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Curtis-Straus LLC, a wholly owned subsidiary of BV CPS

# Test Report

Report No	EP0635-1
Client	Onset Computer Corporation Jim Corrigan
Address	470 MacArthur Blvd. Bourne, MA 02532
Phone	508-743-3195
Items tested	HOBO BLE MODULE
FCC ID	WXF-ONST1
IC	7936A-ONST1
FRN	0009380064
Equipment Type	Part 15.247 Digitally Modulated
Equipment Code	DTS
FCC/IC Rule Parts	47 CFR 15.247, RSS-210 Issue 8
Test Dates	March 24 – 25, 2015
Results	As detailed within this report
Prepared by	 _____ Tuyen Truong A. – Test Engineer
Authorized by	 _____ Christopher Reynolds – EMC Supervisor
Issue Date	4/15/2015
Conditions of Issue	This Test Report is issued subject to the conditions stated in the 'Conditions of Testing' section on page 29 of this report.

Curtis-Straus LLC is accredited by the American Association for Laboratory Accreditation for the specific scope of accreditation under Certificate Number 1627-01. This report may contain data which is not covered by the A2LA accreditation.



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Form Final Report REV 7-20-07 (DW)



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## Summary

This test report supports an application for Limited Modular Approval authorization of a transmitter operating pursuant to 47 CFR 15.247. The product is the HOBO BLE MODULE. It is a digitally modulated transmitter that operates in the range 2402-2480MHz. Product was tested with an on board antenna with a gain of -2dBi.

We found that the products met the above requirements without modification. Jim Corrigan from Onset Computer Corporation was present during the testing. The test samples were received in good condition.

Issue No.	Reason for change	Date Issued
1	Original Release	April 15, 2015

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## Test Methodology

Radiated emission testing were performed according to the DTS guidance document 558074D01 v03r02 specified in FCC Guidance for performing compliance measurement on DTS operating under section 15.247, April 19, 2013 and ANSI C63.10 (2009) and C63.4 (2003). Radiated Emissions were maximized by rotating the device around its axes as well as varying the test antenna's height and polarity. The antenna was maximized separately.

Conducted emissions at the antenna port were performed, as required by rule section.

The EUT operating voltage is 6Vdc (4xAA battery). No AC Line conducted testing required.

Low operating channel frequency = 2402MHz

Mid operating channel frequency = 2440MHz

High operating channel frequency = 2480MHz

The following bandwidths were used during radiated spurious and line conducted emissions.

Frequency	RBW	VBW
0.15-30MHz	9kHz	30kHz
30-1000MHz	120kHz	1MHz
1-10GHz	1MHz	3MHz



**Product Tested - Configuration Documentation**

EUT Configuration							
<b>Work Order:</b> P0635							
<b>Company:</b> Onset Computer Corporation							
<b>Company Address:</b> 470 MacArthur Blvd. Bourne, MA 02532							
<b>Contact:</b> Jim Corrigan							
<b>Person Present:</b> Jim Corrigan							
		MN	SN	Comment			
EUT:	BLE Module	91-18296	10702865	Conducted Testing only			
	BLE Module	91-18296	10702867	Radiated EMI testing			
<b>EUT Description:</b> HOBO BLE Module							
<b>EUT Max Frequency:</b> 16MHz							
<b>EUT Min Frequency:</b> 32KHz							
<b>EUT TX Frequency:</b> 2402-2480MHz							
<b>Support Equipment:</b>		MN	SN				
MX1102 (Host) (Temp/CO2/RH)	MX1102		--				
Dell Laptop	Latitude 6440		--				
<b>EUT Ports:</b>							
Port Label	Port Type	No. of ports	No. Populated	Cable Type	Shielded		
				Ferrites	Length		
				Max Length	In/Out NEBS Type		
					Unpopulated Reason		
None							
<b>Software / Operating Mode Description:</b>							
EUT is set to transmit on Low (2402 MHz), Mid (2440 MHz) and High (2480 MHz) channels throughout 2.402GHz to 2.480GHz range.							



## Statement of Conformity

The HOBO BLE MODULE has been found to conform to the following parts of 47 CFR and as detailed below:

RSS-GEN	RSS 210	Part 15	Comments
5.3		15.15(b)	There are no controls accessible to the user that varies the output power above specified limits.
5.2		15.19	The label is shown in the label exhibit.
7.1.5		15.21	Information to the user is shown in the instruction manual exhibit.
		15.27	No special accessories are required for compliance.
		15.31	The EUT was tested in accordance with the measurement standards in this section.
		15.33	Frequency range was investigated according to this section, unless noted in specific rule section under which the equipment operates.
		15.35	The EUT emissions were measured using the measurement detector and bandwidth specified in this section, unless noted in specific rule section under which the equipment operates.
7.1.4		15.203	EUT employs a permanently -2dBi connected antenna.
	2.6	15.205 15.209	The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209.
7.2.2		15.207	No testing required since EUT is battery operated (2xAA batteries).
	Annex 8	15.247	The unit complies with the requirements of 15.247
4.6.1		15.247	Occupied Bandwidth measurements were made.



## Test Results

### Bandwidth

#### LIMIT

The minimum 6 dB bandwidth shall be at least 500 kHz. [15.247(a) (2)]

### MEASUREMENTS / RESULTS

Engineer	Chris Bramley
Date	March 24, 2015
Site	Chamber 2
Environmental Conditions	24.7°C, 3%, 1011mb

6dB Bandwidth					
15:247(a)(2): Specifies that the minimum 6dB bandwidth shall be at least 500kHz.					
Frequency (MHz)	Mode	6dB BW (MHz)	Limit (kHz)	Margin (MHz)	
2402	DMSS	0.690	>500	-0.190	
2440	DMSS	0.695	>500	-0.195	
2480	DMSS	0.690	>500	-0.190	
<b>Tested by:</b> Chris Bramley		<b>RBW</b> = 100KHz	<b>VBW</b> = 300KHz		
<b>Date:</b> 3/24/2015			<b>Analyzer:</b> Brown SA		
<b>Company:</b> Onset Computer Corporation			<b>Attenuator:</b> PE7019-20 #791		
<b>EUT:</b> BLE Module					

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<b>Spectrum Analyzers / Receivers /Preselectors</b> Brown	<b>Range</b> 9kHz-26.5GHz	<b>MN</b> E4407B	<b>Mfr</b> Agilent	<b>SN</b> SG44210511	<b>Asset</b> 1510	<b>Cat</b> I	<b>Calibration Due</b> 5/12/2015	<b>Calibrated on</b> 5/12/2014
<b>Radiated Emissions Sites</b> EMI Chamber 2	<b>FCC Code</b> 719150	<b>IC Code</b> 2762A-7	<b>VCCI Code</b> A-0015	<b>Range</b> 30-1000MHz		<b>Cat</b> II	<b>Calibration Due</b> 3/22/2017	<b>Calibrated on</b> 3/22/2015
<b>Preamps/Couplers Attenuators / Filters</b> HF 20dB 50W Attenuator	<b>Range</b> 0.009-18 GHz	<b>MN</b> PE 7019-20	<b>Mfr</b> Paternack	<b>SN</b> 1	<b>Asset</b> 791	<b>Cat</b> II	<b>Calibration Due</b> 7/14/2015	<b>Calibrated on</b> 7/14/2014
<b>Meteorological Meters</b> Weather Clock (Pressure Only) TH A#1833	<b>MN</b> BA928 35519-044	<b>Mfr</b> Oregon Scientific Control Company	<b>SN</b> C3166-1 130318278	<b>Asset</b> 831 1833	<b>Cat</b> I II	<b>Calibration Due</b> 3/19/2016 6/13/2015	<b>Calibrated on</b> 3/19/2014 6/13/2013	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

