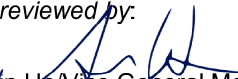


Prüfbericht-Nr.: <i>Test Report No.:</i>	50302753 001	Auftrags-Nr.: <i>Order No.:</i>	238109346	Seite 1 von 52 Page 1 of 52
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	29-Aug-2019	
Auftraggeber: <i>Client:</i>	串雲科技有限公司 臺北市中山區長安東路 1 段 18 號 9 樓			
Prüfgegenstand: <i>Test item:</i>	tracMo Station			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	T402			
Auftrags-Inhalt: <i>Order content:</i>	NCC LP0002 test report			
Prüfgrundlage: <i>Test specification:</i>	NCC Low-power Radio-frequency Devices Technical Regulations LP0002(2018) Section 3.10.1			
Wareneingangsdatum: <i>Date of receipt:</i>	11-Sep-2019			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000990074 - 001 to 002			
Prüfzeitraum: <i>Testing period:</i>	02-Oct-2019 – 22-Oct-2019			
Ort der Prüfung: <i>Place of testing:</i>	EMC/RF Laboratory Taipei			
Prüflaboratorium: <i>Testing laboratory:</i>	TUV Rheinland Taiwan Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:  22-Oct-2019 Jack Chang/Project Manager		kontrolliert von / reviewed by:  22-Oct-2019 Arvin Ho/Vice General Manager		
Datum <i>Date(Report Date)</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* 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. <i>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.</i>				

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: *Passed*

5.1.2 PEAK OUTPUT POWER

RESULT: *Passed*

5.1.3 6dB 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*

5.2.1 MAINS CONDUCTED EMISSIONS

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 internal view
(File Name: 50302753 001 APPENDIXP)

Appendix D: Test Result of Radiated Emissions
(File Name: 50302753 001 APPENDIXD)

Test Specifications

The following standards were applied.

Table 1: Applied Standard and Test Levels

Radio
NCC Low-power Radio-frequency Devices Technical Regulations LP0002(2018) (107 年 1 月 10 日)

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.
Taipei Testing Laboratories

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

2.2 Test Facility

TUV Rheinland Taiwan Ltd.
Taipei Office

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

FCC RegistrationNo.: 180491
IC Canada Registration No.: 9465A
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	102109	2019/4/17	2020/4/16
Spectrum Analyzer	R&S	FSV40	101509	2019/2/4	2020/2/4
Pre-Amplifier	Agilent	8447D	2727A05146	2019/2/22	2020/2/22
Pre-Amplifier	EMCI	EMC051845SE	980635	2019/2/25	2020/2/25
Pre-Amplifier	EMCI	EMC184045SE	980656	2019/2/23	2020/2/23
Bilog Antenna	SCHWARZBECK	VULB-9168	00950	2019/1/14	2020/1/14
Horn Antenna	ETS-Lindgren	3117	00218929	2018/12/27	2019/12/27
Horn Antenna	SCHWARZBECK	BBHA 9170	00890	2019/4/12	2020/4/11
Loop Antenna	EMCI	LPA600	287	2018/12/20	2019/12/19
Test Software	Audix	e3	Ver. 9	N/A	N/A
Spectrum Analyzer	R&S	FSV40	101513	2019/2/8	2020/2/8
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 in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular schedule using in house standards or comparisons.

2.6 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements.

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF power, conducted	± 1.5 dB
RF power density, conducted	± 3 dB
spurious emissions, conducted	± 3 dB
all emissions, radiated	± 6 dB
Temperature	± 1 °C
Humidity	± 5 %
DC and low frequency voltages	± 3 %

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a tracMo Station. It contains a WiFi and Bluetooth 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/Test Item	tracMo Station
Type Designation	T402
Brand Name	Tracmo, Inc.

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequencies	802.11b/g/n HT20 : 2412 MHz ~ 2462 MHz 802.11n HT40 : 2422 MHz ~ 2452 MHz
Channel Spacing	802.11b/g/n HT20 : 5MHz 802.11n HT40 : 5MHz
Channel number	802.11b/g/n HT20 : 11 802.11n HT40 : 7
Operation Voltage	5Vdc
Modulation	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Antenna gain	3.71dBi

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

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description
- Block Diagram

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	10	10	10
802.11g	10	10	10
802.11n20	10	10	10

Mode	Channel Frequency		
	2422 MHz	2437 MHz	2452 MHz
802.11n40	10	10	10

4.2 Test Operation and Test Software

Setup for testing: Test samples are provided with a test mode software which use the UART-USB interface which makes it possible to control the DUT through an espRFTTool.

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 sample: A000990074-001

Radiation sample: A000990074-002

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 MCS0 data rate were chosen for full testing.

IEEE 802.11n HT 40 mode:

Channel Low (2422MHz), Channel Mid (2437MHz) and Channel High (2452MHz) with MCS0 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:

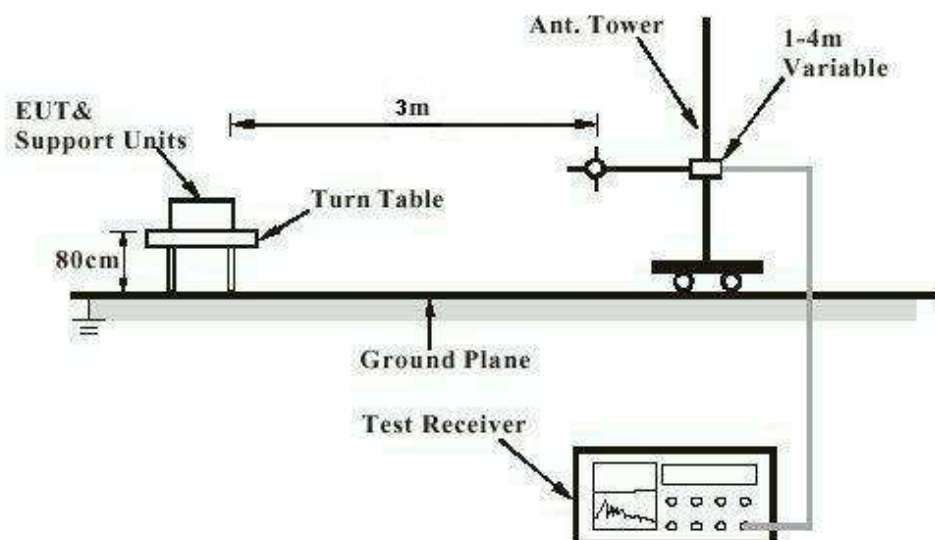
Description	Manufacturer	Model No.	Serial No.
Notebook for setup	HP	15-DA1046TX	-
Notebook for AC mains	Lenovo	E480	-
Test tool	Espressif	espRFTool	2.0

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 Mains Conduction Measurement (if applicable)

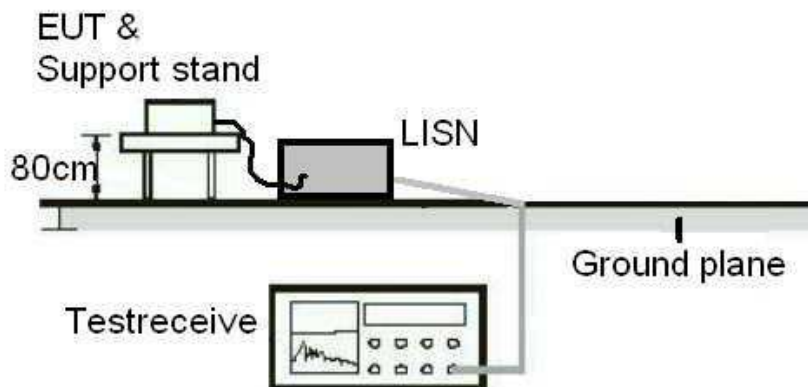
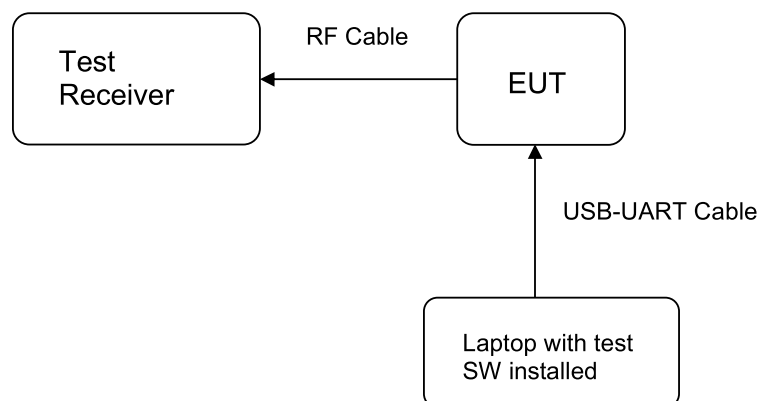


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Test standard : LP0002(2018): 2.2, 3.10.1.3, 3.10.1.4

Requirement : use of approved antennas only with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with Max directional gain of 3.71dBi. 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 : LP0002(2018): 3.10.1.2(1)(C)
 Basic standard : ANSI C63.10:2013
 LP0002(2008) Appendix II
 Limit : 1 Watt
 Kind of test site : Shielded room

Test setup

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

 Ambient temperature : 20-24 °C
 Relative humidity : 50-65 %
 Atmospheric pressure : 100-103 kPa

Table 7: Test result of Maximum conducted Peak output power, 802.11b

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	14.44	0.02780	1
Middle Channel	2437	14.60	0.02884	1
High Channel	2462	14.81	0.03027	1

Pmax: 14.81dBm, 30.27mW

Table 8: Test result of Maximum conducted Peak output power, 802.11g

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	15.84	0.03837	1
Middle Channel	2437	16.13	0.04102	1
High Channel	2462	16.31	0.04276	1

Pmax: 16.31dBm, 42.76mW

**Table 9: Test result of Maximum conducted Peak output power,
802.11n20**

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	16.18	0.04150	1
Middle Channel	2437	16.36	0.04325	1
High Channel	2462	16.52	0.04487	1

Pmax: 16.52dBm, 44.87mW

**Table 10: Test result of Maximum conducted Peak output power,
802.11n40**

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2422	14.64	0.02911	1
Middle Channel	2437	13.82	0.02410	1
High Channel	2452	13.33	0.02153	1

Pmax: 14.64dBm, 29.11mW

5.1.3 6dB Bandwidth

RESULT:
Passed

Test standard : LP0002(2018): 3.10.1.6(2)(A)
 Basic standard : ANSI C63.10:2013
 LP0002(2008) Appendix II
 Kind of test site : Shielded room

Test setup

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

 Ambient temperature : 20-24°C
 Relative humidity : 50-65%
 Atmospheric pressure : 100-103 kPa

Table 11: Test result of 6dB Bandwidth, 802.11b

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	10.01	>0.5	Pass
Mid Channel	2437	10.04	>0.5	Pass
High Channel	2462	10.01	>0.5	Pass

Table 12: Test result of 6dB Bandwidth, 802.11g

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	16.304	>0.5	Pass
Mid Channel	2437	16.304	>0.5	Pass
High Channel	2462	16.304	>0.5	Pass

Table 13: Test result of 6dB Bandwidth, 802.11n20

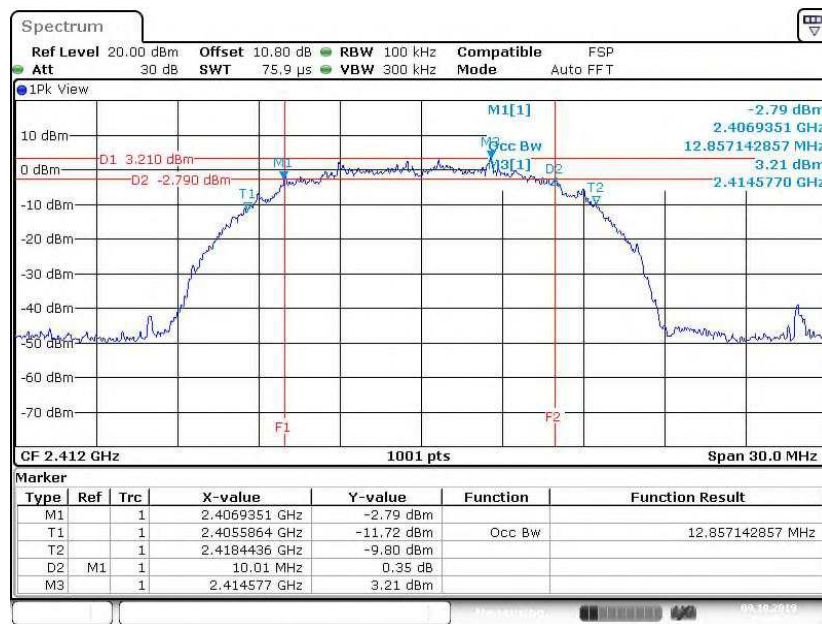
Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	16.544	>0.5	Pass
Mid Channel	2437	16.783	>0.5	Pass
High Channel	2462	16.544	>0.5	Pass

