

Electromagnetic Compatibility Test Report

Prepared in accordance with

LP0002, (23 - Aug - 2016)

On

WiFi Transmitter

DRX PLUS DETECTOR RADIO

Carestream Health Inc.

1049 W. Ridge Road

Rochester, NY 14615

Prepared by:

TUV Rheinland of North America, Inc.

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Client:	Carestream Health Inc. 1049 W. Ridge Road Rochester, NY 14615	Contact:	Ronald Cain Tel: 585-627-8321 Fax: 585-627-8802 e-mail: ronald.cain@carestream.com		
Identification:	WiFi Transmitter	Serial No.:	13A32S1011361		
Test item:	DRX PLUS DETECTOR RADIO	Date tested:	11/12/2017		
Testing location:	TUV Rheinland of North America 710 Resende Road Webster, NY 14580 U.S.A.	Tel: (585) 645-0125			
Test specification:	Emissions: LP0002, (23 - Aug - 2016) LP0002, 3.10.1.5 LP0002, 2.7, 2.8 LP0002, 3.10.1.2, LP0002, 4.7.3.3 (1) LP0002, 3.10.1.6 (2) (A), LP0002, 4.75 LP0002, 3.10.1.6 (2) (B), LP0002, 4.7.3.3 (2) LP0002, 5.4 LP0002, 3.10.1.3 LP0002, 2.11 LP0002, 5.20				
Test Result	The above product was found to be Compliant to the above test standard(s)				
tested by: Richard Decker		reviewed by: David Spencer			
 18 November 2017 Date Signature		 18 November 2017 Date Signature			
Other Aspects:	None				
Abbreviations: OK, Pass, Compliant, Complies = passed Fail, Not Compliant, Does Not Comply = failed N/A = not applicable					
					
US5253	Testing Cert.# 3331.08	482B-1	A-0203	SL2-IN-E-050R	

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General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the LP0002, (23 - Aug - 2016) based on the results of testing completed on 11/12/2017 on the WiFi Transmitter, Model No. DRX PLUS DETECTOR RADIO, manufactured by Carestream Health Inc. This report only applies to the specific samples tested under the stated test conditions. 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 (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

This report updates TUV Report # 31462562.006 to the Taiwan FP0002 standard.

1.3 Revision History

Rev.	Date	Description of Revision
--	06 May 2015	Initial Release
3	21 April 2016	Corrected operating frequency for Taiwan
4	4 November 2016	Correct range-of-frequency in section 1.4 of this report
5	1 August 2017	Channel 11 Band edge, Spurious emissions
6	October 4, 2017	Emissions outside the band, Antenna Conducted power, Emission receive mode, Band edge, Maximum power spectral density
7	November 12, 2017	Made requested updates from Taiwan review

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1.4 Summary of Test Results

Applicant	Carestream Health Inc. 1049 W. Ridge Road Rochester, NY 14615	Tel	585-627-8321	Contact	Ronald Cain
		Fax	585-627-8802	e-mail	ronald.cain@carestream.com
Description	WiFi Transmitter	Model Number	DRX PLUS DETECTOR RADIO		
Serial Number	13A32S1011361	Test Voltage/Freq.	DC		
Test Date Completed:	11/12/2017	Test Engineer	Richard Decker		
Standards	Description	Severity Level or Limit		Criteria	Test Result
LP0002, (23 - Aug - 2016) Standard	Low-power Radio-frequency Devices Technical Regulations	See called out parts below		See Below	Complies
LP0002, 3.10 LP0002, 4.7	Operation within the bands 2400.0-2483.5 MHz, 5725.0-5850.0 MHz	See called out parts below		Below Limit	Complies
LP0002, 3.10.1.5	Emissions Outside the Frequency Band	Below the applicable limits		Below Limit	Complies
LP0002, 2.7, 2.8 LP0002, 2.7, 2.8	Band Edge Radiated Emission 2400.0 - 2483.5 MHz 5725.0 - 5850.0 MHz	Per requirements of the standard		Below Limit	Complies
LP0002, 3.10.1.2 LP0002, 4.7.3.3 (1)	Maximum Peak Output Power 2400.0 - 2483.5 MHz 5725.0 - 5850.0 MHz	Shall not exceed 1 watt		Below Limit	Complies
LP0002, 3.10.1.6 (2) (A) LP0002, 4.7.5	Occupied Bandwidth 2400.0 - 2483.5 MHz 5725.0 - 5850.0 MHz	6 dB $\geq$ 500 kHz		Below Limit	Complies
LP0002, 3.10.1.6 (2) (B) LP0002, 4.7.3.3 (2)	Peak Power Spectral Density 2400.0 - 2483.5 MHz 5725.0 - 5850.0 MHz	$\leq$ 8 dBm in any 3 kHz $\leq$ 30 dBm in any 500 kHz		Below Limit	Complies
LP0002, 5.4	Frequency Stability	Battery Operated, using a fresh Battery		Below Limit	Complies
LP0002, 3.10.1.3	Antenna Requirements	Per requirements of the standard		Below Limit	Complies
LP0002, 2.11	Radiated Emissions while EUT in Receive Mode	Below limit		Below Limit	Complies
LP0002, 4.7.4	Undesirable emissions	Figure 1 Emission Mask		Below Limit	Complies
LP0002, 5.20	RF Exposure	SAR or MPE Requirements		0.63 mW	Complies

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2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at, 710 Resende Road, Building 199, Webster, NY 14580 is accredited by the commission 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 the FCC (Registration No 90575). The laboratory scope of accreditation includes: Title 47 Part 15, and 18. The accreditation is updated every 3 years.

2.1.2 ILAC/A2LA

This is a program which is administered under the auspices of A2LA. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2005 (Certificate Number: 3331.08). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 VCCI

VCCI Accredited test lab. Registration numbers A-0203

2.1.4 Industry Canada

(Registration No.: 482B-1) The 10M SEMI-ANECHOIC CHAMBER has been accepted by Industry Canada to perform testing to 3 and to 10m, based on the test procedures described in ANSI C63.4-2009.

2.1.5 BSMI

Registration No.: SL2-IN-E-050R. The BSMI accreditation was obtained by NIST MRA with the BSMI.

