Prüfbericht-Nr.: *Test Report No.*:	**50199587 001**	**Auftrags-Nr.:** *Order No.*:	114083071	**Seite 1 von 58** *Page 1 of 58*
Kunden-Referenz-Nr.: *Client Reference No.*:	N/A	**Auftragsdatum:** *Order date*:	19-Oct-2018	
Auftraggeber: *Client*:	Hon Hai Precision Industry Co., Ltd. No.151, Sec. 1, Nankan Rd., Lujhu Township, Taoyuan County 33859, Taiwan.			
Prüfgegenstand: *Test item*:	IEEE 802.11b/g/n WiFi Module			
Bezeichnung / Typ-Nr.: *Identification / Type No.*:	WFU03-VZ			
Auftrags-Inhalt: *Order content*:	FCC Part 15C / IC RSS-247 Test report (Wi-Fi 2.4GHz)			
Prüfgrundlage: *Test specification*:	FCC 47CFR Part 15: Subpart C Section 15.247 RSS-247 (02-2017)			

Wareneingangsdatum: *Date of receipt*:	19-Oct-2018
Prüfmuster-Nr.: *Test sample No.*:	A000824813-002 A000824813-003
Prüfzeitraum: *Testing period*:	22-Oct-2018 – 23-Nov-2018
Ort der Prüfung: *Place of testing*:	EMC/RF Laboratory Taipei
Prüflaboratorium: *Testing laboratory*:	TUV Rheinland Taiwan Ltd.
Prüfergebnis*: *Test result**:	Pass

Report Date / *tested by*:			**kontrolliert von /** *reviewed by*:		
27-Nov-2018	Jack Chang/Project Manager		27-Nov-2018	i.A. Arvin Ho/Vice General Manager	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other*:

Zustand des Prüfgegenstandes bei Anlieferung:
Condition of the test item at delivery: Prüfmuster vollständig und unbeschädigt
Test item complete and undamaged

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT
RESULT: Passed

5.1.2 PEAK OUTPUT POWER
RESULT: Passed

5.1.3 6DB BANDWIDTH AND 99% BANDWIDTH
RESULT: Passed

5.1.4 POWER DENSITY
RESULT: Passed

5.1.5 CONDUCTED SPURIOUS EMISSIONS AND FREQUENCY BAND EDGE MEASURED IN 100KHZ BANDWIDTH
RESULT: Passed

5.1.6 SPURIOUS EMISSION
RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS
RESULT: Passed

Contents

1. General Remarks

1.1 Complementary Materials

The following attachments are integral parts of this test report:

Appendix P: Photo Documentation
(File Name: 50199587 001 APPENDIXP)
Appendix D: Test Result of Radiated Emissions
(File Name: 50199587 001 APPENDIXD)

Test Specifications

The following standards were applied (in bold: product standards, otherwise: basic standards).

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
RSS-Gen, Issue 5, April 2018
ANSI C63.10:2013
KDB558074 D01 DTS Meas Guidance v05
KDB447498 D01 General RF Exposure Guidance v06

2. Test Sites

2.1 Test Facilities

TUV Rheinland Taiwan Ltd.
Taipei Office

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

FCC RegistrationNo.: 340738
IC Canada Registration No.: 9465A-1
TAF Accredited NCC Test Lab. No.:0759
TAF ISO17025 Certification effective periods: 2016-Jul-1st to 2019-Jun-30th

Testing Laboratory
0759

2.2 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	101062	2018/10/01	2019/10/01
Spectrum Analyzer	R&S	FSV 40	100921	2018/05/02	2019/05/02
Spectrum Analyzer	Agilent	N9010A	MY53470241	2018/06/04	2019/06/04
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	2018/08/22	2019/08/22
Preamplifier (18 GHz -40 GHz)	COM-POWER	PAM-840	461257	2018/01/18	2019/01/18
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	60558	2017/11/21	2018/11/30
Bilog Antenna	TESEQ	CBL6111D	29802	2018/08/22	2019/08/22
Horn Antenna	ETS-Lindgren	3117	00138160	2018/06/01	2019/06/01
Horn Antenna (18GHz~40GHz)	COM-POWER	AH-840	101029	2017/11/28	2018/11/28
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	2017/03/09	2019/03/09
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2018/06/21	2019/06/21
Test Software	Agilent	300328 testsystem	V1.9.1	N/A	N/A
Power sensor	Agilent	U2021XA	MY54020001	2018/03/31	2019/03/31

2.3 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.

2.4 Calibration

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

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements are ±3dB.

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
RF power, conducted	± 1.5 dB
Adjacent channel power	± 3 dB
Radiated emission of transmitter, valid up to 26 GHz	± 6 dB
Radiated emission of receiver, valid up to 26 GHz	± 6 dB
Temperature	± 2 ºC
Humidity	± 10 %

3. General Product Information

3.1 Product Function and Intended Use

The EUT is an IEEE 802.11b/g/n WiFi Module. The Module has RF Shield and Metal Stamping Antenna.

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	IEEE 802.11b/g/n WiFi Module
Type Designation	WFU03-VZ
FCC ID	RX3-WFU03VZ
Canada ID	2878F-WFU03VZ
Canada HVIN	WFU03-VZ

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequencies	2412 MHz ~ 2462 MHz
Channel Spacing	5 MHz
Channel number	802.11b/g/n HT20 : 11 (2412 MHz ~ 2462 MHz), 802.11n HT40 : 9 (2422 MHz ~ 2452 MHz)
Operation Voltage	5V
Modulation	802.11b: DSSS；802.11g/n: OFDM
Antenna gain	Metal Stamping Antenna, 1.28dBi

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

- Photo Document
- Technical Description
- Rating Label
- Circuit Diagram
- Blocking Diagram

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: Test samples are provided with a USB interface which makes it possible to control them 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: A000824813-002
Radiation: A000824813-003
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 6.5Mbps data rate were chosen for full testing.

IEEE 802.11n HT 40 mode:
Channel Low (2422MHz), Channel Mid (2437MHz) and Channel High (2452MHz) with 6.5Mbps data rate were chosen for full testing.

4.3 Auxiliary Equipment

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

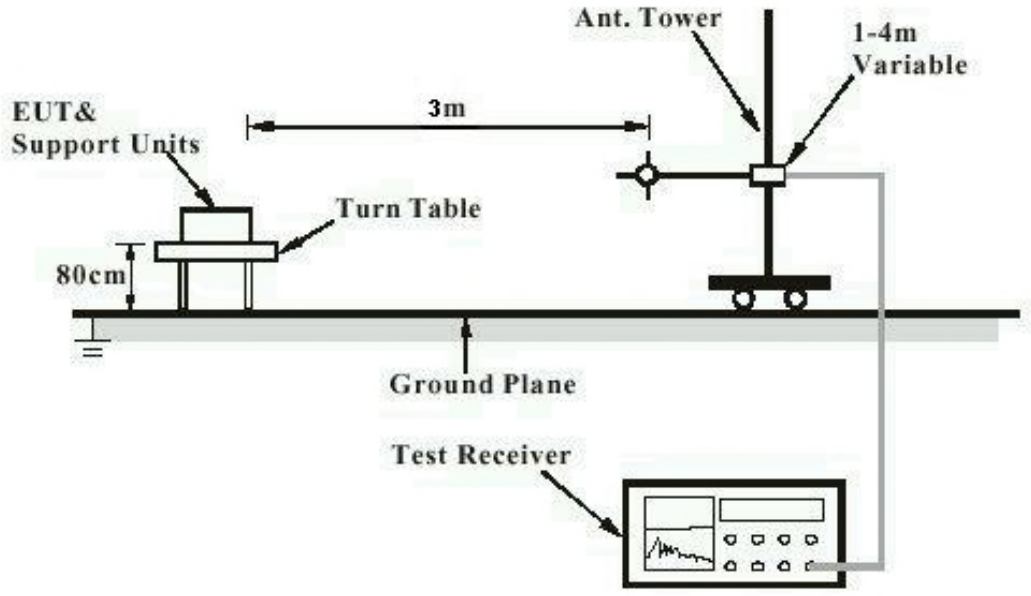
Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2
Test tool	MediaTek	MT7601USB	N/A

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)

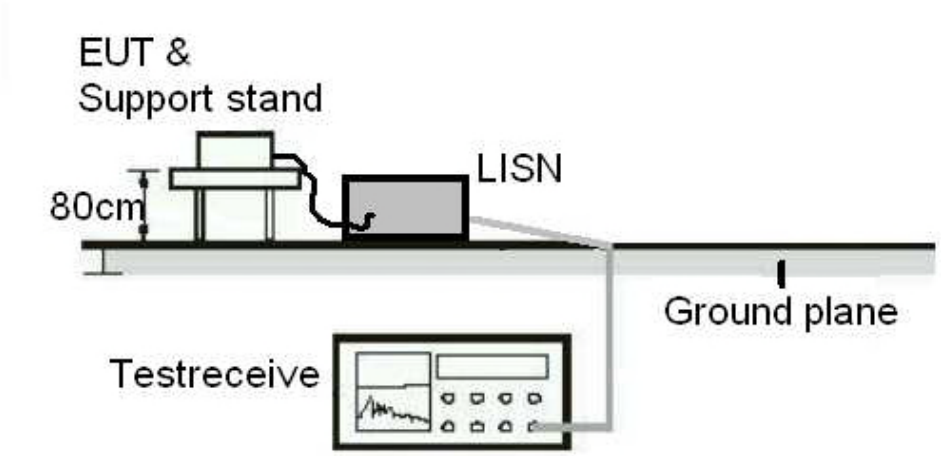
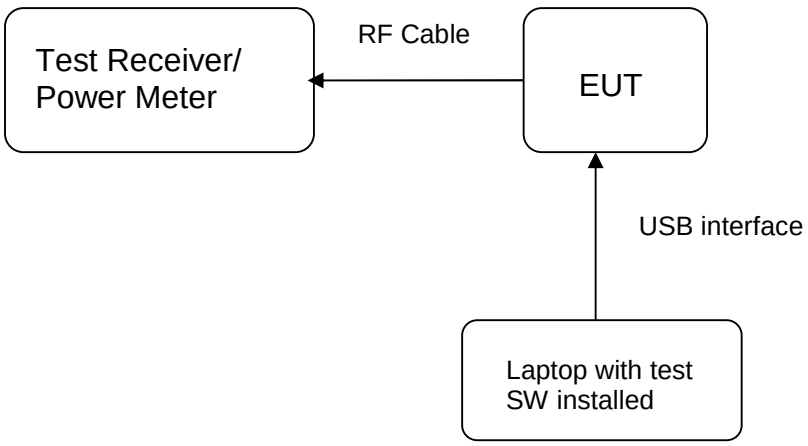


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT: **Passed**

Test standard	:	LP0002(2018): 3.10.1.3 FCC Part 15.247(b)(4), Part 15.203 and RSS-Gen 8.3
Limit	:	the use of antennas with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with Max directional gain of 1.28dBi. The antenna is a Metal Stamping 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 Peak Output Power

RESULT: **Passed**

Test standard	:	LP0002(2018): 3.10.1.2 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/Conducted room

Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A
Ambient temperature	:	18-25 °C
Relative humidity	:	50-65 %
Atmospheric pressure	:	100-103kPa

Table 6: Test result of Peak Output Power (802.11b)

Channel	Channel Frequency (MHz)	Output Power		Limit	Power Setting
		(dBm)	(W)	(W)	
Low Channel	2412	14.75	0.02985	1	1A
Middle Channel	2437	14.52	0.02831	1	1A
High Channel	2462	14.77	0.02999	1	1A

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

Channel	Channel Frequency (MHz)	Output Power		Limit	Power Setting
		(dBm)	(W)	(W)	
Low Channel	2412	11.05	0.01274	1	13
Middle Channel	2437	14.98	0.03148	1	19
High Channel	2462	12.28	0.01690	1	15

Table 8: Test result of Peak Output Power (802.11n HT20)

Channel	Channel Frequency (MHz)	Output Power		Limit	Power Setting
		(dBm)	(W)	(W)	
Low Channel	2412	11.21	0.01321	1	19
Middle Channel	2437	14.72	0.02965	1	20
High Channel	2462	10.91	0.01233	1	19

Table 9: Test result of Peak Output Power (802.11n HT40)

Channel	Channel Frequency (MHz)	Output Power		Limit	Power Setting
		(dBm)	(W)	(W)	
Low Channel	2422	8.34	0.00682	1	13
Middle Channel	2437	13.83	0.02415	1	20
High Channel	2452	13.75	0.02371	1	16

5.1.3 6dB Bandwidth and 99% Bandwidth

RESULT: **Passed**

Test standard	:	LP0002(2018): 3.10.1.5 FCC Part 15.247(a)(2), RSS-247 5.2(1)
Basic standard	:	ANSI C63.10:2013, KDB558074
Kind of test site	:	Shielded room/Conducted room

Test setup

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

Ambient temperature	:	18-25°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103kPa

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

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	12.197	0.5	Pass
Mid Channel	2437	12.212	0.5	Pass
High Channel	2462	12.209	0.5	Pass

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

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	16.480	0.5	Pass
Mid Channel	2437	16.478	0.5	Pass
High Channel	2462	16.478	0.5	Pass

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

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	17.566	0.5	Pass
Mid Channel	2437	17.558	0.5	Pass
High Channel	2462	17.572	0.5	Pass

Table 13: Test result of 6dB Bandwidth (802.11n HT40)

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2422	35.95	0.5	Pass
Mid Channel	2437	35.96	0.5	Pass
High Channel	2452	36.33	0.5	Pass

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

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Mid Channel	2437	12.225

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

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Mid Channel	2437	16.743

Table 16: Test result of 99% Bandwidth (802.11n HT20)

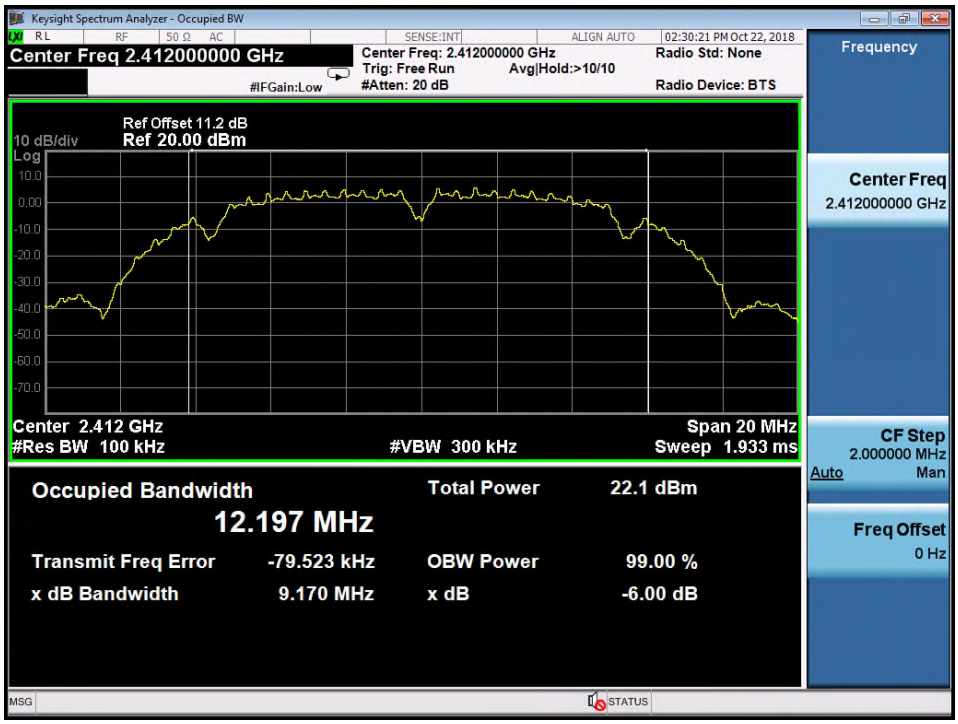
Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Mid Channel	2437	17.773

Table 17: Test result of 99% Bandwidth (802.11n HT20)

