Testing Tomorrow's Technology

Application

For

Part 2, Subpart J, Paragraph 2.907 Equipment Authorization of Certification for an Intentional Radiator per Part 15, Subpart C, paragraphs 15.207, 15.209 and 15.249

And

Innovation, Science and Economic Development Canada Certification per IC RSS-Gen General Requirements for Radio Apparatus and RSS-210 License-Exempt Radio Apparatus: Category I Equipment

For the

Viper Design, LLC

Model: VDLC52-79DP

FCC ID: 2AB7YVDLC52
IC: 20699-VDLC52

UST Project: 16-0279
Issue Date: December 9, 2016

Total Pages in This Report: 37

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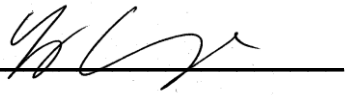
I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: George Yang

Name: 

Title: Laboratory Manager

Date: December 9, 2016

NVLAP LAB CODE 200162-0

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MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Viper Design, LLC

MODEL: VDLC52-79DP

FCC ID: 2AB7YVDLC52

IC: 20699-VDLC52

DATE: December 9, 2016

This report concerns (check one): Original grant [X]
Class II change

Equipment type: 2402 – 2480 MHz Bluetooth LE Transmitter Device

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes_____ No X

If yes, defer until: _____N/A_____
date
agrees to notify the Commission by N/A
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech
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Alpharetta, GA 30004
Phone Number: (770) 740-0717
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1 General Information

1.1 Purpose of this Report

This report is prepared as a means of conveying test results and information concerning the suitability of this exact product for public distribution according to the FCC Rules and Regulations Part 15, Section 249.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on November 18, 2016 in good operating condition.

1.3 Product Description

The Equipment Under Test (EUT) is the Viper Design, LLC Model VDLC52-79DP. The VDLC52-79DP is a Bluetooth Low Energy Battery Monitor Module. The EUT is capable of sending and receiving data from a multitude of Bluetooth enabled devices including smart phones, tablets, and computers. The EUT is intended to be installed on or inside another product in order to receive power and signals required for operation. The RF circuitry and radio is completely controlled from within the radio module.

1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.4:2014, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2014)*,and *ANSI C63.10.2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices*.

A list of EUT and Peripherals is found in Table 1 below. A block diagram of the tested system is shown in Figure 1. Test configuration photographs are provided in separate Appendices

1.5 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC. Its designation number is 186022. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 9900A-1.

1.6 Related Submittals

The EUT is subject to the following FCC authorizations:

a) Certification under section 15.249 as a transmitter.
b) Verification under 15.101 as a digital device and receiver.

The Verification requirement shares many common report elements with the Certification report. Therefore, though this report is mostly intended to provide data for the Certification process, the Verification authorization report (part 15.107 and 15.109) for the EUT is included herein.

Table 1. EUT and Peripherals

PERIPHERAL MANUFACTURER.	MODEL NUMBER	SERIAL NUMBER	FCC & IC ID:	CABLES P/D
Viper Design, LLC	VDLC52-79DP	Engineering Sample	FCC ID: 2AB7YVDLC52 IC: 20699-VDLC52	1.5 m U P

U= Unshielded S= Shielded P= Power D= Data

2 Tests and Measurements

2.1 Test Equipment

The table below lists test equipment used to evaluate this product. Model numbers, serial numbers and their calibration status are indicated.

Table 2. Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	CALIBRATION DUE DATE
SPECTRUM ANALYZER	E4407B	AGILENT	US41442935	2/11/2017
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	8/23/2017
LOOP ANTENNA	SAS-200/562	A.H. Systems	142	9/28/2017 2 yr
BICONICAL ANTENNA	3110B	EMCO	9307-1431	8/25/2017 2 yr
LOG PERIODIC ANTENNA	3146	EMCO	9305-3600	9/21/2018 2 yr
HORN ANTENNA	3115	EMCO	9107-3723	9/22/2018 2 yr
PRE-AMPLIFIER	8449B	HEWLETT-PACKARD	3008A00480	10/26/2017
PRE-AMPLIFIER	8477D	HEWLETT-PACKARD	2434A02157	9/26/2017
LISN X 2	8028-50-TS24-BNC	SOLAR ELECTRONICS	910495 &910494	02/20/17 Extended 90 days

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

2.2 Modifications to EUT Hardware

No physical modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Radiator Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator Limits (Receiver and Digital Device) Requirements

2.3 Number of Measurements for Intentional Radiators (15.31(m))

Measurements of intentional radiators or receivers shall be performed and reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in Table 3 below.

Table 3. Number of Test Frequencies for Intentional Radiators

Frequency Range over which the device operates	Number of Frequencies	Location in the Range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near the top 1 near the bottom
Greater than 10 MHz	3	1 near top 1 near middle 1 near bottom

Because the EUT operates at 2402 MHz to 2480 MHz, 3 test frequencies were used.

2.4 Frequency Range of Radiated Measurements (Part 15.33)

2.4.1 Intentional Radiator

The spectrum was investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the 10^{th} harmonic of the highest fundamental frequency generated or 40 GHz, whichever is the lowest.

2.4.2 Unintentional Radiator

For the digital device, an unintentional radiator, the frequency range tested was 30 MHz to 1000 MHz, or to 5 times the highest internal clock frequency.

2.5 Measurement Detector Function and Bandwidth (CFR 15.35)

The radiated and conducted emissions limits shown herein are based on the following:

1. Detector Function and Associated Bandwidth

On frequencies below 1000 MHz, the limits herein are based upon measurement equipment employing a CISPR Quasi-peak detector function and related measurement bandwidths (i.e. 9 kHz from 150 kHz to 30 MHz and 120 kHz from 30 MHz to 1000 MHz). Alternatively, measurements may be made with equipment employing a peak detector function as long as the same bandwidths specified for the Quasi-peak device are used.

2. Corresponding Peak and Average Requirements

Above 1000 MHz, radiated limits are based on measuring instrumentation employing an average detector function. When average radiated emissions are specified there is also a corresponding Peak requirement, as measured using a peak detector, of 20 dB greater than the average limit. For all measurements above 1000 MHz the Resolution Bandwidth shall be at least 1 MHz.

3. Pulsed Transmitter Averaging

When the radiated emissions limit is expressed as an average value, and the transmitter is pulsed, the measured field strength shall be determined by applying a Duty Cycle Correction Factor based upon dividing the total ON time during the first 100 ms period by 100 ms (or by the period if less than 100 ms). The duty cycle may be expressed logarithmically in dB.

NOTE: If the transmitter was programmed to transmit at >98% duty cycle, then, wherever applicable (where the detection mode was AVG), the duty cycle factor calculated will be applied.

2.6 EUT Antenna Requirements (CFR 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. Only the antenna(s) listed in Table 4 will be used with this module.

