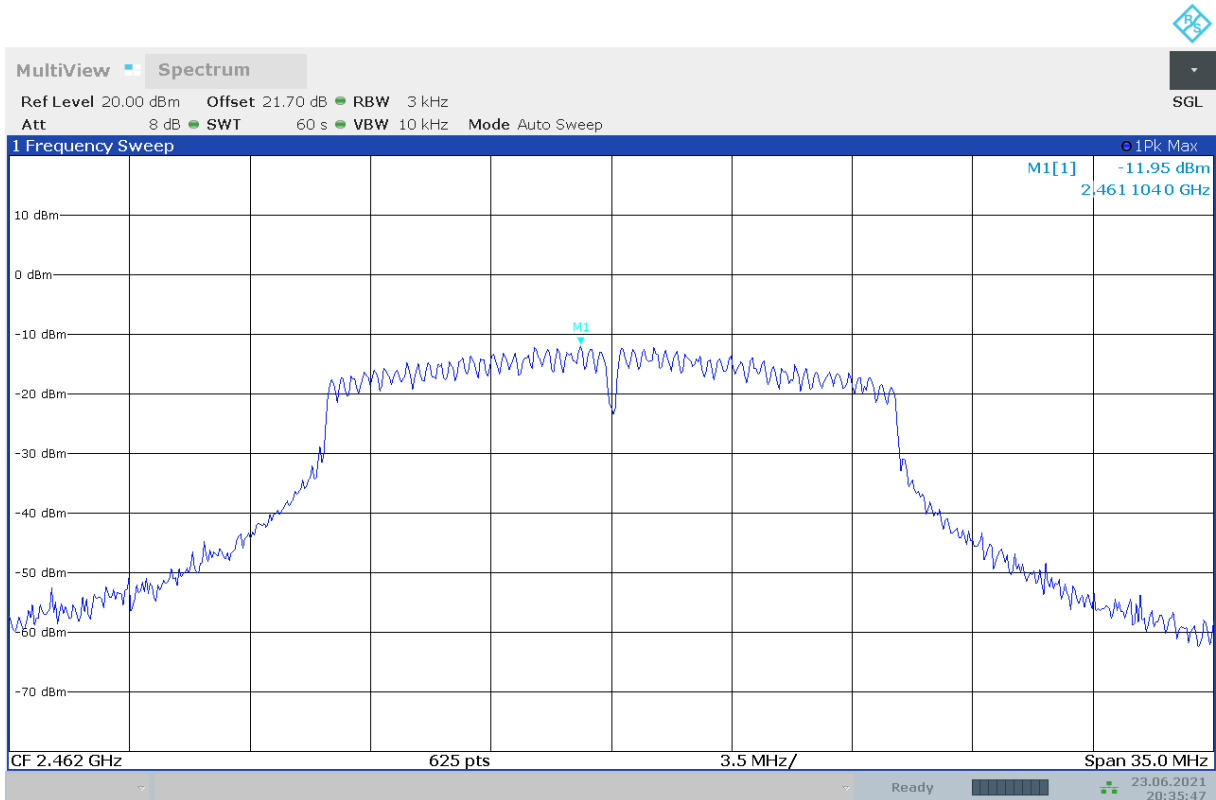
**Fig.A.3.3 Power Spectral Density (802.11b, Ch 11)**



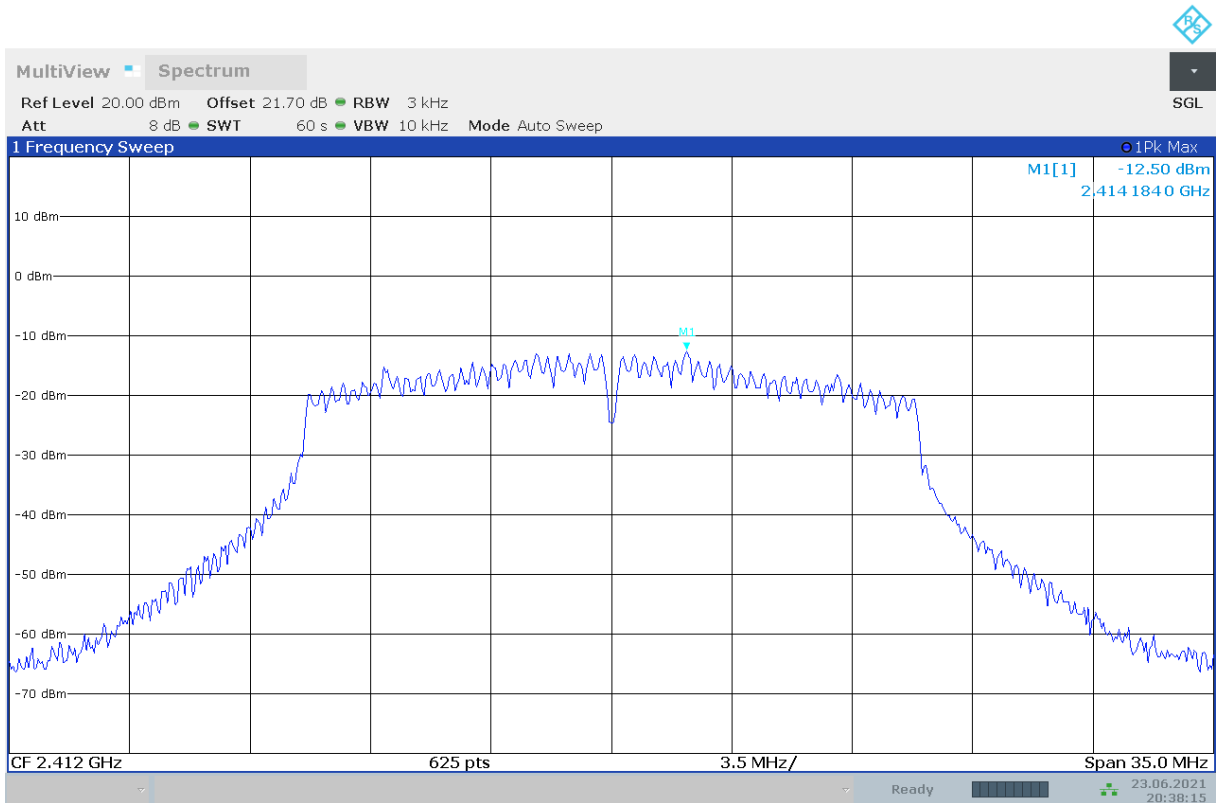
**Fig.A.3.4 Power Spectral Density (802.11g, Ch 1)**



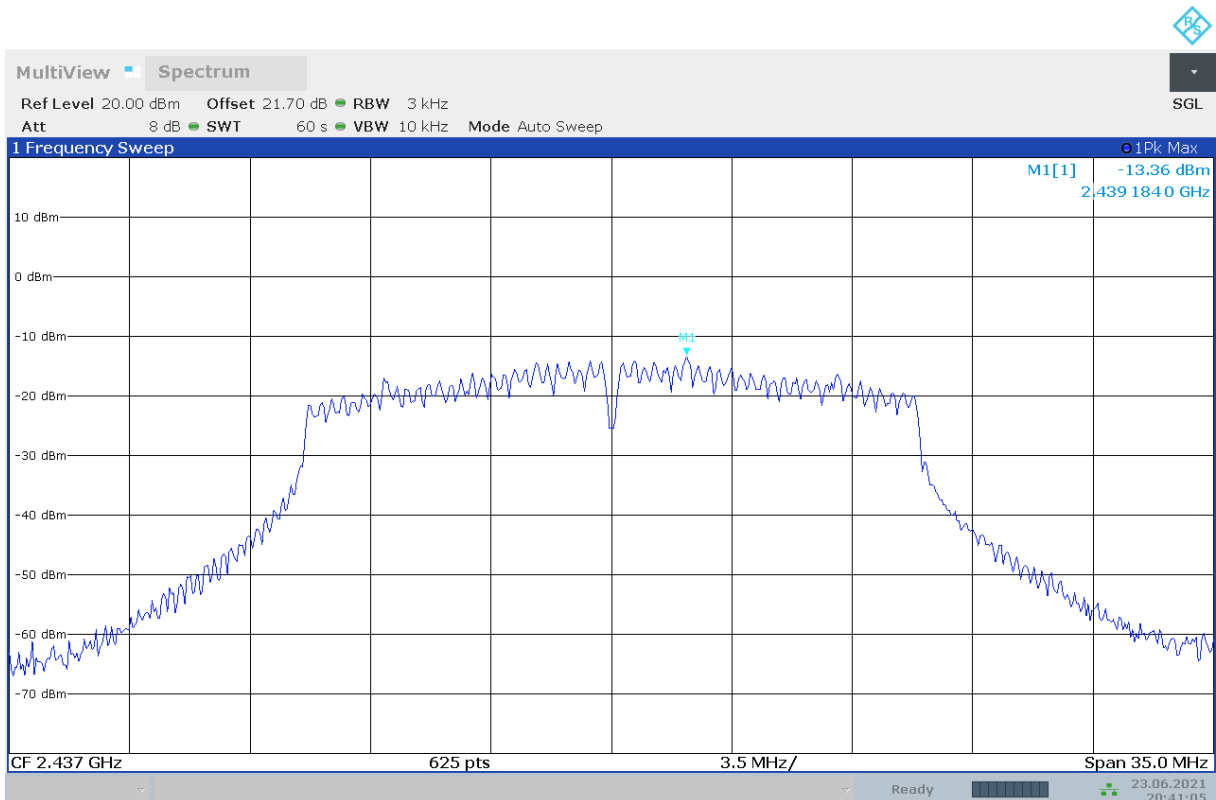
**Fig.A.3.5 Power Spectral Density (802.11g, Ch 6)**



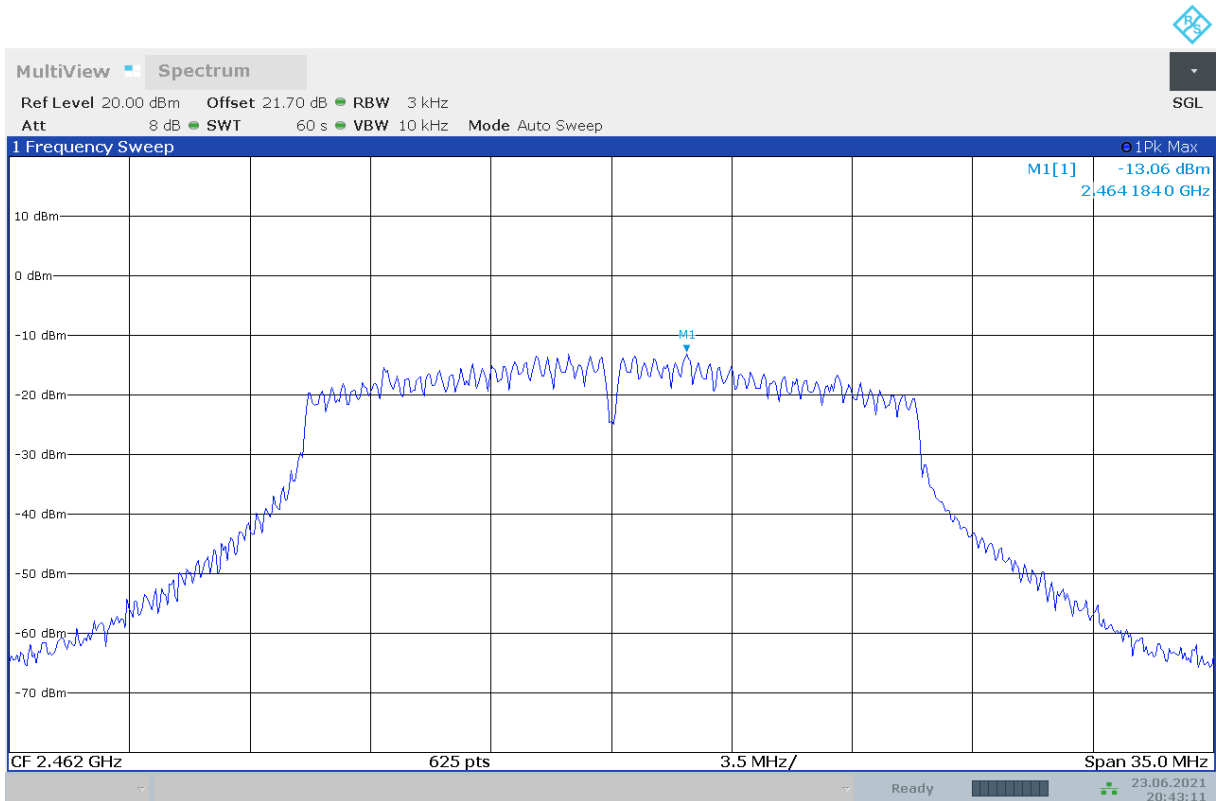
**Fig.A.3.6 Power Spectral Density (802.11g, Ch 11)**



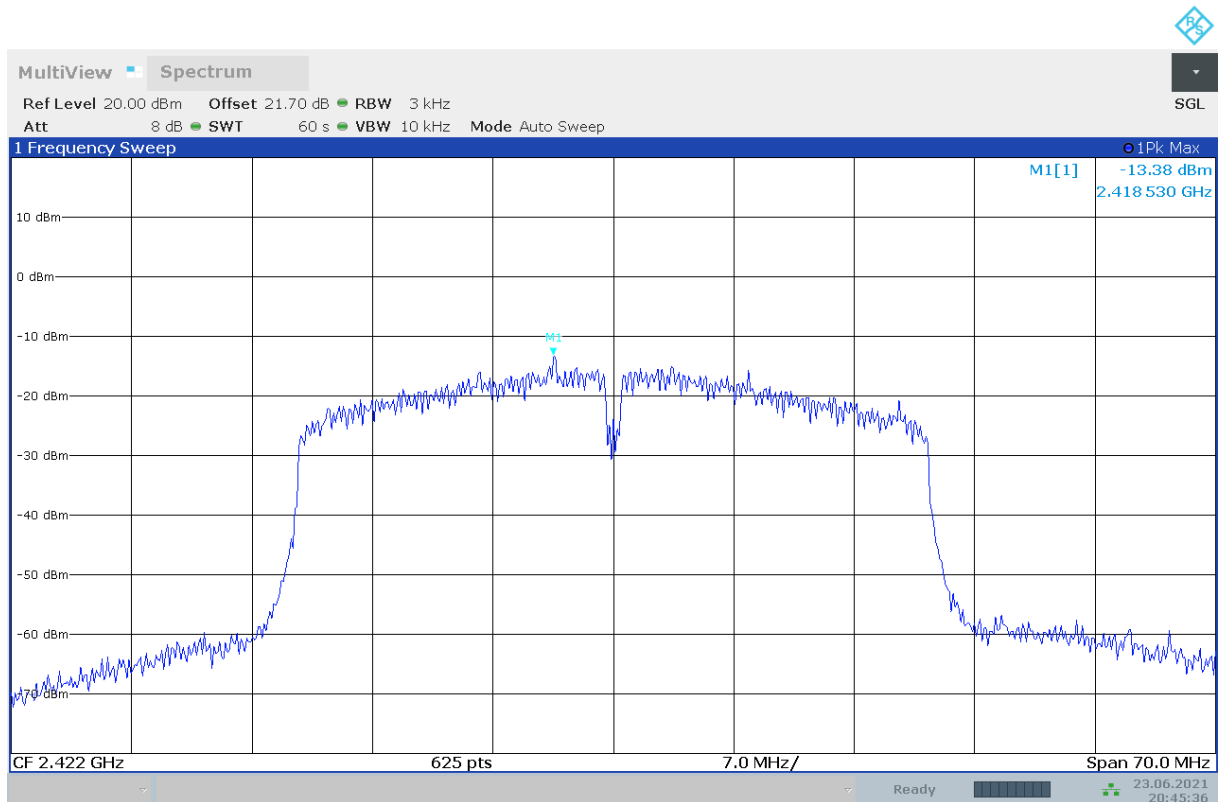
**Fig.A.3.7 Power Spectral Density (802.11n-HT20, Ch 1)**



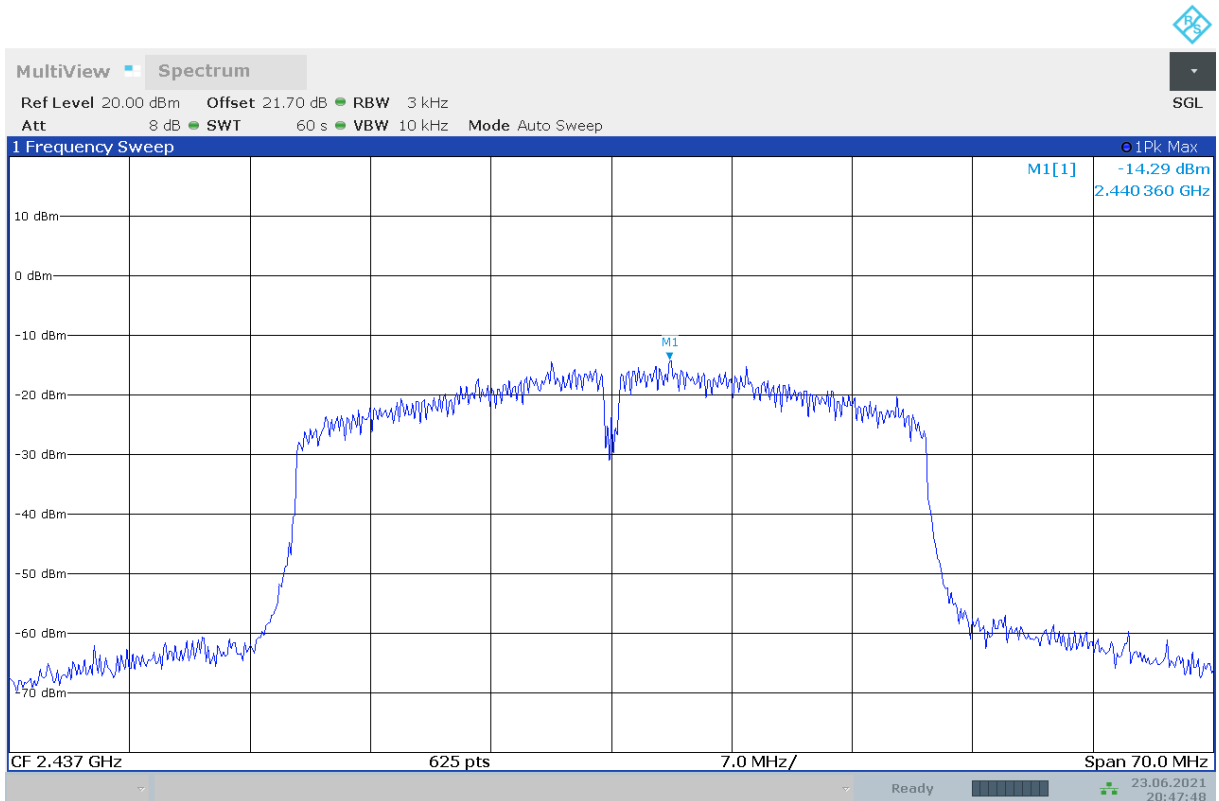
**Fig.A.3.8 Power Spectral Density (802.11n-HT20, Ch 6)**



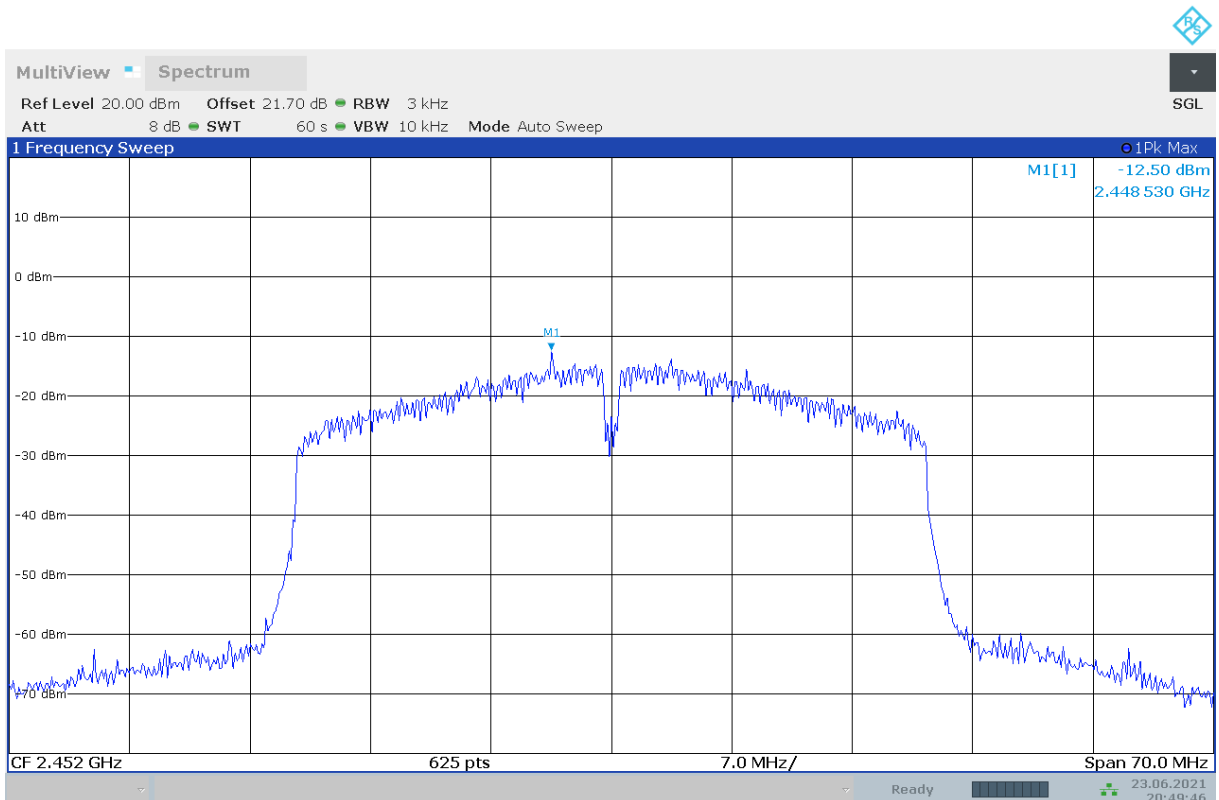
**Fig.A.3.9 Power Spectral Density (802.11n-HT20, Ch 11)**



