CERTIFICATE #3478.01

TEST REPORT

EUT Description	**WLAN and BT, 1x1 PCIe M.2 2230 adapter card**
Brand Name	**Intel® Wireless-AC 9461**
Model Name	**9461NGW**
FCC ID	**PD99461NG**
ISED ID	**1000M-9461NG**
Date of Test Start/End	**2017-08-24 / 2017-08-28**
Features	**802.11 a/b/g/n/ac Wireless LAN + Bluetooth 5** (see section 5)

Applicant	**Intel Mobile Communications**
Address	**100 Center Point Circle, Suite 200** **Columbia, South Carolina 29210** **USA**
Contact Person	**Steven Hackett**
Telephone/Fax/ Email	**steven.c.hackett@intel.com**

Reference Standards	**FCC CFR Title 47 Part 15 B** **ICES-003 Issue 6** (see section 1)

Test Report identification	**170727-01.TR39**
Revision Control	**This test report revision replaces any previous test report revision** (see section 8)

The test results relate only to the samples tested.
The test report shall not be reproduced in full, without written approval of the laboratory.

Issued by	Reviewed by
Digitally signed by Walid EL HAJJ Date: 2017.09.12 17:09:00 +02'00'	Digitally signed by Olivier FARGANT DN: cn=Olivier FARGANT, o=Intel Mobile Communications, ou=WRF Lab, email=olivier.fargant@intel.com, c=FR Date: 2017.09.12 19:15:00 +02'00'
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1. Standards, reference documents and applicable test methods

1. FCC 47 CFR part 15 - Subpart B – Unintentional Radiators
2. FCC 47 CFR part 15 - Subpart B – §15.109 Radiated emission limits
3. FCC 47 CFR part 15 - Subpart B – §15.107 Conducted limits
4. ANSI C63.4-2014 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz
5. ICES-003 Issue 6 - Information Technology Equipment (Including Digital Apparatus) — Limits and Methods of Measurement

2. General conditions, competences and guarantees

- ✓ Intel Mobile Communications Wireless RF Lab (Intel WRF Lab) is a testing laboratory accredited by the American Association for Laboratory Accreditation (A2LA).
- ✓ Intel Mobile Communications Wireless RF Lab (Intel WRF Lab) is an Accredited Test Firm listed by the FCC, with Designation Number FR0011.
- ✓ Intel Mobile Communications France SAS Wireless RF Lab (Intel WRF Lab) is a Registered Test Site listed by ISED, with ISED Assigned Code 1000Y.
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- ✓ Intel WRF Lab has developed calibration and proficiency programs for its measurement equipment to ensure correlated and reliable results to its customers.
- ✓ This report is only referred to the item that has undergone the test.
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3. Environmental Conditions

- ✓ At the site where the measurements were performed the following limits were not exceeded during the tests:

Temperature	22ºC ± 3ºC
Humidity	55% ± 15%

4. Test samples

Sample	Control #	Description	Model	Serial #	Date of receipt	Note
#01	170727-01.S04	Module	9461NGW	WFM : 3413E86AD7BD	2017-07-28	Used for AC power-line conducted emission measurements
	170524-02.S13	Extender Board	PCB00609_01	6092416-418	2017-02-20	
	170000-01.S02	Laptop	Latitude E5470	21HTPF2	2017-04-25	
#02	170727-01.S06	Module	9461NGW	WFM : 3413E86AD7B3	2017-07-28	Used for radiated tests
	170220-02.S03	Extender Board	PCB00609_01	6092416-446	2017-02-20	
	170727-01.S12	PCI cable	NA	NA	2017-08-28	
	170000-01.S13	Laptop	Latitude E5470	FT6LMC2	2017-04-25	

NA: Not Applicable

5. EUT features

Brand Name	Intel® Wireless-AC 9461
Model Name	9461NGW
FCC / ISED ID	PD99461NG1000M-9461NG
Software Version	10.1730.0-05594
Driver Version	99.0.28.6
Prototype / Production	Production
Supported Radios	802.11b/g/n 2.4GHz (2400.0 – 2483.5 MHz) 802.11a/n/ac 5.2GHz (5150.0 – 5350.0 MHz) 5.6GHz (5470.0 – 5725.0 MHz) 5.8GHz (5725.0 – 5850.0 MHz) Bluetooth 5 2.4GHz (2400.0 – 2483.5 MHz)
Antenna Information	WLAN/BT: Slot antenna. WiFi 2.4GHz & 5GHz and BT (DRTU CHAIN A)

