

**Application for Certification
For a Transmitter.**

Vutiliti Inc.
126 W. Sego Lily Drive, Suite 150
Sandy, UT 84070

Limited Modular Transmitter LoRa 500 kHz (DTS)

M/N: VUHDC1

FCC ID: 2APCG-VUHDC1

REPORT # UT06070A-004

This report was prepared in accordance with the requirements of the FCC Rules and Regulations Part 2, Subpart J, 2.1033, Part 15.247, RSS-247 Issue 2, and other applicable sections of the rules as indicated herein.

Prepared By:

DNB Engineering, Inc.
1100 E Chalk Creek Road
Coalville, UT 84017

13 Jun 2020

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Paragraph numbers in this report follow the application section numbers found in the FEDERAL COMMUNICATIONS COMMISSION Rules and Regulations, Part 2, Subpart J for Certification of electronic equipment.

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1.0 ADMINISTRATIVE DATA

1.1 Certifications and Qualifications

I certify that DNB Engineering, Inc conducted the tests performed in order to obtain the technical data presented in this application. Also, based on the results of the enclosed data, I have concluded that the equipment tested meets or exceeds the requirements of the Rules and Regulations governing this application.

1.2 Measurement Repeatability Information

The test data presented in this report has been acquired using the guidelines set forth in FCC Part 2.1031 through 2.1057, Part 15. The test results presented in this document are valid only for the equipment identified herein under the test conditions described. Repeatability of these test results will only be achieved with identical measurement conditions. These conditions include: The same test distance, EUT Height, Measurement Site Characteristics, and the same EUT System Components. The system must have the same Interconnecting Cables arranged in identical placement to that in the test set-up, with the system and/or EUT functioning in the identical mode of operation (i.e. software and so on) as on the date of the test. Any deviation from the test conditions and the environment on the date of the test may result in measurement repeatability difficulties.

All changes made to the EUT during the course of testing as identified in this test report must be incorporated into the EUT or identical models to ensure compliance with the FCC regulations.



C. L. Payne III (Para. 1.1)
Facility Manager
Coalville Facility.
DNB Engineering, Inc.
Tel. (435) 336-4433
FAX (435) 336-4436

1.3 Test Equipment List

TEST EQUIPMENT LIST - CONDUCTED EMISSIONS					
Description	Manufacturer	Model No.	Asset #	Serial #	Cal Due
LISN	Fisher Custom Communications	FCCLISN5032401	U-286	2020	03 Feb 2021
Spectrum Analyzer	Rhode & Schwarz	FSV30	U-248	101367	17 Aug 2020
TILE Software	ETS Lindgren	3.4.11.13	U-317	8112006	07 Mar 2021

TEST EQUIPMENT LIST - RADIATED EMISSIONS					
Description	Manufacturer	Model No.	Asset #	Serial #	Cal Due
Pre-Amplifier	Hewlett Packard	8447D	U-068	2727A06184	04 Aug 2020
Pre-Amplifier	DNB	S-21G	U-095	U-095-1	03 Feb 2021
DRG Horn Antenna	AH Systems	SAS-571	U-071	417	11 Jul 2020
Spectrum Analyzer	Rhode & Schwarz	FSV30	U-248	101367	17 Aug 2020
TILE Software	ETS- Lindgern	3.4.11.13	U-317	8112006	07 Mar 2021

TEST EQUIPMENT LIST - ANTENNA CONDUCTED					
Description	Manufacturer	Model No.	Asset #	Serial #	Cal Due
Spectrum Analyzer	Rhode & Schwarz	FSV30	U-248	101367	17 Aug 2020

1.4 Test Summary Cross Reference

Test Item	FCC Requirement	IC Requirement	Test Method	Result
Antenna Requirement	15.203/15.247	RSS-Gen 6.8	---	Pass
Conducted Emissions (General Provisions)	15.207	RSS-Gen 8.8	ANSI C63.10-2013	Pass
Radiated Emissions (General Provisions)	15.209	RSS-Gen 8.9	ANSI C63.10-2013	Pass
Output Power (FHSS)	15.247 (b,2)	RSS-247 5.4 d)	ANSI C63.10-2013 Clause 11.9.1.1	Pass
Power Spectral Density	15.247 (e)	RSS-247 5.2 b)	ANSI C63.10-2013 Clause 11.10.2	Pass
Band-edge RF Conducted	15.247 (d)	RSS-247 5.5	ANSI C63.10-2013 Clause 11.13.2	Pass
DTS Bandwidth	15.247 (a,2)	RSS-247 5.2 a)	ANSI C63.10-2013 Clause 11.8.1	Pass
Conducted Spurious	15.247 (d)	RSS-247 5.5	ANSI C63.10-2013 Clause 11.11.3	Pass
Radiated Spurious Emissions	15.247 (d)	RSS-247 5.5	ANSI C63.10-2013 Clause 11.12.2.7	Pass
Restricted Bands	15.247 (d)	RSS-Gen 8.10	ANSI C63.10-2013 Clause 11.12.2	Pass

RSS-GEN Issue 5 Mar 2019
 RSS-247 Issue 2 Feb 2017

Preliminary scans were performed to determine worst case modulation, packet length, and data rates. Only worst case data has been recorded within the body of the test report.

1.5 Measurement Uncertainty

Measurement Type	Uncertainty
AC Conducted Emissions	± 1.67 dB
OATS - Radiated Emissions - Vertical Biconical (30-300MHz)	± 4.17 dB
OATS - Radiated Emissions - Horizontal Biconical (30-300MHz)	± 4.22 dB
OATS - Radiated Emissions - Vertical Log Periodic (300-100MHz)	± 4.92 dB
OATS - Radiated Emissions - Horizontal Log Periodic (300-1000MHz)	± 4.79 dB
OATS - Radiated Emissions - Vertical DRG Horn (> 1GHz)	± 5.74 dB
OATS - Radiated Emissions - Horizontal DRG Horn (>1GHz)	± 5.80 dB
Antenna Conducted Measurements	± 1.96 dB

2.1033 (b) (1) Application for Certification

Name of Applicant:	Vutiliti Inc. 126 W. Segoe Lily Drive, Suite 150 Sandy, UT 84070
FRN Number:	0027379361
Name of Manufacturer :	Vutiliti Inc. 126 W. Segoe Lily Drive, Suite 150 Sandy, UT 84070
Description:	Limited Modular Transmitter LoRa 500 kHz (DTS)
Model Number(s):	VUHDC1
Anticipated Production Quantity:	Multiple Units
Frequency Band:	DTS 902.3 - 914.9 MHz
Rated Power:	DTS 15.72dBm (37.3mW)
Type of Signal:	Digital Transmission System (DTS)
Channels:	8 Channels
Max Data Rate:	27kbps - Data transmission is not continuous, it happens for short intervals for short periods of time.
Antenna Type:	External - Monopole
Antenna Gain:	2dBi

2.1033 (b,2) FCC Identifier

Model Number: VUHDC1
FCC ID: 2APCG-VUHDC1

The FCC ID is placed on the exterior surface of a plastic shell which covers the module and after insertion into the Vutiliti Host Device is still visible per FCC Module Label Guidelines.

Furthermore, both the module and the “host” are under the complete control of the grantee (Vutiliti).

The module is not sold to any third party or OEM manufacturer and is never outside the complete control of the Grantee (Vutiliti).

Photograph below shows the FCC ID placement.



2.1033 (b,3)	Installation and Operating Instructions -	Supplied separately.
2.1033 (b,4)	Brief Description of Circuit Function -	Supplied separately.
2.1033 (b,5)	Block Diagram -	Supplied separately.
2.1033 (b,7)	Equipment Photographs -	Supplied separately.

2.1033 (b,6) Report of Measurements

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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Pass - Antenna gain is equal to or less than 2dBi

Pass - Module is limited to Grantee's own products and not intended for sale to third parties, antennas are supplied by the grantee and are professionally installed by grantee in end use products at the time of manufacture.

Antenna is limited to one of the following two antennas:

Dongguan Haonuo Electronic Co Ltd
Bondale Electronics Ltd

P/n: HN0915-57C01SM
P/n: G-RA0K11165091-Q0011

Test Procedure: As specified in ANSI C63.10-2013

To measure conducted emissions, the EUT was set upon a wooden table in the shielded enclosure. AC power was fed into the EUT from the Artificial Mains Network. With the Artificial Mains Network connected to an Rhode & Schwarz FSV Signal and Spectrum Analyzer, and using Personal Computer with TILES Measurement Software, the spectrum was searched from 0.15 - 30 MHz for emissions emanating from the EUT.

