Wi-Fi 802.11 a, ac, b, g, n

FCC / IC Test Report

FOR:

Intel Corporation

Model Name: DZ110

Product Description: Smartphone with GSM/GPRS/EDGE, UMTS/HSPA+/LTE, Wi-Fi, BT, NFC and GPS Radios

FCC ID: O2Z-DZ110
IC ID: 1000W-DZ110

47 CFR PART 15.E (U-NII), Old Rules
IC RSS-210 Issue 8, Annex 9 (LE-LAN)

TEST REPORT #: EMC_INTEL-039-14001_UNII_Rev1
DATE: 2014-06-16

FCC : Accredited

IC recognized # 3462B-1

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1 Assessment

The following equipment (and as identified in Ch.3 of this test report) was evaluated against the applicable criteria specified in FCC CFR47 Part 15 subpart E and Industry Canada Standards RSS-210 Issue 8, Annex 9.

No deviations were ascertained during the course of the tests performed.

Note**:** The evaluation has been applied according to the "OLD UNII Rules" as requested per KDB 926956 D01 U-NII Transition Plan v01r01 and as defined in the generic part of KDB 905462 UNII Compliance Procedures of June 3, 2014.

Note: Additional requirements as stipulated in the KDB 594280 D01 Software Configuration v02, 06-02-14 and KDB 848637, Approval of DFS UNII Devices WHITHOUT radar detection, 06-03-214 are covered in the associate report EMC_INTEL-039-14001_CHANNEL_PLAN_COMPLIANCE.

Company	Description	Model #
Intel Corporation	Smartphone with GSM/GPRS/EDGE, UMTS/HSDPA+/LTE, Wi-Fi, BT, NFC and GPS Radios	DZ110

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2014-06-16	Compliance	Franz Engert (Manager Compliance)	Digitally signed by Franz Engert DN: cn=Franz Engert, c=US, o=CETECOM, ou=Complience, email=franz.engert@cetecom.com Date: 2014.07.02 20:12:47 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2014-06-16	Compliance	Dan Le (EMC Engineer)	Digitally signed by Danh Le DN: cn=Danh Le, o=Cetecom, ou=Compliance, email=danh.le@cetecom.com, c=US Date: 2014.07.02 20:14:05 -07'00'

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Test Lab Manager:	Franz Engert
Responsible Project Leader:	Saman Rami

2.2 Identification of the Client

Applicant's Name:	Intel Corporation
Street Address:	2200 Mission College MS:SC1-20
City/Zip Code	Santa Clara, CA 94085
Country	USA
Contact Person:	Christine Ryan
Phone No.	+1 (408) 300-2167
e-mail:	Christine.m.ryan@intel.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as client.
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name / Model No:	Intel 4.5-inch Premium LTE Smartphone / DZ110
HW Revision :	PR2D.2
FCC-ID / IC-ID:	O2Z-DZ110 / 1000W-DZ110
Product Description:	Smartphone with GSM/GPRS/EDGE, UMTS/HSPA+/LTE, Wi-Fi, BT, NFC and GPS Radios
Authorized Frequency Range:	Nominal bands: 5150 – 5250 (band 1) 5250 – 5350 (band 2) 5470 – 5725 (band 3) 5.725– 5825 (band 4)
Modes of Operation	UNII-1 Client with passive scan for indoor use only UNII-2/2e Client with passive scan UNII-3 Client with Active Scan, Hotspot and ad-hoc mode DFS client only TCP is not supported Channels 12-14, 118 - 128, 138 – 144 are not supported 1 transmit and 1 receive chain (no MIMO technology support) The detail channel plan is given in the manufacturer's Operational Description which is part of the exhibits for the FCC/IC filings.
Type(s) of Modulation:	Wi-Fi: 802.11a,n,ac: OFDM with either BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
Channel Bandwidth:	This report covers all channels with 20MHz, 40MHz and 80MHz bandwidths for UNII-1, UNII-2 and UNII-2e as well as the 40MHz and 80MHz bandwidths of UNII-3 under rule part 15.407(15E) 20MHz channels 149 - 165 are treated under rule part 15.247 (15C) in the corresponding report.
Data rates used:	802.11b: 1 Mbps ; 802.11a/g: 6 Mbps ; 802.11n: 6.5 Mbps; 802.11 ac
Antenna/Antenna gain:	Internal PCB-trace antenna / highest declared Antenna Gain: 0.0dBi in band 4.
Declared Output Powers:	According to "DZ110 Maximum RF Output Power Declaration" included in filing.
power supply	AA lithium battery pack (dedicated) Voltage Range 3.6V-4.35V DC Nominal Voltage 3.8V DC
Operating temperature range	-10ºC to 55ºC

Prototype / Production unit	Prototype

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	INV133601723	PR2D.2	SB SB JB r43-main-weekly-973 (WW46)	Radiated and Conducted RF Sample
2	INV133600961	PR2D.2	SB SB JB r43-main-weekly-973 (WW46)	RF Conducted Sample

3.3 Identification of Accessory equipment

STE #	Type	Manufacturer	Model	Serial Number
1	AC/DC Adapter	Solcomp	SC1402	12374000330319

3.4 Environmental conditions during Test:

The following environmental conditions were maintained during the course of testing:
Ambient Temperature: 20-25°C
Relative humidity: 40-60%

3.5 Dates of Testing:

11/11/2013 – 04/05/2014

3.6 Other Testing Notes:

The device was configured with a manufacturer provided test SW, capable of setting the unit in different supported modulation schemes, data rates and channels of operation.

The device was set to continuous framed TX (burst) mode per test SW and could thus be operated with 100% duty cycle during testing.

The EUT was tested on the low, mid and high channels of the tested frequency bands (5GHz sub-bands 1, 2 and 3).

The DFS functionality was tested with "off the shelf" SW configuration of the DUT including the Android operating system SW version 4.4.2 IFWI version 0003.00B4 and Kernel version 3.10.20-262866.

The different Wi-Fi standards contain the following variables that are expected to make a real difference in the radio- and EMC- performance as they have physical influence on the radio signal.

- Frequency (channel, band, subband)
- Modulation (e.g. 16-QAM)
- Bandwidth of channel (e.g. 40MHz)

Differences in the coding rate are considered irrelevant as they will only change the channel coding of the data on the signal. E.g. individual testing of 802.11a at MCS 0 and 802.11n[20] at MCS 0 will not bring additional coverage as in this case just the channel coding is different.

For this reason the following modulations / data rates are considered representative and are used in this report unless otherwise indicated:

Mode	Data Rate
802.11a, OFDM + BPSK	MCS0 - 6M
802.11n[20], OFDM + 64-QAM	MCS7 - 65M
802.11n[40], OFDM + QPSK	MCS1 - 27M
802.11ac[80], OFDM + 256-QAM	MCS9 – 390M

4 Subject of Investigation

The objective of the measurements applied by CETECOM Inc. was to establish compliance of the EUT as described under Ch. 3 of this Test Report, with the applicable criteria specified in

- FCC CFR47 Parts 15, subpart E
- IC RSS-210 Issue 8, Annex 9

The evaluation has been applied according to the "OLD UNII Rules" as requested per KDB 926956 D01 U-NII Transition Plan v01r01 and as defined in the generic part of KDB 905462 UNII Compliance Procedures of June 3, 2014.

