



Test report

according to ISO/IEC 17025:2017

FCC

(Federal Communications Commission)

Test Firm Registration Number: 768032

Designation Number DE0022

ISED

(Innovation, Science and Economic Development)

CAB identifier: DE0012

ISED#: 6155A

Electromagnetic compatibility

Intentional Radiators



Deutsche
Akkreditierungsstelle
D-PL-17379-01-00
D-PL-17379-01-02
D-PL-17379-01-03



BNetzA-CAB-18/21-19



STC Germany GmbH
Ohmstrasse 1
84160 Frontenhausen, Germany
Tel.: + 49 (0) 8732 6381
Fax: + 49 (0) 8732 2345
E-mail: grstc@stc.group

Test report no.: **20/01-0030-A**

Page 1 of 108 pages

Table of contents

1.	Client information	3
2.	Equipment under test (EUT)	3
3.	Description of the Equipment under test and test conditions	4
4.	Performed measurements and results.....	6
5.	AC Mains conducted emissions	7
6.	Radiated emission measurements	13
7.	Operation within the band 902-928 MHz, 2400-2483,5 MHz and 5725-5850 MHz	20
8.	Test equipment.....	98
9.	Test Setups	100
10.	Measurement uncertainty.....	104
11.	Photos setup	106
12.	Conclusions.....	107
13.	Photos of tested sample	108

Location of test facility:



STC Germany GmbH
Ohmstrasse 1
84160 Frontenhausen
Germany

1. Client information

Name: Vestel Elektronik San ve Tic. A.S.
Address: Organize Sanayi Bölgesi
Vestel City, High-End
45030 MANISA
TURKEY
Name of contact: Mr. Andac Pamuk
Telephone: +90 236 2332582
Fax: +90 236 2332584
E-mail: Andac.pamuk@vestel.com.tr

2. Equipment under test (EUT)

2.1 Identification of the EUT

Equipment: WIFI Module
Model: 17WFM21
Brand name: -/
Serial no.: -/
Manufacturer: Vestel Elektronik San ve Tic. A.S., Organize Sanayi Bölgesi, Vestel City, High-End, 45030 MANISA, TURKEY
Country of origin: TURKEY
Power rating:
Highest frequency generated or used in the device or on which the device operates or tunes (MHz): 5.70 GHz
Date Sample Received: 16.01.2020, 25.03.2020
Tests were performed: 01.04.2020 – 08.04.2020

2.2 Additional information about the EUT:

The EUT can also operate as 5 GHz Wifi module, but not simultaneously to the 2.4 Ghz RF-function. The 5 GHz is not documented in this Report.

To duplicate parts of this test report needs the written confirmation of the test laboratory.

The test results relate only to the above mentioned test sample(s).

3. Description of the Equipment under test and test conditions

FCC-ID:	2AVQS-17WFM21			
IC:	25888-17WFM21			
HVIN:	260419-R3			
Firmware version:	3.4.1			
Software to control EUT:	MT7662 QA tool (V1.0.3.24)			
Power:	nominal 5 V $\pm$, +/- 5 %			
Cables:	USB cable 100 cm Cable to test adaptor 30 cm			
Approx. Size (l x w x h):	(70 x 25 x 4.5) mm			
Test conditions:	The "WIFI Module – 17WFM21" (= equipment under test – EUT) had been tested, where applicable, in the following modes: (1) 802.11b: Tx mode BW 20MHz CCK 1Mbps 2412 MHz (2) 802.11b: Tx mode BW 20MHz CCK 1Mbps 2437 MHz (3) 802.11b: Tx mode BW 20MHz CCK 1Mbps 2462 MHz (4) 802.11g: Tx mode BW 20MHz OFDM 6Mbps 2412 MHz (5) 802.11g: Tx mode BW 20MHz OFDM 6Mbps 2437 MHz (6) 802.11g: Tx mode BW 20MHz OFDM 6Mbps 2462 MHz (7) 802.11n: Tx mode BW 20MHz HT Greenfield 6.5Mbps 2412 MHz (8) 802.11n: Tx mode BW 20MHz HT Greenfield 6.5Mbps 2437 MHz (9) 802.11n: Tx mode BW 20MHz HT Greenfield 6.5Mbps 2462MHz (10) 802.11n: Tx mode BW 40MHz HT Greenfield 15Mbps 2422 MHz (11) 802.11n: Tx mode BW 40MHz HT Greenfield 15Mbps 2437 MHz (12) 802.11n: Tx mode BW 40MHz HT Greenfield 15Mbps 2452 MHz with an active WLAN connection as well as controlled by a test software with maximum RF-output power and different data rate in order to find the worst case.			
RF Module Model Number:	17WFM21			
Frequency range:	2.400 GHz – 2.483,5 GHz			
Type of modulation:	802.11 b	802.11 g	802.11 n [20]	802.11 n [40]
Operating frequencies [MHz]:	2412 - 2462	2412 - 2462	2412 - 2462	2422 - 2452
6 dB Bandwidth [MHz]:	10.07	16.30	17.06	34.46
Emission classification:	12M9G1D	16M6D1D	17M6D1D	36M2D1D
Transmission protocol:	CCK	OFDM	OFDM (HT Greenfield)	OFDM (HT Greenfield)
Number of channels:	1 - 11	1 - 11	1 - 11	3 - 9
Spurious Emissions:	50.24 dB μ V/m @ 3m	45.88 dB μ V/m @ 3m	48.00 dB μ V/m @ 3m	53.54 dB μ V/m @ 3m
Max. conducted RF output Power [dBm / mW]:	11.86 dBm 15.35 mW	11.51 dBm 14.16 mW	14.39 dBm 27.45 mW	13.75 dBm 23.74 mW
TX Power setting:	19	19	19	19
Duty Cycle:	$\geq 98\%$	$\geq 98\%$	$\geq 98\%$	$\geq 98\%$
Module Transmission Type:	WLAN (1TX, 1RX) / WLAN (2TX, 2RX)			
Transmission protocol Specification:	CCK MCS=0; 1 Mbps - MCS = 11; 11 Mbps OFDM MCS=0; 6 Mbps - MCS = 7; 54 Mbps OFDM (HT Greenfield) MCS=0; 6.5 Mbps - MCS = 9; 26 Mbps			
Environmental conditions during tests:	Ambient temperature 20 °C Relative humidity 40 % Atmospheric pressure 962 mbar			
Antenna specification:	Model: Printed PCB Antennas Antenna 1 Gain: max. 3.4 dBi Antenna 2 Gain: max 2.12 dBi Type: ☐ External (with accessible antenna socket) ☒ Internal (integrated, PCB antenna)			

Test standard:	- e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz - RSS-247 issue 02 February 2017 Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
----------------	---

Channel List

2.4 GHz Band

Frequency Allocation for 802.11b/g/n			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		
20 MHz bandwidth systems, use Channel 1 – Channel 11 / TX Power setting: 19 40 MHz bandwidth systems, use Channel 3 – Channel 9 / TX Power setting: 19			

The EUT has two antennas which can be used for transmitting and receiving simultaneously as 2TX and 2RX

The EUT can also operate as 5 GHz Wifi module, but not simultaneously to the 2.4 Ghz RF-function.

4. Performed measurements and results

The complete list of measurements required in e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 is given below.

Standard:	Standard:	Test Method:		Test requirements: applicable: fulfilled:			
§ 15.207	RSS-Gen issue 5	ANSI 63.10 Section 6.2	AC Mains Conducted Emissions	☒	☐	☒	☐
§ 15.209	RSS-Gen issue 5	ANSI 63.10 Section 6.3 - 6.6	Radiated Emissions	☒	☐	☒	☐
§15.247	RSS-247 issue 2	ANSI 63.10 Section 11.8.1	6 dB DTS Bandwidth	☒	☐	☒	☐
§15.247	RSS-247 issue 2	ANSI 63.10 Section 11.9.2	Output Power of Fundamental Emissions	☒	☐	☒	☐
§15.247	RSS-247 issue 2	ANSI 63.10 Section 11.10.3	Maximum Power Spectral Density	☒	☐	☒	☐
§15.247	RSS-247 issue 2	ANSI 63.10 Section 11.13.2	Band Edges Measurement	☒	☐	☒	☐
	RSS-Gen issue 5	ANSI 63.10 Section 6.9.3	99% Power Bandwidth	☒	☐	☒	☐
	RSS-Gen issue 5		Antenna requirement	☒	☐	☒	☐

All required / applicable tests according to the following standards were performed under Ref-No. 20/01-0030.

- e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 with test Method according to ANSI C63.10-2013

-RSS-247 issue 02 February 2017 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

- e-CFR data is current as of February 06, 2020

Remark: -/-

5. AC Mains conducted emissions

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.207 Conducted limits
-RSS-Gen issue 05 section 8.8

Test site

Measurements of conducted emission from EUT was made in the shielded chamber (DC - 10GHz) located in the test facility.

Test equipment and test set up

Test equipment used for conducted measurements on Mains as given in clause Test equipment of this report.
Test setup used for conducted measurements on Mains as given in clause Test setups of this report.

Detector function selection and bandwidth

In conducted emissions measurement CISPR quasi-peak- and average-detector were used.
The bandwidth of the detector of instrument is 10 kHz over the frequency range of 150 kHz to 30 MHz.

Frequency range to be scanned

For conducted emission measurements, the spectrum in the range of 150 kHz to 30 MHz was investigated.

Test conditions and configuration of EUT

The EUT was configured and operated with conditions as mentioned under “Test conditions” in clause 3 above.

All modes are investigated by operating the EUT in a range of typical modes of operation, with typical cable positions, and with a typical system equipment configuration and arrangement. For each mode of operation and for each ac power current-carrying conductor, cable manipulation are performed within the range of likely configurations. The highest values measured are shown in the table below. The corresponding configuration is shown in the “Photo(s) of test setup”.

The EUT was placed on a 80 cm high non metallic table. Measurements were performed on the AC terminals of the Host AC-Adaptor (Laptop), on neutral (N)- and live (L1)-wire had been performed.

Requirements

Frequency Range [MHz]	Quasi-Peak Limits [dB μ V]	Average Limits [dB μ V]
0.15 - 0.5	66 to 56 ^{Note 1}	56 to 46 ^{Note 1}
0.5 - 5.0	56	46
5.0 - 30.0	60	50
Note 1: The level decreases linearly with the logarithm of the frequency		

Measurement

Measurement performed on 08.04.2020

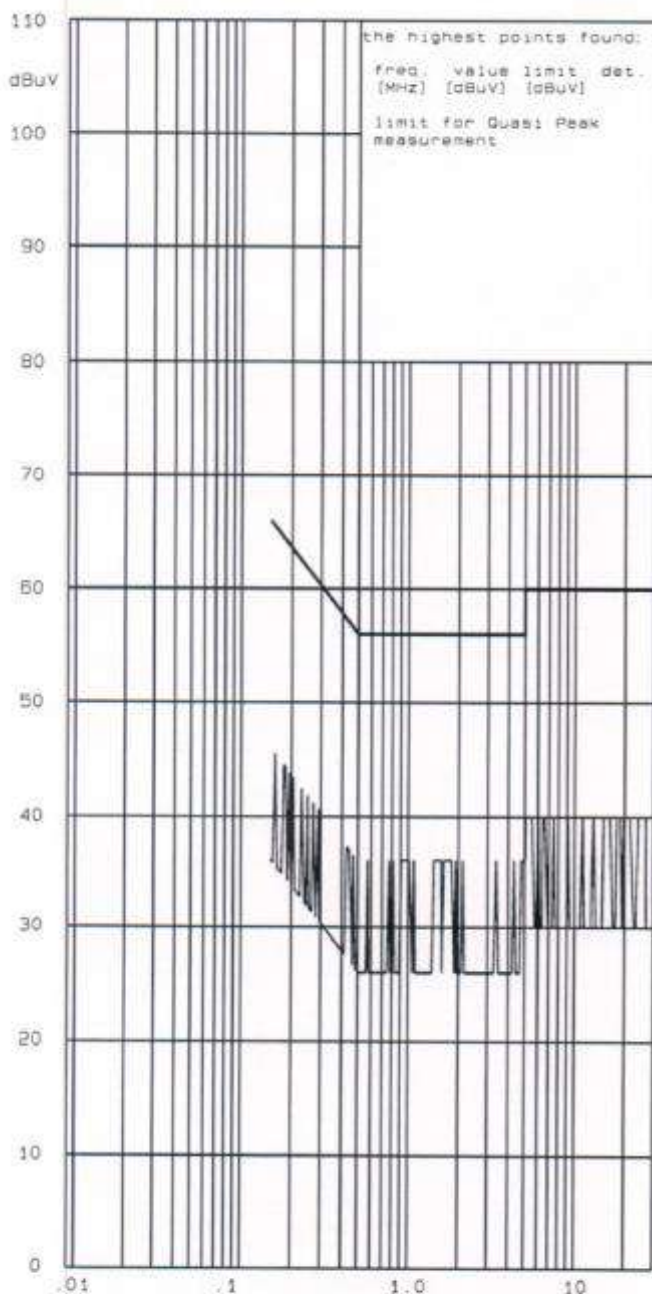
As worst cases the mode No. 3. with conditions as mentioned under “Test conditions” in clause 3 was found and documented in this report

IT 1/2

Interference Voltage 150 KHz - 30 MHz

acc. FCC 15.207 / RES-Gen

Cabin 1



Ref.-No.: 20/01-0030

Product: Trans.-/Rec.-System

Sample: D1

Date: 8 Apr 2020

Operator: B1

Test equipment:

Rohde & Schwarz ESHS 30

Rohde & Schwarz ESH 2-Z5

Connected sets:

Host PC

Operating mode:

WLAN CH.11 / CCK / 802.11 b

Power level: 19 / BW 20MHz

Tested on N

RFI suppression parts:

* two dB safety margin for
type approval recommended

Result: pass ☒ fail ()

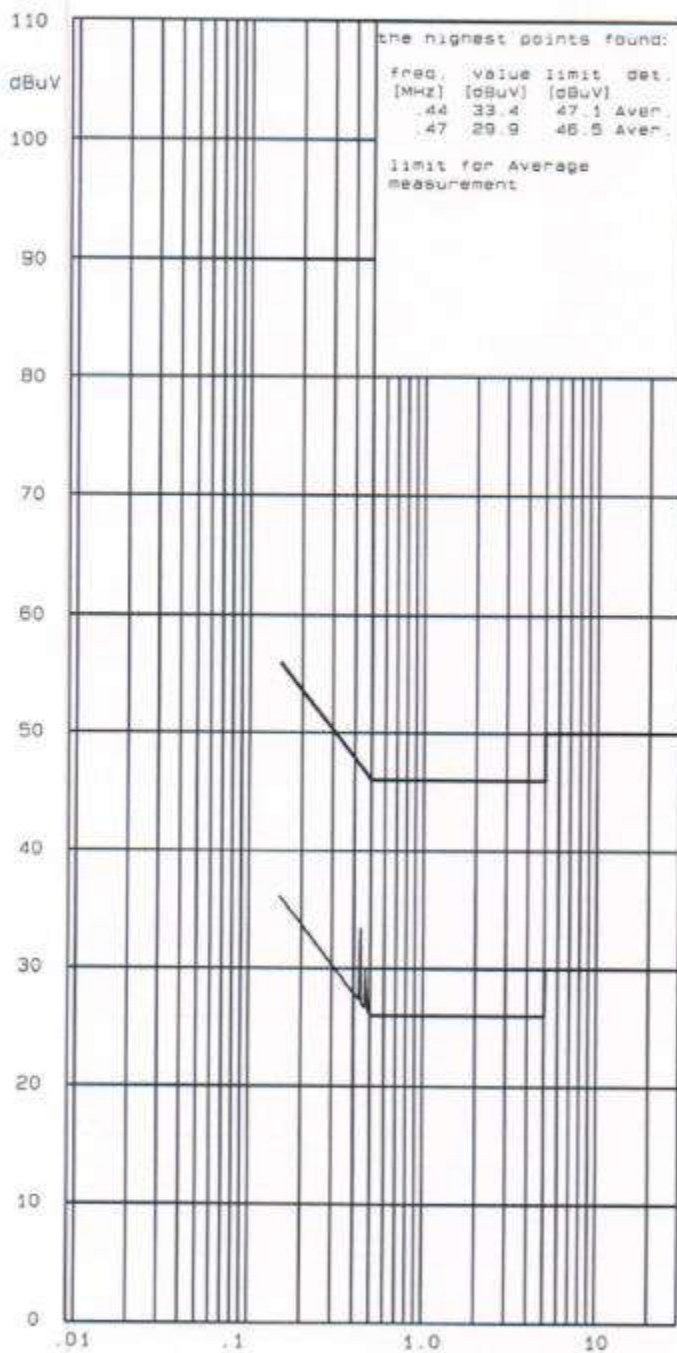
STC Germany GmbH

IT 1/2

Interference Voltage 150 KHz - 30 MHz

acc. FCC 15.207 / RES-Gen

Cabin 1



Ref.-No.: 20/01-0030

Product: Trans.-/Rec.-System

Sample: 01

Date: 8 Apr 2020

Operator: B1

Test equipment:

Rohde & Schwarz ESH5 30

Rohde & Schwarz ESH 2-Z5

Connected sets:

Host PC

Operating mode:

WLAN CH.11 / CCK / 802.11 b

Power level: 19 / BW 20MHz

Tested on N

RFI suppression parts:

* two dB safety margin for
type approval recommended

Result: pass ☒ fail []

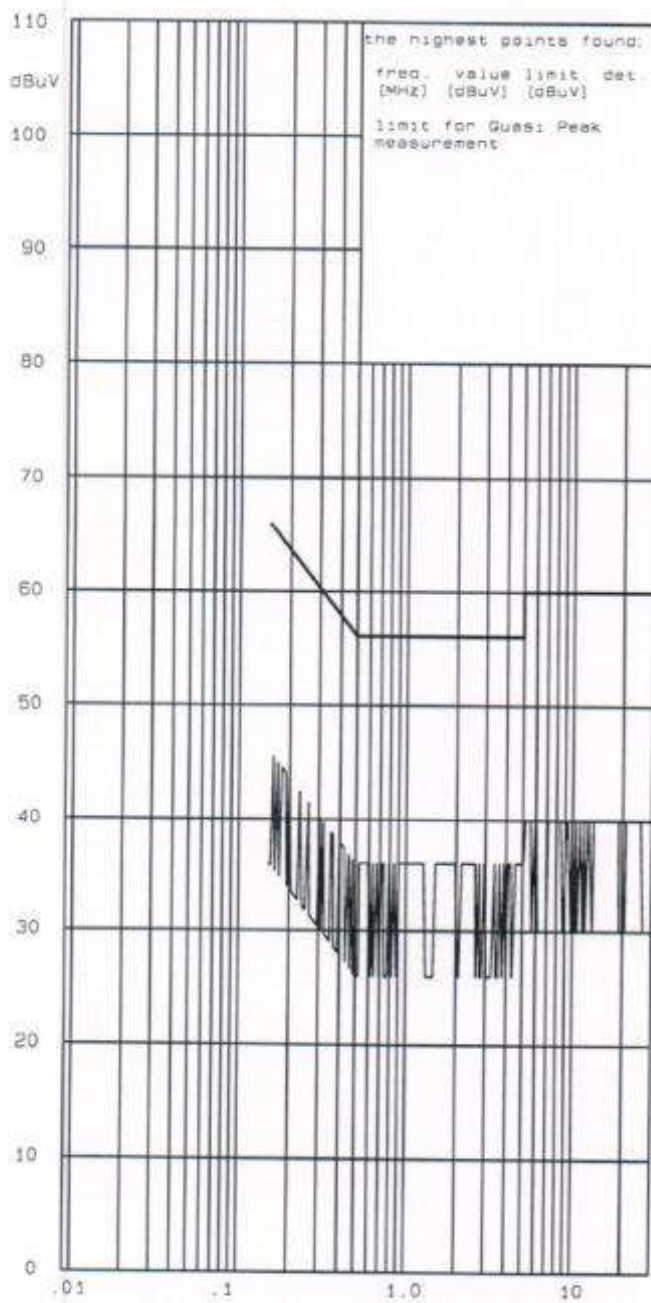
STC Germany GmbH

IT 1/2

Interference Voltage 150 KHz - 30 MHz

acc. FCC 15.207 / RES-Gen

Cabin 1



Ref.-No.: 20/01-0030

Product: Trans.-/Rec.-System

Sample: 01

Date: 8. Apr 2020

Operator: B1

Test equipment:

Rohde & Schwarz ESHS 30

Rohde & Schwarz ESH 2-25

Connected sets:

Host PC

Operating mode:

WLAN CH.11 / CCK / 802.11 b

Power level: 19 / BW 20MHz

Tested on Li

RFI suppression parts:

* two dB safety margin for
type approval recommended

Result: pass ☒ fail ☐

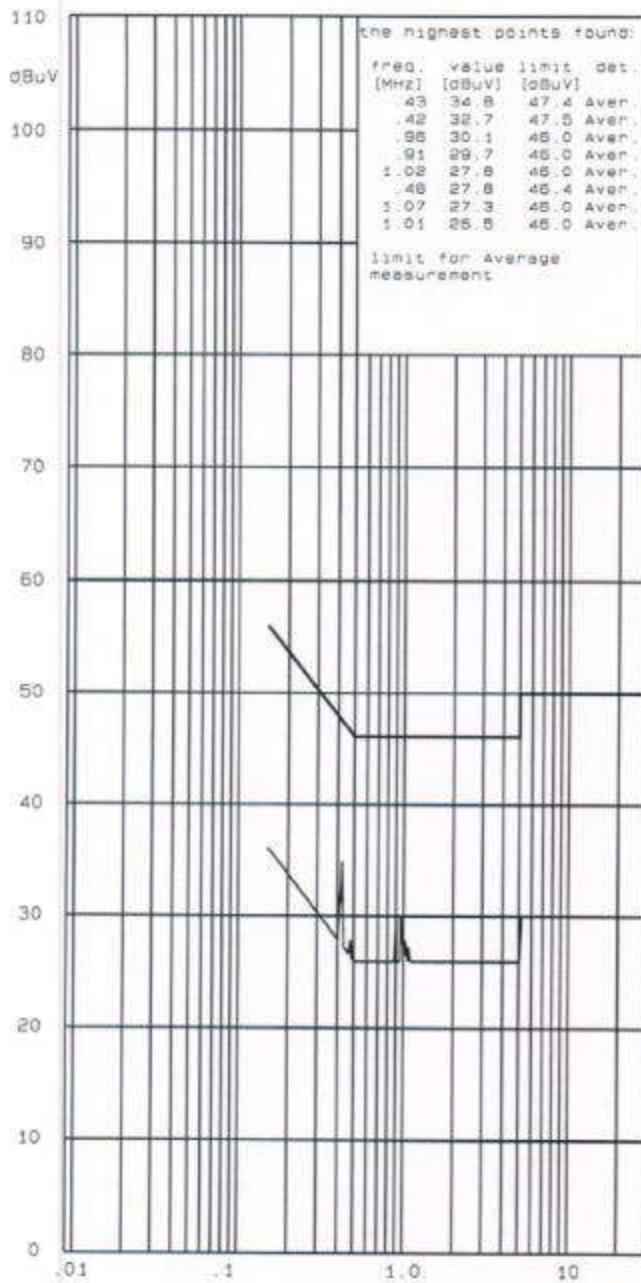
STC Germany GmbH

IT 1/2

Interference Voltage 150 KHz - 30 MHz

acc. FCC 15.207 / RES-Gen

Cabin 1



Ref.-No.: 20/01-0030

Product: Trans.-/Rec.-System

Sample: 01

Date: 8 Apr 2020

Operator: B1

Test equipment:

Rohde & Schwarz ESHS 30

Rohde & Schwarz ESH 2-Z5

Connected sets:

Host PC

Operating mode:

WLAN CH.11 / CCK / 802.11 b

Power level: 19 / BW 20MHz

Tested on L1

RFI suppression parts:

* two dB safety margin for
type approval recommended

Result: pass ☒ fail ☐

STC Germany GmbH

The six highest emissions for each port (L/N)/detector are as following:

Frequency [MHz]	Reading of test receiver [dBμV]	Detector	Port	loss of cable between LISN and test receiver [dB]	LISN correction [dB]	AC power line conducted emission [dBμV]	Limit [dBμV]	Result
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
-/-	-/-	QP	N	0.10	0.10	-/-	-/-	Pass
-/-	-/-	QP	N	0.10	0.10	-/-	-/-	Pass
-/-	-/-	QP	N	0.10	0.10	-/-	-/-	Pass
-/-	-/-	QP	N	0.10	0.10	-/-	-/-	Pass
-/-	-/-	QP	N	0.10	0.10	-/-	-/-	Pass
-/-	-/-	QP	N	0.10	0.10	-/-	-/-	Pass
0.44	33.2	AV	N	0.10	0.10	33.4	47.1	Pass
0.47	29.7	AV	N	0.10	0.10	29.9	46.5	Pass
-/-	-/-	AV	N	0.10	0.10	-/-	-/-	Pass
-/-	-/-	AV	N	0.10	0.10	-/-	-/-	Pass
-/-	-/-	AV	N	0.10	0.10	-/-	-/-	Pass
-/-	-/-	AV	N	0.10	0.10	-/-	-/-	Pass
-/-	-/-	QP	L1	0.10	0.10	-/-	-/-	Pass
-/-	-/-	QP	L1	0.10	0.10	-/-	-/-	Pass
-/-	-/-	QP	L1	0.10	0.10	-/-	-/-	Pass
-/-	-/-	QP	L1	0.10	0.10	-/-	-/-	Pass
-/-	-/-	QP	L1	0.10	0.10	-/-	-/-	Pass
-/-	-/-	QP	L1	0.10	0.10	-/-	-/-	Pass
0.43	34.6	AV	L1	0.10	0.10	34.8	47.4	Pass
0.42	32.5	AV	L1	0.10	0.10	32.7	47.5	Pass
0.91	29.9	AV	L1	0.10	0.10	30.1	46.0	Pass
1.02	29.5	AV	L1	0.10	0.10	29.7	46.0	Pass
0.48	27.6	AV	L1	0.10	0.10	27.8	46.4	Pass
1.07	27.6	AV	L1	0.10	0.10	27.8	46.0	Pass

- (1) = test frequency
- (2) = Reading of test receiver in dBμV without correction factors
- (3) = used detector
- (4) = tested port Phase (live, L1) or Neutral (N)
- (5) = loss of cable between LISN and test receiver in dB
- (6) = correction factor of LISN in dB
- (7) = Reading of test receiver [dBμV] (2) + loss of cable between Line impedance stabilisation network (LISN) and test receiver (dB) (5) + LISN correction [dB] (6)
- (8) = relevant limit in dBμV
- (9) = comparison between Limit [dBμV] (7) / (8) and AC power line conducted emission [dBμV]

Result 0.15 MHz – 30 MHz

All emissions in the frequency range 0.15 MHz – 30 MHz are at least 20 dB below the relevant limit.

Results

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the **Conducted Emission**.

6. Radiated emission measurements

Test site

Measurement of radiated emissions from EUT was made in the semi-anechoic chamber SAC3 (DC to 40 GHz) located in the test facility.

Test equipment and test set up

Test equipment used for radiated measurements as given in clause Test equipment of this report.
Test setup used for radiated measurements as given in clause Test setups of this report.

Detector function selection and bandwidth

In radiated emissions measurement, an EMI test receiver that have CISPR detectors was used.

Frequency range	Resolution Bandwidth
9KHz – 150kHz (Quasi Peak & Average* Detector)	200Hz
150KHz – 30MHz (Quasi Peak & Average* Detector)	9kHz
30MHz – 1GHz (Quasi Peak Detector)	120kHz
Above 1GHz (Peak & Average Detector)	1MHz

*Average Detector only in specify frequency range.

Antennas

Measurements were made using a calibrated loop antenna in the range 9 kHz – 30 MHz, as well as a calibrated bilog antenna in the range of 30 to 1000 MHz to determine the emission characteristics of the EUT. Measurements were also made for both horizontal and vertical polarization.

The horizontal distance between the receiving antenna and the EUT was 3 meters.

In the range of 1 GHz to 26 GHz measurements were made using a calibrated horn antenna to determine the emission characteristics of the EUT. Measurements were also made for both horizontal and vertical polarization. The horizontal distance between the receiving antenna and the EUT was 3 meters.

Frequency range to be scanned

For radiated emissions measurements, the spectrum in the range of 9kHz MHz to 40 GHz was investigated as the highest frequency generated in the EUT is 5.7 GHz.

Test conditions and configuration of EUT

The EUT was configured and operated with conditions as mentioned under “Test conditions” in clause 3 above.

During test the EUT was operated as specified in the user manual of the EUT. For frequencies below 1000 MHz the EUT was placed on a 80 cm and for frequencies above 1000 MHz the RF Transmitter modul was placed on a 150 cm high non metallic table placed on the turntable. The EUT was rotated and the antenna height was varied between 1 m to 4 m to find the maximum RF energy generated from EUT. The procedure according to ANSI C63.10:2013 is used and all modes are investigated by operating the EUT in a range of typical modes of operation, with typical cable positions, and with a typical system equipment configuration and arrangement. For each mode of operation, cable manipulation are performed within the range of likely configurations. The highest values measured are shown in the table below.

As worst cases the mode No. 3 and 4 with conditions as mentioned under “Test conditions” in clause 3 were found and documented in this report

Remarks:

- Correction factor included antenna factor and cable attenuation.
- In the frequency range 1 GHz – 7 GHz the Band Reject Filter 2,4 GHz (ID11243) was used to attenuate the fundamental emission.

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.209 Radiated emission limits
-RSS-Gen issue 05 section 8.9

Requirements:

acc. e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.209 Radiated emission limits

Frequency MHz	Limits [μV/m] Quasi-peak	Limits [dBμV/m] Quasi-peak	Limits [μV/m] Average	Limits [dBμV/m] Average	Test distance [m]
0.009 – 0.090	-/-	-/-	2400/F (kHz)	48.5 – 28.5	300
0.090 - 0.110	2400/F (kHz)	28.5 – 26.8	-/-	-/-	300
0.110 – 0.490	-/-	-/-	2400/F (kHz)	26.8 – 13.8	300
0.490 - 1.705	24000/F (kHz)	33.8 – 23.0	-/-	-/-	30
1.705 - 30.0	30	29.5	-/-	-/-	30

acc. RSS-Gen issue 05 section 8.9

Frequency MHz	Limits [μA/m] Quasi-peak	Limits [dBμA/m] Quasi-peak	Limits [μA/m] Average	Limits [dBμA/m] Average	Test distance [m]
0.009 – 0.090	-/-	-/-	6.37/F (kHz)	-3 – -23.0	300
0.090 - 0.110	6.37/F (kHz)	-23.0 – -24.7	-/-	-/-	300
0.110 – 0.490	-/-	-/-	6.37/F (kHz)	-24.7 – -37.7	300
0.490 - 1.705	63.7/F (kHz)	-17.7 – -28.5	-/-	-/-	30
1.705 - 30.0	0.08	-22	-/-	-/-	30

acc. e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.209 Radiated emission limits
and RSS-Gen issue 05 section 8.9

Frequency MHz	Limits [μV/m] Quasi-peak	Limits [dBμV/m] Quasi-peak	Limits [μV/m] Average	Limits [dBμV/m] Average	Test distance [m]
30 - 88	100	40	-/-	-/-	3
88 - 216	150	43.5	-/-	-/-	3
216 - 960	200	46	-/-	-/-	3
960 - 1000	500	54	-/-	-/-	3
Above 1000	-/-	-/-	500	54	3

Measurements

The Measurement was performed on: 07.04.2020

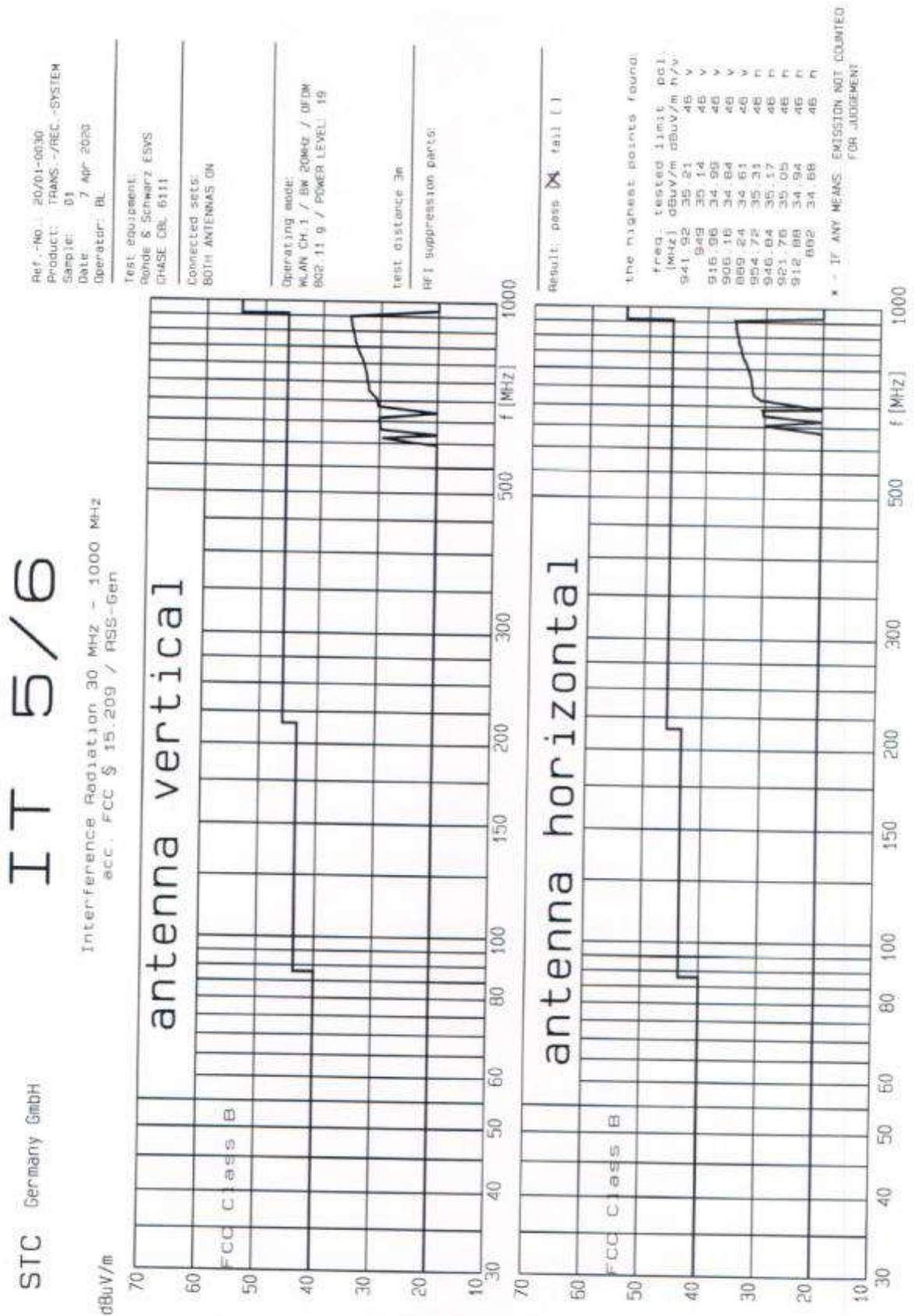
Result 9 kHz – 30 MHz

In the frequency range 9 kHz – 30 MHz the EUT had been scanned in a distance of 3 m and the Limit were corrected to the test distance of 3 m using a factor with 40 dB/decade acc. to § 15.31 (f)(2).

All emissions in the frequency range 9 kHz – 30 MHz are at least 20 dB below the relevant limit.

Result 30 MHz – 1000 MHz

Operation Mode: Mode No.: 4 WLAN 802.11g 20MHz CH1



The six highest emissions for each polarization (H/V) in the frequency range 30 MHz – 1000 MHz are as following:

Frequency [MHz]	Detector	Antenna polarization	Radiated emission [dBμV/m]	Radiated emission [μV/m]	Limit [dBμV/m] (3 m)	Limit [μV/m] (3 m)	Result
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
941.92	QP	V	35.21	57.61	46.00	200	Pass
949.00	QP	V	35.14	57.15	46.00	200	Pass
916.96	QP	V	34.99	56.17	46.00	200	Pass
906.16	QP	V	34.84	55.21	46.00	200	Pass
889.24	QP	V	34.61	53.77	46.00	200	Pass
-/-	QP	V	-/-	-/-	-/-	-/-	-/-
954.72	QP	H	35.31	58.28	46.00	200	Pass
946.84	QP	H	35.17	57.35	46.00	200	Pass
921.76	QP	H	35.05	56.56	46.00	200	Pass
912.88	QP	H	34.94	55.85	46.00	200	Pass
882.00	QP	H	34.68	54.20	46.00	200	Pass
-/-	QP	H	-/-	-/-	-/-	-/-	-/-

- (1) = test frequency
- (2) = used detector - quasi peak (QP), peak, average (AV)
- (3) = polarization of the test antenna (Horizontal/Vertical)
- (4) = Reading of test receiver [dBμV] + correction factor
- (5) = $10^{\frac{((\text{Radiated emission [dBμV/m]} (5))}{20}}$
- (6) = relevant limit in dBμV/m
- (7) = relevant limit in μV/m
- (8) = comparison between Limit [dBμV/m] (6) and Radiated emission [dBμV/m] (4)

Result 1 GHz – 7 GHz

Mode No.: 3 with 802.11b 20MHz

TESTED
IN GERMANY

IT 5/6
Interference radiation
acc. to FCC § 15.209 / RSS-Gen

STC

Ref.-No.: 20/01-0030

Product: Transmitting/Receiving System

Sample: 01

Date: 07.04.2020

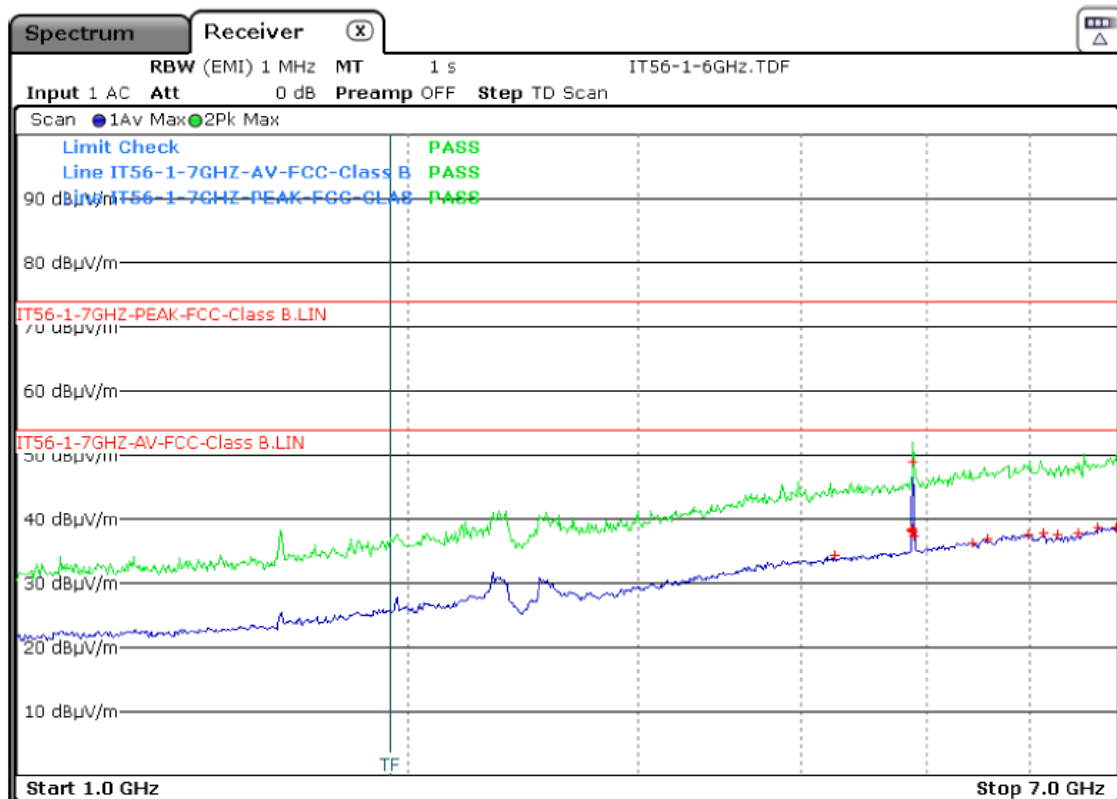
Operator: BI

Remarks: Both ANT. ON; Band Stop Filter (2.4GHz / 11244) used

pass fail

Result: ☒ ☐

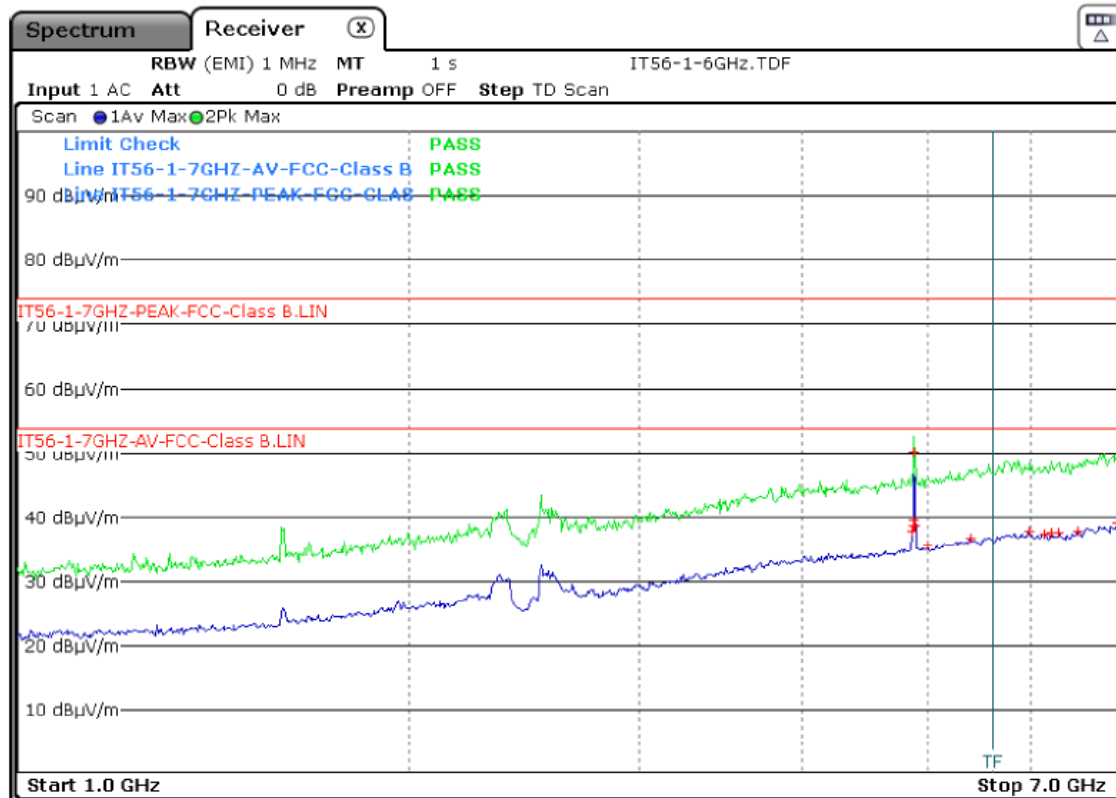
Operation mode: WLAN CH.11; BW = 20MHz; CCK; 802.11b; Power level 19



Polarisation: V									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
4,8740	48,82	-5,18	54,00	pass	1 - 7	-/-	>20	74,00	pass
6,9880	38,80	-15,20	54,00	pass					
6,7708	38,63	-15,37	54,00	pass					
4,8770	38,56	-15,44	54,00	pass					
4,8660	38,17	-15,83	54,00	pass					
4,8710	37,96	-16,04	54,00	pass					

Ref.-No.: 20/01-0030

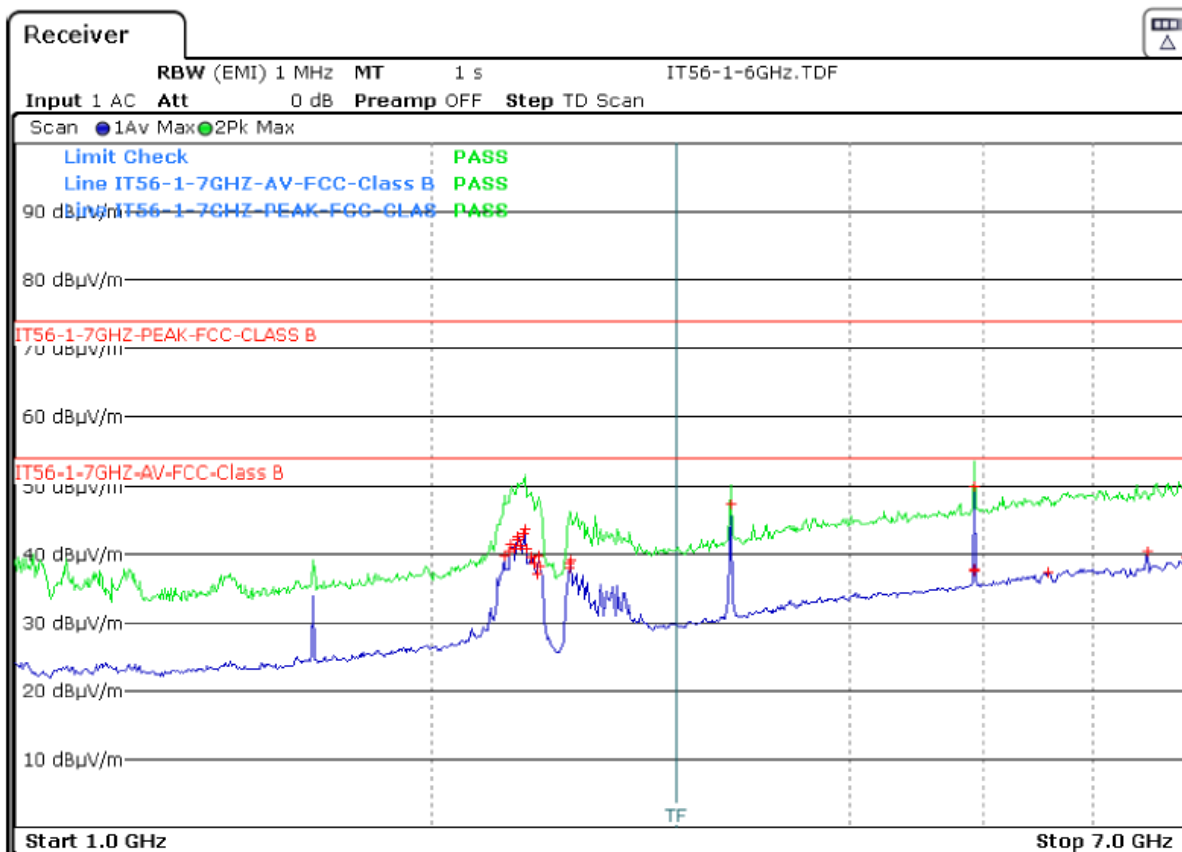
Operation mode: WLAN CH.11; BW = 20MHz; CCK; 802.11b; Power level 19



Polarisation: H									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
4,8740	50,24	-3,76	54,00	pass	1 - 7	-/-	>20	74,00	pass
4,8710	39,65	-14,35	54,00	pass					
6,9913	39,11	-14,89	54,00	pass					
4,8820	38,66	-15,34	54,00	pass					
4,8770	38,64	-15,36	54,00	pass					
4,8660	37,84	-16,16	54,00	pass					

Ref.-No.: 18/11-0061

Operation mode: Tx 2.4GHz (802.11b 20MHz/CH11 – 2462MHz); BPF 2,4GHz (ID11243) used



Polarisation: H									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
4,9240	49,95	-4,05	54,00	pass	1 - 7	---	>20	74	pass
3,2828	47,45	-6,55	54,00	pass					
2,3340	43,64	-10,36	54,00	pass					
2,3305	43,07	-10,93	54,00	pass					
2,3075	42,53	-11,47	54,00	pass					
2,3050	42,19	-11,81	54,00	pass					

Result 7GHz – 40GHz

All emissions in the frequency range 7 GHz – 40 GHz are at least 20 dB below the relevant limit

Results

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the **Radiated Emissions**.

7. Operation within the band 902-928 MHz, 2400-2483,5 MHz and 5725-5850 MHz

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247
-RSS-247 issue 2

7.1. 6 dB DTS Bandwidth Measurement

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 (a) (2)
-RSS-247 issue 2 Section 5.2 (a)

Limit

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

Test equipment and test set up

Test equipment used for conducted measurements as given in clause Test equipment of this report.
Test setup used for conducted measurements as given in clause Test setups of this report.

