



HARRIS

GE HARRIS
Railway Electronics

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Exhibit D

Frequency Stability Data: Variation of Ambient Temperature

D.1 Introduction

The frequency stability of the ITCU was measured with variation of the ambient temperature. The following data supports FCC requirements outlined in Section 2.995.

D.2 Equipment

- Sorensen LT 30-3 DC Power Supply (Set at 12.0 V, 0.6 A)
- Thermotron Temperature Chamber
- Fluke Multimeter with Thermocouple Module (taped directly to ITCU)
- HP Spectrum Analyzer 8563 E
- Maintenance Monitor with special test mode software

D.3 Overview

Testing for temperature stability took place at GE Harris under the supervision of Michael Lipsky.

In compliance with FCC code 2.995,(a),1, ambient temperature was varied from -40 C to +70 C.

In compliance with FCC code 2.995,(b), measurements were made at intervals of 10 C, while allowing a sufficient period of time (30 min.) to stabilize all of the components.

For this test, the radio was placed in a test mode that causes it to generate two non-spread tones at $f_c \pm 5.5$ MHz. The actual center frequency is derived by calculating the centerpoint between the frequencies of these tones. This center frequency was determined for ambient temperatures from -40°C to +70°C, the operating temperature range of the device. The test data and a plot of frequency deviation vs. ITCU temperature is provided below.

D.4 Test Data

Temperature Stability Test (Center Frequency - 2438 MHz)

5-Mar-99

Performed by Michael Lipsky

Chamber Temperature	ITCU Temperature	Lower	Upper	Center (Calculated - GHz)	Deviation from Nominal Center Freq.
-40	-33.5	2.4325054	2.4435069	2438006.15	6.15
-30	-29.5	2.4325069	2.4435078	2438007.35	7.35
-20	-19.9	2.4325069	2.4435061	2438006.5	6.5
-10	-9.4	2.432506	2.4435054	2438005.7	5.7
0	0.1	2.432506	2.4435057	2438005.85	5.85
10	10.2	2.432506	2.4435067	2438006.35	6.35
20	19.1	2.4325057	2.4435057	2438005.7	5.7
25	25.2	2.43250459	2.4435044	2438004.495	4.495000001
30	28.5	2.4325047	2.443505	2438004.85	4.85
40	39.1	2.4325035	2.44350373	2438003.615	3.615
50	46.8	2.432504	2.4435043	2438004.15	4.15
60	57.3	2.432504	2.443504	2438004	4
70	67.8	2.432504	2.4435037	2438003.85	3.85

Table D.4 Temperature Stability Test Data

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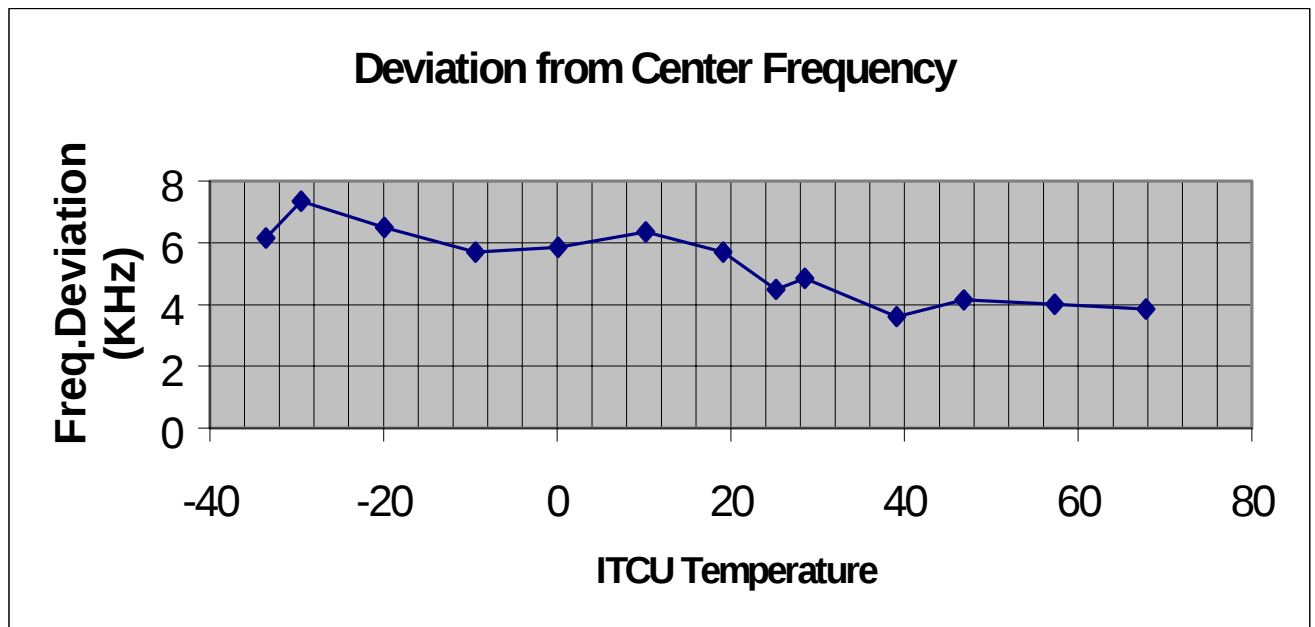


Figure D.4 Deviation vs. Temperature

D.5 Test Results

The test data presented in Section D.4 proves that the ITCU is frequency stable under all specified ambient temperature conditions. The largest frequency deviation was 7.35 kHz which occurred at -30°C . The specified requirement for center frequency variation is $f_c \pm 40\text{ KHz}$