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FCC PART 15.231(a)

MOMENTARILY OPERATED TRANSMITTER

TEST REPORT

Applicant	**MOTOPPAR INDÚSTRIA E COMÉRCIO DE AUTOMATIZADORES LTDA.**
Address	**Av. Dr. Labieno da Costa Machado, 3526 Garca SP Brazil 17400-000**
Product Model Number	TX003
Product Description	4 BUTTON DOOR/GATE OPENER REMOTE CONTROLLER
FCC ID	2AMB2TX003
Date Sample Received	6/9/2017
Date Tested	7/2/2017
Tested By	Tim Royer
Approved By	Sid Sanders

Report Number	Version Number	Description	Issue Date
1041UT17TestReport	Rev1	Initial Issue	7/7/2017
1041UT17TestReport	Rev2	Updated General Information on Page 4	7/12/2017

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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 and was selected by the customer.

☐ 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.

I attest that the necessary measurements were made at:

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

Tested by:
Name and Title: Tim Royer, Project Manager/Testing Engineer

Date: 7/3/2017

Reviewed and approved by: Name and Title: Sid Sanders, Engineer

Date: 7/7/17

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GENERAL INFORMATION

EUT Description	4 BUTTON DOOR/GATE OPENER REMOTE CONTROLLER
FCC ID	2AMB2TX003
Model Number	TX003
Operating Frequency	433.92 MHz
Test Frequencies	433.92 MHz
Type of Emission	G1D
Modulation	OOK
Antenna Type	Internal trace antenna
EUT Power Source	☐ 110–120Vac/50– 60Hz
	☐ DC Power 12V
	☒ Battery Operated Exclusively
Test Item	☐ Prototype
	☐ Pre-Production
	☒ Production
Type of Equipment	☐ Fixed
	☐ Mobile
	☒ Portable
Test Conditions	Temperature: 24-26ºC Relative humidity: 50-65% Barometric Pressure: 30.01”
Modification to the EUT	None
Test Exercise	For radiated emissions testing a continuously transmitting modulated carrier was used, for verification of duty cycle and compliance with periodic operation a normally operating transmitter was used
Regulatory Standards	FCC CFR Title 47 Part 15C
Measurement Standards	ANSI C63.10: 2013 FCC CFR Title 47 Part 15.31, 15.33, 15.35

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TEST RESULTS SUMMARY

Requirement	FCC Rules Part No.	RESULTS Pass / Fail / NA
Types of Momentary Signals	15.231(a)	Pass
Fundamental Output Power	15.231(b)	Pass
Spurious Emissions and Harmonics	15.231(b) 15.209(a) 15.205(a)(b)	Pass
Occupied Bandwidth	15.231(c) 15.215(c)	Pass

TEST SETUP

Test Exercise (e.g. software description, test signal, etc.):	None
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	None

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PERIODIC OPERATION

FCC Rule Part No: 15.231(a)

Requirements:

The intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition

(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (1) and (2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

Procedure: ANSI C63.10 § 7.4(e) Compliance for periodic operation

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PERIODIC OPERATION

Declaration Provided by Applicant

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
5	If manually operated does this device stop transmitting within 5 seconds of releasing the button?	X	
6	If automatically operated does it deactivate 5 seconds after activation?	NA	
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?		NA
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?		
10	Duty cycle: Maximum on-time?	41%	
	If YES, on-time in 100 mS? If Other, please specify here	41	
	On time in		
11	Modulation technique: Please specify the modulation of the test sample, FM, or AFSK, or FSK, or on-off keying, or others?	On-OFF Keying	

Periodic Transmission Per Hour Calculation

Transmissions Per Hour	On Time per Transmission	Total Hourly On Time (s)	Hourly On Time Limit (s)	Margin (s)
NA				

Meets all requirements.

