

Prüfbericht-Nr.: <i>Test Report No.:</i>	50246752 001	Auftrags-Nr.: <i>Order No.:</i>	238102764	Seite 1 von 55 <i>Page 1 of 55</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	19-Mar-2019	
Auftraggeber: <i>Client:</i>	Eve Systems LLC 100 Pine St., Suite 1250, San Francisco CA 94111 USA			
Prüfgegenstand: <i>Test item:</i>	Eve Extend			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	20EAB9901			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C, FCC Part 2, IC RSS-247 Issue 2, IC RSS-102 Issue 5			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.247(DTS) FCC 47CFR Part 2: Subpart J Section 2.1091 RSS-247 Issue 2 Feb 2017 RSS-102 Issue 5 Mar 2015			
Wareneingangsdatum: <i>Date of receipt:</i>	03-Apr-2019			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000899853-001 to 002			
Prüfzeitraum: <i>Testing period:</i>	12-Apr-2019 - 26-Apr-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:		kontrolliert von / reviewed by:		
2019-05-29	Mars Y.J. Lin / Project Engineer	2019-05-29	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>
				Unterschrift <i>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 PEAK OUTPUT POWER

RESULT: *Passed*

5.1.3 6dB & 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

These attachments are integral parts of this test report:

Appendix P: Photo Documentation internal view
(File Name: 50246752 001APPENDIXP)

Appendix D: Test Result of Radiated Emissions
(File Name: 50246752 001APPENDIXD)

Test Specifications

The following standards were applied.

Table 1: Applied Standard and Test Levels

Radio
FCC CFR47 Part 15: Subpart C Section 15.247
FCC 47CFR Part 2: Subpart J Section 2.1091
ANSI C63.10:2013
KDB558074 D01 DTS Meas Guidance v05
RSS-247 Issue 2 Feb 2017
RSS-102 Issue 5 Mar 2015
RSS-Gen Issue 5 Apr 2018

1.2 Complementary Materials

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_EMC	Ver. TUV3A1	N/A	N/A
EMI Test Receiver	R&S	ESR 7	101549	2018/11/12	2019/11/10
Spectrum Analyzer	R&S	FSV 40	100921	2018/05/02	2019/05/02
EXA Signal Analyzer	KEYSIGHT	N9010A	MY52221334	2018/06/04	2019/06/03
Preamplifier (30MHz -1GHz)	Hewlett Packard	8447D	2944A06641	2018/08/31	2019/08/31
Preamplifier (18 GHz -40 GHz)	EMC Instruments	EMC184045SE	980408	2018/06/08	2019/06/08
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	60649	2018/08/24	2019/08/24
Bilog Antenna	TESEQ	CBL6111D	29804	2018/07/02	2019/07/02
Horn Antenna	ETS-Lindgren	3117	138160	2018/06/01	2019/06/01
Horn Antenna (18GHz~40GHz)	COM-POWER	AH-840	101029	2018/12/22	2019/12/22
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2018/06/14	2019/06/13
Spectrum Analyzer	R&S	FSL3	101943	2018/09/07	2019/09/07
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	2019/04/09	2020/04/08

Kind of Equipment	Manu-facturer	Type	S/N	Last Calibration	Next Calibration
Spectrum Analyzer	Agilent	N9010A	MY53470241	2018/06/04	2019/06/03
Test Software	Agilent	300328 testsystem	V1.9.1	N/A	N/A
Power sensor	Agilent	U2021XA	MY54020001	2019/03/31	2020/03/31
Signal Generator	R&S	SMU200	104260	2018/09/06	2019/09/05
EXG-B RF Analog Signal Generator	Agilent	N5171B	MY53050377	2019/04/10	2020/04/09
MXG-B RF Vector Signal Generator	Agilent	N5182B	MY53050524	2019/04/10	2020/04/09
Embedded Attenuator	Keysight	AD211	TW5451121	N/A	N/A

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	± 0.1 ppm
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 Extend. It contains a IEEE® 802.11 b/g/n compatible module enabling the user to communicate data through a Wireless interface.
 For details refer to the User Guide, Data Sheet and Block Diagram.

3.2 System Details and Ratings

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	Eve Extend
Type Identification	20EAB9901
FCC ID	SNE-EXT-001
IC ID	11192A-EXT001
HVIN	20EAB9901

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequencies	802.11b/g/n20 : 2412MHz ~ 2462MHz
Channel Spacing	5 MHz
Channel number	13, only support BW 20MHz
Operation Voltage	100-240Vac
Modulation	802.11b : DSSS(BPSK, QPSK, CCK) 802.11g/n : OFDM(BPSK, QPSK, 16QAM, 64QAM)
Antenna gain	2.7dBi

3.3 Independent Operation Modes

Basic operation modes are:

- A. Transmitting
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel
- B. Receiving

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Block Diagram.

3.5 Submitted Documents

- Block Diagram
- Instruction Manual
- 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					
	NCB: 20MHz			NCB: 40MHz		
	2412 MHz	2437 MHz	2462 MHz	2422 MHz	2437 MHz	2452 MHz
802.11b DSSS 1M	Default (-1)	Default (-1)	Default (-1)	x	x	x
802.11g OFDM 6M	13	13	13	x	x	x
802.11n MCS0 HT20 MCS0	12	13	12	x	x	x
802.11n MCS0 HT40 MCS0	x	x	x	x	x	x

4.2 Test Operation and Test Software

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

This software "Dos.exe" 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:
A000899853-001 for Radiated test
A000899853-002 for Conducted test

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:

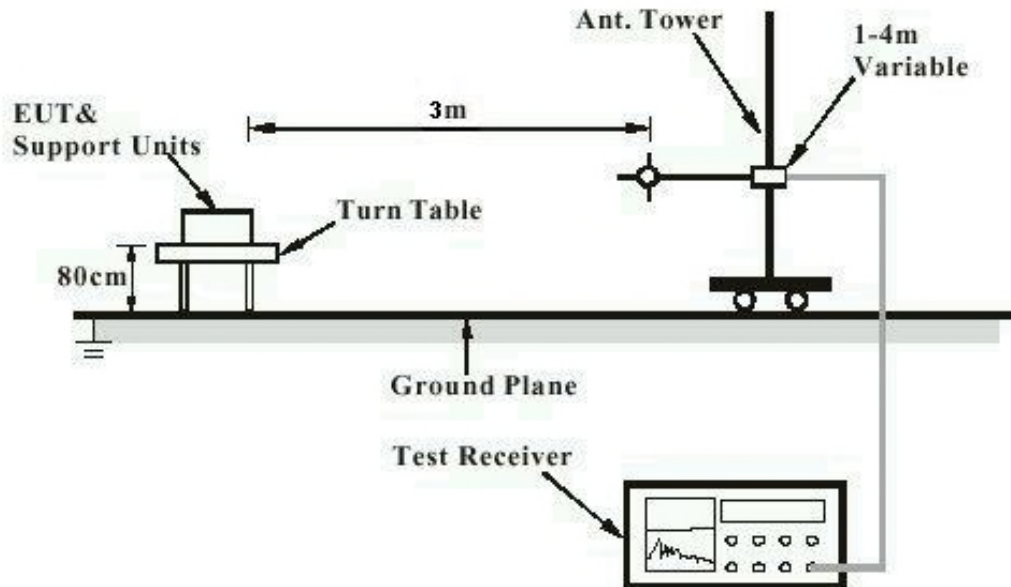
Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2

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 Mains Conduction Measurement (if applicable)

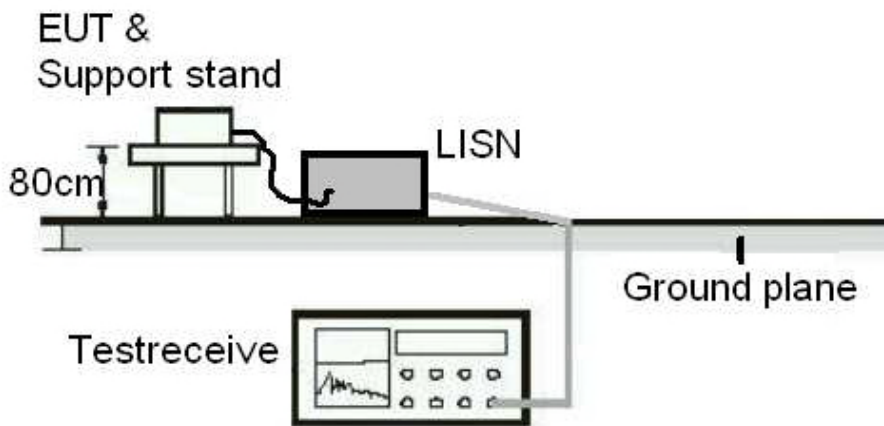
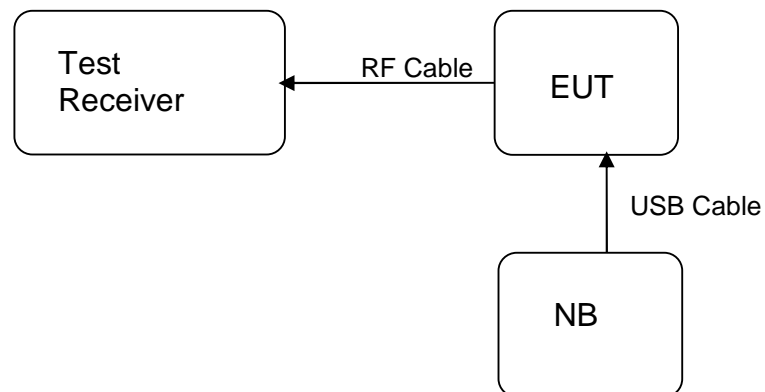


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



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, RSS-Gen
8.3

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 a directional gain of 2.7 dBi. The antenna is a Pifa Antenna 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 Peak Output Power