**Fig.A.3.10 Power Spectral Density (802.11n-HT40, Ch 3)**



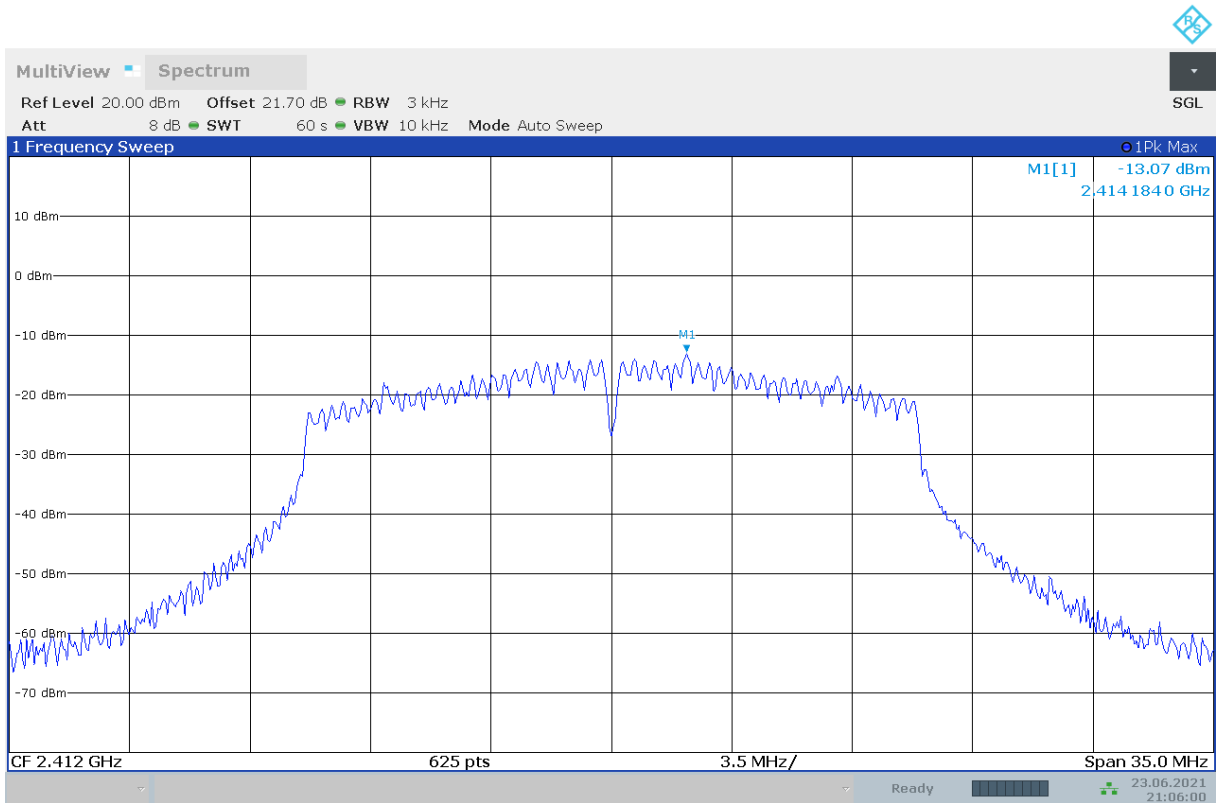
**Fig.A.3.11 Power Spectral Density (802.11n-HT40, Ch 6)**



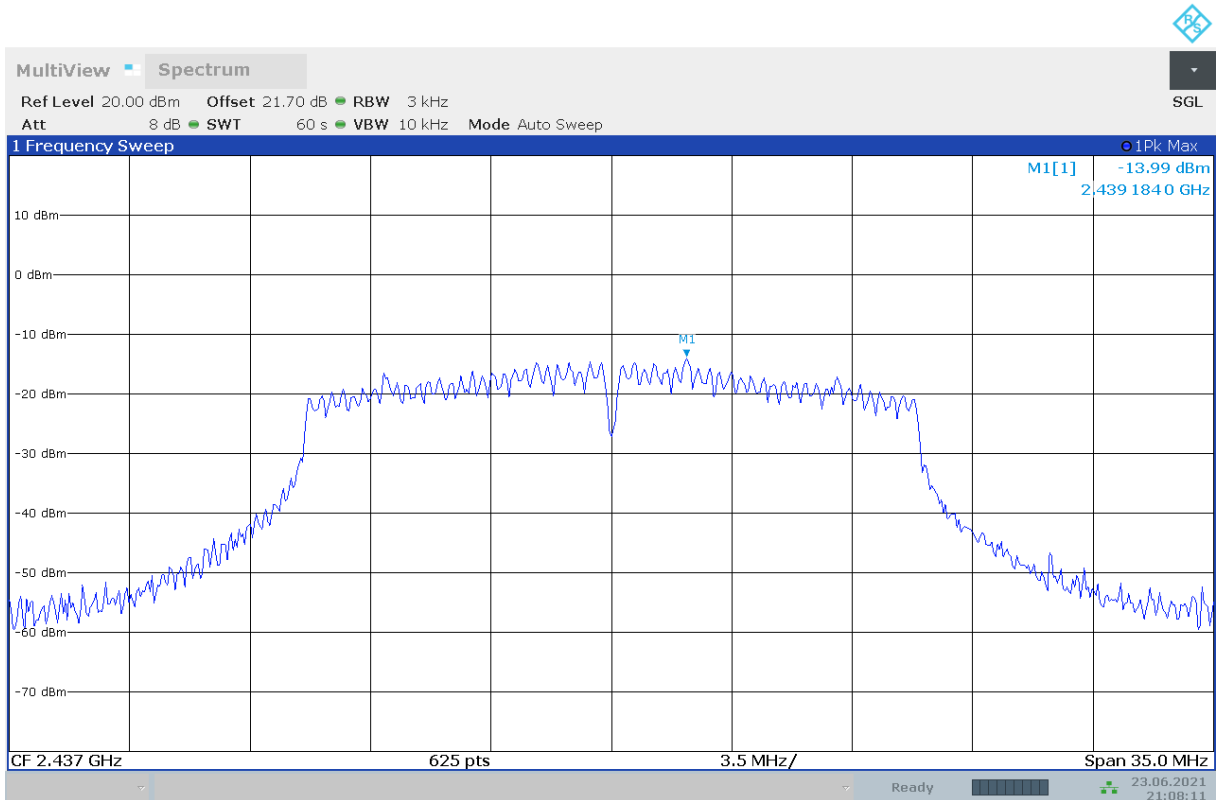
**Fig.A.3.12 Power Spectral Density (802.11n-HT40, Ch 9)**



**SISO ANT1:**



**Fig.A.3.13 Power Spectral Density (802.11n-HT20, Ch 1)**



**Fig.A.3.14 Power Spectral Density (802.11n-HT20, Ch 6)**

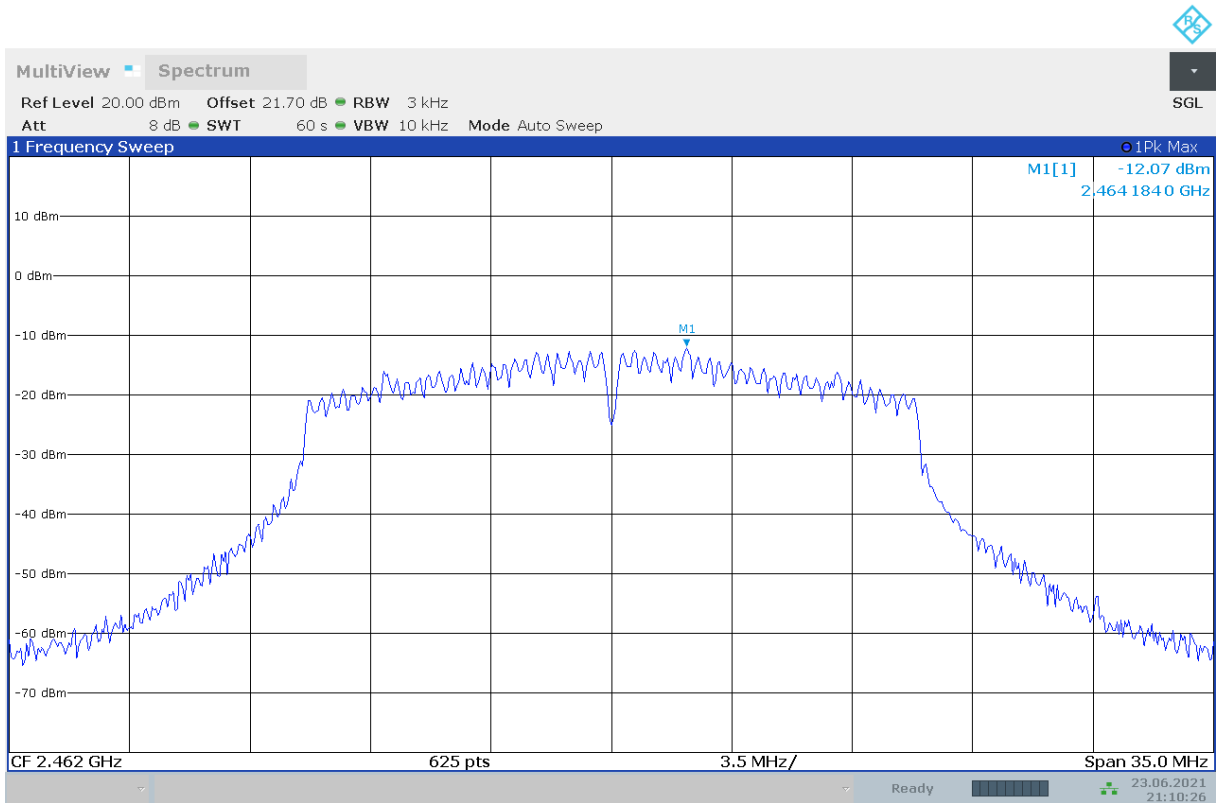


Fig.A.3.15 Power Spectral Density (802.11n-HT20, Ch 11)

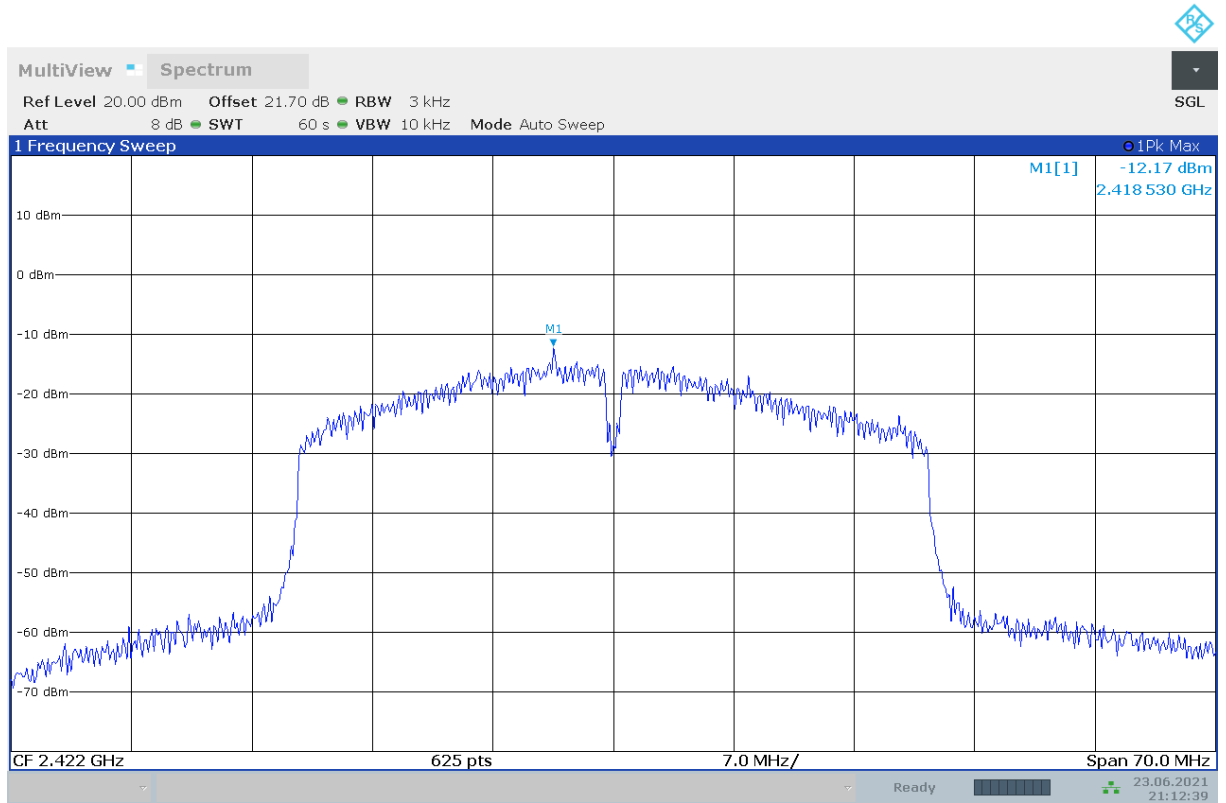
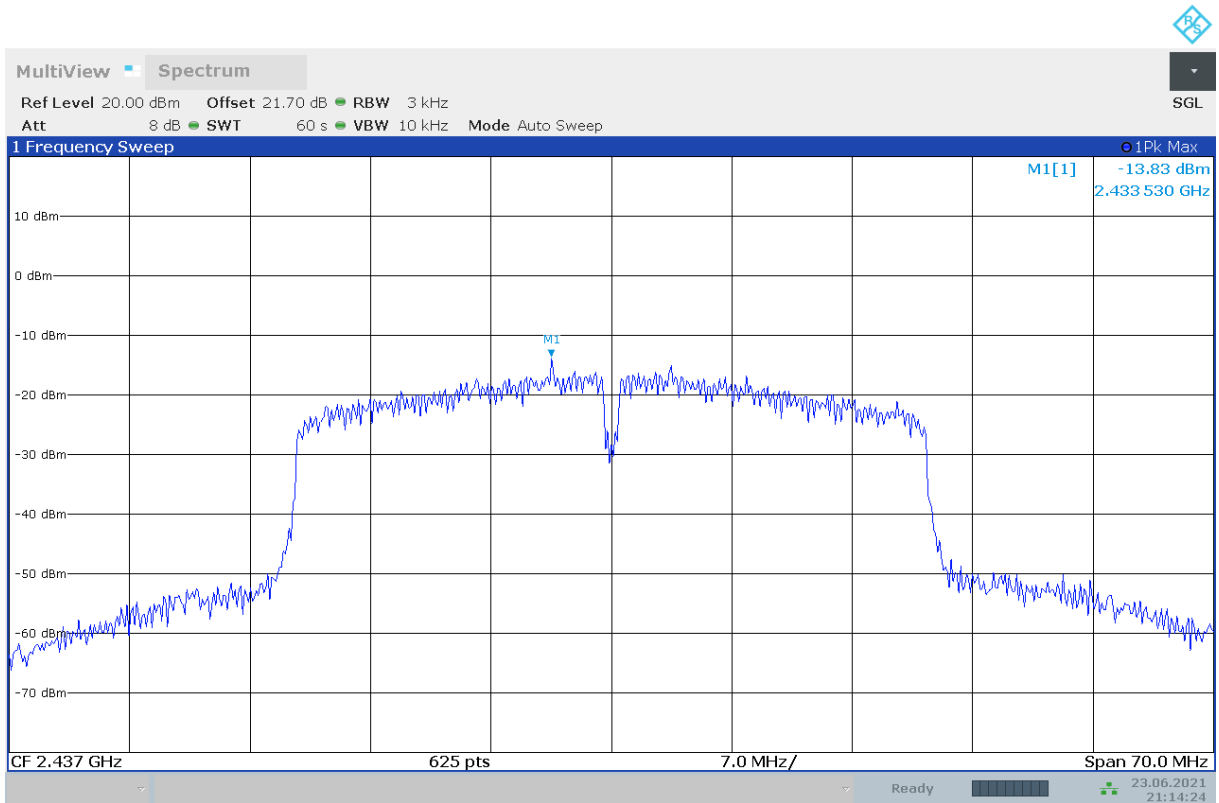
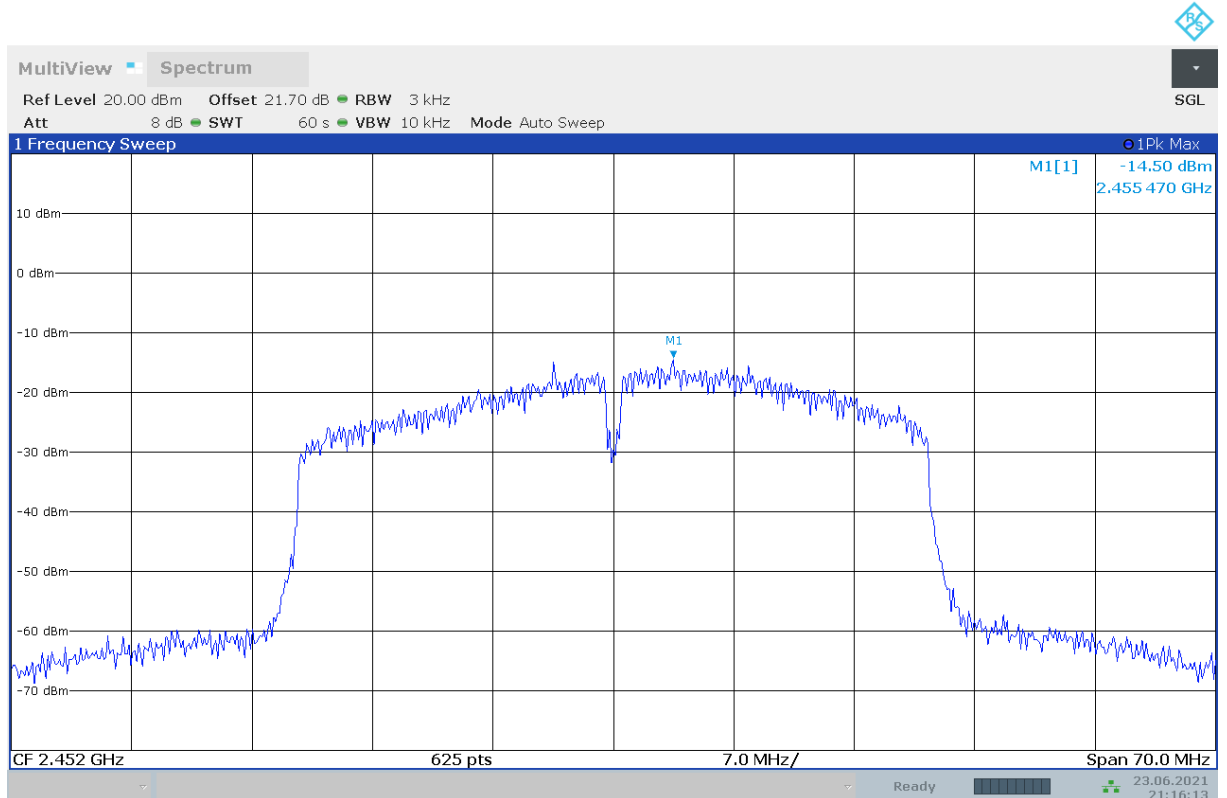


Fig.A.3.16 Power Spectral Density (802.11n-HT40, Ch 3)