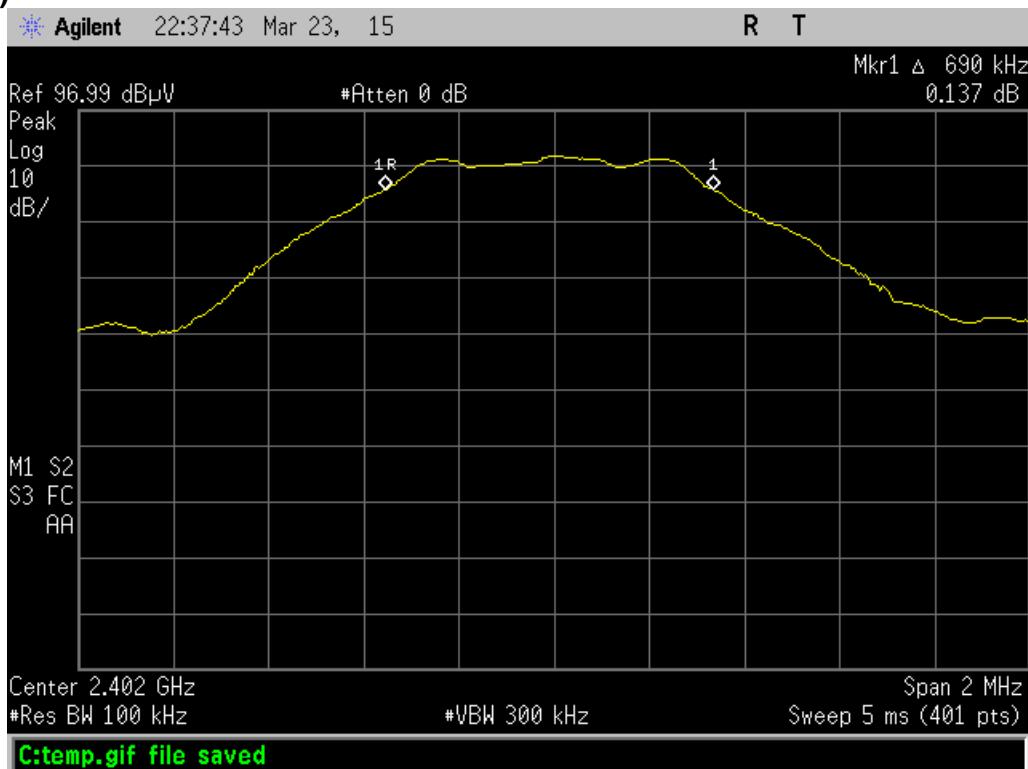


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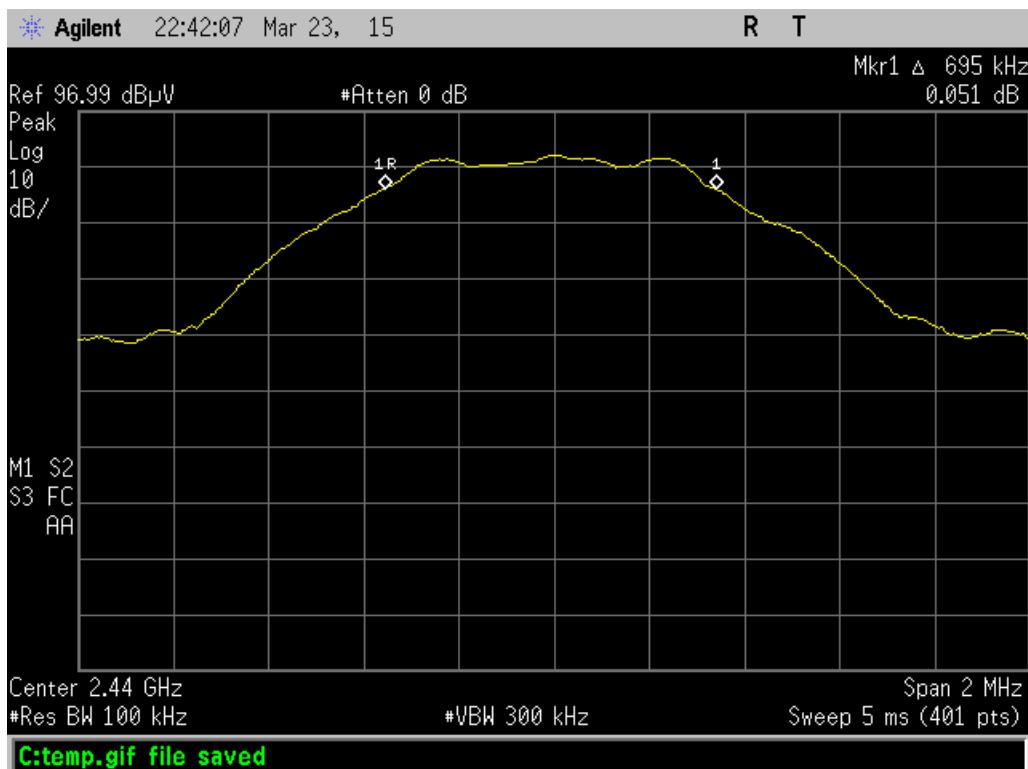


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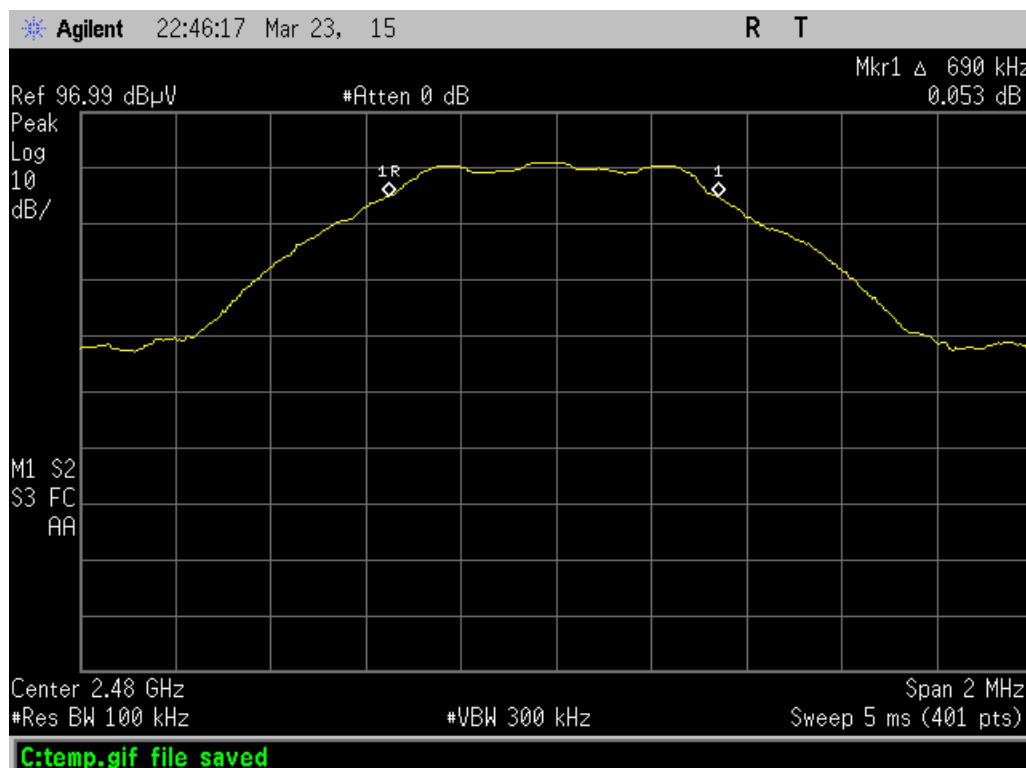
**PLOT(s)**

Low Channel – 6dB Bandwidth



Mid Channel – 6dB Bandwidth





High Channel – 6 dB Bandwidth



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## Fundamental Emission Output Power

### LIMIT

Conducted Output Power

1 Watt

[15.247(b) (3)]

## MEASUREMENTS / RESULTS

Engineer	Tuyen Truong
Date	March 24, 2015
Site	Chamber 2
Environmental Conditions	24.7°C, 3%, 1011mb

## Maximum Conducted Peak Output Power

Tested by:	Tuyen Truong	WO: P0635
Date:	3/24/2015	RBW = 1000KHz
Company:	Onset Computer Corp	VBW = 3000KHz
EUT:	BLE Module in MX1102 Temp/CO2/RH	Analyzer: SA#2
		Attenuator: PE7019-20 #791
		Operating Voltage: 6Vdc

TX Mode: DSSS

Channel (MHz)	Measured power (dBm)	Attenuator factor (dB)	Adjusted power measurement (dBm)	Limit (dBm)	Margin (dB)	Result
2402	-18.40	19.73	1.33	30	-28.67	PASS
2440	-18.40	19.73	1.33	30	-28.67	PASS
2480	-19.42	19.73	0.31	30	-29.69	PASS

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Spectrum Analyzers / Receivers/Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Brown	9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	5/12/2015	5/12/2014
Radiated Emissions Sites EMI Chamber 2	FCC Code 719150	IC Code 2762A-7	VCCI Code A-0015	Range >1GHz		Cat I	Calibration Due 5/16/2015	Calibrated on 5/16/2013
Preamps/Couplers Attenuators / Filters HF 20dB 50W Attenuator	Range 0.009-18 GHz	MN PE 7019-20	Mfr Pasternack	SN 1	Asset 791	Cat II	Calibration Due 7/14/2015	Calibrated on 7/14/2014
Meteorological Meters Weather Clock (Pressure Only) TH A#1833	MN BA928 35519-044	Mfr Oregon Scientif 35519-044	SN C3166-1	Asset 831	Cat I	Calibration Due 3/19/2016	Calibrated on 3/19/2014	
		Control Compan	130318278	1833	II	6/13/2015	6/13/2013	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



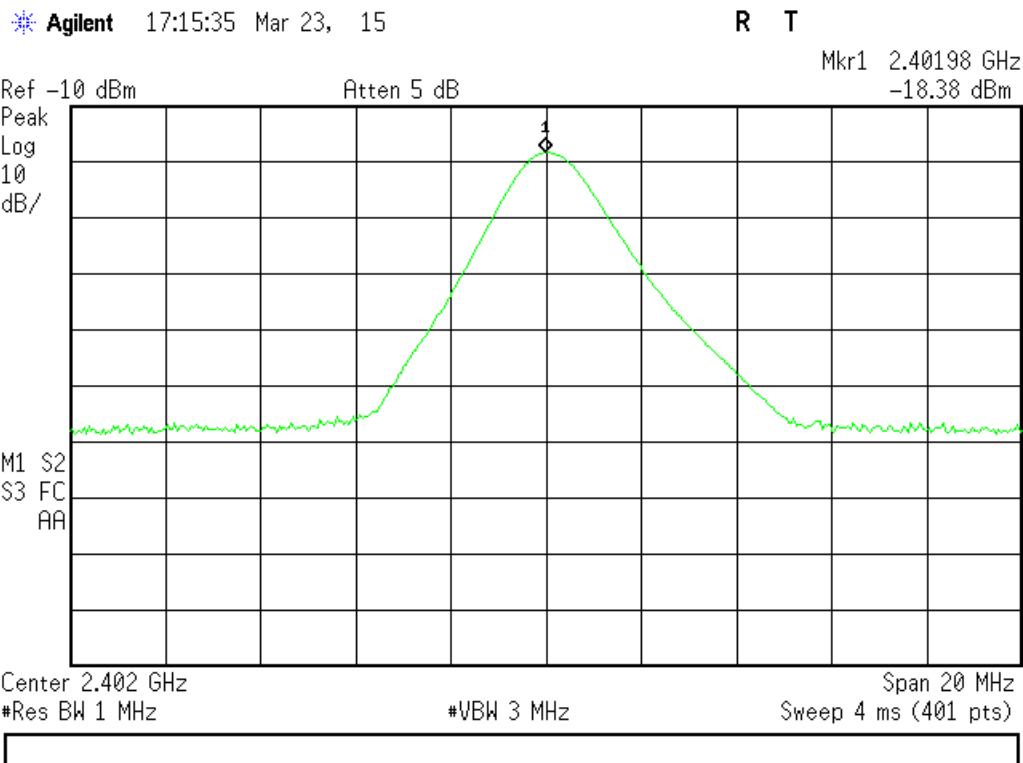
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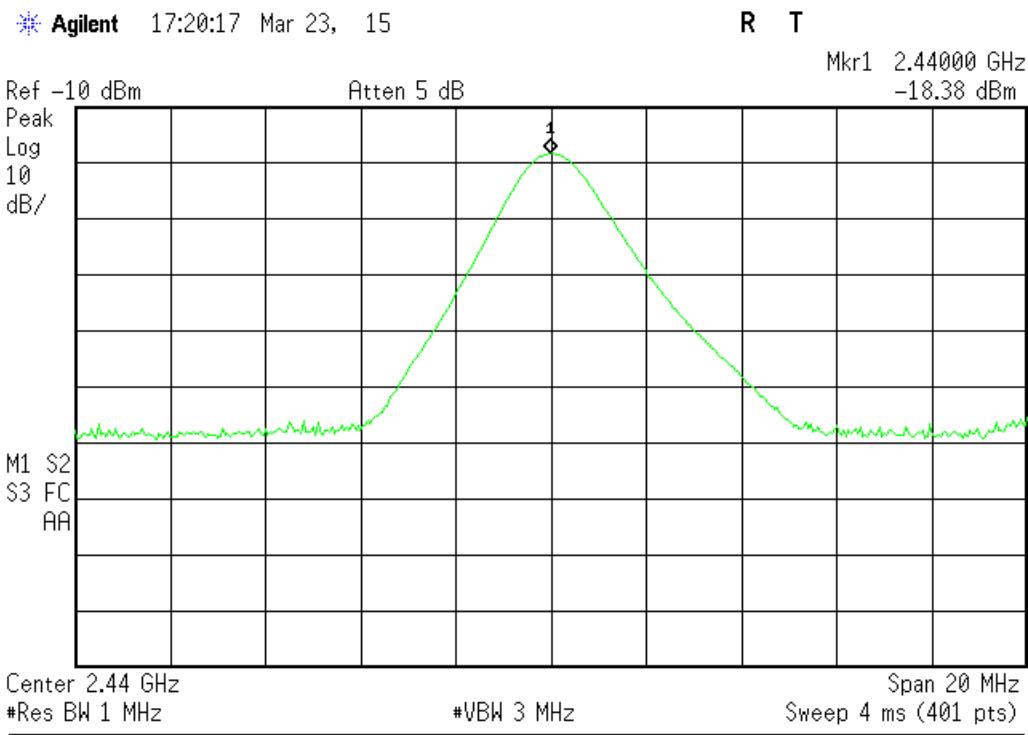
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## PLOTS



