

Prüfbericht-Nr.: <i>Test Report No.:</i>	50278953 001	Auftrags-Nr.: <i>Order No.:</i>	238107925	Seite 1 von 49 Page 1 of 49
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	19-Jul-2019	
Auftraggeber: <i>Client:</i>	Cyberpower Systems, Inc. 11F., No.26, Jinzhuang Rd., Neihu Dist., Taipei City 114, Taipei, Taiwan			
Prüfgegenstand: <i>Test item:</i>	WICED module			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	CPWMU01			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C / IC RSS-247 Test report (WiFi b/g/n)			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.247(DTS) RSS-247 (02-2017)			
Wareneingangsdatum: <i>Date of receipt:</i>	11-Apr-2019			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000965638-001 to 002			
Prüfzeitraum: <i>Testing period:</i>	17-Jun-2019 – 16-Aug-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			
Report date / tested by: 01-Oct-2019 Jack Chang/Project Manager <i>Datum Name / Stellung Unterschrift</i> <i>Date Name / Position Signature</i>		kontrolliert von / reviewed by: 01-Oct-2019 Arvin Ho/Vice General Manager <i>Datum Name / Stellung Unterschrift</i> <i>Date Name / Position Signature</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 MAXIMUM CONDUCTED 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*

5.2.1 MAINS CONDUCTED EMISSIONS

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 internal view
(File Name: 50278953 001 APPENDIXP)

Appendix D: Test Result of Radiated Emissions
(File Name: 50278953 001 APPENDIXD)

Test Specifications

The following standards were applied.

Table 1: Applied Standard and Test Levels

Radio
FCC 47CFR Part 15: Subpart C Section 15.247 FCC 47CFR Part 2: Subpart J Section 2.1091 RSS-247 Issue 2, Feb 2017 RSS-102 Issue 5, March 2015 RSS-Gen, Issue 5, March 2019 ANSI C63.10:2013 KDB558074 D01 DTS Meas Guidance v05r02 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.
Taipei Testing Laboratories

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

2.2 Test Facility

TUV Rheinland Taiwan Ltd.

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

Kind of Equipment	Manu-facturer	Type	S/N	Last Calibration	Next Calibration
Test Software	Farad	EZ_EMCC	Ver. TUV3A1	N/A	N/A
EMI Test Receiver	R&S	ESR 7***	101062	2018/10/01	2019/10/01
Spectrum Analyzer	R&S	FSV 40**	101514	2019/02/07	2020/02/07
EXA Signal Analyzer	KEYSIGHT	N9010A***	MY52221334	2019/02/15	2020/02/15
Preamplifier (30MHz -1GHz)	HP	8447F**	2805A03335	2018/08/22	2019/08/22
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G**	060558	2018/11/30	2019/11/30
Bilog Antenna	TESEQ	CBL 6111D**	29802	2018/08/22	2019/08/22
Horn Antenna	ETS-Lindgren	3117**	00218931	2018/12/27	2019/12/27
Horn Antenna (18GHz~40GHz)	COM-POWER	AH-840**	101029	2018/12/22	2019/12/22
Loop Antenna	Schwarzbeck	FMZB 1513**	1513-076	2018/06/21	2019/06/21
EMI Test Receiver	Rohde & Schwarz	ESCI 7*	100797	2019/01/16	2020/01/16
Two-Line V-Network	Rohde & Schwarz	ENV216*	101243	2019/06/23	2020/06/23

*The test date of AC mains is 16th-Aug-2019.

**The test date of Radiated test is 17th-Jun-2019.

***The test date of Conducted test is 17th-Jun-2019.

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 %

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a WICED module. It contains a IEEE802.11b/g/n 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	WICED module
Type Designation	CPWMU01
FCC ID	2AFG8CPWMU01
IC	11470A-CPWMU01
HVIN	V1.0

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequencies	802.11b/g/n HT20 : 2412 MHz ~ 2462 MHz
Channel Spacing	802.11b/g/n HT20 : 5MHz
Channel number	802.11b/g/n HT20 : 11
Operation Voltage	12Vdc
Modulation	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Antenna gain	2.74dBi

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
- Blocking Diagram
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Setup for testing: The module is mounted on an Evaluation Board provided by the manufacturer. The EVB is provided with an USB interface which makes it possible to control the module through the 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 sample: A000965638-001
Radiation sample: A000965638-002

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.

4.3 Special Accessories and Auxiliary Equipment

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

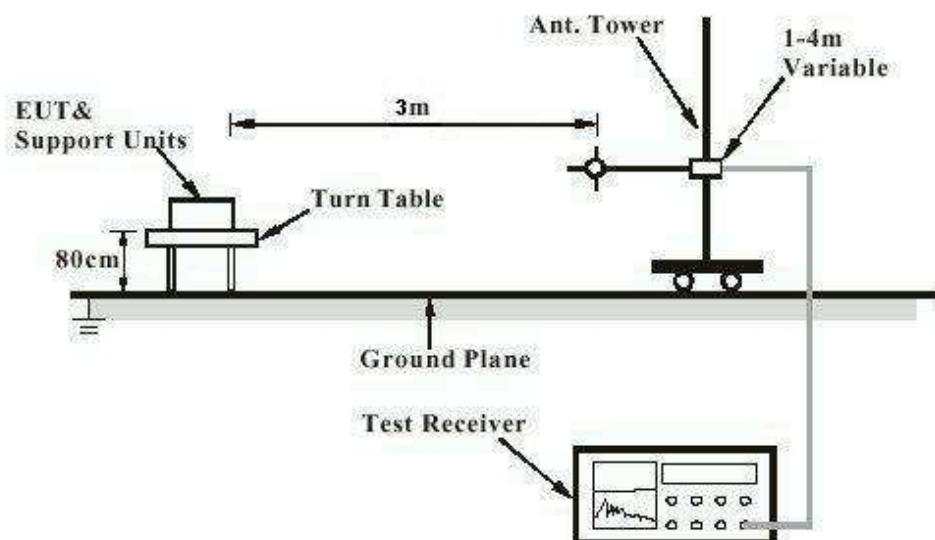
Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2
Test tool	cypress	WI_tool	-

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)

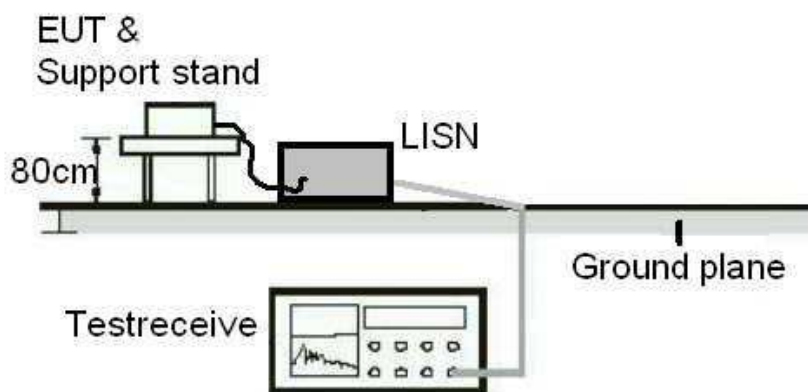
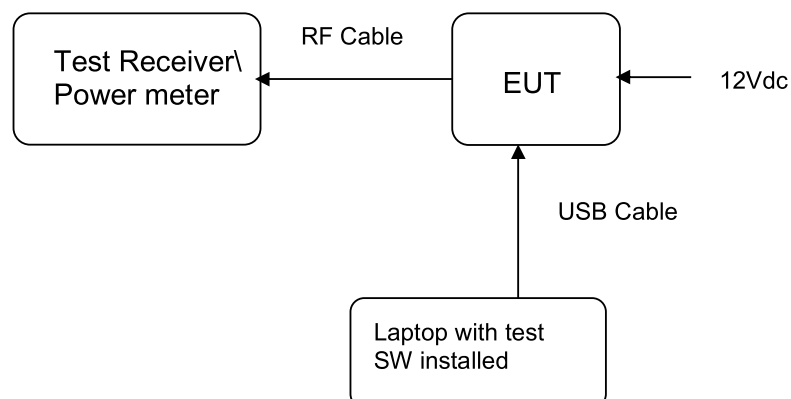


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Test standard : FCC Part 15.247(b)(4), Part 15.203 and RSS-Gen 6.8

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 2.74dBi. The antenna is connected through a proprietary connector 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 Maximum conducted Peak output power**RESULT:****Passed**

Test standard	:	FCC Part 15.247(b)(3), RSS-247 5.4(b)
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	:	20-24 °C
Relative humidity	:	50-65 %
Atmospheric pressure	:	100-103 kPa

Table 6: Test result of Maximum conducted Peak output power (802.11b)

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	22.49	0.17742	1
Middle Channel	2437	22.29	0.16943	1
High Channel	2462	22.18	0.16520	1

Pmax: 22.49dBm, 177.42mW

Table 7: Test result of Maximum conducted Peak output power (802.11g)

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	24.72	0.29648	1
Middle Channel	2437	24.61	0.28907	1
High Channel	2462	24.51	0.28249	1

Pmax: 24.72dBm, 296.48mW

Table 8: Test result of Maximum conducted Peak output power (802.11n HT20)

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	24.68	0.29376	1
Middle Channel	2437	24.64	0.29107	1
High Channel	2462	24.54	0.28445	1

Pmax: 24.68dBm, 293.76mW

5.1.3 6dB Bandwidth and 99% Bandwidth

RESULT:
Passed

Test standard : FCC Part 15.247(a)(2), RSS-247 5.2(a)
 RSS-Gen (Issue 5) 6.7
 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 : 20-24°C
 Relative humidity : 50-65%
 Atmospheric pressure : 100-103 kPa

Table 9: Test result of 6dB Bandwidth (802.11b)

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	9.057	>0.5	Pass
Mid Channel	2437	8.541	>0.5	Pass
High Channel	2462	8.541	>0.5	Pass

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

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	15.315	>0.5	Pass
Mid Channel	2437	14.446	>0.5	Pass
High Channel	2462	14.835	>0.5	Pass

Table 11: Test result of 6dB Bandwidth (802.11n HT20)

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	15.135	>0.5	Pass
Mid Channel	2437	15.285	>0.5	Pass
High Channel	2462	15.105	>0.5	Pass

Table 12: Test result of 99% Bandwidth (802.11b)

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Mid Channel	2437	13.726

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

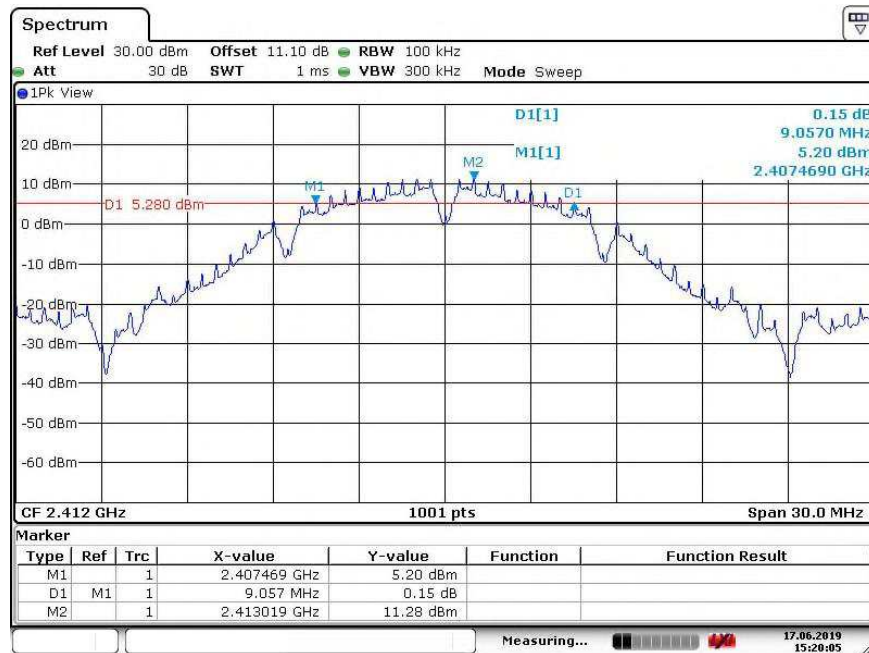
Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Mid Channel	2437	17.922

