

Prüfbericht-Nr.: Test Report No.:	50323264 001	Auftrags-Nr.: Order No.:	238110492	Seite 1 von 51 Page 1 of 51
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	26-Sep-2019	
Auftraggeber: Client:	Pamex Inc. PAMEX INC, 4680 VINITA CT, CHINO, CA, 91710, UNITED STATES			
Prüfgegenstand: Test item:	Enkore			
Bezeichnung / Typ-Nr.: Identification / Type No.:	KE1-LNP5C			
Auftrags-Inhalt: Order content:	FCC Part 15C Test report (WiFi 2.4GHz)			
Prüfgrundlage: Test specification:	FCC 47CFR Part 15: Subpart C Section 15.247			
Wareneingangsdatum: Date of receipt:	04-Dec-2019			
Prüfmuster-Nr.: Test sample No.:	A001037229-001,002			
Prüfzeitraum: Testing period:	05-Dec-2019 - 31-Jan-2020			
Ort der Prüfung: Place of testing:	EMC/RF Laboratory Taipei			
Prüflaboratorium: Testing laboratory:	TUV Rheinland Taiwan Ltd.			
Prüfergebnis*: Test result*:	Pass			
Report date / tested by:		kontrolliert von / reviewed by:		
 03-Feb-2020 Mars Y.J. Lin / Project Engineer		 03-Feb-2020 Ryan Chen / Project Manager		
Datum Date	Name / Stellung Name / Position	Unterschrift Signature	Datum Date	Name / Stellung Name / Position
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.				

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Passed

5.1.2 PEAK OUTPUT POWER

RESULT: Passed

5.1.3 6dB BANDWIDTH AND 99% BANDWIDTH

RESULT: Passed

5.1.4 POWER DENSITY

RESULT: Passed

5.1.5 CONDUCTED SPURIOUS EMISSIONS AND FREQUENCY BAND EDGE MEASURED IN 100kHz BANDWIDTH

RESULT: Passed

5.1.6 SPURIOUS EMISSION

RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed

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1. General Remarks

1.1 Complementary Materials

The following attachments are integral parts of this test report:

Appendix P: Photo Documentation

(File Name: 50323264 001 APPENDIX P)

Appendix D: Test Result of Radiated Emissions

(File Name: 50323264 001 APPENDIX D)

Test Specifications

Table 1: Applied Standard and Test Levels

Radio
FCC CFR47 Part 15: Subpart C Section 15.247 FCC CFR47 Part 2: Subpart J Section 2.1091 ANSI C63.10:2013 KDB558074 D01 DTS Meas Guidance v05 KDB447498 D01 General RF Exposure Guidance v06

1.2 Decision Rule of conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

TUV Rheinland Taiwan Ltd.

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facility

TUV Rheinland Taiwan Ltd.

No. 458-18, Sec 2, Fenliao., Linkou Dist.
New Taipei City 244
Taiwan (R.O.C.)

FCC Registration No.: 226631
IC Canada Registration No.: 25563
TAF Accredited NCC Test Lab. No.:3567
TAF ISO17025 Certification effective period: 6th-May-2019 to 05th-May-2022



Testing Laboratory
3567

2.3 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
EMI Test Receiver	R&S	ESR7	102108	2019/2/06	2020/2/05
Spectrum Analyzer	R&S	FSV40	101508	2019/2/05	2020/2/04
Pre-Amplifier	Agilent	8447D	2944A10772	2019/2/22	2020/2/21
Pre-Amplifier	EMCI	EMC051845SE	980633	2019/2/25	2020/2/24
Pre-Amplifier	EMCI	EMC184045SE	980657	2019/2/23	2020/2/22
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2020/1/14	2021/1/13
Horn Antenna	ETS-Lindgren	3117	00218930	2020/12/27	2021/12/26
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2019/4/12	2020/4/11
Loop Antenna	EMCI	LPA600	287	2019/12/20	2020/12/19
Test Software	Audix	e3	Ver. 9	N/A	N/A
Test Cable	HUBER+SUHNER	SUCOFLEX 104EA 9k~18G	800056/4EA	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 104 9k~18G	804680/4	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 104 9k~18G	MY37202/4	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 102EA 1G~40G	800898/2EA	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 102EA 1G~40G	800901/2EA	2019/4/18	2020/4/17
Test Cable	HUBER+SUHNER	SUCOFLEX 102EA 1G~40G	801027/2EA	2019/4/18	2020/4/17
Spectrum Analyzer	R&S	FSV40	101513	2019/2/8	2020/2/8
Thermo Chamber	Giant Force	GHT-150-40-CP-SD	MAA1902-010	2019/2/1	2020/2/1
Power Meter	Anritsu	ML2495A	1901008	2019/4/29	2020/4/28
Power Sensor	Anritsu	MA2411B	1725269	2019/4/29	2020/4/28

2.4 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.5 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.6 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements are $\pm 3\text{dB}$.

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
RF power, conducted	$\pm 1.5 \text{ dB}$
Adjacent channel power	$\pm 3 \text{ dB}$
Radiated emission of transmitter, valid up to 26 GHz	$\pm 6 \text{ dB}$
Radiated emission of receiver, valid up to 26 GHz	$\pm 6 \text{ dB}$
Temperature	$\pm 2 \text{ }^{\circ}\text{C}$
Humidity	$\pm 10 \text{ } \%$

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a Door Lock. It contains a WiFi compatible module enabling the user to communicate data through a Wireless interface.
For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment	Enkore
Type Designation	KE1-LNP5C
FCC ID	2AQ8A-KE1LNP5C

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequencies	2412~2462 MHz
Channel Spacing	5 MHz
Channel number	802.11b/g/n: 11
Operation Voltage	6Vdc
Modulation	802.11b: DSSS 802.11g/n: OFDM with BPSK, QPSK, QAM
Antenna gain	3.3 dBi

3.3 Independent Operation Modes

Basic operation modes are:

- A. Transmitting
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel
- B. Receiving
- C. Standby
- D. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- | | |
|-------------------------|----------------------|
| - Block Diagram | - Circuit Diagram |
| - PCB Layout | - Instruction Manual |
| - Photo Document | - Rating Label |
| - Technical Description | |

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The test modes were adapted accordingly in reference to the instructions for use.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Table 6: Table for Parameters of Test Software Setting

Mode	Channel Frequency		
	2412 MHz	2437 MHz	2462 MHz
802.11b	0	0	0
802.11g	0	0	0
802.11n20	0	0	0

4.2 Test Operation and Test Software

Setup for testing: Test samples are provided with a USB interface which makes it possible to control them through a test software installed on a notebook computer.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 3.3 as appropriate.

The samples were used as follows:

Conducted: A001037229-001

Radiation: A001037229-002

Full test was applied on all test modes, but only worst case was shown

IEEE 802.11b mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 1Mbps data rate were chosen for full testing.

IEEE 802.11g mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11n HT 20 mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 13Mbps data rate were chosen for full testing.

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

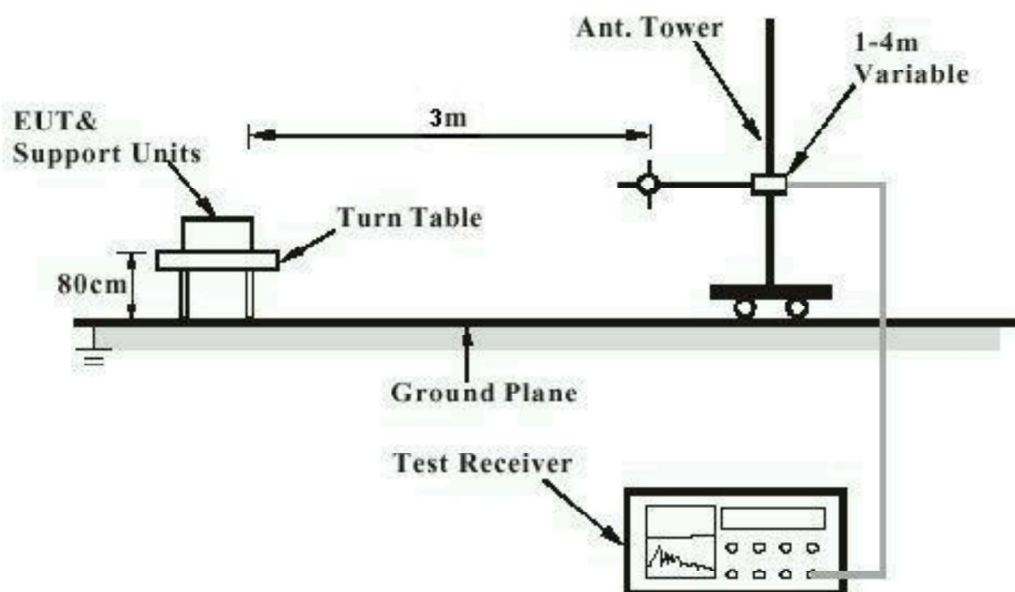
Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

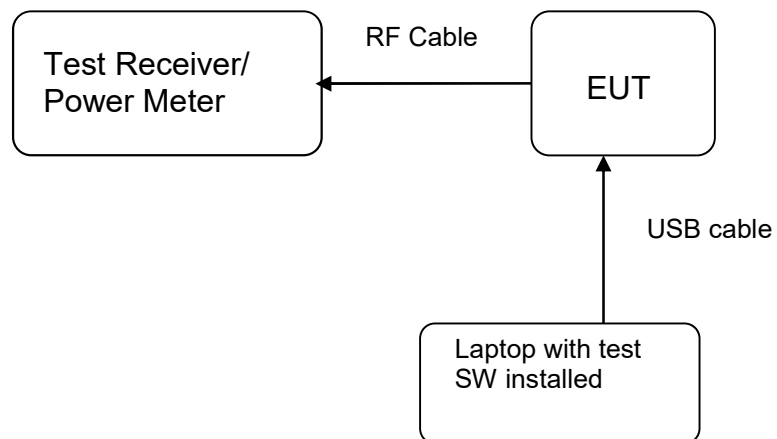
4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m.

Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Test standard	:	FCC Part 15.247 (b)(4), Part 15.203
Limit	:	the use of antennas with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 3.3 dBi. The antenna is a printed PCB trace with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

5.1.2 Peak Output Power

RESULT:

Passed

Test standard : FCC Part 15.247 (b)(3)
 Basic standard : ANSI C63.10:2013, KDB558074
 Limit : 1 Watt
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A

 Ambient temperature : 22-26 °C
 Relative humidity : 50-65 %
 Atmospheric pressure : 100-103 kPa

Table 7: Test result of Peak Output Power (802.11b)

Channel	Channel Frequency (MHz)	Peak Output Power		Average Output Power	Limit
		(dBm)	(W)	(W)	(W)
Low Channel	2412	13.75	0.02371	0.01445	1
Middle Channel	2437	15.71	0.03724	0.02249	1
High Channel	2462	13.63	0.02307	0.01462	1

Table 8: Test result of Peak Output Power (802.11g)

Channel	Channel Frequency (MHz)	Peak Output Power		Average Output Power	Limit
		(dBm)	(W)	(W)	(W)
Low Channel	2412	17.81	0.06039	0.01396	1
Middle Channel	2437	17.78	0.05998	0.01807	1
High Channel	2462	17.37	0.05458	0.01167	1

Table 9: Test result of Peak Output Power (802.11n HT20)

Channel	Channel Frequency (MHz)	Output Power		Average Output Power	Limit
		(dBm)	(W)	(W)	(W)
Low Channel	2412	17.78	0.05998	0.01112	1
Middle Channel	2437	17.71	0.05902	0.01742	1
High Channel	2462	17.37	0.05458	0.00966	1

Max Avg Value: 22.49mW

5.1.3 6dB Bandwidth and 99% Bandwidth**RESULT:****Passed**

Test standard : FCC Part 15.247 (a)(2)
Basic standard : ANSI C63.10:2013, KDB558074
Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
Operation Mode : A

Ambient temperature : 22-26°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103 kPa

Table 10: Test result of 6dB Bandwidth (802.11b)

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	9.08	≥0.5	Pass
Mid Channel	2437	9.53	≥0.5	Pass
High Channel	2462	9.08	≥0.5	Pass

Table 11: Test result of 6dB Bandwidth (802.11g)

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	15.02	≥0.5	Pass
Mid Channel	2437	14.12	≥0.5	Pass
High Channel	2462	14.99	≥0.5	Pass

Table 12: Test result of 6dB Bandwidth (802.11n HT20)

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	12.98	≥0.5	Pass
Mid Channel	2437	12.83	≥0.5	Pass
High Channel	2462	13.10	≥0.5	Pass

Table 13: Test result of 99% Bandwidth (802.11b)

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Low Channel	2412	14.055
Mid Channel	2437	13.966
High Channel	2462	13.936

Table 14: Test result of 99% Bandwidth (802.11g)

