

FCC Test Report for Part 15

Product name : EX-SM14 Smart phone
Applicant : TechNed Benelux
FCC ID : 2AD2CEX-SM14

Test report No. : 20153885303-1 Ver 1.00



Report number: 20153885303-1 Ver 1.00



Laboratory information

Accreditation

Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Designation number is: NL0001

Documentation

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Testing Location

Test Site	Telefication BV
Test Site location	Edisonstraat 12a 6902 PK Zevenaar The Netherlands Tel. +31316583180 Fax. +31316583189
Test Site FCC	NL0001

Report number: 20153885303-1 Ver 1.00

Revision History

Version	Date	Remarks	By
v0.50	29-01-2016	Draft version	RvB
v1.00	01-02-2016	Release version	RvB

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Summary of Test results

FCC	IC	Description	Section in report	Verdict
15.247(a) (2)	RSS 247 5.2.1	6dB Bandwidth	3.1	Pass
15.247(b)	RSS 247 5.4.4	RF output Power	3.2	Pass
15.247(e)	RSS 247 5.2.2	Power Spectral Density	3.3	Pass
2.1049(h)	RSS-GEN 4.6.1	99% Bandwidth	3.4	Pass
15.247(d)	RSS 247 5.5	Conducted Spurious Emissions	3.5	Pass
15.247(d)	RSS 247 5.5	Radiated Spurious Emissions(cabinet)	3.6	Pass
15.247(d)	RSS 247 5.5	Conducted Band edge	3.7	Pass

1 General Description

1.1 Applicant

Client name: TechNed Benelux
Address: Veersteeg 15, Spijk
Zip code: 4212 LR
Telephone: +31 183631295
Fax: +31 1836 31778
Contact name: M. Geluk

1.2 Manufacturer

Manufacturer name: TechNed Benelux
Address: Veersteeg 15, Spijk
Zip code: 4212 LR
Telephone: +31 183631295
Fax: +31 1836 31778
Contact name: M. Geluk

1.3 Tested Equipment Under Test (EUT)

Product name: EX-SM14 Smart Phone
Brand name: Rough Pro
Product type: Mobile Phone
FCC ID: 2AD2CEX-SM14
Model(s): EX0150_20141106_M312_SP EX-SM14
Serial number: 00004
Software version: Android 4.2.2
Hardware version: EX0150_20141106_M312_SP
Date of receipt: 3 June 2015
Tests started: 17-November-2015
Testing ended: 29 January 2016

1.4 Product specifications of Equipment under test

Tx Frequencies:	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1712.4 MHz ~ 1752.6 MHz WCDMA Band V: 826.4 MHz ~ 1907.6 MHz Bluetooth : 2402 MHz ~ 2480 MHz Bluetooth LE: 2402 MHz ~ 2480 MHz WLAN: 2412 MHz ~ 2462 MHz
Rx frequencies:	GSM850: 869.2 MHz ~ 893.8 MHz GSM1900: 1930.2 MHz ~ 1989.8 MHz WCDMA Band II: 1932.4 MHz ~ 1987.6 MHz WCDMA Band V: 871.4 MHz ~ 891.6 MHz Bluetooth : 2402 MHz ~ 2480 MHz Bluetooth LE: 2402 MHz ~ 2480 MHz WLAN: 2412 MHz ~ 2462 MHz
Maximum output power to antenna:	GSM/GPRS: 31 dBm GSM1900: 28 dBm WCDMA Band II: 23.5 dBm WCDMA Band V: 23.5 dBm Bluetooth: 8 dBm IEEE 802.11b: 18.5 dBm IEEE 802.11g: 15.5 dBm IEEE 802.11n (HT20): 15.5 dBm IEEE 802.11n (HT40): 13.5 dBm
Antenna type and gain:	Integrated antenna: Monopole FPC; Antenna Gain: GSM -2,4 dBi; WCDMA -2.5 dBi Bluetooth: 2.5 dBi WLAN: 2.5 dBi
Type of modulation:	GSM/GPRS: GMSK EDGE: GMSK/8PSK WCDMA: QPSK (UL) HSUPA: QPSK (UL) Bluetooth: Basic Rate (1Mbps) GFSK WLAN: DSSS/OFDM

1.5 Modification of the Equipment Under Test (EUT)

in order to be able to do the conducted tests, the EUT has been modified by.

- 1 Soldering a 50 Ohm matched coaxial cable to the antenna pads of the EUT, disconnecting the integrated antenna terminals and a SMA female connector has been added to the other end of the RF coaxial cable (pigtail).
- 2 The battery terminal has been taken out of the EUT for variations of the Supply voltage.

The modifications are done following the manufacturer's instructions. The modifications have been performed by an external company. See the details below.

Techniveau
Bijsterhuizen 2414
6604 LL Wijchen
Tel. +31 (0)6 21 551 223
www.techniveau.nl
info@techniveau.nl

1.6 Environmental conditions

Test date	17-11-2015	20-11-2015	29-01-2016
Ambient temperature	21.3°C	24.0°C	20.8°C
Humidity	39.0%	42.2%	45.4%

1.7 Applicable standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247 and Part15 Subpart C §15.207.
- FCC KDB Publication No. 558074, D01DTS Meas. Guidance V03r04.

1.8 Observations and remarks

- All tested items were verified and recorded according to the standards and no deviations were identified during testing.
- This report is an addition to report 20153885303 v2.00.
- Any information not included in this report can be found in report 20153885303 v2.00.

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1.9 Conclusions

The sample of the product showed NO NON-COMPLIANCES to the specifications stated in paragraph 1.7 of this report.

The results of the test as stated in this report are exclusively applicable to the product items as identified in this report. Telefication accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.7 "Applicable standards".

All tests are performed by:

Name : ing R van Barneveld

Review of test methods and report by:

Name : ing P.A Suringa

The above conclusions have been verified by the following signatory:

Date : 15-03-2016

Name : ing M.T.P.M Wouters v/d Oudenweijer

Function : Director Certification

Signature :



2 Test configuration of the Equipment Under Test

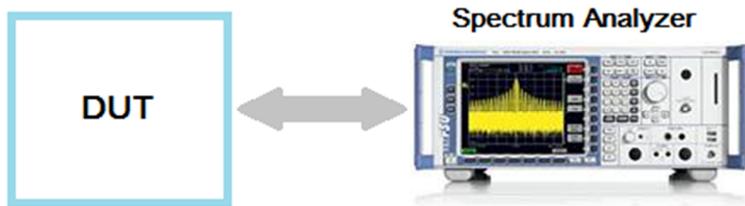
2.1 Test mode

Antenna port conducted and radiated test cases were performed with the EUT configured to transmit at its maximum power. Frequency range from 30 MHz up to 10th Harmonic of the Fundamental Frequencies at low, mid and high channel were examined.

2.2 Tested channels and Data rates

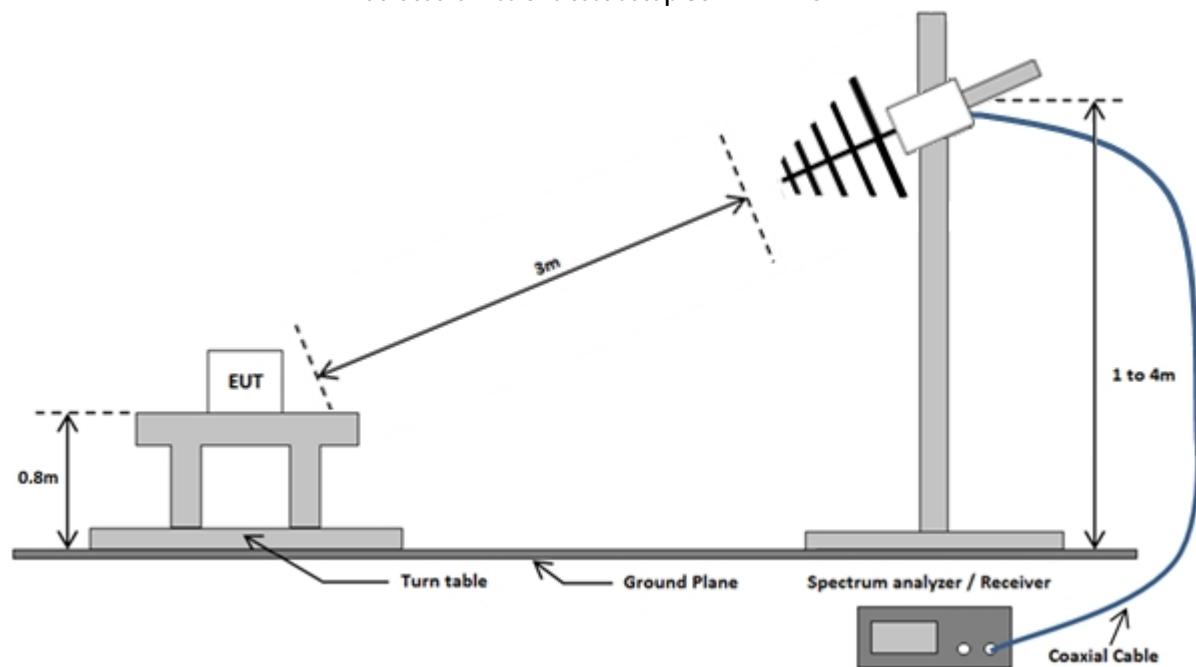
Technology	Channels	Data rate .	Frequency (MHz)
IEEE 802.11n (HT40)	3 (Low)	MCS7	2422
	6 (Mid)	MCS7	2437
	9 (High)	MCS7	2452

