FCC PART 15 SUB-PART B & C
EMI TEST REPORT

On

Field Service Unit Transceiver

[FCC ID: OWS-922]

model

922

Provided for evaluation by

Innovatec Communications, LLC
101 South Second Street
Milwaukee, Wisconsin 53204 USA

evaluated and prepared by

International Technology Company (ITC)

9959 Calaveras Road, Box 543
Sunol, California 94586-0543
Tel: (925) 862-2944
Fax: (925) 862-9013
Email: itcemc@aol.com
Web Site: www.itcemc.com

EN45001 Accredited Compliance Laboratory (RES-GmbH)
Registration number: TTI-P-G 159/98-00 (RES-GmbH)

TEST RESULT SUMMARY
FCC PART 15 SUB-PART B & C

General Information

Product Name *FCC ID* *Model / Type*	Field Service Unit Transceiver OWS-922 922
Manufacturer's Name: *Manufacturer's Address* *Contact:*	Innovatec Communications, LLC 101 South Second Street Milwaukee, Wisconsin 53204 USA • Tel: (414) 272-2255 • Fax: (414) 272-5421 Mr. Kimbel A. Nap
Laboratory	International Technology Company (ITC) 9959 Calaveras Road, PO Box 543 Sunol, CA 94586-0543 Tel: (925) 862-2944 • Fax: (925) 862-9013 Email: itcemc@aol.com • Web Site: www.itcemc.com
Test Number *Test Report Number* *Test Date* *Project Technician*	120000216-1 0002RS116-2/F January 27 through February 16, 2000 Bruce Gordon

According to testing performed at International Technology Company (ITC); the above-mentioned unit is in compliance with the emissions requirements defined in FCC Part 15 B and C. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

International Technology Company (ITC) as an independent testing laboratory, declares that the equipment tested as specified above conforms to the emissions requirements of FCC Part 15 B & C.

EMI Test Report

Product Type	Field Service Unit Transceiver
Model	922
Applicant / Manufacturer Address	Innovatec Communications, LLC 101 South Second Street Milwaukee, Wisconsin 53204 USA • Tel: (414) 272-2255 • Fax: (414) 272-5421
Client Contact	Mr. Mr. Kimbel A. Nap
Test Results	☑ Pass ☐ Fail
Total Number of Pages including Appendices	39 Pages
Test Report File No. 0002RS116-2/F	***Date of Issue:*** Tuesday March 14, 2000

International Technology Company is:

Accepted by the Federal Communications Commission (FCC) for FCC Methods, CISPR Methods and AUSTEL Technical Standards (Ref: NVLAP Lab Code 200172-0)

Validated by the Chinese Taipei Bureau of Standards, Metrology, and Inspection (BSMI) under APEC MRA as a Conformity Assessment Body (CAB) under Appendix B, Phase 1 Procedures. BSMI # SL2-IN-E-024R

Approved by the Industry Canada for Telecom Testing

Certified by International Technology Company (ITC)GmbH for EMC Testing according to the European EMC Directive 89/336/EEC per EN45001

Certified by Reg. TP for EMC Testing according to the European EMC Directive 89/336/EEC per EN45001 for RES GmbH (DAR-Registration number: TTI-P-G 159/98-00)

Certified by the Voluntary Control Council for Interference by Information Technology Equipment (VCCI) for EMC testing, in accordance with the Regulations for Voluntary Control Measures, Article 8, Registration Numbers- Site 1: C-714 & R-696 and Site 2: C-715 & R-697

Engineering Services Offered by ITC

1) RELIABILITY CONSULTING AND SERVICES

- Reliability Svcs. for Systems & Components
- MTBF Calculations
- MTTF Calculations
- Temperature Cycling Testing
- Thermal Shock Testing
- Vibration Shock testing

2) ENGINEERING EVALUATION & TESTING

- OSHA Third Party Evaluations
- SEMI S2 Reviews, 1993
- USB Specification Evaluations/Testing
- SAE Specification Evaluations/Testing
- EIA/TIA Specifications i.e. 571-A and 631
- MIL-STD i.e. 461,462,1541/EMC, 883/ESD

3) COMPLIANCE DESIGN CONSULTATION AND REGULATORY TESTING SERVICES

US: EMI/Telecom (FCC)	**Product Safety (UL/NRTL)**	**EU: EMI/EMC (EN)**
FCC 15 /Class A	**All UL Standards, Including:**	EN 50081-1 /50081-2
FCC 15 /Class B and B DoC	UL 1950 /ITE	EN 50082-1 /50082-2
FCC 15 /SubPart C	UL 2601/Medical	EN 55103-1/ 55103-2
FCC 24	UL 1459 /Telecom	EN 60601-1-2
FCC 68 (Analog and Digital)	UL 1411 /Audio, Radio, TV	EN 55011 /55013 /55014
FCC 90	UL 813 /Commercial Audio	EN 55015 /55020 /55022
FCC 95	UL 1604 /Hazard. Location	EN 60555-2 /60555-3
	UL 508 /Energy Mgmt. Equip.	EN 61000-3-2 /61000-3-3
		EN 61000-4-2 /61000-4-3
		EN 61000-4-4 /61000-4-5
		EN 61000-4-6 /61000-4-8 /61000-4-11

Canada: EMI, Safety, Telecom	**Asia - Australia/ International**	
RSS 210 & RSS 221	CISPR 11, 13, 14, 15, 16, 20, 22	
Industry Canada /IC CS-03	VCCI Class 1 & 2 /Japan	
All c-UL Standards for Canada	AS/NZ 3548: C-Tick Mark, EMC	EU: Safety/Machinery (EN)
All CSA Standards, including:	CNS 13438 - 1996/Taiwan	EN 60950 /61010-1
CSA No. 950/ ITE	ITU Standards	EN 60204 /60065
CSA No. 601-1/Medical	IEC /ETSI Standards	EN 60601-1-1
CSA No. 1010-1/ Lab, Measurement	BellCore Standards	TÜV
CSA No. 225/ Telecom	IEEE /ANSI Standards	*Competent Body Representation/EU

ITC – Your One-Stop-Shop

Our comprehensive capabilities, friendly environment & fast project turn-around time makes ITC the ideal **one-stop-shop** for your engineering services needs, providing manufacturers with compliance design consultation, reliability & compliance engineering. We are committed to delivering the highest-quality engineering services & expertise you can expect at reasonable, competitive rates. We look forward to working with you on your next design, reliability compliance or engineering consultation project. For more information, contact our Business Services Department.
You can call or e-mail us at:

Toll-Free: 1-888-336-7625 – Internet**:** http://www.itcemc.com – E**-mail:** itcemc@aol.com

Table of Contents

Prepared By: International Technology Company (ITC)
Tel: (925) 862-2944
Fax: (925) 862-9013
Email: itcemc@aol.com
Web: www.itcemc.com

Table of Contents...

PART 1
GENERAL

1.1 Test Methodology

The electromagnetic interference tests, which this report describes, were performed by an independent electromagnetic compatibility consultant, International Technology Company, in accordance with the FCC test procedure ANSI C63.4-1992.

1.1.1 Test Facility

The open area test site, the conducted measurement facility, and the test equipment used to collect the emissions data is located in Sunol, California, and is fully described in site attenuation report. The approved site attenuation description is on file at the Federal Communications Commission.

1.1.2 Accuracy of Test Data

The test results contained in this report accurately represent Powerline Conducted Emissions, Open Field Radiated Emissions, Occupied Bandwidth, Frequency Stability, RF Power Output, Spurious and Harmonic tests generated by the sample equipment under test.

Equipment Tested	Field Service Unit Transceiver
FCC ID	OWS-922
Date of Test	January 27 through February 16, 2000

Tests Performed:

1. Powerline Conducted Emissions in a shielded room utilizing two LISN's in accordance with the FCC test procedure 47 CFR §15.207. Part 2 of this report contains details.