Description

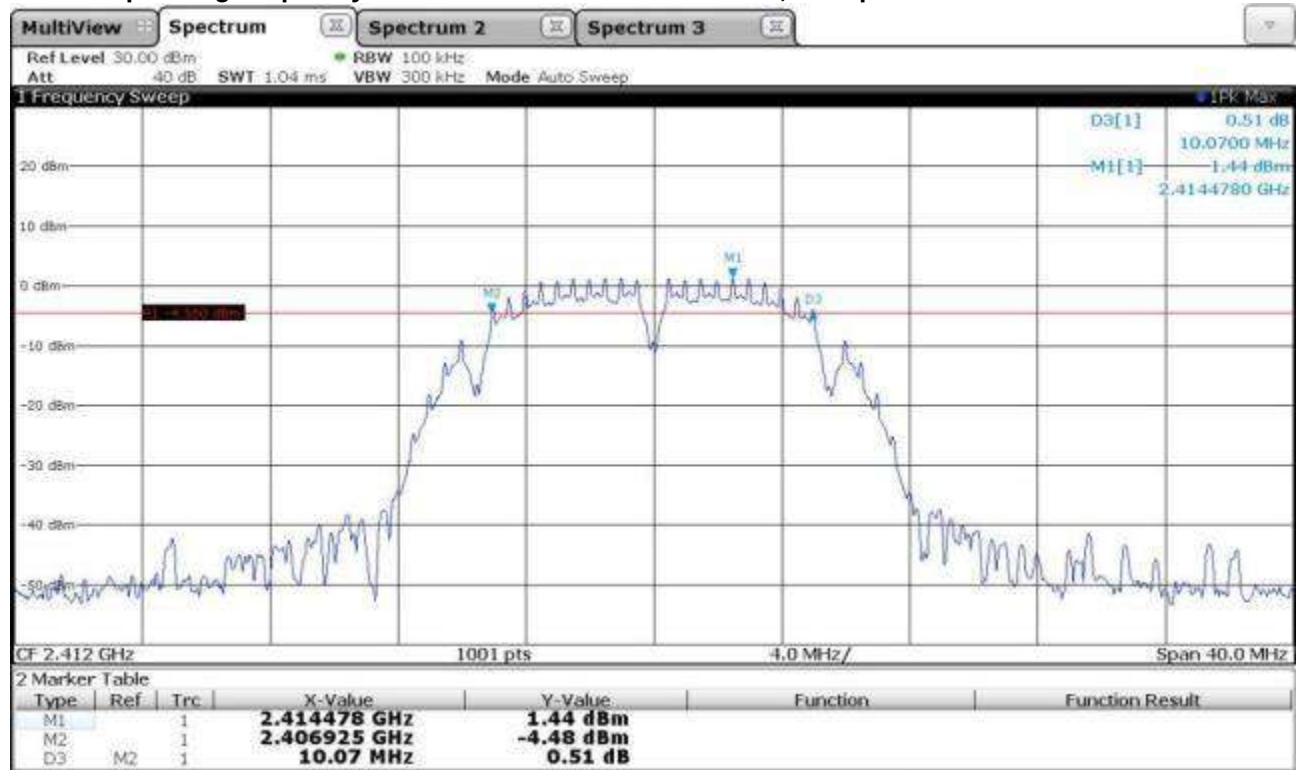
Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Measurement

The Measurement was performed on: 01.04.2020 and 02.04.2020

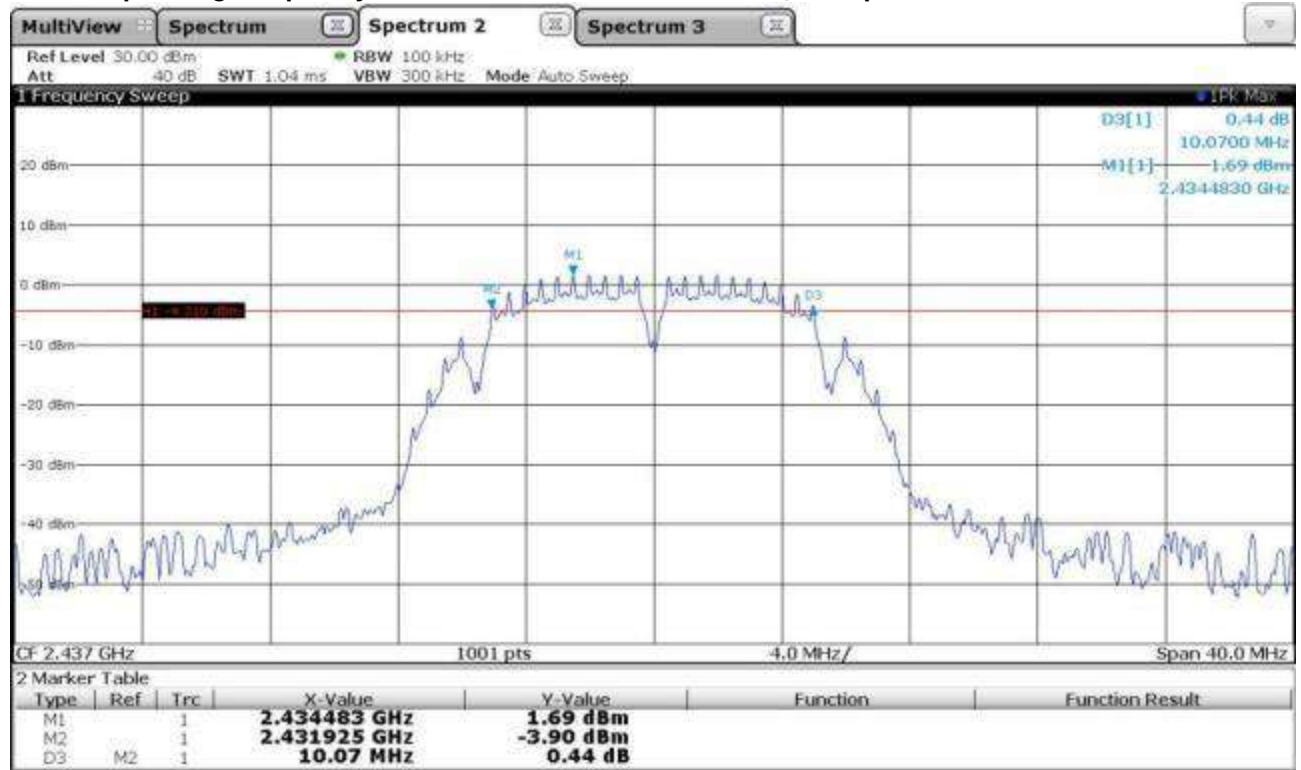
Conducted measurement data

Lowest operating frequency - 802.11b 20MHz / CCK – MCS=0; 1 Mbps / Antenna 1



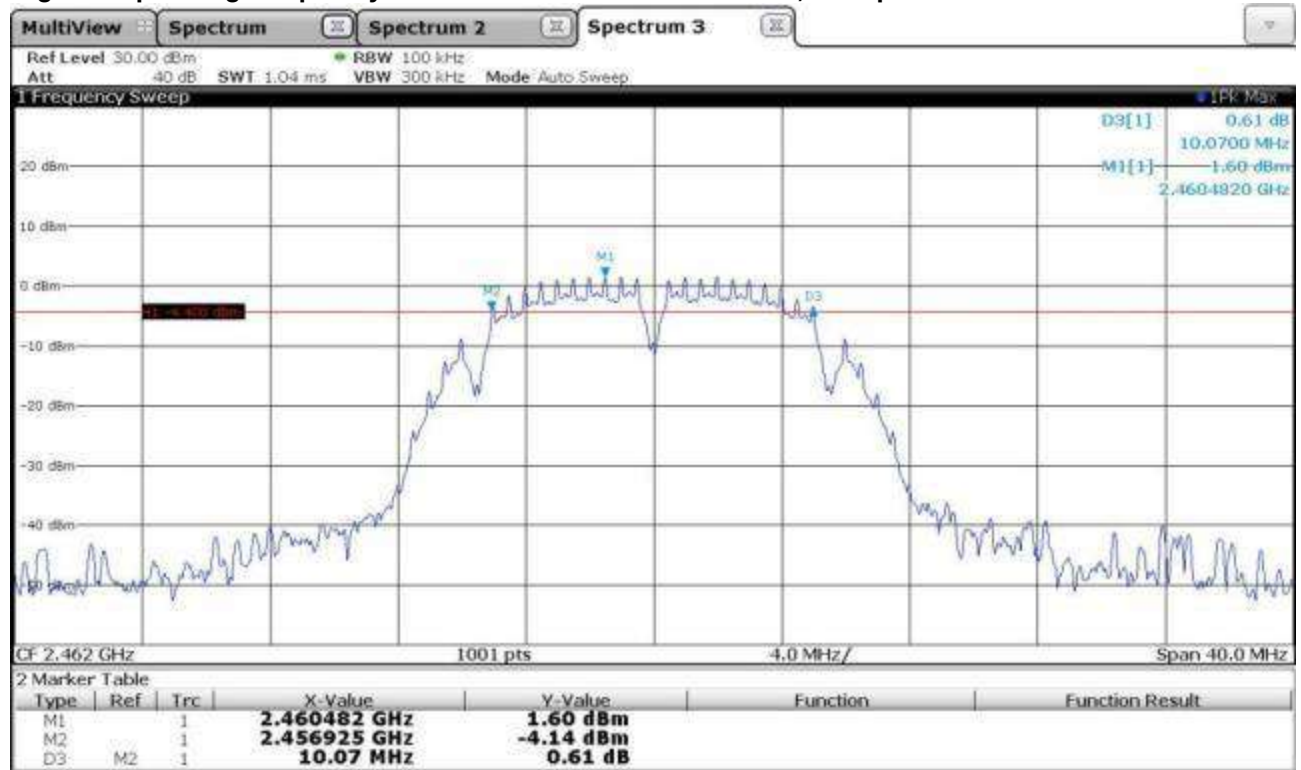
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
1	2412	10.07	0.5	Pass

Middle Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 Mbps / Antenna 1



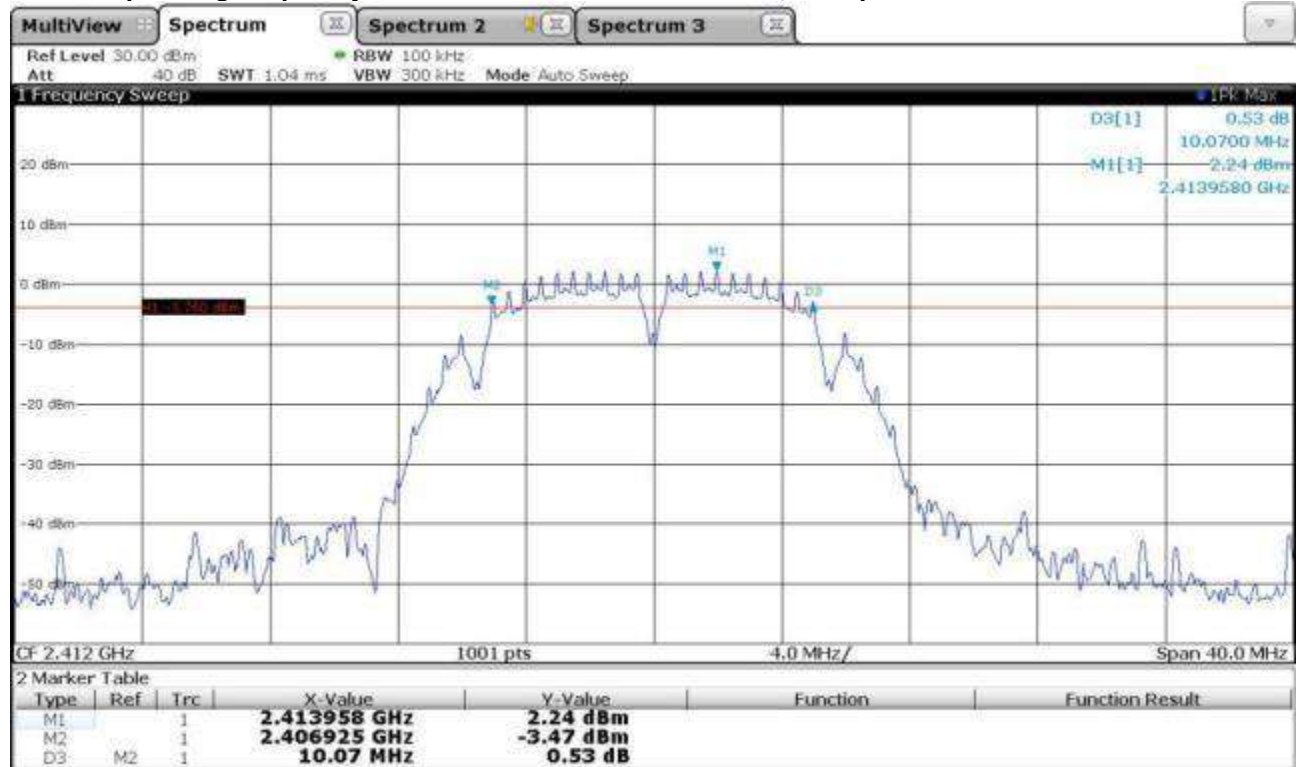
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
6	2437	10.07	0.5	Pass

Highest Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 Mbps / Antenna 1



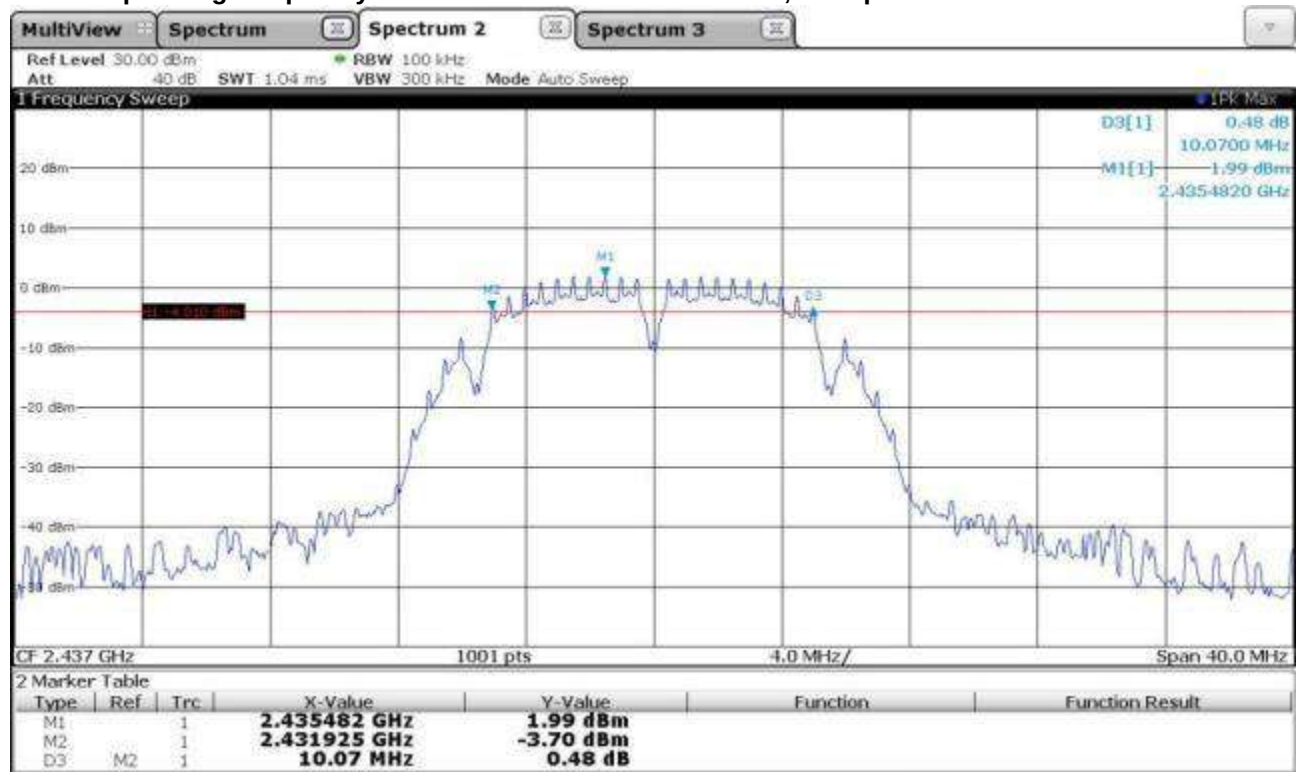
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
11	2462	10.07	0.5	Pass

Lowest operating frequency - 802.11b 20MHz / CCK – MCS=0; 1 Mbps / Antenna 2



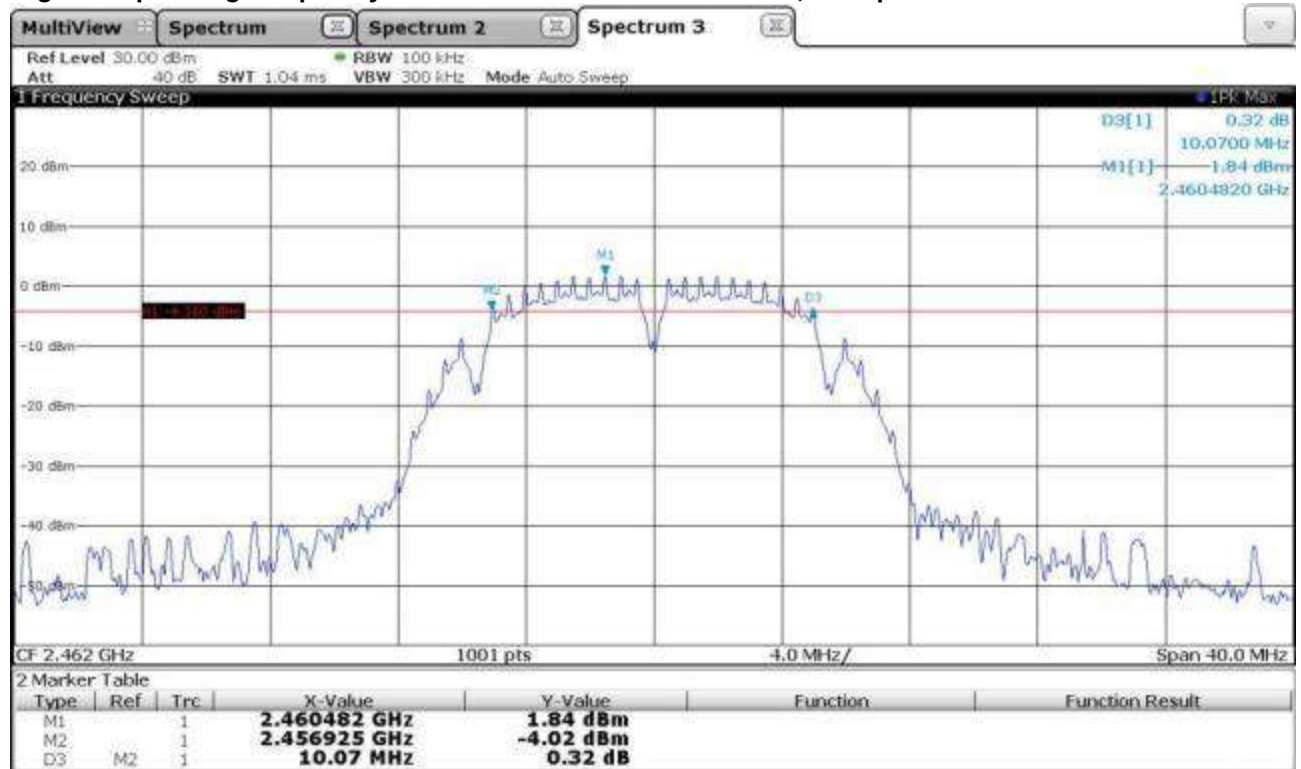
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
1	2412	10.07	0.5	Pass

Middle Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2



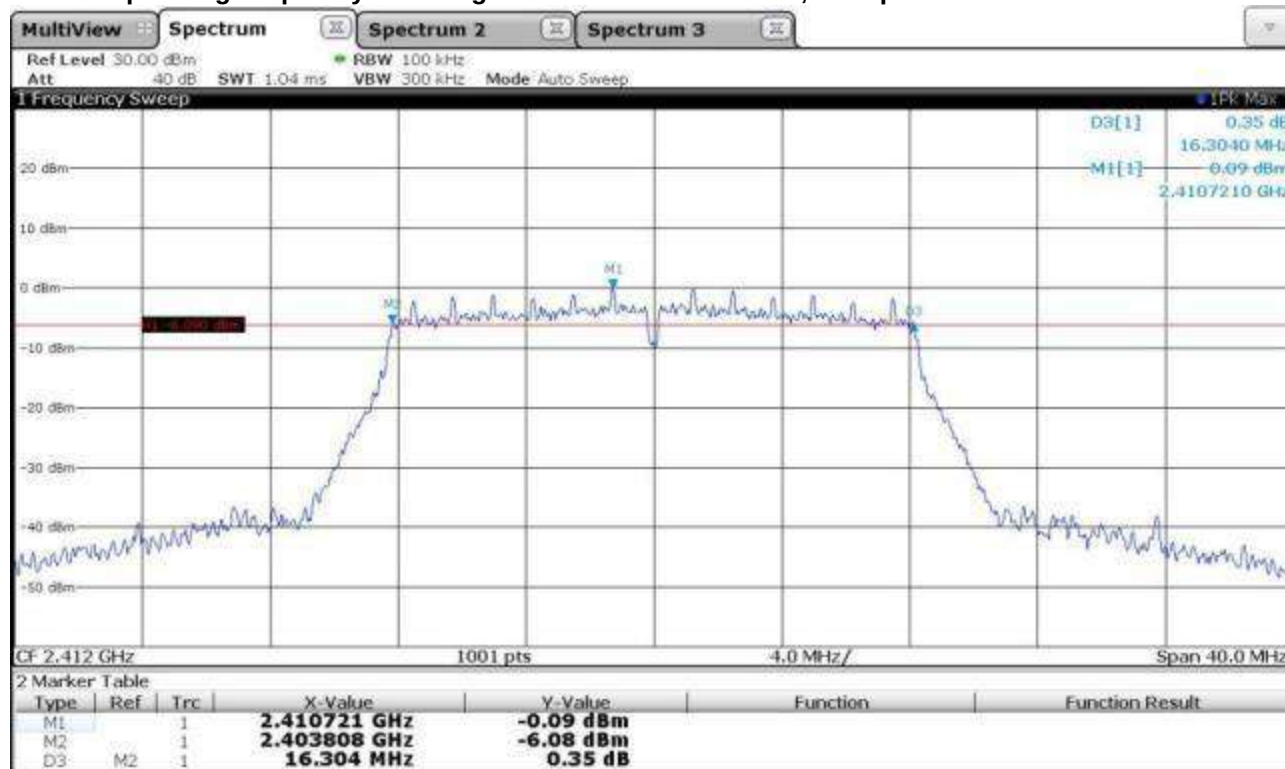
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
6	2437	10.07	0.5	Pass

Highest Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2



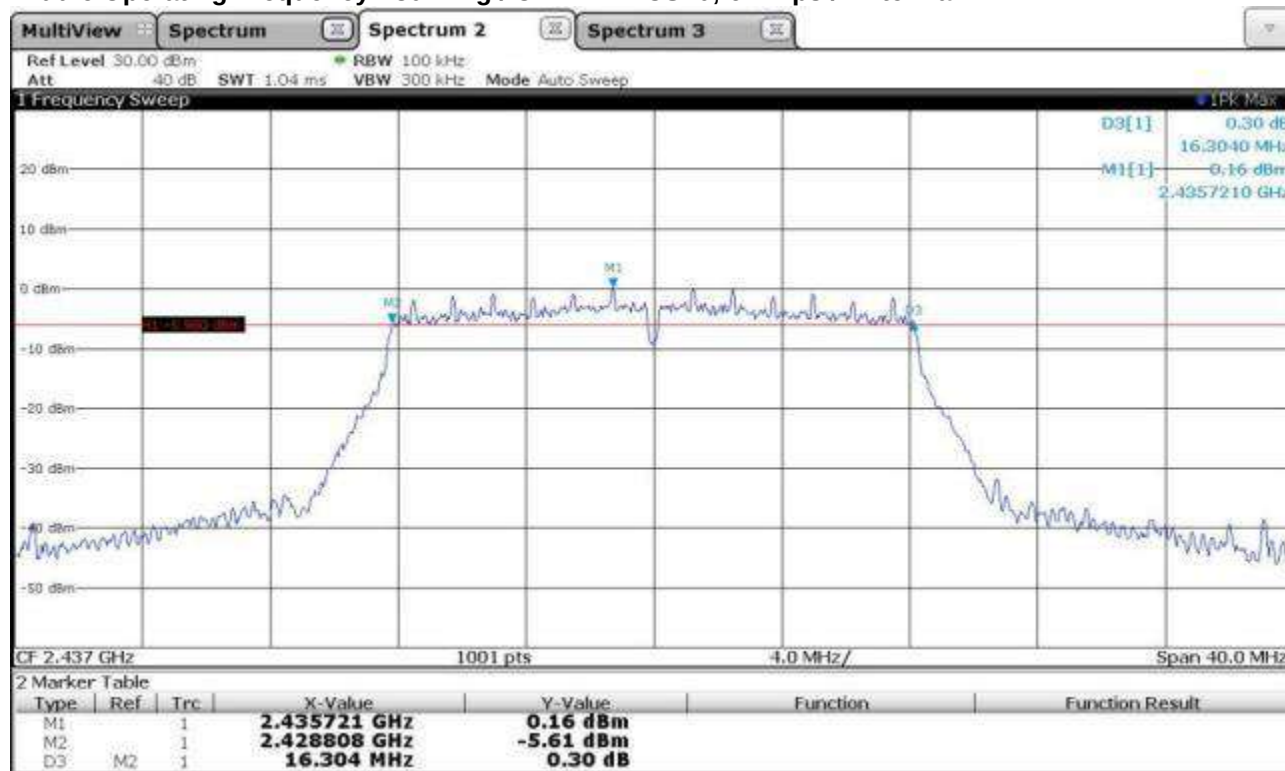
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
11	2462	10.07	0.5	Pass

Lowest operating frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1



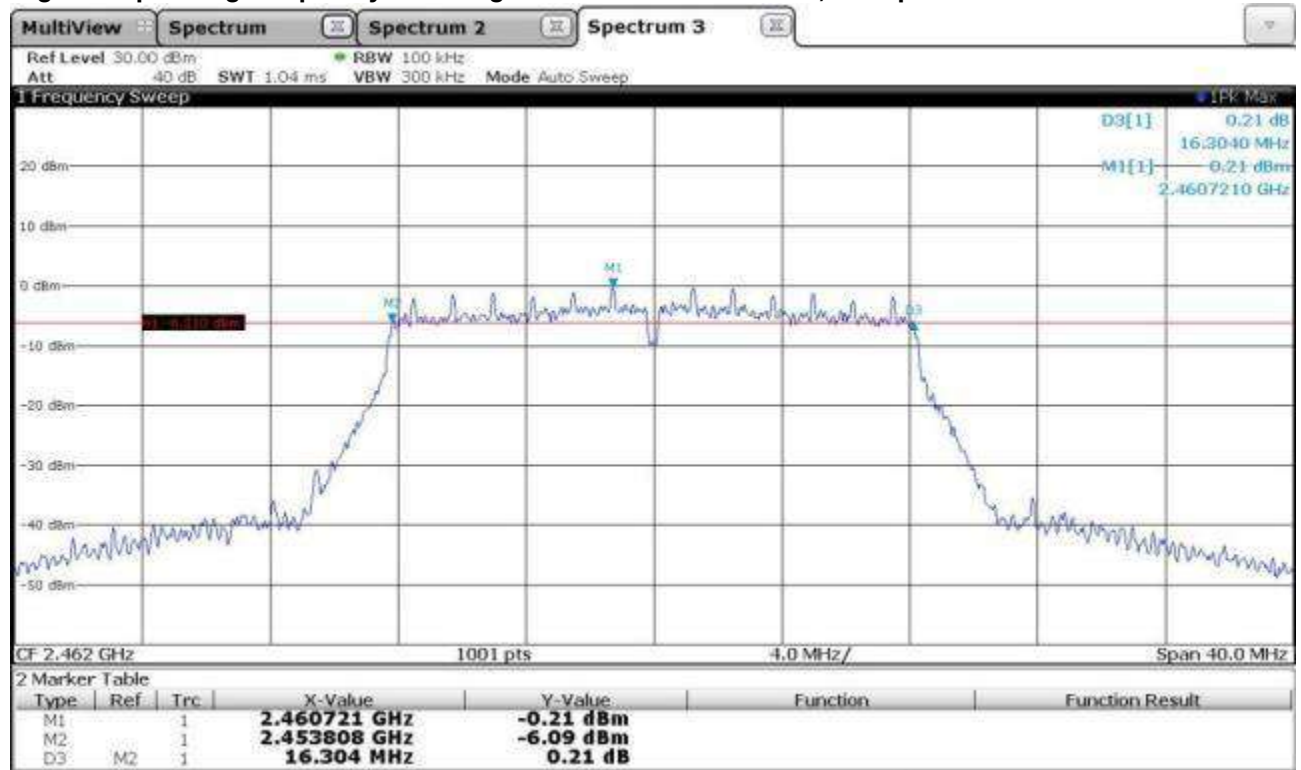
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
1	2412	16.304	0.5	Pass

Middle Operating Frequency - 802.11g / OFDM – MCS=0; 6 MBps / Antenna 1



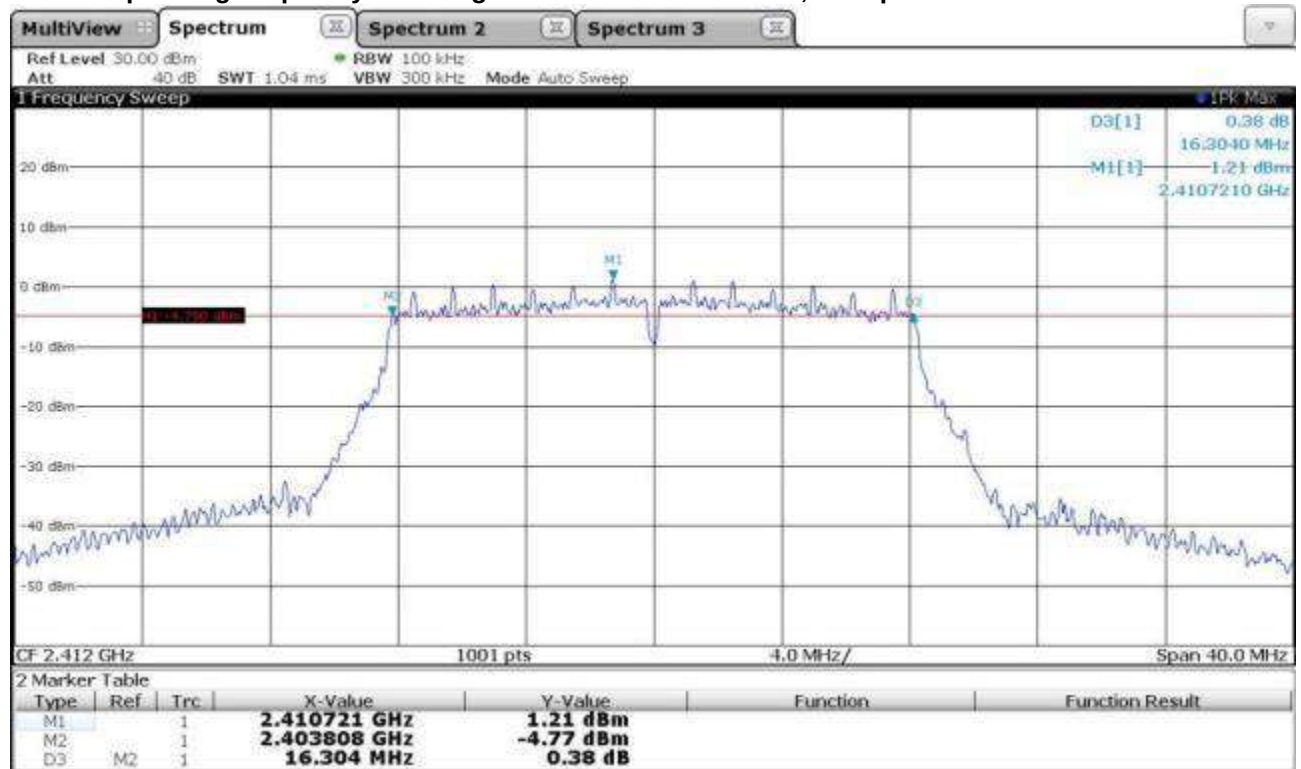
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
6	2437	16.304	0.5	Pass

Highest Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1



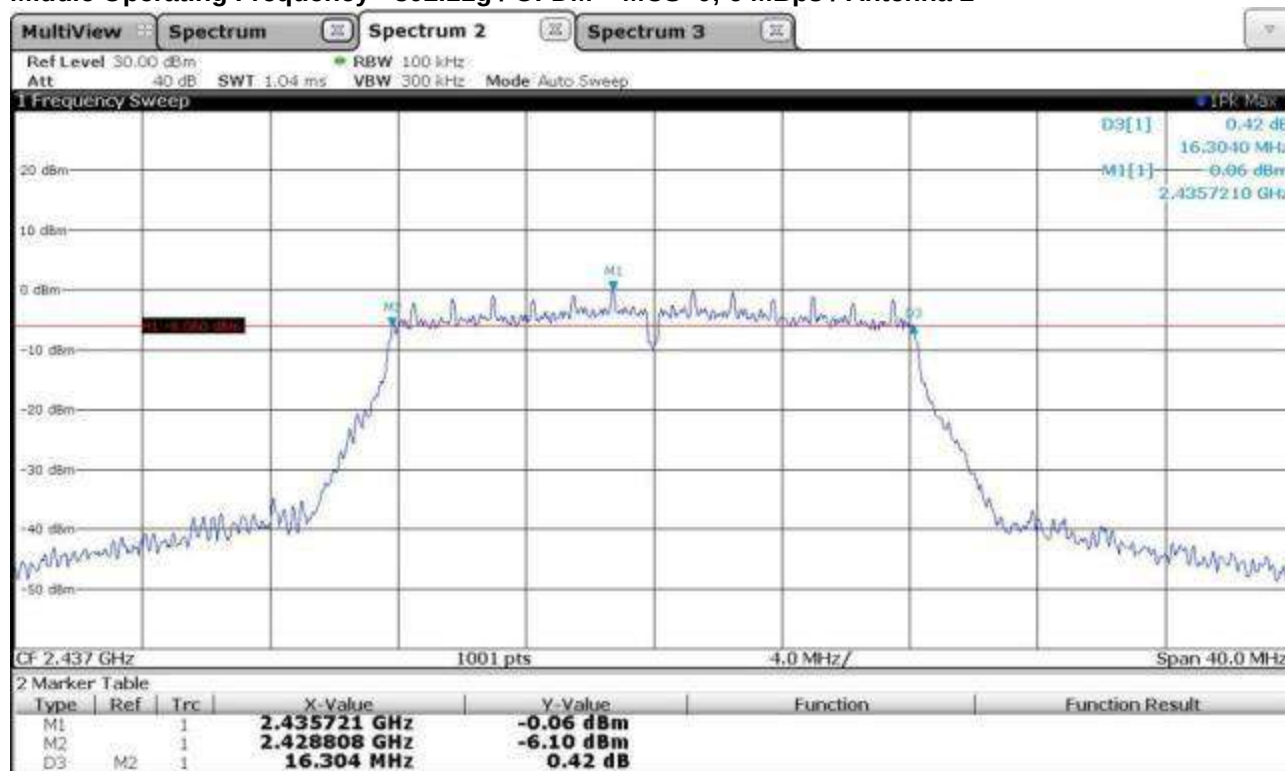
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
11	2462	16.304	0.5	Pass

Lowest operating frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 2



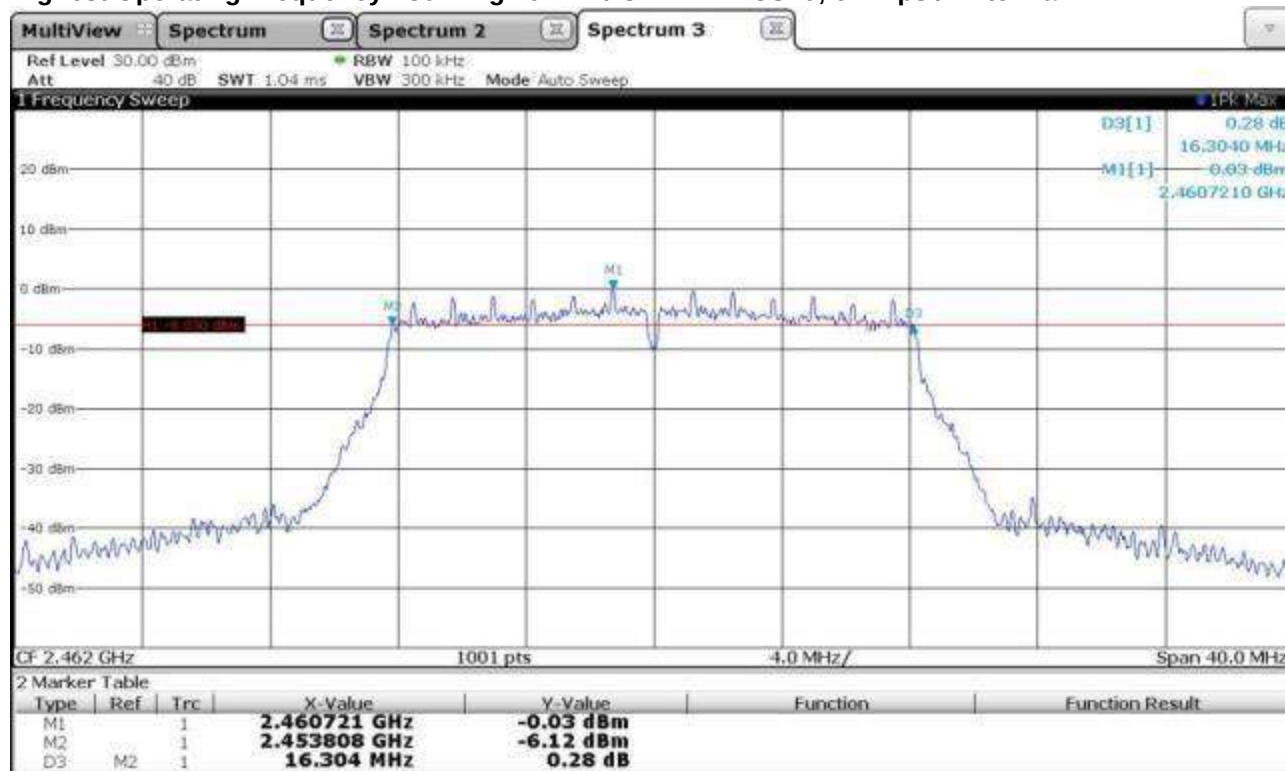
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
1	2412	16.304	0.5	Pass

Middle Operating Frequency - 802.11g / OFDM – MCS=0; 6 MBps / Antenna 2



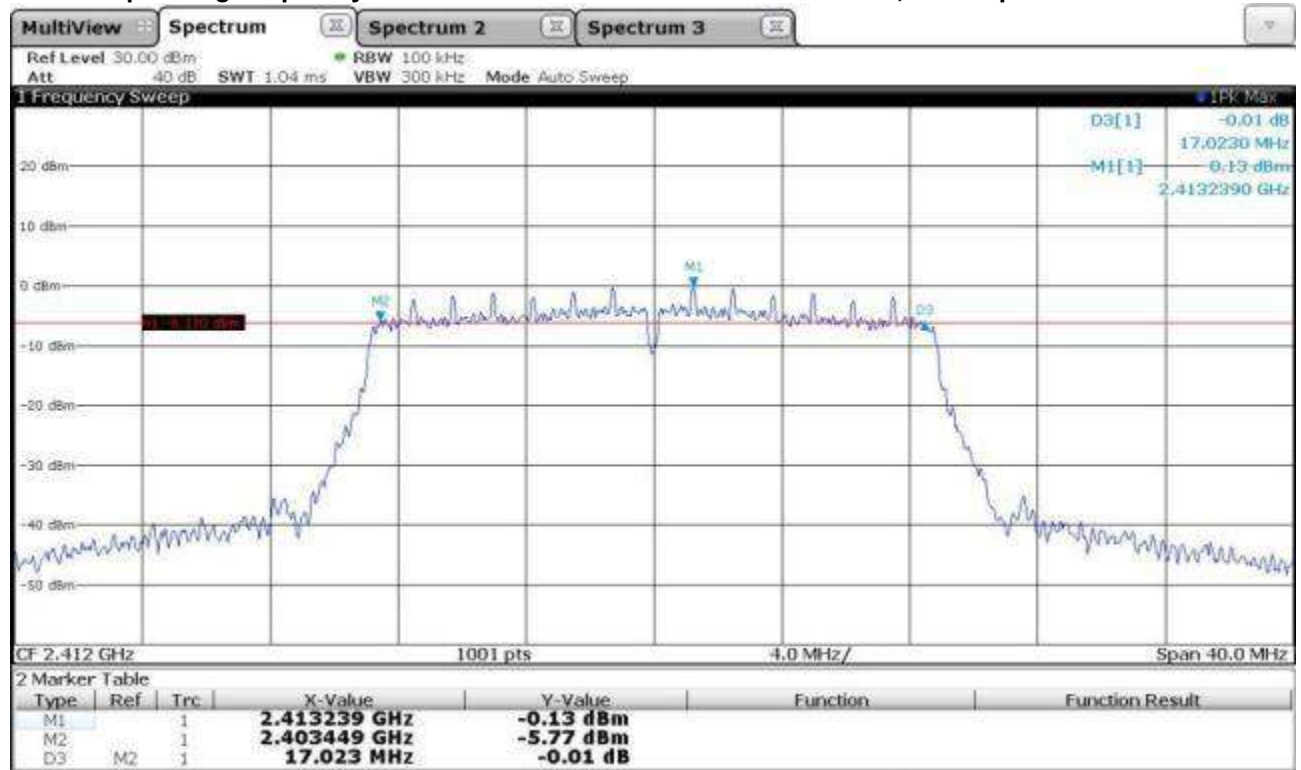
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
6	2437	16.304	0.5	Pass

Highest Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 2



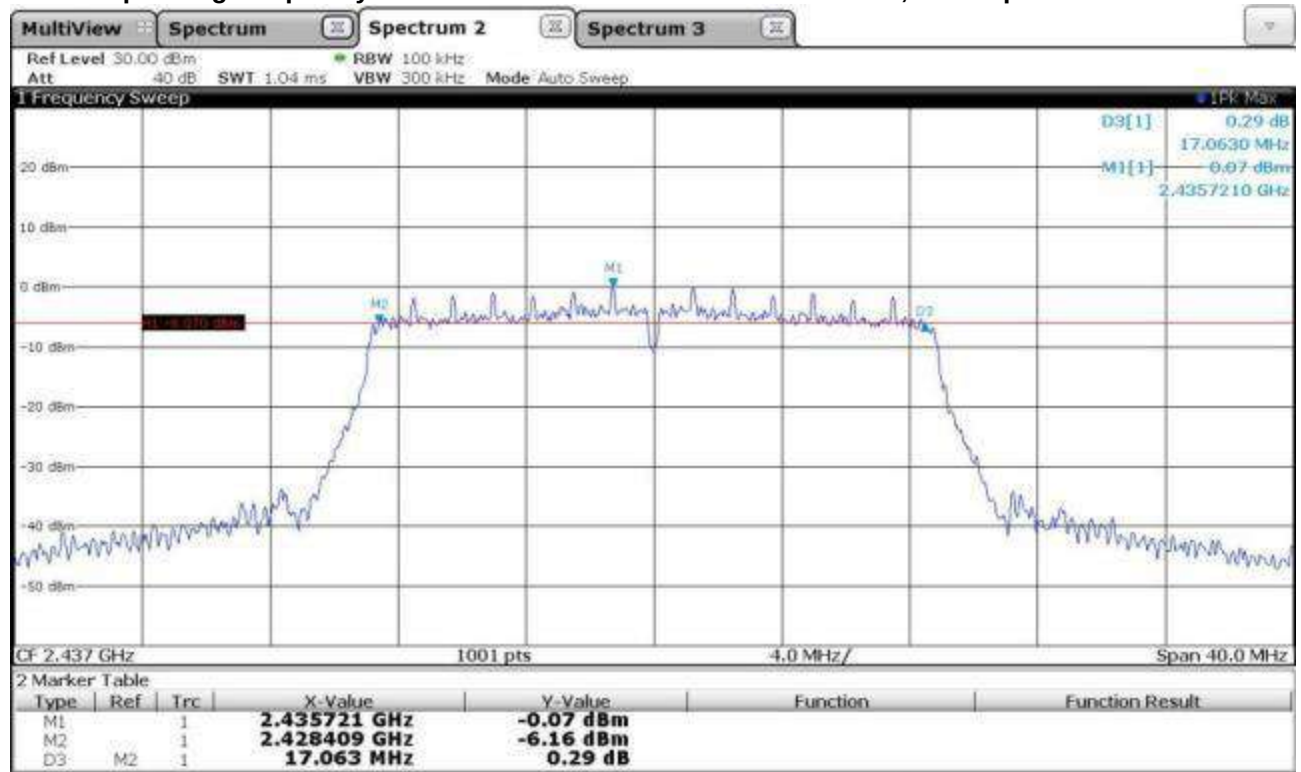
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
11	2462	16.304	0.5	Pass

Lowest operating frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



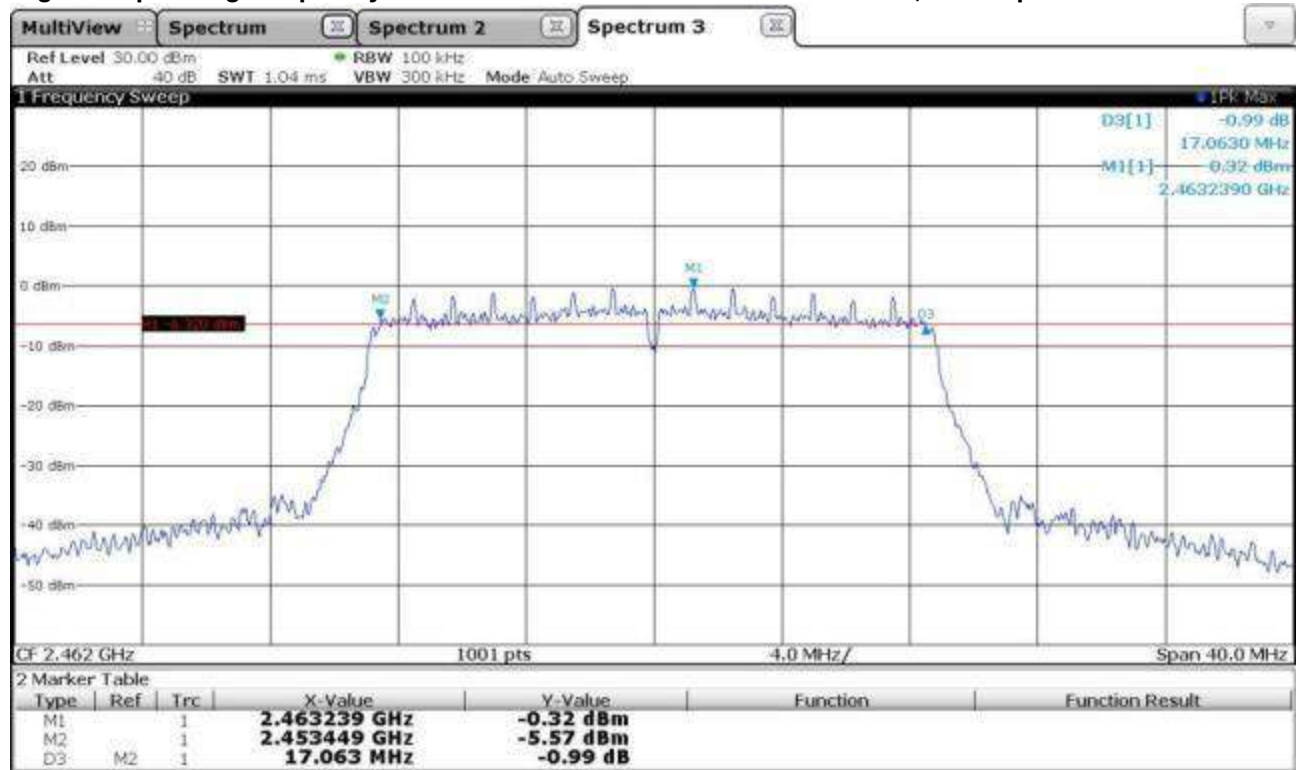
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
1	2412	17.023	0.5	Pass

Middle Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



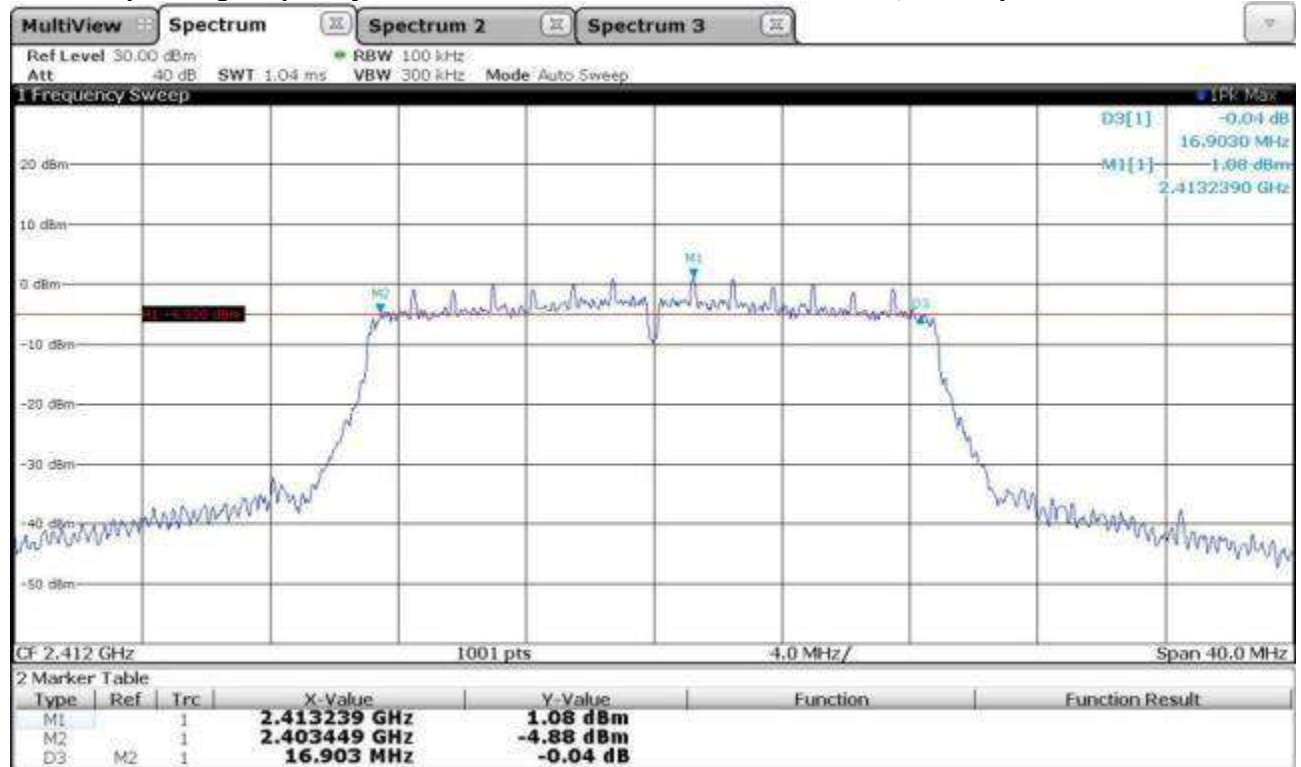
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
6	2437	17.063	0.5	Pass

Highest Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



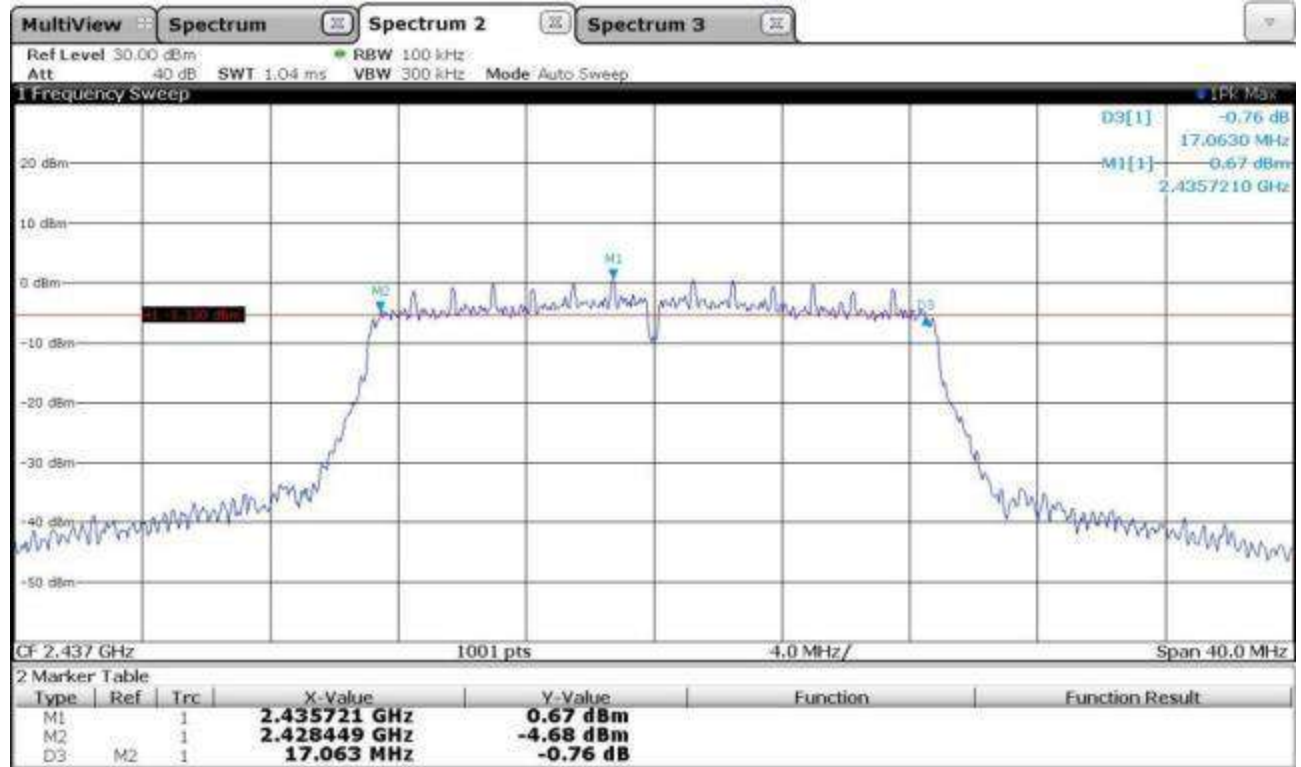
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
11	2462	17.063	0.5	Pass

Lowest operating frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



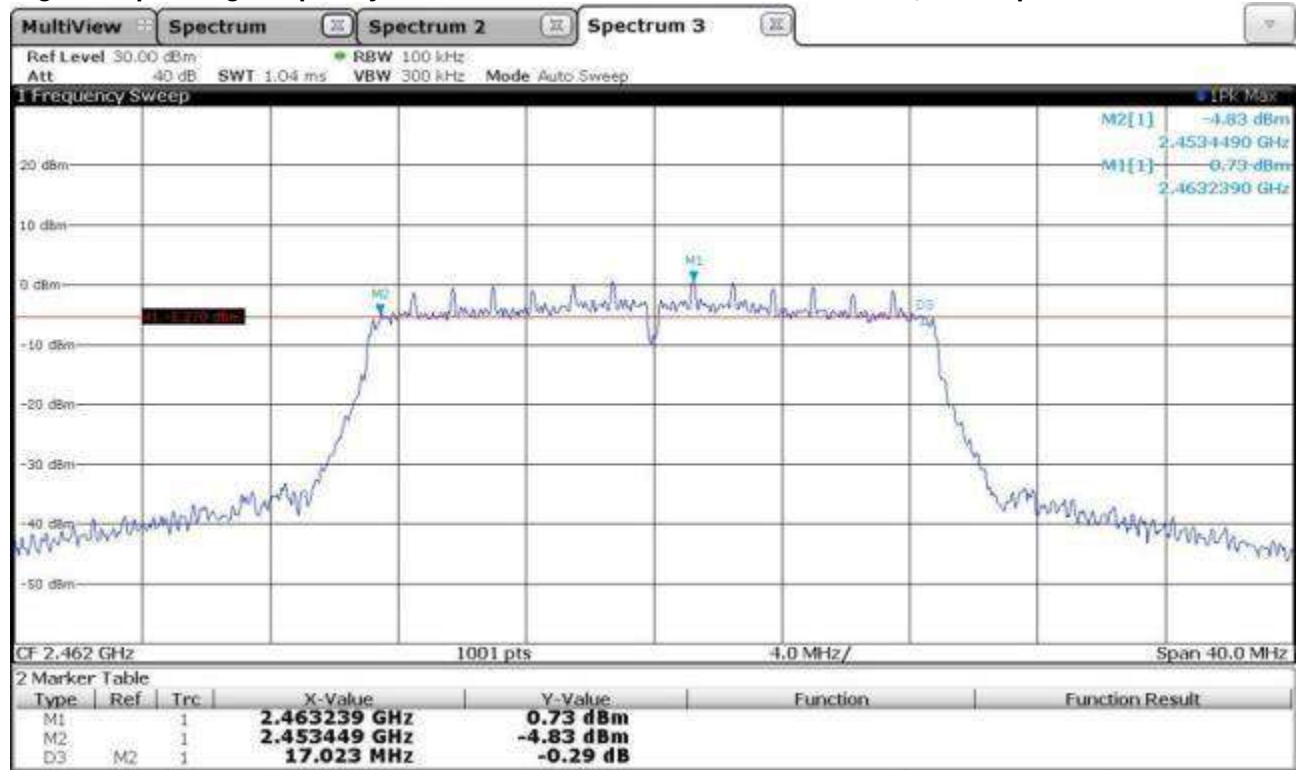
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
1	2412	16.903	0.5	Pass

Middle Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



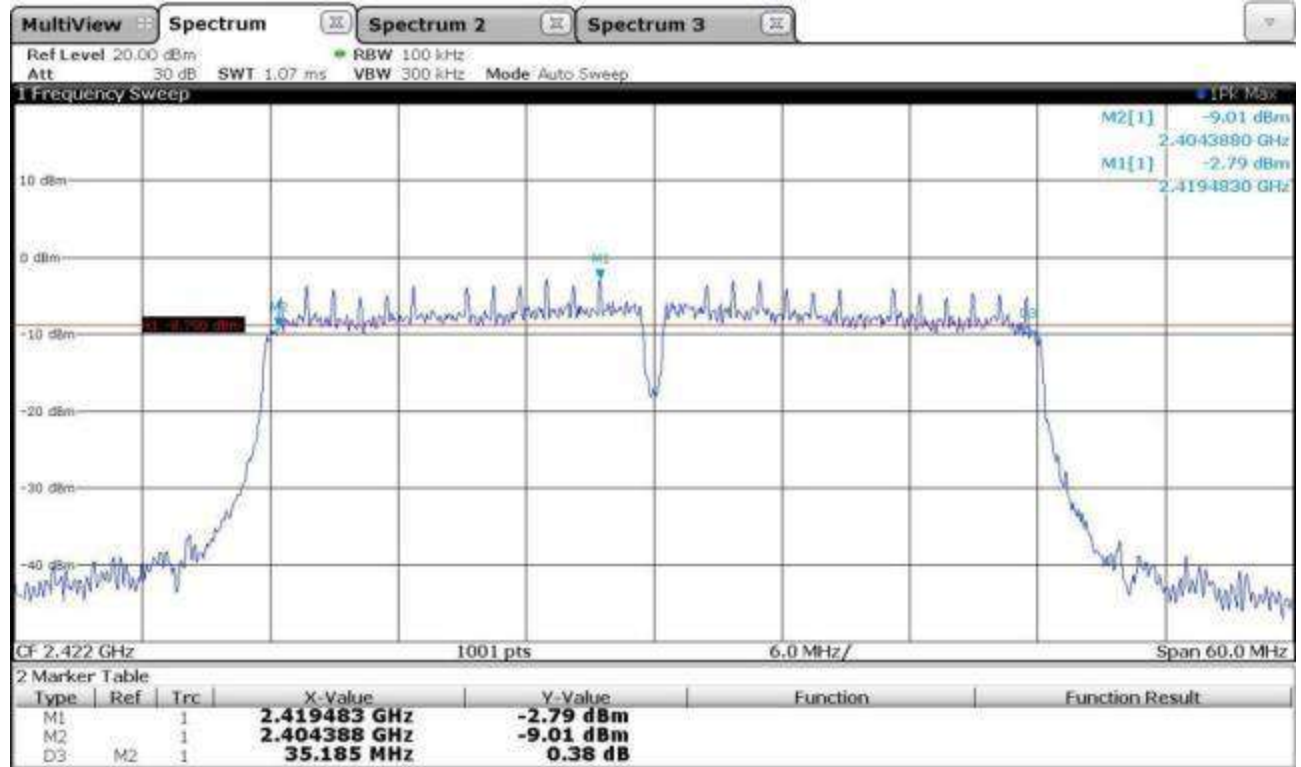
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
6	2437	17.063	0.5	Pass

Highest Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



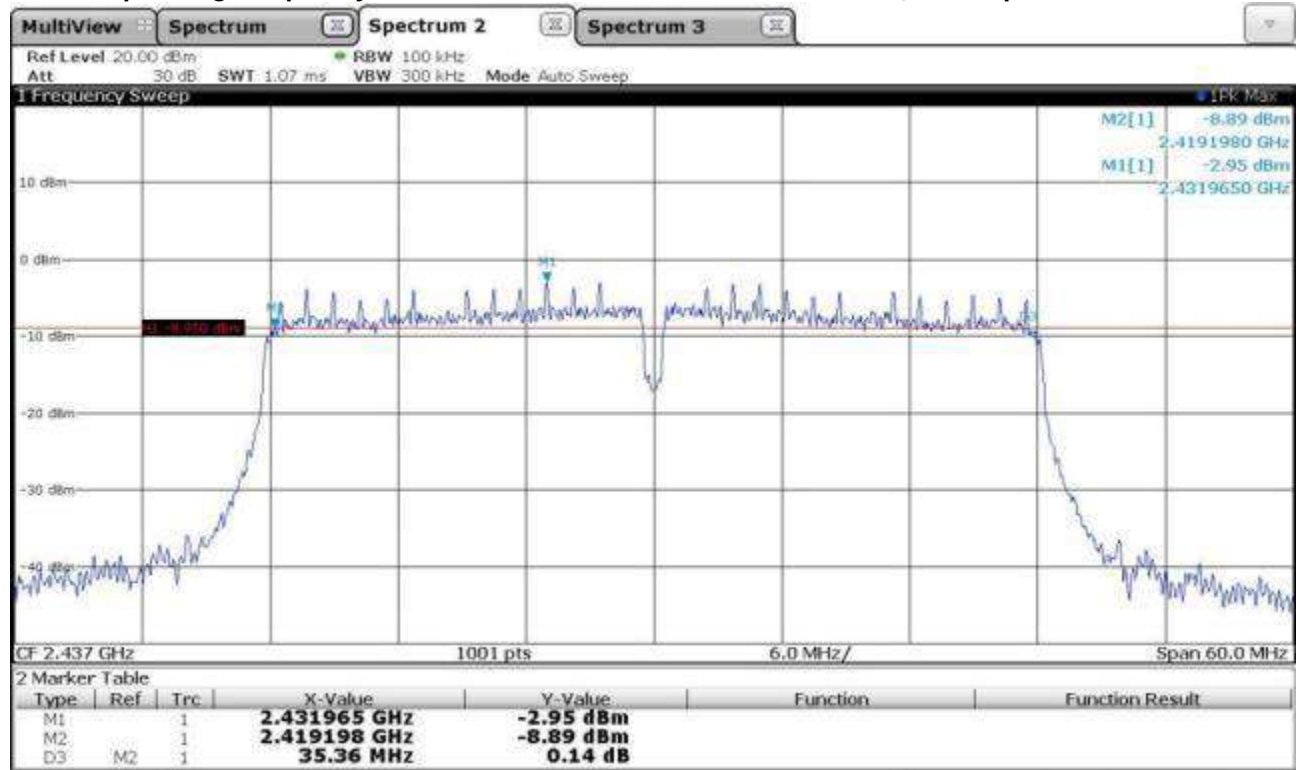
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
11	2462	17.023	0.5	Pass