Table 4. Allowed Antenna(s)

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB_i	TYPE OF CONNECTOR
Antenna	Viper Design, LLC	PCB Etched Meander Antenna	Engineering Sample	0.0	N/A

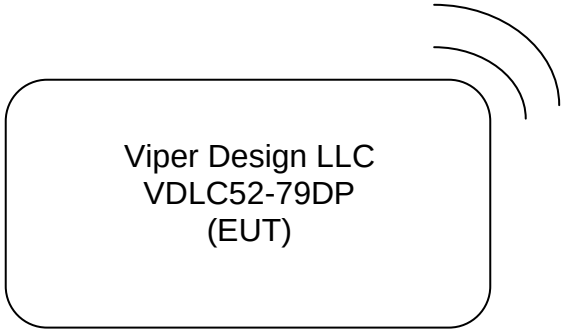


Figure 1. Block Diagram of Test Configuration

2.7 Restricted Bands of Operation (Part 15.205)

Only spurious emissions can fall in the frequency bands of CFR 15.205. The field strength of these spurious cannot exceed the limits of 15.209. Radiated harmonics and other Spurious are examined for this requirement; see test data presented in the sections below.

2.8 Transmitter Duty Cycle (CFR 35 (c))

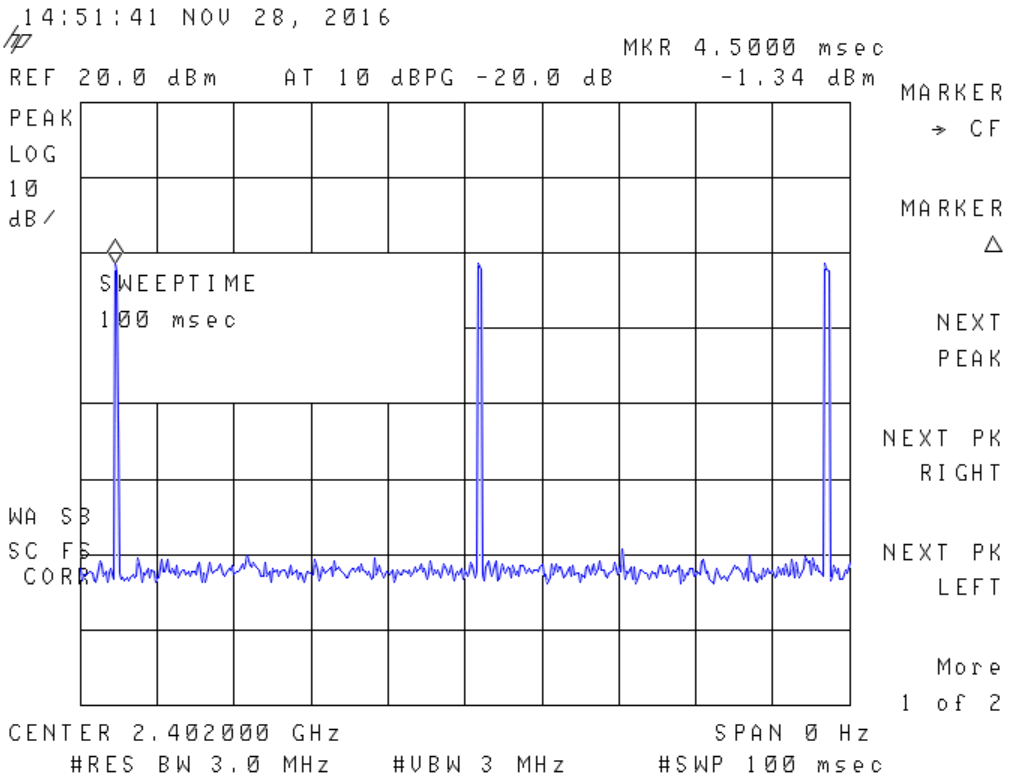


Figure 2. Duty Cycle 100ms Sweep

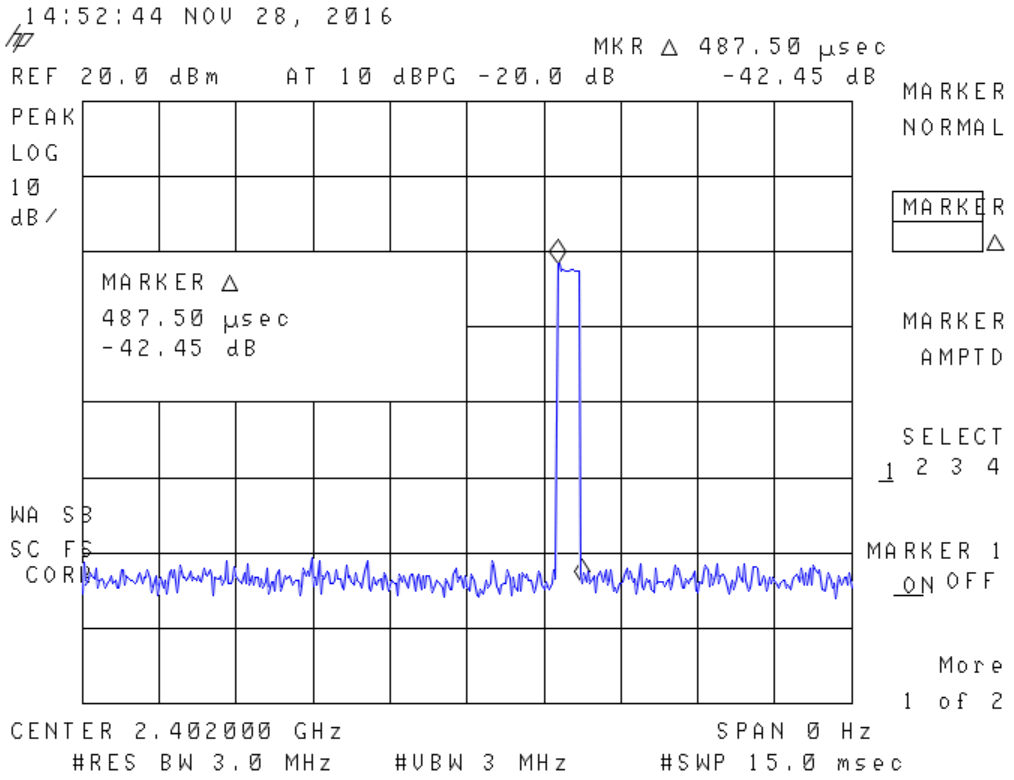


Figure 3. Transmitter Pulse Width

Pulse Width from Figure 3 = .4875 ms
Total Pulses in 100ms from Figure 2 = 3

(.4875 ms Pulse Width * 3) / (100 ms Total Pulses) = .015 Numeric Duty Cycle
Duty Cycle = 20 Log (.015) = -36.5 dB

Since the Duty Cycle is less than -20 dB, only a -20 dB Duty Cycle correction factor will be applied in this test report.