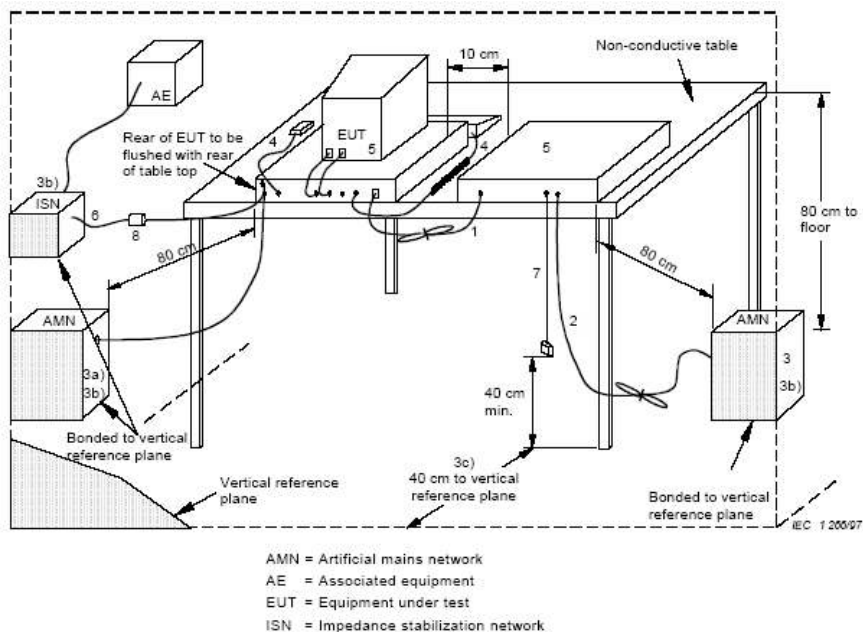
Frequency of emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 - 0.5	66 to 56*	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

* Decreases with the logarithm of the frequency.

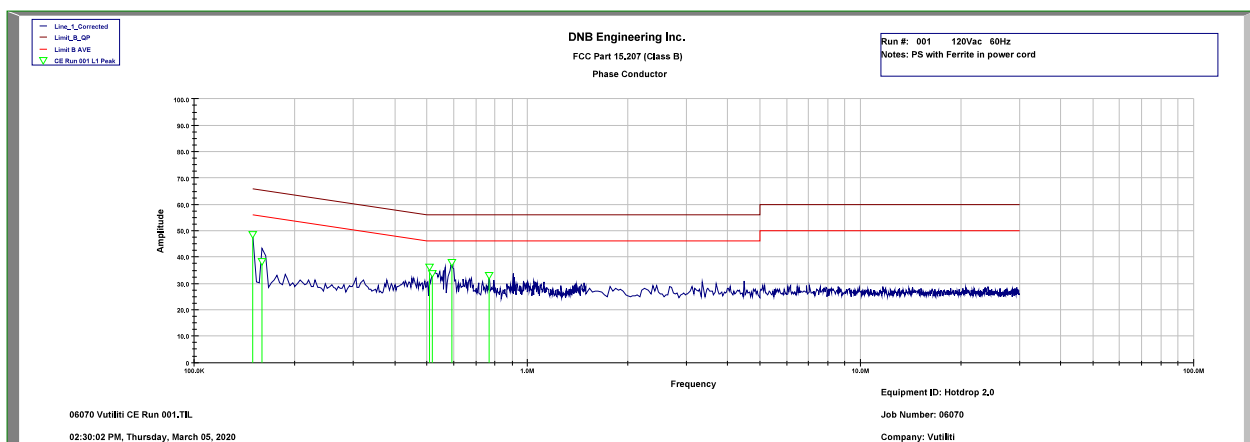
EUT operating conditions:

The software provided by the client to enable the EUT to transmit continuously.

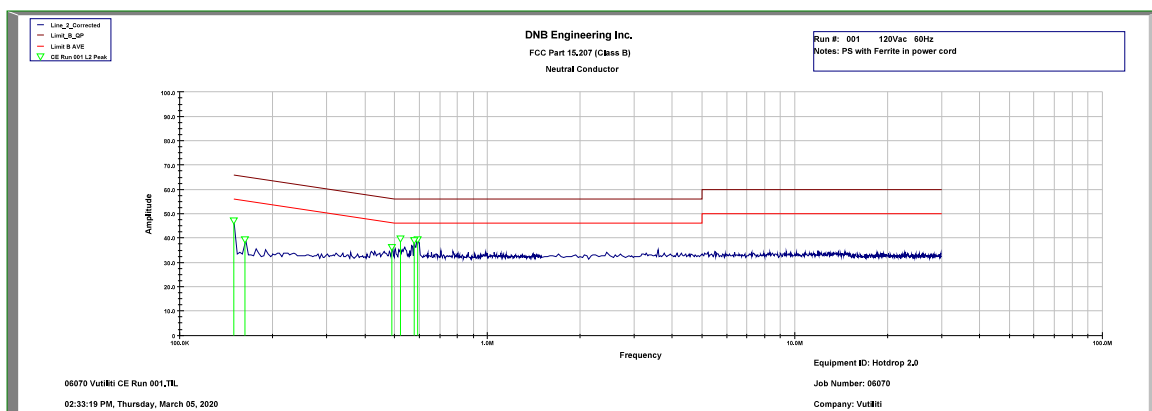
Test Set Up:



		1100 E Chalk Creek Road Coalville, UT 84017 (435) 336-4433 FAX (435) 336-4436				Conducted Emissions				
DNB Job Number:		06070			Date:		5 Mar 2020		Specification [X] 15.207 [X] ANSI C63.10-2013	
Customer:		Vutiliti Inc.								
Model Number:		VUHDC1								
Description:		Limited Modular Transmitter								
		Power supply as supplied from manufacturer (w/ferrite)								
EUT is in conformance with FCC 15.207				X	YES		NO	Signed	Y Staples	
CONDUCTED EMISSIONS										
Freq in MHz	Meter Reading dBuV	Factors in dB		Corr'd Reading dBuV	Limit		Lead	Measure Type	Delta dB	
		LISN	Cable		dBuV	Type				
0.150	48.40	0.0	0.1	48.54	56.00	AVE	Phase	Peak	-7.46	
0.160	38.00	0.0	0.1	38.15	55.71	AVE	Phase	Peak	-17.56	
0.508	36.00	0.1	0.0	36.10	46.00	AVE	Phase	Peak	-9.90	
0.517	33.70	0.1	0.0	33.80	46.00	AVE	Phase	Peak	-12.20	
0.595	38.00	0.1	0.0	38.10	46.00	AVE	Phase	Peak	-7.90	
0.767	33.00	0.1	0.0	33.10	46.00	AVE	Phase	Peak	-12.90	



		1100 E Chalk Creek Road Coalville, UT 84017 (435) 336-4433 FAX (435) 336-4436				Conducted Emissions					
DNB Job Number:		06070				Date:		5 Mar 2020		Specification [X] 15.207 [X] ANSI C63.10-2013	
Customer:		Vutiliti Inc.									
Model Number:		VUHDC1									
Description:		Limited Modular Transmitter									
		Power supply as supplied from manufacturer (w/ferrite)									
EUT is in conformance with FCC 15.207					X	YES		NO	Signed	Y Staples	
CONDUCTED EMISSIONS											
Freq in MHz	Meter Reading dBuV	Factors in dB		Corr'd Reading dBuV	Limit		Lead	Measure Type	Delta dB		
		LISN	Cable		dBuV	Type					
0.150	47.00	0.0	0.1	47.14	56.00	AVE	Neutral	Peak	-8.86		
0.163	39.00	0.0	0.1	39.15	55.63	AVE	Neutral	Peak	-16.48		
0.490	36.10	0.1	0.0	36.20	46.29	AVE	Neutral	Peak	-10.09		
0.521	39.60	0.1	0.0	39.70	46.00	AVE	Neutral	Peak	-6.30		
0.578	38.90	0.1	0.0	39.00	46.00	AVE	Neutral	Peak	-7.00		
0.595	39.20	0.1	0.0	39.30	46.00	AVE	Neutral	Peak	-6.70		





