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TEST REPORT PER FCC PT 15.247 FHSS

APPLICANT	HOBICO INC.
ADDRESS	2904 RESEARCH ROAD CHAMPAIGN IL 61821 USA
FCC ID	IYFTTX404
PRODUCT DESCRIPTION	2.4GHz REMOTE CONTROL TRANSMITTER
DATE SAMPLE RECEIVED	6/26/2009
DATE TESTED	7/6/2009
TESTED BY	Joe Scoglio
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	1432AUT9TestReport.doc
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.**



Testing Certificate #0955-01



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ATTESTATION

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

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025:2005 requirements.

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.



Testing Certificate #0955-01

AUTHORIZED BY: Mario de Aranzeta



SIGNATURE:

FUNCTION: Lab Supervisor/ Test Engineer

DATE: 7/7/2009

APPLICANT: HOBBICO INC.

FCC ID: IYFTTX404

REPORT: H\HOBBICO\1432AUT9\1432AUT9TestReport.doc

REPORT SUMMARY

Disclaimer:	The test results relate only to the items tested.
Purpose of Test:	To demonstrate that the DUT is compliant with FCC Pt 15.247 requirements for a 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

DUT Description	2.4GHz REMOTE CONTROL TRANSMITTER
FCC ID	IYFTTX404
Model Number	TTX404
Maximum Output Power	
Operating Frequency	2403-2380 MHz
Type of Modulation	
DUT Power Source	<input type="checkbox"/> 110-120Vac/50- 60Hz
	<input type="checkbox"/> DC Power
	<input checked="" type="checkbox"/> Battery Operated Exclusively
Test Item	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
Type of Equipment	<input type="checkbox"/> Fixed
	<input type="checkbox"/> Mobile
	<input checked="" type="checkbox"/> Portable

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 2/5/09	2/5/12
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 5/11/07	5/11/10
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 11/30/07	11/30/09
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 11/30/07	11/30/09
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 11/30/07	11/30/09
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 11/30/07	11/30/09
Frequency Counter	HP	5385A	2730A03025	CAL 7/6/07	7/6/09
Hygro-Thermometer	Extech	445703	0602	CAL 11/15/07	11/15/09
Antenna: Log-Periodic	Electro-Metrics	LPA-30	409	CAL 7/18/08	7/18/09
Measuring Tape-7.5M	Kraftixx	7.5M PROFI		CHAR 11/13/07	11/13/09
System One	Audio Precision	System One	SYS1-45868	CHAR 2/27/08	2/27/10
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 4/25/08	4/25/10

APPLICANT: HOBBICO INC.

FCC ID: IYFTTX404

REPORT: H\HOBBICO\1432AUT9\1432AUT9TestReport.doc

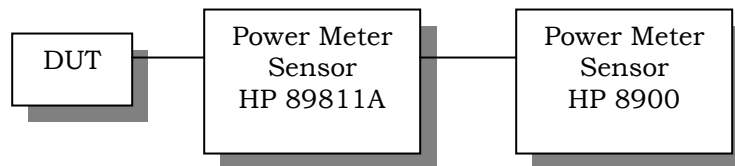
TEST PROCEDURES

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.

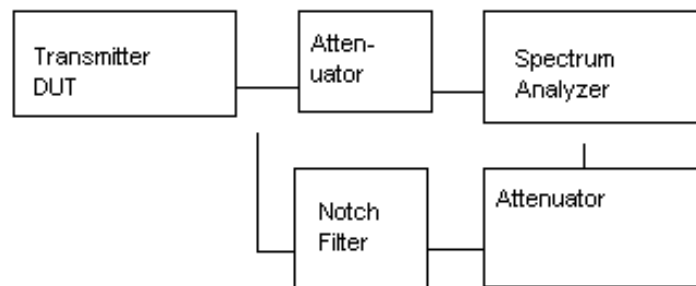
RF Power Output: The RF power output was measured at the antenna feed point using a peak power meter.

