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TEST REPORT

Report Number: 16061281HKG-001

Application
for
Original Grant of 47 CFR Part 15 Certification

4-Port Ethernet Router

FCC ID: EW780-0554-00

Prepared and Checked by:

Signed On File
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Location: Intertek Testing Services Hong Kong Ltd.

Koo Wai Ip
Assistant Supervisor
August 18, 2016

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GENERAL INFORMATION

Applicant Name:	VTech Telecommunications Ltd.
Applicant Address:	23/F., Tai Ping Industrial Centre, Block 1, 57 Ting Kok Road, Tai Po, Hong Kong.
FCC Specification Standard:	FCC Part 15, October 1, 2014 Edition
FCC ID:	EW780-0554-00
FCC Model(s):	VNT832
Type of EUT:	Spread Spectrum Transmitter
Description of EUT:	4-Port Ethernet Router
Serial Number:	N/A
Sample Receipt Date:	June 20, 2016
Date of Test:	August 8, 2016
Report Date:	August 18, 2016
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%

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EXHIBIT 1
TEST RESULTS SUMMARY & STATEMENT OF COMPLIANCE

1.0 Test Results Summary & Statement of Compliance

1.1 Summary of Test Results

Test Items	FCC Part 15 Section	Results	Details see section
Antenna Requirement	15.203	Pass	2.1
Max. Conducted Output Power (peak)	15.247(b)(3)&(4)	Pass	4.1
Min. 6dB RF Bandwidth	15.247(a)(2)	Pass	4.2
Max. Power Density (peak)	15.247(e)	Pass	4.3
Out of Band Antenna Conducted Emission	15.247(d)	Pass	4.4
Radiated Emission in Restricted Bands and Spurious Emissions	15.247(d), 15.209 & 15.109	Pass	4.6
AC Power Line Conducted Emission	15.207 & 15.107	Pass	4.7

Note: Pursuant to FCC Part 15 Section 15.215(c), the 20dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over expected variations in temperature and supply voltage were considered.

1.2 Statement of Compliance

The equipment under test is found to be complying with the following standard:

FCC Part 15, October 1, 2014 Edition

EXHIBIT 2
GENERAL DESCRIPTION

2.0 General Description

2.1 Product Description

The VNT832 is a 4-Port Ethernet Router.

The Equipment Under Test (EUT) operates at frequency range of 2412MHz to 2462MHz with 11 channels. For 802.11g mode, it operates at frequency range of 2412.000MHz to 2462.000MHz with 11 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can be up to 54Mbps. For 802.11n (with 20MHz bandwidth) mode, it operates at frequency range of 2412.000MHz to 2462.000MHz with 11 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 65Mbps. For 802.11n (with 40MHz bandwidth) mode, it operates at frequency range of 2422.000MHz to 2452.000MHz with 7 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 65Mbps.

It operates at frequency range of The EUT is power by a 100-240VAC to 12VDC 1.0A adaptor.

The antenna(s) used in the EUT is integral, and the test sample is a prototype.
The circuit description is saved with filename: descri.pdf.

2.2 Test Methodology

Both AC power line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (2014). Preliminary radiated scans and all radiated measurements were performed in radiated emission test sites. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application. Antenna port conducted measurements were performed according to ANSI C63.10 (2013), KDB Publication No.558074 D01 v03r05 (08-April-2016) and 662911 D01 Multiple Transmitter Output v02r01 (31-October-2013). All other measurements were made in accordance with the procedures in 47 CFR Part 2.

2.3 Test Facility

The radiated emission test site and antenna port conducted measurement facility used to collect the radiated data and conductive data are at Workshop No. 3, G/F., World-Wide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, N.T., Hong Kong. This test facility and site measurement data have been fully placed on file with the FCC.

2.4 Related Submittal(s) Grants

This is a single application for certification of a transceiver (WiFi portion).

The Certification procedure of PC Connectivity for this transceiver (with FCC ID: EW780-0554-00) is being processed as the same time of this application.

EXHIBIT 3
SYSTEM TEST CONFIGURATION

3.0 System Test Configuration

3.1 Justification

For radiated emissions testing, the equipment under test (EUT) was setup to transmit / receive continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, all cables (if any) were manipulated to produce worst case emissions.

The EUT was powered by a 100-240VAC to 12VDC 1.0A adaptor.

For the measurements, the EUT was attached to a plastic stand if necessary and placed on the wooden turntable. If the base unit attached to peripherals, they were connected and operational (as typical as possible).

The signal was maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization were varied during the search for maximum signal level. The antenna height was varied from 1 to 4 meters. Radiated emissions were taken at three meters unless the signal level was too low for measurement at that distance. If necessary, a pre-amplifier was used and/or the test was conducted at a closer distance.

For any intentional radiator powered by AC power line, measurements of the radiated signal level of the fundamental frequency component of the emission was performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

Radiated emission measurement for transmitter were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Emission that are directly caused by digital circuits in the transmit path and transmitter portion were measured, and the limit are according to FCC Part 15 Section 15.209. Digital circuitries used to control additional functions other than the operation of the transmitter are subject to FCC Part 15 Section 15.109 Limits.

3.1 Justification – Cont'd

Detector function for radiated emissions was in peak mode. Average readings, when required, were taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in section 4.2.3.

Determination of pulse desensitization was made according to *Hewlett Packard Application Note 150-2, Spectrum Analysis... Pulsed RF.* The effective period (Teff) was referred to Exhibit 4.6.3. With the resolution bandwidth 1MHz and spectrum analyzer IF bandwidth 3dB, the pulse desensitization factor was 0dB.

The EUT along with its peripherals were placed on a 1.0m(W)x1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane. The EUT power cord connected to one LISN (Line impedance stabilization network), which provided 50ohm coupling impedance for measuring instrument. Meanwhile, the peripheral or support equipment power cords connected to a separate LISN. The ac powers for all LISNs were obtained from the same power source. The LISN housing, measuring instrument case, reference ground plane, and vertical ground plane were bounded together. The excess power cable between the EUT and the LISN was bundled. Power cords of non-EUT equipment (peripherals) were not bundled. AC power cords of peripheral equipments draped over the rear edge of the table, and routed them down onto the floor of the ac power line conducted emission test site to the second LISN.

All connecting cables of EUT and peripherals were manipulated to find the maximum emission.

Different data rates have been tested. Worst case is reported only.

All relevant operation modes have been tested, and the worst case data is included in this report.

All data rates were tested under normal mode of WiFi. Only the worst-case data is shown in the report for DSSS and OFDM

3.2 EUT Exercising Software

The EUT exercise program (if any) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

3.3 Details of EUT and Description of Accessories

Details of EUT:

An AC adaptor (provided with the unit) was used to power the device. Their description are listed below.

(1) An AC adaptor (100-240VAC to 12VDC 1.0A, Model: CS12N120100FUF) (Supplied by Client)

Description of Accessories:

(1) 5 X LAN cable of 1m in length (Supplied by Intertek)
(2) Notebook (HP Probook 430) (Provided by Intertek)
(3) 1 X 4GB USB flash drive (Provided by Intertek)

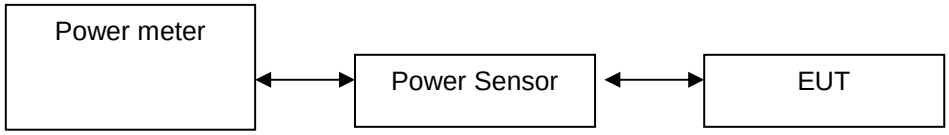
3.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test at a level of confidence of 95% has been considered. The values of the Measurement uncertainty for radiated emission test and RF conducted measurement test are ± 5.3dB and ±0.99dB respectively. The value of the Measurement uncertainty for conducted emission test is ±4.2dB.

Uncertainty and Compliance - Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value.

EXHIBIT 4
TEST RESULTS

4.0 Test Results



4.1 Maximum Conducted (peak) Output Power at Antenna Terminals

The antenna port of the EUT was connected to the input of a power meter.

☒ The antenna power of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to the obtain power at the EUT antenna terminals. The measurement procedure 9.1.2 was used.

☐ The EUT should be configured to transmit continuously (at a minimum duty cycle of 98%) at full power over the measurement duration. The measurement procedure AVG1 was used.

(Antenna 0) IEEE 802.11b (DSSS, 1 Mbps) Antenna Gain = 1.5 dBi		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2412	25.5	354.813
Middle Channel: 2437	25.1	323.594
High Channel: 2462	24.8	301.995

(Antenna 1) IEEE 802.11b (DSSS, 1 Mbps) Antenna Gain = 1.5 dBi		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2412	24.3	269.154
Middle Channel: 2437	24.1	257.040
High Channel: 2462	23.8	239.883

(Antenna 0) IEEE 802.11g (OFDM, 6 Mbps) Antenna Gain = 1.5 dBi		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2412	25.6	363.078
Middle Channel: 2437	25.5	354.813
High Channel: 2462	25.2	331.131

(Antenna 1) IEEE 802.11g (OFDM, 6 Mbps) Antenna Gain = 1.5 dBi		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2412	25.5	354.813
Middle Channel: 2437	25.5	354.813
High Channel: 2462	25.3	338.844

(Antenna 0) IEEE 802.11n (20MHz) (OFDM, MCS0) Antenna Gain = 1.5 dBi		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2412	25.7	371.535
Middle Channel: 2437	25.5	354.813
High Channel: 2462	25.3	338.844

(Antenna 1) IEEE 802.11n (20MHz) (OFDM, MCS0) Antenna Gain = 1.5 dBi		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2412	25.7	371.535
Middle Channel: 2437	25.6	363.078
High Channel: 2462	25.4	346.737

IEEE 802.11n (20MHz) (OFDM, MCS0)			
Frequency (MHz)	Output in dBm		
	Antenna 0	Antenna 1	Antenna 0 + Antenna 1
Low Channel: 2412	25.7	25.7	28.7
Middle Channel: 2437	25.5	25.6	28.6
High Channel: 2462	25.3	25.4	28.4

(Antenna 0) IEEE 802.11n (40MHz) (OFDM, MCS0) Antenna Gain = 1.5 dBi		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2422	25.5	354.813
Middle Channel: 2437	25.4	346.737
High Channel: 2452	25.1	323.594

(Antenna 1) IEEE 802.11n (40MHz) (OFDM, MCS0) Antenna Gain = 1.5 dBi		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2422	25.6	363.078
Middle Channel: 2437	25.4	346.737
High Channel: 2452	25.3	338.844

IEEE 802.11n (40MHz) (OFDM, MCS0)			
Frequency (MHz)	Output in dBm		
	Antenna 0	Antenna 1	Antenna 0 + Antenna 1
Low Channel: 2422	25.5	25.6	28.6
Middle Channel: 2437	25.4	25.4	28.4
High Channel: 2452	25.1	25.3	28.2

4.1 Maximum Conducted Output Power at Antenna Terminals – Cont'd

Cable loss : 0.5 dB External Attenuation : 20 dB

Cable loss, external attenuation: ☒ included in OFFSET function
☐ added to SA raw reading

IEEE 802.11b (DSSS, 1 Mbps)
max. conducted (peak) output level = 25.5 dBm

IEEE 802.11g (OFDM, 9 Mbps)
max. conducted (peak) output level = 25.6 dBm

IEEE 802.11n (20MHz) (OFDM, MCS0)
max. conducted (peak) output level = 28.7 dBm

IEEE 802.11n (40MHz) (OFDM, MCS0)
max. conducted (peak) output level = 28.6 dBm

The transmit signals are correlated with each other,
Directional gain = G_{Ant} + 10 log(N_{Ant}) dBi = 1.5 + 3 = 4.5 dBi

Limits:
☒ 1W (30dBm) for antennas with gains of 6dBi or less

☐ ___W (___dBm) for antennas with gains more than 6dBi

The plots of conducted output power are saved as below.

4.2 Minimum 6dB RF Bandwidth

The antenna port of the EUT was connected to the input of a spectrum analyzer. The EBW measurement procedure was used. A PEAK output reading was taken, a DISPLAY line was drawn 6dB lower than PEAK level. The 6dB bandwidth was determined from where the channel output spectrum intersected the display line.

IEEE 802.11b (DSSS, 1 Mbps)		
Frequency (MHz)	6dB Bandwidth (MHz)	
	Ant0 Gain = 1.5 dBi	Ant1 Gain = 1.5 dBi
Low Channel: 2412	10.3	9.3
Middle Channel: 2437	10.2	9.3
High Channel: 2462	10.3	9.4

IEEE 802.11g (OFDM, 6 Mbps)		
Frequency (MHz)	6dB Bandwidth (MHz)	
	Ant0 Gain = 1.5 dBi	Ant1 Gain = 1.5 dBi
Low Channel: 2412	16.6	16.6
Middle Channel: 2437	16.6	16.6
High Channel: 2462	16.6	16.6

IEEE 802.11n (20MHz) (OFDM, MCS0)		
Frequency (MHz)	6dB Bandwidth (MHz)	
	Ant0 Gain = 1.5 dBi	Ant1 Gain = 1.5 dBi
Low Channel: 2412	17.9	17.9
Middle Channel: 2437	17.8	17.9
High Channel: 2462	17.8	17.8

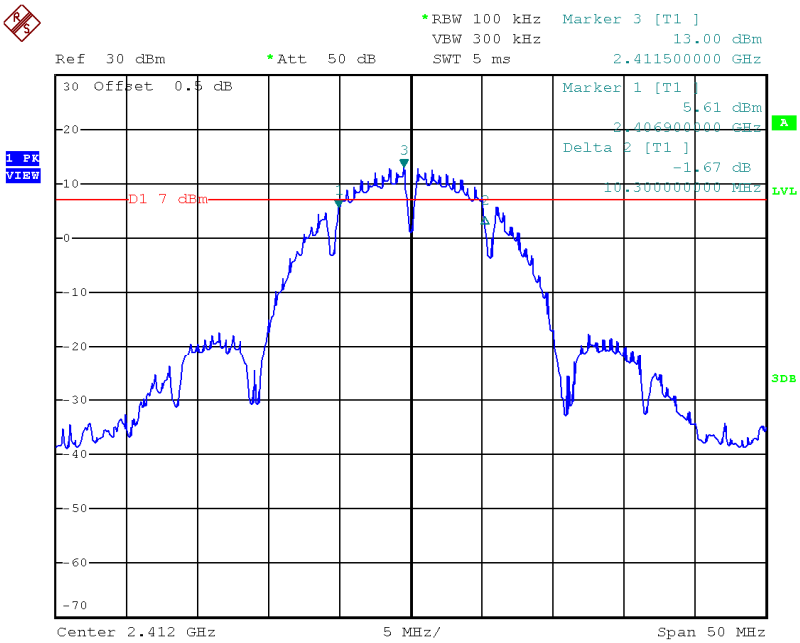
IEEE 802.11n (40MHz) (OFDM, MCS0)		
Frequency (MHz)	6dB Bandwidth (MHz)	
	Ant0 Gain = 1.5 dBi	Ant1 Gain = 1.5 dBi
Low Channel: 2422	36.12	36.15
Middle Channel: 2437	36.00	36.00
High Channel: 2452	35.88	36.00

Limits
6 dB bandwidth shall be at least 500kHz

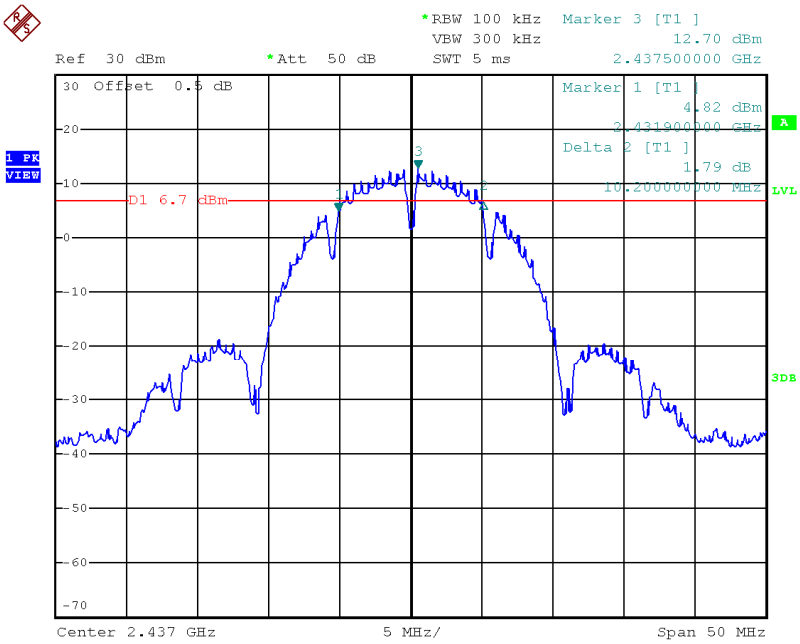
The plots of 6dB RF bandwidth and occupied bandwidth are saved as below.

Plots of 6dB RF bandwidth (Antenna 0)

802.11b, Lowest Channel

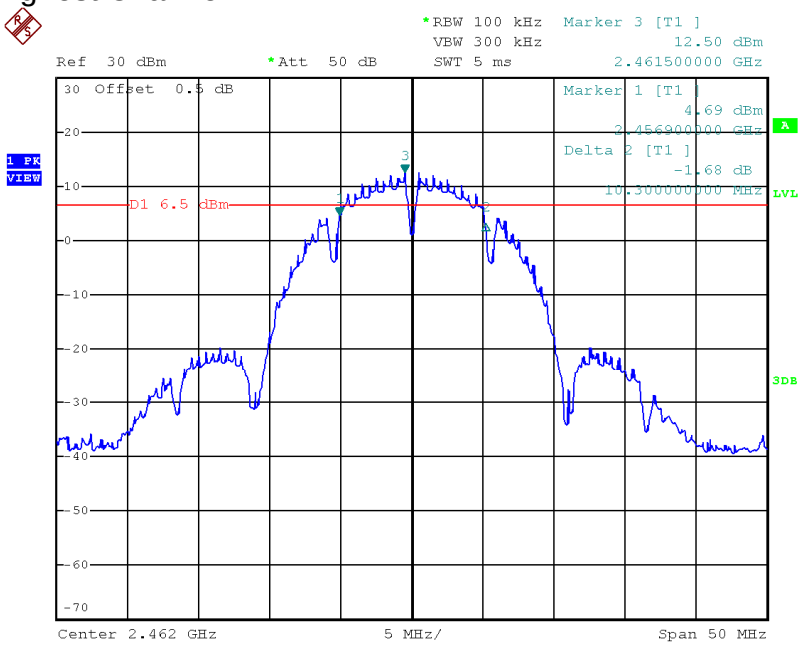


802.11b, Middle Channel



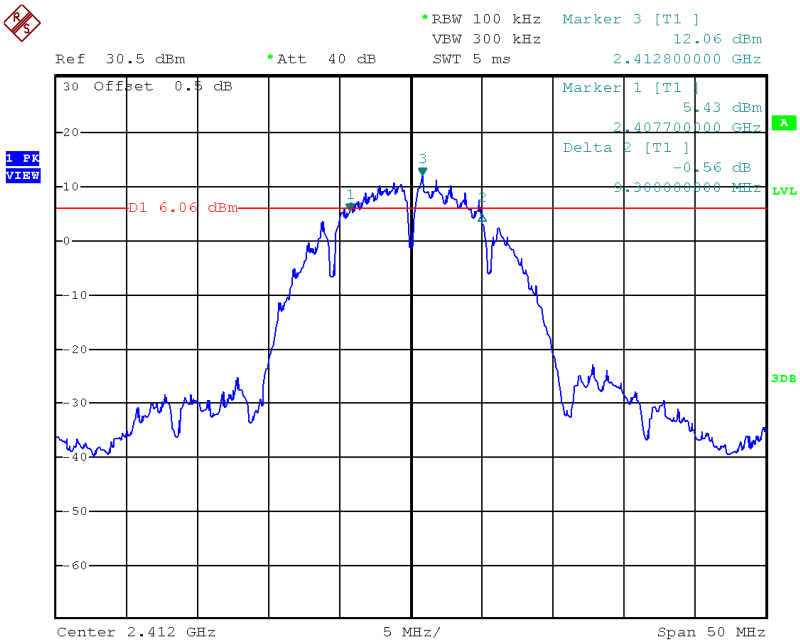
Plots of 6dB RF bandwidth (Antenna 0)

802.11b, Highest Channel

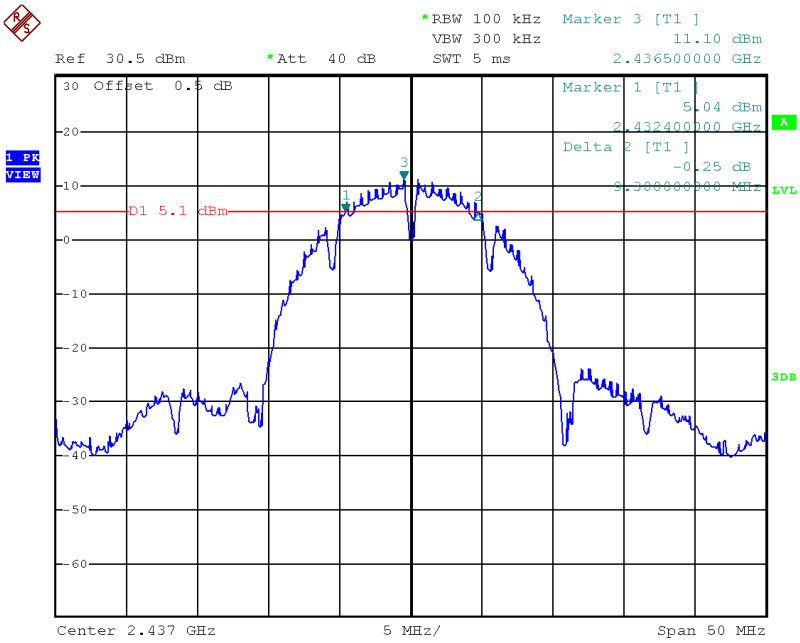


Plots of 6dB RF bandwidth (Antenna 1)

802.11b, Lowest Channel

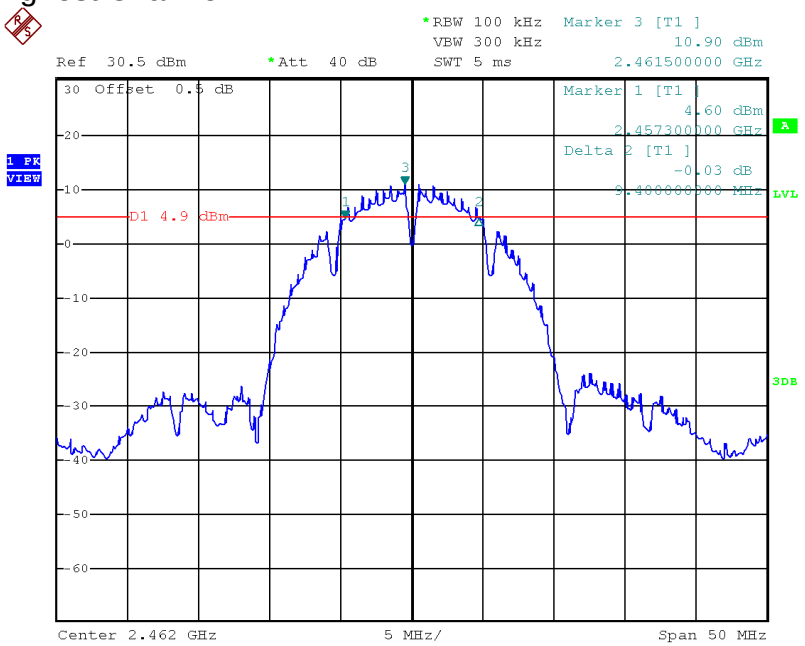


802.11b, Middle Channel



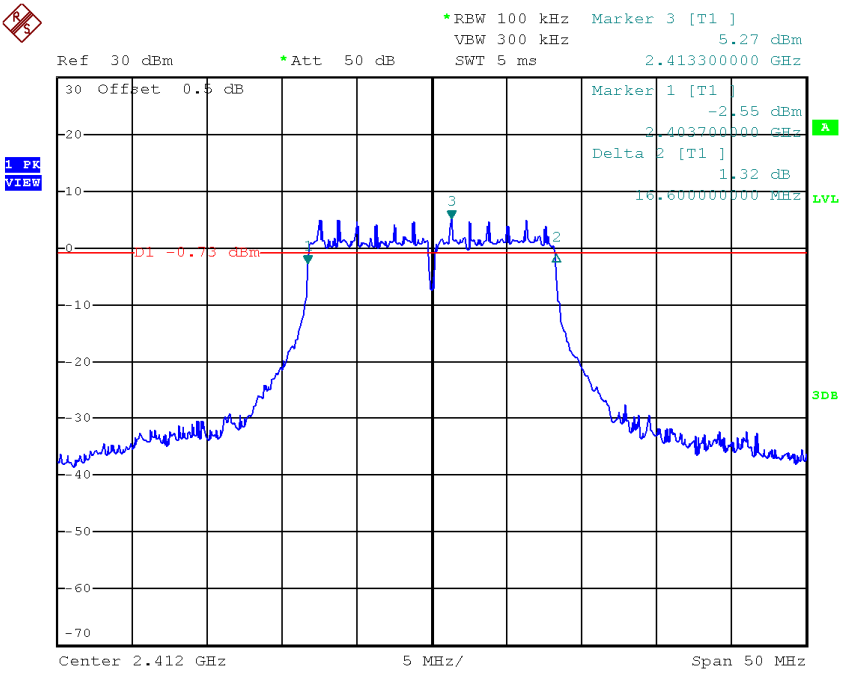
Plots of 6dB RF bandwidth (Antenna 1)

802.11b, Highest Channel

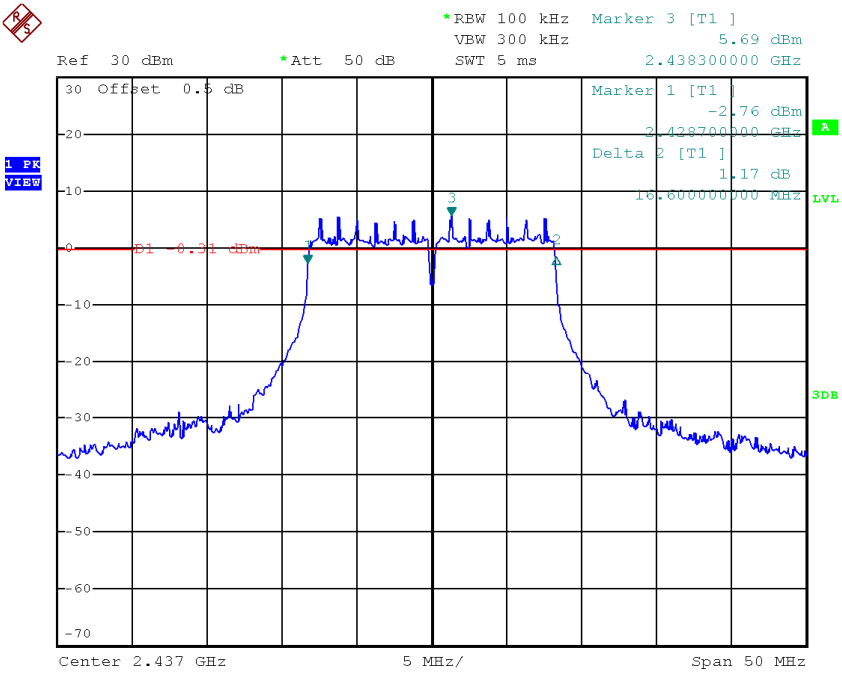


Plots of 6dB RF bandwidth (Antenna 0)

802.11g, Lowest Channel

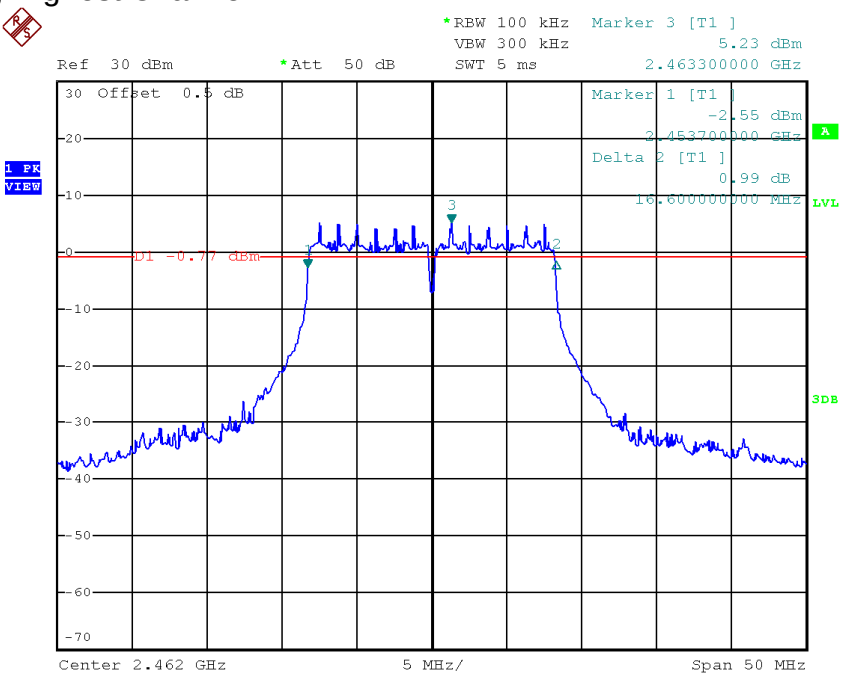


802.11g, Middle Channel



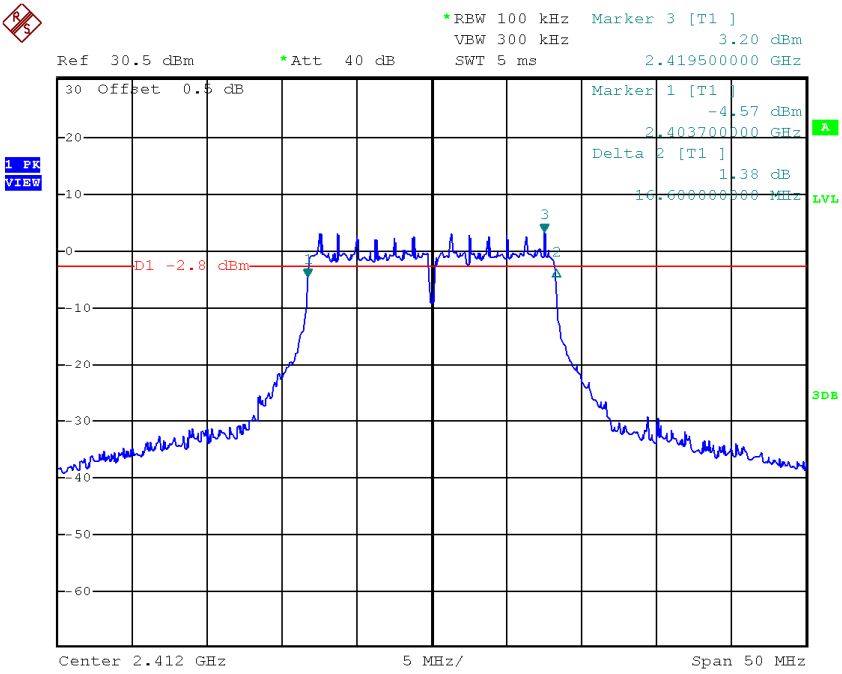
Plots of 6dB RF bandwidth (Antenna 0)