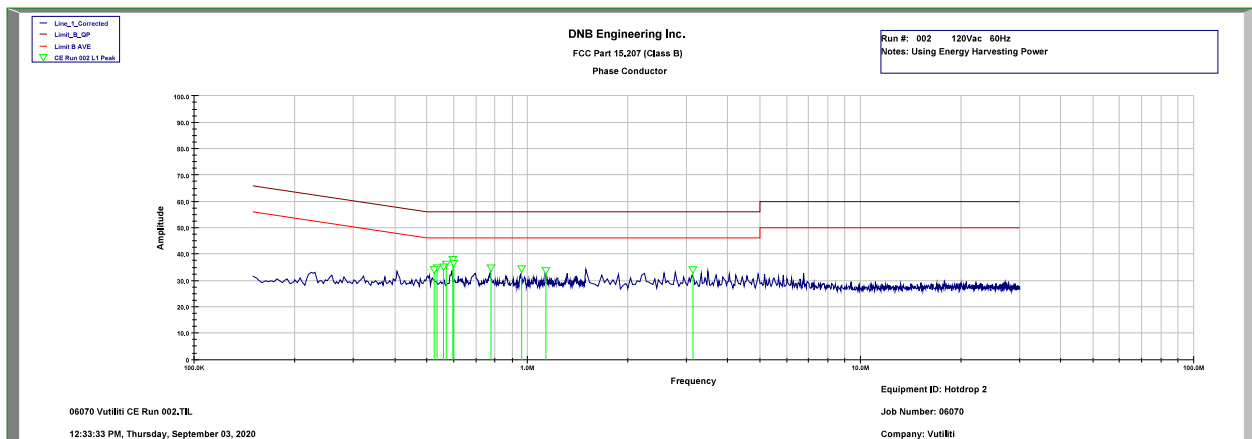
1100 E Chalk Creek Road
Coalville, UT 84017
(435) 336-4433
FAX (435) 336-4436

Conducted Emissions

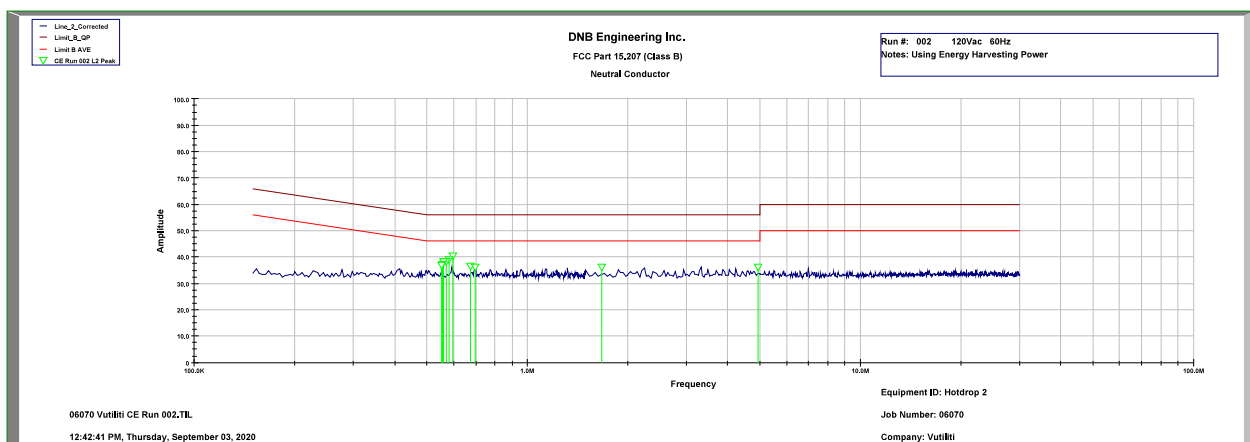
DNB Job Number:	06070	Date:			3 Sep 2020	Specification [X] 15.207 [X] ANSI C63.10-2013	
Customer:	Vutiliti Inc.						
Model Number:	VUHDC1						
Description:	Limited Modular Transmitter						
	Powered using energy harvesting method (Clamp-on)						
EUT is in conformance with FCC 15.207		X	YES		NO	Signed	CL Payne

CONDUCTED EMISSIONS

Freq in MHz	Meter Reading dBuV	Factors in dB		Corr'd Reading dBuV	Limit		Lead	Measure Type	Delta dB
		LISN	Cable		dBuV	Type			
0.525	33.82	0.1	0.0	33.94	46.0	AVE	L1	Peak	-12.06
0.535	34.69	0.1	0.0	34.80	46.0	AVE	L1	Peak	-11.20
0.562	34.88	0.1	0.0	35.00	46.0	AVE	L1	Peak	-11.00
0.572	36.00	0.1	0.0	36.12	46.0	AVE	L1	Peak	-9.88
0.596	37.94	0.1	0.0	38.06	46.0	AVE	L1	Peak	-7.94
0.602	36.47	0.1	0.0	36.59	46.0	AVE	L1	Peak	-9.41
0.778	34.56	0.1	0.0	34.70	46.0	AVE	L1	Peak	-11.30
0.960	34.34	0.1	0.1	34.53	46.0	AVE	L1	Peak	-11.47
1.140	33.54	0.1	0.1	33.76	46.0	AVE	L1	Peak	-12.24
3.150	33.49	0.1	0.4	33.97	46.0	AVE	L1	Peak	-12.03



		1100 E Chalk Creek Road Coalville, UT 84017 (435) 336-4433 FAX (435) 336-4436		Conducted Emissions					
DNB Job Number:	06070	Date:	3 Sep 2020	Specification [X] 15.207 [X] ANSI C63.10-2013					
Customer:	Vutiliti Inc.								
Model Number:	VUHDC1								
Description:	Limited Modular Transmitter Powered using energy harvesting method (Clamp-on)								
EUT is in conformance with FCC 15.207		X	YES		NO	Signed	CL Payne		
CONDUCTED EMISSIONS									
Freq in MHz	Meter Reading dBuV	Factors in dB		Corr'd Reading dBuV	Limit		Lead	Measure Type	Delta dB
		LISN	Cable		dBuV	Type			
0.552	36.95	0.1	0.0	37.07	46.0	AVE	L2	Peak	-8.94
0.555	37.00	0.1	0.0	37.12	46.0	AVE	L2	Peak	-8.88
0.558	38.13	0.1	0.0	38.25	46.0	AVE	L2	Peak	-7.75
0.572	38.36	0.1	0.0	38.48	46.0	AVE	L2	Peak	-7.52
0.582	38.90	0.1	0.0	39.02	46.0	AVE	L2	Peak	-6.98
0.596	40.48	0.1	0.0	40.60	46.0	AVE	L2	Peak	-5.40
0.673	36.40	0.1	0.0	36.53	46.0	AVE	L2	Peak	-9.47
0.697	36.23	0.1	0.0	36.36	46.0	AVE	L2	Peak	-9.64
1.670	35.76	0.1	0.2	36.09	46.0	AVE	L2	Peak	-9.91
4.940	35.67	0.1	0.5	36.26	46.0	AVE	L2	Peak	-9.74





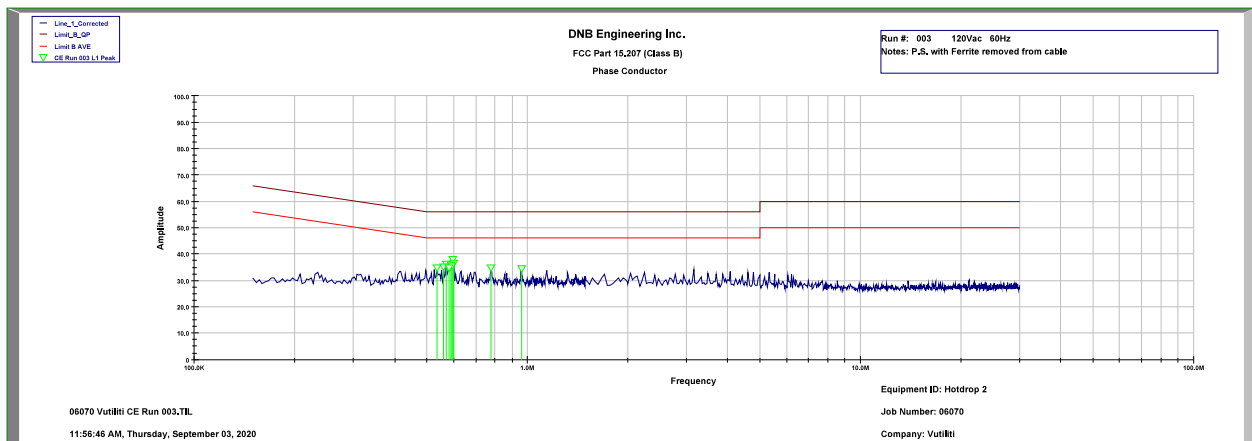
1100 E Chalk Creek Road
Coalville, UT 84017
(435) 336-4433
FAX (435) 336-4436

