

Engineering Report

Subject: Measurement of Field Strength of Spurious Radiation in
Accordance with the FCC Rules & Regulations Part 2.1053

FCC ID: NVA010164-005A

Equipment: Point of Sale Device

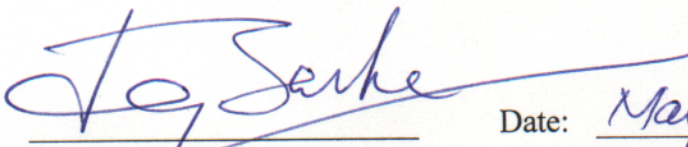
Model: SmartICE with a Novatel NRM-6832 transmitter, CDPD

Client: Hypercom Corporation
2851 West Kathleen Road
Phoenix, Arizona 85053
U.S.A.

Project #: HYPB-SMARTICE CDPD-3365

Prepared By: APREL Laboratories,
Regulatory Compliance Division

Approved by:



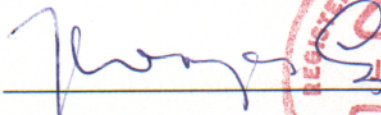
Date:

May 19, 2000

Jay Sarkar

Director, Standards & Certification

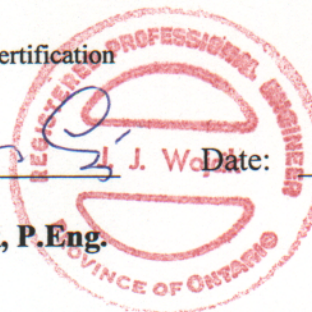
Released by:



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Date:

May 10/2000



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FCC ID: NVA010164-005A
Applicant: Hypercom Corporation
Equipment: Point of Sale Device
Model: SmartICE with a Novatel NRM-6832 transmitter, CDPD
Standard: FCC Rules and Regulations Part 2.1053

ENGINEERING SUMMARY

This report contains the results of Field Strength of Spurious Radiation measurement performed on an Hypercom Point of Sale Device operating with a built-in Novatel NRM-6832 radio transmitter. The measurements were carried out in accordance with the FCC Rules and Regulations Part 2.1053. The product was evaluated for Spurious Emissions when it was set at the maximum power level.

Summary of the Results

Test Description	Page No.	Test Set-up Figure No.	Results Summary
Field Strength of Spurious Radiation Ref. Paragraph 2.1053	8	1	Passed

INTRODUCTION

General

This report describes the results of the Field Strength of Spurious Radiation measurement conducted on an Hypercom Point of Sale Device model SmartICE operating with a built-in Novatel NRM-6832 radio transmitter.

Test Facility

The tests were performed for Hypercom Corporation by APREL Laboratories at APREL's EMI facility located in Nepean, Ontario, Canada. The laboratory operates an (3m and 10m) Open Area Test Site (OATS). The measurement facility is calibrated in accordance with ANSI C63.4-1992.

A description of the measurement facility in accordance with the radiated and AC line conducted test site criteria per ANSI C63.4-1992 is on file with the Federal Communications Commission and is in compliance with the requirements of Section 2.948 of the Commissions rules and regulations.

APREL's registration number is 90416

APREL is accredited by Standard Council of Canada, under PALCAN program (ISO Guide 25). APREL is also accredited by Industry Canada (formerly DOC) and recognised by the Federal Communications Commissions (FCC).

Standard

The evaluation and analysis were conducted in accordance with FCC Rules and Regulations Parts 2.1053 and the appropriate limits.

Test Equipment

The test equipment used during the evaluation is listed in Appendix A with calibration due dates.

Environmental Conditions

Measurements were conducted in open area test site.