Table 14: Test result of 99% Bandwidth (802.11n HT20)

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Mid Channel	2437	18.821

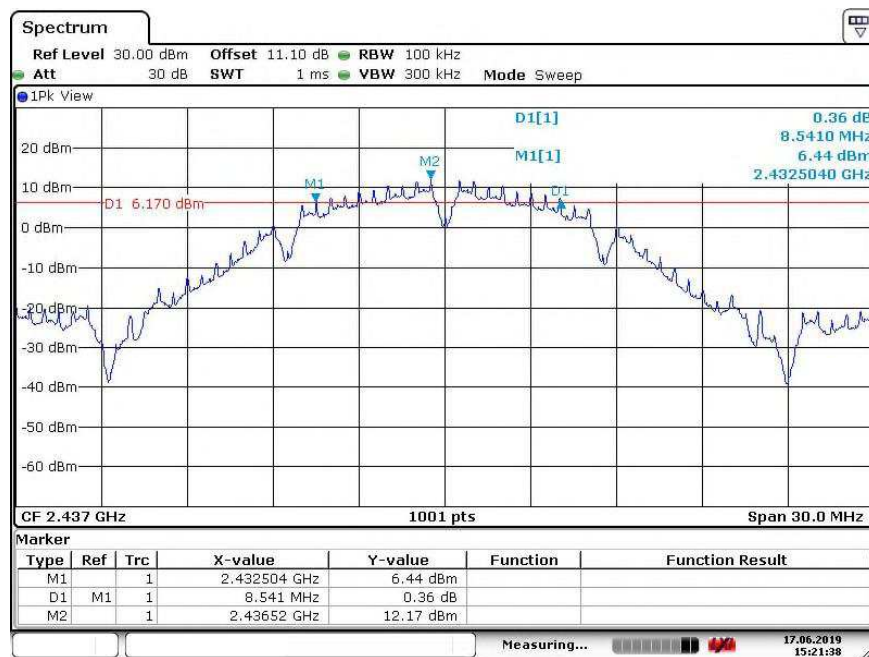
Test Plot of 6dB Bandwidth, 802.11b

Low Channel



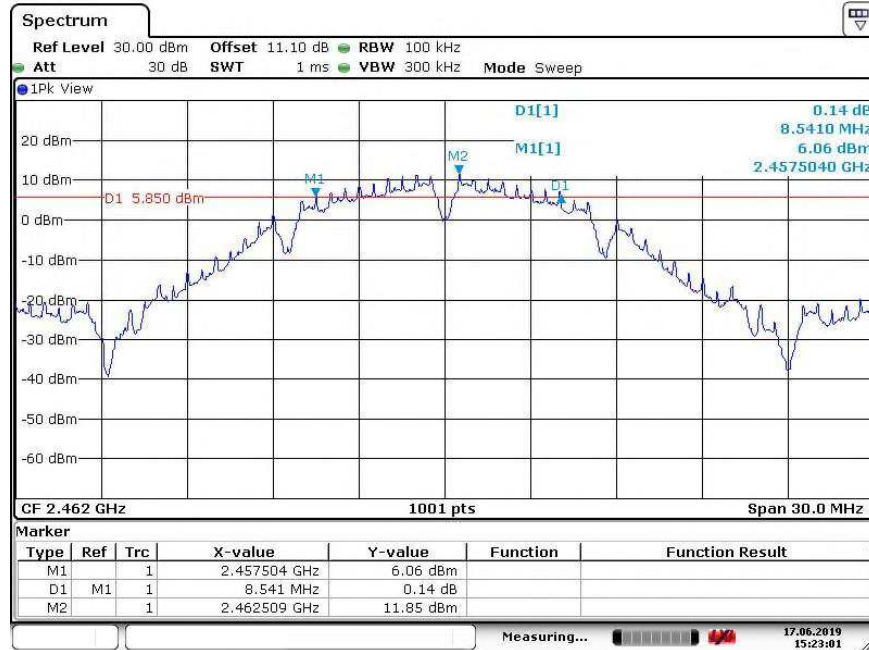
Date: 17. JUN. 2019 15:20:05

Middle Channel



Date: 17. JUN. 2019 15:21:39

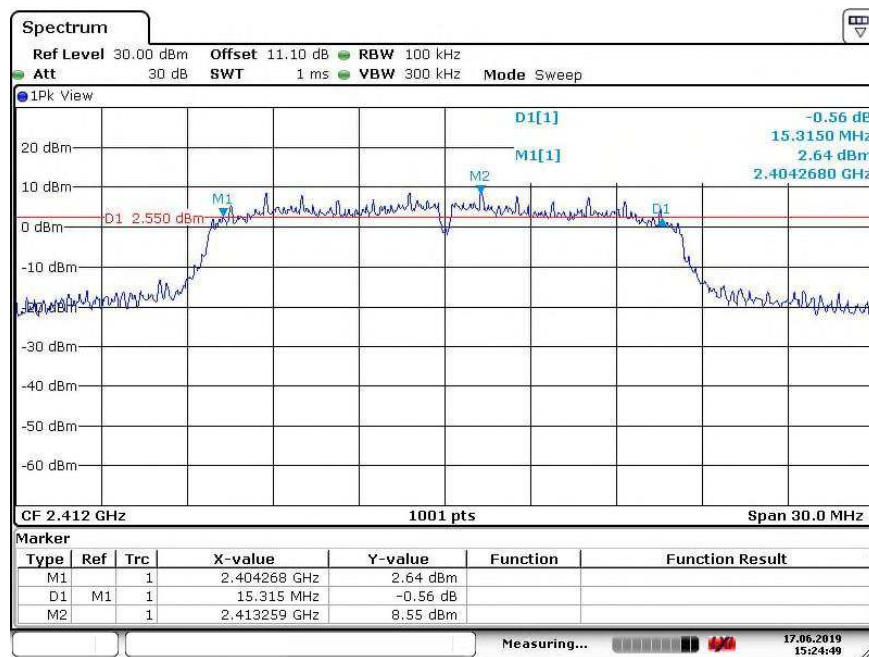
High Channel



Date: 17.JUN.2019 15:23:02

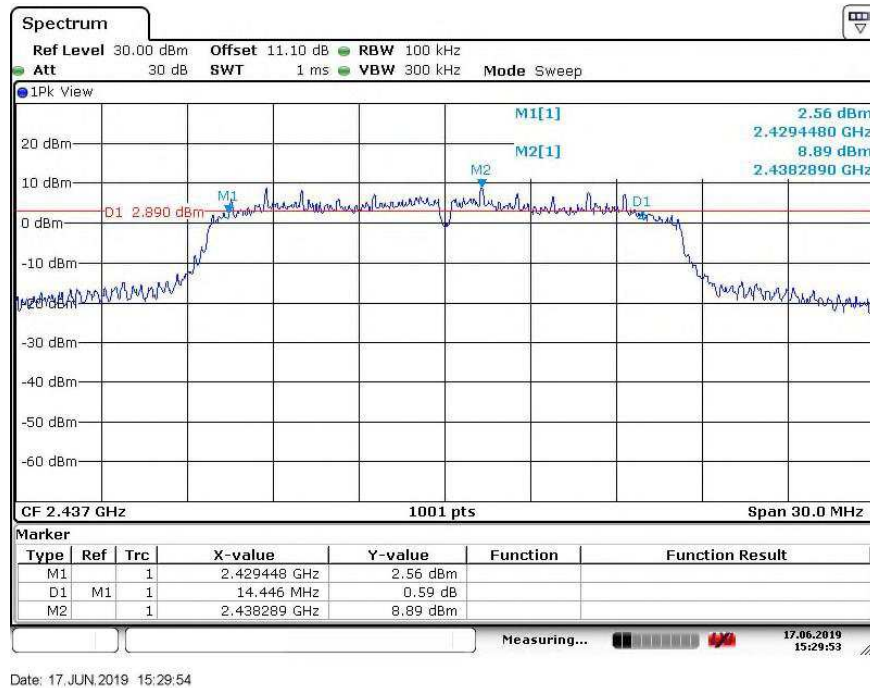
Test Plot of 6dB Bandwidth, 802.11g

Low Channel

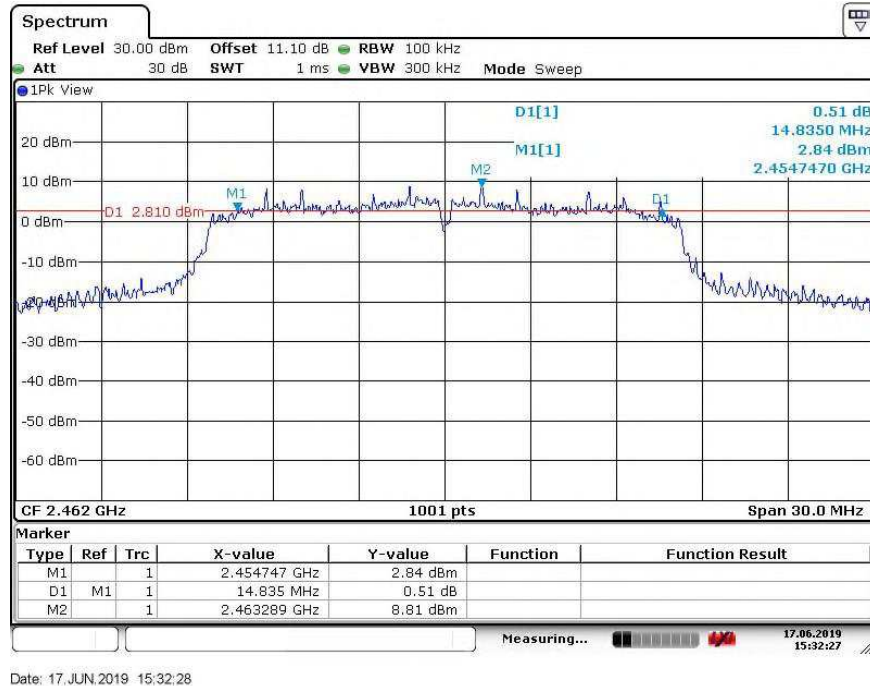


Date: 17.JUN.2019 15:24:49

Middle Channel

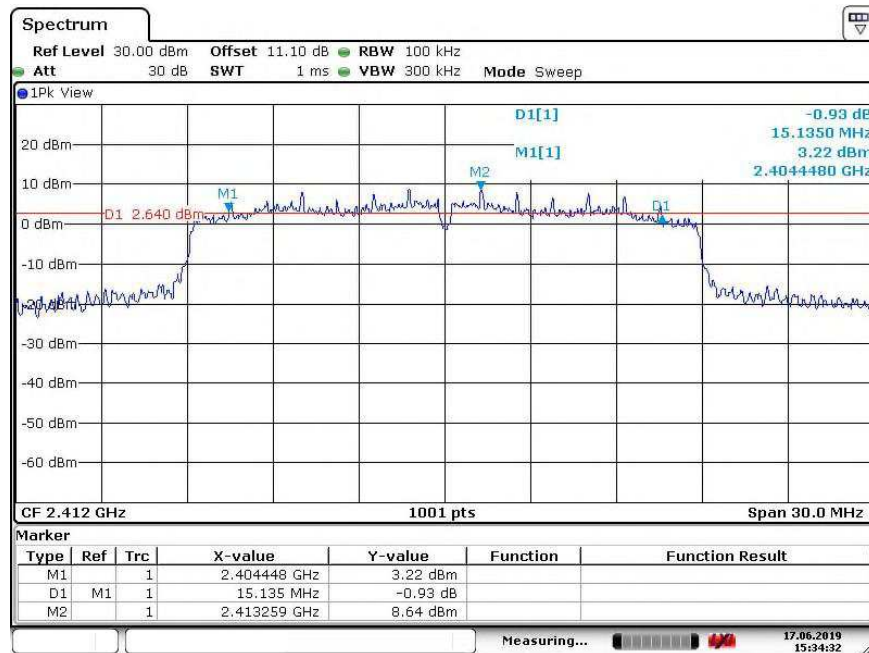


High Channel



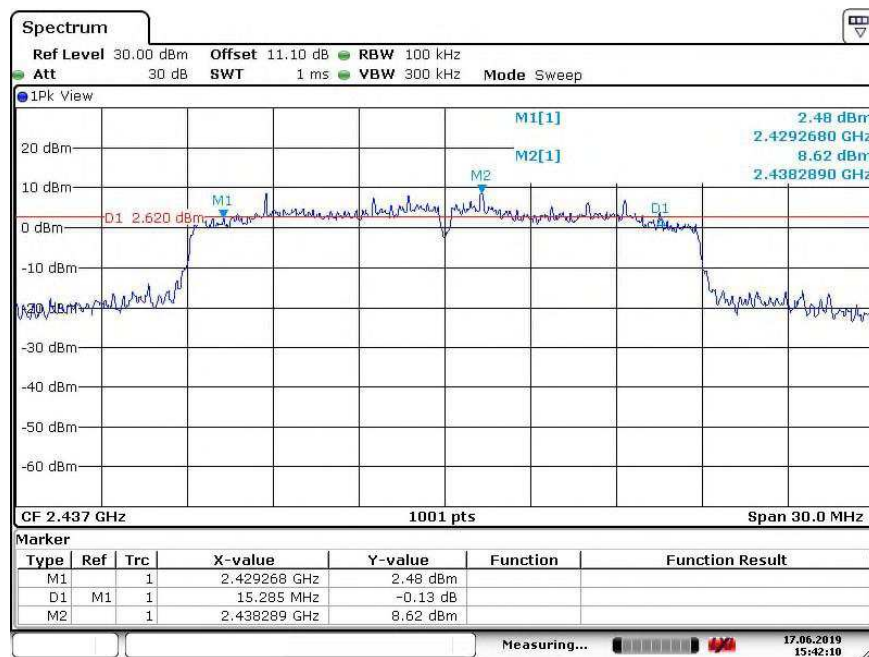
Test Plot of 6dB Bandwidth, 802.11n HT20

Low Channel



