

FCC Part 15C Compliance Test Report

Test Report no.:	FCC15CWLAN_RM-846_44	Date of Report:	27-May-2013
Number of pages:	50	Customer's Contact person:	Juha Paukku
Testing laboratory:	TCC Nokia Tampere Laboratory P.O. Box 68 Sinitaival 5 FIN-33720 TAMPERE, FINLAND Tel. +358 (0) 7180 46800 Fax. +358 (0) 7180 46880	Customer:	Nokia Corporation P.O. Box 68 Sinitaival 5 FIN-33720 TAMPERE, FINLAND Tel. +358 (0) 7180 46800 Fax. +358 (0) 7180 46880
FCC listing no.:	94436		
IC recognition no.:	661AK-1		
Tested devices/ accessories:	Phone RM-846 / Battery BL-4J / AC charger AC-50E / Data cable CA-190CD / Headset WH-108		
FCC ID:	PDNRM-846X	IC:	661R-RM846
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, RSS-210 (Issue 8, December 2010). 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:			

Jari Jantunen, System Manager, EMC

1. Summary for FCC Part 15C Compliance Test Report

Date of receipt	11-Oct-2012
Testing completed	19-Oct-2012
The customer's contact person	Paukku Juha
Test Plan referred to	T:\Projects\RM-846\TestPlan\RS_testplan_RM-846.xlsm
Notes	-
Document name	T:\Projects\RM-846\EMC\FCC15CWLAN_RM-846_44.docx

1.1. EUT and Accessory Information

The EUT is a mobile phone with following features:

GSM/WCDMA/WLAN/Bluetooth

The EUT is tested with maximum rated TX power.

Devices under tests

Product	Type	SN	HW	MV	SW	DUT
Phone	RM-846	004402471069694	1640	FAV5	1030.1801.9200.9900.133	42913
Battery	BL-4J	49554022630A0100872;0670616	LG PWB ver. 2.1	-	-	42914
Phone	RM-846	004402471069629	1640	FAV5	1030.51.9200.9903.145	42928
Battery	BL-4J	49554022630A0105584;0670616	LG PWB ver. 2.1	-	-	42925
Charger	AC-50E	5321402345011100458;0675619	1.1	0.2	-	42916
Data Cable	CA-190CD	-	-	-	-	42918
Headset	WH-108	-	4.0	4.0	-	42927
Phone	RM-846	004402471070056	1640	FAV5	1030.51.9200.9903.145	42929
Battery	BL-4J	49554022020A0108950;0670616	LG PWB ver. 2.1	-	-	42924
AC charger	AC-50E	4090492023260400600;0675619	HW0.5MW0.4PV04	-	-	42785
Headset	WH-108	-	4.0	4.0	-	42926

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

5GHz RLAN:

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	NP
15.247(d)	A8(0.5)	Spurious RF conducted emissions	NP
15.247(d), 15.209	A8(0.5)	Spurious radiated emissions	NP
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

The EUT complies with the essential requirements in the standard.

FAILED

The EUT does not comply with the essential requirements in the standard.

NP

The test was not performed by the TCC Nokia Laboratory.

The test results of PDNRM-846 are re-used for certification of the PDNRM-846X. The table above indicates the results, which will be re-used.

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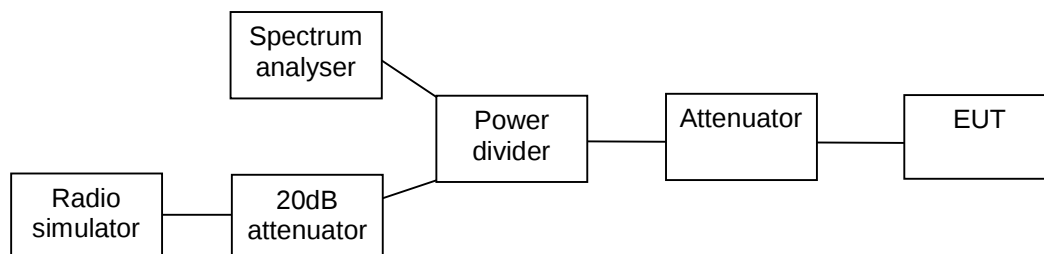
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2. Conducted peak output power (15.247(b)(1), RSS-210 A8.4 (4))

EUT with DUT number	RM-846, DUT 42913
Accessories with DUT numbers	BL-4J, DUT 42914
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	20-22 / 47-51 / 99.6-100.2
Date of measurements	11..12-Oct-2012
Measured by	Jari Jantunen

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 WLAN, all modes, modulations and data rates

Channel / f _c [MHz]	Mode	Modulation	Data rate	Level [dBm]
6 / 2437	DSSS	BPSK	1 Mbps	19.58
6 / 2437	DSSS	QPSK	2 Mbps	19.73
6 / 2437	DSSS	QPSK	5.5 Mbps	21.4
6 / 2437	DSSS	QPSK	11 Mbps	21.82
6 / 2437	OFDM	BPSK	6 Mbps	23.32
6 / 2437	OFDM	BPSK	9 Mbps	23.54
6 / 2437	OFDM	QPSK	12 Mbps	23.04
6 / 2437	OFDM	QPSK	18 Mbps	23.21
6 / 2437	OFDM	16-QAM	24 Mbps	22.72
6 / 2437	OFDM	16-QAM	36 Mbps	22.78
6 / 2437	OFDM	64-QAM	48 Mbps	21.41
6 / 2437	OFDM	64-QAM	54 Mbps	21.25
6 / 2437	n-mode, 20 MHz CBW	BPSK	6.5 / 7.25 Mbps	21.44
6 / 2437	n-mode, 20 MHz CBW	QPSK	13.0 / 14.4 Mbps	21.19
6 / 2437	n-mode, 20 MHz CBW	QPSK	19.5 / 21.7 Mbps	19.36
6 / 2437	n-mode, 20 MHz CBW	16-QAM	26.0 / 28.9 Mbps	19.42
6 / 2437	n-mode, 20 MHz CBW	16-QAM	39.0 / 43.3 Mbps	19.98
6 / 2437	n-mode, 20 MHz CBW	64-QAM	52.0 / 57.8 Mbps	19.33
6 / 2437	n-mode, 20 MHz CBW	64-QAM	58.5 / 65.0 Mbps	18.27
6 / 2437	n-mode, 20 MHz CBW	64-QAM	65.0 / 72.2 Mbps	18.34

2.4. Power results summary 5GHz RLAN, all modes, modulations and data rates

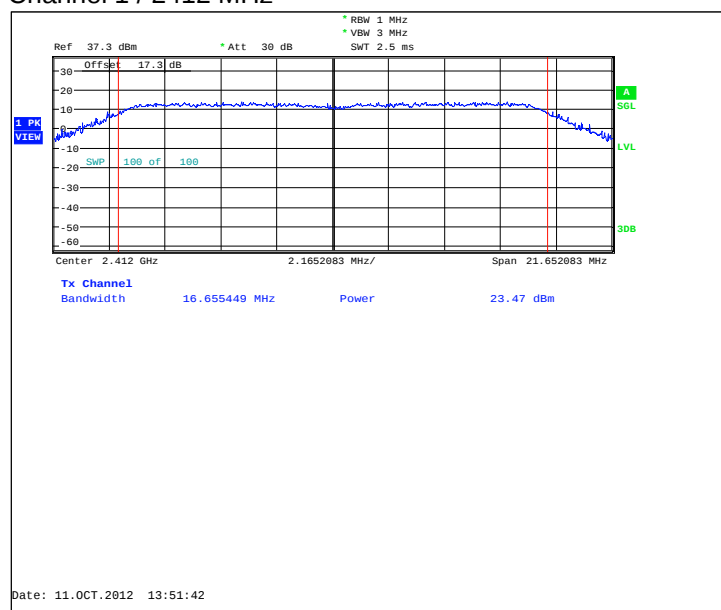
Channel / f _c [MHz]	Mode	Modulation	Data rate	Level [dBm]
157 / 5785	OFDM	BPSK	6 Mbps	22.43
157 / 5785	OFDM	BPSK	9 Mbps	22.46
157 / 5785	OFDM	QPSK	12 Mbps	22.44
157 / 5785	OFDM	QPSK	18 Mbps	22.32
157 / 5785	OFDM	16-QAM	24 Mbps	22.73
157 / 5785	OFDM	16-QAM	36 Mbps	21.73
157 / 5785	OFDM	64-QAM	48 Mbps	20.84
157 / 5785	OFDM	64-QAM	54 Mbps	19.88
157 / 5785	n-mode, 20 MHz CBW	BPSK	6.5 / 7.25 Mbps	20.44
157 / 5785	n-mode, 20 MHz CBW	QPSK	13.0 / 14.4 Mbps	20.45
157 / 5785	n-mode, 20 MHz CBW	QPSK	19.5 / 21.7 Mbps	19.52
157 / 5785	n-mode, 20 MHz CBW	16-QAM	26.0 / 28.9 Mbps	19.83
157 / 5785	n-mode, 20 MHz CBW	16-QAM	39.0 / 43.3 Mbps	18.96
157 / 5785	n-mode, 20 MHz CBW	64-QAM	52.0 / 57.8 Mbps	18.9
157 / 5785	n-mode, 20 MHz CBW	64-QAM	58.5 / 65.0 Mbps	17.69
157 / 5785	n-mode, 20 MHz CBW	64-QAM	65.0 / 72.2 Mbps	17.83
157+161 / 5795	n-mode, 40 MHz CBW	BPSK	13.5 / 15.0 Mbps	19.26
157+161 / 5795	n-mode, 40 MHz CBW	QPSK	27.0 / 30.0 Mbps	19.06
157+161 / 5795	n-mode, 40 MHz CBW	QPSK	40.5 / 45.0 Mbps	19.22
157+161 / 5795	n-mode, 40 MHz CBW	16-QAM	54.0 / 60.0 Mbps	19.35
157+161 / 5795	n-mode, 40 MHz CBW	16-QAM	81.0 / 90.0 Mbps	18.41
157+161 / 5795	n-mode, 40 MHz CBW	64-QAM	108.0 / 120.0 Mbps	18.48
157+161 / 5795	n-mode, 40 MHz CBW	64-QAM	121.5 / 135.0 Mbps	17.29
157+161 / 5795	n-mode, 40 MHz CBW	64-QAM	135.0 / 150.0 Mbps	17.31

2.5. WLAN Test results

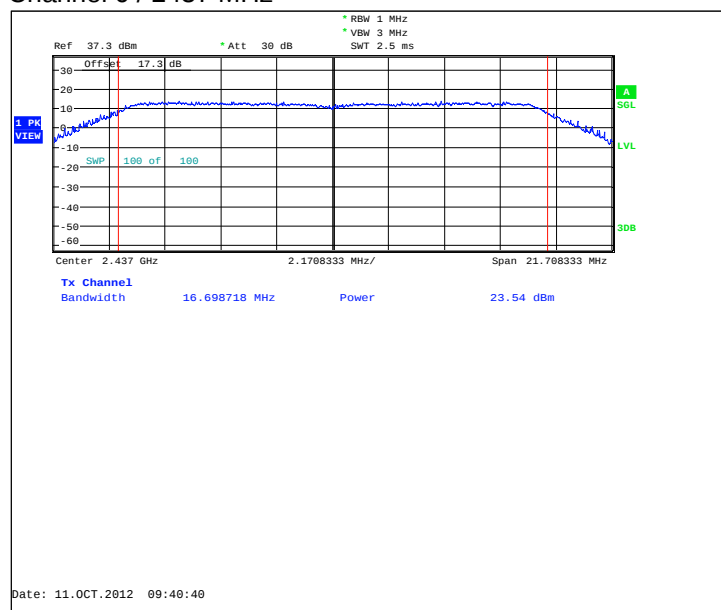
2.5.1 OFDM mode, BPSK modulation, 9 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
1 / 2412	23.47	222.331	PASSED
6 / 2437	23.54	225.944	PASSED
11 / 2462	22.94	196.789	PASSED

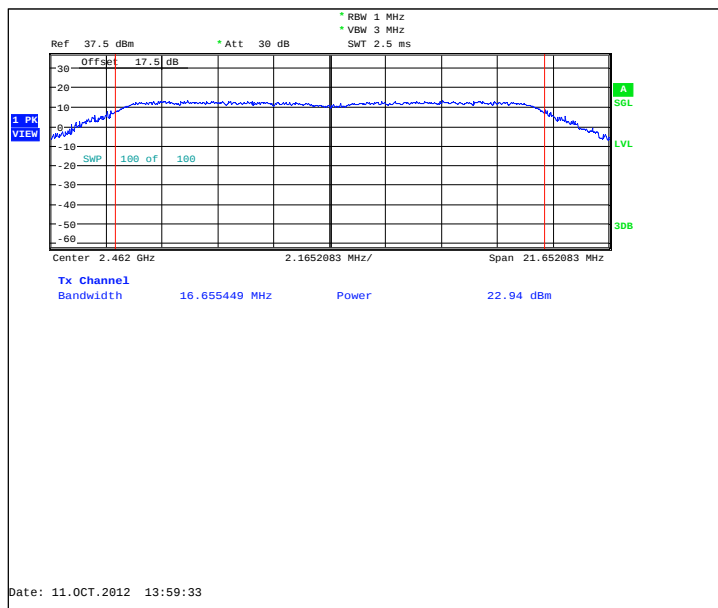
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



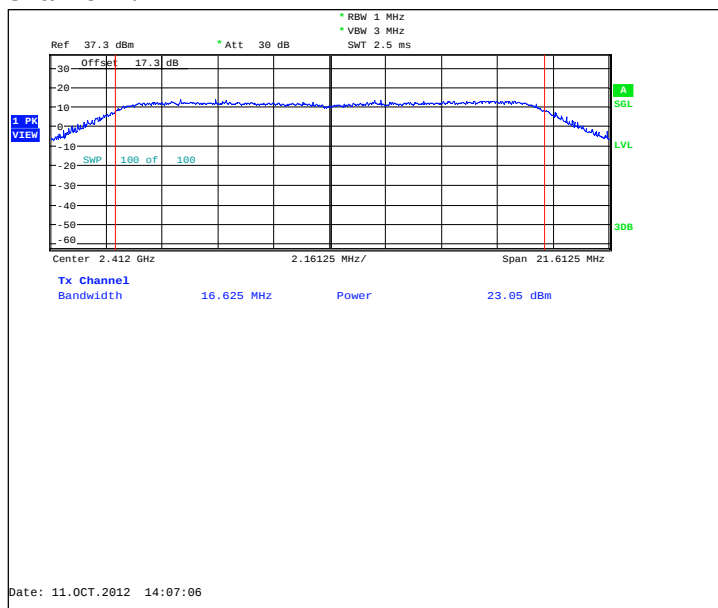
Channel 11 / 2462 MHz



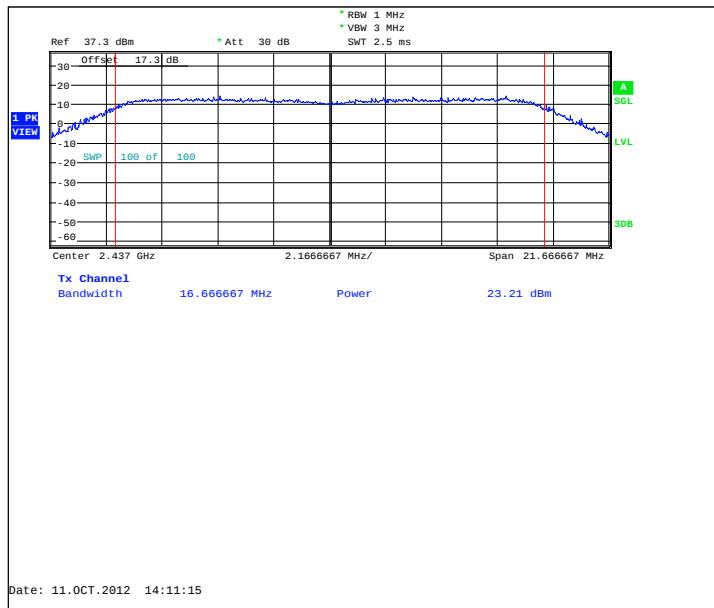
2.5.2 OFDM mode, QPSK modulation, 18 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
1 / 2412	23.05	201.837	PASSED
6 / 2437	23.21	209.411	PASSED
11 / 2462	22.61	182.39	PASSED

