

FCC CFR47 PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

802.11 a/b/g/n WLAN, BT 2.1 and RF4CE SATELLITE SETTOP BOX

MODEL NUMBER: ID:075

FCC ID: DKNCB1138

REPORT NUMBER: 13U16072-6 Revision A

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Prepared for ECHOSTAR 90 INVERNESS CIRCLE EAST ENGLEWOOD, CO 80112, U.S.A.

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Rev.	Issue Date	Revisions	Revised By
	11/20/13	Initial Issue	F. de Anda
Α	11/20/13	Updated Duty cycle information	F. de Anda

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1. ATTESTATION OF TEST RESULTS

CFR 47 Part 15 Subpart C

S	TANDARD	TEST RESULTS
	APPLICABLE STANDARI	DS
DATE TESTED:	SEPTEMBER 23 - NOVEMB	BER 15, 2013
SERIAL NUMBER:	200101R01292Y00107H (C (Radiated)	onducted), 200101R01292Y0110H
MODEL:	ID:075	
EUT DESCRIPTION:	802.11 a/b/g/n WLAN, BT 2.4	1 and RF4CE Satellite SetTop Box
COMPANY NAME:	ECHOSTAR CORPORATIO 90 INVERNESS CIRCLE EA ENGLEWOOD, CO 80112,	DN AST U.S.A

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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Tested By:

Dony War

Pass

TONY WANG WiSE Lab Technician UL Verification Services Inc.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections

47173 Benicia Street	47266 Benicia Street
Chamber A	Chamber D
Chamber B	🖂 Chamber E
Chamber C	🛛 Chamber F

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <u>http://www.ul.com</u>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) 36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	±3.52 dB
Radiated Disturbance, 30 to 1000 MHz	±4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11 a/b/g/n WLAN, BT 2.1 and RF4CE Satellite SetTop Box operates in the 2400-2483.5MHz, 5150-5250MHz and 5725-5825 bands.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

2402 - 2480	Basic GFSK	0.70	1.18
2402 - 2480	Enhanced 8PSK	3.55	2.26

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PiFA antenna, with a maximum gain as below table.

Frequency (MHz)	Antenna Gain (dBi)
2402 -2480	0.0

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was FCC Test Script version: SW0906 v.1.

The EUT driver software installed in the support equipment during testing was Broadcom BlueTool, rev. 1.6.4.

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT supports only one orientation; therefore, X orientation (Lay down) was investigated and is considered the worst case.

Worst-case data rates from the base line scans of output powers were: GFSK: 1Mbps 8PSK: 3Mbps

The worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was in the blue tooth mode and channel with the highest output power.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List						
Description Manufacturer Model Serial Number FCC ID						
Laptop	HP	8570W	NA	DoC		
AC Adapter	HP	HSTNN-DA25	WBXYE0AAR3A168	DoC		

I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	COAX	0.1m	To Spectrum Analyzer
2	AC	1	AC	Un-Shielded	1.5m	NA

I/O CABLES (RADIATED TEST)

I/O Cable List						
Cable	Port	# of identical	Connector	Cable Type	Cable	Remarks
No		ports	Туре		Length (m)	
1	AC	1	AC	Un-Shielded	1.5m	NA

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SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS



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6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List							
Description	Manufacturer	Model	Asset	Cal Due			
Horn Antenna 1-18GHz	ETS Lindgren	3117	F00132	02/19/14			
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	05/21/14			
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB3	F00027	03/07/14			
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	01/14/14			
Peak / Average Power Sensor	Agilent / HP	E9323A	F00026	04/03/14			
P-Series single channel Power Meter	Agilent / HP	N1911A	F00153	04/05/14			
Spectrum Analyzer, 44GHz	Agilent	N9030A	F00129	02/22/14			
PreAmplifier, 1-26.5GHz	Agilent	8449B	F00167	03/23/14			
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	04/23/14			
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/09/14			

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7. ANTENNA PORT TEST RESULTS