2.3 Conducted Test setup

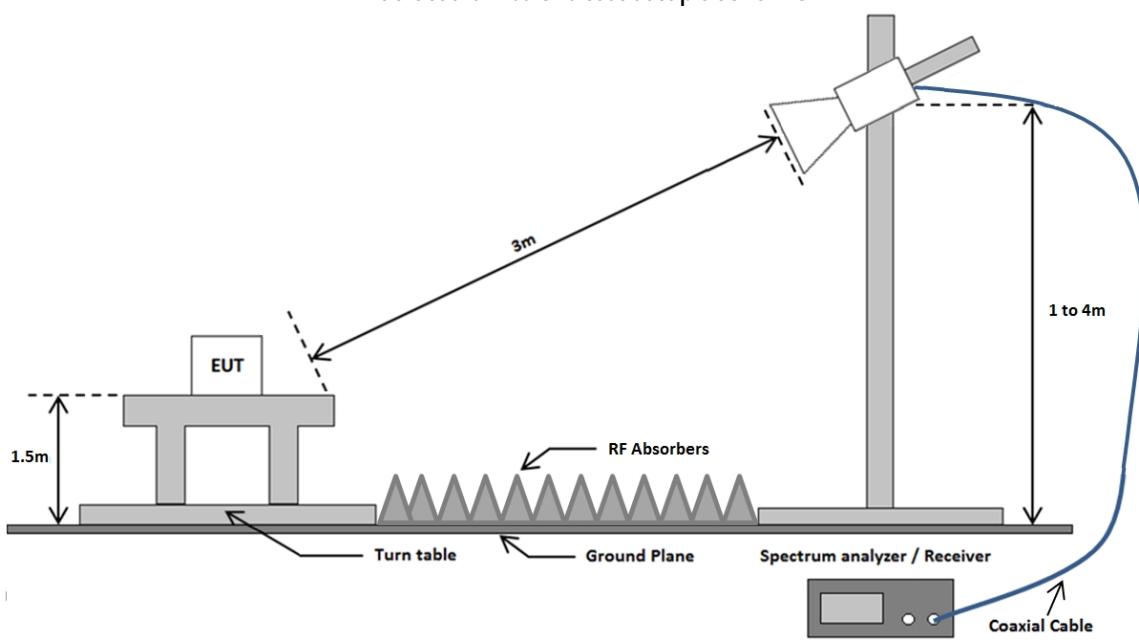


2.4 Radiated Test setup

Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



2.5 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
Spectrum Analyser	Rohde & Schwarz	FSV40	TE01269	3.1, 3.2, 3.3, 3.4, 3.5, 3.7
Signal Generator	Hewlett & Packard	83650b	TE00487	3.1, 3.2, 3.3, 3.4, 3.5, 3.7
Spectrum Analyser	Rohde & Schwarz	FSP40	TE11125	3.6
EMI Receiver	Rohde & Schwarz	ESCI	TE11124	3.6
Biconilog Antenna	Chase	CBL6112A	TE00967	3.6
Horn Antenna	EMCO The Electro – Mechanics Co	3115	TE00531	3.6
Standard gain Antenna	Flann Microwave	20240-25	TE00818	3.6
Pre-amplifier	Miteq	AFS42-041001800-29- OP-42	TE11132	3.6
Pre-amplifier	Miteq	JF4-18004000-30-8P-A1	TE11131	3.6
Semi Anechoic Room	Comtest Engineering BV	--	TE00861	3.6
High pass filter	Wainwright instruments	WHKX7.0/18G-8SS	TE01141	3.6
High pass filter	Wainwright instruments	WHk3.0/18G-10EF	TE01140	3.6

2.6 Explanation of the Measurement results for all conducted test items

The path loss between the EUT and the spectrum analyser for the frequency range of 30 MHz to 40 GHz has been measured and stored in the transducer table of the spectrum analyser. This transducer table is used for level offset of the spectrum analyser. With this level offset the spectrum analysers reading will be exactly the RF output.

2.7 Sample calculations

dB μ V/m to dBm.

$$E(\text{dB}\mu\text{V}/\text{m}) = \text{EIRP}(\text{dBm}) + 95.2$$

3 Test results

3.1 6dB bandwidth Measurement

3.1.1 Limit

The minimum 6 dB Bandwidth shall be at least 500 kHz.

3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.1.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.1.4 Test procedure

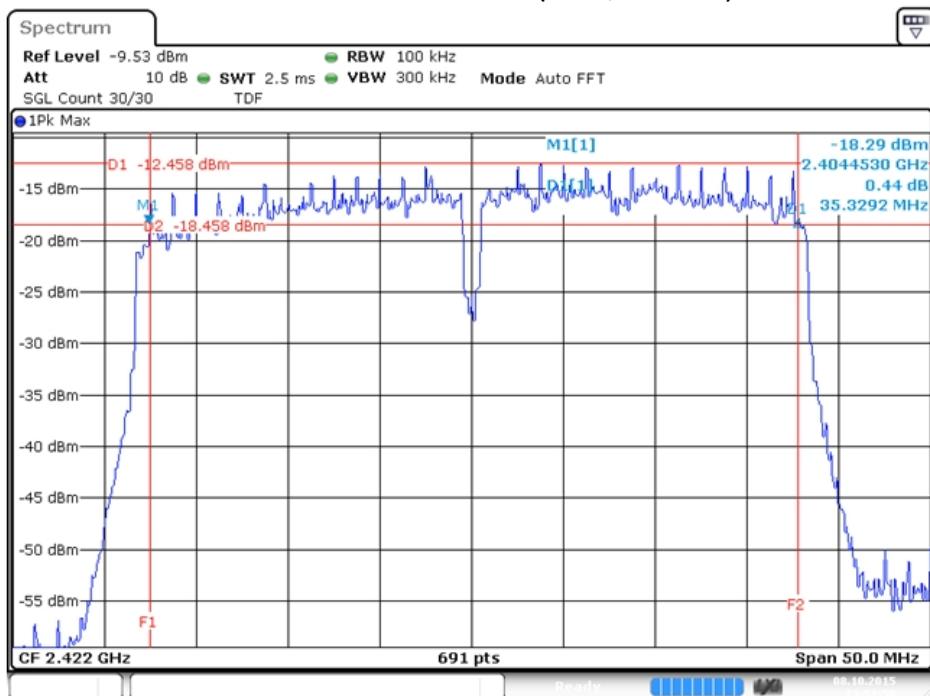
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r04.
2. The RF output of EUT was connected to the spectrum analyser by RF cable and attenuator.
3. The measurement results are compensated with the path loss of the test setup. This path loss is stored within the transducer table of the Spectrum analyser.
4. Measurement is made with the following Spectrum analyser settings:
 - RBW =100 kHz.
 - VBW = 3xRBW = 300 kHz.
5. The measurement results are recorded in the test report.

3.1.5 Test results of the 6 dB bandwidth Measurement

Technology Std.	Channel	Frequency (MHz)	Data rate	6dB bandwidth (MHz)
IEEE 802.11n (HT40)	3	2422	MCS7	35.329
IEEE 802.11n (HT40)	6	2437	MCS7	35.032
IEEE 802.11n (HT40)	9	2452	MCS7	35.691
Uncertainty	± 88.2 kHz			

3.1.6 Plots of the 6 dB bandwidth Measurement

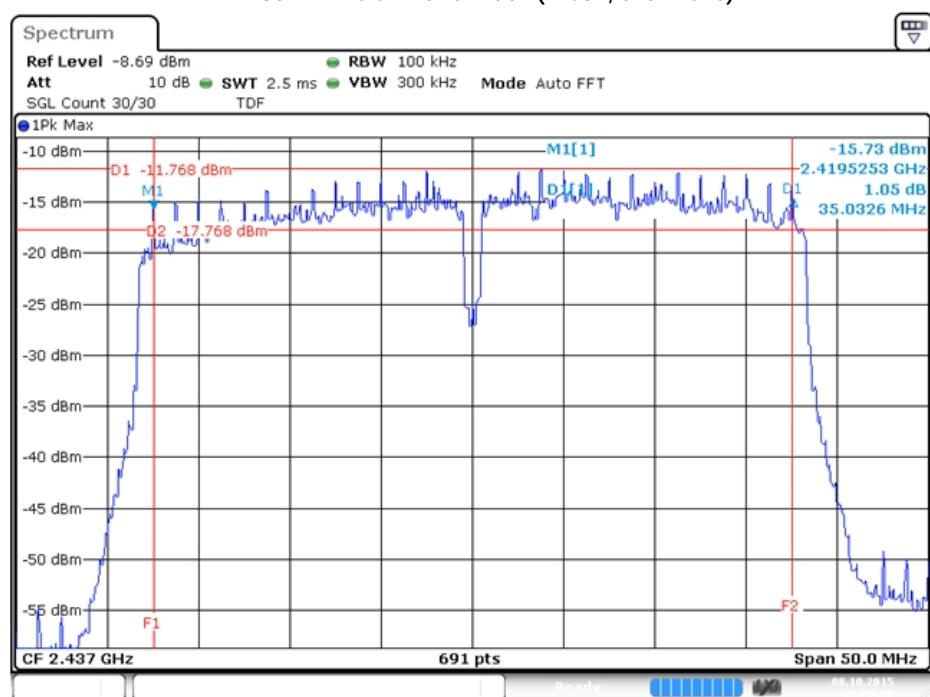
IEEE 802.11n 6 dB Bandwidth (MCS7, channel 3)



IEEE802_11n_MCS7_40, channel: 3 : 6dB BW measurement

Date: 8.OCT.2015 13:52:00

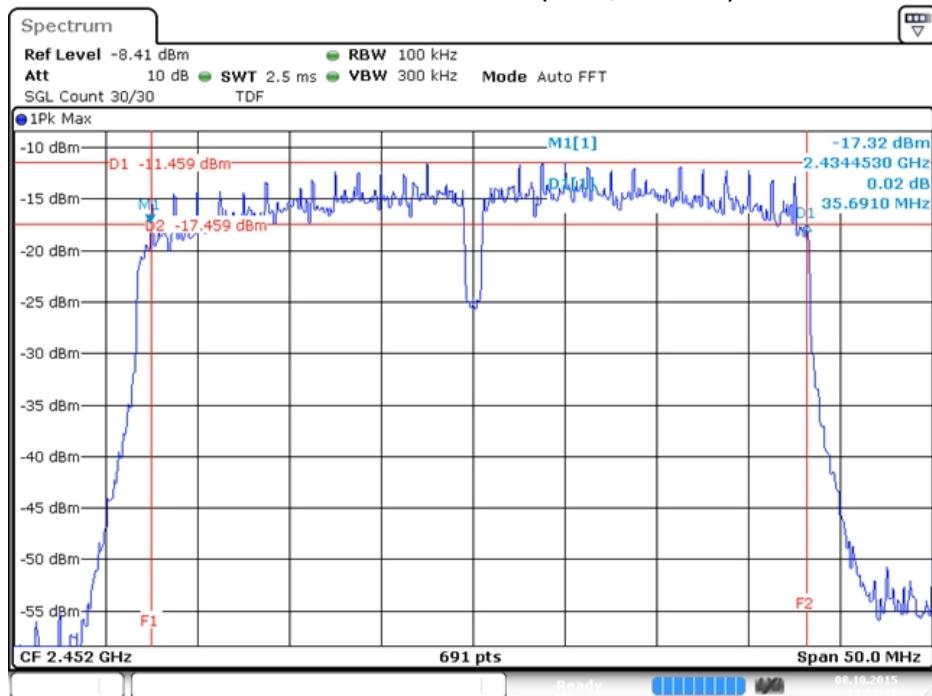
IEEE 802.11n 6 dB Bandwidth (MCS7, channel 6)



IEEE802_11n_MCS7_40, channel: 6 : 6dB BW measurement

Date: 8.OCT.2015 13:52:36

IEEE 802.11n 6 dB Bandwidth (MCS7, channel 9)



IEEE802_11n_MCS7_40, channel: 9 : 6dB BW measurement

Date: 8.OCT.2015 13:53:12

3.2 Output Power Measurement

3.2.1 Limit

For systems using digital modulation in the 2400-2483.5 MHz, the limit for the peak output power is 30 dBm. If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point to point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.2.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.2.4 Test procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r04.
2. The duty cycle is measured in order to determine the measurement method.
3. The RF output of EUT was connected to the spectrum analyser by RF cable and attenuator.
4. The measurement results are compensated with the path loss of the test setup. This path loss is stored within the transducer table of the Spectrum analyser.
5. The measurement results are recorded in the test report.

