

**FCC Part 15 Sub-Part B & C
EMI Test Report**

on

C & I Gas Meter Interface
[FCC ID: OWS-962]

model names

962

provided for evaluation by

Innovatec Communications, LLC
13000 W. Silver Spring Drive, PO Box 910
Butler, Wisconsin 53007

evaluated and prepared by

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

General Information

Product Name FCC ID Model / Type	C & I Gas Meter Interface OWS-962 962	
Manufacturer's Name: Manufacturer's Address	Innovatec Communications, LLC 13000 W. Silver Spring Drive, PO Box 910 Butler, Wisconsin 53007USA Tel: 262-783-0200 Fax: 262-783-0205	
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Total No. of Pages	32	
Test No. & Report No.	20010404-1	0104FRS104-1
Test Date & Issue Date	May 2 - 4, 2001	May 10, 2001
Project Technician(s)	Elijah Garcia & O'Lanre Owoborode	Michael Gbadebo, PE

According to testing performed by 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 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 conforms to the emissions requirements of FCC Part 15 B & C.

Tests Performed:

1. Radiated Emissions in a 3-meter open area site in accordance with 47 CFR §15.209 and §15.31(m). Part 3 of this report contains details.
2. Occupied Bandwidth Test in accordance with 47 CFR §15.247(2). Part 4 of this report contains details.
3. Harmonics and Spurious Emissions Test in accordance with 47 CFR §2.1053 and §15.249(a). Part 5 of this report contains details.
4. 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: Open Field Radiated Emissions. Occupied Bandwidth, Harmonics and Spurious Emissions and Maximum Peak Output Power test requirement limits of, SubPart C.

Michael Gbadebo, PE
Chief Engineer / Principal Consultant

Applicant: Innovatec Communications, LLC

Report No. 0104FRS104-1

Prepared By: 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: www.itcemc.com		C & I Gas Meter Interface Model: 962 FCC ID: OWS-962	Rev. No 1.0 FCC Part 15 SubPart B & C
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Declaration / Disclaimer

International Technology Company (ITC) reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. International Technology Company (ITC) shall have no liability for any deductions, inferences or generalizations drawn by the client or others from International Technology Company (ITC) issued reports.

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International Technology Company (ITC) is:

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

Approved by the Industry Canada for Telecom Testing

Certified by Rockford Engineering Services 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 and R-696; Site 2: C-715 and R-697

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C & I Gas Meter Interface
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FCC Part 15 SubPart B & C

Engineering Services Offered by ITC

1) Reliability / Environmental 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)

FCC 15 / Class - A
FCC 15 / Class B and DoC
FCC 15 / SubPart C
FCC 24
FCC 68 (Analog and Digital)
FCC 90
FCC 95

Product Safety (UL/NRTL)

All UL Standards, Including:

UL 1950 / ITE
UL 2601 / Medical
UL 1459 / Telecom
UL 1411 / Audio, Radio, TV
UL 813 / Commercial Audio
UL 1604 / Hazard. Location
UL 508 / Energy Mgmt. Equip.

EU: EMI/EMC (EN)

EN 50081-1 / 50081-2
EN 50082-1 / 50082-2
EN 55103-1 / 55103-2
EN 55024:1998
EN 55011 / 55013 / 55014
EN 55015 / 55020 / 55022
EN 60555-2 / 60555-3
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

RSS 210 & RSS 221
Industry Canada / IC CS-03

All c-UL Standards for Canada

All CSA Standards, including:

CSA No. 950 / ITE
CSA No. 601-1 / Medical
CSA No. 1010-1 / Lab, Measurement
CSA No. 225 / Telecom

Asia - Australia / International

CISPR 11, 13, 14, 15, 16, 20, 22
VCCI Class 1 & 2 / Japan

AS / NZ 3548: C-Tick Mark, EMC

CNS 13438 - 1996 / Taiwan

ITU Standards
IEC / ETSI Standards
BellCore Standards
IEEE / ANSI Standards

EU: Safety / Machinery (EN)

EN 60950 / 61010-1
EN 60204 / 60065
EN 60601-1-1
TÜV
*Competent Body Representation / EU

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Part 1

General

Test Methodology

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

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.

Accuracy of Test Data

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

Support Equipment included in the Tests:

The C & I Gas Meter Interface was tested as a stand-alone device.

Part 2
Powerline Conducted Emissions
per FCC Part 15 Subpart B

Powerline Conducted Emissions test was not performed on the C & I Gas Meter Interface because it was powered by 3.6Vdc Lithium / Thionyl / Chloride Battery.

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C & I Gas Meter Interface

Model: 962

FCC ID: OWS-962

Rev. No 1.0

FCC Part 15 SubPart B & C

Part 3

Open Field Radiated Emissions per FCC Part 15 Subpart B

3.1 EUT Configuration

Pre-scan measurements were first performed with a spectrum analyzer set in fast sweep mode. 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; using a receiver with bandwidth parameters. The C & I Gas Meter Interface 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 mid-way above the ground plane. Frequency measurement was taken from 30MHz up to 10th harmonic.

3.2 Test Procedure

The EUT was set up as described above while transmitting and receiving continuously. It was rotated 360 degrees azimuth and the search antenna height varied 1 to 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.

3.3 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 – amplifier gain.

3.4 Nominal 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

Open Field Radiated Emissions per FCC Part 15 SubPart B

3.5 Administrative Details

Date(s) of Test	May 2 - 4, 2001
Emission Limits	Class B
Distance	10M Field
Antenna Used	Biconical Antenna, model # EMCO 3104, S / N 3459 and Log Periodic Antenna, model # EMCO 3146, S / N 2075 (calibrated 01 / 19 / 2001, next calibration due date is 01 / 19 / 2002)

3.6 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 Frequency MHz	Amplitude dBuV / M	Antenna Distance dB	Cable Factor dB	Corrected Amplitude dBuV / M	Turntable Angle Degree	Height M	Antenna Polarization -	FCC 15 Limit dBuV / M	Class B Margin dB
33.10	9.2	11.7	2.5	23.4	90	1.0	VB	40.0	-16.6
112.20	8.5	13.9	3.9	26.3	180	2.0	HB	43.5	-17.2
198.10	10.7	15.3	4.7	30.7	0	2.0	HB	43.5	-12.8
249.52	19.1	13.2	5.2	37.5	180	2.0	HL	46.0	-8.5
552.00	12.4	19.7	6.8	38.9	270	1.0	VL	46.0	-7.1
946.00	0.5	23.8	8.3	32.6	180	3.0	HL	46.0	-13.4

No emissions of significant levels were observed between 30 MHz and 1 GHz. No significant emission levels were observed between 1 GHz and 10th harmonics of the EUT.

Conclusion

The C & I Gas Meter Interface meets the requirements of the test reference for Open Field Radiated Emissions of Section 15.109 for class B Digital Devices.