Low Channel – Channel Power



C:\temp.gif file saved

Mid Channel – Channel Power



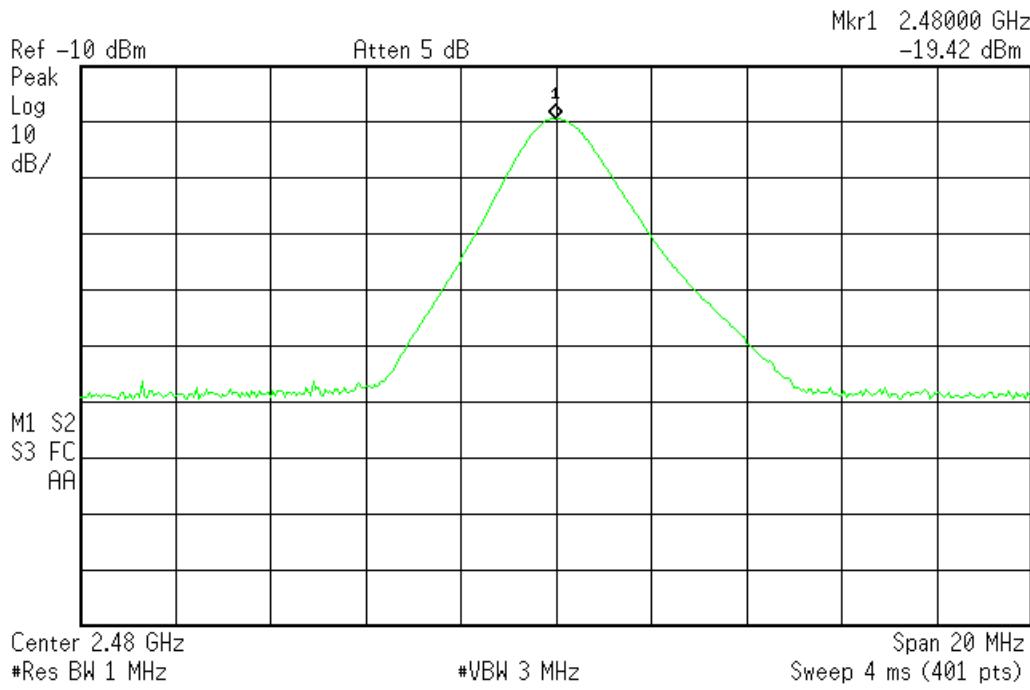
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\* Agilent 17:22:23 Mar 23, 15

R T



High Channel – Channel Power



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## Radiated Spurious Emissions

### LIMITS

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).  
[15.247(d)]

### MEASUREMENTS / RESULTS

Radiated Emissions Table													
Date: 24-Mar-15	Company: Onset Computer Corporation				Work Order: P0635								
Engineer: Tuyen Truong	EUT Desc: BLE Module in MX1102 Temp/CO2/RH				EUT Operating Voltage/Frequency: 6Vdc								
Temp: 24°C	Humidity: 10%				Pressure: 1011mBar								
Frequency Range: 30-1000MHz								Measurement Distance: 3 m					
Notes: all 3 orientations of EUT (x, y and z) were checked.								EUT Tx Freq: 2402-2480 MHz					
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dB $\mu$ V)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dB $\mu$ V/m)							
										Limit (dB $\mu$ V/m)	Margin (dB)	Result (Pass/Fail)	
v	51.49	28.9	25.4	8.4	0.4	12.3							
h	184.275	33.0	24.3	11.7	0.8	21.2							
v	196.4	27.7	24.8	12.9	0.9	16.7							
v	197.9	30.3	24.8	13.3	0.9	19.7							
v	467.3	30.9	25.6	17.5	1.4	24.2							
h	467.3	30.0	25.6	17.5	1.4	23.3							
v	835.2	32.8	25.5	22.3	1.8	31.4							
<b>Table Result:</b> Pass by -14.6 dB							<b>Worst Freq:</b> 835.2 MHz						
Test Site: EMI Chamber 2	Cable 1: Asset #2052			Cable 2: Asset #2054			Cable 3: ---						
Analyzer: Rental SA#2	Preamp: Blue-Blk			Antenna: Red-White			Preselector: ---						

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Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
SA #2 (1860)	9kHz-26.5 GHz	E7405A	Agilent	MY45104916	1860	I	6/4/2015	
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range		Cat	Calibration Due	Calibrated on
EMI Chamber 2	719150	2762A-7	A-0015	30-1000MHz		II	3/22/2017	3/22/2015
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Blue-Black	0.009-2000MHz	ZFL-1000-LN	CS	N/A	800	II	12/26/2015	12/26/2014
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Red-White Biolog	30-2000MHz	JB1	Sunol	A091604-1	1105	I	7/24/2015	7/24/2013
Cables	Range	Mfr				Cat	Calibration Due	Calibrated on
Asset #2052	9kHz - 18GHz	Florida RF				II	3/8/2016	3/8/2015
Asset #2054	9kHz - 18GHz	Florida RF				II	3/8/2016	3/8/2015
Meteorological Meters	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	3/19/2016	3/19/2014	
TH A#1833	35519-044	Control Company	130318278	1833	II	6/13/2015	6/13/2013	

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**Radiated Emissions Table**

Date: 24-Mar-15 Engineer: Chris Bramley Temp: 24.7°C		Company: Onset Computer Corporation EUT Desc: BLE Module in MX1102 Temp/CO2/RH Humidity: 3% Pressure: 1011mBar							Work Order: P0635 EUT Operating Voltage/Frequency: 6Vdc												
Frequency Range: 1-6GHz									Measurement Distance: 3 m												
Notes: EUT Tx on Low Channel - 2402MHz Using a Duty Cycle Correction Factor of 16.6dB									EUT Tx Freq: 2402MHz												
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dB <sub>µ</sub> V)	Average Reading (dB <sub>µ</sub> V)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dB <sub>µ</sub> V/m)	Adjusted Avg Reading (dB <sub>µ</sub> V/m)	FCC 15.209 High Frequency - Peak												
									Limit (dB <sub>µ</sub> V/m)	Margin (dB)	Result (Pass/Fail)										
h	1669.0	33.08	16.5	20.6	29.6	2.9	45.0	28.4	74.0	-29.0	Pass										
v	1865.0	31.97	15.4	20.6	30.9	2.9	45.2	28.6	74.0	-28.8	Pass										
v	4804.0	30.31	13.7	19.6	34.4	4.6	49.7	33.1	74.0	-24.3	Pass										
h	4804.0	29.46	12.9	19.6	34.4	4.6	48.9	32.3	74.0	-25.1	Pass										
<b>Table Result:</b>		Pass	by	-20.9 dB							<b>Worst Freq:</b> 4804.0 MHz										
Test Site: EMI Chamber 2		Cable 1: Asset #2052			Cable 2: Asset #2054																
Analyzer: Rental SA#1		Preamp: Asset #1517			Antenna: Blue Horn																

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<b>Spectrum Analyzers / Receivers /Preselectors</b> SA #2 (1860)			Range 9kHz-26.5 GHz	MN E7405A	Mfr Agilent	SN MY45104916	Asset 1860	Cat I	Calibration Due 6/4/2015	Calibrated on
<b>Radiated Emissions Sites</b> EMI Chamber 2			FCC Code 719150	IC Code 2762A-7	VCCI Code A-0015	Range 30-1000MHz		Cat II	Calibration Due 3/22/2017	Calibrated on 3/22/2015
<b>Preamps /Couplers Attenuators / Filters</b> Brown			Range 1-10GHz	MN CS	Mfr CS	SN N/A	Asset 1523	Cat II	Calibration Due 4/10/2015	Calibrated on 4/10/2014
<b>Antennas</b> Blue Horn			Range 1-18Ghz	3117	Mfr ETS	SN 157647	Asset 1861	Cat I	Calibration Due 2/8/2017	Calibrated on 2/8/2015
<b>Cables</b> Asset #2052			Range 9kHz - 18GHz		Mfr Florida RF			Cat II	Calibration Due 3/8/2016	Calibrated on 3/8/2015
Asset #2054			9kHz - 18GHz		Florida RF			II	3/8/2016	3/8/2015
<b>Meteorological Meters</b> Weather Clock (Pressure Only)			MN BA928	Mfr Oregon Scientific	SN C3166-1	Asset 831	Cat I	Calibration Due 3/19/2016	Calibrated on 3/19/2014	
TH A#1833			35519-044	Control Company	130318278	1833	II	6/13/2015	6/13/2013	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

