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FCC ISED RF Test Report			
Test Report Number	GLS-20042831-LC-FCC-IC-RF-R1		
FCC ID	2AH4HATD500X 21385-ATD500X		
	Mohilogix		
Applicant	MOBIORIX		
Applicant Address	5500 Trabuco Road, Suite 150, Irvine, CA 92620		
Product Name	ATD500X		
Model (s)	BA1-X		
	04/28/2020		
Report Issue Date	04/20/2020-00/05/2020		
Test Standards	47 CFR Part 15 247		
	RSS-247 Issue 2. Feb 2017		
	47CFR Part 22		
	47CFR Part 24		
	47CFR Part 27		
	47CFR Part 90		
	RSS-130 Issue 2: Feb 2019		
	RSS-132 Issue 3: Jan 2013		
	RSS-133 Issue 6: Jan 2018		
Test Desult	RSS-139 Issue 3: Jul 2015		
lest Result	PA33		
St. Plance Laboratories	Issued by:		
Vista Labs	Vista Compliance Laboratorios		
pate	vista compliance Laboratories		
10010	1261 Puerta Del Sol, San Clemente, CA 92673 USA		
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results that were obtained in the period between the date of initial receipt of samples and the date of issue of the report. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested and the results thereof based upon the information provided to us. The applicant has 60 days from date of issuance of this report to notify us of any material error or omission. Failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. The report must not be used by the client to claim product certification, approval, or endorsement by any government agencies. This report is not to be reproduced by any means except in full and in any case not without the written approval of Vista Laboratories.





#### **REVISION HISTORY**

Report Number	Version	Description	Issued Date
GLS-20042831-LC-FCC-IC-RF	01	Initial report	06/04/2020
GLS-20042831-LC-FCC-IC-RF-R1	R1	Update FCC and ISED ID	07/01/2020





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## 1 Test Summary

Test Item	Test Requirement	Test Method	Result
Radiated Spurious Emissions into Restricted Frequency Bands (intentional)	47 CFR Part 15.247 RSS-247 Issue 2, Feb 2017	ANSI C63.10: 2013 KDB 558074 D01 15.247 Meas Guidance v05r02	Pass
Field Strength of Spurious Radiation (licensed band)	2.1046 22.917 (a), 24.238 (a), 90.691, 27.53 (f), (g), (h), (c)(2) and (5) RSS-130(4.7.1) and (4.7.2) RSS-132 (5.5) RSS-133 (6.5) RSS-139 (6.6) SRSP-510(5.1.2)	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01 KDB 412172 D01 Determining ERP and EIRP v01r01	Pass





### 2 General Information

### 2.1 Applicant

Applicant	Mobilogix, Inc.	
Applicant address	5500 Trabuco Road, Suite 150, Irvine, CA 92620	
Manufacturer	Mobilogix, Inc.	
Manufacturer Address	5500 Trabuco Road, Suite 150, Irvine, CA 92620	

### 2.2 Product information

Product Name	ATD500X	
Product Description	LTE Asset Tracker with GSM, WLAN RX and BLE	
Model Number	BAT-X	
Family Models	N/A	
Serial Number	866425030183745	
	BLE: 2402-2480MHz	
	GSM850: 824.2 - 848.8 MHz	
	GSM1900: 1850.2 - 1909.8 MHz	
	LTE CAT-M1/NB-IOT Band 2: 1850.7-1909.3MHz	
Frequency Band	LTE CAT-M1/NB-IOT Band 4: 1710.7-1754.3MHz	
	LTE CAT-M1/NB-IOT Band 5: 824.7-848.3MHz	
	LTE CAT-M1/NB-IOT Band 12: 699.7-715.3MHz	
	LTE CAT-M1/NB-IOT Band 13: 779.5-784.5 MHz	
	LTE CAT-M1/NB-IOT Band 26: 815.5 – 847.5 MHz	
	BLE: GFSK	
Type of modulation	GSM: GMSK, 8PSK	
Type of modulation	LTE CAT-M1: QPSK, 16QAM	
	LTE NB-IOT: BPSK, QPSK	
Equipment Class	DTS, PCB	
	BLE: Internal PCB antenna, 1 dBi Gain.	
Antonna Information	WCDMA/LTE: PCB antenna, -0.21 dBi for 698-803MHz; 0.77 dBi	
Antenna information	for 824-894 MHz; 3.05 dBi for 1710-1880 MHz; 2.92 dBi for 1850-	
	1990MHz; 3.72 dBi for 2500-2690MHz	
Clock Frequencies	N/A	
Input Power	3.7VDC (battery powered)	
Power Adapter	N/A	
Manufacturer/Model		
Power Adapter SN	er SN N/A	
Hardware version	n N/A	
Software version	1 N/A	
Simultaneous	<b>IS</b> BT and GSM/LTE can transmit simultaneously	
Transmission	วท	
	EMC Emission Class B	
Additional Info	Cat M1	
	NB-IOT Category – NB1	





