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FCC REPORT SZEM1803001689RG **Application No:** Applicant: Neutron Holdings, Inc. Neutron Holdings, Inc. Manufacturer: **Product Name:** Tracking device Model No.(EUT): LBCAT-B/LBCAT-H/LBCAT-E LimeBike Trade Mark: FCC ID: 2APB2LBCAT Standards: 47 CFR Part 15, Subpart C KDB 558074 D01 DTS Meas Guidance v04 **Test Method** ANSI C63.10 (2013) Date of Receipt: 2018-03-29 Date of Test: 2018-04-02 to 2018-05-13 Date of Issue: 2018-05-16 PASS * **Test Result:**

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Derele yang

Derek Yang Wireless Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.



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2 Version

Revision Record								
Version Chapter Date Modifier Remark								
01		2018-05-16		Original				

Authorized for issue by:		
Tested By	Mike Mu	2018-05-16
	(Mike Hu) /Project Engineer	Date
Checked By	John Hing	2018-05-16
	(Jim Huang) /Reviewer	Date



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3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	enna Requirement 47 CFR Part 15, Subpart C Section 15.203/15.247 (c)		PASS
AC Power Line Conducted Emission	Conducted 47 CFR Part 15, Subpart C Section 15,207		PASS
Conducted Peak Output Power	47 CFR Part 15, Subpart C Section 15.247 (b)(3)	ANSI C63.10 2013	PASS
6dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.247 (a)(2)	ANSI C63.10 2013	PASS
Power Spectral Density	47 CFR Part 15, Subpart C Section 15.247 (e)	ANSI C63.10 2013	PASS
Band-edge for RF Conducted Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10 2013	PASS
RF Conducted Spurious Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10 2013	PASS
Radiated Spurious Emissions	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 2013	PASS
Restricted bands around fundamental frequency (Radiated Emission) 47 CFR Part 15, Subpart C Section 15.205/15.209		ANSI C63.10 2013	PASS



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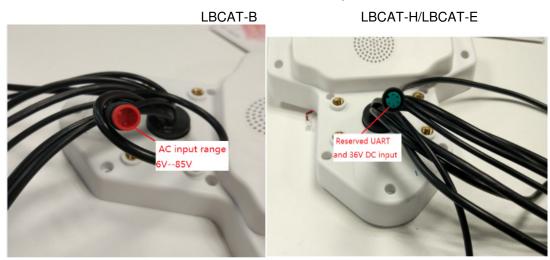
Note:

1 LBCAT-B and LBCAT-H/LBCAT-E share a mainboard PCB, achieve different functional requirements of the tow projects through bom refueling.

2 LBCAT-B and LBCAT-H/LBCAT-E difference point.



The difference between the above two differences corresponds to the whole 26PIN line as follows:



According to the declaration from the applicant, the Model LBCAT-H/LBCAT-E was tested fully, only Radiated Spurious Emission was tested on LBCAT-B, since the electrical circuit design, layout, components used and internal wiring were identical for all above models. And only the worst data had been recorded.

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4 General Information

4.1 Client Information

Applicant:	Neutron Holdings, Inc.
Address of Applicant:	2121 S El Camino real, suite B-100, San Mateo, CA 94403 USA
Manufacturer:	Neutron Holdings, Inc.
Address of Manufacturer:	2121 S El Camino real, suite B-100, San Mateo, CA 94403 USA

4.2 General Description of EUT

Product Name:	Tracking device
Model No.:	LBCAT-B/LBCAT-H/LBCAT-E
Trade Mark:	LimeBike
Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	Bluetooth V4.0 Dual-mode
Modulation Type:	GFSK
Number of Channel:	40
Sample Type:	Portable production
Antenna Type:	Monopole
Antenna Gain:	3dBi
Power Supply	DC3.7V



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	Operation Frequency each of channel						
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	10	2422MHz	20	2442MHz	30	2462MHz
1	2404MHz	11	2424MHz	21	2444MHz	31	2464MHz
2	2406MHz	12	2426MHz	22	2446MHz	32	2466MHz
3	2408MHz	13	2428MHz	23	2448MHz	33	2468MHz
4	2410MHz	14	2430MHz	24	2450MHz	34	2470MHz
5	2412MHz	15	2432MHz	25	2452MHz	35	2472MHz
6	2414MHz	16	2434MHz	26	2454MHz	36	2474MHz
7	2416MHz	17	2436MHz	27	2456MHz	37	2476MHz
8	2418MHz	18	2438MHz	28	2458MHz	38	2478MHz
9	2420MHz	19	2440MHz	29	2460MHz	39	2480MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel (CH0)	2402MHz
The middle channel (CH19)	2440MHz
The highest channel (CH39)	2480MHz



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4.3 Test Environment

Operating Environment			
Temperature:	25.0 °C		
Humidity:	50 % RH		
Atmospheric Pressure:	1010 MPa		

4.4 Description of Support Units

The EUT has been tested independent unit.

4.5 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594 No tests were sub-contracted.

4.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS (No. CNAS L2929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

FCC – Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

Industry Canada (IC)

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

4.7 Deviation from Standards

None.

4.8 Abnormalities from Standard Conditions



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None.

4.9 Other Information Requested by the Customer

None.

4.10 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty	
1	Total RF power, conducted	0.75dB	
2	RF power density, conducted	2.84dB	
3	Spurious emissions, conducted	0.75dB	
		4.5dB (30MHz-1GHz)	
4	Radiated Spurious emission test	4.8dB (1GHz-25GHz)	
5	Conduct emission test	3.12 dB(9KHz- 30MHz)	
6	Temperature test	1℃	
7	Humidity test	3%	
8	DC and low frequency voltages	0.5%	



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5.11 Equipment List

	Conducted Emission						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm- dd)	Cal.Duedate (yyyy-mm- dd)	
1	Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2018/3/10	2019/3/9	
2	LISN	Rohde & Schwarz	ENV216	SEM007-01	2017/10/9	2018/10/9	
3	LISN	ETS-LINDGREN	3816/2	SEM007-02	2018/2/14	2019/2/13	
4	8 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN- T8-02	EMC0120	2017/9/28	2018/9/28	
5	4 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN- T4-02	EMC0121	2017/9/28	2018/9/28	
6	2 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN- T2-02	EMC0122	2017/9/28	2018/9/28	
7	EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2018/2/14	2019/2/13	
8	DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2017/10/9	2018/10/9	

