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Results of Electromagnetic Compatibility Testing Performed in Accordance with Title 47, Part 15 of the United States Code of Federal Regulations on the Model TTID-GT1 Transmitter of the Trailer Tracking Transmitter (TTTX) System, Sold by International Marketing, Inc. 25 Penncraft Ave., Suite C Chambersburg, Pennsylvania 17201

by
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Abstract

As requested by a verbal purchase order issued by International Marketing, Inc., during the period of May 20 - June 10, 2008 TEMPEST INC. performed the Electromagnetic Compatibility Tests that are required by Title 47, Part 15 of the United States Code Of Federal Regulations, for intentional transmitters operating periodically at frequencies that are higher than 70 MHz, on the Model TTID-GT1 transmitter, FCC ID# to be determined, of the TTTX system; a trailer tracking system sold by International Marketing, Inc.

The TTTX system is called the "Trailer Tracking Transmitter system." It consists of a transmitter powered by a 3 Volt Lithium watch battery, and a receiver.

The model TTID-GT1 transmitter operates at a frequency of 433.92 MHz with an output power of +5 dBm. It is normally located in the trailer of a commercial tractor-trailer. The transmitter signals the receiver, located in the cab. The information is used to track and locate trailers.

Using Amplitude Shift Keying, the transmitter sends 14 characters at 9600 baud (approximate duration 14.6 milliseconds) approximately every 15 seconds.

The transmitter has a 13.56 MHz crystal-controlled local oscillator; this is multiplied by 32 using a phase locked loop to obtain 433.92 MHz. This signal is transmitted by a loop antenna etched into the transmitter's printed circuit board.

This report presents the results of testing performed on the Model TTID-GT1 transmitter. Receiver testing is described in a separate report.

The Transmitter's radiated emissions were measured, as required for intentional radiators by Title 47 of the United States Code of Federal Regulations, Part 15, sections 15.33(a,) 15.33(a)(1), 15.209(a), 15.231

The testing was performed in accordance with ANSI C63.4-2003.

The field strength of the fundamental transmit frequency did not exceed 12,500 microvolts per meter at 3 meters. The field strengths of the spurious emissions and of the first ten harmonics did not exceed 1,250 microvolts per meter at 3 meters.

The transmitter that was tested, Model TTID-GT1, serial number 0001-C8F3, complies with the requirements of Title 47, Part 15 of the United States Code of Federal Regulations for intentional radiators.

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List of Illustrations

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Reference Documents:

(a) United States Code Of Federal Regulations, Title 47, Part 15

(b) ANSI C63.4-2003: "American National Standard for Methods of Measurement of Radio-Noise Emissions of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"

(c) "Results of Electromagnetic Compatibility Testing Performed in Accordance with Title 47, Part 15 of the United States Code of Federal Regulations on the Model TTID-GR1 Receiver of the Trailer Tracking Transmitter (TTTX) System, Sold by International Marketing, Inc. 25 Penncraft Ave., Suite C Chambersburg, Pennsylvania 17201"
TEMPEST INC.: May 24, 2008

1.0 Introduction.

As requested by a verbal purchase order issued by International Marketing, Inc., during the period of May 20 - June 10, 2008 TEMPEST INC. performed Electromagnetic Compatibility tests in accordance with References (a) and (b) on the Receiver of the TTTX system sold by International Marketing, Inc.

1.1 Purpose.

The purpose of this test was to determine if the TTTX Receiver complies with the requirements of Reference (a.)

1.2 Test Location.

Testing was performed in the Electromagnetic Compatibility Laboratory and the FCC-listed Open Area Test Site of TEMPEST INC.

1.3 Cognizant Personnel.

The following personnel conducted, witnessed, or are cognizant of the test:

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2.0 Description of the TTTX Transmitter.

The TTTX system is called the "Trailer Tracking Transmitter system." It consists of a transmitter powered by a 3-Volt Lithium watch battery, and a receiver. The transmitter, model TTID-GT1, is 2 1/2 inches high, 2 1/4 inches wide, and 1 inch thick.

The transmitter operates at a frequency of 433.92 MHz with an output power of +5 dBm. It is normally located in the trailer of a commercial tractor-trailer. The transmitter signals the receiver, located in the cab. The information is used to track and locate trailers.

Using Amplitude Shift Keying, the transmitter sends 14 characters at 9600 baud (approximate duration 14.6 milliseconds) approximately every 15 seconds.

The transmitter has a 13.56 MHz crystal-controlled local oscillator; this is multiplied by 32 using a phase locked loop to obtain 433.92 MHz. This signal is transmitted by a loop antenna etched into the transmitter's printed circuit board.

The transmitter that was tested was Model TTID-GT1, serial number 0001-C8F3.