NOTE: The transmitter was programmed to transmit at >98% duty cycle, therefore wherever applicable (where the detection mode was AVG) the duty cycle factor calculated above will be applied.

2.9 Intentional Radiator, Power Line Conducted Emissions (CFR 15.207)

The EUT can operate over a DC voltage input range of +3.3VDC to +18VDC, the nominal voltage was determined to be +15VDC, therefore the EUT was tested while being supplied a nominal voltage of +15VDC via non-filter bench top DC power supply.

Power line conducted emissions testing was performed to ensure that with the EUT in operation (exercising all transmitter functions), the complete system will meet the applicable requirements for CFR 15.207. These measurements were completed and are displayed in the sections below.

Table 5. Transmitter Power Line Conducted Emissions Test Data, Part 15.207/107

Conducted Emissions 150 kHz to 30 MHz						
Tested By: HR	Specification Requirement: FCC Part 15.207		Project No.: 16-0279	Manufacturer: Viper Design, LLC Model: VDLC52-79DP		
Frequency (MHz)	**Test Data (dBuV)**	**LISN+CL (dB)**	**Corrected Results (dBuV)**	**Avg Limits (dBuV)**	**Margin (dB)**	**Detector**
120 VAC, 60 Hz, Phase Line						
0.1800	27.58	0.43	28.01	54.5	26.5	PK
0.6370	24.96	0.29	25.25	46.0	20.7	PK
4.5200	27.40	0.37	27.77	46.0	18.2	PK
8.4120	20.94	0.48	21.42	50.0	28.6	PK
16.0300	15.90	0.65	16.55	50.0	33.4	PK
22.2300	16.45	0.80	17.25	50.0	32.8	PK
120 VAC, 60 Hz, Neutral Line						
0.2230	18.59	0.28	18.87	52.7	33.8	PK
0.9610	15.67	0.20	15.87	46.0	30.1	PK
4.5100	17.26	0.28	17.54	46.0	28.5	PK
8.4120	17.03	0.39	17.42	50.0	32.6	PK
11.1800	32.65	0.40	33.05	50.0	17.0	PK
22.8800	34.64	0.63	35.27	50.0	14.7	PK

(*)= Quasi-Peak limit used

SAMPLE CALCULATION AT 0.1800 MHz:

Magnitude of Measured Frequency	27.58	dBuV
+ Cable Loss+ LISN Loss	0.43	dB
Corrected Result	28.01	dBuV

Test Date: November 17, 2016
Tested By
Signature: Hossein Rahnama Name: Hossein Rahnama

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.249(a),(c)) (IC RSS 210, A2.9 (a))

Radiated Spurious measurements: the EUT was placed into a continuous transmit mode of operation (>98% duty cycle) and tested per FCC KDB Publication 558074 and ANSI C63.10:2013. A preliminary scan was performed on the EUT to find signal frequencies that were caused by the transmitter part of the device. To obtain worse case results the EUT was tested in X, Y, and Z axes or in the orientation of normal operation if the device is designed to operation in a fixed position.

Radiated measurements were then conducted between the frequency range of 9 KHz (or lowest frequency used/generated by the device) up to the tenth harmonic of the device (no greater than 40 GHz). In the band below 30 MHz a resolution bandwidth (RBW) of 9 kHz was used; emissions below 1 GHz were tested with a RBW of 120 KHz and emissions above 1 GHz were tested with a RBW of 1 MHz. All video bandwidth settings were at least three times the RBW value.

The EUT was investigated to CFR 15.209, General requirements for unwanted spurious emissions.

Table 6. Spurious Radiated Emissions Below 30 MHz (X-Position)

9 kHz to 30 MHz, 15.209 limits							
Test: Radiated Emissions				**Client:** Viper Design, LLC			
Project: 16-0279				**Model:** VDLC52-79DP			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance**	**Margin (dB)**	**Detector PK, or AVG**
0.02	35.96	71.90	107.86	119.8	3 M	12.0	**PK**
0.15	22.11	57.54	79.65	103.9	3 M	24.3	**PK**
0.94	22.20	38.92	61.12	68.1	3 M	7.0	**PK**
4.54	21.39	26.17	47.56	54.5	3 M	6.9	**PK**
9.87	22.04	17.19	39.23	47.7	3 M	8.5	**PK**
18.12	34.26	-9.08	25.18	42.4	3 M	17.3	**PK**
20.12	25.87	1.96	27.83	41.5	3 M	13.7	**PK**

Sample Calculation at 20.12 MHz:

Magnitude of Measured Frequency	25.87	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	1.96	dB/m
Corrected Result	27.83	dBuV/m

Test Date: November 18, 2016
Tested By
Signature: Hossein Rahnama Name: Hossein Rahnama

Table 7. Spurious Radiated Emissions Below 30 MHz (Y-Position)

9 kHz to 30 MHz, 15.209 limits							
Test: Radiated Emissions				**Client:** Viper Design, LLC			
Project: 16-0279				**Model:** VDLC52-79DP			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance**	**Margin (dB)**	**Detector PK, or AVG**
0.06	45.62	63.80	109.42	112.7	3 M	3.3	**PK**
0.15	25.32	57.54	82.86	103.8	3 M	21.0	**PK**
0.68	18.99	42.32	61.31	71.0	3 M	9.6	**PK**
5.04	17.08	24.09	41.17	69.5	3 M	28.4	**PK**
18.30	32.89	-9.08	23.81	69.5	3 M	45.7	**PK**
21.35	33.28	1.96	35.24	69.5	3 M	34.3	**PK**
28.80	16.04	10.56	26.60	69.5	3 M	42.9	**PK**

Sample Calculation at 28.80 MHz:

Magnitude of Measured Frequency	16.04	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	10.56	dB/m
Corrected Result	26.60	dBuV/m

Test Date: November 21, 2016
Tested By
Signature: Hossein Rahnama Name: Hossein Rahnama

Table 8. Spurious Radiated Emissions Below 30 MHz (Z-Position)

9 kHz to 30 MHz, 15.209 limits							
Test: Radiated Emissions				**Client:** Viper Design, LLC			
Project: 16-0279				**Model:** VDLC52-79DP			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance**	**Margin (dB)**	**Detector PK, or AVG**
0.01	31.78	78.40	110.18	127.6	3 M	17.4	**PK**
0.07	34.81	62.40	97.21	111.0	3 M	13.8	**PK**
0.15	25.14	57.54	82.68	104.0	3 M	21.4	**PK**
0.68	20.13	42.32	62.45	70.9	3 M	8.5	**PK**
9.46	17.26	17.19	34.45	69.5	3 M	35.1	**PK**
17.95	33.30	-4.18	29.12	69.5	3 M	40.4	**PK**

Sample Calculation at 17.95 MHz:

Magnitude of Measured Frequency	33.30	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	-4.18	dB/m
Corrected Result	29.12	dBuV/m

Test Date: November 21, 2016
Tested By
Signature: Hossein Rahnama Name: Hossein Rahnama

Table 9. Unintentional Radiator, Peak Radiated Emissions (CFR 15.209)

30 MHz to 1000 MHz							
Test: Radiated Emissions				**Client:** Viper Design, LLC			
Project: 16-0279				**Model:** VDLC52-79DP			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or QP**
No emissions within 20 dB below the limit were detected.							