### 2.3 Test standard and method

	47 CFR Part 15.247
	RSS-247 Issue 2, Feb 2017
	47CFR Part 22
	47CFR Part 24
	47CFR Part 27
Test stendend	47CFR Part 90
Test standard	RSS-130 Issue 2: Feb 2019
	RSS-132 Issue 3: Jan 2013
	RSS-133 Issue 6: Jan 2018
	RSS-139 Issue 3: Jul 2015
	SRSP-510 Issue 5: Feb 2009
	RSS-Gen Issue 5: Mar 2019
	ANSI C63.10: 2013
	ANSI C63.26: 2015
Test method	KDB 558074 D01 15.247 Meas Guidance v05r02
	KDB 971168 D01 Power Meas License Digital Systems v03r01
	KDB 412172 D01 Determining ERP and EIRP v01r01





### 3 Test Site Information

Lab performing tests	Vista Laboratories, Inc.	
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA	
Phone Number	+1 (949) 393-1123	
Website	www.vista-compliance.com	

Test Condition	Temperature	Humidity	Atmospheric Pressure
RF Testing	23.5°C	58.2%	996 mbar
Radiated Emission Testing	23.5°C	58.2%	996 mbar

### 4 Modification of EUT / Deviations from Standards

N/A

### 5 Test Configuration and Operation

### 5.1 EUT Test Configuration

EUT is powered by internal battery. The cellular radio of EUT is connected to and controlled by CMW500, the base station emulator, communicate continuously in different modulation, test channel and data rate. The radio of BLE is set to transmit continuously by using mobile application.

The following software was used for testing and to monitor EUT performance

Software	Description
EMISoft Vasona	EMC/RF Spurious emission test software used during testing





### 5.2 Supporting Equipment

Description	Manufacturer	Model #	Serial #
_	_	_	_

## 6 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
RF Output Power (Conducted)	±1.2 dB
Power Spectral Density	±0.9 dB
Unwanted Emission (conducted)	±2.6 dB
Occupied Channel Bandwidth	±5 %
Radiated Emission (9KHz-30MHz)	±3.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB





### 7 Test Results

#### 7.1 Radiated Spurious Emissions into Restricted Frequency Bands

#### 7.1.1 Requirement

Per § 15.247 (d), RSS-247

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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in §15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency range (MHz)	Field Strength (µV/m)
0.009~0.490	2400/F(KHz)
0.490~1.705	24000/F(KHz)
1.705~30.0	30
30 - 88	100
88 – 216	150
216 960	200
Above 960	500

#### 7.1.2 Test setup









#### Radiated emissions test setup above 1 GHz







#### 7.1.3 Test Procedure

According to section 8.6 in KDB 558074 D01 DTS Meas Guidance v05r01 and subclause 11.12.2.7 Radiated spurious emission measurements in ANSI C63.10-2013 as well as the procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 was followed. Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

- 1. The EUT was switched on and allowed to warm up to its normal operating condition.
- 2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
  - a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
  - b. The EUT was then rotated to the direction that gave the maximum emission.
  - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
- 3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
- 4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz 30MHz.
- 5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz 1GHz.
- 6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
- 7. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.





#### 7.1.4 Test Result

## **RADIATED EMISSIONS BELOW 1 GHZ**

Т	est Standa	urd:		15.	247, F	RSS-247		Mode:				BLE+	LTE I	B2	
Free	quency Ra	ange:		30	MHz	- 1 GHz		Test Date:			04/	/28/2020	-06/0	3/202	20
Anten	na Type/P	olarity:		Bi-I	Log/H	or & Ver	Te	est Personnel	1:			Danie	l Brui	no	
	Remark:				N/	A	,	Test Result:				P	ass		
Wm —					V	asona by EMiSoft				1				19 N	tay 20 12:46 [1] Horizontal
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Ra	idiated Emissions		Temp	late: FCC	Class B (3)	m) 30MHz-1 GHz									
File	ename: c:\users\c;	amara\google o	lrive\2020\gls-2	10042831-lo	o'testing lal	bs\fcc_ised%testing%test re	sults're (radiate	l emission)\below 1ghz	102_RE-BLE-LTE E	95-Below 1GH:	zemi				
									120					Res	Bw (KH2)

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
60.957	47.4	3	-24.9	25.5	Quasi Max	V	102	114	40	-14.5	Pass

Note: Frequency at around 835MHz is EUT fundamental emission.





