
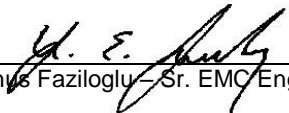




# Test Report

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

Report No	ER3666-1
Client	TowGo, LLC Daniel Shepard
Address	8 Easton Hill Lane Stratham, NH 03885
Phone	(603) 498-3300
Items tested	2017S1
FCC ID	2AOGL1
IC	23599-1
FRN	0027037068
Equipment Type	Digital Transmission System
Equipment Code	DTS
Emission Designator	1M07F1D
FCC/IC Rule Parts	CFR Title 47 FCC Part 15.247, ISSED Canada RSS-247 Issue 2
Test Dates	1/23/2017 and 1/24/2017
Results	As detailed within this report
Prepared by	 Zachary Johnson – EMC Engineer
Authorized by	 Yunus Faziloglu – Sr. EMC Engineer
Issue Date	<u>2/23/2018</u>
Conditions of Issue	This Test Report is issued subject to the conditions stated in the 'Conditions of Testing' section on page 25 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 12-07-15



## **Summary**

This test report supports an application for certification of a transmitter operating pursuant to:  
CFR Title 47 FCC Part 15.247, ISED Canada RSS-247 Issue 2

2017S1 operates in the 2404-2480MHz frequency range and has a 0dBi PCB trace antenna.  
The Steering Wheel Sensor is powered by 3.7V DC battery.

We found that the product met the above requirements without modification. The test sample  
was received in good condition.



## Test Methodology

All testing was performed according to the following rules/procedures/documents;  
CFR Title 47 FCC Part 15.247, RSS-247 Issue 2, RSS-Gen Issue 4, FCC KDB 558074 D01  
DTS Measurement Guidance v04 and ANSI C63.10-2013.

Radiated emissions were maximized by rotating the device around 3 orthogonal planes (X, Y and Z) as well as varying the test antenna's height and polarity. Worst case results were recorded.

RF measurements were performed at the antenna port on 3 channels as follows:

- 2404MHz: Low Channel
- 2444MHz: Mid Channel
- 2480MHz: High Channel

AC line conducted emissions testing was not performed since the unit is battery powered only.

The following bandwidths were used during radiated spurious emissions testing.

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

## Product Tested - Configuration Documentation

EUT Configuration										
Work Order:	R3666									
Company:	TowGo, LLC									
Company Address:	8 Easton Hill Lane									
	Stratham, NH, 03885									
Contact:	Daniel Shepard									
	MN			PN			SN			
EUT:	2017S1H1									
EUT Description:	Steering Wheel BLE Sensor									
EUT Max Frequency:	2480 MHz									
EUT Min Frequency:	32 MHz									
Port Label	Port Type	# ports	# populated	cable type	shielded	ferrites	length (m)	in/out	under test	comment
Battery connector	Power DC	1	1	Power DC	No	No	0.05	in	yes	
Software Operating Mode Description:										
Performance Criteria:										
EMI only										

Clock Frequencies	
frequencies (MHz)	2480, 2444, 2404, 64, 32

## Statement of Conformity

The device was found to conform to the following parts of 47 CFR and RSS 247 as detailed below:

RSS-GEN	RSP-100	RSS 247	Part 15	Comments
6.3			15.15(b)	There are no controls accessible to the user that varies the output power to operate in violation of the regulatory requirements.
	3.1		15.19	The label is shown in the label exhibit.
	3.2		15.21	Information to the user is shown in the instruction manual exhibit.
			15.27	No special accessories are required for compliance.
3, 6.1, 6.5			15.31	The EUT was tested in accordance with the measurement standards in this section.
6.13			15.33	Frequency range was investigated according to this section, unless noted in specific rule section under which the equipment operates.
8.1			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.
8.3			15.203	EUT has 0dBi PCB trace antenna
8.10			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 or RSS-Gen as applicable
8.8			15.207	N/A. Battery powered only.
			15.247	The unit complies with the requirements of 15.247
		RSS 247		The unit complies with the requirements of RSS-247
6.6				Occupied Bandwidth measurements were made.