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 (dBμV)	
	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: The following plots represent the emissions read for power line conducted. Both lines were observed

NOTE DUT BATTERY POWERED ONLY

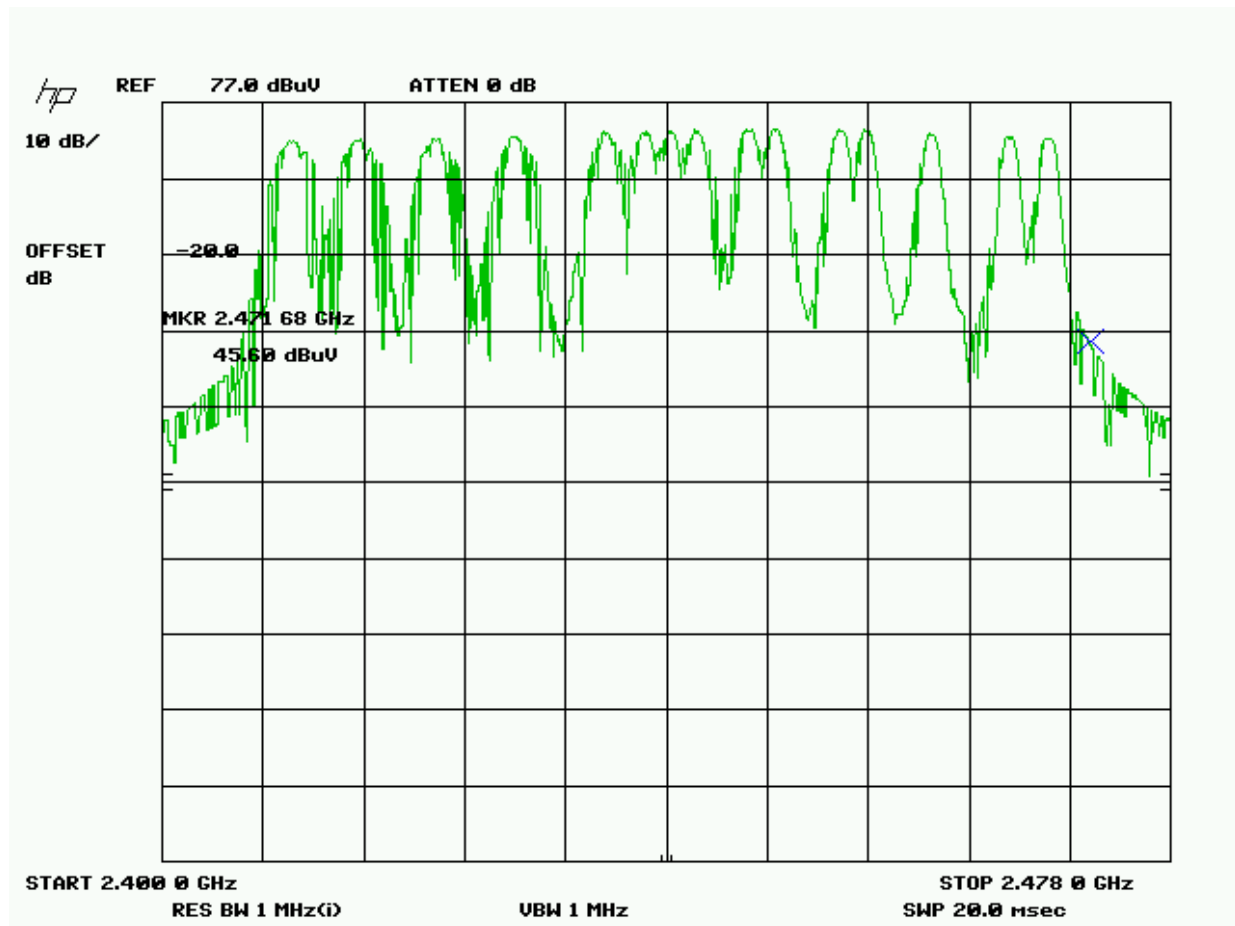
NUMBER OF HOPPING CHANNELS

Rules Part No.: 15.247(a)(1), RSS-210

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: There are 15 hopping channels