	RF connected test											
Item	Test Equipment	st Equipment Manufacturer		Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Duedate (yyyy-mm-dd)						
1	DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2017/10/9	2018/10/9						
2	Signal Analyzer	Rohde &Schwarz	FSV	W005-02	2018/3/13	2019/3/12						
3	Signal Generator	enerator Rohde & Schwarz		SEM006-02	2018/2/14	2019/2/13						
4	Power Meter	Meter Rohde & Schwarz		SEM014-02	2017/10/9	2018/10/9						
5	Power Sensor	Agilent Technologies	U2021XA	SEM009-01	2017/10/9	2018/10/9						



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	RE in Chamber											
Item	Test Equipment	Test Equipment Manufacturer Model No. Inventory No.		Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)							
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2018/3/10	2019/3/9						
2	EMI Test Receiver	Agilent Technologies	N9038A	SEM004-05	2017/10/9	2018/10/9						
3	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017/11/1	2020/11/1						
4	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEM003-11	2015/10/17	2018/10/17						
5	Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEM003-12	2017/11/24	2020/11/24						
6	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2018/2/14	2019/2/13						
7	Band filter	Amindeon	Asi 3314	SEM023-01	N/A	N/A						
8	DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2017/10/9	2018/10/9						
9	Loop Antenna	Beijing Daze	ZN30401	SEM003-09	2018/3/10	2019/3/9						

	RE in Chamber											
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)						
1	10m Semi-Anechoic Chamber	SAEMC	FSAC1018	SEM001-03	2018/3/10	2019/3/9						
2	EMI Test Receiver (9k-7GHz)	Rohde & Schwarz	ESR	SEM004-03	2018/2/14	2019/2/13						
3	Trilog-Broadband Antenna(30M-1GHz)	Schwarzbeck	VULB9168	SEM003-18	2016/6/29	2019/6/29						
4	Pre-amplifier	Sonoma Instrument Co	310N	SEM005-03	2017/7/6	2018/7/6						
5	.Loop Antenna	ETS-Lindgren	6502	SEM003-08	2015/8/14	2018/8/14						



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	RE in Chamber										
Item	Test Equipment	Test Equipment Manufacturer Model No. Inventory No. No. No. No.		Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)						
1	3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018/3/10	2019/3/9					
2	EXA Spectrum Analyzer	Agilent Technologies Inc	N9010A	SEM004-09	2017/7/19	2018/7/19					
3	BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-02	2017/11/15	2020/11/15					
4	Amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2017/10/9	2018/10/9					
5	Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2015/6/14	2018/6/14					
6	Horn Antenna (18-26GHz)	ETS-Lindgren	3160	SEM003-12	2017/11/24	2020/11/24					
7	HornAntenna (26GHz-40GHz)	A.H.Systems, inc.	SAS-573	SEM003-13	2017/10/17	2020/10/16					
8	Low Noise Amplifier	Black Diamond Series	BDLNA- 0118- 352810	SEM005-05	2017/10/9	2018/10/9					
9	Band filter	Amindeon	Asi 3314	SEM023-01	N/A	N/A					



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5 Test results and Measurement Data

5.1 Antenna Requirement

Standard requirement: 47 CFR Part 15C Section 15.203 /247(c)

15.203 requirement: 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, 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.

15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 3dBi.



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5.2 Conducted Emissions

Not Application

5.3 Conducted Peak Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)					
Test Method:	ANSI C63.10 :2013 Section 11.9.1.1					
Test Setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane					
Limit:	30dBm					
Test Mode:	Transmitting with GFSK modulation.					
Instruments Used:	Refer to section 5.10 for details.					
Test Results:	Pass					

Measurement Data

GFSK mode										
Test channelPeak Output Power (dBm)Limit (dBm)Result										
Lowest	4.27	30.00	Pass							
Middle	2.99	30.00	Pass							
Highest	3.71	30.00	Pass							



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Test plot as follows:			
Test mode:	GFSK	Test channel:	Lowest
Spectrum			
Att 45 dB 👄	Offset 1.00 dB ■ RBW 3 Mi SWT 1 ms ■ VBW 20 Mi		
●1Pk Max			
20 dBm		M1[1]	4.27 dBm 2.4024490 GHz
10 dBm		M1	
0 dBm			
-10 dBm			
-20 dBm			
-30 dBm			
-40 dBm			
-50 dBm			
-60 dBm			
-70 dBm			
CF 2.402 GHz	69		Span 10.0 MHz
		Measuring	

Date: 2.APR.2018 08:12:40



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Test mode:	GFSK	Test chan	nel:	Middle					
Spectrum									
RefLevel 26.00 dBr Att 45 d	m Offset 1.00 dB 👄 RE B 👄 SWT 1 ms 👄 VE		Auto Sweep		`				
●1Pk Max			•						
20 dBm		M	1[1]	2.44	3.99 dBm 05210 GHz				
10 dBm		M1							
0 dBm									
-10 dBm									
-20 dBm-									
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.44 GHz		691 pts			10.0 MHz				
		Mea	asuring 🚺 🚺	u () () () () () () () () () () () () ())2.04.2018 08:13:32 //				

Date: 2.APR.2018 08:13:33



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Test mode:		C	GFSK		Tes	st chann	el:		Highes	t	
Spectrun	n										♥
Ref Level Att	26.00 dBm 45 dB	Offs SW	set 1.00 dB	 RBW 31 VBW 201 	ИНZ ИНZ	Modo 🔥	uto Sweep				
IPk Max	15 45	- 0N	· 100	• 10 70 70 70 7		moue A	uto oweep				
20 dBm						M:	[1]	1		2.47	3.71 dBm 99130 GHz
10 dBm					М1						
0 dBm											
-10 dBm									\rightarrow		
, ⊳20 d Bm—											
-30 dBm—											
-40 dBm—											
-50 dBm—											
-60 dBm											
-70 dBm—											
CF 2.48 GI	Hz			6	91 pts	1				-	10.0 MHz
	П					Mea	suring		• • •		08:14:06 /

