Report No. 389081-01-R00

Test Report

Product	Handheld Battery Powered Power Tool with WiFi
Name and address of the applicant	Atlas Copco SE-105 23 Stockholm Sweden
Name and address of the manufacturer	Atlas Copco SE-105 23 Stockholm Sweden
Model	ICB-A
Rating	Secondary Battery (Li-Ion, 18 V_{DC}, 2.6 Ah, 46.8 Wh)
Trademark	Atlas Copco
Serial number	Nemko Order/Item No 3890810004
Additional information	WiFi
Tested according to	**Parts of FCC Part 15.247** Frequency Hopping Transmitters / Digital Transmission Systems **Parts of Industry Canada RSS-247, Issue 2** Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	389081
Tested in period	2020-07-03 to 2020-08-26
Issue date	2020-09-17
Name and address of the testing laboratory	Nemko Instituttveien 6 Kjeller, Norway CAB Number: FCC: NO0001 ISED: NO470

An accredited technical test executed under the Norwegian accreditation scheme

Prepared by [Jan G Eriksen]	Approved by [Frode Sveinsen]

Template version: C

CONTENTS

1 INFORMATION

1.1 Test Item

Name	**Atlas Copco**
Model/version	**ICB-A**
FCC ID	**2AQ8P-ICB**
ISED ID	**24224-ICB**
Serial number	**Item no: 3890810004**
Hardware identity and/or version	**2**
Software identity and/or version	**3.3**
Frequency Range	**2412 – 2462 MHz**
Number of Channels	**11**
Channel Separation	**5 MHz**
Operating Modes	**802.11b/g/n (HT20)**
Type of Modulation	**802.11b: DSSS** **802.11g/n: OFDM**
User Frequency Adjustment	**None**
Conducted Output Power	**802.11b: 17.0 mW** **802.11g: 66.1 mW** **802.11n HT20: 60.3 mW**
Power Supply	**Secondary Battery (Li-Ion, 18 V_{DC}, 46.8 Wh, 2.6 Ah)**
Desktop Charger	**N/A (Battery is charged in a separate charger)**
Antenna Connector	**None**
Number of Antennas	**2**
Diversity or Smart Antennas	**Diversity**

Description of Test Item

The tested device is a Power Tool with 2.4GHz and 5GHz WiFi.

1.2 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	18 V_{DC} (Nominal Voltage)

The values are the limit registered during the test period.

All tests were performed with a fully charged battery.

1.3 Test Engineer(s)

Jan G. Eriksen

1.4 Antenna Requirement

Is the antenna detachable? ☐ Yes ☒ No

If detachable, is the antenna connector non-standard? ☐ Yes ☐ No

Type of antenna connector: N/A

Ref. FCC §15.203

1.5 Worst-Case Configuration, Mode and Duty Cycle

Radiated Emissions and Power Line Conducted Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario. All measurements were performed with bitrate and duty cycle reported below.

Modulation	Worst Case Bitrate	Duty Cycle
802.11b	1 Mb	100 %
802.11g	6 Mb	100 %
802.11n HT20	MCS0	100 %

1.6 EUT Operating Modes

Description of operating modes	Continuous TX, 2.4GHz, IEEE 802.11 b/g/n HT20/HT40
Additional information	A computer was connected by USB to the EUT. Putty was used to log in with SH, and batch commands were used to program antenna, modulation, bit-rate and channel.

1.7 Power Levels

Output Power values below were used for all tests on this model. This is the maximum value.

	Modulation and Power Level		
Carrier No	802.11b	802.11g	802.11n HT20
1 to 11	127	127	127

1.8 Comments

All tested parameters are passed.

2 TEST REPORT SUMMARY

2.1 General

All measurements are tracable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and ISED RSS-247 Issue 2 and RSS-GEN Issue 5.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were performed in a semi-anechoic chamber at measuring distance of 3m.

A description of the test facility is on file with FCC and ISED Canada.

☒ New Submission	☒ Production Unit
☐ Class II Permissive Change	☐ Pre-production Unit
DTS Equipment Code	☐ Family Listing

THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in “Summary of Test Data”.

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 5 reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	**N/A**[1]
Antenna Requirement	15.203	6.8 (RSS-GEN)	**Complies**
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	**Complies**
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	**Complies**
DTS Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	**Complies**
Peak Power Output	15.247(b)	5.4 (RSS-247)	**Complies**
Power Spectral Density	15.247(d)	5.2 (2) (RSS-247)	**Complies**
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	**Complies**
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 7.3 (RSS-GEN) 8.9 (RSS-GEN)	**Complies**

[1] Covered by UPCS test report

Revision history

Revision	Date	Comment	Sign
00	2020-09-17	First edition	FS

3 TEST RESULTS

3.1 Occupied Bandwidth (99% BW)

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2013 Clause 6.9.2

Test Results: Complies

Measurement Data:

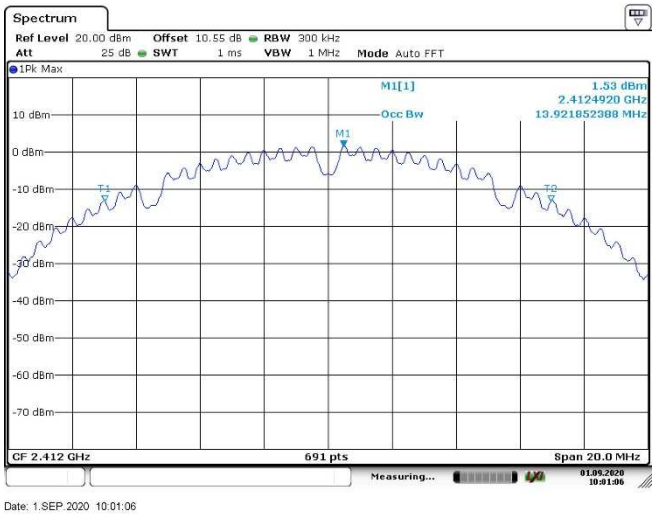
Modulation type and bitrate	Occupied Bandwidth (99% BW) (MHz)		
	Ch 01, 2412 MHz	Ch 06, 2437 MHz	Ch 11, 2462 MHz
802.11b, 1 Mbps	13.9	13.9	13.9
802.11g, 6 Mbps	17.5	17.6	17.5
802.11n, HT20	18.2	18.3	18.3

Occupied Bandwith is reported for information only.

See attached plots

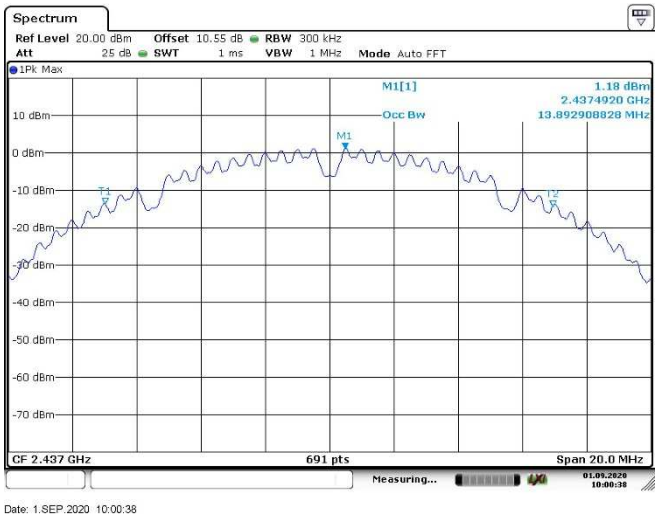
Requirements:

No requirements for Digital Transmission Systems.



Date: 1.SEP.2020 10:01:06

99% Occupied BW, 2412 MHz, 802.11b, 1Mb

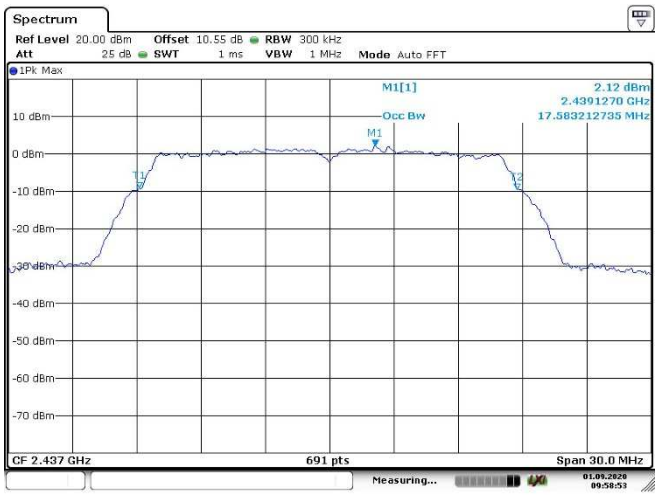


Date: 1.SEP.2020 10:00:38

99% Occupied BW, 2437 MHz, 802.11b, 1Mb

Date: 1.SEP.2020 10:01:39

99% Occupied BW, 2412 MHz, 802.11g, 6Mb



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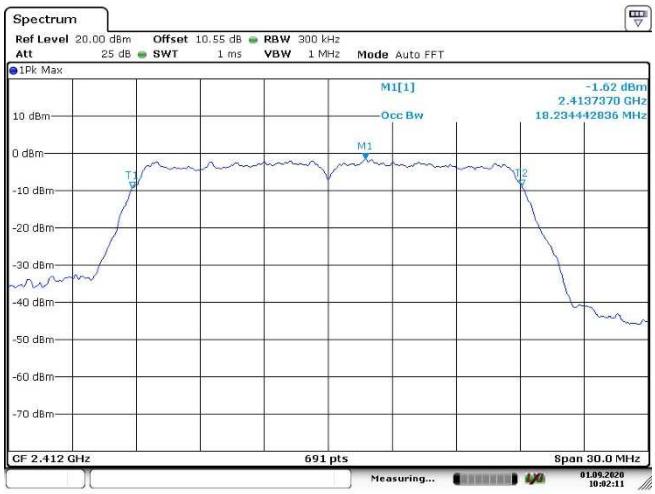
99% Occupied BW, 2437 MHz, 802.11g, 6Mb



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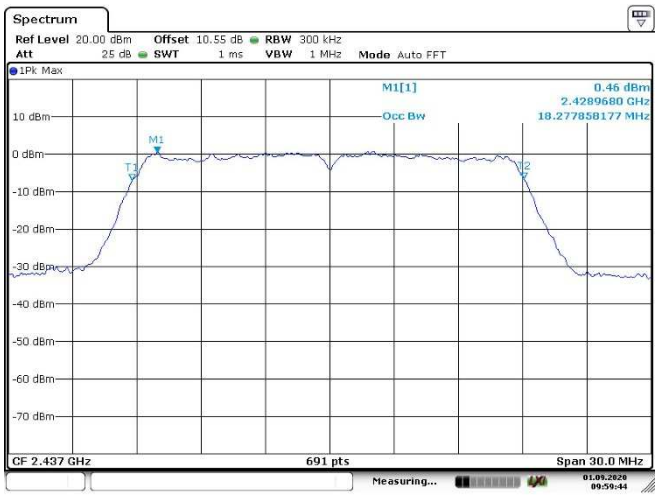
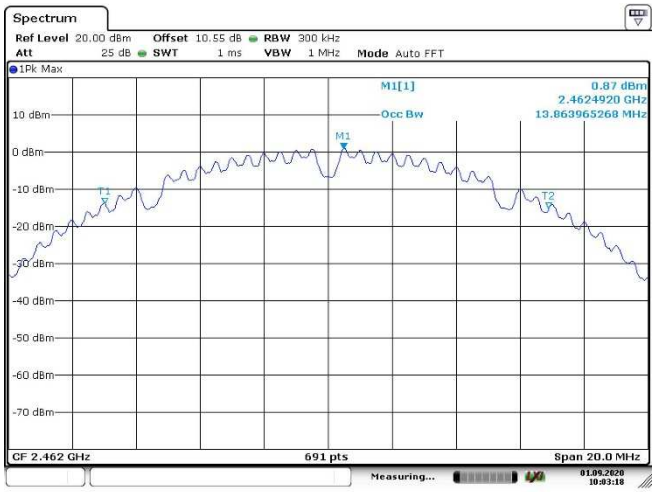
99% Occupied BW, 2412 MHz, 802.11n, HT20