Test Date: November 29, 2016

Tested By
Signature: 

Name: Ashton J. Picas

Table 10. Fundamental Emissions (Peak & AVG)

Test: FCC Part 15, Part 15.209, 15.249(a)					**Client:** Viper Design, LLC			
Project: 16-0279					**Model:** VDLC52-79DP			
Frequency (MHz)	**Test Data (dBuV)**	**Factor (dB)**	**AF+CA -AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector Mode**
Low - Channel								
2401.95	60.65	-	30.16	90.81	114.0	3.0m./HORZ	23.2	**PK**
2401.95	47.06	-	30.16	77.22	94.0	3.0m./HORZ	16.8	**AVG**
Mid - Channel								
2440.00	62.05	-	30.13	92.18	114.0	3.0m./HORZ	21.8	**PK**
2440.00	47.73	-	30.13	77.86	94.0	3.0m./HORZ	16.1	**AVG**
High – Channel								
2479.88	60.74	-	30.13	90.87	114.0	3.0m./HORZ	23.1	**PK**
2479.88	46.86	-	30.13	76.99	94.0	3.0m./HORZ	17.0	**AVG**

Notes:
1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.249
2. (~) Measurements taken at 1 meter were extrapolated to 3 meters using a factor of (-9.5 dB).
3. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 2440 MHz:

Magnitude of Measured Frequency	62.05	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	30.13	dB/m
Corrected Result	92.18	dBuV/m

Test Date: November 22, 2016
Tested By
Signature: Hossein Rahnama Name: Hossein Rahnama

Table 11. Spurious Emissions (Peak & AVG)

Test: FCC Part 15, Part 15.209, 15.249(a)					**Client:** Viper Design, LLC			
Project: 16-0279					**Model:** VDLC52-79DP			
Frequency (MHz)	**Test Data (dBuV)**	**Factor (dB)**	**AF+CA -AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector Mode**
Low - Channel								
4804.00	46.95	-	2.30	49.25	74.0	3.0m./HORZ	24.7	**PK**
4804.00	35.25	-	2.30	37.55	54.0	3.0m./HORZ	16.4	**AVG**
7205.53	51.34	-	7.77	59.11	74.0	3.0m./HORZ	14.9	**PK**
7205.53	38.51	-	7.77	46.28	54.0	3.0m./HORZ	7.7	**AVG**
Mid – Channel								
4880.00	45.42	-	1.36	46.78	74.0	3.0m./HORZ	27.2	**PK**
4880.00	32.49	-	1.36	33.85	54.0	3.0m./HORZ	20.2	**AVG**
7319.58	52.14	-	6.15	58.29	74.0	3.0m./HORZ	15.7	**PK**
7319.58	39.17	-	6.15	45.32	54.0	3.0m./HORZ	8.7	**AVG**
High – Channel								
4960.00	46.46	-	2.34	48.80	74.0	3.0m./HORZ	25.2	**PK**
4960.00	34.02	-	2.34	36.36	54.0	3.0m./HORZ	17.6	**AVG**
7435.83	51.89	-	7.50	59.39	74.0	3.0m./HORZ	14.6	**PK**
7444.28	38.64	-	7.50	46.14	54.0	3.0m./HORZ	7.9	**AVG**

Notes:
1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.249
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. (~) Measurements taken at 1 meter were extrapolated to 3 meters using a factor of (-9.5 dB) if applicable.
4. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 4960 MHz:

Magnitude of Measured Frequency	46.46	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	2.34	dB/m
Duty Cycle Correction Factor	N/A	dB
Corrected Result	48.80	dBuV/m

Test Date: November 22, 2016
Tested By
Signature: Hossein Rahnama Name: Hossein Rahnama

2.11 Band Edge Measurements – (CFR 15.249 (d))

Band Edge measurements are made following the guidelines in FCC KDB Publication No. 558074 with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation. Radiated measurements are performed to demonstrate compliance with the requirement of 15.249(d) that all emissions outside of the band edges be attenuated by at least 50 dB or 15.209 limits, when compared to its highest in-band value (contained in a 100 kHz band).

To capture the band edge, set the Spectrum Analyzer frequency span was set to 2 MHz to capture the peak level of the emission operating on the channel closest to the band edge as well as any modulation products falling outside of the authorized band of operation. See the following figures and calculations for more detail.

For restricted band measurements the conducted method per 12.2.2 of KDB 558071 v03r05 was used. The measured output power was converted to field strength using the following relationship:

$$E = EIRP - 20\log D + 104.8$$

E= electric field strength in dBuV/m
EIRP= equivalent isotropic radiated power in dBm
D= specified measurement distance in meters

