

Emissions Test Report

EUT Name: Secure Wireless Satellite Norton Core Mini

Model No.: 518

CFR 47 Part 15.247:2018, CFR47 part15.409:2018 and RSS-247:2017

Prepared for: Symantec Inc.

Prepared by:

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Revisions

Revision No.	Date MM/DD/YYYY	Reason for Change	Author
1	7/10/2018	Initial	D. Foster
2	8/28/2018	Revisions per reviewer	D. Foster

Note: Latest revision report will replace all previous reports.

Statement of Compliance

Manufacturer:Symantec Inc. Requester / Applicant: Vijay Poojari Name of Equipment: Norton Core Mini Model No. 518 Type of Equipment: Access point router Application of Regulations: CFR 47 Part 15.247:2018, CFR47 part15.409:2018 and RSS-247:2017 Test Dates: 4/12-8/15 2018

Guidance Documents:

Emissions: ANSI C63.10:2013, CFR47 part 15.247:2018, CFR47 part 15.409:2018, RSS247: 2017

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that the equipment described above has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report. This report must not be used to claim product endorsement by A2LA or any agency of the U.S. Government. This report shall not be reproduced except in full, without the written authorization of TUV Rheinland of North America.

Douglas Antioco 08/28/2018

Test Engineer (Power, PPSD) Date

the Man

Donn Foster08/28/2018Josie Sabado08/28/2018Test EngineerDateLaboratory SignatureDateImport SignatureImport SignatureImport SignatureImport SignatureFeesting Vert #3331.02US11312932M-1

Report Date: 07/19/2018

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1 Executive Summary

1.1 Scope

The purpose of the following report is to demonstrate compliance of the Symantec Norton Core Mini to the various regulatory requirements further listed in this Report.

It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Summary of Test Results

 Table 1: Summary of Test Results

Test	Test Method	Test Parameters	Result
ACPower Conducted Emission	CFR47 15.207, RSS-GEN Sect.8.8	Class B	Complied
DTS Bandwidth (6dB)	CFR47 15.247 (a)(2), RSS 247 Sect. 5.2(a)	Limit	Complied
Maximum Output Power	CFR47 15.247 (b), RSS 247 Sect. 5.4 (d)	Limit	Complied
Peak Power Spectral Density	CFR47 15.247 (e), RSS 247 Sect. 5.2	Limit	Complied
Out of Band Emissions	CFR47 15.247 (d), RSS 247 Sect.5.5	Limit	Complied
Transmit Radiated Spurious Emissions	CFR47 15.247 (d), RSS 247 Sect.5.5	Limit	Complied

Test	Test Method	Test Parameters	Result
Maximum Output Power	CFR47 15.407 (a)	Limit	Complied
Maximum Output Power	RSS 247 Sect.6.2.1.1	Limit	Complied
Bandwidth (26dB)	CFR47 15.407 (a) RSS-247 5.2(a)	Limit	Complied
Peak Power Spectral Density	CFR47 15.407 (a)	Limit	Complied
Peak Power Spectral Density	RSS 247 Sect.6.2	Limit	Complied
Out of Band Emissions: U-NII-1 Restricted Band Edge	CFR47 15.407 (a)	Limit	Complied
Out of Band Emissions: U-NII-3 Unrestricted Band Edge	CFR47 15.407 (b)(4)(i) RSS 247 Sect.6.2.1.2	Limit	Complied
Transmitter Spurious Emissions	CFR47 15.209, CFR47 15.407 (b) RSS-GEN Sect.8.9, RSS-247 Sect. 6.2.1.2	Limit	Complied
AC Power Conducted Emission	CFR47 15.207 RSS-GEN Sect.8.8	Class B	Complied
Frequency Stability	CFR47 15.407 (g) RSS-GEN Sect. 6.11	Manufacturer Declaration Comp	

1.4 Special Accessories

QRCT software was used to set the transmitter parameters

1.5 Equipment Modifications

None

Laboratory Information 2

2.1 Accreditations & Endorsements

2.1.1 **US Federal Communications Commission**



TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 is recognized by the commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (US1131). The laboratory scope of accreditation includes: Title 47 CFR Parts 15, 18,

and 90. The accreditation is updated every 3 years.

2.1.2 NIST / A2LA



TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:2005 and ISO 9002 (Lab Code 3331.02). The scope of laboratory accreditation includes

emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada – Industry Canada

Industrie

Canada

TUV Rheinland of North America at the 1279 Quarry Ln, Pleasanton, CA 94566 address is accredited by Industry Canada for performing testing services for the general public on a fee basis. This laboratory test facilities have been

fully described in reports submitted to and accepted by Industry Canada (File Number 2932M). The accreditation is updated every 3 years.

2.1.4 Japan – VCCI

Industry Canada



The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby

contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 has been assessed and approved in accordance with the Regulations for Voluntary Control Measures.

VCCI Registration No. for Pleasanton: A-0268

Acceptance by Mutual Recognition Arrangement 2.1.5



The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Ln, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory NIST / A2LA accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 1279 Quarry Lane, Pleasanton, California 94566, USA.