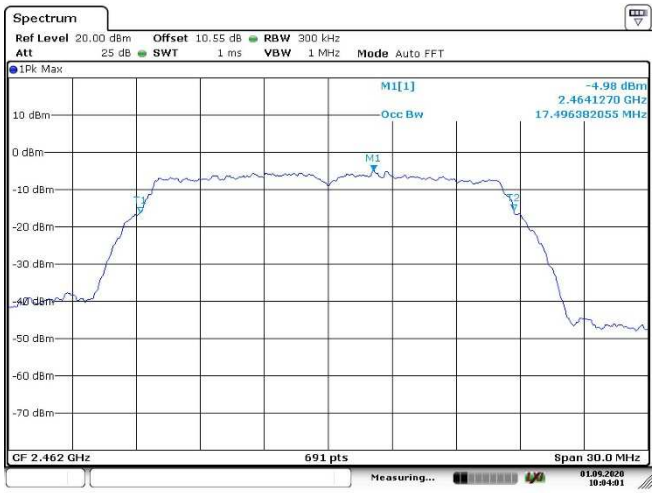
Date: 1.SEP.2020 09:59:44

99% Occupied BW, 2437 MHz, 802.11n, HT20



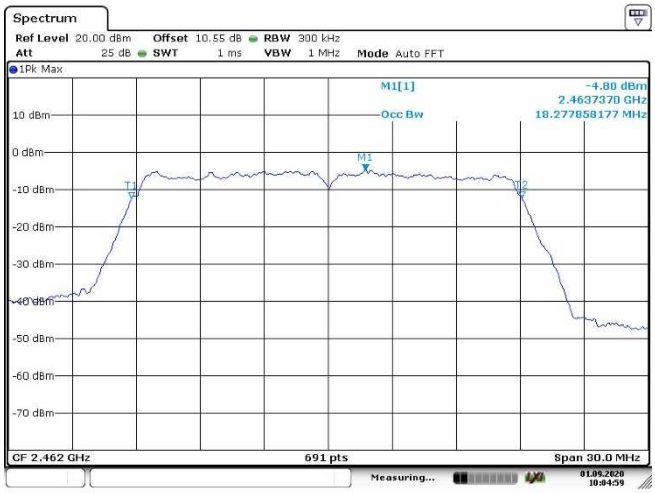
Date: 1.SEP.2020 10:03:18

99% Occupied BW, 2462 MHz, 802.11b, 1Mb



Date: 1.SEP.2020 10:04:01

99% Occupied BW, 2462 MHz, 802.11g, 6Mb



Date: 1.SEP.2020 10:04:59

99% Occupied BW, 2462 MHz, 802.11n, HT20

3.2 DTS Bandwidth

FCC Part 15.247 (a)(2)

ISED Canada RSS-247 Issue 2, Clause 5.2 (1)

Measurement procedure: **ANSI C63.10-2013 Clause 11.8**

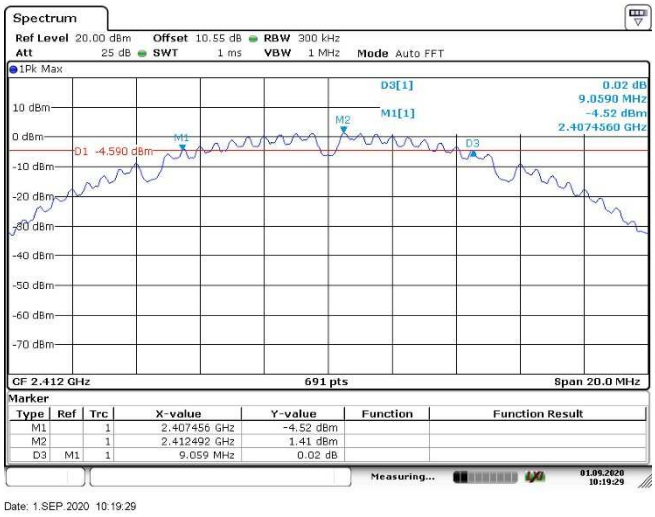
Test Results: **Complies**

Measurement Data:

Modulation type and bitrate	Measured DTS Bandwidth (MHz)		
	Ch 01, 2412 MHz	Ch 06, 2437 MHz	Ch 11, 2462 MHz
802.11b, 1 Mbps	9.1	9.1	8.1
802.11g, 6 Mbps	16.6	16.5	16.5
802.11n, HT20	17.8	17.8	17.8

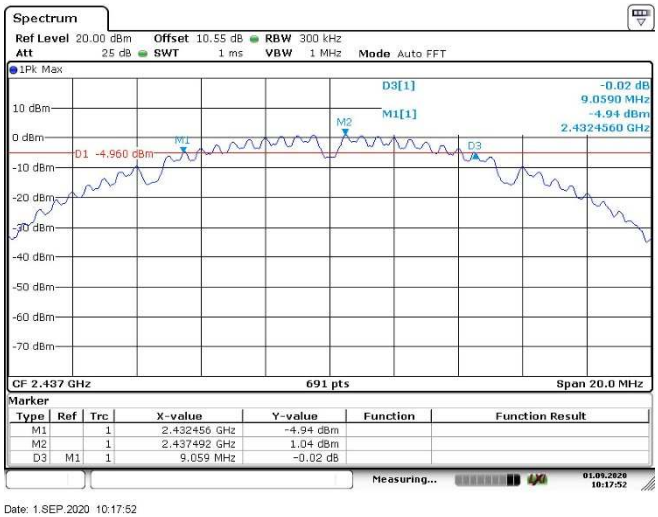
Requirements:

For Digital Transmission Systems in the 2400-2483.5 MHz band the minimum 6 dB bandwidth (DTS BW) shall be at least 500 KHz.



Date: 1.SEP.2020 10:19:29

DTS Bandwidth, 2412 MHz, 802.11b, 1Mb



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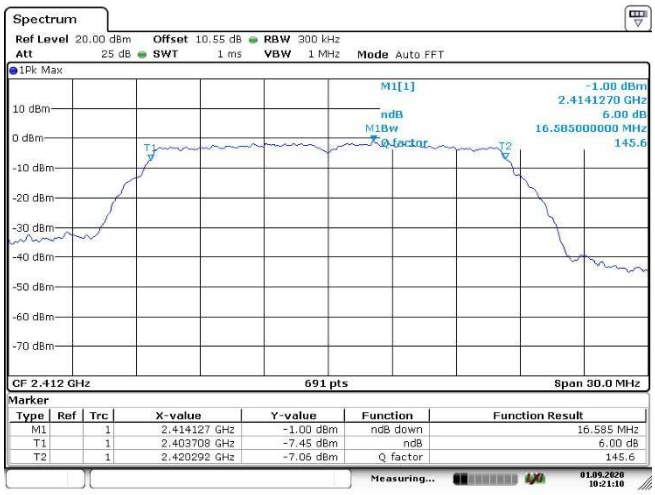
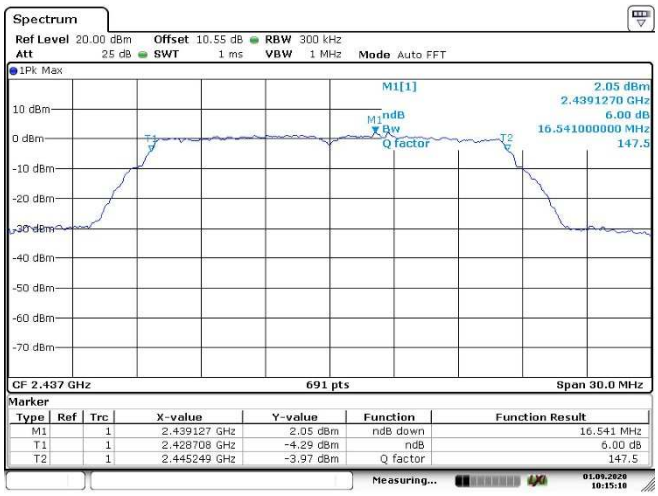
DTS Bandwidth, 2437 MHz, 802.11b, 1Mb



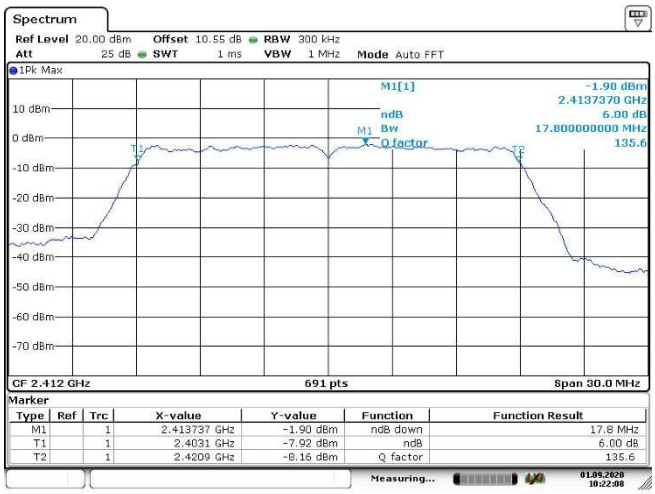
Date: 1.SEP.2020 10:21:11

DTS Bandwidth, 2412 MHz, 802.11g, 6Mb



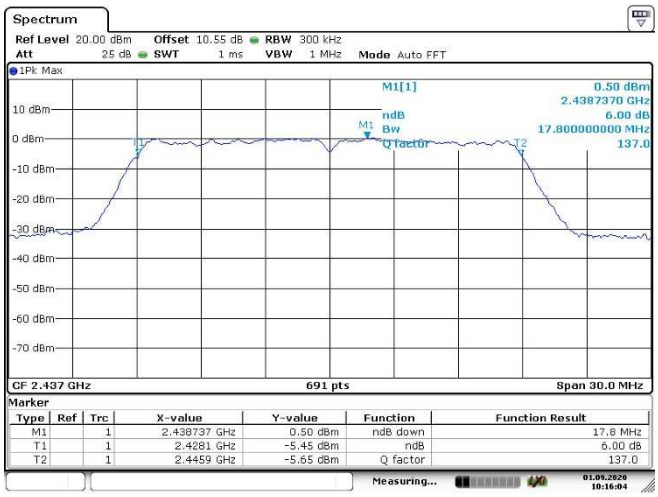
Date: 1.SEP.2020 10:15:10

DTS Bandwidth, 2437 MHz, 802.11g, 6Mb



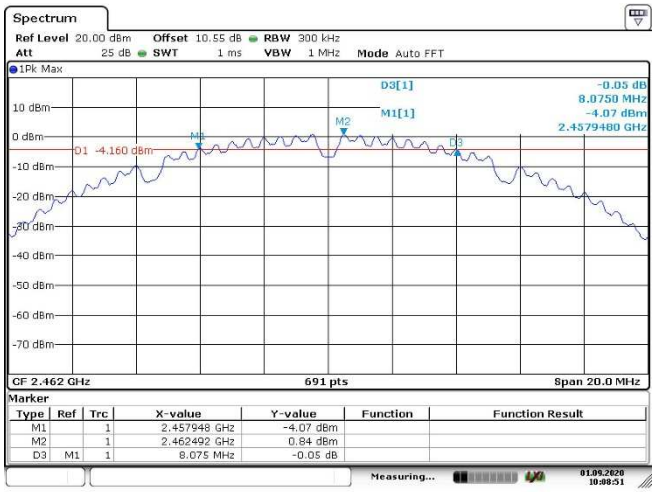
Date: 1.SEP.2020 10:22:08

DTS Bandwidth, 2412 MHz, 802.11n, HT20



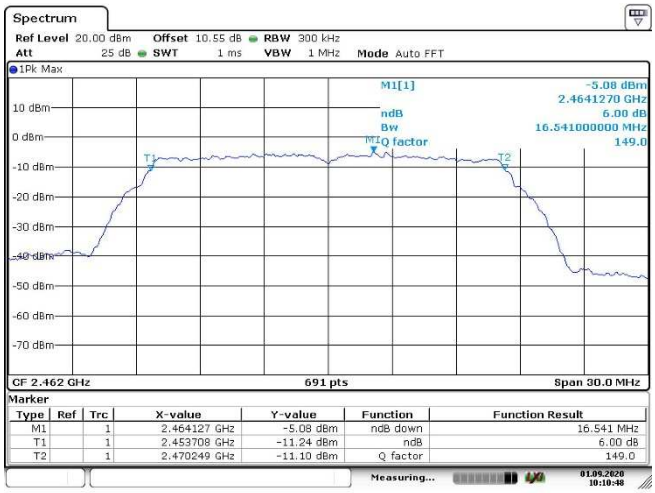
Date: 1.SEP.2020 10:16:05

DTS Bandwidth, 2437 MHz, 802.11n, HT20



Date: 1.SEP.2020 10:08:51

DTS Bandwidth, 2462 MHz, 802.11b, 1Mb



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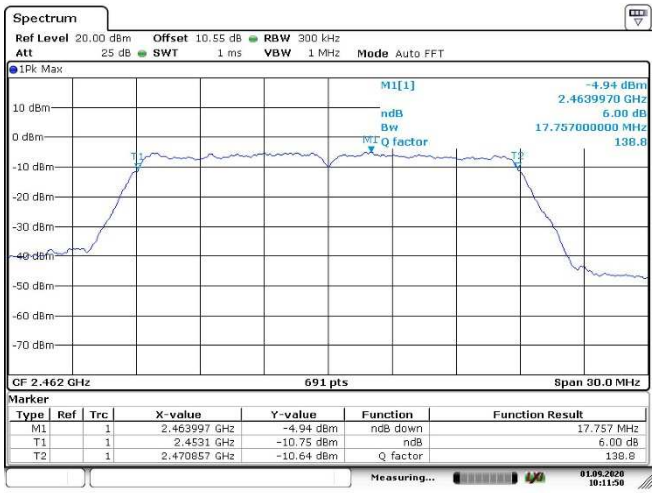
DTS Bandwidth, 2462 MHz, 802.11g, 6Mb