Part 4

Occupied Bandwidth

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

4.1 EUT Configuration

The EUT was set up in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-1992; using a Hewlett Packard 8566B Spectrum Analyzer with detector and bandwidth parameters as stipulated in C63.4-1992. The C & I Gas Meter Interface was powered by 3.6Vdc power supply.

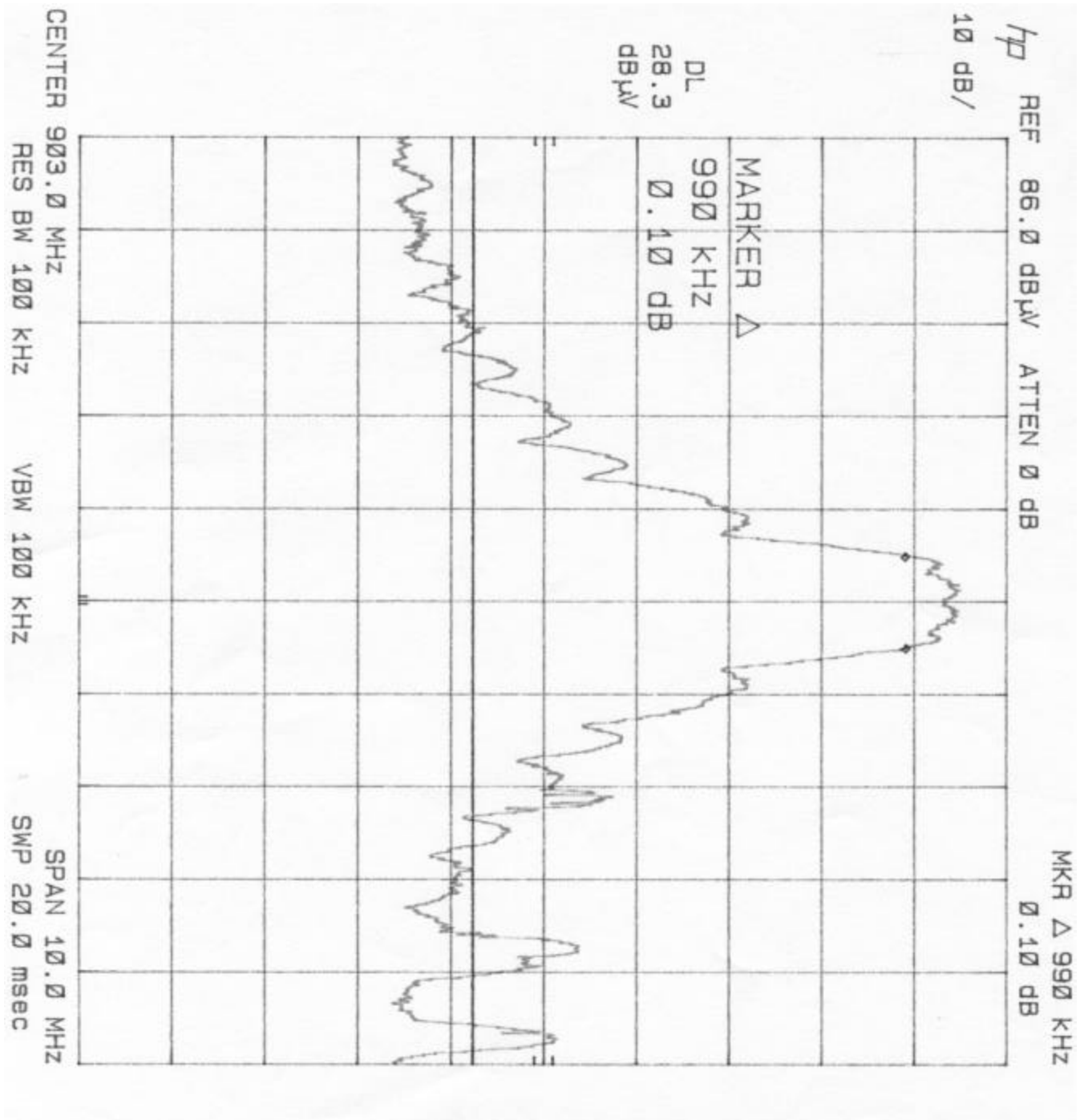
4.2 Test Procedure

The EUT was placed on the wooden turntable and the table was rotated until the highest emissions were observed. It was transmitting continuously with modulation turned ON at low, medium, and high channel frequencies. Signal was monitored with HP 8566B Spectrum Analyzer, using the EMCO Double-Ridged Wave-guide Horn Antenna, model # 3115. Unless stated otherwise. The receiving antenna was raised to maximize the signal strength (1-1.6 meter above the referenced ground plane). At each channel frequency, the EUT was monitored for spurious modulation products including harmonics (up to 10th), 6dB bandwidth, peak spectral power density, peak conductive power, and dwell time.

4.3 Bandwidth Test

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

6dB Bandwidth Plot Performed at 3-Meter Distance (Low Channel Frequency)



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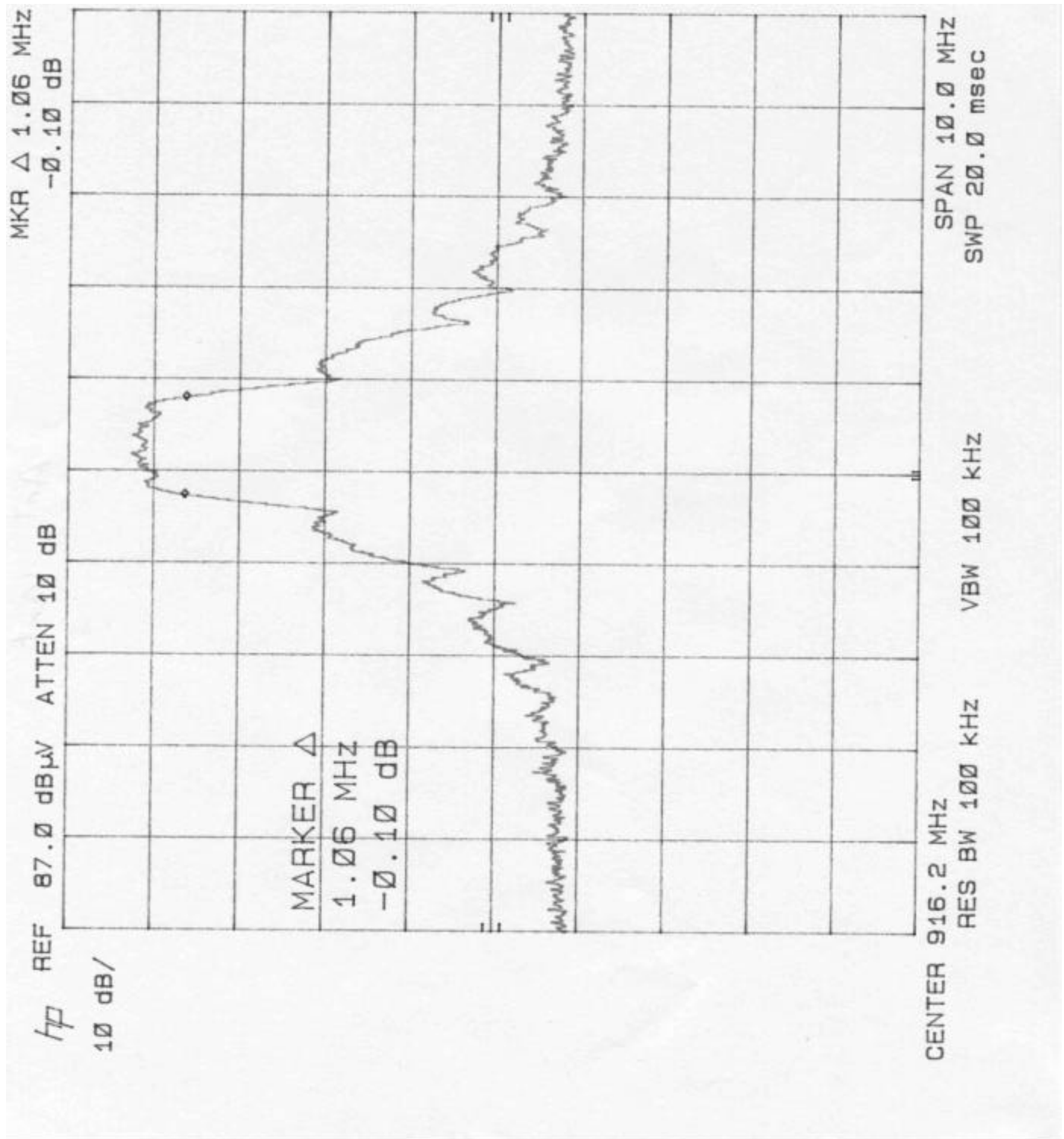
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4.4 Bandwidth Test

