U. S. Telemetry Corporation
FCC Part 95, Certification Application
USTC-TED-0001

May 21, 2000

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **U. S. Telemetry Corporation**

MODEL: **USTC-TED-0001**

FCC ID: **OZ9USTC-TED-0001**

DATE: **May 21, 2000**

This report concerns (check one): Original grant_X_
Class II change_____

Equipment type: _____

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No_X_

If yes, defer until:_____
date

__N.A.__ agrees to notify the Commission by__N.A.____
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

United States Technologies, Inc.
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

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GENERAL INFORMATION

GENERAL INFORMATION

1.1 Product Description

The Equipment Under Test (EUT) is a U. S. Telemetry Corporation, Model USTC-TED-0001. The EUT is a 218.75 MHz Transmitter.

The EUT operates as a Response Transmitter Unit (RTU) under the operating conditions set forth by the FCC for the 218-219 MHz service. The unit is a battery operated, one-way device, transmitting data generated by its internal microprocessor dependent on pre-programmed test data or external inputs to the device.

The unit is manufactured by the following company:

Axonn Corporation
101 West Robert E. Lee Blvd.
Suite 202
New Orleans, LA 70124

1.2 Related Submittal(s)/Grant(s)

The EUT will be used with part of a system to send/receive data. The transmitter presented in this report will be used with a receiver which has been previously approved under a DoC authorization.

The EUT is subject to the following authorizations:

a) Certification as a transmitter as specified by Part 95.851.

The information contained in this report is presented for the certification authorization(s) for the EUT.

SECTION 2

TESTS AND MEASUREMENTS

TEST AND MEASUREMENTS

2.1 Configuration of Tested System

Prepared in accordance with the requirements of the FCC Rules and Regulations Part 95. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are shown in Figure 2.

The sample used for testing was received by U.S. Technologies on April 12 in good condition.

2.2 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and submitted to the FCC, and accepted in their letter marked 31040/SIT. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number IC2982.

2.3 Test Equipment

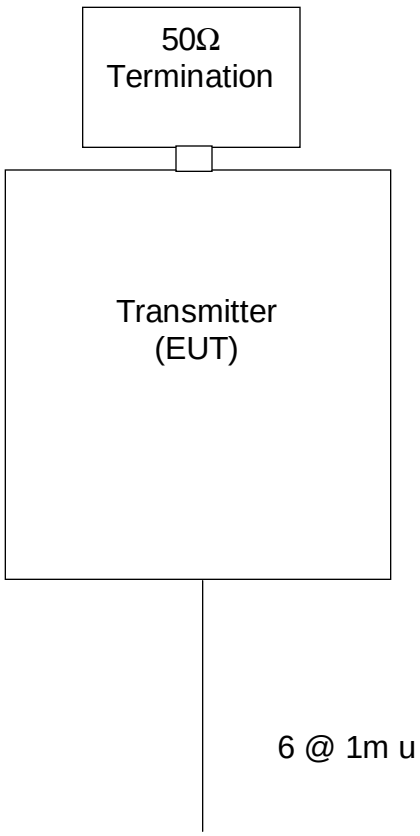
Table 2 describes test equipment used to evaluate this product.

2.4 Modifications

No modifications were made by US Tech, to bring the EUT into compliance with FCC Part 95 limits for the transmitter portion of the EUT.

FIGURE 1

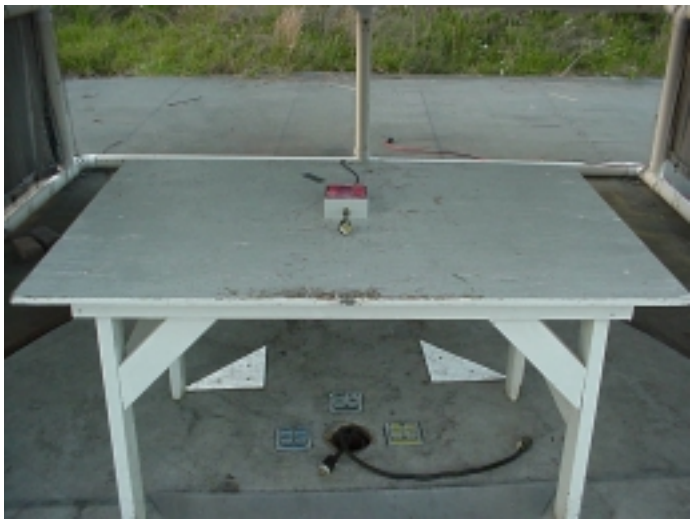
TEST CONFIGURATION



Test Date: April 22, 2000
UST Project: 00-0141
Customer: U. S. Telemetry Corporation
Model: USTC-TED-0001

FIGURE 2a

Photograph(s) for Spurious Emissions (Front)



Test Date: April 22, 2000
UST Project: 00-0141
Customer: U. S. Telemetry Corporation
Model: USTC-TED-0001

FIGURE 2b

Photograph(s) for Spurious Emissions (Back)