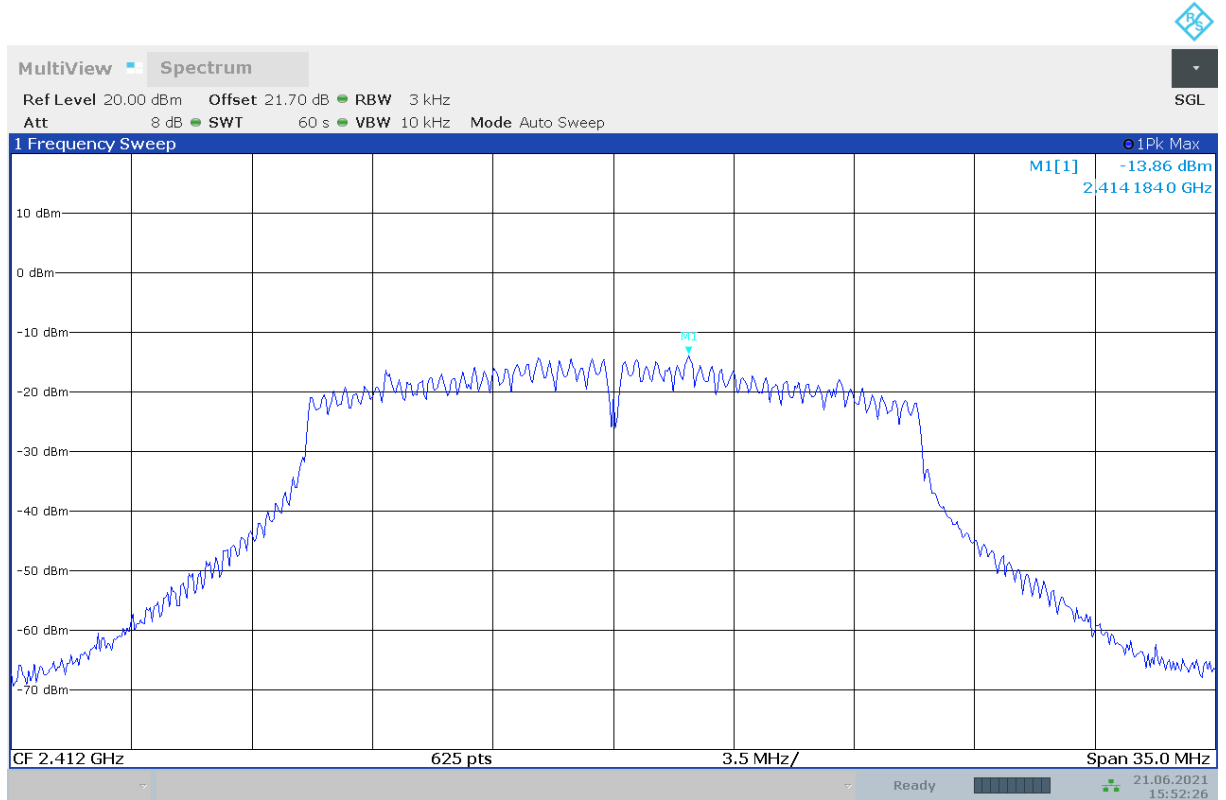


**Fig.A.3.17 Power Spectral Density (802.11n-HT40, Ch 6)**

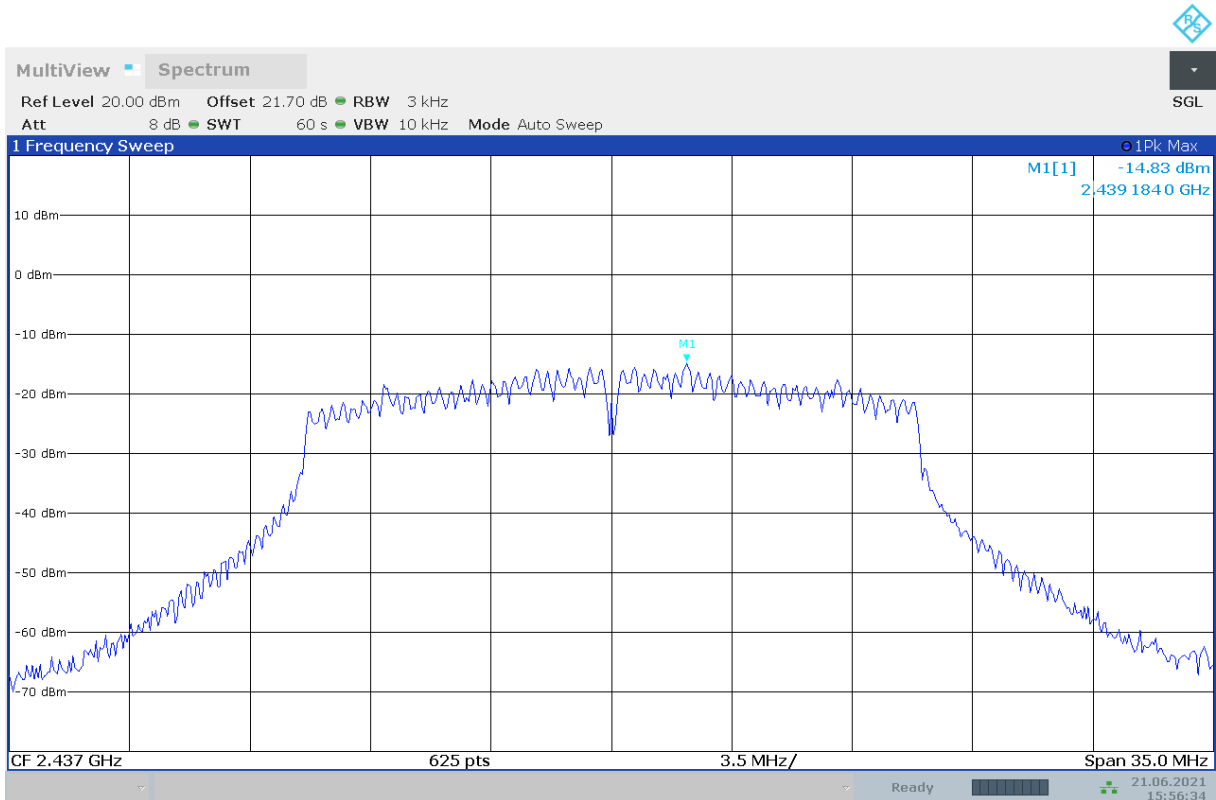


**Fig.A.3.18 Power Spectral Density (802.11n-HT40, Ch 9)**

**MIMO ANT0:**



**Fig.A.3.19 Power Spectral Density (802.11n-HT20, Ch 1)**



**Fig.A.3.20 Power Spectral Density (802.11n-HT20, Ch 6)**

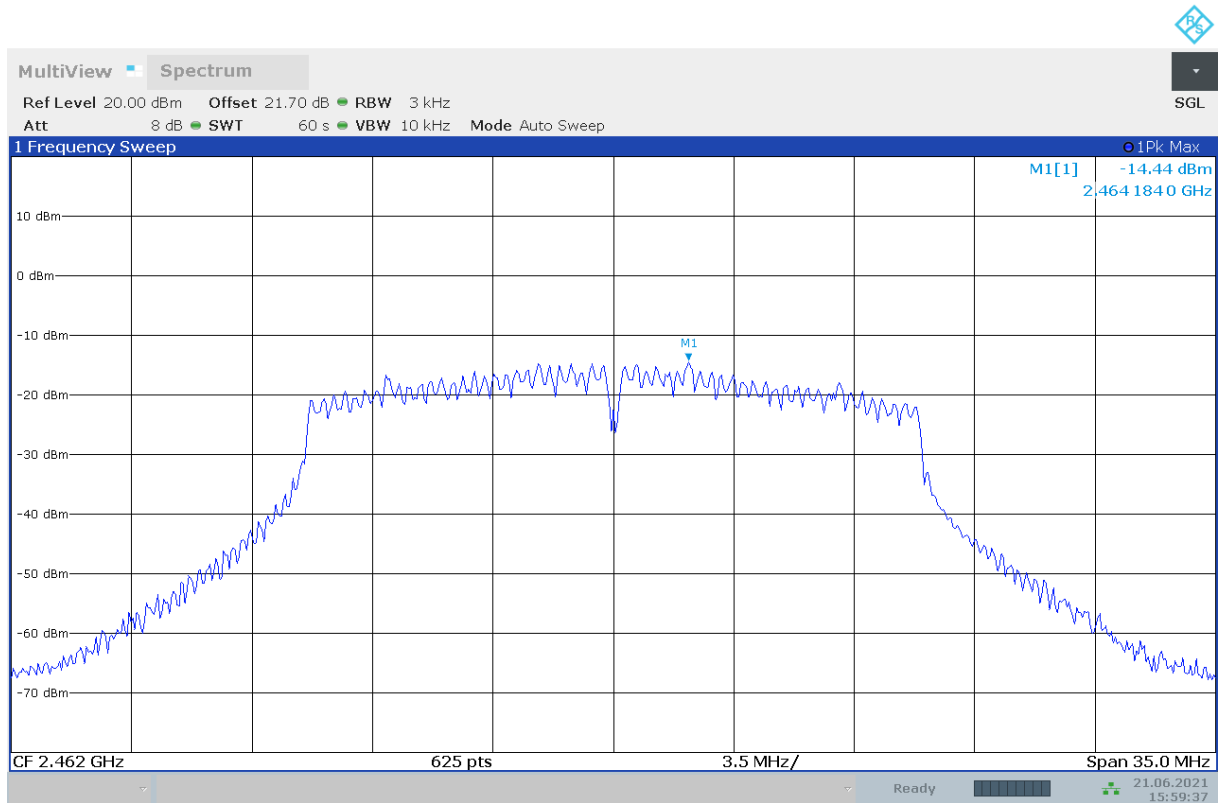


Fig.A.3.21 Power Spectral Density (802.11n-HT20, Ch 11)

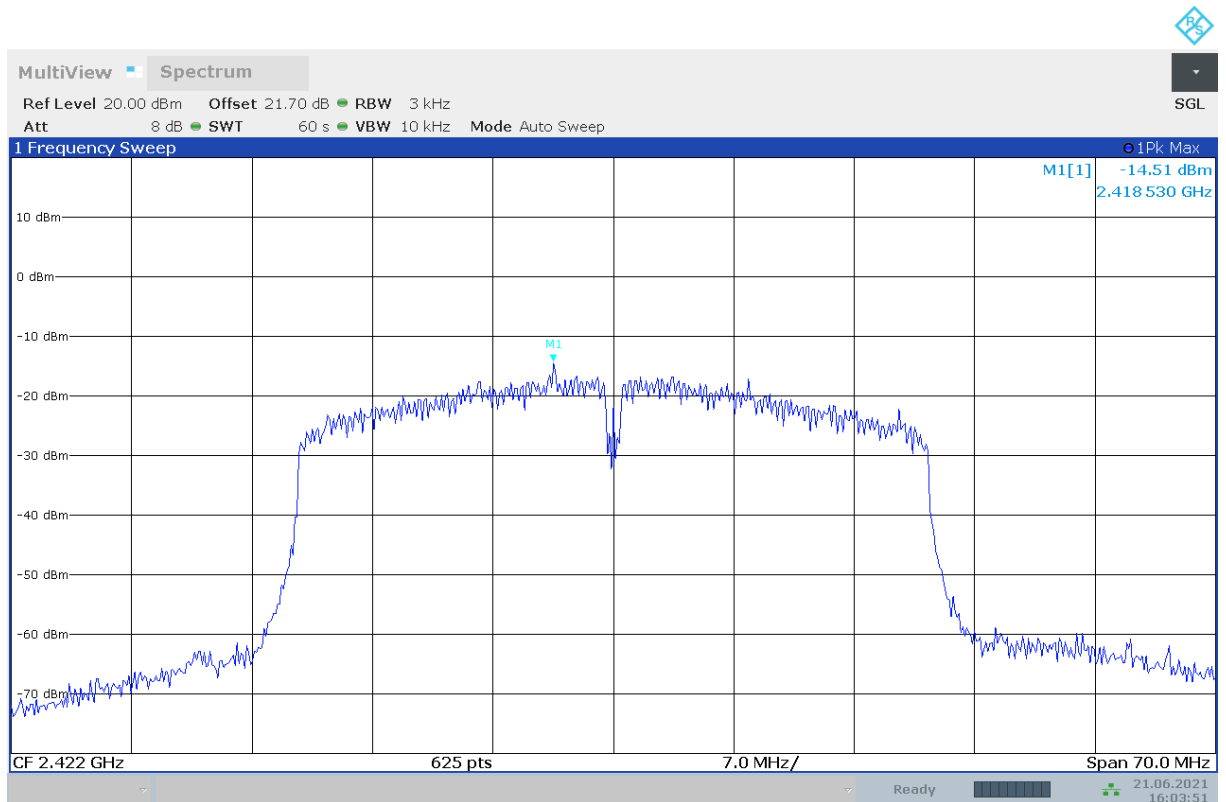


Fig.A.3.22 Power Spectral Density (802.11n-HT40, Ch 3)

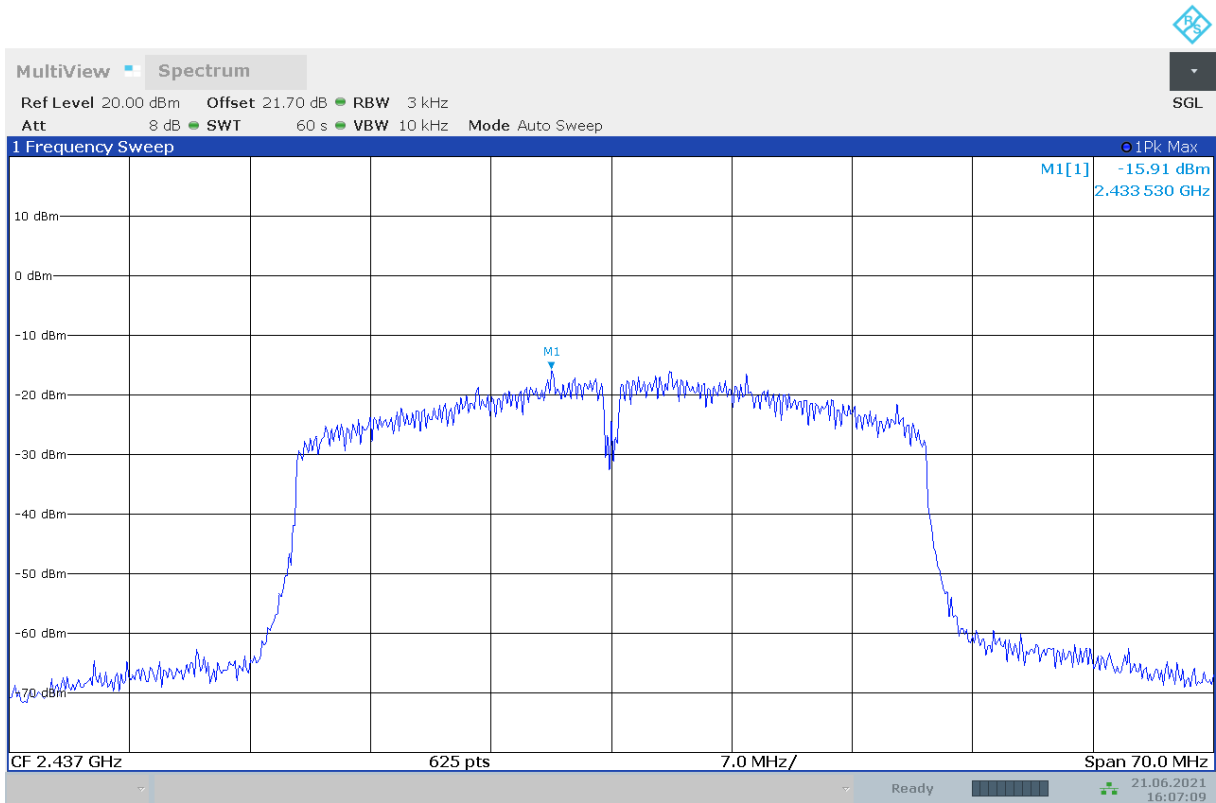


Fig.A.3.23 Power Spectral Density (802.11n-HT40, Ch 6)

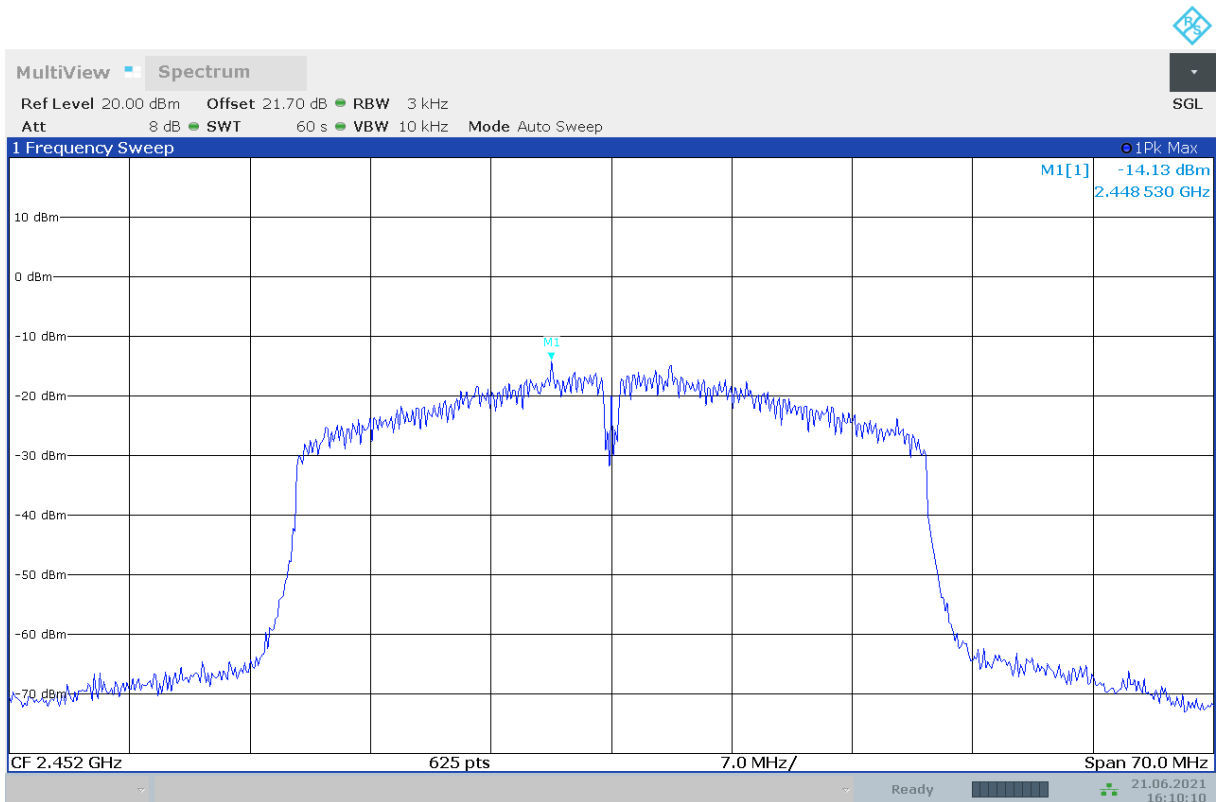
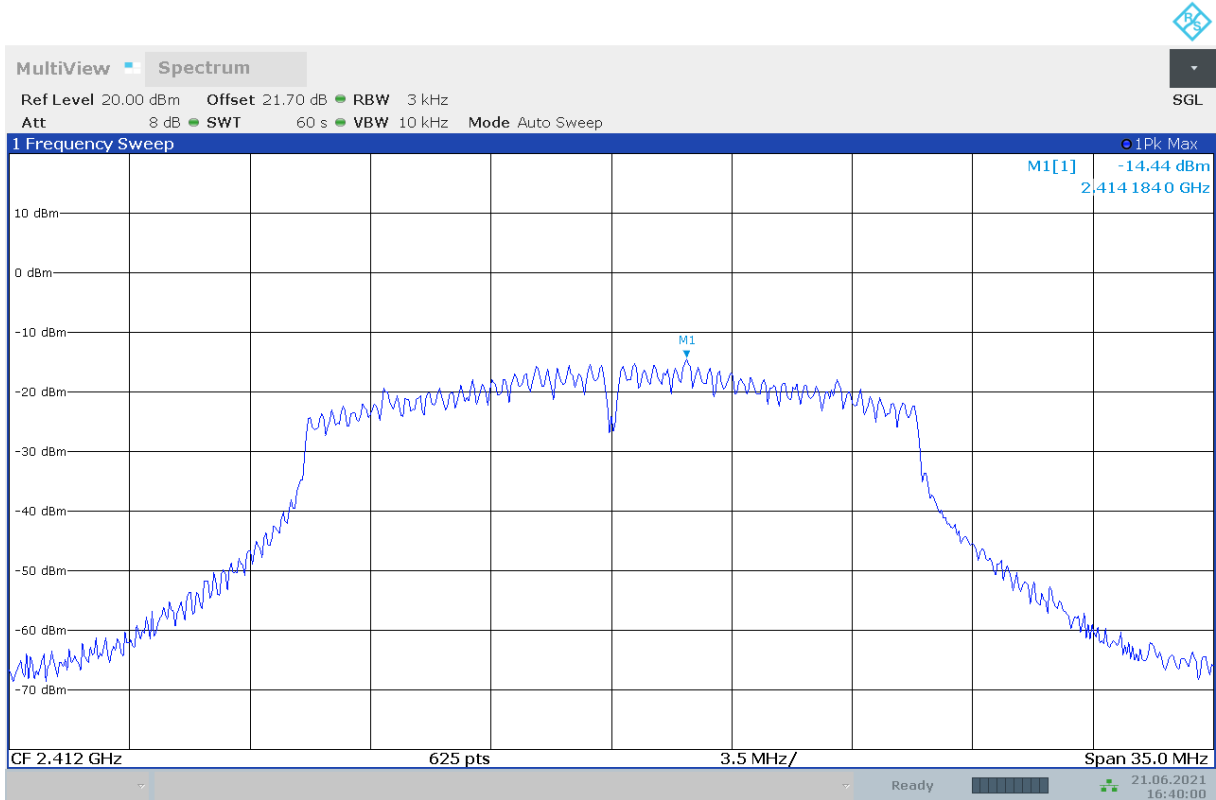
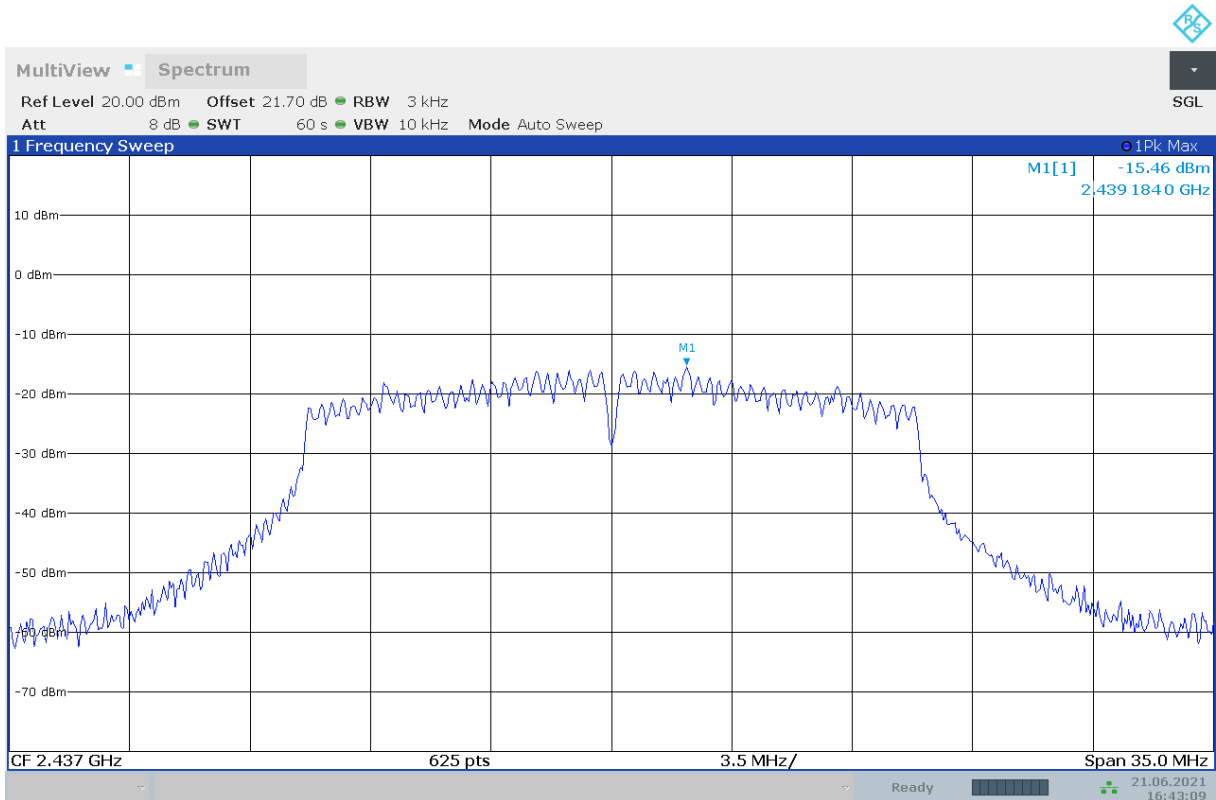


Fig.A.3.24 Power Spectral Density (802.11n-HT40, Ch 9)