2.1.6 Korea

Recognized by Radio Research Agency as an accredited Conformity Assessment Body (CAB) under the terms of Phase I of the APEC TEL.

2.1.7 Test Software

- Agilent MXE Receiver A.10.04
(The installed EMC software in the MXE has p/n N6141A-2FP and version 1.3.50510.18099)
- CIGUI 32 Version 1.4 for California Instruments AC power source
- HP software E7415A Version A.01.45
- National Instruments “Measurement & Automation Employer” Version 4.6.2f1
- TILE version 3.4.K.28
- Voltech PM 6000 Firmware 1.22.07RC6, Software IEC61000-3 for PM6000 Release 1.24.12
- California Instruments AC power source MXHCL
- Rohde & Schwarz EMI Measurement software EMC32 version 8.50.0
- TILE version 4.0.B
- Keytek CEWare 2.10

2.1.8 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:

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

Where: RAW = Measured level before correction (dB μ V)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

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

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dB μ V/m)

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

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2.2 Measurement Uncertainty Emissions

Per CISPR 16-4-2	Ulab	Ucisp
Radiated Disturbance @ 10m		
30 MHz – 1,000 MHz	4.57 dB	5.2 dB
Radiated Disturbance @ 3m		
1.0 GHz – 6.0 GHz	5.08 dB	5.2 dB
6.0 GHz – 18.0 GHz	5.16 dB	5.5 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	2.62 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.88 dB	4.5 dB

2.2.1 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. Equipment calibration records are kept on file at the test facility.

2.3 Measurement Equipment Used

Equipment	Manufacturer	Model #	Ref.	Serial #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Radiated Emissions						
BiLog	Chase	CBL6111	C017	1169	6-Dec-15	6-Dec-17
Horn(1-18 GHz)	ETS	3117		040361	4-Feb-16	4-Feb-18
Horn(18-26.5 GHz)	ETS	3160-09		1275	4-Feb-16	4-Feb-18
Horn(26.5-40 GHz)	ETS	3160-10		1180	4-Feb-16	4-Feb-18
Receiver (20Hz-40GHz)	Rohde & Schwarz	ESI(B) 40		100090	1-Aug-17	1-Aug-18
N9038A	Agilent Technologies	MXE		MY52130004	1-Aug-17	1-Aug-18
Signal Generator	R&S	SMR 40		100195	1-Aug-17	1-Aug-18
General Laboratory Equipment						
Multimeter	Fluke	87		59890224	1-Aug-17	1-Aug-18
Pressure/Temperature/RH	Davis	Perception II		PB00217A27	13-Apr-17	13-Apr-18

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3 Product Information

3.1 Product Description

Wi-Fi 802.11 a, b, g, n
SISO only

This transmitter is used inside the following models:

Caresteam DRX Plus 3543 Detector, model number 2272233001
Caresteam DRX Plus 3543C Detector, model number 2272233002

MODULATION TECHNOLOGY DSSS, OFDM

TRANSFER RATE

802.11b: 11.0/ 5.5/ 2.0/ 1.0Mbps

802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps

802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps

802.11n: up to 300.0Mbps

OPERATING FREQUENCY

2.4GHz: 2412.0 ~ 2462.0MHz

5.0GHz: 5725.0 ~ 5875.0MHz

NUMBER OF CHANNEL

2.4GHz: 11 for 802.11b, 802.11g, 802.11n (20MHz)

5.0GHz: 5 for 802.11a, 802.11n (20MHz)

3.2 Equipment Modifications

No modifications were needed to bring product into compliance.

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4 2400MHz – 2483.5 MHz band

4.1 Emissions in Receive Mode.

4.1.1 Radiated Emissions

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

4.1.2 Over View of Test

Results	Complies (as tested per this report)					Date	11/12/2017	
Standard	LP0002, 2.11							
Product Model	DRX PLUS DETECTOR RADIO				Serial#	13A32S1011361		
Configuration	EUT set to receive mode							
Test Set-up	Per LP0002, APPENDIX I							
EUT Powered By	DC	Temp	74° F	Humidity	32%	Pressure	1010mbar	
Frequency Range	30 MHz to 26.5 GHz @ 3m							
Perf. Criteria	(Below Limit)			Perf. Verification		Readings Under Limit		
Mod. to EUT	None			Test Performed By		Richard Decker		

4.1.3 Test Procedure

Radiated emissions tests were performed using the procedures of LP0002, APPENDIX I including methods for signal maximizations and EUT configuration.

The frequency range from 30 MHz to 26.5GHz was investigated for radiated emissions.

Radiated emission testing was performed at a distance of 3 meters in a 10 meter semi-anechoic chamber.

4.1.4 Deviations

There were no deviations from the test methodology.

4.1.5 Final Test

All final radiated emissions measurements were below (in compliance) the limits.

*The worst case radiated emissions for the 2412.0 ~ 2462.0MHz band in receive mode is 802.11n.

