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FCC PART 15.247 FHSS

TEST REPORT

APPLICANT	Tattle-Trail LLC
ADDRESS	7887 Bryan Dairy Road Largo, FL 33377 USA
PROPOSED FCC ID	VNE001000101
PRODUCT DESCRIPTION	Towing Monitor System
DATE SAMPLE RECEIVED	April 7, 2008
DATE TESTED	April 7, 2008
TESTED BY	Mario de Aranzeta
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	678UT8TestReport.pdf
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**



Certificate # 0955-01

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ATTESTATION

The device under test does:

- ☒ fulfill the general approval requirements as identified in this test report
☐ not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.



Testing Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

I attest that the necessary measurements were made by me or under my supervision, at Timco Engineering, Inc. located at 849 N.W. State Road 45, Newberry, Florida 32669 USA.

AUTHORIZED BY: Mario de Aranzeta

SIGNATURE: On file

FUNCTION: Lab Supervisor/ Test Engineer

DATE: April 28, 2008

REPORT SUMMARY

Declaration of Report	The test result only related to the item tested.
Purpose of Test:	To demonstrate that the DUT is in compliant with FCC Pt 15.247 requirements for FHSS radio.
Applicable Standards:	FCC Pt 15.247, ANSI C63.4: 2003, ANSI TIA-603: 2004, FCC Pt 15.109
Related Reports:	N/A

TEST ENVIRONMENT AND TEST SETUP

Test Facilities:	All measurements were made at one or more of the test sites of TIMCO ENGINEERING INC. located at 849 N.W. State Road 45, Newberry, FL 32669.
Laboratory Test Conditions:	Temperature: 26°C, Humidity: 55%
Test Exercise:	The DUT was set in continuous transmit mode of operation.
Deviation to the Standards:	There was no deviation from the standard.
Modification to the DUT:	No modification was made.
Supporting Accessories:	None

DUT DESCRIPTION

Applicant:	Tattel-Trail LLC
Product Description	Towing Monitor System
FCC ID:	VNE001000101
Operating Frequency:	2405 ~ 2475 MHz
Max. Output Pwr:	21 dBm/ 125 mW
Power Source:	Primary Power – 12Vdc Secondary Power – N/A
Test Item:	Prototype
Type of Equipment	Mobile
Antenna	(Fixed) PCB type F
Antenna Connector	None

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3/10-Meter OATS	TEI	N/A	N/A	Listed 3/20/07	3/19/10
3-Meter OATS	TEI	N/A	N/A	Listed 1/11/06	1/10/09
Antenna: Biconnical	Eaton	94455-1	1057	CAL 12/12/07	12/12/09
Antenna: Biconnical	Eaton	94455-1	1096	CAL 10/11/06	10/11/08
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	CAL 7/18/07	7/18/09
Analyzer Blue Tower Quasi-Peak Adapter	HP	85650A	2811A01279	CAL 5/17/07	5/17/09
Analyzer Blue Tower RF Preselector	HP	85685A	2926A00983	CAL 5/17/07	5/17/09
Analyzer Blue Tower Spectrum Analyzer	HP	8568B	2928A04729 2848A18049	CAL 5/17/07	5/17/09
LISN	Electro-Metrics	ANS-25/2	2604	CAL 10/5/06	10/5/08
LISN	Electro-Metrics	EM-7820	2682	CAL 7/23/07	7/23/09
Antenna: Log-Periodic	Eaton	96005	1243	CAL 12/14/07	12/14/09

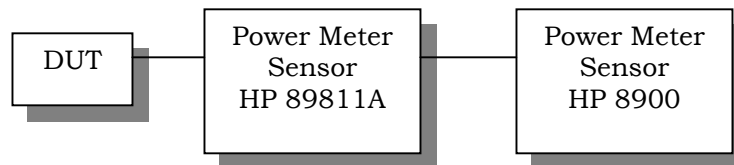
TEST PROCEDURES

Power Line Conducted Interference: The procedure used was ANSI C63.4-2003 using a 50uH LISN. Both lines were observed with the DUT transmitting. The resolution bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