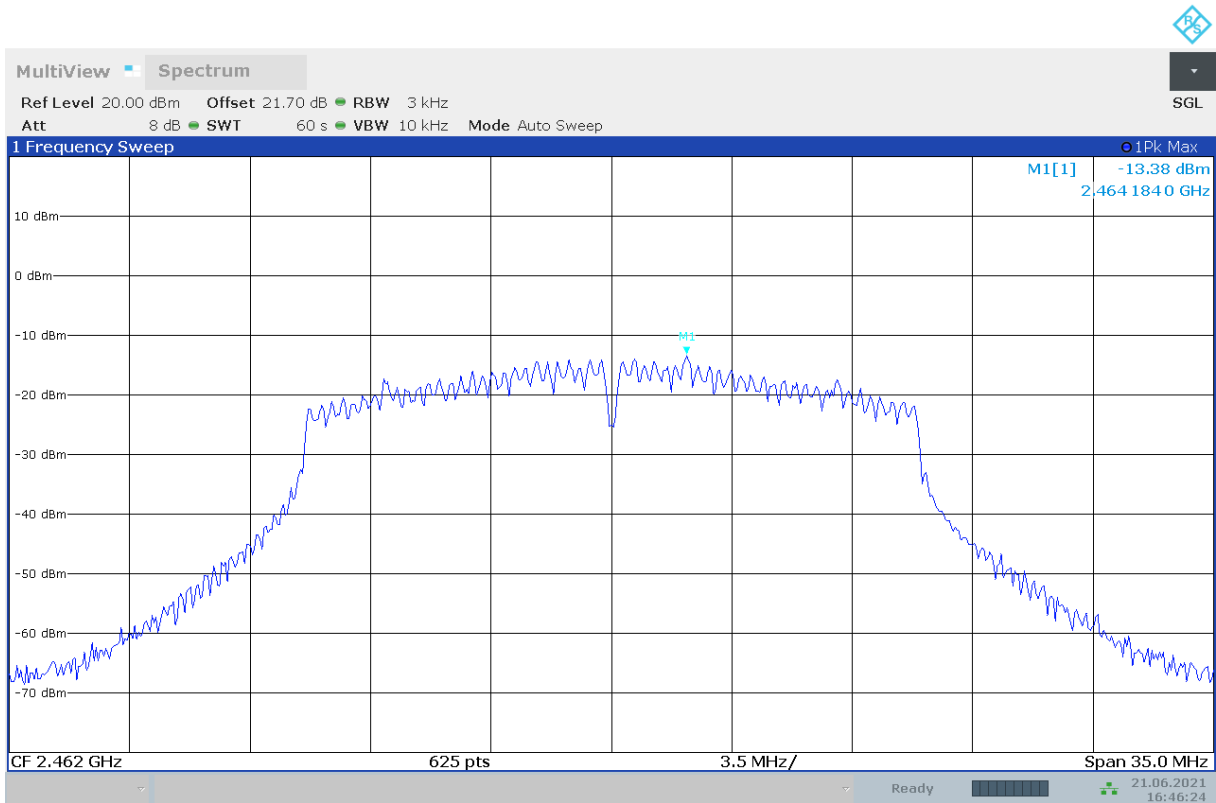
**MIMO ANT1:**



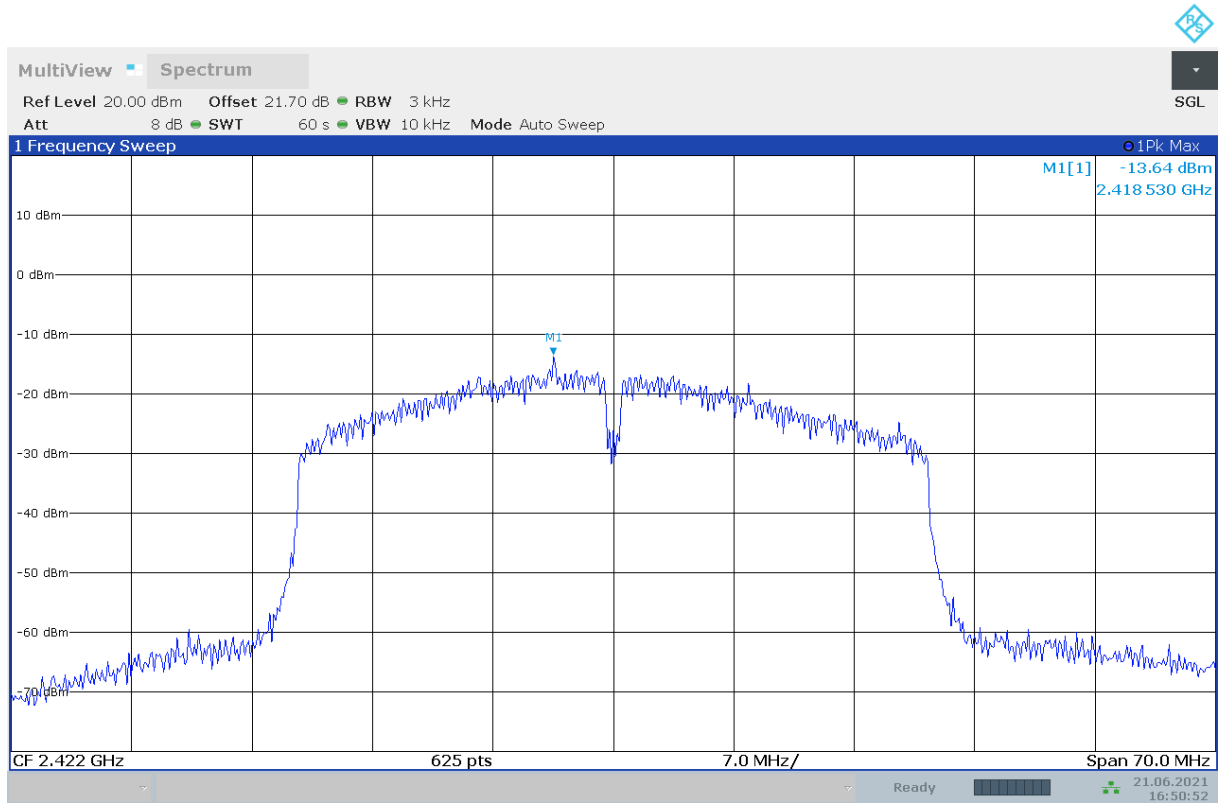
**Fig.A.3.25 Power Spectral Density (802.11n-HT20, Ch 1)**



**Fig.A.3.26 Power Spectral Density (802.11n-HT20, Ch 6)**

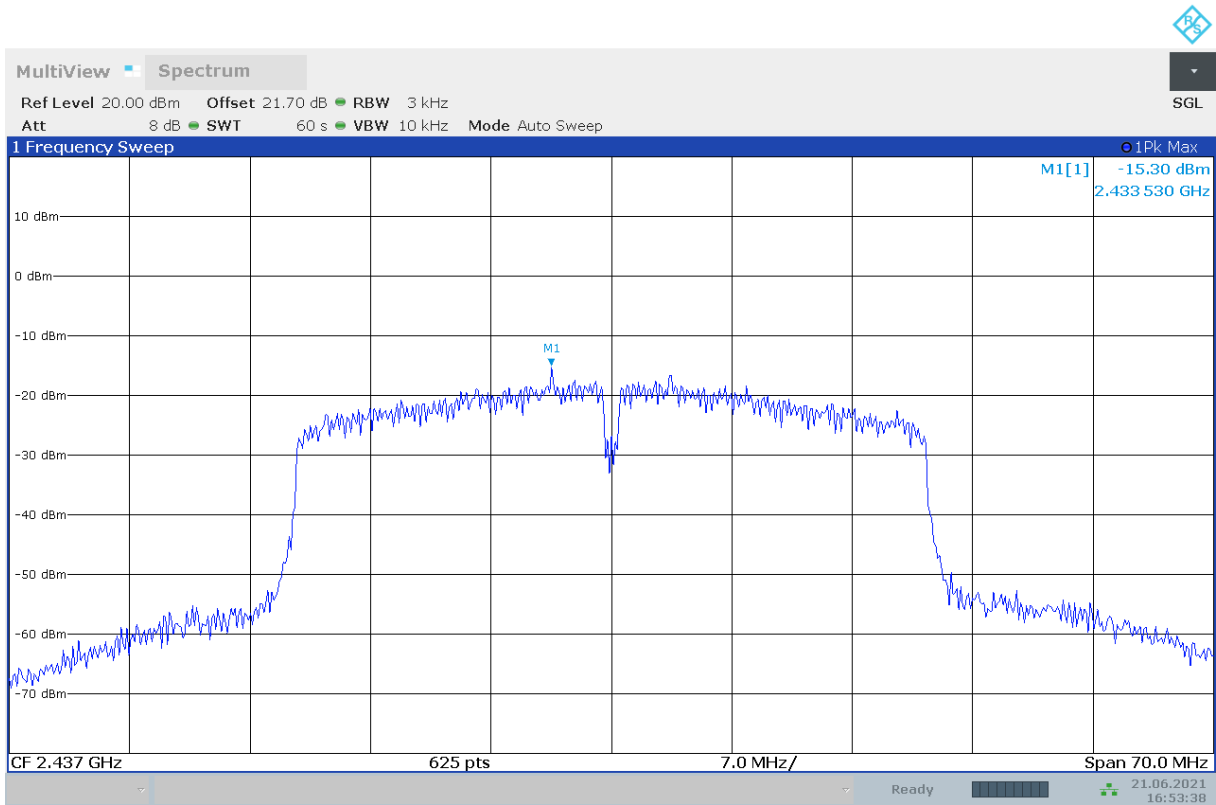


**Fig.A.3.27 Power Spectral Density (802.11n-HT20, Ch 11)**

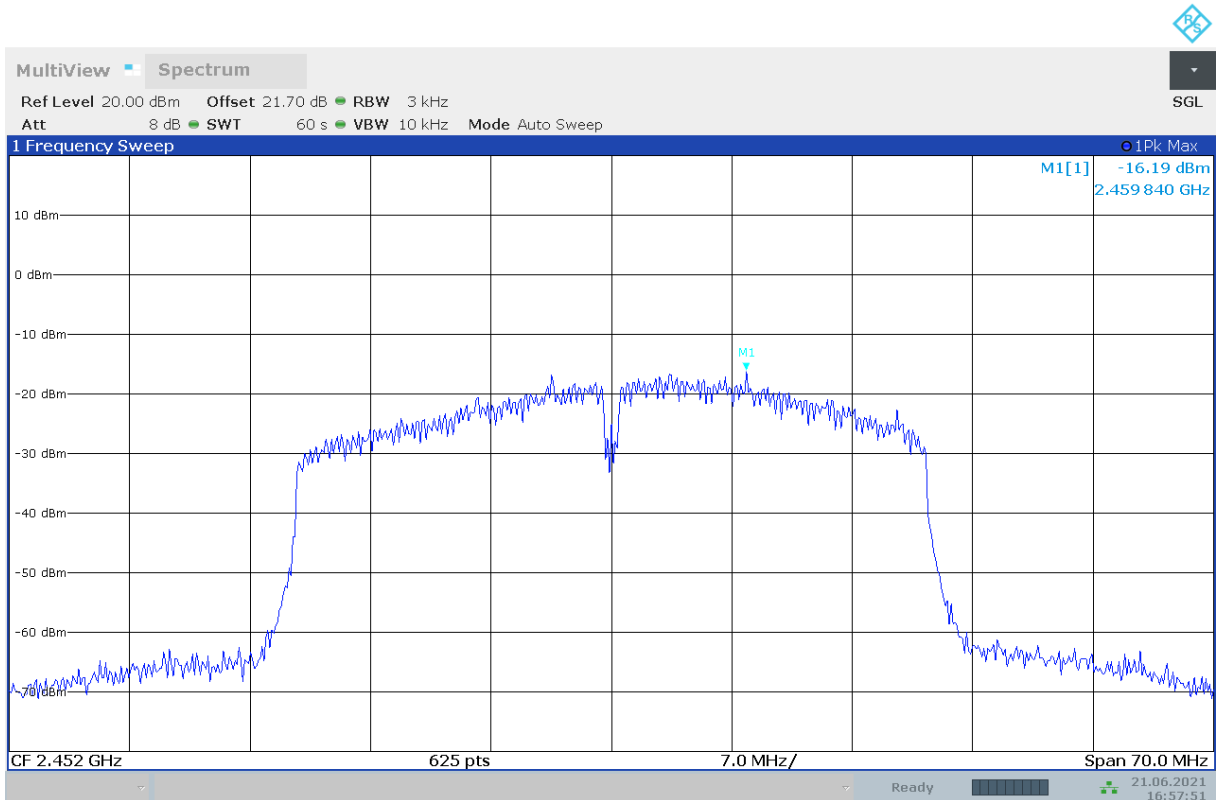


**Fig.A.3.28 Power Spectral Density (802.11n-HT40, Ch 3)**





**Fig.A.3.29 Power Spectral Density (802.11n-HT40, Ch 6)**



**Fig.A.3.30 Power Spectral Density (802.11n-HT40, Ch 9)**

#### **A.4. DTS 6-dB Signal Bandwidth**

**Method of Measurement: See ANSI C63.10-2013 section 11.8.1.**

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) = 300 kHz.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

**Measurement Limit:**

Standard	Limit (kHz)
FCC 47 CFR Part 15.247 (a)	≥ 500

**EUT ID: EUT1**

The ANT0's result is higher than ANT1, the graphs of ANT0 as below

**Measurement Result:**

**SISO ANT0:**

**802.11b/g mode**

Mode	Channel	Occupied 6dB Bandwidth ( kHz)		conclusion
802.11b	1	Fig.A.4.1	10050	P
	6	Fig.A.4.2	10100	P
	11	Fig.A.4.3	10150	P
802.11g	1	Fig.A.4.4	15300	P
	6	Fig.A.4.5	15900	P
	11	Fig.A.4.6	15800	P

**802.11n-HT20 mode**

Mode	Channel	Occupied 6dB Bandwidth ( kHz)		conclusion
802.11n (HT20)	1	Fig.A.4.7	15400	P
	6	Fig.A.4.8	16300	P
	11	Fig.A.4.9	15400	P

**802.11n-HT40 mode**

Mode	Channel	Occupied 6dB Bandwidth ( kHz)		conclusion
------	---------	-------------------------------	--	------------

802.11n (HT40)	3	Fig.A.4.10	27840	P
	6	Fig.A.4.11	25840	P
	9	Fig.A.4.12	22800	P

**MIMO ANT0:**

**802.11n-HT20 mode**

Mode	Channel	Occupied 6dB Bandwidth ( kHz)		conclusion
802.11n (HT20)	1	Fig.A.4.13	15400	P
	6	Fig.A.4.14	28080	P
	11	Fig.A.4.15	16300	P

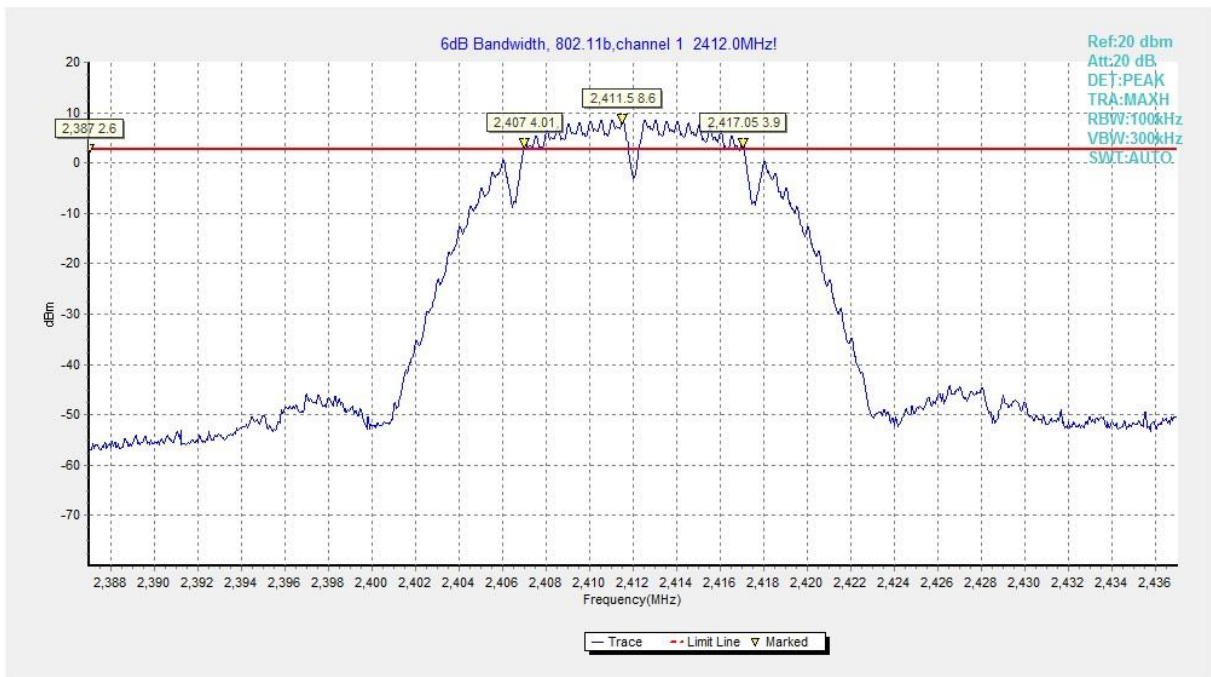
**802.11n-HT40 mode**

Mode	Channel	Occupied 6dB Bandwidth ( kHz)		conclusion
802.11n (HT40)	3	Fig.A.4.16	27760	P
	6	Fig.A.4.17	22800	P
	9	Fig.A.4.18	27120	P

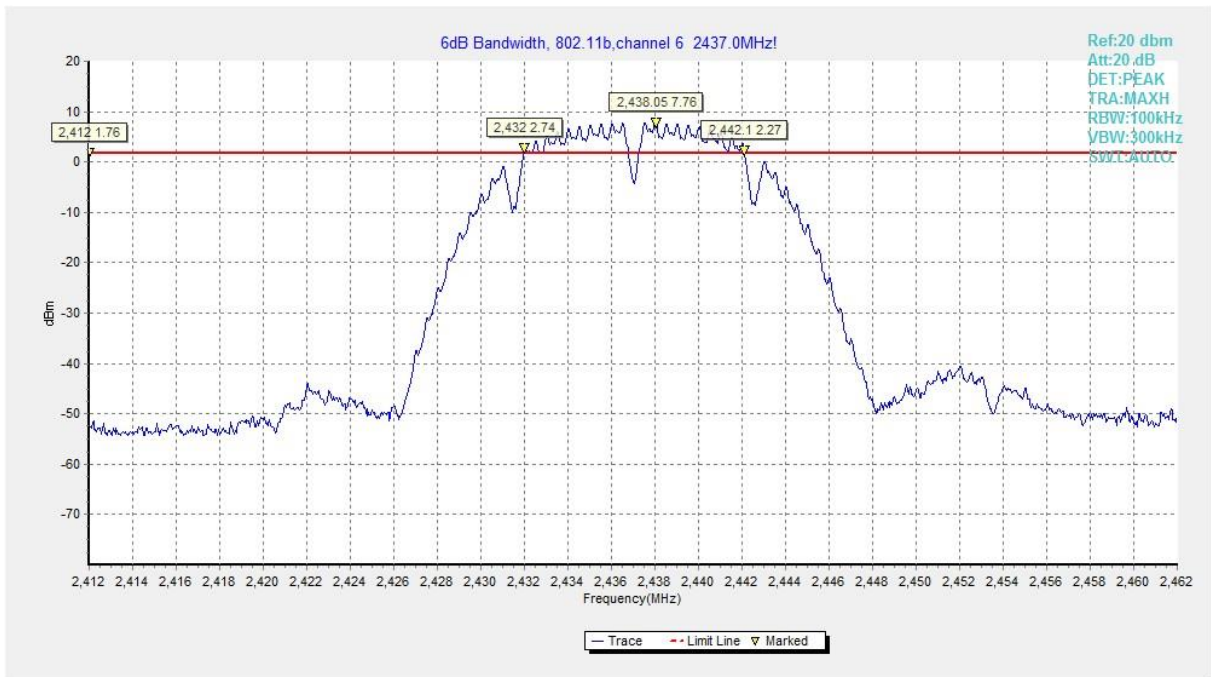
**Conclusion: Pass**

**Test graphs as below:**

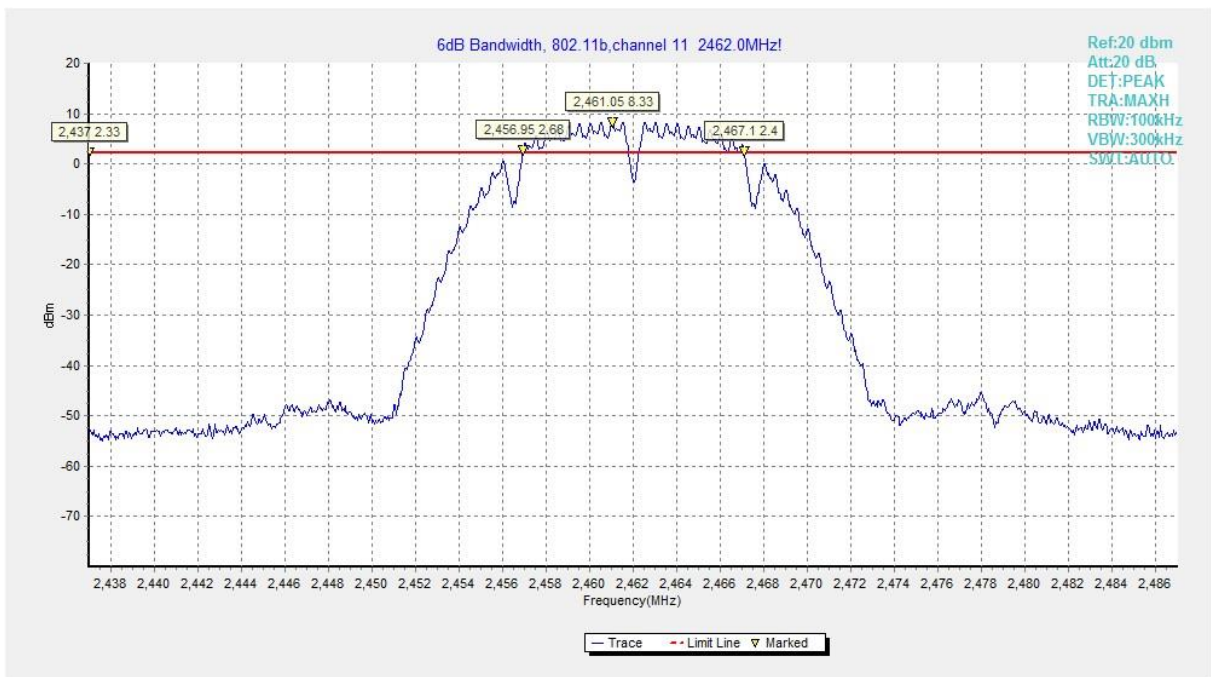
**SISO ANT0:**



**Fig.A.4.1 Occupied 6dB Bandwidth(802.11b,Ch 1)**



**Fig.A.4.2 Occupied 6dB Bandwidth (802.11b, Ch 6)**



**Fig.A.4.3 Occupied 6dB Bandwidth (802.11b, Ch 11)**

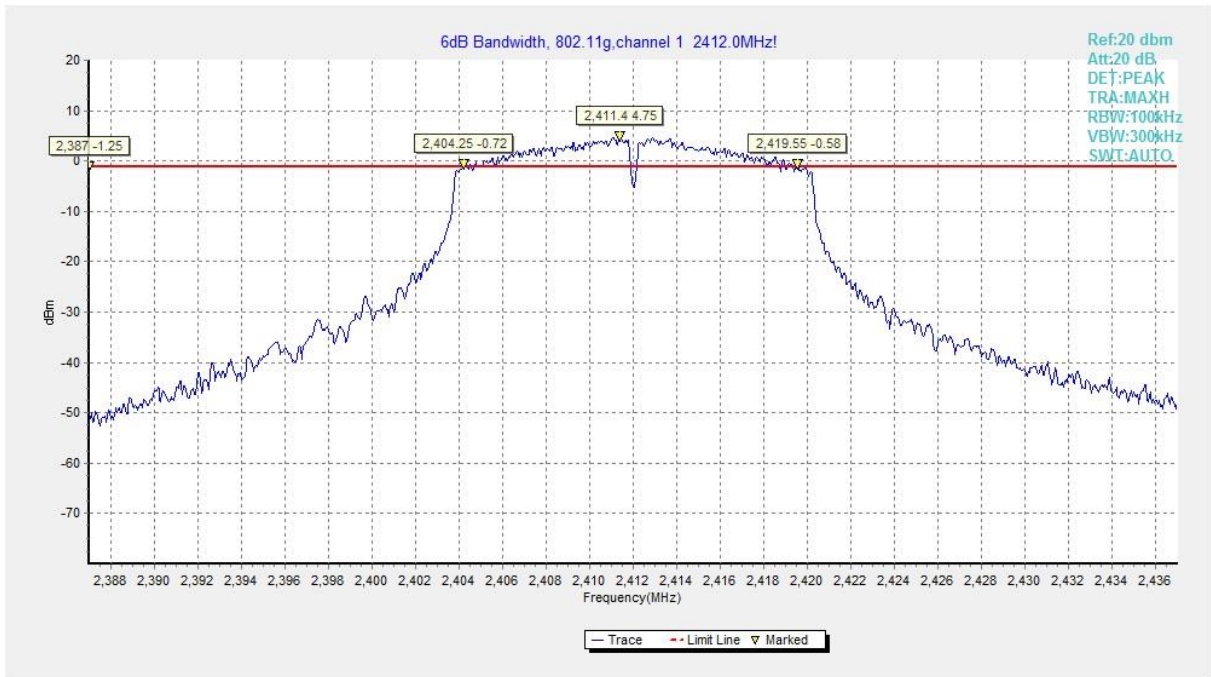


Fig.A.4.4 Occupied 6dB Bandwidth (802.11g, Ch 1)

