SANDIA aerospace Albuquerque, New Mexico	Document Number **Part87 supplement**	Effective Date: **03/02/2017**	Revision: **2**
	Title: **Supplemental FCC test frequency stability – STX 360**		

REVISION	DATE	DESCRIPTION	BY/APPROVAL
1	03092017	Initial Release	Gabriel Martinez
2	03162017	Test photos	Gabriel Martinez
3	03172017	Table update - kHz	Gabriel Martinez

Contents

Tables

Figures

General

Test data in this report is a supplement to the testing to TIMCO engineering inc. The self-test data was performed at Sandia Aerospace, 3700 Osuna Rd. NE Suite 711, Albuquerque, NM 87109.

Supplemental data is specifically for "Frequency Stability" Part 2.1055, Part 87.133 for both the 1090MHz Mode C transponder and 978MHz of the UAT (Universal Access Transceiver).

Firmware Version

Table 1: STX 360 firmware versions

CPU	FPGA
Ver. ER-2	Ver. ER-8

Equipment

Table 2: Equipment List for STX 360 frequency stability supplemental tests

DEVICE	MANUFACTURER	MODEL	SERIAL NUM	CAL/Char Date	Due Date
24 Volt Supply	Rigol	DP832A	SAT074	N/A	N/A
Temperature Chamber	TPS	ETCU04RC2.5 Blue M	SAT041 ID 31692	06/15/2016	06/15/2017
Spectrum Analyzer	Hewlett Packard	89441A	SAT067	08/30/2016	08/30/2017
Spectrum Analzyer	Agilent	E4443A	SAT068	09/01/2015	09/01/2017
ATC/DME Test Set	Tel. Instrument	TB-2100	SAT043	06/20/2016	06/20/2017

UUT

Table 3: Unit under test (UUT)

S/N	Description
97	STX 360 panel mount unit
90	STX 360 panel mount unit

Measurements required

The frequency stability shall be measured with variations of ambient temperature from -30° to +50° centigrade. Measurements shall be made at the extremes of the temperature range and at intervals of not more than 10° centigrade through the range. A period sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. In addition to temperature stability, the frequency stability shall be measured with variation of primary supply voltage as follows:

1. Vary primary supply voltage from 85 to 115 percent of nominal value.
2. The supply voltage shall be measured at the input to the cable.

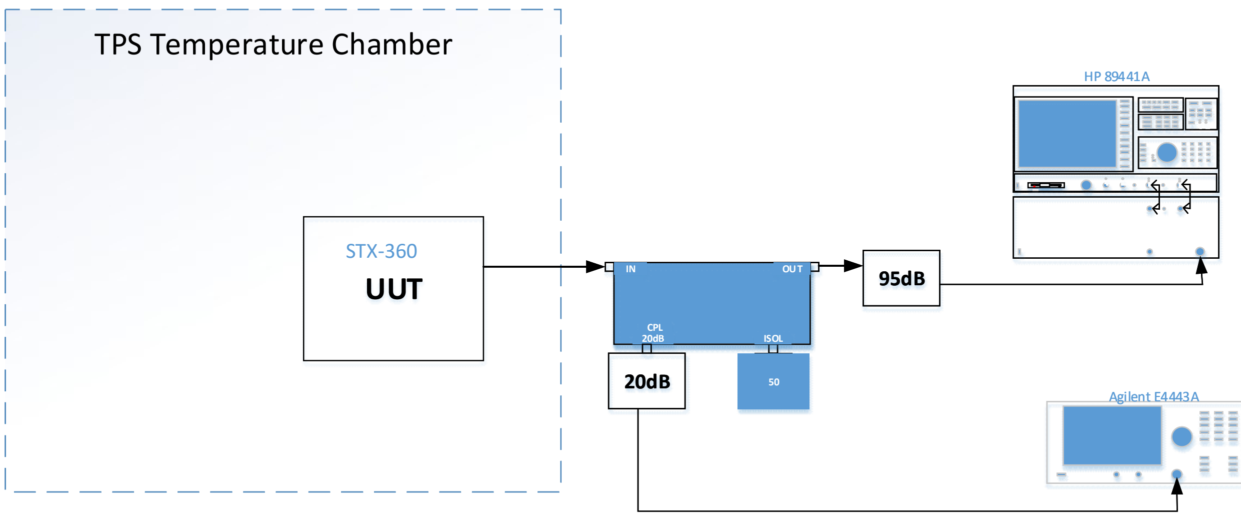

Figure 1: Frequency Stability Test Setup

The measurement procedure outlined below shall be followed.

1. The transmitter shall be installed in an environmental test chamber whose temperature is controllable. Provision shall be made to measure the frequency of the transmitter.
2. With the transmitter inoperative (power switched "OFF), the temperature of the test chamber shall be adjusted to +25° centigrade. After a temperature stabilization period of one hour at +25° centigrade, the transmitter shall be switched "ON" with standard test voltage applied.
3. The carrier shall be keyed "ON", and the transmitter shall be operated at full radio frequency power output at the duty cycle, for which it is rated, for duration of at least 5

minutes. The radio frequency carrier frequency shall be monitored and measurements shall be recorded.

4. The test procedure outlined in Steps 2 and 3, shall be repeated after stabilizing the transmitter at the environmental temperatures specified, -30° centigrade to +50° centigrade in 10-degree increments.

The frequency stability was measured with variations in the power supply voltage from 85 to 115 percent of the nominal value. An Rigol DP832A Power Supply was used to vary the DC input voltage from 11.8VDC to 32.2VDC. The frequency was measured and the variation in parts per million was calculated. Data was taken per CFR47 Paragraphs 2.1055 and applicable paragraphs of part 87.133.

Below is the measurement data for both the ATCRBS (Mode C transponder 1090MHz) and the UAT 978MHz in the respective sections below.

ATCRBS -1090MHz

Frequency Stability

Rule Parts. No.: Part 2.1055, Part 87.133

Requirements: Temperature range requirements: -30 to +50 deg C

Voltage variation +/- 15%   +/-20 PPM

Test Data: Measurement Table

Table 4: ATCRBS (1090MHz) Frequency Stability results

Temperature	**Frequency (kHz)**	**Cycles**	**PPM**
25°C (reference)	0.830	830	.761
-30°C	0.200	200	.183
-20°C	0.200	200	.183
-10°C	0.200	200	.183
0°C	0.167	167	.153
10°C	0.117	117	.107
20°C	0.092	92	.084
30°C	0.067	67	.061
40°C	0.050	50	.045
50°C	0.050	50	.045
Input Voltage	**Frequency (kHz)**	**Cycles**	**PPM**
-15%	0.830	830	.761
15%	0.830	830	.761

UAT-978MHz

Frequency Stability

Rule Parts. No.: Part 2.1055, Part 87.133

Requirements: Temperature range requirements: -30 to +50 deg C

Voltage variation +/- 15%   +/-20 PPM

Test Data: Measurement Table

Table 5: UAT (978MHz) Frequency Stability results

Temperature	Frequency (kHz)	Cycles	PPM
25°C (reference)	-4.8348	4835	4.83
-30°C	1.9512	1951	1.95
-20°C	4.2385	4239	4.23
-10°C	4.3458	4346	4.34
0°C	4.54	4540	4.54
10°C	3.1623	3162	3.16
20°C	1.7385	1739	1.77
30°C	-1.5799	-1580	1.58
40°C	-4.462	4462	-4.5
50°C	-3.4025	-3403	-3.4
Input Voltage	**Frequency (kHz)**	**Cycles**	**PPM**
-15%	-4.8039	4804	4.8
15%	-4.6982	4698	4.69