Date: 2.APR.2018 08:14:06



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5.4 6dB Occupy Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)					
Test Method:	ANSI C63.10: 2013 Section 11.8 Option 2					
Test Setup:	Spectrum Analyzer E.U.T Non-Conducted Table					
	Ground Reference Plane					
Limit:	≥ 500 kHz					
Test Mode:	Transmitting with GFSK modulation.					
Instruments Used:	Refer to section 5.10 for details.					
Test Results:	Pass					

Measurement Data

	GFSK mode										
Test channel	6dB Occupy Bandwidth (kHz)	Limit (kHz)	Result								
Lowest	686.3	≥500	Pass								
Middle	674.3	≥500	Pass								
Highest	68.3	≥500	Pass								



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Test plot as follows:											
Test mode:		GFSł	<		Test	chann	el:		Low	est	
Spectrum											Ē
Ref Level 2				DDUL 100 M							(🗸
Att		dB 👄 SWT	10 ms e	● RBW 100 kH ● VBW 300 kH		ode 4	uto Sw	een			
1Pk Max						ouo ,		000			
-						M	[1]				3.98 dBm
20 dBm										2.401	.82620 GHz
						nd					6.00 dB
10 dBm				M1		-Bv				686.3000	000000 kHz
						~	factor 12	I		1	3499.6
0 dBm				- V) V				
10 40								\sim			
-10 dBm											
-20 dBm											
20 abin	minen	m I	1						\mathcal{A}	m	
-30 dBm		marker							No.	and the	
											\sim \sim
-40 dBm											"hugen we
-50 dBm											
-60 dBm											
-70 dBm											
CF 2.402 GH	lz			100:	l pts					Spa	n 3.0 MHz
Marker										<u> </u>	
Type Ref		X-value		<u>Y-value</u> 3.98 dB	<u> </u>	Funct			Fund	ction Result	
M1 T1	1	2.40182		3.98 dE -2.01 dE		naB	down ndB				686.3 kHz 6.00 dB
T2	1	2.40241		-1.94 dE		Q f	actor				3499.6
	Л					Meas	suring				08:55:12

Date: 2.APR.2018 08:55:12



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Test mode:			GFSK	<u> </u>		Tes	st chanr	nel:		Midd	lle	
Spectrum												
Ref Level 2	۔ 7.00 d	Bm (Offset 1	.00 dB 🧉	• RBW 100 k	Hz						
Att		dB 🕳 🕄		-	• VBW 300 k		Mode /	∖uto Sv	veep			
●1Pk Max												
							M	1[1]				3.71 dBm
20 dBm											2.440	31470 GHz
							no	1B				6.00 dB
10 dBm							—Вұ	n Mactor			674.3000	000000 kHz
					T1 ~~~	1	Q					3618.9
0 dBm						-		T2				
-10 dBm												
				1						<		
-20 dBm				(+				$\overline{}$		
and the second second	munu	\sim	~ aluar							mar .	-	
-30 dBm											F	
												Wallow and and
-40 dBm												
-50 dBm												
-60 dBm												
-70 dBm												
CF 2.44 GHz					100	1 pts					Spa	n 3.0 MHz
Marker												
Type Ref	Trc		X-value		Y-value		Func			Func	ction Result	
M1	1		2.440314		3.71 d		ndB	down				674.3 kHz
T1	1		2.439733		-2.28 d			ndB				6.00 dB
T2	1		2.440407	76 GHz	-2.33 d	Bm	Q	factor				3618.9
	\prod						Mea	suring			1 X0)2.04.2018 08:55:40 //

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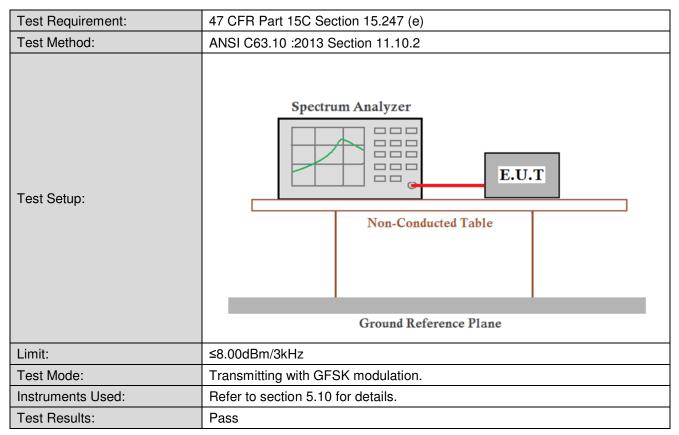
Test mode:			GFSK	K		Tes	st chanr	nel:		High	est	
Spectrum												
Ref Level 2	.7.00 d	Bm	Offset 1	00 dB 📢	RBW 100 kł	Ηz						
Att	45	dB 😑	SWT	10 ms (> VBW 300 kł	Ηz	Mode /	Auto Sv	veep			
●1Pk Max												
00 d0							М	1[1]			0.470	3.53 dBm
20 dBm							no	In			2.479	82620 GHz 6.00 dB
10 dBm											669 2000	0.00 uB 100000 kHz
					M1			factor			000.0000	3710.5
0 dBm							<u> </u>	T2			1	0710.0
0 abiii					- Da			V				
-10 dBm				-					man and a second			
-10 dbiii												
-20 dBm									`	<u>\</u>		
		\sim	~ /								- Andrew	\sim
30 dBm			met							Malino	man an	word the second
	Set.											
-40 dBm	9 0											
10 0.0												
-50 dBm												
-60 dBm						_						
-70 dBm												
CF 2.48 GHz	2	I		I	100	1 pts	;		I		Spa	n 3.0 MHz
Marker						· ·					I	
	Trc		X-value	.	Y-value	1	Func	tion		Fund	tion Result	
M1	1		2.479826		3.53 d	Bm		down				668.3 kHz
T1	1		2.479742	23 GHz	-2.48 d	Bm		ndB				6.00 dB
T2	1		2.480410	D6 GHz	-2.53 d	Bm	Q	factor				3710.5
)[Mea	suring.			1 /0)2.04.2018 08:56:09 //

Date: 2.APR.2018 08:56:08



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5.5 Power Spectral Density



Measurement Data

	GFSK mode									
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result							
Lowest	-7.56	≤8.00	Pass							
Middle	-7.48	≤8.00	Pass							
Highest	-7.74	≤8.00	Pass							