Date: 1.SEP.2020 10:11:51

DTS Bandwidth, 2462 MHz, 802.11n, HT20

3.3 Peak Power Output, RMS

FCC Part 15.247 (b)

ISED Canada RSS-247 Issue 2, Clause 5.4

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

Carrier Frequency	Peak Conducted Power (dBm)		
(MHz)	802.11b 1Mbps	802.11g 6Mbps	802.11n HT20
2412	12.3	15.3	15.1
2437	11.8	18.2	17.8
2462	11.3	11.2	11.9

The Integrated Band Power Method was used to measure Output Power

Radiated Power was calculated from measured Field Strength using the method described in FCC KDB 412172 D01

Cable loss and Attenuator is included in the Conducted plots.

Transducer factor is included in the radiated plots.

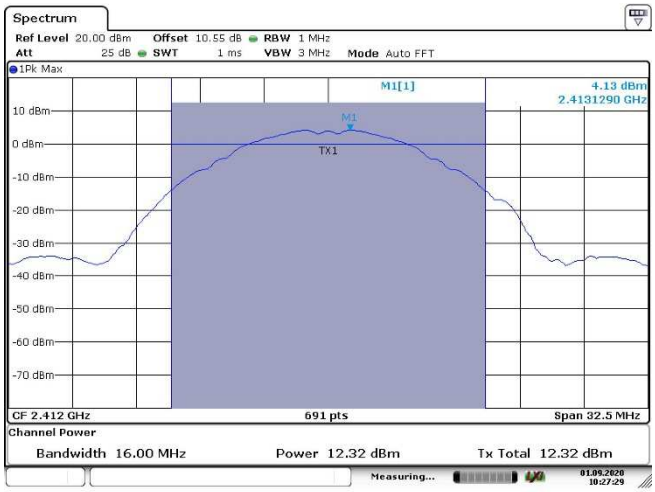
See attached plots

Requirements:

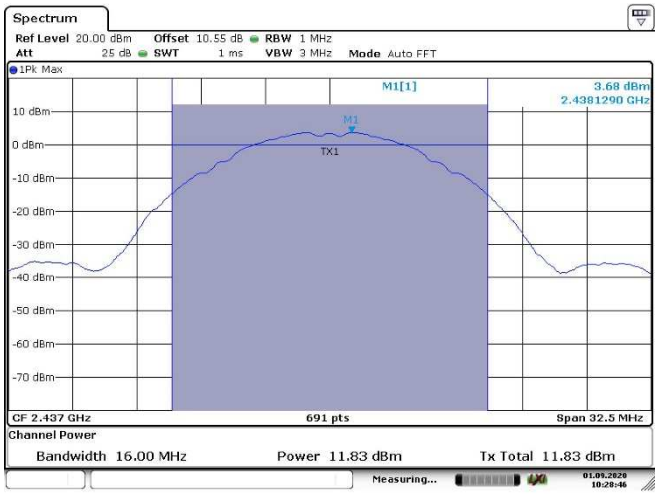
The maximum peak output power shall not exceed the following limits:

For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

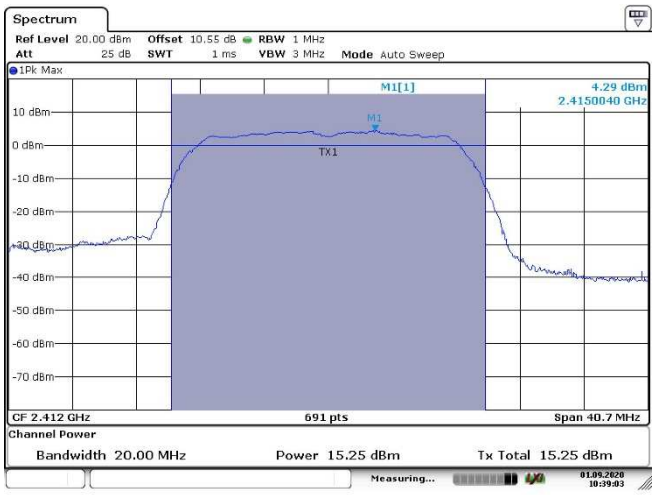
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



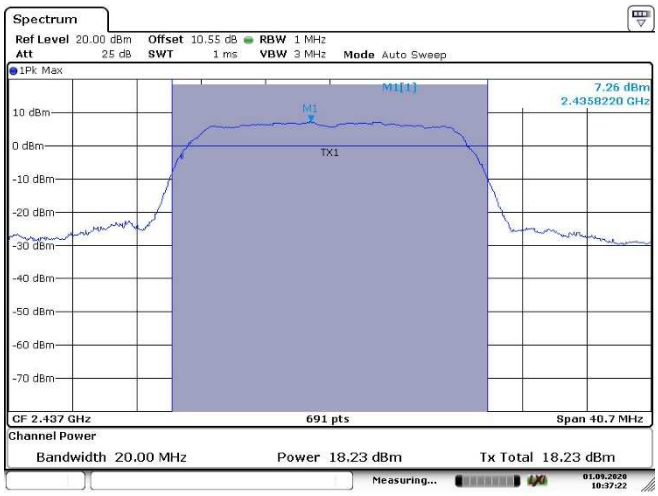
Peak Conducted Power, 2412 MHz, 802.11b, 1Mb



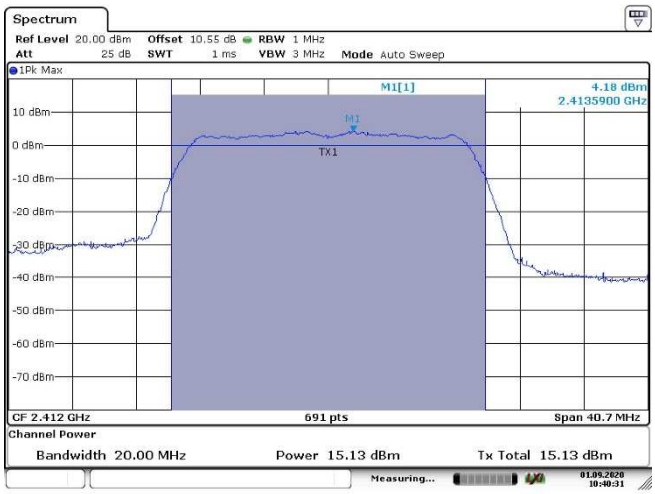
Peak Conducted Power, 2437 MHz, 802.11b, 1Mb



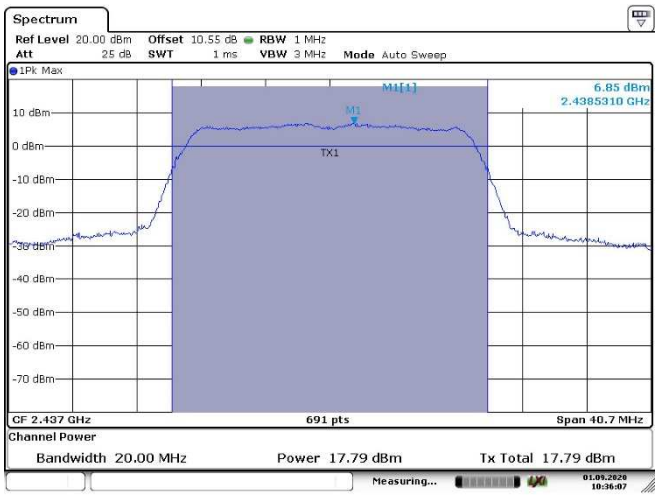
Peak Conducted Power, 2412 MHz, 802.11g, 6Mb



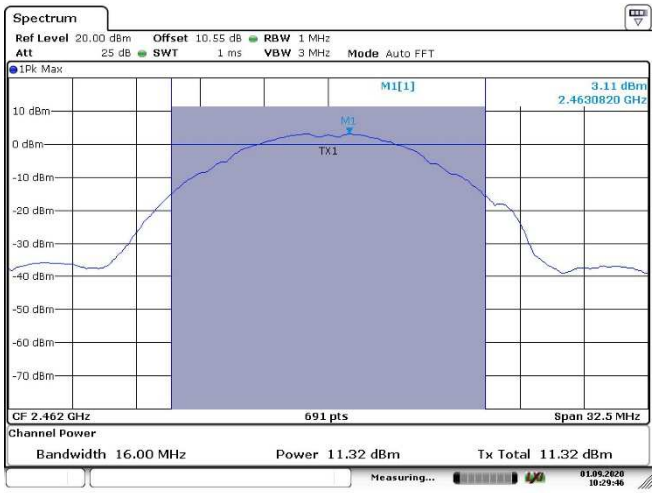
Peak Conducted Power, 2437 MHz, 802.11g, 6Mb



Peak Conducted Power, 2412 MHz, 802.11n, HT20



Peak Conducted Power, 2437 MHz, 802.11n, HT20



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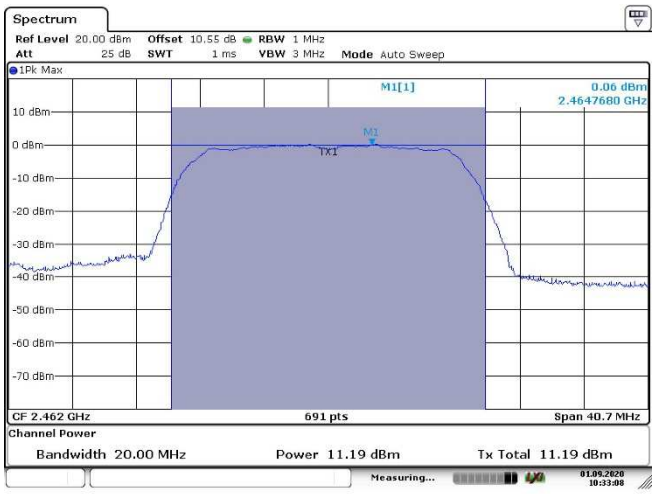
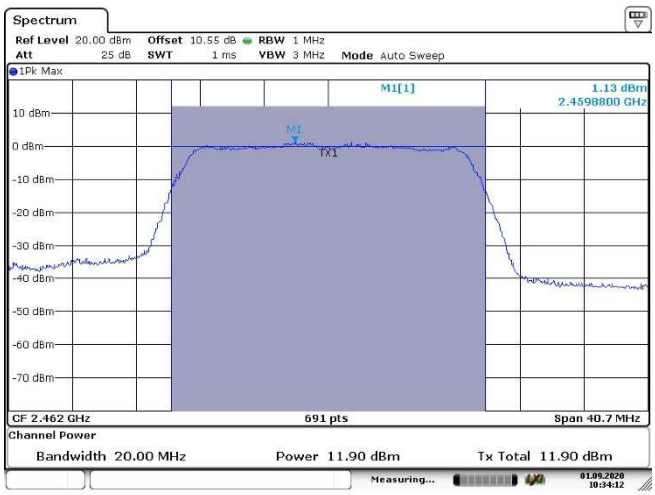
Peak Conducted Power, 2462 MHz, 802.11b, 1Mb



Date: 1.SEP.2020 10:33:08

Peak Conducted Power, 2462 MHz, 802.11g, 6Mb



Date: 1.SEP.2020 10:34:12

Peak Conducted Power, 2462 MHz, 802.11n, HT20

3.4 Restricted Bands of operation

Restricted Bands of operation for FCC and ISED are defined in FCC Part 15.205 and ISED RSS-GEN, Issue 5 clause 8.10.

