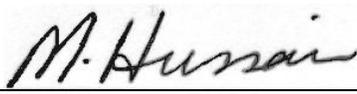




**CURTIS-STRAUS**

# Test Report

Report No	EM2038-1
Client	BeeWave Systems, LLC
Address	4018 Ban Oak St. High Point, NC 27265
Phone	336-446-9467
Items tested	BW2155 module
FCC ID	OIPBW2155
FRN	0021941430
Equipment Type	Digital Transmission System
Equipment Code	DTS
Emission Designator	DTS
FCC/IC Rule Parts	47 CFR 15.247, RSS 210 issue 8 and RSS GEN issue 3
Test Dates	October 8, 9, 2012
Results	As detailed within this report
Prepared by	 Christopher Reynolds – Test Engineer
Authorized by	 Mairaj Hussain – EMC Supervisor
Issue Date	<u>Jan 3rd, 2013</u>
Conditions of Issue	This Test Report is issued subject to the conditions stated in the 'Conditions of Testing' section on page 38 of this report.

Curtis-Straus LLC is accredited to ISO/IEC 17025 by A2LA for the specific scope of accreditation under Certificate Number 1627-01. This report may contain data which is not covered by the A2LA accreditation. See our scope of accreditation at the end of this test report. Any opinions or interpretations expressed in this report are outside the scope of our A2LA accreditation as A2LA only accredits testing.

Testing Cert. No. 1627-01



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



## Summary

This test report supports an application for certification of a transmitter operating pursuant to 47 CFR 15.247. The product is the BW2155 Module. It is a transmitter that operates in the range 2400-2483.5MHz.

Where applicable, board SN:28 MN:BW2155A was tested. Board SN:4 MN:BW215B is a subset of this board. The difference between the two boards is that the B board does not include the user switches, the USB, or the top left temperature sensor.

We found that the product met the above requirements with modification (see *Modifications Required for Compliance* section on page 5). Iqbal Chaudhry from BeeWave Systems, LLC was present during the testing. The test sample was received in good condition.

## Test Methodology

Radiated emission and AC Line conducted testing was performed according to the procedures specified in ANSI C63.4 (2003). Radiated Emissions were maximized by rotating the device around three orthogonal axes as well as varying the test antenna's height and polarity. The device antenna was maximized separately. Product is configured with three antenna ports. Two of them are designed for chip antenna and 3<sup>rd</sup> one is for Whip antenna. Only one antenna transmits at a time. Two chip antennas are same type one has a lower gain. Spurious emissions / band edges were checked with whip antenna and higher gain chip antenna.

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

The EUT operating voltage is 120VAC, 60Hz.

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

Frequency	RBW	VBW
0.15-30MHz	9kHz	30kHz
30-1000MHz	120kHz	1MHz
1-25GHz	1MHz	3MHz

Release Control Record

Issue No. Reason for change  
1 Original Release

Date Issued  
February 15, 2013

## Product Tested - Configuration Documentation

EUT Configuration									
<b>Work Order:</b> M2038 <b>Company:</b> BeeWave Systems, LLC. <b>Company Address:</b> 4018 Ban Oak St. High Point, NA 27265 <b>Contact:</b> Iqbal Chaudhry <b>Person Present:</b> Iqbal Chaudhry									
<b>MN</b>					<b>SN</b>				
<b>EUT:</b>		BW2155A			28				
		BW2155B			4				
<b>EUT Description:</b> Zigbee Module <b>EUT Max Frequency:</b> 2475GHz									
<b>Support Equipment:</b>					<b>MN</b>				
None									
<b>EUT Ports:</b>									
		<b>No.</b>				<b>Max</b>			
<b>Port Label</b>	<b>Port Type</b>	<b>No. of ports</b>	<b>Populated</b>	<b>Cable Type</b>	<b>Shielded</b>	<b>Ferrites</b>	<b>Length</b>	<b>Length</b>	<b>Unpopulated Reason</b>
USB	USB	1	1	USB	Yes	None	2.5m	5m	
<b>Software / Operating Mode Description:</b>									
The EUT was set such that a push of a selector button could change the channel,power, or duty cycle with the transmitter constantly on.									

### Statement of Conformity

The BW2155 Module has been found to conform to the following parts of 47 CFR and RSS 210 as detailed below:

RSS-GEN	RSS 210	Part 15	Comments
5.3		15.15(b)	The user controls shall be factory software limited such that end user will not cause operation of the device in violation of the regulations.
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	The EUT has three possible antenna options. Two are chip antennas that are hardwired to the PCB. The third is a whip antenna with a unique connector as mentioned in the modular approval letter.
	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	EUT meets the AC Line conducted emissions requirements of 15.207.
	Annex 8	15.247	The unit complies with the requirements of 15.247
4.6.1			Occupied Bandwidth measurements were made.

### Modifications Required for Compliance

Use of channel 26 is not allowed. Additionally, please see the allowable power levels for each channel based duty cycle correction factor.

## Test Results

### Bandwidth

#### LIMIT

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

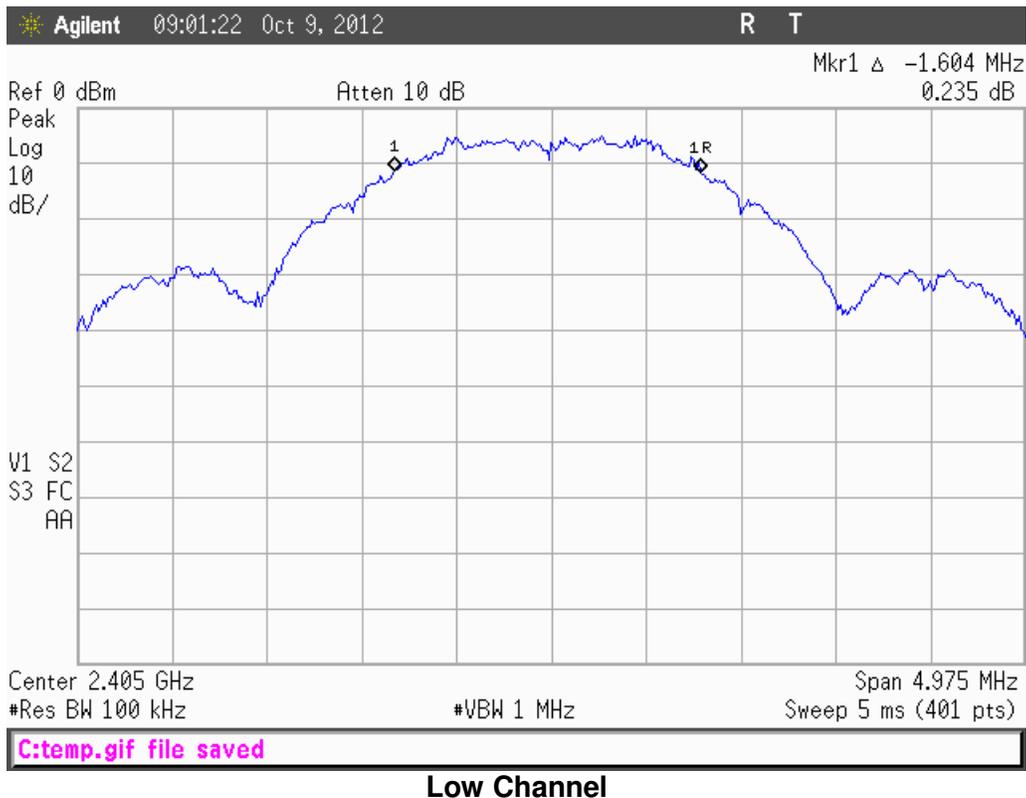
### MEASUREMENTS / RESULTS

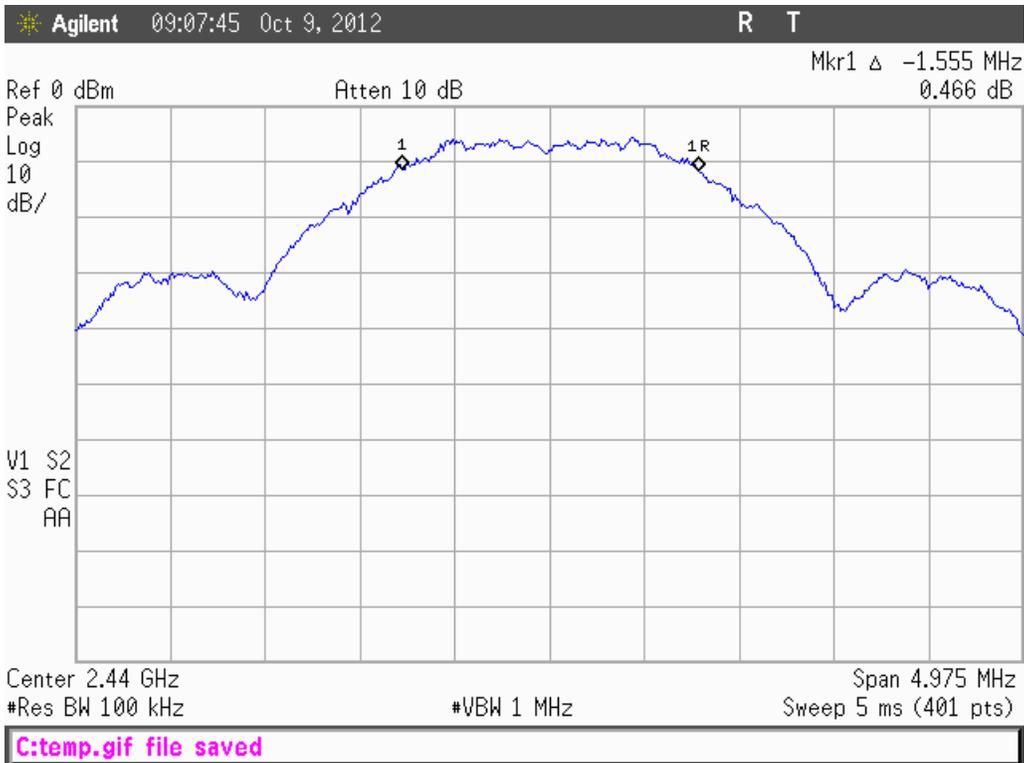
Engineer	Arik Zwirner
Date	10/9/12
Site	3M OATS

25 °C, 36%, 1012mb

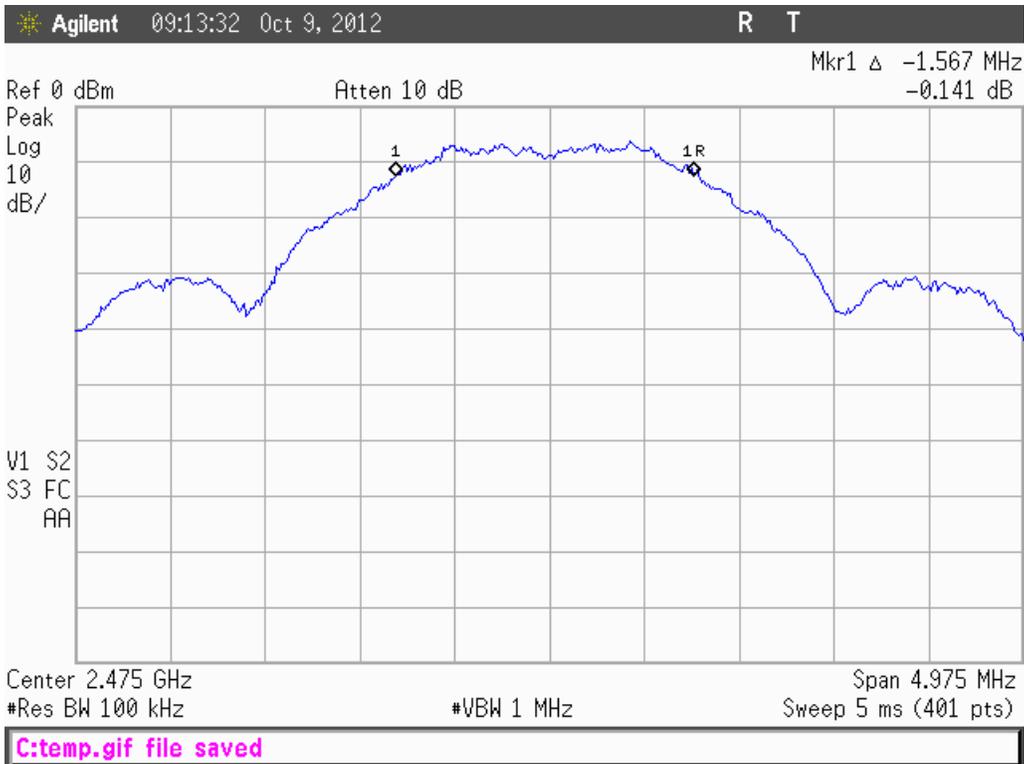
Measured 6dB bandwidth = 1.604MHz

### PLOT





Middle Channel



Upper Channel

Rev. 10/5/2012

**Spectrum Analyzers / Receivers /Preselectors**  
Gold

Range	MN	Mfr	SN	Asset	Cat	Calibration Due
100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	2/3/2013

**Radiated Emissions Sites**  
1DCC-OATS-3M-I

FCC Code	IC Code	VCCI Code	Cat	Calibration Due
719150	2762A-8	A-0015	II	11/7/2012

**Preamps /Couplers Attenuators / Filters**  
HF 20dB 50W Attenuator

Range	MN	Mfr	SN	Asset	Cat	Calibration Due
0.009-18 GHz	PE 7019-20	Pasternack	1	791	II	6/1/2013

**Meteorological Meters**

	MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	3/28/2013
1DCC-OATS-3M-I Thermohyrometer	35519-044	Control Company	72457635	1334	II	8/19/2013

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

## Peak Power

### LIMIT

Conducted Output Power

1 Watt

[15.247(b) (3)]

## MEASUREMENTS / RESULTS

Engineer	Arik Zwirner
Date	10/9/12
Site	3M OATS

25 °C, 36%, 1012mb

Channel	Frequency (MHz)	Power level setting	Reading (dBm)	Pad + Dongle (dB)	Adjusted Reading (dBm)	Limit (dBm)
11	2405	10	-9.63	20.4	10.77	30
18	2440	1	0.46	20.4	20.86	30
25	2475	5	-2.98	20.4	17.42	30