## **RADIATED EMISSIONS BELOW 1 GHZ**



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
836.929	94.2	7.4	-6.9	94.7	Quasi Max	Н	106	145	46	48.7	N/A
58.34	48.6	3	-25	26.5	Quasi Max	V	100	261	40	-13.5	Pass

Note: Frequency at around 835MHz is EUT fundamental emission.





Test Standard:	15.247, RSS-	-247		Mode:					BLE+GSM B	2		
Frequency Range:	1 GHz – 180	SHz	Т	'est Dat	e:				04/28/2020-06/03	/202	0	
Antenna Type/Polarity:	Horn/Hor &	Ver	Tes	t Person	nnel:				Daniel Brunc	)		
Remark:	N/A		Те	est Resi	ılt:				Pass			
//m	Vasona	by EMiSoft								19 Ma	y 20 16:14	-
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1												[2] Vertical
										-		Pk Lmt
1												Av Lmt
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1 L										Pk	+	Formal
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					1000				Res Bw p	Hzj	
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
1882.749	29.9	14.4	-21.5	22.7	Peak Max	V	353	52	74	-51.3	Pass
1882.749	18.2	14.4	-21.5	11.1	Average Max	V	353	52	54	-42.9	Pass





Test Standard:	15.247, RSS	-247		Mode:					BLE+LTE	B2		
Frequency Range:	1 GHz – 180	GHz	1	Fest Dat	te:				04/28/2020-06/0	)3/2(	020	
Intenna Type/Polarity:	Horn/Hor &	Ver	Tes	t Perso	nnel:				Daniel Bru	no		
Remark:	N/A		Т	est Res	ult:				Pass			
1	Vasona	a by EMiSoft								19	9 May 20 14:04	
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Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
4936.532	28.3	17.4	-13.3	32.4	Peak Max	V	392	334	74	-41.6	Pass
4936.532	16.4	17.4	-13.3	20.5	Average Max	V	392	334	54	-33.5	Pass





#### <u> 18GHz – 25GHz test result</u>

Note: no substantial emission is found other than the noise floor. Different modes have been verified.





#### 7.2 Strength of Spurious Radiation

#### 7.2.1 Requirement

§ 2.1051,22.917(a), 24.238(a), 27.53 (f), (g), (h) and (c)(2) and (5) RSS-130(4.7.1) and (4.7.2), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)

#### FCC 47 CFR Part 22, Clause 22.917 (a) and FCC 47 CFR Part 24, Clause 24.238 (a)

(a)Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

#### FCC 47 CFR Part 27, Clause 27.53 (c)(2) and (5)

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P) dB$ ;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

#### FCC 47 CFR Part 27, Clause 27.53 (f)

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

#### FCC 47 CFR Part 27, Clause 27.53 (g)

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.





#### FCC 47 CFR Part 27, Clause 27.53 (h)

(h) AWS emission limits — (1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

#### FCC 47 CFR Part 90, Clause 90.691

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

#### RSS-130, Clause 4.7.1 and 4.7.2

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:

- a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:
  - (i) 76 + 10 log10 p (watts), dB, for base and fixed equipment, and
  - (ii) 65 + 10 log10 p (watts), dB, for mobile and portable equipment.
- b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and 80 dBW for discrete emission with bandwidth less than 700 Hz.

#### RSS-132, Clause 5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.





(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts).

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS-139, Clause 6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be

attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.





#### 7.2.2 Test setup



Radiated emissions test setup above 1 GHz



#### 7.2.3 Test Procedure

ANSI C63.26: 2015 section 5.5

KDB 971168 D01 Power Meas License Digital Systems v03r01 section 7

Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

- 1. The EUT was switched on and allowed to warm up to its normal operating condition.
- 2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
  - a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
  - b. The EUT was then rotated to the direction that gave the maximum emission.
  - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
- 3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
- 4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz 30MHz.