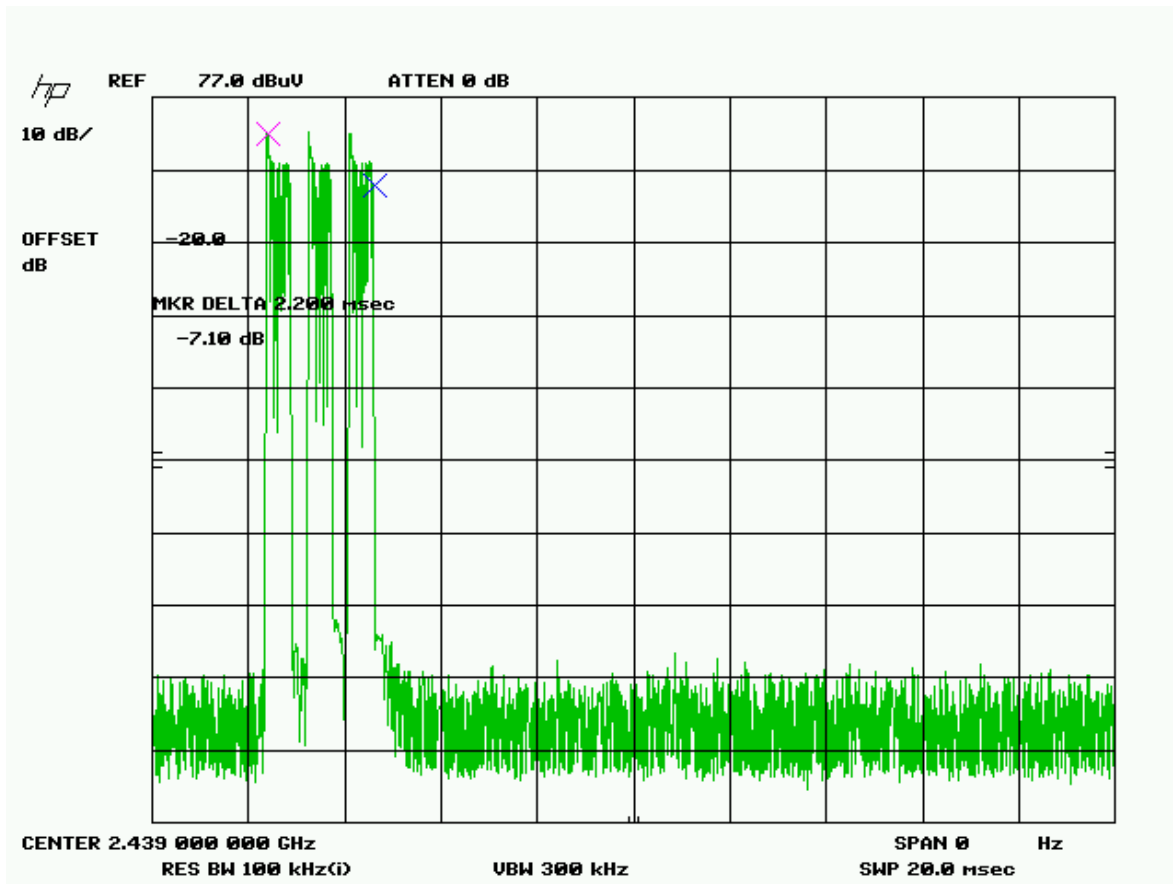
DWELL TIME OF A HOPPING CHANNEL

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 2.2 ms per hop.
 Three places in the band were measured and the worst case presented.