2.2.1 Emission Test Facility

The Semi-Anechoic chamber and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 and 5 meters. The site is listed with the FCC and accredited by A2LA (Lab Code 3331.02). The 3/5-meter semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st Edition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities; it is equal to the positive square root of the sum of the variances or co-variances of these other quantities, weighted according to how the measurement result varies with changes in these quantities. The term *standard uncertainty* is the result of a measurement expressed as a standard deviation.

2.2.3 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength $(dB\mu V/m) = RAW - AMP + CBL + ACF$

Where: $RAW = Measured level before correction (dB<math>\mu$ V)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor-Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

$$25 \text{ dBuV/m} + 17.5 \text{ dB} - 20 \text{ dB} + 1.0 \text{ dB} = 23.5 \text{ dBuV/m}$$

2.2.4 Measurement Uncertainty Emissions

Per CISPR 16-4-2	U _{lab}	Ucispr			
Radiated Disturbance @ 10 meters					
30 – 1,000 MHz	2.25 dB	4.51 dB			
Radiated Disturbance @ 3 meters					
30 – 1,000 MHz	2.26 dB	4.52 dB			
1 – 6 GHz	2.12 dB	4.25 dB			

6 – 18 GHz	2.47 dB	4.93 dB
Conducted Disturbance @		
150 kHz – 30 MHz	1.09 dB	2.18 dB
Disturbance Power		
30 MHz- 300 MHz	3.92 dB	4.3 dB

2.3 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005.

3 Duty Cycle 2.4GHz

Test Method

The ANSI C63.10-2013 Section 11.6 Conducted method was used to measure the duty cycle. The preliminary investigation was performed at different data rate to determine the highest power output for each mode. The system was powered on and port 1 connected to the Spectrum analyzer. A diag program called QRCT was used to set the AP in continuous Tx mode and also to set the channel, channel power and data rate. This test was conducted on 3 channels for each of the throughput modes. The analyzer was configured as follows.

Cable loss was entered as an offset

RBW=8MHz

VBW= 50MHz

Span = 0Hz

Reference level= as needed to maintain headroom

SWT= 5ms adjusted as needed to capture approx. 1.5 cycles

The off time and cycle time were were captured using the marker functions and the duty cycle calculated.

Test Conditions: Conducted Measurement (SA), Normal Temperature	Date: 6/26/2018
Antenna Type:	Stamped metal dipole
Duty cycle correction: table below	Data Rate: CCK=802.11b 1mbps, nonHT=802.11g 6mbps, HT/VHT=802.11ac MCS0
Ambient Temp.: 22° C	Relative Humidity: 39 %RH

Duty cycle					
Mode	Channel 1	Channel 6	Channel 11	Channel 3	DCCE
nonHT	0.96	0.96	0.96	n/a	0.17
HT20	0.98	0.98	0.98	n/a	0.00
HT40				0.97	0.13
VHT20	0.99	0.98	0.99	n/a	0.00
VHT40				0.97	0.13
ССК	0.99	0.99	0.99	n/a	0.00

3.1 Duty cycle plots

	RF 50	R DC			SENSE:IN	r .	AL10	NAUTO		12:0	4:26 PM Jun 26,
ker 3 2	2.98500 r	ns	PN0 IFGa	:Fast -+	Trig Atte	Free Run n: 40 dB		Avg Type:	Log-Pwr		TYPE WANA DET NINN
3/div	Ref Offset	8.1 dB 0 dBm								Mkr	3 2.985 24.58 di
		A 1 2					3	3			
Th Hit	dilitinit	dan hadi	ann hid			in dia b	In here is	Intrial	idahihi	itilteitt	a han ha
						1.1.1		10.00			
nál, h	s da a fin t lla	64 P.I	Rotan I h		1.1	in a d	1	Julii Lini	In June	1.64.64.00	14.00(.
		ín.					- 1				
-											
		1									
BW 8	12000000 MHz	GHZ		#VE	3W 50 I	MHz			SW	eep 5.000	ms (601
MODE TRO	SOL	×	anna 1	Y		FUNCTION	FUNCTIO	ON WIDTH		FUNCTION VALU	E
N 1	t		883.3 µs	22.9	6 dBm						
N 1	t		2.985 ms	24.5	8 dBm						

