

Test Report No.:		15031104.fcc02	<i>Page 1 of 31</i>		
<i>Client:</i>	LANCOM Systems GmbH Adenauerstraße 20 / B2 52146 Wuerselen				
<i>Test Item:</i>	Digital Transmission System L-322agn dual Wireless (R2)				
<i>Identification:</i>	L-322agn dual Wireless (R2)	<i>Serial No.:</i>	4003550518100072		
<i>Project No.:</i>	15031104	<i>Date of Receipt:</i>	2015-04-08		
<i>Testing Location:</i>	TÜV Rheinland Nederland B.V. Eiberkamp 10 9351 VT Leek				
<i>Test Specification:</i>	FCC 47 CFR Part 15, Subpart E, Section 15.407 (1-10-14 Edition) ANSI C63.10-2009				
<i>Test Result:</i>	<i>The test item passed the test specification(s).</i>				
<i>Testing Laboratory:</i>	TÜV Rheinland Nederland B.V. Eiberkamp 10 9351 VT Leek				
<i>Tested by:</i>	<i>Reviewed by:</i>				
2015-05-07	R. van der Meer / Inspector				
<i>Date</i>	<i>Name/Position</i>	<i>Signature</i>	<i>Date</i>	<i>Name/Position</i>	<i>Signature</i>
<i>Other Aspects: On request by the applicant only Band Edges Emissions are tested as part of a Permissive Change Class II as authorized by the original certificate holder Wistron NeWeb Corporation</i>					
				Abbreviations:	<i>P(pass) = passed F(fail) = failed N/A = not applicable N/T = not tested</i>
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TEST SUMMARY

5.1.1 VOLTAGE REQUIREMENTS

RESULT: N/A

5.1.2 ANTENNA REQUIREMENTS

RESULT: PASS

5.1.3 RESTRICTED BANDS OF OPERATION

RESULT: N/A

5.2.1 CONDUCTED OUTPUT POWER

RESULT: N/A

5.2.2 6dB BANDWIDTH

RESULT: N/A

5.2.3 CONDUCTED SPURIOUS EMISSION

RESULT: N/A

5.2.4 PEAK POWER SPECTRAL DENSITY

RESULT: N/A

5.2.5 BAND EDGE CONDUCTED EMISSIONS

RESULT: Pass

5.2.6 RADIATED SPURIOUS EMISSIONS OF TRANSMITTER

RESULT: N/A

5.3.1 AC POWER LINE CONDUCTED EMISSION OF TRANSMITTER

RESULT: N/A

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1. General Remarks

1.1 Complementary Materials

The EUT contains two 802.11 WiFi modules. The test data are provided in two separate test reports.

	Test standard	Test report reference
WLAN 802.11b/g, 802.11n	FCC Part 15, Subpart C, Section 15.247	15031104.fcc01
WLAN 802.11a, 802.11n (5180-5240 MHz)	FCC Part 15, Subpart E, Section 15.407	15031104.fcc02 This report

There is no attachment to this test report.

The EUT was not provided with FCC label.

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2. Test Sites

2.1 Test Facilities

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland Nederland B.V., located in Leek, 9351VT Eiberkamp 10, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948.

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 90828. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The description of the test facilities has been filed to Industry Canada under registration number 2932G-2. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

Normal test conditions:

Temperature (*) : +15°C to +35°C
Relative humidity (*) : 20 % to 75 %
Supply voltage : 120VAC/60Hz
Air pressure : 950 – 1050 hPa

When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately.

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2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (mm/yyyy)	Calibration due date (mm/yyyy)
For Radiated Emission					
RF cable	Huber + Suhner	Sucoflex102	A00338 +A00343	04/2015	04/2016
Controller	Maturo	SCU/088/ 8090811	A00450	N/A	N/A
Test facility	Comtest	FCC listed: 90828	A00235 / A00436	02/2015	02/2017
Spectrum Analyzer	Rohde & Schwarz	FSV	A00337	08/2014	08/2015
Filter+Amplifier Box (Pass1 PreAmp ON)	EMCS	RFS06S	A00255	11/2014	11/2015
Antenna mast	EMCS	AP-4702C	A00258	N/A	N/A
Temperature-Humidity meter	Extech	SD500	A00444	02/2015	02/2016
Guidehorn 1-18 GHz	EMCO	3115	A00009	04/2015	04/2016
Power Supply Filter Box	EMCS	-	A00320	N/A	N/A
Controller	EMCS	-	A00321	N/A	N/A
Preamplifier 0.5 - 18 GHz	Miteq	AMF-5D- 005180-28- 13p	A00247 part of A00255	11/2014	11/2015

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing.

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2.3 Measurement Uncertainty

Table 2: Emission Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Radiated Emission	150kHz - 30MHz	±5.0dB
	30MHz - 1GHz	±5.0dB
	> 1GHz	±5.5dB

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3. General Product Information

3.1 Product Function and Intended Use

The brand Lancom model L-322agn dual Wireless (R2), hereafter referred to as EUT, is a digitally modulated transmitter intended to be used in WiFi applications. It contains 2 pre-certified W-LAN modules.

The content of this report and measurement results have not been changed other than the way of presenting the data.

3.2 System Details

Details and an overview of the system and all of its components, as it has been tested, may be found below.

EUT	:	Digital Transmission System
Manufacturer	:	LANCOM Systems GmbH
Brand	:	LANCOM
Model	:	L-322agn dual Wireless (R2)
Serial number	:	4003550518100072
Voltage input rating	:	12 Vdc
Voltage output rating	:	--
Current input rating	:	--
Antenna	:	4 External antennas
Operating frequency	:	2412 – 2462 MHz and 5180-5240
Modulation Type	:	DSSS, OFDM
Modulation Technology	:	OFDM

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Photo 1a: photo of the EUT



Photo 1b: photo of the bottom side of the EUT

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3.3 Countermeasures to achieve Compliance

No additional measures were employed to achieve compliance.

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4. Test Set-up and Operation Modes

4.1 Test Methodology

The test methodology used is based on the requirements of 47 CFR Part 15, Sections 15.31, 15.35, 15.205, 15.407.

The test methods, which have been used, are based on ANSI C63.10-2009.

For details, see under each test item.

4.2 Operation Modes

The frequency bands used in this EUT are listed below.

Frequency band (MHz)	2412-2462	5180-5240
802.11b	✓	-
802.11g	✓	-
802.11a	-	✓
802.11n 20MHz	✓	✓
802.11n 40MHz	✓	✓

The basic operation modes used for testing are:

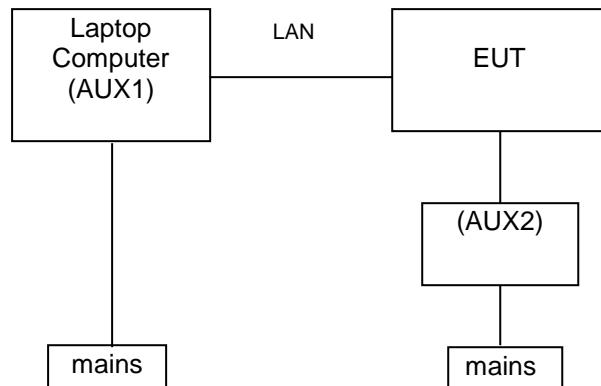
Mode	Tested Channel	Modulation Technology	Transmit Power (dBm)	Power Reduction (dB)
802.11a	36 & 48	OFDM	14	0
802.11n-20MHz	36 & 48	OFDM	14	0
802.11n-40MHz	38 & 46	OFDM	14	0

4.3 Physical Configuration for Testing

The EUT was configured in a typical fashion (as a customer would normally use it).

