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August 7, 2015

Prüfbericht / *Test Report* Nr. / *No.* 168237-52348-01 (Edition 5)

Applicant:	Rodenstock GmbH
Type of equipment:	3D video centering system
Type designation:	ImpressionIST® 3
Order No.:	N/A
Test standards:	FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.205, 15.207, 15.215 and 15.247

Note:

The test data of this report is related only to the individual item which has been tested. This report shall not be reproduced except in full extent without the written approval of the testing laboratory.

Table of Contents

1 Description of the Equipment Under Test (EUT)

General data of EUT	
Type designation[1]:	ImpressionIST® 3
Parts[2]:	
Serial number(s):	Test Sample
Manufacturer:	Rohde & Schwarz GmbH & Co. KG
Type of equipment:	3D video centering system
Version:	As received
FCC ID:	2AD6Y5126128802
Additional parts/accessories:	

[1] Type designation of the system if EUT consists of more than one part.
[2] Type designations of the parts of the system, if applicable.

Technical data of EUT	
Application frequency range:	2400.0 - 2438.5 MHz
Frequency range:	2412 MHz – 2462 MHz
Operating frequency:	2412 MHz, 2437 MHz, 2462 MHz
Type of modulation:	OFDM: Tests were performed in modes 802.11b with 11 Mbps, 802.11g with 54 Mbps and 802.11n with 130 Mbps. Please find below notes as well.
Pulse train:	---
Pulse width:	---
Number of RF-channels:	11
Channel spacing:	5 MHz
Designation of emissions[3]:	16M6W7D
Type of antenna:	Two integrated 2T-2R antennas (W5I-BO-07)
Size/length of antenna:	48 mm x 8 mm, each
Connection of antenna:	☐ detachable ☒ not detachable
Type of power supply:	AC supply
Specifications for power supply:	nominal voltage: 110 V nominal frequency: 60 Hz

Notes:

Beamforming Function:
Not applicable!

Antenna „2R“ and Bandwidth:

Antenna (1)	2R		2T	
Bandwidth mode	20 MHz	40 MHz	20 MHz	40 MHz
IEEE 802.11b	✓	-- (2)	✓	-- (2)
IEEE 802.11g	✓	-- (2)	✓	-- (2)
IEEE 802.11n	✓	-- (2)	✓	-- (2)

(1) Simultaniously antenna mode isn´t appli**cable**
(2) 40 MHz is deactivated!

[3] Also known as "Class of Emission".

2 Administrative Data

Application details	
Applicant (full address):	Rodenstock GmbH Strategic Business Unit Lenses Elsenheimerstraße 33 D-80687 München
Contact person:	Ms. Nicole Schaarschmidt Mr. Ludwig Peschl – Rohde & Schwarz GmbH & Co KG
Order number:	N/A
Receipt of EUT:	2014-11-27, 2015-05-29
Date(s) of test:	2014-11-27 to 2014-11-28, 2015-05-29, 2015-07-14, 2015-08-07
Note(s):	Mr. Peschl attended tests on 2014-11-27, 2015-05-29 and 2015-07-14.

Report details	
Report number:	168237-52348-01
Edition:	5
Issue date:	2015-08-07

3 Identification of the Test Laboratory

Details of the Test Laboratory	
Company name:	TÜV SÜD Product Service GmbH
Address:	Aeussere Fruehlingstrasse 45 D-94315 Straubing Germany
Laboratory accreditation:	DAkkS Registration No. D-PL-11321-11-01
FCC test site registration number	90926
Industry Canada test site registration:	3050A-2
Contact person:	Mr. Johann Roidt Phone: +49 9421 5522-0 Fax: +49 9421 5522-99

4 Summary

Summary of test results
The tested sample complies with the requirements set forth in the **Code of Federal Regulations CFR 47, Part 15, Sections 15.205, 15.207, 15.215 and 15.247** of the Federal Communication Commission (FCC).

Personnel involved in this report	
Laboratory Manager:	 Mr. Johann Roidt
Responsible for testing:	 Mr. Martin Steindl
Responsible for test report:	Mr. Martin Steindl

5 Operation Mode and Configuration of EUT

Operation Mode(s)
Test transmitting mode, transmitting continuously on lowest, middle and highest channel, each, with modes 802.11b with 11 Mbps, 802.11g with 54 Mbps and 802.11n with 130 Mbps. Radiated tests were performed with mode 802.11.b, only, which showed maximum -6 dBc bandwidth.

Configuration(s) of EUT
The EUT was configured as stand alone equipment. Conducted RF tests were performed on the antenna port of the module.

List of ports and cables

Port	*Description*	*Classification*[4]	*Cable type*	*Cable length*
1	AC supply of AC/DC adapter	ac power	Unshielded	1.5 m
2	DC supply of EUT	dc power	Unshielded	1.5 m
3	Ethernet configuration	signal/control port	Shielded	1.5 m [5]

List of devices connected to EUT

Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	AC/DC adapter	DELL dimension		DELL
2	RF adapter	R-12G7210100CB		Farnell

List of support devices

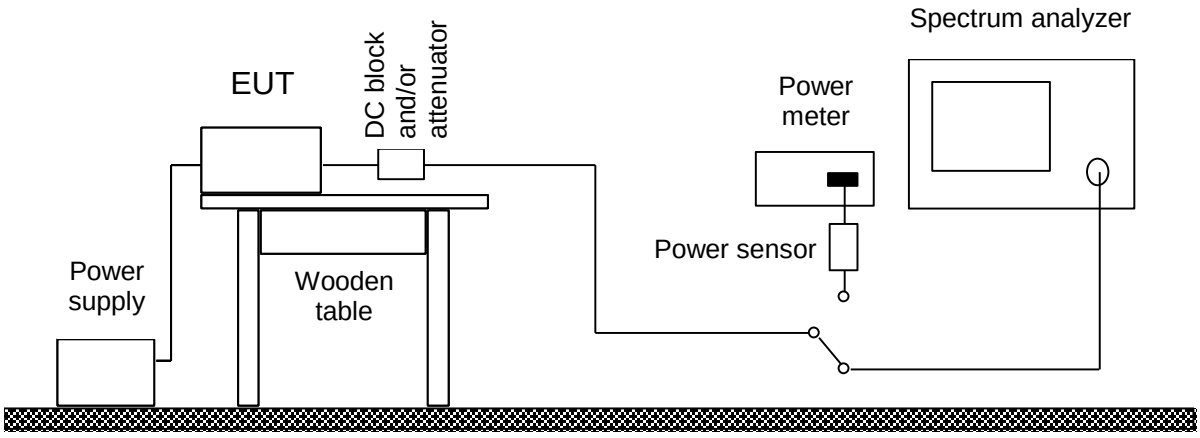
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	Configuration PC	DELL dimension		DELL

[4] Ports shall be classified as ac power, dc power or signal/control port
[5] The ethernet interface was used as temporary configuration interface, only.

6 Measurement Procedures

6.1 Conducted Output Power

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 2, section 2.1046(a) CFR 47 Part 15, section 15.247(b)(2)
Guide:	ANSI C63.10 / CFR 47 Part 2, section 2.1046 KDB558074 v03r03 KDB662911 v02r01
Conducted output power is measured at the RF output terminals (e.g. antenna connector if antenna is detachable) when the transmitter is adjusted in accordance with the tune-up procedure, if applicable. The RF output terminals are connected to a spectrum analyzer and/or a power meter with appropriate sensor. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as DC block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable. If a spectrum analyzer is used for peak measurement the resolution bandwidth (RBW) is set to a value equal or greater than the digital transmission systems (DTS) bandwidth. The video bandwidth (VBW) shall be at least three times greater than the RBW. The settings used have to be indicated within the appropriate test record(s).	



Test instruments used:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☐	Spectrum analyzer	FSP30	1666	100063	Rohde & Schwarz
☒	Spectrum analyzer	FSP30	(R&S)	1093.4495.30	Rohde & Schwarz
☐	EMI test receiver	ESPI7	1711	836914/0002	Rohde & Schwarz
☐	EMI test receiver	ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☒	Power meter	NRVS	1264	836856/015	Rohde & Schwarz
☒	Peak power sensor	NRV-Z31	1701	8579604.03	Rohde & Schwarz
☐	Power sensor	NRV-Z52	1499	837901/030	Rohde & Schwarz
☐	Power sensor	NRV-Z4	1034	863828/015	Rohde & Schwarz
☐	DC-block	7006	1636	A2798	Weinschel
☒	Microwave cable	ST-18/SMAm/SMAm/48	1949	696378	Huber+Suhner
☐	Attenuator	4776-10	1638	9412	Narda
☐	Attenuator	4776-20	1639	9503	Narda

6.2 Duty cycle Measurement

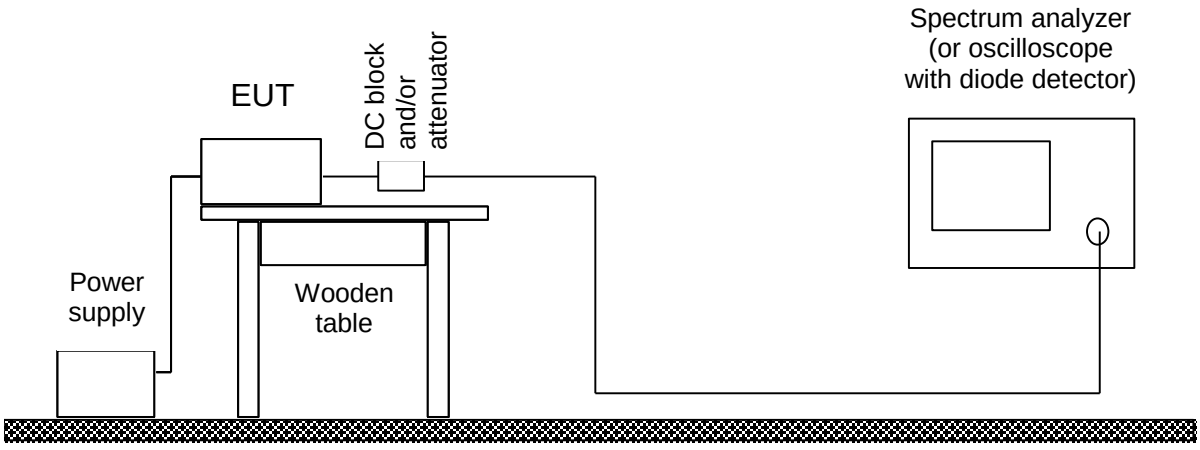
Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.35(c)
Guide:	ANSI C63.10 KDB 558074 v03r03 (6.0)
Measurement setup:	☒ Conducted: See below (direct connection or via test fixture) ☐ Radiated: Radiated Emission Measurement 9 kHz to 30 MHz (6.6) Radiated Emission in Fully or Semi Anechoic Room (6.7)

If antenna is detachable pulse train measurements shall be performed at the antenna connector (conducted measurement). The RF output terminals are connected to a spectrum analyzer in zero-span mode or to a diode detector in combination with an oscilloscope. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.

If antenna is not detachable a test fixture may be used instead of direct connection to RF output terminals.

If radiated measurements are performed similar test setups and instruments are used as with radiated emission measurements for the appropriate frequency range. However, the spectrum analyzer may be replaced by a diode detector connected to an oscilloscope.

If a spectrum analyzer is used the resolution bandwidth (RBW) should be set to a value equal or greater the occupied bandwidth (OBW), if possible, or the largest value available, otherweise. The video bandwidth (VBW) shall be at least as large than the RBW. The detector should be peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100, where T is the minimum transmission duration of the device under test. The settings used have to be indicated within the appropriate test record(s).



Test instruments used:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☐	Spectrum analyzer	FSP30	1666	100036	Rohde & Schwarz
☐	EMI test receiver	ESPI7	1711	836914/0002	Rohde & Schwarz
☐	EMI test receiver	ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☐	Diode detector negative	8473D	1581	01492	Hewlett Packard
☐	Oscilloscope	54602B	1535	US35060304	Hewlett Packard
☐	Digital oscilloscope	Wave Surfer 452	1796	LCRY0301J11938	LeCroy
☐	Test probe	TP 01	1628	001	TÜV SÜD PS
☐	DC-block	7006	1636	A2798	Weinschel
☒	Microwave cable	ST-18/SMAm/SMAm/48	1949	696378	Huber+Suhner
☐	Attenuator	4776-10	1638	9412	Narda
☐	Attenuator	4776-20	1639	9503	Narda

6.3 Bandwidth Measurements

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 2, section 2.202(a) CFR 47 Part 15, sections 15.215(c) and 15.247(a)(2) ANSI C63.10, annex 6.9
Guide:	ANSI C63.4, ANSI C63.10 KDB558074 v03r03
Measurement setup:	☒ Conducted: See below ☐ Radiated: Radiated Emission in Fully or Semi Anechoic Room (6.7)

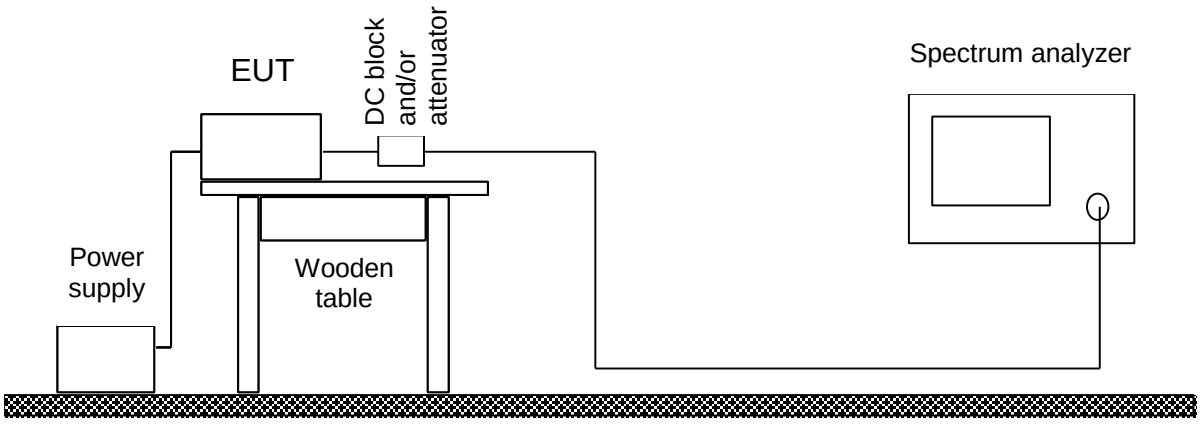
If antenna is detachable bandwidth measurements shall be performed at the antenna connector (conducted measurement) when the transmitter is adjusted in accordance with the tune-up procedure, if applicable. The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.

If radiated measurements are performed the same test setups and instruments are used as with radiated emission measurements for the appropriate frequency range.

For measuring the digital transmission systems (DTS) bandwidth the resolution bandwidth (RBW) shall be set to 100 kHz. The video bandwidth (VBW) shall be at least three times greater than the RBW. The detector is set to peak and the trace mode to max-hold. The DTS is the bandwidth between the outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

For measuring the occupied bandwidth (OBW) the RBW shall be set to a value in the range 1 % and 5 % of the OBW. The VBW shall be at least three times greater than the RBW. Where practical a sample detection and single sweep shall be used. Otherwise peak-detection and max-hold mode shall be used. The OBW is the bandwidth measured by the 99 % power bandwidth function of the spectrum analyzer. This might require iteration to adjust within the specified range.

The analyzer settings are specified by the test description of the appropriate test record(s).



Test instruments used for conducted measurements:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☐	Spectrum analyzer	FSP30	1666	100036	Rohde & Schwarz
☐	EMI test receiver	ESPI7	1711	836914/0002	Rohde & Schwarz
☐	EMI test receiver	ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☒	EMI test receiver	ESCI	1863	100008	Rohde & Schwarz
☐	Power meter	NRVS	1264	836856/015	Rohde & Schwarz
☐	Peak power sensor	NRV-Z31	1701	8579604.03	Rohde & Schwarz
☐	Power sensor	NRV-Z52	1499	837901/030	Rohde & Schwarz
☐	Power sensor	NRV-Z4	1034	863828/015	Rohde & Schwarz
☐	DC-block	7006	1636	A2798	Weinschel
☒	Microwave cable	ST-18/SMAm/SMAm/48	1949	696378	Huber+Suhner
☐	Attenuator	4776-10	1638	9412	Narda
☐	Attenuator	4776-20	1639	9503	Narda

6.4 Power spectral density

Measurement Procedure:		
Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.247 KDB558074 v03r03	
Guide:	ANSI C63.4, ANSI C63.10	
Measurement setup:	☒ Conducted:	See below
	☐ Radiated:	Radiated Emission in Fully or Semi Anechoic Room (6.7)

If antenna is detachable bandwidth measurements shall be performed at the antenna connector (conducted measurement) when the transmitter is adjusted in accordance with the tune-up procedure, if applicable. The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.

If radiated measurements are performed the same test setups and instruments are used as with radiated emission measurements for the appropriate frequency range.

The center frequency of the spectrum analyzer is set to the center frequency of the digital transmission systems (DTS) channel center frequency and the span shall be set to 1.5 times the DTS bandwidth. The resolution bandwidth (RBW) shall be set in the range 3 kHz to 100 kHz. The video bandwidth (VBW) shall be at least three times greater than the RBW. The detector is set to peak and the trace mode to max-hold. The maximum power spectral density is the maximum amplitude level of the fully stabilized trace. If the measured value exceeds the limit the RBW is reduced, but not less than 3 kHz and the test is repeated.

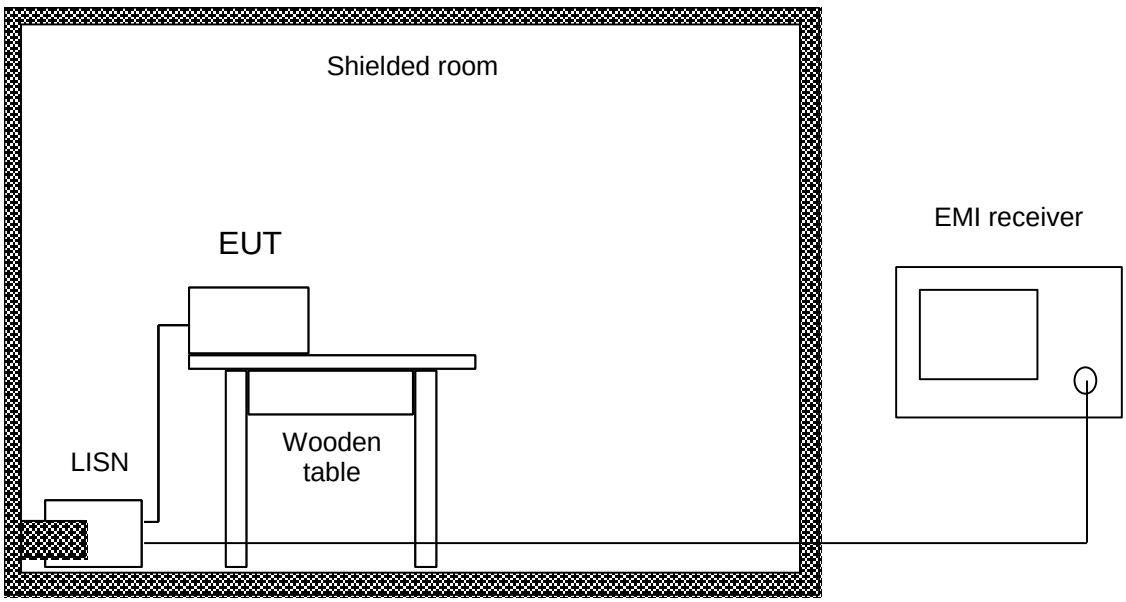
6.5 Conducted AC Powerline Emission

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.207
Guide:	ANSI C63.4, ANSI C63.10 / CISPR 22

Conducted emission tests in the frequency range 150 kHz to 30 MHz are performed using Line Impedance Stabilization Networks (LISNs). To simplify testing with quasi-peak and average detector the following procedure is used:

First the whole spectrum of emission caused by the equipment under test (EUT) is recorded with detector set to peak using CISPR bandwidth of 10 kHz. After that all emission levels having less margin than 10 dB to or exceeding the average limit are retested with detector set to quasi-peak.
If average limit is kept with quasi-peak levels no additional scan with average detector is necessary. In cases of emission levels between quasi-peak and average limit an additional scan with detector set to average is performed.

According to ANSI C63.10, section 6.2.5, testing of intentional radiators with detachable antenna shall be performed using a suitable dummy load connected to the antenna output terminals. Otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended.
Testing with dummy load may be necessary to distinguish (unintentional) conducted emissions on the supply lines from (intentional) emissions radiated by the antenna and coupling directly to supply lines and/or LISN. Usage of dummy load has to be stated in the appropriate test record(s) and notes should be added to clarify the test setup.



Test instruments used:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	Test receiver	ESHS 10	1028	860043/016	Rohde & Schwarz
☒	V-network	ESH 3-Z5	1059	894785/005	Rohde & Schwarz
☐	V-network	ESH 3-Z5	1218	830952/025	Rohde & Schwarz
☐	Artificial mains network	ESH 2-Z5	1536	842966/004	Rohde & Schwarz
☒	Microwave cable	FB293C1080005050	2157	72110-02	Rosenberger Micro-Coax
☒	Coax cable	RG214 N/N 5m	1188	---	Senton
☐	Shielded room	No. 1	1451	---	Albatross
☒	Shielded room	No. 4	1454	3FD 100 544	Euroshield

6.6 Radiated Emission Measurement 9 kHz to 30 MHz

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.247(d) KDB558074 v03r03
Guide:	ANSI C63.4, ANSI C63.10

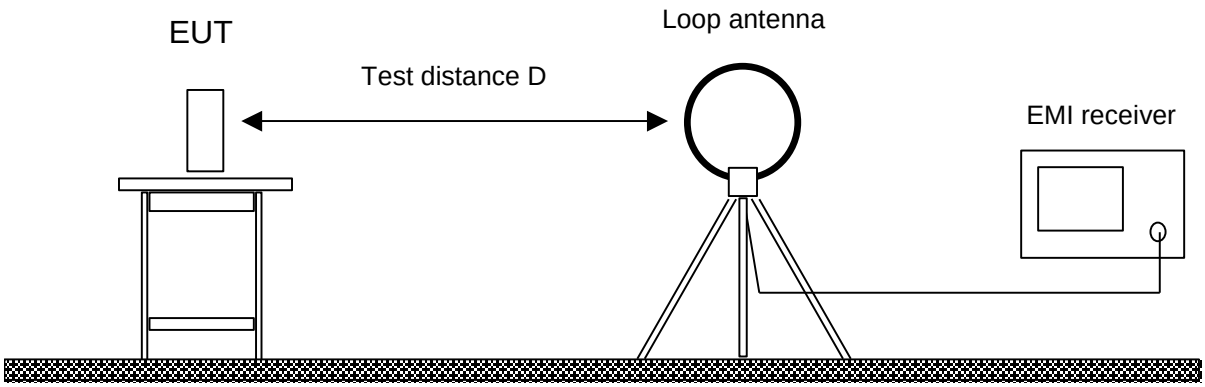
Radiated emission in the frequency range 9 kHz to 30 MHz is measured using an active loop antenna. First the whole spectrum of emission caused by the equipment is recorded at a distance of 3 meters in a fully or semi anechoic room with the detector of the spectrum analyzer or EMI receiver set to peak. This configuration is also used for recording the spectrum of intentional radiators.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.
If worst case emission of the EUT cannot be recorded with EUT in standard position and loop antenna in vertical polarization the EUT (or the radiating part of the EUT) is rotated by 90 degrees instead of changing the loop antenna to horizontal polarization. This procedure is selected to minimize the influence of the environment (e.g. effects caused by the floor especially with longer distances).

Final measurement is performed at a test distance D of 30 meters using an open field test site. In case the regulation requires testing at other distances, the result is extrapolated by either making measurements at an additional distance D of 10 meters to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). In cases of very low emissions measurements are performed at shorter distances and results are extrapolated to the required distance. The provisions of CFR 47 Part 15 sections 15.31(d) and (f)(2) apply. According to CFR 47 Part 15 section 15.209(d) final measurement is performed with detector function set to quasi-peak except for the frequency bands 9 to 90 kHz and 110 to 490 kHz where, for non-pulsed operation, average detector is employed.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.



Test instruments used:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	Spectrum analyzer	FSP30	1666	100036	Rohde & Schwarz
☐	EMI test receiver	ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☐	Test receiver	ESHS 10	1028	860043/016	Rohde & Schwarz
☐	Preamplifier Cabin no. 2	CPA9231A	1716	3557	Schaffner
☒	Loop antenna	HFH2-Z2	1016	882964/1	Rohde & Schwarz
☒	Microwave cable Cabin no. 2	UFA210A-FG	1681	23516	Rosenberger Micro-Coax
☒	Microwave cable Cabin no. 2	KKSF1040016	2020	289854/4	Huber + Suhner
☒	Microwave cable Cabin no. 2	FA210AF020000000	2060	64566-2	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	EF393	2053	---	Albatross Projects
☐	Microwave cable Cabin no. 8	FB293C1050005050	2054	63834-1	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	FB293C1080005050	2055	63833-1	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.3.9	RFS
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.4.12	RFS
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.6.19	RFS
☐	Microwave cable Cabin no. 8	FA210AF040005050G	2127	72061-01	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	FA210AF04000505G	2056	64567-01	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	FA210AF04000505	2068	64610-1	Rosenberger Micro-Coax
☒	Fully anechoic room	No. 2	1452	---	Albatross
☐	Semi anechoic room	No. 3	1453	---	Siemens
☐	Semi anechoic room	No. 8	2057	---	Albatross

6.7 Radiated Emission in Fully or Semi Anechoic Room

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.247 KDB558074 v03r03
Guide:	ANSI C63.4, ANSI C63.10

Radiated emission in fully or semi anechoic room is measured in the frequency range from 30 MHz to the maximum frequency as specified in CFR 47 Part 15 section 15.33.

Measurements are made in both the horizontal and vertical planes of polarization using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set to 100 kHz (below 1 GHz) or 1 MHz (above 1 GHz).

Testing up to 1 GHz is performed with a linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna"). For testing above 1 GHz horn antennas are used.

All tests below 8.2 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance may be reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation factor of 20 dB/decade. If required, preamplifiers are used for the whole frequency range. Special care is taken to avoid overload, using appropriate attenuators and filters, if necessary.

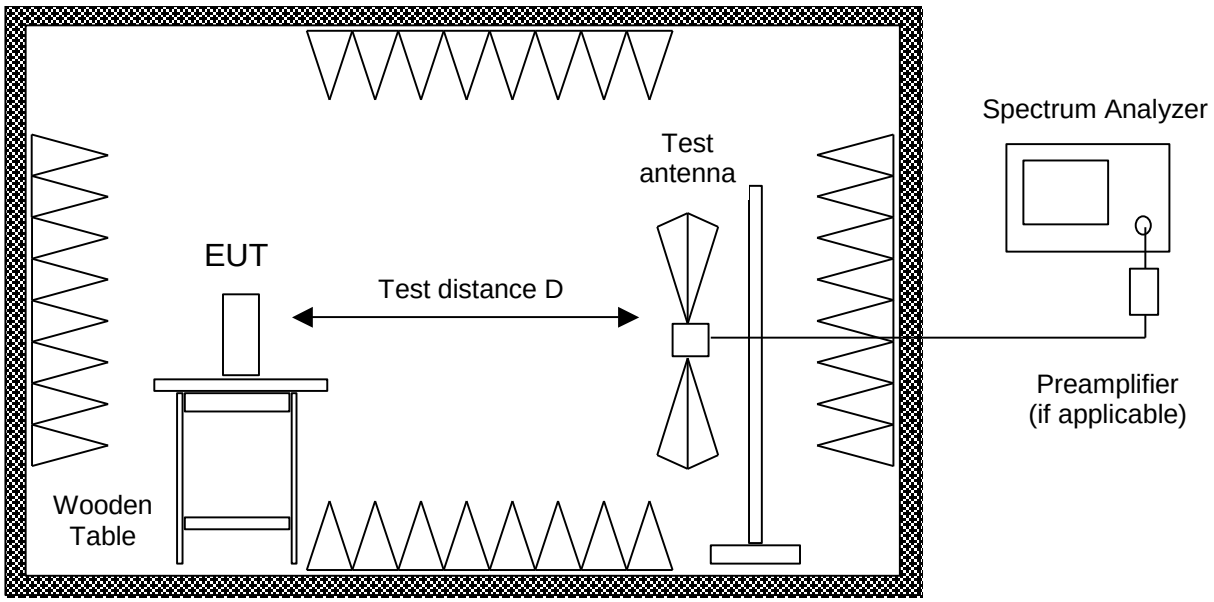
If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

During testing the EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For final testing below 1 GHz a semi anechoic room complying with the NSA requirements of ANSI C63.4 for alternative test sites is used (see 6.8). If prescans are recorded in fully anechoic room they are indicated appropriately.

According to section 13 of KDB558074 the requirement for radiated emissions on the band edges was performed with a reduced bandwidth of 100 kHz instead of 1 MHz.



Fully or semi anechoic room

Test instruments used:

	Type		*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	Spectrum analyzer		FSP30	1666	100036	Rohde & Schwarz
☐	EMI test receiver	Cabin no. 3	ESPI7	2010	101018	Rohde & Schwarz
☐	EMI test receiver		ESU8	2044	100232	Rohde & Schwarz
☒	EMI test receiver		ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☒	Preamplifier	Cabin no. 2	CPA9231A	1716	3557	Schaffner
☐	Preamplifier		R14601	1142	13120026	Advantest
☒	Preamplifier (1 - 8 GHz)		AFS3-00100800-32-LN	1684	847743	Miteq
☐	Preamplifier (0.5 - 8 GHz)		AMF-4D-005080-25-13P	1685	860149	Miteq
☒	Preamplifier (8 - 18 GHz)		ACO/180-3530	1484	32641	CTT
☐	External Mixer		WM782A	1576	845881/005	Tektronix
☐	Harmonic Mixer Accessories		FS-Z30	1577	624413/003	Rohde & Schwarz
☒	Trilog antenna	Cabin no. 2	VULB 9162	2256	9162-048	Schwarzbeck
☐	Trilog antenna	Cabin no. 2	VULB 9163	1802	9163-214	Schwarzbeck
☐	Trilog antenna	Cabin no. 3	VULB 9163	1722	9163-188	Schwarzbeck
☐	Trilog antenna	Cabin no. 8	VULB 9163	2058	9163-408	Schwarzbeck
☒	Horn antenna		3115	1516	9508-4553	EMCO
☐	Horn antenna		3160-03	1010	9112-1003	EMCO
☐	Horn antenna		3160-04	1011	9112-1001	EMCO
☒	Horn antenna		3160-05	1012	9112-1001	EMCO
☒	Horn antenna		3160-06	1013	9112-1001	EMCO
☒	Horn antenna		3160-07	1014	9112-1008	EMCO
☒	Horn antenna		3160-08	1015	9112-1002	EMCO
☒	Horn antenna		3160-09	1265	9403-1025	EMCO
☐	Horn antenna		3160-10	1575	399185	EMCO

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	Microwave cable Cabin no. 2	UFA210A-FG	1681	23516	Rosenberger Micro-Coax
☒	Microwave cable Cabin no. 2	KKSF1040016	2020	289854/4	Huber + Suhner
☒	Microwave cable Cabin no. 2	FA210AF020000000	2060	64566-2	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	EF393	2053	---	Albatross Projects
☐	Microwave cable Cabin no. 8	FB293C1050005050	2054	63834-1	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	FB293C1080005050	2055	63833-1	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.3.9	RFS
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.4.12	RFS
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.6.19	RFS
☐	Microwave cable Cabin no. 8	FA210AF040005050G	2127	72061-01	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	FA210AF04000505G	2056	64567-01	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	FA210AF04000505	2068	64610-1	Rosenberger Micro-Coax
☒	Microwave cable	ST-18/SMAm/SMAm/48	1949	696378	Huber+Suhner
☒	Fully anechoic room	No. 2	1452	---	Albatross
☐	Semi anechoic room	No. 3	1453	---	Siemens
☐	Semi anechoic room	No. 8	2057	---	Albatross

6.8 Radiated Emission at Alternative Test Site

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.247 KDB558074 v03r03
Guide:	ANSI C63.4, ANSI C63.10

Radiated emission in the frequency range 30 MHz to 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4 for alternative test sites. A linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna") is used. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.

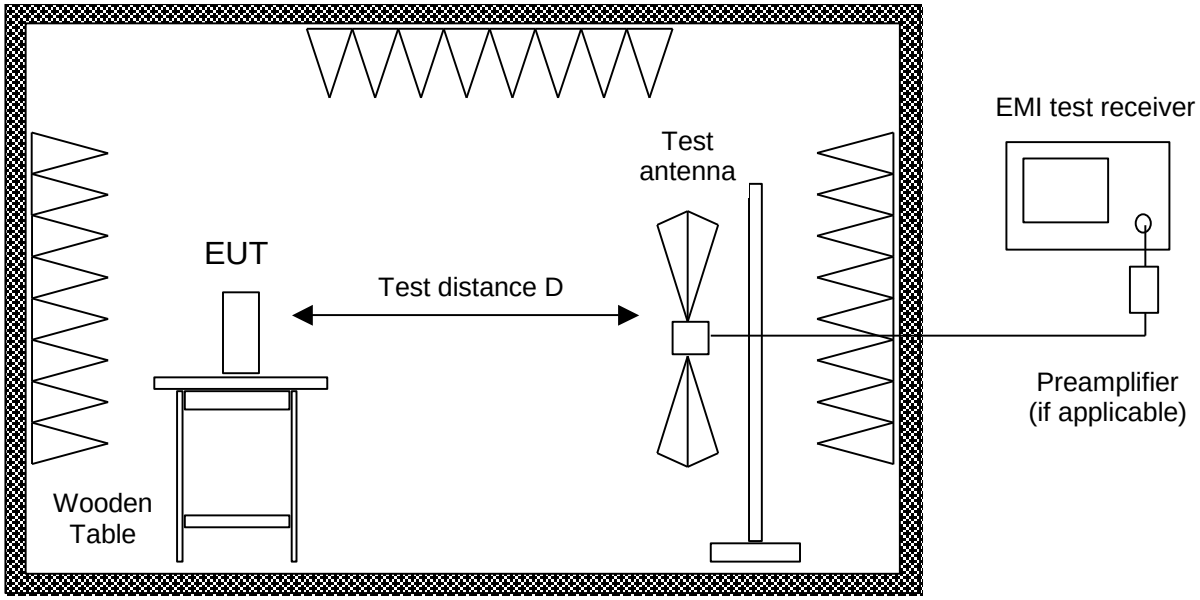
If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are tested in the position producing the highest emission relative to the limit as verified by prescans in fully anechoic room.

If no prescan in a fully anechoic room is used first a peak scan is performed in four positions to get the whole spectrum of emission caused by EUT with the measuring antenna raised and lowered from 1 to 4 m to find table position, antenna height and antenna polarization for the maximum emission levels.
Data reduction is applied to these results to select those levels having less margin than 10 dB to or exceeding the limit using subranges and limited number of maximums. Further maximization is following.
With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

In cases where prescans in a fully anechoic room are taken (e. g. if EUT is operating for a short time only or battery is dircharged quickly) final measurements with quasi-peak detector are performed manually at frequencies indicated by prescan with EUT rotating all around and receiving antenna raising and lowering within 1 meter to 4 meters to find the maximum levels of emission.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For measuring emissions of intentional radiators and receivers a test distance D of 3 meters is selected. Testing of unintentional radiators is performed at a distance of 10 meters. If limits specified for 3 meters shall be used for measurements performed at 10 meters distance the limits are calculated according to CFR 47 Part 15 section 15.31(d) and (f)(1) using an inverse linear-distance extrapolation factor of 20 dB/decade.



Alternate test site (semi anechoic room)

Test instruments used:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	EMI test receiver	ESU8	2044	100232	Rohde & Schwarz
☒	Microwave cable Cabin no. 8	EF393	2053	---	Albatross Projects
☒	Microwave cable Cabin no. 8	LCF12-50	2057	P1.6.19	RFS
☒	Microwave cable Cabin no. 8	FA210AF04000505	2068	64610-1	Rosenberger Micro-Coax
☒	Trilog antenna Cabin no. 8	VULB 9163	2058	9163-408	Schwarzbeck
☒	Semi anechoic room	No. 8	2057	---	Albatross

6.9 Restricted bands of operation

Measurement Procedure:		
Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.247 KDB558074 v03r03	
Guide:	ANSI C63.4, ANSI C63.10	
Measurement setup:	☐ Conducted:	See below
	☒ Radiated:	Radiated Emission in Fully or Semi Anechoic Room (6.7)

The DTS rules specify that emissions which fall into restricted frequency bands shall comply with the general radiated emission limits. Since the emission limits are specified in terms of radiated field strength levels, measurements perfomed remain the principal method for demonstrating compliance to the specified limits; however antenna-port conducted measurements are also acceptable to demonstrate compliance. When radiated measurements are utilized, test site requirements and procedures for maximizing and measuring radiated emissions are the same as for radiated emissions. If conducted measurements are preformed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

When measuring emissions in restricted bands with conducted procedure the conducted output power is measured (in dBm) using the detector specified. For determining the EIRP level the maximum transmit antenna gain (in dBi) and the appropriate maximum ground reflection factor are added to the measured level. For devices with multiple antenna-ports the EIRP values of all chains are measured individually and the power levels are summarized in linear terms (e.g. W, mW). The resultant cumulative EIRP values is converted to an equivalent electric field strength using the relationship E = EIRP - 20 log(D) + 104.8, where D is the specified distance in meters.