This test report is to support a request for new equipment authorization under the FCC ID: O2Z-DZ110 and IC ID: 1000W – DZ110.

5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.407 (a)(1) RSS210 A9.2	Power Spectral Density	Nominal	802.11a/n/ac	■	☐	☐	☐	Complies
RSS GEN, issue 3, section 4.6.1	Spectrum Bandwidth	Nominal	802.11a/n/ac	■	☐	☐	☐	Complies
§15.407 (a)(1) RSS210 A9.2	Maximum Output Power	Nominal	802.11a/n/ac	■	☐	☐	☐	Complies
§15.407 (a)(6)	Peak Excursion	Nominal	802.11a/n/ac	■	☐	☐	☐	Complies
§15.407 (b)(1)(2)(3) RSS GEN , issue 3 section 7.2.5	unwanted emissions into non-restricted bands	Nominal	802.11a/n/ac	■	☐	☐	☐	Complies
§15.205 (a)(c) RSS GEN , issue 3 section 7.2.2	unwanted emissions into restricted bands	Nominal	802.11a/n/ac	■	☐	☐	☐	Complies
§15.207(a) RSS GEN , issue 3 section 7.2.4	Conducted Emissions AC power line	Nominal	802.11a/n/ac	■	☐	☐	☐	Complies
15.407 (h) RSS210 A9.4	DFS	Nominal	802.11a/n/ac	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.

6 Measurements

6.1 Measurement Uncertainty

	Uncertainty in dB radiated <30MHz	Uncertainty in in dB radiated 30MHz - 1GHz	Uncertainty in dB radiated > 1GHz	Uncertainty in dB Conducted measurement
standard deviation k=1	2.48	1.93	2.16	0.63
95% confidence interval in dB	4.86	3.79	4.23	1.24
95% confidence interval in dB in delta to Result	+-2.5 dB	+-2.0 dB	+- 2.3dB	+-0.7dB