802.11g, Highest Channel

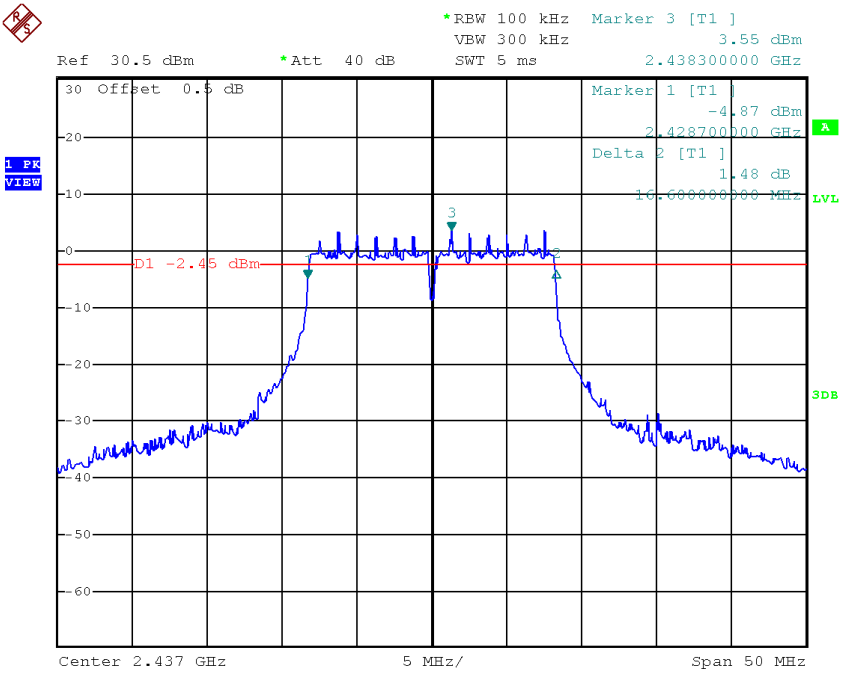


Plots of 6dB RF bandwidth (Antenna 1)

802.11g, Lowest Channel

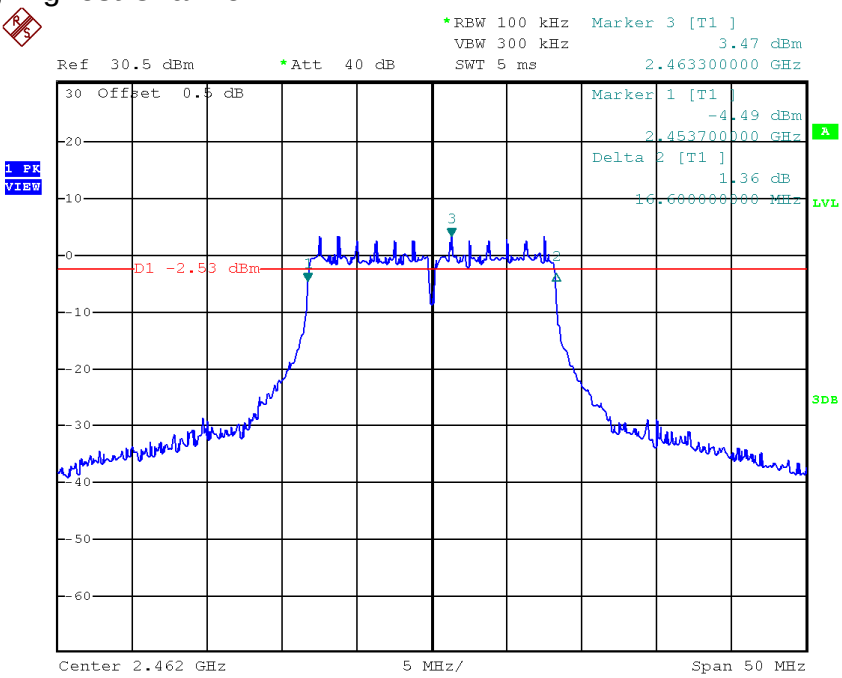


802.11g, Middle Channel



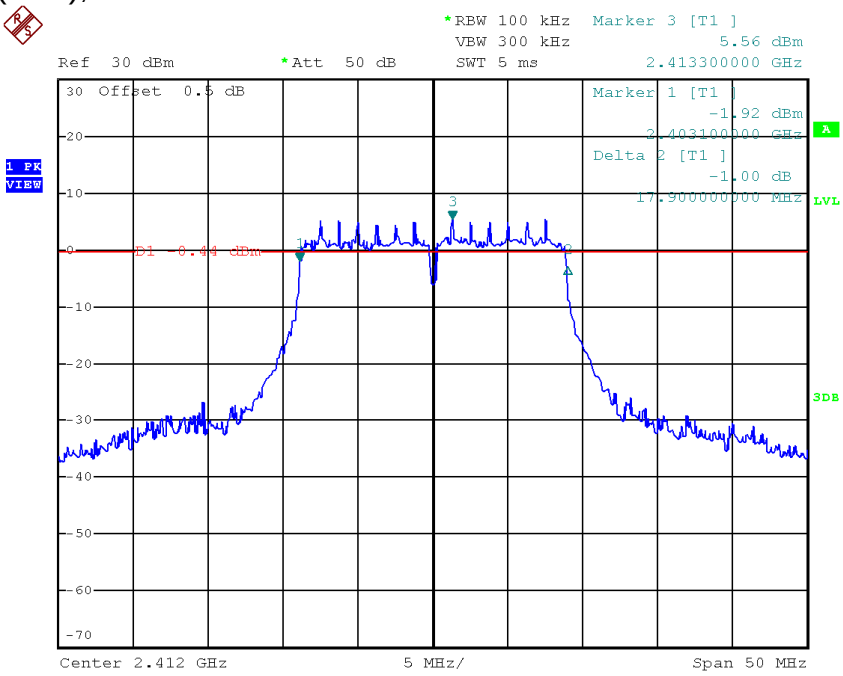
Plots of 6dB RF bandwidth (Antenna 1)

802.11g, Highest Channel

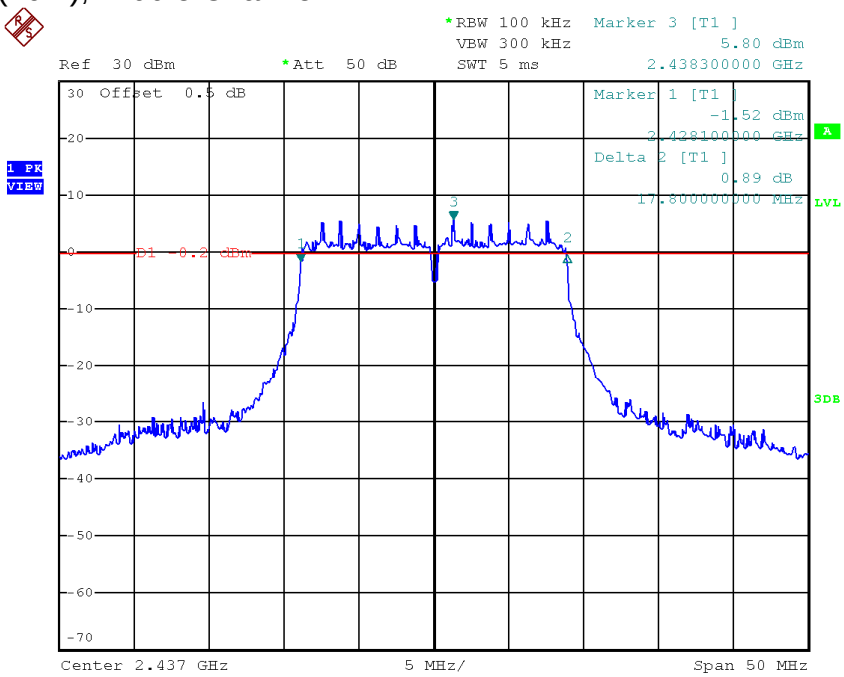


Plots of 6dB RF bandwidth (Antenna 0)

802.11n(20M), Lowest Channel

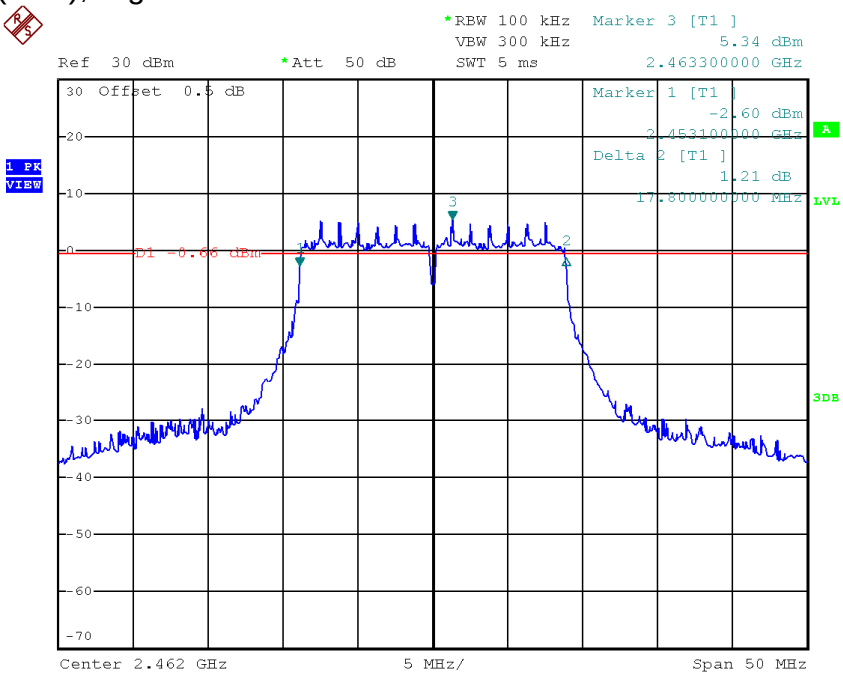


802.11n(20M), Middle Channel



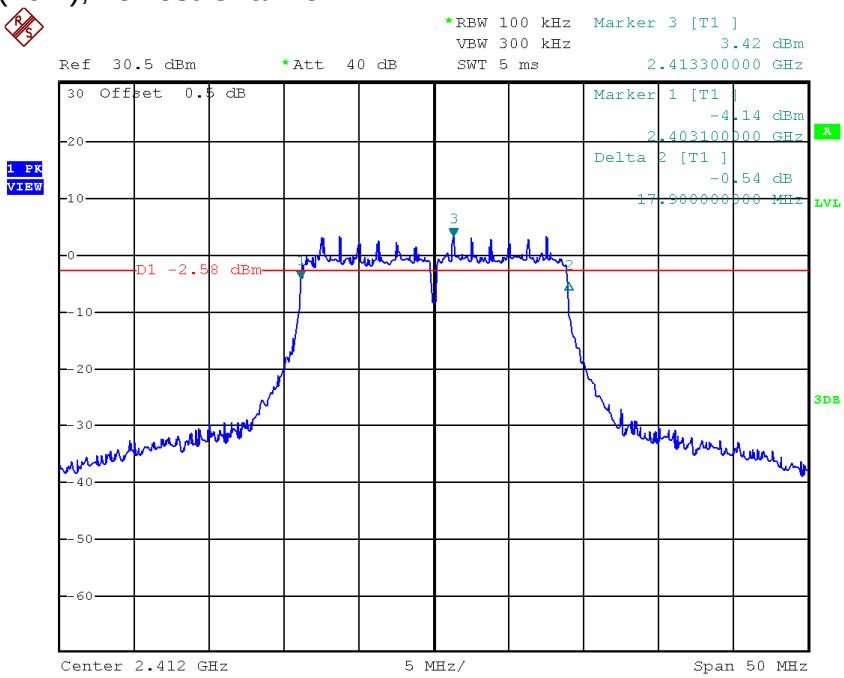
Plots of 6dB RF bandwidth (Antenna 0)

802.11n(20M), Highest Channel

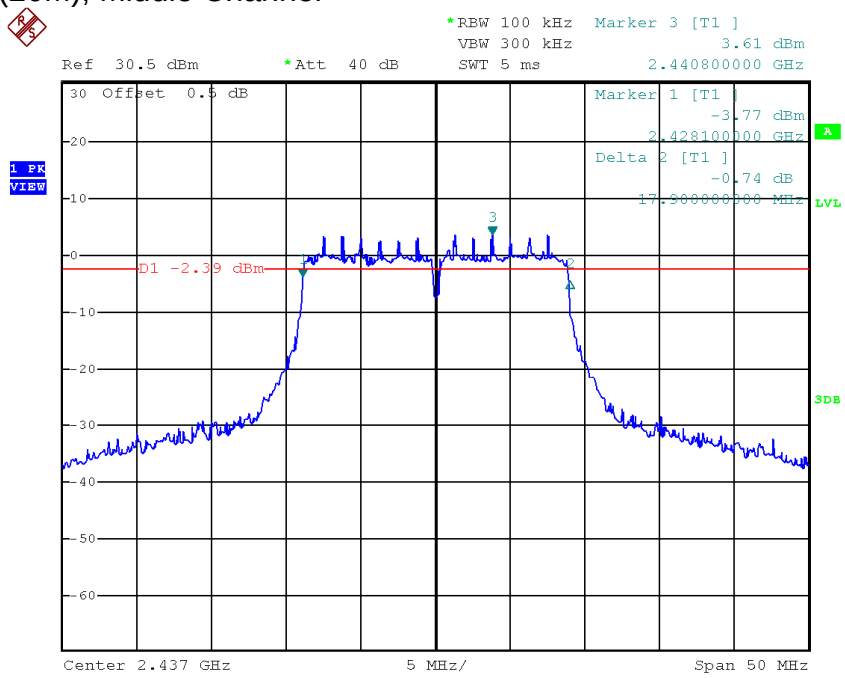


Plots of 6dB RF bandwidth (Antenna 1)

802.11n(20M), Lowest Channel

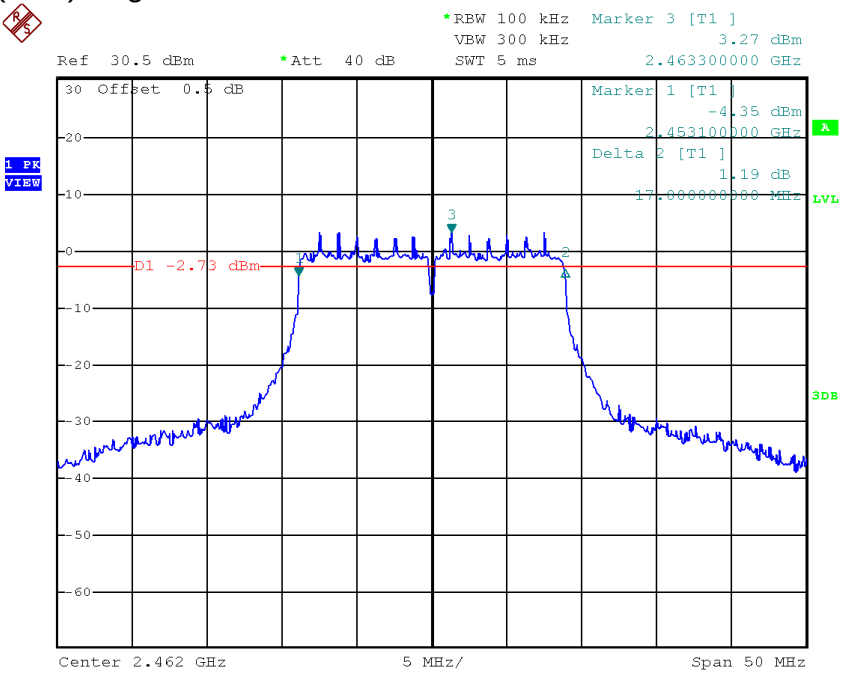


802.11n(20M), Middle Channel



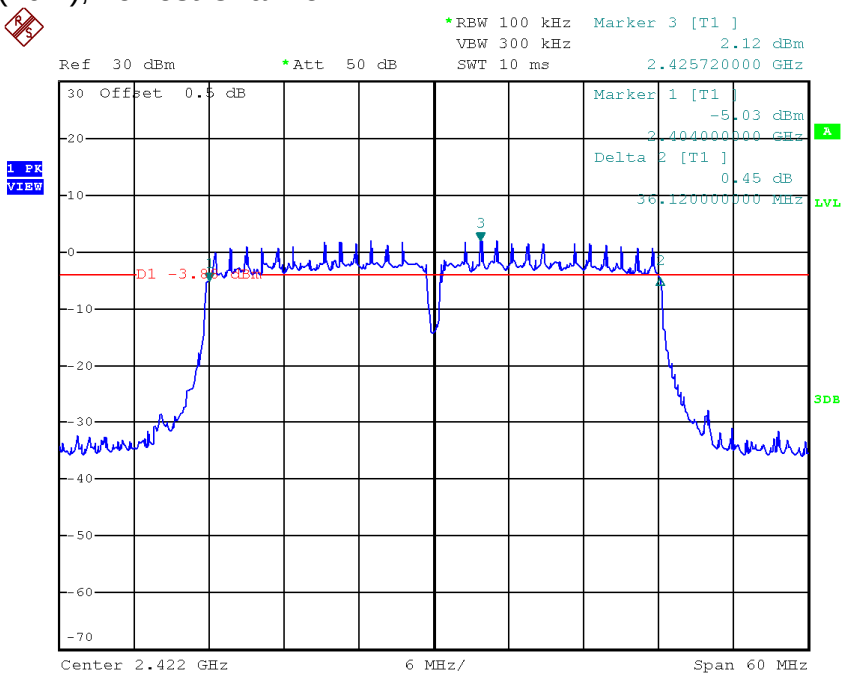
Plots of 6dB RF bandwidth (Antenna 1)

802.11n(20M), Highest Channel

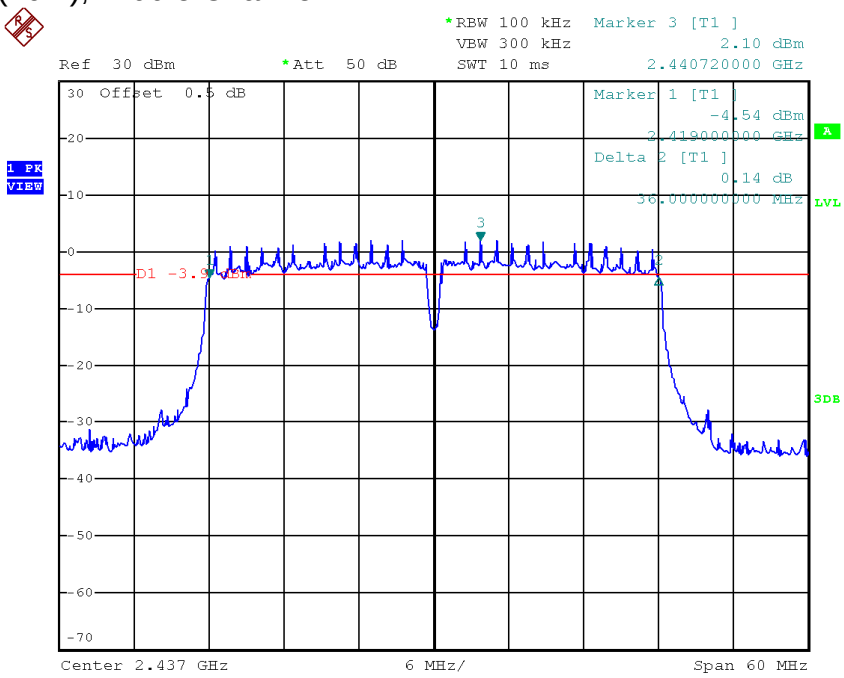


Plots of 6dB RF bandwidth (Antenna 0)

802.11n(40M), Lowest Channel

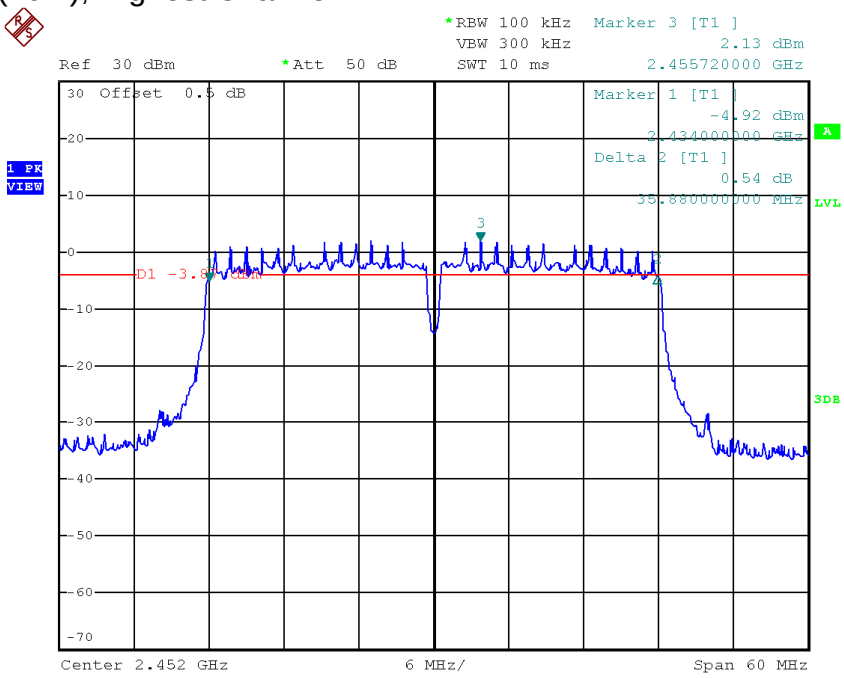


802.11n(40M), Middle Channel



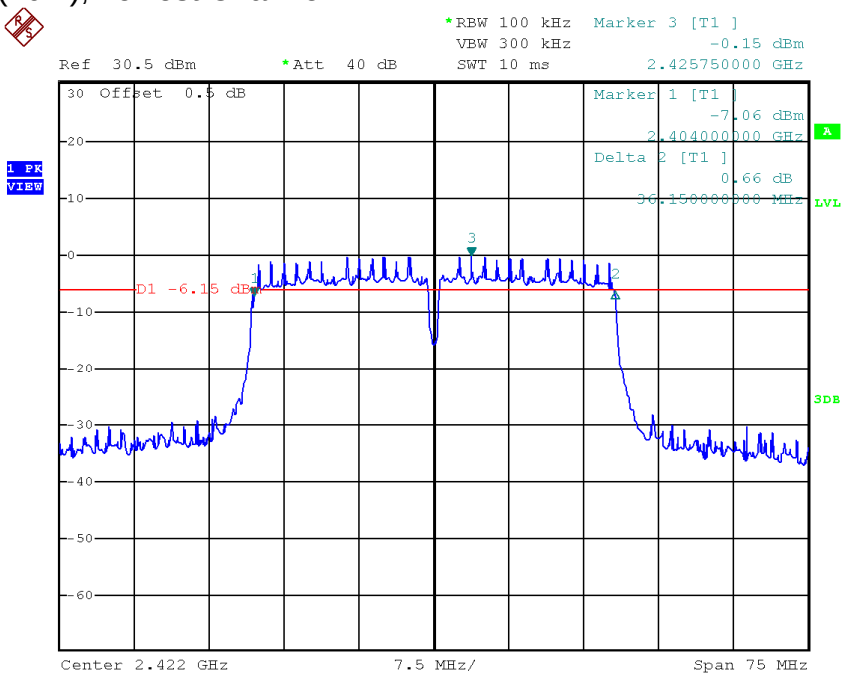
Plots of 6dB RF bandwidth (Antenna 0)

802.11n(40M), Highest Channel

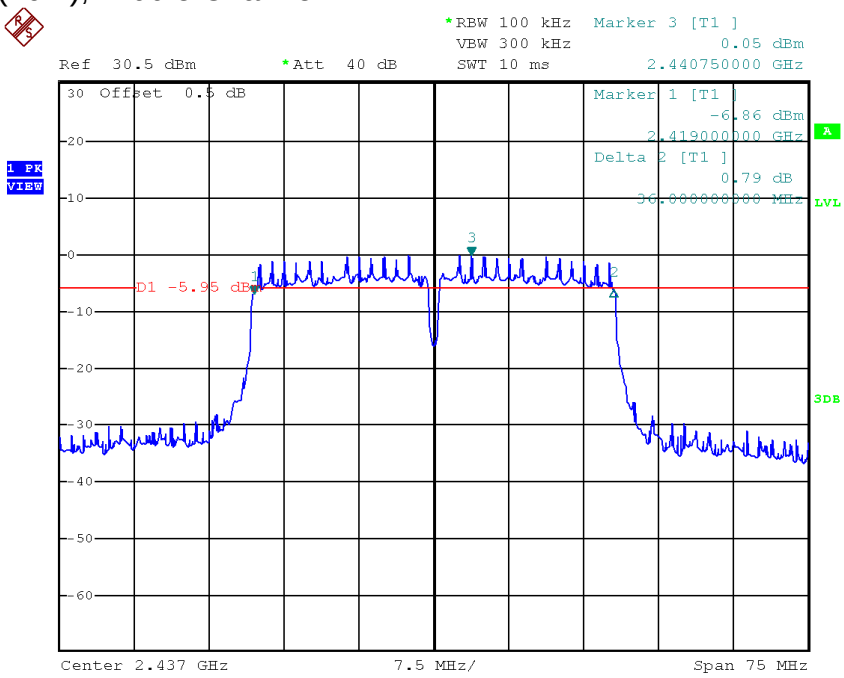


Plots of 6dB RF bandwidth (Antenna 1)

802.11n(40M), Lowest Channel

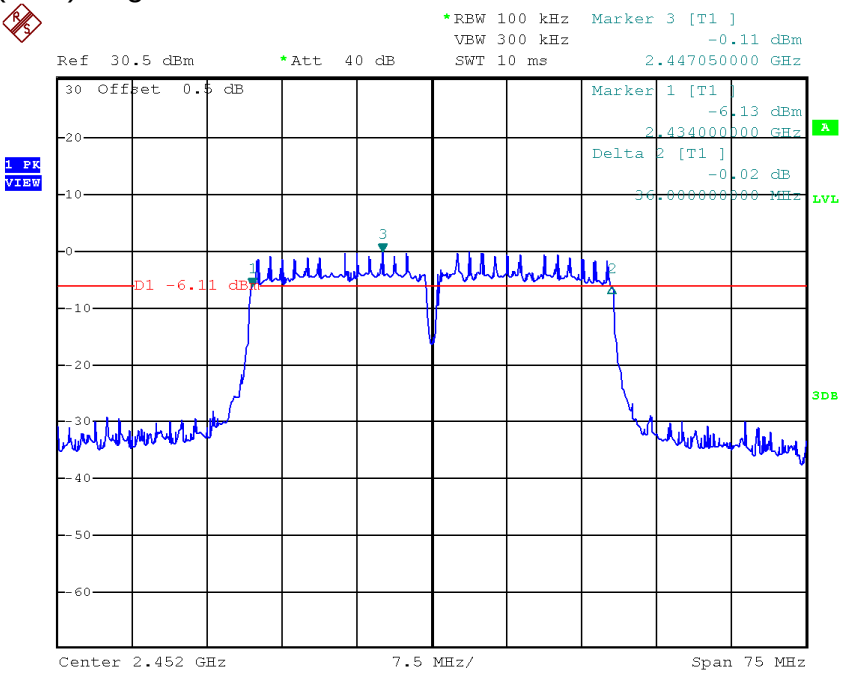


802.11n(40M), Middle Channel



Plots of 6dB RF bandwidth (Antenna 1)

802.11n(40M), Highest Channel



4.3 Maximum Power Spectral Density

Antenna output of the EUT was coupled directly to spectrum analyzer. The measurement procedure 10.2 PKPSD-1 was used. If an external attenuator and/or cable was used, these losses are compensated for using the OFFSET function of the analyser.