N/A: Not Applicable

6. Remarks and comments

N/A

7. Test Verdicts summary

FCC part	Test name	Verdict
15.107 (a)	AC power-line conducted emission measurements	P
15.109 (a)	Radiated Emission Limits	P

P: Pass
F: Fail
NM: Not Measured
NA: Not Applicable

8. Document Revision History

Revision #	Date	Modified by	Details
Rev. 00	2017-09-11	G.GERBAUD	First Issue

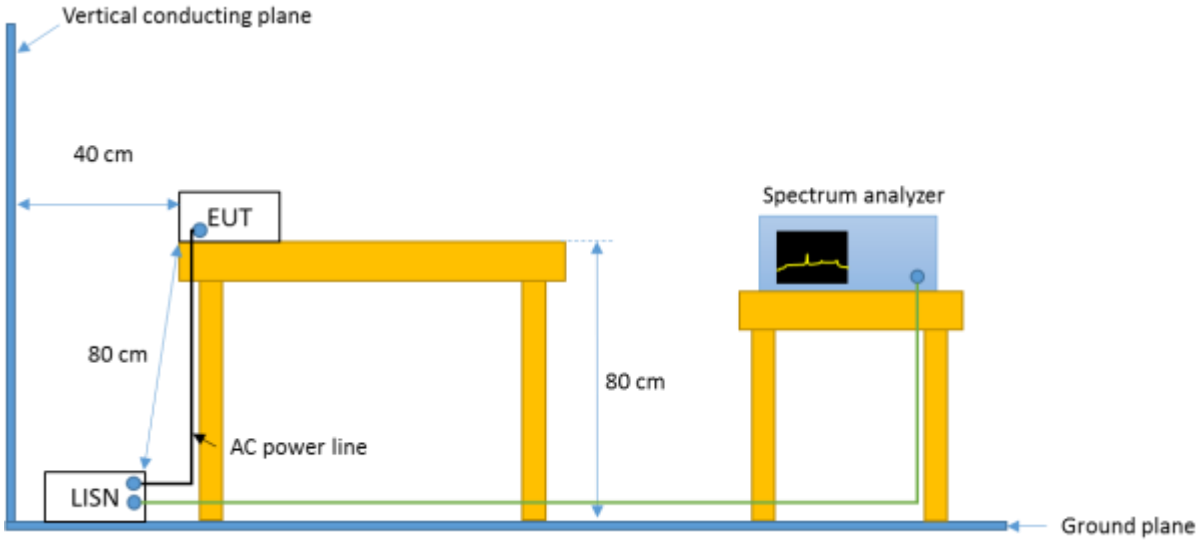
Annex A.Test & System Description

A.1 Measurement system

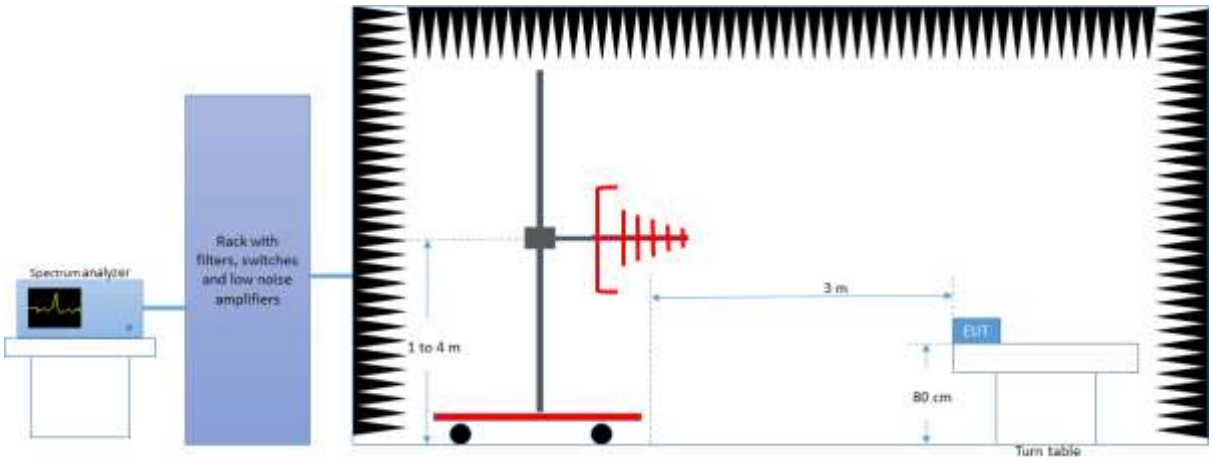
Measurements were performed using the following setups, made in accordance to the ANSI 63.4-2014.