Lowest operating frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



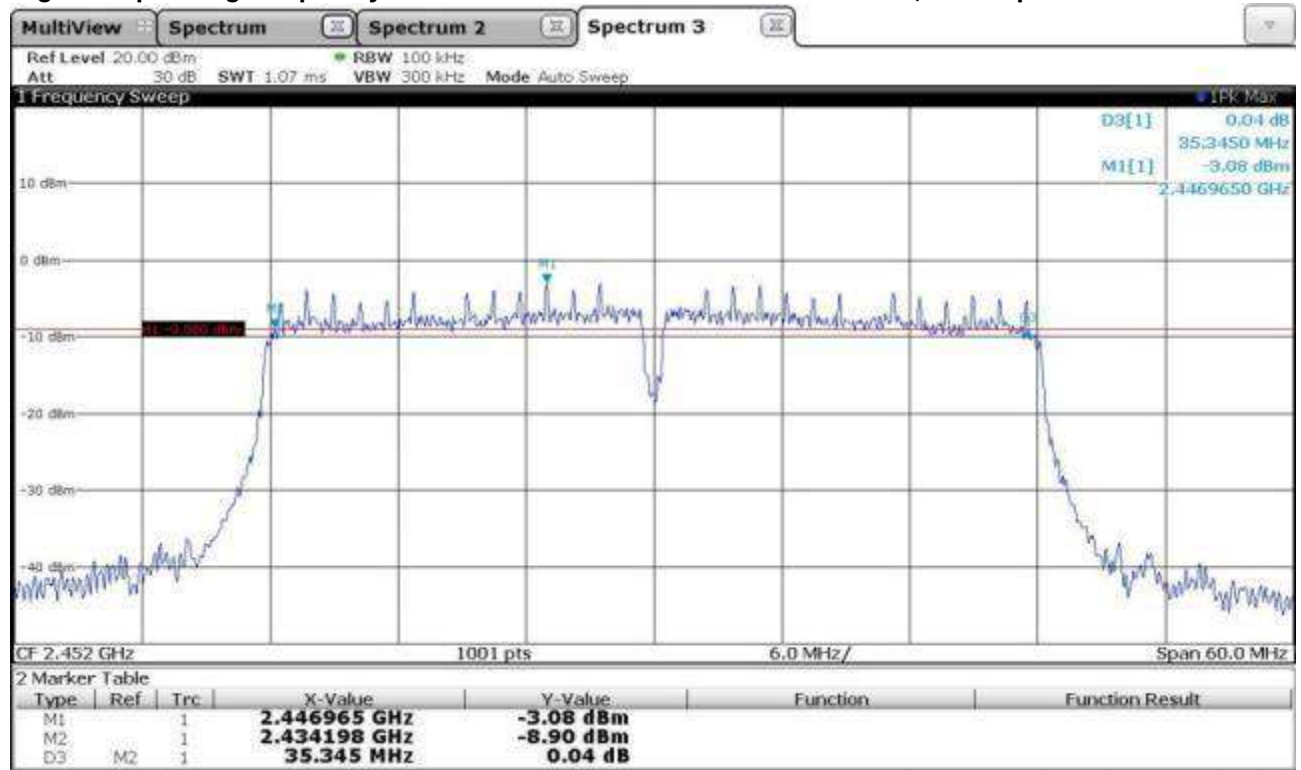
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
3	2422	35.185	0.5	Pass

Middle Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



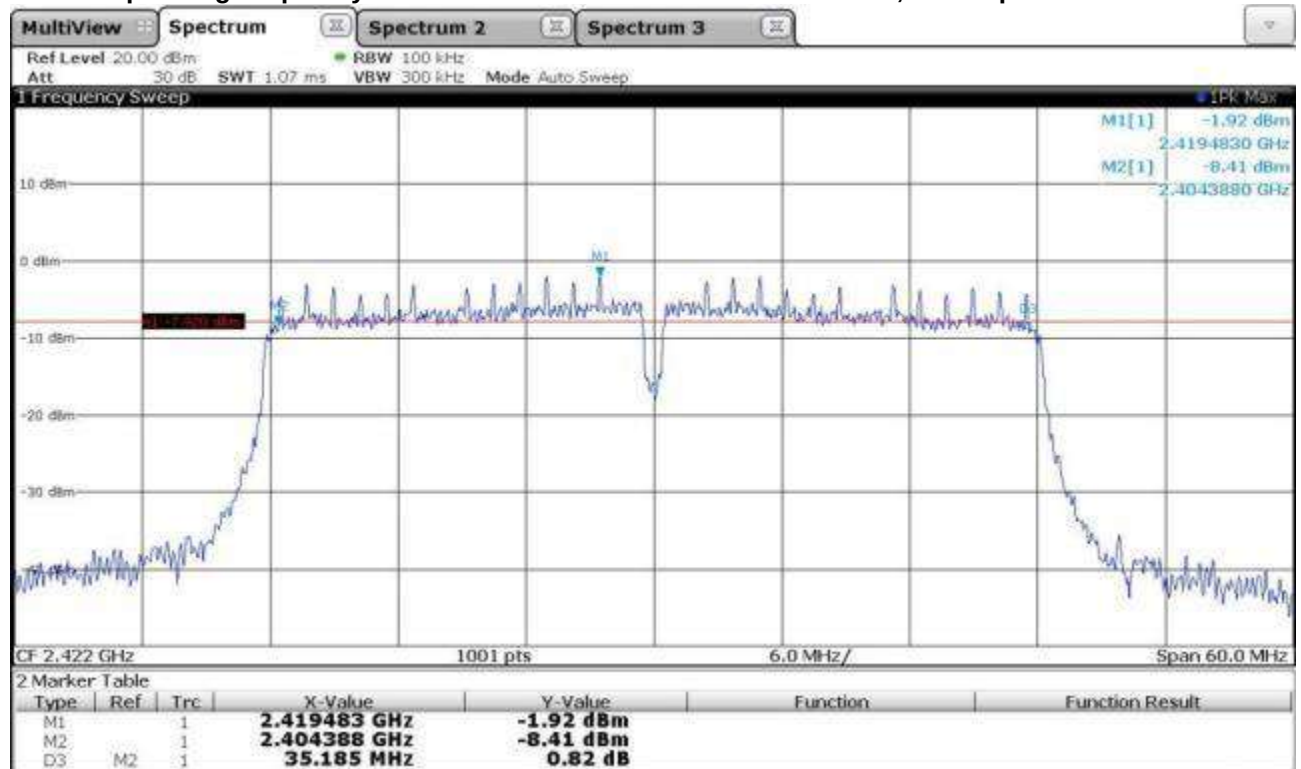
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
6	2437	35.36	0.5	Pass

Highest Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



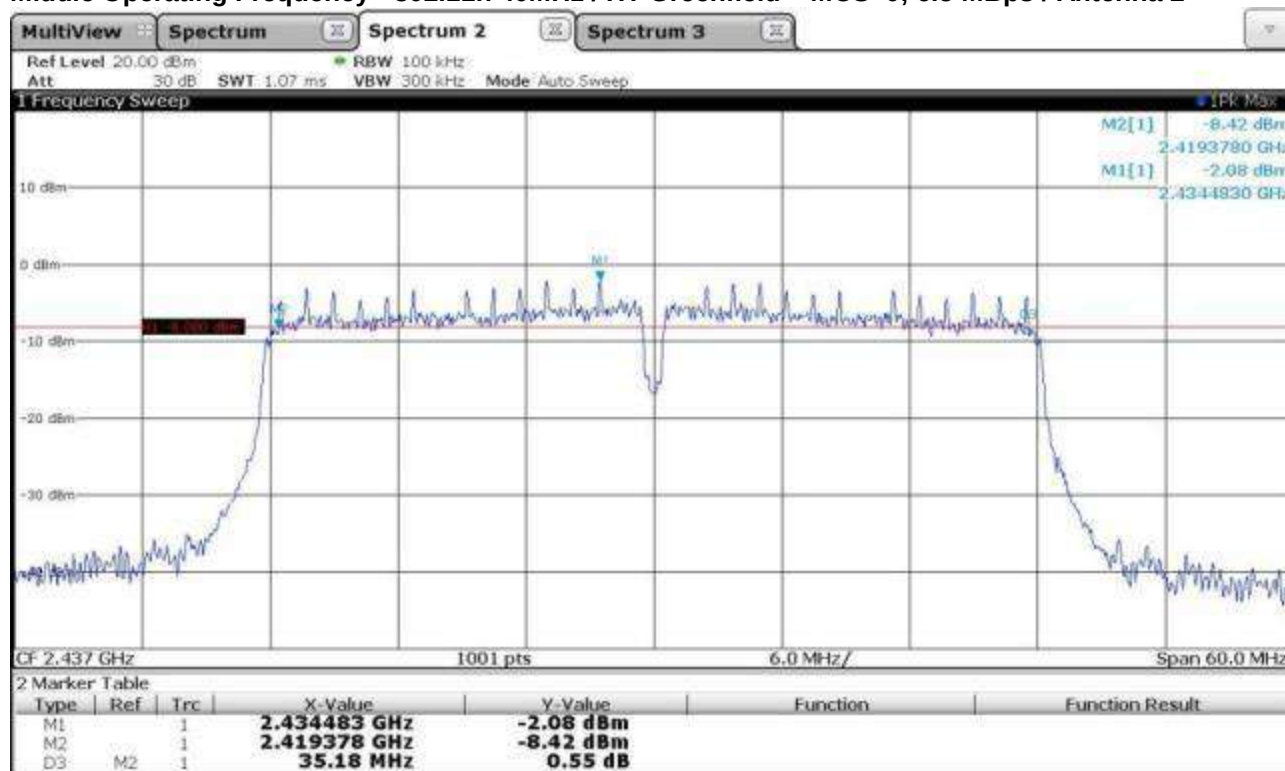
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
9	2452	35.345	0.5	Pass

Lowest operating frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



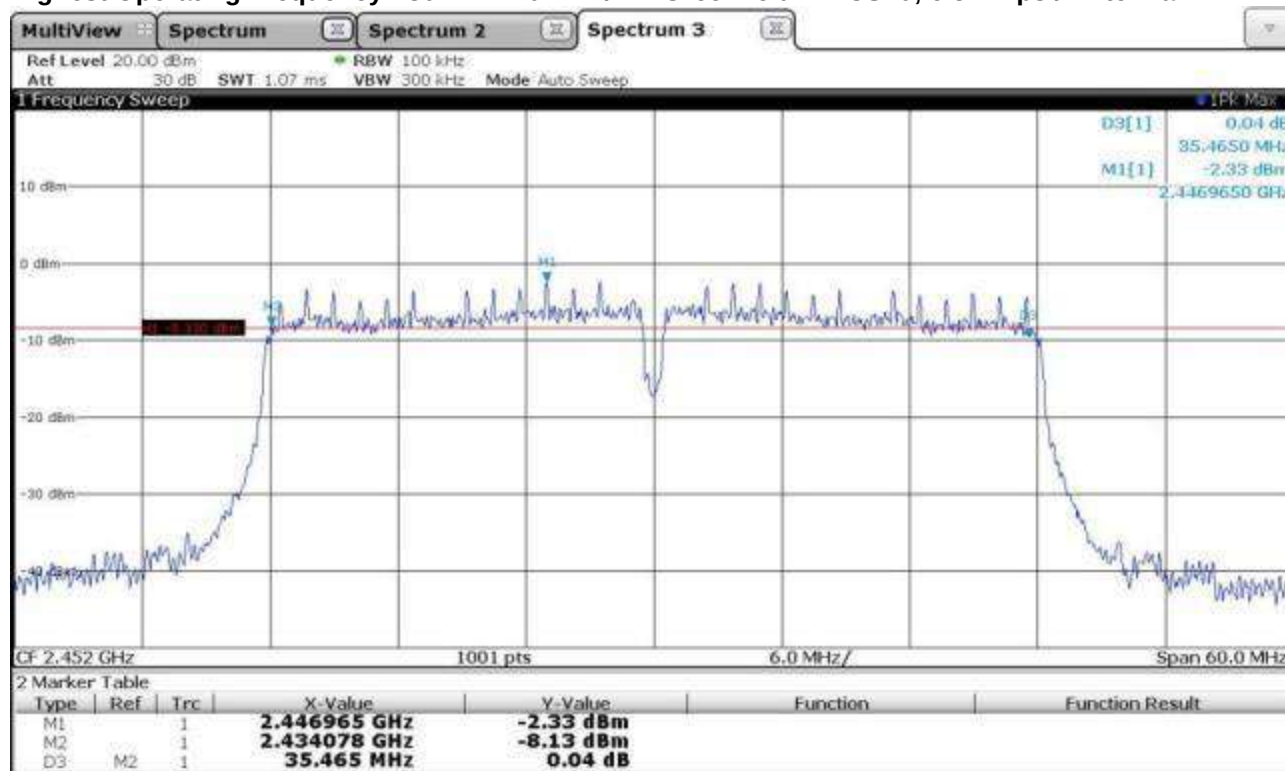
Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
3	2422	35.185	0.5	Pass

Middle Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
6	2437	35.18	0.5	Pass

Highest Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]	Result
9	2452	35.465	0.5	Pass

Results

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the **6 dB Bandwidth**.

7.2. Output Power of Fundamental Emissions

Maximum Conducted Output Power

Applied standards

- e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 (b) (3)
- RSS-247 Issue 2 section 5.4 (d)

Limits for Peak Output Power of Fundamental

The maximum peak conducted output power of the intentional radiator shall not exceeded: 1 Watt

As an alternative to the maximum peak conducted output power the average output power is measured to show compliance to the limit.

Test equipment and test set up

Test equipment used for conducted measurements as given in clause Test equipment of this report.

Test setup used for conducted measurements as given in clause Test setups of this report.

Description

For the conducted measurement, the RF output of the EUT was connected to the Analyzer. All the attenuation or cable loss will be added to the measured maximum output power.

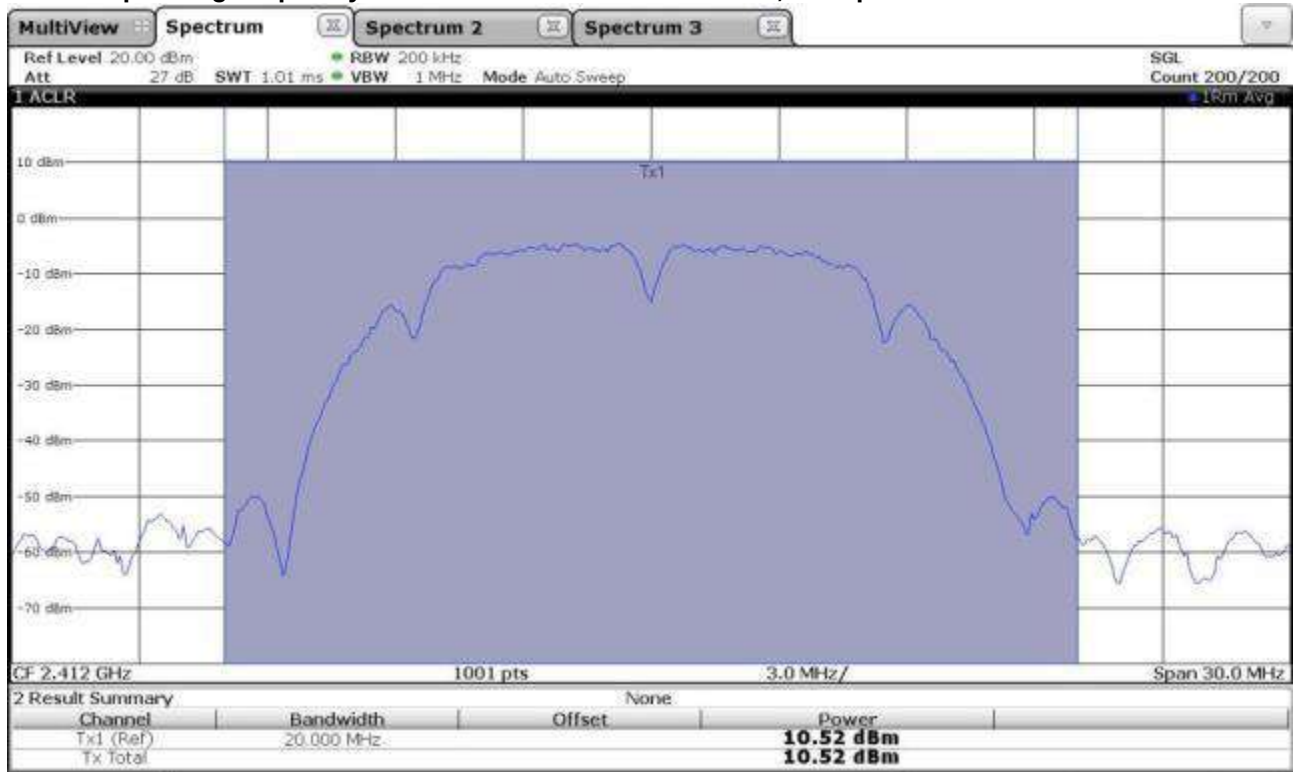
The results are recorded in Watt.

In addition, the EIRP was calculated taking into account the antenna gain.

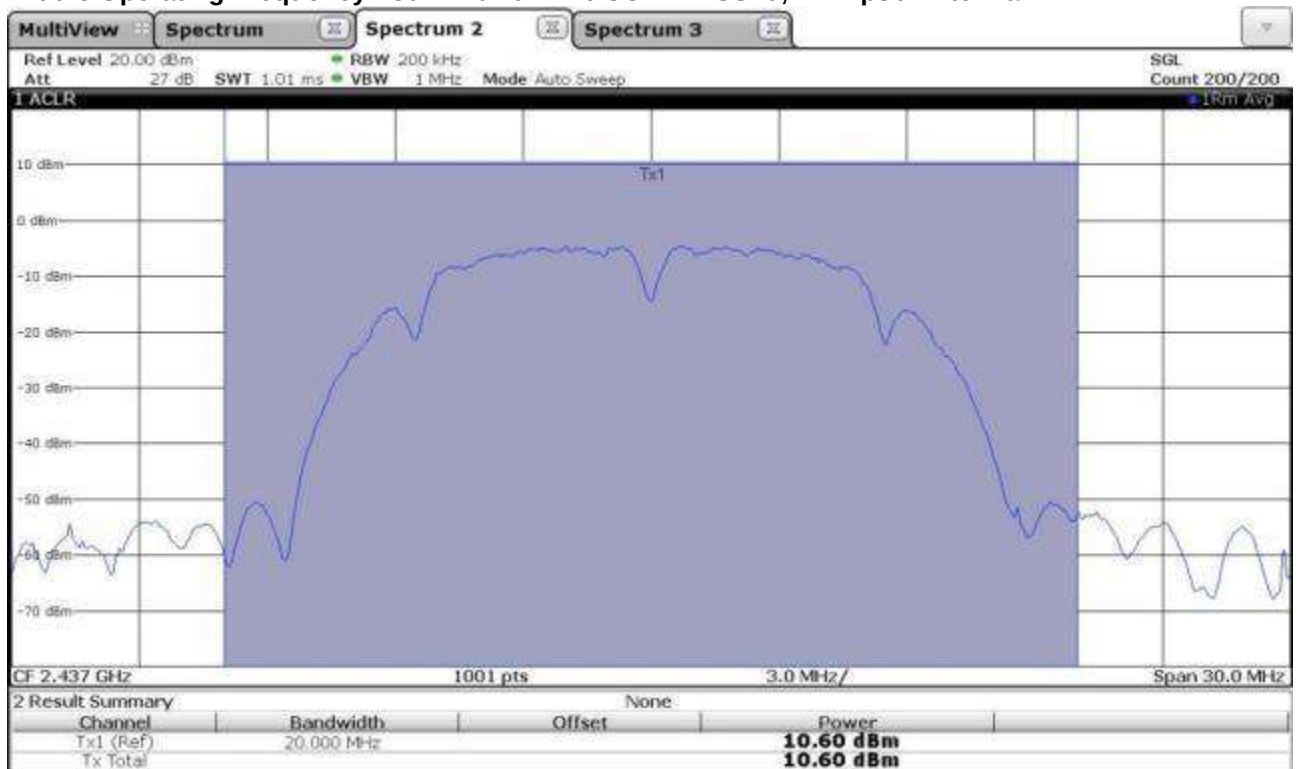
Measurement

The Measurement was performed on: 01.04.2020 and 02.04.2020

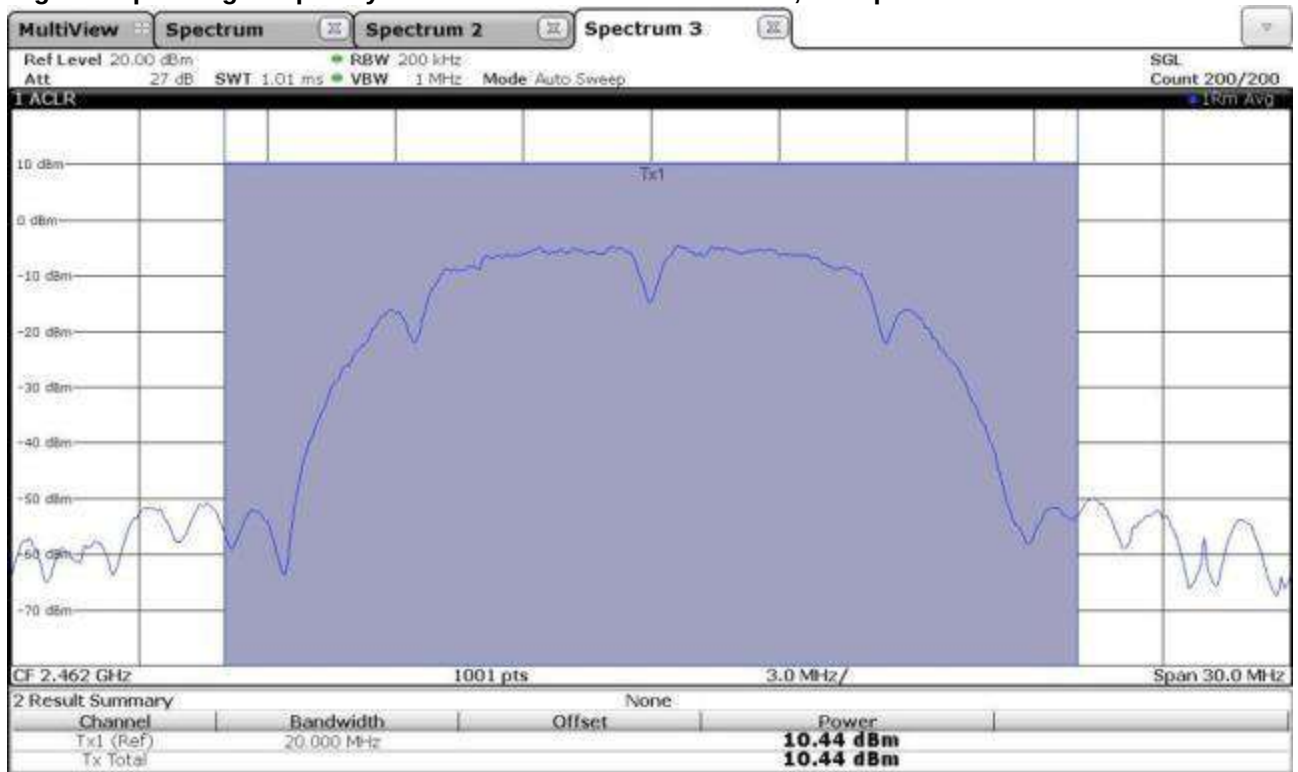
Lowest operating frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1



Middle Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1



Highest Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1



Maximum output power conducted measurement:

802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1

Channel	Frequency [MHz]	Reading of Analyzer [dBm]	Cable Loss [dB]	Output Power		Limit		Result
				[dBm]	[mW]	[dBm]	[mW]	
1	2412	10.52	1.2	11.72	14.86	30	1000	Pass
6	2437	10.60	1.2	11.80	15.14	30	1000	Pass
11	2462	10.44	1.2	11.64	14.59	30	1000	Pass

Calculated EIRP:

802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1

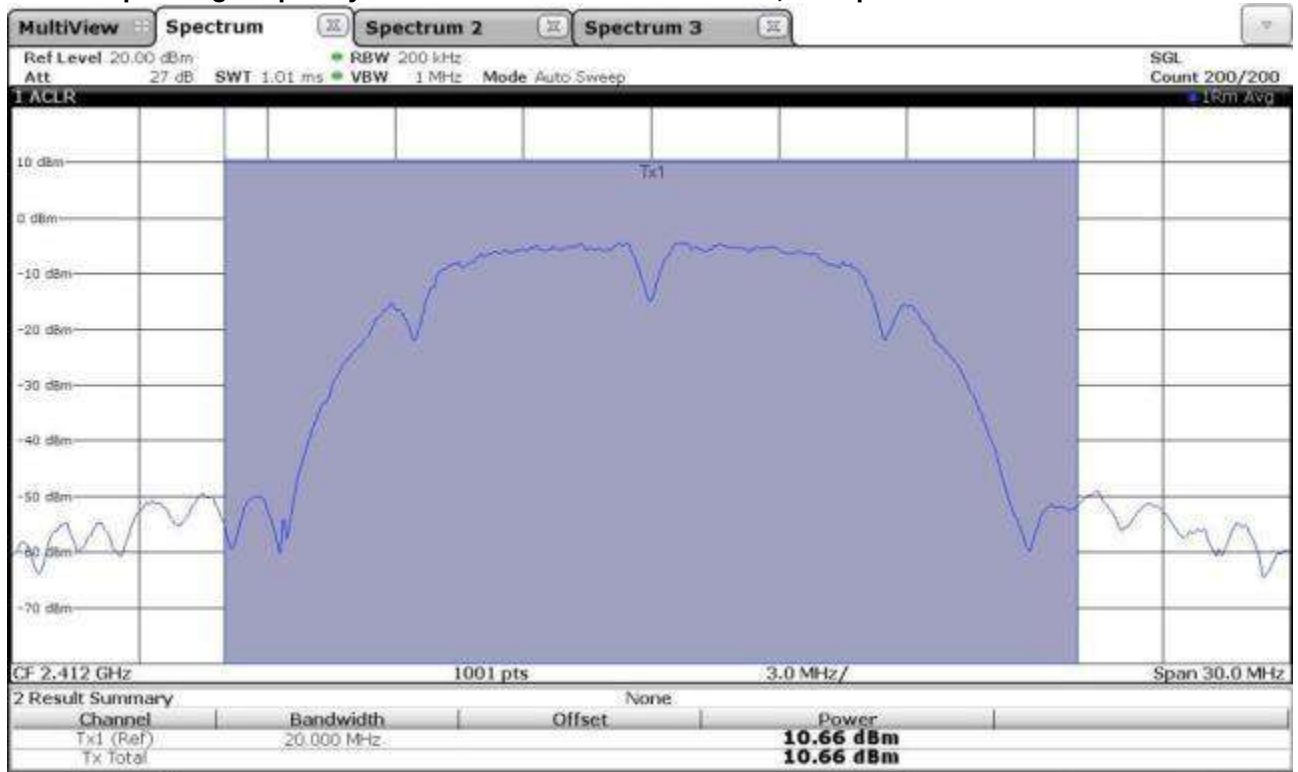
Channel	Frequency [MHz]	Output Power		Output Power EIRP		Limit		Result
		[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
1	2412	11.72	14.86	15.1	32.51	36	4000	Pass
6	2437	11.80	15.14	15.2	33.11	36	4000	Pass
11	2462	11.64	14.59	15.0	31.92	36	4000	Pass

Formula: [Output Power] + [Antenna Gain] = [EIRP]

Antenna 1 Gain: max. 3.4dBi

Antenna 2 Gain: max. 2.12dBi

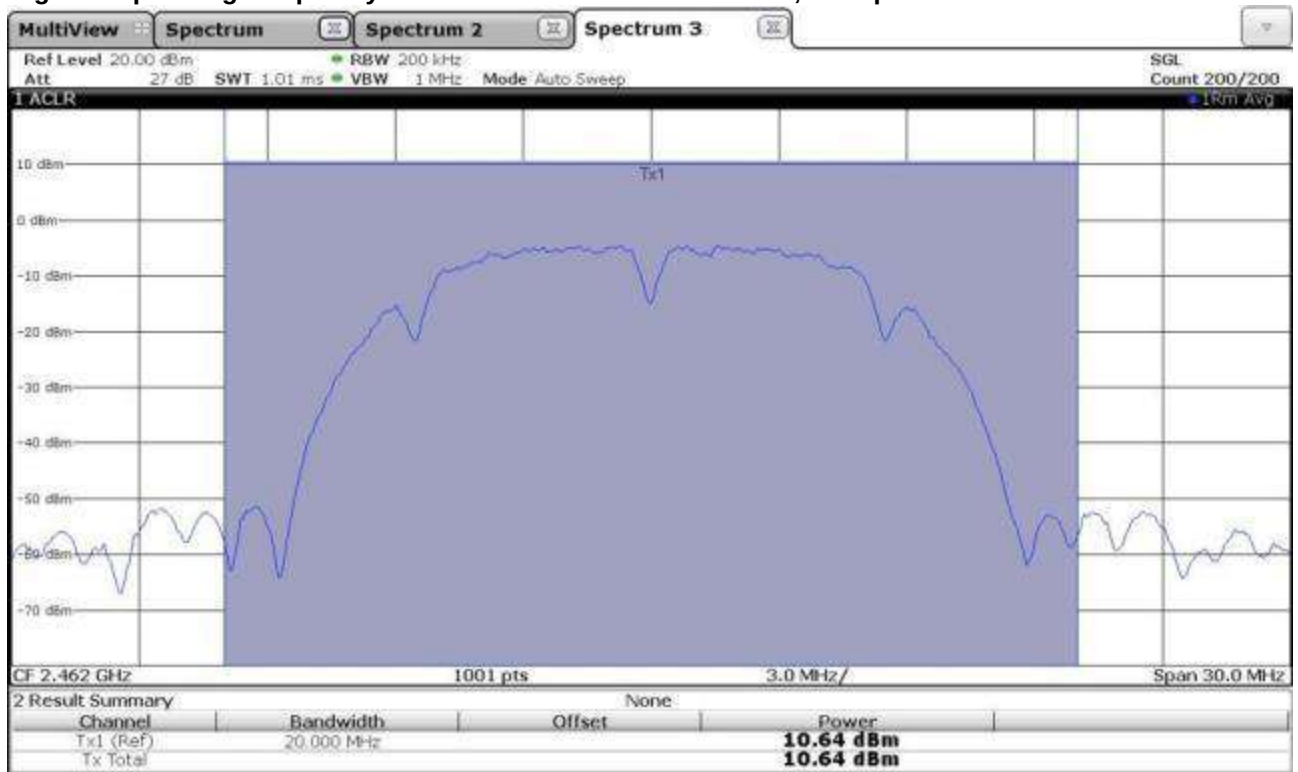
Lowest operating frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2



Middle Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2



Highest Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2



Maximum output power conducted measurement:

802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2

Channel	Frequency [MHz]	Reading of Analyzer [dBm]	Cable Loss [dB]	Output Power		Limit		Result
				[dBm]	[mW]	[dBm]	[mW]	
1	2412	10.66	1.2	11.86	15.35	30	1000	Pass
6	2437	10.65	1.2	11.85	15.31	30	1000	Pass
11	2462	10.64	1.2	11.84	15.28	30	1000	Pass

Calculated EIRP:

802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2

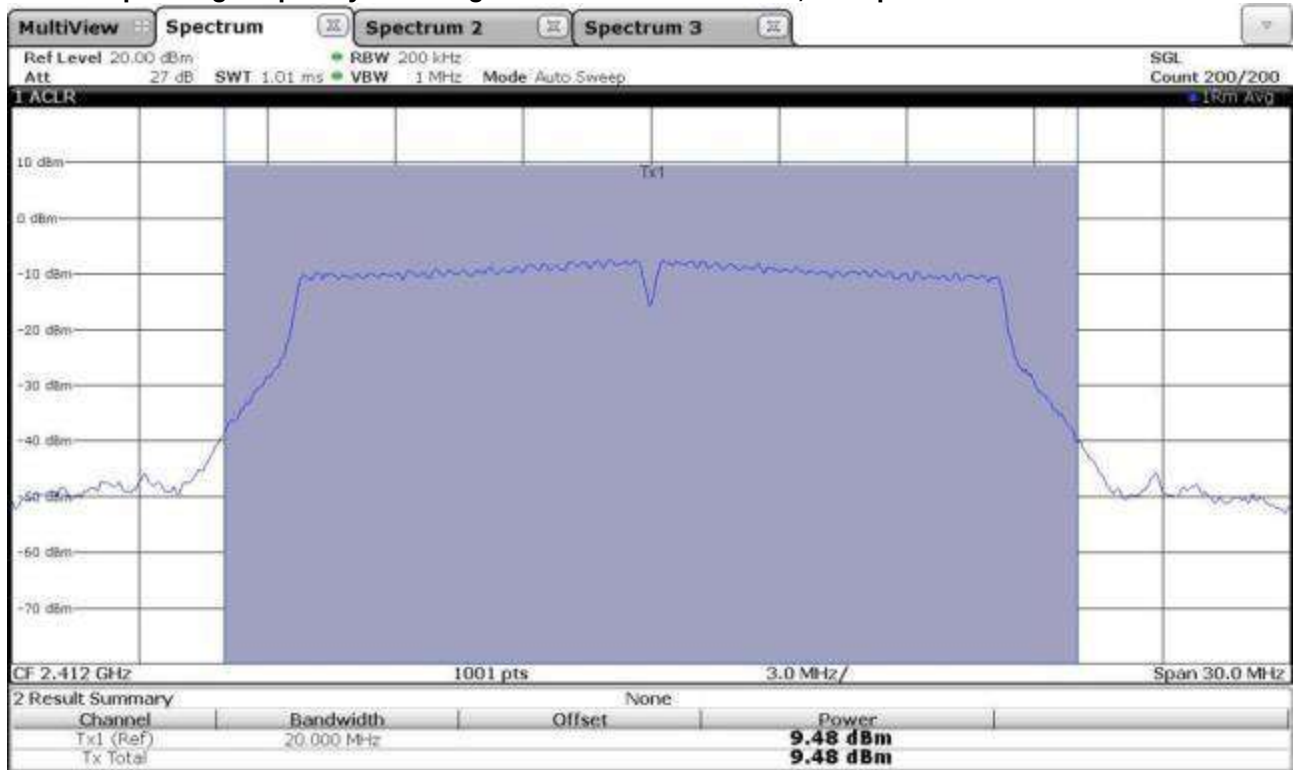
Channel	Frequency [MHz]	Output Power		Output Power EIRP		Limit		Result
		[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
1	2412	11.86	15.35	14.0	25.00	36	4000	Pass
6	2437	11.85	15.31	14.0	24.95	36	4000	Pass
11	2462	11.84	15.28	14.0	24.89	36	4000	Pass

Formula: [Output Power] + [Antenna Gain] = [EIRP]

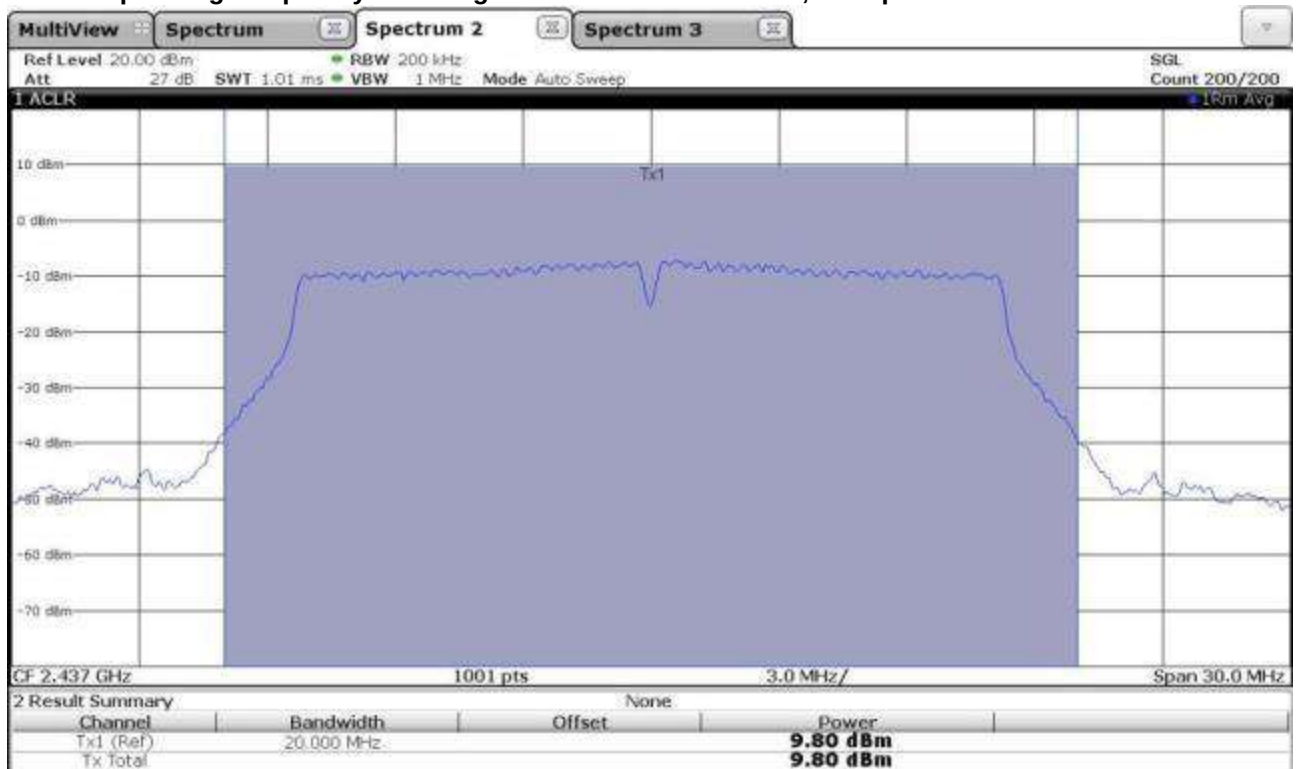
Antenna 1 Gain: max. 3.4dBi

Antenna 2 Gain: max. 2.12dBi

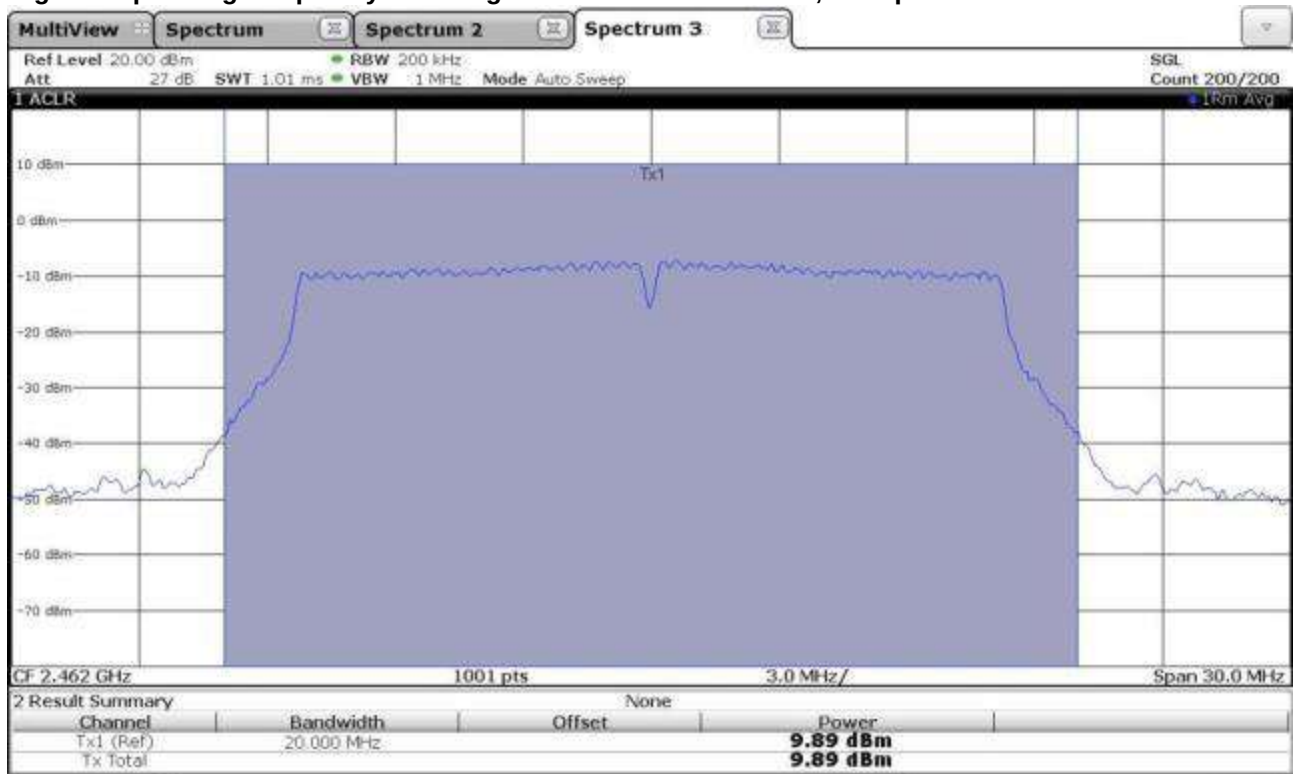
Lowest operating frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1



Middle Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1



Highest Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1



Maximum output power conducted measurement:
802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1

Channel	Frequency [MHz]	Reading of Analyzer [dBm]	Cable Loss [dB]	Output Power		Limit		Result
				[dBm]	[mW]	[dBm]	[mW]	
1	2412	9.48	1.2	10.68	11.69	30	1000	Pass
6	2437	9.80	1.2	11.00	12.59	30	1000	Pass
11	2462	9.89	1.2	11.09	12.85	30	1000	Pass

Calculated EIRP:
802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1

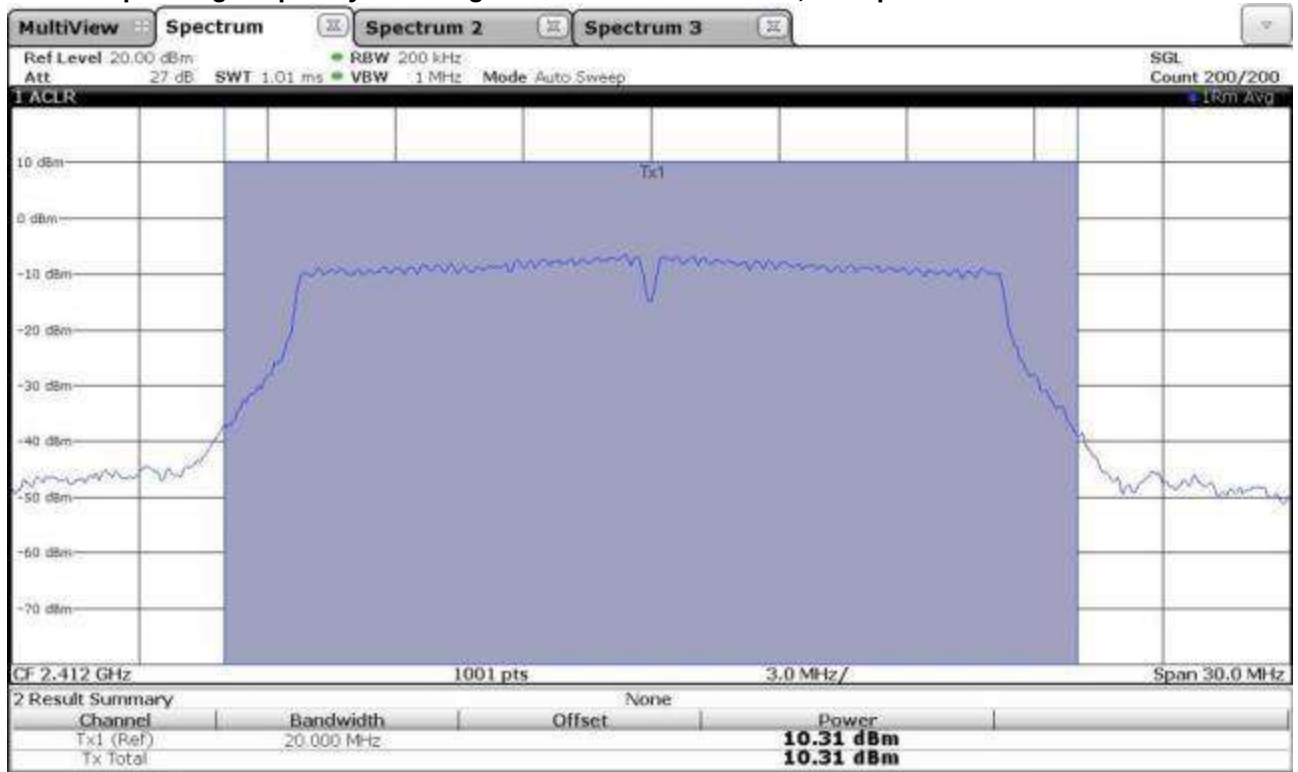
Channel	Frequency [MHz]	Output Power		Output Power EIRP		Limit		Result
		[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
1	2412	10.68	11.69	14.1	25.59	36	4000	Pass
6	2437	11.00	12.59	14.4	27.54	36	4000	Pass
11	2462	11.09	12.85	14.5	28.12	36	4000	Pass

Formula: [Output Power] + [Antenna Gain] = [EIRP]

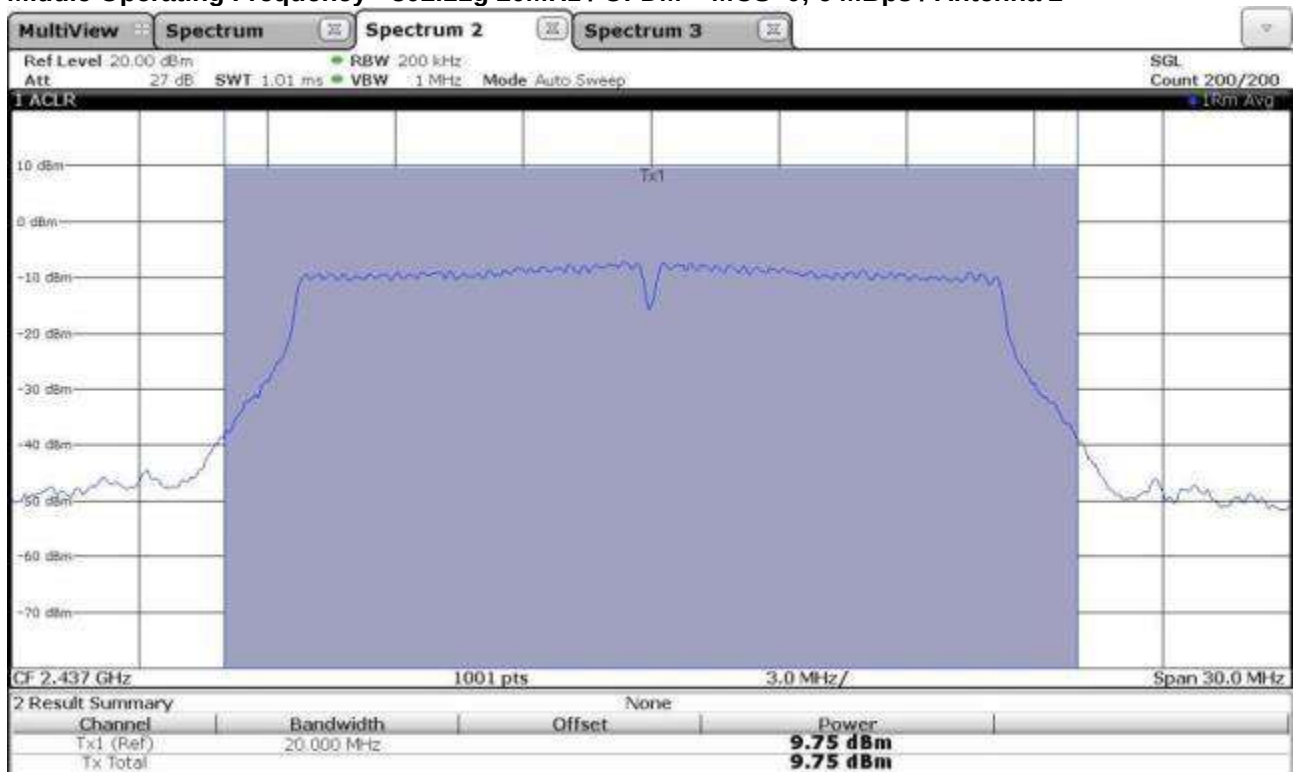
Antenna 1 Gain: max. 3.4dBi

Antenna 2 Gain: max. 2.12dBi

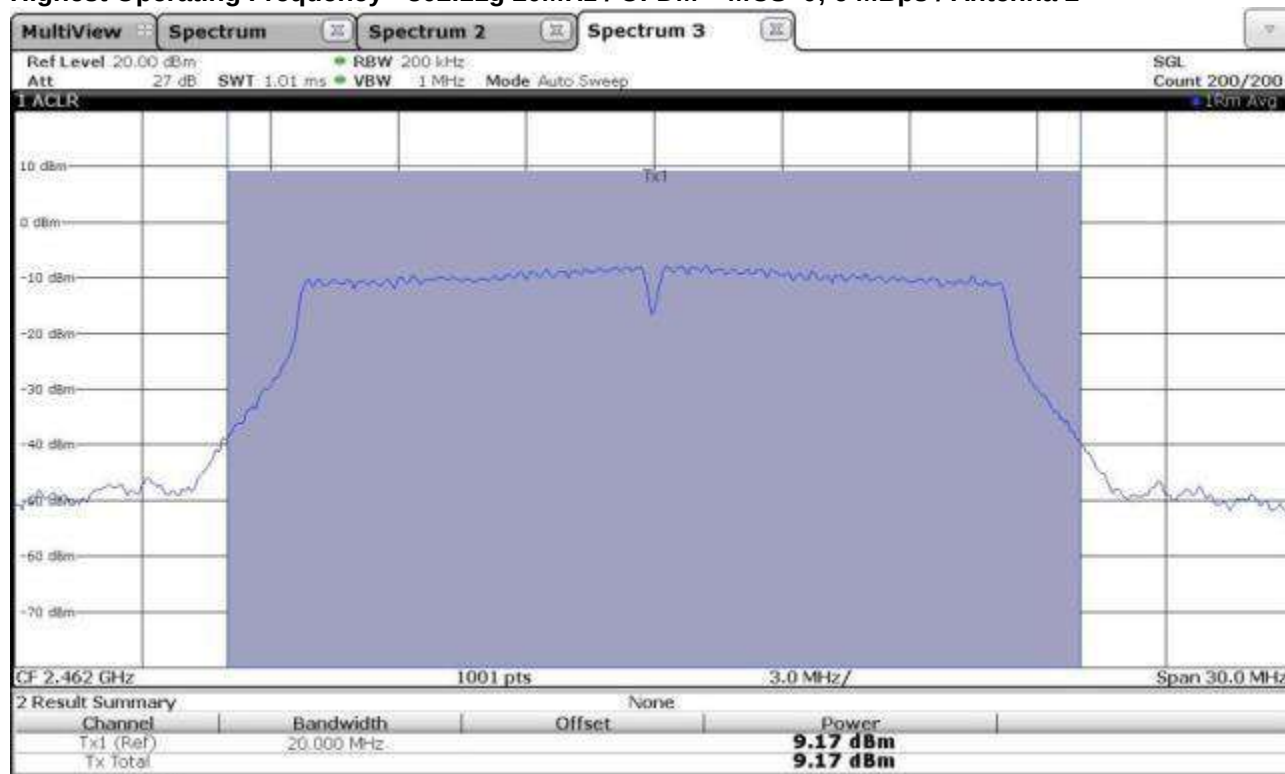
Lowest operating frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 2



Middle Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 2



Highest Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 Mbps / Antenna 2



Maximum output power conducted measurement:
802.11g 20MHz / OFDM – MCS=0; 6 Mbps / Antenna 2

Channel	Frequency [MHz]	Reading of Analyzer [dBm]	Cable Loss [dB]	Output Power		Limit		Result
				[dBm]	[mW]	[dBm]	[mW]	
1	2412	10.31	1.2	11.51	14.16	30	1000	Pass
6	2437	9.75	1.2	10.95	12.45	30	1000	Pass
11	2462	9.17	1.2	10.37	10.89	30	1000	Pass

Calculated EIRP:
802.11g 20MHz / OFDM – MCS=0; 6 Mbps / Antenna 2

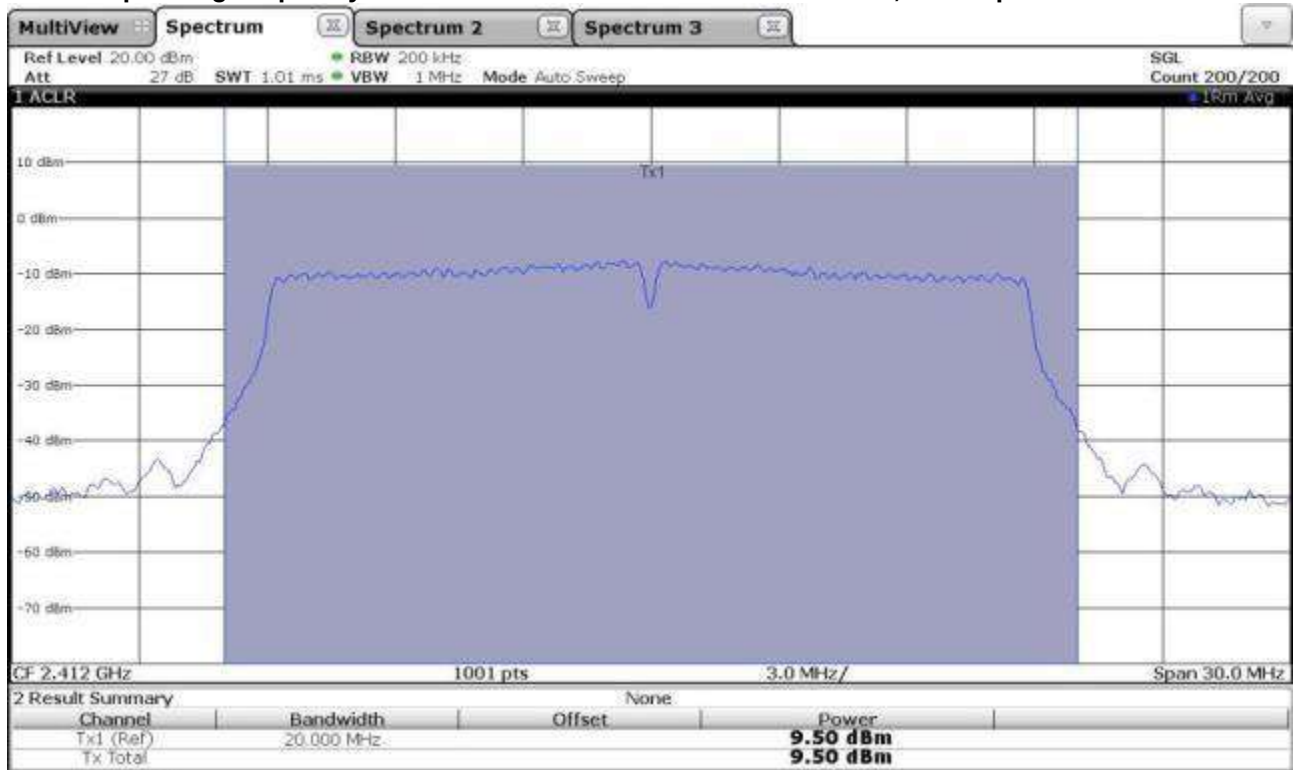
Channel	Frequency [MHz]	Output Power		Output Power EIRP		Limit		Result
		[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
1	2412	11.51	14.16	13.6	23.07	36	4000	Pass
6	2437	10.95	12.45	13.1	20.28	36	4000	Pass
11	2462	10.37	10.89	12.5	17.74	36	4000	Pass

Formula: [Output Power] + [Antenna Gain] = [EIRP]