RESULT:
Passed

Test standard : FCC Part 15.247(b)(3), RSS-247 5.4(4)
 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 7: Test result of Peak Output Power

Mode	Channel Frequency (MHz)	Average Output Power		Limit (W)
		Ant 1 (dBm)	Total (dBm)	
802.11b DSSS 1M	2412	17.31	17.31	1
	2437	17.45	17.45	1
	2462	17.49	17.49	1
802.11g OFDM 6M	2412	13.92	13.92	1
	2437	13.91	13.91	1
	2462	13.91	13.91	1
802.11n HT20 MCS0	2412	13.02	13.02	1
	2437	13.83	13.83	1
	2462	13.11	13.11	1

5.1.3 6dB & 99% Bandwidth

RESULT:
Passed

Test standard : FCC Part 15.247(a)(2), RSS-247 5.2(1)
 RSS-Gen (Issue 4)
 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

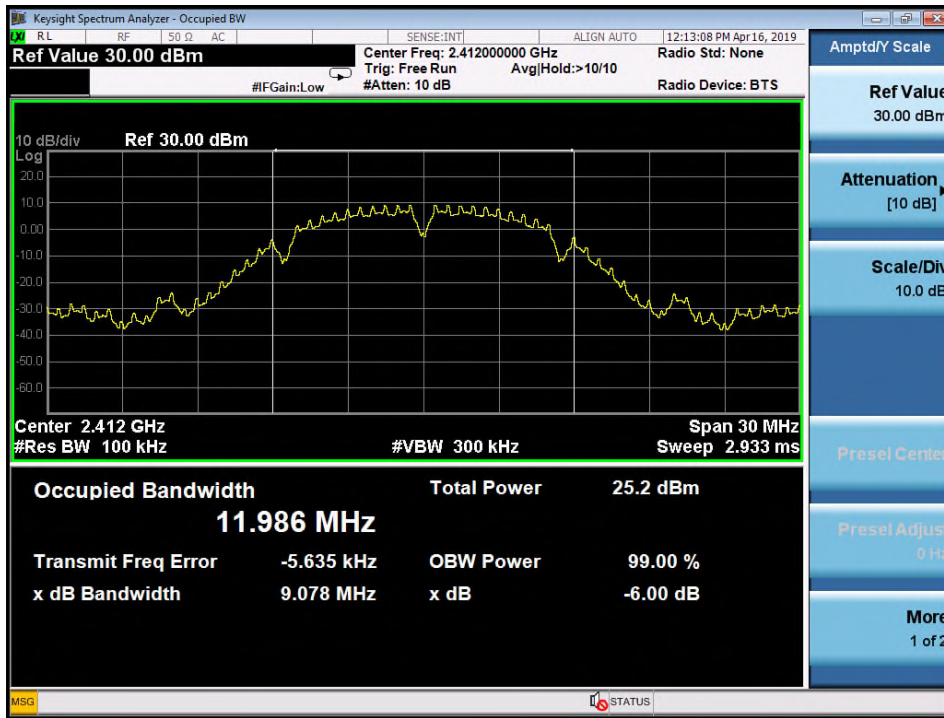
Table 8: Test result of 6dB Bandwidth

Mode	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
802.11b DSSS 1M	2412	9.08	>500	Pass
	2437	8.60	>500	Pass
	2462	9.06	>500	Pass
802.11g OFDM 6M	2412	16.37	>500	Pass
	2437	16.37	>500	Pass
	2462	16.38	>500	Pass
802.11n HT20 MCS0	2412	17.63	>500	Pass
	2437	17.61	>500	Pass
	2462	17.61	>500	Pass

Table 9: Test result of 99% Bandwidth

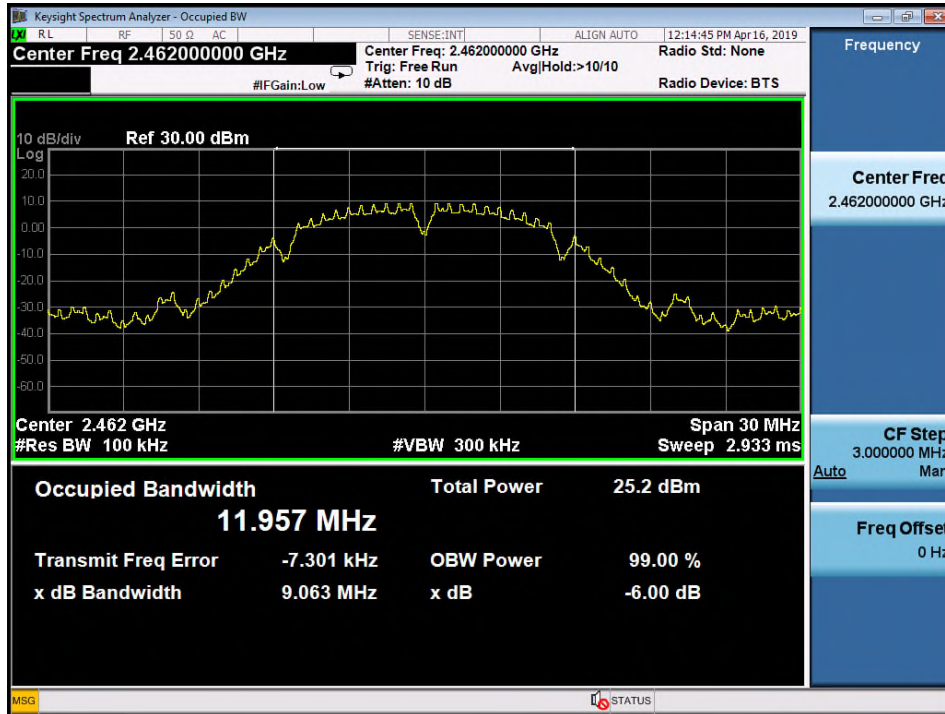
Mode	Channel Frequency (MHz)	99% Bandwidth (MHz)	Result
802.11b DSSS 1M	2412	12.00	Pass
	2437	11.97	Pass
	2462	11.96	Pass
802.11g OFDM 6M	2412	17.14	Pass
	2437	17.17	Pass
	2462	17.16	Pass
802.11n HT20 MCS0	2412	18.23	Pass
	2437	18.24	Pass
	2462	18.21	Pass

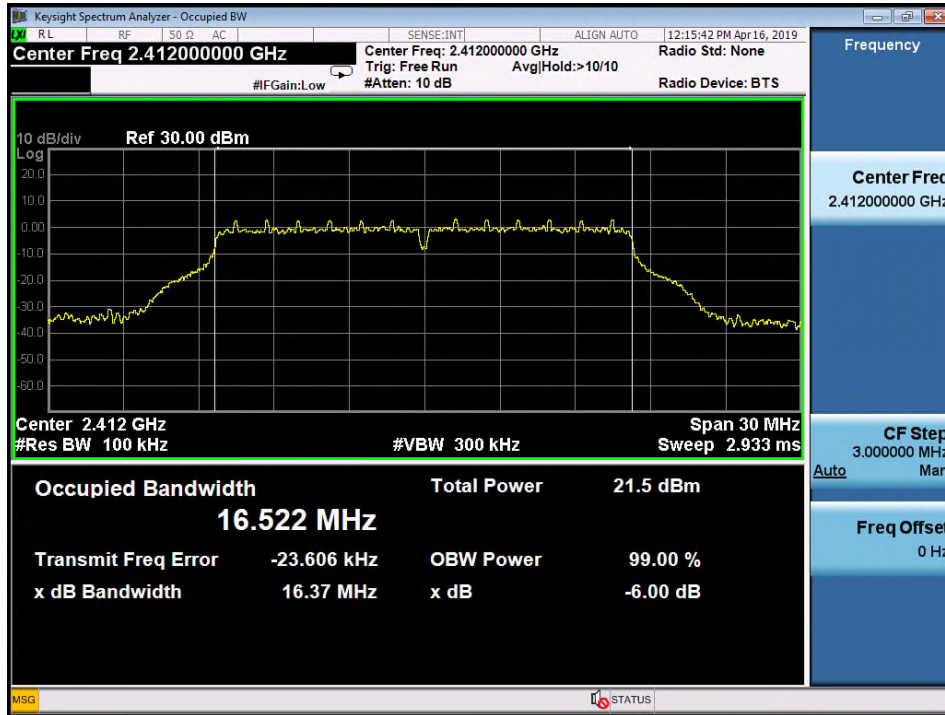
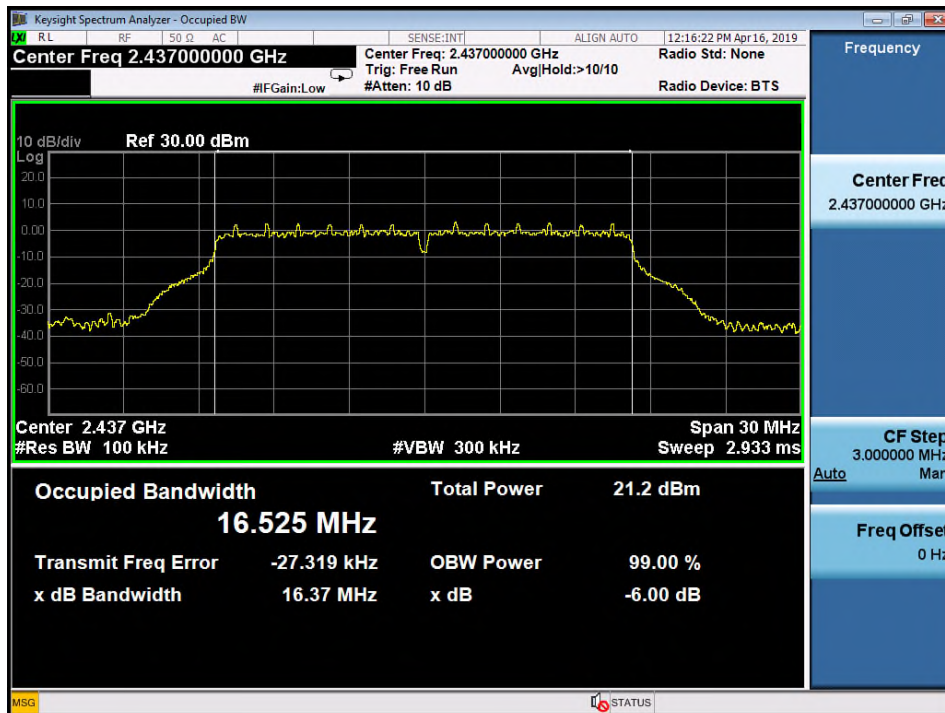
Test Plot of 6dB Bandwidth