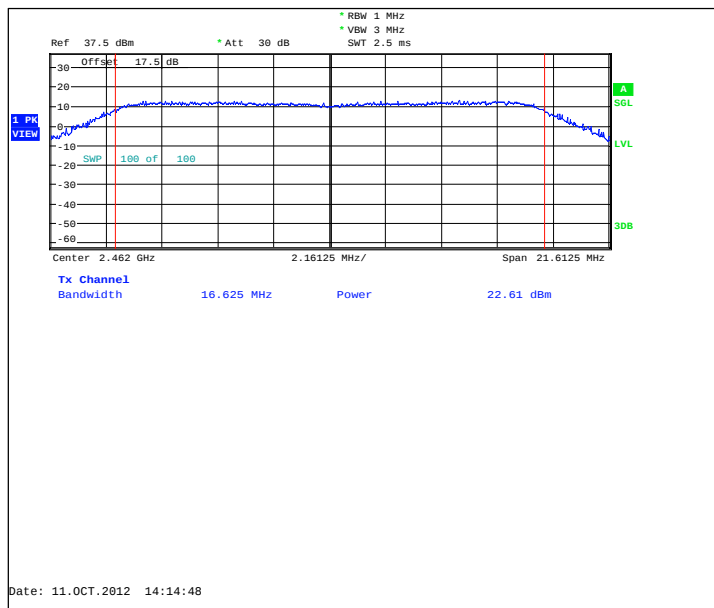
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



Channel 11 / 2462 MHz

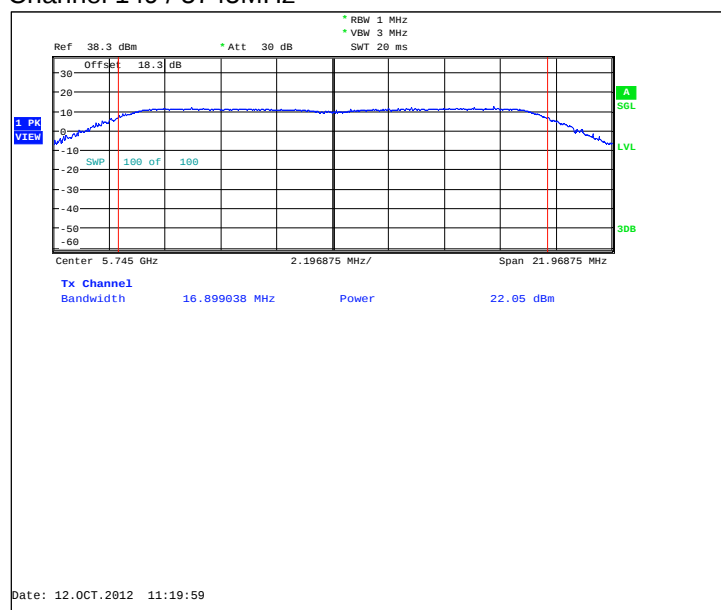


2.6. 5 GHz RLAN Test results

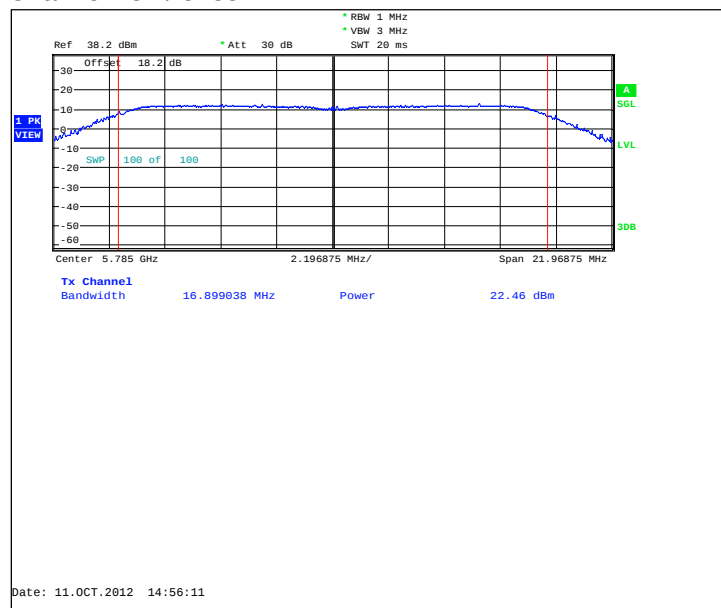
2.6.1 OFDM mode, BPSK modulation, 9 Mbps data rate

Channel / f _c [MHz]	P [dBm]	P [mW]	Result
149 / 5745	22.05	160.325	PASSED
157 / 5785	22.46	176.198	PASSED
165 / 5825	22.34	171.396	PASSED

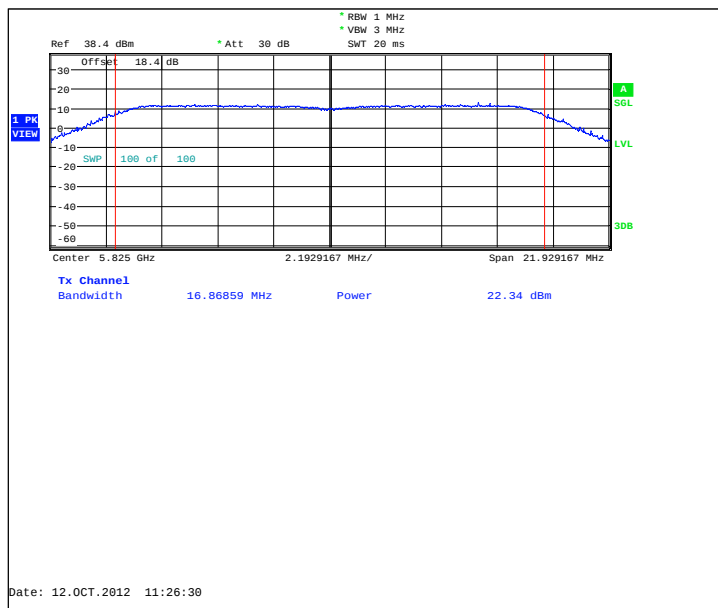
Channel 149 / 5745MHz



Channel 157 / 5785MHz



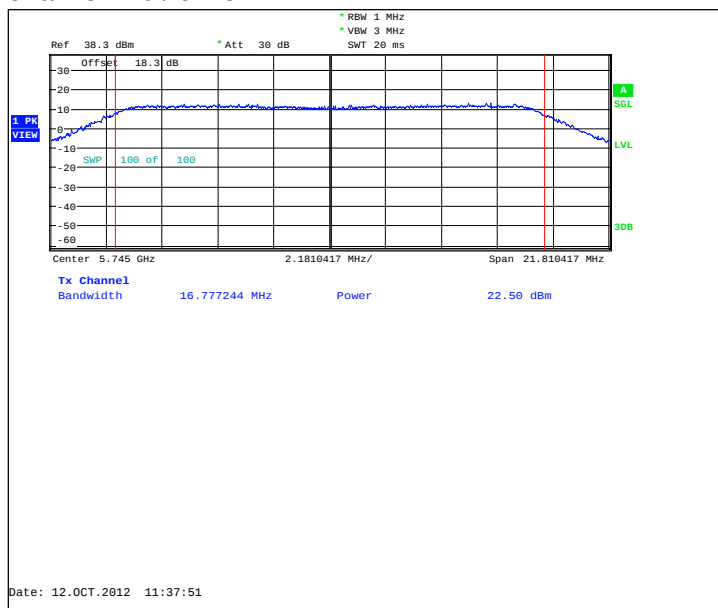
Channel 165 / 5825MHz



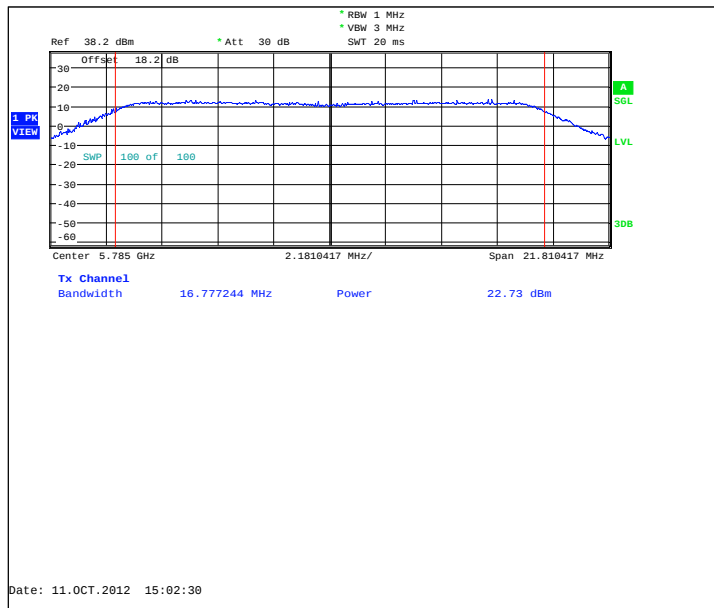
2.6.2 OFDM mode, 16-QAM modulation, 24 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
149 / 5745	22.5	177.828	PASSED
157 / 5785	22.73	187.499	PASSED
165 / 5825	22.6	181.97	PASSED

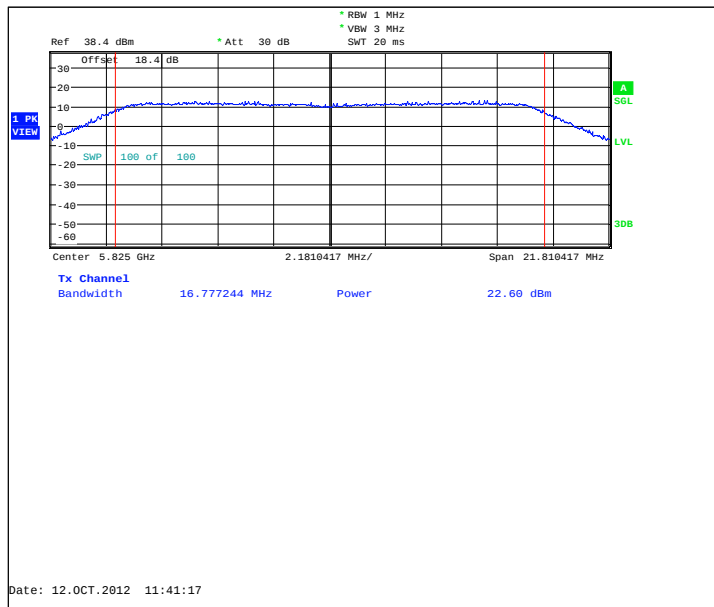
Channel 149 / 5745MHz



Channel 157 / 5785MHz



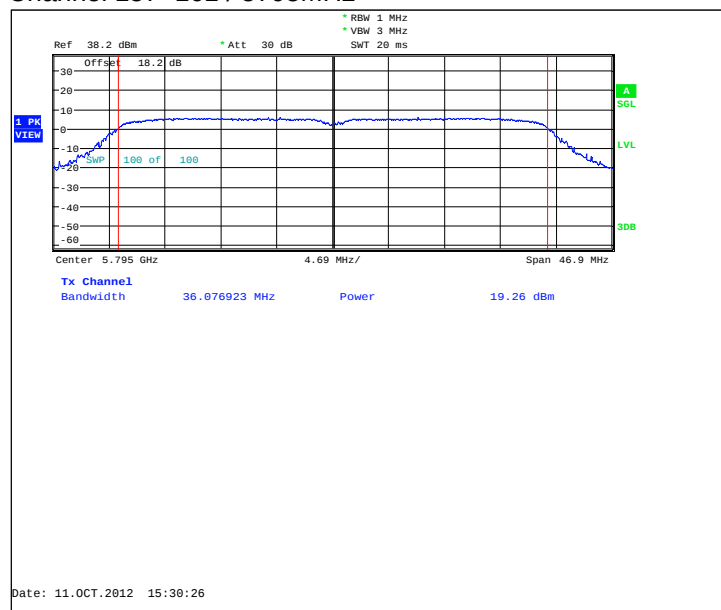
Channel 165 / 5825MHz



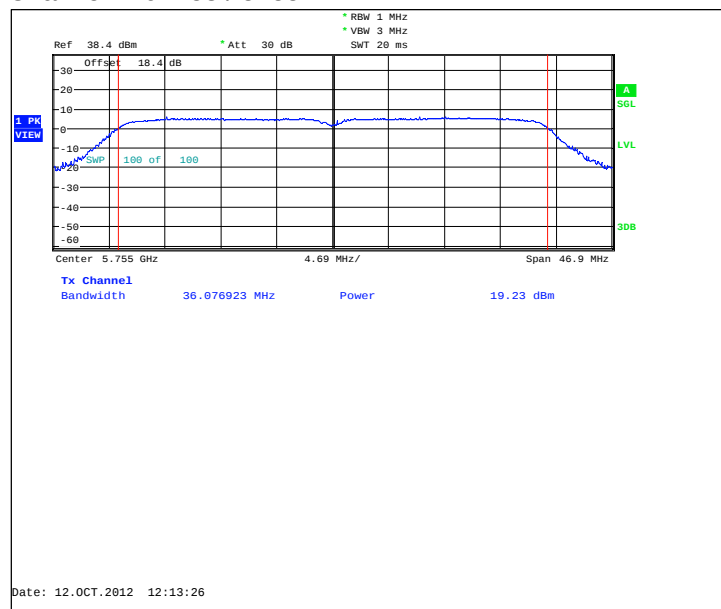
2.6.3 n-mode, 40 MHz CBW mode, BPSK modulation, 13.5 / 15.0 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
157+161 / 5795	19.26	84.333	PASSED
149+153 / 5755	19.23	83.753	PASSED

Channel 157+161 / 5795MHz



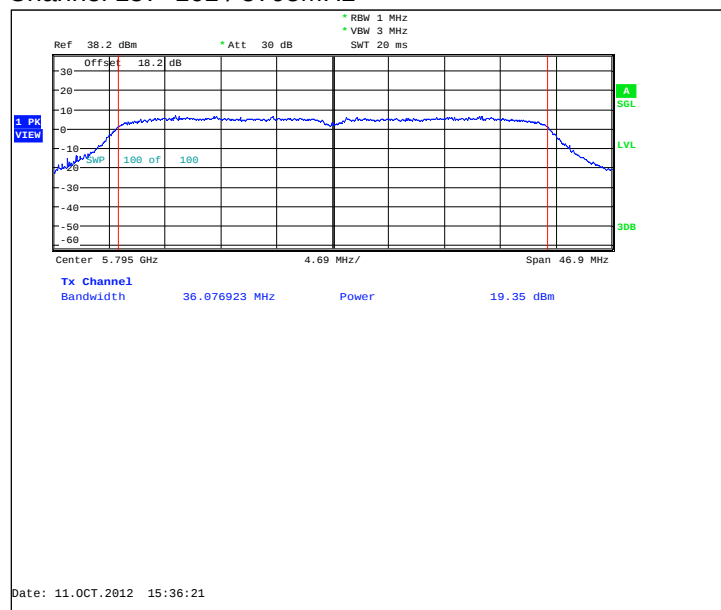
Channel 149+153 / 5755MHz



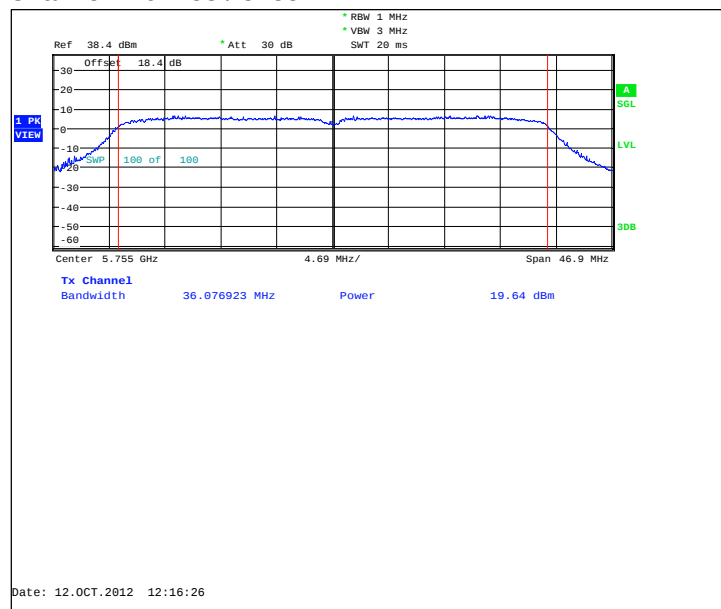
2.6.4 n-mode, 40 MHz CBW mode, 16-QAM modulation, 54.0 / 60.0 Mbps data rate

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
157+161 / 5795	19.35	86.099	PASSED
149+153 / 5755	19.64	92.045	PASSED

Channel 157+161 / 5795MHz



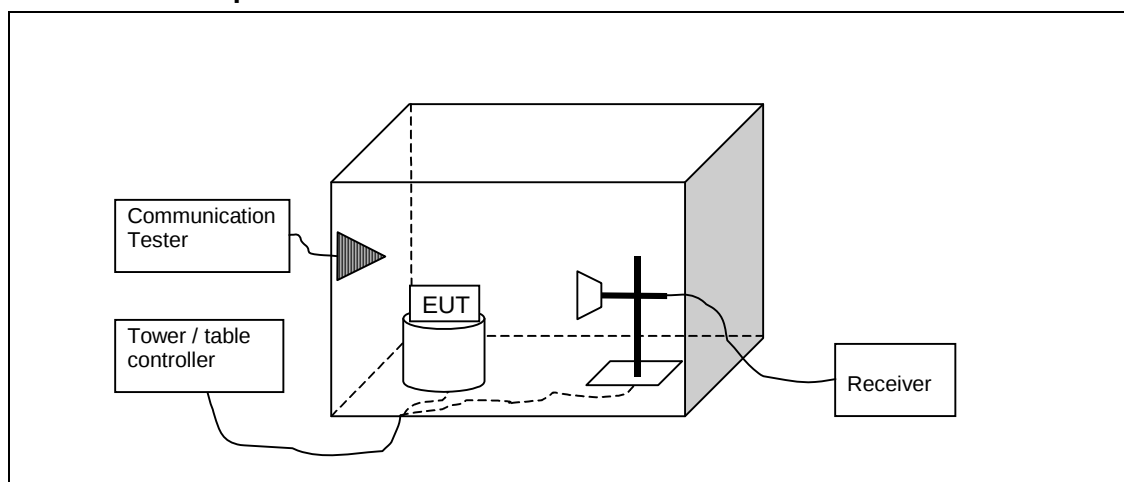
Channel 149+153 / 5755MHz



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

EUT with DUT number	RM-846, DUT 42929
Accessories with DUT numbers	BL-4J, DUT 42924 ; AC-50E, DUT 42785 ; CA-190CD, DUT 42918 ; WH-108, DUT 42926
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	24 / 51 / 103
Date of measurements	19-Oct-2012
Measured by	Hannu Söderholm

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 ($A_{TOT} = L_{CABLES} + A_F - G_{PREAMP}$).