The analyzer settings are specified by the test description of the appropriate test record(s).

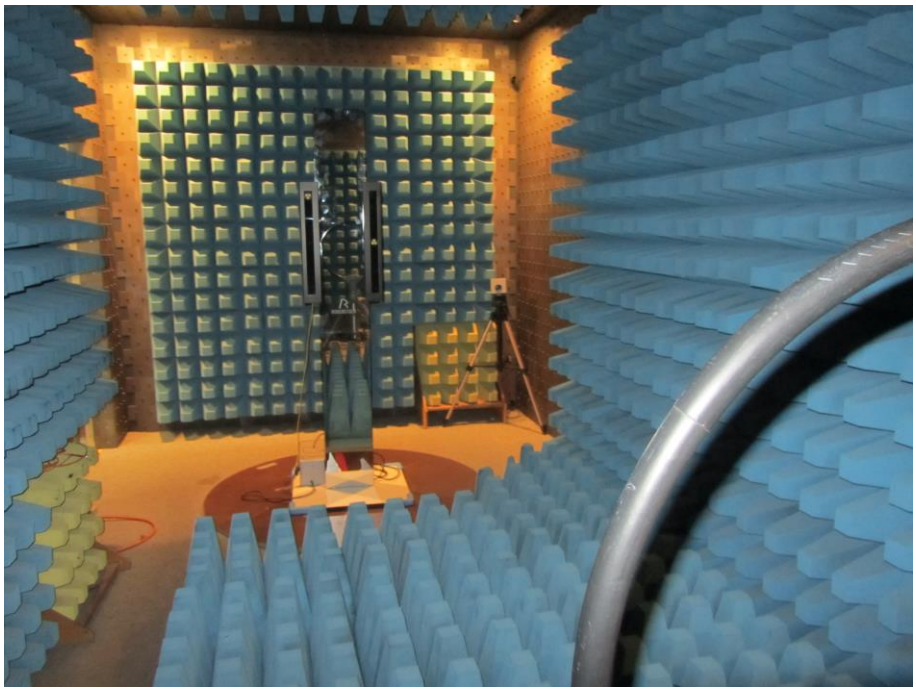
6.10 Band Edge Measurement

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.247 KDB558074 v03r03 (13.3.3)
Guide:	ANSI C63.4, ANSI C63.10
Measurement setup:	☐ Conducted: See below ☒ Radiated: Radiated Emission in Fully or Semi Anechoic Room (6.7)
If continuous transmission of the EUT (i.e., duty cycle ≥ 98 percent) cannot be achieved and the duty cycle is not constant (i.e., duty cycle variations equal or exceed ± 2 percent), then the procedure according to KDB558074 v03r03 section 13.3.3 “Reduced VBW averaging across on and off times of the EUT transmission with max hold was used.	

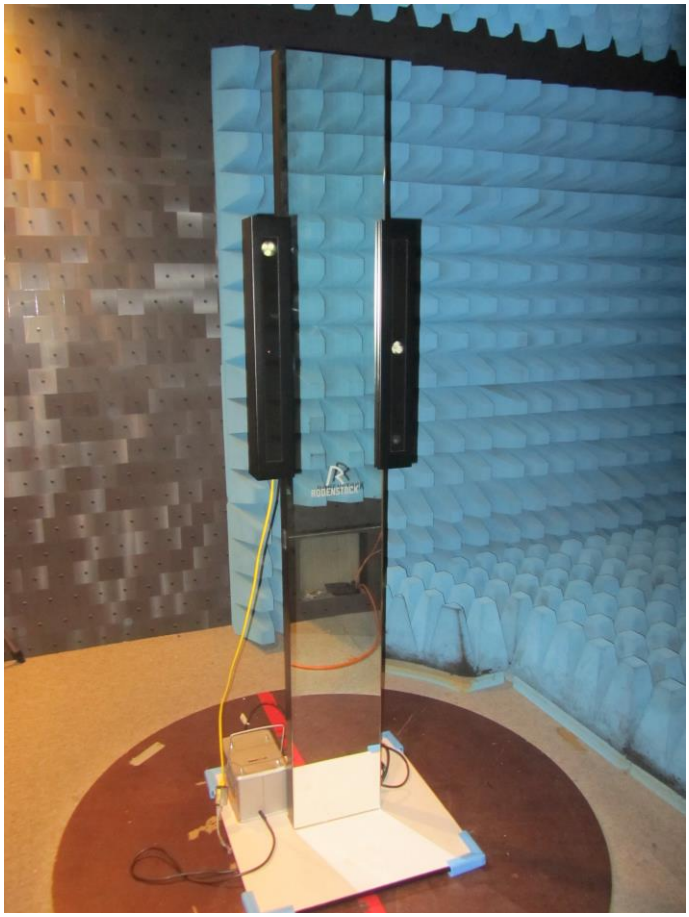
7 Photographs Taken During Testing

Test setup for conducted AC powerline emission measurement

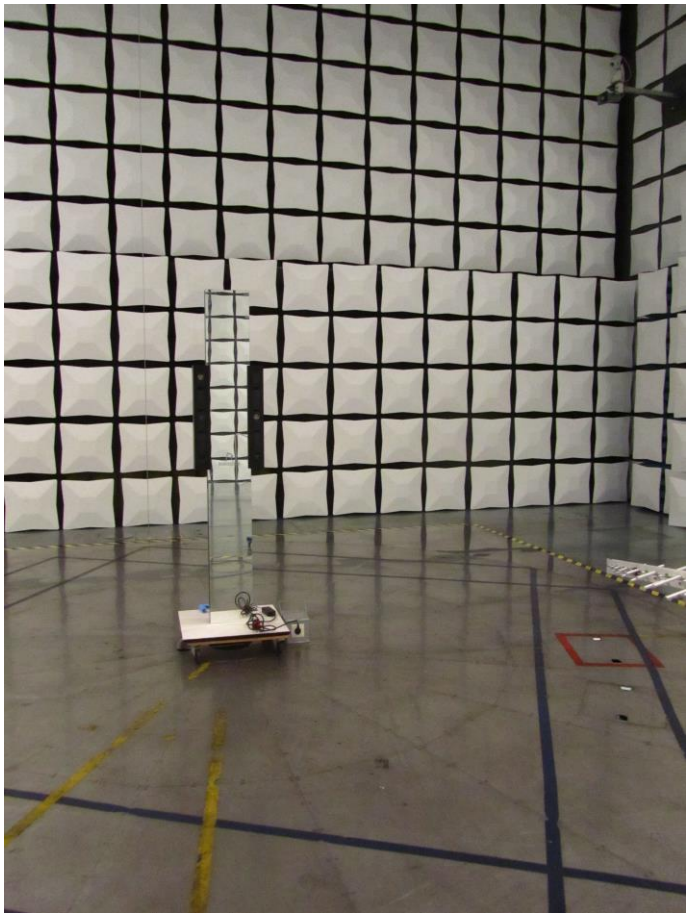
Test setup for radiated emission measurement 9 kHz – 30 MHz



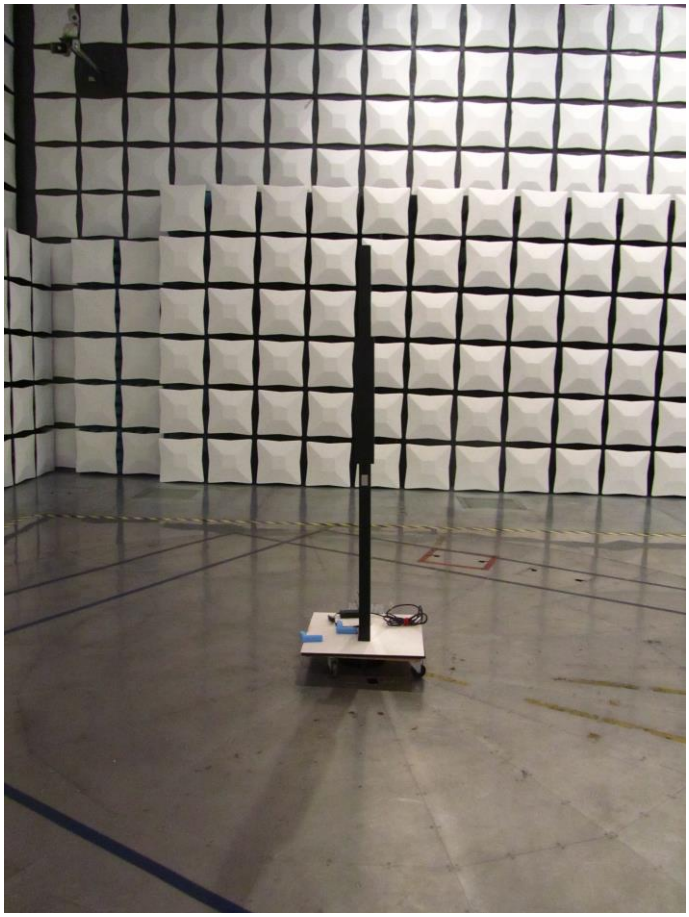
Test setup for radiated emission measurement (fully anechoic room)



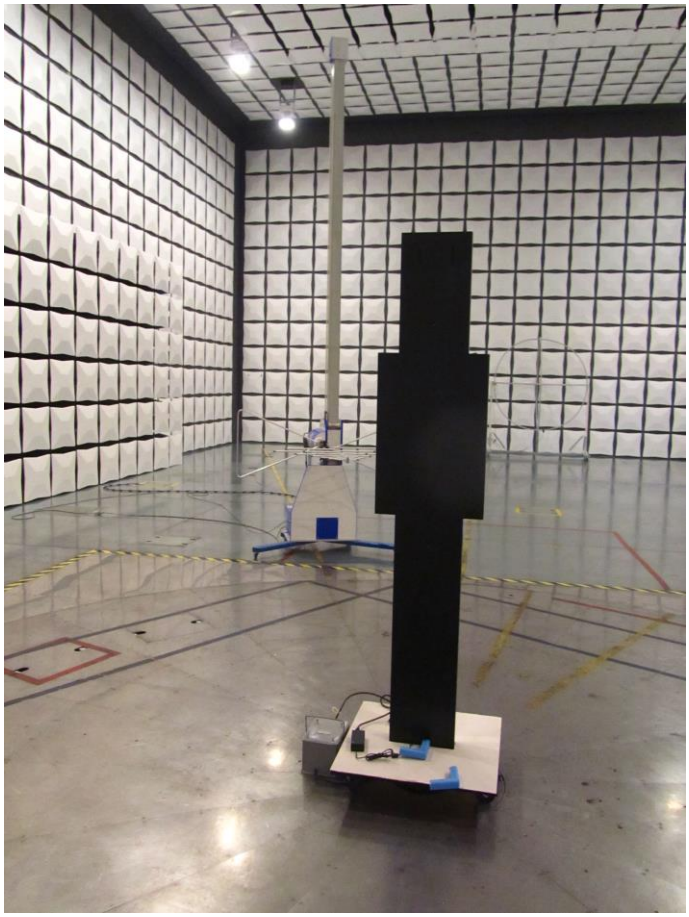
Test setup for radiated emission measurement (alternate test site)



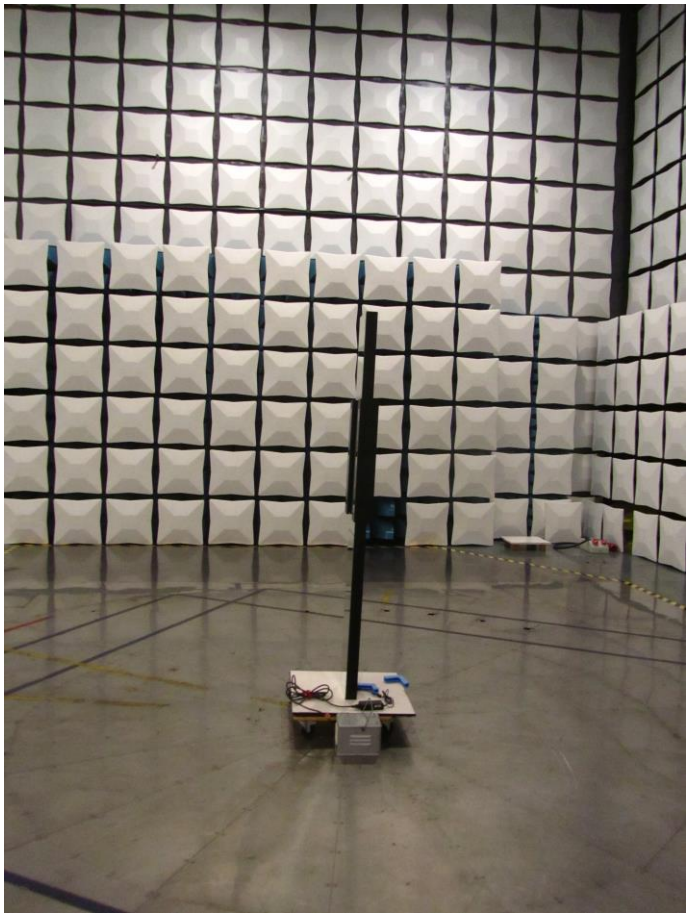
Test setup for radiated emission measurement (alternate test site) - continued -



Test setup for radiated emission measurement (alternate test site) - continued -



Test setup for radiated emission measurement (alternate test site) - continued -



8 Test Results

FCC CFR 47 Parts 2 and 15			
Section(s)	*Test*	*Page*	*Result*
2.1046(a)	Conducted output power	---	Not applicable
2.202(a)	Occupied bandwidth	47	Recorded
15.204	Antenna requirement	---	Integrated Antenna
15.215(c)	Bandwidth of the emission	---	Not applicable
2.201, 2.202	Class of emission	57	Calculated
15.35(c)	Pulse train measurement for pulsed operation	58	Recorded
15.205(a)	Restricted bands of operation	68	Test passed
15.247(a)(2)	6 dB Bandwidth	37	Test passed
15.247(e)	Spectral power density	78	Test passed
15.247(b)(3)	Maximum peak output power	88	Test passed
15.207	Conducted AC powerline emission 150 kHz to 30 MHz	89	Test passed
15.247(d)	Conducted emissions	92	Test passed
15.205(b) 15.247(d)	Radiated emission 9 kHz to 30 MHz	96	Test passed
15.205(b) 15.215(b) 15.247(d)	Radiated emission 30 MHz to 25 GHz	100	Test passed
15.247(i) 2.1093	RF exposure requirement	120	Test passed

8.1 6 dB bandwidth

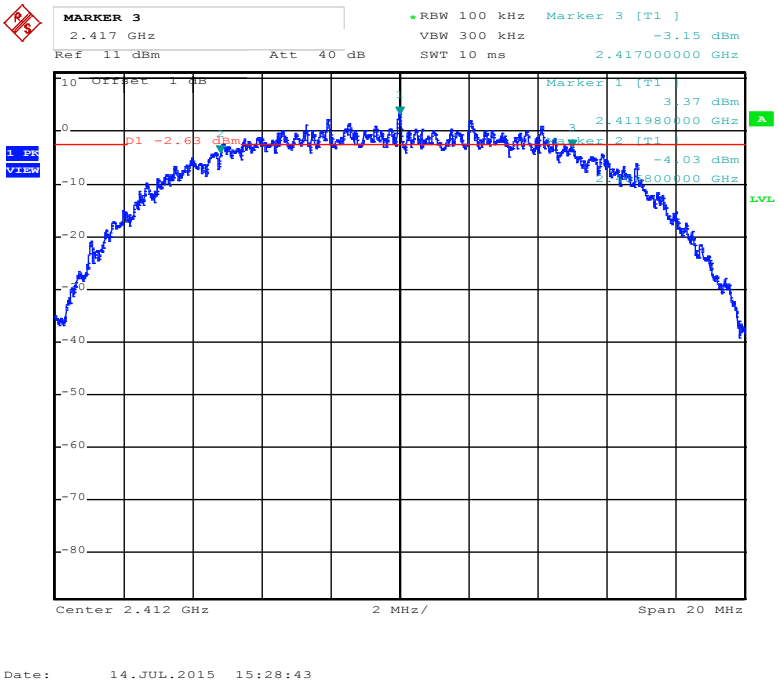
Rules and specifications:	CFR 47 Part 15, section 15.247(a)(2)	
Guide:	ANSI C63.4, ANSI C63.10	
Description:	The minimum 6 dB bandwidth shall be at least 500 kHz	
	Fundamental frequency	Minimum resolution bandwidth
	9 kHz to 30 MHz	1 kHz
	30 MHz to 1000 MHz	10 kHz
	1000 MHz to 40 GHz	100 kHz
Measurement procedure:	Bandwidth Measurements (6.3)	

Comment:	
Cable attenuation:	1 dB
Date of test:	2015-07-14
Test site:	Shielded room, cabin no. 7

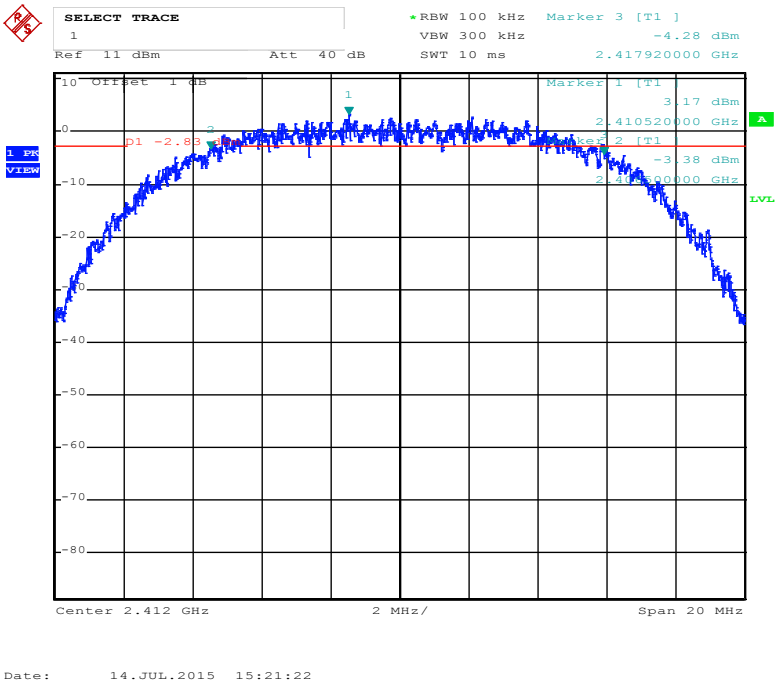
Mode	Antenna-Port	Frequency (MHz)	Channel Band-with (MHz)	Limit (kHz)	Result
11b 11 Mbps	0	2412	10.20	≥ 500	Pass
11b 11 Mbps	0	2437	10.20	≥ 500	Pass
11b 11 Mbps	0	2462	11.44	≥ 500	Pass
11b 11 Mbps	1	2412	11.42	≥ 500	Pass
11b 11 Mbps	1	2437	9.68	≥ 500	Pass
11b 11 Mbps	1	2462	9.72	≥ 500	Pass
11g 54 Mbps	0	2412	16.35	≥ 500	Pass
11g 54 Mbps	0	2437	16.45	≥ 500	Pass
11g 54 Mbps	0	2462	16.45	≥ 500	Pass
11g 54 Mbps	1	2412	16.32	≥ 500	Pass
11g 54 Mbps	1	2437	16.36	≥ 500	Pass
11g 54 Mbps	1	2462	15.76	≥ 500	Pass
11n 130 Mbps	0	2412	16.60	≥ 500	Pass
11n 130 Mbps	0	2437	15.84	≥ 500	Pass
11n 130 Mbps	0	2462	15.88	≥ 500	Pass
11n 130 Mbps	1	2412	16.60	≥ 500	Pass
11n 130 Mbps	1	2437	15.80	≥ 500	Pass
11n 130 Mbps	1	2462	15.96	≥ 500	Pass

Test Result:	Test passed

6 dB bandwidth (11b 11 Mbps, lowest channel):

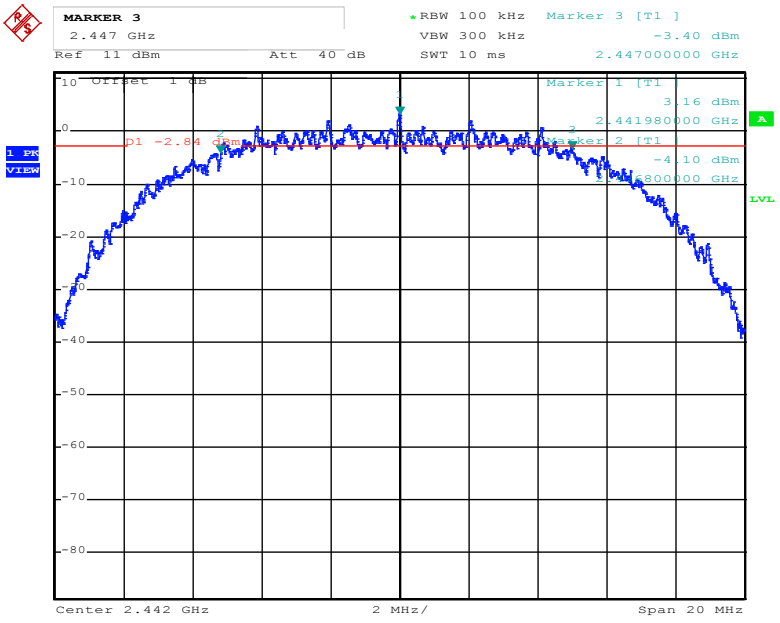


Antenna port 0

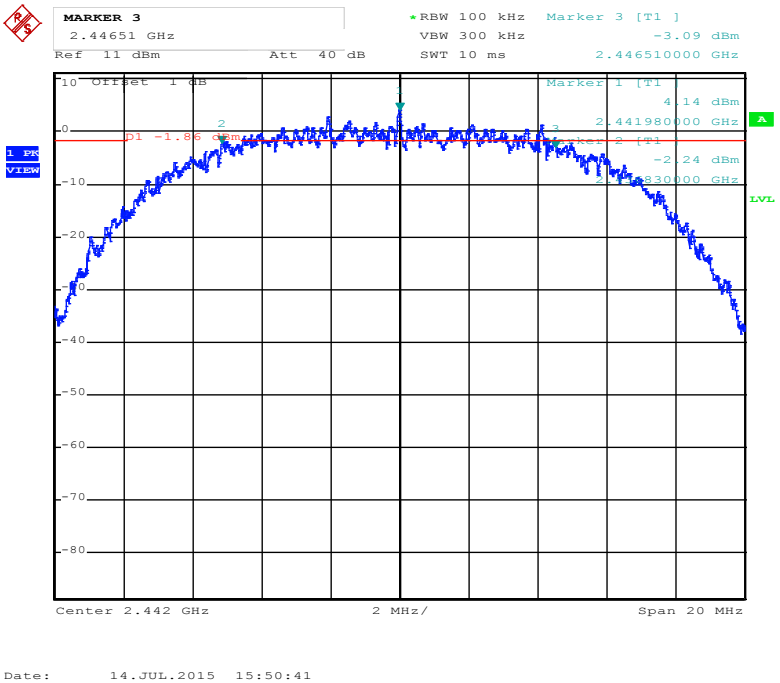


Antenna port 1

6 dB bandwidth (11b 11 Mbps, middle channel):

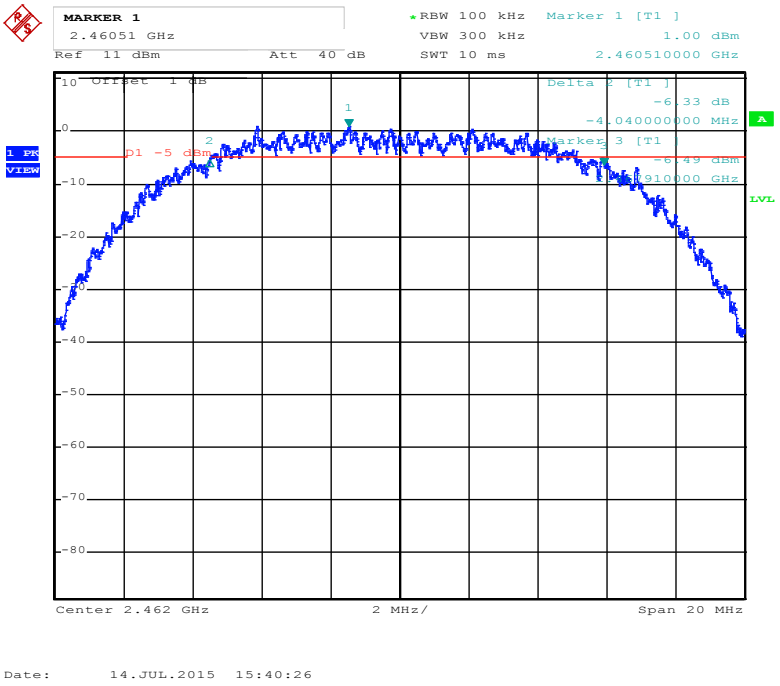


Antenna port 0

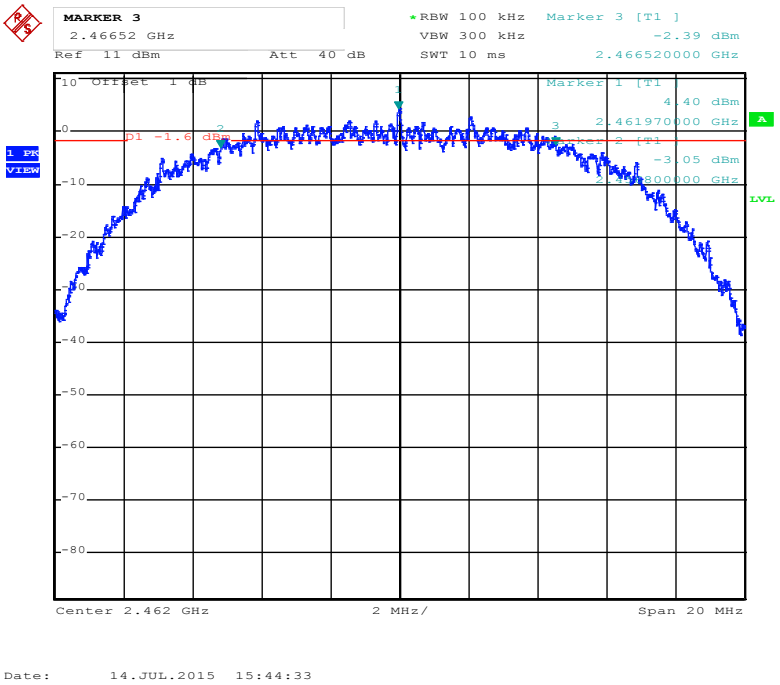


Antenna port 1

6 dB bandwidth (11b 11 Mbps, highest channel):

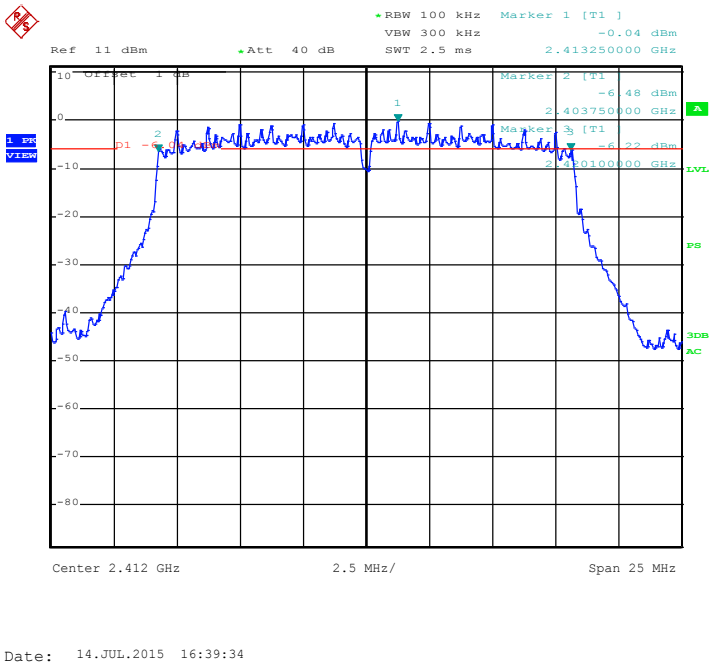


Antenna port 0

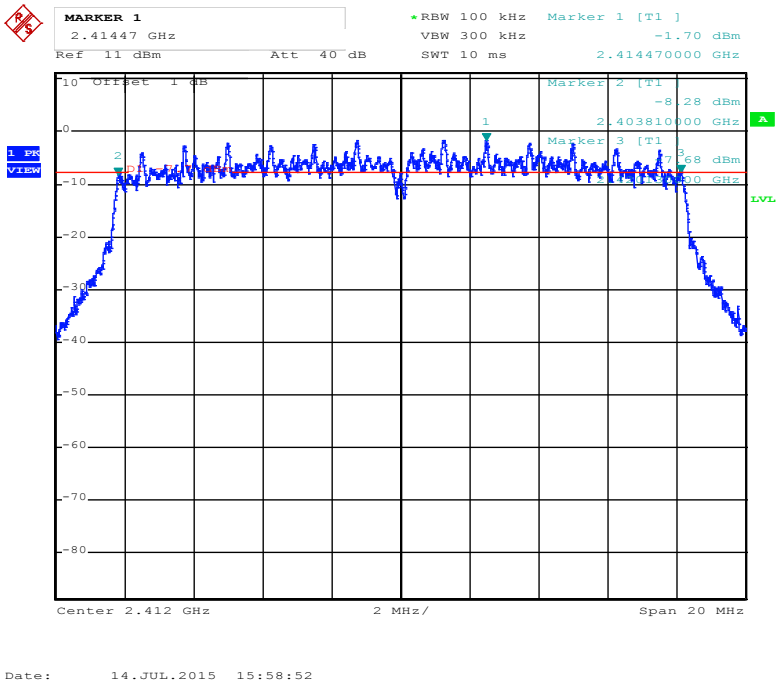


Antenna port 1

6 dB bandwidth (11g 54 Mbps, lowest channel):

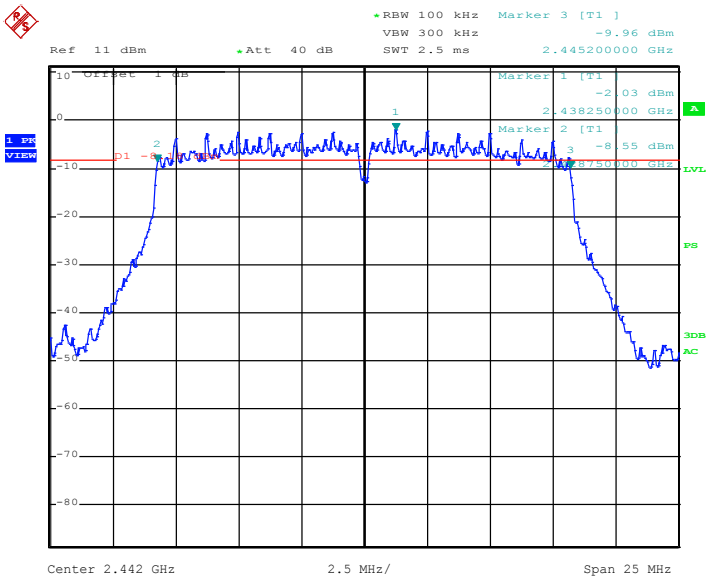


Antenna port 0



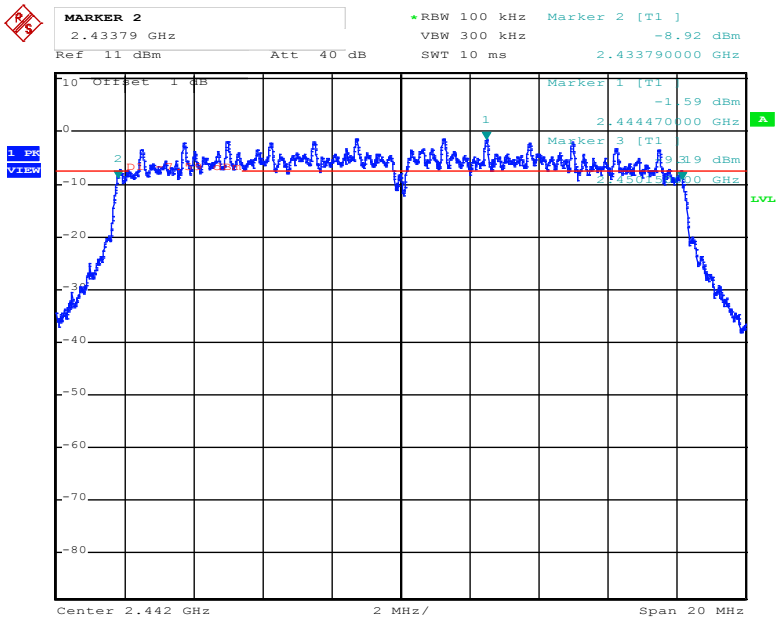
Antenna port 1

6 dB bandwidth (11g 54 Mbps, middle channel):



Date: 14.JUL.2015 16:41:05

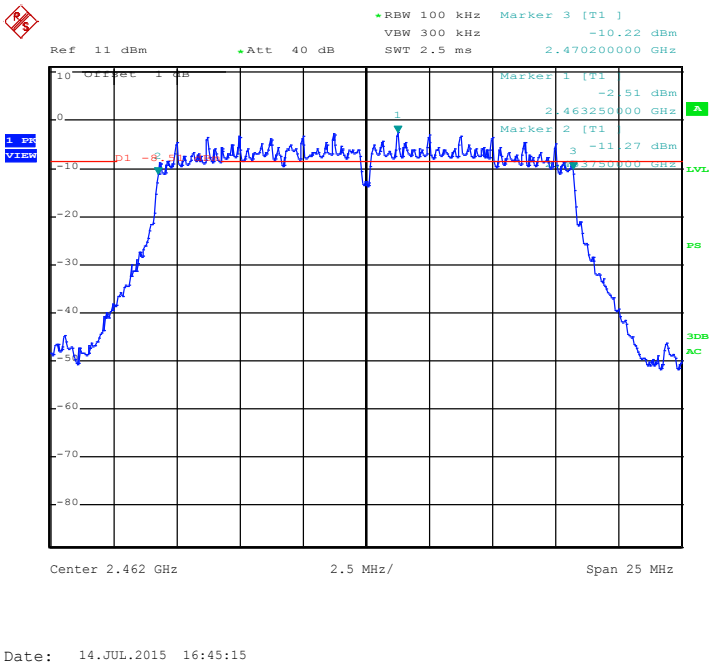
Antenna port 0



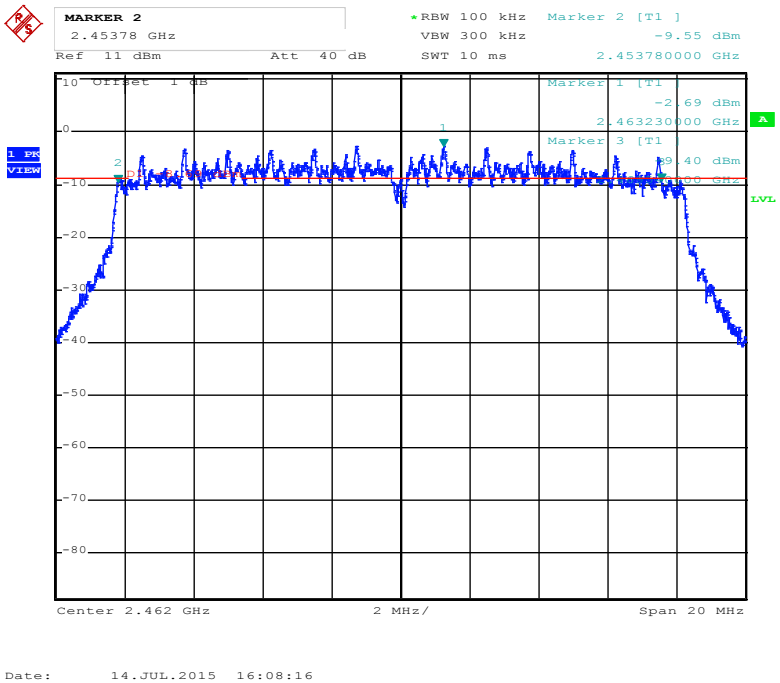
Date: 14.JUL.2015 15:54:49

Antenna port 1

6 dB bandwidth (11g 54 Mbps, highest channel):