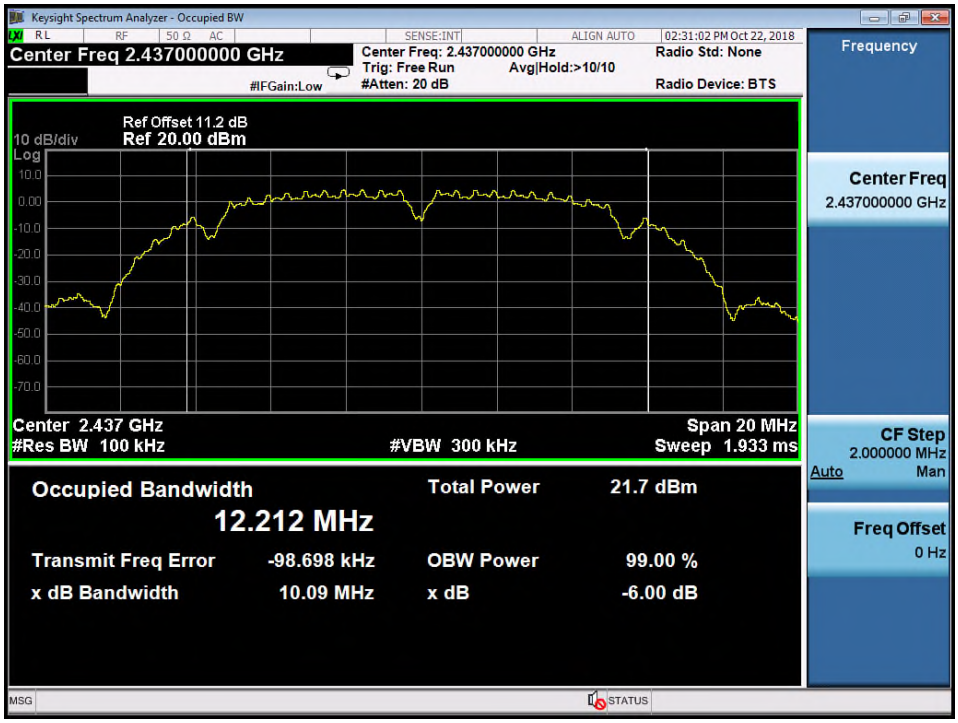
Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Mid Channel	2437	36.887

Test Plot of 6dB Bandwidth (802.11b)

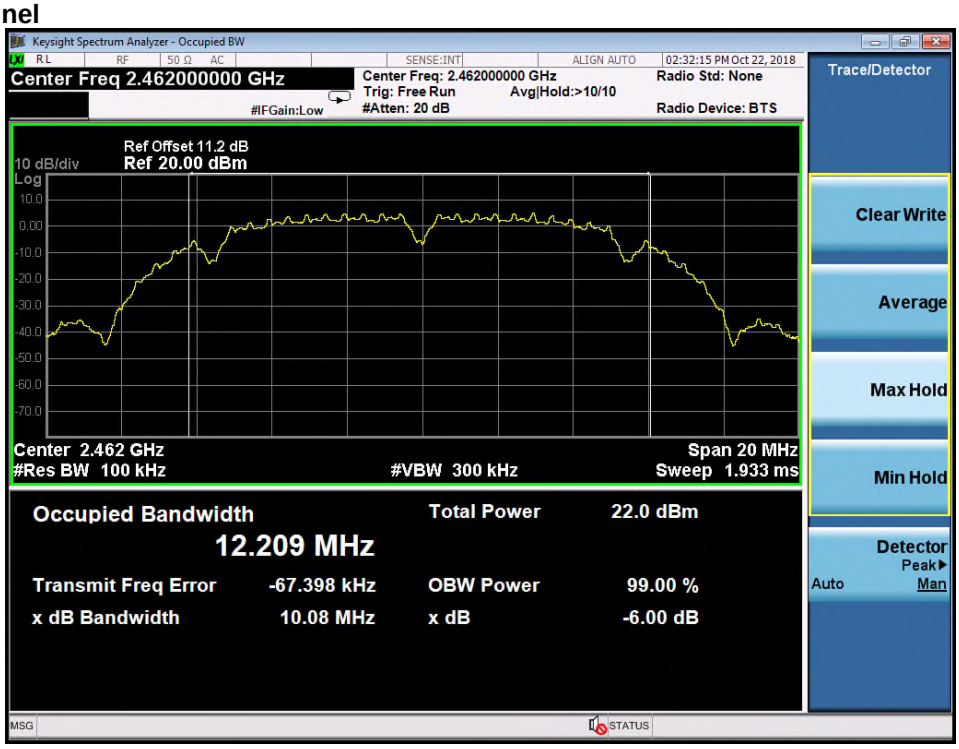
Low Channel



Middle Channel

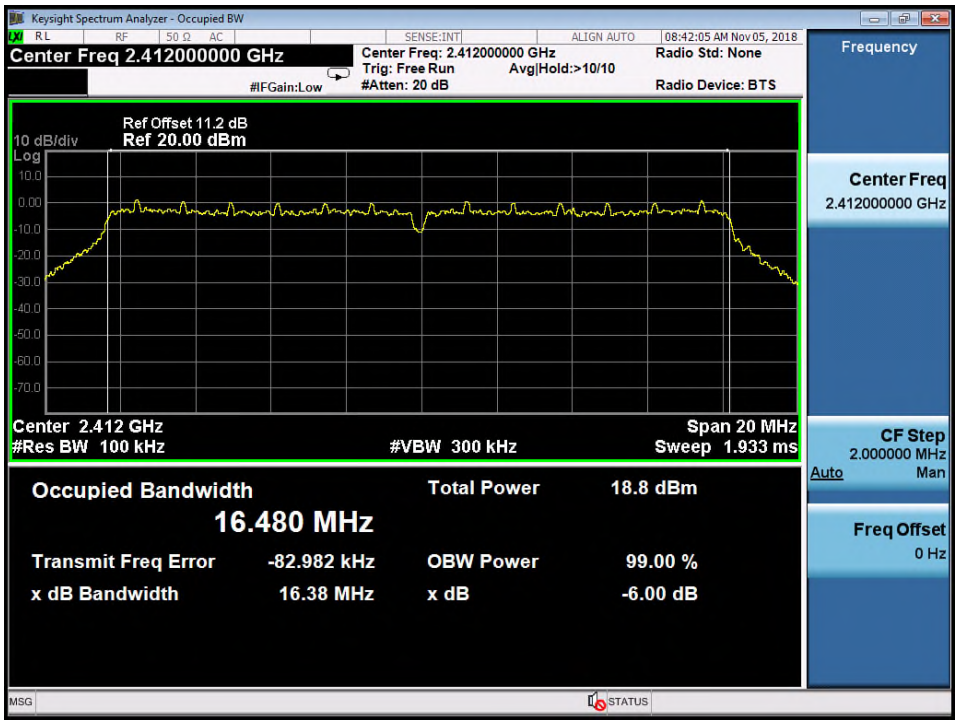


High Channel

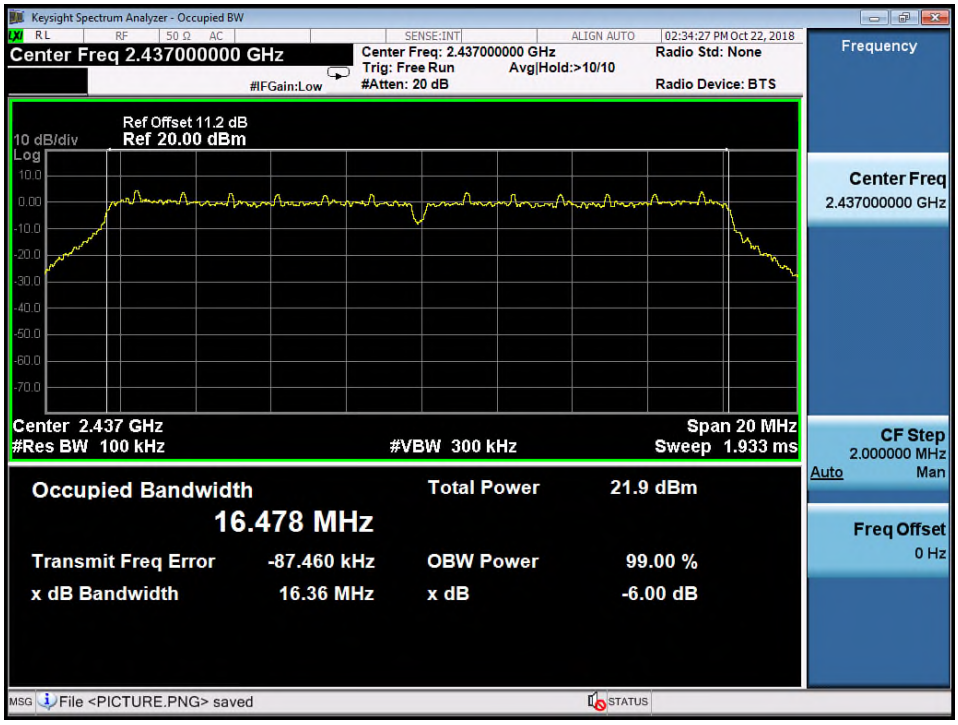


Test Plot of 6dB Bandwidth (802.11g)

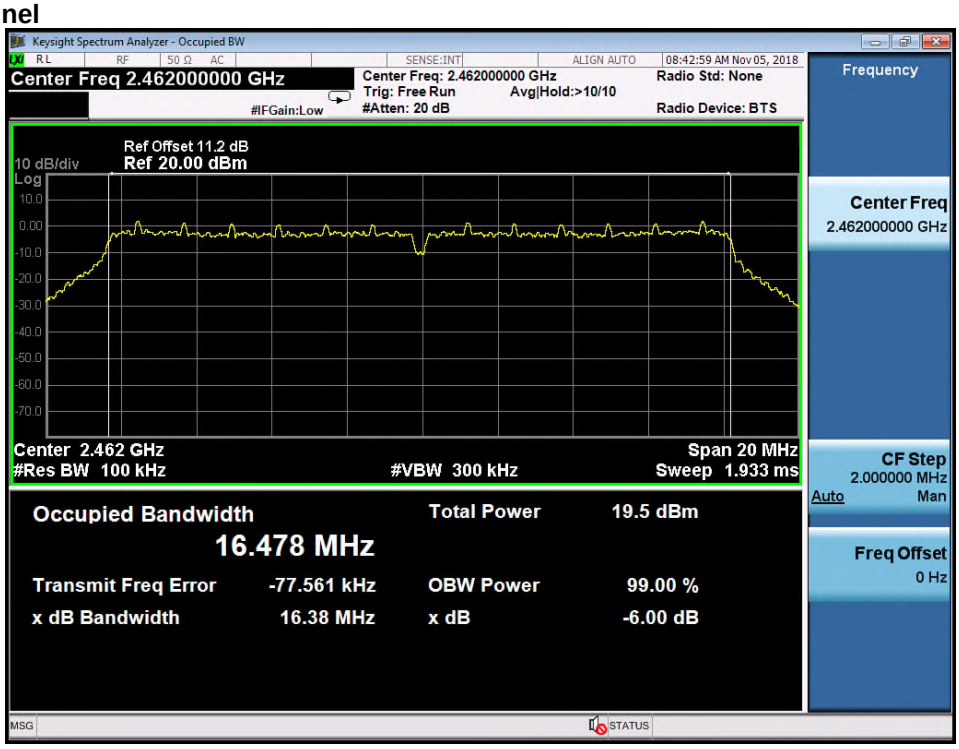
Low Channel



Middle Channel

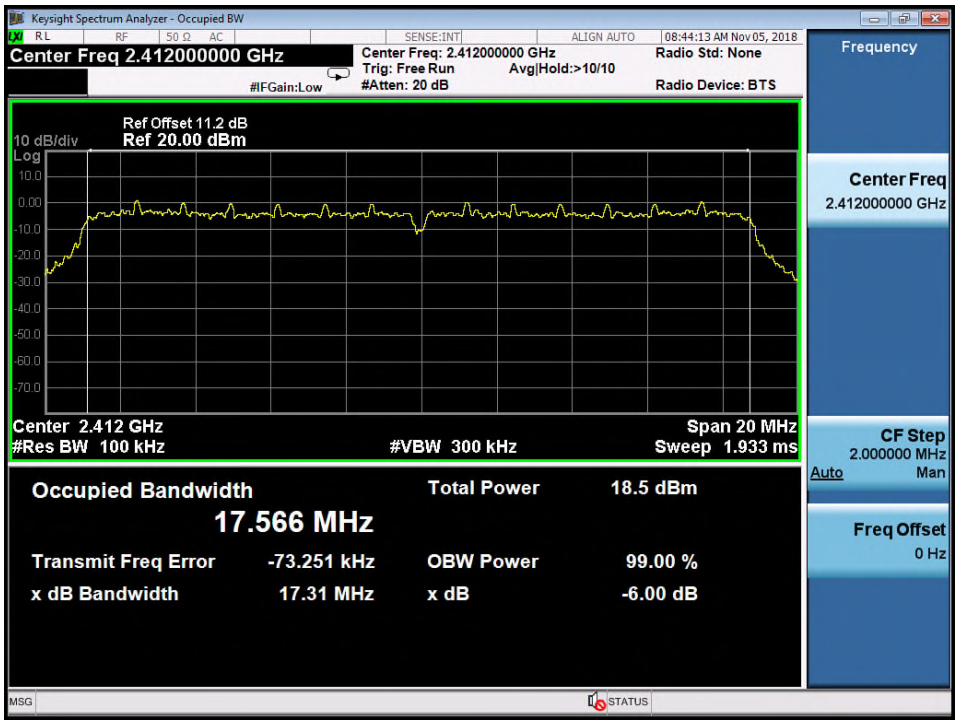


High Channel

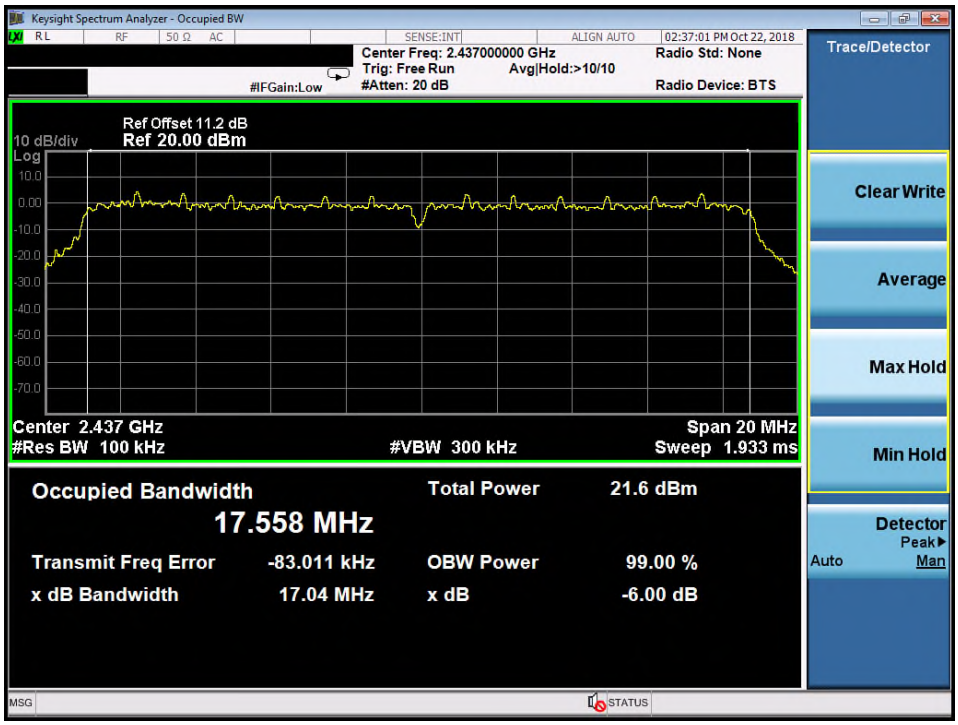


Test Plot of 6dB Bandwidth (802.11n HT20)