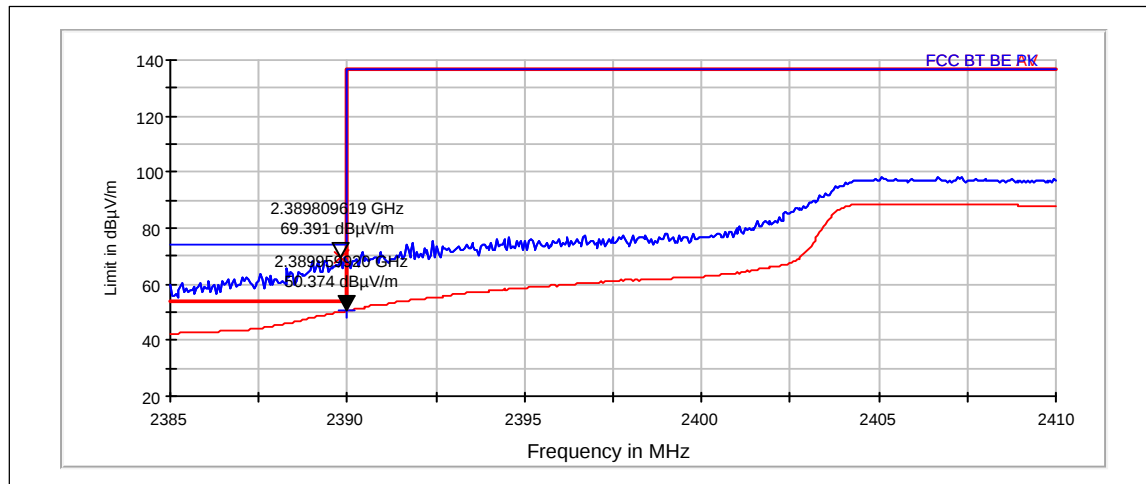
Limits for band edge compliance of RF emissions measurements (3 m measurement distance)

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

3.3. WLAN test results

3.3.1 OFDM, BPSK modulation, 9 Mbps data rate.

Channel 1 / 2412 MHz



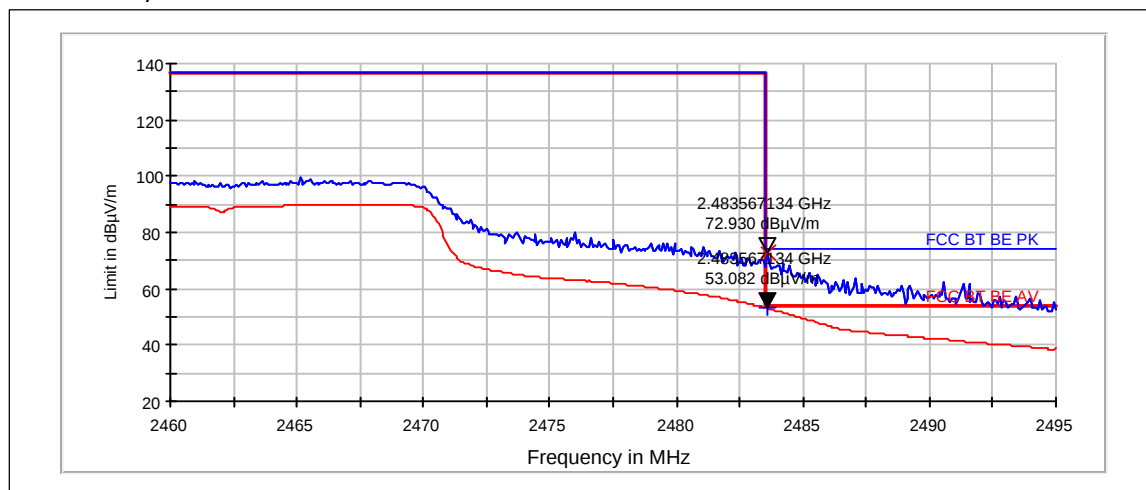
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2389.81	69.39	2948.153	78.99	-9.6	PASSED

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

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2389.96	50.37	330.141	59.97	-9.6	PASSED

Channel 11 / 2462 MHz



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

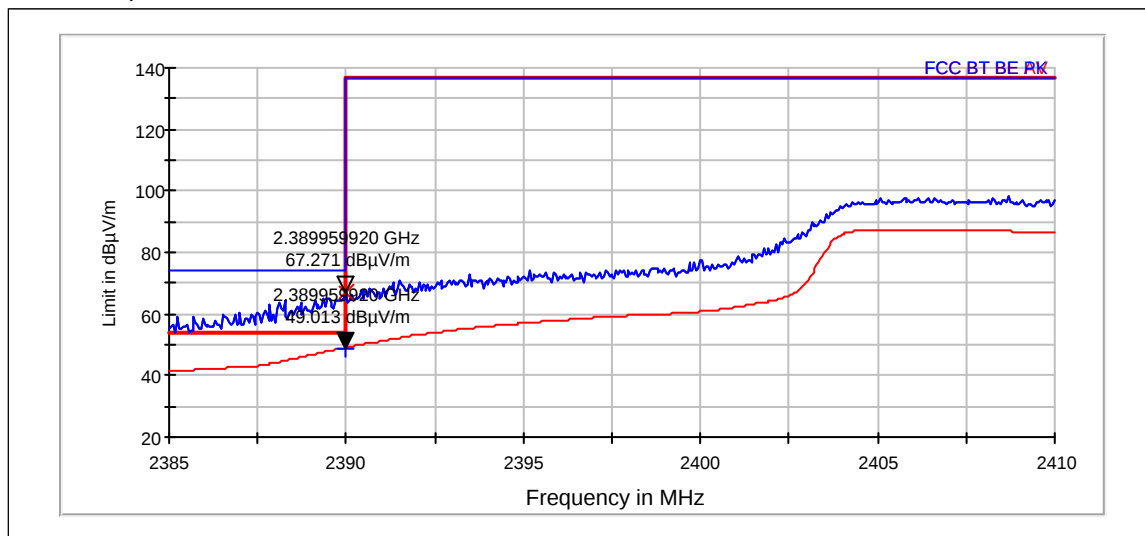
Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2483.567	72.93	4430.982	82.52	-9.59	PASSED

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

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2483.567	53.08	450.921	62.67	-9.59	PASSED

3.3.2 OFDM, QPSK modulation, 18 Mbps data rate.

Channel 1 / 2412 MHz



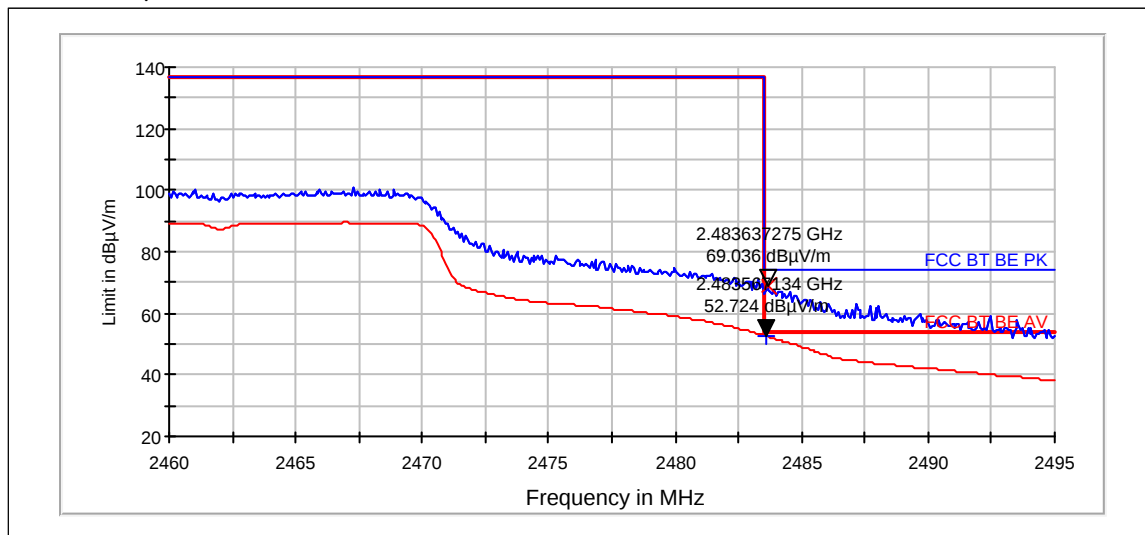
Peak (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2389.96	67.27	2309.67	76.87	-9.6	PASSED

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

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2389.96	49.01	282.26	58.61	-9.6	PASSED

Channel 11 / 2462 MHz



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

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2483.637	69.04	2830.088	78.63	-9.59	PASSED

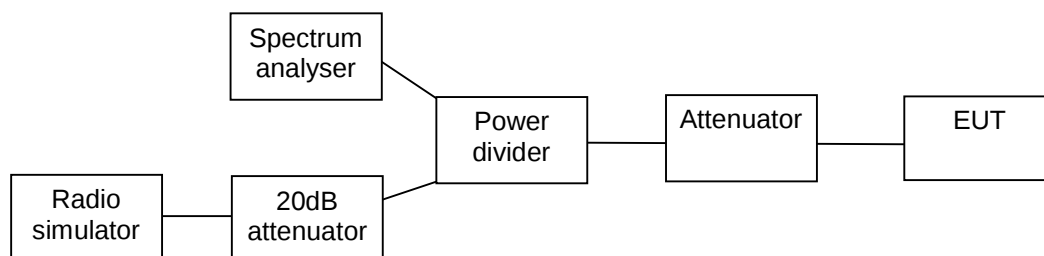
Average (RBW: 1 MHz, VBW: 10 Hz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Results
2483.567	52.72	432.713	62.31	-9.59	PASSED

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

EUT with DUT number	RM-846, DUT 42913
Accessories with DUT numbers	BL-4J, DUT 42914
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	20-22 / 47-51 / 99.6-100.2
Date of measurements	11..12-Oct-2012
Measured by	Jari Jantunen

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.

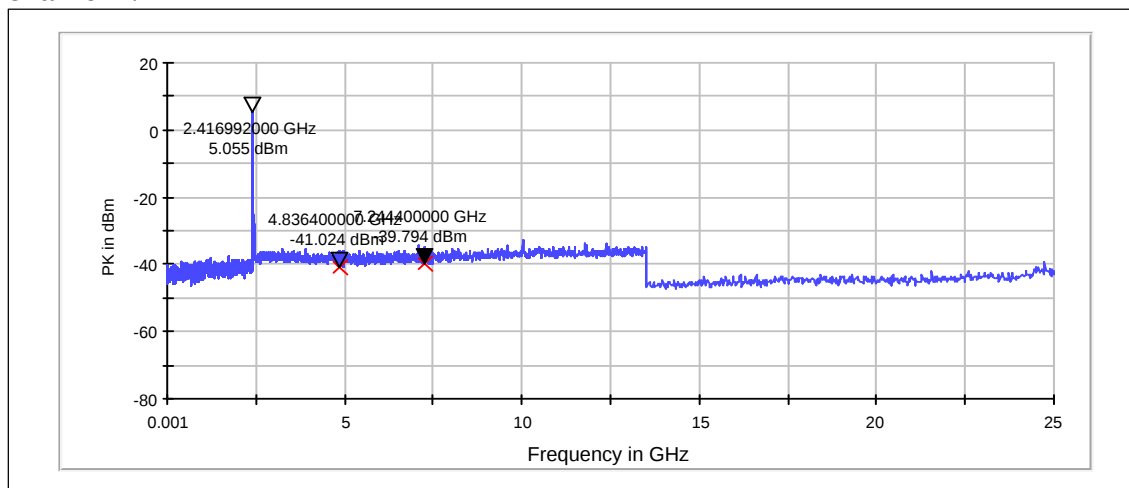
Limits for spurious RF conducted emissions measurements