7.1. BASIC DATA RATE GFSK MODULATION

7.1.1. ON TIME, DUTY CYCLE

<u>LIMITS</u>

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

RESULTS

Mode	ON Time	Period	Duty Cycle	Duty	Duty Cycle	1/T
	В		х	Cycle	Correction Factor	Minimum VBW
	(msec)	(msec)	(linear)	(%)	(dB)	(kHz)
2.4 GHz						
	1.00	1.00	1.000	100.0%	0.00	0.010



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7.1.2. 20 dB AND 99% BANDWIDTH

<u>LIMIT</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to \geq 1% of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

<u>GFSK</u>

Channel	Frequency	20 dB Bandwidth	99% Bandwidth	
	(MHz)	(KHz)	(KHz)	
Low	2402	954.90	893.22	
Middle	2441	955.00	866.35	
High	2480	956.20	870.76	

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20 dB AND 99% BANDWIDTH

GFSK 20 dB BANDWIDTH





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GFSK 99% BANDWIDTH



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7.1.3. HOPPING FREQUENCY SEPARATION

<u>LIMIT</u>

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

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HOPPING FREQUENCY SEPARATION

GFSK



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7.1.4. NUMBER OF HOPPING CHANNELS

<u>LIMIT</u>

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 nonoverlapping channels.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

<u>RESULTS</u>

Normal Mode: 79 Channels observed.

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<u>GFSK</u>

NUMBER OF HOPPING CHANNELS



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7.1.5. AVERAGE TIME OF OCCUPANCY

<u>LIMIT</u>

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

<u>RESULTS</u>

DH Packet	Pulse	Number of	Average Time	Limit	Margin
	Width (msec)	Pulses in 3.16 seconds	of Occupancy (sec)	(sec)	(sec)
GFSK Mode					
DH1	0.390	31	0.121	0.4	-0.279
DH3	1.658	15	0.249	0.4	-0.151
DH5	2.895	13	0.376	0.4	-0.024

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PULSE WIDTH - DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH1



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PULSE WIDTH – DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH3



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PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH5



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7.1.6. OUTPUT POWER

<u>LIMIT</u>

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

<u>RESULTS</u>

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	0.00	30	-30.00
Middle	2441	0.68	30	-29.32
High	2480	0.70	30	-29.30

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OUTPUT POWER





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7.1.7. AVERAGE POWER

<u>LIMIT</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Average Power	
	(MHz)	(dBm)	
Low	2402	-0.23	
Middle	2441	0.39	
High	2480	0.41	

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7.1.8. CONDUCTED SPURIOUS EMISSIONS

<u>LIMITS</u>

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

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SPURIOUS EMISSIONS, LOW CHANNEL





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SPURIOUS EMISSIONS, MID CHANNEL





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SPURIOUS EMISSIONS, HIGH CHANNEL





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SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





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7.2. ENHANCED DATA RATE QPSK MODULATION

7.2.1. ON TIME, DUTY CYCLE

<u>LIMITS</u>

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

RESULTS

Mode	ON Time	Period	Duty Cycle	Duty	Duty Cycle	1/T
	В		x	Cycle	Correction Factor	Minimum VBW
	(msec)	(msec)	(linear)	(%)	(dB)	(kHz)
2.4 GHz						
	1.00	1.00	1.000	100.0%	0.00	0.010



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7.2.1. OUTPUT POWER

<u>LIMIT</u>

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	2.47	20.97	-18.50
Middle	2441	3.15	20.97	-17.82
High	2480	3.11	20.97	-17.86

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OUTPUT POWER





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7.2.2. AVERAGE POWER

<u>LIMIT</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	0.10
Middle	2441	0.70
High	2480	0.72

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7.3. ENHANCED DATA RATE 8PSK MODULATION

7.3.1. ON TIME, DUTY CYCLE

<u>LIMITS</u>

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

RESULTS

Mode	ON Time	ON Time Period Duty Cycle Duty		Duty Cycle	1/T		
	В		х	Cycle	Correction Factor	Minimum VBW	
	(msec)	(msec)	(linear)	(%)	(dB)	(kHz)	
2.4 GHz							
	1.00	1.00	1.000	100.0%	0.00	0.010	