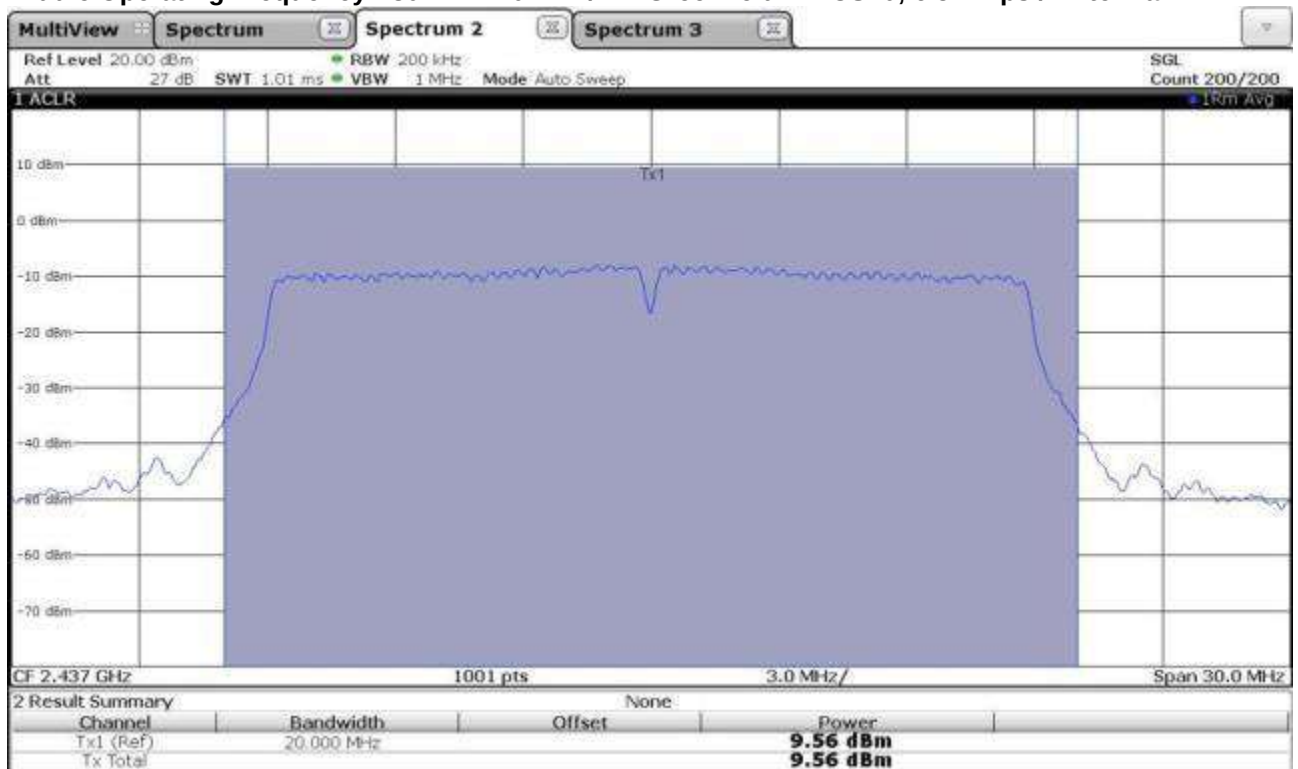
Antenna 1 Gain: max. 3.4dBi

Antenna 2 Gain: max. 2.12dBi

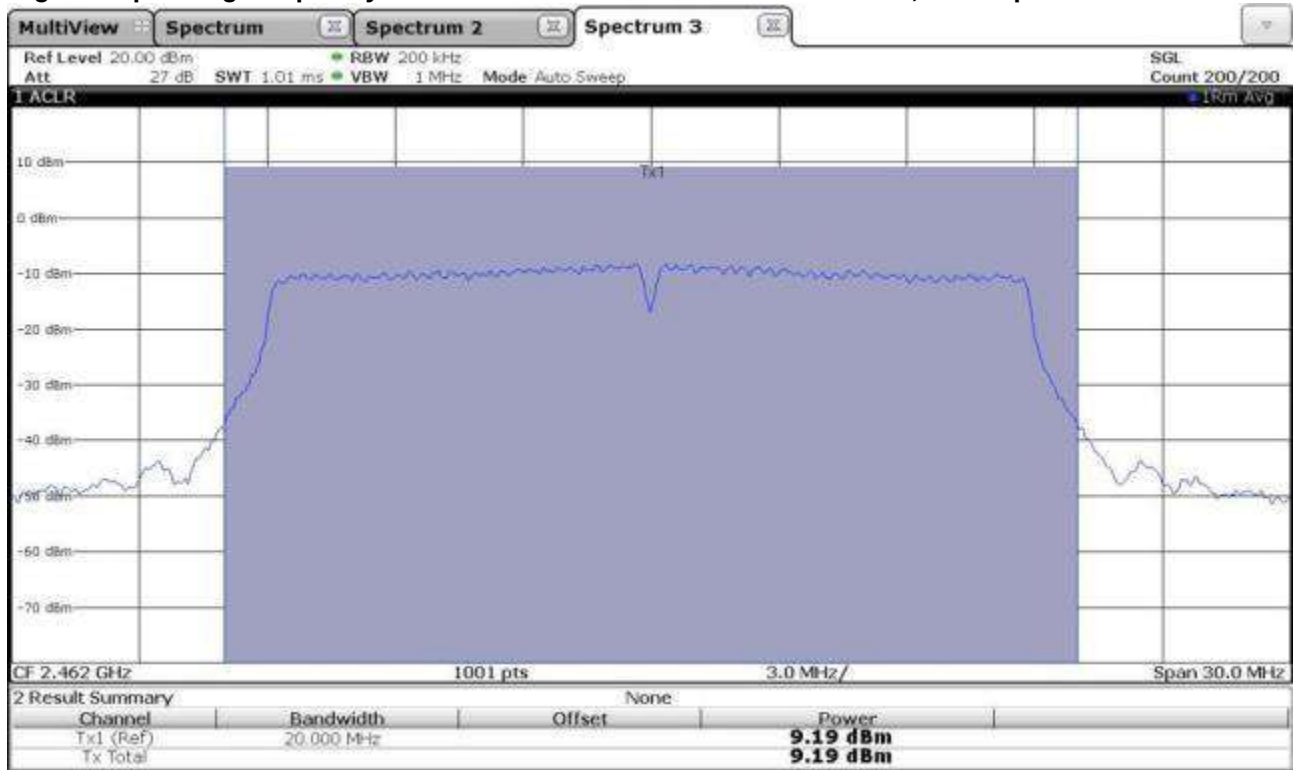
Lowest operating frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



Middle Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



Highest Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1

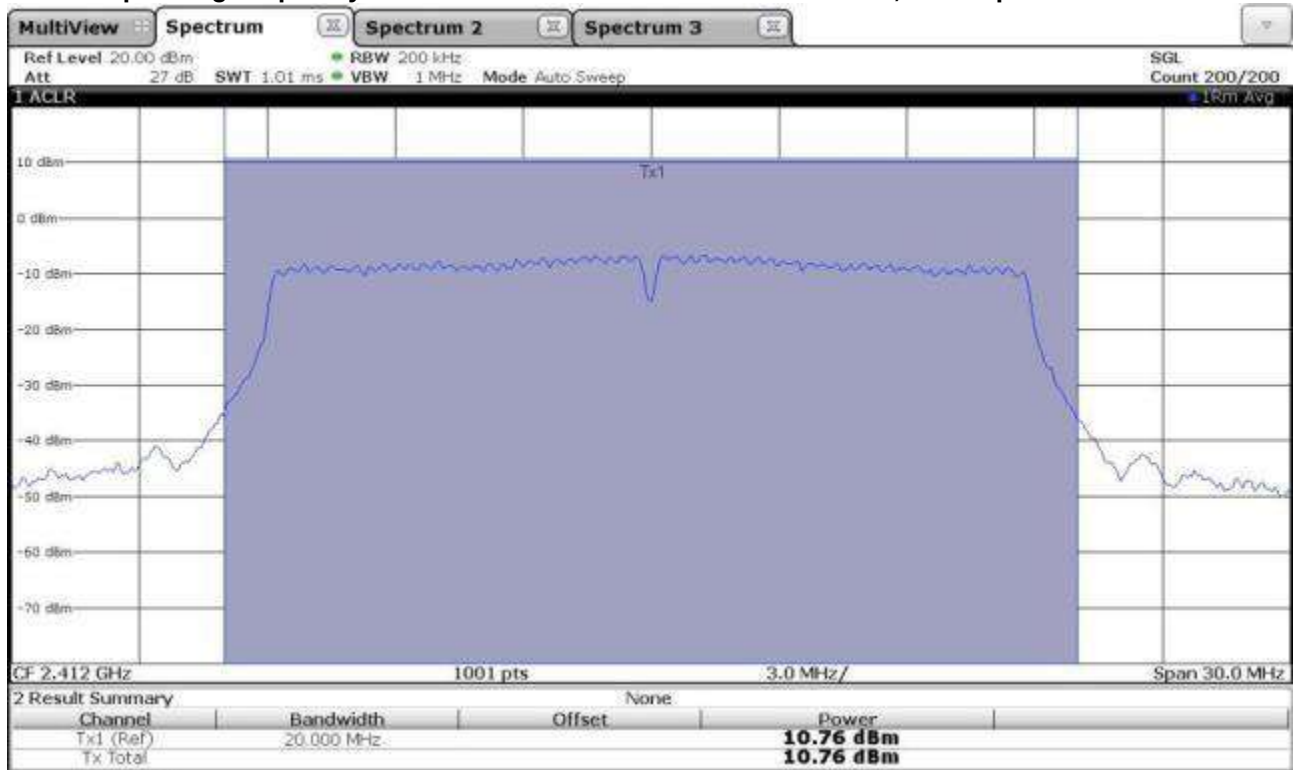


Maximum output power conducted measurement:

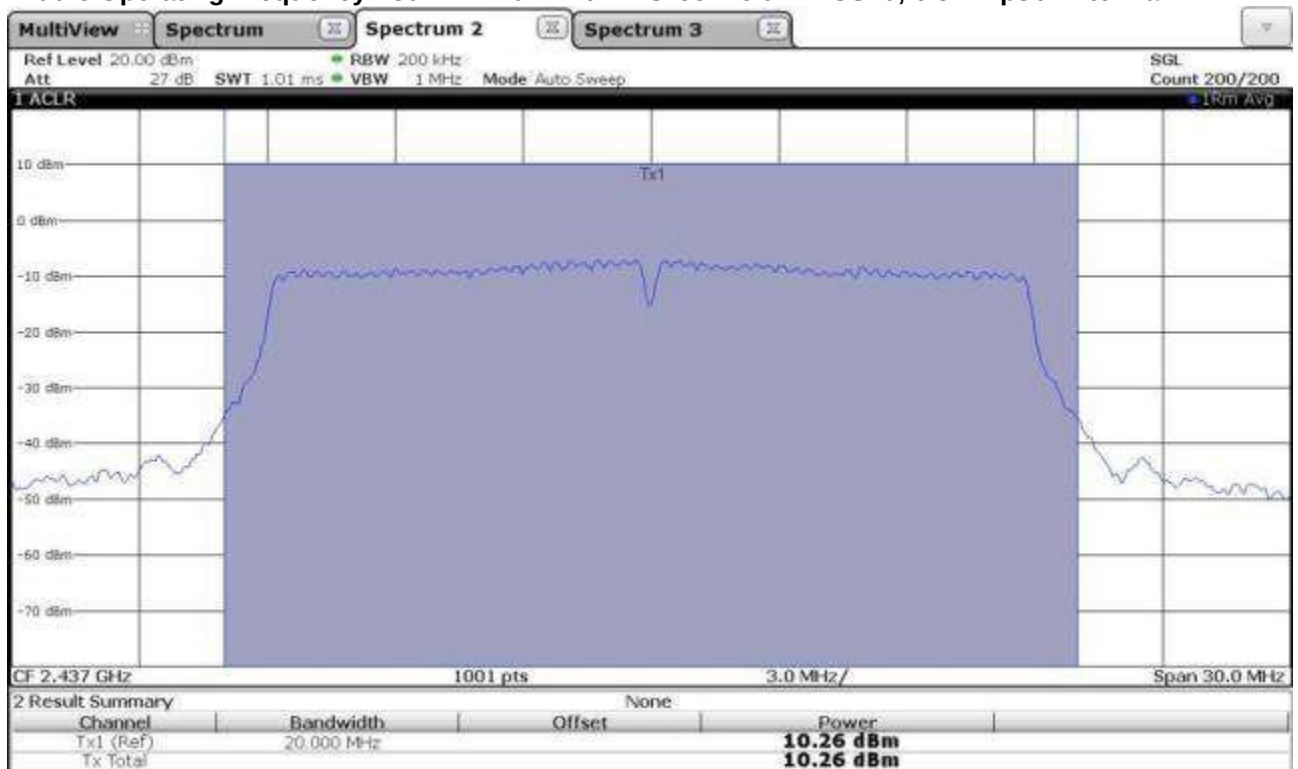
802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1

Channel	Frequency [MHz]	Reading of Analyzer [dBm]	Cable Loss [dB]	Output Power		Limit		Result
				[dBm]	[mW]	[dBm]	[mW]	
1	2412	9.50	1.2	10.70	11.75	30	1000	Pass
6	2437	9.56	1.2	10.76	11.91	30	1000	Pass
11	2462	9.19	1.2	10.39	10.94	30	1000	Pass

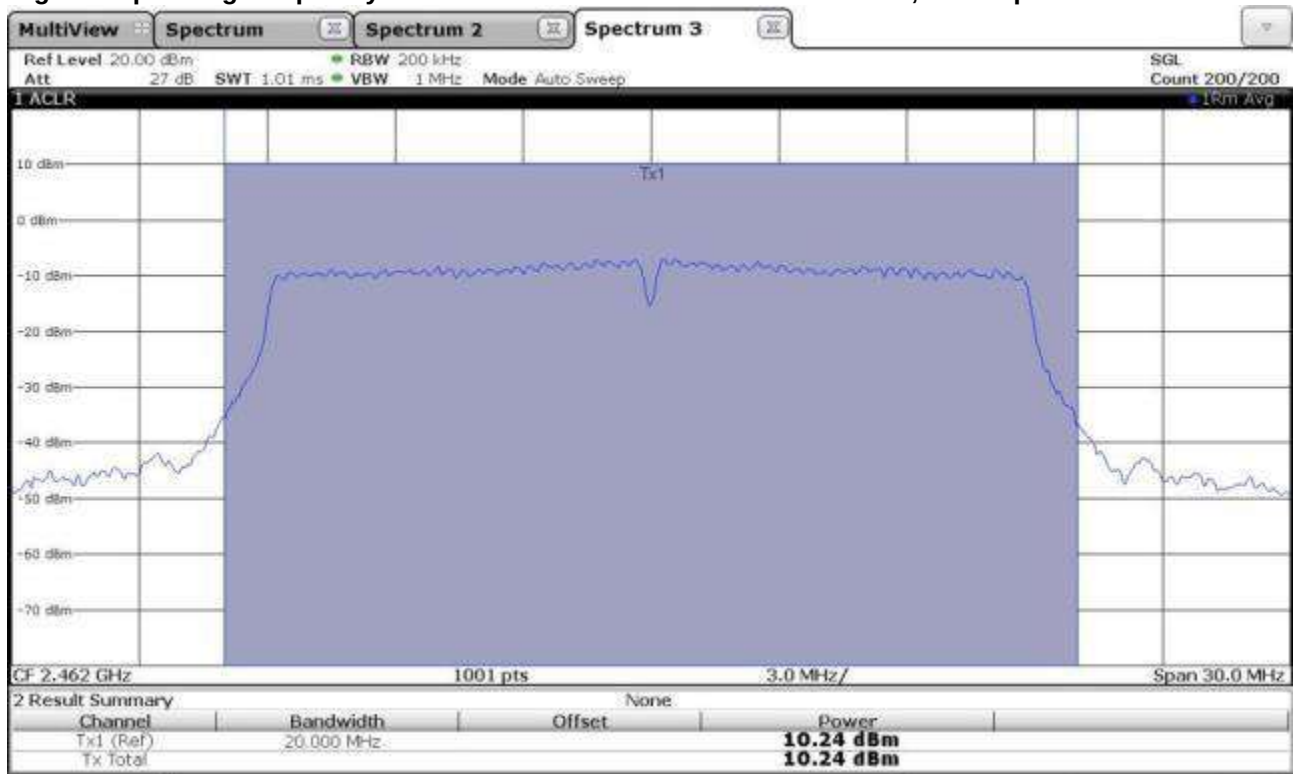
Lowest operating frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Middle Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Highest Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Maximum output power conducted measurement:
802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2

Channel	Frequency [MHz]	Reading of Analyzer [dBm]	Cable Loss [dB]	Output Power		Limit		Result
				[dBm]	[mW]	[dBm]	[mW]	
1	2412	10.76	1.2	11.96	15.70	30	1000	Pass
6	2437	10.26	1.2	11.46	14.00	30	1000	Pass
11	2462	10.24	1.2	11.44	13.93	30	1000	Pass

Maximum output power conducted measurement:
802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1 + Antenna 2

Channel	Frequency [MHz]	Output Antenna 1 [mW]	Output Antenna 2 [mW]	Total Output Power		Limit		Result
				[dBm]	[mW]	[dBm]	[mW]	
1	2412	11.75	15.70	14.39	27.45	30	1000	Pass
6	2437	11.91	14.00	14.13	25.91	30	1000	Pass
11	2462	10.94	13.93	13.96	24.87	30	1000	Pass

According to KDB 662911 D01

Calculated EIRP:
802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1 + Antenna 2

Channel	Frequency [MHz]	Total Output Power		Total Output Power EIRP		Limit		Result
		[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
1	2412	14.39	27.45	20.19	104.47	36	4000	Pass
6	2437	14.13	25.91	19.93	98.40	36	4000	Pass
11	2462	13.96	24.87	19.76	94.62	36	4000	Pass

Formula: [Total Output Power] + [Directionl Gain] = [EIRP]

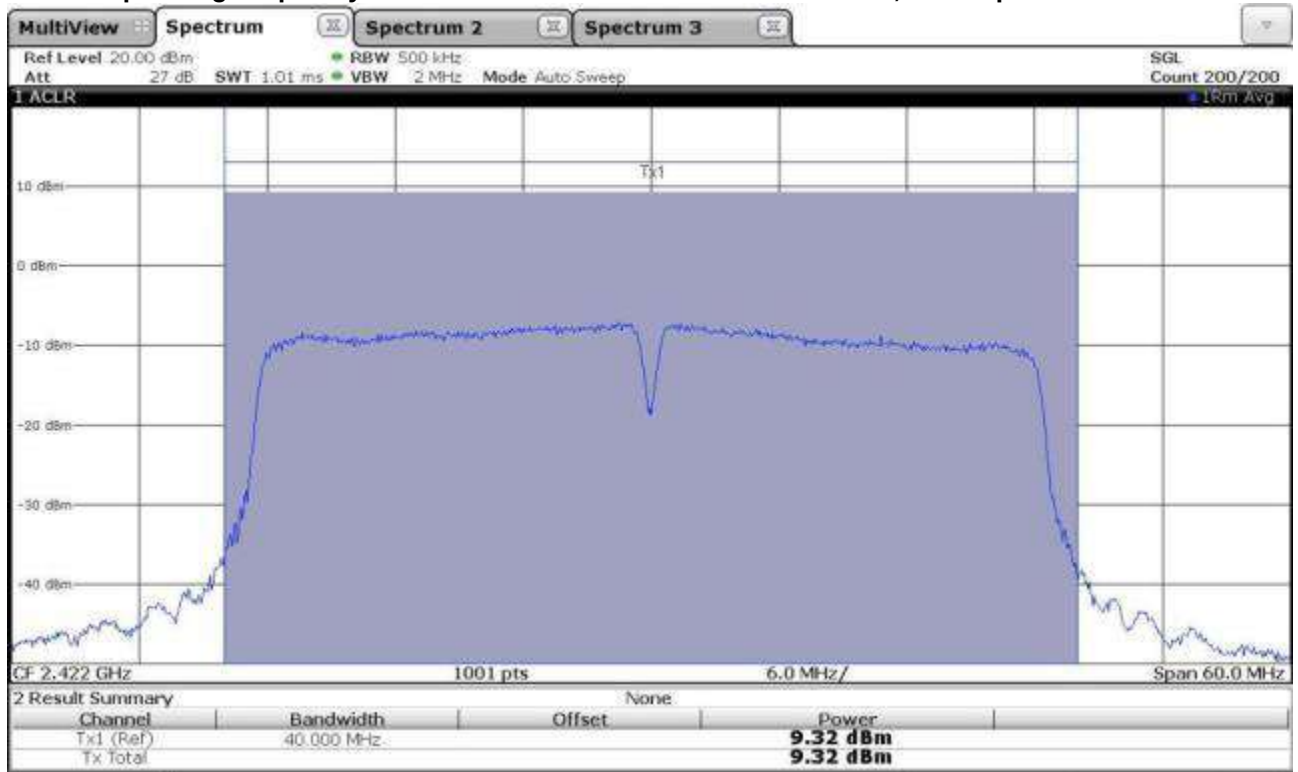
Antenna 1 Gain: max. 3.4dBi

Antenna 2 Gain: max. 2.12dBi

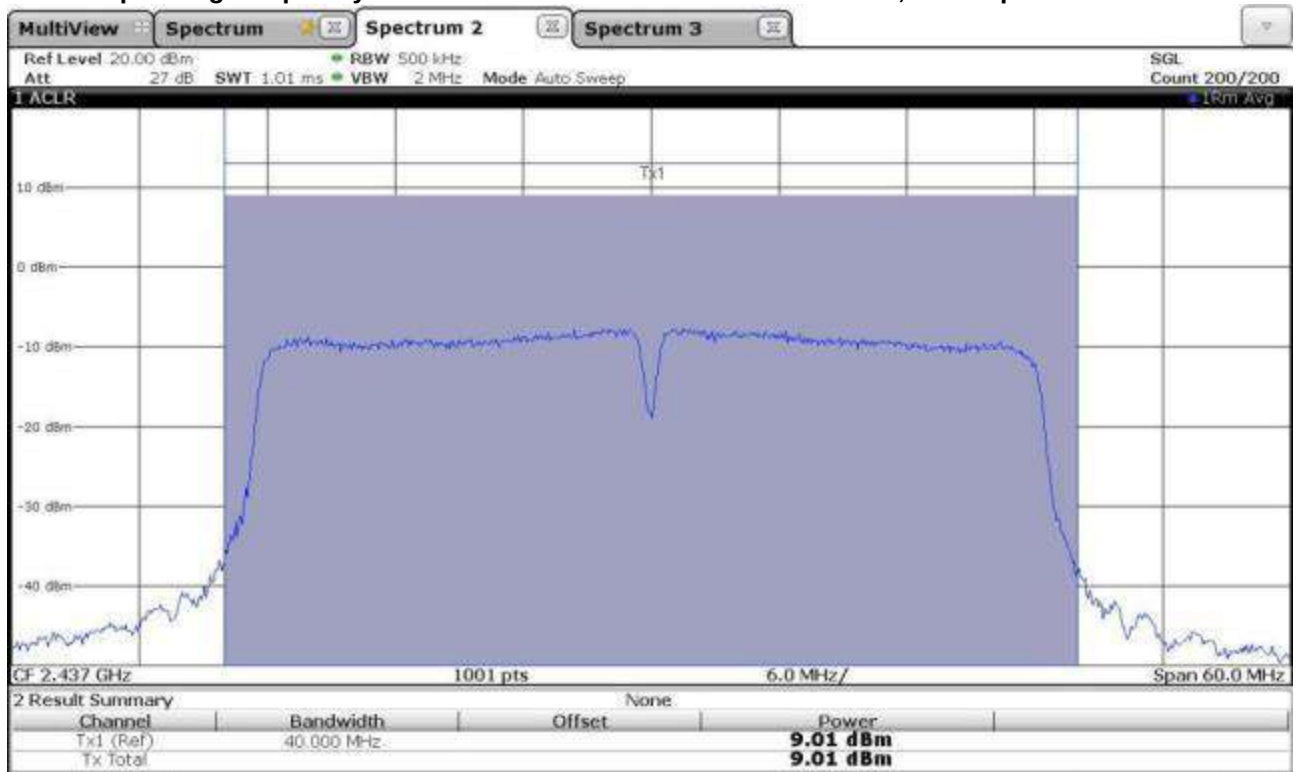
Directionl Gain: 5.8dBi

According to KDB 662911 D01

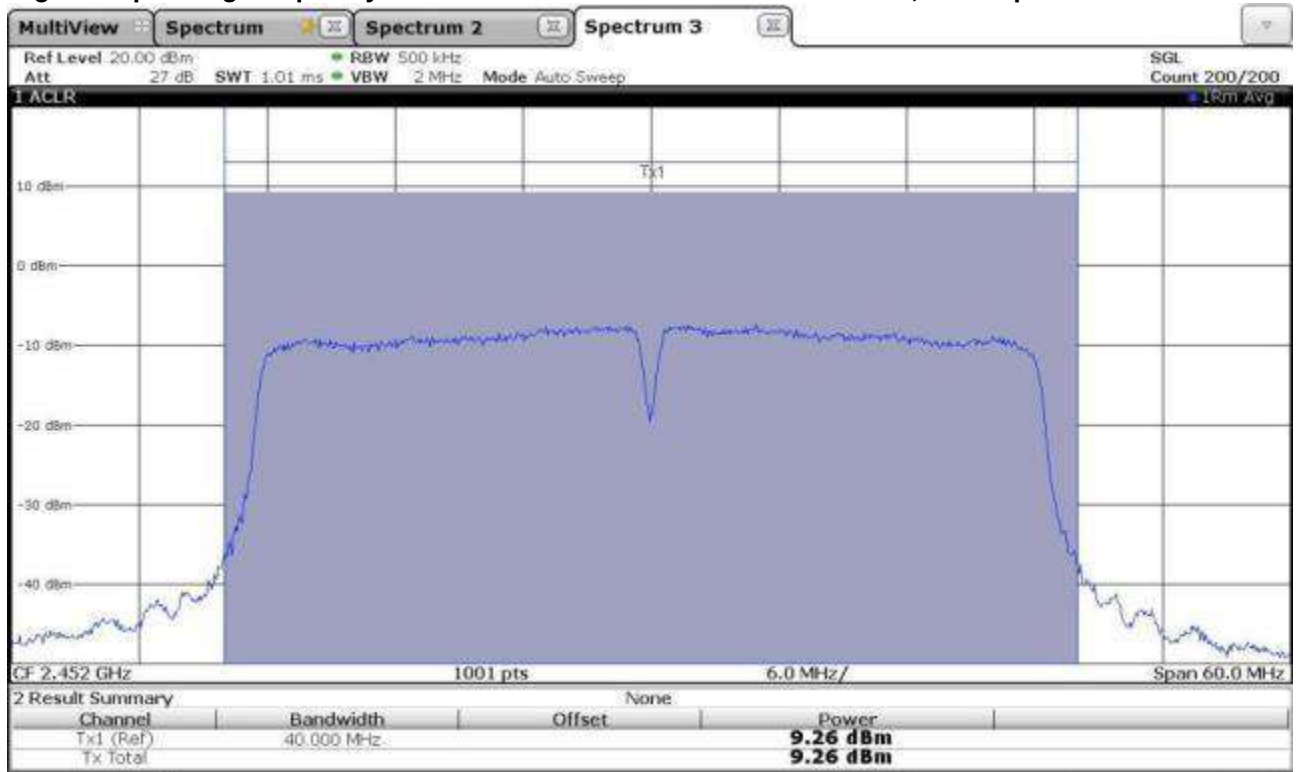
Lowest operating frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



Middle Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



Highest Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1

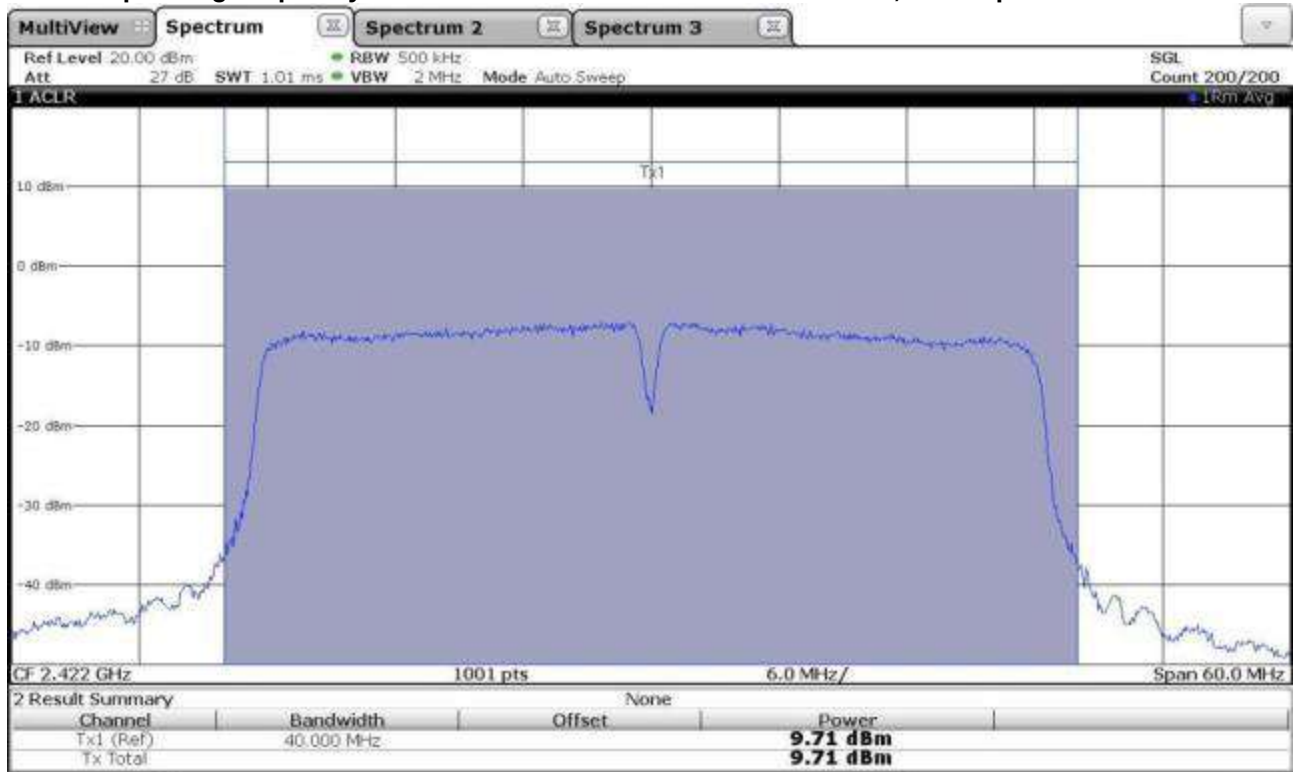


Maximum output power conducted measurement:

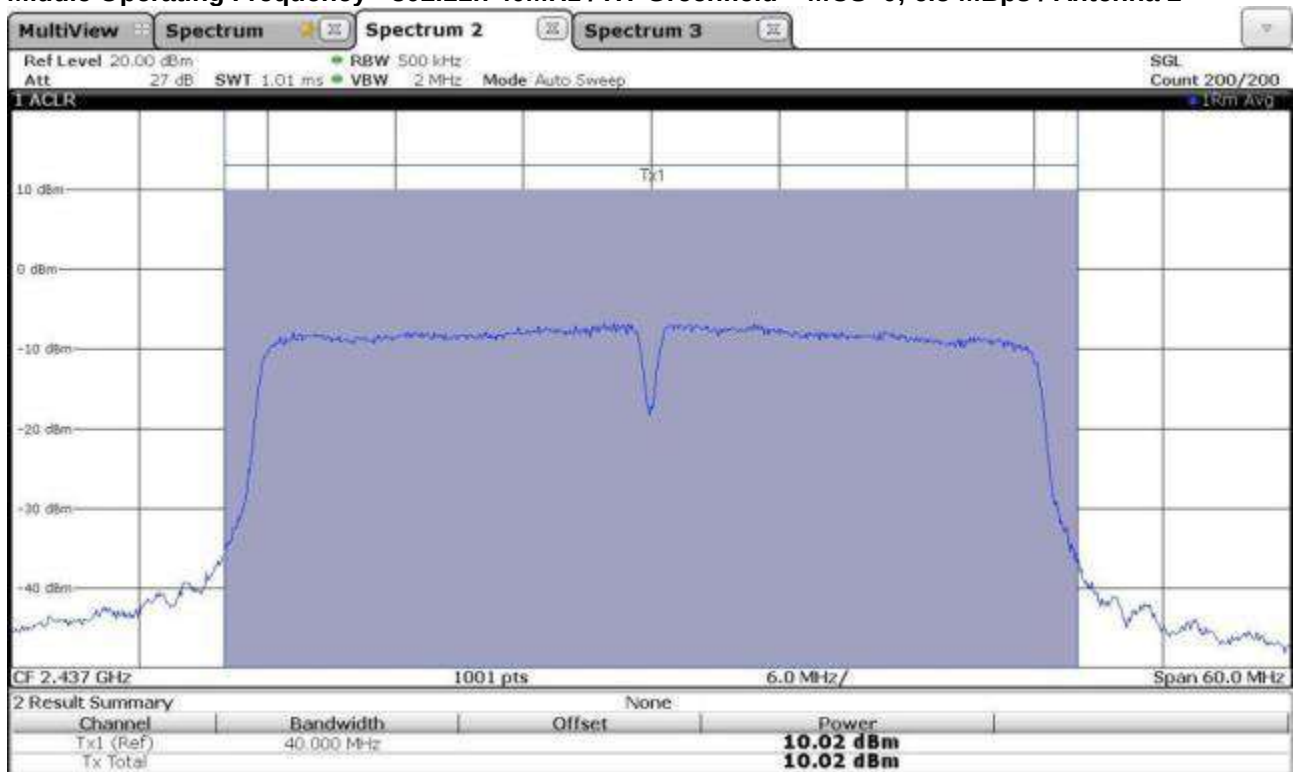
802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 1

Channel	Frequency [MHz]	Reading of Analyzer [dBm]	Cable Loss [dB]	Output Power		Limit		Result
				[dBm]	[mW]	[dBm]	[mW]	
3	2422	9.32	1.2	10.52	11.27	30	1000	Pass
6	2437	9.01	1.2	10.21	10.50	30	1000	Pass
9	2452	9.26	1.2	10.46	11.12	30	1000	Pass

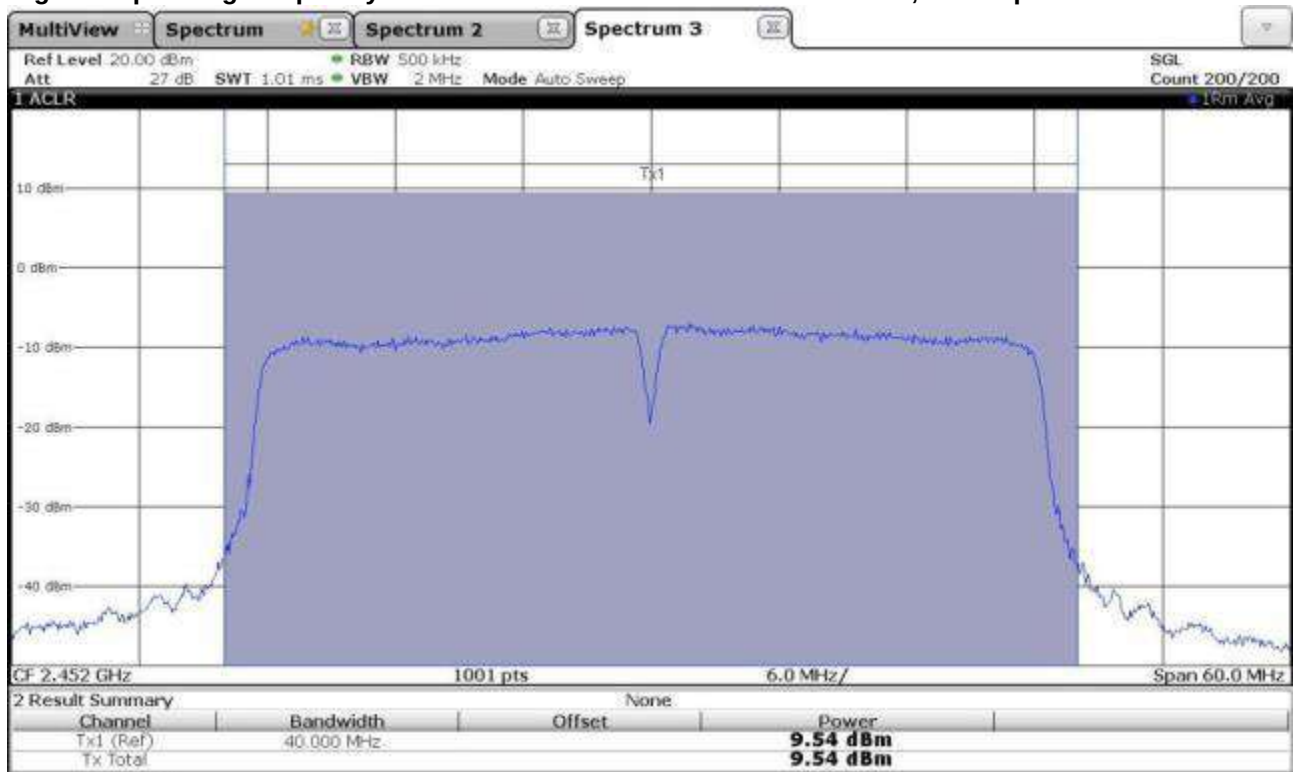
Lowest operating frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Middle Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Highest Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Maximum output power conducted measurement:
802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 2

Channel	Frequency [MHz]	Reading of Analyzer [dBm]	Cable Loss [dB]	Output Power		Limit		Result
				[dBm]	[mW]	[dBm]	[mW]	
3	2422	9.71	1.2	10.91	12.33	30	1000	Pass
6	2437	10.02	1.2	11.22	13.24	30	1000	Pass
9	2452	9.54	1.2	10.74	11.86	30	1000	Pass

Maximum output power conducted measurement:
802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 1 + Antenna 2

Channel	Frequency [MHz]	Output Antenna 1 [mW]	Output Antenna 2 [mW]	Total Output Power		Limit		Result
				[dBm]	[mW]	[dBm]	[mW]	
3	2422	11.27	12.33	13.73	23.60	30	1000	Pass
6	2437	10.50	13.24	13.75	23.74	30	1000	Pass
9	2452	11.12	11.86	13.61	22.98	30	1000	Pass

According to KDB 662911 D01

Calculated EIRP:
802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 1 + Antenna 2

Channel	Frequency [MHz]	Total Output Power		Total Output Power EIRP		Limit		Result
		[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]	
1	2412	13.73	23.60	19.53	89.74	36	4000	Pass
6	2437	13.75	23.74	19.55	90.16	36	4000	Pass
11	2452	13.61	22.98	19.41	87.30	36	4000	Pass

Formula: [Total Output Power] + [Directionl Gain] = [EIRP]

Antenna 1 Gain: max. 3.4dBi

Antenna 2 Gain: max. 2.12dBi

Directionl Gain: 5.8dBi

According to KDB 662911 D01

Results

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements of **Output Power of Fundamental Emissions**.

7.3. Power Spectral Density

Applied standards

- e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 (e)
- RSS-247 issue 2 Section 5.2 (b)

Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test equipment and test set up

Test equipment used for conducted measurements as given in clause Test equipment of this report.
Test setup used for conducted measurements as given in clause Test setups of this report.

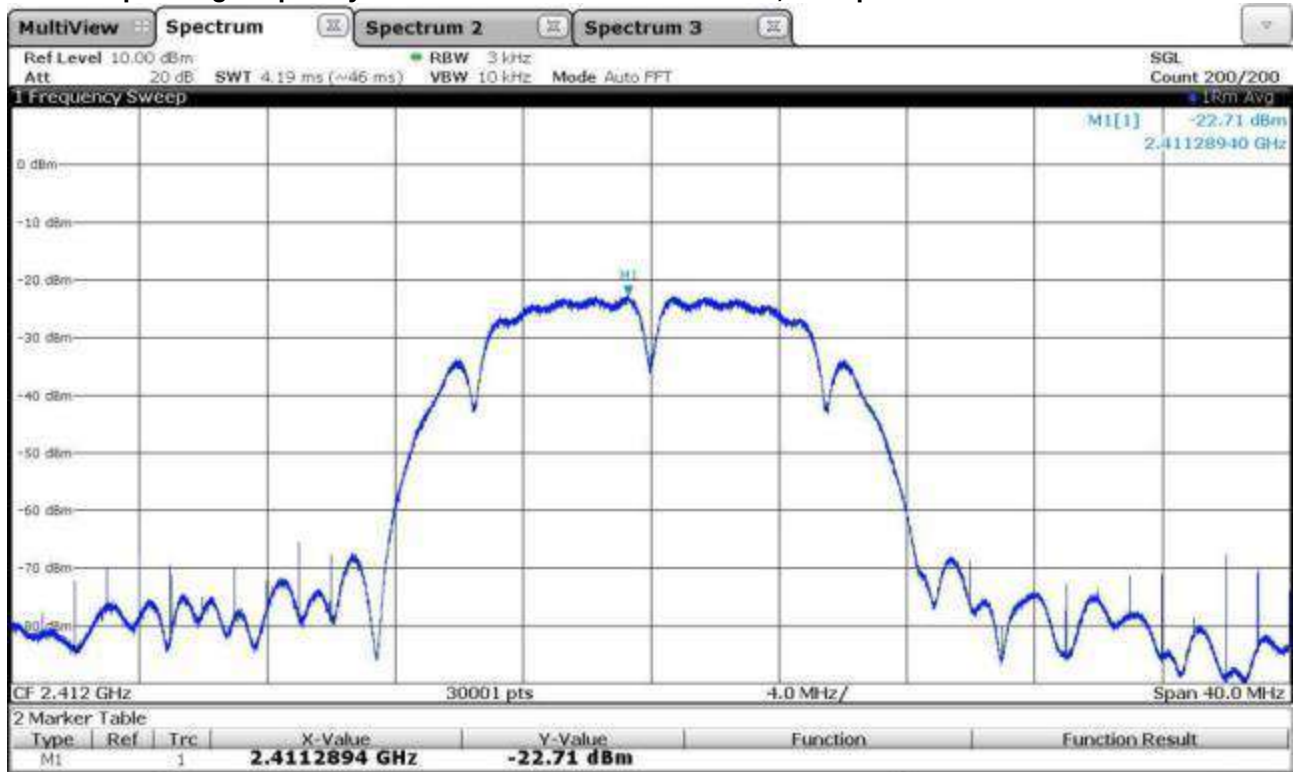
Description

The maximum average conducted output power was used to determine compliance to the fundamental output power limit. So the maximum average conducted PSD level is measured with a power averaging (rms) detector.

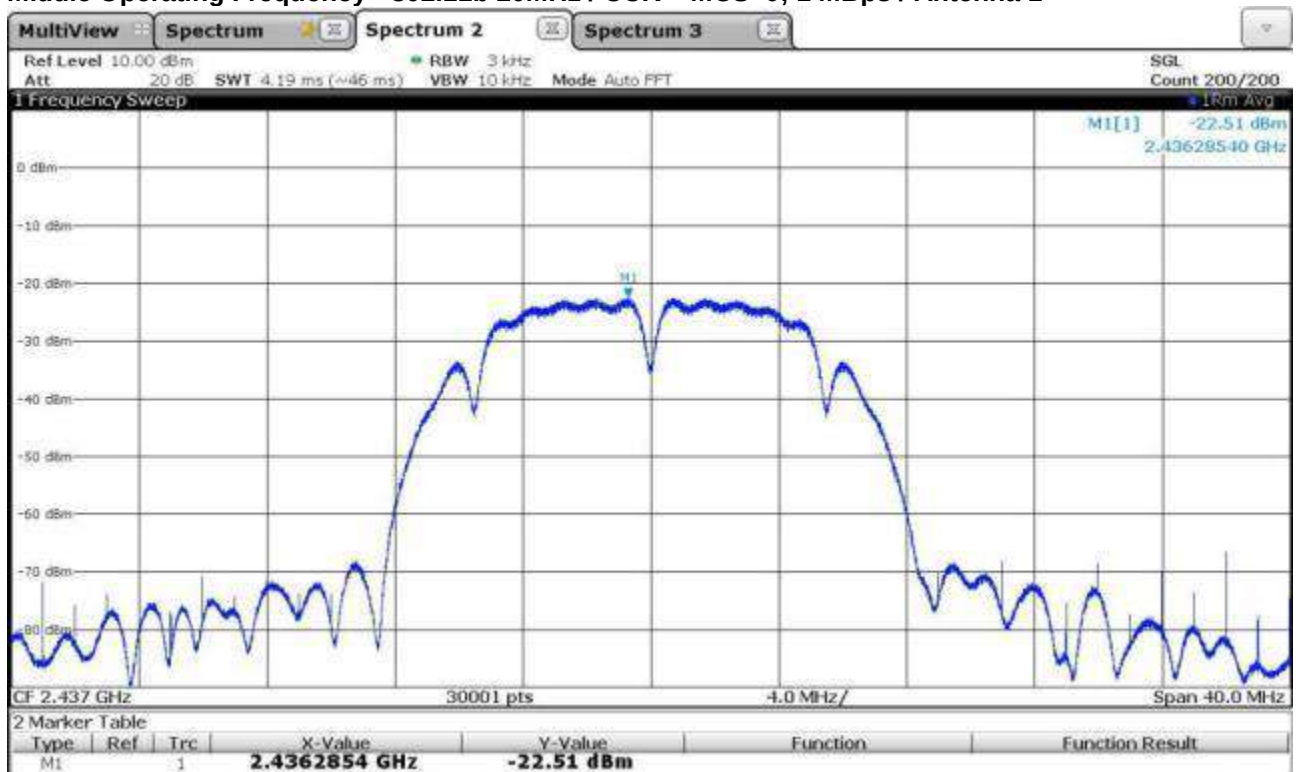
Measurement

The Measurement was performed on: 01.04.2020 and 02.04.2020

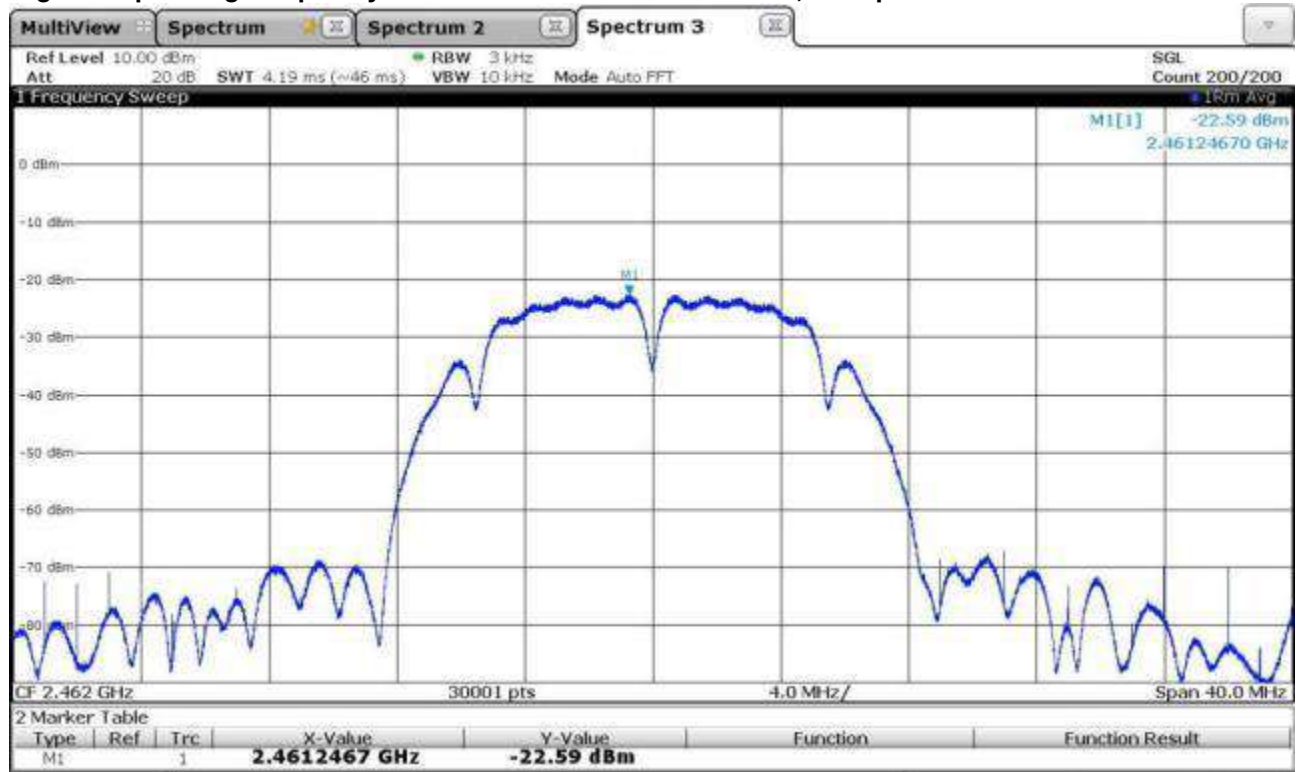
Lowest operating frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1



Middle Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1



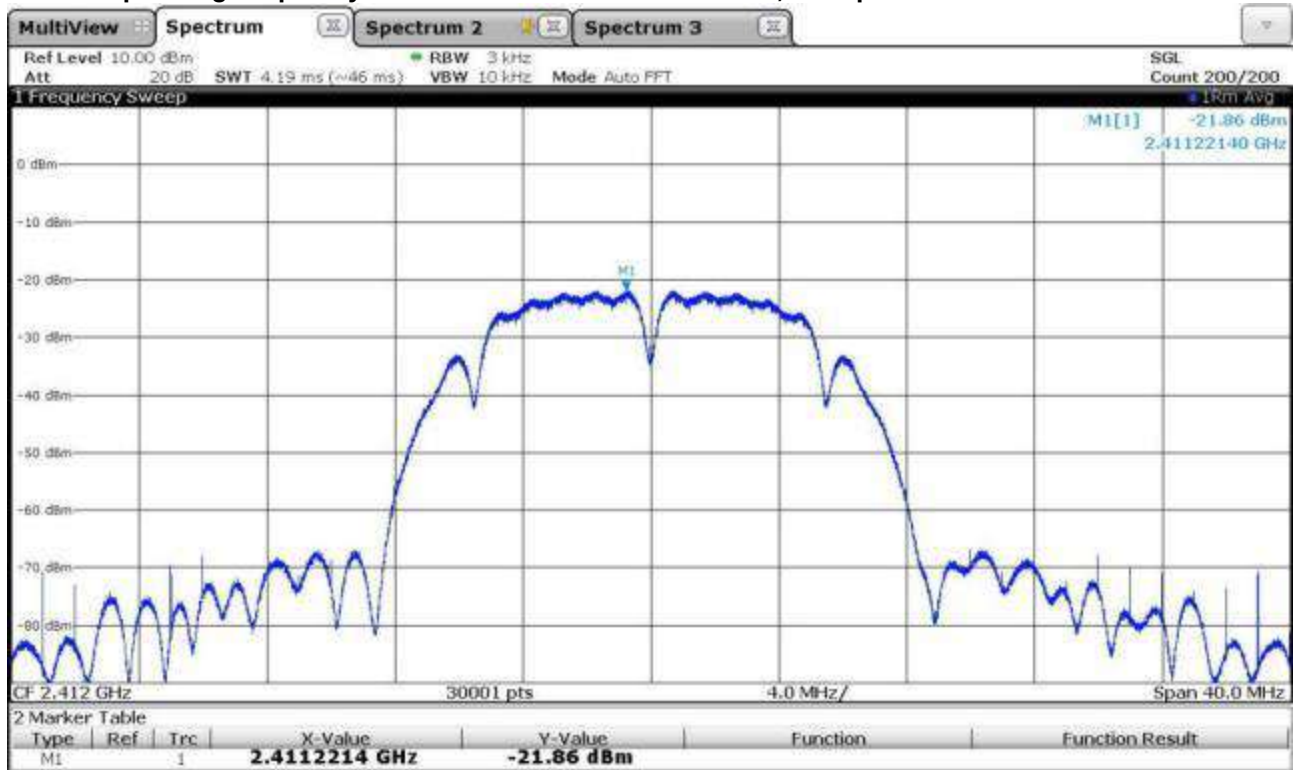
Highest Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1



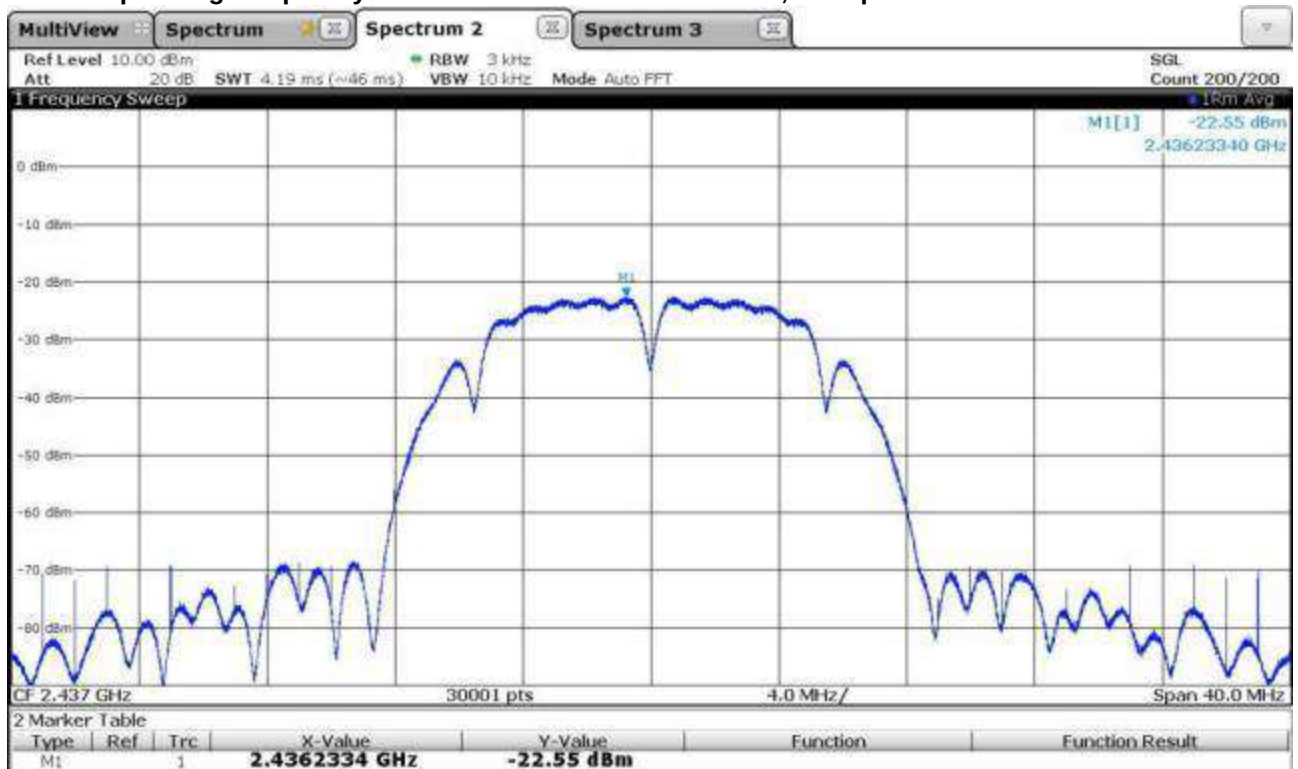
Maximum power spectral density 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1

Channel	Frequency [MHz]	Reading of Analyzer [dBm / 3 kHz]	Cable Loss [dB]	Power Spectral Density [dBm / 3 kHz]	Limit [dBm / 3 kHz]	Result
1	2412	-22.71	1.2	-21.51	8	Pass
6	2437	-22.51	1.2	-21.31	8	Pass
11	2462	-22.59	1.2	-21.39	8	Pass