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

4.3. WLAN Test results

4.3.1 OFDM mode, BPSK modulation, 9 Mbps data rate

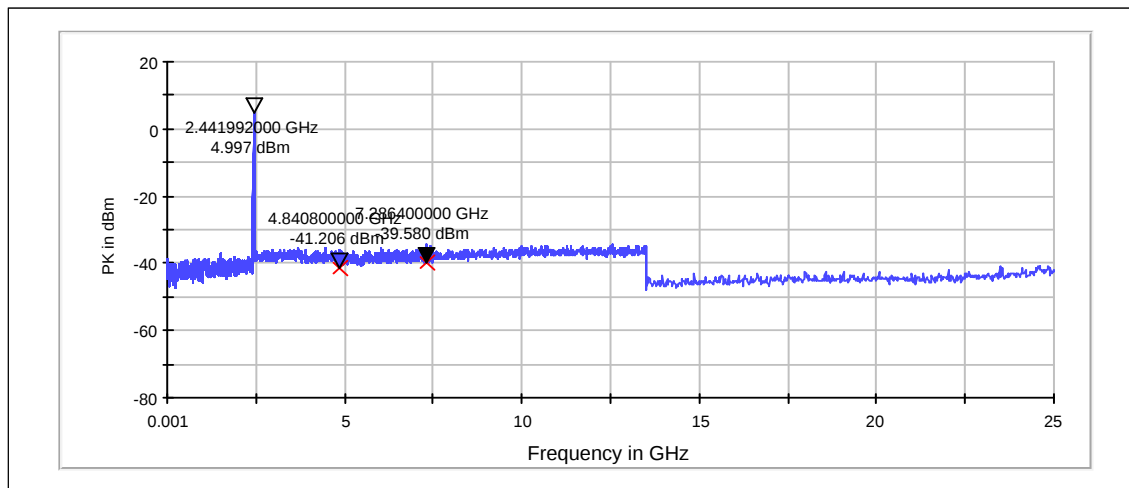
Channel 1 / 2412 MHz



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

Frequency [MHz]	P [dBc]	Result
4836.4	-41.02	PASSED
7244.4	-39.79	PASSED

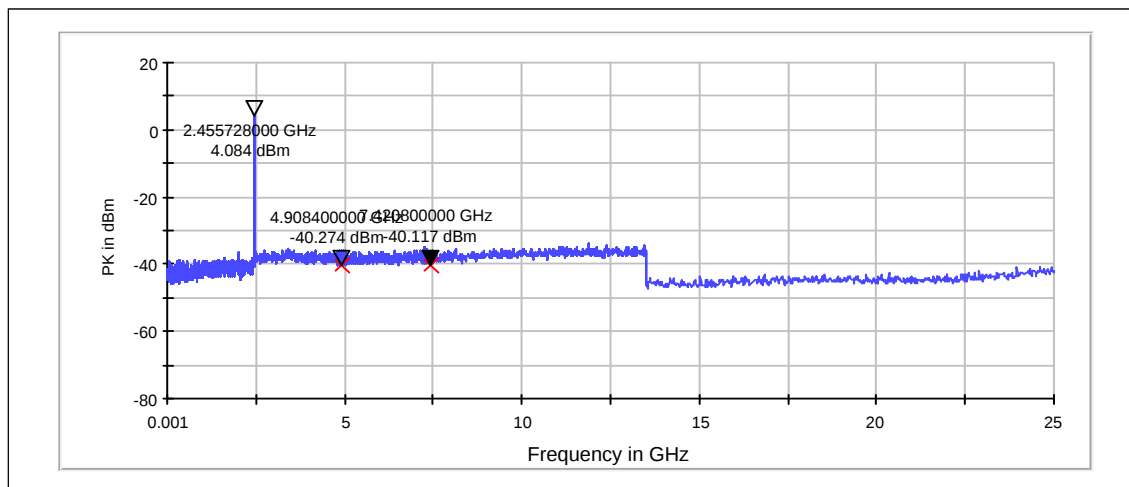
Channel 6 / 2437 MHz



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

Frequency [MHz]	P [dBc]	Result
4840.8	-41.21	PASSED
7286.4	-39.58	PASSED

Channel 11 / 2462 MHz

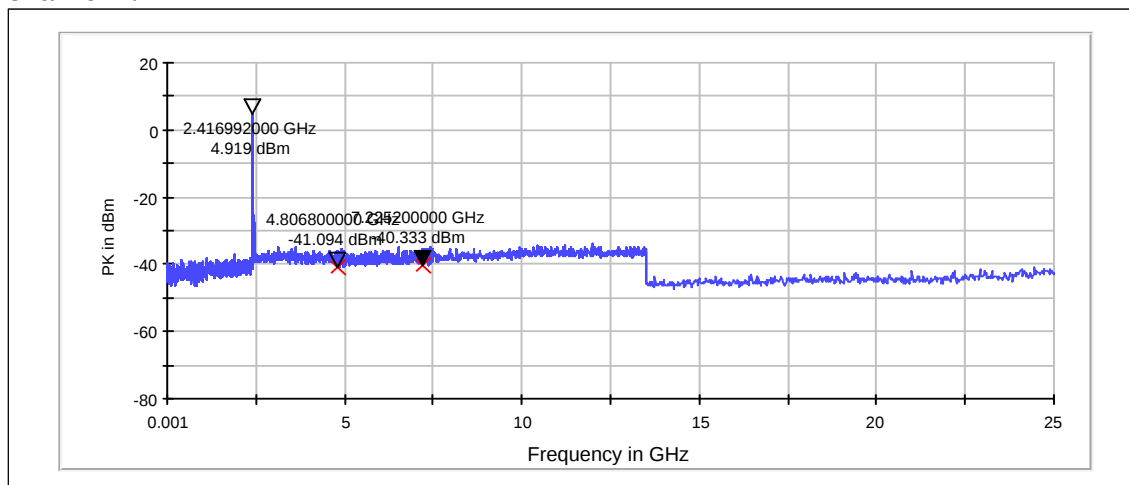


Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4908.4	-40.27	PASSED
7420.8	-40.12	PASSED

4.3.2 OFDM mode, QPSK modulation, 18 Mbps data rate

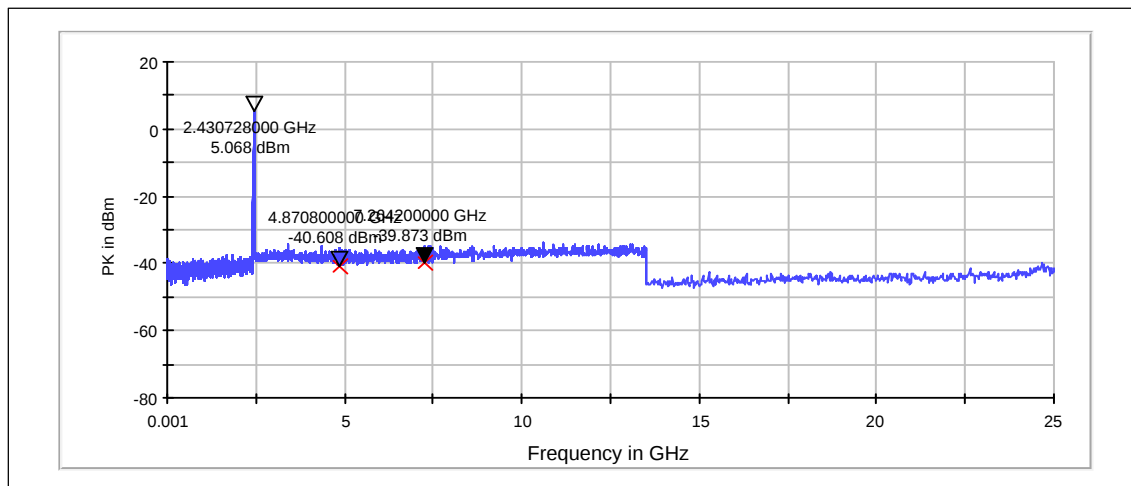
Channel 1 / 2412 MHz



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

Frequency [MHz]	P [dBc]	Result
4806.8	-41.09	PASSED
7225.2	-40.33	PASSED

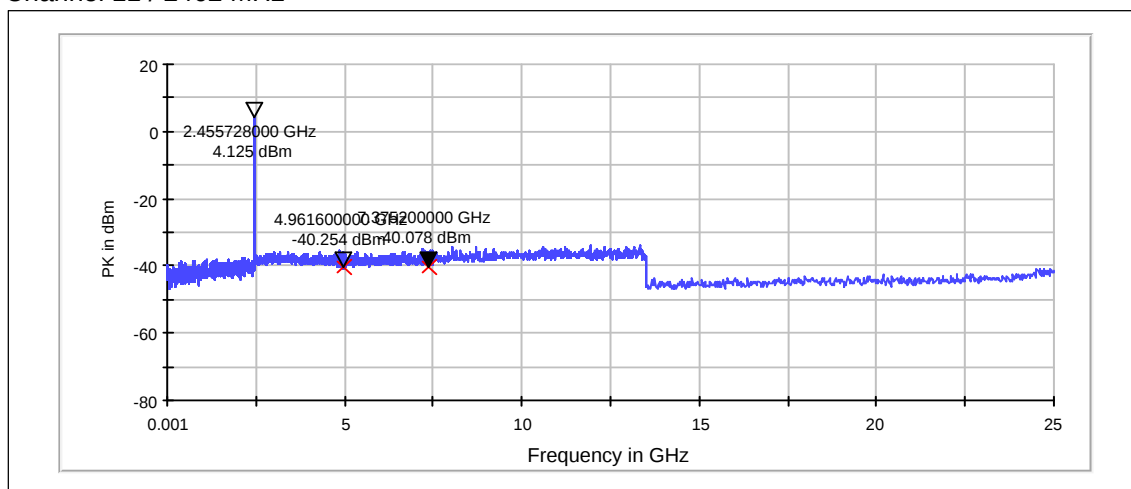
Channel 6 / 2437 MHz



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

Frequency [MHz]	P [dBc]	Result
4870.8	-40.61	PASSED
7264.2	-39.87	PASSED

Channel 11 / 2462 MHz



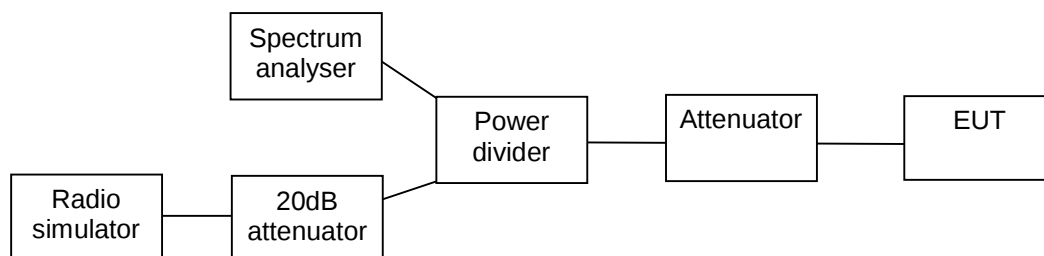
Peak (RBW: 100 kHz, VBW: 300 kHz)

Frequency [MHz]	P [dBc]	Result
4961.6	-40.25	PASSED
7375.2	-40.08	PASSED

5. 6 dB bandwidth (FCC §15.247(a)(2), RSS-210 A8.2 (1))

EUT with DUT number	RM-846, DUT 42913
Accessories with DUT numbers	BL-4J, DUT 42914
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	20-22 / 47-51 / 99.6-100.2
Date of measurements	11..12-Oct-2012
Measured by	Jari Jantunen

5.1. Test Setup



5.2. 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

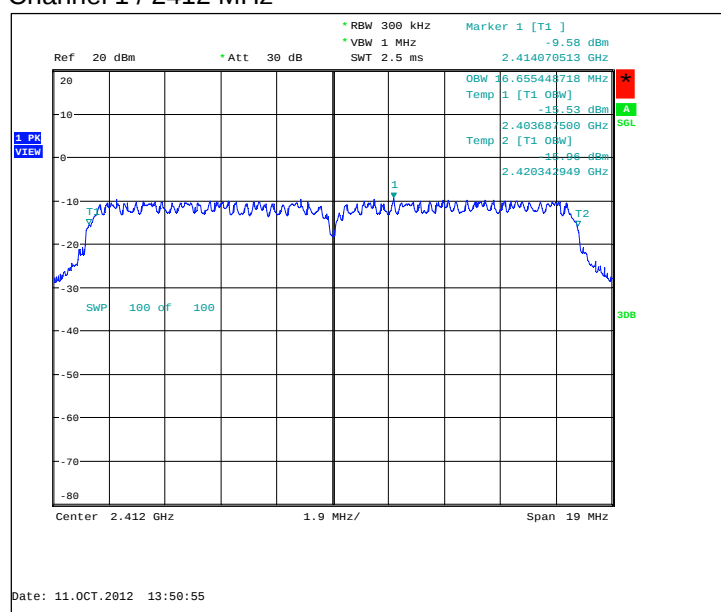
Limit [kHz]
≥ 500

5.3. WLAN Test results

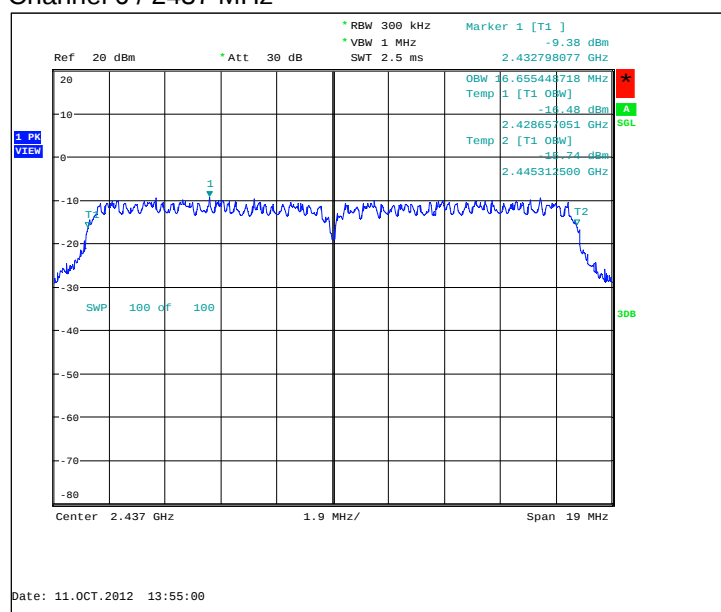
5.3.1 OFDM mode, BPSK modulation, 9 Mbps data rate

Channel / f _c [MHz]	6 dB bandwidth [kHz]	Result
1 / 2412	16655.4	PASSED
6 / 2437	16655.4	PASSED
11 / 2462	16655.4	PASSED

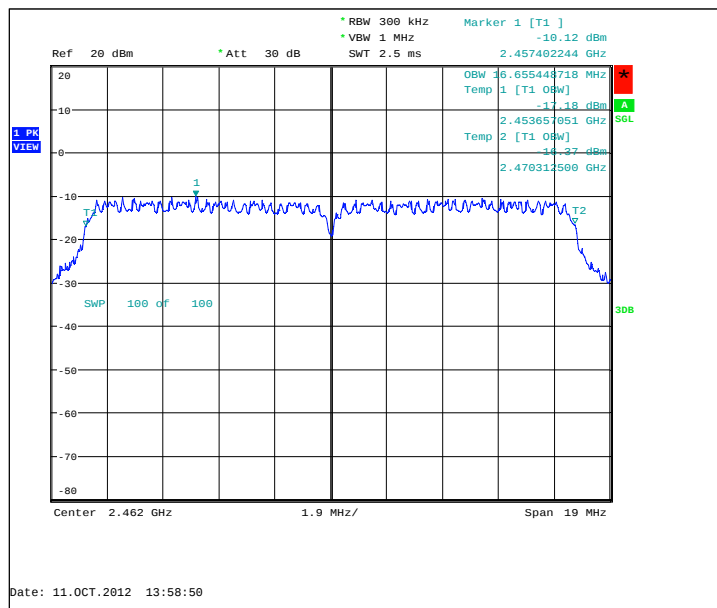
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



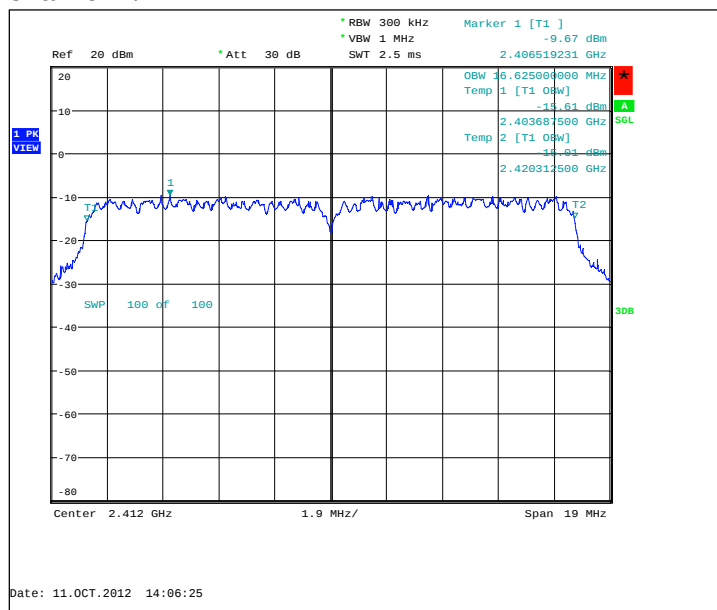
Channel 11 / 2462 MHz



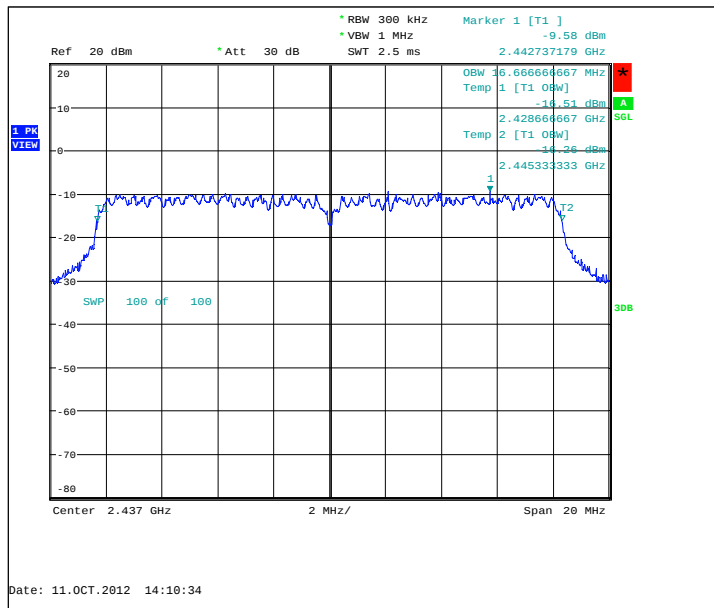
5.3.2 OFDM mode, QPSK modulation, 18 Mbps data rate