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 5, clause 8.9.

FCC (MHz)	ISED (MHz)	FCC (GHz)	ISED (GHz)
0.090-0.110		**0.96-1.24** **1.3-1.427**	**0.96-1.427**
0.495-0.505		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	3.020-3.026	1.660-1.710	
4.125-4.128		1.7188-1.7222	
4.17725-4.17775		2.2-2.3	
4.20725-4.20775		2.31-2.39	
	5.677-5.683	2.4835-2.5	
6.215-6.218		**2.69-2.9**	**2.655-2.9**
6.26775-6.26825		3.26-3.267	
6.31175-6.31225		3.332-3.339	
8.291-8.294		3.3458-3.358	
8.362-8.366		**3.6-4.4**	**3.5-4.4**
8.37625-8.38675		4.5-5.15	
8.41425-8.41475		5.35-5.46	
12.29-12.293		7.25-7.75	
12.51975-12.52025		8.025-8.5	
12.57675-12.57725		9.0-9.2	
13.36-13.41		9.3-9.5	
16.42-16.423		10.6-12.7	
16.69475-16.69525		13.25-13.4	
16.80425-16.80475		14.47-14.5	
25.5-25.67		15.35-16.2	
37.5-38.25		17.7-21.4	
73-74.6		22.01-23.12	
74.8-75.2		23.6-24.0	
108-121.94 **123-138**	**108-138**	31.2-31.8	
149.9-150.05		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
162.0125-167.17			
167.72-173.2			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISED, all other frequencies are common.

3.5 Radiated Emissions, Band Edge

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3 / 8.9

Measurement procedure: **ANSI C63.10-2013 Clause 11.12**

Test Results: Complies

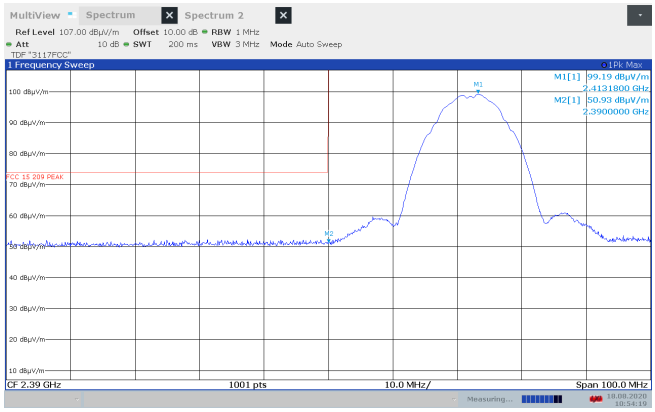
Measurement Data:

Peak Detector					
Modulation and Bitrate	Measured field strength (dBµV/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
802.11b, 1 Mbps	50.9	52.0	74	23.1	22.0
802.11g, 6 Mbps	61.8	53.2	74	12.2	20.8
802.11n, MCS0, HT20	62.7	52.6	74	11.3	21.4

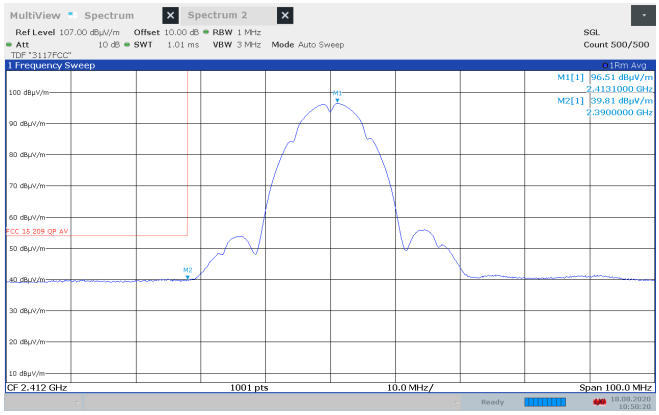
Average Detector					
Modulation and Bitrate	Measured field strength (dBµV/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
802.11b, 1 Mbps	39.8	39.9	54	14.2	14.1
802.11g, 6 Mbps	45.3	39.7	54	8.7	14.3
802.11n, MCS0, HT20	46.0	39.6	54	8.0	14.4

Average values were measured using method SA-1 (Duty Cycle ≈100%)

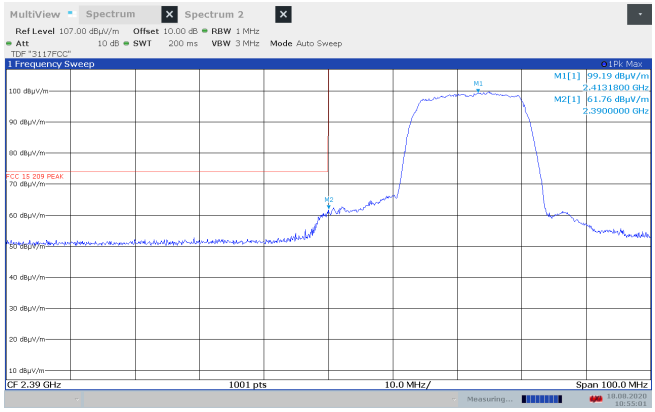
See attached plots



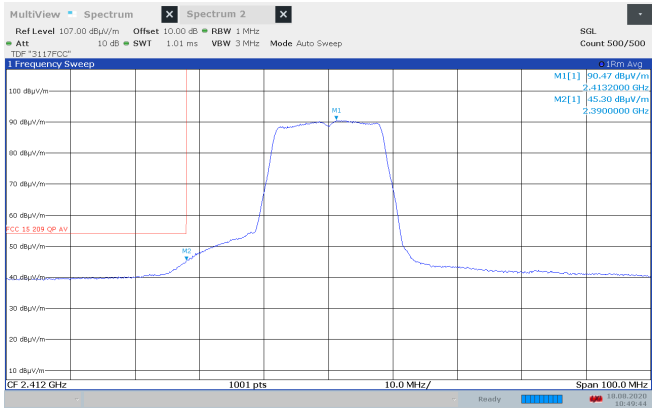
Lower Band Edge, 2412 MHz, 802.11b, 1Mb, Ant 2, VP, Peak



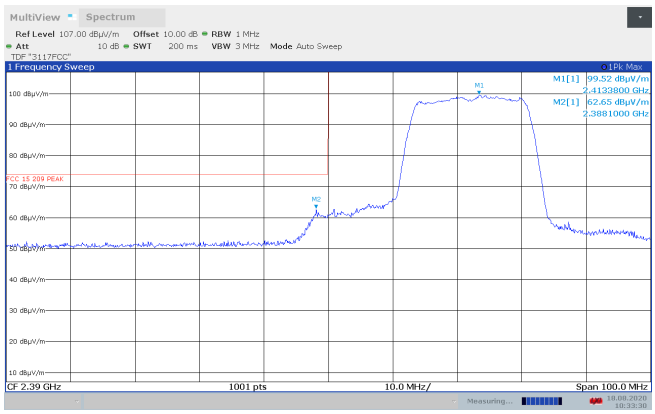
Lower Band Edge, 2412 MHz, 802.11b, 1Mb, Ant 2, VP, Average



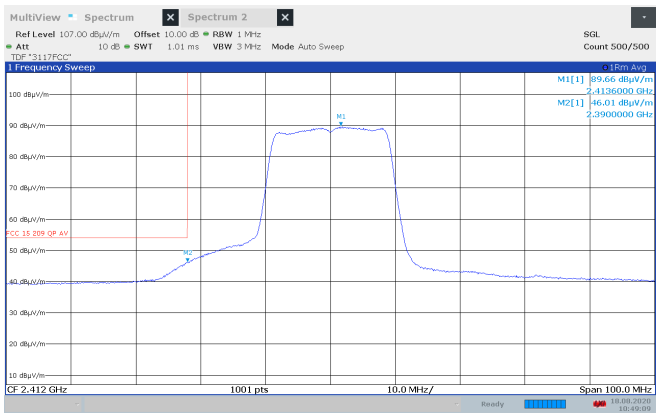
Lower Band Edge, 2412 MHz, 802.11g, 6Mb, Ant 2, VP, Peak



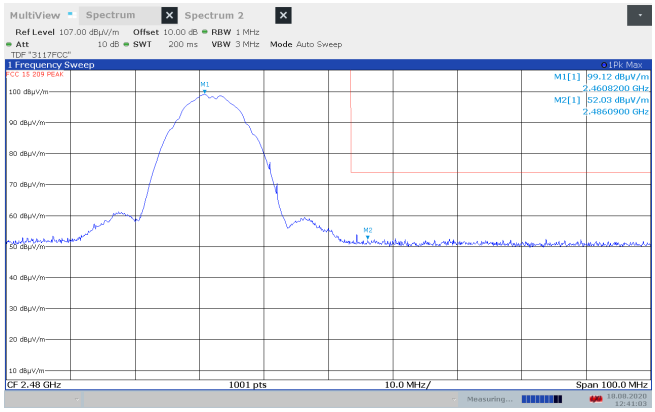
Lower Band Edge, 2412 MHz, 802.11g, 6Mb, Ant 2, VP, Average



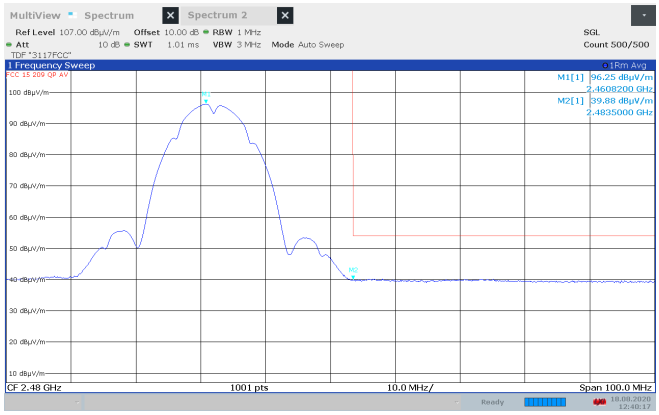
Lower Band Edge, 2412 MHz, 802.11n, HT20, Ant 2, VP, Peak



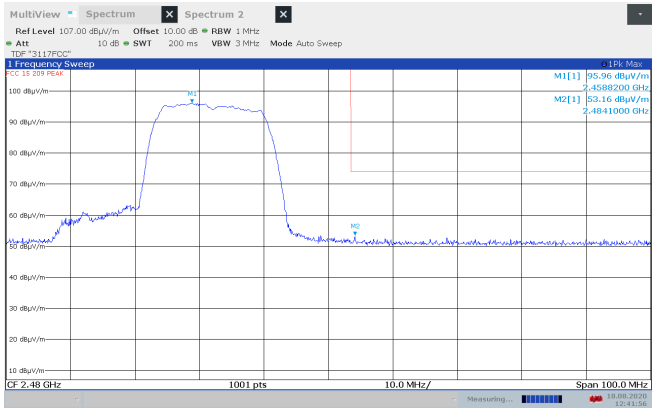
Lower Band Edge, 2412 MHz, 802.11n, HT20, Ant 2, VP, Average



