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FCC / IC Certification Application  
FCC ID: O8FMADECA  
IC:3959A-MADECA

Treo 650 (CDMA)  
Frequency and Power Stability  
Vs.  
Temperature and Supply Voltage

IC: RSS129 - 6.2.1, 6.2.2

IC: RSS 133 - 7

FCC: Part 2.1055

This document outlines the compliance of the Treo 650 against Industrie Canada RSS 129 and RSS 133 and FCC Part 2.1055 Frequency and power stability requirements for the Treo 650.

#### Frequency Versus Temperature and Supply Voltage

#### RSS129 Section 9.2.1 Compliance and FCC Part 1055 (900 MHz )

#### IC RSS 129 Section 9.2.1 Specification

##### **9.2.1 Minimum Standard for Frequency Stability (Mobile and Base Stations)**

The RF carrier frequency, when tested over the temperature range of -30°C to +50°C, or over the supply voltage range of  $\pm 15\%$  from the nominal value, but non-accumulatively, shall not depart from the reference frequency (reference frequency is the frequency at +20°C and rated supply voltage) in excess of  $5 \times 10^{-8}$  (0.000005%), i.e. non-accumulatively. (Note: This frequency stability is required for satisfactory soft-handoff functions).

In addition, the mobile station transmit carrier frequency shall be 45.0 MHz  $\pm 300$  Hz lower than the frequency of the base station transmit carrier as measured at the mobile station receiver. A suitable method of measurement is described in TIA/EIA IS-98.

#### **FCC Part 2.1055 Specification:**

-30 to 50 C temperature Range and a Supply voltage variation of +/- 15% from the nominal supply voltage.

#### **Notes:**

The standards require the unit to be tested over a voltage range of +/- 15% from nominal. In the case of the Treo 650, this is not possible. The nominal operating voltage is 3.9 VDC. A 15% variation yields a voltage range of 3.315 to 4.485 VDC.

In the case of 3.315VDCe voltage is to low for the device to operate. In the case of 4.485VDC the device will shut down due to the over voltage protection circuitry.

The product was tested over the operating voltage range of nominal supply voltage +/-10% ( 3.51VDC to 4.20 VDC)

#### Results: Frequency Drift Vs. Supply Voltage (900 MHz)

Supply Voltage	Channel	Freq MHz	Drift From Ref (Hz)	Drift (Micro %) IC Limit =5
3.510	1013	824.7	7	<b>0.085</b>
3.510	384	836.5	7	<b>0.084</b>
3.510	777	848.3	5	<b>0.059</b>
3.900	1013	824.7		
3.900	384	836.5		
3.900	777	848.3		
4.200	1013	824.7	7	<b>0.085</b>
4.200	384	836.5	-4	<b>-0.048</b>
4.200	777	848.3	-2	<b>-0.024</b>

**IC RSS 129 Section 9.2.1**  
**FCC Part 2.1055**

Results: Frequency Drift Vs. Temperature (900 MHz)

Temp (C)	Channel	Freq (MHz)	Freq Error (Hz)	Drift From Ref (Hz)	Drift (Micro %) IC Limit =5
-20	1013	824.7	10	10	<b>1.213</b>
-20	384	836.5	20	0	<b>0.000</b>
-20	777	848.3	10	20	<b>2.358</b>
-10	1013	824.7	11	9	<b>1.091</b>
-10	384	836.5	20	0	<b>0.000</b>
-10	777	848.3	25	5	<b>0.589</b>
0	1013	824.7	14	6	<b>0.728</b>
0	384	836.5	20	0	<b>0.000</b>
0	777	848.3	20	10	<b>1.179</b>
10	1013	824.7	17	3	<b>0.364</b>
10	384	836.5	20	0	<b>0.000</b>
10	777	848.3	25	5	<b>0.589</b>
20	1013	824.7	20	0	<b>0.000</b>
20	384	836.5	20	0	<b>0.000</b>
20	777	848.3	30	0	<b>0.000</b>
30	1013	824.7	16	4	<b>0.485</b>
30	384	836.5	15	5	<b>0.598</b>
30	777	848.3	28	2	<b>0.236</b>
40	1013	824.7	12	8	<b>0.970</b>
40	384	836.5	10	10	<b>1.195</b>
40	777	848.3	24	6	<b>0.707</b>
50	1013	824.7	10	10	<b>1.213</b>
50	384	836.5	5	15	<b>1.793</b>
50	777	848.3	22	8	<b>0.943</b>
60	1013	824.7	10	10	<b>1.213</b>
60	384	836.5	0	20	<b>2.391</b>
60	777	848.3	20	10	<b>1.179</b>