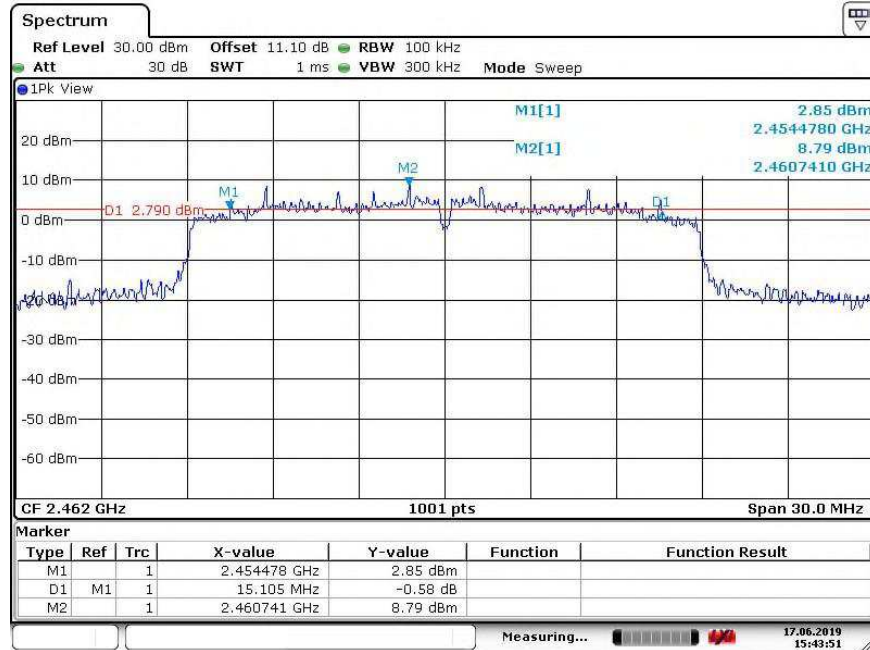
Date: 17 JUN 2019 15:34:32

Middle Channel



Date: 17 JUN 2019 15:42:10

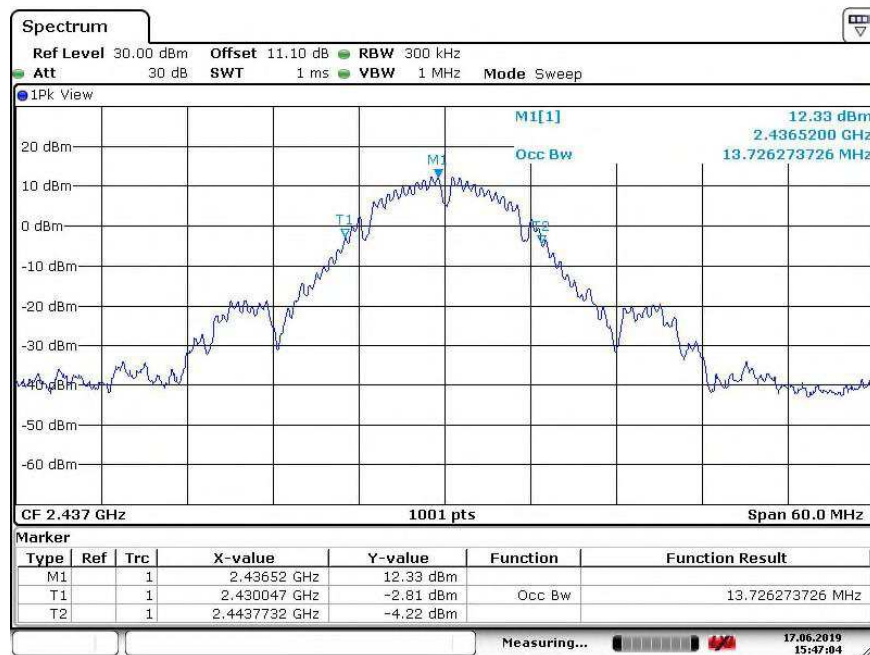
High Channel



Date: 17.JUN.2019 15:43:51

Test Plot of 99% Bandwidth, 802.11b

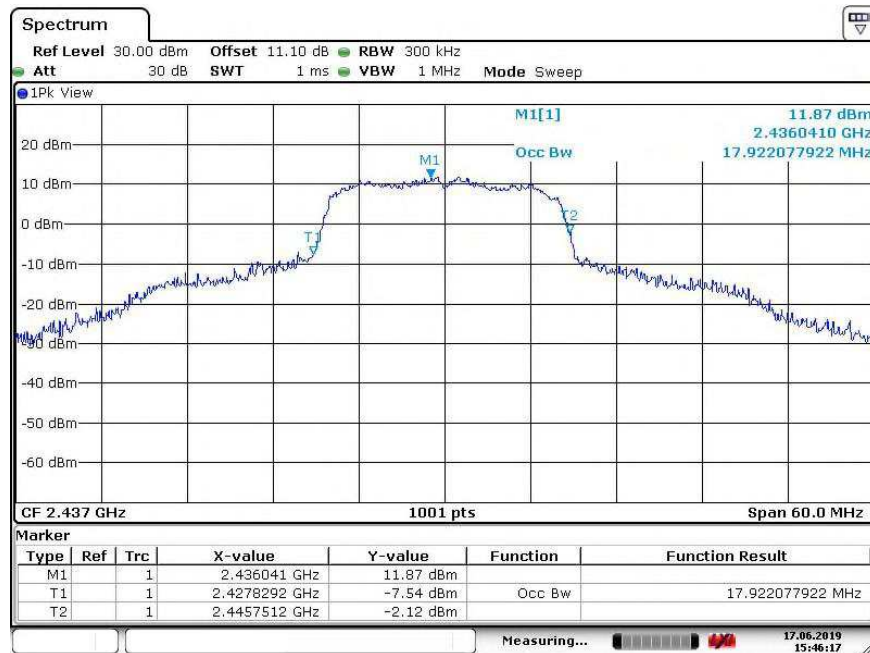
Middle Channel



Date: 17.JUN.2019 15:47:05

Test Plot of 99% Bandwidth, 802.11g

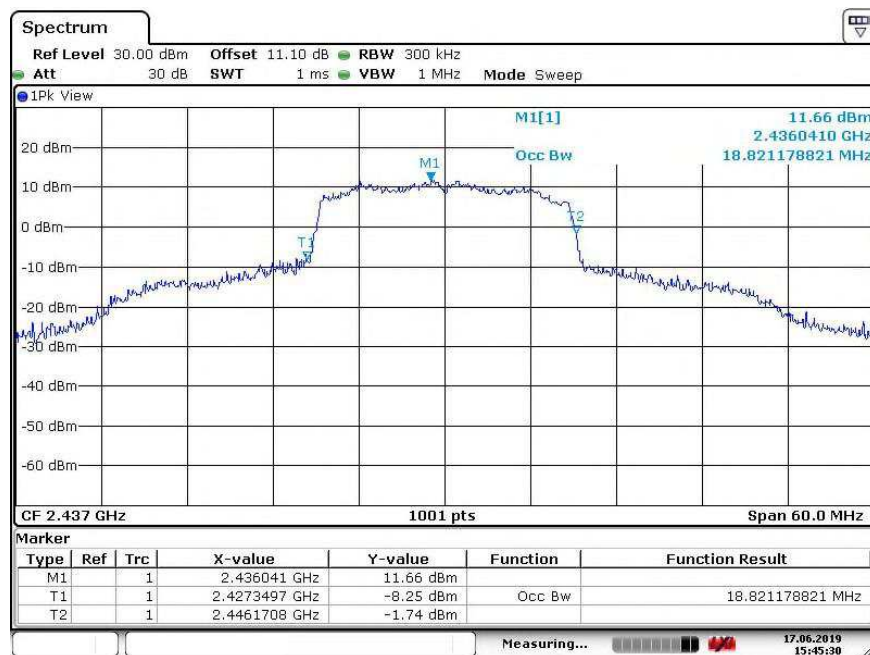
Middle Channel



Date: 17 JUN 2019 15:46:17

Test Plot of 99% Bandwidth, 802.11n HT20

Middle Channel



Date: 17 JUN 2019 15:45:30

5.1.4 Power Density

RESULT:
Passed

Test standard : FCC Part 15.247(e) , RSS-247 5.2(b)
 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 : 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	-2.34	8
Middle Channel	2437	-2.29	8
High Channel	2462	-2.21	8