Bandwidth 20 dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

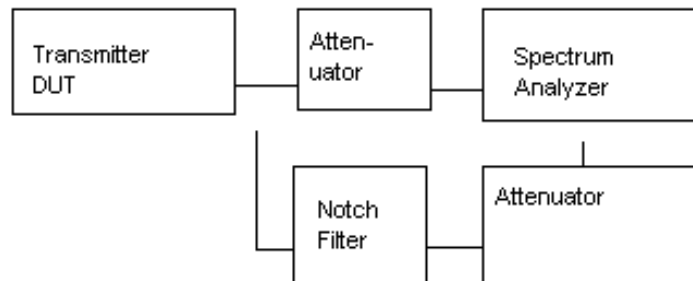
RF Power Output: The RF power output was measured at the antenna feed point using a peak power meter.

Output Power Test Setup Diagram



Antenna Conducted Emissions: The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10th Harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz. Power was measured by disconnecting the antennas and measuring across a 50 ohm load as recommended by the manufacturer using a peak power meter. The antenna is non-directional and doesn't exceed 6 dBi gain. The power output was measured at three places in the band highest is reported below.

Spurious Emissions at Antenna Terminals





Radiation Interference: The test procedure used was ANSI C63.4-2003 using an Agilent spectrum receiver with preselector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

Radiated Spurious Emissions Into Adjacent Restricted Band: An in band field strength measurement of the fundamental emission using the RBW and detector function required by ANSI C63.4-2003 and the FCC rules.

POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: 15.207

Requirements:

Emission Frequency (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak (QP)	Average (AV)
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.		

Test Data: Not applicable to this device. Automotive power source operated.

NUMBER OF HOPPING CHANNELS

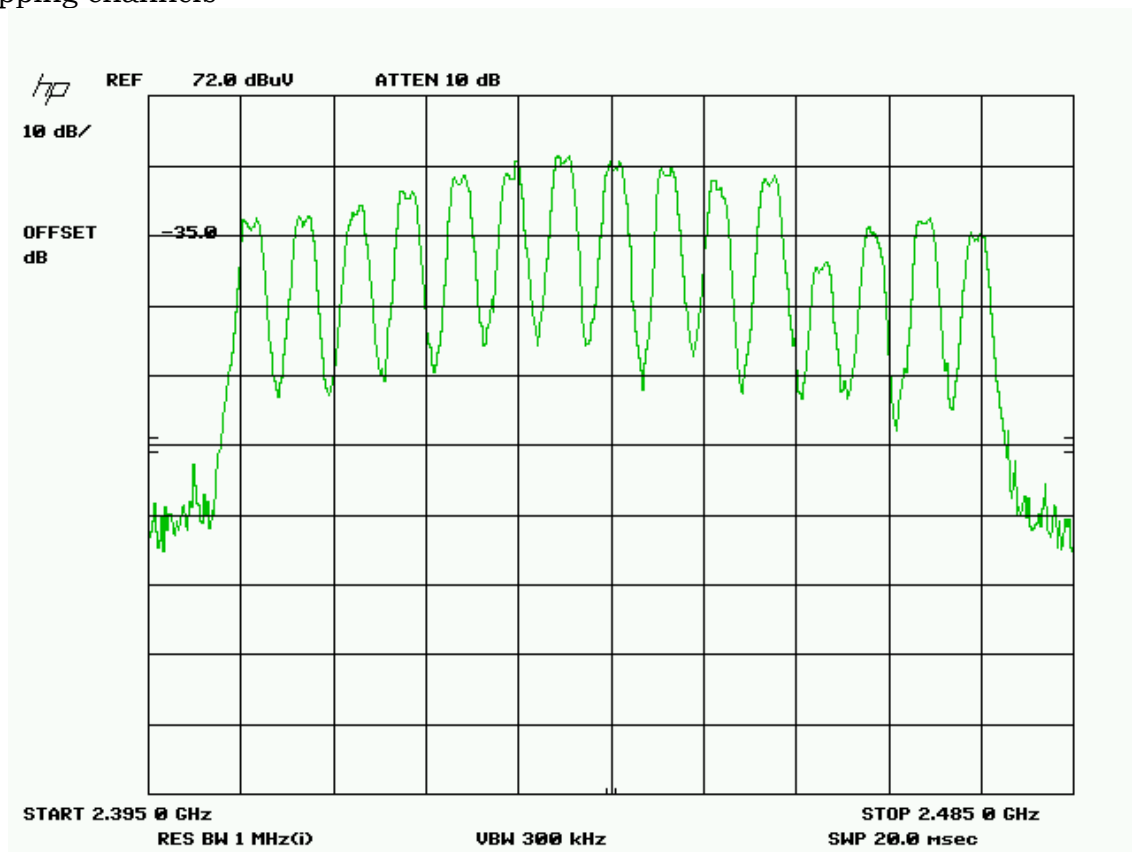
Rules Part No.: 15.247(a)(1)

