

Prüfbericht-Nr.: Test Report No.:	50177430 001	Auftrags-Nr.: Order No.:	114078137	Seite 1 von 46 Page 1 of 46
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	22-May-2018	
Auftraggeber: Client:	奧迪福斯汽車股份有限公司 -臺北市信義區松高路 1 號 15 樓			
Prüfgegenstand: Test item:	Head Unit			
Bezeichnung / Typ-Nr.: Identification / Type No.:	MIB2 STD			
Auftrags-Inhalt: Order content:	NCC LP0002 Test report (WiFi)			
Prüfgrundlage: Test specification:	NCC Low-power Radio-frequency Devices Technical Regulations LP0002(2018) Section 3.10.1			
Wareneingangsdatum: Date of receipt:	1-Jun-2018			
Prüfmuster-Nr.: Test sample No.:	A000751573 001 Radiated A000751573 001 Conducted			
Prüfzeitraum: Testing period:	28-Jun-2018 – 24-Aug-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: 13-Sep-2018 Jack Chang/Sr. Project Manager Datum Name / Stellung Unterschrift Date Name / Position Signature		kontrolliert von / reviewed by: 13-Sep-2018 René Charton/Expert Datum Name / Stellung Unterschrift Date Name / Position 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				
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. 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.				

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 100 kHz BANDWIDTH

RESULT: Passed

5.1.6 SPURIOUS EMISSION

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

(File Name: 50177430 001 APPENDIX P)

Appendix D: Test Result of Radiated Emissions

(File Name: 50177430 001 APPENDIX D)

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)

2. Test Sites

2.1 Test Laboratory

TUV Rheinland Taiwan Ltd.
Taichung Branch Office

No.9, Lane 36, Minsheng Rd., Sec. 3, Daya District,
Taichung City 428
Taiwan (R.O.C.)

2.2 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

2.3 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	101062	2017/09/25	2018/09/25
Spectrum Analyzer	R&S	FSV 40	100921	2018/05/02	2019/05/02
EXA Signal Analyzer	KEYSIGHT	N9010A	MY52221334	2018/02/05	2019/02/05
Preamplifier (30MHz -1GHz)	HP	8447D	2944A06641	2017/12/26	2018/12/26
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	2018/11/21
Bilog Antenna	TESEQ	CBL6111D	29804	2018/07/02	2019/07/02
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
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2018/06/21	2019/06/21
EMI Test Receiver	R&S	ESR 7	101549	2017/11/10	2018/11/10
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	2017/03/09	2019/03/09
LISN (1 phase)	R&S	ENV216	101243	2018/06/18	2019/06/18
LISN	R&S	ENV216	101262	2018/06/22	2019/06/22
Spectrum Analyzer	Agilent	N9010A	MY53470241	2018/06/04	2019/06/04
Test Software	Agilent	300328 testsystem	V1.9.1	N/A	N/A
Power sensor	Agilent	U2021XA	MY54020001	2018/03/31	2018/11/09

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 by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.6 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements are $\pm 3\text{dB}$.

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
RF power, conducted	$\pm 1.5 \text{ dB}$
Adjacent channel power	$\pm 3 \text{ dB}$
Radiated emission of transmitter, valid up to 26 GHz	$\pm 6 \text{ dB}$
Radiated emission of receiver, valid up to 26 GHz	$\pm 6 \text{ dB}$
Temperature	$\pm 2 \text{ }^{\circ}\text{C}$
Humidity	$\pm 10 \text{ \%}$

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a Car Radio Infotainment System. It contains a Bluetooth BR/EDR and 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 Circuit Diagram.

3.2 System Details and Ratings

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment	Head Unit
Type Designation	MIB2 STD
Brand Name	VW

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequencies	2412~2462MHz
Channel Spacing	5 MHz
Channel number	11 (HT20)
Operation Voltage	12Vdc
Modulation	802.11b: DSSS 802.11g/n: OFDM
Antenna gain	-3.02dBi

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

- | | |
|-------------------------|----------------------|
| - Bill of Material | - Circuit Diagram |
| - PCB Layout | - Instruction Manual |
| - Photo Document | - 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

Test operation refers to test setup in chapter 4. All testing were performed according to the procedures in ANSI C63.10: 2013

The samples were used as follows:

Conducted: A000751573 001 Conducted

Radiation: A000751573 001 Radiated

Full test was applied on all test modes, but only worst case was shown

Test FW	B000
---------	------

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.

4.3 Special Accessories and Auxiliary Equipment

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

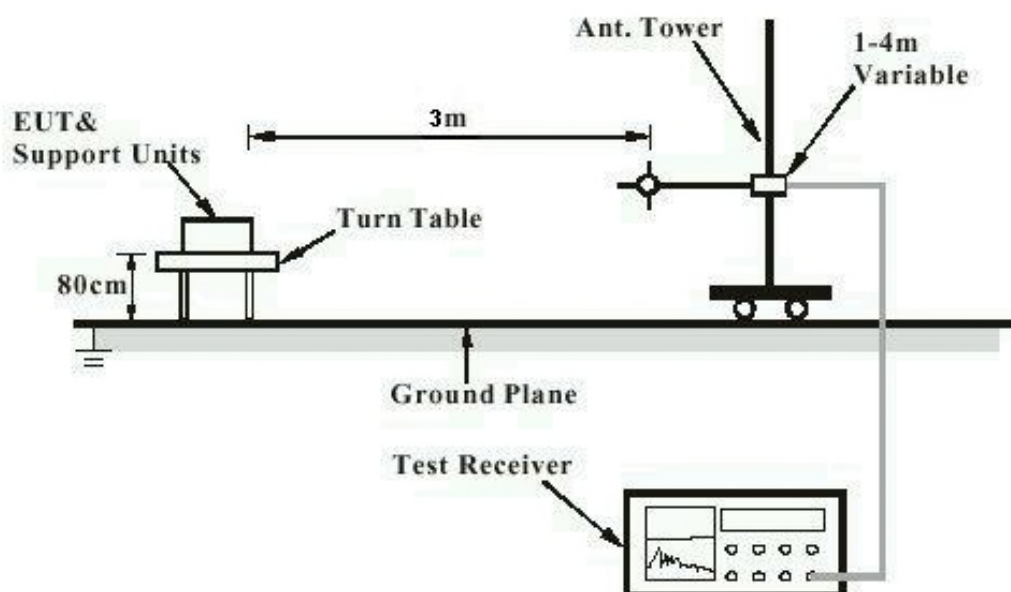
Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2

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)

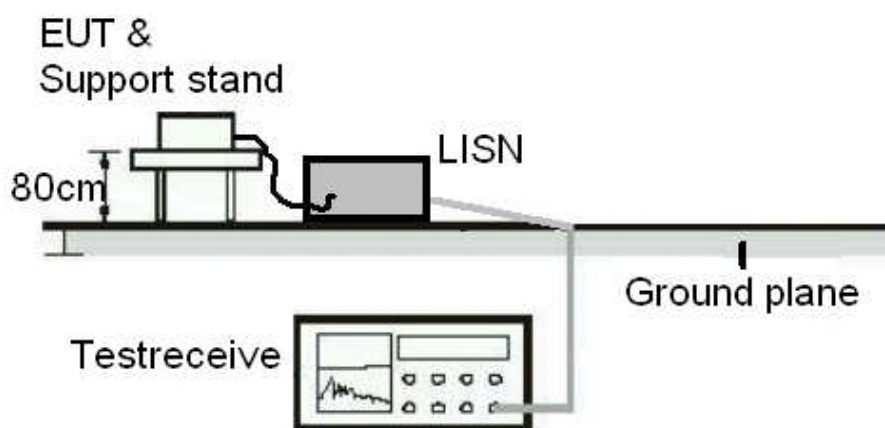
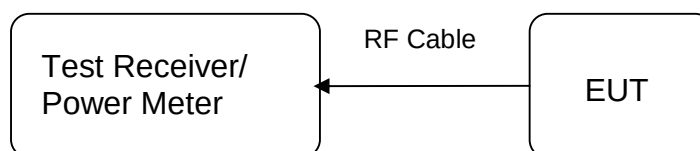


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Test standard	:	LP0002(2018): 3.10.1.3, 3.10.1.4 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 a directional gain of -3.02 dBi .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.