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Spectrum Ref Level 27 Att 1Pk Max 20 dBm 10 dBm	.00 dBm 45 dB •		.00 dB 👄 R 10 ms 👄 V		Mode A	uto FFT 1[1]			-7.65 dBm
Ref Level 27 Att P1Pk Max 20 dBm					Mode A				-7.65 dBm
● 1Pk Max 20 dBm	45 dB ●	SWT	10 ms 🕳 V	BW 10 kHz					
20 dBm					М	1[1]			
					M	1[1]			
								9.401	
10 dBm						I I	1	2.401	98350 GHz
10 dBm									
0 dBm									
				M1					
10 d8m				monte	mour	wannon	al contra		
-10 4600		. the souther	land and a star				The short of the second	Monter	A.
-10 dBm -20 dBm	werner burgers	AN IN I				www.thr.there			WWWWWWWWWWWWWWWWWWWW
-20 dBm									
wee Walk									
"-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.402 GHz	,			1001	nts			Qna	n 1.1 MHz
	- (1001		suring			2.04.2018

Date: 2.APR.2018 08:58:39



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Test mode:		GFSK			Test chann	nel:	Mido	lle	
Spectrum									
Ref Level 27 Att	7.00 dBm 45 dB 🖷	Offset 1.0 SWT 1		BW 3 kHz BW 10 kHz		uto FFT			
●1Pk Max									
20 dBm					M	1[1] 		2.439	-7.48 dBm 99890 GHz
10 dBm									
0 dBm				M	1				
-10 dBm -20 dBm -20 dBm		mannahude	rhy have and	- maker	marina	manhanthene	howwww.	Www.	
-20 dBm	S. Martin Varan	V							www.helphort.
∿-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.44 GHz				1001	L pts			-	n 1.1 MHz
					Mea	suring		1,XI 0)2.04.2018 08:58:13 //

Date: 2.APR.2018 08:58:13



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Test mode:		GFSK	< Comparison of the second sec		Test	channel:		High	est	
Spectrum	n									
Ref Level Att	27.00 dBm 45 dB		00 dB 👄 R 10 ms 👄 V	BW 3 kHz BW 10 kHz		de Auto F	FT			
😑 1Pk Max										
20 dBm						M1[1]				-7.74 dBm 99890 GHz
10 dBm										
0 dBm				м	1					
-10 dBm		mound	pertendent the	n and a strength of the state o	man	warmen and	Saml Brand	The owner of	whoman	Mullima
-20 dBm-	Most and Mark	PV ''								
1430 dBm										
-40 dBm										
-50 dBm										
-60 dBm										
-70 dBm—										
CF 2.48 GH	lz			1001	pts				Spa	n 1.1 MHz
						Measurin	g 🔳		1/1 0	12.04.2018 08:57:48

Date: 2.APR.2018 08:57:48



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Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.13
Test Setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

5.6 Band-edge for RF Conducted Emissions



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Test plot as follows	S:						
Test mode:	GFSK		Test chann	nel:	Lowe	est	
Spectrum							
RefLevel 27.00 dBr Att 45 d		RBW 100 kH VBW 300 kH		Auto Sweep			
⊖1Pk Max							
20 dBm				1[1] 1[1]		-2.	-28.22 dB 98700 MHz 3.98 dBm
10 dBm					M1	2.402	31800 GHz
0 dBm				r p	~		
-10 dBm					\rightarrow		
-20 dBm	70 dBm	D1				n M	\sim
-30 dBm		\bigwedge	$\overline{\mathbb{A}}$	V	V		
-40 dBm	How was have been and the way	1				•	hun
-50 dBm							
-60 dBm							
-70 dBm CF 2.4 GHz		1001	nte				10.0 MHz
		1001		suring			2.04.2018
				suring		a de la de	09:02:39 //

Date: 2.APR.2018 09:02:39



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Test mode:		GFS	К		Test chann	nel:	Hig	ghest		
Spectrun	n									
Ref Level Att	27.00 dBm 45 dB	Offset e SWT	1.00 dB 👄 R 10 ms 👄 V	BW 100 k⊢ ' BW 300 k⊢		Auto Sweep				
😑 1Pk Max										
20 dBm						1[1] 1[1]		3.	-46.60 dB 65600 MHz 3.38 dBm	
						1[1]		2.47983400 GHz		
10 dBm										
0 dBm	M1 J									
-10 dBm—		\								
/	D1 -16.640									
-20 dBm-+			_							
,-30 dBm—				A						
\sum			VV							
-40 dBm				لأسها	butupunhand	Mammeraubrah	addentifier	wenterson	Mannapalation	
-50 dBm										
-60 dBm										
-70 dBm—										
CF 2.4835	GHz			100:	L pts			Span	10.0 MHz	
					Mea	suring		III 1 ,70	02.04.2018 09:04:49	

Date: 2.APR.2018 09:04:49



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5.7 Spurious RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.11
Test Setup:	Spectrum Analyzer E-U.T Non-Conducted Table Ground Reference Plane
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass



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Test plot a	s follows:								
Test mode:		GFSK			Test chanr	nel:	Lowe	est	
Spectrur									
Ref Level Att SGL	27.00 dBm 45 dB	Offset 1 SWT 2	_	BW 100 kH 'BW 300 kH		Auto Sweep			
●1Pk Max									
20 dBm D1[1] -39.02 d 4.582670 GF 1 09 dB									
								1.08 dBm 01880 GHz	
0 dBm	1								
-10 dBm									
-20 dBm—	D1 -18.920	dBm							
-30 dBm—									
-40 dBm—	latelles and an articles	D1							
property and		anal a <mark>dapita pini</mark> ^{ind} a	alahla alam	panaltetta ha	ll the production of the	Merin II. Spale all yes	الروالي الجاري في الدين. 1	Mananahhaha	daan.dootullah
<mark>սիհինիդեկներ</mark> -60 dBm—	i el la superiori de suc	իս իստ հղվե	and detailed the	endline John I. K. Jinh	and the second	(upplind)helle	լեմլի այինդեր՝՝	^a llaineachail	n fel _n fan her
-70 dBm				3200	1 ntc				25.0 GHz
				3200	· .	lo adu			123.0 GHZ
					•	leady (09:13:37

