EMC TEST REPORT

NVLAP Lab Code 200033-0

Standard(s):

47 CFR FCC Parts 15.247 RSS 247, Issue 3, 2023

FCC ID:DGFPSD225B IC:458A-PSD225B

Product: 3M™ Advanced Electronics Gateway

Model (HVIN): 70-0020-1020-8

Company Name: 3M Company

Address: Fire & SCBA Solutions 4320 Goldmine Road, Monroe, NC 28110

Report Number: HRE202105206-2 Report Issue Date: April 1, 2024

Report Prepared by:

Signature: Young distinor

Yuriy Litvinov Lead EMC Engineer

Tested by: 3M Hardgoods Regulatory Engineering Laboratory 410 E. Fillmore Avenue, Building 76 St. Paul, Minnesota 55107-1208, USA

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1.0 Test Summary

Based on the results of our investigation, we have concluded the product tested **comply** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

	Requirement – Test	Test Description	Result	Comments
4.1	FCC Part 15.247(a)(2)/ RSS-247(5.2(a))/RSS-Gen (6.7)	DTS Bandwidth	pass	
4.2	FCC Part 15.247(b)(3)/ RSS-247(5.4(d))	Maximum Peak Conducted Output Power	pass	
4.3	FCC Part 15.247(e)/ RSS-247(5.2(b))	Maximum Power Spectral Density level	pass	
4.4	FCC Part 15.209 RSS-Gen, 8.9	Radiated Emissions in restricted band	pass	
4.5	FCC Part 15.247(d)/ RSS-247(5.5)	Radiated Emissions in non-restricted band	pass	
4.6	FCC Part 15.247(d)(1)/ RSS-247(5.5)	DTS Band-edge Emissions Measurements	pass	
4.7	FCC Part 15.207/ RSS-Gen (8.8)	Conducted Emissions	pass	

Note:

1.1 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements. The measurement uncertainty figures were calculated and correspond to a coverage factor of k=2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Radiated emissions 30MHz to 1000MHz	4.9 dB
Radiated emissions 1GHz to 18GHz	4.6 dB
Conducted emissions 150KHz to 30MHz (AMN)	2.7 dB
Conducted emissions 150KHz to 30MHz (AAN)	1.92 dB
RF frequency	±3 × 10 ⁻⁸
RF power, conducted	1.4 dB
RF Power Spectral Density	0.96 dB

1.2 Test Facility

	ISO/IEC 17025:2017, NVLAP LAB CODE: 200033-0
Test Facility Accreditations:	FCC US5320
Abbrealtations.	ISED Canada CAB identifier: US0012



2.0 Equipment Description

2.1 Equipment Under Test					
Description:		The Valor Gateway is a device used to "connect" a handheld Toughbook tablet or computer to SCBA (a self-contained breathing apparatus) telemetry systems worn by firefighters inside a fire scene. It contains LoRa 915MHz, Bluetooth (Low Energy) 2.4GHz and RFID 13.56MHz transmitters.			
Mod	el(s):	70-0020-1020-8			
Serial nur	nber:	N/A			
3M Divi	sion:	Personal Safety			
Modifications and Special Meas	ures:	none			
Frequency Ra	ange:	913-923 MHz			
Channel No.:		20			
Modulation Type:		GFSK			
FCC Classification:		Digital Transmission System (DTS)			
RF Conducted Output Pe	ower:	91.2mW (19.6 dBm)			
Antenna Type and Antenna Asse	mbly	External	Monopol Antenna		Dedicated
	Gain:	🛛 -2dBi	Declared by the Manufacturer		Measured
Test Deviations or Exclusion	sions	Yes	🖾 No		
		Voltage:	120VAC	230VAC	⊠ 5.0VDC
Rated Po		Phase:	🗌 1ph	🗌 3ph	🛛 via USB-C
	Jwer.	Frequency:	☐ 50Hz	🗌 60Hz	
		Current:	Current: 0.5 Amp.		
Test D	ates:	08/16/2021-03/25/2024			
Received	Date:	08/16/2021			
Received Condit	ionsi	Poor 🛛 Good			
Received Collait	10115.	Prototype	Production		

