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FCC PART 15.231 TEST REPORT

LOW POWER UNLICENSED TRANSMITTER

Applicant	MATRIX PRODUCT DEVELOPMENT, INC.
Address	13 N. BIRD STREET SUN PRAIRIE, WI 53590
FCC ID	VGCTP1000
Product Description	BASE STATION TRANSCEIVER
Date Sample Received	OCTOBER 19, 2007
Date Tested	OCTOBER 30, 2007
Tested By	NAM NGUYEN
Approved By	Mario de Aranzeta
Timco Report No.	3312AUT7TestReport.doc
Test Results	☒ Pass ☐ Fail

ACCREDITED
Certificate # 0955-01

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

Summary

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.

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

Authorized Signatory Name: *Mario de Aranzeta*

Mario de Aranzeta C.E.T.
Compliance Engineer/ Lab. Supervisor

Date: 11/5/2007

Tested By: Nam Nguyen

Signature: on file

REPORT SUMMARY

Disclaimer	The test results only relate to the item tested.
Applicable Rule(s)	FCC Pt 15.231, Pt 15.209, Pt 15.207, ANSI C63.4: 2003
Related Report(s) or Approval(s)	3312BUT7TestReport.doc

Receiver
The receiver portion of this system has been tested and meets all of the FCC requirements per FCC rules Part 15.109. A report was issued and a copy of this report is available upon request.

TEST ENVIRONMENT

Test Facility	The test sites are located at 849 NW State Road 45 Newberry, FL 32669 USA.
Test Condition:	Temperature: 26°C Relative humidity: 50%

TEST SETUP

Test Exercise (e.g software description, test signal, etc.):	The DUT was placed in continuous transmit mode of operation.
Deviation from the standard(s)	No deviation from the standard(s)
Modification to the DUT:	No modification was made to the DUT.
Supporting Peripheral Equipment	Not applicable. The device is a stand-alone remote control radio.

DUT SPECIFICATION

Applicant	MATRIX PRODUCT DEVELOPMENT, INC.		
Description	BASE STATION TRANSCEIVER		
FCC ID	VGCTP1000		
Model Number	TP1000		
Frequency Range	433.5 MHz		
DUT Power Source	☒ 110–120Vac/50– 60Hz		
	☐ DC Power		
	☐ Battery Operated Exclusively		
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☐ Fixed	☐ Mobile	☒ Portable

MANUFACTURE DECLARATION OF COMPLIANCE WITH PART 15.231(A)

Item	Description	Yes	No
1	Does this device transmit a signal that is only used to control another device?		X
2	Does this device send data with this control signal?	X	
3	Does this device send data? Data is, things like: temperature, wind direction, fluid amount, rate of flow, etc.	X	
4	Does this device transmit continuously or automatically?	X (Automatically)	
5	If manually operated does this device stop transmitting within 5 seconds of releasing the button?	N/A	
6	If automatically operated does it deactivate 5 seconds after activation?	X	
7	Does it transmit at regular predetermined intervals?	X	
8	Does it poll or send supervisory information?	X	
	If yes does it do a system integrity check? How often?	X – Every 55 Seconds	
9	Is this a fire, security or safety of life device?	X	
	If YES does the device stop transmitting after the alarm condition is satisfied?	X	
10	Duty cycle: Maximum on-time?		X
	If YES, on-time in 100 ms? If Other, please specify here		
	On time in 14.7ms		
11	Modulation technique: Please specify the modulation of the test sample, FM, or AFSK, or FSK, or on-off keying, or others?	OOK	

TEST 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
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 5/11/07	5/10/10
Antenna: Biconnical	Eaton	94455-1	1057	CAL 12/12/05	12/12/07
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 12/14/05	12/14/07

TEST PROCEDURES

Power line conducted Emissions: The test procedure used was ANSI C63.4-2003. The testing ranges is .15 – 30 MHz.

