

OCTOBER 2017

FCC PART 15.247 CERTIFICATION TEST REPORT

for the

BlueFIRE Inflation Device FCC ID: 2AMVF-IN10

REPORT# 15083-01 REV 0

Prepared for: Merit Medical Systems, Inc. 1600 West Merit Parkway South Jordan, UT 84095

Prepared By: Washington Laboratories, Ltd. 7560 Lindbergh Drive Gaithersburg, Maryland 20879



Testing Certificate AT-1448

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FCC Part 15.247 Certification Test Report

for the

Merit Medical Systems, Inc. BlueFIRE Inflation Device

FCC ID: 2AMVF-IN10

October 2017 WLL REPORT# 15083-01 REV 0

Prepared by:

Mulal F. Colitte

Michael F. Violette, P.E. Test Engineer

Reviewed by:

Steve Koster President



ABSTRACT

This report has been prepared on behalf of Merit Medical Systems, Inc. to support the attached Application for Equipment Authorization. The test report and application are submitted for a Digital Transmission System (DTS) Transmitter under Part 15.247 of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy and under RSS-247 of Innovation, Science and Economic Development Canada (ISED). This Certification Test Report documents the test configuration and test results for the Merit Medical Systems, Inc. BlueFIRE Inflation Device.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The ISED OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Certificate AT-1448 as an independent FCC test laboratory.

The Merit Medical Systems, Inc. BlueFIRE Inflation Device complies with the limits for a Digital Transmission System (DTS) Transmitter device under FCC Part 15.247 and Innovation, Science and Economic Development Canada (ISED) RSS-247.

Revision History	Description of Change	Date
Rev 0	Initial Release	October 2017
Rev 1	Revised per ACB comments	November 2, 2017



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1 INTRODUCTION

1.1 COMPLIANCE STATEMENT

The Merit Medical Systems, Inc. BlueFIRE Inflation Device complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247 and ISED Canada RSS-247.

1.2 TEST SCOPE

Tests for radiated and conducted (at antenna terminal) emissions were performed. All measurements were performed in accordance with FCC Public Notice DA-00-705 "Measurement Guidance for Frequency Hopping Spread Spectrum Systems. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 CONTRACT INFORMATION

Customer:	Merit Medical Systems, Inc.	
Address	1600 West Merit Parkway	
	South Jordan, UT 84095	

Purchase Order Number:	378584
Quotation Number:	70106

1.4 TEST DATES

Testing was performed on the following date(s): 31 May 2017

1.5 Test and Support Personnel

Washington Laboratories, LTDMichael VioletteCustomer RepresentativeJon Davis



1.6 ABBREVIATIONS

А	Ampere
ac	alternating current
AM	Amplitude Modulation
Amps	Amperes
b/s	bits per second
BW	BandWidth
CE	Conducted Emission
cm	Centimeter
CW	Continuous Wave
dB	deciBel
dc	direct current
EMI	Electromagnetic Interference
EUT	Equipment Under Test
FM	Frequency Modulation
G	g iga – prefix for 10 ⁹ multiplier
Hz	Hertz
IF	Intermediate Frequency
k	kilo – prefix for 10 ³ multiplier
LISN	Line Impedance Stabilization Network
М	Mega – prefix for 10 ⁶ multiplier
m	Meter
μ	m icro – prefix for 10 ⁻⁶ multiplier
NB	Narrow b and
QP	Quasi-Peak
RE	Radiated Emissions
RF	Radio Frequency
rms	root-mean-square
SN	Serial Number
S/A	Spectrum Analyzer
V	Volt



2 EQUIPMENT UNDER TEST

2.1 EUT IDENTIFICATION & DESCRIPTION

The BlueFIRE Inflation Device and Fluid Dispensing Syringe by Merit Medical is a 30mL disposable device with an integral pressure transducer, microcomputer, back-lit LCD, threaded plunger assembly with lock/release bar, a flexible high pressure extension tube, and a three-way stopcock. The BlueFIRE Syringe is designed to generate positive and negative pressure, and monitor positive pressures over a range of zero to +35ATM/BAR (zero to 514 PSI).

The BlueFIRE device communicates with a tablet computer that is running proprietary software (BlueFIRE Monitor) via a Bluetooth connection.

The BlueFIRE Monitor displays pressures created by the BlueFIRE Syringe. The BlueFIRE Syringe is connected to the Monitor via Bluetooth wireless technology. In addition to displaying pressure parameters in ATM (atmospheres), psi (pounds per square inch), mmHg (millimeters of mercury), or Bar, the BlueFIRE Monitor displays duration of pressurization in minutes and seconds, time elapsed since last pressurization, and when a negative pressure has been reached. The Monitor also has the capability to store a log of the inflation pressures and times for each BlueFIRE Syringe, and to email or print these logs.