- Temperature: $18^{\circ}\text{C} \pm 2$
- Relative Humidity: 30 - 50 %

- Air Pressure: 101 kPa \pm 3

FCC SUBMISSION INFORMATION

FCC ID: NVA010164-005A

Equipment: Point of Sale Device

Model: SmartICE with a Novatel NRM-6832 transmitter, CDPD

For: Certification

Applicant: Hypercom.
2851 West Kathleen Road
Phoenix
Arizona, 85053
USA

Manufacturer: Hypercom.
2851 West Kathleen Road
Phoenix
Arizona, 85053
USA

Evaluated by: APREL Laboratories
51 Spectrum Way
Nepean, Ontario
Canada K2R 1E6

MANUFACTURER'S DATA

FCC ID No: NVA 010164-005A

Equipment Type: Point of Sale Device

Model: SmartICE with a Novatel NRM-6832 transmitter, CDPD

Reference: FCC Rules and Regulations Parts 2 and Part 22

Manufacturer: Hypercom Corporation

Power Source: 7.4/8.4 VDC Battery

**Development
Stage of Unit:** Production

GENERAL SPECIFICATIONS

1. Frequency Range: 824 to 849 MHz (Transmitter)
2. Rated Transmitted
Output Power: 0.6 W Class III
3. Frequency Tolerance: ± 2.5 PPM
4. Type of Modulation: GMSK
5. Emission Designations (See 47 CFR § 2.201 and §2.202): 28K8FXW
6. Antenna Impedance: 50 Ohms

TEST RESULTS

FOR

Field Strength of Spurious Radiation
Of
Point of Sale Device
SmartICE with a Novatel NRM-6832
Radio transmitter, CDPD

Hypercom Corporation

Test: **Field Strength of Transmitter Spurious Radiation**

Ref.: **FCC Parts: 2.1053 and 22.917(e)**

Criteria: On any frequency twice or more than twice the fundamental frequency of the mobile, the mean power of spurious emissions shall be attenuated below the power of the unmodulated carrier by at least $43 + 10 \log (P)$ dB.

This was calculated to be 84.6 dB μ V/m at 3 meters.

Set-up: See Figure No. 3.

Environmental

Conditions: Temperature: $23^{\circ}\text{C} \pm 2$.
 Air pressure: 101 ± 3 kPa

Procedure: The final measurements were taken at APREL Laboratory's open area test site (OATS) measurement facility. This open area test site is calibrated to ANSI C63.4 document and a description of the measurement facility is on file with the Federal Communications Commission and is in compliance with the requirements of Section 2.948 of the Commissions rules and regulations. (FCC Registration No.: 90416).

The mobile was configured to operate at maximum power with appropriate GMSK modulation. The mobile was keyed on channel with frequency 836.000 MHz. Special software was employed in order that the transmitter was processing data in a normal manner.

Prior to final measurements in the OATS, preliminary radiated spurious emissions were scanned in a shielded enclosure at a distance of 1 m using a broadband log-periodic and horn antennas in order to determine the characteristic frequencies of the field strength of spurious emissions. Based on this information, measurements were performed in the OATS at these characteristic frequencies using calibrated antennas.

The transmitter output was fed to a HP 8920 A/D RF Communication Test Set and the output power was noted for reference. All field strength measurements were made with

spectrum analyzer and the appropriate calibrated antenna for the frequency range of 9 kHz up to 10th harmonics of the transmit frequency .

The equipment under test was placed on a turntable positioned 3 meters away from the calibrated receiving antenna, which in turn was connected to the spectrum analyzer. For each identified frequency, the received signal was maximized by the positioning of the turntable and the height of the antenna. The process was repeated for both horizontal and vertical polarization.

Information submitted includes the relative radiated power of each spurious emissions with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antenna.

Measurements given in the spurious emissions test result tables contain: analyzer reading, correction factor, and final reading. The final field strength level are derived from the analyzer measurement and the correction factor (antenna factor and cable loss) as shown in the following example:

Sample Calculation:

A. Spectrum analyzer reading (Direct measurement)

At 32.20 MHz a spurious level of 17.65 dBμV @ 3 meters is measured.

B. Correction factor (antenna factor and cable loss)

Cable loss: 0.66 dB

Antenna factor: 13.60 dB

Total Correction Factor: $0.66 + 13.60 = 14.26$ dB/m

C. Final Reading (Field Strength of spurious emission)

$C = A + B$

$C = 17.65 \text{ dB}\mu\text{V} + 14.26 \text{ dB}$

$C = 31.91 \text{ dB}\mu\text{V/m @ 3 meters}$

D. The criteria level.

The field intensity which would be produced by the transmitter carrier operating into a half-wave dipole antenna (gain of 1.64), at a distance of 3 m was calculated using the following formula:

$$\text{Field Strength of carrier (dB}\mu\text{V/m)} = 10\log_{10}\left(\frac{P_t G}{4\pi r^2}\right) + 146 \text{ dB}$$