The EUT was installed in a test fixture and this test fixture is connected to a laptop computer and AC/DC power adapter. The laptop computer was used to configure the EUT in operating mode so that all the functions are exercised.

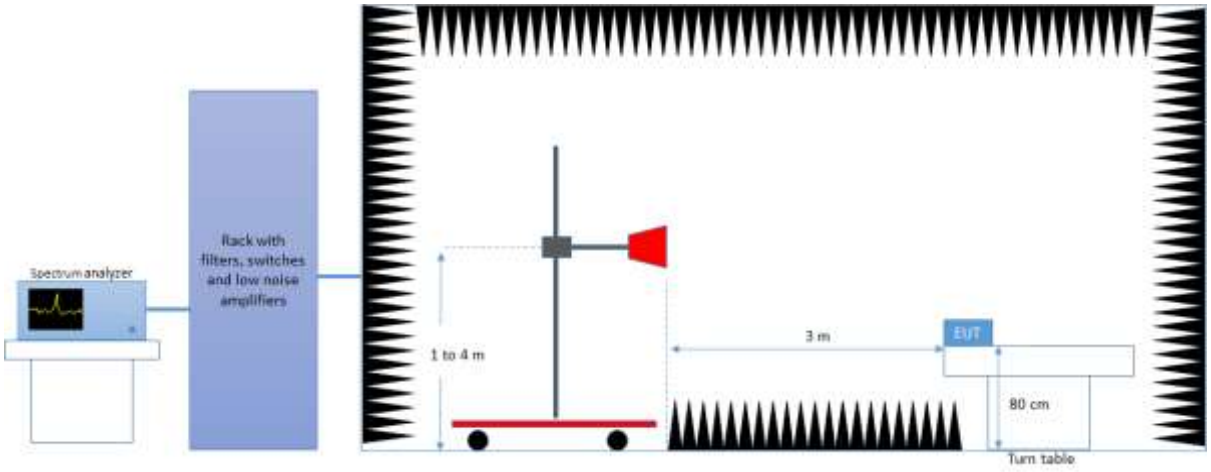
AC power-line conducted emission Setup 150 kHz – 30 MHz