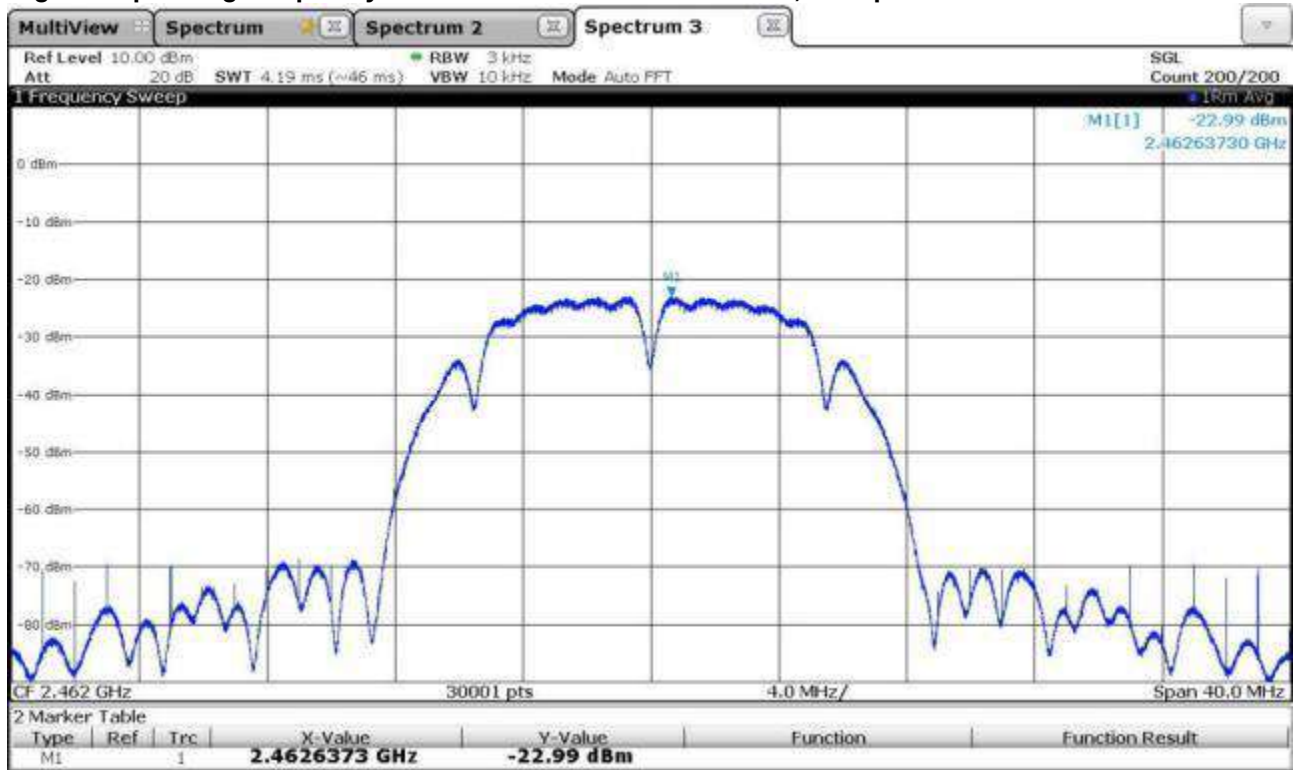
Lowest operating frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2



Middle Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2



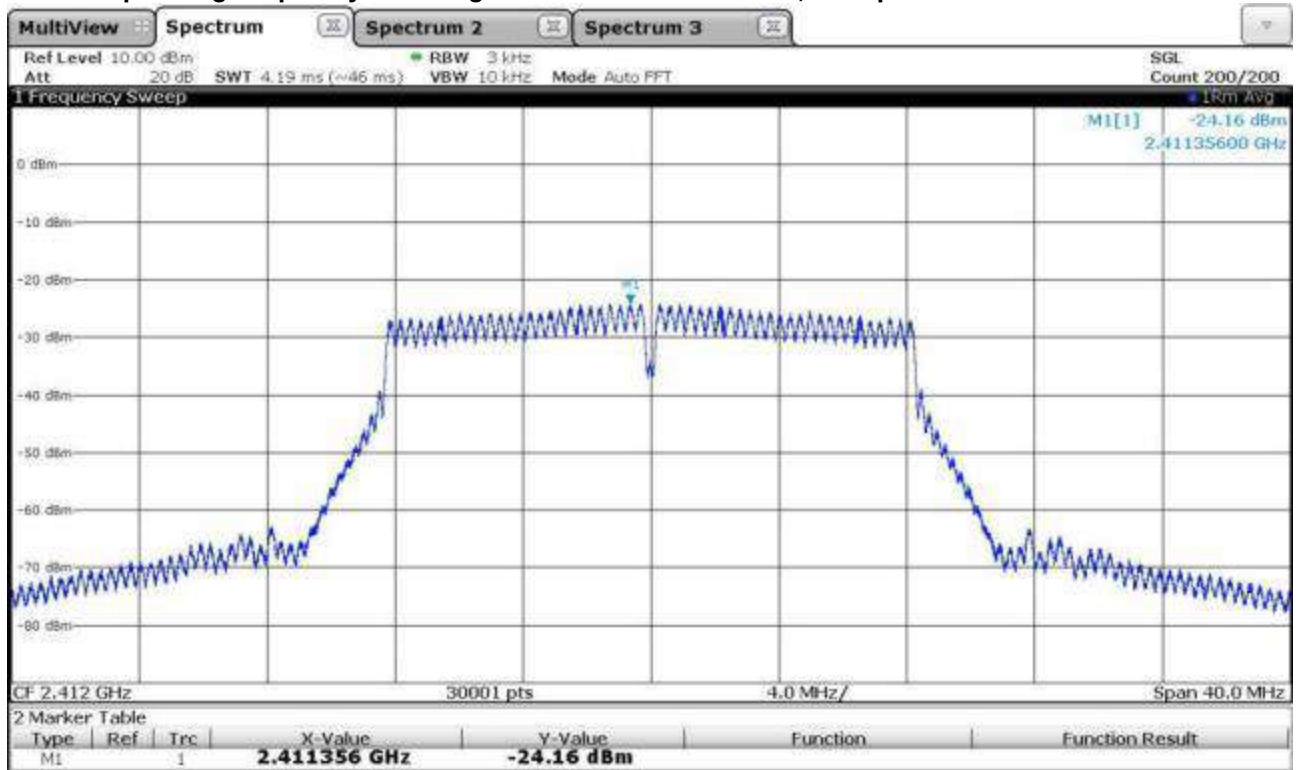
Highest Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2



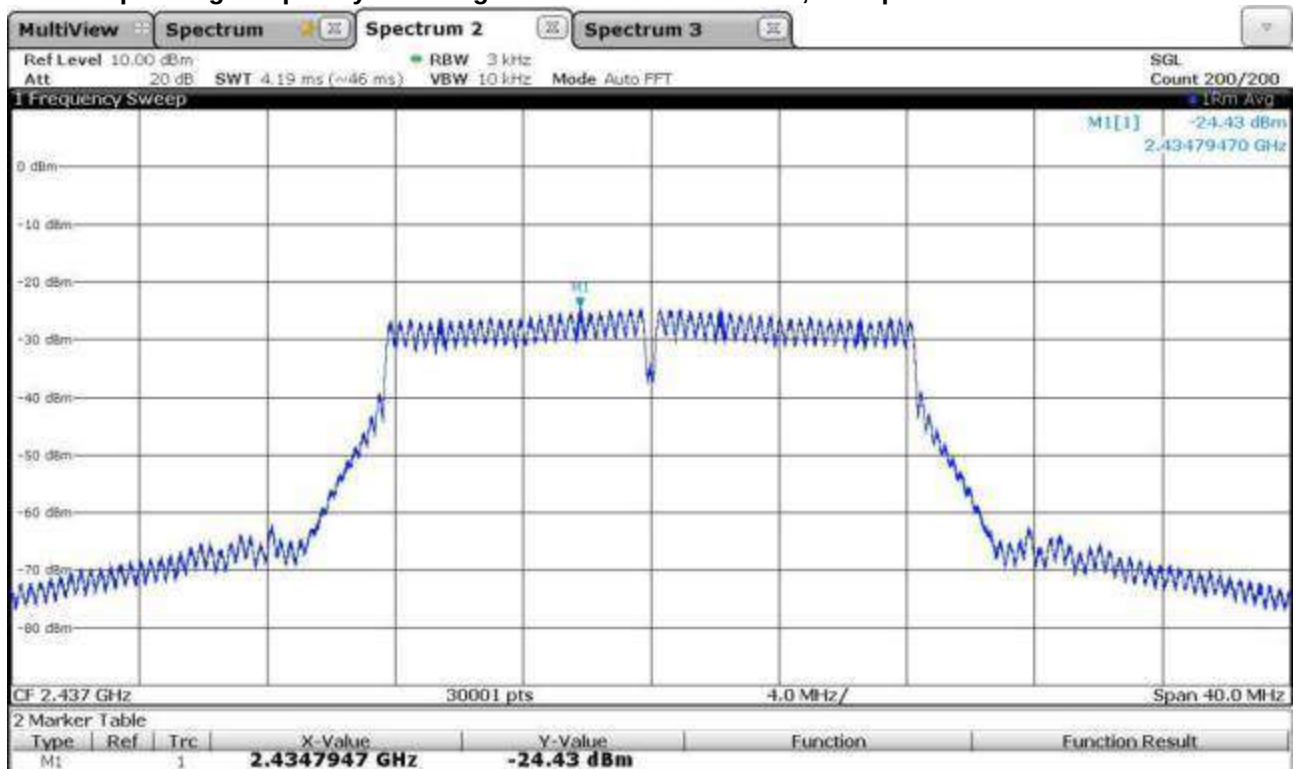
Maximum power spectral density 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2

Channel	Frequency [MHz]	Reading of Analyzer [dBm / 3 kHz]	Cable Loss [dB]	Power Spectral Density [dBm / 3 kHz]	Limit [dBm / 3 kHz]	Result
1	2412	-21.86	1.2	-20.66	8	Pass
6	2437	-22.55	1.2	-21.35	8	Pass
11	2462	-22.99	1.2	-21.79	8	Pass

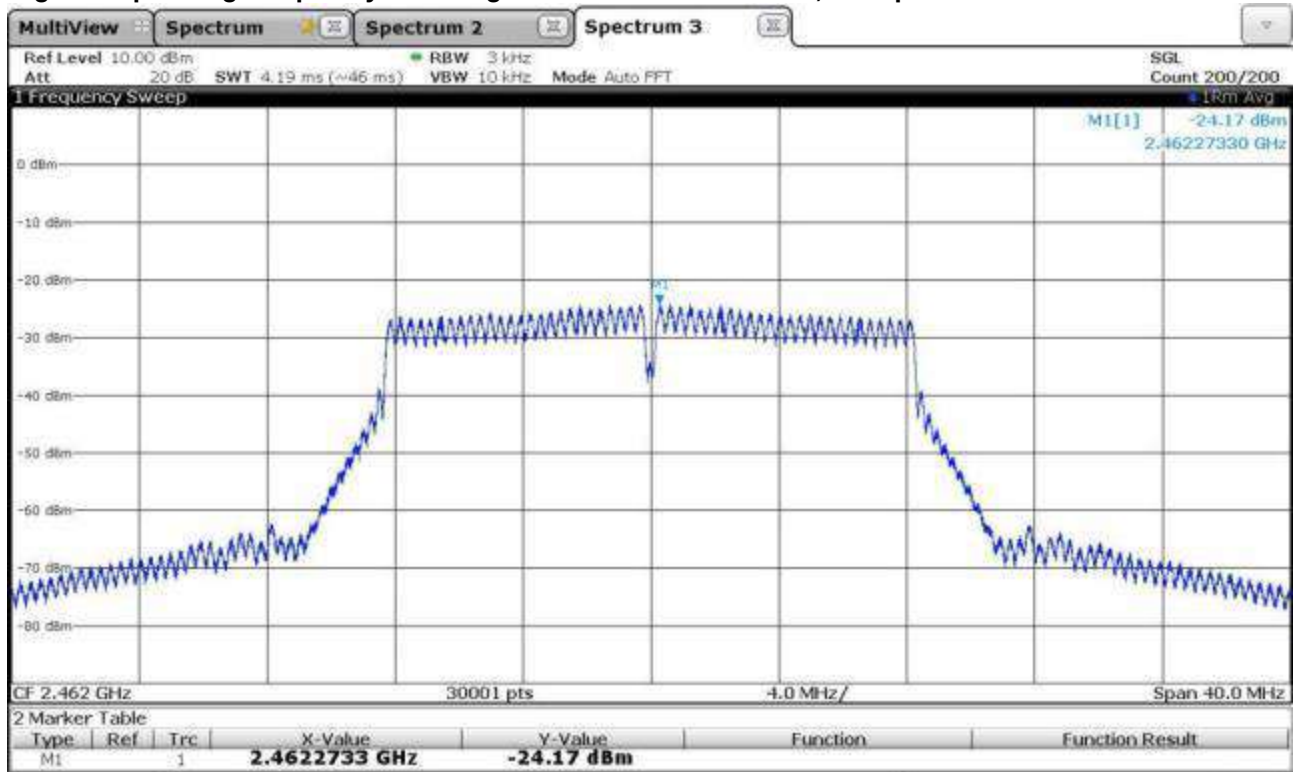
Lowest operating frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1



Middle Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1



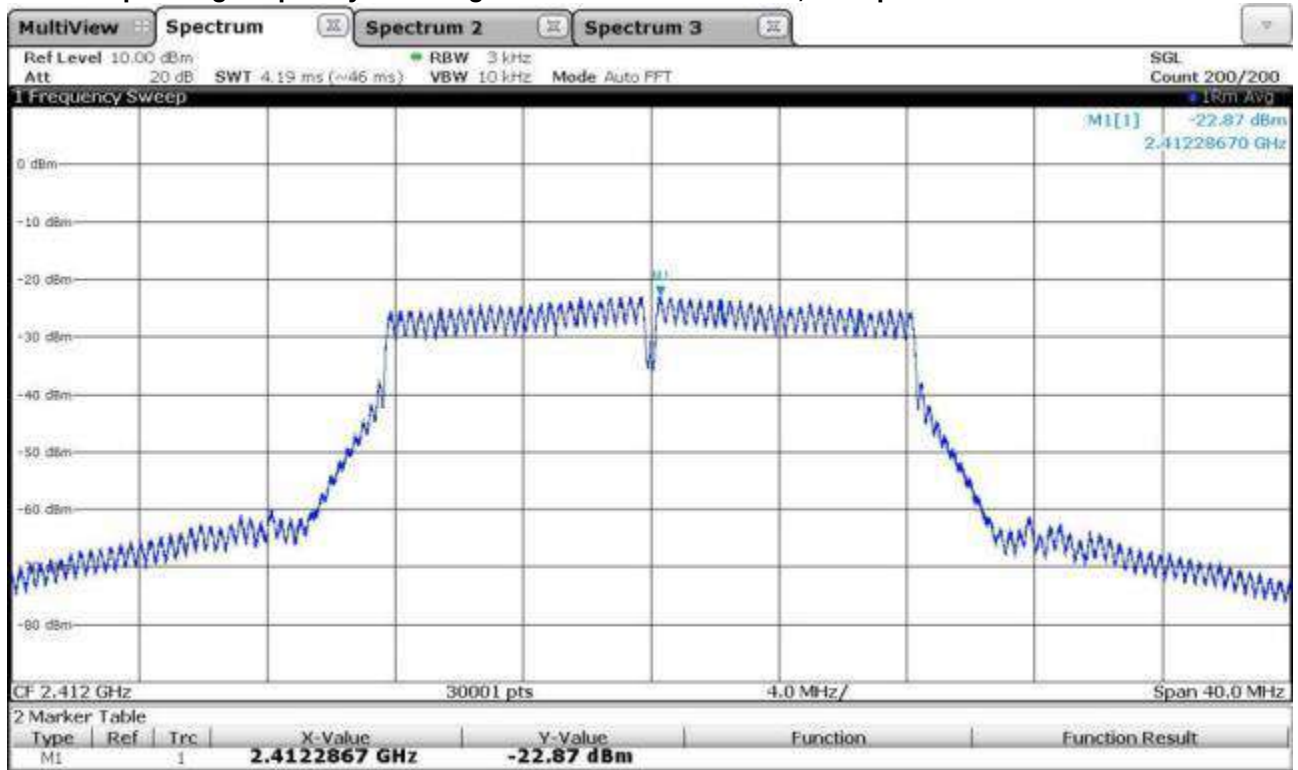
Highest Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1



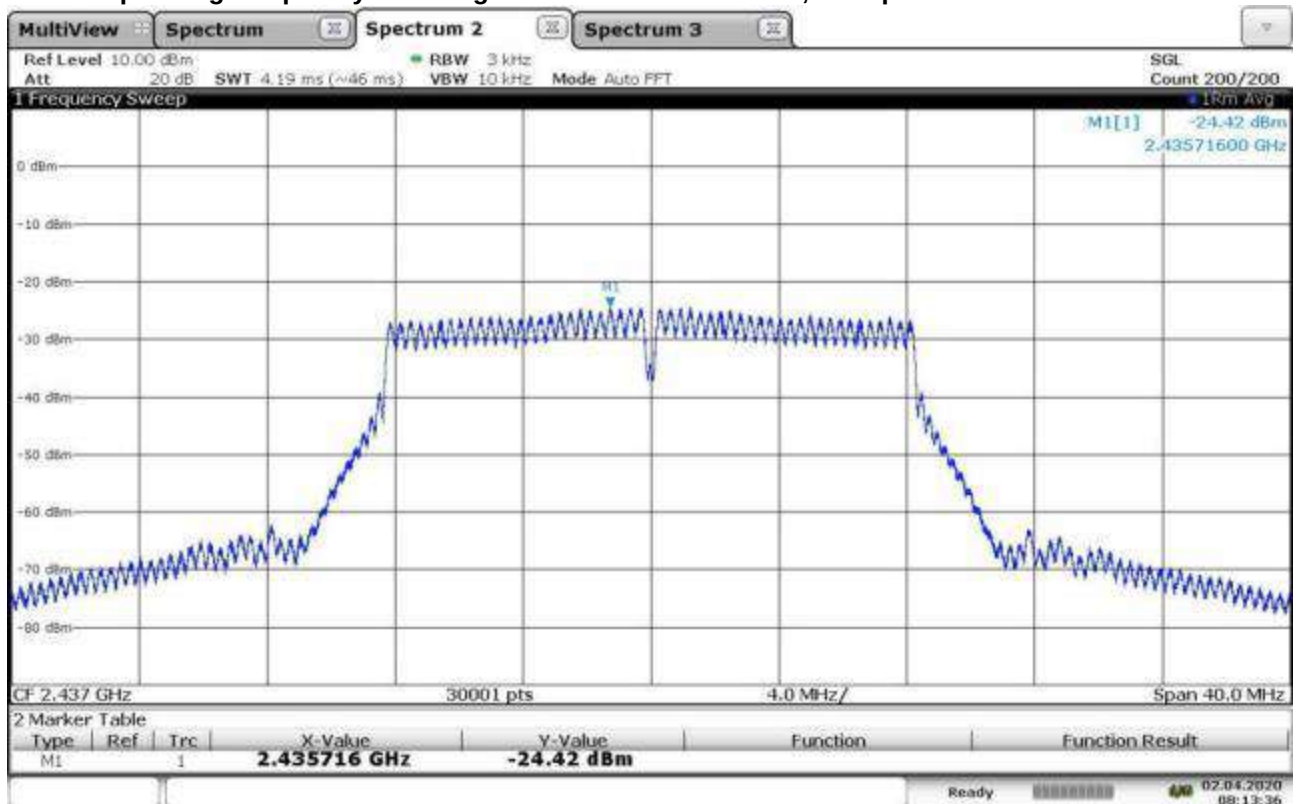
Maximum power spectral density
802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1

Channel	Frequency [MHz]	Reading of Analyzer [dBm / 3 kHz]	Cable Loss [dB]	Power Spectral Density [dBm / 3 kHz]	Limit [dBm / 3 kHz]	Result
1	2412	-24.16	1.2	-22.96	8	Pass
6	2437	-24.43	1.2	-23.23	8	Pass
11	2462	-24.17	1.2	-22.97	8	Pass

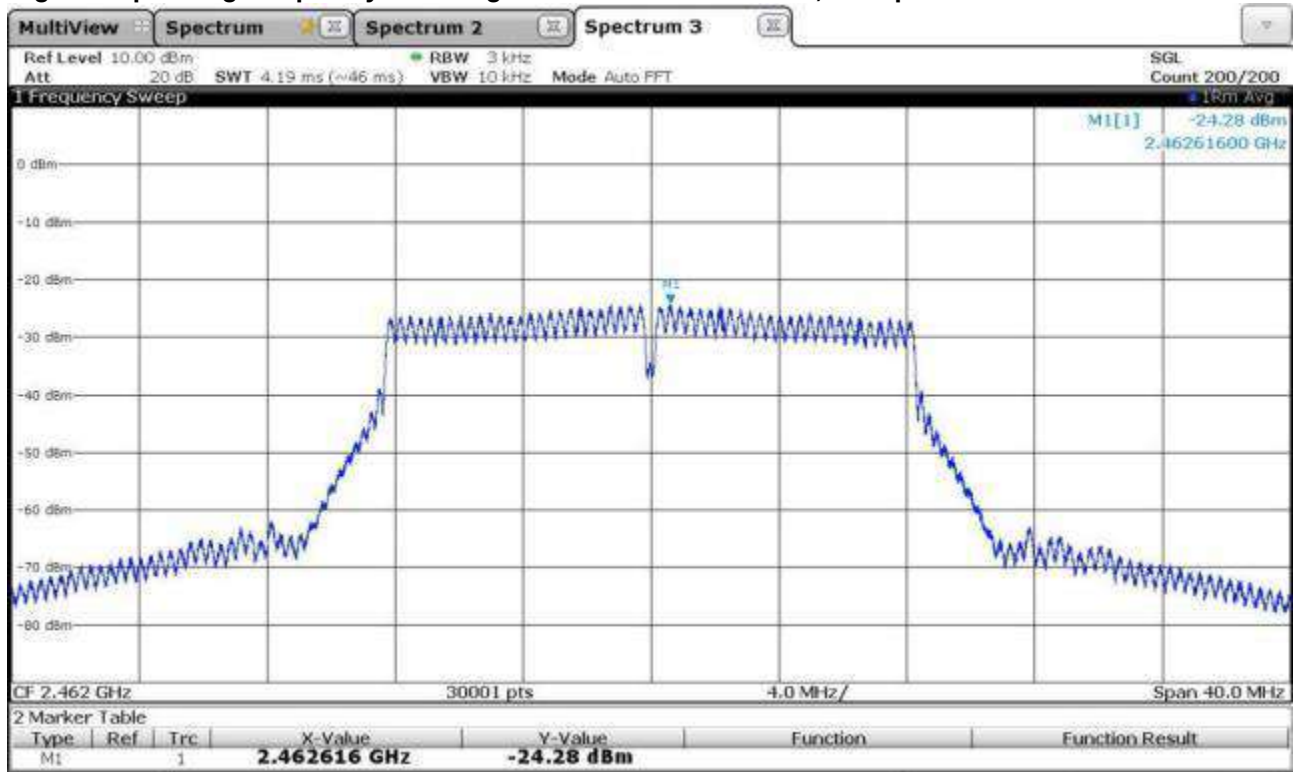
Lowest operating frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 2



Middle Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 2



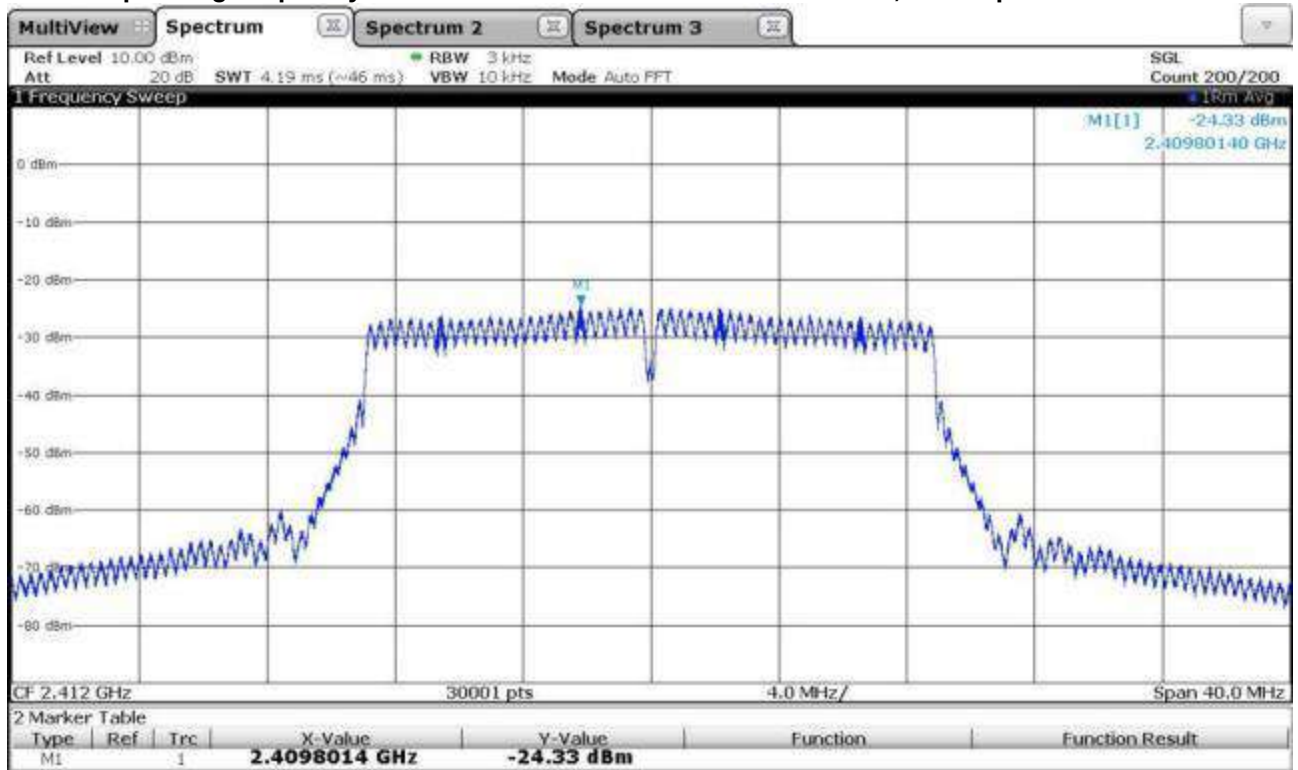
Highest Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 2



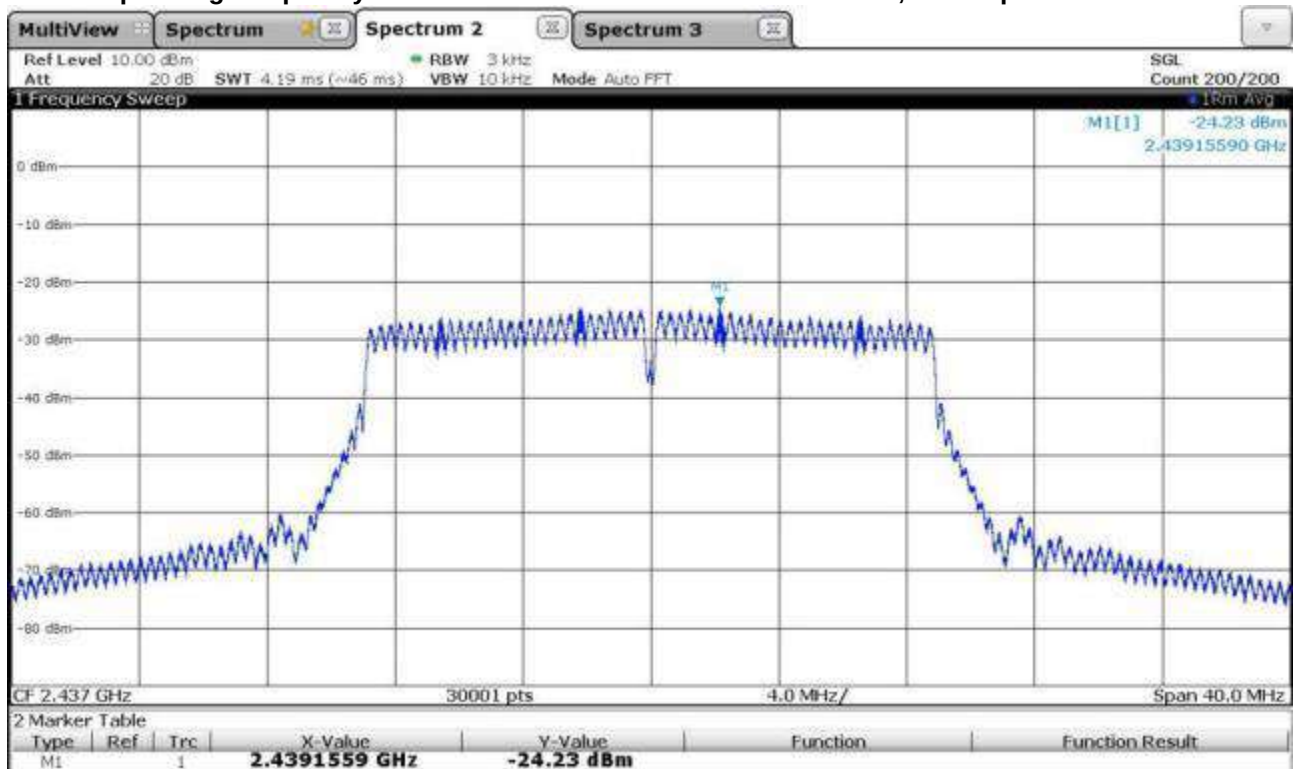
Maximum power spectral density
802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 2

Channel	Frequency [MHz]	Reading of Analyzer [dBm / 3 kHz]	Cable Loss [dB]	Power Spectral Density [dBm / 3 kHz]	Limit [dBm / 3 kHz]	Result
1	2412	-22.87	1.2	-21.67	8	Pass
6	2437	-24.42	1.2	-23.22	8	Pass
11	2462	-24.28	1.2	-23.08	8	Pass

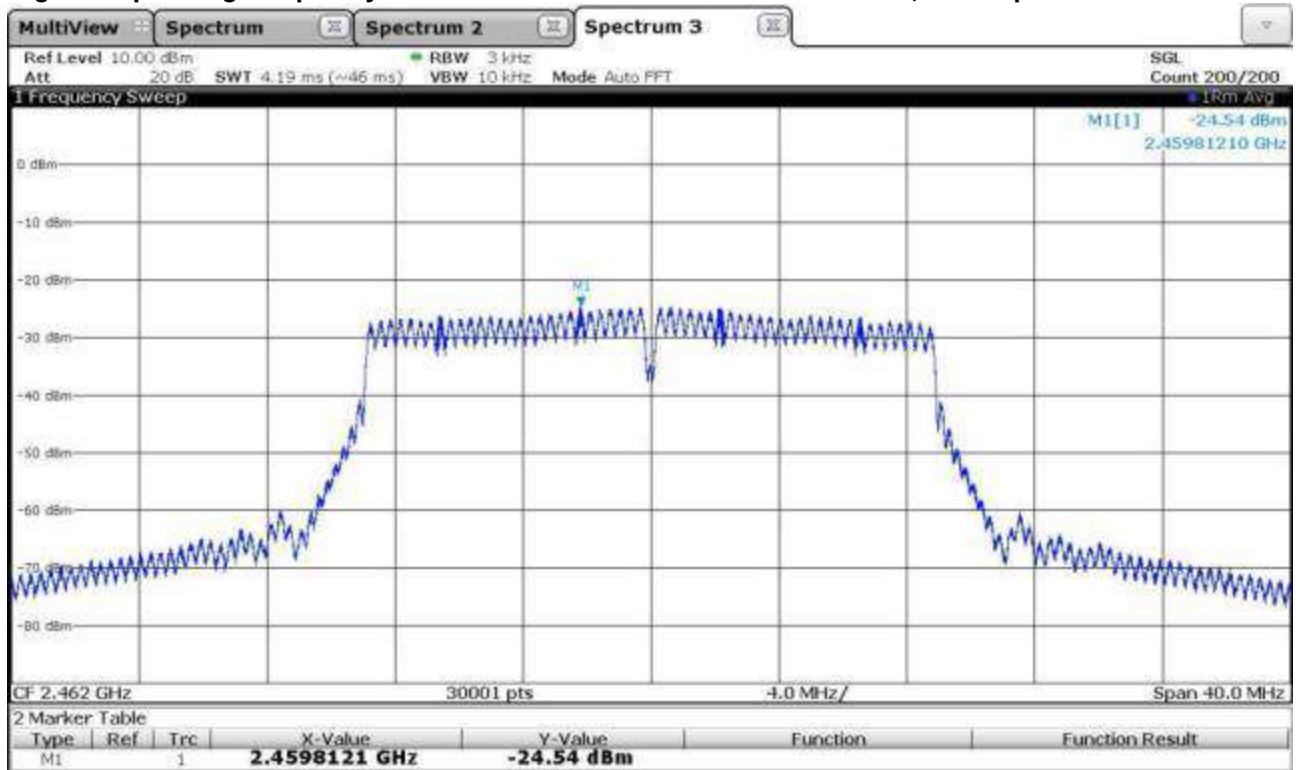
Lowest operating frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



Middle Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



Highest Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1

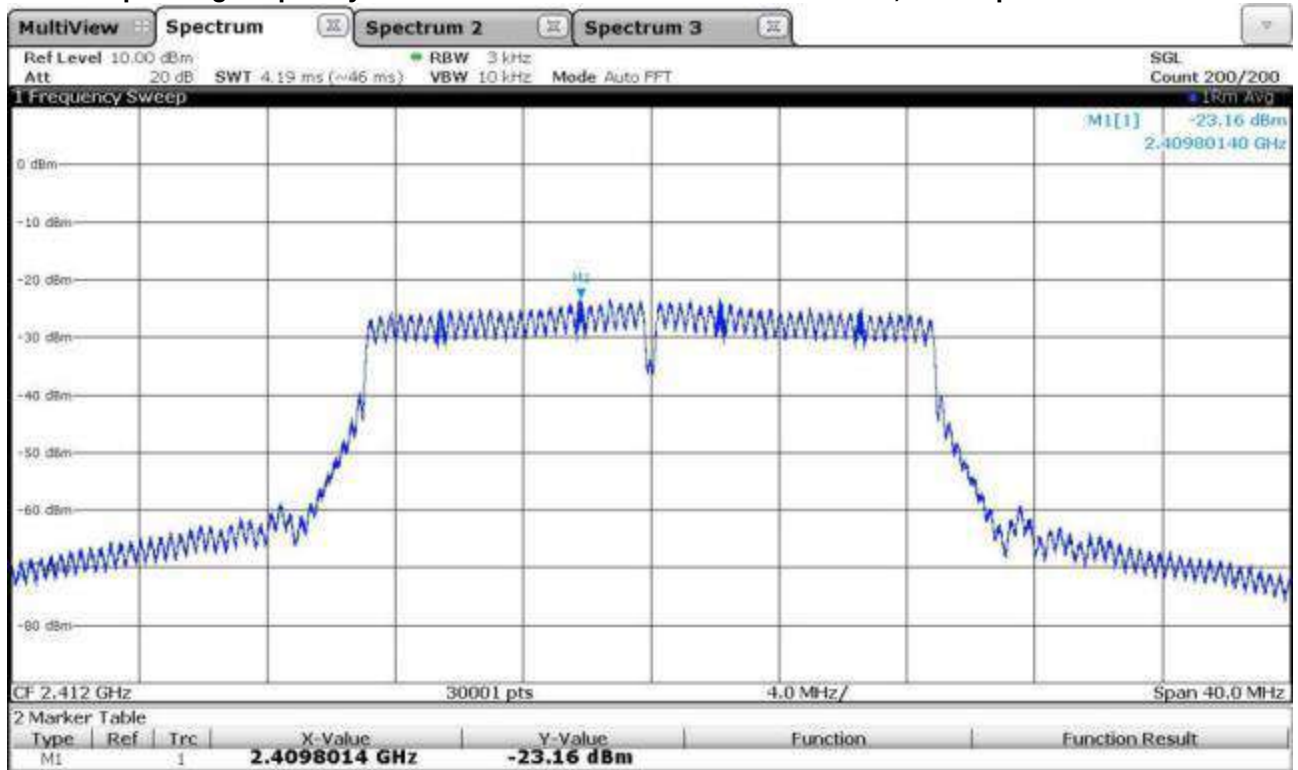


Maximum power spectral density

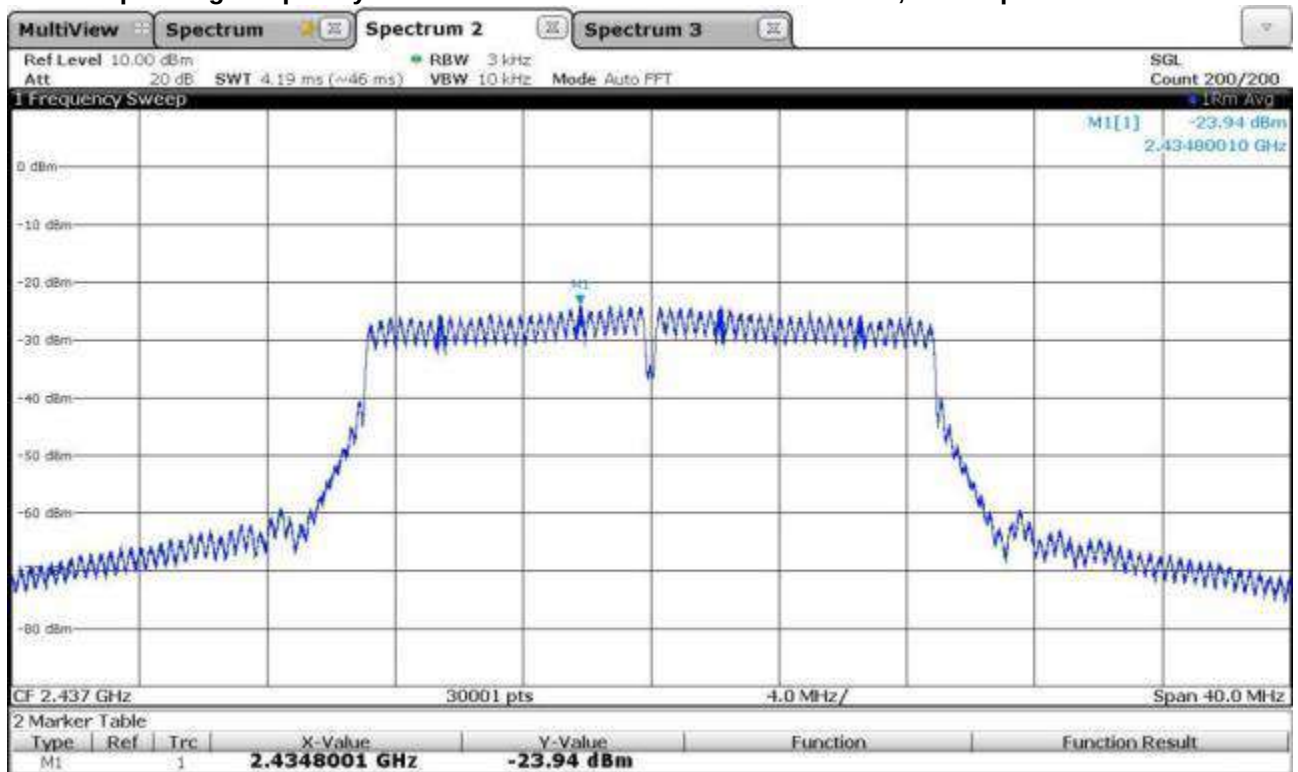
802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1

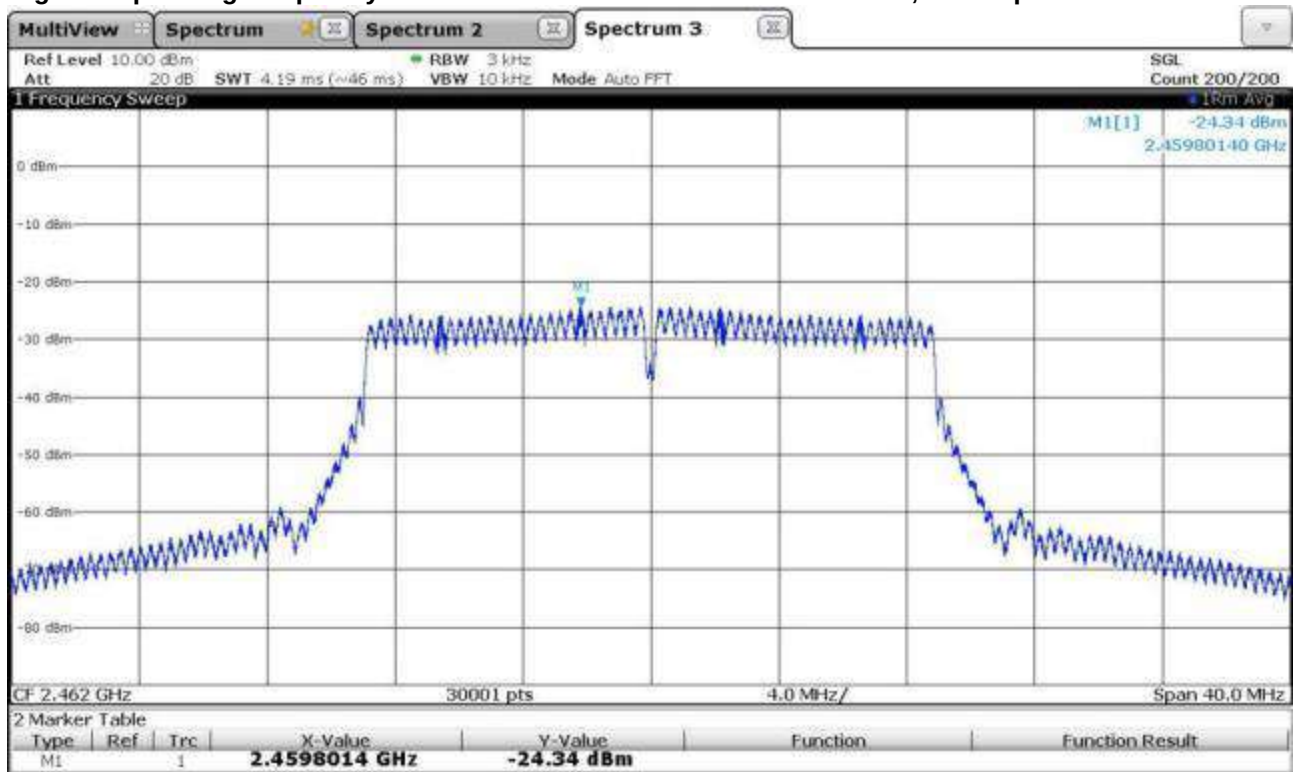
Channel	Frequency [MHz]	Reading of Analyzer [dBm / 3 kHz]	Cable Loss [dB]	Power Spectral Density [dBm / 3 kHz]	Limit [dBm / 3 kHz]	Result
1	2412	-24.33	1.2	-23.13	8	Pass
6	2437	-24.23	1.2	-23.03	8	Pass
11	2462	-24.54	1.2	-23.34	8	Pass

Lowest operating frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Middle Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Highest Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2

Maximum power spectral density
802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2

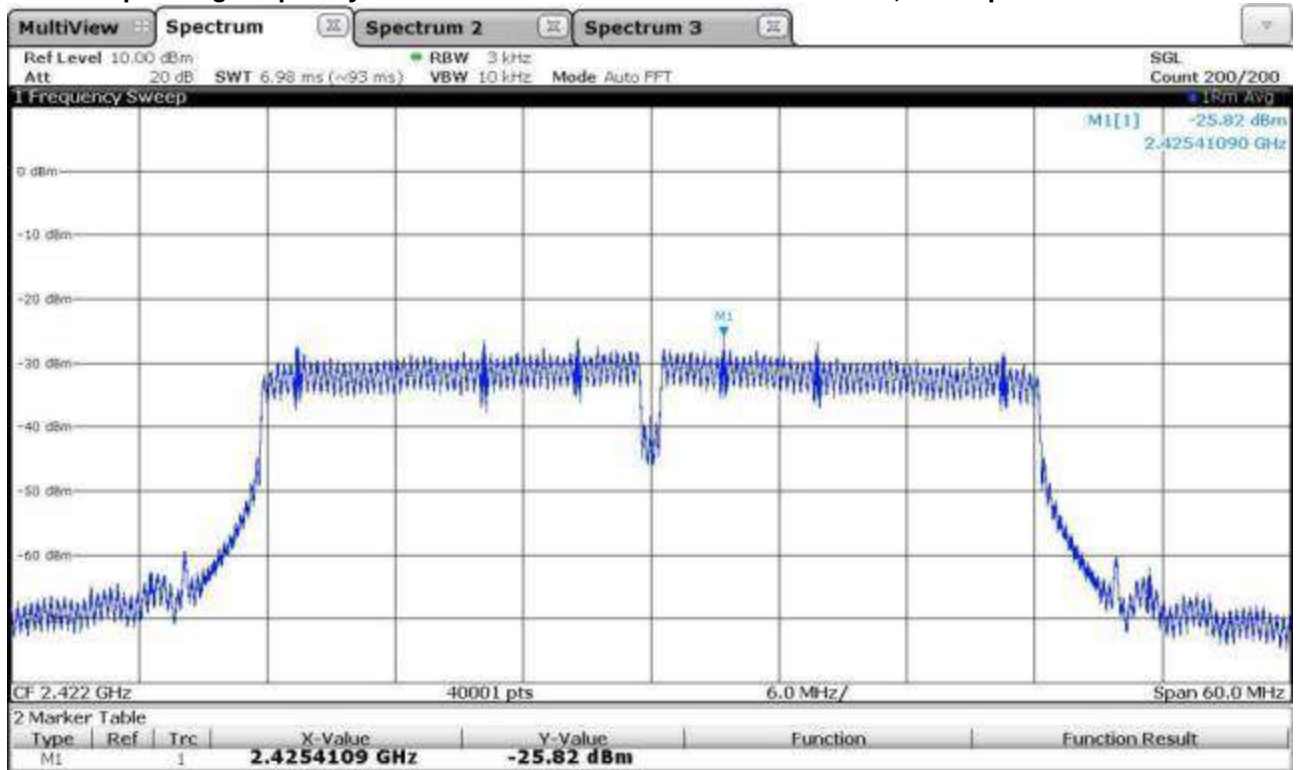
Channel	Frequency [MHz]	Reading of Analyzer [dBm / 3 kHz]	Cable Loss [dB]	Power Spectral Density [dBm / 3 kHz]	Limit [dBm / 3 kHz]	Result
1	2412	-23.16	1.2	-21.96	8	Pass
6	2437	-23.94	1.2	-22.74	8	Pass
11	2462	-24.34	1.2	-23.14	8	Pass

Maximum power spectral density
802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1 + Antenna 2

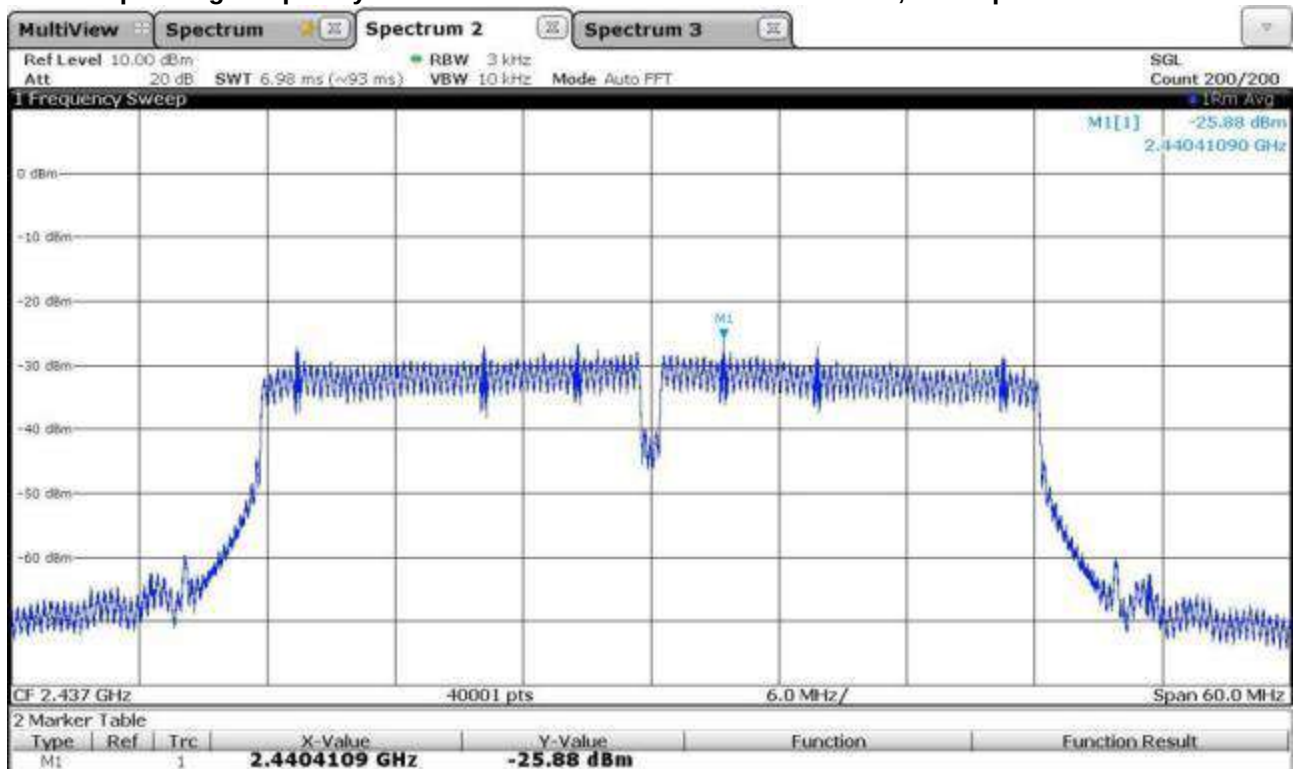
Channel	Frequency [MHz]	Highest PSD of Ant 1 or Ant 2 [dBm/3kHz]	PSD calculated * Ant1 + Ant 2 [dBm/3kHz]	Limit [dBm/3kHz]	Result
1	2412	-21.96	-18.95	8	Pass
6	2437	-22.74	-19.73	8	Pass
11	2462	-23.14	-20.13	8	Pass

*According to KDB 662911 D01, add 10 log (N_{ANT}) dB, N = 2

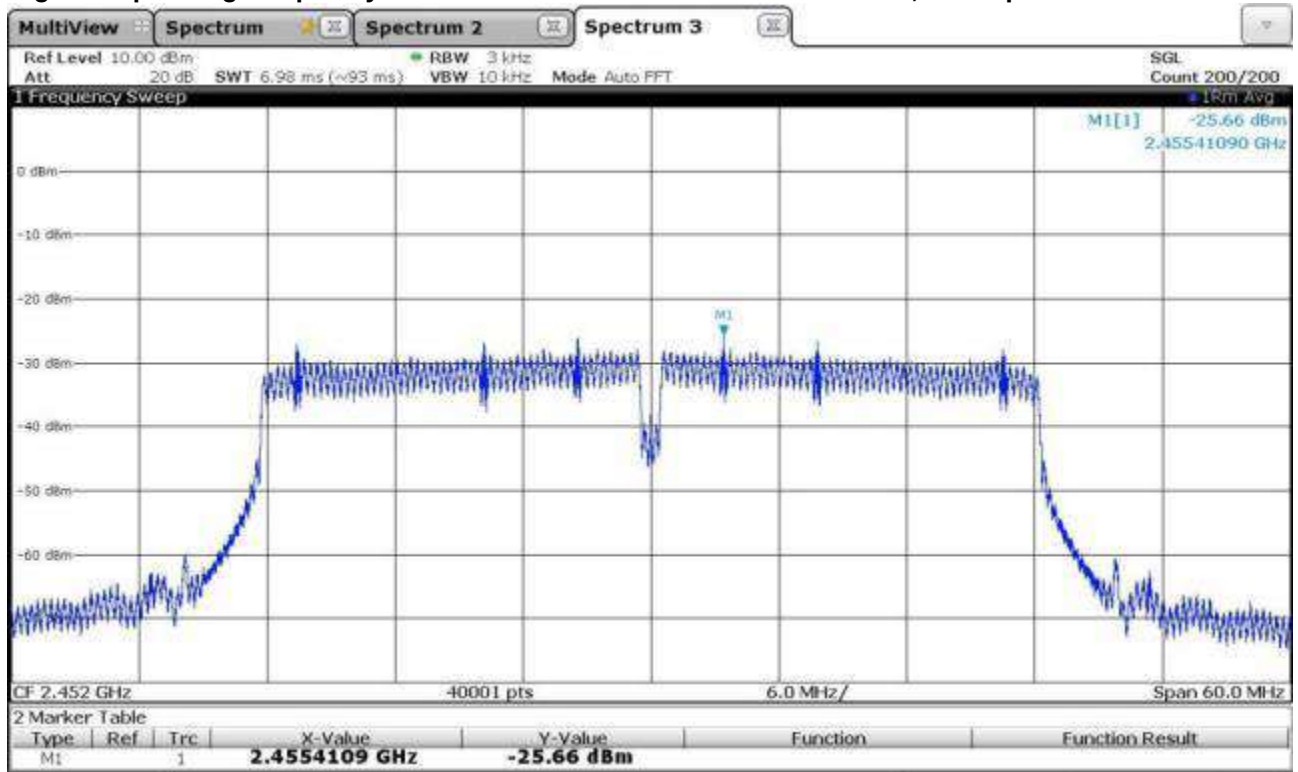
Lowest operating frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 1



Middle Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 1



Highest Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 1

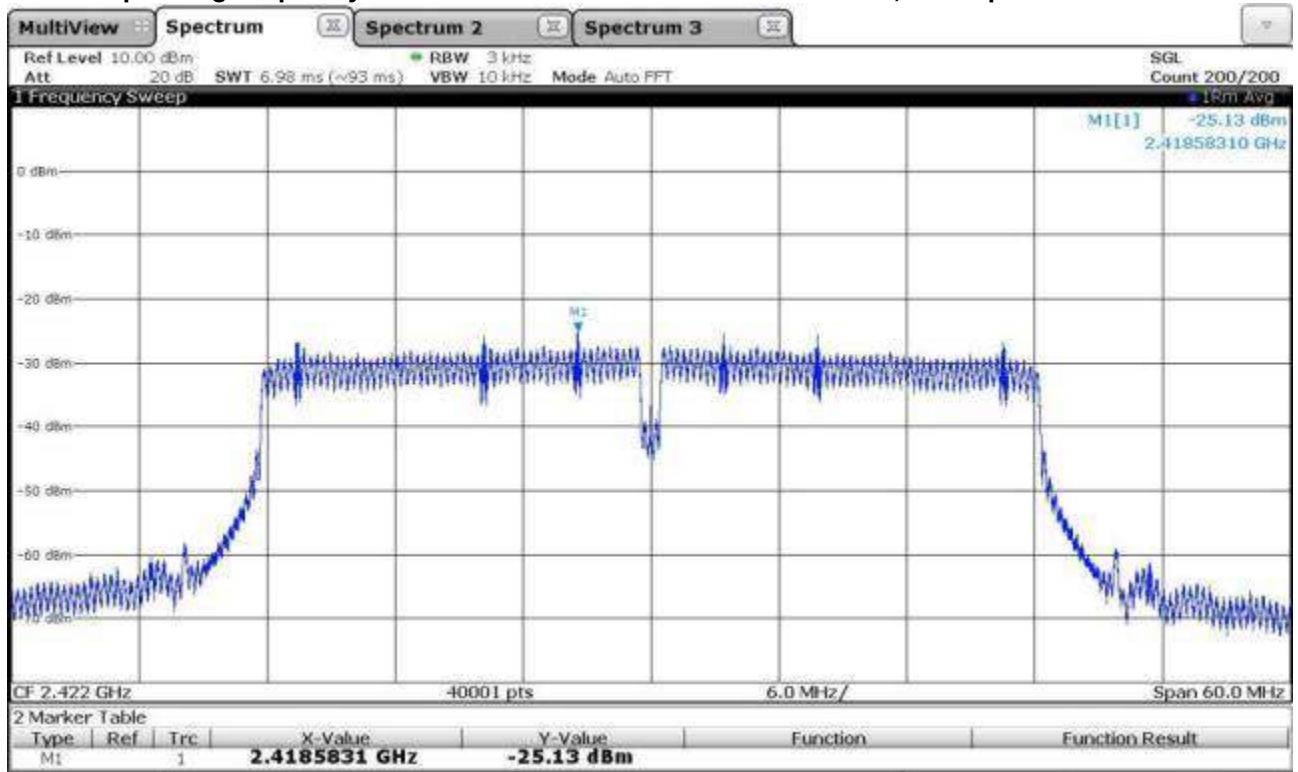


Maximum power spectral density

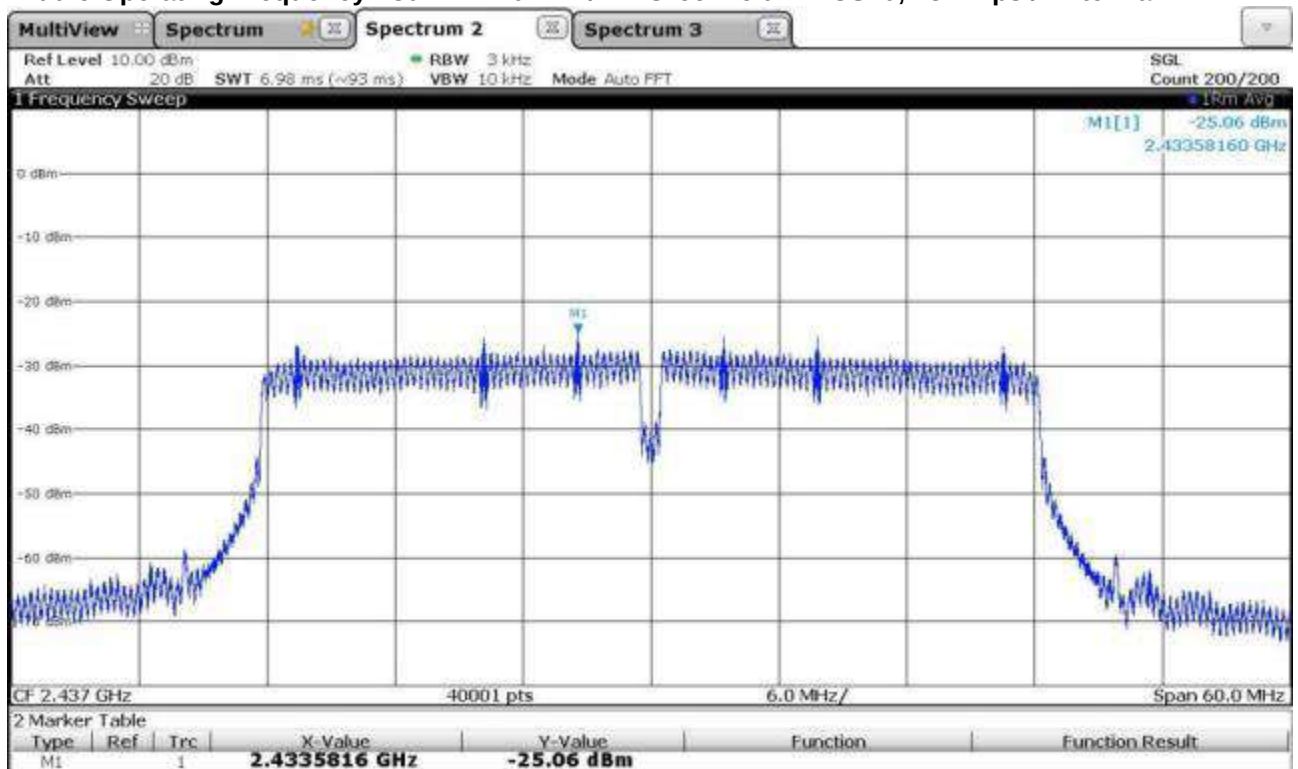
802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 1

Channel	Frequency [MHz]	Reading of Analyzer [dBm / 3 kHz]	Cable Loss [dB]	Power Spectral Density [dBm / 3 kHz]	Limit [dBm / 3 kHz]	Result
3	2422	-25.82	1.2	-24.62	8	Pass
6	2437	-25.88	1.2	-24.68	8	Pass
9	2452	-25.66	1.2	-24.46	8	Pass

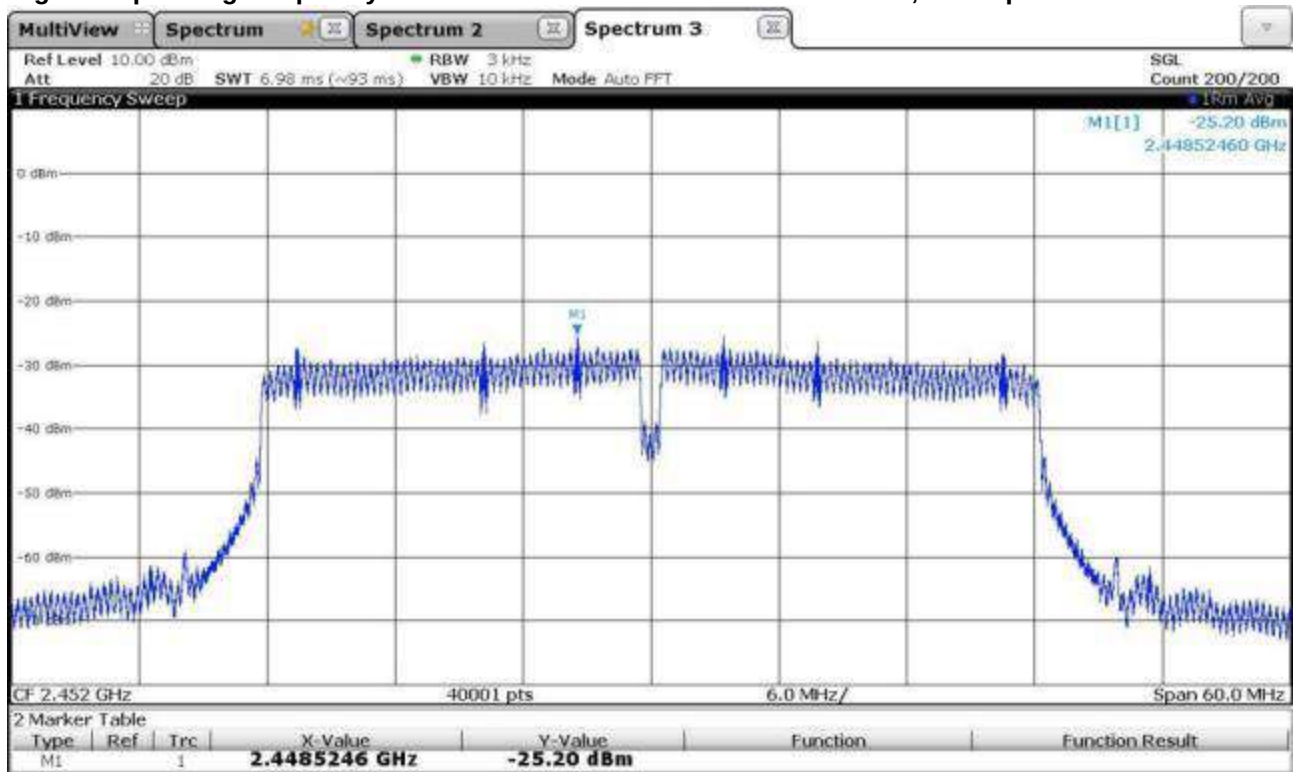
Lowest operating frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 2



Middle Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 2



Highest Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 2



Maximum power spectral density

802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 2

Channel	Frequency [MHz]	Reading of Analyzer [dBm / 3 kHz]	Cable Loss [dB]	Power Spectral Density [dBm / 3 kHz]	Limit [dBm / 3 kHz]	Result
3	2422	-25.13	1.2	-23.93	8	Pass
6	2437	-25.06	1.2	-23.86	8	Pass
9	2452	-25.20	1.2	-24.00	8	Pass

Maximum power spectral density

802.11n 40MHz / HT Greenfield – MCS=0; 15 MBps / Antenna 1 + Antenna 2

Channel	Frequency [MHz]	Highest PSD of Ant 1 or Ant 2 [dBm/3kHz]	PSD calculated * Ant1 + Ant 2 [dBm/3kHz]	Limit [dBm/3kHz]	Result
3	2422	-23.93	-20.92	8	Pass
6	2437	-23.86	-20.85	8	Pass
9	2452	-24.00	-20.99	8	Pass

*According to KDB 662911 D01, add 10 log (N_{ANT}) dB, N = 2

Results

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the **Power Spectral Density**.