## Modifications Required for Compliance

None

# Test Results

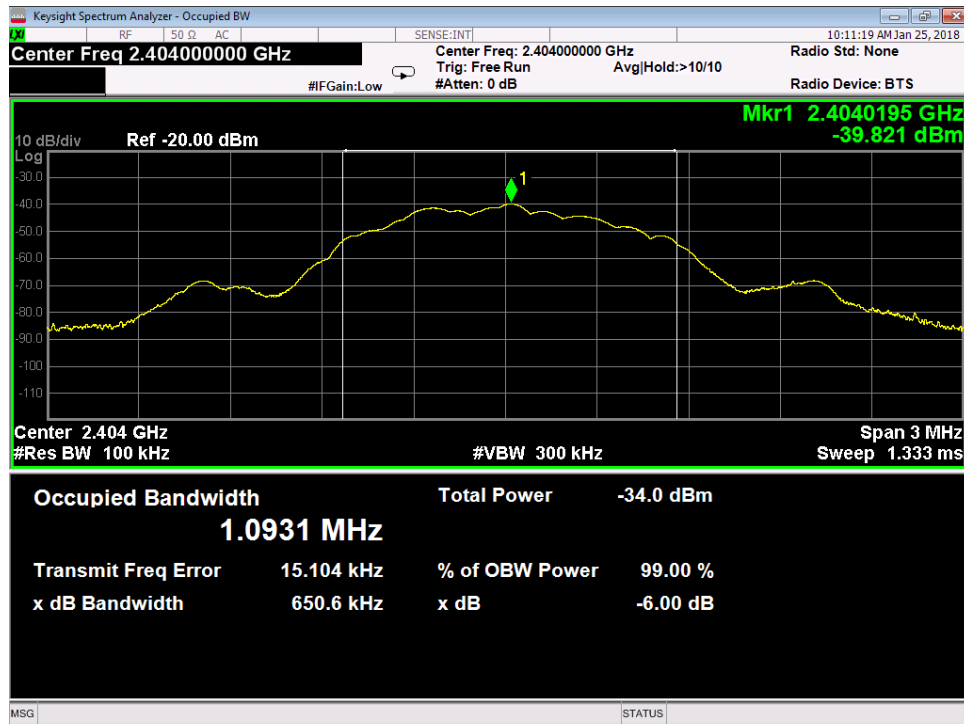
## Bandwidth

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

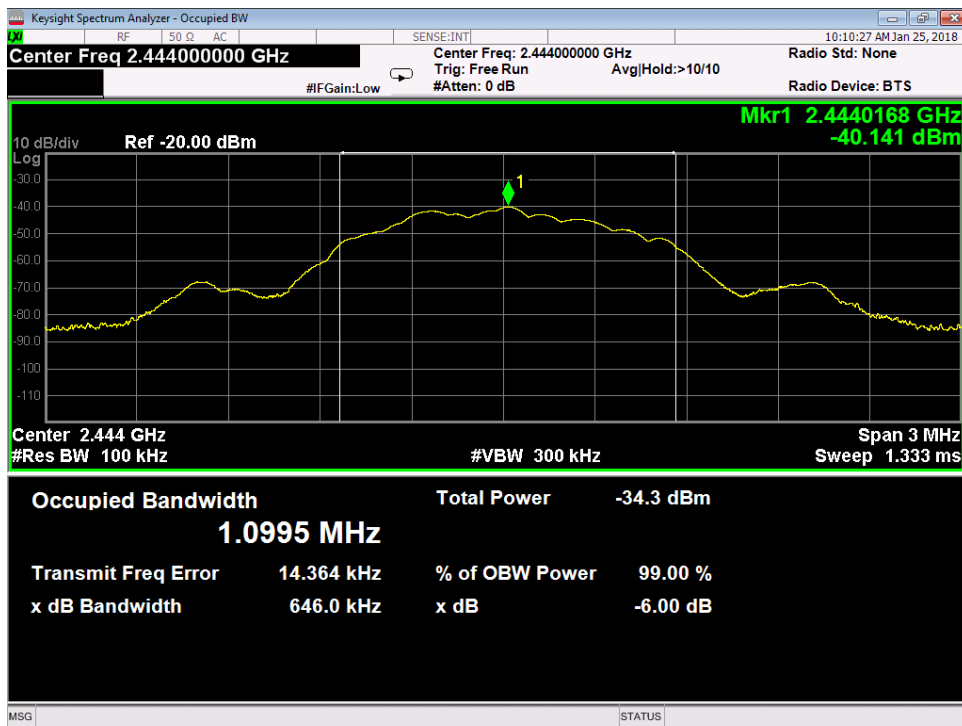
## MEASUREMENTS / RESULTS

6dB Bandwidth							
Date: 1/24/2017		Company: TowGo		Work Order: R3666			
Engineer: Zac Johnson		EUT: Steering Wheel Sensor with BLE		Operating Voltage/Frequency: 3.7V DC			
Temp: 21.8°C		Humidity: 32%	Pressure: 999mBar	Battery			
Frequency Range: 2404-2480 MHz		Measurement Type: Conducted					
Measurement Method: FCC KDB 558074 D01 DTS Meas Guidance V04							
Notes:							
Frequency  (MHz)	Reading  (kHz)		6dB Bandwidth				
			Limit	Margin	Result		
			(kHz)	(kHz)	(Pass/Fail)		
			2404	650.6	≥500	151	Pass
			2444	646.0	≥500	146	Pass
2480	647.8	≥500	148	Pass			
Test Site: EMC-3		Cable: 2213 Cbl		Attenuator: 2107 40dB Pad			
Analyzer: 1118472 SA		Copyright Curtis-Straus LLC 2000					

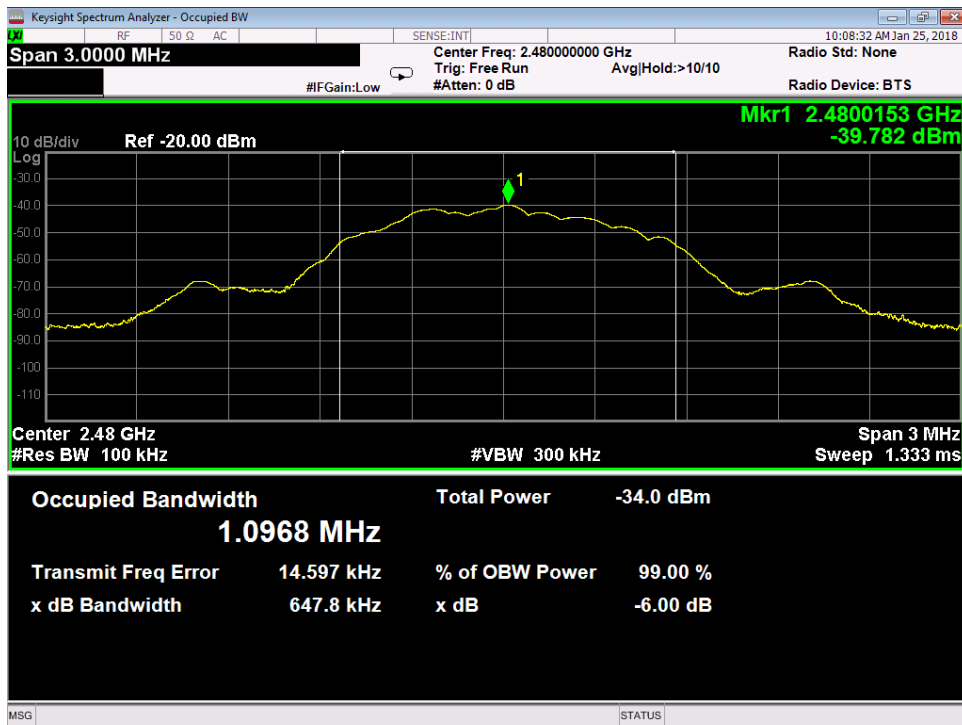
## PLOTS



Low Channel DTS Bandwidth



Middle Channel DTS Bandwidth



High Channel DTS Bandwidth



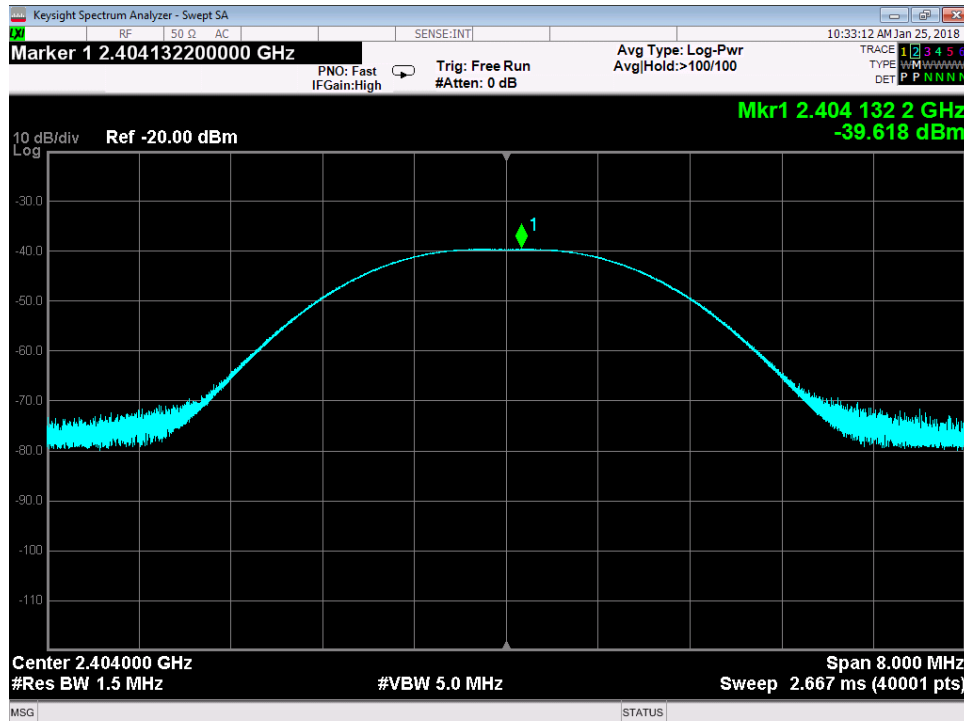
## Peak Power

LIMIT: 1 Watt Conducted Output Power  
[15.247(b) (3)]

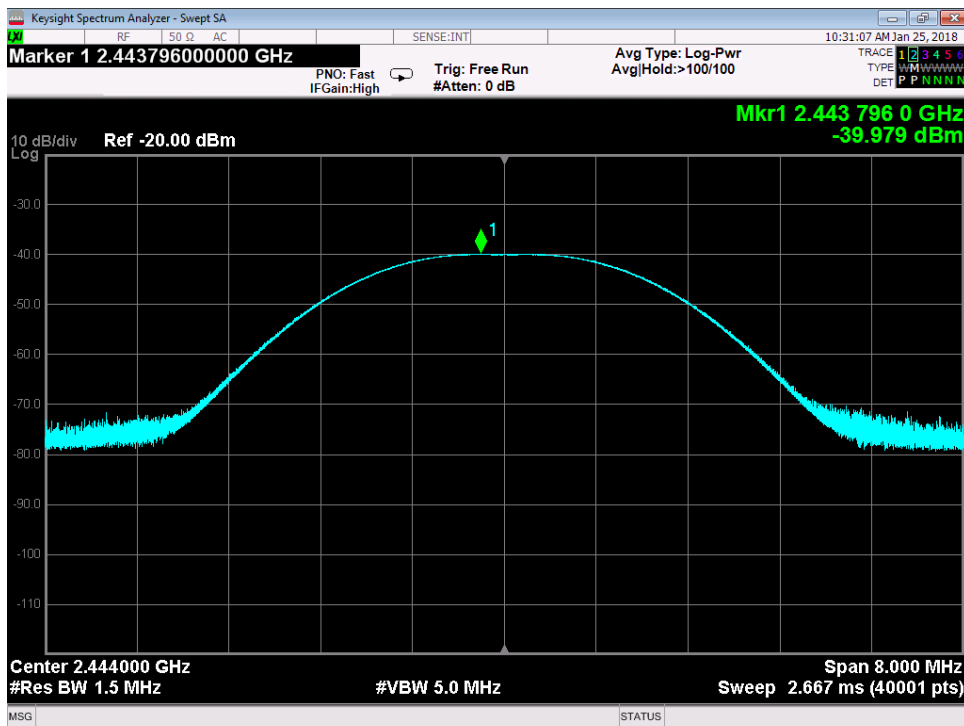
## MEASUREMENTS / RESULTS

Peak Output Power							
Date: 1/24/2017		Company: TowGo			Work Order: R3666		
Engineer: Zac Johnson		EUT: Steering Wheel Sensor with BLE			Operating Voltage/Frequency: 3.7V DC		
Temp: 21.8°C		Humidity: 32%		Pressure: 999mBar			
Frequency Range: 2404-2480 MHz				Measurement Type: Conducted			
Notes:							
Frequency	Peak Reading	Cable Loss	Attenuator Loss	Peak Output Power	Limit	Margin	Result
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	(Pass/Fail)
2404	-39.62	0.71	40.0	1.09	30.0	-28.91	Pass
2444	-39.98	0.71	40.0	0.73	30.0	-29.27	Pass
2480	-39.56	0.71	40.0	1.15	30.0	-28.85	Pass
Test Site: EMC-3		Cable: 2213 Cbl		Attenuator: 2107 40dB Pad			
Analyzer: 1118472 SA							
Peak Output Power (dBm)= Peak Reading (dBm) + Cable Loss (dB) + Attenuator Loss (dB)							