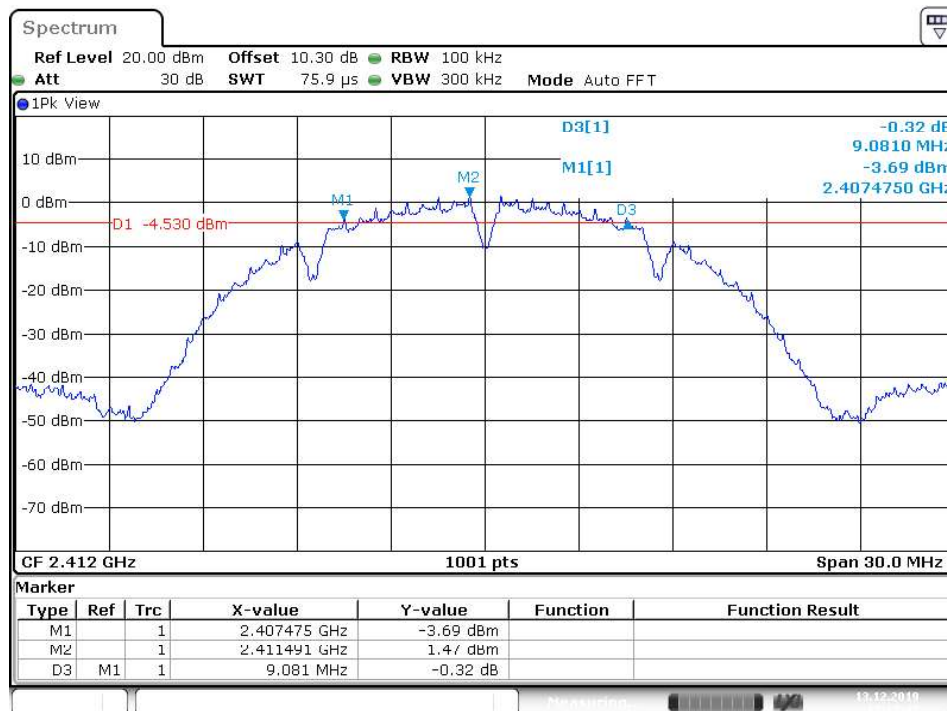
Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Low Channel	2412	16.543
Mid Channel	2437	16.633
High Channel	2462	16.693

Table 15: Test result of 99% Bandwidth (802.11n HT20)

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Low Channel	2412	17.562
Mid Channel	2437	17.682
High Channel	2462	17.562

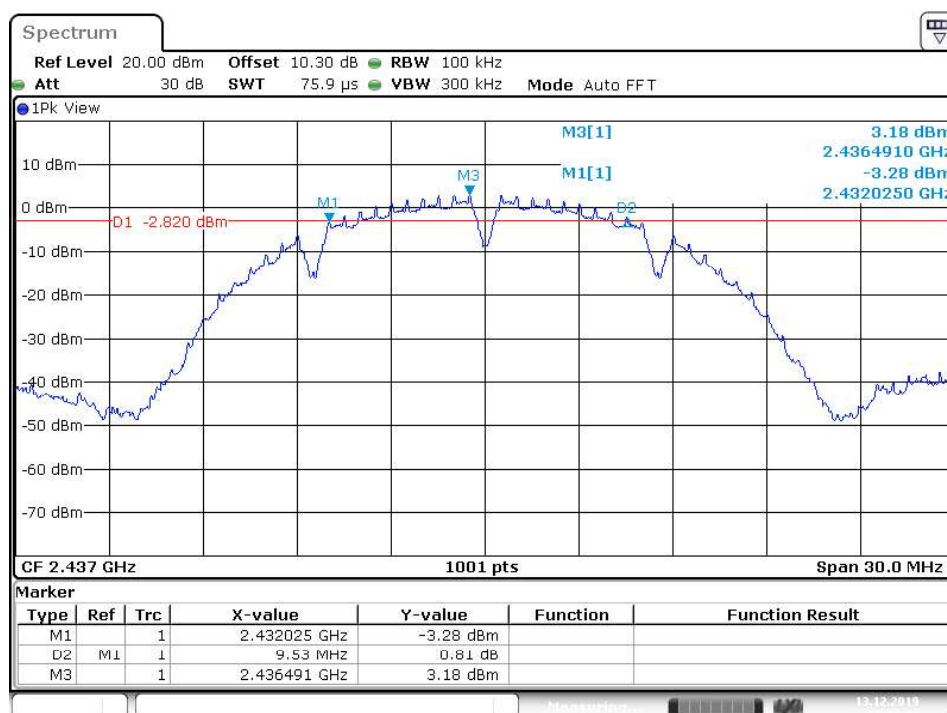
Test Plot of 6dB Bandwidth (802.11b)

Low Channel

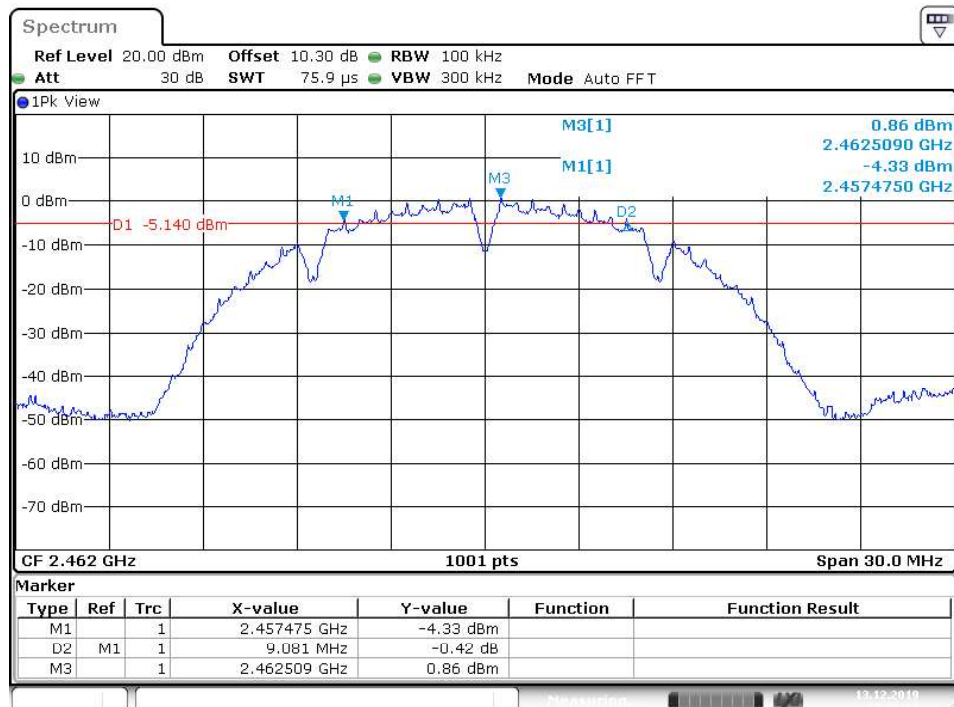
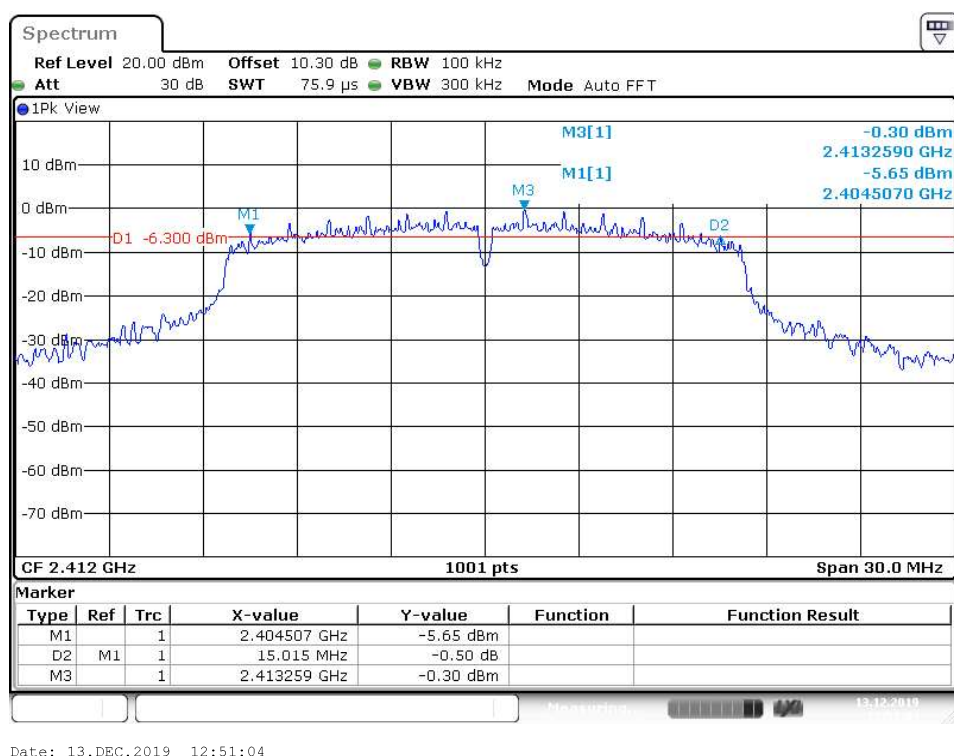


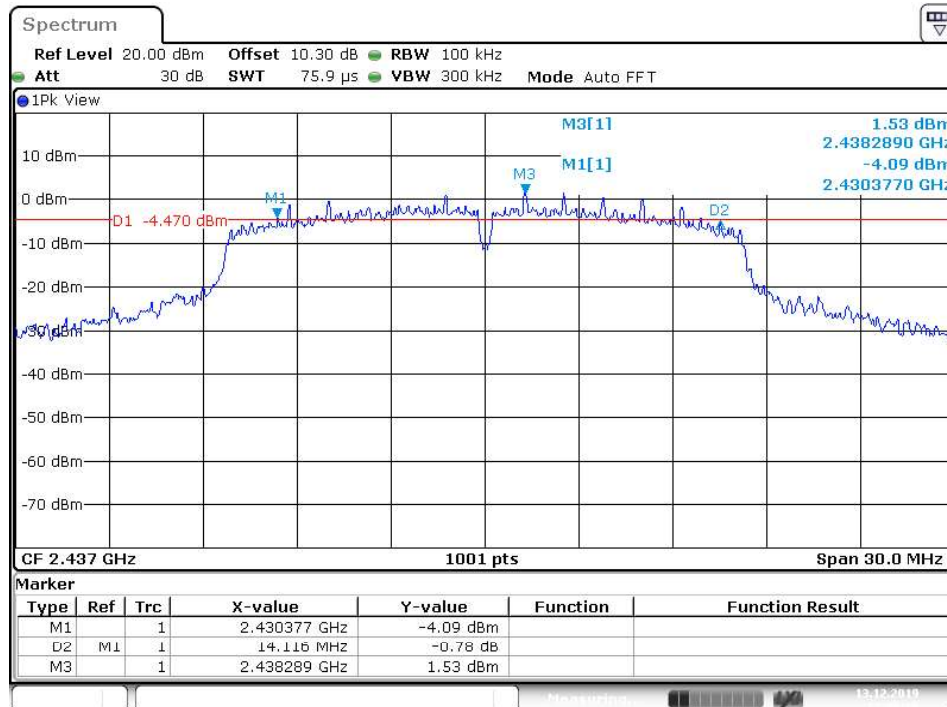
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Middle Channel

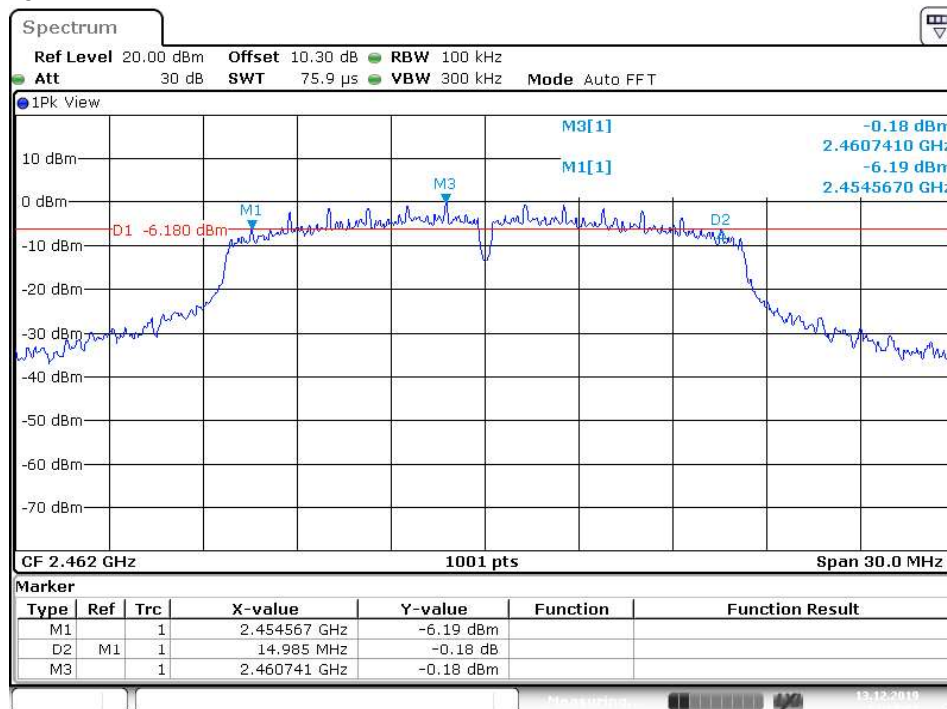


Date: 13.DEC.2019 12:27:21

High Channel

Test Plot of 6dB Bandwidth (802.11g)
Low Channel


Middle Channel


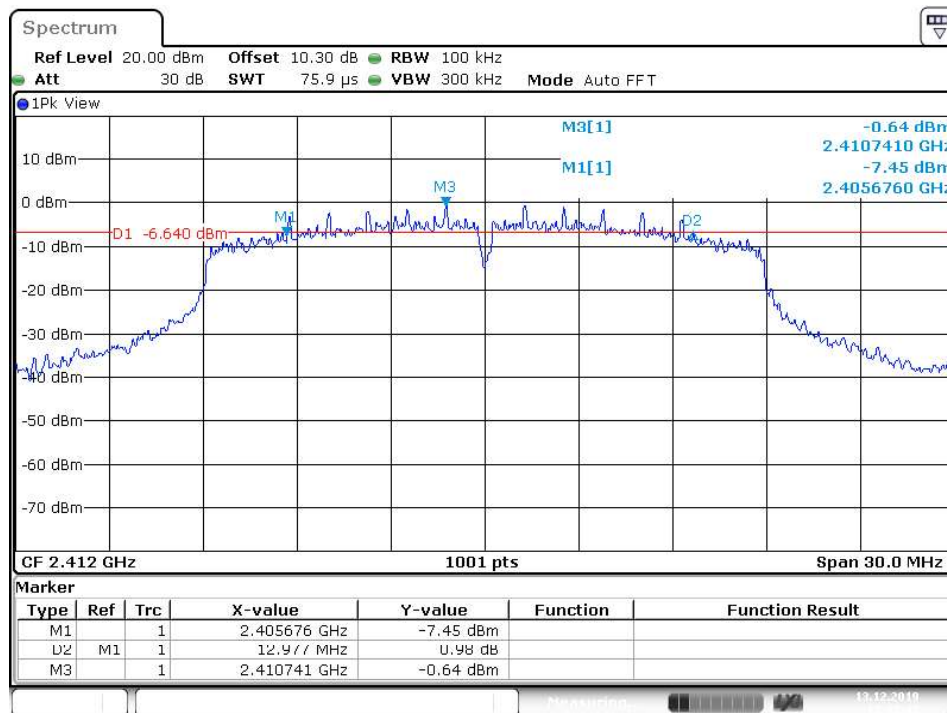
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High Channel