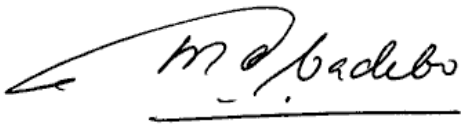
2. Radiated Emissions in a 3-meter open area site in accordance with the FCC test procedure 47 CFR §15.209 and §15.31(m). Part 3 of this report contains details.

3. Occupied Bandwidth Test in accordance with the FCC test procedure 47 CFR §15.247(2). Part 4 of this report contains details.

4. Harmonics and Spurious Emissions Test in accordance with the FCC test procedure 47 CFR §2.1053 and §15.249(a). Part 5 of this report contains details.

5. Maximum Peak Output Power Test Requirement in accordance with 47 CFR §15.247(b). Part 6 of this report contains details.

The results show that the sample equipment tested as described in this report is in compliance with the FCC Rules Part 15, SubPart B: Powerline Conducted Emissions, Open Field Radiated Emissions. Occupied Bandwidth, Harmonics and Spurious Emissions, Maximum Peak Output Power tests requirement limits of, SubPart C.



Michael Gbadebo, PE
Chief Engineer/Principal Consultant

1.2 Summary

1.2.1 Description of Equipment Under Test (EUT)

See Appendix D for more information

Model Name(s):	922
Applicant:	Innovatec Communications, LLC
Address:	101 South Second Street Milwaukee, Wisconsin 53204 USA • Tel: (414) 272-2255 • Fax: (414) 272-5421
Client Contact:	Mr. Mr. Kimbel A. Nap
Test Technician:	Bruce Gordon
Test Number:	120000216-1
File Number:	0002RS116-2/F

1.2.2 Support Equipment included in the Tests:

The Field Service Unit Transceiver was tested as a stand-alone device.

PART 2
POWERLINE CONDUCTED EMISSIONS
Per FCC PART 15 SUBPART B

2.1 Configuration and Procedure

2.1.1 EUT Configuration

Pre-scan measurements are first performed by collecting data with a spectrum analyzer. Significant peaks are marked and then quasi-peaked. Measurement range investigated was from 450KHz to 30MHz. The Field Service Unit Transceiver was set up in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-1992. The measurement instrumentation used was a receiver with bandwidth parameters as stipulated in ANSI C63.4-1992. The Field Service Unit Transceiver was set up on a wooden non-conductive tabletop, 80 cm above the ground reference plane, in a shielded room. The dimension of the table was 1.5m x 1.0m. Excess cords of the equipment were folded back and forth, on top of LISN to form a 30-cm by 40-cm bundle. Grounding was through the power cord and voltage was 220Vac.

2.1.2 Test Procedure

The system was set up as described above, with the Field Service Unit was running in a continuous transmission mode with modulation turned on. The Field Service Unit Transceiver was operated in a worst-case condition of orientation. The power line conducted EMI tests were run on all phases of the current carrying conductors of the power cords of the EUT. The highest line conducted emissions were also analyzed in detail by operating the spectrum analyzer in fixed tuned mode to determine the precise amplitude of the emissions. While doing so, the interconnecting cables were moved around to maximize the emissions, and the position of the peripheral devices were interchanged to check for any changes in emissions.

2.1.3 Data Table Legend and Field Strength Calculation

'Margin' indicates the degree of compliance with the applicable limit. For example, a margin of -8 dB means that the emission is 8 dB below the limit (in compliance). A margin of +4 dB means that the emission is 4 dB over the limit (out of compliance). The margin is calculated as follows: Margin = Corrected Amplitude - Limit; where Corrected Amplitude = Amplitude + Cable Loss - Distance Factor, the amplitude measured in a quasi peak mode.

2.1.4 Spectrum Analyzer Configuration (during swept frequency scans)

Start Frequency..... 450 KHz
Stop Frequency..... 30MHz
Sweep Speed ..... Manual
Resolution Bandwidth..... 10KHz
Video Bandwidth..... 10KHz
Quasi Peak Adapter Bandwidth..... 9KHz

Quasi Peak Adapter Mode..... Normal

Prepared By: International Technology Company (ITC)
Tel: (925) 862-2944
Fax: (925) 862-9013
Email: itcemc@aol.com
Web: www.itcemc.com

2.2 Powerline Conducted Emissions Per FCC Part 15 SubPart B

2.2.1 Administrative Details

Date(s) of Test: January 27 through February 16, 2000
Emission Limits: Class B
Temperature/Humidity: 22.1$^{0^{\circ}}$C / 67%
Test Technician(s): Bruce Gordon

2.2.2 Test Results

The table below shows a summary of the highest conducted emissions on all current carrying conductors of the EUT power cord compared to the FCC Class B limit.

INDICATED FREQ MHz	MPL dBuV	CABLE LOSS dB	CORR AMPL dBuV	COND -	GND -	FCC 15 LIMIT dBuV	CLASS A MARGIN dB	FCC 15 LIMIT dBuV	CLASS B MARGIN dB
0.570	45.0	1.0	46.0	Neut	con	60.0	-14.0	48.0	-2.0
1.010	45.7	1.0	46.7	Hot	con	60.0	-13.3	48.0	-1.3
5.180	38.4	1.0	39.4	Hot	con	69.5	-30.1	48.0	-8.6
5.180	40.9	1.0	41.9	Neut	con	69.5	-27.6	48.0	-6.1
17.530	24.7	1.0	25.7	Neut	con	69.5	-43.8	48.0	-22.3
17.740	29.4	1.0	30.4	Hot	con	69.5	-39.1	48.0	-17.6

Table 2.2.2 Power line Conducted Emissions

No emissions of significant levels were observed between 450 KHz and the lowest frequencies shown in the above data. No emissions of significant levels were observed between the highest frequencies shown in the above data and 30 MHz.

Conclusion: The Field Service Unit Transceiver meets the requirements of the test reference for Powerline Conducted Emissions.

PART 3
OPEN FIELD RADIATED EMISSIONS
Per FCC PART 15 SUBPART B

3.1 Configuration and Procedure

3.1.1 EUT Configuration

Pre-scan measurements are first performed by collecting data with a spectrum analyzer. Significant peaks are marked and then quasi-peaked. Measurement range investigated was from 30 MHz to 1 GHz. The EUT was set up in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-1992. The measurement instrumentation used was a receiver with bandwidth parameters as stipulated in ANSI C63.4-1992. The Field Service Unit Transceiver was set up on a wooden non-conductive tabletop, 80 cm above the ground reference plane, in an open field. The dimension of the table was 1.5m x 1.0m. Excess cord was folded back to form a 30-cm by 40-cm bundle, which was hanging in the middle distance above the ground plane. Frequency measurement was taken from 30MHz to 10^{th} harmonic.

3.1.2 Test Procedure

The EUT was set up as described above, acquiring Remote Meter Interface continuously. The Field Service Unit Transceiver was rotated 360 degrees azimuth and the search antenna height varied 1to 4 m in order to maximize the emissions from the EUT. The highest emissions were also analyzed in detail by operating the spectrum analyzer in fixed tuned mode to determine the precise amplitude of the emissions. While doing so, interconnecting cables were moved around to maximize the emissions.

3.1.3 Data Table Legend and Field Strength Calculation

'Margin' indicates the degree of compliance with the applicable limit. For example, a margin of -8 dB means that the emissions are 8 dB below the limit (in compliance); +a margin of +4 dB means that the emission is 4 dB over the limit (out of compliance). The margin calculated as follows:
Margin = Corrected Amplitude - Limit, where Corrected Amplitude = Amplitude + Antenna Correction Factor + Cable Loss - Distance Factor, measured in quasi peak mode.