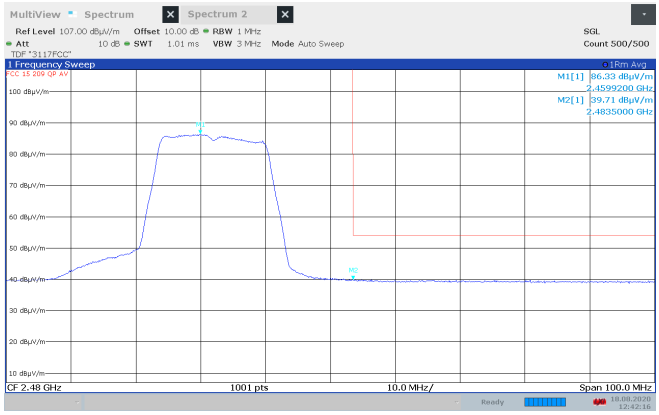
Upper Band Edge, 2462 MHz, 802.11b, 1Mb, Ant 1, VP, Peak



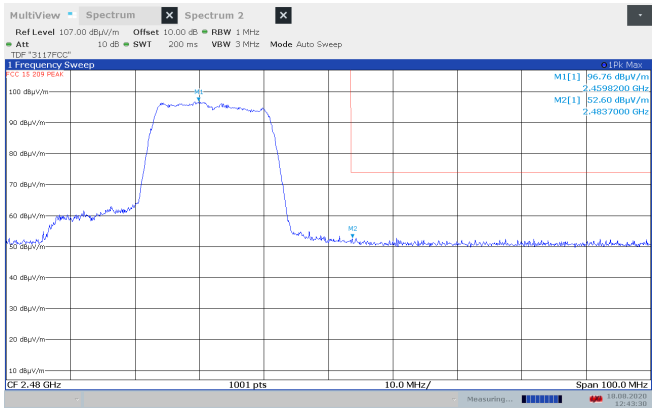
Upper Band Edge, 2462 MHz, 802.11b, 1Mb, Ant 1, VP, Average



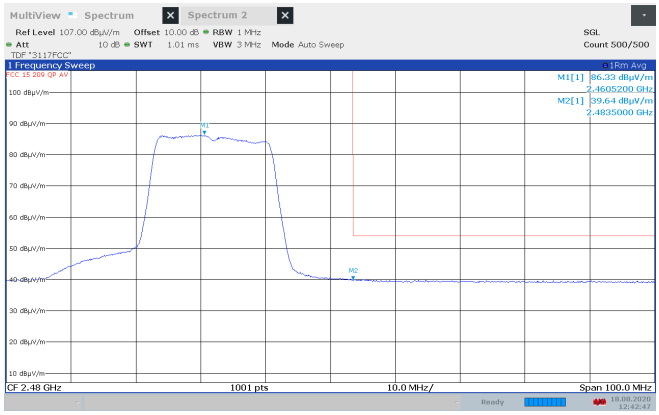
Upper Band Edge, 2462 MHz, 802.11g, 6Mb, Ant 1, VP, Peak



Upper Band Edge, 2462 MHz, 802.11g, 6Mb, Ant 1, VP, Average



Upper Band Edge, 2462 MHz, 802.11n, HT20, Ant 1, VP, Peak



Upper Band Edge, 2462 MHz, 802.11n, HT20, Ant 1, VP, Average

3.6 Radiated Emissions 30 – 1000 MHz

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

Detector: Peak

Measuring distance 3m.

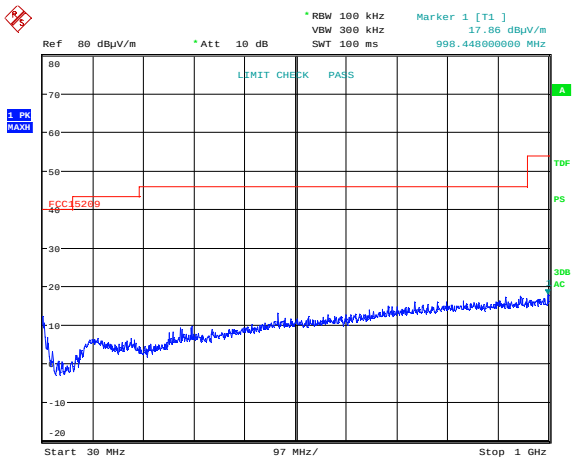
Tested in test mode with EUT transmitting on Ch06 with any modulation.

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol
30-1000	< 20.0	See table below	> 20	120.000	1-4 m	H/V

See attached plots.

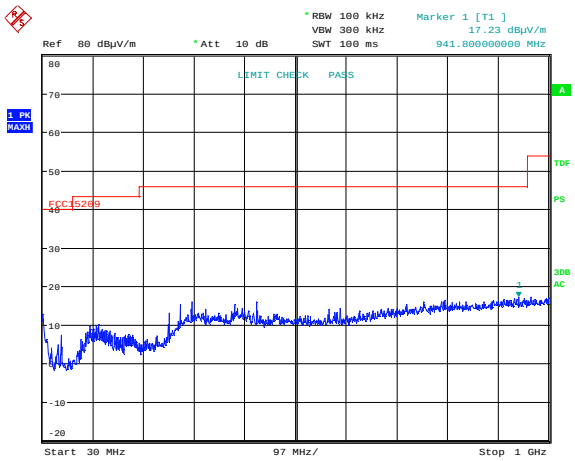
Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 µV/m	40.0 dBµV/m
88 – 216 MHz	150 µV/m	43.5 dBµV/m
216 – 960 MHz	200 µV/m	46.0 dBµV/m
960 – 1000 MHz	500 µV/m	54.0 dBµV/m
	Limits above are with Quasi Peak Detector	



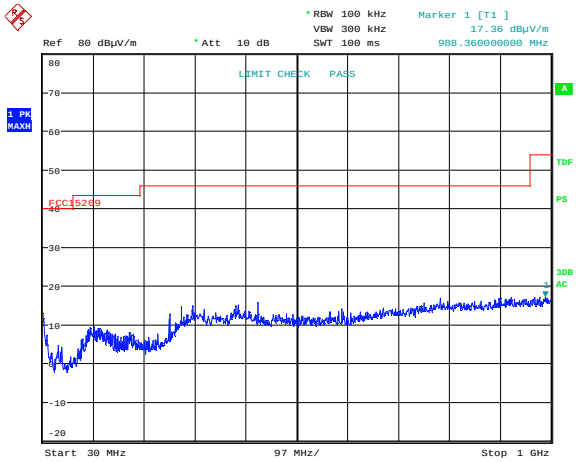
Date: 26.AUG.2020 07:59:51

Radiated Emissions 30 -1000 MHz, 2437 MHz, 802.11g, 1Mb, VP



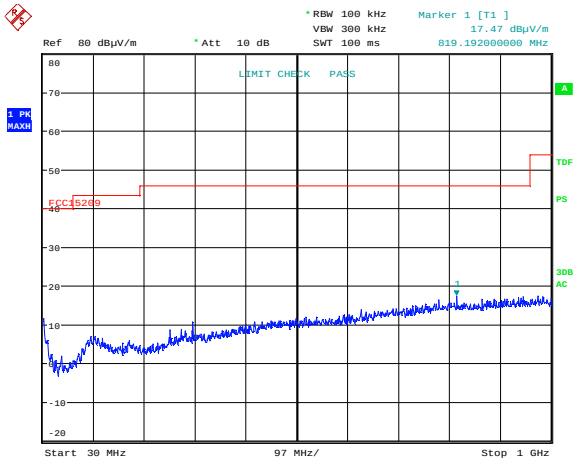
Date: 26.AUG.2020 08:23:31

Radiated Emissions 30 -1000 MHz, 2437 MHz, 802.11g, 1Mb, HP



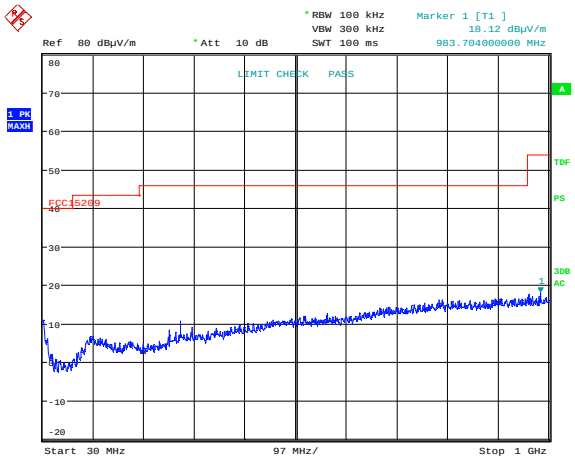
Date: 26.AUG.2020 08:18:10

Radiated Emissions 30 -1000 MHz, 2437 MHz, 802.11n, 6Mb, VP



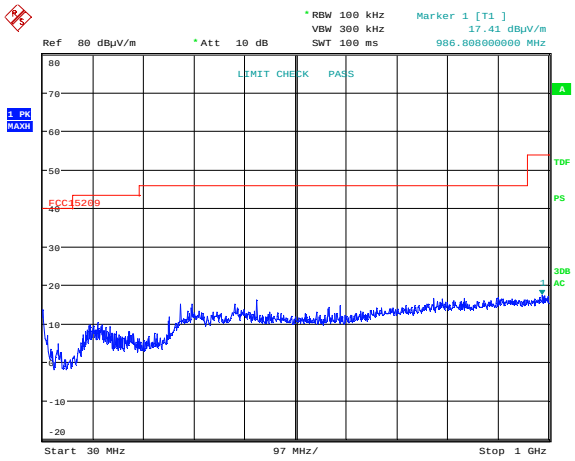
Date: 26.AUG.2020 08:32:58

Radiated Emissions 30 -1000 MHz, 2437 MHz, 802.11n, 6Mb, HP



Date: 26.AUG.2020 08:20:04

Radiated Emissions 30 -1000 MHz, 2437 MHz, 802.11n, HT20, VP



Date: 26.AUG.2020 08:07:54

Radiated Emissions 30 -1000 MHz, 2437 MHz, 802.11g, HT20, HP

3.7 Radiated Emissions, 1 – 18 GHz

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: **ANSI C63.10-2013 Clause 11.12**

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1–18 GHz)
a pre-scan was performed above 18 GHz at approximately 20 cm distance.

Bandwidths: RBW=1MHz / VBW=3MHz

Carrier Frequency (MHz)	Measured Frequency (MHz)	Modulation Scheme	Peak Level (dBµV/m)	Average Level (dBµV/m)	Pk Limit (dBµV/m)	Av Limit (dBµV/m)	Peak Margin (dB)	Av Margin (dB)
2412	1000-2390	802.11b 1Mb	< 45	< 40	74	54	> 29	> 14
2412	2493.5-4000	802.11b 1Mb	< 45	< 40	74	54	> 29	> 14
2412	4000-15000	802.11b 1Mb	< 50	< 40	74	54	> 24	> 14
2412	15000-18000	802.11b 1Mb	< 54	< 45	74	54	> 20	> 9
2412	1000-2390	802.11g 6Mb	< 45	< 40	74	54	> 29	> 14
2412	2493.5-4000	802.11g 6Mb	< 45	< 40	74	54	> 29	> 14
2412	4000-15000	802.11g 6Mb	< 50	< 40	74	54	> 24	> 14
2412	15000-18000	802.11b 1Mb	< 54	< 45	74	54	> 20	> 9
2462	1000-2390	802.11b 1Mb	< 45	< 40	74	54	> 29	> 14
2462	2493.5-4000	802.11b 1Mb	< 45	< 40	74	54	> 29	> 14
2462	4000-15000	802.11b 1Mb	< 50	< 40	74	54	> 24	> 14
2462	15000-18000	802.11b 1Mb	< 54	< 45	74	54	> 20	> 9
2462	1000-2390	802.11g 6Mb	< 45	< 40	74	54	> 29	> 14
2462	2493.5-4000	802.11g 6Mb	< 45	< 40	74	54	> 29	> 14
2462	4000-15000	802.11g 6Mb	< 50	< 40	74	54	> 24	> 14
2462	15000-18000	802.11g 6Mb	< 54	< 45	74	54	> 20	> 9
2437 *	18000-26000	802.11g 1Mb	< 63	< 50	74	54	> 11 *	> 4 *
2437 *	18000-26000	802.11g 6Mb	< 63	< 50	74	54	> 29 *	> 9 *

Note: *) Prescan at 20 cm distance.

Measured results are for 802.11b 1Mb, and 802.11a 6 Mbps, it was checked that other modulations and/or bitrates did not produce higher emissions.