Duty cycle channel 1 nonHT



Duty cycle channel 11 nonHT



Duty cycle channel 6 HT20



Duty cycle channel 6 nonHT



Duty cycle channel 1 HT20



Duty cycle channel 11 HT20





Duty cycle channel 1 CCK



Duty cycle channel 11 CCK



Duty cycle channel 1 VHT20

Duty cycle channel 6 CCK







Duty cycle channel 6 VHT20

larker 3 6.388	333 ms PN IFG	D: Fast Trig: Free I ain:Low Atten: 40 d	Aug Ty Run iB	/pe: Log-Pwr	TRACE 1045 F	Marker 3 3.79167 n	P DC 1S PNO: F IFGain:
Ref C 0 dB/div Ref	offset 8.1 dB 38.10 dBm			MI	kr3 6.388 ms 19.03 dBm	Ref Offset 8	8.1 dB dBm
04 10.1 10		paper untra providente en provide de la companya d	gentin antiniana pilan-miny	s. Lifester, Briefe		Log 10 10 10 10 10 10 10 10 10 10	oriclms.the Bruss
es BW 8 MHz	0000 GH2	#VBW 50 MHz		Sweep 8.0	00 ms (601 pts)	Res BW 8 MHz	GHZ
N 1 t 1 N 1 t 2 N 1 t 3 N 1 t 4 5 5 5 6 5 5 5 7 8 5 5	× 1.337 ms 1.427 ma 6.388 ms	21.21 dBm 18.43 dBm 19.03 dBm	TION FUNCTION WOTH	FUNCTION V	ALUE	MER MODE TRC SEL 1 N 1 E 2 N 1 E 3 N 1 E 6 6 7	× 1.312 ms 1.393 ms 3.792 ms
9					*	9 10 11	

Duty cycle channel 11 VHT20



Duty cycle channel 3 HT40

4 2.4GHz test results

4.1 Occupied bandwidth 99% and 6db

Test Method

The ANSI C63.10-2013 Section 11.8.2 option 2 Conducted method was used to measure the occupied bandwidth and DTS bandwidth. The preliminary investigation was performed at different data rate to determine the highest power output for each mode. The system was powered on and port 1 connected to the Spectrum analyzer. A diag program called QRCT was used to set the AP in continuous Tx mode and also to set the channel, channel power and data rate. This test was conducted on 3 channels for each of the throughput modes. The analyzer was configured as follows.

Cable loss and duty cycle correction were entered as an offset

The measure function of the instrument was used to capture the 99% and 6db bandwidths

RBW= 100 kHz.

VBW= 300 kHz.

Span+~1.5xOBW

SWT= auto

Detector = peak

The occupied bandwidth function was selected the xdb BW set to -6db and max hold.

Test Conditions: Conducted Measurement (SA), Normal Temperature	Date : 6/26/2018
Antenna Type:	Stamped metal dipole
Duty cycle correction: see sect. 3	Data Rate: 1mbps,6mbps, MCS0
Ambient Temp.: 22° C	Relative Humidity: 39 %RH

4.2 Results and plots

Occupied Bandwidth MHz.						
Mode	Channel 1	Channel 6	Channel 11	Channel 3	BW type	
nonHT	16.33	16.33	16.33	n/a	99%	
nonHT	16.38	16.38	16.38	n/a	6db	
HT20	17.54	17.55	17.54	n/a	99%	
HT20	17.60	17.59	17.60	n/a	6db	
HT40				35.83	99%	
HT40				35.19	6db	
VHT20	17.54	17.55	17.55	n/a	99%	
VHT20	17.60	17.59	17.60	n/a	6db	
VHT40				35.82	99%	
VHT40				35.19	6db	
ССК	12.87	12.97	12.90	n/a	99%	
ССК	8.09	8.55	8.09	n/a	6db	

Agilent Spectrum Analyzer - Occupied BW					
μ RF 50 Ω DC	SE	ENSE:INT	ALIGNAUTO		04:46:38 PM Jun 26, 2018
Center Freq 2.412000000 GHz		Trig: Free Run	412000000 GHz AvaiHold:>10/10	Radio	Std: None
	#IFGain:Low	#Atten: 40 dB	J.	Radio	Device: BTS
				Mkr1	2.46146 GHz
10 dB/div Ref 20.00 dBm					dBm
Log					1
10.0	- D - A - A - A	0 A	A A A A A		
0.00			a protono natione protono protono protono protono protono	1	
-10.0				L	
-20.0				- Vilan	
-30.0				J.M.	ъ.
-40.0 hrannon					man who and have
-50.0					
-60.0					
-70.0					
Center 2.412 GHz			NY AVAINA DISTAN		Span 30 MHz
#Res BW 100 kHz		#VBW	300 kHz	\$	weep 2.933 ms
Occupied Bondwidth		Total Powe	ar 2/17 dBm		
Occupied Bandwidth		Total Town	24.7 GDm		
16.33	38 MHz				
Transmit Freq Error -2	28.966 kHz	OBW Powe	er 99.00 %		
x dB Bandwidth	16.38 MHz	x dB	-6.00 dB		
MSG			STATUS		