**Radiated Emissions Table**

Date: 24-Mar-15 Engineer: Chris Bramley Temp: 24.7°C		Company: Onset Computer Corporation EUT Desc: BLE Module in MX1102 Temp/CO2/RH Humidity: 3% Pressure: 1011mBar							Work Order: P0635 EUT Operating Voltage/Frequency: 6Vdc												
Frequency Range: 6-18GHz									Measurement Distance: 1 m												
Notes: EUT Tx on Low Channel - 2402MHz Using a Duty Cycle Correction Factor of 16.6dB									EUT Tx Freq: 2402MHz												
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dB <sub>µ</sub> V)	Average Reading (dB <sub>µ</sub> V)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dB <sub>µ</sub> V/m)	Adjusted Avg Reading (dB <sub>µ</sub> V/m)	FCC 15.209 High Frequency - Peak												
									Limit (dB <sub>µ</sub> V/m)	Margin (dB)	Result (Pass/Fail)										
v	7206.0	40.09	23.5	19.2	35.9	5.8	62.6	46.0	83.5	-20.9	Pass										
h	7206.0	37.08	20.5	19.2	35.9	5.8	59.6	43.0	83.5	-23.9	Pass										
v	9608.0	29.89	13.3	18.5	37.3	6.0	54.7	38.1	83.5	-28.8	Pass										
h	9608.0	29.41	12.8	18.5	37.3	6.0	54.2	37.6	83.5	-29.3	Pass										
<b>Table Result:</b>		Pass	by	-17.5 dB							<b>Worst Freq:</b> 7206.0 MHz										
Test Site: EMI Chamber 2		Cable 1: Asset #2052			Cable 2: Asset #2054																
Analyzer: Rental SA#1		Preamp: Asset #1517			Antenna: Blue Horn																

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<b>Spectrum Analyzers / Receivers /Preselectors</b> SA #2 (1860)			Range 9kHz-26.5 GHz	MN E7405A	Mfr Agilent	SN MY45104916	Asset 1860	Cat I	Calibration Due 6/4/2015	Calibrated on
<b>Radiated Emissions Sites</b> EMI Chamber 2			FCC Code 719150	IC Code 2762A-7	VCCI Code A-0015	Range 30-1000MHz		Cat II	Calibration Due 3/22/2017	Calibrated on 3/22/2015
<b>Preamps /Couplers Attenuators / Filters</b> Brown			Range 1-10GHz	MN CS	Mfr CS	SN N/A	Asset 1523	Cat II	Calibration Due 4/10/2015	Calibrated on 4/10/2014
<b>Antennas</b> Blue Horn			Range 1-18Ghz	3117	Mfr ETS	SN 157647	Asset 1861	Cat I	Calibration Due 2/8/2017	Calibrated on 2/8/2015
<b>Cables</b> Asset #2052			Range 9kHz - 18GHz		Mfr Florida RF			Cat II	Calibration Due 3/8/2016	Calibrated on 3/8/2015
Asset #2054			9kHz - 18GHz		Florida RF			II	3/8/2016	3/8/2015
<b>Meteorological Meters</b> Weather Clock (Pressure Only)			MN BA928	Mfr Oregon Scientific	SN C3166-1	Asset 831	Cat I	Calibration Due 3/19/2016	Calibrated on 3/19/2014	
TH A#1833			35519-044	Control Company	130318278	1833	II	6/13/2015	6/13/2013	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



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**Radiated Emissions Table**

Date: 24-Mar-15	Company: Onset Computer Corporation	Work Order: P0635												
Engineer: Chris Bramley	EUT Desc: BLE Module in MX1102 Temp/CO2/RH	EUT Operating Voltage/Frequency: 6Vdc												
Temp: 24.7°C	Humidity: 3%	Pressure: 1011mBar												
<b>Frequency Range:</b> 18-25GHz		<b>Measurement Distance:</b> 0.1 m												
<b>Notes:</b> EUT Tx on Low Channel - 2402MHz Using a Duty Cycle Correction Factor of 16.6dB		<b>EUT Max Freq:</b> 2402MHz												
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dB $\mu$ V)	Average Reading (dB $\mu$ V)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dB $\mu$ V/m)	Adjusted Avg Reading (dB $\mu$ V/m)	FCC 15.209 High Frequency - Peak			FCC 15.209 High Frequency - Average		
									Limit (dB $\mu$ V/m)	Margin (dB)	Result (Pass/Fail)	Limit (dB $\mu$ V/m)	Margin (dB)	Result (Pass/Fail)

No emissions found

**Table Result:** --- by --- dB**Worst Freq:** --- MHz

Test Site: EMI Chamber 2

Cable 1: EMIR-HIGH-06

Analyzer: Rental SA#1

Preamp: 18-26.5GHz

Antenna: 18-26.5GHz Horn

Rev.3/22/2015

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Brown	9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	5/12/2015	
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range		Cat	Calibration Due	Calibrated on
EMI Chamber 2	719150	2762A-7	A-0015	30-1000MHz		II	3/22/2017	3/22/2015
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
HF (Yellow)	18-26.5GHz	AFS4-18002650-60-8P-4	CS	467559	1266	I	3/13/2016	3/13/2015
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
HF (White) Horn	18-26.5GHz	801-WLM	Waveline	758	758	III	Verify before Use	date of test
Cables	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
REMI-High-06	1 - 26.5GHz	TRU-21B0707-120	TRU			II	7/27/2015	7/27/2014
Meteorological Meters	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	3/19/2016	3/19/2014	
TH A#1833	35519-044	Control Company	130318278	1833	II	6/13/2015	6/13/2013	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



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Testing Cert. No. 1627-01

## Radiated Band Edge

### Radiated Emissions Table

Date: 24-Mar-15	Company: Onset Computer Corporation	Work Order: P0635												
Engineer: Tuyen Truong	EUT Desc: BLE Module in MX1102 Temp/CO2/RH	EUT Operating Voltage/Frequency: 6Vdc												
Temp: 24°C	Humidity: 10%	Pressure: 1011mBar												
<b>Frequency Range:</b> Band Edge		<b>Measurement Distance:</b> 3 m												
<b>Notes:</b> Modulation - PRBS9 37 bytes DCCF (16.6dB)		<b>EUT Tx Freq:</b> 2402-2480 MHz												
Antenna Polarization (H/V)	Frequency (MHz)	Peak Reading (dB <sub>µ</sub> V)	Average Reading (dB <sub>µ</sub> V)	Preamp Factor (dB)	Antenna	Cable Factor (dB)	Adjusted Peak Reading (dB <sub>µ</sub> V/m)	Adjusted Avg Reading (dB <sub>µ</sub> V/m)	FCC 15.209 High Frequency - Peak			FCC 15.209 High Frequency - Average		
									Limit (dB <sub>µ</sub> V/m)	Margin (dB)	Result (Pass/Fail)	Limit (dB <sub>µ</sub> V/m)	Margin (dB)	Result (Pass/Fail)

**Table Result:** Pass by -0.9 dB

**Worst Freq:** 2400.0 MHz

Test Site: EMI Chamber 2	Cable 1: Asset #2052	Cable 2: Asset #2054	Cable 3: ---
Analyzer: Rental SA#2	Preamp: Brown	Antenna: Blue Horn	Preselector: ---

Rev.3/22/2015

Spectrum Analyzers / Receivers/Preselectors SA #2 (1860)	Range 9kHz-26.5 GHz	MN E7405A	Mfr Agilent	SN MY45104916	Asset 1860	Cat I	Calibration Due 6/4/2015	Calibrated on
Radiated Emissions Sites EMI Chamber 1	FCC Code 719150	IC Code 2762A-6	VCCI Code A-0015	Range 30-1000MHz		Cat II	Calibration Due 3/21/2017	Calibrated on 3/21/2015
Preamps /Couplers Attenuators / Filters 1517 HF Preamp	Range 1-20GHz	MN CS	Mfr CS	SN N/A	Asset 1517	Cat II	Calibration Due 9/9/2015	Calibrated on 9/9/2014
Antennas Blue Horn	Range 1-18Ghz	MN 3117	Mfr ETS	SN 157647	Asset 1861	Cat I	Calibration Due 2/8/2017	Calibrated on 2/8/2015
Cables Asset #2052 Asset #2054	Range 9kHz - 18GHz 9kHz - 18GHz		Mfr Florida RF Florida RF			Cat II	Calibration Due 3/8/2016 3/8/2016	Calibrated on 3/8/2015 3/8/2015
Meteorological Meters Weather Clock (Pressure Only) TH A#1833	MN BA928 35519-044	Mfr Oregon Scientific Control Company	SN C3166-1 130318278	Asset 831 1833	Cat I II	Calibration Due 3/19/2016 6/13/2015	Calibrated on 3/19/2014	

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## Conducted Spurious Emissions

### LIMITS

*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 20dB below that in the 100kHz bandwidth that contains the highest level of 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB ...*