IEEE 802.11b (DSSS, 1 Mbps) (Antenna 0)		
Frequency (MHz)	PSD in 100kHz (dBm)	PSD in 3kHz (dBm)
Low Channel: 2412	--	7.27
Middle Channel: 2437	--	7.24
High Channel: 2462	--	5.47

IEEE 802.11b (DSSS, 1 Mbps) (Antenna 1)		
Frequency (MHz)	PSD in 100kHz (dBm)	PSD in 3kHz (dBm)
Low Channel: 2412	--	5.62
Middle Channel: 2437	--	4.98
High Channel: 2462	--	5.58

IEEE 802.11g (OFDM, 6 Mbps) (Antenna 0)		
Frequency (MHz)	PSD in 100kHz (dBm)	PSD in 3kHz (dBm)
Low Channel: 2412	5.59	--
Middle Channel: 2437	5.66	--
High Channel: 2462	5.33	--

IEEE 802.11g (OFDM, 6 Mbps) (Antenna 1)		
Frequency (MHz)	PSD in 100kHz (dBm)	PSD in 3kHz (dBm)
Low Channel: 2412	3.49	--
Middle Channel: 2437	3.70	--
High Channel: 2462	3.46	--

IEEE 802.11n (20MHz) (OFDM, MCS0) (Antenna 0)		
Frequency (MHz)	PSD in 100kHz (dBm)	PSD in 3kHz (dBm)
Low Channel: 2412	5.71	--
Middle Channel: 2437	5.72	--
High Channel: 2462	5.46	--

IEEE 802.11n (20MHz) (OFDM, MCS0) (Antenna 1)		
Frequency (MHz)	PSD in 100kHz (dBm)	PSD in 3kHz (dBm)
Low Channel: 2412	3.64	--
Middle Channel: 2437	3.66	--
High Channel: 2462	4.05	--

IEEE 802.11n (20MHz) (OFDM, MCS0)			
Frequency (MHz)	PSD in 100kHz (dBm)		
	Antenna 0	Antenna 1	Antenna 0 + Antenna 1
Low Channel: 2412	5.71	3.64	7.81
Middle Channel: 2437	5.72	3.66	7.82
High Channel: 2462	5.46	4.05	7.82

IEEE 802.11n (40MHz) (OFDM, MCS0) (Antenna 0)		
Frequency (MHz)	PSD in 100kHz (dBm)	PSD in 3kHz (dBm)
Low Channel: 2422	2.66	--
Middle Channel: 2437	2.47	--
High Channel: 2452	2.35	--

IEEE 802.11n (40MHz) (OFDM, MCS0) (Antenna 1)		
Frequency (MHz)	PSD in 100kHz (dBm)	PSD in 3kHz (dBm)
Low Channel: 2422	0.67	--
Middle Channel: 2437	0.75	--
High Channel: 2452	0.66	--

IEEE 802.11n (20MHz) (OFDM, MCS0)			
Frequency (MHz)	PSD in 100kHz (dBm)		
	Antenna 0	Antenna 1	Antenna 0 + Antenna 1
Low Channel: 2422	2.66	0.67	4.79
Middle Channel: 2437	2.47	0.75	4.70
High Channel: 2452	2.35	0.66	4.60

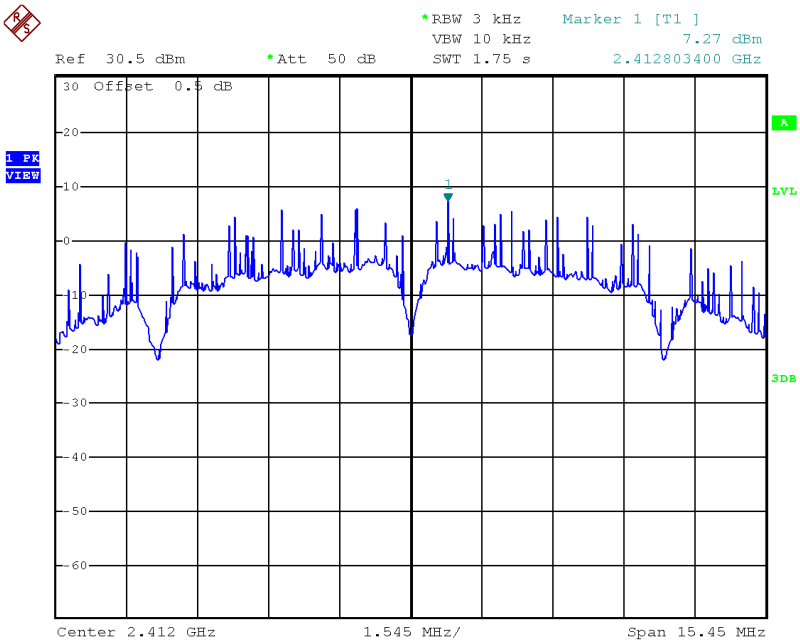
Cable Loss: 0.5 dB

Limit:
8dBm

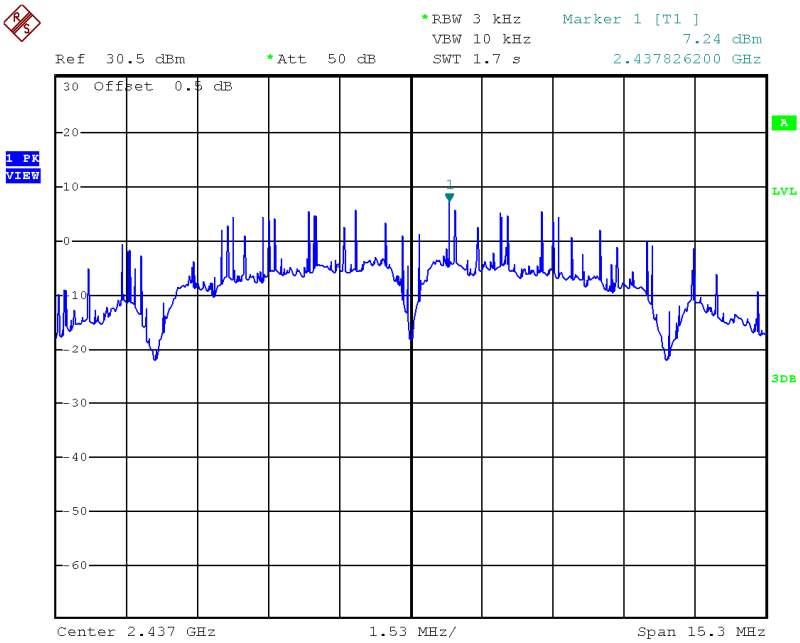
The plots of power spectral density are as below.

Plots of power spectral density in 3KHz (Antenna 0)

802.11b, Lowest channel

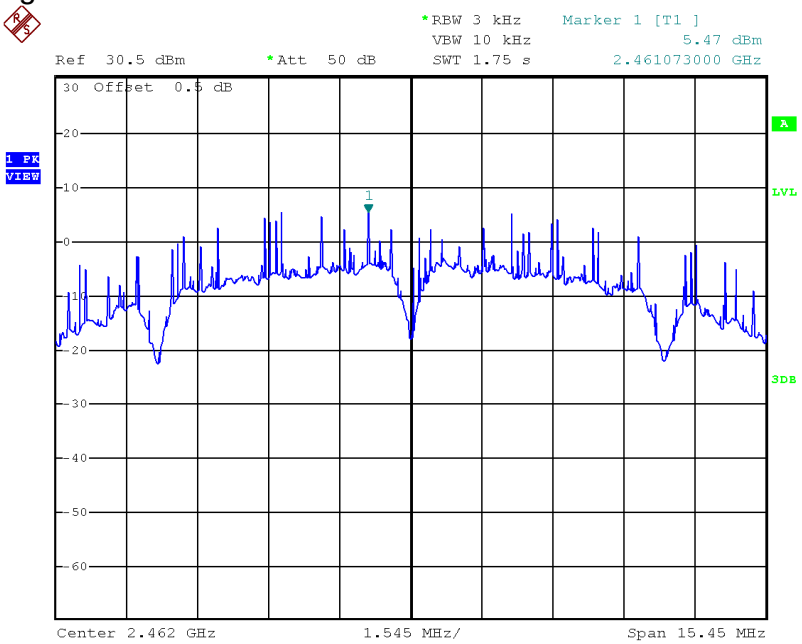


802.11b, Middle channel



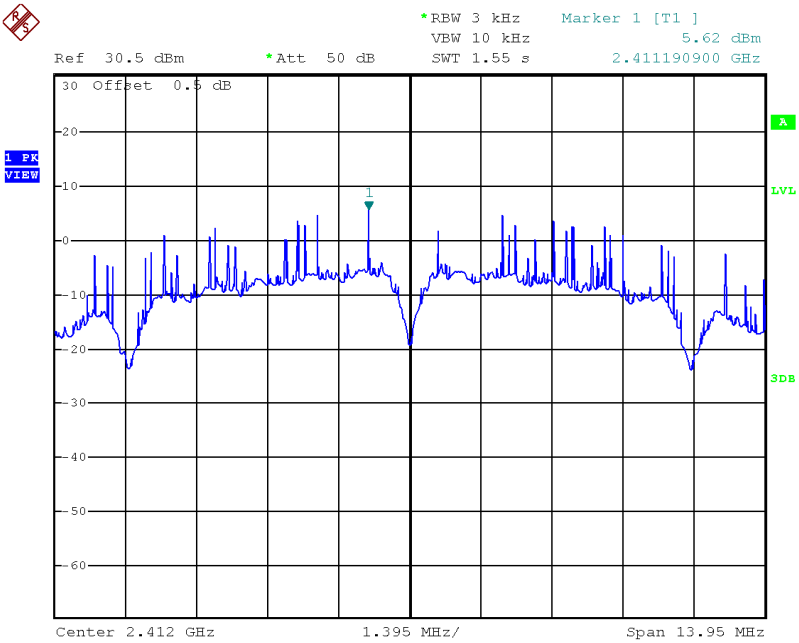
Plots of power spectral density in 3KHz (Antenna 0)

802.11b, Highest channel

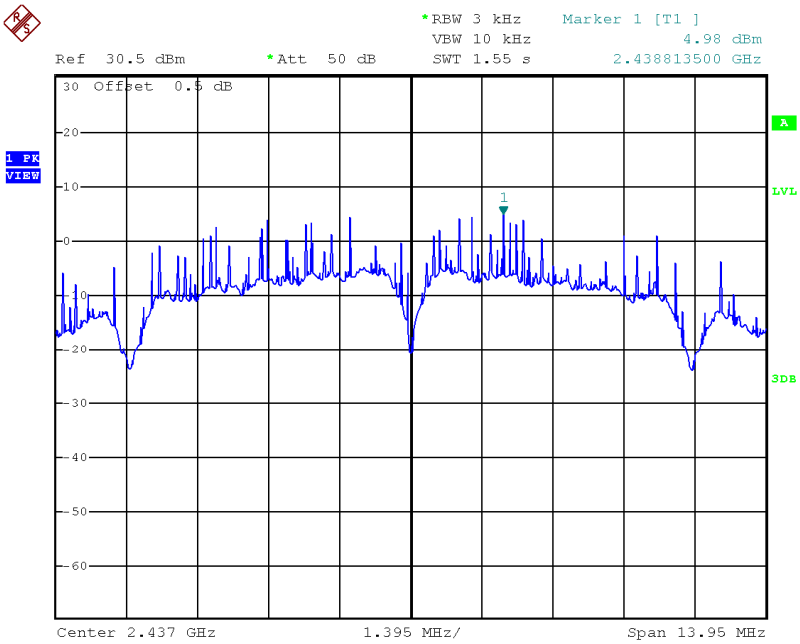


Plots of power spectral density in 3KHz (Antenna 1)

802.11b, Lowest channel

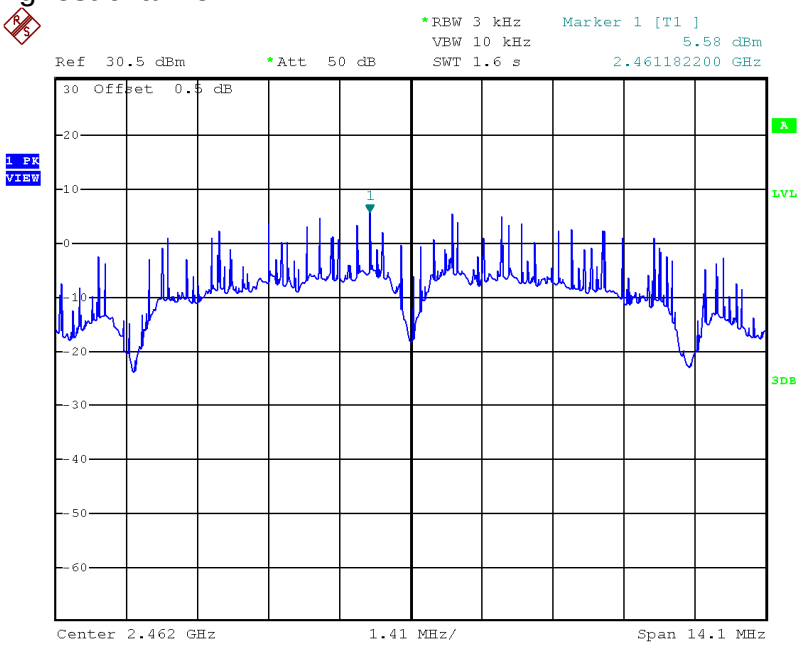


802.11b, Middle channel



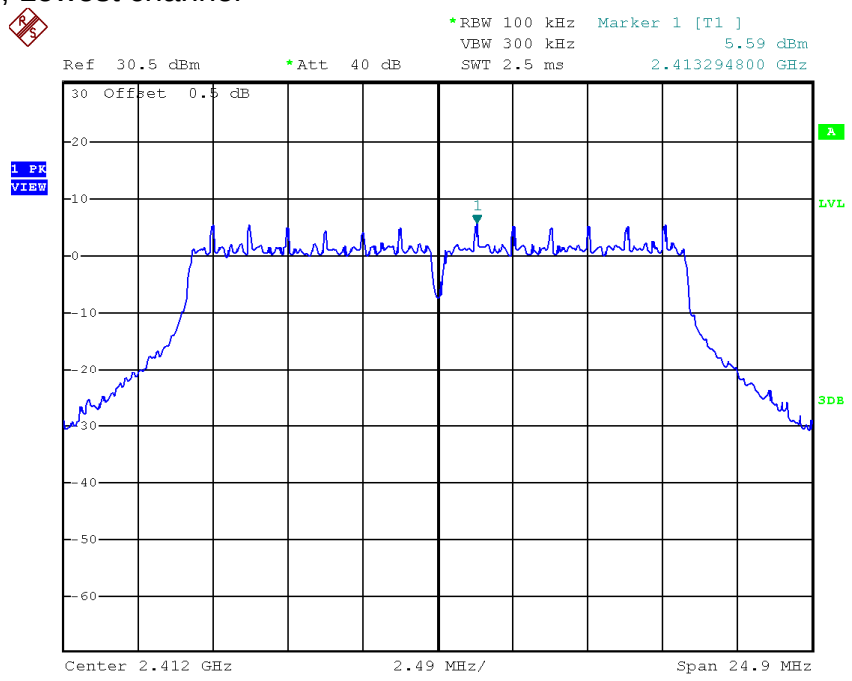
Plots of power spectral density in 3KHz (Antenna 1)

802.11b, Highest channel

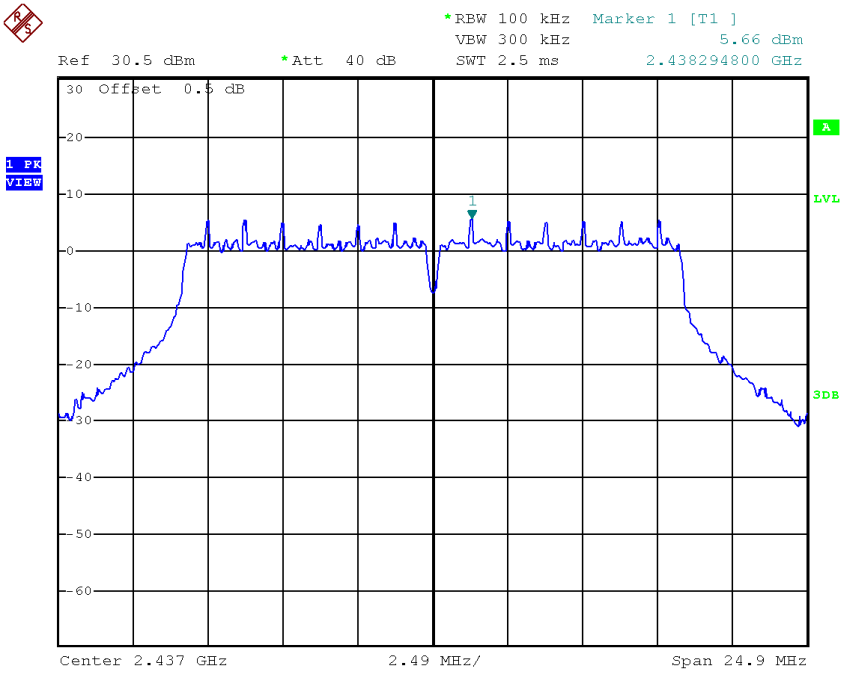


Plots of power spectral density (Antenna 0)

802.11g, Lowest channel

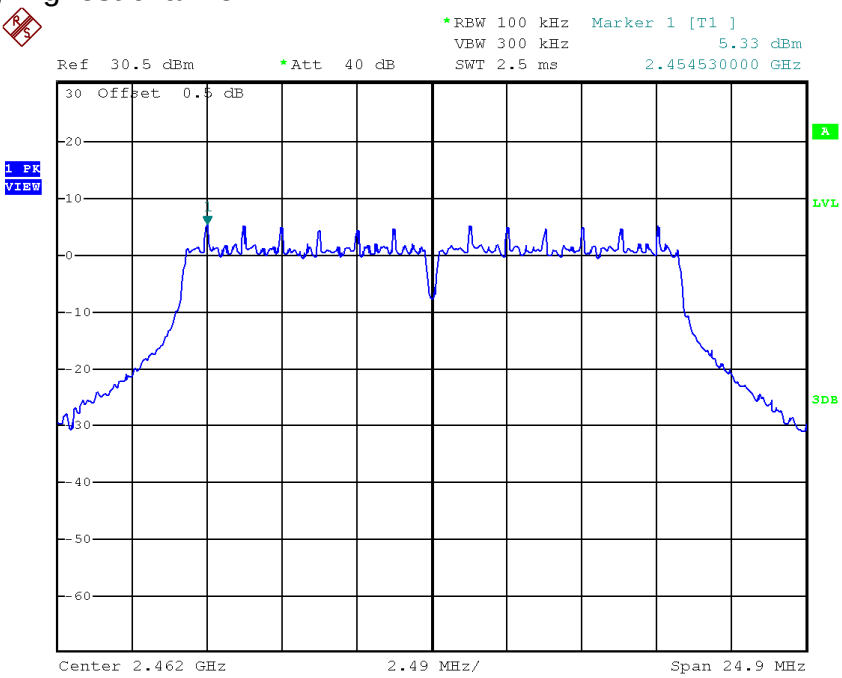


802.11g, Middle channel



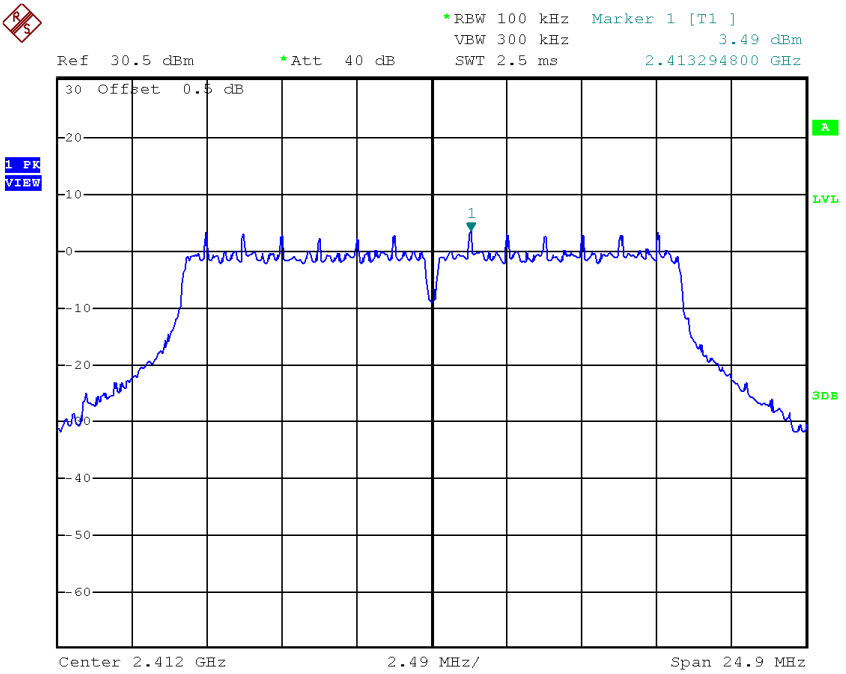
Plots of power spectral density (Antenna 0)

802.11g, Highest channel

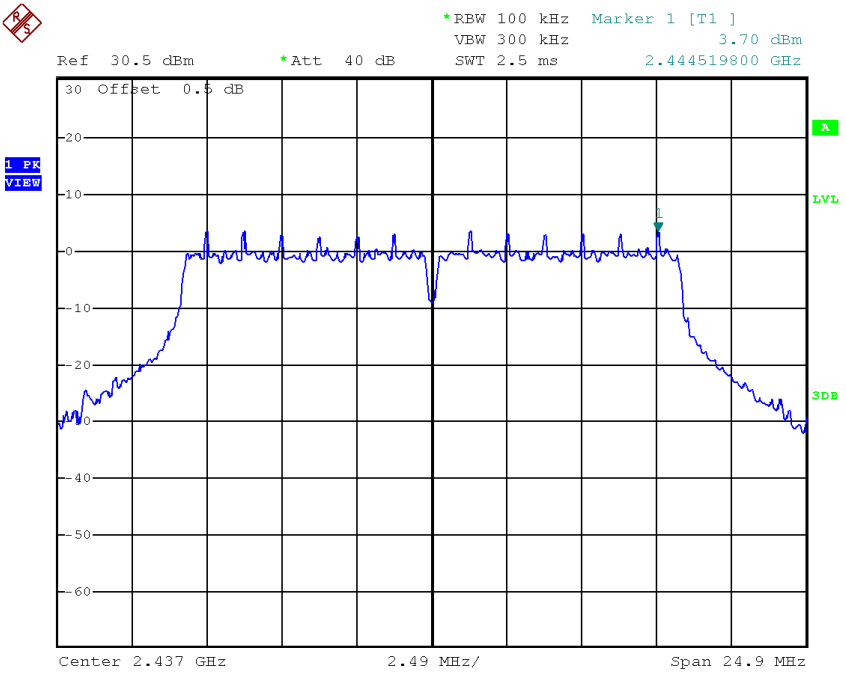


Plots of power spectral density (Antenna 1)

802.11g, Lowest channel

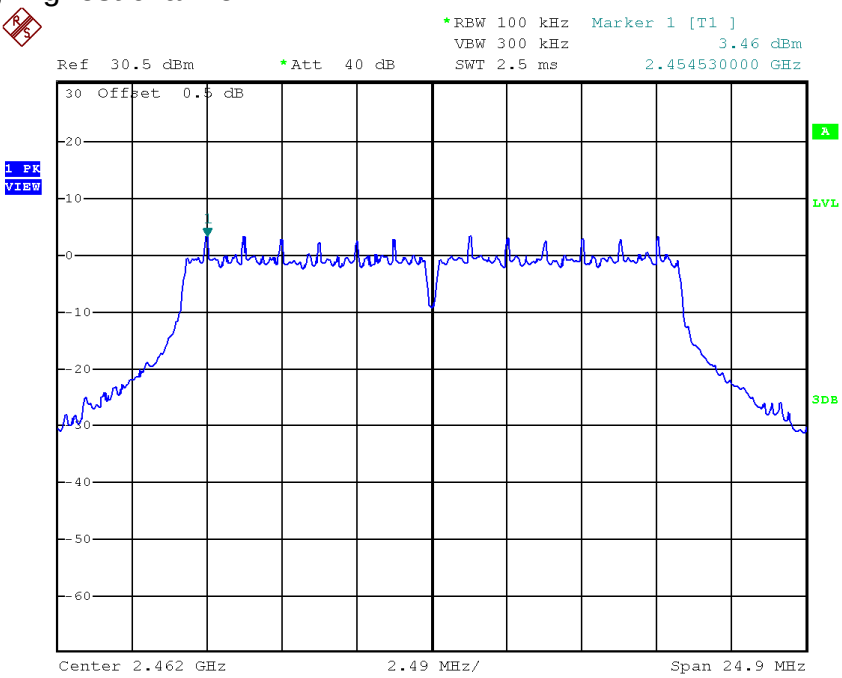


802.11g, Middle channel



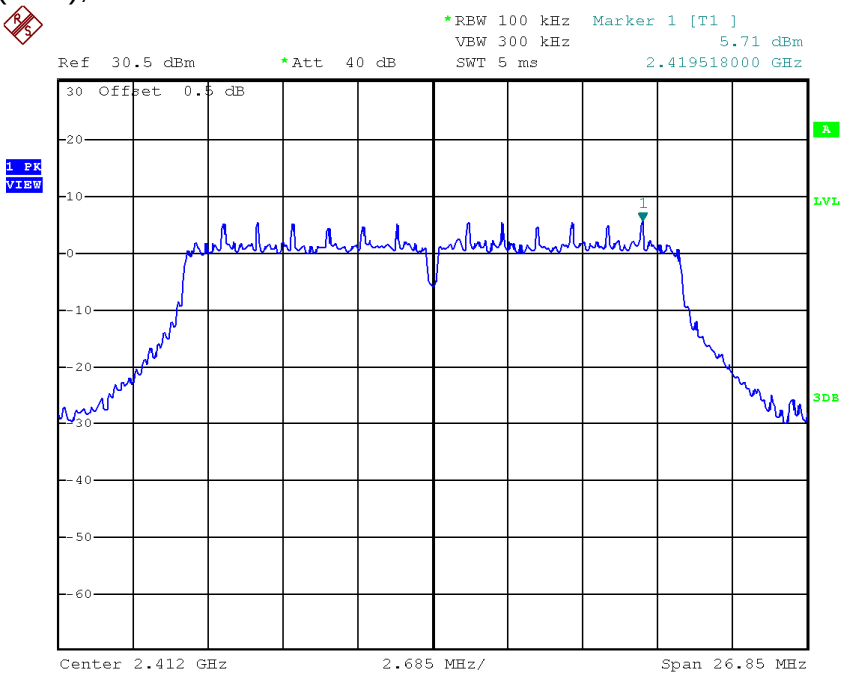
Plots of power spectral density (Antenna 1)

802.11g, Highest channel

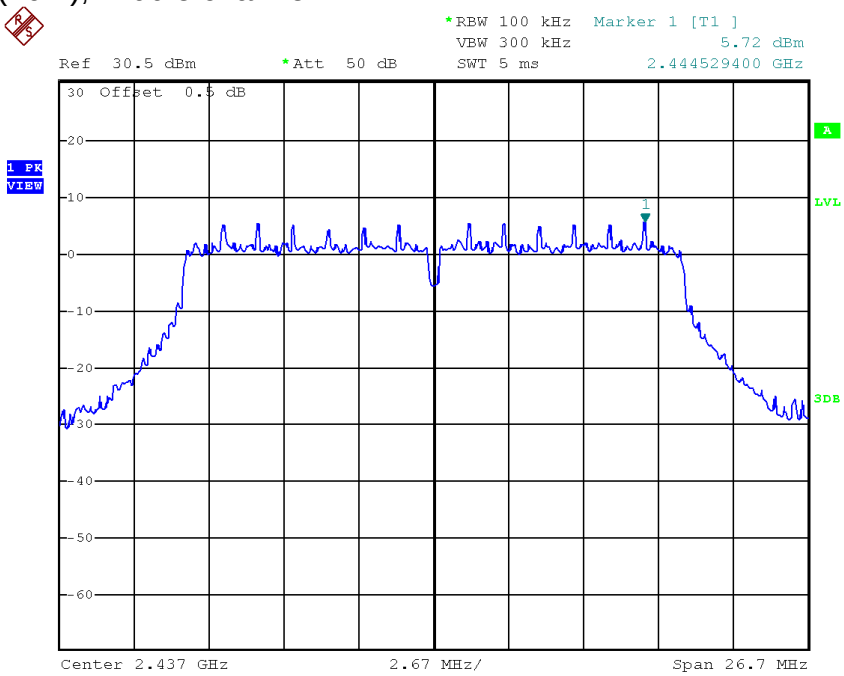


Plots of power spectral density (Antenna 0)

802.11n(20M), Lowest channel

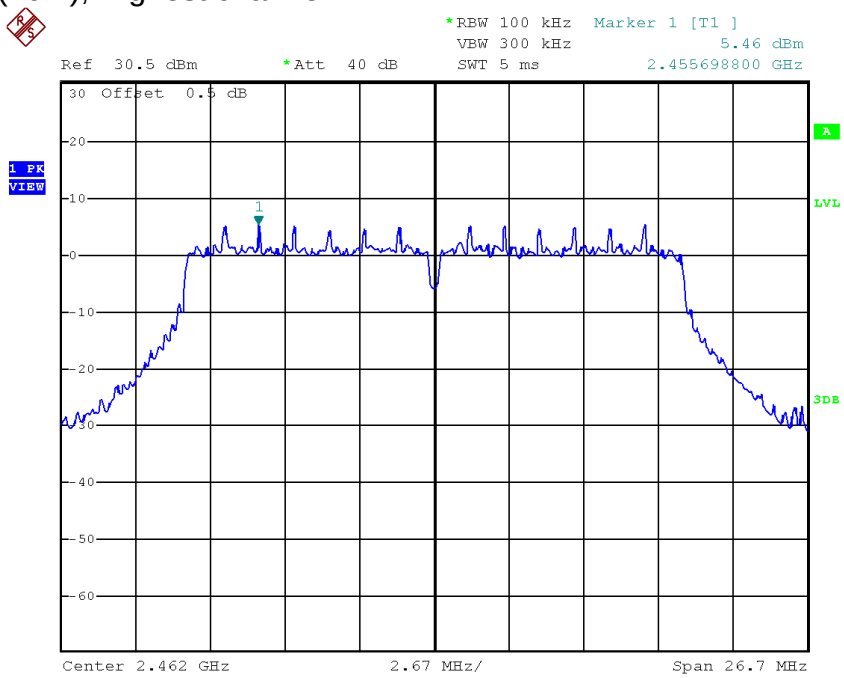


802.11n(20M), Middle channel



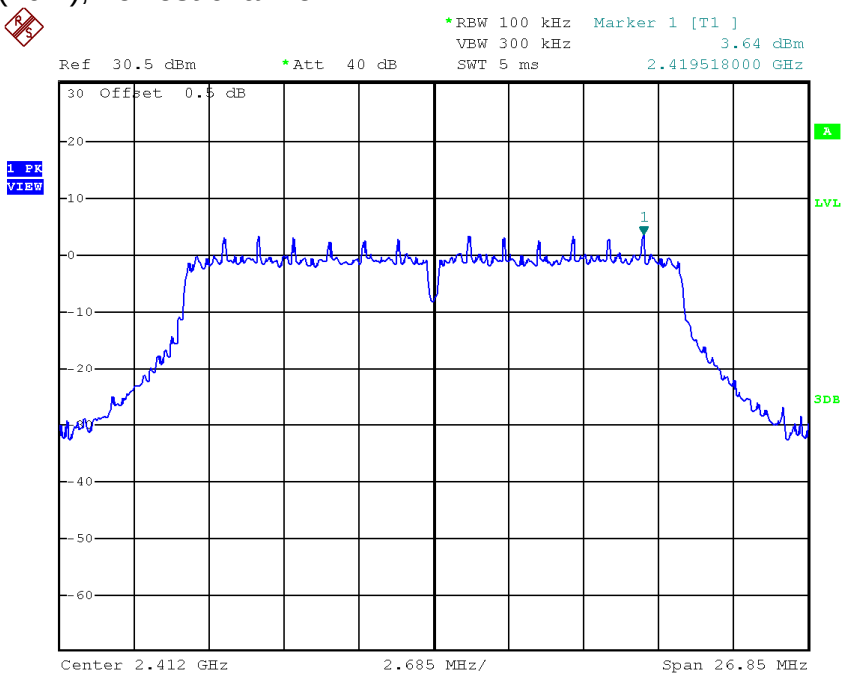
Plots of power spectral density (Antenna 0)