**Frequency Drift Versus Temperature AND Supply Voltage**  
**IC RSS129 Section 9.2.2 Compliance**

IC RSS129 Section 9.2.2 Specification

**9.2.2 Minimum Standard for Output Power (Mobile Station)**

The effective radiated power (ERP) at maximum output power, when tested over the temperature range of -30°C to +60°C, **and** over the supply voltage range of  $\pm 10\%$  from the nominal value, accumulatively (using the antenna gain recommended by the mobile manufacturer) shall not exceed the limits in Table 9.1.

IC RSS129 Section 9.2.2 Results:

The limit referred to in table 9.1 of the specification shows a power limit of 1 Watt ERP (1.64 Watts EIRP)

The typical power output of the Treo 650 CDMA unit is approximately 250 mW. At no time during the testing (Varying temperature and supply voltage  $+\/- 10\%$  from nominal) did the output power of the device exceed 1.64 Watts EIRP

## Frequency Drift Versus Temperature AND Supply Voltage

### IC RSS133 Section 7 Compliance

#### **7. Frequency Stability**

The unmodulated carrier frequency shall be measured under the conditions specified below. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement:

- (a) at temperatures of -30°C, +20°C and +50°C at the manufacturer's rated supply voltage, and
- (b) at 85% and at 115% of the manufacturer's rated supply voltage, when the temperature is at +20°C.

#### **Minimum Standard**

The RF carrier frequency shall not depart from the reference frequency (reference frequency is the frequency at +20°C and rated supply voltage) by more than +2.5 ppm for mobiles and +1.0 ppm for base stations.

#### Notes:

The standard requires the unit to be tested over a voltage range of +/- 15% from nominal. In the case of the Treo 650, this is not possible. The nominal operating voltage is 3.9 VDC. A 15% variation yields a voltage range of 3.315 to 4.485 VDC.

In the case of 3.315VDCe voltage is to low for the device to operate. In the case of 4.485VDC the device will shut down due to the over voltage protection circuitry.

The product was tested over the operating voltage range of nominal supply voltage +/-10% ( 3.51VDC to 4.20 VDC)

Additionally, the Treo 650 is not specified to operate down to -30C. As expected, the device did not operate at -30C, thus a measurement was not possible. The unit was tested fro -20 to + 60 C.

Frequency Drift  
Versus Temperature  
and Supply Voltage  
(IC 1900MHz)