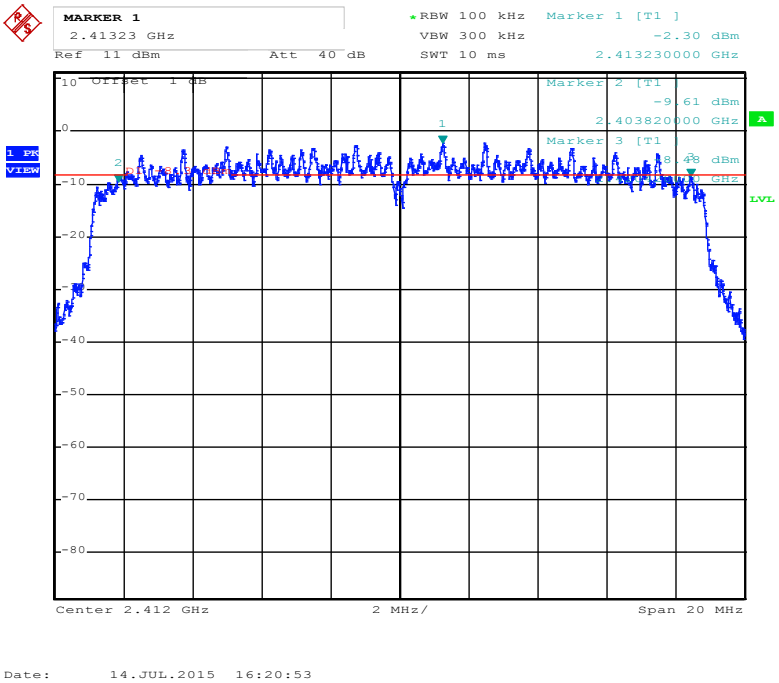


Antenna port 0

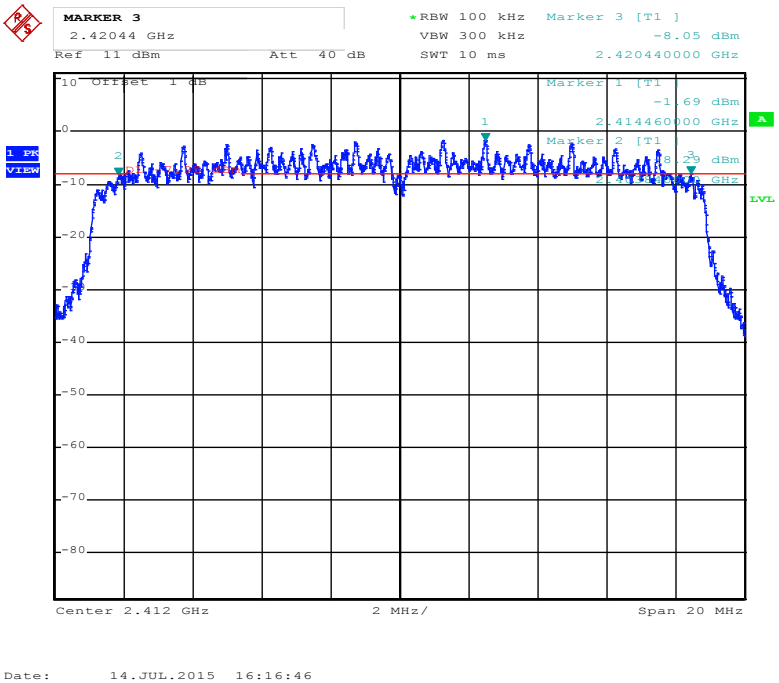


Antenna port 1

6 dB bandwidth (11n 130 Mbps, lowest channel):

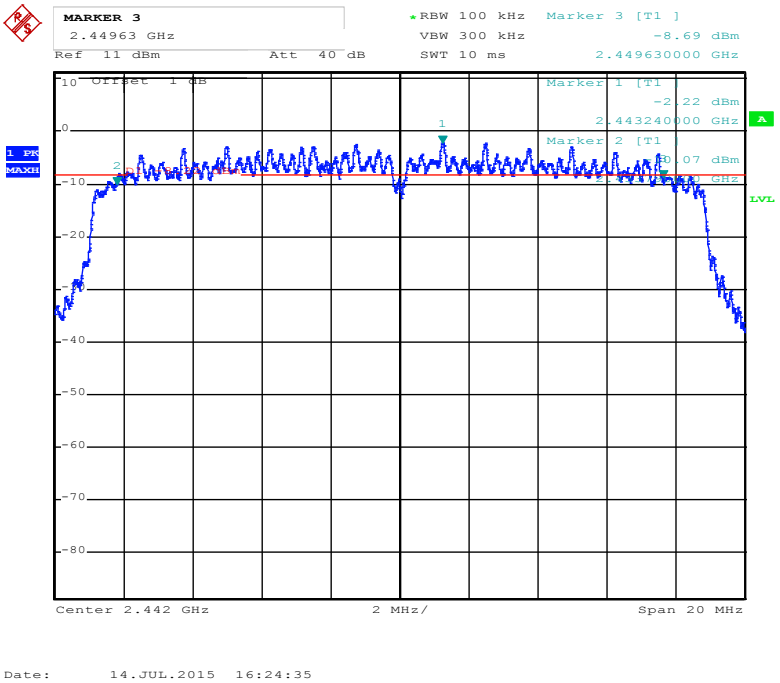


Antenna port 0

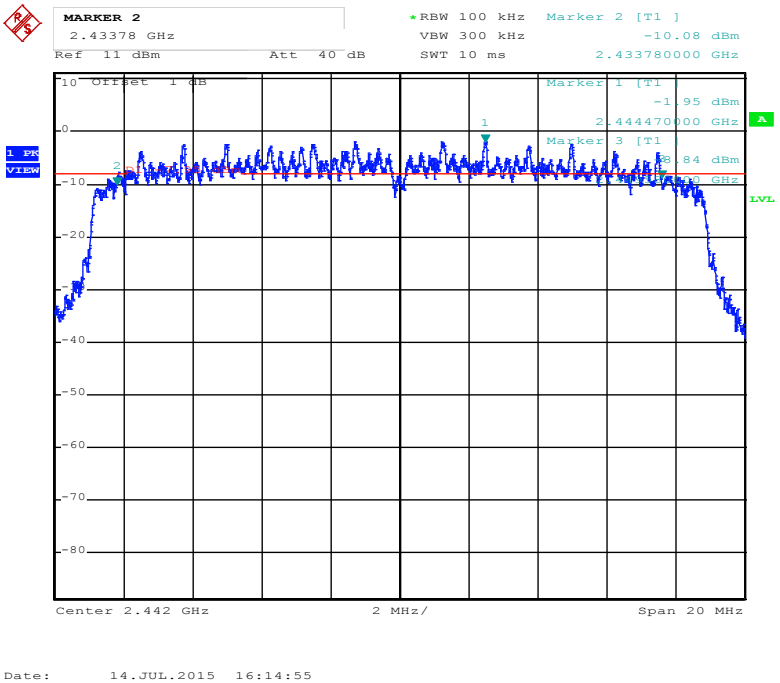


Antenna port 1

6 dB bandwidth (11n 130 Mbps, middle channel):

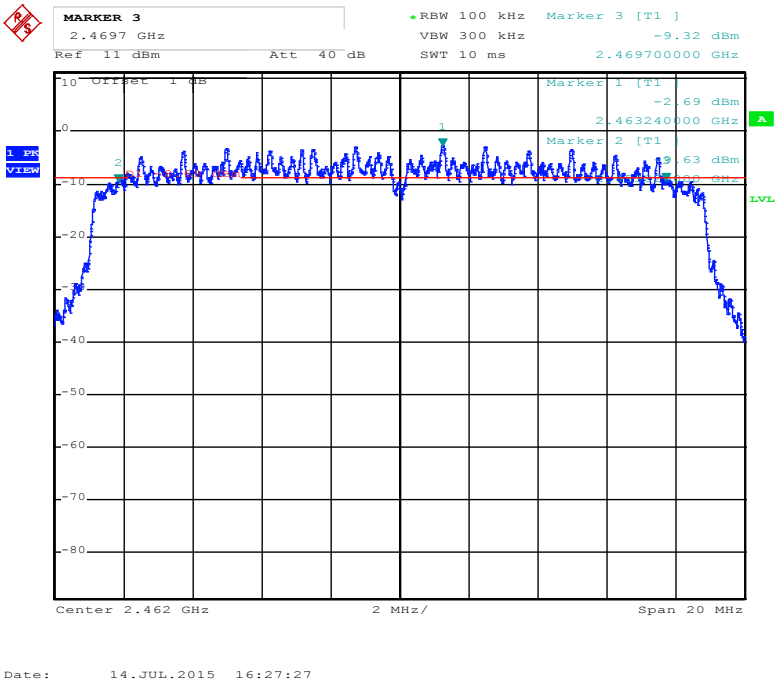


Antenna port 0

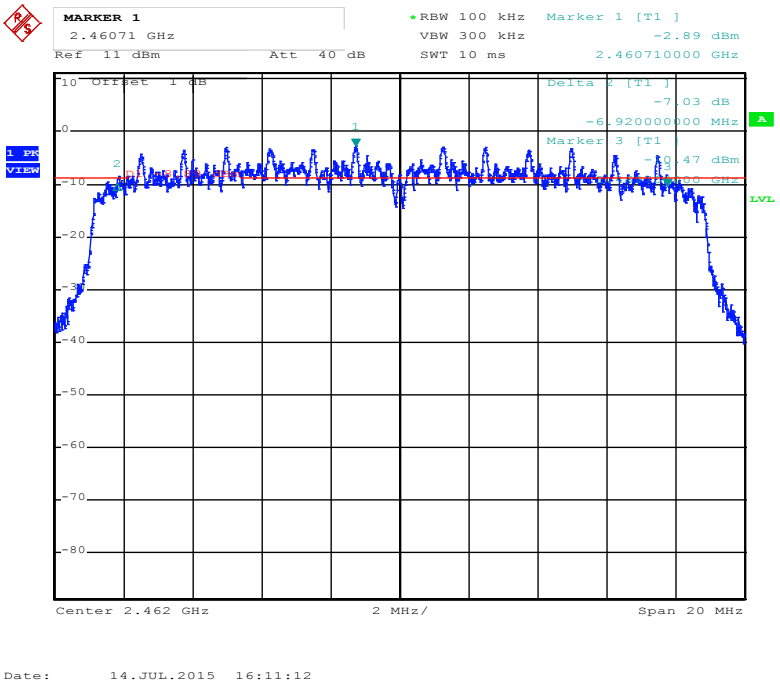


Antenna port 1

6 dB bandwidth (11n 130 Mbps, highest channel):



Antenna port 0



Antenna port 1

8.2 Occupied Bandwidth

Rules and specifications:	CFR 47 Part 2, section 2.202(a) ANSI C63.4, annex H.6
Guide:	ANSI C63.4, ANSI C63.10
Description:	The occupied bandwidth according to CFR 47 Part 2, section 2.202(a), is measured as the 99% emission bandwidth, i.e. below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission. The occupied bandwidth according to ANSI C63.4, annex H.6; is measured as the frequency range defined by the points that are 26 dB down relative to the maximum level of the modulated carrier. The resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:

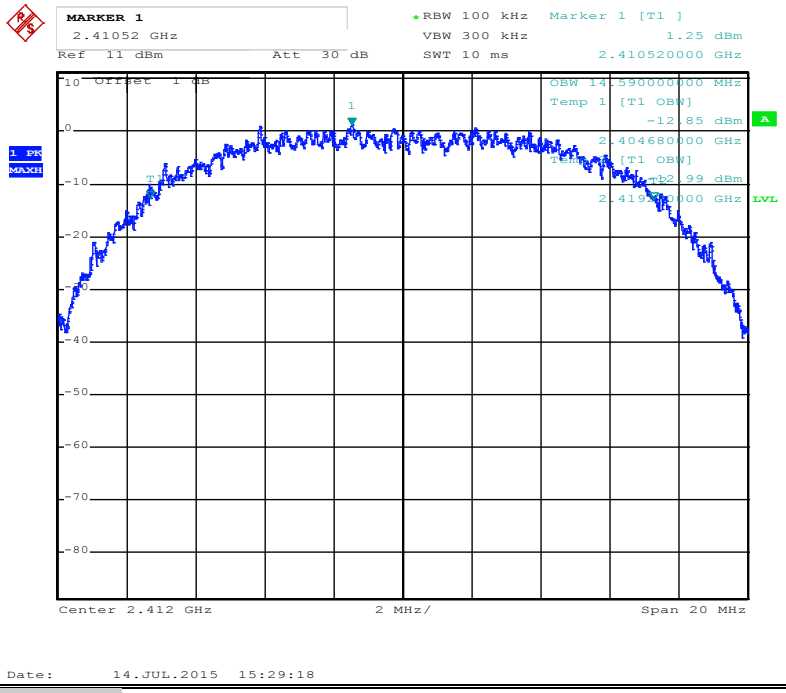
Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1 kHz
30 MHz to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

The video bandwidth shall be at least three times greater than the resolution bandwidth.

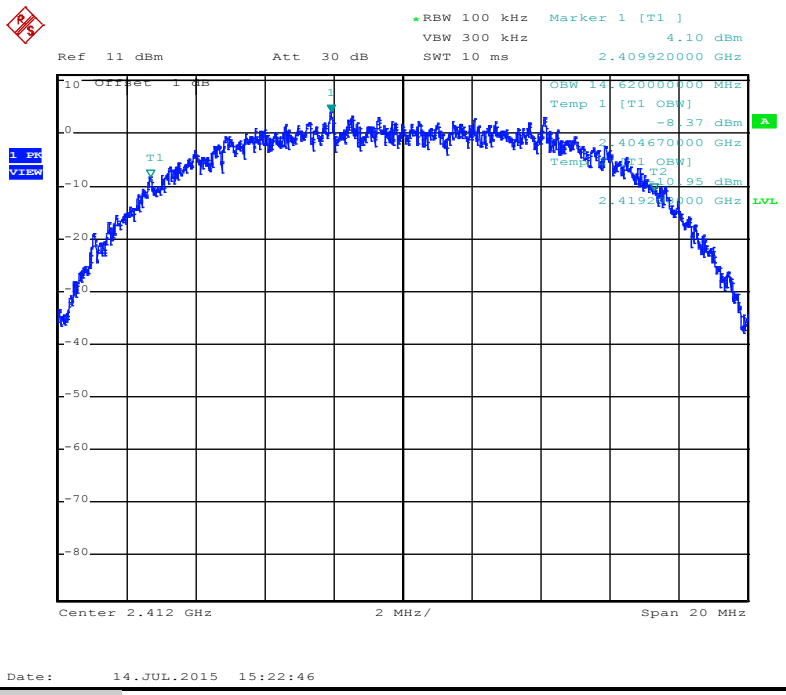
Measurement procedure:	Bandwidth Measurements (6.3)

Comment:	
Cable attenuation:	1 dB
Date of test:	2015-07-14
Test site:	Shielded room, cabin no. 7

Occupied Bandwidth (99 % - 11b 11 Mbps, lowest channel):

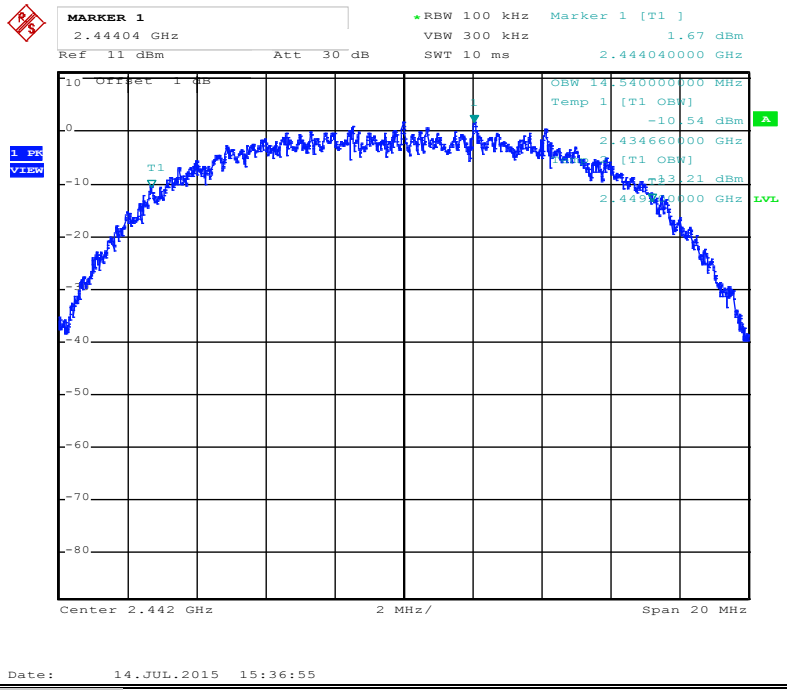


Antenna port:	0
Occupied Bandwidth (99 %):	**14.59 MHz**

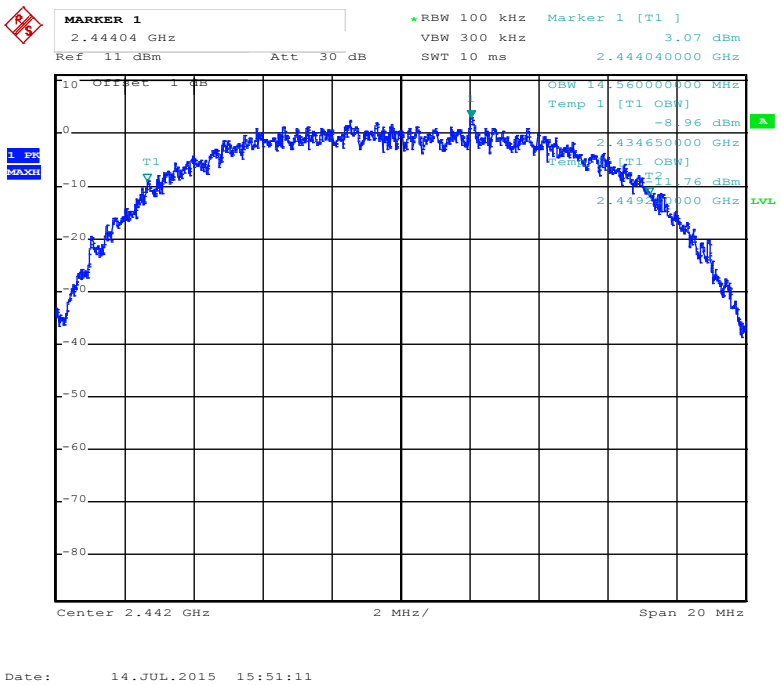


Antenna port:	1
Occupied Bandwidth (99 %):	**14.62 MHz**

Occupied Bandwidth (99 % - 11b 11 Mbps, middle channel):

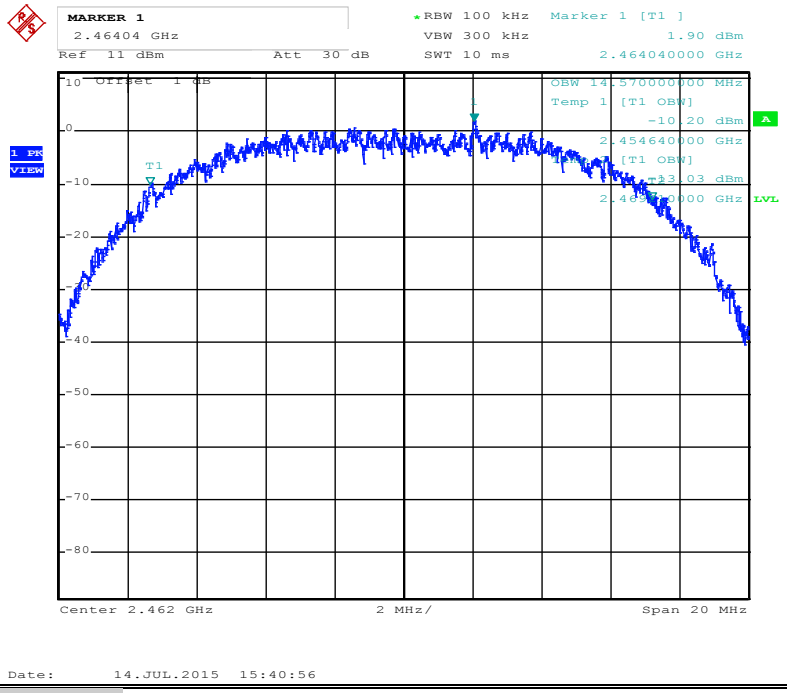


Antenna port:	0
Occupied Bandwidth (99 %):	**14.54 MHz**

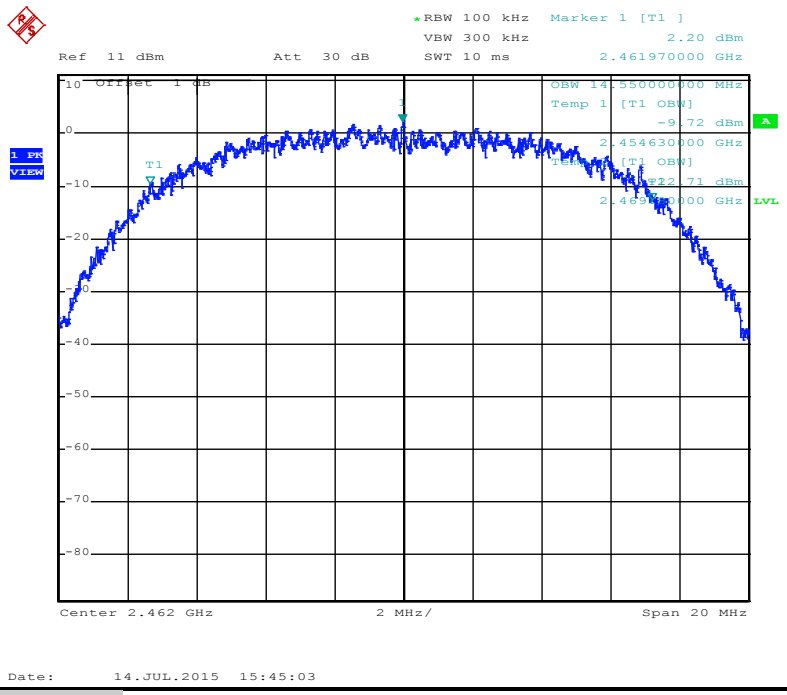


Antenna port:	1
Occupied Bandwidth (99 %):	**14.56 MHz**

Occupied Bandwidth (99 % - 11b 11 Mbps, highest channel):

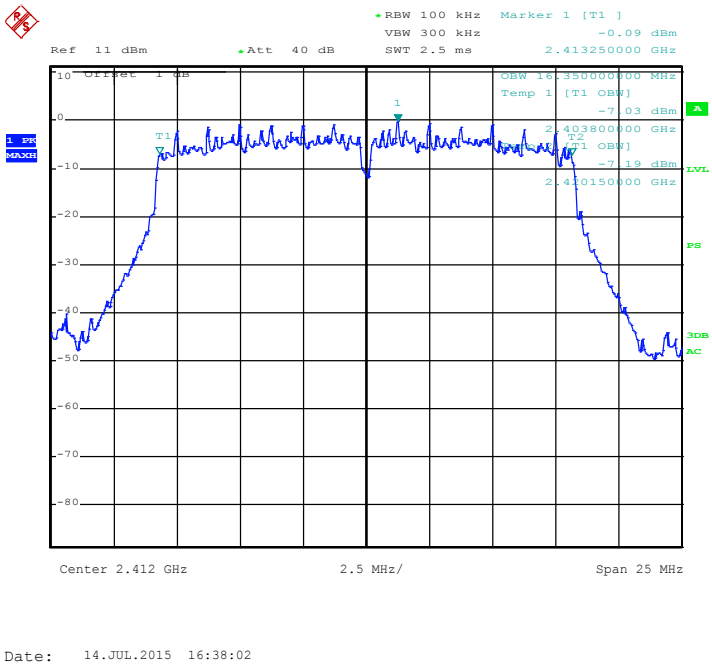


Antenna port:	0
Occupied Bandwidth (99 %):	**14.57 MHz**

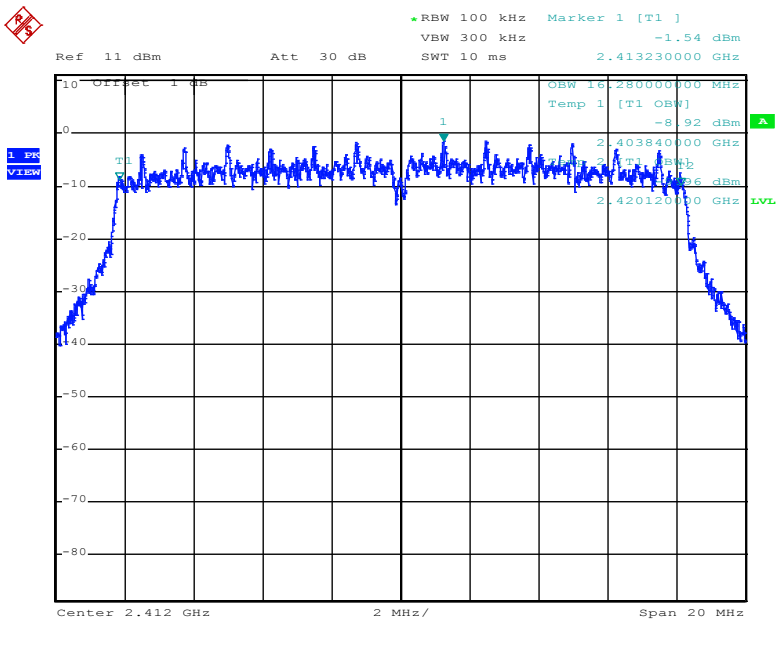


Antenna port:	1
Occupied Bandwidth (99 %):	**14.55 MHz**

Occupied Bandwidth (99 % - 11g 54 Mbps, lowest channel):

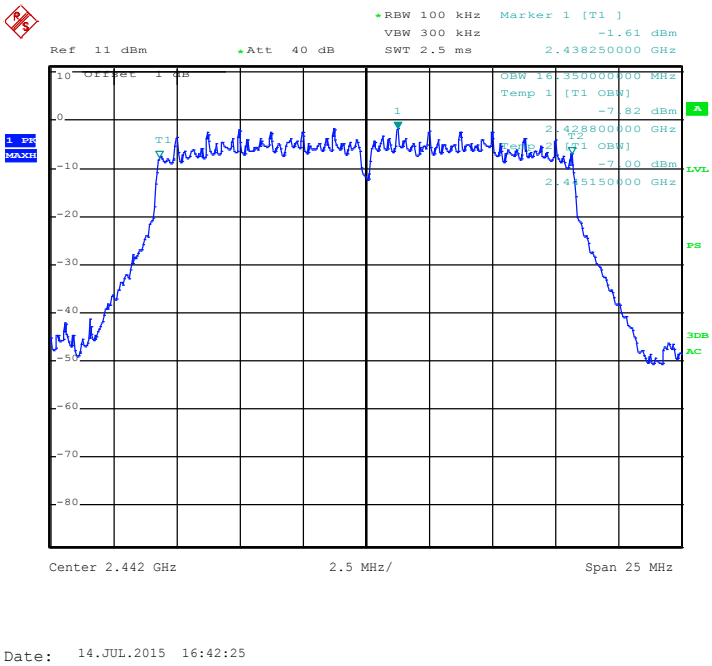


Antenna port:	0
Occupied Bandwidth (99 %):	**16.35 MHz**

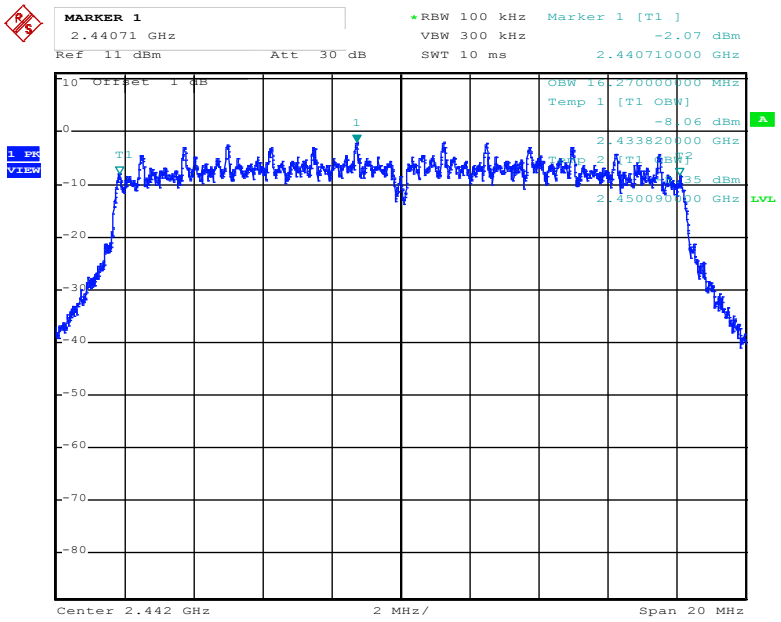


Antenna port:	1
Occupied Bandwidth (99 %):	**16.28 MHz**

Occupied Bandwidth (99 % - 11g 54 Mbps, middle channel):

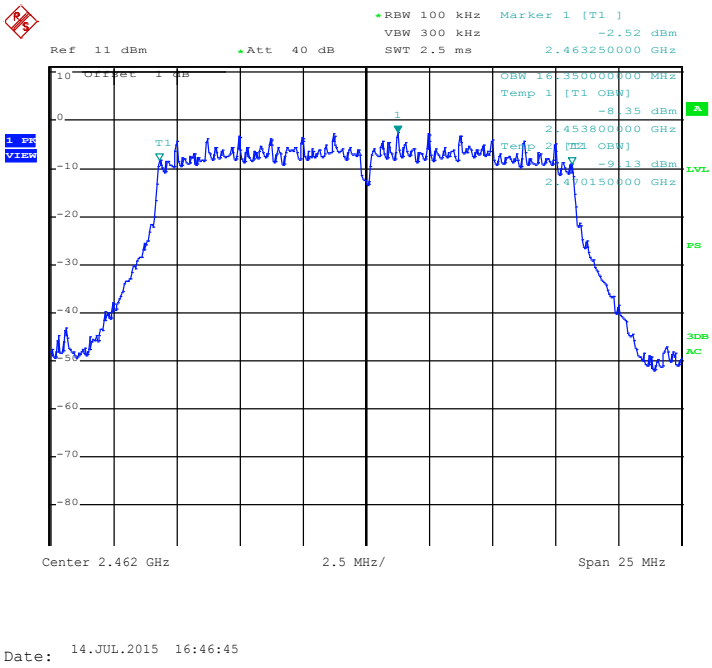


Antenna port:	0
Occupied Bandwidth (99 %):	**16.35 MHz**

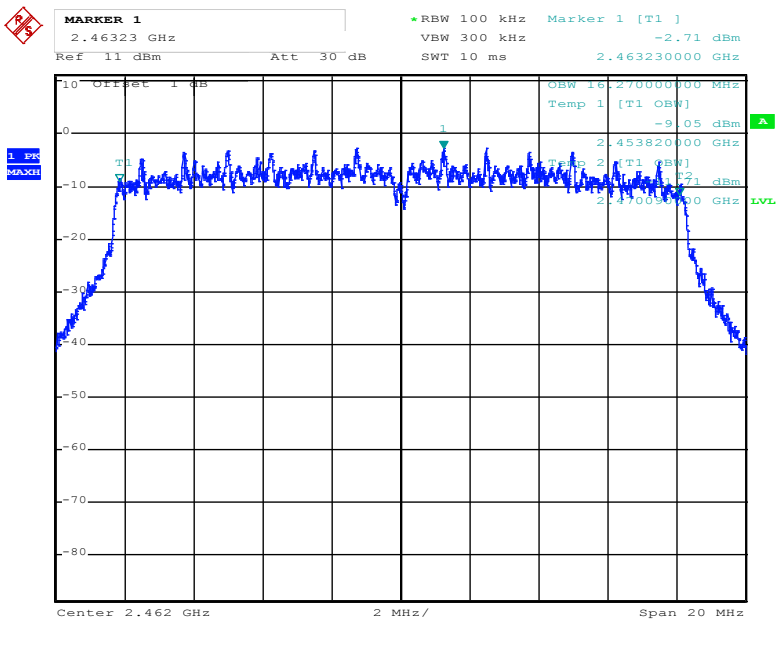


Antenna port:	1
Occupied Bandwidth (99 %):	**16.27**

Occupied Bandwidth (99 % - 11g 54 Mbps, highest channel):

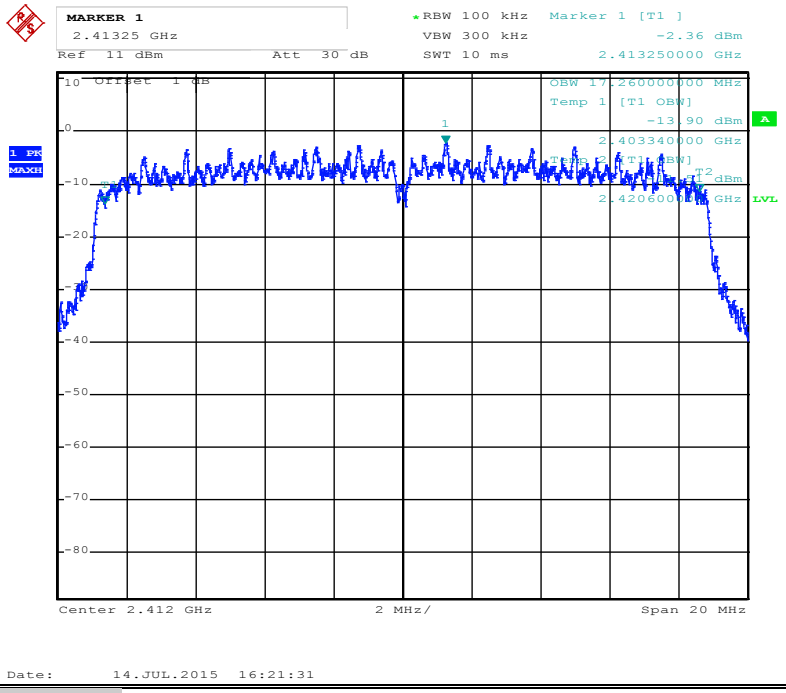


Antenna port:	0
Occupied Bandwidth (99 %):	**16.35 MHz**

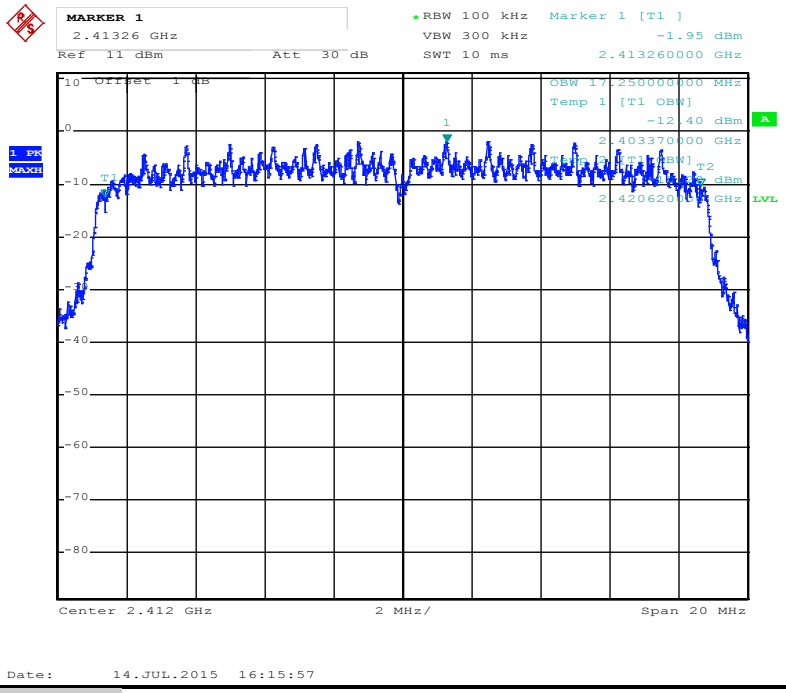


Antenna port:	1
Occupied Bandwidth (99 %):	**16.27 MHz**

Occupied Bandwidth (99 % - 11n 130 Mbps, lowest channel):

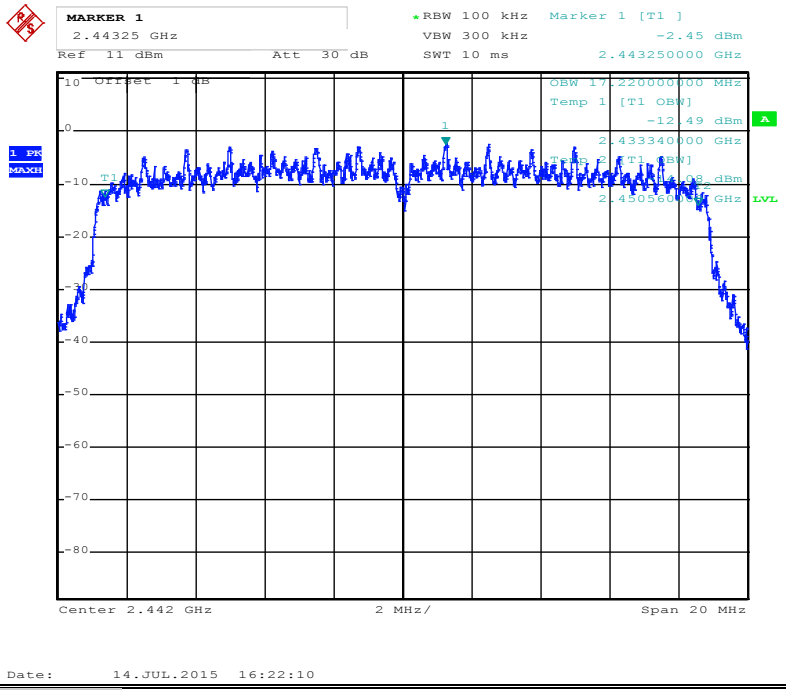


Antenna port:	0
Occupied Bandwidth (99 %):	**17.26 MHz**

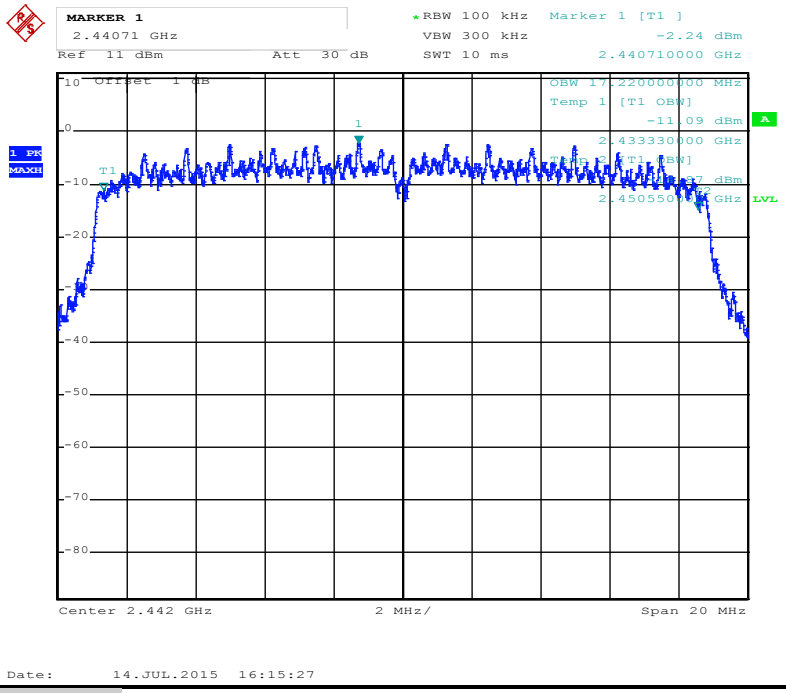


Antenna port:	1
Occupied Bandwidth (99 %):	**17.25 MHz**

Occupied Bandwidth (99 % - 11n 130 Mbps, middle channel):