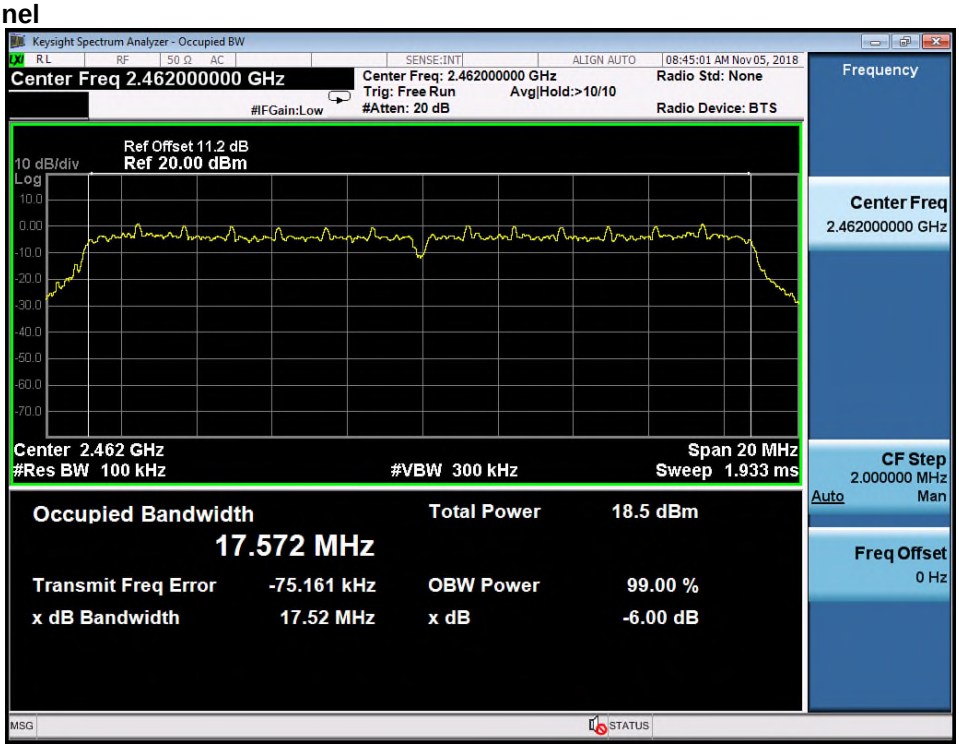
Low Channel



Middle Channel

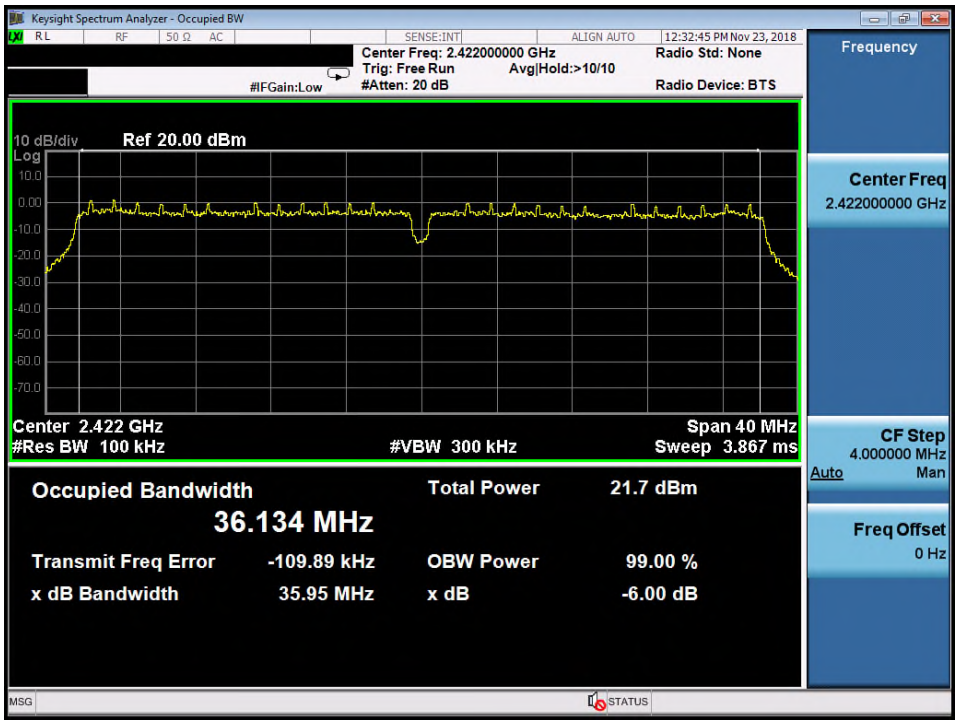


High Channel



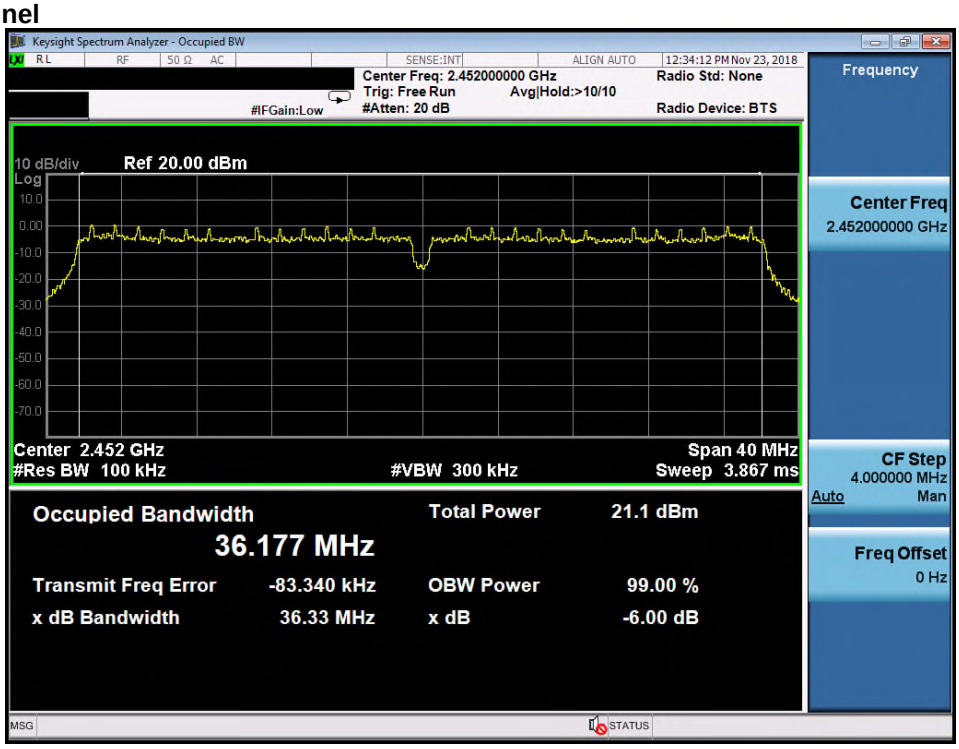
Test Plot of 6dB Bandwidth (802.11n HT40)

Low Channel



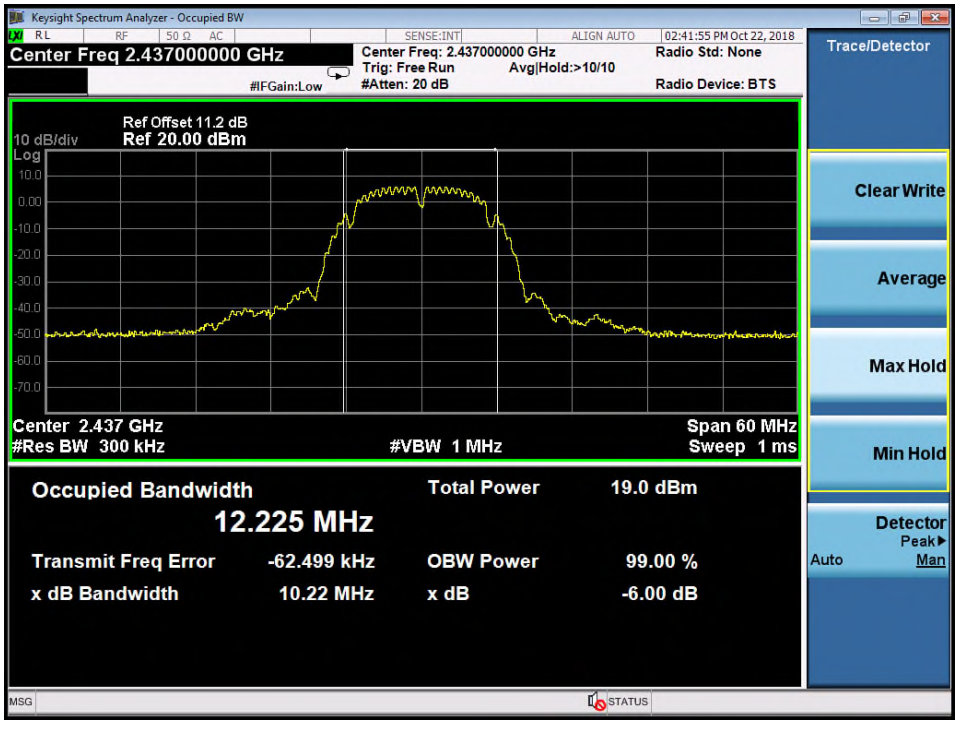
Middle Channel

High Channel



Test Plot of 99% Bandwidth (802.11b)

Middle Channel

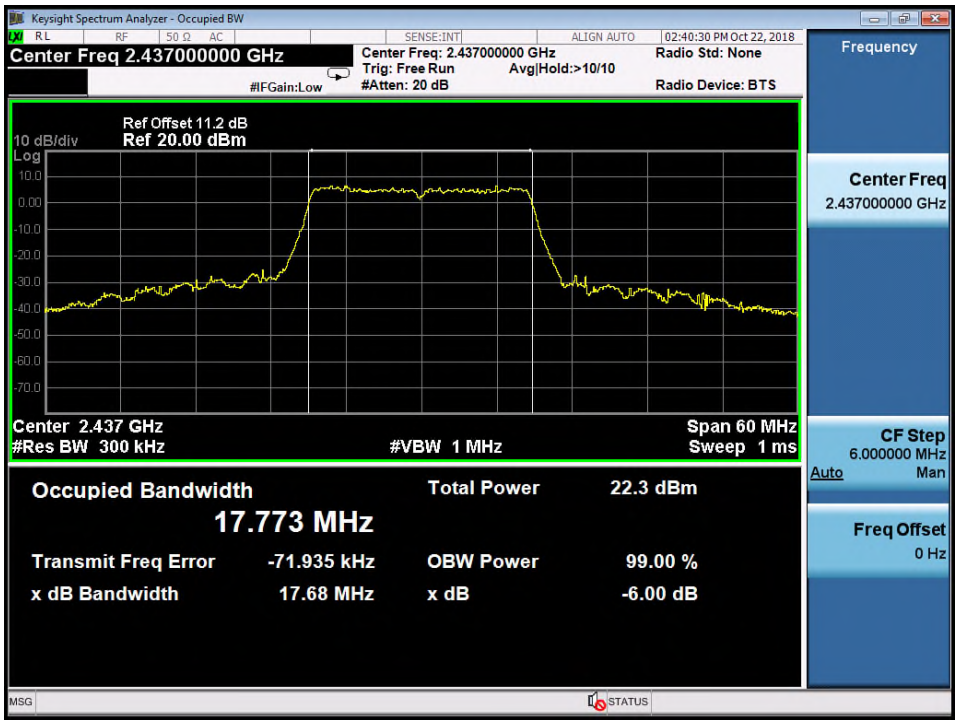


Test Plot of 99% Bandwidth (802.11g)

Middle Channel

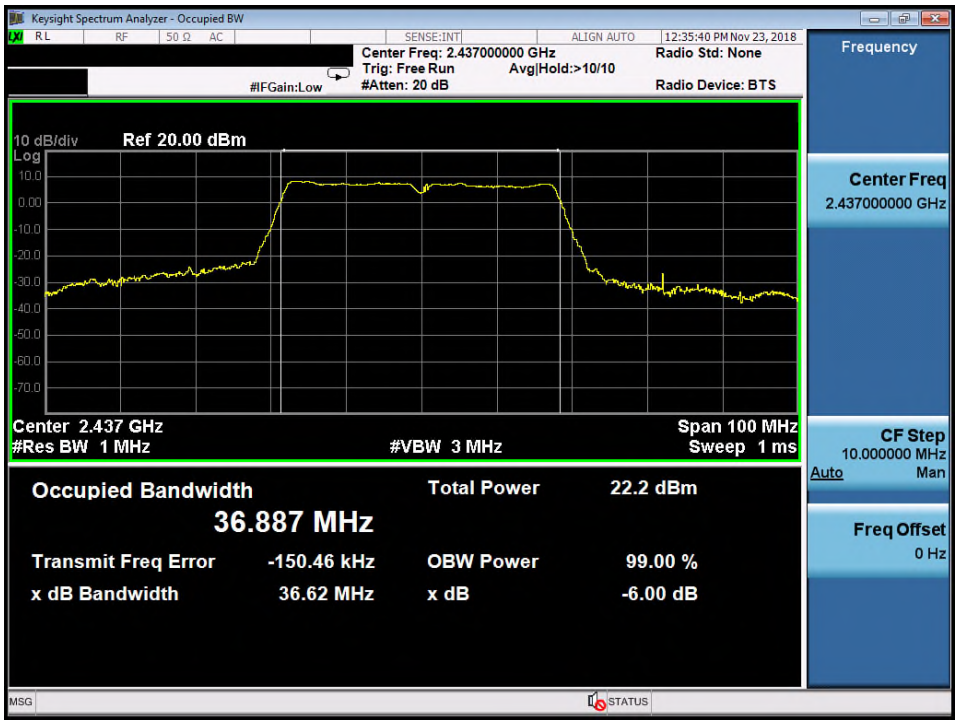
Test Plot of 99% Bandwidth (802.11n HT20)

Middle Channel



Test Plot of 99% Bandwidth (802.11n HT40)

Middle Channel



5.1.4 Power Density

RESULT: **Passed**

Test standard	:	LP0002(2018): 3.10.1.6 (2) (B) FCC Part 15.247(e) , RSS-247 5.2(2)
Basic standard	:	ANSI C63.10:2013, KDB558074
Kind of test site	:	Shielded room/Conducted room

Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A
Ambient temperature	:	18-25°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103kPa

Table 18: Test result of Power Density (802.11b)

Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-2.46	8
Middle Channel	2437	2.748	8
High Channel	2462	1.566	8

Table 19: Test result of Power Density (802.11g)

Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-13.73	8
Middle Channel	2437	-11.231	8
High Channel	2462	-14.92	8

Table 20: Test result of Power Density (802.11n HT20)

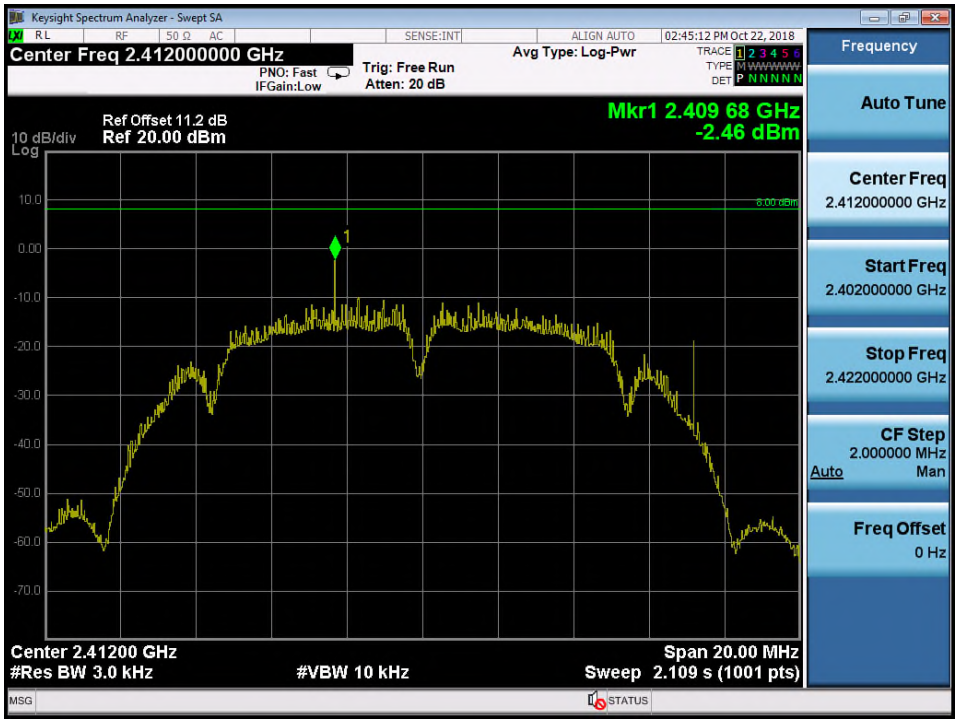
Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-14.72	8
Middle Channel	2437	-12.199	8
High Channel	2462	-15.33	8

Table 21: Test result of Power Density (802.11n HT40)

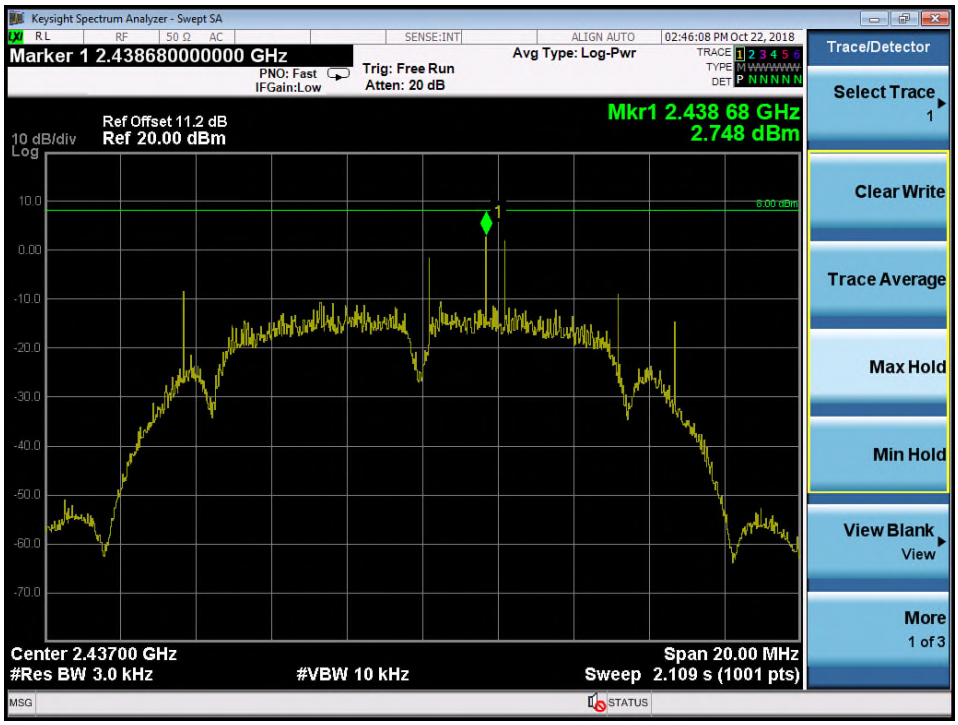
Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-15.31	8
Middle Channel	2437	-14.34	8
High Channel	2462	-15.65	8