Requirements:

902-928 MHz	If the 20 dB bandwidth is < 250 kHz, the system shall use at least 50 hopping frequencies.
	If the 20 dB bandwidth is 250 kHz or greater, the system shall use at least 25 hopping frequencies.
2400-2483.5 MHz	At least 15 channels
5725-5850 MHz	At least 75 channels

Test Data:

15 Hopping channels



DWELL TIME OF A HOPPING CHANNEL

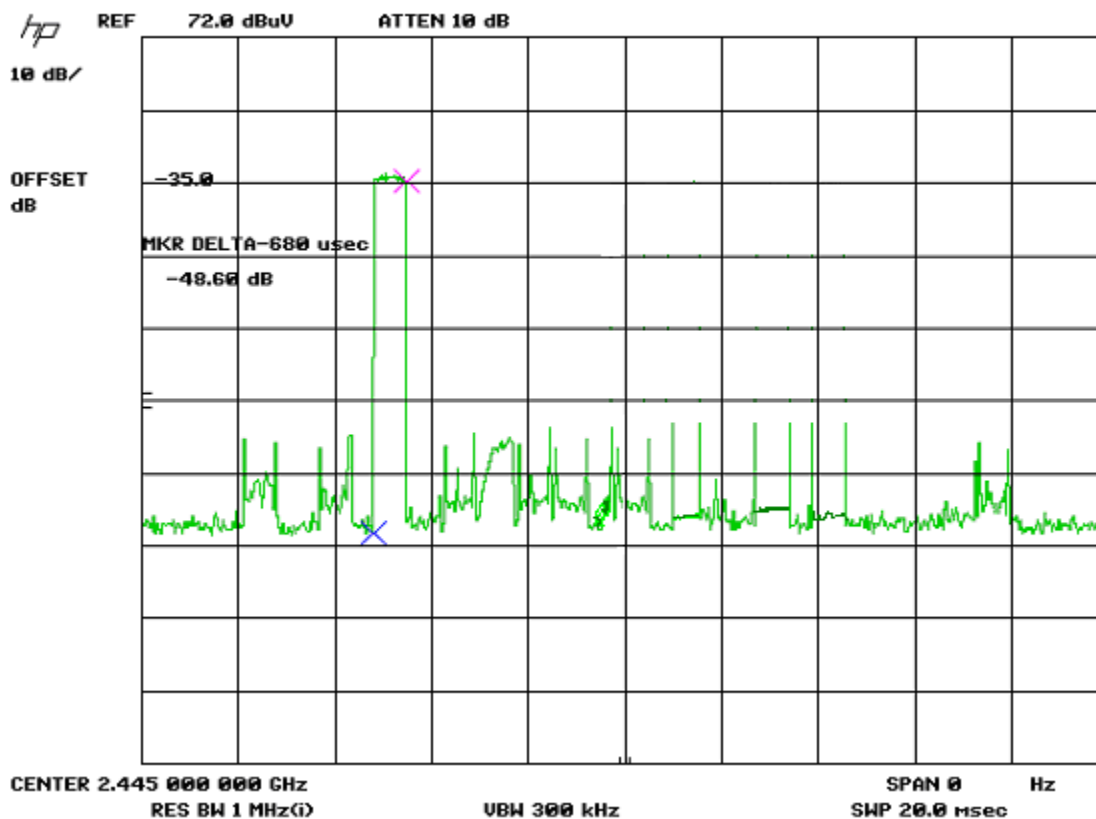
rules part no.: 15.247(a)(1)(i)