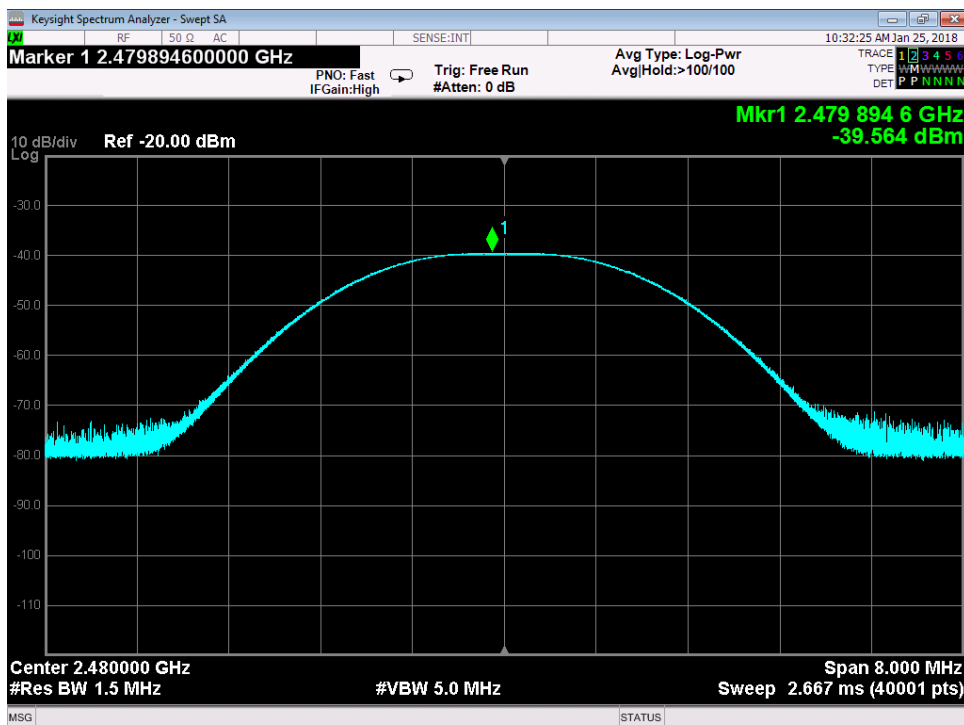
## PLOTS



Low Channel Peak Output Power



Middle Channel Peak Output Power



High Channel Peak Output Power

## Band Edge Measurements

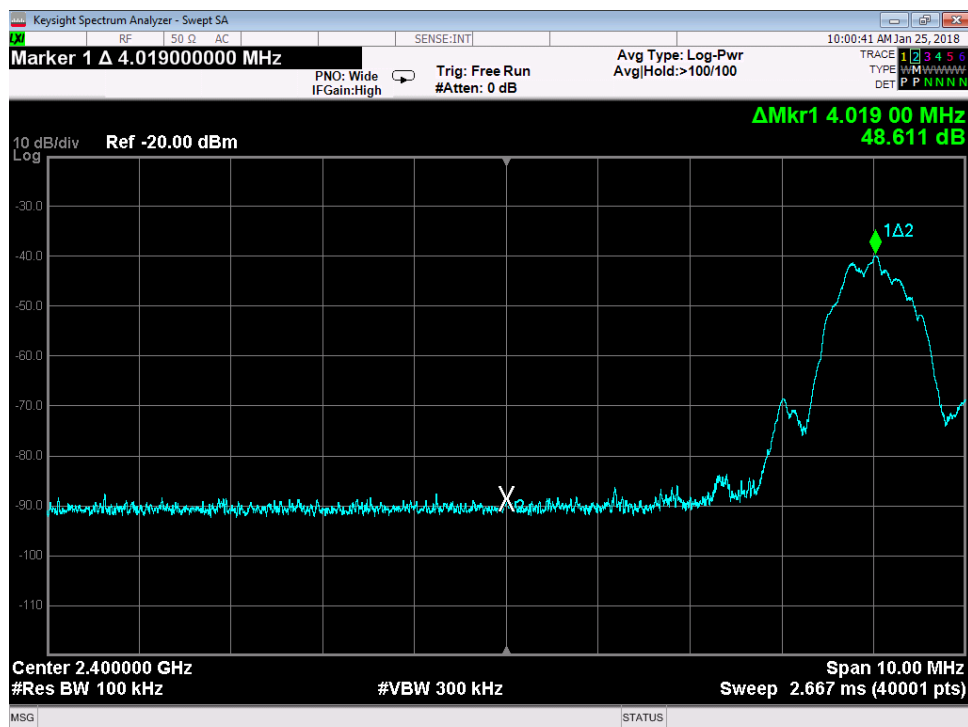
Limits: Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a). [15.247(d)]

## MEASUREMENTS / RESULTS

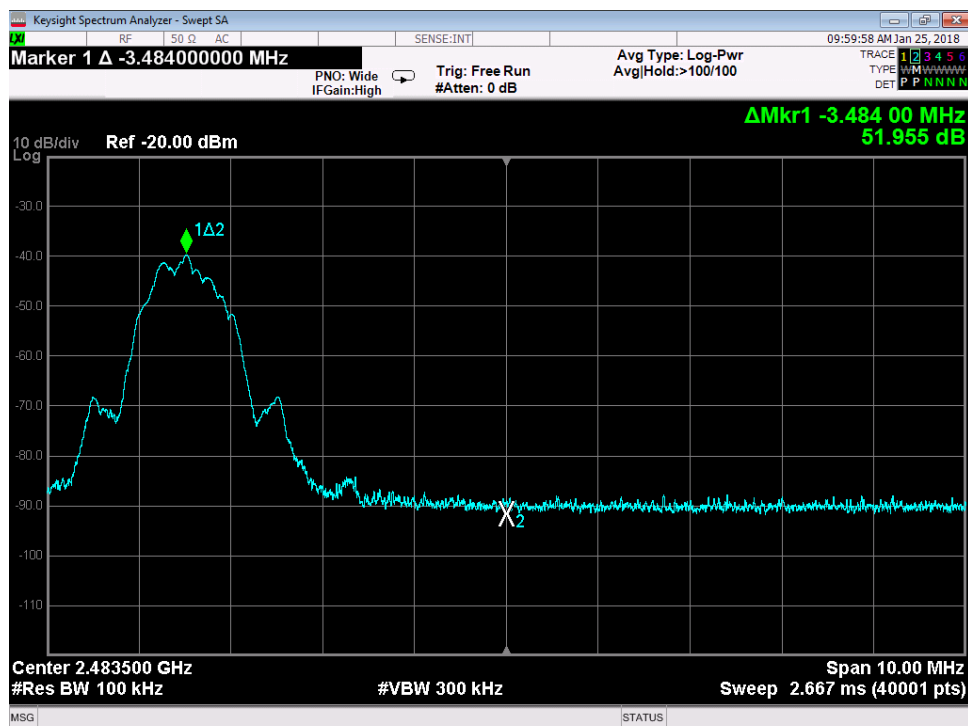
Radiated Bandedge														
Date: 22-Jan-18			Company: TowGo						Work Order: R3666					
Engineer: Aristotelis Castemopoulos			EUT Desc: Steering Wheel BLE Sensor						EUT Operating Voltage/Frequency: 3.7V Battery					
Temp: 23.6			Humidity: 22%						Pressure: 1014					
Frequency Range: Bandedges									Measurement Distance: 3 m					
Notes:			EUT Max Freq: 2480MHz											
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)
High Ch				---	---	---	---	---	---	---	---	---	---	---
H	2483.50	28.9	13.2	0.0	32.4	3.2	64.5	48.8	74.0	-9.5	Pass	54.0	-5.2	Pass
H	2483.79	30.7	13.1	0.0	32.4	3.2	66.3	48.7	74.0	-7.7	Pass	54.0	-5.3	Pass
H	2484.49	31.0	13.0	0.0	32.4	3.2	66.6	48.6	74.0	-7.4	Pass	54.0	-5.4	Pass
H	2493.43	26.7	12.7	0.0	32.4	3.2	62.3	48.3	74.0	-11.7	Pass	54.0	-5.7	Pass
Low Ch				---	---	---	---	---	---	---	---	---	---	---
H	2390.00	22.5	12.5	0.0	32.2	3.1	57.8	47.8	74.0	-16.2	Pass	54.0	-6.2	Pass
H	2349.89	23.9	12.4	0.0	32.0	3.1	59.0	47.5	74.0	-15.0	Pass	54.0	-6.5	Pass
H	2351.37	24.6	12.4	0.0	32.0	3.1	59.7	47.5	74.0	-14.3	Pass	54.0	-6.5	Pass
Table Result: Pass by -5.2 dB Worst Freq: 2483.5 MHz														
Test Site: EMI Chamber 1			Cable 1: Asset #2051						Cable 2: Asset #2456			Cable 3: ---		
Analyzer: Rental SA#1			Preamp: None						Antenna: Blue Horn			Preselector: ---		
CSsoft Radiated Emissions Calculator v 1.017.197														
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor														
Copyright Curtis-Straus LLC 2000														