- 5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz 1GHz.
- 6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
- 7. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.





#### 7.2.4 Test Result

## **RADIATED EMISSIONS BELOW 1 GHZ**



Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
837.067	-38.7	19.2	23.6	4	RMS Max	Н	182	332	-13	17	N/A
61.071	-66.1	14.8	6.6	-44.8	RMS Max	V	124	113	-13	-31.8	Pass
Note: Frequer	ov at around 835	MHzicEI	IT fundamental a	mission							

Note: Frequency at around 835MHz is EUT fundamental emission.





# **RADIATED EMISSIONS BELOW 1 GHZ**

Test Standard:				Part	24H	Ξ&	RSS 133		Mode:			BI	LE+L	TE (	CAT	-M1	B2	
Frequen	cy Range:			30	) MI	Hz -	1 GHz		Test Date:			04	4/28/2	2020	-06/0	)3/2	020	
Antenna T	ype/Polari	ity:		Bi-	Log	g/Ho	or & Ver	Т	est Personnel	:			D	aniel	Bru	no		
Rer	nark:					N/A	A		Test Result:					Pa	ass			
						Va	sona by EMiSoft									C	8 May 20 13:57	
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Radiated B	nissions		Tempi	ate: FC0	C Lie ba	and - 31	DM-1G											
										120							tes Bw (kHz)	

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
400.531	-85.7	18.1	18.1	-49.5	RMS Max	V	264	106	-13	-36.5	Pass





# **RADIATED EMISSIONS BELOW 1 GHZ**

Test Standard:					Pa	rt 27	7&	RSS 139		Mode:		BI	LE+L7	TE (	CAT	Γ-M	1 B4	
I	Frequency	Range:			30	0 M	Hz	- 1 GHz		Test Date:		04	/28/20	020-	-06/	03/2	2020	
An	tenna Type	e/Polari	ty:		Bi	-Lo	g/H	or & Ver	Т	est Personnel	:		Da	niel	Bru	ino		
	Rema	rk:					N/.	A		Test Result:				Pa	ass			
dBm							Va	asona by EMiSoft									08 May 20 14:10	)
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-800																		
3	30.00 100.00					ш								1000				
	Radiated Emissi	ons		Temp	late: FC	C Lie b	and - C	30M+1G										
											120	 					Res Bw (kHz)	

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
790.139	-98.9	19	23.7	-56.2	RMS Max	Н	161	212	-13	-43.2	Pass





## **RADIATED EMISSIONS BELOW 1 GHZ**

Т	est Stan	dard:			Par	rt 22	2 &	RSS 132		Mode:			BI	LE+L'	ГЕ С	AT	-M1	l B5	
Fre	quency	Range:			30	) MJ	Hz ·	- 1 GHz		Test Date:			04	4/28/2	020-0	06/0	)3/2	020	
Anten	nna Type	/Polari	ty:		Bi	-Log	g/He	or & Ver	Т	est Personnel:				Da	niel I	Bru	no		
	Remar	k:					N/2	A		Test Result:					Pas	ss			
dBm							Va	asona by EMiSoft									C	08 Mary 20 14:27	'
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auu							1001												
Ra	adiated Emissio	ns		Temp	late: FC	C Lic ba	and - 3	0M-1G											
											15	20						Res Bw (kHz)	

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
835.186	-45.2	19.1	23.6	-2.5	RMS Max	Н	153	153	-13	10.5	N/A
212.317	-100.3	16.6	10.6	-73	RMS Max	Н	108	315	-13	-60	Pass

Note: Frequency at around 835MHz is EUT fundamental emission.





## **RADIATED EMISSIONS BELOW 1 GHZ**

	Test Stan	dard:			Pa	rt 27	&	RSS 130		Mode:				BL	E+L7	ΓE C	AT-	M1	B12		
F	requency	Range:			30	) MI	Hz -	1 GHz	Т	est Date:	:			04	1/28/2	2020-	06/0	)3/2(	020		
Ant	enna Type	e/Polarit	y:		Bi	-Log	g/Ho	or & Ver	Tes	Personn	nel:				Da	aniel	Bru	no			
	Rema	rk:					N//	4	Te	st Resul	t:					Pa	ss				
dBm							Va	sona by EMiSoft										80	May 20 14:	44	
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	Radiated Emissi	ons		Templ	late:FC	C Lie ba	and - 31	DM+1G				120						B	es Buo IkH21		

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
705.61	-37.9	19.1	22.7	3.9	RMS Max	Н	128	212	-13	16.9	N/A
57.774	-99.6	14.7	6.4	-78.4	RMS Max	V	283	56	-13	-65.4	Pass

Note: Frequency at around 700 MHz is EUT fundamental emission.