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10:2009.

Figure 1: Test Setup Diagram



Test setup photographs are provided in Section 6 of this report.

4.4 Test Software

The EUT was provided by the manufacturer with suitable software to allow operation in all the required modes.

Software used for testing: DiagGUI.

This software was running on a laptop computer (AUX1). It was used to enable the test operation modes listed in section 4.2 as appropriate.

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4.5 Special Accessories and Auxiliary Equipment

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

1. EUT

Product: Digital Transmission System
Brand: LANCOM
Model: L-322agn dual Wireless (R2)
Rated Voltage: 12 Vdc
Antenna: external, 4 pieces SMA-female contra connector
Serial Number: 4003550518100072
Remarks: -

2. AUX1

Product: Laptop Computer
Brand: HP
Model: Compaq 610
Serial Number: -
Remark: host for test software connects to EUT through LAN connection

5. AUX2

Product: Power supply adapter
Brand: -
Model: FW7555O/12
Rated Input Voltage: 100-240 Vac 47/63 Hz
Rated Output Voltage: 12Vdc, 1.25A
Remarks: used to power EUT



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5. Test Results

5.1 Technical Requirements

5.1.1 Voltage Requirements

RESULT: N/A

Requirements:

FCC 15.31(e)

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Verdict:

N/A.

5.1.2 Antenna Requirements

RESULT: PASS

Requirements:

FCC 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Verdict:

Nonstandard SMA connectors are used of the reversed type. Hence it complies with the requirements.

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5.1.3 Restricted Bands of Operation

RESULT: NOT TESTED

5.2 Conducted Measurements at Antenna Port

5.2.1 Conducted Output Power

RESULT: N/A

Date of testing: N/A

5.2.2 6dB Bandwidth

RESULT: N/A

Date of testing: N/A

5.2.3 Conducted Spurious Emission

RESULT: N/A

Date of testing: N/A

5.2.4 Peak Power Spectral Density

RESULT: N/A

Date of testing: N/A

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5.2.5 Band Edge Emissions in the 5G band

RESULT: Pass

Date of testing: 2015-05-07

Requirements:

FCC 15.407

For transmitters operating in the 5.15–5.25 GHz band: All emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

Test procedure:

Measurements were performed using a spectrum analyzer with a suitable span to encompass the peak of the fundamental and using the following settings:

RBW = 1MHz, VBW = 3MHz, Detector = Peak.

For signals out of the assigned frequency band a measurement was made of the amplitude (dBm) of the spurious emissions. The highest emission amplitudes were measured and recorded in this report. Pre-scan showed that the worst case situation was when the EUT's antennas were in vertical polarization and measurement antenna was in vertical polarization. Plots of these worst case situations are provided on the next pages. Line D1 indicates the limit. Line F1 indicates the band edge frequency.

Results: All out of band spurious emissions are below the limit of -27 dBm/MHz.
See Plots 1 through 6 on the following pages.

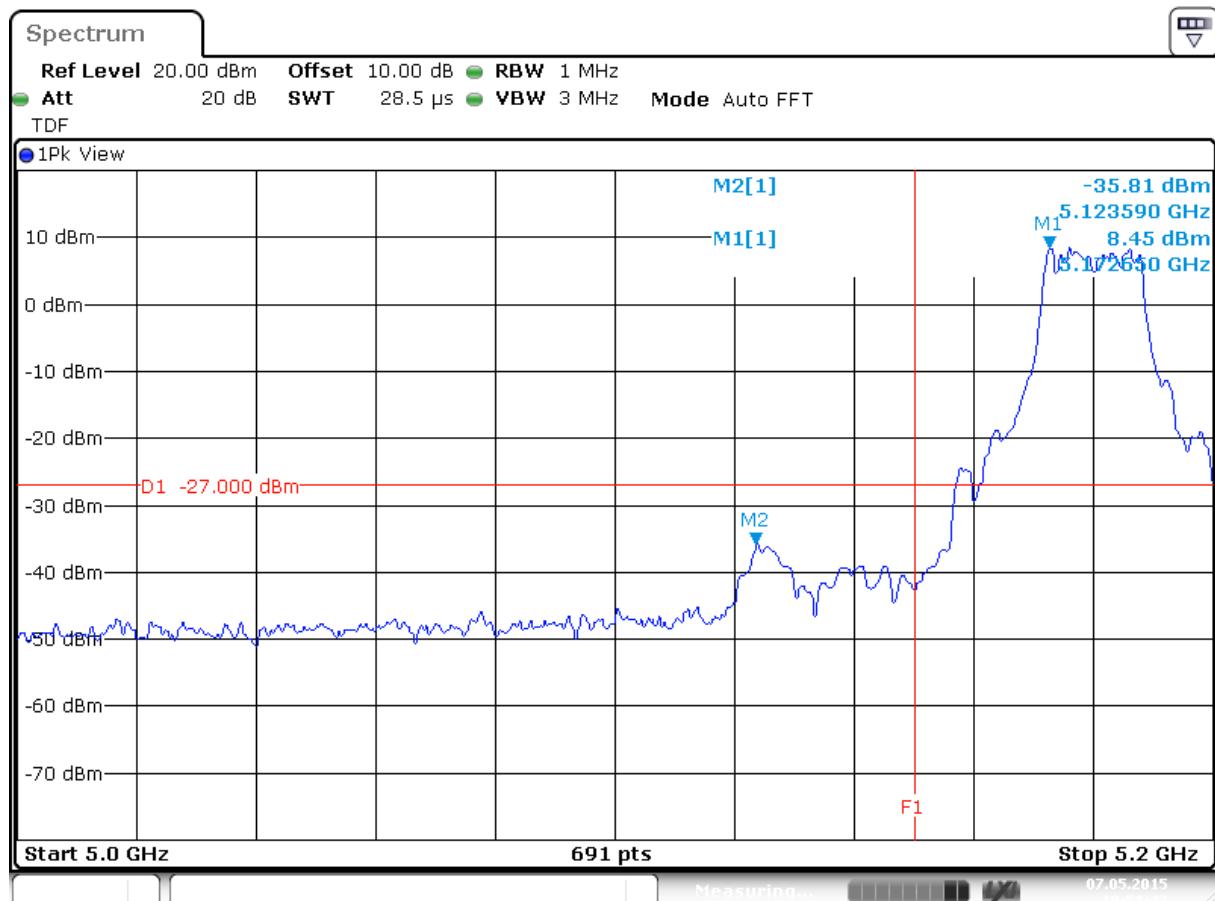
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802.11a