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

6dB Bandwidth Plot Performed at 3 Meter Distance (Medium Channel Frequency)



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C & I Gas Meter Interface
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FCC Part 15 SubPart B & C

6dB Bandwidth Plot Performed at 3 Meter Distance (High Frequency)



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 EUT Configuration

The C & I Gas Meter Interface was set up in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-1992, using a 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 pre-selector functions were disabled. The EUT was DC powered, at 3.6 V nominal voltage.

5.2 Test Procedure

The EUT was configured for maximum response and was set up as described above and configured to transmit continuously (with modulation on) at low, medium, and high channel frequencies. Spurious emissions were monitored with HP 8566B and 8569A Spectrum Analyzers, below and above the center frequencies using an appropriate receiving antenna. The spurious emissions were obtained by varying the height of the antennas and then rotating the turntable in 360-degree turns until the maximum signal to noise ratio is obtained. Unless stated otherwise, the receiving antenna to EUT distance was set at 3-meter distance. Highest emission was obtained when the EUT was placed in the horizontal plane while the antenna polarization was in the vertical plane to maximize the readings. The measurements were either peak quasi-peak measurements below 1 GHz and average measurements above 1 GHz

5.3 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

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

5.4 Administrative Details

Date(s) of Test	May 2 - 4, 2001
Emission Limits	Class C

5.5 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.

Table #1: Harmonics and Spurious Emissions at Low Frequency - at Channel 0 [Low Frequency]

Indicated Frequency MHz	Amplitude dBuV / M	Antenna Distance dB	Cable Factor dB	Corrected Amplitude dBuV / M	Turntable Angle Degree	Height M	Antenna Polarization -	FCC15 Limit dBuV / M	Class C Margin dB
276.00	13.5	11.9	6.4	31.8	0	1.0	HL	46.0	-14.2
300.00	13.2	13.5	7.1	33.8	0	1.0	HL	46.0	-12.2
324.00	11.8	12.5	7.3	31.6	0	1.0	HL	46.0	-14.4
336.00	13.5	12.5	7.4	33.4	0	1.0	HL	46.0	-12.6
336.00	10.7	12.5	7.4	30.6	90	1.0	VL	46.0	-15.4
783.12	10.4	19.1	12.3	41.8	0	1.0	HL	46.0	-4.2
* * 902.97		23.8	1.1		45	1.0	VL	94.0	
1805.97	14.0	27.2	2.2	33.4	0	1.0	VH	54.0	-20.6
1805.72	3.0	27.2	2.2	32.4	225	1.0	HH	54.0	-21.6
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	0	1.0	VH	54.0	-14.4
7223.20	0.0	36.9	4.0	40.9	0	1.0	VH	54.0	-13.1
8126.10	0.0	37.9	4.4	42.3	0	1.0	VH	54.0	-11.7
9029.00	0.0	38.9	4.7	43.6	0	1.0	VH	54.0	-10.4

** Fundamental frequency at channel 0

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

Table # 2: Harmonics and Spurious Emissions at Middle Frequency - at Channel 9 [Middle Frequency]

Indicated Frequency MHz	Amplitude dBuV / M	Antenna Distance dB	Cable Factor dB	Corrected Amplitude dBuV / M	Turntable Angle Degree	Height M	Antenna Polarization -	FCC 15 Limit dBuV / M	Class C Margin dB
276.02	11.6	11.9	6.4	29.9	0	1.0	HL	46.0	-16.1
299.99	10.8	13.5	7.1	31.4	0	1.0	HL	46.0	-14.6
324.00	11.9	12.5	7.3	31.7	0	1.0	HL	46.0	-14.3
335.99	9.5	12.5	7.4	29.4	90	1.0	VL	46.0	-16.6
336.00	14.5	12.5	7.4	34.4	0	1.0	HL	46.0	-11.6
795.99	11.0	19.3	12.4	42.7	0	1.0	HL	46.0	-3.3
* 916.50		23.8	1.1		45	1.0	VL	94.0	
1178.01	12.9	24.8	1.3	39.0	0	1.0	HH	54.0	-15.0
1230.01	10.7	24.9	1.3	36.9	0	1.0	VH	54.0	-17.1
1833.00	21.3	27.3	2.3	50.9	0	1.0	HH	54.0	-3.1
1833.00	17.2	27.3	2.3	46.8	0	1.0	VH	54.0	-7.2
2749.50	0.0	29.5	2.6	32.1	0	1.0	VH	54.0	-21.9
3666.00	0.0	32.8	2.9	35.7	0	1.0	VH	54.0	-18.3
4582.50	0.0	33.7	3.2	36.9	0	1.0	VH	54.0	-17.1
5499.00	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
8248.50	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 at channel 9

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

Table #3: Harmonics and Spurious Emissions at High Frequency - Channel 16 [High Frequency]

