

FCC Part 15C Compliance Test Report

Test Report no.:	FCC15CWLAN_RM-860_02.docx	Date of Report:	12-Feb-2013
Number of pages:	68	Customer's Contact person:	Thomas Mary
Testing laboratory:	TCC Nokia Salo Laboratory P.O.Box(86) Joensuunkatu 7H / Kiila 1B FIN-24101 SALO, FINLAND Tel. +358 (0) 7180 08000 Fax. +358 (0) 7180 45220	Customer:	Nokia, Inc. 16620 West Bernardo Drive San Diego, CA 92127 USA Tel. +1 858 831 5000 Fax. +1 858 385 1598
FCC listing no.:	533467		
IC recognition no.:	661V-1		
Tested devices/ accessories:	Phone RM-860 / Headset WH-902 / AC-Charger AC-50U		
FCC ID:	QMNRM-860	IC:	661X-RM860
Supplement reports:	-		
Testing has been carried out in accordance with:	CFR 47, FCC rules Part 15 Subpart C, ANSI C63.4 (2003), DTS procedures KDB 558074, IC standards. Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".		
Documentation:	The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 15 years at TCC Nokia.		
Test Results:	The EUT complies with the requirements in respect of all parameters subject to the test. The test results relate only to devices specified in this document		
Date and signature for the contents:			

Sami Lehtonen, Specialist, EMC

1. Summary for FCC Part 15C Compliance Test Report

Date of receipt	02-Dec-2012
Testing completed	30-dec-2012
The customer's contact person	Thomas Mary
Test Plan referred to	T:\Projects\RM-860\TestPlan\RS_testplan_RM-860 EMC FCC SAR HAC.xlsm
Notes	-
Document name	T:\Projects\RM-860\EMC\FCC15CWLAN_RM-860_02.docx

1.1. EUT and Accessory Information

The EUT is a mobile phone with following features:
GSM/CDMA/WCDMA/WLAN/Bluetooth
The EUT is tested with maximum rated TX power.

Devices under tests

Product	Type	SN	HW	MV	SW	DUT
Phone	RM-860	354106050003398	0102	-	1532.5701.9200.10205.56	16892
Phone	RM-860	35410650003968	0102	-	1532.5701.9200.10205.56	17227
Phone	RM-860	354106050009015	0103	-	1532.5701.9200.10205.56	17007
Headset	WH-902	06949721245B2R	-	-	-	17006
AC-Charger	AC-50U	409049215427050145100675620	860	-	-	17005
Phone	RM-860	354106050008520	0103	-	1532.5951.1249.0000	17028

1.2. Summary of Test Results

WLAN:

Section in CFR 47	Section in RSS-GEN or RSS-210	Name of the test	Result
15.247(b)(1)	A8(0.4(4))	Conducted peak output power	PASSED
15.247(d), 15.205(b)	A8(0.5)	Band edge compliance of RF emissions	PASSED
15.247(d)	A8(0.5)	Spurious RF conducted emissions	PASSED
15.247(d), 15.209	A8(0.5)	Spurious radiated emissions	PASSED
15.207	7.2.2	AC powerline conducted emissions	PASSED
15.247(a)(2)	A8(0.1(1))	6dB(bandwidth)	PASSED
15.247(e)	A8(0.1(2))	Power spectral density	PASSED

PASSED
FAILED
NP

The EUT complies with the essential requirements in the standard.
The EUT does not comply with the essential requirements in the standard.
The test was not performed by the TCC Nokia Laboratory.

CONTENTS

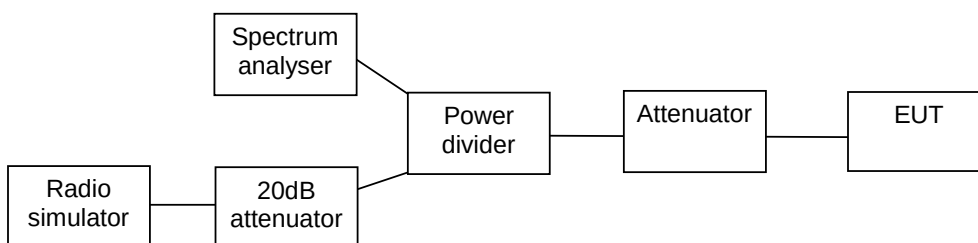
1. Summary for FCC Part 15C Compliance Test Report.....	2
1.1. EUT and Accessory Information.....	2
1.2. Summary of Test Results.....	2
2. (15.247(b)(1), RSS-210 A8.4 (4)).....	5
2.1. Test Setup.....	5
2.2. Test method and limit.....	5
2.3. Power results summary.....	6
2.4. WLAN Test results	7
3. Band edge compliance of RF emissions (FCC §15.247(d), 15.205(b), RSS-210 A8.5).....	23
3.2. Test method and limit.....	23
3.3. 2.4 GHz WLAN BPSK 6MBPS test results.....	24
3.4. 2.4 GHz WLAN 64-QAM 54 MBPS test results	26
4. Spurious RF conducted emissions (FCC §15.247(d), RSS-210 A8.5).....	28
4.1. Test Setup.....	28
4.2. Test method and limit.....	28
4.3. WLAN Test results	29
5. AC powerline conducted emissions (FCC §15.207, RSS-GEN 7.2.2)	38
5.1. Test Setup.....	38
5.2. Test method and limit.....	38
5.3. WLAN Test results	39
6. 6 dB bandwidth (FCC §15.247(a)(2), RSS-210 A8.2 (1)).....	41
6.1. Test Setup.....	41
6.2. Test method and limit.....	41
6.3. WLAN Test results	42
7. Spurious radiated emissions (FCC §15.247(d), §15.209, RSS-210 A8.5)	53
7.2. Test method and limit.....	53
7.3. 2.4 GHz WLAN BPSK 6,5 / 7,25 test results	55
7.4. 2.4 GHz WLAN 16-QAM 24 MBPS test results	56
8. Power spectral density (FCC §15.247(e), RSS-210 A8.2 (2))	57
8.1. Test Setup.....	57

8.2.	Test method and limit.....	57
8.3.	WLAN Test results	58
9.	Test Equipment.....	67
9.1.	Conducted measurements	67
9.2.	Radiated measurements	67

2. (15.247(b)(1), RSS-210 A8.4 (4))

EUT with DUT number	RM-860, DUT 17227
Accessories with DUT numbers	-
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 40 / 100.9
Date of measurements	03-Feb-2013
Measured by	Sami Lehtonen

2.1. Test Setup



2.2. Test method and limit

The measurement is made according to DTS procedures KDB 558074 and IC standard RSS-210.

Limits for conducted peak output power measurements

Frequency range [MHz]	Limit [W]	Limit [dBm]
2400 – 2483.5 5725 - 5850	<= 1	<= 30

2.3. Power results summary

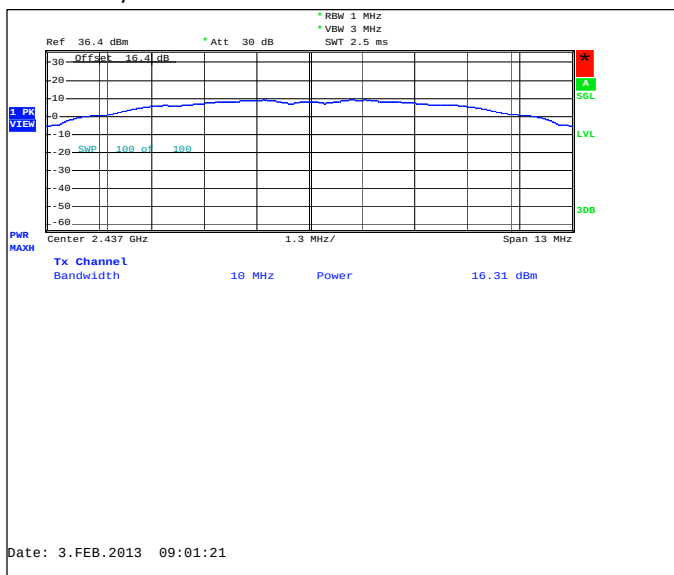
Channel / f_c [MHz]	Mode	Modulation	Data rate	Level [dBm]
6 / 2437	DSSS	BPSK	1 Mbps	16.31
6 / 2437	DSSS	BPSK	2 Mbps	16.54
6 / 2437	DSSS	BPSK	5.5 Mbps	17.85
6 / 2437	DSSS	BPSK	11 Mbps	19.19
6 / 2437	OFDM	BPSK	6 Mbps	21.22
6 / 2437	OFDM	BPSK	9 Mbps	21.23
6 / 2437	n-mode, 20 MHz CBW	BPSK	6.5 / 7.25 Mbps	21.38
1 / 2412	n-mode, 20 MHz CBW	BPSK	6.5 / 7.25 Mbps	21.33
11 / 2462	n-mode, 20 MHz CBW	BPSK	6.5 / 7.25 Mbps	21.9
6 / 2437	OFDM	QPSK	12 Mbps	20.87
6 / 2437	OFDM	QPSK	18 Mbps	20.98
6 / 2437	OFDM	16-QAM	24 Mbps	21.31
6 / 2437	OFDM	16-QAM	36 Mbps	21.34
6 / 2437	OFDM	64-QAM	48 Mbps	21.38
6 / 2437	OFDM	64-QAM	54 Mbps	21.38
6 / 2437	n-mode, 20 MHz CBW	QPSK	13.0 / 14.4 Mbps	20.97
6 / 2437	n-mode, 20 MHz CBW	QPSK	19.5 / 21.7 Mbps	20.92
6 / 2437	n-mode, 20 MHz CBW	16-QAM	26.0 / 28.9 Mbps	21.34
6 / 2437	n-mode, 20 MHz CBW	16-QAM	39.0 / 43.3 Mbps	21.28
6 / 2437	n-mode, 20 MHz CBW	64-QAM	52.0 / 57.8 Mbps	21.32
6 / 2437	n-mode, 20 MHz CBW	64-QAM	58.5 / 65.0 Mbps	21.34
6 / 2437	n-mode, 20 MHz CBW	64-QAM	65.0 / 72.2 Mbps	21.17
1 / 2412	n-mode, 20 MHz CBW	64-QAM	65.0 / 72.2 Mbps	20.95
11 / 2462	n-mode, 20 MHz CBW	64-QAM	65.0 / 72.2 Mbps	21.61

2.4. WLAN Test results

2.4.1 DSSS mode, BPSK modulation, 1 Mbps data rate

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	16.31	42.756	PASSED

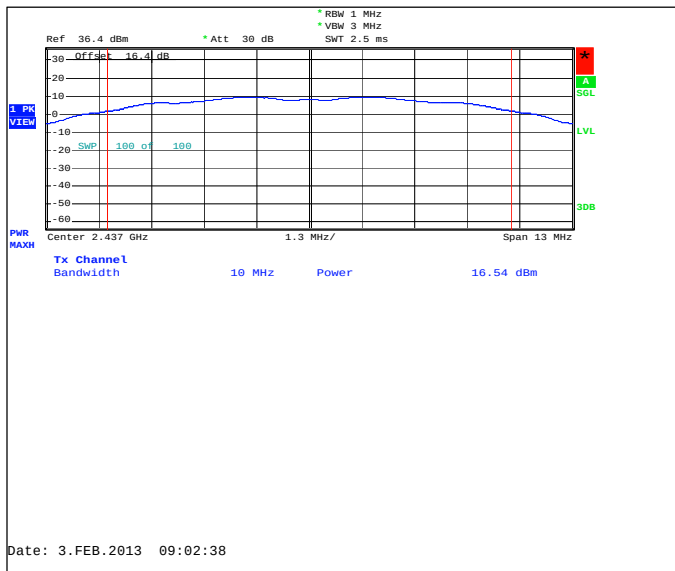
Channel 6 / 2437 MHz



2.4.2 DSSS mode, BPSK modulation, 2 Mbps data rate

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	16.54	45.082	PASSED

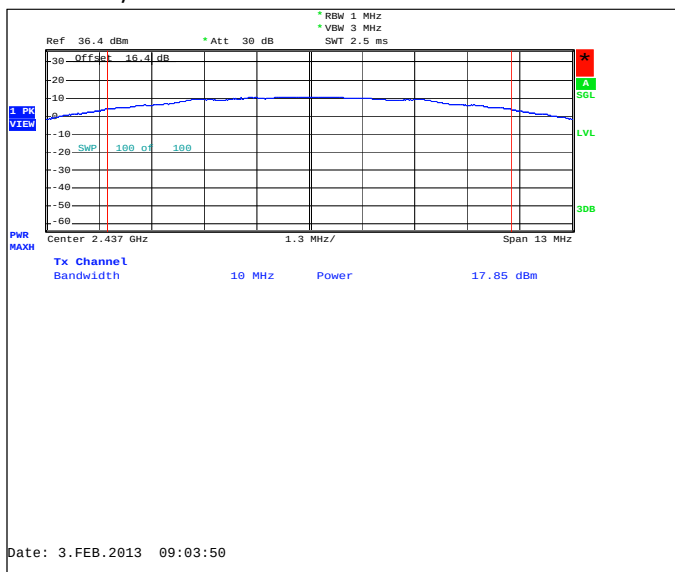
Channel 6 / 2437 MHz



2.4.3 DSSS mode, BPSK modulation, 5.5 Mbps data rate

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	17.85	60.954	PASSED

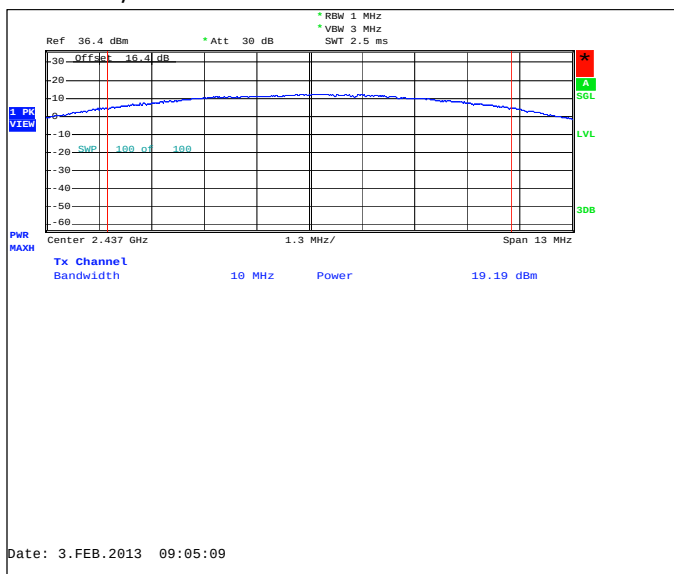
Channel 6 / 2437 MHz



2.4.4 DSSS mode, BPSK modulation, 11 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	19.19	82.985	PASSED

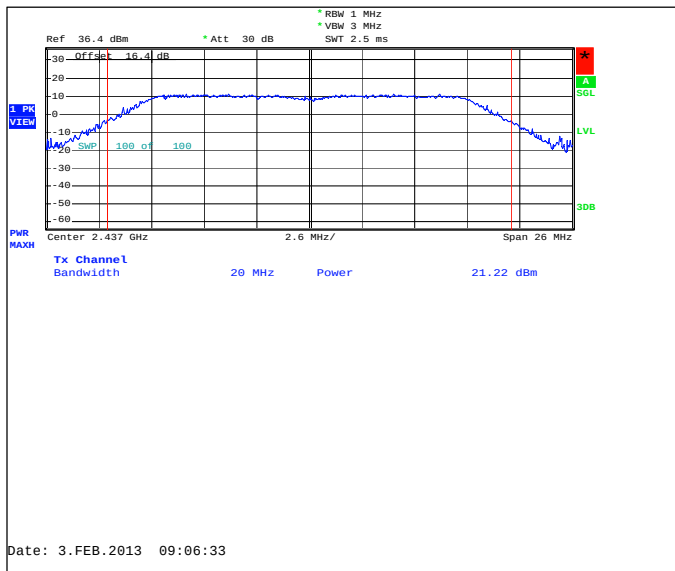
Channel 6 / 2437 MHz



2.4.5 OFDM mode, BPSK modulation, 6 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.22	132.434	PASSED

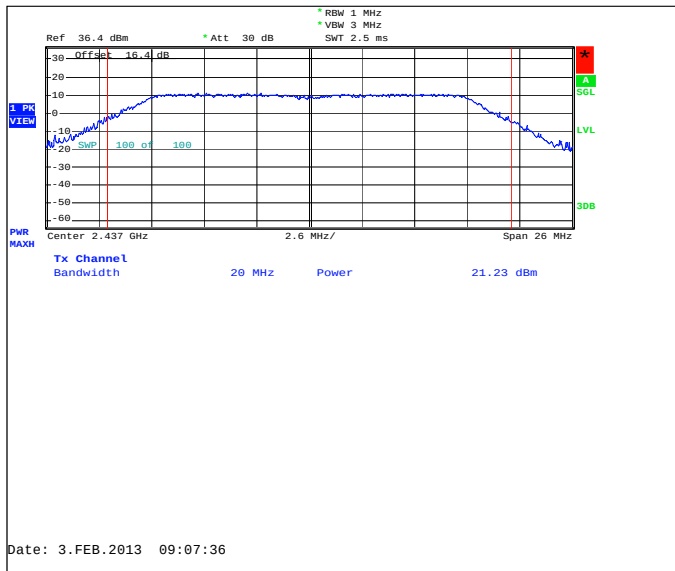
Channel 6 / 2437 MHz



2.4.6 OFDM mode, BPSK modulation, 9 Mbps data rate

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.23	132.739	PASSED

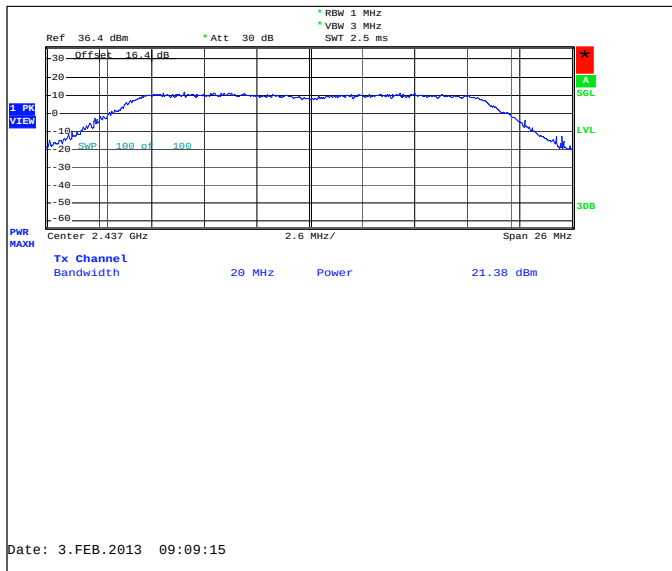
Channel 6 / 2437 MHz



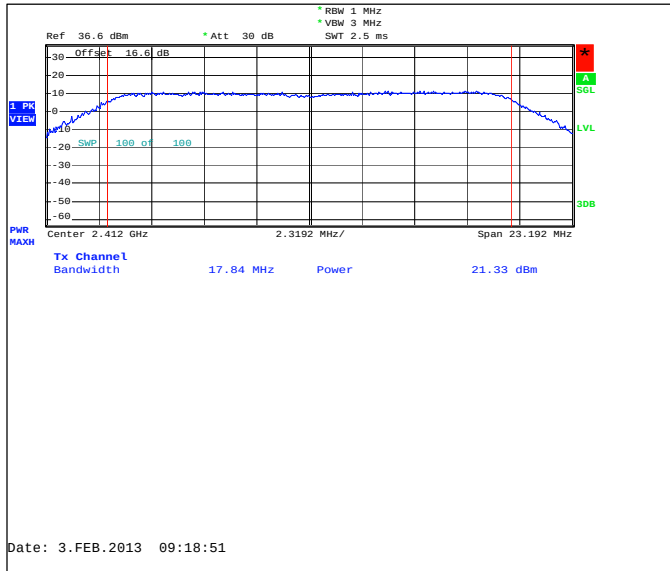
2.4.7 n-mode, 20 MHz CBW mode, BPSK modulation, 6.5 / 7.25 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.38	137.404	PASSED
1 / 2412	21.33	135.831	PASSED
11 / 2462	21.9	154.882	PASSED