Plot 1a: Band Edge Emissions, Spectral Diagram, 802.11a Ch36/5180 MHz WLAN-1



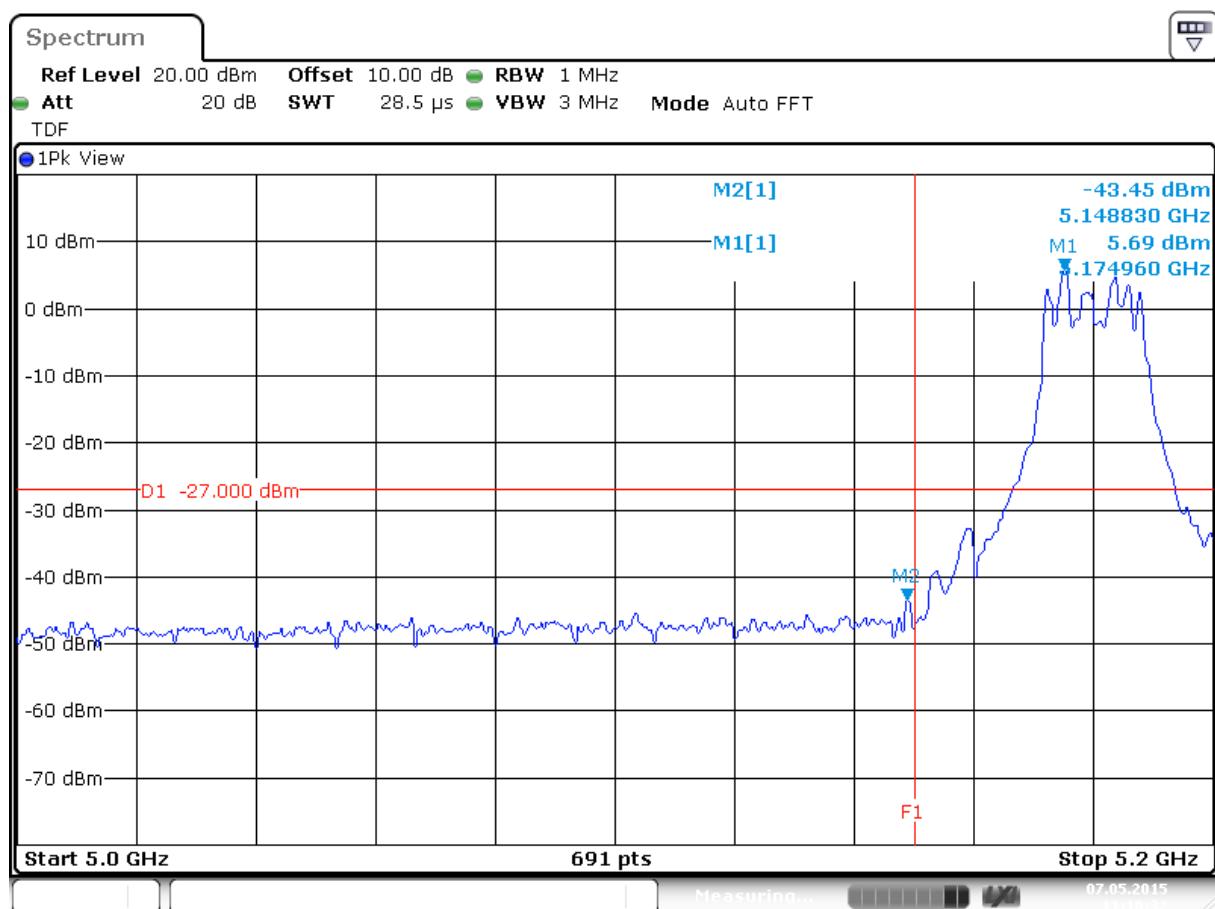
Date: 7.MAY.2015 10:51:42

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Plot 1b: Band Edge Emission, Spectral Diagram, 802.11a Ch36 5180 MHz WLAN-2.



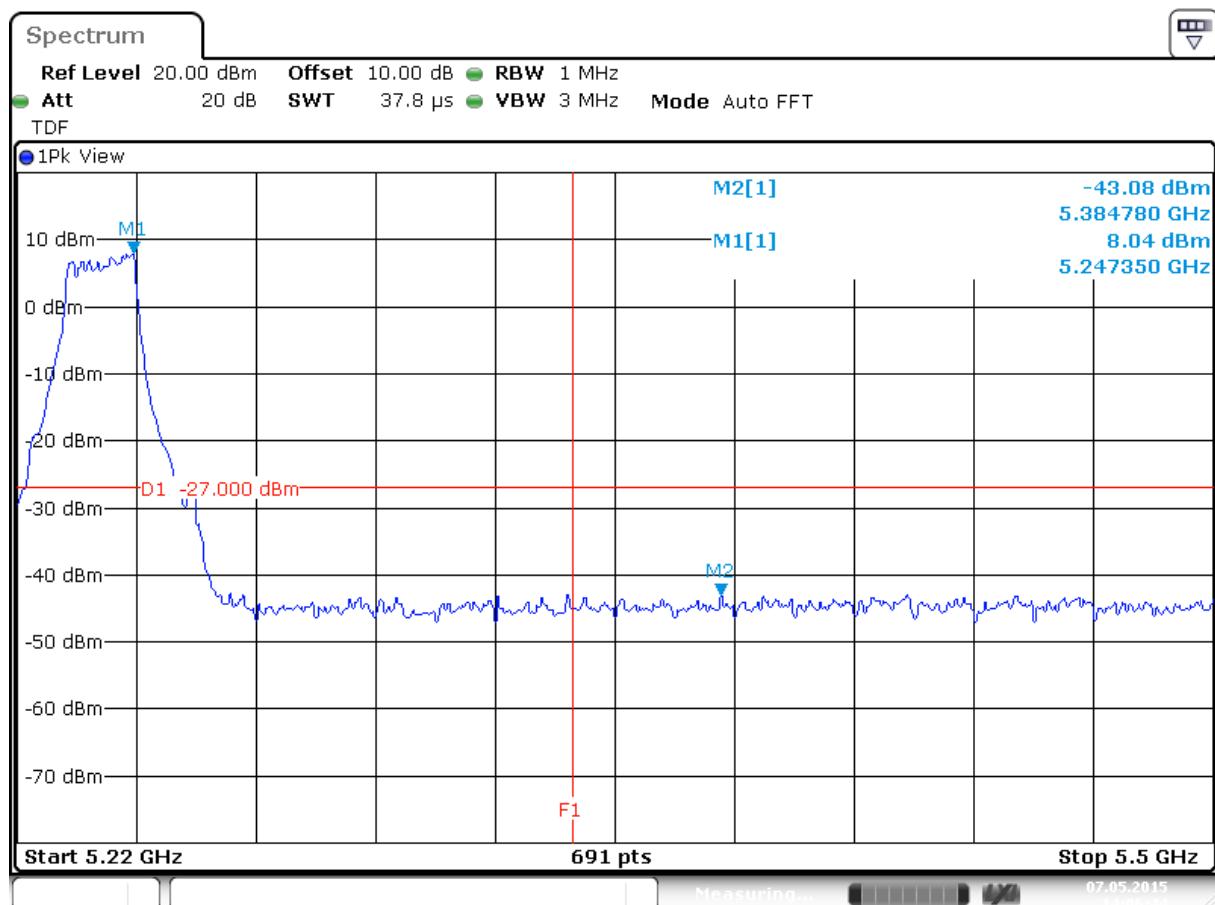
Date: 7.MAY.2015 11:10:32

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Plot 2a: Band Edge Emissions, Spectral Diagram, 802.11a Ch 48 5240 MHz WLAN-1