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5.1.2 Peak Output Power

RESULT:**Passed**

Test standard	:	LP0002(2018): 3.10.1.2 (1)(C) FCC Part 15.247(b)(3), RSS-247 5.4(4)
Basic standard	:	ANSI C63.10:2009, KDB558074
Limit	:	1 Watt
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A
Ambient temperature	:	22-26 °C
Relative humidity	:	50-65 %
Atmospheric pressure	:	100-103 kPa

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

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	13.17	0.02075	1
Middle Channel	2437	14.29	0.02685	1
High Channel	2462	14.34	0.02716	1

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

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	19.96	0.09908	1
Middle Channel	2437	19.99	0.09977	1
High Channel	2462	20.00	0.10000	1

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

Channel	Channel Frequency (MHz)	Output Power		Limit
		(dBm)	(W)	(W)
Low Channel	2412	19.90	0.09772	1
Middle Channel	2437	20.09	0.10209	1
High Channel	2462	20.01	0.10023	1

5.1.3 6dB Bandwidth and 99% Bandwidth

RESULT:
Passed

Test standard : LP0002(2018): 3.10.1.6 (2)(A)
 FCC Part 15.247(a)(2), RSS-247 5.2(1)
 Basic standard : ANSI C63.10:2009, KDB558074
 Kind of test site : Shielded room

Test setup

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

 Ambient temperature : 22-26°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	10.13	0.5	Pass
Mid Channel	2437	10.12	0.5	Pass
High Channel	2462	10.11	0.5	Pass

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

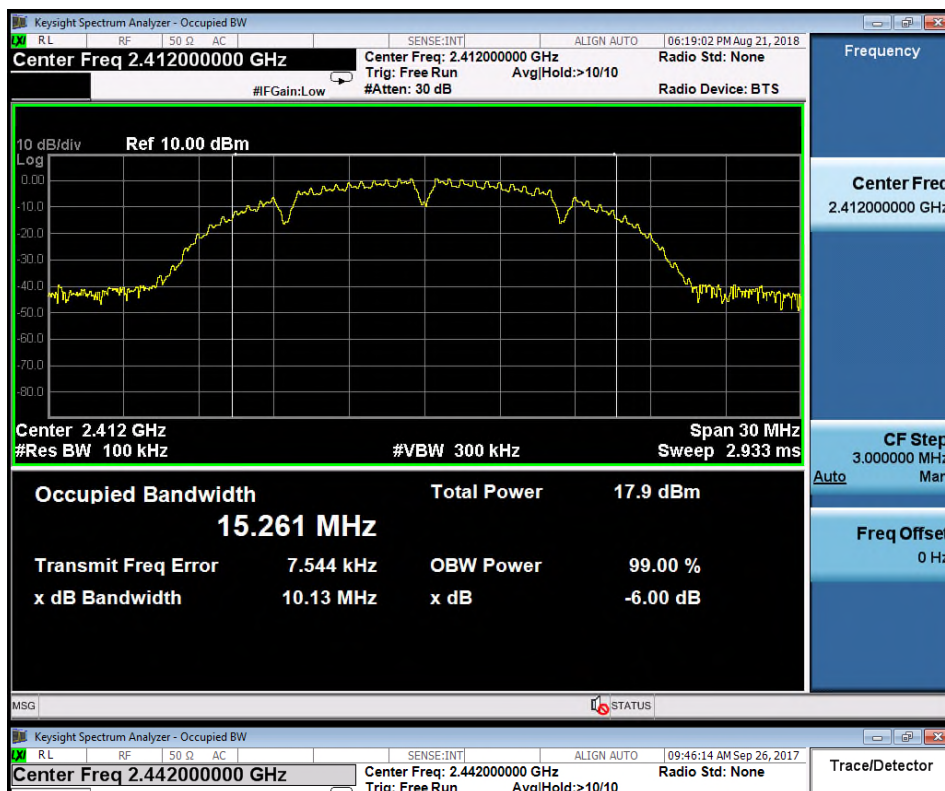
Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	16.31	0.5	Pass
Mid Channel	2437	16.31	0.5	Pass
High Channel	2462	16.31	0.5	Pass

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

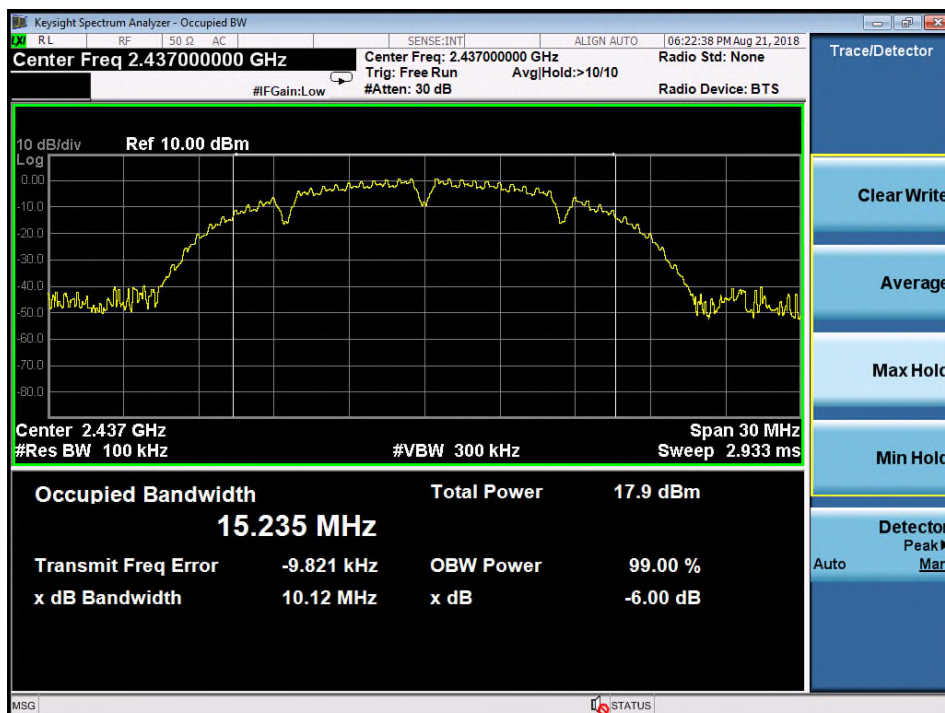
Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2412	16.95	0.5	Pass
Mid Channel	2437	16.93	0.5	Pass
High Channel	2462	16.96	0.5	Pass

Test Plot of 6dB Bandwidth (802.11b)