## **RADIATED EMISSIONS BELOW 1 GHZ**

	Test Stand	lard:		Part	27 &	RSS 130		Mode:			BL	E+LTE	E CAT	-M1	l B13
I	Frequency F	Range:		30	MHz	- 1 GHz		Test Date:			04	/28/20	20-06/	03/2	2020
An	tenna Type/	Polarity:		Bi-I	Log/H	or & Ver	Т	est Personne	el:			Dan	iel Brı	Jno	
	Remarl	K:			N/	'A		Test Result:					Pass		
dBm					v	asona by EMiSoft									08 Mary 20 15:01
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	000				107									100	חת
	Radiated Emission	15	Tem	plate: FCC	Lic band - :	 30M41G									
									120						Res Bw [kHz]

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
780.65	-41.3	19	23.6	1.3	RMS Max	Н	340	108	-13	14.3	N/A
399.04	-100.1	18.1	18.1	-63.9	RMS Max	Н	231	0	-13	-50.9	Pass

Note: Frequency at around 780 MHz is EUT fundamental emission.





## **RADIATED EMISSIONS BELOW 1 GHZ**

	Test Stan	Pest Standard: Part 90   200 MHz 1 GHz								Mode:		BI	LE+L'	TE C	AT-	M1	B26	
F	requency	Range:			30	) MI	Iz -	1 GHz		Test Date:		04	4/28/2	2020-	-06/0	13/2	020	
Ant	enna Type	e/Polarit	y:		Bi-	Log	;/Ho	or & Ver	T	est Personnel	:		D	aniel	Bru	no		
	Remai	rk:					N//	4		Test Result:				Pa	SS			
dBm							Va	sona by EMiSoft								0	4 May 20 10:13	-
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	Radiated Emissio	ons		Tempt	late: FCC	C Lie ba	ind - 3	DM-1G										
											120	 				F	tes Bw (kHz)	

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
708.21	-80.3	19	23.6	-37.7	RMS Max	Н	340	108	-13	-24.7	N/A





## **RADIATED EMISSIONS BELOW 1 GHZ**



						····			Neo De p		
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
159.993	-63.7	16.1	9.4	-38.2	RMS Max	V	258	311	-13	-25.2	Pass





## **RADIATED EMISSIONS BELOW 1 GHZ**

	Test Standard: Part 27& RSS 130						30		Mode:			BI	LE+L	TE N	NB-I	OT	B12			
F	requency	Range:			301	MHz	- 1 GH	Z		Test Date:			04	/28/2	020	-06/	03/2	2020		
Ant	enna Type	Polarit	y:		Bi-L	.og/H	or & V	er	Te	est Personn	el:			Da	aniel	Bru	ino			
	Remar	:k:				N/	A		,	Test Result	:				Pa	iss				
Bm						V	asona by E	EMiSoft										EUT fun & BS sig	idame gnal	ntal
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						120			Res Bu	v (kHz)	
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
932.28	-84.61	19.51	23.63	-41.47	RMS	V	187	136	-13.00	-28.47	Pass
621.82	-84.90	18.97	21.45	-44.48	RMS	V	286	160	-13.00	-31.48	Pass

Note: Frequency at around 700 MHz is EUT fundamental emission.



MHz

1883.869

Loss

16.2

-1.6

-82.8



## **RADIATED EMISSIONS 1 - 18 GHZ**

Test St	andard:	Part 2	2 & RSS 132	2	Mode:			BLE+G	SM B5			
Frequence	y Range:	1 G	Hz – 18GHz		Test Date:		04/	/28/2020-	06/03/202	20		
Antenna Ty	pe/Polarity:	Hor	n/Hor & Ver	Т	est Personnel:			Daniel	Bruno			
Ren	nark:		N/A		Test Result:			Pa	SS			
			Vasona by EM	liSoft					19 M	/ay 20 16:00	D	
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		+							s	pec Dist 3m		
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Radiated Err	issions	Template: FCC Lic	band - 1G-18G									
					1000				Res	Bw (KHZ)		
Frequency	Raw dBm	Cable	AF dB	Level	Measurement	Pol	Hgt	Azt	Limit	М	argin	Pass