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

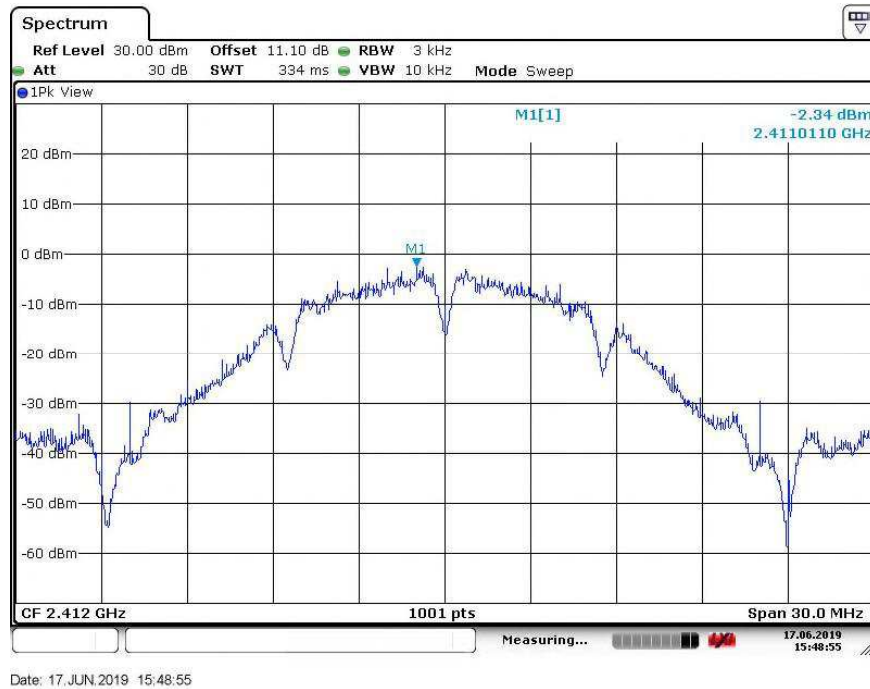
Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-5.76	8
Middle Channel	2437	-4.92	8
High Channel	2462	-5.40	8

Table 17: Test result of Power Density (802.11n HT20)

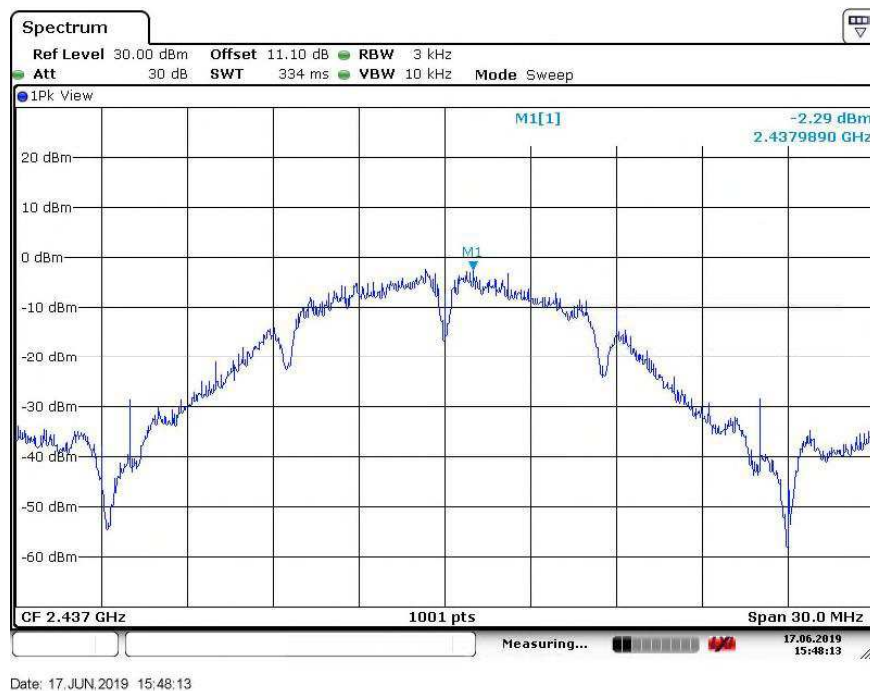
Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-5.61	8
Middle Channel	2437	-4.96	8
High Channel	2462	-5.12	8