Rev. 10/5/2012

**Spectrum Analyzers / Receivers / Preselectors**  
Gold

<b>Range</b>	<b>MN</b>	<b>Mfr</b>	<b>SN</b>	<b>Asset</b>	<b>Cat</b>	<b>Calibration Due</b>
100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	2/3/2013

**Radiated Emissions Sites**  
1DCC-OATS-3M-I

<b>FCC Code</b>	<b>IC Code</b>	<b>VCCI Code</b>	<b>Cat</b>	<b>Calibration Due</b>
719150	2762A-8	A-0015	II	11/7/2012

**Preamps / Couplers Attenuators / Filters**  
HF 20dB 50W Attenuator

<b>Range</b>	<b>MN</b>	<b>Mfr</b>	<b>SN</b>	<b>Asset</b>	<b>Cat</b>	<b>Calibration Due</b>
0.009-18 GHz	PE 7019-20	Pasternack	1	791	II	6/1/2013

**Meteorological Meters**

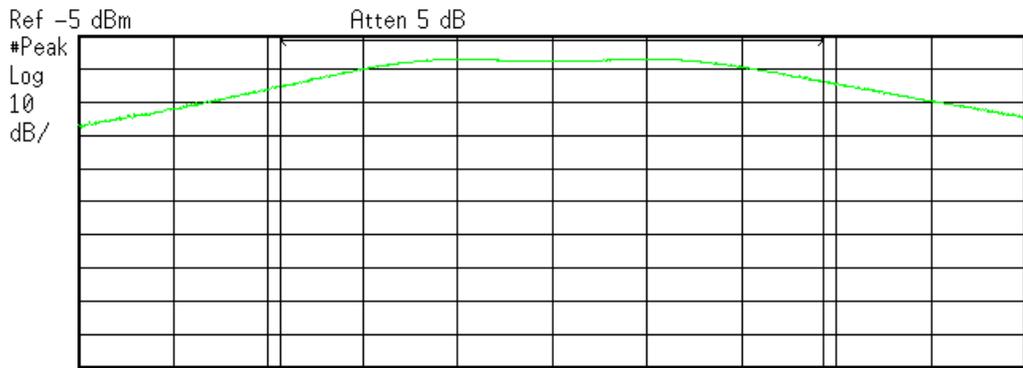
<b>Weather Clock (Pressure Only)</b>	<b>MN</b>	<b>Mfr</b>	<b>SN</b>	<b>Asset</b>	<b>Cat</b>	<b>Calibration Due</b>
1DCC-OATS-3M-I Thermohyrometer	BA928	Oregon Scientific	C3166-1	831	I	3/28/2013
	35519-044	Control Company	72457635	1334	II	8/19/2013

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

**PLOTS**

Agilent 12:11:01 Oct 9, 2012

R T



Center 2.405 GHz Span 5.075 MHz  
#Res BW 1 MHz #VBW 3 MHz Sweep 9.99 ms (1000 pts)

**Channel Power**

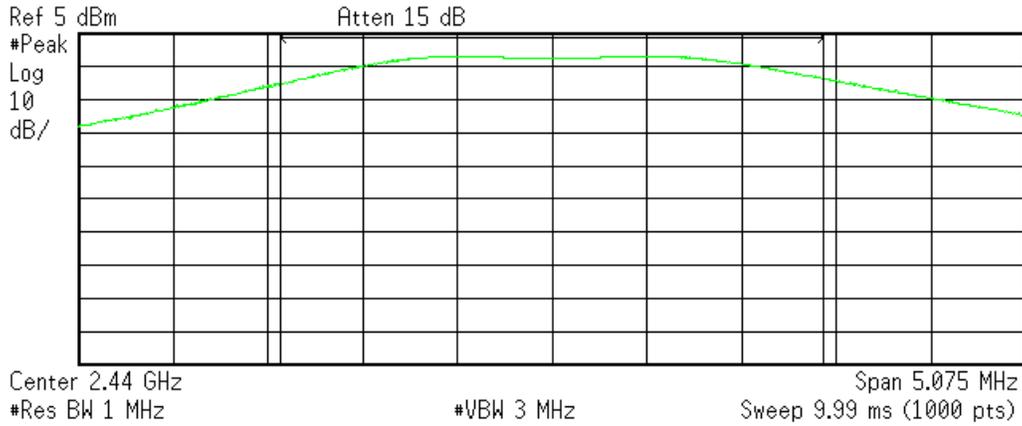
-9.63 dBm /2.9000 MHz

**Power Spectral Density**

-74.25 dBm/Hz

C:\temp.gif file saved

Low Channel



**Channel Power**

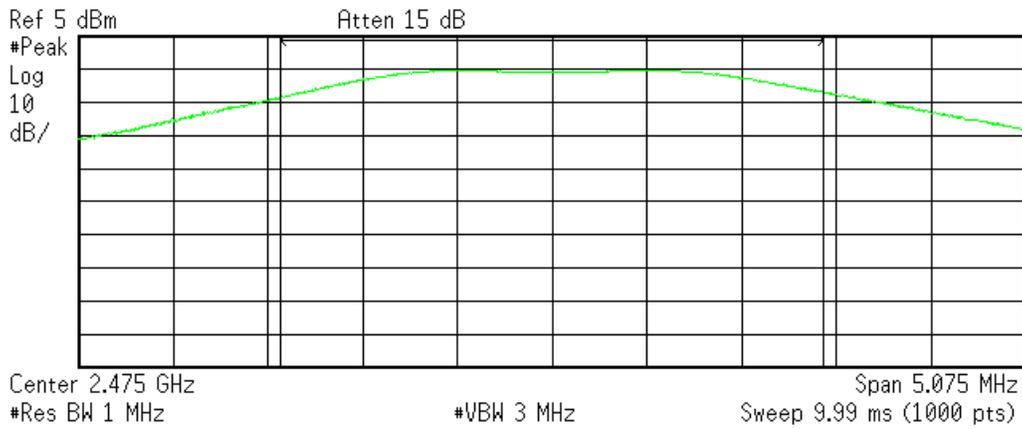
0.46 dBm /2.9000 MHz

**Power Spectral Density**

-64.17 dBm/Hz

C:\temp.gif file saved

**Middle Channel**



**Channel Power**  
-2.98 dBm /2.9000 MHz

**Power Spectral Density**  
-67.60 dBm/Hz

C:\temp.gif file saved

Upper Channel

## Band Edge Measurements

### 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

### Whip Antenna

Date: 8-Oct-12		Company: BeeWave		Work Order: M2038												
Engineer: Arik Zwirner		EUT Desc: BW2155 Module		EUT Operating Voltage/Frequency: 120Vac/60Hz												
Temp: 24°C		Humidity: 25%		Pressure: 1017mBar												
Frequency Range: Band Edge Readings				Measurement Distance: 3 m												
Notes: Whip Antenna Module 28																
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average				
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)		
Whip Antenna mounted horizontally, Channel 11, power level 10																
H	2389.6	52.9	37.5	19.7	28.6	4.5	66.3	50.9	74.0	-7.7	Pass	54.0	-3.1	Pass		
Power Level 1, Channel 16 (2430MHz center)																
H	2382.0	64.6	61.5	41.1	28.6	4.4	56.5	53.4	74.0	-17.5	Pass	54.0	-0.6	Pass		
Whip Antenna mounted Channel 18, Power level 1																
H	2487.9	63.0	62.1	41.3	29.0	4.2	54.9	54.0	74.0	-19.1	Pass	54.0	0.0	Pass		
Whip Antenna mounted Channel 20, Power level 1																
H	2483.6	69.4	61.4	41.3	29.0	4.2	61.3	53.3	74.0	-12.7	Pass	54.0	-0.7	Pass		
Whip Antenna mounted Channel 23, Power level 1																
H	2483.6	72.0	61.8	41.3	29.0	4.2	63.9	53.7	74.0	-10.1	Pass	54.0	-0.3	Pass		
Whip Antenna mounted Channel 25, Power level 5																
H	2484.0	76.9	61.5	41.3	29.0	4.2	68.8	53.4	74.0	-5.2	Pass	54.0	-0.6	Pass		

### Channel and Duty Cycle Assignment (Whip Antenna)

Channel	Frequency	Power Level	Power Output	Passing Duty Cycle	For FCC
11	2405	10	10.8	17	17
12	2410	10	10.8	17	17
13	2415	10	10.8	17	17
14	2420	10	10.8	17	17
15	2425	10	10.8	17	17
16	2430	1	20.8	70	67
17	2435	1	20.8	70	67
18	2440	1	20.8	70	67
19	2445	1	20.8	40	30
20	2450	1	20.8	40	30
21	2455	1	20.8	30	30
22	2460	1	20.8	30	30
23	2465	1	20.8	30	30
24	2470	5	17.4	17	17
25	2475	5	17.4	17	17
26	2480	skip	skip	skip	skip

## Channel and Duty Cycle Assignment (Chip Antenna)

Channel	Frequency	Power Level	Power Output	Passing Duty Cycle	For FCC
11	2405	1	20.8	17	17
12	2410	1	20.8	17	17
13	2415	1	20.8	17	17
14	2420	1	20.8	17	17
15	2425	1	20.8	17	17
16	2430	1	20.8	100	100
17	2435	1	20.8	100	100
18	2440	1	20.8	100	100
19	2445	1	20.8	67	67
20	2450	1	20.8	67	67
21	2455	1	20.8	49	30
22	2460	1	20.8	49	30
23	2465	1	20.8	30	30
24	2470	5	17.4	17	17
25	2475	5	17.4	17	17
26	2480	skip	skip	skip	skip

Date: 8-Oct-12		Company: Bee Wave		Work Order: M2038										
Engineer: Anik Zwirner		EUT Desc: BW2155 Module		EUT Operating Voltage/Frequency: 120Vac/60Hz										
Temp: 24°C		Humidity: 25%		Pressure: 1017mBar										
Frequency Range: Band Edge Readings				Measurement Distance: 3 m										
Notes: DC Module 28														
Antenna Polarization (H/V)	Frequency (MHz)	Peak Reading (dBμV)	Average Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBμV/m)	Adjusted Avg Reading (dBμV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)
<b>Chip Antenna A1</b>														
channel 11, Power level 1; board is flat on table														
H	2389.8	74.4	59.0	41.1	28.6	4.5	66.4	51.0	74.0	-7.6	Pass	54.0	-3.0	Pass
V	2389.7	69.1	53.7	41.1	28.6	4.5	61.1	45.7	74.0	-12.9	Pass	54.0	-8.3	Pass
channel 11, Power level 1; board is upright (on its edge) on table with antenna horizontal														
H	2389.6	70.8	55.4	41.1	28.6	4.5	62.8	47.4	74.0	-11.2	Pass	54.0	-6.6	Pass
V	2389.6	74.5	59.1	41.1	28.6	4.5	66.5	51.1	74.0	-7.5	Pass	54.0	-2.9	Pass
channel 11, Power level 1; board is upright (on its edge) on table with antenna vertical														
H	2389.6	76.6	61.2	41.1	28.6	4.5	68.6	53.2	74.0	-5.4	Pass	54.0	-0.8	Pass
V	2389.6	74.1	58.7	41.1	28.6	4.5	66.1	50.7	74.0	-7.9	Pass	54.0	-3.3	Pass
<b>Channel 16, Power Level 1</b>														
H	2390.0	42.5	42.5	21.7	28.1	4.1	53.0	53.0	74.0	-20.0	Pass	54.0	-1.0	Pass
<b>Channel 18, Power Level 1</b>														
H	2483.5	60.9	60.9	41.3	29.0	4.2	52.8	52.8	74.0	-21.2	Pass	54.0	-1.2	Pass
<b>Channel 20, Power level 1</b>														
H	2483.5	65.5	62.0	41.3	29.0	4.2	57.4	53.9	74.0	-16.6	Pass	54.0	-0.1	Pass
<b>Channel 22, Power level 1</b>														
H	2483.5	68.2	62.0	41.3	29.0	4.2	60.1	53.9	74.0	-13.9	Pass	54.0	-0.1	Pass
<b>Channel 23, Power level 1</b>														
H	2483.5	71.6	62.0	41.3	29.0	4.2	63.5	53.9	74.0	-10.5	Pass	54.0	-0.1	Pass
<b>Channel 25, Power level 5</b>														
H	2483.5	76.4	62.0	41.3	29.0	4.2	68.3	53.9	74.0	-5.7	Pass	54.0	-0.1	Pass

Rev. 11/15/2012

<b>Spectrum Analyzers / Receivers / Preselectors</b>		<b>Range</b>	<b>MN</b>	<b>Mfr</b>	<b>SN</b>	<b>Asset</b>	<b>Cat</b>	<b>Calibration Due</b>
Gold		100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	2/3/2013
<b>Radiated Emissions Sites</b>		<b>FCC Code</b>	<b>IC Code</b>	<b>VCCI Code</b>			<b>Cat</b>	<b>Calibration Due</b>
EMI Chamber 1		719150	2762A-6	A-0015			II	2/16/2014
<b>Preamps / Couplers Attenuators / Filters</b>		<b>Range</b>	<b>MN</b>	<b>Mfr</b>	<b>SN</b>	<b>Asset</b>	<b>Cat</b>	<b>Calibration Due</b>
Brown		1-18GHz	CS	CS	N/A	1523	II	12/10/2012
<b>Antennas</b>		<b>Range</b>	<b>MN</b>	<b>Mfr</b>	<b>SN</b>	<b>Asset</b>	<b>Cat</b>	<b>Calibration Due</b>
Black Horn		1-18GHz	3115	EMCO	9703-5148	56	I	6/29/2013
<b>Meteorological Meters</b>			<b>MN</b>	<b>Mfr</b>	<b>SN</b>	<b>Asset</b>	<b>Cat</b>	<b>Calibration Due</b>
Temp./Humidity/Atm. Pressure Gauge			7400 Perception II	Davis	N/A	965	I	4/4/2013
CHAMBER1 Thermohyrometer			35519-044	Control Company	72457642	1345	II	8/19/2013
<b>Cables</b>		<b>Range</b>		<b>Mfr</b>			<b>Cat</b>	<b>Calibration Due</b>
Asset #1505		9kHz - 18GHz		Florida RF			II	2/9/2013
Asset #1507		9kHz - 26.5GHz		Florida RF			II	1/31/2013