Date: 13.DEC.2019 14:19:21

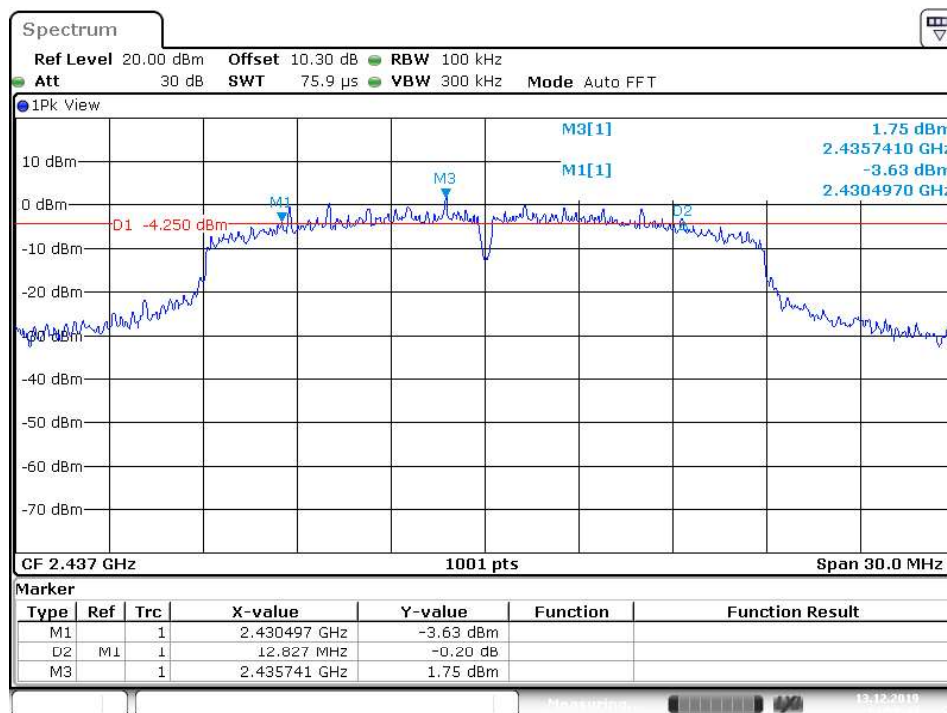
Test Plot of 6dB Bandwidth (802.11n HT20)

Low Channel



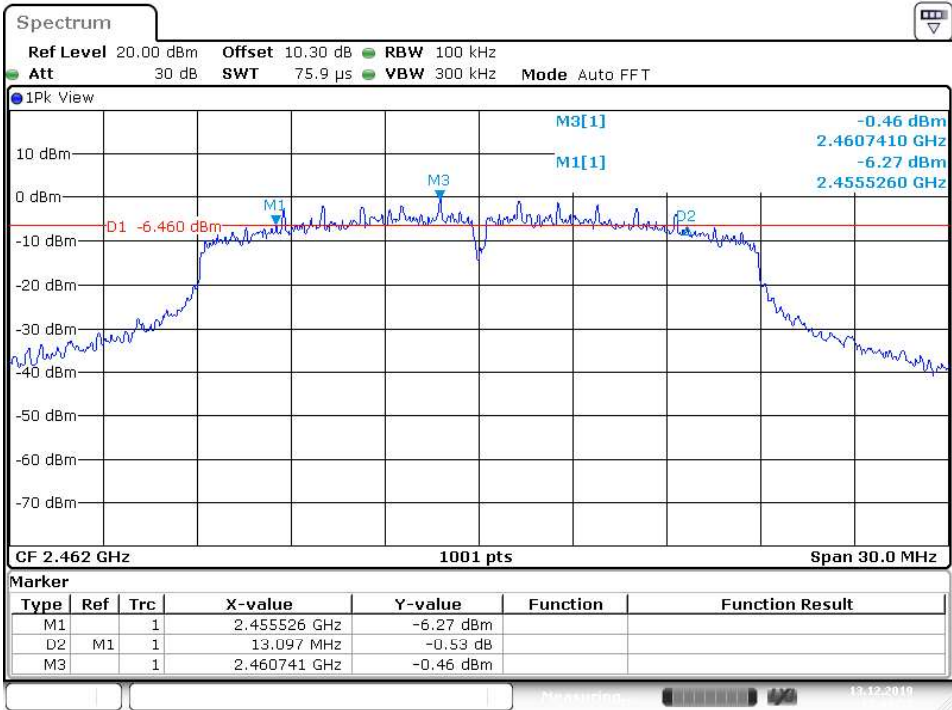
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Middle Channel



Date: 13.DEC.2019 14:50:44

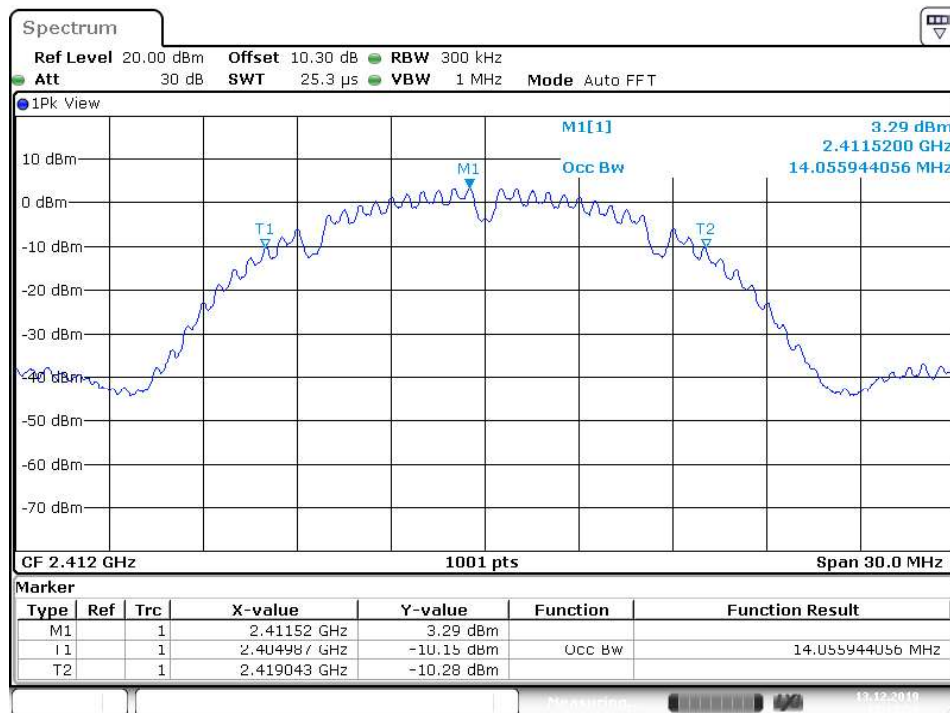
High Channel



Date: 13.DEC.2019 15:00:57

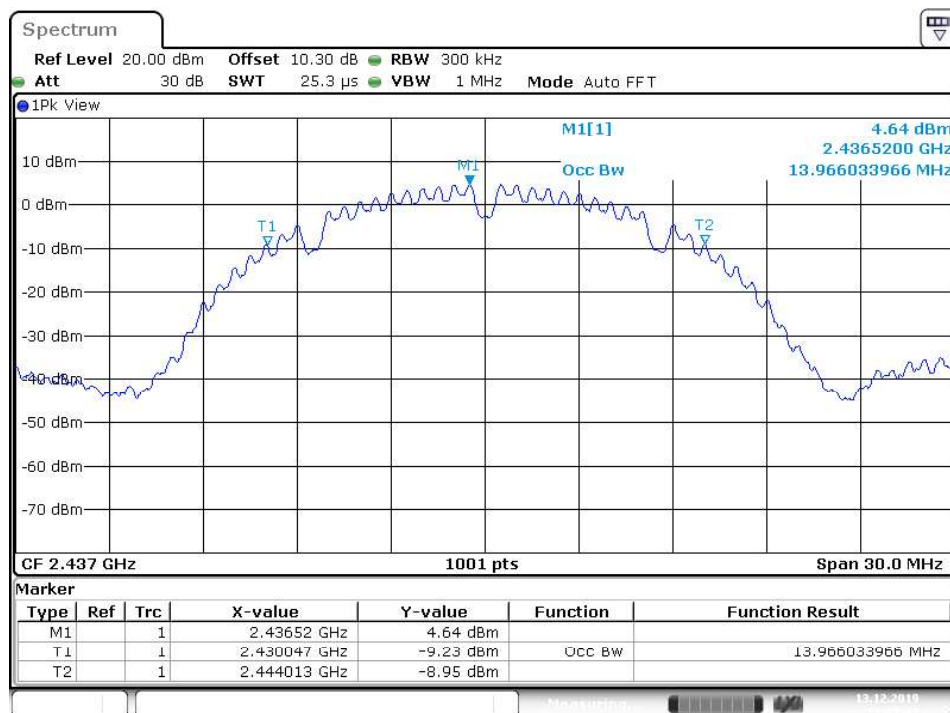
Test Plot of 99% Bandwidth (802.11b)