3.2.5 Test results of Output Power Measurement

Average method

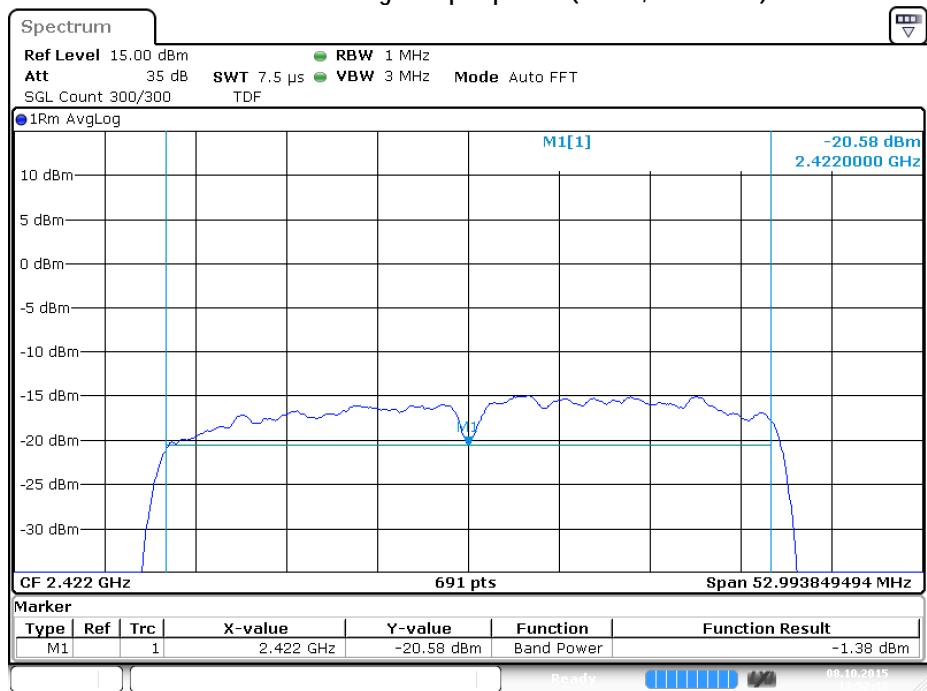
Technology Std.	Channels	Frequency (MHz)	Data rate	Average output power (dBm)
IEEE 802.11n (HT40)	3	2422	MCS7	-1.38
IEEE 802.11n (HT40)	6	2437	MCS7	-0.86
IEEE 802.11n (HT40)	9	2452	MCS7	-0.43
Uncertainty	± 1.78 dB			

Duty cycle

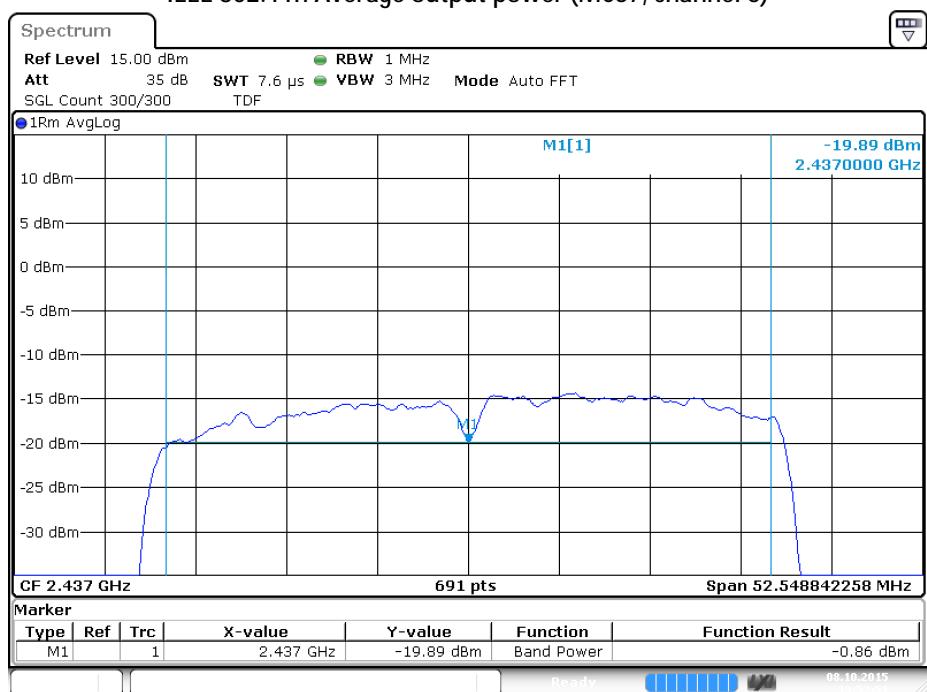
Technology Std.	Channels	Frequency (MHz)	Data rate	Duty cycle (%)
IEEE 802.11n (HT40)	3	2422	MCS7	85.71
IEEE 802.11n (HT40)	6	2437	MCS7	85.71
IEEE 802.11n (HT40)	9	2452	MCS7	85.71

3.2.6 Plots of the Output Power Measurement

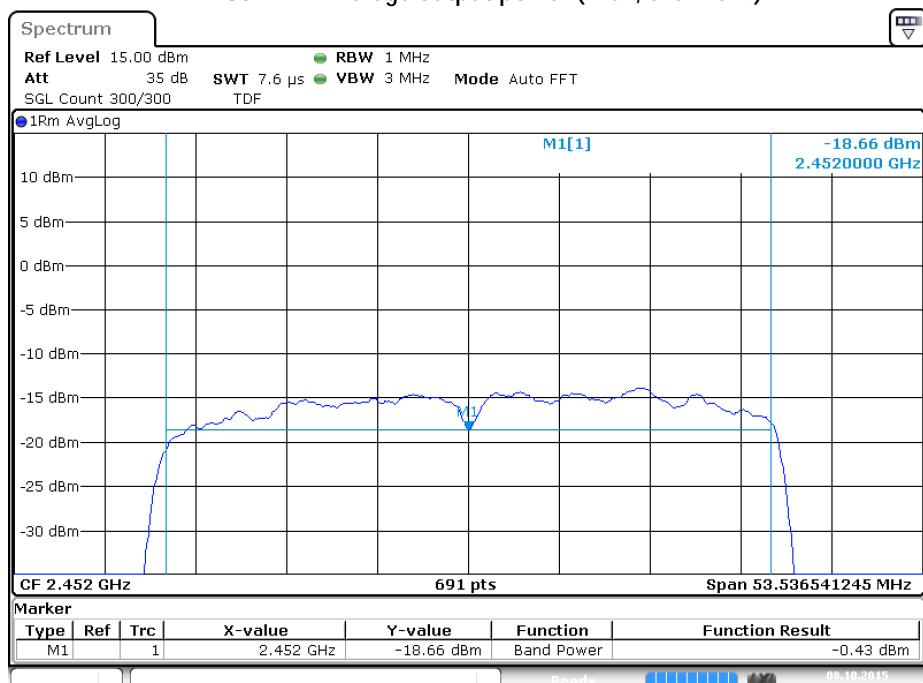
IEEE 802.11n Average output power (MCS7, channel 3)



IEEE 802.11n Average output power (MCS7, channel 6)



IEEE 802.11n Average output power (MC7, channel 9)



IEEE802_11n_MCS7_40, channel: 9 : Maximum conducted output power

Date: 8.OCT.2015 13:53:27

3.3 Power Spectral Density

3.3.1 Limit

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.3.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.3.4 Test procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r04.
2. The RF output of EUT was connected to the spectrum analyser by RF cable and attenuator.
3. The measurement results are compensated with the path loss of the test setup. This path loss is stored within the transducer table of the Spectrum analyser.
4. The EUT is configured by use of the build-in software application provided by the Device manufacturer.
5. The EUT is set to transmit continuously on the maximum power setting.
6. Measurement is made with the following Spectrum analyser settings:
 - RBW =100 kHz.
 - VBW = 300 kHz which is equal or greater than 3xRBW.
 - Detector = Peak.
 - Sweep time = Auto couple.
 - Trace mode = Max hold, Allow the trace to fully stabilize.
 - Using the marker function of the spectrum analyser to determine the maximum power level.
7. The measurement results are recorded in the test report.

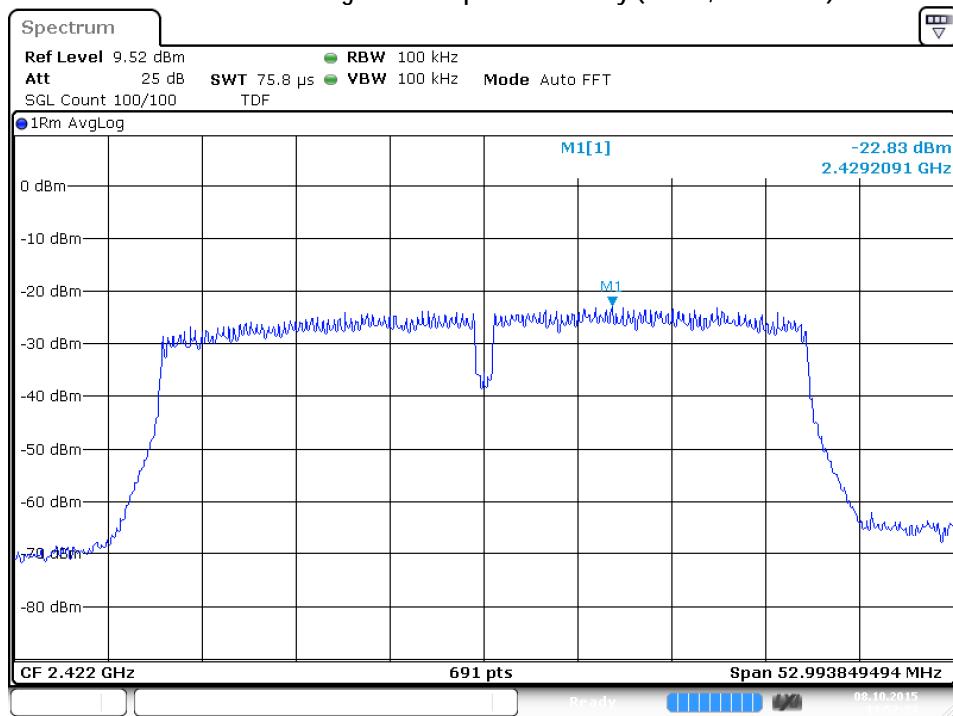
3.3.5 Test results of Power Spectral Density Measurement

Average method

Technology Std.	Channels	Frequency (MHz)	Data rate	PSD/100 kHz (dBm)	PSD/3 kHz (dBm)
IEEE 802.11n (HT40)	3	2422	MCS7	-22.83	-39.47
IEEE 802.11n (HT40)	6	2437	MCS7	-22.10	-39,09
IEEE 802.11n (HT40)	9	2452	MCS7	-22.02	-38.66
Uncertainty	± 0.63 dB				