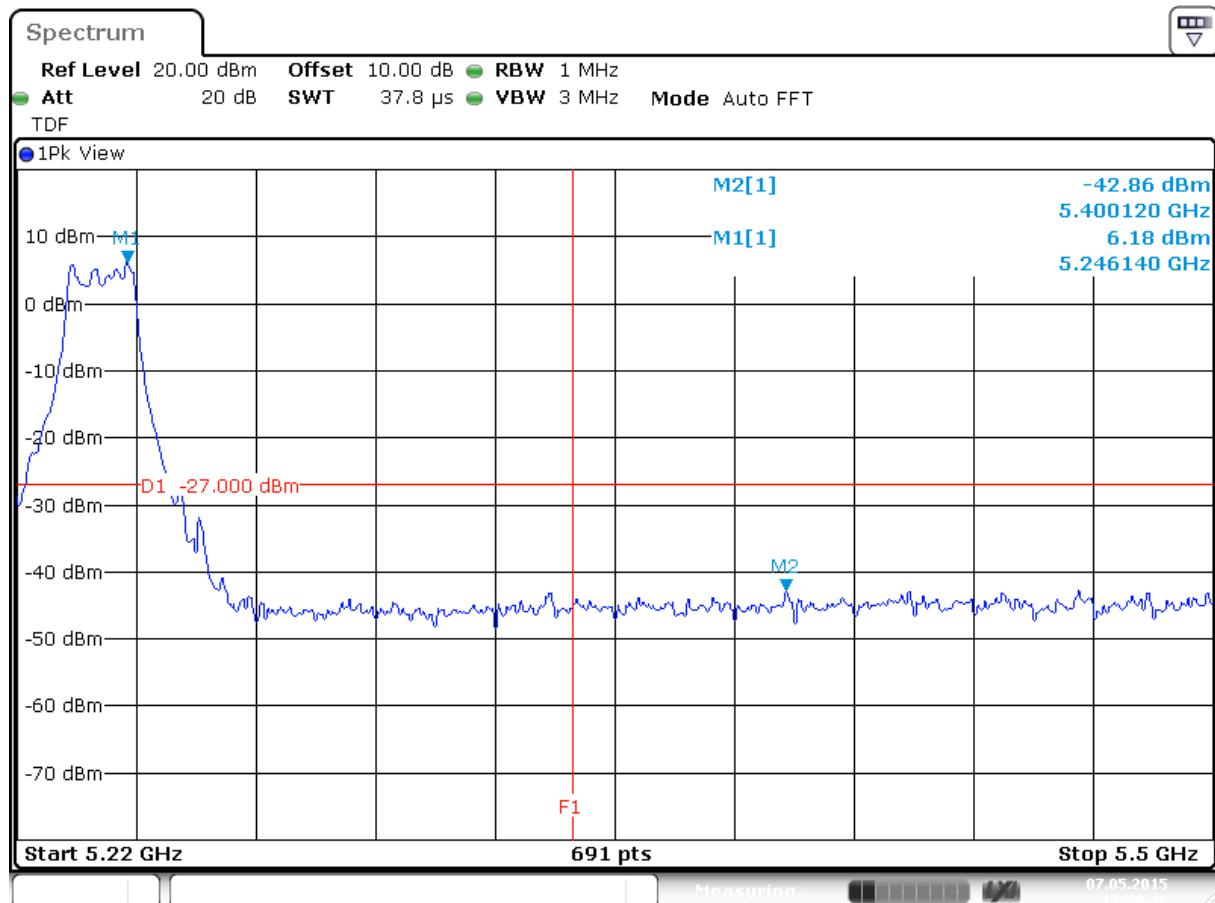
Date: 7.MAY.2015 14:06:43

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Plot 2b: Band Edge Emissions, Spectral Diagram, 802.11a Ch 48 5240 MHz WLAN-2



Date: 7.MAY.2015 13:50:46

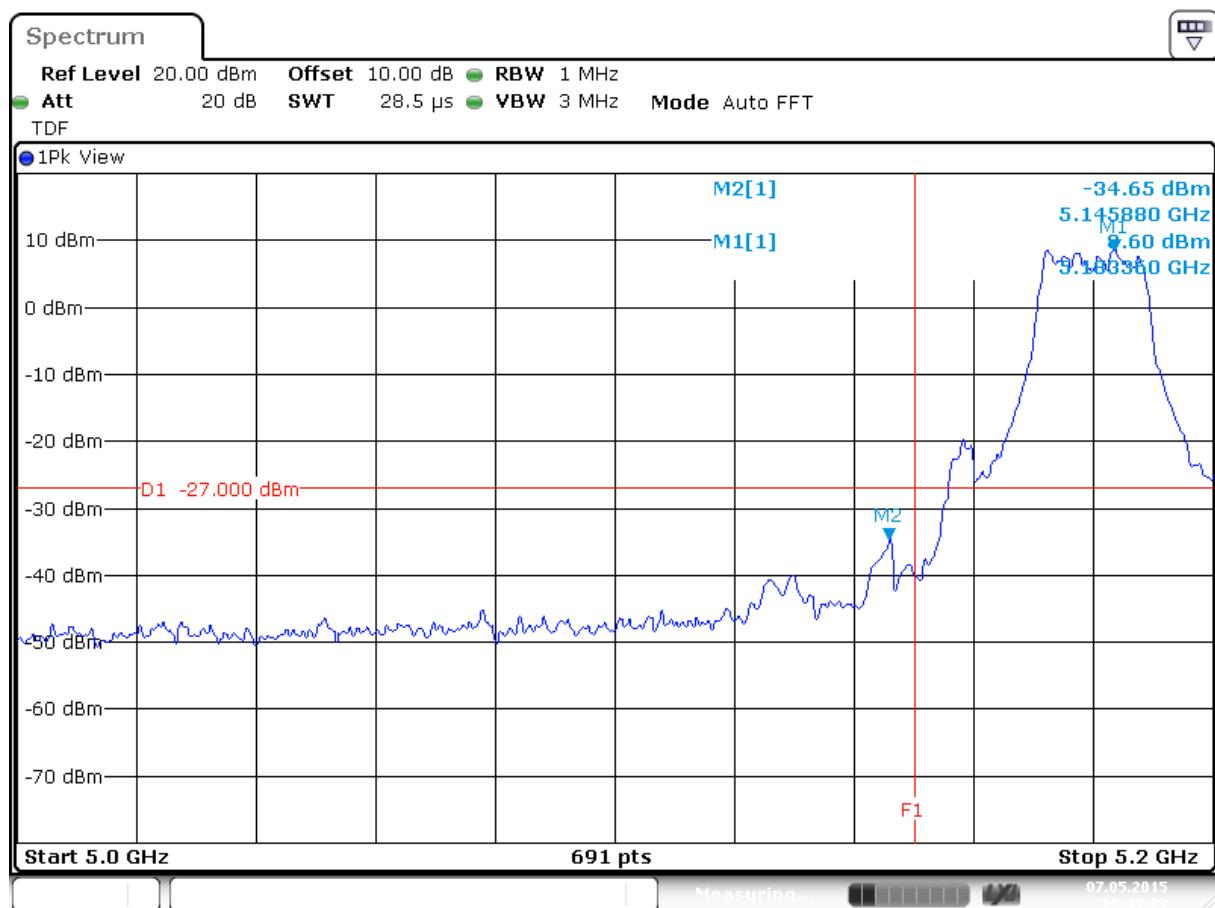
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802.11n-20MHz

Plot 3a: Band Edge Emissions, Spectral Diagram, 802.11n-20MHz Ch36 5180 MHz WLAN-1