Conducted Emissions

DNB Job Number:	06070	Date:			3 Sep 2020	Specification [X] 15.207 [X] ANSI C63.10-2013	
Customer:	Vutiliti Inc.						
Model Number:	VUHDC1						
Description:	Limited Modular Transmitter						
	With ferrite removed from power cord						
EUT is in conformance with FCC 15.207		X	YES		NO	Signed	CL Payne

CONDUCTED EMISSIONS

Freq in MHz	Meter Reading dBuV	Factors in dB		Corr'd Reading dBuV	Limit		Lead	Measure Type	Delta dB
		LISN	Cable		dBuV	Type			
0.535	34.69	0.0	0.1	34.80	46.0	AVE	L1	Peak	-11.20
0.562	34.88	0.0	0.1	35.00	46.0	AVE	L1	Peak	-11.00
0.572	36.00	0.0	0.1	36.12	46.0	AVE	L1	Peak	-9.88
0.582	34.62	0.0	0.1	34.74	46.0	AVE	L1	Peak	-11.26
0.589	35.83	0.0	0.1	35.95	46.0	AVE	L1	Peak	-10.05
0.592	35.47	0.0	0.1	35.59	46.0	AVE	L1	Peak	-10.41
0.596	37.94	0.0	0.1	38.06	46.0	AVE	L1	Peak	-7.94
0.602	36.47	0.0	0.1	36.59	46.0	AVE	L1	Peak	-9.41
0.778	34.56	0.0	0.1	34.70	46.0	AVE	L1	Peak	-11.30
0.960	34.34	0.1	0.2	34.53	46.0	AVE	L1	Peak	-11.47





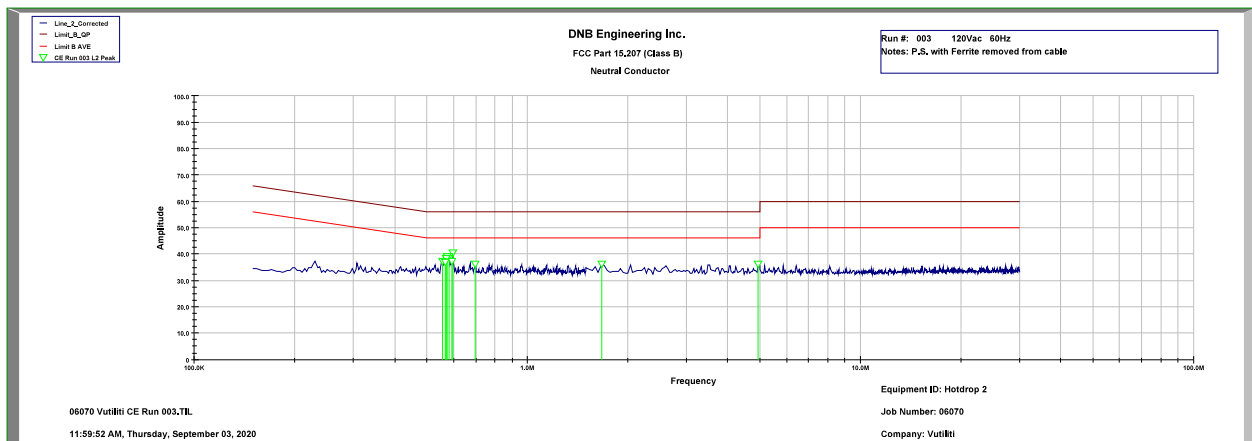
1100 E Chalk Creek Road
Coalville, UT 84017
(435) 336-4433
FAX (435) 336-4436

Conducted Emissions

DNB Job Number:	06070	Date:			3 Sep 2020	Specification [X] 15.207 [X] ANSI C63.10-2013	
Customer:	Vutiliti Inc.						
Model Number:	VUHDC1						
Description:	Limited Modular Transmitter						
	With ferrite removed from power cord						
EUT is in conformance with FCC 15.207		X	YES		NO	Signed	CL Payne

CONDUCTED EMISSIONS

Freq in MHz	Meter Reading dBuV	Factors in dB		Corr'd Reading dBuV	Limit		Lead	Measure Type	Delta dB
		LISN	Cable		dBuV	Type			
0.555	37.00	0.0	0.1	37.12	46.0	AVE	L2	Peak	-8.88
0.569	36.88	0.0	0.1	37.00	46.0	AVE	L2	Peak	-9.00
0.572	38.36	0.0	0.1	38.48	46.0	AVE	L2	Peak	-7.52
0.575	38.80	0.0	0.1	38.92	46.0	AVE	L2	Peak	-7.08
0.582	38.90	0.0	0.1	39.02	46.0	AVE	L2	Peak	-6.98
0.592	37.10	0.0	0.1	37.22	46.0	AVE	L2	Peak	-8.78
0.596	40.48	0.0	0.1	40.60	46.0	AVE	L2	Peak	-5.40
0.697	36.23	0.0	0.1	36.36	46.0	AVE	L2	Peak	-9.64
1.670	35.76	0.2	0.3	36.09	46.0	AVE	L2	Peak	-9.91
4.940	35.67	0.5	0.6	36.26	46.0	AVE	L2	Peak	-9.74



Test Procedure: ANSI C63.10-2013

The EUT was measured on an open area test site (OATS).

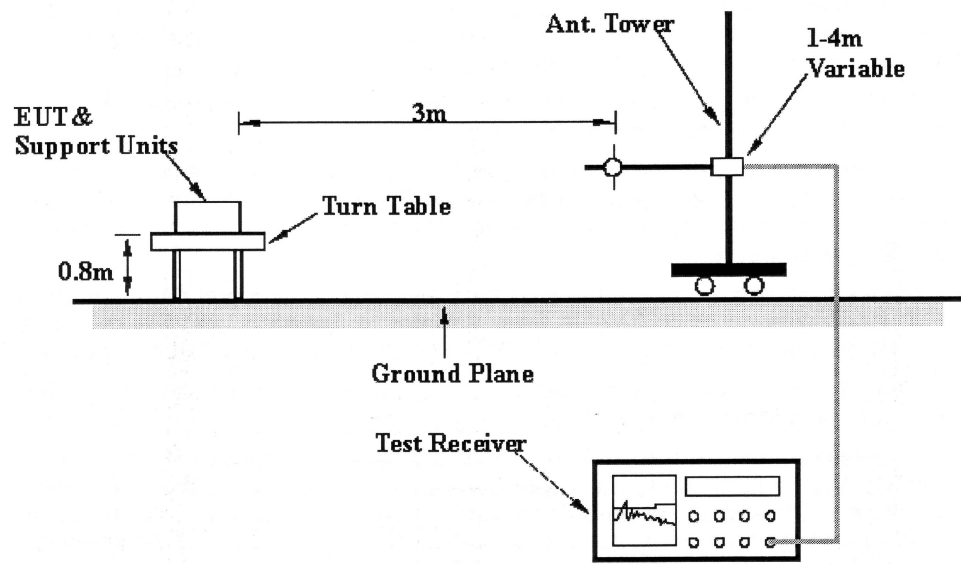
A measuring distance of at least 3 m shall be used for measurements at frequencies up to 1 GHz. For frequencies above 1 GHz, any suitable measuring distance may be used. The equipment size (excluding the antenna) shall be less than 20 % of the measuring distance.

Sufficient precautions shall be taken to ensure that reflections from extraneous objects adjacent to the site do not degrade the measurement results, in particular:

- no extraneous conducting objects having any dimension in excess of a quarter wavelength of the highest frequency tested shall be in the immediate vicinity of the site;
- all cables shall be as short as possible; as much of the cables as possible shall be on the ground plane or preferably below; and the low impedance cables shall be screened.
- EUT was positioned in three orthogonal axis - only the worst case data (X-Axis) has been recorded

The EUT shall be placed upon a non-conductive table (wooden for below 1GHz and styrene above 1GHz) 0.80 meters above the ground plane for frequencies from 30 to 1000MHz and 1.5 meters above the ground plane above 1 GHz and shall be placed in the “worst case” transmitting mode. The EUT shall be rotated 360 degrees to find the azimuth maxima. The receive antenna shall then be raised and lowered between 1 to 4 meters to find the maximum signal emanating from the EUT. This signal strength is then recorded on the data sheets.