Low Channel



Middle Channel

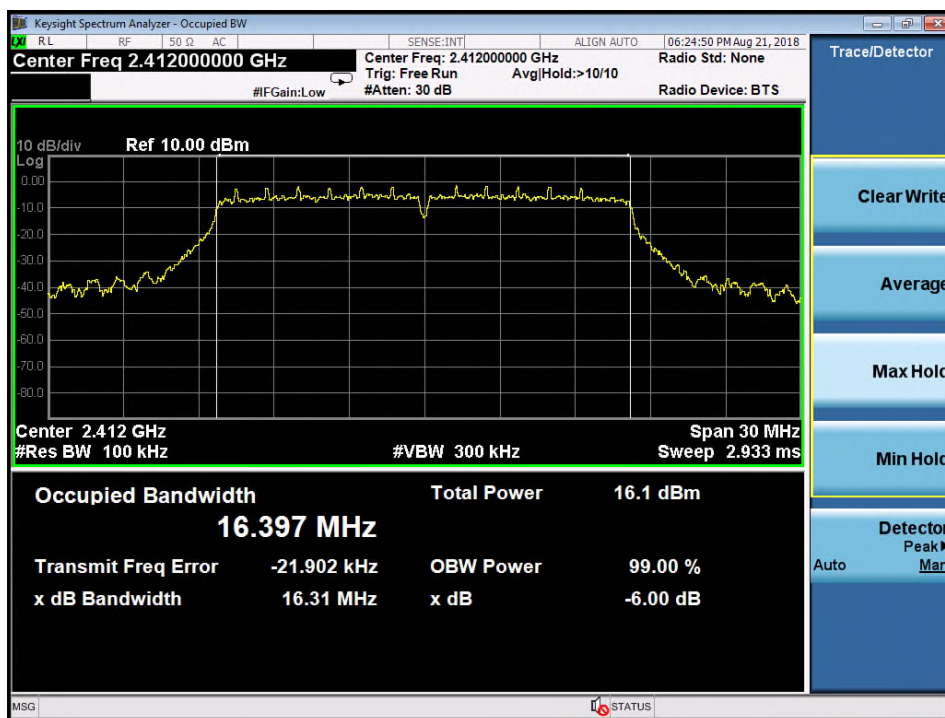


High Channel

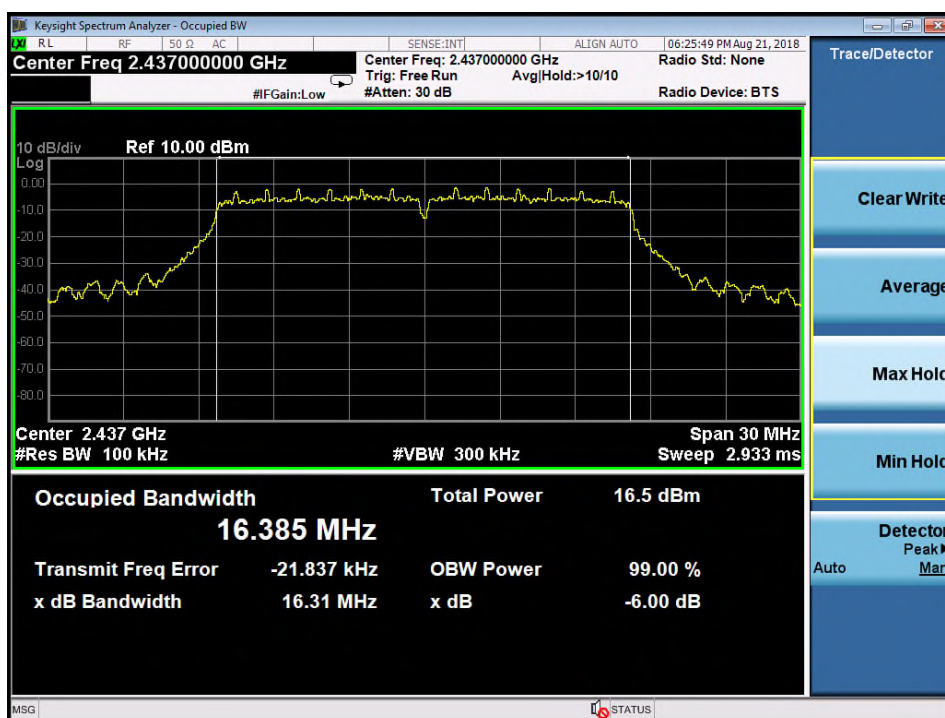


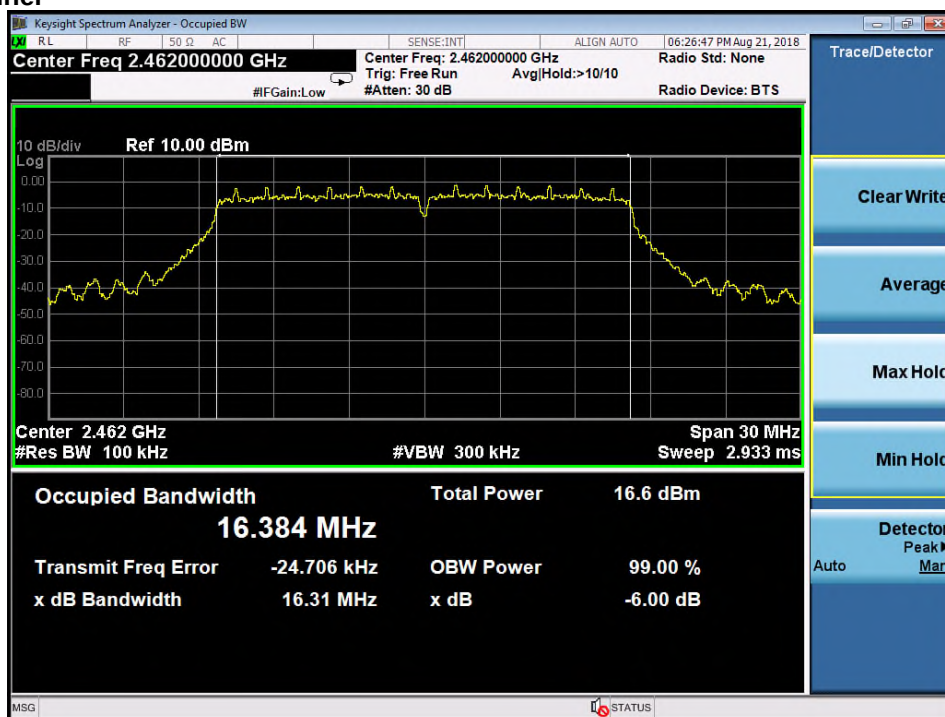
Test Plot of 6dB Bandwidth (802.11g)

Low Channel



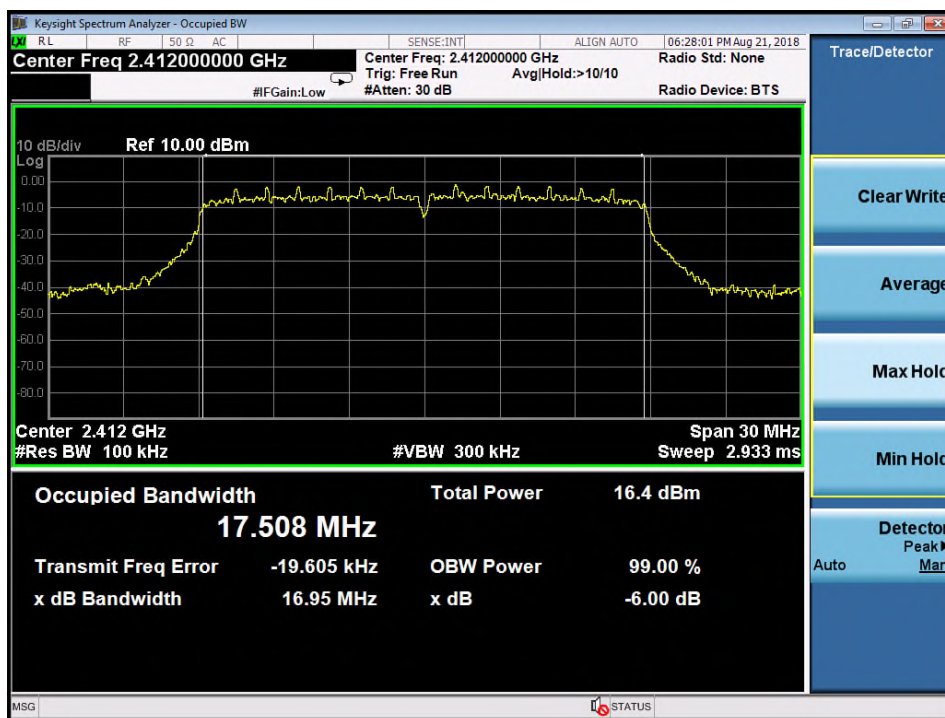
Middle Channel



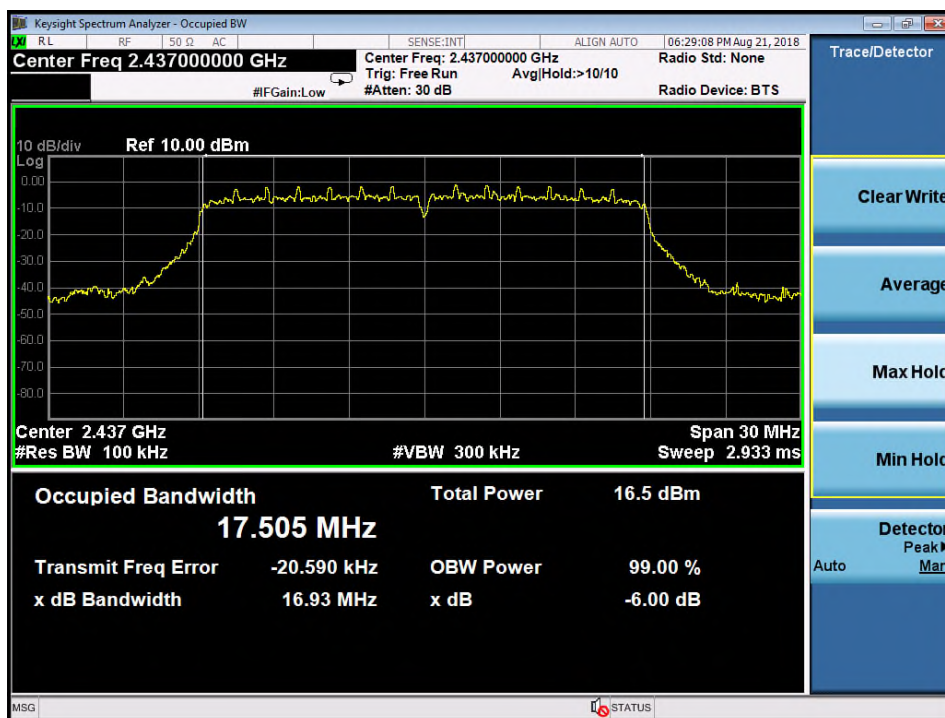
High Channel


Test Plot of 6dB Bandwidth (802.11n HT20)