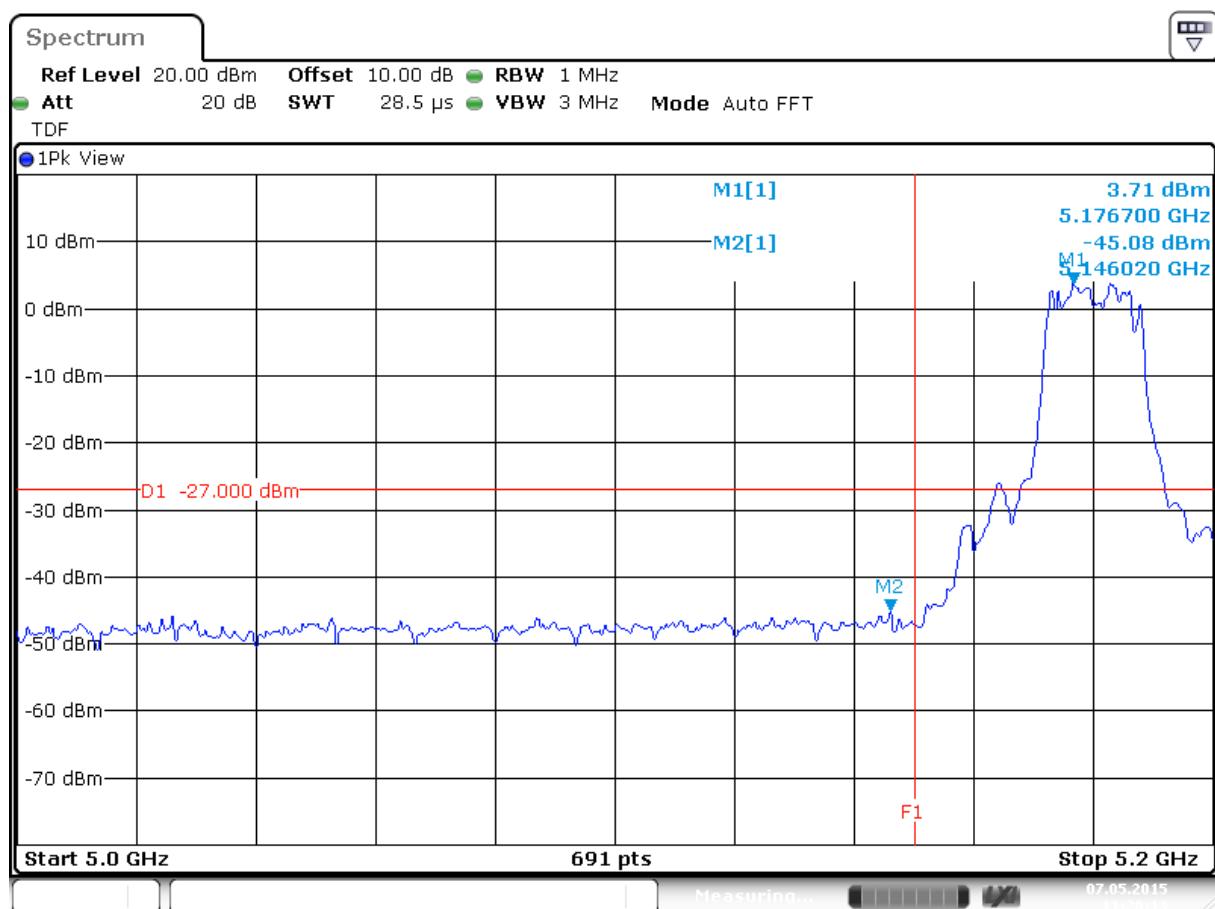
Date: 7.MAY.2015 10:49:23

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Plot 3b: Band Edge Emissions, Spectral Diagram, 802.11n-20MHz Ch36 5180 MHz WLAN-2



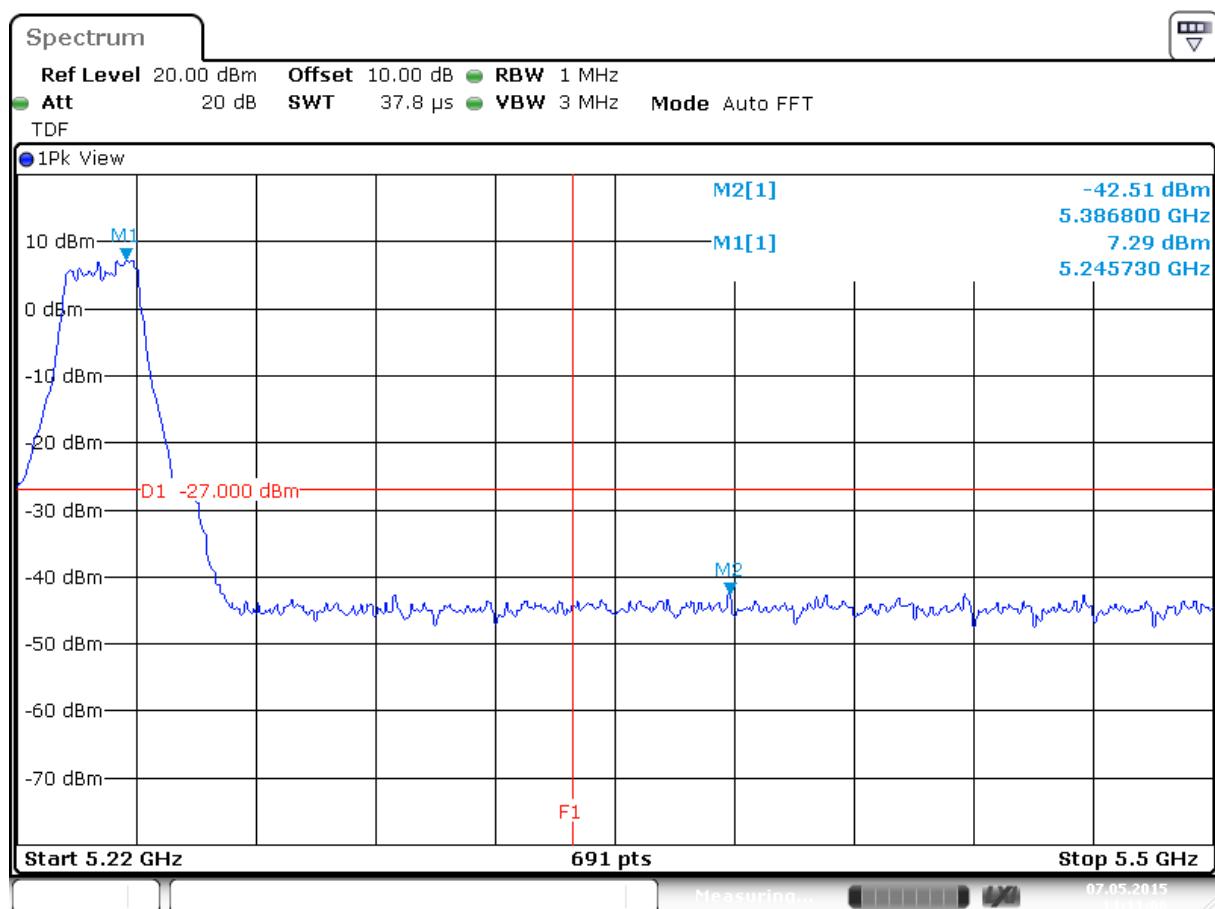
Date: 7.MAY.2015 11:20:13

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Plot 4a: Band Edge Emissions, Spectral Diagram, 802.11n-20MHz Ch 48 5240 MHz WLAN-1