Table 14: Test result of 6dB Bandwidth, 802.11n40

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2422	36.064	>0.5	Pass
Mid Channel	2437	35.914	>0.5	Pass
High Channel	2452	36.314	>0.5	Pass

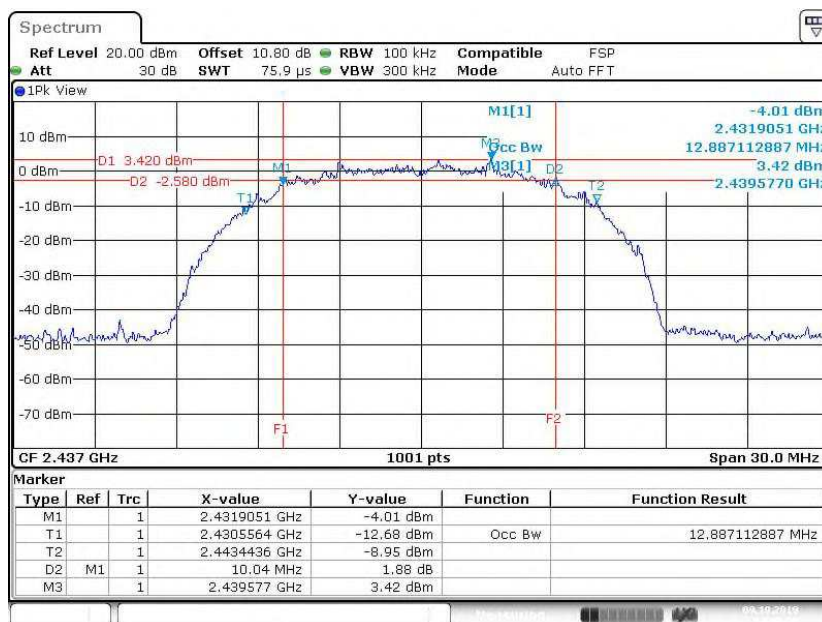
Test Plot of 6dB Bandwidth, 802.11b

Low Channel

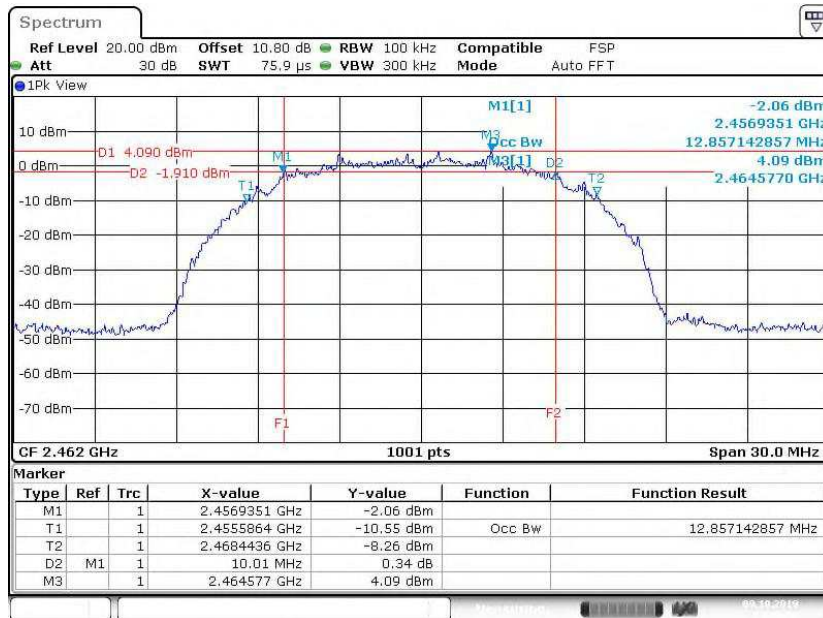


Date: 9.OCT.2019 13:45:57

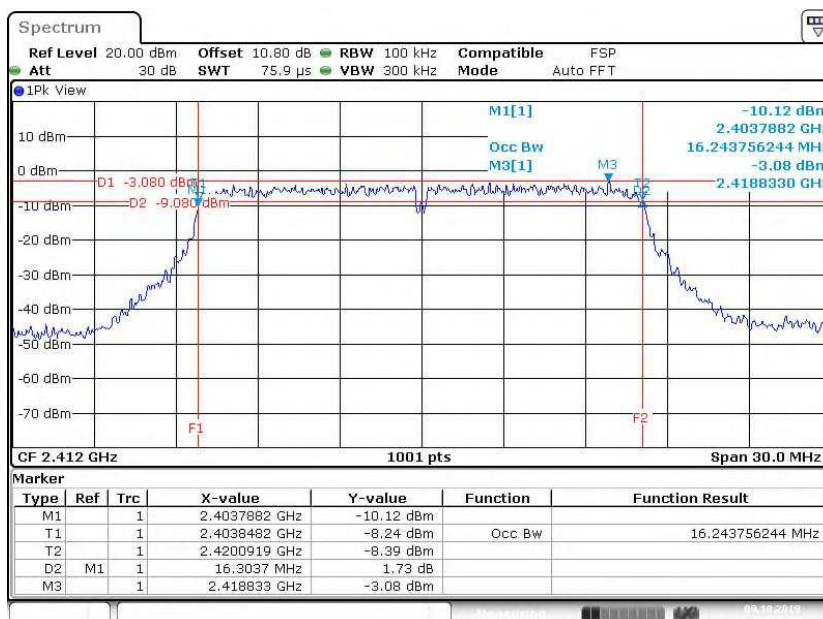
Middle Channel



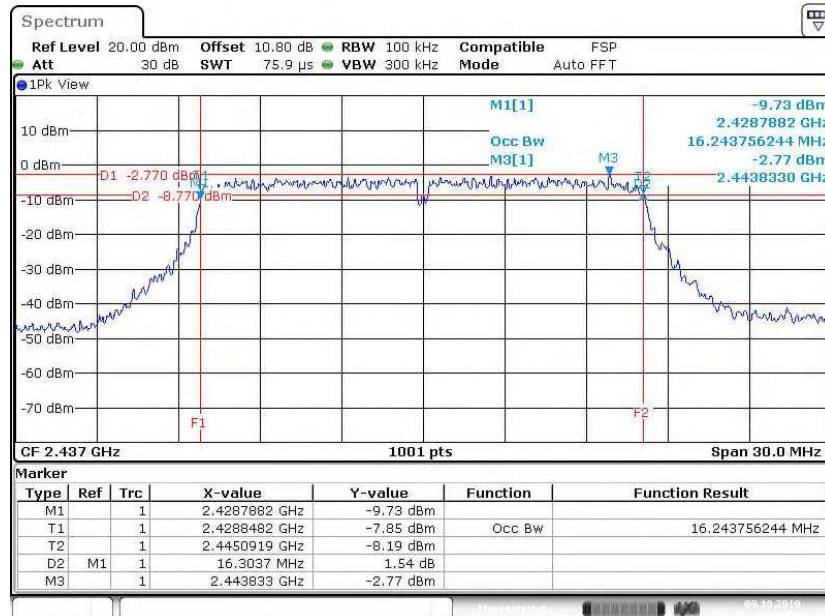
Date: 9.OCT.2019 14:10:39

High Channel


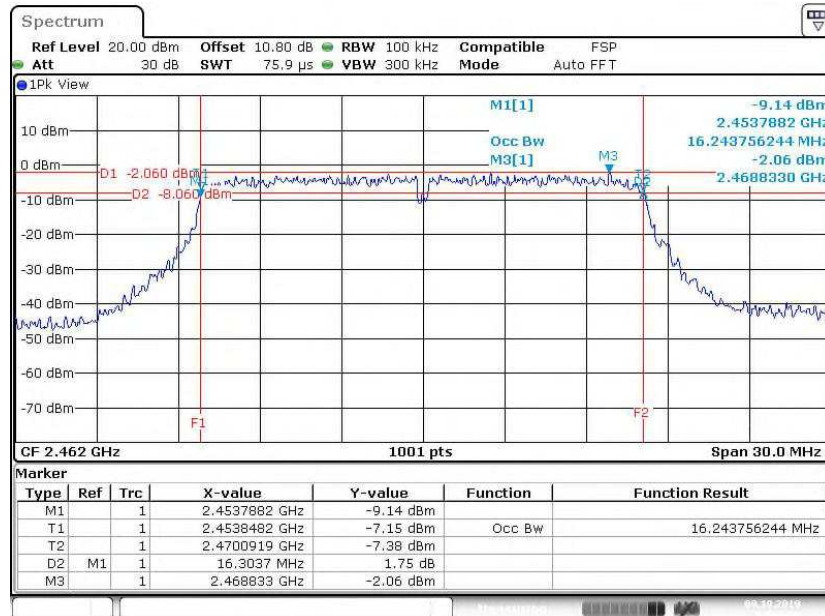
Date: 9.OCT.2019 14:15:51

Test Plot of 6dB Bandwidth, 802.11g
Low Channel


Date: 9.OCT.2019 14:24:54

Middle Channel


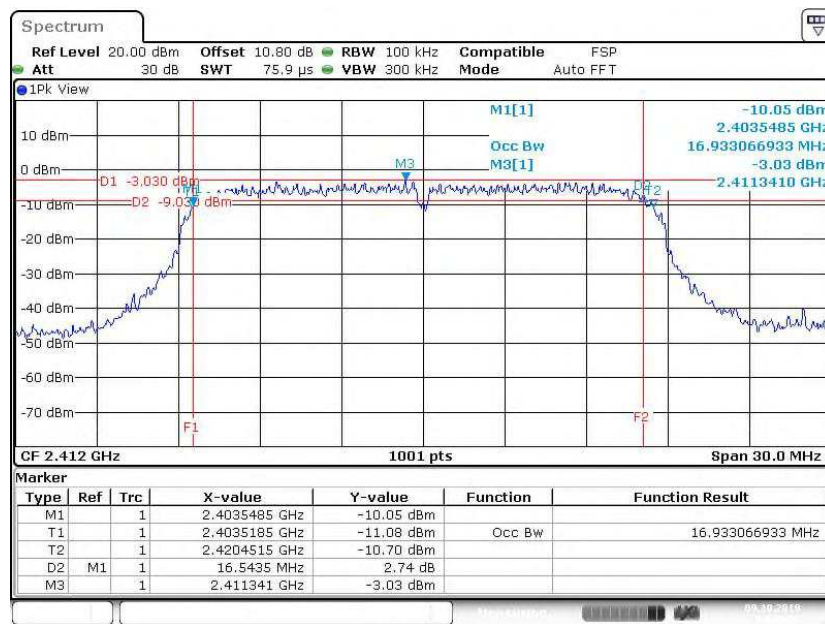
Date: 9.OCT.2019 14:28:36

High Channel


Date: 9.OCT.2019 14:34:20

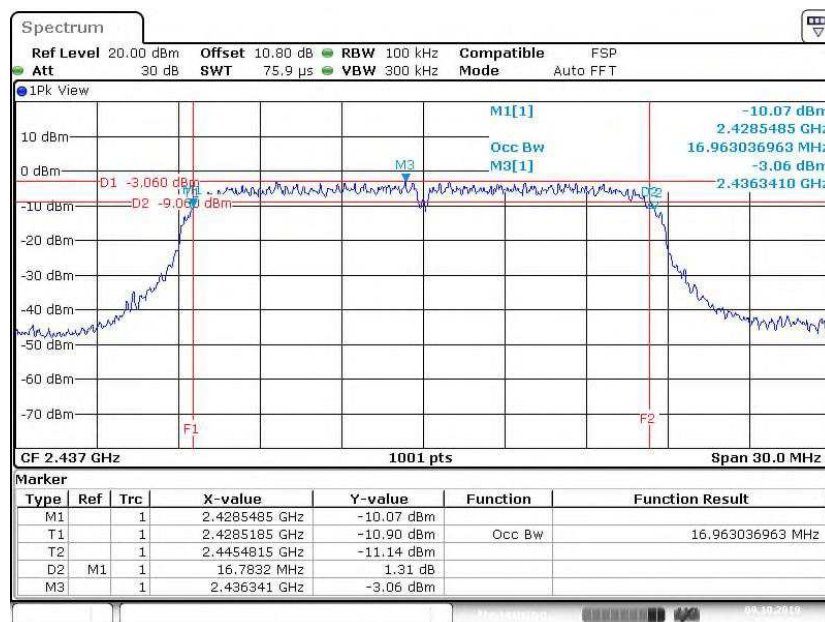
Test Plot of 6dB Bandwidth, 802.11n20

Low Channel

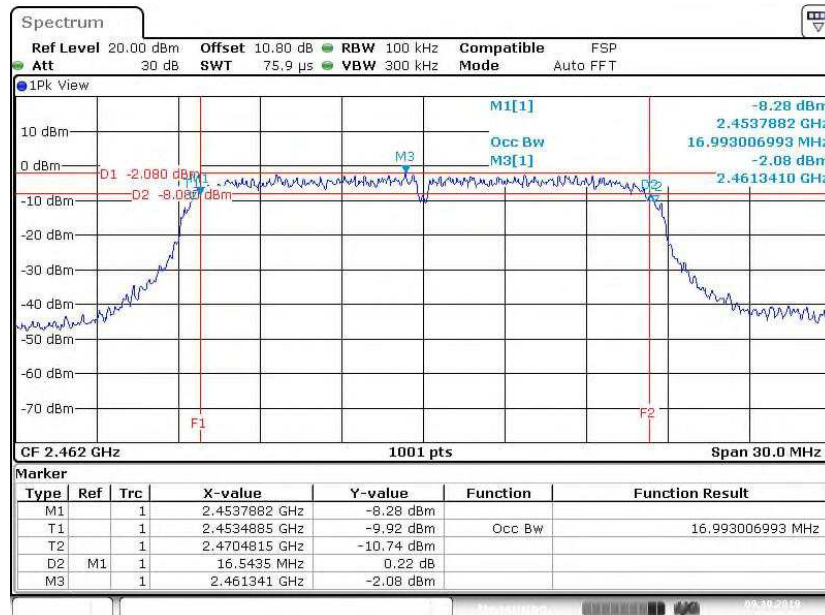


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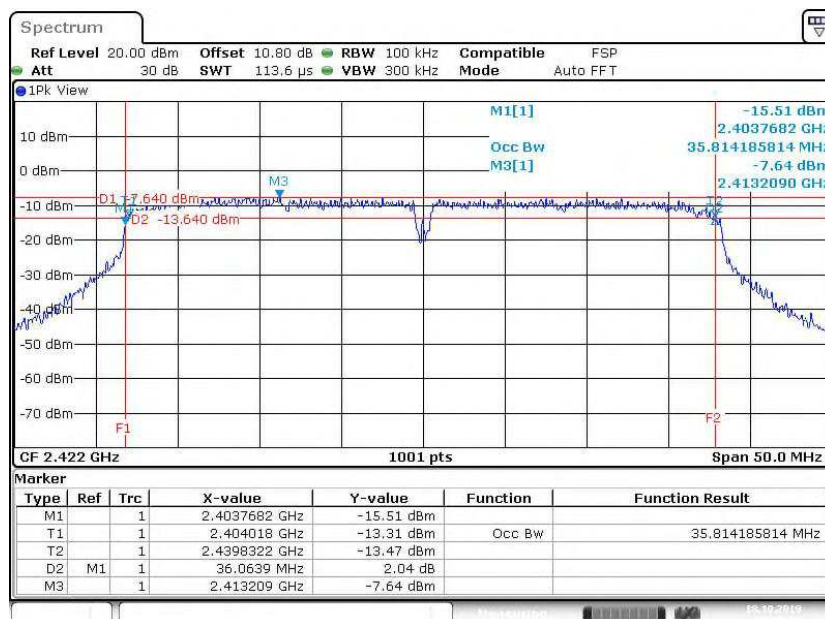
Middle Channel



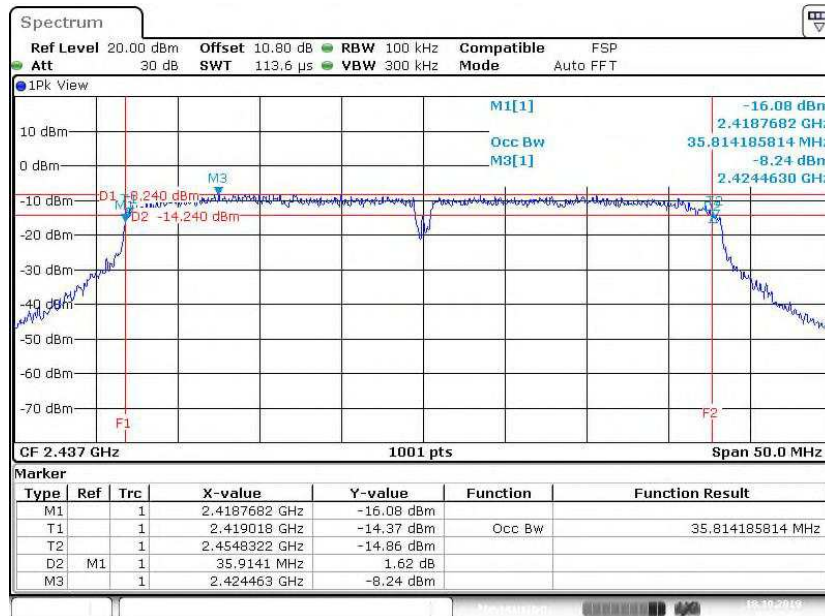
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High Channel


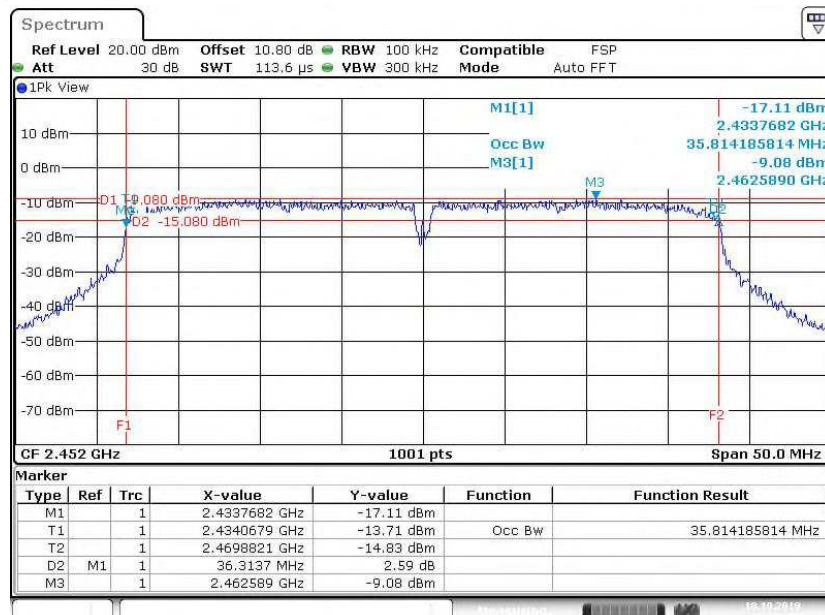
Date: 9.OCT.2019 14:48:48