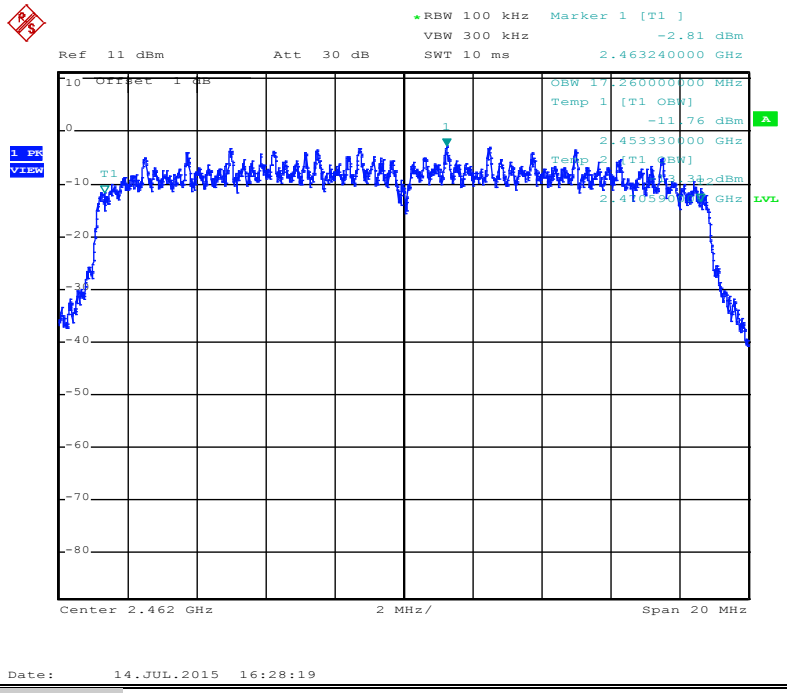


Antenna port:	0
Occupied Bandwidth (99 %):	**17.22 MHz**

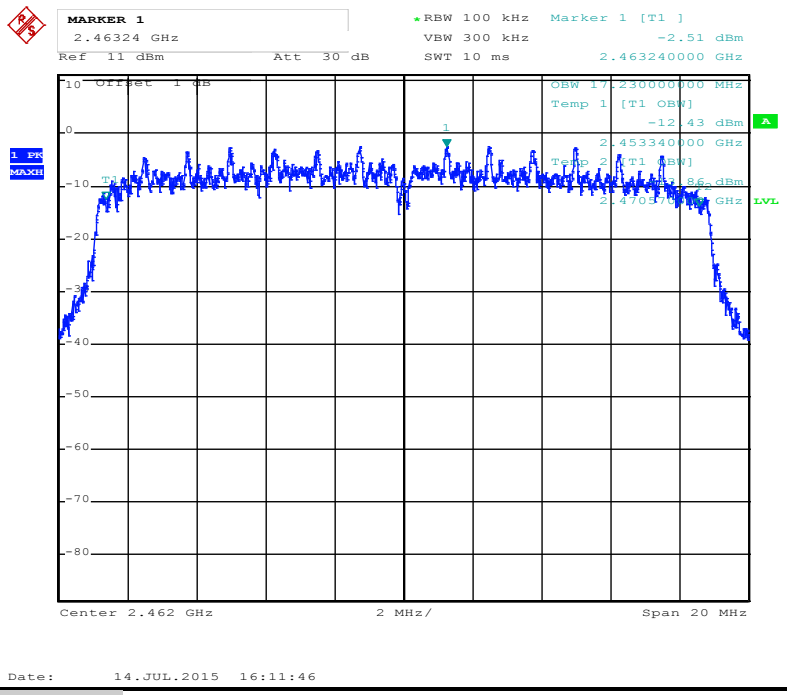


Antenna port:	1
Occupied Bandwidth (99 %):	**17.22 MHz**

Occupied Bandwidth (99 % - 11n 130 Mbps, highest channel):



Antenna port:	0
Occupied Bandwidth (99 %):	**17.26 MHz**



Antenna port:	1
Occupied Bandwidth (99 %):	**17.23 MHz**

8.3 Designation of Emissions

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202
Guide:	ANSI C63.4, ANSI C63.10 / TRC-43

Type of modulation:	Orthogonal Frequency-Division Multiplexing (OFDM)

B_n = Necessary Bandwidth	$B_n = N_S K$
N_S = Frequency spearation:	N_S = 312.5 kHz
K = Overall numerical factor	K = 53
Calculation:	B_n =312.5 kHz · 53 = 16.6 MHz

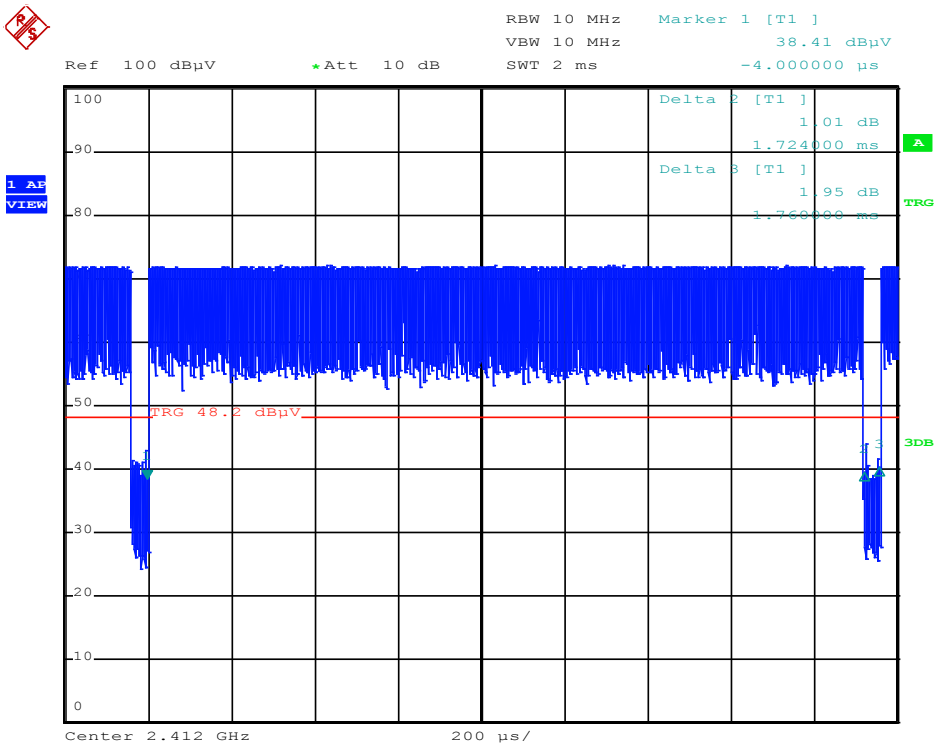
Designation of Emissions:	**16M6W7D**

8.4 Duty cycle Measurement

Rules and specifications:	CFR 47 Part 15, section 15.35(c)
Guide:	ANSI C63.10
Measurement procedure:	KDB 558074 v03r03 (6.0)

Comment:	--
Date of test:	2015-07-14
Test site:	Fully anechoic room, cabin no. 2

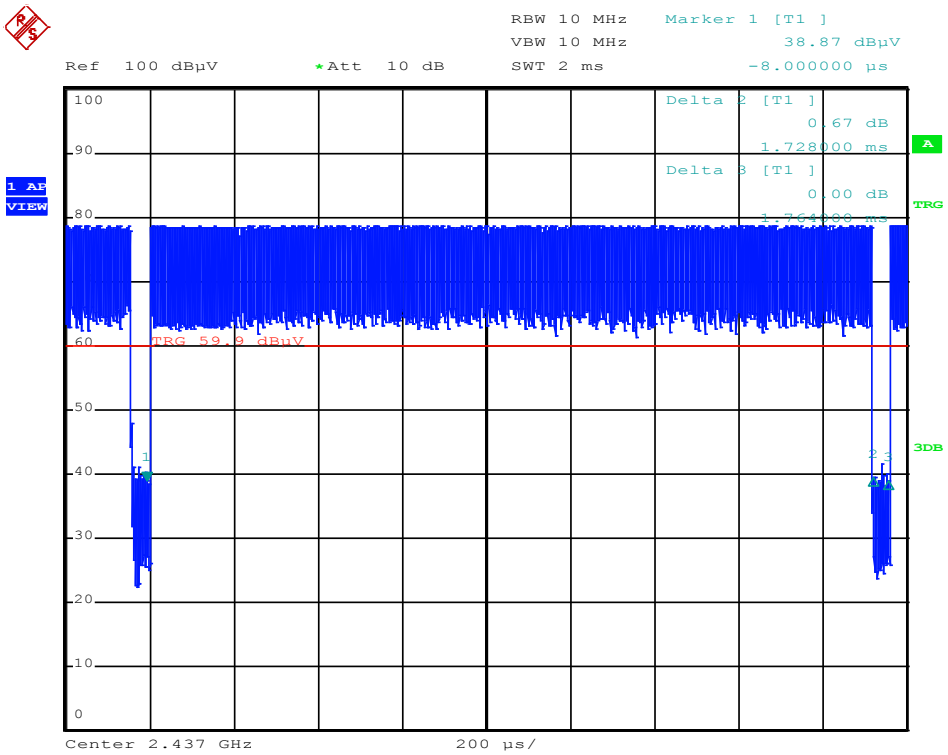
11b 11 Mbps, lowest channel:



Calculation of duty cycle:

Tx-On-Time:	Tx_{on}	=	1.724 ms
Tx-Off-Time:	Tx_{Off}	=	0.036 ms
Tx-Period-Time:	T_{period}	=	1.760 ms
Duty cycle ration:		=	$((Tx_{on} / (Tx_{on+} Tx_{off}))$
		=	**98 %**

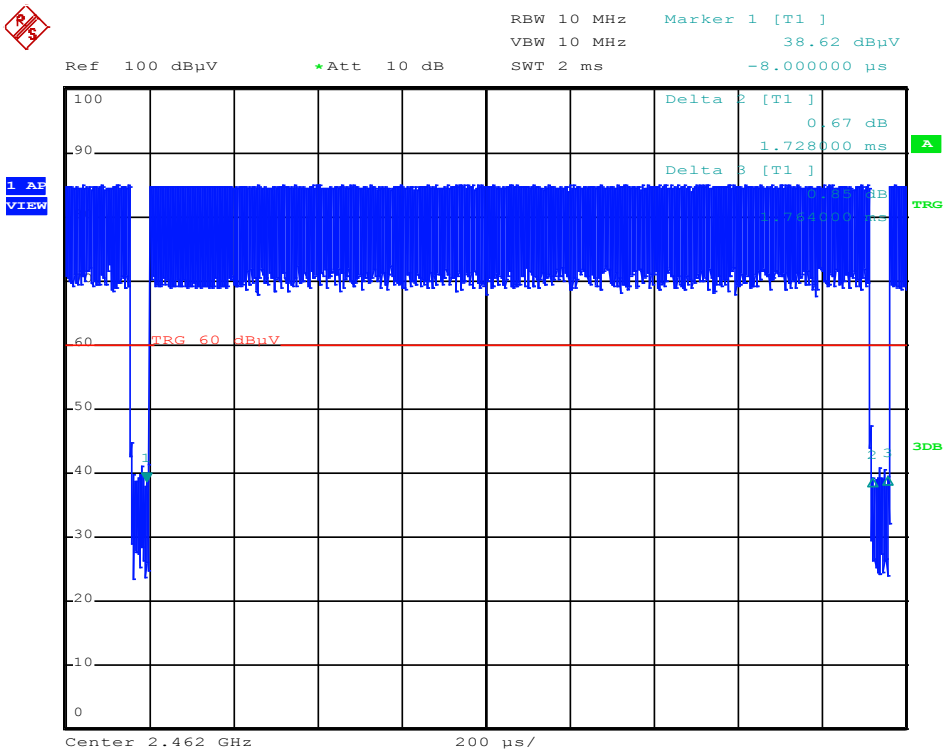
11b 11 Mbps, middle channel:



Calculation of duty cycle:

Tx-On-Time:	Tx_{on}	=	1.728 ms
Tx-Off-Time:	Tx_{Off}	=	0.036 ms
Tx-Period-Time:	T_{period}	=	1.764 ms
Duty cycle ration:		=	$((Tx_{on} / (Tx_{on+} Tx_{off}))$
		=	**98 %**

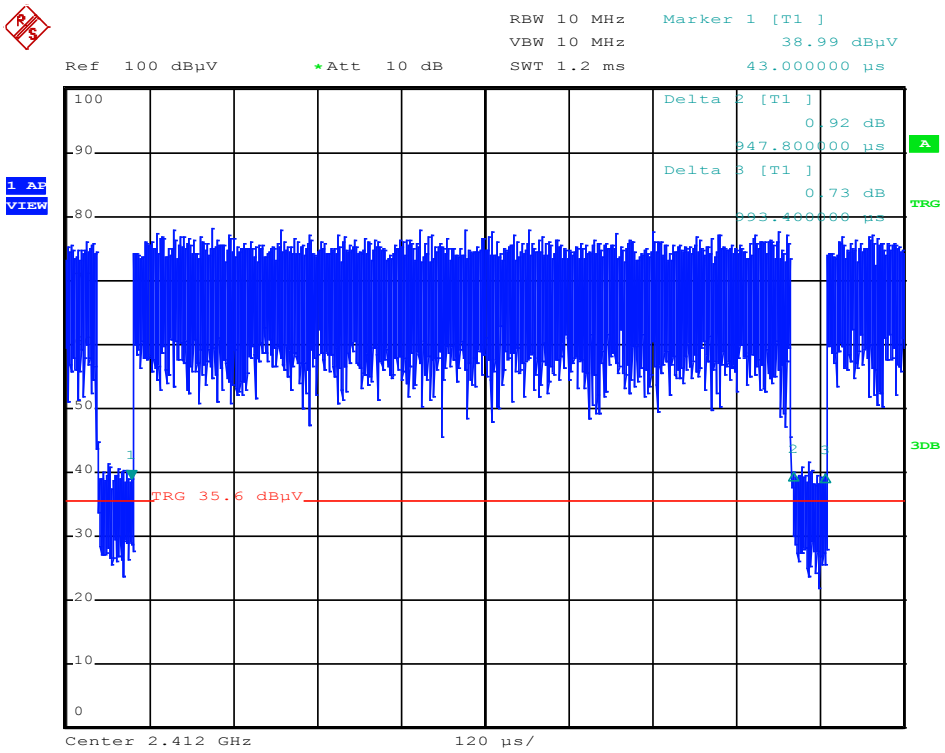
11b 11 Mbps, highest channel:



Calculation of duty cycle:

Tx-On-Time:	Tx_{on}	=	1.728 ms
Tx-Off-Time:	Tx_{Off}	=	0.036 ms
Tx-Period-Time:	T_{period}	=	1.764 ms
Duty cycle ration:		=	$((Tx_{on} / (Tx_{on+} Tx_{off}))$
		=	**98 %**

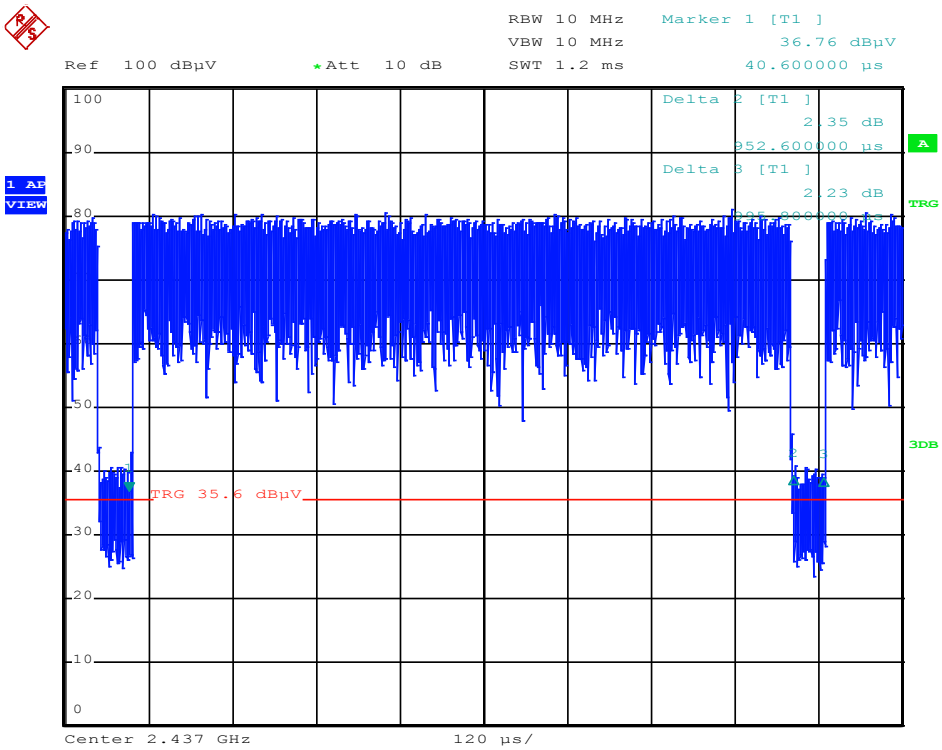
11g 54 Mbps, lowest channel:



Calculation of duty cycle:

Tx-On-Time:	Tx_{on}	=	947.8 µs
Tx-Off-Time:	Tx_{Off}	=	45.6 µs
Tx-Period-Time:	T_{period}	=	993.4 µs
Duty cycle ration:		=	$((Tx_{on} / (Tx_{on+} Tx_{off}))$
		=	**95 %**

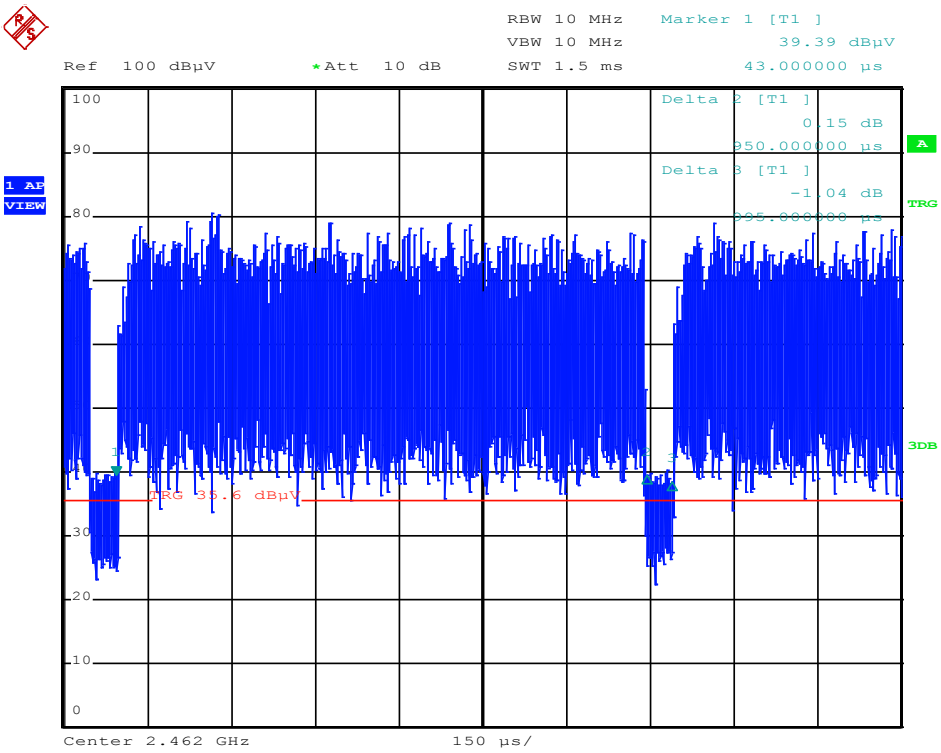
11g 54 Mbps, middle channel:



Calculation of duty cycle:

Tx-On-Time:	Tx_{on}	=	952.6 µs
Tx-Off-Time:	Tx_{Off}	=	43.2 µs
Tx-Period-Time:	T_{period}	=	995.8 µs
Duty cycle ration:		=	$((Tx_{on} / (Tx_{on+} Tx_{off}))$
		=	**96 %**

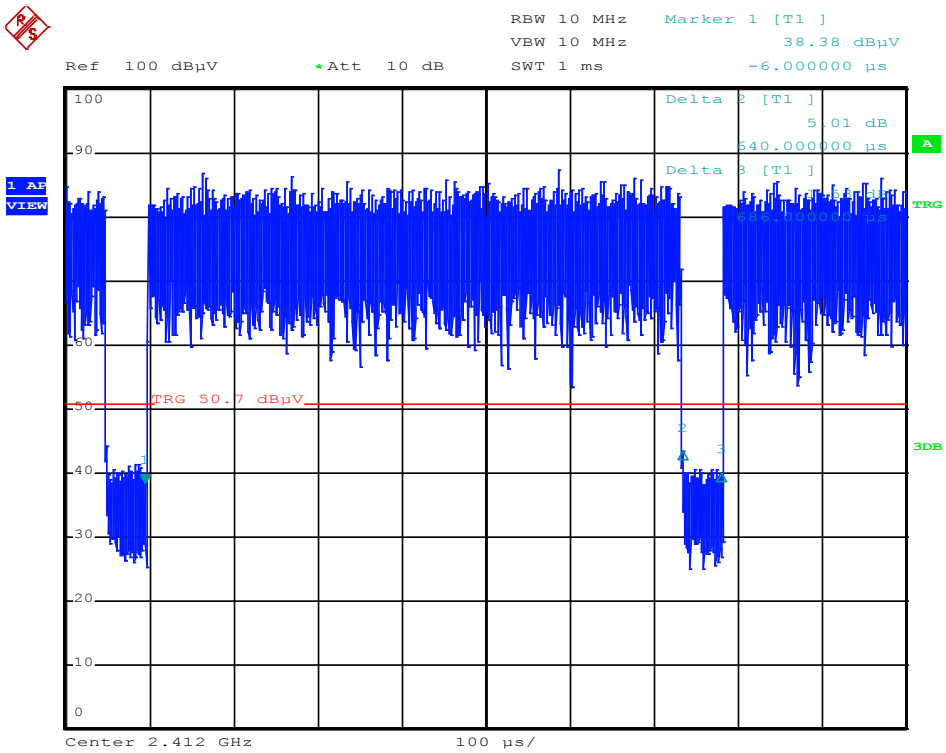
11g 54 Mbps, highest channel:



Calculation of duty cycle:

Tx-On-Time:	Tx_{on}	=	950.0 µs
Tx-Off-Time:	Tx_{Off}	=	45.0 µs
Tx-Period-Time:	T_{period}	=	995.0 µs
Duty cycle ration:		=	$((Tx_{on} / (Tx_{on+} Tx_{off}))$
		=	**96 %**

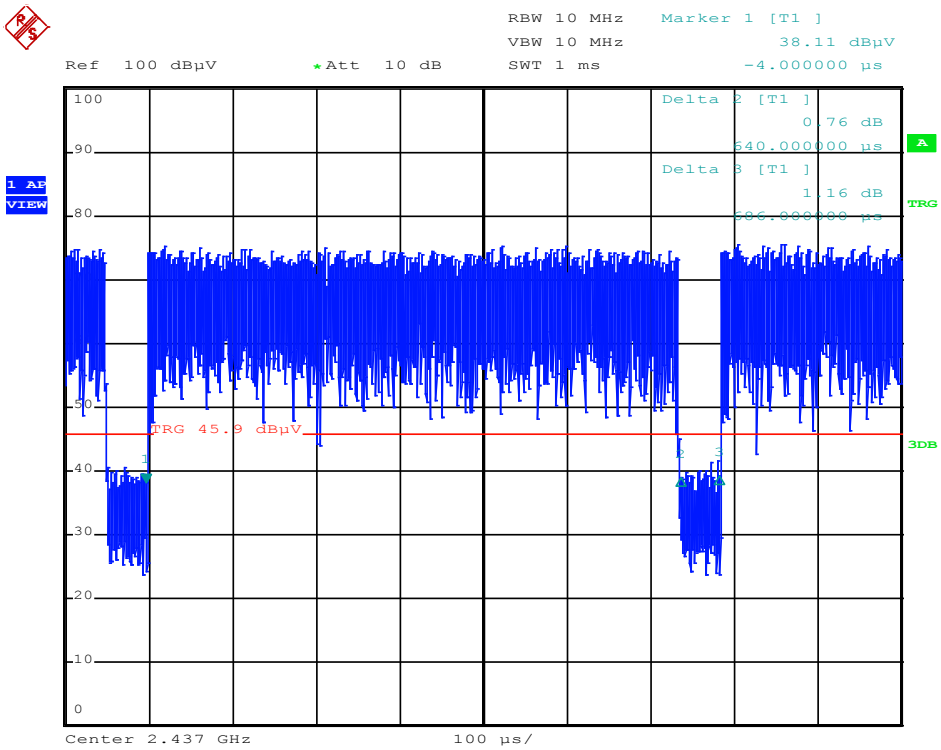
11n 130 Mbps, lowest channel:



Calculation of duty cycle:

Tx-On-Time:	Tx_{on}	=	640.0 µs
Tx-Off-Time:	Tx_{Off}	=	46.0 µs
Tx-Period-Time:	T_{period}	=	686.0 µs
Duty cycle ration:		=	$((Tx_{on} / (Tx_{on+} Tx_{off}))$
		=	**93 %**

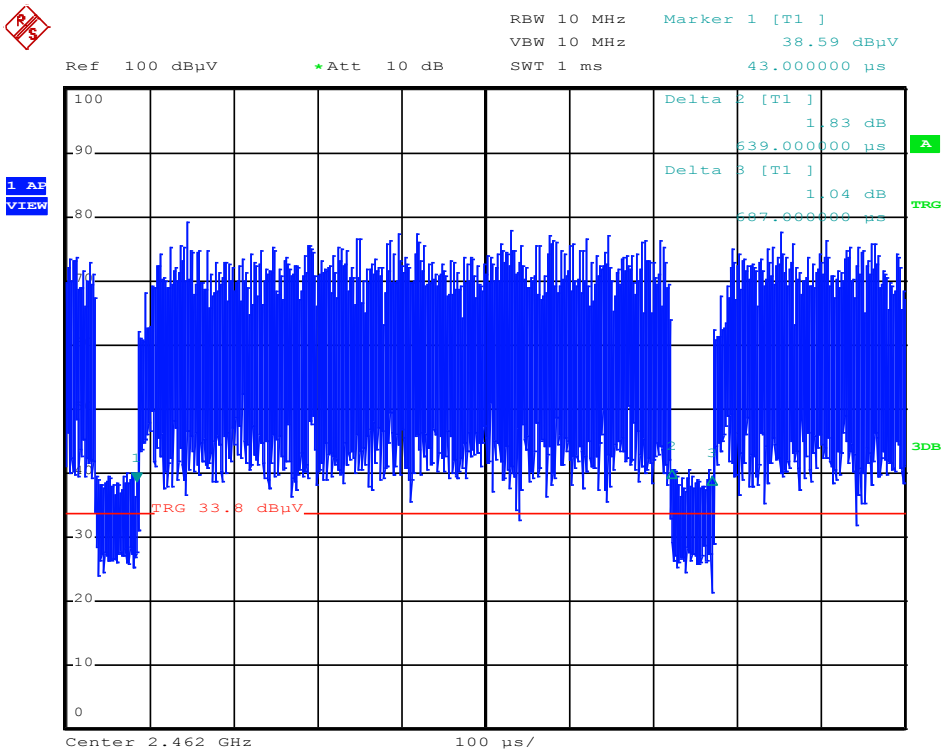
11n 130 Mbps, middle channel:



Calculation of duty cycle:

Tx-On-Time:	Tx_{on}	=	640.0 µs
Tx-Off-Time:	Tx_{Off}	=	46.0 µs
Tx-Period-Time:	T_{period}	=	686.0 µs
Duty cycle ration:		=	$((Tx_{on} / (Tx_{on+} Tx_{off}))$
		=	**93 %**

11n 130 Mbps, highest channel:



Calculation of duty cycle:

Tx-On-Time:	Tx_{on}	=	639.0 µs
Tx-Off-Time:	Tx_{Off}	=	46.0 µs
Tx-Period-Time:	T_{period}	=	687.0 µs
Duty cycle ration:		=	$((Tx_{on} / (Tx_{on+} Tx_{off}))$
		=	**93 %**

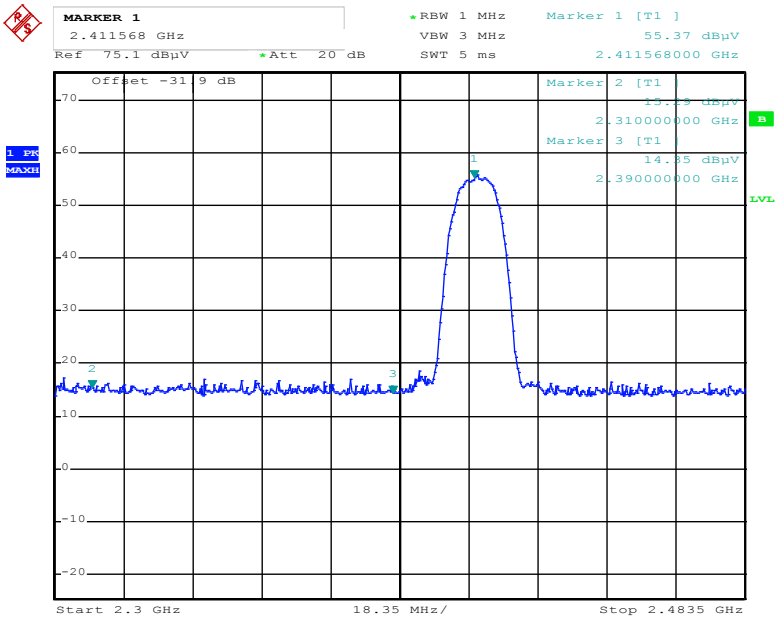
8.5 Restricted Bands of Operation

Rules and specifications:	CFR 47 Part 15, sections 15.205(a) and 15.247(d)
Guide:	ANSI C63.4, ANSI C63.10
Limit:	Only spurious emissions are permitted in any of the frequency bands listed in CFR 47 Part 15, section 15.205(a). In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits specified in CFR 47 Part 15, section 15.209(a).
Measurement procedure:	Restricted bands of operation (6.9)

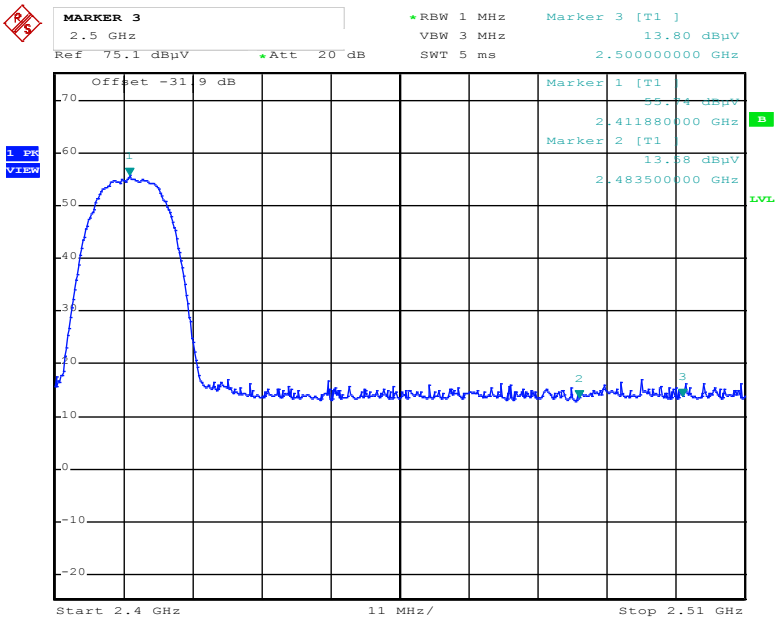
Comment:	The restricted bands were tested radiated with both antennas operation at same time. The test was performed as radiated emission measurement.
Date of test:	2015-07-14
Test site:	Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

Restricted bands of operation (11b 11 Mbps, lowest channel):

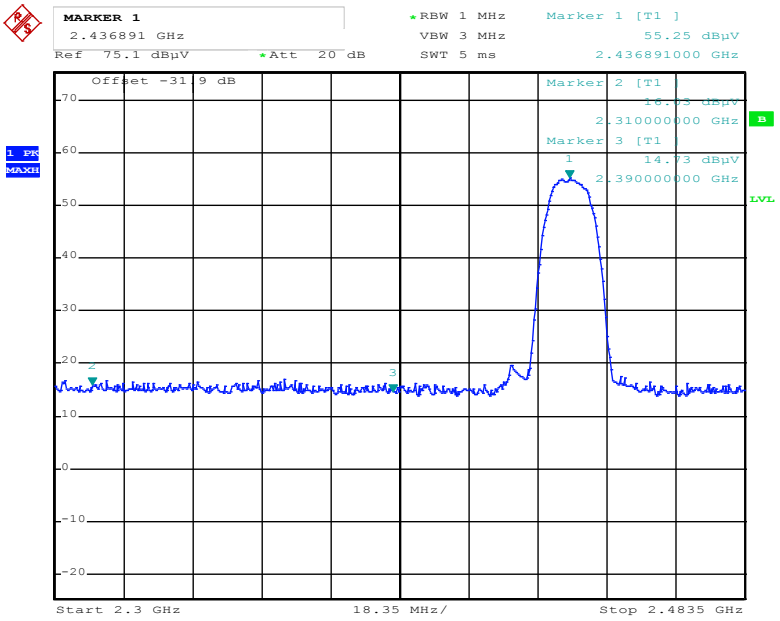


Date: 14.JUL.2015 13:36:39

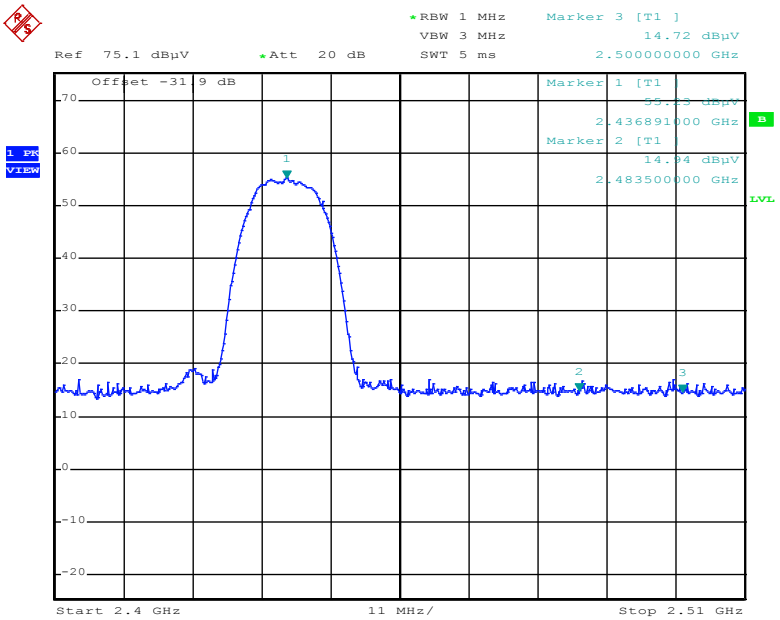


Date: 14.JUL.2015 13:37:14

Restricted bands of operation (11b 11 Mbps, middle channel):