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

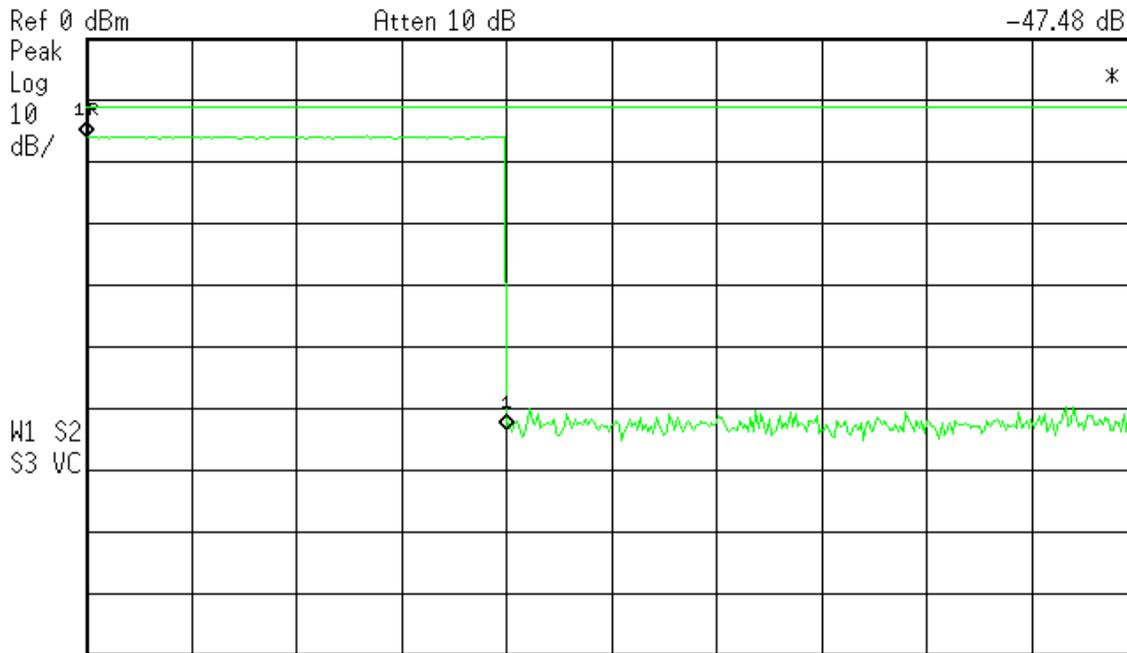
# Duty Cycle Correction Calculation

## MEASUREMENTS / CALCULATIONS

Agilent

R L

Mkr1 Δ 2 ms  
-47.48 dB

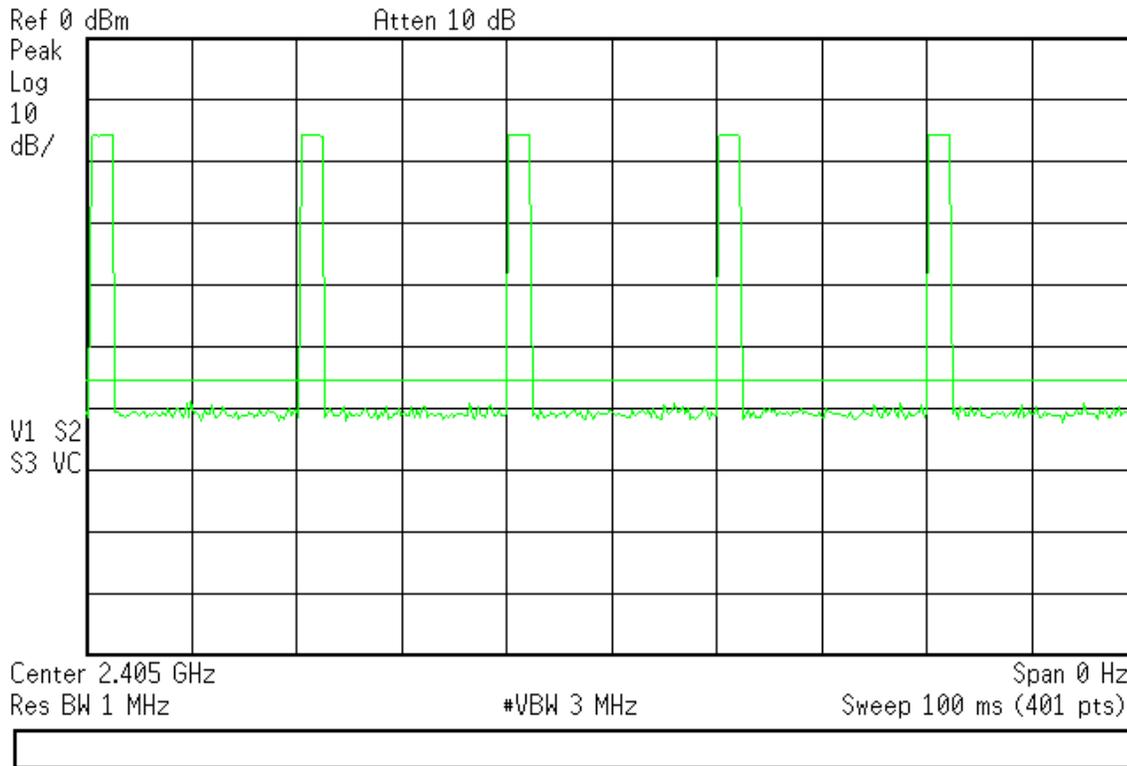


Center 2.405 GHz Res BW 1 MHz #VBW 3 MHz Sweep 5 ms (401 pts) Span 0 Hz

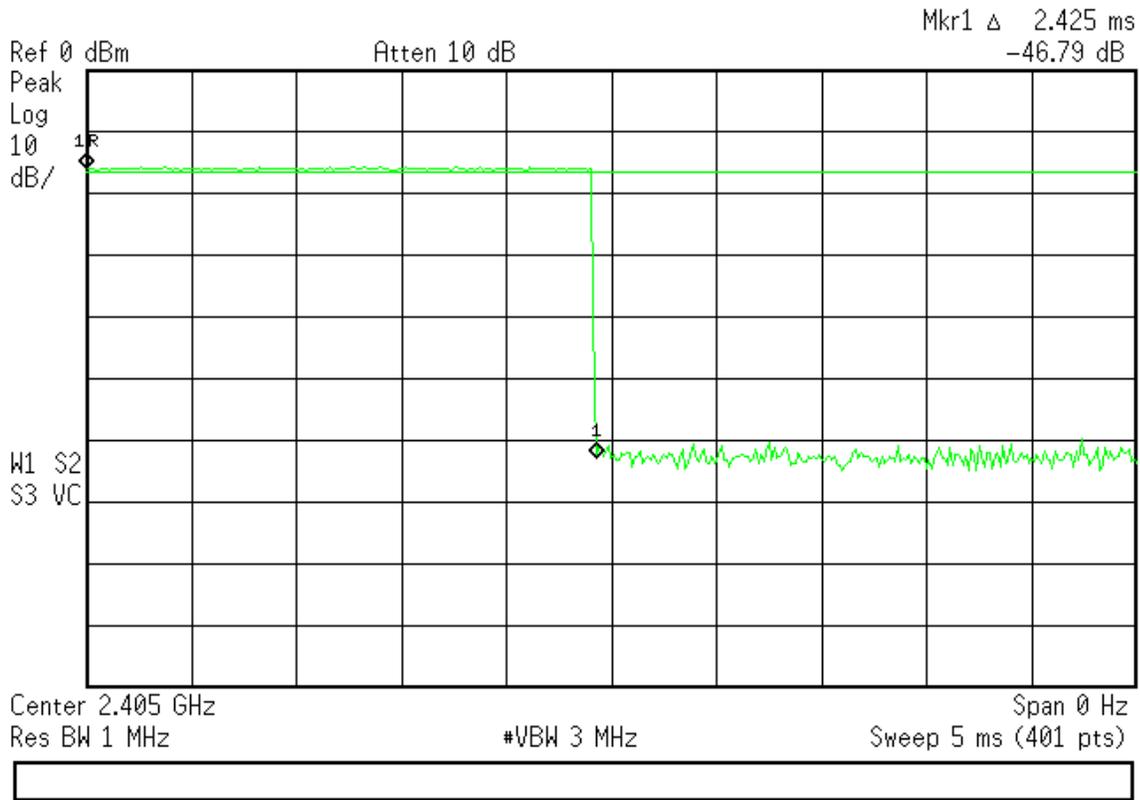


Duty Cycle 2ms pulse width

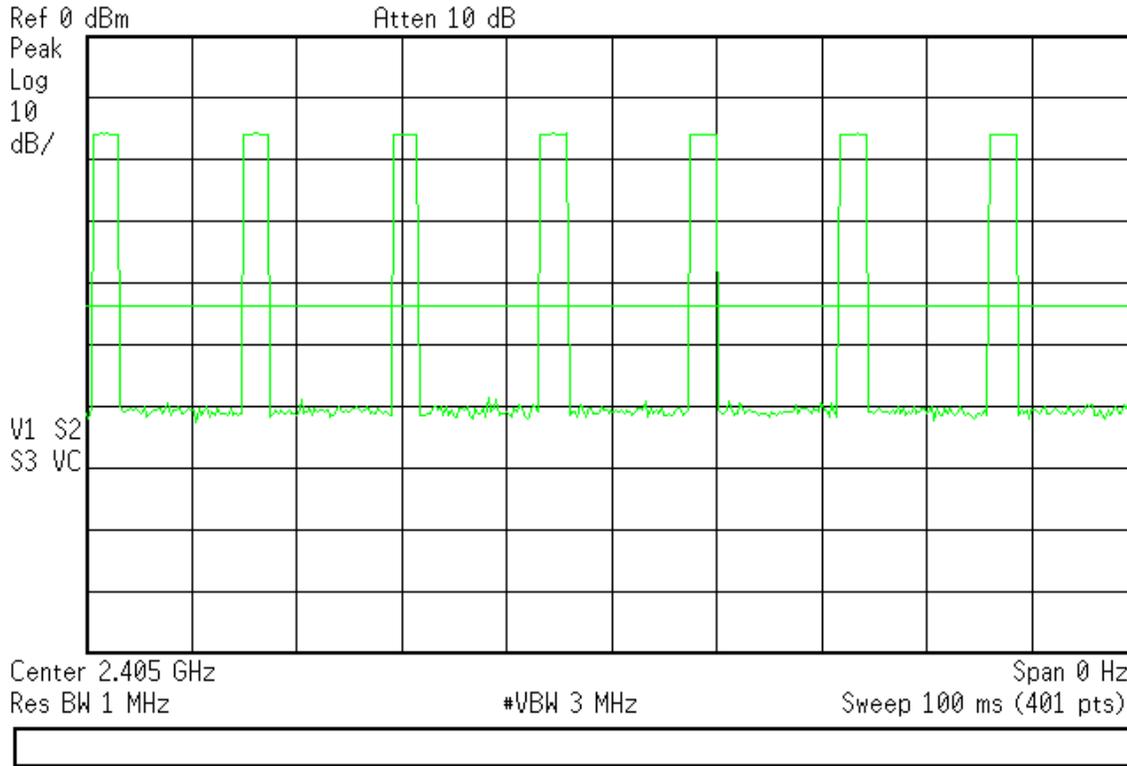
10%



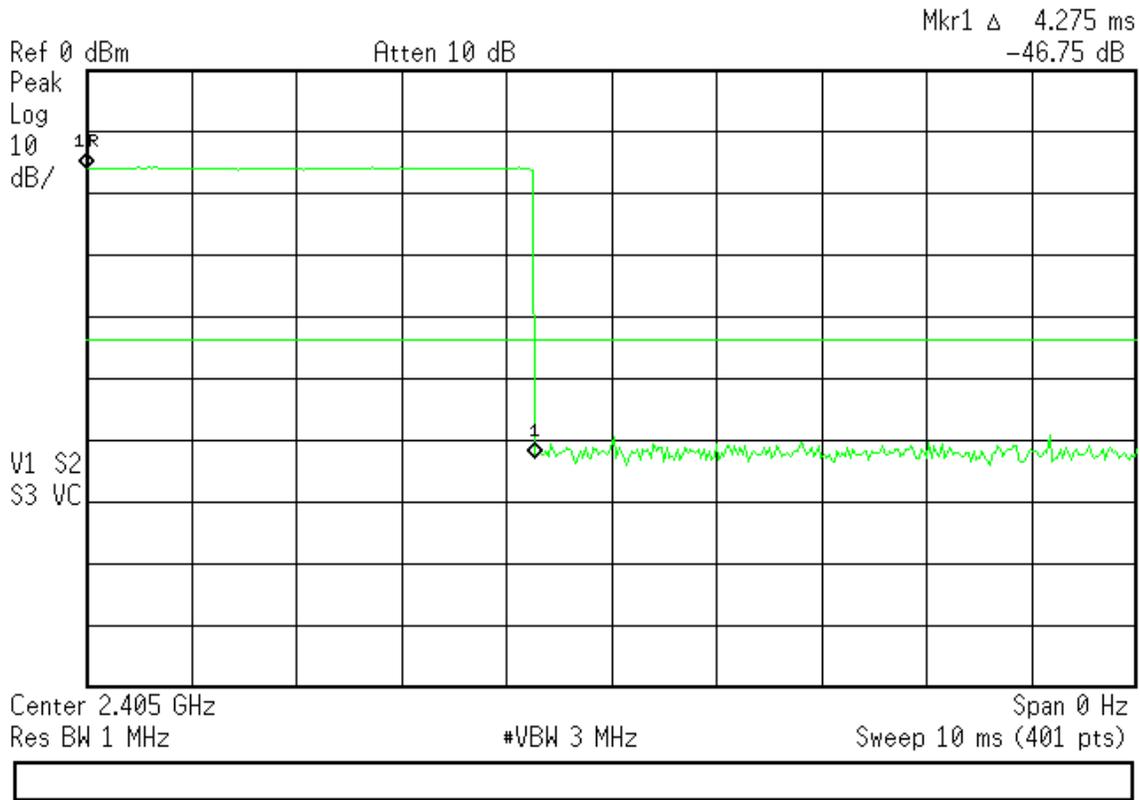
10 % Duty Cycle, 5 peaks in 100ms window