3.0 EUT Configuration

3.1 System Configuration

No.	Product Type	Manufacturer	Model	Comments
1	Valor Gateway	3M	Valor 225 Gateway	
2	USB Power Supply	Samsung	ETA-U90AWS	Support Equipment

3.2 Input/Output Ports of EUT

No.	Description	Туре	Comments
1	DC Power	USB-C	
2			

3.3 Cables

No.	Description	Туре	Length	Shielding	Comments
1	USB-C	USB 2.0	1m	Yes	
2					

3.4 Measurement Arrangements of EUT

	Intended Operational Arrangement(s)	Comments
\square	Table-top only	
	Floor-standing only	
	Floor-standing or table-top	
	Other	

3.5 Primary function(s) of EUT

No.	List of Essential Functions
1	Transferring of various data via LoRa radio to SCBA telemetry systems.
2	

3.6 Exercising of EUT and Interfaces

No.	Mode of Operation
1	Transmitting at lowest 913MHz and highest 923MHz channels of operation with unmodulated CW carrier
2	Continues transmission of modulated signal at lowest and highest channels with a single channel BW >500KHz using SF (spreading factor) 11.
3	Device programming using YAT v 2.4.1 (Yet Another Terminal) software for continues transmission of modulated carrier at maximum rated RF output power and Duty Cycle.



4.0 Test Conditions and Results

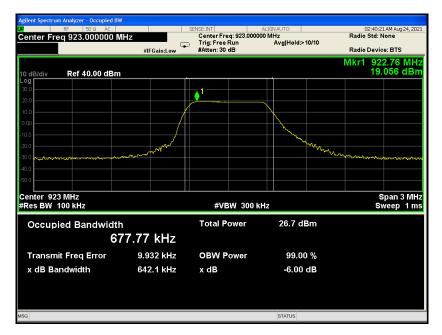
4.1	DTS Bandwidth	DTS Bandwidth			
		Laboratory Ambient Temperature:	23°C		
		Relative Humidity:	48%		
		Atmospheric Pressure:	1011 mbars		
Referer	nce Standard(s):	 ☑ ANSI C63.10:2020, Section 11.8.2 ☑ FCC Part 15.247/RSS 247 ☑ KDB 558074 	Measurement Point		
Fre	equency Range:	⊠ 913-923 MHz	RBW = 100KHz VBW ≥ 3 x RBW		
Nominal Voltage:		□ 120VAC 🛛 5VDC			
	Test Personnel:	Yuriy Litvinov youry distino	Date: 08/23/2021		

Frequency (MHz)	Data Rate	99% dB Bandwidth (KHz)	6 dB Bandwidth (KHz)	6dB OBW Limit (KHz)	Results
913	2 Kbps	544.6	544.8	> 500	pass
923	2 Kbps	677.8	642.1	> 500	pass



RF 50 Ω AC		SENSE:INT	ALIGNAUTO	03:08:52 AM Aug 24, 20
arker 1 913.03 MHz	#IFGain:Low	Center Freq: 913.031 Trig: Free Run #Atten: 30 dB	000 MHz Avg Hold>10/10	Radio Std: None Radio Device: BTS
dB/div Ref 40.00 dBn				Mkr1 913.028 MH 19.244 dB
g		_		
.0				
.0				
0	/		<u>\</u>	
0	/			
	www		and the second s	
www.www.	an market			mon month marine
0				
enter 913 MHz tes BW 30 kHz		#VBW 300	kHz	Span 3 Mi Sweep 4 n
Occupied Bandwidt	h	Total Power	31.5 dBm	
5	44.64 kHz			
Transmit Freq Error	-25.580 kHz	OBW Power	99.00 %	
x dB Bandwidth	544.8 kHz	x dB	-6.00 dB	