Indicated Frequency MHz	Amplitude dBuV/M	Antenna Distance dB	Cable Factor dB	Corrected Amplitude dBuV/M	Turntable Angle Degree	Height M	Antenna Polarization -	FCC 15 Limit dBuV/M	Class C Margin dB
276.00	13.3	11.9	6.4	31.6	0	1.0	HL	46.0	-14.4
300.00	13.1	13.5	7.1	33.7	0	1.0	HL	46.0	-12.3
324.00	12.7	12.5	7.3	32.5	0	1.0	HL	46.0	-13.5
336.00	14.0	12.5	7.4	33.9	0	1.0	HL	46.0	-12.1
336.00	12.1	12.5	7.4	32.0	90	1.0	VL	46.0	-14.0
806.50	11.0	19.6	12.4	43.0	0	1.0	HL	46.0	-3.0
*927.00		23.9	1.3		0	1.0	HH	94.0	
1034.01	19.0	24.2	1.4	34.6	0	1.0	VH	54.0	-19.4
1250.01	14.8	25.0	1.5	41.3	0	1.0	VH	54.0	-14.7
1262.80	11.1	25.1	1.5	37.7	0	1.0	HH	54.0	-16.3
1854.00	11.0	27.4	2.3	40.7	0	1.0	HH	54.0	-13.3
2781.00	0.0	29.6	2.7	32.3	0	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 at channel 16

Emissions radiated outside of the fundamental frequency meet the requirement of section 15.209. The field strength of the harmonics also meets the requirements of section 15.249

Conclusion

The C & I Gas Meter Interface meets the requirements of the test reference for Fundamental Harmonics and Spurious Emissions.

Part 6
Maximum Peak Output Power
per FCC Part 15 Section 47 CFR §15.247 (b)

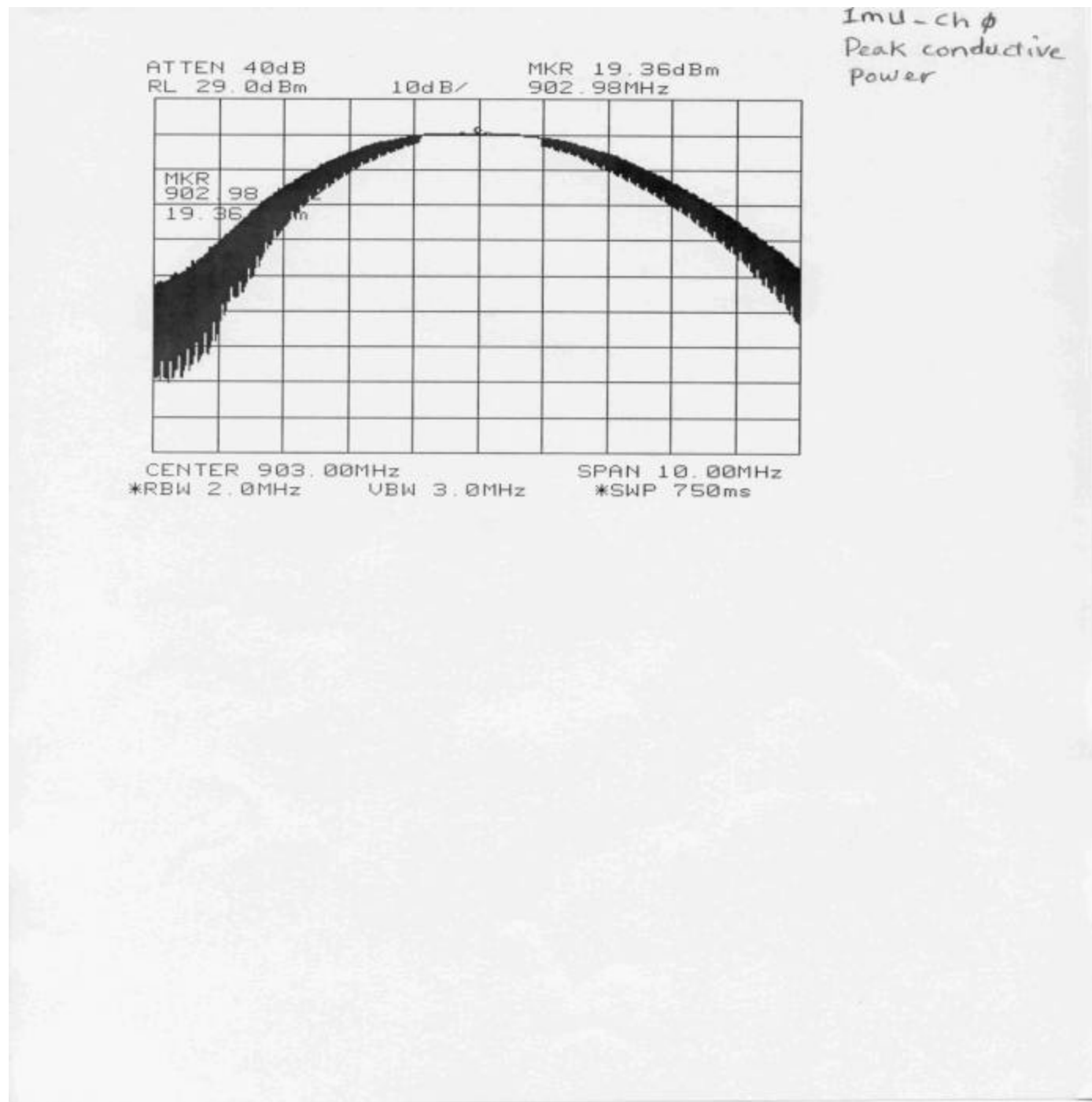
6.1 EUT Configuration

The C & I Gas Meter Interface 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. The output of the EUT was connected directly to the input of spectrum analyzer via the shortest cable possible. The EUT was then powered by an external power supply set to 3.6 V dc at each channel frequency (low, high, and medium).

6.2 Test Procedure

The EUT was configured for maximum response and was set up as described above and configured to transmit continuously with modulation turned on. Signal was monitored with a HP 8566B Spectrum Analyzer, The RF power output = Measured value + cable correction factor.

6.3 Maximum Peak Output Power
per FCC Part 15 Section 47 CFR §15.247(b)
Maximum Conductive Peak Output Power (Low Frequency-Channel 0)