Frequency (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measurement Distance (meters)
.0009 - 0.490	2400/F(kHz)	20*(Log ₁₀ (2400/F(kHz)))	300
0.490 - 1.705	24000/F(kHz)	20*(Log ₁₀ (24000/F(kHz)))	30
1.705 - 30.0	30	29.5	30
30 - 88	100	40.0	3
88 - 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54.0	3



		1100 E Chalk Creek Road Coalville, UT 84017 (435) 336-4433 FAX (435) 336-4436		Radiated Emissions (General)							
DNB Job Number:		06070		Date:		4 Mar 2020		Specification [X] 15.209 [X] ANSI C63.10-2013			
Customer:		Vutiliti Inc.									
Model Number:		VUHDC1									
Description:		Limited Modular Transmitter									
EUT is in conformance with FCC 15.209				X	YES		NO	Signed	Y Staples		
X - Axis											
FREQ (Mhz)	S/A Reading (dBuV/m)	Correction Factors (dB)			dBuV/m			Positions			
		Ant	Cbl	Amp	Corr	Lim	Delta	Typ	Tbl	Pl	Hgt
30.838	19.58	19.43	1.23	26.30	13.94	40.0	-26.06	QP	0	Horz	4.00
33.558	19.46	17.91	1.34	26.30	12.41	40.0	-27.60	QP	0	Horz	4.00
36.478	19.89	16.30	1.43	26.27	11.35	40.0	-28.66	QP	0	Horz	4.00
54.644	34.22	10.65	1.69	26.15	20.41	40.0	-19.59	QP	67	Vert	1.00
62.830	33.95	10.77	1.83	26.10	20.45	40.0	-19.56	QP	214	Vert	1.00
64.600	32.30	10.88	1.85	26.10	18.92	40.0	-21.09	QP	214	Vert	1.00
128.280	35.56	11.85	2.57	25.96	24.02	43.5	-19.49	QP	158	Vert	1.00
129.210	34.47	11.88	2.58	25.95	22.98	43.5	-20.53	QP	158	Vert	1.00
169.979	29.30	14.50	3.25	25.80	21.25	43.5	-22.26	QP	0	Vert	1.05
746.400	33.05	27.60	7.62	27.01	41.27	46.0	-4.74	QP	108	Vert	4.00

		1100 E Chalk Creek Road Coalville, UT 84017 (435) 336-4433 FAX (435) 336-4436		Radiated Emissions (General)							
DNB Job Number:		06070		Date:		4 Mar 2020		Specification [X] 15.209 [X] ANSI C63.10-2013			
Customer:		Vutiliti Inc.									
Model Number:		VUHDC1									
Description:		Limited Modular Transmitter									
EUT is in conformance with FCC 15.209				X	YES		NO	Signed	Y Staples		
Y - Axis											
FREQ (Mhz)	S/A Reading (dBuV/m)	Correction Factors (dB)			dBuV/m			Positions			
		Ant	Cbl	Amp	Corr	Lim	Delta	Typ	Tbl	Pl	Hgt
127.808	17.94	11.83	2.56	25.96	6.37	43.5	-37.14	QP	0	Horz	4.00
135.620	17.72	12.07	2.71	25.92	6.58	43.5	-36.93	QP	0	Horz	4.00
170.072	17.25	14.50	3.25	25.80	9.20	43.5	-34.31	QP	0	Horz	4.00
54.680	34.98	10.65	1.69	26.15	21.17	40.0	-18.83	QP	292	Vert	1.00
63.200	34.22	10.79	1.83	26.10	20.74	40.0	-19.26	QP	147	Vert	1.00
126.525	32.03	11.80	2.53	25.97	20.39	43.5	-23.12	QP	154	Vert	1.00
128.630	33.45	11.86	2.57	25.96	21.92	43.5	-21.58	QP	152	Vert	1.00
170.002	29.00	14.50	3.25	25.80	20.95	43.5	-22.56	QP	0	Vert	1.10
746.400	32.60	27.60	7.62	27.01	40.82	46.0	-5.19	QP	112	Vert	4.00

		1100 E Chalk Creek Road Coalville, UT 84017 (435) 336-4433 FAX (435) 336-4436		Radiated Emissions (General)							
DNB Job Number:		06070		Date:		4 Mar 2020		Specification [X] 15.209 [X] ANSI C63.10-2013			
Customer:		Vutiliti Inc.									
Model Number:		VUHDC1									
Description:		Limited Modular Transmitter									
EUT is in conformance with FCC 15.209				X	YES		NO	Signed		Y Staples	
Z - Axis											
FREQ (Mhz)	S/A Reading	Correction Factors (dB)			dBuV/m			Positions			
		Ant	Cbl	Amp	Corr	Lim	Delta	Typ	Tbl	Pl	Hgt
170.273	34.98	14.49	3.25	25.80	26.92	43.5	-16.59	QP	0	Horz	4.00
746.355	26.30	27.60	7.62	27.01	34.52	46.0	-11.49	QP	285	Horz	3.07
54.547	36.27	10.65	1.69	26.15	22.46	40.0	-17.55	QP	221	Vert	1.00
61.970	35.37	10.72	1.82	26.10	21.81	40.0	-18.20	QP	81	Vert	1.00
82.480	27.96	10.92	2.10	26.00	14.98	40.0	-25.02	QP	205	Vert	1.00
126.410	34.20	11.79	2.53	25.97	22.55	43.5	-20.96	QP	139	Vert	1.00
128.260	31.99	11.85	2.57	25.96	20.44	43.5	-23.06	QP	139	Vert	1.00
170.002	28.70	14.50	3.25	25.80	20.65	43.5	-22.86	QP	0	Vert	1.17
746.379	31.55	27.60	7.62	27.01	39.77	46.0	-6.24	QP	172	Vert	4.00

11.9.1 Maximum peak conducted output power**11.9.1.1 $RBW \geq DTS$ bandwidth**

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

- a) Set the $RBW \geq DTS$ bandwidth.
- b) Set $VBW \geq [3 \times RBW]$.
- c) Set span $\geq [3 \times RBW]$.
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

Requirement: FCC Part 15.247 Clause (b,3)

15.247 Operation within the bands 902-928 MHz.

- (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
- (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Limit : 1 watt or 30dBm

Client: Vutiliti

Date: 3 May 2020

DNB Job: 06070

EUT: Limited Modular Transmitter LoRa 500 kHz (DTS)

Model No: VUHDC1

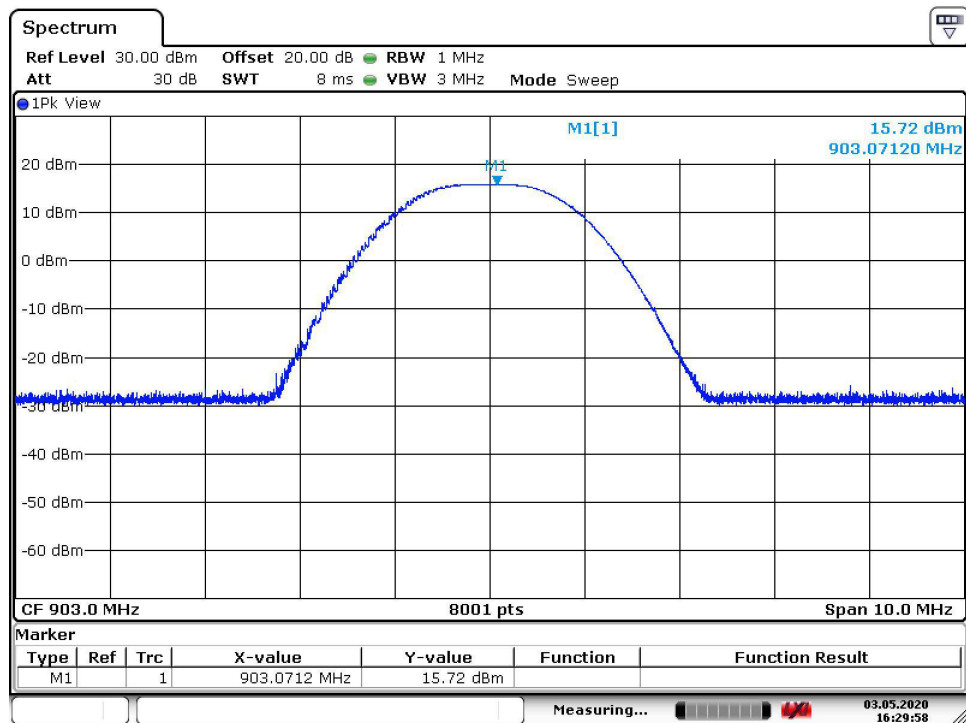
Requirement ≤ 1 Watt or 30dBm

Tech: CL Payne

Low Channel: 903 MHz

Power: 15.72dBm

Result: Pass



Date: 3.MAY.2020 16:29:58

Client: Vutiliti

Date: 3 May 2020

DNB Job: 06070

EUT: Limited Modular Transmitter LoRa 500 kHz (DTS)