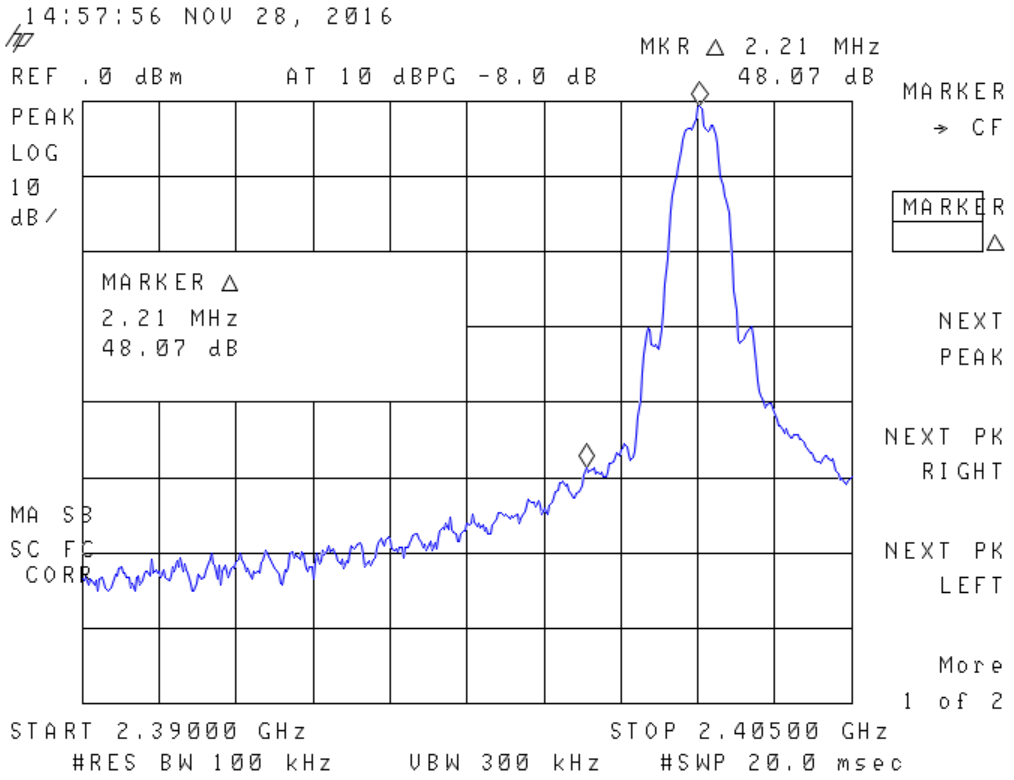


Figure 4. Band Edge Compliance, Low Channel Delta - Peak

Low Channel Corrected Measured Value from Table 10	90.81	dBuV/m
Low Channel Band Edge Delta from Figure 4	48.07	dB
Calculated Result	42.74	dBuV/m
Band Edge Limit	54.00	dBuV/m
Calculated Result	42.74	dBuV/m
Band Edge Margin	11.26	dB

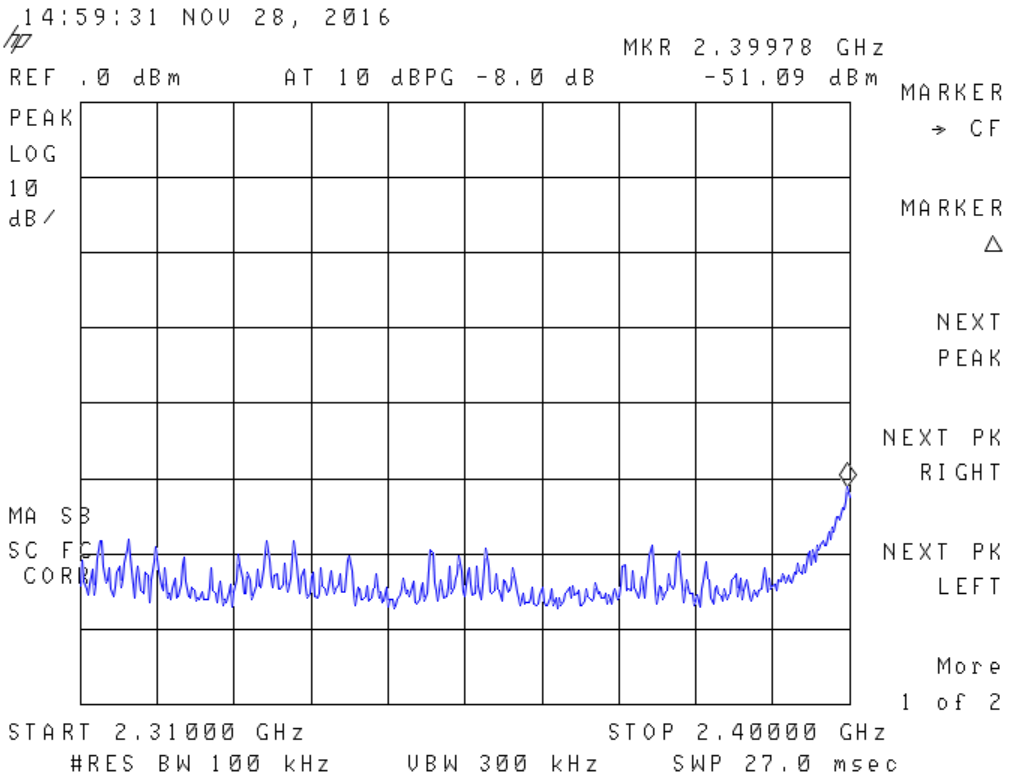


Figure 5. Conducted Restricted Band 2310 MHz to 2390 MHz, Peak

Table 12. Conducted Restricted Band 2310 MHz to 2390 MHz, Peak

2310 MHz to 2390 MHz Restricted Band Peak Measurements							
Test: Conducted Emissions				**Client:** Viper Design, LLC			
Project: 16-0279				**Model:** VDLC52-79DP			
Frequency (MHz)	**Test Data (dBm)**	**Antenna Gain (dBi)**	**Results EIRP (dBm)**	**Results dBuV/m**	**Limit (dBuV/m)**	**Margin (dB)**	**Detector PK, or AVG**
2399.78	-51.09	0.0	-51.09	44.17	74.0	29.8	**PK**
2399.78	-51.09	0.0	-51.09	44.17	54.0*	9.8	**PK**

* = AVG Limit

Test Date: November 28, 2016
Tested By
Signature: _____ Name: George Yang

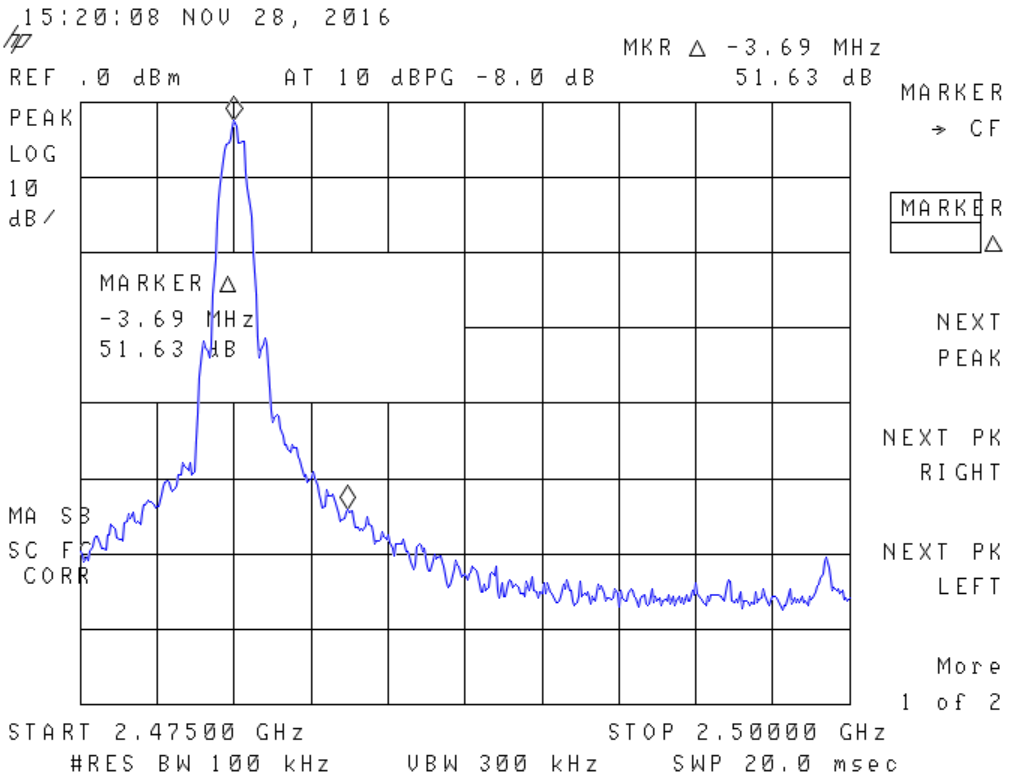


Figure 6. Band Edge Compliance, High Channel Delta – Peak

High Channel Corrected Measured Value from Table 10	90.87	dBuV/m
High Channel Band Edge Delta from Figure 6	51.63	dB
Calculated Result	39.24	dBuV/m
Band Edge Limit	54.00	dBuV/m
Calculated Result	39.24	dBuV/m
Band Edge Margin	14.76	dB