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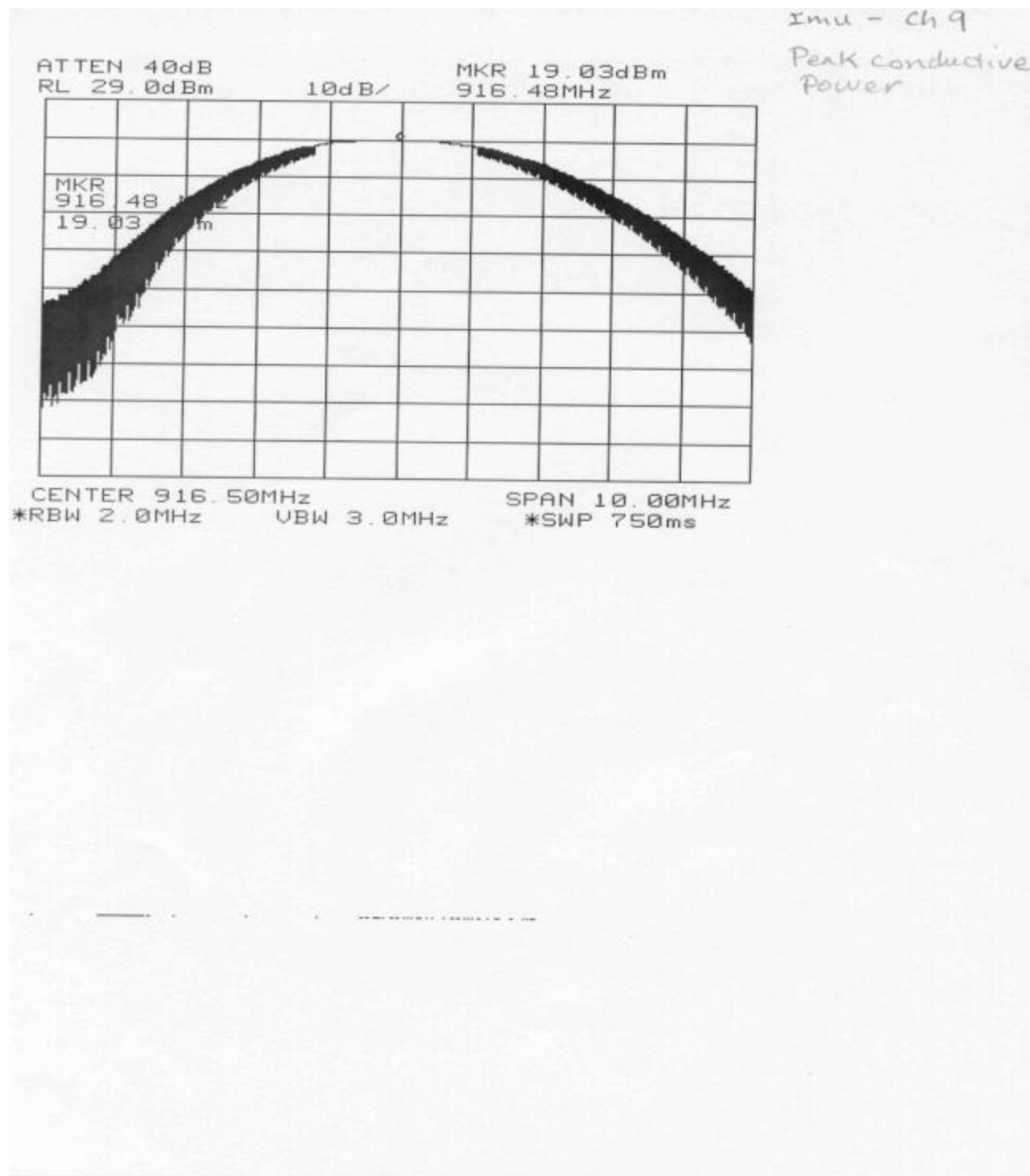
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6.4 Maximum Peak Output Power
per FCC Part 15 Section 47 CFR §15.247(b)
Maximum Conductive Peak Output Power (Medium Frequency-Channel 9)



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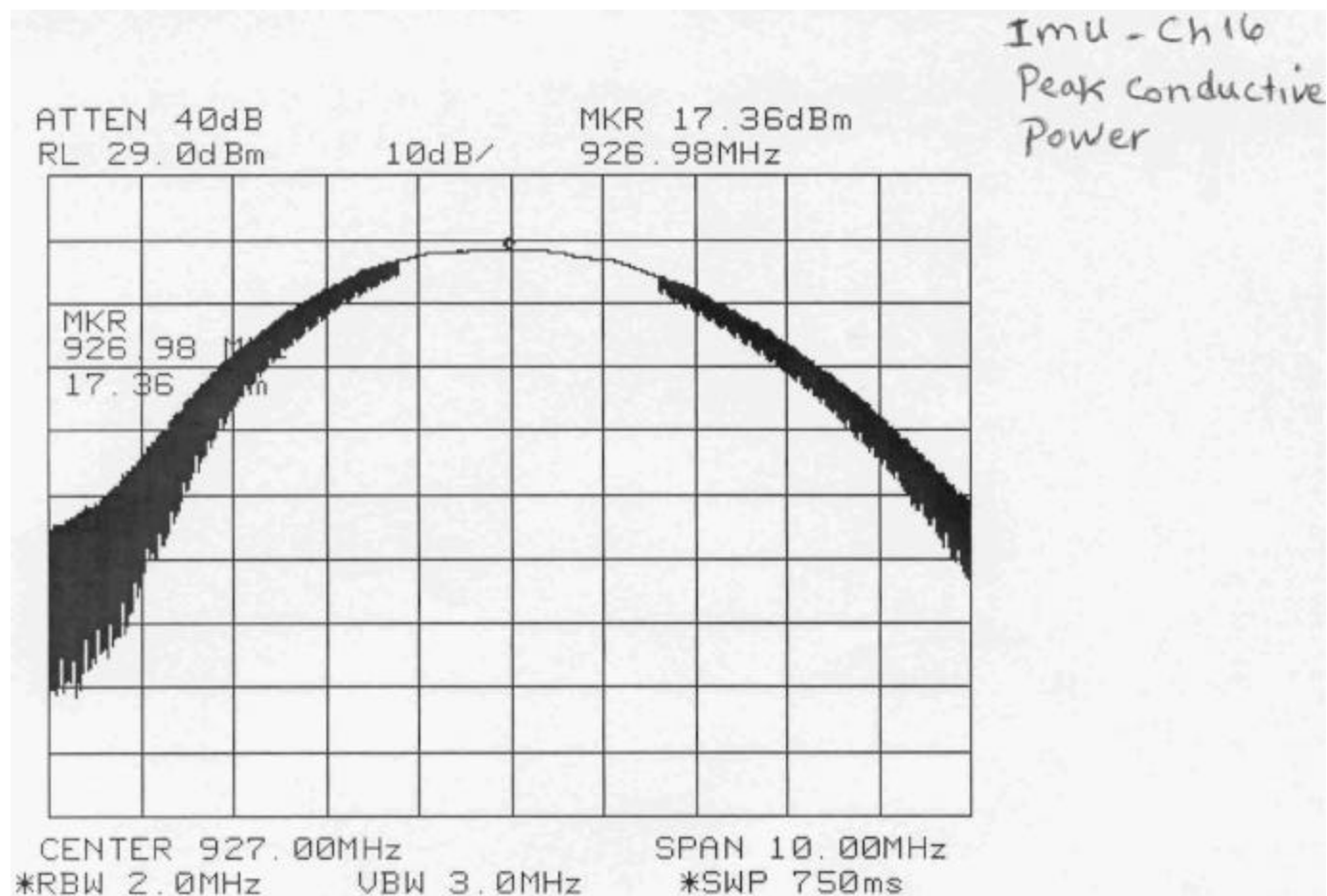
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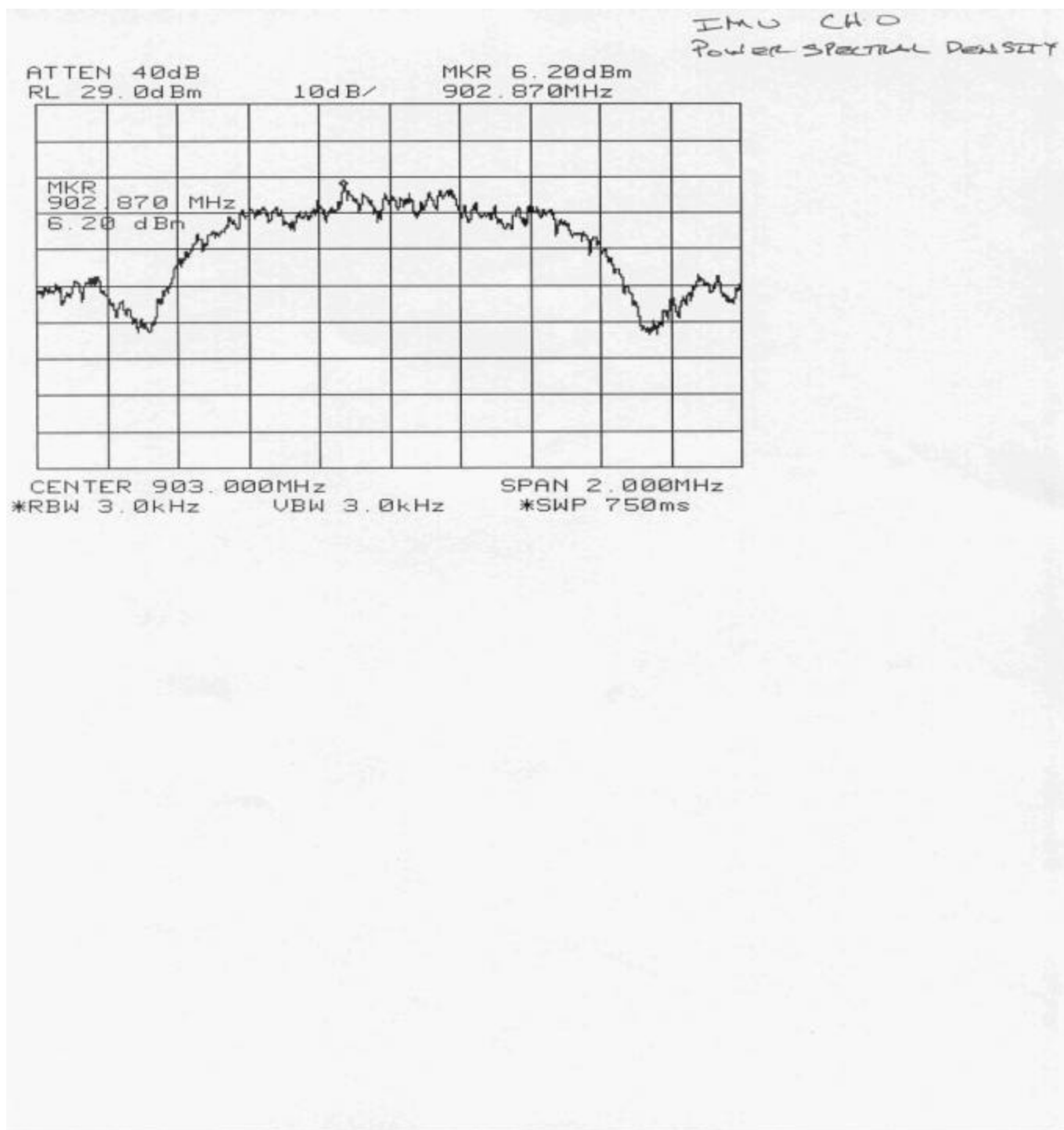
FCC Part 15 SubPart B & C