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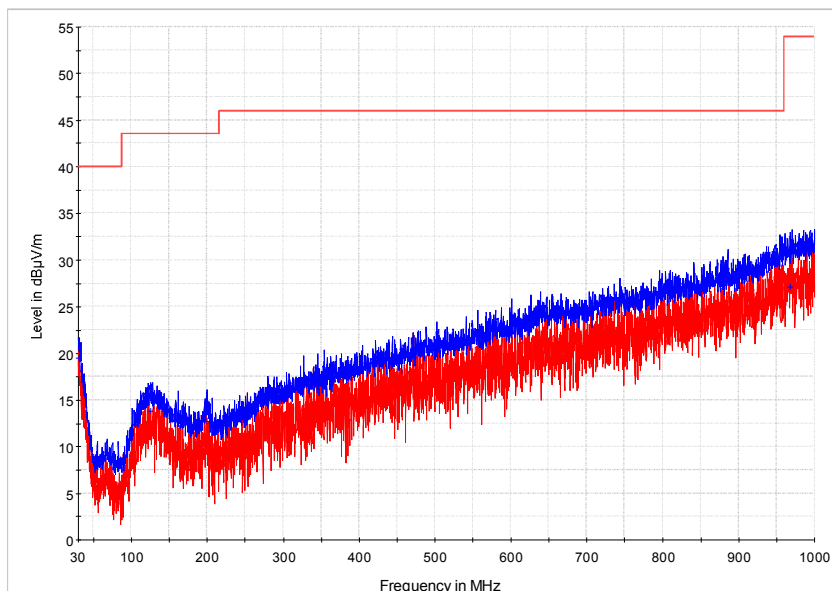
Frequency MHz	QuasiPeak dBμV/m	Height cm	Polarization	Azimuth deg	Corr. dB	Limit dBμV/m	Margin dB
31.0	19.5	100.0	V	321.0	0.2	40	-20.5
968.4	27.1	100.0	V	321.0	15.8	54	-26.9
125.0	13.8	100.0	V	321.0	-4.7	43.5	-29.7
199.8	12.7	100.0	V	321.0	-3.9	43.5	-30.8
30.0	21.0	400.0	H	312.0	0.9	43.5	-22.5
129.1	13.8	400.0	H	300.0	-4.6	43.5	-29.7
307.8	14.1	400.0	H	276.0	-1.1	46	-31.9
975.2	26.9	400.0	H	257.0	15.9	54	-27.1
802.11b Receive Mode 30MHz – 1GHz							

Frequency MHz	Coverage dBμV/m	Height cm	Polarization	Azimuth deg	Corr. dB	Limit dBμV/m	Margin dB
1069.8	39.6	150.0	V	3.0	-0.4	54.0	-14.4
1199.0	39.9	170.0	V	317.0	0.7	54.0	-14.1
1294.0	38.9	150.0	V	273.0	1.1	54.0	-15.1
1496.5	37.7	150.0	V	254.0	0.9	54.0	-16.3
1559.3	37.2	170.0	V	228.0	0.9	54.0	-16.8
1576.3	38.1	160.0	V	206.0	0.8	54.0	-15.9
1692.0	38.3	150.0	V	154.0	1.4	54.0	-15.7
1892.5	43.9	180.0	V	90.0	4.0	54.0	-10.1
1892.5	44.0	160.0	V	87.0	4.0	54.0	-10.0
2089.8	33.7	150.0	V	27.0	4.5	54.0	-20.3
2497.8	38.5	150.0	V	328.0	5.4	54.0	-15.5
2696.5	35.4	150.0	V	56.0	5.3	54.0	-18.6
2997.5	35.3	150.0	V	116.0	6.0	54.0	-18.7
3096.0	32.7	150.0	V	260.0	6.1	54.0	-21.3
3747.3	40.1	150.0	V	174.0	6.7	54.0	-13.9
4996.8	35.2	150.0	V	268.0	9.0	54.0	-18.8
1066.3	41.0	200.0	H	152.0	-0.4	54.0	-13.0
1297.5	38.7	190.0	H	152.0	1.1	54.0	-15.3
1397.8	35.9	180.0	H	322.0	1.2	54.0	-18.1
1498.0	42.6	220.0	H	230.0	0.8	54.0	-11.4
1698.8	39.9	200.0	H	140.0	1.5	54.0	-14.1
2098.3	37.7	200.0	H	196.0	4.5	54.0	-16.3
2497.8	35.5	190.0	H	173.0	5.4	54.0	-18.5
802.11b Receive Mode 1GHz - 18GHz							
Red is maximum emission for 802.11b							

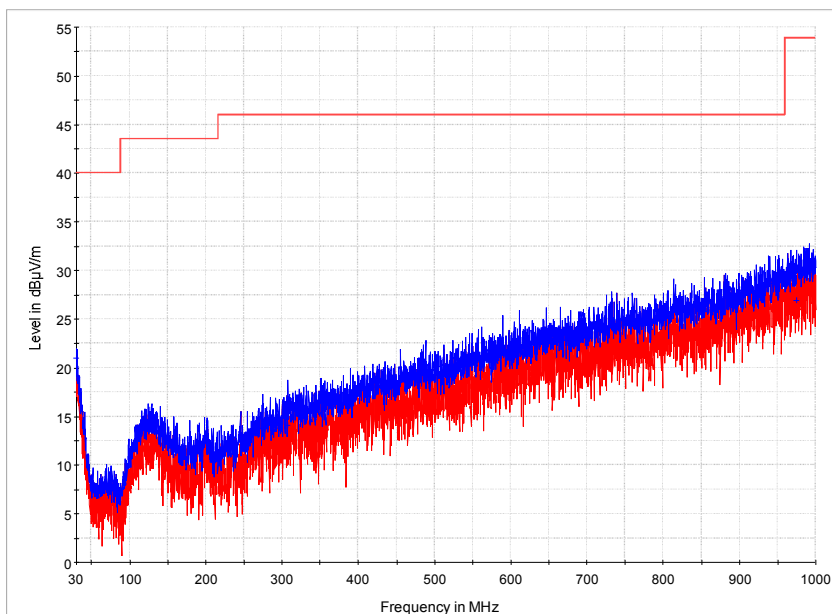
Frequency MHz	Coverage dBμV/m	Height cm	Polarization	Azimuth deg	Corr. dB	Limit dBμV/m	Margin dB
26374.2	35.8	150.0	V	360.0	22.8	54.0	-18.2
23355.8	38.0	200.0	H	0.0	21.5	54.0	-16.0
802.11b Receive Mode 18GHz - 26.5GHz							

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802.11b Receive Mode 30MHz – 1GHz