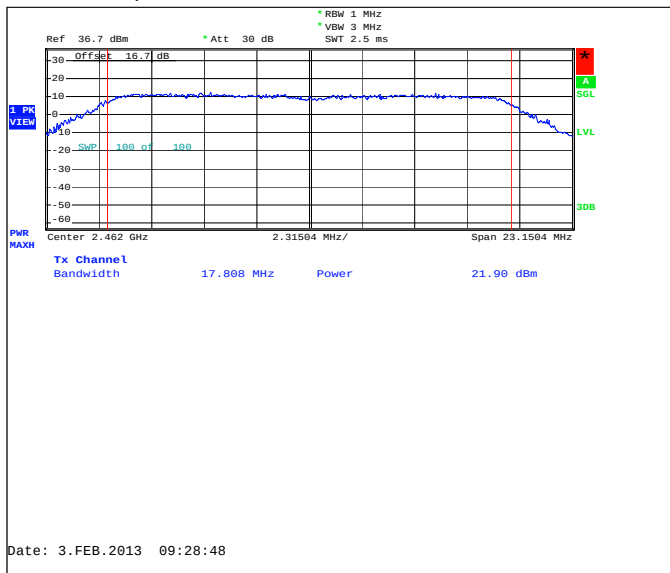
Channel 6 / 2437 MHz



Channel 1 / 2412 MHz



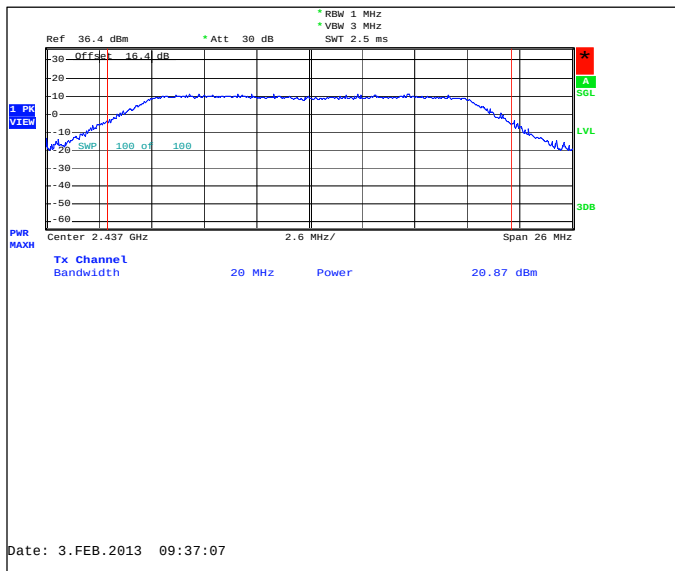
Channel 11 / 2462 MHz



2.4.8 OFDM mode, QPSK modulation, 12 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	20.87	122.18	PASSED

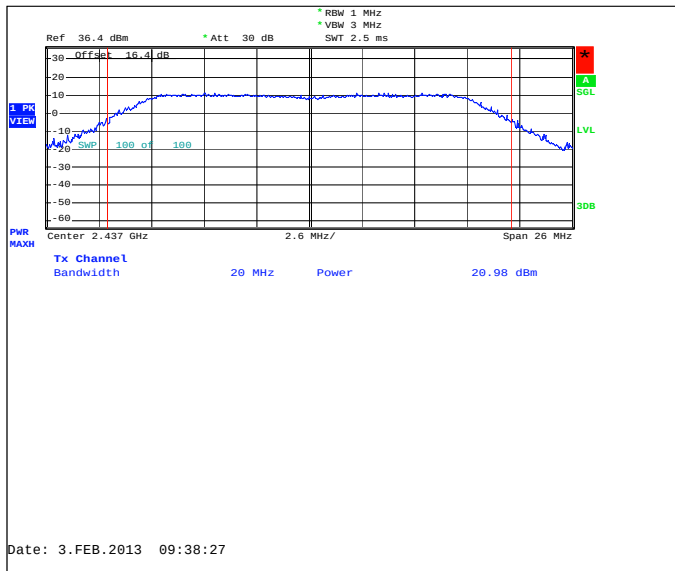
Channel 6 / 2437 MHz



2.4.9 OFDM mode, QPSK modulation, 18 Mbps data rate

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	20.98	125.314	PASSED

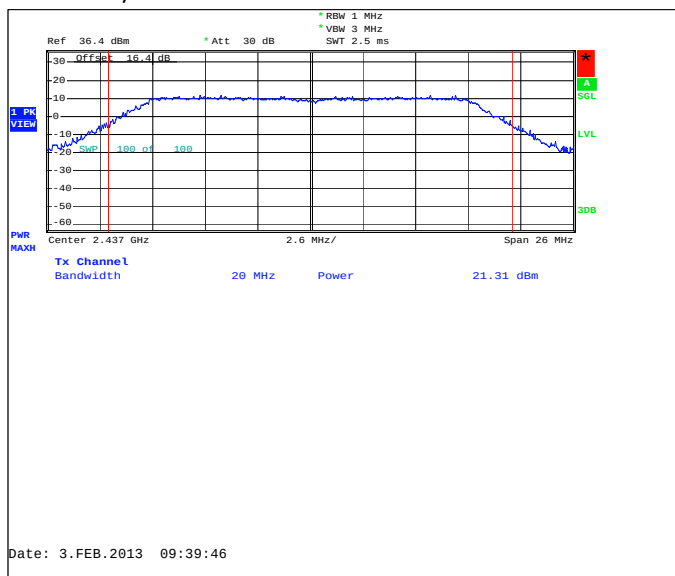
Channel 6 / 2437 MHz



2.4.10 OFDM mode, 16-QAM modulation, 24 Mbps data rate

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.31	135.207	PASSED

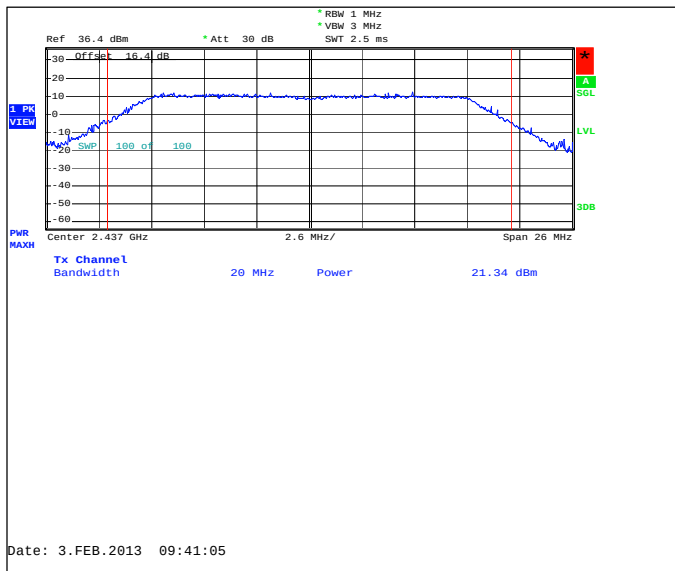
Channel 6 / 2437 MHz



2.4.11 OFDM mode, 16-QAM modulation, 36 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.34	136.144	PASSED

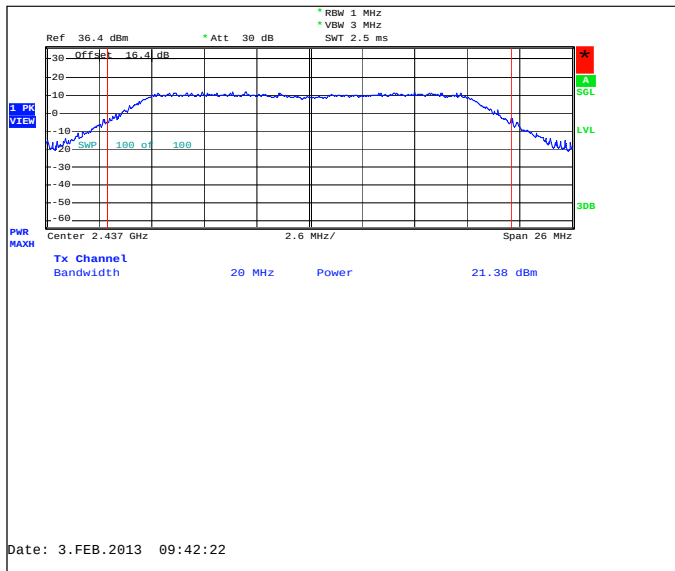
Channel 6 / 2437 MHz



2.4.12 OFDM mode, 64-QAM modulation, 48 Mbps data rate

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.38	137.404	PASSED

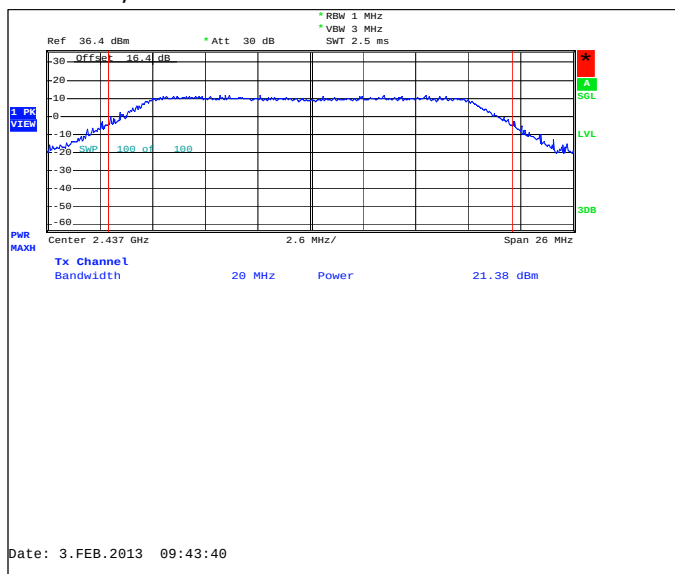
Channel 6 / 2437 MHz



2.4.13 OFDM mode, 64-QAM modulation, 54 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.38	137.404	PASSED

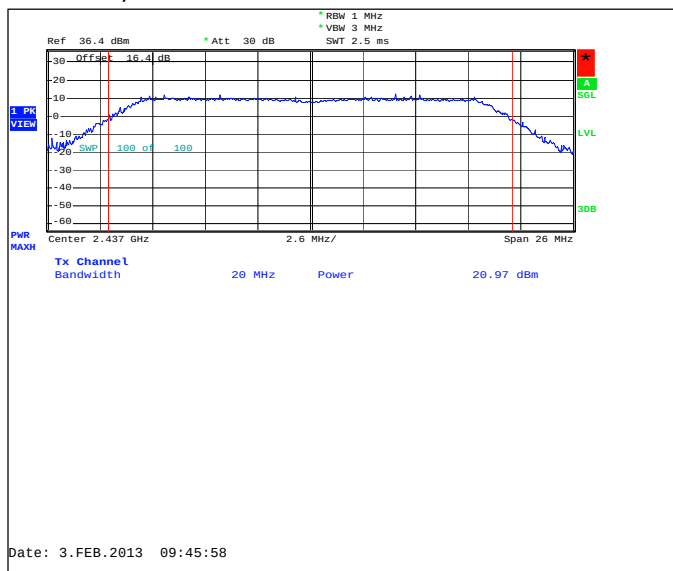
Channel 6 / 2437 MHz



2.4.14 n-mode, 20 MHz CBW mode, QPSK modulation, 13.0 / 14.4 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	20.97	125.026	PASSED

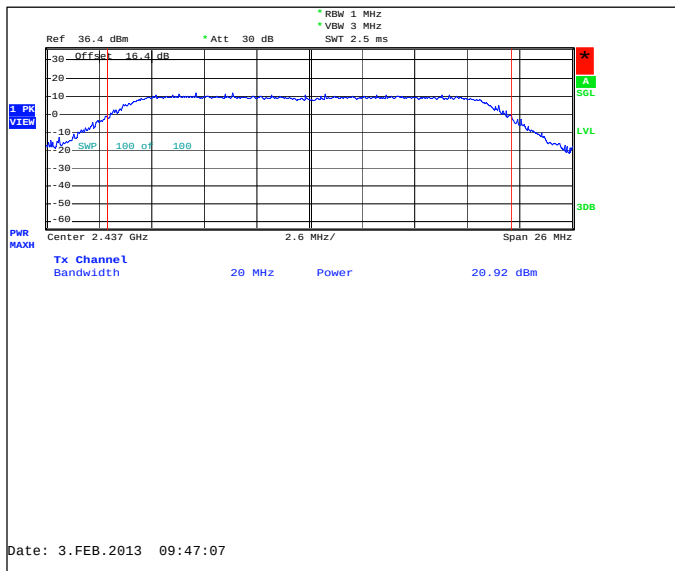
Channel 6 / 2437 MHz



2.4.15 n-mode, 20 MHz CBW mode, QPSK modulation, 19.5 / 21.7 Mbps data rate

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	20.92	123.595	PASSED

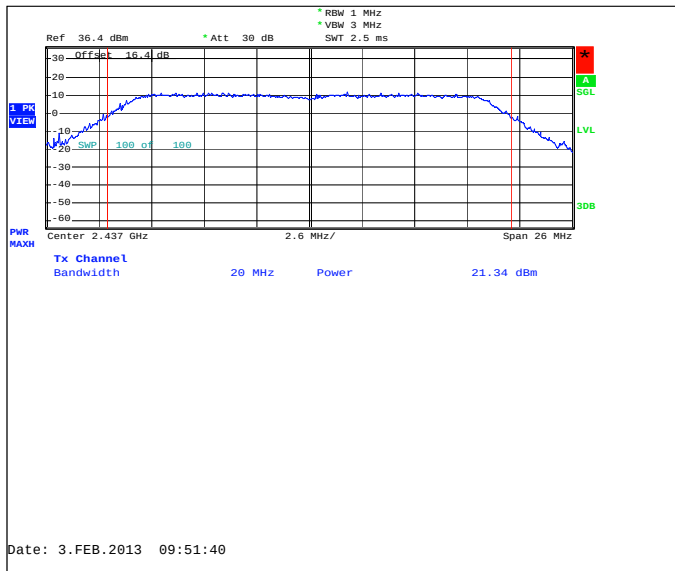
Channel 6 / 2437 MHz



2.4.16 n-mode, 20 MHz CBW mode, 16-QAM modulation, 26.0 / 28.9 Mbps data rate

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.34	136.144	PASSED

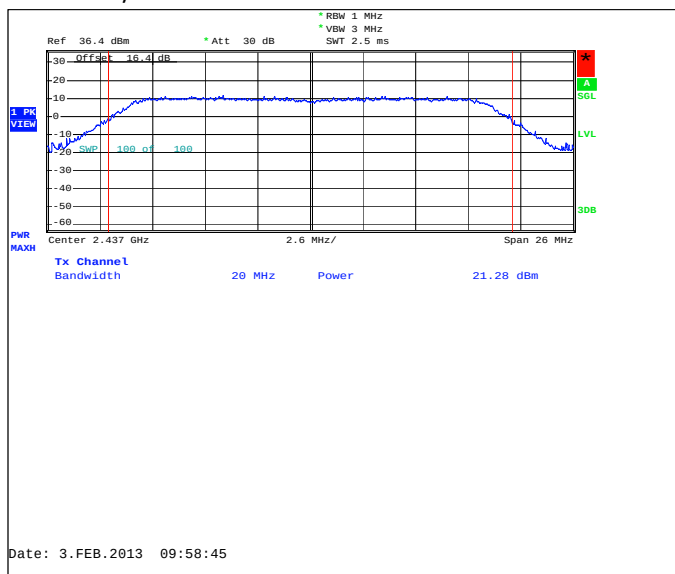
Channel 6 / 2437 MHz



2.4.17 n-mode, 20 MHz CBW mode, 16-QAM modulation, 39.0 / 43.3 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.28	134.276	PASSED

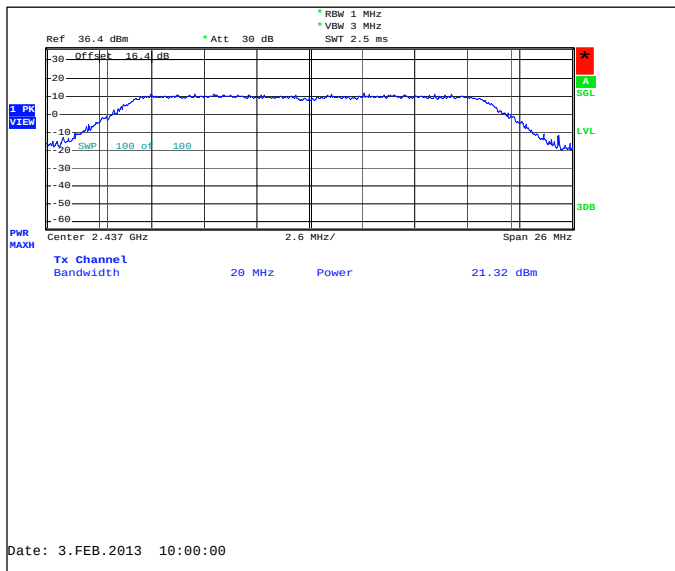
Channel 6 / 2437 MHz



2.4.18 n-mode, 20 MHz CBW mode, 64-QAM modulation, 52.0 / 57.8 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.32	135.519	PASSED