Test Plot of Power Density, 802.11b

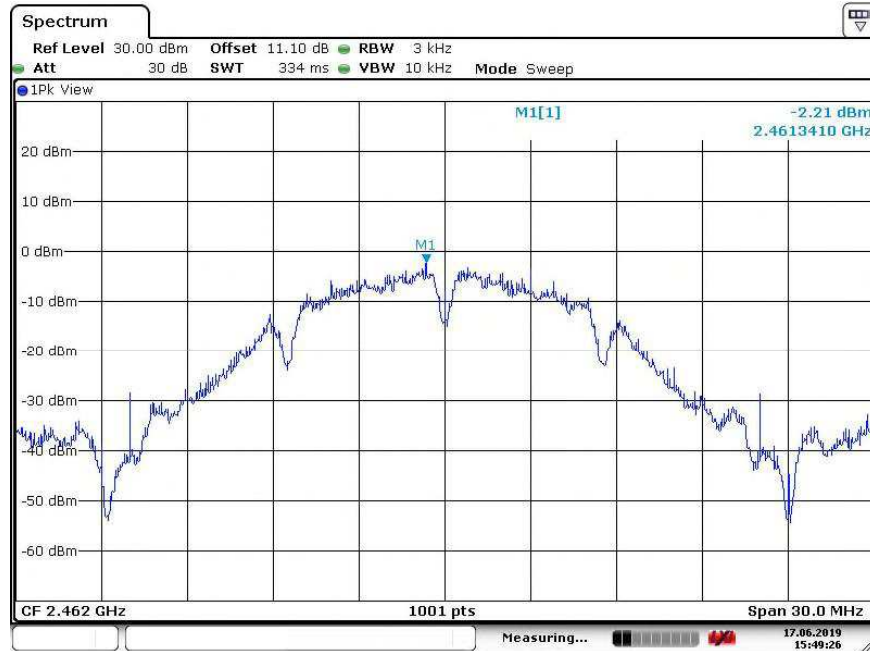
Low Channel



Middle Channel

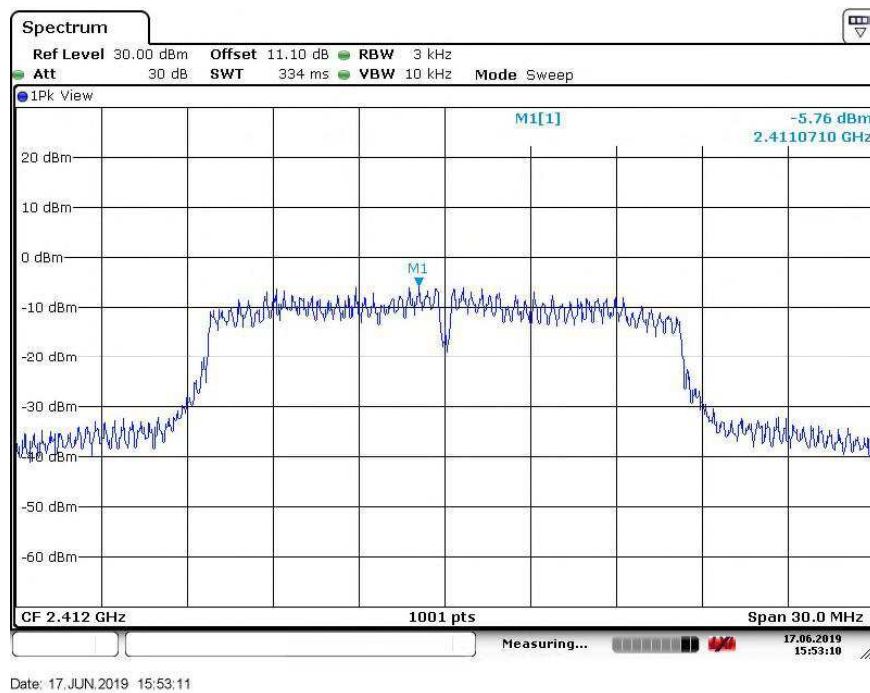


High Channel

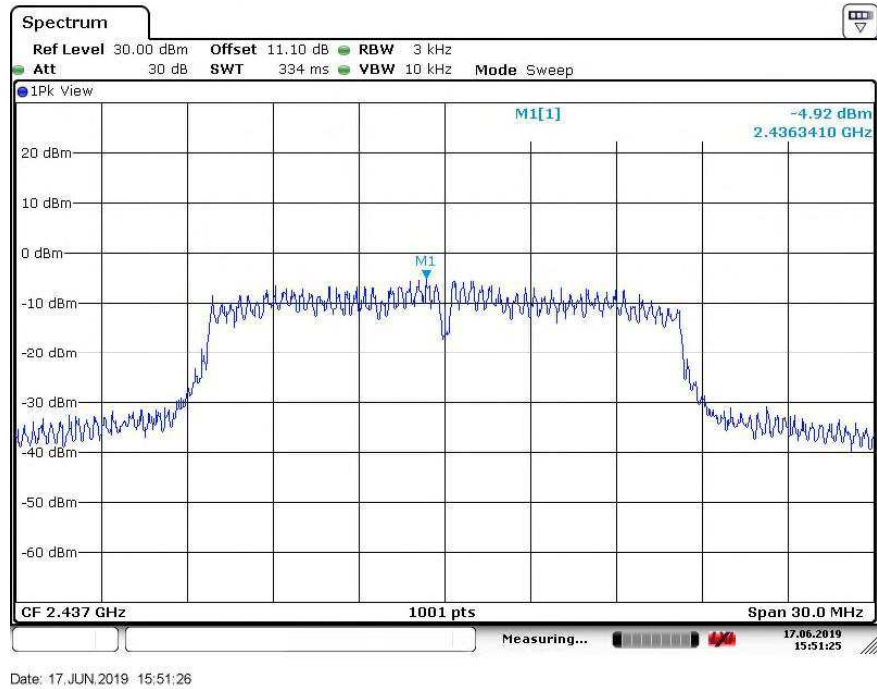


Test Plot of Power Density, 802.11g

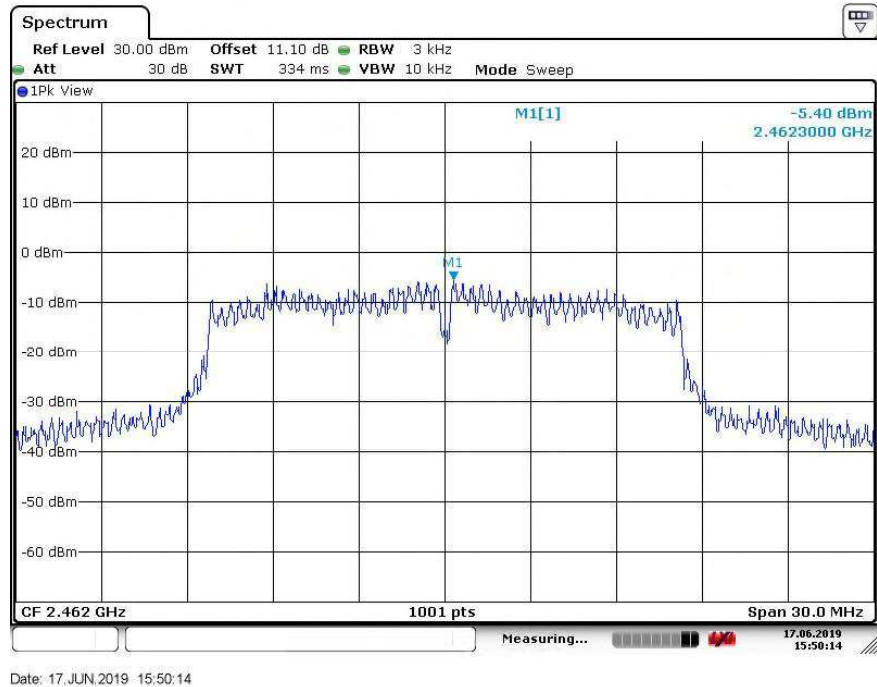
Low Channel



Middle Channel

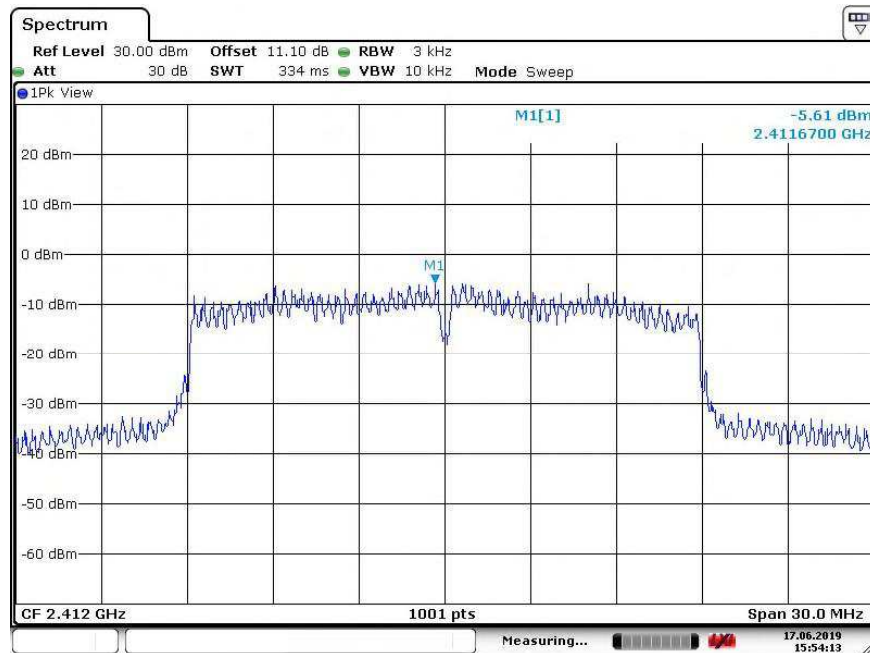


High Channel



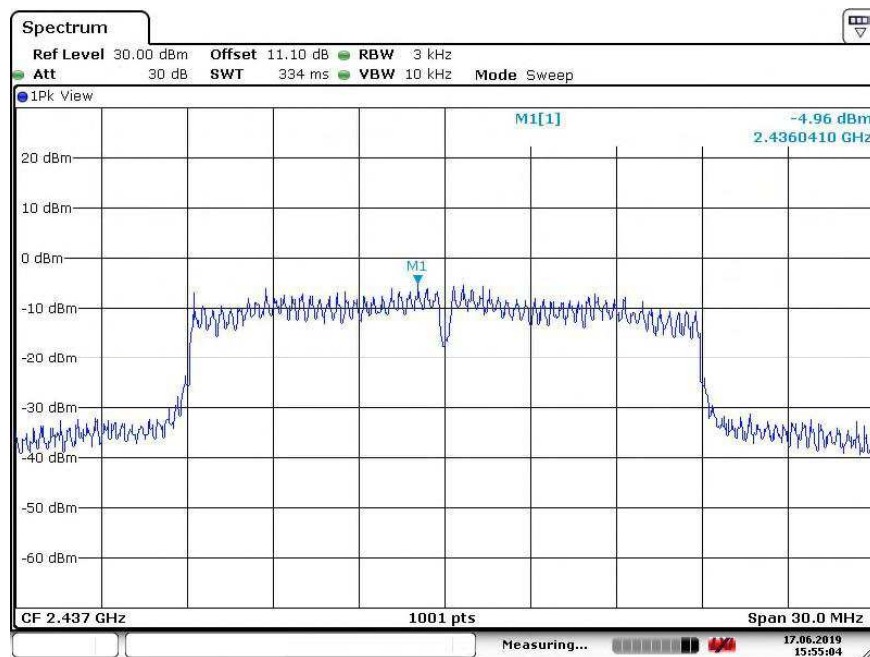
Test Plot of Power Density, 802.11n HT20

Low Channel



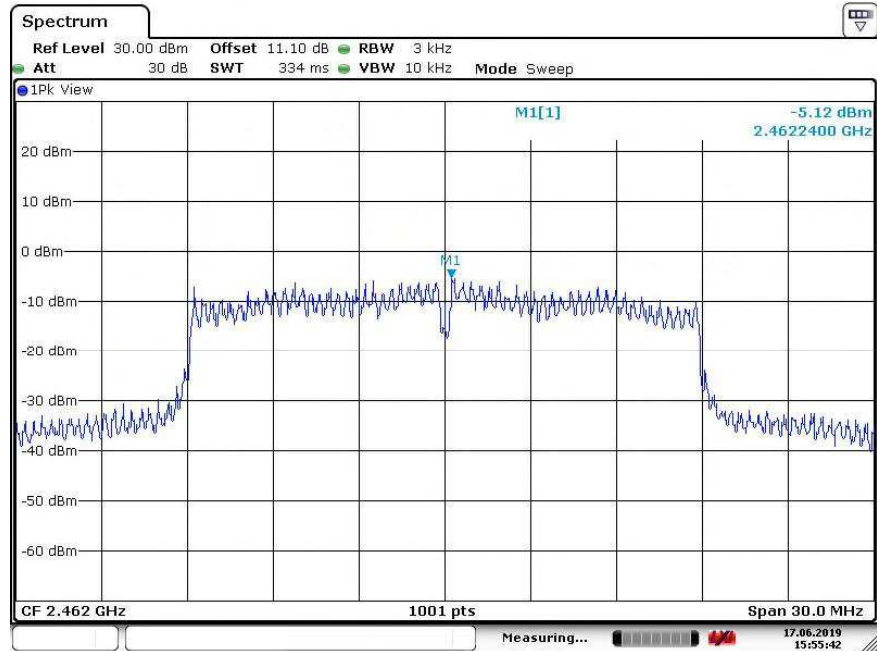
Date: 17 JUN 2019 15:54:14

Middle Channel



Date: 17 JUN 2019 15:55:04

High Channel



Date: 17. JUN. 2019 15:55:42

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

Test standard	:	FCC part 15.247(d), RSS-247 5.5
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

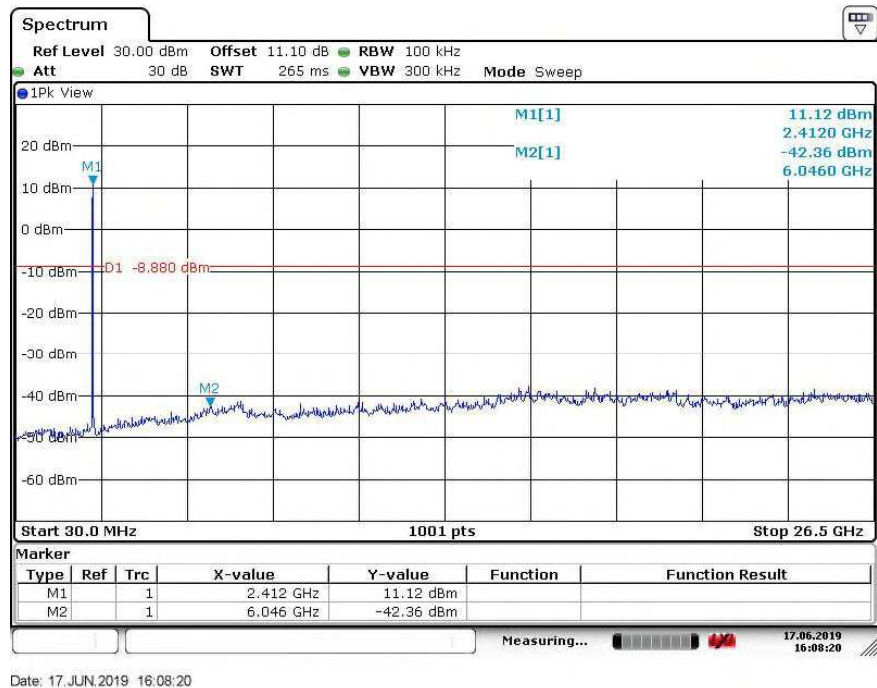
Test Channel	:	Low/ Mid/ High for spurious, Low/ High for Band Edge
Operation mode	:	A
Ambient temperature	:	20-24°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103 kPa

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

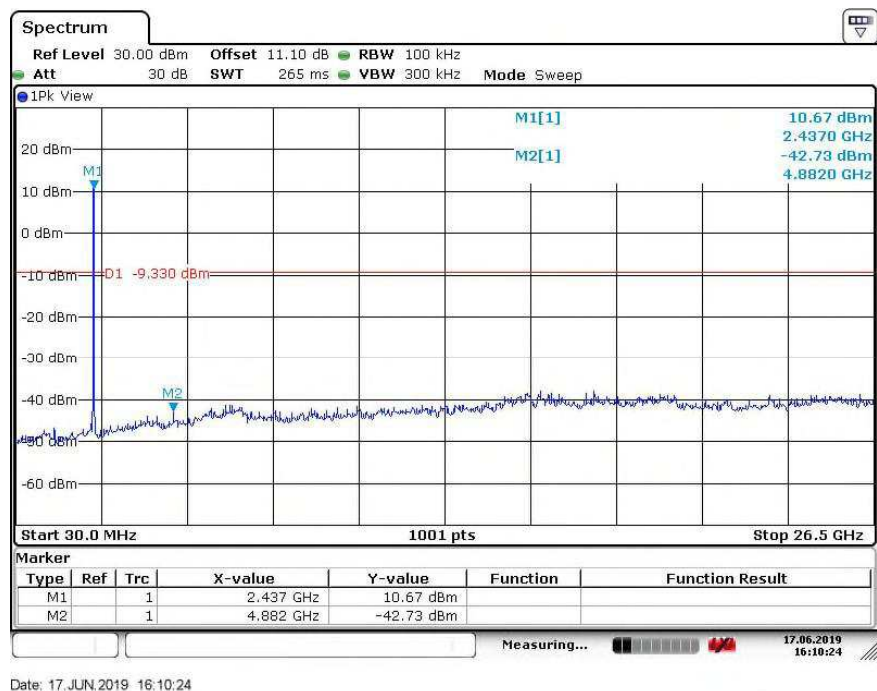
Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