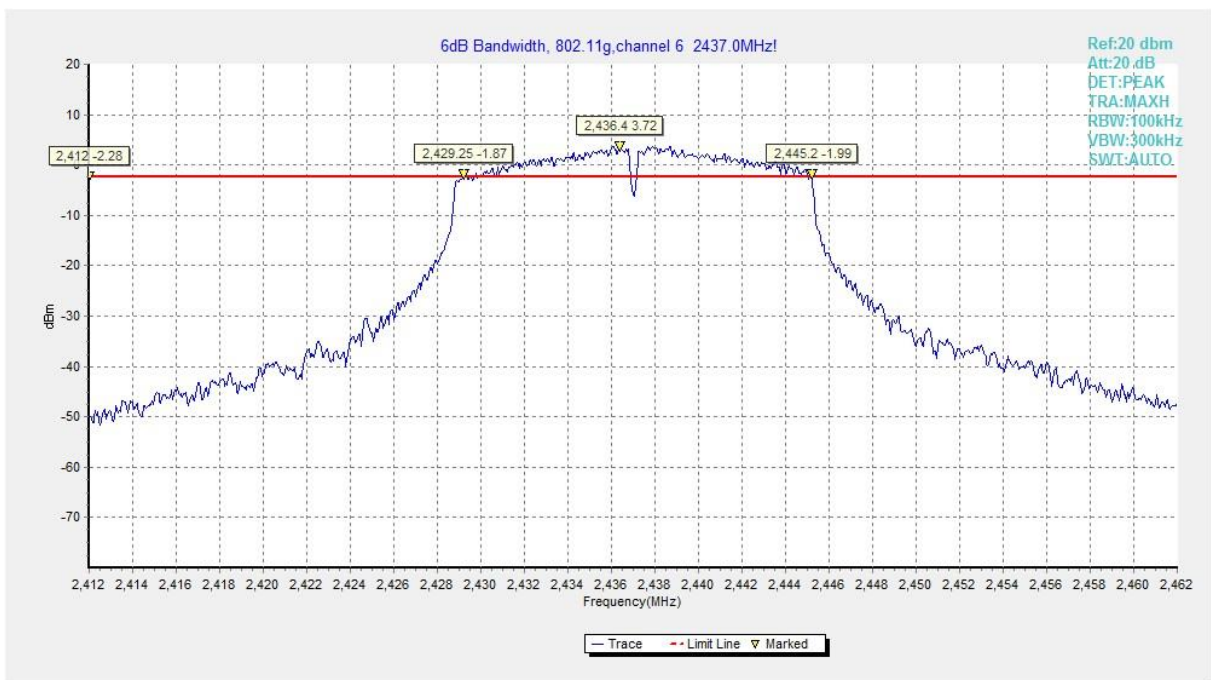


Fig.A.4.5 Occupied 6dB Bandwidth (802.11g, Ch 6)

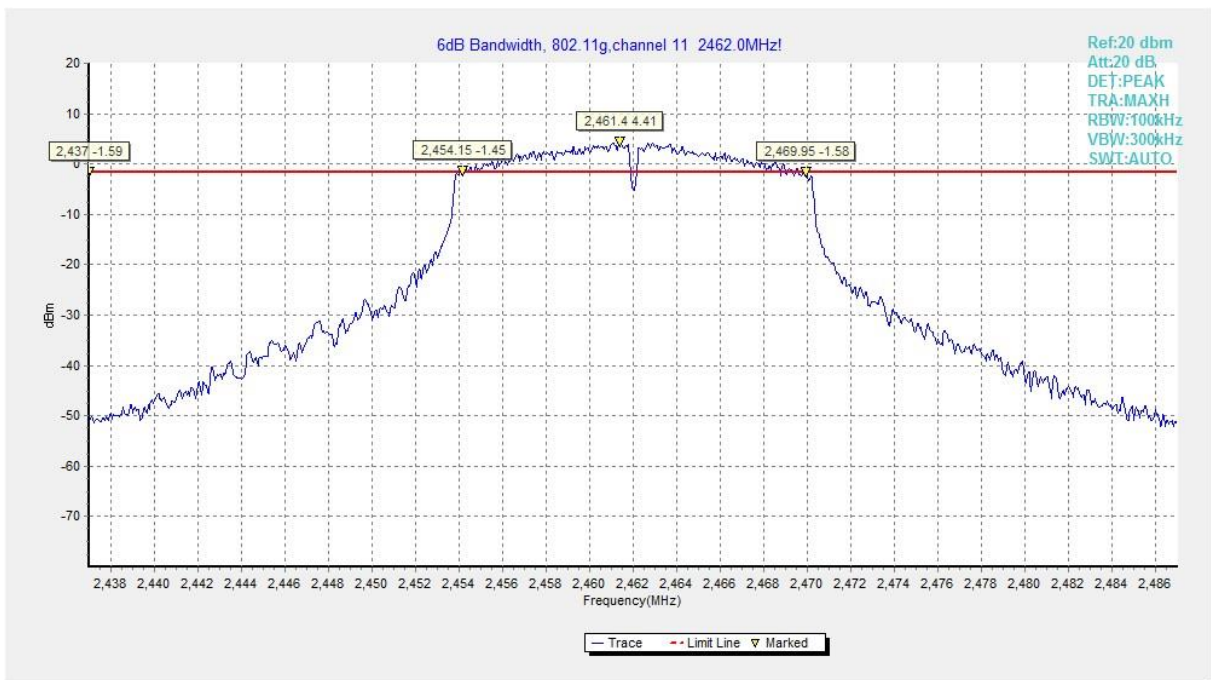


Fig.A.4.6 Occupied 6dB Bandwidth (802.11g, Ch 11)

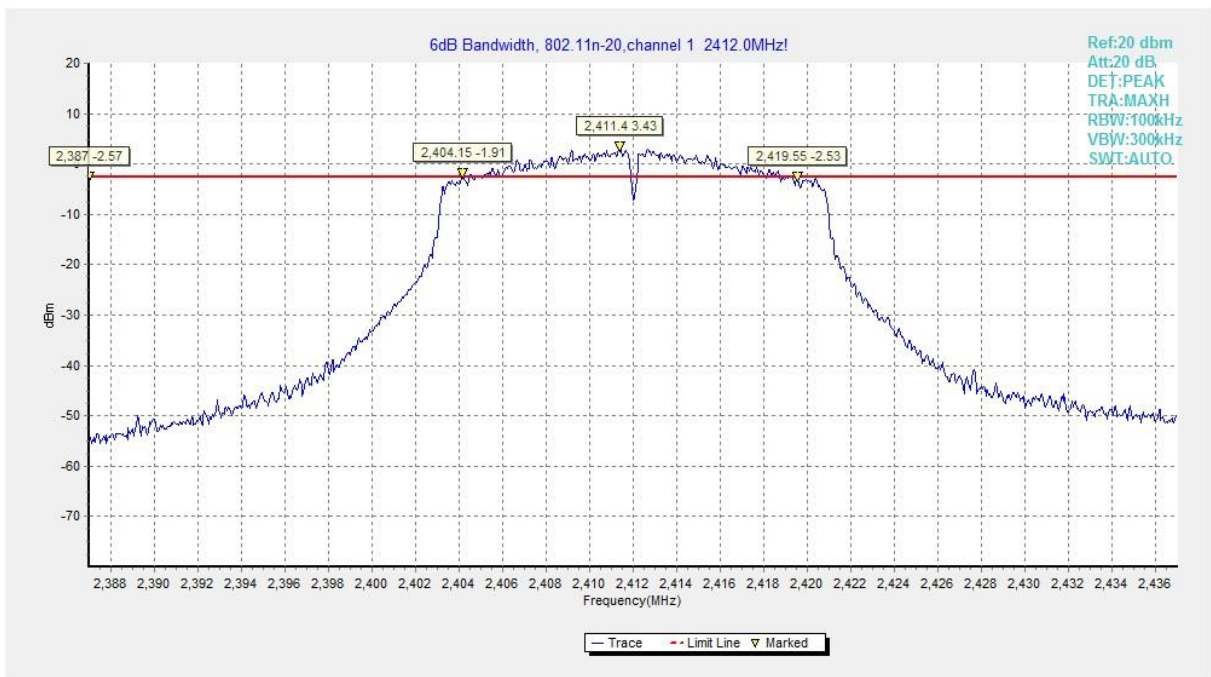


Fig.A.4.7 Occupied 6dB Bandwidth (802.11n-20MHz, Ch 1)

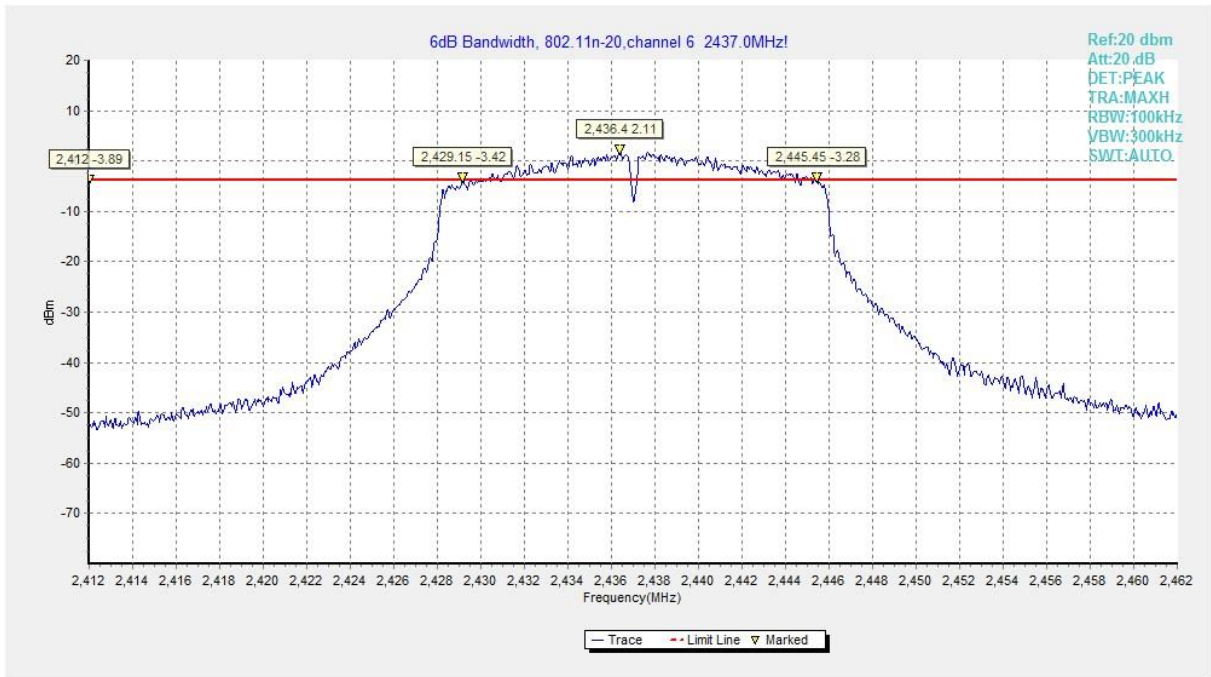


Fig.A.4.8 Occupied 6dB Bandwidth (802.11n-HT20, Ch 6)

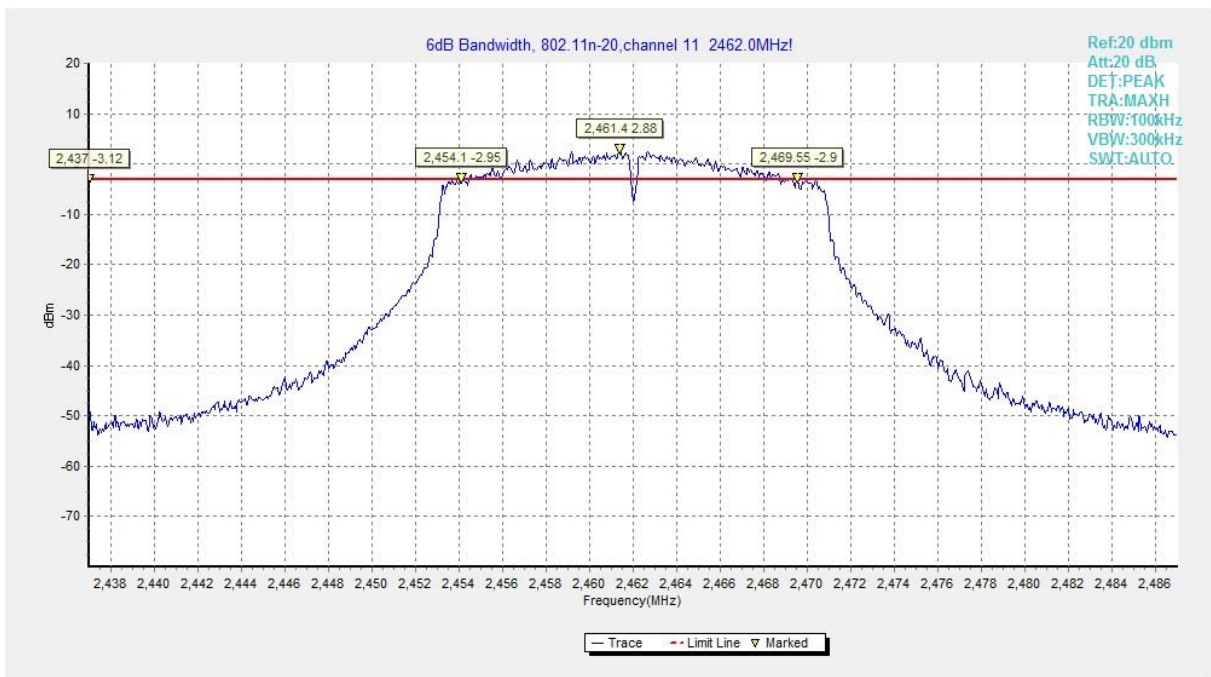


Fig.A.4.9 Occupied 6dB Bandwidth (802.11n-HT20, Ch 11)

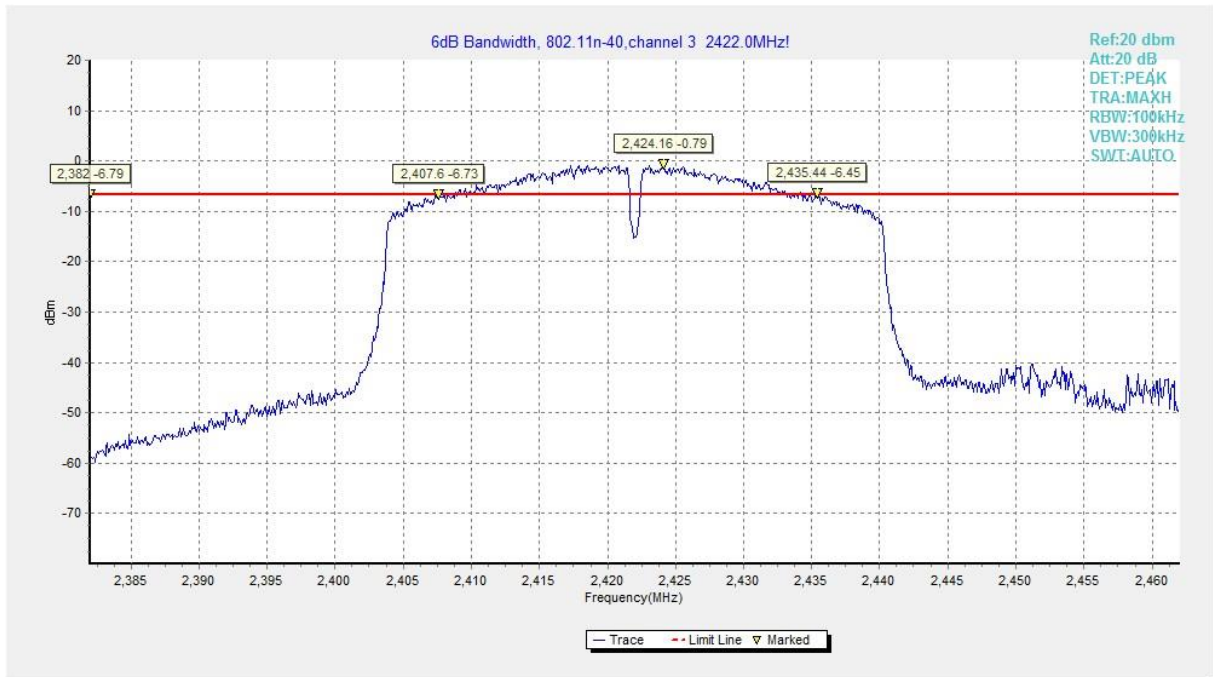


Fig.A.4.10 Occupied 6dB Bandwidth (802.11n-HT40 Ch 3)

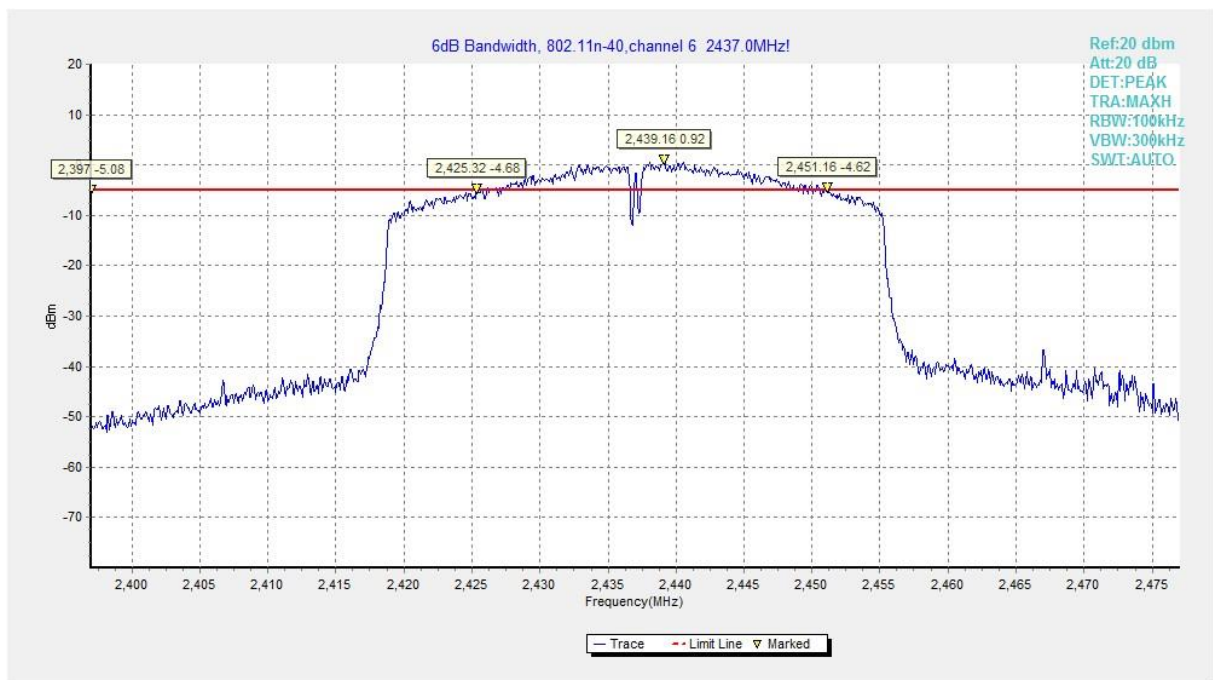


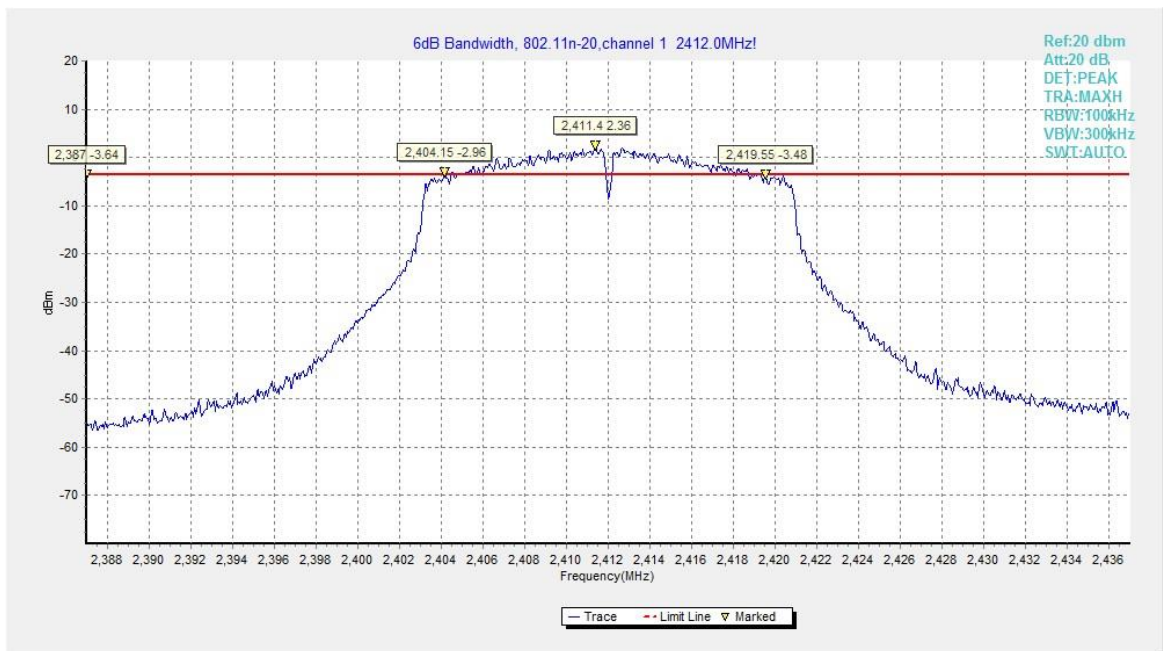
Fig.A.4.11 Occupied 6dB Bandwidth (802.11n-HT40, Ch 6)