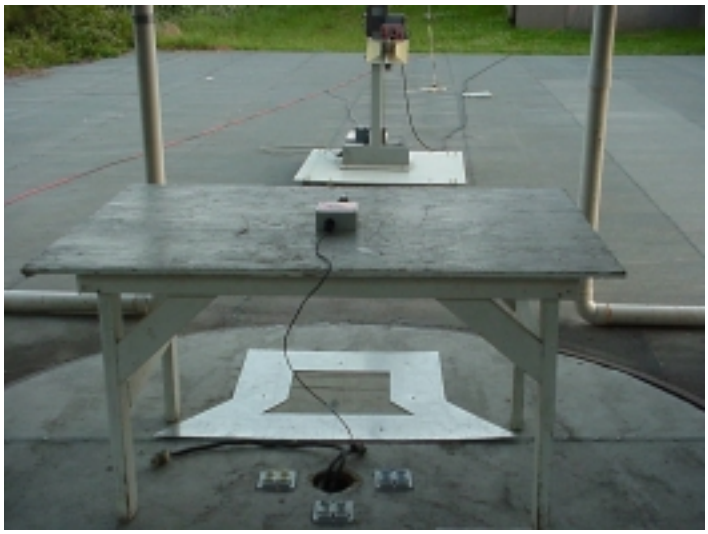


TABLE 1

EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Transmitter (EUT) Axonn Corporation	USTC-TED-0001	FCC1	OZ9USTC-TED-0001 (Pending)	6 @ 1m u
Termination Component General, Inc.	CFT-15 BM	None	None	

TABLE 2
TEST INSTRUMENTS

TYPE	MANUFACTURER	MODEL	SN.
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124
SPECTRUM ANALYZER	HEWLETT-PACKARD	8558B	2332A09900
S A DISPLAY	HEWLETT-PACKARD	853A	2404A02387
COMB GENERATOR	HEWLETT-PACKARD	8406A	1632A01519
RF PREAMP	HEWLETT-PACKARD	8447D	1937A03355
RF PREAMP	HEWLETT-PACKARD	8449B	3008A00480
HORN ANTENNA	EMCO	3115	3723
HORN ANTENNA	EMCO	3116	9505-2255
BICONICAL ANTENNA	EMCO	3110	9307-1431
LOG PERIODIC ANTENNA	EMCO	3146	9110-3600
TEMPERATURE CHAMBER	THERMOTRON	SM16	17095
MULTIMETER	FLUKE	85	53710469
PLOTTER	HEWLETT-PACKARD	7475A	2325A65394

2.5 Antenna Description (FCC Section 95.859)

Connectors that are used to connect RTU to external antenna shall not be of the types generally known as “F-type” or “BNC type”.

The Model U. S. Telemetry Corporation USTC-TED-0001 incorporates an external antenna.

Manufacturer:	Axonn Corporation 101 West Robert E. Lee Blvd. Suite 202 New Orleans, LA 70124
Type:	Printed Circuit Board Antenna
Model Number:	0656-137-AWO Rev. X2
Gain:	-2 dBi
Connector:	SMA

2.6 RF Power Output (FCC Section 2.1046)

The effective radiated power (ERP) of each CTS and RTU shall be limited to the minimum necessary for successful communications. No CTS or fixed RTU may transmit with an ERP exceeding 20 Watts.

EUT was modulated by its own internal sources. The EUT was directly connected to a spectrum analyzer with the input resistance set to 50Ω. An external 50 dB attenuation was used during the test. The measured results are shown in Figure 3.

FCC Minimum Standard (FCC Section 95.855)