Test Plot 100kHz Conducted Emissions, 802.11b

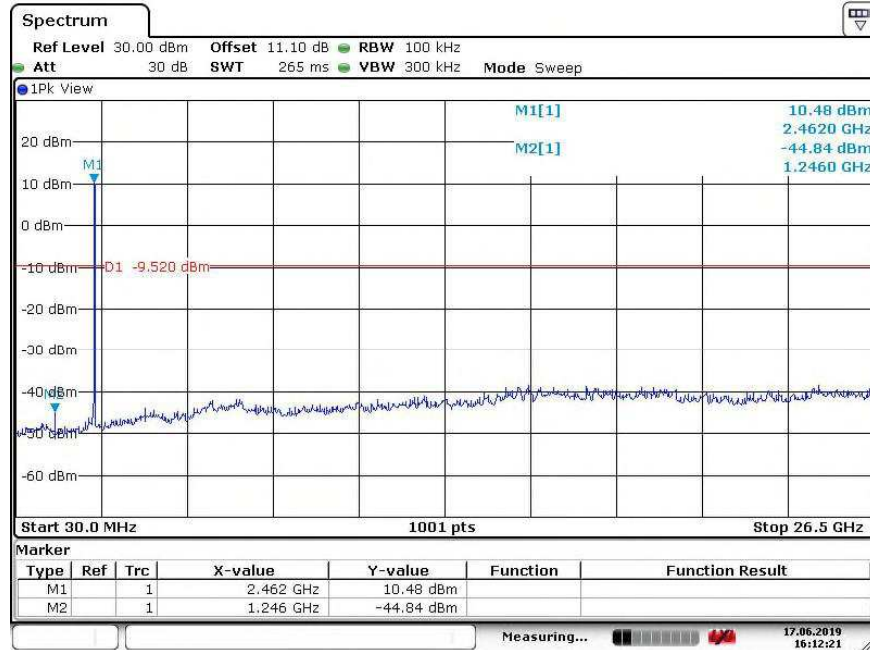
Low Channel



Middle Channel



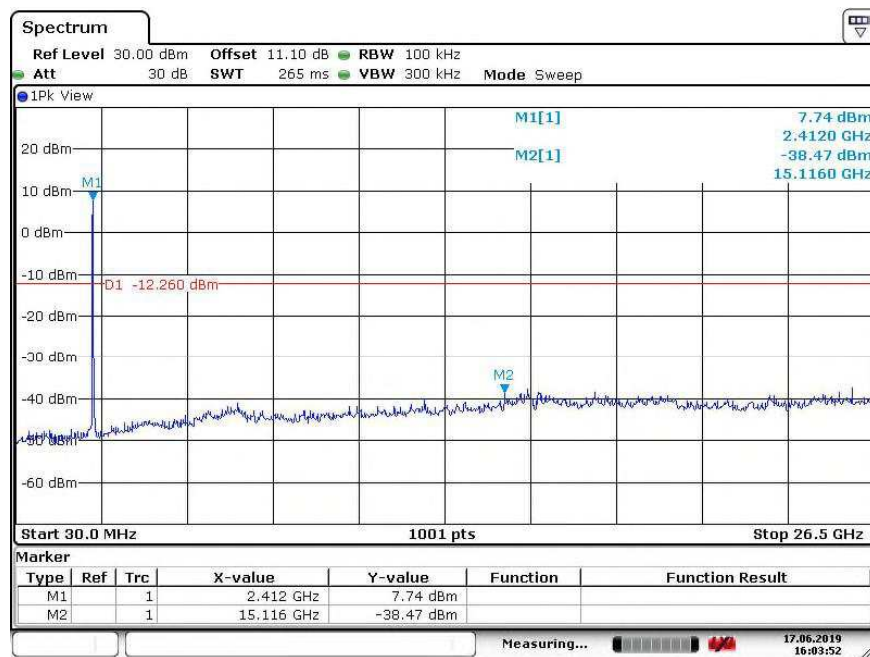
High Channel



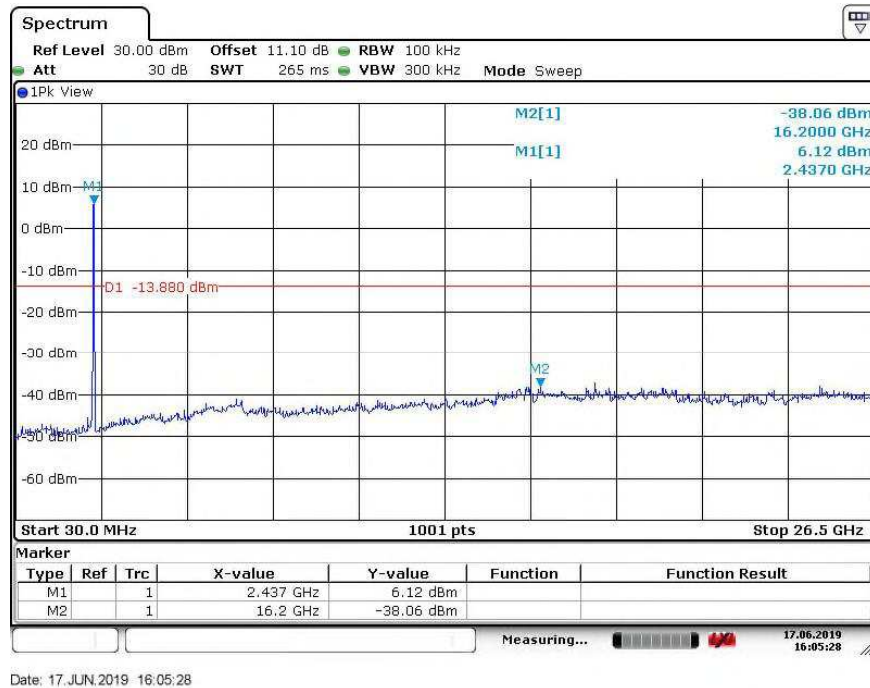
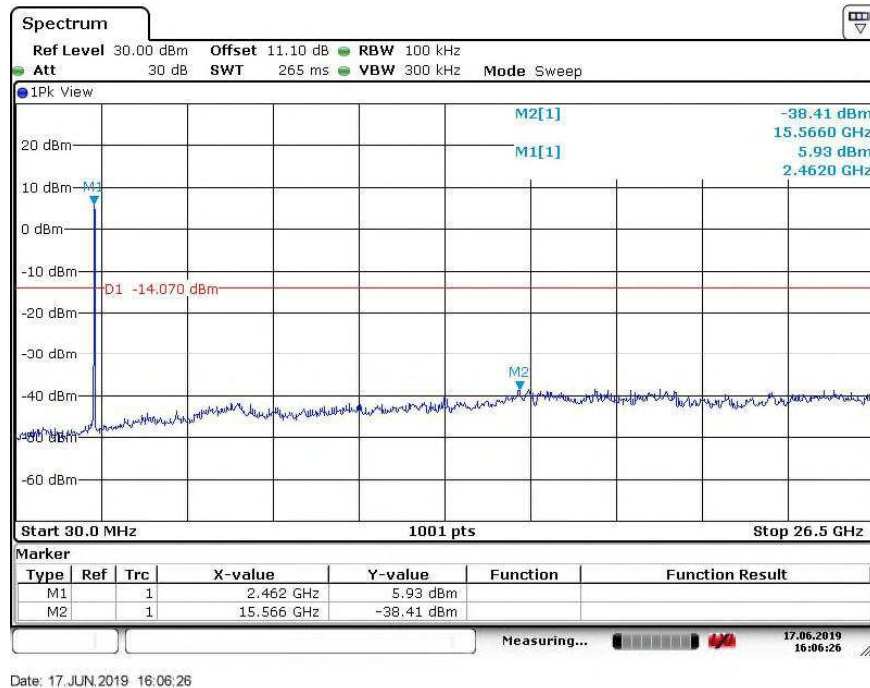
Date: 17.JUN.2019 16:12:22

Test Plot 100kHz Conducted Emissions, 802.11g

Low Channel

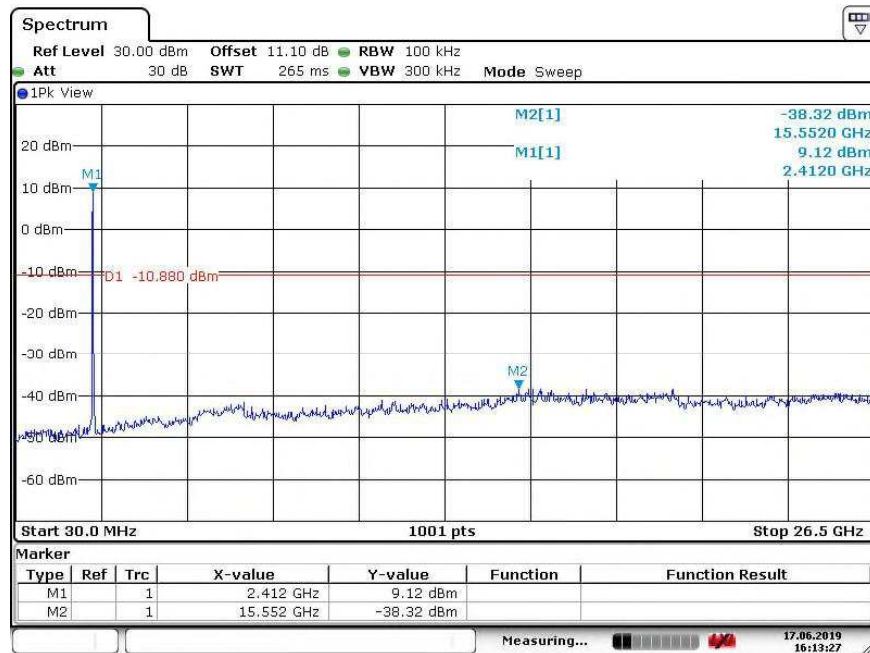


Date: 17.JUN.2019 16:03:53

Middle Channel

High Channel


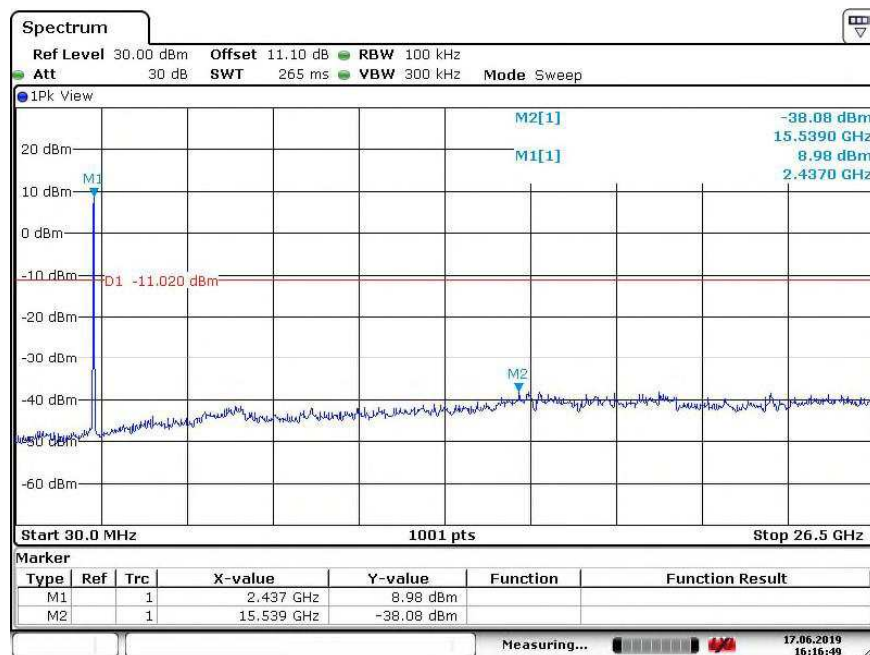
Test Plot 100kHz Conducted Emissions, 802.11n HT20