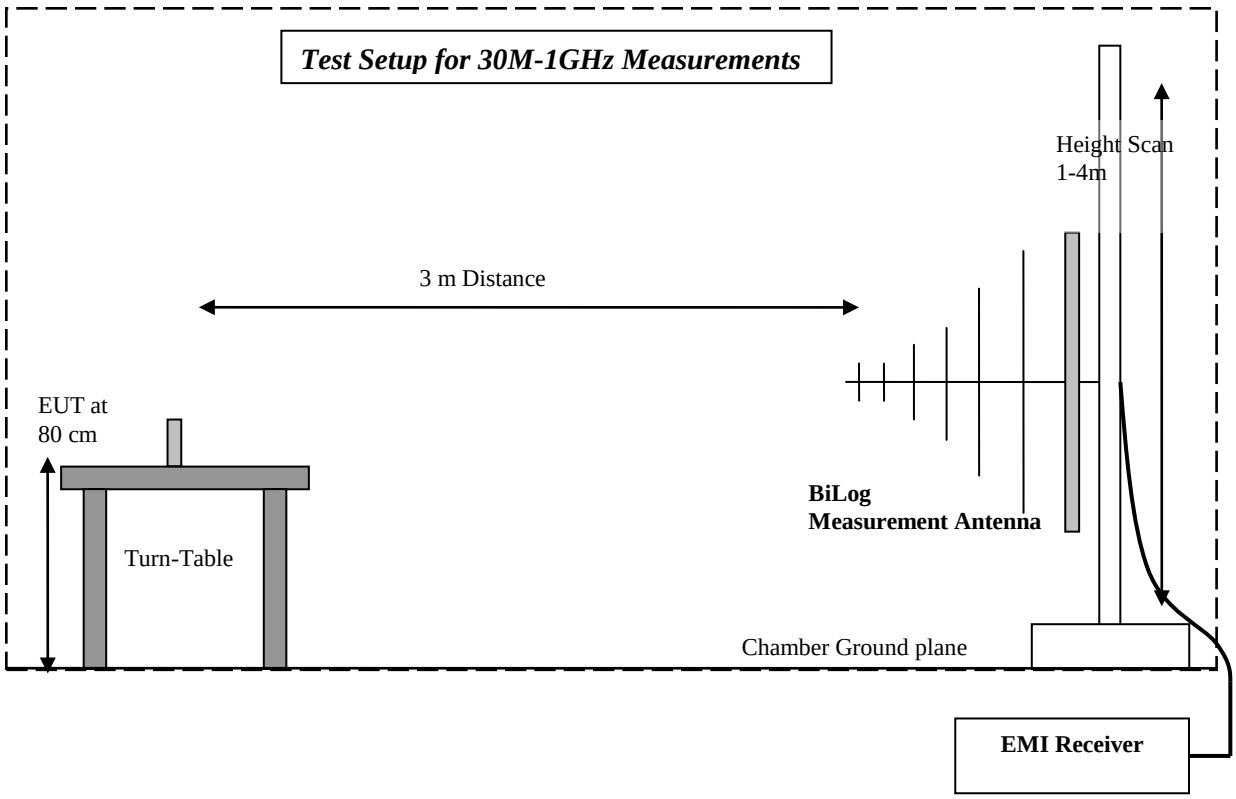
6.2 Test Conditions

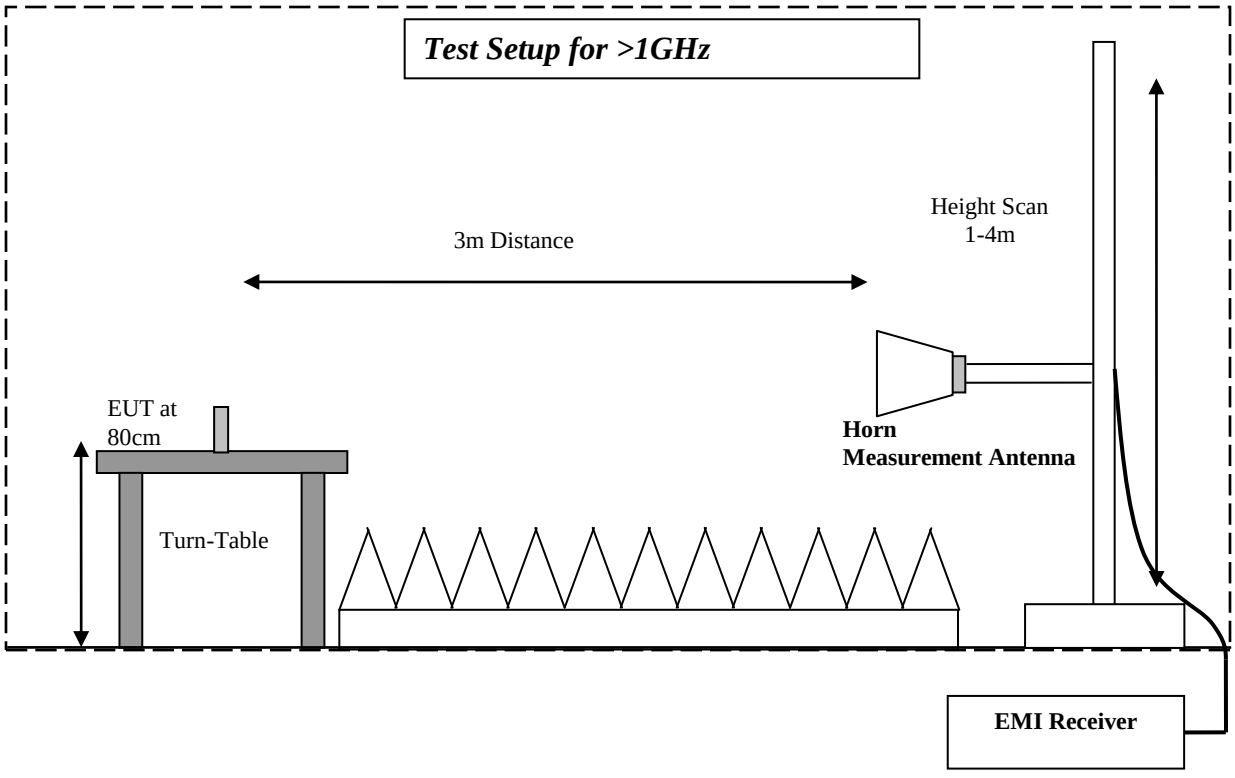
Temperature: 19°C to 25°C;
Operating Voltage: 3.8V for radio measurements;
Operating Voltage: 4.35V for emission measurements due to connected charger;
Relative Humidity 20% to 50%

6.3 Radiated Emissions Measurement Procedure

The radiated measurement is performed according to:
ANSI C63.4 (2009)
ANSI C63.10 (2009)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 16 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9kHz to 30MHz, a Biconlog antenna is used from 30MHz to 1GHz, two different horn antennas are used to cover frequencies up to 40GHz.


Test Setup for 30M-1GHz Measurements
Height Scan
1-4m
3 m Distance
EUT at
80 cm
BiLog
Measurement Antenna
Turn-Table
Chamber Ground plane
EMI Receiver


Test Setup for >1GHz
Height Scan
1-4m
3m Distance
EUT at
80cm
Horn
Measurement Antenna
Turn-Table
EMI Receiver

6.3.1 Sample Calculations for Radiated Measurements

6.3.1.1 Field Strength Measurements:

Measurements from the Spectrum Analyzer/ Receiver are used to calculate the Field Strength, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

FS (dBµV/m) = Measured Value on SA (dBµV) + Cable Loss (dB) + Antenna Factor (dB/m)
Eg:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the above equation.

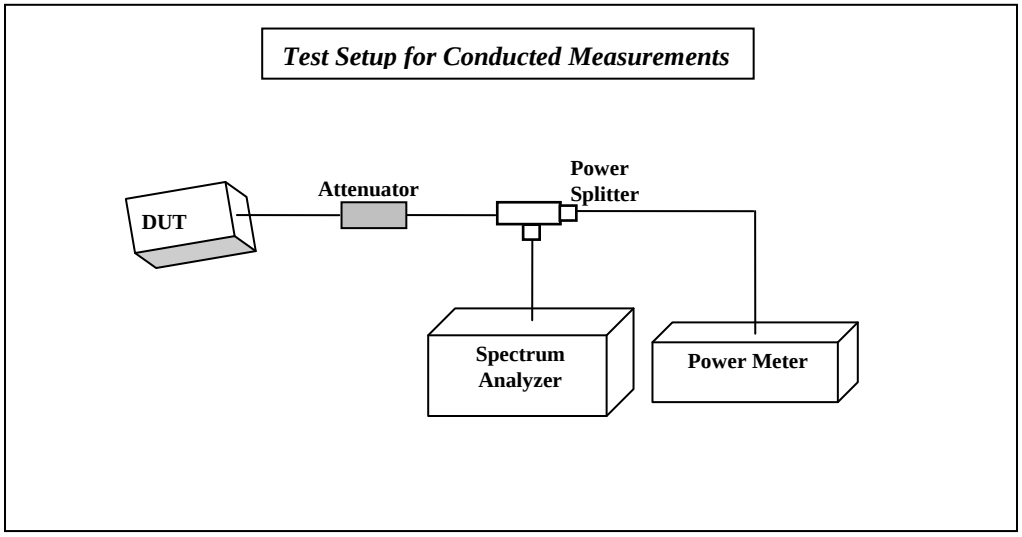
6.3.1.2 Power Measurements using Substitution Procedure:

The measurement on the Spectrum Analyzer is used as a basis for the Substitution procedure.
The EUT is replaced with a Signal Generator and an antenna. The setting on the Signal Generator is varied until the Spectrum Analyzer displays the original reading. EIRP is calculated as-

EIRP (dBm)= Signal Generator setting (dBm)- Cable Loss (dB)+ Antenna Gain (dBi)
Eg:

Frequency (MHz)	Measured SA (dBµV)	Signal Generator setting (dBm)	Antenna Gain (dBi)	Dipole Gain (dBd)	Cable Loss (dB)	EIRP (dBm)
1000	95.5	24.5	6.5	0	3.5	27.5

6.4 Conducted Measurement Setup and Procedure



1. Connect the equipment as shown in the above diagram.
2. A test SW provided by the manufacturer is used to control the different modulations, data rates and max output power configurations.
3. Measurements are to be performed with the EUT set to the low, middle and high channels for 802.11 a/n/ac modes.

6.5 Measurement Procedures according to FCC guidelines

In addition to the related rules in FCC 15(E) and RSS-210 Annex 9 the guidelines in the following FCC publications have been applied for evaluation:

- KDB 905462 UNII Compliance Procedures Old & New Rules, 06-03-2014(generic part)
- KDB 905462 D05 802.11 Channel Plans Old Rules v01, 06-02-2014
- KDB 905462 D01 UNII DFS Compliance Procedures Old Rules v01 (re-assigned FCC 06-96 DFS order)
- KDB 848637, Approval of DFS UNII Devices WITHOUT radar detection, 06-03-2014
- KDB 789033 D01 General UNII Test Procedures Old Rules v01r04, 06-06-2014
- KDB 443999 D01 Approval of DFS UNII Devices v01, 06-03-2014
- KDB 644545 D01 Guidance for IEEE 802.11ac v01r02: Guidance for IEEE 802.11ac and Pre-ac Device Emissions Testing, Oct 31, 2013

7 Maximum Conducted Output Power

7.1 Reference:

FCC	☒ Part 15 Subpart C, §15.407(a)(1)(2)(3)
IC	☒ RSS-210Issue 8: A9.2 (1)(2)(3)(4)
ANSI	☒ C63.10-2009 for TX-mode
KDB Guidance no.	☒ 789033 D01 General UNII test procedures v01r04: E) Method SA-1
Limits	5150-5250: FCC limit is 50mW RMS conducted output power (17dBm) IC limit is 200mW EIRP (23dBm) 5250-5350 and 5470-57125: FCC limit is 250mW RMS conducted output power (24dBm) IC limit is a 250mW RMS conducted output power (24dBm) and EIRP 1W 5725-5825: FCC limit is 1W RMS conducted output power (30dBm) IC limit is 1W RMS conducted output power (30dBm) and EIRP 4W

7.2 Antenna characteristics:

According §15.407(a)(1)(2):
☒ directional gain < 6 dBi (measured: difference between measured conducted and radiated eirp. power)
☐ directional gain > 6 dBi (measured / applicant's declaration) -> conducted power reduction necessary

7.3 EUT settings:

The EUT was instructed to send with maximum power according applicants instructions.
Different modulation characteristics have been checked according to 3.6.
Three operating frequencies within each operating band have been selected. The EUT was transmitting continuously.