3.1.4 Spectrum Analyzer Configuration (during swept frequency scans)

Start Frequency 30MHz
Stop Frequency.....1000MHz
Sweep Speed .....Manual
Measurements below 1GHz
RES Bandwidth..... 100 KHz
Video Bandwidth..... 100 KHz
Quasi Peak Adapter Mode..... Normal
Quasi peak Adapter Bandwidth..... 120 KHz
Measurements above 1GHz (unless stated otherwise)
Analyzer Mode .....Video Filter
RES Bandwidth..... 1MHz
Video Bandwidth..... 1MHz
Freq. Span..... 3MHz
Offset..... 0dB
Quasi Peak Adapter Mode.....Disabled

3.2 Open Field Radiated Emissions Per FCC Part 15 SubPart B

3.2.1 Administrative Details

Date(s) of Test: January 27 through February 16, 2000
Emission Limits: Class B
Temperature/Humidity: $19.8^{0^{\circ}}$C / 64%
ATM Pressure: 1010 Mbar
Test Technician(s): Bruce Gordon
Antenna Used: Biconical Antenna, model # 3104, S/N 3459 and Log Periodic Antenna, model # 3146, S/N 2075 (calibrated June 25, 1999, next calibration due date is June 25, 2000)

3.2.2 Test Results

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarization, and EUT orientations.

INDICATED FREQ MHz	AMPL dBuV/m	CORRECTION ANT dB	CAB dB	CORR AMPL dBuV/m	T/TAB ANG DEG	HT m	ANT POL -	FCC 15 LIMIT dBuV/m	CLASS B MARG dB
33.17	12.2	11.7	2.5	26.4	90	1.0	VB	40.0	-13.6
112.25	7.5	13.9	3.9	25.3	180	2.0	HB	43.5	-18.2
198.08	11.9	15.3	4.7	31.9	0	2.0	HB	43.5	-11.6
249.56	19.2	13.2	5.2	37.6	180	2.0	HL	46.0	-8.4
552.13	12.4	19.7	6.8	38.9	270	1.0	VL	46.0	-7.1
946.33	2.6	23.8	8.3	34.7	180	3.0	HL	46.0	-11.3

Table 3.2.2 Open Field Radiated Emissions for Field Service Unit (FSU)

No emissions of significant levels were observed between 30 MHz and the lowest frequencies shown in the above data. No emissions of significant levels were observed between the highest frequency shown in the above data and 1000MHz.

Conclusion: The Field Service Unit Transceiver meets the requirements of the test reference for Open Field Radiated Emissions.

PART 4
OCCUPIED BANDWIDTH
Per FCC PART 15 SECTION 47 CFR §15.247(2)

4.1 Configuration and Procedure

4.1.1 EUT Configuration

The Field Service Unit Transceiver was set up in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-1992. The measurement instrumentation used was an Hewlett Packard 8566B Spectrum Analyzer with detector and bandwidth parameters as stipulated in C63.4-1992.

4.1.2 Test Procedure

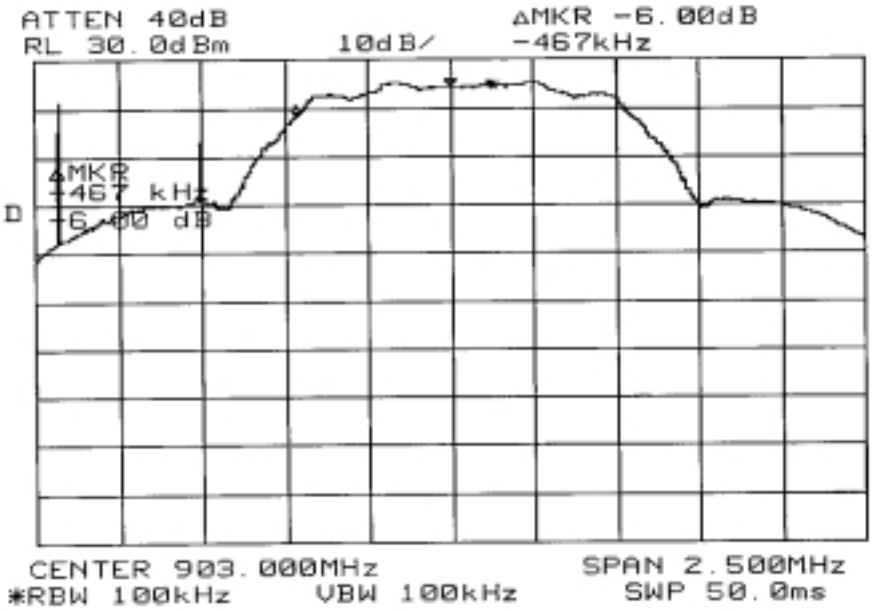
The Field Service Unit Transceiver was placed on the test table. The EUT was configured for maximum response and was set up as described above to transmit continuously. Signal was monitored with a HP 8566B Spectrum Analyzer, using the EMCO Double-Ridged Waveguide Horn Antenna, model #3115. Unless stated otherwise, the antenna to EUT distance was at 3 meter.

4.2.1 Bandwidth Test

Per FCC Part 15 Section 47 CFR §15.247(2)

6dB Bandwidth Plot –Conductive (Low Channel Frequency)

SN #10



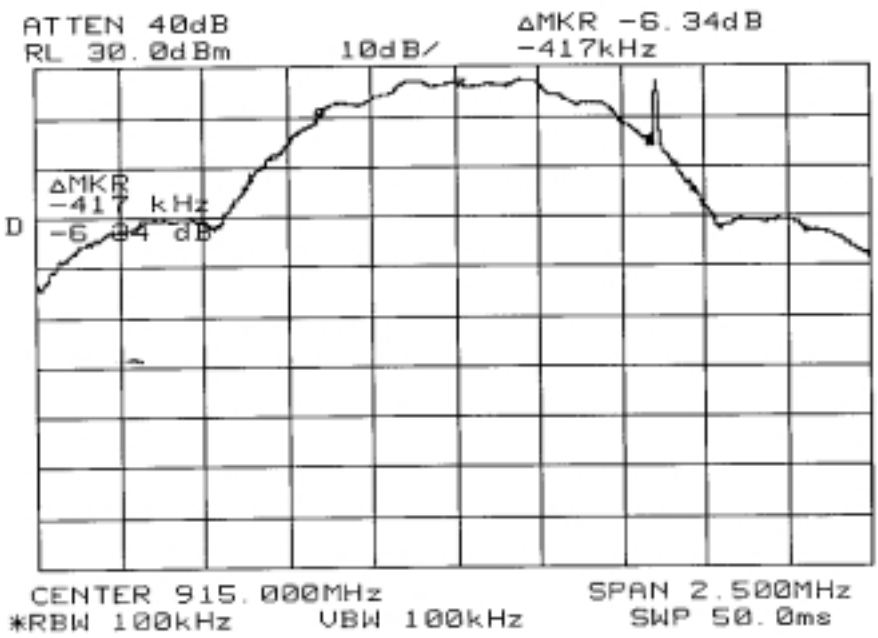
Prepared By: International Technology Company (ITC)
Tel: (925) 862-2944
Fax: (925) 862-9013
Email: itcemc@aol.com
Web: www.itcemc.com

4.2.2 Bandwidth Test

Per FCC Part 15 Section 47 CFR §15.247(2)

6dB Bandwidth Plot –Conductive (Medium Channel Frequency)

SN #10

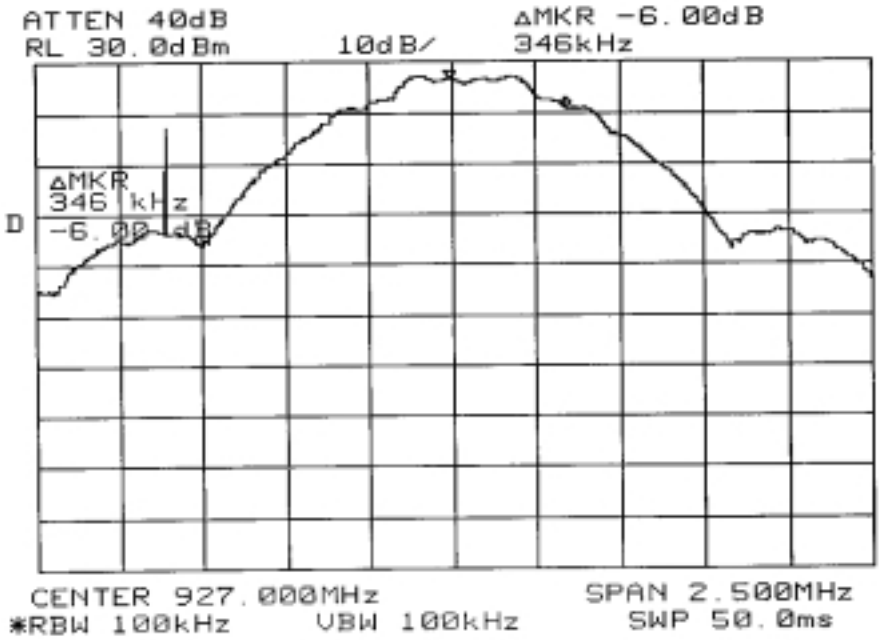


4.2.3 Bandwidth Test

Per FCC Part 15 Section 47 CFR §15.247(2)