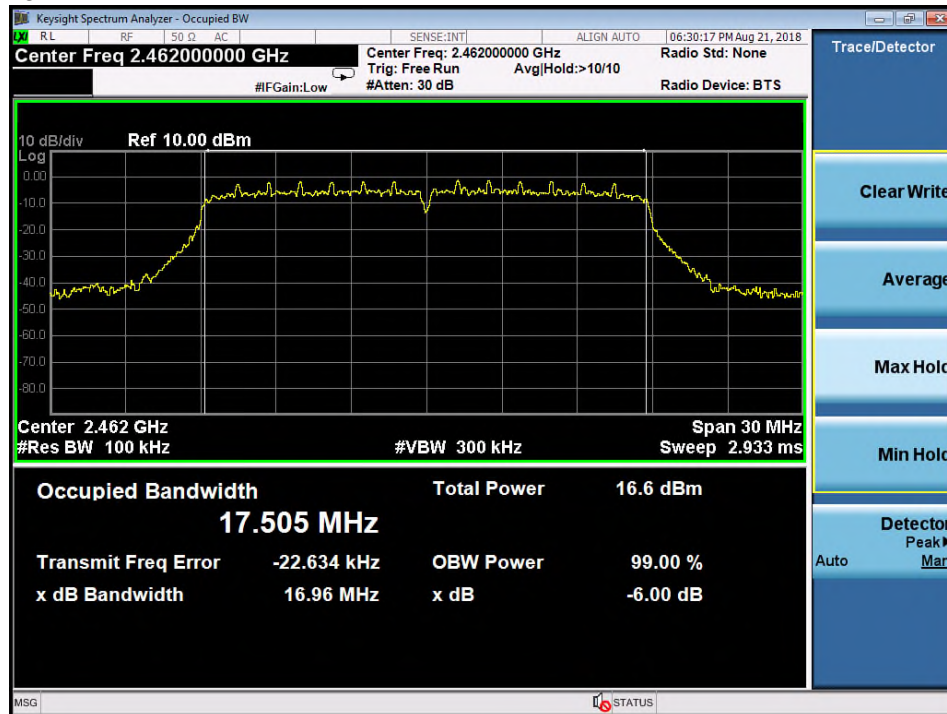
Low Channel



Middle Channel



High Channel



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 C63.10:2009, KDB558074
 Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A
 Ambient temperature : 22-26°C
 Relative humidity : 50-65%
 Atmospheric pressure : 100-103 kPa

Table 12: Test result of Power Density (802.11b)

Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	2.17	8
Middle Channel	2437	1.99	8
High Channel	2462	2.87	8

Table 13: Test result of Power Density (802.11g)

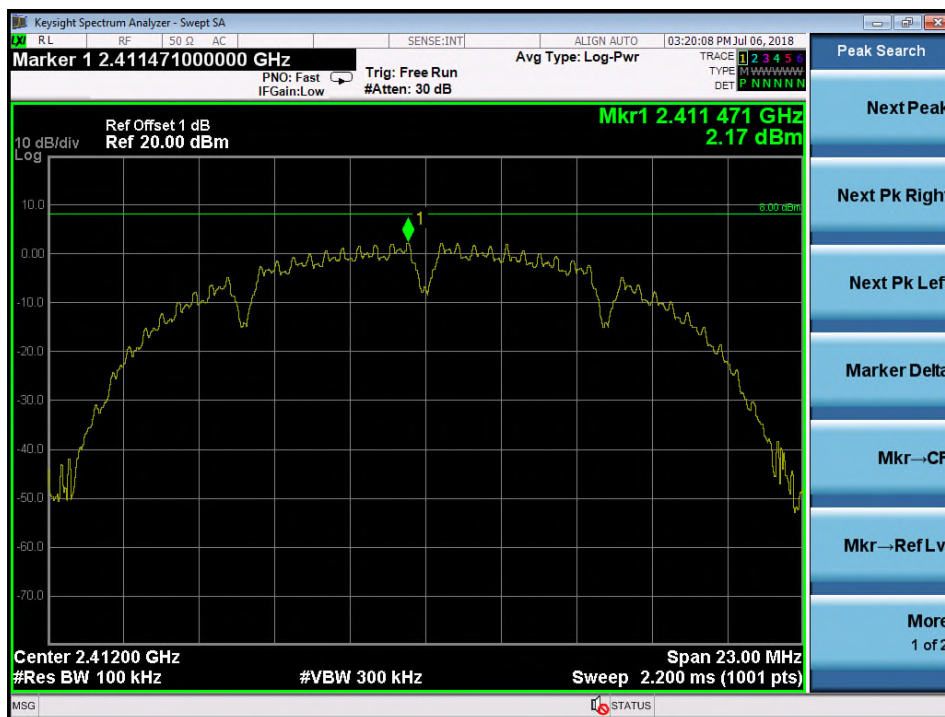
Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-0.26	8
Middle Channel	2437	-0.20	8
High Channel	2462	-0.50	8

Table 14: Test result of Power Density (802.11n HT20)

Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2412	-0.06	8
Middle Channel	2437	-0.74	8
High Channel	2462	0.00	8

Test Plot of Power Density (802.11b)

Low Channel



Middle Channel



High Channel

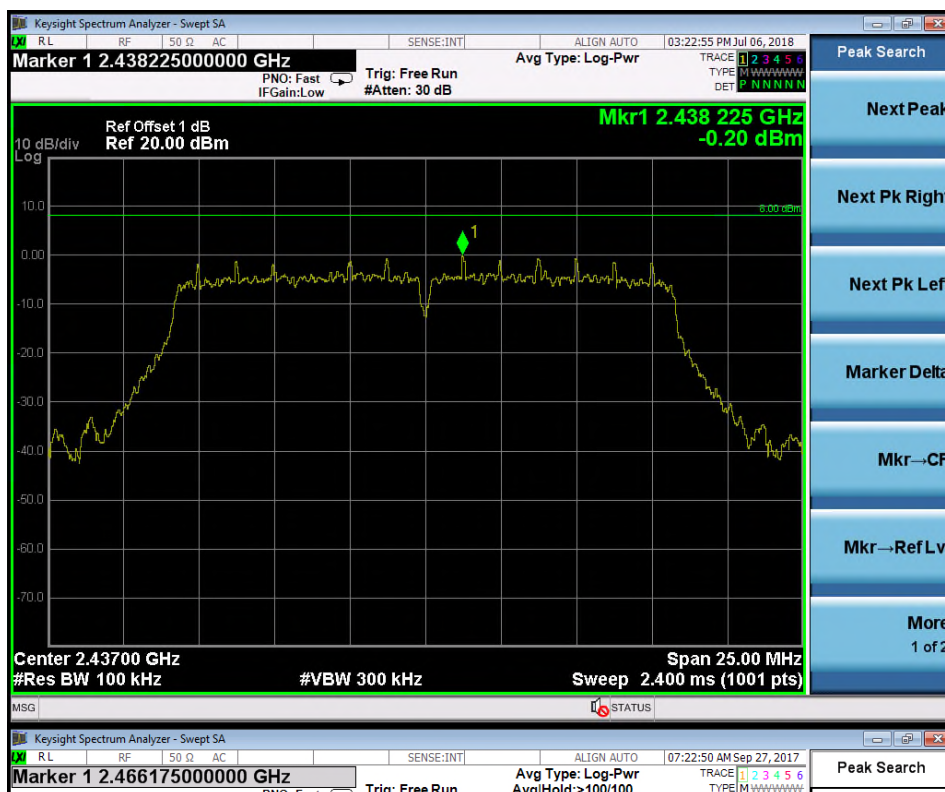


Test Plot of Power Density (802.11g)

Low Channel



Middle Channel



High Channel



Test Plot of Power Density (802.11n HT20)

Low Channel



Middle Channel



High Channel



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

Test standard	:	LP0002(2018): 3.10.1.5 FCC part 15.247(d), RSS-247 5.5
Basic standard	:	ANSI C63.10:2009, 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	:	22-26°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, 9 KHz 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