6.5 Maximum Peak Output Power
per FCC Part 15 Section 47 CFR §15.247(b)
Maximum Conductive Peak Output Power (High Frequency-Channel 16)



The maximum conductive peak power did not exceed 1 watt as required per section 15.247.

6.6 Maximum Peak Output Power Density
Per FCC Part 15 Section 47 CFR §15.247(d)
Peak Conductive Power Density (Low Frequency-Channel 0)



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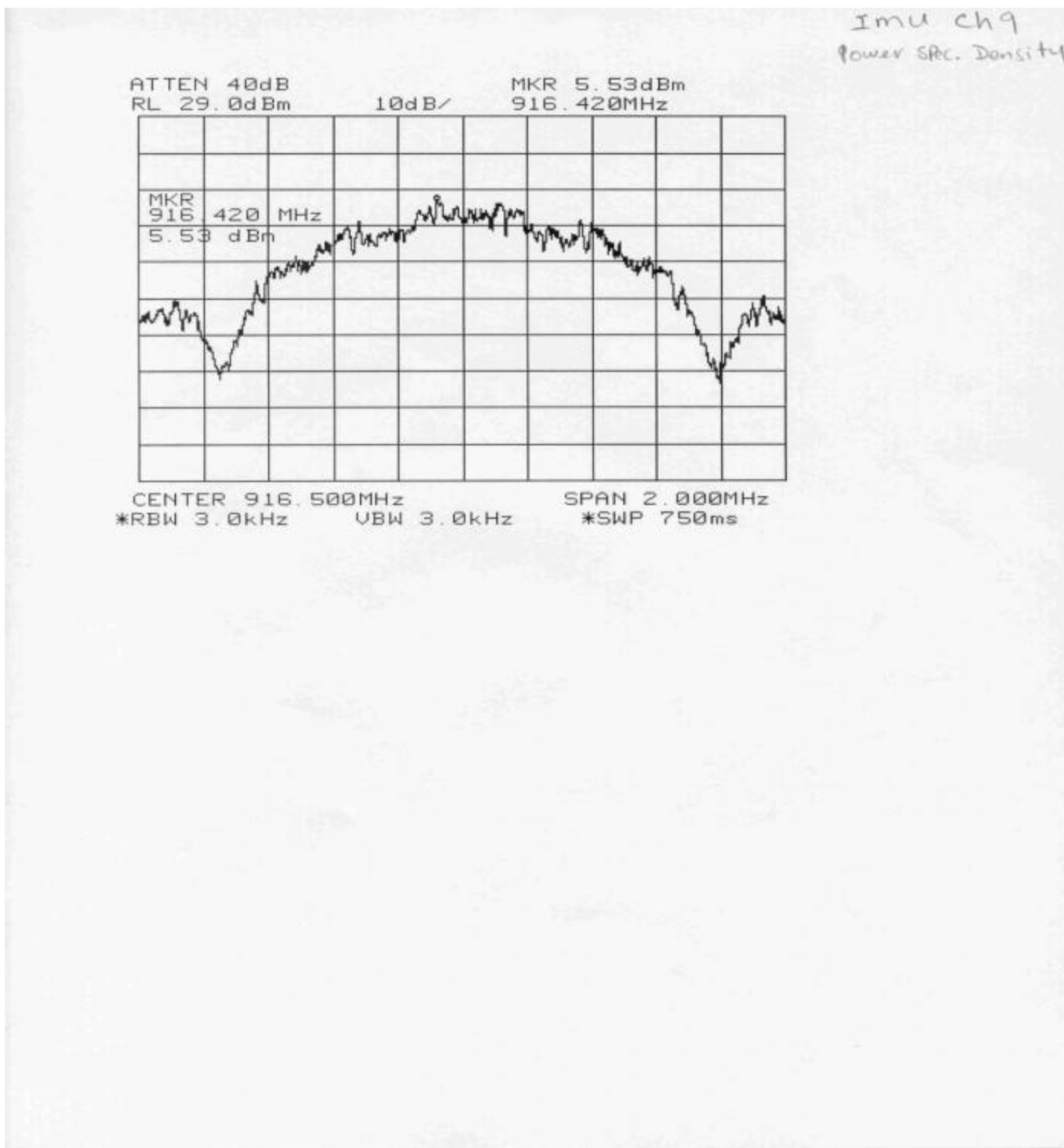
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6.7 Maximum Peak Output Power Density
Per FCC Part 15 Section 47 CFR §15.247(d)
Peak Conductive Power Density (Medium Frequency -Channel 9)