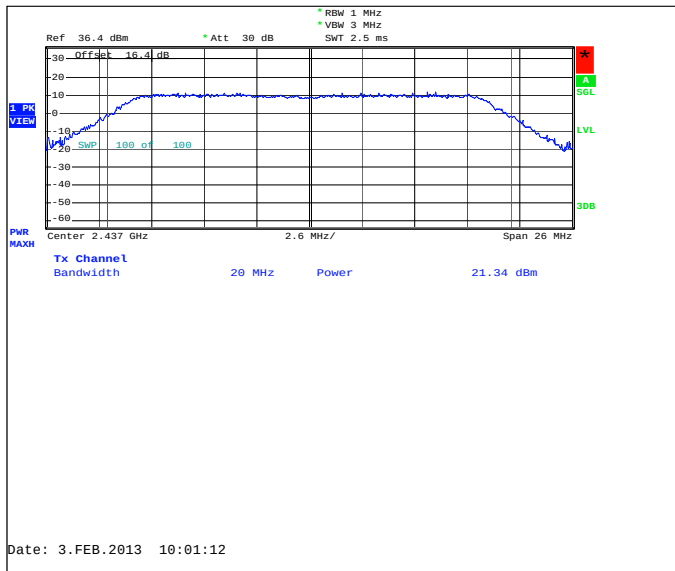
Channel 6 / 2437 MHz



2.4.19 n-mode, 20 MHz CBW mode, 64-QAM modulation, 58.5 / 65.0 Mbps data rate

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.34	136.144	PASSED

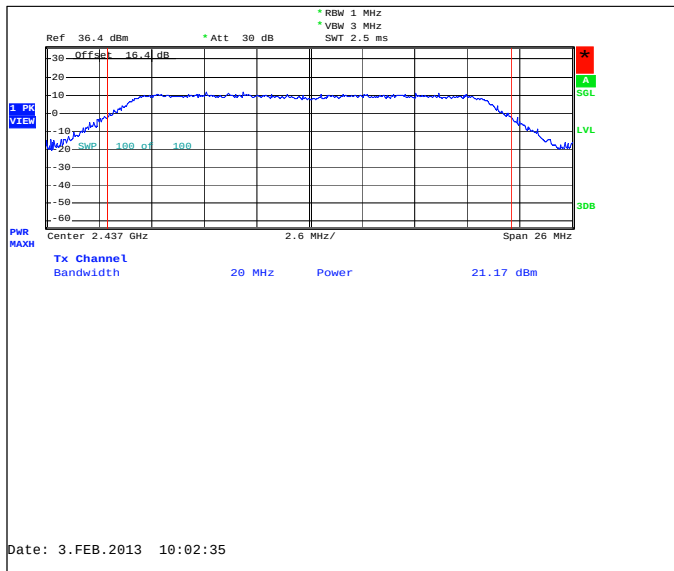
Channel 6 / 2437 MHz



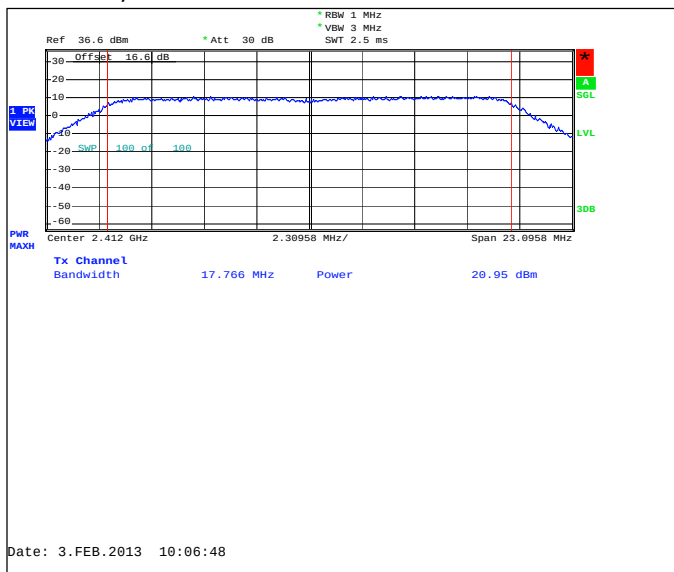
2.4.20 n-mode, 20 MHz CBW mode, 64-QAM modulation, 65.0 / 72.2 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
6 / 2437	21.17	130.918	PASSED
1 / 2412	20.95	124.451	PASSED
11 / 2462	21.61	144.877	PASSED

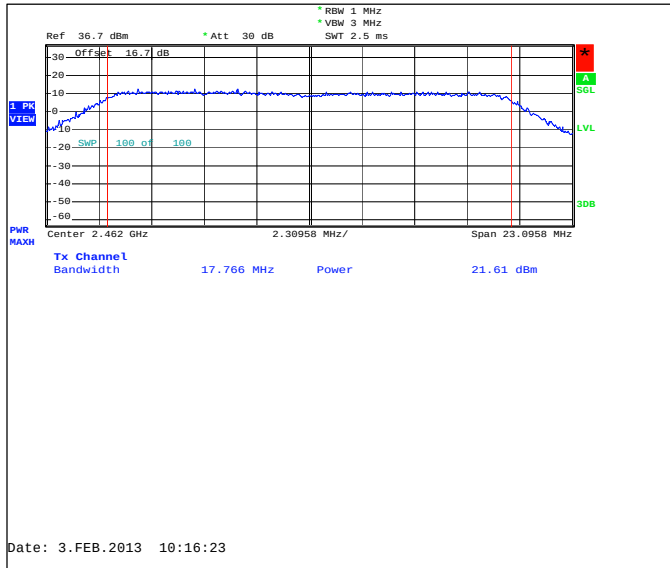
Channel 6 / 2437 MHz



Channel 1 / 2412 MHz



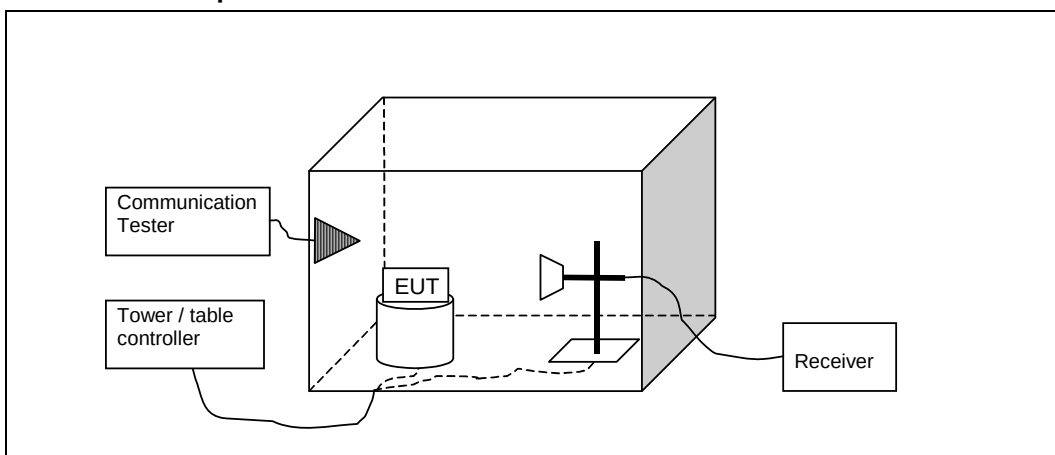
Channel 11 / 2462 MHz



3. Band edge compliance of RF emissions (FCC §15.247(d), 15.205(b), RSS-210 A8.5)

EUT with DUT number	RM-860, DUT 17007
Accessories with DUT numbers	WH-902, DUT 17006 ; AC-50U, DUT 17005
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 41 / 101.4
Date of measurements	28-Dec-2012
Measured by	Kalle Hannila

3.1.1 Test setup



3.2. Test method and limit

The measurement is made according to DTS procedures KDB 558074 and IC standard RSS-210.

The measurement results are obtained as described below:

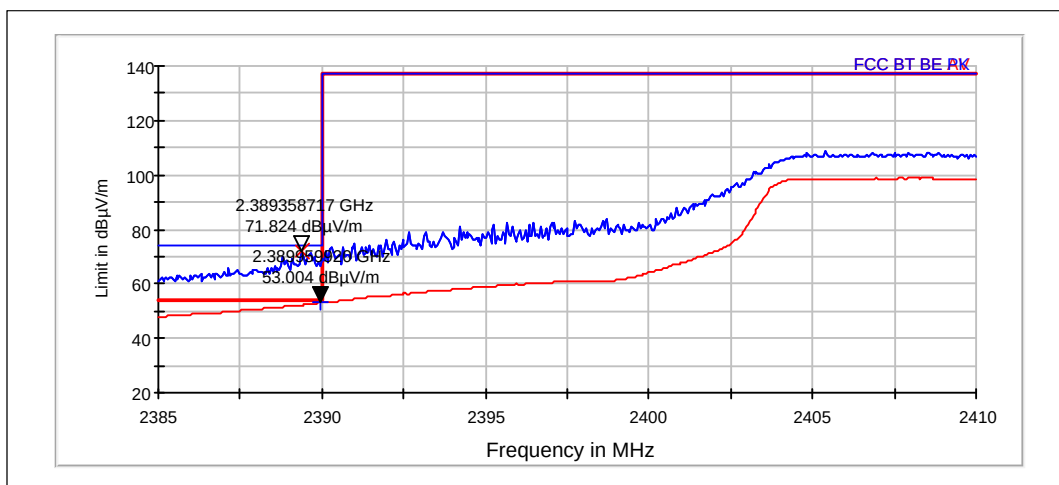
$$E [dB\mu V/m] = U_{RX} + A_{TOT}$$

Where U_{RX} is receiver reading and A_{TOT} is total correction factor including cable loss, antenna factor and preamplifier gain ($A_{TOT} = L_{CABLES} + A_F - G_{PREAMP}$).

Limits for band edge compliance of RF emissions measurements (3 m measurement distance)

Frequency range [MHz]	Limit
Below 2390 and above 2483.5	54 dBuV/m (avg) and 74 dBuV/m (pk)

3.3. 2.4 GHz WLAN BPSK 6MBPS test results

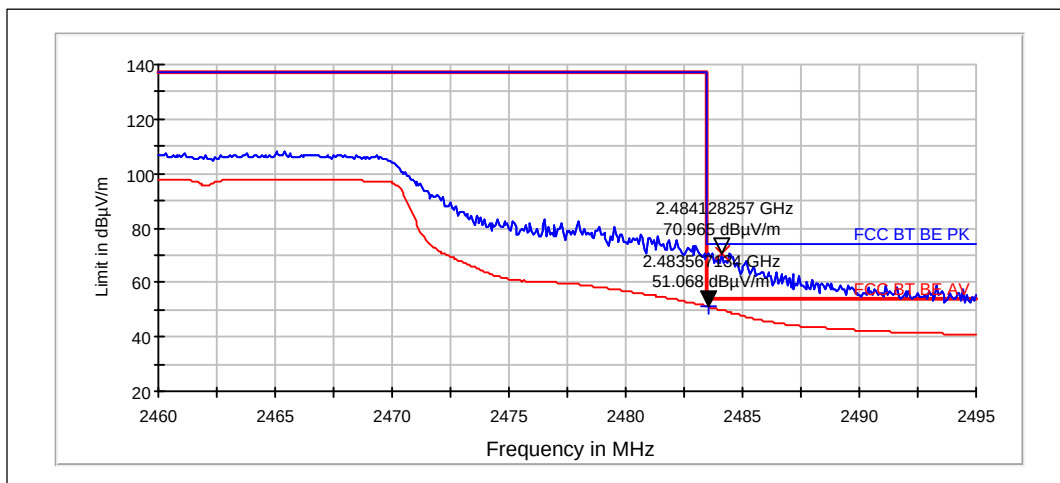


Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	Mode []	Channel number []	Channel frequency []	Correction [dB]	Results
2389.359	BPSK	1	2412000000	0.46	PASSED

Average (RBW: 1 MHz, VBW: 10 Hz)

Frequency [MHz]	Average [dBμV/m]	Mode []	Channel number []	Channel frequency []	Correction [dB]	Results
2389.96	53.004	BPSK	1	2412000000	0.46	PASSED



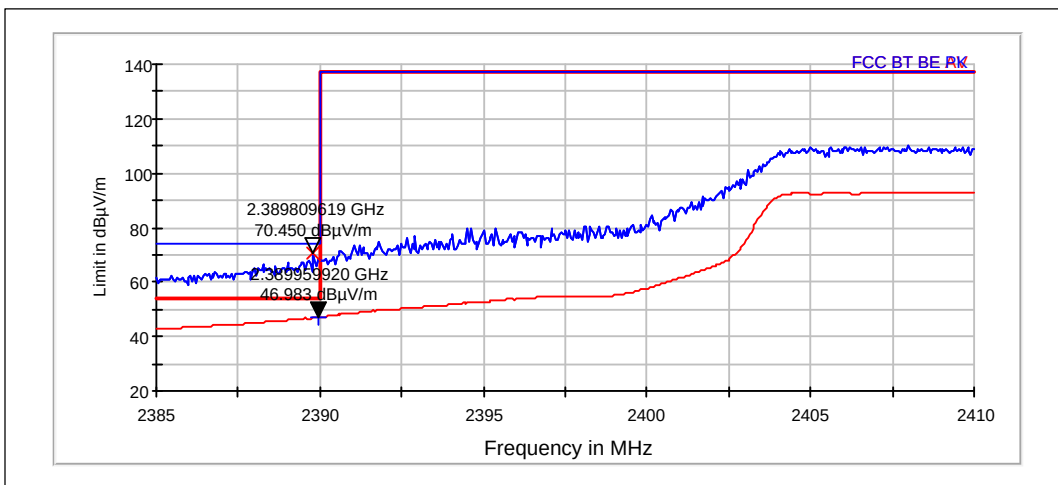
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	Mode []	Channel number []	Channel frequency []	Correction [dB]	Results
2484.128	BPSK	11	2462000000	0.595	PASSED

Average (RBW: 1 MHz, VBW: 10 Hz)

Frequency [MHz]	Average [dBμV/m]	Mode []	Channel number []	Channel frequency []	Correction [dB]	Results
2483.567	51.068	BPSK	11	2462000000	0.595	PASSED

3.4. 2.4 GHz WLAN 64-QAM 54 MBPS test results

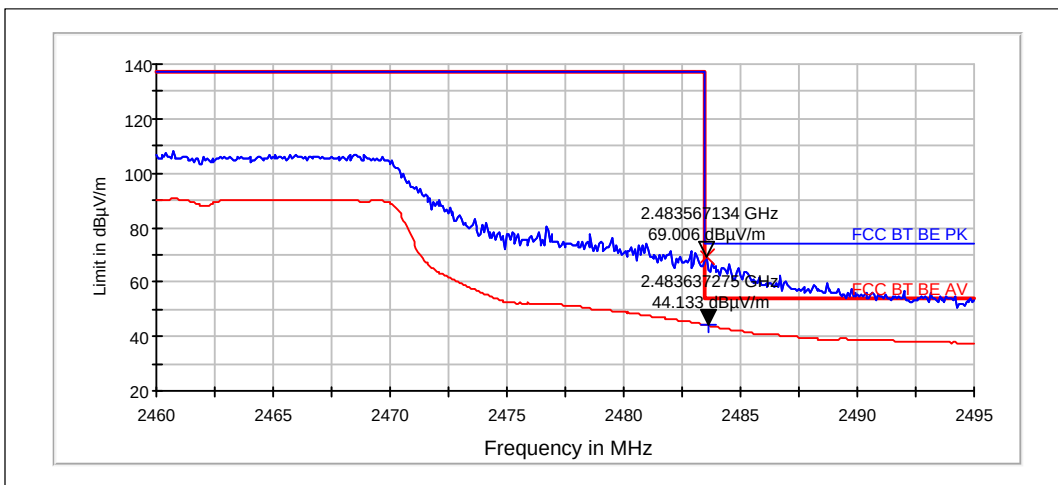


Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	Mode []	Channel number []	Channel frequency []	Correction [dB]	Results
2389.81	64-QAM	1	2412000000	0.46	PASSED

Average (RBW: 1 MHz, VBW: 10 Hz)

Frequency [MHz]	Average [dBμV/m]	Mode []	Channel number []	Channel frequency []	Correction [dB]	Results
2389.96	46.983	64-QAM	1	2412000000	0.46	PASSED



Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	Mode []	Channel number []	Channel frequency []	Correction [dB]	Results
2483.567	64-QAM	11	2462000000	0.595	PASSED

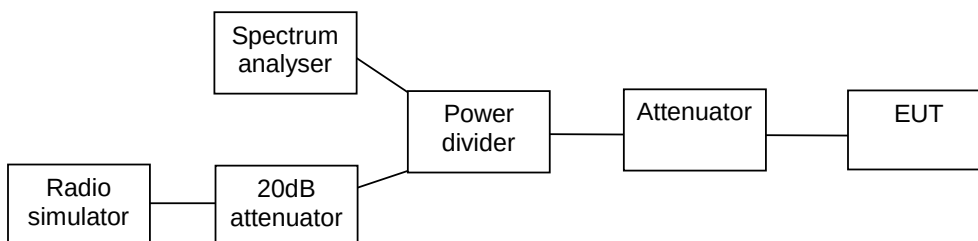
Average (RBW: 1 MHz, VBW: 10 Hz)

Frequency [MHz]	Average [dBμV/m]	Mode []	Channel number []	Channel frequency []	Correction [dB]	Results
2483.637	44.133	64-QAM	11	2462000000	0.595	PASSED

4. Spurious RF conducted emissions (FCC §15.247(d), RSS-210 A8.5)

EUT with DUT number	RM-860, DUT 16892
Accessories with DUT numbers	WH-902, DUT 17006
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 44 / 100.9
Date of measurements	02-Dec-2012
Measured by	Sami Lehtonen

4.1. Test Setup



4.2. Test method and limit

The measurement is made according to Public notice KDB 558 074 and IC standard RSS-210.

The reference level for the -20 dBc measurement was obtained as instructed in section 5.4.1.1 of the KDB 558074, using 5-30 % wider span than the EBW.