dBm

-68.2

Туре

RMS Max

cm

329

Н

Deg

289

dBm

-13

dB

-55.2

Pass





uuency Range: na Type/Polarity: Remark:	1 GHz – 180 Horn/Hor & N/A	Hz Ver	Tes Tes	Test Dat t Person	te: nnel:				04/28/2020-06/03	/2020	
na Type/Polarity: Remark:	Horn/Hor & N/A Vasona	Ver	Tes Te	t Person	nnel:				Denial Dama	<b>`</b>	
Remark:	N/A Vasona		Te	act Daci					Daniel Brund	,	
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		a by EMiSoft								08 May 20 12:23	1] Horizontal
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Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
1879.917	-82.8	16.2	-1.5	-68.1	RMS Max	Н	100	0	-13	-55.1	N/A
5430.079	-84.3	18.6	7.6	-58	RMS Max	Н	185	146	-13	-45	Pass

Note: Frequency at around 1900 MHz is EUT fundamental emission.





	Test Standard:	Part 27 & RSS 13	9	Mode	e:		BLE+LTE CAT-	M1 B4
F	Frequency Range:	1 GHz – 18GHz		Test D	ate:		04/28/2020-06/0	3/2020
Ant	enna Type/Polarity:	Horn/Hor & Ver		Test Pers	onnel:		Daniel Bruz	no
	Remark:	N/A		Test Re	sult:		Pass	
dBm DD		Vasona by E	MiSoft					08 May 20 12:41
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1							10000.00	18000.0
	Radiated Emissions	Template: FCC Lic band - 16-186			1000			Res Dw (strz)

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
1731.275	-50.6	16.2	-2.4	-36.7	RMS Max	Н	171	188	-13	-23.7	N/A
3463.409	-83.6	17.6	2	-64	RMS Max	Н	172	74	-13	-51	Pass

Note: Frequency at around 1700 MHz is EUT fundamental emission.





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Daniel Bruno Pass
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2506.047	-83.3	16.7	-1.8	-68.4	RMS Max	Н	364	304	-13	-55.4	Pass





Test Standard:	Part 27 & RSS 130	Mode:	BLE+LTE CAT-	м1 В12
Frequency Range:	1 GHz – 18GHz	Test Date:	04/28/2020-06/0	03/2020
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bru	no
Remark:	N/A	Test Result:	Pass	
9m 00	Vasona by EMiSoft			08 May 20 13:13
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Radiated Emissions	Template: FCC Lio band - 16-186			
		1000		Res Bw (kHz)

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
2116.767	-79.5	16.3	-2.4	-65.5	RMS Max	Н	190	48	-13	-52.5	Pass
1412.568	-74.8	16.1	-0.8	-59.5	RMS Max	Н	158	0	-13	-46.5	Pass





Те	est Standard:	Part 27 & RSS 130	Mode:	BLE+LTE	CAT-M1 B13
Freq	juency Range:	1 GHz – 18GHz	Test Date:	04/28/202	20-06/03/2020
Antenr	na Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Dani	el Bruno
	Remark:	N/A	Test Result:		Pass
		Vasona by EMiSoft			08 May 20 13:30
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			100	0	Res Bw (Hz)

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
2339.66	-83.9	16.5	-2.2	-69.6	RMS Max	Н	366	14	-13	-56.6	Pass





	Test Standard:	Part 9	90		Mode:				BLE+LTE CAT-M	1 B26	
Fı	equency Range:	1 GHz – 1	8GHz	1	Test Date:				04/28/2020-06/03/	/2020	
Ante	enna Type/Polarity:	Horn/Hor	& Ver	Tes	t Personne	1:			Daniel Brunc	)	
	Remark:	N/A	1	Т	est Result:				Pass		
		Vas	sona by EMiSoft							19 May 20 15:35	
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	v	A								Meas Dist 3m	
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	Radiated Emissions	Template: FCC Lic band - 10	i-18G						×	·	
						1000				Res Bw (kHz)	

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
7463.595	-84.1	21.5	12.4	-50.2	RMS Max	V	209	256	-13	-37.2	Pass