Test Plot of Power Density (802.11b)

Low Channel



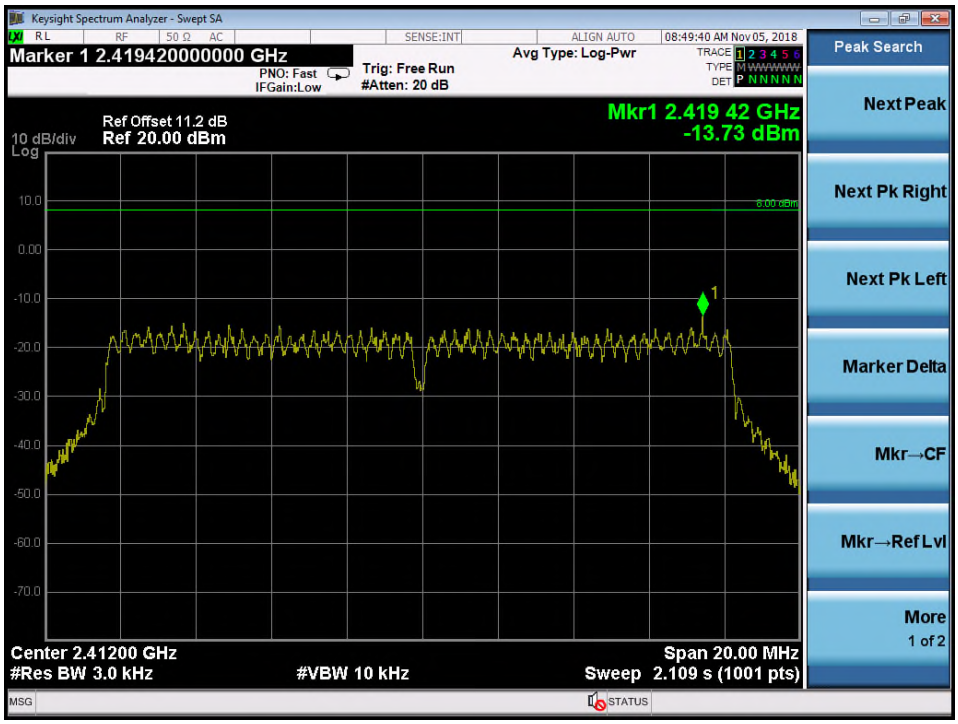
Middle Channel



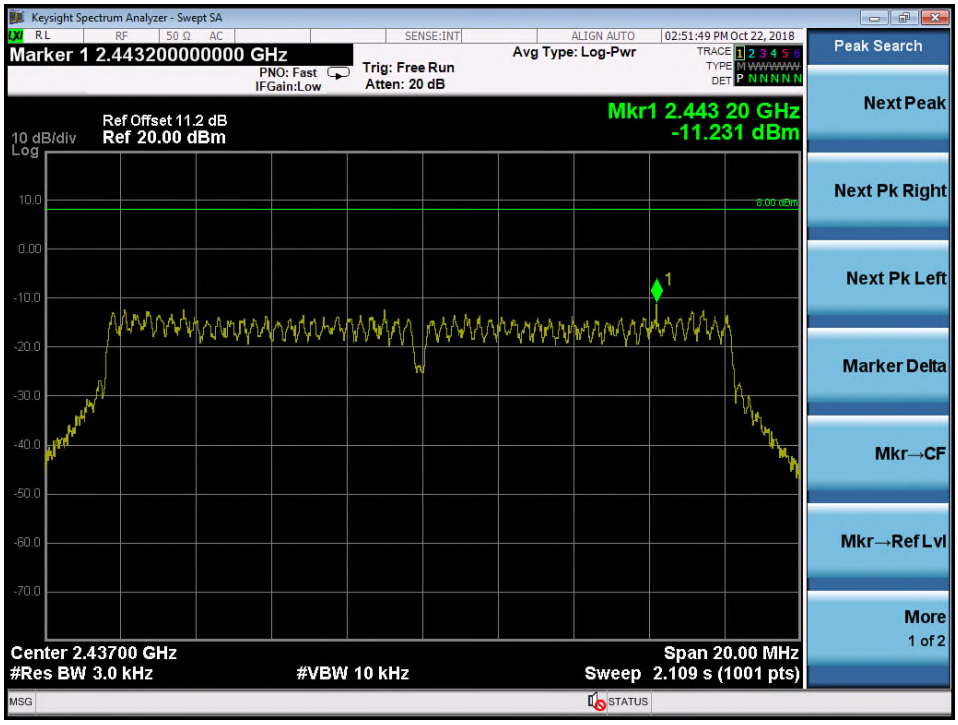
High Channel

Test Plot of Power Density (802.11g)

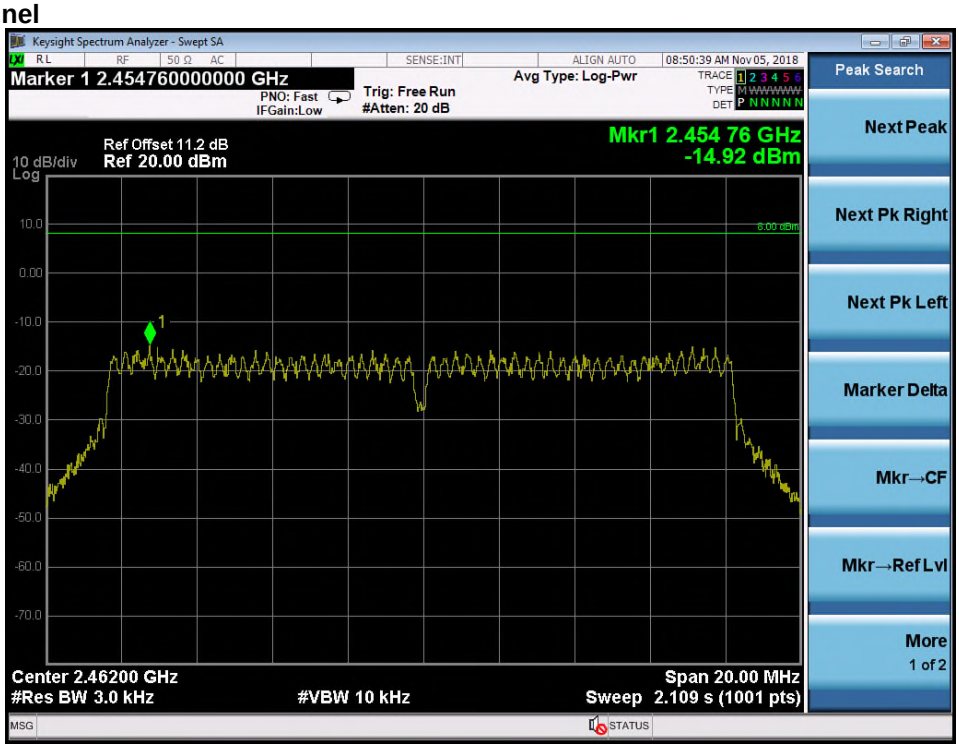
Low Channel



Middle Channel

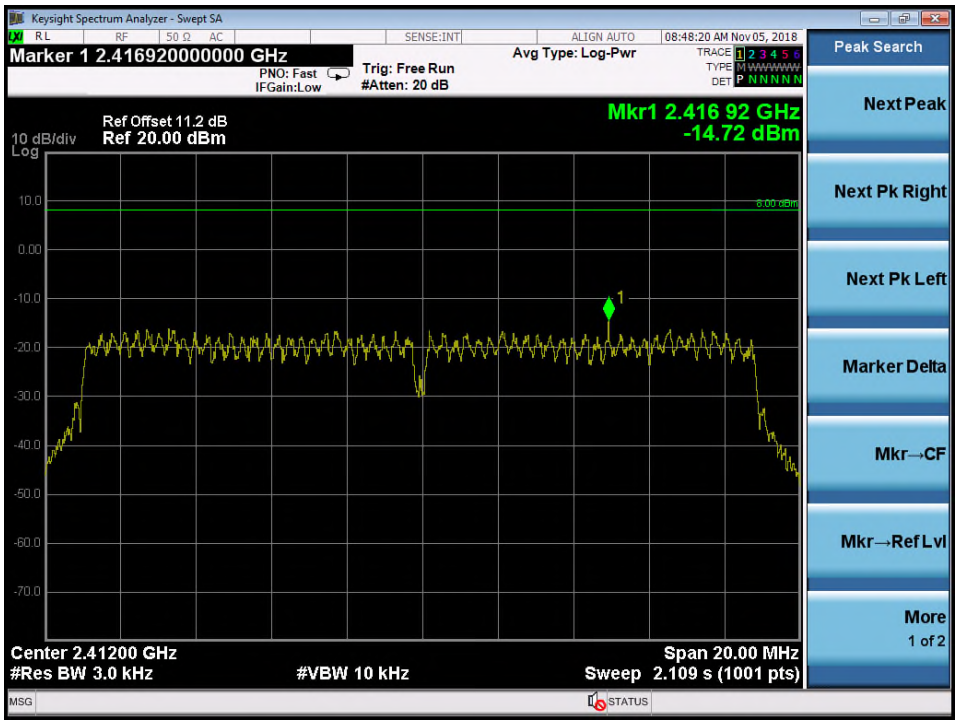


High Channel

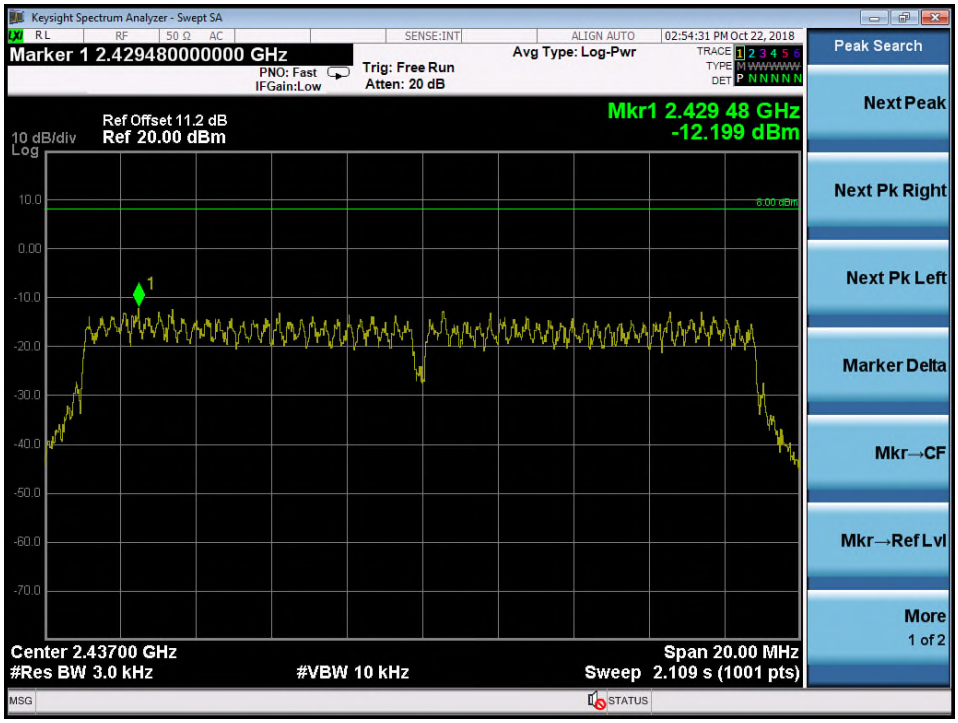


Test Plot of Power Density (802.11n HT20)

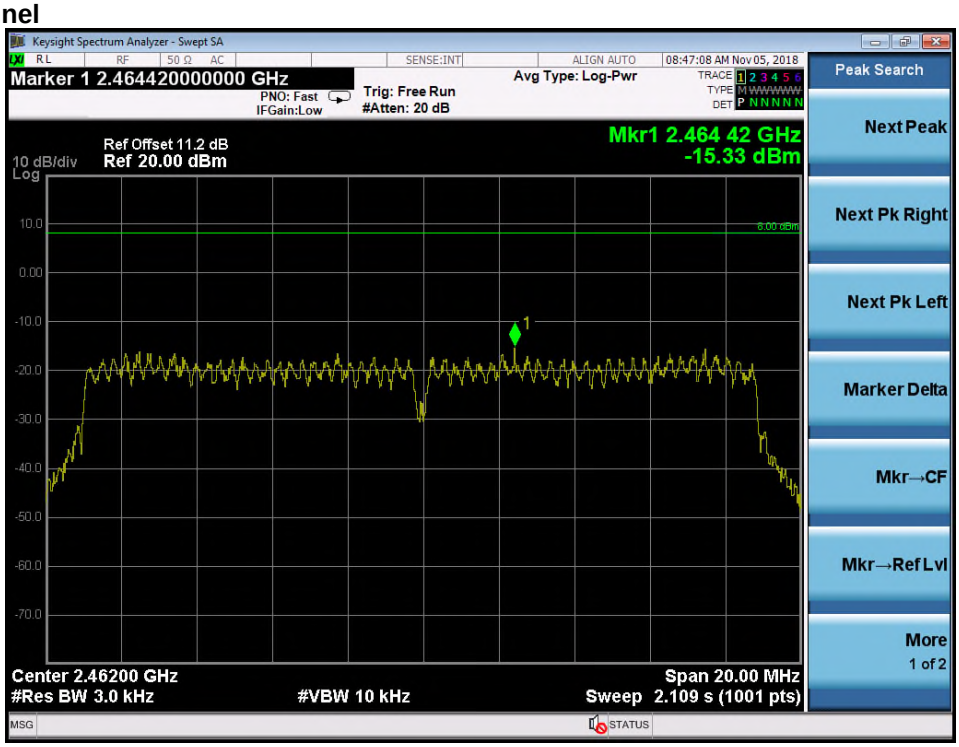
Low Channel



Middle Channel

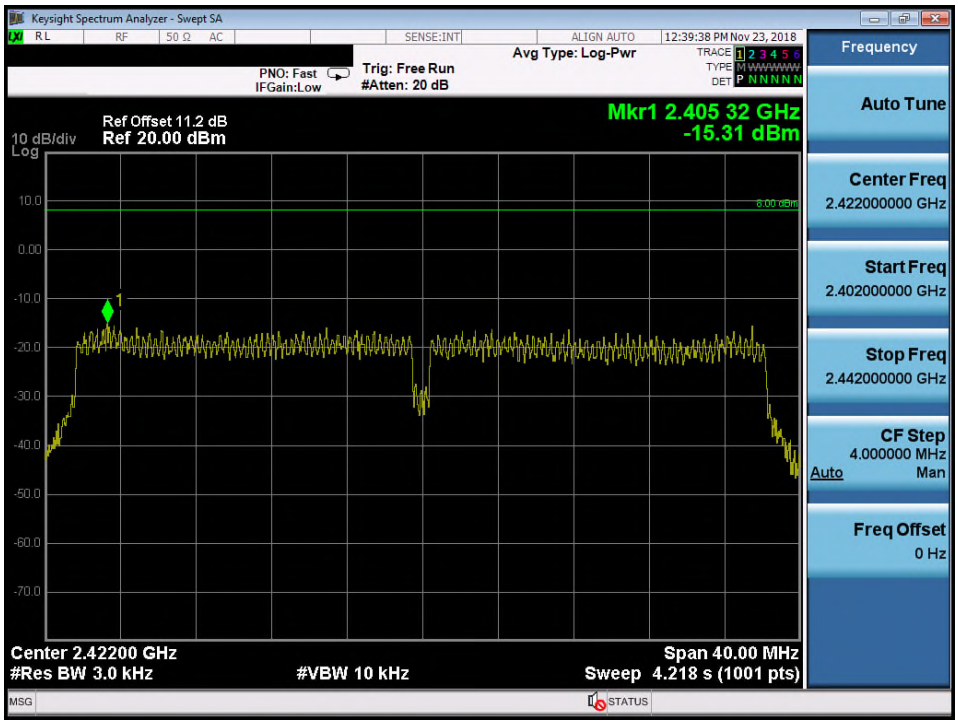


High Channel

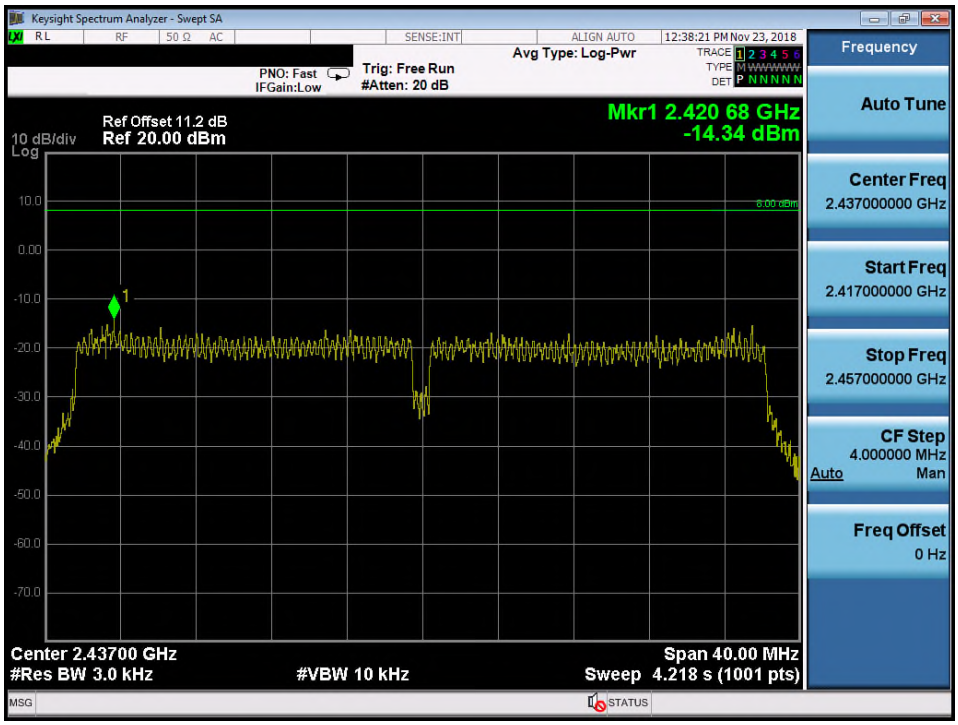


Test Plot of Power Density (802.11n HT40)