Date: 2.APR.2018 09:13:38



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Test mode:		GFSK			Test chanr	nel:	Midd	le	
Spectrun	n)								
Ref Level Att SGL	27.00 dBm 45 dB 👄	Offset 1. SWT 2		BW 100 kH BW 300 kH		∖uto Sweep			`
😑 1Pk Max									
20 dBm						l[1] l[1]		4.5	-35.80 dB 29550 GHz -1.54 dBm
10 dBm								2.4	40160 GHz
0 dBm	<u>1</u>								
-10 dBm—									
-20 dBm—	D1 -18.920 dB	3m							
-30 dBm—		D1							
-40 dBm—	un an					Latin and A		ان بالته	an an an an an
a na parte da cara da cara d	en en ser en dellakelerine	u <mark>shebhan</mark> ana	nt hay ben diversion	anger van de fan de Fan de fan de	and a state of the second s	er i se proces and analysis	annana fananda Banana		ala da anti da anti. Anti anti anti anti anti anti anti anti a
	all the second of the		(option), et al Mariana	phalippan (pha)	, hour day, sayi,	and an and a second	allinda. Caller de	a hillen silane	ahy <mark>hatabaha</mark> ka
-60 dBm									
-70 dBm——									
CF 12.5 GH	-tz			3200	1 pts			Span	25.0 GHz
) R	eady (1/0	2.04.2018 09:15:07

Date: 2.APR.2018 09:15:07



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Test mode:	GFSK	Test channel:	Highest
Spectrum			
RefLevel 27.00 dBm Att 45 dB e		00 kHz 00 kHz Mode Auto Sweep	X
●1Pk Max			
20 dBm		D1[1] M1[1]	-38.35 dB 4.405330 GHz 1.51 dBm
10 dBm			2.480000 GHz
0 dBm			
-10 dBm			
-20 dBmD1 -18.490 d	Bm		
-30 dBm	D1		
-40 dBm		u na antan ann a na dhuadhadhaannadh dha n	an na han a san an a
particular concernance of the second state of the second se	personal to the second s	and the second state of the se	almost increased all the state of
-60 dBm	بىرىم بار <mark>مى</mark> لىرى مەركىلارىن م ايىلار	all de la factor de la la construction de la construc-	en l'alle a l'hanne a malagne an an
-70 dBm			
CF 12.5 GHz		32001 pts	Span 25.0 GHz
[][Ready	02.04.2018 09:16:36

Date: 2.APR.2018 09:16:36

Remark:

Scan from 9kHz to 25GHz, the disturbance below 30MHz was very low, and the above harmonics were the highest point could be found when testing. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



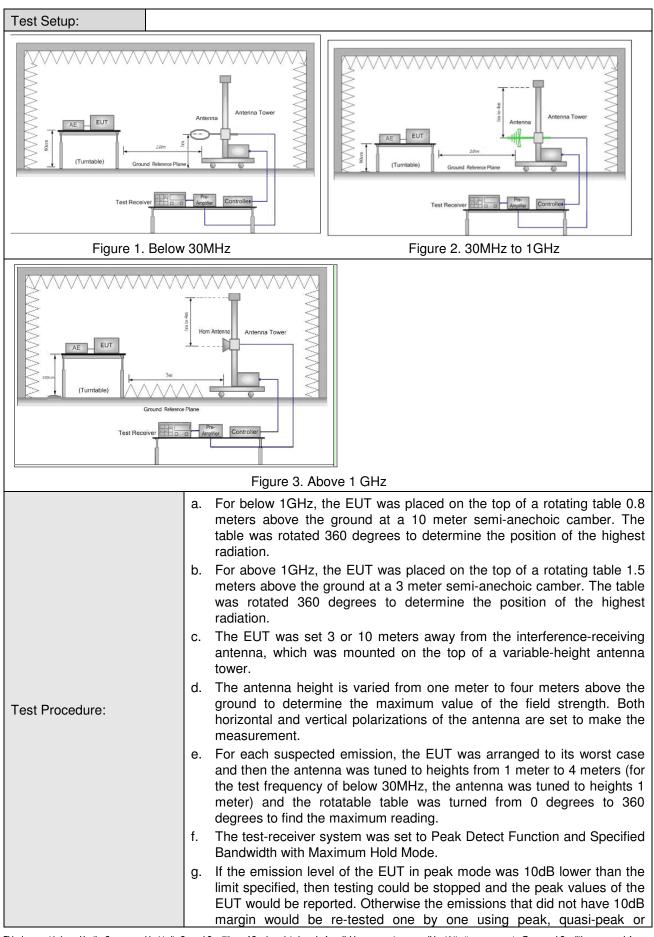
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5.8 Radiated Spurious Emission

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205						
Test Method:	ANSI C63.10 :2013 Section 11.12						
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)						
	Frequency	Detector	RBW	VBW	Remark		
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak		
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average		
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi- peak		
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak		
Receiver Setup:	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average		
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi- peak		
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi- peak		
		Peak	1MHz	3MHz	Peak		
	Above 1GHz	Peak	1MHz	10Hz	Average		
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Measureme nt distance (m)	Remark		
	0.009MHz-0.490MHz	2400/F(kHz)	-	300	-		
	0.490MHz-1.705MHz	24000/F(kHz)	-	30	-		
	1.705MHz-30MHz	30	-	30	-		
	30MHz-88MHz	100	40.0	3	Quasi-peak		
	88MHz-216MHz	150	43.5	3	Quasi-peak		
	216MHz-960MHz	200	46.0	3	Quasi-peak		
	960MHz-1GHz	500	54.0	3	Quasi-peak		
	Above 1GHz	500	54.0	3	Average		
	Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.						