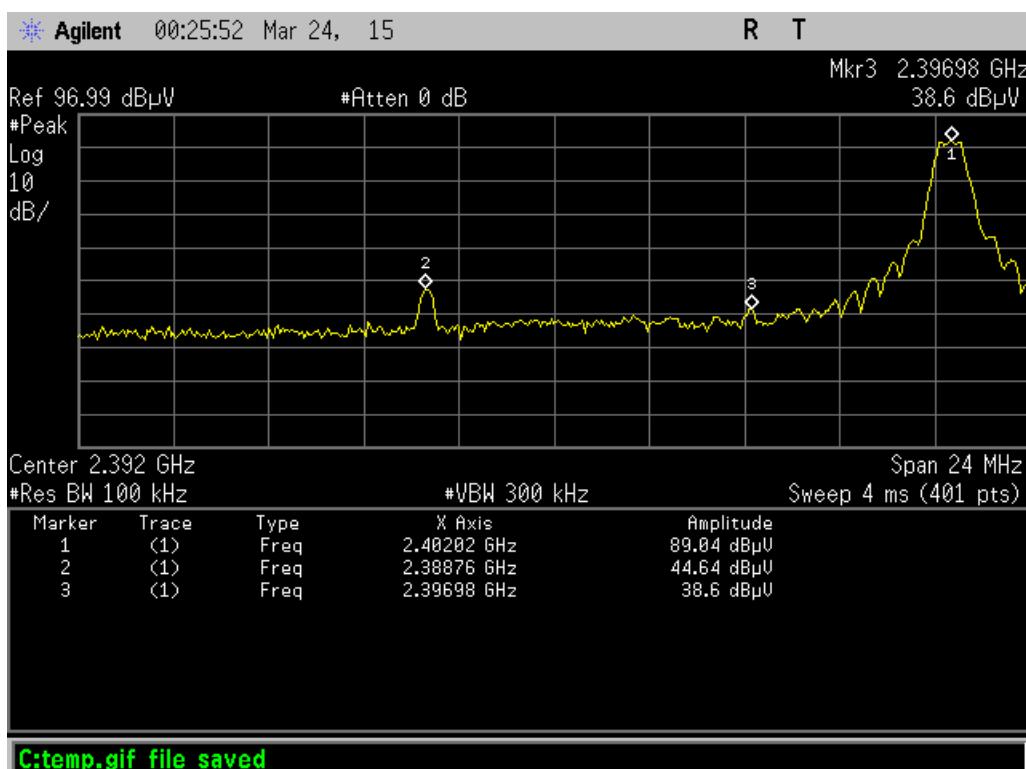
[15.247(d)]

Engineer	Chris Bramley and Tuyen Truong
Date	March 24 and 25, 2015
Site	Chamber 2
Environmental Conditions	24.7°C, 3%, 1011mb

## MEASUREMENTS / RESULTS

### Plots

#### Conducted Band Edge



Lower Channel - Band-edge (<-20dBm) - Normal Operation

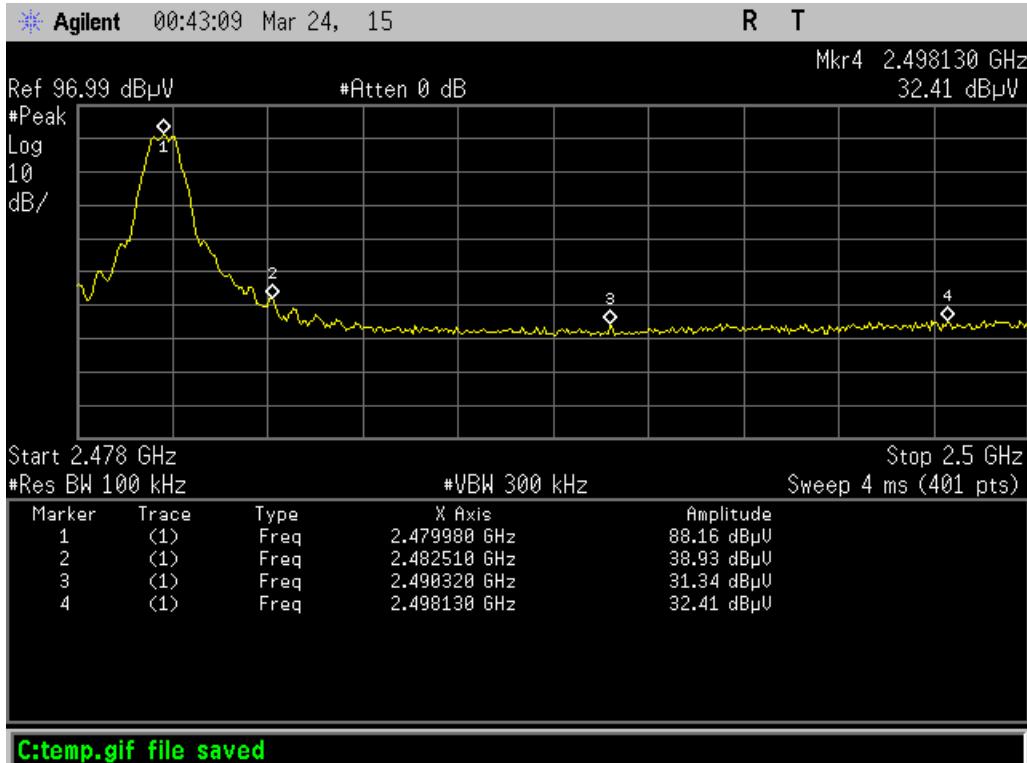


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Upper Channel – Band-edge (<-20dBm) – Normal Operation

## Conducted Spurious Emission

Conducted Spurious Emissions at the Antenna Port:

For these scans, the spectrum analyzer was set to the following:

Span: 400MHz or lower  
 Resolution Bandwidth: 100 KHz  
 Video Bandwidth: 300 KHz  
 Points per sweep: 8192

The frequency range 30MHz-25GHz was tested at EUT antenna port and no emissions were found within 10dB of the limit, which was set at 20dB below the power of the transmit frequency. The low, mid, and high channels were tested.



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Spectrum Analyzers / Receivers / Preselectors		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Brown		9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	5/12/2015	5/12/2014
Radiated Emissions Sites	FCC Code	719150	IC Code	2762A-7	VCCI Code	Range	Cat	Calibration Due	Calibrated on
EMI Chamber 2					A-0015	>1GHz	I	5/16/2015	5/16/2013
Preamps / Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
HF 20dB 50W Attenuator	0.009-18 GHz	PE 7019-20	Pastermack	1	791	II	7/14/2015	7/14/2014	
Meteorological Meters	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on		
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	3/19/2016	3/19/2014		
TH A#1833	35519-044	Control Company	130318278	1833	II	6/13/2015	6/13/2013		
Signal Generators	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
Reference HF Signal Generator	250kHz-40GHz	E8257D-540	Agilent	MY51110041	1859	I	6/6/2015	6/6/2014	
Cables	Range		Mfr			Cat	Calibration Due	Calibrated on	
REMI-High-06	1 - 26.5GHz	TRU-21B0707-120	TRU			II	7/27/2015	7/27/2014	

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## Power Spectral Density

### LIMIT

*...the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.  
[15.247(e)]*

### MEASUREMENTS / RESULTS

Engineer	Chris Bramley
Date	March 24, 2015
Site	Chamber 2
Environmental Conditions	24.7°C, 3%, 1011mb

### 15.247 (e) Maximum Power Spectral Density

**Tested by:** Chris Bramley **RBW** = 100KHz  
**Date:** 3/24/2015 **Analyzer:** Brown SA **VBW** = 300KHz  
**Company:** Onset Computer Corporation **Attenuation:** PE7019-20 #791 **Span** = 1.05MHz  
**EUT:** BLE Module

channel (MHz)	mode	measured PSD (dBm)	attenuator factor (dB)	adjusted power measurement	limit (dBm)	margin (dB)	result
2402	DMSS	-18.23	19.73	1.50	8	-6.50	Pass
2440	DMSS	-18.06	19.68	1.62	8	-6.38	Pass
2480	DMSS	-19.04	19.63	0.59	8	-7.41	Pass

Rev. 3/22/2015

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Brown	9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	5/12/2015	5/12/2014
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range		Cat	Calibration Due	Calibrated on
EMI Chamber 2	719150	2762A-7	A-0015	>1GHz		I	5/16/2015	5/16/2013
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
HF 20dB 50W Attenuator	0.009-18 GHz	PE 7019-20	Pasterнак	1	791	II	7/14/2015	7/14/2014
Meteorological Meters	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
Weather Clock (Pressure Only) TH A#1833	BA928 35519-044	Oregon Scientifi Control Compan	C3166-1 130318278	831 1833	I II	3/19/2016 6/13/2015	3/19/2014 6/13/2013	