OBW – Low Channel



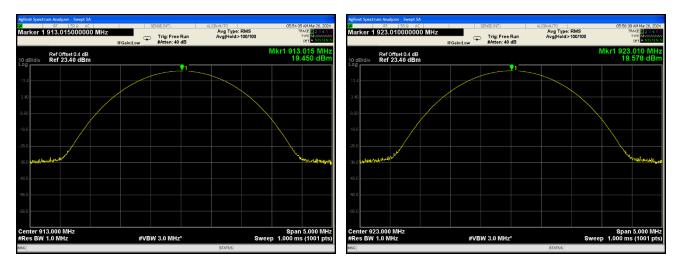
OBW – High Channel



Maximum Output Power						
Measurements was performed with CW carrier at the highest power level at which the transmitter is intended to operate. The analyzer offset was adjusted to compensate for the attenuator and other losses.						
	Laboratory Ambient Temperature:	23°C				
	Relative Humidity:	48%				
	Atmospheric Pressure:	1011 mbars				
rence Standard(s):	 ☑ ANSI C63.10:2020, Section 11.9 ☑ FCC Part 15.247/RSS 247 ☑ KDB 558074 	Measurement Point ⊠ Conducted □ Radiated at 3 meters				
Frequency Range:	⊠ 913-923 MHz					
Antenna Gain:	-2.0dBi	Maximum Conducted RF Power:				
Limit:	30 dBm	19.6 dBm				
Nominal Voltage:	Voltage: 120VAC 🛛 5VDC					
Test Personnel:	Yuriy Litvinov you'y divino	Date: 03/25/2024				
	Measurements was pe analyzer offset was ad ence Standard(s): Frequency Range: Antenna Gain: Limit: Nominal Voltage:	Measurements was performed with CW carrier at the highest power level at w analyzer offset was adjusted to compensate for the attenuator and other losse Laboratory Ambient Temperature: Relative Humidity: Atmospheric Pressure: MANSI C63.10:2020, Section 11.9 Sector Standard(s): KDB 558074 Frequency Range: 913-923 MHz Antenna Gain: -2.0dBi Limit: 30 dBm				

Note:

EIRP (dBm) = Conducted Power (dBm) +Antenna Gain (dBi)= 19.6-2.0=17.6dBm

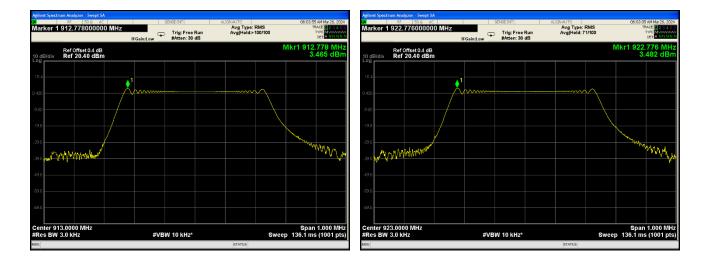


Low Channel

High Channel



4.3	Maximum Power	Maximum Power Spectral Density level						
Method:	Measurements was performed with modulated carrier at the highest power level at which the transmitter is intended to operate. The analyzer offset was adjusted to compensate for the attenuator and other losses.							
		Laboratory Ambient Temperature:	23°C					
		Relative Humidity:	48%					
		Atmospheric Pressure:	1011 mbars					
Refere	ence Standard(s):	 ANSI C63.10:2020, Section 11.10.2 FCC Part 15.247/RSS 247 KDB 558074 	Measurement Point Conducted Radiated					
F	requency Range:	🖾 913-923 MHz	PSD Results					
	PSD Limit:	8 dBm in any 3KHz band	3.5dBm					
	Nominal Voltage: 🗌 120VAC 🛛 5VDC							
	Test Personnel:	Yuriy Litvinov Yuriy divinor	Date: 08/23/2021					