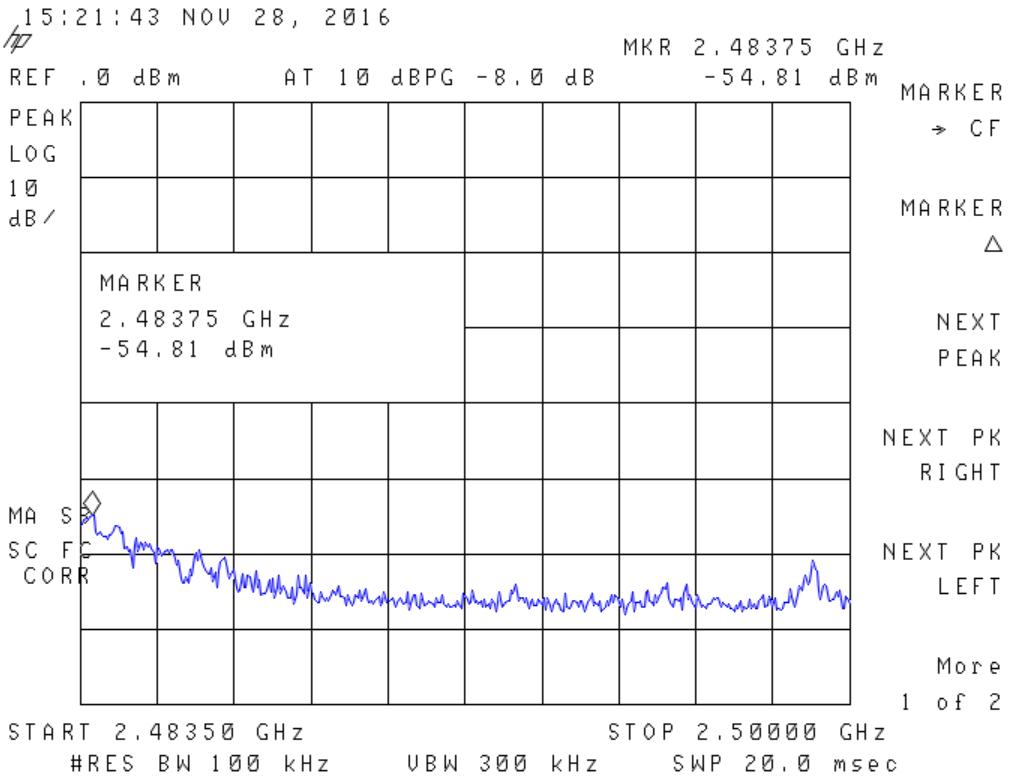


Figure 7. Conducted Restricted Band 2483.5 MHz to 2500 MHz, Peak

Table 13. Conducted Restricted Band 2483.5 MHz to 2500 MHz, Peak

2483.5 MHz to 2500 MHz Restricted Band Peak Measurements							
Test: Conducted Emissions				**Client:** Viper Design LLC			
Project: 16-0279				**Model:** VDLC52-79DP			
Frequency (MHz)	**Test Data (dBuv)**	**Antenna Gain (dBi)**	**Results EIRP (dBm)**	**Results dBuV/m**	**Limit (dBuV/m)**	**Margin (dB)**	**Detector PK, or AVG**
2483.75	-54.81	N/A	-54.81	40.45	74.0	33.5	**PK**
2483.75	-54.81	N/A	-54.81	40.45	54.0*	13.5	**PK**

* = AVG Limit

Test Date: November 28, 2016
Tested By
Signature: _____ Name: George Yang

2.12 99% Occupied Bandwidth (Part 2.1049 and RSS-Gen)

These measurements were performed while the EUT was in a constant transmit mode. A method similar to the marker delta method was used to capture the points. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW ≥ RBW. The results of this test are given in Table 14 and Figures 8-10.