P_t is transmitter power, 0.6 Watts

G is gain, 1.64

r is distance, 3 meters

Field Strength of carrier was calculated: 125.4 dBμV/m

$$D = \text{Field Strength of carrier} - (43 + (10 \log P))$$

$$D = 125.4 \text{ dB}\mu\text{V/m} - (43 + (10 \log 0.6))$$

$$D = 84.6 \text{ dB}\mu\text{V/m @ 3 meters}$$

Criteria (reference) level at 3 meters from 0.6 Watts into half-wave dipole antenna is 84.6 dBμV/m

E = Margin (spurious emission below the reference level)

$$E = D - C$$

$$E = 84.6 \text{ dB}\mu\text{V/m} - 69.5 \text{ dB}\mu\text{V/m}$$

$$E = 15.0 \text{ dB}$$

Results: **PASSED.** See Tables 4 & 5.

TABLE 4
Field Strength of Transmitter Spurious Radiation

Transmitter Frequency: 836.000 MHz

Power Level: High

Antenna Polarization: Horizontal

Frequency (MHz)	Measured Level (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m) "C"	Criteria Level (dBμV/m) "D"	Margin (dB) "E"
	"A"	"B"			
1672.000	22.5	32.1	54.6	84.6	30.0
2508.000	8.3	38.1	46.4	84.6	38.2

"C" = "A" + "B"

"E" = "D" - "C"

No other signals were detected (below 6 dB - the noise level on the spectrum analyser).

TABLE 5
Field Strength of Transmitter Spurious Radiation

Transmitter Frequency: 836.000 MHz

Power Level: High

Antenna Polarization: Vertical

Frequency (MHz)	Measured Level (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m) "C"	Criteria Level (dBμV/m) "D"	Margin (dB) "E"
	"A"	"B"			
1672.000	11.1	32.1	43.2	84.6	41.4
2508.000	7.0	38.1	45.1	84.6	39.5

"C" = "A" + "B"

"E" = "D" - "C"

No other signals were detected (below 6 dB - the noise level on the spectrum analyser).

Note: No signals were detected in the base station (cellular) frequency range (890-894 MHz).

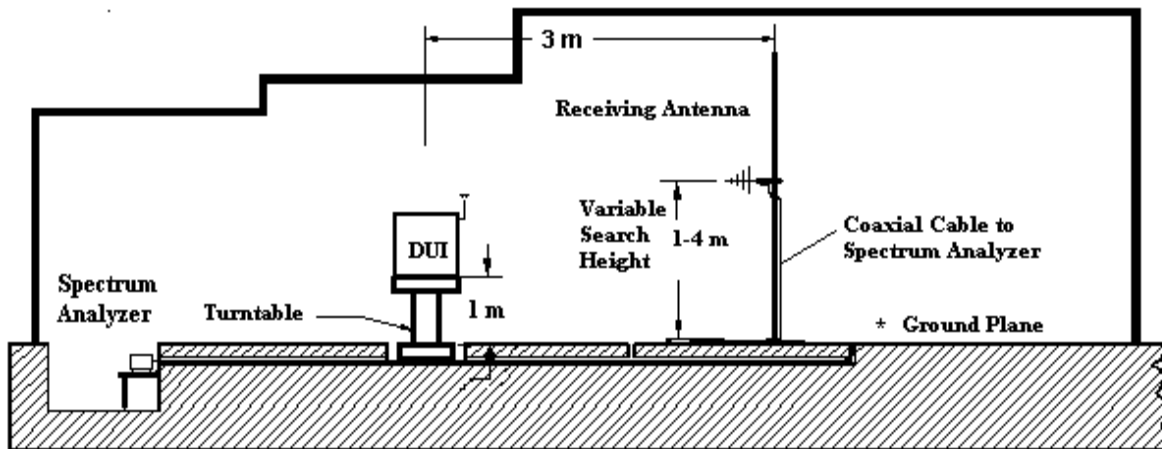


Figure 1.a Test set up for the Field Strength of Spurious Radiation Measurement in OATS
(not to scale)



Fig. 1.b APREL's OATS (Open Area Test Site)