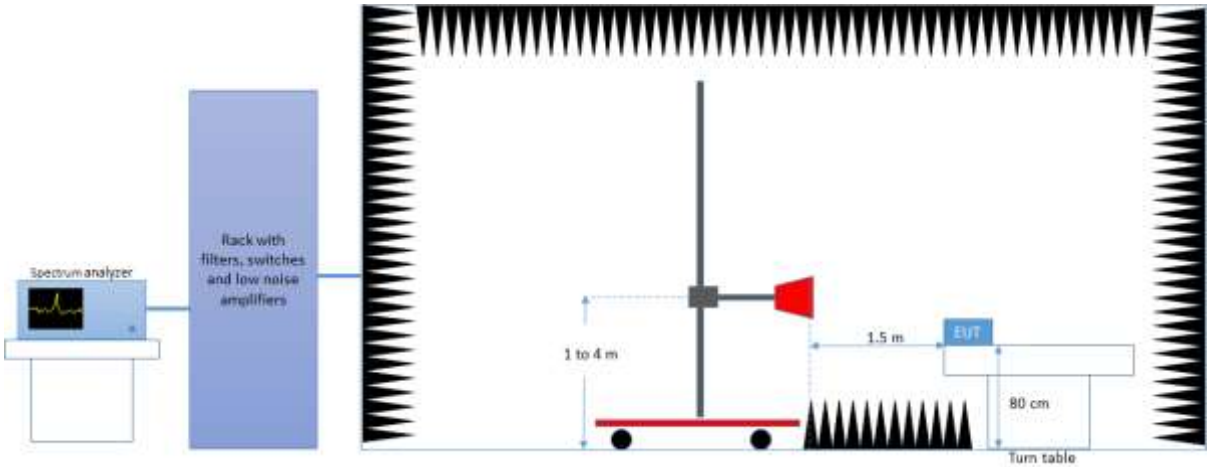
Radiated Setup < 1GHz



Radiated Setup 1 GHz - 18 GHz



Radiated Setup 18 GHz - 40 GHz



A.2 Test Equipment List

AC power-line conducted emission Setup

ID#	Device	Type/Model	Serial Number	Manufacturer	Cal. Date	Cal. Due Date
0027	Measurement software	EMC32	1300.7010.02	Rohde & Schwarz	NA	NA
0317	Spectrum Analyzer	FSV30	103308	Rohde & Schwarz	2017-08-05	2019-08-05
0532	LISN	ENV216	101321	Rohde & Schwarz	2016-09-13	2018-09-13
0607	LISN	ENV216	101342	Rohde & Schwarz	2017-09-06	2018-09-06
0538	Transformer	Monophase	TIMM3.15	Montelem	N/A	N/A
095	Millivoltmeter	2000	4009301	KEITHLEY	2015-10-26	2017-10-26
0624	AC power source	61604	SM135546	CHROMA	N/A	N/A
0346	Multimeter	34401A	US36054685	HP	2016-02-04	2018-02-04

N/A: Not Applicable

Radiated Setup

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
0133	Spectrum analyzer	FSV40	101358	Rohde & Schwarz	2016-04-15	2018-04-15
0137	Log antenna 30 MHz – 1 GHz	3142E	00156946	ETS Lindgren	2015-12-11	2017-12-11
0138	Double Ridge Horn antenna 1 GHz - 18 GHz	3117	00152266	ETS Lindgren	2016-3-14	2018-03-14
0139	Horn Antenna 18 GHz - 26.5 GHz	114514	00167100	ETS Lindgren	2016-03-16	2018-03-16
0140	Horn Antenna 26.5 GHz - 40 GHz	120722	00169638	ETS Lindgren	2016-07-26	2018-07-26
0135	Semi Anechoic chamber	FACT 3	5720	ETS Lindgren	2016-04-28	2018-04-28
0530	Measurement Software	EMC32	100623	Rohde & Schwarz	N/A	N/A
0296	Power Supply	6673A	MY41000318	Agilent	N/A	N/A
0346	Multimeter	34401A	US36054685	HP	2016-02-04	2018-02-04

N/A: Not Applicable

A.3 Measurement Uncertainty Evaluation

The measurement uncertainty evaluation is shown in the table below. The coverage probability is 95% (coverage factor K=2).

Measurement type	Level Uncertainty [±dB]
AC power-line conducted emission	±1.45
Radiated emission < 1GHz	±3.8
Radiated emission 1GHz - 40 GHz	±4.7

A.4 Calibration / Correction factor

Conducted emission

The measured level at the spectrum analyzer in dBuV is corrected by a transducer factor taking into account the losses of the RF cable and the LISN as follows:

Conducted Emission level $_{(dBuV)}$ = SA_{Level} + $RFCable_{Losses}$ + $LISN_{Losses}$

Where:
SA_{Level} is the voltage level displayed on the measurement receiver, in dBuV.
$RFCable_{Losses}$ is the value of the cable losses between the LISN and the measurement receiver, in dB.
$LISN_{Losses}$ is the value of the insertion losses of the LISN, in dB.

Radiated emission

The spurious received power *Pr* in the spectrum Analyzer is converted to Electric field strength using the transducer factor F corresponding to the Rx path Loss:

F (dB) = *Rx Antenna Factor + Free Space Attenuation + Cable losses – Amplifiers Gain (All in dB)*

F (dB) is converted to field strength unit at distance D by:

F (dBuV/m) = *F (dB) + 104.8 – 20 log (D)*

Annex B. Test Results

B.1 AC power-line conducted emission

Standard references:

<table>
<tr><th>FCC part</th><th>ICES part</th><th>Limits</th></tr>
<tr><td>15.107</td><td>ICES-003 clause 6.1</td><td>Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.
<table>
<tr><th rowspan="2">Frequency of emission (MHz)</th><th colspan="2">Conducted limit (dBµV)</th></tr>
<tr><th>Quasi-peak</th><th>Average</th></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
*Decreases with the logarithm of the frequency.</td></tr>
</table>