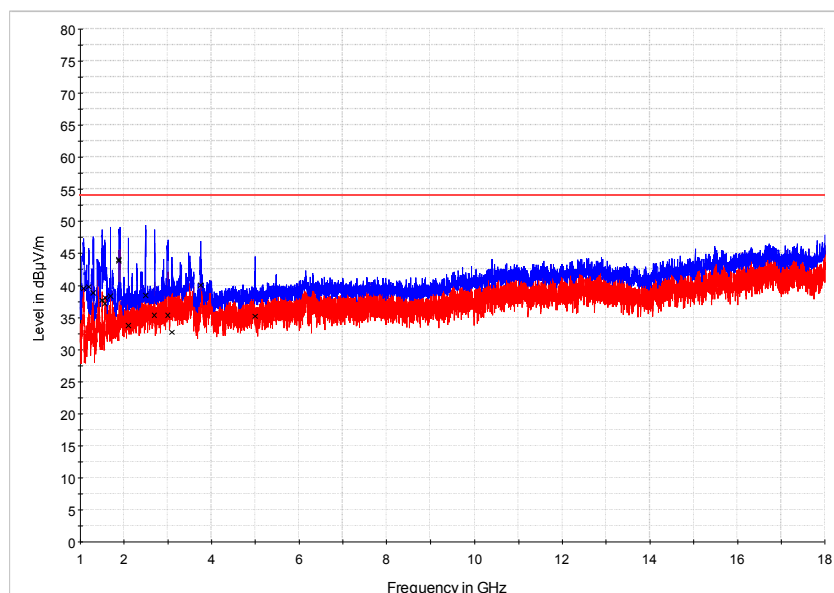
Vertical



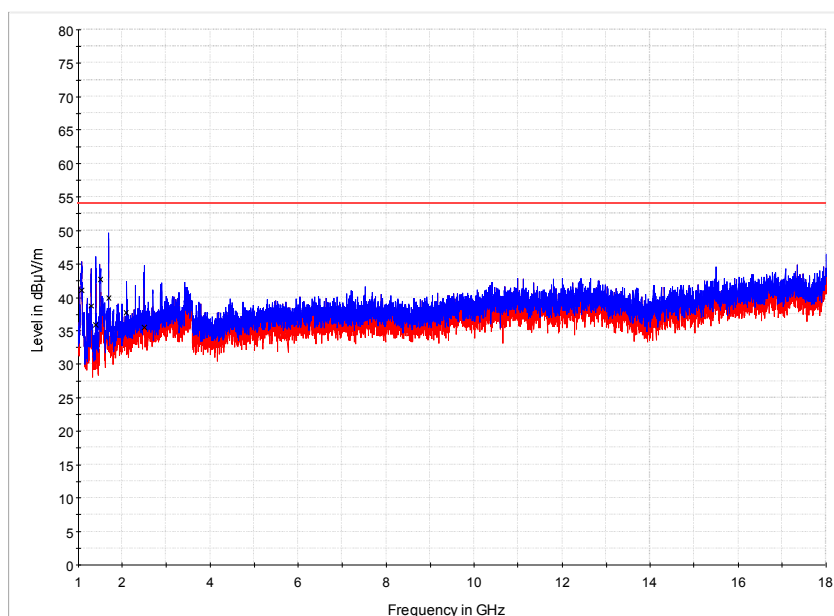
Horizontal

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802.11b Receive Mode 1GHz – 18GHz



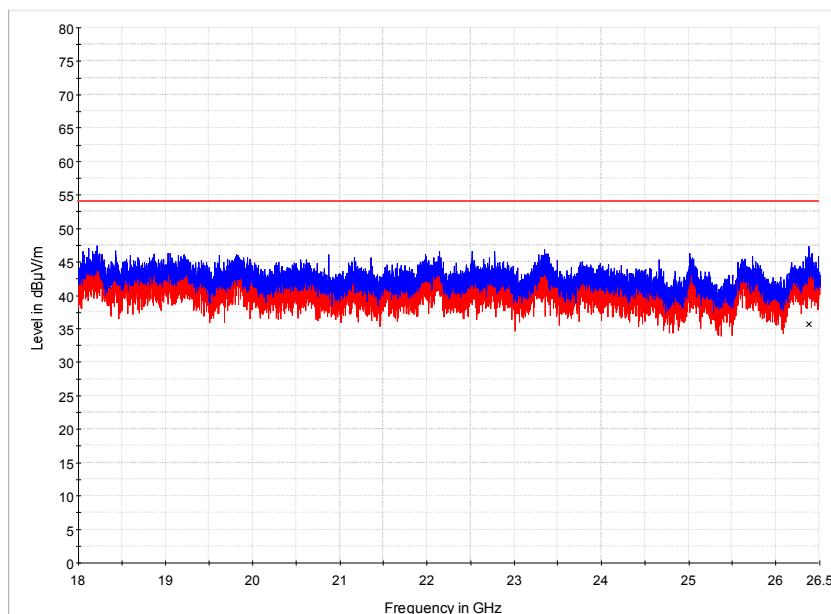
Vertical



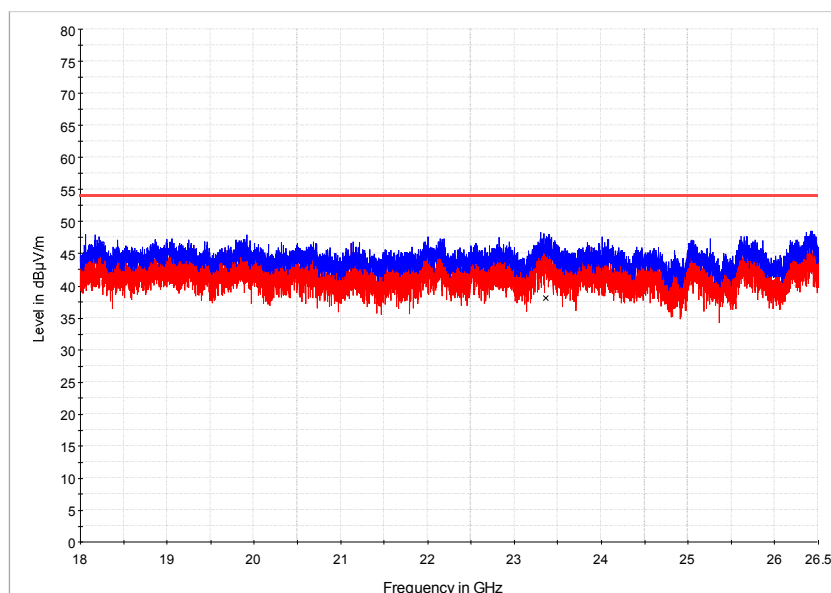
Horizontal

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802.11b Receive Mode 18GHz – 26.5GHz