Item	See above	
Manufacturer:	Merit Medical Systems, Inc.	
FCC ID:	2AMVF-IN10	
ISED ID:	NA	
Model:	BlueFIRE Inflation Device	
Serial Number of Unit Tested	None	
FCC Rule Parts:	§15.247	
Frequency Range:	2402-2480 MHz	
Maximum Output Power:	0.62mW (-2.1dBm)	
Modulation:	PSK	
Occupied Bandwidth:	1.7MHz	
Keying:	Automatic	
Type of Information:	Data	

Table 1: Device Summary

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Number of Channels:	40
Power Output Level	Fixed
Antenna Connector	None
Antenna Type	PIFA
Interface Cables:	None
Power Source & Voltage:	3V CR1616 coin cell battery



2.2 TEST CONFIGURATION

The BlueFIRE Inflation Device was configured with a SMA connector at the output of the matching network with the PCB antenna cut away. The conducted measurements were performed at the antenna input.

Software, provided by the client, was used to control the output frequency and modes of the device during the RF measurements

2.3 TESTING ALGORITHM

The BlueFIRE Inflation Device was tested was programmed for FHSS operation via ?? Worst cast emission levels are provided in the test results data.using software provided by the chip manufacturer, Nordic Semiconductor.

2.4 TEST LOCATION

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The ISED Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Certificate AT-1448 as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4-2014: American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

ANSI 63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.



2.6 MEASUREMENT UNCERTAINTY

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 (R2002) with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.



Equation 1: Standard Uncertainty

$$u_{c} = \pm \sqrt{\frac{a^{2}}{div_{a}^{2}} + \frac{b^{2}}{div_{b}^{2}} + \frac{c^{2}}{div_{c}^{2}} + \dots}$$

Where $u_c = standard$ uncertainty

a, b, c,.. = individual uncertainty elements

 $\operatorname{Div}_{a, b, c}$ = the individual uncertainty element divisor based on the probability distribution

Divisor = 1.732 for rectangular distribution

Divisor = 2 for normal distribution

Divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

Where U	= expanded uncertainty
k	= coverage factor
	$k \leq 2$ for 95% coverage (ANSI/NCSL Z540-2 Annex G)
uc	= standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is <u>not</u> used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 2 below.

Table 2: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty
Conducted Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	<u>+</u> 2.63 dB
Radiated Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	<u>+</u> 4.55 dB

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3 TEST EQUIPMENT

Table 3 shows a list of the test equipment used for measurements along with the calibration information.

Table 3: Test Equipment List

Asset #	Manufacturer/Model	Description	Cal. Due
4	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	12/14/2018
66	B&Z (HP) - BZ-01002650-401545-282525	HF PRE-AMPLIFIER 1-26.5GHZ (MODIFIED)	2/14/2018
823	AGILENT - N9010A	EXA SPECTRUM ANALYZER	12/21/2017
382	SUNOL SCIENCES CORPORATION - JB1	ANTENNA BICONLOG	8/31/2017
626	ARA - DRG-118/A	ANTENNA HORN	4/7/2018
210	NARDA - V638	HORN STANDARD GAIN	CNR
453	AH SYSTEMS - PAM1840	PRE-AMPLIFIER 18GHZ-40 GHZ	5/11//2019
280	ITC - 21C-3A1	WAVEGUIDE 3.45-11.0GHZ	8/1/2017
281	ITC - 21A-3A1	WAVEGUIDE 4.51-10.0GHZ	8/1/2017
282	ITC - 21X-3A1	WAVEGUIDE 6.8-15GHZ	10/22/2017



4 TEST RESULTS

The Table Below shows the results of testing for compliance with a Frequency Hopping Spread Spectrum device in accordance with FCC Part 15.247 10/2014 and RSS-247 Issue 1. Full test results are shown in subsequent sub-sections.

FCC Rule Part	Description	Result
15.247 (a)(1)	20dB Bandwidth	1.7 MHz
15.247 (b)	Transmit Output Power	0.6mW
15.247 (a)(1)	Channel Separation	1.02 MHz
15.247 (a)(1)	Number of Channels	40
15.247 (a)(1)	Time of Occupancy	0.196 ms
15.247 (d)	Occupied BW / Out-of-Band Emissions (Band Edge @ 20dB below)	Pass
15.205 15.209	General Field Strength Limits (Restricted Bands & RE Limits)	Pass
15.207	AC Conducted Emissions	N/A
FCC Rule Part	Description	Result
15.207	AC Conducted Emissions	N/A

Table 4: Test Summary Table



4.1 TIME OF OCCUPANCY

In accordance with the FCC Public Notice the spurious radiated emissions measurements may be adjusted if using a duty cycle correction factor if the dwell time per channel of the hopping signal is less than 100 ms.