Conducted Bandedge				
Date: 1/24/2017		Company: TowGo		Work Order: R3666
Engineer: Zac Johnson		EUT: Steering Wheel Sensor with BLE		Operating Voltage/Frequency: 3.7V DC
Temp: 21.8°C		Humidity: 32%		Pressure: 999mBar
Frequency Range: 2404-2480 MHz		Measurement Type: Conducted		
Measurement Method: FCC KDB 558074 D01 DTS Meas Guidance V04				
Notes:				
	Bandedge Frequency (MHz)	Delta to Peak (dB)	Limit	
			(dB)	(Pass/Fail)
	Low Bandedge	2400	48.6	≥ 20
High Bandedge	2483.5	52.0	≥ 20	Pass
Test Site: EMC-3		Cable: 2213 Cbl		Attenuator: 2107 40dB Pad
Analyzer: 1118472 SA				
Copyright Curtis-Straus LLC 2000				

## PLOTS



Low Band Edge - Conducted



High Band Edge – Conducted

## 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)] High, low, and center channels were tested above 1GHz.

### MEASUREMENTS / RESULTS

Curtis Straus - a Bureau Veritas Company				Work Order - R3666					
Radiated Emissions Electric Field 3m Distance				EUT Power Input - Battery					
Top Peaks Vertical 30-1000MHz				Test Site - CH-1					
Operator: ZJ				Conditions - 21.6°C; 32%RH; 1018mBar					
Config 1 Center Channel									
11:09:53 PM Monday January 22 2018				EUT Maximum Frequency - 2480MHz					
Frequency	Peak Reading	Correction Factor	Adjusted Peak Amplitude	Lim1: FCC_pt15_109_Class_B	Lim1 Margin	Lim1 Test Results	Worst Margin Lim1	Antenna Height	Turntable Azimuth
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
30.024	33.2	-7.5	25.6	40	-14.4	PASS	-14.4	100	90
66.205	38.1	-21.1	17	40	-23	PASS		100	315
125.569	32.8	-14.8	18	43.5	-25.5	PASS		150	0
930.111	31.9	-2.1	29.7	46	-16.3	PASS		200	180
984.917	31.3	-1.3	30	54	-24	PASS		150	315

Curtis Straus - a Bureau Veritas Company				Work Order - R3666					
Radiated Emissions Electric Field 3m Distance				EUT Power Input - Battery					
Top Peaks Horizontal 30-1000MHz				Test Site - CH-1					
Operator: ZJ				Conditions - 21.6°C; 32%RH; 1018mBar					
Config 1 Center Channel									
11:09:53 PM Monday January 22 2018				EUT Maximum Frequency - 2480MHz					
Frequency	Peak Reading	Correction Factor	Adjusted Peak Amplitude	Lim1: FCC_pt15_109_Class_B	Lim1 Margin	Lim1 Test Results	Worst Margin Lim1	Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
30.582	33	-8.1	24.9	40	-15.1	PASS	-15.1	100	90
160.101	40.7	-16.5	24.2	43.5	-19.3	PASS		150	270
261.369	41.2	-15.6	25.6	46	-20.5	PASS		150	270
387.809	35.2	-12.1	23.1	46	-22.9	PASS		250	90
912.264	32.3	-2.4	29.9	46	-16.2	PASS		250	135
990.688	31.5	-1.1	30.4	54	-23.6	PASS		100	45

30-1000MHz



Curtis Straus - a Bureau Veritas Company					Work Order - R3666								
Radiated Emissions Electric Field 3m Distance					EUT Power Input - 3.7V Battery								
Top Peaks Vertical 1-6GHz					Test Site - CH1								
Operator: Aristotelis Casternopoulos					Conditions - 23.6°C; 22%RH; 1014mBar								
EUT Power: Battery													
Mode: Channel 0					EUT Maximum Frequency - 2480MHz								

Curtis Straus - a Bureau Veritas Company				Work Order - R3666									
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 3.7V Battery									
Top Peaks Horizontal 1-6GHz				Test Site - CH1									
Operator: Aristotelis Casternopoulos				Conditions - 23.6°C; 22%RH; 1014mBar									
EUT Power: Battery													
Mode: Channel 0				EUT Maximum Frequency - 2480MHz									
								</					

### 1GHz-6GHz Low Channel

Curtis Straus - a Bureau Veritas Company				Work Order - R3666									
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 3.7V Battery									
Top Peaks Vertical 1-6GHz				Test Site - CH1									
Operator: Aristotelis Casternopoulos				Conditions - 23.6°C; 22%RH; 1014mBar									
EUT Power: Battery													
Mode: Channel 19 (2444MHz)				EUT Maximum Frequency - 2480MHz									
											Average Limit Worst Margin		
Frequency	Raw Peak Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_209_Peak	Margin to Peak Limit	Peak Limit Test Results	Peak Limit Worst Margin	Av Lim: FCC_pt15_209_Average	Margin to Average Limit	Average Limit Test Result		Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
1165.63	55.8	-9.7	46.1	74	-27.9	PASS		54	-7.9	PASS		100	153
1371.75	49.6	-8.6	41	74	-33	PASS		54	-13	PASS		100	192
2176.38	48.3	-4	44.3	74	-29.7	PASS		54	-9.7	PASS		100	34
2878.75	49.1	-3.4	45.7	74	-28.3	PASS		54	-8.3	PASS		200	123
4563	47.9	-2.6	45.3	74	-28.7	PASS		54	-8.7	PASS		100	309
5431.5	46.7	0.4	47.1	74	-26.9	PASS	-26.9	54	-6.9	PASS	-6.9	200	242

Curtis Straus - a Bureau Veritas Company				Work Order - R3666									
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 3.7V Battery									
Top Peaks Horizontal 1-6GHz				Test Site - CH1									
Operator: Aristotelis Casternopoulos				Conditions - 23.6°C; 22%RH; 1014mBar									
EUT Power: Battery													
Mode: Channel 19 (2444MHz)				EUT Maximum Frequency - 2480MHz									
Frequency	Raw Peak Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_209_Peak	Margin to Peak Limit	Peak Limit Results	Peak Limit Worst Margin	Av Lim: FCC_pt15_209_Average	Margin to Avg Limit	Avg Limit Results	Avg Limit Worst Margin	Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
1090.63	50.6	-10.2	40.4	74	-33.6	PASS		54	-13.6	PASS		200	281
1274.13	49.9	-8.4	41.5	74	-32.5	PASS		54	-12.5	PASS		300	310
2173.63	48.6	-4	44.5	74	-29.5	PASS		54	-9.5	PASS		200	242
2948.25	49.1	-3.8	45.3	74	-28.7	PASS		54	-8.7	PASS		100	309
5159.25	48	-0.9	47.2	74	-26.8	PASS	-26.8	54	-6.8	PASS	-6.8	200	202
5746.5	46.6	0.6	47.2	74	-26.8	PASS		54	-6.8	PASS		100	113