A Band High Pass Filter was used for measurements over 3000 MHz.

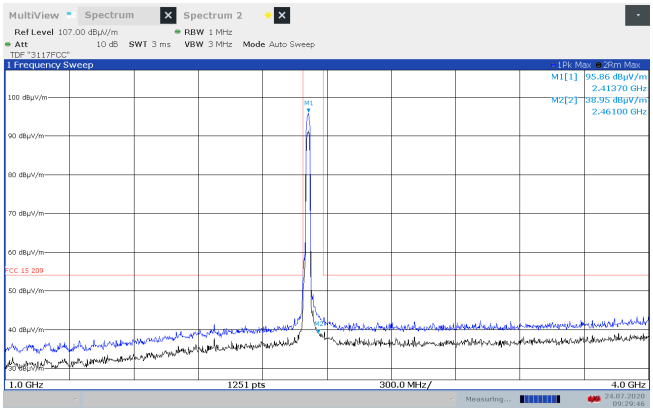
Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer “Transducer factor”.

See attached plots.

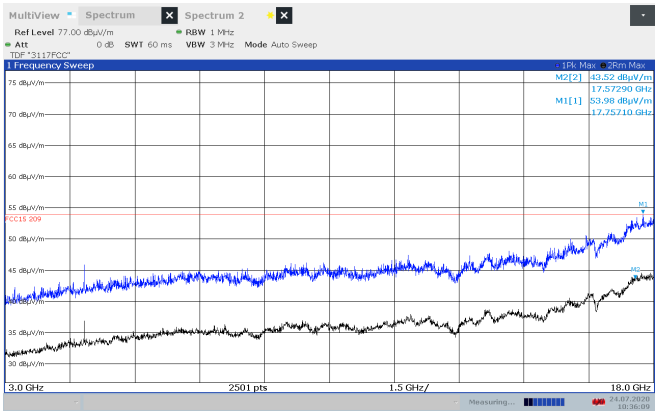
Average Detector values were measured with method SA-1. Duty Cycle was 100% for all measurements.

Requirements/Limit

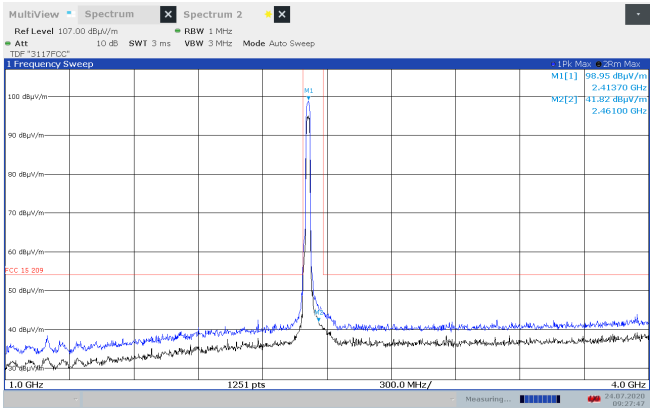
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	Average Detector	Peak Detector
1 – 25 GHz	54.0 dBµV/m	74.0 dBµV/m



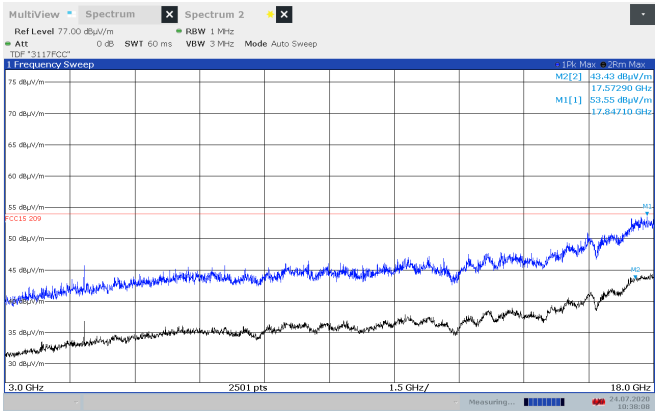
Radiated Emissions 1-4 GHz, 2412 MHz, 802.11g, 1Mb, Ant 1, VP



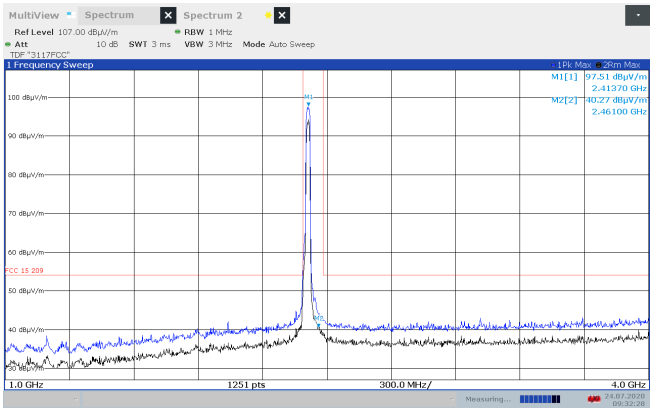
Radiated Emissions 3-18 GHz, 2412 MHz, 802.11g, 1Mb, Ant 1, VP



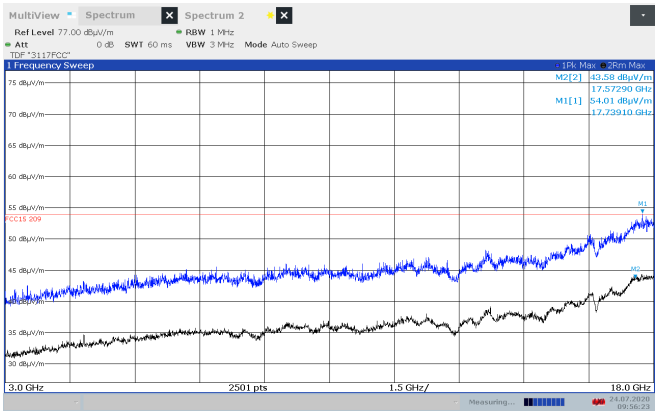
Radiated Emissions 1-4 GHz, 2412 MHz, 802.11n, 1Mb, Ant 1, HP



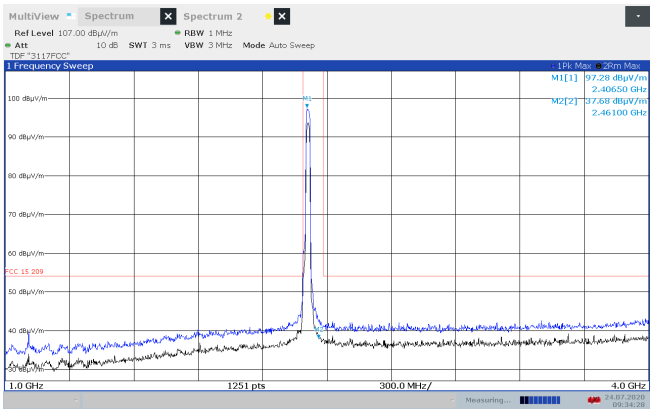
Radiated Emissions 3-18 GHz, 2412 MHz, 802.11n, 1Mb, Ant 1, HP

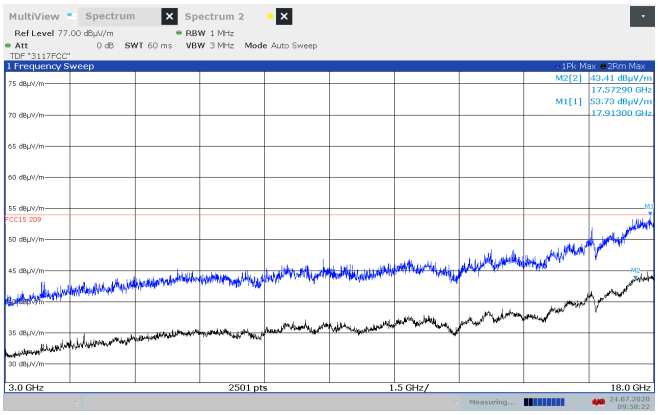


Radiated Emissions 1-4 GHz, 2412 MHz, 802.11b, 6Mb, Ant 1, VP

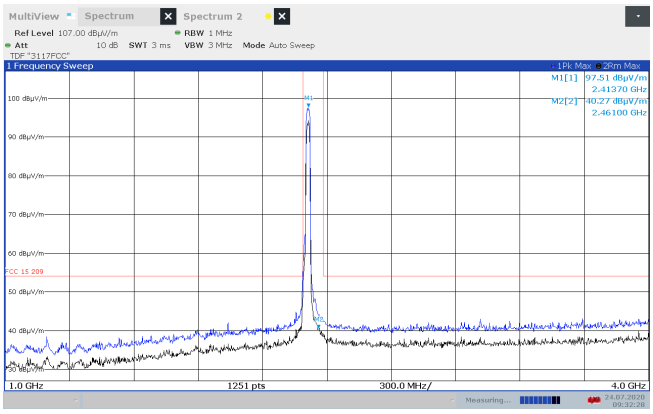


Radiated Emissions 3-18 GHz, 2437 MHz, 802.11b, 6Mb, Ant 1, VP

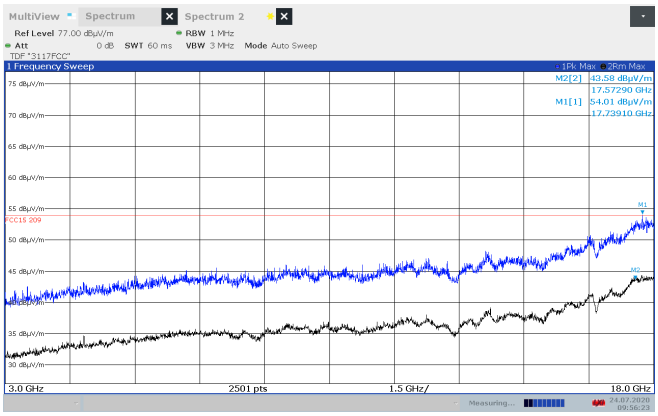




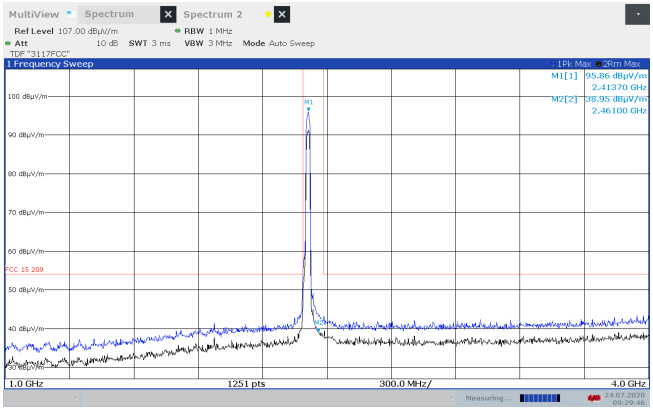
Radiated Emissions 1-4 GHz, 2412 MHz, 802.11g, 6Mb, Ant 1, HP



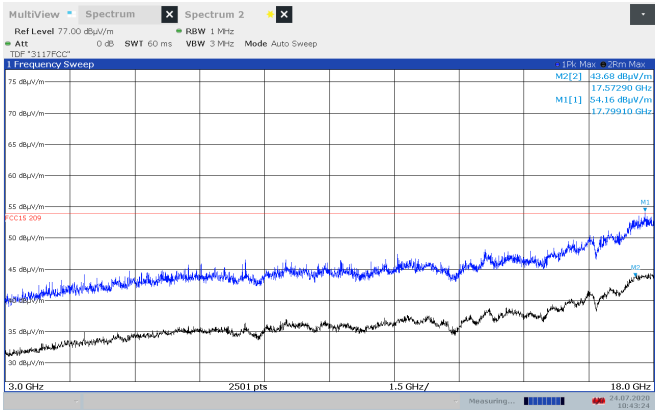
Radiated Emissions 1-18 GHz, 2412 MHz, 802.11g, 6Mb, Ant 1, HP