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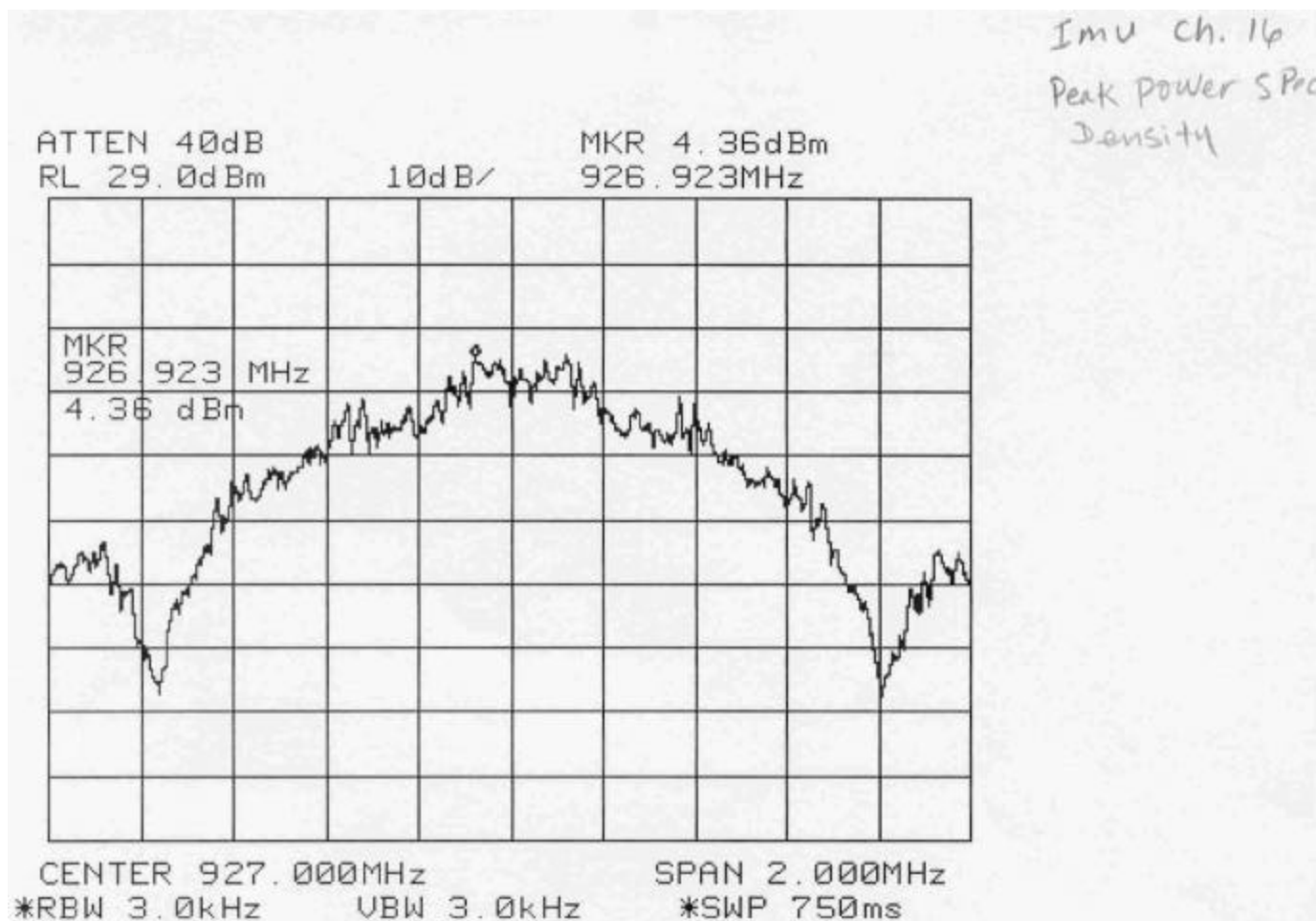
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6.8 Maximum Peak Output Power Density
Per FCC Part 15 Section 47 CFR §15.247(d)
Peak Conductive Power Density (High Frequency-Channel 16)



The conductive peak power density did not exceed 8 dBm as required per section 15.247(d).