Vertical



Horizontal

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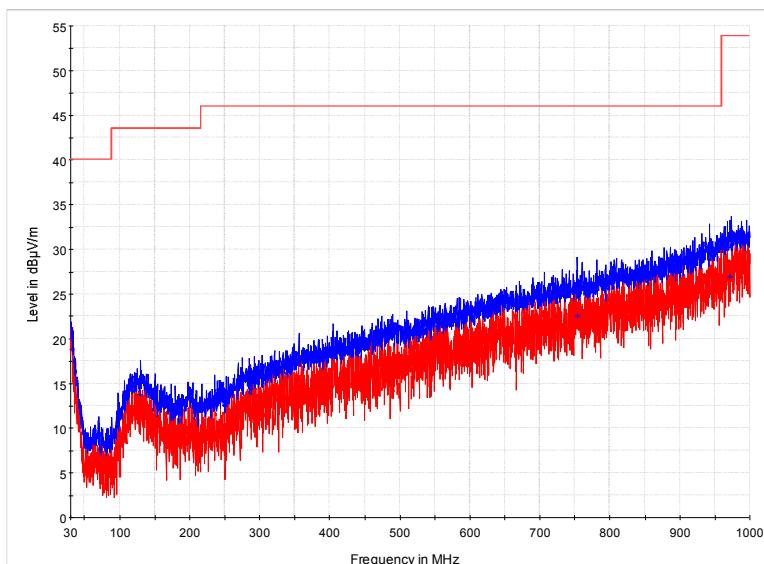
Frequency	QuasiPeak	Height	Polarization	Azimuth	Corr.	Limit	Margin
MHz	dBμV/m	cm		deg	dB	dBμV/m	dB
32	18.9	100	V	150	-0.6	40	-21.1
130.1	13.8	100	V	129	-4.6	43.5	-29.7
753.4	22.5	100	V	98	9.8	46	-23.5
971.5	26.9	100	V	74	15.9	54	-27.1
31.5	21.2	400	H	224	-0.2	40	-18.8
115.4	13.2	400	H	189	-5.5	43.5	-30.3
129.5	13.8	400	H	240	-4.6	43.5	-29.7
972.6	27	400	H	240	15.9	54	-27
802.11g Receive Mode 30MHz – 1GHz							

Frequency	CAverage	Height	Polarization	Azimuth	Corr.	Limit	Margin
MHz	dBμV/m	cm		deg	dB	dBμV/m	dB
1080.0	38.6	150.0	V	-2.0	-0.4	54.0	-15.4
1498.0	37.6	150.0	V	49.0	0.8	54.0	-16.4
1698.8	40.1	160.0	V	66.0	1.5	54.0	-13.9
1897.5	43.6	160.0	V	84.0	4.1	54.0	-10.4
2489.3	35.3	160.0	V	114.0	5.4	54.0	-18.7
2688.0	35.2	150.0	V	211.0	5.3	54.0	-18.8
2997.5	42.2	150.0	V	175.0	6.0	54.0	-11.8
1066.3	40.0	300.0	H	116.0	-0.4	54.0	-14.0
1498.0	40.7	300.0	H	116.0	0.8	54.0	-13.3
1698.8	38.9	300.0	H	127.0	1.5	54.0	-15.1
1897.5	39.7	300.0	H	150.0	4.1	54.0	-14.3
2497.8	37.7	300.0	H	181.0	5.4	54.0	-16.3
2696.5	34.6	300.0	H	200.0	5.3	54.0	-19.4
802.11g Receive Mode 1GHz - 18GHz							
Red is maximum emission for 802.11g							

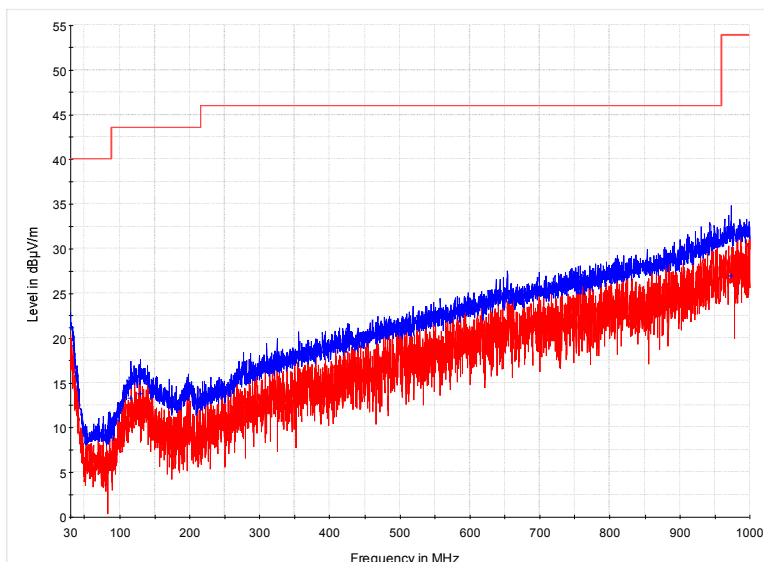
Frequency	CAverage	Height	Polarization	Azimuth	Corr.	Limit	Margin
MHz	dBμV/m	cm		deg	dB	dBμV/m	dB
26401.4	35.5	150.0	V	84.0	22.8	54.0	-18.5
19003.0	36.7	200.0	H	225.0	20.7	54.0	-17.3
802.11g Receive Mode 18GHz - 26.5GHz							

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802.11g Receive Mode 30MHz – 1GHz