Radiated Emissions 1-4 GHz, 2412 MHz, 802.11n, 6Mb, Ant 2, VP

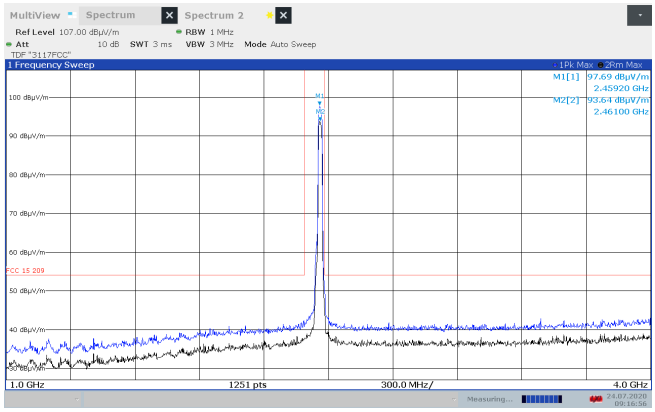


Radiated Emissions 1-18 GHz, 2412MHz, 802.11n, 6Mb, Ant 2, VP

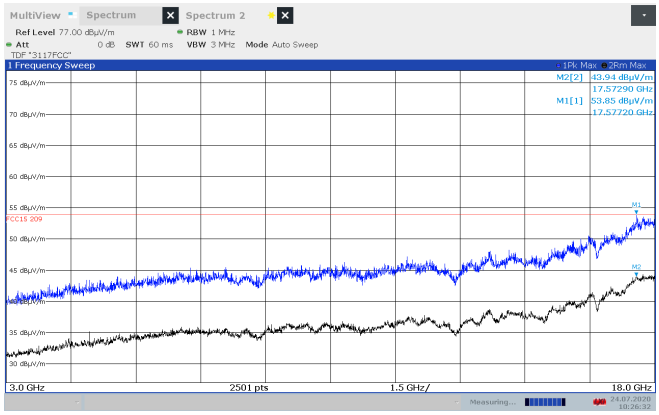


Radiated Emissions 1-4 GHz, 2412 MHz, 802.11n, 6Mb, Ant 2, HP

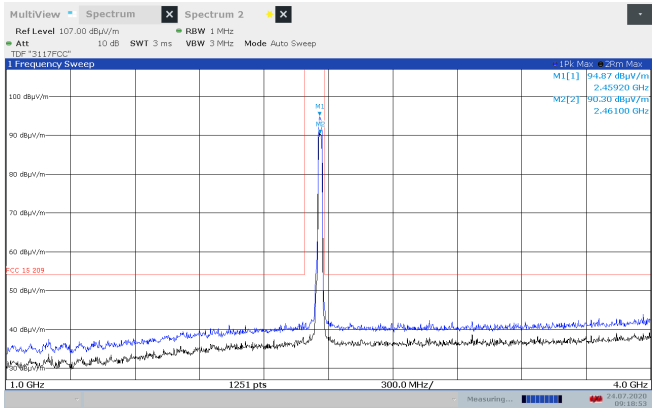
Radiated Emissions 1-18 GHz, 2412MHz, 802.11n, 6Mb, Ant 2, HP



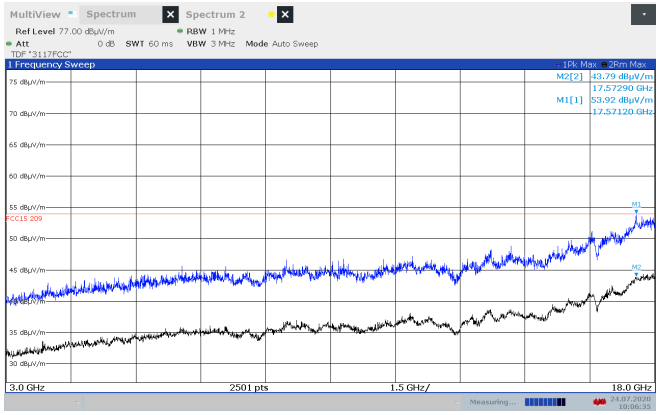
Radiated Emissions 1-4 GHz, 2462 MHz, 802.11n, 6Mb, Ant 1, VP



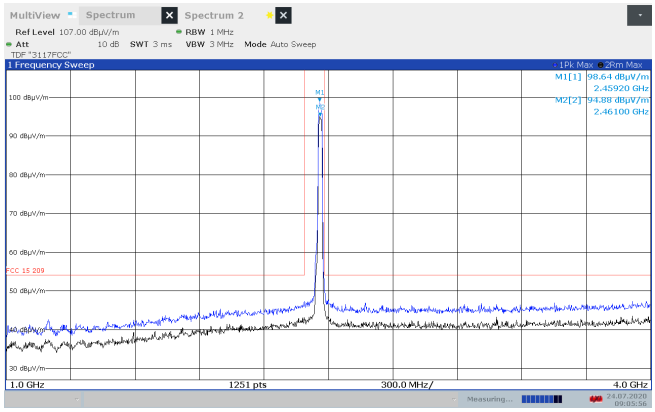
Radiated Emissions 1-18 GHz, 2462MHz, 802.11n, 6Mb, Ant 1, VP



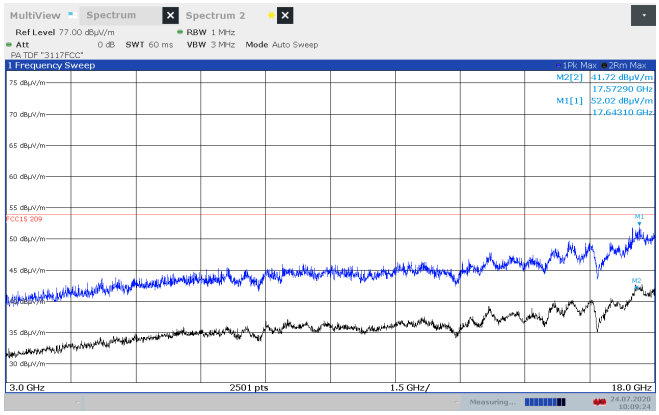
Radiated Emissions 1-4 GHz, 2462 MHz, 802.11n, 6Mb, Ant 1, HP



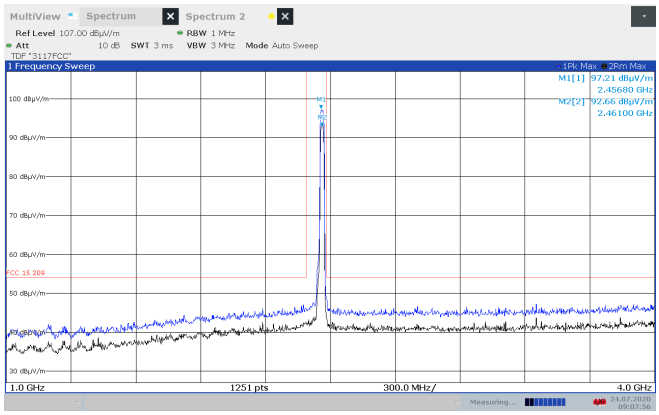
Radiated Emissions 1-18 GHz, 2462MHz, 802.11n, 6Mb, Ant 1, HP

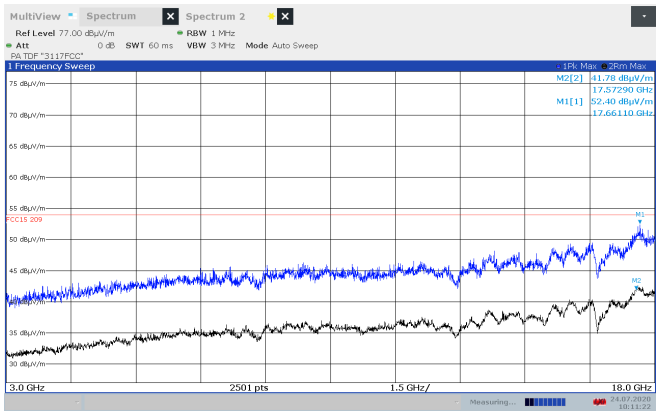


Radiated Emissions 1-4 GHz, 2462 MHz, 802.11n, 6Mb, Ant 2, VP



Radiated Emissions 1-18 GHz, 2462MHz, 802.11n, 6Mb, Ant 2, VP





Radiated Emissions 1-4 GHz, 2462 MHz, 802.11n, 6Mb, Ant 2, HP

Radiated Emissions 1-18 GHz, 2462MHz, 802.11n, 6Mb, Ant 2, HP

3.8 Power Spectral Density (PSD)

FCC part 15.247(d)

ISED Canada RSS-247 Issue 2, Clause 5.2 (2)

Measurement procedure: ANSI C63.10-2013 Clause 11.10

Test Results: Complies

Measurement Data:

The measurement procedures PKPSD described in ANSI C63.10-2013 was used.

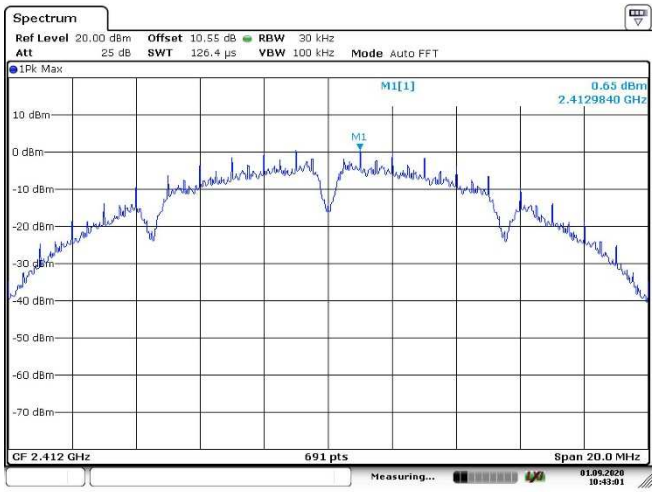
Carrier Frequency	Power Spectral Density (dBm/3kHz)		
	802.11b, 1Mbps	802.11g, 6 Mbps	802.11n, MCS0
2412 MHz	-9.3	-19.0	-19.7
2437 MHz	-9.3	-15.9	-17-3
2462 MHz	-9.5	-23.2	-22.8

Values measured with 30 kHz RBW are corrected by a Bandwidth Correction Factor of -10 dB.

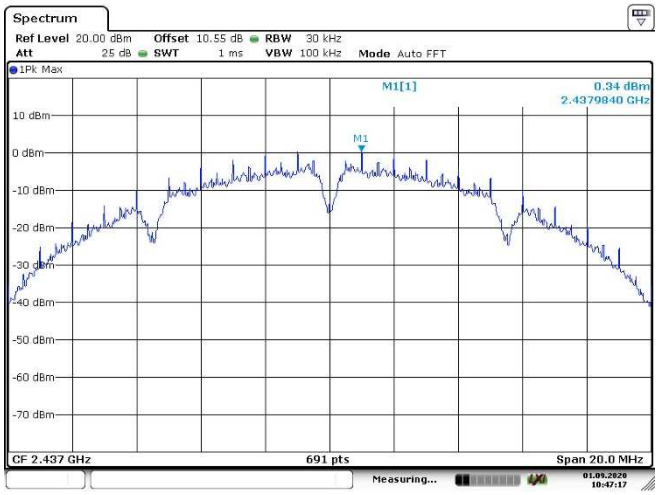
Measured on the highest and lowest channels with Maximum Power.