Test Plot of 6dB Bandwidth, 802.11n40
Low Channel


Date: 18.OCT.2019 10:19:26

Middle Channel


Date: 18.OCT.2019 13:27:27

High Channel


Date: 18.OCT.2019 13:31:46

5.1.4 Power Density

RESULT:
Passed

Test standard : LP0002(2018): 3.10.1.6 (2)(B)
 Basic standard : ANSI C63.10:2013
 LP0002(2008) Appendix II
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A
 Ambient temperature : 20-24°C
 Relative humidity : 50-65%
 Atmospheric pressure : 100-103 kPa

Table 15: Test result of Power Density, 802.11b

Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-11.89	8
Middle Channel	2437	-11.25	8
High Channel	2462	-10.50	8

Table 16: Test result of Power Density, 802.11g

Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-14.78	8
Middle Channel	2437	-14.03	8
High Channel	2462	-13.26	8

Table 17: Test result of Power Density, 802.11n20

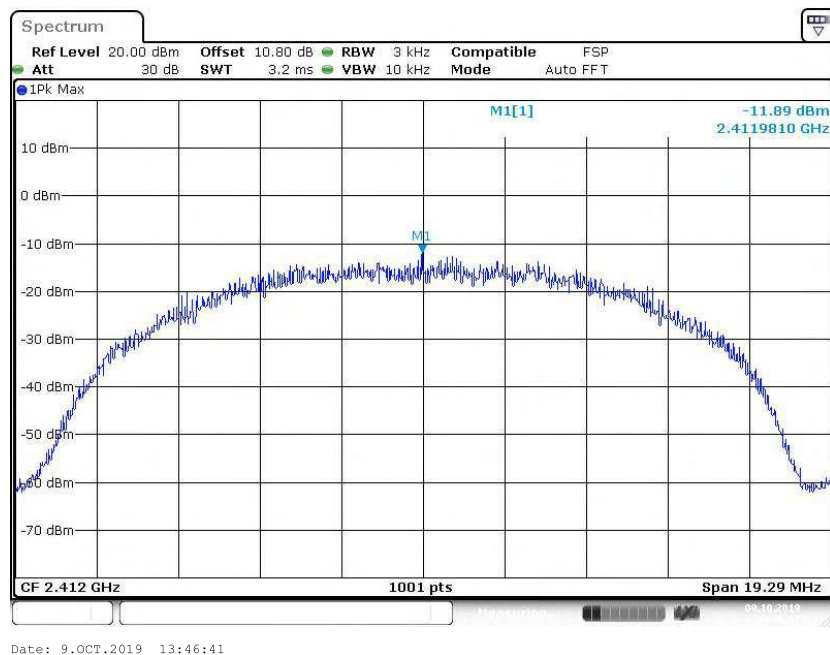
Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-14.43	8
Middle Channel	2437	-14.01	8
High Channel	2462	-13.06	8

Table 18: Test result of Power Density, 802.11n40

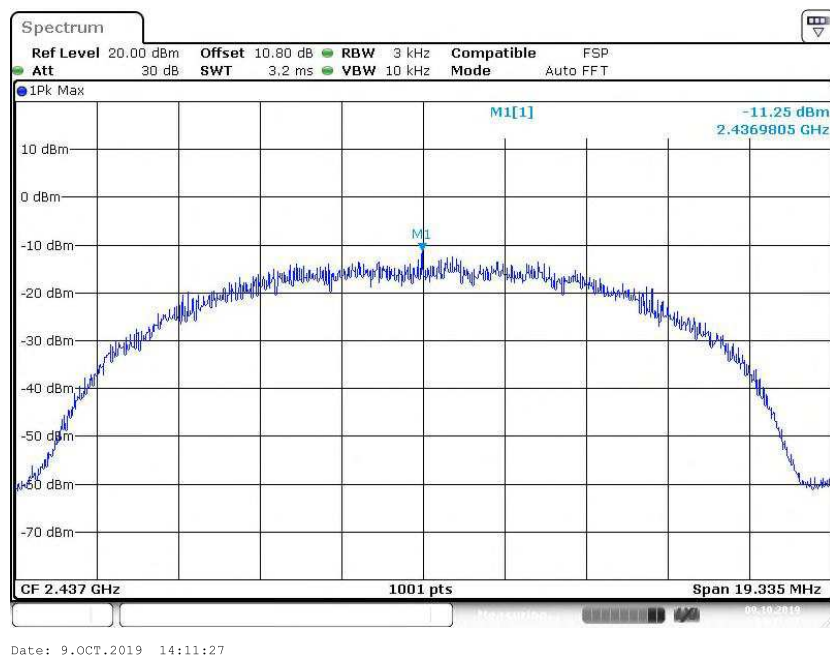
Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2422	-18.13	8
Middle Channel	2437	-18.23	8
High Channel	2452	-19.17	8