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	average method as specified and then reported in a data sheet.		
	h. Test the EUT in the lowest channel (2402MHz),the middle channel (2440MHz),the Highest channel (2480MHz)		
	i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.		
	j. Repeat above procedures until all frequencies measured was complete.		
Exploratory Test Mode:	Transmitting with GFSK modulation.		
	Charge + Transmitting mode.		
	Transmitting with GFSK modulation.		
	Pretest the EUT at Charge + Transmitting mode,		
Final Test Mode:	For below 1GHz part, through pre-scan, the worst case is the lowest channel.		
	Only the worst case is recorded in the report.		
Instruments Used:	Refer to section 5.10 for details.		
Test Results:	Pass		

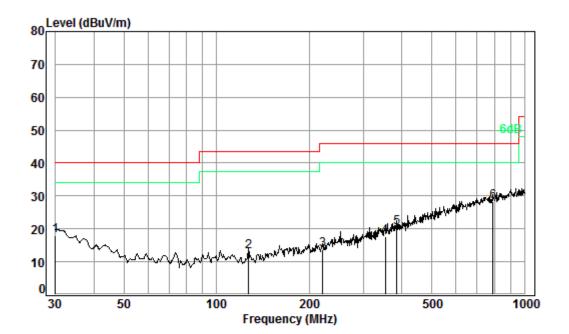


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5.8.1 Radiated Emission below 1GHz

The level at 3m test distance is below:

30MHz~1GHz (QP)		
Test mode:	Charge + Transmitting	Vertical



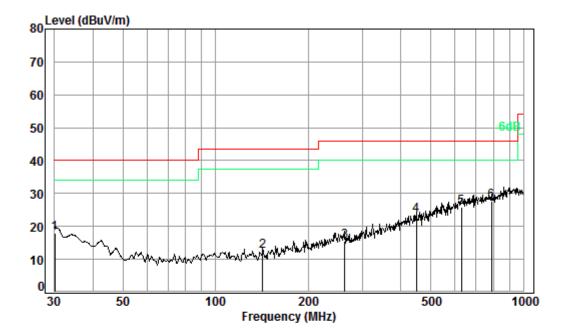
Condition: 3m VERTICAL Job No. : 01689RG Test mode: a

Fr	Cable eq Loss		Preamp Factor				
м	Hz dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 30. 2 127. 3 221. 4 352. 5 385. 6 pp 790.	22 1.27 39 1.52 94 2.07 28 2.16	13.33 17.32 21.18 22.04	27.67 27.52 27.53 27.65 27.71 27.43	26.04 22.31 22.09 24.03	13.12 13.62 17.69 20.52	43.50 46.00 46.00 46.00	-30.38 -32.38 -28.31 -25.48



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	arge + Transmitting	Horizontal
--	---------------------	------------



Condition: 3m HORIZONTAL Job No. : 01689RG Test mode: a

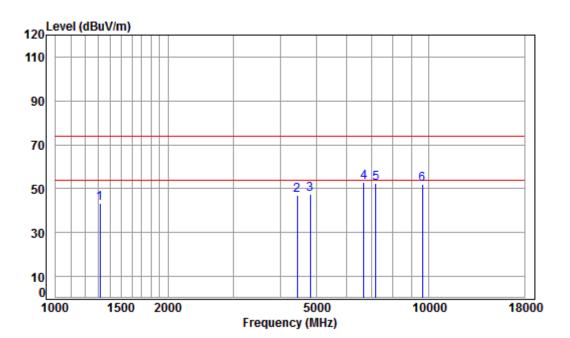
		Cable	Ant	Preamp	Read		Limit	0ver
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit
-	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	30.11	0.60	22.44	27.67	22.44	17.81	40.00	-22.19
2	142.32	1.30	13.92	27.52	24.74	12.44	43.50	-31.06
3	262.90	1.74	19.06	27.54	22.29	15.55	46.00	-30.45
4	449.56	2.41	23.55	27.81	25.30	23.45	46.00	-22.55
5	629.48	2.76	27.00	27.65	23.60	25.71	46.00	-20.29
6 pp	787.85	3.17	28.43	27.43	23.64	27.81	46.00	-18.19



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5.8.2 Transmitter Emission above 1GHz

rest mode. Tost channel. Lowest fremark. Fear Ventear	Test mode:	GFSK	Test channel:	Lowest	Remark:	Peak	Vertical
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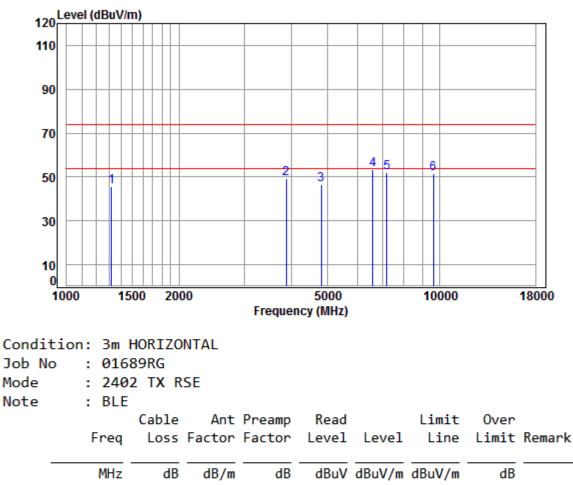
Condition:	3m VERTICAL
Job No :	01689RG
Mode :	2402 TX RSE
Note :	BLE

	Freq			Preamp Factor					Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1315.985								•
2	4443.453	7.50	33.60	42.41	48.36	47.05	74.00	-26.95	peak
3	4804.000	7.89	34.16	42.47	47.88	47.46	74.00	-26.54	peak
4 pp	6679.040	11.02	35.61	41.08	47.49	53.04	74.00	-20.96	peak
5	7206.000	10.08	36.42	40.71	46.78	52.57	74.00	-21.43	peak
6	9608.000	10.75	37.52	37.74	41.27	51.80	74.00	-22.20	peak



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Test mode: GFSK	Test channel:	Lowest	Remark:	Peak	Horizontal
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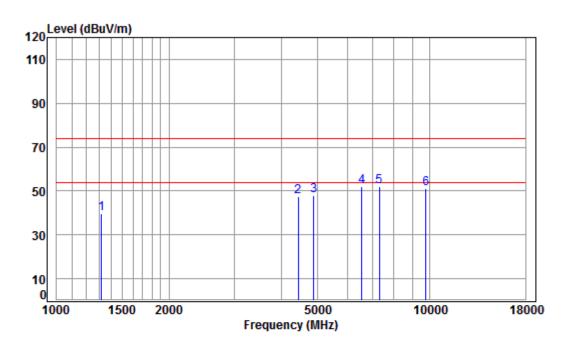