Bandwidth 99% and 6db channel 1 nonHT

Agilent Spectrum Analyzer - Occupied B	W				
μ RF 50 Ω DC		SENSE:INT	ALIGN AUTO	Deall	04:49:34 PM Jun 26, 2018
Center Freq 2.43/00000	GHZ	Trig: Free Run	Avg Hold:>10/10	Radio	o Sta: None
	#IFGain:Low	#Atten: 40 dB		Radi	o Device: BTS
				Mkr1	2.46146 GHz
10 dB/div Ref 20.00 dBn	n				dBm
Log					1
10.0	0 . B . B . O .				
0.00	and the construction of the second se	How we want we want we want the	and the and the particle and full		
-10.0				h	
-20.0				N.	
-30.0				"M	4
-40.0 watchangen					The show and the show
-50.0					
70.0					
-70.0					
Center 2.437 GHz			,		Span 30 MHz
#Res BW 100 kHz		#VBW 300 k	(Hz	\$	Sweep 2.933 ms
Occupied Bandwidt	h	Total Power	24.8 dBm		
10	2 226 MLI-				
10	5.550 IVITIZ				
Transmit Freq Error	-26.804 kHz	OBW Power	99.00 %		
x dB Bandwidth	16.38 MHz	x dB	-6.00 dB		
MSC			STATUS		
Nico			10 STATUS		

Bandwidth 99% and 6db channel 6 nonHT

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Bandwidth 99% and 6db channel 11 nonHT



Bandwidth 99% and 6db channel 1 HT20



Bandwidth 99% and 6db channel 6 HT20

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Bandwidth 99% and 6db channel 11 HT20

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Bandwidth 99% and 6db channel 3 HT40



Bandwidth 99% and 6db channel 1 VHT20



Bandwidth 99% and 6db channel 6 VHT20

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Agilent Spectrum Analyzer - Occupied B	W			
LXU RF 50Ω DC		SENSE:INT	ALIGNAUTO	02:33:46 PM Jun 26, 2018
Center Freq 2.46200000	GHz	Center Freq: 2.462000	0000 GHz	Radio Std: None
	#IFGain:Low	⊃ Trig: Free Run #Atten: 40 dB	Avg Hold:>10/10	Radio Device: BTS
				Mkr1 2.41698 GHz
10 dB/div Ref 20.00 dBn	n			dBm
Log 1				
10.0				
	mannon	mmmy minter	montomborton	~ <u>,</u> ,
		Ŷ		
-10.0				
-20.0		4		- bra
-30.0				
10.0 be the all arms (and				www.www.hore.hore.el
-40101				
-50.0				
-60.0				
-70.0				
Center 2.462 GHz				Span 30 MHz
#Res BW 100 kHz		#VBW 3001	kHz	Sweep 2.933 ms
Occupied Bandwidt	h	Total Power	24.8 dBm	
11	.549 IVIHz			
Transmit Freq Error	-34.433 kHz	OBW Power	99.00 %	
x dB Bandwidth	17.60 MHz	x dB	-6.00 dB	
MSG			STATUS	

Bandwidth 99% and 6db channel 11 VHT20



Bandwidth 99% and 6db channel 3 VHT40



Bandwidth 99% and 6db channel 1 CCK



Bandwidth 99% and 6db channel 6 CCK



Bandwidth 99% and 6db channel 11 CCK

4.3 Output Power

4.3.1 Limits

The maximum output power requirement is the maximum equivalent isotropic radiated power delivering at the transmitting antenna under specified conditions of measurements in the presence of modulation.

The maximum output power and harmonics shall not exceed CFR47 Part 15.247 (b):2016 and RSS 247: 2017 Sect. 5.4 (d).

The maximum transmitted power in the band 2400-2483.5 MHz: 1 W

4.3.2 Test Method

Conducted method was used to measure the channel power output. The preliminary investigation was performed at different data rate / chain to determine the highest power output for each mode. The worst findings were conducted on 3 channels in each operating range per CFR47 Part 15.247(b) and RSS 247 Sect. 5.4(d); 2400 MHz to 2483.5 MHz. The worst mode results indicated below.

Test Setup:



For CCK and HT20 Mode, the measurement method from ANSI C63.10-2013 Section 11.9.2.3.2 was used. Each chain was measured individually and applied the measure-and-sum approach per section 14.3.2.2 of ANSI C63.10-2013.

4.3.3 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

RF Output Power at the Antenna Port - Test Results - Non Beamforming

Test Conditions: Conducted Measurement, Normal Temperature

Antenna Type: Stamped Metal

Power Setting: 23.5 (CCK), 17 (HT20)

Max. Antenna Gain: Chain 0 = 2.7 dBi, Chain 1 = 1.8 dBi

Signal State: Modulated at 99.3% (CCK) and 98.4% (HT20) Duty Cycle.

Ambient Temp.: 22° C

Relative Humidity: 36%

802.11b	(CCK)
---------	-------

002.110 (CCK)						
Operating Channel (MHz)	Limit [dBm]	Total Power (RMS) [dBm]	Margin [dB]			
2412.00	30.00	25.6	4.4			
2437.00	30.00	25.9	4.1			
2462.00	30.00	25.8	4.2			
Note: 1.The highest output power was observed at 802.11b mode, 1.0 Mbps, 1 Data Streams. 2. The sum of Chains 0 and 1 is the total power.						
802.11n (HT20)						
Operating Channel (MHz)Limit [dBm]Total Power (RMS) [dBm]Margin [dB]						
2412.00	30.00	20.0	10.0			
2437.00	30.00	20.1	9.9			
2462.00	30.00	20.0	10.0			
Note: 1. The highest output power was observed at HT20 MCS0, 1 Data Streams. 2. The sum of Chains 0 and 1 is the total power.						