Test Plot of Power Density, 802.11b

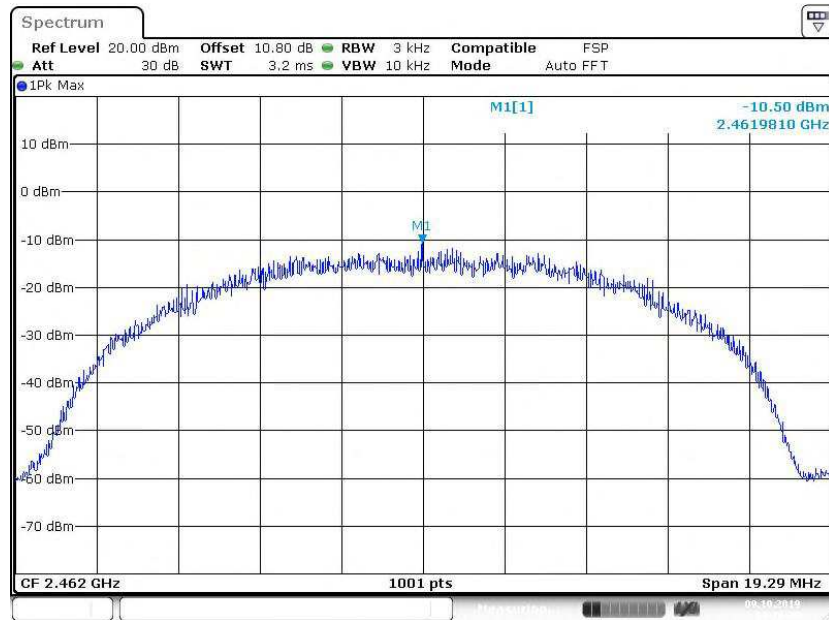
Low Channel



Middle Channel

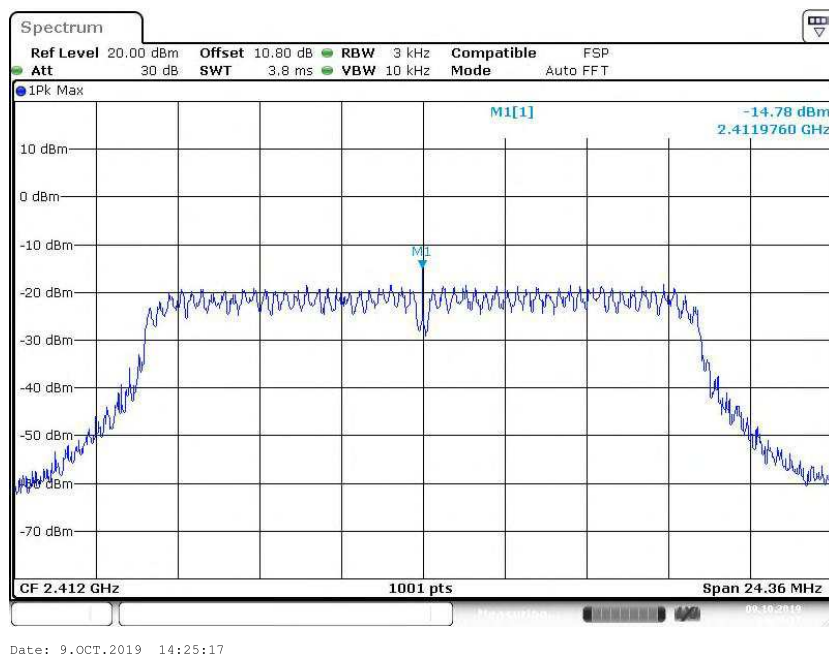


High Channel

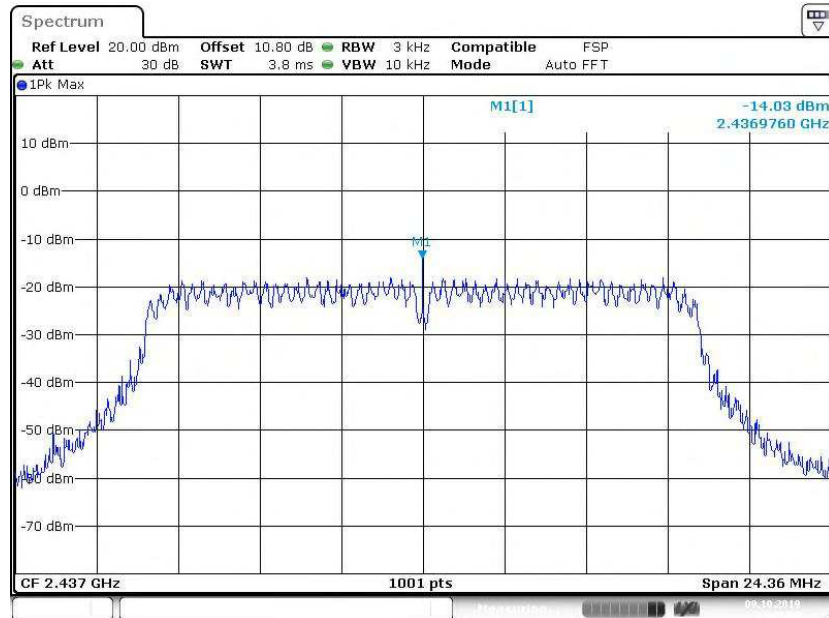


Test Plot of Power Density, 802.11g

Low Channel

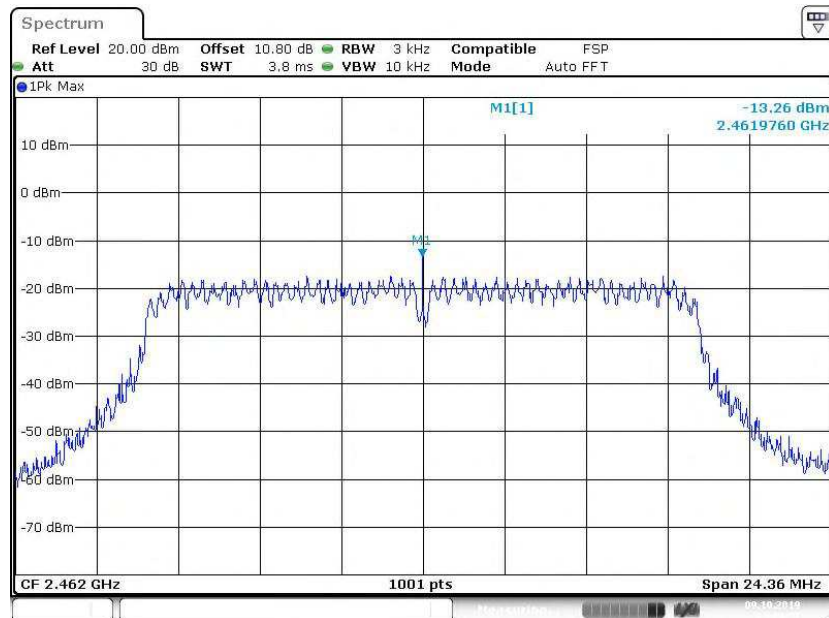


Middle Channel



Date: 9.OCT.2019 14:29:44

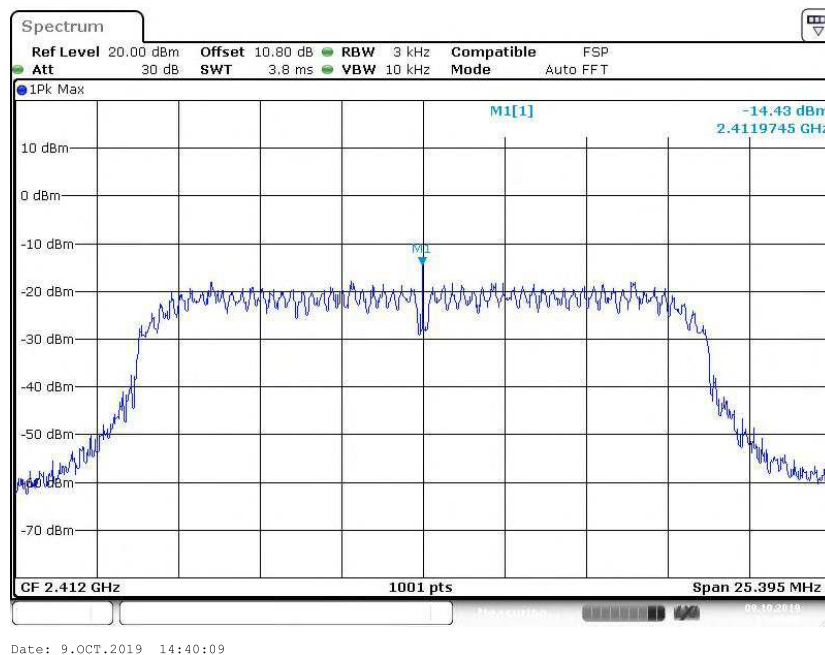
High Channel



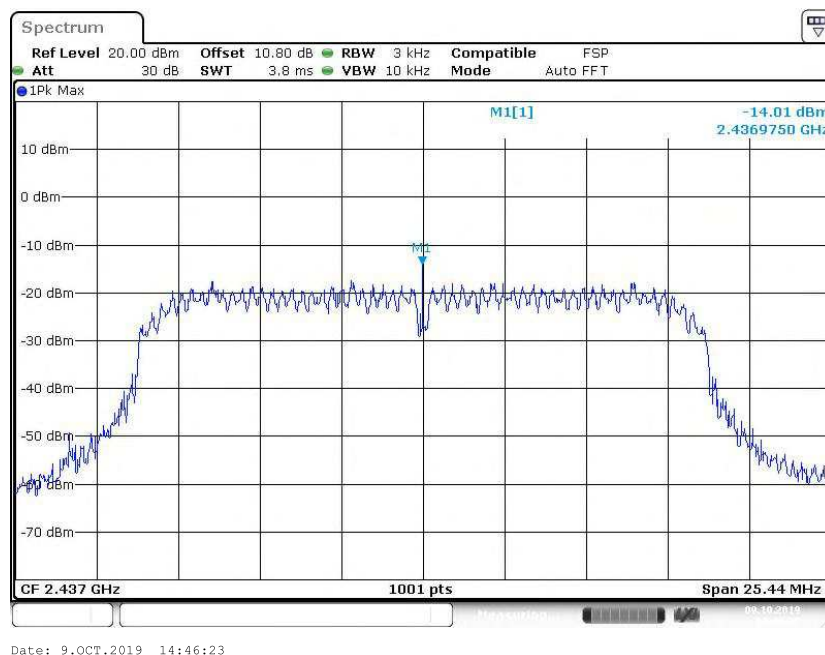
Date: 9.OCT.2019 14:34:50

Test Plot of Power Density, 802.11n20

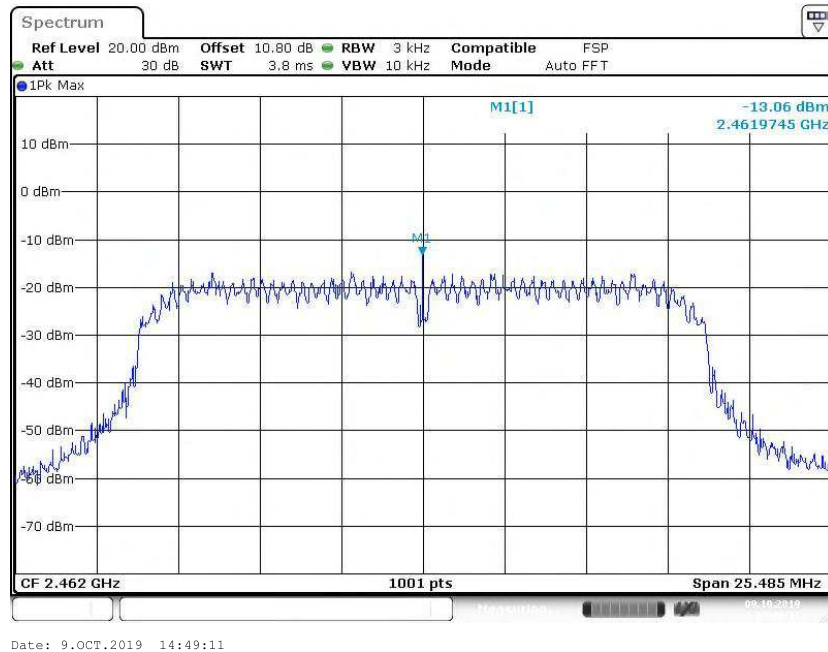
Low Channel



Middle Channel

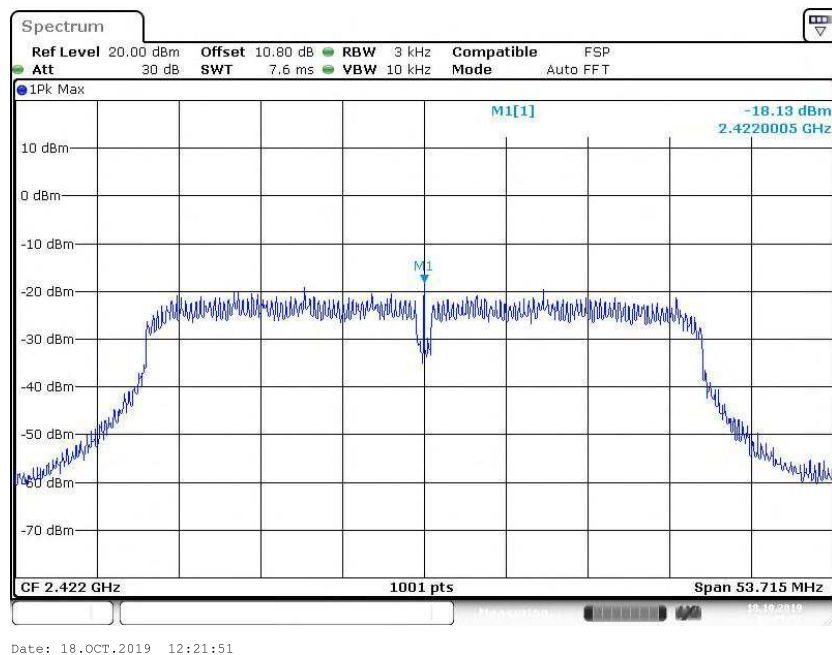


High Channel

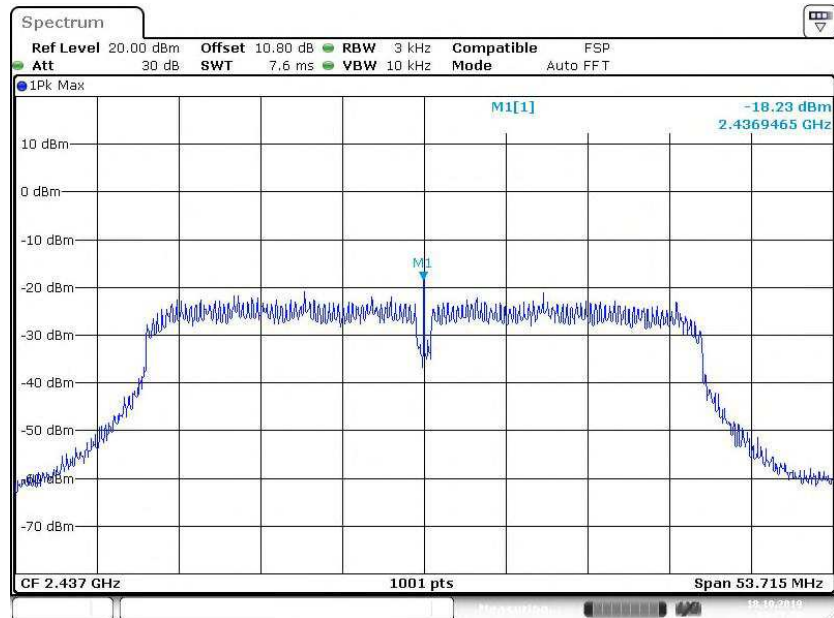


Test Plot of Power Density, 802.11n40

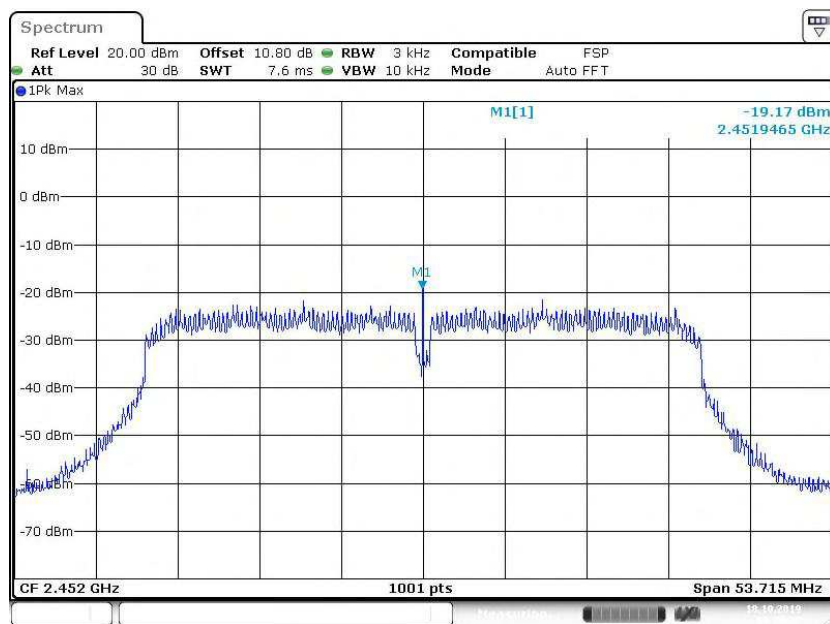
Low Channel



Middle Channel