6dB Bandwidth Plot –Conductive (High Channel Frequency)

SW # 10



PART 5
FUNDAMENTAL HARMONIC & SPURIOUS EMISSIONS
Per FCC PART 2 SECTION 47 CFR §2.1053 &
PART 15 SECTION 47 CFR §15.249(a)

5.1. Configuration and Procedure

5.1.1 EUT Configuration

The Field Service Unit Transceiver was set up in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-1992. The measurement instrumentation used was Hewlett Packard 8566B and 8569A Spectrum Analyzers with detector and bandwidth parameters as stipulated in C63.4-1992. At frequencies above 1GHz, average measurements, if necessary, were made using the video filter method and quasi peak detector and preselector functions were disabled.

5.1.2 Test Procedure

The Field Service Unit Transceiver was placed on the test table. The EUT was configured for maximum response and was set up as described above and configured to transmit continuously. Signal strength was monitored at HP 8566B and 8569A Spectrum Analyzers, below and above the center frequencies using an appropriate receiving antenna. Maximum emissions were obtained by varying the height of the antennas and then orienting the turntable in 360-degree turns with the analyzer in the manual mode. Unless stated otherwise, the antenna to EUT distance was 3 meters. Any multiple entries cover the two orientations of the Field Service Unit Transceivers and cover all three axes due to rotation of the test table and EUT and are the maximum signals resulting from rotation and height search at each frequency. The measurements are quasi-peak measurements below 1 GHz and average measurements above 1 GHz

5.1.3 Spectrum Analyzer Configuration (During Swept Frequency Scans)

Start Frequency ..... 30 MHz
Stop Frequency.....1,000MHz
Sweep Speed ..... Manual
RES Bandwidth..... 100KHz
Video Bandwidth..... 100 KHz
Quasi Peak Adapter Mode..... Normal
Quasi peak Adapter Bandwidth..... 120 KHz
Measurements above 1GHz (unless stated otherwise)
Start Frequency .....1 GHz
Stop Frequency..... 24.835 GHz
Sweep Speed ..... Manual
Analyzer Mode .....Video Filter
RES Bandwidth..... 1MHz

Video Bandwidth..... 1MHz

Prepared By: International Technology Company (ITC)
Tel: (925) 862-2944
Fax: (925) 862-9013
Email: itcemc@aol.com
Web: www.itcemc.com

5.2 Fundamental Harmonic & Spurious Emissions Per FCC Part 2 Section 47 CFR §2.1053 & Part 15 Section 47 CFR §15.249(a)

5.2.1 Administrative Details

Date(s) of Test: January 27 through February 16, 2000
Emission Limits: Class C
Test Technician(s): Bruce Gordon

5.2.2 Test Results

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarizations, and EUT orientations.

Table #1: Fundamental Harmonic and Spurious Emissions at Low Frequency - at Channel 0

INDICATED FREQ MHz	AMPL dBuV/m	CORRECTION ANT dB	CAB dB	CORR AMPL dBuV/m	T/TAB ANG DEG	HT m	ANT POL -	FCC 15 LIMIT dBuV/m	CLASS C MARGIN dB
276.00	13.2	11.9	6.4	31.5	0	1.0	HL	46.0	-14.5
300.00	13.8	13.5	7.1	34.4	0	1.0	HL	46.0	-11.6
324.00	12.2	12.5	7.3	32.0	0	1.0	HL	46.0	-14.0
336.00	14.2	12.5	7.4	34.1	0	1.0	HL	46.0	-11.9
336.00	11.0	12.5	7.4	30.9	90	1.0	VL	46.0	-15.1
783.12	10.4	19.1	12.3	41.8	0	1.0	HL	46.0	-4.2
**902.86		23.8	1.1		225	1.0	VH	94.0	
1805.72	3.0	27.2	2.2	32.4	225	1.0	HH	54.0	-21.6
1805.72	8.2	27.2	2.2	37.6	225	1.0	HH	54.0	-16.4
2708.62	0.0	29.4	2.5	31.9	225	1.0	VH	54.0	-22.1
3611.88	0.0	32.6	2.7	35.3	0	1.0	VH	54.0	-18.7
4514.50	0.0	33.5	3.0	36.5	0	1.0	VH	54.0	-17.5
5417.40	0.0	35.3	3.3	38.6	0	1.0	VH	54.0	-15.4
6320.30	0.0	35.9	3.7	39.6	225	1.0	VH	54.0	-14.4
7223.20	0.0	36.9	4.0	40.9	225	1.0	VH	54.0	-13.1
8126.10	0.0	37.9	4.4	42.3	225	1.0	VH	54.0	-11.7
9029.00	0.0	38.9	4.7	43.6	225	1.0	VH	54.0	-10.4

** Fundamental Frequency

5.2 Fundamental Harmonic & Spurious Emissions
Per FCC Part 2 Section 47 CFR §2.1053 & Part 15 Section 47 CFR §15.249(a)...

Table #2: Fundamental Harmonic and Spurious Emissions at Middle Frequency - at Channel 9

INDICATED FREQ MHz	AMPL dBuV/m	CORRECTION ANT dB	CAB dB	CORR AMPL dBuV/m	T/TAB ANG DEG	HT m	ANT POL -	FCC 15 LIMIT dBuV/m	CLASS C MARGIN dB
276.02	12.4	11.9	6.4	30.7	0	1.0	HL	46.0	-15.3
300.00	13.4	13.5	7.1	34.0	0	1.0	HL	46.0	-12.0
324.00	13.0	12.5	7.3	32.8	0	1.0	HL	46.0	-13.2
336.00	14.3	12.5	7.4	34.2	90	1.0	HL	46.0	-11.8
336.00	12.7	12.5	7.4	32.6	90	1.0	VL	46.0	-13.4
900.00	4.0	21.2	1.1	27.1	180	1.0	VL	46.0	-18.9
**916.54		22.1	1.1		0	1.0	VL	94.0	
932.00	3.0	22.5	1.3	27.4	180	1.0	VL	46.0	-18.6
1833.00	0.0	27.3	2.3	29.6	0	1.0	VH	54.0	-24.4
2749.10	0.0	29.5	2.6	32.1	0	1.0	VH	54.0	-21.9
3666.10	0.0	32.8	2.9	35.7	0	1.0	VH	54.0	-18.3
4582.60	0.0	33.7	3.2	36.9	0	1.0	VH	54.0	-17.1
5499.10	0.0	35.3	3.5	38.8	0	1.0	VH	54.0	-15.2
6415.50	0.0	35.9	3.9	39.8	0	1.0	VH	54.0	-14.2
7332.00	0.0	37.1	4.1	41.5	0	1.0	VH	54.0	-12.5
8248.70	0.0	38.0	4.5	42.5	0	1.0	VH	54.0	-11.5
9165.00	0.0	39.0	4.8	43.8	0	1.0	VH	54.0	-10.2

** Fundamental Frequency

5.2 Fundamental Harmonic & Spurious Emissions
Per FCC Part 2 Section 47 CFR §2.1053 & Part 15 Section 47 CFR §15.249(a)...