Channel / f _c [MHz]	6 dB bandwidth [kHz]	Result
1 / 2412	16625	PASSED
6 / 2437	16666.7	PASSED
11 / 2462	16625	PASSED

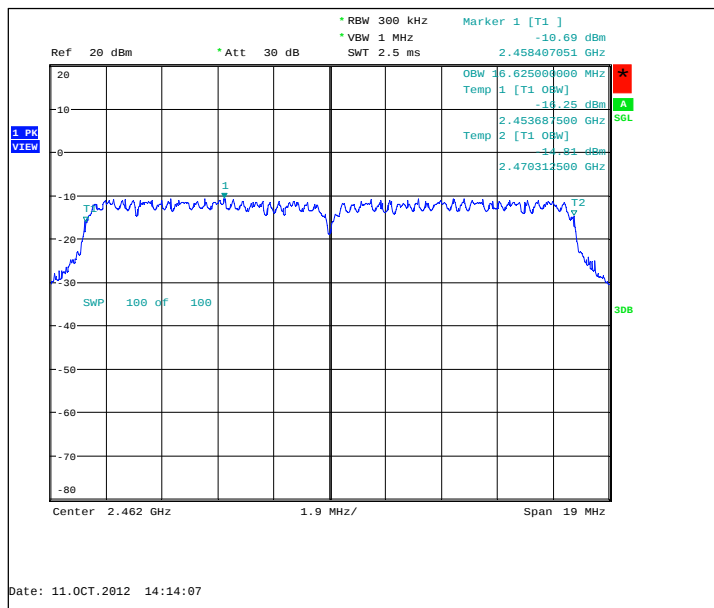
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



Channel 11 / 2462 MHz

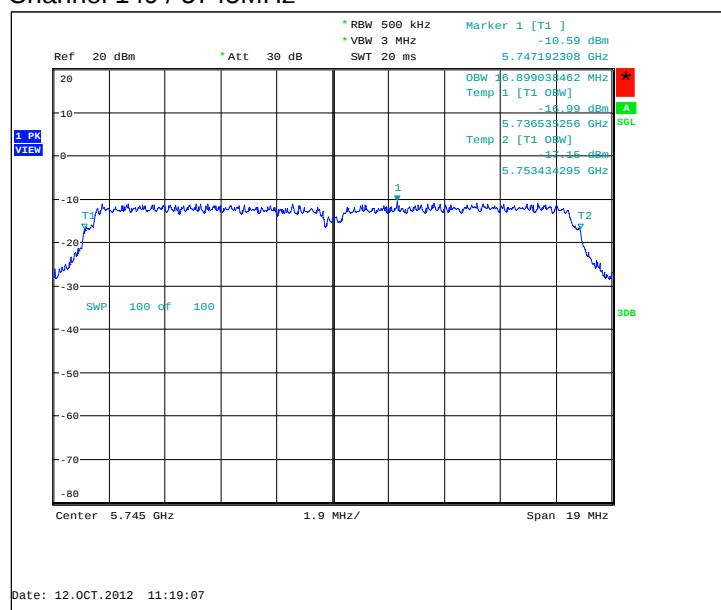


5.4. 5 GHz RLAN Test results

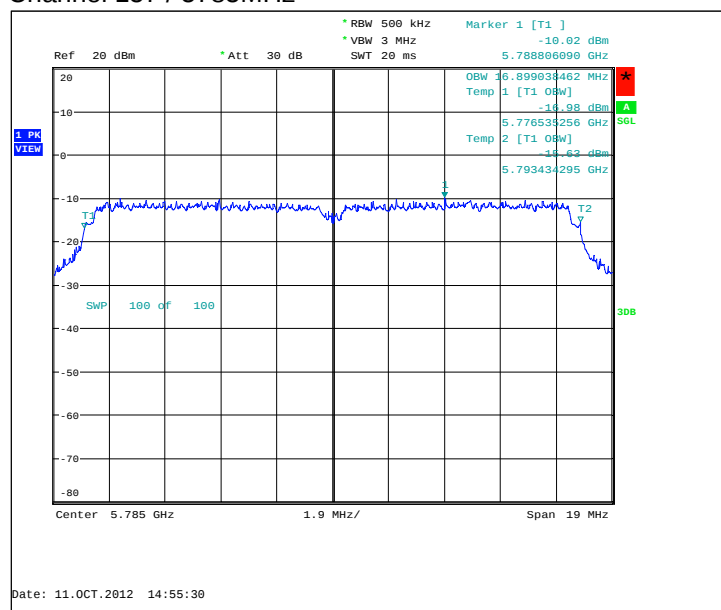
5.4.1 OFDM mode, BPSK modulation, 9 Mbps data rate

Channel / f _c [MHz]	6 dB bandwidth [kHz]	Result
149 / 5745	16899	PASSED
157 / 5785	16899	PASSED
165 / 5825	16868.6	PASSED

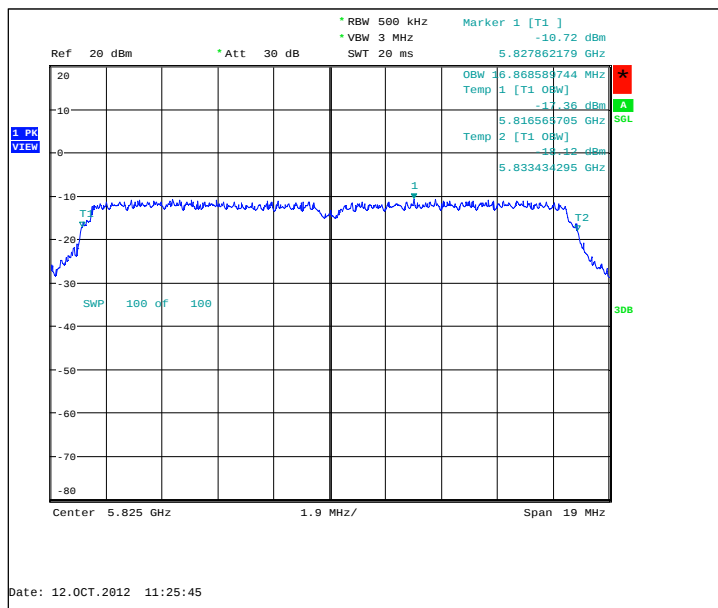
Channel 149 / 5745MHz



Channel 157 / 5785MHz



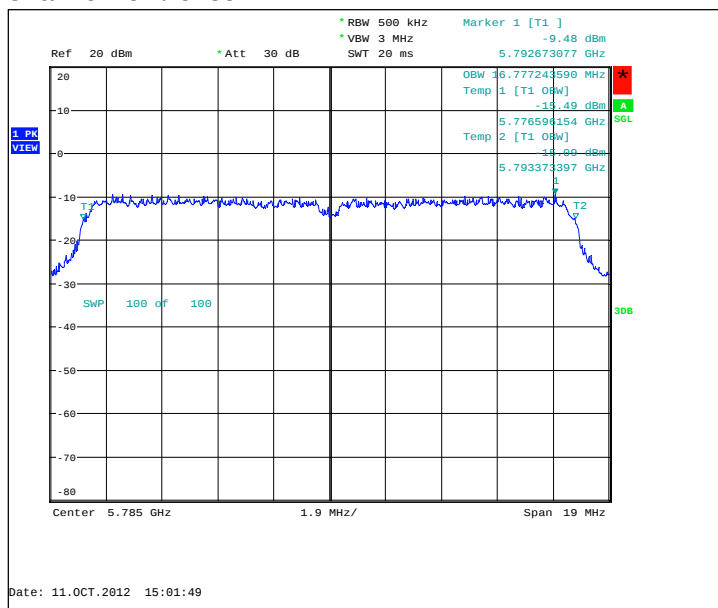
Channel 165 / 5825MHz



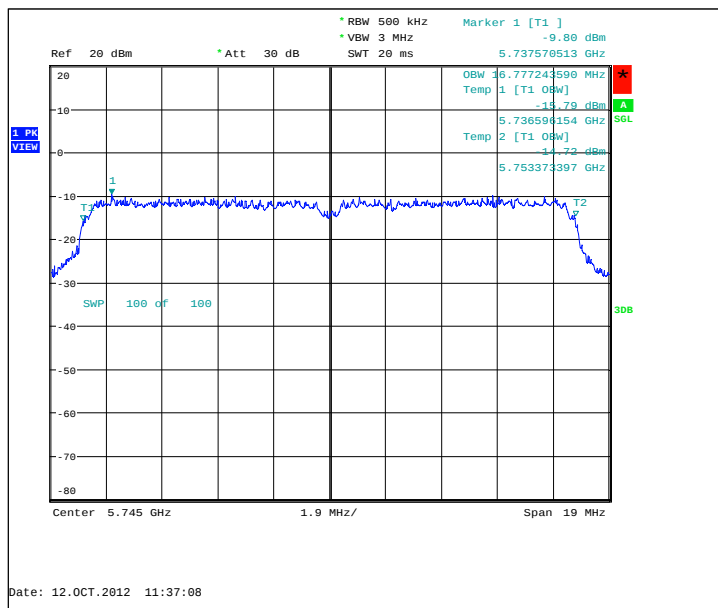
5.4.2 OFDM mode, 16-QAM modulation, 24 Mbps data rate

Channel / f _c [MHz]	6 dB bandwidth [kHz]	Result
157 / 5785	16777.2	PASSED
149 / 5745	16777.2	PASSED
165 / 5825	16777.2	PASSED

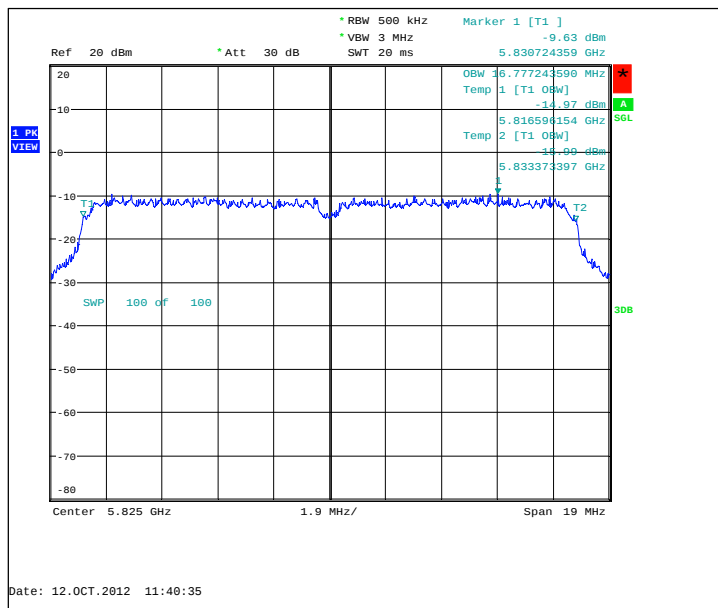
Channel 157 / 5785MHz



Channel 149 / 5745MHz



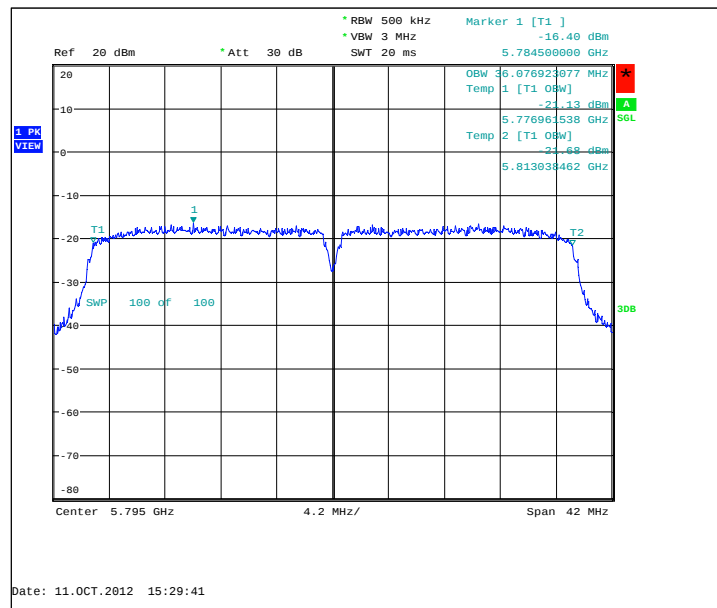
Channel 165 / 5825MHz



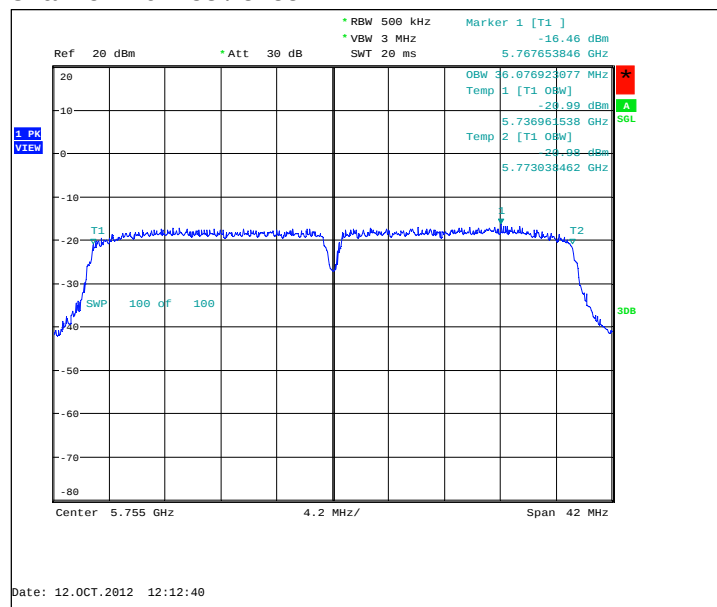
5.4.3 n-mode, 40 MHz CBW mode, BPSK modulation, 13.5 / 15.0 Mbps data rate

Channel / f _c [MHz]	6 dB bandwidth [kHz]	Result
157+161 / 5795	36076.9	PASSED
149+153 / 5755	36076.9	PASSED

Channel 157+161 / 5795MHz



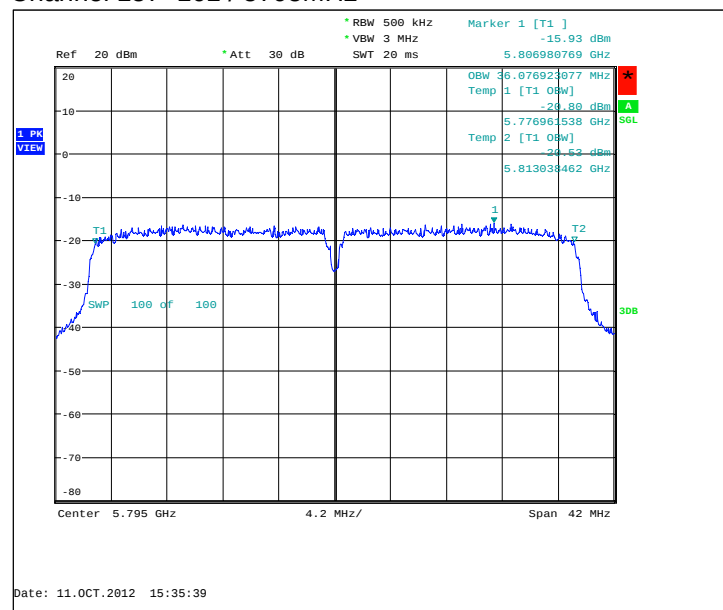
Channel 149+153 / 5755MHz



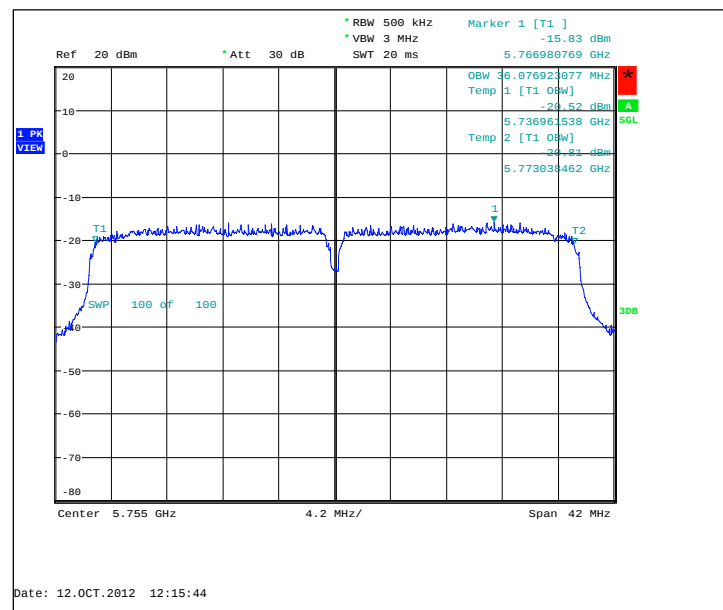
5.4.4 n-mode, 40 MHz CBW mode, 16-QAM modulation, 54.0 / 60.0 Mbps data rate