Low Channel

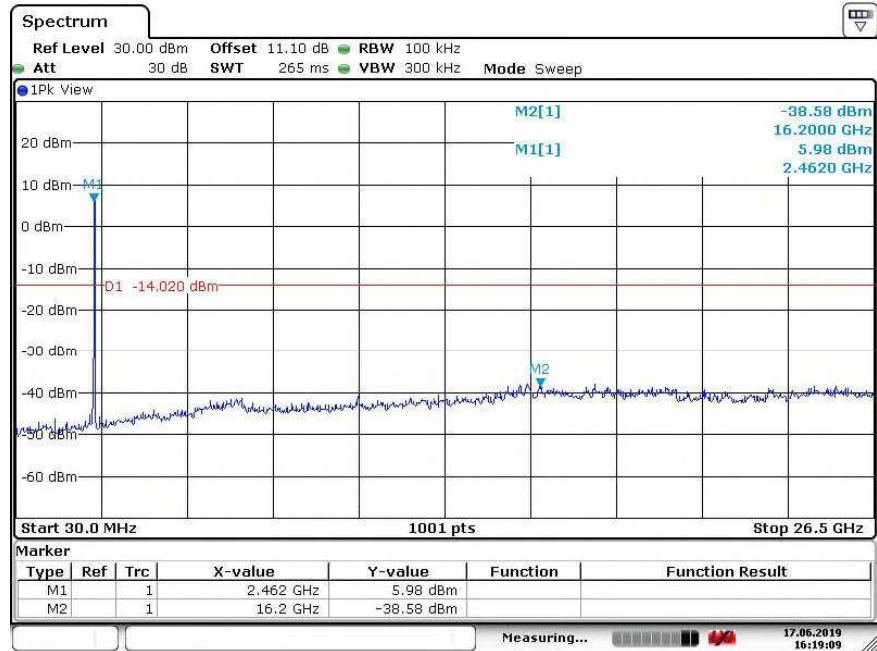


Date: 17.JUN.2019 16:13:28

Middle Channel



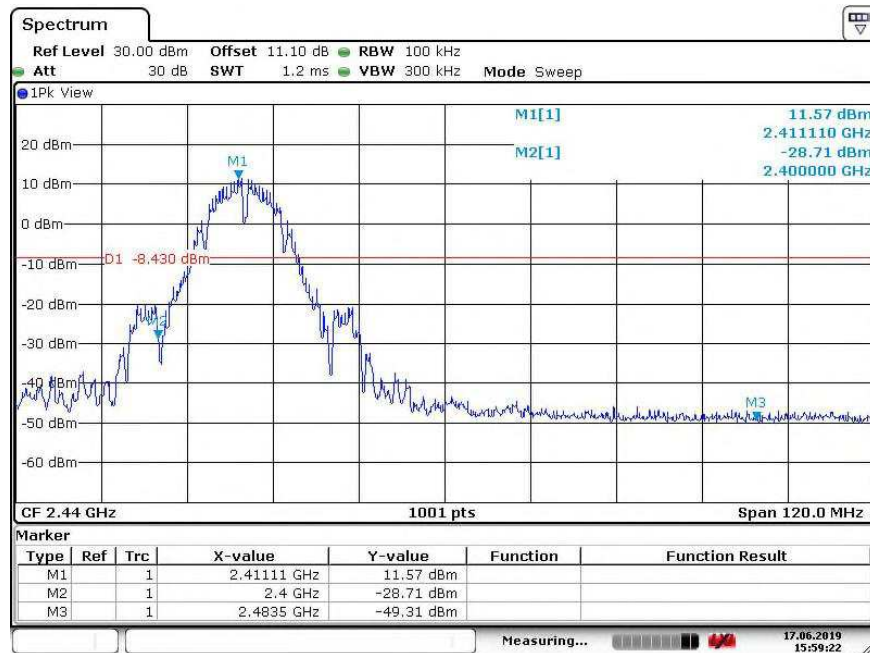
Date: 17.JUN.2019 16:16:49

High Channel


Date: 17.JUN.2019 16:19:09

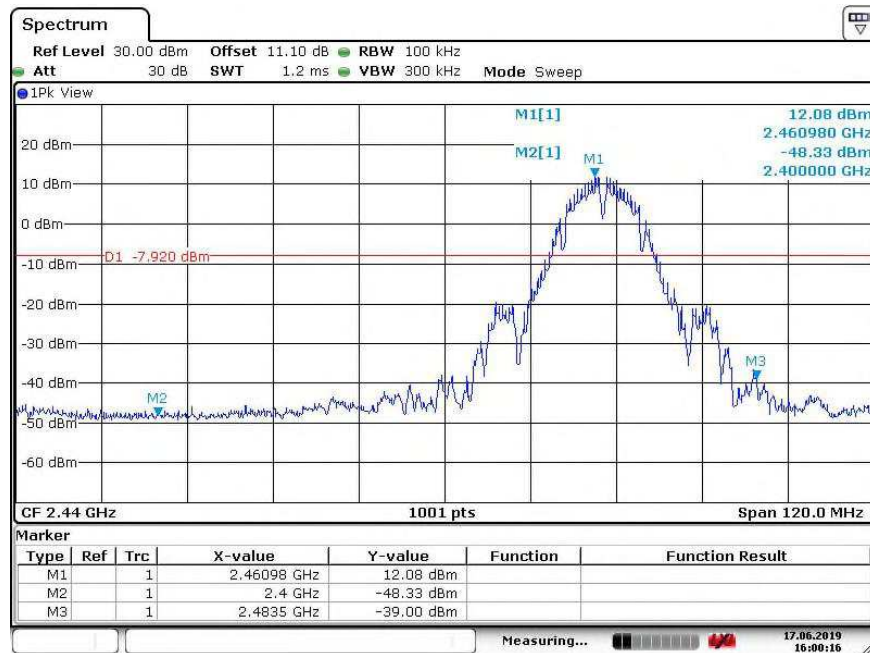
Test Plot 100kHz RBW of Band Edge, 802.11b

Low Channel



Date: 17. JUN. 2019 15:59:22

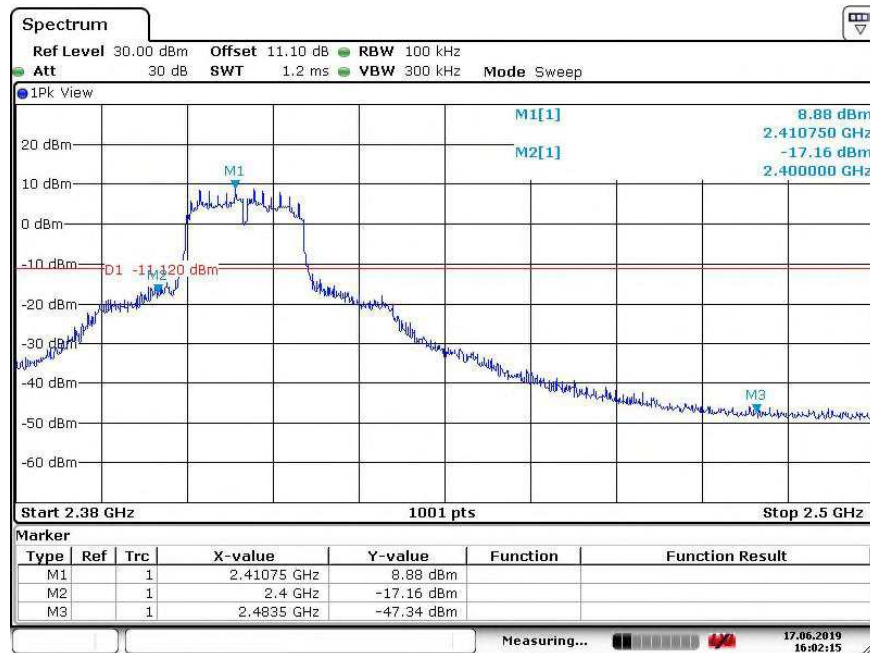
High Channel



Date: 17. JUN. 2019 16:00:16

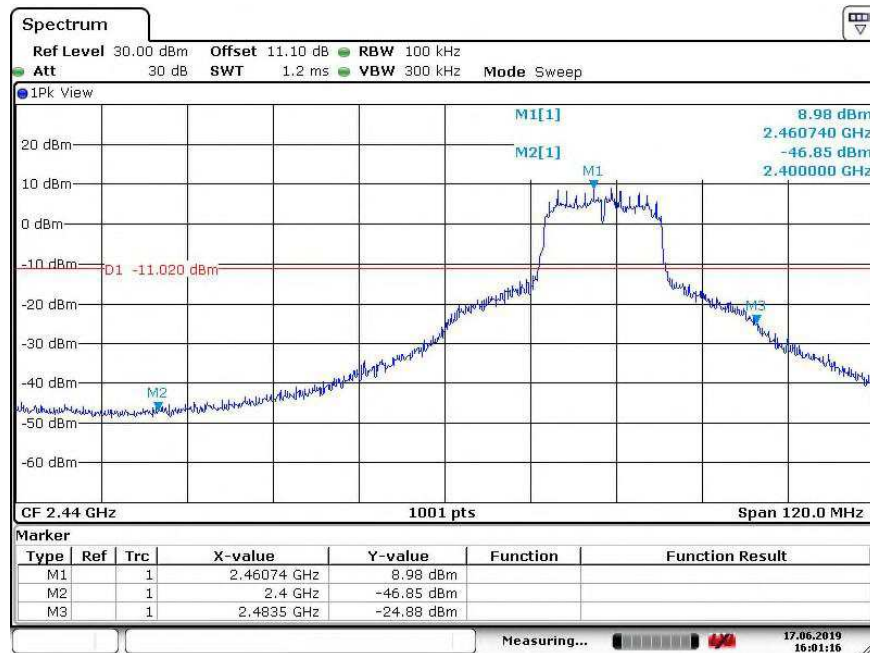
Test Plot 100kHz RBW of Band Edge, 802.11g

Low Channel



Date: 17 JUN 2019 16:02:15

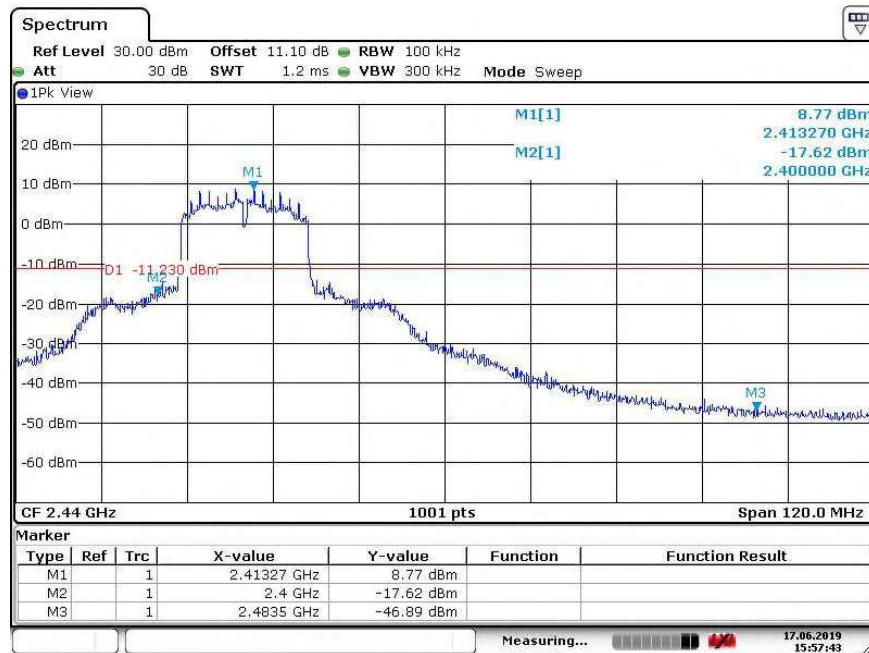
High Channel



Date: 17 JUN 2019 16:01:17

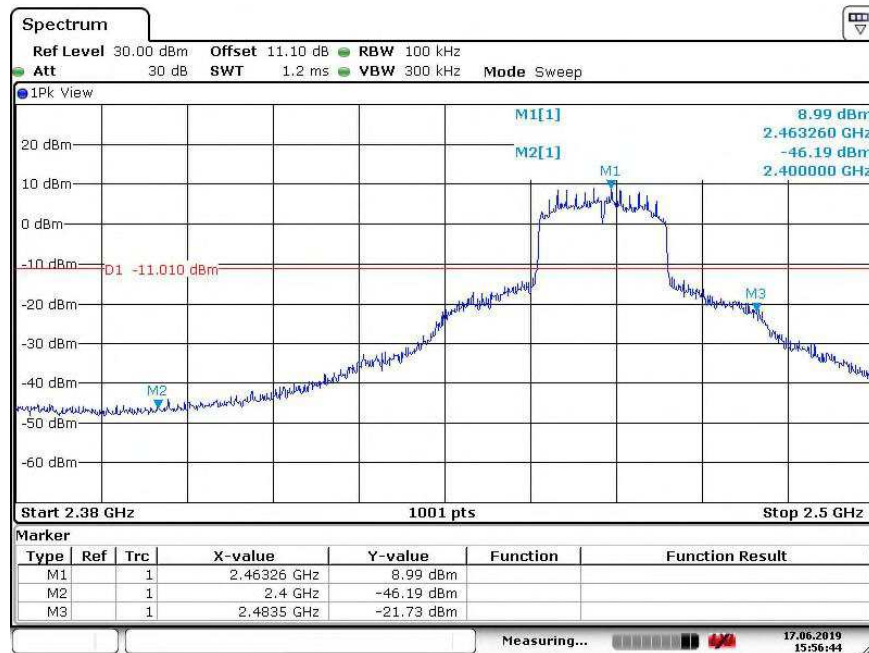
Test Plot 100kHz RBW of Band Edge, 802.11n HT20

Low Channel



Date: 17.JUN.2019 15:57:44

High Channel



Date: 17.JUN.2019 15:56:44

5.1.6 Spurious Emission

RESULT:**Passed**

Test standard : FCC part 15.247(d), FCC 15.205, FCC 15.209,
RSS-247 5.5 and RSS-Gen issue 5

Basic standard : ANSI C63.10: 2013

Limits : Radiated emissions which fall in the restricted bands, as
defined in FCC 15.205(a) and RSS-Gen i5, 8.10 (Table 7),
must comply with the radiated emission limits specified in
FCC 15.209(a) and RSS-Gen i5, 8.9 (Table 5 and 6).
Emission radiated outside the specified frequency bands
must comply with the radiated emission limits specified in
FCC 15.209(a) and RSS-Gen i5, 8.9 (Table 5 and 6).