The following figure shows the plot of the dwell time for the transmitter. Each channel is on for 0.196 ms which corresponds to 64.6 hops per channel per second. Thus, each channel is active for 6.46 times over 100ms. The total "ON" time for each channel over 100ms is (6.46*0.196ms) or 1.2 ms.

Duty cycle = 20*Log(1.2/100) = 58.4 dB

These tests were conducted with the RF output connected through appropriate attenuators to the input of a spectrum analyzer set to zero span mode. The unit was set to hopping mode with the spectrum analyzer set to 2442MHz. The results are shown in the plots below.

	Test	Result	Limit	Pass/Fail
А	Dwell time per Hop	0.196ms		
В	Averaging time (79 *0.4) seconds	31.6 s		
С	Number of hops per second (1/A)	5100 hops		
D	Number of hops per channel per second (C/79)	64.6		
Е	Number of hops over averaging time (D*B)	2040.8		
F	Total on-time over averaging time (A*E)	0.4	0.4	Pass

Table 5: Duty Cycle/Time of Occupancy Results



Figure 1: Channel Occupancy





Figure 2: Sweep of 50 seconds





RF Power Output: (FCC Part §2.1046)

To measure the output power the hopping sequence was stopped while the frequency dwelled on a low, high and middle channel. The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system.

Table 6: RF Power Output

Frequency	Level (dBm)	Limit (dBm)	Pass/Fail
Low Channel: 2402MHz	-2.1	30	Pass
Mid Channel: 2442MHz	-2.3	30	Pass
High Channel: 2480MHz	-2.6	30	Pass





Figure 3: RF Peak Power, Low Channel





Figure 4: RF Peak Power, Mid Channel





Figure 5: RF Peak Power, High Channel



4.2 OCCUPIED BANDWIDTH: (FCC PART §2.1049)

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

For Frequency Hopping Spread Spectrum Systems, FCC Part 15.247 requires the maximum 20 dB bandwidth not exceed 500 kHz.

At full modulation, the occupied bandwidth was measured as shown.

Table 7 provides a summary of the Occupied Bandwidth Results.

Table 7: Occupied Bandwidth Results (20 dB OBW)

Frequency	Bandwidth (MHz)	Limit (kHz)	Pass/Fail
Low Channel: 2402MHz	1.7	None	Pass
Mid Channel: 2442MHz	1.6	None	Pass
High Channel: 2480MHz	1.5	None	Pass



Agilent Spectrum Analyzer - Occupie	d BW				
10 RF 50 Ω AC		SENSE:INT	ALIGNAUTO 0	5:25:02 AM May 31, 2017	Trace/Detector
x aB -20.00 aB	Tri				
	#IFGain:Low #A	ten: 10 dB	Ra	dio Device: BTS	
Ref Offset 3 de 10 dB/div Ref 10.00 de	3 Bm				
0.00		mm			Clear Write
-20.0	m	- Marry	man		
-40.0			ر بر	and and a second and and	Average
-50.0					MaxHold
-70.0					Maxmore
-80.0					
Center 2.402 GHz Res BW 27 kHz		VBW 270 kHz	Sv	Span 3 MHz veep 4.933 ms	Min Hold
Occupied Bandwid	dth	Total Power	4.72 dB	m	Detector
·	1.6949 MHz				Average Man
Transmit Freq Error	-1.945 kHz	OBW Power	99.00	%	
x dB Bandwidth	1.640 MHz	x dB	-20.00 c	IB	
MSG			STATUS		