7.4. Band-Edges Measurement

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 (d)
-RSS-247 issue 2 Section 5.5

Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Emissions which fall in the restricted bands, as defined in §15.205 Restricted Bands of operation as well as in restricted bands of the RSS-Gen Issue 5 (see Section 8.10 Restricted Frequency Bands) and must also comply with the radiated emission limits specified in §15.209 Radiated emission limits as well as the limits specified in RSS-Gen Table 5.

Test equipment and test set up

Test equipment used for Band Edge measurements as given in clause Test equipment of this report.
Test setup used for Band Edge measurements as given in clause Test setups of this report.

Description

The band edge is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. In the Restricted Bands defined in § 15.205 the compliance with the §15.209 and RSS-Gen Radiated emission limits is investigate.

Detector function selection and bandwidth

For the measurement, an EMI test receiver that have CISPR peak and avearge detector was used.

Frequency range:	Bandwidth	
See measurement graph	RBW:	100 kHz
	VBW:	300 kHz

Measurement

The Measurement was performed on: 07.04.2020

Lower Band Edge - 802.11b 20MHz / CCK – MCS=0; 1 MBps / both antennas are active



FCC 3

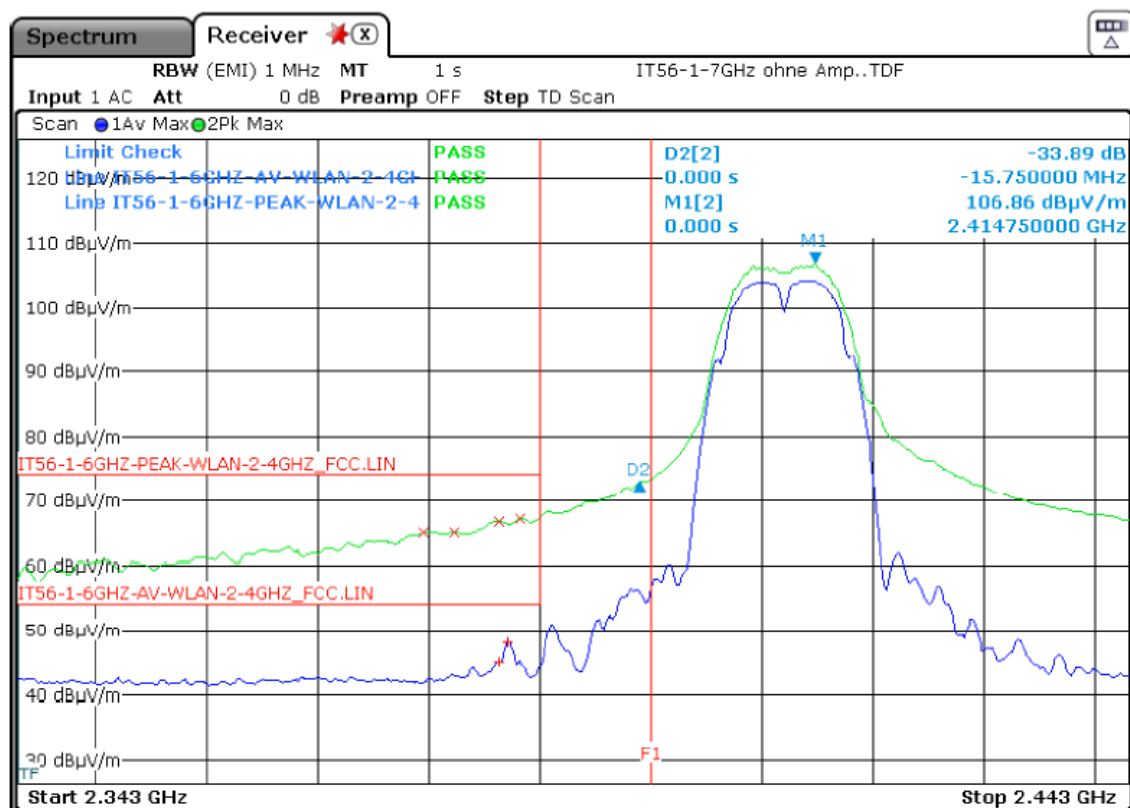
Band edge emission
according to

FCC §15.247, RSS-247, FCC §15.209 RSS-Gen



Ref.-No.: 20/01-0030

Operation mode: WLAN CH.01; BW = 20MHz; CCK; 802.11b; Low edge



Polarisation: V									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
2,3870	48,05	-5,95	54,00	pass	2,3883	67,11	-6,89	74,00	pass
2,3863	44,84	-9,16	54,00	pass	2,3863	66,63	-7,37	74,00	pass
					2,3823	64,92	-9,08	74,00	pass
					2,3795	64,84	-9,16	74,00	pass



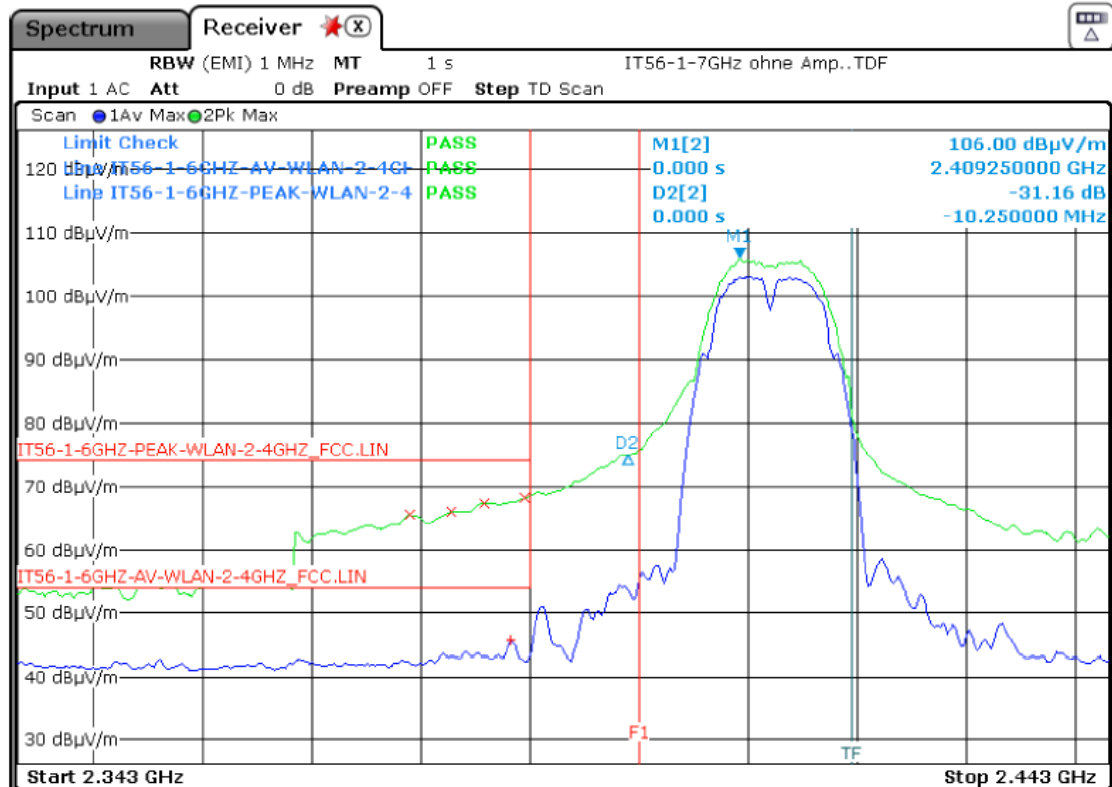
FCC 3
Band edge emission
according to



FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Ref.-No.: 20/01-0030

Operation mode: WLAN CH.01; BW = 20MHz; CCK; 802.11b; Low edge



Polarisation: H									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result	Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
2,3883	45,57	-8,43	54,00	pass	2,3895	68,11	-5,89	74,00	pass
					2,3858	67,36	-6,64	74,00	pass
					2,3828	65,96	-8,04	74,00	pass
					2,3790	65,46	-8,54	74,00	pass

Higher Band Edge - 802.11b 20MHz / CCK – MCS=0; 1 MBps / both antennas are active

TESTED
IN GERMANY

FCC 3
Band edge emission
according to

STC

FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Ref.-No.: 20/01-0030

Product: Transmitting/Receiving System

Sample: 01

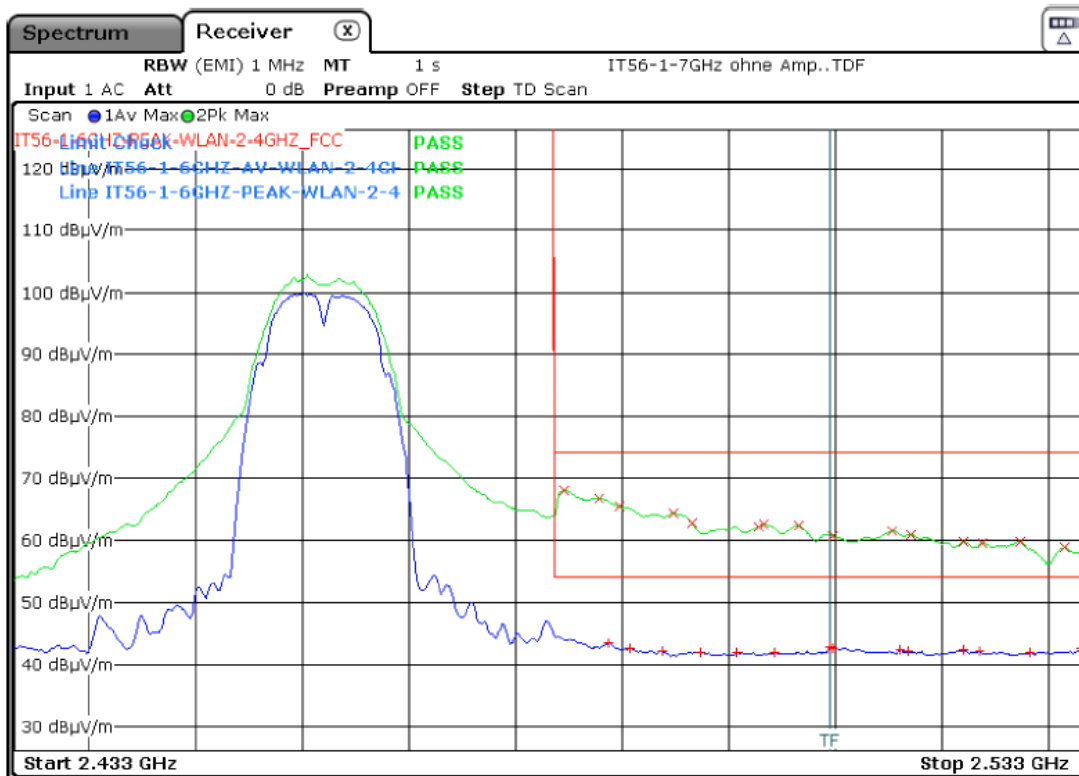
Date: 07.04.2020

Operator: BI

Remarks: DAC 0 (ANT1); DAC1 (ANT 2) Both Antennas ON

pass fail
Result: ☒ ☐

Operation mode: WLAN CH.11; BW = 20MHz; CCK; 802.11b; High edge



Polarisation: V									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result	Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
2,4888	43,39	-10,61	54,00	pass	2,4845	67,86	-6,14	74,00	pass
2,5095	42,64	-11,36	54,00	pass	2,4878	66,73	-7,27	74,00	pass
2,5098	42,61	-11,39	54,00	pass	2,4898	65,26	-8,74	74,00	pass
2,4908	42,60	-11,40	54,00	pass	2,4948	64,24	-9,76	74,00	pass
2,5330	42,60	-11,40	54,00	pass	2,4965	62,69	-11,31	74,00	pass
2,5220	42,28	-11,72	54,00	pass	2,5033	62,47	-11,53	74,00	pass



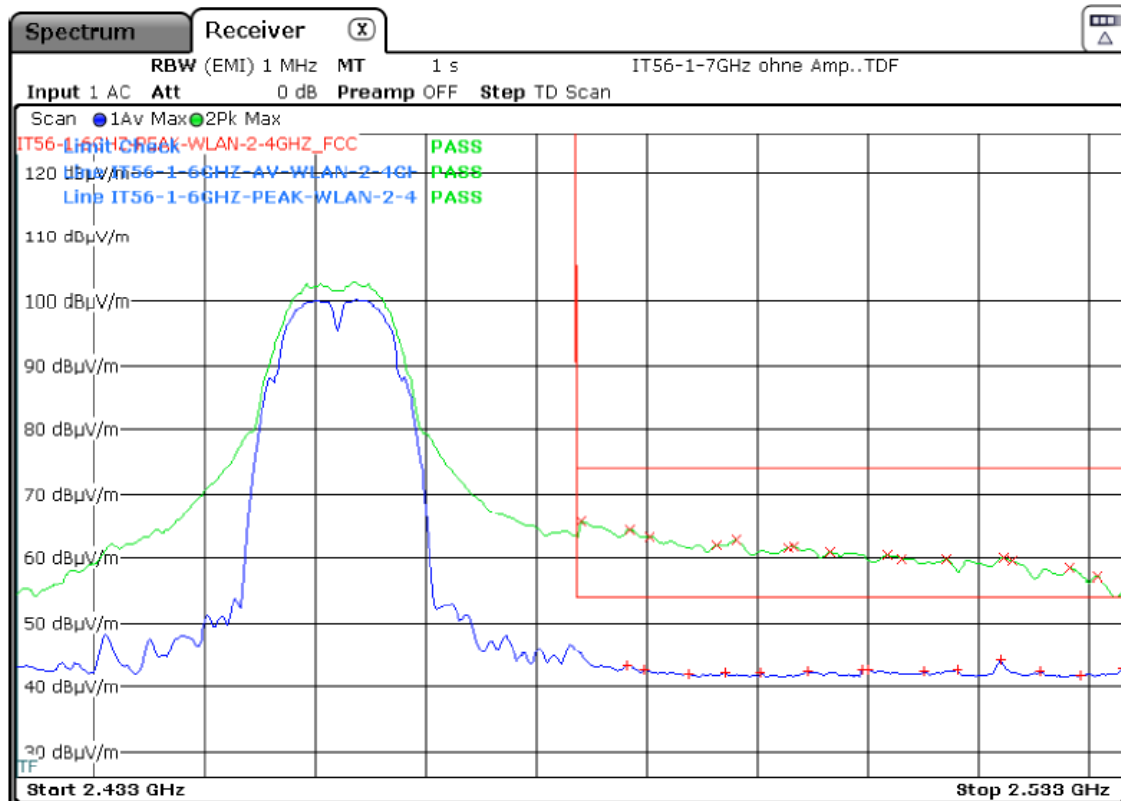
FCC 3
Band edge emission
according to



FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Ref.-No.: 20/01-0030

Operation mode: WLAN CH.11; BW = 20MHz; CCK; 802.11b; High edge

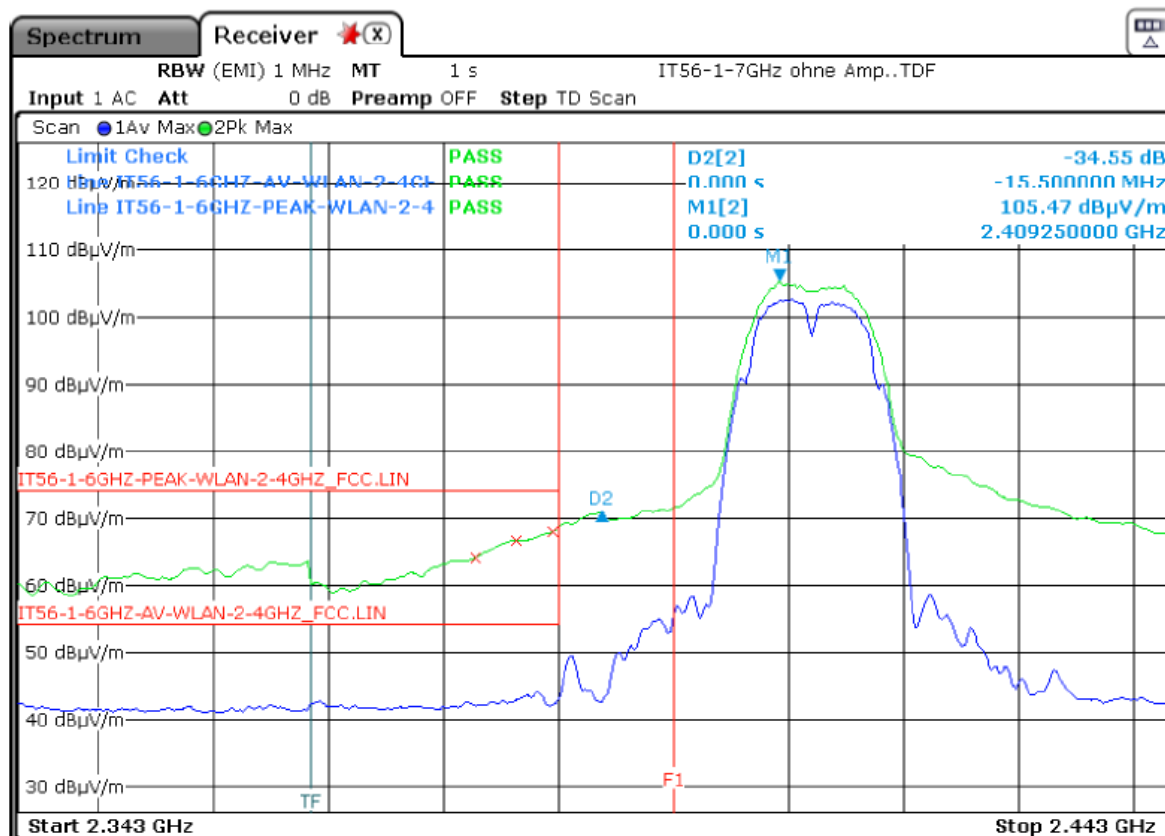


Polarisation: H									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result	Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
2,5220	44,04	-9,96	54,00	pass	2,4840	65,50	-8,50	74,00	pass
2,4883	43,24	-10,76	54,00	pass	2,4885	64,35	-9,65	74,00	pass
2,5330	42,68	-11,32	54,00	pass	2,4903	63,27	-10,73	74,00	pass
2,5100	42,54	-11,46	54,00	pass	2,4980	62,76	-11,24	74,00	pass
2,5095	42,53	-11,47	54,00	pass	2,4963	61,93	-12,07	74,00	pass
2,4898	42,53	-11,47	54,00	pass	2,5033	61,72	-12,28	74,00	pass



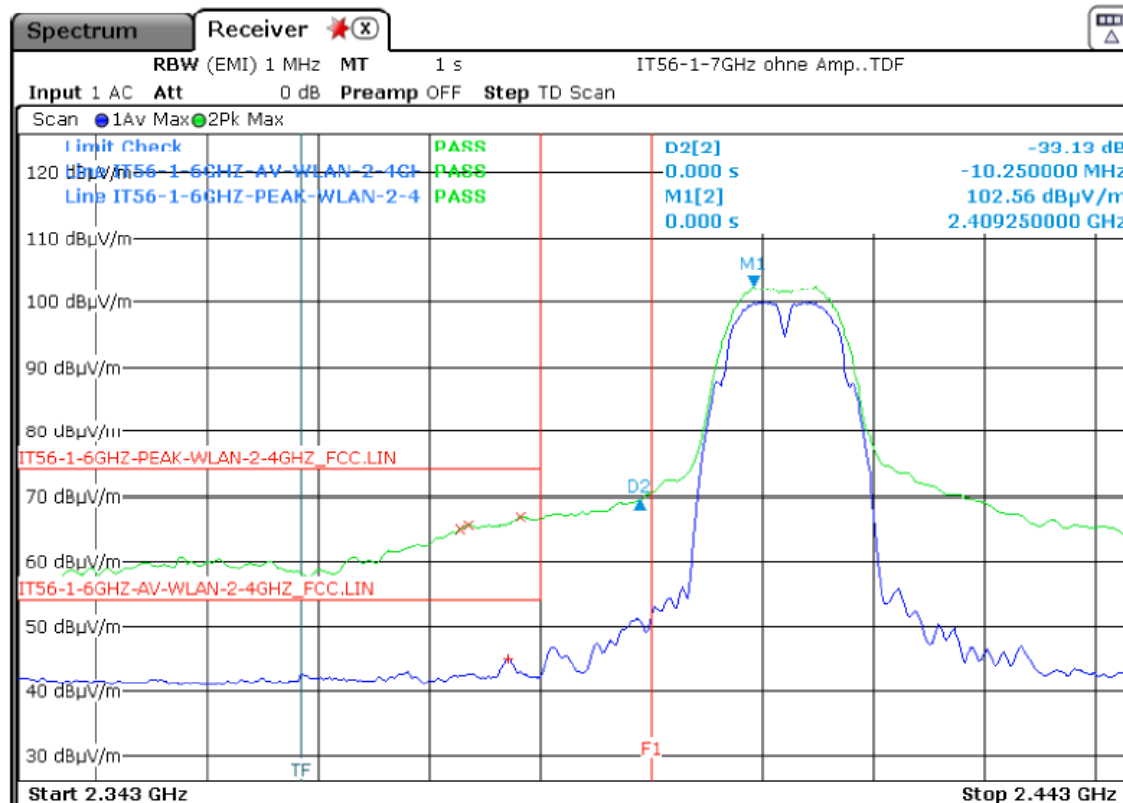
FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Operation mode: WLAN CH.01; BW = 20MHz; OFDM; 802.11g; Low edge

[illegible]

FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Operation mode: WLAN CH.01; BW = 20MHz; OFDM; 802.11g; Low edge

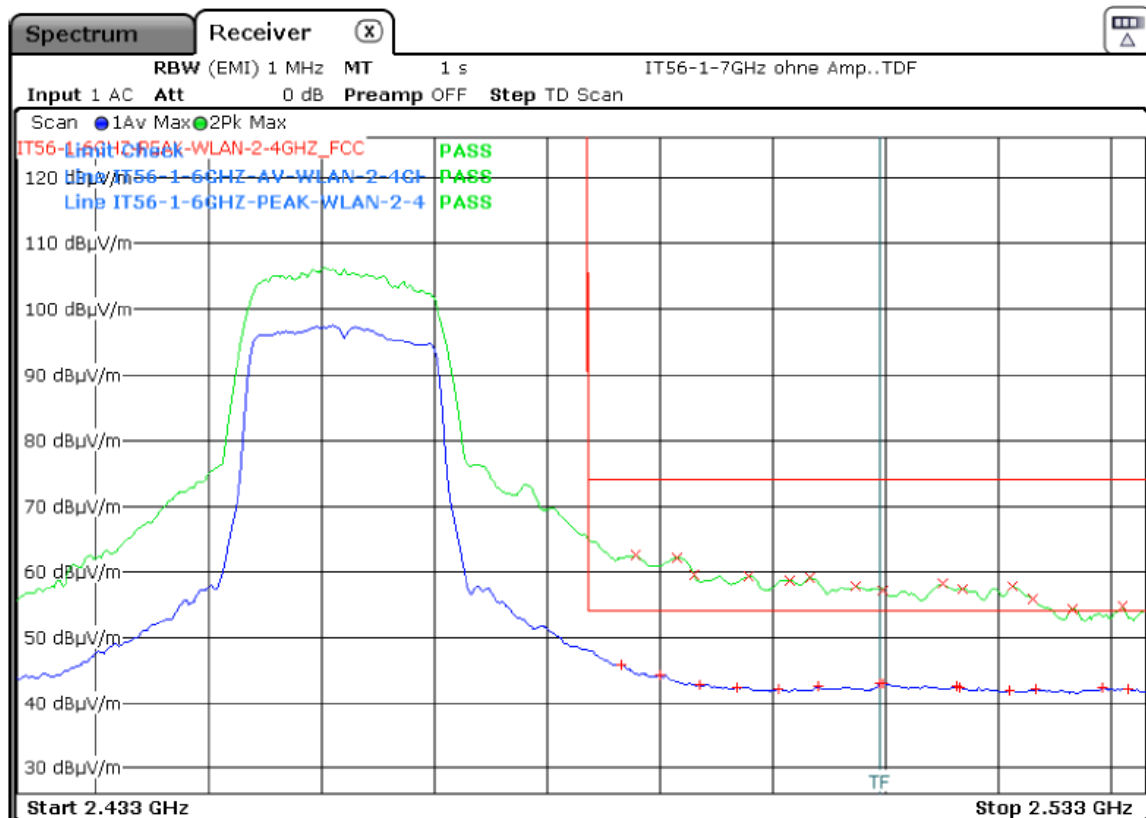


Polarisation: H									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
2,3870	44,87	-9,13	54,00	pass	2,3883	66,92	-7,08	74,00	pass
					2,3835	65,49	-8,51	74,00	pass
					2,3828	64,83	-9,17	74,00	pass

Higher Band Edge - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / both antennas are active

Ref.-No.: 20/01-0030

Operation mode: WLAN CH.11; BW = 20MHz; OFDM; 802.11g; High edge



Polarisation: V

Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
2,4865	45,88	-8,12	54,00	pass	2,4878	62,44	-11,56	74,00	pass
2,4900	44,23	-9,77	54,00	pass	2,4915	62,14	-11,86	74,00	pass
2,5095	42,94	-11,06	54,00	pass	2,4930	59,41	-14,59	74,00	pass
2,5098	42,90	-11,10	54,00	pass	2,4978	59,22	-14,78	74,00	pass
2,4935	42,69	-11,31	54,00	pass	2,5033	59,04	-14,96	74,00	pass
2,5163	42,57	-11,43	54,00	pass	2,5015	58,69	-15,31	74,00	pass



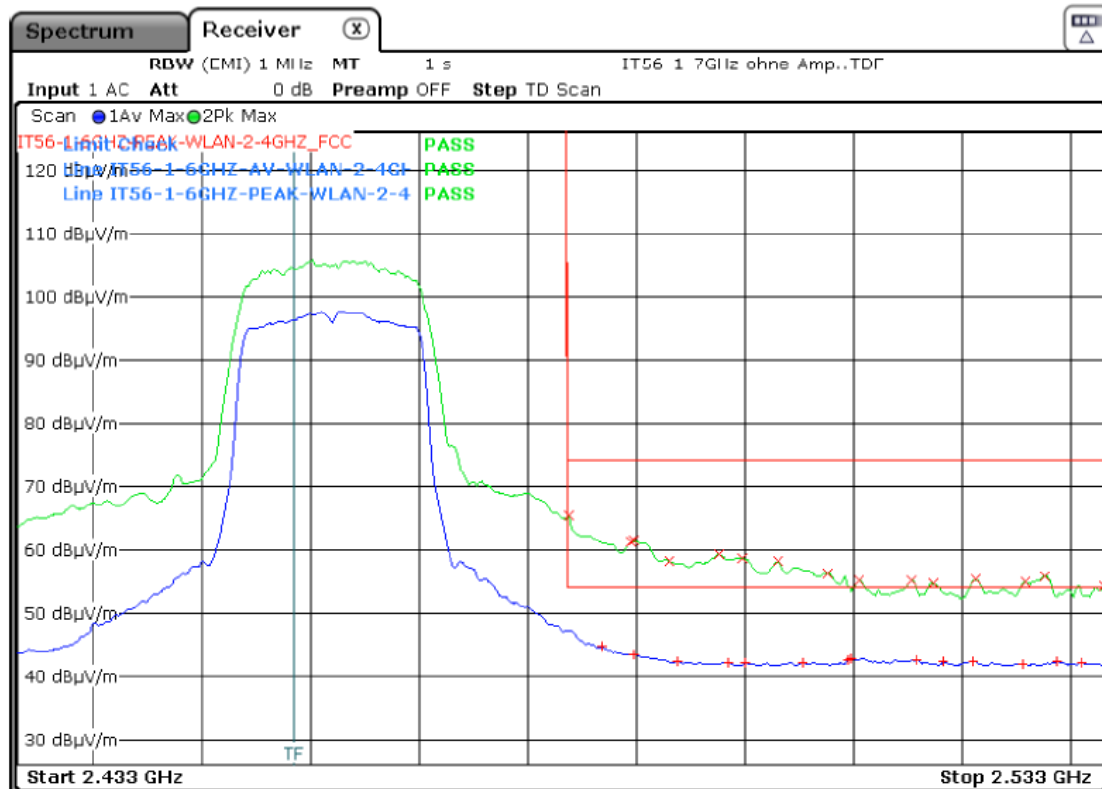
FCC 3 Band edge emission



according to
FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Ref.-No.: 20/01-0030

Operation mode: WLAN CH.11; BW = 20MHz; OFDM; 802.11g; High edge

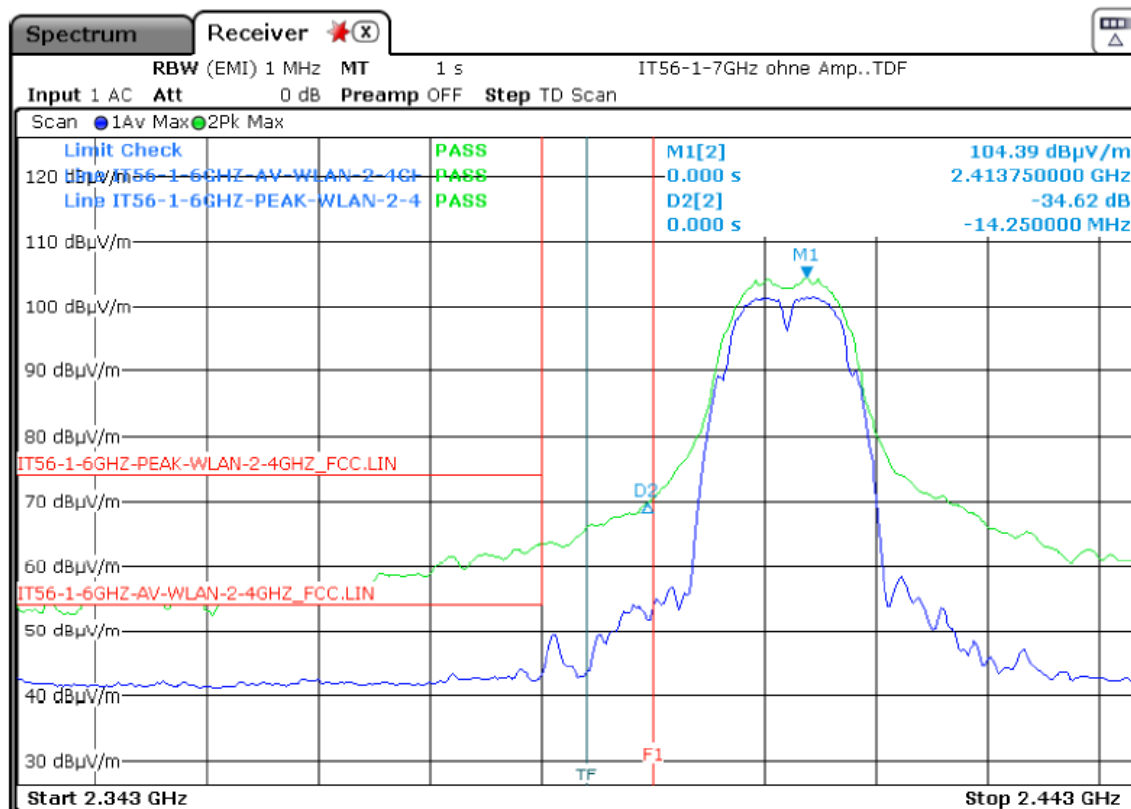


Polarisation: H									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result	Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
2,4868	44,69	-9,31	54,00	pass	2,4838	65,28	-8,72	74,00	pass
2,4898	43,42	-10,58	54,00	pass	2,4898	61,35	-12,65	74,00	pass
2,5098	42,74	-11,26	54,00	pass	2,4895	61,24	-12,76	74,00	pass
2,5158	42,62	-11,38	54,00	pass	2,4975	59,17	-14,83	74,00	pass
2,5095	42,59	-11,41	54,00	pass	2,4998	58,52	-15,48	74,00	pass
2,4938	42,41	-11,59	54,00	pass	2,4930	58,14	-15,86	74,00	pass



FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Operation mode: WLAN CH.01; BW = 20MHz; Greenfield; 802.11n; Low edge

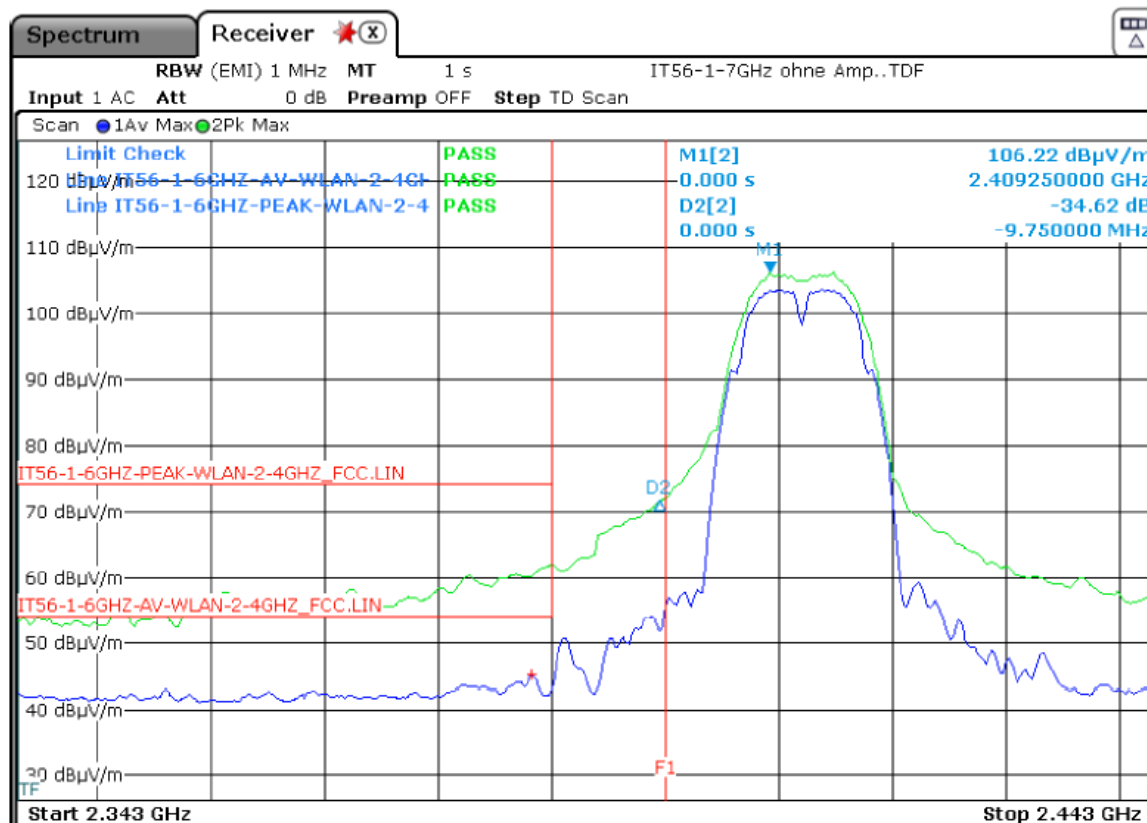


Polarisation: V									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
all emissions are 10dB below limit				pass	all emissions are 10dB below limit				pass

FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Ref.-No.: 20/01-0030

Operation mode: WLAN CH.01; BW = 20MHz; Greenfield; 802.11n; Low edge

[illegible]

Higher Band Edge - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / both antennas are active



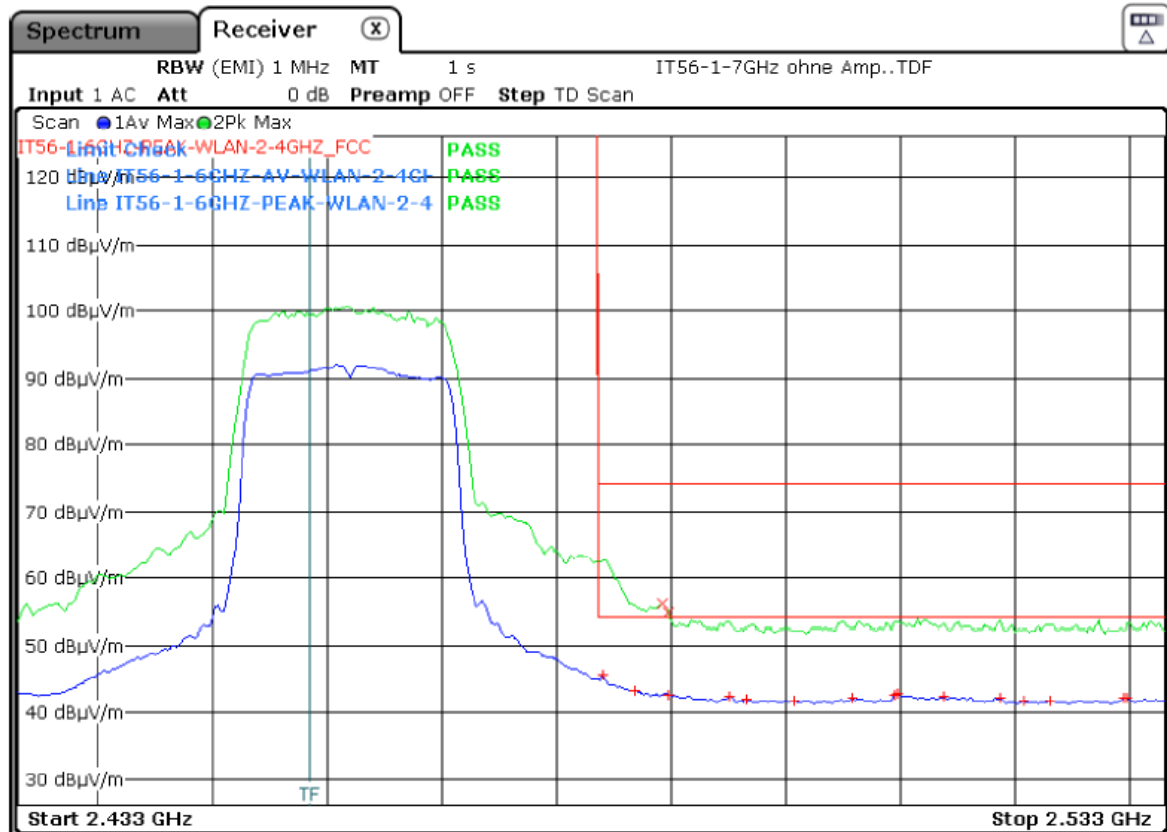
FCC 3
Band edge emission
according to



FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Ref.-No.: 20/01-0030

Operation mode: WLAN CH.11; BW = 20MHz; Greenfield; 802.11n; High edge



Polarisation: V									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result	Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
2,4840	45,53	-8,47	54,00	pass	2,4893	55,93	-18,07	74,00	pass
2,4868	43,27	-10,73	54,00	pass	2,4898	54,76	-19,24	74,00	pass
2,5098	42,68	-11,32	54,00	pass					
2,5095	42,60	-11,40	54,00	pass					
2,4898	42,43	-11,57	54,00	pass					
2,4950	42,41	-11,59	54,00	pass					



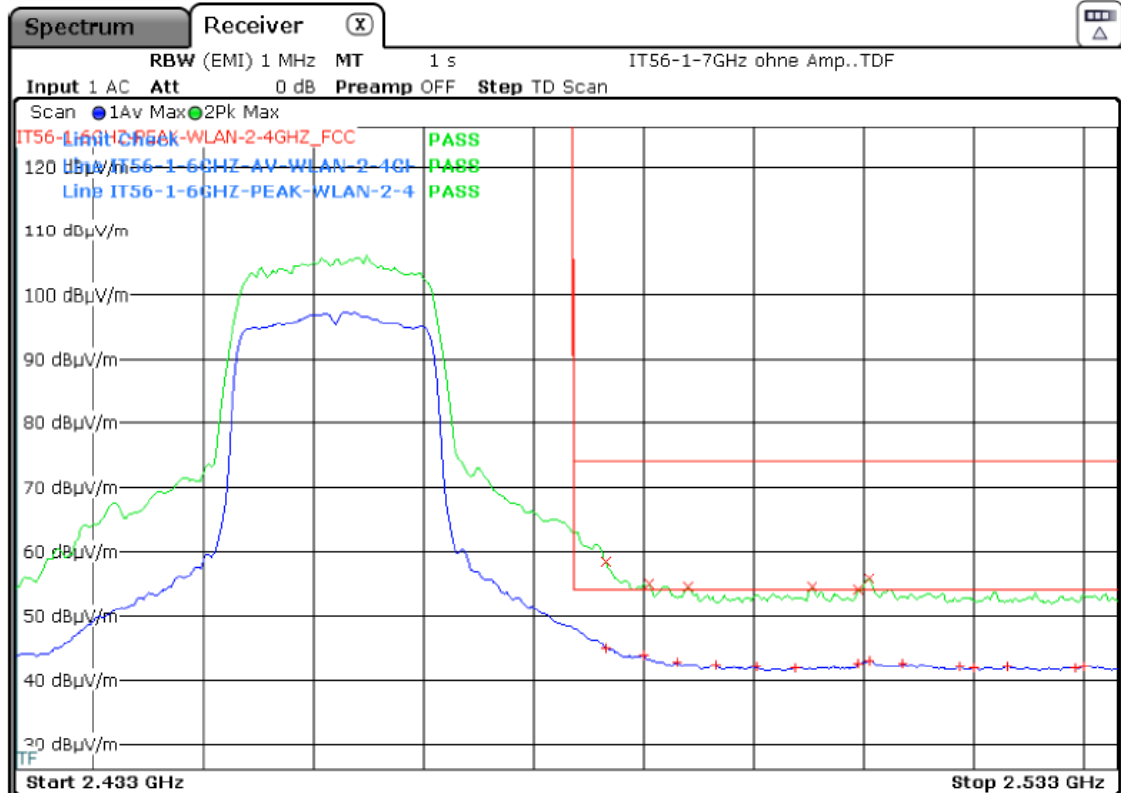
FCC 3
Band edge emission
according to



FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Ref.-No.: 20/01-0030

Operation mode: WLAN CH.11; BW = 20MHz; Greenfield; 802.11n; High edge



Polarisation: H									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result	Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
2,4865	45,02	-8,98	54,00	pass	2,4865	58,33	-15,67	74,00	pass
2,4900	43,76	-10,24	54,00	pass	2,5105	55,76	-18,24	74,00	pass
2,5105	43,06	-10,94	54,00	pass	2,4905	54,99	-19,01	74,00	pass
2,4930	42,65	-11,35	54,00	pass	2,4940	54,41	-19,59	74,00	pass
2,5095	42,52	-11,48	54,00	pass	2,5053	54,40	-19,60	74,00	pass
2,5135	42,42	-11,58	54,00	pass	2,5095	54,03	-19,97	74,00	pass

Lower Band Edge - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / both antennas are active

TESTED
IN GERMANY

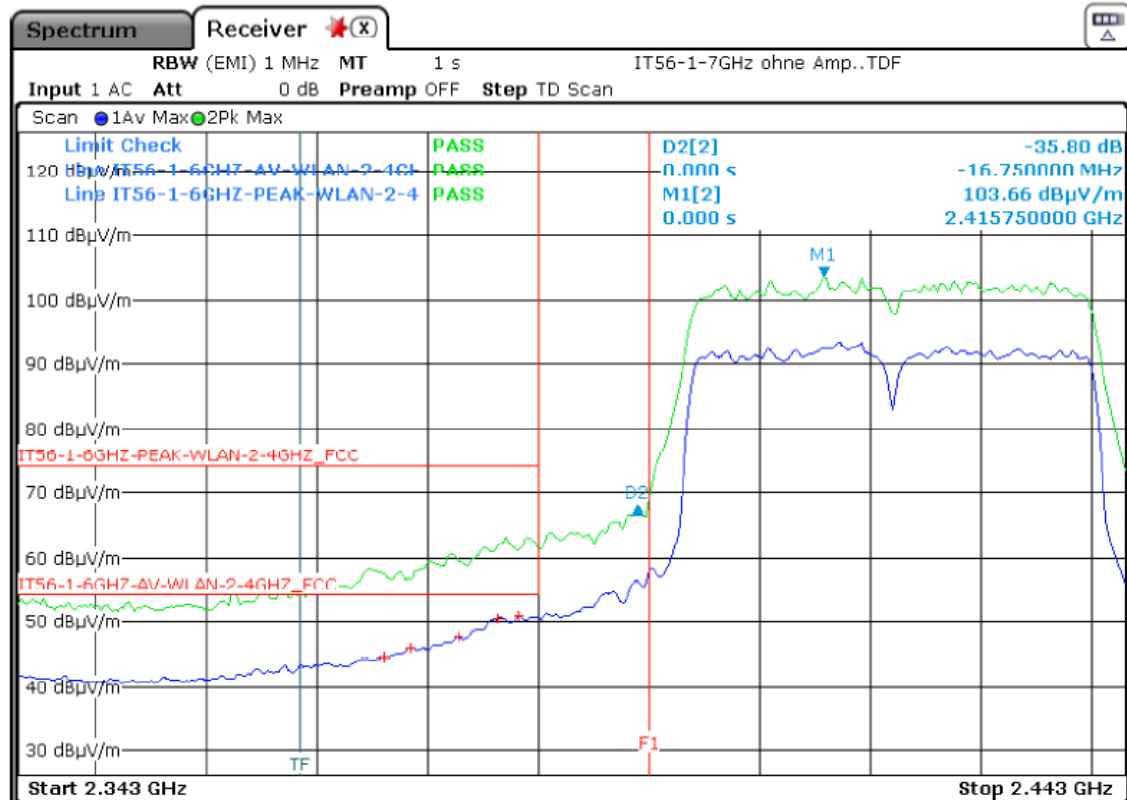
FCC 3
Band edge emission
according to

STC

FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Ref.-No.: 20/01-0030

Operation mode: WLAN CH.03; BW = 40MHz; Greenfield; 802.11n40; Low edge



Polarisation: V									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result	Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
2,3883	50,87	-3,13	54,00	pass	all emissions are 10dB below limit				pass
2,3863	50,30	-3,70	54,00	pass					
2,3828	47,44	-6,56	54,00	pass					
2,3785	45,85	-8,15	54,00	pass					
2,3760	44,44	-9,56	54,00	pass					



FCC 3



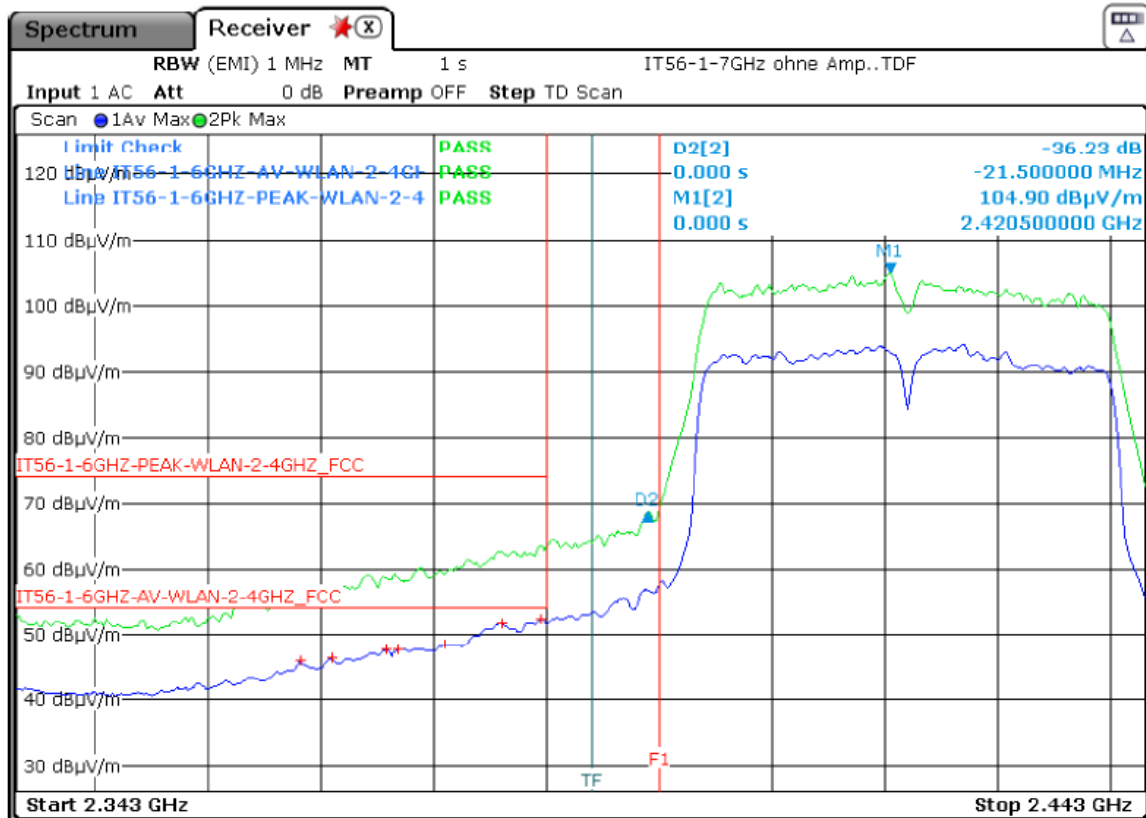
Band edge emission

according to

FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Ref.-No.: 20/01-0030

Operation mode: WLAN CH.03; BW = 40MHz; Greenfield; 802.11n40; Low edge



Polarisation: H									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result	Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
2,3895	52,28	-1,72	54,00	pass	all emissions are 10dB below limit				pass
2,3860	51,61	-2,39	54,00	pass					
2,3810	48,29	-5,71	54,00	pass					
2,3768	47,62	-6,38	54,00	pass					
2,3758	47,49	-6,51	54,00	pass					
2,3710	46,16	-7,84	54,00	pass					

Higher Band Edge - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / both antennas are active



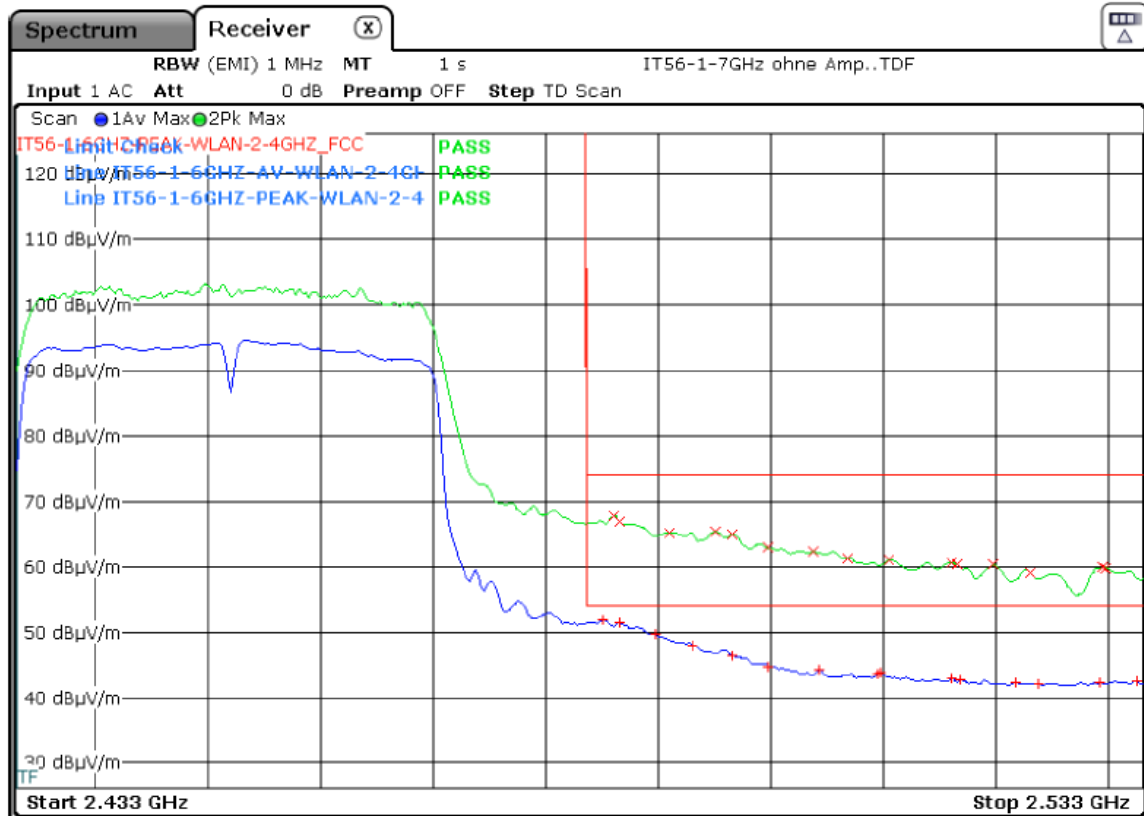
FCC 3
Band edge emission
according to



FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Ref.-No.: 20/01-0030

Operation mode: WLAN CH.09; BW = 40MHz; Greenfield; 802.11n40; High edge



Polarisation: V									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
2,4850	51,78	-2,22	54,00	pass	2,4860	67,79	-6,21	74,00	pass
2,4865	51,33	-2,67	54,00	pass	2,4865	66,94	-7,06	74,00	pass
2,4898	49,68	-4,32	54,00	pass	2,4950	65,32	-8,68	74,00	pass
2,4930	48,05	-5,95	54,00	pass	2,4910	65,16	-8,84	74,00	pass
2,4965	46,52	-7,48	54,00	pass	2,4965	64,88	-9,12	74,00	pass
2,4998	44,75	-9,25	54,00	pass	2,4998	62,85	-11,15	74,00	pass



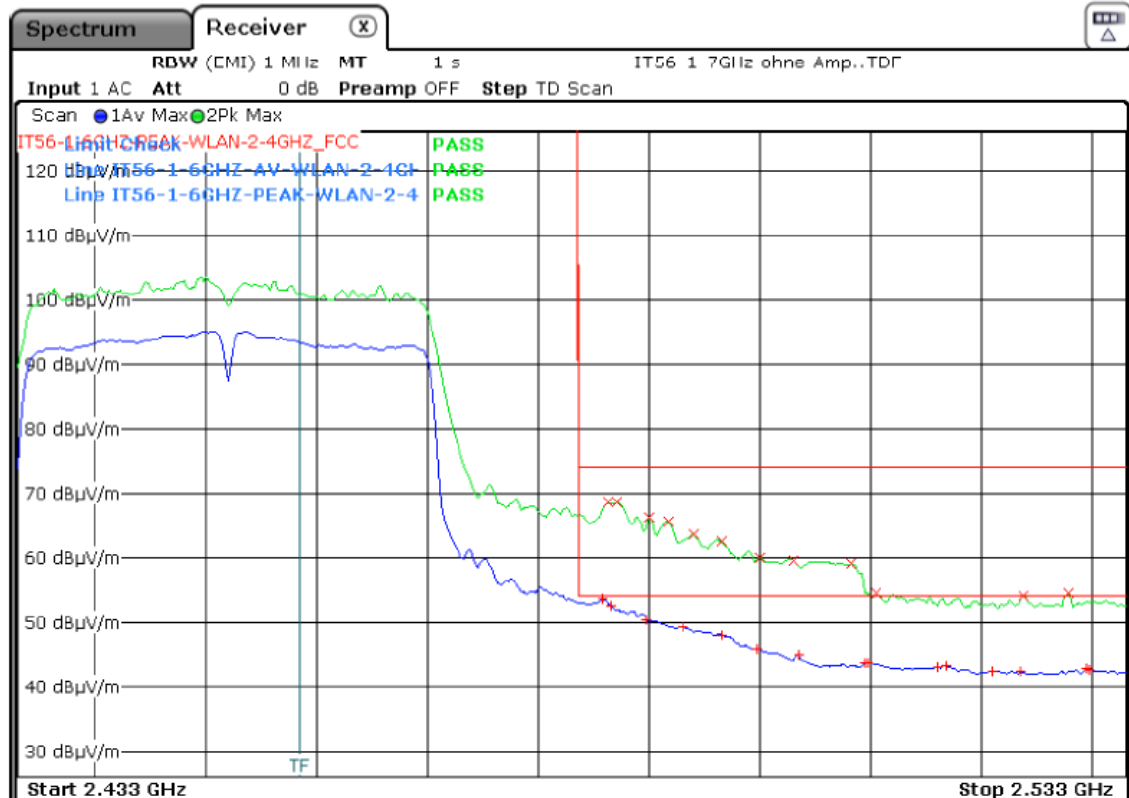
FCC 3
Band edge emission
according to



FCC §15.247, RSS-247, FCC §15.209 RSS-Gen

Ref.-No.: 20/01-0030

Operation mode: WLAN CH.09; BW = 40MHz; Greenfield; 802.11n40; High edge



Polarisation: H									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result	Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
2,4858	53,54	-0,46	54,00	pass	2,4863	68,54	-5,46	74,00	pass
2,4865	52,43	-1,57	54,00	pass	2,4870	68,52	-5,48	74,00	pass
2,4898	50,37	-3,63	54,00	pass	2,4900	66,20	-7,80	74,00	pass
2,4930	49,20	-4,80	54,00	pass	2,4918	65,53	-8,47	74,00	pass
2,4965	48,06	-5,94	54,00	pass	2,4940	63,55	-10,45	74,00	pass
2,4998	45,78	-8,22	54,00	pass	2,4965	62,42	-11,58	74,00	pass

Results

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the **Band Edges Emission**.