Requirements:

902-928 MHz	If 20 dB bandwidth is < 250 kHz, average time of occupancy of any frequency shall not exceed 0.4 sec in 20 seconds.
	If 20 dB bandwidth is 250 kHz or greater, dwell time < = 0.4 seconds n a 10 second period.
2400-2483.5 MHz	< = 0.4 seconds in a 0.4 seconds multiplied the number of hopping channels employed.
5725-5850 MHz	< = 0.4 seconds in a 30 second period.

Test Data: The dwell time is 700 usec per hop.

Three places in the band were measured and the worst case presented.



DUTY CYCLE

The period of the pulse train is determined by observing it on an oscilloscope or a spectrum analyzer with zero (0) frequency span. A plot is then made of the pulse train with a sweep time of 100 milliseconds. This sweep determines the duration of the pulse train. This sweep allows the determination of the number of and type of pulses, i.e. long & short. Plots are then made showing the duration of each type of pulse and its duration. From the 100-millisecond plot, the number of a given type of pulse is then multiplied by the duration of that type pulse. This allows the calculation of the amount of time the DUT is on within 100 ms.

Pulse Length	700 usec
Number of hops in 100 msec	10
On Time	7msec

$\text{dB} = 20 \cdot \log(\text{ON TIME}) / \text{PERIOD}$
 $\text{dB} = 20 \cdot \log(7 / 100)$
 $\text{dB} = 20 \cdot \log(.07)$
 $\text{dB} > -20$

See dwell time plot.

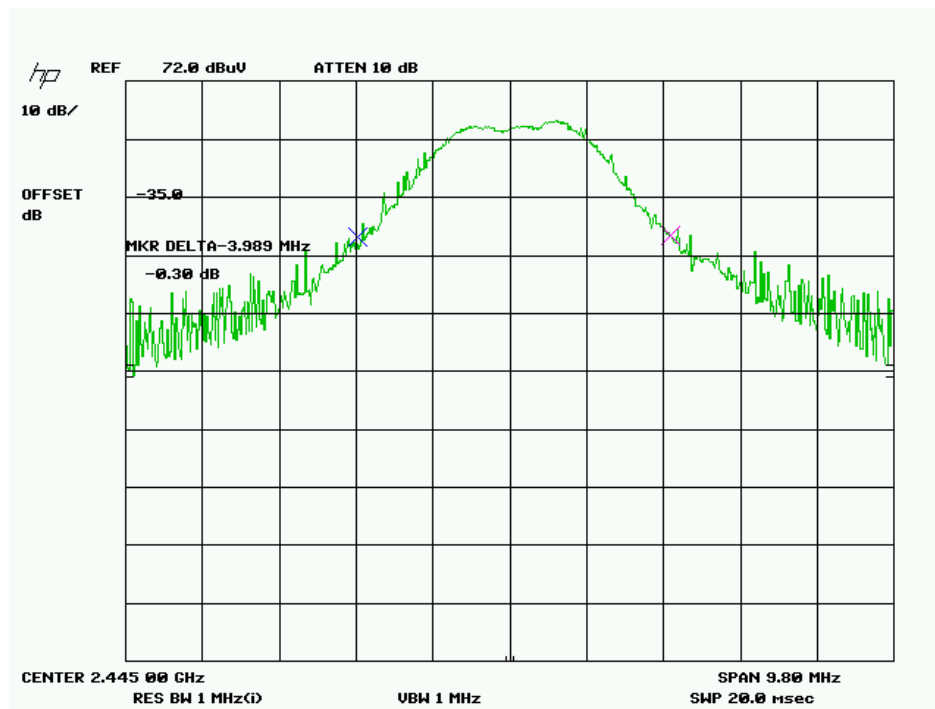
20 dB BANDWIDTH

Rules Part No.: 15.247(a)(2)