7.4 Measurement Method:

789033 D01 General UNII test procedures v01r04: E) Method SA-1

7.5 Settings on Spectrum-Analyzer:

Center Frequency	Nominal channel frequency
Span	40/80/120 MHz
Resolution Bandwidth (RBW)	1 MHz
Video Bandwidth (VBW)	3 MHz
Sweep time	coupled
Detector	RMS
Sweep Mode	AVG mode, 100 Traces

7.6 Conducted power measurement and EIRP calculation

- Maximum declared antenna gain is 0.0dBi 5 GHz. This worst case gain is applied to the conducted power measurement results as a worst case representation of the EIRP limits for Industry Canada.

7.7 Results:

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.						
Op. Mode:	1 (20MHz nominal bandwidth)						
	Channel No.	Band-width	Power [dBm] (limit 17dBm) FCC		EIRP[dBm] (limit 23dBm) IC		Diagram no.
			a-Mode BPSK	n20-Mode 64-QAM	a-Mode BPSK	n20-Mode 64-QAM	
UNII-1	36	20	16.38	15.96	16.58	16.16	Diagram Ch36, a-Mode Diagram Ch36, n-Mode
	40		16.02	15.85	16.22	16.05	Diagram Ch40, a-Mode Diagram Ch40, n-Mode
	44		15.72	NP	15.92	NP	Diagram Ch44, a-Mode
	48		15.56	15.49	15.76	15.69	Diagram Ch48, a-Mode Diagram Ch48, n-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"
NP - not performed as low, mid, high and channel already covered in a-mode.

	Channel No.	Band-width	Power [dBm] (limit 24dBm) FCC & IC		EIRP[dBm] (limit 30dBm) IC		Diagram no.
			a-Mode BPSK	n20-Mode 64-QAM	a-Mode BPSK	n20-Mode 64-QAM	
UNII-2A	52	20	15.75	15.64	15.95	15.84	Diagram Ch52, a-Mode Diagram Ch52, n-Mode
	56		15.65	NP	15.85	NP	Diagram Ch56, a-Mode
	60		15.47	15.63	15.67	15.83	Diagram Ch60, a-Mode Diagram Ch60, n-Mode
	64		15.69	15.76	15.89	15.96	Diagram Ch64, a-Mode Diagram Ch64, n-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"
NP - not performed as low, mid, high and channel already covered in a-mode.

	Channel No.	Band-width	Power [dBm] (limit 24dBm) FCC & IC		EIRP[dBm] (limit 30dBm) IC		Diagram no.
			a-Mode BPSK	n20-Mode 64-QAM	a-Mode BPSK	n20-Mode 64-QAM	
UNII-2C	100	20	15.78	15.72	15.98	15.92	Diagram Ch100, a-Mode Diagram Ch100, n-Mode
	104		15.75	NP	15.95	NP	Diagram Ch104, a-Mode
	136		15.65	NP	15.85	NP	Diagram Ch136, a-Mode
	140		15.55	15.59	15.75	15.79	Diagram Ch140, a-Mode Diagram Ch140, n-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"
NP - not performed as low, mid, high and channel already covered in a-mode.

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.				
Op. Mode:	1 (40MHz nominal bandwidth)				
	Channel No.	Nominal bandwidth	Power [dBm] (limit 17dBm) FCC	EIRP[dBm] (limit 23dBm) IC	
			n40-Mode QPSK	n40-Mode QPSK	Diagram no.
UNII-1	38	40	6.17	6.37	Diagram Ch38, n40-Mode
	46		14.55	14.75	Diagram Ch46, n40-Mode
	Channel No.	Nominal bandwidth	Power [dBm] (limit 24dBm) FCC & IC	EIRP[dBm] (limit 30dBm) IC	
			n40-Mode QPSK	n40-Mode QPSK	Diagram no.
UNII-2 A	54	40	14.37	14.57	Diagram Ch54, n40-Mode
	62		14.32	14.52	Diagram Ch62, n40-Mode
UNII-2 C	102	40	14.79	14.99	Diagram Ch102, n40-Mode
	134		6.44	6.64	Diagram Ch134,n40-Mode
	Channel No.	Nominal bandwidth	Power [dBm] (limit 30dBm) FCC & IC	EIRP[dBm] (limit 36dBm) IC	
			n40-Mode QPSK	n40-Mode QPSK	Diagram no.
UNII-3	159	40	15.86	16.06	Diagram Ch159,n40-Mode

Remark: See diagrams in separate annex “Annex A to EMC_INTEL-039-14001_UNII”

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.				
Op. Mode:	1 (80MHz nominal bandwidth)				
	Channel No.	Nominal bandwidth	Power [dBm] (limit 17dBm) FCC	EIRP[dBm] (limit 23dBm) IC	
			AC80-Mode 256-QAM	AC80-Mode 256-QAM	Diagram no.
UNII-1	42	80	12.32	12.52	Diagram Ch42, AC80-Mode
	Channel No.	Nominal bandwidth	Power [dBm] (limit 24dBm) FCC & IC	EIRP[dBm] (limit 30dBm) IC	
			AC80-Mode 256-QAM	AC80-Mode 256-QAM	Diagram no.
UNII-2A	58	80	11.97	12.17	Diagram Ch58, AC80-Mode
UNII-2C	106	80	13.33	13.53	Diagram Ch106, AC80-Mode
	122		13.36	13.56	Diagram Ch122, AC80-Mode
	Channel No.	Nominal bandwidth	Power [dBm] (limit 30dBm) FCC & IC	EIRP[dBm] (limit 36dBm) IC	
			AC80-Mode 256-QAM	AC80-Mode 256-QAM	Diagram no.
UNII-3	155	80	13.00	13.2	Diagram Ch155, AC80-Mode

Remark: See diagrams in separate annex “Annex A to EMC_INTEL-039-14001_UNII”

7.8 Verdict:

Passed

8 Occupied and Emission Bandwidth

8.1 References of occupied and emission bandwidth

FCC	☒ Part 15 Subpart C, §15.407(b)(1)(2)(3)
IC	RSS-Gen, Issue 3, chapter 4.6.1
ANSI	☒ C63.10-2009 for TX-mode
KDB Guidance no.	☒ 789033 D01 General UNII test procedures v01r04
Limits	--

8.2 EUT Settings:

The EUT was instructed to send with maximum power and a duty cycle >98%. The modulations were chosen as defined in 3.6.
Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

8.3 Measurement method:

As described in KDB 789033 D01 General UNII test procedures v01r04

8.4 Measurement Uncertainty

The Uncertainty of the FSU spectrum analyzer used is 0.2Hz. Thus the results have been rounded to tenths of one Hz.