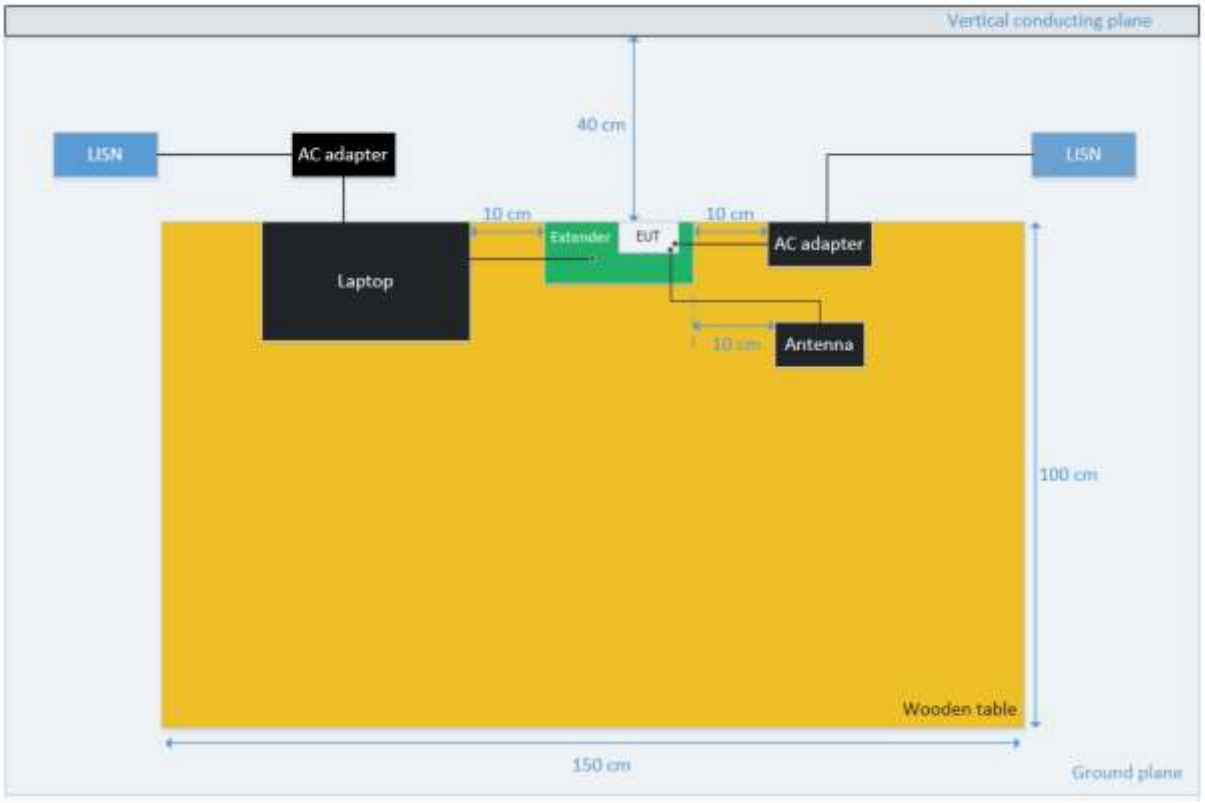
Test procedure:

The EUT and peripherals are placed on a wooden table with a nominal size of 1.0 m by 1.5 m, raised 80 cm above the reference ground plane. The EUT is connected to AC-Power line through a Line Impedance Stabilization Network (LISN) to accommodate a 50 Ω/50 µH coupling impedance for the measurement system. The EUT control PC is considered as a peripheral and therefore is connected to a second LISN which has the measurement port connected to a 50 ohms impedance.

Each measurement is done for each current-carrying conductor (Line and Neutral) at the end plug of the EUT power cord. The EUT is tested in operating mode so that all the functions are exercised.

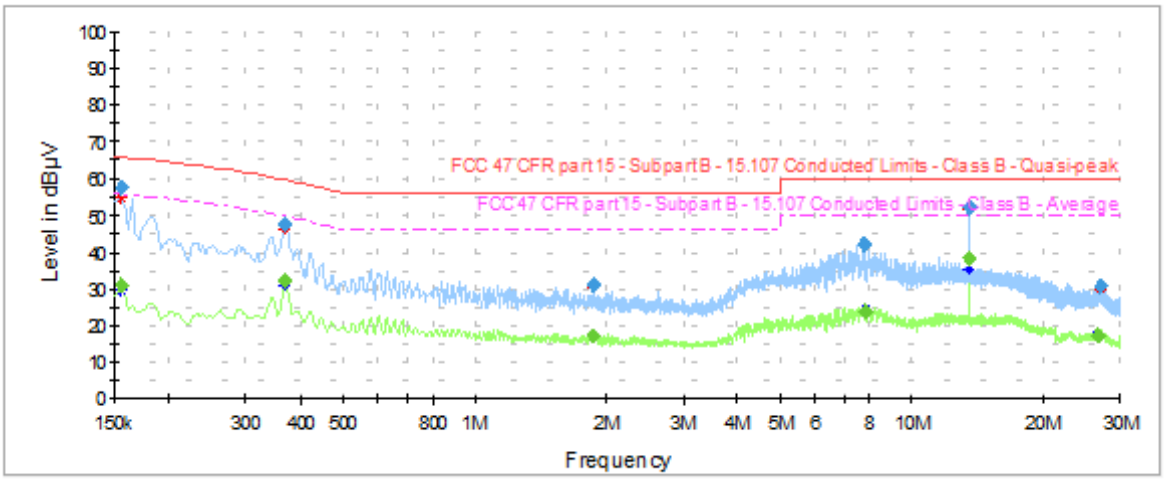
The exploratory measurement is done over the frequency range from 150 kHz to 30 MHz, while the measurement receiver is recording the Peak and Average signal at 10 kHz steps in Max Hold mode. The cables manipulation is performed within the range of likely configurations to determine the maximum emission. Once the EUT cable configuration, arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit is found the six highest AC power-line conducted emissions relative to 20 dB of the limit are reported as the final measurement. If fewer than six emission frequencies are within 20 dB of the limit, the noise level is reported. For the final measurement, the measurement receiver records the Quasi Peak values with 9 kHz resolution bandwidth and the average values with 10 kHz resolution bandwidth.