Test Conditions: Conducted Measurement, Normal Temperature						
Antenna Type: Stampled M	Antenna Type: Stampled MetalPower Setting: 13.5					
Antenna Gain: Chain 0 = 2.7 dBi, Chain 1 = 1.8 dBi						
Signal State: Modulated at	Signal State: Modulated at 96.8% Duty Cycle.					
Ambient Temp.: 22° C	Ambient Temp.: 22° CRelative Humidity: 36%					
802.11n (HT40)						
Operating Channel (MHz)	Limit [dBm] Total Power Margin [dBm] [dBm]					
2422.00	30.00	16.7	13.3			
2437.00	2437.00 30.00 16.7 13.3					
2452.00 30.00 16.6 13.4						
Note:1. The highest output power was observed at HT40 MCS0, 1 Data Streams.2. The sum of Chains 0 and 1 is the total power.						

Table 2: RF Output Power at the Antenna Port – Test Results – Non Beamforming Continued

Beamforming Mode:

The same power settings and modulations that are used for 802.11n mode are are used for Beamforming mode (802.11ac). In a conducted setup, there is no difference in output power from the antenna port since beamforming is a spatially dependent phenomena.

The only difference is the directional gain (in a radiated setup), thus for a 2x2 system the beamforming gain is 3 dB, which accounts for a total maximum directional gain of 5.3 dBi (for antenna gains of 2.7 and 1.8). This gain has no effect on the RF Output power limit of 30 dBm for Beamforming mode per 15.247 (c)(2)(ii). The margin showed by the same modulation family in non-beamforming mode (802.11n) is sufficient to prove compliance to the reduced output power limits for beamforming mode. Spotchecks were done to verify that 802.11 ac mode power setting consistency in relation to 802.11 n modes.

4.4 Power Spectral Density

4.4.1 Limit

According to the CFR47 Part 15.247 (e) and RSS 247 Sect.5.2 (b), the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.4.2 Test Method

The conducted method was used to measure the channel power output per ANSI C63.10-2013 Section 11.10.2. The measurement was performed with modulation per CFR47 Part 15.247 (e) and RSS 247 Sect.5.2 (b). A pre-evaluation was performed to find the worst case chains and modes. The worst findings were conducted on 3 channels in each operating frequency range of 2400 MHz to 2483.5 MHz. The worst sample result indicated below. Beamforming mode (802.11ac) was not measured since they have the same output powers and modulation characteristics as 802.11n mode (OFDM).

Test Setup:



Method PKPSD of "KDB 558074 – DTS Measurement Guidance v04" was used.

The worst case chain (Chain 1) was measured and a correction factor of $10*log(N_{ant}) dB$ applied per ANSI C63.10-2013 Section 14.3.2.3.

4.4.3 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Peak Power Sp	pectral Density – Test R	esults – Non Beamforming			
Test Conditio	ns: Conducted Measure	ment, Normal Temperature			
Antenna Type	e: Stamped Metal	Power S	etting: 23.5 (C	CK), 17 (HT20)	
Max. Antenna	a Gain: Chain $0 = 2.7$ d	Bi, Chain 1 = 1.8 dBi			
Signal State:	Modulated at 99.3% (Co	CK) and 98.4% (HT20) Duty C	ycle.		
Ambient Tem	р.: 22° С	Relative H	umidity:38%		
	Pe	eak Power Spectral Density			
		802.11b CCK			
Freq. (MHz)	Chain 1 [dBm]	Total PSDLimitMargin[dBm][dBm][dB]			
2412	1.0	4.0	8.0	4.0	
2437	1.9	4.9	8.0	3.1	
2462	1.2	4.2	8.0	3.8	
Note: 1. The	highest peak output pow	er was observed at 802.11b 1	Mbps per data s	stream.	
		802.11n HT20			
Freq.Chain 1Total PSDLimitMargin(MHz)[dBm][dBm][dB]					
2412	-8.5	-5.5	8.0	13.5	
2437	-8.6	-5.6	8.0	13.6	
2462 -8.7 -5.7 8.0 13.7					
Note: 1. The	highest peak output pow	er was observed at HT20 MCs	S0 per data stre	eam.	

Test Condi	Test Conditions: Conducted Measurement, Normal Temperature						
Antenna Ty	Antenna Type: Stamped MetalPower Setting: 13.5						
Antenna G	Antenna Gain: Chain 0 = 2.7 dBi, Chain 1 = 1.8 dBi						
Signal State: Modulated at 96.8% Duty Cycle.							
Ambient Temp.: 22° CRelative Humidity: 38%							
Peak Power Spectral Density							
802.11n HT40							
Freq. (MHz)	Freq.Chain 1Total PSDLimitMargin(MHz)[dBm][dBm][dB]						
2422	-13.5	-10.5	8.0	-18.5			
2437	-13.9	-10.9	8.0	-18.9			
2452	2452 -14.9 -11.9 8.0 -19.9						
Note: 1. The highest peak output power was observed at HT40 MCS0 per data stream.							