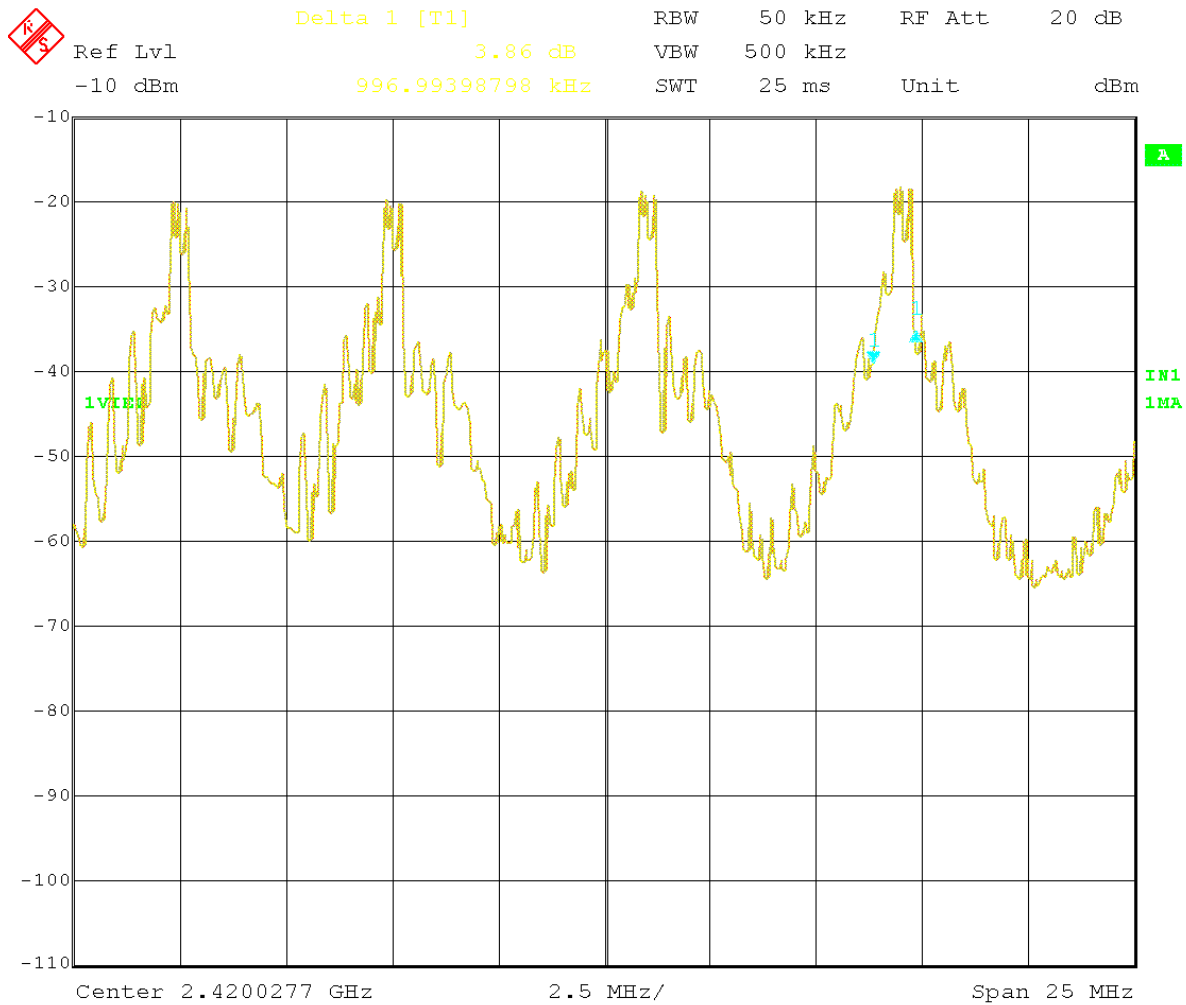
20 dB BANDWIDTH

RULES PART NO.: 15.247(a)(2), RSS-210

REQUIREMENTS:

TEST DATA: See the following plot(s).