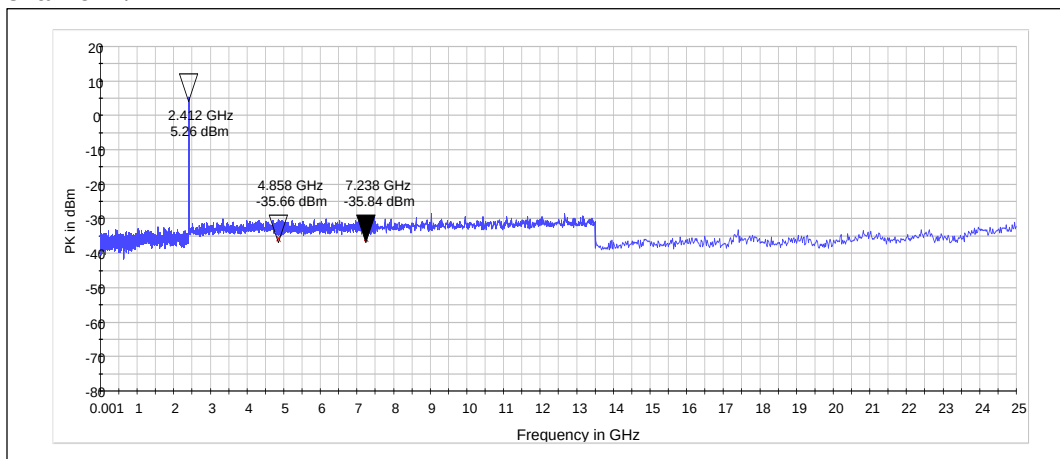
Limits for spurious RF conducted emissions measurements

Frequency range [MHz]	Limit [dBc]
1 – 25000	<= -20

4.3. WLAN Test results

4.3.1 DSSS mode, BPSK modulation, 11 Mbps data rate

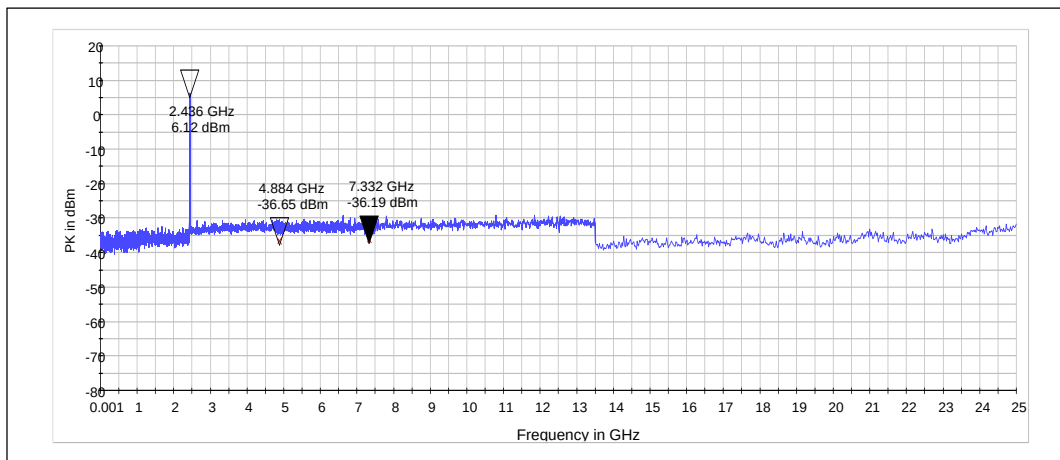
Channel 1 / 2412 MHz



Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4857.6	-35.66	PASSED
7237.8	-35.84	PASSED

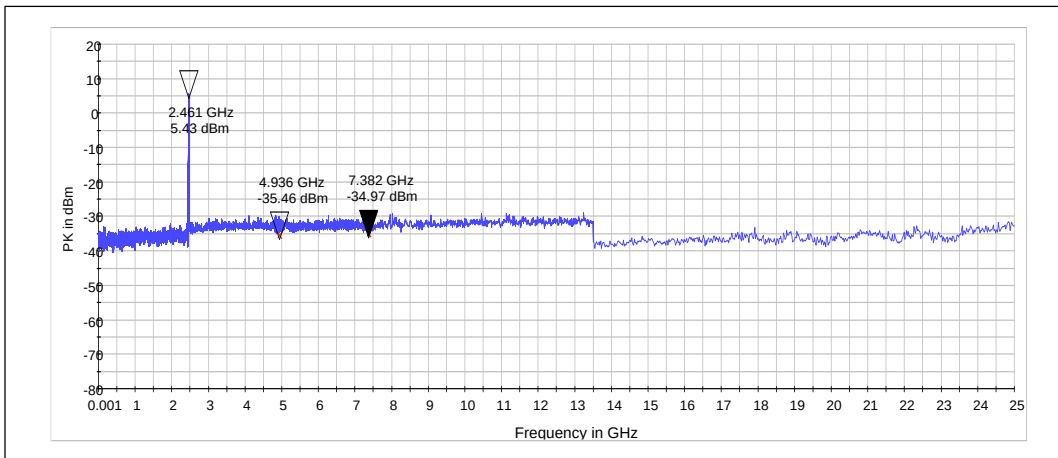
Channel 6 / 2437 MHz



Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4884.4	-36.65	PASSED
7332	-36.19	PASSED

Channel 11 / 2462 MHz

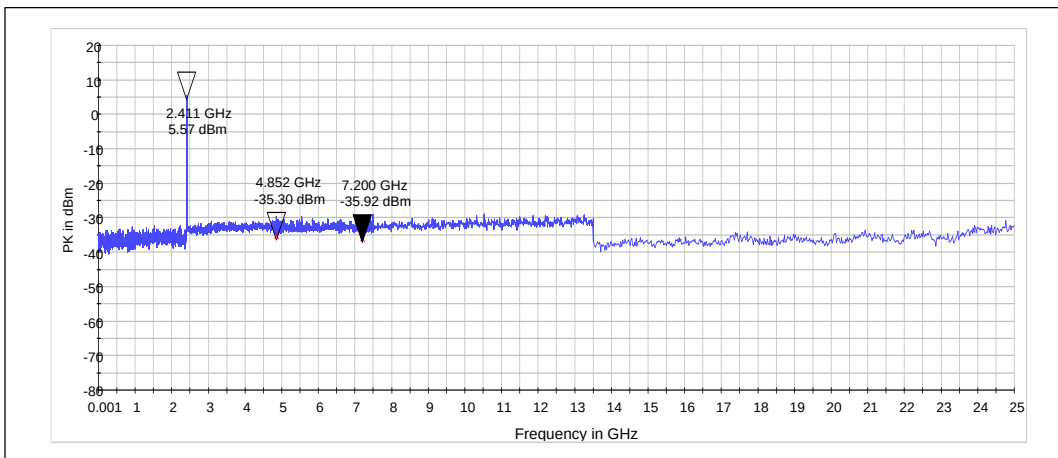


Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4935.6	-35.46	PASSED
7381.8	-34.97	PASSED

4.3.2 DSSS mode, BPSK modulation, 1 Mbps data rate

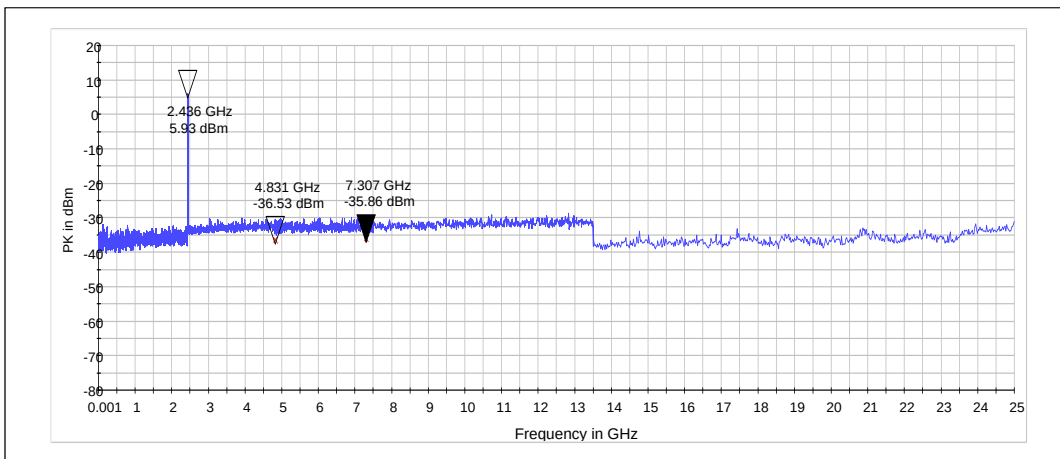
Channel 1 / 2412 MHz



Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4852	-35.3	PASSED
7200	-35.92	PASSED

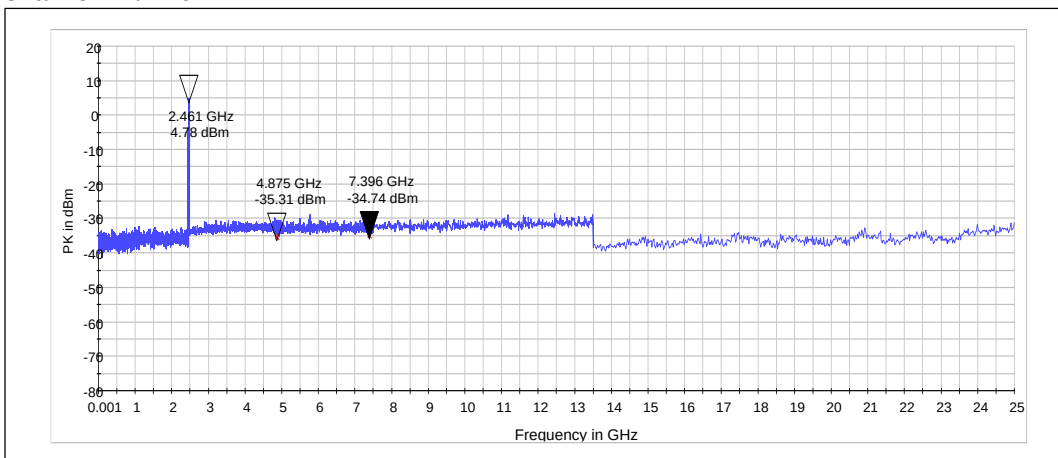
Channel 6 / 2437 MHz



Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4831.2	-36.53	PASSED
7307.4	-35.86	PASSED

Channel 11 / 2462 MHz

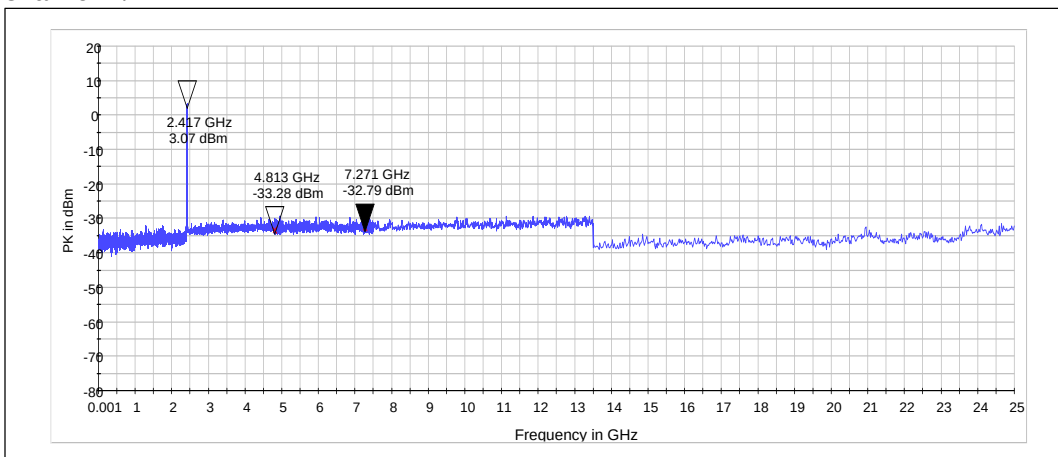


Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4874.8	-35.31	PASSED
7396.2	-34.74	PASSED

4.3.3 OFDM mode, 16-QAM modulation, 24 Mbps data rate

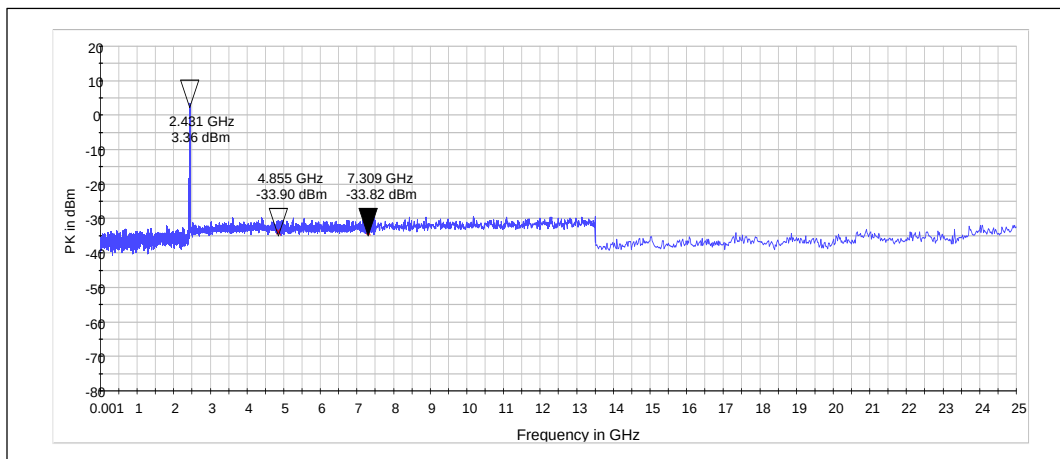
Channel 1 / 2412 MHz



Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4812.8	-33.28	PASSED
7270.8	-32.79	PASSED

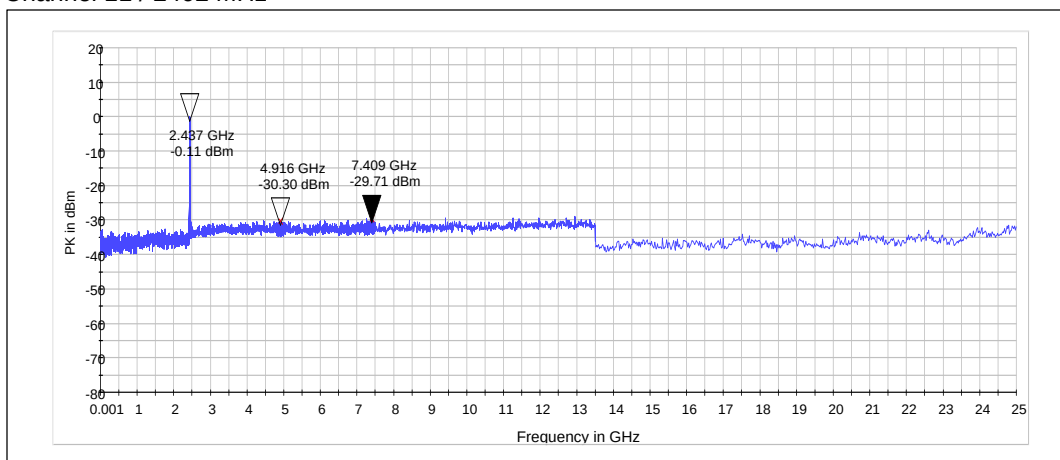
Channel 6 / 2437 MHz



Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4855.2	-33.9	PASSED
7308.6	-33.82	PASSED

Channel 11 / 2462 MHz

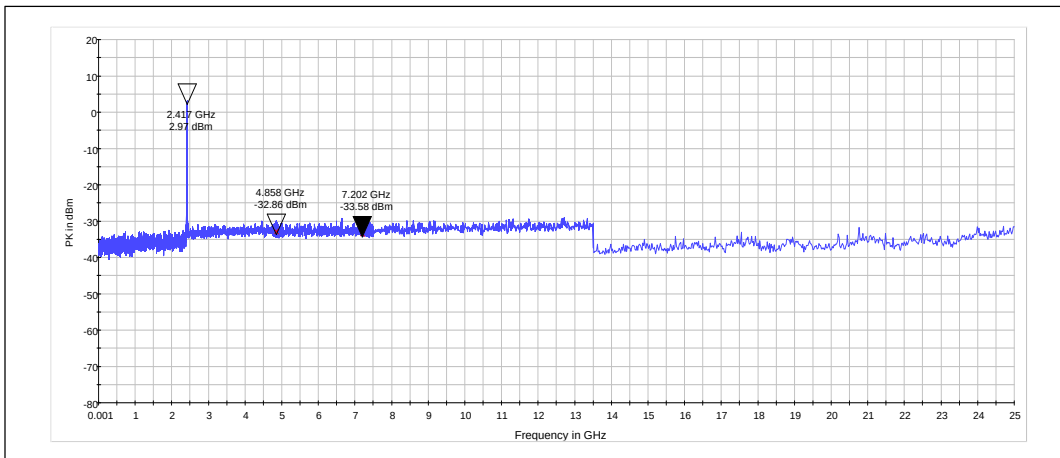


Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4915.6	-30.3	PASSED
7408.8	-29.71	PASSED

4.3.4 n-mode, 20 MHz CBW mode, BPSK modulation, 6.5 / 7.25 Mbps data rate

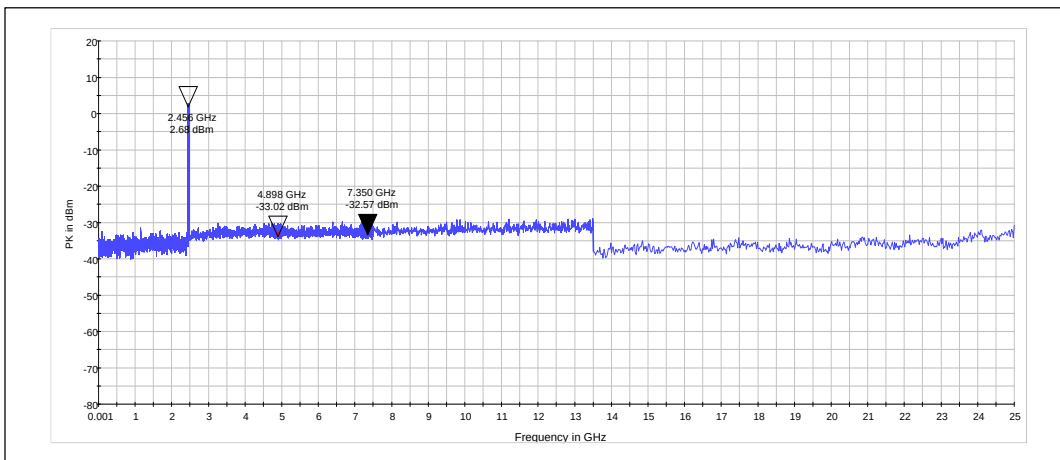
Channel 1 / 2412 MHz



Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4858	-32.86	PASSED
7201.8	-33.58	PASSED

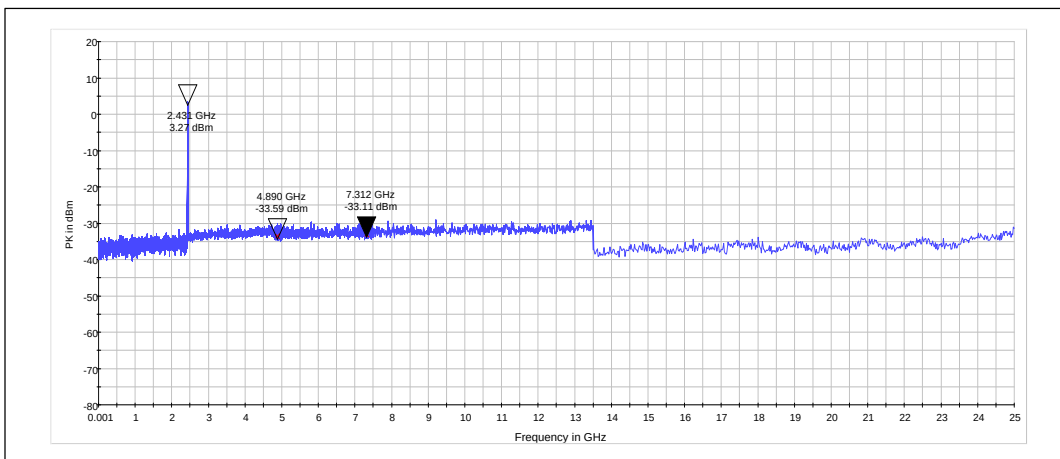
Channel 11 / 2462 MHz



Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4897.6	-33.02	PASSED
7350	-32.57	PASSED

Channel 6 / 2437 MHz

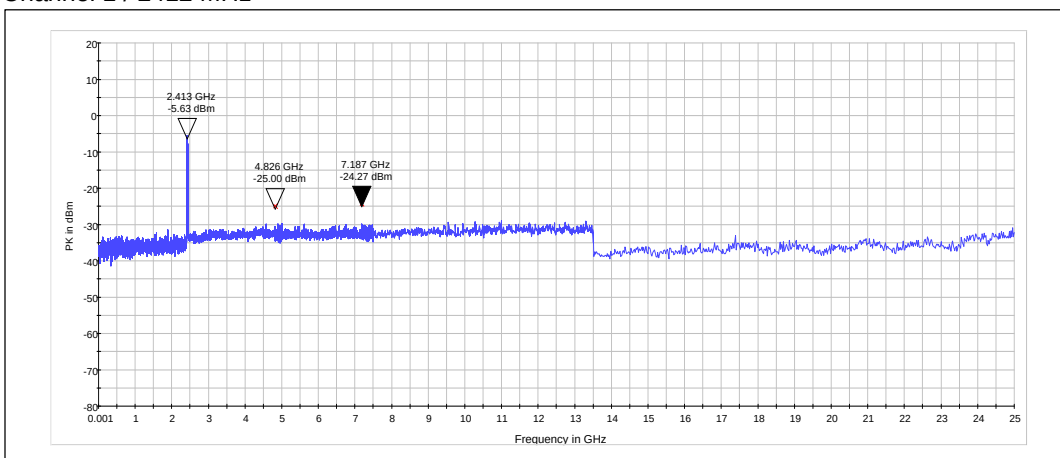


Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4890	-33.59	PASSED
7312.2	-33.11	PASSED