Spurious Emissions: The test procedure used was ANSI C63.4-2003 using a spectrum analyzer with a preselector. The bandwidth of the spectrum analyzer was 100 kHz with an appropriate sweep speed. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100 kHz and the video bandwidth was always greater than the RBW.

Occupied Bandwidth: A small sample of the transmitter output was fed into the spectrum analyzer and the following plot was generated. The vertical scale is set to 10 dB per division.

Formula Of Conversion Factors: The field strength at 3m was established by adding the meter reading of the spectrum analyzer to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB/m. The gain of the preselector was accounted for in the spectrum analyzer reading.

Example:

Freq MHz	Meter Reading dBuV	ACF dB/m	Cable Loss dB	Field Strength dBuV/m @ 3 m
33	20	+10.36	+1.2	= 31.56

ANSI C63.4-2003 Measurement: The DUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The DUT was placed in the center of the table. The table used for radiated measurements is capable of continuous rotation. The spectrum was scanned from 30 MHz to the 10th harmonic of the fundamental.

Peak readings were taken in three (3) orthogonal planes when necessary and the highest readings were converted to average readings based on the duty cycle.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

RADIATION INTERFERENCE

Rules Part No.: 15.231

Requirements:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBμV/m)	Field Strength of Harmonics and Spurious Emissions (dBμV/m @ 3m)
40.66 to 40.70	67.04	47.04
70 to 130	61.94	41.94
130 to 174	61.94 to 71.48	41.94 to 51.48
174 to 260	71.48	51.48
260 to 470	71.48 to 81.94	51.48 to 61.94
470 and above	81.94	61.94

No fundamental frequency is allowed in the restricted bands.

Spurious emissions in the restricted bands must be less than 54 dBμV/m or to the limits of 15.209.

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows:
1) for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F)-6136.3636;
2) for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F)-7083.3333.

Sample calculation of limit @ 315 MHz:

41.6667 (315)-7083.3333 = 6041.68 uV/m
20log(6041.68) = 75.62dBuV/m limit @ 315 MHz

Sample calculation of limit @ 433.92 MHz:

41.6667 (433.9)-7083.3333 = 10,995.85 uV/m
20log(10,995.85) = 80.82 dBuV/m limit @ 433.9 MHz

FOR DUT:
The limit for average field strength dBuV/m for the fundamental frequency = 80.81 dBμV/m.

The limit for average field strength dBuV/m for the harmonics and spurious frequencies = 60.81 dBμV/m unless it is in a restricted band.

Test Data:

Tuned Frequency MHz	Emission Frequency MHz	*	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Duty Cycle Factor dB	Field Strength dBuV/m	Margin dB
433.5	433.45		73.3	H	1.23	16.60	15.60	75.53	5.28
433.5	433.45		73.8	V	1.23	16.17	15.60	75.60	5.21
433.5	866.90		14.8	V	1.93	22.40	15.60	23.53	37.28
433.5	866.90		17.9	H	1.93	22.94	15.60	27.17	33.64
433.5	1,300.35	**	9.6	V	2.34	27.84	15.60	24.18	29.82
433.5	1,300.35	**	10.1	H	2.34	27.84	15.60	24.68	29.32
433.5	1,733.80		9.5	V	2.69	29.50	15.60	26.09	34.72
433.5	1,733.80		11.3	H	2.69	29.50	15.60	27.89	32.92
433.5	2,167.25		8.4	H	3.02	31.63	15.60	27.45	33.36
433.5	2,600.70		8.8	H	3.32	32.52	15.60	29.04	31.77
433.5	3,901.05	**	22.4	H	4.41	33.44	15.60	44.65	9.35
433.5	3,901.05	**	24.3	V	4.41	33.44	15.60	46.55	7.45
433.5	2,167.25		8.8	V	3.02	31.63	15.60	27.85	32.96

** -Denotes restricted bands

Note: Emissions that are 20 dB below the limit are not required to be reported.

CALCULATION OF 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.