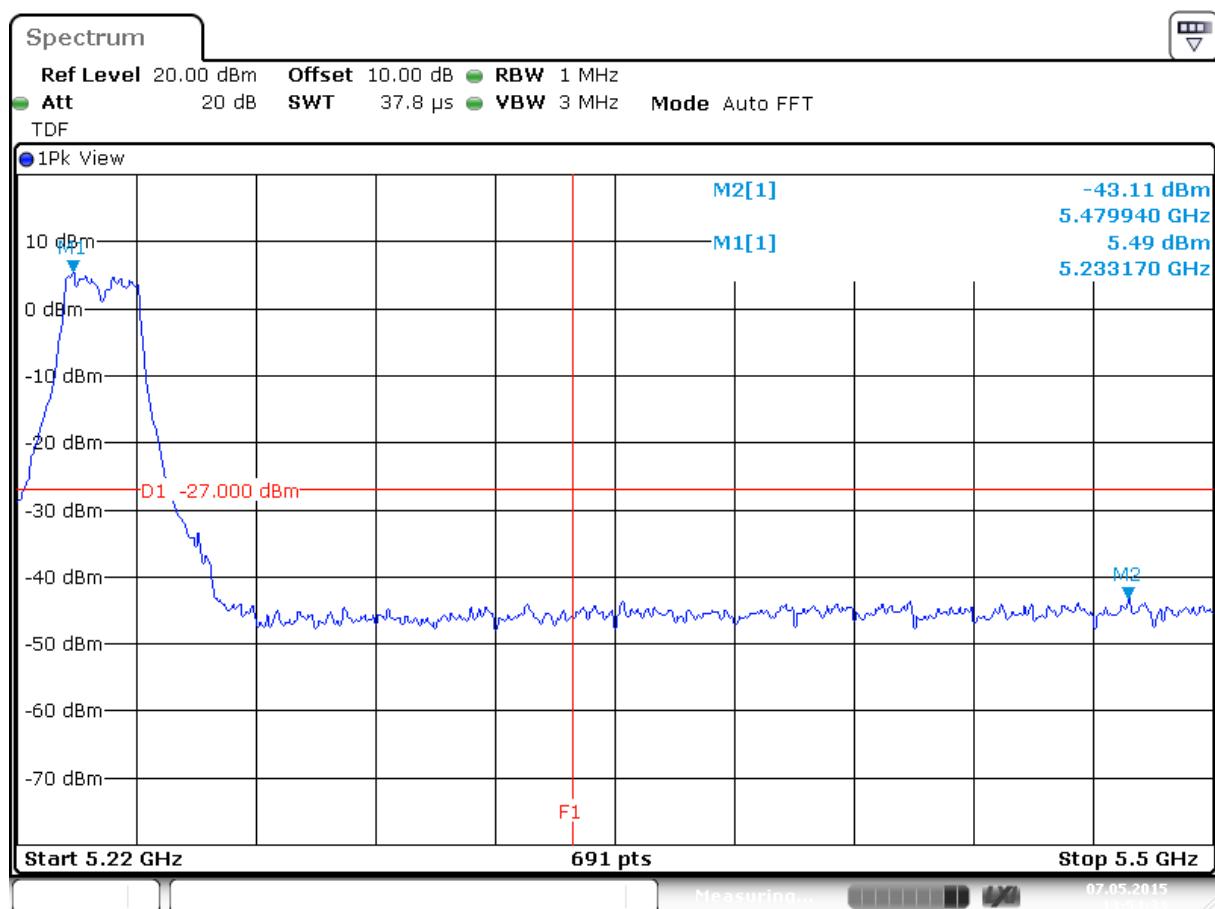
Date: 7.MAY.2015 14:11:06

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Plot 4b: Band Edge Emissions, Spectral Diagram, 802.11n-20MHz Ch 48 5240 MHz WLAN-2



Date: 7.MAY.2015 13:54:33

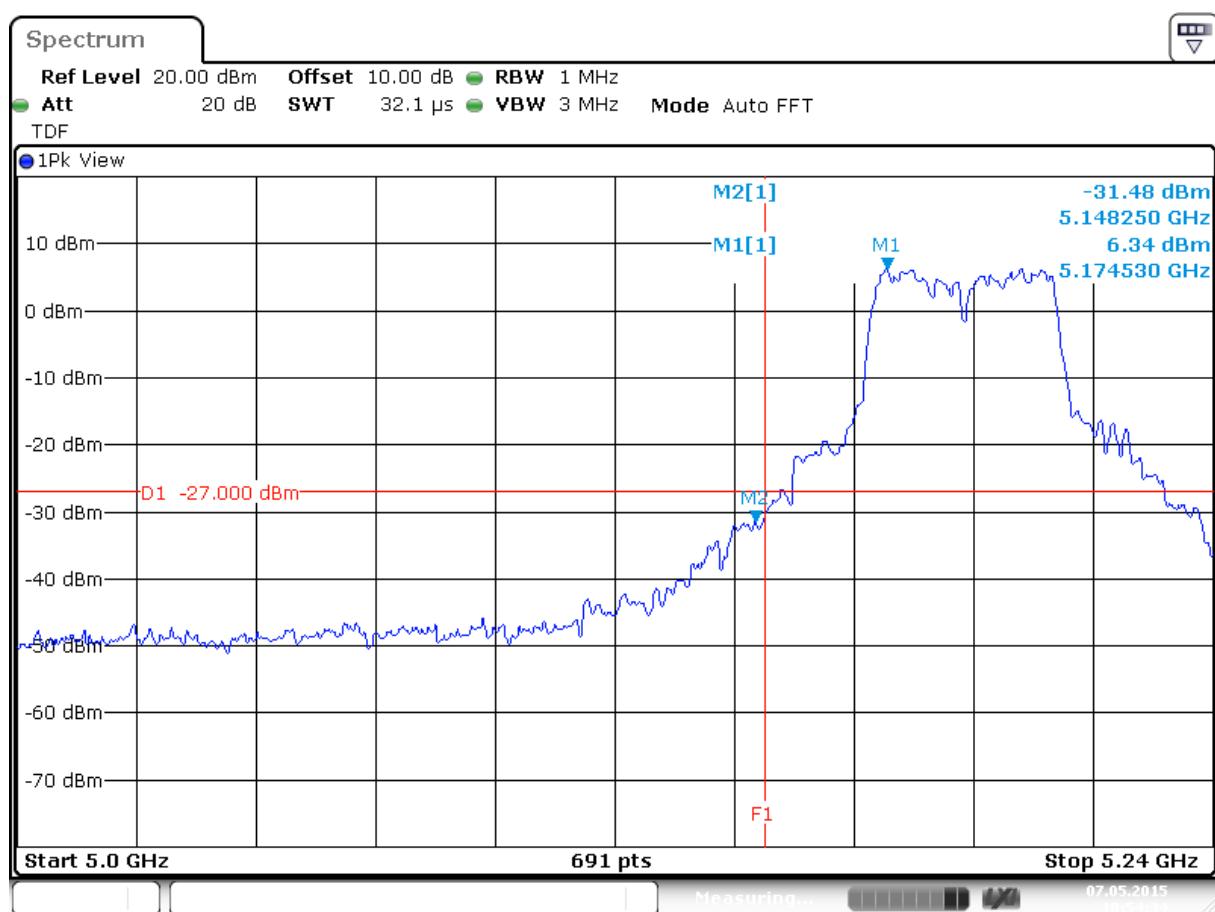
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802.11n – 40 MHz

Plot 5a: Band Edge Emissions, Spectral Diagram, 802.11n-40MHz Ch 38 5190 MHz WLAN-1