3.0 Test Procedures.

As described below, testing was performed in accordance with references (a) and (b.) Radiated emissions were measured.

3.1 Instruments.

Table 1 is a list of the instruments used. No ancillary equipment was needed to make the TTTX Transmitter operate normally.

A double-ridged waveguide horn antenna, a log periodic antenna, a biconical antenna, an active rod antenna, and two Hewlett-Packard spectrum analyzers were used in a three meter Open Area Test Site to detect radiated emissions.

3.2 Calibration Check.

Using their internal calibration sources, the calibration of the spectrum analyzers was verified both immediately before and immediately after the test.

3.3 Dynamic Range and Detection System Sensitivity Tests.

Before testing, the dynamic range of the instrumentation was determined to be 80 dB, and the detection system sensitivity was -95 dBm.

3.4 Local Interference Test.

With the model TTID-GT1 Transmitter turned off, the ambient signals in the Open Area Test Site were measured and recorded, to verify that any signals being measured were coming from the transmitter, and not from other local sources, such as cellular telephones.

3.4.1 Preliminary Tests.

Since the transmitter sends a short 14.6 millisecond burst only once in every 15 seconds, its fundamental frequency, its harmonics, and its spurious signals are difficult to detect. For this reason, an identical transmitter was first programmed to transmit continuously. In the laboratory, this continuously-running transmitter was used a hand held probe and the horn antenna to identify the fundamental, the first ten harmonics, and the spurious emissions. This process was then repeated in the open area test site. At each frequency, the transmitter under test was then substituted, and the spectrum analyzer was set to operate in the multiple sweep, storage mode. This ensured that all of the spurious emissions and the first ten harmonics would be detected as they occurred.

3.5 Measurements.

All measurements were performed in accordance with reference (b.)

3.5.1 Radiated Measurements.

The model TTID-GT1 Transmitter was placed normally, with its loop antenna facing the test antenna, on a nonconductive turntable 3 meters from the antenna hoist. It was then rotated about 360 degrees in 16 equal increments of 22.5 degrees each, as recommended by reference (b.) With the exception of the active rod antenna, the receive antennas were raised from 1 to 4 meters above the ground plane while the emissions were measured. The peak values of the signals detected from the transmitter were recorded in dBm. These were converted to μV/m using the following formulas:

Field strength (dBμV/m) = measured level (dBm) +107 dB
+ antenna factor (dB) + cable loss (dB)

Field Strength in dBμV/m = 20 Log $_{10}$ (Field Strength in μV/m)

Field Strength (μV/m) = Anti Log $_{10}$[(Field Strength in dBμV/m) / 20]

The battery voltage was checked before and after the tests.

3.5.2 Cables.

Twenty feet of constant-phase cable were used. The cable loss ranged from less than 1 dB at 1 GHz to 9 dB at 11 GHz.

4.0 Results.

As shown in Table 2, The transmitter passed all tests.
Radiated emissions consisted of the main carrier frequency of 433.92 MHz and its first ten harmonics, all of whose field strengths were within the limits of reference (a.)

The field strength of the fundamental transmit frequency did not exceed 12,500 microvolts per meter at 3 meters.

No harmonics or spurious emissions were found to exceed 1,250 microvolts per meter at 3 meters.