EUT arrangement for AC power-line conducted emission tests



Test Results:

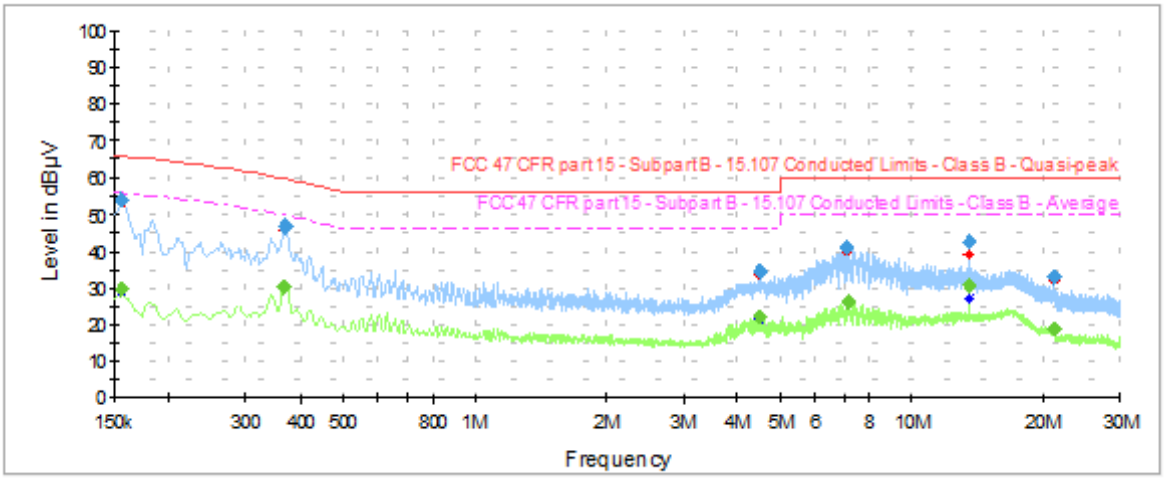
AC power-line conducted – Phase L1



Peak measurements Avg measurements Limit FCC Ouasi-Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBµV	dBµV	dBµV	dB
0.2	57.4	--	65.8	8.4
0.2	--	30.9	55.8	24.9
0.4	47.4	--	59.8	12.4
0.4	--	32.2	49.8	17.6
1.9	30.9	--	56.0	25.1
1.9	--	17.4	46.0	28.6
7.8	42.2	--	60.0	17.8
7.8	--	23.7	50.0	26.3
13.5	52.3	--	60.0	7.7
13.5	--	38.3	50.0	11.7
26.5	30.5	--	60.0	29.5
26.5	--	17.3	50.0	32.7

AC power-line conducted – Neutral N



Peak measurements Avg measurements Limit FCC Ouasi-Peak Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBµV	dBµV	dBµV	dB
0.2	53.9	--	65.8	11.9
0.2	--	29.6	55.8	26.2
0.4	46.7	--	59.9	13.2
0.4	--	30.2	49.9	19.7
4.5	34.4	--	56.0	21.6
4.5	--	22.3	46.0	23.7
7.1	41.2	--	60.0	18.8
7.1	--	26.1	50.0	23.9
13.5	42.6	--	60.0	17.4
13.5	--	30.7	50.0	19.3
21.2	33.0	--	60.0	27
21.2	--	18.7	50.0	31.3