1	1319.794	4.87	25.04	41.28	56.94	45.57	74.00 -28.43 peak
2	3879.027	6.86	33.28	42.30	51.44	49.28	74.00 -24.72 peak
3	4804.000	7.89	34.16	42.47	46.80	46.38	74.00 -27.62 peak
4 pp	6602.265	11.24	35.39	41.14	48.02	53.51	74.00 -20.49 peak
5	7206.000	10.08	36.42	40.71	46.14	51.93	74.00 -22.07 peak
6	9608.000	10.75	37.52	37.74	40.89	51.42	74.00 -22.58 peak



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Test mode: GFSK	Test channel:	Middle	Remark:	Peak	Vertical
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Condition:	3m VERTICAL
Job No :	01689RG

Mode	:	2440	ΤХ	RSE
	-			

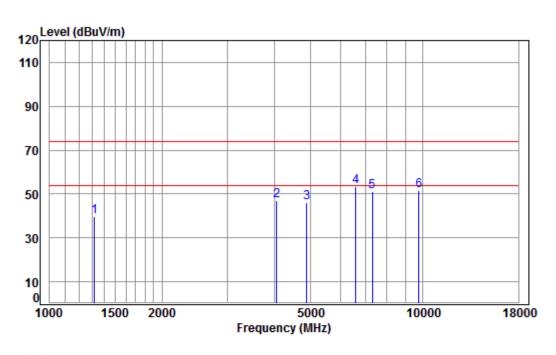
Note	:	BLE

				Preamp					
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1319.794	4.87	25.04	41.28	50.93	39.56	74.00	-34.44	peak
2	4430.628	7.48	33.60	42.41	48.57	47.24	74.00	-26.76	peak
3	4880.000	7.97	34.29	42.48	48.36	48.14	74.00	-25.86	peak
4 pp	6564.209	11.35	35.29	41.17	46.70	52.17	74.00	-21.83	peak
5	7320.000	10.05	36.37	40.63	46.05	51.84	74.00	-22.16	peak
6	9760.000	10.82	37.55	37.53	40.08	50.92	74.00	-23.08	peak



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Test mode: GFSK	Test channel:	Middle	Remark:	Peak	Horizontal
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Condition:	3m HORIZONTAL
Job No :	01689RG

300 110		0100.	2ING	
Mode	:	2440	ТΧ	RSE

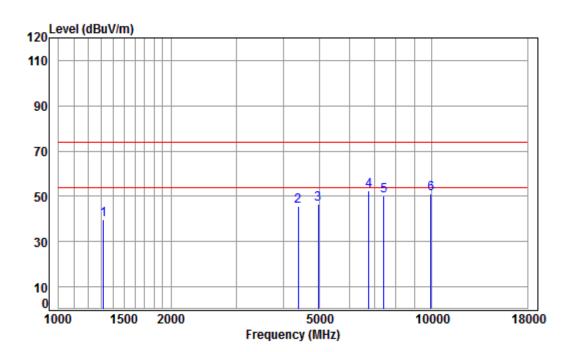
Note	 BLE

		Cable	Ant	Preamp	Read		Limit	0ver	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1319.794	4.87	25.04	41.28	51.27	39.90	74.00	-34.10	peak
2	4050.904	7.04	33.60	42.34	48.68	46.98	74.00	-27.02	peak
3	4880.000	7.97	34.29	42.48	46.44	46.22	74.00	-27.78	peak
4 pp	6602.265	11.24	35.39	41.14	47.91	53.40	74.00	-20.60	peak
5	7320.000	10.05	36.37	40.63	45.47	51.26	74.00	-22.74	peak
6	9760.000	10.82	37.55	37.53	40.75	51.59	74.00	-22.41	peak



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Test mode: GFSK	Test channel:	Highest	Remark:	Peak	Vertical
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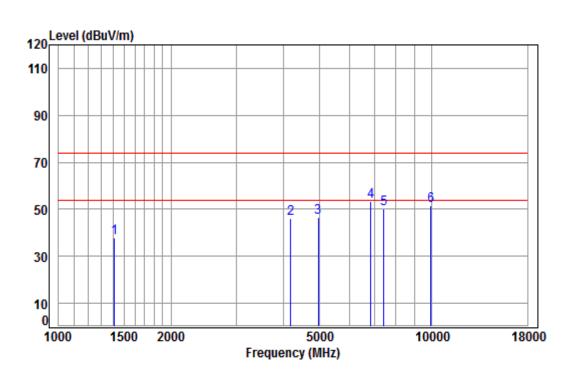


Condition: 3m VERTICAL										
Job No : 01689RG										
Mode : 2480 TX RSE										
Note	: BLE									
		Cable	Ant	Preamp	Read		Limit	0ver		
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark	
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
1	1319.794	4.87	25.04	41.28	51.09	39.72	74.00	-34.28	peak	
2	4379.699	7.43	33.60	42.40	46.94	45.57	74.00	-28.43	peak	
3	4960.000	8.05	34.43	42.49	46.42	46.41	74.00	-27.59	peak	
4 pp	6776.265	10.75	35.89	41.01	46.98	52.61	74.00	-21.39	peak	
5	7440.000	10.02	36.32	40.56	44.56	50.34	74.00	-23.66	peak	
6	9920.000	10.90	37.58	37.31	40.14	51.31	74.00	-22.69	peak	



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Test mode: GFSK	Test channel:	Highest	Remark:	Peak	Horizontal
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Condition:	3m HORIZONTAL
	0460000

Job No	:	01689	ƏRG	
Mode	:	2480	ТΧ	RSE

		_	-
No	te	 BL	Е

ole									
				Preamp					
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1410.514	5.19	25.44	41.34	48.39	37.68	74.00	-36.32	peak
2	4181.768	7.20	33.60	42.36	47.43	45.87	74.00	-28.13	peak
3	4960.000	8.05	34.43	42.49	46.60	46.59	74.00	-27.41	peak
4 pp	6855.063	10.53	36.10	40.96	47.54	53.21	74.00	-20.79	peak
5	7440.000	10.02	36.32	40.56	44.46	50.24	74.00	-23.76	peak
6	9920.000	10.90	37.58	37.31	40.53	51.70	74.00	-22.30	peak



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Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
 - Final Test Level = Receiver Reading + Antenna Factor + Cable Factor Preamplifier Factor
- 2) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.