Model No: VUHDC1

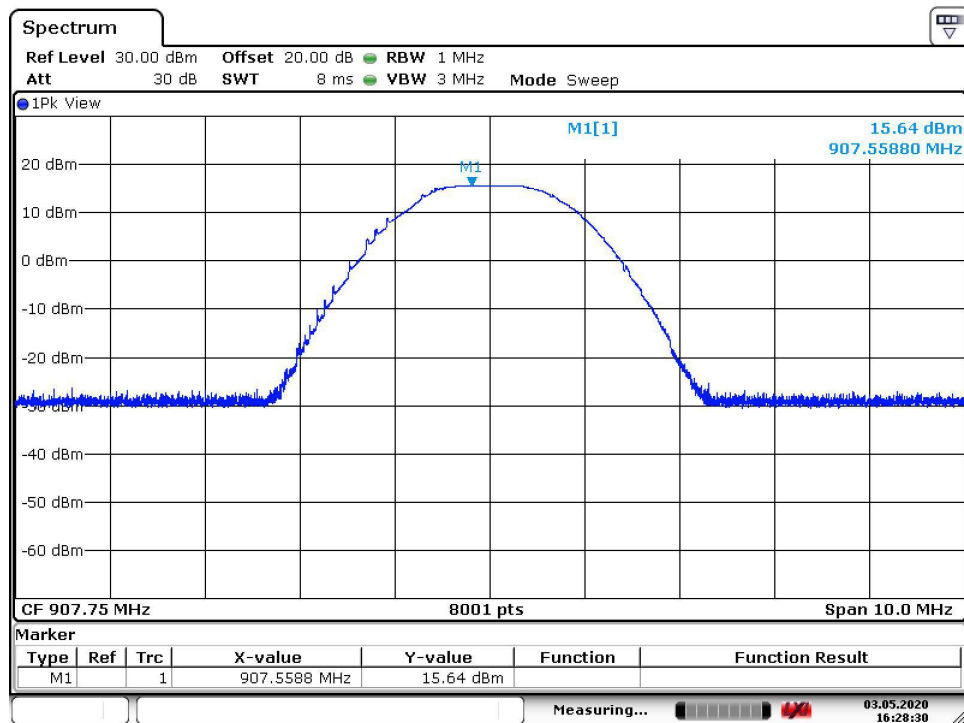
Requirement ≤ 1 Watt or 30dBm

Tech: CL Payne

Mid Channel: 907.75 MHz

Power: 15.64dBm

Result: Pass



Date: 3.MAY.2020 16:28:30

Client: Vutiliti

Date: 3 May 2020

DNB Job: 06070

EUT: Limited Modular Transmitter LoRa 500 kHz (DTS)

Model No: VUHDC1

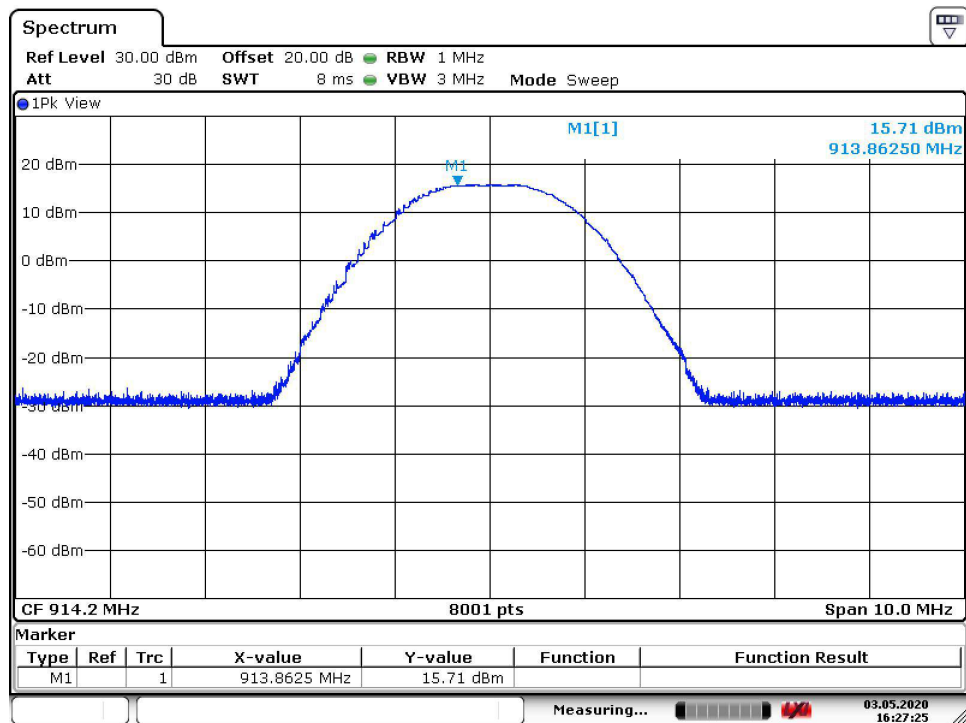
Requirement ≤ 1 Watt or 30dBm

Tech: CL Payne

High Channel: 914.2 MHz

Power: 15.71dBm

Result: Pass



Date: 3.MAY.2020 16:27:26

Clause 11.10.2 Method PKPSD (peak PSD)

The following procedure shall be used if the maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

- a) Set analyzer center frequency to DTS channel center frequency
- b) Set the span to 1.5 times the DTS bandwidth
- c) Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
- d) Set the VBW $\geq [3 \times \text{RBW}]$
- e) Detector = peak
- f) Sweep time = auto couple
- g) Trace mode = max hold
- h) Allow trace to fully stabilize
- i) Use the peak marker function to determine the maximum amplitude level within the RBW
- j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat
- k) Submit plots

Requirement: FCC Part 15.247 Clause (e)

15.247 Power Spectral Density.

- (e) For digitally modulated systems, 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Client: Vutiliti

Date: 3 May 2020

DNB Job: 06070

EUT: Limited Modular Transmitter LoRa 500 kHz (DTS)

Model No: VUHDC1

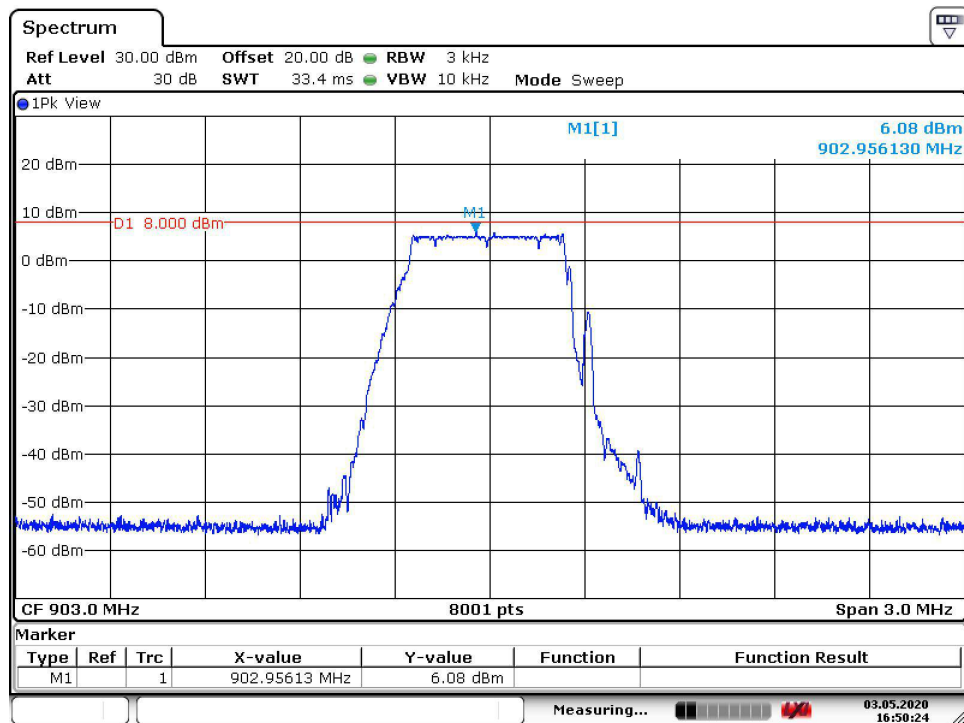
Requirement $\leq 8\text{dBm}$

Tech: CL Payne

Low Channel: 903 MHz

Power: 6.08 dBm

Result: Pass



Date: 3.MAY.2020 16:50:25

Client: Vutiliti

Date: 3 May 2020

DNB Job: 06070

EUT: Limited Modular Transmitter LoRa 500 kHz (DTS)