3.3.6 Plots of the Power Spectral Density Measurement

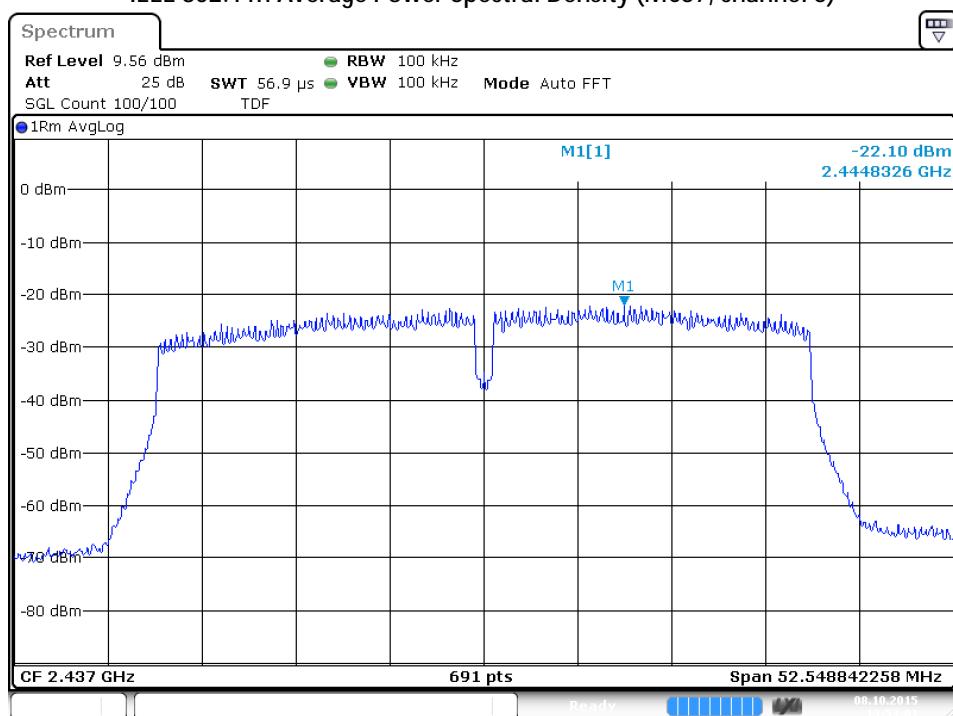
IEEE 802.11n Average Power Spectral Density (MCS7, channel 3)



IEEE802_11n_MCS7_40, channel: 3 : Power spectral density

Date: 8.OCT.2015 13:52:23

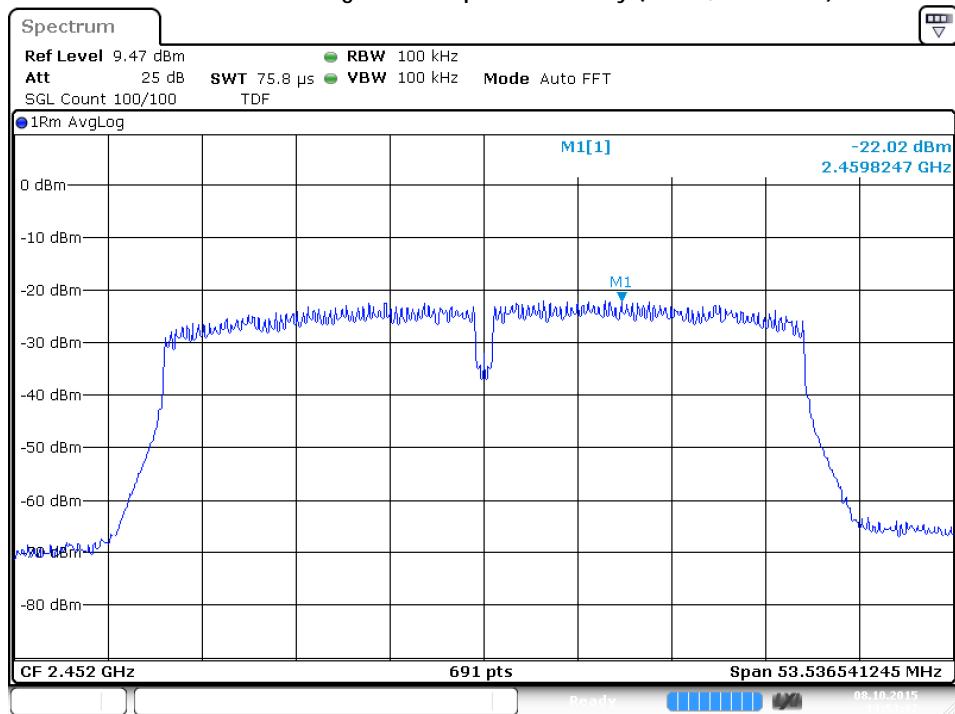
IEEE 802.11n Average Power Spectral Density (MCS7, channel 6)



IEEE802_11n_MCS7_40, channel: 6 : Power spectral density

Date: 8.OCT.2015 13:53:01

IEEE 802.11n Average Power Spectral Density (MCS7, channel 9)



IEEE802_11n_MCS7_40, channel: 9 : Power spectral density

Date: 8.OCT.2015 13:53:37

3.4 99% Occupied Bandwidth

3.4.1 Limit

According to FCC part 2.1049(h).

3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.4.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.4.4 Test procedure

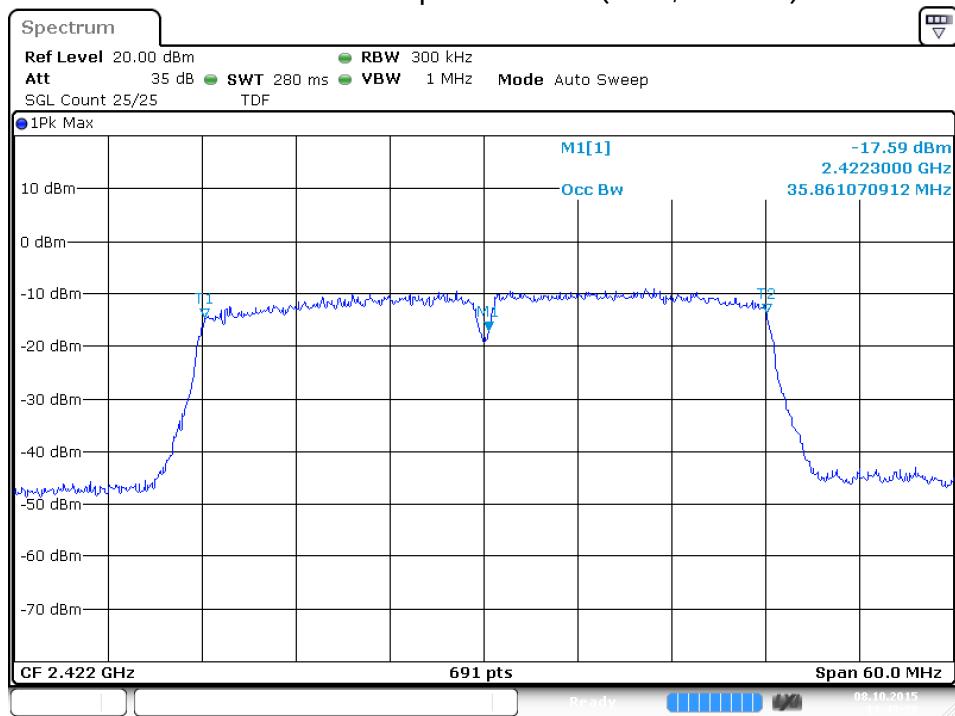
- 1 The RF output of EUT was connected to the spectrum analyser by RF cable and attenuator.
- 2 The measurement results are compensated with the path loss of the test setup. This path loss is stored within the transducer table of the Spectrum analyser.
- 3 The EUT is configured by use of the build-in software application provided by the Device manufacturer.
- 4 Measurement is made with the following Spectrum analyser settings:
 - Centre frequency to the nominal EUT channel centre frequency.
 - Span = 1.5 times to 0.5 times the Occupied Bandwidth.
 - VBW $\geq 3 \times$ RBW.
 - Video averaging is not permitted. Where practical detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode(until the trace stabilizes) shall be used.
5. The measurement results are recorded in the test report.

3.4.5 Test results of the 99% Occupied Bandwidth Measurement

Technology Std.	Channels	Frequency (MHz)	Data rate	99% Occupied Bandwidth (MHz)
IEEE 802.11n (HT40)	3	2422	MCS7	35.861
IEEE 802.11n (HT40)	6	2437	MCS7	35.774
IEEE 802.11n (HT40)	9	2452	MCS7	35.774
Uncertainty	± 18.2 kHz			

3.4.6 Plots of the 99% Occupied Bandwidth Measurement

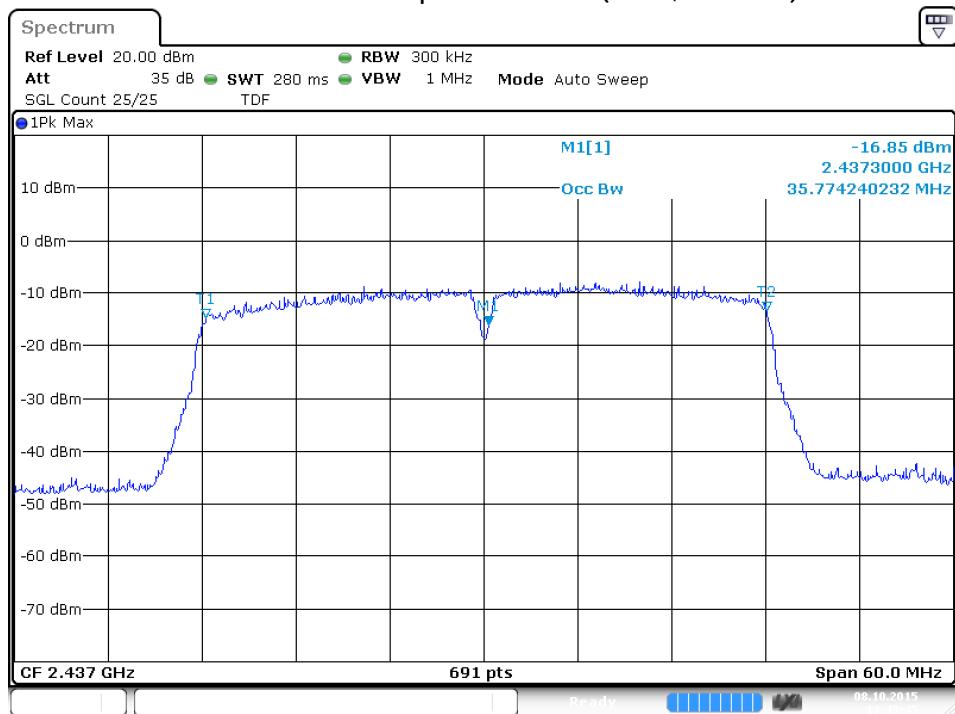
IEEE 802.11n 99% Occupied Bandwidth (MCS7, channel 3)