PSD Low Channel

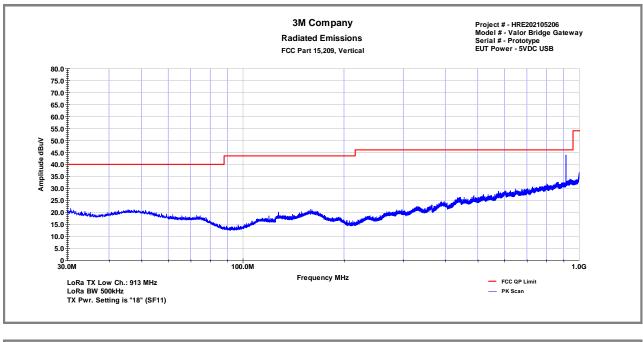
PSD High Channel

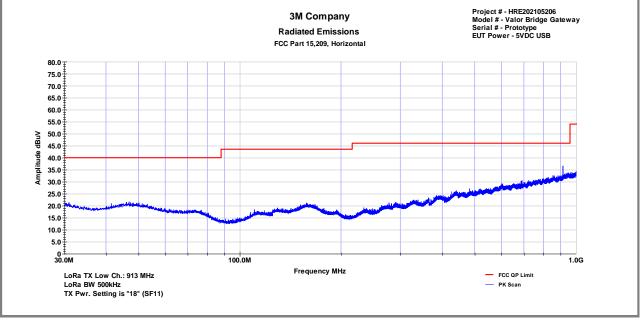


4.4	Radiated Emissions in restricted band						
Method:	Measurements were made in a 3-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4 standards. EUT was rotated through three orthogonal axes to determine which attitude (orientation) and arrangement produces the highest emission relative to the limit; the attitude and device arrangement that produces the highest emission relative to the limit; the attitude emission measurements. Spurious Radiated emissions measurements ware performed with external preamp and a high pass filter. Final measurements were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.						
		Laborato	ry Ambient Tempe	rature:		23°C	;
Test	Verification:		Relative Hu	midity:		55%	
			Atmospheric Pre	ssure:		1011 mb	oars
	Reference Standard(s):		2020, Section 11.12 05/15.209/RSS Ger			Measurement	Distance
	Frequency Range:		⊠ 30 MHz to 1 GHz ⊠ 1 GHz to 10 GHz				
	Nominal Voltage:	□ 120VAC 🛛 5VDC					
	Test Personnel:	Keith Schwartz KS			Date: 08/19/2021		
		Limits –15	.209 and RSS Ger	า			
En	equency (MHz)	Limit dB (µV/m)					
FR		Quasi-Peak	Average	Pe	eak	Distance	Results
	0.009-0.490		2400/F(KHz)			300	N/A
	0.490-1.705	24000/F(KHz)				30	N/A
	1.705-30	30				30	N/A
	30 to 88	40	40			3	pass
	88 to 216	43.5				3	pass
	216 to 960	46				3	pass
	Above 960		54	7	74	3	pass

Modifications:	
Note:	The lower limit applies at the transition frequency. An inverse proportionality factor of 20 dB per decade has been used to normalize the measured data to the specified distance for determining compliance For emission in the restricted bands, the limit of 15.209 was used.