Requirements:

Test Data: See the following plot(s)

4 MHz



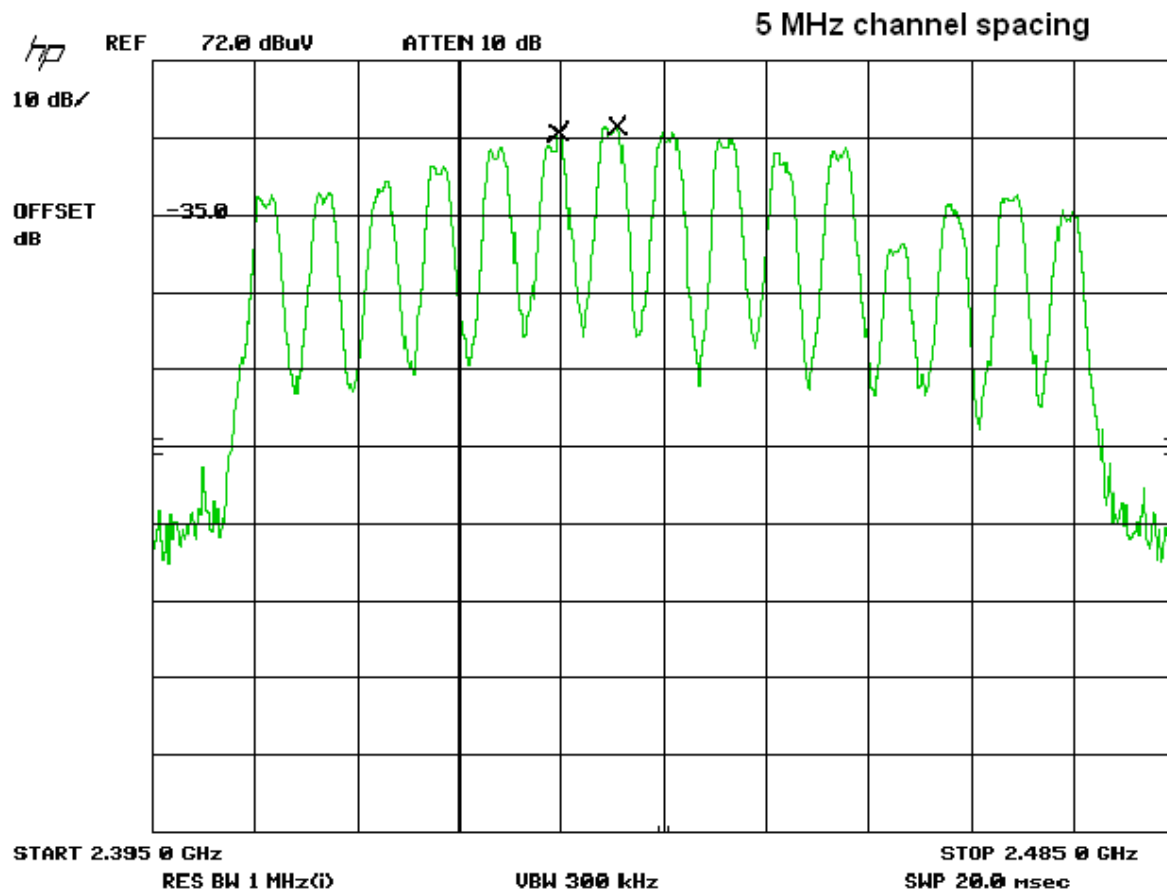
Three places in the band were measured and the worst case presented above.

CARRIER FREQUENCY SEPARATION

Rules Part No.: 15.247(a)(2)

Requirements: The hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Test Data: See the following plot



POWER OUTPUT

Rules Part No.: 15.247(b)

Requirements: The maximum peak output power shall not exceed 1 watt (30 dBm). If directional transmitting antennas with a gain of more than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Data: The power reported is conducted. A special test sample was used.