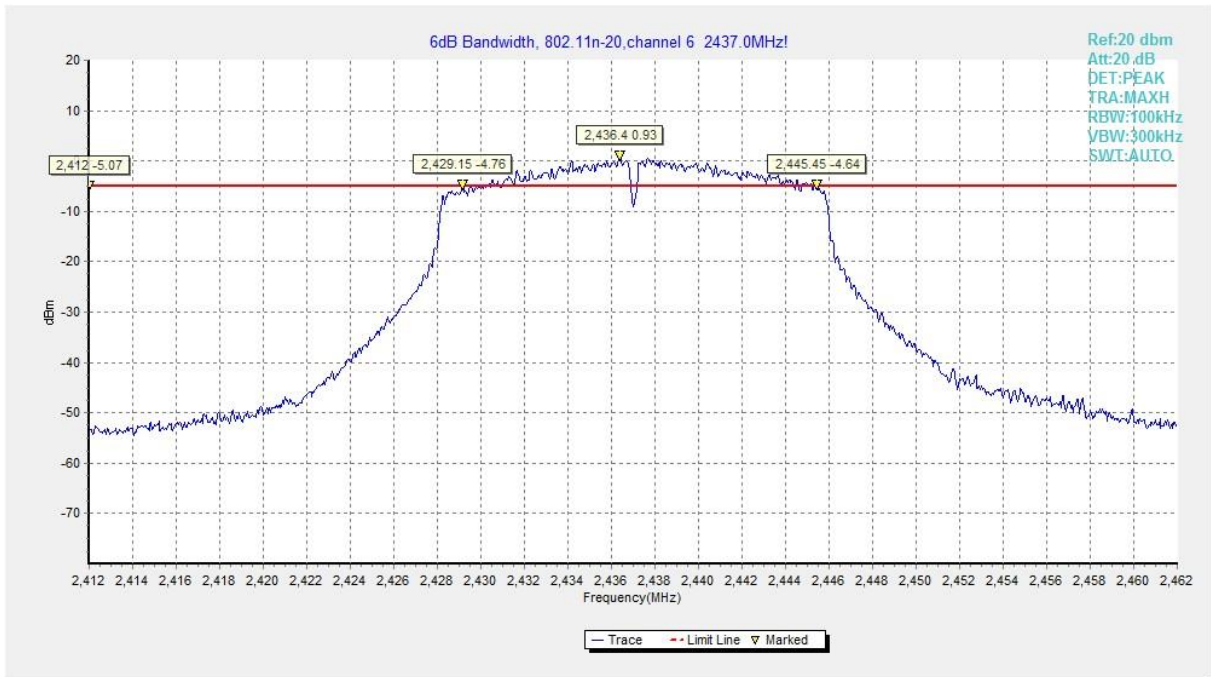


Fig.A.4.12 Occupied 6dB Bandwidth (802.11n-HT40, Ch 9)

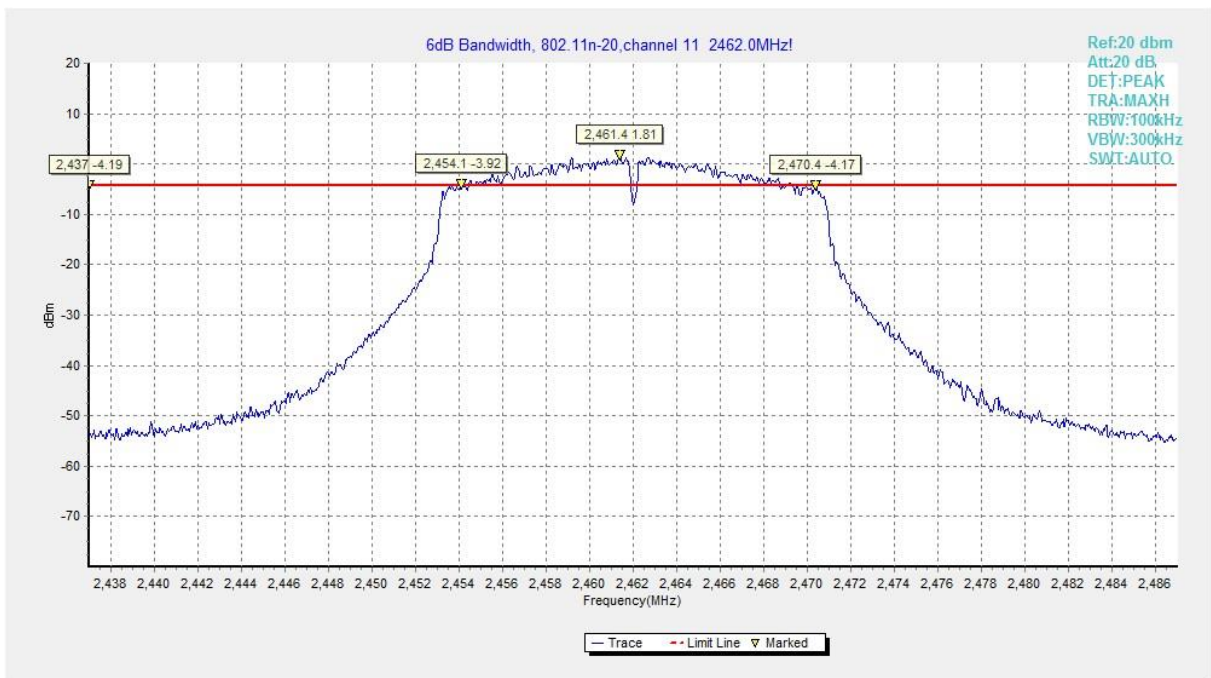
MIMO ANT0:



**Fig.A.4.13 Occupied 6dB Bandwidth (802.11n-20MHz, Ch 1)**



**Fig.A.4.14 Occupied 6dB Bandwidth (802.11n-HT20, Ch 6)**



**Fig.A.4.15 Occupied 6dB Bandwidth (802.11n-HT20, Ch 11)**



Fig.A.4.16 Occupied 6dB Bandwidth (802.11n-40MHz, Ch 3)

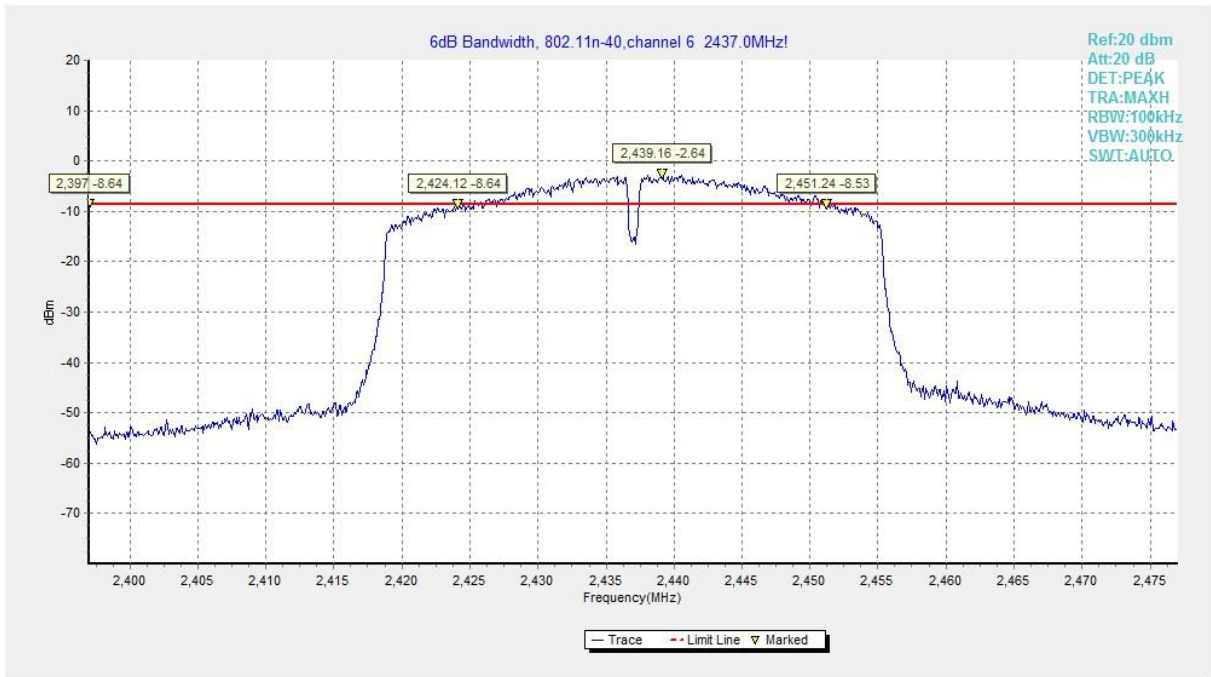


Fig.A.4.17 Occupied 6dB Bandwidth (802.11n-HT40, Ch 6)

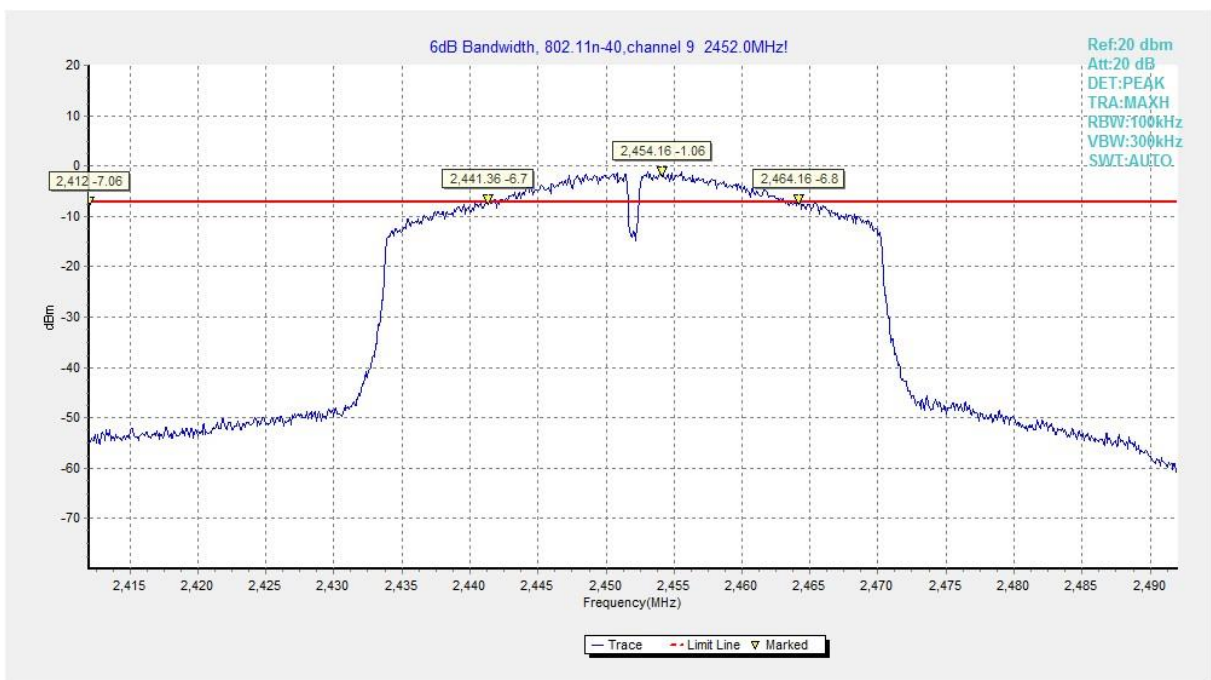


Fig.A.4.18 Occupied 6dB Bandwidth (802.11n-HT40, Ch 9)

## **A.5. Band Edges Compliance**

**Method of Measurement: See ANSI C63.10-2013-clause 6.10.4**

Connect the spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described below.

- a) Set Span = 100MHz
- b) Sweep Time: coupled
- c) Set the RBW= 100 kHz
- c) Set the VBW= 300 kHz
- d) Detector: Peak
- e) Trace: Max hold

**Measurement Limit:**

Standard	Limit (dBc)
FCC 47 CFR Part 15.247 (d)	> 20

**EUT ID: EUT1**

**Measurement Result:**

**SISO ANT0:**

**802.11b/g mode**

Mode	Channel	Test Results	Conclusion
802.11b	1	Fig.A.5.1	<b>P</b>
	11	Fig.A.5.2	<b>P</b>
802.11g	1	Fig.A.5.3	<b>P</b>
	11	Fig.A.5.4	<b>P</b>

**802.11n-HT20 mode**

Mode	Channel	Test Results	Conclusion
802.11n (HT20)	1	Fig.A.5.5	<b>P</b>
	11	Fig.A.5.6	<b>P</b>

**802.11n-HT40 mode**

Mode	Channel	Test Results	Conclusion
802.11n (HT20)	3	Fig.A.5.7	<b>P</b>
	9	Fig.A.5.8	<b>P</b>

**MIMO ANT0:**

**802.11n-HT20 mode**

Mode	Channel	Test Results	Conclusion
802.11n (HT20)	1	Fig.A.5.9	<b>P</b>
	11	Fig.A.5.10	<b>P</b>

**802.11n-HT40 mode**

Mode	Channel	Test Results	Conclusion
802.11n (HT20)	3	Fig.A.5.11	P
	9	Fig.A.5.12	P

**MIMO ANT1:**

**802.11n-HT20 mode**

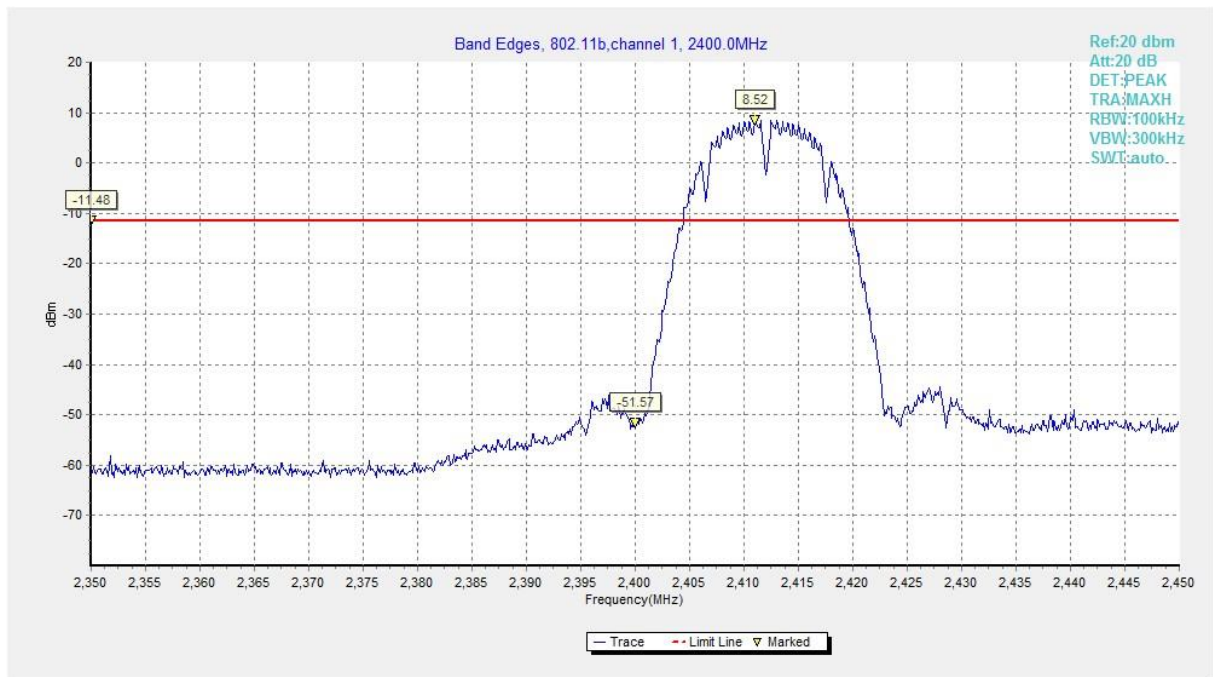
Mode	Channel	Test Results	Conclusion
802.11n (HT20)	1	Fig.A.5.13	P
	11	Fig.A.5.14	P

**802.11n-HT40 mode**

Mode	Channel	Test Results	Conclusion
802.11n (HT20)	3	Fig.A.5.15	P
	9	Fig.A.5.16	P

**Conclusion: Pass**

**Test graphs as below:**



**Fig.A.5.1 Band Edges (802.11b, Ch 1)**

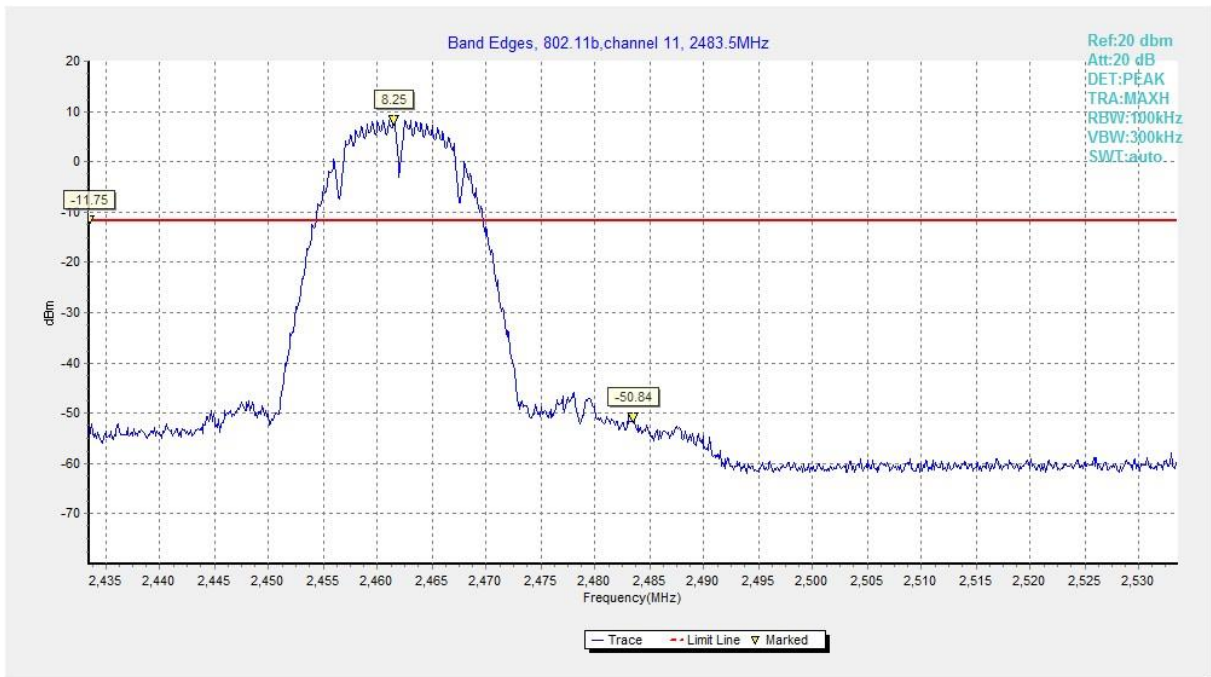


Fig.A.5.2 Band Edges (802.11b, Ch 11)

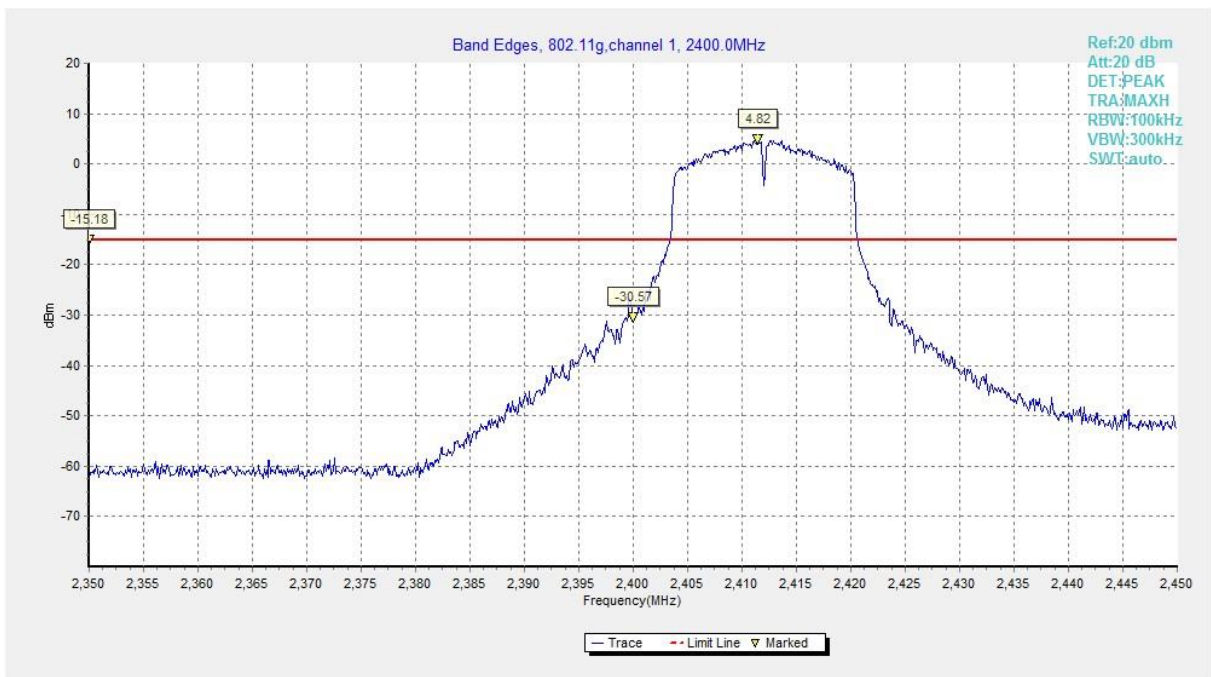


Fig.A.5.3 Band Edges (802.11g, Ch 1)