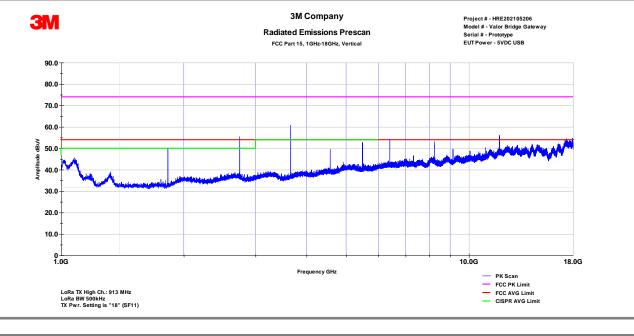


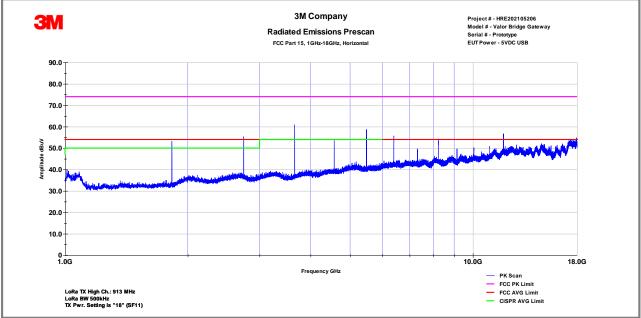








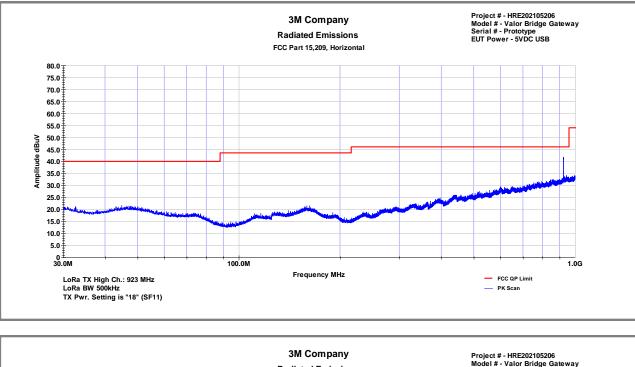


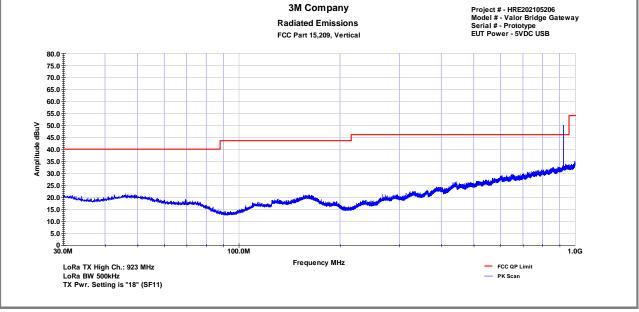




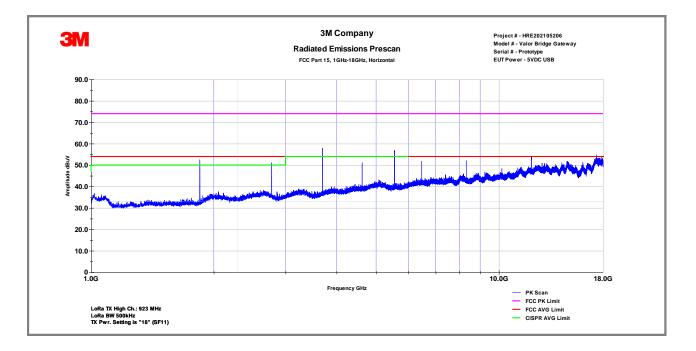


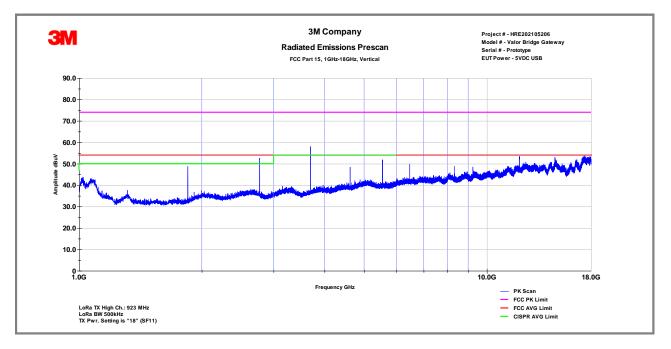
Report Number: HRE202105206-2 Date: April 1, 2024





FCC Part 15.209 Radiated Emissions in restricted band - High Channel







Pol	Frequency (MHz)	Peak dBµV/m	AVG dBµV/m	Total CF dB	Net Peak dBµV/m	Net AVE dBµV/m	PK Limit dBµV/m	AVE Limit dBµV/m	PK Margin dB	AVG Margin dB
V	2739.00	66.46	59.1	-12.40	54.06	46.72	74.00	54.00	-19.94	-7.28
н	2739.00	67.70	57.5	-12.40	55.30	45.08	74.00	54.00	-18.70	-8.92
V	3652.00	72.53	64.8	-11.24	61.29	53.53	74.00	54.00	-12.71	-0.47
н	3652.00	72.74	62.3	-11.24	61.50	51.09	74.00	54.00	-12.50	-2.91
V	5478.00	58.86	46.72	-5.20	53.66	41.52	74.00	54.00	-20.34	-12.48
н	5478.00	60.46	51.48	-5.20	55.26	46.28	74.00	54.00	-18.74	-7.72
V	6391.00	58.48	46.81	-3.56	54.92	43.25	74.00	54.00	-19.08	-10.75
н	6391.00	60.12	48.74	-3.56	56.56	45.18	74.00	54.00	-17.44	-8.82
	Net Reading (dBuV) = Reading (dB μ V) + (Antenna with amp CF(dB)+Cable CF(dB))									
		Low Chann	nel							