P_{ERP} < 20 Watts for Fixed RTU

TABLE 3
RF POWER OUTPUT

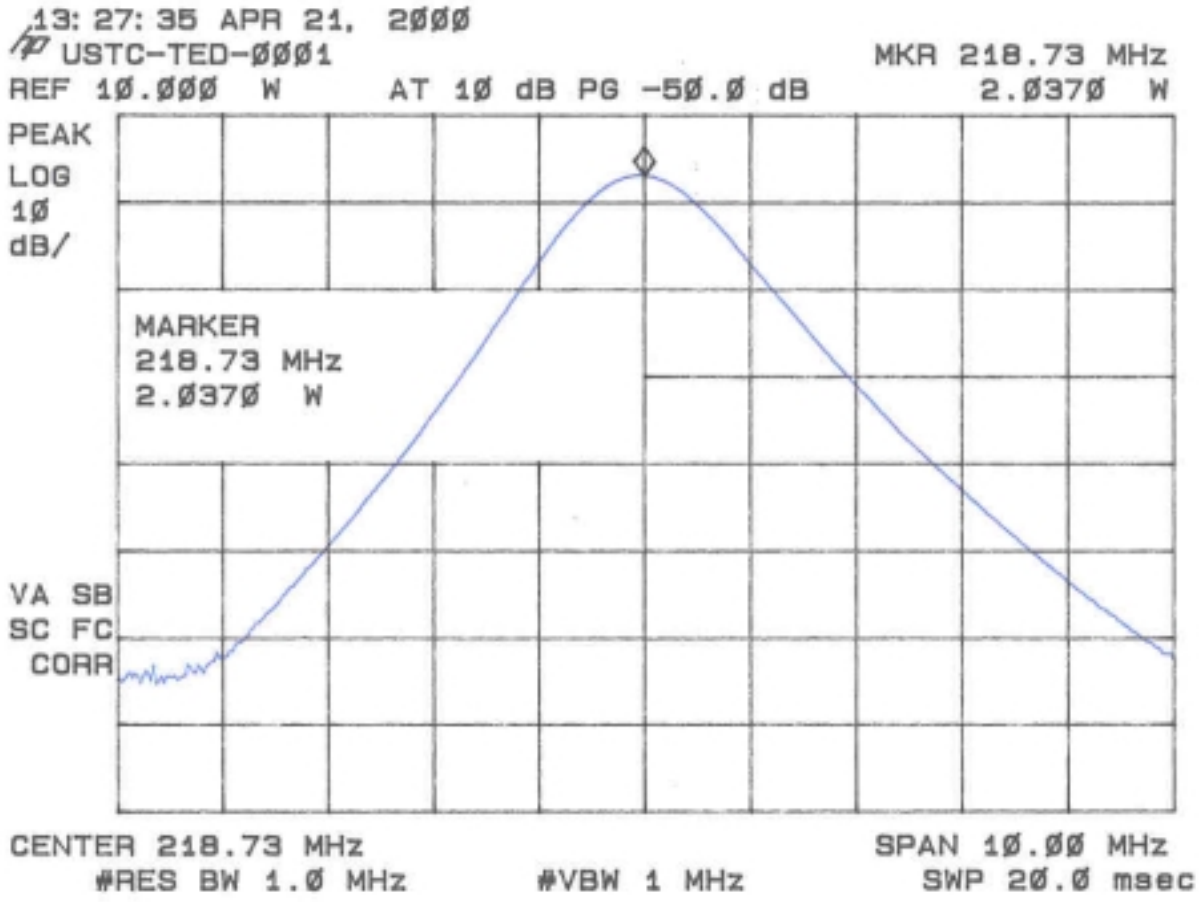
Test Date: **April 21, 2000**
UST Project: **00-0141**
Customer: **U. S. Telemetry Corporation**
Model: **USTC-TED-0001**

Frequency of Fundamental (MHz)	Measurement (Watt)*	Antenna Gain (dBi)	P_{ERP} (Watt)	FCC Limit (Watt)
218.75	2.04	-2.0	1.3	20.0

*** Measurement cable was considered negligible**

Tester
Signature: _____ **Name:** **Timothy R. Johnson**

Figure 3.
RF Power Output



2.7 Modulation Characteristics (FCC Section 2.1047)

Where applicable, the modulation characteristics of the EUT have been supplied as stipulated by the following FCC requirements:

a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. For equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.

b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

FCC Minimum Standard

None

Figure 4.
Modulation Characteristics

The EUT uses digital modulation techniques only which were employed during the tests for occupied bandwidth.

2.8 Occupied Bandwidth (FCC Section 2.1049)

EUT was modulated by its own internal sources. The bandwidth of the fundamental was measured using a spectrum analyzer, as shown in Figure 5a through Figure 5b.

FCC Minimum Standard (FCC Section 95.857)

For out-of-band emissions for frequencies removed from the midpoint of the assigned frequency segment (218.501-219.000 MHz) by more than 250 kHz up to and including 750 kHz, at least 28 dB.

For out-of-band emissions for frequencies removed from the midpoint of the assigned frequency segment (218.501-219.000 MHz) by more than 750 kHz up to and including 1250 kHz, at least 35 dB.

For out-of-band emissions for frequencies removed from the midpoint of the assigned frequency segment (218.501-219.000 MHz) by more than 1250 kHz, at least

$$43 + 10 \log (P_{Watts}) = 43 + 10 \log (2.04) = 46.1 \text{ dB}$$

The resolution bandwidth was 100 Hz or greater for measuring up to 250 kHz from the edge of the authorized frequency segment, and 10 kHz for measuring more than 250 kHz from the authorized frequency segment.