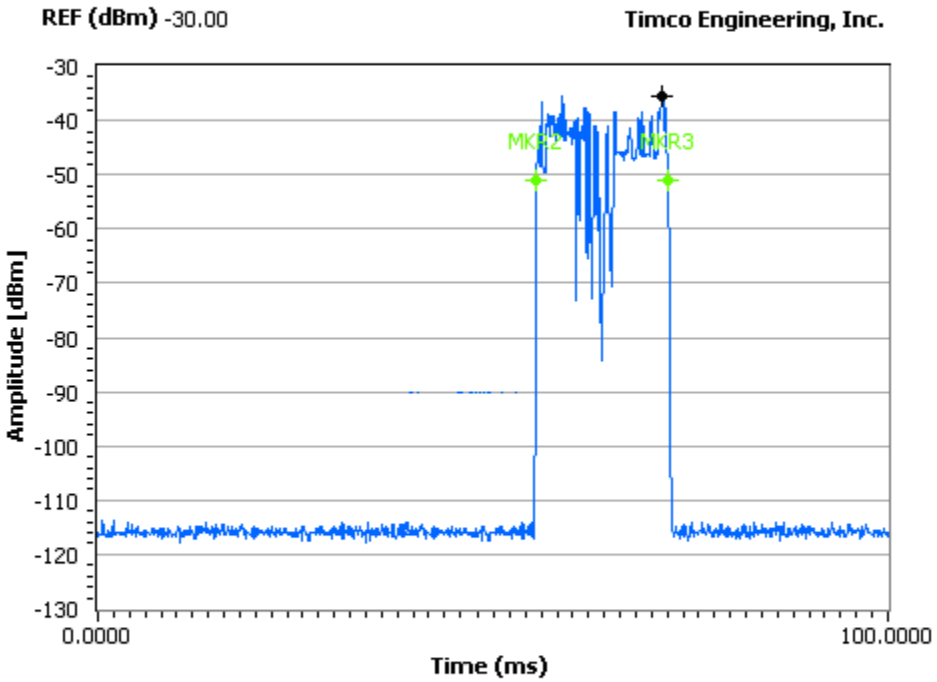
Long Pulse	16.6 ms
Short Pulse	0
On Time	16.6 ms
Length of Pulse Train	16.6 ms
Total	16.6ms

dB = 20*log(ON TIME)/PERIOD
dB = 20*log(16.60/100)
dB = 20*log(0.1660)
dB = -15.6

See the following plots.

NOTES:

MATRIX PRODUCT DEVELOPMENT, INC. - FCC ID: VGCTP1000
DUTY CYCLE PLOT - MARKER DELTA = 16.6 ms



RBW	VBW	ST (sec)
10 kHz	10 kHz	100m

Center Frequency (Hz) 433.450M

Marker Delta (sec) 16.60m

Peak	71.200	-35.50
MKR2	55.400	-51.00
MKR3	72.000	-51.00
HWMK	23.076	6.27

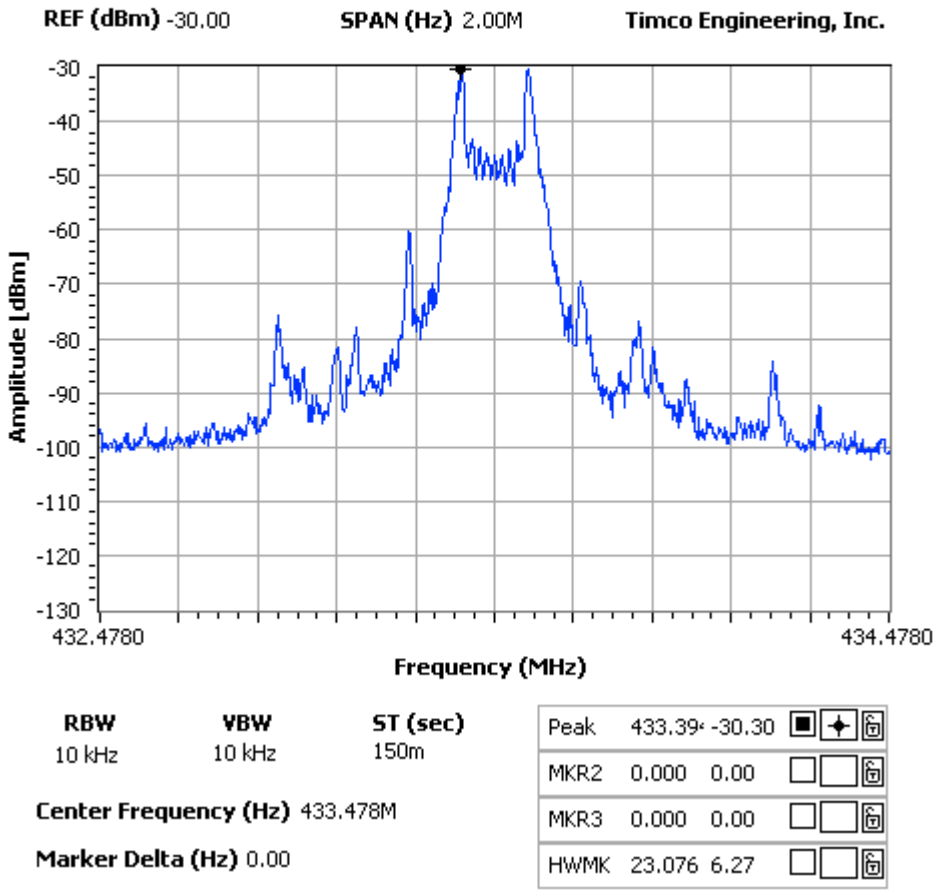
OCCUPIED BANDWIDTH

Rules Part No.: 15.231(C)

Requirements: The bandwidth of the emission shall be no wider than .25% of the center frequency for devices operating between 70 and 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Data: Please refer to the following plot.

NOTES:
MATRIX PRODUCT DEVELOPMENT, INC. - FCC ID: VGCTP1000
OCCUPIED BANDWIDTH PLOT



POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: Pt 15.207

Requirements:

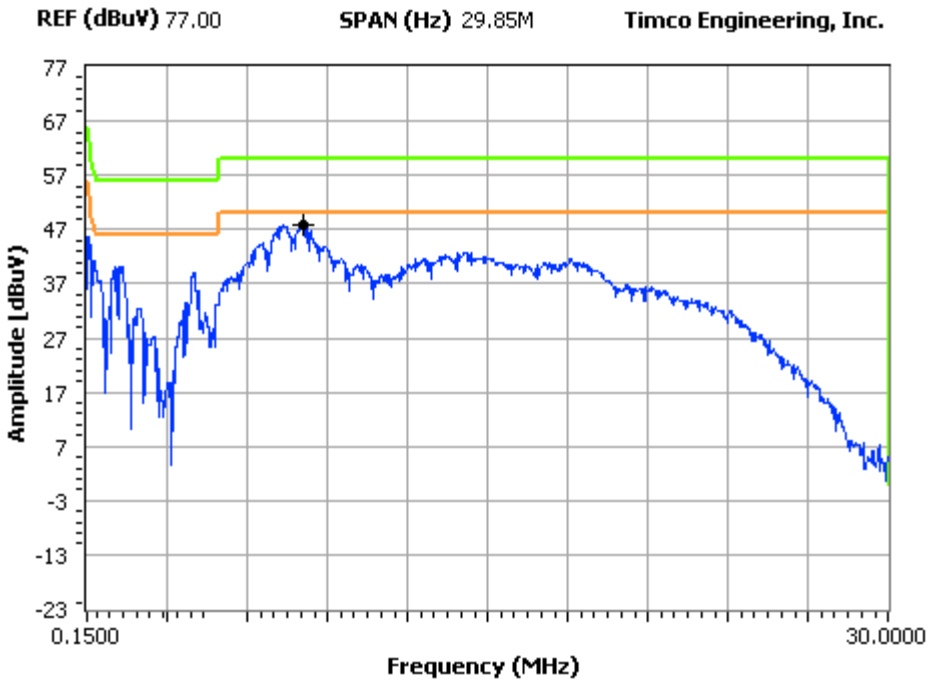
Frequency (MHz)	Quasi Peak Limits (dBuv)	Average Limits (dBuV)
0.15 – 0.5	66 – 56 *	56 – 46 *
0.5 – 5.0	56	46
5.0 – 30	60	50
* Decrease with logarithm of frequency		