High Channel



**5.1.5 Conducted spurious emissions and Frequency Band Edge
measured in 100kHz Bandwidth****RESULT:****Passed**

Test standard	:	LP0002(2018): 3.10.1.5
Basic standard	:	ANSI C63.10:2013, KDB558074, LP0002(2008) Appendix II
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

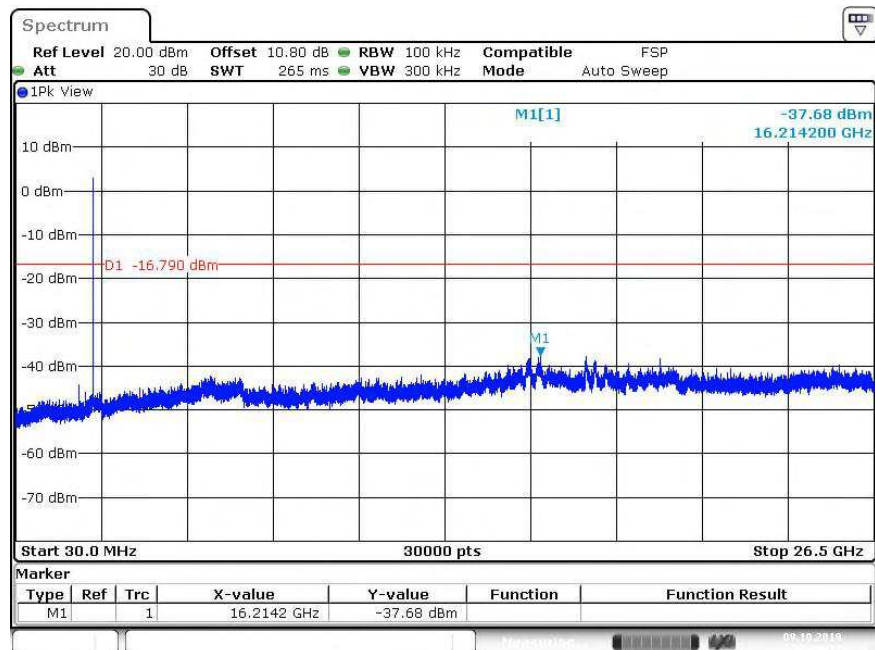
Test Channel	:	Low/ Mid/ High for spurious, Low/ High for Band Edge
Operation mode	:	A
Ambient temperature	:	20-24°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103 kPa

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

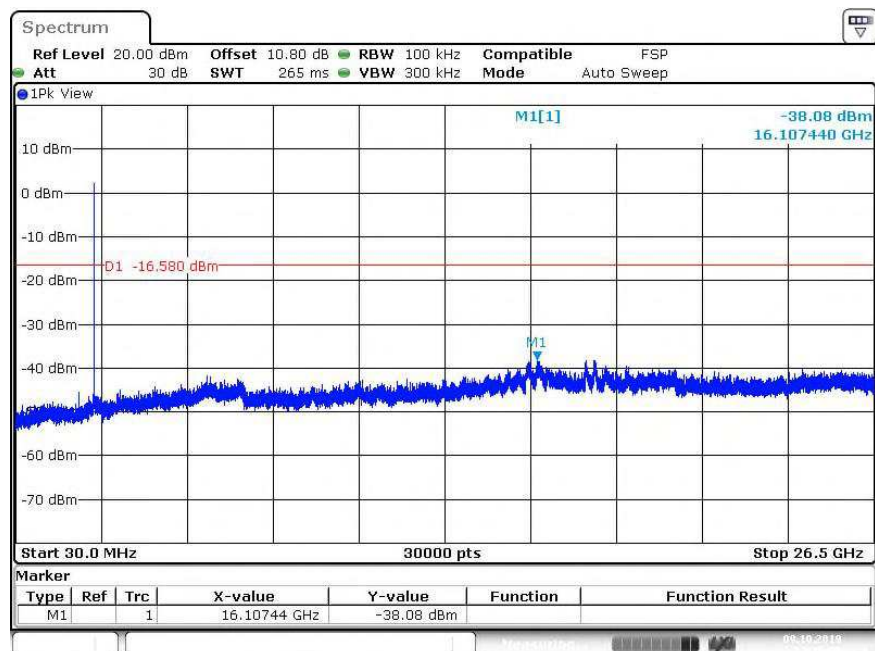
Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

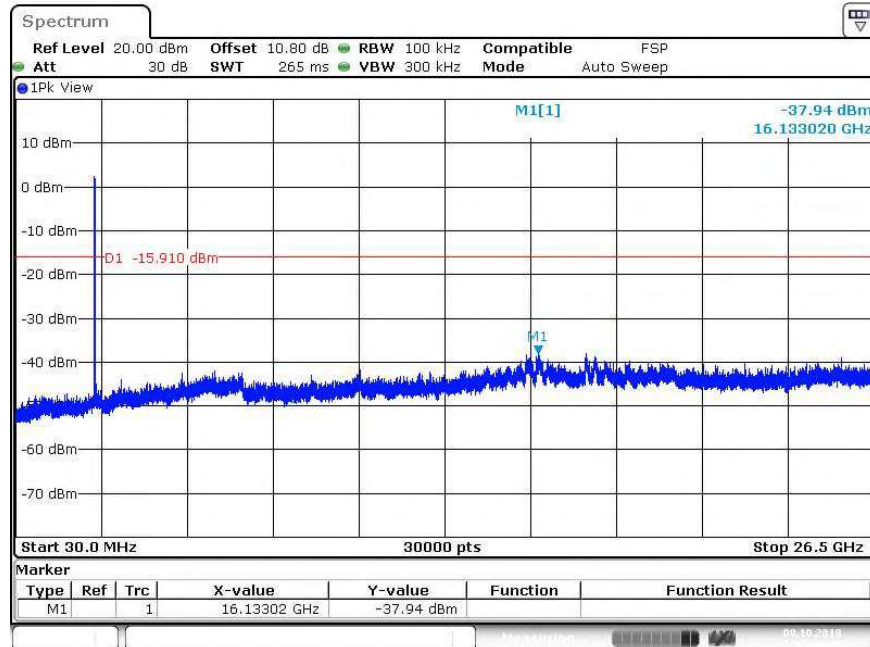
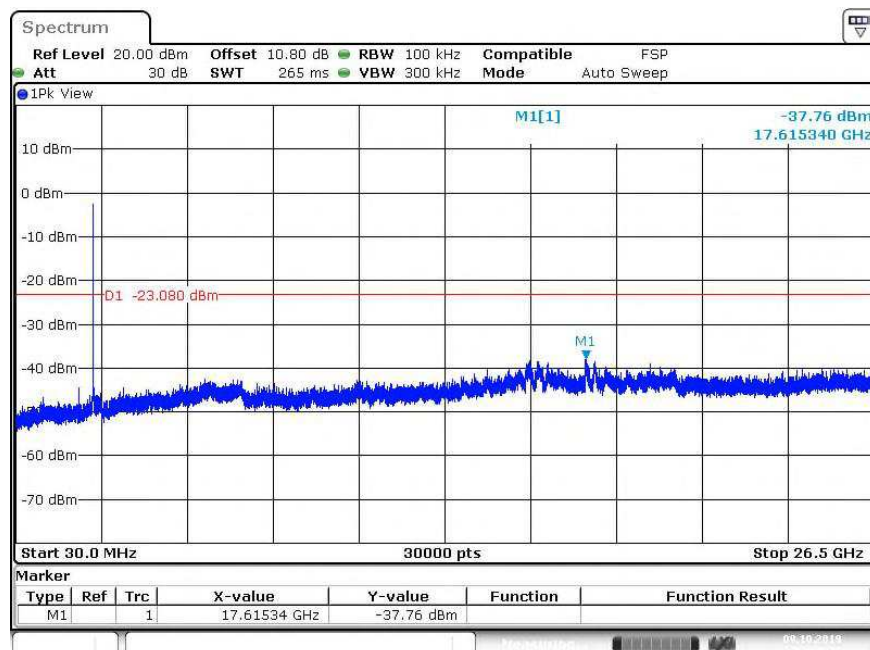
Test Plot 100kHz Conducted Emissions, 802.11b