802.11n(20M), Highest channel

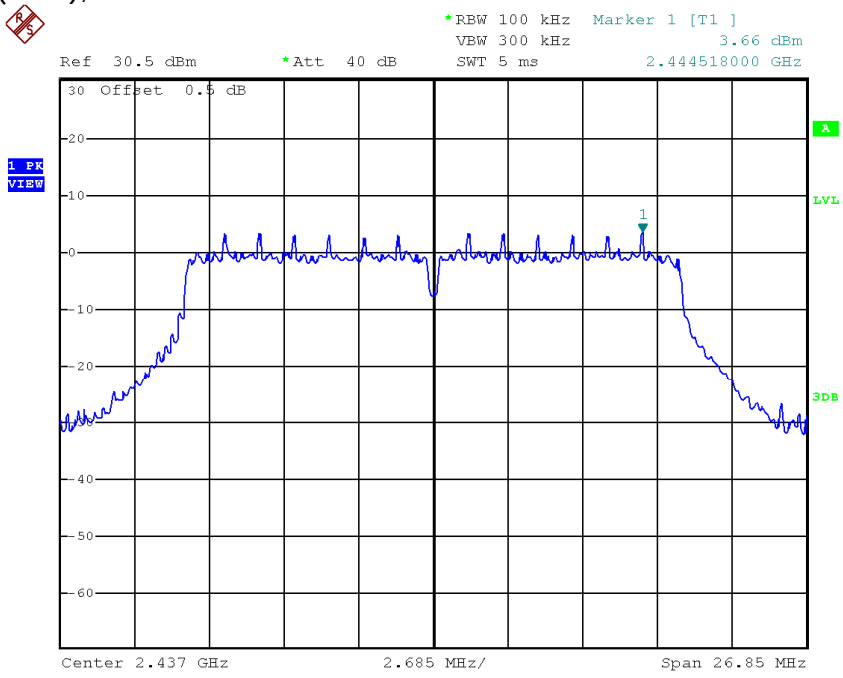


Plots of power spectral density (Antenna 1)

802.11n(20M), Lowest channel

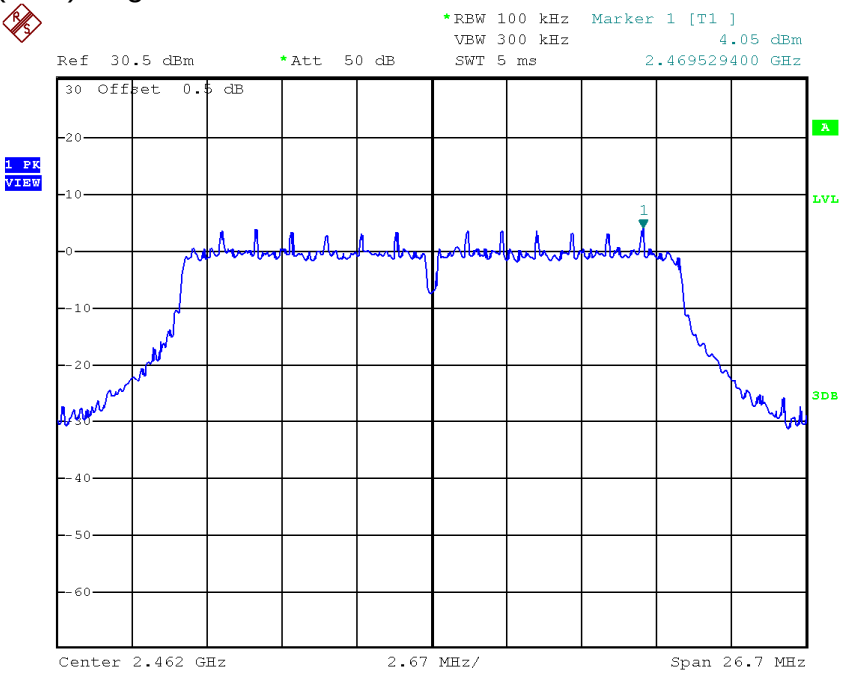


802.11n(20M), Middle channel



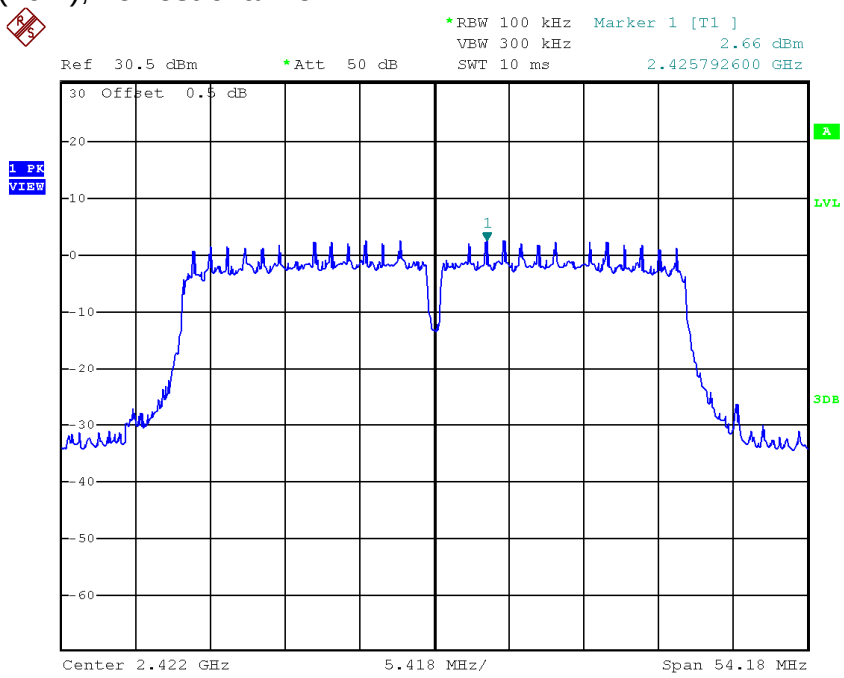
Plots of power spectral density (Antenna 1)

802.11n(20M), Highest channel

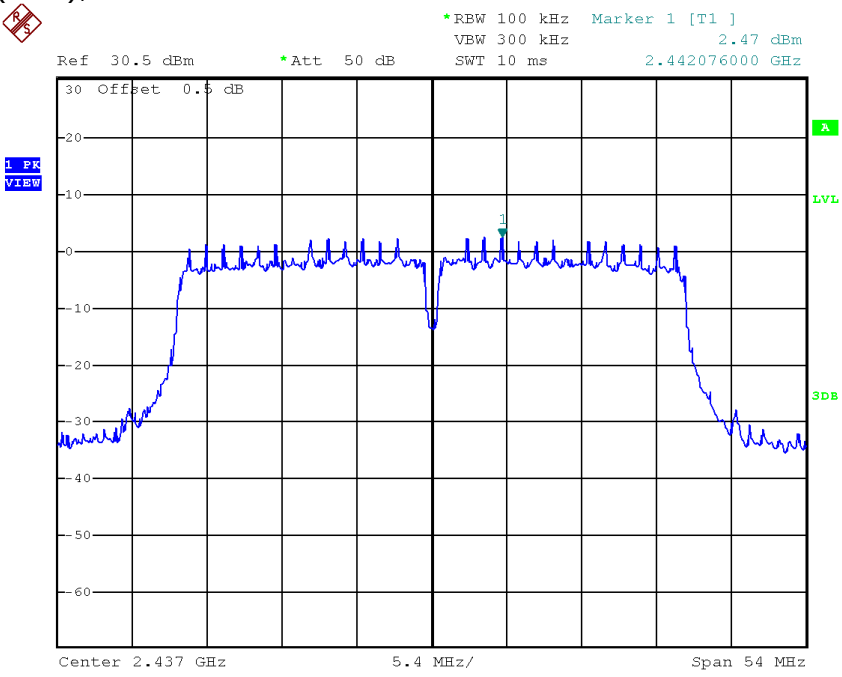


Plots of power spectral density (Antenna 0)

802.11n(40M), Lowest channel

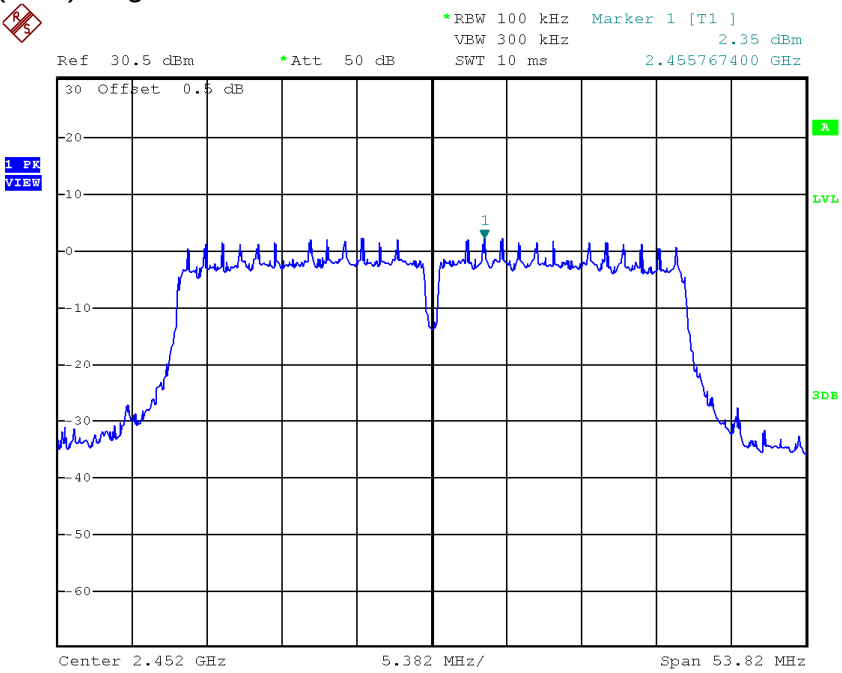


802.11n(40M), Middle channel



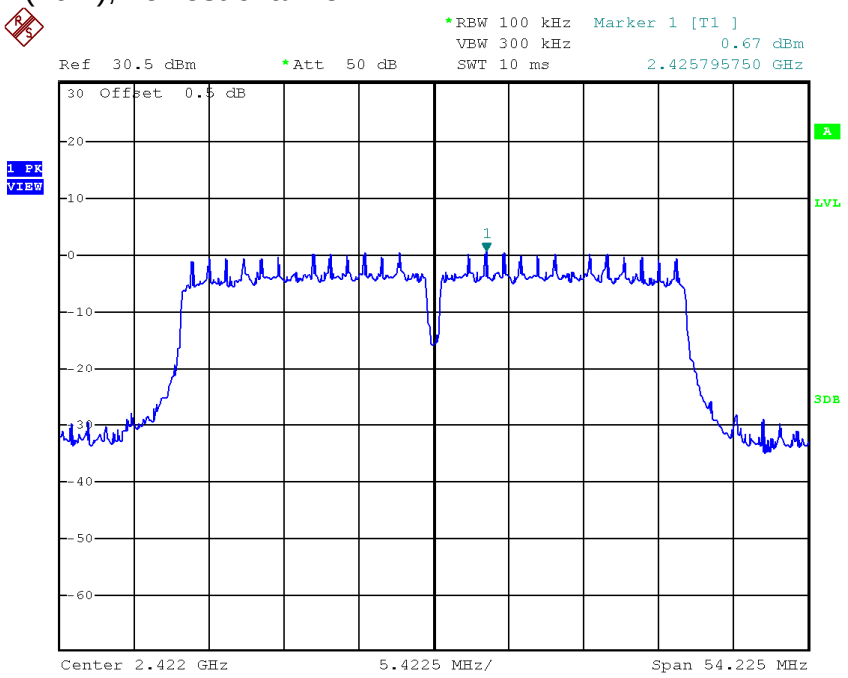
Plots of power spectral density (Antenna 0)

802.11n(40M), Highest channel

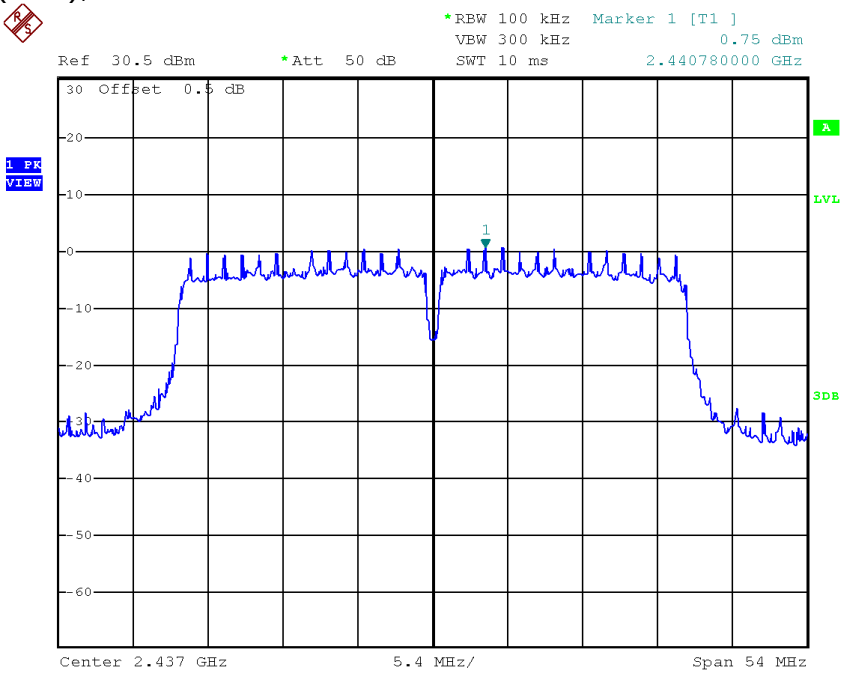


Plots of power spectral density (Antenna 1)

802.11n(40M), Lowest channel

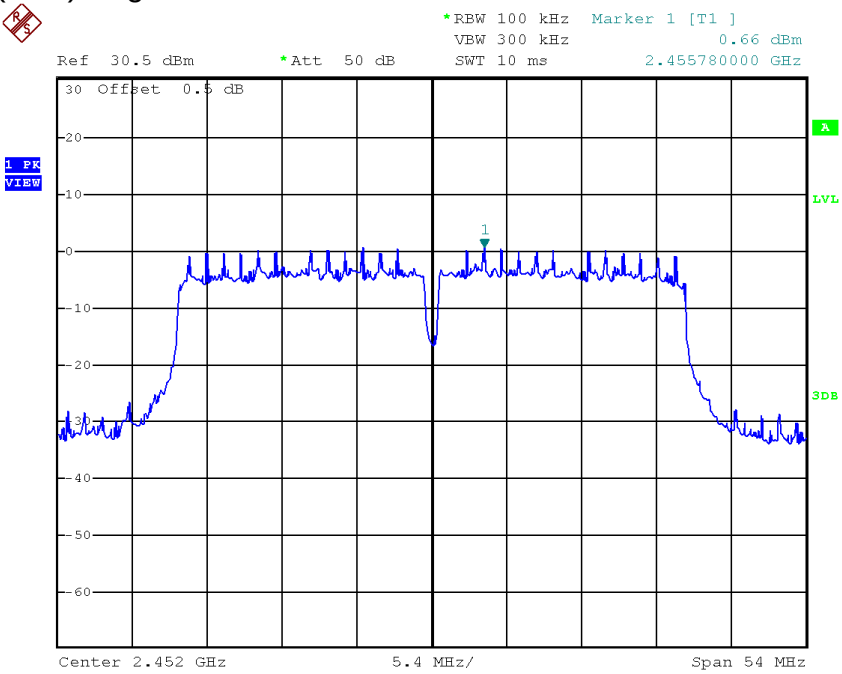


802.11n(40M), Middle channel



Plots of power spectral density (Antenna 1)

802.11n(40M), Highest channel



4.4 Out of Band Conducted Emissions

For 802.11b/g/n20MHz/N40MHz, the maximum conducted (peak) output power was used to demonstrate compliance as described in 9.1. Then the display line (in red) shown in the following plots denotes the limit at 20dB below maximum measured in-band peak PSD level in 100 KHz bandwidth.

The measurement procedures under sections 11 of KDB558074 D01 v03r03 (08-April-2016) were used.

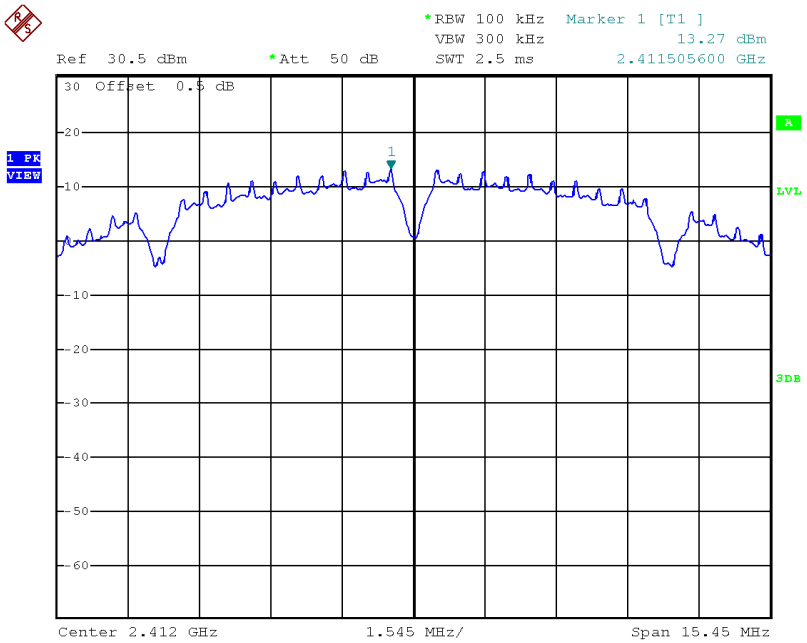
Furthermore, delta measurement technique for measuring bandedge emissions was incorporated in the test of the edge at 2483.5MHz.

Limits:
All spurious emission and up to the tenth harmonic was measured and they were found to be at least 20 dB for 802.11b,g,n20MHz,n40MHz below the maximum measured in-band peak PSD level.

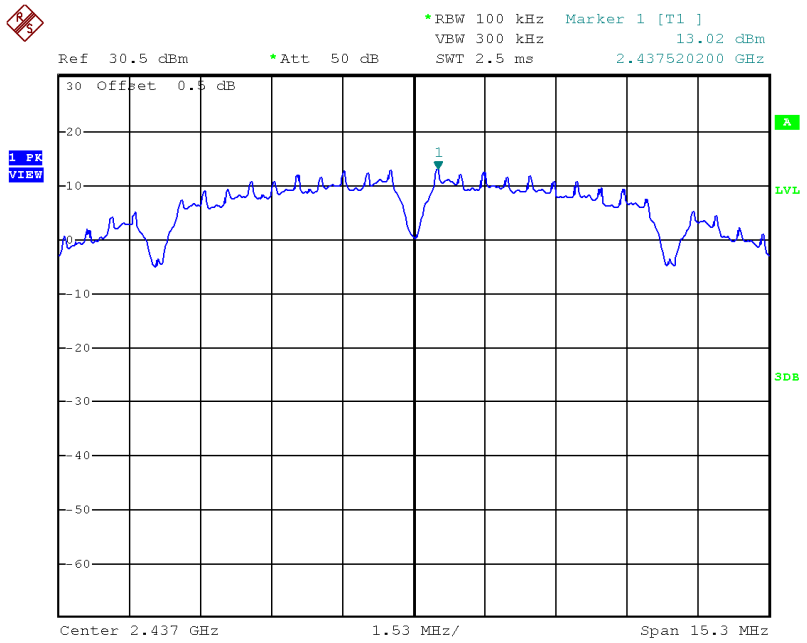
The plots of reference level measurement and out of band conducted emissions are as below.

Plots of power spectral density in 100KHz (Antenna 0)

802.11b, Lowest channel

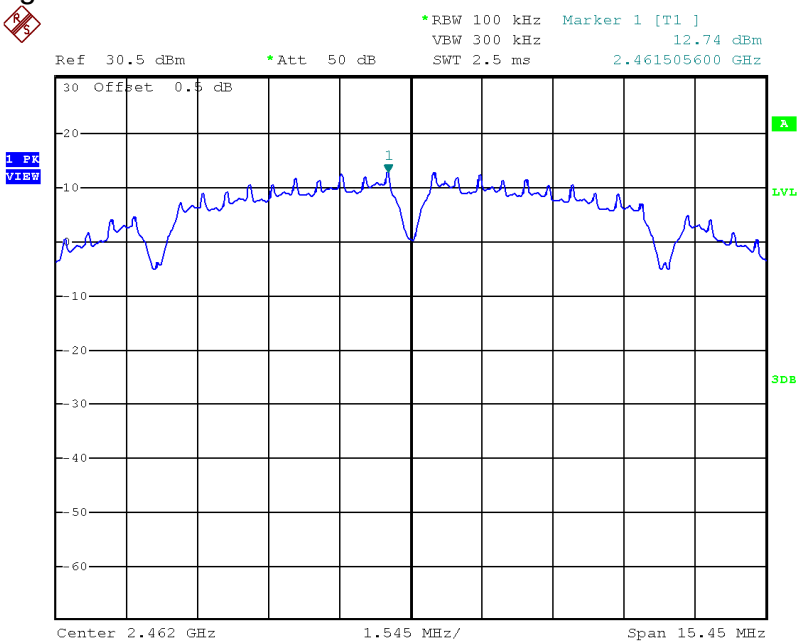


802.11b, Middle channel



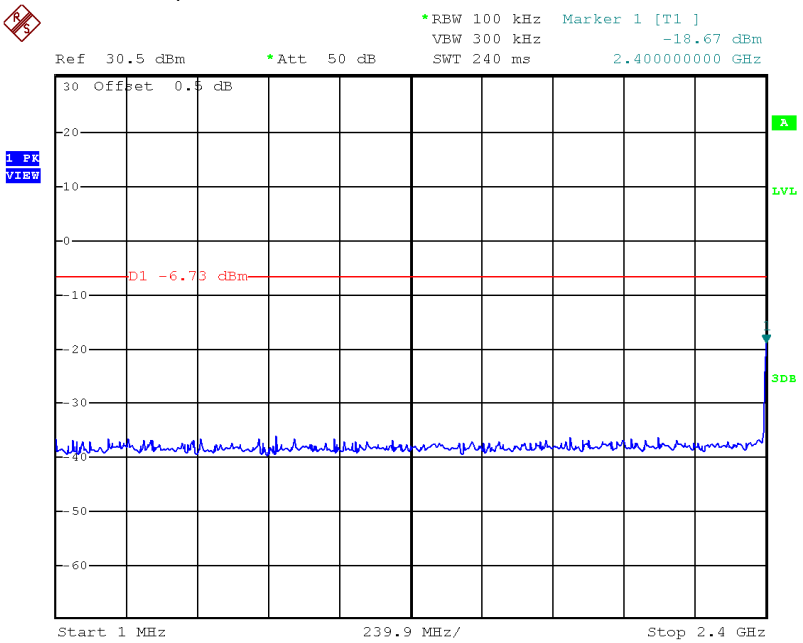
Plots of power spectral density in 100KHz (Antenna 0)

802.11b, Highest channel

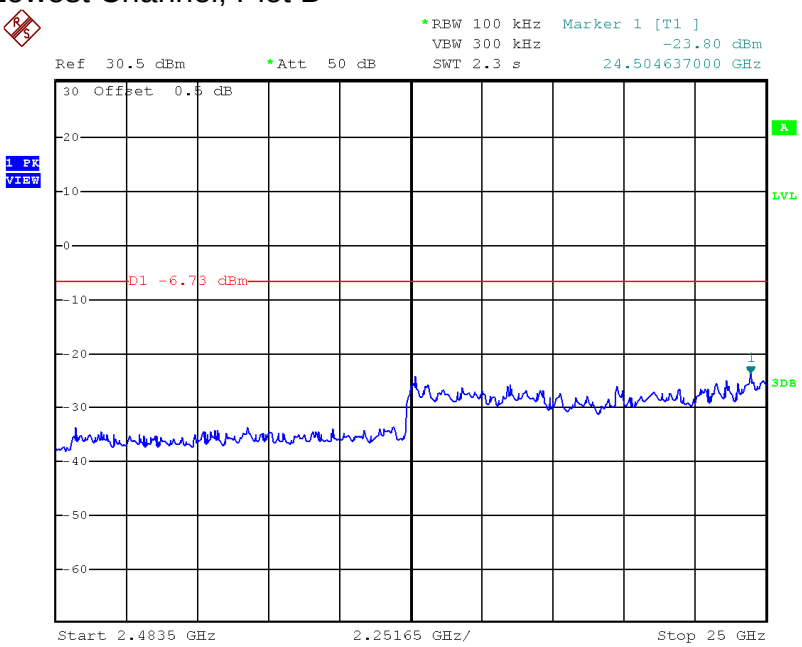


Plots of out of band conducted emissions (Antenna 0)

802.11b, Lowest Channel, Plot A

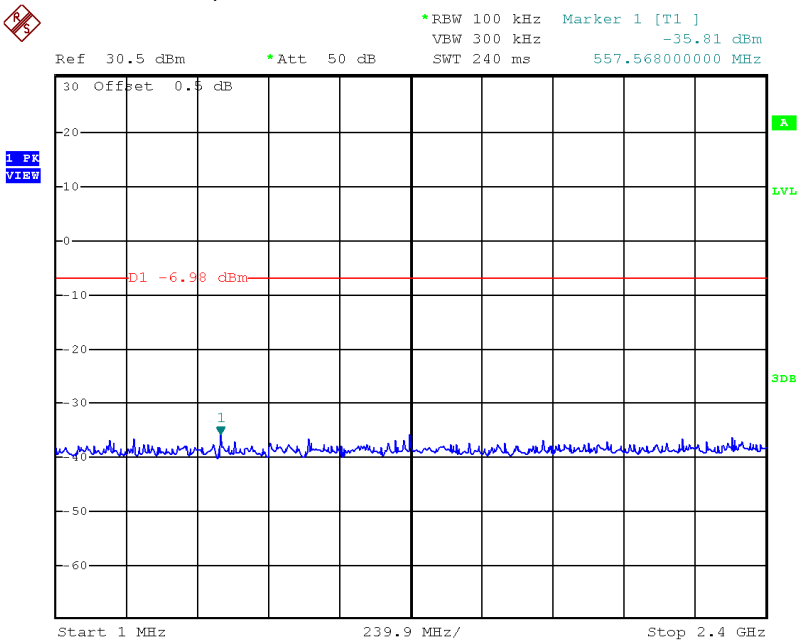


802.11b, Lowest Channel, Plot B

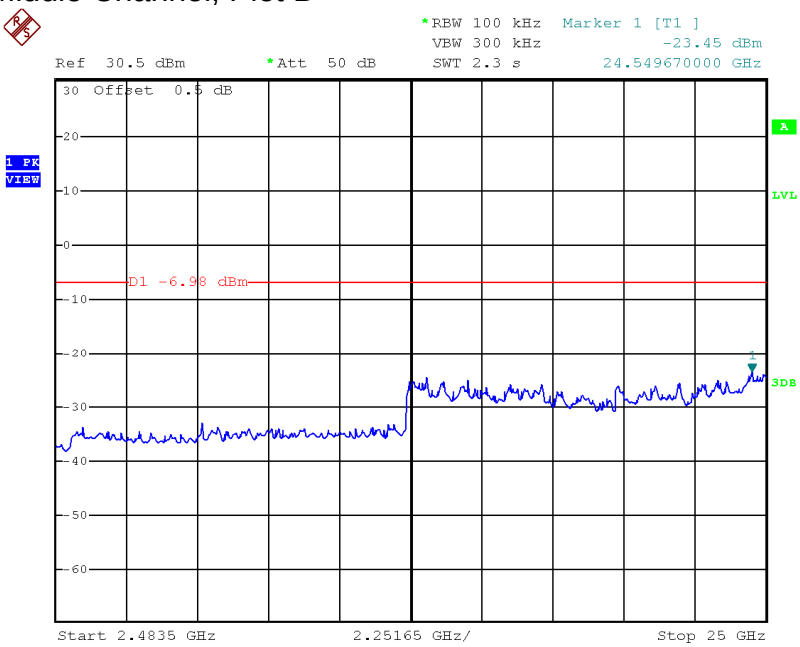


Plots of out of band conducted emissions (Antenna 0)