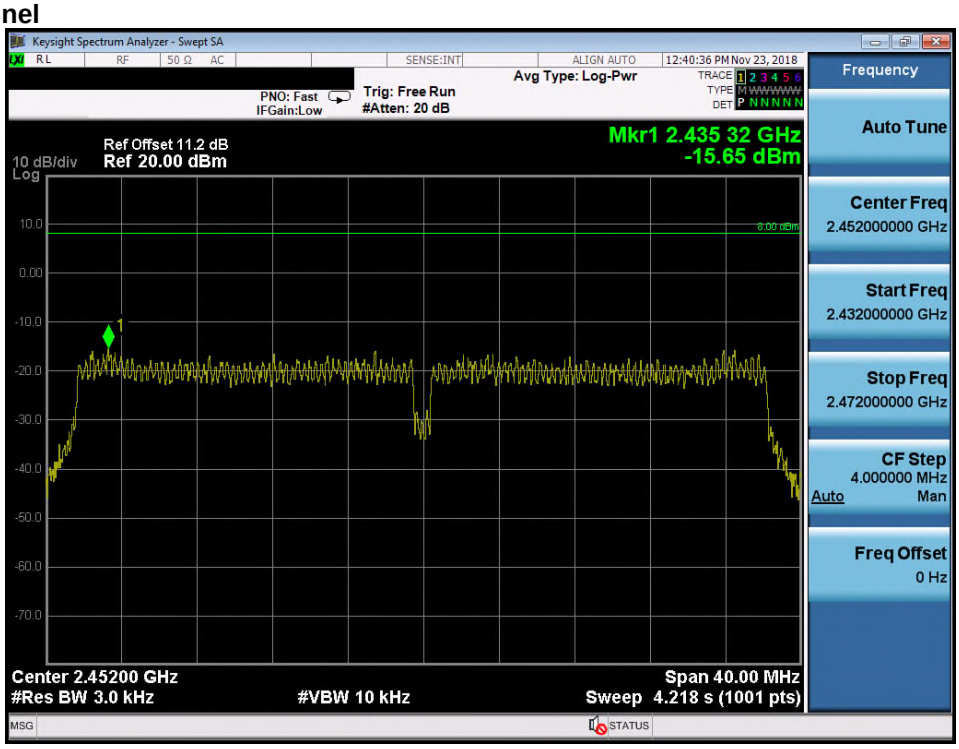
Low Channel



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 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/Conducted room

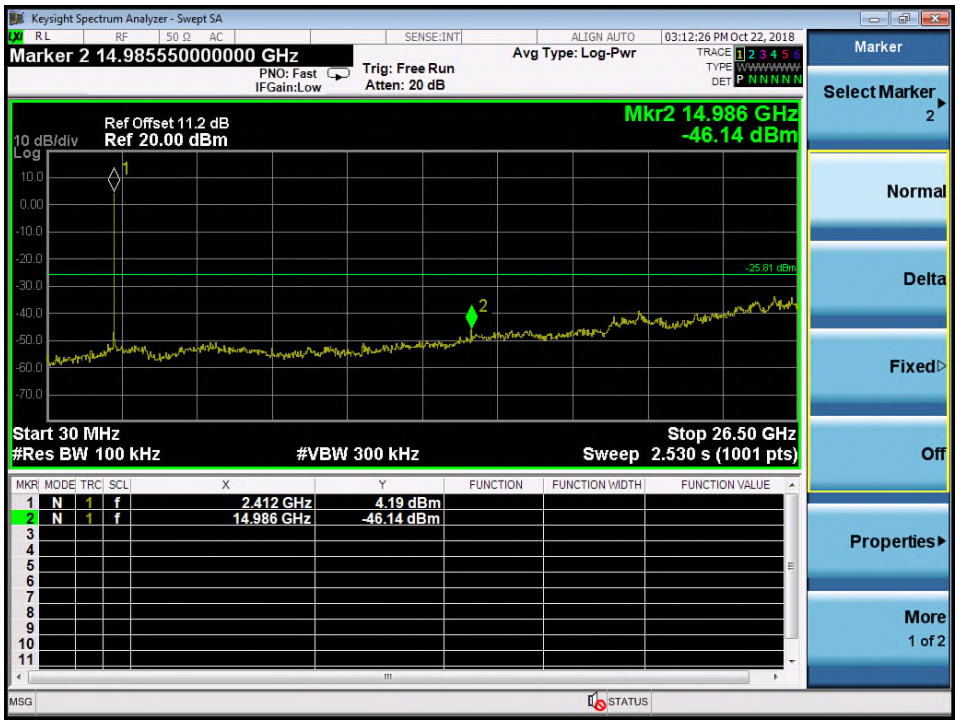
Test setup

Test Channel	:	Low/ Mid/ High for spurious, Low/ High for Band Edge
Operation mode	:	A
Ambient temperature	:	18-25°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103kPa

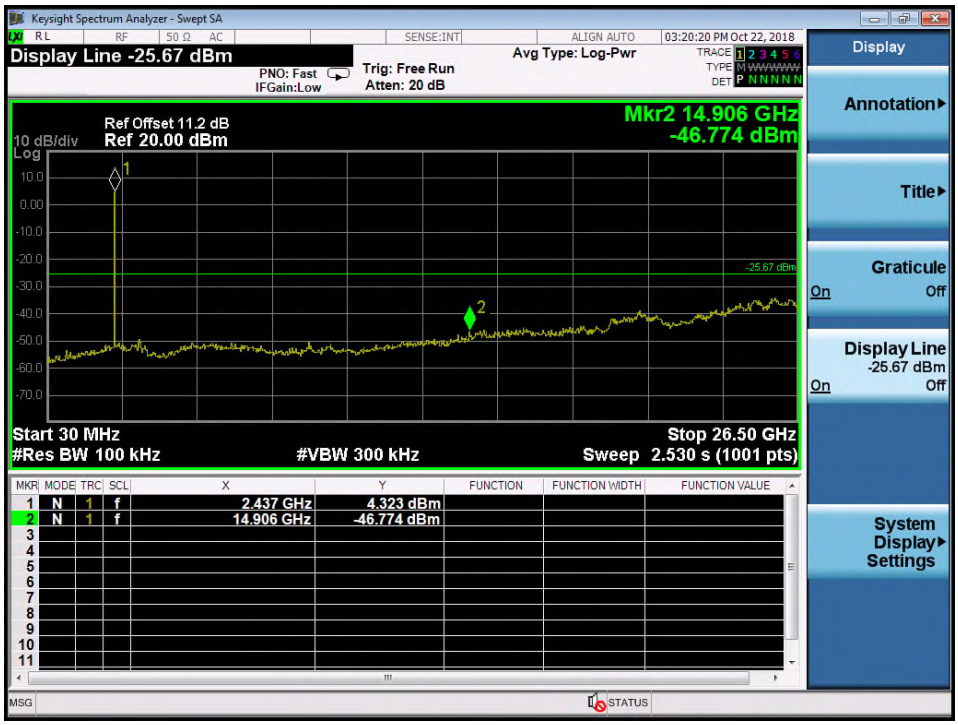
All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achieved as well.
Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

Test Plot 100kHz Conducted Emissions (802.11b)

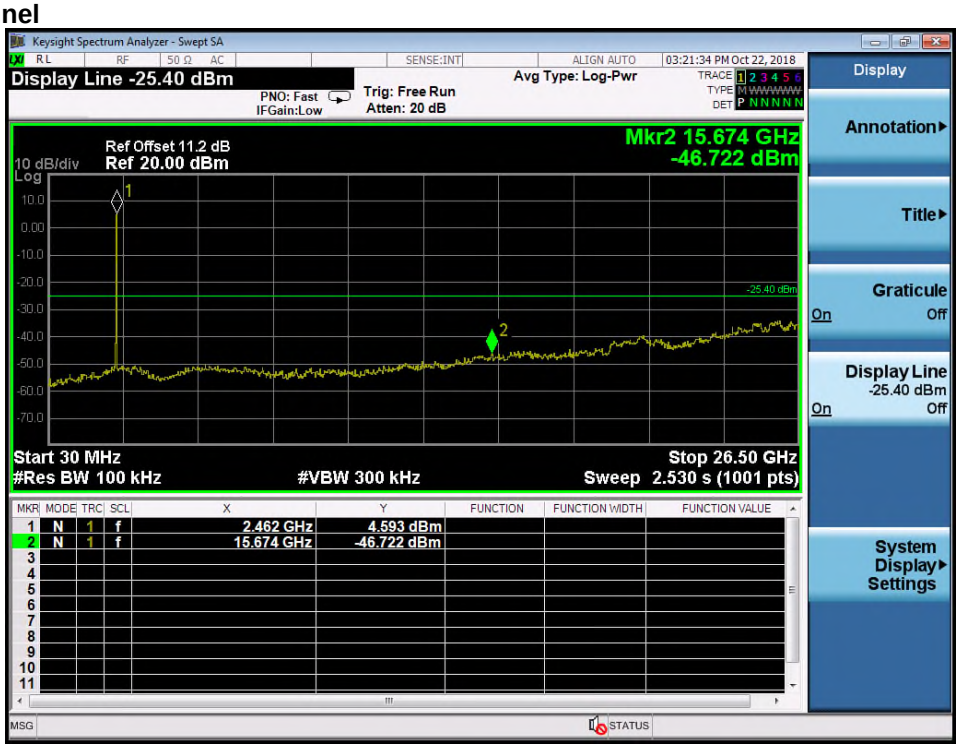
Low Channel



Middle Channel

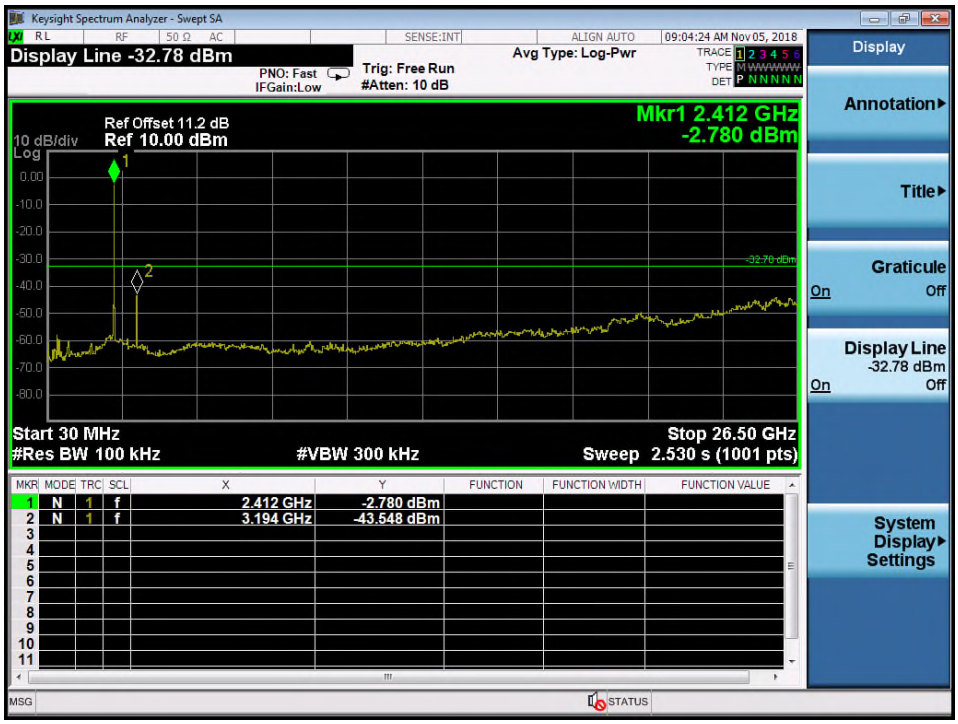


High Channel

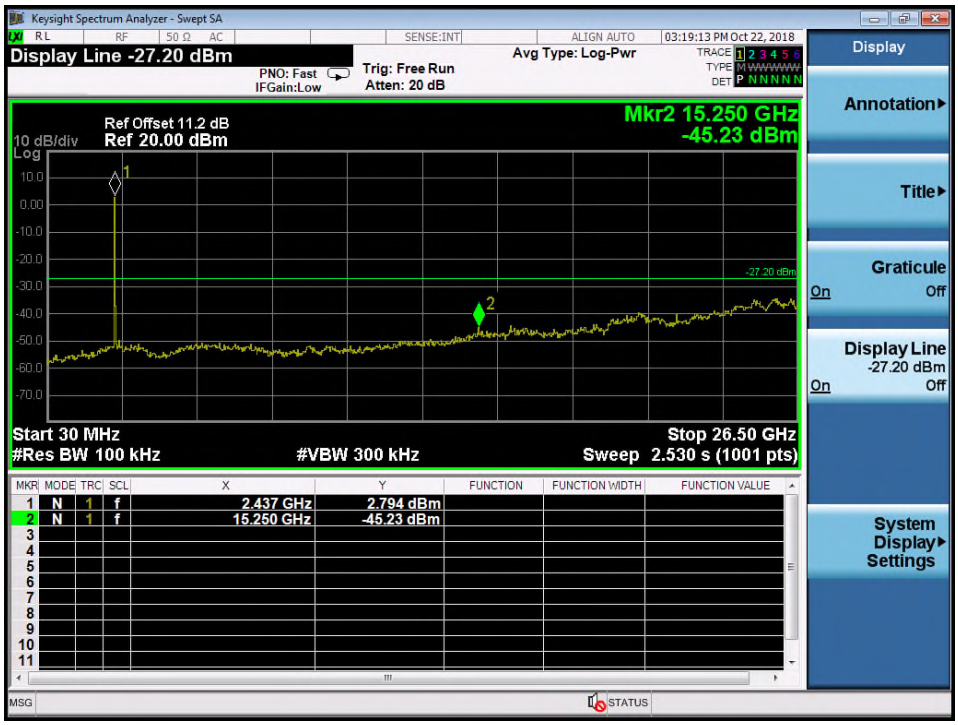


Test Plot 100kHz Conducted Emissions (802.11g)