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 : FCC Part 15.207
FCC Part 15.107
RSS-Gen i5 8.8

Limits : Mains Conducted emissions as defined in
above test standards must comply with the
mains conducted emission limits specified

Kind of test site : Shielded Room

Test setup

Test Channel : Middle
Operation mode : A

Remark: For details refer to Appendix D.

6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:**Passed**

Test standard : FCC KDB Publication 447498 D01 v06
47CFR 1.1310
47CFR 2.1091
RSS-102 issue 5

FCC:

Therefore the maximum output power of the transmitter is 487.5mW < 496mW(Distance: 90mm), hence the EUT is excluded from SAR evaluation according to FCC KDB publication 447498 D01: Mobile Portable RF Exposure.

Canada:

Separation distance is more than 20 cm, thus mobile device exposure limits can be applied.

Maximum Exposure:

Power to Antenna (mW)	296.48 mW
Power to Antenna (dBm)	24.7 dBm
Antenna Gain	2.74 dBi
Power+Ant Gain	557.2 mW
Distance	20 cm
S=	0.111 mW/cm ²

Limit Canada: 0.557 mW/cm²

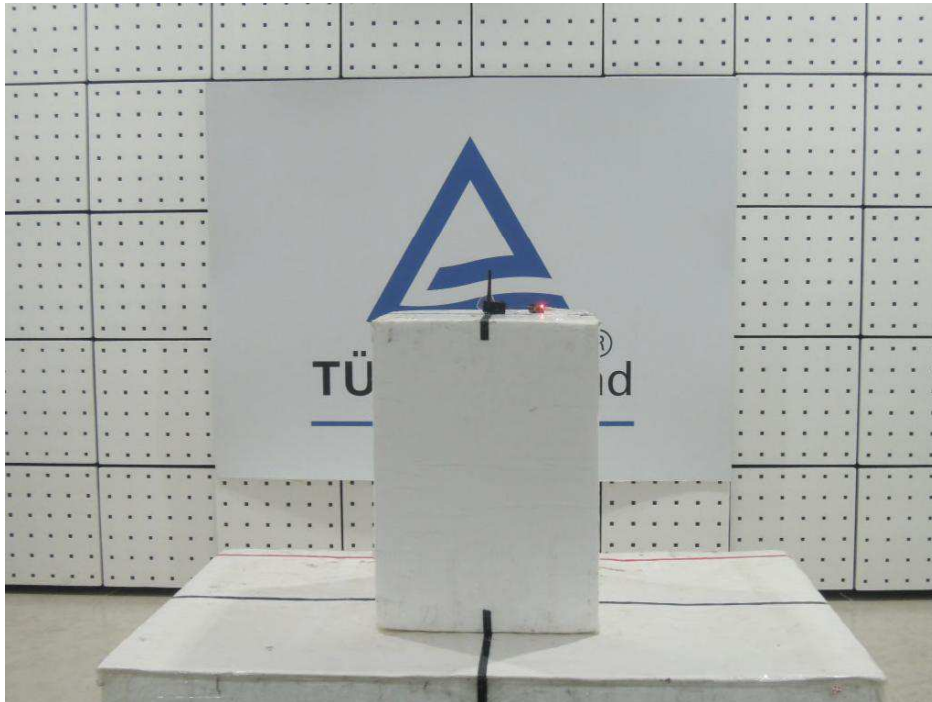
---End---

7. Photographs of the Test Set-Up

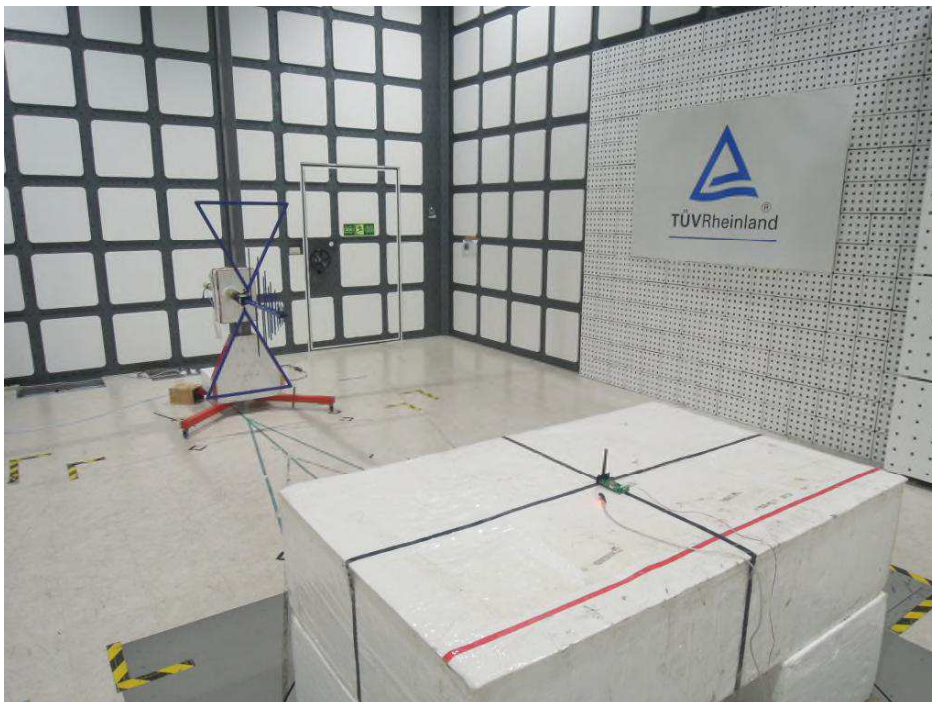
Photograph 1: Set-up for Spurious Emissions (Front View 1)



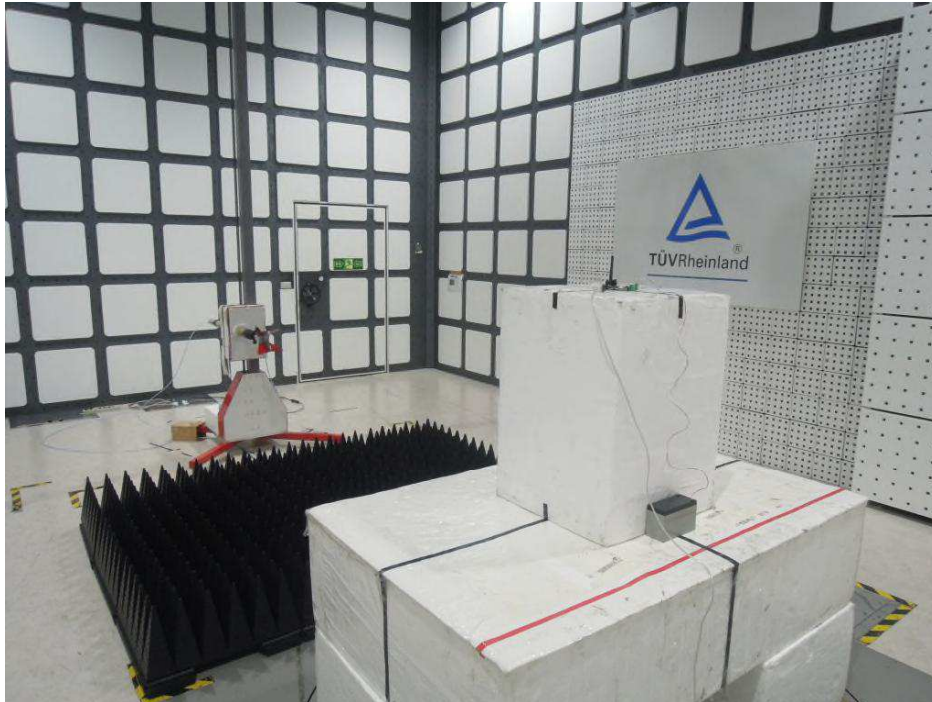
Photograph 2: Set-up for Spurious Emissions (Front View 2)



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



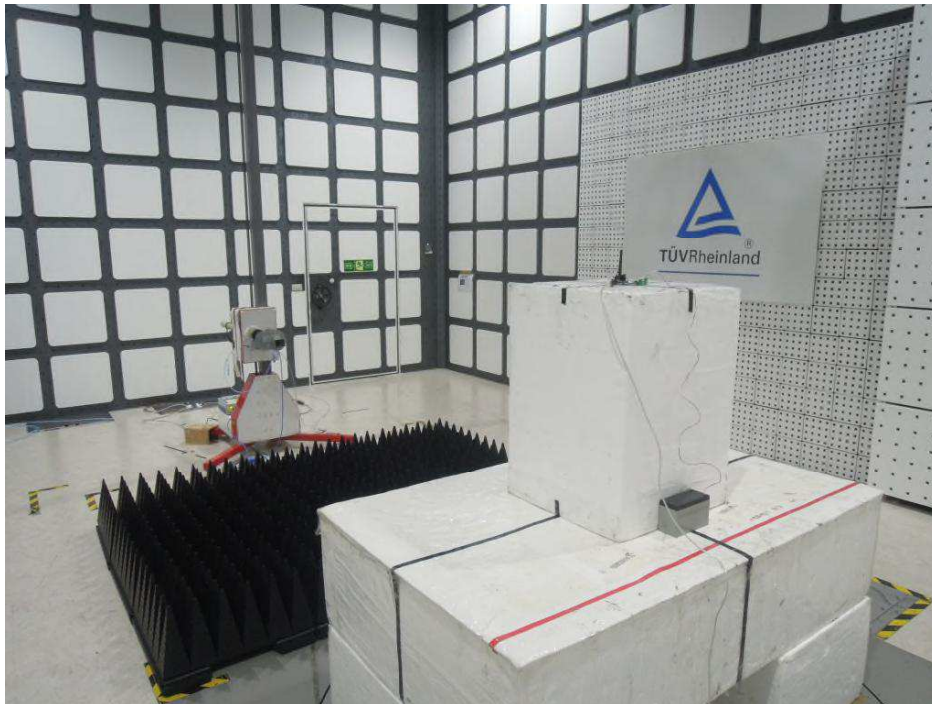
Photograph 4: Set-up for Spurious Emissions (Back View 2)



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



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



Photograph 7: Set-up for Conducted testing



Photograph 10: Set-up for Mains Conducted testing (Front View)



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