802.11b, Middle Channel, Plot A

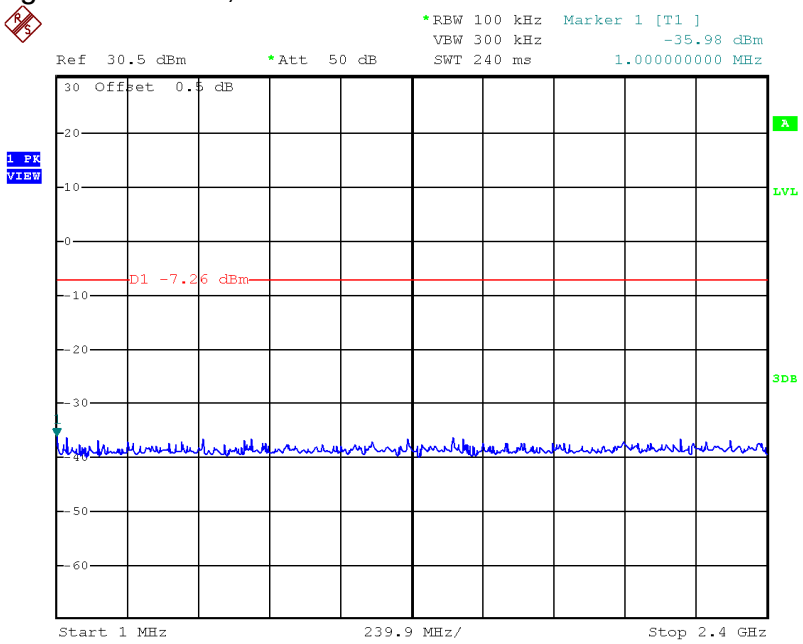


802.11b, Middle Channel, Plot B

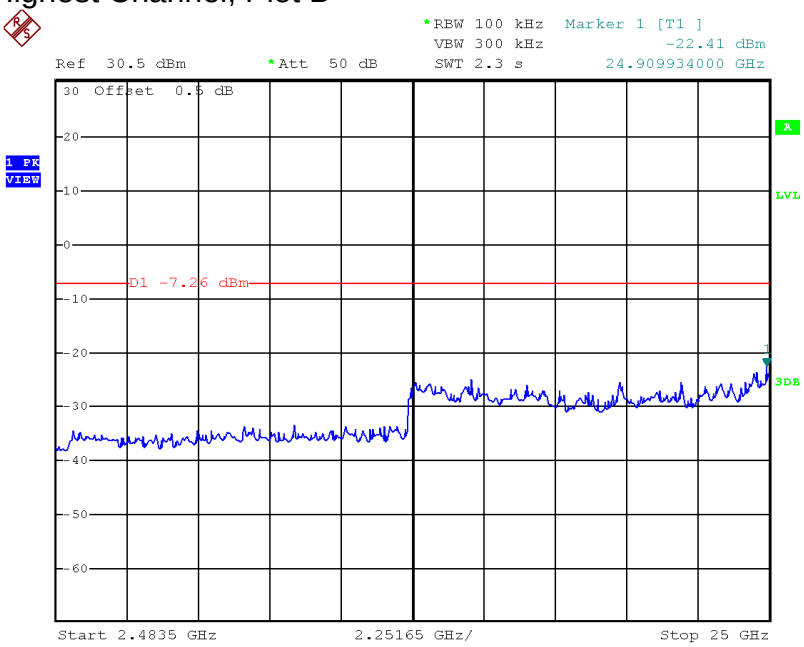


Plots of out of band conducted emissions (Antenna 0)

802.11b, Highest Channel, Plot A

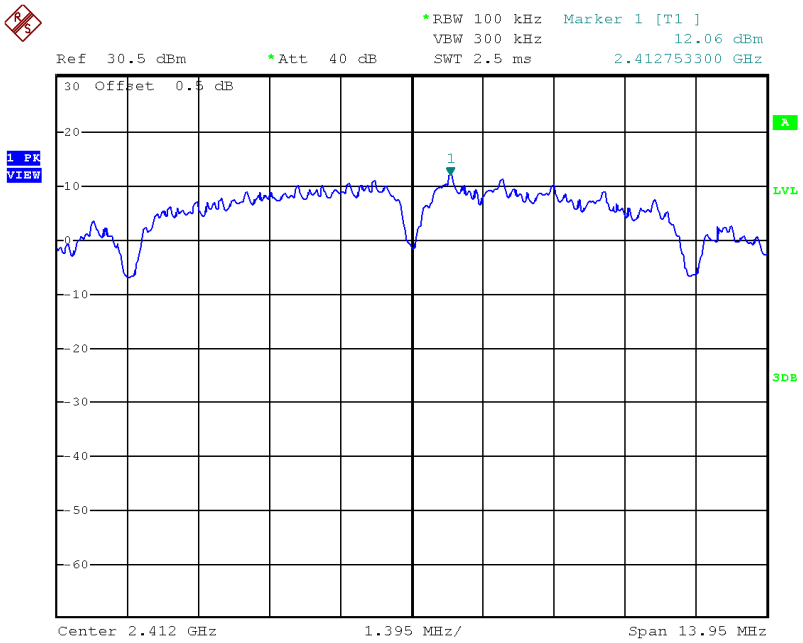


802.11b, Highest Channel, Plot B

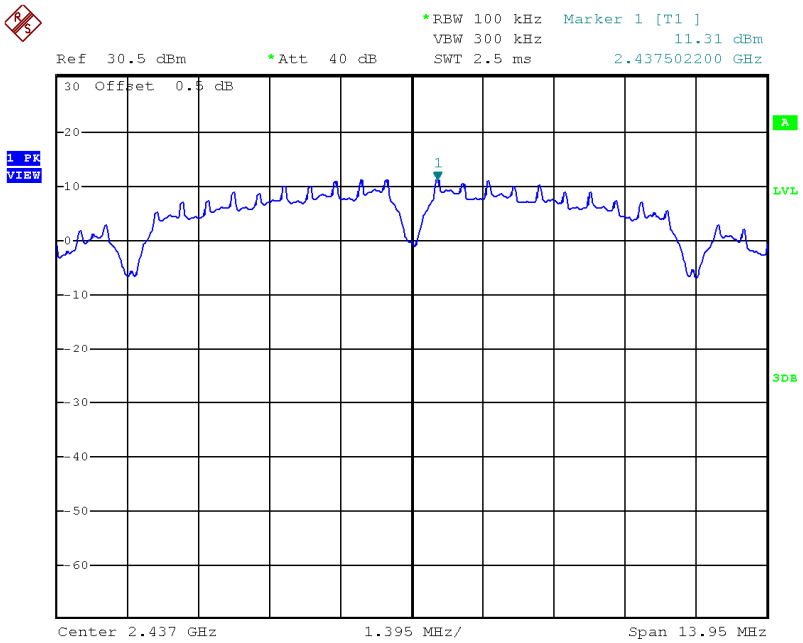


Plots of power spectral density in 100KHz (Antenna 1)

802.11b, Lowest channel

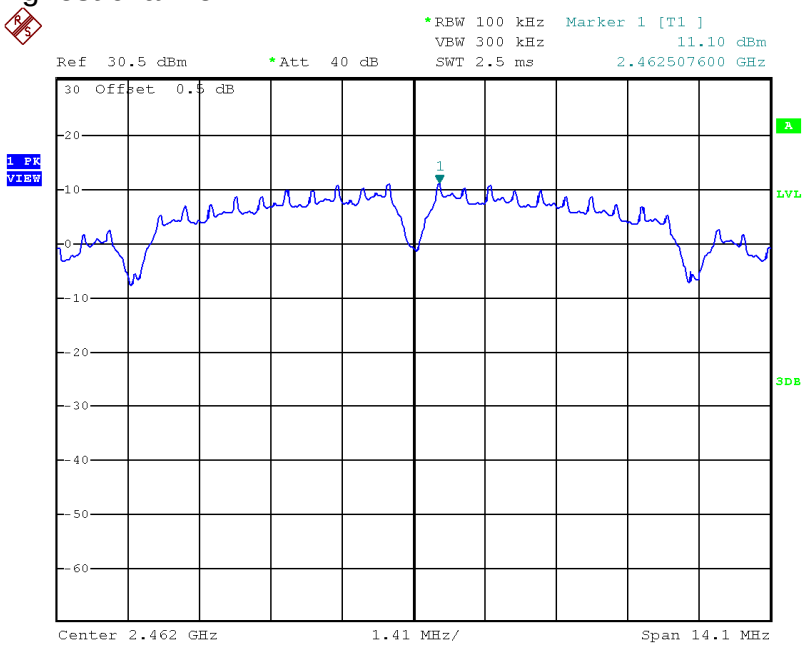


802.11b, Middle channel



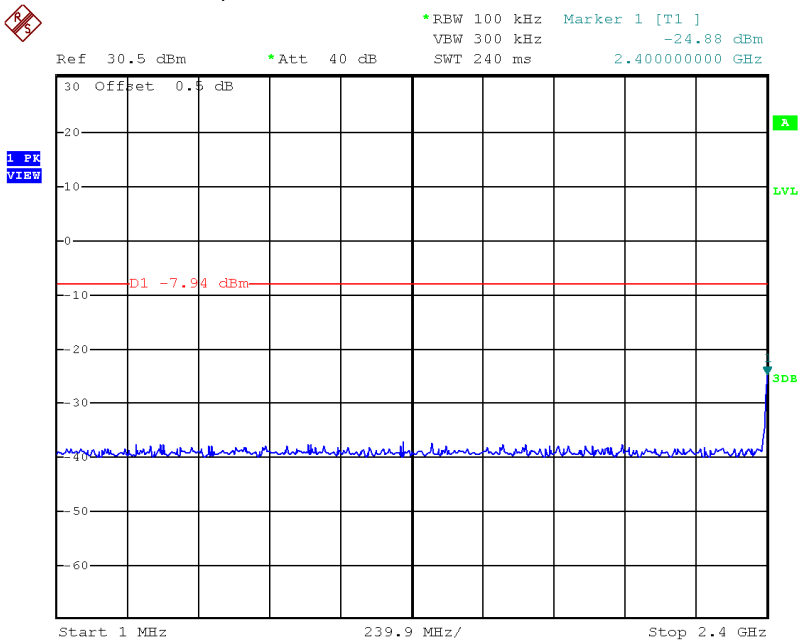
Plots of power spectral density in 100KHz (Antenna 1)

802.11b, Highest channel

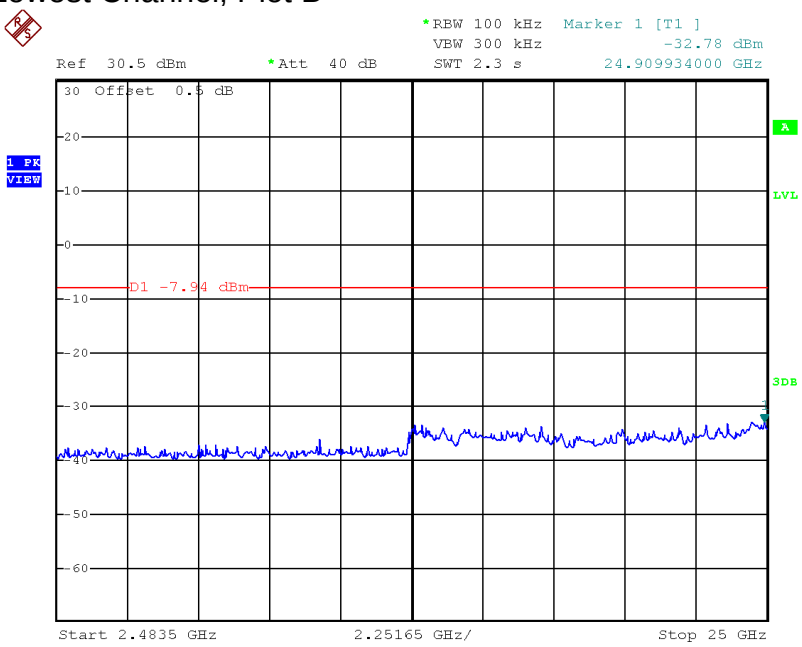


Plots of out of band conducted emissions (Antenna 1)

802.11b, Lowest Channel, Plot A

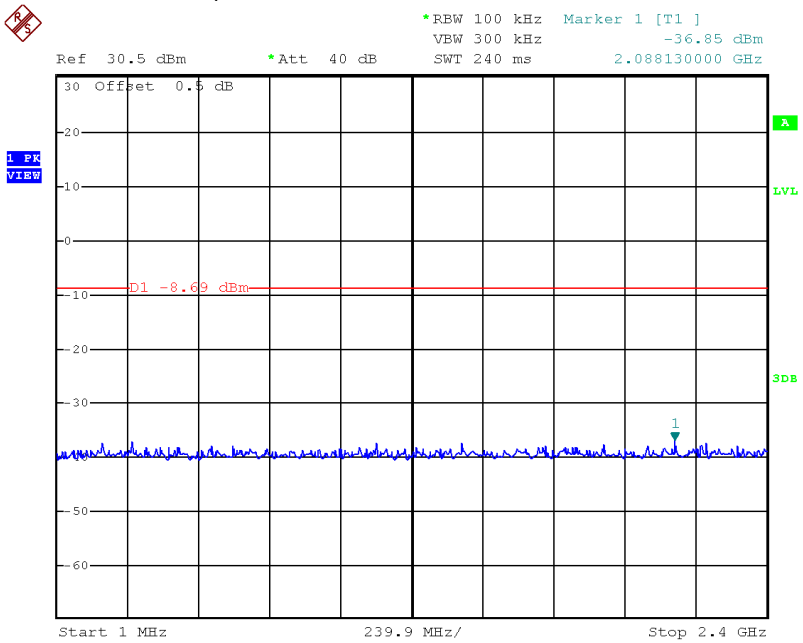


802.11b, Lowest Channel, Plot B

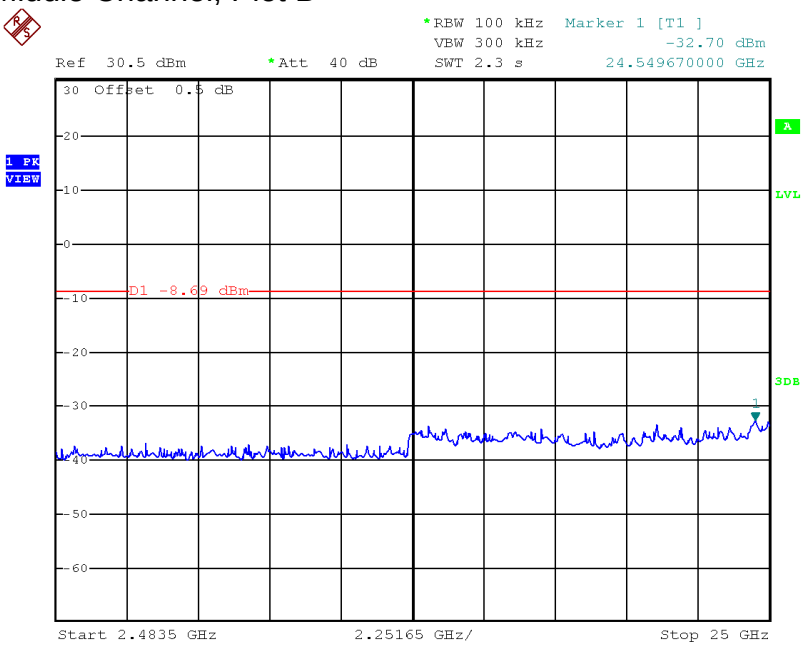


Plots of out of band conducted emissions (Antenna 1)

802.11b, Middle Channel, Plot A

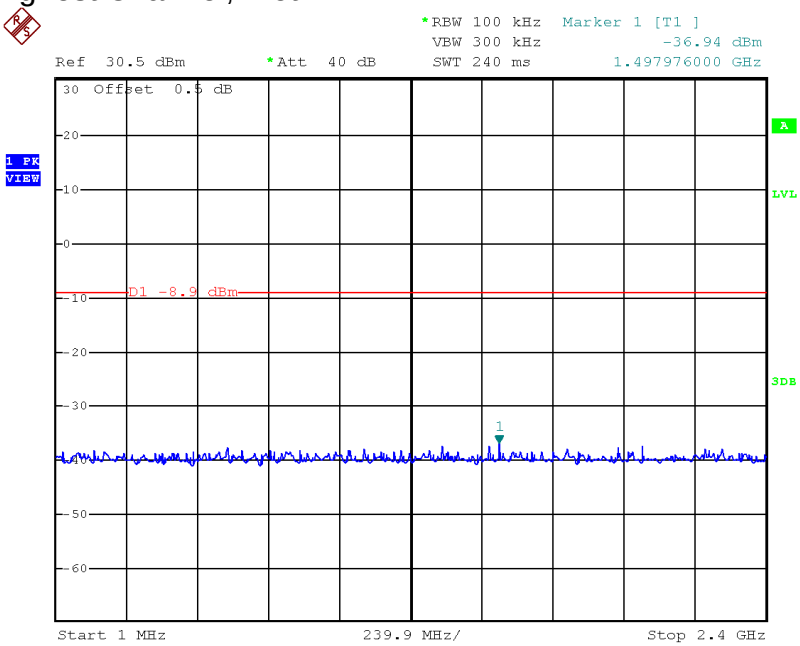


802.11b, Middle Channel, Plot B

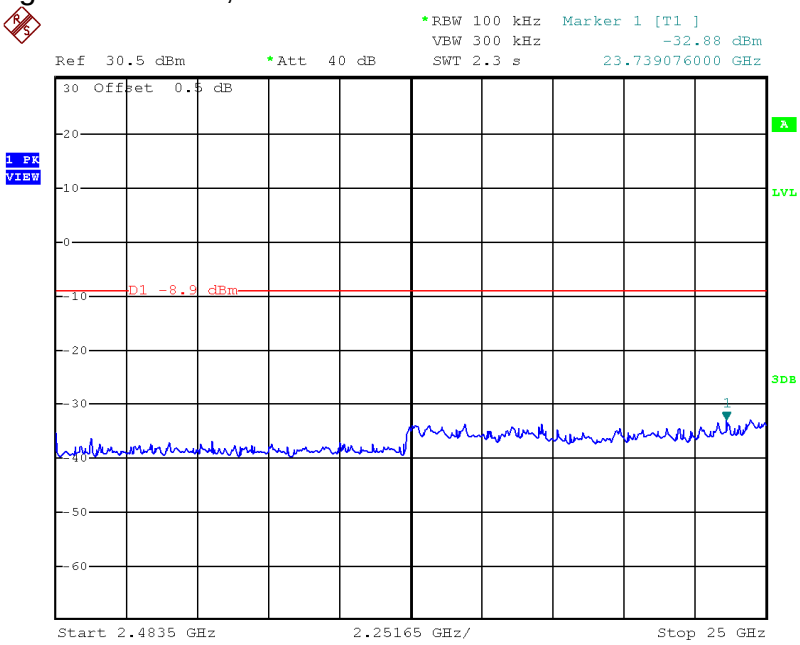


Plots of out of band conducted emissions (Antenna 1)

802.11b, Highest Channel, Plot A

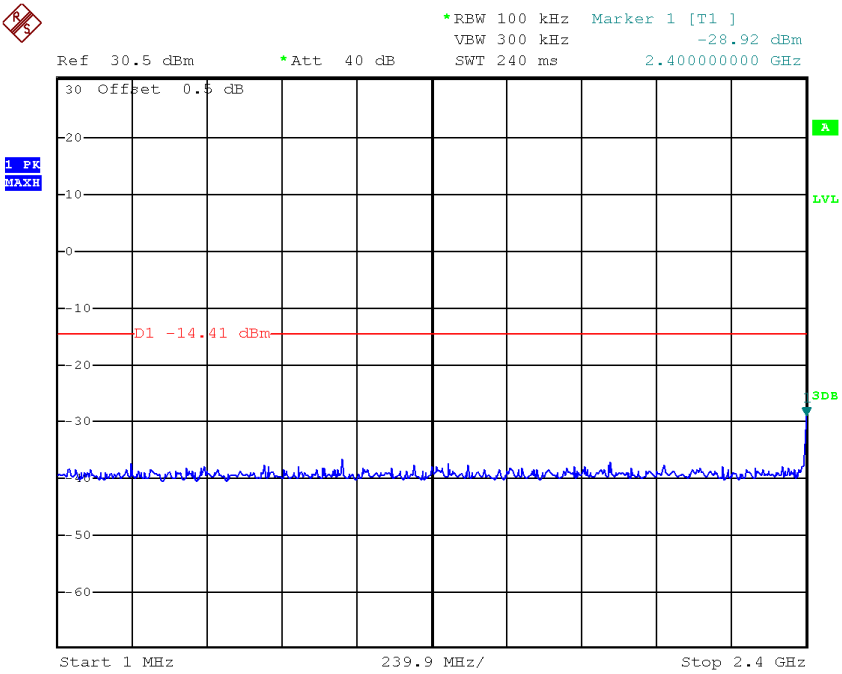


802.11b, Highest Channel, Plot B

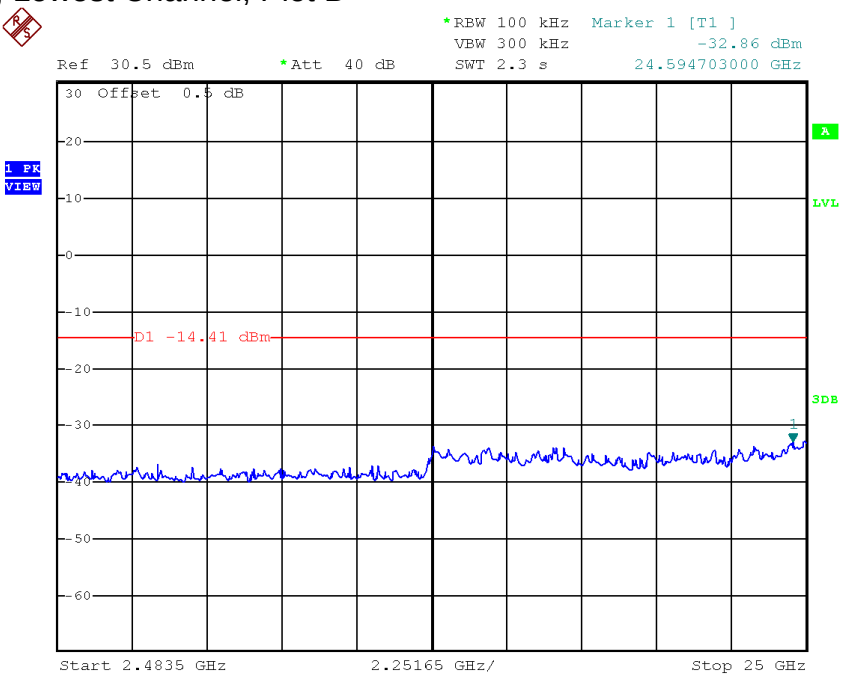


Plots of out of band conducted emissions (Antenna 0)

802.11g, Lowest Channel, Plot A

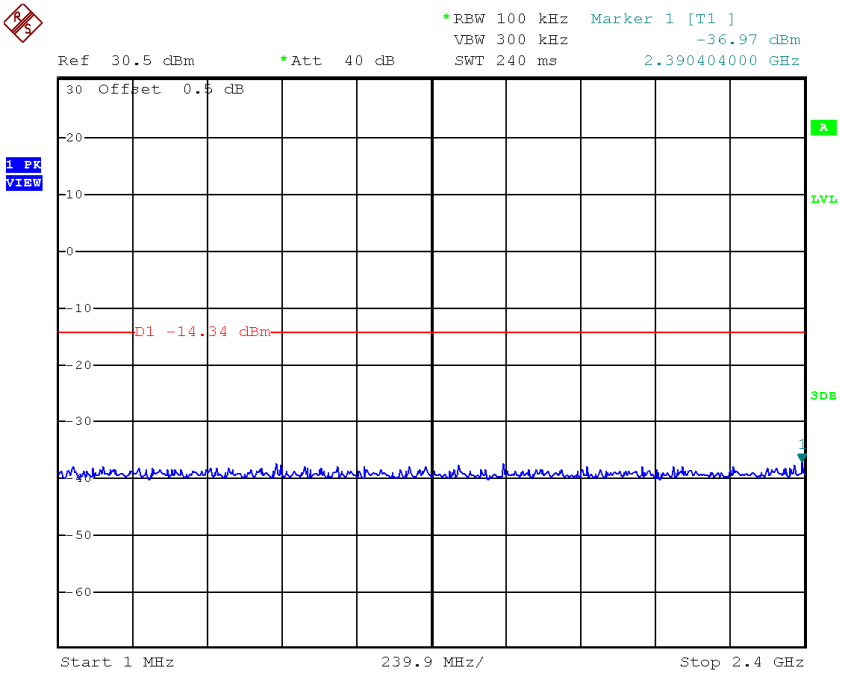


802.11g, Lowest Channel, Plot B

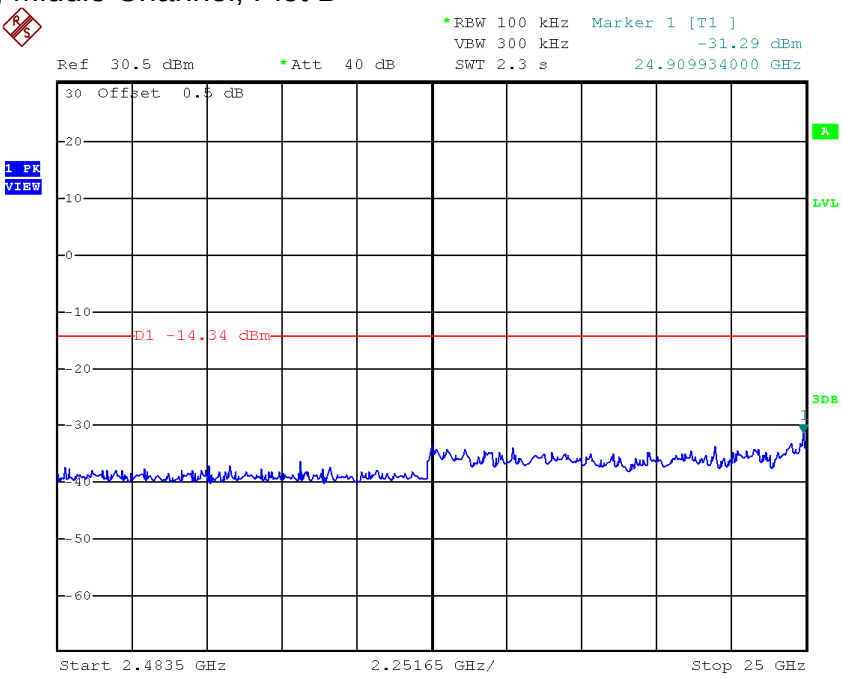


Plots of out of band conducted emissions (Antenna 0)

802.11g, Middle Channel, Plot A

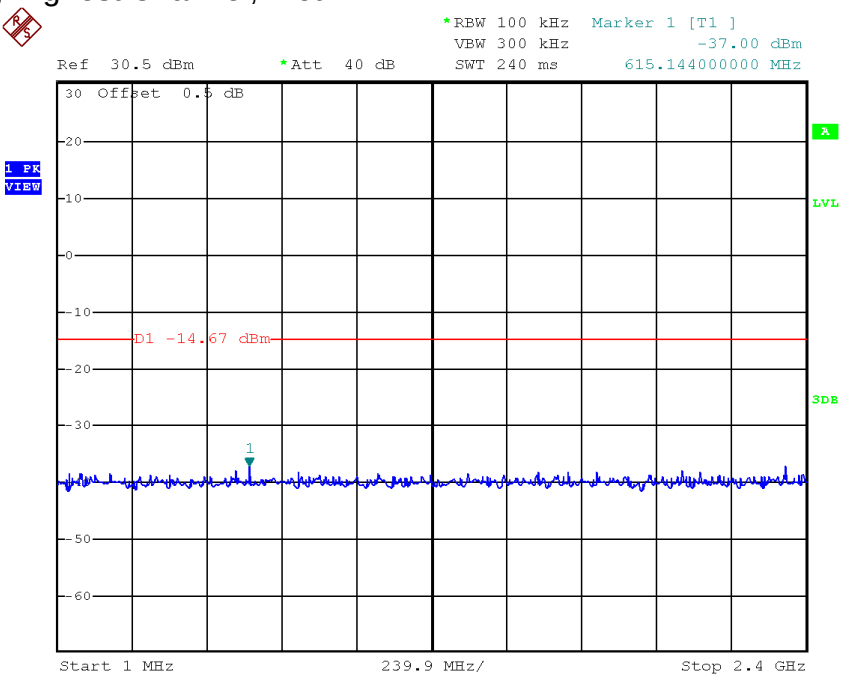


802.11g, Middle Channel, Plot B

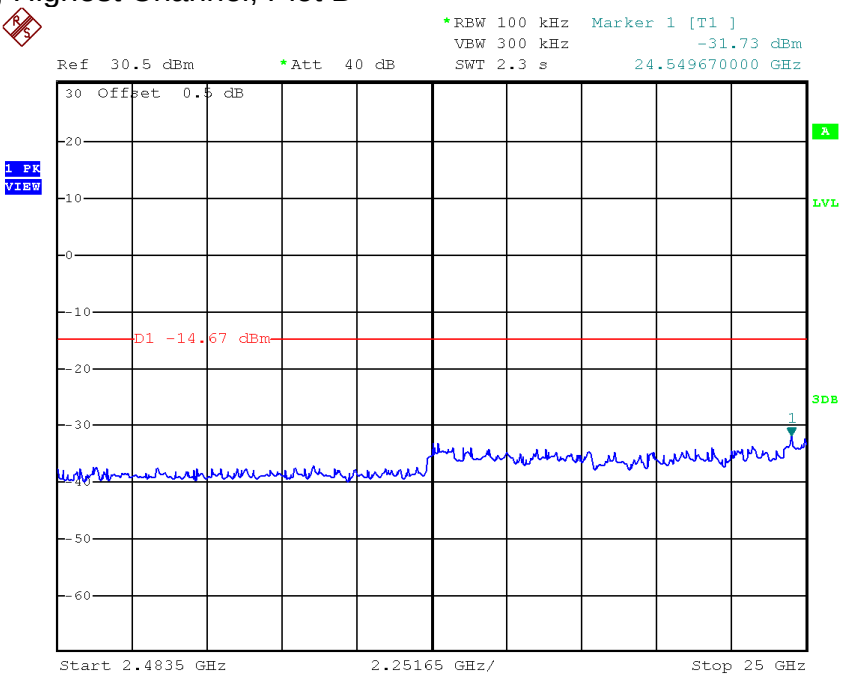


Plots of out of band conducted emissions (Antenna 0)