Channel / f_c [MHz]	6 dB bandwidth [kHz]	Result
157+161 / 5795	36076.9	PASSED
149+153 / 5755	36076.9	PASSED

Channel 157+161 / 5795MHz



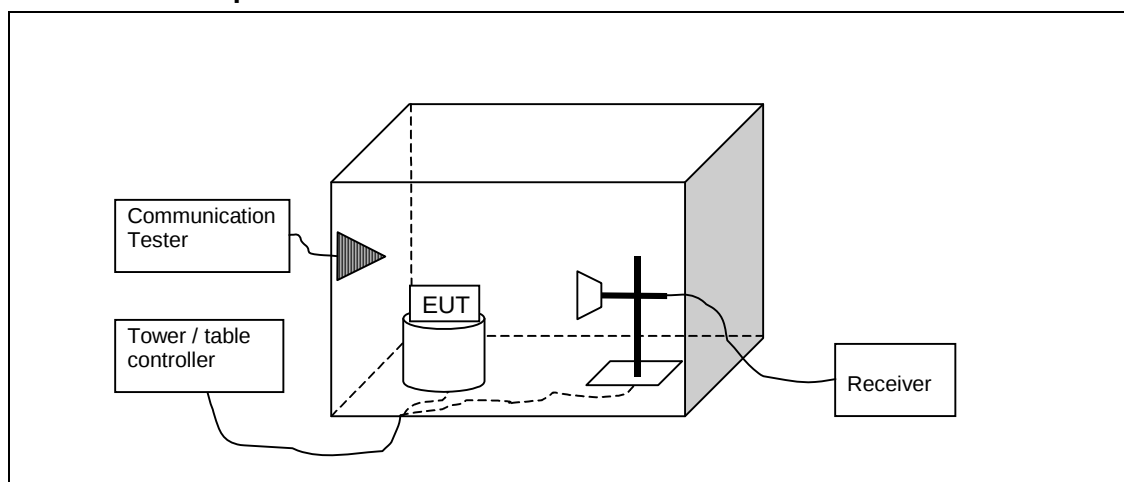
Channel 149+153 / 5755MHz



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

EUT with DUT number	RM-846, DUT 42929
Accessories with DUT numbers	BL-4J, DUT 42924 ; AC-50E, DUT 42785 ; CA-190CD, DUT 42918 ; WH-108, DUT 42926
Operation Voltage [V] / [Hz]	115 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	24 / 51 / 103
Date of measurements	19-Oct-2012
Measured by	Hannu Söderholm

6.1.1 Test setup



6.2. 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

6.3. WLAN test results

6.3.1 OFDM, BPSK modulation, 9 Mbps data rate.

Channel 1 / 2412 MHz

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
4822.2	44.52	168.19	46.85	-2.33	29.5	73.979	PASSED
7234.9	44.39	165.73	42.73	1.66	80.8	125.23	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
4822.2	30.43	33.212	32.76	-2.33	23.6	53.98	PASSED
7234.9	31.14	36.066	29.48	1.66	---	---	PASSED

Channel 7 / 2442 MHz

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
30.33	29.36	29.363	49.2	-19.84	10.6	40	PASSED
33.028	25.28	18.363	46.33	-21.05	14.7	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
3932.161	40.25	102.885	43.51	-3.26	33.7	73.979	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
3932.161	27.13	22.727	30.39	-3.26	26.8	53.98	PASSED

Channel 11 / 2462 MHz

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	48.49	265.613	50.37	-1.88	25.5	73.979	PASSED
7385.9	44.36	165.272	41.95	2.41	29.6	73.979	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	33.21	45.761	35.09	-1.88	20.8	53.98	PASSED
7385.9	31.48	37.476	29.07	2.41	22.5	53.98	PASSED

6.3.2 OFDM, QPSK modulation, 18 Mbps data rate.

Channel 1 / 2412 MHz

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
4825.2	43.73	153.568	46.1	-2.37	30.3	73.979	PASSED
7234.7	43.79	154.632	42.09	1.7	81.4	125.23	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
4825.2	30.52	33.589	32.89	-2.37	23.5	53.98	PASSED
7234.7	31.22	36.383	29.52	1.7	---	---	PASSED

Channel 7 / 2442 MHz

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	29.18	28.787	48.89	-19.71	10.8	40	PASSED
30.33	18.33	8.249	38.17	-19.84	21.7	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
3911.125	40.09	101.076	43.38	-3.29	33.9	73.979	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
3911.125	27.04	22.48	30.33	-3.29	26.9	53.98	PASSED

Channel 11 / 2462 MHz

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
4924.9	45.22	182.369	47.09	-1.87	28.8	73.979	PASSED
7386.6	45.01	177.992	42.6	2.41	29	73.979	PASSED

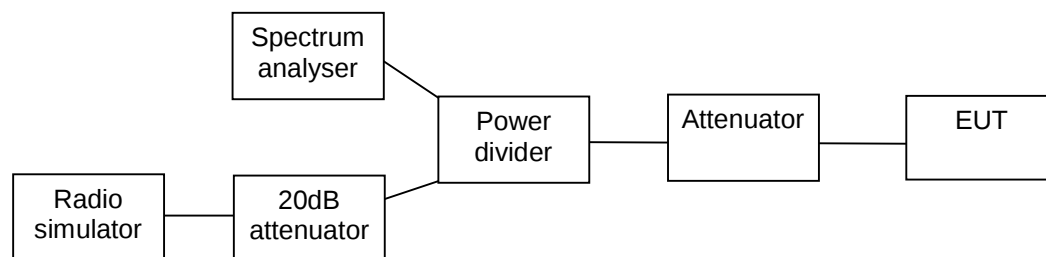
Average (RBW: 1 MHz, VBW: 1 MHz)

Frequency [MHz]	E [dBμV/m]	E [μV/m]	U _{RX} [dBμV]	A _{TOT} [dB]	Margin	Limit [dBμV/m]	Results
4924.9	32.22	40.837	34.09	-1.87	21.8	53.98	PASSED
7386.6	31.86	39.179	29.45	2.41	22.1	53.98	PASSED

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

EUT with DUT number	RM-846, DUT 42913
Accessories with DUT numbers	BL-4J, DUT 42914
Operation Voltage [V] / [Hz]	Nominal
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	20-22 / 47-51 / 99.6-100.2
Date of measurements	11..12-Oct-2012
Measured by	Jari Jantunen

7.1. Test Setup



7.2. 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

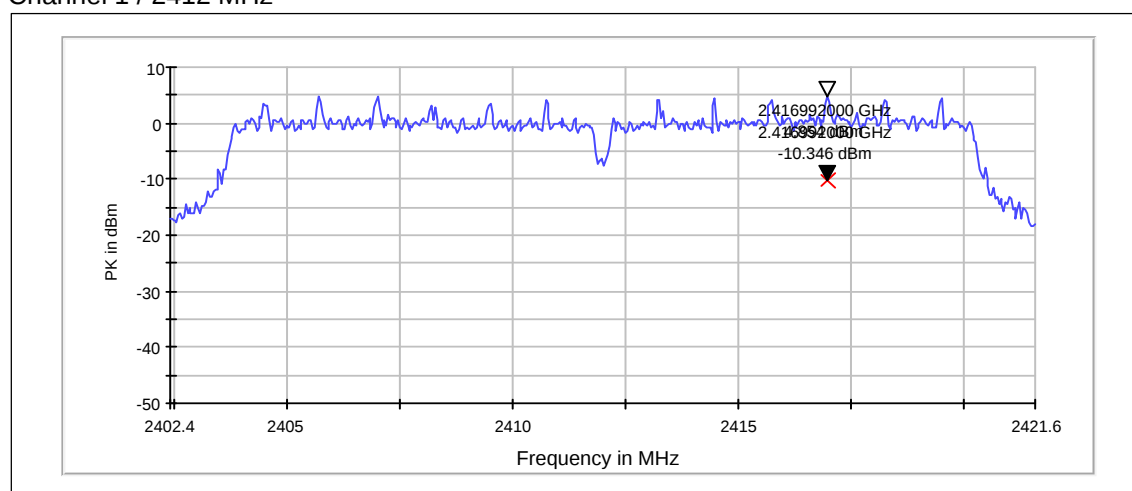
7.3. WLAN Test results

7.3.1 OFDM mode, BPSK modulation, 9 Mbps data rate

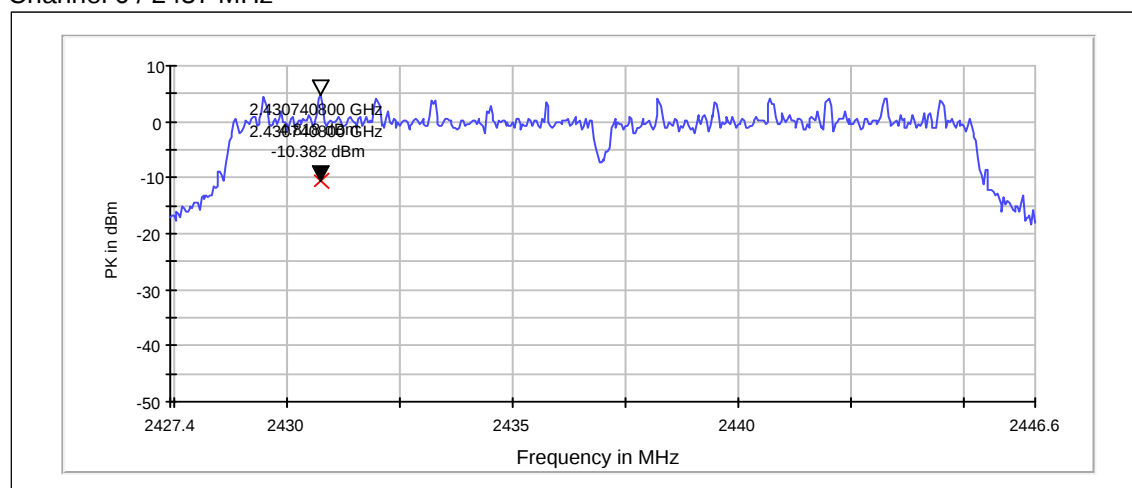
Peak (RBW: 100 kHz, VBW: 300 kHz, Max hold)

Channel / f _c [MHz]	P [dBm]	Result
1 / 2412	-10.35	PASSED
6 / 2437	-10.38	PASSED
11 / 2462	-11.16	PASSED

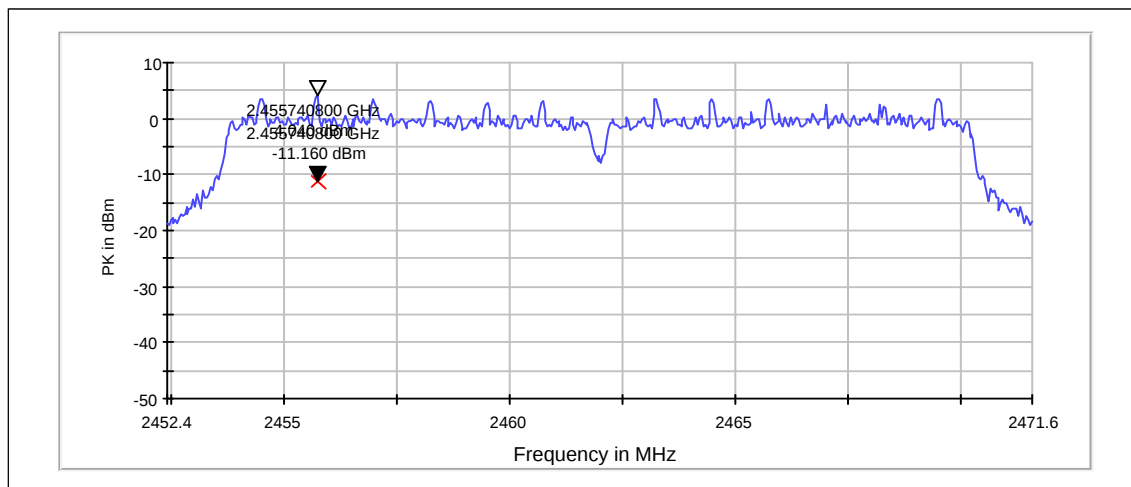
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



Channel 11 / 2462 MHz

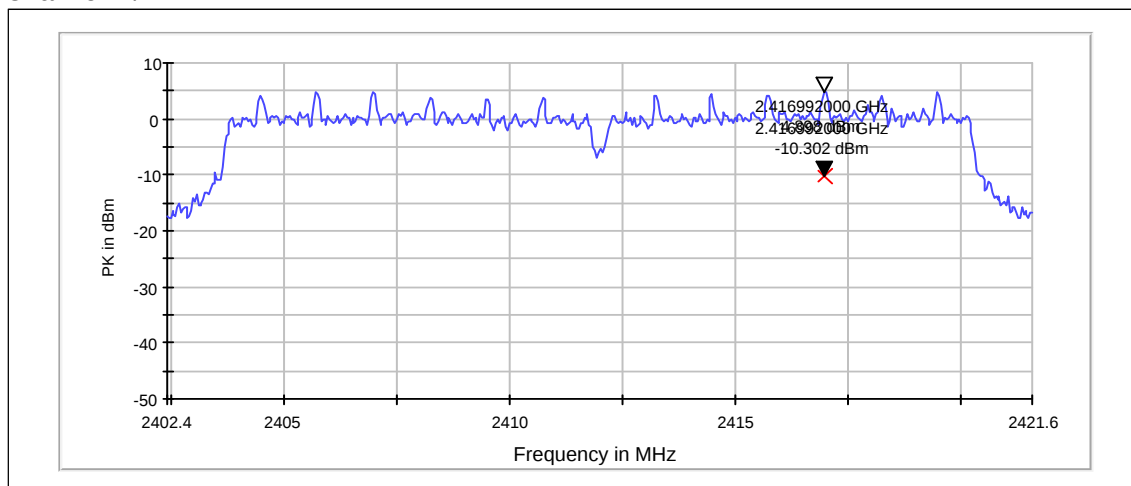


7.3.2 OFDM mode, QPSK modulation, 18 Mbps data rate

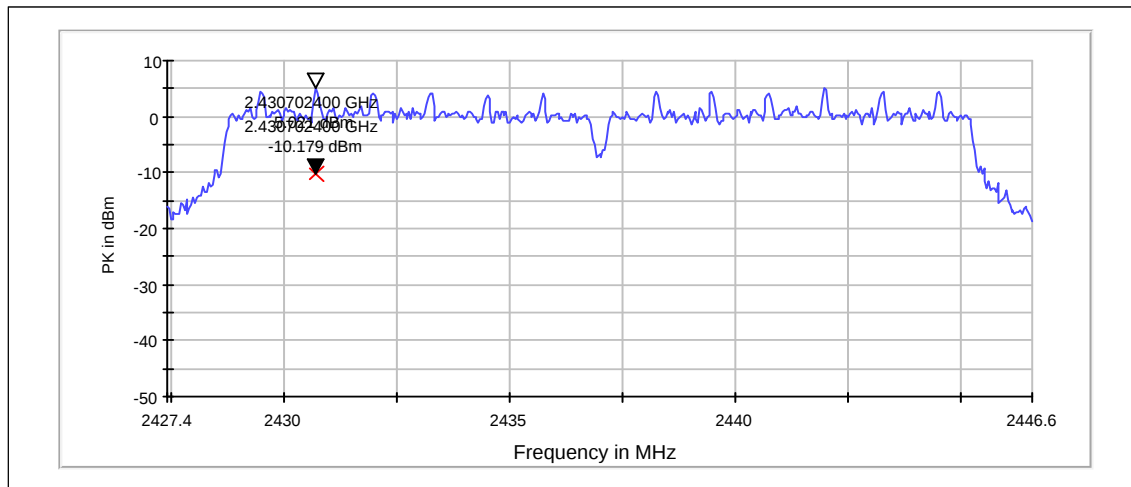
Peak (RBW: 100 kHz, VBW: 300 kHz, Max hold)