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7.3.2. 20 dB AND 99% BANDWIDTH

<u>LIMIT</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to \geq 1% of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

Channel	Frequency	20 dB Bandwidth	99% Bandwidth		
	(MHz)	(MHz)	(MHz)		
Low	2402	1.3480	1.2284		
Middle	2441	1.3480	1.2079		
High	2480	1.3490	1.2307		

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8PSK 20 dB BANDWIDTH





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8PSK 99% BANDWIDTH



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7.3.3. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION

RL.	1 HA 1410 CC	726555W	SERVICE AND	May Type	RMS	TACE 1 2 1 1	Frequency
0 dBłdiv	Ref Offset 10.9 dB Ref 10.00 dBm	PMO: Wide Car If Gain:Low	* Trig: Free Run #Atten: 20 dB	Avg[Hold>	100/100 ΔN	Akr1 1.000 MH: -0.445 dE	Auto Tune
		and the second	and the second	Na-march	162	And the second second	Center Freq 2.441000000 GHz
2.0							Start Freq 2.438500000 GHz
x10 412							Stop Freq 2.443500000 GHz
92-3 10 6							CF Step 500.000 kHz Auto Man
nip							Freq Offset 0 Hz
410							
Center 2	.441000 GHz	#UDW	200 111-		Davage	Span 5.000 MH	z

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7.3.4. NUMBER OF HOPPING CHANNELS

<u>LIMIT</u>

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 79 Channels observed.

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NUMBER OF HOPPING CHANNELS





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7.3.5. AVERAGE TIME OF OCCUPANCY

<u>LIMIT</u>

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

<u>RESULTS</u>

8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.392	32	0.125	0.4	-0.275
DH3	1.650	17	0.281	0.4	-0.120
DH5	2.908	9	0.262	0.4	-0.138

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PULSE WIDTH - DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH1



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PULSE WIDTH – DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH3



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PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH5



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7.3.6. OUTPUT POWER

<u>LIMIT</u>

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	2.935	20.97	-18.03
Middle	2441	3.549	20.97	-17.42
High	2480	3.519	20.97	-17.45

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OUTPUT POWER





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7.3.7. AVERAGE POWER

<u>LIMIT</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	0.10
Middle	2441	0.72
High	2480	0.74

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7.3.8. CONDUCTED SPURIOUS EMISSIONS

<u>LIMITS</u>

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

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SPURIOUS EMISSIONS, LOW CHANNEL





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SPURIOUS EMISSIONS, MID CHANNEL





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SPURIOUS EMISSIONS, HIGH CHANNEL





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SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





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8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

<u>LIMITS</u>

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)





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RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)





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RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





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RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





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HARMONICS AND SPURIOUS EMISSIONS





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REPORT NO: 13U16072-6A DATE: NOVEMBER 21, 2013 EUT: 802.11 a/b/g/n WLAN, BT 2.1 and RF4CE SATELLITE SETTOP BOX FCC ID: DKNCB1138

Radiated Emissions

Marker	Frequency	Meter	Det	AF T346 (dB/m)	Amp/Cbl/ 10dB Pad	Corrected	Avg Limit (dBuV/m)	Margin	Peak Limit (dBuV/m)	Margin	Azimuth	Height	Polarity
	(GHz)	Reading				Reading		(dB)		(dB)	(Degs)	(cm)	
		(dBuV)				(dBuV/m)							
1	* 1.329	53.93	РК	29.1	-26.9	56.13	-	-	74	-17.87	0-360	100	V
2	* 1.327	50.42	Avg	29.1	-26.9	52.62	53.97	-1.35	-	-	0-360	100	V
3	1.859	45.3	РК	31.2	-25.8	50.7	-	-	74	-23.3	0-360	199	V
4	1.859	40.65	Avg	31.2	-25.8	46.05	53.97	-7.92	-	-	0-360	199	V