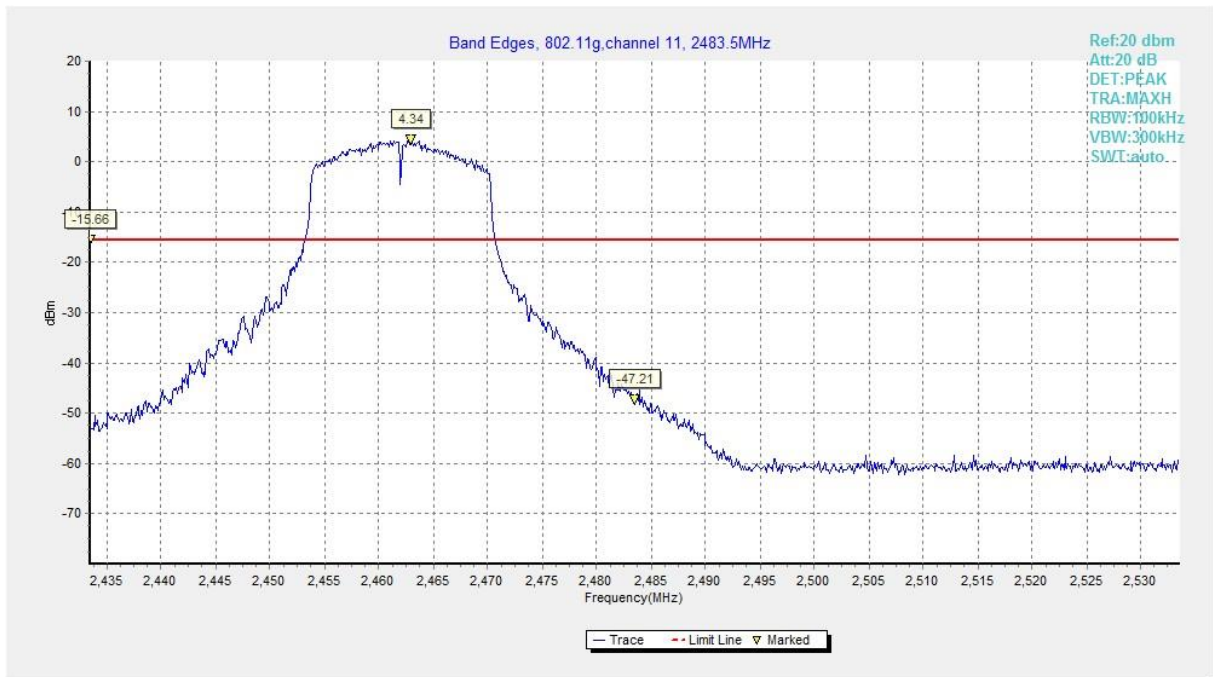


Fig.A.5.4 Band Edges (802.11g, Ch 11)



Fig.A.5.5 Band Edges (802.11n-HT20, Ch 1)





Fig.A.5.6 Band Edges (802.11n-HT20, Ch 11)



Fig.A.5.7 Band Edges (802.11n-HT40, Ch 3)

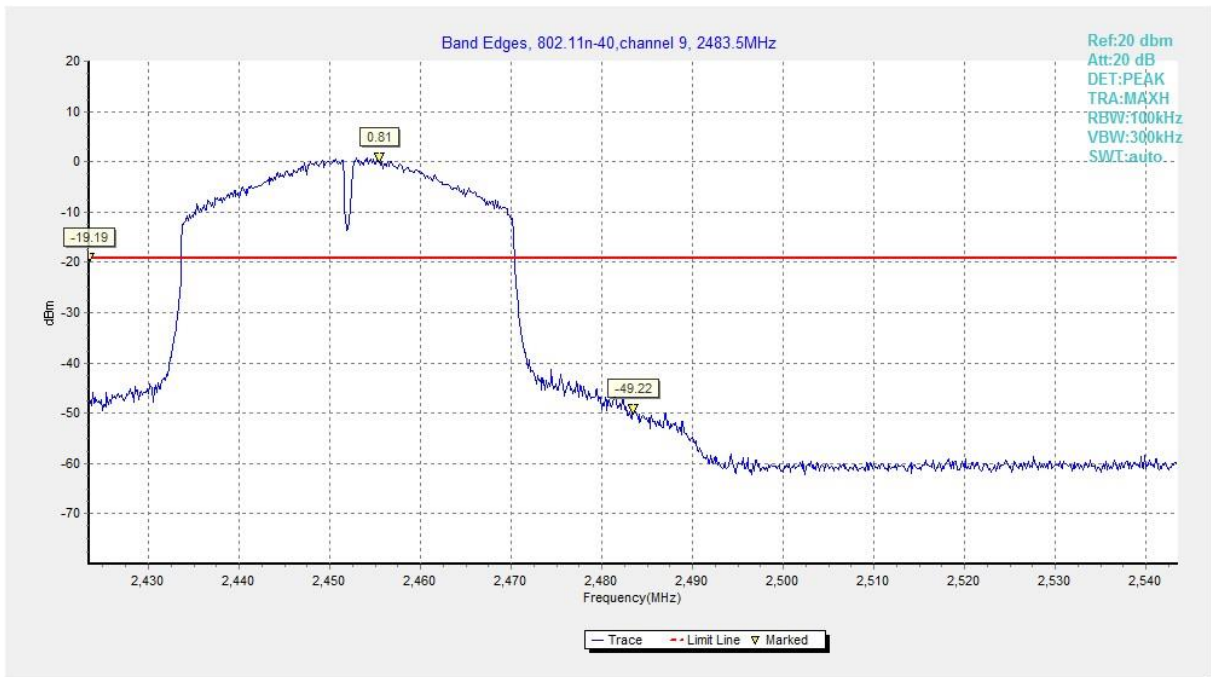


Fig.A.5.8 Band Edges (802.11n-HT40, Ch 9)

MIMO ANT0:



Fig.A.5.9 Band Edges (802.11n-HT20, Ch 1)



Fig.A.5.10 Band Edges (802.11n-HT20, Ch 11)

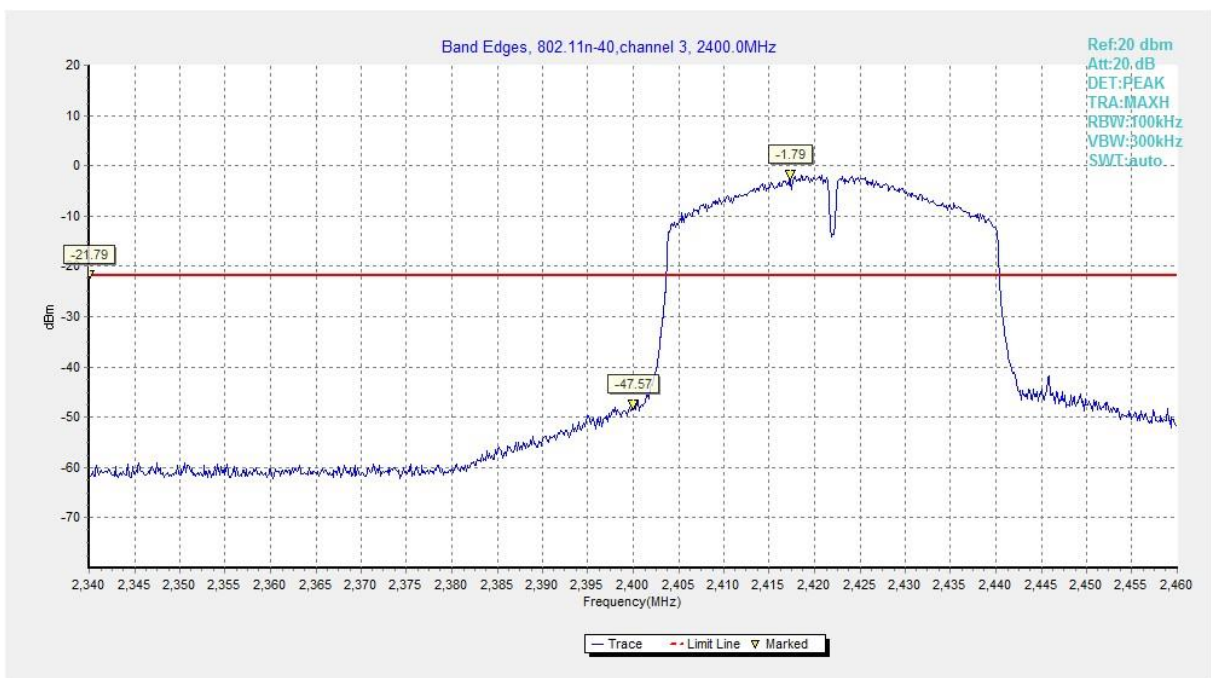


Fig.A.5.11 Band Edges (802.11n-HT40, Ch 3)

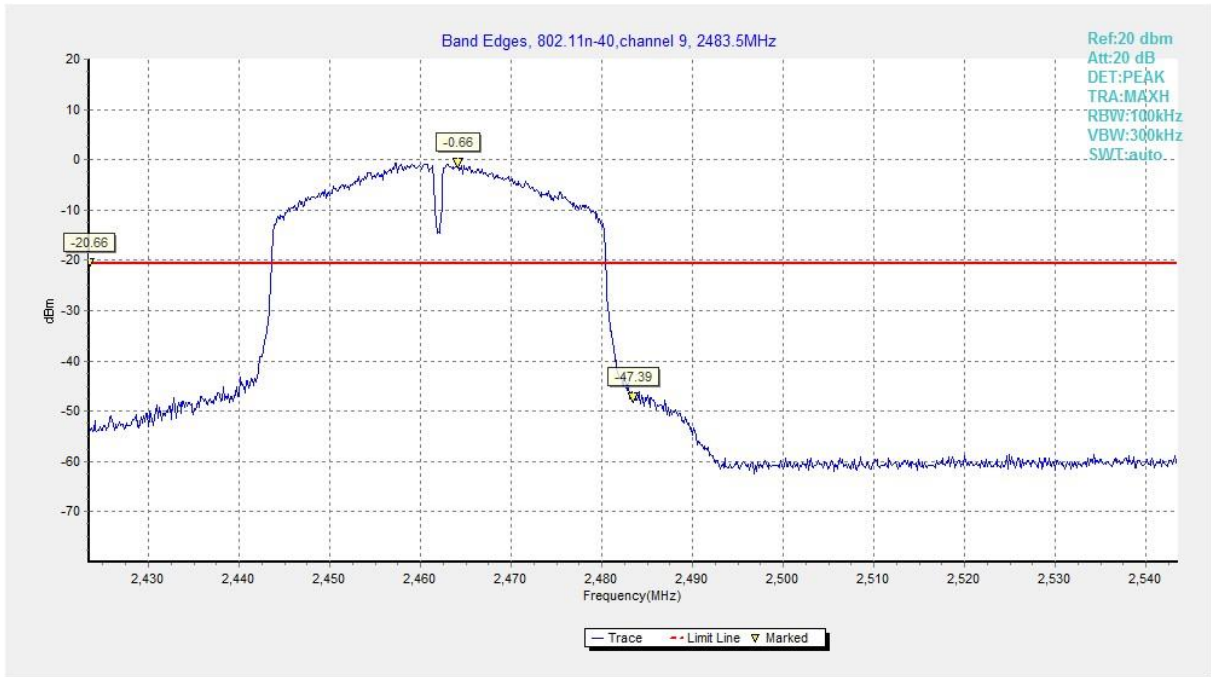


Fig.A.5.12 Band Edges (802.11n-HT40, Ch 9)

MIMO ANT1:



Fig.A.5.13 Band Edges (802.11n-HT20, Ch 1)



Fig.A.5.14 Band Edges (802.11n-HT20, Ch 11)

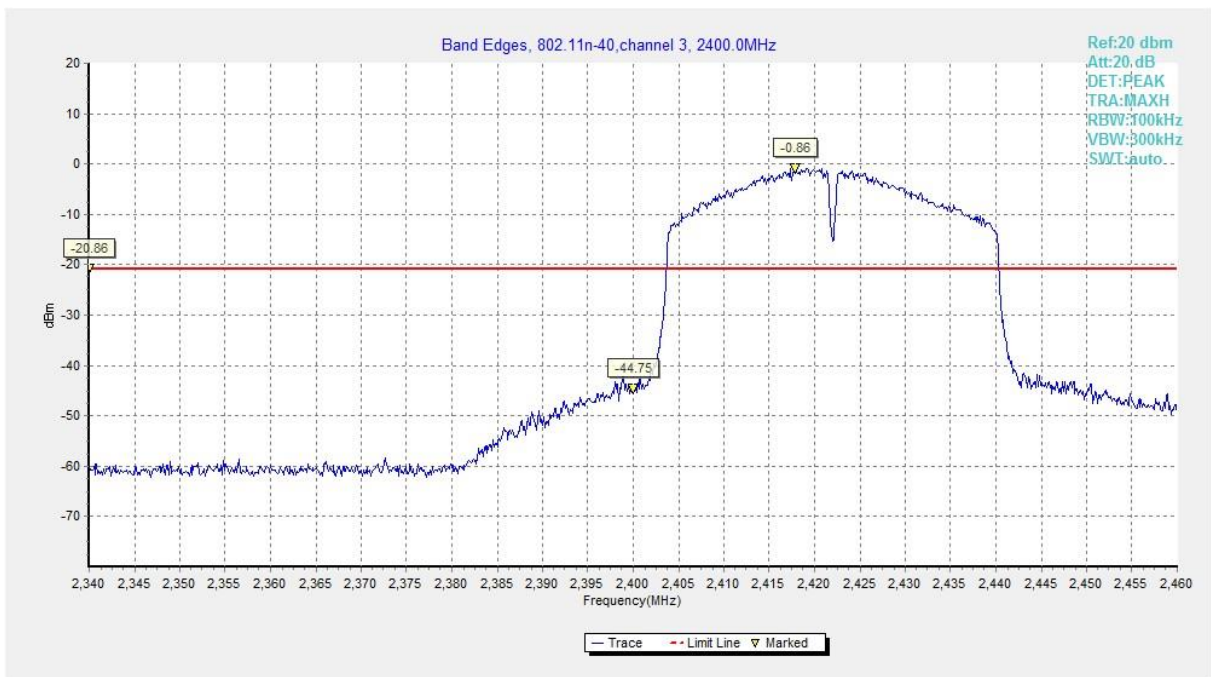


Fig.A.5.15 Band Edges (802.11n-HT40, Ch 3)



Fig.A.5.16 Band Edges (802.11n-HT40, Ch 9)

## **A.6. Transmitter Spurious Emission**

### **A.6.1 Transmitter Spurious Emission – Conducted**

**Method of Measurement: See ANSI C63.10-2013-clause 11.11**

Establish a reference level by using the following procedure:

- a) Set instrument center frequency to DTS channel center frequency
- b) Set the span to  $\geq 1.5$  times the DTS bandwidth
- c) Set the RBW= 100 kHz
- d) Set the VBW= 300 kHz
- e) Detector = Peak
- f) Sweep time = auto couple
- g) Trace mode = max hold
- h) Allow trace to fully stabilize
- i) Use the peak marker function to determine the maximum PSD level

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Establish an emission level by using the following procedure:

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW = 300 kHz.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

#### **Measurement Limit:**

<b>Standard</b>	<b>Limit</b>
FCC 47 CFR Part 15.247 (d)	20dB below peak output power in 100 kHz bandwidth

**EUT ID: EUT1**

**Measurement Results:**

**SISO ANT0:**

MODE	Channel	Frequency Range	Test Results	Conclusion
802.11b	1	2.412 GHz	Fig.A.6.1.1	P
		30 MHz ~ 26 GHz	Fig.A.6.1.2	P
	6	2.437 GHz	Fig.A.6.1.3	P
		30 MHz ~ 26 GHz	Fig.A.6.1.4	P
	11	2.462 GHz	Fig.A.6.1.5	P
		30 MHz ~ 26 GHz	Fig.A.6.1.6	P
MODE	Channel	Frequency Range	Test Results	Conclusion
802.11g	1	2.412 GHz	Fig.A.6.1.7	P
		30 MHz ~ 26 GHz	Fig.A.6.1.8	P
	6	2.437 GHz	Fig.A.6.1.9	P
		30 MHz ~ 26 GHz	Fig.A.6.1.10	P
	11	2.462 GHz	Fig.A.6.1.11	P
		30 MHz ~ 26 GHz	Fig.A.6.1.12	P
MODE	Channel	Frequency Range	Test Results	Conclusion
802.11n (HT20)	1	2.412 GHz	Fig.A.6.1.13	P
		30 MHz ~ 26 GHz	Fig.A.6.1.14	P
	6	2.437 GHz	Fig.A.6.1.15	P
		30 MHz ~ 26 GHz	Fig.A.6.1.16	P
	11	2.462 GHz	Fig.A.6.1.17	P
		30 MHz ~ 26 GHz	Fig.A.6.1.18	P
MODE	Channel	Frequency Range	Test Results	Conclusion
802.11n (HT40)	3	2.422 GHz	Fig.A.6.1.19	P
		30 MHz ~ 26 GHz	Fig.A.6.1.20	P
	6	2.437 GHz	Fig.A.6.1.21	P
		30 MHz ~ 26 GHz	Fig.A.6.1.22	P
	9	2.452 GHz	Fig.A.6.1.23	P
		30 MHz ~ 26 GHz	Fig.A.6.1.24	P

**SISO ANT1:**

MODE	Channel	Frequency Range	Test Results	Conclusion
802.11n (HT20)	1	2.412 GHz	Fig.A.6.1.25	P
		30 MHz ~ 26 GHz	Fig.A.6.1.26	P
	6	2.437 GHz	Fig.A.6.1.27	P
		30 MHz ~ 26 GHz	Fig.A.6.1.28	P
	11	2.462 GHz	Fig.A.6.1.29	P
		30 MHz ~ 26 GHz	Fig.A.6.1.30	P
MODE	Channel	Frequency Range	Test Results	Conclusion



802.11n (HT40)	3	2.422 GHz	Fig.A.6.1.31	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.32	<b>P</b>
	6	2.437 GHz	Fig.A.6.1.33	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.34	<b>P</b>
	9	2.452 GHz	Fig.A.6.1.35	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.36	<b>P</b>

**MIMO ANT0:**

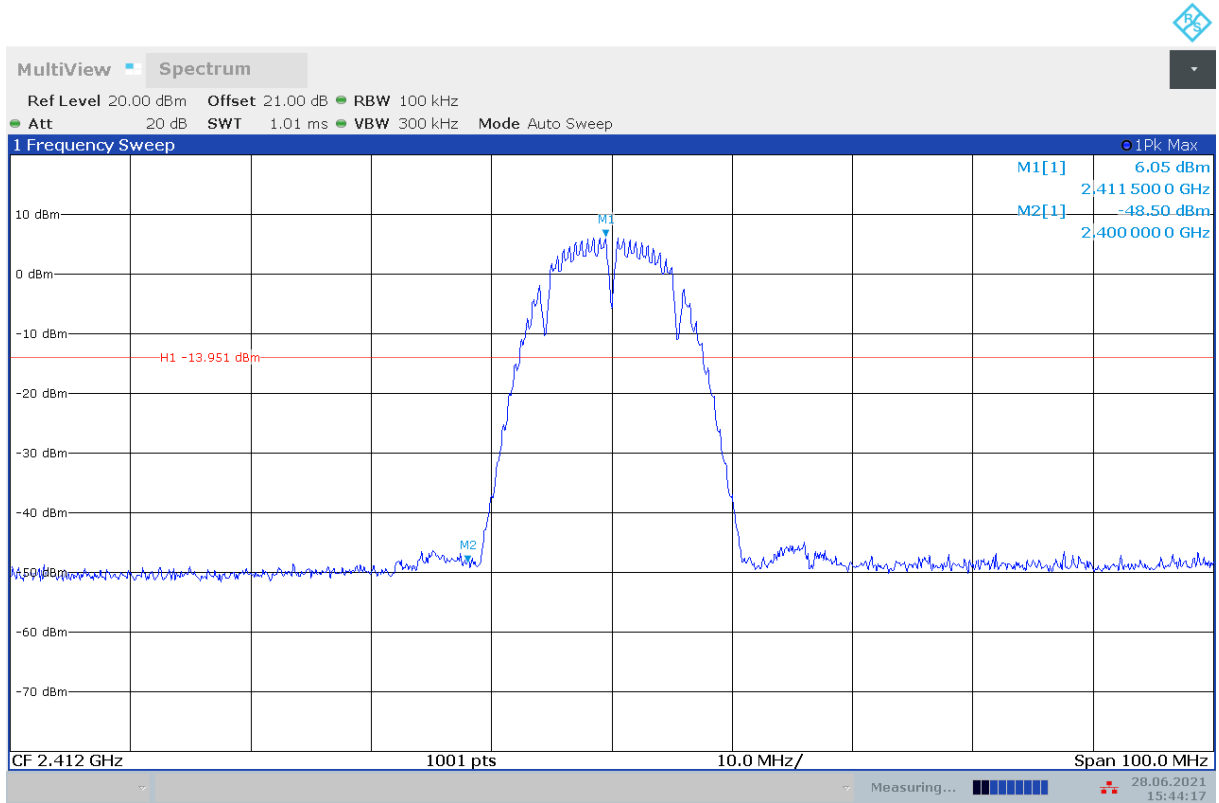
MODE	Channel	Frequency Range	Test Results	Conclusion
802.11n (HT20)	1	2.412 GHz	Fig.A.6.1.37	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.38	<b>P</b>
	6	2.437 GHz	Fig.A.6.1.39	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.40	<b>P</b>
	11	2.462 GHz	Fig.A.6.1.41	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.42	<b>P</b>
MODE	Channel	Frequency Range	Test Results	Conclusion
802.11n (HT40)	3	2.422 GHz	Fig.A.6.1.43	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.44	<b>P</b>
	6	2.437 GHz	Fig.A.6.1.45	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.46	<b>P</b>
	9	2.452 GHz	Fig.A.6.1.47	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.48	<b>P</b>