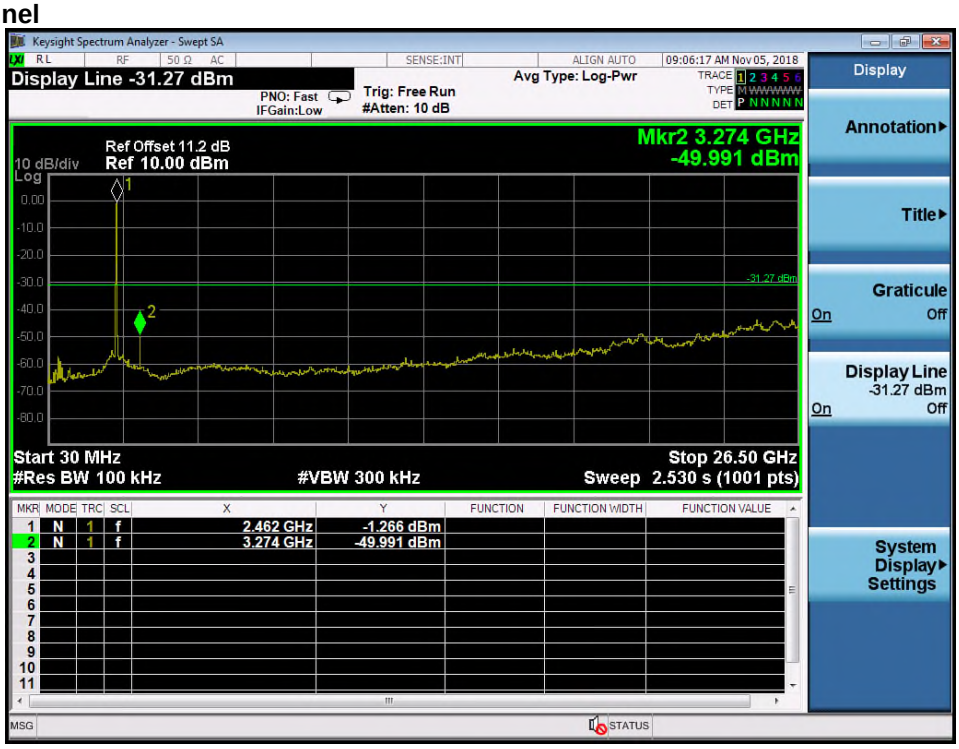
Low Channel



Middle Channel

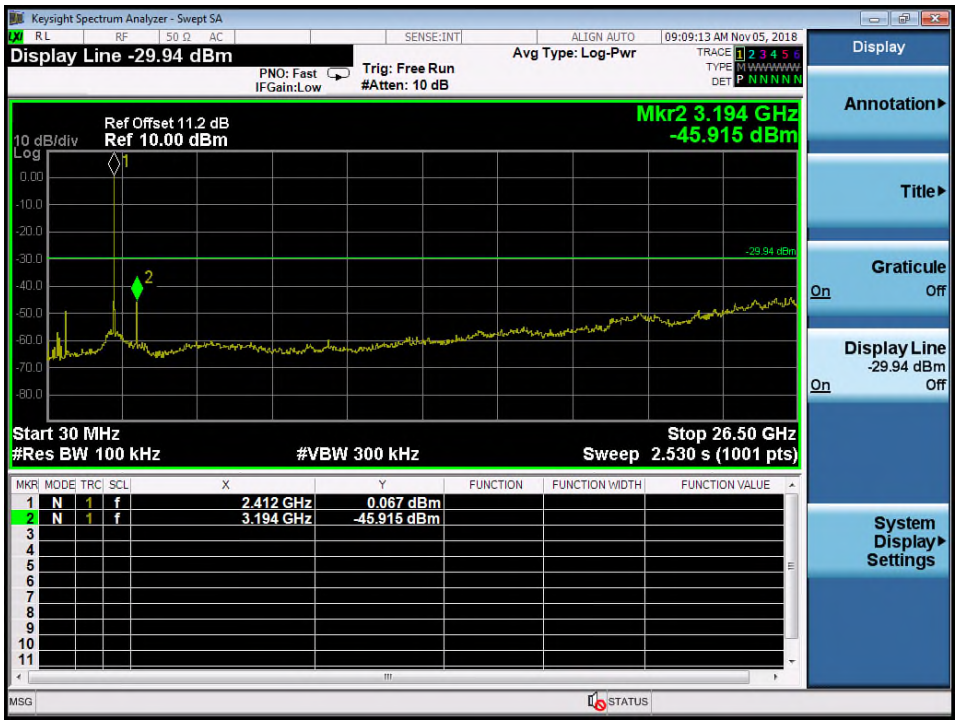


High Channel

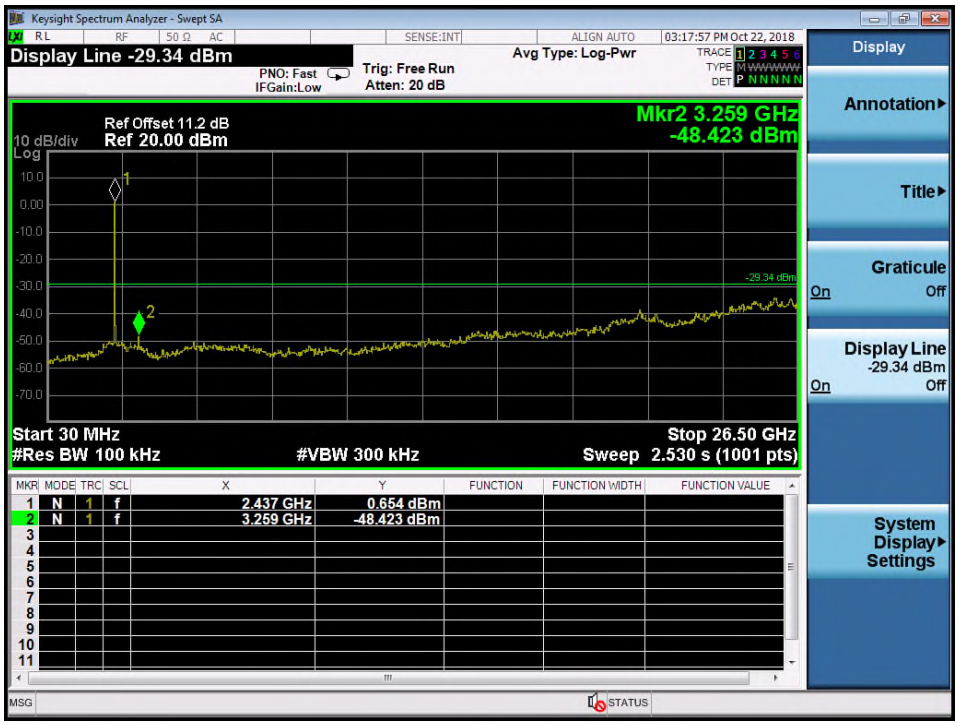


Test Plot 100kHz Conducted Emissions (802.11n HT20)

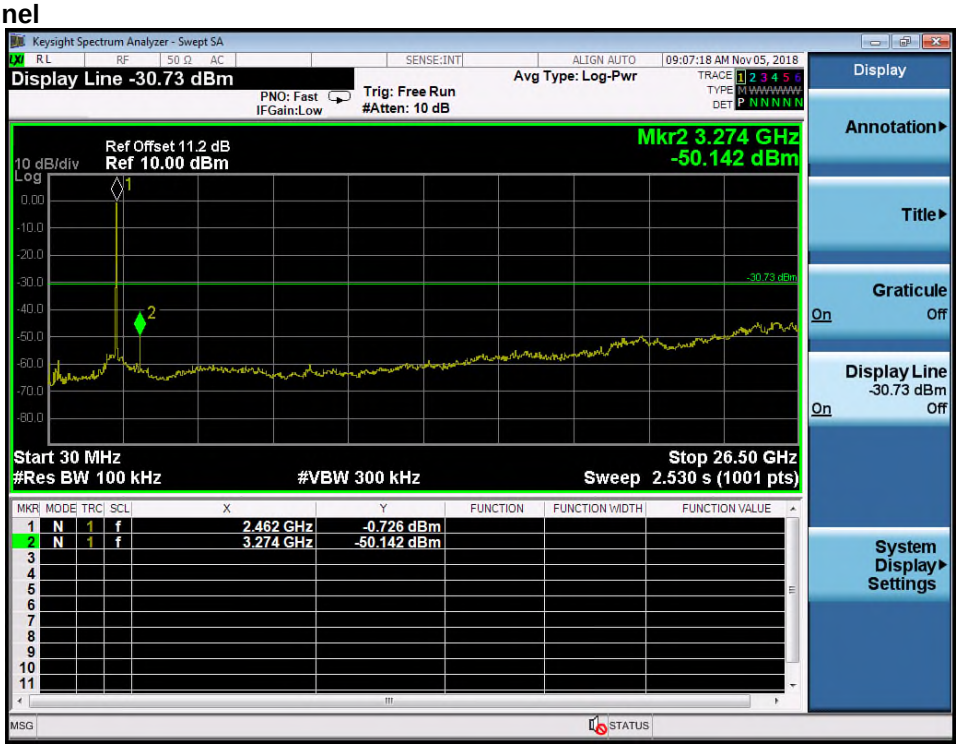
Low Channel



Middle Channel

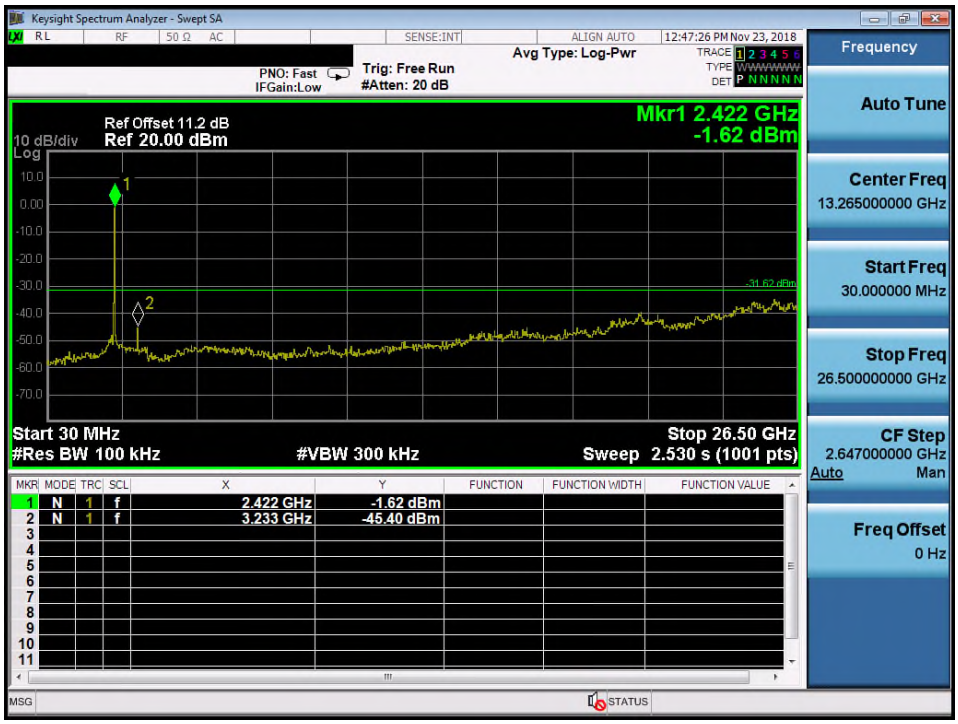


High Channel

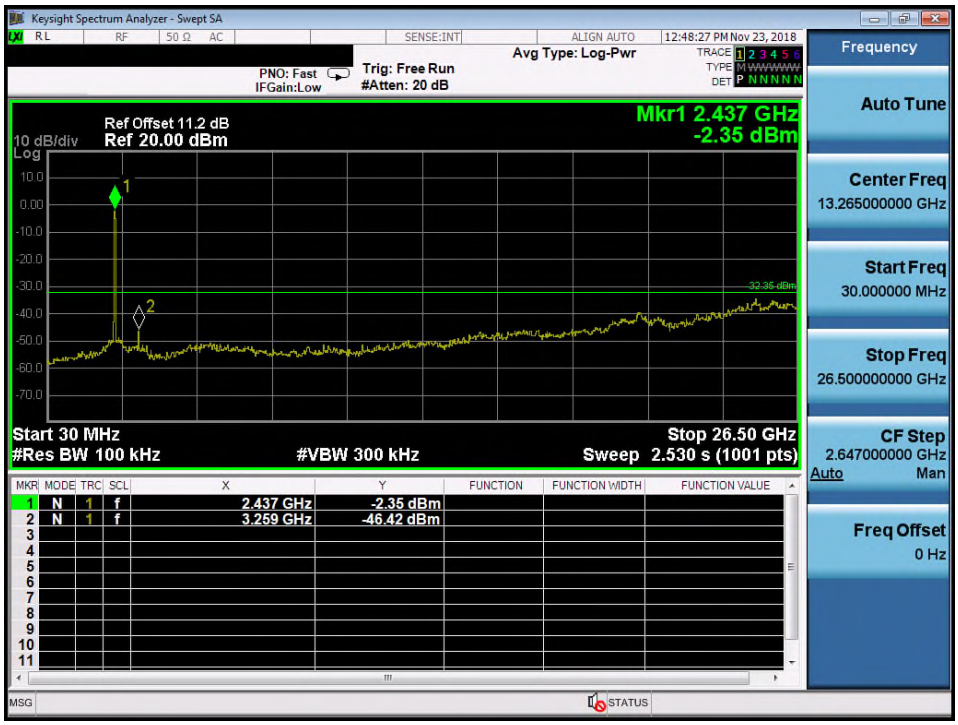


Test Plot 100kHz Conducted Emissions (802.11n HT40)