8.5 Spectrum-Analyzer Settings:

Span	Set as to fully display the emissions and at least 26 dB below the PEAK level
Resolution Bandwidth (RBW)	Set to approx 1%
Video Bandwidth (VBW)	3 times the resolution bandwidth
Sweep time	Coupled and low enough to have no gaps within power envelope
Detector	PK (26 dB BW)/Sample (99% OBW)
Sweep mode	Repetitive Mode, MAX-HOLD

8.6 Results:

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.				
Op. Mode:	1, a-Mode BPSK				
	Channel No.	Nominal bandwidth	26 dB Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Diagram no.
UNII-1	36	20	21.794871	16.746794	Diagram Ch36, a-Mode
	40		21.474358	**16.826923**	Diagram Ch40, a-Mode
	48		21.314102	16.746794	Diagram Ch48, a-Mode
UNII-2	52	20	21.314102	16.746794	Diagram Ch52, a-Mode
	60		21.314102	16.746794	Diagram Ch60, a-Mode
	64		21.394230	16.746794	Diagram Ch64, a-Mode
UNII-2e	100	20	21.233974	16.746794	Diagram Ch100, a-Mode
	116		21.474358	16.746794	Diagram Ch116, a-Mode
	140		**21.554487**	16.746794	Diagram Ch140, a-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.				
Op. Mode:	1, n-Mode, 64-QAM				
	Channel No.	Nominal bandwidth	26 dB Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Diagram no.
UNII-1	36	20	21.794871	**18.028846**	Diagram Ch36, n-Mode
	40		**21.875000**	**18.028846**	Diagram Ch40, n-Mode
	48		21.714743	17.948717	Diagram Ch48, n-Mode
UNII-2	52	20	21.714743	**18.028846**	Diagram Ch52, n-Mode
	60		21.714743	**18.028846**	Diagram Ch60, n-Mode
	64		21.714743	17.948717	Diagram Ch64, n-Mode
UNII-2e	100	20	21.714743	**18.028846**	Diagram Ch100, n-Mode
	140		21.794871	17.948717	Diagram Ch140, n-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.				
Op. Mode:	1, HT40-Mode, QPSK				
	Channel No.	Nominal bandwidth	26 dB Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Diagram no.
UNII-1	38	40	40.673076	**36.730769**	Diagram Ch38, n40-Mode
	46		40.673076	**36.730769**	Diagram Ch46, n40-Mode
UNII-2	54	40	40.673076	**36.730769**	Diagram Ch54, n40-Mode
	62		40.673076	**36.730769**	Diagram Ch62, n40-Mode
UNII-2e	102	40	**40.769230**	**36.730769**	Diagram Ch102, n40-Mode
	110		40.576923	36.634615	Diagram Ch110, n40-Mode
	134		**40.769230**	**36.730769**	Diagram Ch134, n40-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.				
Op. Mode:	1, AC80-Mode, 256-QAM				
	Channel No.	Nominal bandwidth	26 dB Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Diagram no.
UNII-1	42	80	82.307692	**75.961538**	Diagram Ch42, AC80-Mode
UNII-2	58	80	82.307692	**75.961538**	Diagram Ch58, AC80-Mode
UNII-2e	106	80	**82.692307**	75.769230	Diagram Ch106, AC80-Mode
	122		82.307692	**75.961538**	Diagram Ch122, AC80-Mode
UNII-3	155	80	82.307692	**75.961538**	Diagram Ch155, AC80-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.				
Op. Mode:	1, AC80-Mode, 16-QAM				
	Channel No.	Nominal bandwidth	26 dB Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Diagram no.
UNII-1	42	80	82.307692308	75.961538462	Diagram Ch42, AC80-Mode
UNII-2	58	80	**82.307692692**	75.961538462	Diagram Ch58, AC80-Mode
UNII-2e	106	80	82.307692308	**76.153846154**	Diagram Ch106, AC80-Mode
	122		82.307692308	**76.153846154**	Diagram Ch122, AC80-Mode
UNII-3	155	80	82.307692308	**76.153846154**	Diagram Ch155, AC80-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"

8.7 Verdict

PASS

9 Peak Power Spectral Density

9.1 References

FCC	☒ Part 15 Subpart C, §15.407(a)(1)(2)(5)
IC	☒ RSS-210Issue 8: A9.2 (1)(2)
ANSI	☒ C63.10-2009 for TX-mode
KDB Guidance no.	☒ 789033 D01 General UNII test procedures v01r04: F) Method SA-1
Limits [dBm/MHz]	5150-5250: FCC limit is 4dBm/1MHz conducted RMS IC limit is 10dBm EIRP 5250-5350 and 5470-57125: FCC limit is 11dBm/MHz conducted RMS IC limit is 11dBm/MHz conducted RMS 5725-5825: FCC limit is 17dBm/MHz conducted RMS IC limit is 17dBm/MHz conducted RMS

9.2 EUT settings:

The EUT was instructed to send with maximum power according applicants instructions
Different modulation characteristics have been checked as defined in 3.6.

9.3 Measurement Method:

789033 D01 General UNII test procedures v01r04: F Method SA-1

9.4 Results:

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.				
Op. Mode:	1 (20MHz nominal bandwidth)				
Band	Channel No.	Nominal bandwidth	Power spectral density [dBm/MHz]		Diagram no.
			a-Mode BPSK	n20-Mode 64-QAM	
UNII-1	36	20	4.00[1]	5.22[1]	Diagram Ch36, a-Mode Diagram Ch36, n-Mode
	40		5.13[1]	5.48[1]	Diagram Ch40, a-Mode Diagram Ch40, n-Mode
	48		4.72[1]	5.07[1]	Diagram Ch48, a-Mode Diagram Ch48, n-Mode
UNII-2	52	20	5.00	5.10	Diagram Ch52, a-Mode Diagram Ch52, n-Mode
	60		4.76	5.14	Diagram Ch60, a-Mode Diagram Ch60, n-Mode
	64		4.51	5.06	Diagram Ch64, a-Mode Diagram Ch64, n-Mode
UNII-2e	100	20	4.55	5.46	Diagram Ch100, a-Mode Diagram Ch100, n-Mode
	112		5.51	5.08	Diagram Ch112, a-Mode Diagram Ch112, n-Mode
	140		4.58	4.82	Diagram Ch140, a-Mode Diagram Ch140, n-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"
Remark: Due to the small maximum gain of 0dBi EIRPs have not been calculated and conducted measurements are taken as worst case.