Low Channel

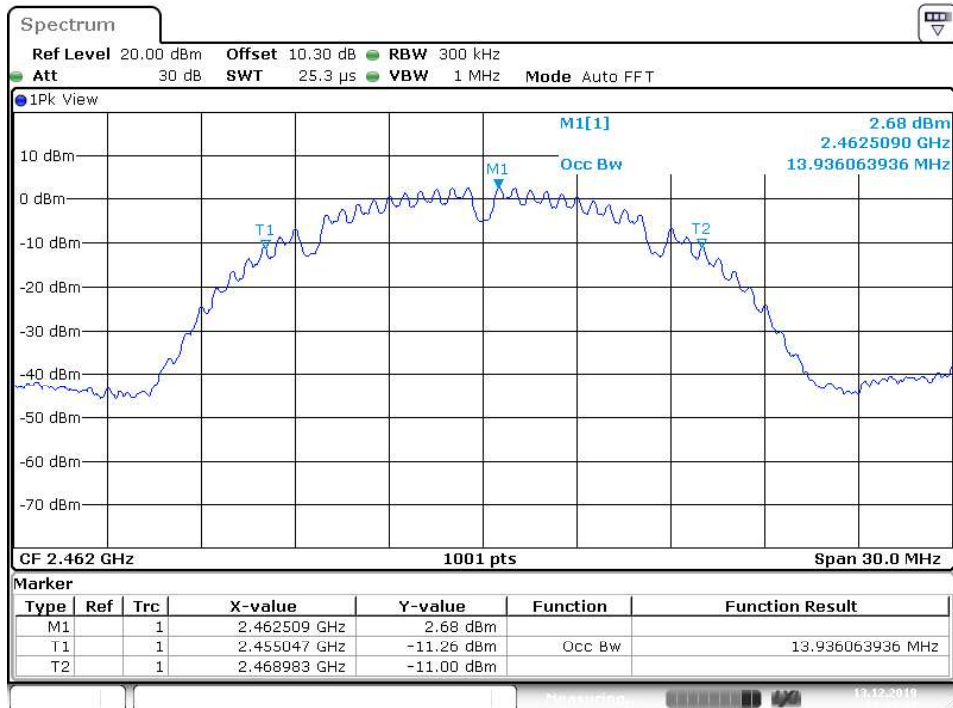


Date: 13.DEC.2019 12:17:53

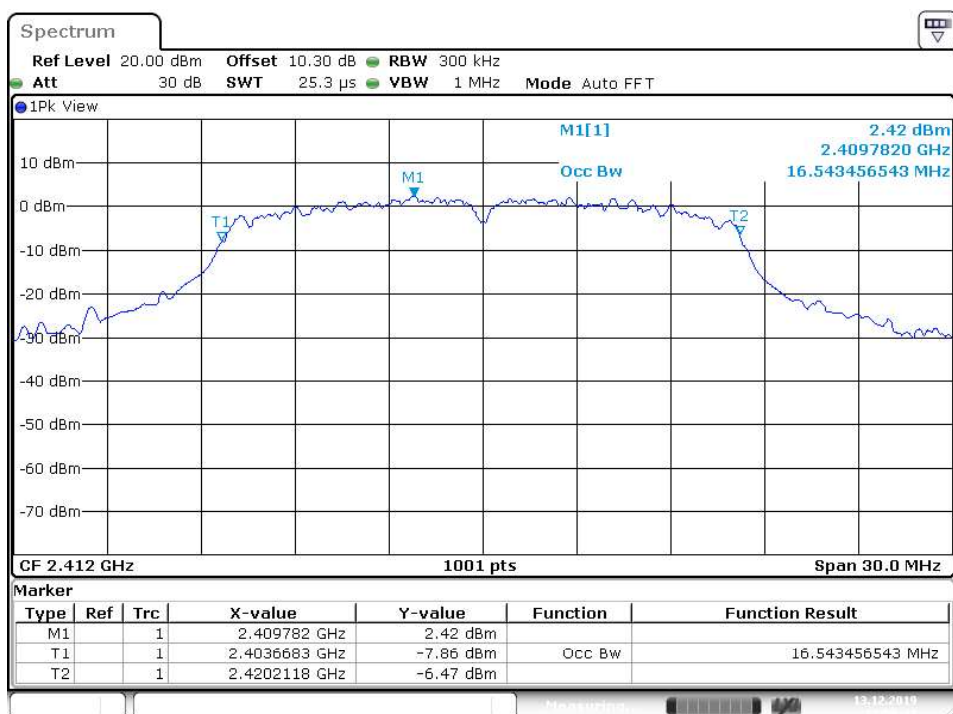
Middle Channel



Date: 13.DEC.2019 12:28:41

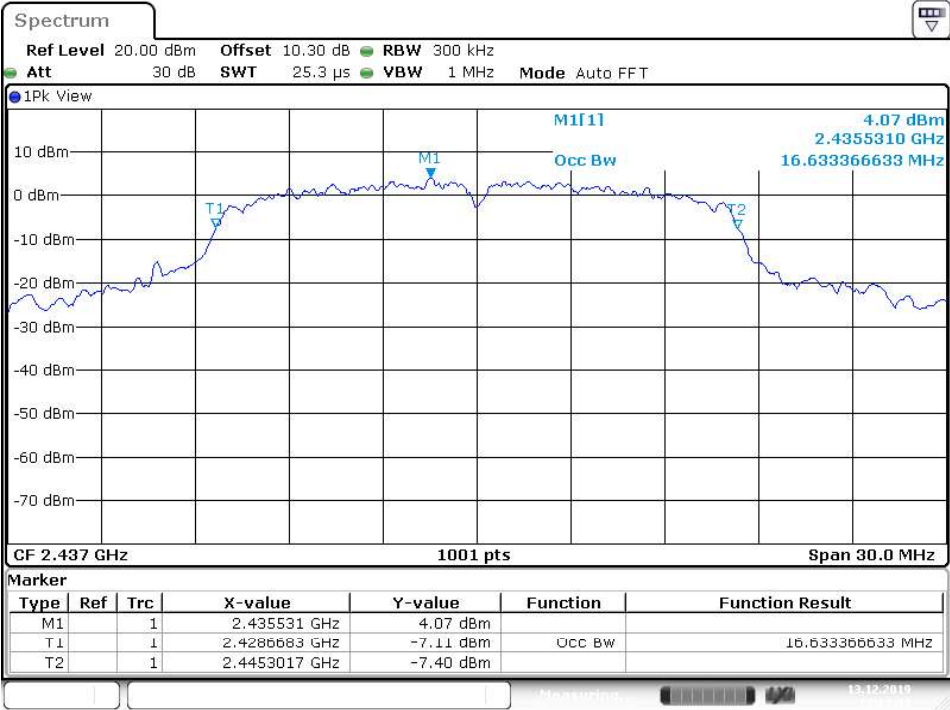
High Channel


Date: 13.DEC.2019 12:37:35

Test Plot of 99% Bandwidth (802.11g)
Low Channel


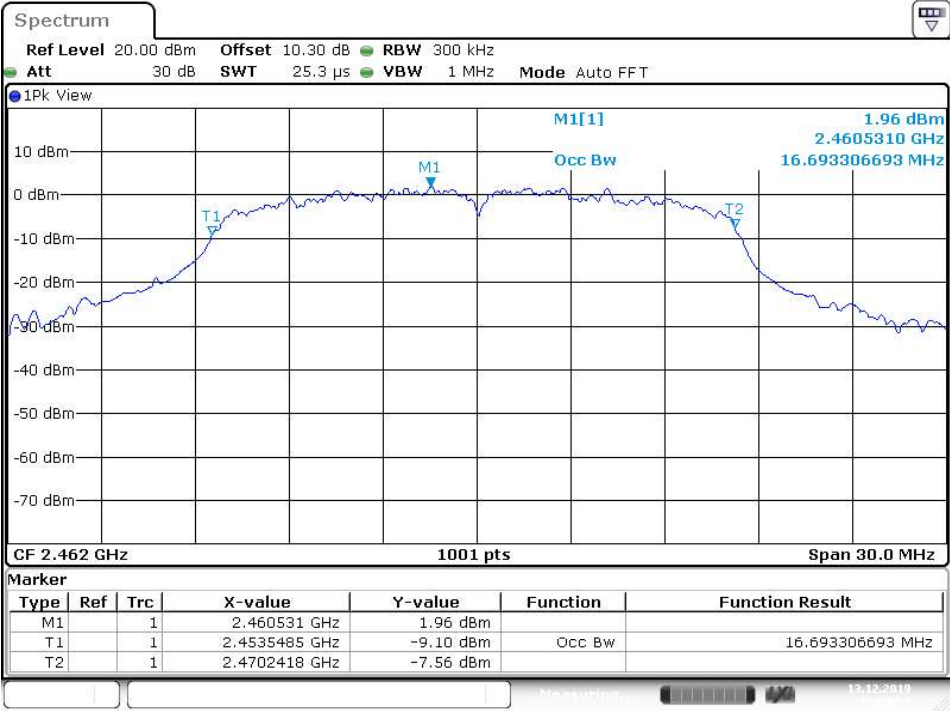
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Middle Channel



Date: 13.DEC.2019 13:11:31

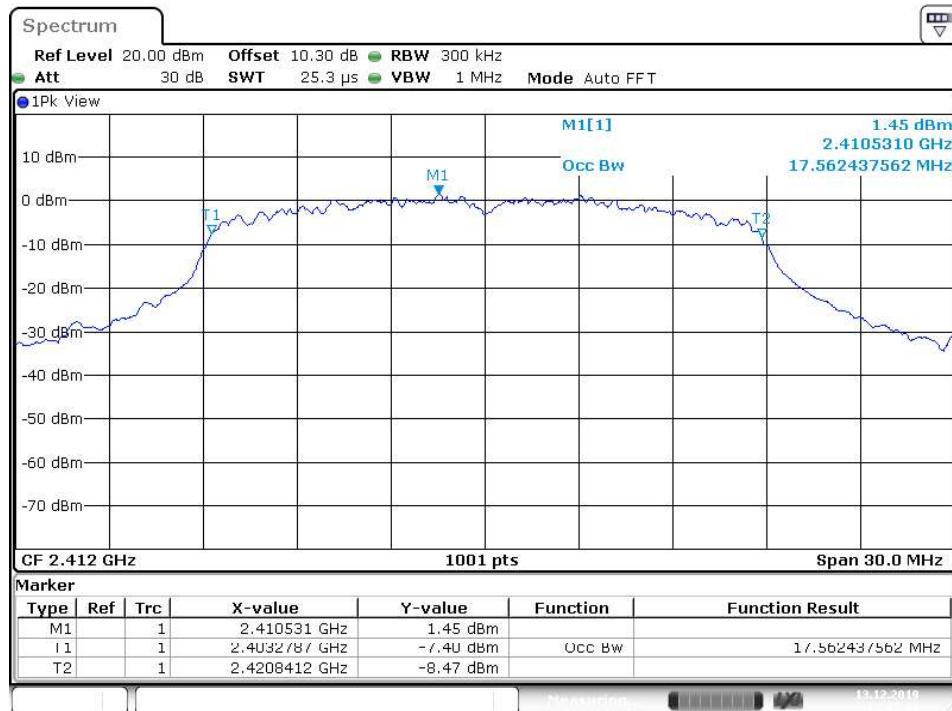
High Channel



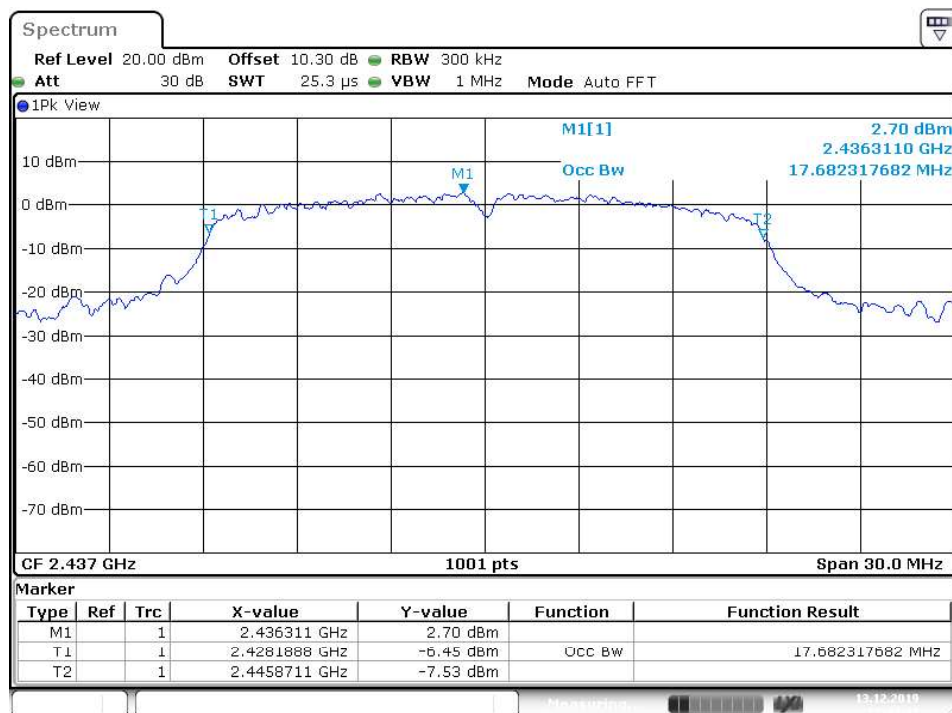
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Test Plot of 99% Bandwidth (802.11n HT20)

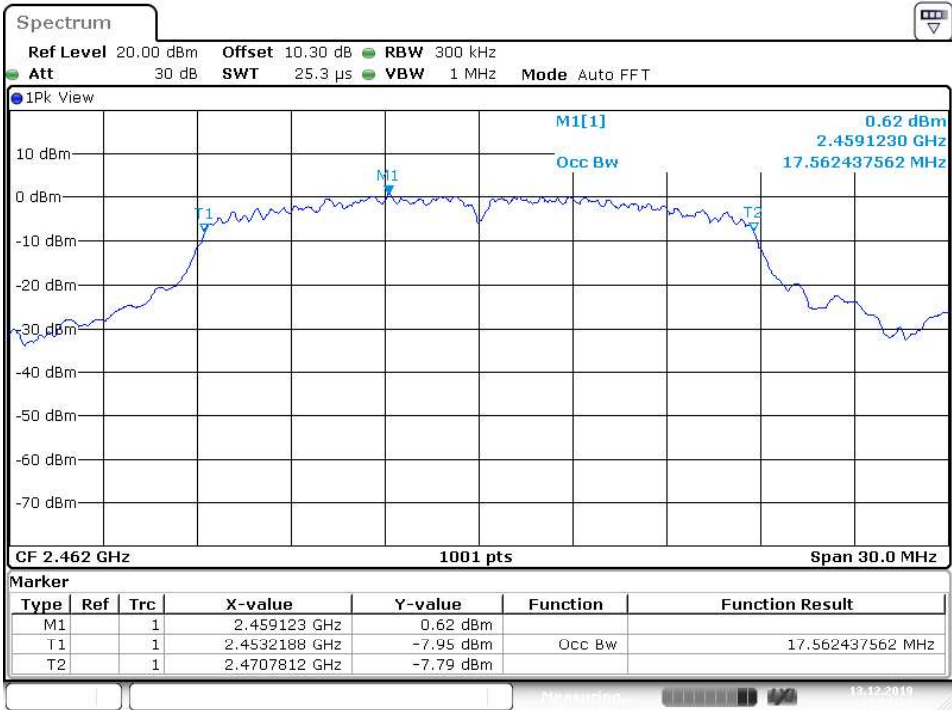
Low Channel



Middle Channel



High Channel



Date: 13.DEC.2019 13:52:12

5.1.4 Power Density

RESULT:
Passed

Test standard : FCC Part 15.247 (e)
 Basic standard : ANSI C63.10:2013, KDB558074
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A
 Ambient temperature : 22-26°C
 Relative humidity : 50-65%
 Atmospheric pressure : 100-103 kPa

Table 16: Test result of Power Density (802.11b)

Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-12.85	8
Middle Channel	2437	-11.50	8
High Channel	2462	-13.44	8

Table 17: Test result of Power Density (802.11g)

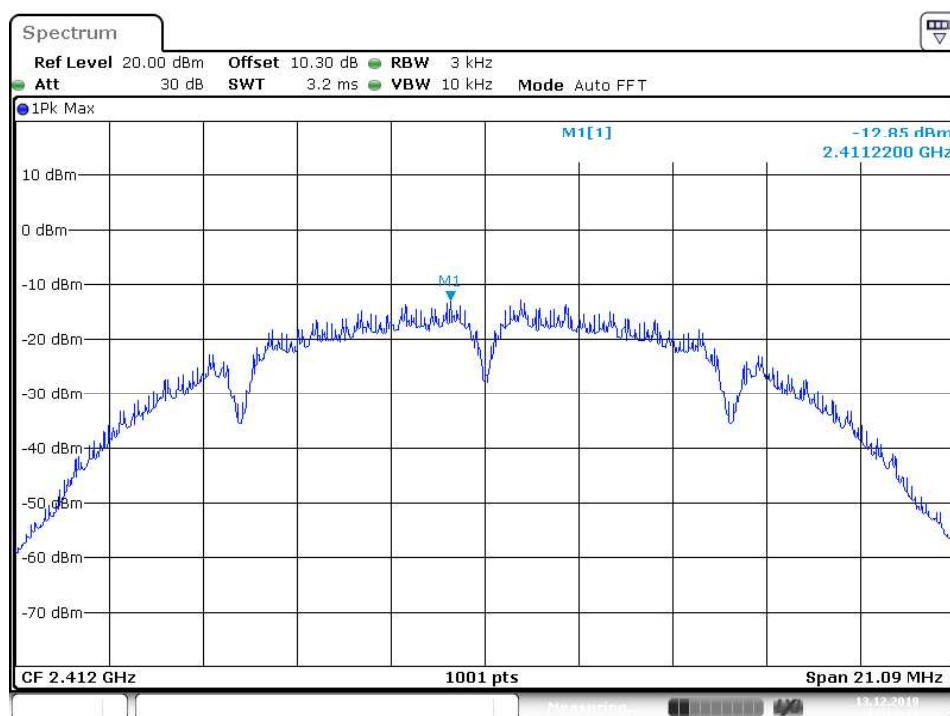
Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-15.31	8
Middle Channel	2437	-13.95	8
High Channel	2462	-15.06	8