1 MHz



Date: 31.JUL.2009 10:49:00

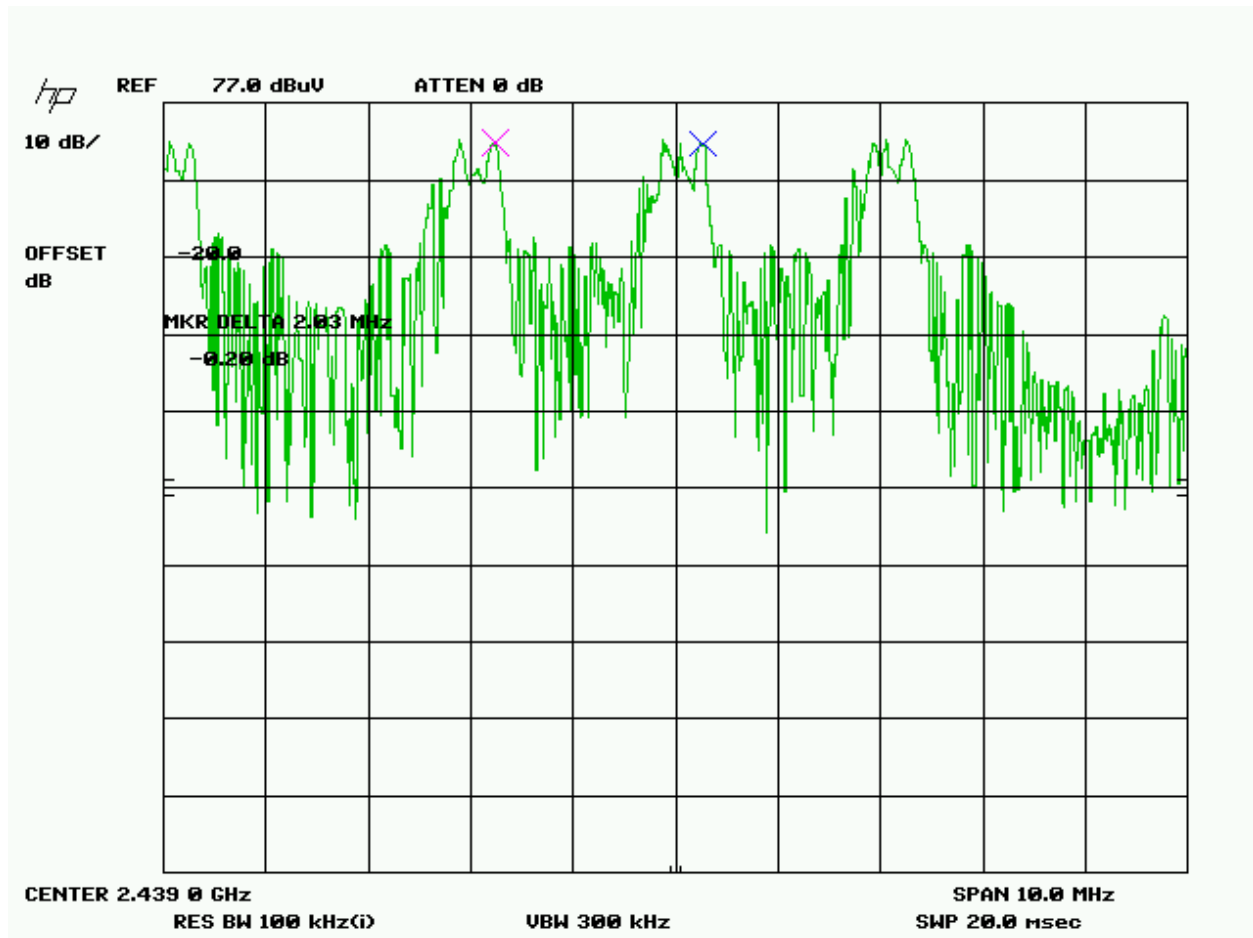
Three places in the band were measured and the worst case presented above.

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. 2.03 MHz



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 device under test has an integral antenna and the power was measured on a radiated basis.

Frequency MHz	Power (EIRP) W
2405	0.110
2442	0.105
2478	0.102



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:

Not applicable.

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 – 928MHz 2.4 – 2.4835GHz	127.37dBuV/m
§15.209	
30 - 88 MHz	40 dBμV/m @3M
88 -216 MHz	43.5 dBμV/m @3M
216 -960 MHz	46 dBμV/m @3M
ABOVE 960 MHz	54 dBμV/m

Emissions that fall in the restricted bands (15.205) must be less than or equal to 500 μV/m (54 dBμV/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 dBμV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBμV/m	Margin dB
2,405.0	2,405.00	74.3	H	3.18	32.25	20	89.73	37.64
2,405.0	2,405.00	81.9	V	3.18	32.25	20	97.33	30.04
2,405.0	4,810.00 R	21.4	H	4.91	34.10	20	40.41	13.59
2,405.0	4,810.00 R	23.3	V	4.91	34.10	20	42.31	11.69
2,405.0	7,215.00	23.1	H	5.73	36.04	20	44.87	32.46
2,405.0	7,215.00	24.3	V	5.73	36.04	20	46.07	31.26
2,405.0	9,620.00	21.3	H	6.79	36.72	20	44.81	32.52
2,405.0	9,620.00	24.7	V	6.79	36.72	20	48.21	29.12
2,405.0	14,430.00	7.7	H	9.07	39.93	20	36.70	40.63
2,405.0	14,430.00	9.6	V	9.07	39.93	20	38.60	38.73
2,442.0	2,442.00	70.9	H	3.21	32.35	20	86.46	40.91
2,442.0	2,442.00	80.3	V	3.21	32.35	20	95.86	31.51
2,442.0	4,884.00 R	27.6	H	4.94	34.10	20	46.64	7.36
2,442.0	4,884.00 R	29.0	V	4.94	34.10	20	48.04	5.96
2,442.0	7,326.00 R	23.1	H	5.80	36.07	20	44.97	9.03
2,442.0	7,326.00 R	23.7	V	5.80	36.07	20	45.57	8.43