Date: 14.JUL.2015 13:43:46



Date: 14.JUL.2015 13:44:42

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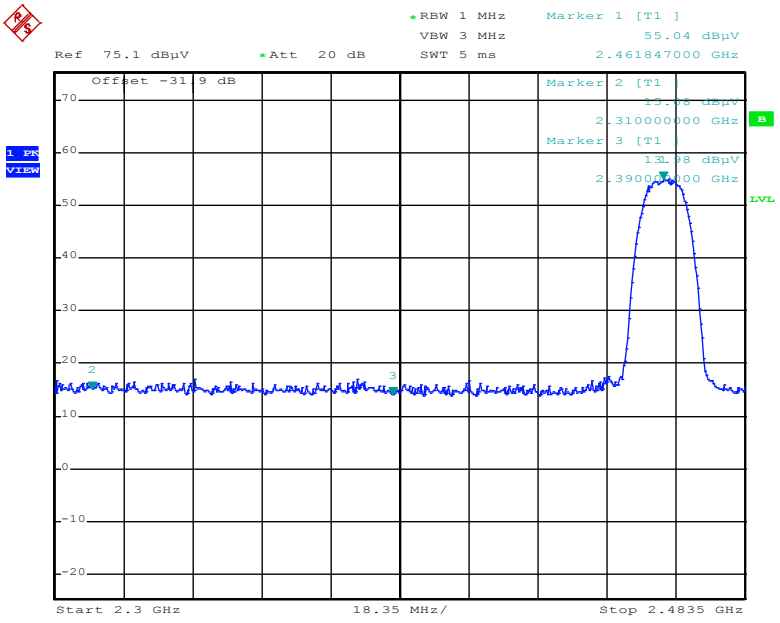
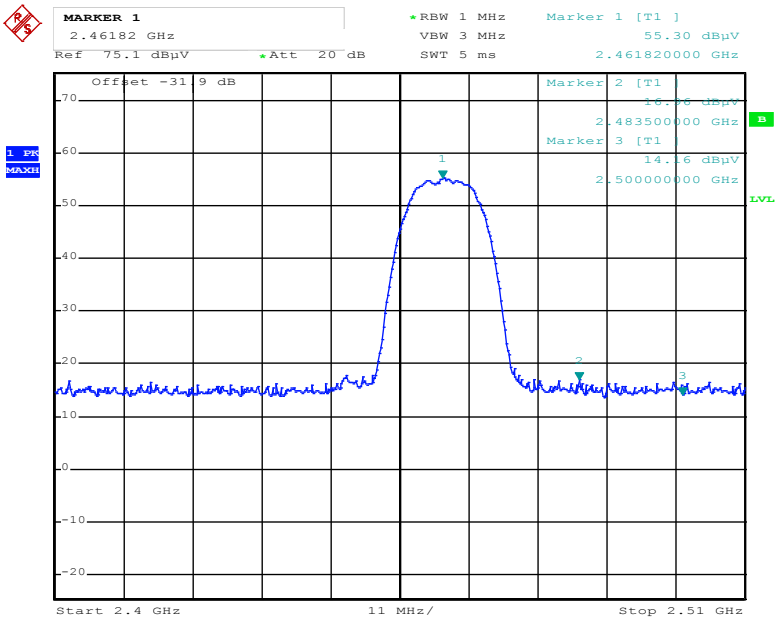
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

Restricted bands of operation (11b 11 Mbps, highest channel):

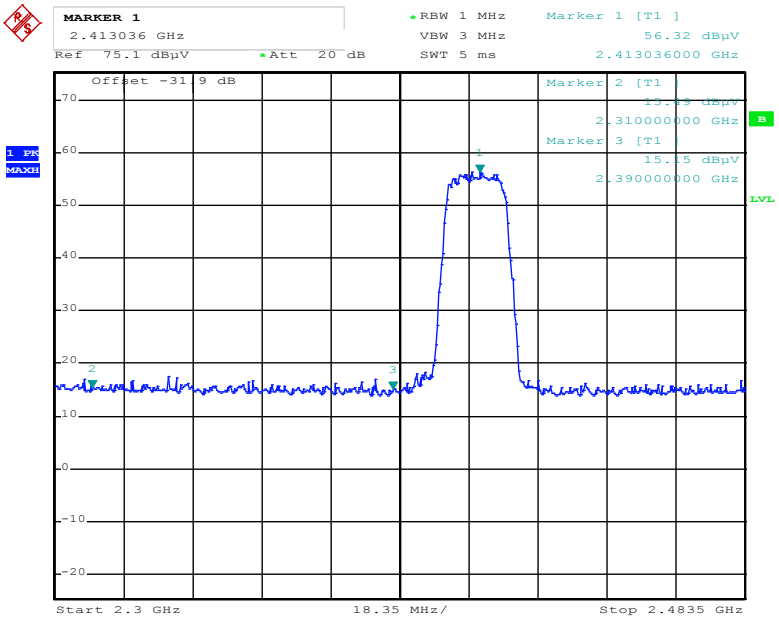


Date: 14.JUL.2015 13:36:05

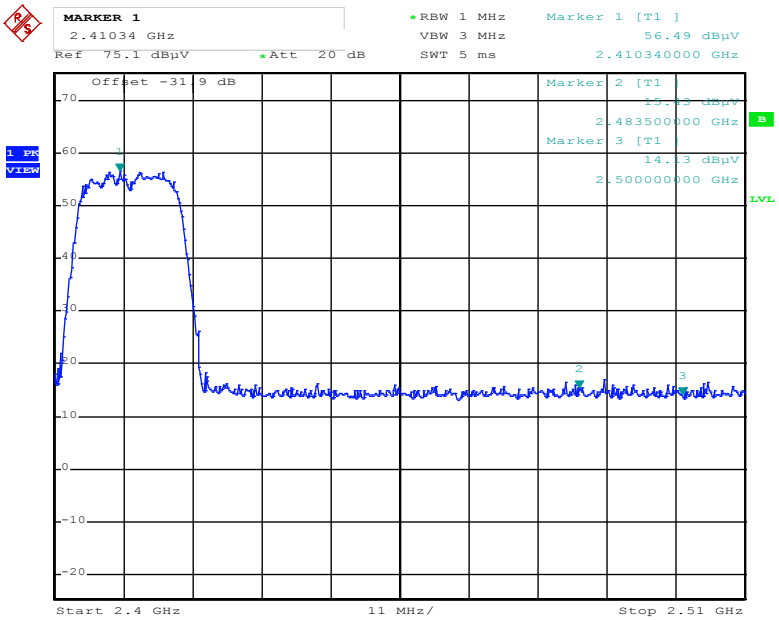


Date: 14.JUL.2015 13:35:34

Restricted bands of operation (11g 54 Mbps, lowest channel):

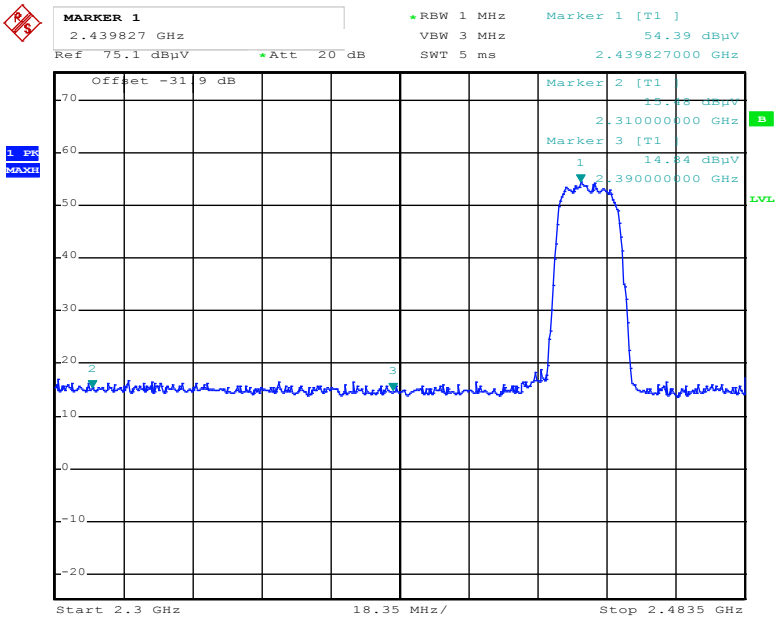


Date: 14.JUL.2015 14:16:17

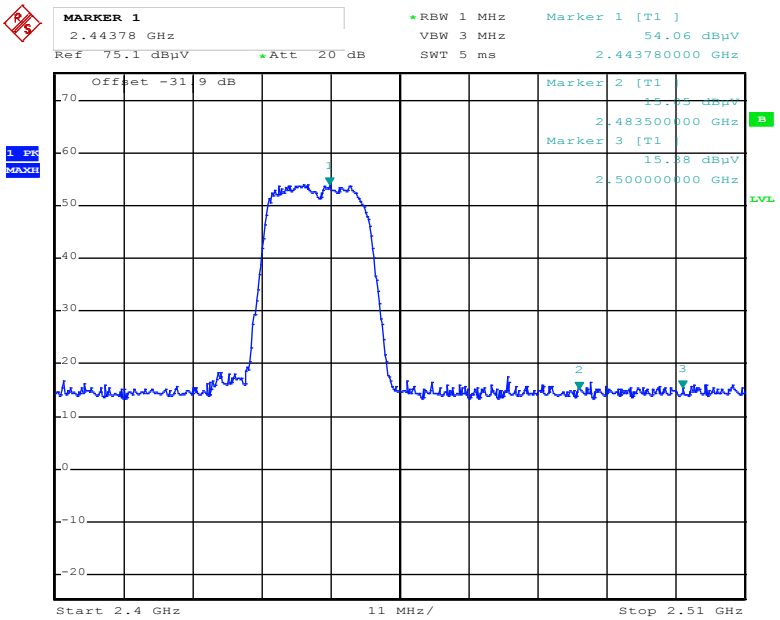


Date: 14.JUL.2015 14:11:09

Restricted bands of operation (11g 54 Mbps, middle channel):



Date: 14.JUL.2015 14:05:20



Date: 14.JUL.2015 14:04:43

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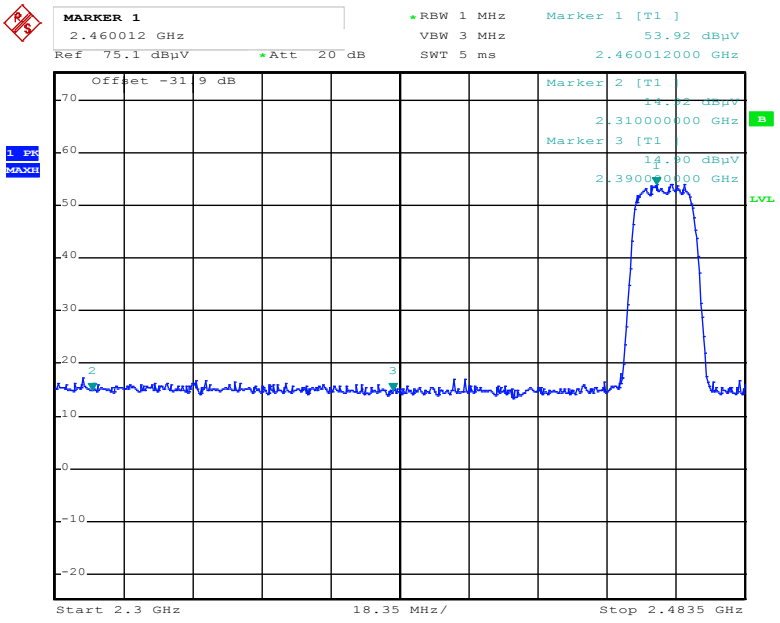
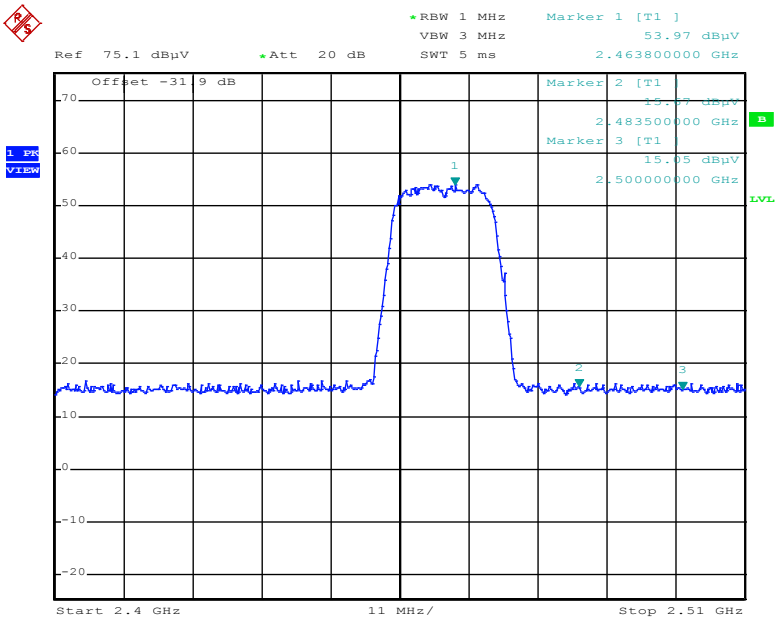
Restricted bands of operation (11g 54 Mbps, highest channel):

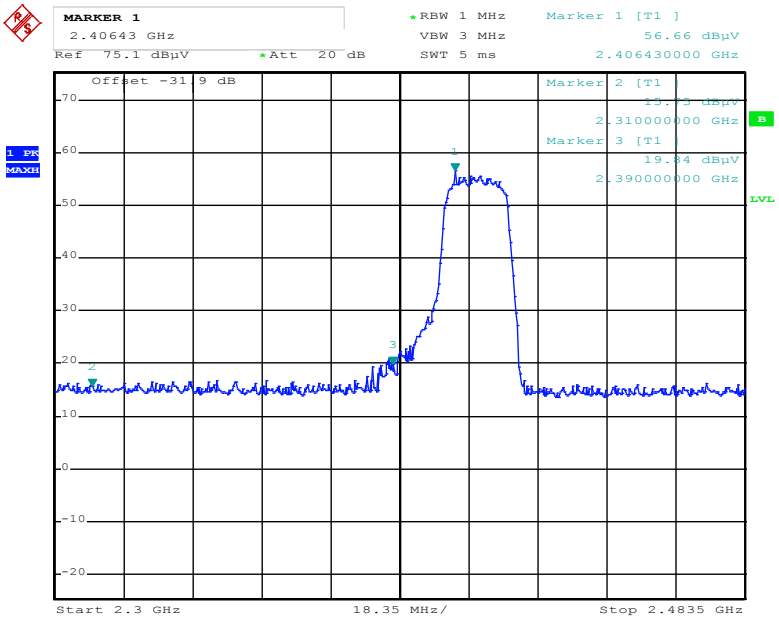


Date: 14.JUL.2015 13:57:29

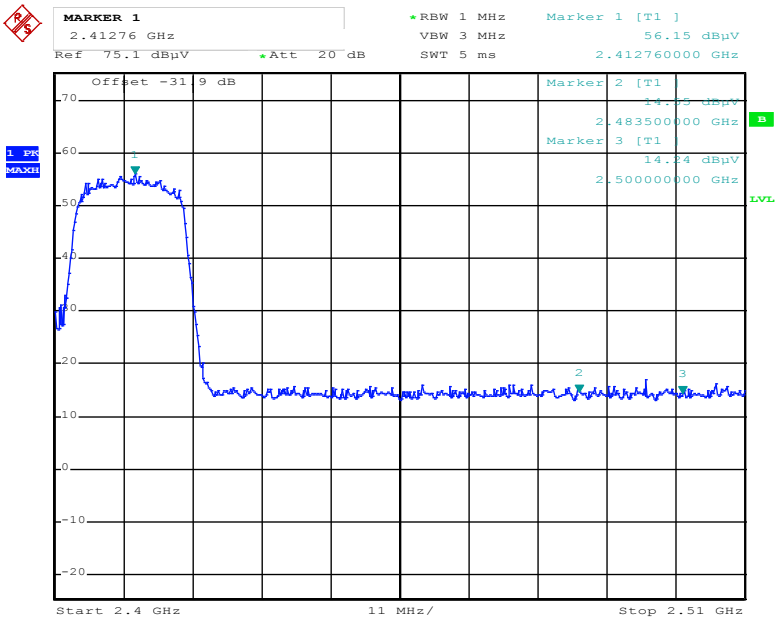


Date: 14.JUL.2015 13:58:27

Restricted bands of operation (11n 130 Mbps, lowest channel):

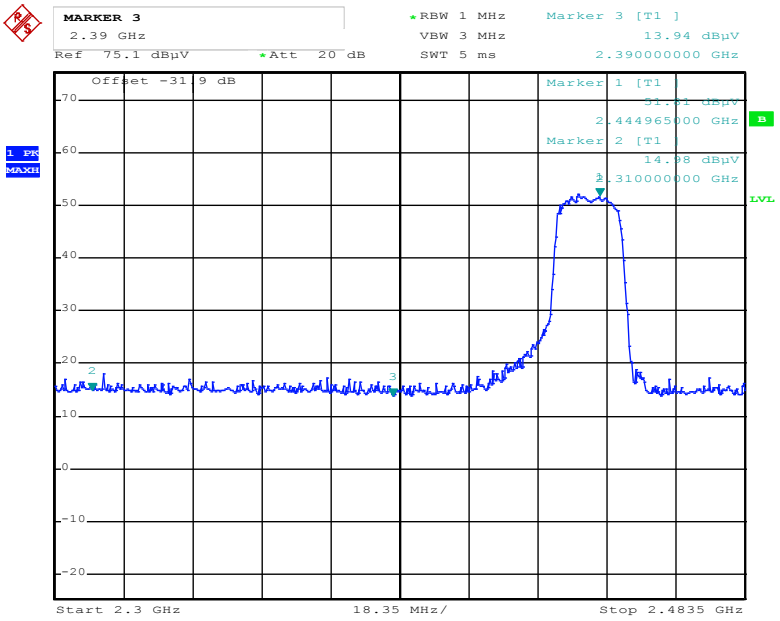


Date: 14.JUL.2015 14:48:50

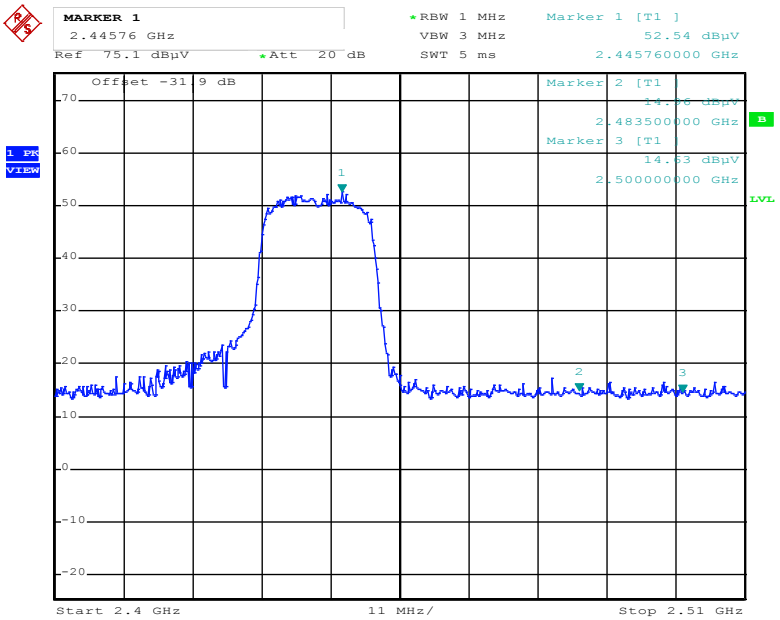


Date: 14.JUL.2015 14:48:24

Restricted bands of operation (11n 130 Mbps, middle channel):

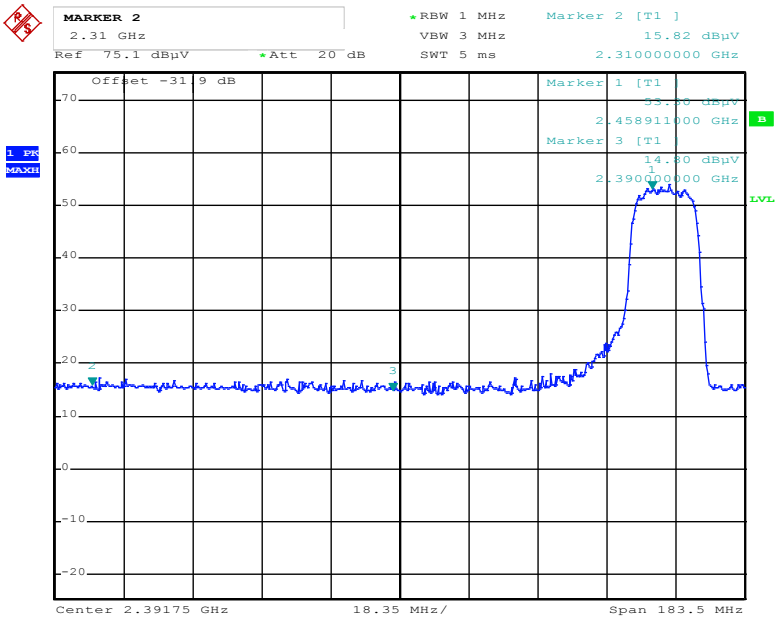


Date: 14.JUL.2015 14:30:51

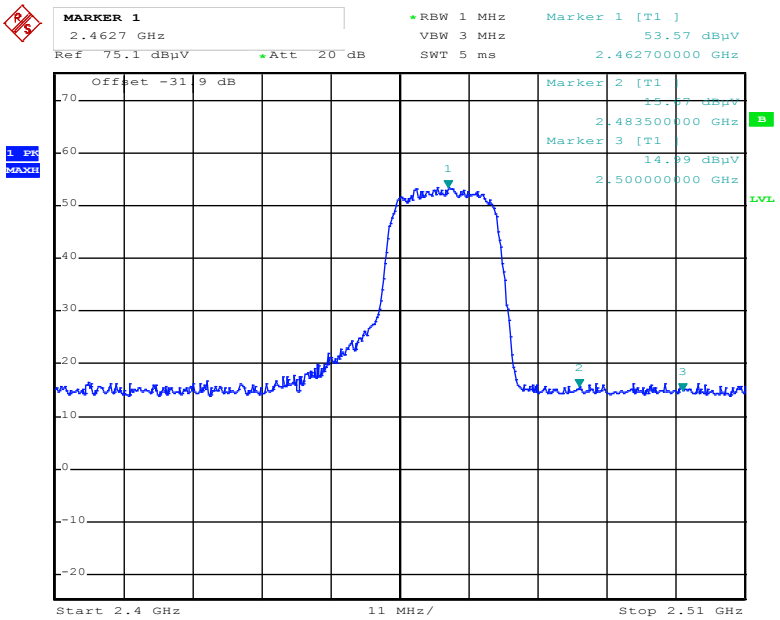


Date: 14.JUL.2015 14:31:29

Restricted bands of operation (11n 130 Mbps, highest channel):



Date: 14.JUL.2015 14:47:13



Date: 14.JUL.2015 14:47:52

8.6 Spectral Power Density

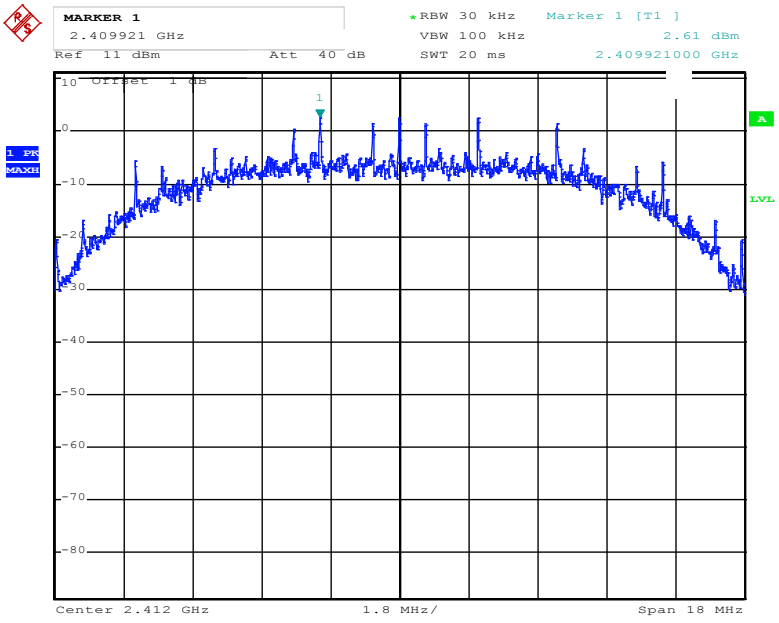
Rules and specifications:	CFR 47 Part 15, section 15.247(e)
Guide:	ANSI C63.4, ANSI C63.10
Limit:	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
Measurement procedure:	Spectral Power Density (8.6)

Comment:	The test was performed with peak measurement (PKPSD method)
Cable attenuation:	1 dB
Date of test:	2015-05-29
Test site:	Shielded room, cabin no. 7

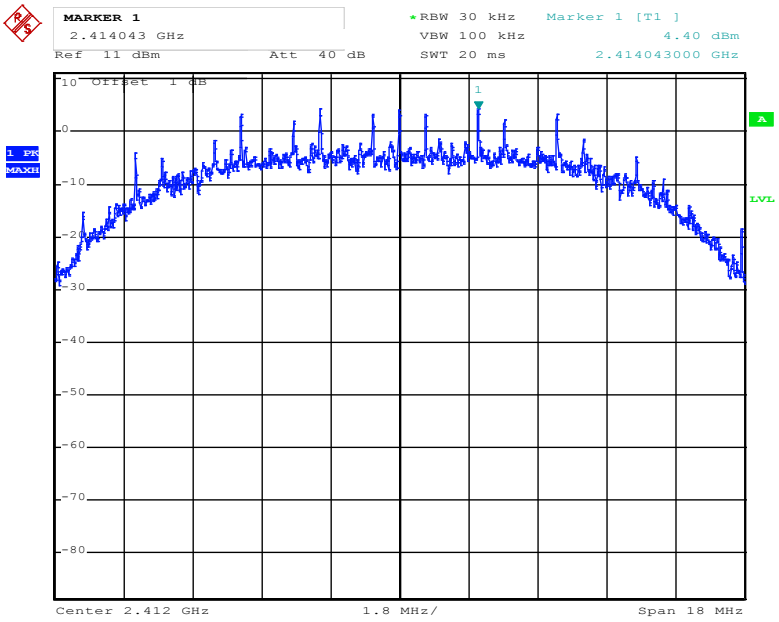
Mode	*Frequency*	*Spectral Power Density (dBm)*		*Summarized Spectral Power Density*	*Limit*	*Margin*
	(MHz)	*Port 0*	*Port 1*	*(dBm)*	*(dBm)*	*(dB)*
11b 11 Mbps	2412	2.61	4.40	6.6	8.0	1.4
11b 11 Mbps	2437	2.97	3.34	6.2	8.0	1.8
11b 11 Mbps	2462	2.23	4.51	6.5	8.0	1.5
11g 54 Mbps	2412	-6.05	-6.24	-3.1	8.0	11.1
11g 54 Mbps	2437	-7.68	-7.98	-4.8	8.0	12.8
11g 54 Mbps	2462	-8.07	-8.37	-5.2	8.0	13.2
11n 130 Mbps	2412	-7.19	-6.82	-4.0	8.0	12.0
11n 130 Mbps	2437	-6.58	-7.64	-4.1	8.0	12.1
11n 130 Mbps	2462	-7.60	-6.96	-4.3	8.0	12.3

Test Result:	Test passed

Spectral Power Density (11b 11 Mbps, lowest channel):

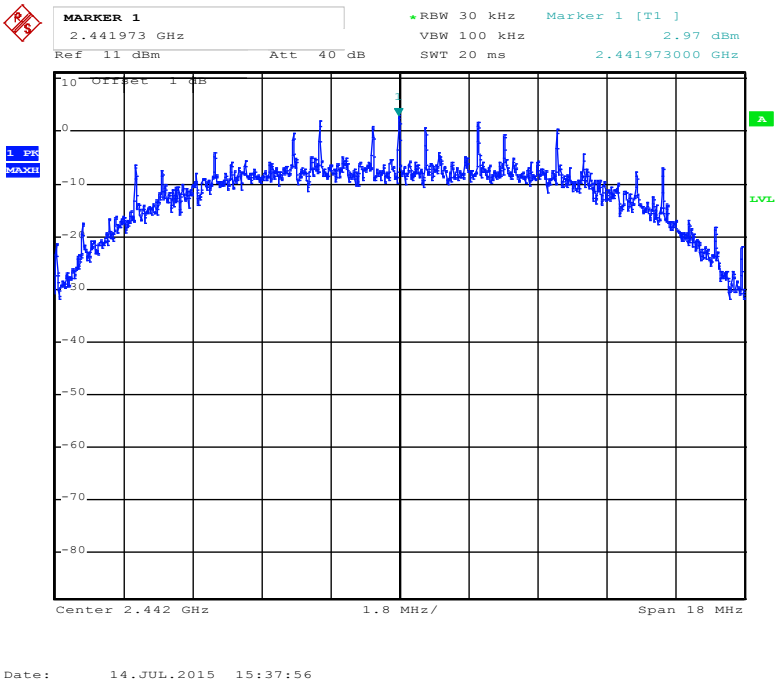


Antenna port 0

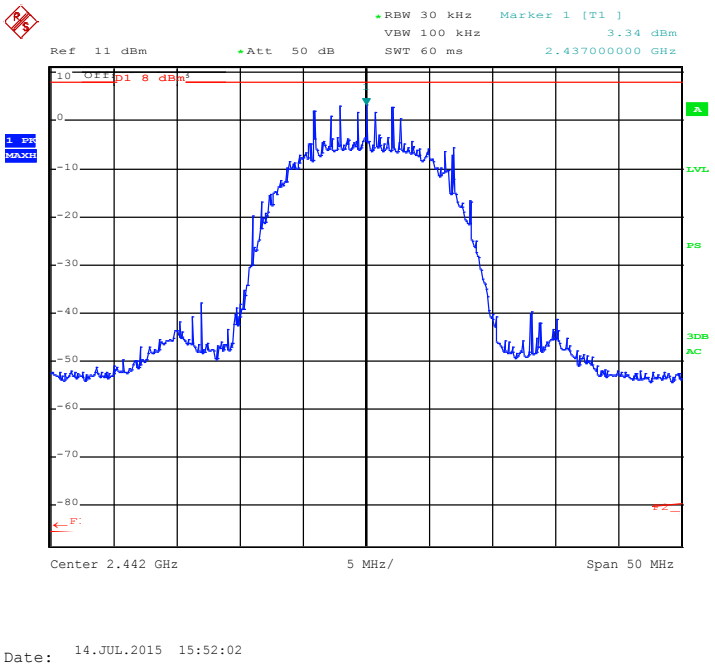


Antenna port 1

Spectral Power Density (11b 11 Mbps, middle channel):

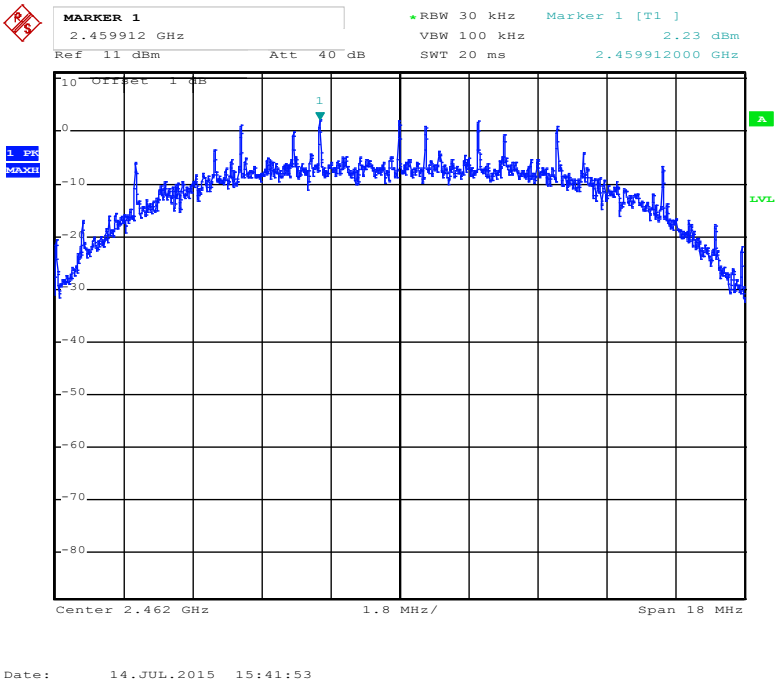


Antenna port 0

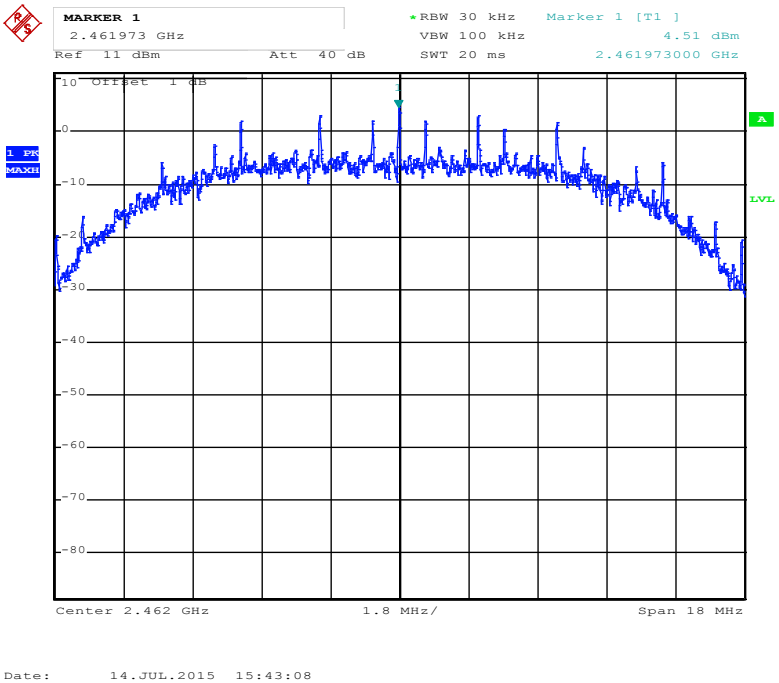


Antenna port 1

Spectral Power Density (11b 11 Mbps, highest channel):

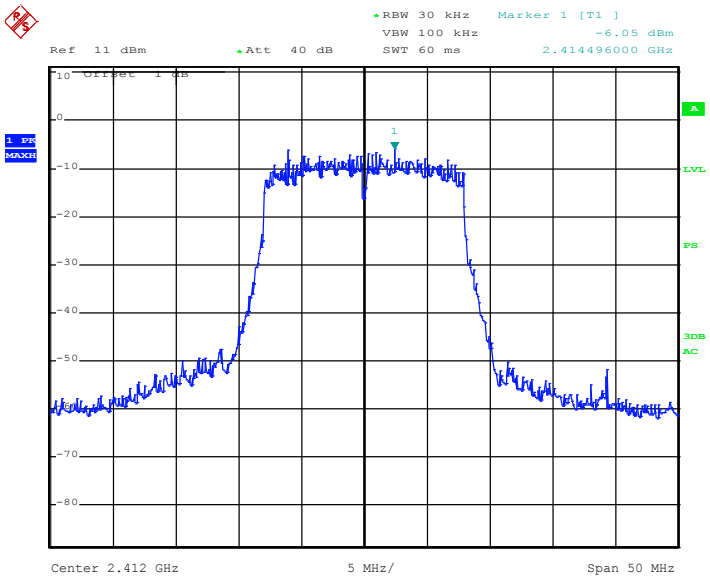


Antenna port 0

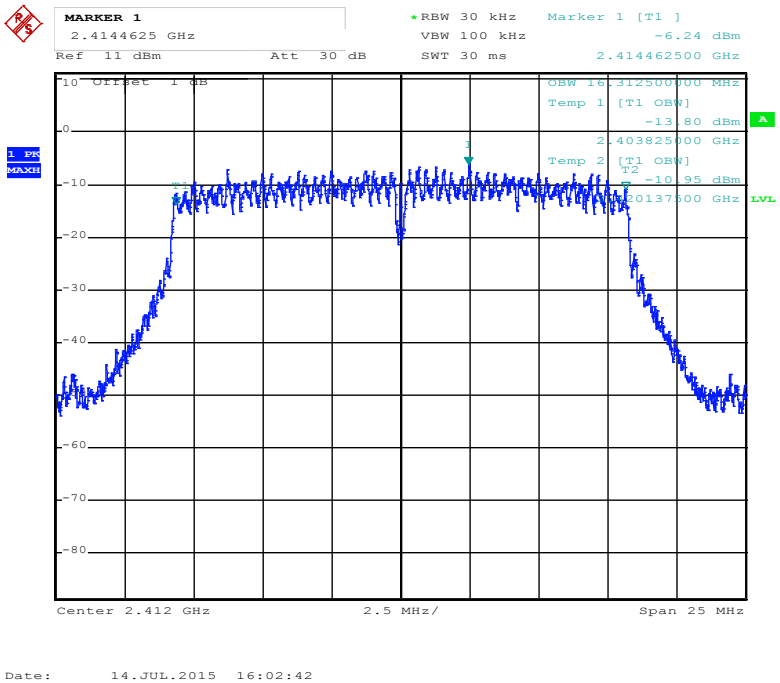


Antenna port 1

Spectral Power Density (11g 54 Mbps, lowest channel):