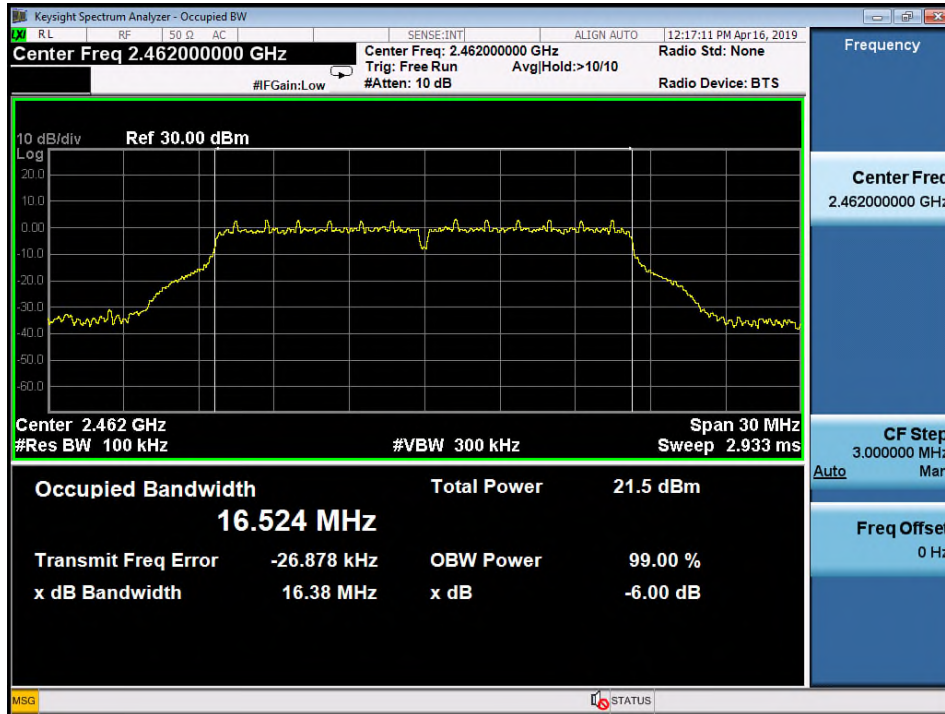
802.11b
Low Channel


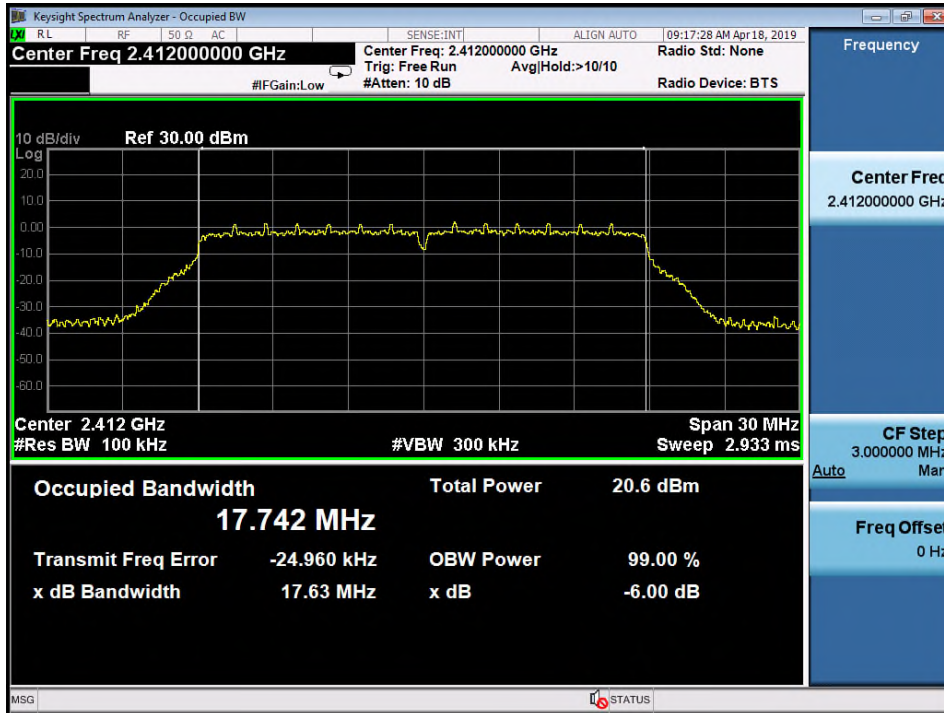
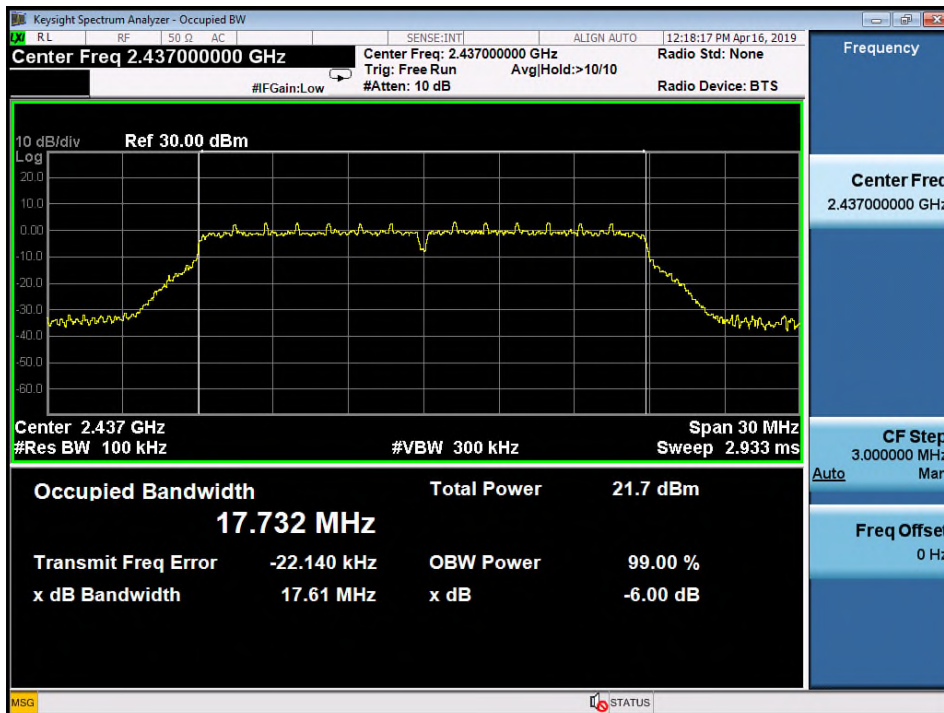
Middle Channel

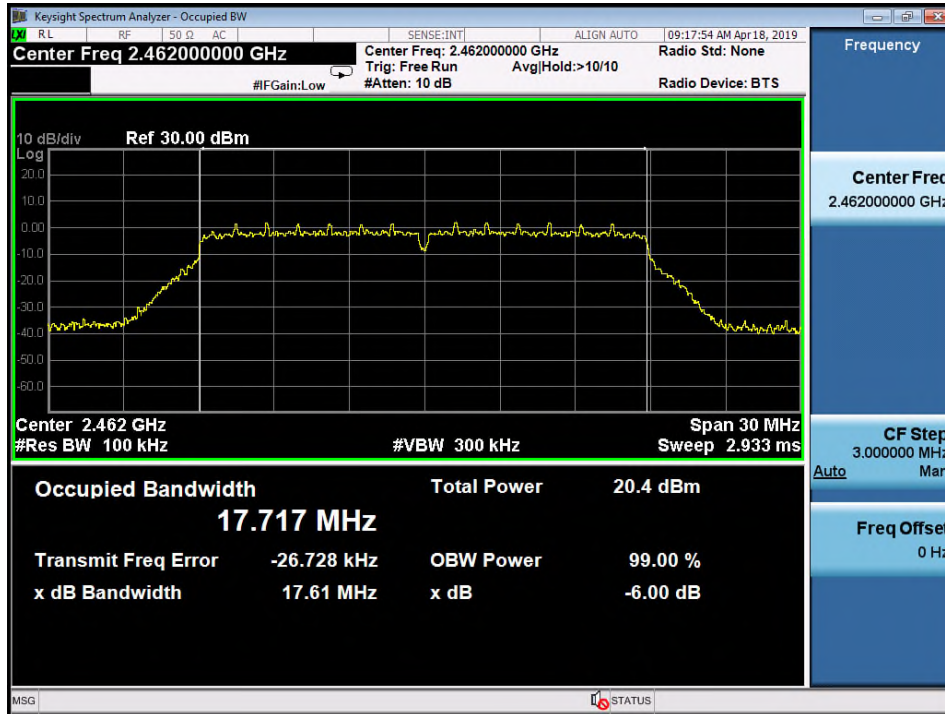


High Channel


802.11g
Low Channel

Middle Channel


High Channel


802.11n HT20
Low Channel

Middle Channel


High Channel


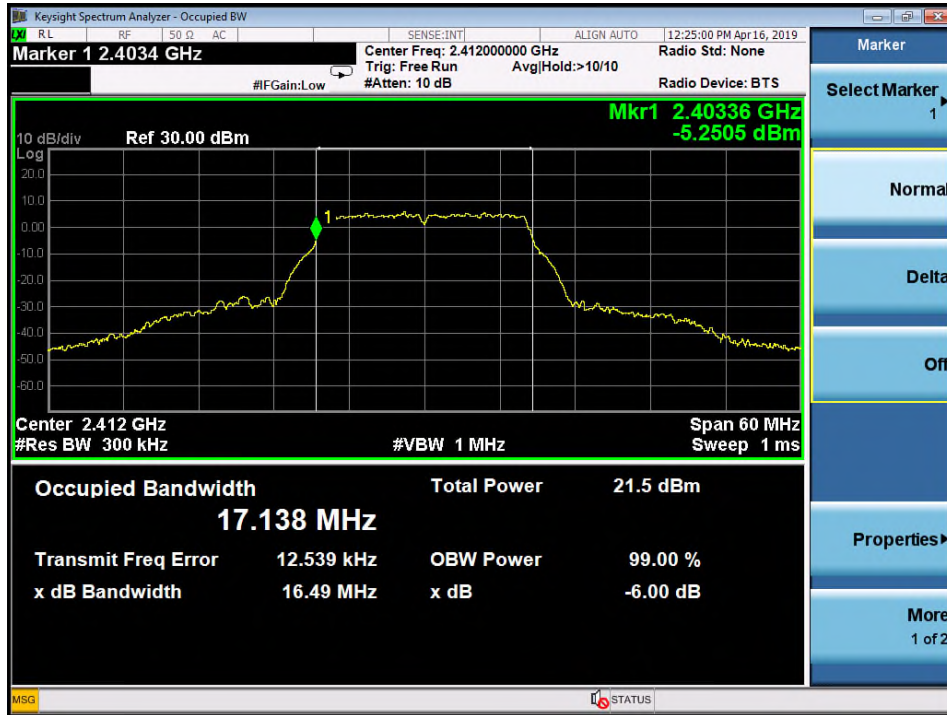
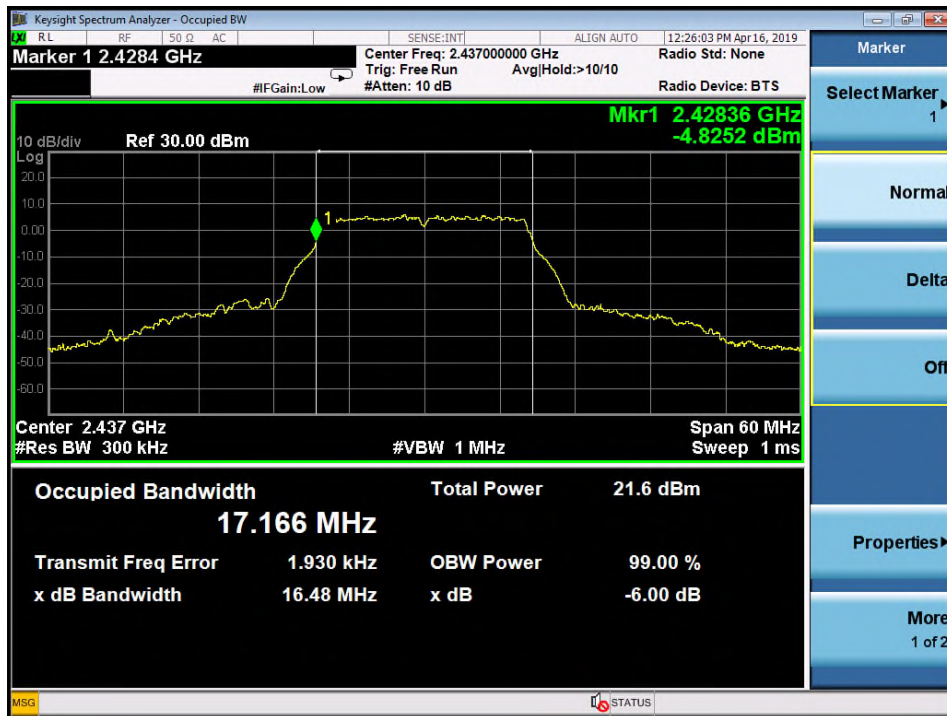
Test Plot of 99% Bandwidth

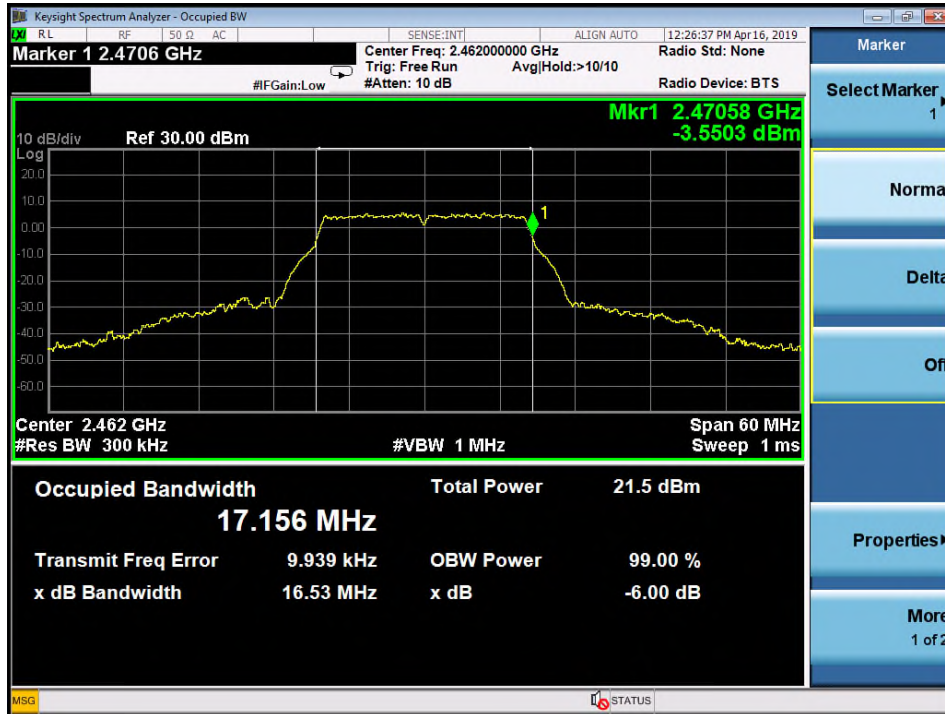
802.11b
Low Channel

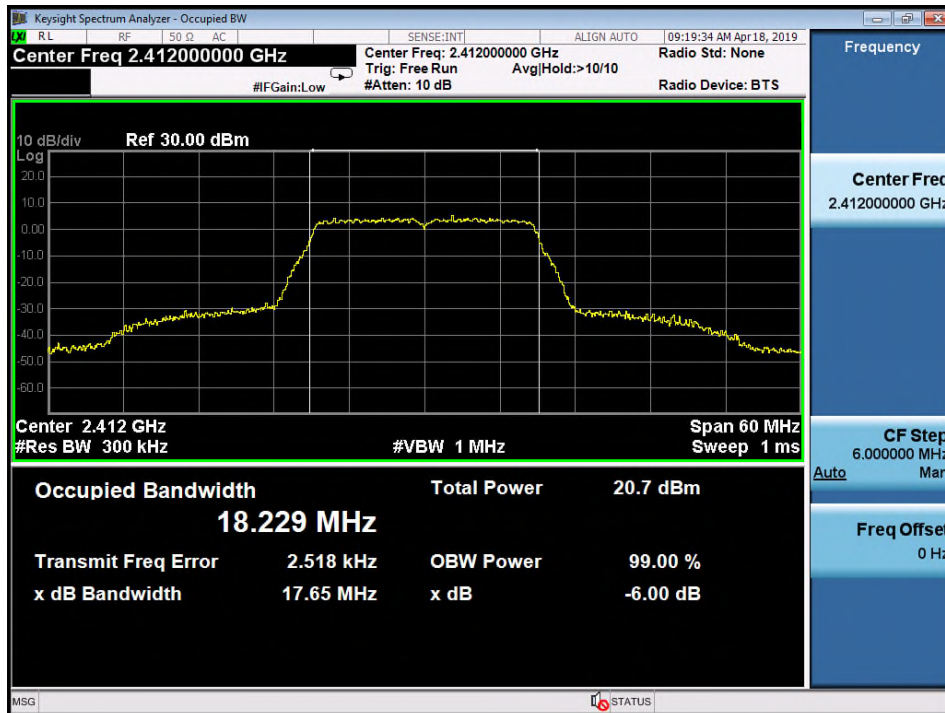
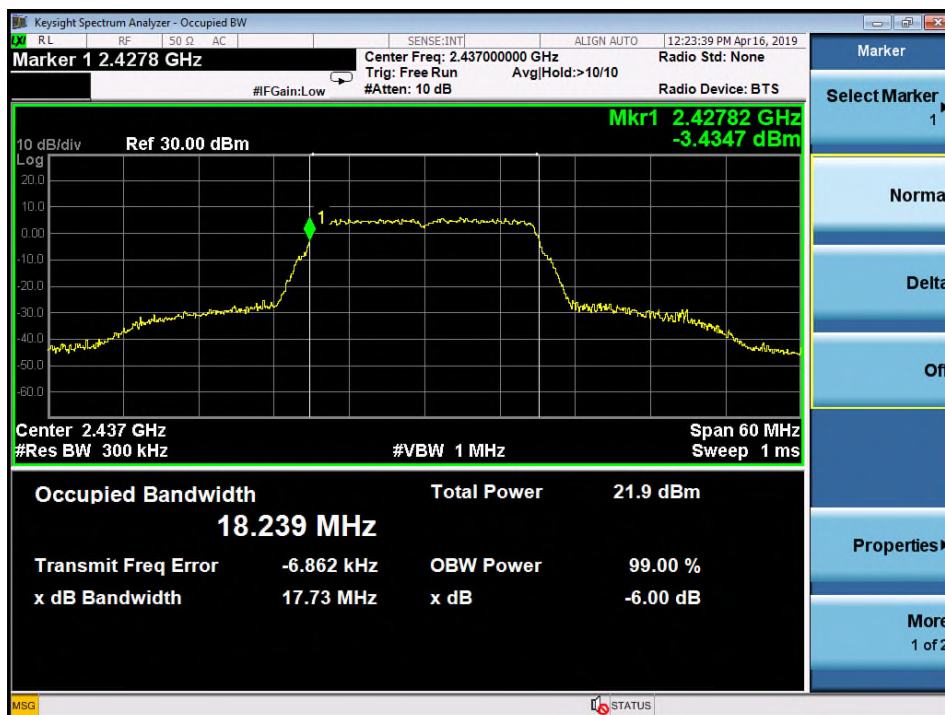

Middle Channel

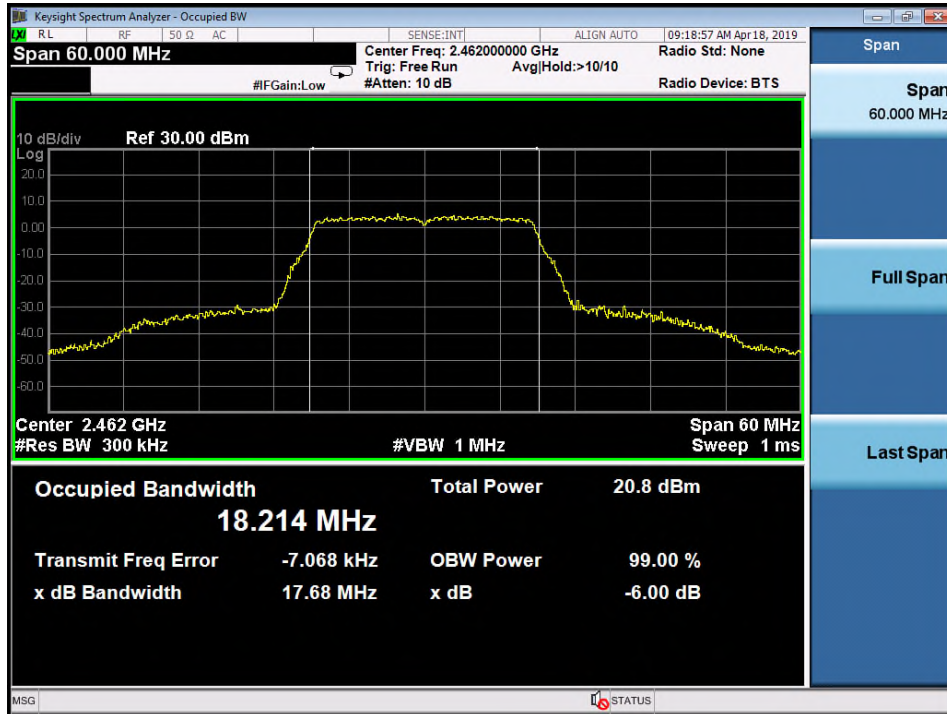


High Channel


802.11g
Low Channel

Middle Channel


High Channel


802.11n HT20
Low Channel

Middle Channel


High Channel


5.1.4 Power Density

RESULT:
Passed

Test standard : FCC Part 15.247(e), RSS-247 5.2(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 : 20-24°C
 Relative humidity : 50-65%
 Atmospheric pressure : 100-103 kPa

Table 10: Test result of Power Density

Mode	Channel Frequency (MHz)	Peak Power Density		Limit (dBm/3kHz)
		Ant 1 (dBm)	Total (dBm)	
802.11b DSSS 1M	2412	-5.71	-5.71	8
	2437	-5.69	-5.69	8
	2462	-5.35	-5.35	8
802.11g OFDM 6M	2412	-11.41	-11.41	8
	2437	-11.66	-11.66	8
	2462	-11.48	-11.48	8
802.11n HT20 MCS0	2412	-13.31	-13.31	8
	2437	-11.49	-11.49	8
	2462	-12.67	-12.67	8

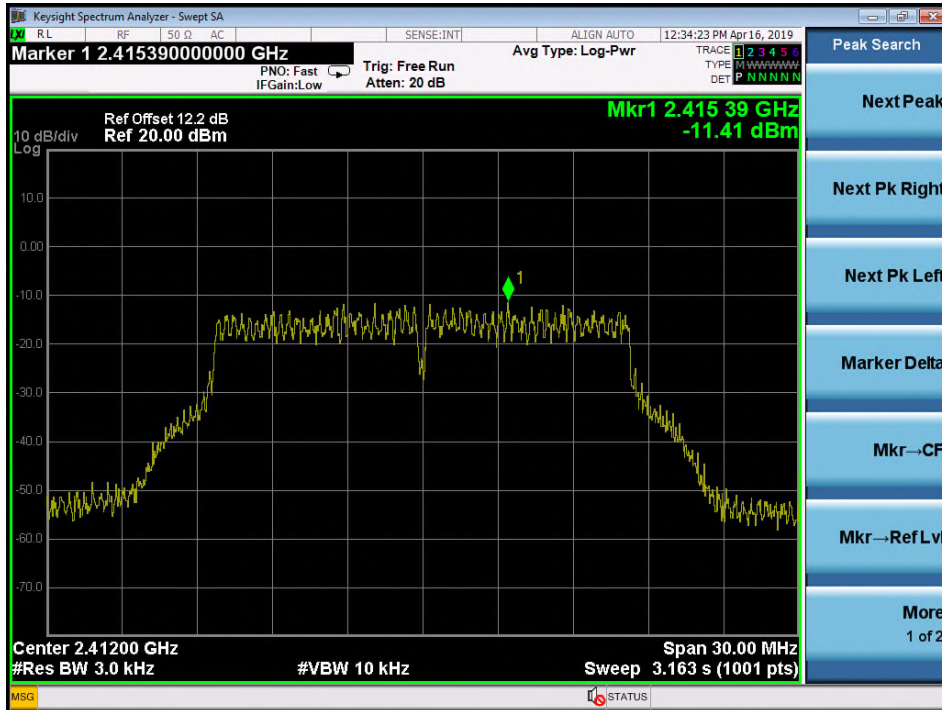
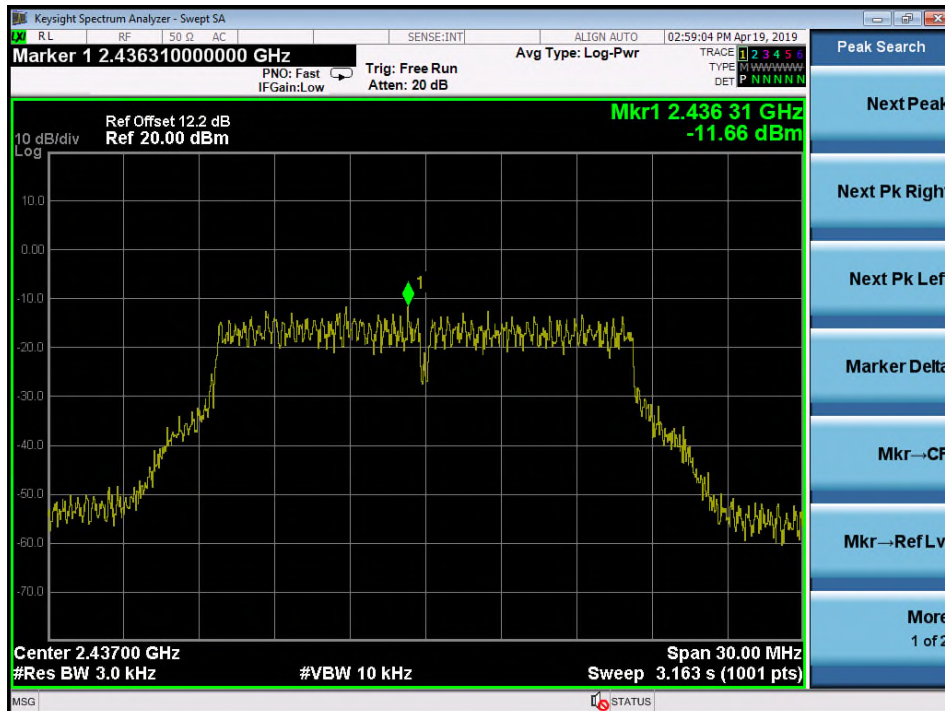
Test Plot of Peak Power Density

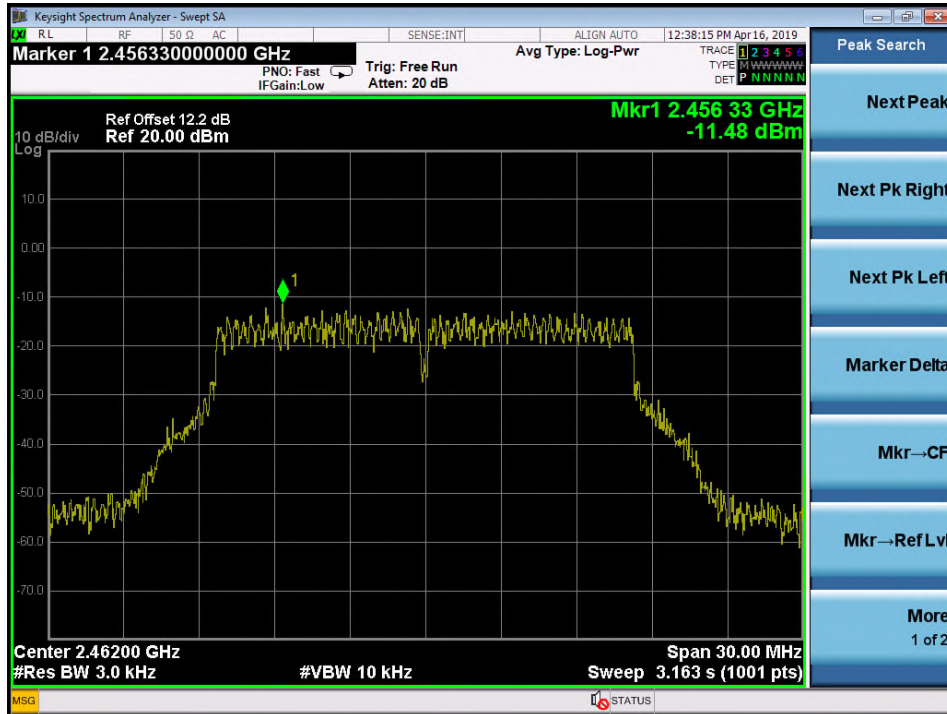
802.11b
Low Channel

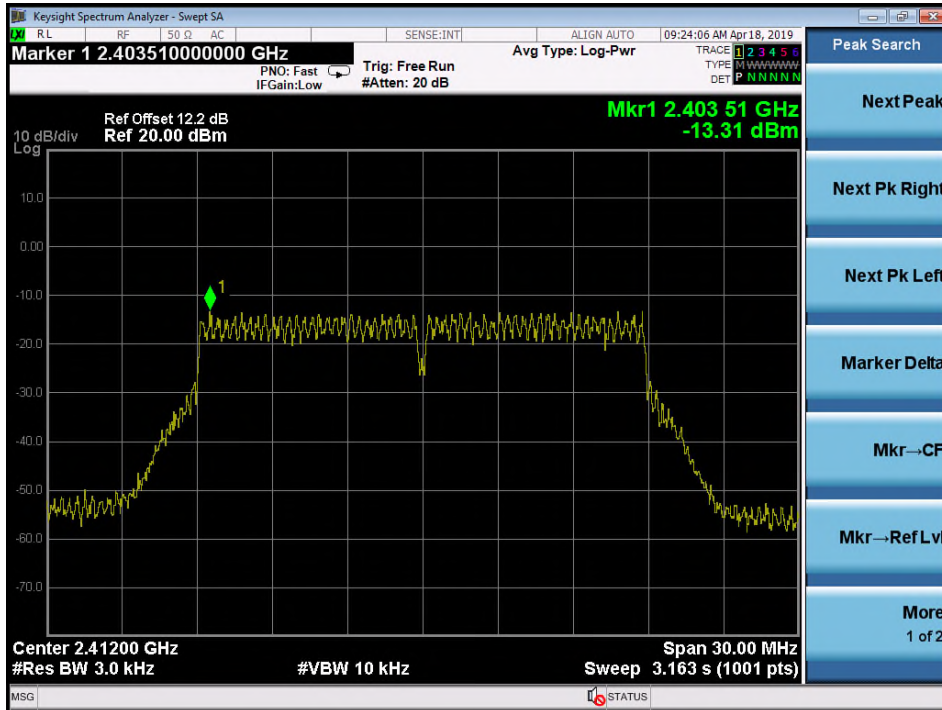
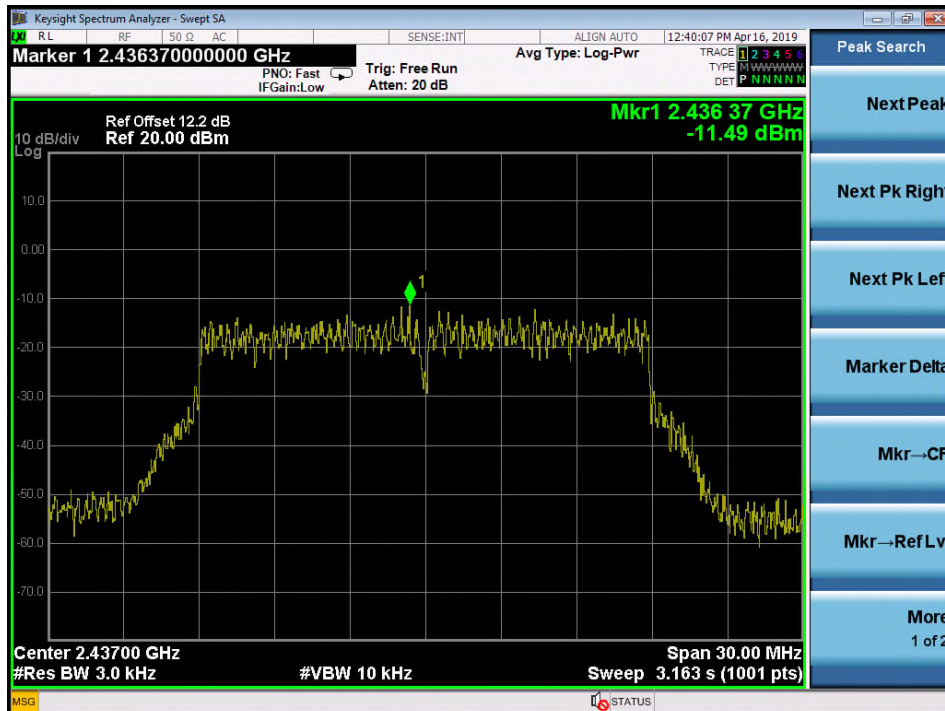

Middle Channel



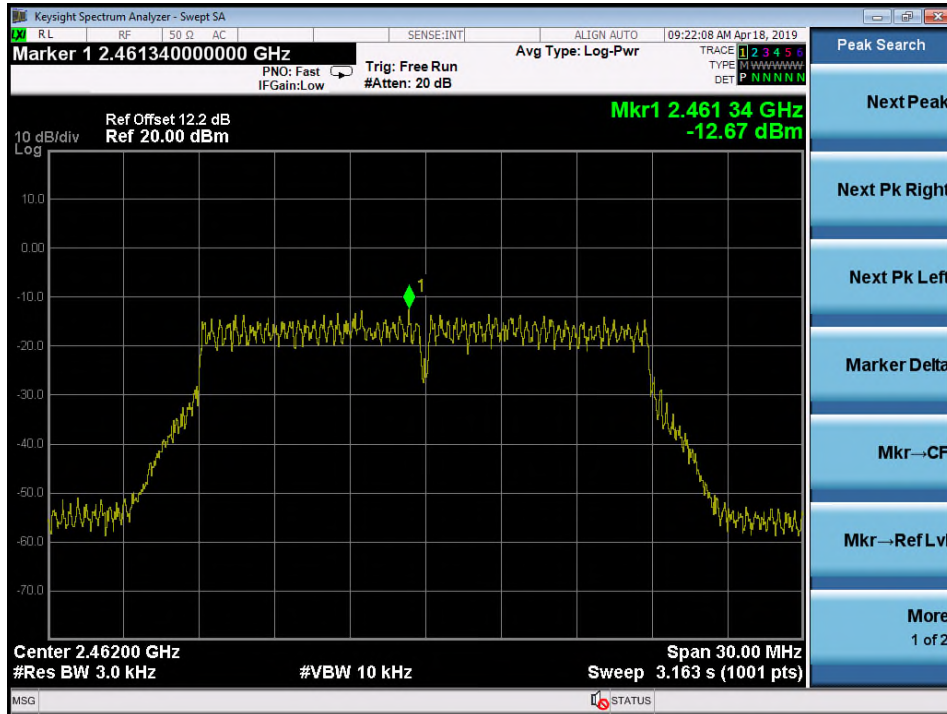
High Channel


802.11g
Low Channel

Middle Channel


High Channel


802.11n HT20
Low Channel

Middle Channel


High Channel



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

RESULT:**Passed**

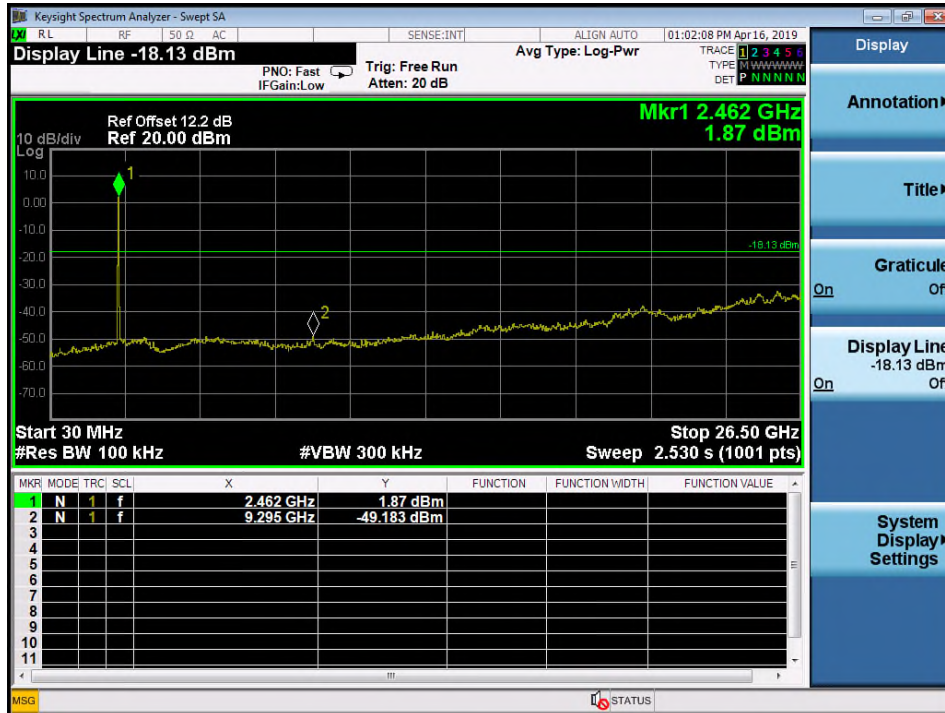
Test standard	:	FCC part 15.247(d), RSS-247 5.5
Basic standard	:	ANSI C63.10:2013, KDB558074
Limit	:	20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power)
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Low/ Middle/ High for Conducted Spurious Emissions Low/ High for Frequency Band Edge
Operation Mode	:	A
Ambient temperature	:	20-24°C
Relative humidity	:	50-65%

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

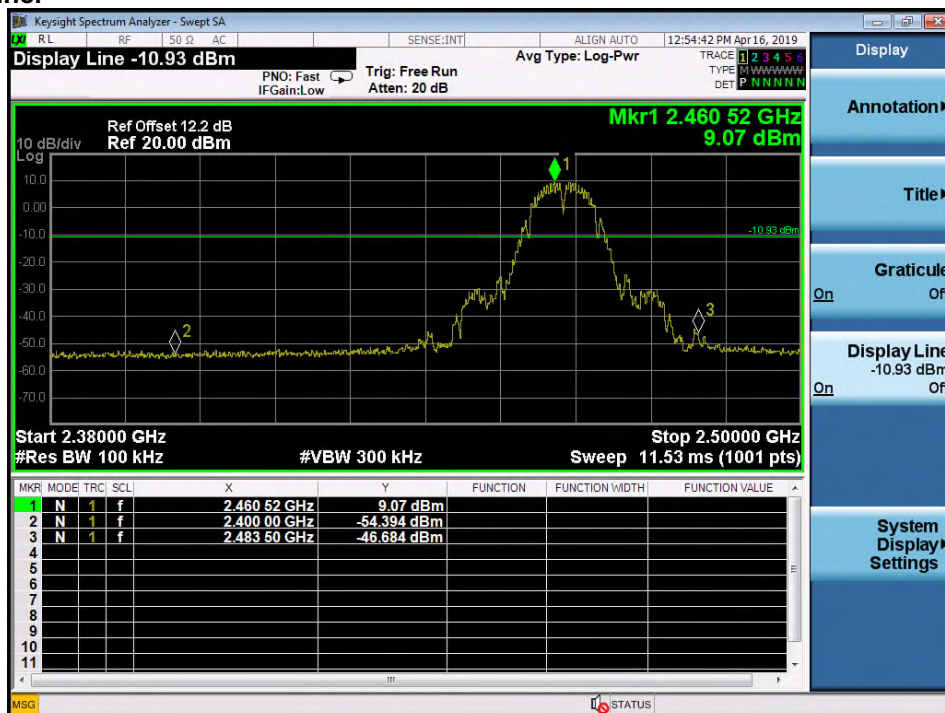
Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

High Channel


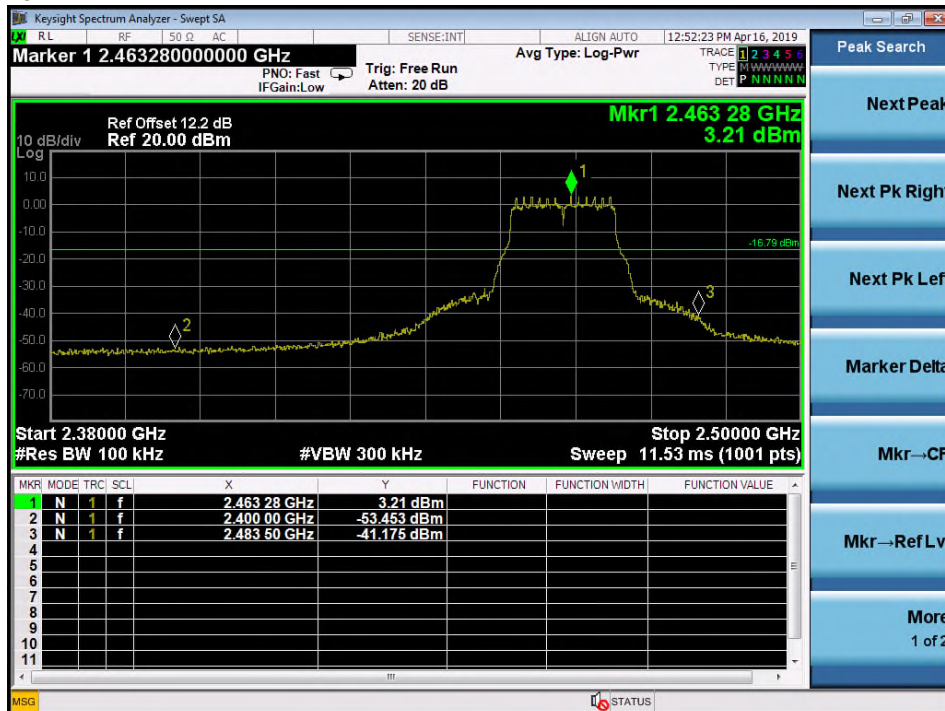
Test Plot 100kHz RBW of Band Edge

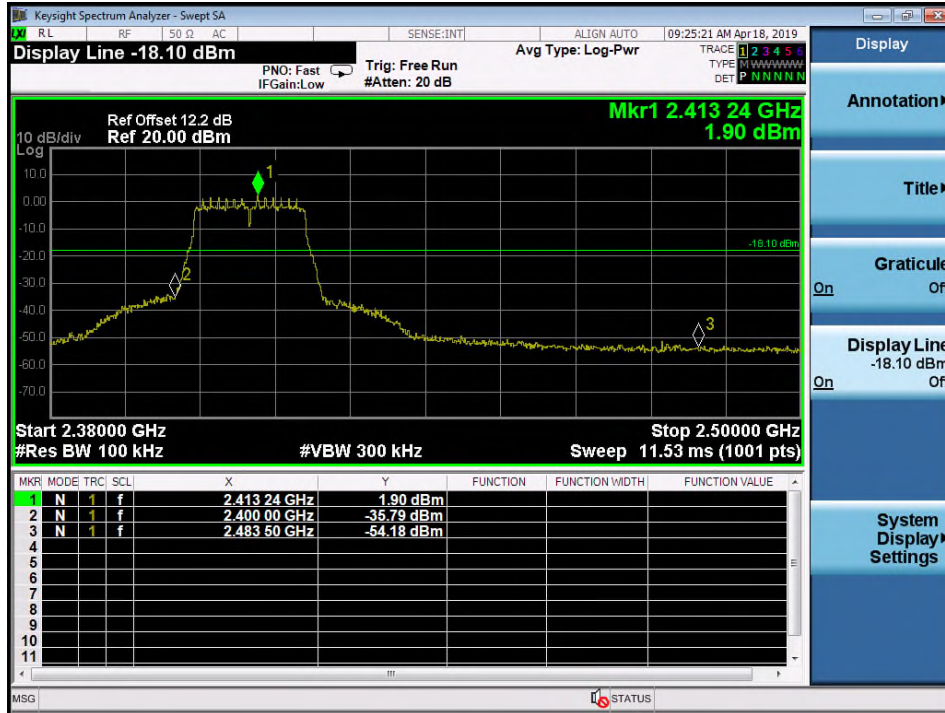
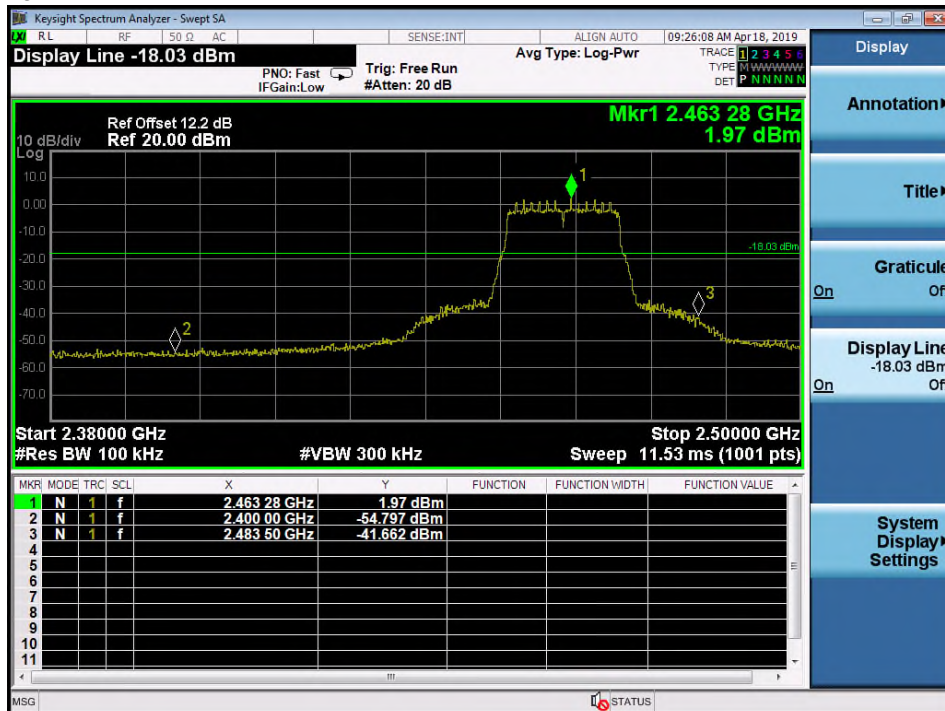
802.11b
Low Channel


High Channel



802.11g
Low Channel

High Channel


802.11n HT20
Low Channel

High Channel


5.1.6 Spurious Emission

RESULT:**Passed**

Test standard : FCC part 15.247(d), FCC 15.205, FCC 15.209, RSS-Gen 8.9

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 5, 8.9 (Table 5 and 6).

Emission radiated outside the restricted and authorized frequency bands must either comply with the radiated emission limits specified for the restricted bands or in FCC15.247(d) and RSS-247 i2, 5.5.

Kind of test site : 3m Semi-Anechoic Chamber

Test setup

Test Channel : Low/ Middle/ High

Operation mode : A

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

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

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 worst-case Axis orientation is recorded in this test report.

5.2 Mains Emissions

5.2.1 Mains Conducted Emissions

RESULT:**Passed**

Test standard : FCC Part 15.207
FCC Part 15.107
RSS-Gen 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

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

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

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

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 CFR 47 Part 2 Subpart J Section 2.1091
 RSS-102 Issue 5, Table 4

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

FCC Maximum Exposure:

Mode	Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Maximum Output Power (dBm)	Output Power (mW)	Power Density (S)(mW/cm ²)	Test Result
802.11b	2462	2.7	1.8621	17.49	56.10	0.020795	Pass

Limit FCC: 1500-100,000 MHz 1.0 mW/cm²

IC Maximum Exposure:

Mode	Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Maximum Output Power (dBm)	Output Power (mW)	Power Density (S)(mW/cm ²)	Test Result
802.11b	2412	2.7	1.8621	17.31	53.83	0.019950	Pass

Limit Canada: 0.537 mW/cm²

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ f ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ f ^{0.25}	0.1540/ f ^{0.25}	8.944/ f ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619f ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ f ^{1.2}
150000-300000	0.158 f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000/ f ^{1.2}

Note: f is frequency in MHz.

*Based on nerve stimulation (NS).

** Based on specific absorption rate (SAR).

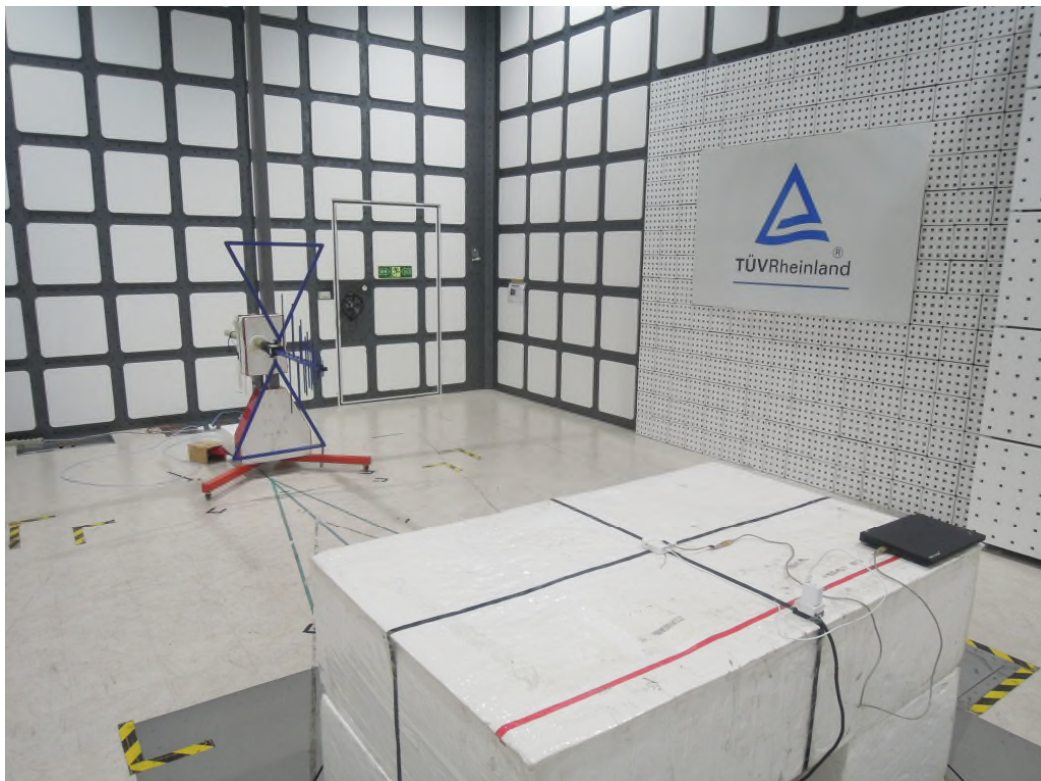
$$f = 2412, \text{Limit} : 0.02619f^{0.6834} = 0.537(\text{s})(\text{mW}/\text{cm}^2)$$

7. Photographs of the Test Set-Up

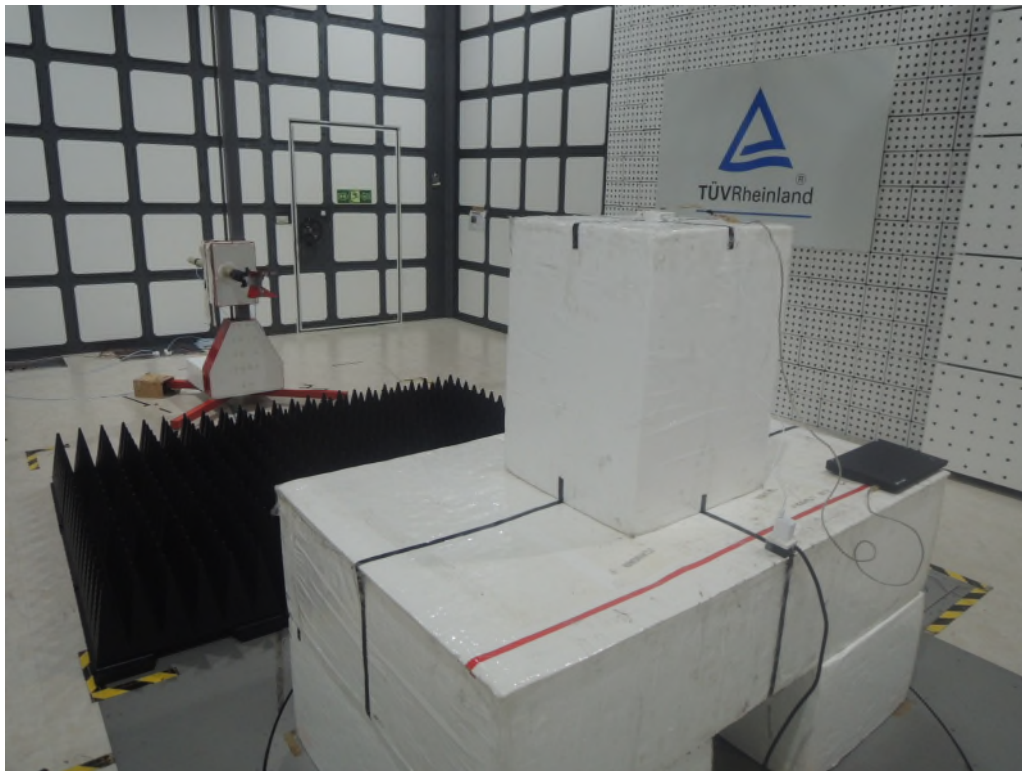
Photograph 1: Set-up for Spurious Emissions (Front)



Photograph 2: Set-up for Spurious Emissions (Back View 1)



Photograph 3: Set-up for Spurious Emissions (Back View 2)



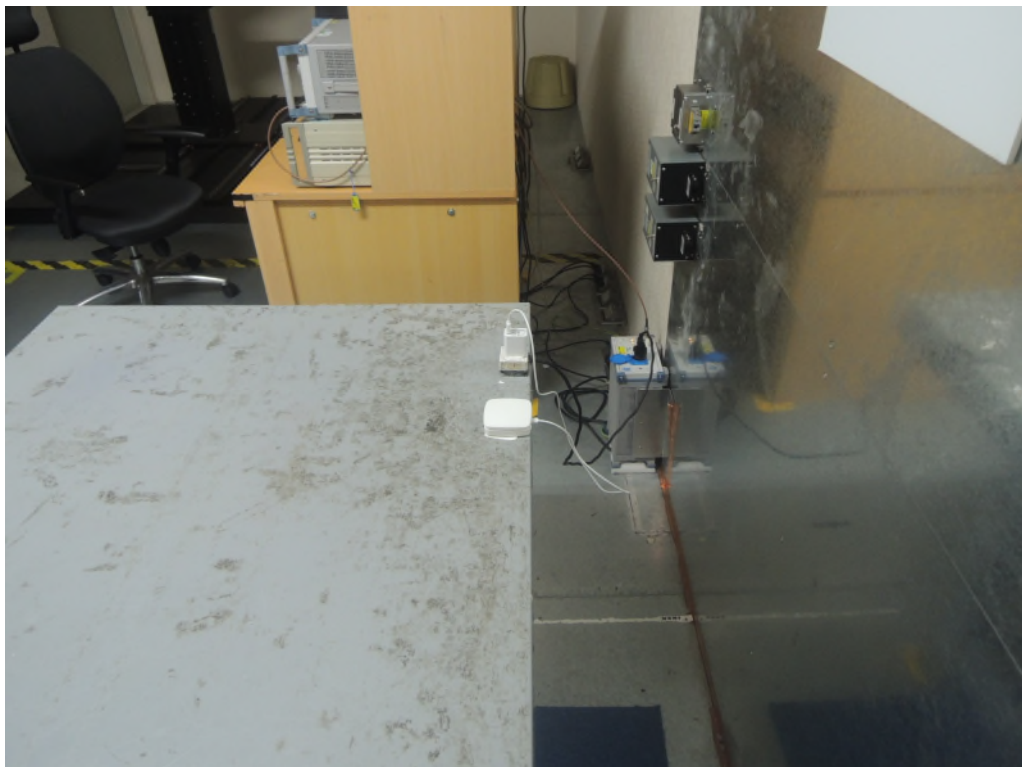
Photograph 4: Set-up for Conducted testing



Photograph 5: Set-up for AC Mains (Front)



Photograph 6: Set-up for AC Mains (Back)



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