(1) The conducted power results are passing the limit of 4dBm/MHz if an allowance of 6dB is considered for using an antenna with a gain lower than 6dBi.

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.			
Op. Mode:	1 (40MHz nominal bandwidth)			
Band	Channel No.	Nominal bandwidth	Power spectral density [dBm/MHz] n40-Mode QPSK	Diagram no.
UNII-1	38	40	2.11	Diagram Ch38, n40-Mode
	46		2.18	Diagram Ch46, n40-Mode
UNII-2	54	40	2.09	Diagram Ch54, n40-Mode
	62		2.01	Diagram Ch62, n40-Mode
UNII-2e	102	40	2.19	Diagram Ch102, n40-Mode
	110		2.09	Diagram Ch110,n40-Mode
	134		1.24	Diagram Ch134,n40-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"
Remark: Due to the small maximum gain of 0dBi EIRPs have not been calculated and conducted measurements are taken as worst case.

Set-up no.:	1, 50Ohm connection, battery at VNOM 3.8V, no charger connected.			
Op. Mode:	1 (80MHz nominal bandwidth)			
Band	Channel No.	Nominal bandwidth	Power spectral density [dBm/MHz]	Diagram no.
			256-QAM	
UNII-1	42	80	-4.75	Diagram Ch42,n80-Mode
UNII-2	58		-4.28	Diagram Ch58,n80-Mode
UNII-2e	106		-3.5	Diagram Ch106,n80-Mode
	122		-2.7	Diagram Ch122,n80-Mode
UNII-3	155		-4.21	Diagram Ch155,n80-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"
Remark: Due to the small maximum gain of 0dBi EIRPs have not been calculated and conducted measurements are taken as worst case.

9.5 Verdict:

Passed

10 Peak Excursion

10.1 References

FCC	☒ Part 15 Subpart C, §15.407(a)(6)
IC	☐ --
ANSI	☒ C63.10-2009 for TX-mode
KDB Guidance no.	☒ 789033 D01 General UNII test procedures v01r04: G
Limit	≤ 13 dB

10.2 EUT settings:

The EUT was instructed to send with maximum power according applicants instructions.
The EUT was set to the different bandwidths and modulations as required by 789033 D01 General UNII test procedures v01r03: G

10.3 Measurement Method:

789033 D01 General UNII test procedures v01r04: G

10.4 Results:

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.				
Op. Mode:	A 20MHz nominal bandwidth, BPSK N 20MHz nominal bandwidth, 64-QAM				
Band	Channel No.	Nominal bandwidth	Peak to Average Ratio [dB]		Diagram no.
			a-Mode BPSK	n20-Mode 64-QAM	
UNII-1	36	20	7.71	7.39	Diagram Ch36, a-Mode Diagram Ch36, n-Mode
	40		7.22	7.42	Diagram Ch40, a-Mode Diagram Ch40, n-Mode
	48		7.21	7.42	Diagram Ch48, a-Mode Diagram Ch48, n-Mode
UNII-2	52	20	7.19	7.40	Diagram Ch52, a-Mode Diagram Ch52, n-Mode
	60		7.30	7.44	Diagram Ch60, a-Mode Diagram Ch60, n-Mode
	64		7.40	7.42	Diagram Ch64, a-Mode Diagram Ch64, n-Mode
UNII-2e	100	20	7.71	7.34	Diagram Ch100, a-Mode Diagram Ch100, n-Mode
	140		6.82	7.24	Diagram Ch140, a-Mode Diagram Ch140, n-Mode

Remark: See diagrams in separate annex “Annex A to EMC_INTEL-039-14001_UNII”

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.			
Op. Mode:	N 40MHz nominal bandwidth, QPSK			
Band	Channel No.	Nominal bandwidth	Peak to Average Ratio [dB] n40-Mode QPSK	Diagram no.
UNII-1	38	40	6.67	Diagram Ch38, n40-Mode
	46		7.20	Diagram Ch46, n40-Mode
UNII-2	54	40	6.68	Diagram Ch54, n40-Mode
	62		6.65	Diagram Ch62, n40-Mode
UNII-2e	102	40	6.79	Diagram Ch102, n40-Mode
	134		6.66	Diagram Ch134,n40-Mode

Remark: See diagrams in separate annex “Annex A to EMC_INTEL-039-14001_UNII”

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.			
Op. Mode:	AC 80MHz nominal bandwidth, 256-QAM			
Band	Channel No.	Nominal bandwidth	Peak to Average Ratio [dB] AC80-Mode 256-QAM	Diagram no.
UNII-1	42	80	8.42	Diagram Ch42, AC80-Mode
UNII-2	58		8.58	Diagram Ch58, AC80-Mode
UNII-2e	106		8.79	Diagram Ch106, AC80-Mode
	122		8.83	Diagram Ch122, AC80-Mode
UNII-3	155		8.60	Diagram Ch155, AC80-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"

Set-up no.:	1. 50Ohm connection, battery at VNOM 3.8V, no charger connected.			
Op. Mode:	80MHz nominal bandwidth, 16-QAM			
Band	Channel No.	Nominal bandwidth	Peak to Average Ratio [dB] AC80-Mode 16-QAM	Diagram no.
UNII-1	42	80	7.92	Diagram Ch42, AC80-Mode
UNII-2	58		8.03	Diagram Ch58, AC80-Mode
UNII-2e	106		7.98	Diagram Ch106, AC80-Mode
	122		7.79	Diagram Ch122, AC80-Mode
UNII-3	155		8.86	Diagram Ch155, AC80-Mode

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"

10.5 Verdict:

Passed

11 Band Edge Compliance – Radiated (Restricted band limits applied)

11.1 Reference:

§15.407/15.205/15.209
RSS GEN, ch. 7.7

15.205 (a) Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

15.209 (a) Emission Limits:

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30 (29.5 dBµV/m)	30
30–88	100 (40dBµV/m)	3
88–216	150 (43.5 dBµV/m)	3
216–960	200 (46 dBµV/m)	3
Above 960	500 (54 dBµV/m)	3

11.2 Measurement method

Peak measurements are made using a peak detector and RBW=1MHz.
*PEAK LIMIT= 74dBµV/m

Average measurements performed using a peak detector and according to video averaging procedure with RBW=1MHz and VBW=10Hz.
*AVG. LIMIT= 54dBµV/m

11.3 Verdict:

Pass.