B.2 Radiated emissions

Standard references:

<table>
<tr><th>FCC part</th><th>ICES part</th><th>Limits</th></tr>
<tr><td>15.109 (a)</td><td>ICES-003
clause 6.2</td><td>Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:
<table>
<tr><th>Frequency of emission (MHz)</th><th>Field strength (microvolts/meter)</th></tr>
<tr><td>30-88</td><td>100</td></tr>
<tr><td>88-216</td><td>150</td></tr>
<tr><td>216-960</td><td>200</td></tr>
<tr><td>Above 960</td><td>500</td></tr>
</table>
</td></tr>
</table>

Test procedure:

The EUT and peripheral are placed on a non-conductive platform, of a nominal size 1m by 1.5 m, raised 80 cm above the reference ground plane. The AC Power line radiated emission measurements are made over the frequency range from 30 MHz to the 5th harmonic of the highest frequency or 40 GHz, whichever is lower.

In the frequency range of 30 MHz to 18 GHz, the measurement antennas are set at 3 m distance from the EUT. While from 18 GHz to 40 GHz the antennas are set at a 1.5 m distance.

In each case, the cables manipulation is performed within the range of likely configurations to determine the maximum emission.

From 30 MHz to 1 GHz:

The exploratory measurement is recording the maximum field strength generated from the EUT and peripheral, through the use of a Peak and Average detector with the RBW of the receiver set at 100 kHz, in Max Hold mode. The antenna height is varied between 1 m and 4 m in both vertical and horizontal polarization, while the turn table is rotated continuously from 0 to 360 degrees.

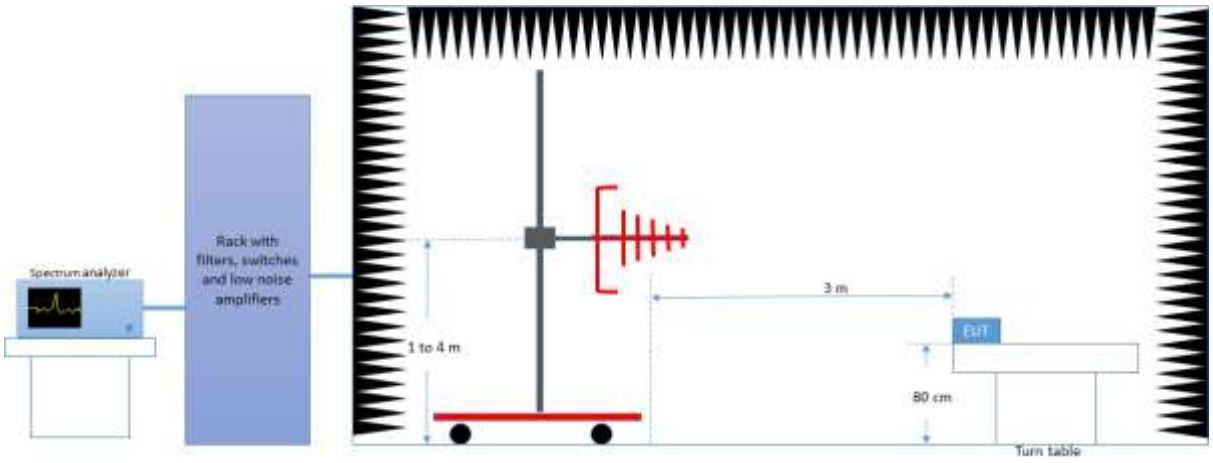
The final measurement is recording the value for each frequency whose maximum is above or close to the limit, through the use of a Quasi-Peak and Average detector with the RBW of the receiver set at (CISPR) 120 kHz, in Max Hold mode. The antenna height is varied and the turn table rotated to find the height and degree of the EUT's maximum radiated emission.