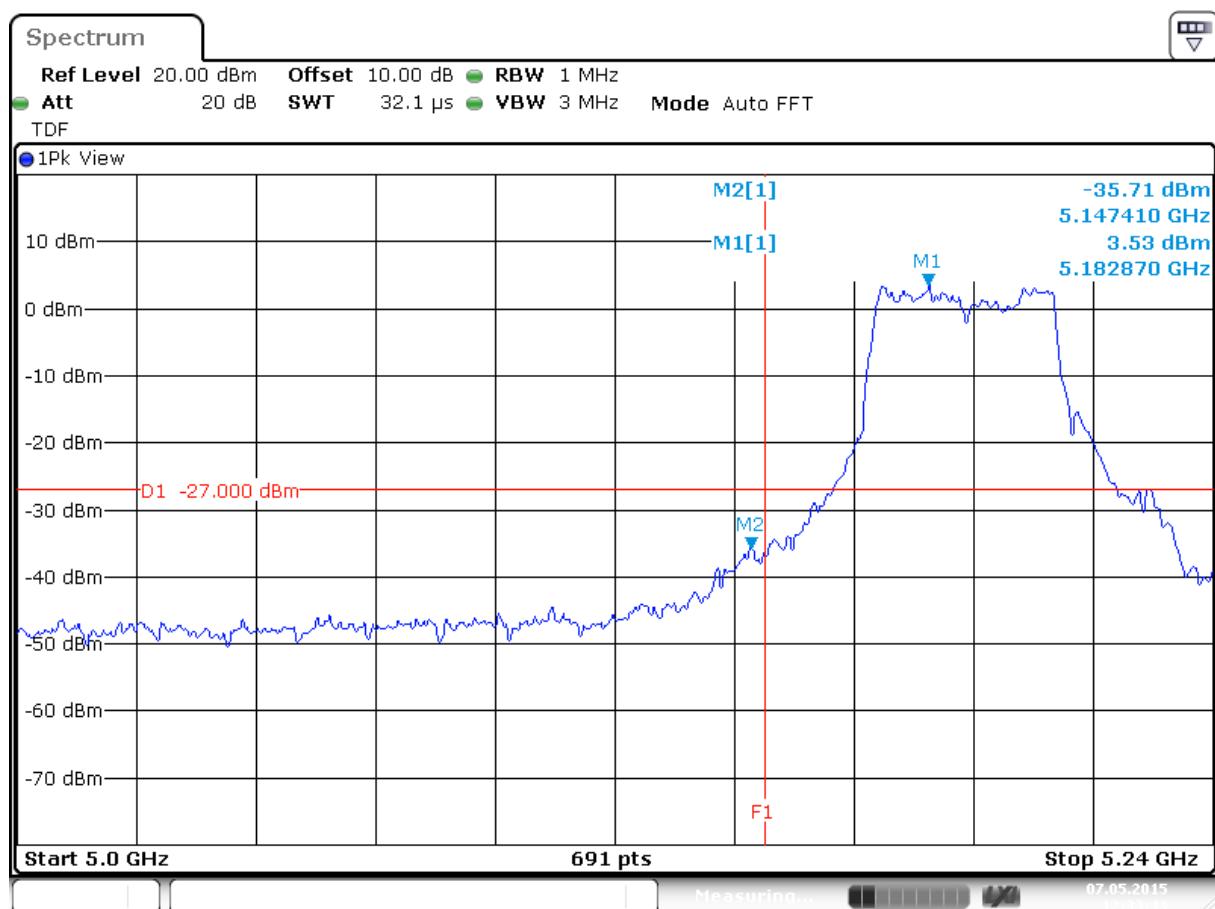


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Plot 5b: Band Edge Emissions, Spectral Diagram, 802.11n-40MHz Ch 38 5190 MHz WLAN-2



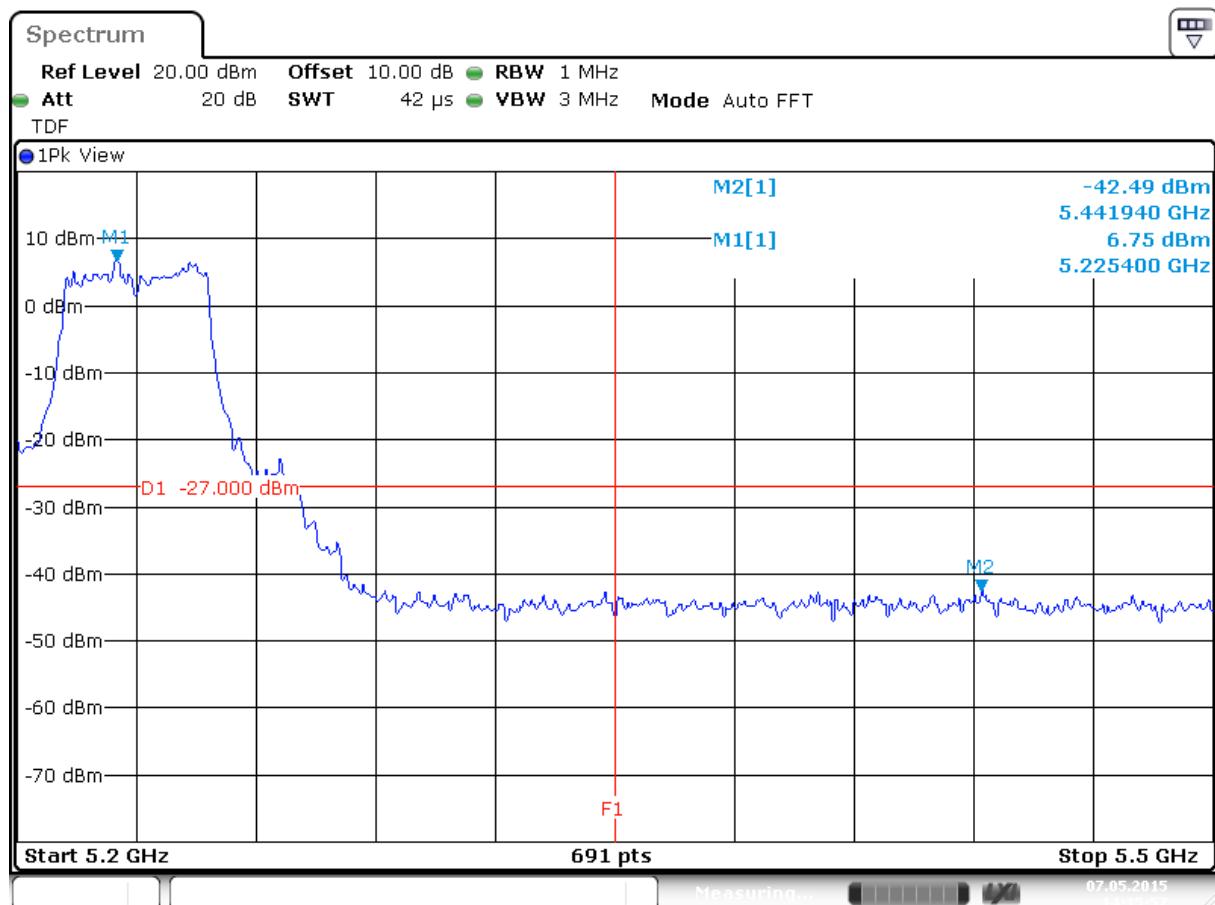
Date: 7.MAY.2015 12:33:43

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Plot 6a: Band Edge Emissions, Spectral Diagram, 802.11n-40MHz Ch 46 5230 MHz WLAN-1