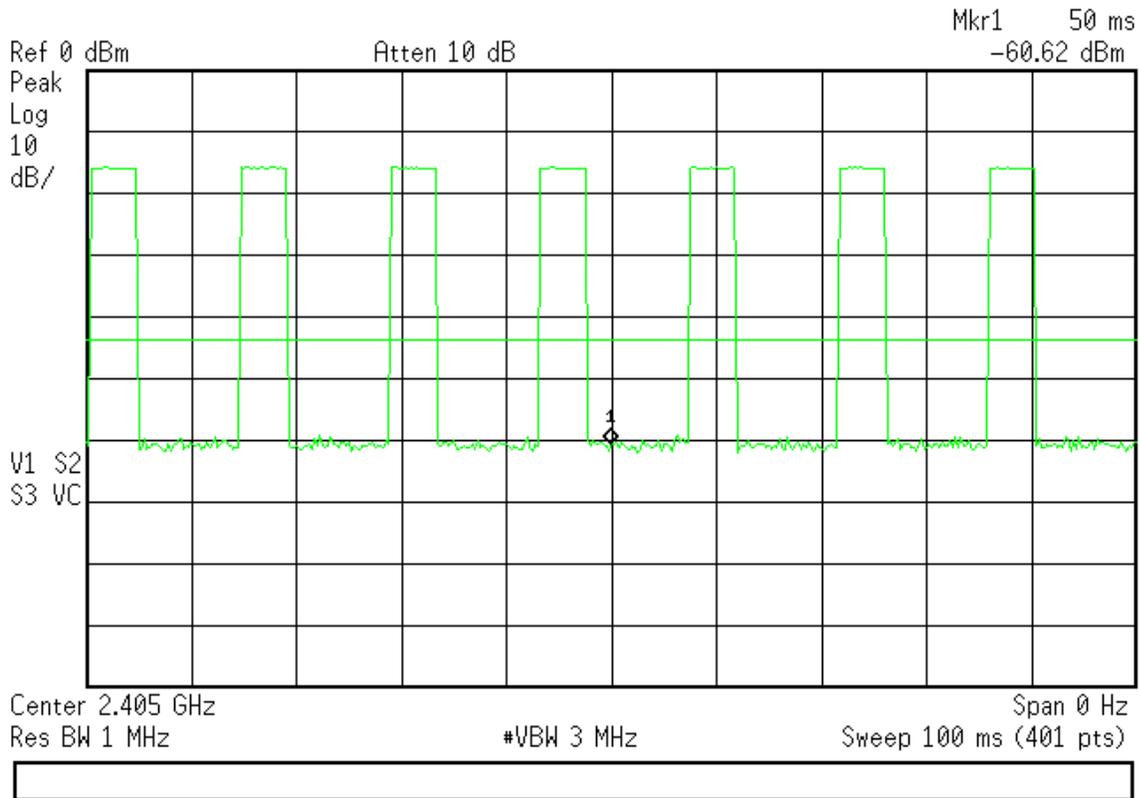
17% Duty Cycle 2.43ms pulse width



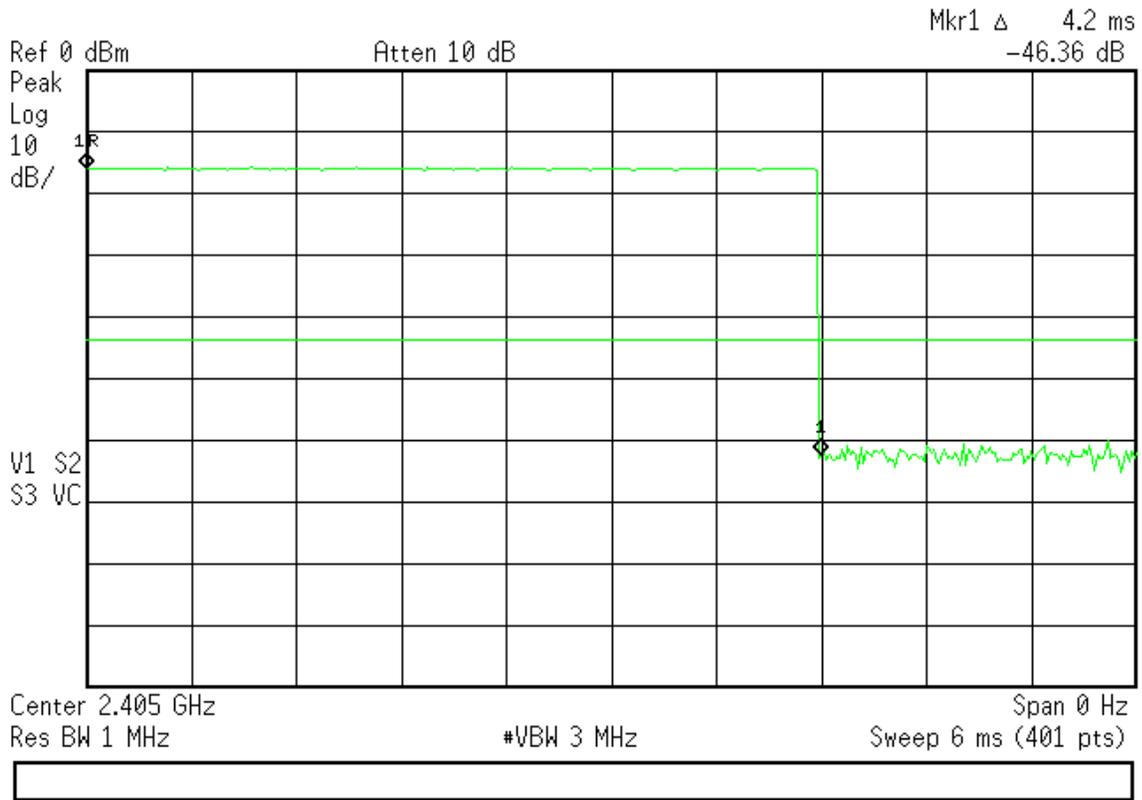
17% Duty Cycle 7 pulses over 100ms window



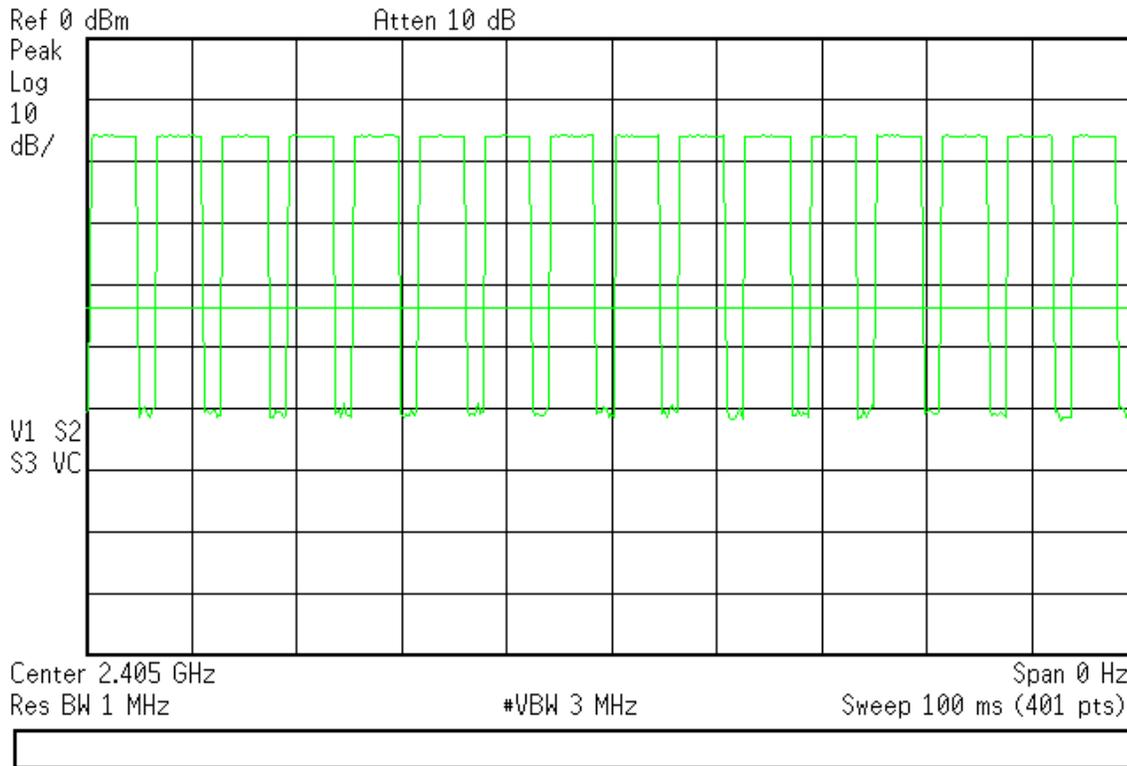
30% Duty Cycle 4.29ms pulse width



30% Duty Cycle 7 pulses over 100ms window



67% Duty Cycle 4.2ms pulse width



67% Duty Cycle 16 pulses over 100ms window

# 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

Chip Antenna

Transmit Mode

Radiated Emissions Table												
Date: 21-Aug-12			Company: BeeWave				Work Order: M2038					
Engineer: Chris Bramley			EUT Desc: BW2155				EUT Operating Voltage/Frequency: 120V/60Hz					
Temp: 25.3°C			Humidity: 34%				Pressure: 1009mBar					
Frequency Range: 30-1000MHz							Measurement Distance: 3 m					
Notes: Module 28 - TX Mode, Channel 11 Peak Readings							EUT Max Freq: 2475GHz					
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBμV/m)	---			FCC Class B		
							Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)
v	38.9	43.8	25.6	14.5	0.5	33.2	---	---	---	40.0	-6.8	Pass
v	102.0	33.8	25.7	11.4	0.7	20.2	---	---	---	43.5	-23.3	Pass
v	180.5	38.0	25.8	11.1	1.1	24.4	---	---	---	43.5	-19.1	Pass
h	246.0	37.3	25.8	11.6	1.3	24.4	---	---	---	46.0	-21.6	Pass
h	468.0	31.9	25.9	17.4	2.0	25.4	---	---	---	46.0	-20.6	Pass
h	614.0	28.5	25.6	19.2	2.3	24.4	---	---	---	46.0	-21.6	Pass
<b>Table Result:</b> Pass by -6.8 dB							<b>Worst Freq:</b> 38.9 MHz					
Test Site: EMI Chamber 2			Cable 1: Asset #1506				Cable 2: Asset #1507					
Analyzer: Rental SA#2			Preamp: Green				Antenna: Red-Brown					

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Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Rental SA #2	9kHz-26.5 GHz	E7405A	Agilent	MY45104194	rental	I	1/5/2013
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code			Cat	Calibration Due
EMI Chamber 2	719150	2762A-7	A-0015			II	2/15/2014
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Green	0.009-2000MHz	ZFL-1000-LN	CS	N/A	802	II	9/16/2012
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Red-Brown Bilog	30-2000MHz	JB1	Sunol	A0032406	1218	I	8/25/2012
Cables	Range		Mfr			Cat	Calibration Due
Asset #1506	9kHz - 18GHz		Florida RF			II	2/2/2013
Asset #1507	9kHz - 26.5GHz		Florida RF			II	1/31/2013
Meteorological Meters		MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	3/28/2013
CHAMBER2 Thermohygrometer		35519-044	Control Company	72457639	1347	II	8/19/2013

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

Radiated Emissions Table														
Date: 21-Aug-12			Company: BeeWave						Work Order: M2038					
Engineer: Chris Bramley			EUT Desc: BW2155						EUT Operating Voltage/Frequency: 120V/60Hz					
Temp: 25.3°C			Humidity: 34%						Pressure: 1009mBar					
Frequency Range: 1-4.8GHz									Measurement Distance: 3 m					
Notes: Module 28 - TX Mode, Channel 11 Peak Readings, 20dbm, 45% Duty Cycle									EUT Max Freq: 2475GHz					
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
h	4800.0	30.5	30.5	17.4	33.3	5.8	52.2	52.2	74.0	-21.8	Pass	54.0	-1.8	Pass
<b>Table Result:</b>		Fail by 5.6 dB						<b>Worst Freq:</b> 4811.0 MHz						
Test Site: EMI Chamber 2			Cable 1: Asset #1506						Cable 2: Asset #1507					
Analyzer: Rental SA#2			Preamp: Brown						Antenna: Black Horn					

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Spectrum Analyzers / Receivers / Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Rental SA #2	9kHz-26.5 GHz	E7405A	Agilent	MY45104194	rental	I	1/5/2013
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code			Cat	Calibration Due
EMI Chamber 2	719150	2762A-7	A-0015			II	2/15/2014
Preamps / Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Brown	1-18GHz	CS	CS	N/A	1523	II	12/10/2012
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Black Horn	1-18GHz	3115	EMCO	9703-5148	56	I	6/29/2013
Cables	Range		Mfr			Cat	Calibration Due
Asset #1506	9kHz - 18GHz		Florida RF			II	2/2/2013
Asset #1507	9kHz - 26.5GHz		Florida RF			II	1/31/2013
Meteorological Meters		MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	3/28/2013
CHAMBER2 Thermohygrometer		35519-044	Control Company	72457639	1347	II	8/19/2013

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

Radiated Emissions Table														
Date: 21-Aug-12			Company: BeeWave						Work Order: M2038					
Engineer: Chris Bramley			EUT Desc: BW2155						EUT Operating Voltage/Frequency: 120V/60Hz					
Temp: 25.3°C			Humidity: 34%						Pressure: 1009mBar					
Frequency Range: 4.801-18GHz									Measurement Distance: 1 m					
Notes: Module 28 - TX Mode, Channel 11 23% Duty Cycle (13.3dBµV), 20dbm, High Pass Filter(1311)									EUT Max Freq: 2475GHz					
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
v	4809.0	44.81	31.5	17.4	33.8	5.8	67.0	53.7	83.5	-16.5	Pass	63.5	-9.8	Pass
v	4811.0	45.07	31.8	17.4	33.8	5.8	67.3	54.0	83.5	-16.2	Pass	63.5	-9.5	Pass
<b>Table Result:</b>		Pass by -9.5 dB						<b>Worst Freq:</b> 4811.0 MHz						
Test Site: EMI Chamber 2			Cable 1: Asset #1506						Cable 2: Asset #1507					
Analyzer: Rental SA#2			Preamp: Brown						Antenna: Black Horn					