Test Data: The following plots represent the emissions read for powerline conducted. Both lines were observed.

NOTES:

MATRIX PRODUCT DEVELOPMENT, INC. - FCC ID: VGCTP1000
POWER LINE CONDUCTED PLOT - LINE 1

FCC 15.107 Mask Class B



RBW	VBW	ST (sec)
10 kHz	30 kHz	2

Center Frequency (Hz) 15.075M

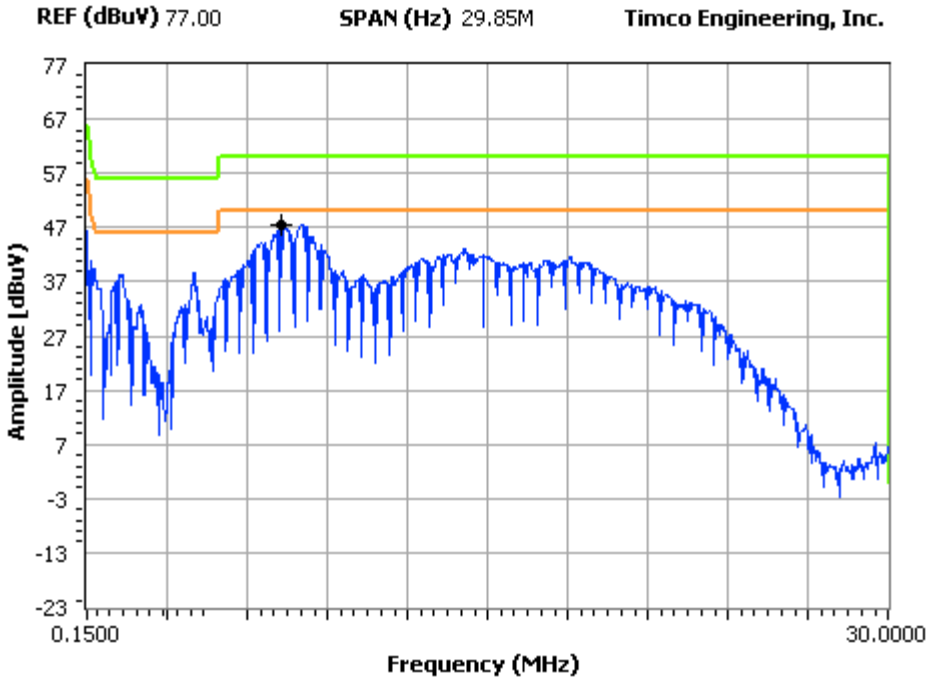
Marker Delta (Hz) 0.00

Peak	8.210	47.80
MKR2	0.000	0.00
MKR3	0.000	0.00
HWMK	23.076	6.27

NOTES:

MATRIX PRODUCT DEVELOPMENT, INC. - FCC ID: VGCTP1000
POWER LINE CONDUCTED PLOT - LINE 2

FCC 15.107 Mask Class B



RBW	VBW	ST (sec)
10 kHz	30 kHz	2

Center Frequency (Hz) 15.075M

Marker Delta (Hz) 0.00

Peak	7.374	47.50
MKR2	0.000	0.00
MKR3	0.000	0.00
HWMK	23.076	6.27