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TEST DATA CONTD.

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB μ V	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dB μ V/m	Margin dB
2,442.0	9,768.00	23.3	V	6.83	36.87	20	47.00	28.86
2,442.0	9,768.00	24.7	H	6.83	36.87	20	48.40	27.46
2,442.0	12,210.00 R	5.5	V	7.95	38.87	20	32.32	21.68
2,442.0	12,210.00 R	6.9	H	7.95	38.87	20	33.72	20.28
2,478.0	2,478.00	71.9	H	3.23	32.44	20	87.57	39.80
2,478.0	2,478.00	79.0	V	3.23	32.44	20	94.67	32.70
2,478.0	4,956.00 R	24.9	H	4.98	34.10	20	43.98	10.02
2,478.0	4,956.00 R	25.3	V	4.98	34.10	20	44.38	9.62
2,478.0	7,434.00 R	22.9	H	5.86	36.09	20	44.85	9.15
2,478.0	7,434.00 R	23.7	V	5.86	36.09	20	45.65	8.35
2,478.0	9,912.00	18.8	V	6.87	37.01	20	42.68	31.99
2,478.0	9,912.00	20.9	H	6.87	37.01	20	44.78	29.89
2,478.0	12,390.00 R	7.2	H	8.07	39.01	20	34.28	19.72
2,478.0	12,390.00 R	7.7	V	8.07	39.01	20	34.78	19.22

NOTE: DUTY CYCLE 20 dB

All readings are peak unless marked otherwise.

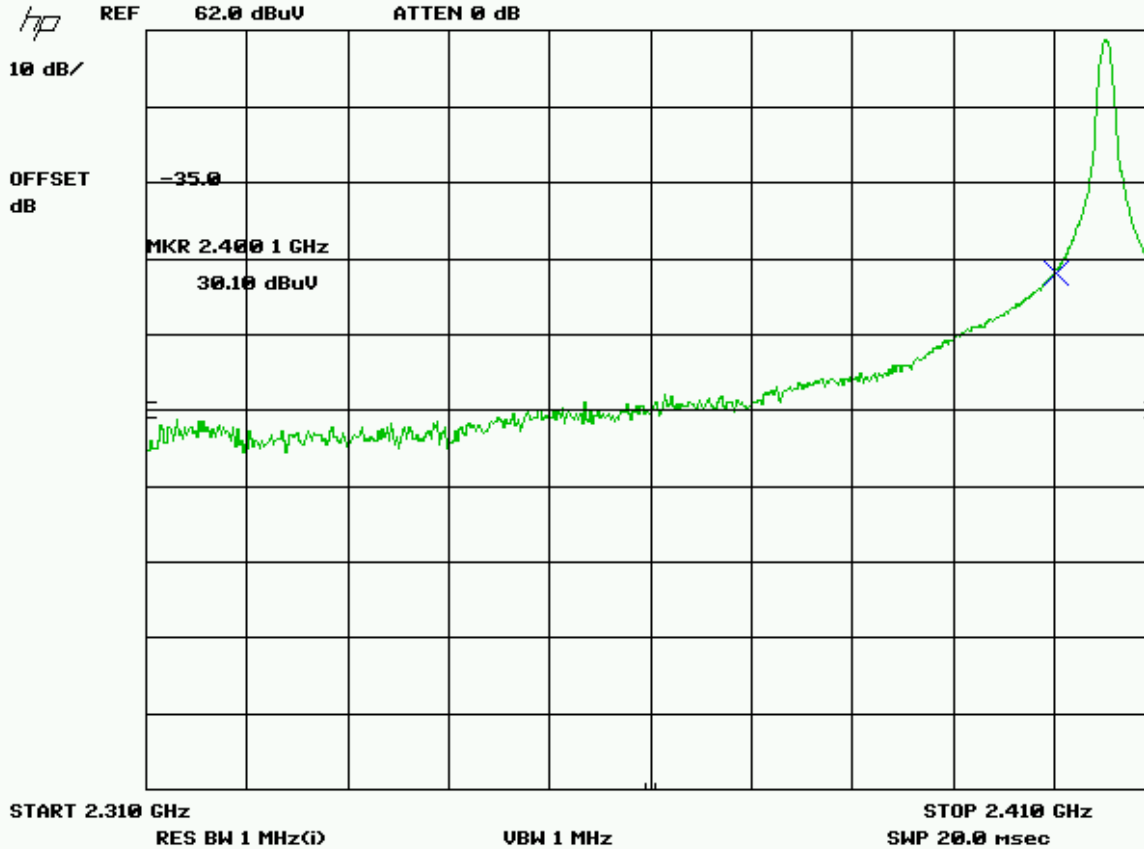
P= Peak, A= Average, R= Restricted band frequency