7.5. 99% Power Bandwidth

Applied standards

-RSS-Gen issue 5 Section 6.7

Test equipment and test set up

Test equipment used for conducted measurements as given in clause Test equipment of this report.

Test setup used for conducted measurements as given in clause Test setups of this report.

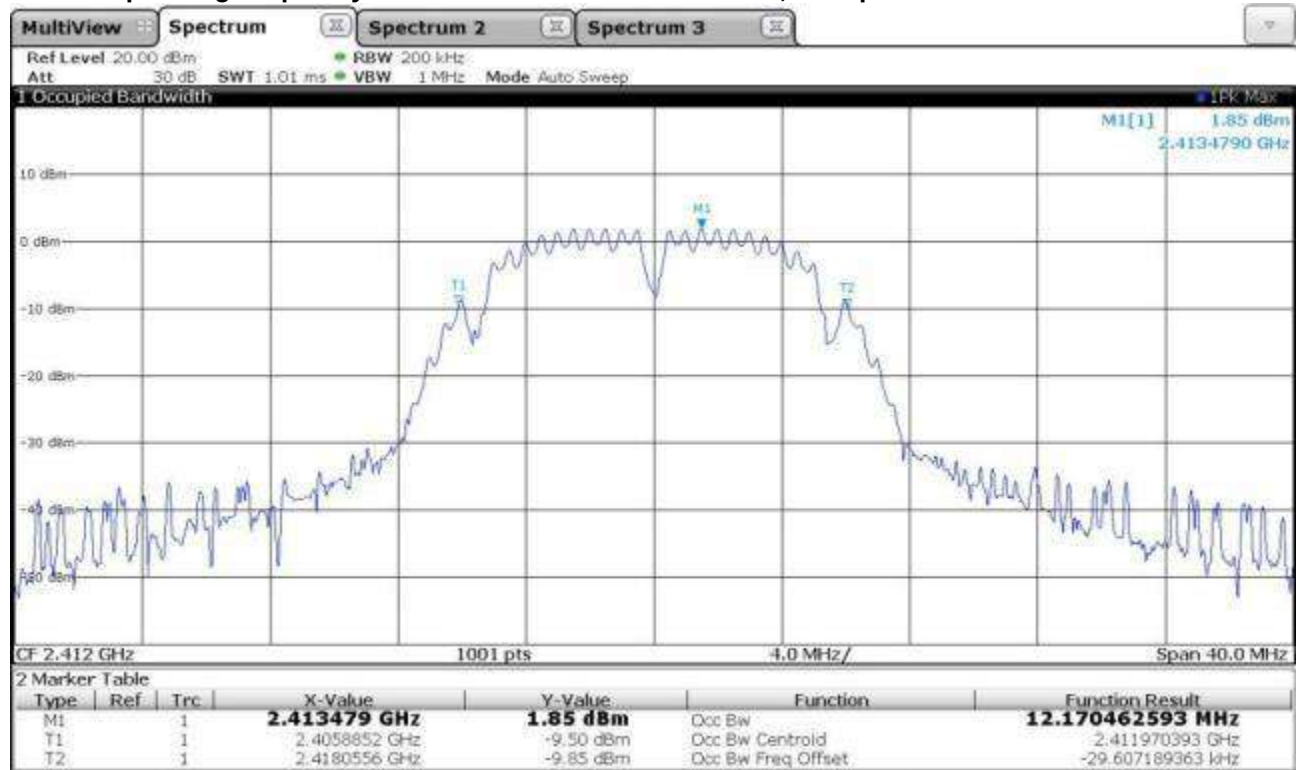
Description

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The 99% power bandwidth function of the instrument was used for the measurement.

Measurement:

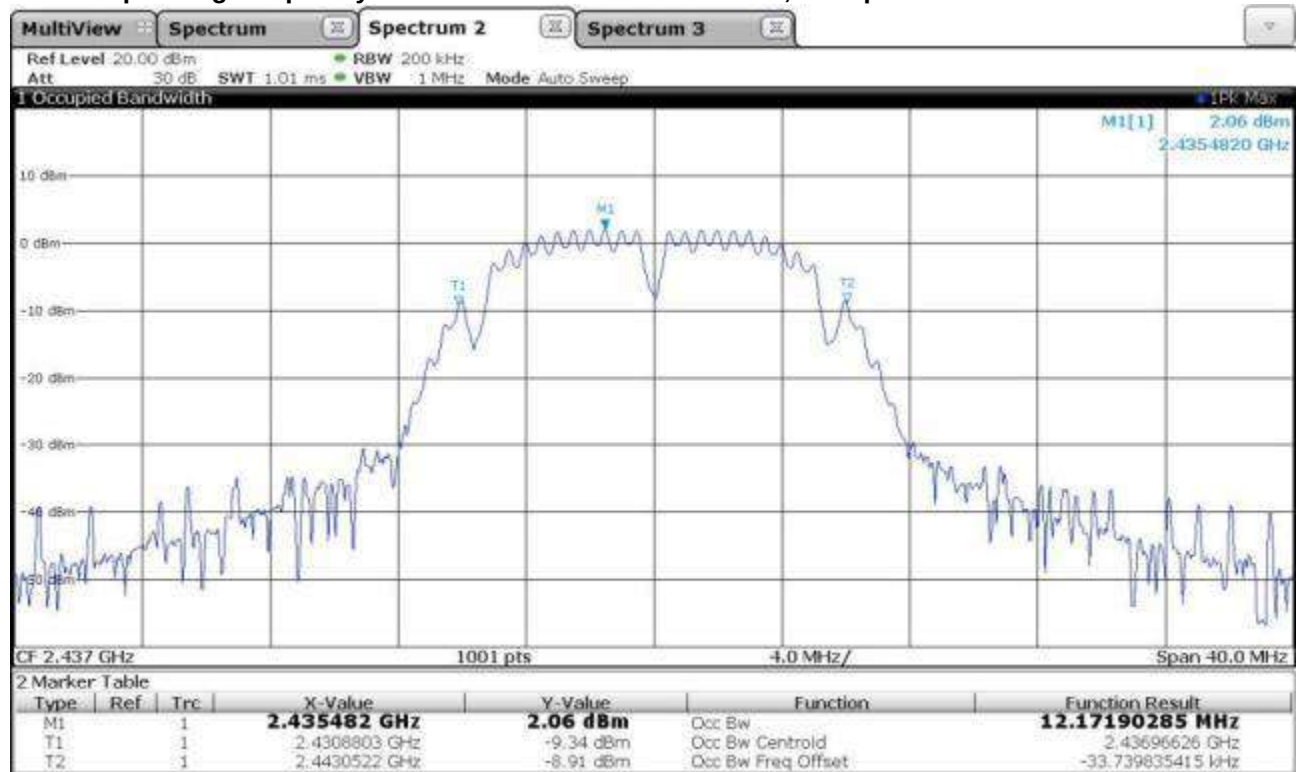
The Measurement was performed on: 01.04.2020 and 02.04.2020

Lowest operating frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1



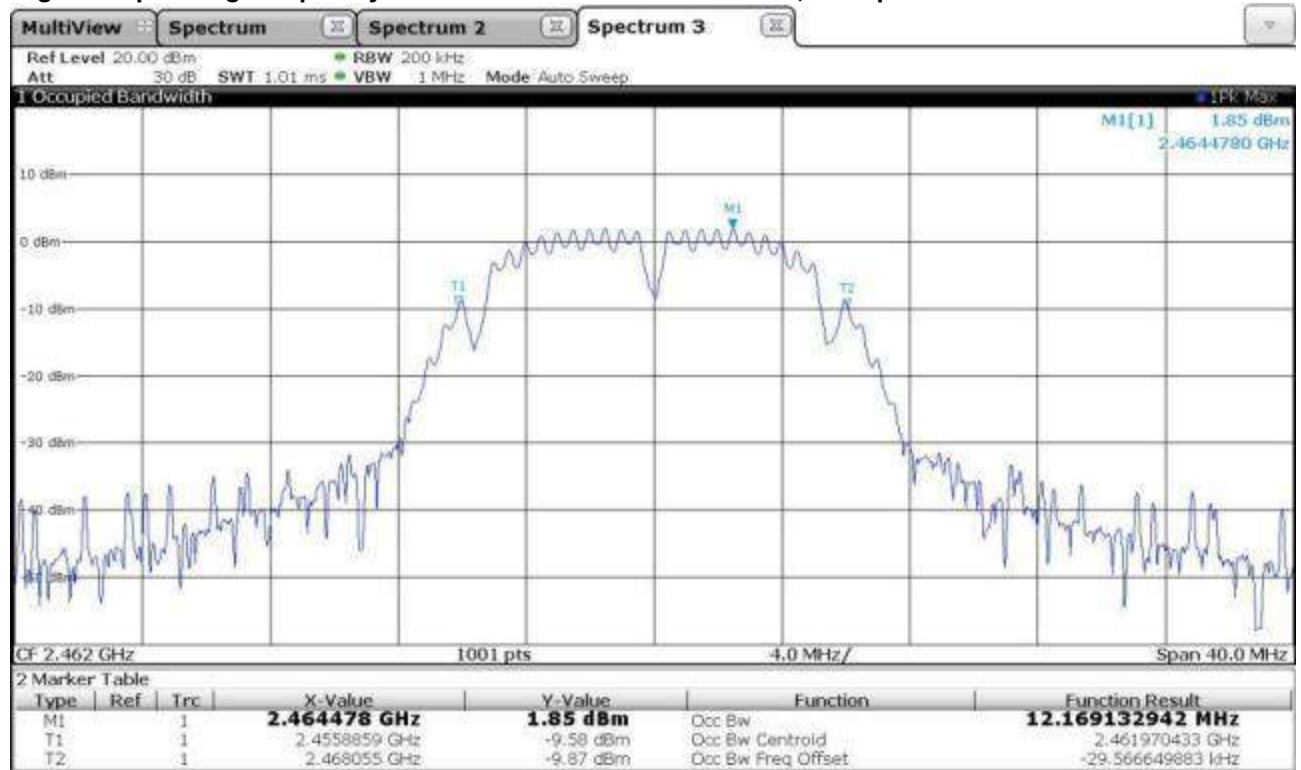
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
1	2412	12.170462593	-/-	Pass

Middle Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1



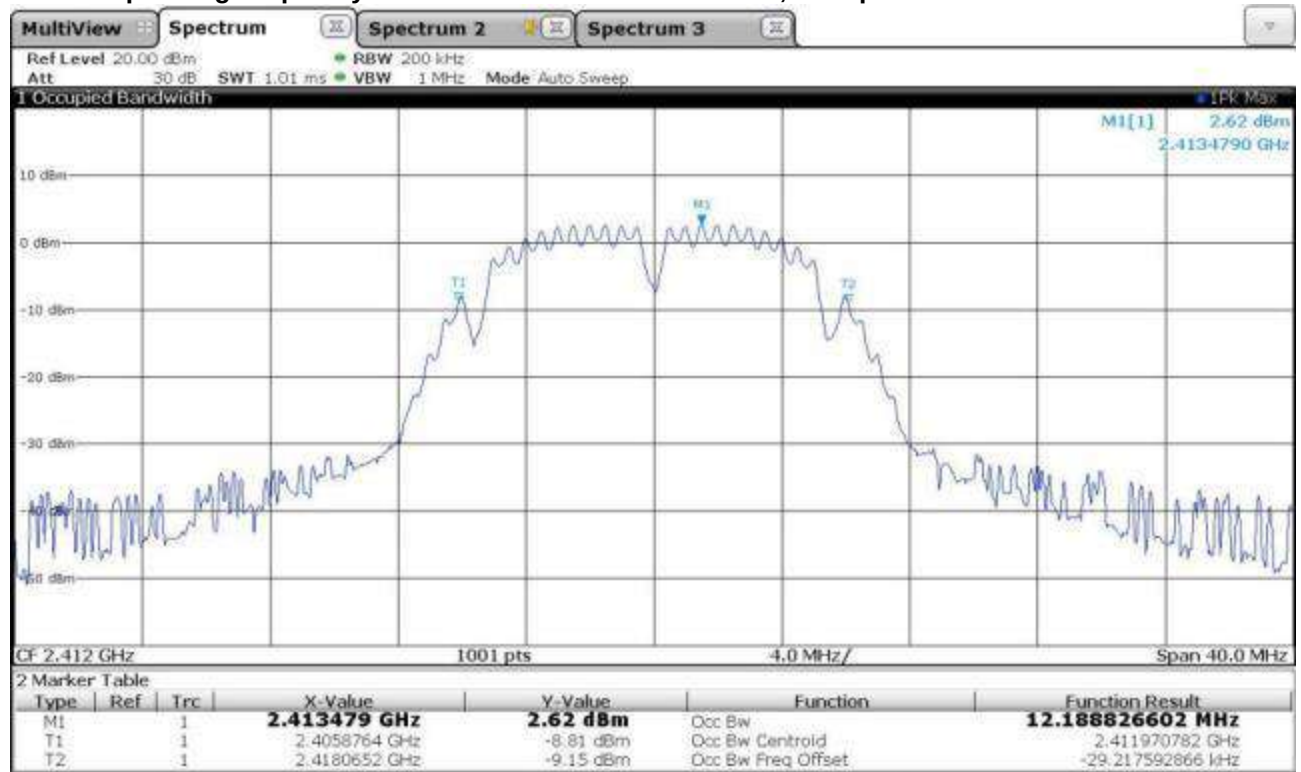
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
6	2437	12.17190285	-/-	Pass

Highest Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 1



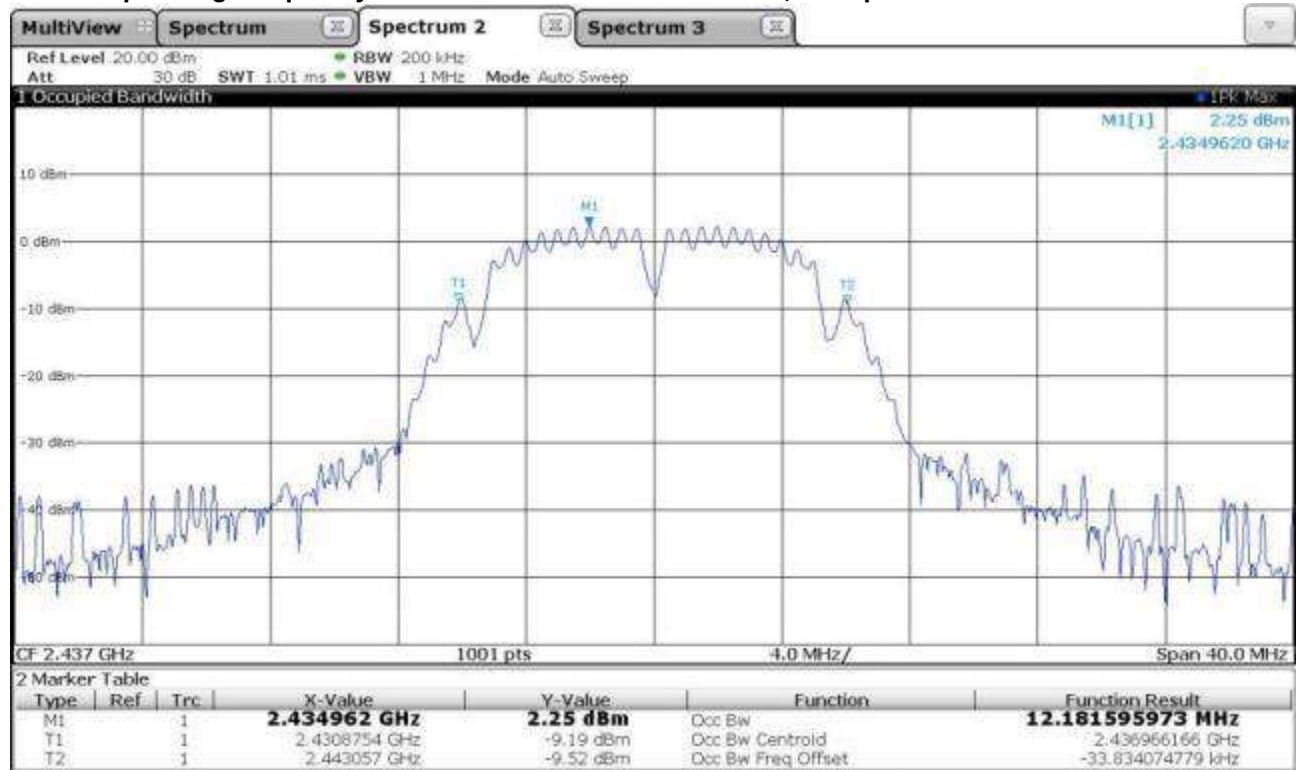
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
11	2462	12.169132942	-/-	Pass

Lowest operating frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2



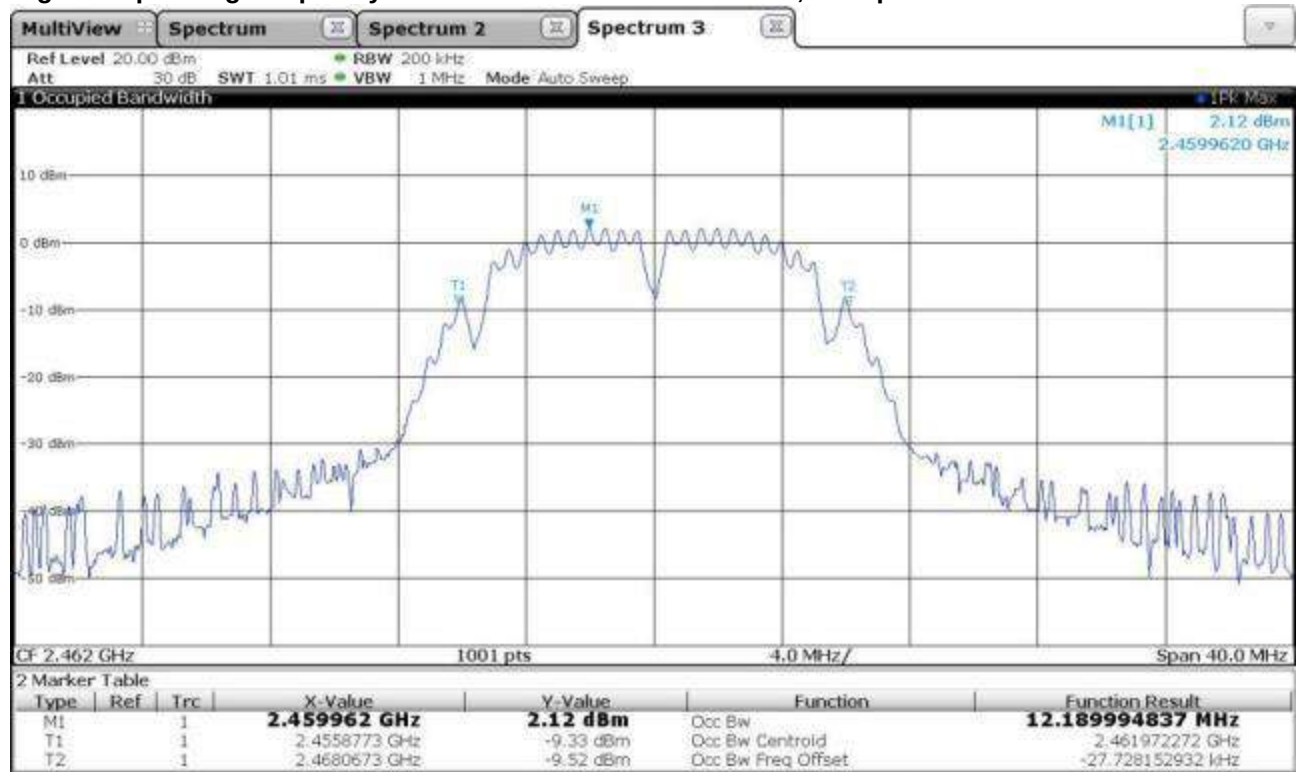
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
1	2412	12.18826602	-/-	Pass

Middle Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2



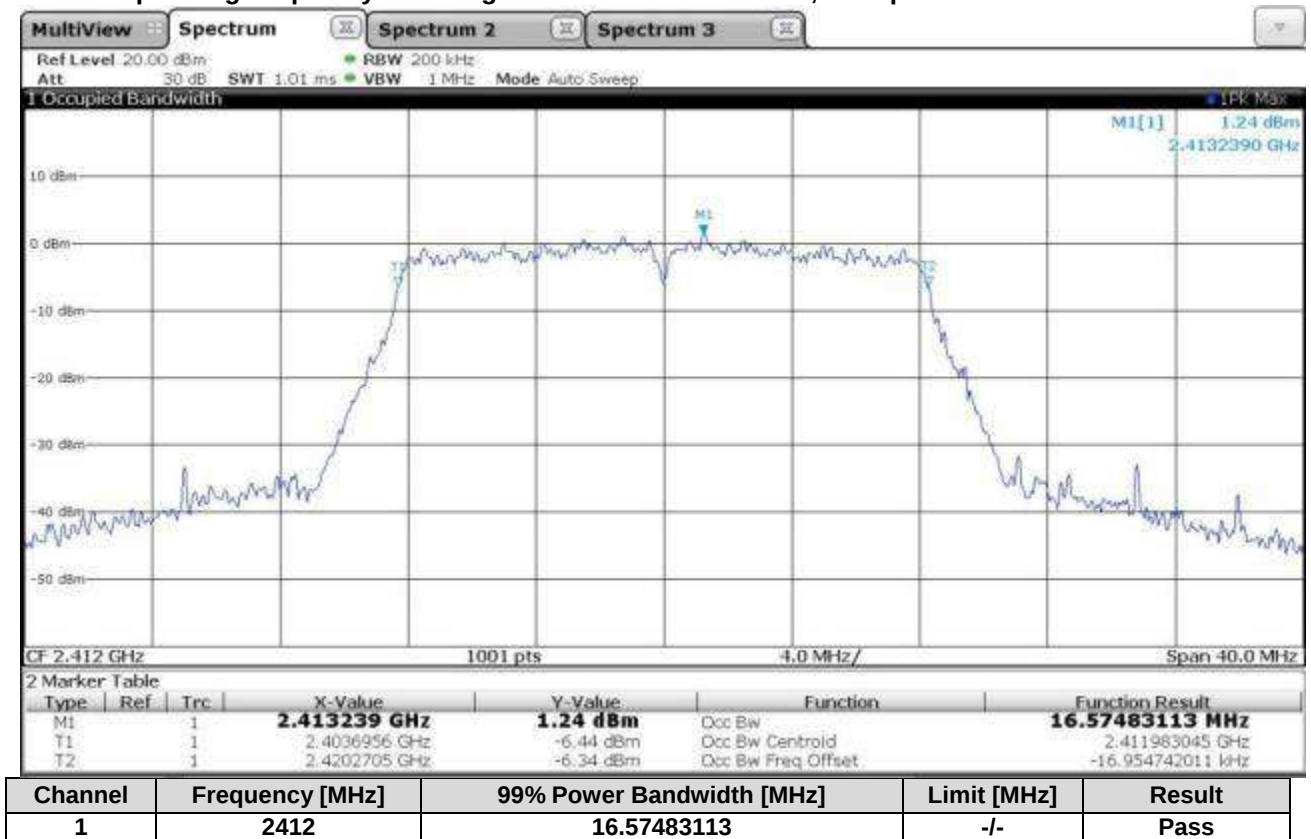
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
6	2437	12.181595973	-/-	Pass

Highest Operating Frequency - 802.11b 20MHz / CCK – MCS=0; 1 MBps / Antenna 2

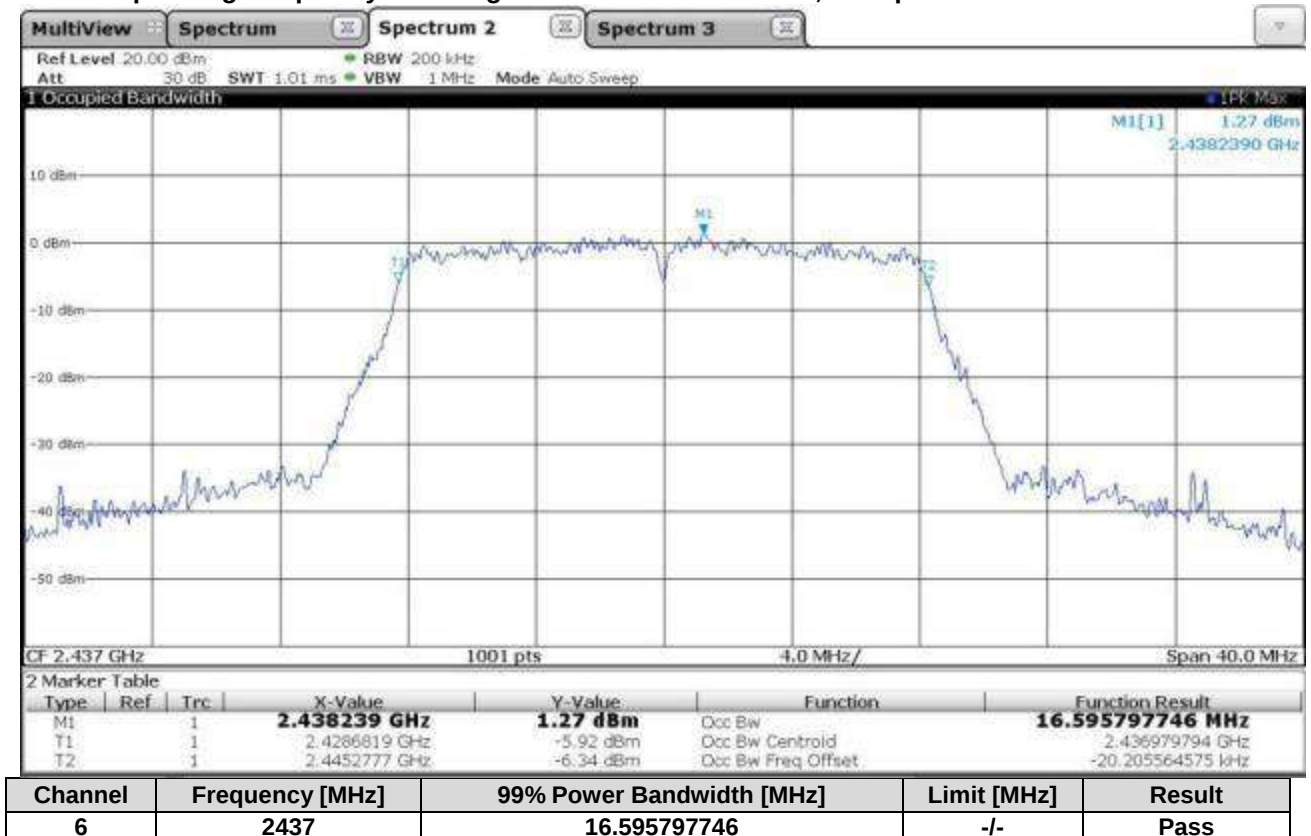


Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
11	2462	12.189994837	-/-	Pass

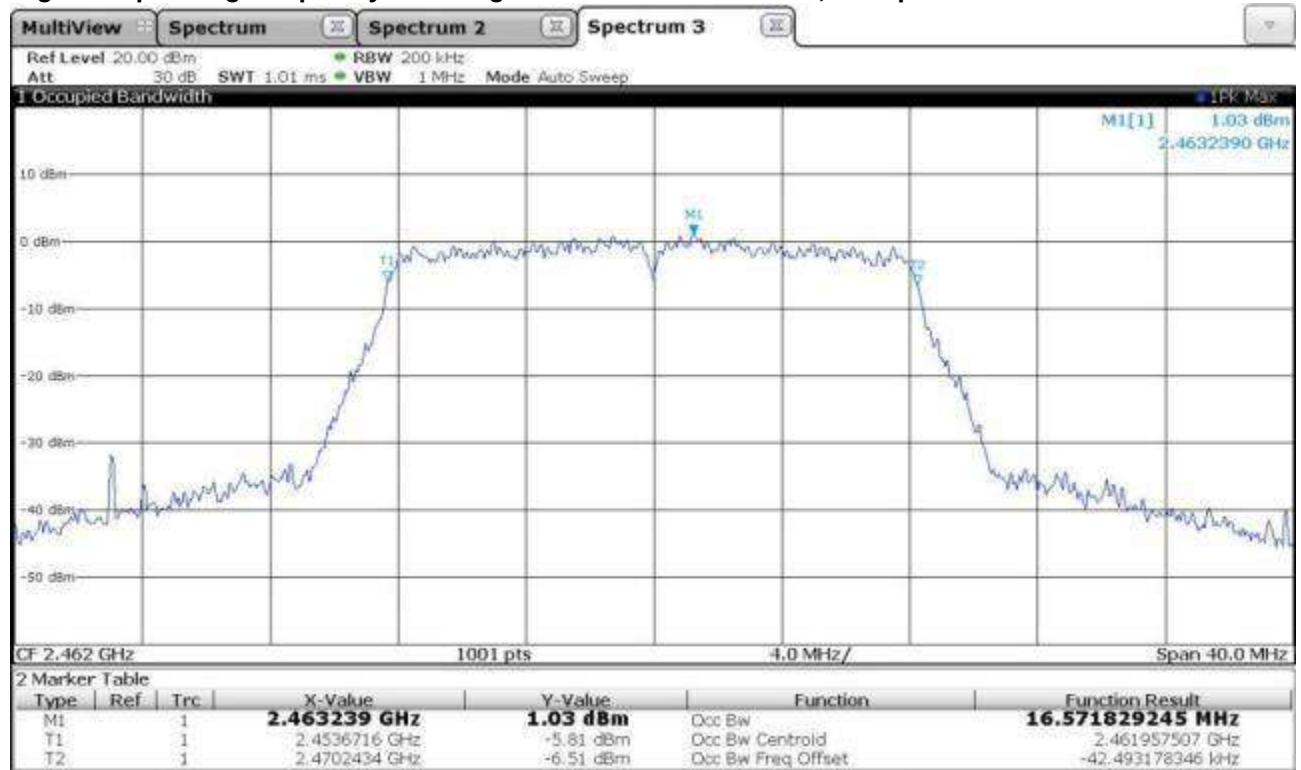
Lowest operating frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1



Middle Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1

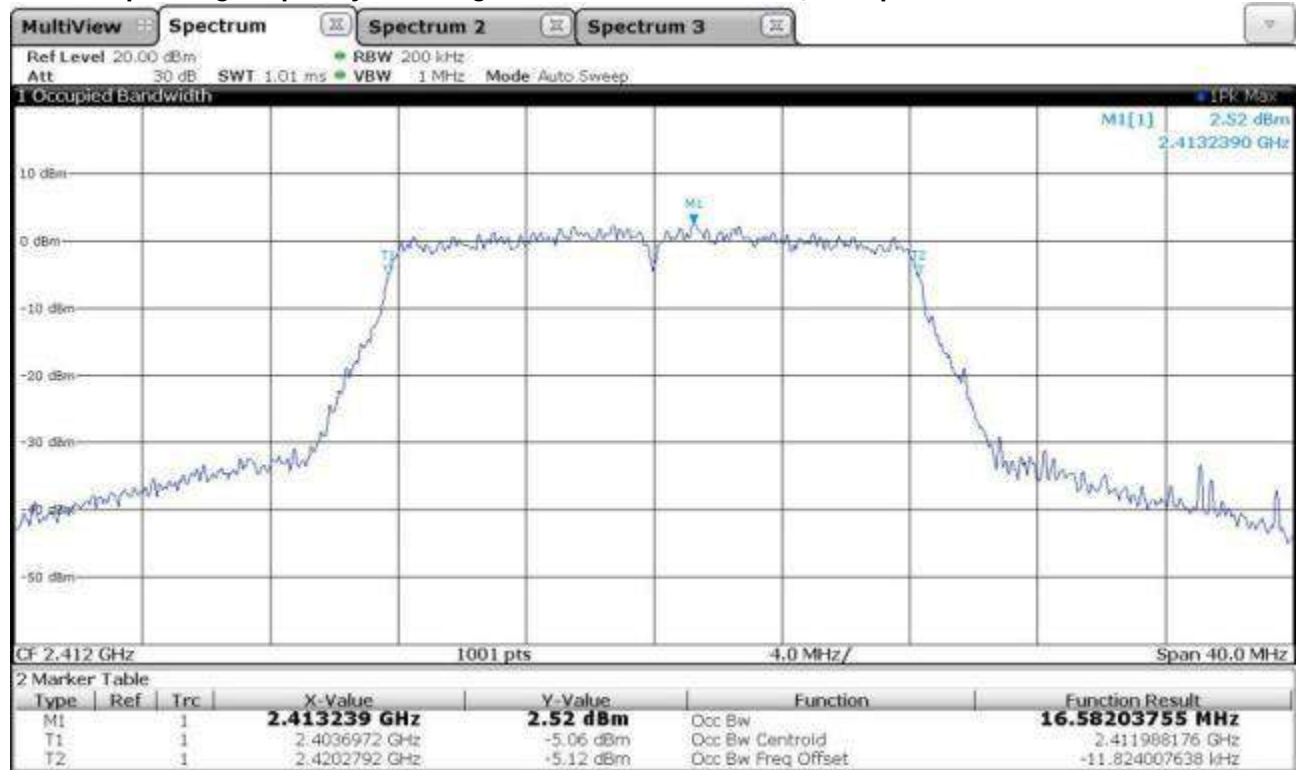


Highest Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 1



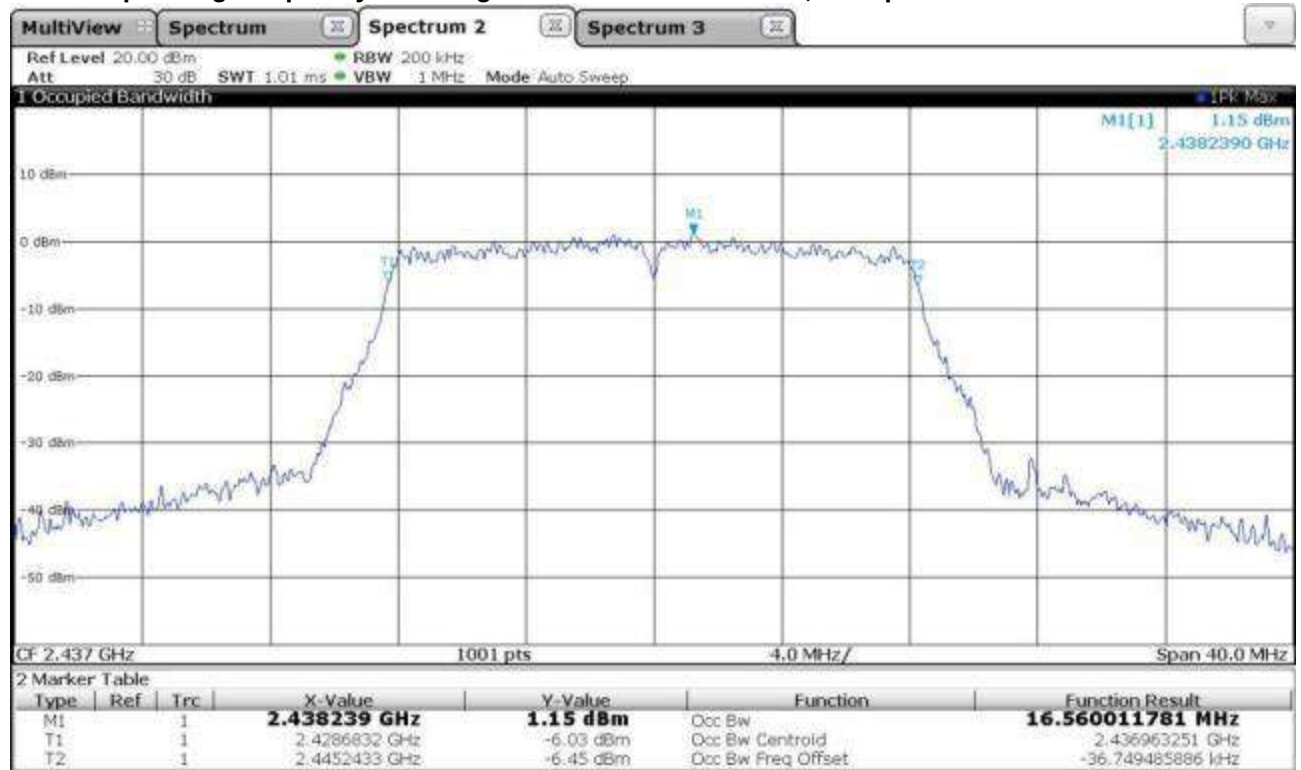
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
11	2462	16.571829245	-/-	Pass

Lowest operating frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 2



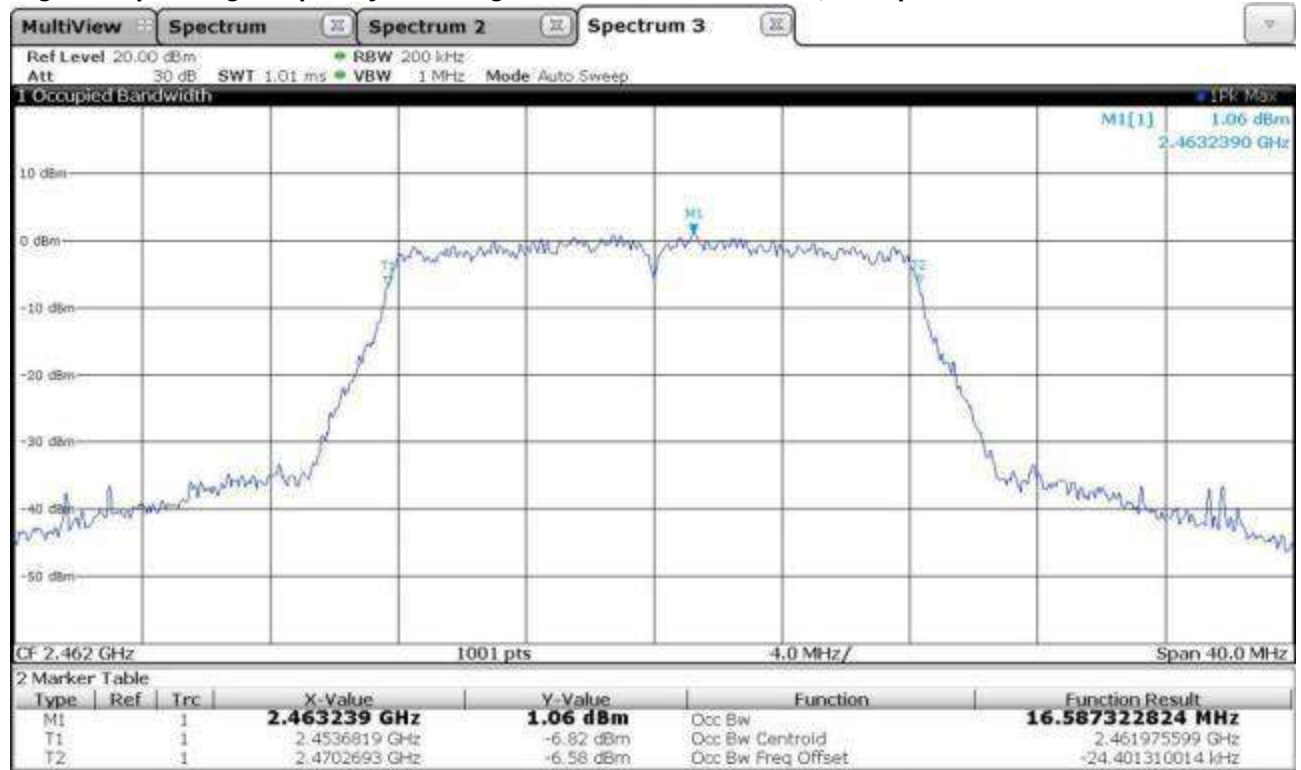
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
1	2412	16.58203755	-/-	Pass

Middle Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 2



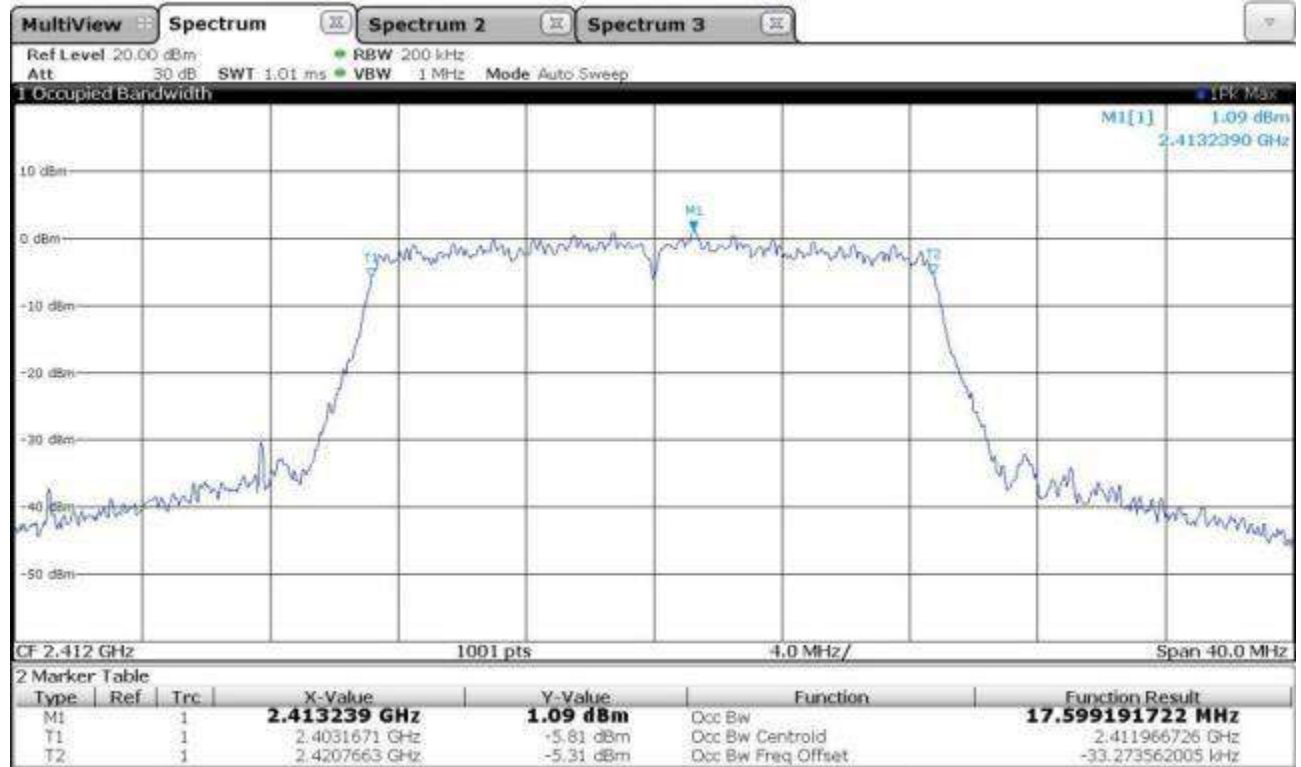
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
6	2437	16.560011781	-/-	Pass

Highest Operating Frequency - 802.11g 20MHz / OFDM – MCS=0; 6 MBps / Antenna 2



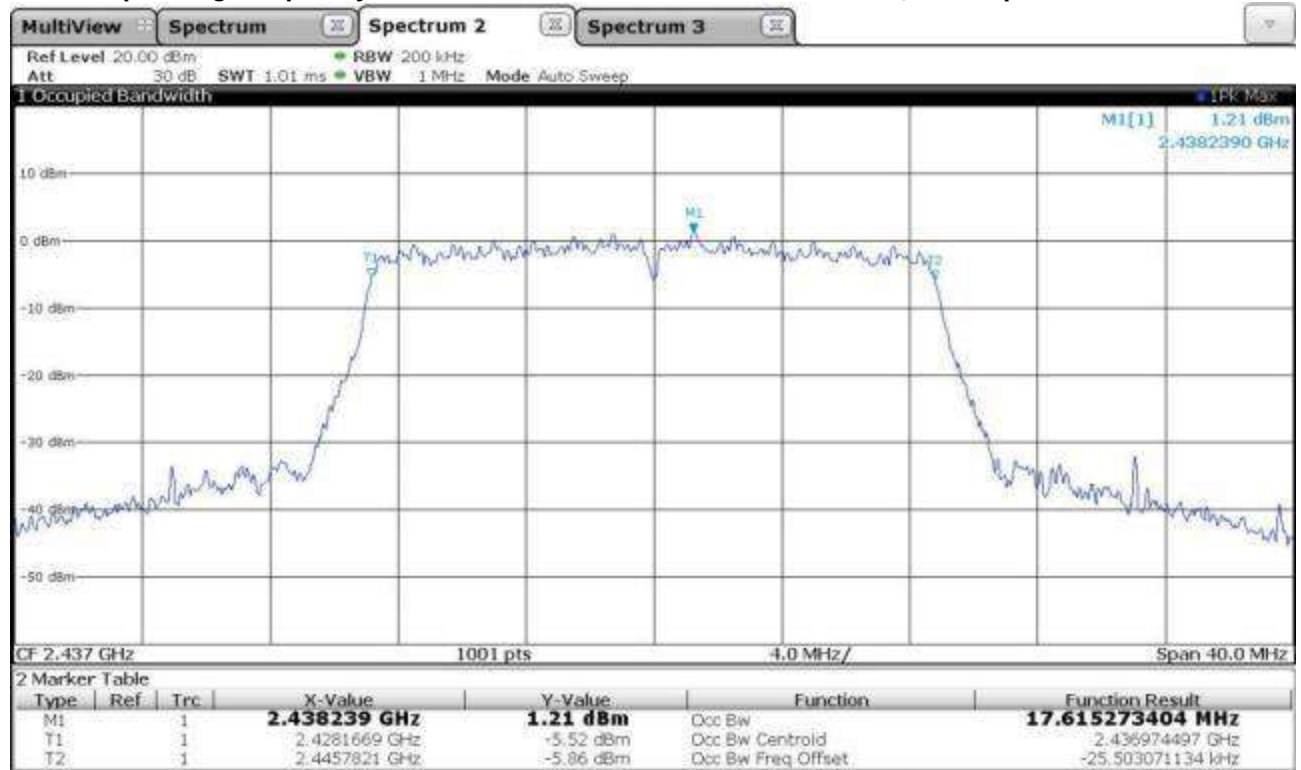
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
11	2462	16.587322824	-/-	Pass

Lowest operating frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



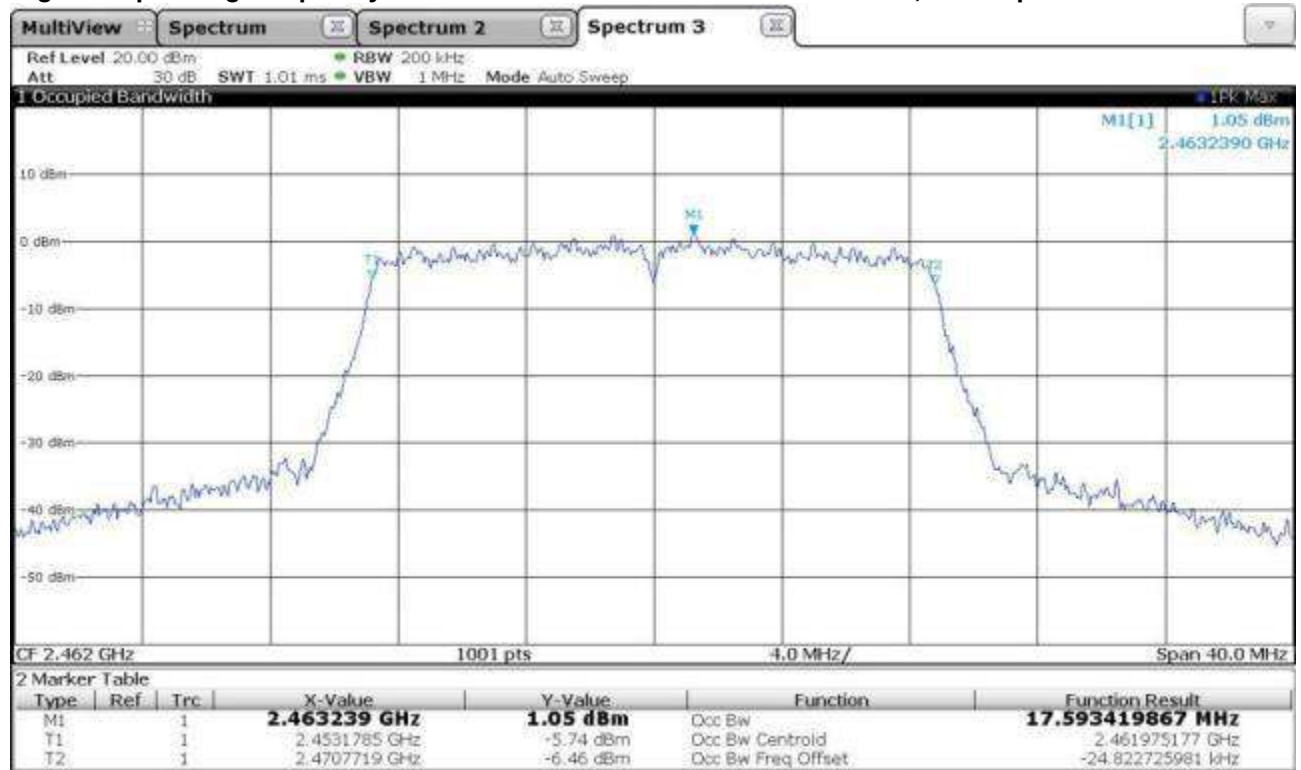
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
1	2412	17.599191722	-/-	Pass