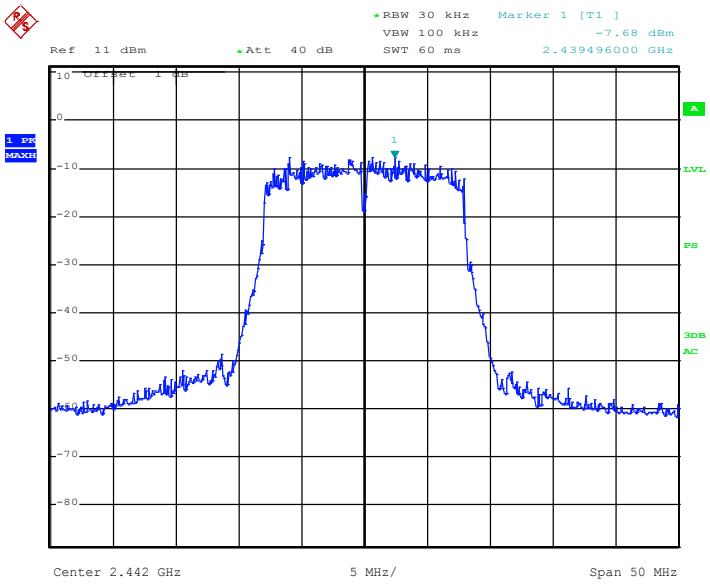


Antenna port 0

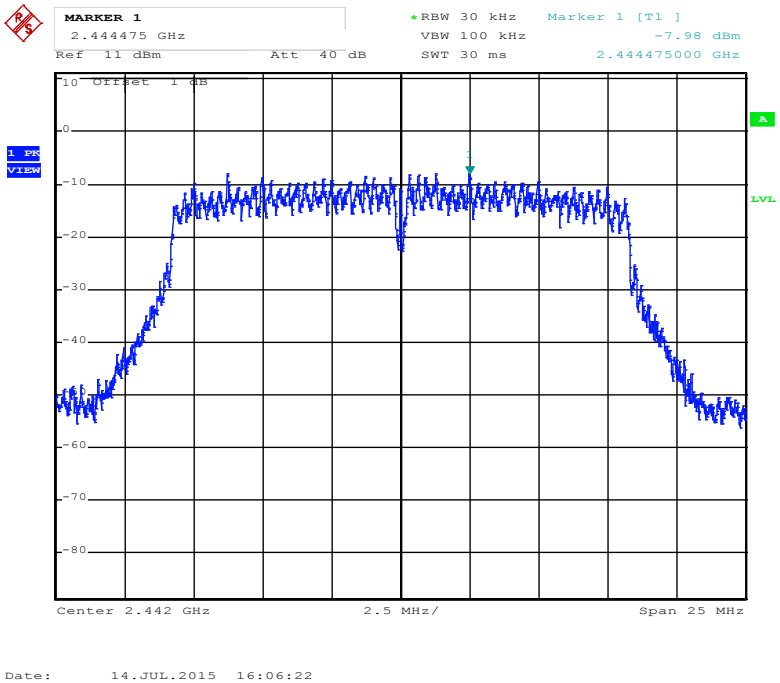


Antenna port 1

Spectral Power Density (11g 54 Mbps, middle channel):

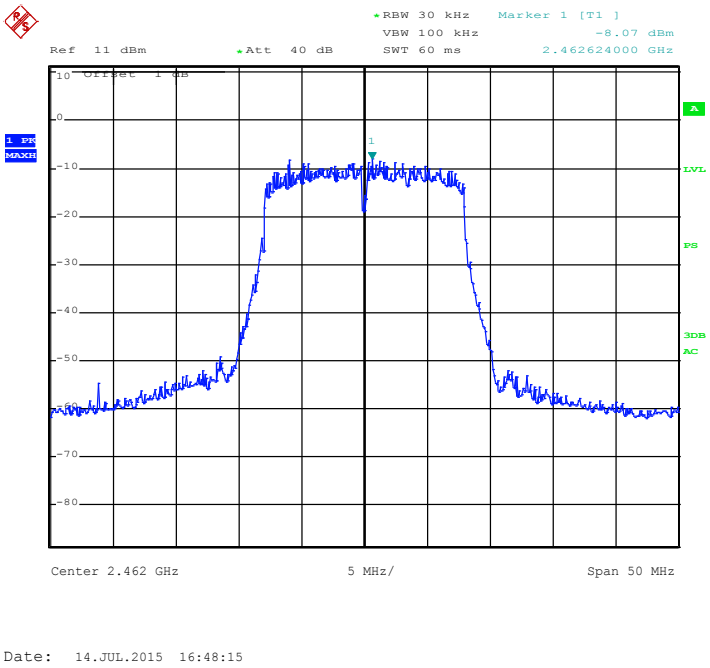


Antenna port 0

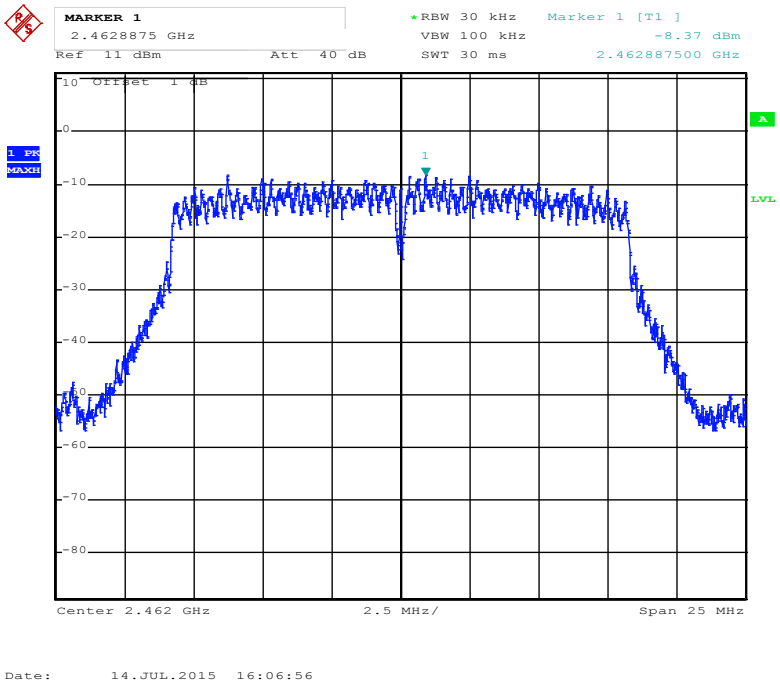


Antenna port 1

Spectral Power Density (11g 54 Mbps, highest channel):

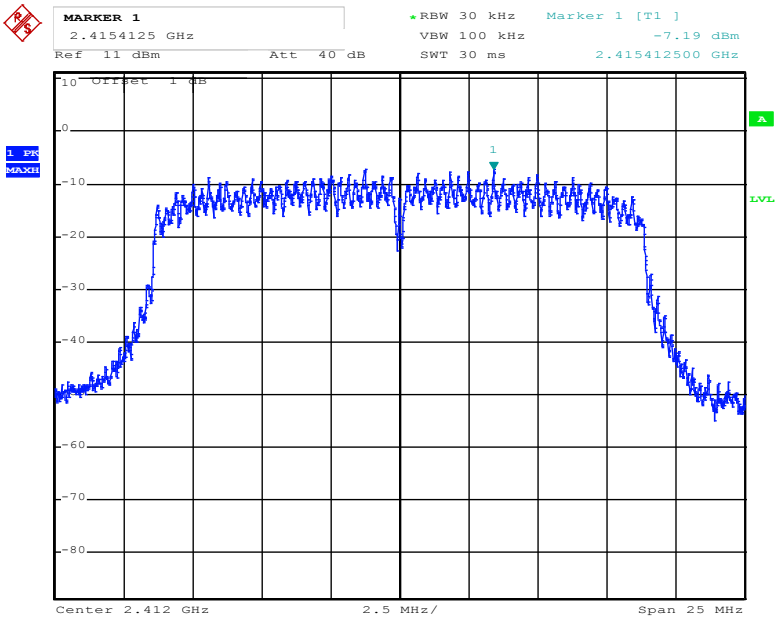


Antenna port 0

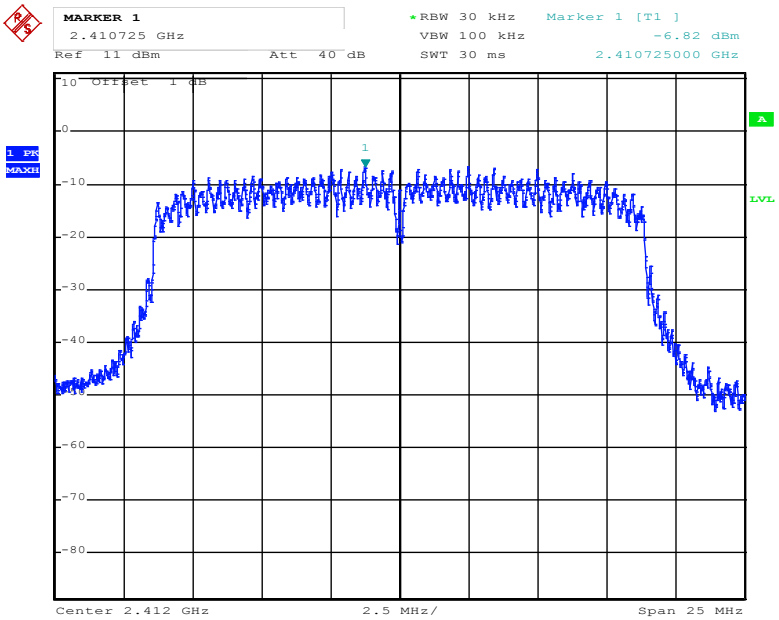


Antenna port 1

Spectral Power Density (11n 130 Mbps, lowest channel):

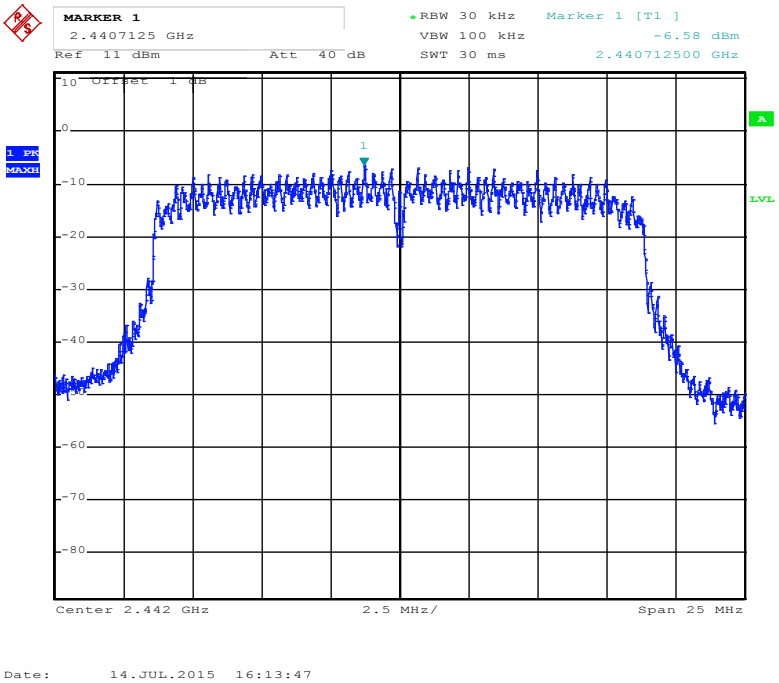


Antenna port 0

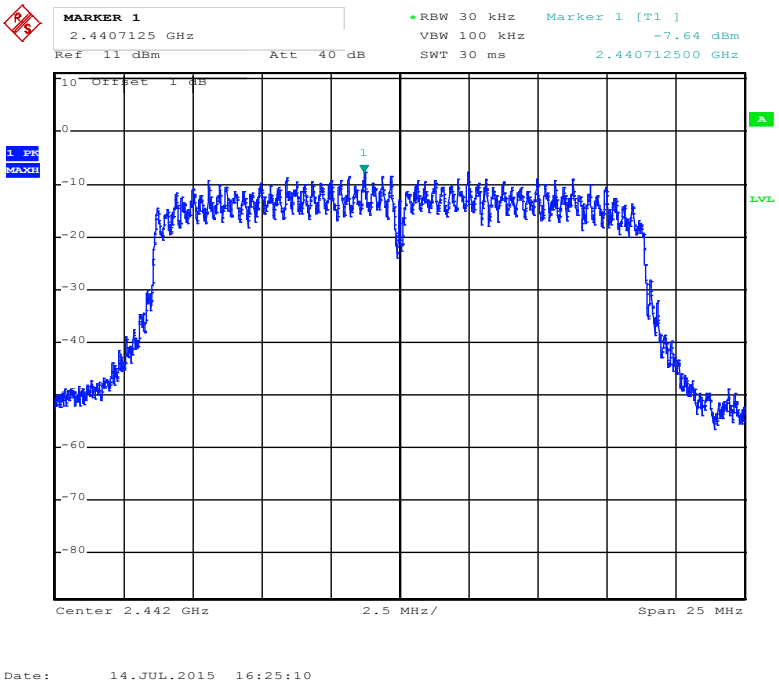


Antenna port 1

Spectral Power Density (11n 130 Mbps, middle channel):

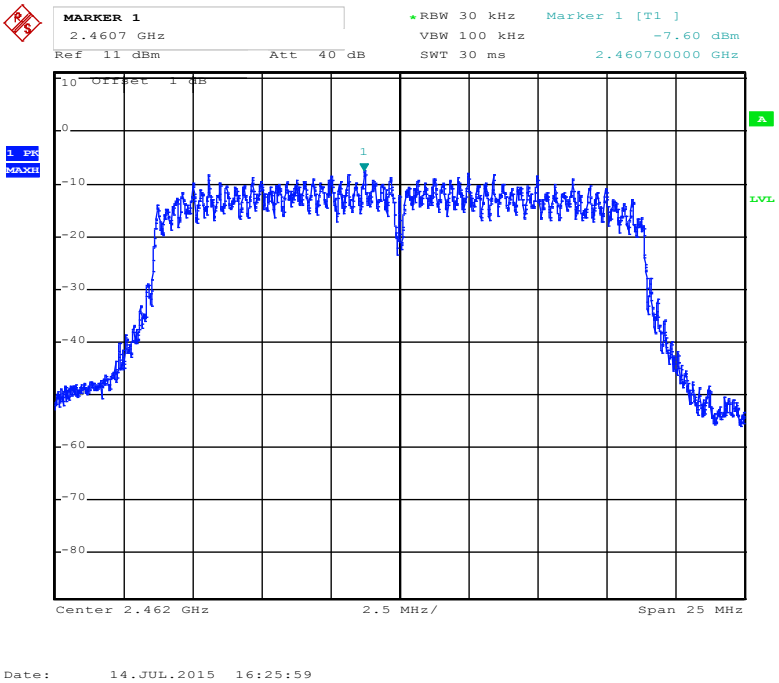


Antenna port 0

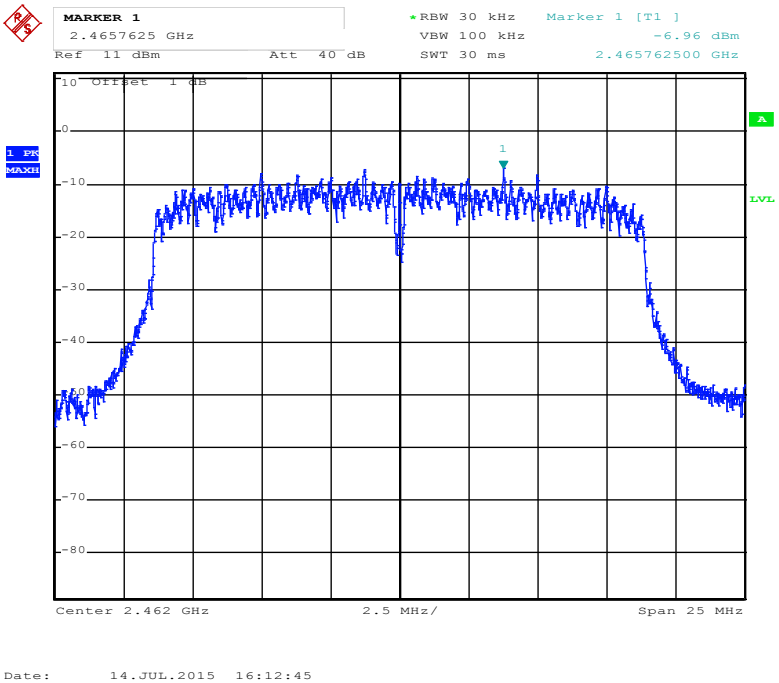


Antenna port 1

Spectral Power Density (11n 130 Mbps, highest channel):



Antenna port 0



Antenna port 1

8.7 Maximum output power

Rules and specifications:	CFR 47 Part 15, section 15.247(b)(2)
Guide:	ANSI C63.4, ANSI C63.10
Limit:	The maximum output power is 1 W (30 dBm) for systems employing digital modulation.
Measurement procedure:	Conducted Output Power (6.1)

Comment:	The test was performed using a broad band peak power sensor.
Cable attenuation:	1 dB
Date of test:	2015-05-29
Test site:	Shielded room No. 7

Mode	*Frequency*	*Conducted output power (PEP) (dBm)*		*Summarized conducted output power (PEP)*	*Limit*	*Margin*
	(MHz)	*Port 0*	*Port 1*	*(dBm)*	*(dBm)*	*(dB)*
11b 11 Mbps	2412	15.1	14.7	17.9	30.0	12.1
11b 11 Mbps	2437	13.9	13.7	16.8	30.0	13.2
11b 11 Mbps	2462	12.9	13.7	16.3	30.0	13.7
11g 54 Mbps	2412	16.2	18.0	20.2	30.0	9.8
11g 54 Mbps	2437	14.8	15.8	18.3	30.0	11.7
11g 54 Mbps	2462	14.8	14.2	17.5	30.0	12.5
11n 130 Mbps	2412	16.8	16.4	19.6	30.0	10.4
11n 130 Mbps	2437	14.8	15.2	18.0	30.0	12.0
11n 130 Mbps	2462	14.4	14.3	17.4	30.0	12.6

Test Result:	Test passed

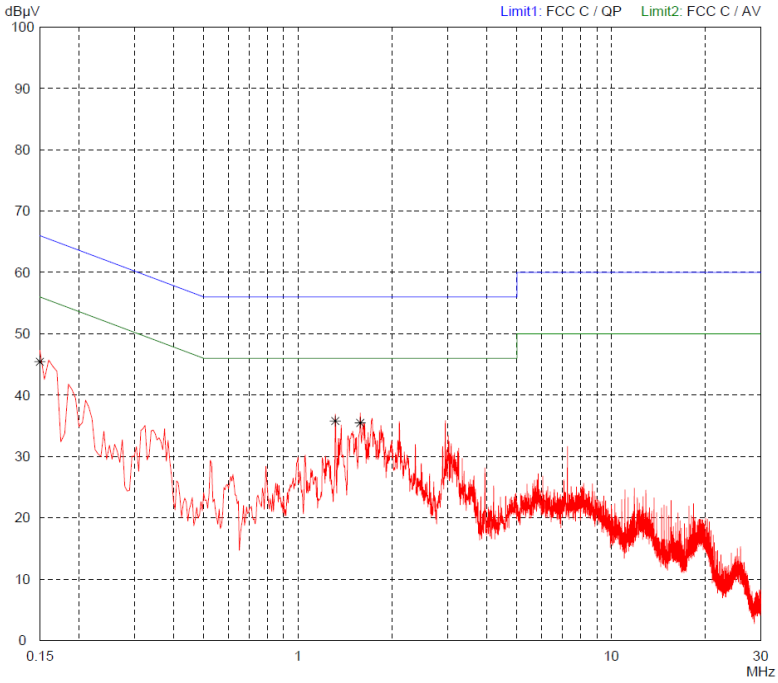
8.8 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, section 15.207		
Guide:	ANSI C63.4, ANSI C63.10 / CISPR 22		
Limit:	Frequency of Emission (MHz)	Conducted Limit (dBµV)	
		Quasi-peak	Average
	0.15 - 0.5	66 to 56	56 to 46
	0.5 - 5	56	46
	5 - 30	60	50
Measurement procedure:	Conducted AC Powerline Emission (6.5)		

Comment:	
Date of test:	2014-11-28
Test site:	Shielded room, cabin no. 4

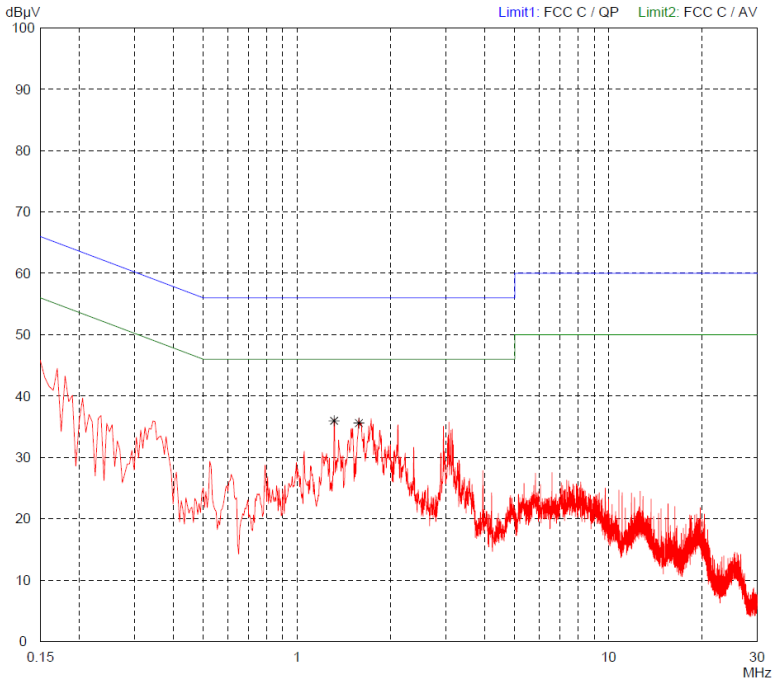
Test Result:	Test passed

Tested on:	L1



Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
0.150	Quasi-Peak	45.4	0.0	45.4	66.0	20.6
1.315	Quasi-Peak	35.8	0.0	35.8	56.0	**20.2**
1.580	Quasi-Peak	35.5	0.0	35.5	56.0	20.5

Tested on:	N



Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
1.315	Quasi-Peak	36.0	0.0	36.0	56.0	**20.0**
1.580	Quasi-Peak	35.6	0.0	35.6	56.0	20.4

Sample calculation of final values:

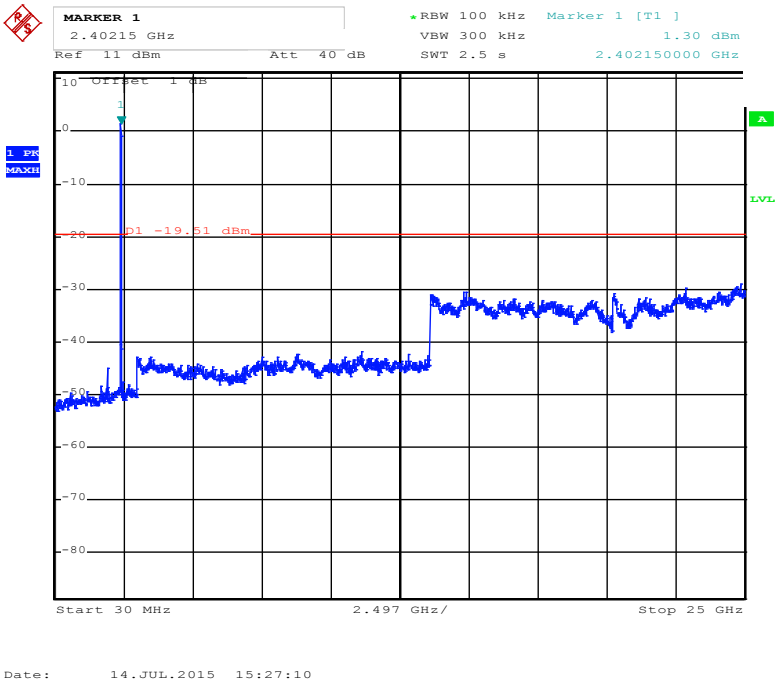
Final Value (dBµV) = Reading Value (dBµV) + Correction Factor (dB)

8.9 Conducted Emission Measurement 30 MHz to 25 GHz

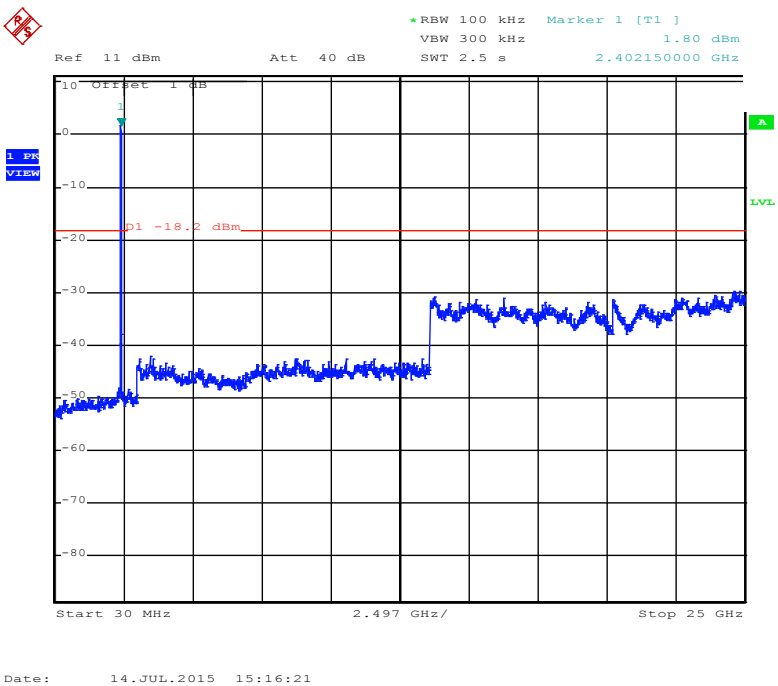
Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.247
Guide:	ANSI C63.4, ANSI C63.10
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limit is not required. In addition, radiated emissions which fall in the restricted bands must also comply with the general radiated emission limits.
Measurement procedures:	Conducted Output Power (6.1)
Date of test:	2015-07-14
Comment:	Test was performed with mode 802.11g with 54 Mbps with showed maximum -6 dBc bandwidth

Test Result:	Test passed

Spectral Power Density (lowest channel):

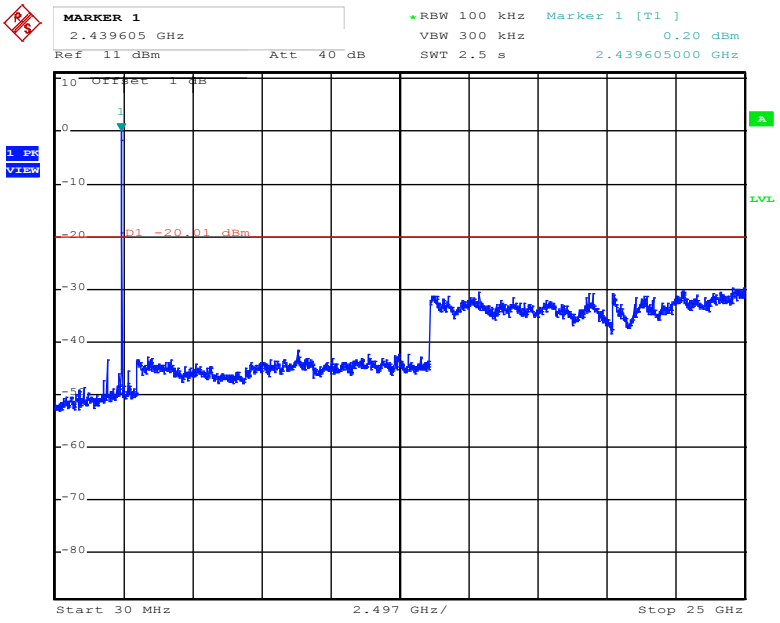


Antenna port 0

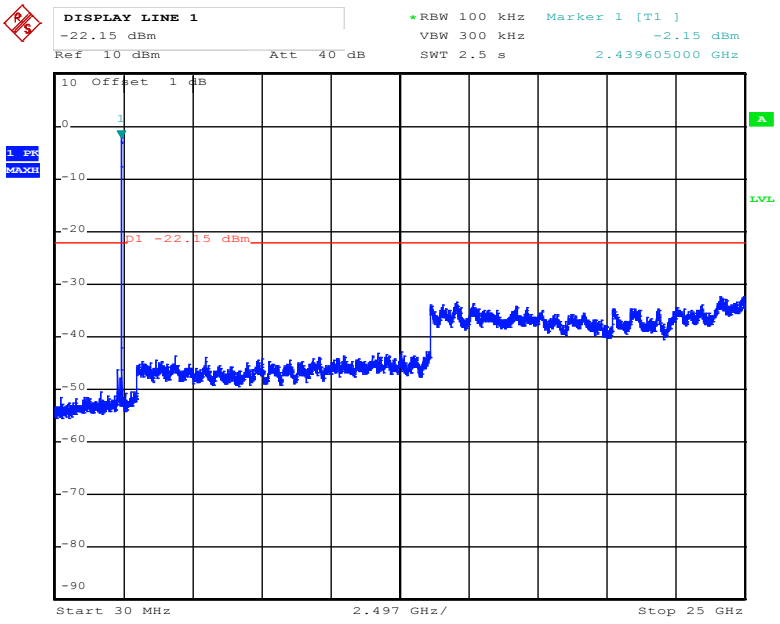


Antenna port 1

Spectral Power Density (middle channel):

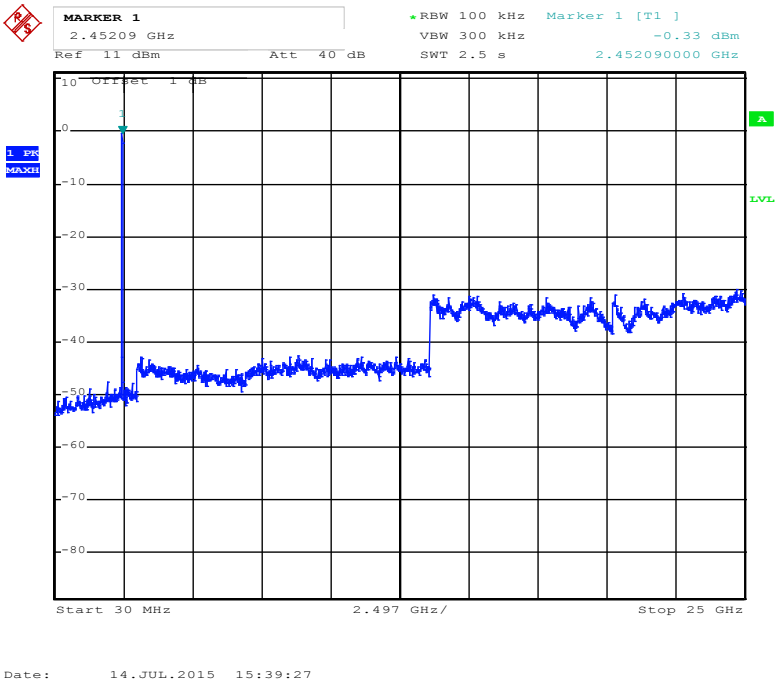


Antenna port 0

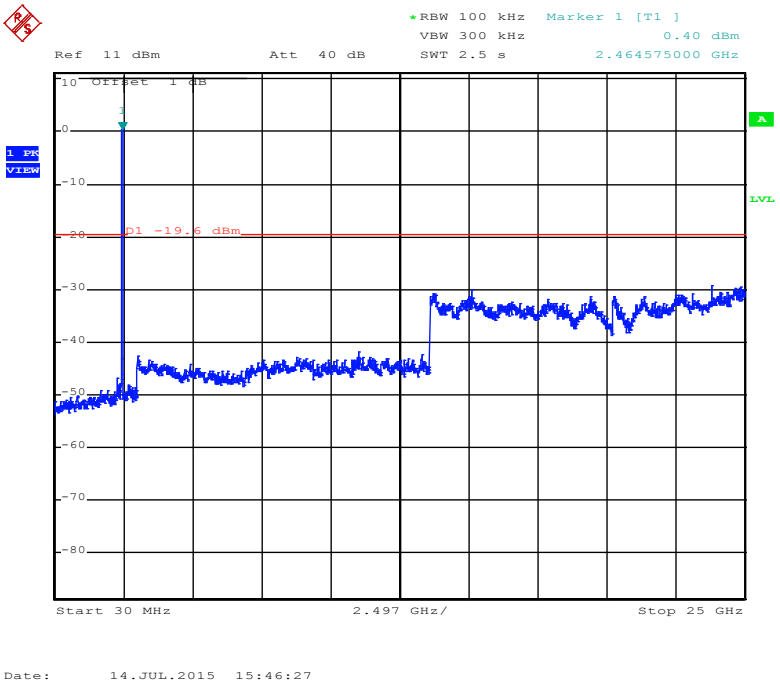


Antenna port 1

Spectral Power Density (highest channel):



Antenna port 0



Antenna port 1

8.10 Radiated Emission Measurement 9 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.247
Guide:	ANSI C63.4, ANSI C63.10
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limit is not required. In addition, radiated emissions which fall in the restricted bands must also comply with the general radiated emission limits.
General limit:	See table below
Measurement procedure:	Radiated Emission Measurement 9 kHz to 30 MHz (6.6)
Comment:	Test was performed with mode 802.11g with 54 Mbps with showed maximum -6 dBc bandwidth

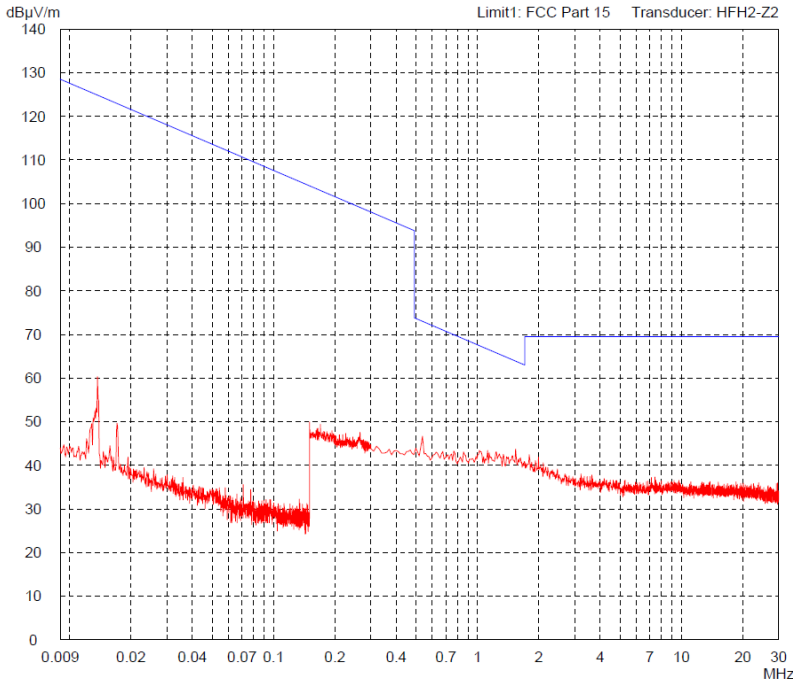
Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance d (meters)
0.009 - 0.490	2400/F(kHz)	67.6 - 20 · log(F(kHz))	300
0.490 - 1.705	24000/F(kHz)	87.6 - 20 · log(F(kHz))	30
1.705 - 30.000	30	29.5	30

Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.

Test Result:	Test passed

Comment:	Lowest channel
Date of test:	2014-11-27
Test site:	Open field test site

Test Result:	Test passed



No emissions above noise level detected

Sample calculation of final values:

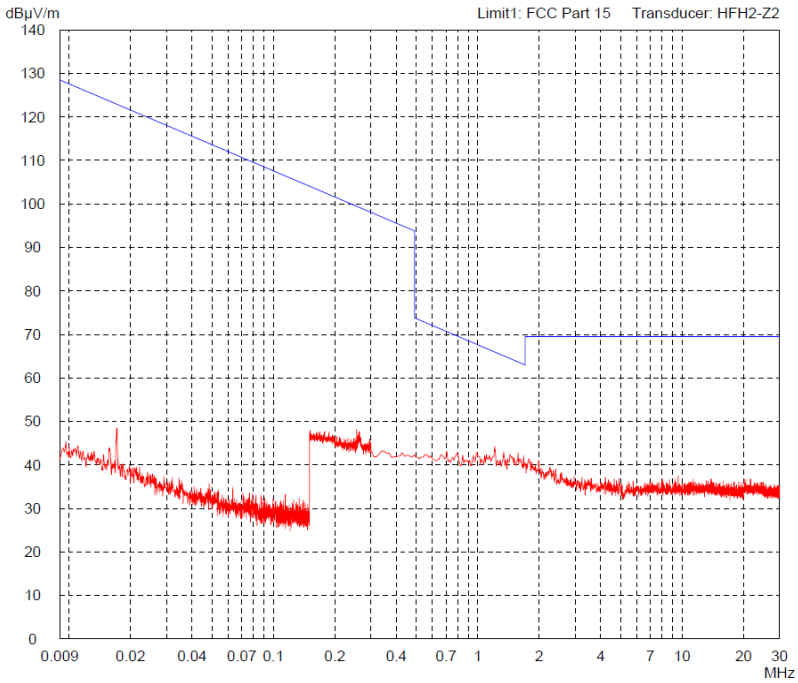
Extrapolation Factor (dB) = (Log(d) - Log(d_1)) · Extrapolation Factor (dB/decade)

Final Value (dBµV/m) = Reading Value d_1 (dBµV) + Correction Factor (dB/m) + Extrapolation Factor (dB) + Pulse Train Correction (dB)

Note: Extrapolation factor (dB) and final value (dBµV/m) are relating to distance d.