Harmonics were checked through the 10th harmonic.

RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

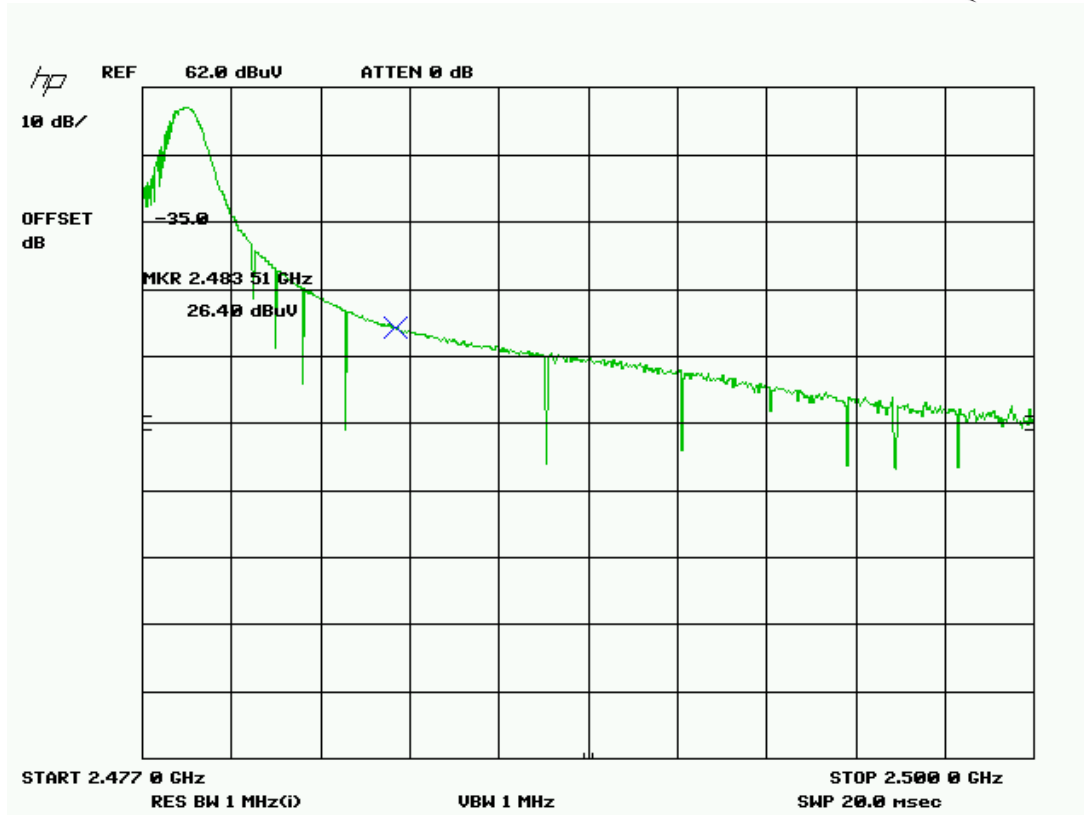
REQUIREMENTS: Emissions that fall in the restricted bands (15.205). These emissions must be less than or equal to 500 $\mu\text{V}/\text{m}$ (54 $\text{dB}\mu\text{V}/\text{m}$). Emissions not in the restricted band must be 20 dBc .