Figure 6: Occupied Bandwidth, Low Channel



Agilent Spectrum Analyzer - Occupied BW											
Cepter Freq 2 442000000 (GHz C	SENSE:INT	م ا 00000 GHz	LIGN AUTO	06:25:39 / Radio Std	AM May 31, 2017 : None	Frequency				
		rig: Free Run	Avg Hold:	> 10/10	Padia Day	vice: BTS					
#IFGain:Low #Attern to db Radio Device: BIS											
10 dB/div Ref Offset 3 dB Ref 10.00 dBm											
							Contor From				
10.00		in the					2.442000000 GHz				
-10.0	as more and	and a more	mar .								
-20.0	And A start		and the second	mon							
-30.0					and when the second second	~~~~					
-40.0						V V VVV					
-50.0											
-60.0											
-70.0											
-80.0							05.0445				
Cepter 2 442 CHz					- Cr	an 3 M⊌z	2.402000000 GHz				
Res BW 27 kHz		VBW 270 ki	lz		Sweep	4.933 ms	Auto <u>Man</u>				
Occupied Bandwidth		Total P	ower	4.45	dBm		Freq Offset				
1.6	722 MHz						0 Hz				
Transmit Freq Error	-3.875 kHz	OBW P	ower	99	.00 %						
x dB Bandwidth	1.621 MHz	x dB		-20.0	00 dB						
MSG				STATUS	;						

Figure 7: Occupied Bandwidth, Mid Channel



Agilent Spectrum Analyzer - Occupie	ed BW						
N RF 50 Ω AC Compton Enor 2 4200000		SENSE:INT	48000000 G	ALIGN AUTO	06:26:14	AM May 31, 2017	Trace/Detector
Center Fred 2.4800000		Trig: Free Run	Trig: Free Run Avg Hold:>10/10				
	#IFGain:Low	#Atten: 10 dB			Radio De	vice: BTS	
Ref Offset 3 df	8						
10 dB/div Ref 10.00 dl	Bm						
Log							
0.00		~					Clear Write
-10.0	~	m					
-20.0	- market		كمسي	m			
ann				- marine	m.		
and the second s					ww	m	Average
-40.0						\sim	
-50.0							
-60.0							MaxHold
-70.0							Maxmon
-80.0							
Center 2.48 GHz					Sr	oan 3 MHz	Min Hold
Res BW 27 kHz		VBW 27	'0 kHz		Sweep	4.933 ms	
A		T -6	-l Damar	4.24	4 .dD		Bataata
Occupied Bandwi	ath	100	ai Power	4.2	гавт		Detector Average
	1.6969 MH	z					<u>Auto</u> Man
Transmit Freq Error	-8.449 k	Hz OB	N Power	9	9.00 %		
x dB Bandwidth	1.536 M	Hz ydl	3	-20	00 dB		
			-	20.			
MSG				STATL	IS		

Figure 8: Occupied Bandwidth, High Channel



4.3 CHANNEL SPACING AND NUMBER OF HOP CHANNELS (FCC PART §15247(A)(1)

Per the FCC requirements, frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth, whichever is greater. In addition, for a 2.4GHz transmitter the number of hopping channels shall be stated.

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 10 dB attenuator. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator. The spectrum analyzer resolution bandwidth was set to 30 kHz and the video bandwidth was set to 100 kHz. The channel spacing of 2 adjacent channels was measured using a spectrum analyzer span setting of 100 kHz.

The following are plots of the channel spacing and number of hopping channels data.

Note: In the following plots, each channel is composed of 2 distinct peaks.

Table 8: Channel Spacing and Number of Channels Results

Frequency	Result	Limit	Pass/Fail
Channel Spacing	1.02 MHz	25 kHz Minimum	Pass
Number of channels	79 channels	15 Channels Minimum	Pass



Figure 9: Channel Spacing





Figure 10: Number of Hopping Channels

The software that was used was generic software and all 79 channels were measured. The 40 channels represent a subset of the full hopping channels, however the device firmware employs BT LE functionality.





4.4 CONDUCTED SPURIOUS EMISSIONS AT ANTENNA TERMINALS (FCC PART §2.1051)

The EUT must comply with requirements for spurious emissions at antenna terminals. Per §15.247(c) all spurious emissions in any 100 kHz bandwidth outside the frequency band in which the spread spectrum device is operating shall be attenuated 20 dB below the highest power level in a 100 kHz bandwidth within the band containing the highest level of the desired power.

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 10 dB attenuator. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator. The spectrum analyzer resolution bandwidth was set to 100 kHz and the video bandwidth was set to 300 kHz. The amplitude of the EUT carrier frequency was measured to determine the emissions limit (20 dB below the carrier frequency amplitude). The emissions outside of the allocated frequency band were then scanned from 30 MHz up to the tenth harmonic of the carrier.

The following are plots of the conducted spurious emissions data.