Table #3: Fundamental Harmonic and Spurious Emissions at High Frequency - at Channel 16

INDICATED FREQ MHz	AMPL dBuV/m	CORRECTION ANT dB	CAB dB	CORR AMPL dBuV/m	T/TAB ANG DEG	HT m	ANT POL -	FCC 15 LIMIT dBuV/m	MARGIN dB
276.00	14.1	11.9	6.4	32.4	0	1.0	HL	46.0	-13.6
300.00	12.4	13.5	7.1	33.0	0	1.0	HL	46.0	-13.0
324.00	13.7	12.5	7.3	33.5	0	1.0	HL	46.0	-12.5
336.00	11.5	12.5	7.4	31.4	0	1.0	HL	46.0	-14.6
336.00	13.9	12.5	7.4	33.8	90	1.0	VL	46.0	-12.2
806.20	11.0	19.6	1.9	32.5	0	1.0	HL	46.0	-13.5
**927.00		22.5	1.3		0	1.0	HL	94.0	
1854.08	8.6	27.4	2.3	38.3	0	1.0	VH	54.0	-15.7
1854.08	9.7	27.4	2.3	39.4	0	1.0	HH	54.0	-14.6
2781.10	0.0	29.6	2.7	32.3	10	1.0	VH	54.0	-21.7
2781.10	0.0	29.6	2.7	32.3	240	1.0	HH	54.0	-21.7
3708.00	0.0	33.0	2.9	35.9	0	1.0	HH	54.0	-18.1
4653.00	0.0	33.9	3.3	37.2	0	1.0	HH	54.0	-16.8
5562.00	0.0	35.3	3.6	38.9	0	1.0	HH	54.0	-15.1
6489.00	0.0	36.0	3.9	39.9	0	1.0	HH	54.0	-14.1
7416.00	0.0	37.2	4.2	41.4	0	1.0	HH	54.0	-12.6
8343.00	0.0	38.1	4.5	42.6	0	1.0	HH	54.0	-11.4
9270.00	0.0	39.1	4.9	44.0	0	1.0	HH	54.0	-10.0

** Fundamental Frequency

No emissions of significant levels were observed between 9KHz and the lowest frequencies shown in the above data. No emissions of significant levels were observed between the highest frequency shown in the above data and 24.835 GHz

Conclusion: The Field Service Unit Transceiver meets the requirements of the test reference for
Harmonics and Spurious Emissions.

PART 6
MAXIMUM PEAK OUTPUT POWER
Per FCC PART 15 SECTION 47 CFR §15.247 (b)

6.1. Configuration and Procedure

6.1.1 EUT Configuration

The Field Service Unit Transceiver was set up in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-1992. The measurement instrumentation used was an Hewlett Packard 8569A Spectrum Analyzer with detector and bandwidth parameters as stipulated in C63.4-1992.

6.1.2 Test Procedure

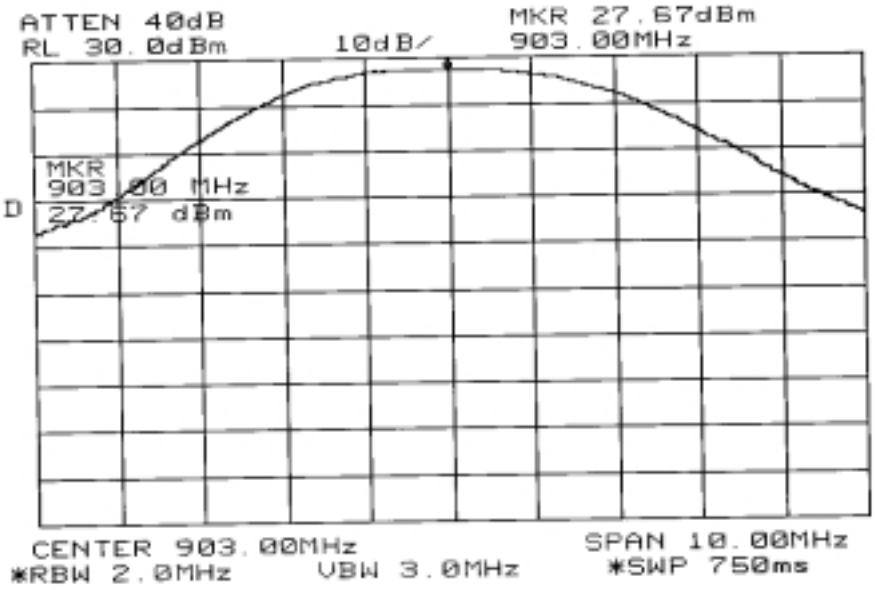
The Field Service Unit Transceiver was placed on the test table. The EUT was configured for maximum response and was set up as described above and configured to transmit continuously. Signal was monitored with a HP 8566B Spectrum Analyzer, using the EMCO Double-Ridged Waveguide Horn Antenna, model 3115. Unless stated otherwise, the antenna to EUT distance was 1 meter. The RF power output = Measured value + antenna correction + cable correction –Amplifier Gain (if provided)

6.2.1 Maximum Peak Output Power

Per FCC Part 15 Section 47 CFR §15.247(b)

Maximum Conductive Peak Output Power Plot Low Frequency

NCI - Conductive
Peak Power Ch Φ

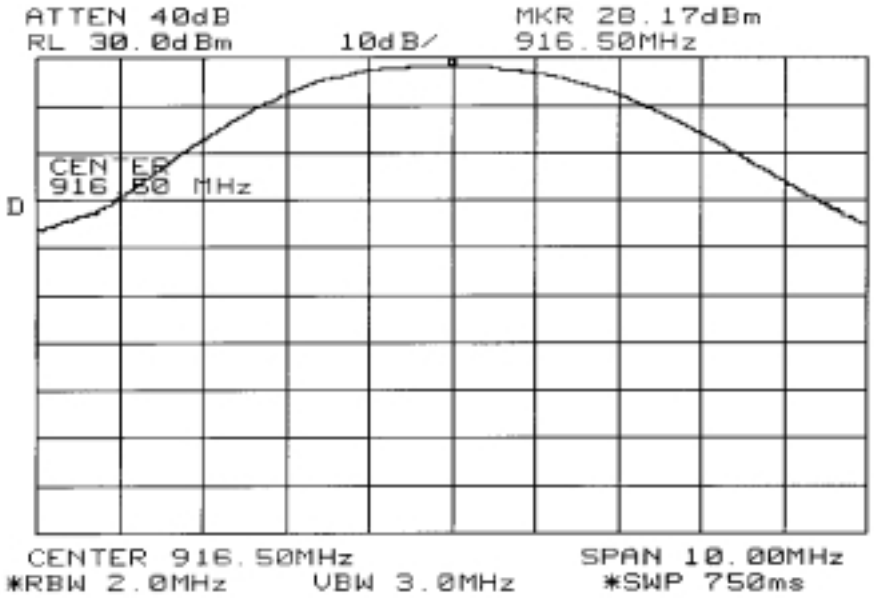


6.2.2 Maximum Peak Output Power

Per FCC Part 15 Section 47 CFR §15.247(b)

Maximum Conductive Peak Output Power Plot Middle Frequency

NCI - conductive Peak Power ch 9



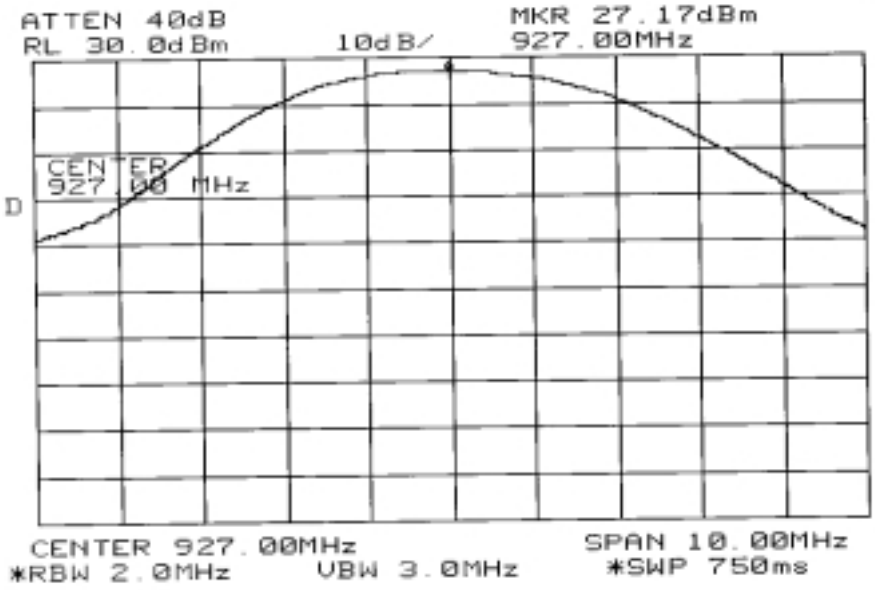
Prepared By: International Technology Company (ITC)
Tel: (925) 862-2944
Fax: (925) 862-9013
Email: itcemc@aol.com
Web: www.itcemc.com