Model No: VUHDC1

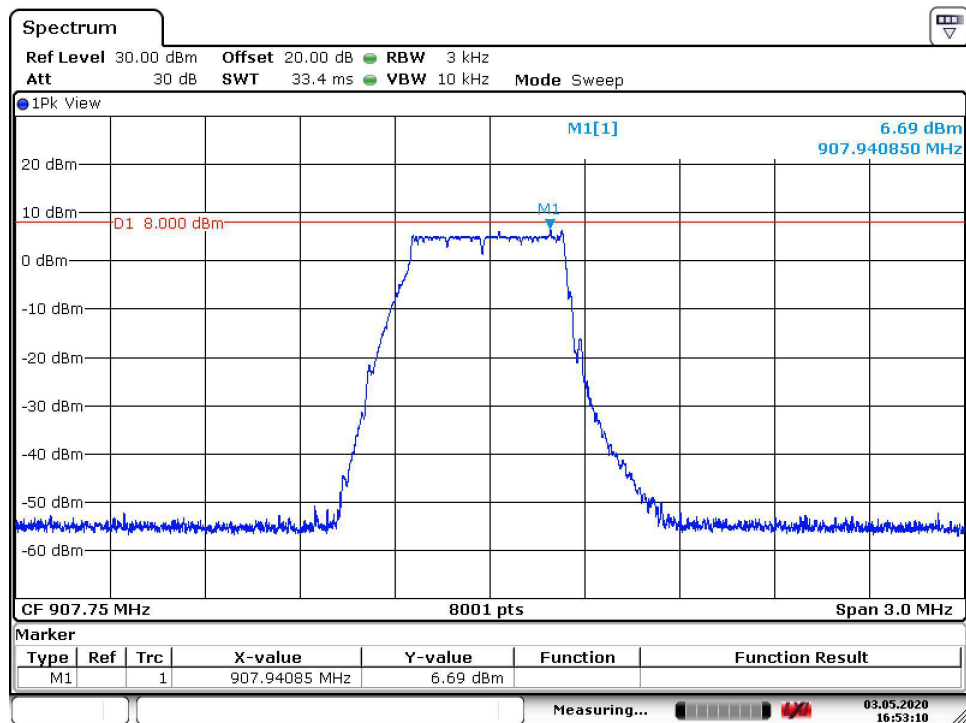
Requirement $\leq 8\text{dBm}$

Tech: CL Payne

Mid Channel: 907.75 MHz

Power: 6.69 dBm

Result: Pass



Date: 3.MAY.2020 16:53:10

Client: Vutiliti

Date: 3 May 2020

DNB Job: 06070

EUT: Limited Modular Transmitter LoRa 500 kHz (DTS)

Model No: VUHDC1

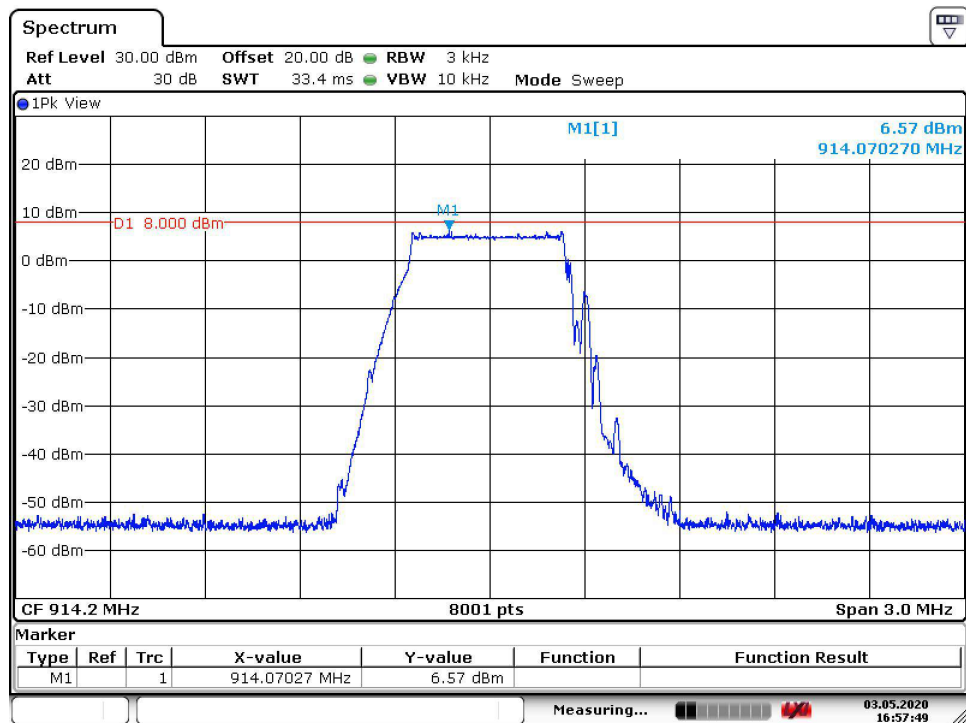
Requirement $\leq 8\text{dBm}$

Tech: CL Payne

High Channel: 914.2 MHz

Power: 6.57 dBm

Result: Pass



Date: 3.MAY.2020 16:57:49

For band-edge measurements, use the band-edge procedure in 6.10. Band-edge measurements shall be tested both on single channels, and with the EUT hopping.

6.10 Band-edge testing

The following procedure shall be used when band-edge measurements are required.

6.10.1 Band-edge data reporting requirements

These reporting requirements are applicable to all devices for which band-edge measurements are required. On each operating frequency measured, band-edge emissions shall be reported by providing plots of the measuring instrument display. The axes, the scale units per division, and the limit shall be clearly labeled in the test report. Tabular data are not suitable for reporting band-edge emissions.

6.10.4 Authorized-band band-edge measurements (relative method)

These procedures are applicable for determining compliance at authorized-band band-edges where the requirements are expressed as a value relative to the in-band signal level.

For devices that support frequency hopping, this test sequence shall be performed twice: once with the hopping function turned OFF and then repeated with the hopping function turned ON.

- a) Connect the EMI receiver or spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described in step e) (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).
- b) Set the EUT to the lowest frequency channel (for the hopping on test, the hopping sequence shall include the lowest frequency channel).
- c) Set the EUT to operate at maximum output power and 100% duty cycle, or equivalent “normal mode of operation”.
- d) Blank
- e) Perform the test as follows:
 - 1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.

15.247 (d) Band-edge RF Conducted (*continued*)

- 2) Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (\text{OBW/RBW})]$ below the reference level. Specific guidance is given in 4.1.5.2.
 - 3) Attenuation: Auto (at least 10 dB preferred).
 - 4) Sweep time: Coupled.
 - 5) Resolution bandwidth: 100 kHz
 - 6) Video bandwidth: 300 kHz
 - 7) Detector: Peak.
 - 8) Trace: Max hold.
- f) Allow the trace to stabilize. For the test with the hopping function turned ON, this can take several minutes to achieve a reasonable probability of intercepting any emissions due to oscillator overshoot.
- g) Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
- h) Repeat step c) through step e) for every applicable modulation.
- i) Set the EUT to the highest frequency channel (for the hopping on test, the hopping sequence shall include the highest frequency channel) and repeat step c) through step d).
- j) The band-edge measurement shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

Requirement: FCC Part 15.247 Clause (d)

In any 100 kHz 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 the desired power.