### 1GHz-6GHz Mid Channel

Curtis Straus - a Bureau Veritas Company				Work Order - R3666									
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 3.7V Battery									
Top Peaks Vertical 1-6GHz				Test Site - CH1									
Operator: Aristotelis Casternopoulos				Conditions - 23.6°C; 22%RH; 1014mBar									
EUT Power: Battery													
Mode: Channel 39				EUT Maximum Frequency - 2480MHz									
Frequency	Raw Peak Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_209_Peak	Margin to Peak Limit	Peak Limit Test Results	Peak Limit Worst Margin	Av Lim: FCC_pt15_209_Average	Margin to Average Limit	Average Limit Test Result	Average Limit Worst Margin	Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
1318	50	-8.6	41.4	74	-32.6	PASS		54	-12.6	PASS		200	315
2139	49.2	-4.4	44.9	74	-29.1	PASS		54	-9.1	PASS		300	231
3150.13	49.3	-3.9	45.4	74	-28.6	PASS		54	-8.6	PASS		300	34
5735.63	46.5	0.6	47.1	74	-26.9	PASS	-26.9	54	-6.9	PASS	-6.9	100	114

Curtis Straus - a Bureau Veritas Company				Work Order - R3666									
Radiated Emissions Electric Field 3m Distance				EUT Power Input - 3.7V Battery									
Top Peaks Horizontal 1-6GHz				Test Site - CH1									
Operator: Aristotelis Casternopoulos				Conditions - 23.6°C; 22%RH; 1014mBar									
EUT Power: Battery													
Mode: Channel 39				EUT Maximum Frequency - 2480MHz									
Frequency	Raw Peak Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_209_Peak	Margin to Peak Limit	Peak Limit Results	Peak Limit Worst Margin	Av Lim: FCC_pt15_209_Average	Margin to Avg Limit	Avg Limit Results	Avg Limit Worst Margin	Antenna Height	EUT Azimuth
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(dBµV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)
1859.75	50.8	-6.4	44.4	74	-29.6	PASS		54	-9.6	PASS		200	202
2083.63	49.9	-5.2	44.7	74	-29.3	PASS		54	-9.3	PASS		200	163
2872.13	48.9	-3.4	45.5	74	-28.5	PASS		54	-8.5	PASS		100	308
4560.75	48.2	-2.6	45.6	74	-28.4	PASS		54	-8.4	PASS		300	0
5700.5	47.9	0.6	48.6	74	-25.4	PASS	-25.4	54	-5.4	PASS	-5.4	100	308

### 1GHz-6GHz High Channel

Curtis Straus - a Bureau Veritas Company				Work Order - R3666													
Radiated Emissions Electric Field 1m Distance				EUT Power Input - Battery													
Top Peaks Vertical 6-18GHz				Test Site - CH-1													
Operator: ZJ				Conditions - 21.6°C; 32%RH; 1018mBar													
Config 1 - Mid Channel				EUT Maximum Frequency - 2480MHz													
Frequency	Raw Peak Reading	Correction Factor	Adjusted Peak Amplitude	Pk Lim: FCC_pt15_109_ClassB_Peak	Margin to Peak Limit	Peak Limit Test Results	Peak Limit Worst Margin	Av Lim: FCC_pt15_109_ClassB_AVG	Margin to Avg Limit	Avg Limit Test Results	Avg Limit Worst Margin	Antenna Height	EUT Azimuth				
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(dBμV/m)	(dB)	(Pass/Fail)	(dB)	(cm)	(degrees)				
11893.5	45.5	1.9	47.4	83.5	-36.1	PASS		63.5	-16.1	PASS		150	0				
12882	46.2	1.8	48	83.5	-35.5	PASS		63.5	-15.5	PASS		150	269				
13403.1	45.5	3	48.5	83.5	-35	PASS		63.5	-15	PASS		125	46				
13715.4	47	2	49	83.5	-34.5	PASS		63.5	-14.5	PASS		175	8				
14997.6	46.6	2.4	49.1	83.5	-34.4	PASS		63.5	-14.4	PASS		175	8				
16974.3	46.8	5.3	52.1	83.5	-31.4	PASS	-31.4	63.5	-11.4	PASS	-11.4	175	87				

## 6GHz-18GHz

Radiated Emissions Table														
Date: 23-Jan-18					Company: TowGo					Work Order: R3666				
Engineer: Zac Johnson					EUT Desc: Steering Wheel Sensor with BLE					EUT Operating Voltage/Frequency: Battery				
Temp: 24.1°C					Humidity: 21%					Pressure: 1004mBar				
Frequency Range: 18-25GHz										Measurement Distance: 0.1 m				
Notes: Harmonic seen, tested 3 channels										EUT Max Freq: 2480MHz				
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)
Low Channel H / V	19234	57.3	57.3	---	---	---	---	---	---	---	---	---	---	---
				40.8	40.3	7.0	63.8	63.8	103.5	-39.7	Pass	83.5	-19.7	Pass
				---	---	---	---	---	---	---	---	---	---	---
Mid Channel H / V	19554	56.9	56.9	40.8	40.3	7.0	63.4	63.4	103.5	-40.1	Pass	83.5	-20.1	Pass
				---	---	---	---	---	---	---	---	---	---	---
				---	---	---	---	---	---	---	---	---	---	---
High Channel H / V	19843	55.3	55.3	40.9	40.3	7.0	61.7	61.7	103.5	-41.8	Pass	83.5	-21.8	Pass
				---	---	---	---	---	---	---	---	---	---	---
				---	---	---	---	---	---	---	---	---	---	---
Table Result:		Pass by -19.7 dB										Worst Freq: 19234.0 MHz		
Test Site: EMI Chamber 1					Cable 1: Asset #2323					Cable 2: ---				
Analyzer: Brown SA					Preamp: 18-26.5GHz					Antenna: 18-26.5GHz Horn				
CSsoft Radiated Emissions Calculator v 1.017.197										Cable 3: ---				
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor										Preselector: ---				
Copyright Curtis-Straus LLC 2000														

## 18GHz-25GHz

Rev. 1/19/2018

Spectrum Analyzers / Receivers/Preselectors		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Brown		9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	7/26/2018	7/26/2017
Rental MXE EMI Receiver(1168255)		20Hz-8.4GHz	N9038A	Agilent	MY53290009	1168255	I	8/15/2018	8/15/2017
2093 MXE EMI Receiver		20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	11/16/2018	11/16/2017
Radiated Emissions Sites		FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due	Calibrated on
EMI Chamber 1		719150	2762A-6	A-0015	30-1000MHz	1685	I	12/21/2018	12/21/2016
EMI Chamber 1		719150	2762A-6	A-0015	1-18GHz	1685	I	12/21/2018	12/21/2016
Preamps/Couplers Attenuators / Filters		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2311 PA		1-1000MHz	PAM-103	COM-POWER	441174	2311	II	10/29/2018	10/29/2017
2111 HF Preamp		0.5-18GHz	PAM-118A	COM-POWER	551063	2111	II	11/19/2018	11/19/2017
HF (Yellow)		18-26.5GHz	AFS4-18002650-60-8P-4	CS	467559	1266	II	10/16/2018	10/16/2017
2116 BRF		0.009-18000MHz	BRM50702	Micro-Tronics	G226	2116	II	11/8/2018	11/8/2017
Antennas		Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Red-Brown Bilog		30-2000MHz	JB1	Sunol	A0032406	1218	I	1/13/2019	1/13/2017
HF (White) Horn		18-26.5GHz	801-WLIM	Waveline	758	758	III	Verify before Use	date of test
Blue Horn		1-18GHz	3117	ETS	157647	1861	I	2/14/2019	2/14/2017
Meteorological Meters/Chambers			MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Weather Clock (Pressure Only)			BA928	Oregon Scientific	C3166-1	831	I	4/28/2018	4/28/2016
TH A#2084			HTC-1	HDE		2084	I	3/23/2018	3/23/2017
Cables		Range		Mfr			Cat	Calibration Due	Calibrated on
Asset #2051		9kHz - 18GHz		Florida RF			II	3/5/2018	3/5/2017
Asset #2456		9kHz-18GHz		MegaPhase			II	10/29/2018	10/29/2017
Asset #2466		9kHz-18GHz		MegaPhase			II	10/29/2018	10/29/2017
Asset #2323		1-26.5GHz	TM26-S1S1-120	MEGAPHASE	17139101 002	2323	II	8/19/2018	8/19/2017