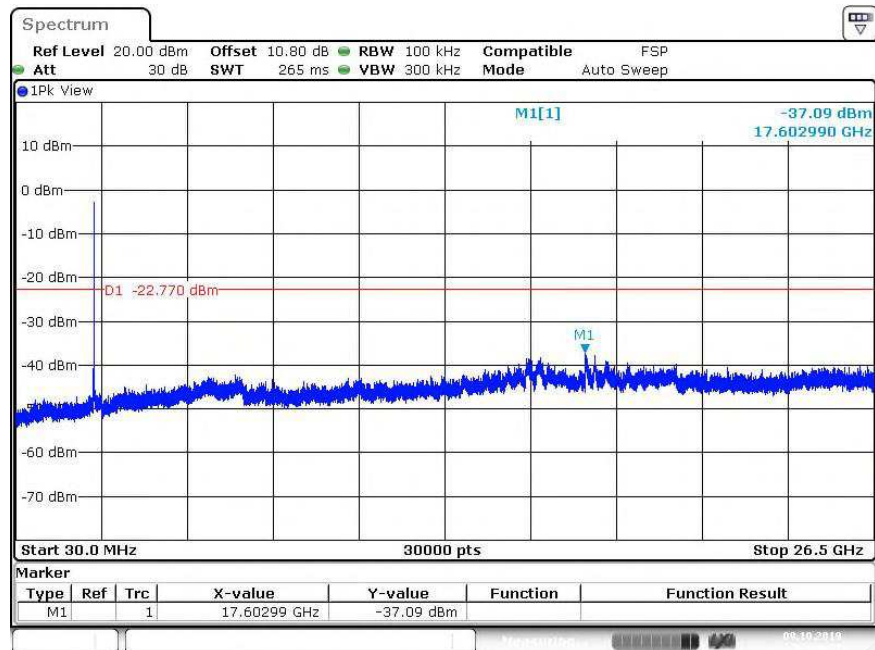
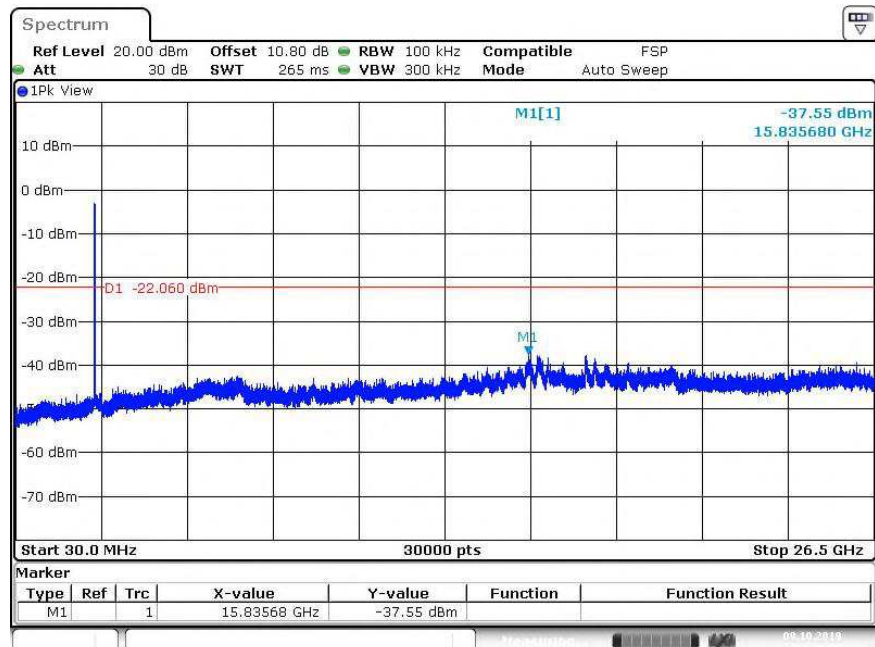
Low Channel



Middle Channel

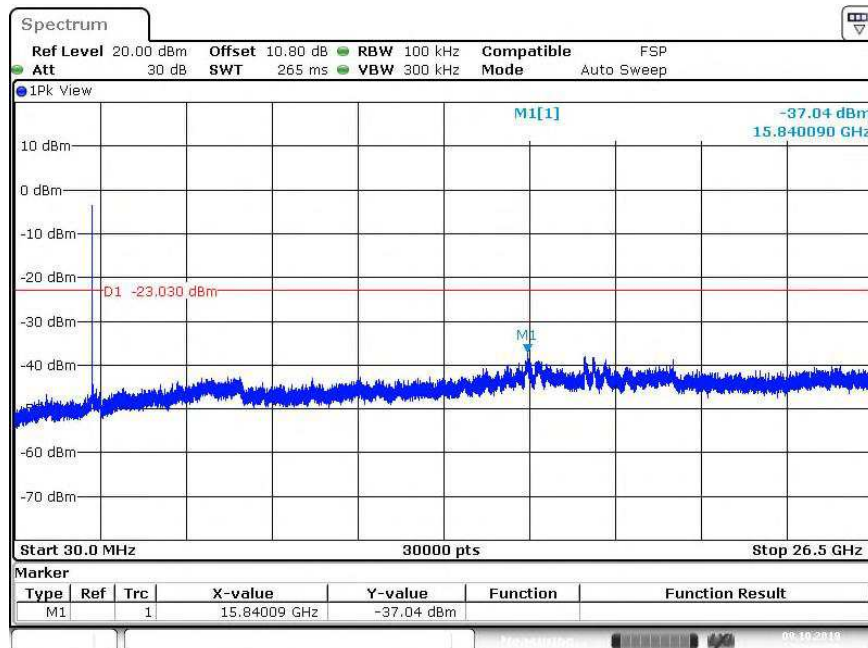


High Channel

Test Plot 100kHz Conducted Emissions, 802.11g
Low Channel


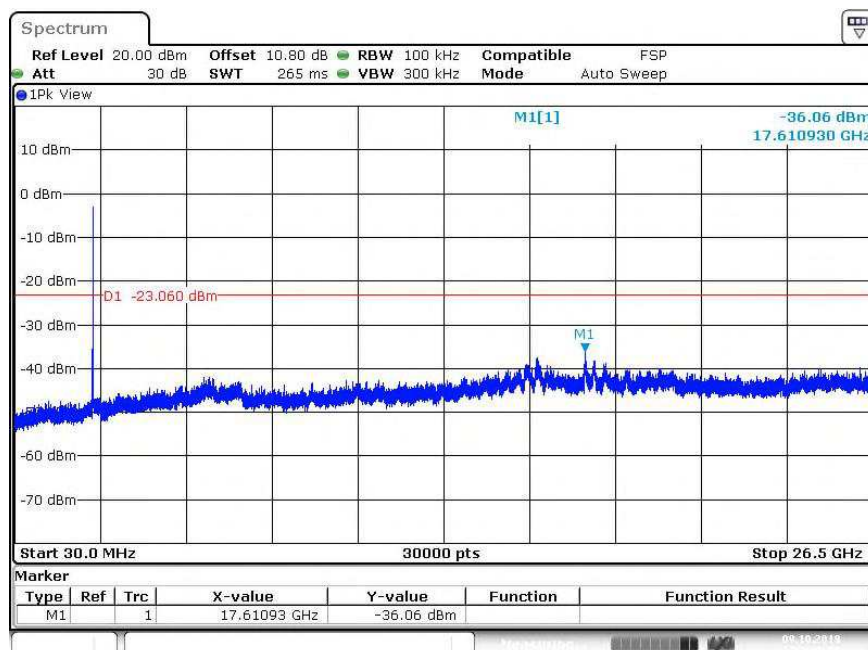
Middle Channel

High Channel


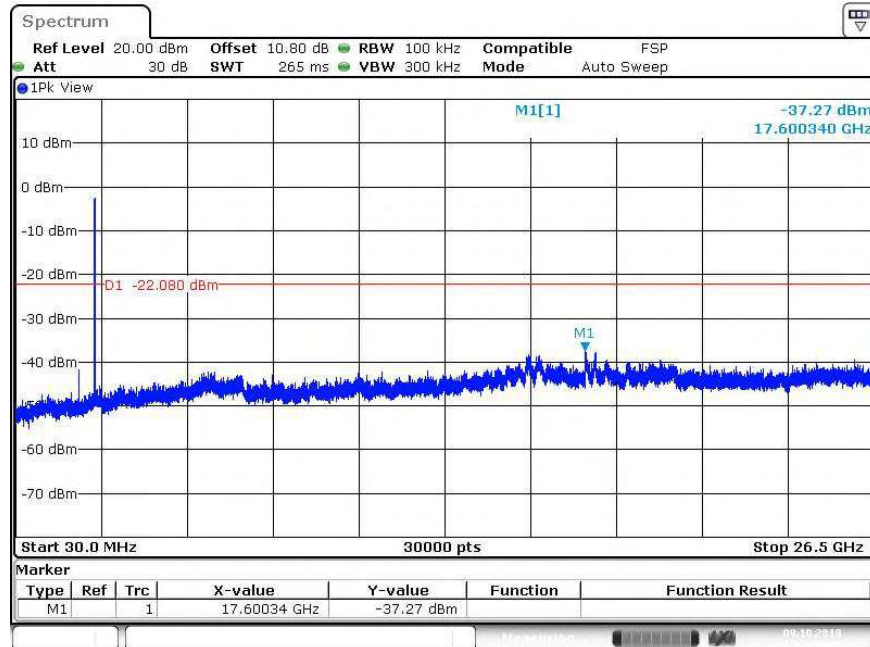
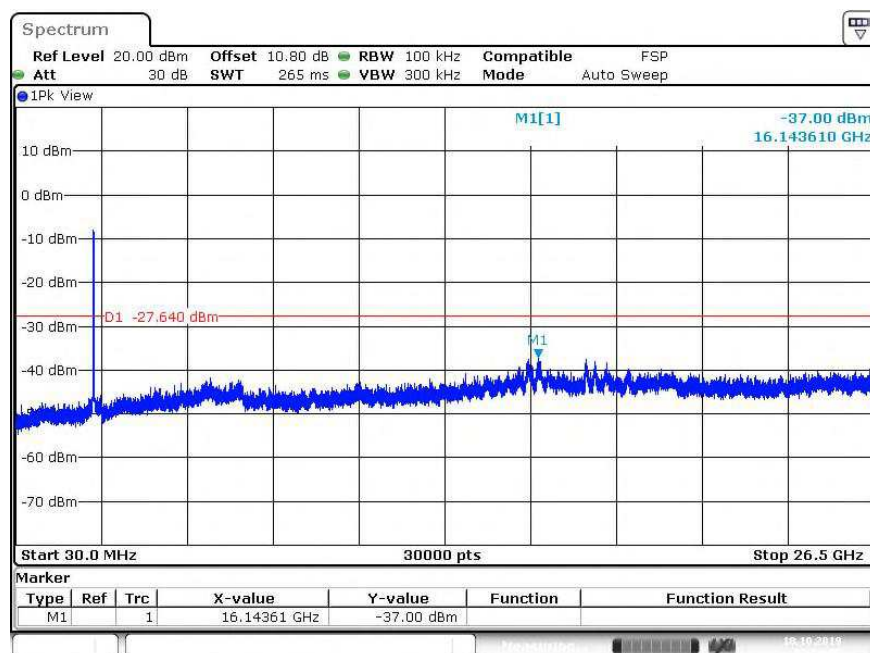
Test Plot 100kHz Conducted Emissions, 802.11n20