Table 3: Peak Power Spectral Density – Test Results – Non Beamforming Continued
4.4.4 Power spectral density plots

Note: Plots are corrected only for cable and attenuator losses



22:34:46 14.08.2018

Channel 1 Power Spectral Density CCK Mode



Channel 6 Power Spectral Density CCK Mode



Channel 11 Power Spectral Density CCK Mode

MultiView 88	Spectrum 2	Spect	rum 🖾	Spectrum 3	Spectru	ım 4 🛛 🖾			
Ref Level 30	.00 dBm Offse	t 10.60 dB • R	BW 3 kHz	de Curre	\		L		
Att 1 Frequency S	20 db SWI	334 ms 🔍 V	BWFIUKHZ MM	ode Sweep					●1Pk Max
								M1[1]	-8.67 dBm
								:	2.4094830 GHz
20 dBm									
10 dBm									
0 dBm									
0.000									
				M1 Y					
-10 dBm		Ahadarah	MANAAAA	MANNNN	NWWWW	MARAAN	MANANAN		
		10000.000				111111000	ANAAAAAA		
-20 dBm									
								k l	
-30 dBm	*								
	N ^Y							11/2	
-40 dBm	N'							ML	
io abiii	N							1 ha	
	N'							MA.	
-50 dBm	٨M							1 Win	
MARAMAN	ſ							· · · ·	MMAAAAA
4-60 dBm									· • • • • • • • • • • • • • • • • • • •
CE 2 412 CH2			1001 pt		د ا	0 MHz /			 Snan 30 0 MHz
	Υ		1001 pt	-3			Measuring		14.08.2018
·							j measuring		22:42:14
2:42:15 14.	08.2018								

Channel 1 Power Spectral Density HT20 Mode

MultiView 88	Spectrum 2	Spectr	um 🖾	Spectrum 3	Spectru	ım 4 🛛 🖾			□ □
Ref Level 30	.00 dBm Offse	t 10.60 dB • RE	SW 3 kHz	de Curren					
1 Frequency S	weep	554 ms 🔍 VE	NAN TOKUZ MU	de Sweep					●1Pk Max
								M1[1]	-8.58 dBm
								:	4307060 GHz
20 dBm									
10 dBm									
0 dBm									
		M1							
-10 dBm		. houkan h	ant anno	najaanaa	AAAAAA AA	haddadada	6. allinas		
		VAAAAAAAAA	NAMAAAAA.	MAMMAAAMA	10000000000	LANAAAAAA	477 v V v v V v V V		
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-40 dBm	L N							VW.	
								- [™] Ν.	
- 50 dBm	Well							Wy	
-50 UBm	WNY							My My	
MANAMAN	1								MAAAAAA
-do dBm <u>Y V</u>									
CE 0 407 CU-			1001 1					ļ,	
UF 2.437 GHZ	T		1001 pt	5	3	JU MHZ/			14.08.2018
							Measuring		22:41:11
2:41:11 14.	08.2018								

Channel 6 Power Spectral Density HT20 Mode

MultiView 😁	Spectrum 2	Spect	rum 🖾	Spectrum 3	Spectru	ım 4 🛛 🖾			
Ref Level 30	.00 dBm Offse	t 10.60 dB • F	BW 3 kHz	de Curre					
Att 1 Frequency S	20 db SWI	334 ms 🛡 🛛	BW IUKHZ MC	de Sweep					●1Pk Max
								M1[1]	-8.46 dBm
								:	2.4572950 GHz
20 dBm									
10 dBm									
0 dBm									
			M1						
-10 dBm			half lakan	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	ARADA MA	undo o baita	M. C. A. A.		
		WWWW	ANAAAAAAA	AAAAAAAAA	10000000000	AAAAAAAAA	anahahan		
-20 dBm					/				
					ř				
-30 dBm	1							η	
30 dbiii	N _A							N.	
40.40.0	J ^M							M.	
-40 aBm	ANV							M.	
	W							ΥN _λ	
-50 dBm	K A							Ma	
1 North	14							v v	MAAAAAAA
V-eentable //////									
CF 2.462 GHz			1001 pt	is	3	.0 MHz/	I	1	j Span 30.0 MHz
							Measuring		14.08.2018 22:39:47
22-39-48 14	08 2018								