Table 18: Test result of Power Density (802.11n HT20)

Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-15.44	8
Middle Channel	2437	-13.90	8
High Channel	2462	-14.22	8

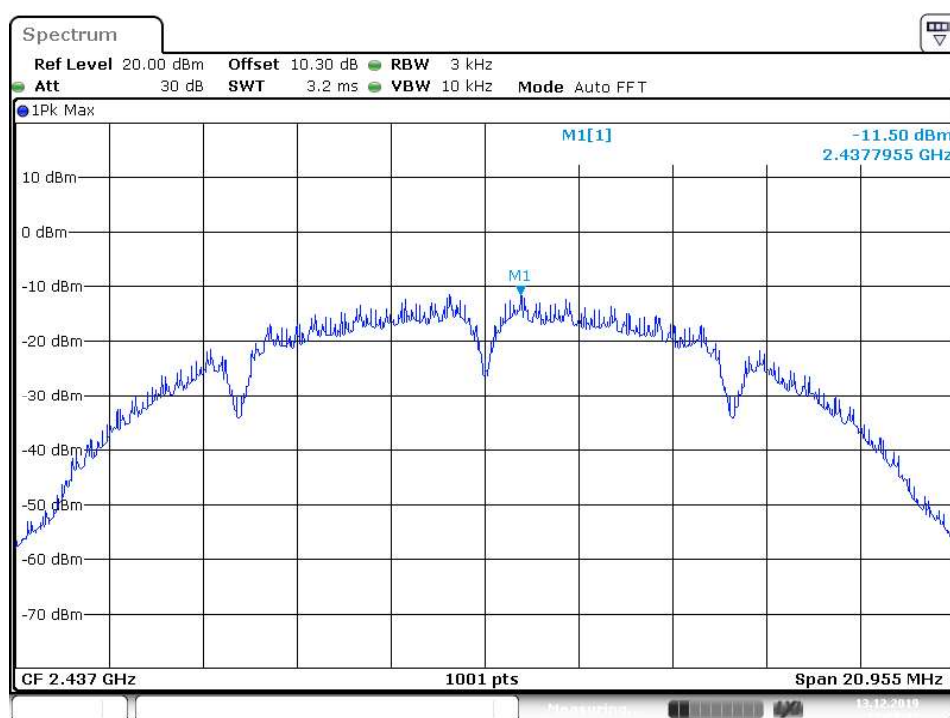
Test Plot of Power Density (802.11b)