Requirements:

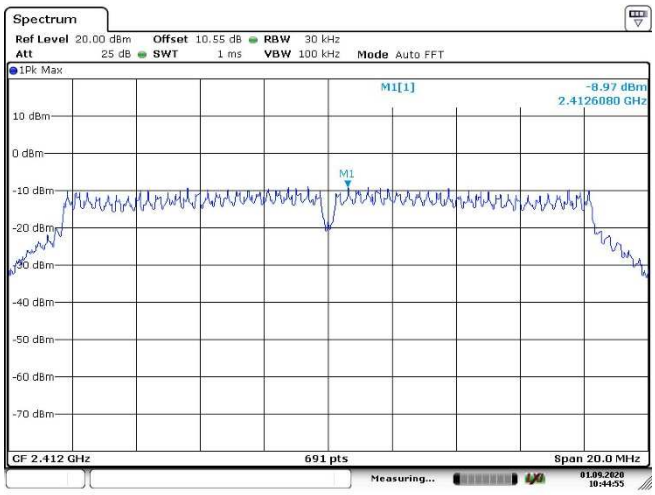
The Power Spectral Density of a Digital Transmission System shall be no greater than +8 dBm in any 3 kHz band



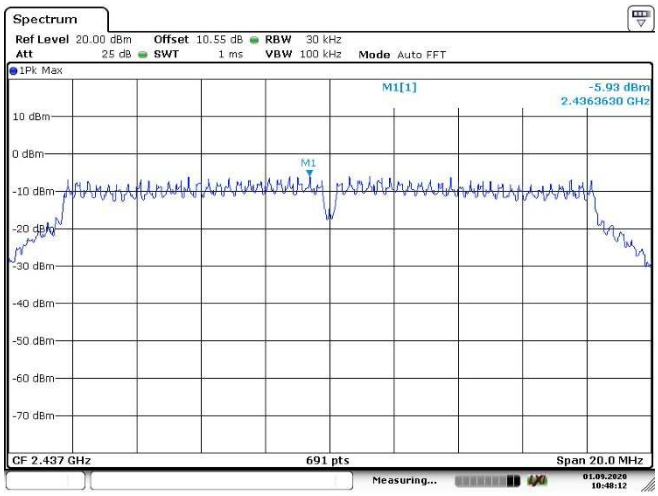
PSD, 2412 MHz, 802.11b, 1Mb



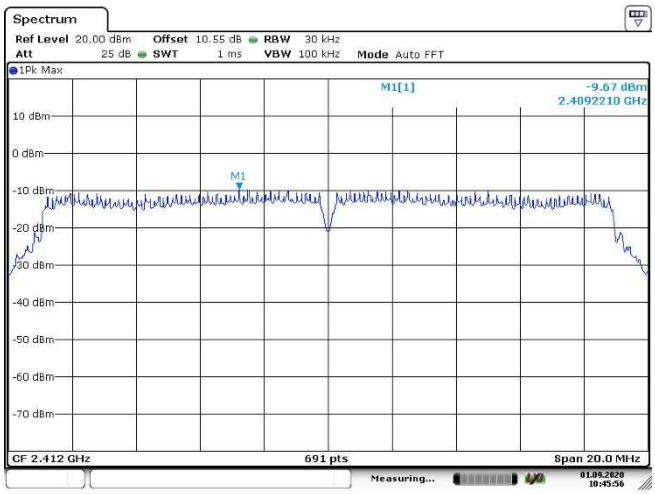
PSD, 2437 MHz, 802.11b, 1Mb



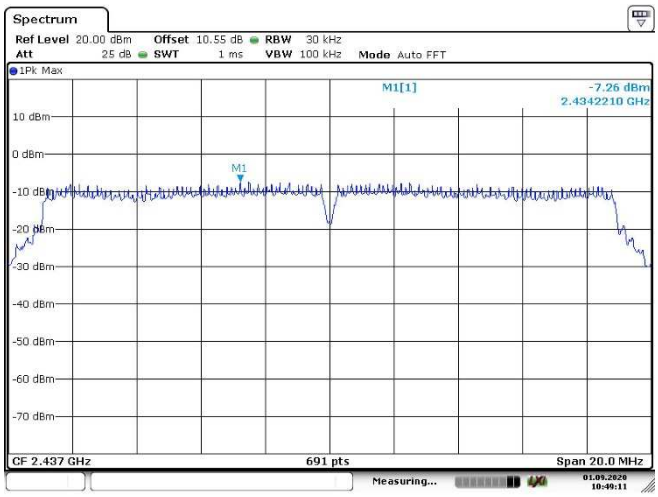
PSD, 2412 MHz, 802.11g, 6Mb



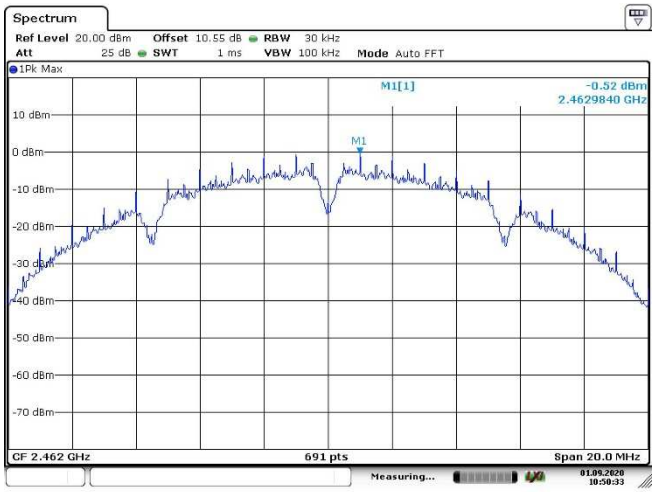
PSD, 2437 MHz, 802.11g, 6Mb



PSD, 2412 MHz, 802.11n, HT20

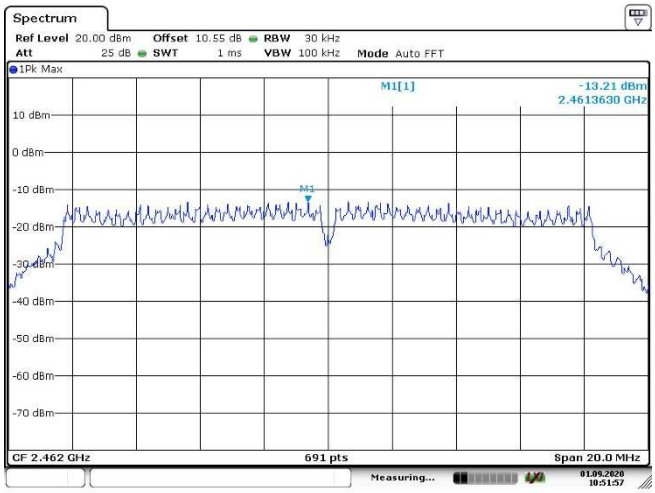


PSD, 2437 MHz, 802.11n, HT20



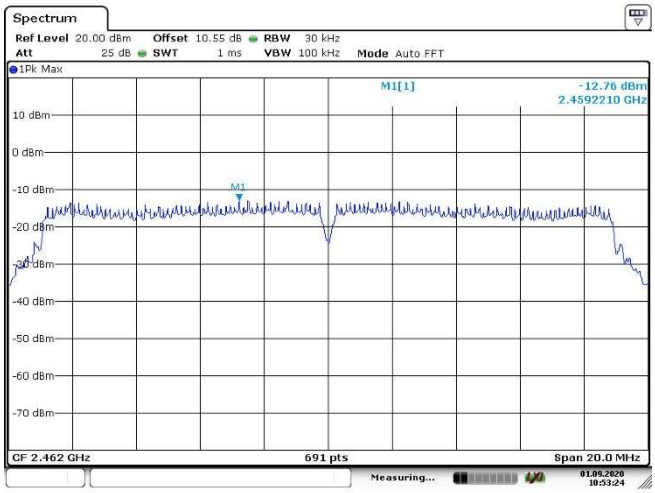
Date: 1.SEP.2020 10:50:33

PSD, 2462 MHz, 802.11b, 1Mb



Date: 1.SEP.2020 10:51:57

PSD, 2462 MHz, 802.11g, 6Mb



Date: 1.SEP.2020 10:53:25

PSD, 2462 MHz, 802.11n, HT20

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		**Uncertainty**
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	**< 3.6 GHz**	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	**< 1 GHz**	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	**Frequency**	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2020-01	2021-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2020-01	2021-01
3	6810.17B	Attenuator	Suhner	LR 1669	2019-07 2020-08	2020-07 2021-08
4	NO324415	Band Reject Filter	Microwave Circuits	LR 1760	COU	
5	VULB 9163	BiLog Antenna	Schwarzbech	LR 1616	2020-01	2023-01
6	317	Preamplifier	Sonoma Inst.	LR 1687	2019-07 2020-08	2020-07 2021-08
7	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2017-12	2020-12
8	8449B			LR 1332	2019-07 2020-08	2020-07 2021-08
9	WLK5-1100-1485-7000-40SS	Low Pass Filter	Wainwright Inst.	LR 1761	COU	
10	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	
11	Sucoflex 102	Microwave Cable (1m)	Suhner	S/N: 500111	COU	
12	Sucoflex 102	Microwave Cable (2m)	Suhner	S/N: 500100	COU	

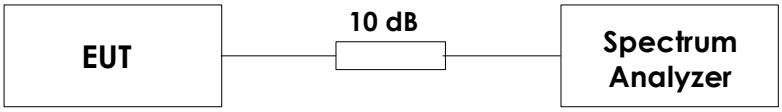
Note: COU – calibrate on use; N/A – Not Applicable

The software listed below has been used for one or more tests.

No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.10	Radiated Emission test software
2	Rohde & Schwarz	GPIBShot	2.7	Screenshots from R&S Spectrum Analyzers
3				

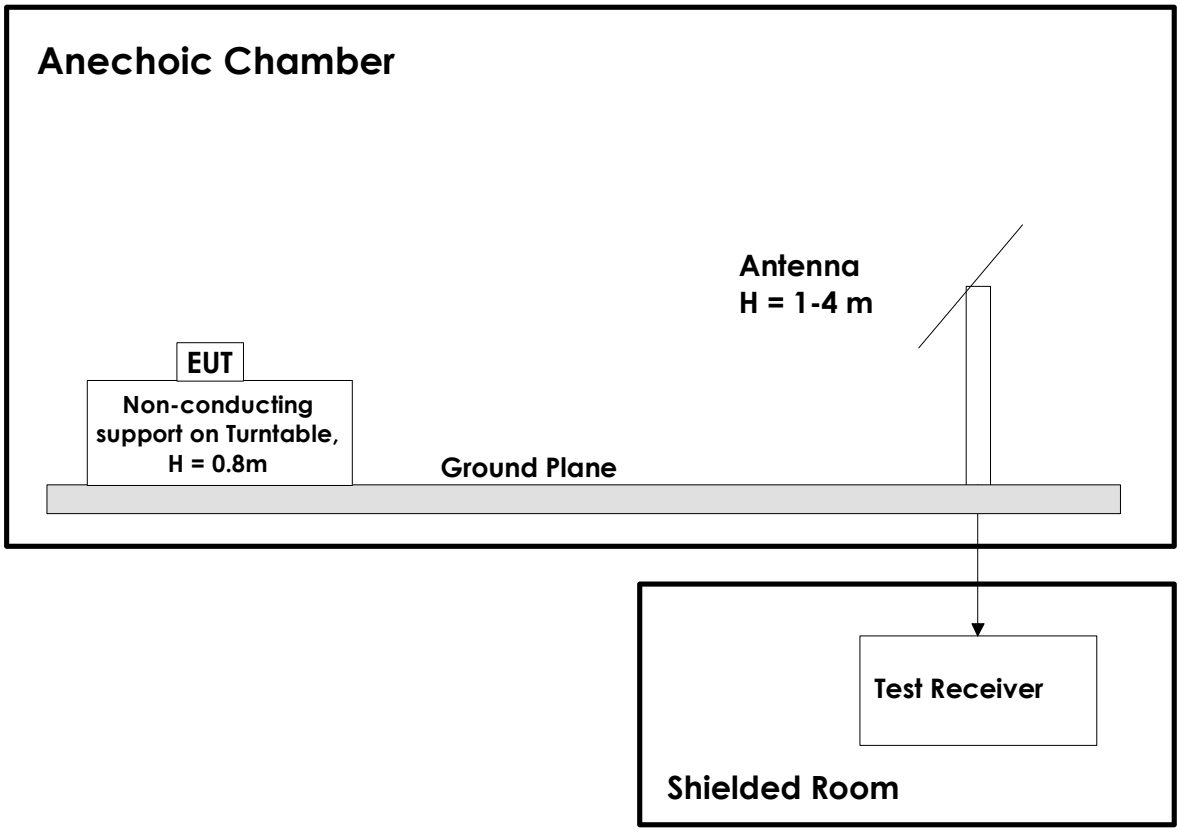
6 BLOCK DIAGRAM

6.1 Conducted Tests



This test set-up is used for all Conducted tests.

6.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. Measuring distance is 3m for all frequencies up to 18 GHz. Above 18 GHz measuring distance is 1m or prescan at 20 cm distance.

Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna.

All measurements at 1 GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers.

A pre-amplifier is used for all measurements, and High-Pass filter is used for all harmonics.

Above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss.