

TEST REPORT

Report Number: 17110387HKG-001

Application for Original Grant of 47 CFR Part 15 Certification

FCC ID: 2AKC5-SFC01

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Date: May 03, 2018

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TEST REPORT

GENERAL INFORMATION

Applicant Name:	Smarter Applications Ltd.
Applicant Address:	1 Long Lane, London, SE1 4PG, United Kingdom.
FCC Specification Standard:	FCC Part 15, October 1, 2016 Edition
FCC ID:	2AKC5-SFC01
FCC Model(s):	SFC01, LHFC01
Type of EUT:	Spread Spectrum Transmitter
Description of EUT:	FridgeCam
Serial Number:	N/A
Sample Receipt Date:	November 10, 2017
Date of Test:	April 02, 2018 to April 16, 2018
Report Date:	May 03, 2018
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%

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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

1.2 Statement of Compliance

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

FCC Part 15, October 1, 2016 Edition

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2.0 GENERAL DESCRIPTION

2.1 Product Description

The SFC01 is a FridgeCam.

The Equipment Under Test (EUT) operates at frequency range of 2412MHz to 2462MHz with 11 channels.

For 802.11b mode, it operates at frequency range of 2412.000MHz to 2462.000MHz with 11 channels. It transmits via Direct-sequence spread spectrum (DSSS) modulation. Maximum bit rate can be up to 11Mbps.

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.

The EUT is powered by a USB (5VDC)/3.7VDC Li-Ion rechargeable battery.

The antenna(s) used in the EUT is integral, and the test sample is a prototype.

The Model(s): LHFC01 is the same as the Model: SFC01 in electronics/electrical designs including software & firmware, PCB layout and construction design/physical design/enclosure. The only differences between these models are model number, trade name and cosmetic details to be sold for marketing purpose.

The circuit description is saved with filename: descri.pdf.

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2.2 Test Methodology

Both AC power line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). 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) and KDB Publication No.558074 D01 v04 (05-April-2017) 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)

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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 is powered by a USB (5VDC)/3.7VDC Li-Ion rechargeable battery.

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.

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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 4.8.3.

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 4.8.3. With the resolution bandwidth 1MHz and spectrum analyzer IF bandwidth 3dB, the pulse desensitization factor was 0dB.

For AC line conducted emission test, 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 was connected to power mains through a line impedance stabilization network (LISN), which provided 50ohm coupling impedance for measuring instrument. 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.

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.

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3.3 Details of EUT and Description of Accessories

Details of EUT:

The EUT is power by a USB (5VDC)/3.7V Li-Ion rechargeable battery.

Description of Accessories:

- (1) HP Notebook Computer(Adaptor Model: HSTNN-CA15) Provided by Intertek
- (2) USB cable of 60cm long(provided by Client)

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 $\pm 5.3\text{dB}$ and $\pm 0.99\text{dB}$ respectively. The value of the Measurement uncertainty for conducted emission test is $\pm 4.2\text{dB}$.

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.

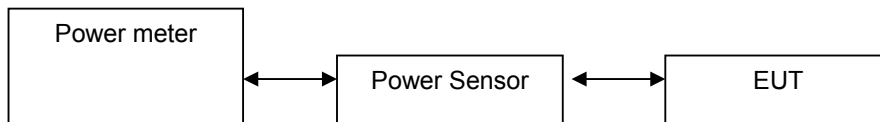
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4.0 TEST RESULTS

4.1 Maximum Conducted (peak) Output Power at Antenna Terminals

RF Conduct Measurement Test Setup

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



The antenna port of the EUT was connected to the input of a spectrum analyzer.

- ☒ 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 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.

IEEE 802.11b (DSSS, 1 Mbps) Antenna Gain = 1.2 dBi

Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2412	19.4	87.096358996
Middle Channel: 2437	19.32	85.506671288
High Channel: 2462	19.2	83.17637711

IEEE 802.11g (OFDM, 6 Mbps) Antenna Gain = 1.2 dBi

Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2412	23.15	206.53801558
Middle Channel: 2437	23.28	212.8139046
High Channel: 2462	23.16	207.01413488

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IEEE 802.11n (20MHz) (OFDM, MCS0) Antenna Gain = 1.2 dBi

Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2412	23.2	208.92961309
Middle Channel: 2437	23.1	204.17379447
High Channel: 2462	22.9	194.98445998

Cable loss : 0.5 dB External Attenuation : 0 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 = 19.4 dBm

IEEE 802.11g (OFDM, 9 Mbps)
max. conducted (peak) output level = 23.28 dBm

IEEE 802.11n (20MHz) (OFDM, MCS0)
max. conducted (peak) output level = 23.2 dBm

Limits:

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

☐ ___ W (___ dBm) for antennas with gains more than 6dBi

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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)
Low Channel:	2412	8.3
Middle Channel:	2437	8.3
High Channel:	2462	8.3

IEEE 802.11g (OFDM, 6 Mbps)

Frequency (MHz)		6dB Bandwidth (MHz)
Low Channel:	2412	16.5
Middle Channel:	2437	16.5
High Channel:	2462	16.5

IEEE 802.11n (20MHz) (OFDM, MCS0)

Frequency (MHz)		6dB Bandwidth (MHz)
Low Channel:	2412	17.1
Middle Channel:	2437	17.7
High Channel:	2462	17.7

Limits

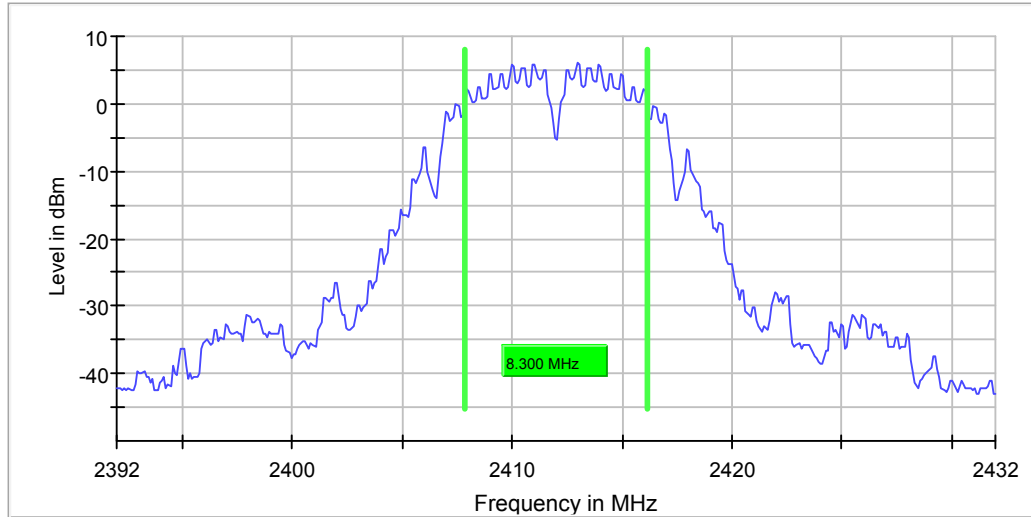
6 dB bandwidth shall be at least 500kHz

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

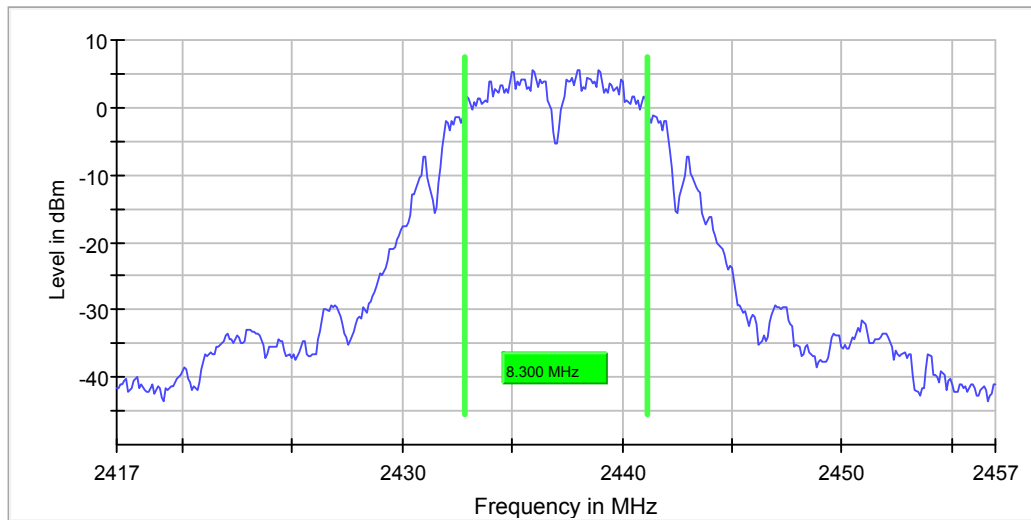
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PLOTS OF 6dB RF BANDWIDTH

802.11b, Lowest Channel



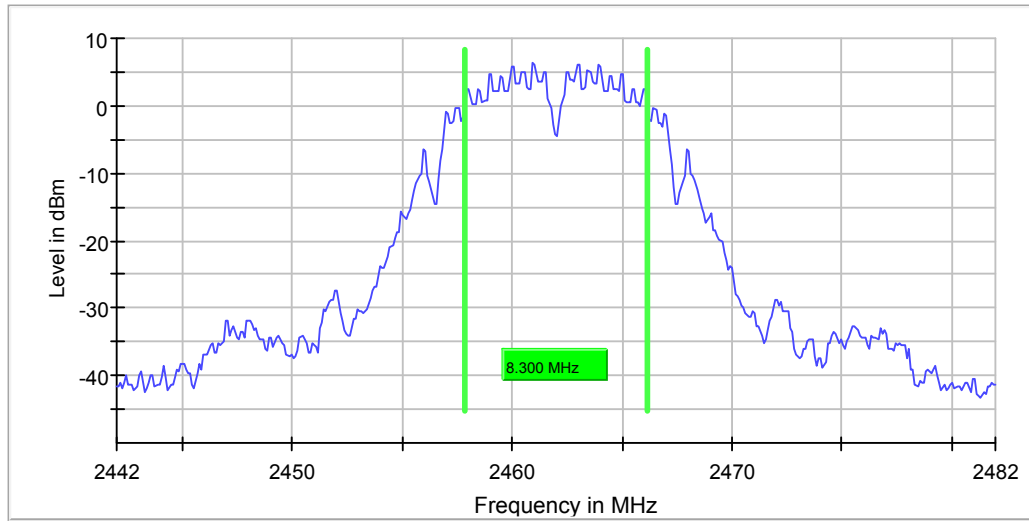
802.11b, Middle Channel



TEST REPORT

PLOTS OF 6dB RF BANDWIDTH

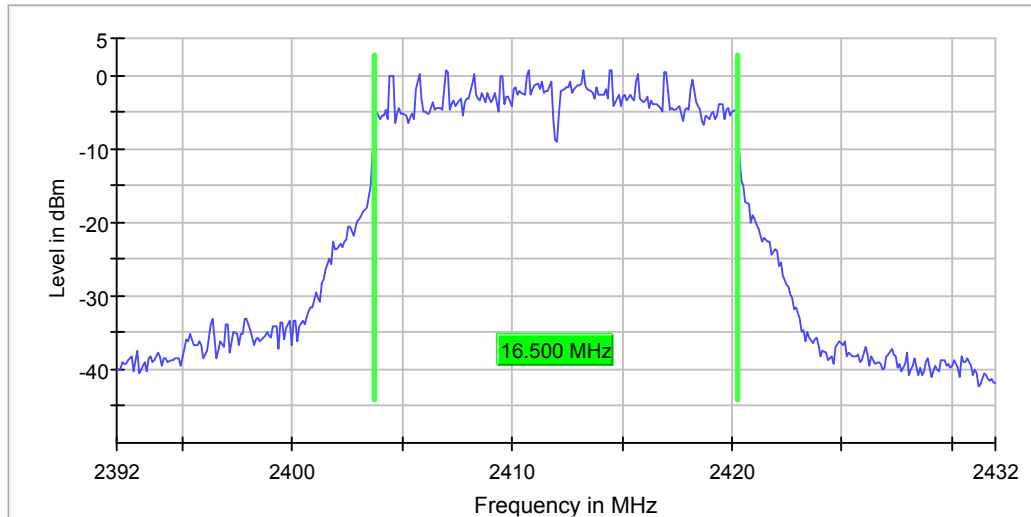
802.11b, Highest Channel



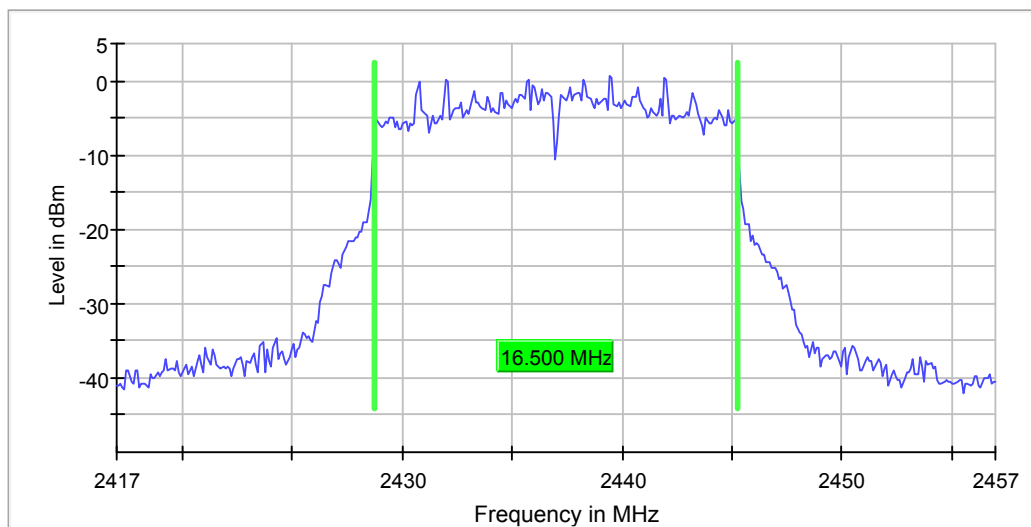
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PLOTS OF 6dB RF BANDWIDTH

802.11g, Lowest Channel



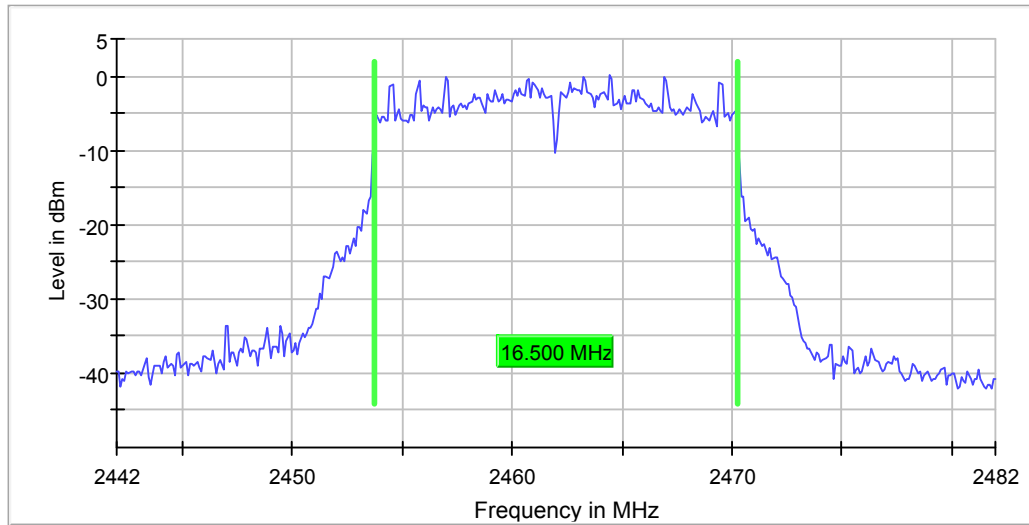
802.11g, Middle Channel



TEST REPORT

PLOTS OF 6dB RF BANDWIDTH

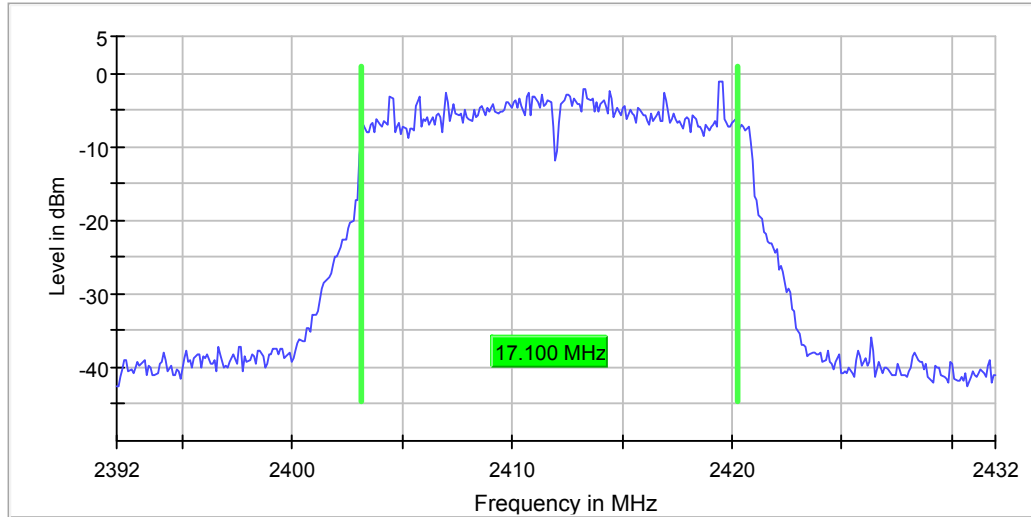
802.11g, Highest Channel



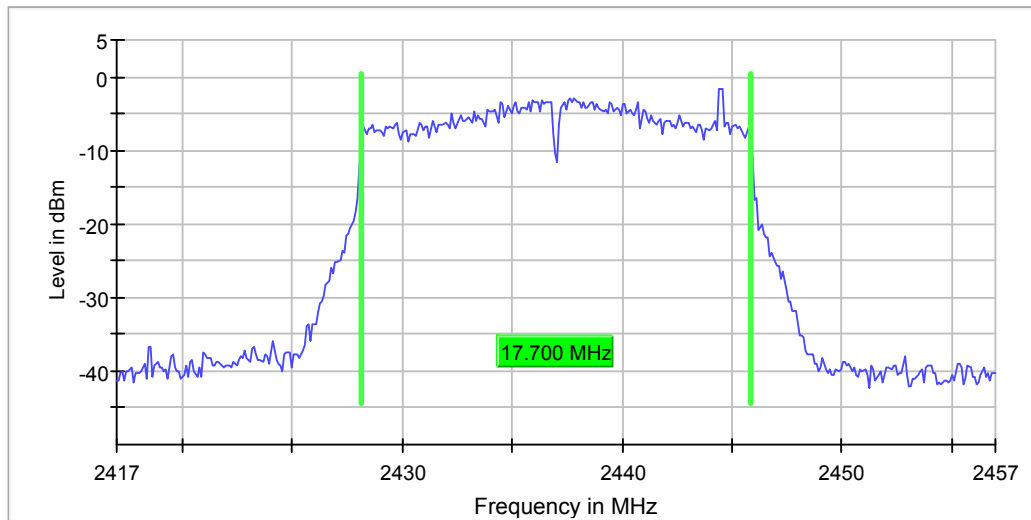
TEST REPORT

PLOTS OF 6dB RF BANDWIDTH

802.11n (20MHz), Lowest Channel



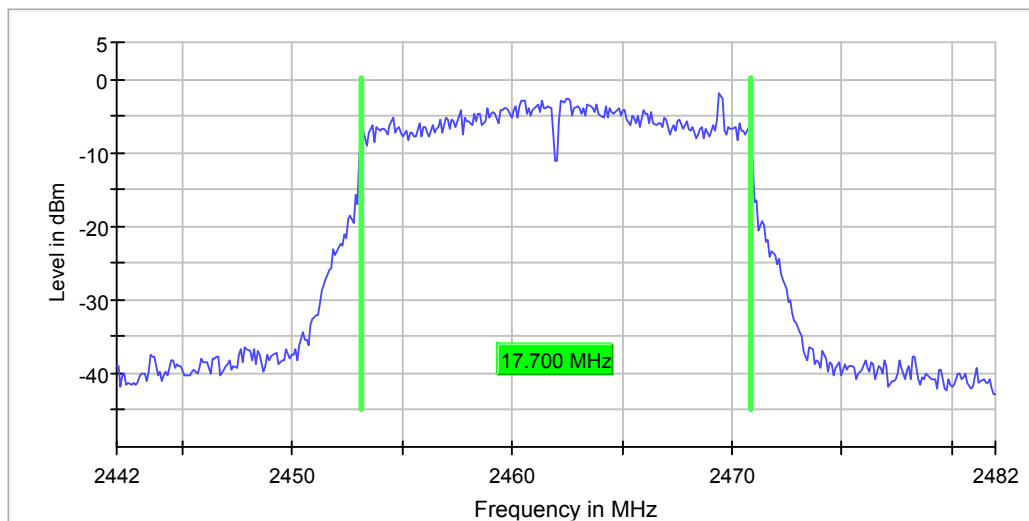
802.11n (20MHz), Middle Channel



TEST REPORT

PLOTS OF 6dB RF BANDWIDTH

802.11n (20MHz), Highest Channel



Measurement

Setting	Instrument Value	Target Value
Span	40.000 MHz	40.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	400	~ 400
SweepTime	56.886 μ s	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Peak	Peak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

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4.3 Maximum Power Spectral Density

Antenna output of the EUT was coupled directly to spectrum analyzer. The measurement procedure 10.2 PKPSD 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)

Frequency (MHz)		PSD in 100kHz (dBm)
Low Channel:	2412	6.333
Middle Channel:	2437	6.016
High Channel:	2462	6.312

IEEE 802.11g (OFDM, 6 Mbps)

Frequency (MHz)		PSD in 100kHz (dBm)
Low Channel:	2412	0.316
Middle Channel:	2437	0.393
High Channel:	2462	0.324

IEEE 802.11n (20MHz) (OFDM, MCS0)

Frequency (MHz)		PSD in 100kHz (dBm)
Low Channel:	2412	-0.744
Middle Channel:	2437	-0.534
High Channel:	2462	-0.681

Cable Loss: 0.5 dB

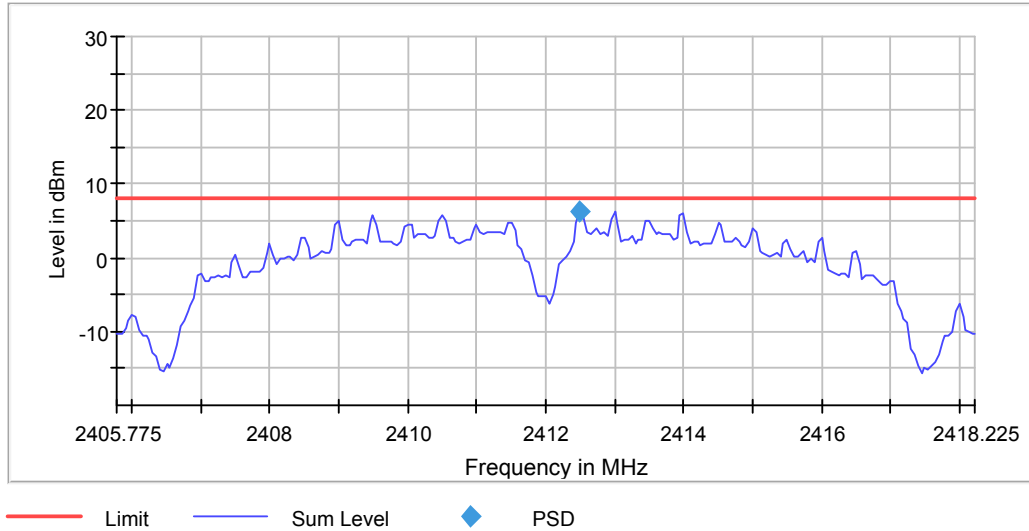
Limit:
8dBm

The plots of power spectral density are as below.

TEST REPORT

PLOTS OF POWER SPECTRAL DENSITY

802.11b, Lowest channel

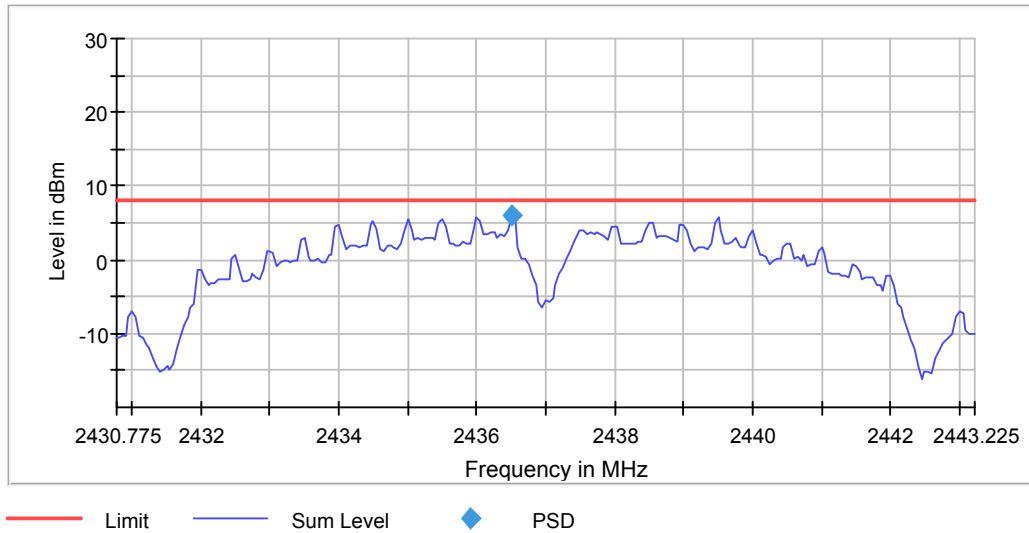


Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.40578 GHz	2.40578 GHz
Stop Frequency	2.41823 GHz	2.41823 GHz
Span	12.450 MHz	12.450 MHz
RBW	100.000 kHz	≤ 100.000 kHz
VBW	300.000 kHz	≥ 300.000 kHz
SweepPoints	249	~ 249
SweepTime	1.020 ms	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Peak	Peak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace

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802.11b, Middle channel



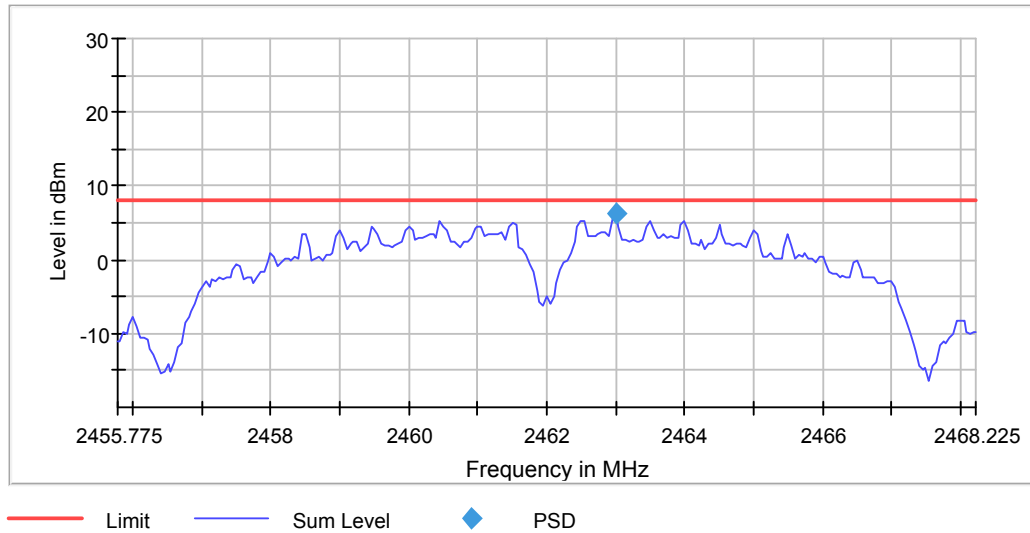
Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.43078 GHz	2.43078 GHz
Stop Frequency	2.44323 GHz	2.44323 GHz
Span	12.450 MHz	12.450 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	249	~ 249
Sweeptime	1.020 ms	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Peak	Peak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace

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PLOTS OF POWER SPECTRAL DENSITY

802.11b, Highest channel



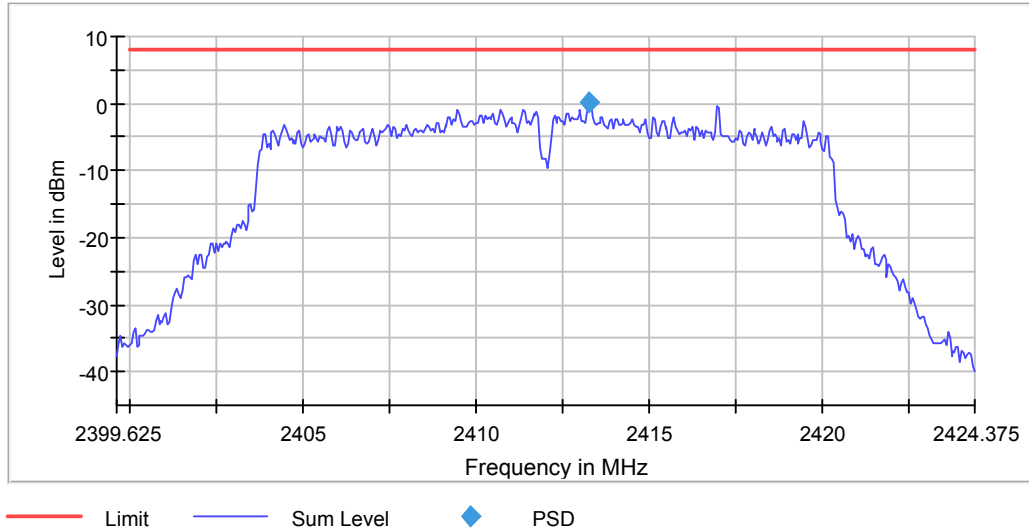
Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.45578 GHz	2.45578 GHz
Stop Frequency	2.46823 GHz	2.46823 GHz
Span	12.450 MHz	12.450 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	249	~ 249
SweepTime	1.020 ms	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Peak	Peak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off

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PLOTS OF POWER SPECTRAL DENSITY

802.11g, Lowest channel

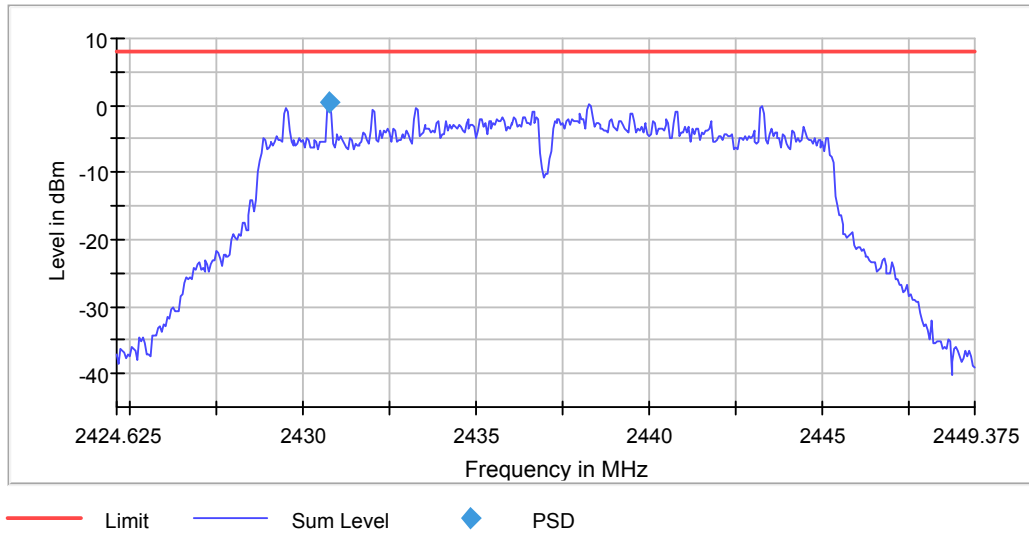


Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.39963 GHz	2.39963 GHz
Stop Frequency	2.42438 GHz	2.42438 GHz
Span	24.750 MHz	24.750 MHz
RBW	100.000 kHz	≤ 100.000 kHz
VBW	300.000 kHz	≥ 300.000 kHz
SweepPoints	495	~ 495
SweepTime	1.040 ms	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Peak	Peak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	Sweep
Preamp	off	off

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802.11g, Middle channel



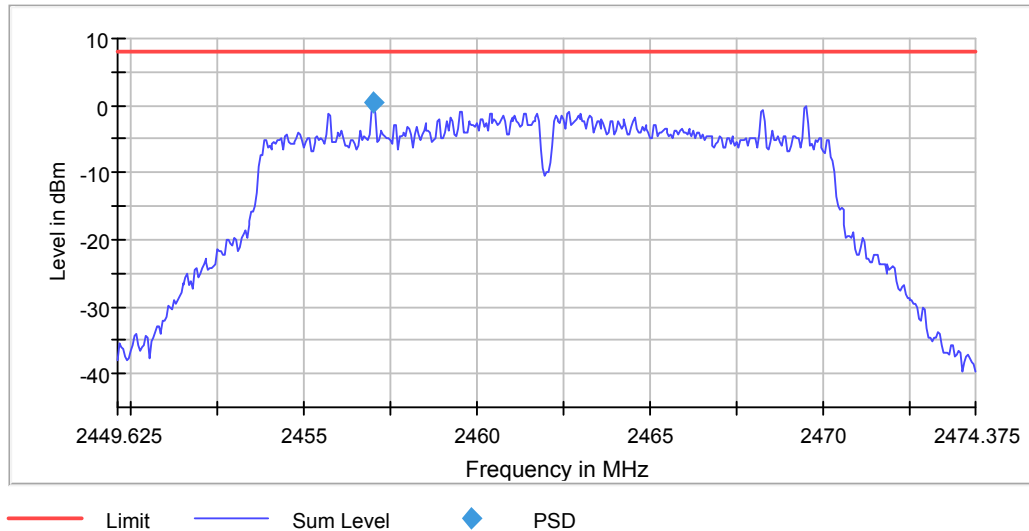
Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.42463 GHz	2.42463 GHz
Stop Frequency	2.44938 GHz	2.44938 GHz
Span	24.750 MHz	24.750 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	495	~ 495
SweepTime	1.040 ms	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Peak	Peak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off

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PLOTS OF POWER SPECTRAL DENSITY

802.11g, Highest channel



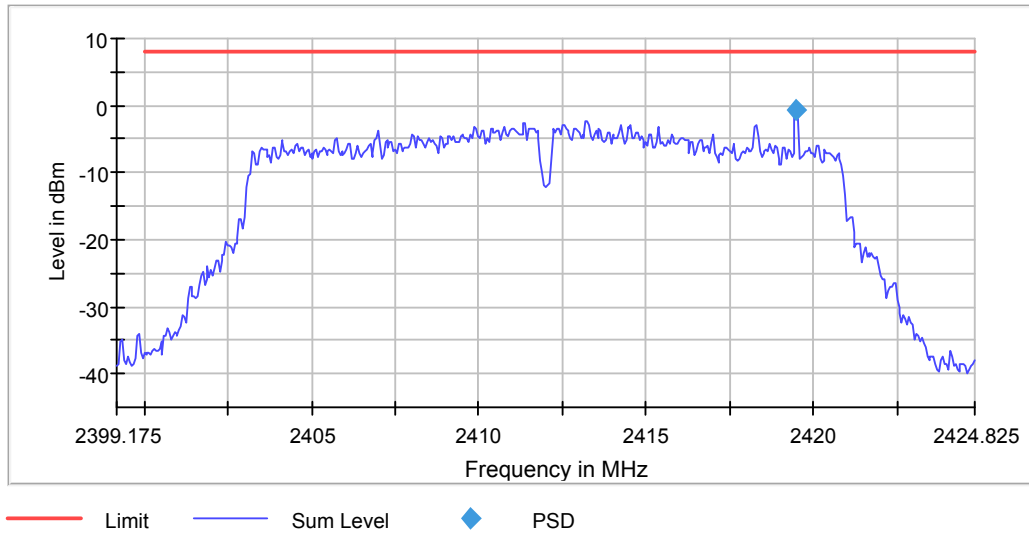
Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.44963 GHz	2.44963 GHz
Stop Frequency	2.47438 GHz	2.47438 GHz
Span	24.750 MHz	24.750 MHz
RBW	100.000 kHz	≤ 100.000 kHz
VBW	300.000 kHz	≥ 300.000 kHz
SweepPoints	495	~ 495
SweepTime	1.040 ms	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Peak	Peak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace

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PLOTS OF POWER SPECTRAL DENSITY

802.11n (20MHz), Lowest channel

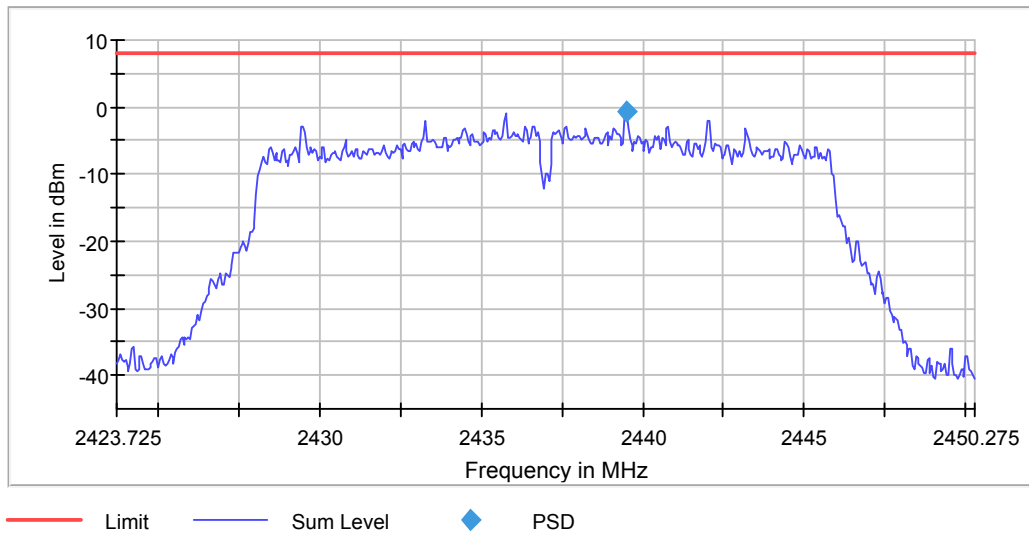


Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.39918 GHz	2.39918 GHz
Stop Frequency	2.42483 GHz	2.42483 GHz
Span	25.650 MHz	25.650 MHz
RBW	100.000 kHz	≤ 100.000 kHz
VBW	300.000 kHz	≥ 300.000 kHz
SweepPoints	513	~ 513
SweepTime	1.080 ms	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Peak	Peak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off

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802.11n (20MHz), Middle channel



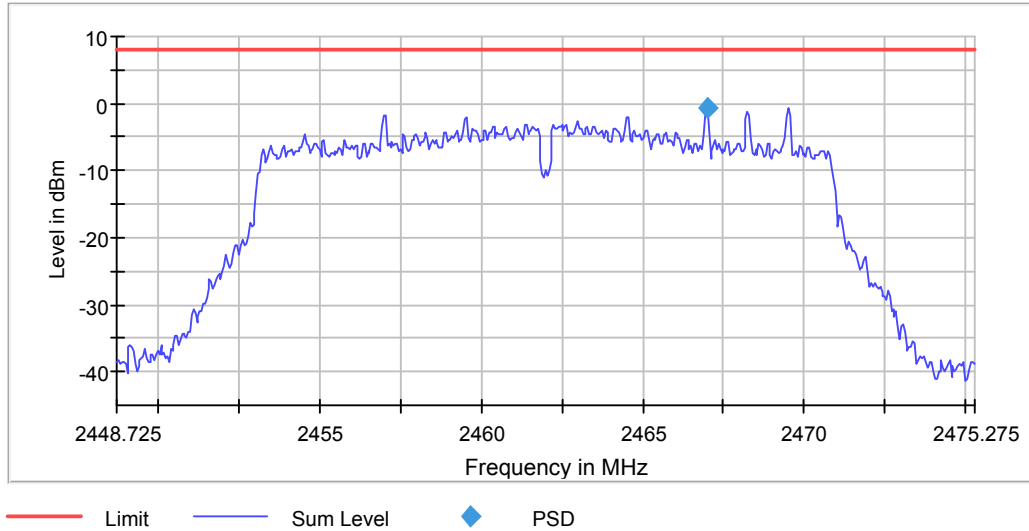
Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.42373 GHz	2.42373 GHz
Stop Frequency	2.45028 GHz	2.45028 GHz
Span	26.550 MHz	26.550 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	531	~ 531
SweepTime	1.010 ms	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Peak	Peak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	Sweep
Preamp	off	off

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PLOTS OF POWER SPECTRAL DENSITY

802.11n (20MHz), Highest channel



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.44873 GHz	2.44873 GHz
Stop Frequency	2.47528 GHz	2.47528 GHz
Span	26.550 MHz	26.550 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	531	~ 531
SweepTime	1.010 ms	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Peak	Peak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off

TEST REPORT

4.4 Out of Band Conducted Emissions

For 802.11b/g/n20, 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 for 802.11b/g/n20.

The measurement procedures under sections 11 of KDB558074 D01 v04 (05-April-2017) 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 for 802.11b,g and n20MHz below the maximum measured in-band peak PSD level.

TEST REPORT

PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

802.11b, Lowest Channel

Result

DUT Frequency (MHz)	Result
2412.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
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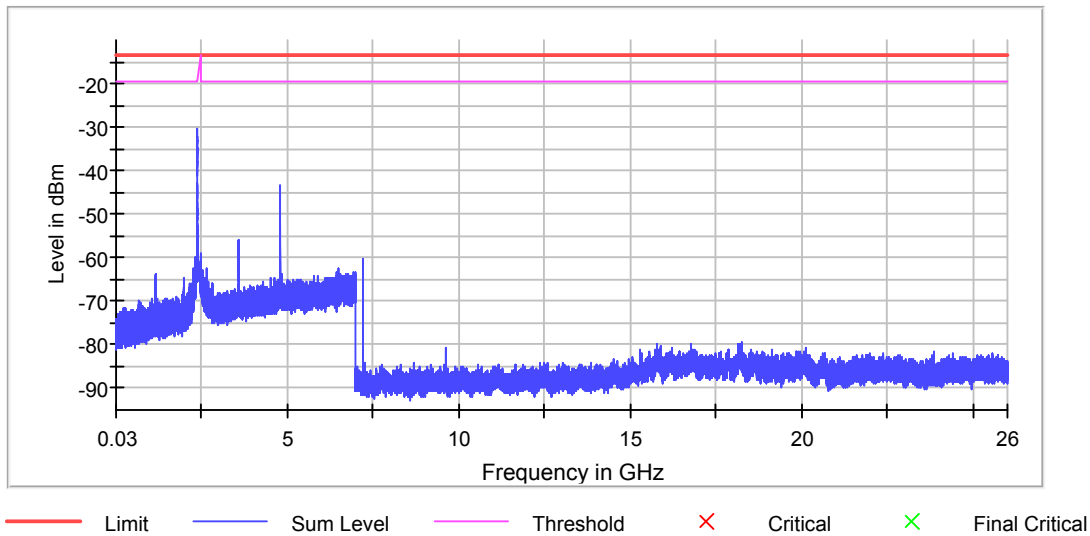
Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
2398.025000	-30.3	16.6	-13.7
2397.975000	-30.7	17.0	-13.7
2398.525000	-32.0	18.3	-13.7
2397.025000	-32.3	18.7	-13.7
2396.975000	-32.6	19.0	-13.7
2398.075000	-32.7	19.0	-13.7
2398.475000	-32.8	19.1	-13.7
2398.375000	-33.0	19.3	-13.7
2398.325000	-33.1	19.4	-13.7
2398.125000	-33.2	19.5	-13.7
2398.425000	-33.5	19.8	-13.7
2398.275000	-33.5	19.9	-13.7
2398.175000	-33.7	20.1	-13.7
2398.575000	-33.8	20.1	-13.7
2398.225000	-33.9	20.2	-13.7

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

TEST REPORT



Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	1.061 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	28000	~ 28000
SweepTime	28.000 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

TEST REPORT

802.11b, Middle Channel

Result

DUT Frequency (MHz)	Result
2437.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
---	---	---	---	---	---

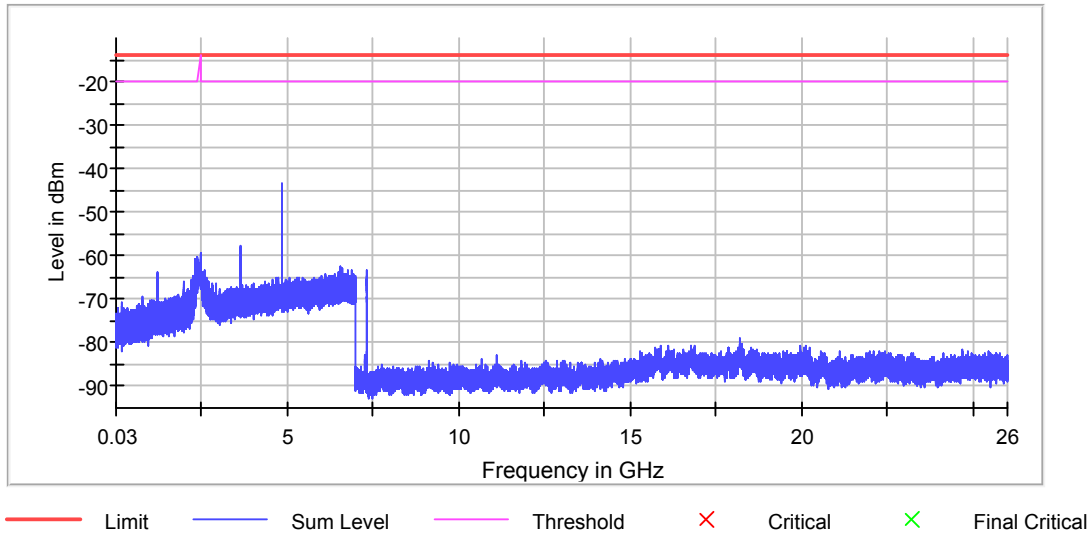
Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
4873.994633	-43.3	29.3	-14.0
4874.135769	-47.3	33.3	-14.0
4877.099630	-52.7	38.7	-14.0
4873.853497	-52.8	38.8	-14.0
4871.030772	-53.0	39.0	-14.0
4876.958493	-53.1	39.2	-14.0
4874.982586	-56.9	42.9	-14.0
4873.006679	-57.6	43.6	-14.0
3653.448650	-57.9	43.9	-14.0
3656.977055	-58.0	44.0	-14.0
3657.541600	-58.0	44.0	-14.0
3655.001148	-58.0	44.0	-14.0
3653.589786	-58.1	44.1	-14.0
3654.436604	-58.2	44.2	-14.0
3654.577740	-58.6	44.6	-14.0

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

TEST REPORT



Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	1.061 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	28000	~ 28000
SweepTime	28.000 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

TEST REPORT

PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

802.11b, Highest Channel

Result

DUT Frequency (MHz)	Result
2462.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
---	---	---	---	---	---

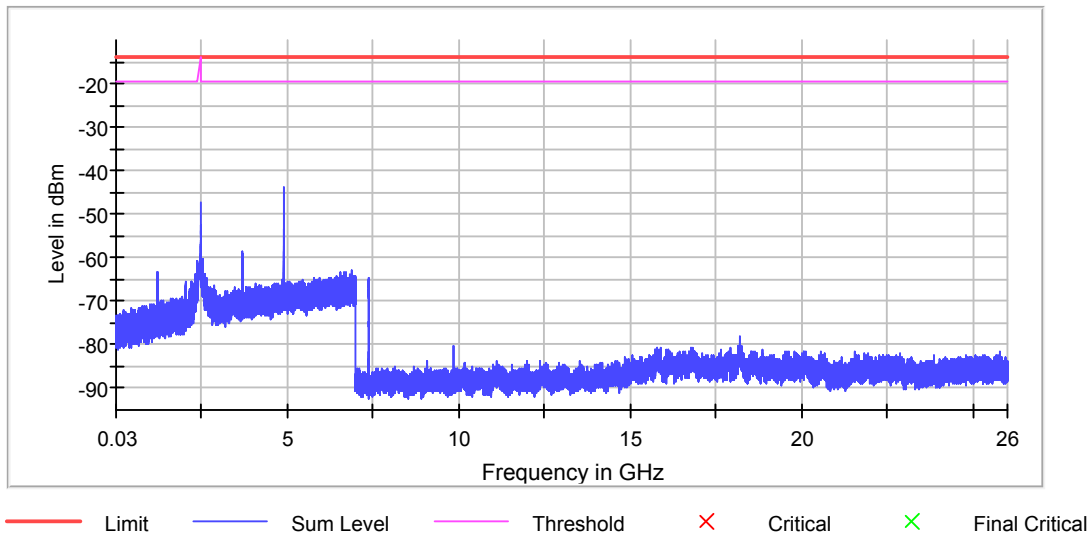
Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
4923.956853	-43.8	30.1	-13.7
4924.097989	-45.5	31.8	-13.7
2483.570568	-47.4	33.7	-13.7
2483.500000	-47.4	33.7	-13.7
2484.699658	-52.5	38.8	-13.7
4920.992992	-53.2	39.5	-13.7
4927.061850	-53.2	39.5	-13.7
2484.558522	-53.3	39.6	-13.7
2484.417385	-53.5	39.8	-13.7
2483.993977	-53.8	40.1	-13.7
2483.711704	-54.1	40.4	-13.7
2484.981930	-54.1	40.4	-13.7
2483.852841	-54.2	40.5	-13.7
4923.815717	-54.4	40.7	-13.7
2484.840794	-54.6	41.0	-13.7

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

TEST REPORT



Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	1.061 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	28000	~ 28000
SweepTime	28.000 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

TEST REPORT

PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

802.11g, Lowest Channel

Result

DUT Frequency (MHz)	Result
2412.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
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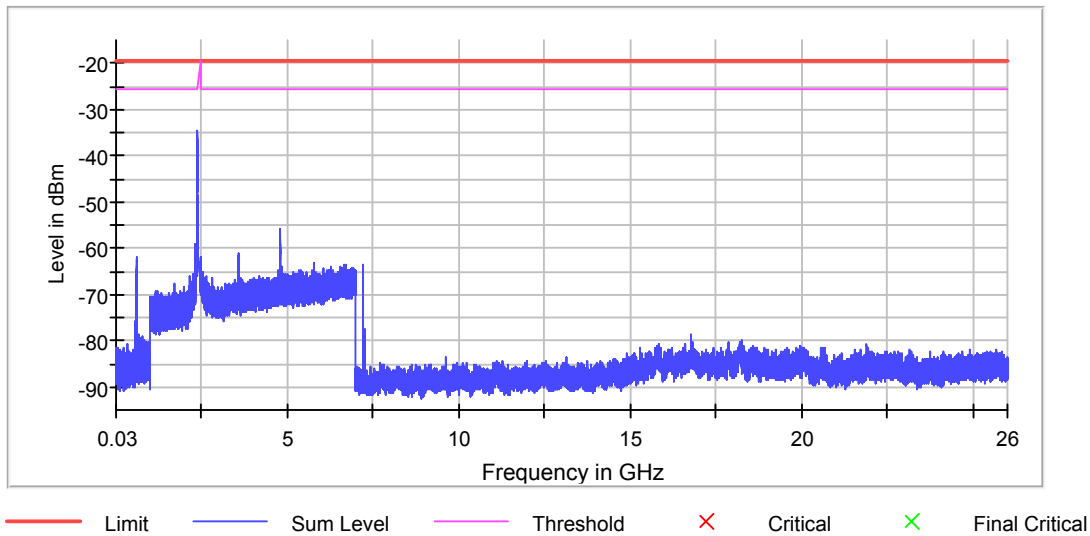
Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
2397.775000	-34.5	14.8	-19.7
2397.825000	-34.8	15.1	-19.7
2397.725000	-35.1	15.4	-19.7
2399.825000	-35.4	15.7	-19.7
2399.775000	-35.6	15.9	-19.7
2397.875000	-36.0	16.3	-19.7
2399.275000	-36.1	16.4	-19.7
2399.225000	-36.2	16.5	-19.7
2398.225000	-36.7	17.0	-19.7
2397.925000	-36.7	17.0	-19.7
2398.275000	-36.7	17.0	-19.7
2399.475000	-37.2	17.5	-19.7
2399.525000	-37.2	17.5	-19.7
2399.875000	-37.3	17.6	-19.7
2399.725000	-37.4	17.7	-19.7

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

TEST REPORT



Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	1.061 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	28000	~ 28000
SweepTime	28.000 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

TEST REPORT

802.11g, Middle Channel

Result

DUT Frequency (MHz)	Result
2437.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
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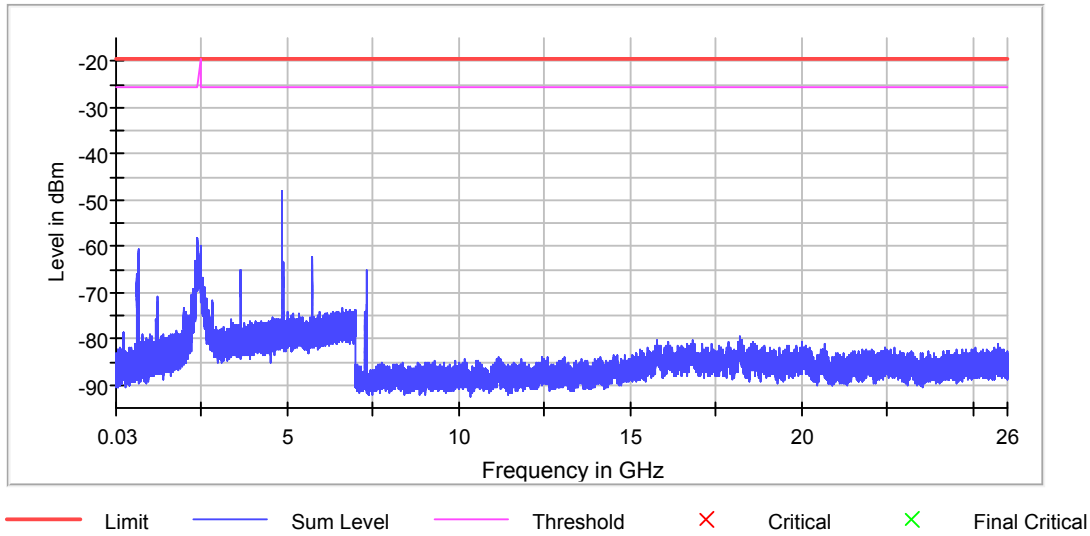
Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
4873.430088	-47.9	28.3	-19.6
4873.571224	-48.0	28.4	-19.6
4879.075537	-48.7	29.1	-19.6
4872.724407	-49.0	29.4	-19.6
4875.264859	-49.0	29.4	-19.6
4874.276905	-49.3	29.7	-19.6
4871.595317	-49.4	29.7	-19.6
4871.454181	-49.4	29.8	-19.6
4878.934400	-49.4	29.8	-19.6
4877.099630	-49.5	29.9	-19.6
4867.925776	-49.6	30.0	-19.6
4878.652128	-49.7	30.1	-19.6
4870.889636	-49.8	30.2	-19.6
4869.337138	-49.8	30.2	-19.6
4879.357809	-49.9	30.3	-19.6

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

TEST REPORT



Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	1.061 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	28000	~ 28000
SweepTime	28.000 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

TEST REPORT

PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

802.11g, Highest Channel

Result

DUT Frequency (MHz)	Result
2462.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
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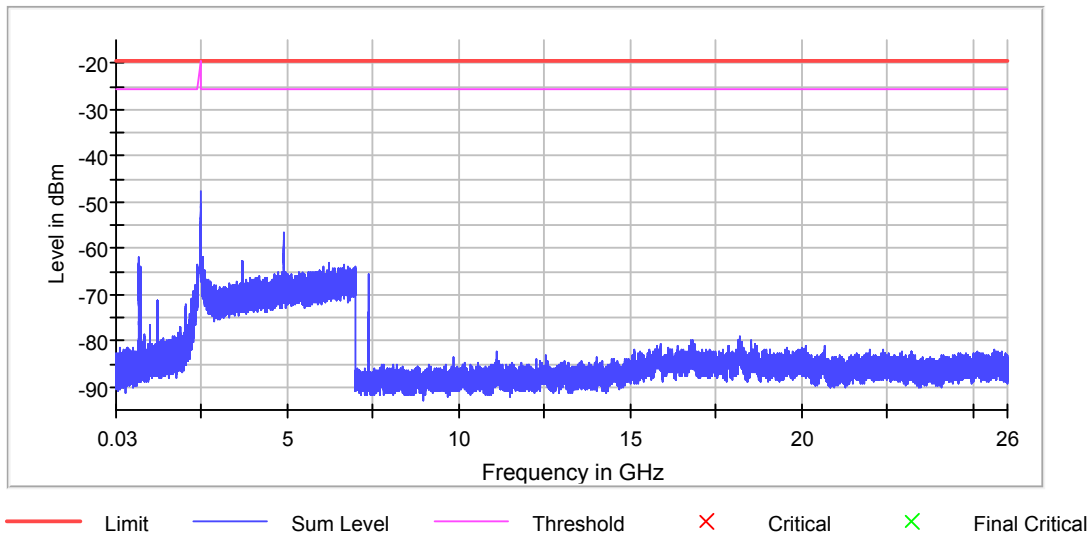
Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
2483.570568	-47.7	28.0	-19.7
2483.500000	-47.7	28.0	-19.7
2483.711704	-47.9	28.2	-19.7
2483.852841	-48.8	29.1	-19.7
2484.276249	-50.6	30.9	-19.7
2484.135113	-51.1	31.4	-19.7
2484.558522	-51.1	31.4	-19.7
2484.417385	-51.4	31.7	-19.7
2485.123066	-52.1	32.4	-19.7
2485.969884	-52.3	32.6	-19.7
2483.993977	-52.3	32.7	-19.7
2486.252156	-52.7	33.0	-19.7
2488.651472	-53.0	33.3	-19.7
2484.981930	-53.1	33.4	-19.7
2487.240110	-53.2	33.5	-19.7

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

TEST REPORT



Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	1.061 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	28000	~ 28000
SweepTime	28.000 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

TEST REPORT

PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

802.11n (20MHz), Lowest Channel

Result

DUT Frequency (MHz)	Result
2412.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
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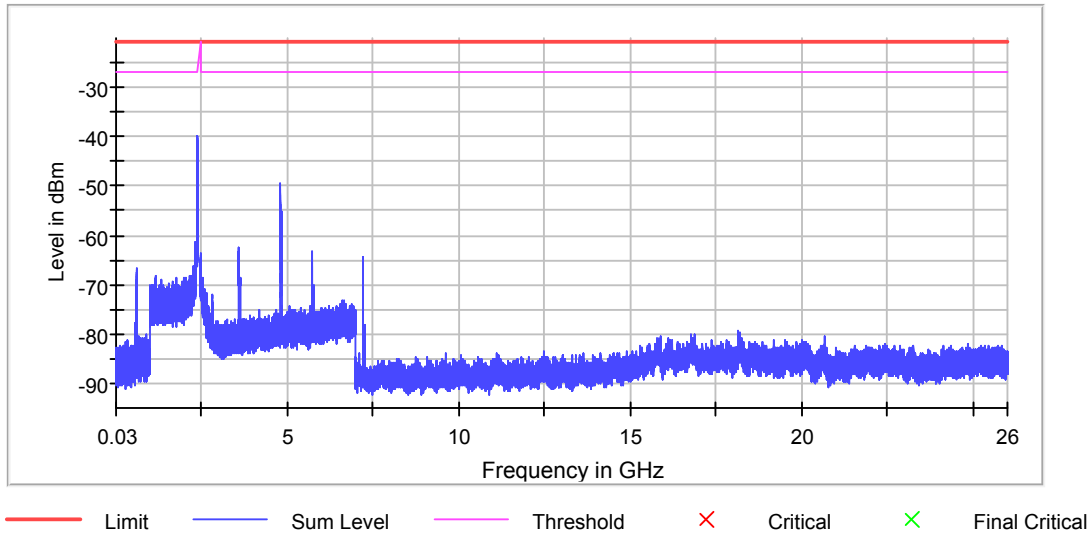
Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
2396.425000	-39.7	19.0	-20.7
2396.375000	-40.0	19.2	-20.7
2398.925000	-40.0	19.3	-20.7
2398.175000	-40.1	19.3	-20.7
2399.875000	-40.1	19.4	-20.7
2398.975000	-40.2	19.4	-20.7
2399.925000	-40.3	19.6	-20.7
2398.225000	-40.3	19.6	-20.7
2396.625000	-40.5	19.7	-20.7
2399.475000	-40.6	19.9	-20.7
2398.275000	-40.8	20.0	-20.7
2399.525000	-40.8	20.1	-20.7
2397.375000	-41.1	20.4	-20.7
2398.325000	-41.2	20.4	-20.7
2399.825000	-41.2	20.5	-20.7

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

TEST REPORT



Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	1.061 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	28000	~ 28000
SweepTime	28.000 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

TEST REPORT

PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

802.11n (20MHz), Middle Channel

Result

DUT Frequency (MHz)	Result
2437.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
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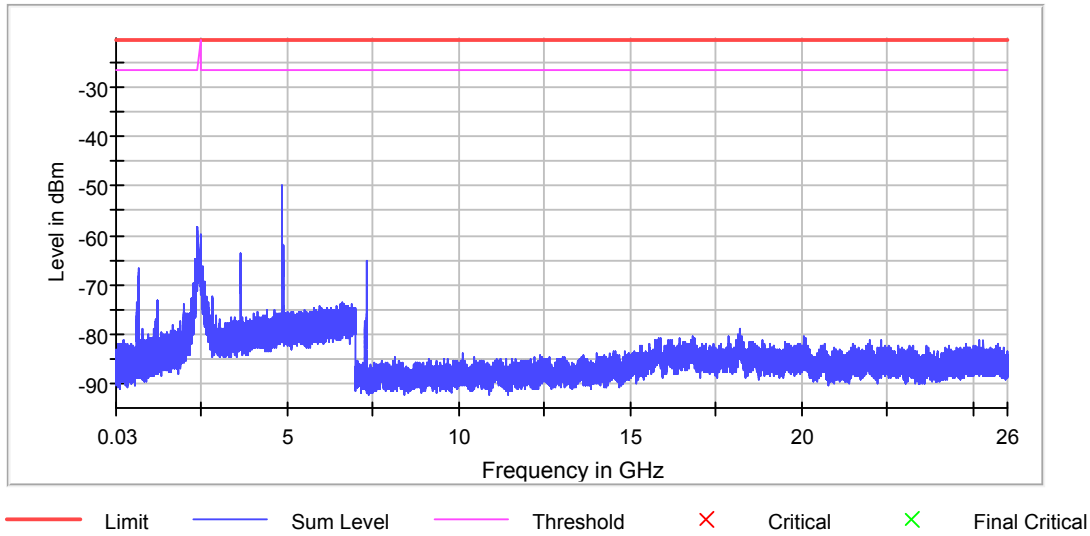
Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
4870.042819	-49.8	29.3	-20.5
4870.607364	-51.1	30.6	-20.5
4869.901683	-51.3	30.7	-20.5
4868.490321	-51.3	30.8	-20.5
4877.523038	-51.5	31.0	-20.5
4868.349184	-51.7	31.2	-20.5
4875.264859	-51.8	31.3	-20.5
4870.325091	-51.9	31.3	-20.5
4867.502367	-52.0	31.4	-20.5
4870.466228	-52.0	31.5	-20.5
4870.183955	-52.0	31.5	-20.5
4873.430088	-52.3	31.8	-20.5
4877.099630	-52.4	31.9	-20.5
4869.337138	-52.6	32.1	-20.5
4873.006679	-52.9	32.3	-20.5

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

TEST REPORT



Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	1.061 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	28000	~ 28000
SweepTime	28.000 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

TEST REPORT

PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

802.11n (20MHz), Highest Channel

Result

DUT Frequency (MHz)	Result
2437.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
---	---	---	---	---	---

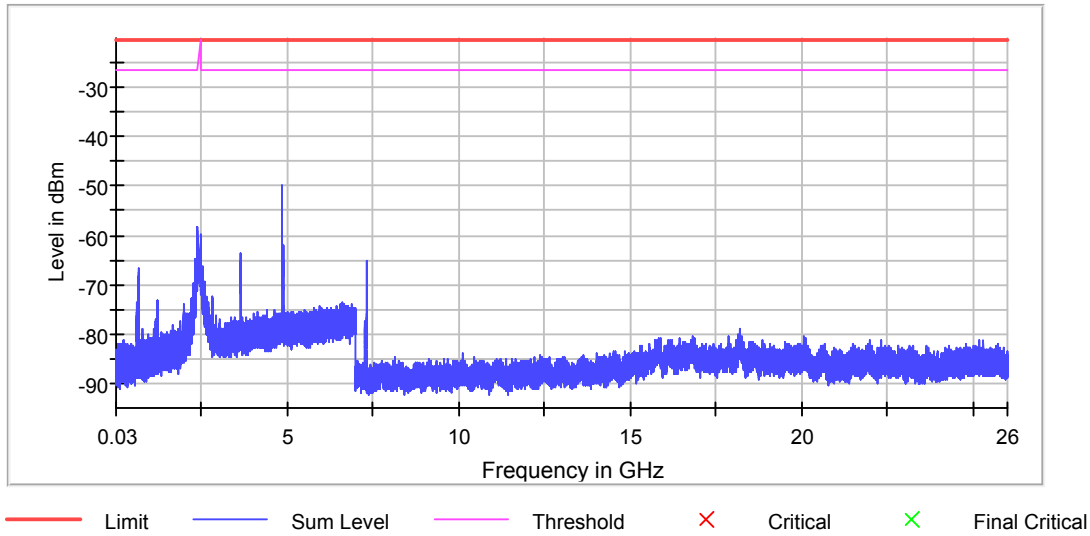
Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
4870.042819	-49.8	29.3	-20.5
4870.607364	-51.1	30.6	-20.5
4869.901683	-51.3	30.7	-20.5
4868.490321	-51.3	30.8	-20.5
4877.523038	-51.5	31.0	-20.5
4868.349184	-51.7	31.2	-20.5
4875.264859	-51.8	31.3	-20.5
4870.325091	-51.9	31.3	-20.5
4867.502367	-52.0	31.4	-20.5
4870.466228	-52.0	31.5	-20.5
4870.183955	-52.0	31.5	-20.5
4873.430088	-52.3	31.8	-20.5
4877.099630	-52.4	31.9	-20.5
4869.337138	-52.6	32.1	-20.5
4873.006679	-52.9	32.3	-20.5

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

TEST REPORT



Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	1.061 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	28000	~ 28000
SweepTime	28.000 ms	AUTO
Reference Level	-10.000 dBm	-30.000 dBm
Attenuation	20.000 dB	AUTO
Detector	Peak	Peak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB

TEST REPORT

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 dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

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 dB μ V 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 dB μ V/m. This value in dB μ V/m is converted to its corresponding level in μ V/m.

$$RA = 62.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$PD = 0.0 \text{ dB}$$

$$AV = -10 \text{ dB}$$

$$FS = 62.0 + 7.4 + 1.6 - 29.0 + 0.0 + (-10.0) = 32.0 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32.0 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

TEST REPORT

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 1-10 list the significant emission frequencies, the limit and the margin of compliance.

Judgement -

Passed by 0.5 dB margin

TEST REPORT

RADIATED EMISSION DATA

Mode: TX-Channel 01

Table 1
IEEE 802.11b (DSSS, 1 Mbps)

Polarization	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	54.0	33	29.4	50.4	54.0	-3.6
H	4824.000	27.0	33	34.9	28.9	54.0	-25.1
H	7236.000	26.8	33	37.9	31.7	54.0	-22.3
H	9648.000	31.0	33	40.4	38.4	54.0	-15.6
V	12060.000	33.1	33	40.5	40.6	54.0	-13.4
H	14472.000	34.3	33	40.0	41.3	54.0	-12.7

Polarization	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	2390.000	64.6	33	29.4	61.0	74.0	-13.0
H	4824.000	38.6	33	34.9	40.5	74.0	-33.5
H	7236.000	40.0	33	37.9	44.9	74.0	-29.1
H	9648.000	42.8	33	40.4	50.2	74.0	-23.8
V	12060.000	45.3	33	40.5	52.8	74.0	-21.2
H	14472.000	46.4	33	40.0	53.4	74.0	-20.6

- NOTES:
1. Peak detector is used for the 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.

TEST REPORT

Mode: TX-Channel 06

Table 2
IEEE 802.11b (DSSS, 1 Mbps)

Polarization	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	31.3	33	34.9	33.2	54.0	-20.8
V	7311.000	30.1	33	37.9	35.0	54.0	-19.0
V	9748.000	30.4	33	40.4	37.8	54.0	-16.2
H	12185.000	33.4	33	40.5	40.9	54.0	-13.1
H	14622.000	36.7	33	38.4	42.1	54.0	-11.9

Polarization	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	43.6	33	34.9	45.5	74.0	-28.5
V	7311.000	41.6	33	37.9	46.5	74.0	-27.5
V	9748.000	42.3	33	40.4	49.7	74.0	-24.3
H	12185.000	44.7	33	40.5	52.2	74.0	-21.8
H	14622.000	48.2	33	38.4	53.6	74.0	-20.4

- NOTES:
1. Peak detector is used for the 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.

TEST REPORT

Mode: TX-Channel 11

Table 3
IEEE 802.11b (DSSS, 1 Mbps)

Polarization	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	2483.500	52.2	33	29.4	48.6	54.0	-5.4
V	4924.000	30.2	33	34.9	32.1	54.0	-21.9
H	7386.000	32.2	33	37.9	37.1	54.0	-16.9
V	9848.000	32.4	33	40.4	39.8	54.0	-14.2
H	12310.000	34.3	33	40.5	41.8	54.0	-12.2
V	14772.000	36.6	33	38.4	42.0	54.0	-12.0

Polarization	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	2483.500	65.2	33	29.4	61.6	74.0	-12.4
V	4924.000	41.9	33	34.9	43.8	74.0	-30.2
H	7386.000	43.7	33	37.9	48.6	74.0	-25.4
V	9848.000	42.7	33	40.4	50.1	74.0	-23.9
H	12310.000	46.2	33	40.5	53.7	74.0	-20.3
V	14772.000	47.9	33	38.4	53.3	74.0	-20.7

- NOTES:
1. Peak detector is used for the 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.

TEST REPORT

Mode: TX-Channel 01

Table 4
IEEE 802.11g (OFDM, 6 Mbps)

Polarization	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	54.7	33	29.4	51.1	54.0	-2.9
H	4824.000	27.7	33	34.9	29.6	54.0	-24.4
H	7236.000	27.4	33	37.9	32.3	54.0	-21.7
V	9648.000	27.3	33	40.4	34.7	54.0	-19.3
H	12060.000	27.9	33	40.5	35.4	54.0	-18.6
H	14472.000	30.5	33	40.0	37.5	54.0	-16.5

Polarization	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	2390.000	69.9	33	29.4	66.3	74.0	-7.7
H	4824.000	41.5	33	34.9	43.4	74.0	-30.6
H	7236.000	43.7	33	37.9	48.6	74.0	-25.4
V	9648.000	40.8	33	40.4	48.2	74.0	-25.8
H	12060.000	44.2	33	40.5	51.7	74.0	-22.3
H	14472.000	46.1	33	40.0	53.1	74.0	-20.9

- NOTES:
1. Peak detector is used for the 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.

TEST REPORT

Mode: TX-Channel 06

Table 5
IEEE 802.11g (OFDM, 6 Mbps)

Polarization	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	26.4	33	34.9	28.3	54.0	-25.7
V	7311.000	28.1	33	37.9	33.0	54.0	-21.0
H	9748.000	27.2	33	40.4	34.6	54.0	-19.4
H	12185.000	27.4	33	40.5	34.9	54.0	-19.1
V	14622.000	31.3	33	38.4	36.7	54.0	-17.3

Polarization	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	41.7	33	34.9	43.6	74.0	-30.4
V	7311.000	42.7	33	37.9	47.6	74.0	-26.4
H	9748.000	41.4	33	40.4	48.8	74.0	-25.2
H	12185.000	44.8	33	40.5	52.3	74.0	-21.7
V	14622.000	48.1	33	38.4	53.5	74.0	-20.5

- NOTES:
1. Peak detector is used for the 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.

TEST REPORT

Mode: TX-Channel 11

Table 6
IEEE 802.11g (OFDM, 6 Mbps)

Polarization	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	2483.500	55.3	33	29.4	51.7	54.0	-2.3
H	4924.000	28.2	33	34.9	30.1	54.0	-23.9
H	7386.000	27.9	33	37.9	32.8	54.0	-21.2
H	9848.000	25.5	33	40.4	32.9	54.0	-21.1
H	12310.000	28.1	33	40.5	35.6	54.0	-18.4
V	14772.000	31.7	33	38.4	37.1	54.0	-16.9

Polarization	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	2483.500	73.4	33	29.4	69.8	74.0	-4.2
H	4924.000	40.8	33	34.9	42.7	74.0	-31.3
H	7386.000	41.4	33	37.9	46.3	74.0	-27.7
H	9848.000	38.3	33	40.4	45.7	74.0	-28.3
H	12310.000	44.3	33	40.5	51.8	74.0	-22.2
V	14772.000	48.0	33	38.4	53.4	74.0	-20.6

- NOTES:
1. Peak detector is used for the 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.

TEST REPORT

Mode: TX-Channel 01

Table 7
IEEE 802.11n (20MHz) (OFDM, MCS0)

Polarization	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	55.8	33	29.4	52.2	54.0	-1.8
H	4824.000	25.2	33	34.9	27.1	54.0	-26.9
H	7236.000	26.4	33	37.9	31.3	54.0	-22.7
V	9648.000	23.7	33	40.4	31.1	54.0	-22.9
V	12060.000	33.2	33	40.5	40.7	54.0	-13.3
V	14472.000	35.6	33	40.0	42.6	54.0	-11.4

Polarization	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	2390.000	77.1	33	29.4	73.5	74.0	-0.5
H	4824.000	40.2	33	34.9	42.1	74.0	-31.9
H	7236.000	41.8	33	37.9	46.7	74.0	-27.3
V	9648.000	39.2	33	40.4	46.6	74.0	-27.4
V	12060.000	44.8	33	40.5	52.3	74.0	-21.7
V	14472.000	46.6	33	40.0	53.6	74.0	-20.4

- NOTES:
1. Peak detector is used for the 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.

TEST REPORT

Mode: TX-Channel 06

Table 8
IEEE 802.11n (20MHz) (OFDM, MCS0)

Polarization	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	26.7	33	34.9	28.6	54.0	-25.4
H	7311.000	26.6	33	37.9	31.5	54.0	-22.5
V	9748.000	26.8	33	40.4	34.2	54.0	-19.8
H	12185.000	33.8	33	40.5	41.3	54.0	-12.7
V	14622.000	37.6	33	38.4	43.0	54.0	-11.0

Polarization	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	39.6	33	34.9	41.5	74.0	-32.5
H	7311.000	42.1	33	37.9	47.0	74.0	-27.0
V	9748.000	39.3	33	40.4	46.7	74.0	-27.3
H	12185.000	44.9	33	40.5	52.4	74.0	-21.6
V	14622.000	48.1	33	38.4	53.5	74.0	-20.5

- NOTES:
1. Peak detector is used for the 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.

TEST REPORT

Mode: TX-Channel 11

Table 9
IEEE 802.11n (20MHz) (OFDM, MCS0)

Polarization	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	2483.500	50.8	33	29.4	47.2	54.0	-6.8
V	4924.000	26.0	33	34.9	27.9	54.0	-26.1
H	7386.000	25.5	33	37.9	30.4	54.0	-23.6
V	9848.000	26.1	33	40.4	33.5	54.0	-20.5
H	12310.000	34.2	33	40.5	41.7	54.0	-12.3
H	14772.000	37.0	33	38.4	42.4	54.0	-11.6

Polarization	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	2483.500	66.6	33	29.4	63.0	74.0	-11.0
V	4924.000	39.6	33	34.9	41.5	74.0	-32.5
H	7386.000	41.3	33	37.9	46.2	74.0	-27.8
V	9848.000	39.4	33	40.4	46.8	74.0	-27.2
H	12310.000	44.2	33	40.5	51.7	74.0	-22.3
H	14772.000	48.0	33	38.4	53.4	74.0	-20.6

- NOTES:
1. Peak detector is used for the 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.

TEST REPORT

Mode: WiFi Charging

Table 9

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
V	31.316	38.9	16	10.0	32.9	40.0	-7.1
H	114.944	40.0	16	14.0	38.0	43.5	-5.6
V	162.405	32.5	16	16.0	32.5	43.5	-11.0
H	244.301	37.0	16	20.0	41.0	46.0	-5.0
V	249.982	38.0	16	20.0	42.0	46.0	-4.0
H	326.127	32.1	16	24.0	40.1	46.0	-5.9
V	374.974	30.7	16	24.0	38.7	46.0	-7.3
H	500.034	31.5	16	26.0	41.5	46.0	-4.6
V	625.026	25.3	16	29.0	38.3	46.0	-7.7
H	750.086	24.8	16	30.0	38.8	46.0	-7.2

- 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.

TEST REPORT

Mode: WiFi On

Table 10

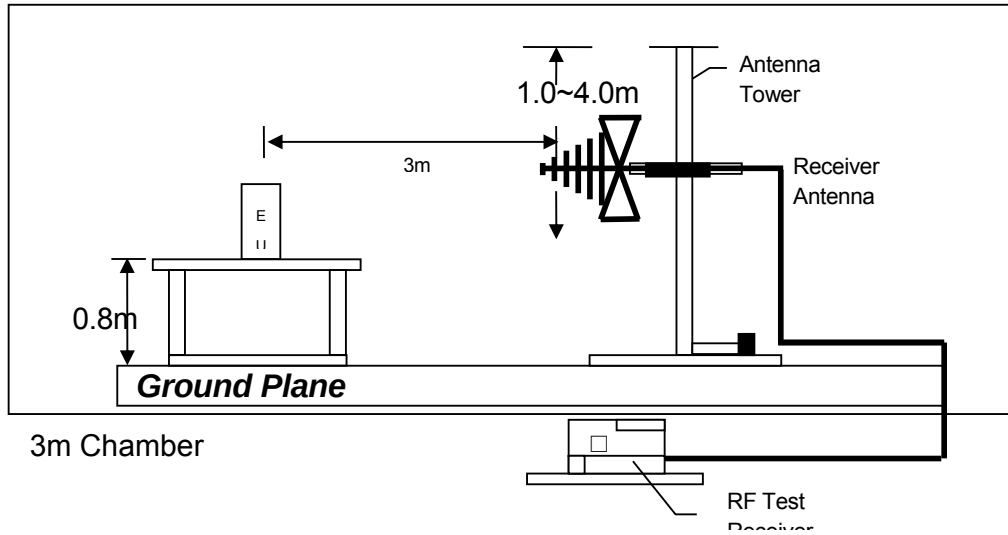
Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
V	44.342	31.4	16	10.0	25.4	40.0	-14.6
V	82.449	34.6	16	7.0	25.6	40.0	-14.4
V	166.978	28.3	16	17.0	29.3	43.5	-14.2
V	249.982	34.2	16	20.0	38.2	46.0	-7.8
V	374.974	30.6	16	24.0	38.6	46.0	-7.4
V	500.034	27.7	16	26.0	37.7	46.0	-8.3
V	625.026	25.4	16	29.0	38.4	46.0	-7.6
V	750.086	25.9	16	30.0	39.9	46.0	-6.1

- 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.

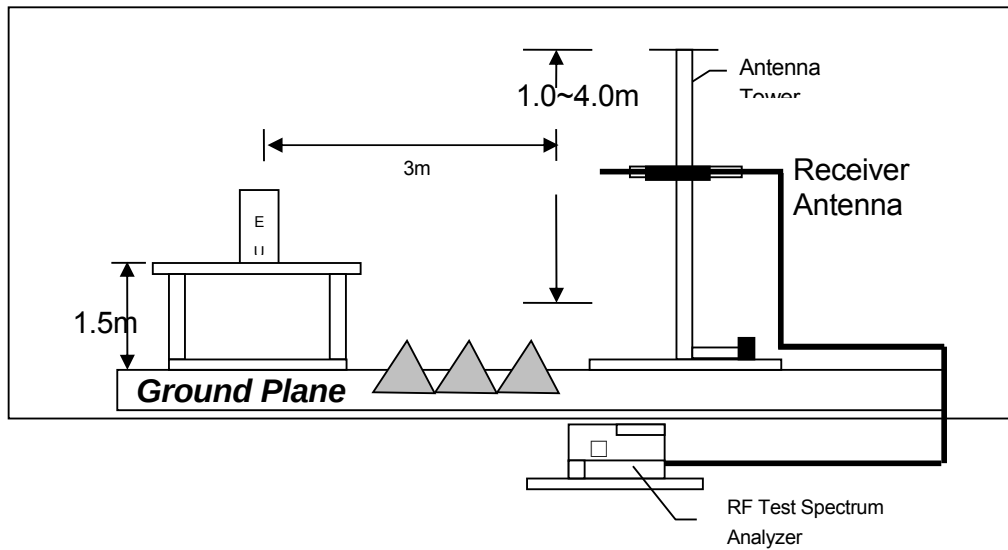
TEST REPORT

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

TEST REPORT

4.6.4 Transmitter Duty Cycle Calculation

Not applicable – No average factor is required.

TEST REPORT

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

195 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

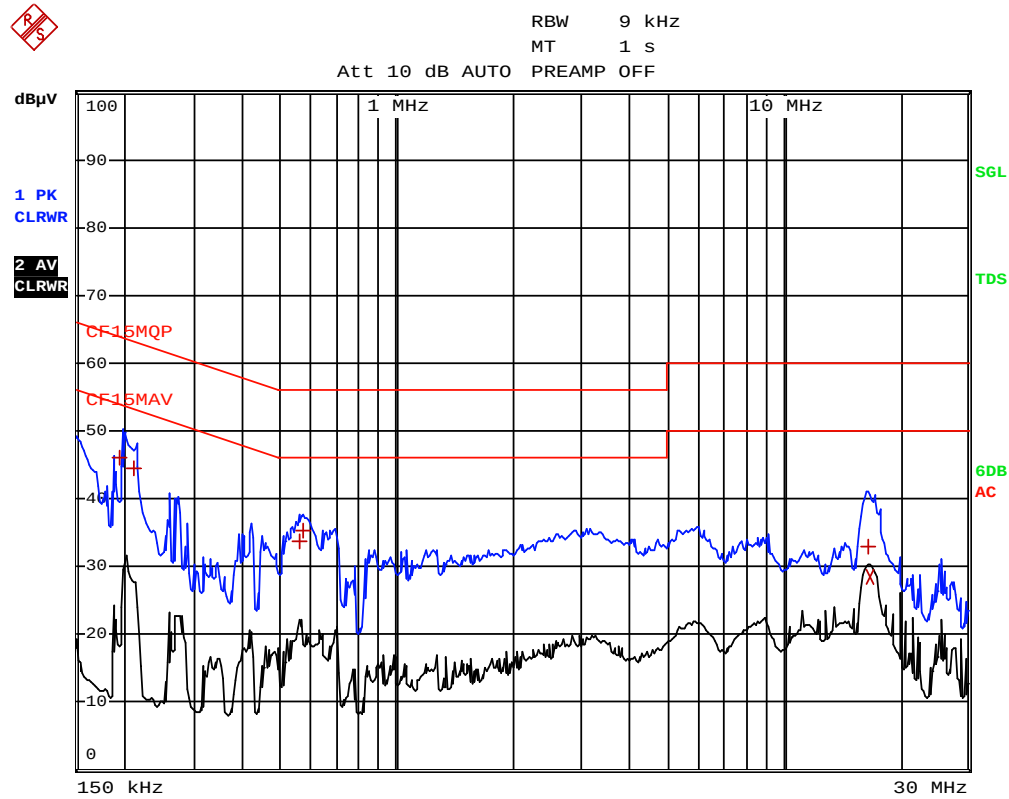
The plot(s) and data in the following pages list the significant emission frequencies, the limit and the margin of compliance.

Passed by 17.79 dB margin compare with Quasi-peak limit

TEST REPORT

AC POWER LINE CONDUCTED EMISSION

Worst Case: Wi-Fi On Mode



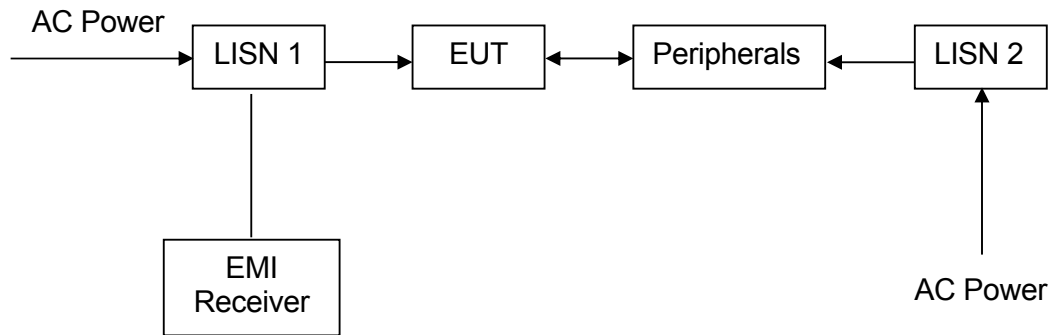
TEST REPORT

Worst Case: Wi-Fi On Mode

EDIT PEAK LIST (Final Measurement Results)				
Trace1:	CF15MQP			
Trace2:	CF15MAV			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dBμV	DELTA LIMIT dB	
1 Quasi Peak	195 kHz	46.03 L1	-17.79	
1 Quasi Peak	213 kHz	44.39 L1	-18.69	
1 Quasi Peak	559.5 kHz	33.64 L1	-22.35	
1 Quasi Peak	573 kHz	35.36 L1	-20.63	
1 Quasi Peak	16.629 MHz	33.04 L1	-26.95	
2 CISPR Average	16.6785 MHz	28.45 L1	-21.54	

TEST REPORT

4.7.3 Conducted Emission Test Setup



TEST REPORT

5.0 EQUIPMENT LIST

1) Radiated Emissions Test

Equipment	BiConiLog Antenna	Double Ridged Guide Antenna	EMI Test Receiver
Registration No.	EW-3061	EW-1133	EW-3156
Manufacturer	EMCO	EMCO	R&S
Model No.	3142E	3115	ESR26
Calibration Date	November 02, 2017	May 24, 2017	November 10, 2017
Calibration Due Date	November 02, 2018	November 24, 2018	November 10, 2018

2) Conducted Emissions Test

Equipment	EMI Test Receiver	Artificial Mains	Pulse Limiter
Registration No.	EW-2500	EW-0192	EW-3248
Manufacturer	R&S	R&S	R&S
Model No.	ESCI	ESH3-Z5	E3H3-Z2
Calibration Date	October 13, 2017	October 27, 2017	November 03, 2017
Calibration Due Date	October 13, 2018	August 25, 2018	October 12, 2018

Equipment	RF Cable 9kHz to 1000MHz	LISN
Registration No.	EW-3170	EW-2874
Manufacturer	N/A	R&S
Model No.	9kHz to 1000MHz	ENV-216
Calibration Date	March 20, 2017	March 16, 2017
Calibration Due Date	March 20, 2018	March 16, 2018

3) Conductive Measurement Test

Equipment	Spectrum Analyzer	RF Cable (up to 40GHz) 1.5m length	RF Power Meter with Power Sensor (N1921A)
Registration No.	EW-2253	EW-3104	EW-2270
Manufacturer	R&S	N/A	N/A
Model No.	FSP40	SMA-M to SMA-M	AGILENTTECH
Calibration Date	July 24, 2017	February 28, 2017	January 15, 2018
Calibration Due Date	July 24, 2018	February 28, 2018	January 15, 2019

END OF TEST REPORT