Low Channel

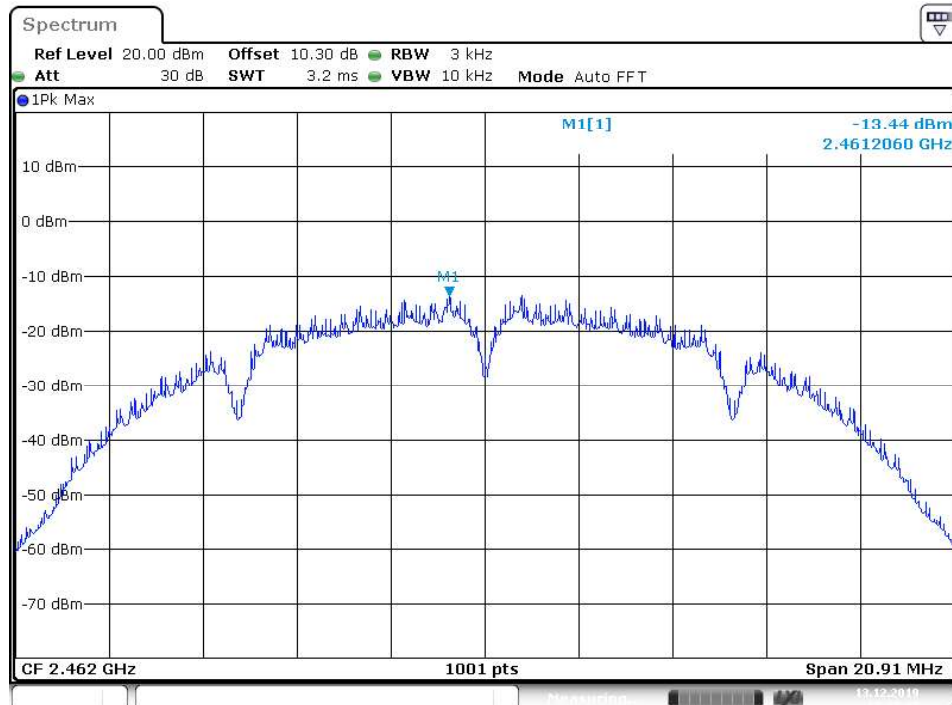


Date: 13.DEC.2019 12:18:45

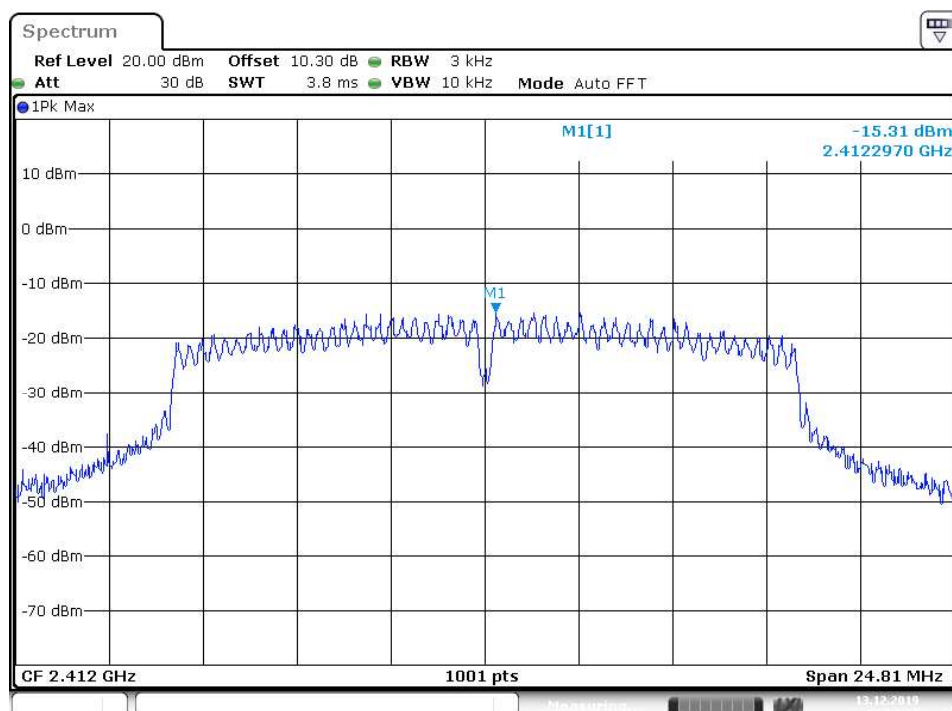
Middle Channel



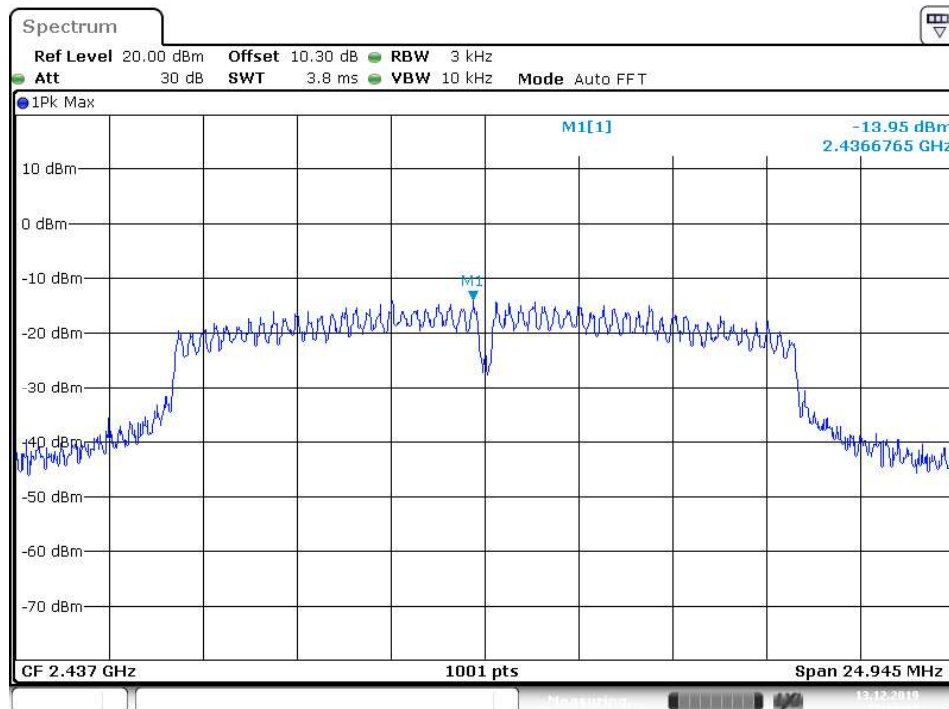
Date: 13.DEC.2019 12:29:36

High Channel


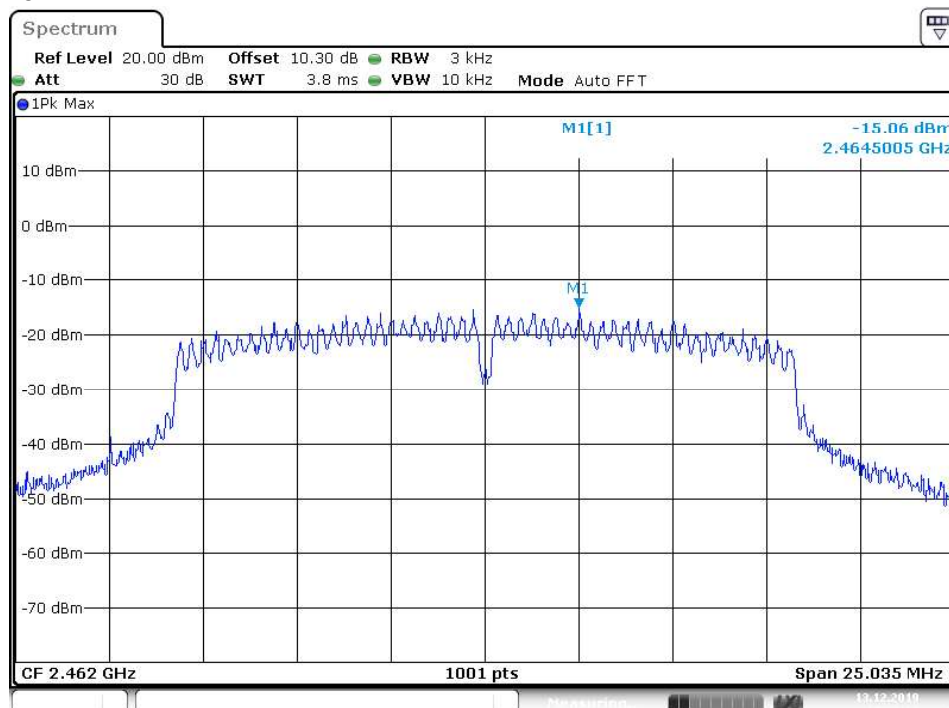
Date: 13.DEC.2019 12:38:05

Test Plot of Power Density (802.11g)
Low Channel


Date: 13.DEC.2019 12:57:08

Middle Channel


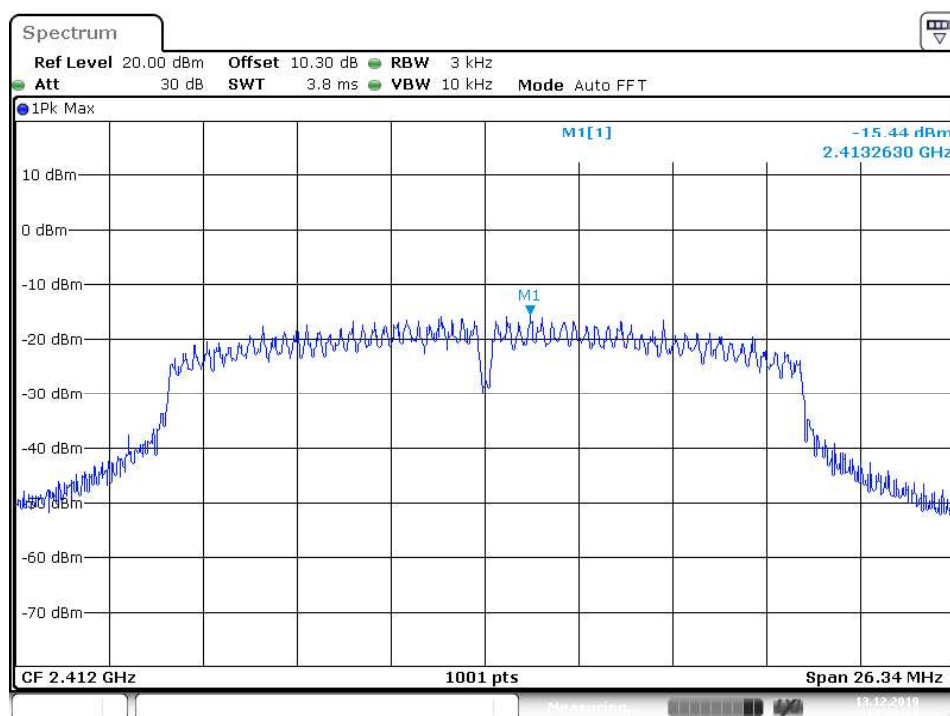
Date: 13.DEC.2019 13:12:21

High Channel


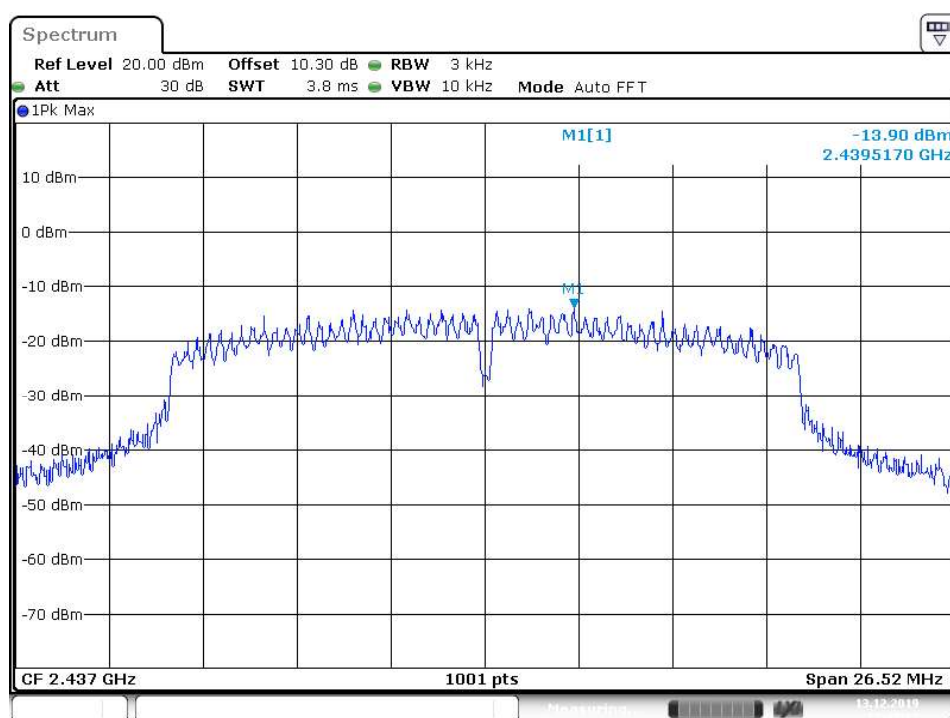
Date: 13.DEC.2019 13:26:19

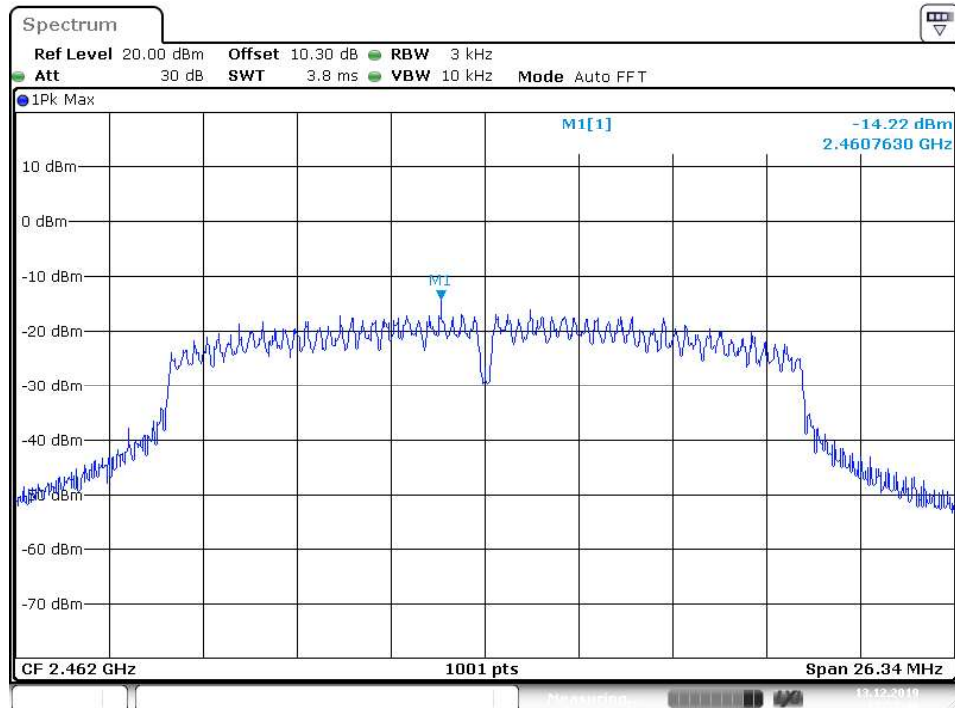
Test Plot of Power Density (802.11n HT20)

Low Channel



Middle Channel



High Channel


Date: 13.DEC.2019 13:52:40

5.1.5 Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth

RESULT:**Passed**

Test standard	:	FCC part 15.247 (d)
Basic standard	:	ANSI C63.10:2013, KDB558074
Limit	:	20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power)
Kind of test site	:	Shielded room

Test setup

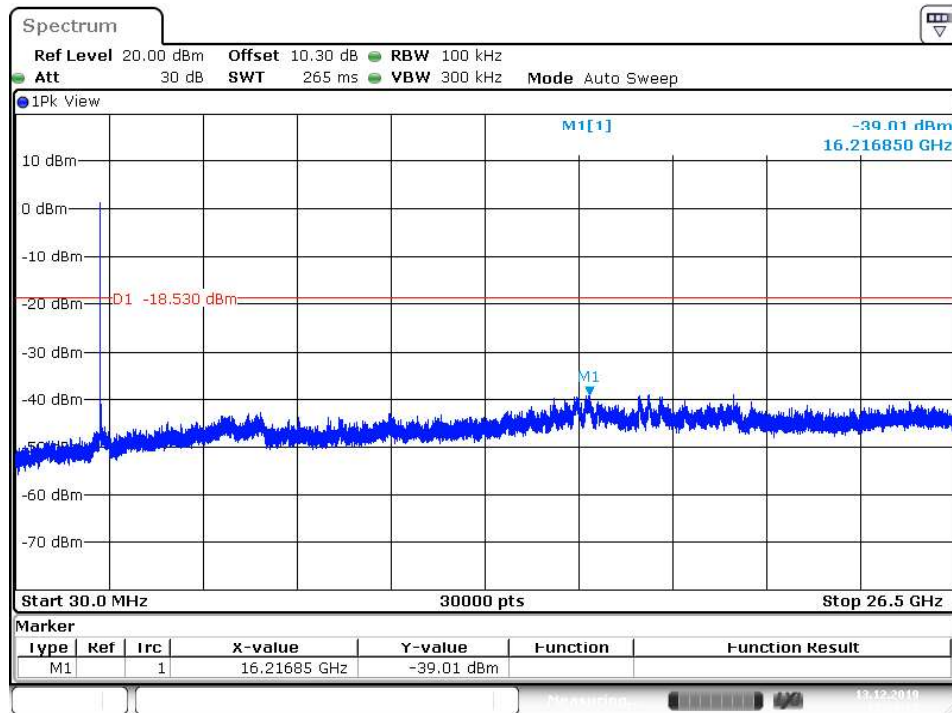
Test Channel	:	Low/ Middle/ High for Conducted Spurious Low/High for Frequency Band Edge
Operation mode	:	A
Ambient temperature	:	22-26°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103 kPa

All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achieved as well.

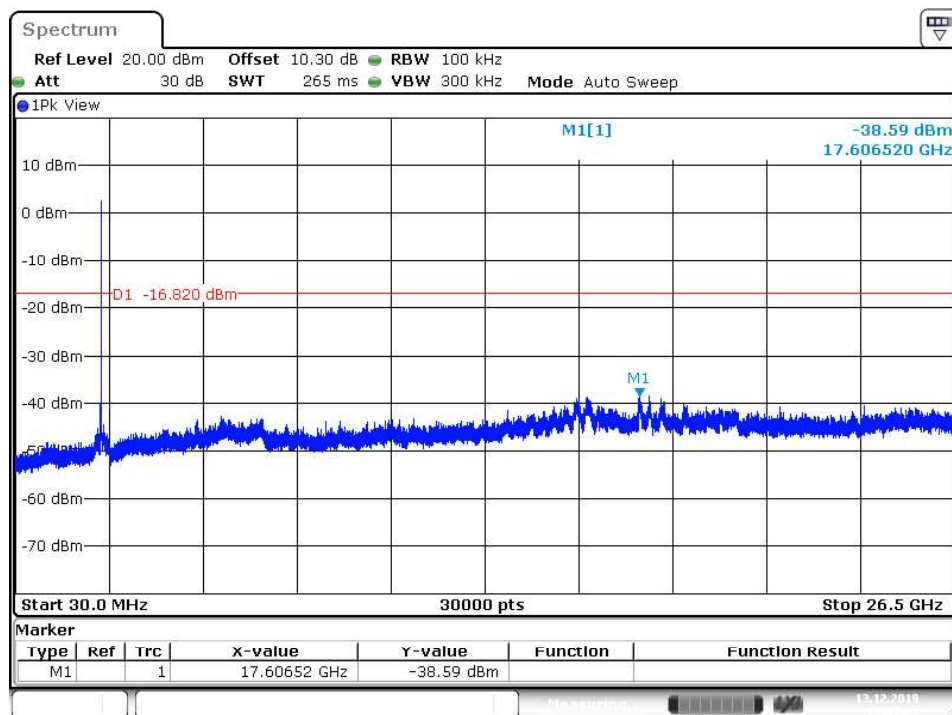
Due to the small size of the product and that there are no inductive components of significant size connected to the antenna port, 9kHz to 30MHz frequency range is not tested based on technical judgment.

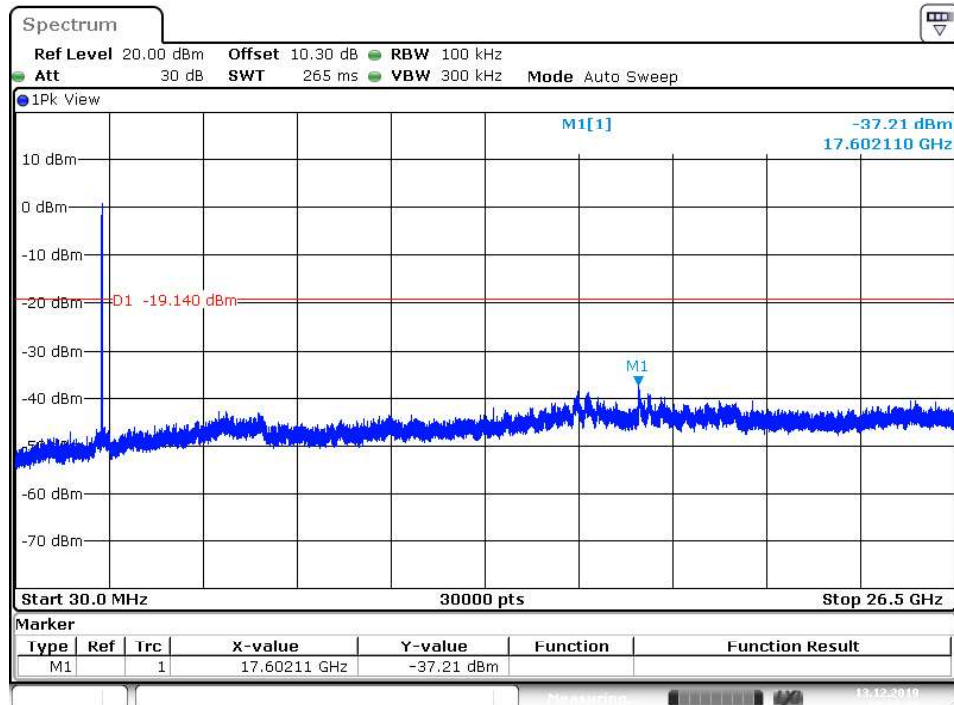
Test Plot 100kHz Conducted Emissions (802.11b)