Tables - Radiated Emissions in restricted band

Pol	Frequency (MHz)	Peak dBµV/m	AVG dBµV/m	Total CF dB	Net Peak dBµV/m	Net AVE dBµV/m	PK Limit dBµV/m	AVE Limit dBµV/m	PK Margin dB	AVG Margin dB
V	1846.00	66.43	63.40	-16.60	49.83	46.80	74.00	54.00	-24.17	-7.20
н	1846.00	66.78	63.40	-16.60	50.18	46.80	74.00	54.00	-23.82	-7.20
V	2768.00	65.69	60.94	-12.40	53.29	48.54	74.00	54.00	-20.71	-5.46
Н	2768.00	64.00	58.80	-12.40	51.60	46.40	74.00	54.00	-22.40	-7.60
V	3692.00	64.64	57.10	-10.80	53.84	46.30	74.00	54.00	-20.16	-7.70
н	3692.00	67.87	60.91	-10.80	57.07	50.11	74.00	54.00	-16.93	-3.89
V	8308.40	53.00	39.90	-1.70	51.30	38.20	74.00	54.00	-22.70	-15.80
Н	8308.40	55.13	42.10	-1.70	53.43	40.40	74.00	54.00	-20.57	-13.60
	Notes:	Net AVG V	BW>1/T=2K	Hz Reading	(dBuV) = Rea	ading (dBµV)) + (Antenna	with amp CF(c	dB)+Cable C	F(dB))
	NOLES.	High Chan	nel							

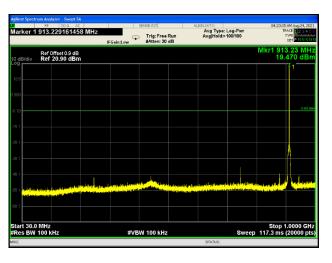


4.5	Radiated Emission	Radiated Emissions in non-restricted band							
Method:	The measurements were made with transmitter set to transmit continuously at low and high channels.								
		Laboratory Ambient Temperature:	23°C						
		Relative Humidity:	48%						
		Atmospheric Pressure:	1011 mbars						
Reference Standard(s):		 ☑ ANSI C63.10:2020, Section 11.11 ☑ FCC Part 15.247/RSS 247 ☑ KDB 558074 	Measurement Point						
	Frequency Range:	🛛 913-923 MHz	Radiated						
In-band	power in 100KHz:	⊠ 19.6dBm	Results:						
	Limit:	C -10.4dBm (30dBc below in-band power)	>50dBc						
	Nominal Voltage:	□ 120VAC ⊠ 5VDC							
	Test Personnel:	Yuriy Litvinov young divinos	Date: 08/23/2021						

Note:

No spurious emissions above floor noise detected from 7.5GHz.

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3M

RF 50 Ω A	C	SENSE	INT	ALIGNAUTO AVIG TYPE	: Log-Pwr		AM Aug 24, 20 ACE
a Level 0.90 abili			ig: Free Run	Avg Hold	>100/100	T	VPE MULLOUG
	IFG	iain:Low #A	tten: 10 dB				
Ref Offset 0.9 dE						Mkr2 1.82	25 8 GH
dB/div Ref 0.90 dBm						-32.1	102 dB
10							
3.1							
↓ 2	◊'						
Charles and Charle			ا بىلىكىسى			and in character	
1 Y W Lunder	and series of the series						
.1							
						Ston	7 580 GI
art 1.000 GHz		#VBW 1.	0 MHz		Sweep	Stop 8.000 ms (7.580 GI 20000 p
art 1.000 GHz Res BW 1.0 MHz	×	#VBW 1.	O MHZ	FUNCTION WIDTH		Stop 8.000 ms (UNCTION VALUE	7.580 GI 20000 p
art 1.000 GHz Res BW 1.0 MHz R MODE TRC SOL	2.739 5 GHz	۲ -29.514 dBm	FUNCTION	FUNCTION WIDTH		8.000 ms (7.580 GI 20000 p
art 1.000 GHz Res BW 1.0 MHz R MODE TRC SOL		Y	FUNCTION	FUNCTION WADTH		8.000 ms (7.580 GI 20000 pi
art 1.000 GHz ces BW 1.0 MHz R MODE TRC SQ. N 1 f N 1 f	2.739 5 GHz	۲ -29.514 dBm	FUNCTION	FUNCTION WIDTH		8.000 ms (7.580 GI 20000 p
art 1.000 GHz tes BW 1.0 MHz R NODE TRC SO. N 1 f N 1 f	2.739 5 GHz	۲ -29.514 dBm	FUNCTION	FUNCTION WIDTH		8.000 ms (7.580 GI 20000 p
art 1.000 GHz Res BW 1.0 MHz R MODE TRC SCI N 1 f	2.739 5 GHz	۲ -29.514 dBm	FUNCTION	FUNCTION WIDTH		8.000 ms (7.580 GI 20000 pi
art 1.000 GHz tes BW 1.0 MHz R MODE TRC 601	2.739 5 GHz	۲ -29.514 dBm	FUNCTION	FUNCTION WADTH		8.000 ms (7.580 Gł 20000 pi
art 1.000 GHz tes BW 1.0 MHz R MODE TRC SCI	2.739 5 GHz	۲ -29.514 dBm	FUNCTION	FUNCTION WIDTH		8.000 ms (7.580 GI 20000 p
	2.739 5 GHz	۲ -29.514 dBm	FUNCTION	FUNCTION WADTH		8.000 ms (7.580 Gł 20000 pi