Channel 11 Power Spectral Density HT20 Mode

MultiView 🕀	Spectrum 2	Spectr	um 🕱	Spectrum 3	Spectru	ım 4 🛛 🕱			
Ref Level 30	.00 dBm Offse	t 10.60 dB = RE	3W 3 kHz W 10 kHz Mo	de Sween	•				
1 Frequency S	ween	007 113 - 42		ac oncep					• 1 Pk Max
I Trequency o	Тобр							M1[1]	-13.45 dBm
								, militi	13,45 dbm
								4	.4209730 GHz
20 dBm									
10 dBm									
0 dBm									
-10 dBm					MI				
			al have been	march had all	Aurobard	day dout in			
		ANAMAMMANA ANA ANA ANA ANA ANA ANA ANA A	NAMANANANYAN	MANANAN PANA	i halamalamahala	WWWWWWWWW	MAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA		
-20 dBm		And dates and the second second					+ + + + + + + + + + + + + + + +		
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-50 dBm-	p							ų.	
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-60 dBm	WARAN V							Ma alas	INAMARAN
MMD-AAAAAA AAA								- way	a hana a a a a a a a a a a a a a a a a a
CF 2.422 GHz			1001 pt	s	6	.0 MHz/	•		pan 60.0 MHz
							Measuring		14.08.2018
L) · · · · · · · · · · · · · · · · · · ·		22:48:14

22:48:15 14.08.2018



MultiView 88	Spectrum 2	Spectr	um 🖾	Spectrum 3	🛛 🖾 Spectrı	ım 4 🛛 🖾			\bigtriangledown
Ref Level 30	.00 dBm Offse	t 10.60 dB • RE	SW 3 kHz	de Cuisse					
Att 1 Frequency S	Weep	007 ms - VE		de sweep					●1Pk Max
								M1[1]	-13.90 dBm
									.4419750 GHz
20 dBm									
10 dBm									
0 dBm									
-10 dBm					M1				
		an I	. Talalasanada da	ALARRA MORALA	Marabassisish	Abantana da da anti.	e ter serter		
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-50 UBm	J ^{rr}							N	
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-60 dBm	Take a how							<u> </u>	. (.)
WWWWWWWWW	INNAM .							MWWW I	WMMMMMM
CF 2.437 GHz			1001 pt	s	6	.0 MHz/		9	pan 60.0 MHz
							Measuring		14.08.2018 22:49:44
0.40.45 14	08 0018								

Channel 6 Power Spectral Density HT40+ Mode

MultiView 88	Spectrum 2	Spectr	um 🖾	Spectrum 3	Spectru	um 4 🛛 🖾			
Ref Level 30	.00 dBm Offse	et 10.60 dB • RI	SW 3 kHz	de Curre					
I Frequency S	weep	667 ms 🔍 VE		de Sweep					●1Pk Max
								M1[1]	-14.89 dBm
									2.4531990 GHz
20 dBm									
10 dBm									
0 dBm									
o dbiii									
-10 dBm					M1				
		1 11 1 1 1 1 1	Acres Beerly Hand	Annensehternetahtet	AND RANGES AND	and the balance at the	date water		
-20 dBm		How had a second a second s	Andrews Addrews and	a Milana ana Ana a A	LANDAR A AND MARKAN	<u>LI AN AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA</u>	A MANAMANA ANA ANA ANA ANA ANA ANA ANA A	nh	
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CE 2 452 GHz			1001 pt	 s	6				 Spap 60.0 MHz
GI 21-152 GI 12			1001 pt	3	0	10 14112/	Measuring		14.08.2018
							, measuring		22:53:13
22:53:14 14.	08.2018								

Channel 9 Power Spectral Density HT40+ Mode

4.5 Non-Restricted band emissions

Test Method

The ANSI C63.10-2013 Section 11.11.1 Conducted method was used to measure the Emissions in the nonrestricted band. The preliminary investigation was performed at different data rate to determine the highest power output for each mode. The system was powered on and port 1 connected to the Spectrum analyzer. A diag program called QRCT was used to set the AP in continuous Tx mode and also to set the channel, channel power and data rate. This test was conducted on 3 channels for each of the throughput modes. The analyzer was configured as follows.

Cable loss and duty cycle correction were entered as an offset

RBW = 100 kHz.

VBW= 300kHz.

Span= 2390-2500 MHz.

SWT= auto

Detector = peak

Test Conditions: Conducted Measurement (SA), Normal Temperature	Date: 6/26/2018
Antenna Type:	Stamped metal dipole
Duty cycle correction: see sect. 3	Data Rate: 1mbps,6mbps, MCS0
Ambient Temp.: 23° C	Relative Humidity: 38 %RH

non	nonrestricted band worst case emissions dbm							
Mode	Channel 1	Channel 11	Channel 3					
nonHT	-32.98dbm	-47.61 dbm						
HT20	-32.21 dbm	-45.15 dbm						
HT40	n/a	n/a	-42.21 dbm					
VHT20	-30.95 dbm	-46.74 dbm						
VHT40	n/a	n/a	-41.05 dbm					
ССК	-33.76 dbm	-53.60 dbm						