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

## Test Equipment Used



Curtis-Straus LLC, a wholly owned subsidiary of BV CPS  
One Distribution Center Circle, #1 • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828





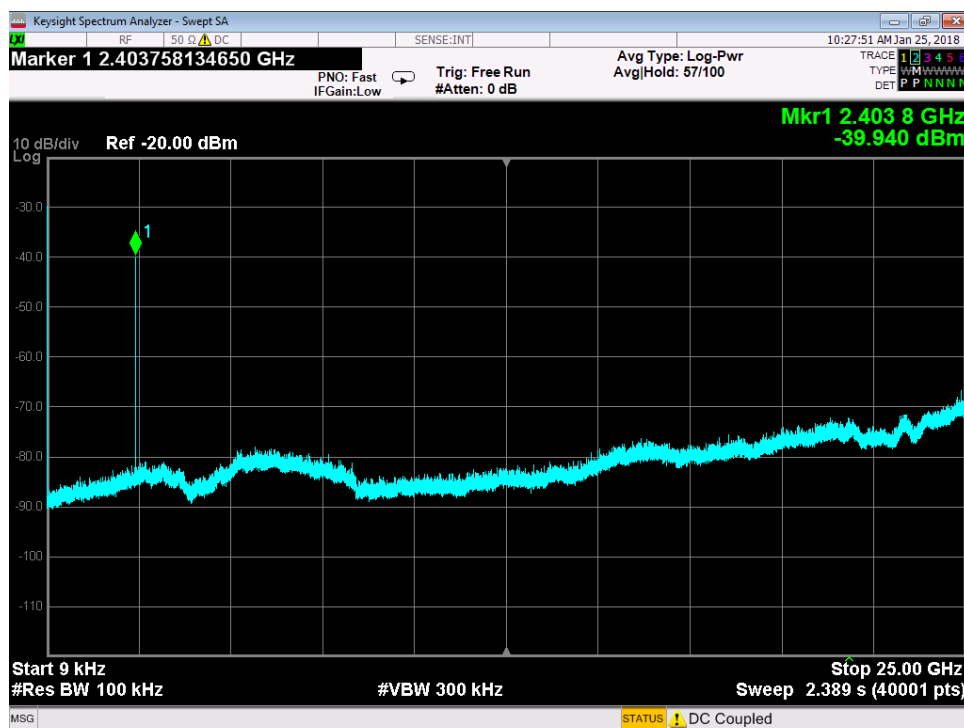
## Conducted Spurious Emissions

*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.*

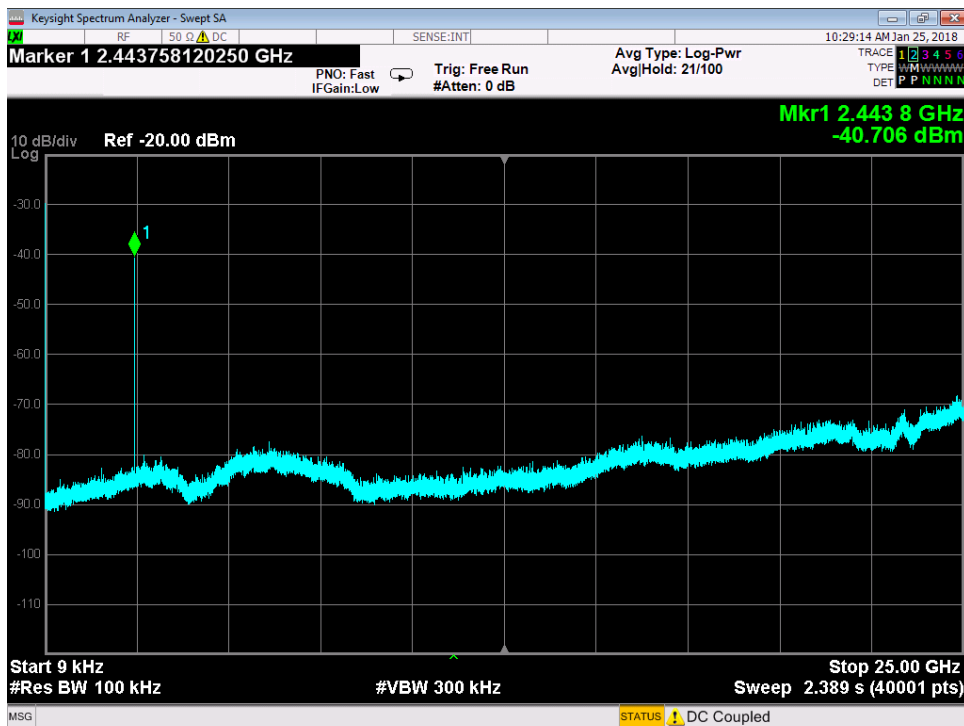
[15.247(d)]

## MEASUREMENTS / RESULTS

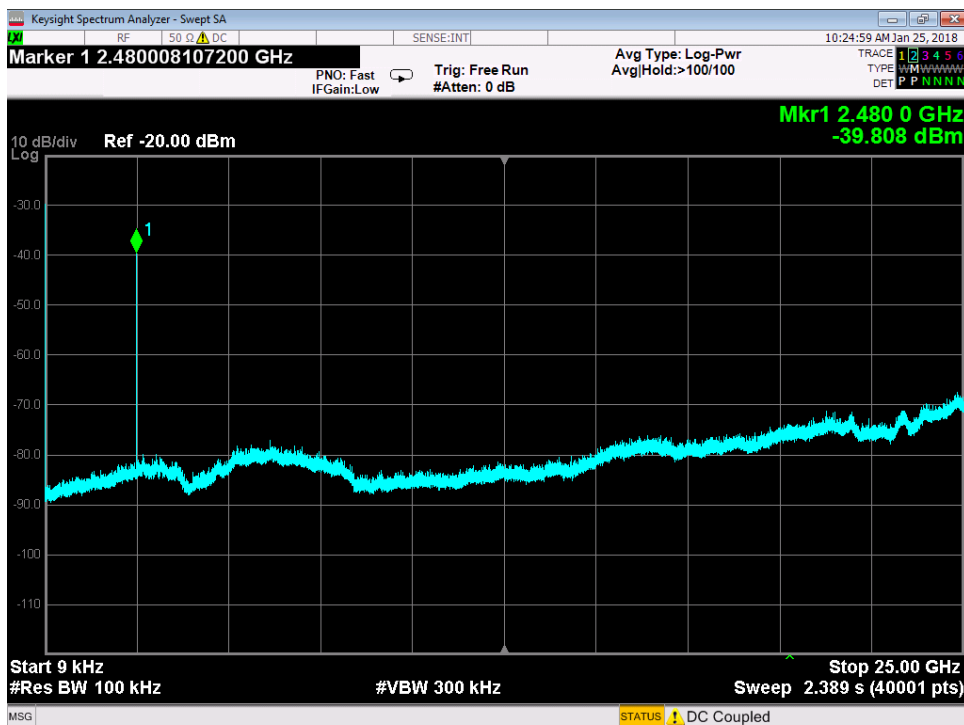
9kHz to 25GHz frequency range was investigated for 3 channels (low, middle and high) and no emissions within 20dB of their corresponding fundamentals were observed.