APPENDIX A

List of Test Equipment

List of Equipment

Description	Range	Manufacturer	Model #	APREL Asset #	Cal. Due Date
Spectrum Analyzer	9 kHz - 3 GHz	Anritsu	MS2661C	301330	Dec 10, 2000
Spectrum Analyzer	9 kHz - 30 GHz	Anritsu	MS2667C	301436	Nov 3, 2000
Biconical Antenna	20 MHz - 200 MHz	Eaton	94455-1	100890	July 21, 2000
Log - Periodic Antenna	200 MHz - 1.0 GHz	Eaton	ALP-1	100761	July 21, 2000
Horn Antenna	1 – 18 GHz	Aprel	AA – 118	100553	March 12, 2000
Anechoic Shielded Room	10 kHz - 10 GHz	APREL Inc.	–	301329	N/A
OATS	30 MHz – 1 GHz	APREL Inc.	3 m & 10 m	N/A	N/A
Mast with the Controller	1 m – 4 m	EMCO	1051 – 12	100507	N/A
Turntable with the Controller	0° - 360°	EMCO	1060 – 1.241	100506	N/A

APPENDIX B

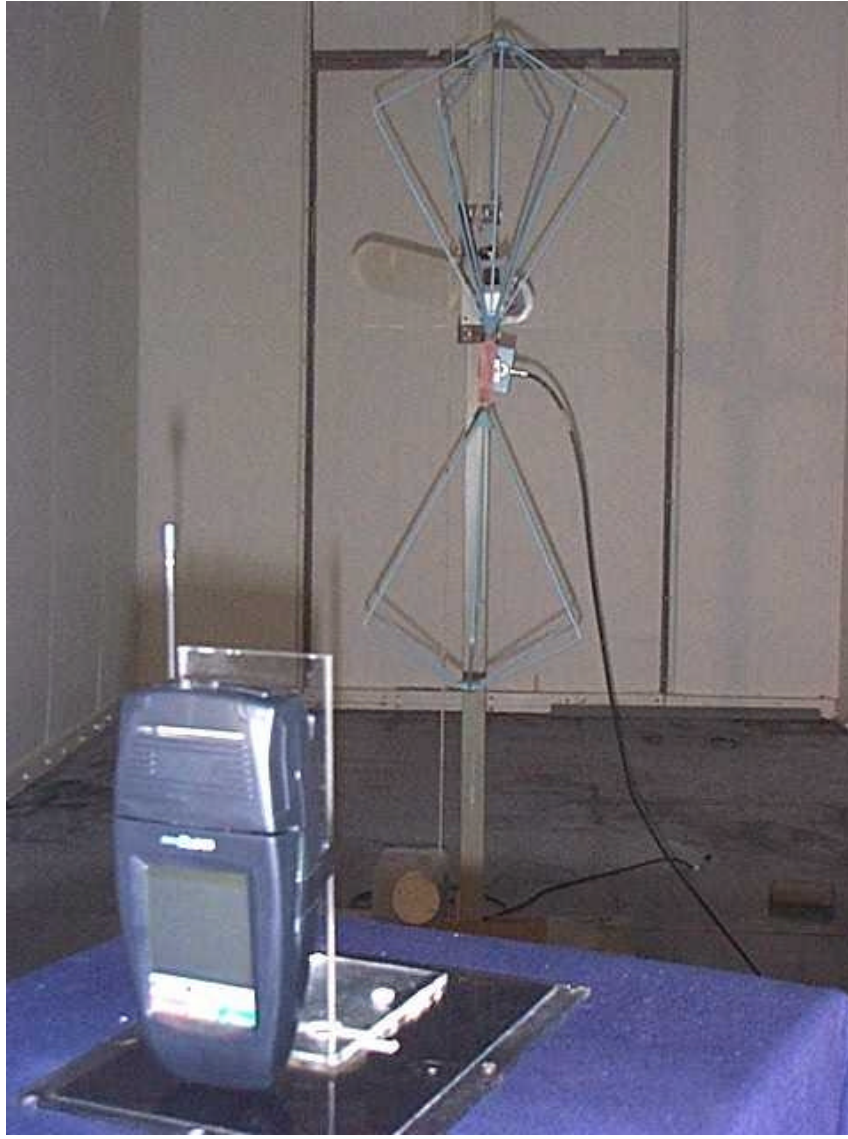
Photographs



Hypercom Smart Ice CDPD



Field Strength measurement in OATS



Field Strength measurement in OATS



Field Strength measurement in OATS