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5.9 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Sectio	n 15.209 and 15.205						
Test Method:	ANSI C63.10: 2013 Sect	ANSI C63.10: 2013 Section 11.12						
Test Site:	Measurement Distance:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)						
	Frequency	Limit (dBuV/m @3m)	Remark					
	30MHz-88MHz	40.0	Quasi-peak Value					
Limit:	88MHz-216MHz	43.5	Quasi-peak Value					
	216MHz-960MHz	46.0	Quasi-peak Value					
	960MHz-1GHz	54.0	Quasi-peak Value					
	Above 1GHz	54.0	Average Value					
	Above TGHZ	74.0	Peak Value					
Test Setup:		Antenna Ground Reference Plane Test Receiver	Antenna Tower					
Test Setup.		Horn Antenna Horn Antenna Ground Reference Plane Test Receiver	Antenna Tower					
Test Procedure:	meters above the g	EUT was placed on the t ground at a 10 meter sen 60 degrees to determine th	ni-anechoic camber. Th					

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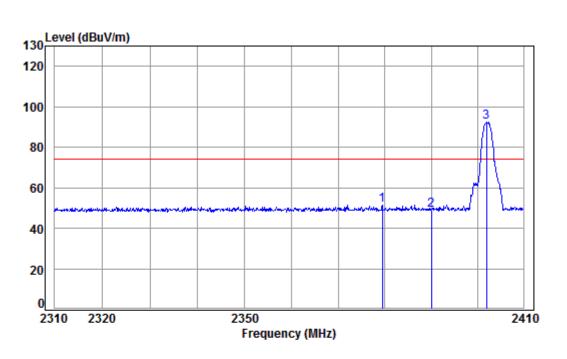
	 radiation. b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was turned to heights from 1 meter to 4 meters and the rotatable table was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel h. Test the EUT in the lowest channel , the Highest channel i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case. j. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with GFSK modulation. Charge + Transmitting mode.
	Transmitting with GFSK modulation.
Final Test Mode:	Pretest the EUT at Charge + Transmitting mode.
	Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass



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Test plot as follows:

Worse case mode: GFSK Test channel: Lowest Remark: Peak Vertical	Worse case mode: GFSK
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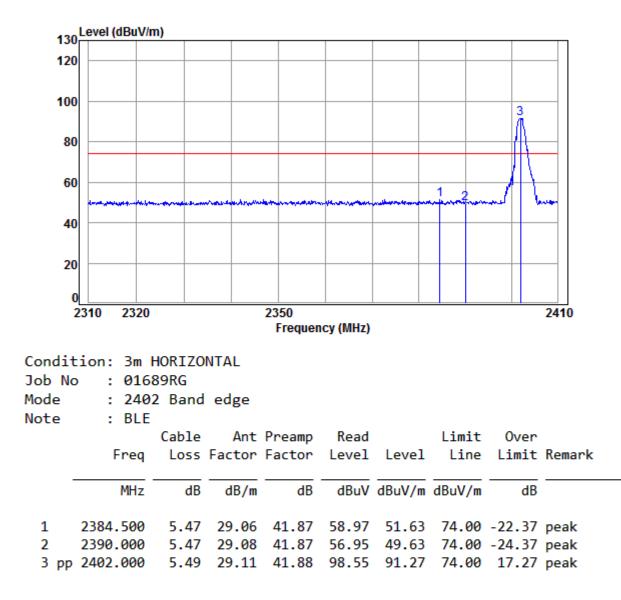
Condition: 3m VERTICAL

Job No) : 01 68	89RG							
Mode	: 240	2 Band	edge						
Note	: BLE								
		Cable	Ant	Preamp	Read		Limit	0ver	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
-									
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2379.453	5.46	29.05	41.87	58.75	51.39	74.00	-22.61	peak
2	2390.000	5.47	29.08	41.87	56.14	48.82	74.00	-25.18	peak
3 рр	2402.000	5.49	29.11	41.88	99.53	92.25	74.00	18.25	peak



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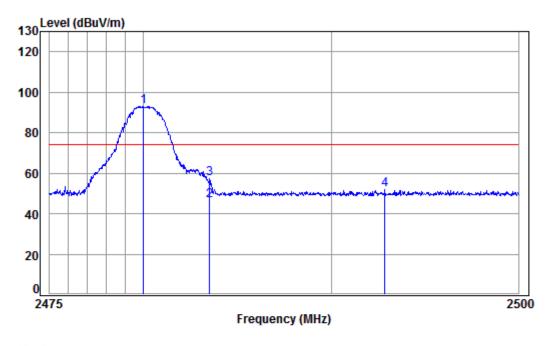
Worse case mode: GFSK	Test channel:	Lowest	Remark:	Peak	Horizontal
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Worse case mode: GFSK	Test channel:	Highest	Remark:	Peak	Vertical
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Condition:	Зm	VERTICAL
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Job No	:	01689RG
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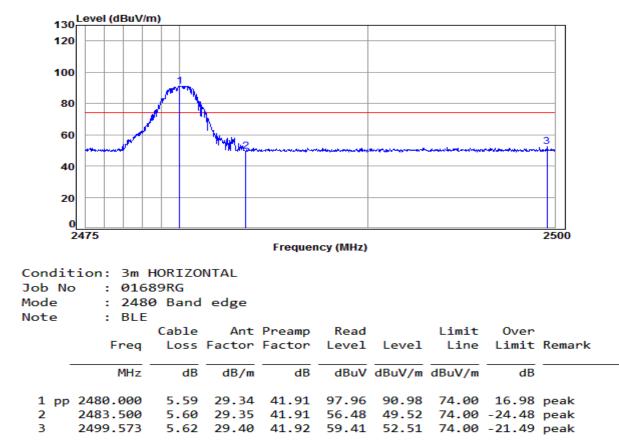
Mode	:	2480 Band edge
Note	:	BLE
		Cable Ant Preamp

	Freq			Preamp Factor					Remark
	MHz			dB				dB	
2 av 3	2480.000 2483.500 2483.500 2492.849	5.60 5.60	29.35 29.35	41.91 41.91	53.50 64.27	46.54 57.31	54.00 74.00	-7.46 -16.69	Average peak



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Worse case mode:	GFSK	Test channel:	Highest	Remark:	Peak	Horizontal



Note:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor



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6 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1803001689