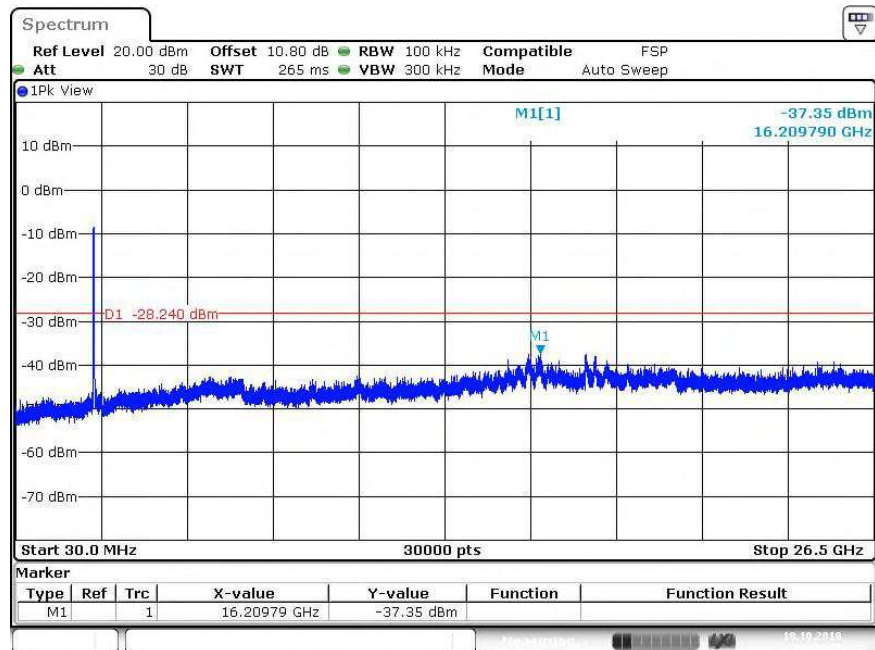
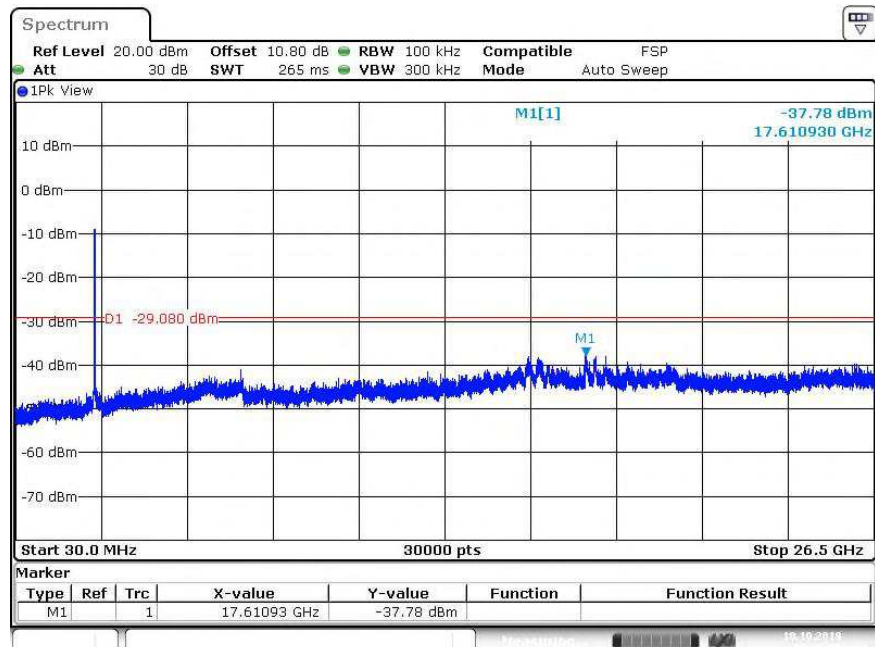
Low Channel