11.4 Results

Detector	Bandwidth	UNII-1 low	UNII-2 high	UNII-2e low	UNII-2e high	UNII-3 low	UNII-3 high
Average	20MHz	Diagram 802.11a Ch36 Low Band Edge Average	Diagram 802.11a Ch64 High Band Edge Average	Diagram 802.11a Ch100 Low Band Edge Average	Diagram 802.11a Ch140 High Band Edge Average	Refer to 15.247 report	Refer to 15.247 report
Peak	20MHz	Diagram 802.11a Ch36 Low Band Edge Peak	Diagram 802.11a Ch64 High Band Edge Peak	Diagram 802.11a Ch100 Low Band Edge Peak	Diagram 802.11a Ch140 High Band Edge Peak	Refer to 15.247 report	Refer to 15.247 report
Average	40MHz	Diagram 802.11n Ch38 Low Band Edge Average	Diagram 802.11n Ch62 High Band Edge Average	Diagram 802.11n Ch102 Low Band Edge Average	Diagram 802.11n Ch134 High Band Edge Average	Diagram 802.11n Ch151 Low Band Edge Average	Diagram 802.11n Ch159 High Band Edge Average
Peak	40MHz	Diagram 802.11n Ch38 Low Band Edge Peak	Diagram 802.11n Ch62 High Band Edge Peak	Diagram 802.11n Ch102 Low Band Edge Peak	Diagram 802.11n Ch134 High Band Edge Peak	Diagram 802.11n Ch151 Low Band Edge Peak	Diagram 802.11n Ch159 High Band Edge Peak
Average	80MHz	Diagram 802.11ac Ch42 Low Band Edge Average	Diagram 802.11ac Ch58 High Band Edge Average	Diagram 802.11ac Ch106 Low Band Edge Average	Diagram 802.11ac Ch122 High Band Edge Average	Diagram 802.11ac Ch155 Low Band Edge Average	Diagram 802.11ac Ch155 High Band Edge Average
Peak	80MHz	Diagram 802.11ac Ch42 Low Band Edge Peak	Diagram 802.11ac Ch58 High Band Edge Peak	Diagram 802.11ac Ch106 Low Band Edge Peak	Diagram 802.11ac Ch122 High Band Edge Peak	Diagram 802.11ac Ch155 Low Band Edge Peak	Diagram 802.11ac Ch155 High Band Edge Peak

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"
Remark: As channel 144,142, 138 are not supported by the DUT the channels 140,134,122 have been chosen to prove the band edge compliance instead.
Remark: UNII-3 HT[20] is part of the 15.247 report.
Remark: The fact that some traces show no or little signal is due to large distance to Band edge. It has been confirmed that the transmitter was turned on and operating on the channel as documented.

12 Unwanted Emissions into Restricted and Non-restricted bands

12.1 References

§15.407/15.205/15.209
RSS-GEN, ch. 7.7

(b) Undesirable emission limits: Except as shown in paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

(2) For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 dBm/MHz in the 5.15–5.25 GHz band.

(3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.

(4) For transmitters operating in the 5.725–5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of –17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of –27 dBm/MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

(7) The provisions of § 15.205 apply to intentional radiators operating under this section.

(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

12.2 Limits:

§15.209

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (m)
0.009–0.490	2400/F(kHz)	300[1]
0.490–1.705	24000/F(kHz)	30[1]
1.705–30.0	30 (29.5 dBµV/m)	30[1]
30–88	100 (40dBµV/m)	3
88–216	150 (43.5 dBµV/m)	3
216–960	200 (46 dBµV/m)	3
Above 960	500 (54 dBµV/m)	3

NOTE:

1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels in different frequency ranges.
2. As measurements were made at 3m distance applicable field strength limits have been scaled to 3m measurement distance.
3. For simplicity reasons all emission tests have been done against the restricted limits according 15.209 and 15.35. In cases emissions should fail these limits it is checked whether they are in a restricted band or not. If not the dBuV value is converted into a dBm value and compared to the more relaxed limit of -27dBm to make a final pass/fail decision.

12.3 Test Result:

Plots reported here represent the worst case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.

Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.

Low/Mid/High channels in each sub-band of operation were tested and results reported for both 802.11a and n modes of operation.
Only worst case mid channel test results reported for 9k-1GHz and >18 GHz ranges of test.

Measurement Uncertainty: ±3.0dB

12.4 Testing Notes:

For the measurement range up to 30 MHz in the following plots the field strength results from 3m distance measurement are extrapolated to 300m and 30m distance respectively, by 40dB/decade, according to part 15.31(f)(2), per antenna factor scaling. The red limit line shows the 300 m limit up to 490 kHz, the 30m limit up to 30 MHz and 3m limit above 30MHz.

For simplicity reasons all emission tests have been done against the restricted limits according 15.209 and 15.35. In cases emissions should fail these limits it is checked whether they are in a restricted band or not. If not the dBuV value is converted into a dBm value and compared to the more relaxed limit of -27dBm to make a final pass/fail decision.

12.5 Measurement Verdict

Pass.

12.6 Results:

Band	Modulation and channel	9kHz – 30MHz Peak Emissions	30MHz – 1GHz Peak Emissions	1GHz – 18GHz Peak & Average Emissions according to 15.209, 15.35	18GHz – 40GHz Peak & Average Emissions according to 15.209, 15.35
UNII-1	**802.11a -Ch36**	Diagram **802.11a Ch36 9kHz–30MHz**	Diagram **802.11a Ch36 30MHz-1GHz**	Diagram **802.11a Ch36 1GHz–18GHz**	Diagram **802.11a Ch36 18GHz-40GHz**
UNII-1	**802.11n [40]-Ch38**	Diagram **802.11n Ch38 9kHz-30MHz**	Diagram **802.11n Ch38 30MHz-1GHz**	Diagram **802.11n Ch38 1GHz-18GHz**	Diagram **802.11n Ch38 18GHz-40GHz**
UNII-1	**802.11ac [80]-Ch42**	Diagram **802.11ac Ch42 9kHz-30MHz**	Diagram **802.11ac Ch42 30MHz-1GHz**	Diagram **802.11ac Ch42 1GHz-18GHz**	Diagram **802.11ac Ch42 18GHz-40GHz**
UNII-2	**802.11ac [80]-Ch58**	Diagram **802.11ac Ch58 9kHz-30MHz**	Diagram **802.11ac Ch58 30MHz-1GHz**	Diagram **802.11ac Ch58 1GHz-18GHz**	Diagram **802.11ac Ch58 18GHz-40GHz**
UNII-2	**802.11a -Ch60**	Diagram **802.11a Ch60 9kHz-30MHz**	Diagram **802.11a Ch60 30MHz-1GHz**	Diagram **802.11a Ch60 1GHz-18GHz**	Diagram **802.11a Ch60 18GHz-40GHz**
UNII-2e	**802.11n [40]-Ch102**	Diagram **802.11n Ch102 9kHz-30MHz**	Diagram **802.11n Ch102 30MHz-1GHz**	Diagram **802.11n Ch102 1GHz-18GHz**	Diagram **802.11n Ch102 18GHz-40GHz**
UNII-2e	**802.11ac [80]-Ch106**	Diagram **802.11ac Ch106 9kHz-30MHz**	Diagram **802.11ac Ch106 30MHz-1GHz**	Diagram **802.11ac Ch106 1GHz-18GHz**	Diagram **802.11ac Ch106 18GHz-40GHz**
UNII-2e	**802.11n [40]-Ch134**	Diagram **802.11n Ch134 9kHz-30MHz**	Diagram **802.11n Ch134 30MHz-1GHz**	Diagram **802.11n Ch134 1GHz-18GHz**	Diagram **802.11n Ch134 18GHz-40GHz**
UNII-2e	**802.11a -Ch140**	Diagram **802.11a Ch140 9kHz-30MHz**	Diagram **802.11a Ch140 30MHz-1GHz**	Diagram **802.11a Ch140 1GHz-18GHz**	Diagram **802.11a Ch140 18GHz-40GHz**
UNII-3	**802.11ac -Ch155**	Diagram **802.11ac Ch155 9kHz-30MHz**	Diagram **802.11ac Ch155 30MHz-1GHz**	Diagram **802.11ac Ch155 1GHz-18GHz**	Diagram **802.11ac Ch155 18GHz-40GHz**