Frequency MHz	Power mW
2405	12.5
2445	125
2475	5.6

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Rules Part No.: 15.247(c)

Requirements: Emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

Note: The spectrum was scanned to the tenth harmonic.

TEST DATA: N/A The device under test has an integral antenna.

FIELD STRENGTH OF SPURIOUS EMISSIONS

Rules Part No.: 15.247(c), 15.205 & 15.209(b)

Requirements:

§15.247(c) & §15.205	
(Fundamental) Frequency	(Field Strength) Limits
902 – 928 MHz 2.4 – 2.4835 GHz	127.37 dBuV/m
	54 dBuV/m @ 3m
§15.209	
30 - 88 MHz	40 dBuV/m @ 3M
88 - 216 MHz	43.5 dBuV/m @ 3M
216 - 960 MHz	46 dBuV/m @ 3M
Above 960 MHz	54 dBuV/m

Emissions that fall in the restricted bands (15.205) must be less than or equal to 500 uV/m (54 dBuV/m). Spurious not in a restricted band must be 20 dBc.

Harmonics were measured to the 10th harmonic.

Test Data:

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity V/H	Coax Loss dB	Duty cycle CF dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
2,405.0	2,385.0*	38.3	V	3.17	Pk	32.20	73.67	0.33
2405.0	2385.0*	38.3	V	3.17	20Ave	32.20	53.67	0.33
2,405.0	2,389.6*	38.0	V	3.17	Pk	32.21	73.38	0.62
2405.0	2389.6*	38.0	V	3.17	20Ave	32.21	53.38	0.62
2,405.0	2,405.00	77.0	V	3.18	Pk	32.25	112.43	14.95
2,405.0	4,810.0*	7.7	V	4.91	Pk	34.10	46.71	7.29
2,405.0	4,819.0*	8.0	V	4.91	Pk	34.10	47.01	6.99
2,405.0	7,215.0	14.5	V	5.73	Pk	36.04	56.27	17.73
2,405.0	9,620.0	8.0	V	6.79	Pk	36.72	51.51	2.49

All readings are peak unless marked otherwise.

*= Restricted band frequency

[Continued]

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity V/H	Coax Loss dB	Duty cycle CF dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
2,445.0	2,386.0*	37.9	V	3.17	Pk	32.20	73.27	0.73
2,445.0	2,386.0*	37.9	V	3.17	20Ave	32.20	53.27	0.73
2,445.0	2,445.0	84.0	V	3.21	Pk	32.36	119.57	7.81
2,445.0	2,483.6*	37.2	V	3.24	Pk	32.46	72.90	1.10
2445.0	2483.6*	37.2	V	3.24	20Ave	32.46	52.90	1.10
2,445.0	4,890.0*	23.8	V	4.95	Pk	34.10	62.85	11.15
2445.0	4890.0*	23.8	V	4.95	20Ave	34.10	42.85	11.15
2,445.0	7,335.0*	25.7	V	5.80	Pk	36.07	67.57	6.43
2445.0	7335.0*	25.7	V	5.80	20Ave	36.07	47.57	6.43
2,445.0	9,779.0	13.8	V	6.83	Pk	36.88	57.51	42.06
2,445.0	12,226.0*	6.0	V	7.96	Pk	38.88	52.84	1.16
2,475.0	2,475.0	73.7	V	3.23	Pk	32.44	109.37	18.01
2,475.0	2,483.5*	38.0	V	3.24	Pk	32.46	73.70	0.30
2,475.0	2,483.5*	38.0	V	3.24	20Ave	32.46	53.70	0.30
2,475.0	2,485.7*	37.1	V	3.24	Pk	32.46	72.80	1.20
2,475.0	2,485.7*	37.1	V	3.24	20Ave	32.46	52.80	1.20
2,475.0	4,950.0*	8.5	V	4.98	Pk	34.10	47.58	6.42
2,475.0	7,425.0*	11.0	V	5.86	Pk	36.09	52.95	0.95