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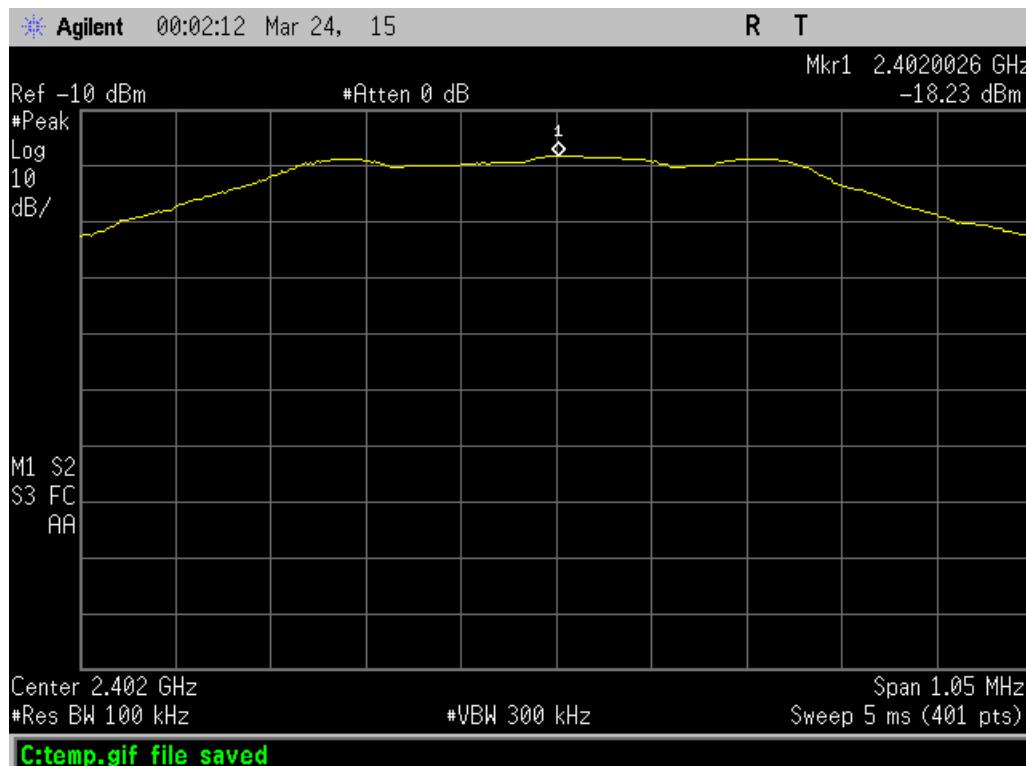
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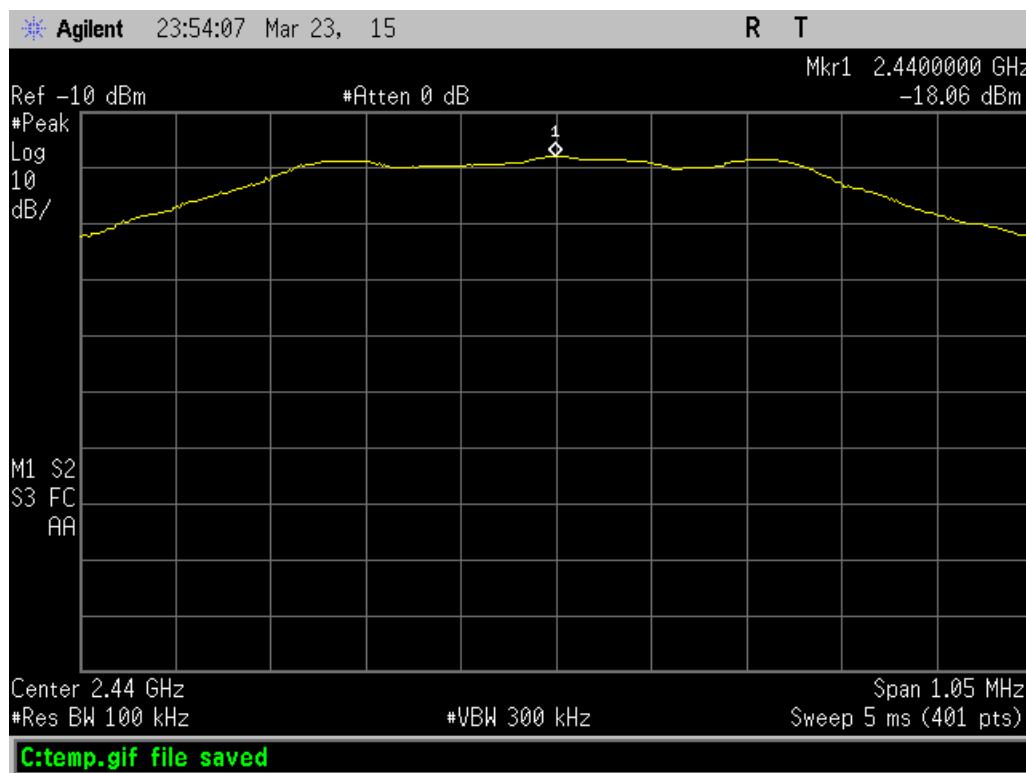
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## PLOTS

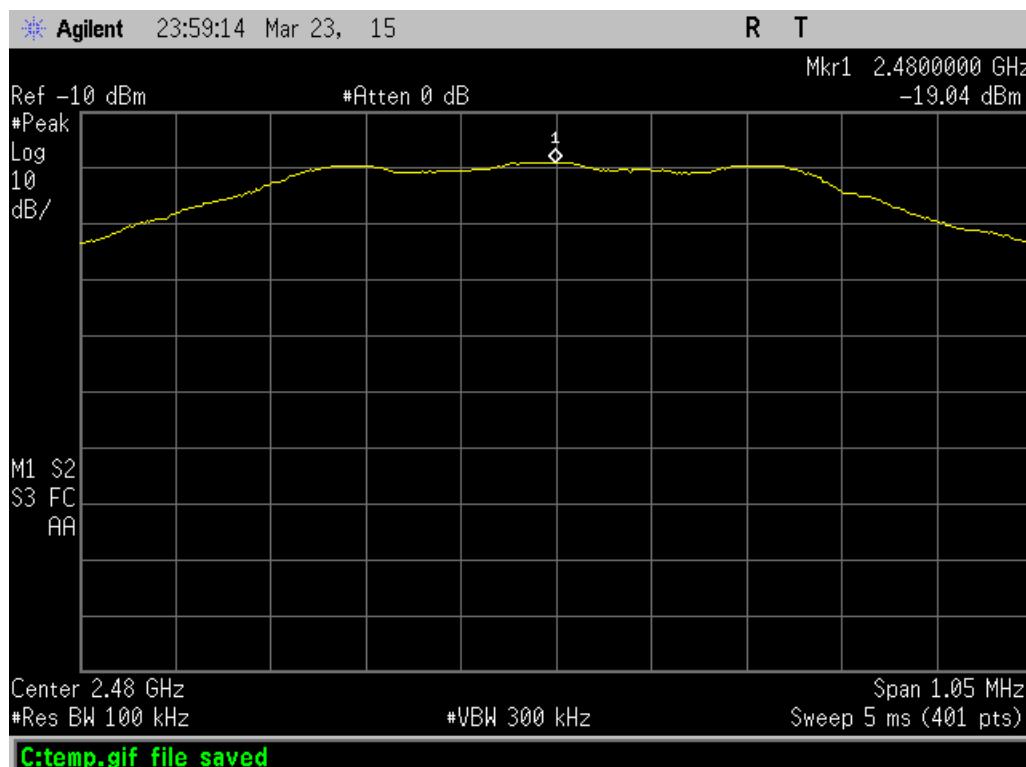


Channel Low – PSD



Channel Mid – PSD





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## AC Line Conducted Emissions

### LIMITS

Frequency of emission (MHz)	Quasi-peak limit (dB $\mu$ V)	Average limit (dB $\mu$ V)
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

[47 CFR 15.207(a)]

### MEASUREMENTS / RESULTS

Engineer	Tuyen Truong
Date	March, 25, 2015
Site	N/A
Environmental Conditions	N/A

No AC Line Conducted Emissions testing required since EUT is battery operated (4xAA batteries)



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## Occupied Bandwidth

### REQUIREMENT

When an occupied bandwidth is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. [RSS-GEN 4.6.1]

### MEASUREMENTS / RESULTS

Engineer	Chris Bramley
Date	March 24, 2015
Site	Chamber 2
Environmental Conditions	24.7°C, 3%, 1011mb

Occupied Bandwidth		
Frequency (MHz)	Mode	99% Occupied Bandwidth (MHz)
2402	DMSS	1.0668
2440	DMSS	1.0480
2480	DMSS	1.0429

**Tested by:** Chris Bramley      **RBW = 100KHz** **VBW = 300KHz**  
**Date:** 3/24/2015      **Analyzer:** Brown SA  
**Company:** Onset Computer Corporation      **Attenuator:** PE7019-20 #791  
**EUT:** BLE Module

Rev. 3/22/2015									
Spectrum Analyzers / Receivers / Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
Brown	9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	5/12/2015	5/12/2014	
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range					
EMI Chamber 2	719150	2762A-7	A-0015	>1GHz					
Preamps / Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on	
HF 20dB 50W Attenuator	0.009-18 GHz	PE 7019-20	Pasternack	1	791	II	7/14/2015	7/14/2014	
Meteorological Meters	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on		
Weather Clock (Pressure Only)	BA928	Oregon Scientifi	C3166-1	831	I	3/19/2016	3/19/2014		
TH A#1833	35519-044	control Compan	130318278	1833	II	6/13/2015	6/13/2013		

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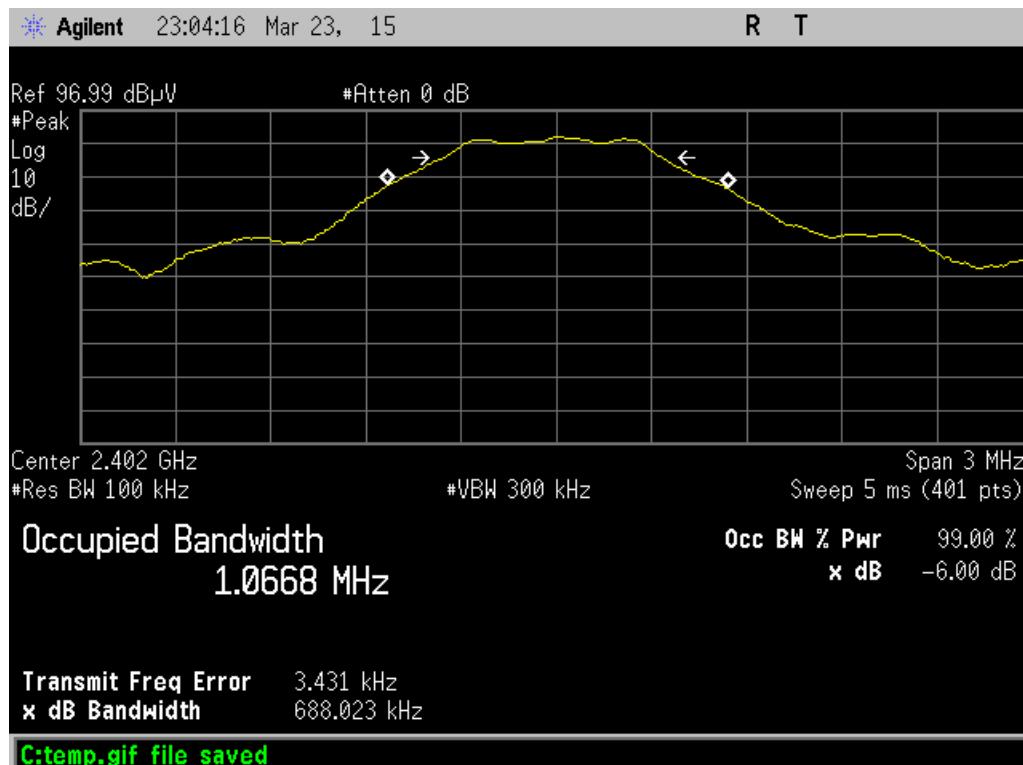