4.3.5 n-mode, 40 MHz CBW mode, BPSK modulation, 13.5 / 15.0 Mbps data rate

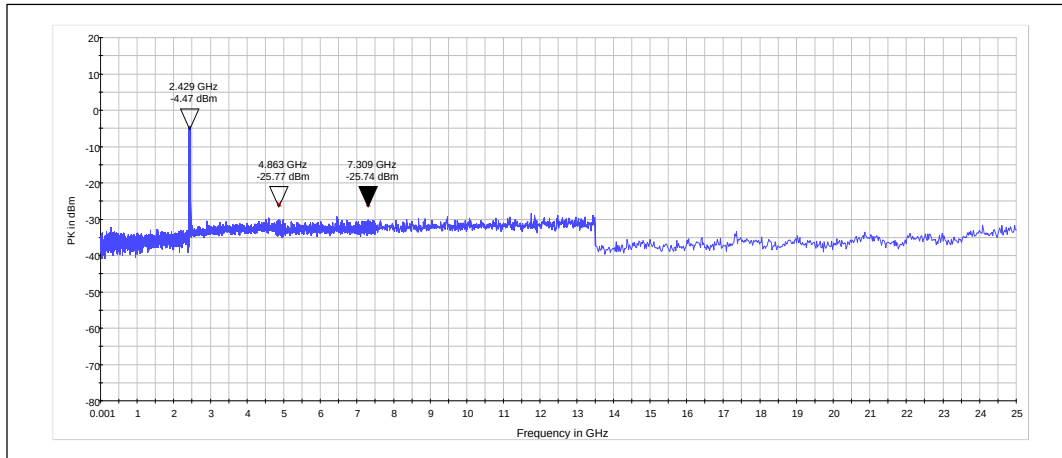
Channel 1 / 2412 MHz



Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4825.6	-25	PASSED
7186.8	-24.27	PASSED

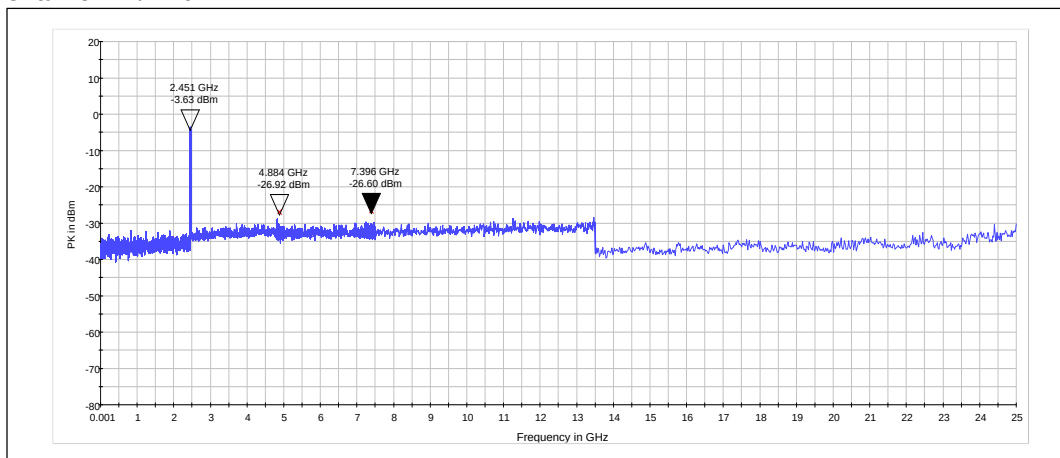
Channel 6 / 2437 MHz



Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4863.2	-25.77	PASSED
7309.2	-25.74	PASSED

Channel 11 / 2462 MHz



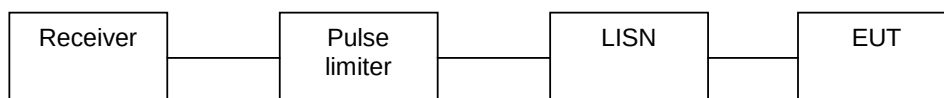
Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4883.6	-26.92	PASSED
7396.2	-26.6	PASSED

5. AC powerline conducted emissions (FCC §15.207, RSS-GEN 7.2.2)

EUT with DUT number	RM-860, DUT 17028
Accessories with DUT numbers	WH-902, DUT 17008 ; AC-50U, DUT 17009
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 43 / 98.5
Date of measurements	27-Dec-2012
Measured by	Jari Keto

5.1. Test Setup



5.2. Test method and limit

The EUT is placed on a wooden table 80 cm above the reference groundplane.

The EUT is connected via LISN to a test power supply.

The measurement results are obtained as described below:

$$U [dB\mu V] = U_{RX} + A_{TOT}$$

Where U_{RX} is receiver reading and A_{TOT} is total correction factor including cable and pulse limiter attenuations.

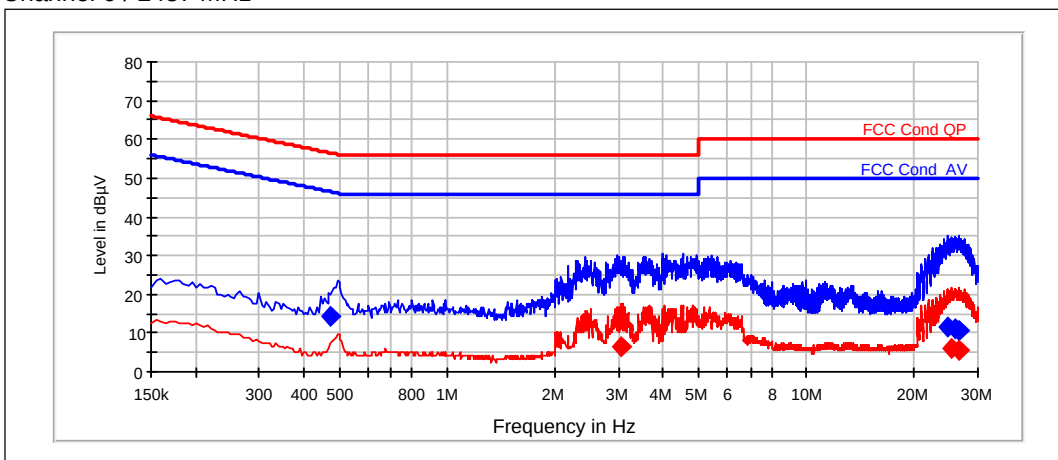
CISPR 22 Class B limits

Frequency range [MHz]	Quasi peak limit [dBμV]	Average limit [dBμV]
0.15 - 0.5	66 - 56	56 - 46
0.5 - 5	56	46
5 - 30	60	50

5.3. WLAN Test results

5.3.1 OFDM mode, 16-QAM modulation, 24 Mbps data rate

Channel 6 / 2437 MHz



QuasiPeak (RBW: 9 kHz)

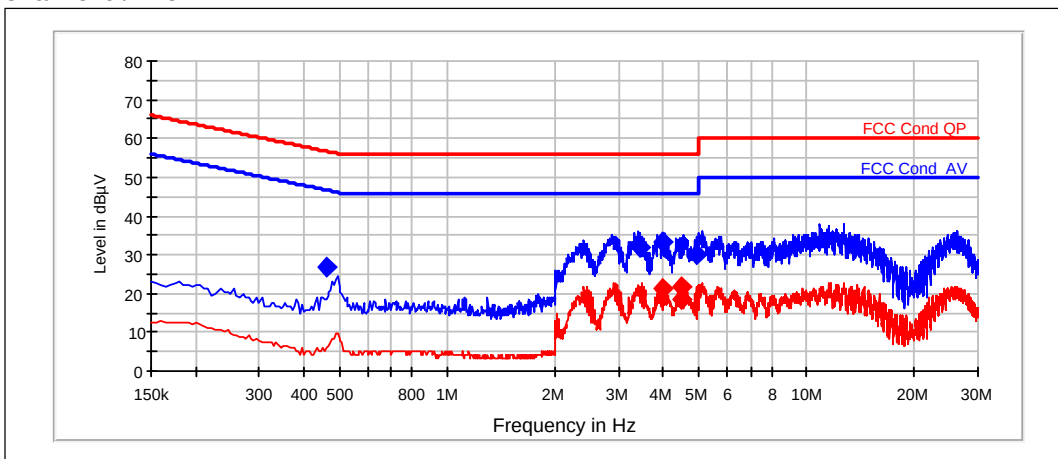
Frequency [MHz]	U [dBμV]	Line	Result
0.475	14.43	L1	PASSED
24.75	11.67	L1	PASSED
25.97	11.23	L1	PASSED
26.485	10.77	L1	PASSED

Average (RBW: 9 kHz)

Frequency [MHz]	U [dBμV]	Line	Result
3.06	6.25	L1	PASSED
25.355	5.88	L1	PASSED
26.53	5.62	L1	PASSED

5.3.2 n-mode, 20 MHz CBW mode, BPSK modulation, 6.5 / 7.25 Mbps data rate

Channel 6 / 2437 MHz



QuasiPeak (RBW: 9 kHz)

Frequency [MHz]	U [dBμV]	Line	Result
0.46	26.86	L1	PASSED
3.45	32.12	L1	PASSED
3.965	33.17	L1	PASSED
4.95	30.15	L1	PASSED

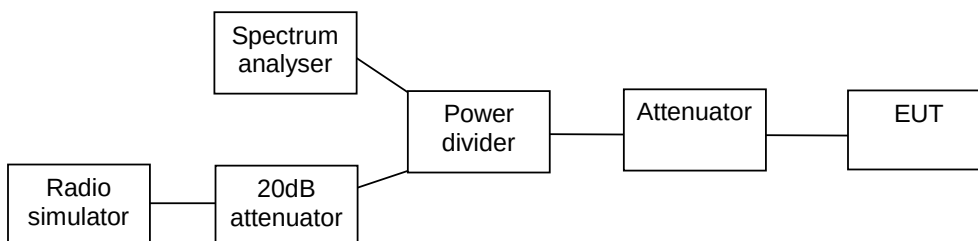
Average (RBW: 9 kHz)

Frequency [MHz]	U [dBμV]	Line	Result
3.995	21.41	L1	PASSED
4.485	21.87	L1	PASSED
4.49	18.54	L1	PASSED

6. 6 dB bandwidth (FCC §15.247(a)(2), RSS-210 A8.2 (1))

EUT with DUT number	RM-860, DUT 16892
Accessories with DUT numbers	WH-902, DUT 17006
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 44 / 100.9
Date of measurements	02-Dec-2012
Measured by	Sami Lehtonen

6.1. Test Setup



6.2. Test method and limit

The measurement is made according to DTS procedures KDB 558074 and IC standard RSS-210.

Limits for 6 dB bandwidth measurements

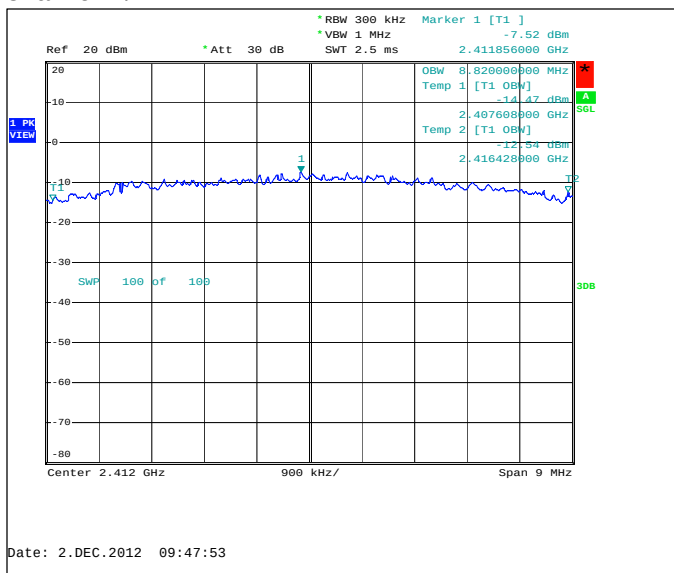
Limit [kHz]
>= 500

6.3. WLAN Test results

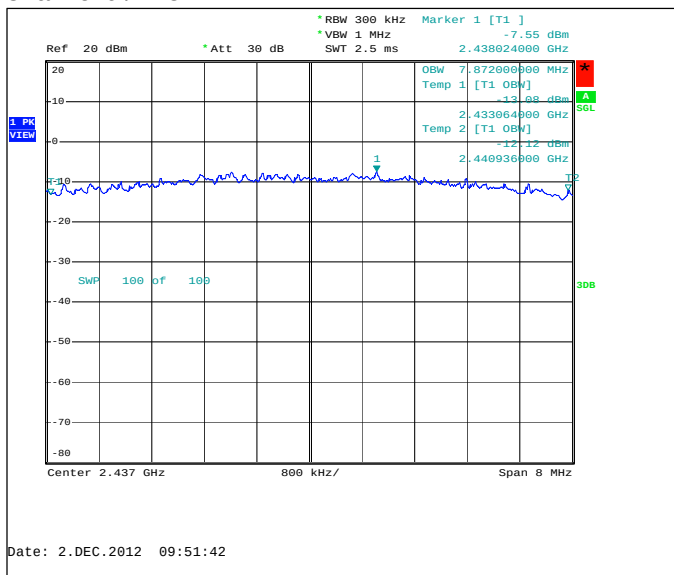
6.3.1 DSSS mode, BPSK modulation, 11 Mbps data rate

Channel / f_c [MHz]	6 dB bandwidth [kHz]	Result
1 / 2412	8820	PASSED
6 / 2437	7872	PASSED
11 / 2462	8802	PASSED

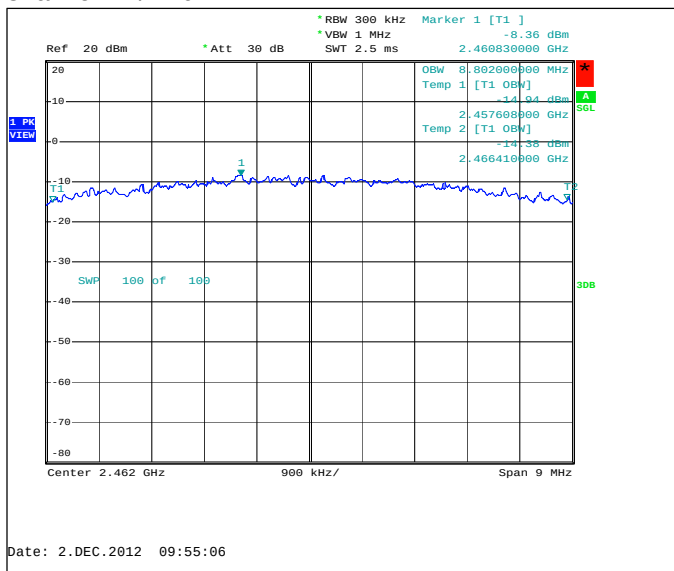
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



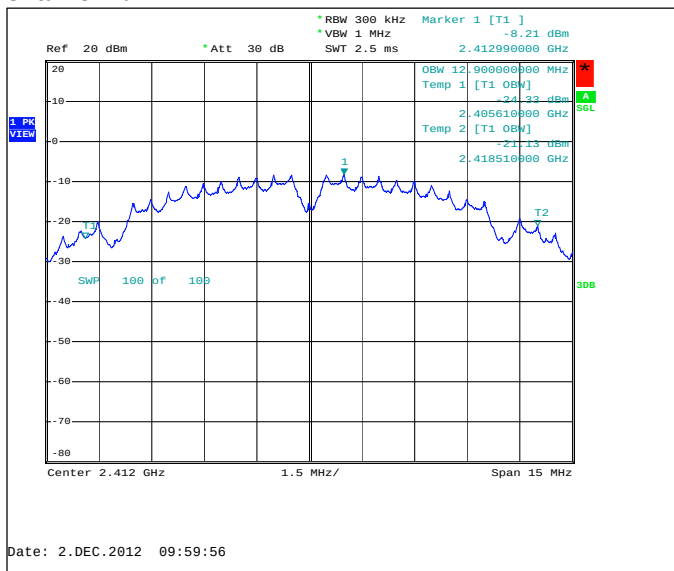
Channel 11 / 2462 MHz



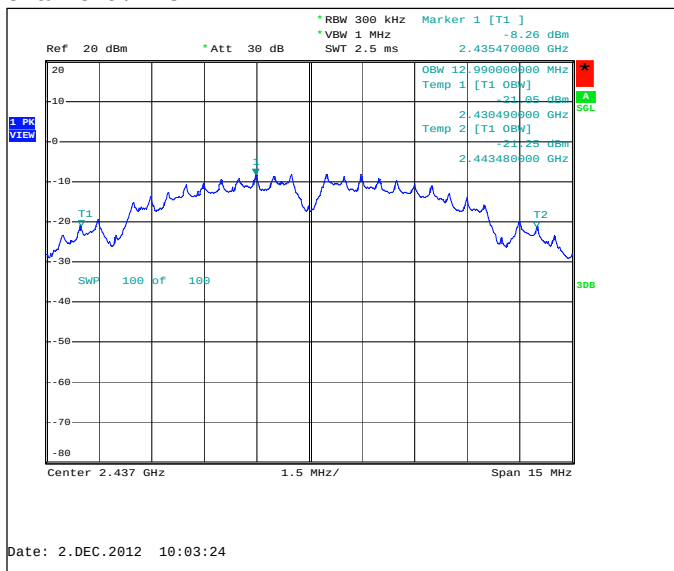
6.3.2 DSSS mode, BPSK modulation, 1 Mbps data rate

Channel / f_c [MHz]	6 dB bandwidth [kHz]	Result
1 / 2412	12900	PASSED
6 / 2437	12990	PASSED
11 / 2462	12960	PASSED

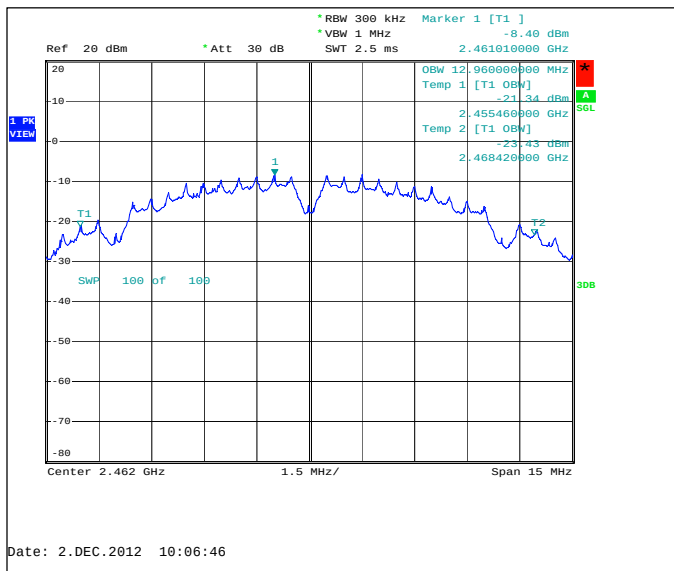
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