Appendix A 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	Manufacturer & Model Number	Serial Number	Calibration Date	Next Calibration Due Date
Spectrum Analyzer	Hewlett Packard 8590A	2752 A02715	02/19/2001	02/19/2002
Spectrum Monitor	Rhode & Schwarz EZM	881 334/025	02/19/2001	02/19/2002
Test Receiver (9 KHz - 30 MHz)	Rhode & Schwarz ESH3	RES 0753	02/23/2001	02/23/2002
Test Receiver (20-1300 MHz)	Rhode & Schwarz ESVP	RES 0749	02/22/2001	02/22/2002
Spectrum Analyzer	Hewlett-Packard 8566B	2618A02909	02/20/2001	02/20/2002
Spectrum Analyzer	Hewlett-Packard 8567A	2602A00239	02/20/2001	02/20/2002
Spectrum Analyzer Display (Site 1)	Hewlett-Packard 8590A	2542A11954	02/21/2001	02/21/2002
Spectrum Analyzer Display (Site 2)	Hewlett-Packard 85662A	2542A12593	03/01/2001	03/01/2002
Quasi Peak Adapter (Site 1)	Hewlett-Packard 85650	2521A00871	03/01/2001	03/01/2002
Quasi Peak Adapter (Site 2)	Hewlett-Packard 85650A	2521A00737	02/21/2001	02/21/2002
Preselector (Site 1)	Hewlett-Packard 85685A	2620A00265	03/01/2001	03/01/2002
Preselector (Site 2)	Hewlett-Packard 85685A	2648A00462	02/21/2001	02/21/2002
Preamplifier	Hewlett-Packard 8447D	2648A04855	03/01/2001	03/01/2002
Preamplifier	Hewlett-Packard 8449B	3008A00101	03/01/2001	03/01/2002
Computer	HP 000 / 300	RES 449	N/A	N/A
Absorbing Clamp	MDS21	891 092 / 025	05/16/2000	05/16/2001
Antenna Cable (OPTK45)	RG8 / u	-	N/A	N/A
Antenna System	EMCO 3230	-	N/A	N/A
Biconical Antenna (Site 1)	EMCO 3104	3459	02/25/2001	02/25/2002
Biconical Antenna (Site 2)	EMCO 3104C	9111-4463	02/23/2001	02/23/2002
Log Periodic Antenna (Site 1) (200-1000 MHz)	EMCO 3146	2075	02/25/2001	02/25/2002
Log Periodic Antenna (Site 2) (200-1000 MHz)	EMCO 3146	9510-4202	02/12/2001	02/12/2002
Adj. Element Dipole Antenna (28 MHz-1 GHz)	EMCO 3120	2632	02/19/2001	02/19/2002
Horn Antenna	Eaton 96001	2632	02/20/2001	02/20/2002
LISN (25 Amp)	EMCO 38825 / 2	9210-2008	02/20/2001	02/20/2002
LISN (100 Amp)	Solar 8610-50-TS-100N		02/19/2001	02/19/2002
LISN	EMCO 3825 / 2R	1188 / 1001	02/22/2001	02/22/2002

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C & I Gas Meter Interface
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Test Equipment

Test Equipment	Manufacturer & Model Number	Serial Number	Calibration Date	Next Calibration Due Date
Remote Controlled 8 ft Rotating Table	RES RT1	Not Provided	N / A	N / A
Remote Controlled 25 ft Rotating Table	RES RT2	Not Provided	N / A	N / A
Remote Controlled 4 ft Rotating Table	RES RT3, RT4, RT5	Not Provided	N / A	N / A
Remote Controlled 4 m Antenna Mast	RES AM1	Not Provided	N / A	N / A
Remote Controlled 6 m Antenna Mast	RES AM2 & AM3	Not Provided	N / A	N / A
3 Phase 220 VAC / 50 Hz Generator	Not Provided	DB7130B40	05/16/2000	05/16/2001
Oscilloscope (300 MHz)	Tektronix 2465	Not Provided	05/16/2000	05/16/2001
Digital Scope	Hitachi VC-6075	Not Provided	05/16/2000	05/16/2001
	Valhalla			
Power Analyzer	Scientific / 2101	RES 574	05/16/2000	05/16/2001
Digital Thermometer	Omega 440	Not Provided	05/16/2000	05/16/2001
DC Computer System	Kepco JQE 150-1.5m	H177085	05/16/2000	05/16/2001

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.

Appendix B

Technical Description and Specification

Assembly Contents

Innovatec IMU Gas PCA and Reed Switch PCA – P / N's: 210-050001 and 217-050001
Three (3) "D"-Cell Lithium / Thionyl / Chloride Battery Pack (3.6V)
2-Wire 22AWG power connection cable assembly
3-Wire 22AWG reed switch pulse input cable assembly
Lexan polycarbonate mounting board
Lexan polycarbonate NEMA 4X enclosure
Lexan polycarbonate mounting tabs

System Details

The Innovatec C&I Gas Meter Interface is a derivative device of the Innovatec Gas IMU. The principal differences in the system are: 1) The unit receives an externally applied pulse input from the C&I gas meters; 2) The unit employs a 3 "D"-Cell battery pack to allow for improved battery life because this system is likely to be queried much more often than the standard gas IMU; and 3) The unit has been repackaged to allow for the significantly larger battery pack and the reed switch pulse pickup from the external source (enclosure dimensions are 6.7" L X 4.8" W X 2.2" H). The IMU included in the assembly has the same specifications as the already certified unit. Some details of that specification include:

Item	Specification
Physical dimensions	6.67"L X 4.76"W X 2.19"H
Weight	2.7 lbs.
Power supply	(3) 3.6 volt D-cell lithium-based battery pack
Output power	20 dBm
Sensitivity	>40 dBm SINAD
Channels	17 (spaced at 1.5 MHz)
Frequency range	902 to 927 MHz
Modulation	Direct Sequence Spread Spectrum
Base data rate	62.5 KB / second
Compliance	FCC Part 15, Class C
Interface	RF LAN
Antenna type	Internal
Enclosure	Lexan NEMA 4X Enclosure
Temperature range	-40° to +85°C

Technical Description and Specification

C&I Gas Meter Interface Features

- Full Two-way 900 MHz spread-spectrum communications between the IMU and the utility
- Direct sequence spread-spectrum communication improves security
- 17 channels allow frequency coordination in dense applications with minimal interference
- Software programmable configuration and control profiles
- 3.6-volt lithium-based long life battery pack
- Unique serial number and assignable PIN
- Autonomous tamper alarms
- Virtual Shut-off capabilities
- Run-away meter detection
- First / Final Reading
- Customer Selectable Billing Dates
- Data and Intelligence Stored in the Meter

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

- Frequency Range 902-927 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 / 240 mA (Constant Tx)
- Power Consumption 3.6Vdc / 90 mA (Constant Rx)
- PLL VCO 1.4 V max
- Null to Null Bandwidth 1.6 MHz
- 6 dB Bandwidth 600 KHz
- First Side-lobe Level 29dBc
- Output Power 20dBm
- Receive Sensitivity -90 dBm
- Frequency Tolerance ± 20 ppm
- Total Frequency Drift ± 45 ppm
- List of Channel Frequency:

Channel	Freq(MHz)
0	902.0
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

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DSS Processing Gain Calculation Per FCC 15.247 (e)(1)

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

$$\text{Processing Gain} = 10 \log(32 \text{ chips} / 2 \text{ bits})$$

$$\text{Processing Gain} = 12 \text{ dB}$$

- 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.

(Additional information is uploaded separately)

Appendix C

Modification Letter

To Whom it May Concern:

This is to certify that no modifications were necessary for:

C & I Gas Meter Interface, model 962

to comply with:

1. Radiated Emissions in a 3-meter open area site in accordance with 47 CFR §15.209 and §15.31(m).
2. Occupied Bandwidth Test in accordance with 47 CFR §15.247(2).
3. Harmonics and Spurious Emissions Test in accordance with 47 CFR §2.1053 and §15.249(a).
4. Maximum Peak Output Power Test Requirement in accordance with 47 CFR §15.247.

The results show that the sample equipment tested as described in this report is in compliance with the FCC Rules Part 15, SubPart B, Open 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
13000 W. Silver Spring Drive, PO Box 910
Butler, Wisconsin 53007USA
Tel: 262-783-0200
Fax: 262-783-0205

Attention: Mr. Kimbel A. Nap

Applicant: Innovatec Communications, LLC

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