Avg - Video bandwidth < Resolution bandwidth

Marker	Frequency	Meter	Det	AF T346 (dB/m)	Amp/Cbl/ 3GHz HPF	Corrected	Avg Limit (dBuV/m)	Margin	Peak Limit (dBuV/m)	Margin	Azimuth	Height	Polarity
	(GHz)	Reading				Reading		(dB)		(dB)	(Degs)	(cm)	
		(dBuV)				(dBuV/m)							
5	* 4.805	47.36	РК	34.4	-30.9	50.86	-	-	74	-23.14	0-360	199	Н
7	* 4.805	48.73	РК	34.4	-30.9	52.23	-	-	74	-21.77	0-360	101	V
6	* 7.501	44.06	РК	36.1	-28.6	51.56	-	-	74	-22.44	0-360	199	Н
8	* 7.501	45.03	PK	36.1	-28.6	52.53	-	-	74	-21.47	0-360	199	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Avg - Video bandwidth < Resolution bandwidth

PK - Peak detector

Frequency	Meter	Det	AF T346	Amp/Cbl/1	Corrected	Avg Limit	Margin	Peak Limit	Margin	Azimuth	Height	Polarity
			(dB/m)	0dB Pad		(dBuV/m)		(dBuV/m)				
(GHz)	Reading				Reading		(dB)		(dB)	(Degs)	(cm)	
	(dBuV)				(dBuV/m)							
* 1.329	48.17	MAv1	29.1	-26.9	50.37	53.97	-3.6	-	-	284	101	V
												-

MAv1 - KDB558074 Option 1 Maximum RMS Average

FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan.TST 30915 24 Sep 2013 Rev 9.5 21 Oct 2013





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Radiated Emissions

Marker	Frequency	Meter	Det	AF T346 (dB/m)	Amp/Cbl/ 10dB Pad	Corrected	Avg Limit (dBuV/m)	Margin	Peak Limit (dBuV/m)	Margin	Azimuth	Height	Polarity
	(GHz)	Reading				Reading		(dB)		(dB)	(Degs)	(cm)	
		(dBuV)				(dBuV/m)							
1	* 1.329	55.05	РК	29.1	-26.9	57.25	-	-	74	-16.75	0-360	101	V
2	* 1.333	51.5	Avg	29.1	-26.9	53.7	53.97	-0.13	-	-	0-360	100	V

Avg - Video bandwidth < Resolution bandwidth

Marker	Frequency	Meter	Det	AF T346 (dB/m)	Amp/Cbl/ 3GHz HPF	Corrected	Avg Limit (dBuV/m)	Margin	Peak Limit (dBuV/m)	Margin	Azimuth	Height	Polarity
	(GHz)	Reading				Reading		(dB)		(dB)	(Degs)	(cm)	
		(dBuV)				(dBuV/m)							
4	* 4.882	49.77	РК	34.4	-31	53.17	-	-	74	-20.83	0-360	101	V
3	* 4.883	46.34	РК	34.4	-31	49.74	-	-	74	-24.26	0-360	101	Н
5	* 7.501	43.32	PK	36.1	-28.6	50.82	-	-	74	-23.18	0-360	101	Н
6	* 7.501	45.35	РК	36.1	-28.6	52.85	-	-	74	-21.15	0-360	199	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Avg - Video bandwidth < Resolution bandwidth

PK - Peak detector

Frequency	Meter	Det	AF T346 (dB/m)	Amp/Cbl/1 OdB Pad	Corrected	Avg Limit (dBuV/m)	Margin	Peak Limit (dBuV/m)	Margin	Azimuth	Height	Polarity
(GHz)	Reading				Reading		(dB)		(dB)	(Degs)	(cm)	
	(dBuV)				(dBuV/m)							
* 1.331	47.28	MAv1	29.1	-26.9	49.48	53.97	-4.49	-	-	254	105	V

MAv1 - KDB558074 Option 1 Maximum RMS Average

FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan.TST 30915 24 Sep 2013 Rev 9.5 21 Oct 2013