6.2.3 Maximum Peak Output Power

Per FCC Part 15 Section 47 CFR §15.247(b)

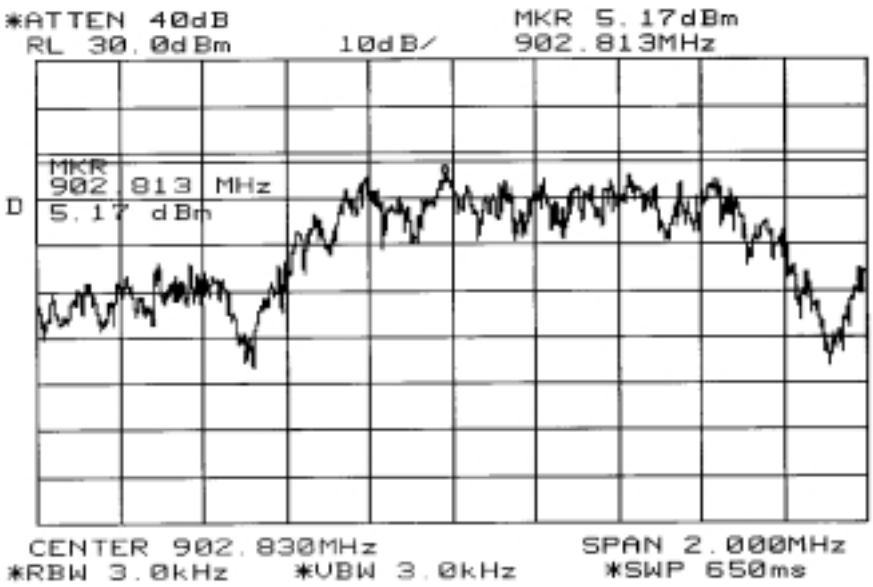
Maximum Conductive Peak Output Power Plot High Frequency

NCI - conductive Pk Power _ Ch 16



6.3.1 Maximum Conductive Peak Power Density
Per FCC Part 15 Section 47 CFR §15.247(b)
Maximum Conductive Peak Power Density Plot Low Frequency

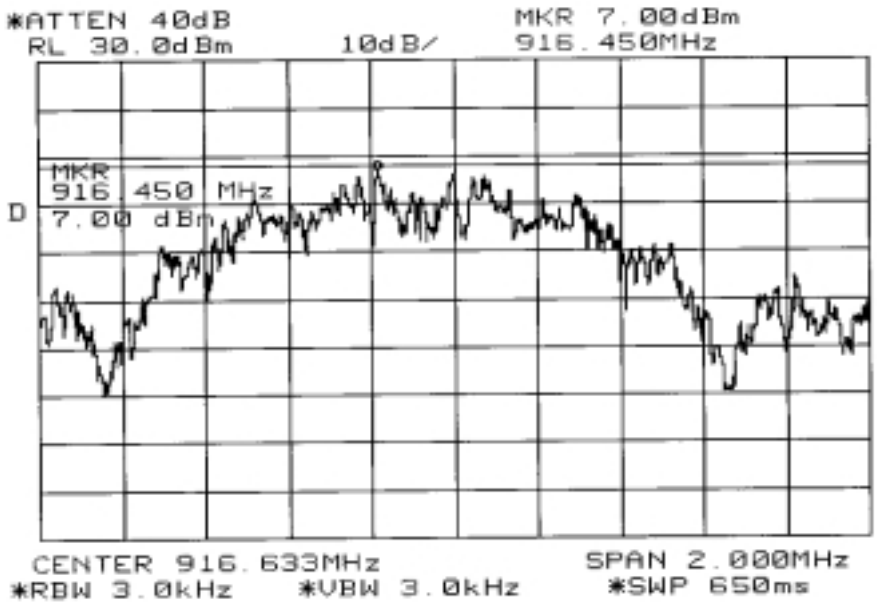
NCI - Peak Spec. Pow Density @ ch ϕ
Field Service Unit



Prepared By: International Technology Company (ITC)
Tel: (925) 862-2944
Fax: (925) 862-9013
Email: itcemc@aol.com
Web: www.itcemc.com

6.3.2 Maximum Conductive Peak Power Density
Per FCC Part 15 Section 47 CFR §15.247(b)
Maximum Conductive Peak Power Density Plot Medium Frequency

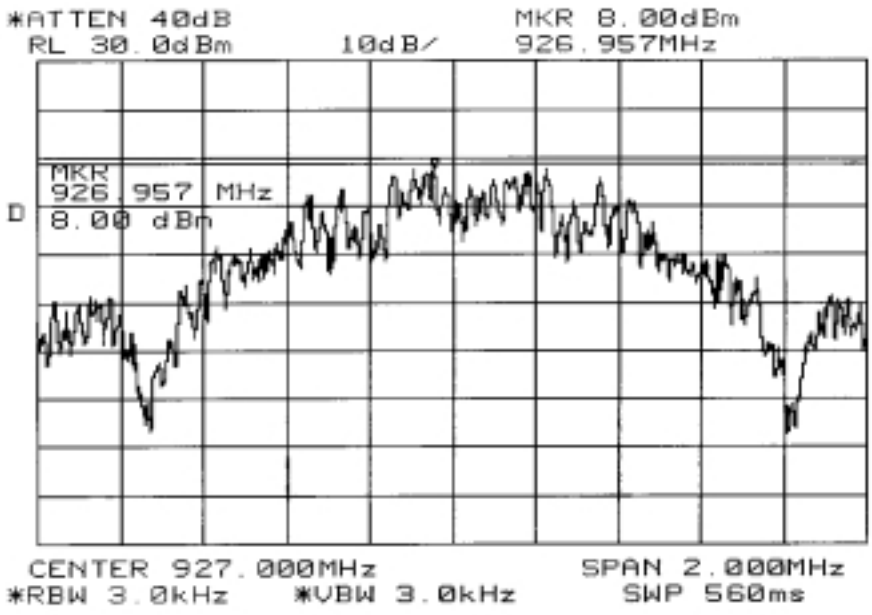
NCI - Peak Power Density @ ch 9 Field service unit



Prepared By: International Technology Company (ITC)
Tel: (925) 862-2944
Fax: (925) 862-9013
Email: itcemc@aol.com
Web: www.itcemc.com

6.3.3 Maximum Conductive Peak Power Density
Per FCC Part 15 Section 47 CFR §15.247(b)
Maximum Conductive Peak Power Density Plot High Frequency