Figure 11: Conducted Spurious Emissions



Agilent Spectro	um Analyzer - Swe	pt SA								
Marker 1	RF 50 Ω 2 40600000		17	SEN	ISE:INT	Avg Type	LIGNAUTO	06:35:22. TRA	AM May 31, 2017 CE 1 2 3 4 5 6	Peak Search
mariter i	2.4000000	P	NO: Fast	Trig: Free	Run	Avg Hold:	18/100	T\ [
		IFU	sain:Low	Atten. 10	40		M	kr1 2 40		Next Peak
	Ref Offset 3 d	B Im					141	-2.2	286 dBm	
Log										
										Next Pk Right
-10.0										
-20.0									22.10 dBm	
									-22.10 GDH	Next Dic Los
-30.0										Next PK Len
-40.0										
										Marker Delta
-50.0										
-60.0										
						1.08				Mkr→CF
-70.0			1.7				the deliver to the	وأحاسره والاروسيلار وال	s kan dha akan ba	
	What has been a few public	an politica production of the second s	population provides	المحمد الليهم وقراقه	in the second	ne provinské kolonistické kol	enderse e substance	an sa mana ang basa	in an	
-80.0	Weiter and the second	فيعدره ومنتشرية إقارأها	and the first of the state of the	enterna de la contra	and a family of the					Mkr→RefLv
										More
Start 2.40	0 GHz		#) (P14)	0 0 MU-			O	Stop (6.400 GHz	1 of 2
#Res BW	100 KHZ		#VBW	3.0 MHZ			sweep	371 ms (4	iuuui pts)	
MSG							STATU	IS		

Figure 12: Conducted Spurious Emissions, Channel



Agilent Spectrum Analyzer - Swept SA					
Marker 1 9 8879000000		SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	06:36:16 AM May 31, 2017 TRACE 1 2 3 4 5 6	Peak Search
	PNO: Fast	Trig: Free Run Atten: 10 dB	Avg Hold: 41/100	TYPE M MOMMA	J
	IFGain:Low	Attent. IV VD	M	lkr1 9 887 9 GHz	Next Peak
Ref Offset 3 dB 10 dB/div Ref 0.00 dBm				-49.177 dBm	
Log					
					Next Pk Right
-20.0				-22.10 dBm	
					Next Pk Lef
				1	Marker Delta
-60.0					Mkr→CF
-70.0					
the provide state of the part	n an	ومعارات الروابة تعمله ا _{للو} ارية _ا لمريط معاملة المسالة. مراجع المريط المسالية المريط المريط المريط المسالة المسالة	eternal (das hates) er en sen eternet for het er en der beiter Name	a for and a subscription of the	
	strong finds to	a statistical statements			Mkr→RefLv
					More
Start 6.400 GHz #Res BW 100 kHz	#VBW	3.0 MHz	Sweep	Stop 10.400 GHz 371 ms (40001 pts)	1 of 2
MSG			STATI	us	
MSG			STAT	us	

Figure 13: Conducted Spurious Emissions, Channel



Agilent Spectru	ım Analyzer - Swept	SA							
Marker 1	RF 50 Ω A 12.28990000	ac 0000 GHz	SEN		Avg Type	ALIGNAUTO	06:36:49 / TRA TY	M May 31, 2017 CE <mark>1 2 3 4 5 6</mark> PE M	Peak Search
10 dB/div	Ref Offset 3 dB Ref 0.00 dBm	PNO: Fast Cy IFGain:Low	Atten: 10	dB		Mk	r1 12.28 -60.4	9 9 GHz 59 dBm	Next Peak
									Next Pk Right
-20.0								-22.10 dBm	Next Pk Lef
									Marker Deita
-60.0		TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT		tarth of had of hith of	Braddan Fritstol nati	. dect a sill vertile das		unda angalagunduk	Mkr→CF
-80.0	n Balandi Mahan (B. Jahar) Baryak ya Jawa na Ad	ang ng kani kani kani kang kang ng kan Kang ng Mag Mang Kang Kang Kang Kang Kang Kang Kang K	ing dash pasing dalam di	lede De serie de plade (de serier	alled in equilate a spectrum	n literie en	Alter Alter	oni kunsting byta <mark>bi</mark> f	Mkr→RefLv
Start 10.40 #Res BW 1	00 GHz 100 kHz	#VBW	3.0 MHz			Sweep	Stop 14 371 ms (4	.400 GHz 0001 pts)	More 1 of 2
MSG						STATL	JS		