IEEE802_11 Channel: 3 : Measure Occupied Bandwidth

Date: 8.OCT.2015 13:43:28

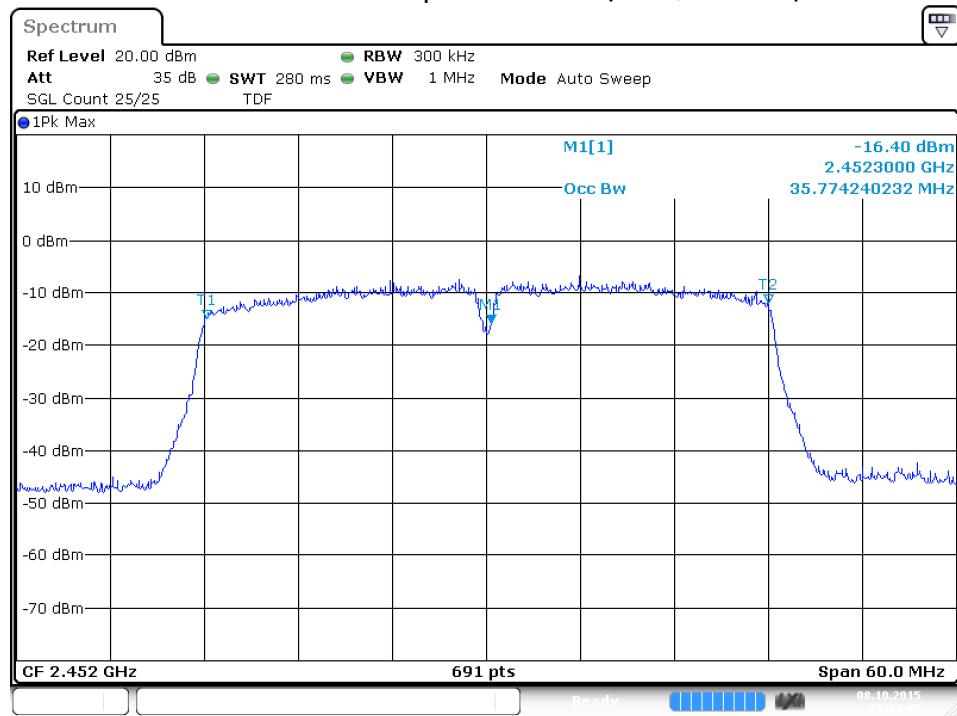
IEEE 802.11n 99% Occupied Bandwidth (MCS7, channel 6)



IEEE802_11 Channel: 6 : Measure Occupied Bandwidth

Date: 8.OCT.2015 13:43:45

IEEE 802.11n 99% Occupied Bandwidth (MCS7, channel 9)



IEEE802_11 Channel: 9 : Measure Occupied Bandwidth

Date: 8.OCT.2015 13:44:02

3.5 Conducted Spurious Emissions Measurement

3.5.1 Limit

In any 100 kHz bandwidth outside the operating frequency band, the RF power 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 a RF conducted or a radiated measurement.

3.5.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.5.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.5.4 Test procedure

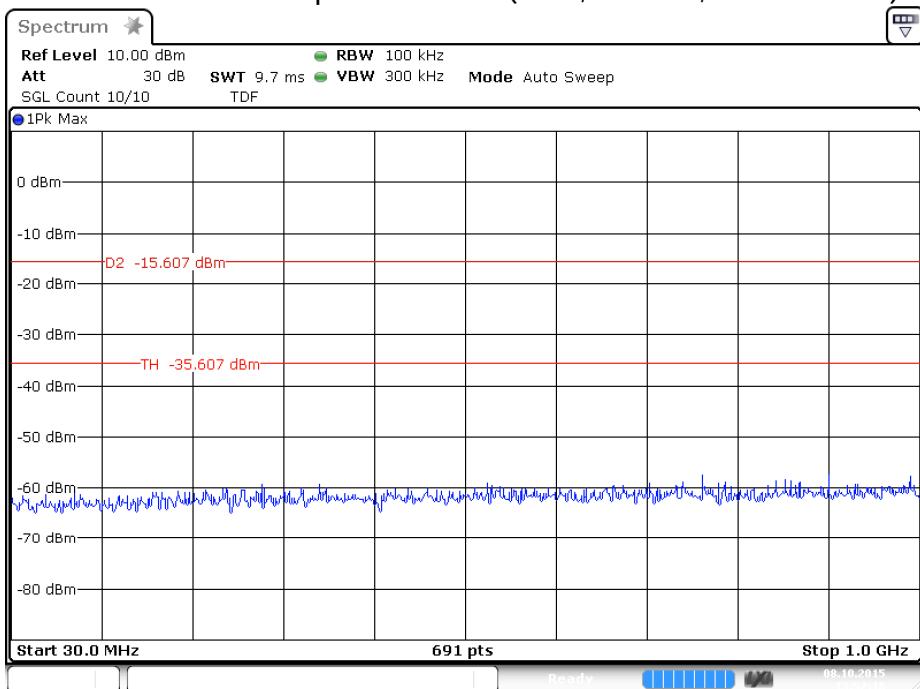
According to FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r04.

3.5.5 Measurement uncertainty

Uncertainty: ± 2.86 dB

3.5.6 Test results and plots of the conducted spurious Emissions

IEEE 802.11n Conducted Spurious Emission (MCS7, channel 3, 30 MHz – 1 GHz)

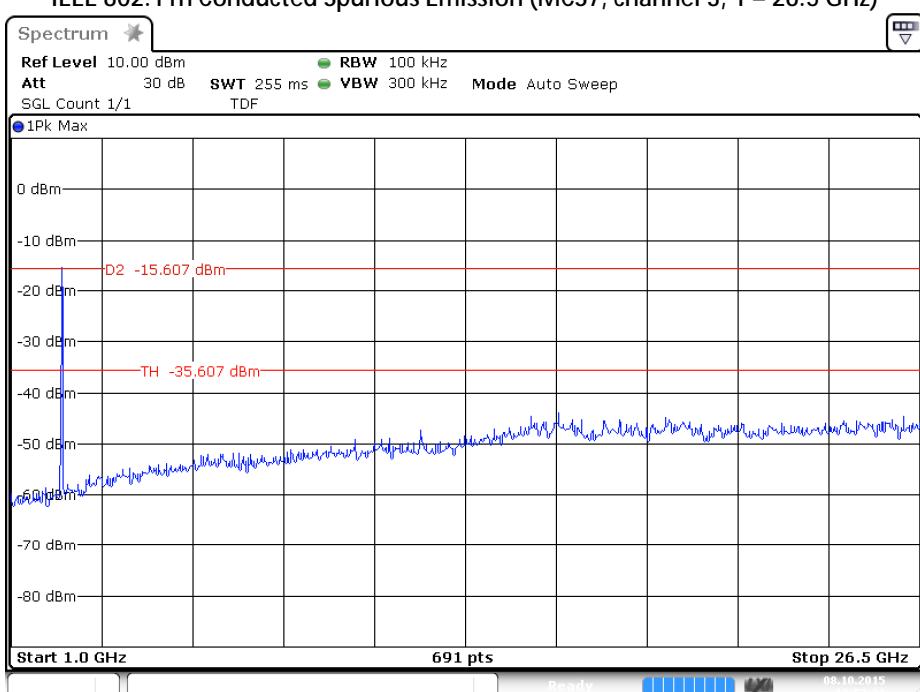


IEEE802_11n_MCS7_40, channel: 3 : Measure Spurious Emission

30M-1GHz

Date: 8.OCT.2015 13:52:18

IEEE 802.11n Conducted Spurious Emission (MCS7, channel 3, 1 – 26.5 GHz)

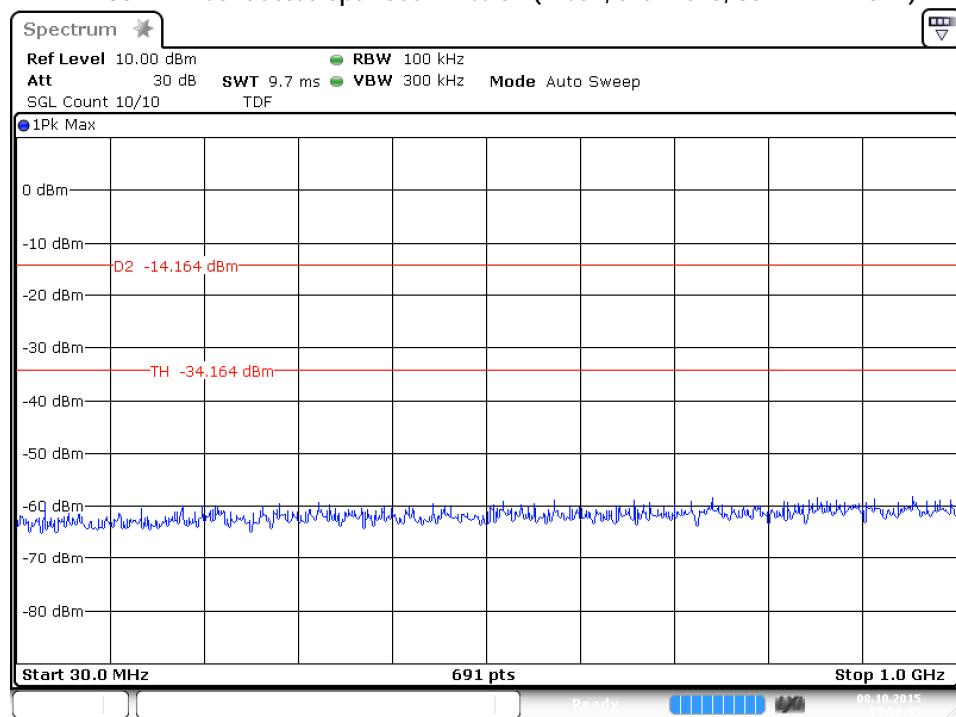


IEEE802_11n_MCS7_40, channel: 3 : Measure Spurious Emission

1-26.5GHz

Date: 8.OCT.2015 13:52:21

IEEE 802.11n Conducted Spurious Emission (MCS7, channel 6, 30 MHz – 1 GHz)

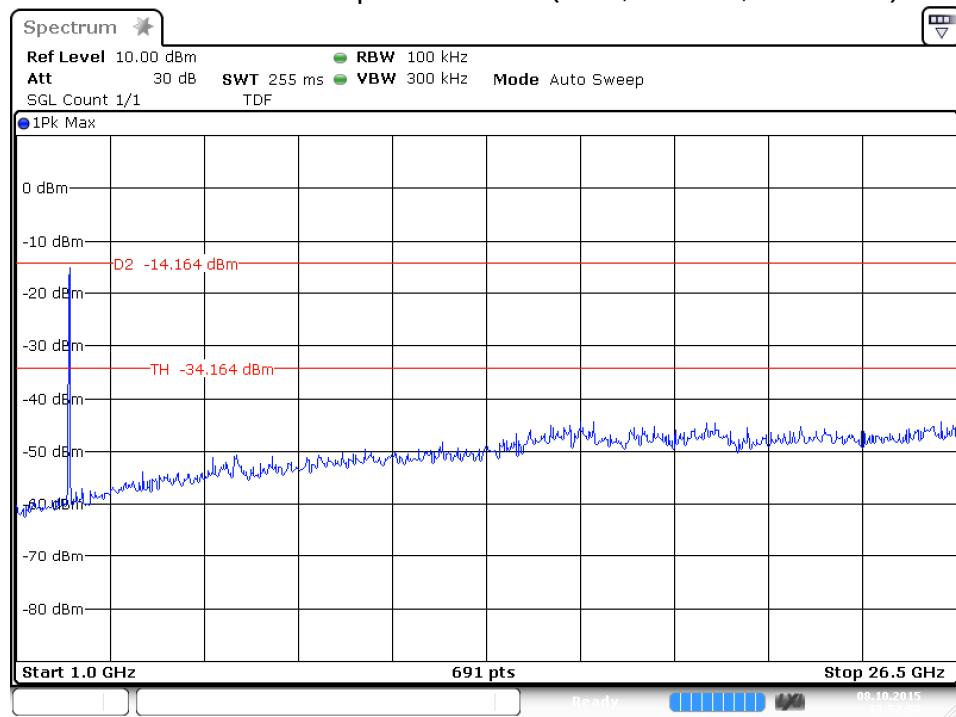


IEEE802_11n_MCS7_40, channel: 6 : Measure Spurious Emission

30M-1GHz

Date: 8.OCT.2015 13:52:56

IEEE 802.11n Conducted Spurious Emission (MCS7, channel 6, 1 – 26.5 GHz)