From 1 GHz to 40 GHz:

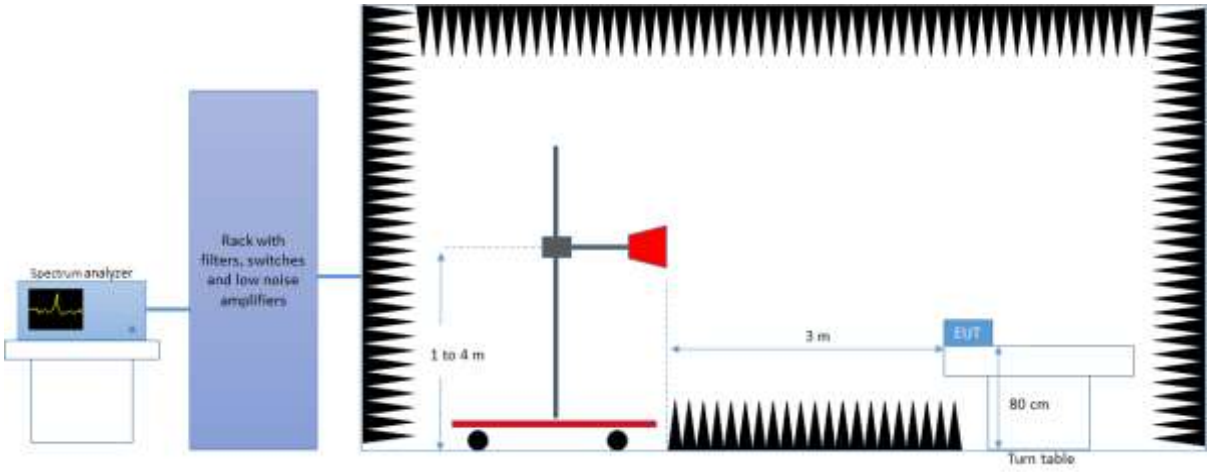
The exploratory measurement is recording the maximum field strength generated from the EUT and peripheral, through the use of a Peak and Average detector with the RBW of the receiver set at 1 MHz, in Max Hold mode. The antenna height is varied between 1m and 4m in both vertical and horizontal polarization, while the turn table is rotated continuously from 0 to 360 degrees.

The final measurement is recording the value for each frequency whose maximum is above or close to the limit, through the use of a Max-Peak and Average detector with the RBW of the receiver set at 3 MHz, in Max Hold mode. The antenna height is varied and the turn table rotated to find the height and degree of the EUT's maximum radiated emission.

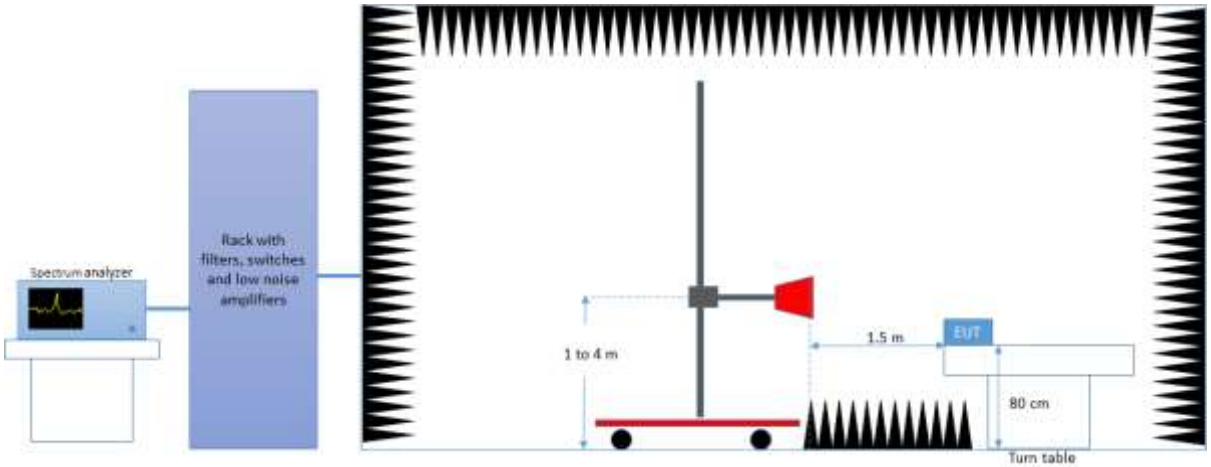
Radiated Setup < 1GHz



Radiated Setup 1 GHz - 18 GHz



Radiated Setup 18 GHz - 40 GHz



Test Results:

30 MHz – 40 GHz

Radiated Spurious emissions

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
599.8	38.0	---	46.0	8.0
2741.0	---	50.3	54.0	3.7
2743.5	59.7	---	74.0	14.3
17458.7	57.9	---	74.0	16.1
17996.6	---	49.2	54.0	4.8
20839.9	---	45.8	54.0	8.2
20839.9	48.0	---	74.0	26.0
36584.0	47.9	---	74.0	26.1
36605.7	---	36.3	54.0	17.7