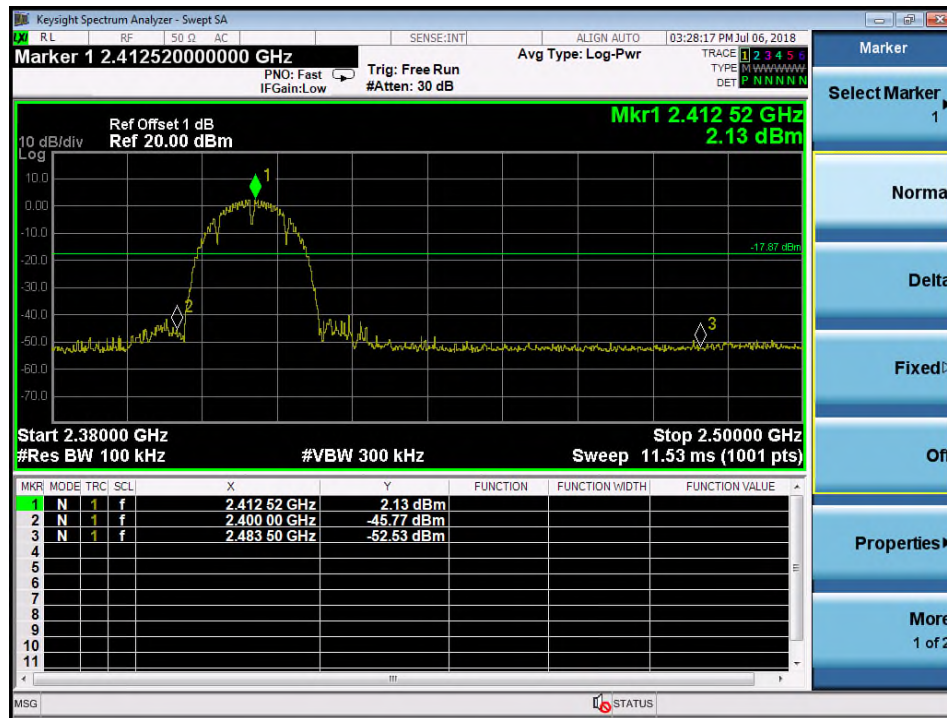


High Channel

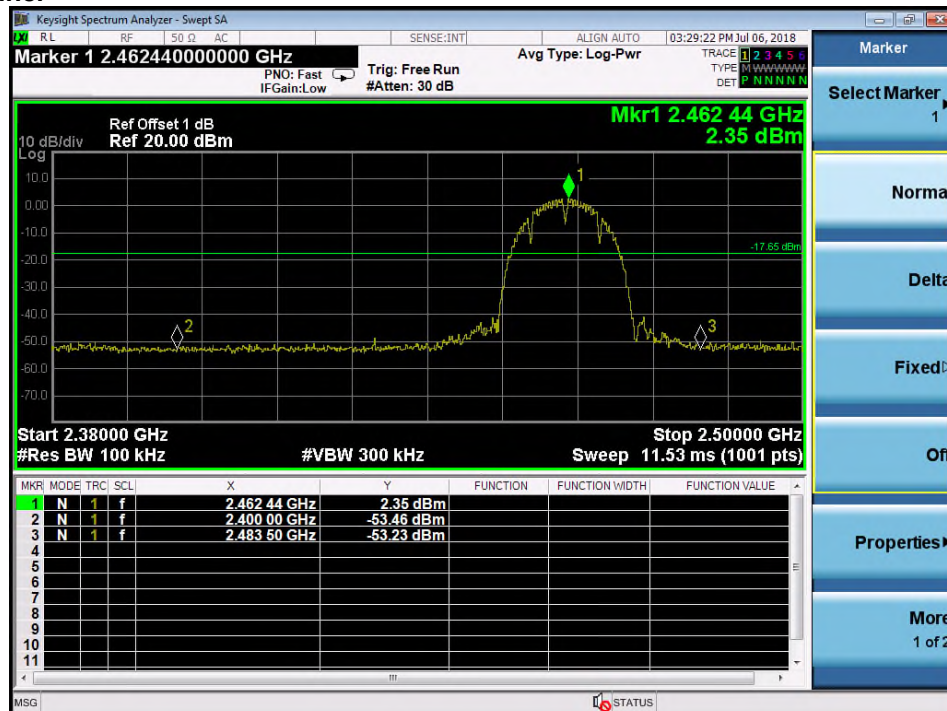


Test Plot 100kHz RBW of Band Edge (802.11b)

Low Channel

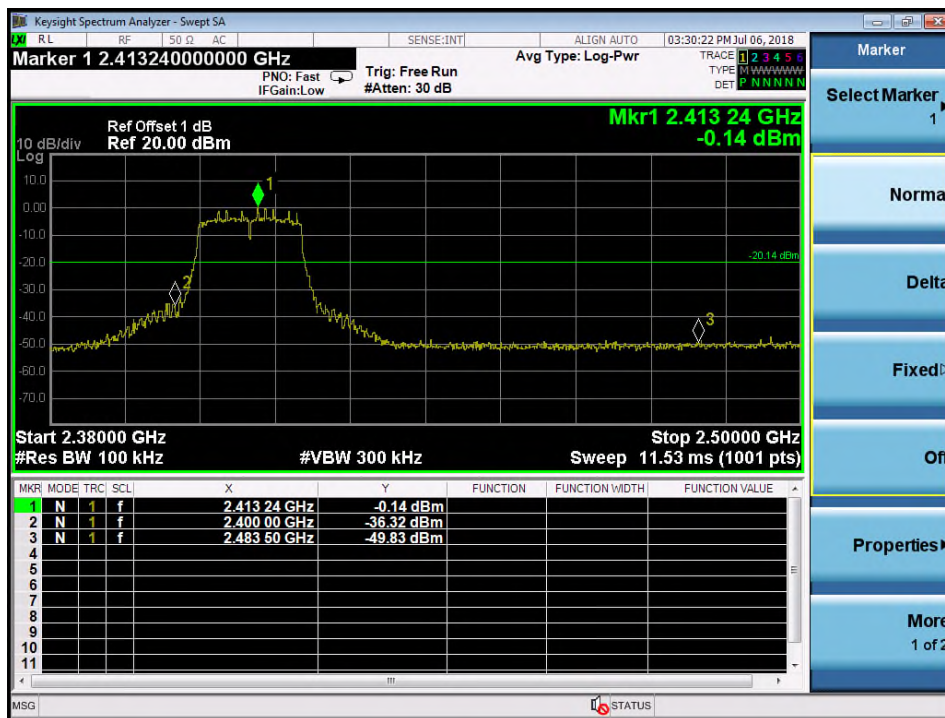


High Channel

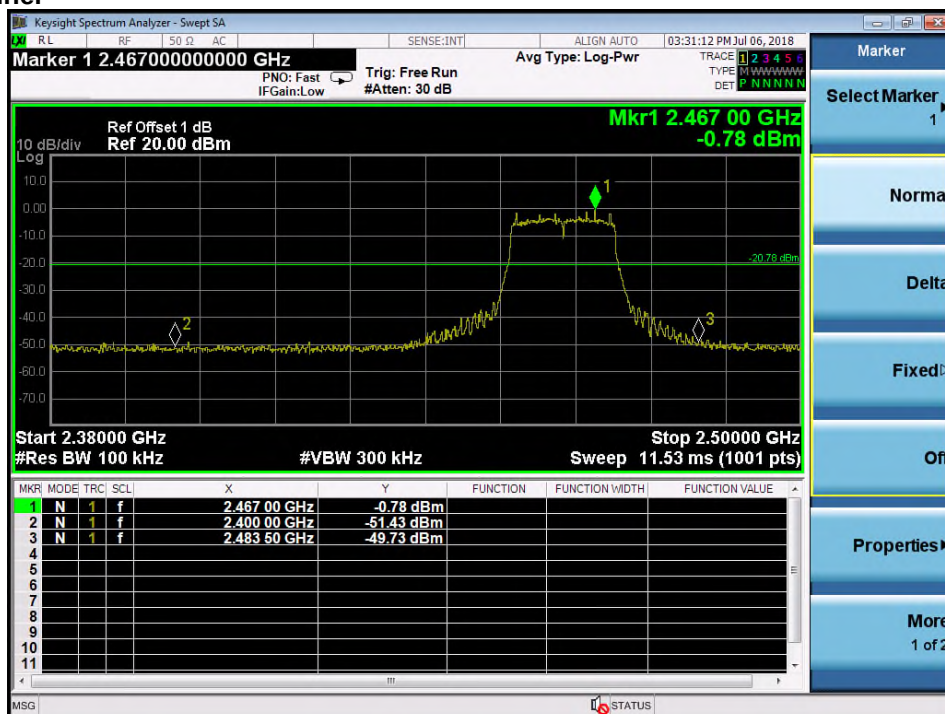


Test Plot 100kHz RBW of Band Edge (802.11g)