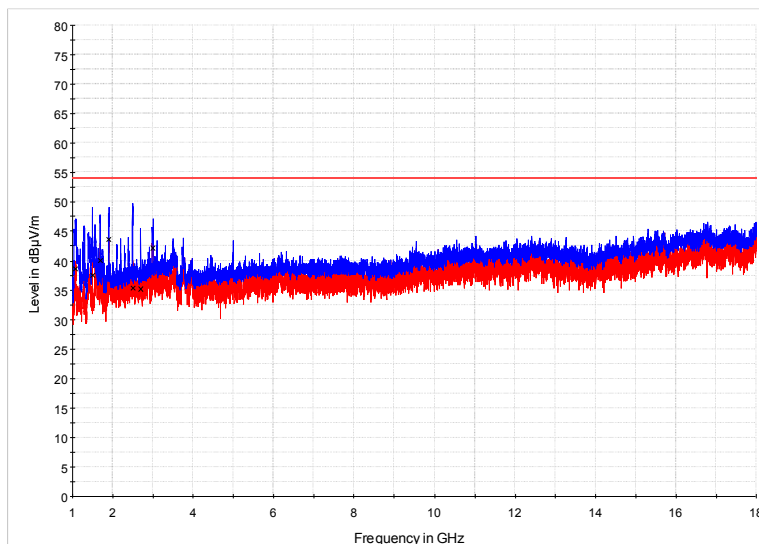
Vertical



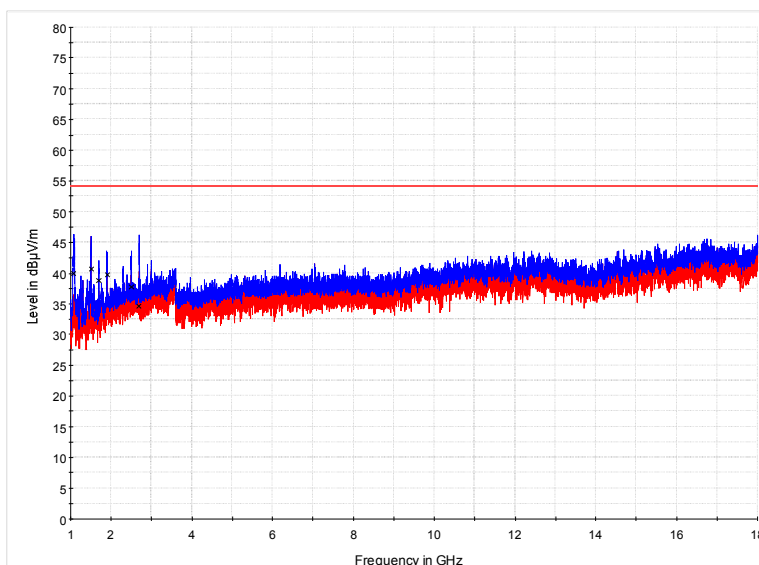
Horizontal

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802.11g Receive Mode 1GHz – 18GHz



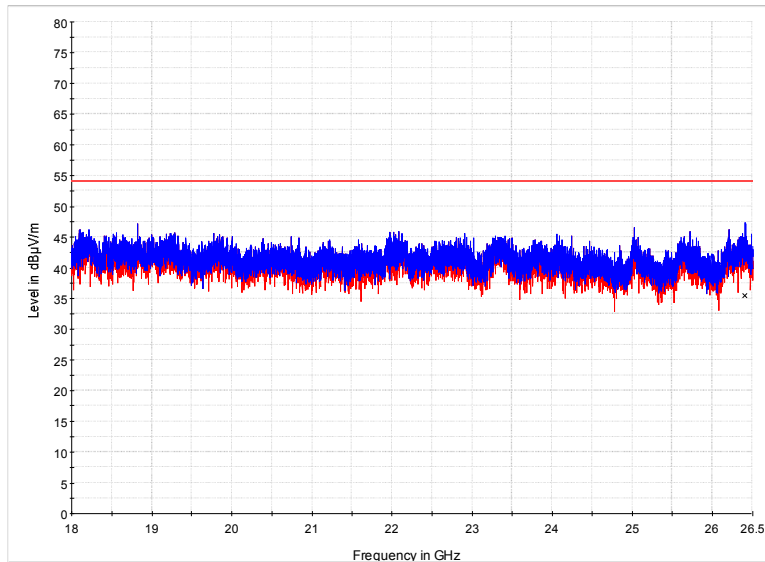
Vertical



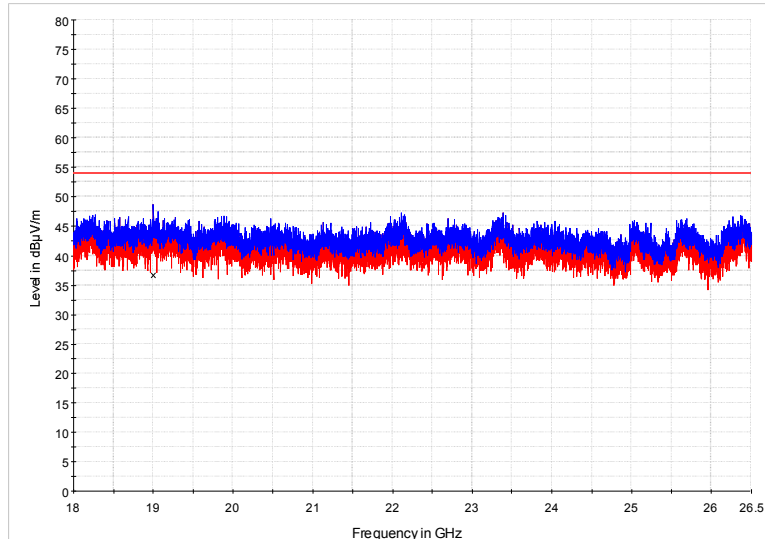
Horizontal

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802.11g Receive Mode 18GHz – 26.5GHz