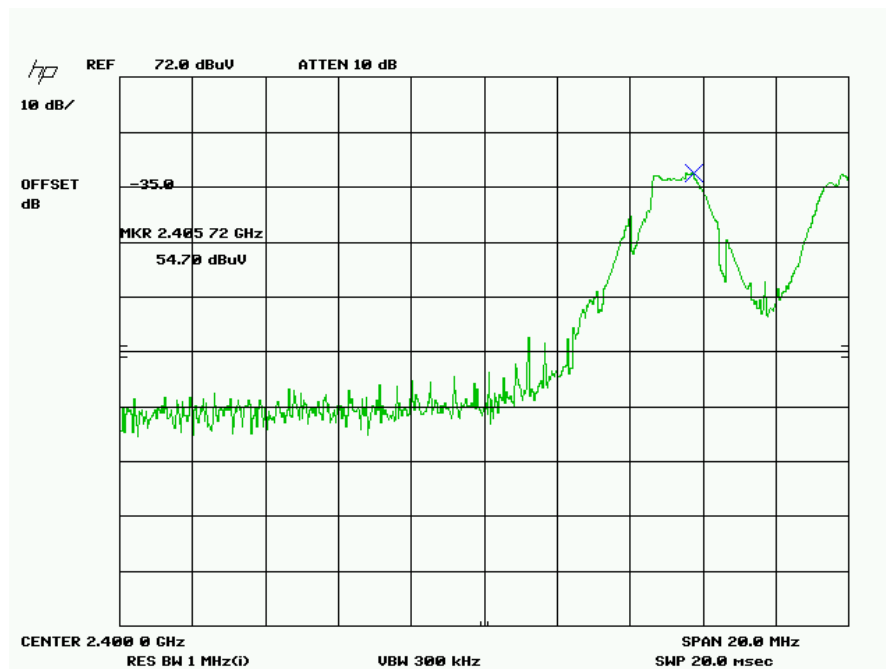
RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

Rule Parts No.: Pt 15.205

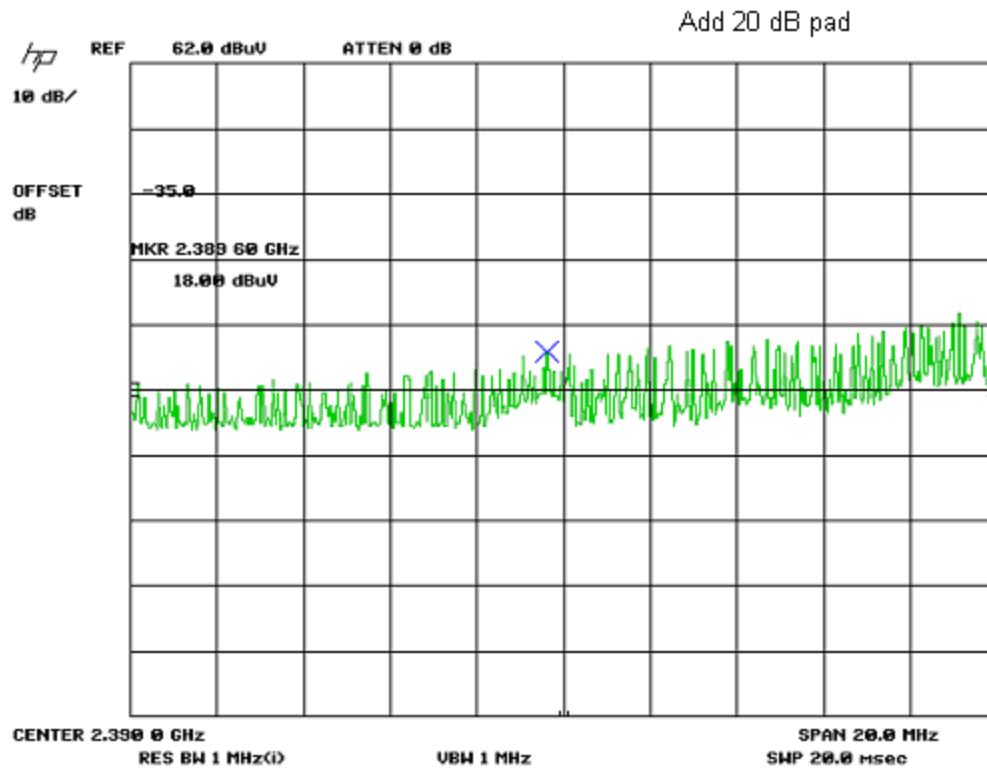
Requirements: Emissions that fall in the restricted bands (15.205). These emissions must be less than or equal to 500 uV/m (54dBuV/m). Emissions not in the restricted band must be 20 dBc.