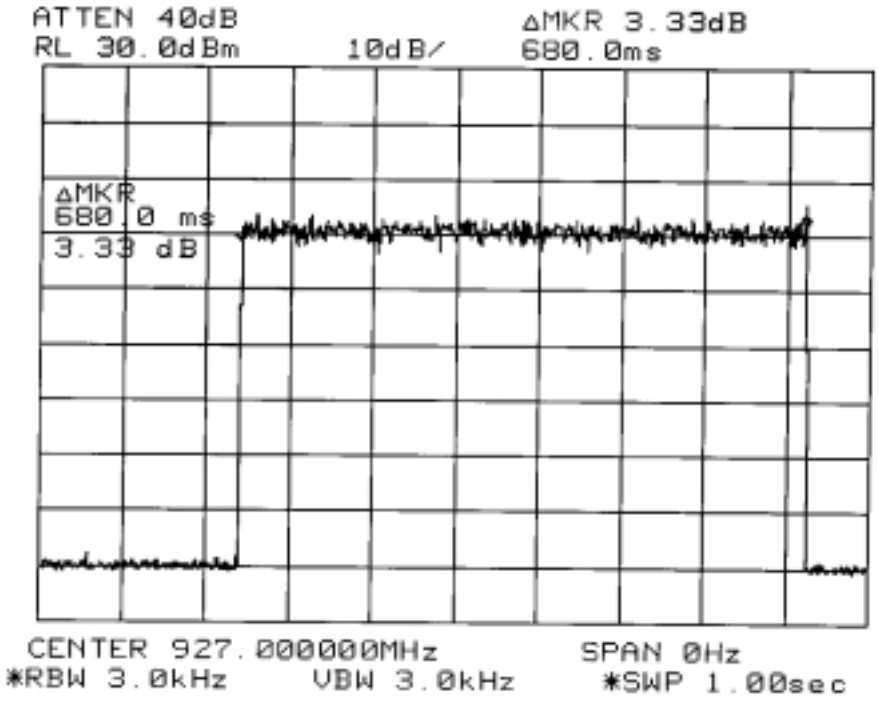
NCI – Peak Spec. Power Density @ ch 116 Field Service Unit



Prepared By: International Technology Company (ITC)
Tel: (925) 862-2944
Fax: (925) 862-9013
Email: itcemc@aol.com
Web: www.itcemc.com

6.4 Dwell Time Test
Per FCC Part 15 Section 47 CFR §15.247

NCI DWELL TIME



APPENDIX A
MEASUREMENT PROCEDURES

Conducted Emissions

The measurements are performed in a 21' x 14' x 9' shielded room. A wooden bench 80 cm in height is located at the center of the shielded room; desktop EUT are placed on top of this bench. The rear of the EUT and bench are placed 40 cm from the shielded room wall. All items on the table (or test-table) are placed at least 10 cm apart. Excess EUT power cord is folded back and forth to form a 30 cm by 40 cm long bundle, hanging approximately in the middle between the ground plane and table. The EUT power cord is plugged into a LISN 80 cm away, while all other devices are plugged into a second LISN, also 80 cm away from the closest part of the EUT.

The highest emissions are also analyzed in detail by operating the spectrum analyzer in fixed tuned mode to determine the precise amplitude of the emissions. While doing so, the interconnecting cables are moved around to maximize the emissions, and the position of the peripheral devices are interchanged to check for any changes in emissions.

Radiated Emissions

The EUT is set up in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-1992.

The EUT and support equipment is set up on the turntable of an open field site. Desktop EUT are set up on a wooden stand (test table), 80 cm above the ground plane. All items on the table are placed at least 10 cm apart. Interconnecting cables which hang closer than 40 cm to the ground plane are folded back and forth to form a 30 cm by 40 cm long bundle, hanging approximately between the ground plane and table.

The highest emissions are also analyzed, in detail, by operating the spectrum analyzer in fixed tuned quasi-peak mode to determine the precise amplitude of the emissions. While doing so, the interconnecting cables are moved around and at the highest amplitudes observed, the EUT is rotated in the horizontal plane while changing the antenna polarization in the vertical plane to maximize the reading. Once the maximum reading is obtained, the antenna elevation and polarization will be varied between specified limits to maximize the readings. The position of the peripheral devices is interchanged to check for any changes in emissions.

APPENDIX B
DESCRIPTION OF OPEN FIELD TEST SITE

The open field test site is located on a 5.5 acre parcel, in the agriculturally zoned section of the city of Sunol, California. It is situated adjacent to Highway 680 on the West Side, and adjacent to Calaveras Road in the Southeast. Distance of the site to each of these roads is a minimum of 200 feet. The north end of the site is surrounded by hills measuring up to 150 ft. high. The distance of the site to the hills is approximately 200 ft.

Supporting structures used to support device being measured and test instrumentation include the following:

a. Test Platform measuring 50 ft by 100 ft. The platform is located on top of a very large ground screen, to enhance a homogeneous reflective surface.

b. Test Site building measures approx. 5000 Sq. ft. This building houses the test laboratory, the shielded room, for performing Line Conducted test, test personnel and other support staff. The test building is an all-wooden building, constructed using 2 by 4-inch studs. It also contains all necessary electrical wiring and utilities.

The International Technology Company (ITC) RFI test site described above has been approved for conducting contract RFI measurement work for client companies following the procedures stated in FCC/OET ANSI C63.4-1992, EN 55011, EN 55022 Vfg. 243/1991 and VDE-0877. The site attenuation characteristics are routinely measured and recorded every three months.

Test site approved by VDE, File # F-R HF-MK.
Test site approved by FCC, Registration # 31010/SIT/ xxxx.
Test site approved by VCCI, Membership # 242.
Test site approved by the Industry Canada, Registration # DEB 5072-7, DEB 90-3008.

APPENDIX C
TEST EQUIPMENT

Some or all of the following test equipment is currently used to measure the conducted and/or radiated emissions from the equipment under test:

Test Equipment	*Model*	*Serial Number*
Spectrum Analyzer	Hewlett Packard 8590A	2752 A02715
Spectrum Monitor	Rhode & Schwarz EZM	881 334/025
Test Receiver (9 KHz - 30 MHz)	Rhode & Schwarz ESH3	RES 0753
Test Receiver (20-1300 MHz)	Rhode & Schwarz ESVP	RES 0749
Spectrum Analyzer	Hewlett-Packard 8566B	2618A02909
Spectrum Analyzer	Hewlett-Packard 8567A	2602A00239
Spectrum Analyzer Display (Site 1)	Hewlett-Packard 8590A	2542A11954
Spectrum Analyzer Display (Site 2)	Hewlett-Packard 85662A	2542A12593
Quasi Peak Adapter (Site 1)	Hewlett-Packard 85650	2521A00871
Quasi Peak Adapter (Site 2)	Hewlett-Packard 85650A	2521A00737
Preselector (Site 1)	Hewlett-Packard 85685A	2620A00265
Preselector (Site 2)	Hewlett-Packard 85685A	2648A00462
Preamp	Hewlett-Packard 8447D	2648A04855
Preamp	Hewlett-Packard 8449B	3008A00101
Computer	Hewlett-Packard 9000/300	RES 449
Absorbing Clamp	MDS21	891 092/025
Antenna Cable (OPTK45)	RG8/u	-
Antenna System	EMCO 3230	-
Biconical Antenna (Site 1)	EMCO 3104	3549
Biconical Antenna (Site 2)	EMCO 3104C	9111-4463
Log Periodic Antenna (Site 1) (200-1000 MHz)	EMCO 3146	2075
Log Periodic Antenna (Site 2) (200-1000 MHz)	EMCO 3146	9510-4202
Adj. Element Dipole Antenna (28 MHz-1 GHz)	EMCO 3120	2632
Horn Antenna	Eaton 96001	2632
LISN (25 Amp)	EMCO 38825/2	9210-2008
LISN (100 Amp)	Solar 8610-50-TS-100N	
LISN	EMCO 3825/2R	1188/1001

Test Equipment...

Test Equipment	*Model*	*Serial Number*
Remote Controlled 8 ft Rotating Table	RES RT1	
Remote Controlled 25 ft Rotating Table	RES RT2	
Remote Controlled 4 ft Rotating Table	RES RT3, RT4, RT5	
Remote Controlled 4 m Antenna Mast	RES AM1	
Remote Controlled 6 m Antenna Mast	RES AM2, RES AM3	
3 Phase 220 VAC/50 Hz Generator	-	DB7130B40
Oscilloscope (300 MHz)	Tektronix 2465	
Digital Scope	Hitachi VC-6075	
Power Analyzer	Valhalla Scientific/2101	RES 574
Digital Thermometer	Omega 440	
DC Power Supply	Kepco JQE 150-1.5m	H177085

The spectrum analyzers are self-calibrated before every test and are calibrated to NIST standards annually. All of the other EMI equipment is calibrated on a monthly basis using the spectrum analyzers as standards. Calibration dates of equipment are June 25, 1999. Next calibration is due on June 25, 2000.