Low Channel

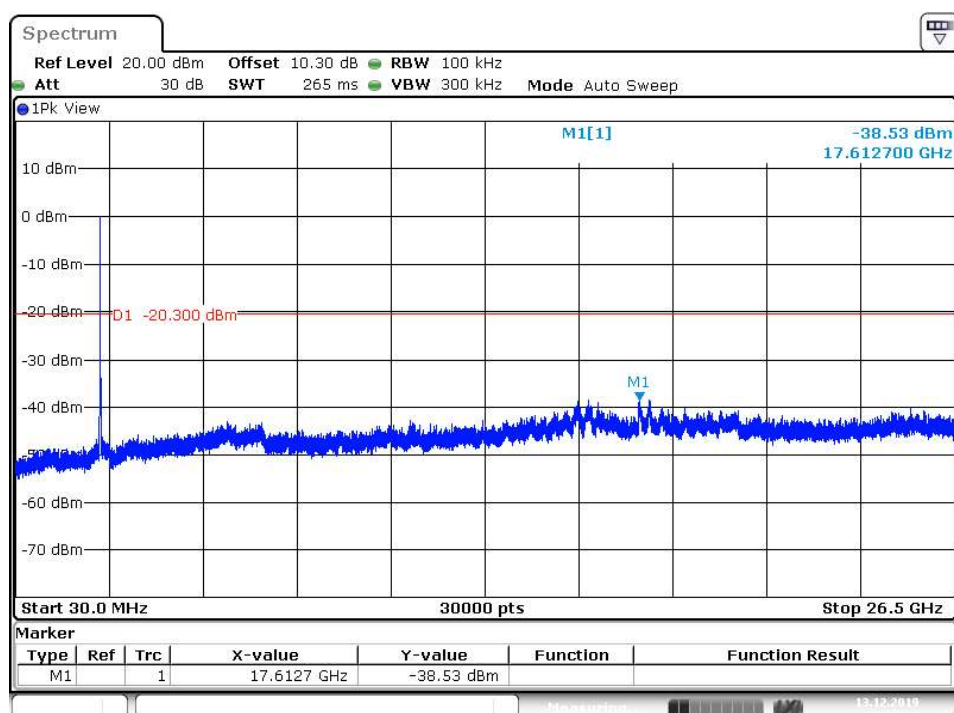


Middle Channel

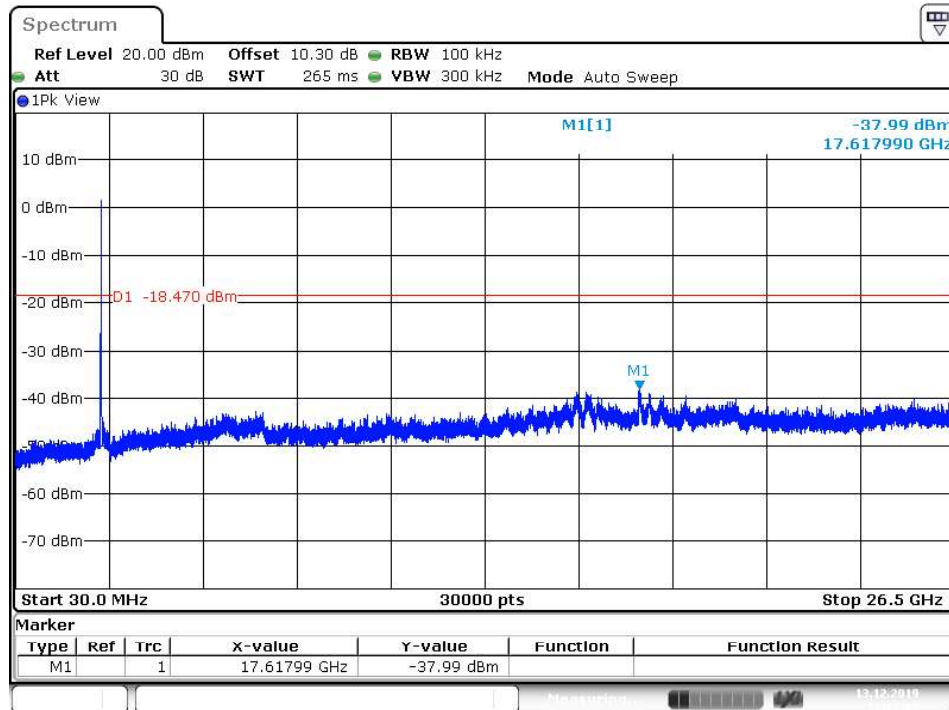


High Channel


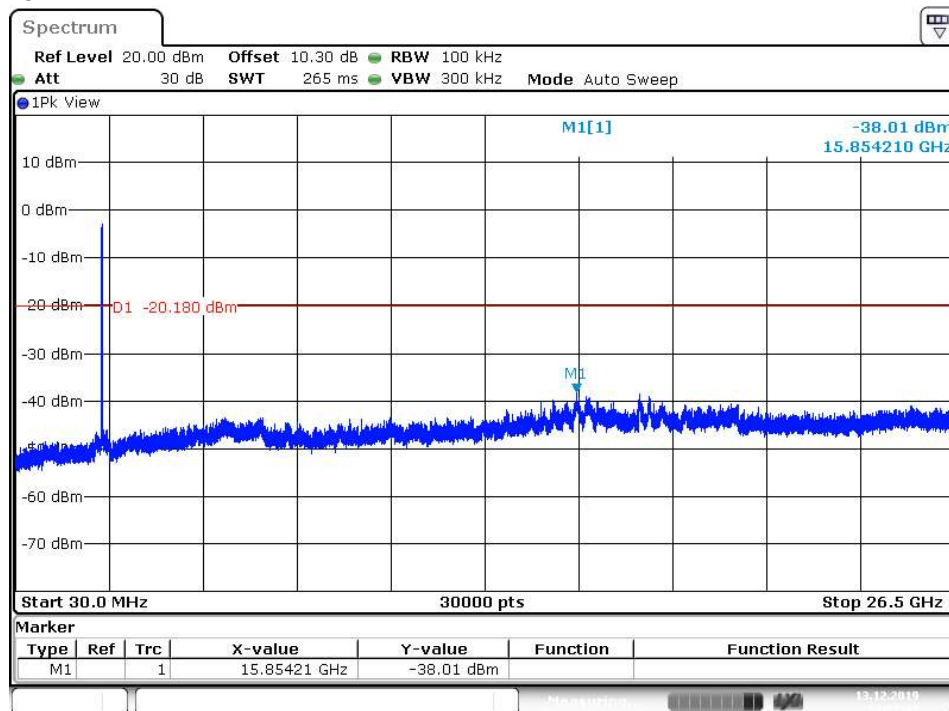
Date: 13.DEC.2019 12:39:35

Test Plot 100kHz Conducted Emissions (802.11g)
Low Channel


Date: 13.DEC.2019 12:58:12

Middle Channel


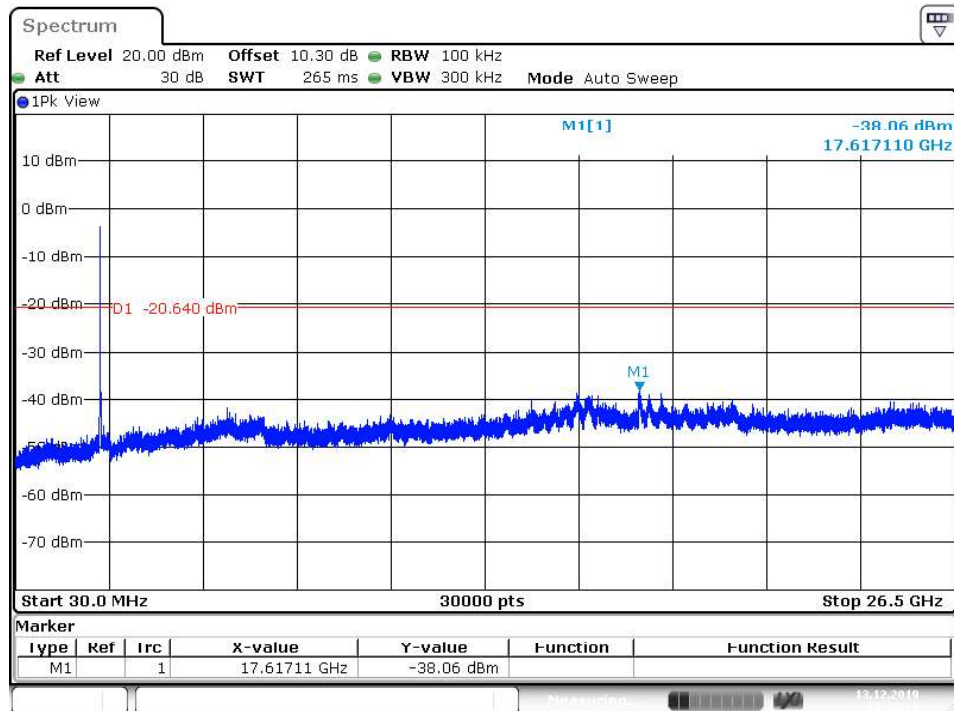
Date: 13.DEC.2019 13:13:10

High Channel


Date: 13.DEC.2019 14:23:43

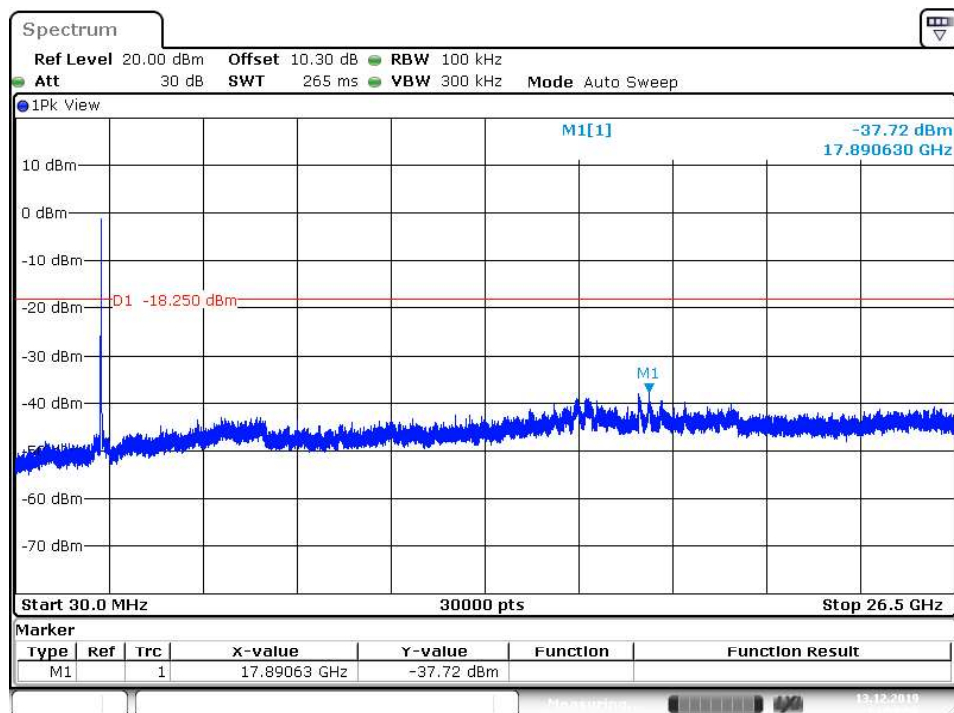
Test Plot 100kHz Conducted Emissions (802.11n HT20)

Low Channel

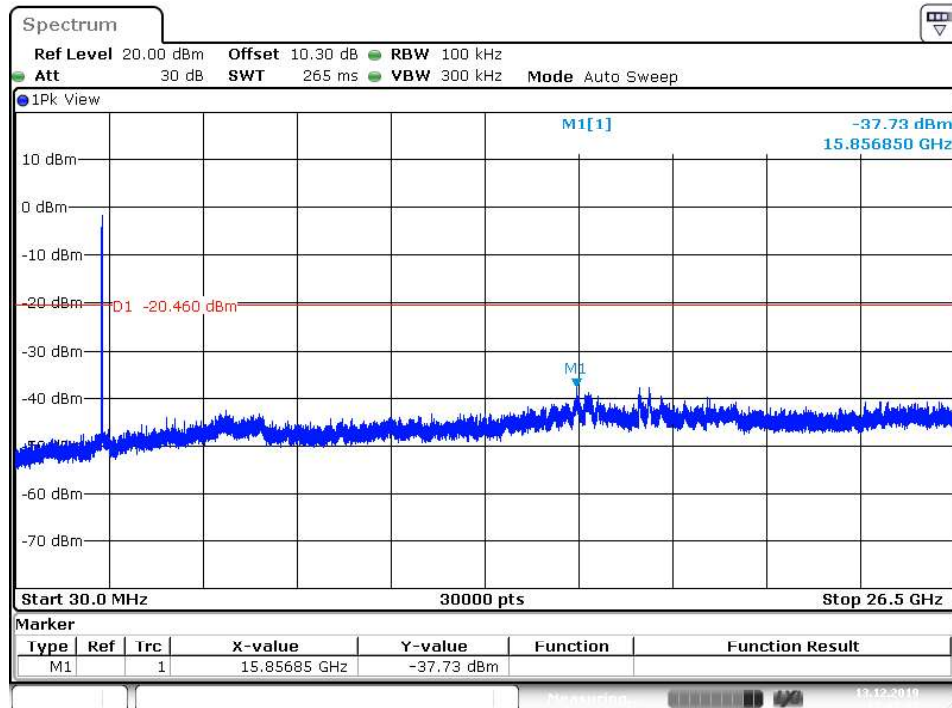
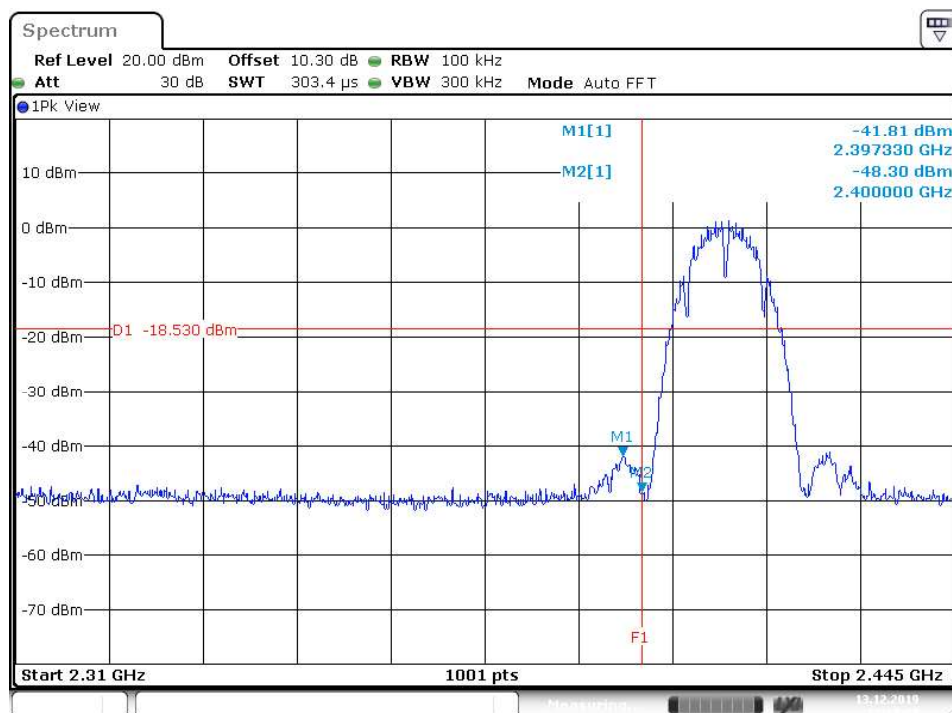