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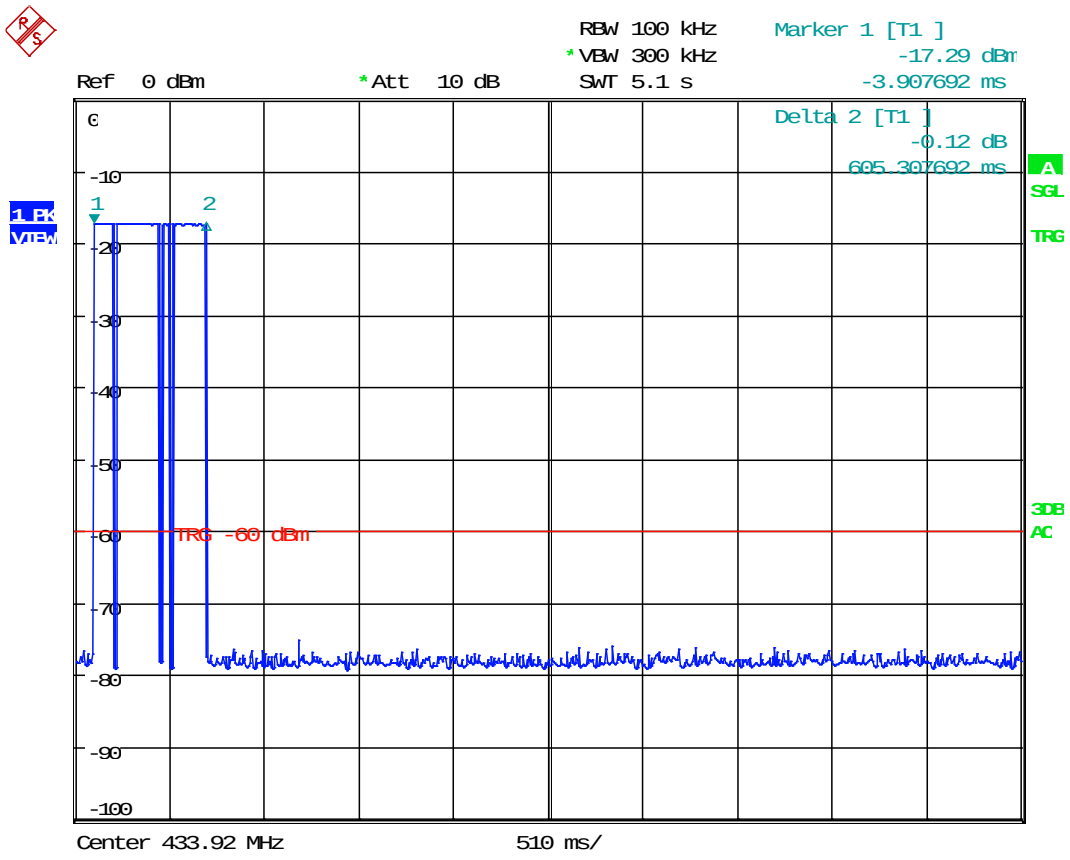
PERIODIC OPERATION

Test Data: **Transmitter Deactivation Plot**

5 Second Deactivation Period



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Result: Meets Requirements

DUTY CYCLE

Requirements: There are no requirements for the duty cycle; it is measured to determine compliance with the periodic operation average emission limits and the automatic transmission on time requirement.

Procedure: ANSI C63.10 § 7.5 Average value of pulsed emissions

Formula: $\delta\ (dB) = 20 \log [\Sigma\ (n_1 t_1 + n_2 t_2) / T]$

Where:

δ is the duty cycle correction factor (dB)
T is the pulse is the period that the pulses are averaged over (100 ms).
t_1 is the pulse width of subpulse 1
t_2 is the pulse width of subpulse 2
n_1 is the number of t_1 pulses
n_2 is the number of t_2 pulses

Test Data: Calculation of Duty Cycle

Sub Pulse	Alias	Duration (ms)	Occurances	Tx Time (ms)
1	"short"	0.50	25	12.5
2	"long"	1.00	28	28