Channel 11 / 2462 MHz

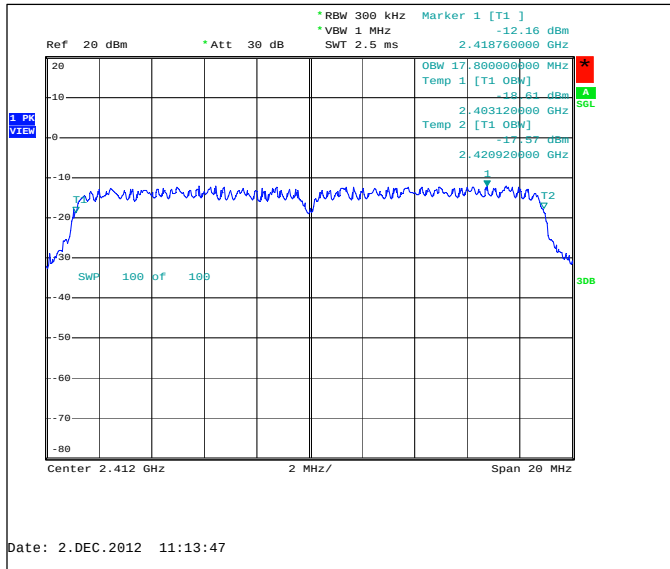


6.3.3 n-mode, 20 MHz CBW mode, BPSK modulation, 6.5 / 7.25 Mbps data rate

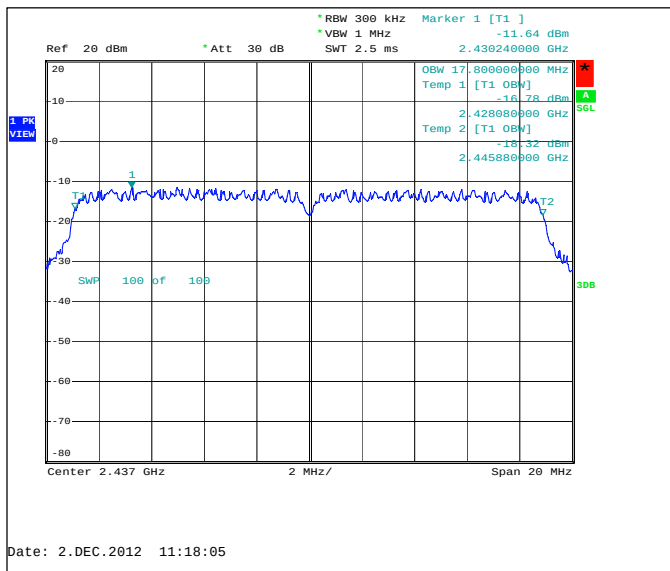
Channel / f _c [MHz]	6 dB bandwidth [kHz]	Result
1 / 2412	17800	PASSED
6 / 2437	17800	PASSED
11 / 2462	17850	PASSED
1 / 2412	17800	PASSED
6 / 2437	17800	PASSED

11 / 2462	17840	PASSED
-----------	-------	--------

Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



RBW 300 kHz VBW 1 MHz Att 30 dB
 Ref 20 dBm
 Center 2.462 GHz Span 21 MHz
 Markers: T1, T2
 SWP 100 of 100
 T1: 17.85000000 MHz, -10.53 dBm
 T2: 2.453012000 GHz, -10.79 dBm
 1 PK VIEW
 100% SOL

1 PK VIEW

Ref 20 dBm *Att 30 dB

*RBW 300 kHz Marker 1 [T1] -11.97 dBm
 *VBW 1 MHz
 SWT 2.5 ms 2.407440000 GHz

OBW 17.800000000 MHz
 Temp 1 [T1 OBW]
 -10.10 dBm
 Temp 2 [T1 OBW]
 -17.47 dBm
 2.420920000 GHz

SWP 100 kHz 100

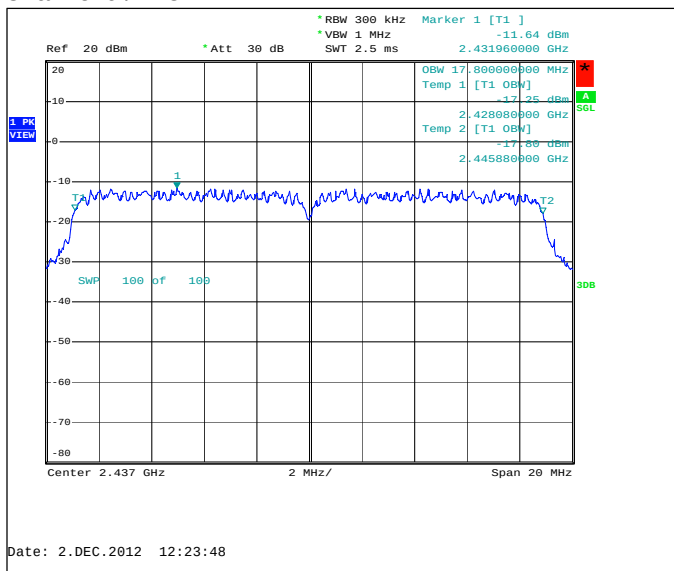
Center 2.412 GHz 2 MHz/ Span 20 MHz

3dB

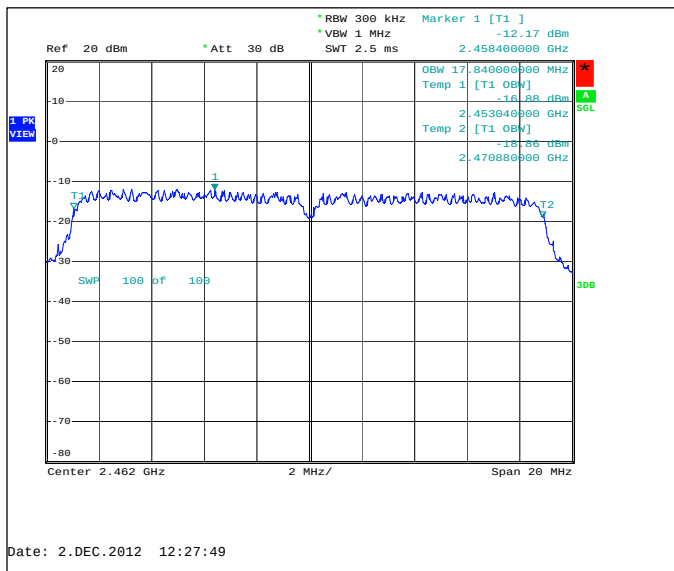
SEL

Date: 2.DEC.2012 12:20:19

Channel 6 / 2437 MHz



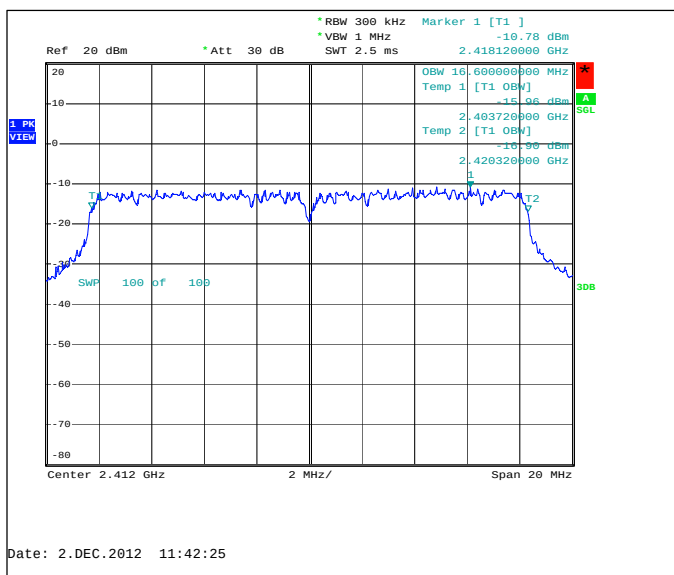
Channel 11 / 2462 MHz



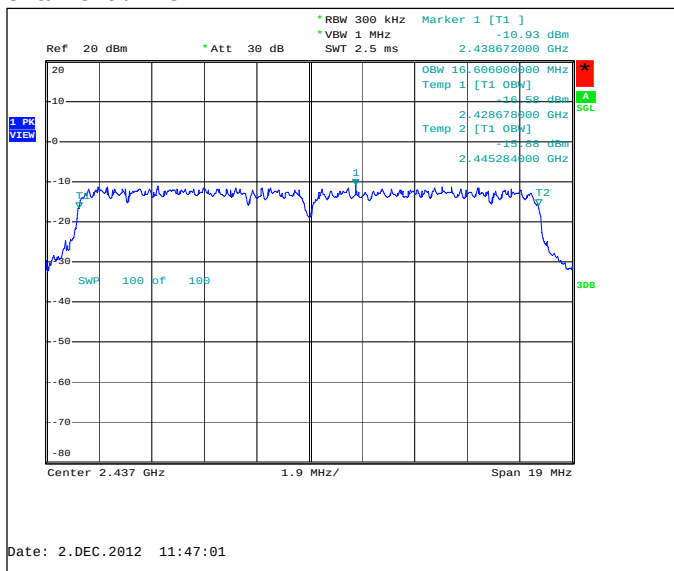
6.3.4 OFDM mode, QPSK modulation, 24 Mbps data rate

Channel / f _c [MHz]	6 dB bandwidth [kHz]	Result
1 / 2412	16600	PASSED
6 / 2437	16606	PASSED
11 / 2462	16568	PASSED

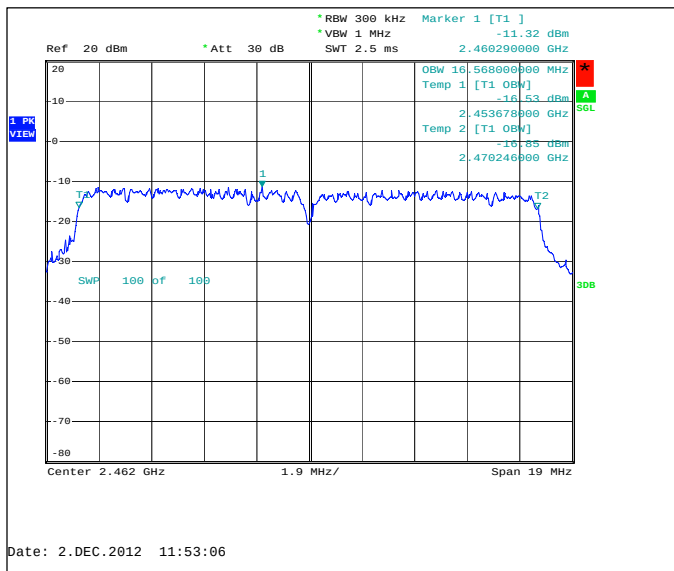
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



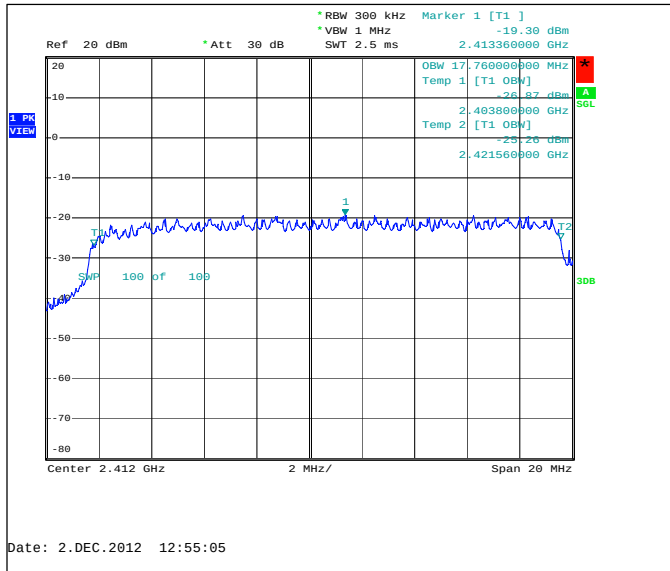
Channel 11 / 2462 MHz



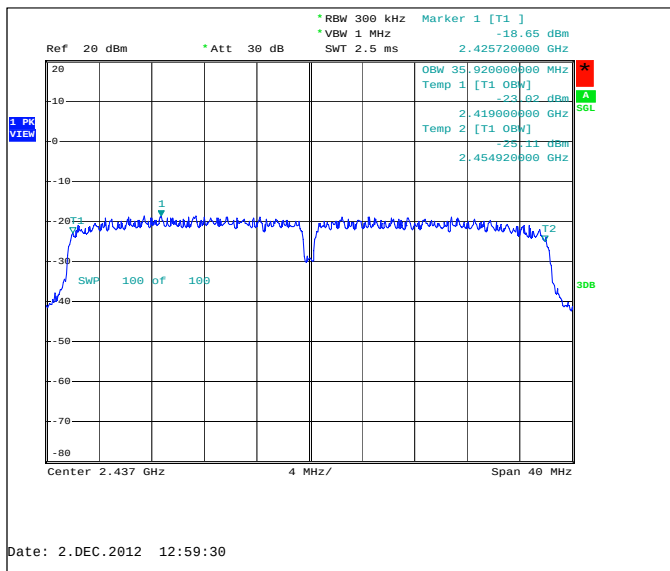
6.3.5 n-mode, 40 MHz CBW mode, BPSK modulation, 13.5 / 15.0 Mbps data rate

Channel / f _c [MHz]	6 dB bandwidth [kHz]	Result
1 / 2412	17760	PASSED
6 / 2437	35920	PASSED
11 / 2462	36036	PASSED

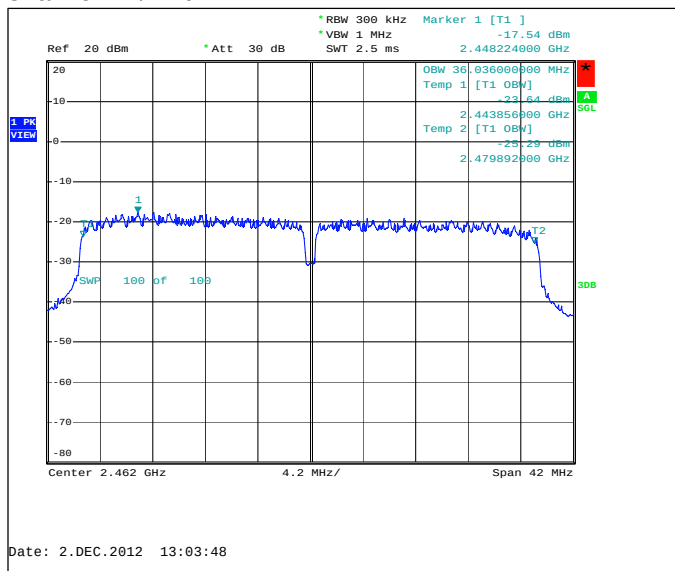
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



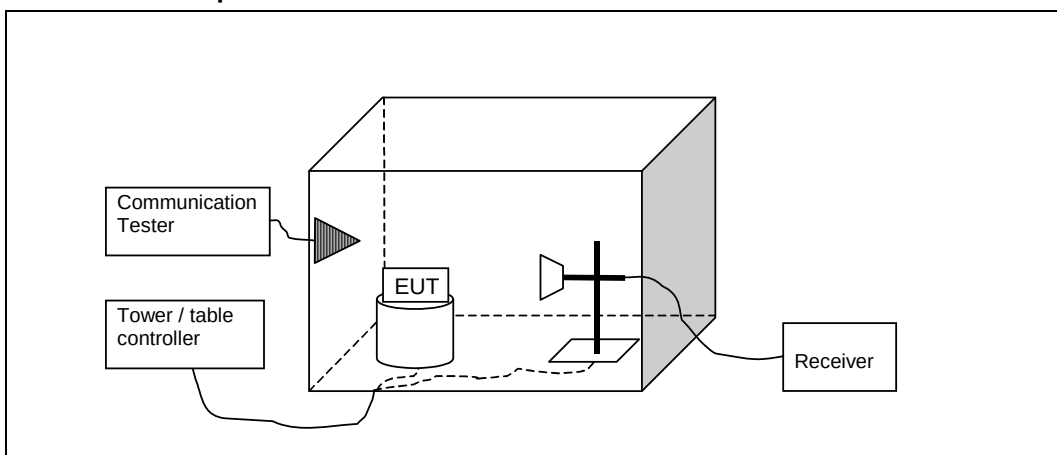
Channel 11 / 2462 MHz



7. Spurious radiated emissions (FCC §15.247(d), §15.209, RSS-210 A8.5)

EUT with DUT number	RM-860, DUT 17007
Accessories with DUT numbers	WH-902, DUT 17006 ; AC-50U, DUT 17005
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 41 / 101.4
Date of measurements	28-Dec-2012
Measured by	Kalle Hannila

7.1.1 Test setup



7.2. Test method and limit

The measurement is made according to DTS procedures KDB 558074 and IC standard RSS-210 as follows:

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with absorbers on the floor and measuring antenna at fixed height using 2-axis EUT position system.

The Final Measurement is performed in the Semi-Anechoic Chamber with conducting metal floor, if the Preliminary Measurement results are closer than 20 dB to the permissible value.

The EUT is placed at nonconductive plate at the turntable center.

For each suspected frequency, the turntable is rotated 360 degrees and antenna is scanned from 1 to 4 m. This is repeated for both horizontal and vertical receive antenna polarizations.

The emissions less than 20 dB below the permissible value are reported.

The measurement results are obtained as described below:

$$E [dB\mu V/m] = U_{RX} + A_{TOT}$$

Where U_{RX} is receiver reading and A_{TOT} is total correction factor including cable loss, antenna factor and preamplifier gain ($A_{TOT} = L_{CABLES} + A_F - G_{PREAMP}$).