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Spectrum Analyzers / Receivers / Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Rental SA #2	9kHz-26.5 GHz	E7405A	Agilent	MY45104194	rental	I	1/5/2013
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code			Cat	Calibration Due
EMI Chamber 2	719150	2762A-7	A-0015			II	2/15/2014
Preamps / Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Brown	1-18GHz	CS	CS	N/A	1523	II	12/10/2012
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Black Horn	1-18GHz	3115	EMCO	9703-5148	56	I	6/29/2013
Cables	Range		Mfr			Cat	Calibration Due
Asset #1506	9kHz - 18GHz		Florida RF			II	2/2/2013
Asset #1507	9kHz - 26.5GHz		Florida RF			II	1/31/2013
Meteorological Meters		MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	3/28/2013
CHAMBER2 Thermohygrometer		35519-044	Control Company	72457639	1347	II	8/19/2013

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

Radiated Emissions Table														
Date: 21-Aug-12			Company: BeeWave			Work Order: M2038								
Engineer: Chris Bramley			EUT Desc: BW2155			EUT Operating Voltage/Frequency: 120V/60Hz								
Temp: 25.3°C			Humidity: 34%			Pressure: 1009mBar								
Frequency Range: 18-25GHz										Measurement Distance: 0.3 m				
Notes: Module 28 - TX Mode, Channel 11 23% Duty Cycle (13.3dBµV), 20dbm										EUT Max Freq: 2475GHz				
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
No emissions found														
<b>Table Result:</b> --- by --- dB <b>Worst Freq:</b> --- MHz														
Test Site: EMI Chamber 2			Cable 1: EMIR-HIGH-22			Antenna: 18-26.5GHz Horn								
Analyzer: Rental SA#2			Preamp: 18-26.5GHz											

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Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Rental SA #2	9kHz-26.5 GHz	E7405A	Agilent	MY45104194	rental	I	1/5/2013
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code			Cat	Calibration Due
EMI Chamber 2	719150	2762A-7	A-0015			II	2/15/2014
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
HF (Yellow)	18-26.5GHz	AFS4-18002650-60-8P-4	CS	467559	1266	I	10/6/2012
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
HF (White) Horn	18-26.5GHz	801-WLM	Waveline	758	758	I	Verify before Use
Cables	Range		Mfr			Cat	Calibration Due
REMI-High-22	9kHz - 15GHz		C-S			II	1/31/2013
Meteorological Meters		MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	3/28/2013
CHAMBER2 Thermohygrometer		35519-044	Control Company	72457639	1347	II	8/19/2013

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

## Stand-by Mode

Radiated Emissions Table														
Date: 21-Aug-12			Company: BeeWave			Work Order: M2038								
Engineer: Chris Bramley			EUT Desc: BW2155			EUT Operating Voltage/Frequency: 120V/60Hz								
Temp: 25.3°C			Humidity: 34%			Pressure: 1009mBar								
Frequency Range: 30-1000MHz										Measurement Distance: 3 m				
Notes: Module 28 - RX Mode, Channel 11 Peak Readings										EUT Max Freq: 2475GHz				
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	---			FCC Class B				
							Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)		
v	37.2	40.1	25.6	15.8	0.5	30.8	---	---	---	40.0	-9.2	Pass		
v	102.0	35.3	25.7	11.4	0.7	21.7	---	---	---	43.5	-21.8	Pass		
v	180.0	38.7	25.8	11.1	1.1	25.1	---	---	---	43.5	-18.4	Pass		
h	244.0	37.4	25.8	11.6	1.3	24.5	---	---	---	46.0	-21.5	Pass		
h	468.0	31.8	25.9	17.4	2.0	25.3	---	---	---	46.0	-20.7	Pass		
h	614.0	29.4	25.6	19.2	2.3	25.3	---	---	---	46.0	-20.7	Pass		
<b>Table Result:</b> Pass by -9.2 dB <b>Worst Freq:</b> 37.2 MHz														
Test Site: EMI Chamber 2			Cable 1: Asset #1506			Cable 2: Asset #1507								
Analyzer: Rental SA#2			Preamp: Green			Antenna: Red-Brown								

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<b>Spectrum Analyzers / Receivers /Preselectors</b> Rental SA #2		<b>Range</b> 9kHz-26.5 GHz	<b>MN</b> E7405A	<b>Mfr</b> Agilent	<b>SN</b> MY45104194	<b>Asset</b> rental	<b>Cat</b> I	<b>Calibration Due</b> 1/5/2013
<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>Cat</b> II	<b>Calibration Due</b> 2/15/2014
<b>Preamps /Couplers Attenuators / Filters</b> Green		<b>Range</b> 0.009-2000MHz	<b>MN</b> ZFL-1000-LN	<b>Mfr</b> CS	<b>SN</b> N/A	<b>Asset</b> 802	<b>Cat</b> II	<b>Calibration Due</b> 9/16/2012
<b>Antennas</b> Red-Brown Bilog		<b>Range</b> 30-2000MHz	<b>MN</b> JB1	<b>Mfr</b> Sunol	<b>SN</b> A0032406	<b>Asset</b> 1218	<b>Cat</b> I	<b>Calibration Due</b> 8/25/2012
<b>Cables</b> Asset #1506 Asset #1507		<b>Range</b> 9kHz - 18GHz 9kHz - 26.5GHz		<b>Mfr</b> Florida RF Florida RF			<b>Cat</b> II II	<b>Calibration Due</b> 2/2/2013 1/31/2013
<b>Meteorological Meters</b> Weather Clock (Pressure Only) CHAMBER2 Thermohyrometer			<b>MN</b> BA928 35519-044	<b>Mfr</b> Oregon Scientific Control Company	<b>SN</b> C3166-1 72457639	<b>Asset</b> 831 1347	<b>Cat</b> I II	<b>Calibration Due</b> 3/28/2013 8/19/2013

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

<b>Radiated Emissions Table</b>														
Date: 21-Aug-12					Company: BeeWave					Work Order: M2038				
Engineer: Chris Bramley					EUT Desc: BW2155					EUT Operating Voltage/Frequency: 120V/60Hz				
Temp: 25.3°C					Humidity: 34%					Pressure: 1009mBar				
Frequency Range: 1-7GHz										Measurement Distance: 1 m				
Notes: Module 28 - RX Mode, Channel 11										EUT Max Freq: 2475GHz				
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
v	2980.0	37.11	23.8	19.5	31.0	4.5	53.1	39.8	83.5	-30.4	Pass	63.5	-23.7	Pass
v	4885.0	35.36	22.1	17.6	34.0	5.9	57.7	44.4	83.5	-25.8	Pass	63.5	-19.1	Pass
v	5605.0	34.61	21.3	17.2	35.4	6.1	58.9	45.6	83.5	-24.6	Pass	63.5	-17.9	Pass
v	6325.0	35.87	22.6	17.0	35.8	7.2	61.9	48.6	83.5	-21.6	Pass	63.5	-14.9	Pass
<b>Table Result:</b> Pass by -14.9 dB <b>Worst Freq:</b> 6325.0 MHz														
Test Site: EMI Chamber 2					Cable 1: Asset #1506					Cable 2: Asset #1507				
Analyzer: Rental SA#2					Preamp: Brown					Antenna: Black Horn				

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<b>Spectrum Analyzers / Receivers /Preselectors</b> Rental SA #2		<b>Range</b> 9kHz-26.5 GHz	<b>MN</b> E7405A	<b>Mfr</b> Agilent	<b>SN</b> MY45104194	<b>Asset</b> rental	<b>Cat</b> I	<b>Calibration Due</b> 1/5/2013
<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>Cat</b> II	<b>Calibration Due</b> 2/15/2014
<b>Preamps /Couplers Attenuators / Filters</b> Brown		<b>Range</b> 1-18GHz	<b>MN</b> CS	<b>Mfr</b> CS	<b>SN</b> N/A	<b>Asset</b> 1523	<b>Cat</b> II	<b>Calibration Due</b> 12/10/2012
<b>Antennas</b> Black Horn		<b>Range</b> 1-18GHz	<b>MN</b> 3115	<b>Mfr</b> EMCO	<b>SN</b> 9703-5148	<b>Asset</b> 56	<b>Cat</b> I	<b>Calibration Due</b> 6/29/2013
<b>Cables</b> Asset #1506 Asset #1507		<b>Range</b> 9kHz - 18GHz 9kHz - 26.5GHz		<b>Mfr</b> Florida RF Florida RF			<b>Cat</b> II II	<b>Calibration Due</b> 2/2/2013 1/31/2013
<b>Meteorological Meters</b> Weather Clock (Pressure Only) CHAMBER2 Thermohyrometer			<b>MN</b> BA928 35519-044	<b>Mfr</b> Oregon Scientific Control Company	<b>SN</b> C3166-1 72457639	<b>Asset</b> 831 1347	<b>Cat</b> I II	<b>Calibration Due</b> 3/28/2013 8/19/2013

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



Radiated Emissions Table														
Date: 21-Aug-12			Company: BeeWave						Work Order: M2038					
Engineer: Chris Bramley			EUT Desc: BW2155						EUT Operating Voltage/Frequency: 120V/60Hz					
Temp: 25.3°C			Humidity: 34%						Pressure: 1009mBar					
Frequency Range: 7-18GHz									Measurement Distance: 1 m					
Notes: Module 28 - RX Mode, Channel 11														
EUT Max Freq: 2475GHz														
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
No emissions found														
<b>Table Result:</b> --- by --- dB <b>Worst Freq:</b> --- MHz														
Test Site: EMI Chamber 2					Cable 1: Asset #1506					Cable 2: Asset #1507				
Analyzer: Rental SA#2					Preamp: Brown					Antenna: Black Horn				

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Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Rental SA #2	9kHz-26.5 GHz	E7405A	Agilent	MY45104194	rental	I	1/5/2013
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code			Cat	Calibration Due
EMI Chamber 2	719150	2762A-7	A-0015			II	2/15/2014
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Brown	1-18GHz	CS	CS	N/A	1523	II	12/10/2012
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Black Horn	1-18GHz	3115	EMCO	9703-5148	56	I	6/29/2013
Cables	Range		Mfr			Cat	Calibration Due
Asset #1506	9kHz - 18GHz		Florida RF			II	2/2/2013
Asset #1507	9kHz - 26.5GHz		Florida RF			II	1/31/2013
Meteorological Meters		MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	3/28/2013
CHAMBER2 Thermohyrometer		35519-044	Control Company	72457639	1347	II	8/19/2013

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

Radiated Emissions Table														
Date: 21-Aug-12			Company: BeeWave						Work Order: M2038					
Engineer: Chris Bramley			EUT Desc: BW2155						EUT Operating Voltage/Frequency: 120V/60Hz					
Temp: 25.3°C			Humidity: 34%						Pressure: 1009mBar					
Frequency Range: 18-25GHz									Measurement Distance: 0.3 m					
Notes: Module 28 - RX Mode, Channel 11														
EUT Max Freq: 2475GHz														
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
No emissions found														
<b>Table Result:</b> --- by --- dB <b>Worst Freq:</b> --- MHz														
Test Site: EMI Chamber 2					Cable 1: EMIR-HIGH-22					Antenna: 18-26.5GHz Horn				
Analyzer: Rental SA#2					Preamp: 18-26.5GHz									

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Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Rental SA #2	9kHz-26.5 GHz	E7405A	Agilent	MY45104194	rental	I	1/5/2013
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code			Cat	Calibration Due
EMI Chamber 2	719150	2762A-7	A-0015			II	2/15/2014
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
HF (Yellow)	18-26.5GHz	AFS4-18002650-60-8P-4	CS	467559	1266	I	10/6/2012
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
HF (White) Horn	18-26.5GHz	801-WLM	Waveline	758	758	I	Verify before Use
Cables	Range		Mfr			Cat	Calibration Due
REMI-High-22	9kHz - 15GHz		C-S			II	1/31/2013
Meteorological Meters		MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	3/28/2013
CHAMBER2 Thermohyrometer		35519-044	Control Company	72457639	1347	II	8/19/2013

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

# Whip Antenna

Radiated Emissions Table (Harmonics & Spurious)														
Date: 09-Oct-12			Company: BeeWave			Work Order: M2038								
Engineer: Arik Zwirner			EUT Desc:			EUT Operating Voltage/Frequency: 120Vac/60Hz								
Temp: 25°C			Humidity: 36%			Pressure: 1012mbar			Measurement Distance: 3 m					
Notes: Duty cycle 70%														
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 Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dB $\mu$ V/m)	Margin (dB)	Result (Pass/Fail)	Limit (dB $\mu$ V/m)	Margin (dB)	Result (Pass/Fail)
Channel 16, Power level 1, Chip antenna A1; board upright on edge and antenna vertical														
V	2390.0	41.9	38.8	21.7	28.1	4.1	52.4	49.3	74.0	-21.6	Pass	54.0	-4.7	Pass
H	2390.0	42.5	39.4	21.7	28.1	4.1	53.0	49.9	74.0	-21.0	Pass	54.0	-4.1	Pass
Power level 1, Whip antenna: Horizontal														
H	4880.0	36.8	29.1	20.4	33.1	6.5	56.0	48.3	74.0	-18.0	Pass	54.0	-5.7	Pass
H	7320.0	31.9	22.9	20.3	36.7	8.7	57.0	48.0	74.0	-17.0	Pass	54.0	-6.0	Pass
<b>Table Result:</b>			Pass			by -4.1 dB			<b>Worst Freq:</b>			2390.0 MHz		
Test Site: EMI Chamber 2			Cable 1: Asset #1506			Cable 2: EMIR-HIGH-21			Cable 3: ---					
Analyzer: Gold			Preamp: Asset #1517			Antenna: Yellow Horn			Preselector: ---					