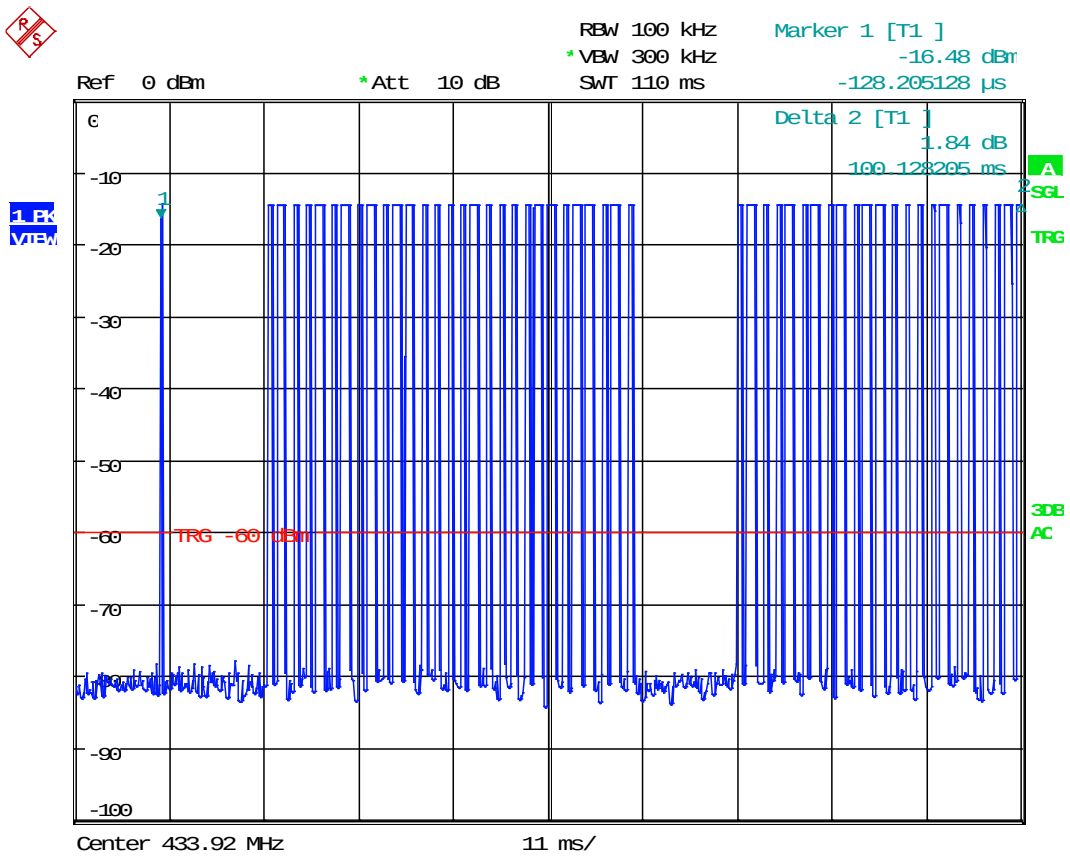
Total Tx Time (ms)	**40.5**
Period (ms)	**100**
Duty Cycle (%)	**41%**
Cor Factor (dB)	**-7.85**

See the following plots.