Test Data: The plots are presented below.

Lower bandedge (Peak): 20 dBc

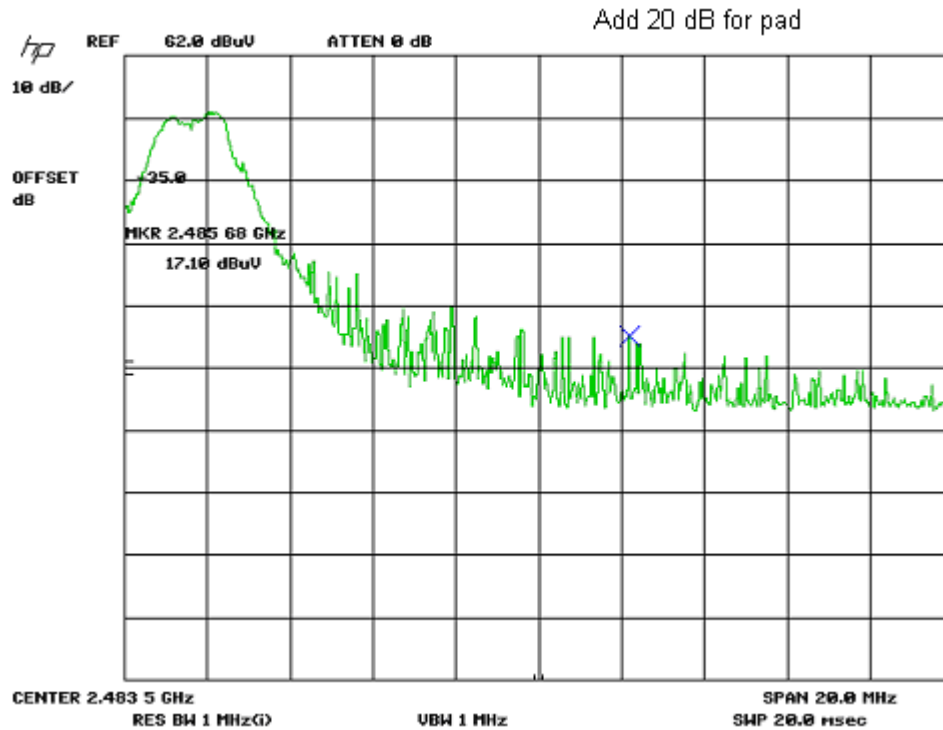


Lower adjacent restricted band



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity V/H	Coax Loss dB	Duty cycle CF dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
2,405.0	2,385.0*	38.3	V	3.17	Pk	32.20	73.67	0.33
2405.0	2385.0*	38.3	V	3.17	20Ave	32.20	53.67	0.33
2,405.0	2,389.6*	38.0	V	3.17	Pk	32.21	73.38	0.62
2405.0	2389.6*	38.0	V	3.17	20Ave	32.21	53.38	0.62

Upper bandedge (peak value)



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity V/H	Coax Loss dB	Duty cycle CF dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
2,475.0	2,483.5*	38.0	V	3.24	Pk	32.46	73.70	0.30
2,475.0	2,483.5*	38.0	V	3.24	20Ave	32.46	53.70	0.30
2,475.0	2,485.7*	37.1	V	3.24	Pk	32.46	72.80	1.20
2,475.0	2,485.7*	37.1	V	3.24	20Ave	32.46	52.80	1.20