Figure 5a.
Occupied Bandwidth

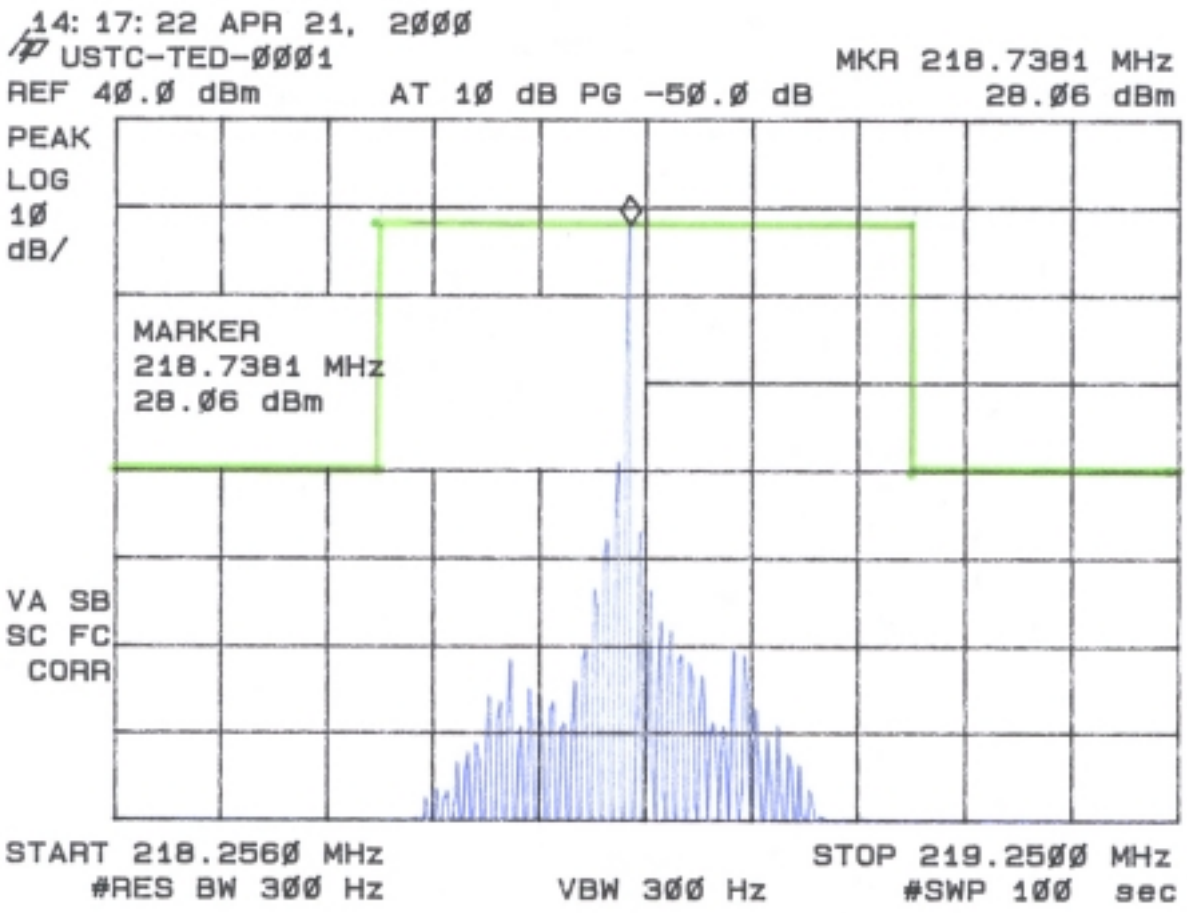
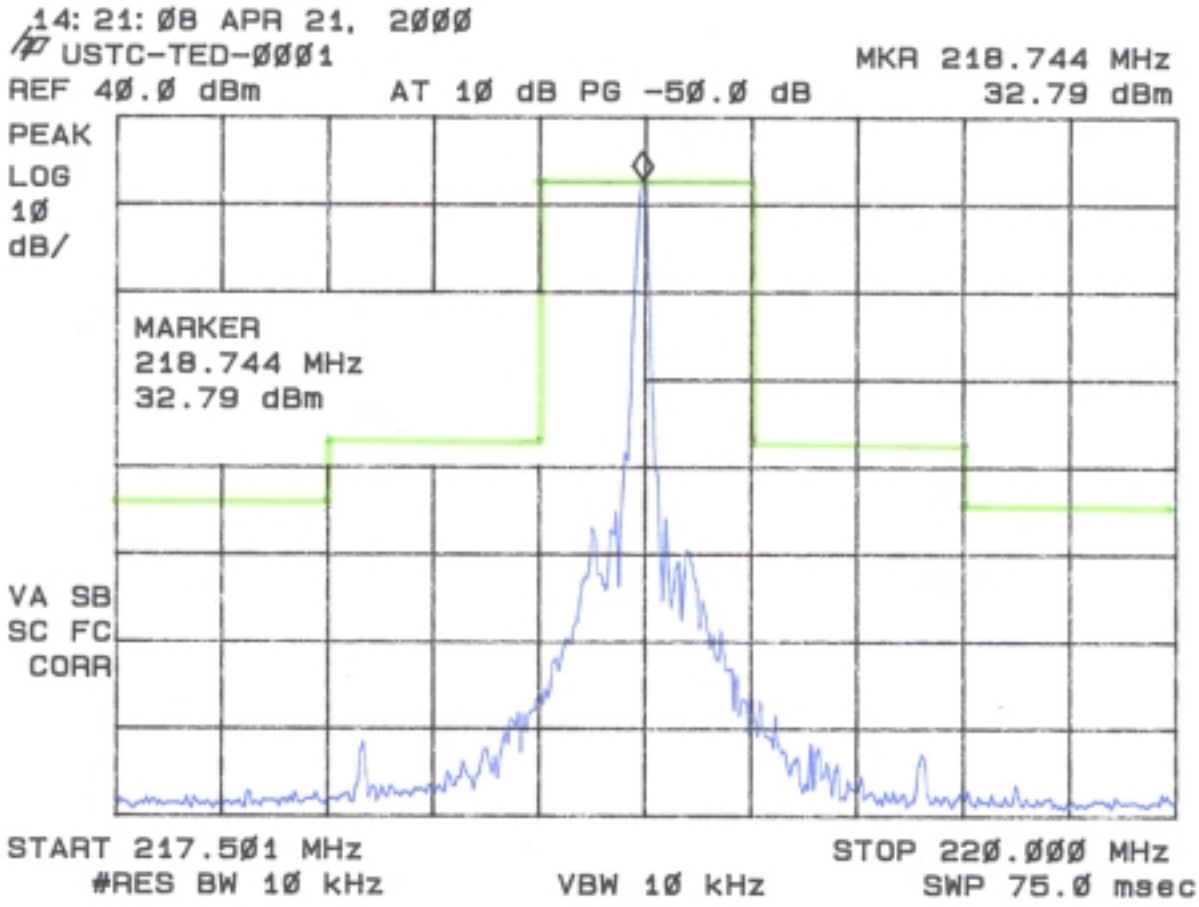


Figure 5b.
Occupied Bandwidth



2.9 Spurious Emissions at Antenna Terminals (FCC Section 2.1051)

Spurious emissions appearing at the antenna terminals were measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminals or across the antenna leads on the PCB as specified by the manufacturer. Results are shown in Figure 6.