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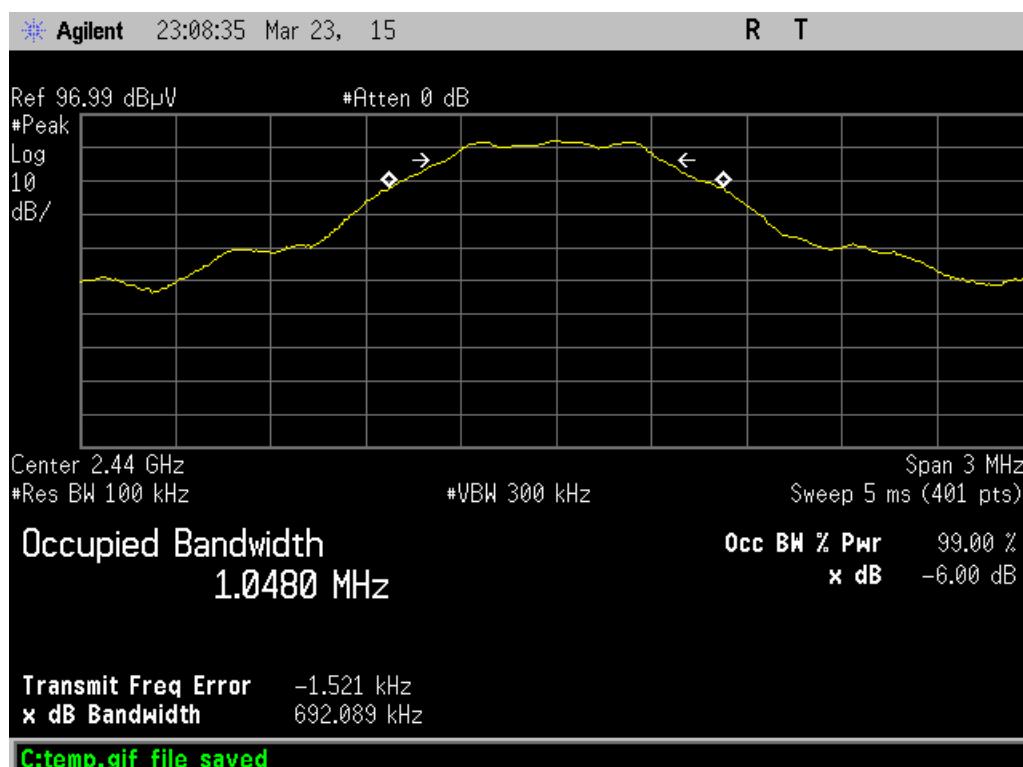


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**Plot(s)**

Low Channel – Occupied Bandwidth

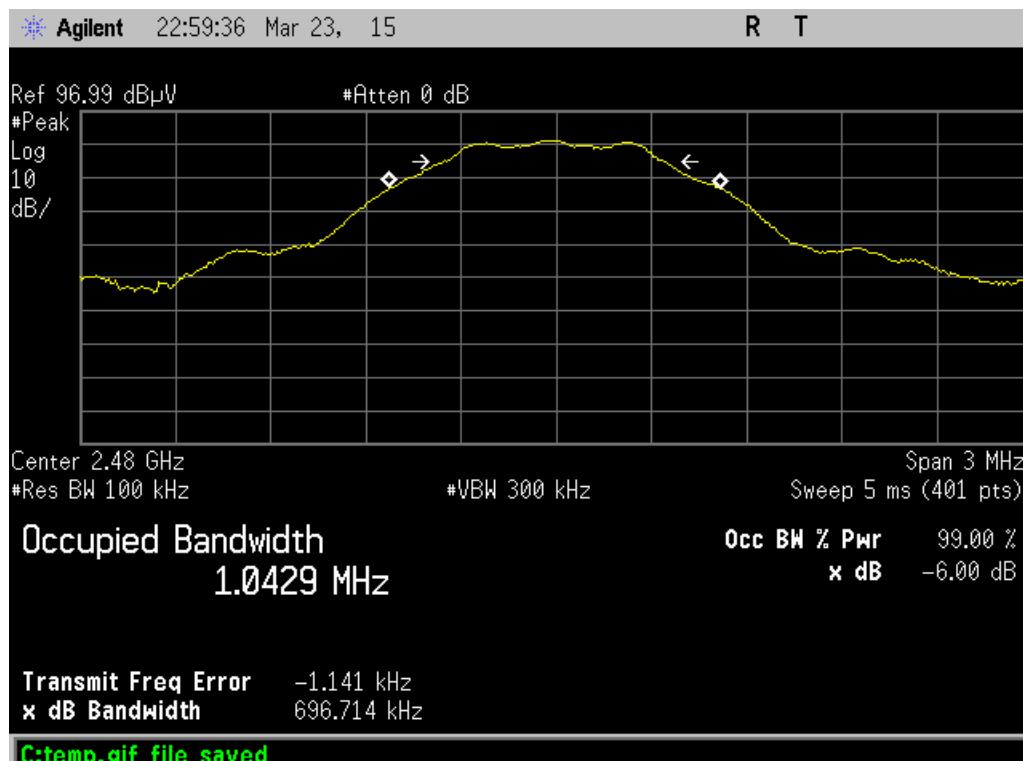


Mid Channel – Occupied Bandwidth



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High Channel – Occupied Bandwidth



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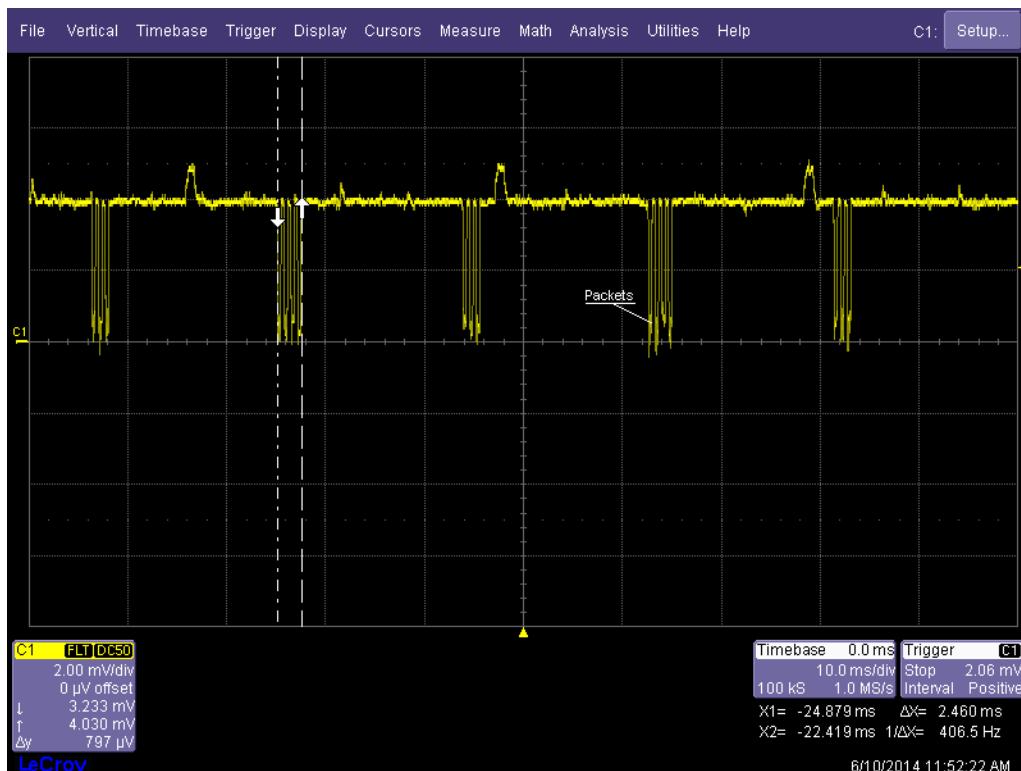
## Duty Cycle Correction Calculation

### MEASUREMENTS / CALCULATIONS

Engineer	Tuyen Truong
Date	March 24
Site	Chamber 2
Environmental Conditions	24.7°C, 3%, 1011mBar

$$\begin{aligned}
 \text{DCCF} &= 20 \cdot \log (\text{total On Time} / 100\text{ms}) \\
 &= 20 \cdot \log (2.46 \cdot 6 / 100) \\
 &= -16.6
 \end{aligned}$$

### PLOTS



Individual Pulse On time (14.76ms) in a 100ms Window



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## Measurement Uncertainty

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Expanded Uncertainty k=2	Maximum allowable uncertainty
Radiated Emissions (30-1000MHz) NIST CISPR	5.6dB 4.6dB	N/A 5.2dB (Ucispr)
Radiated Emissions (1-26.5GHz)	4.6dB	N/A
Radiated Emissions (above 26.5GHz)	4.9dB	N/A
Magnetic Radiated Emissions	5.6dB	N/A
Conducted Emissions NIST CISPR	3.9dB 3.6dB	N/A 3.6dB (Ucispr)
Telco Conducted Emissions (Current)	2.9dB	N/A
Telco Conducted Emissions (Voltage)	4.4dB	N/A
Electrostatic Discharge	11.5%	N/A
Radiated RF Immunity (Uniform Field)	1.6dB	N/A
Electrical Fast Transients	23.1%	N/A
Surge	23.1%	N/A
Conducted RF Immunity	3dB	N/A
Magnetic Immunity	12.8%	N/A
Dips and Interrupts	2.3V	N/A
Harmonics	3.5%	N/A
Flicker	3.5%	N/A
Radio frequency (@ 2.4GHz)	$3.23 \times 10^{-8}$	$1 \times 10^{-7}$
RF power, conducted	0.40dB	0.75dB
Maximum frequency deviation:		
• Within 300Hz and 6kHz of audio frequency / Within 6kHz and 25kHz of audio frequency	3.4% 0.3dB	5% 3dB
Adjacent channel power	1.9dB	3dB
Conducted spurious emission of transmitter, valid up to 12.75GHz	2.39dB	3dB
Conducted emission of receivers	1.3dB	3dB
Radiated emission of transmitter, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of transmitter, valid up to 80GHz	3.3dB	6dB
Radiated emission of receiver, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of receiver, valid up to 80GHz	3.3dB	6dB
Humidity	2.37%	5%
Temperature	0.7°C	1.0°C
Time	4.1%	10%
RF Power Density, Conducted	0.4dB	3dB
DC and low frequency voltages	1.3%	3%
Voltage (AC, <10kHz)	1.3%	2%
Voltage (DC)	0.62%	1%
The above reflects a 95% confidence level		