Middle Channel

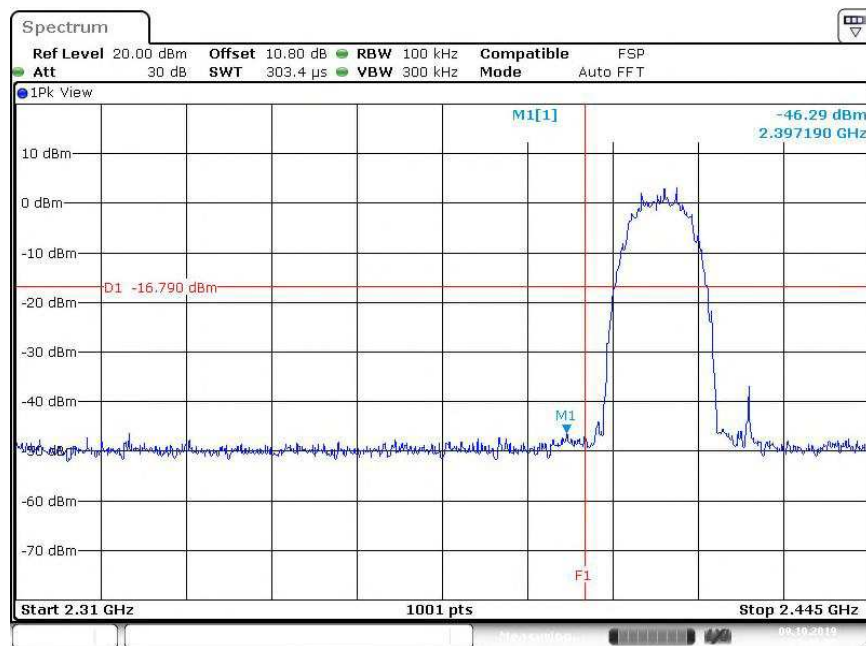


High Channel

Test Plot 100kHz Conducted Emissions, 802.11n40
Low Channel


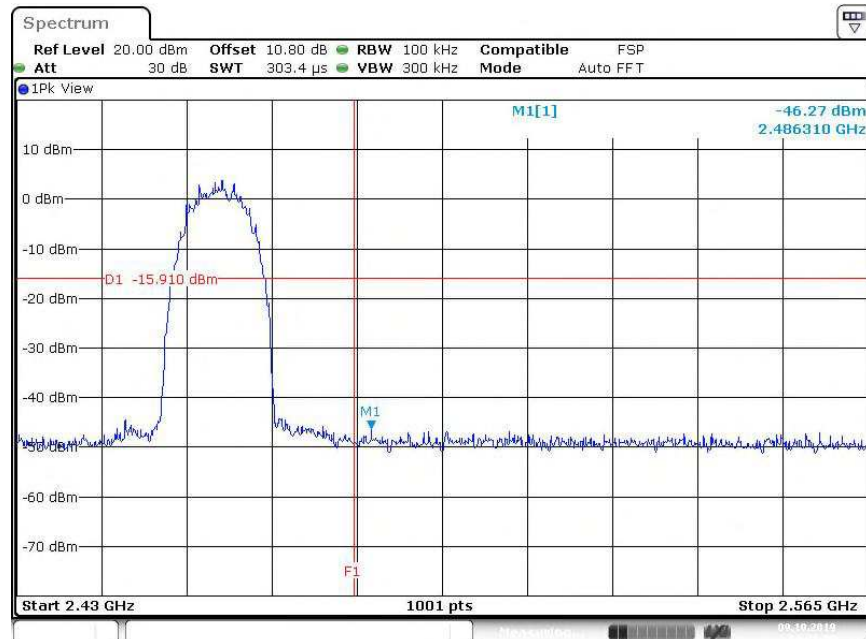
Middle Channel

High Channel


Test Plot 100kHz RBW of Band Edge, 802.11b

Low Channel

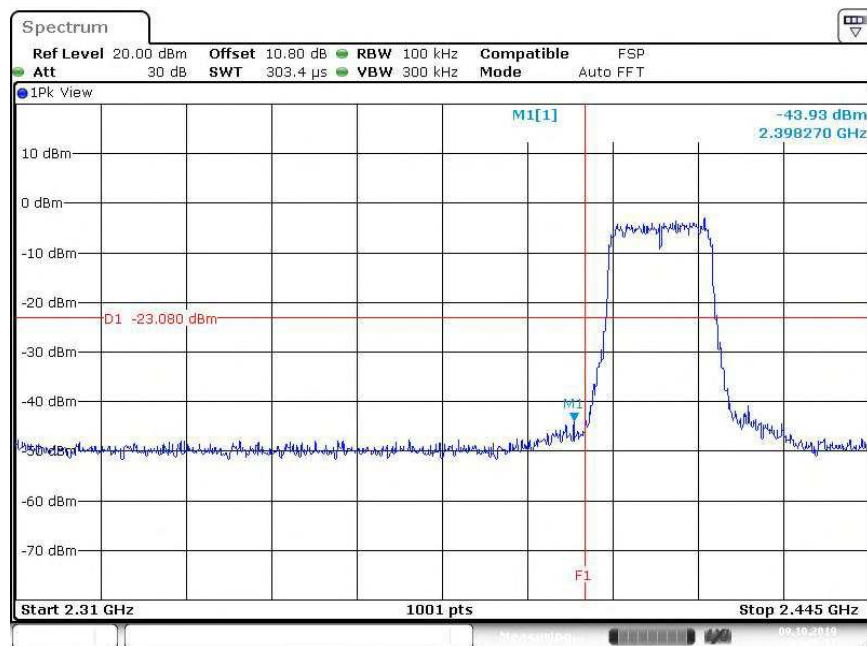


High Channel

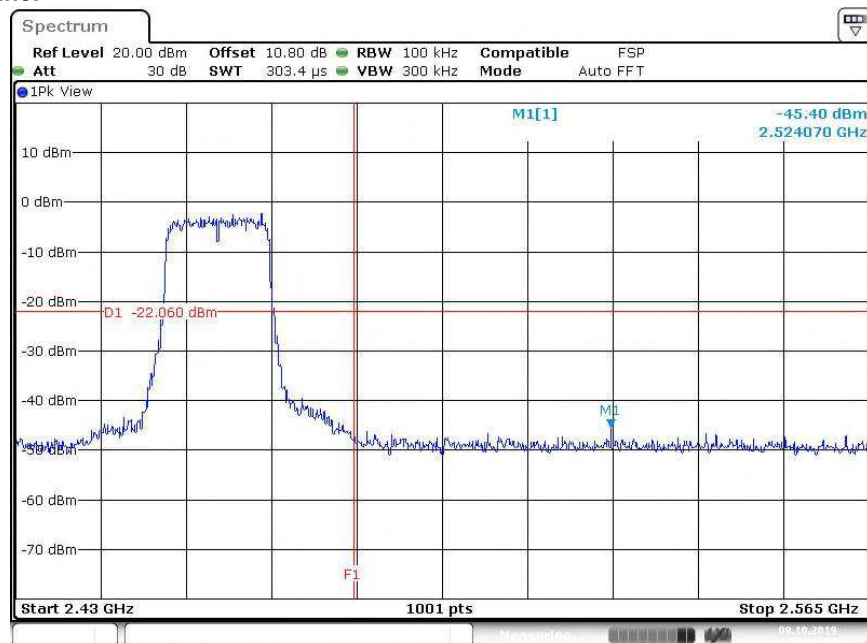


Test Plot 100kHz RBW of Band Edge, 802.11g

Low Channel

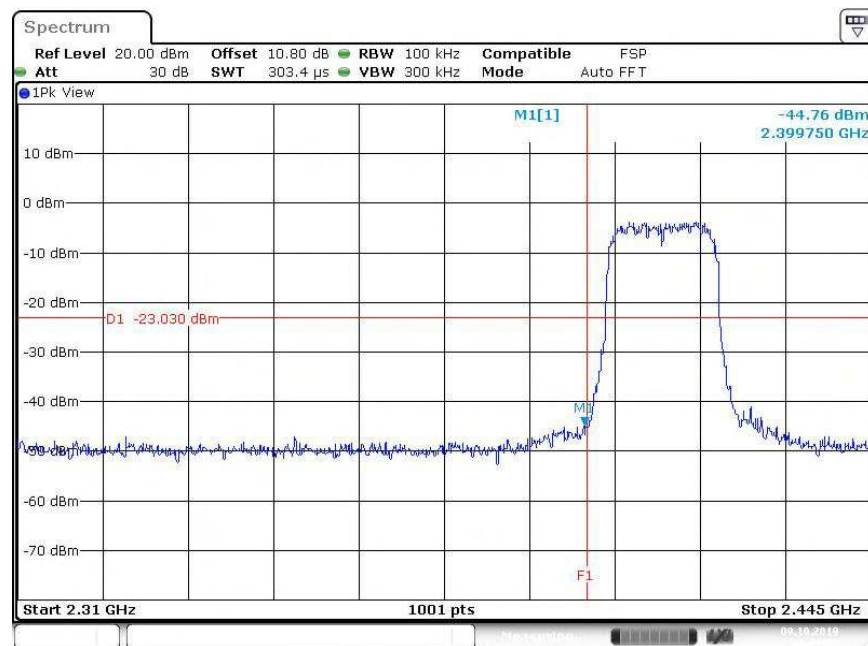


High Channel

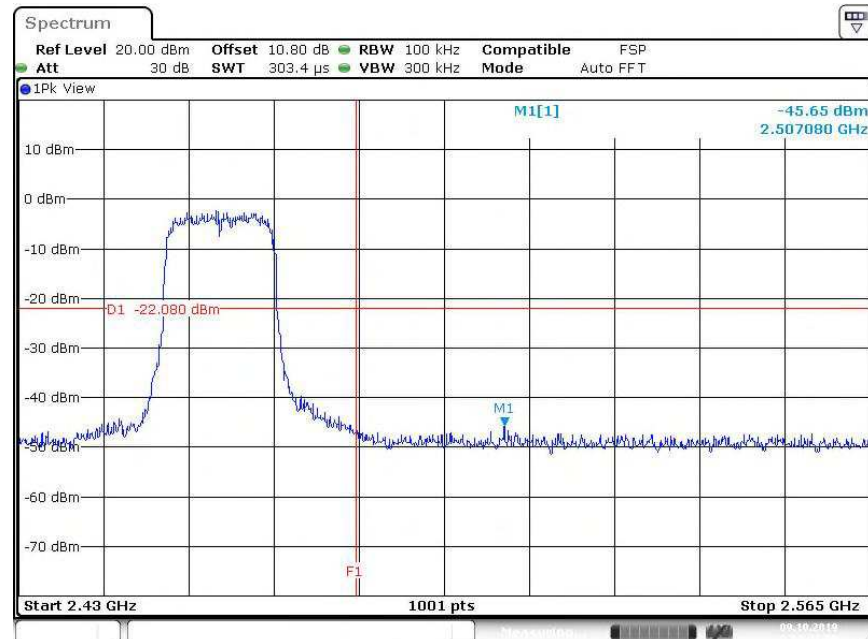


Test Plot 100kHz RBW of Band Edge, 802.11n20

Low Channel

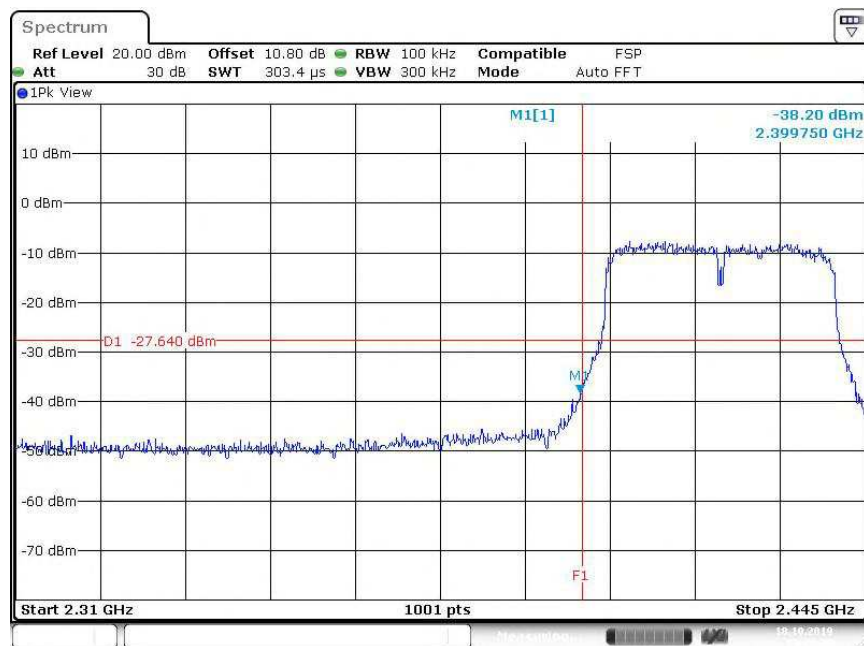


High Channel

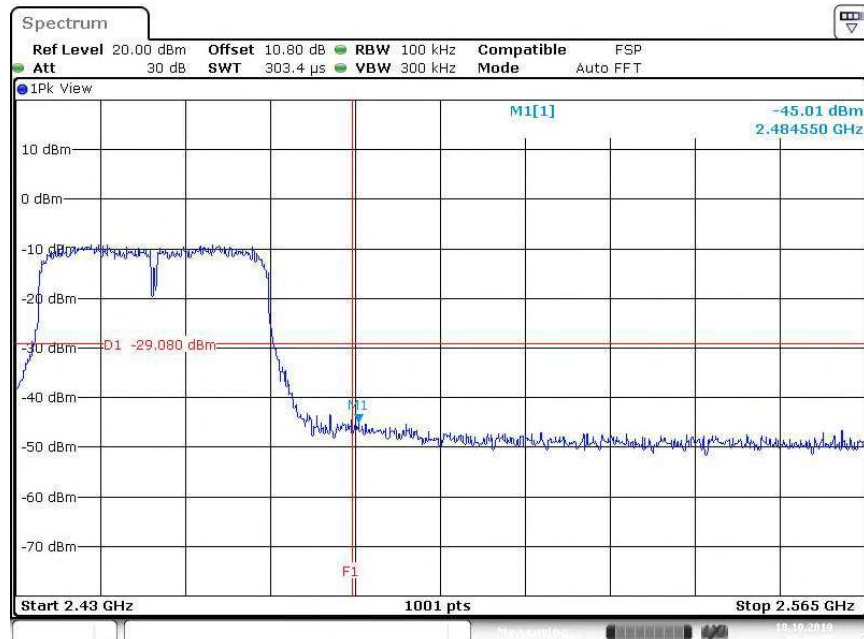


Test Plot 100kHz RBW of Band Edge, 802.11n40

Low Channel



High Channel



5.1.6 Spurious Emission

RESULT:**Passed**

Test standard	:	LP0002(2018): 3.10.1.5
Basic standard	:	ANSI C63.10: 2013, LP0002(2008) Appendix II
Limits	:	Radiated emissions which fall in the restricted bands, as defined in LP0002(2018): 2.7 , must comply with the radiated emission limits specified in LP0002(2018): 2.8 Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in LP0002(2018): 2.8
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

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

For details refer to Appendix D.

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

Factor (dB/m)=Antenna Factor(dB/m)+Cable loss (dB)

Level(dBuV/m)=Reading(dBuV)+ Factor(dB/m)

5.2 Mains Emissions

5.2.1 Mains Conducted Emissions

RESULT:**Passed**

Test standard	:	LP0002 (2018): 2.3
Limits	:	Mains Conducted emissions as defined in above standards
Kind of test site	:	Shielded Room

Test setup

Test Channel	:	Middle
Operation mode	:	A

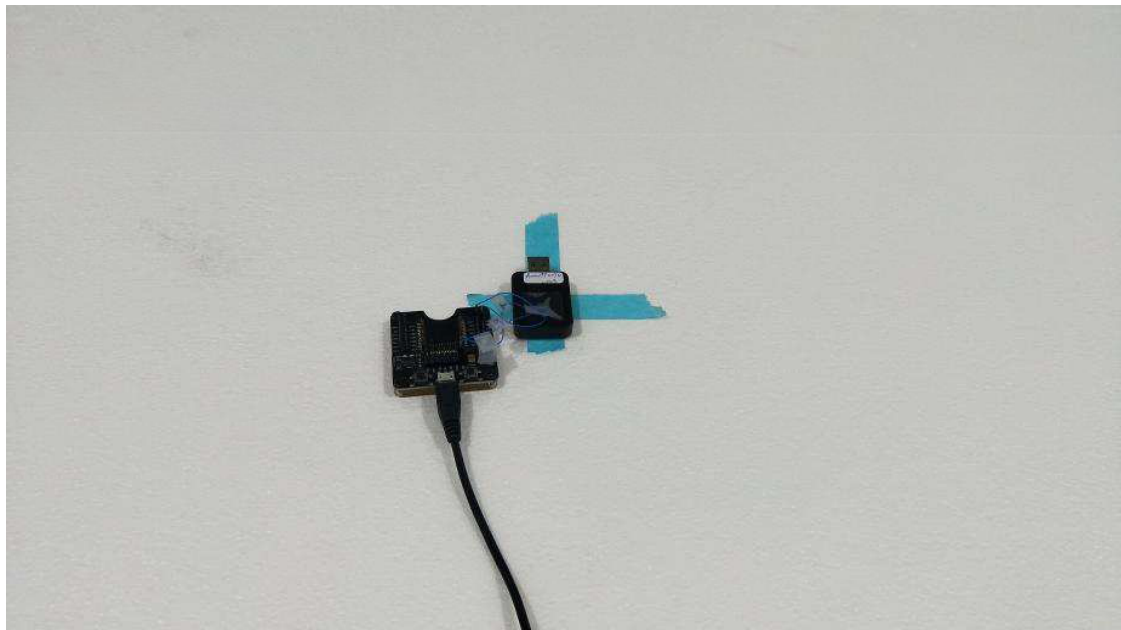
Remark: For details refer to Appendix D.

6. 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)



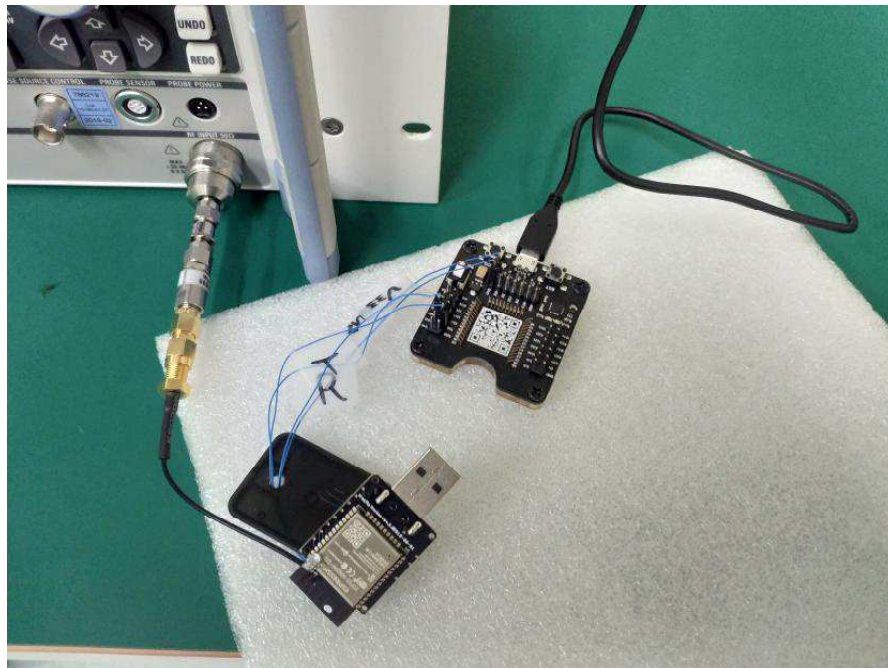
Photograph 6: Set-up for Spurious Emissions (Back View 4)



Photograph 7: Set-up for Conducted Test



Photograph 8: Set-up for Conducted Test



Photograph 9: Set-up for Mains Conducted Emissions



Photograph 10: Set-up for Mains Conducted Emissions



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