FCC Minimum Standard (FCC Section 95.855)

For out-of-band emissions for frequencies removed from the midpoint of the assigned frequency segment by more than 1250 kHz, at least

$$43 + 10 \log (P_{Watts}) = 43 + 10 \log(2.04) = 46.1 \text{ dB}$$

Figure 6
Spurious Emissions at Antenna Terminals

All Antenna Conducted Spurious Emissions were attenuated at least 56 dB below the power of the fundamental.

2.10 Field Strength of Spurious Radiation (FCC Section 2.1053)

Spurious emissions were evaluated from 30 MHz to 2.2 GHz at an EUT to antenna distance of 3 meters. The EUT was tested with a new battery. Measurements for 30 to 1000 MHz were made with the analyzer's bandwidth set to 120 kHz. Measurements above 1 GHz were made with the analyzer's bandwidth set to 1 MHz. Results are shown in Table 4. Following is an example of how the data was calculated.

The spurious radiation measured is interpolated to 30 meters using:

dBm @ 3 meters + 20 log(3/30) = dBm @ 30 meters

this level is compared to the level a transmitter would produce at 30 meters if connected to a 1/2 wave dipole using:

$$E = \frac{(30\ P_t\ G_t)^{1/2}}{d} \text{ volts per meter}$$

E = Field intensity (volts per meter)

P_t = Power output of transmitter (watts)

G_t = Gain of antenna (1.64 for 1/2 wave dipole)

d = distance (meters)

For Example: A 25 watt transmitter would produce

$$\frac{[(30)(25)(1.64)]^{1/2}}{30.0} \text{ volts per meter}$$

= 1,150,635 microvolts per meter @ 30 meters

FCC Minimum Standard

For out-of-band emissions for frequencies removed from the midpoint of the assigned frequency segment by more than 1250 kHz, at least

$$43 + 10 \log (P_{Watts}) = 43 + 10 \log(2.04) = 46.1 \text{ dB}$$

FIELD STRENGTH OF SPURIOUS RADIATION

Test Date: April 22, 2000
UST Project: 00-0141
Customer: U. S. Telemetry Corporation
Model: USTC-TED-0001

FCC Minimum Standard: 43 + 10 log (2.04) = 46.1 dB
Fundamental = Corrected Reading in Far Field (30m) = +3.5 dBm

TABLE 4

FREQ (MHz)	MEASUREMENT @ 3 m (dBm)	CORRECTION AF + CL + AMP GAIN	CORRECTED MEASUREMENT @ 30 m (dBm)	ATTENUATED LEVEL BELOW CARRIER POWER (dB)
437.5	-58.9	21.2	-57.7	61.2
656.2	-66.2	26.3	-59.9	63.4
1090.0	-47.2	-7.9	-75.1	78.6
1530.0	-53.4	-5.3	-78.7	82.2

SAMPLE CALCULATION:
Results dBm @ 30 m:
-58.9 + 21.2 - 20 = -57.7

CONVERSION FROM 3m to 30m = 20 log (3/30) = -20 dBm

Test Results
Reviewed By: _____ **Name:** Tim R. Johnson

2.11 Frequency Stability (FCC Section 2.1055)

The frequency tolerance of the carrier signal was measured by while ambient temperature was varied from -30 to 50 degrees centigrade. The frequency tolerance was verified at 10 degree increments. The EUT was tested with fully charged batteries. Additionally, the supply voltage was varied from 85% to 115% of the nominal value (except for hand carried, battery powered equipment which was additionally measured at battery endpoint). The data is shown in the following tables and figures.

FCC Minimum Standard

None

FCC Certification
U. S. Telemetry Model USTC-TED-0001
Frequency Stability vs. Temperature (At Startup)