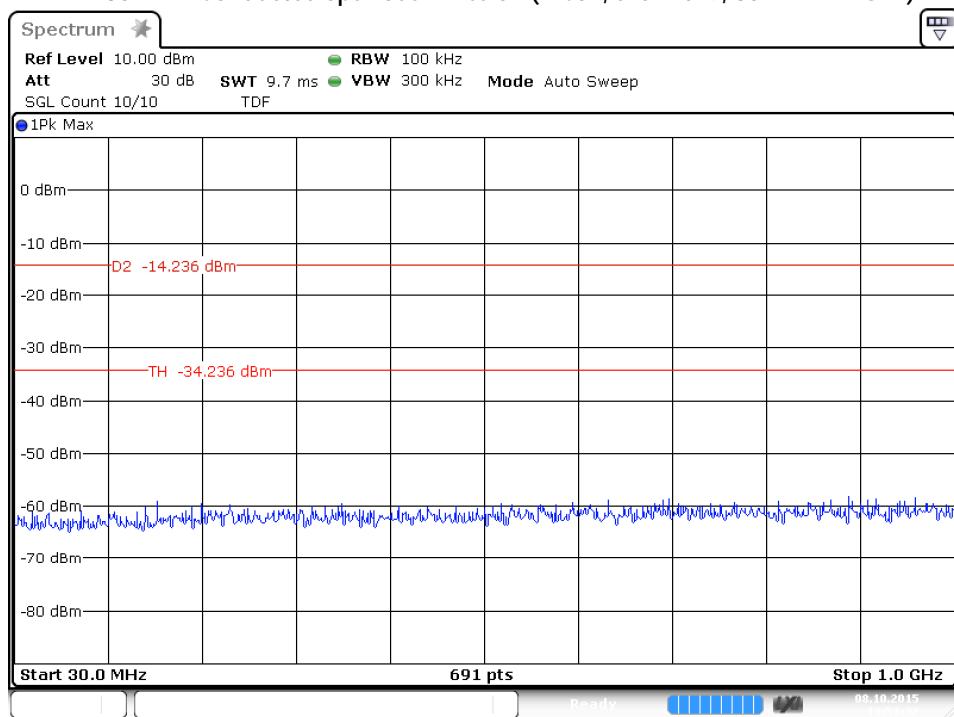


IEEE802_11n_MCS7_40, channel: 6 : Measure Spurious Emission

1-26.5GHz

Date: 8.OCT.2015 13:52:59

IEEE 802.11n Conducted Spurious Emission (MCS7, channel 9, 30 MHz – 1 GHz)

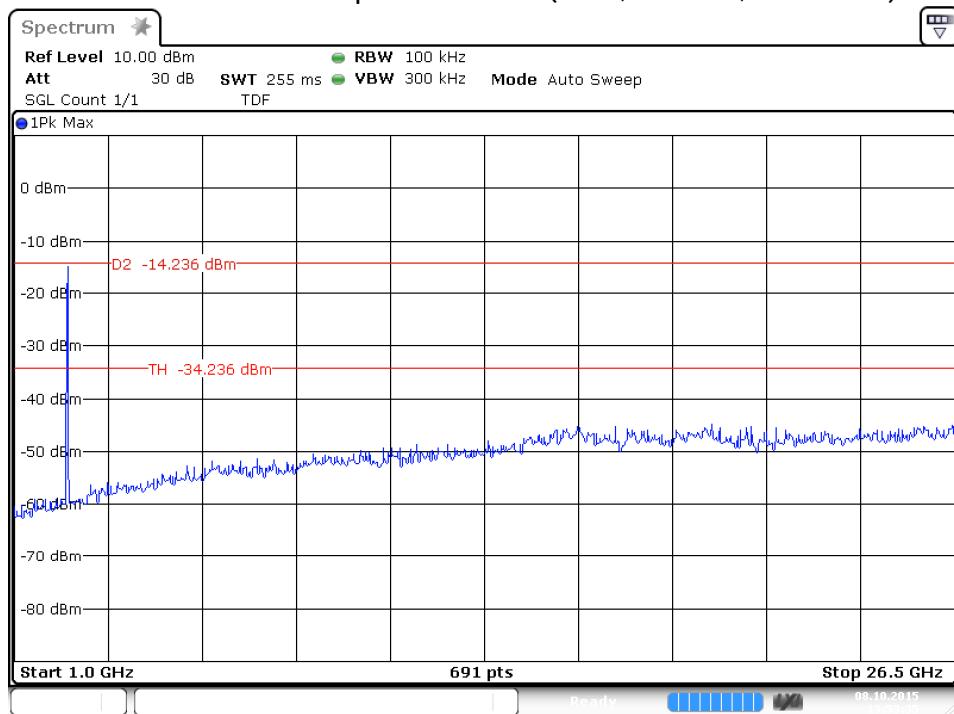


IEEE802_11n_MCS7_40, channel: 9 : Measure Spurious Emission

30M-1GHz

Date: 8.OCT.2015 13:53:32

IEEE 802.11n Conducted Spurious Emission (MCS7, channel 9, 1 – 26.5 GHz)



IEEE802_11n_MCS7_40, channel: 9 : Measure Spurious Emission

1-26.5GHz

Date: 8.OCT.2015 13:53:35

3.6 Radiated Spurious Emissions Measurement (cabinet)

3.6.1 Limit

In any 100 kHz bandwidth outside the operating frequency band, the RF power 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 a RF conducted or a radiated measurement.

3.6.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.6.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.6.4 Test procedure

According to FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r04

3.6.5 Measurement Uncertainty

Measurement uncertainty Radiated Emissions below 1 GHz

Horizontal polarization	
30 – 200 MHz	4.5 dB
200 – 1000 MHz	3.6 dB
Vertical polarization	
30 – 200 MHz	5.4 dB
200 – 1000 MHz	4.6 dB

Measurement uncertainty Radiated emissions above 1 GHz

< 2 GHz	+ 1.7/- 1.9 dB
≥ 2 GHz	+2.4/-2.7 dB

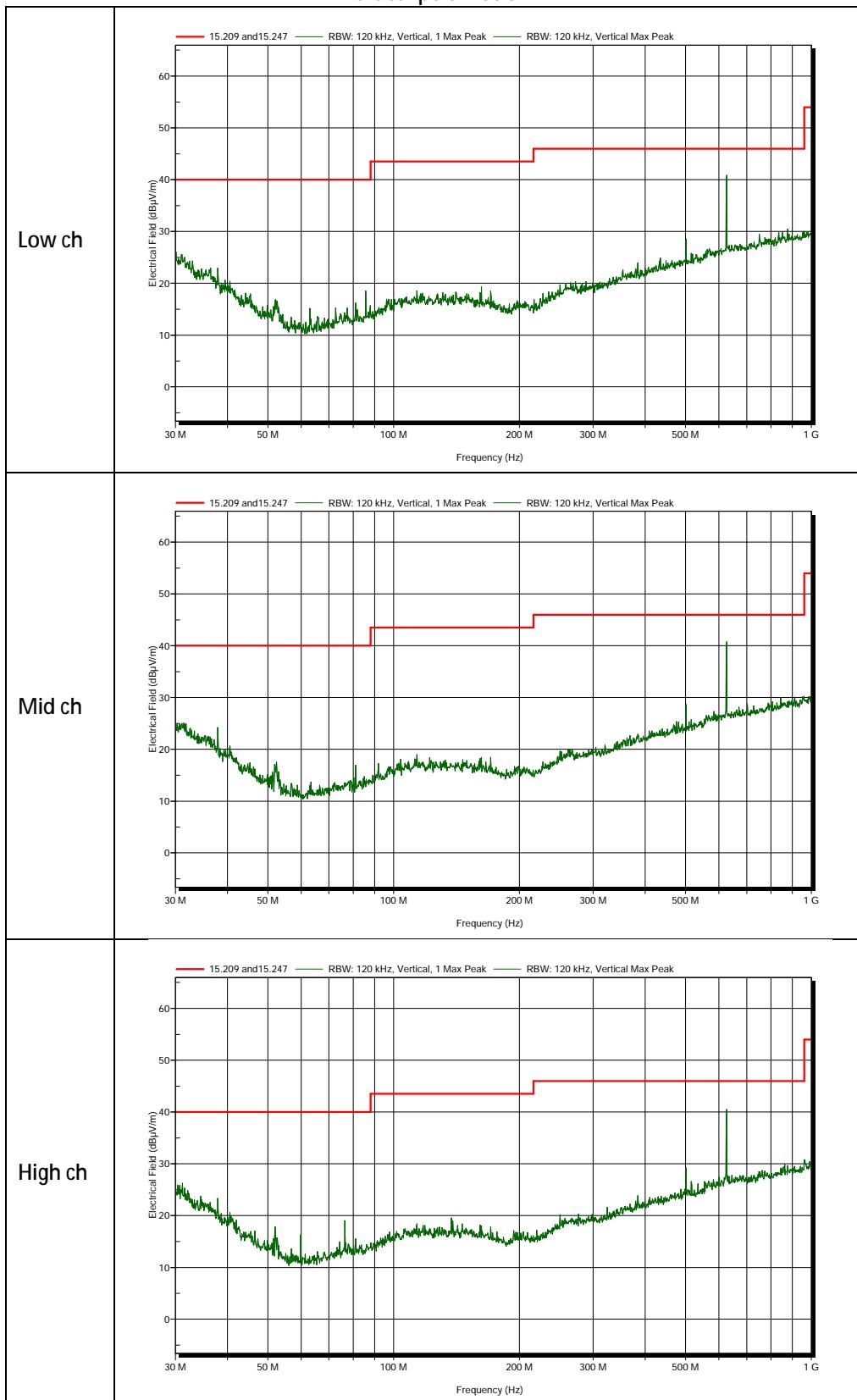
3.6.6 Notes:

- For the frequency range(s) of 1 to 18 GHz and 18 to 26 GHz, the average trace is represented by the (dark)red colour and the peak trace is represented by the green colour.
- For the frequency range(s) of 1 to 18 GHz a high pas filter (TE01140) was used to make sure that the pre-amplifier was not overdriven.
- For the frequency range(s) of 18 to 26 GHz a high pass filter (TE01141) was used to make sure that the pre-amplifier was not overdriven.