## Conducted Spurious Emissions

### LIMITS

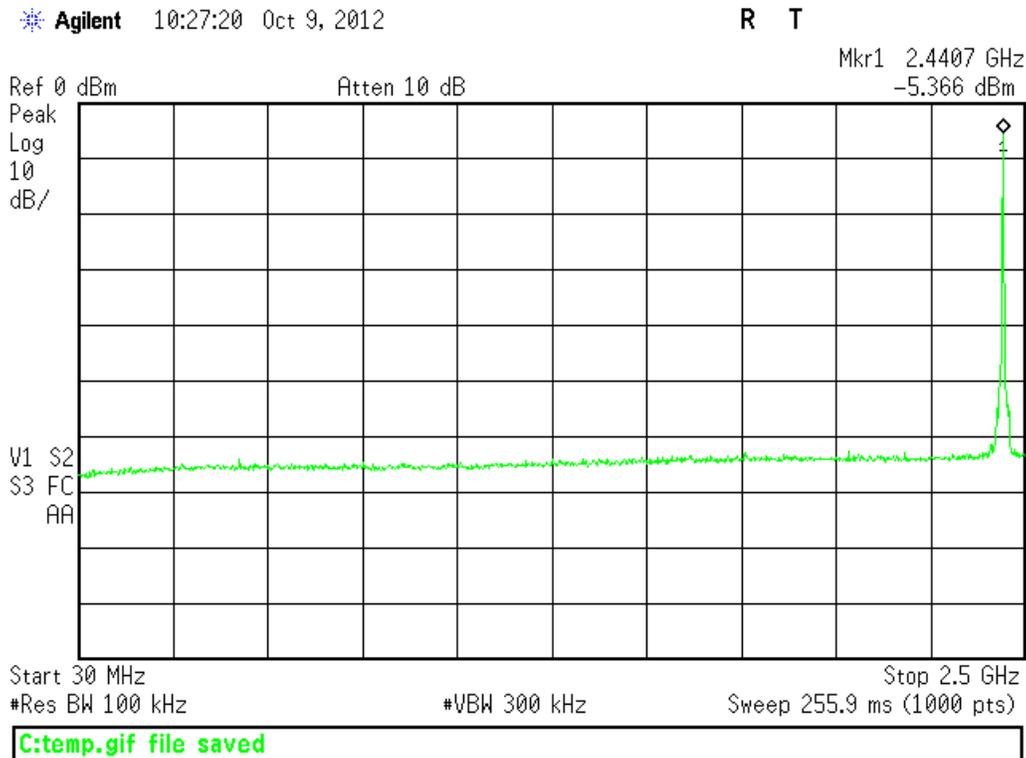
*In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth that contains the highest level of desired power...*

[15.247(d)]

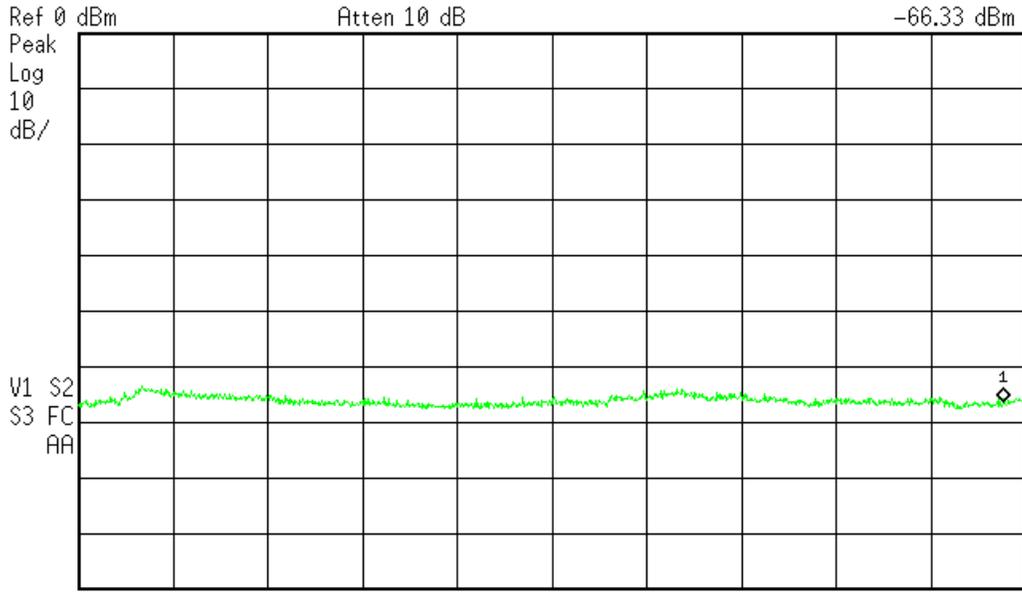
### MEASUREMENTS / RESULTS

Engineer	Arik Zwirner
Date	10/9/12
Site	3M OATS

25 °C, 36%, 1012mb



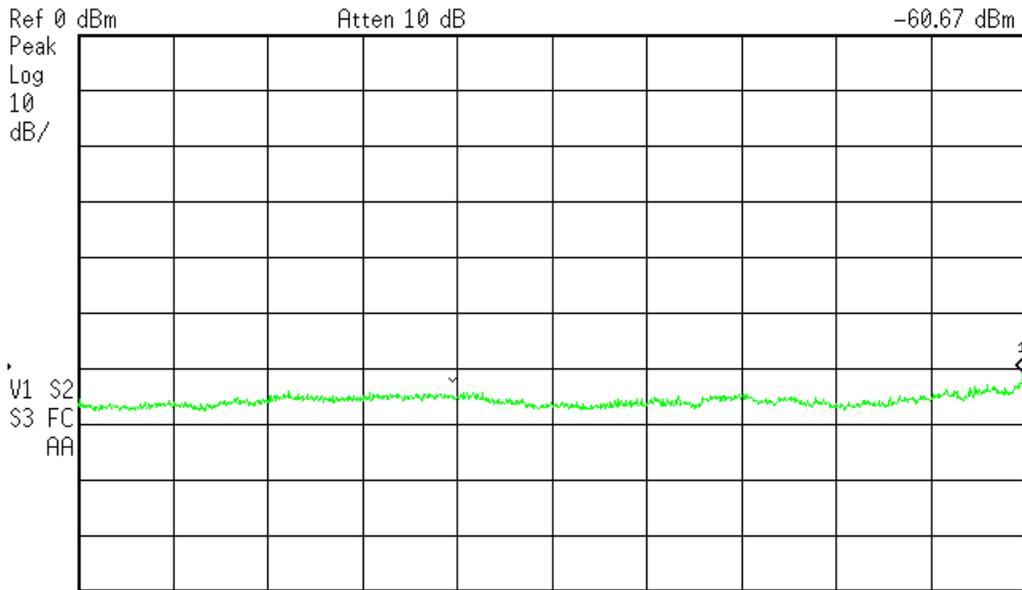
Mkr1 9.820 GHz  
-66.33 dBm



Start 2.5 GHz      Stop 10 GHz  
#Res BW 100 kHz      #VBW 300 kHz      Sweep 777 ms (1000 pts)

C:\temp.gif file saved

Mkr1 24.955 GHz  
-60.67 dBm



Start 10 GHz      Stop 25 GHz  
#Res BW 100 kHz      #VBW 300 kHz      Sweep 1.554 s (1000 pts)

C:\temp.gif file saved

Rev. 10/5/2012

**Spectrum Analyzers / Receivers /Preselectors**  
Gold

Range	MN	Mfr	SN	Asset	Cat	Calibration Due
100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	2/3/2013

**Radiated Emissions Sites**  
1DCC-OATS-3M-I

FCC Code	IC Code	VCCI Code	Cat	Calibration Due
719150	2762A-8	A-0015	II	11/7/2012

**Preamps / Couplers Attenuators / Filters**  
HF 20dB 50W Attenuator

Range	MN	Mfr	SN	Asset	Cat	Calibration Due
0.009-18 GHz	PE 7019-20	Pasternack	1	791	II	6/1/2013

**Meteorological Meters**

	MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	3/28/2013
1DCC-OATS-3M-I Thermohyrometer	35519-044	Control Company	72457635	1334	II	8/19/2013

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

## Power Spectral Density

### LIMIT

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

[15.247(e)]

### MEASUREMENTS / RESULTS

Engineer	Chris Reynolds
Date	12/4/12
Site	3M OATS

21.3°C, 24%, 1012mb

Channel	Power Setting	Freq (MHz)	Reading (in 100KHz RBW) (dBm)	Pad + Dongle (dB)	Adjusted Reading (dBm/100KHz)	100KHz to 3KHz factor (dB)	Final Reading (dBm/3KHz)-	Limit (dBm/3KHz)
11	10	2405	-4.677	20.4	15.723	-15.2	0.523	8.0
18	1	2440	-5.151	20.4	15.249	-15.2	0.049	8.0
25	5	2475	-6.419	20.4	13.981	-15.2	-1.219	8.0

Rev. 11/15/2012

Spectrum Analyzers / Receivers / Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Rental SA #1 (Brown)	9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	2/14/2013
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code			Cat	Calibration Due
1DCC-OATS-3M-I	719150	2762A-8	A-0015			II	12/7/2012
Preamps / Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
HF 20dB 50W Attenuator	0.009-18 GHz	PE 7019-20	Pasternack	1	791	II	6/1/2013
Meteorological Meters		MN	Mfr	SN	Asset	Cat	Calibration Due
Temp./Humidity/Atm. Pressure Gauge		7400 Perception II	Davis	N/A	965	I	4/4/2013
1DCC-OATS-3M-I Thermohyrometer		35519-044	Control Company	72457635	1334	II	8/19/2013

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

# PLOTS

Agilent

R L

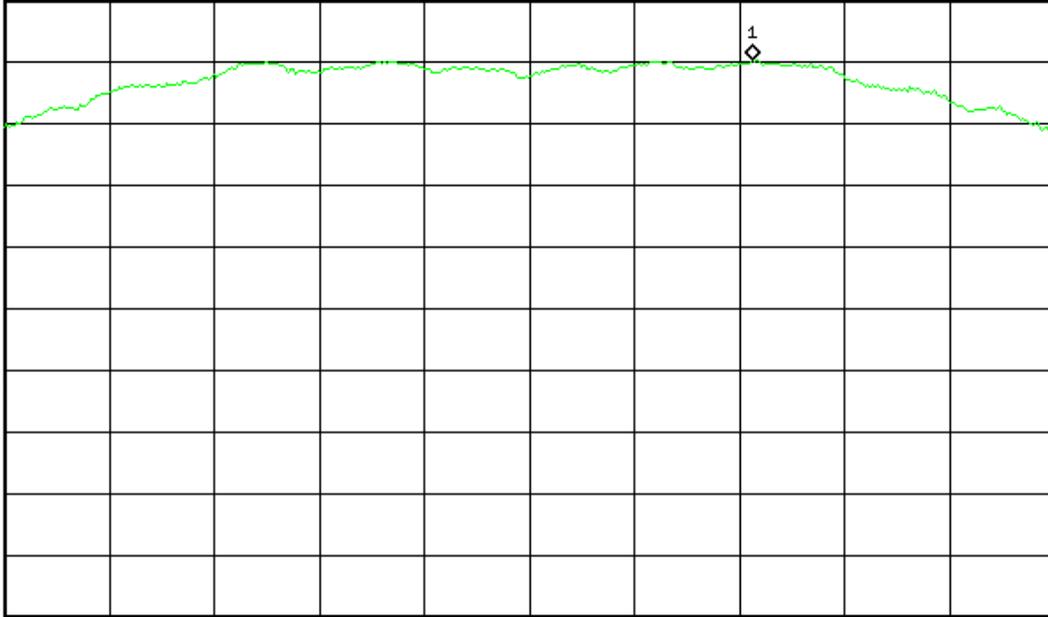
Mkr1 2.405425 GHz  
-4.677 dBm

Ref 5 dBm

#Atten 10 dB

Peak  
Log  
10  
dB/

M1 S2  
S3 FC



Center 2.405 GHz

#Res BW 100 kHz

#VBW 300 kHz

Span 2 MHz

Sweep 5 ms (401 pts)

Low Channel

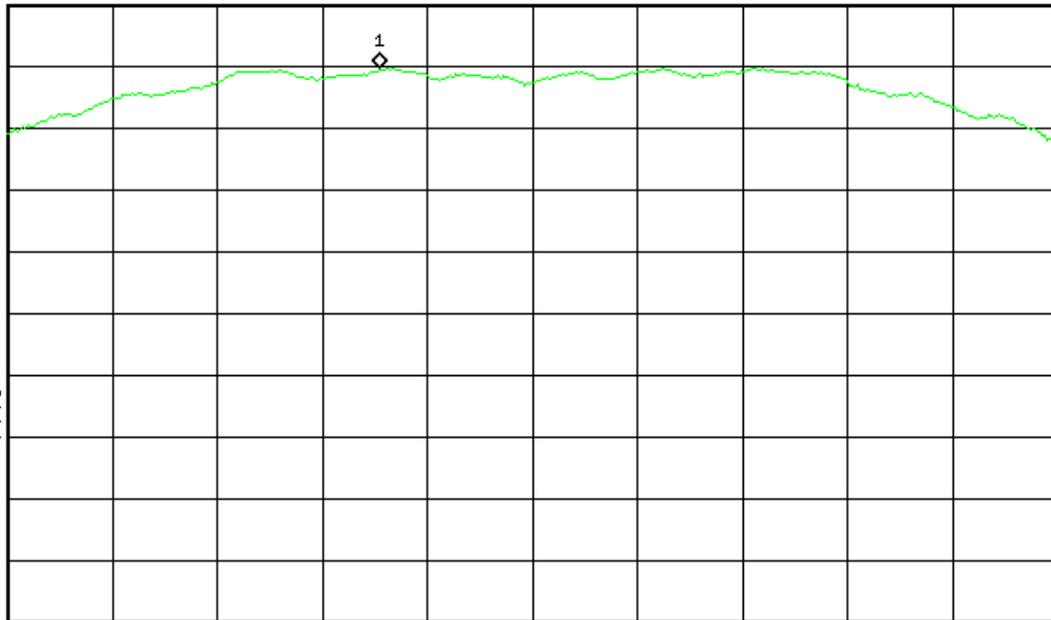
Mkr1 2.439710 GHz  
-5.151 dBm

Ref 5 dBm

#Atten 10 dB

Peak  
Log  
10  
dB/

M1 S2  
S3 FC



Center 2.44 GHz  
#Res BW 100 kHz

#VBW 300 kHz

Span 2 MHz  
Sweep 5 ms (401 pts)