Middle Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



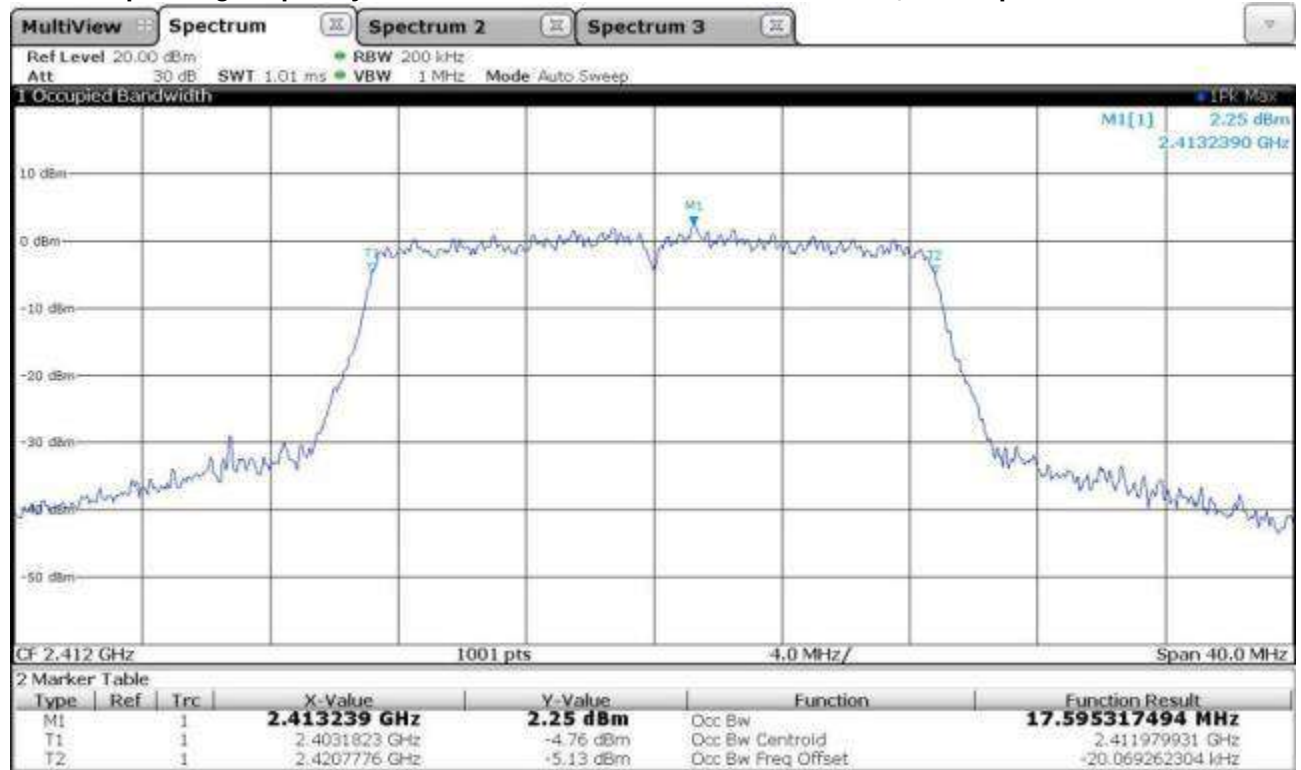
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
6	2437	17.615273404	-/-	Pass

Highest Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



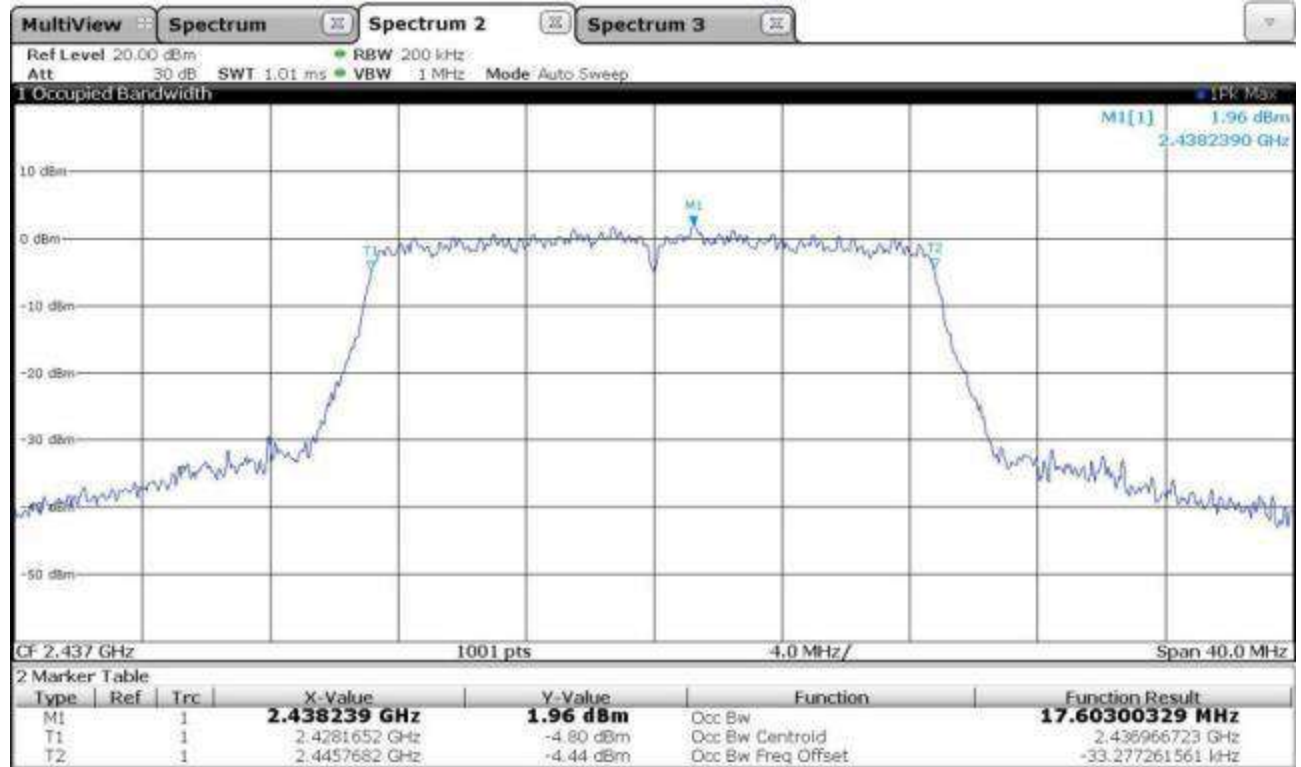
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
11	2462	17.593419867	-/-	Pass

Lowest operating frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



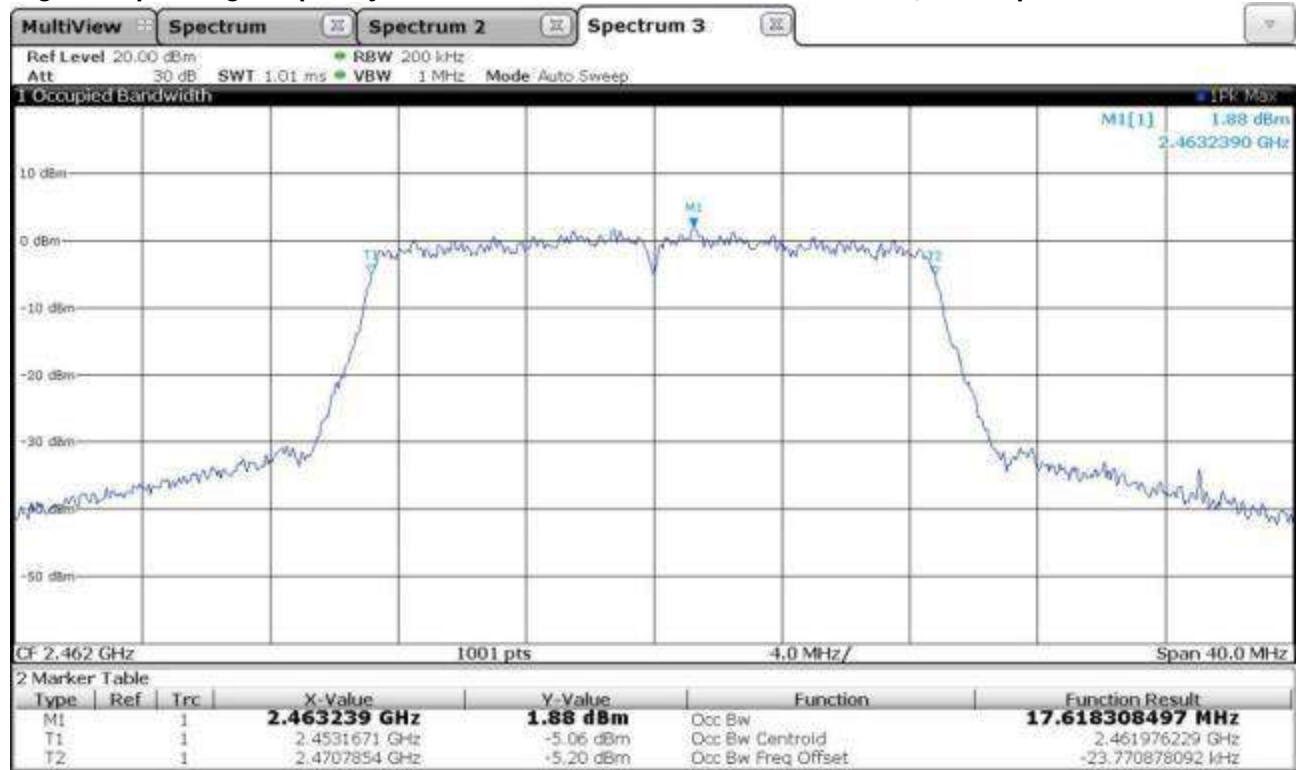
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
1	2412	17.595317494	-/-	Pass

Middle Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



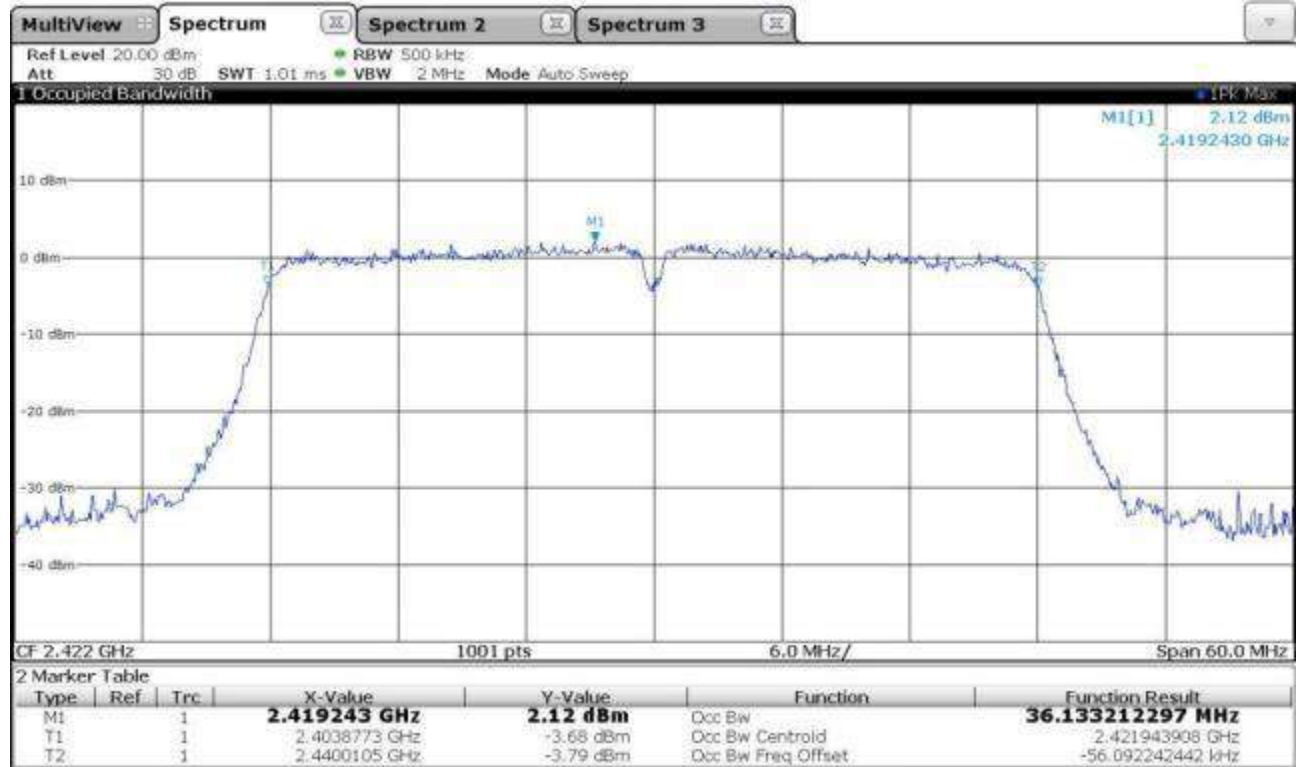
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
6	2437	17.60300329	-/-	Pass

Highest Operating Frequency - 802.11n 20MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



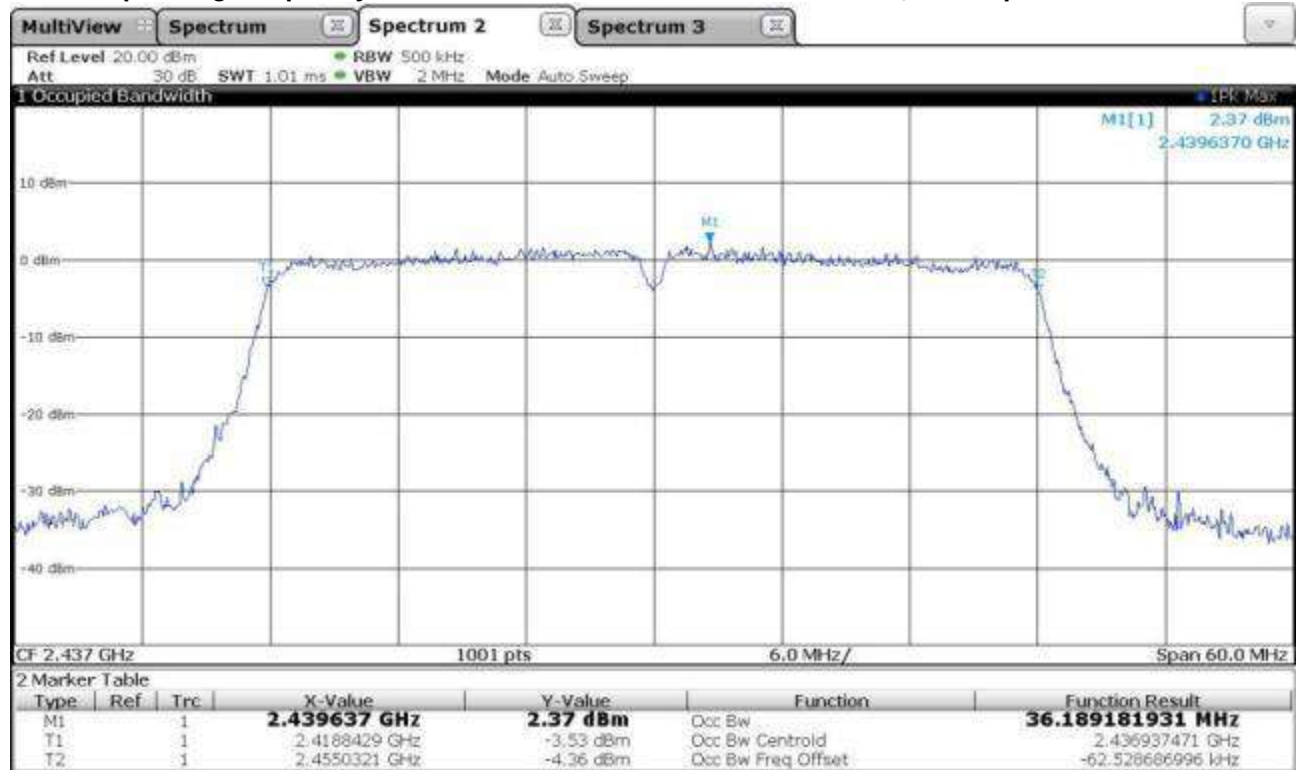
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
11	2462	17.618308497	-/-	Pass

Lowest operating frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



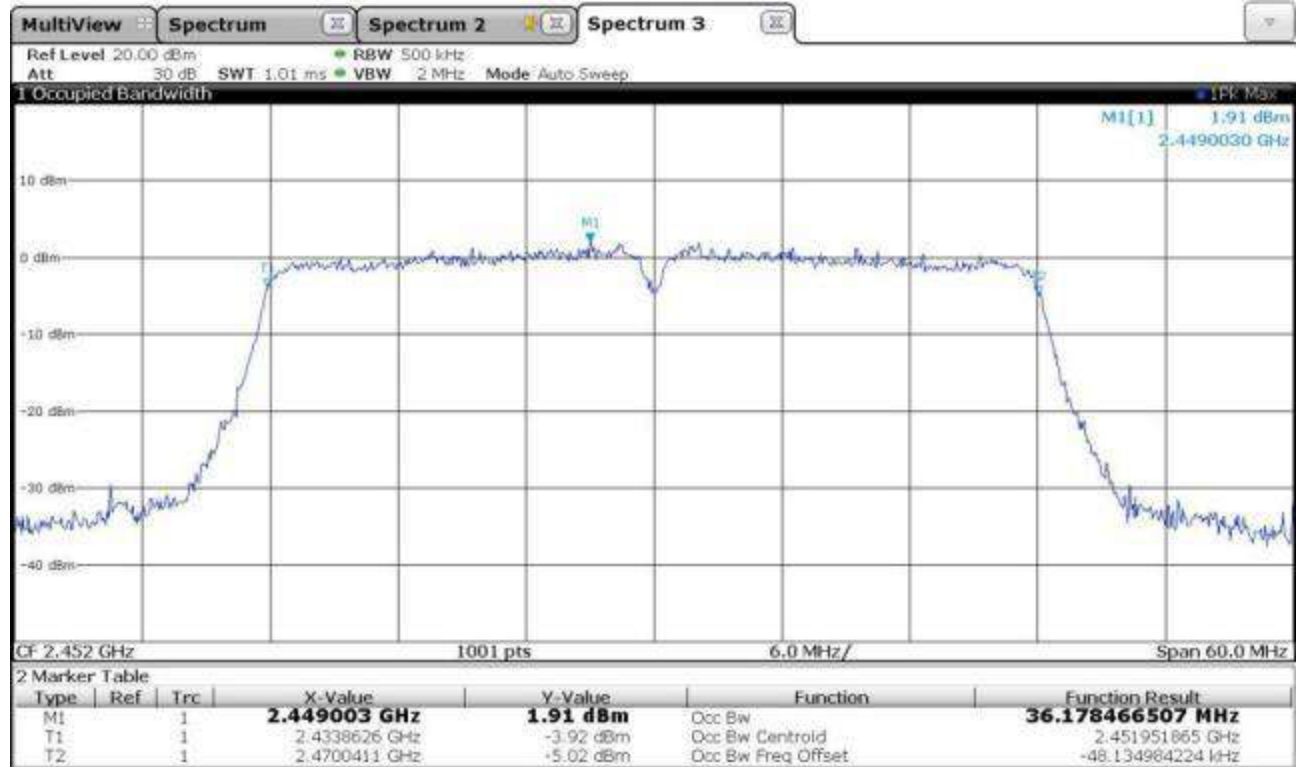
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
3	2422	36.133212297	-/-	Pass

Middle Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



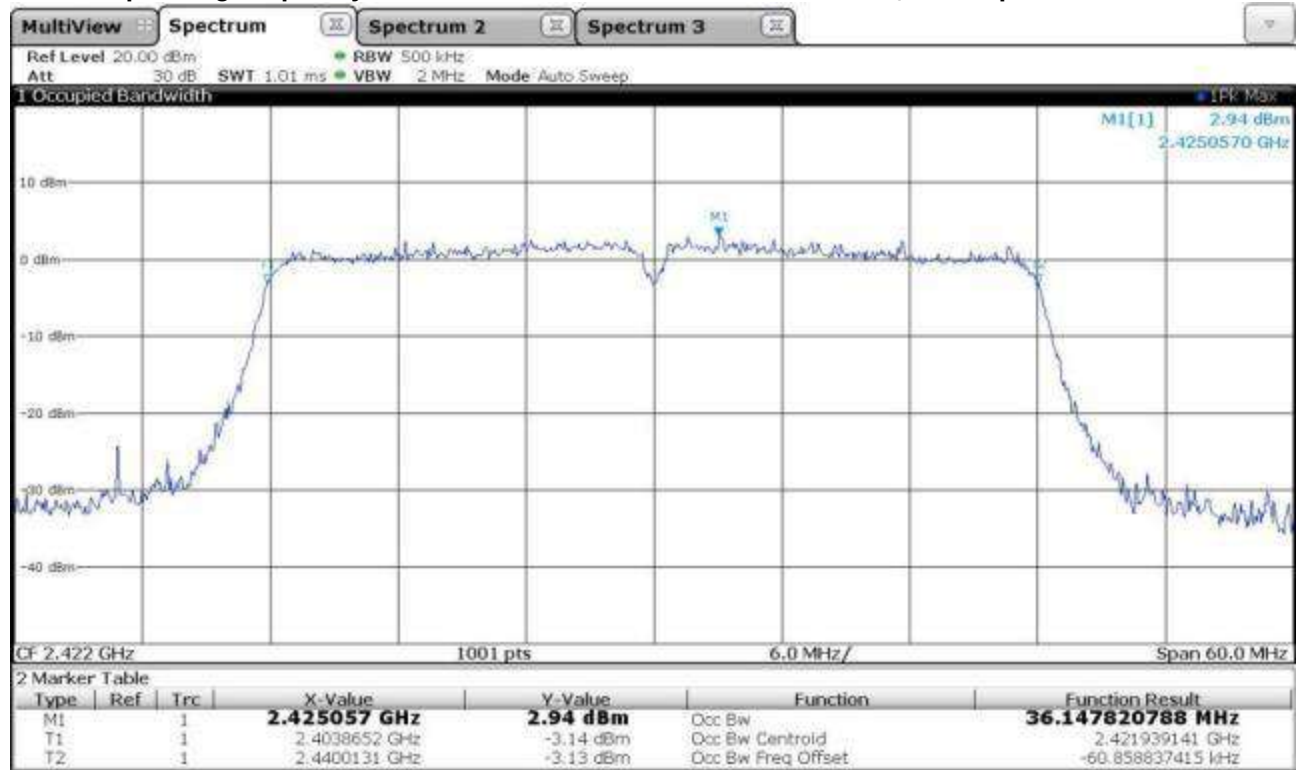
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
6	2437	36.189181931	-/-	Pass

Highest Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 1



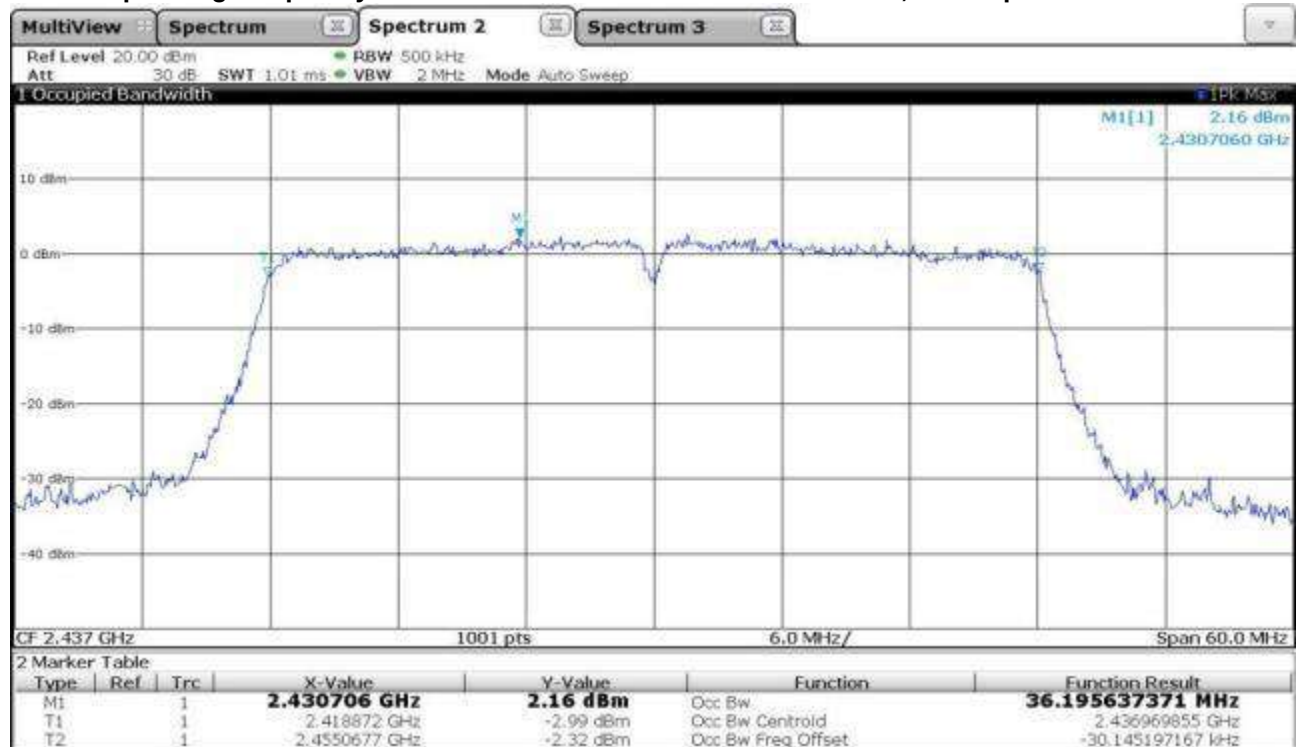
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
9	2452	36.178466507	-/-	Pass

Lowest operating frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



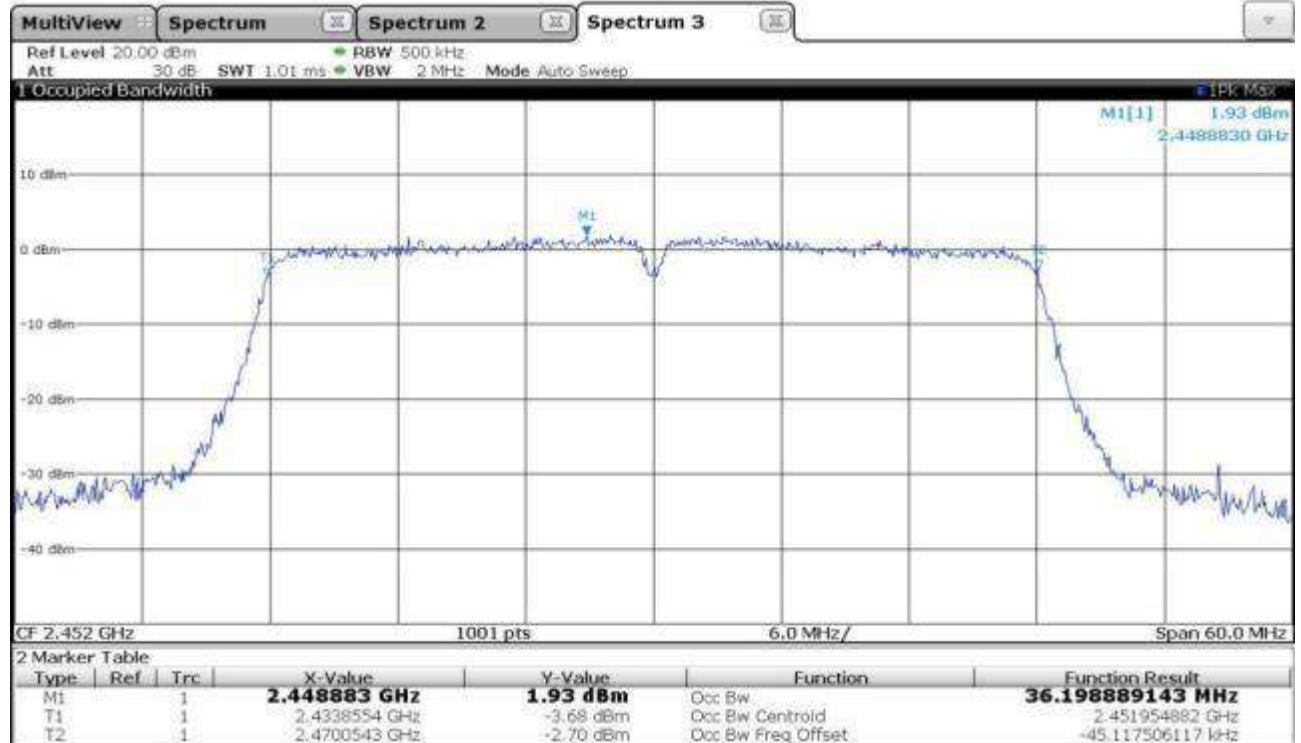
Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
3	2422	36.147820788	-/-	Pass

Middle Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
6	2437	36.195637371	-/-	Pass

Highest Operating Frequency - 802.11n 40MHz / HT Greenfield – MCS=0; 6.5 MBps / Antenna 2



Channel	Frequency [MHz]	99% Power Bandwidth [MHz]	Limit [MHz]	Result
9	2452	36.198889143	-/-	Pass

Results

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the **99% Power Bandwidth**.

8. Test equipment

Test equipment used for radiated Measurements:

Kind of equipment	Manufacturer	Type	Ident no.	Serial no.	Calibrated on (y-m)	Calibration interval
Signal Spectrum Analyzer 2Hz – 26.5 GHz	Rohde & Schwarz	FSW 26 Instrument FW 2.60	11571	102047	2019-Jan.	3 years
ESR7 EMI Testreceiver 7GHz	Rohde & Schwarz	ESR7	11676	101694	2018-March	3 years
Test-Receiver	Rohde & Schwarz	ESVS30	10572	833825/010	2020-April	3 years
Antenna 9 kHz – 30 MHz	EMCO	6502	10546	2018	2017-Nov.	3 years
Antenna 30 MHz – 1 GHz	Chase	CBL6111C	10022	1064	2019-Dec.	3 years
Antenna 1GHz – 18 GHz	Electro Metric	RGA50/60	10273	2753	2017-Nov.	3 years
Broadband-Hornantenne 15 - 26,5 (40) GHz	Schwarzbeck	BBHA 9170	11580	BBHA91706 21	2019-Dec.	3 years
Broadband-Preamplifier 1-18 GHz	Schwarzbeck	BBV9718	11231	9718-002	2017-Oct.	3 years
Preamplifier 18 - 40 GHz	CERNEX	CBM18403523	11679	29711	2019 - July	3 years
Cable	el-spec GmbH	FlexCore-SMA11-SMA11-8000-ARM	11625	-/-	2017-Dec.	3 years
Shielded room/Chamber	Frankonia	SAC3 "SEMI-ANECHOIC-CHAMBER"	11609	004/16	2019-March	3 years
Band Reject Filter	Telemeter	BRF-2450-150-7-N (0441)	11243	-/-	-/-	-/-
Above 26 GHz Substitution procedure						
Spectrum Analyzer	Rohde & Schwarz	FSMS 26	10481	839014/004	-/-	-/-
Spectrum-Analyzer Display	Rohde & Schwarz	FSMS 26	10482	838509/010	-/-	-/-
Harmonic Mixer	Rohde & Schwarz	FS-Z40	10779	842529/003	-/-	-/-
Harmonic Mixer LO-Amp.	Rohde & Schwarz	FS-Z30	10780	624413/005	-/-	-/-
Phase3 Ultra Low Loss Cable Assembly	TECH-INTER	GC12-K1K1-197	11718	1GVT4 19047702 001	-/-	-/-
Preamplifier 18 - 40 GHz	CERNEX	CBM18403523	11679	29711	2019 - July	3 years
A-INFO Braodband Horn Antenna	EMCO Elektronik GmbH	LB-180400-KF	11716	J211060840	-/-	-/-
Signal-Generator 100 KHz - 40 GHz	Rohde & Schwarz	SMB100A	11563	177769	2019-Jan.	3 years
Broadband-Hornantenne 15 - 26,5 (40) GHz	Schwarzbeck	BBHA 9170	11580	BBHA91706 21	2019-Dec.	3 years

Test equipment used for Band Edge Measurements:

Kind of equipment	Manufacturer	Type	Ident no.	Serial no.	Calibrated on (y-m)	Calibration interval
ESR7 EMI Testreceiver 7GHz	Rohde & Schwarz	ESR7	11676	101694	2018-March	3 years
Antenna 1GHz – 18 GHz	Electro Metric	RGA50/60	10273	2753	2017-Nov.	3 years
Cable	el-spec GmbH	FlexCore-SMA11-SMA11-8000-ARM	11625	-/-	2017-Dec.	3 years
Shielded room/Chamber	Frankonia	SAC3 "SEMI-ANECHOIC-CHAMBER"	11609	004/16	2019-March	3 years

Test equipment used for conducted measurements:

Kind of equipment	Manufacturer	Type	Ident no.	Serial no.	Calibrated on (y-m)	Calibration interval
Signal Spectrum Analyzer 2Hz – 26.5 GHz	Rohde & Schwarz	FSW 26 Instrument FW 2.60	11571	102047	2019 - Jan.	3 years
EMI-Test-Receiver	Rohde & Schwarz	ESR7 Instrument FW 3.36	11505	101103	2017 - Nov.	3 years
Automatisation unit RF switch and power meter	Rohde & Schwarz	OSP120 and OSP B157	11573	101282	2017 - Dec.	3 years
Cable	el-spec GmbH	FlexCore-SMA11-SMA11-8000-ARM	11625	-/-	2017 - Dec.	3 years

Test equipment used for Conducted Mains emissions:

Kind of equipment	Manufacturer	Type	Ident no.	Serial no.	Calibrated on (y-m)	Calibration interval
Test-Receiver	Rohde & Schwarz	ESHS30	10571	842053/008	2019 – Mar.	3 years
Software	PKM	PKM U5/6	-/-	V1.01.03	-/-	-/-
Line impedance stabilisation network (LISN)	Rohde & Schwarz	ESH2-Z5	10139	879675/028	2019 – Jan.	3 years
Shielded room	Siemens	(6,2 x 4,7 x 3,3) m (l x w x h) DC – 10 GHz	10113	1	-/-	-/-

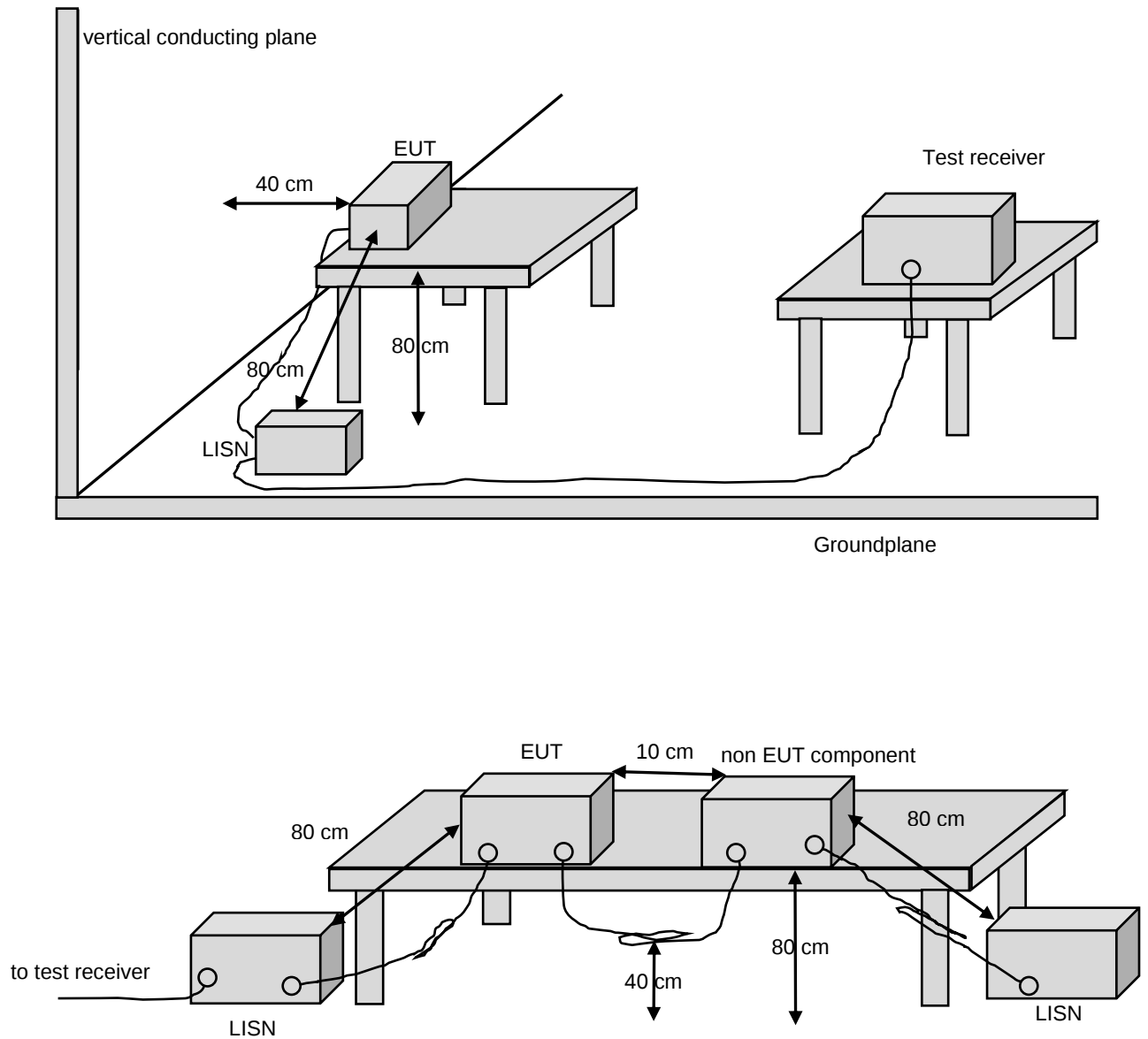
All measurements were made with measuring instruments, including any accessories that may affect test results, calibrated according to the requests of ISO/IEC 17025 according to which the test site is accredited from DAkkS. Measurement of conducted mains emissions was made with instruments conforming to American National Standard Specification, ANSI C63.4-2014.

Test equipment to support EUT functions:

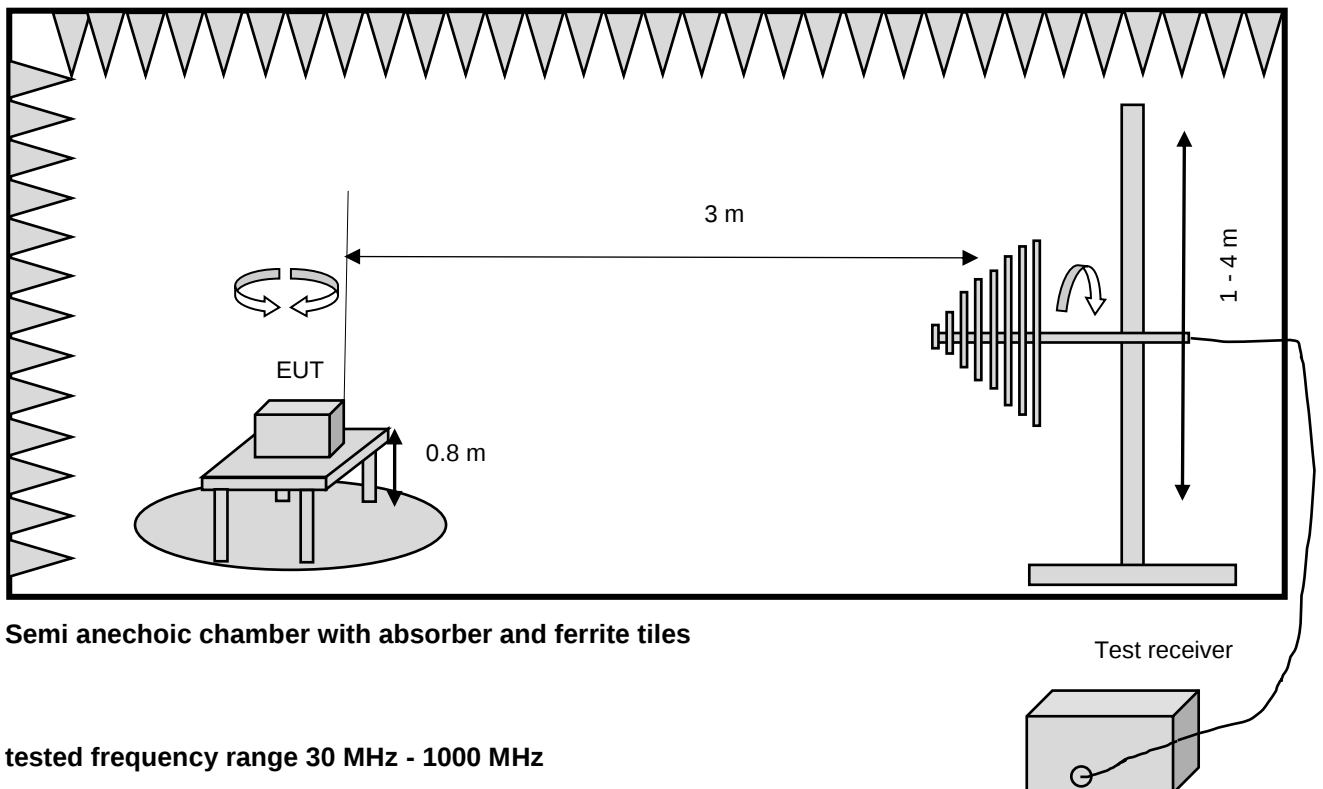
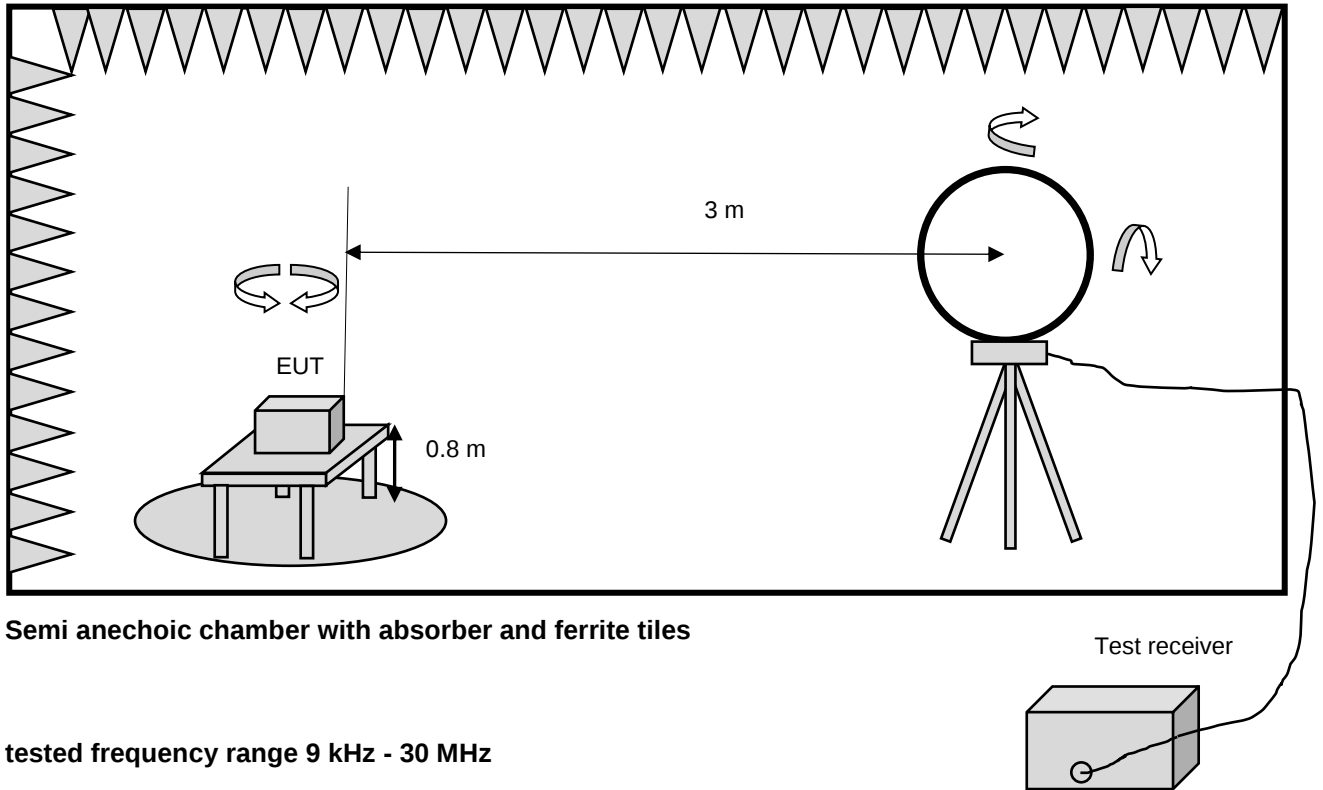
Kind of equipment	Manufacturer	Type	Ident no.
Laptop	DELL	Inspiron	11488
AC-Adaptor [Laptop/EUT]	DELL	DA130PE1-00	Part of 11488
Test Adaptor Board	Vestel (Client)	17TEST02	Client
Software	Provided by Vestel (Client)	MT7662U QA Tool	-/-

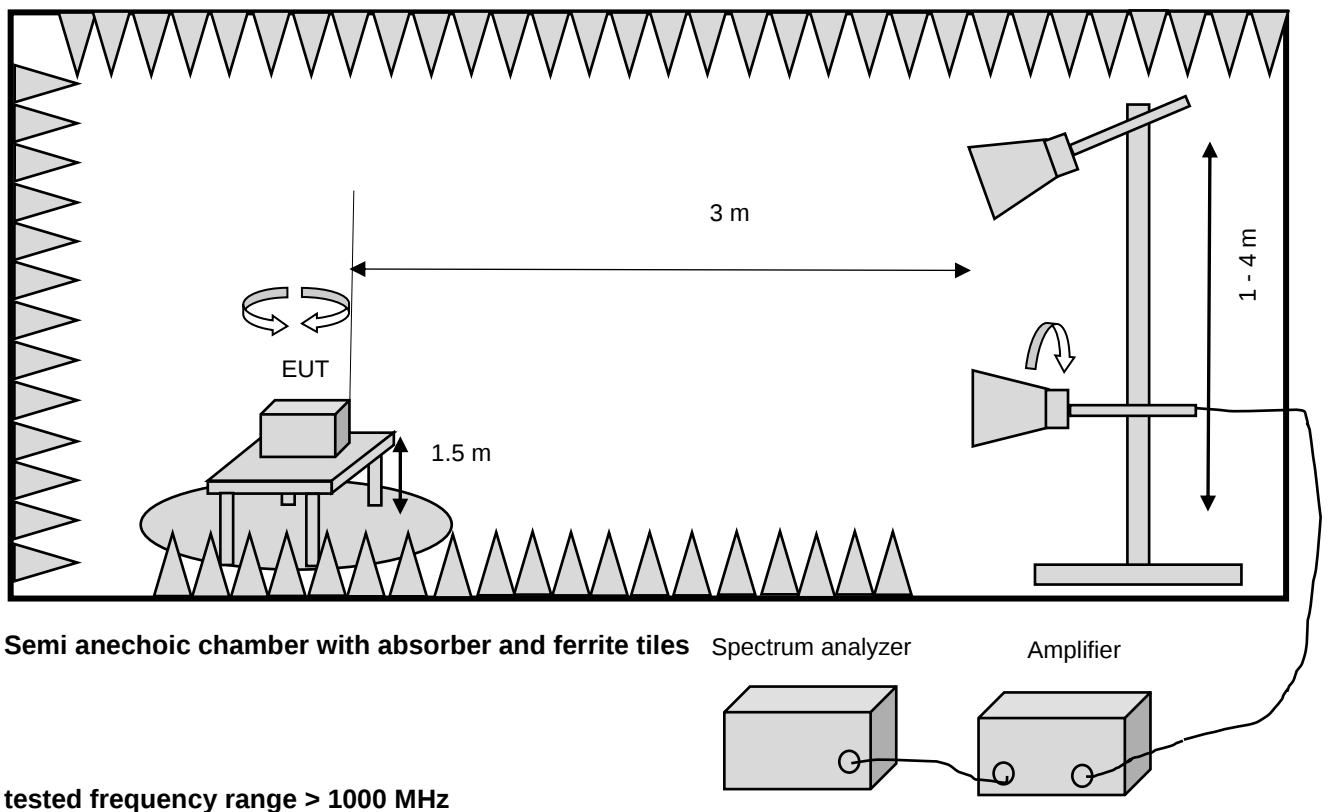
9. Test Setups

Block diagram Conducted Mains emissions

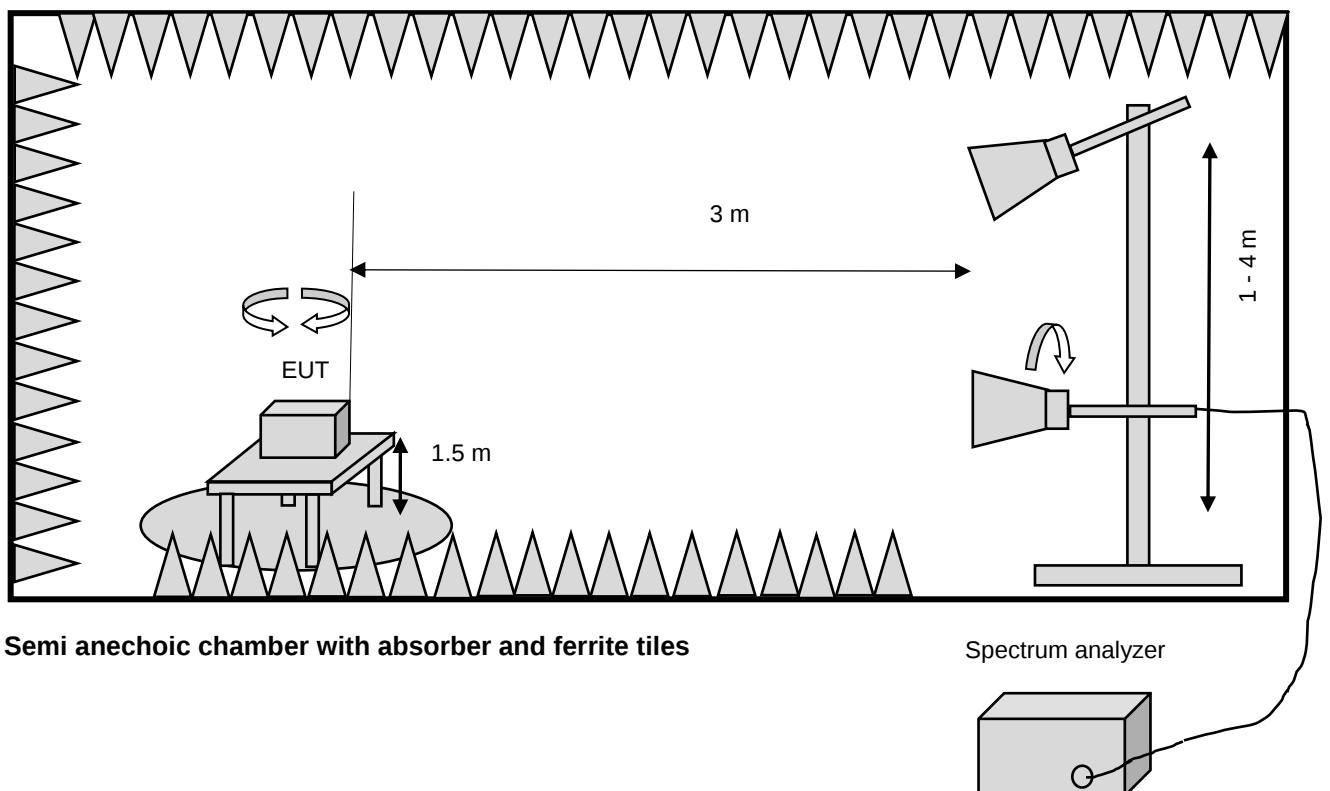


Block diagram Radiated emissions

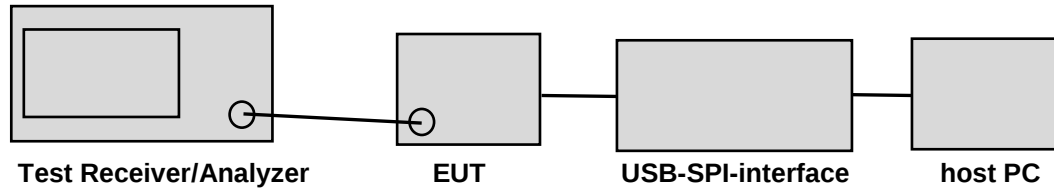




Block diagram Band Edge emissions



Block diagram for conducted measurements



10. Measurement uncertainty

according to CISPR 16-4-2 Edition 2.0 2011-06

Measurement	calculated uncertainty U_{lab}	Specified CISPR uncertainty according CISPR 16-4-2 Edition 2.0 2011-06, table 1 U_{CISPR}
Conducted disturbance at mains port using AMN 9 kHz – 150 kHz	3.6 dB	3.8 dB
Conducted disturbance at mains port using AMN 150 kHz – 30 MHz	3.2 dB	3.4 dB
Magn. fieldstrength 9kHz - 30MHz	3.4 dB	-/-
Radiated disturbance (electric field strength in the SAC) 30 MHz to 1 000 MHz	4.7 dB	6.3 dB
Radiated disturbance (electric field strength in the SAC) 1 GHz to 26.5 GHz	4.1 dB	-/-
Radiated disturbance (electric field strength in the SAC) 26.5 GHz to 40 GHz	3.1 dB	-/-

Measurement	calculated uncertainty U_{lab}	Maximum measurement uncertainty
Channel Bandwidth	$\pm 1.17 \%$	$\pm 5 \%$
RF output power, conducted	$\pm 1.36 \text{ dB}$	$\pm 1.5 \text{ dB}$
Power Spectral Density, conducted	$\pm 1.99 \text{ dB}$	$\pm 3 \text{ dB}$
Unwanted Emissions, conducted	$\pm 1.71 \text{ dB}$	$\pm 3 \text{ dB}$
All emissions, radiated	$\pm 4.8 \text{ dB}$	$\pm 6 \text{ dB}$
Temperature	$\pm 0.72 \text{ }^{\circ}\text{C}$	$\pm 3 \text{ }^{\circ}\text{C}$
Supply voltages	$\pm 0.76 \%$ (DC up to 40V)	$\pm 3 \%$
	$\pm 1.74 \%$ (AC 50Hz up to 400V)	
Time	$\pm 0.012 \%$	$\pm 5 \%$

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT in the above mentioned way.

The measurements uncertainty was calculated in accordance with CISPR 16-4-2 Edition 2.0 2011-06.

The measurement uncertainty was given with a confidence of 95 % ($k = 2$).

11. Photos setup

Refer to “0030-fcc-ised-photos test setup.pdf” file

12. Conclusions

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the relevant §15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the relevant RSS-247 issue 02 Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network

Following specific modifications and/or special attributes are necessary to pass the above mentioned requirements:

none

This test report replaces the test report no. 20/01-0030 dated 10.04.2020.

21.10.2020
Erstellt am/prepared on

M. Beindl, Laboratory Engineer
(Name/name / Stellung/position)


(Unterschrift/signature)

21.10.2020
Freigabe am/released on

A. Tropmann, Head of Laboratory
(Name/name / Stellung/position)


(Unterschrift/signature)

 TESTED IN GERMANY	Test report no.: 20/01-0030-A	Page 108 of 108 pages
--	---	-----------------------

13. Photos of tested sample

Refer to “0030-fcc-ised-ext-photos.pdf” file

End of test report