Figure 14: Conducted Spurious Emissions, Low Channel



Agilent Spectrum Analyzer - Swept SA					
RF 50 Ω AC RF 50 Ω AC		SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	06:37:17 AM May 31, 2017 TRACE 1 2 3 4 5 6	Peak Search
	PNO: Fast CD T IFGain:Low F	rig: Free Run Atten: 10 dB	Avg Hold: 9/100	TYPE MWWWW DET PNNNN	No. 4 Dec.
Ref Offset 3 dB 10 dB/div Ref 0.00 dBm			Mł	r1 14.591 9 GHz -62.620 dBm	NextPeak
					Next Pk Right
				-22.10 dBm	
-30.0					Next Pk Lef
					Marker Delta
-60.0					Mkr.sce
The second s	atenalisatik amerikak lista	Notes and a state of the second states	in a statistic shi dala a ka shi b	unalization provided and metabolic states and and the	MIKI→Gr
	u kan hara sa	and a state of the s	nanyang ng mang ang mang mang mang mang mang	andel <mark>de louister des litetenses stations (</mark>	
-90.0					Mkr→RefLv
					More
Start 14.400 GHz #Res BW 100 kHz	#VBW 3.	0 MHz	Sweep	Stop 18.400 GHz 371 ms (40001 pts)	1 of 2
MSG			STAT	us	-

Figure 15: Conducted Spurious Emissions



Agilent Spectr	um Analyzer - Swept SA								
Markor 1	RF 50 Ω AC		SEN	ISE:INT	Ava Tupe	LIGNAUTO	06:37:51 / TRA	AM May 31, 2017	Peak Search
Marker	21.5567000000	PNO: Fast	Trig: Free Atten: 10	e Run dB	Avg Hold:	11/100	TY		
10 dB/div	Ref Offset 3 dB Ref 0.00 dBm					Mk	r1 21.55 -59.9	6 7 GHz 67 dBm	Next Peak
									Next Pk Right
								-22.10 dBm	
-30.0									Next Pk Lef
									Marker Delta
							1		
-60.0	101	h dan da wat badi na waa da shadada	and the second	uld party and	فالطائه استأنفتهم	overblichedd	Malachudawigh	Hardenbartonak	Mkr→CF
-70.0	والمراجعة الارمير والملحان والمتحج عاريدوا بسروار وت	editional data environmente	nden (Mender	d prompted this are	<mark>, a a de la del de la desena de la desena de la del de la del</mark> La del de la	(gdlegets and th	denne generation and	Nangina paganan	
									Mkr→RefLv
0 4							0 4 04		More
start 18.4 #Res BW	00 GHZ 100 kHz	#VBW	3.0 MHz			Sweep	stop 22 371 ms (4	2.400 GHz 10001 pts)	1 of 2
MSG						STATL	IS		

Figure 16: Conducted Spurious Emissions



Agilent Spectr	um Analyzer - Swept S	ia.							
Marker 1	RF 50Ω A		SENS	E:INT	Ava Tvpe	LIGNAUTO	06:38:43 / TRA	AM May 31, 2017	Peak Search
Marker	24.700100000	PNO: Fast C	Trig: Free	Run	Avg Hold:	15/100	TY		
		IFGain:Low	Attent To	uD		Mkr1	24 788	IOD GHZ	Next Peak
	Ref Offset 3 dB Ref 0.00 dBm						-57.4	86 dBm	
Log									
									Next Pk Right
-20.0					_			-22:10 dBm	
									Next Pk Lef
									Marker Delta
								<u>1</u>	
					al the states and	and determined of	المعدية المحادثة	المالة بداء وسمارين	
ulilurald	Latith Produced in Security and	والإرماع والأعطار فالبلاط والإرمام ألتريعه	, es andre la tel partici	adadhaana A	and the second	i i chantairean ann an 1946. Tha anns an 1949 ann	an the second	an the state of th	Mkr→CF
-70.0 <mark>(1994) - 199</mark> 4	and a part of the order of the part of the	an in the second state of the second seco	and a particular second	ding the state	Poste per como en l	ere an office from the			
									Mkr→RefLv
									Mora
Start 22.4	00 GHz						Stop 2	5.000 GHz	1 of 2
#Res BW	100 kHz	#VBW	3.0 MHz			Sweep	240 ms (4	0001 pts)	
MSG						STATL	JS		

Figure 17: Conducted Spurious Emissions



4.5 **BAND EDGE COMPLIANCE**

In accordance with FCC Public Notice DA-00-705 close-up plots of the upper and lower channels in both hopping and non-hopping modes with respect to the nearest authorized band-edges were measured. The tests were performed in the same manner as the above conducted spurious emissions tests. Hopping data produced worst-case and is shown here.

The following are plots of the conducted spurious emissions data.