Remark: See diagrams in separate annex "Annex A to EMC_INTEL-039-14001_UNII"

13 AC Power Line Conducted Emissions

13.1 References:

FCC: CFR Part 15.207
IC: RSS-Gen Section 7.2.2
The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

13.2 Limits:

§15.207 Conducted limits- Intentional Radiators:

(a) Except as shown in paragraphs (b) and (c) of this section of the CFR, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table (1), as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

RSS-Gen 7.2.2

Except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown below. The tighter limit applies at the frequency range boundaries.

Table 1:

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

Analyzer Settings: CISPR Bandwidth- 9 KHz.

13.3 Test Conditions:

Modulation: 802.11a mode; mid channel of operation.

Note: Plots shown here represent the combined worse case emissions for power lines, phases and neutral line.

13.4 Test Result:

Band	Reference to plot	Highest Peak
UNII-1	Diagram **Cond Emi_N[20] MODE_CH 36**	490kHz/46.3dBuV peak
UNII-2/2e	Diagram **Cond Emi_N[40] MODE_CH 102**	NF
UNII-3	Diagram **Cond Emi_AC[80] MODE_CH 155**	NF

NF = Noise Floor

13.5 Verdict:

Pass

14 DFS

14.1 References:
Clients without radar detection:
KDB 848637 of 06/03/2014.
DFS testing general:
KDB 905462 D01 DFS Order (FCC 06-96)

14.2 Test Setup:

The DUT was connected via 50Ohm conducted port to a CISCO AP (AIR-AP1262N-A-K9) with FCC ID: LDK102073 and S/N: FTX1553E037. The DFS movie according to above KDB was streamed and the DUT responded with ACK. The levels of AP and station were setup in a way that the station level was 5dB higher than the AP level by the usage of attenuators. The connection utilized a 40MHz bandwidth as described in KDB 848637 as an AP with 80MHz support was not available at the time of testing. The SA trace was triggered by the radar signal from the DFS Generator / PXI-5421 card.

During the testing the client proved to be capable of switching channel when commanded by the master. This can be observed from the 4grace beacons from the AP according to 802.11 after the slave data ceases to transmit and the fact that streaming of the movie did not time out. Thus requirement e) of KDB 848637 is met.

A total of 30 pulses of FCC Type 1, 2 and 3 have been triggered with the level calibrated according to Diagram **Radar signal calibration**

Diagram **FCC Type 1 Non-Occupancy period 5520MHz** shows that the AP+DUT fulfill the 30min Non-Occupancy period requirement after being chased away from Ch104. AP+DUT powers are higher then -30dBm as shown e.g. in **FCC Type 1 Reaction Traffic 5520MHz.** This shows that there is a dynamic range of at least 35dB for detection of any traffic on this frequency during the non-occupancy period.

Of these 25 pulses triggered the AP DFS mechanism. Of these 25 pulses all 25 triggered the DUT to change channel.

6 examples of successful reaction can be seen in:
Diagram **FCC Type 1 Reaction Traffic 5520MHz**
Diagram **FCC Type 1 Reaction Traffic 5680MHz**
Diagram **FCC Type 2 Reaction Traffic 5520MHz**
Diagram **FCC Type 2 Reaction Traffic 5580MHz**
Diagram **FCC Type 2 Reaction Traffic 5660MHz**
Diagram **FCC Type 3 Reaction Traffic 5500MHz**

14.3 Verdict:

Passed

15 Test Equipment and Ancillaries used for tests

Item Name	Manufacturer	Equipment Type	Model	Serial #	Calibration Cycle	Last Calibration Date
Binconlog Antenna 3141	EMCO	Binconilog Antenna	3141	0005-1186	3 years	4/5/2012
Digital Radio Comm. Tester CMU 200# 4	R&S	Digital Radio Comm. Tester	CMU 200# 4	110229	2 Years	6/15/2013
Digital Radio Comm. Tester CMU 200 #1	R&S	Digital Radio Comm. Tester	CMU 200 #1	101821	2 Years	6/17/2013
Digital Radio Comm. Tester CMU 200 #2	R&S	Digital Radio Comm. Tester	CMU 200 #2	109879	2 Years	6/15/2013
Digital Radio Comm. Tester CMU 200 #3	R&S	Digital Radio Comm. Tester	CMU 200 #3	110759	2 Years	6/15/2013
ESU Receiver	R&S	EMI Receiver	ESU40	100251	2 Years	9/13/2013
Horn Antenna 3115	EMCO	Horn Antenna	3115	35114	3 years	3/6/2012
Horn Antenna 3116	EMCO	Horn Antenna	3116	70497	3 years	3/2/2012
LISN ESH3-Z5	R&S	LISN	ESH3-Z5	836679/003	2 Years	6/18/2013
LISN ESH3-Z6	R&S	LISN	ESH3-Z6	836154/011	2 Years	6/16/2013
LISN FCC-LISN-50-25-2-08	FCC	LISN	FCC-LISN-50-25-2-08	70497	2 Years	7/12/2012
Log Periodic Antenna 3149	ETS Lindgren	Log Periodic Antenna	3149	1186	3 years	8/23/2011
Loop Antenna 6512	ETS Lindgren	Loop Antenna	6512	49838	3 years	8/1/2011
Thermometer Humidity TM320	Dickson	Thermometer Humidity	TM320	5280063	1 Year	4/15/2013
Thermometer Humidity TM325	Dickson	Thermometer Humidity	TM325	5285354	2 Years	4/15/2013
FSU 26	R&S	Spectrum Analyzer	FSU 26	100189	2 Years	6/1/2013
SMP04	R&S	Signal Generator	SMP04	100151	2 Years	6/17/2013
DFS Generator / PXI-5421 card	National Instruments	NI PXI-1042		E965F1	3 years	7/3/2012
DFS Upconverter PXI-5610 card	National Instruments	NI PXI-1042		E93740	3 years	6/29/2012

16 Revision History

Date	Report Name	Changes to report	Report prepared by
2014-06-11	EMC_INTEL-039-14001_UNII	First official version	F. Engert
2014-06-16	EMC_INTEL-039-14001_UNII_Rev1	First revised version added 30min DFS trace reference	F. Engert