Middle Channel

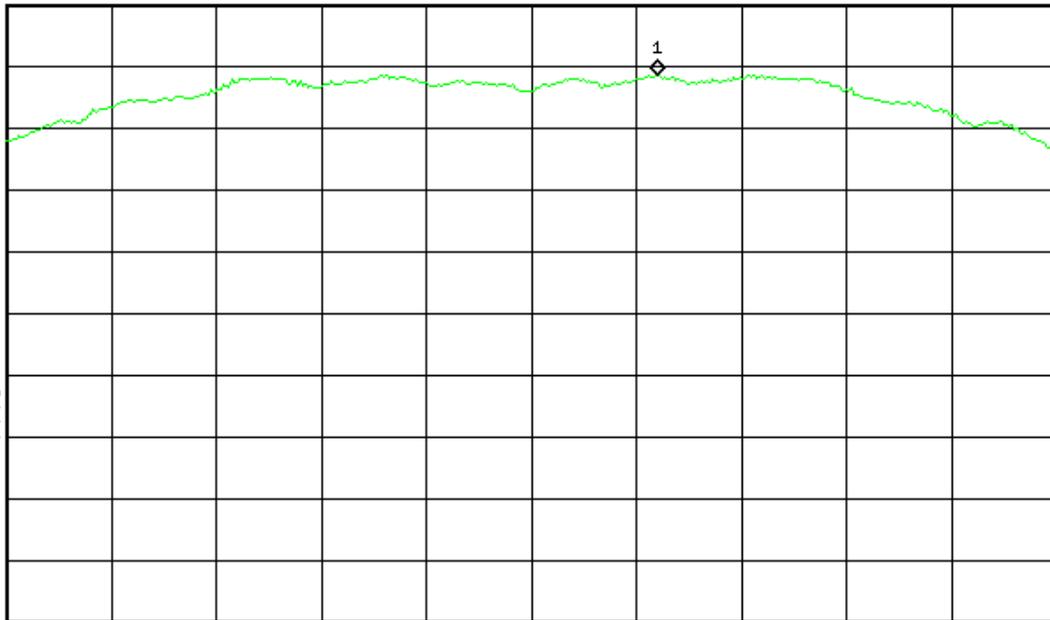
Mkr1 2.475240 GHz  
-6.419 dBm

Ref 5 dBm

#Atten 10 dB

Peak  
Log  
10  
dB/

M1 S2  
S3 FC



Center 2.475 GHz  
#Res BW 100 kHz

#VBW 300 kHz

Span 2 MHz  
Sweep 5 ms (401 pts)

Upper Channel

# AC Line Conducted Emissions LIMITS

Frequency of emission (MHz)	Quasi-peak limit (dBμV)	Average limit (dBμV)
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

AC Conducted Emissions Data Table														
Date: 09-Oct-12 Engineer: Arik Zwirner Temp: 22.0 °C				Company: BeeWave EUT Desc: BW2155 module Humidity: 25%				Work Order: M2038 Pressure: 1012 mBar						
Notes:														
Frequency Range: 0.15-30MHz								EUT Input Voltage/Frequency: 120Vac/60Hz						
Frequency (MHz)	Quasi-Peak Readings		Average Readings		LISN Factors		Cable Factor (dB)	ATTN Factor (dB)	FCC/CISPR Class B			FCC/CISPR Class B		
	QP1 (dBuV)	QP2 (dBuV)	AVG1 (dBuV)	AVG2 (dBuV)	L1 (dB)	L2 (dB)			QP Limit (dB)	Margin (dB)	Result (Pass/Fail)	AVG Limit (dB)	Margin (dB)	Result (Pass/Fail)
0.27	19.7	27.2	19.0	23.9	-0.1	-0.4	0.0	-20.6	61.1	-12.9	Pass	51.1	-6.2	Pass
0.41	15.2	17.0	10.3	14.9	-0.1	-0.3	0.0	-20.6	57.6	-19.7	Pass	47.6	-11.8	Pass
0.56	21.3	26.1	19.2	21.4	-0.1	-0.2	-0.1	-20.6	56.0	-9.1	Pass	46.0	-3.8	Pass
0.83	17.0	20.5	12.5	16.6	-0.1	-0.2	0.0	-20.6	56.0	-14.8	Pass	46.0	-8.7	Pass
0.97	14.0	19.6	10.9	15.7	-0.1	-0.2	-0.1	-20.6	56.0	-15.6	Pass	46.0	-9.5	Pass
1.24	16.3	21.9	13.3	17.8	-0.1	-0.2	-0.1	-20.5	56.0	-13.3	Pass	46.0	-7.4	Pass
<b>Result:</b> Pass				<b>Worst Margin:</b> -3.8 dB				<b>Frequency:</b> 0.56 MHz						
Measurement Device: Green LISN				Cable: CEMI-02				Spectrum Analyzer: Black						
				Attenuator: 20dB Attenuator-41				Site: CEMI 3						

Rev.10/5/2012

<b>Spectrum Analyzers / Receivers / Preselectors</b> Black	<b>Range</b> 9kHz-12.8GHz	<b>MN</b> 8596E	<b>Mfr</b> Agilent	<b>SN</b> 3710A00944	<b>Asset</b> 337	<b>Cat</b> I	<b>Calibration Due</b> 12/2/2012
<b>LISNs/Measurement Probes</b> Green LISN	<b>Range</b> 9kHz-50MHz	<b>MN</b> 8012-50-R-24-BNC	<b>Mfr</b> Solar	<b>SN</b> 411658	<b>Asset</b> 987	<b>Cat</b> I	<b>Calibration Due</b> 5/10/2013
<b>Conducted Test Sites (Mains / Telco)</b> CEMI 3	<b>FCC Code</b> 719150		<b>VCCI Code</b> A-0015			<b>Cat</b> III	<b>Calibration Due</b> NA
<b>Cables</b> CEMI-02	<b>Range</b> 9kHz - 2GHz		<b>Mfr</b> C-S			<b>Cat</b> II	<b>Calibration Due</b> 4/10/2013
<b>Attenuators</b> 20dB Attenuator-41	<b>Range</b> 9kHz-2GHz	<b>MN</b>	<b>Mfr</b>	<b>SN</b> N/A	<b>Asset</b>	<b>Cat</b> II	<b>Calibration Due</b> 10/4/2013
<b>Meteorological Meters</b> Weather Clock (Pressure Only) CEMI3 Thermohygrometer		<b>MN</b> BA928 35519-044	<b>Mfr</b> Oregon Scientific Control Company	<b>SN</b> C3166-1 72457729	<b>Asset</b> 831 1338	<b>Cat</b> I II	<b>Calibration Due</b> 3/28/2013 8/19/2013

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

## Conditions Of Testing

**[Bureau Veritas Consumer Products Services, Inc., a Massachusetts corporation]**, and/or its affiliates (collectively, the "Company") will conduct, at the request of the Submitter ("**Client**"), the tests specified on the submitted Test Request Form or equivalent in accordance with, and subject to, the following terms and conditions (collectively, "**Conditions**"):

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 where 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.

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.

Rev.160009121(2)\_#684340 v13CS

# A2LA Accreditation

## SCOPE OF ACCREDITATION TO ISO/IEC 17025:1999

CURTIS-STRAUS<sup>1</sup>  
527 Great Road  
Littleton, MA 01460  
Barry Quinlan Phone: 978-486-8880  
ELECTRICAL

Valid until: July 31, 2007

Certificate Number: 1627.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following Electromagnetic Compatibility (EMC), Telecommunications, and Product Safety tests:

### Electromagnetic Compatibility (EMC)

Radiated emissions testing (electric and magnetic fields)\*; Conducted emissions testing (voltage and current)\*; Electrostatic Discharge testing\*; Electrical Fast Transient testing\*; Radiated Immunity testing\*; Conducted Immunity testing\*; Lightning Immunity testing\*; Voltage Dips\*, Interrupts and Voltage Variations testing\*; Magnetic Immunity testing\*; RF Power measurements\*; Frequency Stability Measurements\*; Longitudinal Induction measurements\*; Harmonic emissions testing\*; Light flicker testing\*; Low frequency disturbance voltage testing\*; Disturbance Power measurements\*; Power Cross Overvoltage testing\*;

Test Type	Test Method(s)
<b>Emissions</b>	
Radiated and Conducted Emissions	FCC 47 CFR Parts 15 & 18; C63.4; CISPR 22; EN55022; SABS CISPR 22; AS/NZS CISPR 22; AS/NZS 3548; Canada ICES-003; CNS13438; KN 22 (RRL No. 2005-82, September 29, 2005); CISPR 11; EN 55011; SABS CISPR 11; AS/NZS CISPR 11; AS/NZS 2064; Canada ICES-001; CNS13803; CISPR 13; EN 55013; SABS CISPR 13; AS/NZS CISPR 13; AS/NZS 1053; CISPR 14-1; EN 55014-1; SABS CISPR 14; AS/NZS CISPR 14; AS/NZS 1044; CNS 13439; CISPR 15; EN 55015; GR-1089-CORE; CSA C108.8-M1983;
Harmonics	EN 61000-3-2; AS/NZS 61000.3.2
Flicker	EN 61000-3-3; AS/NZS 61000.3.3

1 Note: This accreditation covers testing performed at the laboratory listed above and the satellite facility located at 168 Ayer Rd, Littleton, MA 01460 and, for test types marked with an asterisk, at other sites as defined in "A2LA specific criteria for the accreditation of site testing and site calibration laboratories."

(A2LA Cert. No. 1627.01) 3/27/06

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<b>Immunity</b>	RRL No. 2005-130 (December 27, 2005)
Electrostatic Discharge (ESD)	EN 61000-4-2; AS/NZS 61000.4.2; KN61000-4-2
Radiated Immunity (RFI)	EN 61000-4-3; AS/NZS 61000.4.3; KN61000-4-3
Electrical Fast Transient Bursts (EFT)	EN 61000-4-4; AS/NZS 61000.4.4; KN61000-4-4
Surge	EN 61000-4-5; AS/NZS 61000.4.5; KN61000-4-5
Conducted Immunity	EN 61000-4-6; AS/NZS 61000.4.6; KN61000-4-6
Magnetic Immunity	EN 61000-4-8; AS/NZS 61000.4.8; KN61000-4-8
Voltage Dips and Interrupts	EN 61000-4-11; KN61000-4-11
Low Frequency Conducted Disturbances	EN 61000-2-2

<b>Family Product or Industry Specific Specifications including emissions and/or immunity</b>	GR-1089-CORE; GR-78-CORE (ESD) EN50081-1; EN50081-2; EN50082-2; EN50082-1; EN 61000-6-1; EN 61000-6-2; EN 61000-6-3; EN 61000-6-4; EN 50091-2; EN 55024; CISPR 24 EN 55103-1; EN 55103-2; EN 61326; EN 61547; EN 50130-4; EN 50083-2; EN 60601-1-2; EN 60601-2-2; EN 60601-2-24; EN 60601-2-32; EN 60601-2-38; EN 60601-2-47; IEC 1800-3; EN 61800-3; EN 55020; CISPR 20; EN 60555 Part 2; EN 60555 Part 3; ETS 300 386-1; EN 300 386-2; EN 300 386, ETS 300 132-1; ETS 300 132-2; EN 60669-2-1; AS/NZS 3200.1.2; CNS 13783-1; ETR 283; C62.41
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<b>Radiocommunications</b>	
<i>EU R&amp;TTE Radio Standards;</i>	EN 300 220-1; EN 300 220-3; EN 300 330-1; EN 300 330-2; EN 300 440-1; EN 300 440-2; EN 300 328; EN 300 385; EN 301 893

<i>EU R&amp;TTE EMC Standards</i>	EN 300 339; EN 301 489-01; EN 301 489-03; EN 301 489-17
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<i>Canada Radio Standards</i>	RSS-102; RSS-117; RSS-118; RSS-119; RSS-123; RSS-125; RSS-128; RSS-129; RSS-130; RSS-131; RSS-132; RSS-133; RSS-134; RSS-135; RSS-136; RSS-137; RSS-138; RSS-141; RSS-142; RSS-170; RSS-181; RSS-182; RSS-187; RSS-188; RSS-191; RSS-192; RSS-193; RSS-195; RSS-210; RSS-212; RSS-213; RSS-215; RSS-243; RSS-GEN; RSS-310; GL-36;
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<i>Australia/New Zealand Radio Standards</i>	AS/NZS 4268; AS/NZS 4771; RFS29; Radiocommunications (Data Transmission Equipment Using Spread Spectrum Modulation Techniques); Radiocommunications (Spread Spectrum Devices); Radiocommunications (Short Range Devices); Radiocommunications (Low Interference Potential Devices);
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(A2LA Cert. No. 1627.01) 3/27/06

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<i>Other Radio Standards</i>	RTTE 01 (DGT-Taiwan);
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### FCC Standards and Test methods Support TCB Status--

#### FCC Scope A - Unlicensed Radio Frequency Devices

A1	1. 47 CFR Parts 11, 15 and 18 2. FCC MP-5, 3. ANSI C63.4-2003,
A2	1. 47 CFR Part 15, 2. ANSI C63.4-2003,
A3	1. 47 CFR Part 15, 2. ANSI C63.17-1998, 3. ANSI C63.4-2003,
A4	1. 47 CFR Part 15, 2. ANSI C63.4-2003,

#### FCC Scope B - Licensed Radio Service Equipment

B1	1. 47 CFR Parts 2, 22, 24, 25, and 27 2. ANSI/TIA-603-C (2004)
B2	1. 47 CFR Parts 2, 22, 74, 90, 95, and 97 2. ANSI/TIA-603-C (2004)
B3	1. 47 CFR Parts 2, 80, and 87 2. ANSI/TIA-603-C (2004)
B4	1. 47 CFR Parts 2, 21, 74, and 101 2. ANSI/TIA-603-C (2004)

### Country Specific Standards and Other

<i>ITU EMC Standards</i>	K.20; K.21; K.41; K.44
<i>Swedish EMC Standards</i>	BAKOM 3336.3
<i>South African EMC Standards other than CISPR equivalents</i>	SABS 1718-1; SANS 211/SABS CISPR 11; SANS 224/SABS CISPR 24; SANS 213/SABS CISPR 13; SANS 2200; SANS214-1/SABS CISPR 14-1; SANS214-2/SABS CISPR 14-2; SANS 215/SABS CISPR 15; SANS 222/SABS CISPR 22
<i>Hong Kong EMC Standards</i>	HKTA 1006; HKTA 1007; HKTA 1008; HKTA 1010; HKTA 1015; HKTA 1026; HKTA 1035; HKTA 1039; HKTA 1041; HKTA 1042; HKTA 1045
<i>Singapore EMC Standards</i>	IDA TS SRD; IDA TS EMC
<i>Japanese VCCI Standards</i>	VCCI V-3, VCCI V-4

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### Telecommunications

Telecommunications Registration; General test methods; Lightning surge\*; Drop testing\*; Balance testing\*; Signal power (metallic and longitudinal)\*; Frequency measurements\*; Pulse templates\*; Leakage testing\*; Impedance testing\*; Hearing Aid Compatibility testing (excluding volume control)\*; Protocol analysis\* and Jitter testing\*.