Low Channel

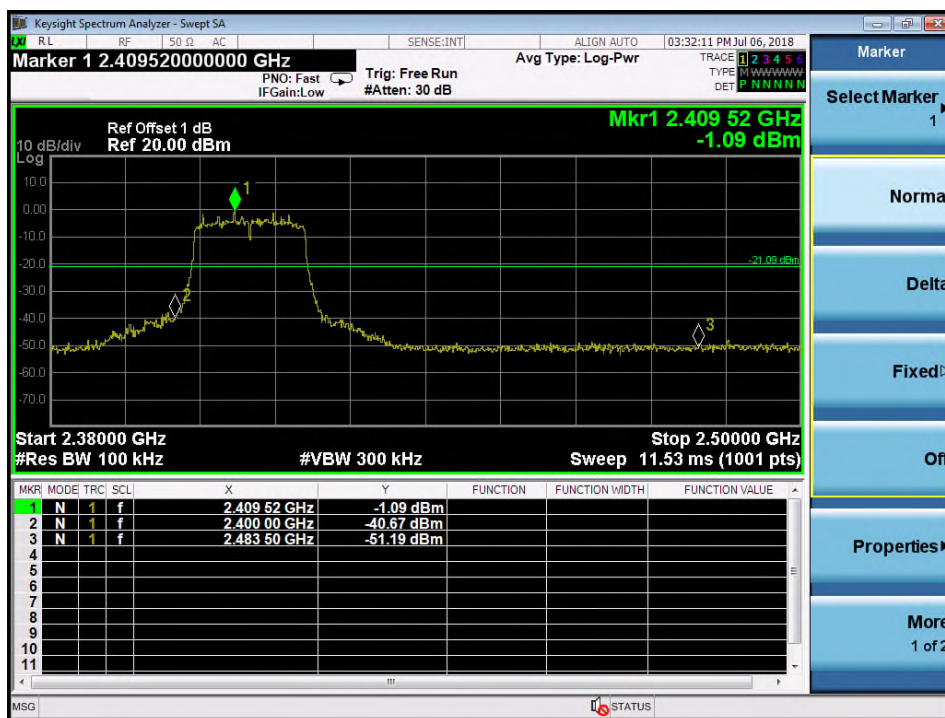


High Channel

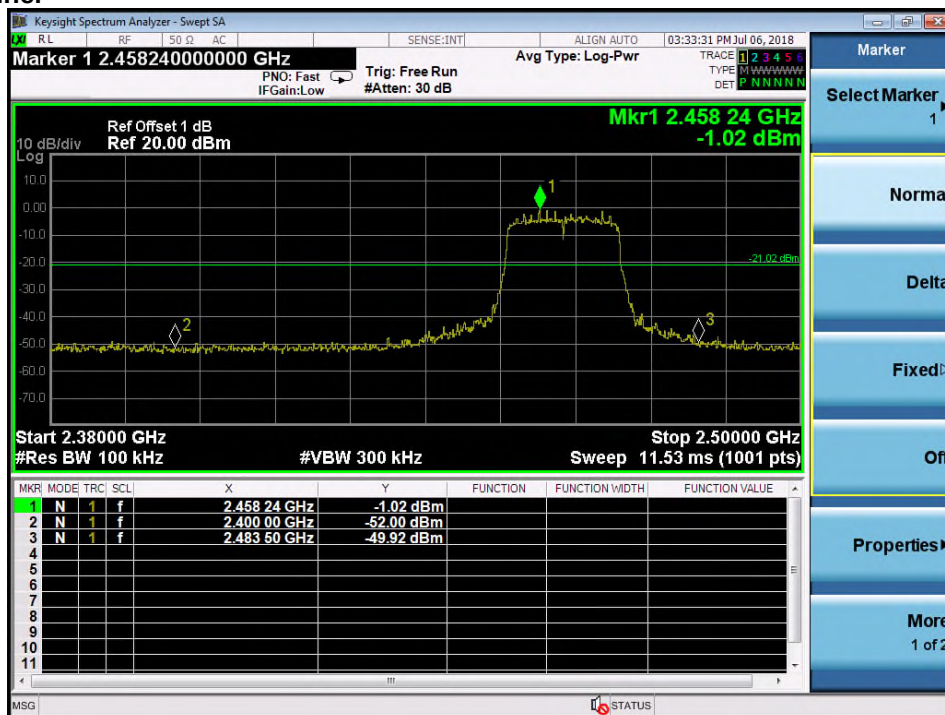


Test Plot 100kHz RBW of Band Edge (802.11n HT20)

Low Channel



High Channel



5.1.6 Spurious Emission

RESULT:

Passed

Test standard	:	FCC part 15.247(d), FCC 15.205, FCC 15.209 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 5, 8.9 (Table 5 and 6). 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 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 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

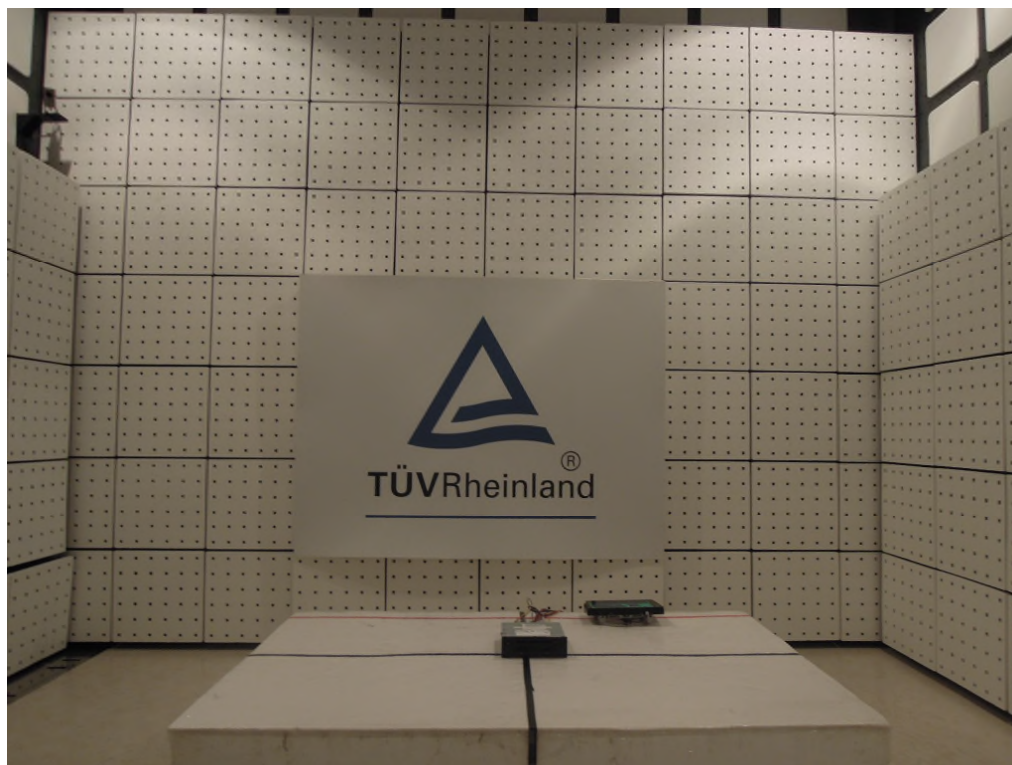
Test Channel	:	Low/ Middle/ High
Operation Mode	:	A, B
Ambient temperature	:	22-26°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103 kPa

For details refer to Appendix D.

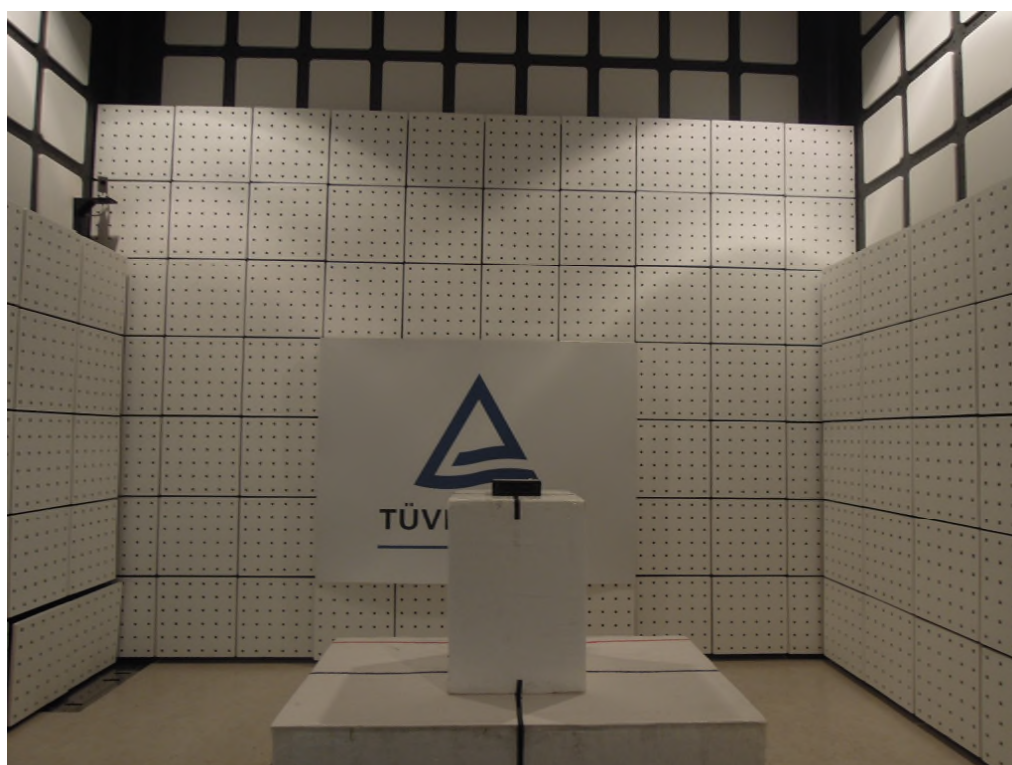
The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report.