802.11g, Highest Channel, Plot A

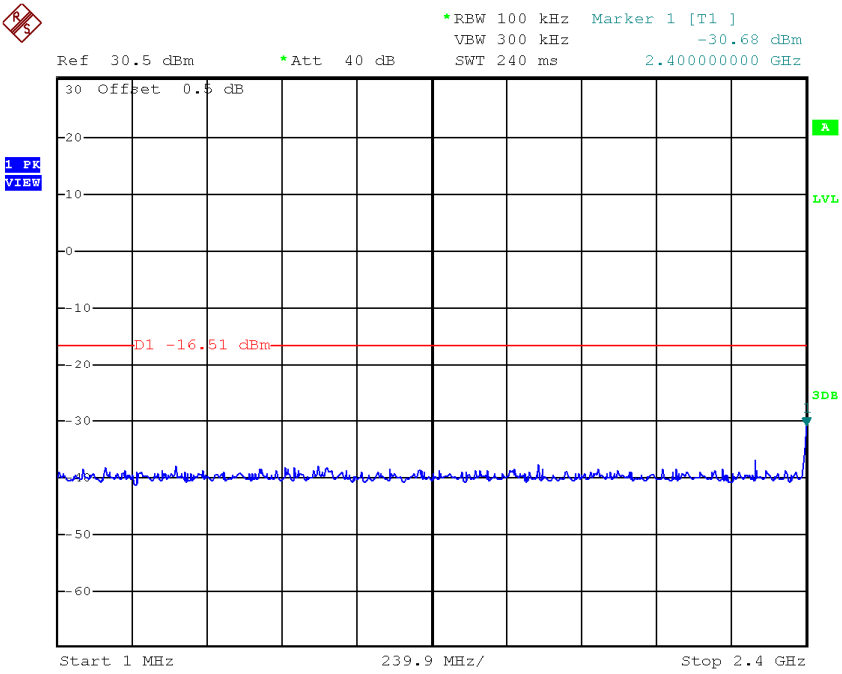


802.11g, Highest Channel, Plot B

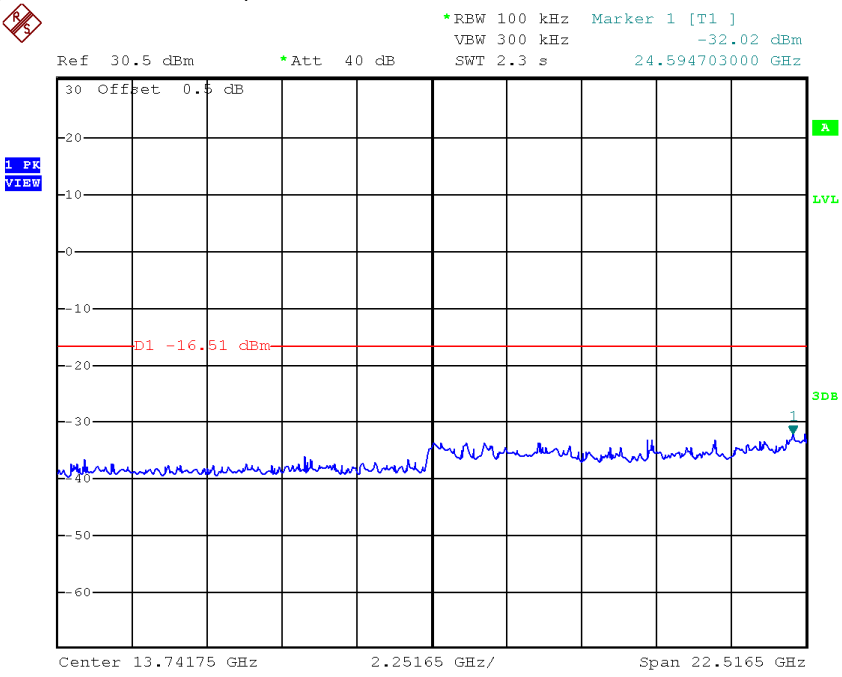


Plots of out of band conducted emissions (Antenna 1)

802.11g, Lowest Channel, Plot A

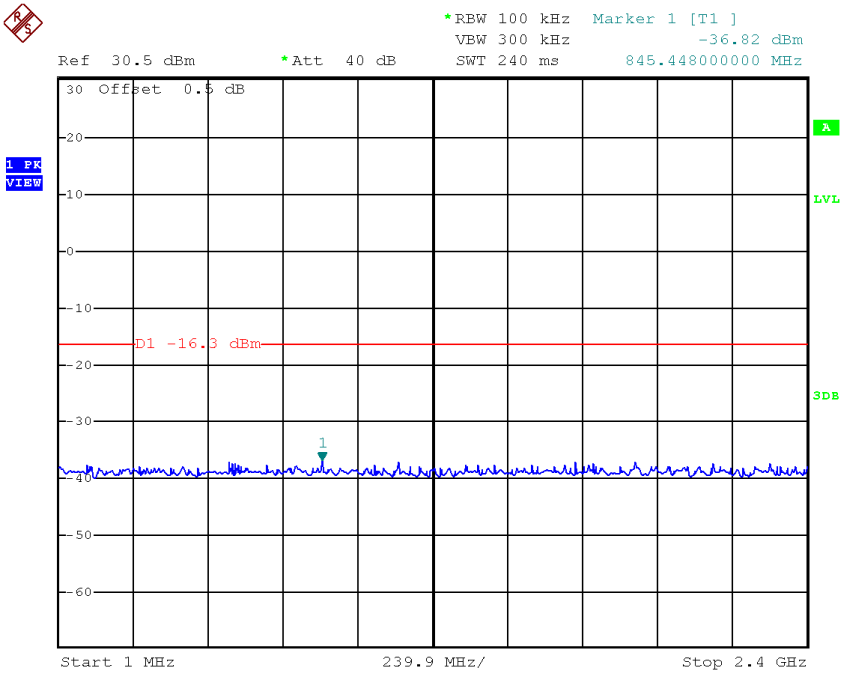


802.11g, Lowest Channel, Plot B

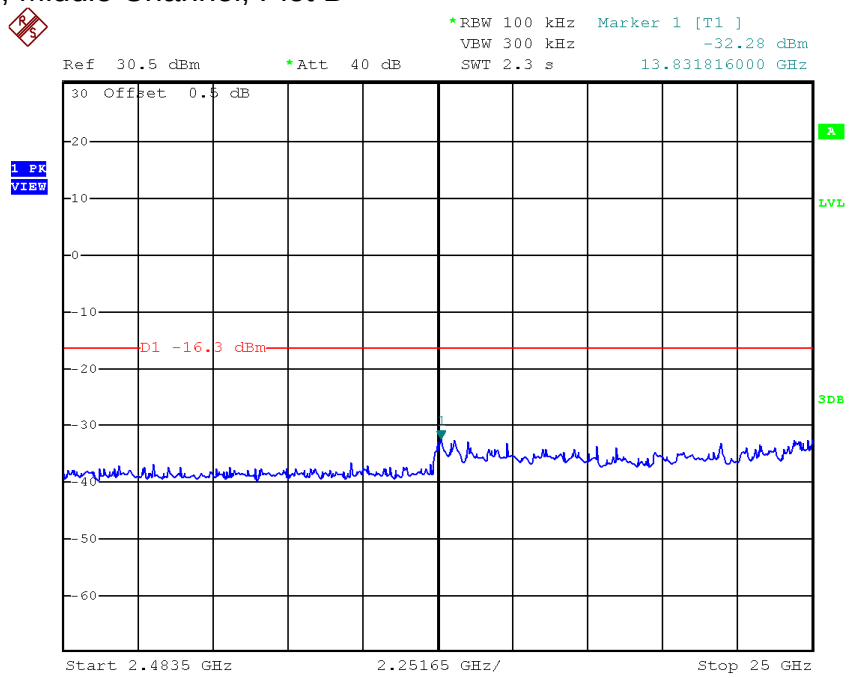


Plots of out of band conducted emissions (Antenna 1)

802.11g, Middle Channel, Plot A

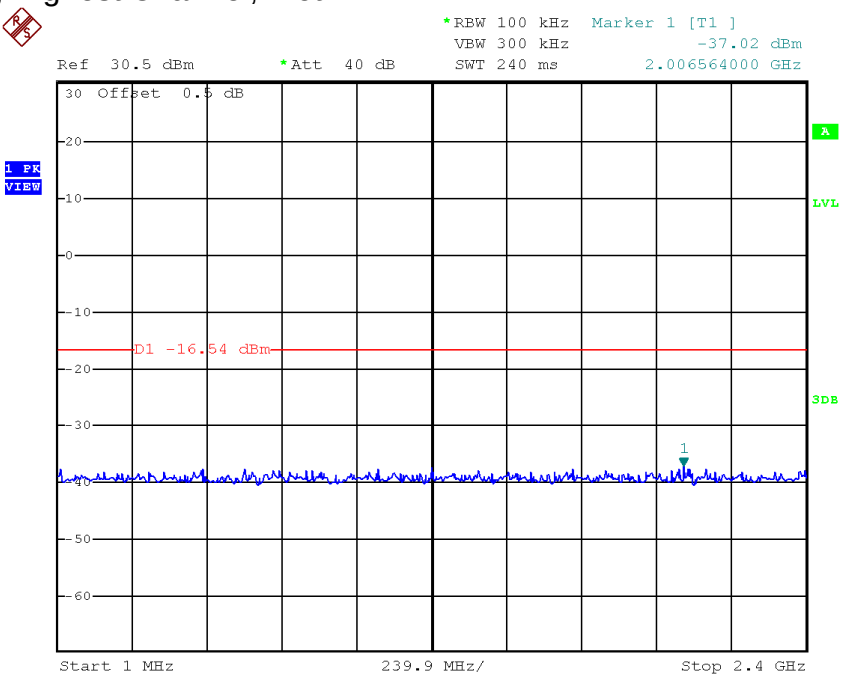


802.11g, Middle Channel, Plot B

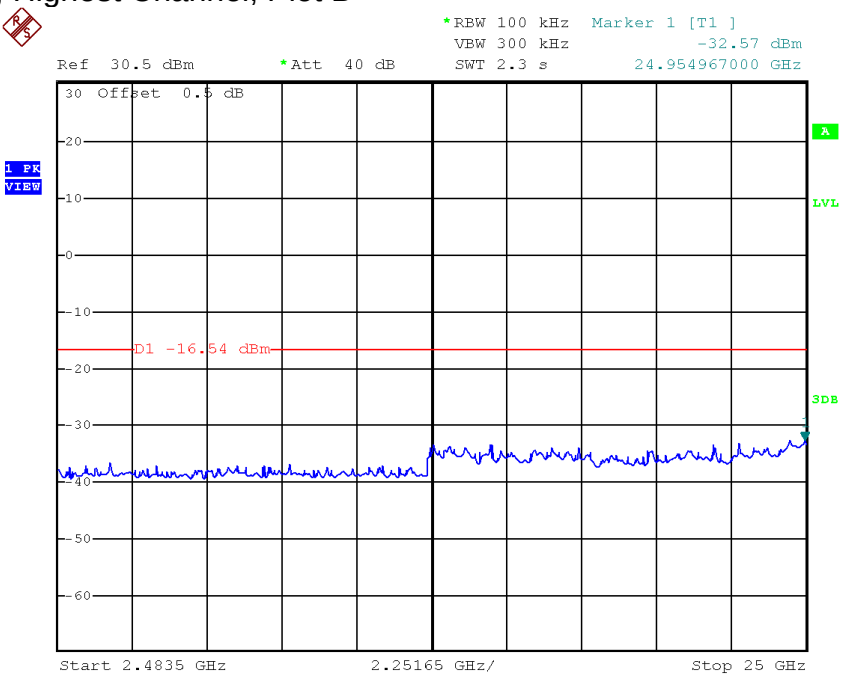


Plots of out of band conducted emissions (Antenna 1)

802.11g, Highest Channel, Plot A

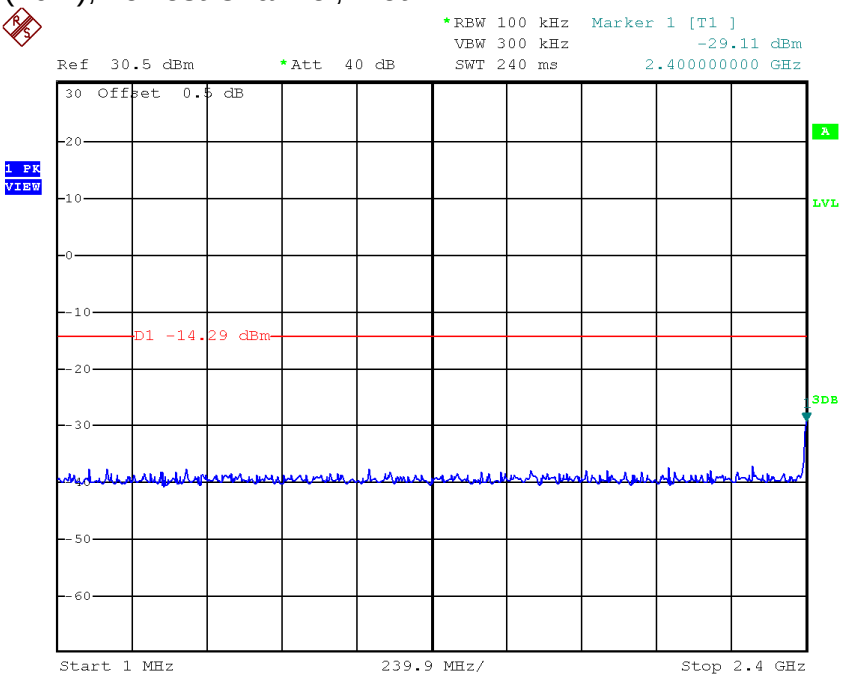


802.11g, Highest Channel, Plot B

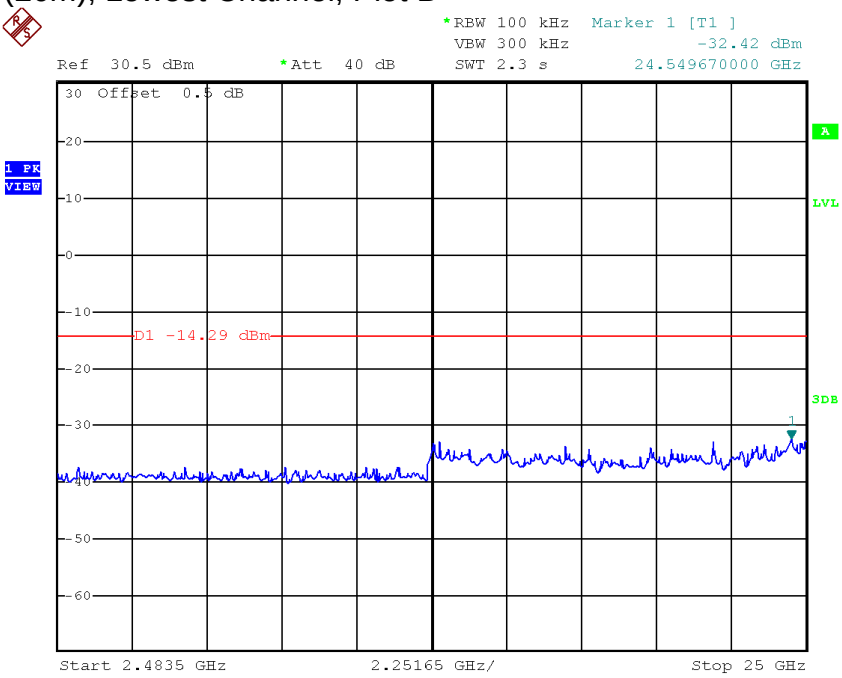


Plots of out of band conducted emissions (Antenna 0)

802.11n (20m), Lowest Channel, Plot A

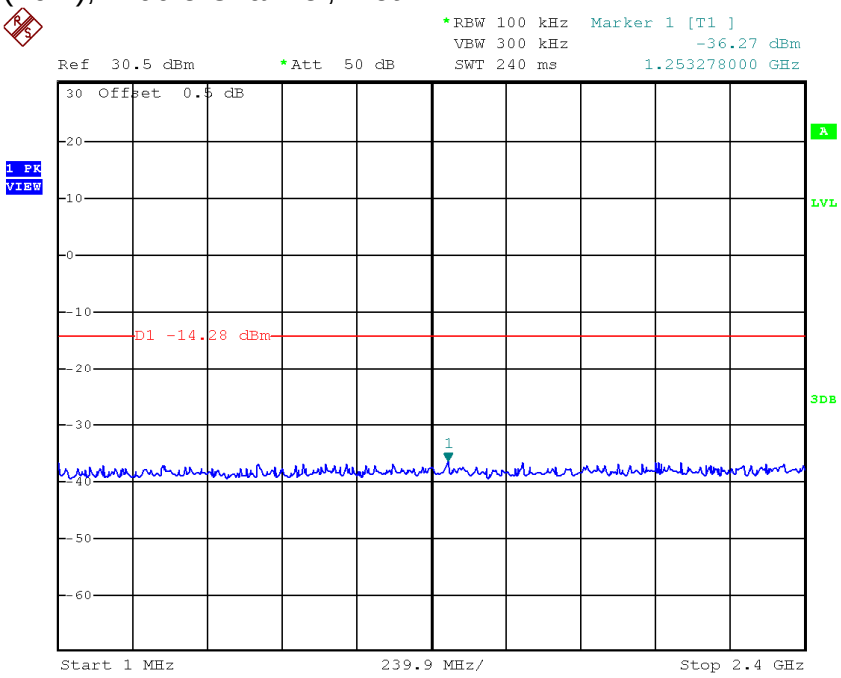


802.11n (20m), Lowest Channel, Plot B

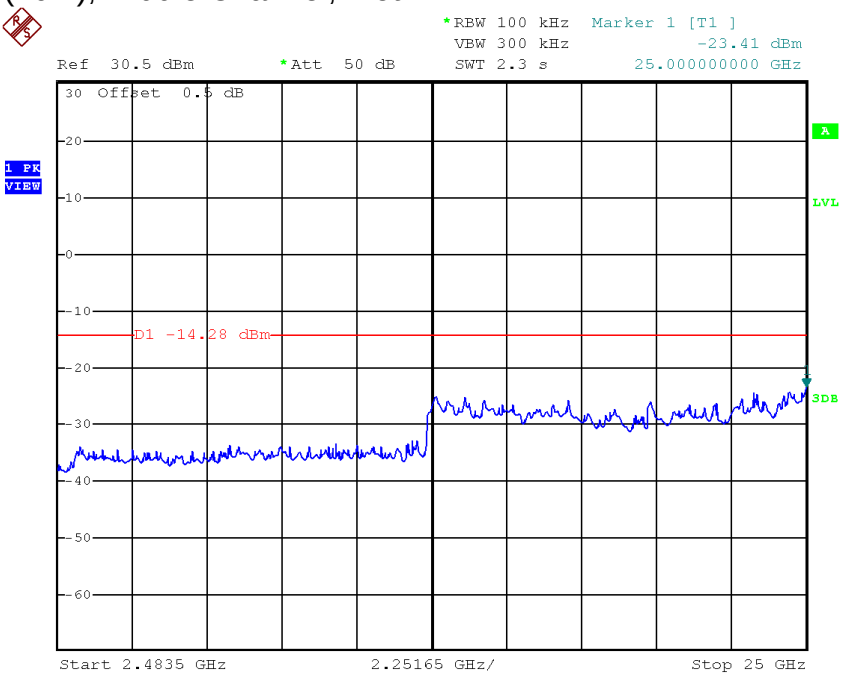


Plots of out of band conducted emissions (Antenna 0)

802.11n (20m), Middle Channel, Plot A

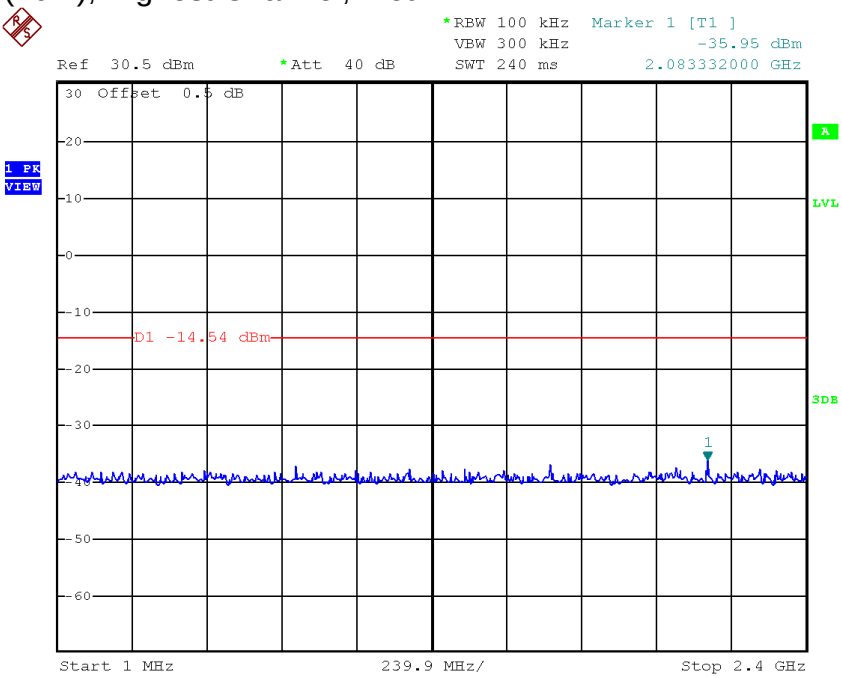


802.11n (20m), Middle Channel, Plot B

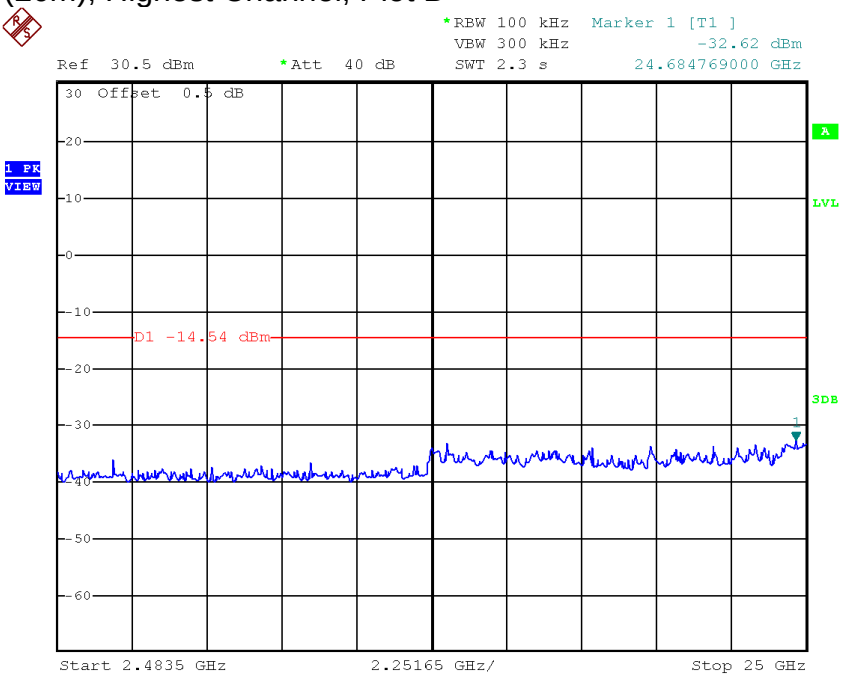


Plots of out of band conducted emissions (Antenna 0)

802.11n (20m), Highest Channel, Plot A

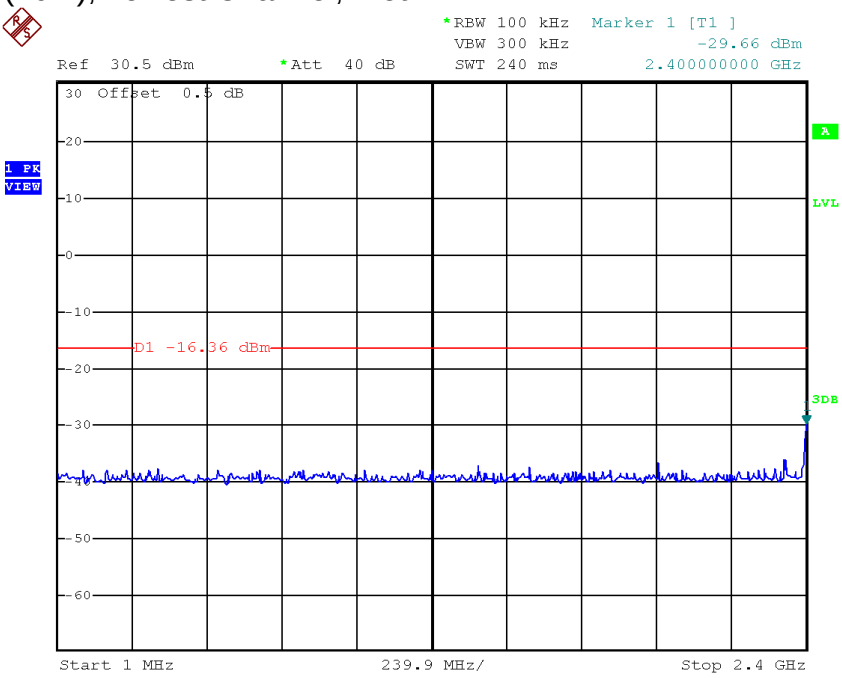


802.11n (20m), Highest Channel, Plot B

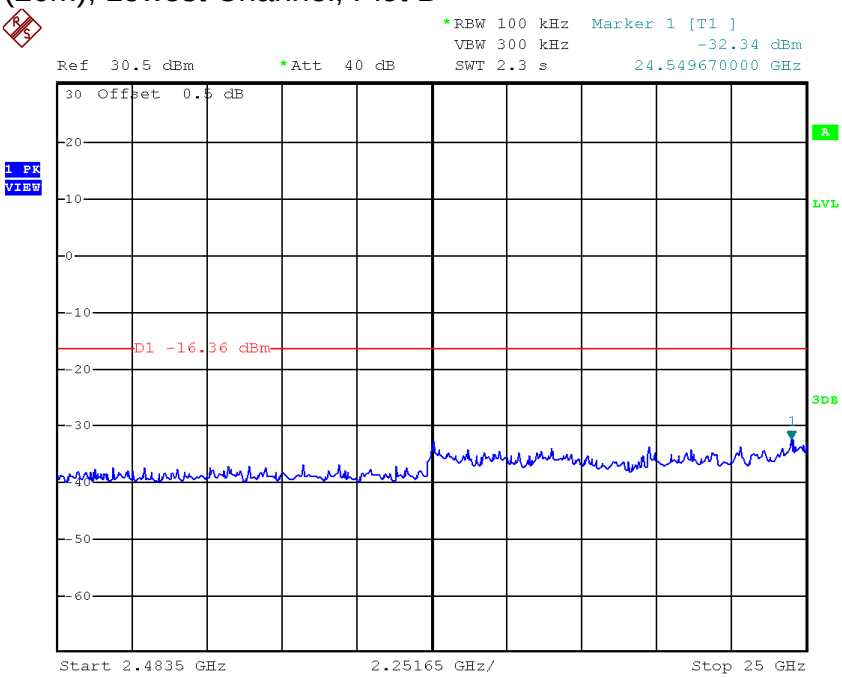


Plots of out of band conducted emissions (Antenna 1)

802.11n (20m), Lowest Channel, Plot A

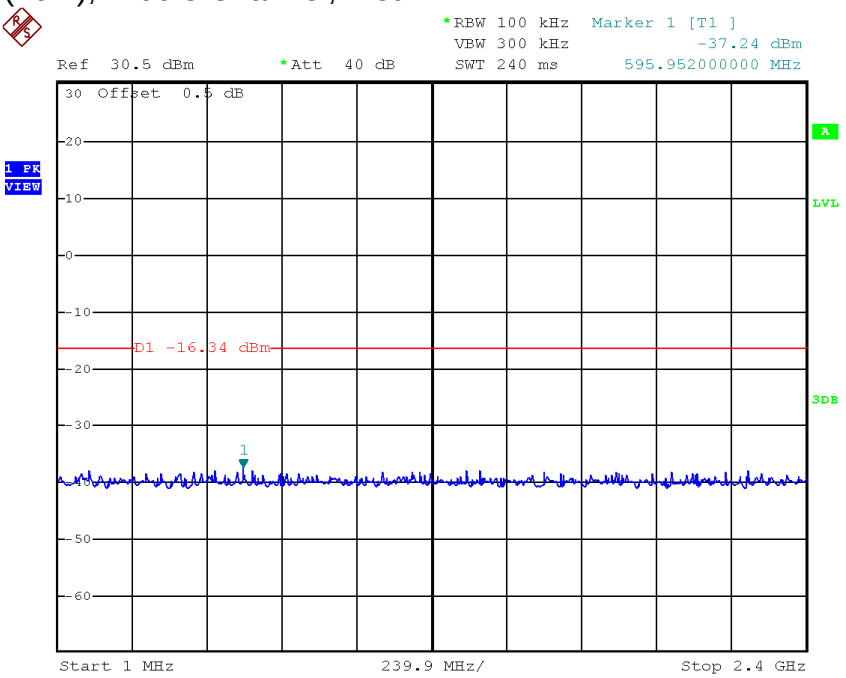


802.11n (20m), Lowest Channel, Plot B

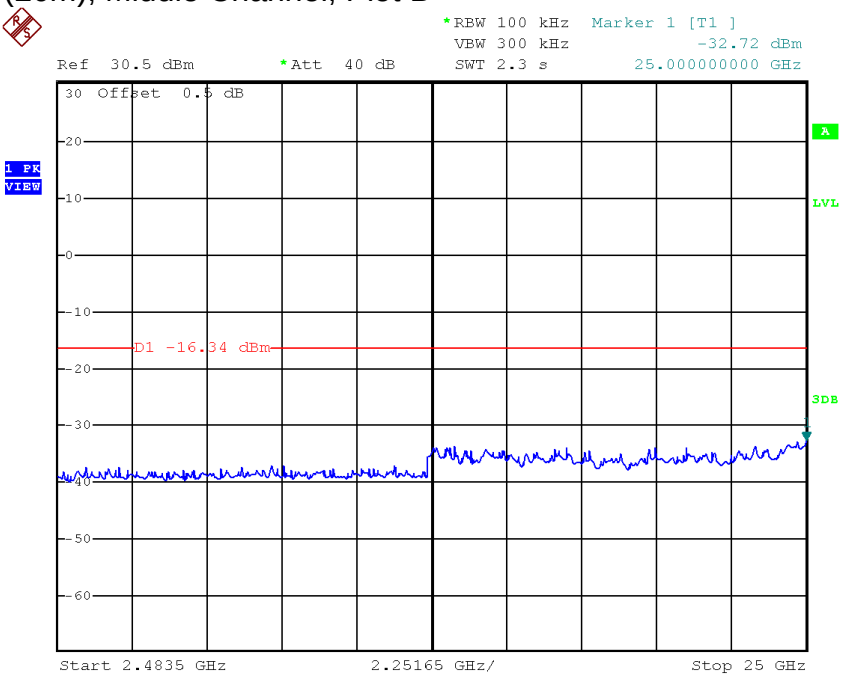


Plots of out of band conducted emissions (Antenna 1)