Vertical



Horizontal

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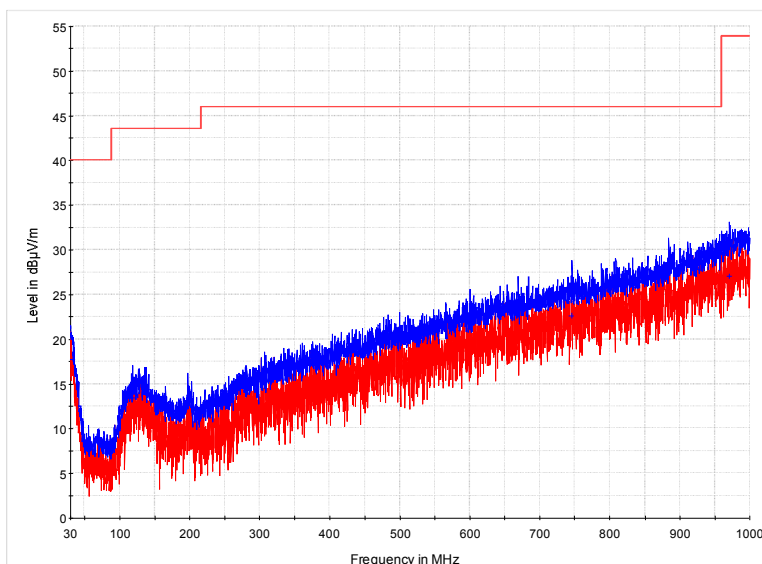
*802.11n is the Emissions in receive mode worst case							
Frequency	QuasiPeak	Height	Polarization	Azimuth	Corr.	Limit	Margin
MHz	dBμV/m	cm		deg	dB	dBμV/m	dB
33.0	17.8	100.0	V	-2.0	-1.4	40.0	-22.2
119.0	13.4	100.0	V	19.0	-5.0	43.5	-30.1
745.7	22.6	100.0	V	54.0	9.8	46.0	-23.4
970.9	27.0	100.0	V	38.0	15.9	54.0	-27.0
33.3	19.8	400.0	H	32.0	-1.6	40.0	-20.2
126.8	13.8	400.0	H	68.0	-4.6	43.5	-29.7
964.7	26.8	400.0	H	97.0	15.6	54.0	-27.2
802.11n Receive Mode 30MHz – 1GHz							

*802.11n is the Emissions in receive mode worst case							
Frequency	CAverage	Height	Polarization	Azimuth	Corr.	Limit	Margin
MHz	dBμV/m	cm		deg	dB	dBμV/m	dB
1193.8	35.3	170.0	V	277.0	0.6	54.0	-15.9
1294.0	38.1	170.0	V	277.0	1.1	54.0	-5.9
1498.0	48.1	150.0	V	313.0	0.8	54.0	-6.7
1562.8	47.3	170.0	V	277.0	0.9	54.0	-13.7
1698.8	40.3	170.0	V	273.0	1.5	54.0	-9.8
1897.5	44.2	180.0	V	249.0	4.1	54.0	-19.8
2089.8	34.2	180.0	V	230.0	4.5	54.0	-18.8
2688.0	35.2	160.0	V	178.0	5.3	54.0	-13.1
1095.3	40.9	300.0	H	2.0	-0.4	54.0	-22.9
1193.8	31.1	300.0	H	147.0	0.6	54.0	-15.6
1498.0	38.4	300.0	H	353.0	0.8	54.0	-13.9
1697.0	40.1	300.0	H	306.0	1.4	54.0	-19.2
1890.8	34.8	280.0	H	249.0	4.0	54.0	-17.2
1897.5	36.8	300.0	H	215.0	4.1	54.0	-22.9
2089.8	31.1	300.0	H	187.0	4.5	54.0	-54.0
802.11n Receive Mode 1GHz - 18MHz							
Red is maximum emission for 802.11n							

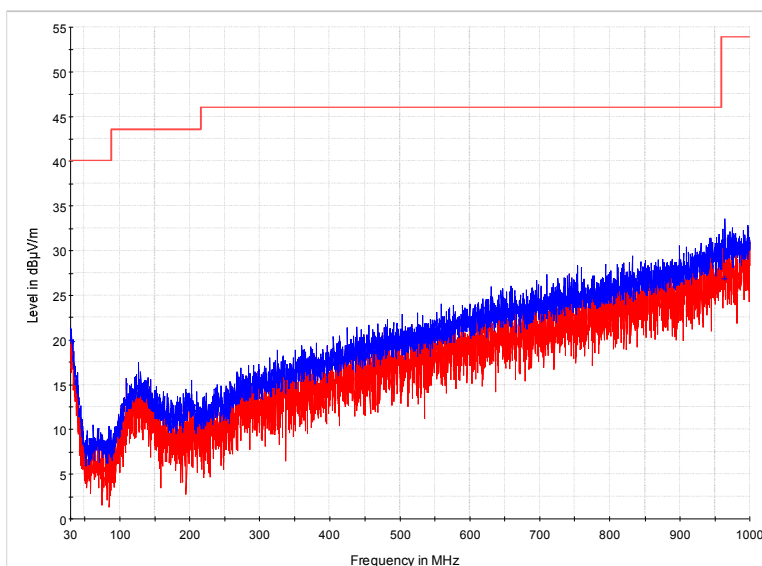
*802.11n is the Emissions in receive mode worst case							
Frequency	CAverage	Height	Polarization	Azimuth	Corr.	Limit	Margin
MHz	dBμV/m	cm		deg	dB	dBμV/m	dB
25044.8	35.9	200.0	H	27.0	20.4	54.0	-18.1
25616.8	34.8	250.0	H	360.0	21.0	54.0	-19.2
802.11n Receive Mode 18MHz - 26.5MHz							

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***802.11n Receive Mode 30MHz – 1GHz**