6. Photographs of the Test Set-Up

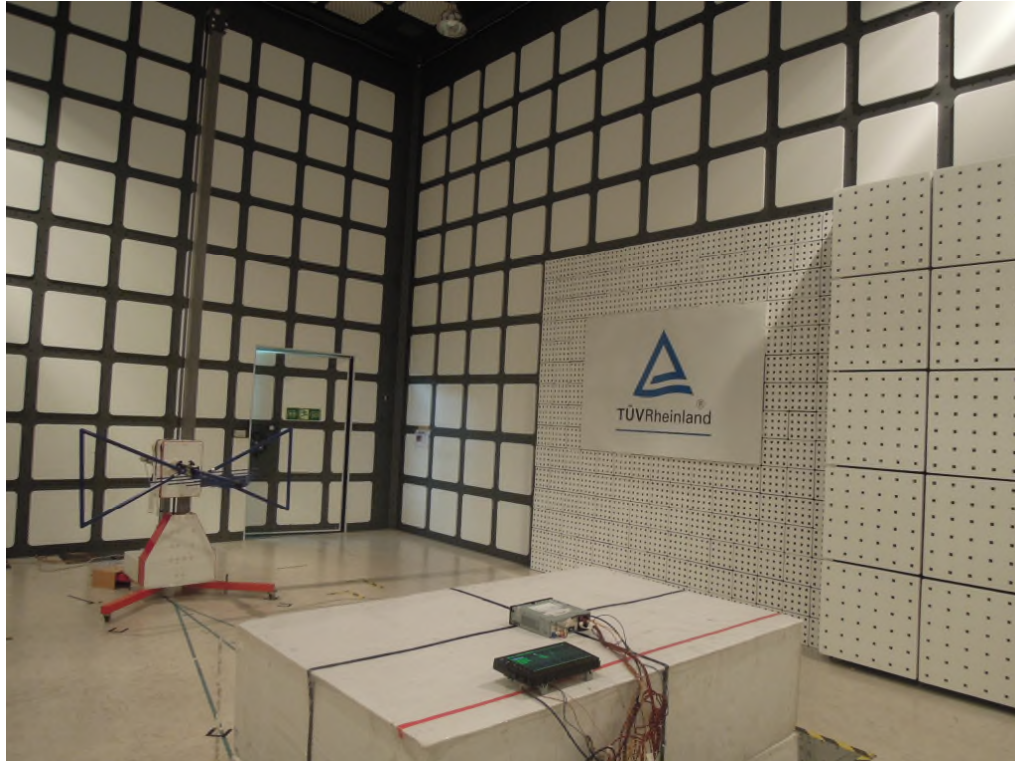
Photograph 1: Spurious Emissions (Front View 1)



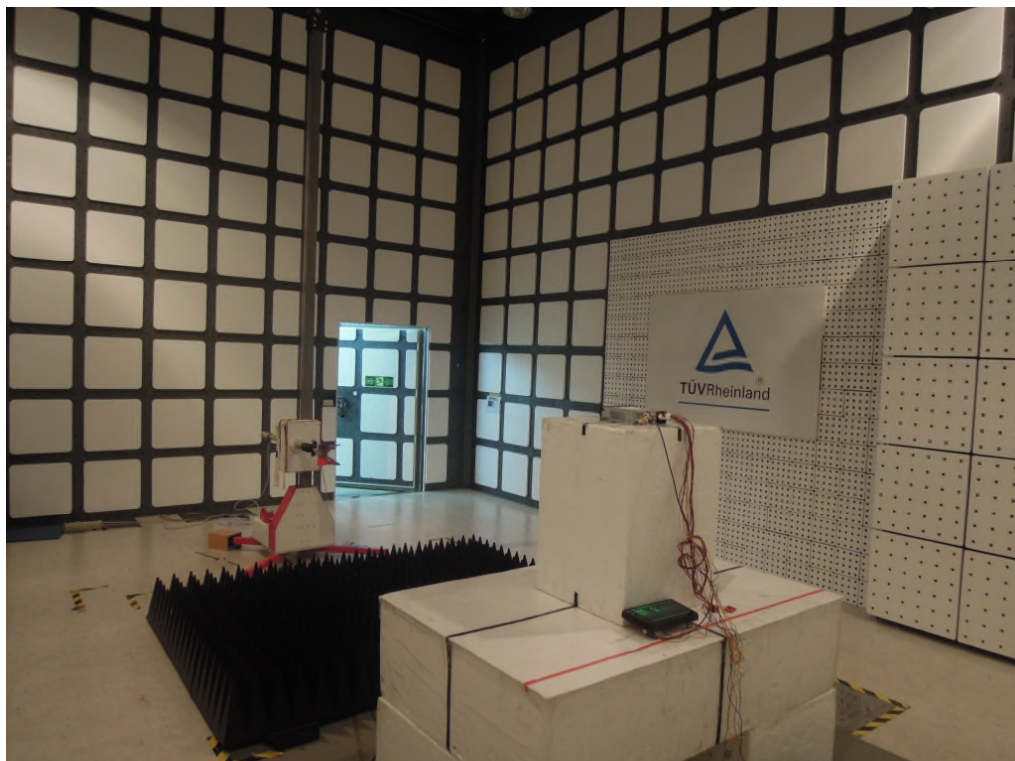
Photograph 2: Spurious Emissions (Front View 2)



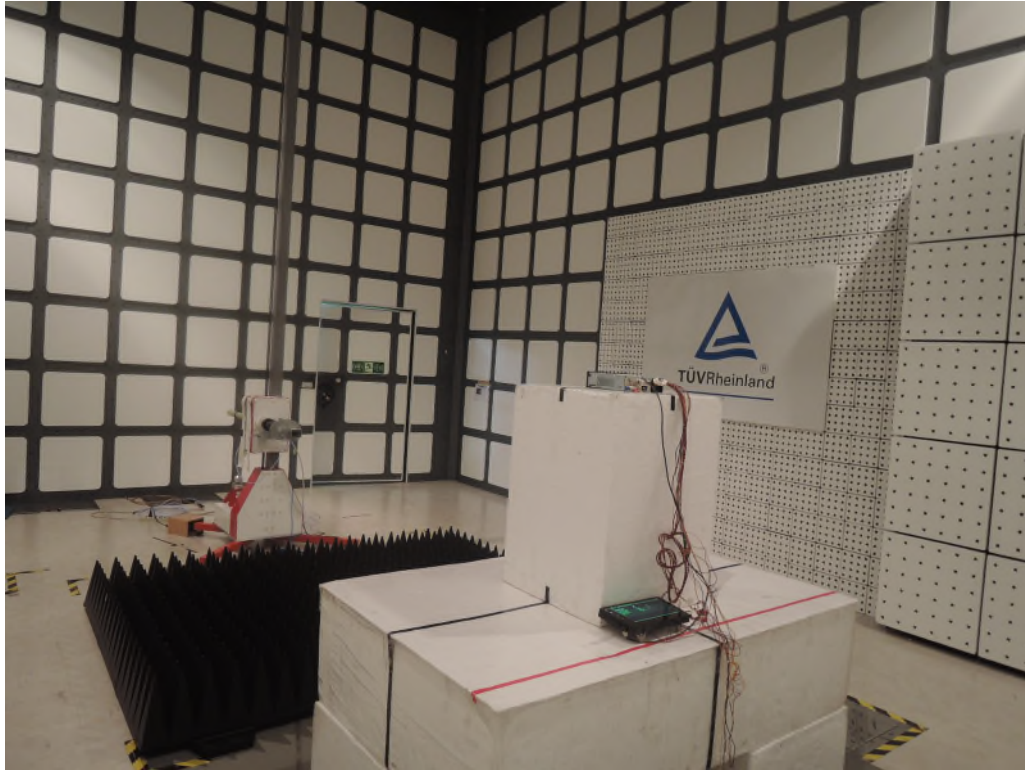
Photograph 3: Set-up for Spurious Emissions (Back View 1)