Agilent Spectrum Analyzer - Swept SA							
パロロン RF 50 Ω AC Marker 1 Δ 2.228057014 MHz	z _		, Avg Type	ALIGN AUTO :: Log-Pwr	06:51:23 AM TRACI	4 May 31, 2017 1 2 3 4 5 6	Marker
P	NO: Fast 😱 🛛 Gain:Low 🥄	rig:Free Run Atten: 10 dB			DE	PNNNN	Select Marker
Ref Offset 3 dB 10 dB/div Ref 0.00 dBm				Δι	Vikr1 2.2 39	28 MHz 9.13 dB	
-10.0							Norma
							Delta
-40.0					X		Fixed▷
-60.0 -70.0 A.I.A.I.A.I.A.I.A.I.A.I.A.I.A.I.A.I.A.I		And Mildler	MANNA	AN ANY			Of
-90.0 M MM M MAINA MAIN	which is a						Properties
							More
Start 2.37500 GHz #Res BW 100 kHz	#VBW 1.	0 MHz		Sweep	Stop 2.40 2.93 ms (4	500 GHz 1000 pts)	1 of 2
MSG				STATU	s		

Figure 18: Low Channel, Lower Band-edge



Agilent Spectrum Analyzer - Swept SA				
0// RF 50 Ω AC Marker 1 A 26 781695424 MHz	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	06:53:21 AM May 31, 2017 TRACE 1 2 3 4 5 6	Marker
PNO: Fast	Trig: Free Run Atten: 10 dB	Avg Hold:>100/100	TYPE MWWWWW DET PNNNN	
Ref Offset 3 dB 10 dB/div Ref 0.00 dBm		ΔΜ	kr1 26.782 MHz -41.343 dB	
				Norma
-20.0				Delta
-40.0				Fixed▷
	white here is here in the second s	ALL	when how how have	Ofi
				Properties►
				More
Start 2.47500 GHz #Res BW 100 kHz #VE	3W 1.0 MHz	Sweep	Stop 2.50500 GHz 2.93 ms (4000 pts)	1 of 2
MSG		STATUS	5	

Figure 19: High Channel, Upper Band-edge



4.6 RADIATED SPURIOUS EMISSIONS: (FCC PART §2.1053)

The EUT must comply with the requirements for radiated spurious emissions that fall within the restricted bands. These emissions must meet the limits specified in §15.209 and §15.35(b) for peak measurements.

4.6.1 **Test Procedure**

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2014. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

Emissions were tested to 10X intentional emission frequency.

The emissions were measured using the following resolution bandwidths:

Table 9: Spectrum Analyzer Settings

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	<10 Hz (Avg.), 1MHz (Peak)



Table 10: Radiated Emission Test Data, Low Frequency Data (<1GHz)

Freq (MHz)	Polarity (H/V)	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Peak or QP	Note
46.48	V	0.0	1.0	47.9	-15.6	32.3	40.0	-7.7	Peak	amb
54.97	V	45.0	2.0	48.7	-17.9	30.7	40.0	-9.3	Peak	
61.03	V	180.0	1.0	49.3	-17.6	31.7	40.0	-8.3	Peak	
75.38	V	90.0	2.0	49.5	-16.7	32.8	40.0	-7.2	Peak	
85.83	V	270.0	1.0	38.0	-17.0	21.0	40.0	-19.0	Peak	
217.58	V	270.0	1.5	37.2	-13.0	24.2	40.0	-15.8	Peak	
266.69	V	180.0	1.0	32.7	-10.2	22.5	47.0	-24.5	Peak	
277.35	V	0.0	1.0	37.5	-9.6	27.9	47.0	-19.1	Peak	
292.48	V	0.0	1.0	31.3	-9.5	21.9	47.0	-25.1	Peak	
649.17	V	180.0	1.0	42.8	-0.8	42.0	47.0	-5.0	Peak	amb
767.27	V	180.0	1.0	40.3	0.9	41.2	47.0	-5.8	Peak	amb
788.83	V	220.0	1.0	38.8	1.3	40.1	47.0	-6.9	Peak	amb
46.48	Н	0.0	1.5	45.0	-15.6	29.4	40.0	-10.6	Peak	amb
54.97	Н	45.0	1.0	46.0	-17.9	28.1	40.0	-11.9	Peak	
61.03	Н	180.0	2.0	46.3	-17.6	28.7	40.0	-11.3	Peak	
75.38	Н	90.0	2.0	47.2	-16.7	30.5	40.0	-9.5	Peak	
85.83	Н	270.0	1.0	38.0	-17.0	21.0	40.0	-19.0	Peak	
217.58	Н	270.0	1.0	37.2	-13.0	24.2	40.0	-15.8	Peak	
266.69	Н	180.0	1.0	32.7	-10.2	22.5	47.0	-24.5	Peak	
277.35	Н	0.0	1.0	37.5	-9.6	27.9	47.0	-19.1	Peak	
292.48	Н	0.0	1.0	31.3	-9.5	21.9	47.0	-25.1	Peak	
649.17	Н	180.0	1.0	40.8	-0.8	40.0	47.0	-7.0	Peak	amb
767.27	Н	180.0	1.0	38.5	0.9	39.4	47.0	-7.6	Peak	amb
788.83	Н	220.0	1.0	37.2	1.3	38.5	47.0	-8.5	Peak	amb