Table 14. 99% Occupied Bandwidth

Frequency (MHz)	99% Occupied Bandwidth (MHz)
2402	1.0966
2442	1.1006
2480	1.1012

Test Date: November 28, 2016
Tested By
Signature: _____ Name: George Yang

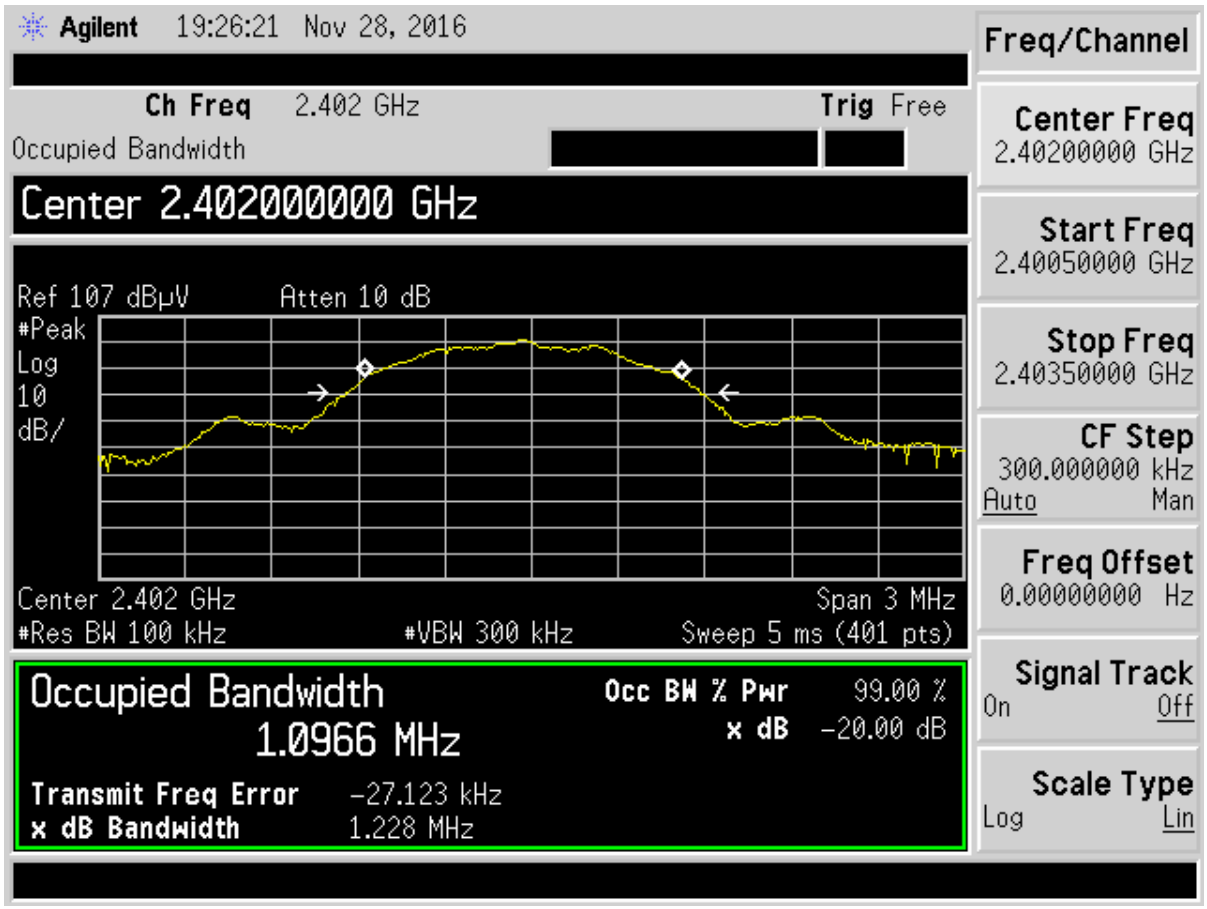


Figure 8. 99% Occupied Bandwidth – Low Channel

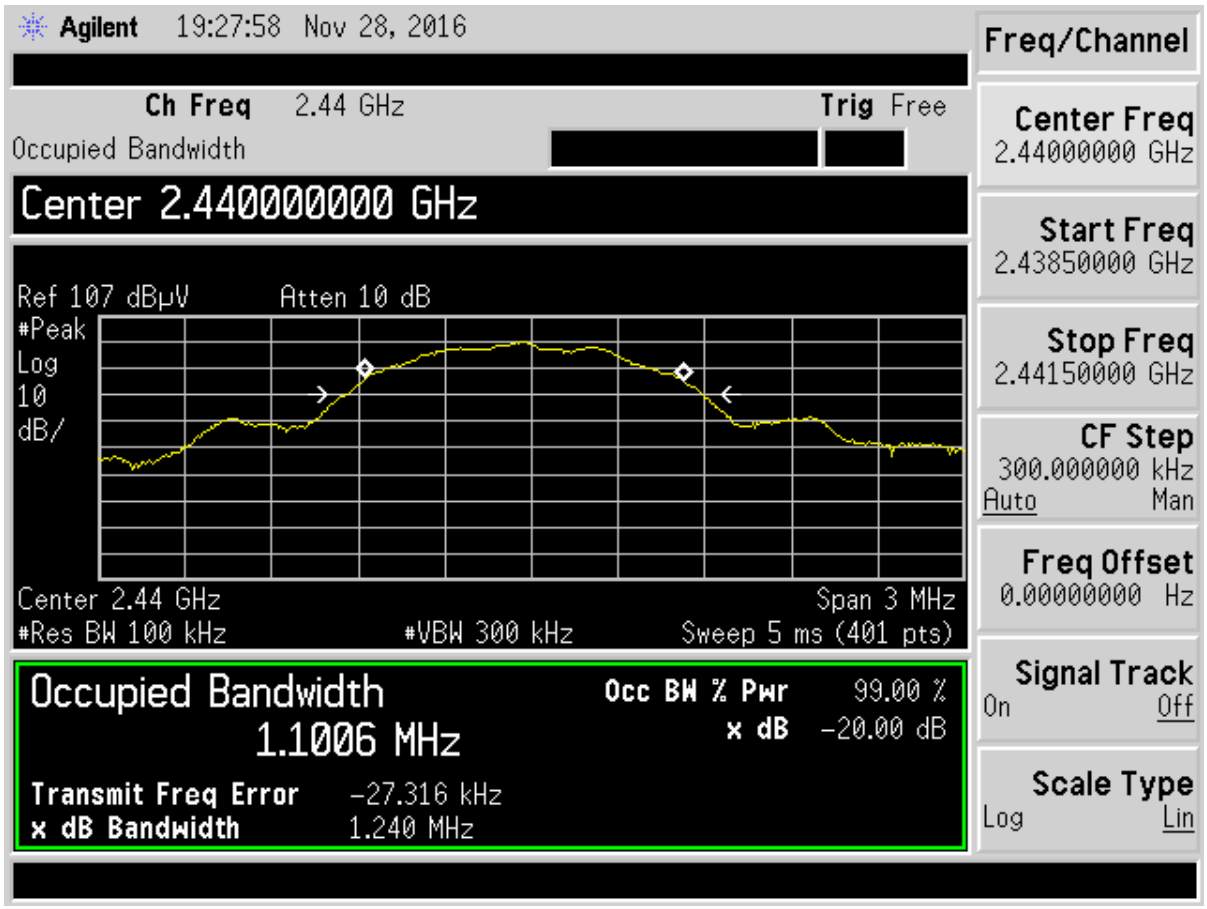


Figure 9. 99% Occupied Bandwidth – Mid Channel

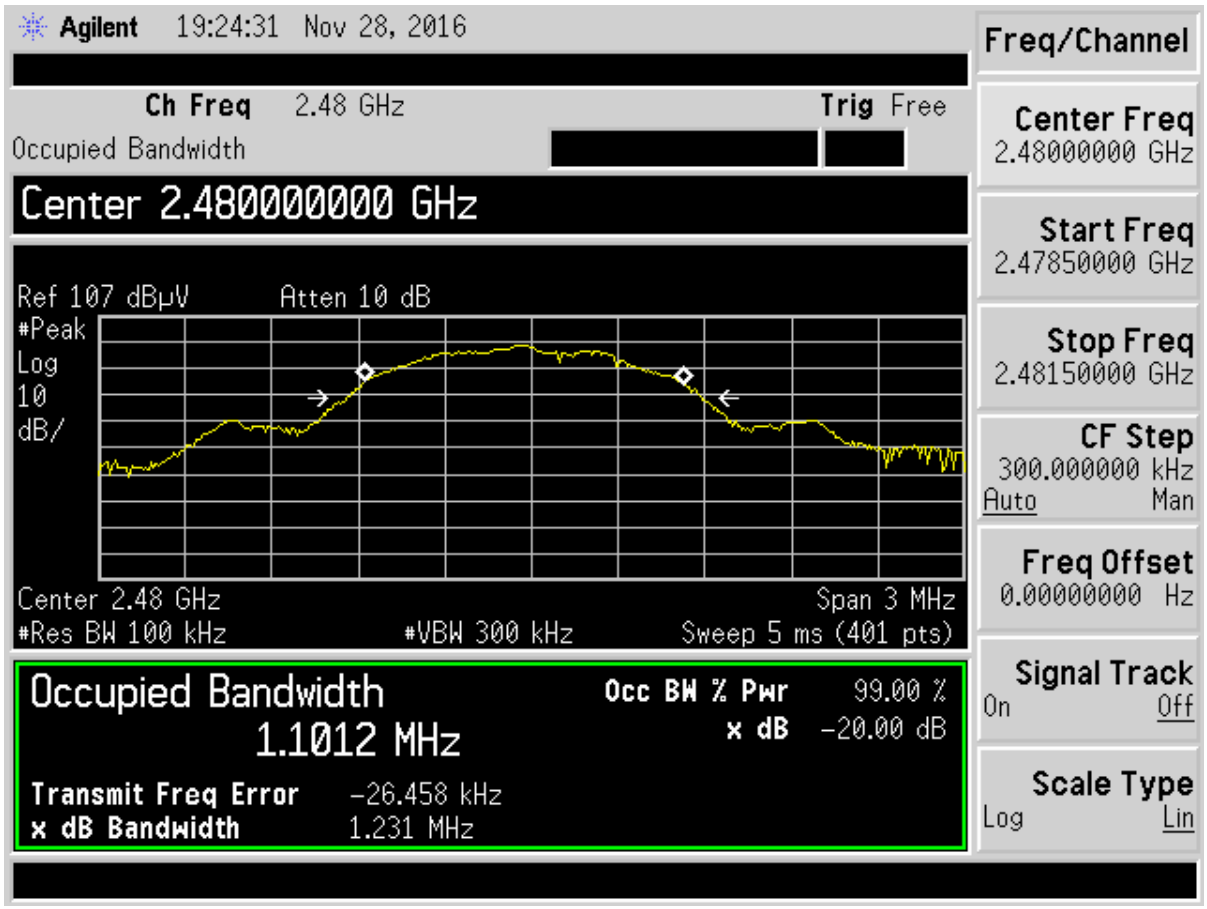


Figure 10. 99% Occupied Bandwidth – High Channel

2.13 Unintentional Radiator, Powerline Conducted Emissions (CFR 15.107)

The EUT can operate over a DC voltage input range of +3.3VDC to +18VDC, the nominal voltage was determined to be +15VDC, therefore the EUT was tested while being supplied a nominal voltage of +15VDC via non-filter bench top DC power supply.

Power line conducted emissions testing was performed to ensure that with the EUT in operation (exercising all transmitter functions), the complete system will meet the applicable requirements for CFR 15.107. These measurements were completed and are displayed in the sections below.

NOTE: The test data provided in this section is to support the Verification and co-location requirement for the digital apparatus and the radios within.

Table 15. Transmitter Power Line Conducted Emissions Test Data, Part 15.107

Conducted Emissions 150 kHz to 30 MHz						
Tested By: HR	Specification Requirement: FCC Part 15.107 Class B		Project No.: 16-0279	Manufacturer: Viper Design, LLC Model: VDLC52-79DP		
Frequency (MHz)	**Test Data (dBuV)**	**LISN+CL (dB)**	**Corrected Results (dBuV)**	**Avg Limits (dBuV)**	**Margin (dB)**	**Detector**
120 VAC, 60 Hz, Phase Line						
0.1800	27.58	0.43	28.01	66.0	38.0	PK
0.6370	24.96	0.29	25.25	60.0	34.7	PK
4.5200	27.40	0.37	27.77	60.0	32.2	PK
8.4120	20.94	0.48	21.42	60.0	38.6	PK
16.0300	15.90	0.65	16.55	60.0	43.4	PK
22.2300	16.45	0.80	17.25	60.0	42.8	PK
120 VAC, 60 Hz, Neutral Line						
0.2230	18.59	0.28	18.87	66.0	47.1	PK
0.9610	15.67	0.20	15.87	60.0	44.1	PK
4.5100	17.26	0.28	17.54	60.0	42.5	PK
8.4120	17.03	0.39	17.42	60.0	42.6	PK
11.1800	32.65	0.40	33.05	60.0	27.0	PK
22.8800	34.64	0.63	35.27	60.0	24.7	PK

SAMPLE CALCULATION AT 0.1800 MHz:

Magnitude of Measured Frequency	27.58	dBuV
+ Cable Loss+ LISN Loss	0.43	dB
Corrected Result	28.01	dBuV

Test Date: November 17, 2016

Tested By
Signature: Hossein Rahnama Name: Hossein Rahnama

2.14 Unintentional Radiator, Radiated Emissions (CFR 15.109)