Channel / f_c [MHz]	P [dBm]	Result
1 / 2412	-10.3	PASSED
6 / 2437	-10.18	PASSED
11 / 2462	-11.14	PASSED

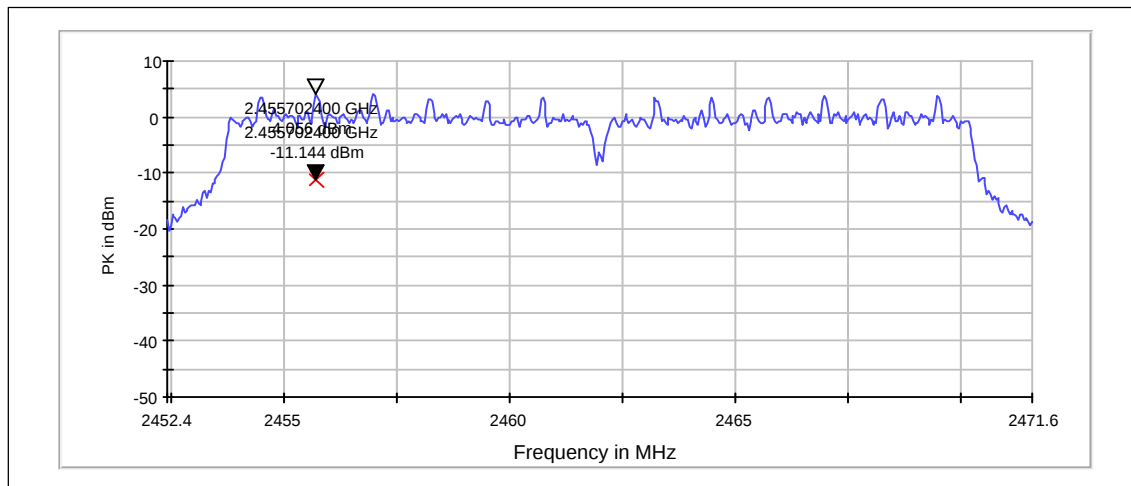
Channel 1 / 2412 MHz



Channel 6 / 2437 MHz



Channel 11 / 2462 MHz



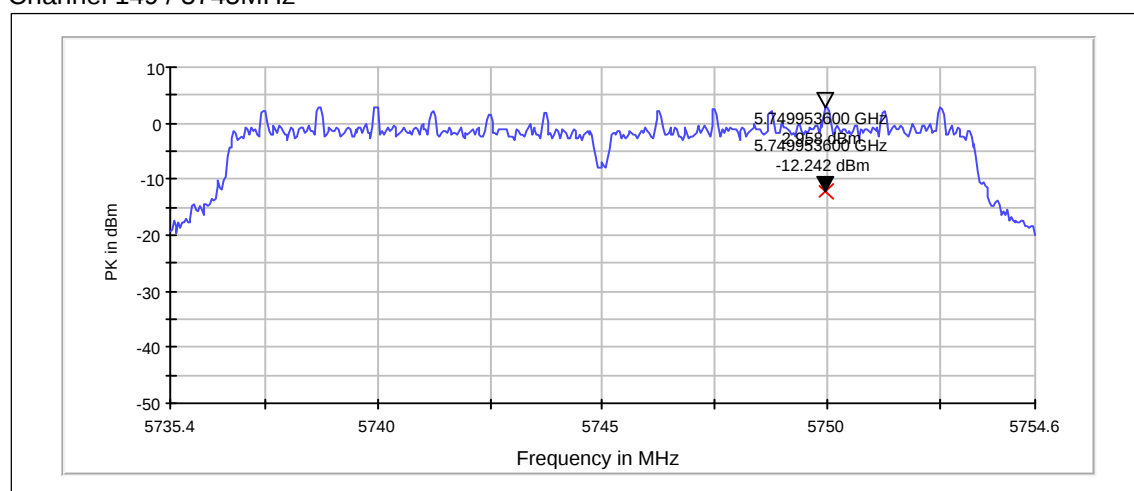
7.4. 5 GHz RLAN Test results

7.4.1 OFDM mode, BPSK modulation, 9 Mbps data rate

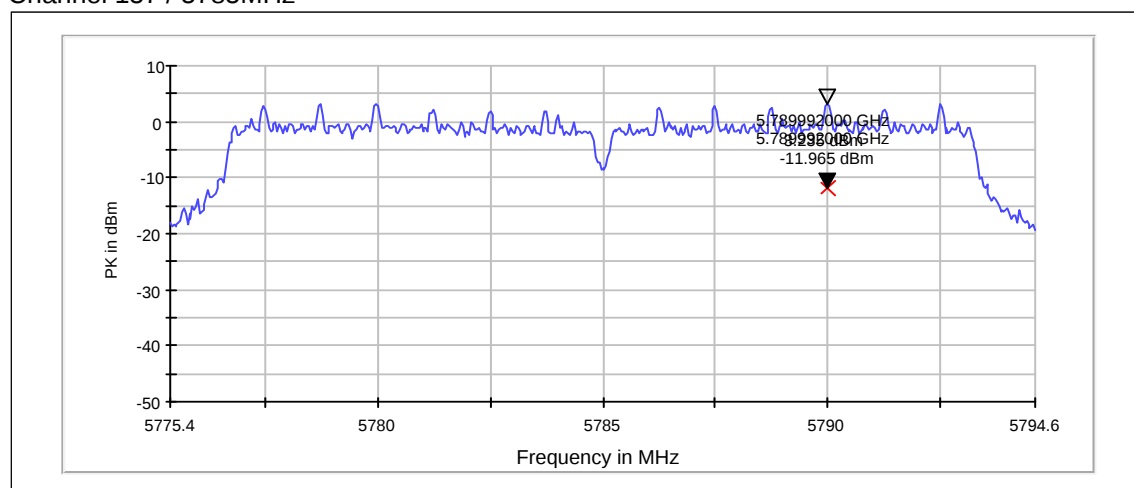
Peak (RBW: 100 kHz, VBW: 300 kHz, Max hold)

Channel / f _c [MHz]	P [dBm]	Result
149 / 5745	-12.24	PASSED
165 / 5825	-12.12	PASSED
157 / 5785	-11.96	PASSED

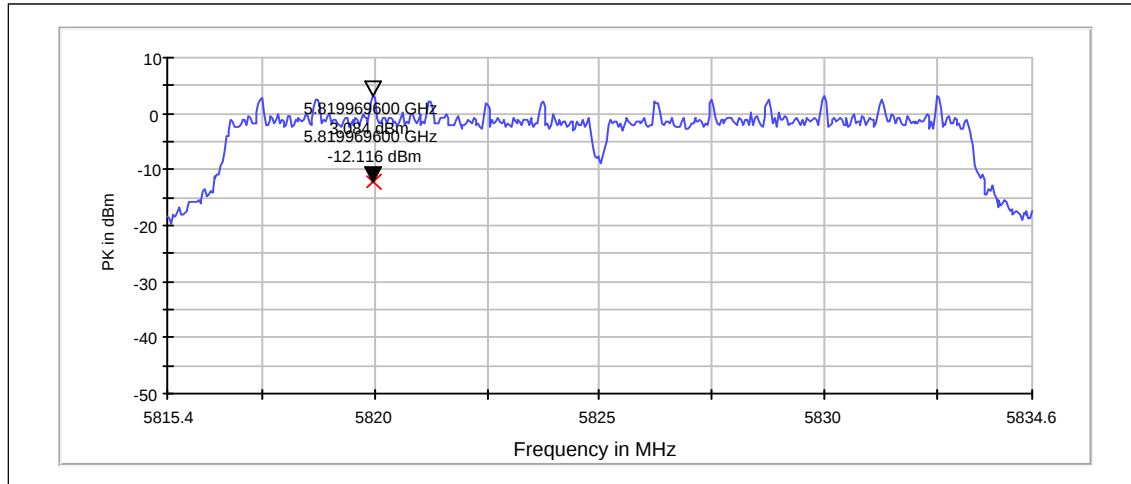
Channel 149 / 5745MHz



Channel 157 / 5785MHz



Channel 165 / 5825MHz

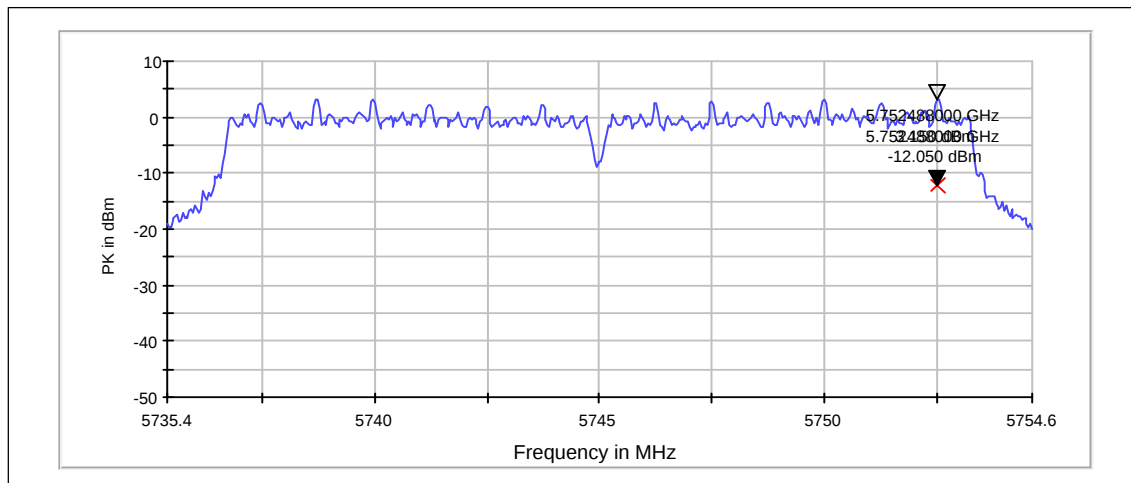


7.4.2 OFDM mode, 16-QAM modulation, 24 Mbps data rate

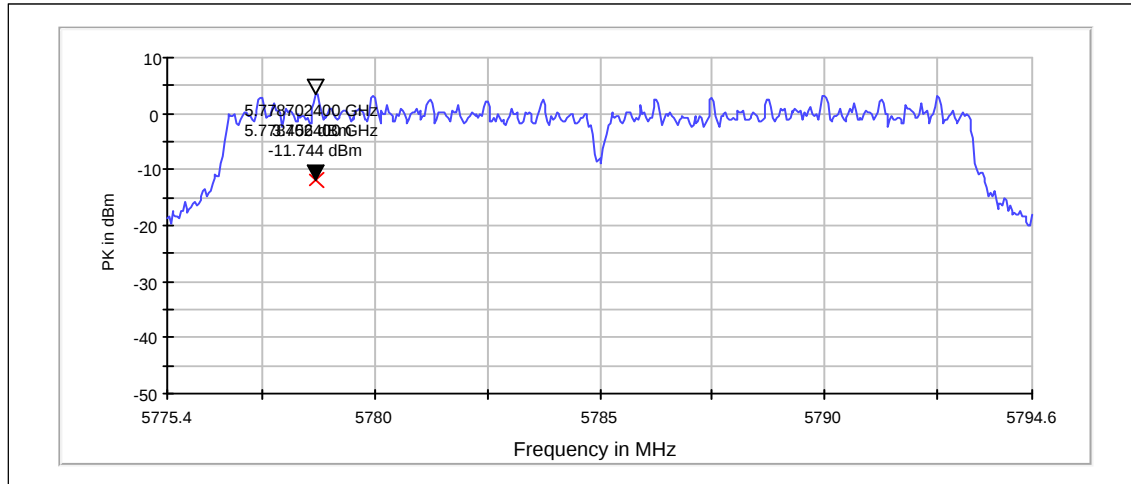
Peak (RBW: 100 kHz, VBW: 300 kHz, Max hold)

Channel / f_c [MHz]	P [dBm]	Result
149 / 5745	-12.05	PASSED
157 / 5785	-11.74	PASSED
165 / 5825	-12.08	PASSED

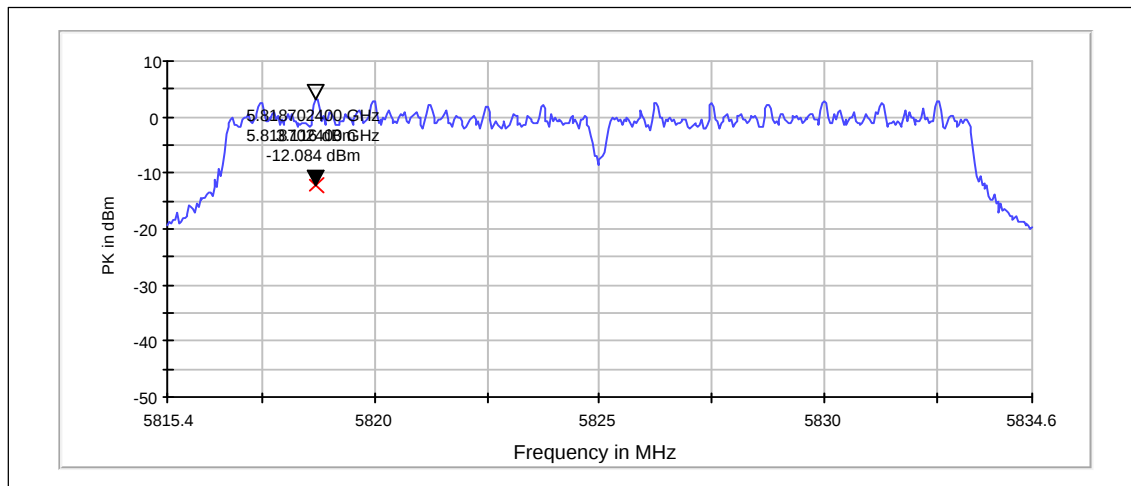
Channel 149 / 5745MHz



Channel 157 / 5785MHz



Channel 165 / 5825MHz

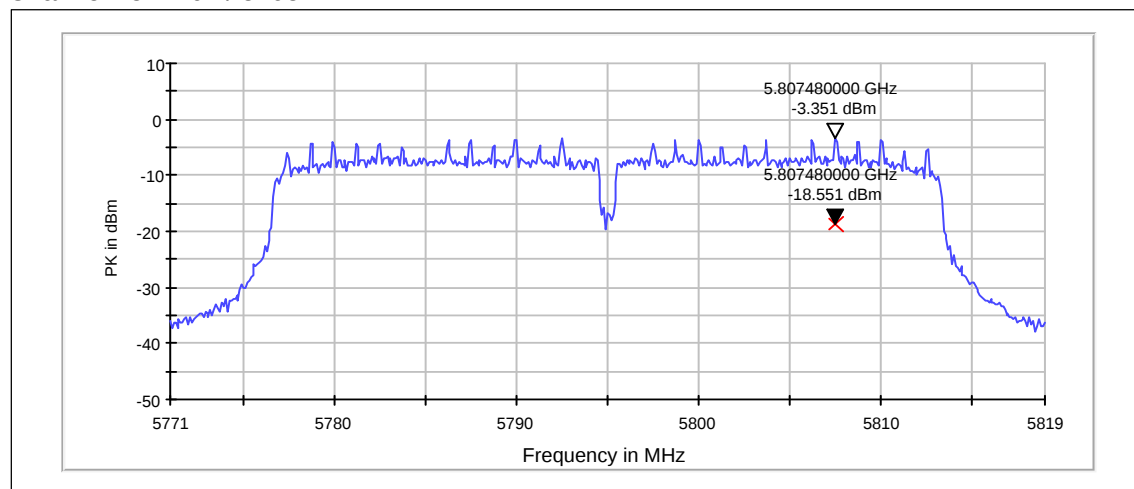


7.4.3 n-mode, 40 MHz CBW mode, BPSK modulation, 13.5 / 15.0 Mbps data rate

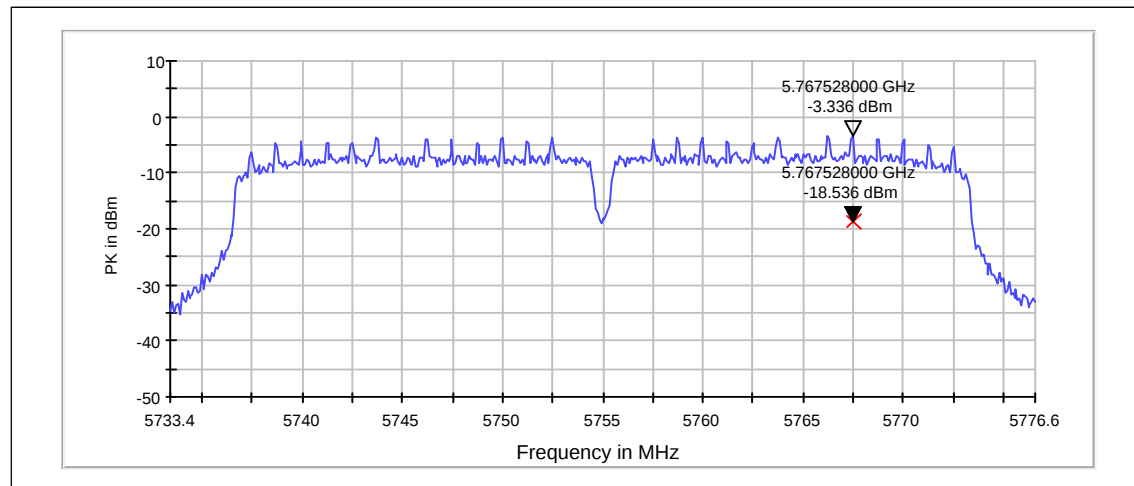
Peak (RBW: 100 kHz, VBW: 300 kHz, Max hold)