APPENDIX D
EUT TECHNICAL DESCRIPTION / SPECIFICATION

System

The Field Service Unit (FSU) is a 900MHz, spread spectrum transceiver used to communicate with Independent Metering Unit (IMU) radios which are mounted on gas, water or electric utility meters. Service personnel use the FSU to communicate configuration settings to an IMU and to read an IMUs status (e.g. meter count, alarms settings and number of transmissions sent). An external computer controls the FSU via an RS-232 (DB-9) interface and 9Vdc power is supplied from a separate wall transformer.

The FSU is composed of two subassemblies; a motherboard and a Node Controller Interface (NCI) which is simply the RF communications module. The motherboard regulates the 9Vdc power and interfaces between the FSU RS-232 port and the NCI's logic. The NCI contains the micro-controller, communications processor and RF circuitry to communicate over-the-air.

Operating in the 902 – 928MHz ISM band, the FSU transmits and receives MSK Direct Sequence Spread Spectrum modulation at approximately 1Mcps. The transmitter has an output power of +30dBm (max.) and remains on for approximately 37s. The receiver remains on, constantly listening for a signal from an IMU.

Circuit Descriptions

ASIC and Supporting Circuitry

The heart of the NCI is an ASIC containing a micro-controller and a communications processor. This ASIC maintains a real time clock using a 32.76KHz internal oscillator. The ASIC also runs a 12MHz crystal oscillator, programs the frequency synthesizer and controls the power to the down-conversion and demodulator circuits. Normally, the ASIC is in Receive mode waiting to hear from an IMU.

When a transmission from an IMU is received, the communications processor part of the ASIC accepts the demodulated signal and performs two functions to convert the DSSS chips to data. First, the chips are de-spread using 64 bit correlators. Next, the de-spread bits are unscrambled to reverse the effect of spectral whitening done at the transmitter. Finally, the data is passed to the micro-controller. If the data contains the Unique Word and serial number correctly identifying the target IMU, then the micro-controller sends the message to the FSU motherboard. The motherboard, in turn, passes the data through a Universal Asynchronous Receiver/Transmitter (UART) and an RS-232 level converter to the FSU serial communications port.

The serial communications port also accepts commands and data for transmission to an IMU and passes it through the motherboard to the NCI. On the NCI, the micro-controller sets the FSU in Transmit mode while the communications processor scrambles (spectrally whitens) and spreads the data before sending the chips (data bits mixed with the PN sequence) to the modulator.

A Power-On-Reset IC ensures that the processor will not malfunction if the wall transformer's output droops.

Frequency Synthesizer and Phase Locked Loops

The frequency synthesizer IC controls two Phase Locked Loops (PLLs) which generate an 800MHz Local Oscillator (LO) and a 120MHz LO. The 800MHz LO step in 1.5MHz increments and the 120MHz PLL is fixed. Both PLLs use a 12MHz crystal oscillator as their reference. While the IMU is receiving, the 800MHz LO is set to 110.6MHz below the channel. To transmit, the 800MHz LO is directly modulated by the chip stream (from the ASIC) and mixed with the 120MHz to produce the output signal.

Frequency Converter

Down and up-conversion is performed using active mixers. An LNA precedes the down-converter and reduces the RF noise figure. Mixing the received signal with the 800MHz LO produces a 110.6MHz IF. Mixing the 120MHz LO with the modulated 800MHz LO produces the transmitted signal.

The down-converter is followed by a 1.5MHz wide SAW filter, which reduces the receiver's pass band from 25MHz to 1.5MHz.

Demodulator

The FM demodulator provides a Received Signal Strength Indicator (RSSI) that controls the variable attenuator. Additionally, the demodulator down converts filters and limits the IF signals before demodulating it with a LC discriminator. The demodulated signal is converted to binary data that is processed by the ASIC.

Power Amplifier

The transmitted signal from the up-converter is pre-amplified by a class AB integrated amplifier and then amplified again by a class C integrated amplifier. The pre-amplifier's output passes through a 915MHz SAW filter to remove spurious signals and then through a Transmit/Receive (T/R) switch, a dielectric filter and an LC matching network before going to the antenna. The output level to the antenna is +30dBm (max.)

Antenna

The FSU uses a purchased, "rubber duck" type antenna with a typical gain of 2.5dB.

Power Supply

The FSU is powered using an adapter rated 9Vdc, 0.5A.

NCI RF Specifications per FCC 2.1033 (b)(4)

- Frequency Range 903-927 Mhz
- Spectrum Technique Direct Sequence Spread Spectrum
- Modulation Scheme Minimum Shift Key (MSK)
- Bit Rate 62.5 kb/sec (12Mhz/192)
- Chipping Rate 1Mc/sec (62.5kb/sec x 16 chips/bit)
- Channel Capacity 17 (From 0-16)
- Channel Spacing 1.5 Mhz
- Power supply 3.6Vdc/500 mA (Constant Tx)
- Power Consumption 3.6Vdc/90 mA (Constant Rx)
- PLL VCO 1.4 V max
- Null to Null Bandwidth 1.5 Mhz
- 6 dB Bandwidth > 600 Khz
- First Side-lobe Level 25dBc
- Output Power 30dBm
- Receive Sensitivity -90 dBm
- Frequency Tolerance ± 20ppm
- Total Frequency Drift ± 45ppm
- List of Channel Frequency:

CHANNEL	Freq.(Mhz)
0	903.0
1	904.5
2	906.0
3	907.5
4	909.0
5	910.5
6	912.0
7	913.5
8	915.0
9	916.5
10	918.0
11	919.5
12	921.0
13	922.5
14	924.0
15	925.5
16	927.0

DSSS Processing Gain Calculation per FCC 15.247 (4)(d)

- The Transmit module generates the spread spectrum binary sequence for output to the RF modulator (directly modulated VCO.

- The Transmitter logic encodes two consecutive bits of data into one of four possible 32- bit (chip) PN sequences. Consequently, an improvement in the signal to noise ratio is achieved since each pair of the data bit is now represented by 32 chips. The improvement, or processing gain in decibel is calculated as:

  Processing Gain = 10 log (32chips/2 bits)
  Processing Gain = 12 dB

- The Transmitted PN sequence is further randomized by modulus-2 addition with a fixed 2047-bit PN sequence. This operation smoothes (spectral Whitens) the output spectrum by eliminating discrete spectral components.

APPENDIX E
MODIFICATION LETTER

To whom it may concern:

This is to certify that **No Modifications** were necessary for:

Field Service Unit Transceiver, model Field Service Unit (FSU)

To comply with:

1. Powerline Conducted Emissions in a shielded room utilizing two LISN's in accordance with the FCC test procedure 47 CFR §15.207.

2. Radiated Emissions in a 3-meter open area site in accordance with the FCC test procedure 47 CFR §15.209 and §15.31(m).

3. Occupied Bandwidth Test in accordance with the FCC test procedure 47 CFR §15.247(2).

4. Harmonics and Spurious Emissions Test in accordance with the FCC test procedure 47 CFR §2.1053 and §15.249(a).

5. Maximum Peak Output Power Test Requirement in accordance with 47 CFR §15.247(b).

The results show that the sample equipment tested as described in this report is in compliance with the FCC Rules Part 15, SubPart B: Powerline Conducted Emissions, en Field Radiated Emissions. Occupied Bandwidth, Harmonics and Spurious Emissions and Maximum Peak Output Power test requirement limits of, SubPart C.

For further information, please contact the manufacturer at

Innovatec Communications, LLC
101 South Second Street
Milwaukee, Wisconsin 53204 USA
Tel: (414) 272-2255
Fax: (414) 272-5421
Attention: Mr. Kimbel A. Nap