FCC ID: OZ9USTC-TED-0001

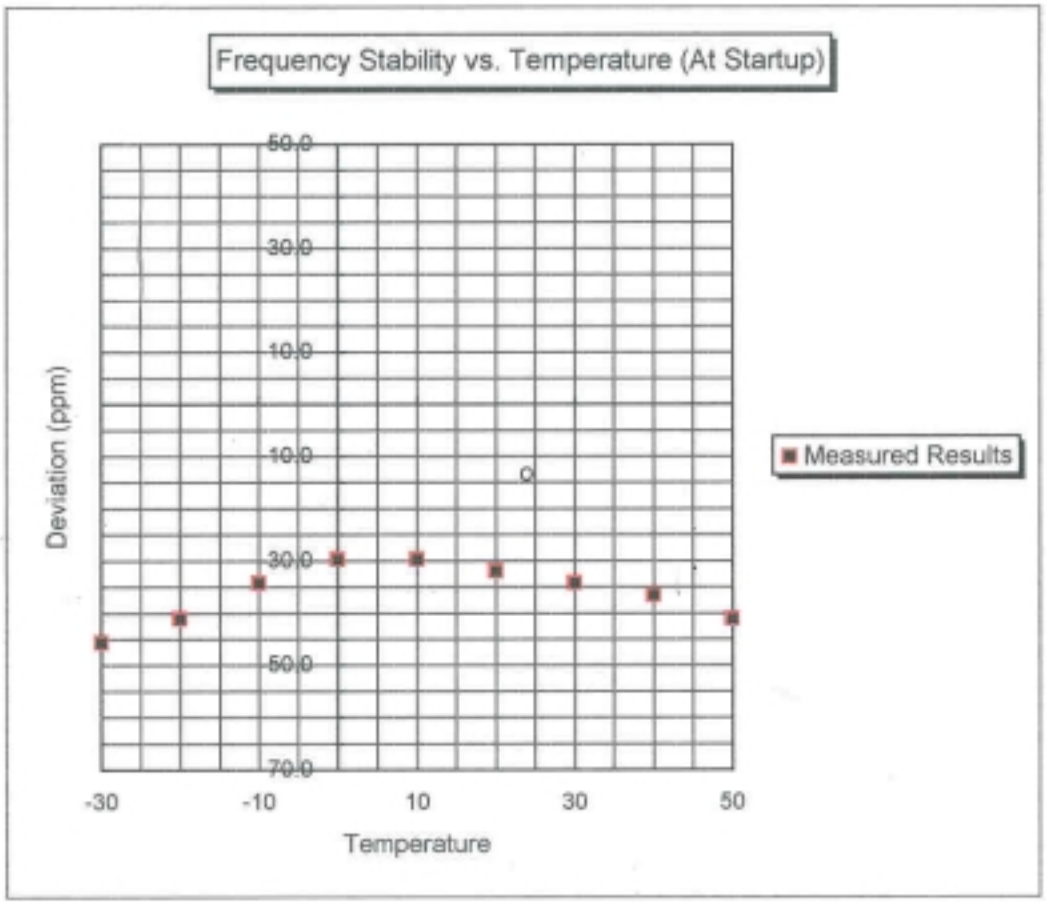
Test Results Reviewed By:

Tim Johnson
NARTE Certified Engineer

Temperature (degrees C)	Measured Frequency (MHz)	Deviation (ppm)
-30	218.7400	-45.7
-20	218.7410	-41.1
-10	218.7425	-34.3
0	218.7435	-29.7
10	218.7435	-29.7
20	218.7430	-32.0
30	218.7425	-34.3
40	218.7420	-36.6
50	218.7410	-41.1

Actual TX Frequency was: 218.750 MHz

Maximum Deviation = N/A



FCC ID: OZ9USTC-TED-0001

FCC Certification
U. S. Telemetry Model USTC-TED-0001
Frequency Stability vs. Temperature (2 Minutes After Startup)

FCC ID: OZ9USTC-TED-0001

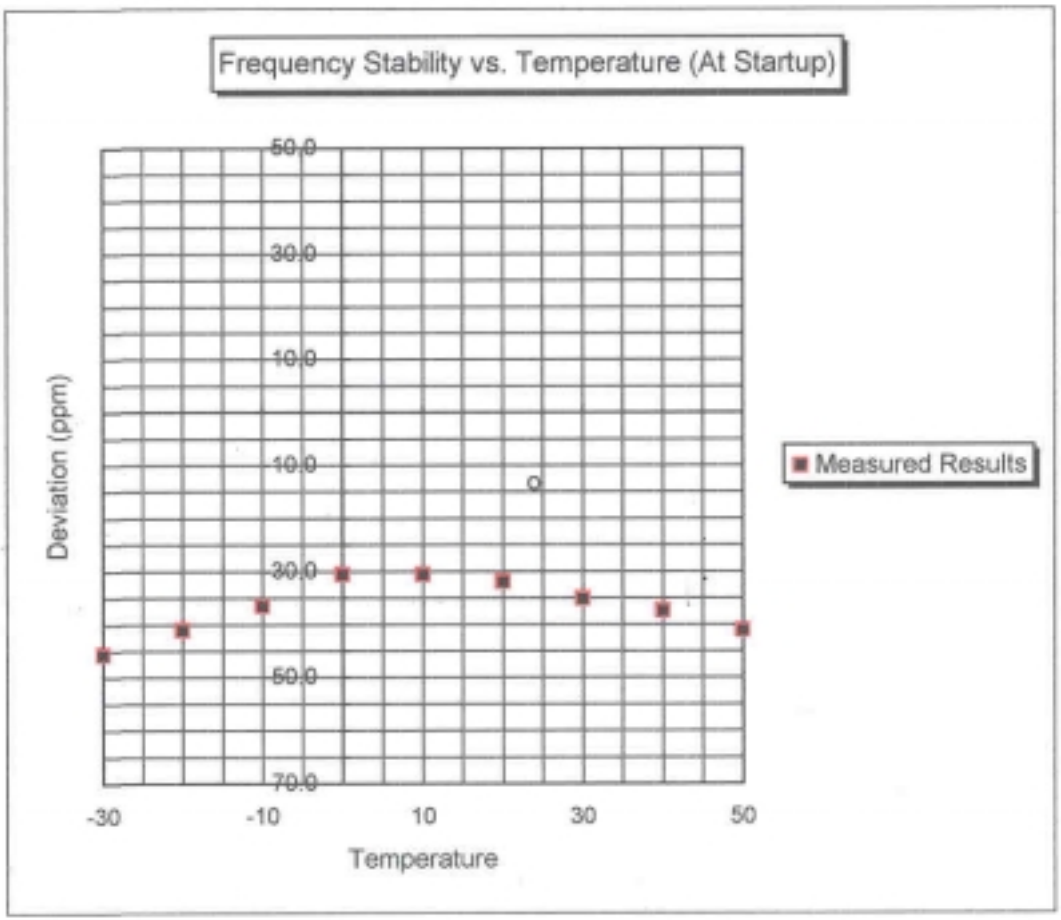
Test Results Reviewed By:

Tim Johnson
NARTE Certified Engineer

Temperature (degrees C)	Measured Frequency (MHz)	Deviation (ppm)
-30	218.7400	-45.7
-20	218.7410	-41.1
-10	218.7420	-36.6
0	218.7433	-30.6
10	218.7433	-30.6
20	218.7430	-32.0
30	218.7423	-35.2
40	218.7418	-37.5
50	218.7410	-41.1

Actual TX Frequency was: 218.750 MHz

Maximum Deviation = N/A



FCC ID: OZ9USTC-TED-0001

FCC Certification
U. S. Telemetry Model USTC-TED-0001
Frequency Stability vs. Temperature (5 Minutes After Startup)

FCC ID: OZ9USTC-TED-0001

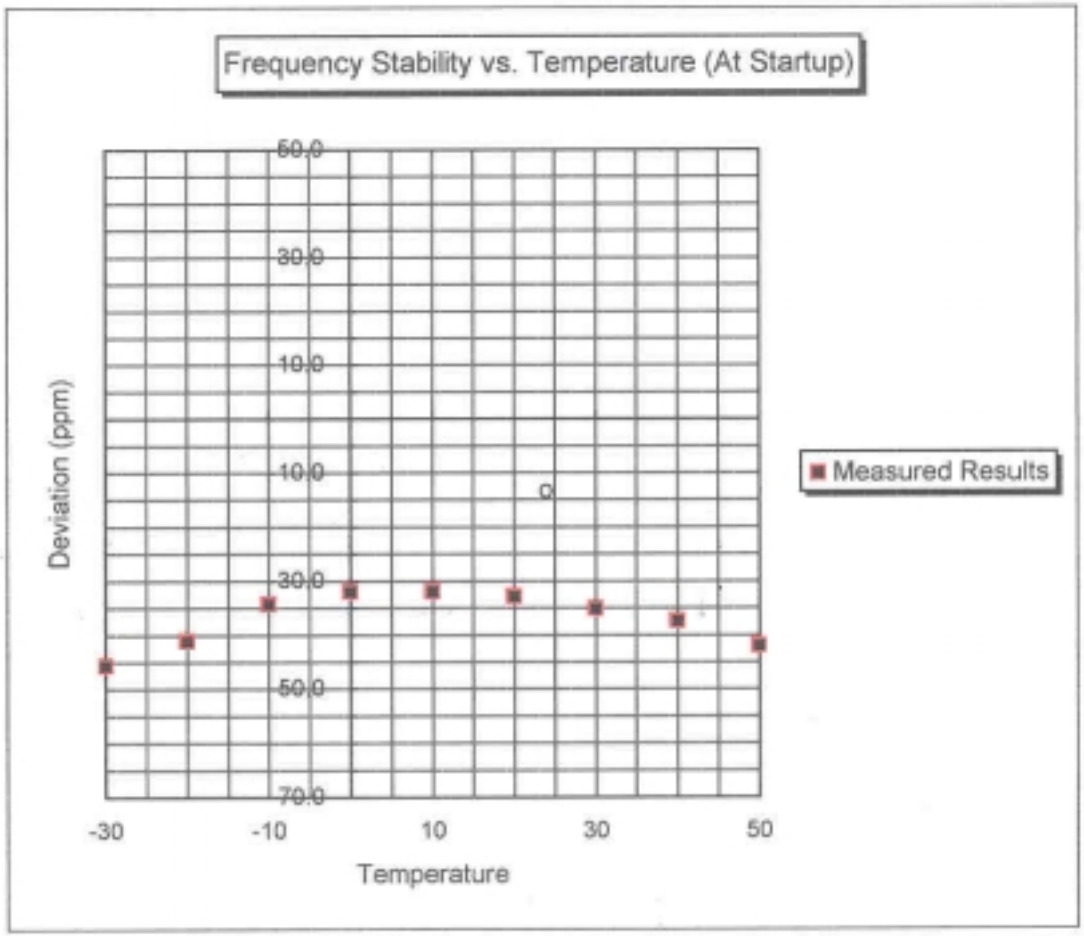
Test Results Reviewed By:

Tim Johnson
NARTE Certified Engineer

Temperature (degrees C)	Measured Frequency (MHz)	Deviation (ppm)
-30	218.7400	-45.7
-20	218.7410	-41.1
-10	218.7425	-34.3
0	218.7430	-32.0
10	218.7430	-32.0
20	218.7428	-32.9
30	218.7423	-35.2
40	218.7418	-37.5
50	218.7408	-42.1

Actual TX Frequency was: 218.750 MHz

Maximum Deviation = N/A



FCC ID: OZ9USTC-TED-0001

FCC Certification
FCC ID: OZ9USTC-TED-0001
U. S. Telemetry Model USTC-TED-0001
Frequency Stability vs. Temperature (10 Minutes After Startup)

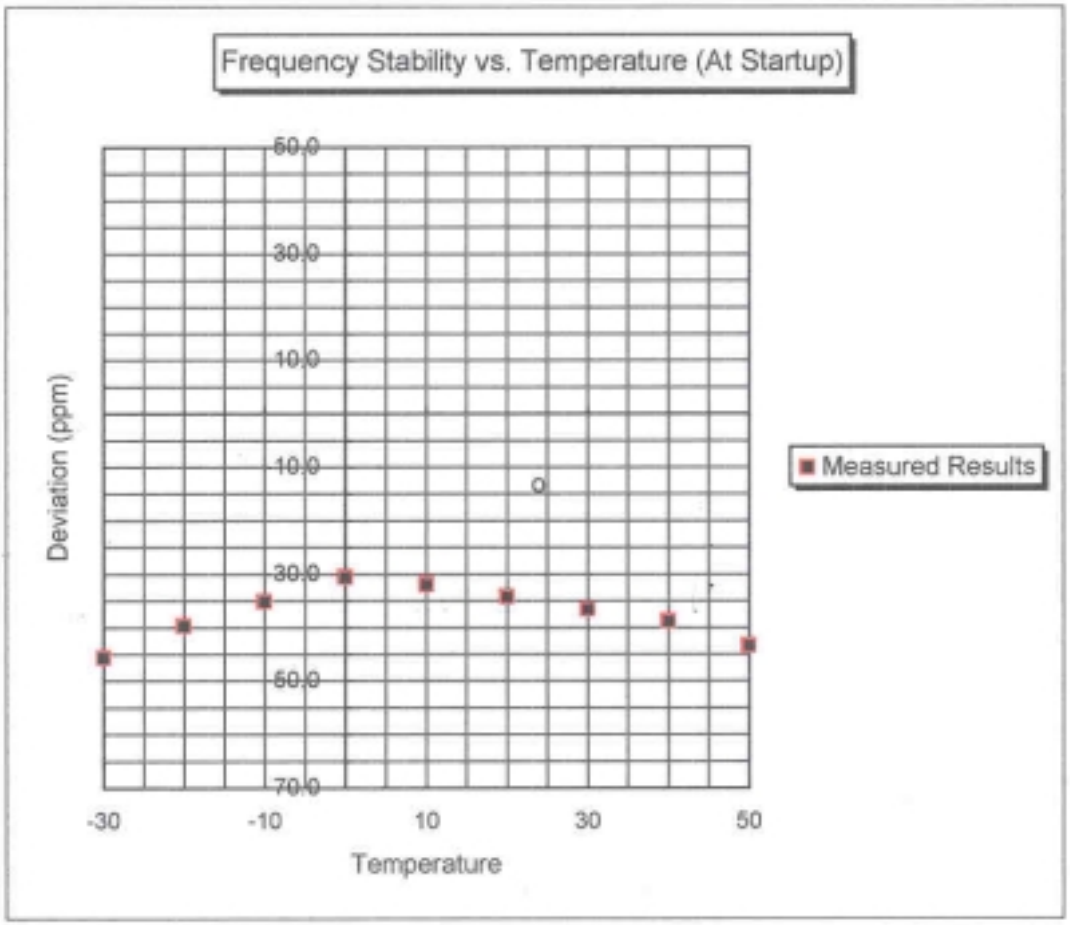
Test Results Reviewed By:

Tim Johnson
NARTE Certified Engineer

Temperature (degrees C)	Measured Frequency (MHz)	Deviation (ppm)
-30	218.7400	-45.7
-20	218.7413	-39.8
-10	218.7423	-35.2
0	218.7433	-30.6
10	218.7430	-32.0
20	218.7425	-34.3
30	218.7420	-36.6
40	218.7415	-38.9
50	218.7405	-43.4

Actual TX Frequency was: 218.750 MHz

Maximum Deviation = N/A



FCC ID: OZ9USTC-TED-0001

FCC Certification
U. S. Telemetry Model USTC-TED-0001
Frequency Stability vs. Voltage

FCC ID: OZ9USTC-TED-0001

Test Results Reviewed By:

Tim Johnson
NARTE Certified Engineer

Voltage (V DC)	Measured Frequency (MHz)	Deviation (ppm)
9.3	218.7413	-39.8
10.2	218.7417	-37.9
12.0	218.7418	-37.5
13.8	218.7417	-37.9

Actual TX Frequency was: 218.750 MHz

Maximum Deviation = N/A