Channel / f _c [MHz]	P [dBm]	Result
157+161 / 5795	-18.55	PASSED
149+153 / 5755	-18.54	PASSED

Channel 157+161 / 5795MHz



Channel 149+153 / 5755MHz

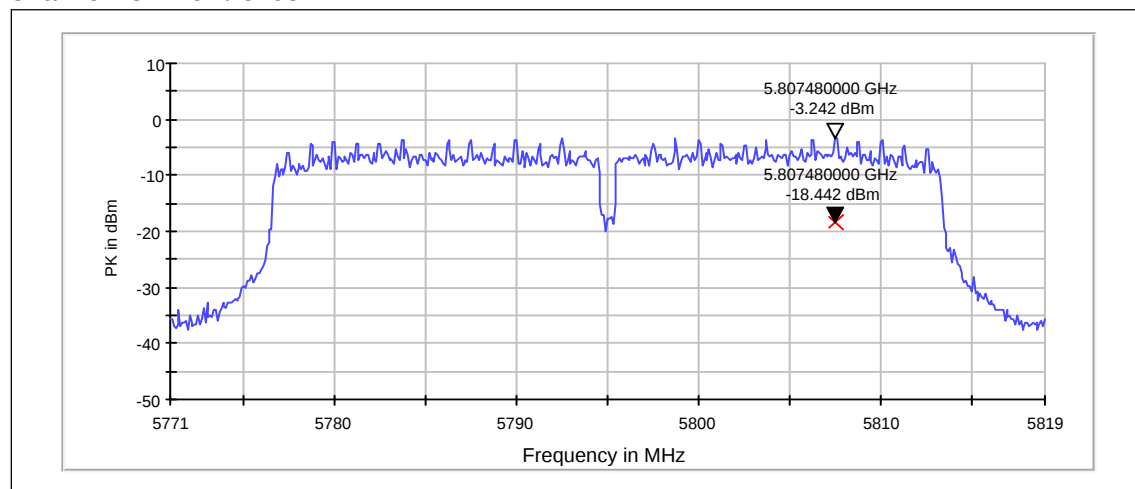


7.4.4 n-mode, 40 MHz CBW mode, 16-QAM modulation, 54.0 / 60.0 Mbps data rate

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

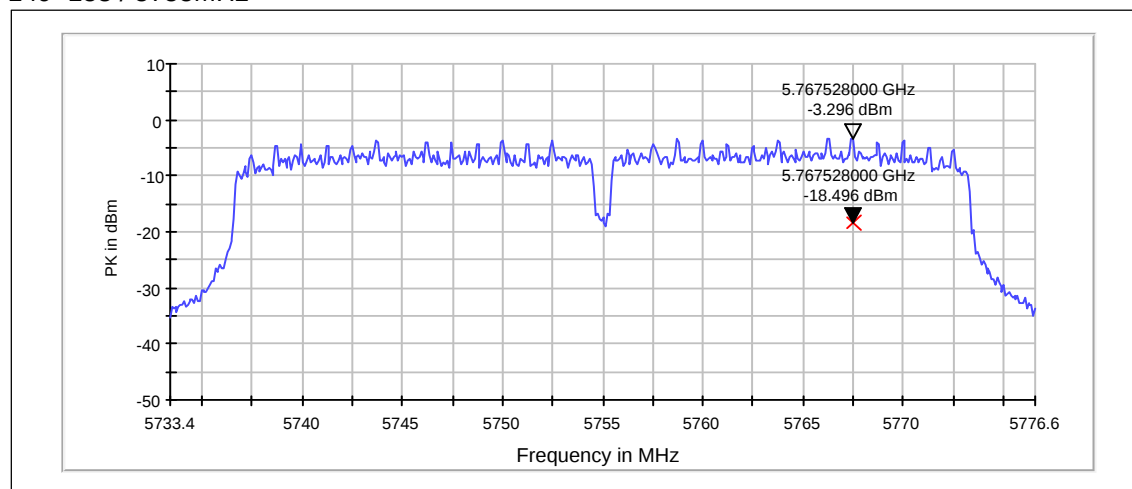
Channel / f _c [MHz]	P [dBm]	Result
157+161 / 5795	-18.44	PASSED
149+153 / 5755	-18.5	PASSED

Channel 157+161 / 5795MHz



Channel

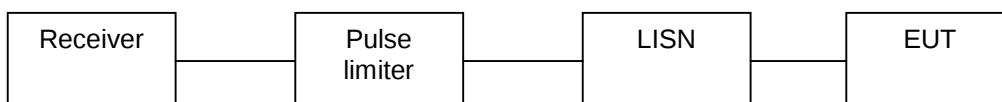
149+153 / 5755MHz



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

EUT with DUT number	RM-846, DUT 42928
Accessories with DUT numbers	BL-4J, DUT 42925 ; AC-50E, DUT 42916 ; CA-190CD, DUT 42918 ; WH-108, DUT 42927
Operation Voltage [V] / [Hz]	110 / 60
Results	PASSED
Remarks	-
Temp [°C] / Humidity [%RH] / Air Pressure [kPa]	19 / 59 / 100.0
Date of measurements	19-Oct-2012
Measured by	Timo Raiskio

8.1. Test Setup



8.2. Test method and limit

The measurement is made according to procedure KDB 558074 D01 and IC standard RSS-GEN as follows:

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.

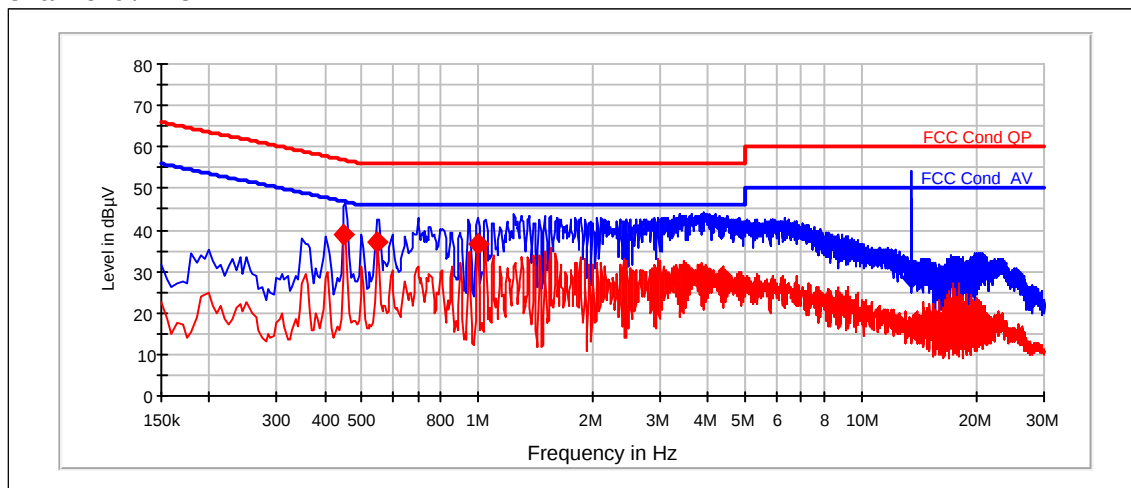
CISPR 22 Class B limits

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

8.3. WLAN Test results

8.3.1 OFDM mode, BPSK modulation, 9 Mbps data rate

Channel 6 / 2437 MHz



QuasiPeak (RBW: 9 kHz)

Frequency [MHz]	U [dBμV]	Line	Result
13.57	28.66	N	PASSED

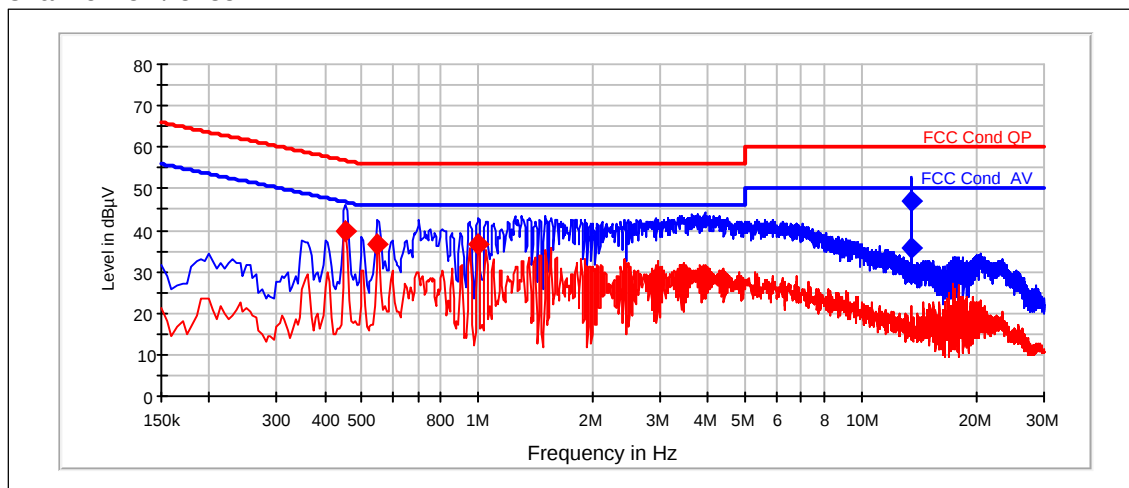
Average (RBW: 9 kHz)

Frequency [MHz]	U [dBμV]	Line	Result
0.45	39	N	PASSED
0.55	37.13	L1	PASSED
1	36.49	N	PASSED

8.4. 5 GHz RLAN Test results

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

Channel 157 / 5785 MHz



QuasiPeak (RBW: 9 kHz)

Frequency [MHz]	U [dBμV]	Line	Result
13.565	47.07	N	PASSED
13.57	35.79	N	PASSED

Average (RBW: 9 kHz)

Frequency [MHz]	U [dBμV]	Line	Result
0.455	39.61	N	PASSED
0.55	36.78	L1	PASSED
1	36.59	N	PASSED

9. Test Equipment

9.1. Conducted measurements

Eq. No	Equipment	Type	Manufacturer	Used in
TM38112	Power supply	6632A	Agilent	22/24/27, 15C, 15E
TM38631	Signal Generator	83640L	Agilent	22/24/27, 15C, 15E, 15B
TM37678	Communication Tester	CMU200	R&S	15C, 15B
TM30600	Impulse limiter	ESH3-Z2	R&S	15C, 15B
TM26490	LISN 50 µH	ESH3-Z5	R&S	15C, 15B
TM26491	LISN 50 µH	ESH3-Z5	R&S	15C, 15B
TM37610	Spectrum Analyzer	FSU26	R&S	22/24/27, 15C, 15E
TM23007	Oscilloscope	TDS684B	Tektronix	15E
TM22806	Battery	BAT 20/E	Fiskars	15C, 15B
TM22805	UPS	PS 20/1.2	Fiskars	15C, 15B
-	Temperature and humidity logger	175-H2	Testo	15C, 15B
-	Temperature and humidity logger	175-H2	Testo	22/24/27, 15C
-	Air pressure and temperature logger	635-2	Testo	22/24/27, 15C, 15B
-	Air pressure sensor	0638-1835	Testo	22/24/27, 15C, 15B
-	Temperature test chamber	VT 4002	Vötsch	22/24/27
2058	Receiver	ESPC	R&S	15C, 15B
2001	Bluetooth tester	CBT	R&S	15C, 15B
2002	Communication Tester	CMU200	R&S	22/24/27, 15C
2009	LISN 50 µH	ENV216	R&S	15C, 15B
2010	LISN 50 µH	ENV216	R&S	15C, 15B
2012	Power splitter	11667B	Agilent	22/24/27, 15C
2013	Attenuator	8493C	Agilent	22/24/27, 15C
2014	Attenuator	8493C	Agilent	22/24/27, 15C
2019	Power splitter	ZN2PD-9G-S+	Mini-Circuits	15E
2020	Power splitter	ZN2PD-9G-S+	Mini-Circuits	15E
2021	Communication Tester	CMW500	R&S	22/24/27
2023	Spectrum Analyzer	ESMI-RF	R&S	15B/15C
2024	Analyzer display unit	ESAI-D	R&S	15B/15C

9.2. Radiated measurements

Eq. No	Equipment	Type	Manufacturer	Used in
TM38114	Power supply	6632A	Agilent	22/24/27, 15C, 15B
TM38631	Signal Generator	83640L	Agilent	22/24/27, 15C, 15E, 15B
-	Antenna	BBHA 9120 D	Schwarzbeck	22/24/27, 15C
TM26497	Antenna	3115	Emco	22/24/27, 15C, 15B
TM37773	Communication Tester	CMU200	R&S	22/24/27, 15B
TM38845	Receiver	ESIB 26	R&S	22/24/27, 15C, 15E, 15B
-	Antenna	HL562	R&S	22/24/27, 15C, 15E, 15B
-	Turntable	2188	EMCO	22/24/27, 15C, 15E, 15B
-	Turntable controller	2090	EMCO	22/24/27, 15C, 15E, 15B
-	RF system panel	TS-RSP	R&S	22/24/27, 15C, 15E, 15B
-	RF system panel	TS-RSP	R&S	22/24/27, 15C, 15E, 15B
-	Mini mast	2075-2	ETS Lindgren	22/24/27, 15C, 15B

Eq. No	Equipment	Type	Manufacturer	Used in
TM38843	Mini mast	2075	Emco	22/24/27, 15C, 15B
TM38842	Antenna mast controller	2090	Emco	22/24/27, 15C, 15B
TM30643	LISN 50 μ H	LISN-5-20-2	FCC	22/24/27, 15C, 15B
TM30644	LISN 50 μ H	LISN-5-20-2	FCC	22/24/27, 15C, 15B
-	Temperature and humidity logger	175-H2	Testo	22/24/27, 15C, 15B
-	Air pressure and temperature logger	635-2	Testo	22/24/27, 15C, 15B
-	Air pressure sensor	0638-1835	Testo	22/24/27, 15C, 15B
TM37523	Preamplifier	AMF-4D-10M-3G-25-20P	Miteq	22/24/27, 15C, 15B
TM37498	Preamplifier	AMF-5D-020180-26-10P	Miteq	22/24/27, 15C, 15B
TM30599	Semi anechoic chambre	UNKNOWN	TDK	22/24/27, 15C, 15B
TM22638	Power supply	OL63743-901	-	22/24/27, 15C, 15E, 15B
TM38066	High pass filter	WHKX3.0/18G-12SS	Wainwright	22/24/27, 15C, 15E, 15B
2028	High pass filter	WHKX 1.0/15G-12SS	Wainwright	22/24/27, 15C, 15E, 15B
TM37545	Tunable notch filter	800.0/960.0-0.2/40-8SSK	Wainwright	22
TM26512	Tunable notch filter	WRCD1850/1910-0.2/40-10SSK	Wainwright	24
-	Band reject filter	WRCG1877/1883-1870/1890-40/6EE	Wainwright	24
-	Band reject filter	WRCG1729.4/1735.4-1722.4/1742.4-40/6SS	Wainwright	27
-	Band reject filter	WRCG832/838-825/848-40/5SS	Wainwright	22
TM23892	Controller	G-1000SDX	Yaesu	22/24/27
2001	Bluetooth tester	CBT	R&S	15C, 15B
6023	Antenna	VUBA 9117	Schwarzbeck	22/24/27
2021	Communication Tester	CMW500	R&S	22/24/27
2025	Antenna	HFH2-Z2	R&S	15C