4.5.1 Emissions in the non-restricted band

Agilent Spectrum Analyzer - Sw	ept SA					
LXI RF 50 Ω	DC	SENSE:IN	IT .	ALIGNAUTO	02:32:25	PM Jun 27, 2018
Marker 2 2.3975029	37867 GHz PNO IFGa	:Wide 🖵 Trig in:Low Atte	: Free Run en: 28 dB	Avg Type: Log Avg Hold:>100/	-Pwr 1- 100	ACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N
Ref Offset 7. 10 dB/div Ref 24.10	1 dB dBm			201	Mkr2 2.397 -33.	503 GHz 765 dBm
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-35.9	many					
-55.9						
Start 2.39000 GHz					Stop 2.	42200 GHz
#Res BW 100 kHz		#VBW 300) kHz		Sweep 3.200 ms	(8000 pts)
MKR MODE TRC SCL	× 2.411 491 GHz 2.397 503 GHz	Y 14.422 dBm -33 765 dBm	FUNCTION F	UNCTION WIDTH	FUNCTION VALUE	^
	2.007 000 0112					
6 						
9 10 10 11						~
<			¹ ш			>
MSG				STATUS		

Non-restricted band emissions 2390MHz CCK



Non-restricted band emissions 2390MHz nonHT



Non-restricted band emissions 2390MHz HT20



Non-restricted band emissions 2390MHz HT40



Non-restricted band emissions 2390MHz VHT20



Non restricted band emissions 2390MHz VHT40

LUV Rheinland 1279 Quarry Lane, Ste. A, Pleasanton, CA 95466

Tel: (925) 249-9123, Fax: (925) 249-9124



Non-restricted band emissions 2483.5MHz CCK

LTUV Rheinland 1279 Quarry Lane, Ste. A, Pleasanton, CA 95466

Tel: (925) 249-9123, Fax: (925) 249-9124



Non-restricted band emissions 2483.5MHz nonHT

LUV Rheinland 1279 Quarry Lane, Ste. A, Pleasanton, CA 95466

Tel: (925) 249-9123, Fax: (925) 249-9124



Non-restricted band emissions 2483.5MHz HT20



Non-restricted band emissions 2483.5MHz VHT20

4.6 Restricted Bands Radiated emissions in the DTS band

Test Method

The ANSI C63.10-2013 Section 11.12.1 were followed as applicable. The preliminary investigation was performed at different data rate to determine the highest power output for each mode. Adiag program called QRCT was used to set the AP in continuous Tx mode and also to set the channel, channel power and data rate. This test was conducted on 3 channels for each of the throughput modes. The analyzer was configured as follows.

RBW= 120 kHz< 1 GHz.< 1 MHz VBW= 3 x RBW Span= Per the band under test SWT= auto

Detector = Per the measurement being made

Test Conditions: Conducted Measurement (SA), Normal Temperature	Date: 5/2-5/12 2018
Antenna Type:	Stamped metal dipole
Duty cycle correction: see sect.	Data Rate:1 mbps, 6mbps, MCS0
Ambient Temp.: 23° C	Relative Humidity: 38 %RH

9KHz-30MHz

	1/1
9KHz-30MHz_Ch_1_VHT20_2x2_(Tx-	
17dBm)_CDD	
Einal Pecult	

-mai_Result										
Frequency (MHz)	Quasi Peak (dBµV/ m)	Avera ge (dBµV/ m)	Limit (dBµV/ m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3 : :			-	Ŧ	-	3 -	-	10 A	-	1

(continuation of the "Final_Result" table from column 16 ...)





5/10/2018

7:20:13 PM



5/10/2018

8:01:24 PM



5/10/2018

7:35:09 PM



5/10/2018

7:47:20 PM

9KHz-30MHz_Ch_3_HT40_2x2_(Tx-13.5dBm)_CDD



5/11/2018

4:39:54 PM

9KHz-30MHz_Ch_6_CCK_2x2_(Tx-23.5dBm)_CDD



5/11/2018

4:13:07 PM



5/11/2018

4:26:25 PM

9KHz-30MHz_Ch_1_CCK_2x2_(Tx-23.5dBm)_CDD



5/14/2018

5:47:18 PM



5/14/2018

6:13:55 PM

9KHz-30MHz_Ch_11_CCK_2x2_(Tx-23.5dBm)_CDD



5/14/2018

5:58:53 PM

9KHz-30MHz_Ch_11_HT20_2x2_(Tx-17dBm)_CDD



5/14/2018

6:31:46 PM

30MHz-1GHz

quency MHz)	Quasi Peak (dBµV/ m)	Avera ge (dBµV/ m)	Limit (dBµV/ m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
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5										
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30MHz-1GHz_Ch_6_CCK_2x2_(Tx-23.5dBm)_CDD



5/3/2018

11:40:46 PM



5/4/2018

3:51:07 PM

30MHz-1GHz_Ch_3_HT40_2x2_(Tx-13.5dBm)_CDD



5/4/2018

4:24:25 PM
1/1

30MHz-1GHz_Ch_6_CCK_2x2_(Tx-23.5dBm)_CDD



5/4/2018

3:26:51 PM



5/4/2018

4:03:13 PM



30MHz-1GHz_Ch_11_CCK_2x2_(Tx-23.5dBm)_CDD



5/4/2018

3:38:39 PM