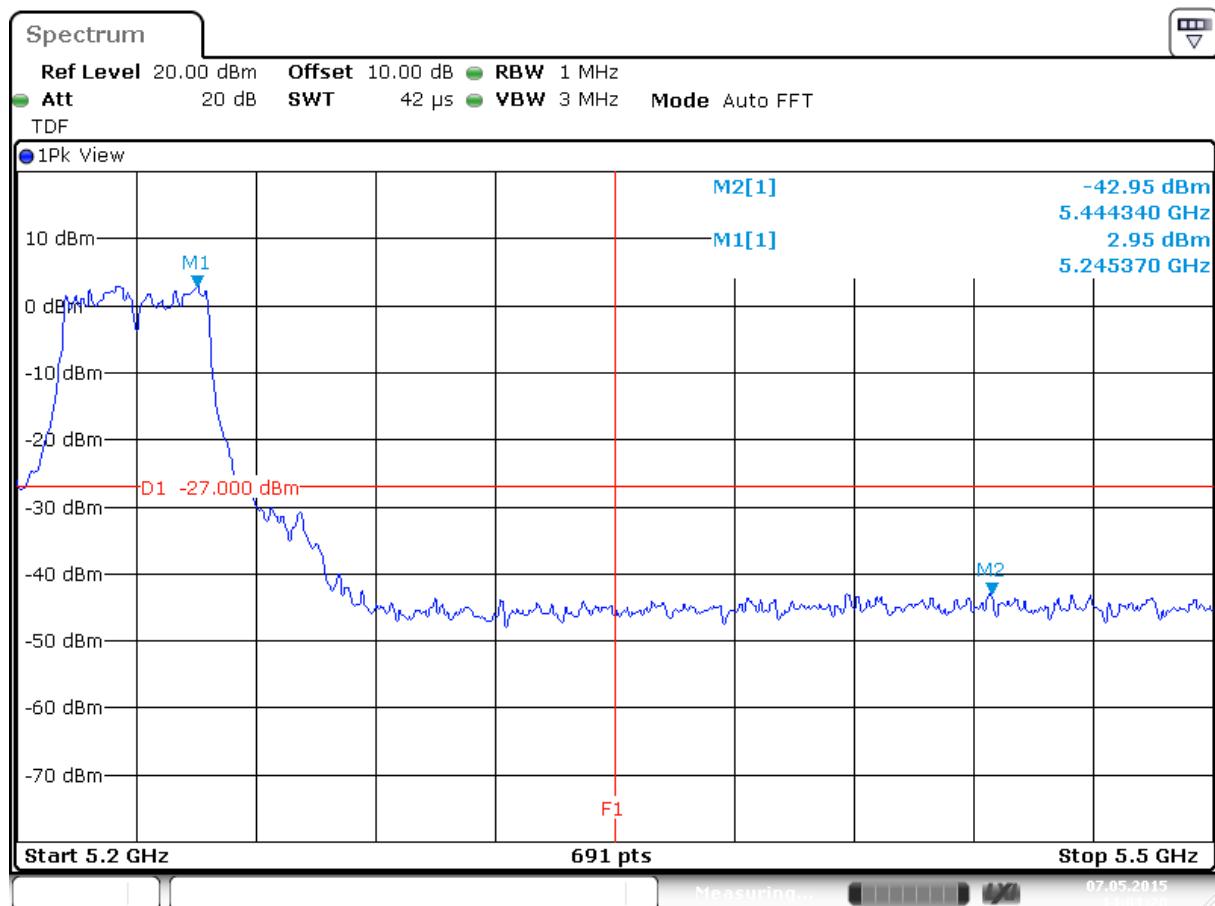
Date: 7.MAY.2015 14:15:57

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Plot 6b: Band Edge Emissions, Spectral Diagram, 802.11n-40MHz Ch 46 5230 MHz WLAN-2



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5.2.6 Radiated Spurious Emissions of Transmitter

RESULT: Not TESTED

Date of testing: N/A

5.3 AC Power Line Conducted Measurements

5.3.1 AC Power Line Conducted Emission of Transmitter

RESULT: Not Tested

Date of testing: N/A

Not tested, see part 15B test report for AC Power Line Conducted measurements

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6. Test setup photographs

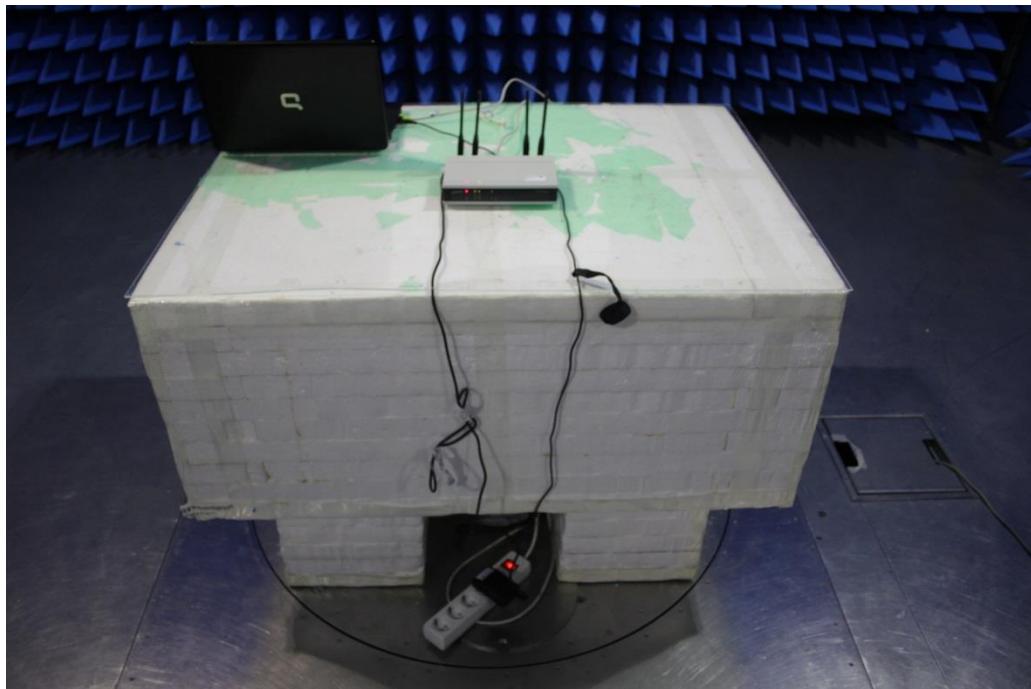


Photo: EUT antennas in vertical position

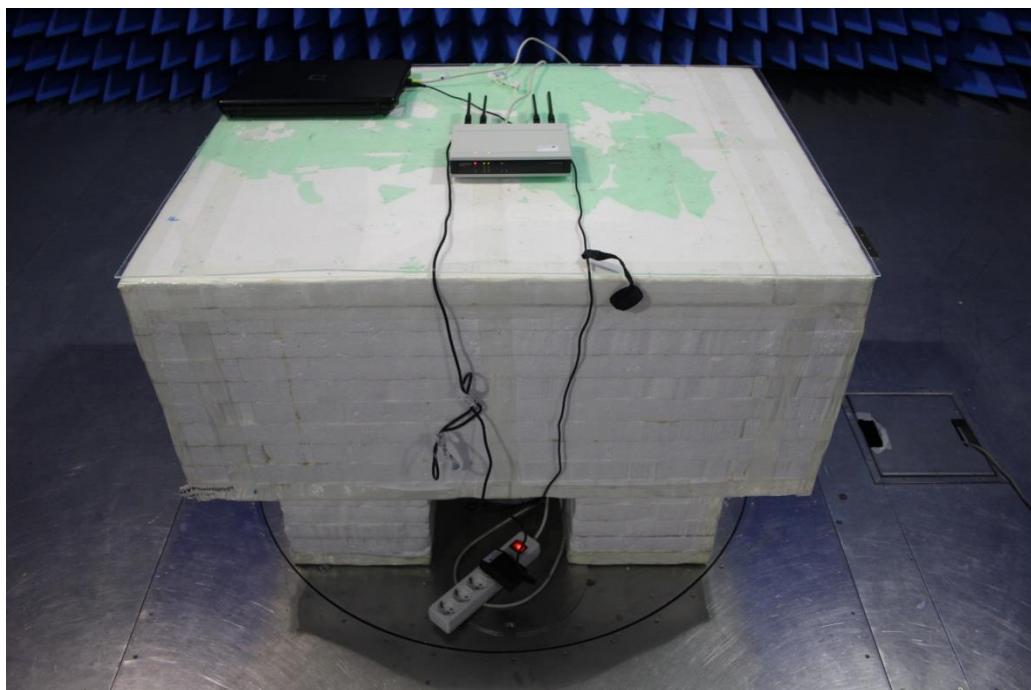


Photo: EUT antennas in vertical position

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End of report