DUTY CYCLE

Test Data: **100 ms Number of Pulses Plot**

Subpulse 1 “short” = 25 times / Subpulse 2 “long” = 28 times



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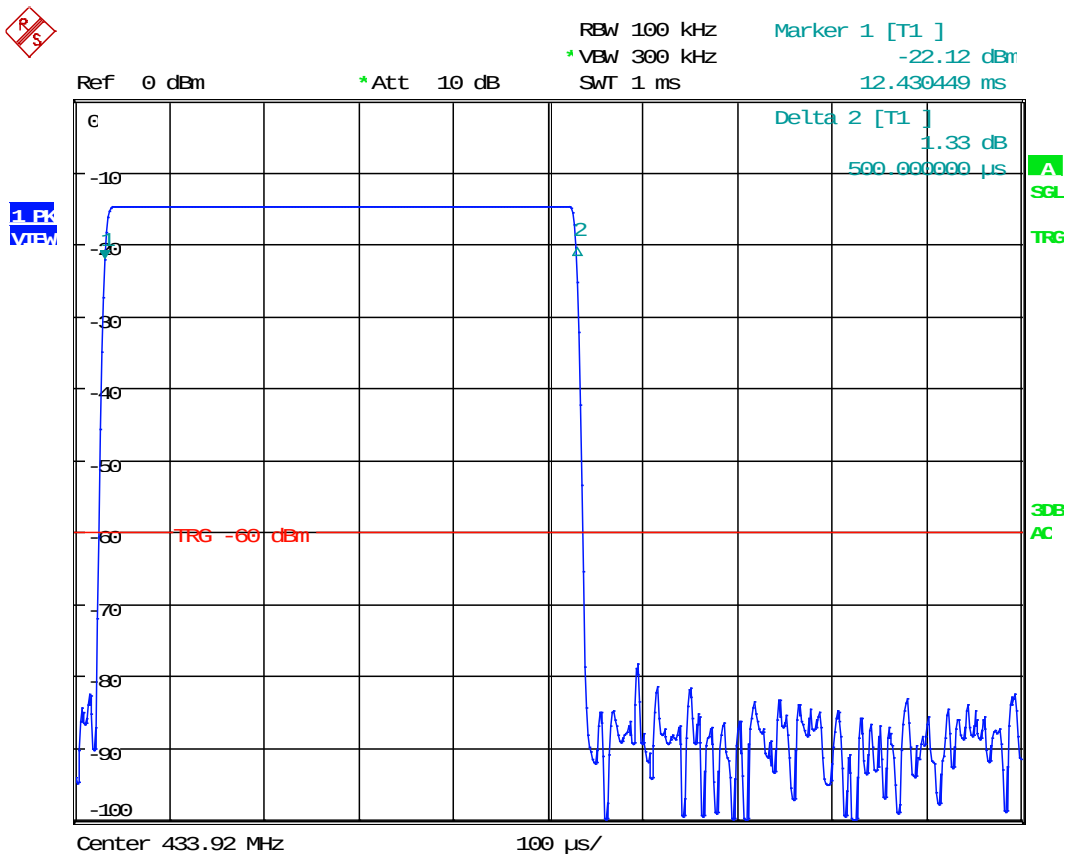
DUTY CYCLE