802.11n (20m), Middle Channel, Plot A

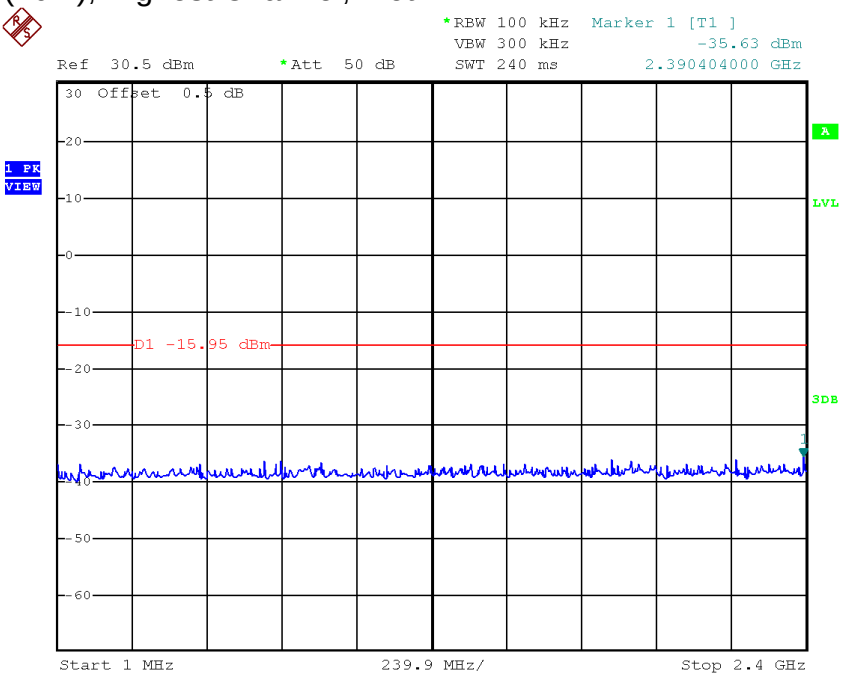


802.11n (20m), Middle Channel, Plot B

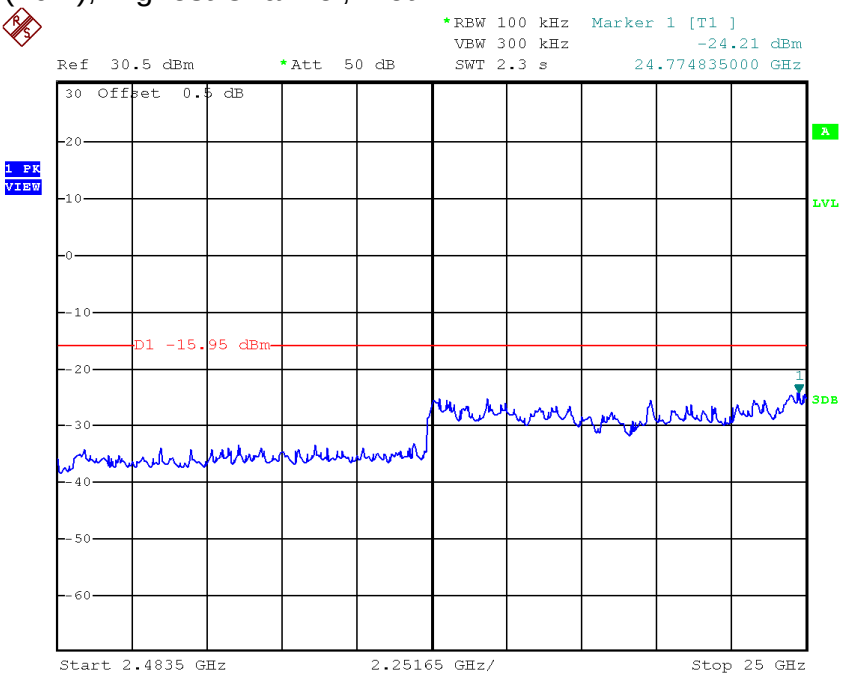


Plots of out of band conducted emissions (Antenna 1)

802.11n (20m), Highest Channel, Plot A



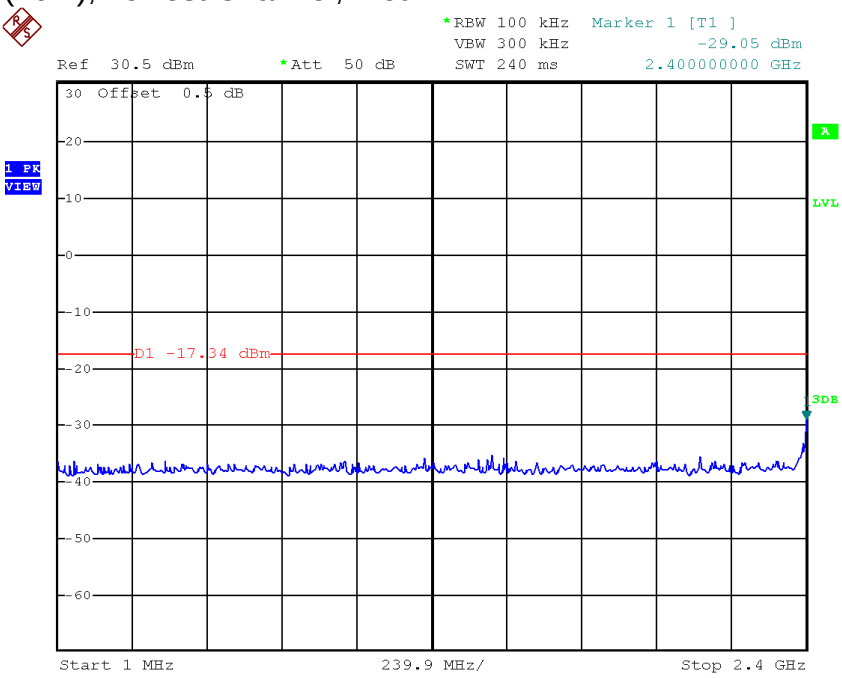
802.11n (20m), Highest Channel, Plot B



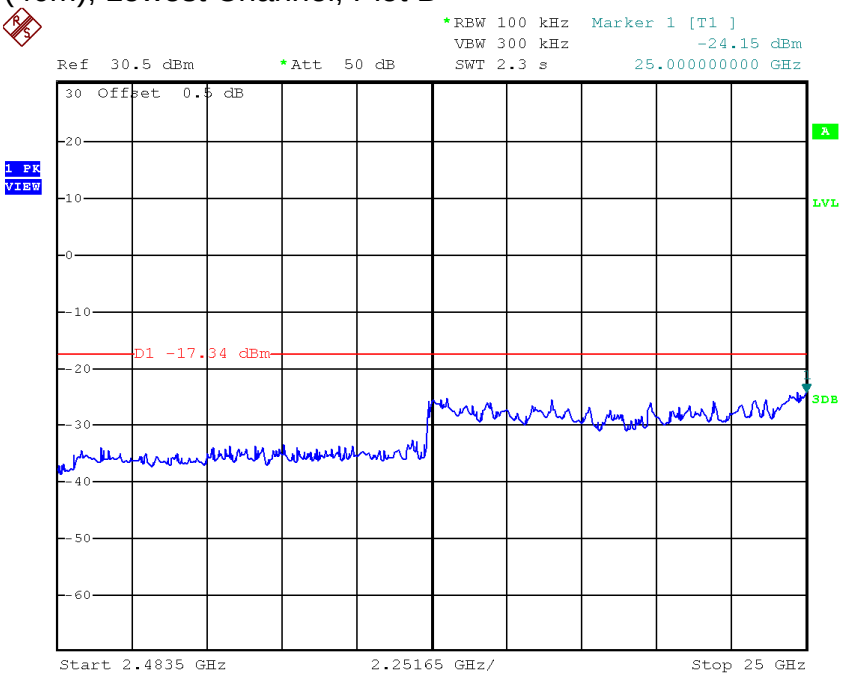
IEEE 802.11n (20MHz)				
Maximum Out of Band Conducted Emissions (dBm)				
Antenna 0	Antenna 1	Antenna 0 + Antenna1	PSD in 100KHz	Limit
-23.41	-24.21	-20.78	7.81	-12.19

Plots of out of band conducted emissions (Antenna 0)

802.11n (40m), Lowest Channel, Plot A

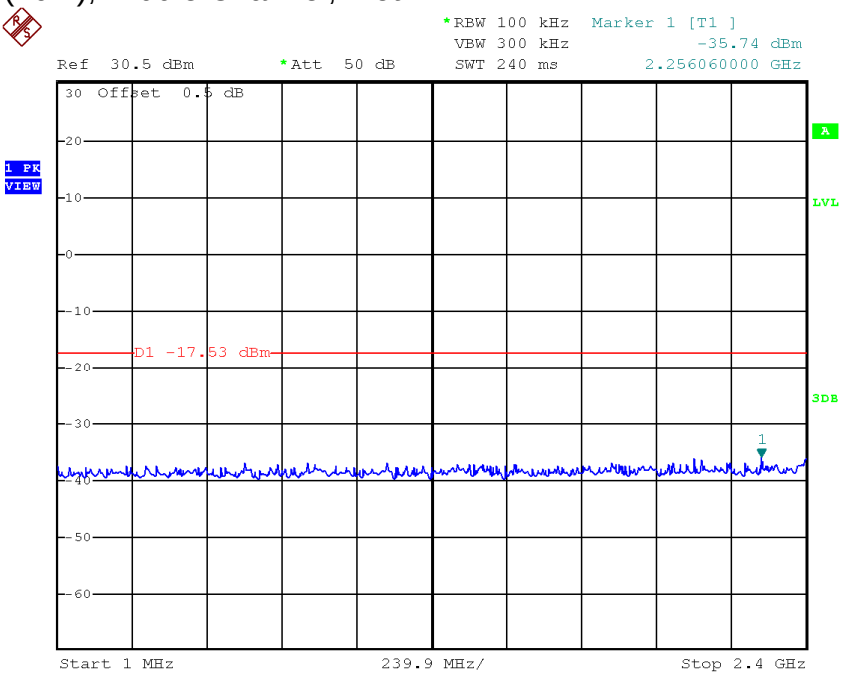


802.11n (40m), Lowest Channel, Plot B

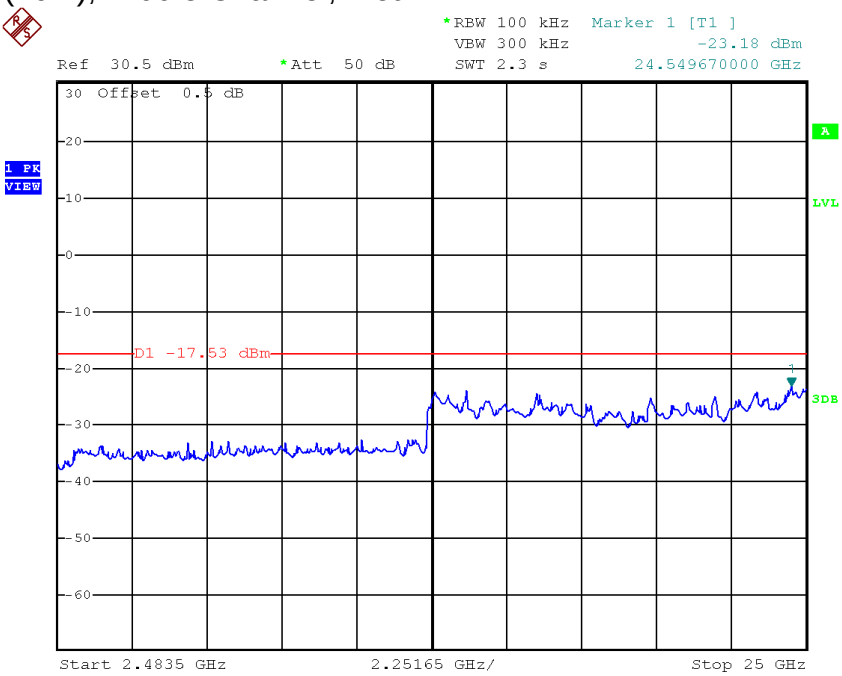


Plots of out of band conducted emissions (Antenna 0)

802.11n (40m), Middle Channel, Plot A

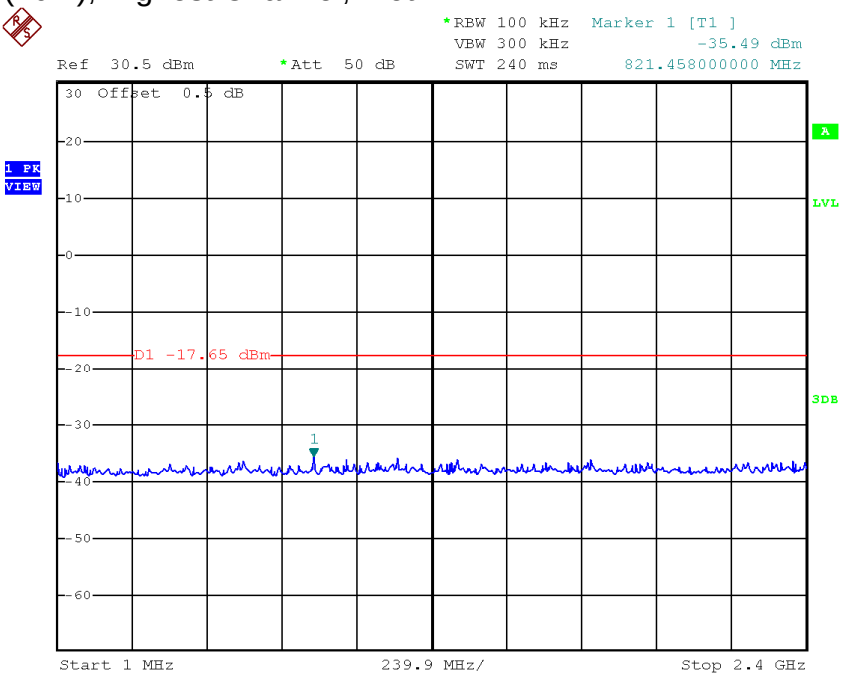


802.11n (40m), Middle Channel, Plot B

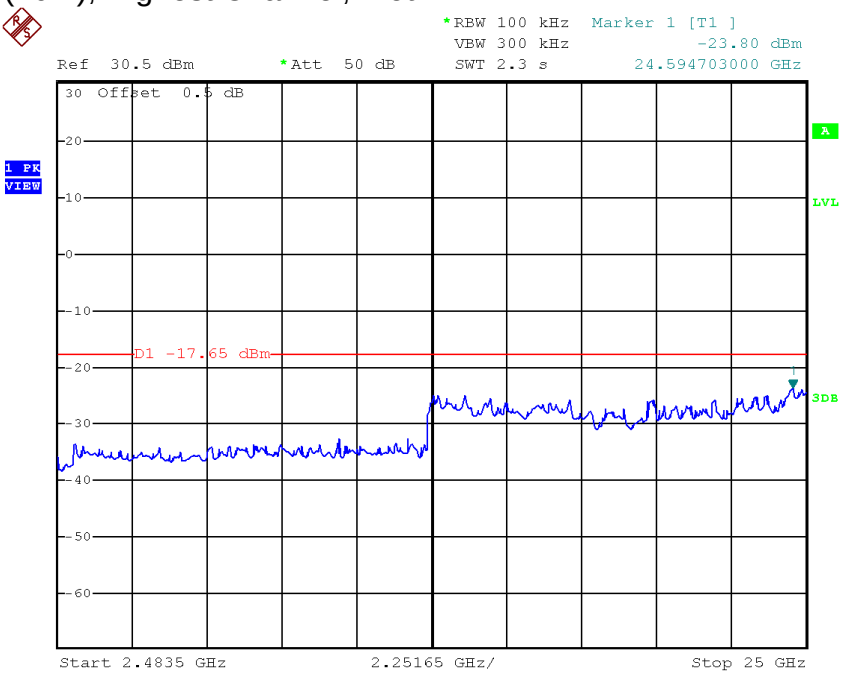


Plots of out of band conducted emissions (Antenna 0)

802.11n (40m), Highest Channel, Plot A

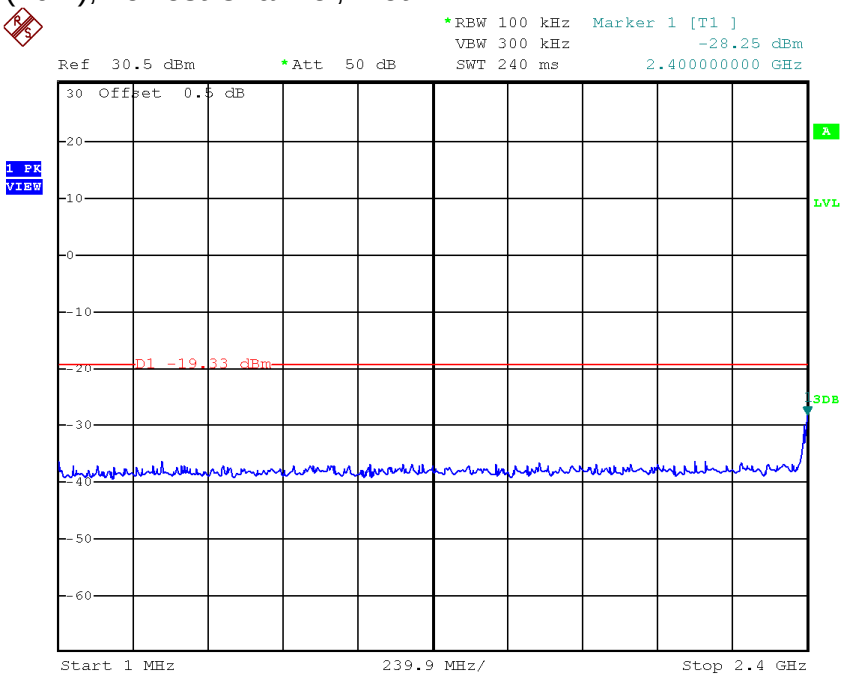


802.11n (40m), Highest Channel, Plot B

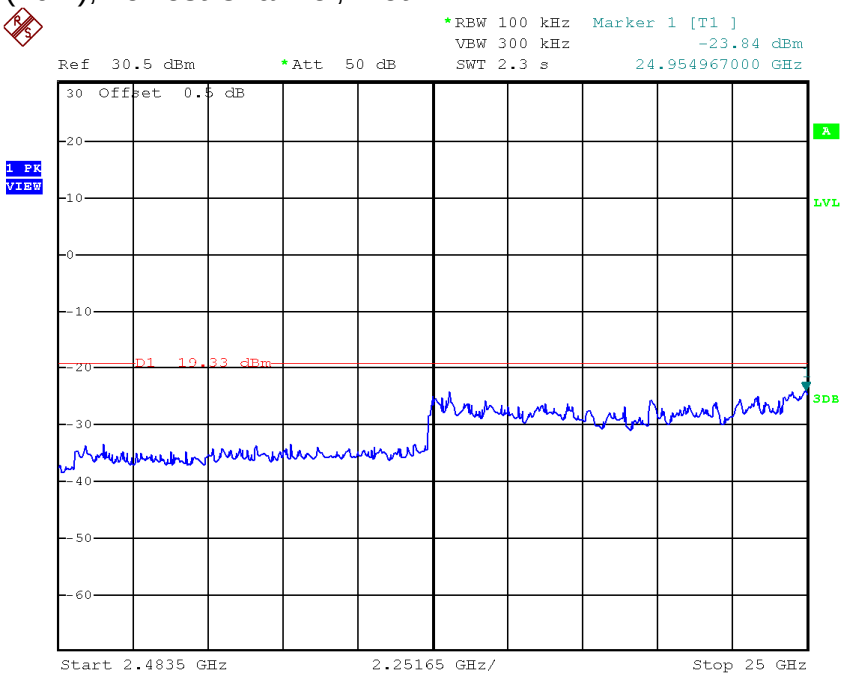


Plots of out of band conducted emissions (Antenna 1)

802.11n (40m), Lowest Channel, Plot A

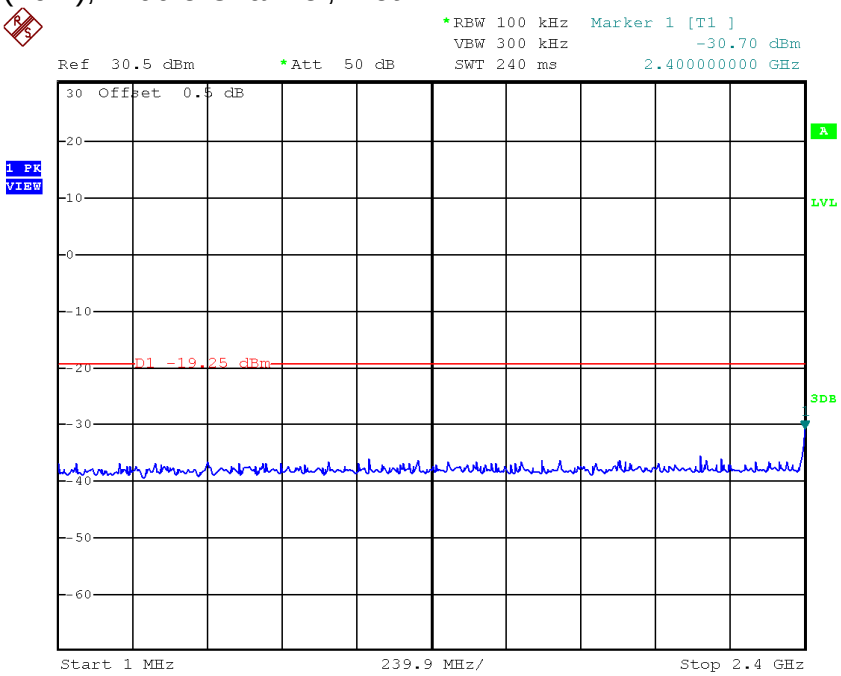


802.11n (40m), Lowest Channel, Plot B

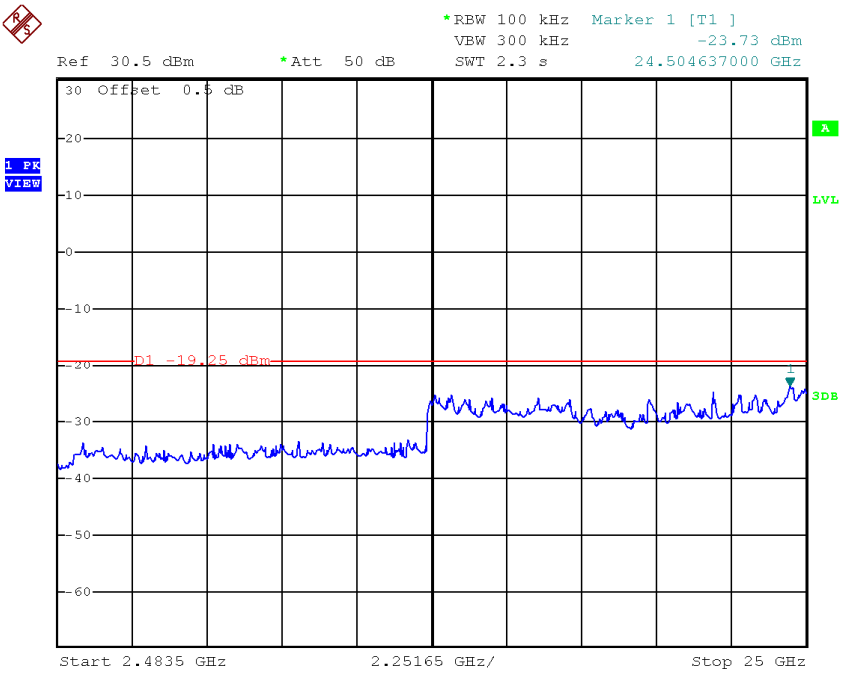


Plots of out of band conducted emissions (Antenna 1)

802.11n (40m), Middle Channel, Plot A

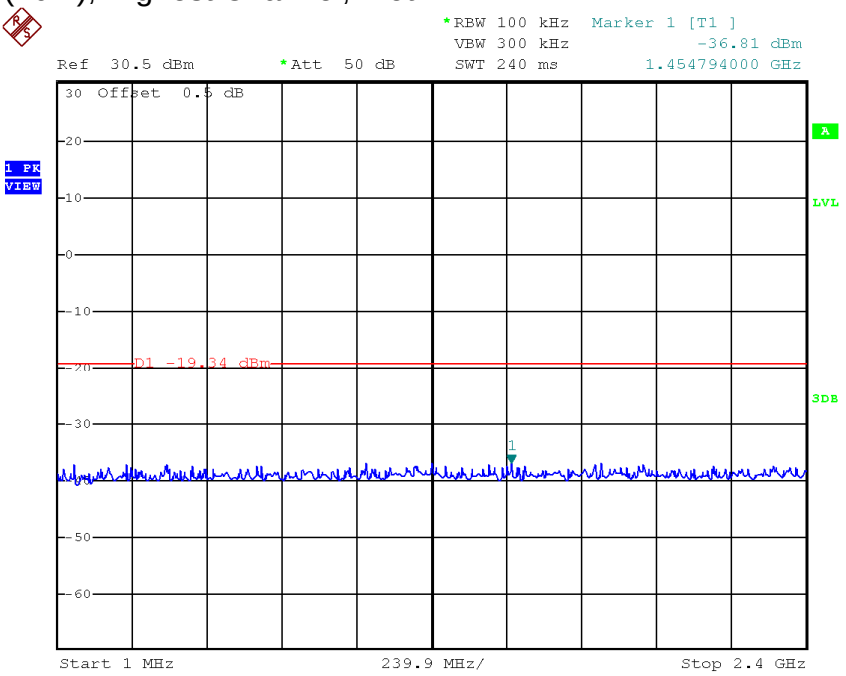


802.11n (40m), Middle Channel, Plot B

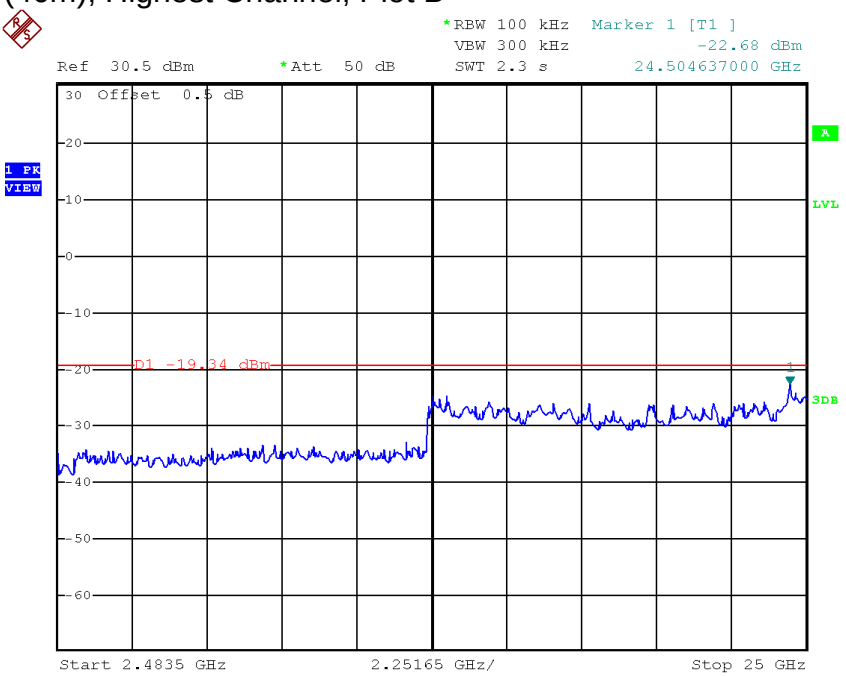


Plots of out of band conducted emissions (Antenna 1)

802.11n (40m), Highest Channel, Plot A



802.11n (40m), Highest Channel, Plot B



IEEE 802.11n (40MHz)				
Maximum Out of Band Conducted Emissions (dBm)				
Antenna 0	Antenna 1	Antenna 0 + Antenna1	PSD in 100KHz	Limit
-23.18	-22.68	-19.91	4.60	-15.40

4.5 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

Example
Assume a receiver reading of 62.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29.0 dB is subtracted. The pulse desensitization factor of the spectrum analyzer is 0.0 dB, and the resultant average factor is -10.0 dB. The net field strength for comparison to the appropriate emission limit is 32.0 dBμV/m. This value in dBμV/m is converted to its corresponding level in μV/m.

RA = 62.0 dBμV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0.0 dB
AV = -10 dB

FS = 62.0 + 7.4 + 1.6 – 29.0 + 0.0 + (-10.0) = 32.0 dBμV/m

Level in μV/m = Common Antilogarithm [(32.0 dBμV/m)/20] = 39.8 μV/m

4.6 Transmitter Radiated Emissions in Restricted Bands and Spurious Emissions

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

4.6.1 Radiated Emission Configuration Photograph

Worst Case Restricted Band Radiated Emission
at

2390 MHz

The worst case radiated emission configuration photographs are saved with filename: config photos.pdf

4.6.2 Radiated Emission Data

The data in tables 1-28 list the significant emission frequencies, the limit and the margin of compliance.