Vertical

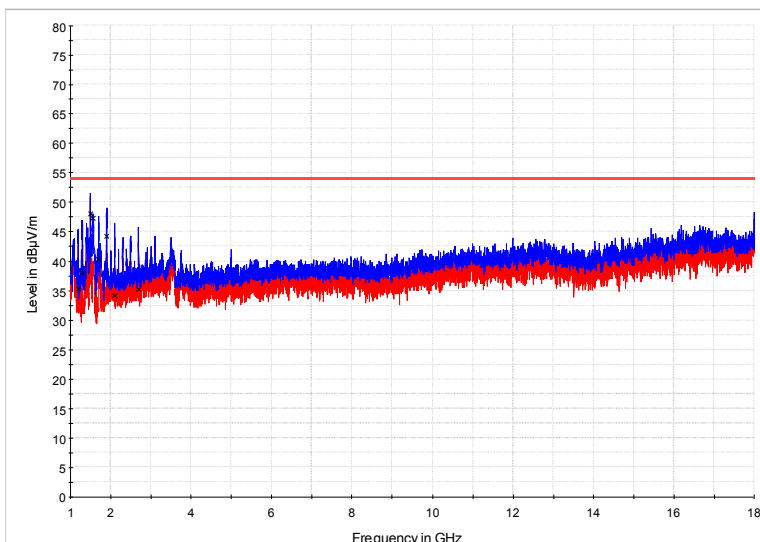


Horizontal

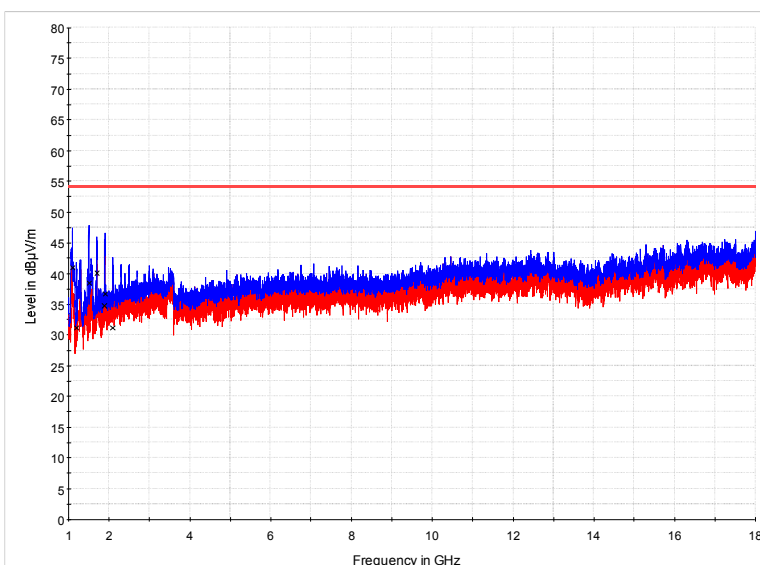
***802.11n is the Emissions in receive mode worst case**

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***802.11n Receive Mode 1GHz – 18GHz**



Vertical

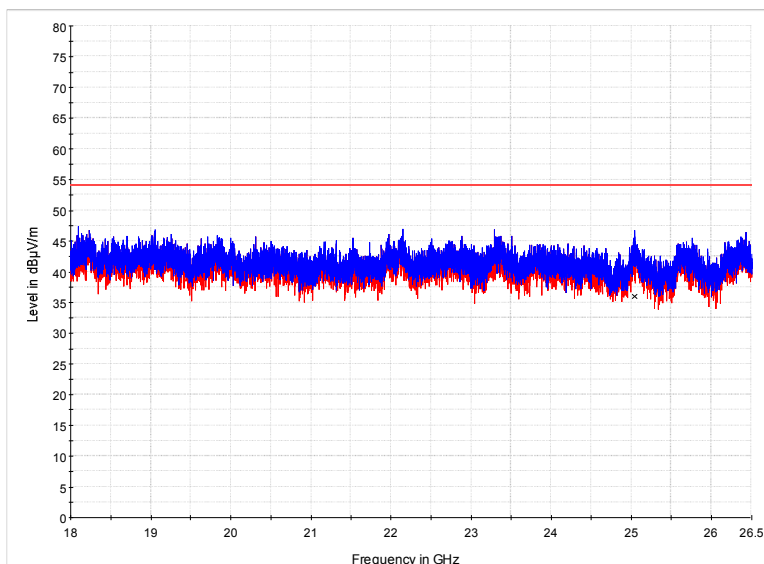


Horizontal

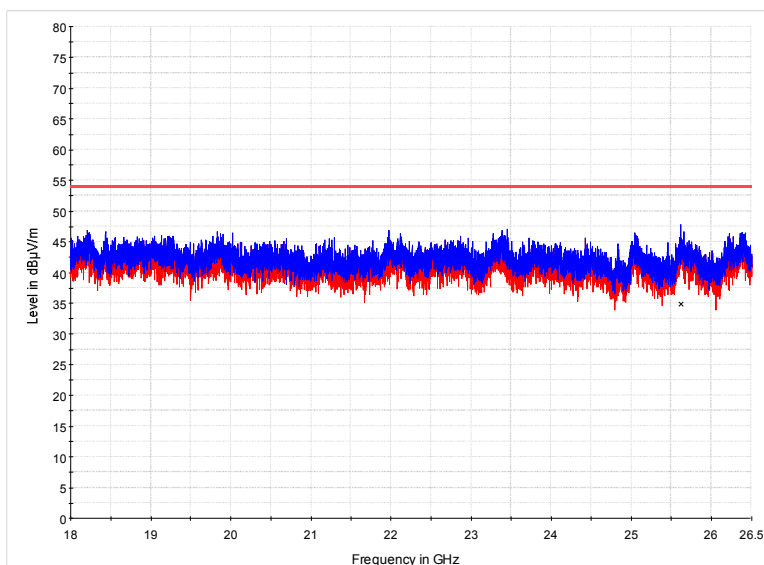
***802.11n is the Emissions in receive mode worst case**

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***802.11n Receive Mode 18GHz – 26.5GHz**



Vertical



Horizontal

***802.11n is the Emissions in receive mode worst case**

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4.2 Spurious Emissions Outside the band

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on radiated measurements. Radiated antenna port measurements are provided below to show that the EUT meets these requirements at the band edges.

4.2.1 Over View of Test

Results	Complies (as tested per this report)					Date	10/27/2014	
Standard	LP0002, 3.10.1.5							
Product Model	DRX PLUS DETECTOR RADIO				Serial#	13A32S1011361		
Test Set-up	Per LP0002, APPENDIX I							
EUT Powered By	DC	Temp	74 °F	Humidity	36%	Pressure	1000 mbar	
Perf. Criteria	(Below Limit)			Perf. Verification		Readings Under Limit		
Mod. to EUT	None			Test Performed By		Richard Decker		

4.2.2 Test Procedure

Testing was performed in accordance with LP0002, (23 - Aug - 2016). These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

The frequency range from 9 kHz to 26.5GHz was investigated for radiated emissions.

4.2.3 Deviations

There were no deviations from the test methodology.

The EUT is compliant to the standard(s).

4.2.4 Final Test

All final radiated spurious emissions measurements were below (in compliance) the limits.

There were no measurable emissions from 9 kHz to 30MHz.

*The worst case radiated spurious emissions for the 2412.0 ~ 2462.0MHz band is 802.11b.

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