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DATE: NOVEMBER 21, 2013 FCC ID: DKNCB1138
Marker	Frequency	Meter	Det	AF T346 (dB/m)	Amp/Cbl/	Corrected	Avg Limit	Margin	Peak Limit	Margin	Azimuth	Height	Polarity
	(GHz)	Reading		(00/11)	1000 F 80	Reading	(0507/11)	(dB)	(ubuv/iii)	(dB)	(Degs)	(cm)	
		(dBuV)				(dBuV/m)							
1	* 1.33	54.26	РК	29.1	-26.9	56.46	-	-	74	-17.54	0-360	100	V
3	* 1.598	46.91	РК	29.5	-26.5	49.91	-	-	74	-24.09	0-360	100	V
2	* 1.328	50.15	Avg	29.1	-26.9	52.35	53.97	-1.62	-	-	0-360	101	V

Avg - Video bandwidth < Resolution bandwidth

Marker	Frequency	Meter	Det	AF T346 (dB/m)	Amp/Cbl/ 3GHz HPF	Corrected	Avg Limit (dBuV/m)	Margin	Peak Limit (dBuV/m)	Margin	Azimuth	Height	Polarity
	(GHz)	Reading				Reading		(dB)		(dB)	(Degs)	(cm)	
		(dBuV)				(dBuV/m)							
5	* 4.96	45.66	РК	34.4	-30.8	49.26	-	-	74	-24.74	0-360	199	V
4	* 7.501	44.46	РК	36.1	-28.6	51.96	-	-	74	-22.04	0-360	100	Н
6	* 7.501	45.24	РК	36.1	-28.6	52.74	-	-	74	-21.26	0-360	199	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Avg - Video bandwidth < Resolution bandwidth

PK - Peak detector

Frequency	Meter	Det	AF T346 (dB/m)	Amp/Cbl/1 OdB Pad	Corrected	Avg Limit (dBuV/m)	Margin	Peak Limit (dBuV/m)	Margin	Azimuth	Height	Polarity
(GHz)	Reading				Reading		(dB)		(dB)	(Degs)	(cm)	
	(dBuV)				(dBuV/m)							
* 1.329	46.44	MAv1	29.1	-26.9	48.64	53.97	-5.33	-	-	289	104	V

MAv1 - KDB558074 Option 1 Maximum RMS Average

FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan.TST 30915 24 Sep 2013 Rev 9.5 21 Oct 2013

8.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ 00.592.49 AM Sep 23, 2013 TRACE Frequency Myg Type: RMS Trig Free Run Atten: 6 dB DET P P S PNO: Fast 😱 Auto Tune Mkr1 2.354 48 GHz Ref Offset 11.4 dB Ref 100.00 dBuV 53.30 dBµV Center Freq 2.35000000 GHz Start Freq 2.310000000 GHz Stop Freq ٥ 2.390000000 GH CF Step 8.000000 MHz Mar Freq Offset 0 Hz Stop 2.39000 GHz Sweep 1.00 ms (1001 pts) Start 2.31000 GHz #VBW 3.0 MHz Res BW 1.0 MHz



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RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)





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RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





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RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





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HARMONICS AND SPURIOUS EMISSIONS





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Marker	Frequency	Meter	Det	AF T344 (db/m)	Amp/Cbl/ Pad	Corrected	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth	Height	Polarity
	(GHz)	Reading				Reading					(Degs)	(cm)	
		(dBuV)				(dBuV/m)							
1*	2.355	42.44	РК	32.4	-21.2	53.64	-	-	74	-20.36	0-360	100	Н
2*	2.789	40.85	РК	32.9	-20.6	53.15	-	-	74	-20.85	0-360	200	V
3	3.185	41.63	РК	33.2	-28.9	45.93	-	-	-	-	0-360	201	V
4	3.203	41.81	РК	33.3	-28.9	46.21	-	-	-	-	0-360	100	Н
5*	4.805	46.52	РК	34.4	-27.5	53.42	-	-	74	-20.58	0-360	201	V
6*	4.805	43.98	РК	34.4	-27.5	50.88	-	-	74	-23.12	0-360	201	Н