#### Telecom Standards

	Title
<i>North American standards</i>	
FCC 47 CFR Part 68 Telephone Terminal Equipment CS-03 Issue 9	Connection of terminal equipment to the telephone network. Analog and Digital Equipment. TCB Scope C1. Specification for terminal equipment, terminal systems, Network protection devices, connection arrangements and hearing aids compatibility.
TIA/EIA TSB31-B 1998	Bulletin Part 68 Rationale and Measurement Guidelines (Feb 1998)
TIA-968-A, A1, A2, A3	Telecommunications Telephone Terminal Equipment Technical Requirements for Connection of Terminal Equipment to the Telephone Network
TI.TRQ.6-2001	Technical Requirements for SHDSL, HDLSL2, HDLSL4 Digital Subscriber Line Terminal Equipment to Prevent Harm to the Telephone Network Industry
<i>Australia standards</i>	
AS/ACIF S002-2001	Analogue interworking and non-interference requirements for Customer Equipment for connection to the Public Switched Telephone Network
AS/ACIF S016-2001	Requirements for Customer Equipment for connection to hierarchical digital interfaces
AS/ACIF S031-2001	Requirements for ISDN Basic Access Interface
AS/ACIF S038-2001	Requirements for ISDN Primary Rate Access Interface
AS/ACIF S043-2001	Requirements for Customer Equipment for Connection to a Metallic Local Loop Interface of a Telecommunications Network — Part 1: General Part 2: Broadband Part 3: DC, Low Frequency AC and Voice band
<i>International standards</i>	
ITU-T G.703	Physical/electrical characteristics of hierarchical Digital interfaces
<i>Hong Kong standards</i>	
HKTA 2011	Network Connection Specification for Connection of Customer Premises Equipment (CPE) to Direct Exchange Lines (DEL) of the Public Switched Telephone Network (PSTN) in Hong Kong
HKTA 2014	Network Connection Specification for Connection of Customer Premises Equipment (CPE) to the Public Telecommunications Network (PTN) in Hong Kong using ISDN Basic Rate Access (BRA) based on ITU-T Recommendations

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<p><u>Telecom Standards</u></p> <p>HKTA 2028</p> <p>HKTA 2029</p> <p>HKTA 2030</p> <p>HKTA 2031</p> <p>HKTA 2032</p> <p>HKTA 2033</p> <p><u>European standards</u></p> <p>TBR 1: 1995</p> <p>TBR 2: 1997</p> <p>TBR 3: 1995 + Amdt : 1997</p> <p>TBR 4: 1995 + Amdt : 1997</p> <p>TBR 012: 1993 + Amdt : 1996</p> <p>TBR 013: 1996</p> <p>(A2LA Cert. No. 1627.01) 3/27/06</p> <p>Page 5 of 10</p>	<p><u>European standards (cont'd)</u></p> <p>TBR 21: 1998</p> <p>TBR 24: 1997</p> <p><u>Taiwan standards (DGT)</u></p> <p>ADSL01</p> <p>ID0002</p> <p>IS6100</p> <p>PSTN01 (non-voice only)</p> <p><u>New Zealand standards</u></p> <p>PTC 200 (non-voice only)</p> <p>PTC 217</p> <p>TNA 117</p> <p>PTC 270</p> <p><u>Singapore Standards</u></p> <p>IDA TS ADSL</p> <p>IDA TS ADSL 2</p> <p>IDA TS DLCN 1</p> <p>IDA TS ISDN 1</p> <p>IDA TS ISDN 2</p> <p>IDA TS PSTN (non-voice only)</p> <p><u>South Africa standards</u></p> <p>TE-001 (non-voice only)</p> <p>Terminal Equipment (TE); Attachment requirements For pan-European approval for connection to the Analogue Public Switched Telephone Networks (PSTNs) of TE (excluding TE supporting the voice telephony service) in which network addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signaling</p> <p>Business TeleCommunications (BTC); 34 Mbit/s Digital Unstructured and structured leased lines (D34U and D34S); Attachment requirements for Terminal equipment interface</p> <p>Asymmetric Digital Subscriber Line Terminal Equipment and POTS Splitter Technical Specifications</p> <p>DS1 Equipment Type Approval Guidelines</p> <p>ISDN Terminal Equipment Technical Specifications</p> <p>Technical Specifications for Terminal Equipment for Connection to Public Switched Telephone Network</p> <p>Requirements for Connection of Customer Equipment to Analogue Lines</p> <p>Requirements for Bandwidth Management Devices</p> <p>Telecom 2048 kbit/s Standard Network Interface</p> <p>Interim arrangements for ADSL CPE</p> <p>Type Approval Specification for Asymmetric Digital Subscriber Line (Full-rate ADSL) Modems</p> <p>Type Approval Specification for Asymmetric Digital Subscriber Line Splitterless (G-Lite) Modems</p> <p>Type Approval Specification for Digital Interfaces based on hierarchical bit rates of 2048 kbit/s, 34 368 kbit/s and 139 264 kbit/s</p> <p>Type Approval Specification for connection of Terminal Equipment to Integrated Services Digital Network (ISDN) Basic Access</p> <p>Type Approval Specification for connection of Terminal Equipment to Integrated Services Digital Network (ISDN) Primary Rate Access (PRA)</p> <p>Type Approval Specification for connection of Terminal Equipment to Public Switched Telephone Network (PSTN)</p> <p>Standard for Telecommunication Line Terminal Equipment (TLTE) for Connection to the Public Switched Telephone Network (PSTN)</p> <p>(A2LA Cert. No. 1627.01) 3/27/06</p> <p>Page 6 of 10</p>
<p><u>Product Safety</u></p> <p>General test methods:</p> <p>Power input*, Permanence of marking*, Accessibility*, Permissibly limits*, Energy hazard measurement*, SELV circuits*, TNV limits*, Limited current*, Capacitor Discharge / voltage limitation*, Ring signal*, Humidity conditioning*, Creepage / Clearance / Distance thru Insulation (excluding CTT)*, Limited power measurement*, Ground Bond/Earthing*, Ground continuity*, Temperature*, Stability*, Applied force*, Steel sphere impact*, Mold stress*, Battery reverse current*, Ball pressure*, Leakage current*, Component abnormal*, Electric strength*, Impulse*, Overvoltage*, Acoustic sound pressure*, 130mm / 20mm flame*, Needle flame*, Hot flaming oil*, Locked rotor/motor armature*, Vibration, Bump, Drop*, Strain relief*, Torque*, Insulation resistance*, Sound level*, Handle loading*, Liquid overflow*, Spillage*, Liquid leakage*, Transformer shorts/overloads*, Rain test*, Wall mount*, Laser radiation (excluding x-ray)*, Voltage surge*, Functionality*, Protective impedance abnormal*, Capacitor short circuit abnormal*, Output abnormal*, Multi-supply abnormal*, Cooling abnormal*, Heating device abnormal*, Interlock abnormal*, Rigidity*, Cleaning*</p> <p><u>Product Safety Standards</u></p> <p><u>Specific Product Safety Standards</u></p> <p>UL 60950 2000</p> <p>IEC 60950 1999</p> <p>EN 60950 2000</p> <p>IEC 60950-1 2001</p> <p>UL 60950-1 2003</p> <p>CSA C22.2 No. 60950-00</p> <p>CSA C22.2 No. 60950-1 03</p> <p>IEC 61010-1 1993</p> <p>EN 61010-1 1993, 2001</p> <p>IEC 61010-1 2001</p> <p>UL 61010B-1 2003</p> <p>CAN/CSA 1010-1 1999 (Including AM 2)</p> <p>IEC 60601-1 1995</p> <p>EN 60601-1 1995 (Including AM 2)</p> <p>UL 2601-1 1997</p> <p>IEC 60065 1998, 2000</p> <p>ANSI/UL 6500: 1998</p> <p>CAN/CSA 60065-00</p> <p>AS/NZS 60065 2000</p> <p>Canadian C22.2 No. 1-94 (1-98)</p> <p>1994, 1998</p> <p>EN 60065 1994</p> <p>IEC 60825 1990</p> <p>EN 60825-1 1994</p> <p>(A2LA Cert. No. 1627.01) 3/27/06</p> <p>Page 7 of 10</p>	<p><u>Product Safety Standards</u></p> <p>IEC 60825-1 2001</p> <p>IEC 60825-2 2000-5</p> <p>IEC 60825-4 1997-11</p> <p>21 CFR 1040.10</p> <p>IEC 60335-1 1995 (Including AM2 - 1997 &amp; AM 12 - 1997)</p> <p>EN 60335-1 2001</p> <p>UL 60335-1 1998</p> <p>CAN/CSA E335-1 1994</p> <p>UL 61010A-1: 2002</p> <p>EN 61010-1: 2001</p> <p>AS/NZS 60950: 2000</p> <p>EN 60950-1: 2001</p> <p>AS/NZS 60950.1: 2003</p> <p>UL 61010 -1: 2004</p> <p>UL 60601-1: 2003</p> <p>IEC 60601-1-1: 2000</p> <p>EN 60601-1-1: 2001</p> <p>UL 60065: 2003</p> <p>CSA 60065: 2003</p> <p>IEC 60065: 2001</p> <p>EN 60065: 2002</p> <p>EN 60204 -1: 1998</p> <p>HKTA 2001</p> <p>Classification, requirements and user's guide.</p> <p>Safety of laser products - Part 2: Safety of optical communication systems</p> <p>Safety of laser products - Part 4: Laser guards</p> <p>Performance standard for laser products</p> <p>Safety of household and similar electrical appliances</p> <p>Part 1: General requirements</p> <p>Electrical equipment for laboratory use; part 1: General requirements</p> <p>Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements</p> <p>Safety information technology equipment</p> <p>Information Technology Equipment - Safety - Part 1: General Requirements</p> <p>Information Technology Equipment - Safety - General requirements</p> <p>Electrical Equipment for Measurement, Control and Laboratory Use; Part 1: General Requirements</p> <p>Medical Electrical Equipment, Part 1: General Requirements for Safety</p> <p>Medical Electrical Equipment - Part 1: General Requirements For Safety 1: Collateral Standard: Safety Requirements For Medical Electrical Systems</p> <p>Medical Electrical Equipment - Part 1: General Requirements for Safety - Section 1-1, Collateral Standard: Safety Requirements For Medical Electrical Systems</p> <p>Audio, Video and Similar Electronic Apparatus - Safety Requirements</p> <p>Audio, Video and Similar Electronic Apparatus - Safety Requirements</p> <p>Audio, Video and Similar Electronic Apparatus - Safety Requirements</p> <p>Audio, Video and Similar Electronic Apparatus - Safety Requirements</p> <p>Safety of Machinery - Electrical Equipment of Machines - Part 1: Specification for General Requirements</p> <p>Compliance Test Specification - Safety and Electrical Protection Requirements for Subscriber Equipment Connected to the Public Telecommunications Networks In Hong Kong</p> <p>(A2LA Cert. No. 1627.01) 3/27/06</p> <p>Page 8 of 10</p>

<i>Environmental Simulation</i>			
<u>Test Technology</u>	<u>Test Standard</u>	<u>Supporting Standards</u>	
Accessibility*	IEC 60529	IP-0x thru IP-6x	<p>Note 1. For standards or methods listed on the scope of accreditation without a revision date, laboratories are expected to be competent in the use of the current version within one year of the date of publication of the standard test method or upon the date specified by the standard test method originator when the originator has implementation authority. When a superseded standard or method is required for an accredited test, the scope will include the superseded date/version. For those that support the TCB/CB status of the organization acting as a certifier on behalf of the FCC or IC the expectation is currency within 30 days of Federal Register publication of changes for FCC and 30 days after IC website update. This note shall not be construed as an Accreditation Body implication to adopt a more current standard than is required in a regulation or code (i.e. the legal requirement) which is adopted by the lab under their responsibility.</p> <p>* On-site test service is available for this technology, test, or method.</p>
Acoustic Noise*	GR-63-CORE Sec 4.6		
Airborne Contaminants	GR-63-CORE Sec 4.5	MFG & Hygroscopic Dust	
Altitude	GR-63-CORE Sec 4.1.3		
Cold Start*	ETS 300 019	IEC 60068-2-1	
Drip	IEC 60529	IP-x1 & IP-x2	
Drops*	ETS 300 019	IEC 60068-2-32	
	GR-63-CORE Sec 4.3		
Dust	IEC 60529	IP-5x & IP-6x	
Firearms Resistance Testing	GR-487		
Fire Resistance	ANSI-T1.319		
	GR-63-CORE Sec 4.2	Fire & Needle Flame	
Heat Dissipation*	GR-63-CORE Sec 4.1,4		
Illumination	GR-63-CORE Sec 4.7		
Operational Temperature & Humidity (OpTH)*	ETS 300 019	IEC 60068-2-1	
		IEC 60068-2-2	
		IEC 60068-2-14	
		IEC 60068-2-56	
Salt Fog & Spray	GR-63-CORE Sec 4.1.2		
Spatial*	ASTM B117		
Spraying-Splashing	GR-63-CORE Sec 2.0 & 3.0	IP-x3 & IP-x4	
Storage (Temperature & Humidity)*	IEC 60529	IEC 60068-2-1	
	ETS 300 019	IEC 60068-2-2	
		IEC 60068-2-14	
		IEC 60068-2-30	
		IEC 60068-2-56	
Vibration	GR-63-CORE Sec 4.1.1		
	ETS 300 019	IEC 60068-2-6	
		IEC 60068-2-27	
		IEC 60068-2-29	
		IEC 60068-2-32	
		IEC 60068-2-57	
		IEC 60068-2-64	
		Earthquake, Office & Transportation	
Water Immersion	GR-63-CORE Sec 4.4		
Water Jet	IEC 60529	IP-x7 & IP-x8	
	IEC 60529	IP-x5 & IP-x6	