Test Data: **SubPulse 1 Duration Plot**

Subpulse 1 “short” Duration = 500.00 us



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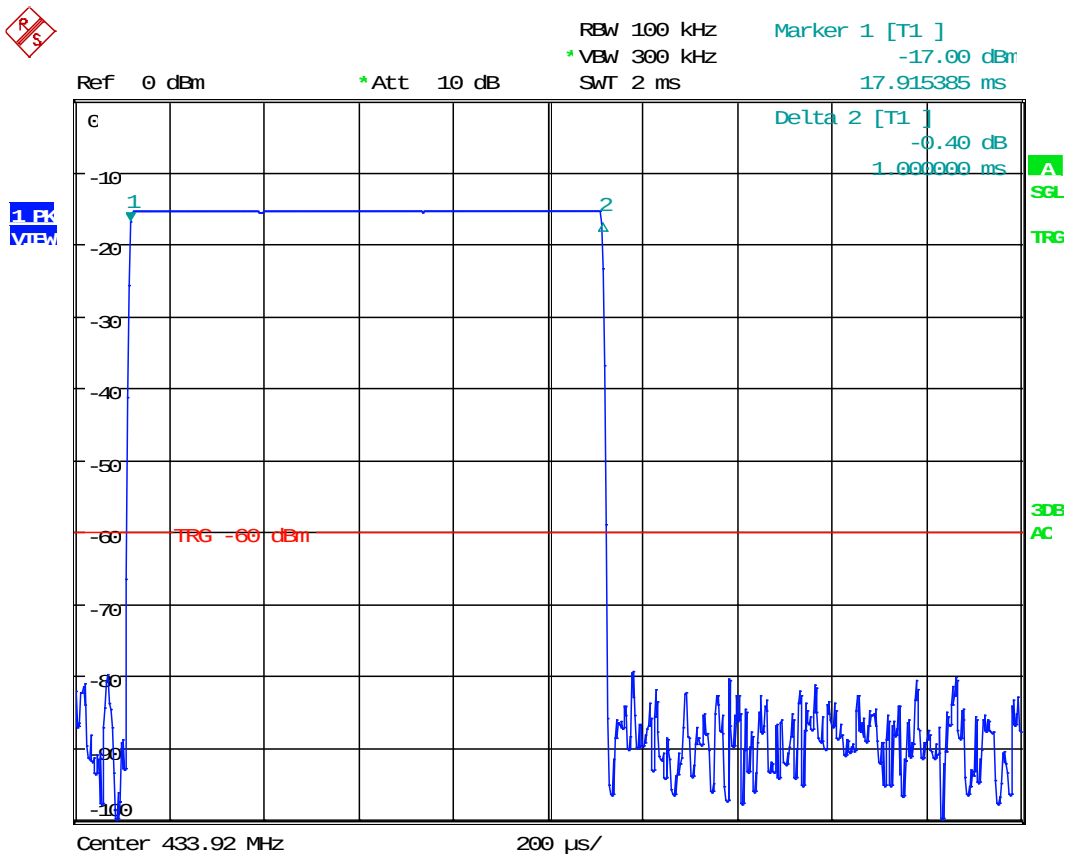
DUTY CYCLE

Test Data: **SubPulse 2 Duration Plot**

Subpulse 2 “long” Duration = 1.00 ms



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RADIATION EMISSIONS:

FCC Rules Part No.: 15.231(b), 15.209 (a), 15.205(a)(b)

Requirements:

Fundamental and Harmonics not in Restricted Bands		
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(12500)	61.94

Restricted Band Emissions	
Frequency (MHz)	Limits
9 – 490 kHz	2400/F (kHz) µV/m @ 300 meters
490 – 1705 kHz	24000/F (kHz) µV/m @ 30 meters
1705 – 30 MHz	29.54 dBµV/m measured @ 30 meters
30 – 88	40.0 dBµV/m measured @ 3 meters
88 – 216	43.5 dBµV/m measured @ 3 meters
216 – 960	46.0 dBµV/m measured @ 3 meters
Above 960	54.0 dBµV/m measured @ 3 meters

No fundamental frequency is allowed in the restricted bands.

No harmonic or spurious emissions may exceed the level of the fundamental carrier frequency.

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RADIATION EMISSIONS:

Fundamental Emission Limit Formula:

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.

   Where F is the fundamental emission frequency in MHz

Example 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

Harmonics and Spurious Emissions Limit:

1) 20 dBc for all emissions outside of restricted bands

2) General limits of 15.209(a) & RSS-Gen for emissions inside restricted bands

3 Meter Field Strength Limit for this EUT:

Fund Freq (MHz)	Fund Limit (dBuV/m)	Harm & Spur (dBuV/m)	Restricted Bands
433.94	80.83	60.83	Limit of 15.209

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RADIATION EMISSIONS:

Test Method: ANSI C63.10 § 6.3 – 6.6 Radiated Emissions Unlicensed Devices

The EUT was placed on a table with dimensions of 1m by 1.5m, 80 cm high below 1 GHz and 150 cm high above 1 GHz. The EUT was placed in the center of the table. The table used for radiated measurements is capable of continuous rotation. The spectrum was scanned from 9 KHz or the lowest frequency generated 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.