Temp (C)	VDC	Channel	Freq (MHz)	Tot Freq Drift Temp & VDC (Hz)	Drift (PPM) Limit (+/- 2.5)
-20	3.510	25	1851.5	3.0	<b>0.002</b>
-20	3.510	600	1880.0	2.0	<b>0.001</b>
-20	3.510	1175	1908.8	5.0	<b>0.003</b>
-20	4.200	25	1851.5	-5.0	<b>-0.003</b>
-20	4.200	600	1880.0	6.0	<b>0.003</b>
-20	4.200	1175	1908.8	4.0	<b>0.002</b>
-10	3.510	25	1851.5	6	<b>0.003</b>
-10	3.510	600	1880.0	2	<b>0.001</b>
-10	3.510	1175	1908.8	-20	<b>-0.010</b>
-10	4.200	25	1851.5	4	<b>0.002</b>
-10	4.200	600	1880.0	6	<b>0.003</b>
-10	4.200	1175	1908.8	-11	<b>-0.006</b>
0	3.510	25	1851.5	3	<b>0.002</b>
0	3.510	600	1880.0	2	<b>0.001</b>
0	3.510	1175	1908.8	-15	<b>-0.008</b>
0	4.200	25	1851.5	1	<b>0.001</b>
0	4.200	600	1880.0	6	<b>0.003</b>
0	4.200	1175	1908.8	-4	<b>-0.002</b>
10	3.510	25	1851.5	0	<b>0.000</b>
10	3.510	600	1880.0	2	<b>0.001</b>
10	3.510	1175	1908.8	-20	<b>-0.010</b>
10	4.200	25	1851.5	-2	<b>-0.001</b>
10	4.200	600	1880.0	2	<b>0.001</b>
10	4.200	1175	1908.8	-20	<b>-0.010</b>
20	3.510	25	1851.5	0.0	<b>0.000</b>
20	3.510	600	1880.0	0.0	<b>0.000</b>
20	3.510	1175	1908.8	0.0	<b>0.000</b>
20	4.200	25	1851.5	0.0	<b>0.000</b>
20	4.200	600	1880.0	0.0	<b>0.000</b>
20	4.200	1175	1908.8	0.0	<b>0.000</b>
30	3.510	25	1851.5	1	<b>0.001</b>
30	3.510	600	1880.0	7	<b>0.004</b>
30	3.510	1175	1908.8	-13	<b>-0.007</b>
30	4.200	25	1851.5	-1	<b>-0.001</b>
30	4.200	600	1880.0	1	<b>0.001</b>
30	4.200	1175	1908.8	-12	<b>-0.006</b>
40	3.510	25	1851.5	5	<b>0.003</b>
40	3.510	600	1880.0	8	<b>0.004</b>
40	3.510	1175	1908.8	-19	<b>-0.010</b>
40	4.200	25	1851.5	3	<b>0.002</b>
40	4.200	600	1880.0	16	<b>0.009</b>
40	4.200	1175	1908.8	-8	<b>-0.004</b>
50	3.510	25	1851.5	7	<b>0.004</b>
50	3.510	600	1880.0	17	<b>0.009</b>
50	3.510	1175	1908.8	-17	<b>-0.009</b>
50	4.200	25	1851.5	5	<b>0.003</b>
50	4.200	600	1880.0	21	<b>0.011</b>
50	4.200	1175	1908.8	-6	<b>-0.003</b>
60	3.510	25	1851.5	-13.0	<b>-0.007</b>
60	3.510	600	1880.0	2.0	<b>0.001</b>
60	3.510	1175	1908.8	-5.0	<b>-0.003</b>
60	4.200	25	1851.5	-15	<b>-0.008</b>
60	4.200	600	1880.0	6	<b>0.003</b>
60	4.200	1175	1908.8	6	<b>0.003</b>

**FCC Part 2.1055 (FCC 1900 MHz)**

## Frequency Stability Vs Temperature

Temp (C)	Channel	Freq (MHz)	Freq Error (Hz)	Drift From Ref (Hz)	Drift (Micro %)
-20	25	1851.5	10	10	<b>0.540</b>
-20	600	1880.0	20	0	<b>0.000</b>
-20	1175	1908.8	10	20	<b>1.048</b>
-10	25	1851.5	11	9	<b>0.486</b>
-10	600	1880.0	20	0	<b>0.000</b>
-10	1175	1908.8	25	5	<b>0.262</b>
0	25	1851.5	14	6	<b>0.324</b>
0	600	1880.0	20	0	<b>0.000</b>
0	1175	1908.8	20	10	<b>0.524</b>
10	25	1851.5	17	3	<b>0.162</b>
10	600	1880.0	20	0	<b>0.000</b>
10	1175	1908.8	25	5	<b>0.262</b>
20	25	1851.5	20	0	<b>0.000</b>
20	600	1880.0	20	0	<b>0.000</b>
20	1175	1908.8	30	0	<b>0.000</b>
30	25	1851.5	16	4	<b>0.216</b>
30	600	1880.0	15	5	<b>0.266</b>
30	1175	1908.8	28	2	<b>0.105</b>
40	25	1851.5	12	8	<b>0.432</b>
40	600	1880.0	10	10	<b>0.532</b>
40	1175	1908.8	24	6	<b>0.314</b>
50	25	1851.5	10	10	<b>0.540</b>
50	600	1880.0	5	15	<b>0.798</b>
50	1175	1908.8	22	8	<b>0.419</b>
60	25	1851.5	10	10	<b>0.540</b>
60	600	1880.0	0	20	<b>1.064</b>
60	1175	1908.8	20	10	<b>0.524</b>