Limits for spurious radiated emissions measurements (3 m measurement distance)

Frequency range [MHz]	Limit [$\mu V/m$]	Limit [$dB\mu V/m$]	Detector
30 - 88	100	40	Quasi peak
88 – 216	150	43.5	Quasi peak
216 – 960	200	46	Quasi peak
960 – 1000	500	54	Quasi peak
Above 1000	500	54	Average
Above 1000	5000	74	Peak

7.3. 2.4 GHz WLAN BPSK 6,5 / 7,25 test results

Channel 1

Peak (RBW: 1 MHz, VBW: 3 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4824.6	41.64	120.74	40.89	0.75	32.3	74	PASSED
7236.1	50.08	318.97	40.77	9.31	75.2	125	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4824.6	28.67	27.136	27.92	0.75	25.3	54	PASSED
7236.1	36.95	70.413	27.64	9.31	---	---	PASSED

Channel 6

Quasi peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
30.03	25.39	18.597	29.25	-3.86	14.6	40	PASSED
31.11	26.03	20.029	30.58	-4.55	14	40	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4879.6	28.69	27.193	28.24	0.45	25.3	54	PASSED
7319.7	37.43	74.388	27.72	9.71	16.5	54	PASSED
11614.329	44.42	166.418	27.92	16.5	9.6	54	PASSED
17998.6	43.27	145.747	28	15.27	10.7	54	PASSED

Peak (RBW: 1 MHz, VBW: 3 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4824.5	40.82	109.926	40.07	0.75	33.2	74	PASSED
7234.9	50.16	322.218	40.83	9.33	75.1	125	PASSED

Channel 11

Peak (RBW: 1 MHz, VBW: 3 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4925.1	42.66	135.878	42.18	0.48	31.3	74	PASSED
7385.4	51.04	356.287	41.09	9.95	22.9	74	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4925.1	29.22	28.903	28.74	0.48	24.8	54	PASSED
7385.4	37.55	75.379	27.6	9.95	16.4	54	PASSED

7.4. 2.4 GHz WLAN 16-QAM 24 MBPS test results

Channel 1

Peak (RBW: 1 MHz, VBW: 3 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4824.6	41.64	120.74	40.89	0.75	32.3	74	PASSED
7236.1	50.08	318.97	40.77	9.31	75.2	125	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4824.6	28.67	27.136	27.92	0.75	25.3	54	PASSED
7236.1	36.95	70.413	27.64	9.31	---	---	PASSED

Channel 6

Quasi peak (RBW: 100 kHz, VBW: 100 kHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
30.03	25.39	18.597	29.25	-3.86	14.6	40	PASSED
31.11	26.03	20.029	30.58	-4.55	14	40	PASSED

Peak (RBW: 1 MHz, VBW: 3 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4824.5	40.82	109.926	40.07	0.75	33.2	74	PASSED
7234.9	50.16	322.218	40.83	9.33	75.1	125	PASSED

Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4824.5	28.04	25.223	27.29	0.75	25.9	54	PASSED
7234.9	36.98	70.632	27.65	9.33	---	---	PASSED

Channel 11

Peak (RBW: 1 MHz, VBW: 3 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4923.4	42.82	138.309	42.36	0.46	31.2	74	PASSED
7386.2	50.97	353.712	41.02	9.96	23	74	PASSED

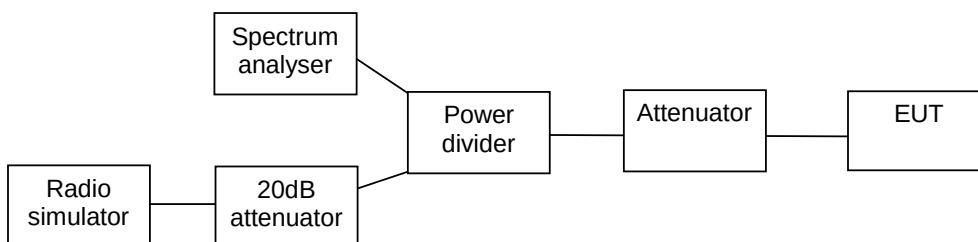
Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4923.4	30.45	33.293	29.99	0.46	23.5	54	PASSED
7386.2	37.61	75.971	27.66	9.96	16.4	54	PASSED

8. Power spectral density (FCC §15.247(e), RSS-210 A8.2 (2))

EUT with DUT number	RM-860, DUT 16892
Accessories with DUT numbers	WH-902, DUT 17006
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	21 / 44 / 100.9
Date of measurements	02-Dec-2012
Measured by	Sami Lehtonen

8.1. Test Setup



8.2. Test method and limit

The measurement is made according to DTS procedures KDB 558074 and IC standard RSS-210.

Result is corrected by bandwidth correction factor -15.2dB (BWCF = $10\log(3\text{ kHz}/100\text{ kHz}) = -15.2\text{ dB}$).

Limits for power spectral density measurements

Limit [dBm] @ 3 kHz
<= 8

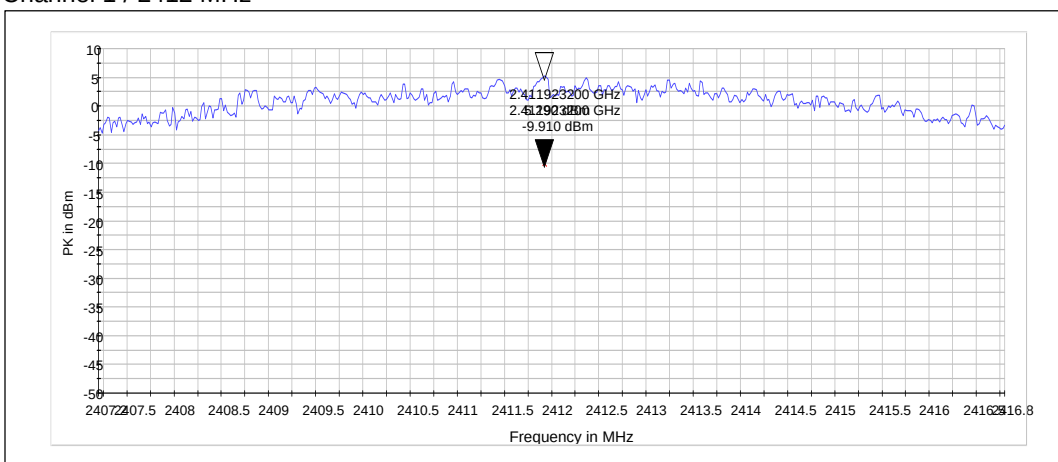
8.3. WLAN Test results

8.3.1 DSSS mode, BPSK modulation, 11 Mbps data rate

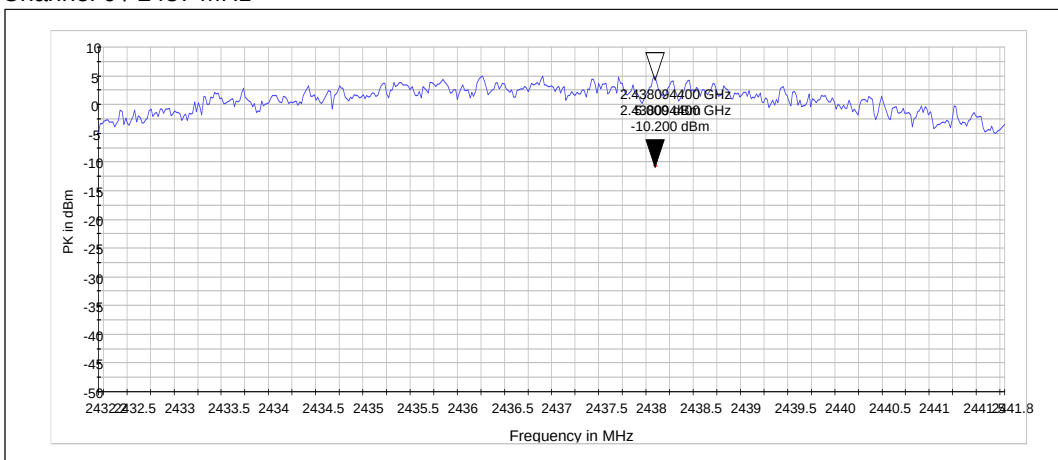
Peak (RBW: 100 kHz, VBW: 300 kHz, Max hold)

Channel / f_c [MHz]	P [dBm]	Result
1 / 2412	-9.91	PASSED
6 / 2437	-10.2	PASSED
11 / 2462	-10.21	PASSED

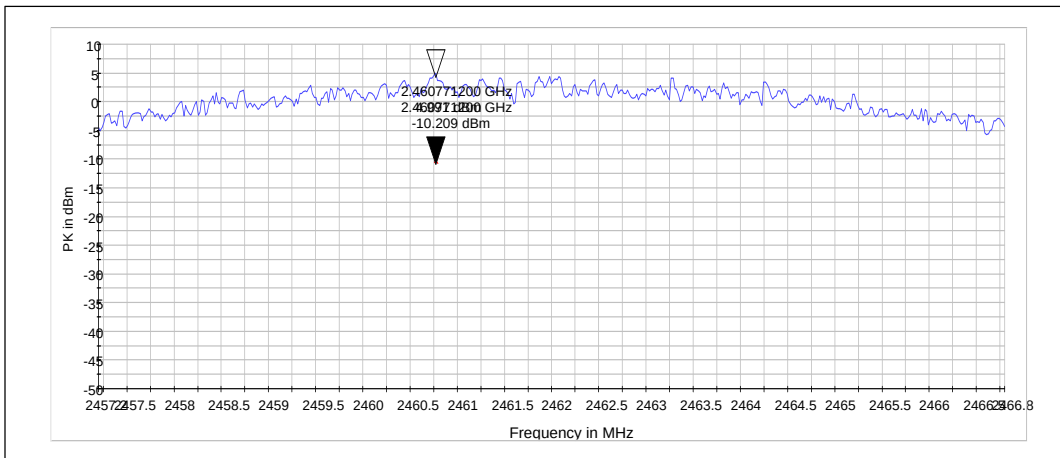
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



Channel 11 / 2462 MHz

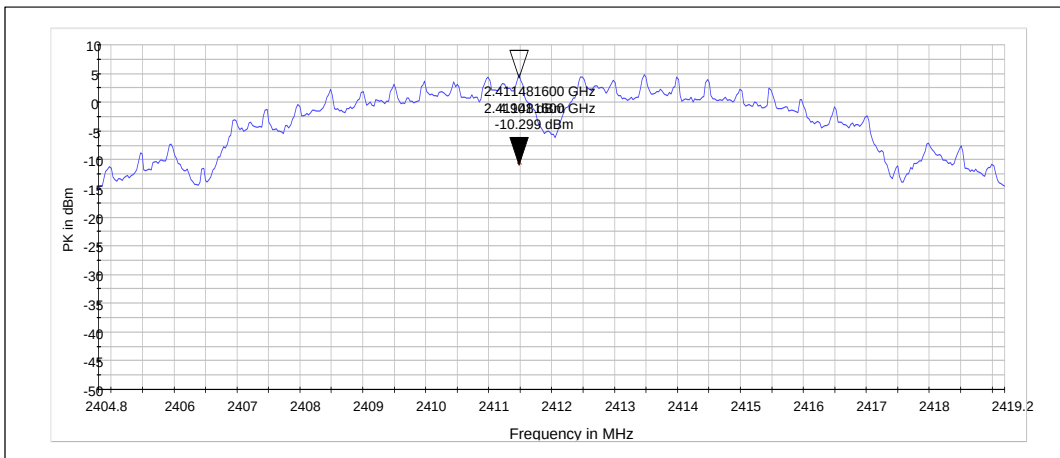


8.3.2 DSSS mode, BPSK modulation, 1 Mbps data rate

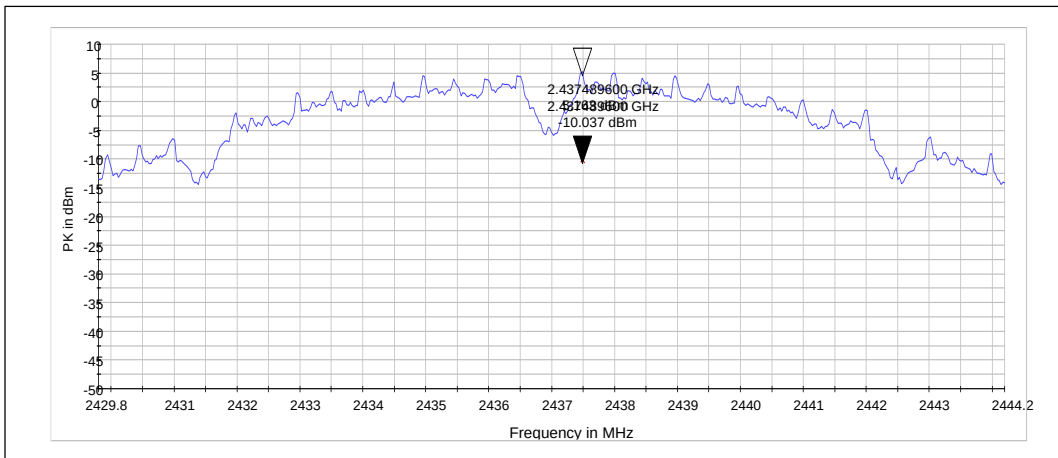
Peak (RBW: 100 kHz, VBW: 300 kHz, Max hold)

Channel / f _c [MHz]	P [dBm]	Result
1 / 2412	-10.3	PASSED
6 / 2437	-10.04	PASSED
11 / 2462	-10.24	PASSED

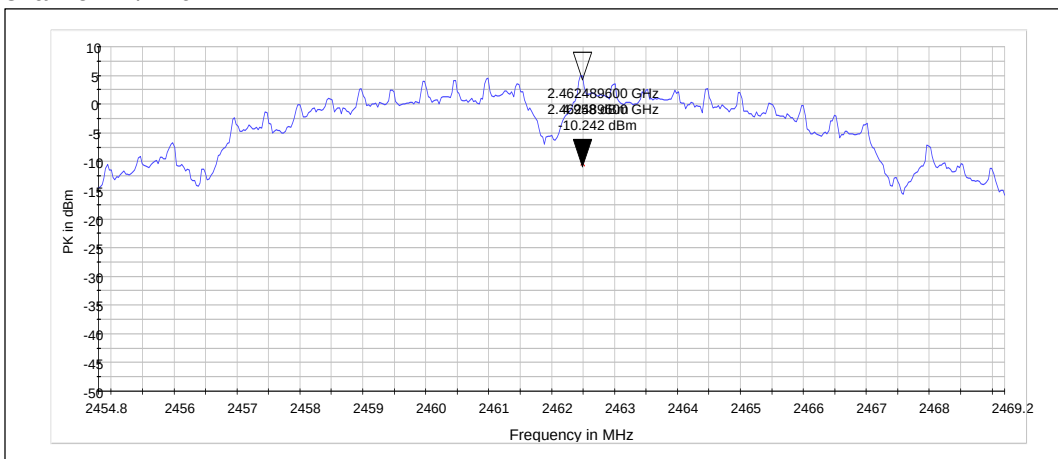
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



Channel 11 / 2462 MHz

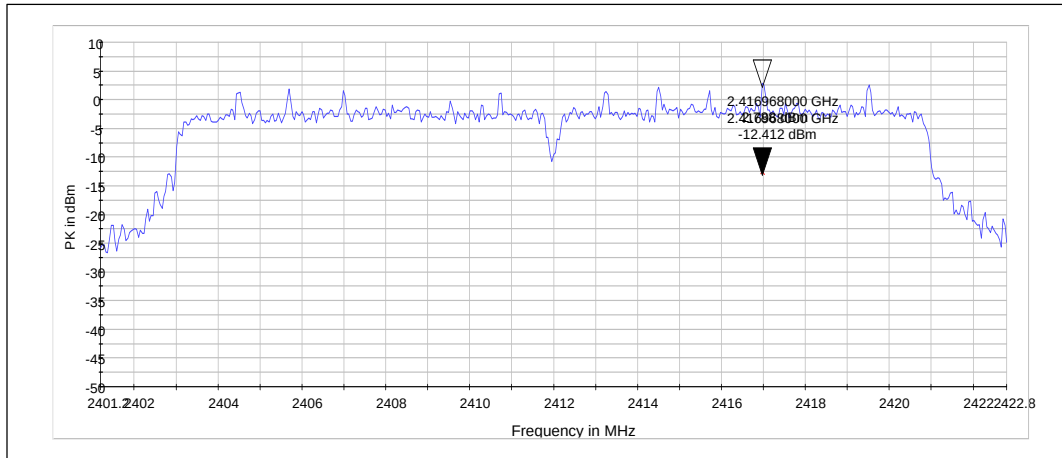


8.3.3 n-mode, 20 MHz CBW mode, BPSK modulation, 6.5 / 7.25 Mbps data rate

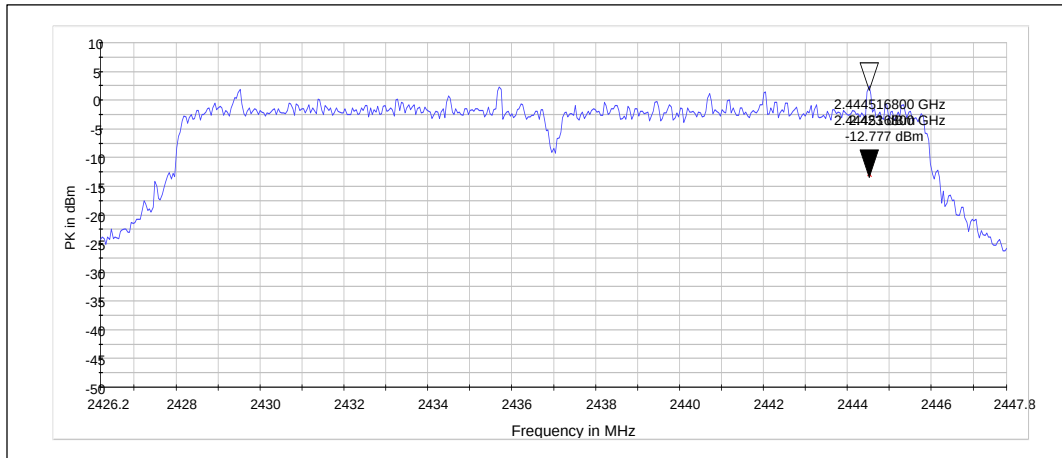
Peak (RBW: 100 kHz, VBW: 300 kHz, Max hold)

Channel / f_c [MHz]	P [dBm]	Result
1 / 2412	-12.41	PASSED
6 / 2437	-12.78	PASSED
11 / 2462	-12.57	PASSED
1 / 2412	-12.69	PASSED
6 / 2437	-12.59	PASSED
11 / 2462	-12.58	PASSED