PK - Peak detector

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Frequency	Meter	Det	AF T344	Amp/Cbl/	Corrected	Avg Limit	Margin	Peak Limit	Margin	Azimuth	Height	Polarity
(GHz)	Reading		(00/11)	rau	Reading	(ubuv/iii)	(ub)	(ubuv/iii)	(ub)	(Degs)	(cm)	
	(dBuV)				(dBuV/m)							
2.359	29.31	MAv1	32.4	-21.2	40.51	53.97	-13.46	-	-	32	152	Н
2.785	29.24	MAv1	32.9	-20.6	41.54	53.97	-12.43	-	-	152	112	V
4.804	38.63	MAv1	34.4	-27.6	45.43	53.97	-8.54	-	-	10	391	V
4.804	39.4	MAv1	34.4	-27.6	46.2	53.97	-7.77	-	-	311	278	Н

MAv1 - KDB558074 v02 10.2.3.2/8.2.1 Option 1 Maximum RMS Average

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DATE: NOVEMBER 21, 2013 DX FCC ID: DKNCB1138





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Marker	Frequency	Meter	Det	AF T344 (db/m)	Amp/Cbl/ Pad	Corrected	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth	Height	Polarity
	(GHz)	Reading				Reading					(Degs)	(cm)	
		(dBuV)				(dBuV/m)							
1*	2.39	41.32	РК	32.4	-21.1	52.62	-	-	74	-21.38	0-360	201	V
2	2.983	40.46	РК	33.1	-20.3	53.26	-	-	-	-	0-360	100	Н
3	3.185	40.95	РК	33.2	-28.9	45.25	-	-	-	-	0-360	100	V
4	3.255	42.07	РК	33.3	-29.3	46.07	-	-	-	-	0-360	201	V
5*	4.882	46.38	РК	34.3	-27.3	53.38	-	-	74	-20.62	0-360	201	V
6*	4.883	46.08	РК	34.3	-27.3	53.08	-	-	74	-20.92	0-360	201	Н

PK - Peak detector

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Frequency	Meter	Det	AF T344	Amp/Cbl/	Corrected	Avg Limit	Margin	Peak Limit	Margin	Azimuth	Height	Polarity
			(db/m)	Pad		(dBuV/m)	(dB)	(dBuV/m)	(dB)			
(GHz)	Reading				Reading					(Degs)	(cm)	
	(dBuV)				(dBuV/m)							
2.388	30.68	MAv1	32.4	-21.1	41.98	53.97	-11.99	-	-	93	179	V
2.979	29.26	MAv1	33.1	-20.4	41.96	53.97	-12.01	-	-	311	160	Н
4.882	41.43	MAv1	34.3	-27.3	48.43	53.97	-5.54	-	-	327	180	V
4.882	38.62	MAv1	34.3	-27.3	45.62	53.97	-8.35	-	-	333	113	Н

MAv1 - KDB558074 v02 10.2.3.2/8.2.1 Option 1 Maximum RMS Average

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Marker	Frequency	Meter	Det	AF T344 (db/m)	Amp/Cbl/ Pad	Corrected	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth	Height	Polarity
	(GHz)	Reading		(00))		Reading	(4247))	(02)	(4541))	(42)	(Degs)	(cm)	
		(dBuV)				(dBuV/m)							
1	2.591	40.95	РК	32.6	-20.7	52.85	-	-	-	-	0-360	100	Н
2	3.185	41.69	РК	33.2	-28.9	45.99	-	-	-	-	0-360	201	V
3	3.307	43.77	РК	33.3	-29.5	47.57	-	-	-	-	0-360	201	V
4	3.307	42.57	РК	33.3	-29.5	46.37	-	-	-	-	0-360	201	Н
5*	4.961	43.16	РК	34.3	-28.6	48.86	-	-	74	-25.14	0-360	201	V
6*	4.961	43.12	РК	34.3	-28.6	48.82	-	-	74	-25.18	0-360	100	н

PK - Peak detector

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Frequency	Meter	Det	AF T344	Amp/Cbl/	Corrected	Avg Limit	Margin	Peak	Margin	Azimuth	Height	Polarity
			(db/m)	Fltr/Pad		(dBuV/m)	(dB)	Limit	(dB)			
(GHz)	Reading				Reading			(dBuV/m)		(Degs)	(cm)	
	(dBuV)				(dBuV/m)							
4.96	38.75	MAv1	34.3	-28.6	44.45	53.97	-9.52	-	-	320	132	V
4.96	29.12	MAv1	34.3	-28.6	34.82	53.97	-19.15	-	-	78	108	Н