3.6.7 Plots of the Radiated Spurious Emissions

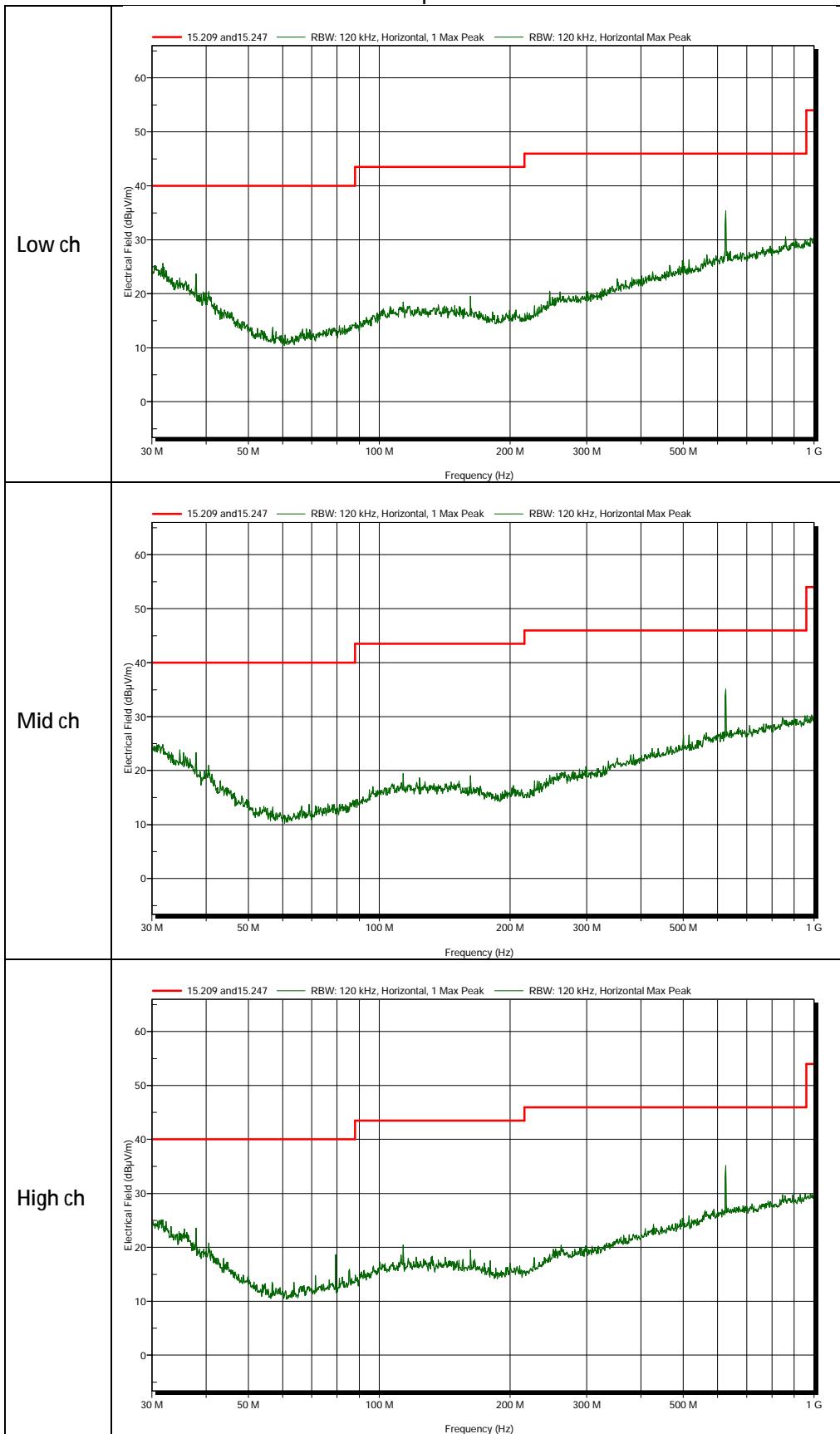
30 MHz to 1 GHz

Vertical polarization



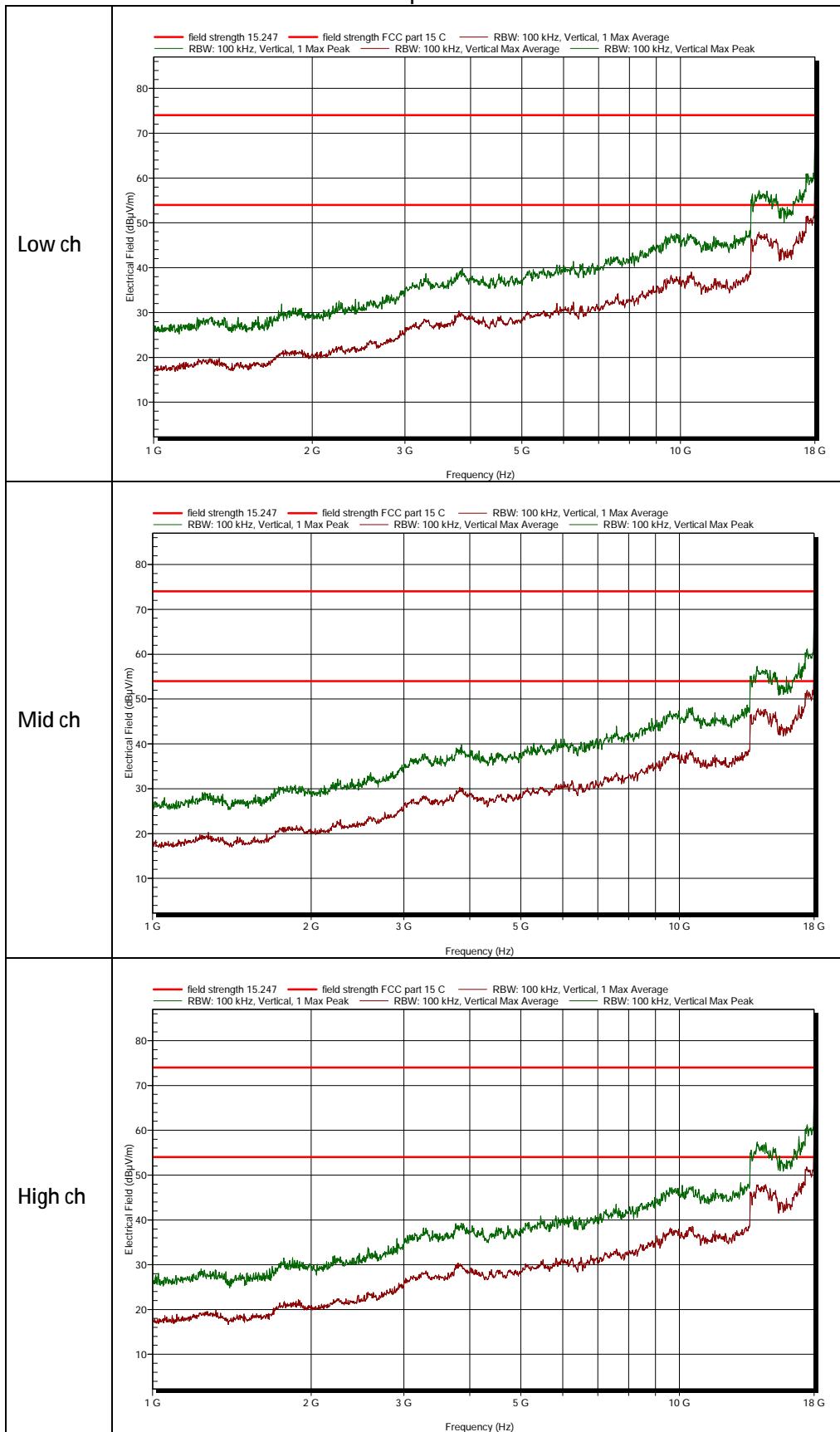
30 MHz to 1 GHz

Horizontal polarization



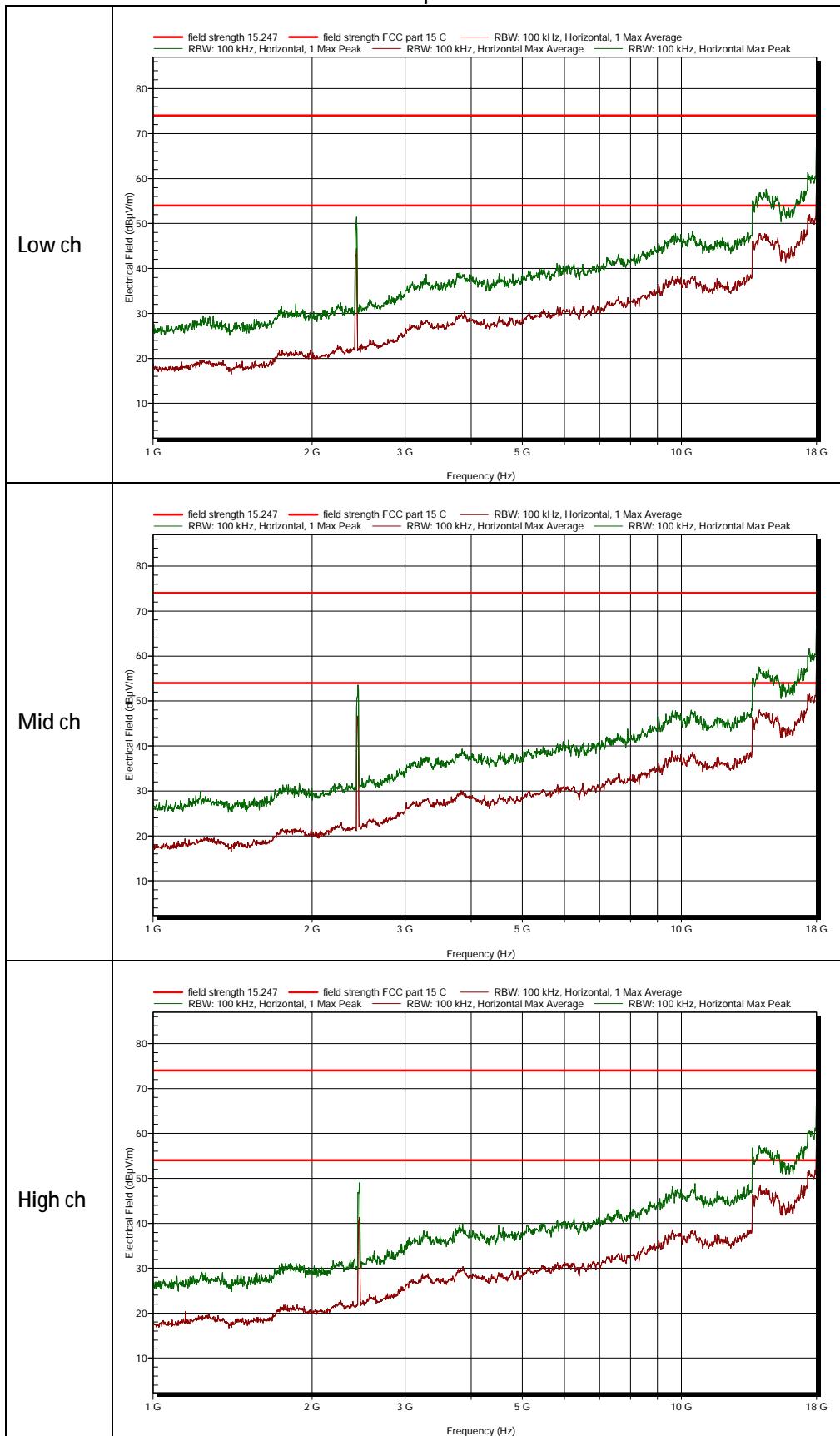
1 GHz to 18 GHz

Vertical polarization



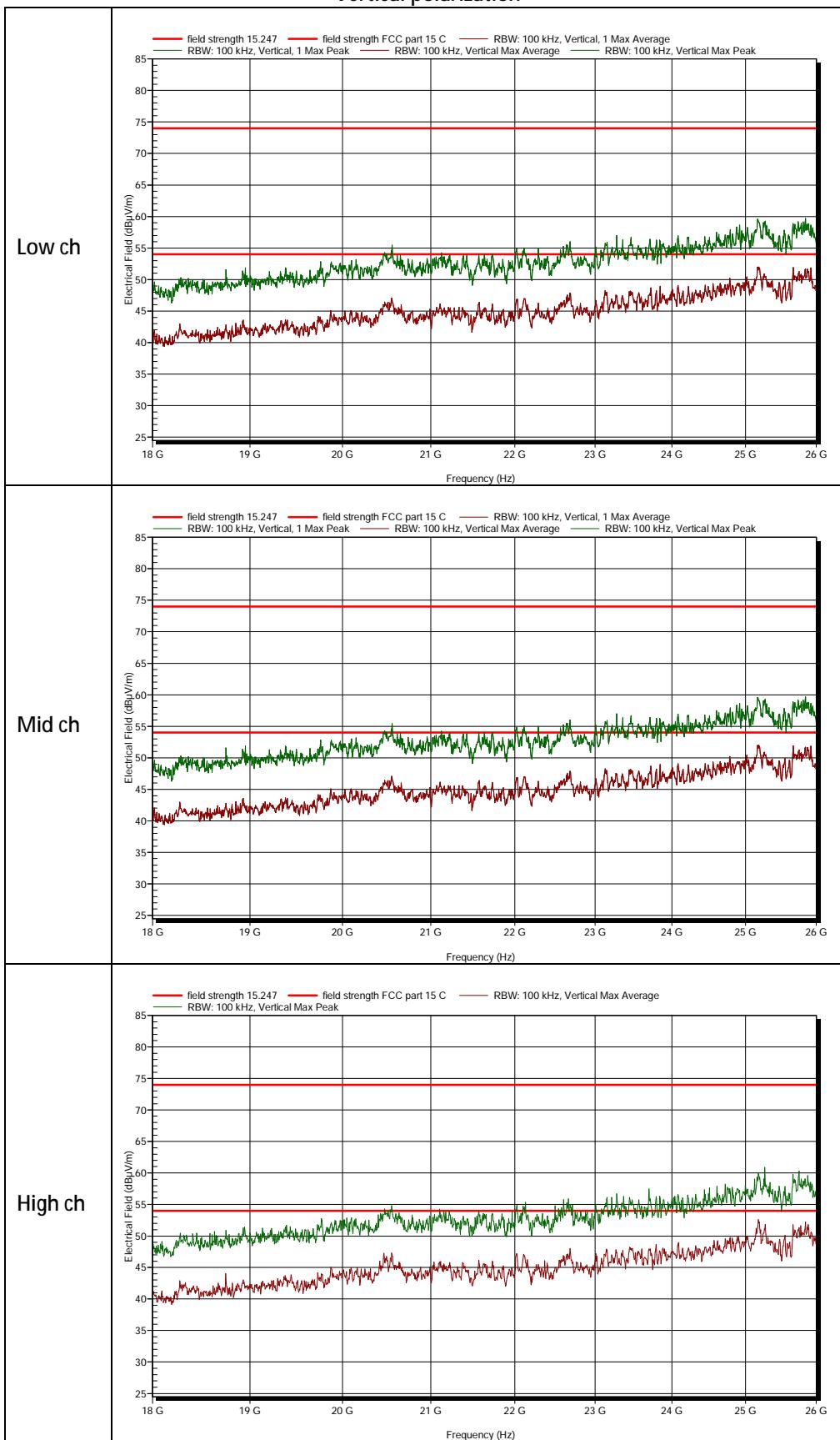
1 GHz to 18 GHz

Horizontal polarization



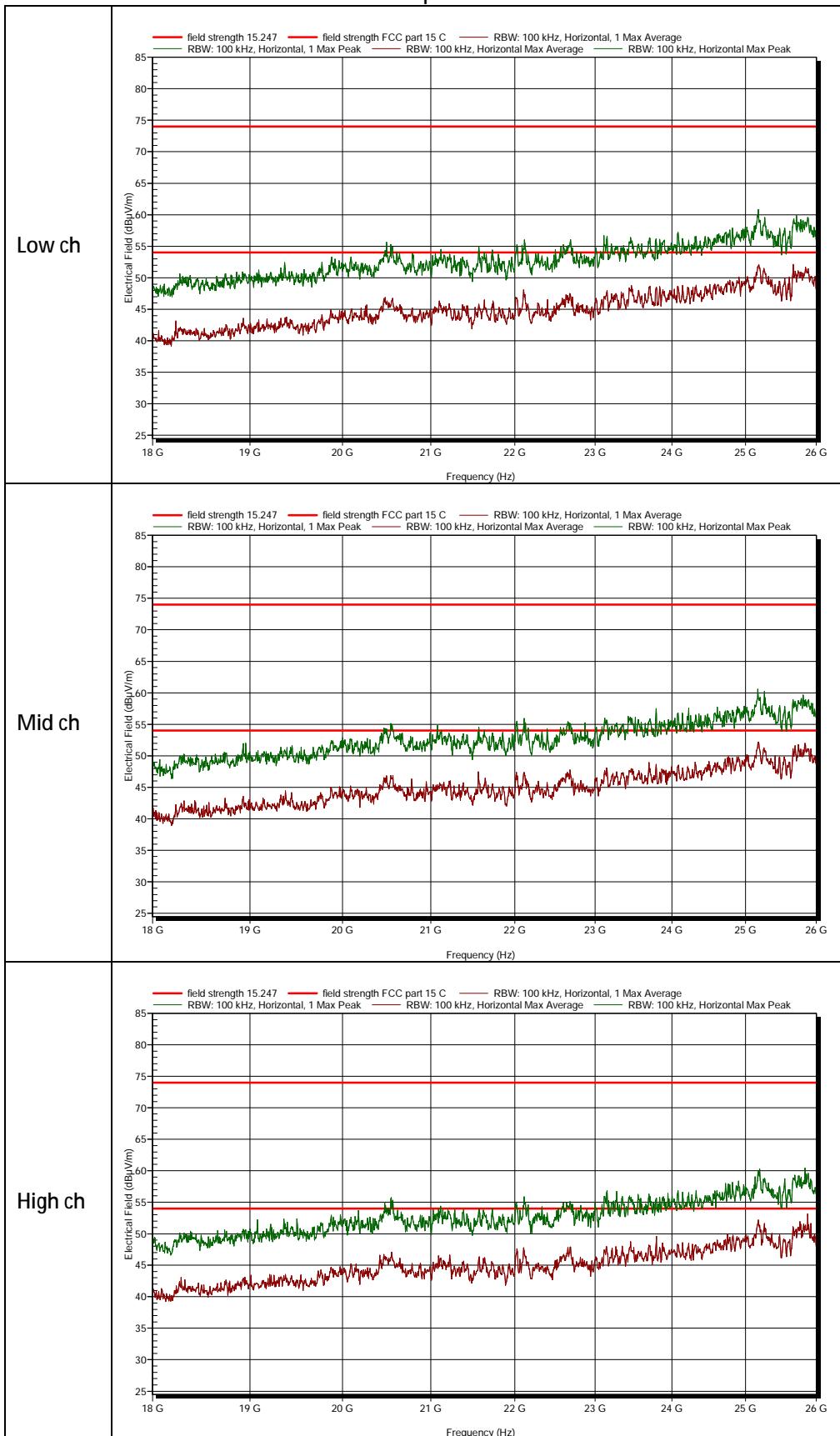
18 GHz to 26 GHz

Vertical polarization



18 GHz to 26 GHz

Horizontal polarization



3.7 Conducted Band edge Measurement

3.7.1 Limit