TEST DATA: The plots are presented below.



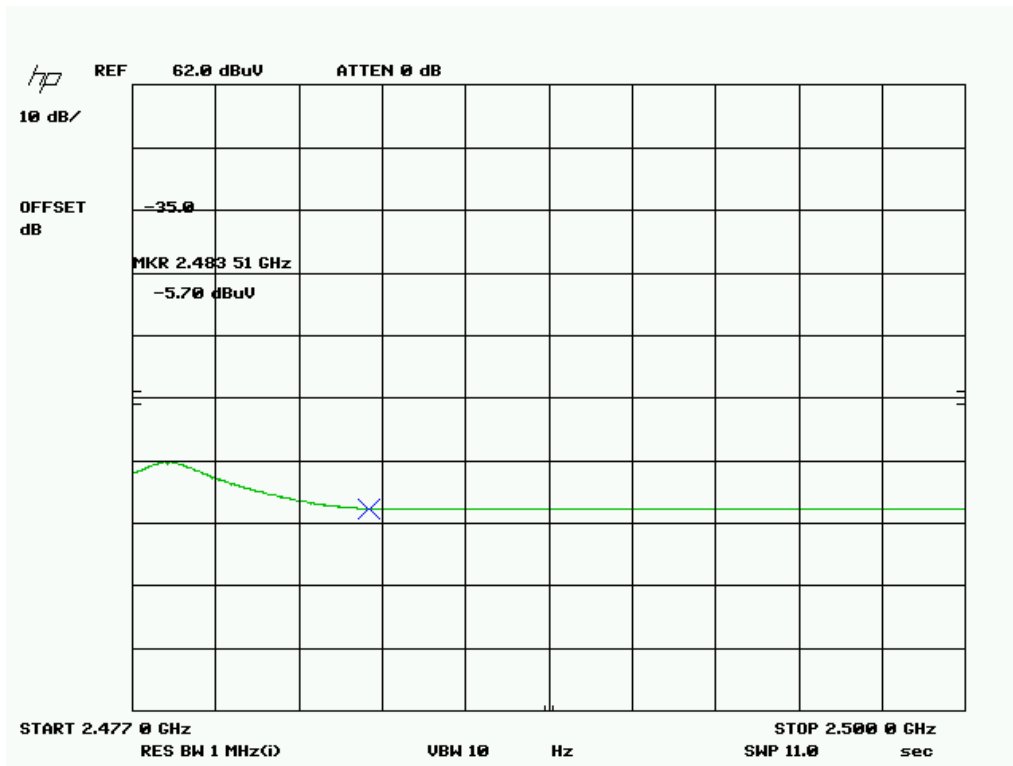
Lower band edge Peak 20 dB pad

Frequency MHz	Polarity V/H	Meter reading dB μV	Coax Loss dB	Correction Factor dB/m	Duty cycle C.F. dB	Field strength dB $\mu\text{V}/\text{m}$	Peak/Average P or A
2400.0	V	30.1	3.18	32.2	20	45.48	P



Upper bandedge (peak value) 20 dB pad

Frequency MHz	Meter Reading dB μ V	Polarity V/H	Coax Loss dB	Correction Factor dB/m	Duty cycle C.F. dB	Field strength dB μ V/m	Peak/Average P or A
2483.5	46.4	V	3.25	32.4	20	62.05	P
2483.5	14.6	V	3.25	32.4	20	30.25	A



Add 20 dB to account for pads

DUTY CYCLE

For this device the duty cycle calculation per any 100msec period is:

$$20*\log(\text{on time in 100 ms})$$
$$20* \log ((0.5 *3)/18).$$

$$20*\log(6.6/100)$$
$$=21.6 \text{ dB}$$

20 dB was taken.

Description: The operational description states that the wave train is 2.5 milliseconds (ms) long with a 0.5 ms on time and a 0.5 ms off time repeated 3 times. The device then hops to the next channel 18 ms later.