Date: April 1, 2024

Conducted Spurious - Low Channel

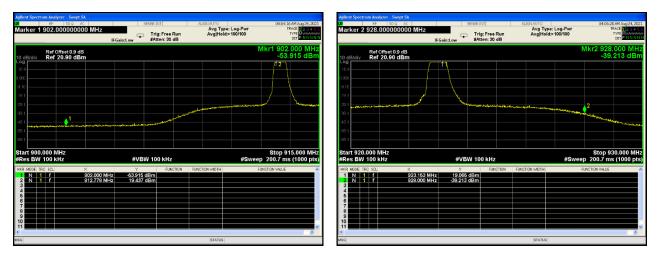
Agilent Spectrum Analyzer - Swept SA			Agilent Spectrum Analyzer - Swept SA	
PF 50 Q AC Points 20000		AUTO 04:17:33 AM Aug 24, 2021 Avg Type: Log-Pwr TRACE 12:24 AUG Avg Hold> 100/100 Type 1 bet 21:14 AUG	DF SEG AC SERVE INT AL3 Marker 1 1.845901295065 GHz Trig: Free Run Trig: Free Run IFGaintow	SNAUTO 04:34:06 AM Aug 24, 2021 Avg Type: Log-Pwr TAx12 Avg Hold>100/100 Type Def Purchaster Type: Log-Pwr
Ref Offset 0.9 dB 10 dB/div Ref 20.90 dBm		Mkr2 923.29 MHz 19.088 dBm	Ref Offset 0.9 dB 10 dB/div Ref 0.90 dBm	Mkr1 1.845 9 GHz -36.344 dBm
10.8		- 2 2 	Log 10 10 10 10 10 10 10 10 10 10	302.42 1000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
-49 1 -69 1 Materia de cuida de Aliabilitación				ON WIDTH FUNCTION WILLIE
49 1 Start 30.0 MHz		Stop 1.0000 GHz	6 7 8 9 9 9	
#Res BW 100 kHz	#VBW 100 kHz	Sweep 117.3 ms (20000 pts) STATUS	le] Nsa	STATUS

Conducted Spurious – High Channel



4.6	Band-Edge Co	ompliance						
Method:	The measureme channels.	he measurements were made with transmitter set to transmit continuously with modulated signal at low and high hannels.						
		Laboratory Ambient Temperature:	23°C					
		Relative Humidity:	48%					
		Atmospheric Pressure:	1011 mbars					
Referenc	e Standard(s):	 ANSI C63.10:2020, Section 11.13.2 FCC Part 15.247/RSS 247 KDB 558074 	Measurement Point					
Frec	uency Range:	⊠ 913-923 MHz	Results					
Limit:		⊠ >30dBc	Low Ch., 913 MHz > 70dBc High Ch., 923 MHz > 60dBc					
No	Nominal Voltage: 120VAC SVDC							
т	est Personnel:	Yuriy Litvinov youry divinas	Date: 08/23/2021					

Note:



Band Edge - Low Channel

Band Edge - High Channel



4.7	Conducted Emissions Data							
	The AMN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.							
Method:	All power was connected to the system through Artificial Mains Network (AMN). All tested telecommunications lines were connected to an Asymmetric Artificial Network (AAN) and conducted voltage measurements on telecommunications lines were made at the output of the ISN. Where an AAN was not appropriate or available measurements were made using a Capacitive Voltage Probe.							
Test Verification: 🛛 Reference Standard(s):			Laboratory Ambient Temperature:		23°C			
			Relative Humidity:		48%			
			Atmosph	eric Pressure:	1011 mbars			
			 ☑ RSS GEN/FCC 15.207 ☑ ANSI C63.4:2014 ☑ ANSI C63.10:2020 		Measurement Point Mains Telecommunication ports 			
		Nominal Voltage:	⊠ 120VAC □ 230VAC ⊠ 5VDC					
Test Personnel:			Keith Schwartz KS	tz KS Date: 08/18/2021				
Limits – Part 15.209/RSS Gen – AC Mains								
Frequen			Limit dB (µV)					
	icy (IVIHZ)	Quasi-Peak	Average	Result	Comments			
0.15 to	0.50	66 to 56	56 to 46	pass	Time Domain Scan			
0.50	to 5	56	46	pass	Time Domain Scan			
5 to 30 60		50	pass	Time Domain Scan				

Modifications:	
Note:	



-10.0 [±]____ 150.0K

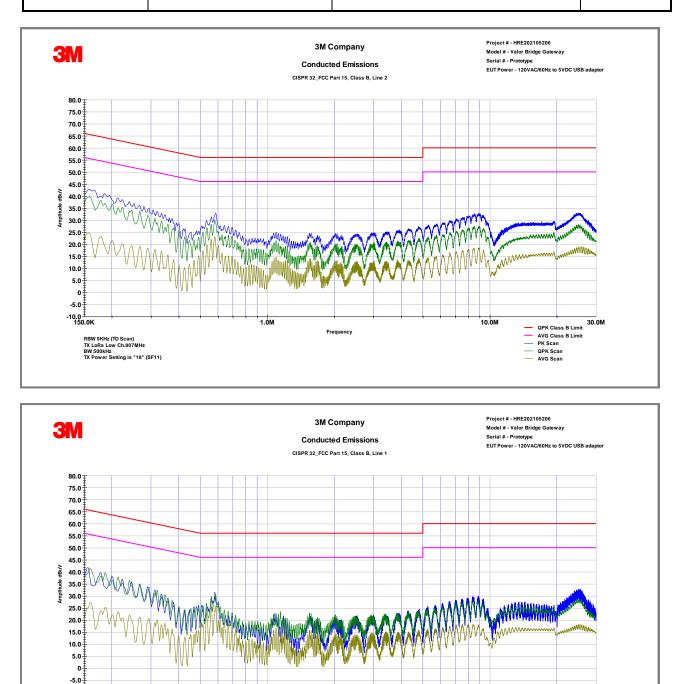
> RBW 9KHz (TD Scan) TX LoRa Low Ch.907MHz BW 500kHz TX Power Setting is *18* (SF11)

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QPK Class B Limit
 AVG Class B Limit
 PK Scan
 QPK Scan
 AVG Scan
 AVG Scan

10.0M



Frequency

1.0M

5.0	Test Equipment						
Test Equipment Used							
Description	Manufacturer	Model	Identifier	Last Cal. Date	Check		
Biconilog Antenna	Schwarzbeck	VULB 9168	9168-1070	10/20/2020			
Horn Antenna	A.H. Systems	SAS 571	1010	10/20/2020			
Loop Antenna	A.H. Systems	EHA-51B	1213E	10/20/2020			
EMI Receiver	Rohde & Schwarz	ESW26	101412	10/20/2020			
Signal Analyzer	Agilent	N9000A	MY53031040	10/20/2020			
EMI Receiver	Agilent	E4448A	1530975	10/20/2020			
LISN	TESEQ	NNB51	1130	10/20/2020			
Coaxial Cable	Insulated Wire	2803	CBL2039	10/20/2020			
EMC Software	ETS-Lindgren	TILE 7		N/A			
Equipment C	alibration Interval:		12 months	24 months			

6.0	Report revision history						
Revision Level		Date Report Number		Notes			
0		04/01/2024	HRE202105206-2	Original Issue			