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 plus the coax loss. 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 dBµV	ACF dB/m	Cable Loss dB	Field Strength dBµV/m @ 3 m
33	20	+10.36	+1.2	= 31.56

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RADIATION EMISSIONS:

Test Data: Emissions from 9 KHz to the 10th harmonic of the Fundamental

Tuned Freq MHz	Emission Frequency MHz	Meter Reading dBu V		Detector	Antenna Polarity	Coax Loss Db	Correction Factor dB/M	Field Strength dBu V/M	Margin
433.94	433.94	56.78		PK	V	2.39	17.40	76.57	4.26
433.94	433.94	61.5		AV	V	2.39	17.40	73.44	7.39
433.94	867.88	26.97		AV	H	3.38	22.31	44.81	16.02
433.94	867.88	18.08		PK	V	3.38	22.31	43.77	17.06
433.94	1301.82	24.17		PK	H	4.14	29.51	57.82	3.01
433.94	1301.82	16.27		PK	H	4.14	29.51	49.92	10.91
433.94	1735.76	5.66		PK	H	4.75	29.67	40.08	20.75
433.94	1735.76	4.01		PK	V	4.75	29.67	38.43	22.40
433.94	2169.70	25.52		AV	V	5.42	30.91	54.00	6.83
433.94	2169.70	13.59		PK	H	5.42	30.91	49.92	10.91
433.94	2603.64	2.37		PK	H	5.91	32.60	40.88	19.95
433.94	2603.64	2.51		PK	V	5.91	32.60	41.02	19.81
433.94	3037.58	9.97		PK	V	6.37	33.26	49.60	11.23
433.94	3037.58	6.07		PK	H	6.37	33.26	45.70	15.13
433.94	3471.52	2.98		PK	H	6.82	33.11	42.91	17.92
433.94	3471.52	8.64		PK	V	6.82	33.11	48.57	12.26
433.94	3905.46	14.16	*	PK	V	7.26	33.47	54.89	19.11
433.94	3905.46	14.16	*	AV	V	7.26	33.47	47.04	6.96
433.94	3905.46	7.67	*	PK	H	7.26	33.47	48.40	5.60
433.94	4339.40	3.63	*	PK	H	7.66	33.63	44.92	9.08
433.94	4339.40	7.19	*	PK	V	7.66	33.63	48.48	5.52

* -Denotes restricted bands which must comply with limits 15.209

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

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OCCUPIED BANDWIDTH

FCC Rules Part No.: 15.231(C), & 15.215(c)

Requirements:

The 20 dB bandwidth of the emission shall fall completely inside the band of operation, and be no wider than .25% of the center frequency for devices operating between 70 and 900 MHz.

Test Method: ANSI C63.10 § 6.9.2 Occupied bandwidth Relative procedure

Test Data: **Occupied Bandwidth Measurement Table**

Tuned Frequency (MHz)	Limit (KHz)	Measured 20 dB BW (KHz)
433.94	1084.85	14.26
Margin (KHz)		1070.59