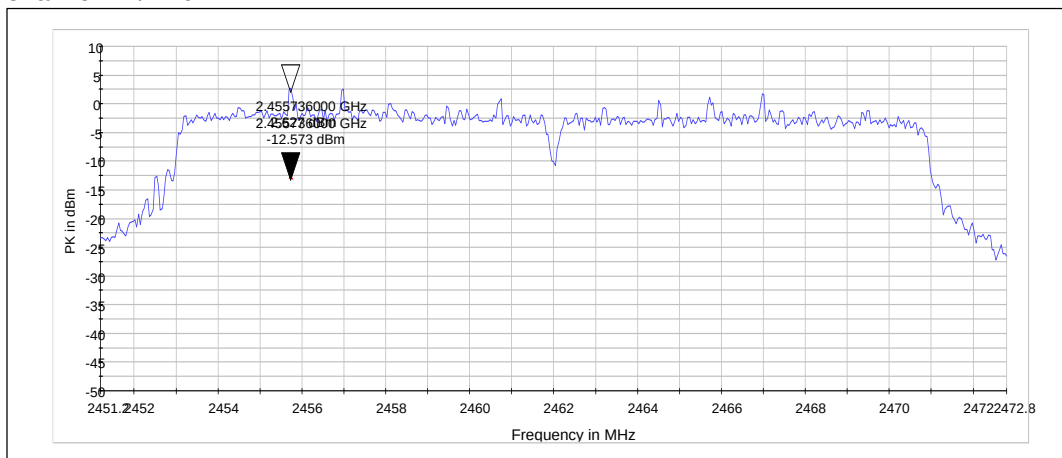
Channel 1 / 2412 MHz



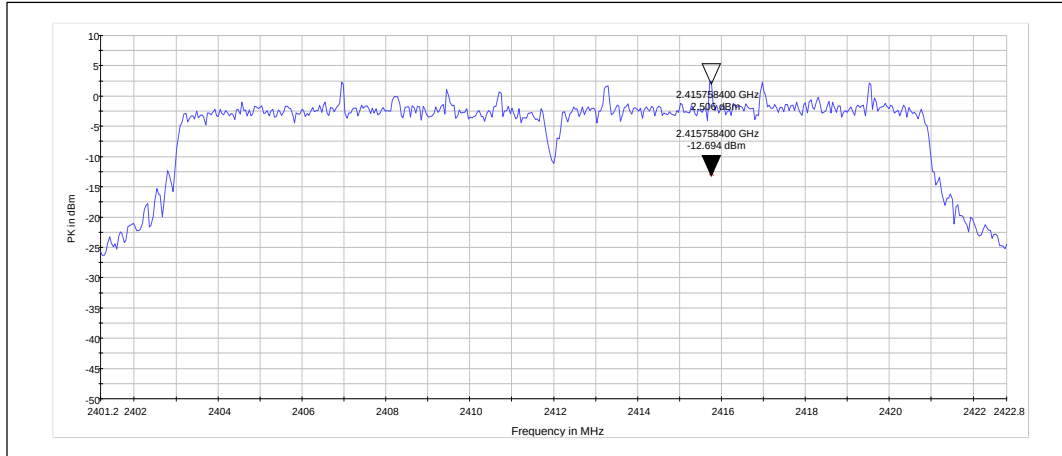
Channel 6 / 2437 MHz



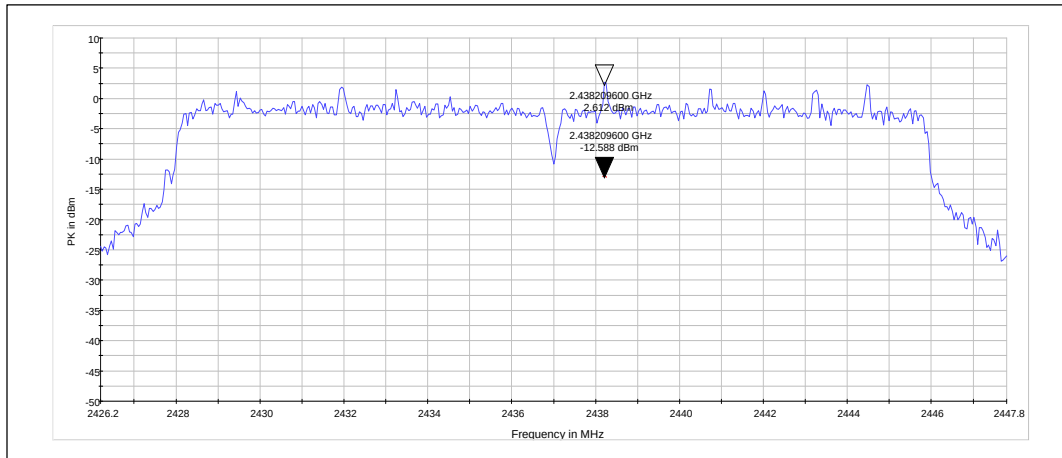
Channel 11 / 2462 MHz



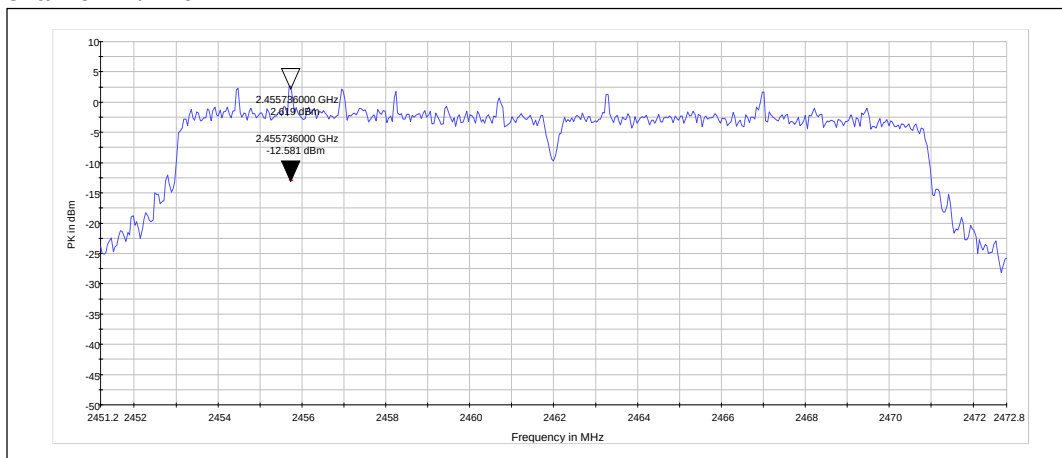
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



Channel 11 / 2462 MHz

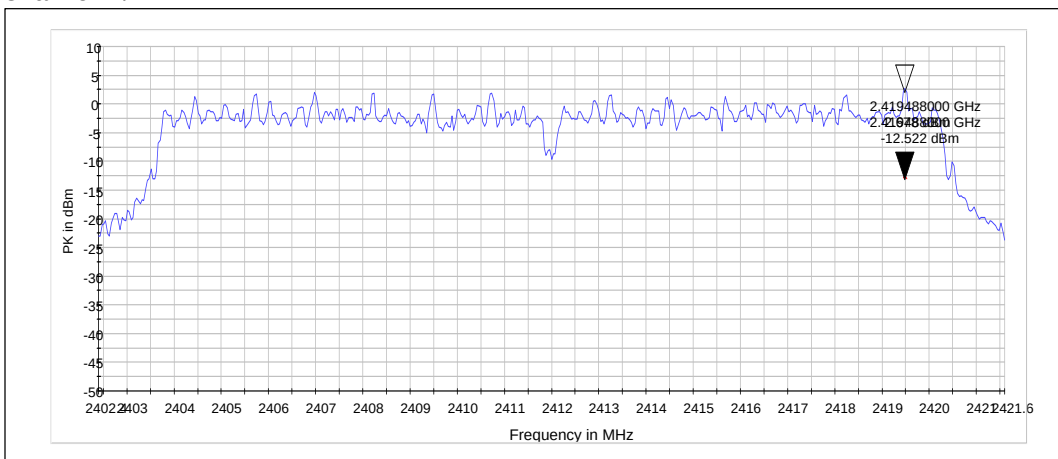


8.3.4 OFDM mode, QPSK modulation, 24 Mbps data rate

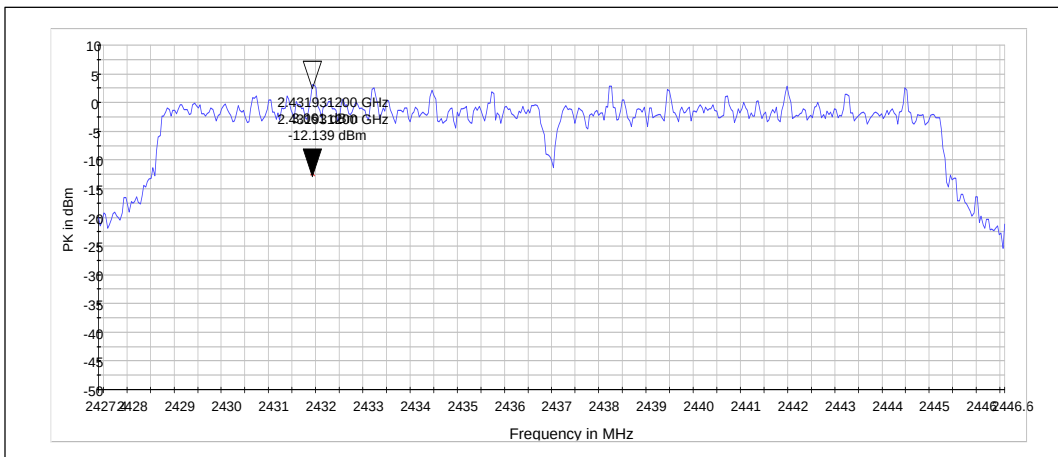
Peak (RBW: 100 kHz, VBW: 300 kHz, Max hold)

Channel / f _c [MHz]	P [dBm]	Result
1 / 2412	-12.52	PASSED
6 / 2437	-12.14	PASSED
11 / 2462	-12.64	PASSED

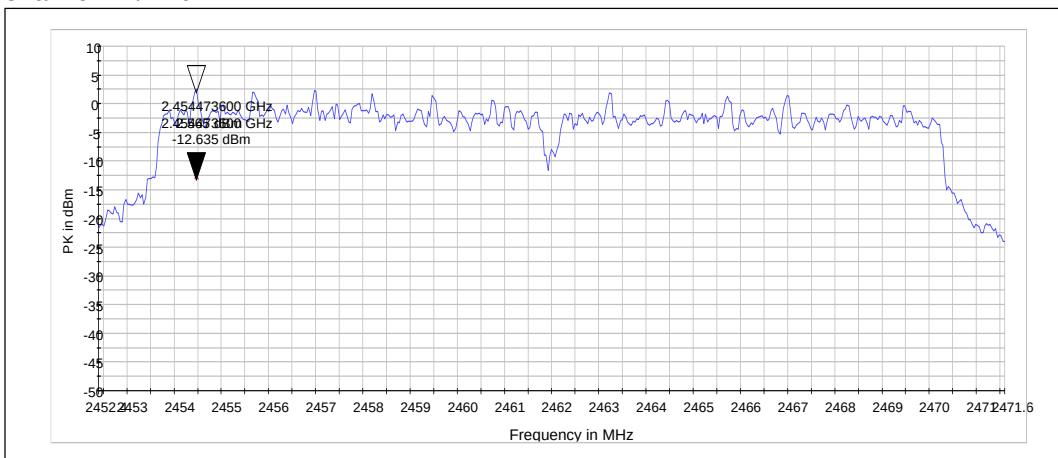
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



Channel 11 / 2462 MHz

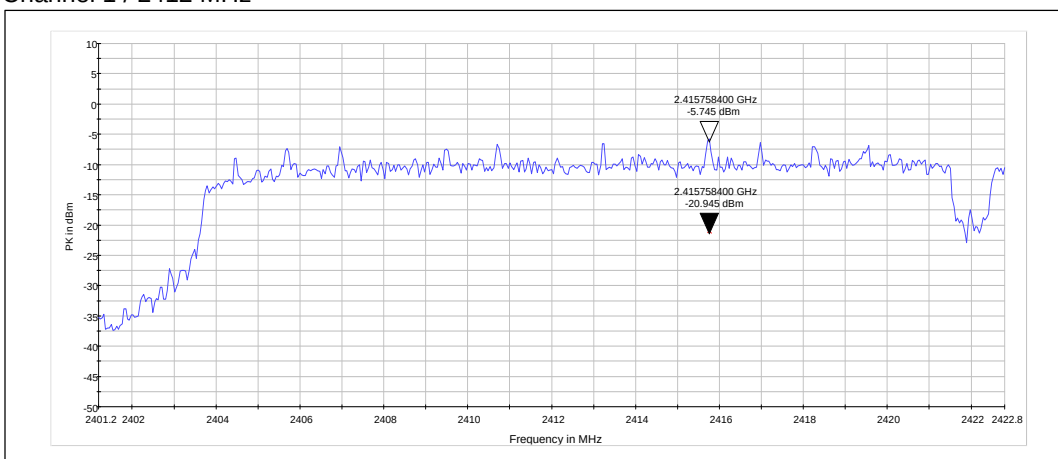


8.3.5 n-mode, 40 MHz CBW mode, BPSK modulation, 13.5 / 15.0 Mbps data rate

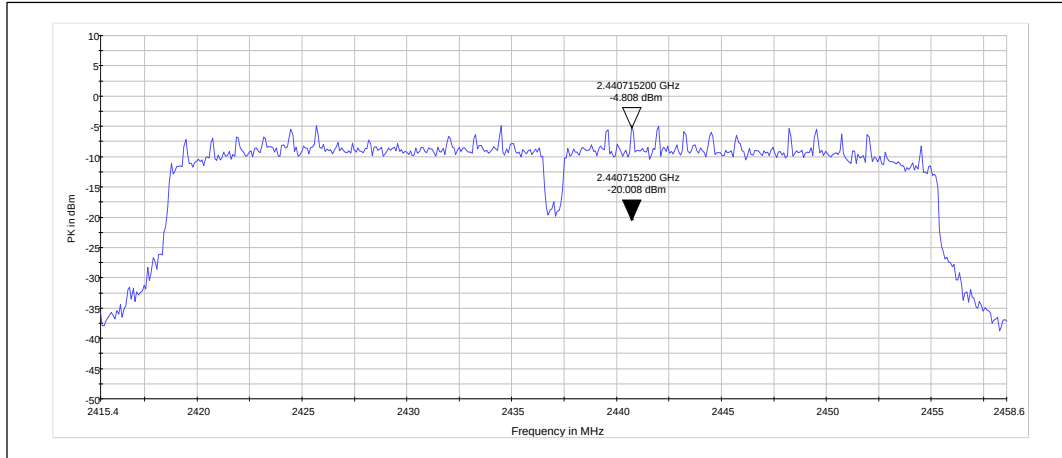
Peak (RBW: 100 kHz, VBW: 300 kHz, Max hold)

Channel / f_c [MHz]	P [dBm]	Result
1 / 2412	-20.95	PASSED
6 / 2437	-20.01	PASSED
11 / 2462	-19.1	PASSED

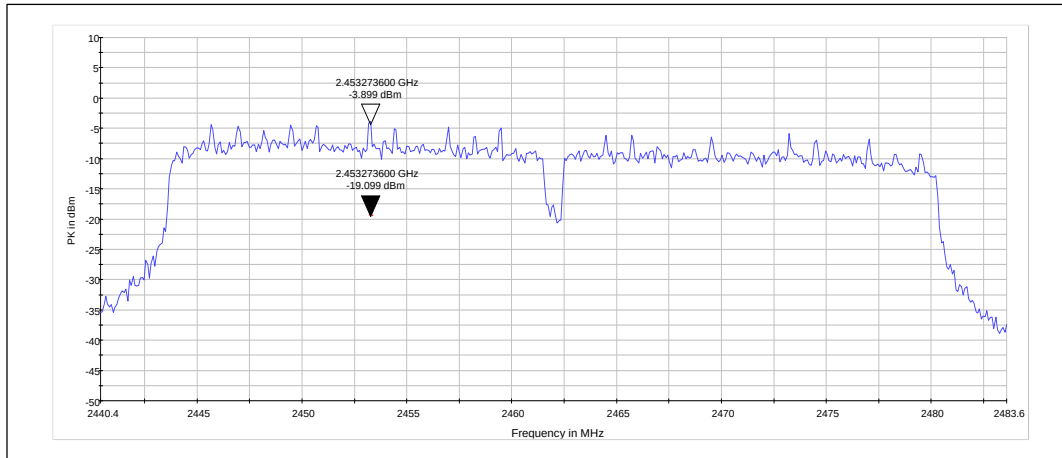
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



Channel 11 / 2462 MHz



9. Test Equipment

9.1. Conducted measurements

Eq. No	Equipment	Type	Manufacturer	Used in
6038	Data Logger	Testo 580	Testo	-
-	BT / WLAN Antenna	SPA 2400/75/9/0/V	Huber-Suhner	-
-	BT / WLAN Antenna	SPA 2400/75/9/0/V	Huber-Suhner	-
2389	Signal Generator	SMJ 100A	R&S	-
6009	GPS Antenna	SA-700	Chronos	-
6010	GPS Network amplifier	NLA20FPDC	GPS Networking, Inc	-
6011	GPS signal Splitter	LDCBS1x4	GPS Networking, Inc	-
6015	Receiver	ESI	R&S	-
2059	V-network	ESH3-Z6	R&S	-
6044	V-network	ESH3-Z6	R&S	-
1759	LISN 50 µH	ESH3-Z5	R&S	-
2390	Directional Coupler	DC2600	AR	-
1916	Communication Tester	CMTA84	R&S	-
6012	CDN	CDN USB/c	Teseq	-
2388	Bluetooth Tester	CBT	R&S	-
6046	Attenuator 10dB	8493C	Agilent	-
6047	Attenuator 20dB	8493C	Agilent	-
6036	Data Logger	175-H2	Testo	-
6045	Power Splitter	11667B	Agilent	-
6039	USB Interface	5541765	Testo	-
10479	Communication Tester	CMW500	R&S	-
6094	Communication Tester	CMW500	R&S	-
6096	EMC Analyzer	E7405A	HP	-
6098	Signal Generator	8648C	Agilent	-
6103	Bluetooth tester	CBT	R&S	-
6113	Signal Generator	SMF100A	R&S	-
6120	Thermal Chamber	WT 20/40	Weiss	-
6121	Power Splitter	HP11667B	Agilent	-
6122	Power Splitter	HP11667B	Agilent	-
6134	Attenuator 10dB	BW-S10-2W263+	Mini-Circuits	-
6136	Attenuator 20dB	BW-S20-2W263+	Mini-Circuits	-
2359	Temperature Test Chamber	VT4002	Vötsch	-
2347	Communication Tester	CMU200	R&S	-
2180	Communication Tester	CMU200	R&S	-
2156	Communication Tester	CMU200	R&S	-
1999	Receiver	ESIB26	R&S	-
2352	Spectrum Analyzer	FSP-30	R&S	-
2097	Pulse Limiter	ESH3-Z2	R&S	-
2039	Power Supply	PL330QMD	Thurlby	-
1992	Signal Generator	83630B	Agilent	-
2206	Signal Generator	SMX	R&S	-

9.2. Radiated measurements

Eq. No	Equipment	Type	Manufacturer	Used in
2391	Band Reject Filter	WRCG1729.4/1735.4-1722.4/1742.4-40/6SS	Wainwright	27
6038	Data Logger	Testo 580	Testo	-
6014	Substitute Calibration Cable	Sucoflex 104PB	Suhner	-
-	BT / WLAN Antenna	SPA 2400/75/9/0/V	Huber-Suhner	-
-	BT / WLAN Antenna	SPA 2400/75/9/0/V	Huber-Suhner	-
2389	Signal Generator	SMJ 100A	R&S	-
6009	GPS Antenna	SA-700	Chronos	-

Eq. No	Equipment	Type	Manufacturer	Used in
6010	GPS Network amplifier	NLA20FPDC	GPS Networking, Inc	-
6011	GPS signal Splitter	LDCBS1x4	GPS Networking, Inc	-
-	RF immunity / Emission Software	EMC32	R&S	-
1917	Communication Tester	CMTA84	R&S	-
2388	Bluetooth Tester	CBT	R&S	-
6037	Data Logger	175-H2	Testo	-
6039	USB Interface	5541765	Testo	-
6087	Antenna	BBHA 9120D	Scharzbeck	-
6088	Antenna	VUBA 9117	Scharzbeck	-
6089	Antenna	HFH2-Z2	R&S	-
10479	Communication Tester	CMW500	R&S	-
6094	Communication Tester	CMW500	R&S	-
6103	Bluetooth tester	CBT	R&S	-
6113	Signal Generator	SMF100A	R&S	-
6115	Open switch and control unit	OSP 130	R&S	-
6116	Open switch and control unit	OSP 150	R&S	-
6130	Notch Filter	WRCD1880-1.1.25/50-10SS	Wainwright	-
6131	Notch Filter	WRCT902.4-0.4/40-8SS	Wainwright	-
6135	Notch Filter	WRCJV2531/2539-2523/2547-60/12SS	Wainwright	-
2140	Antenna	EMCO93110B	EMCO	-
2142	Antenna	3146	EMCO	-
2357	Band Reject Filter	WRCG2400/2483-2390/2493-35/10SS	Wainwright	-
2364	Band Reject Filter	WRCG1877/1883 - 1870/1890-40/6SS	Wainwright	24
2043	Band Reject Filter	WRCA824/849-0,2-6SS	Wainwright	22
2347	Communication Tester	CMU200	R&S	-
2180	Communication Tester	CMU200	R&S	-
2156	Communication Tester	CMU200	R&S	-
2176	CDN	CDN 801-M3	Lüthi	-
2027	CDN	M2 (modified) DC1	MEB	-
2028	CDN	M3 (modified) DC2	MEB	-
1984	Antenna	BBHA 9120 D	Schwarzbeck	-
6017	Antenna	SBA 9113	Schwarzbeck	-
2009	Signal Generator	SMP 22	R&S	-
2029	Power Supply	PL330	Thurlby	-
2361	Anechoic Chamber	3 m Semi / Full Anechoic Chamber	Euroshield	-
2353	Receiver	ESIB26	R&S	-
2135	CDN	CDN 801-M3	Lüthi	-