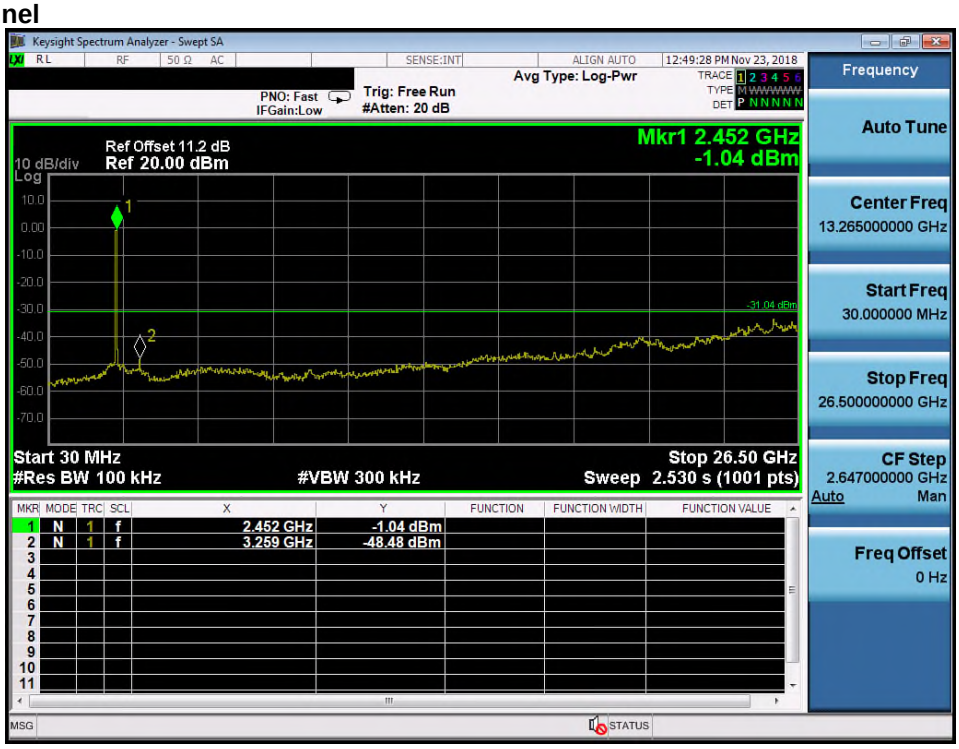
Low Channel



Middle Channel

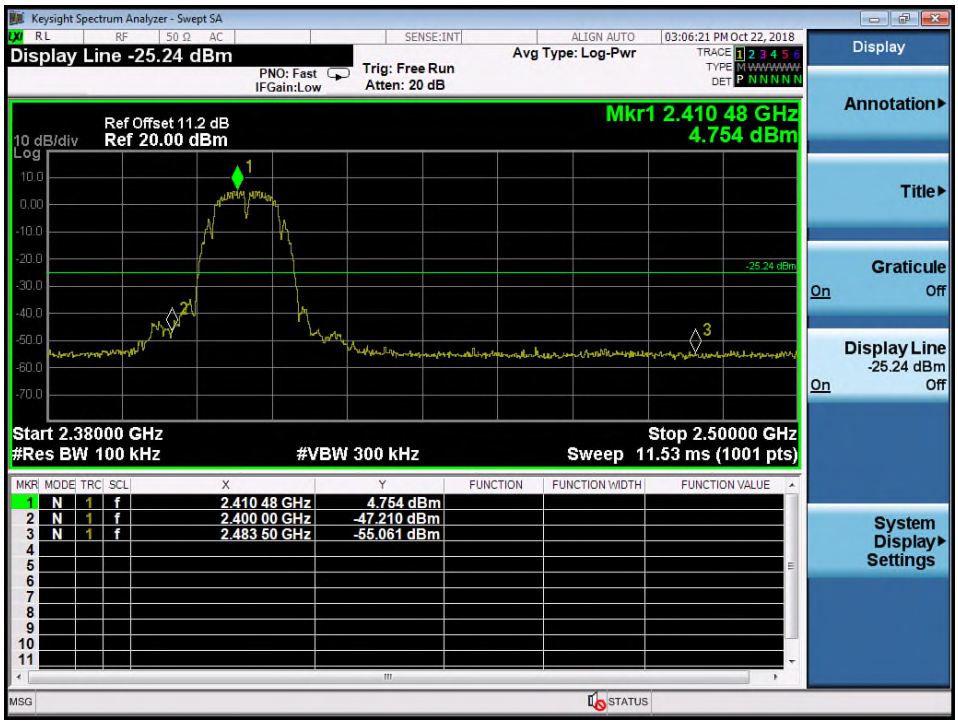


High Channel

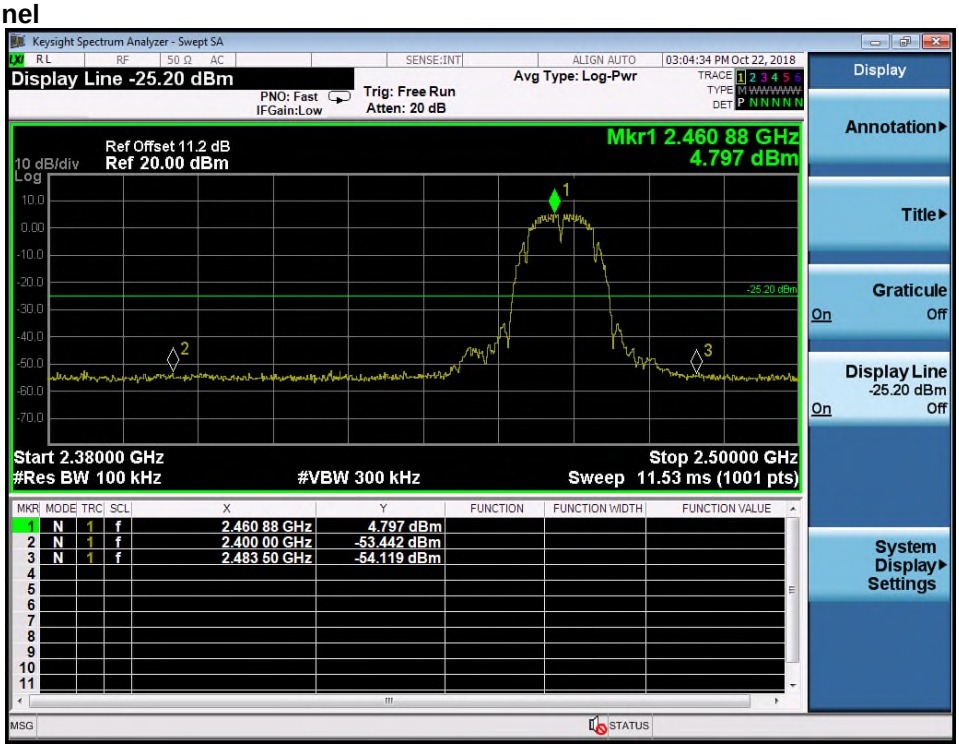


Test Plot 100kHz RBW of Band Edge (802.11b)

Low Channel

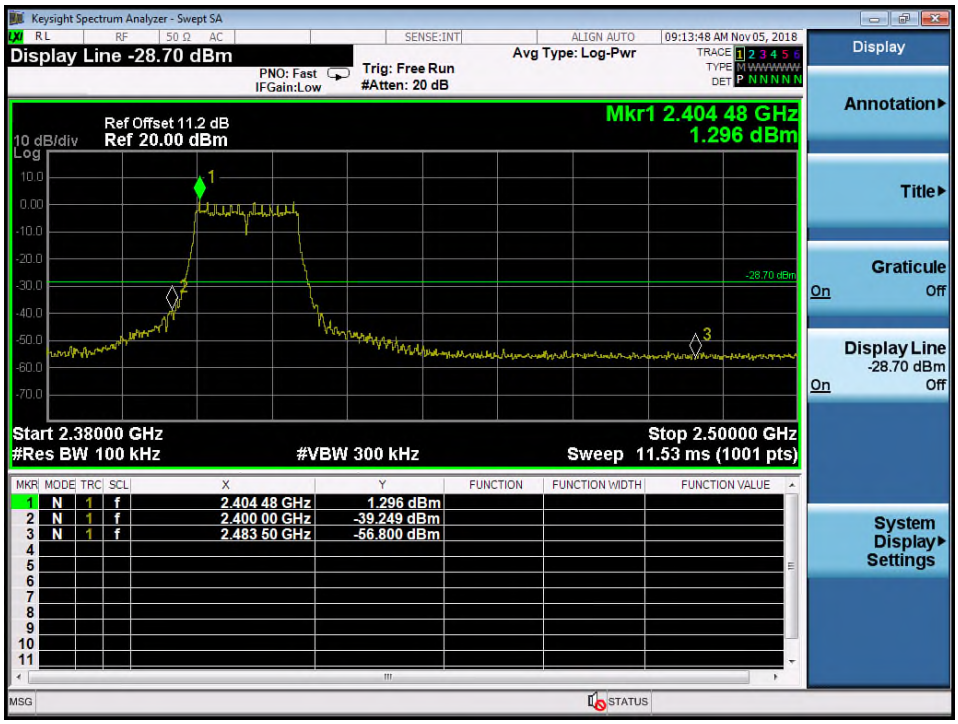


High Channel

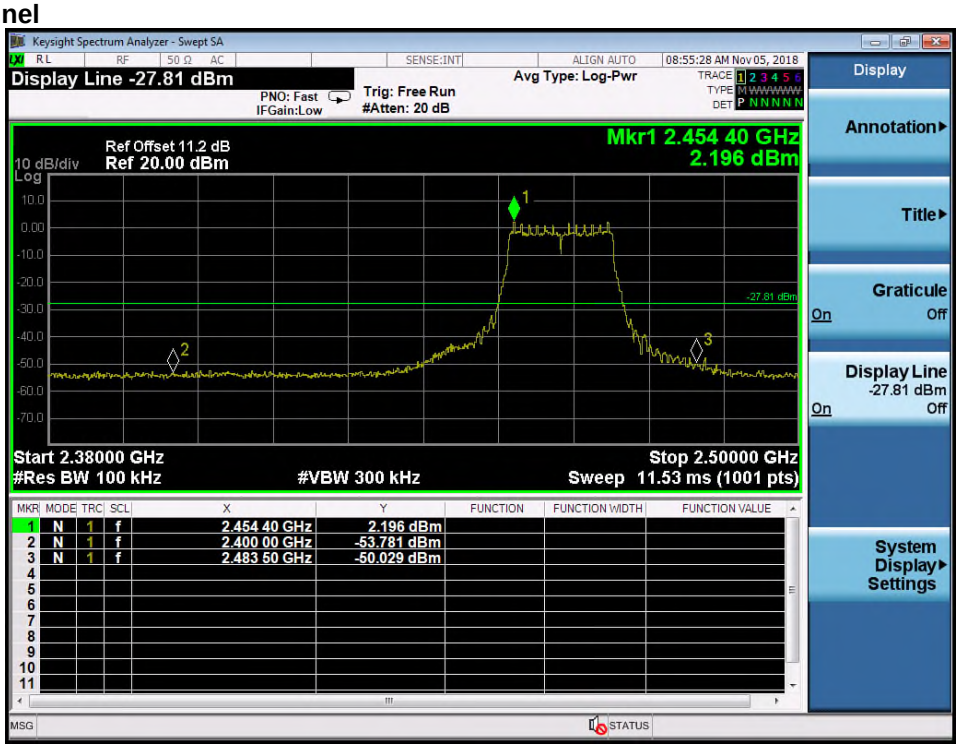


Test Plot 100kHz RBW of Band Edge (802.11g)

Low Channel

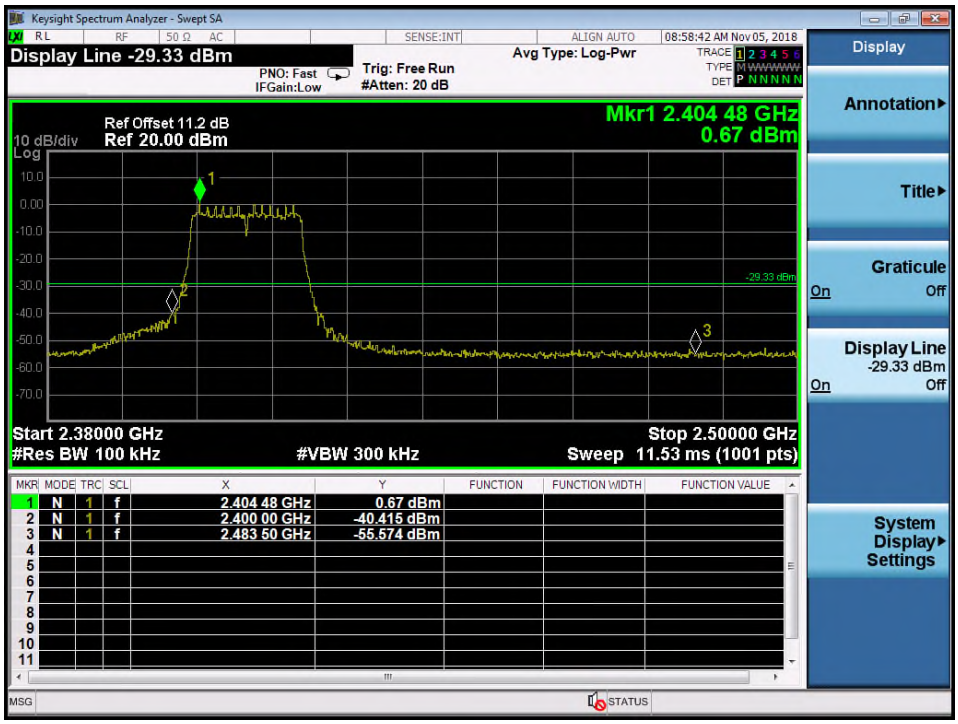


High Channel

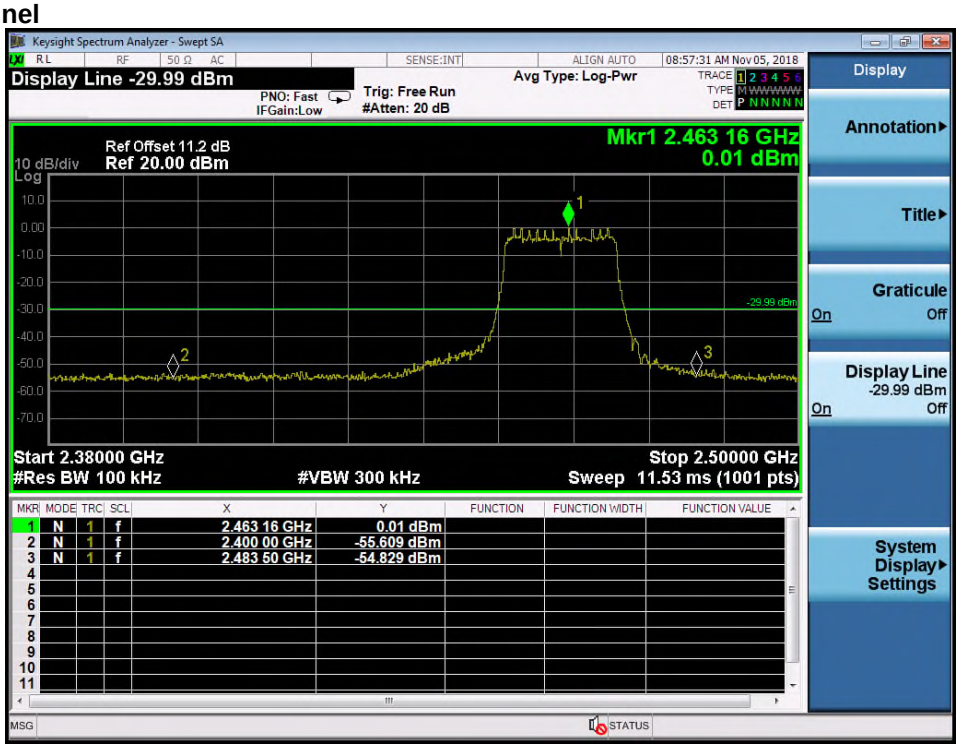


Test Plot 100kHz RBW of Band Edge (802.11n HT20)

Low Channel



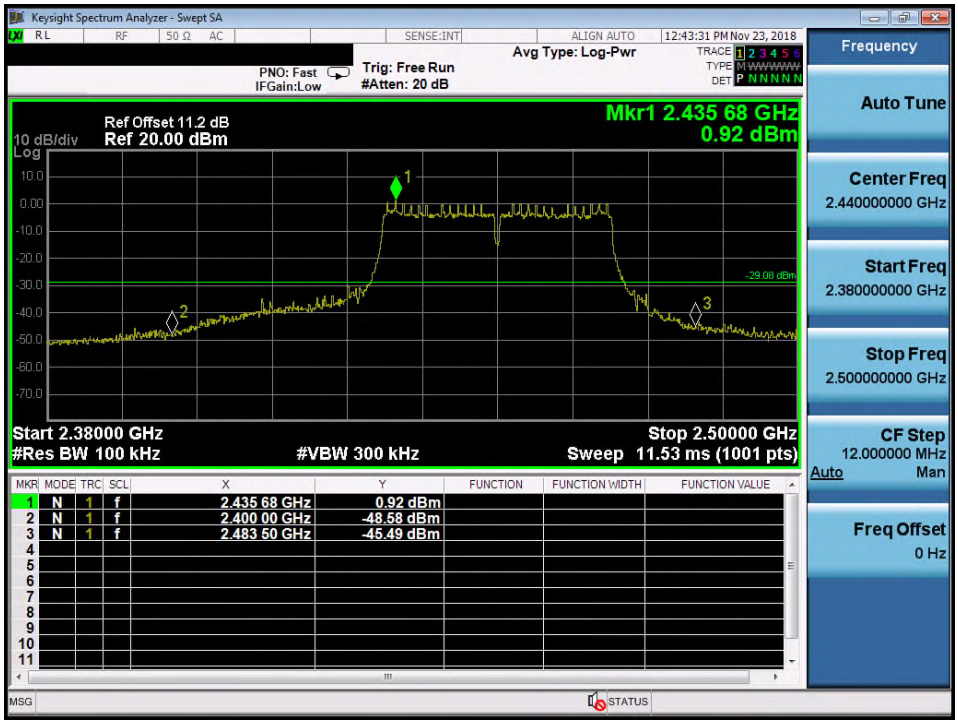
High Channel



Test Plot 100kHz RBW of Band Edge (802.11n HT40)

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-247 5.5 and RSS-Gen 8.9 LP0002(2018): 3.10.1.5
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). Radiated emissions which fall in the restricted bands, as defined in LP0002(2016): 2.7 , must comply with the radiated emission limits specified in LP0002(2016): 2.8 Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in FCC 15.209(a) and FCC 15.249(a), 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 LP0002(2016): 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.

6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT: **Passed**

Test standard : FCC KDB Publication 447498 D01
RSS-102 issue 5, Table 1

FCC:
Therefore the maximum output power of the transmitter is 31.48mW < 38mW(Distance: 20 mm), 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.

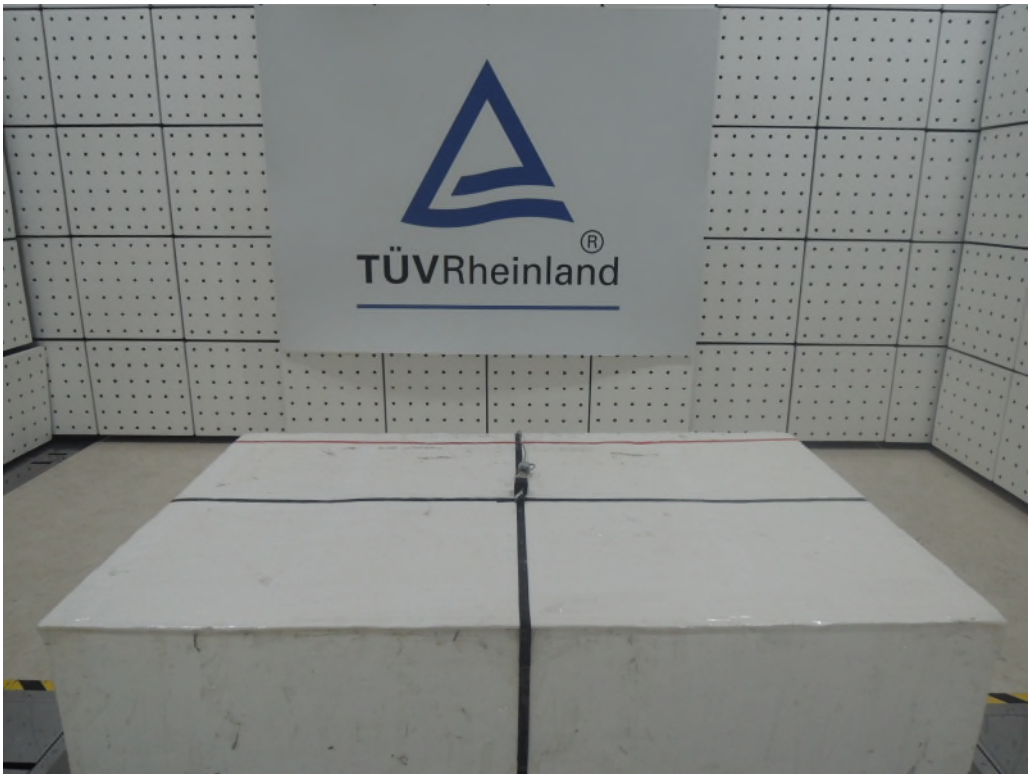
Maximum Exposure:

Power to Antenna (mW)	31.48 mW
Power to Antenna (dBm)	15.0 dBm
Antenna Gain	1.28 dBi
Power+Ant Gain	42.3 mW
Distance	20 cm
S=	0.008 mW/cm^2

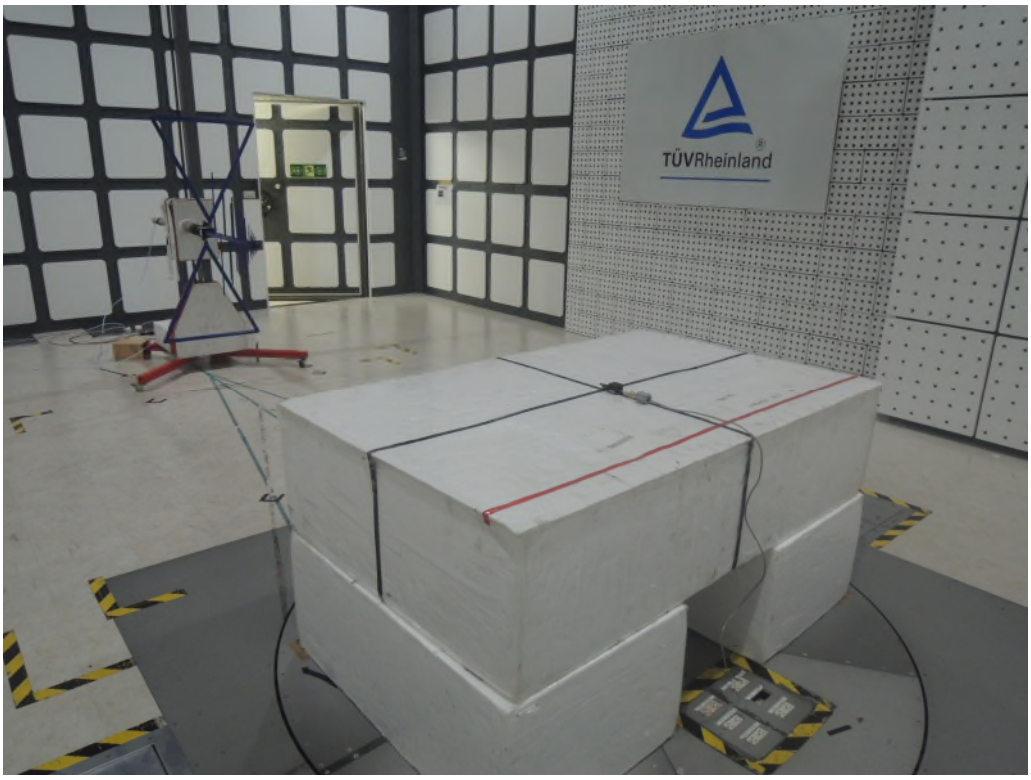
Limit Canada: 0.542 mW/cm2
---End---

7. Photographs of the Test Set-Up

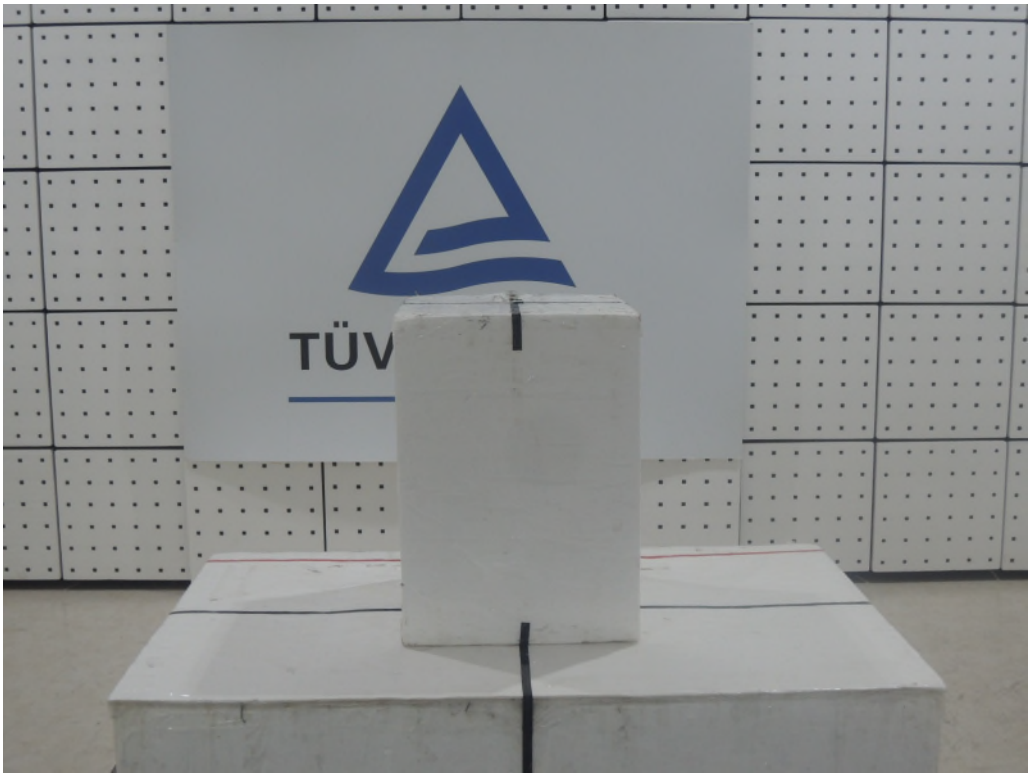
Photograph 1: Set-up for Spurious Emissions (Front View 1)



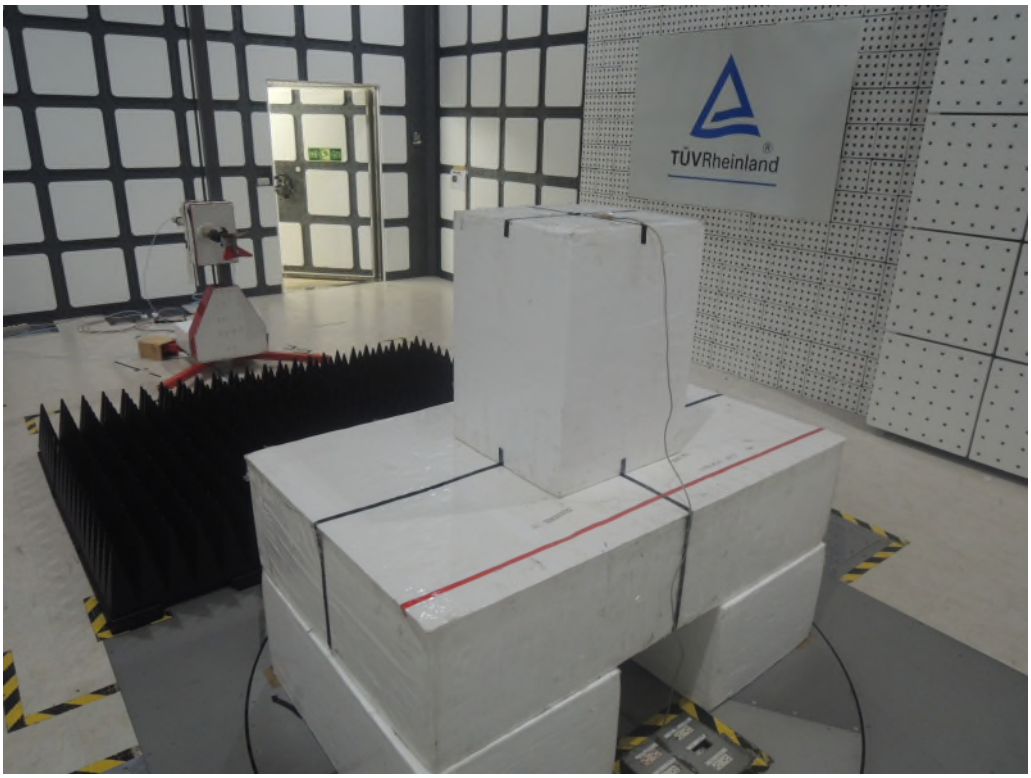
Photograph 2: Set-up for Spurious Emissions (Back View 1)



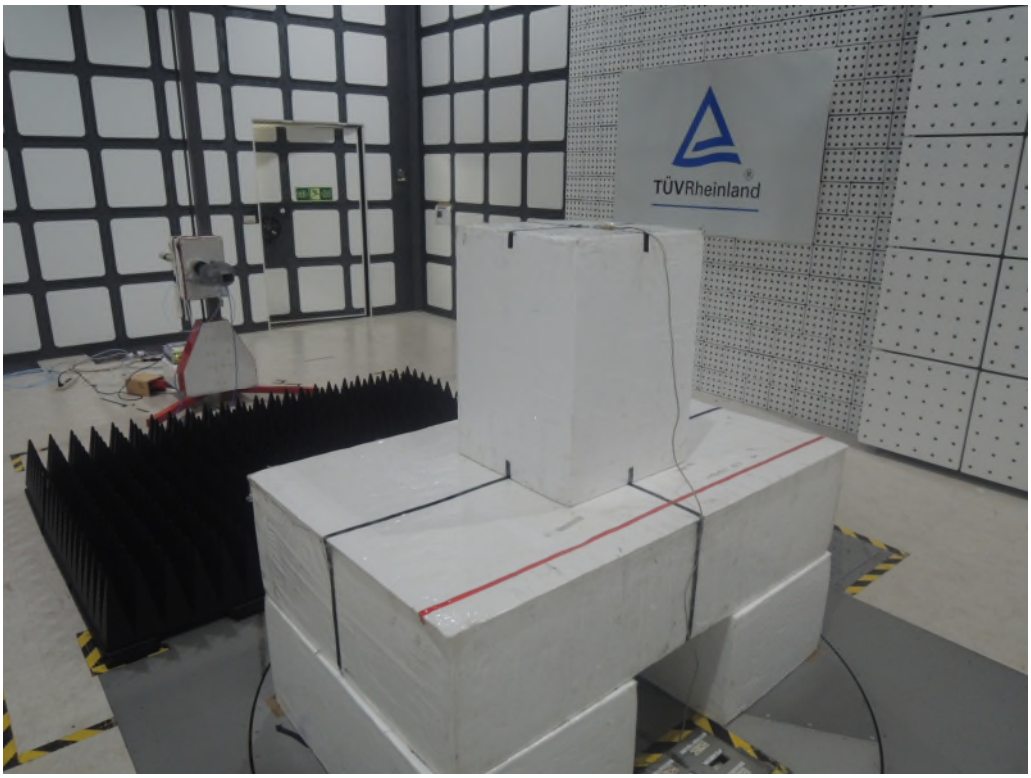
Photograph 3: Set-up for Spurious Emissions (Front View 2)



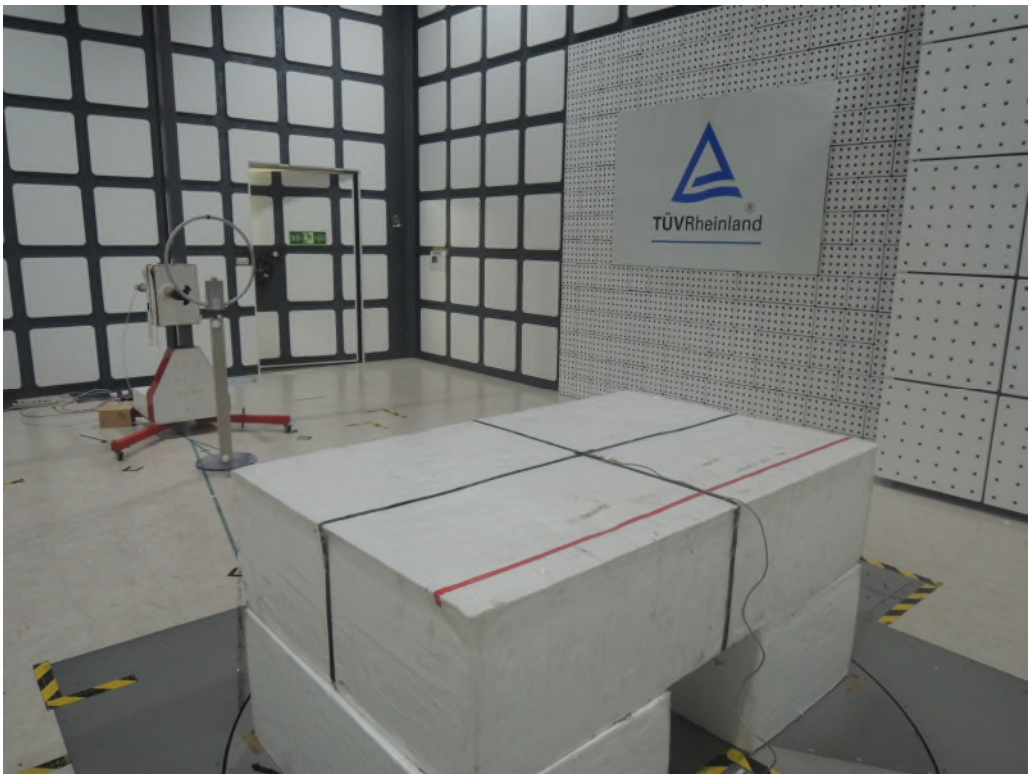
Photograph 4: Set-up for Spurious Emissions (Back View 2)



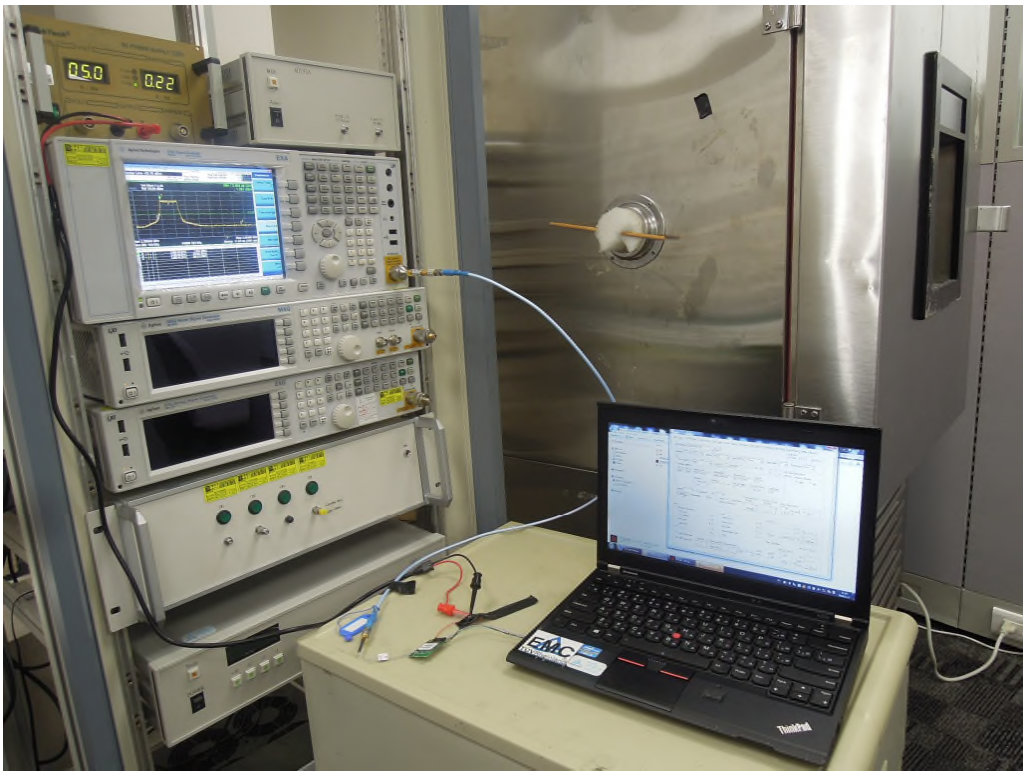
Photograph 5: Set-up for Spurious Emissions (Back View 3)



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



Photograph 7: Set-up for Conducted testing



Photograph 8: Set-up for Conducted testing

8. List of Tables

9. List of Photographs