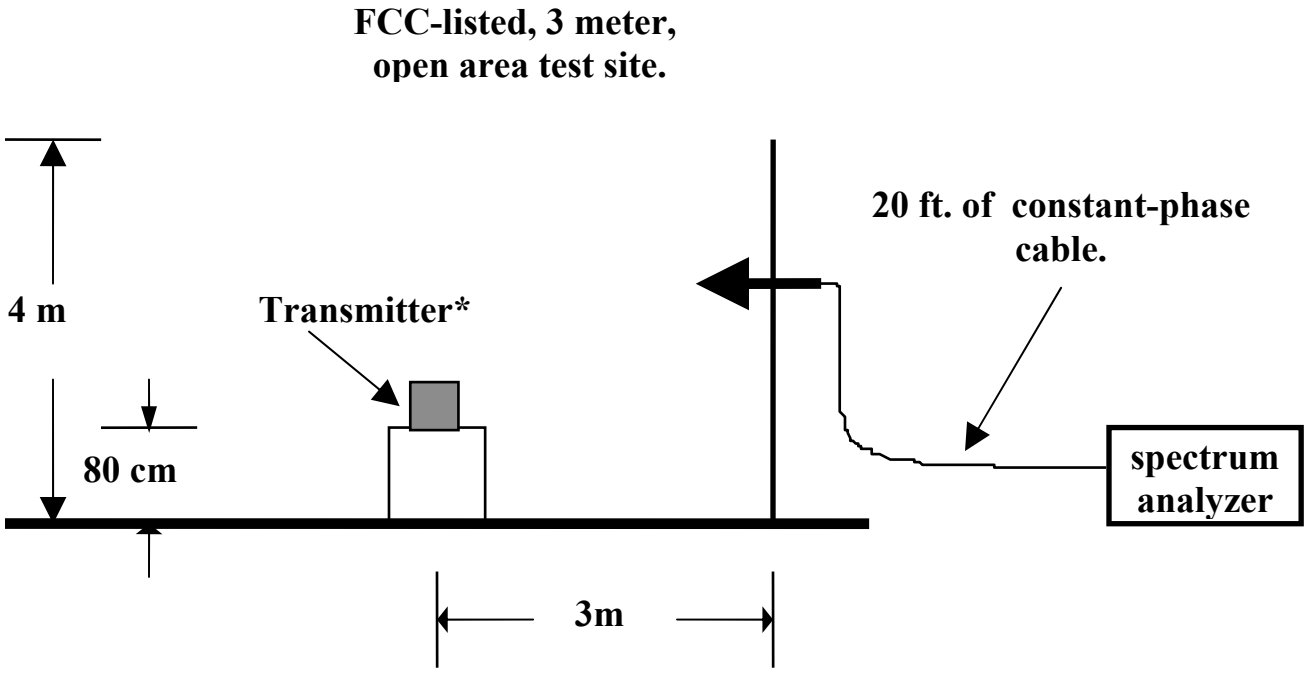
5.0 Conclusions.

The model TTID-GT1 Transmitter that was tested complies with the requirements of Reference (a) for intentional radiators.

Illustrations.

Figure 1: TTTX Transmitter

Figure 2: Block Diagram of Test Setup,
Radiated Emissions



* powered by an internal 3 Volt Lithium watch battery.

Tables.

Table 1: Instruments

Mfg.	Model	Name	Serial No.	calibrated:	Due date:
Hewlett-Packard	141T	Spectrum Analyzer Display	2233A-22141	12/15/07	12/15/08
"	8555A	RF Section	TI-750	"	"
"	8552B	IF Section	TI-751	"	"
Hewlett-Packard	141T	Spectrum Analyzer Display	2506A-23966	12/07	12/08
"	8553B	RF Section	050301	"	"
"	8552B	IF Section	050302	"	"
Tensor	4104	Biconical antenna	2154	12/30/07	12/30/08
TEMPEST INC.	NA 200/2G	Log Periodic Antenna	82	12/29/07	12/29/08
EMCO	3115	Double-Ridged waveguide Horn Antenna	9904 5797	3/27/08	3/27/11
EMCO	3301B	active rod antenna	2883	12/07	12/08
Velleman	850BL	Volt-Ohmmeter	TI-2	12/07	12/08

Cable C2: 20 ft (total) of constant-phase cable with SMA connectors: checked on May 23, 2008.

Spectrum analyzer calibration was spot checked both before and after each test.

Table 2: Data

Horizontal polarization, antenna height: 1 meter.
Frequency accuracy: 2% Amplitude accuracy: +/- 2 dB

Frequency MHz	Level dBm	level dBμV rms	Antenna Factor, dB	Cable loss,* dB	Level dBμV/m	Level μV/m	Limit at 3 meters, μV/m
transmitter's signal & harmonics: NA/200-2G Log periodic antenna							
434	-40	67	11	1	79	10,000	12,500
868	-78	29	14	1	44	160	1,250
EMCO 3115 Horn antenna							
1302	-82	25	26	1	52	400	1,250
1736	-84	23	29	2	54	500	1,250
2170	-84	23	30	3	56	640	1,250
2604	-86	21	30	3	54	500	1,250
3038	-85	22	32	4	58	800	1,250
3472	-84	23	33	4	60	1,000	1,250
3906	-88	19	34	5	58	800	1,250
4340	-95**	12	34	5	51	360	1,250
4774	-95**	12	35	6	53	450	1,250
5208	-95**	12	36	6	54	500	1,250
Typical ambient Signals - Biconical antenna - vertical polarization							
20	-80	27	14	0	31	40	1,250
58	-80	27	10	0	37	70	1,250
66	-40	67	10	0	77	7000	1,250
70	-82	25	7	0	32	40	1,250
Typical ambient signals- Log Periodic Antenna - Vertical polarization							
418	-77	30	11	0	41	113	1,250
525	-46	61	14	0	75	5700	1,250
1000	-78	29	14	0	43	145	1,250

*20 feet of constant-phase cable ** Detection system noise.

Appendix A: Cross-reference.

As a courtesy to the reviewer, the following is a cross reference between this report and the documentation requirements of Ref. (b).

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