The EUT can be sold in an enclosure which contains two EUT boards. Because of this, the version of the enclosure containing two EUT boards was tested to ensure that no spurious emissions were generated that exceeded the applicable limits. The test results are presented below.

Radiated emissions disturbance Measurements were performed with an instrument having both peak and quasi-peak detectors over the frequency range of 30 MHz to 12.5 GHz. Measurements of the radiated emissions were made with the receiver antenna at a distance of 3 m from the boundary of the test unit.

The test antenna was varied from 1 m to 4 m in height while watching the analyzers' display for the maximum magnitude of the signal at the test frequency. The antenna polarization (horizontal or vertical) and test sample azimuth were varied during the measurements to find the maximum field strength readings to record.

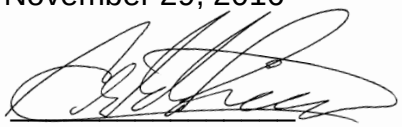
The worst-case radiated emissions in the range of 30 MHz to 12.5 GHz are more than 20 dB below the limit.

NOTE: The test data provided in this section is to support the Verification and co-location requirement for the digital apparatus and the radios within.

Table 16. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109),

30 MHz to 1000 MHz with Class B Limits							
Test: Radiated Emissions				**Client:** Viper Design, LLC			
Project: 16-0279				**Model:** VDLC52-79DP			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or QP**
No emissions within 20 dB of the limit were detected.							

Test Date: November 29, 2016

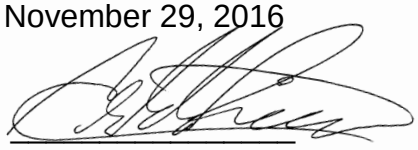
Tested By
Signature: 

Name: Ashton J. Picas

Table 17. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109),

1 GHz to 18 GHz with Class B Limits								
Test: Radiated Emissions					**Client:** Viper Design, LLC			
Project: 16-0279					**Model:** VDLC52-79DP			
Frequency (MHz)	**Test Data (dBuv)**	**Factor (dB)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or QP**
No emissions within 20 dB of the limit were detected.								

Test Date: November 29, 2016

Tested By
Signature: 

Name: Ashton J. Picas

2.15 Measurement Uncertainty

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4. A coverage factor of k=2 was used to give a level of confidence of approximately 95%.

2.15.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ± 2.85 dB.

2.15.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ± 5.4 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ± 5.19 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ± 5.08dB.