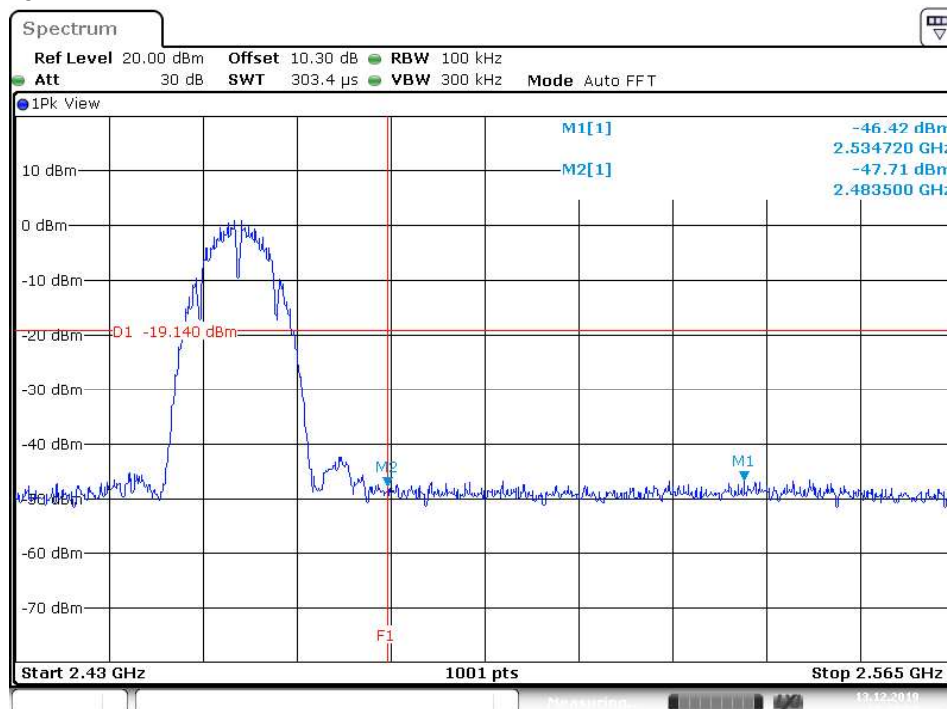
Date: 13.DEC.2019 13:37:19

Middle Channel

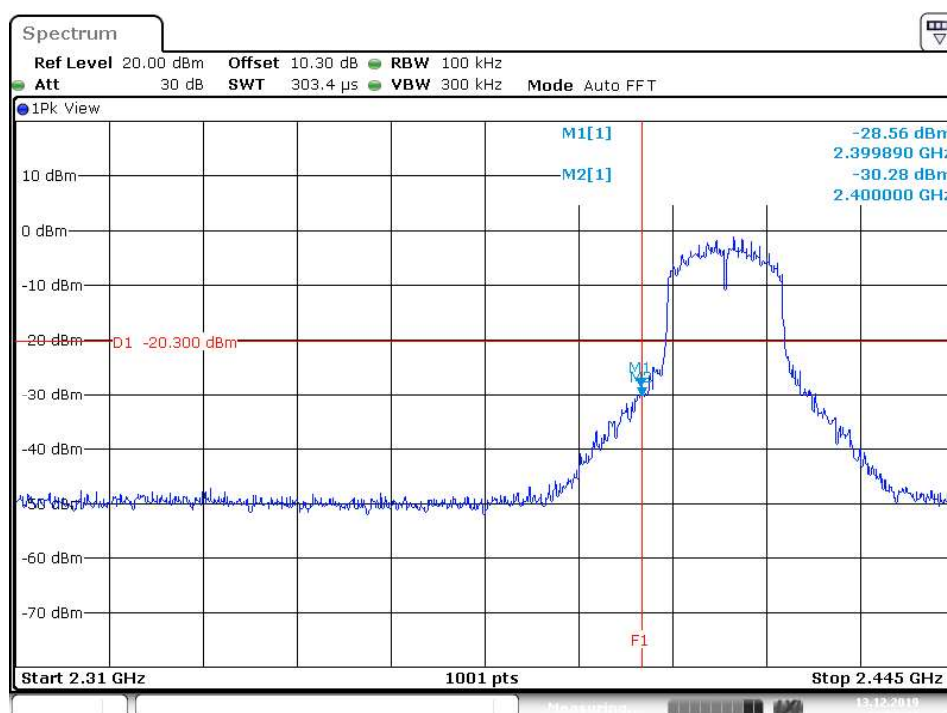


Date: 13.DEC.2019 14:55:56

High Channel

Test Plot 100kHz RBW of Band Edge (802.11b)
Low Channel


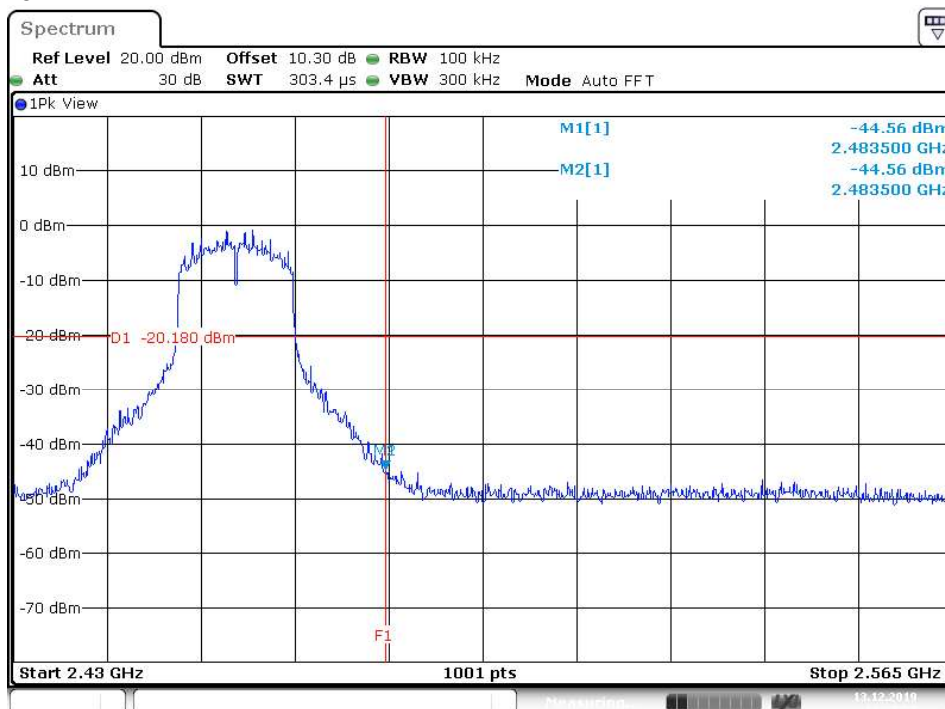
High Channel


Date: 13.DEC.2019 12:38:51

Test Plot 100kHz RBW of Band Edge (802.11g)
Low Channel


Date: 13.DEC.2019 12:57:31

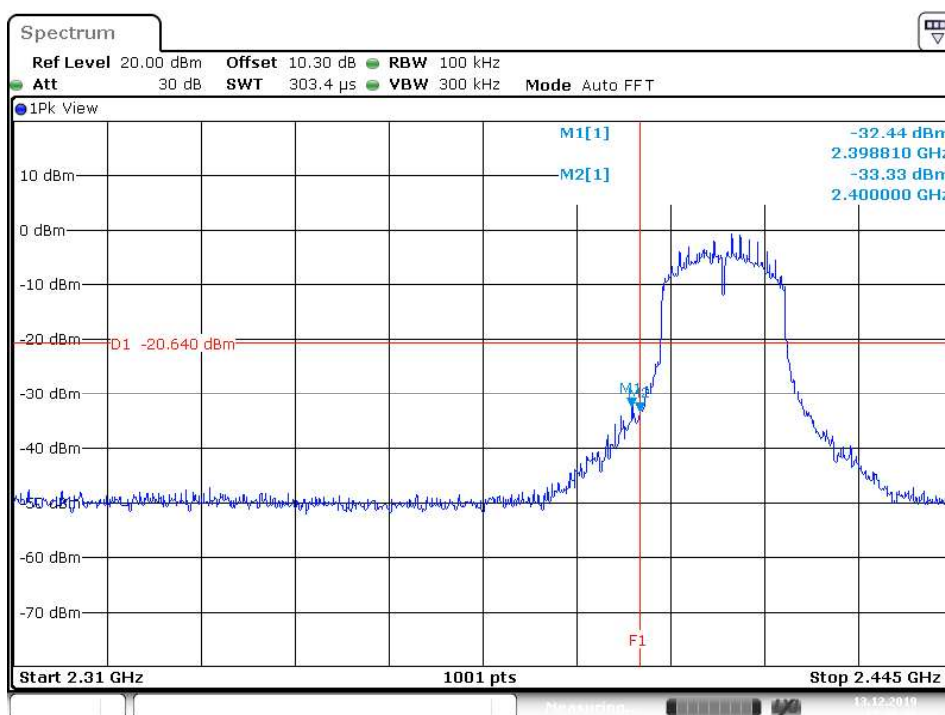
High Channel



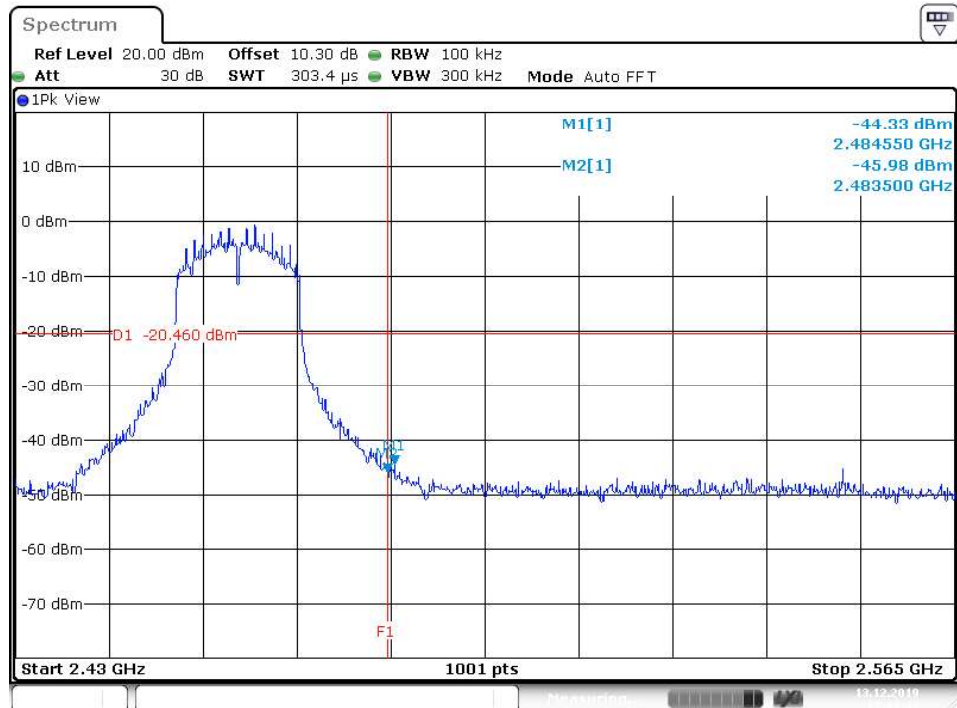
Date: 13.DEC.2019 14:22:52

Test Plot 100kHz RBW of Band Edge (802.11n HT20)

Low Channel



Date: 13.DEC.2019 13:36:36

High Channel


Date: 13.DEC.2019 15:01:49

5.1.6 Spurious Emission

RESULT:**Passed**

Test standard	:	FCC part 15.247 (d), FCC part 15.205, FCC part 15.209
Basic standard	:	ANSI C63.10: 2013
Limits	:	Radiated emissions which fall in the restricted bands, as defined in FCC part 15.205 (a) must comply with the radiated emission limits specified in FCC part 15.209 (a). Emission radiated outside the restricted and authorized frequency bands must either comply with the radiated emission limits specified for the restricted bands or in FCC part 15.247 (d).
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	Low/ Middle/ High
Operation mode	:	A

Remark: Testing was carried out within frequency range 9kHz to the tenth harmonic.

For details refer to Appendix D.

The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The X Axis orientation is the worst-case and recorded in this test report.

6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:**Passed**

Test standard : FCC 47 CFR Part 2:Subpart J Section 2.1093
FCC KDB Publication 447498 D01 v06

When in normal use, only the hands will touch the device.

Frequency Band (MHz)	Maximum output power including tune-up		Threshold power for hand- touched device (mW)	Verdict
	dBm	mW		
2412-2462	13.5	22.49	25	Pass

7. Photographs of the Test Set-Up

Photograph 1: Set-up for Spurious Emissions (Front View 1)



Photograph 2: Set-up for Spurious Emissions (Front View 2)



Photograph 3: Set-up for Spurious Emissions (Back View 1)



Photograph 4: Set-up for Spurious Emissions (Back View 2)



Photograph 5: Set-up for Spurious Emissions (Back View 3)



Photograph 6: Set-up for Spurious Emissions (Back View 4)



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