Test Standard: Frequency Range:		Part 22 & RSS 132 1 GHz – 18GHz			Mode: Test Date:			BLE+LTE NB-IOT <b>B5</b>					
								04/28/2020-06/03/2020					
Antenna Type/Pola	rity:	Horn/Hor & Ver N/A			Test Personnel:			Daniel Bruno					
Remark:					est Resu	ult:				Pass			
		Vasona	by EMiSoft								06 May 20 11:35	-	
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						100	ו				Res Bw (KHz)		

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
1669.281	-71.4	16.2	-2.5	-57.7	RMS Max	V	400	229	-13	-44.7	Pass



-70.0

-30.0

1000.0

Radiated Emissions

Template: FCC Lic band - 1G-18G



Spec Dist 3m

Frequency: MHz

Res Bw (kHz)

3000

# **RADIATED EMISSIONS 1 - 18 GHZ**

	Test Standard:	Part 27 & RSS 130 1 GHz – 18GHz			Mode: Test Date:			BLE+LTE NB-IOT B12						
F	requency Range:							04/28/2020-06/03/2020						
Ante	enna Type/Polarity:	Horn/Hor &	Horn/Hor & Ver		Test Personnel:			Daniel Bruno						
	Remark:	N/A		Т	est Res	ult:		Pass						
dBm		Vasona	a by EMiSoft											
00														
												_	[1] Horizontal	
													[2] Vertical	
-1010											_		rms Lmt	
											ms	+	Debug	
-20.0												+	Formal	
-30.0							+				N IA			
-40.0	and an		a h h washingthe	mound	Mullined	الم <sup>الي</sup> والمراجع المراجع ا	When	week for	Ny M					
-50.0	ρ <sup>ω</sup> ····································	nen siin yn eisty yn yn yn hefer far far f	and Marth				+							
-60.0											•	vleas Dist :	3m	

Frequency	Davy dDm	Cable		Level	Measurement	Del	Hgt	Azt	Limit	Margin	Dece/Eeil
MHz	Kaw dBm	Loss	AF dB	dBm	Туре	POI	cm	Deg	dBm	dB	Pass/Fail
14556.53	-81.19	26.79	20.88	-33.52	RMS Max	V	218	242	-13.00	-20.52	Pass
7411.30	-75.71	21.38	12.32	-42.01	RMS Max	V	285	164	-13.00	-29.01	Pass

1000





#### <u> 18GHz – 40GHz test result</u>

Note: no substantial emission is found other than the noise floor. Different modes have been verified.





## 8 EUT and Test Setup Photos

See FCC exhibits





## 9 Test Instrument List

Equipment	Manufacturer	Model	Instrument Number	Cal. Date	Cal. Due	
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	10/18/19	10/18/20	
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A	
Spectrum Analyzer	Keysight	N9020A	MY50110074	6/17/19	6/17/20	
EMC Test Receiver	R&S	ESL6	100230	6/14/19	6/14/20	
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	5/4/20	5/4/21	
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2019	11/15/2020	
Horn Antenna (1- 18GHz)	Electro-Metrics	EM-6961	6292	5/14/2020	5/14/2021	
Horn Antenna (18- 40GHz)	Com-Power	AH-840	101109	6/24/19	6/24/20	
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	7/15/2019	7/15/2020	
True RMS Multi-meter	UNI-T	UT181A	C173014829	5/5/2020	5/5/2021	
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	5/15/2020	5/15/2021	
RF Attenuator	Pasternack	PE7005-3	VL061	7/16/2019	7/16/2020	
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392- 77150-11	064	7/16/2019	7/16/2020	
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A	
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A	
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A	
Loop Antenna (9k- 30MHz)	Com-Power	AL-130	121012	5/16/20	5/16/21	
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	7/16/2019	7/16/2020	
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	7/16/2019	7/16/2020	
RE test cable (>18GHz)	Sucoflex	104	344903/4	7/16/2019	7/16/2020	
Pulse limiter	Com-Power	LIT-930A	531727	7/16/2019	7/16/2020	
CE test cable #1	FIRST RF	FRF-C-1002- 001	CE-6GHz-01	7/16/2019	7/16/2020	
CE test cable#2	FIRST RF	FRF-C-1002- 001	CE-6GHz-02	7/16/2019	7/16/2020	
Wideband Communication	ANRITSU	MT8821C	6262010316	10/23/2019	10/23/2020	
Wideband Communication	R&S	CMW500	147508	5/8/2020	5/8/2021	