Results Meet Requirements

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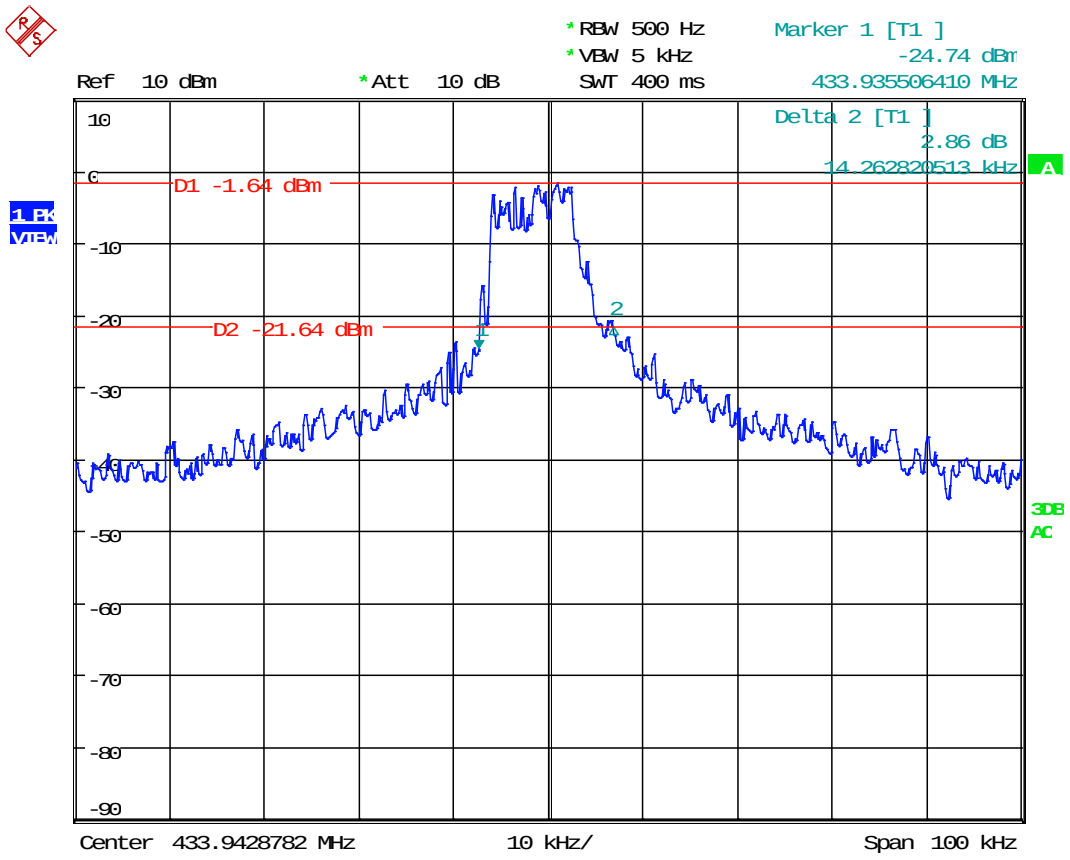
OCCUPIED BANDWIDTH

Test Data: **20 dB Occupied Bandwidth Plot**

20 dB BW = 14.26 KHz



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Results Meet Requirements

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TEST EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconical 1057	Eaton	94455-1	1057	11/18/15	11/18/17
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/14/15	07/14/17
CHAMBER	Panashield	3M	N/A	04/25/16	12/31/17
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren Chamber	3117	00041534	03/01/17	03/01/19
EMI Test Receiver R & S ESIB 40 Screen Room	Rohde & Schwarz	ESIB 40	100274	08/16/16	08/16/18
Software: EMI Test Receiver	Rohde Schwartz	EMC 32	Version 4.30.0	N/A	N/A
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Antenna: Active Loop	ETS-Lindgren	6502	00062529	11/18/15	11/18/17
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Coaxial Cable - Chamber 3 cable set (Primary)	Micro-Coax	Chamber 3 cable set (Primary)	KMKM-0244-01; KMKM-0670-00; KFKF-0198-01	08/09/16	08/09/18
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

STATE OF THE MEASUREMENT UC

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: "Uncertainty in EMC Measurements" and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
RF Frequency Accuracy	± 49.5 Hz	(1)
RF Conducted Power	±0.93dB	(1)
Conducted spurious emission of transmitter valid up to 40GHz	±1.86dB	
Occupied Bandwidth	±2.65%	
Radiated RF Power	±1.4dB	
Maximum frequency deviation: Within 300 Hz and 6kHz of audio freq. Within 6kHz and 25kHz of audio Freq.	 ±1.88% ±2.04%	
Adjacent channel power	±1.47dB	(1)
Transient Frequency Response	±1.88%	
Temperature	±1.0°C	(1)
Humidity	±5.0%	

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

END OF REPORT