## Conditions Of Testing

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1. All orders for tests are subject to acceptance by the Company, and no order will constitute a binding commitment of the Company unless and until such order is accepted by it, as evidenced by the issuance of a written report ("Test Report") by the Company. The Test Report is issued solely by the Company, is intended for the exclusive use of Client and shall not be published, used for advertising purposes, copied or replicated for distribution to any other person or entity or otherwise publicly disclosed without the prior written consent of the Company. By submitting a request for services to the Company, Client consents to the disclosure to accreditation bodies of those records of Client relevant to the accreditation body's assessment of the Company's competence and compliance with relevant accreditation criteria. The Company shall not be liable for any loss or damage whatsoever resulting from the failure of the Company to provide its services within any time period for completion estimated by the Company. If Client anticipates using the Test Report in any legal proceeding, arbitration, dispute resolution forum or other proceeding, it shall so notify the Company prior to submitting the Test Report in such proceeding. The Company has no obligation to provide a fact or expert witness at such proceeding unless the Company agrees in advance to do so for a separate and additional fee.
2. The Test Report will set forth the findings of the Company solely with respect to the test samples identified therein. Unless specifically and expressly indicated in the Test Report, the results set forth in such Test Report are not intended to be indicative or representative of the quality or characteristics of the lot from which a test sample is taken, and Client shall not rely upon the Test Report as being so indicative or representative of the lot or of the tested product in general. The Test Report will reflect the findings of the Company at the time of testing only, and the Company shall have no obligation to update the Test Report after its issuance. The Test Report will set forth the results of the tests performed by the Company based upon the written information provided to the Company. The Test Report will be based solely on the samples and written information submitted to the Company by Client, and the Company shall not be obligated to conduct any independent investigation or inquiry with respect thereto.
3. The Company may, in its sole discretion, destroy samples which have been furnished to the Company for testing and which have not been destroyed in the course of testing. The Company may delegate the performance of all or a portion of the services contemplated hereunder to an affiliate, agent or subcontractor of the Company, and Client consents to such delegation.
4. These Conditions and the Test Report represent the entire understanding of the parties hereto with respect to the subject matter hereof and of the Test Report, and no modification, variance or extrapolation with respect thereto shall be permitted without the prior written consent of the Company.
5. The names, service marks, trademarks and copyrights of the Company and its affiliates, including the names "**BUREAU VERITAS**," "**BUREAU VERITAS CONSUMER PRODUCTS SERVICES**," "**BVCPs**," "**MTL**," "**ACTS**," "**MTL-ACTS**" and **CURTIS-STRAUS** (collectively, the "Marks") are and shall remain the sole property of the Company or its affiliates and shall not be used by Client except solely to the extent that Client obtains the prior written approval of the Company and then only in the manner prescribed by the Company. Client shall not contest the validity of the Marks or take any action that might impair the value or goodwill associated with the Marks or the image or reputation of the Company or its affiliates.
6. Payment in full shall be due 30 days after the date of invoice. Interest shall be due on overdue amounts from the due date until paid at an interest rate of 1.5% per month or, if less, the maximum rate permitted by law. The Company reserves the right, at any time and from time to time, to revoke any credit extended to Client. Client shall reimburse the Company for any costs it incurs in collecting past due amounts, including court costs and fees and expenses of attorneys and collection agencies. The Test Report may not be used or relied upon by Client if and for so long as Client fails to pay when due any invoice issued by the Company or any affiliate of it to Client or any affiliate or subsidiary of Client together with interest and penalties, if any, accrued thereon.
7. The Company disclaims any and all responsibility or liability arising out of or in connection with e-mail transmissions of such information.
8. Client understands and agrees that the Company is neither an insurer nor a guarantor, that the Company does not take the place of Client or any designer, manufacturer, agent, buyer, distributor or transportation or shipping company, and that the Company disclaims all liability in such capacities. Client further understands that if it seeks assurance against loss or damage, it should obtain appropriate insurance.
9. Client agrees that the Company, by providing the services, does not take the place of Client nor any third party, nor does the Company release them from any of their obligations, nor does the Company otherwise assume, abridge, abrogate or undertake to discharge any duty of any third party to Client or any duty of Client or any third party to any other third party, and Client will not release any third party from its obligations and duties with respect to the tested goods.
10. Client shall, on a timely basis, (a) provide adequate instructions to the Company in order to enable the Company to perform properly its services, (b) provide, or cause Client's suppliers and contractors to provide, the Company with all documents necessary to enable the Company to perform its services, (c) furnish the Company with all relevant information regarding Client's intended use and purposes of the tested goods, (d) advise the Company of essential dates and deadlines relevant to the tested goods and (e) fully exercise all rights and remedies available to Client against third parties in respect of the tested goods.
11. The Company shall undertake due care and ordinary skill in the performance of its services to Client, and the Company shall accept responsibility only were such skill has not been exercised and, even in such event, only to the extent of the limitation of liability set forth herein.
12. If Client desires to assert a claim arising from or relating to (i) the performance, purported performance or non-performance of any services by the Company or (ii) the sale, resale, manufacture, distribution or use of any tested goods, it must submit that claim to the Company in a writing that sets forth with particularity the basis for such claim within 60 days from discovery of the potential claim and not more than six months after the date of issuance of the Test Report to Client. Client waives any and all such claims including, without limitation, claims that the Test Report is inaccurate, incomplete or misleading or that additional or different testing is required, unless and then only to the extent that Client submits a written claim to the Company within both such time periods.
13. CLIENT SHALL, EXCEPT TO THE EXTENT OF COMPANY'S LIABILITY TO CLIENT HEREUNDER (WHICH IN NO EVENT SHALL EXCEED THE LIMITATION OF LIABILITY HEREIN), HOLD HARMLESS AND INDEMNIFY THE COMPANY, ITS AFFILIATES AND THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES, AGENTS AND SUBCONTRACTORS AGAINST ALL ACTUAL OR ALLEGED THIRD PARTY CLAIMS FOR LOSS, DAMAGE OR EXPENSE OF WHATSOEVER NATURE AND HOWSOEVER ARISING FROM OR RELATING TO (i) THE PERFORMANCE, PURPORTED PERFORMANCE OR NON-PERFORMANCE OF ANY SERVICES BY THE COMPANY OR (ii) THE SALE, RESALE, MANUFACTURE, DISTRIBUTION OR USE OF ANY TESTED GOODS.
14. EXCEPT AS MAY OTHERWISE BE EXPRESSLY AGREED TO IN WRITING BY THE COMPANY AND NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN OR IN ANY TEST REPORT, NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, IS MADE.



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VERITAS



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Testing Cert. No. 1627-01

15. (A) IN NO EVENT WHATSOEVER SHALL THE COMPANY BE LIABLE FOR ANY CONSEQUENTIAL, SPECIAL, INCIDENTAL, EXEMPLARY OR PUNITIVE DAMAGES IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE TEST REPORT OR THE SERVICES PROVIDED BY THE COMPANY HEREUNDER, INCLUDING WITHOUT LIMITATION LOSS OF OR DAMAGE TO PROPERTY; LOSS OF INCOME, PROFIT OR USE; OR ANY CLAIMS OR DEMANDS MADE AGAINST CLIENT OR ANY OTHER PERSON BY ANY THIRD PARTY IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE SERVICES PROVIDED BY THE COMPANY HEREUNDER.

(B) NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN, AND IN RECOGNITION OF THE RELATIVE RISKS AND BENEFITS TO CLIENT AND THE COMPANY ASSOCIATED WITH THE TESTING SERVICES CONTEMPLATED HEREBY, THE RISKS HAVE BEEN ALLOCATED SUCH THAT UNDER NO CIRCUMSTANCES WHATSOEVER SHALL THE LIABILITY OF THE COMPANY TO CLIENT OR ANY THIRD PARTY IN RESPECT OF ANY CLAIM FOR LOSS, DAMAGE OR EXPENSE, OF WHATSOEVER NATURE OR MAGNITUDE, AND HOWSOEVER ARISING, EXCEED AN AMOUNT EQUAL TO FIVE (5) TIMES THE AMOUNT OF THE FEES PAID TO THE COMPANY FOR THE SPECIFIC SERVICES WHICH GAVE RISE TO SUCH CLAIM OR U.S.\$10,000, WHICHEVER IS THE LESSER AMOUNT.

16. The Company shall not be liable for any loss or damage resulting from any delay or failure in performance of its obligations hereunder resulting directly or indirectly from any event of force majeure or any event outside the control of the Company. If any such event occurs, the Company may immediately cancel or suspend its performance hereunder without incurring any liability whatsoever to Client.

17. Company's services, including these Conditions, shall be governed by, and construed in accordance with, the local laws of the country where the Company performs the tests or, in the case of tests performed in the United States of America, the laws of Massachusetts without regard to conflicts of laws principles. If any aspect(s) of these Conditions is found to be illegal or unenforceable, the validity, legality and enforceability of all remaining aspects of these Conditions shall not in any way be affected or impaired thereby. Any proceeding related to the subject matter hereof shall be brought, if at all, in the courts of the country where the Company performs the tests or, in the case of tests performed in the United States of America, in the courts of Massachusetts. Client waives the right to interpose any counterclaim or setoffs of any nature in any litigation arising hereunder.

The complete list of the Approved Subcontractors Curtis-Straus may use to delegate the performance of work can be provided upon request. Rev.160009121(2)\_#684340 v14CS



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