Client: Vutiliti

Date: 3 May 2020

DNB Job: 06070

EUT: Limited Modular Transmitter LoRa 500 kHz (DTS)

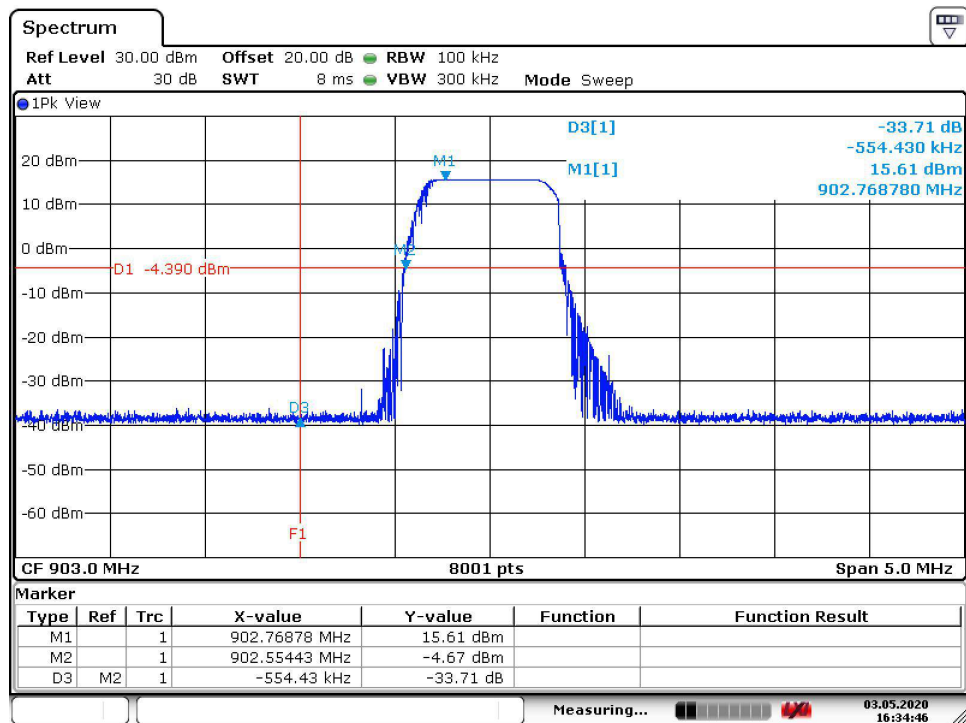
Model No: VUHDC1

Requirement: Band-Edge Compliance (DTS)

Tech: CL Payne

Low Channel: 903 MHz

Result: Pass



Date: 3.MAY.2020 16:34:46

Client: Vutiliti

Date: 3 May 2020

DNB Job: 06070

EUT: Limited Modular Transmitter LoRa 500 kHz (DTS)

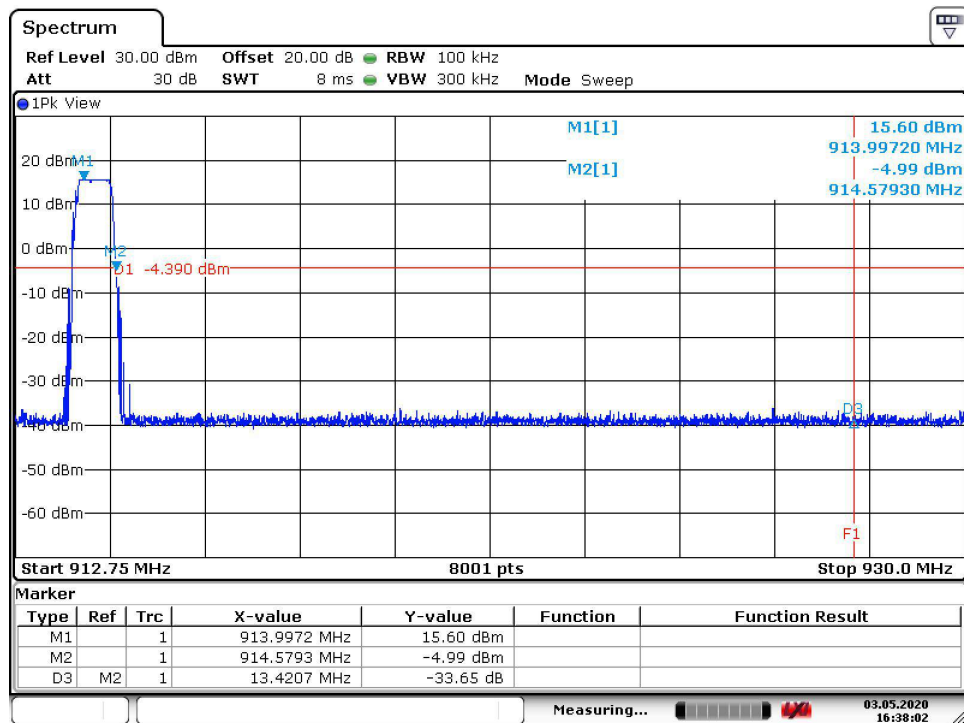
Model No: VUHDC1

Requirement: Band-Edge Compliance (DTS)

Tech: CL Payne

High Channel: 914.2 Mhz

Result: Pass



Date: 3.MAY.2020 16:38:03

DTS bandwidth measurement procedure

- a) Set RBW = 100 kHz
- b) Set the VBW $\geq [3 \times \text{RBW}]$
 - * per ANSI C63.10-2013 clause 6.9.2 Set the span to 2 to 5 times the OBW
- c) Detector = peak
- d) Trace mode = max hold
- e) Sweep = auto couple
- f) Allow trace to stabilize
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6dB relative to the maximum level measured in the fundamental emission.
- h) Submit this plot(s).

Requirement: FCC Part 15.247 Clause (a,2)

The 6 dB DTS bandwidth shall be greater than 500 kHz.

Client: Vutiliti

Date: 3 May 2020

DNB Job: 06070

EUT: Limited Modular Transmitter LoRa 500 kHz (DTS)

Model No: VUHDC1

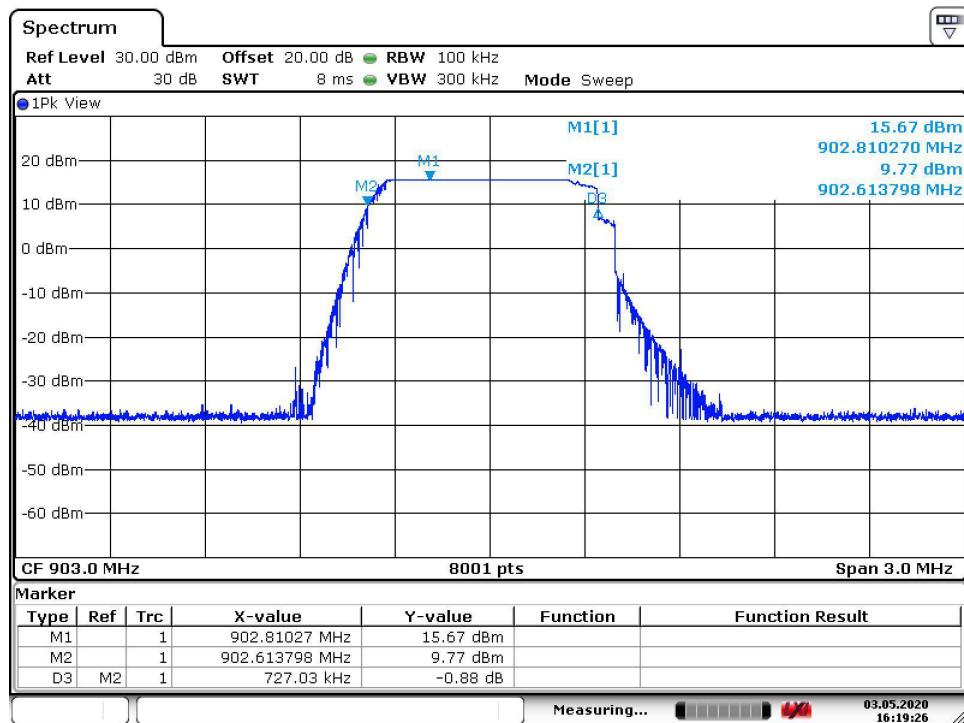
Requirement: 6dB Bandwidth greater than 500kHz

Tech: CL Payne

Low Channel: 903

6dB Bandwidth = 727.03kHz

Result: Pass



Date: 3.MAY.2020 16:19:26