MAv1 - KDB558074 v02 10.2.3.2/8.2.1 Option 1 Maximum RMS Average

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8.3. WORST-CASE ABOVE 18 GHz

SPURIOUS EMISSIONS 18 TO 26 GHz (WORST-CASE CONFIGURATION, HORIZONTAL & VERTICAL)

85 UL EMU	23 Sep 2813 16:15:27
95	RF Emissions Order Number:13016872 Client Echaster
85	Noder 67 18-2664z Scon Tested by / SN:N. Hua
75 Peok Limit (dBuU/m)	
65	
55 Avg Limit (dBuU/m)	
45	all rear where we have a strange where we wanted
45 35	and the second state and the second
45 35 25	and and a specific an
45 35 25	ud an municipal de altra anti-mane a prima anti-manager a transmission de la presidente de la presidente de la
45 35 25 15 18	Erequency (GHz)
45 35 25 15 18 Norge (Ptc) Det. MM / Rog Type 108-25 19-25 10 10 10 10 10 10 10 10 10 10 10 10 10	Enequency (GHz)

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Note: There were no emissions detected above system noise floor.

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8.4. WORST-CASE BELOW 1 GHz

BLUETOOTH

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



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SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)



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SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, DATA)

Radiated Emissions

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 dB/m	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	189.08	53.95	PK	11.4	-31.1	34.25	43.52	-9.27	0-360	99	Н
2	249.22	57.14	PK	11.5	-30.9	37.74	46.02	-8.28	0-360	99	Н
3	283.4125	56.58	PK	13.4	-30.8	39.18	46.02	-6.84	0-360	99	н
4	508.4525	42.43	PK	17.8	-30.3	29.93	46.02	-16.09	0-360	200	н
5	719.9125	41.1	PK	20.2	-30	31.3	46.02	-14.72	0-360	99	Н

FCC Part 15 Subpart C 30-1000MHz.TST 30915 20 Sep 2013 Rev 9.5 12 Jun 2013

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9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted I	.imit (dBuV)
	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.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

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LINE 1 RESULTS



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LINE 2 RESULTS



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Line-L1 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dB(uVolts)	CISPR 11/22 Class B Quasi-peak	Margin to Limit (dB)	CISPR 11/22 Class B Average	Margin to Limit (dB)
1	.177	53.76	PK	.1	0	53.86	64.6	-10.74	-	-
2	.177	45.84	Av	.1	0	45.94	-	-	54.6	-8.66
3	.2355	50.76	PK	.1	0	50.86	62.3	-11.44	-	-
4	.2355	45.82	Av	.1	0	45.92	-	-	52.3	-6.38
5	.708	39.92	PK	.1	0	40.02	56	-15.98	-	-
6	.708	34.04	Av	.1	0	34.14	-	-	46	-11.86
7	24.3735	35.95	PK	.4	.2	36.55	60	-23.45	-	-
8	24.3735	31.37	Av	.4	.2	31.97	-	-	50	-18.03

PK - Peak detector

Av - average detection

Line-L2 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dB(uVolts)	CISPR 11/22 Class B Quasi-peak	Margin to Limit (dB)	CISPR 11/22 Class B Average	Margin to Limit (dB)
9	.177	51.99	PK	.1	0	52.09	64.6	-12.51	-	-
10	.177	44.64	Av	.1	0	44.74	-	-	54.6	-9.86
11	.7665	39.79	PK	.1	0	39.89	56	-16.11	-	-
12	.7665	38.17	Av	.1	0	38.27	-	-	46	-7.73
13	9.3255	36.1	PK	.1	.1	36.3	60	-23.7	-	-
14	9.3255	33.1	Av	.1	.1	33.3	-	-	50	-16.7

PK - Peak detector

Av - average detection