Judgement -

Passed by 0.2 dB margin compare with peak limit

Mode: TX-Channel 01

Table 1
IEEE 802.11b (DSSS, 1 Mbps) (Antenna 0)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	***2390.000***	***56.7***	***33***	***29.4***	***53.1***	***54.0***	***-0.9***
H	***4824.000***	***39.3***	***33***	***34.9***	***41.2***	***54.0***	***-12.8***
V	***12060.000***	***34.2***	***33***	***40.5***	***41.7***	***54.0***	***-12.3***
V	***14472.000***	***36.4***	***33***	***40.0***	***43.4***	***54.0***	***-10.6***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	***2390.000***	***68.3***	***33***	***29.4***	***64.7***	***74.0***	***-9.3***
H	***4824.000***	***44.4***	***33***	***34.9***	***46.3***	***74.0***	***-27.7***
V	***12060.000***	***42.3***	***33***	***40.5***	***49.8***	***74.0***	***-24.2***
V	***14472.000***	***44.0***	***33***	***40.0***	***51.0***	***74.0***	***-23.0***

NOTES:

1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: TX-Channel 07

Table 2
IEEE 802.11b (DSSS, 1 Mbps) (Antenna 1)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
H	***4874.000***	***38.7***	***33***	***34.9***	***40.6***	***54.0***	***-13.4***
V	***7311.000***	***36.0***	***33***	***37.9***	***40.9***	***54.0***	***-13.1***
V	***12185.000***	***33.9***	***33***	***40.5***	***41.4***	***54.0***	***-12.6***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	***4874.000***	***43.7***	***33***	***34.9***	***45.6***	***74.0***	***-28.4***
V	***7311.000***	***43.6***	***33***	***37.9***	***48.5***	***74.0***	***-25.5***
V	***12185.000***	***42.0***	***33***	***40.5***	***49.5***	***74.0***	***-24.5***

NOTES:
1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: TX-Channel 11

Table 3
IEEE 802.11b (DSSS, 1 Mbps) (Antenna 1)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	***2483.500***	***53.7***	***33***	***29.4***	***50.1***	***54.0***	***-3.9***
H	***4924.000***	***37.8***	***33***	***34.9***	***39.7***	***54.0***	***-14.3***
V	***7386.000***	***35.3***	***33***	***37.9***	***40.2***	***54.0***	***-13.8***
V	***12310.000***	***34.2***	***33***	***40.5***	***41.7***	***54.0***	***-12.3***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	***2483.500***	***65.6***	***33***	***29.4***	***62.0***	***74.0***	***-12.0***
H	***4924.000***	***43.2***	***33***	***34.9***	***45.1***	***74.0***	***-28.9***
V	***7386.000***	***42.7***	***33***	***37.9***	***47.6***	***74.0***	***-26.4***
V	***12310.000***	***41.7***	***33***	***40.5***	***49.2***	***74.0***	***-24.8***

NOTES:

1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: TX-Channel 01

Table 7
IEEE 802.11g (OFDM, 6 Mbps) (Antenna 0)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	***2390.000***	***57.0***	***33***	***29.4***	***53.4***	***54.0***	***-0.6***
V	***4824.000***	***33.8***	***33***	***34.9***	***35.7***	***54.0***	***-18.3***
H	***12060.000***	***34.0***	***33***	***40.5***	***41.5***	***54.0***	***-12.5***
V	***14472.000***	***36.2***	***33***	***40.0***	***43.2***	***54.0***	***-10.8***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	***2390.000***	***75.1***	***33***	***29.4***	***71.5***	***74.0***	***-2.5***
V	***4824.000***	***40.4***	***33***	***34.9***	***42.3***	***74.0***	***-31.7***
H	***12060.000***	***42.1***	***33***	***40.5***	***49.6***	***74.0***	***-24.4***
V	***14472.000***	***43.9***	***33***	***40.0***	***50.9***	***74.0***	***-23.1***

NOTES:

1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: TX-Channel 07

Table 8
IEEE 802.11g (OFDM, 6 Mbps) (Antenna 1)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	***4874.000***	***33.6***	***33***	***34.9***	***35.5***	***54.0***	***-18.5***
H	***7311.000***	***33.0***	***33***	***37.9***	***37.9***	***54.0***	***-16.1***
H	***12185.000***	***34.1***	***33***	***40.5***	***41.6***	***54.0***	***-12.4***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	***4874.000***	***40.3***	***33***	***34.9***	***42.2***	***74.0***	***-31.8***
H	***7311.000***	***40.3***	***33***	***37.9***	***45.2***	***74.0***	***-28.8***
H	***12185.000***	***42.2***	***33***	***40.5***	***49.7***	***74.0***	***-24.3***

NOTES:
1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: TX-Channel 11

Table 9
IEEE 802.11g (OFDM, 6 Mbps) (Antenna 1)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	***2483.500***	***55.6***	***33***	***29.4***	***52.0***	***54.0***	***-2.0***
V	***4924.000***	***33.4***	***33***	***34.9***	***35.3***	***54.0***	***-18.7***
H	***7386.000***	***32.8***	***33***	***37.9***	***37.7***	***54.0***	***-16.3***
H	***12310.000***	***34.2***	***33***	***40.5***	***41.7***	***54.0***	***-12.3***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	***2483.500***	***74.3***	***33***	***29.4***	***70.7***	***74.0***	***-3.3***
V	***4924.000***	***40.2***	***33***	***34.9***	***42.1***	***74.0***	***-31.9***
H	***7386.000***	***40.1***	***33***	***37.9***	***45.0***	***74.0***	***-29.0***
H	***12310.000***	***42.3***	***33***	***40.5***	***49.8***	***74.0***	***-24.2***

NOTES:
1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: TX-Channel 01

Table 13
IEEE 802.11n (20MHz) (OFDM, MCS0) (Antenna 0)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	***2390.000***	***57.4***	***33***	***29.4***	***53.8***	***54.0***	***-0.2***
H	***4824.000***	***33.6***	***33***	***34.9***	***35.5***	***54.0***	***-18.5***
V	***12060.000***	***33.8***	***33***	***40.5***	***41.3***	***54.0***	***-12.7***
V	***14472.000***	***36.2***	***33***	***40.0***	***43.2***	***54.0***	***-10.8***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	***2390.000***	***77.1***	***33***	***29.4***	***73.5***	***74.0***	***-0.5***
H	***4824.000***	***40.3***	***33***	***34.9***	***42.2***	***74.0***	***-31.8***
V	***12060.000***	***42.0***	***33***	***40.5***	***49.5***	***74.0***	***-24.5***
V	***14472.000***	***43.8***	***33***	***40.0***	***50.8***	***74.0***	***-23.2***

NOTES:

1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: TX-Channel 07

Table 14
IEEE 802.11n (20MHz) (OFDM, MCS0) (Antenna 0)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
H	***4874.000***	***33.9***	***33***	***34.9***	***35.8***	***54.0***	***-18.2***
V	***7311.000***	***32.6***	***33***	***37.9***	***37.5***	***54.0***	***-16.5***
V	***12185.000***	***34.0***	***33***	***40.5***	***41.5***	***54.0***	***-12.5***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	***4874.000***	***40.8***	***33***	***34.9***	***42.7***	***74.0***	***-31.3***
V	***7311.000***	***39.7***	***33***	***37.9***	***44.6***	***74.0***	***-29.4***
V	***12185.000***	***42.2***	***33***	***40.5***	***49.7***	***74.0***	***-24.3***

NOTES:
1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: TX-Channel 11

Table 15
IEEE 802.11n (20MHz) (OFDM, MCS0) (Antenna 0)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	***2483.500***	***57.0***	***33***	***29.4***	***53.4***	***54.0***	***-0.6***
H	***4924.000***	***33.7***	***33***	***34.9***	***35.6***	***54.0***	***-18.4***
V	***7386.000***	***33.5***	***33***	***37.9***	***38.4***	***54.0***	***-15.6***
V	***12310.000***	***34.2***	***33***	***40.5***	***41.7***	***54.0***	***-12.3***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	***2483.500***	***76.8***	***33***	***29.4***	***73.2***	***74.0***	***-0.8***
H	***4924.000***	***40.5***	***33***	***34.9***	***42.4***	***74.0***	***-31.6***
V	***7386.000***	***40.6***	***33***	***37.9***	***45.5***	***74.0***	***-28.5***
V	***12310.000***	***42.6***	***33***	***40.5***	***50.1***	***74.0***	***-23.9***

NOTES:
1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: TX-Channel 01

Table 19
IEEE 802.11n (40MHz) (OFDM, MCS0) (Antenna 0)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	***2390.000***	***56.9***	***33***	***29.4***	***53.3***	***54.0***	***-0.7***
H	***4844.000***	***33.1***	***33***	***34.9***	***35.0***	***54.0***	***-19.0***
H	***7266.000***	***33.1***	***33***	***37.9***	***38.0***	***54.0***	***-16.0***
V	***12110.000***	***33.9***	***33***	***40.5***	***41.4***	***54.0***	***-12.6***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	***2390.000***	***74.7***	***33***	***29.4***	***71.1***	***74.0***	***-2.9***
H	***4844.000***	***39.9***	***33***	***34.9***	***41.8***	***74.0***	***-32.2***
H	***7266.000***	***40.2***	***33***	***37.9***	***45.1***	***74.0***	***-28.9***
V	***12110.000***	***42.1***	***33***	***40.5***	***49.6***	***74.0***	***-24.4***

NOTES:
1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: TX-Channel 07

Table 20
IEEE 802.11n (40MHz) (OFDM, MCS0) (Antenna 0)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
H	***4874.000***	***33.8***	***33***	***34.9***	***35.7***	***54.0***	***-18.3***
H	***7311.000***	***32.7***	***33***	***37.9***	***37.6***	***54.0***	***-16.4***
V	***12185.000***	***34.2***	***33***	***40.5***	***41.7***	***54.0***	***-12.3***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	***4874.000***	***40.6***	***33***	***34.9***	***42.5***	***74.0***	***-31.5***
H	***7311.000***	***39.8***	***33***	***37.9***	***44.7***	***74.0***	***-29.3***
V	***12185.000***	***42.3***	***33***	***40.5***	***49.8***	***74.0***	***-24.2***

NOTES:
1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: TX-Channel 11

Table 21
IEEE 802.11n (40MHz) (OFDM, MCS0) (Antenna 0)

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	***2483.500***	***55.3***	***33***	***29.4***	***51.7***	***54.0***	***-2.3***
H	***4904.000***	***33.4***	***33***	***34.9***	***35.3***	***54.0***	***-18.7***
H	***7356.000***	***33.1***	***33***	***37.9***	***38.0***	***54.0***	***-16.0***
V	***12260.000***	***34.3***	***33***	***40.5***	***41.8***	***54.0***	***-12.2***

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	***2483.500***	***72.8***	***33***	***29.4***	***69.2***	***74.0***	***-4.8***
H	***4904.000***	***40.2***	***33***	***34.9***	***42.1***	***74.0***	***-31.9***
H	***7356.000***	***40.3***	***33***	***37.9***	***45.2***	***74.0***	***-28.8***
V	***12260.000***	***42.8***	***33***	***40.5***	***50.3***	***74.0***	***-23.7***

NOTES:
1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. For the measurement of radiated emission, summation method was used which numerical integrating (in terms of linear power) over the transmitter occupied bandwidth.
8. For the linear power measurement, data in 1MHz spacing was collected by spectrum analyzer with 1MHz resolution bandwidth.

Mode: ANT0 & ANT1

Table 25

Radiated Emission Data

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
H	***2390.000***	***56.4***	***33***	***29.4***	***52.8***	***54.0***	***-1.2***
H	***2483.500***	***55.8***	***33***	***29.4***	***52.2***	***54.0***	***-1.8***

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
H	31.212	44.8	16	10.0	38.8	40.0	-1.2
H	39.942	37.4	16	10.0	31.4	40.0	-8.6
V	85.412	36.2	16	8.0	28.2	40.0	-11.8
V	99.350	32.0	16	12.0	28.0	43.5	-15.5
H	***120.816***	***27.9***	***16***	***14.0***	***25.9***	***43.5***	***-17.6***
V	499.950	18.1	16	26.0	28.1	46.0	-17.9
V	599.925	14.5	16	29.0	27.5	46.0	-18.5
H	749.942	14.0	16	30.0	28.0	46.0	-18.0
H	***2390.000***	***75.7***	***33***	***29.4***	***72.1***	***74.0***	***-1.9***
H	2483.500	72.0	33	29.4	68.4	74.0	-5.6

NOTES:

1. Peak detector is used for the peak data of emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205

Mode: Data transfer via USB with WiFi ON

Table 27

Radiated Emission Data

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
V	43.458	38.9	16	10.0	32.9	***40.0***	-7.1
V	50.359	37.0	16	11.0	32.0	40.0	-8.0
V	85.411	38.6	16	8.0	30.6	40.0	-9.4
V	100.931	38.3	16	12.0	34.3	43.5	-9.2
V	***118.633***	***38.9***	***16***	***14.0***	***36.9***	***43.5***	***-6.6***
H	499.857	23.1	16	26.0	33.1	46.0	-12.9
H	959.538	17.8	16	33.0	34.8	46.0	-11.2

NOTES:
1. Peak detector is used for the emission measurement.
2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205

Mode: WiFi ON only

Table 28

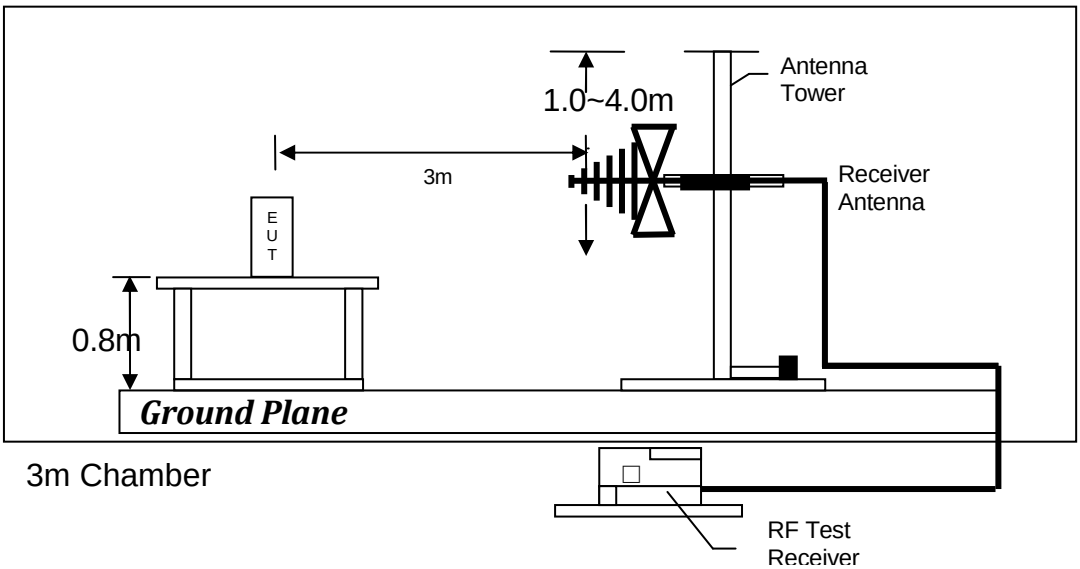
Radiated Emission Data

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
V	50.375	39.7	16	11.0	34.7	40.0	-5.3
V	58.615	40.7	16	11.0	35.7	40.0	-4.3
V	104.690	38.8	16	13.0	35.8	43.5	-7.7
V	***116.936***	***36.2***	***16***	***14.0***	***34.2***	***43.5***	***-9.3***
V	***170.528***	***26.5***	***16***	***18.0***	***28.5***	***43.5***	***-15.0***
H	228.486	25.8	16	18.0	27.8	46.0	-18.2
H	499.947	25.1	16	26.0	35.1	46.0	-10.9
H	599.996	18.1	16	29.0	31.1	46.0	-14.9
H	959.980	17.2	16	33.0	34.2	46.0	-11.8

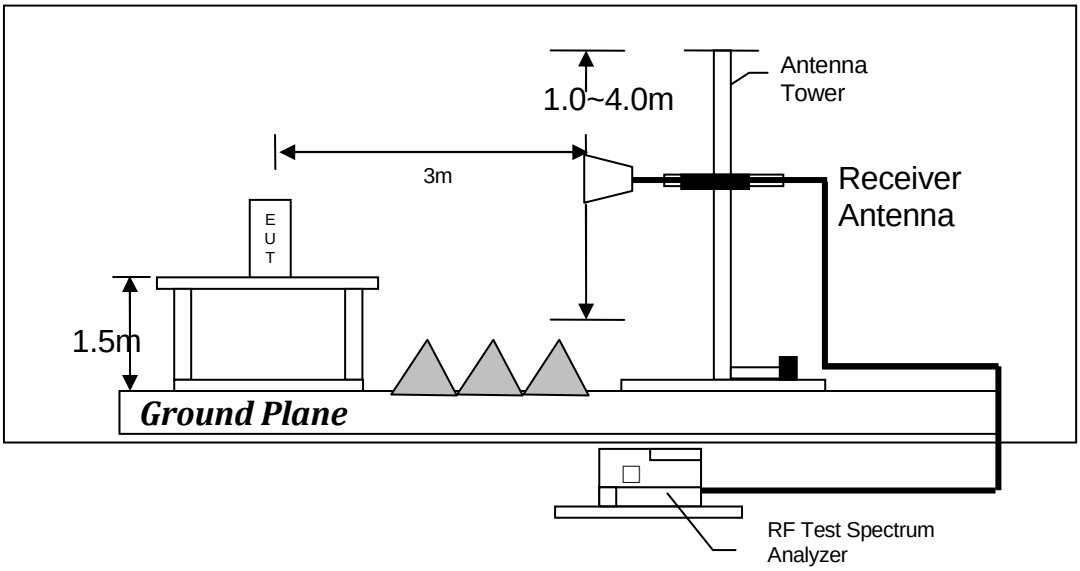
NOTES:
1. Peak detector is used for the emission measurement.
2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205

4.6.3 Radiated Emission Test Setup

The figure below shows the test setup, which is utilized to make these measurements.



Test setup of radiated emissions up to 1GHz



Test setup of radiated emissions above 1GHz

4.6.4 Transmitter Duty Cycle Calculation

Not applicable – No average factor is required.

4.7 AC Power Line Conducted Emission

☐ Not applicable – EUT is only powered by battery for operation.

☒ EUT connects to AC power line. Emission Data is listed in following pages.

☐ Base Unit connects to AC power line and has transmission. Handset connects to AC power line but has no transmission. Emission Data of Base Unit is listed in following pages.

4.7.1 AC Power Line Conducted Emission Configuration Photograph

Worst Case Line-Conducted Configuration
at

465 kHz

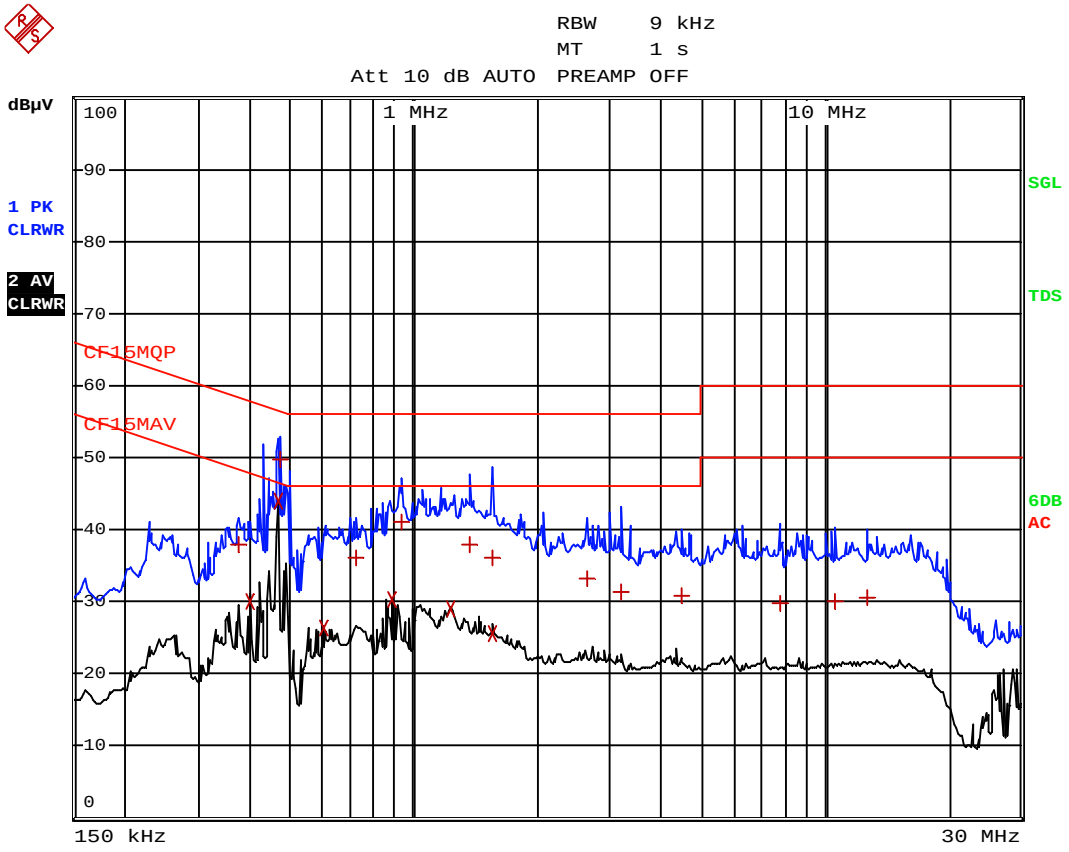
The worst case line conducted configuration photographs are attached in the Appendix and saved with filename: config photos.pdf

4.7.2 AC Power Line Conducted Emission Data

The plot(s) and data in the following pages list the significant emission frequencies, the limit and the margin of compliance.

Passed by 2.45 dB margin compare with CISPR Average limit

Worst Case: WiFi Only



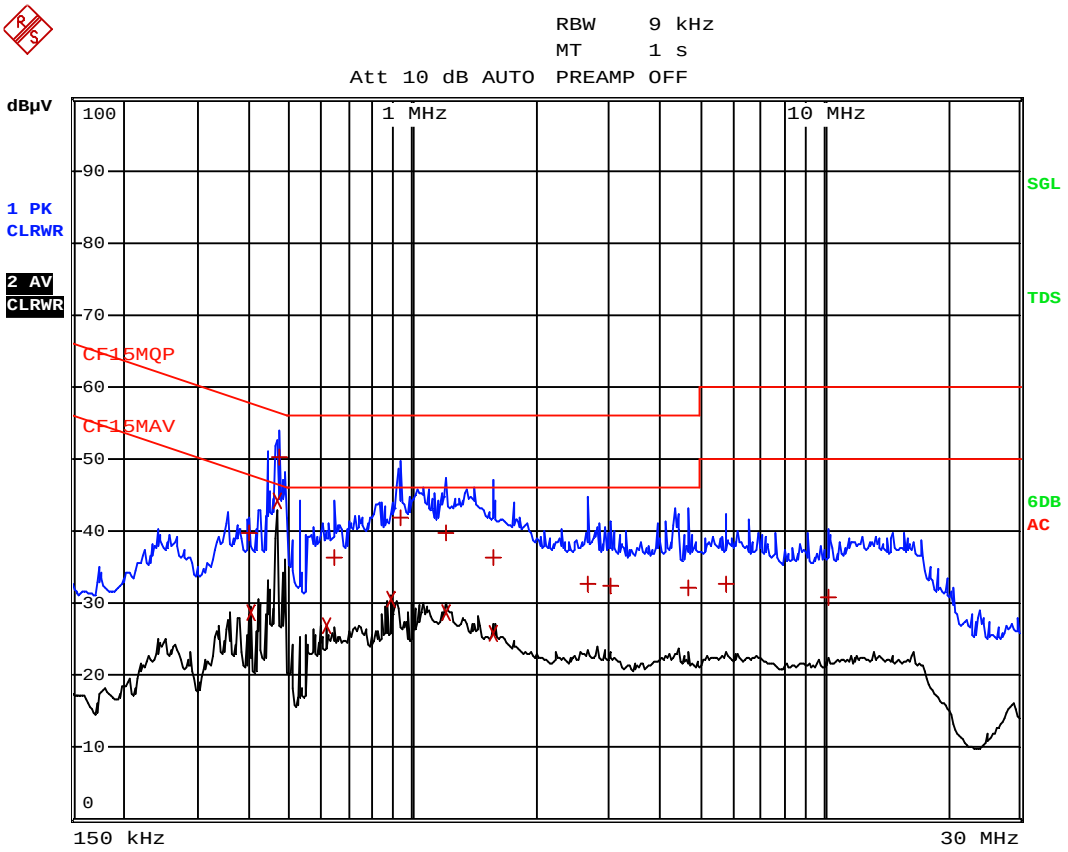
Worst Case: WiFi Only

EDIT PEAK LIST (Final Measurement Results)

Trace1: CF15MQP
Trace2: CF15MAV
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
1	Quasi Peak	213 kHz	32.61	N	-30.46
1	Quasi Peak	393 kHz	38.16	N	-19.83
2	CISPR Average	402 kHz	28.84	L1	-18.96
1	Quasi Peak	465 kHz	51.54	L1	-5.06
2	CISPR Average	465 kHz	44.15	N	-2.45
1	Quasi Peak	748.5 kHz	36.84	N	-19.15
2	CISPR Average	753 kHz	26.64	L1	-19.35
1	Quasi Peak	937.5 kHz	40.16	N	-15.83
2	CISPR Average	1.0635 MHz	29.75	N	-16.24
2	CISPR Average	1.221 MHz	29.02	N	-16.97
1	Quasi Peak	1.338 MHz	39.11	L1	-16.88
2	CISPR Average	1.5405 MHz	25.37	N	-20.62
1	Quasi Peak	1.7205 MHz	35.31	N	-20.68
1	Quasi Peak	2.8905 MHz	33.07	N	-22.92
1	Quasi Peak	2.9985 MHz	32.45	N	-23.54
1	Quasi Peak	4.461 MHz	31.94	N	-24.05
1	Quasi Peak	5.7705 MHz	32.49	L1	-27.50
1	Quasi Peak	8.9205 MHz	30.59	L1	-29.40
1	Quasi Peak	13.6005 MHz	33.58	N	-26.41

Worst Case: Data transfer via USB with WiFi ON



Worst Case: Data transfer via USB with WiFi ON

EDIT PEAK LIST (Final Measurement Results)

Trace1: CF15MQP
Trace2: CF15MAV
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
1	Quasi Peak	397.5 kHz	39.83	N	-18.07
2	CISPR Average	402 kHz	28.72	N	-19.08
2	CISPR Average	465 kHz	44.11	L1	-2.48
1	Quasi Peak	469.5 kHz	50.32	N	-6.20
2	CISPR Average	618 kHz	26.94	N	-19.05
1	Quasi Peak	645 kHz	36.24	L1	-19.75
2	CISPR Average	888 kHz	30.70	N	-15.29
1	Quasi Peak	933 kHz	41.75	L1	-14.24
1	Quasi Peak	1.2075 MHz	39.70	N	-16.29
2	CISPR Average	1.2075 MHz	28.83	L1	-17.16
1	Quasi Peak	1.5675 MHz	36.41	N	-19.58
2	CISPR Average	1.5675 MHz	25.82	N	-20.18
1	Quasi Peak	2.6745 MHz	32.73	N	-23.26
1	Quasi Peak	3.0255 MHz	32.35	N	-23.64
1	Quasi Peak	4.6905 MHz	32.08	N	-23.91
1	Quasi Peak	5.7975 MHz	32.60	N	-27.39
1	Quasi Peak	10.275 MHz	30.82	L1	-29.17

4.7.3 Conducted Emission Test Setup

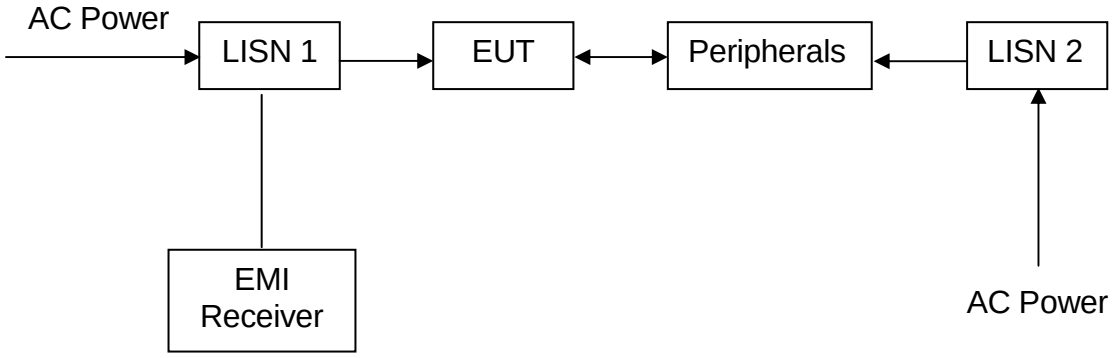


EXHIBIT 5
EQUIPMENT LIST

5.0 **Equipment List**

1) Radiated Emissions Test

Equipment	EMI Test Receiver	Spectrum Analyzer
Registration No.	EW-3156	EW-2466
Manufacturer	R&S	R&S
Model No.	ESR26	FSP30
Calibration Date	Nov. 03, 2015	Sep. 16, 2015
Calibration Due Date	Nov. 03, 2016	Aug. 20, 2016

Equipment	Biconical Antenna	Log Periodic Antenna	Double Ridged Guide Antenna
Registration No.	EW-0571	EW-0447	EW-1133
Manufacturer	EMCO	EMCO	EMCO
Model No.	3104C	3146	3115
Calibration Date	Jun. 23, 2015	Mar. 16, 2015	Nov. 05, 2015
Calibration Due Date	Dec. 23, 2016	Sep. 16, 2016	May 05, 2017

2) Conducted Emissions Test

Equipment	EMI Test Receiver	LISN
Registration No.	EW-2500	EW-2501
Manufacturer	R&S	R&S
Model No.	ESCI	ENV-216
Calibration Date	Jan. 28, 2016	Jan. 28, 2016
Calibration Due Date	Jan. 28, 2017	Jan. 28, 2017

3) Conductive Measurement Test

Equipment	RF Power Meter	Power Sensor	Spectrum Analyzer
Registration No.	SZ182-02	SZ182-02-01	EW-2249
Manufacturer	ANRITSU	ANRITSU	R&S
Model No.	ML2496A	MA2411B	FSP30
Calibration Date	May. 23, 2016	May. 23, 2016	Nov. 17, 2015
Calibration Due Date	May. 23, 2017	May. 23, 2017	Nov. 27, 2016

END OF TEST REPORT