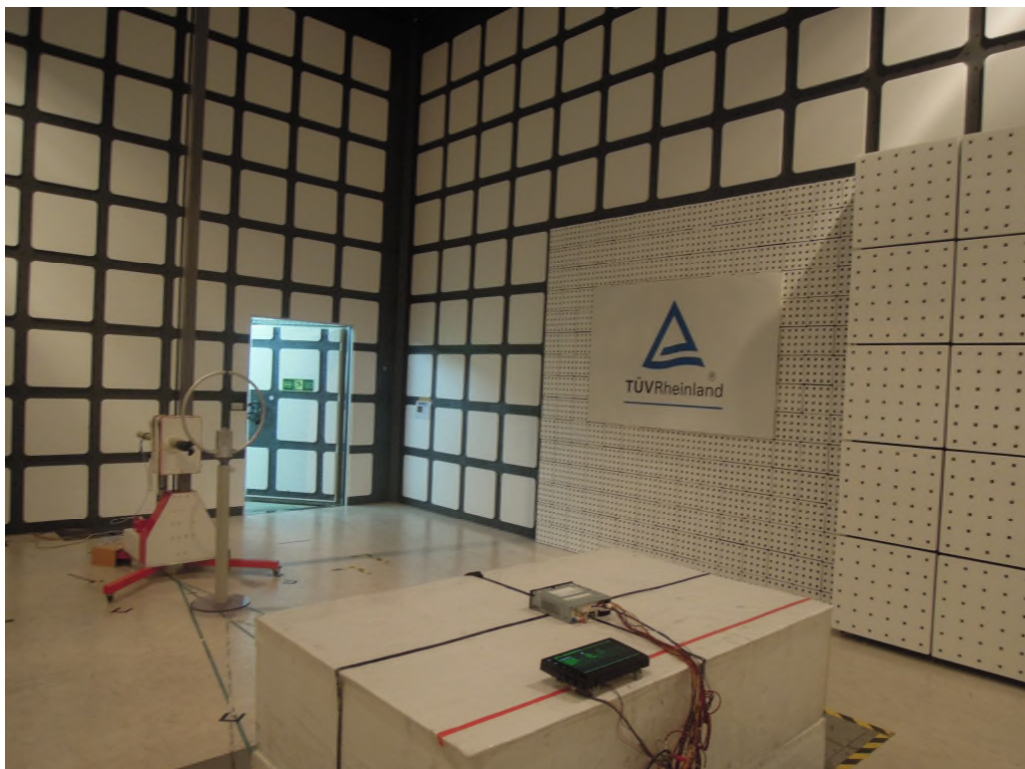
Photograph 4: Set-up for Spurious Emissions (Back View 2)



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



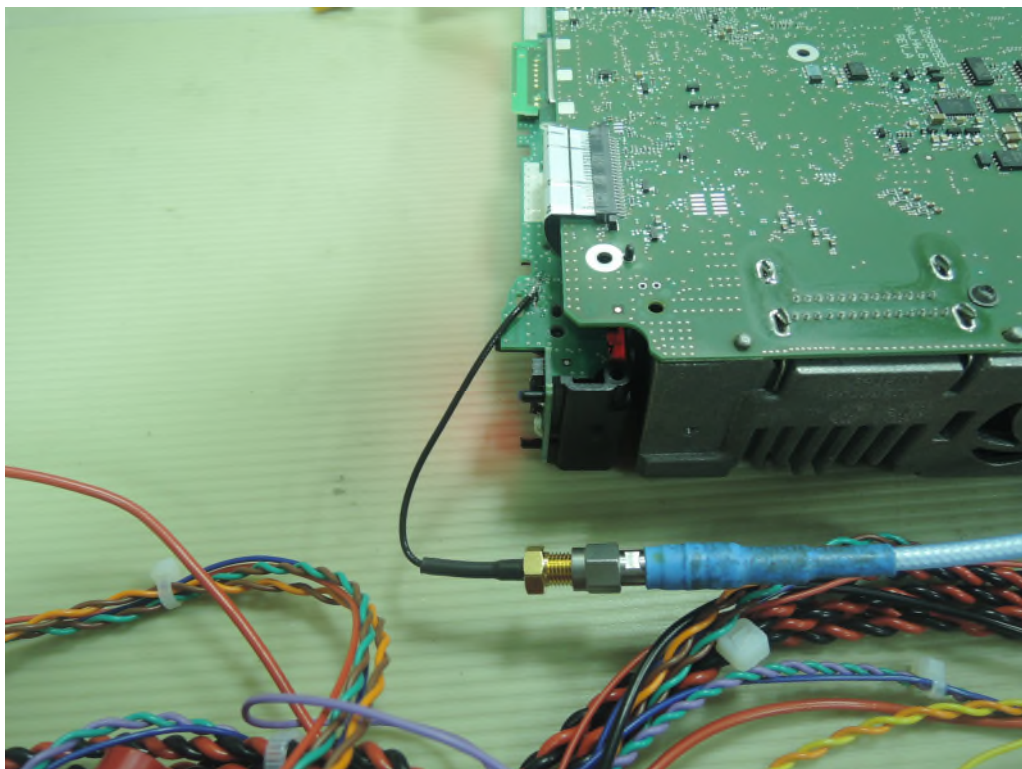
Photograph 6: Set-up for Spurious Emissions (Back View 4)



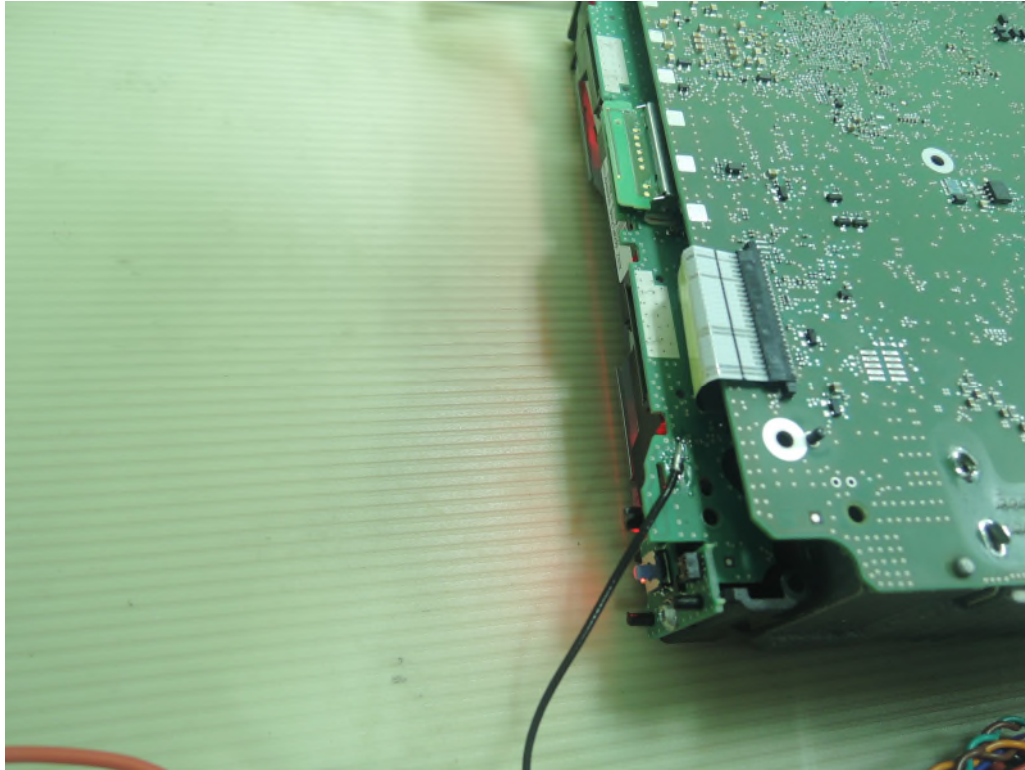
Photograph 7: Set-up for Conducted testing



Photograph 8: Set-up for Conducted testing



Photograph 9: Set-up for Conducted testing



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