Pos	Frequency (MHz)	Polar ity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Note
Х	300.00	V	180.00	0.00	25.00	-9.9	5.7	200.0	-30.9	Ambient
	600.00	V	0.00	2.00	28.00	-4.0	15.8	200.0	-22.1	Ambient
	4884.00	V	180.00	1.50	36.00	15.3	367.6	500.0	-2.7	Average
	6000.00	V	120.00	1.00	26.00	18.5	167.4	500.0	-9.5	Ambient
	7000.00	V	180.00	1.00	28.00	21.9	312.5	500.0	-4.1	Ambient
	7362.00	V	120.00	2.00	25.20	23.4	270.0	500.0	-5.4	Ambient
Y	300.00	V	180.00	1.50	24.50	-9.9	5.4	200.0	-31.4	Ambient
	600.00	V	0.00	1.50	29.00	-4.0	17.7	200.0	-21.1	Ambient
	4884.00	V	180.00	2.00	35.50	15.3	347.0	500.0	-3.2	Average
	6000.00	V	120.00	1.50	25.50	18.5	158.0	500.0	-10.0	Ambient
	7000.00	V	180.00	1.00	28.10	21.9	316.2	500.0	-4.0	Ambient
	7362.00	V	120.00	1.00	25.20	23.4	270.0	500.0	-5.4	Ambient
Z	300.00	V	180.00	1.50	25.00	-9.9	5.7	200.0	-30.9	Ambient
	600.00	V	0.00	1.50	29.00	-4.0	17.7	200.0	-21.1	Ambient
	4884.00	V	0.00	1.50	36.20	15.3	376.1	500.0	-2.5	Average
	6000.00	V	0.00	1.50	25.00	18.5	149.2	500.0	-10.5	Ambient
	7000.00	V	90.00	1.50	28.00	21.9	312.5	500.0	-4.1	Ambient
	7362.00	Н	90.00	1.50	25.20	23.4	270.0	500.0	-5.4	Ambient
Х	300.00	Н	120.00	2.00	26.00	-9.9	6.4	200.0	-29.9	Ambient
	600.00	Н	180.00	0.00	25.50	-4.0	11.8	200.0	-24.6	Ambient
	4884.00	Н	120.00	0.00	35.50	15.3	347.0	500.0	-3.2	Average
	6000.00	Н	0.00	1.50	26.00	18.5	167.4	500.0	-9.5	Ambient
	7000.00	Н	120.00	1.50	26.00	21.9	248.3	500.0	-6.1	Ambient
	7362.00	Н	180.00	0.00	25.20	23.4	270.0	500.0	-5.4	Ambient
Y	300.00	Н	120.00	0.00	26.00	-9.9	6.4	200.0	-29.9	Ambient
	600.00	Н	0.00	1.50	0.00	-4.0	0.6	200.0	-50.1	Ambient
	4884.00	Н	180.00	1.50	0.00	15.3	5.8	500.0	-38.7	Average
	6000.00	Н	0.00	0.00	26.00	18.5	167.4	500.0	-9.5	Ambient
	7000.00	Н	0.00	0.00	26.00	21.9	248.3	500.0	-6.1	Ambient
	7362.00	Н	0.00	0.00	26.00	23.4	296.1	500.0	-4.6	Ambient
Ζ	300.00	Н	0.00	1.00	28.00	-9.9	8.1	200.0	-27.9	Ambient
	600.00	Н	0.00	1.00	26.00	-4.0	12.5	200.0	-24.1	Ambient
	4884.00	Н	120.00	1.50	36.00	15.3	367.6	500.0	-2.7	Average
	6000.00	Н	0.00	1.50	26.00	18.5	167.4	500.0	-9.5	Ambient
	7000.00	Н	0.00	1.50	26.00	21.9	248.3	500.0	-6.1	Ambient
	7362.00	Н	0.00	1.50	26.00	23.4	296.1	500.0	-4.6	Ambient

Table 11: Radiated Emission Test Data, High Frequency Data >1GHz