In any 100 kHz bandwidth outside the operating frequency band, the RF power 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 a RF conducted or a radiated measurement.

3.7.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.7.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.7.4 Test procedure

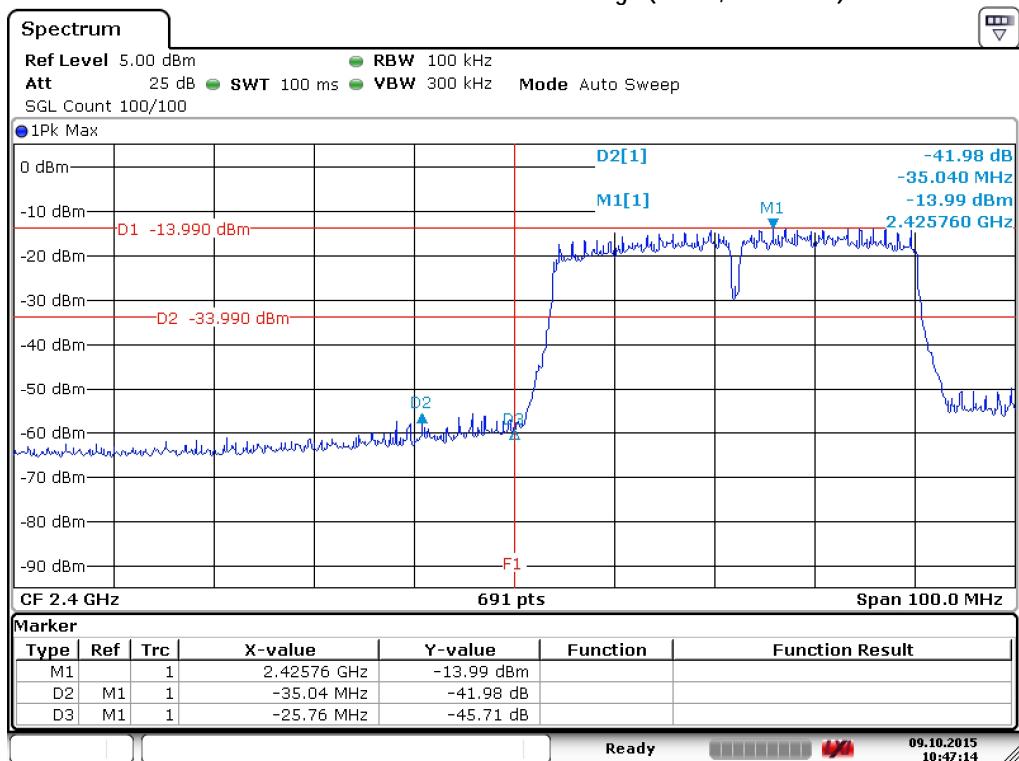
According to FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r04

3.7.5 Measurement Uncertainty

Uncertainty: ± 2.86 dB

3.7.6 Plots of the Conducted Band Edges

IEEE 802.11n Conducted Lower band edge (MCS7, channel 3)



IEEE 802.11n Conducted Upper band edge (MCS7, channel 9)