Comment:	Middle channel
Date of test:	2014-11-27
Test site:	Open field test site

Test Result:	Test passed



No emissions above noise level detected

Sample calculation of final values:

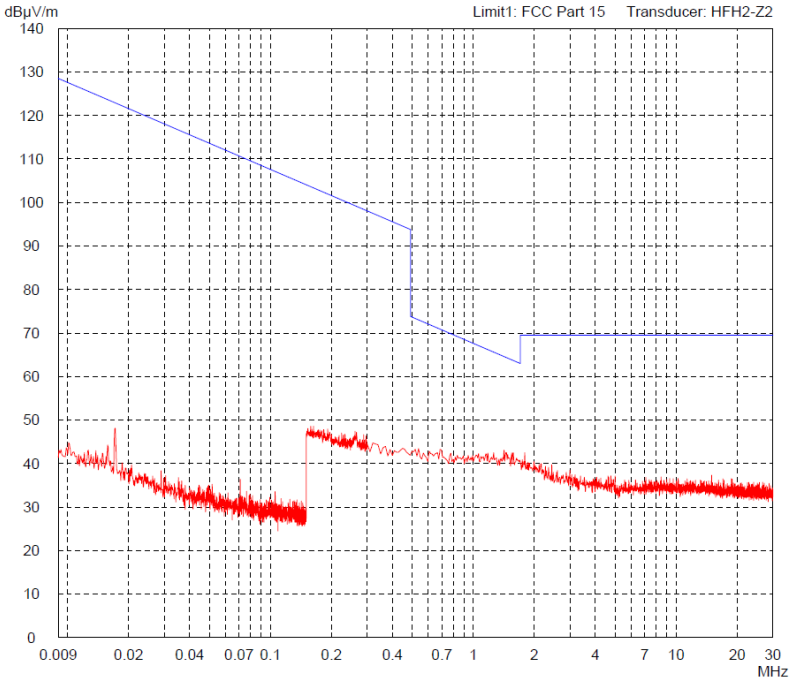
Extrapolation Factor (dB) = (Log(d) - Log(d_1)) · Extrapolation Factor (dB/decade)

Final Value (dBµV/m) = Reading Value d_1 (dBµV) + Correction Factor (dB/m) + Extrapolation Factor (dB) + Pulse Train Correction (dB)

Note: Extrapolation factor (dB) and final value (dBµV/m) are relating to distance d.

Comment:	Highest channel
Date of test:	2014-11-27
Test site:	Open field test site

Test Result:	Test passed



No emissions above noise level detected

Sample calculation of final values:

Extrapolation Factor (dB) = (Log(d) - Log(d_1)) · Extrapolation Factor (dB/decade)

Final Value (dBµV/m) = Reading Value d_1 (dBµV) + Correction Factor (dB/m) + Extrapolation Factor (dB) + Pulse Train Correction (dB)

Note: Extrapolation factor (dB) and final value (dBµV/m) are relating to distance d.

8.11 Radiated Emission Measurement 30 MHz to 25 GHz

Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.247		
Guide:	ANSI C63.4, ANSI C63.10		
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limit is not required. In addition, radiated emissions which fall in the restricted bands must also comply with the general radiated emission limits.		
General limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
	30 - 88	100	40.0
	88 - 216	150	43.5
	216 - 960	200	46.0
	Above 960	500	54.0
	Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.		
Measurement procedures:	Radiated Emission in Fully or Semi Anechoic Room (6.7) Radiated Emission at Alternative Test Site (6.8)		
Comment:	Test was performed with mode 802.11g with 54 Mbps with showed maximum -6 dBc bandwidth.		

Test Result:	Test passed

Comment:	Transmitting on lowest channel
Date of test:	2014-11-27, 2014-11-28
Test site:	Frequencies ≤ 1 GHz: Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	Frequencies ≤ 8.2 GHz: 3 m Frequencies > 8.2 GHz : 1 m

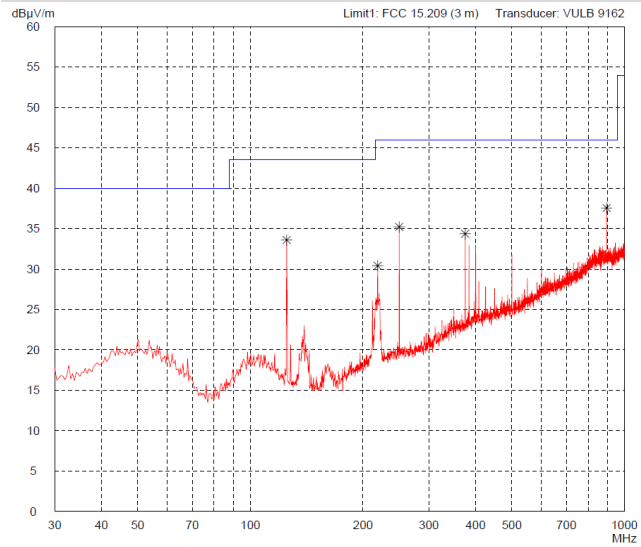
Test Result:	Test passed

Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
985.990	horizontal	Quasi-Peak	12.8	24.9		37.7	46.0	**8.3**
2412.000	horizontal	Peak	59.2	33.4		92.6		

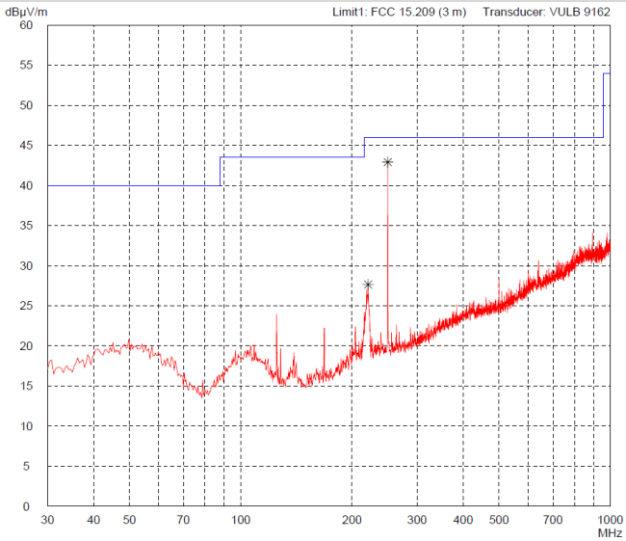
Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

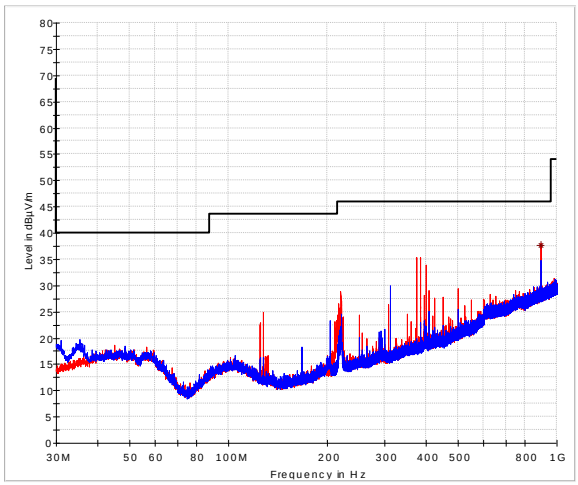
Horizontal Polarisation

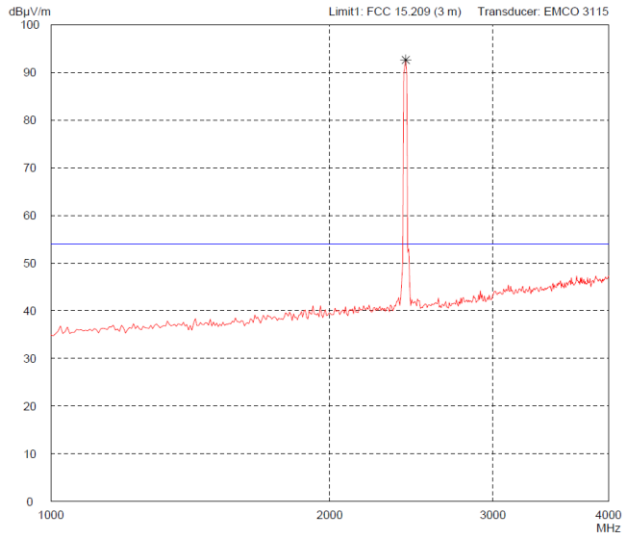


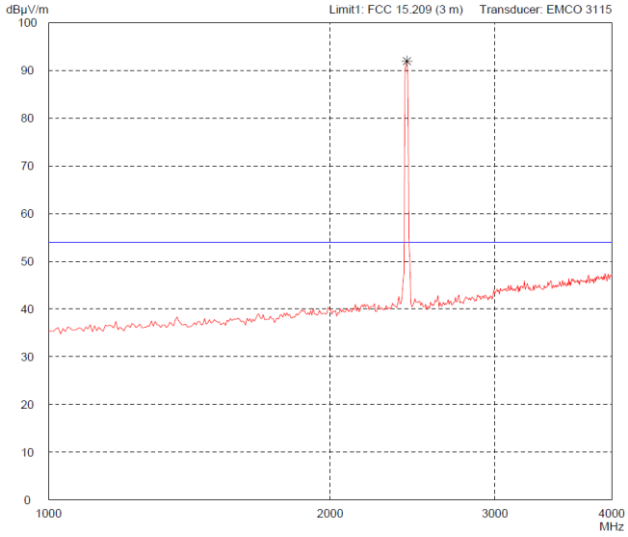
Vertical Polarisation

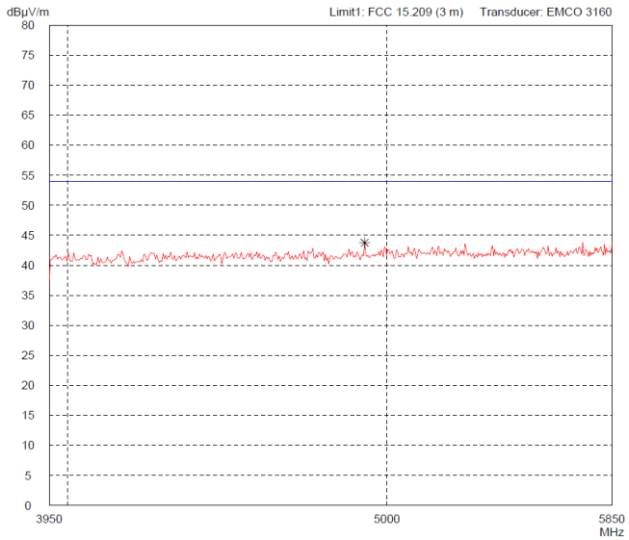


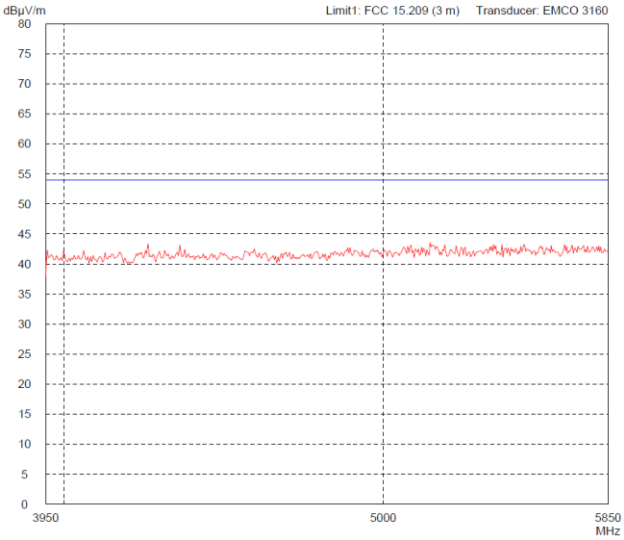
Horizontal Polarisation	Vertical Polarisation



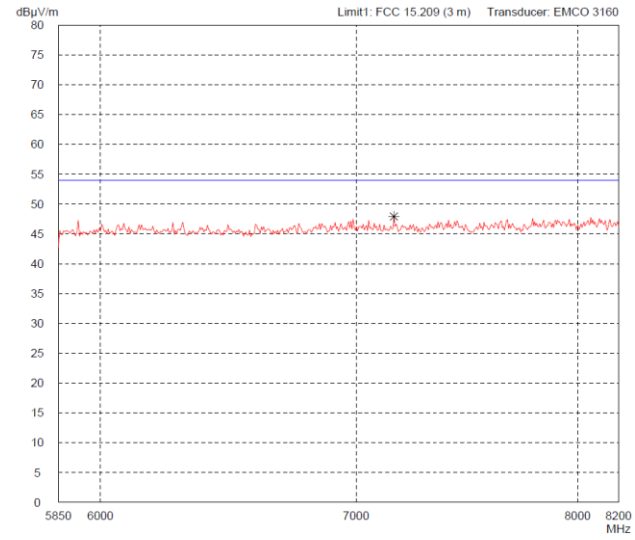


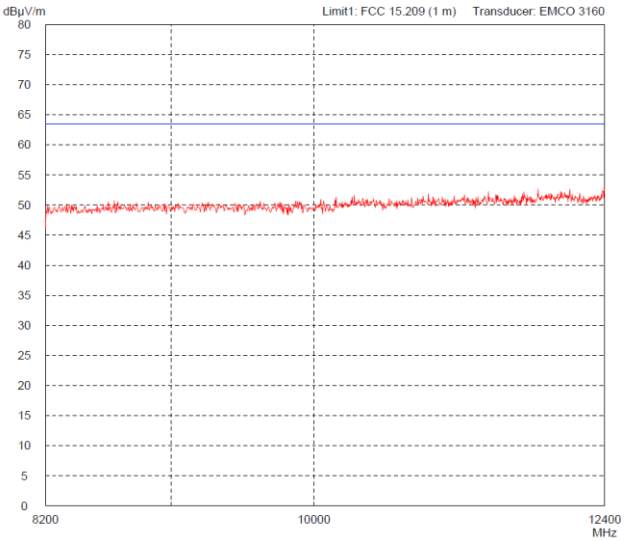




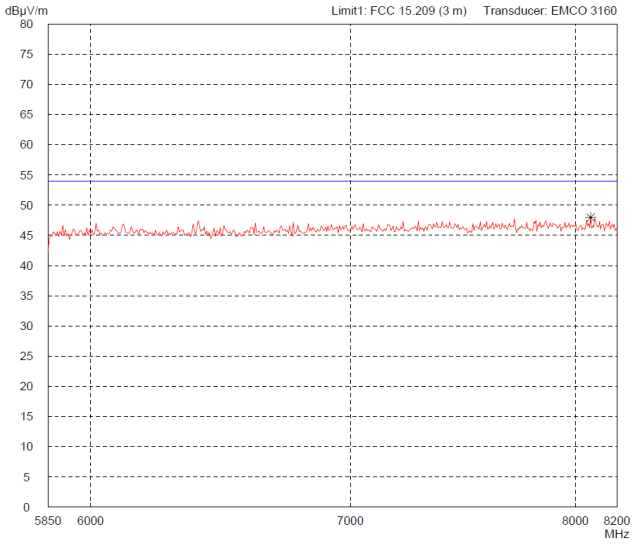


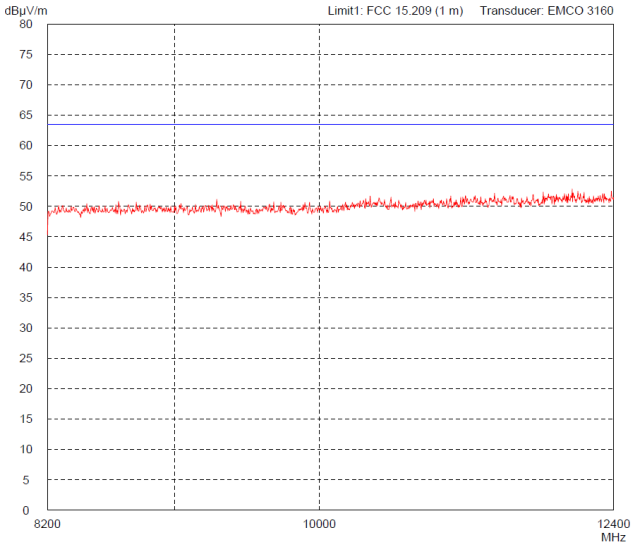
Horizontal Polarisation



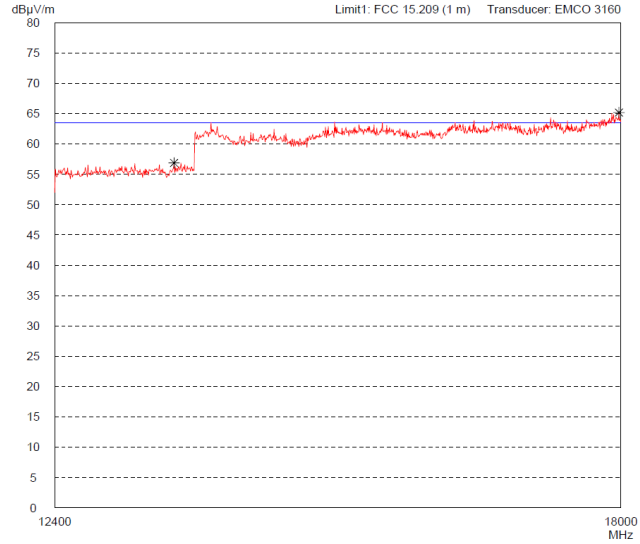


Vertical Polarisation

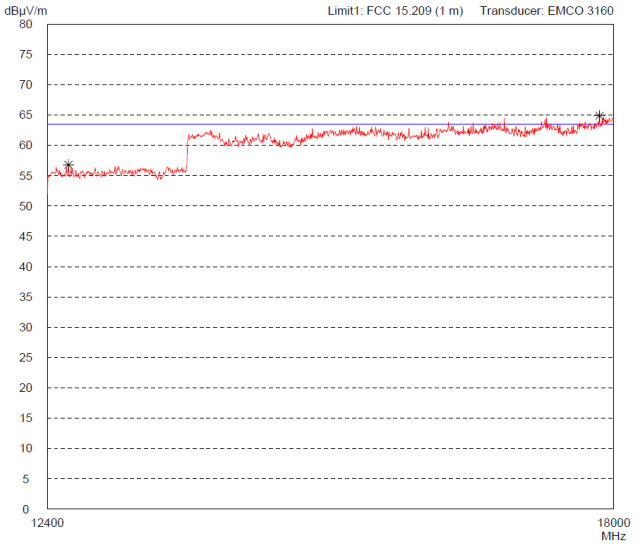




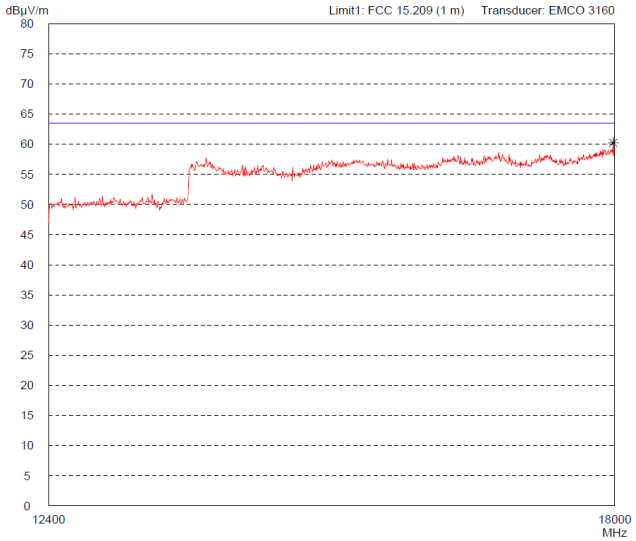
Horizontal Polarisation



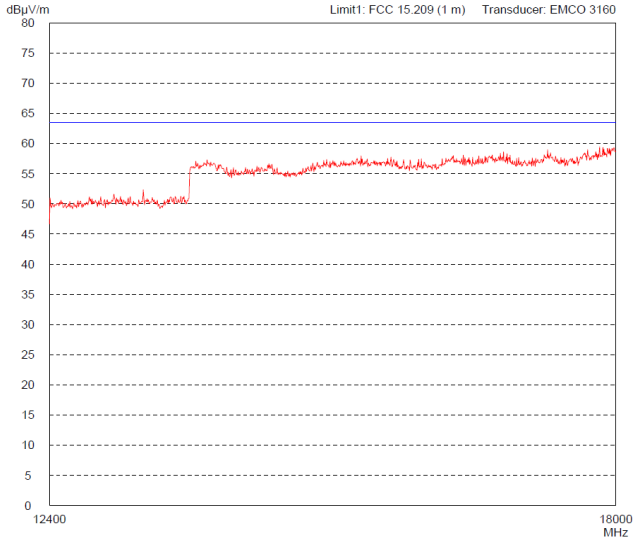
Vertical Polarisation



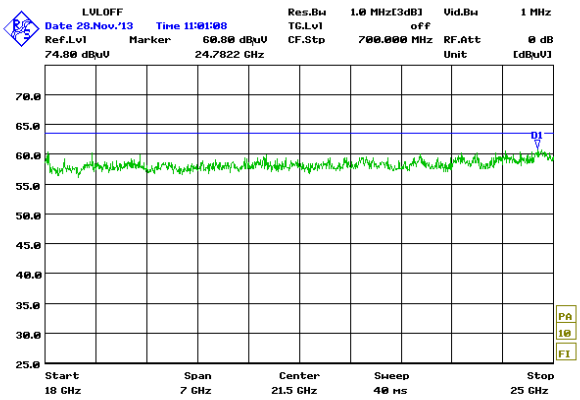
VBW = 1 MHz



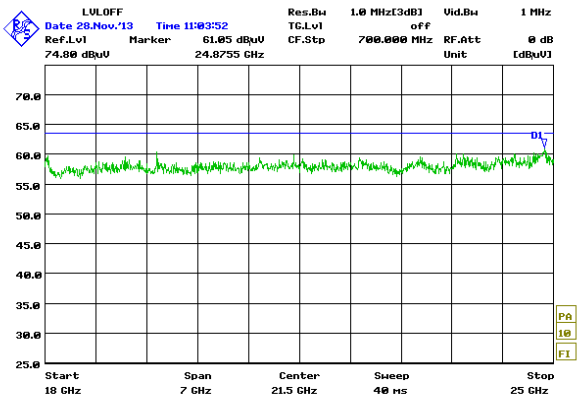
VBW = 1 MHz



VBW = 100 kHz



VBW = 100 kHz



Comment:	Transmitting on middle channel; final measurement values for the frequency range 30 MHz – 1 GHz taken from final measurement for lowest channel.
Date of test:	2014-11-27, 2014-11-28
Test site:	Frequencies ≤ 1 GHz: Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	Frequencies ≤ 8.2 GHz: 3 m Frequencies > 8.2 GHz : 1 m

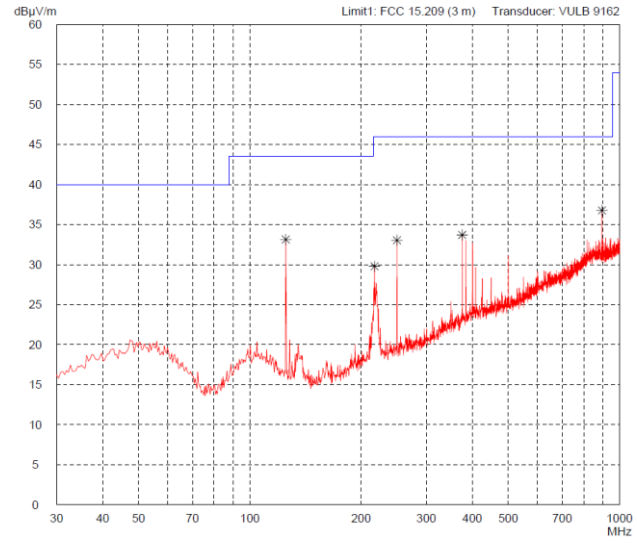
Test Result:	Test passed

Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
985.990	horizontal	Quasi-Peak	12.8	24.9		37.7	46.0	8.3
1936.000	horizontal	Peak	15.4	31.9		47.4	54.0	6.6
2437.000	horizontal	Peak	47.5	33.5		91.0		

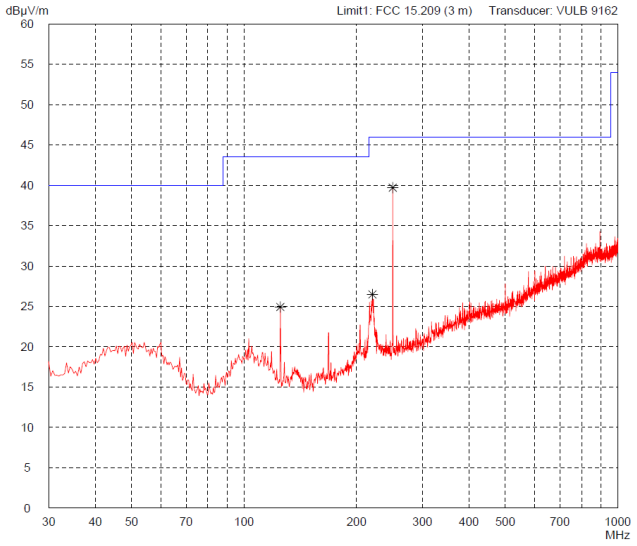
Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

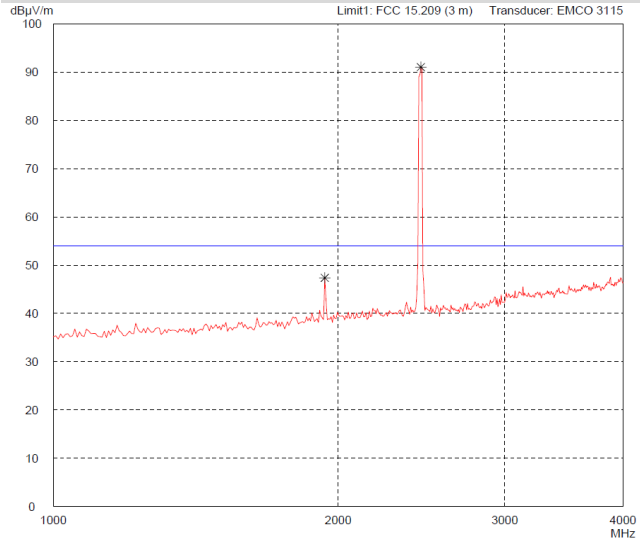
Horizontal Polarisation

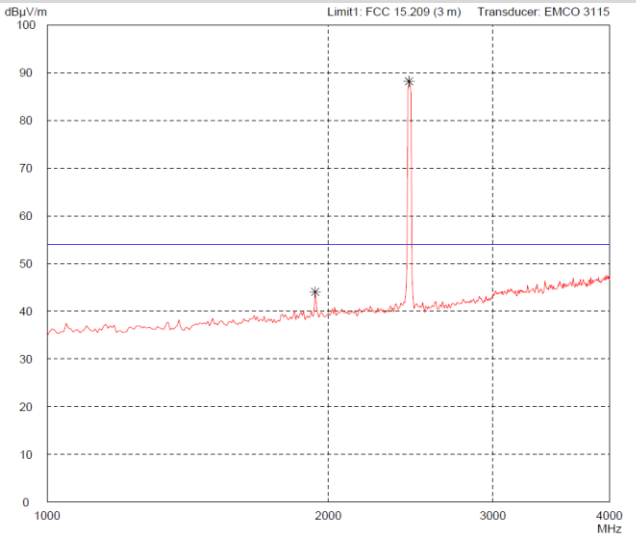


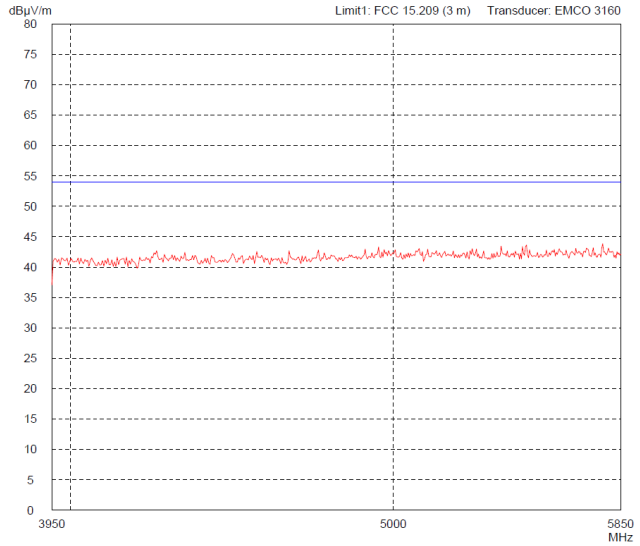
Vertical Polarisation

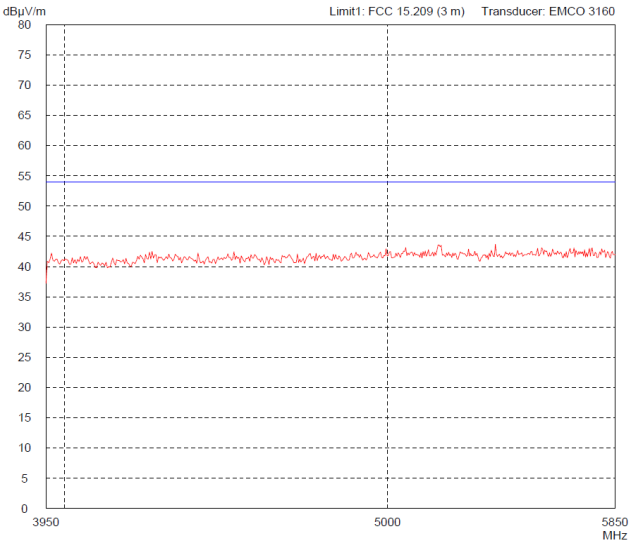


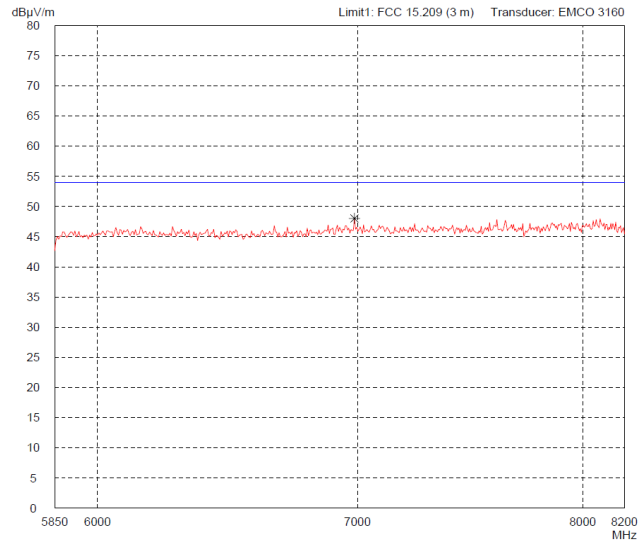
Horizontal Polarisation	Vertical Polarisation

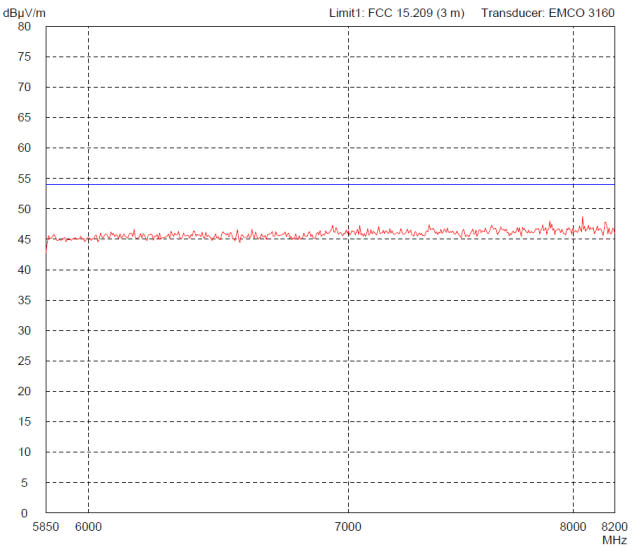




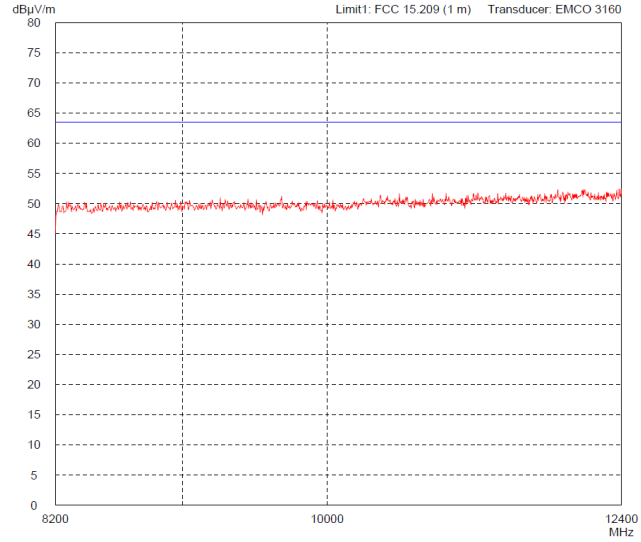




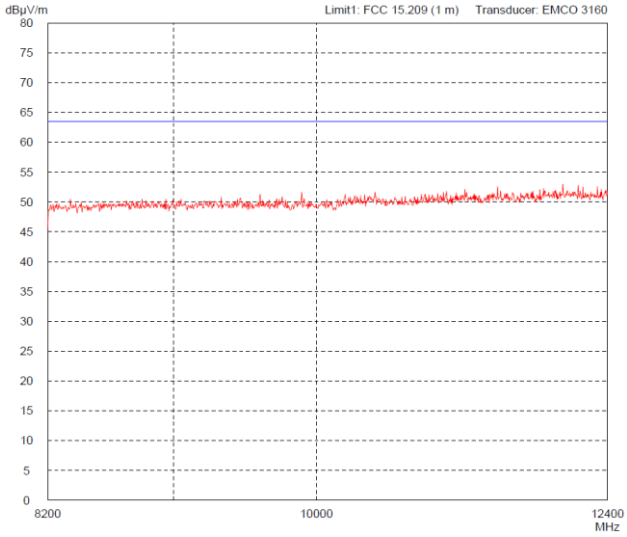




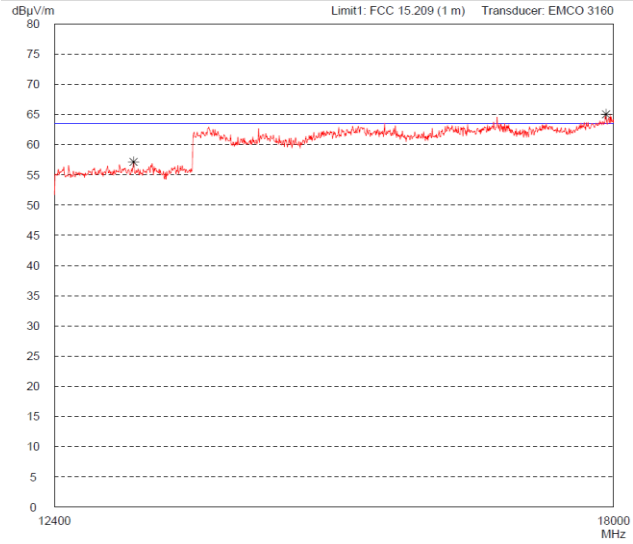
Horizontal Polarisation



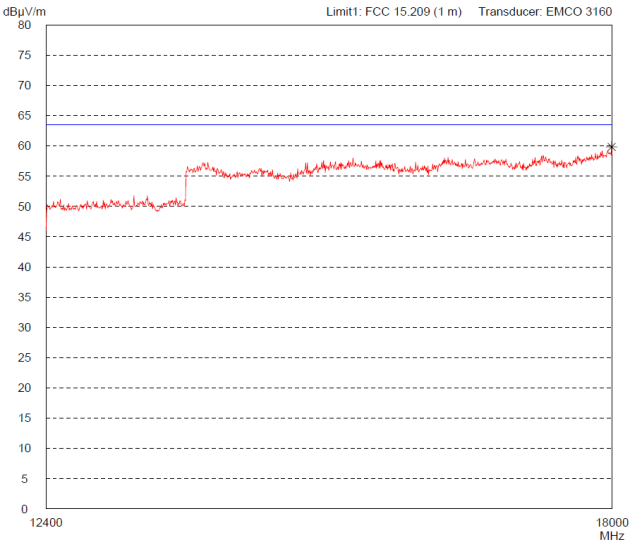
Vertical Polarisation



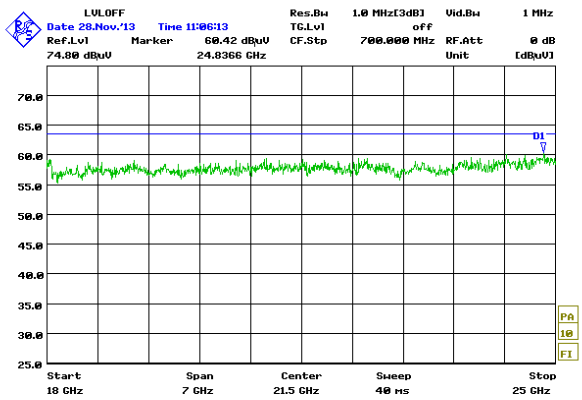
Horizontal Polarisation



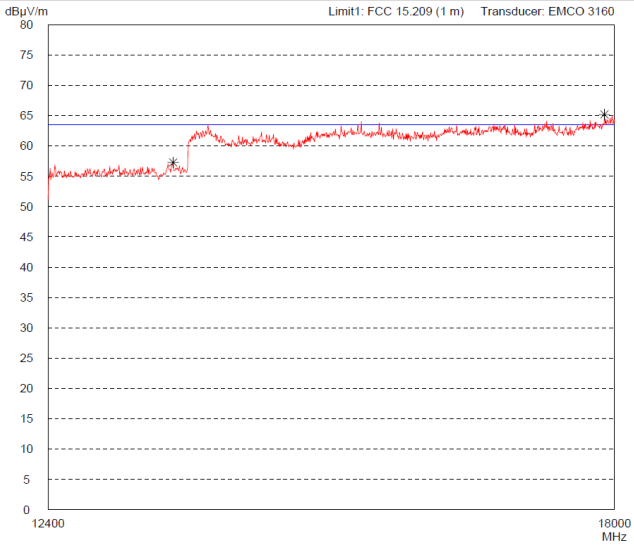
VBW = 1 MHz



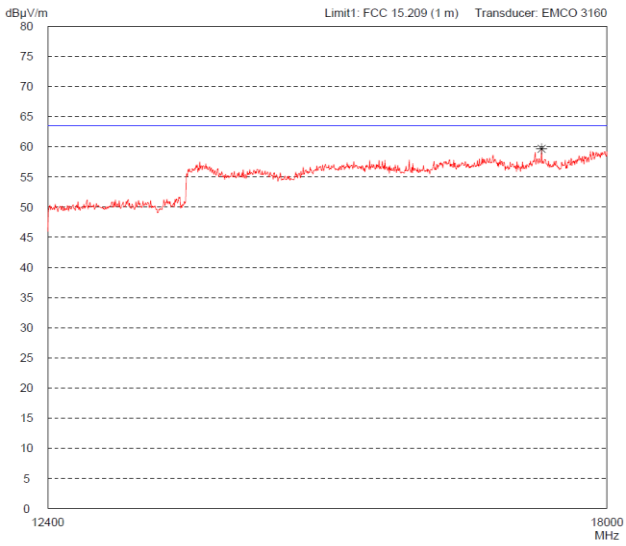
VBW = 100 kHz



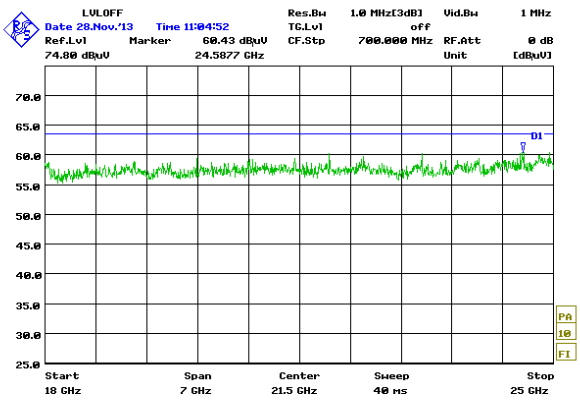
Vertical Polarisation



VBW = 1 MHz



VBW = 100 kHz



Comment:	Transmitting on highest channel; final measurement values for the frequency range 30 MHz – 1 GHz taken from final measurement for lowest channel.
Date of test:	2014-11-27, 2014-11-28
Test site:	Frequencies ≤ 1 GHz: Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	Frequencies ≤ 8.2 GHz: 3 m Frequencies > 8.2 GHz : 1 m