**MIMO ANT1:**

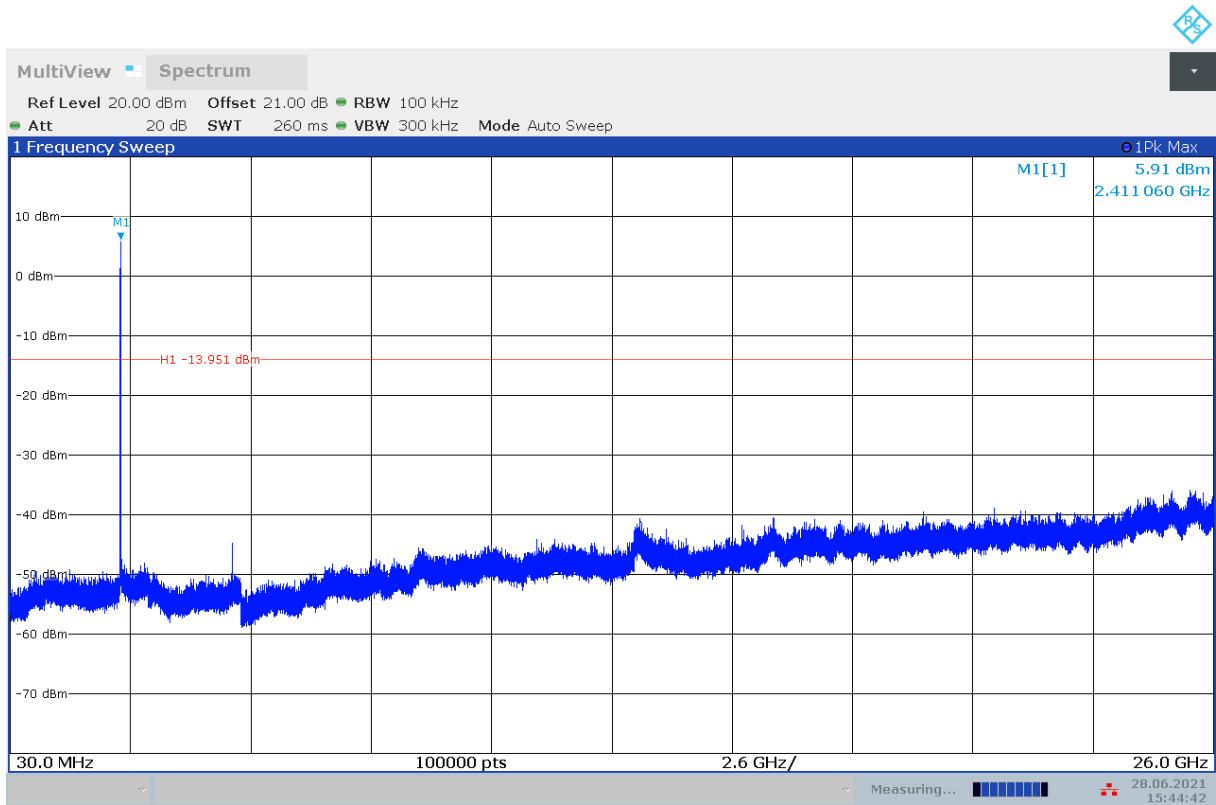
MODE	Channel	Frequency Range	Test Results	Conclusion
802.11n (HT20)	1	2.412 GHz	Fig.A.6.1.49	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.50	<b>P</b>
	6	2.437 GHz	Fig.A.6.1.51	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.52	<b>P</b>
	11	2.462 GHz	Fig.A.6.1.53	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.54	<b>P</b>
MODE	Channel	Frequency Range	Test Results	Conclusion
802.11n (HT40)	3	2.422 GHz	Fig.A.6.1.55	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.56	<b>P</b>
	6	2.437 GHz	Fig.A.6.1.57	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.58	<b>P</b>
	9	2.452 GHz	Fig.A.6.1.59	<b>P</b>
		30 MHz ~ 26 GHz	Fig.A.6.1.60	<b>P</b>

**Conclusion: Pass**

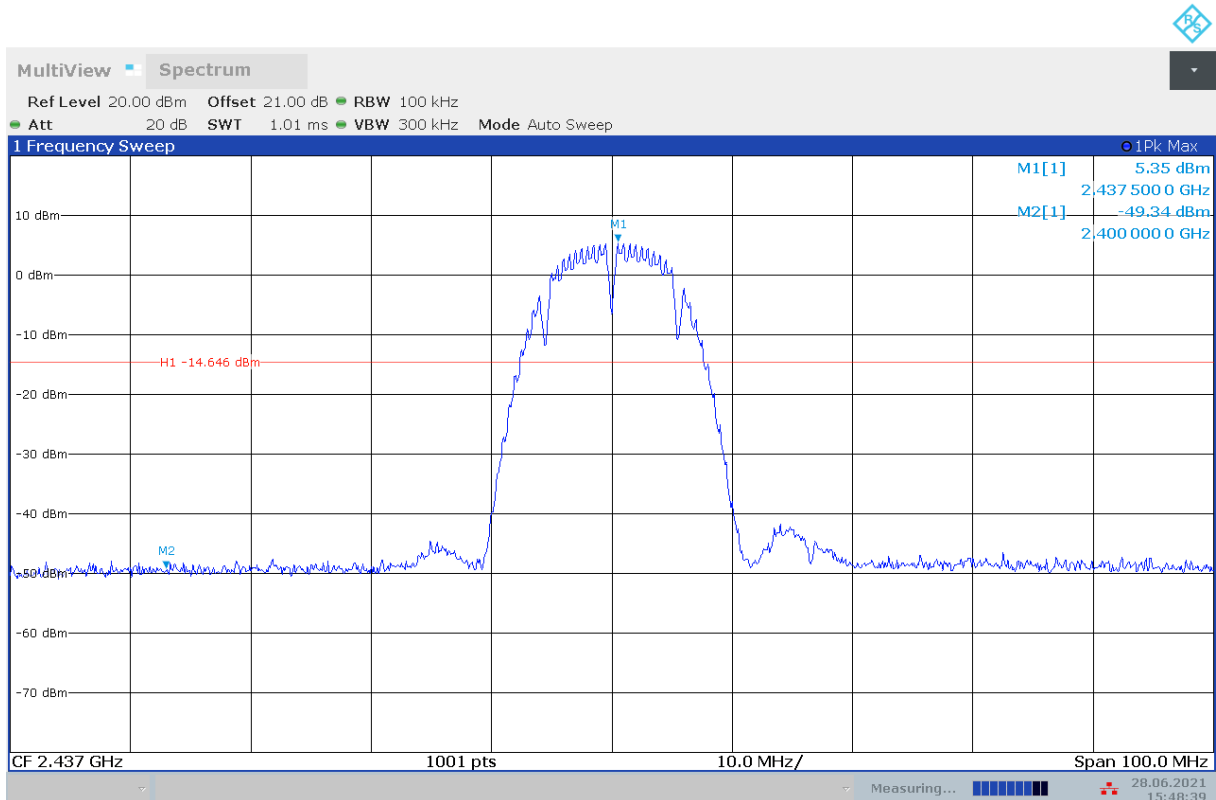
**Test graphs as below:**



**Fig.A.6.1.1 Transmitter Spurious Emission - Conducted (802.11b, Ch1, Center Frequency)**

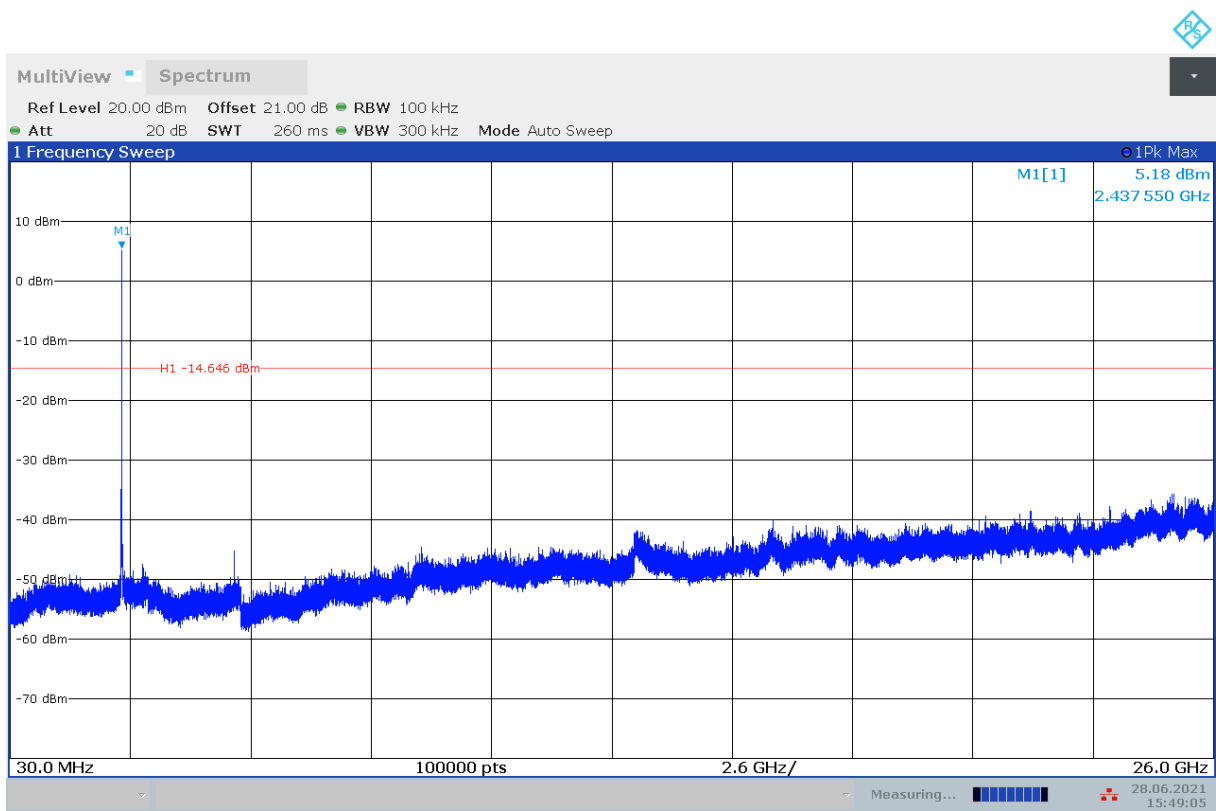


**Fig.A.6.1.2 Transmitter Spurious Emission - Conducted (802.11b, Ch1, 30 MHz-26 GHz)**

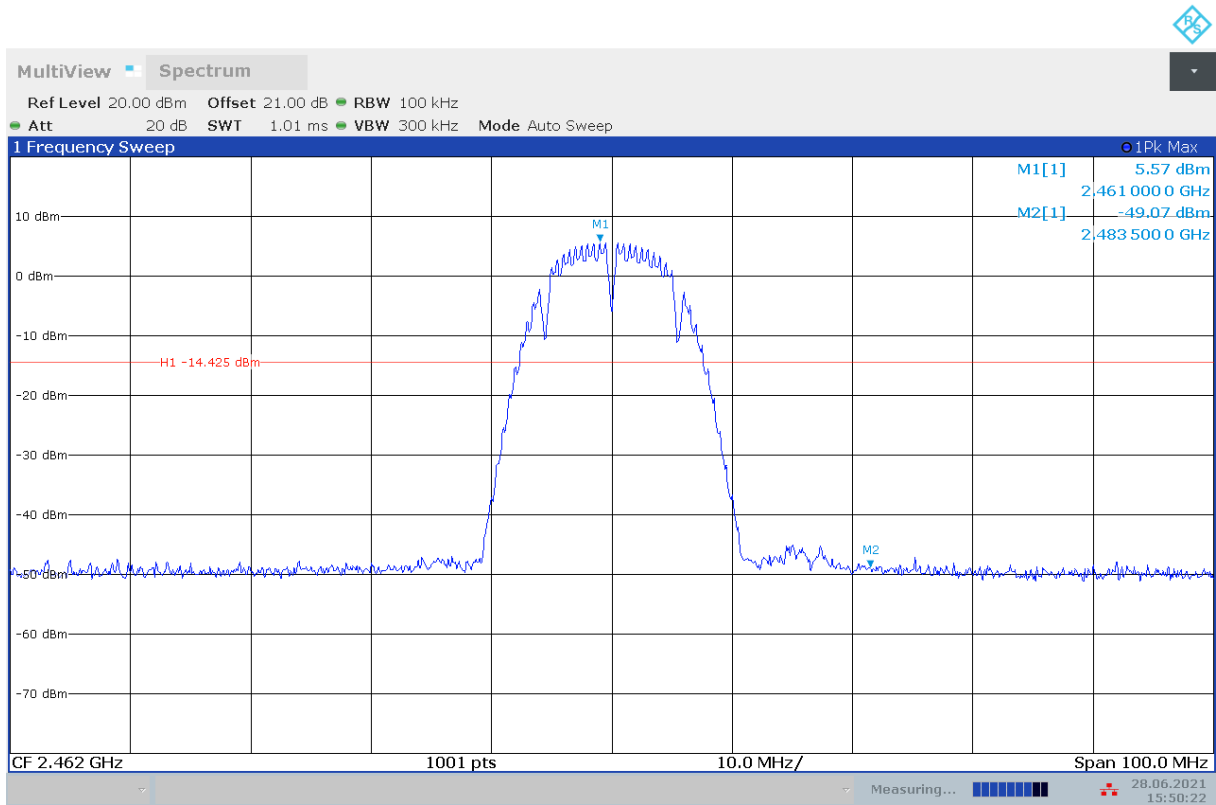


**Fig.A.6.1.3 Transmitter Spurious Emission - Conducted (802.11b, Ch6, Center)**

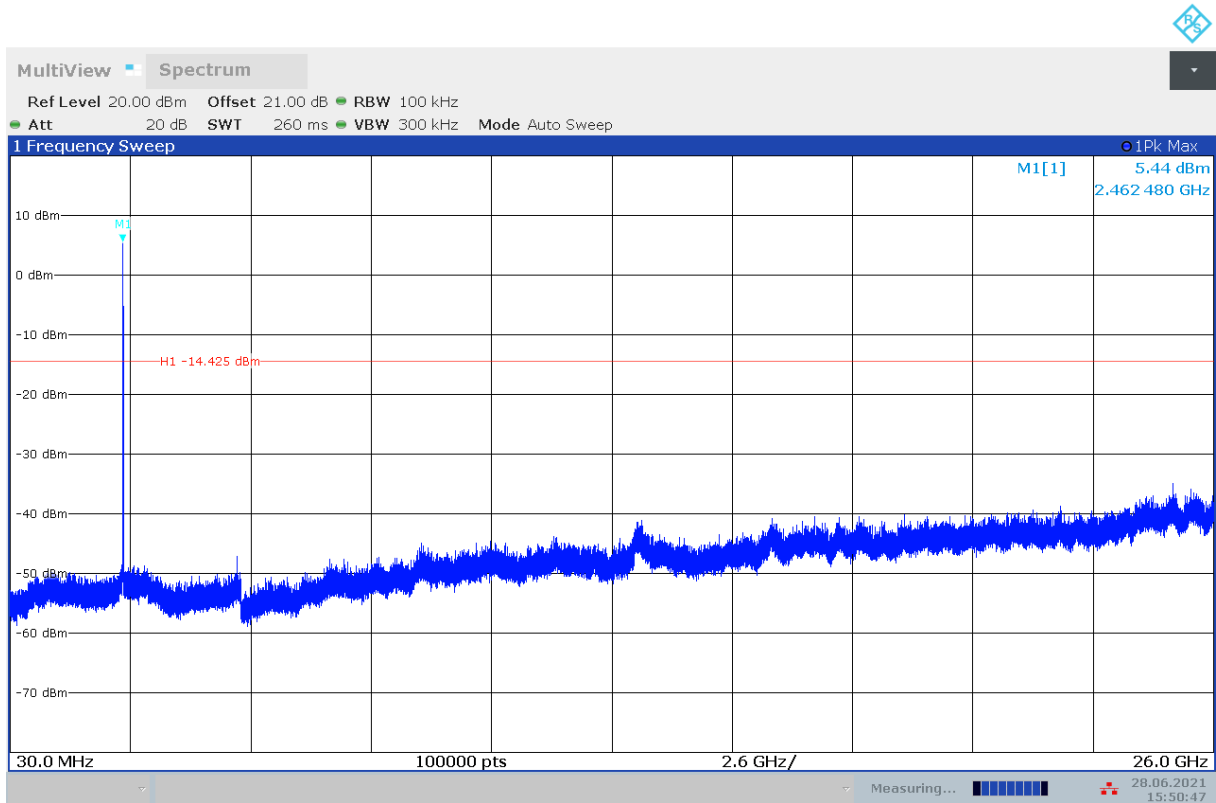
Frequency)



**Fig.A.6.1.4 Transmitter Spurious Emission - Conducted (802.11b, Ch6, 30 MHz-26 GHz)**

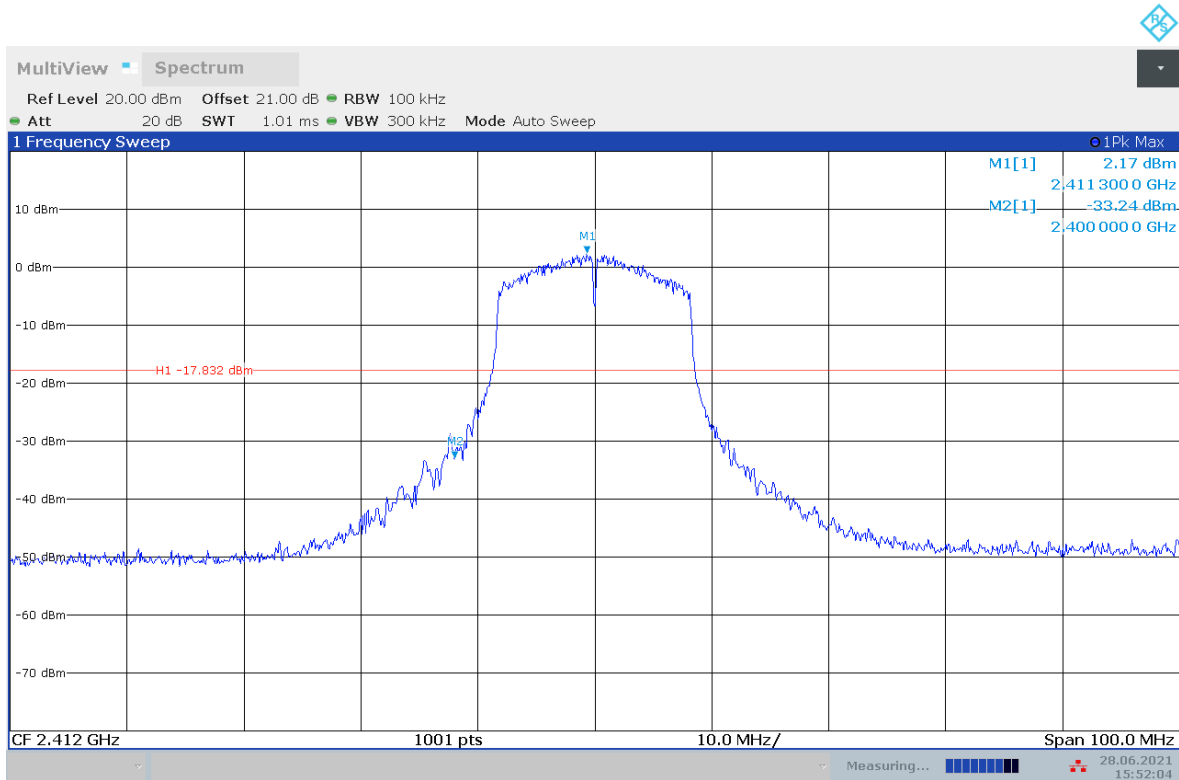


**Fig.A.6.1.5 Transmitter Spurious Emission - Conducted (802.11b, Ch11, Center Frequency)**

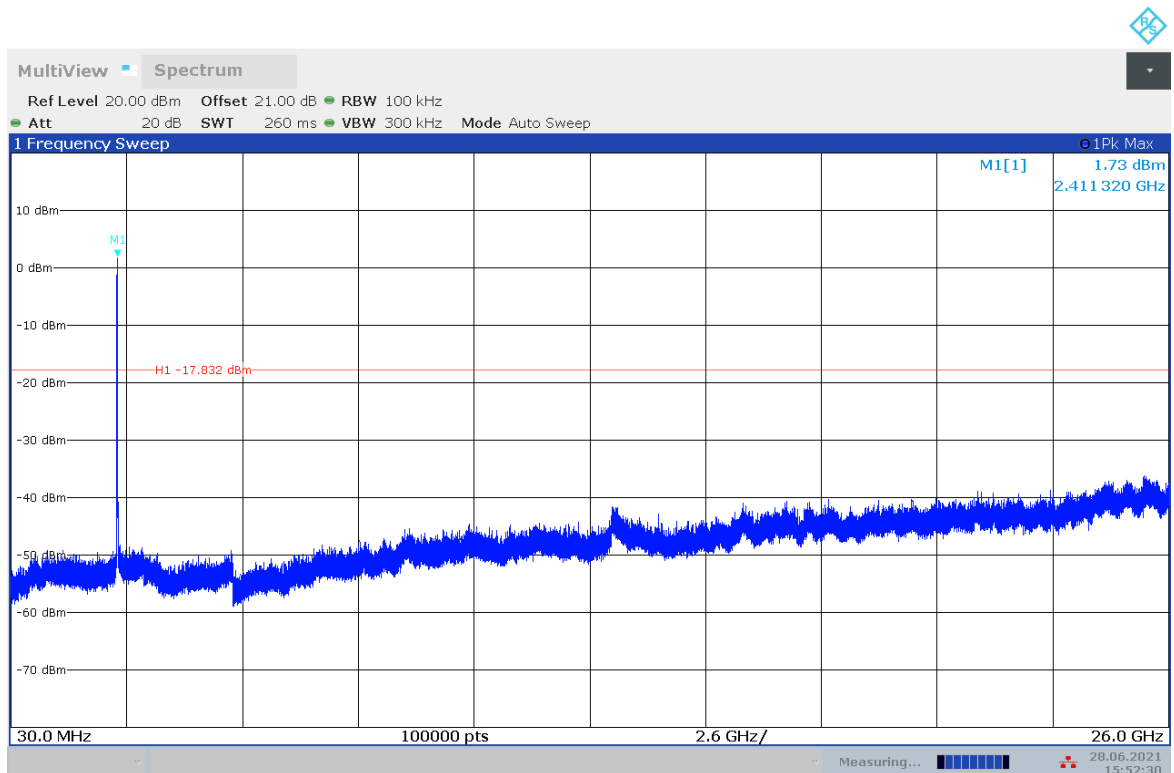


**Fig.A.6.1.6 Transmitter Spurious Emission - Conducted (802.11b, Ch11, 30 MHz-26)**

GHz)



**Fig.A.6.1.7 Transmitter Spurious Emission - Conducted (802.11g, Ch1, Center Frequency)**



**Fig.A.6.1.8 Transmitter Spurious Emission - Conducted (802.11g, Ch1, 30 MHz-26 GHz)**