9kHz-25GHz Conducted Spurious (Low channel)



9kHz-25GHz Conducted Spurious (Mid channel)



9kHz-25GHz Conducted Spurious (High channel)

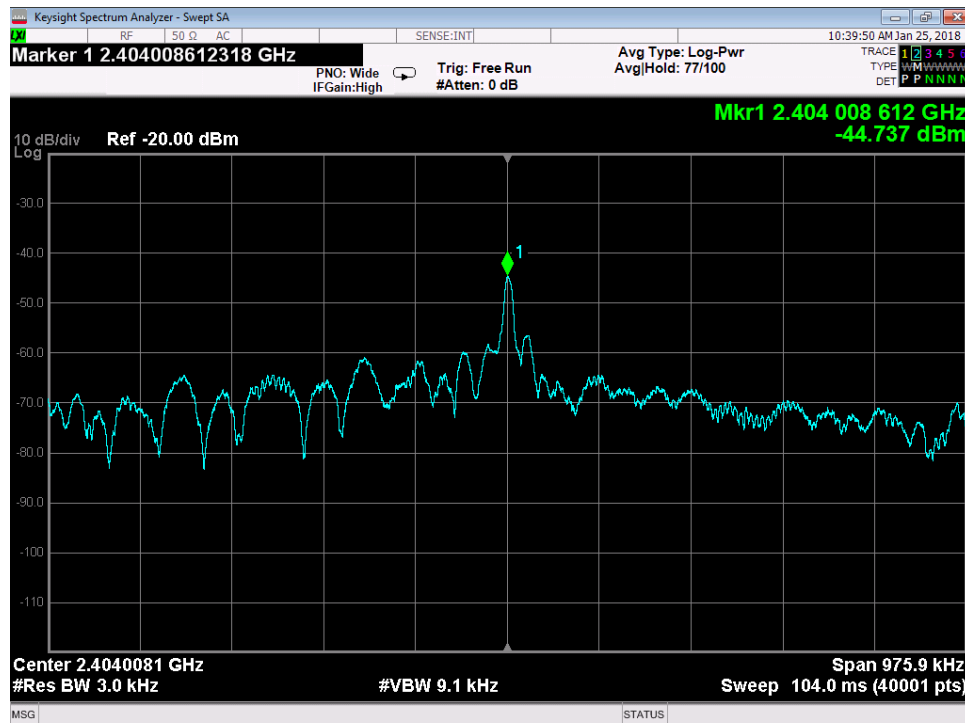
## Power Spectral Density

*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)]*

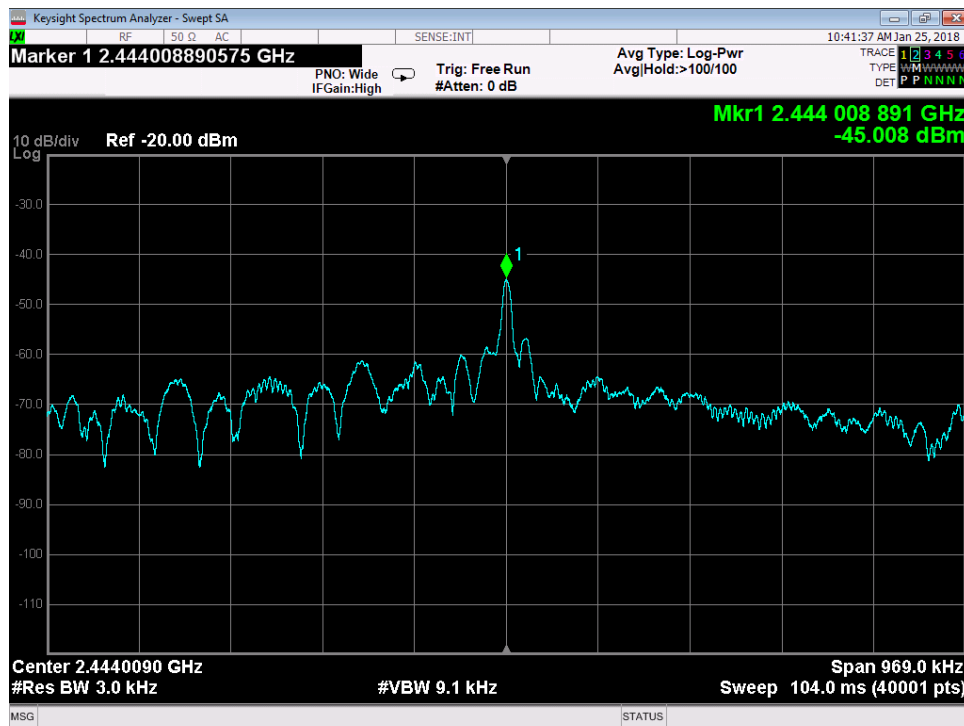
## MEASUREMENTS / RESULTS

Peak Power Spectral Density							
Date: 1/24/2017		Company: TowGo			Work Order: R3666		
Engineer: Zac Johnson		EUT: Steering Wheel Sensor with BLE			Operating Voltage/Frequency: 3.7V DC		
Temp: 21.8°C		Humidity: 32%		Pressure: 999mBar			
Frequency Range: 2404-2480 MHz				Measurement Type: Conducted			
Notes:							
Frequency	Peak Reading	Cable Loss	Attenuator Loss	Peak PSD	Limit	Margin	Result
(MHz)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)	
2404	-44.74	0.71	40.0	-4.03	8.0	-12.03	Pass
2444	-45.01	0.71	40.0	-4.30	8.0	-12.30	Pass
2480	-44.70	0.71	40.0	-3.99	8.0	-11.99	Pass
Test Site: EMC-3		Cable: 2213 Cbl		Attenuator: 2107 40dB Pad			
Analyzer: 1118472 SA							
PSD(dBm) = Reading (dBm) + Cable Loss (dB) + Attenuator Loss (dBm)							