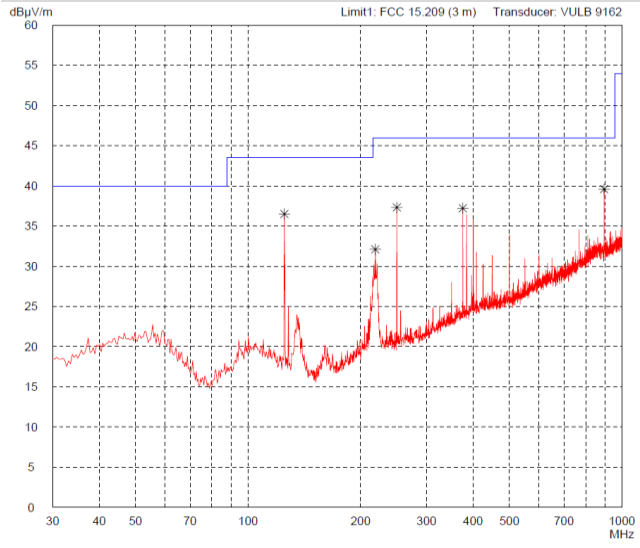
Test Result:	Test passed

Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
985.990	horizontal	Quasi-Peak	12.8	24.9		37.7	46.0	8.3
2462.000	horizontal	Peak	60.2	33.6		93.8		

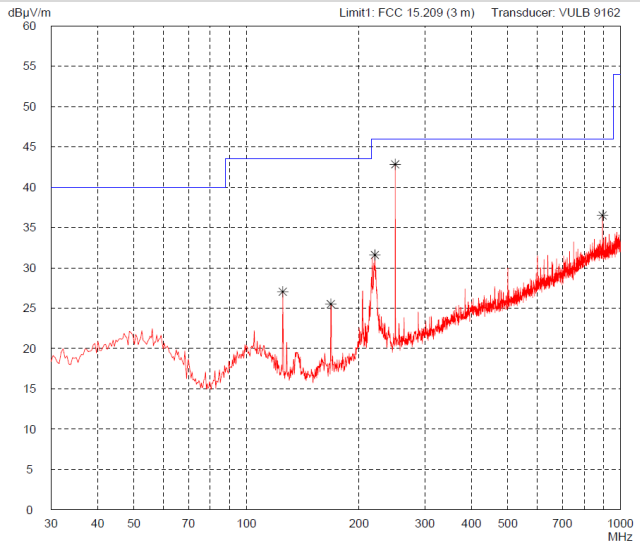
Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

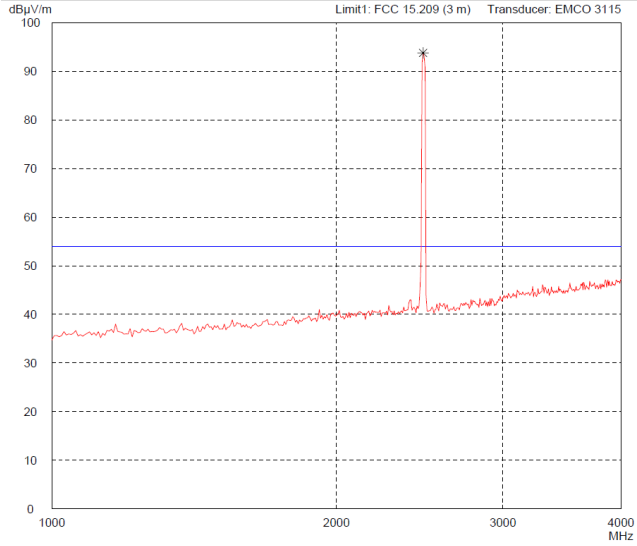
Horizontal Polarisation

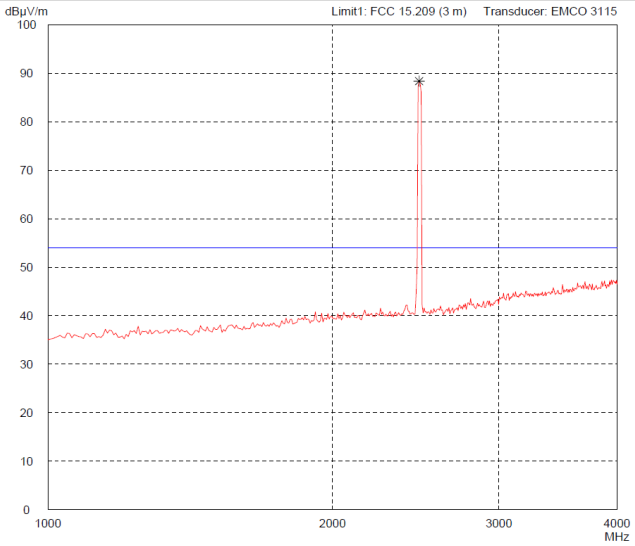


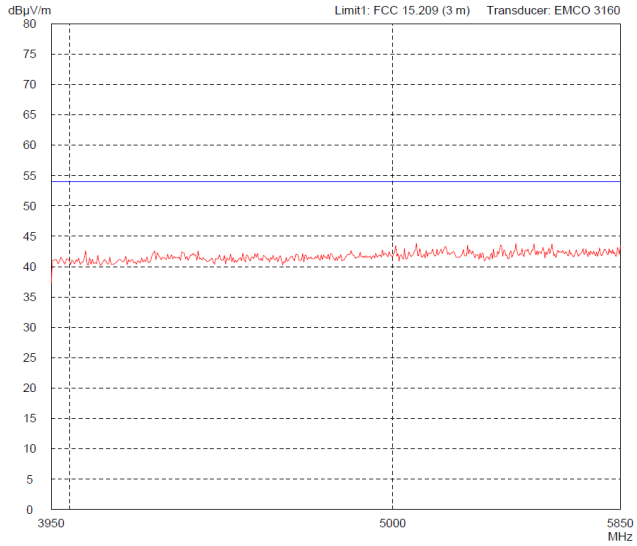
Vertical Polarisation

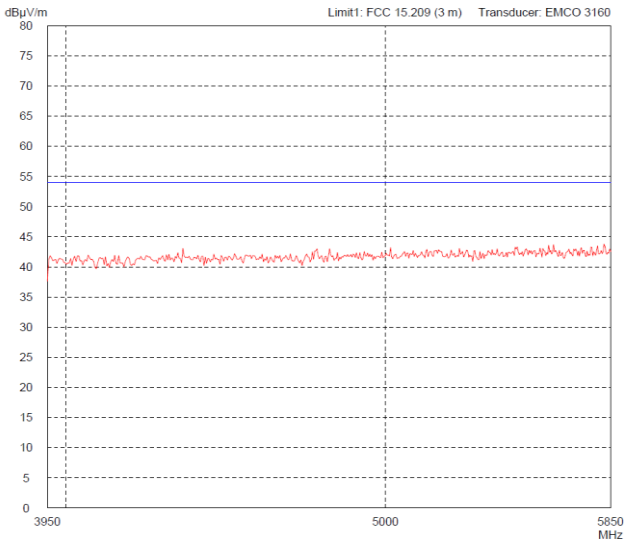


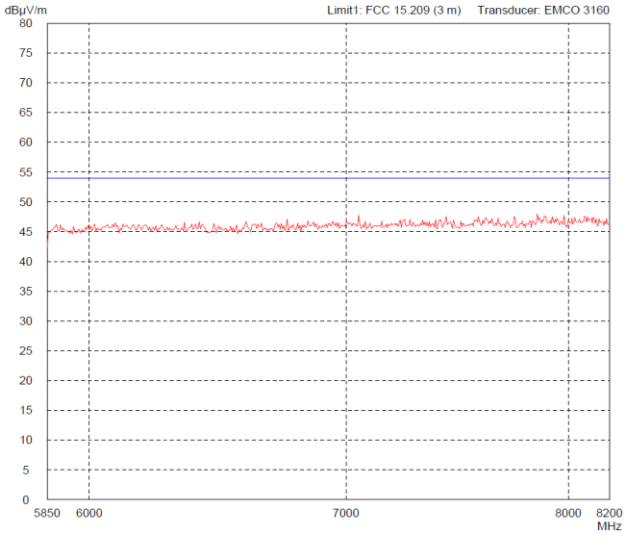
Horizontal Polarisation	Vertical Polarisation

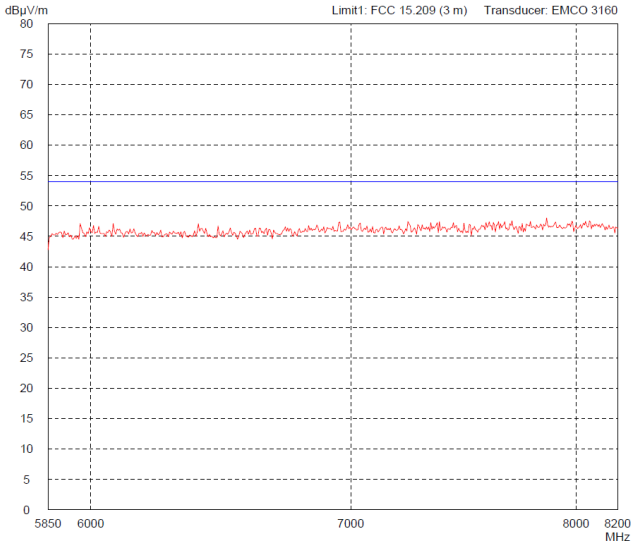




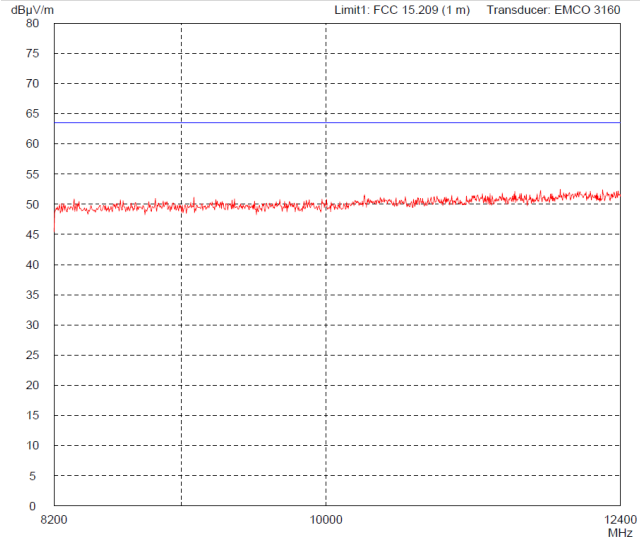


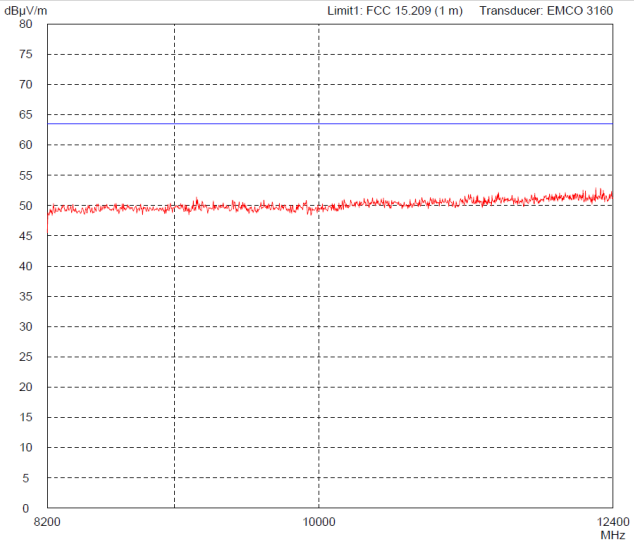


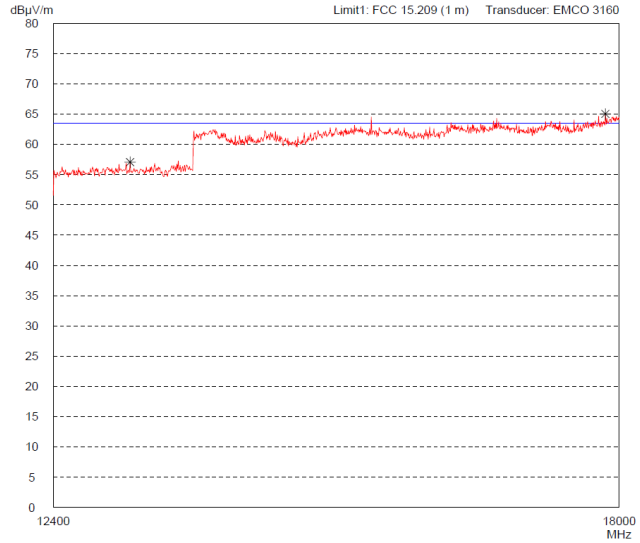




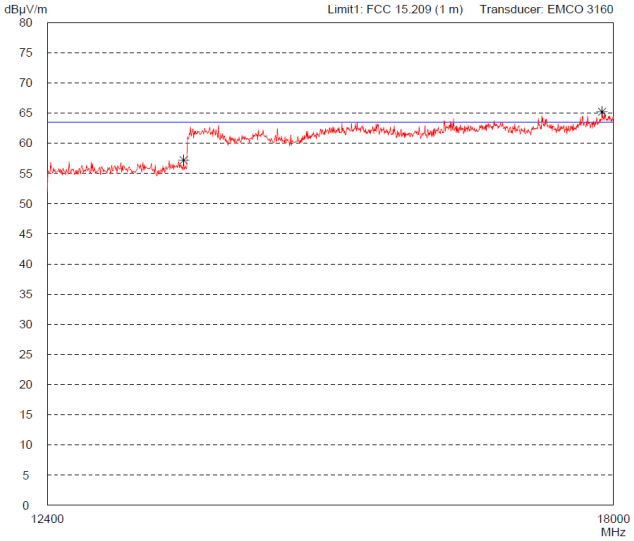
Horizontal Polarisation	Vertical Polarisation



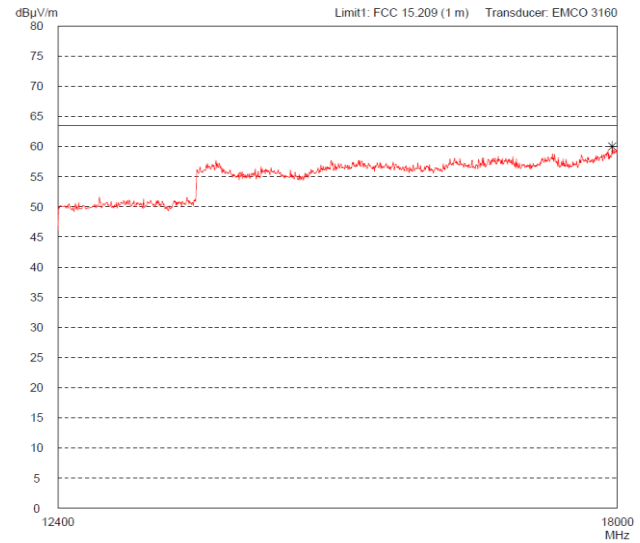




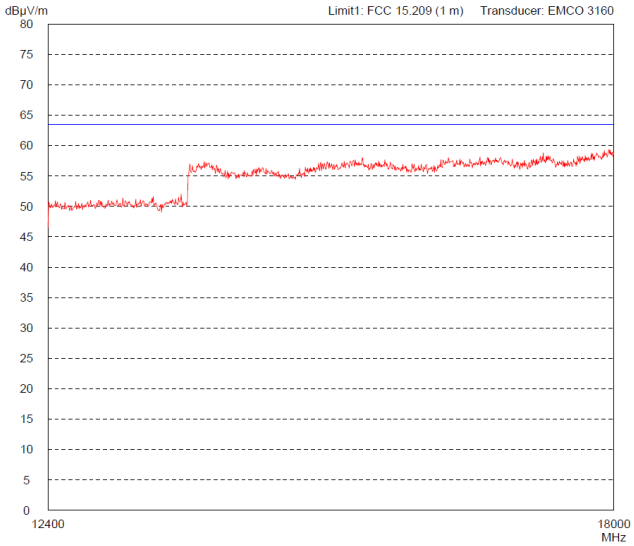
VBW = 1 MHz



VBW = 1 MHz

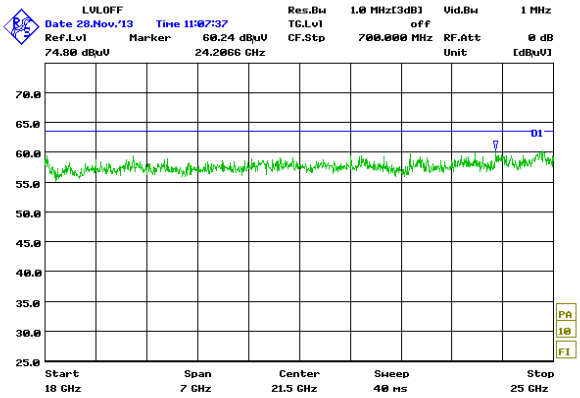


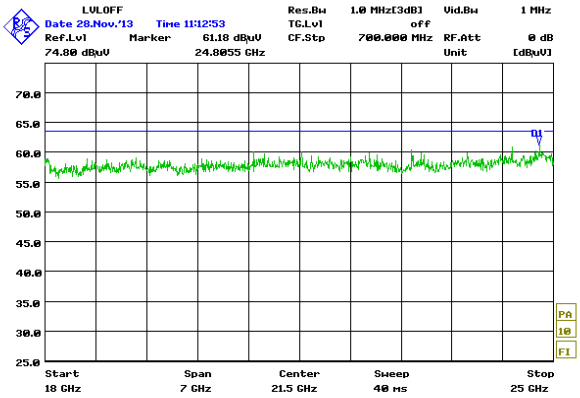
VBW = 100 kHz



VBW = 100 kHz

Horizontal Polarisation	Vertical Polarisation



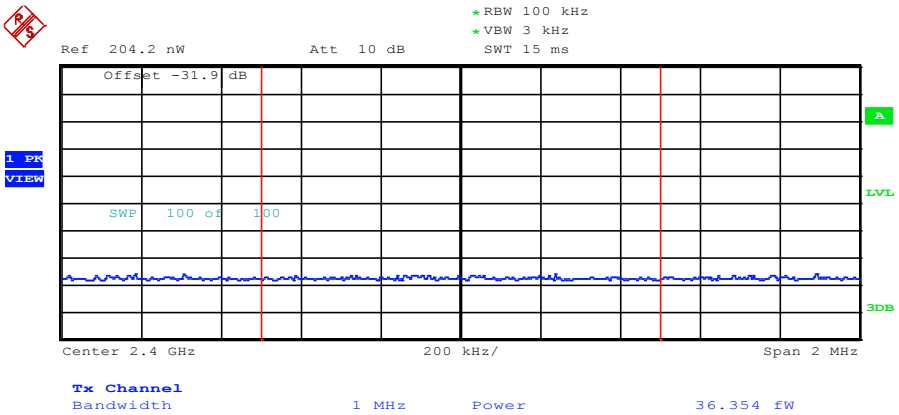


8.12 Band edge Measuement

Rules and specifications:	CFR 47 Part 15, sections 15.215(b) and 15.247		
Guide:	KDB558074 v03r03 (13.3.3)		
General limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
	30 - 88 88 - 216 216 - 960 Above 960	100 150 200 500	40.0 43.5 46.0 54.0
	Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.		
Measurement procedures:	Radiated Emission in Fully or Semi Anechoic Room (6.7)		
Comment:	Test was performed with all modulations.		

Test Result:	Test passed

Band Edge Requirement: Lowest Channel, 11b 11 Mbps:



Reading (fW)	*Reading (dBm)*	*Reading (dBµV)*	*Correction (dB/m)*	*Value (dBµV/m)*	*Limit (dBµV/m)*	*Margin (dB)*
69.333	-104.4	2.6	33.4	36.0	54.0	18.0

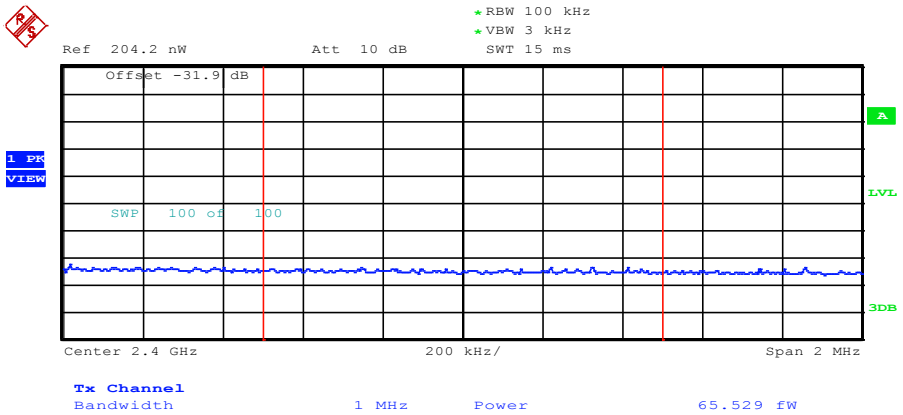
Test Result:	Test passed

Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Since the test was performed in a 50 Ω system dBm is converted into dBµV by adding 107 dB(µV/mW).

Band Edge Requirement: Lowest Channel, 11g 54 Mbps:



Reading (fW)	*Reading (dBm)*	*Reading (dBµV)*	*Correction (dB/m)*	*Value (dBµV/m)*	*Limit (dBµV/m)*	*Margin (dB)*
52.285	-101.8	5.2	33.4	38.6	54.0	15.4

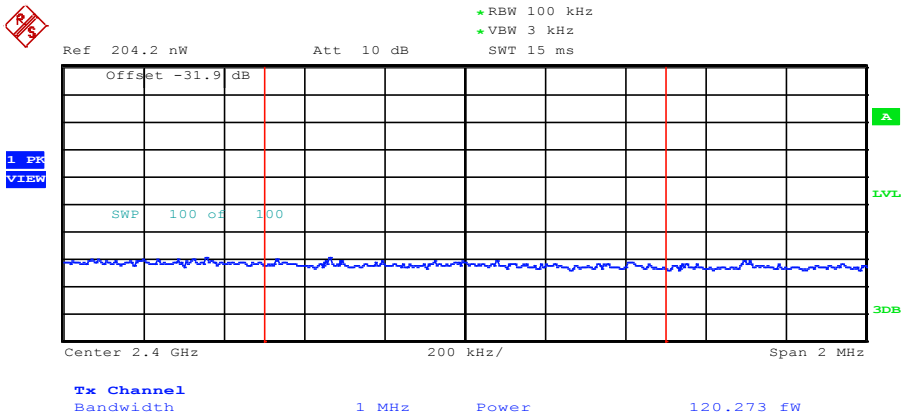
Test Result:	Test passed

Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Since the test was performed in a 50 Ω system dBm is converted into dBµV by adding 107 dB(µV/mW).

Band Edge Requirement: Lowest Channel, 11n 130 Mbps:



Reading (fW)	*Reading (dBm)*	*Reading (dBµV)*	*Correction (dB/m)*	*Value (dBµV/m)*	*Limit (dBµV/m)*	*Margin (dB)*
105.717	-99.2	7.8	33.4	41.2	54.0	12.8

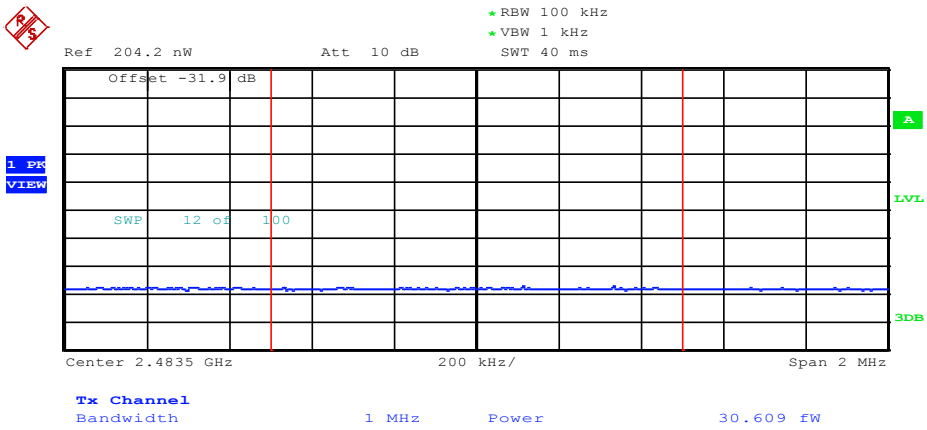
Test Result:	Test passed

Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Since the test was performed in a 50 Ω system dBm is converted into dBµV by adding 107 dB(µV/mW).

Band Edge Requirement: Highest Channel, 11b 11 Mbps:



Reading (fW)	*Reading (dBm)*	*Reading (dBµV)*	*Correction (dB/m)*	*Value (dBµV/m)*	*Limit (dBµV/m)*	*Margin (dB)*
25.832	-103.0	4.0	33.6	37.6	54.0	16.4

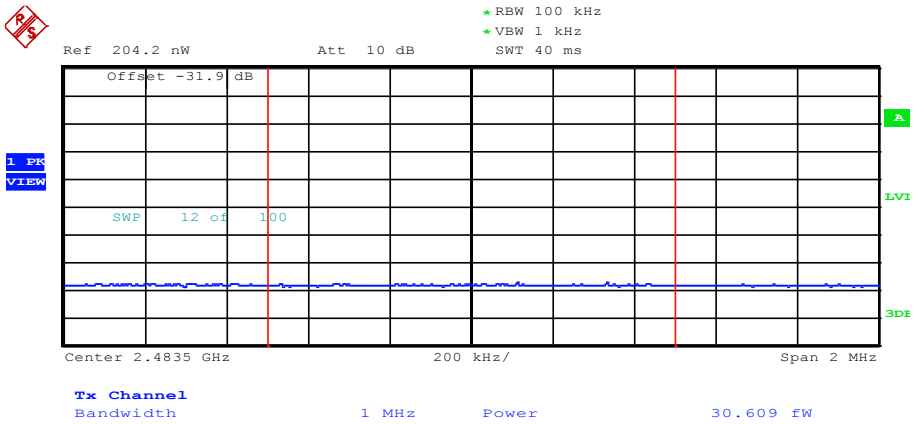
Test Result:	Test passed

Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Since the test was performed in a 50 Ω system dBm is converted into dBµV by adding 107 dB(µV/mW).

Band Edge Requirement: Highest Channel, 11g 54 Mbps:



Reading (fW)	*Reading (dBm)*	*Reading (dBµV)*	*Correction (dB/m)*	*Value (dBµV/m)*	*Limit (dBµV/m)*	*Margin (dB)*
25.726	-103.0	4.0	33.6	37.6	54.0	16.4

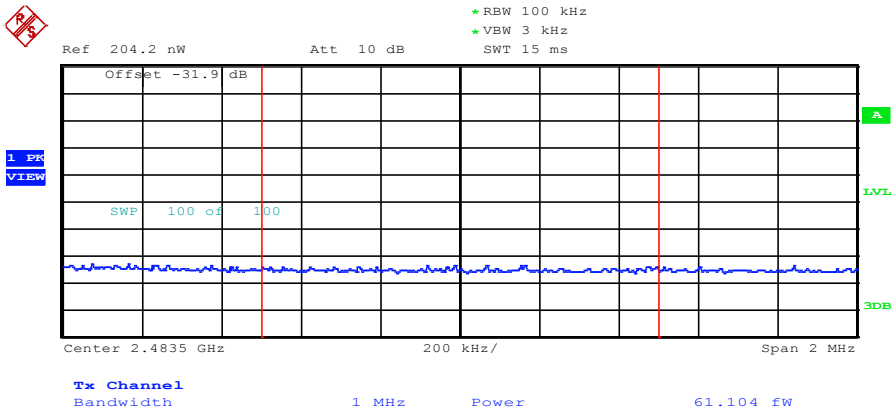
Test Result:	Test passed

Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Since the test was performed in a 50 Ω system dBm is converted into dBµV by adding 107 dB(µV/mW).

Band Edge Requirement: Highest Channel, 11n 130 Mbps:



Reading (fW)	*Reading (dBm)*	*Reading (dBµV)*	*Correction (dB/m)*	*Value (dBµV/m)*	*Limit (dBµV/m)*	*Margin (dB)*
25.613	-102.1	4.9	33.6	38.5	54.0	15.5

Test Result:	Test passed

Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Since the test was performed in a 50 Ω system dBm is converted into dBµV by adding 107 dB(µV/mW).

8.13 RF exposure requirement

Rules and specifications:	CFR 47 Part 15, section 15.247(i) CFR 47 Part 1, sections 1.1307(b)(1)
Guide:	OET Bulletin 65, Edition 97-01
Limits:	Limits for general population / uncontrolled exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm²)	Averaging Time (minutes)
0.3 - 1.34	614	1.63	(100)*	30
1.34 - 30	824 / f	2.19 / f	(180 / f²)*	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	---	---	f/1500	30
1500 - 100000	---	---	1.0	30

f = frequency in MHz
* Plane-wave equivalent power density

Spectral power density			Declared by applicant	Measured
Prediction [6]:	S	= P G / 4 π R²		
Where:	S	= Power density		
	P	= Power input of antenna		
	G	= Power gain of the antenna relativ to an isotropic radiator		
	R	= Distance to the center of radiation of the antenna		
Maximum output power:	P	= 20.2 dBm = 104.71 mW		☒
Antenna gain:	G	= 2 dBi = 1.59	☒	
Prediction distance:	R	= 20 cm		
Power density at 20 cm:	**S**	**= 33.12 µW/cm²**		
Limit	**S_{lim}**	**= 1.0 mW/cm²**		

Test Result:	Test passed

[6] MPE Prediction of MPE according to equation from page 19 of OET Bulletin 65, Ed. 97-01

9 Referenced Regulations

All tests were performed with reference to the following regulations and standards:

☒	CFR 47 Part 2	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)	October 1, 2014
☒	CFR 47 Part 15	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)	October 1, 2014
☐	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	December 11, 2003 (published on January 30, 2004)
☒	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	June 7, 2009 (published on September 15, 2009)
☐	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	June 13, 2014 (published on June 20, 2014)
☒	ANSI C63.10	American National Standard for Testing Unlicensed Wireless Devices	July 3, 2009 (published on September 10, 2009)
☐	ANSI C63.10	American national Standard of Procedures for Compilance Testing of Unlicensed Wireless Devices	June 27, 2013 (published on September 13, 2013)
☒	CISPR 22	Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, “Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement”	1997
☐	CAN/CSA CISPR 22-10	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (Adopted IEC CISPR 22:2008, sixth edition, 2008-09)	2010
☒	TRC-43	Designation of Emissions, Class of Station and Nature of Service, published by Industry Canada	November 2012
☒	KDB558074 v03r03	Guidance for Performing Compilance Measurements on Digital Transmission Systems (DTS) Operating under § 15.247.	June 9, 2015

10 Test Equipment List with Calibration Data

Type	*Inv.-No.*	*Type Designation*	*Serial Number*	*Manufacturer*	*Calibration Organization*	*Last Calibration*	*Next Calibration*
EMI test receiver	1028	ESHS10	860043/016	Rohde & Schwarz	Rohde & Schwarz	10/2014	10/2015
EMI test receiver	1569	ESMI	839699/006	Rohde & Schwarz	Rohde & Schwarz	12/2012	12/2014
EMI test receiver	2044	ESU8	100232	Rohde & Schwarz	Rohde & Schwarz	10/2014	10/2015
EMI test receiver	1863	ESCI3	100008	Rohde & Schwarz	Rohde & Schwarz	09/2014	09/2015
Spectrum analyser	1666	FSP30	100063	Rohde & Schwarz	Rohde & Schwarz	05/2014	11/2015
Spectrum analyser	(R/S)	FSP30	1093.4495.30	Rohde & Schwarz	Rohde & Schwarz	05/2014	05/2016
Preamplifier	1484	ACO/180-3530	32641	CTT	TÜV SÜD PS-EMC-STR	06/2013	06/2015
Preamplifier	1684	AFS3-00100800-32-LN	847743	MITEQ	TÜV SÜD PS-EMC-STR	10/2013	04/2015
Preamplifier	1716	CPA9231A	3557	Schaffner EMC Systems	TÜV SÜD PS-EMC-STR	05/2014	11/2015
V-network	1059	ESH3-Z5	894785/005	Rohde & Schwarz	Rohde & Schwarz	08/2013	08/2015
Double ridged waveguide horn antenna	1516	3115	9508-4553	EMCO Elektronik	Seibersdorf Laboratories	12/2012	12/2014
Horn antenna	1012	3160-05	9112-1001	EMCO Elektronik		see note 1	
Horn antenna	1013	3160-06	9112-1001	EMCO Elektronik		see note 1	
Horn antenna	1014	3160-07	9112-1008	EMCO Elektronik		see note 1	
Horn antenna	1015	3160-08	9112-1002	EMCO Elektronik		see note 1	
Horn antenna	1265	3160-09	9403-1025 (931941-010)	EMCO Elektronik		see note 1	
Loop antenna	1016	HFH2-Z2	882964/0001	Rohde & Schwarz	Rohde & Schwarz	05/2014	11/2015
TRILOG Broadband Ant.	2058	VULB 9163	9163-408	Schwarzbeck	Rohde & Schwarz	06/2014	06/2016
TRILOG Broadband Ant.	2256	VULB 9162	9162-048	Schwarzbeck	Schwarzbeck	09/2013	03/2015
Power meter	1264	NRVS	836856/015	Rohde & Schwarz	Rohde & Schwarz	01/2015	01/2017
Peak power sensor	1701	NRV-Z31	836299/012	Rohde & Schwarz	Rohde & Schwarz	04/2015	04/2017

Note 1: No calibration required.
Note 2: Not calibrated separately but with the whole test system when recording calibration data.
Note 3: No calibration required. Devices are checked before use.
Note 4: No calibration required. Devices are checked by calibrated equipment during test.

11 Revision History

Revision History			
Edition	*Date*	*Issued by*	*Modifications*
1	2014-12-09	M. Steindl	First Edition
2	2015-06-02	M. Steindl	Deleted references to IC standards, Updated to ANSI C63.10. Added conducted measurements on antenna ports.
3	2015-06-26	M. Steindl(as)	Added regulation KDB558074. Added procedure for band edge measurements. Added specification of test PC. Added summation for two ports for power density and carrier power. New calculation of RF exposure.
4	2015-07-23	M. Steindl	Measurement procedures revised. Added adapter to devices connected to EUT. Revised protocols for 6 dB bandwidth, 99 % bandwidth, restricted bands of operation, power density and conducted emissions on RF port. Added protocols for pulse train measurement and band edge requirement.
5	2015-08-08	M. Biberger	Page 5: Table with type of modulation and antenna port modes added. Page 58: RSS-Gen removed. Pulse train measurement changed in duty cycle measurement performed again (protocols added). Measurement procedure of band edge measurement changed and performed again (protocols added).