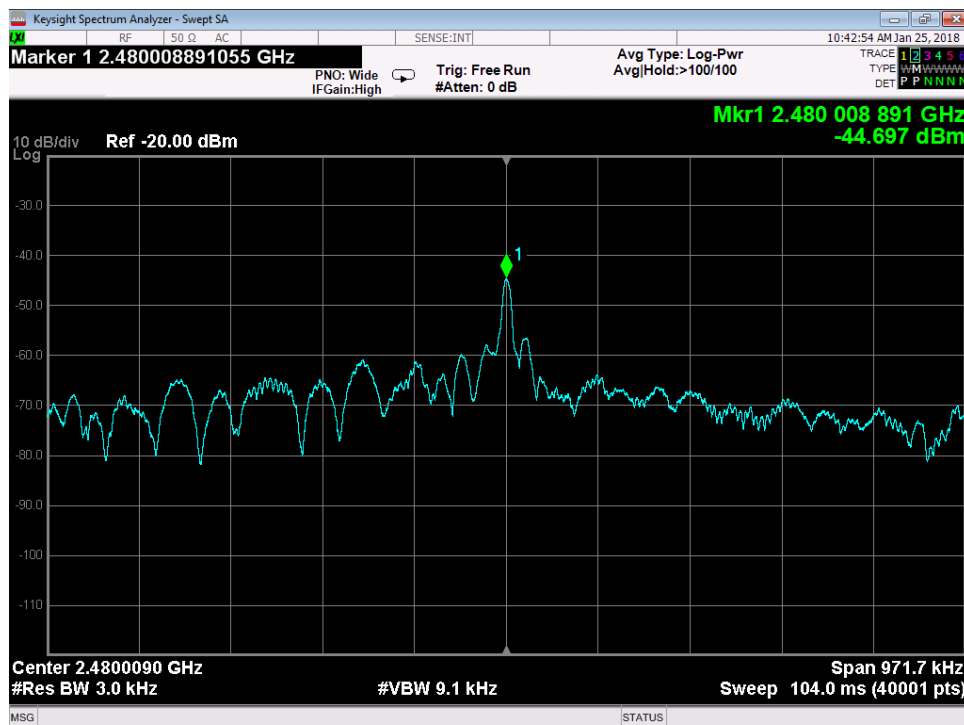
## PLOTS



Low Channel PSD



Middle Channel PSD



High Channel PSD

## Occupied Bandwidth

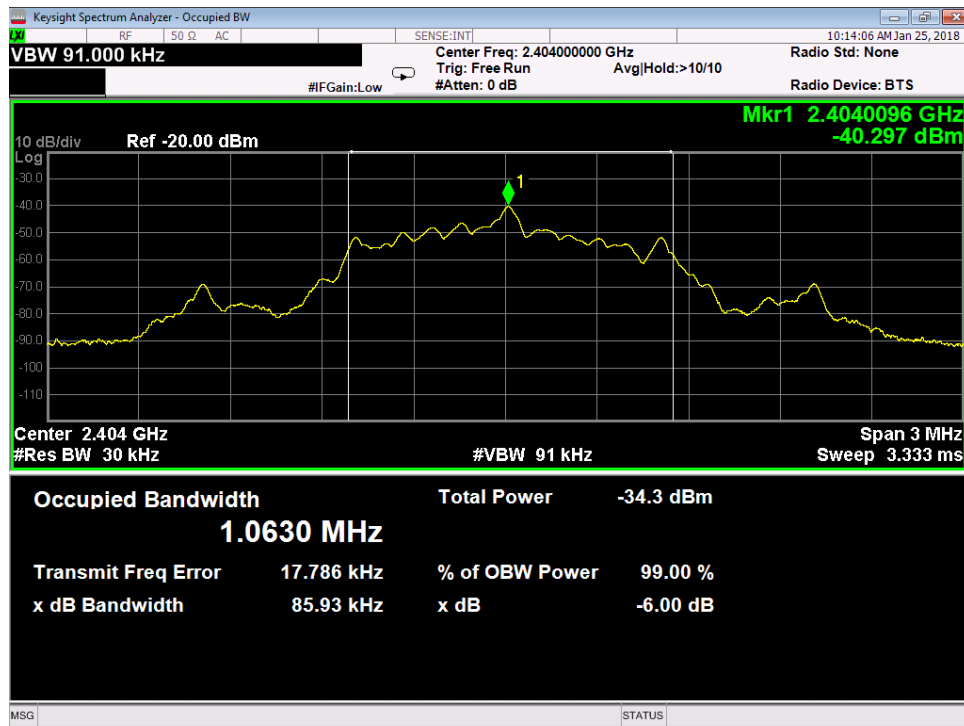
*Requirement: When an occupied bandwidth is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is its 99% emission bandwidth, as calculated or measured.*

[RSS-GEN 6.6]

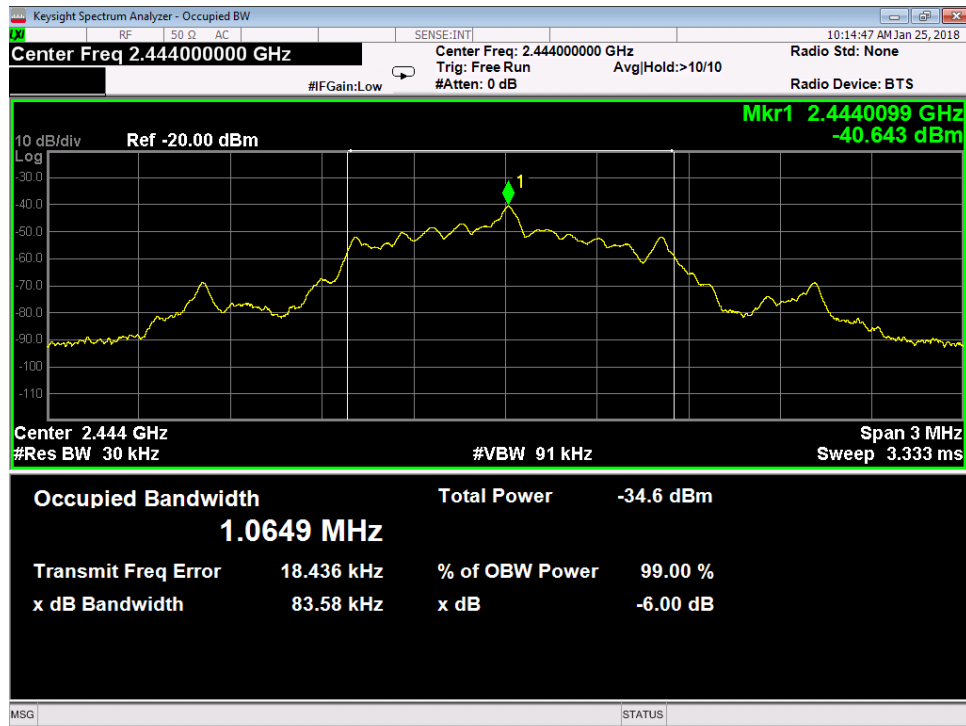
## MEASUREMENTS / RESULTS

99% Occupied Bandwidth			
Date: 1/24/2017		Company: TowGo	
Engineer: Zac Johnson		Work Order: R3666	
EUT: Steering Wheel Sensor with BLE		Operating Voltage/Frequency: 3.7V DC	
Temp: 21.8°C		Humidity: 32%	
Pressure: 999mBar			
Frequency Range: 2404-2480 MHz		Measurement Type: Conducted	
Notes:			
Frequency (MHz)	99% OBW (MHz)		
2404	1.063		
2444	1.065		
2480	1.062		
Test Site: EMC-3		Cable: 2213 Cbl	
Analyzer: 1118472 SA		Attenuator: 2107 40dB Pad	
Copyright Curtis-Straus LLC 2000			

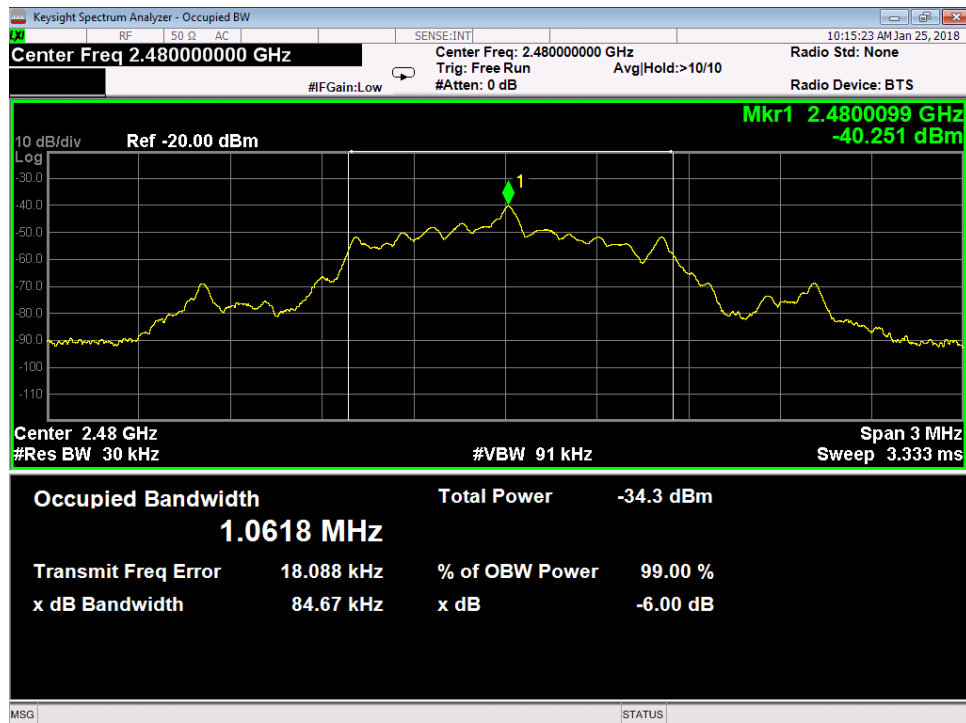
## PLOTS



99% Occupied Bandwidth Low Channel



99% Occupied Bandwidth Middle Channel



99% Occupied Bandwidth High Channel

**Test equipment below used for all conducted antenna port measurement tests within this report**

Rev. 1/23/2018

<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>	<b>Calibrated on</b>
Rental EXA Signal Analyzer(1118472)	9KHz-26.5GHz	N9010A-526;K	AT	MY51170010	1118472	I	7/25/2018	7/25/2017
<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>	<b>Calibrated on</b>
API - 40dB 100W Attenuator	0.009-18GHz	48-40-34	API Weinschel	CG7990	2107	II	10/4/2018	10/4/2017
<b>Cables</b>	<b>Range</b>		<b>Mfr</b>			<b>Cat</b>	<b>Calibration Due</b>	<b>Calibrated on</b>
Asset #2213	9KHz-18GHz		Mini-Circuits			II	10/4/2018	10/4/2017
<b>Meteorological Meters/Chambers</b>		<b>MN</b>	<b>Mfr</b>	<b>SN</b>	<b>Asset</b>	<b>Cat</b>	<b>Calibration Due</b>	<b>Calibrated on</b>
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	4/28/2018	4/28/2016
TH A#2078		HTC-1	HDE		2078	II	3/23/2018	3/23/2017

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



## 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	5.6dB	N/A
CISPR	4.6dB	5.2dB (Ucisp)
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	3.9dB	N/A
CISPR	3.6dB	3.6dB (Ucisp)
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

[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," "BVCPSP," "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.

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

