Excellence in Compliance Testing

Certification Test Report

Test Report

FCC ID: R7PEG0R3S2
IC: 5294A-EG0R3S2

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Report Number: 07-0243-15C

Manufacturer: Cellnet Technology, Inc.
Model(s): 25-1075, 25-1080, 25-1081

Test Begin Date: May 23, 2007
Test End Date: September 25, 2007

Report Issue Date: March 25, 2008

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report is not be used to claim certification, approval, or endorsement by NVLAP, NIST or any government agency.

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This report contains 17 pages

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210.

1.2 Product Description

1.2.1 General

The Cellnet Technology, Inc. models 25-1075, 25-1080, and 25-1081 are radio module transmitters used in utility gas meters for remote data collection.

Manufacturer Information:
Cellnet Technology, Inc.
30000 Mill Creek Avenue
Suite 100
Alpharetta, GA 30022

Test Sample Condition:
The test samples were provided in good working order with no visible defects.

Detailed photographs of the EUT are filed separately with this filing.

1.2.2 Intended Use

Models 25-1075, 25-1080, and 25-1081 are gas meter radio module transmitters.

1.3 Test Methodology and Considerations

Application for certification for models 25-1075, 25-1080, and 25-1081 will be for limited modular approval based on the gas meter types used for each module. The following gas meter manufacturers and models correspond to the module model as follows:

Gas Meter Manufacturer: Elster American Meter
Models: AC-250, AL-250, AL-425, AL-310 (Model AC-250 used for radiated emissions testing)
Cellnet Radio Module: Model 25-1075

Gas Meter Manufacturer: Actaris (formerly known as Sprague Meter Company, Schlumberger Meter) and former Lancaster Meter
Models: 250, 175, 400 (Model 250 used for radiated emissions testing)
Cellnet Radio Module: Model 25-1080

Gas Meter Manufacturer: Sensus (formerly known as Invensys, also as Rockwell and Equimeter)
Models: R-275, R-315, R-415 (Model R-275 used for radiated emissions testing)
Cellnet Radio Module: Model 25-1081

Differences in gas meters among different models of gas meters of one manufacturer are related primarily to the "capacity rating" of the meter. The model number can also specify side entry/exit of the inlet/outlet pipes or top entry/exit of the inlet/outlet pipes. Fundamentally, the differences among the models within one manufacturer's family of models are minor. Therefore one meter model was used for radiated emissions testing to represent all manufacturer models.

All modules are RF identical and will be filed under a single application for certification. Differences in the modules include shape and size to fit the individual gas meters.

For RF conducted measurements, 25-1075, 25-1080, and 25-1081 were configured with the external RF connectors to the PCB and the worst case data presented in this report.

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment. In addition, ACS is compliant to ISO 17025 as certified by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 894540
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

NVLAP Lab Code: 200612-0

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

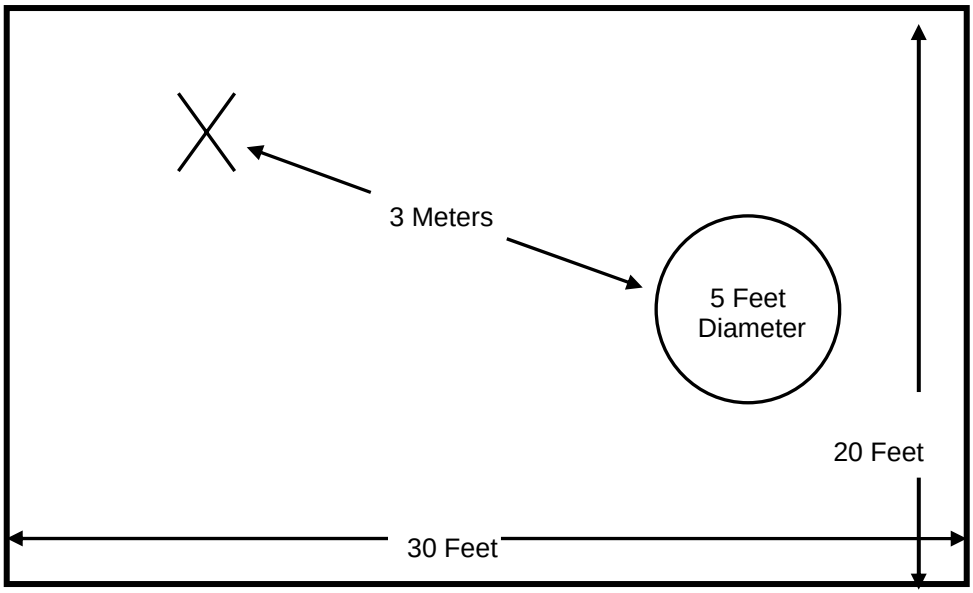

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

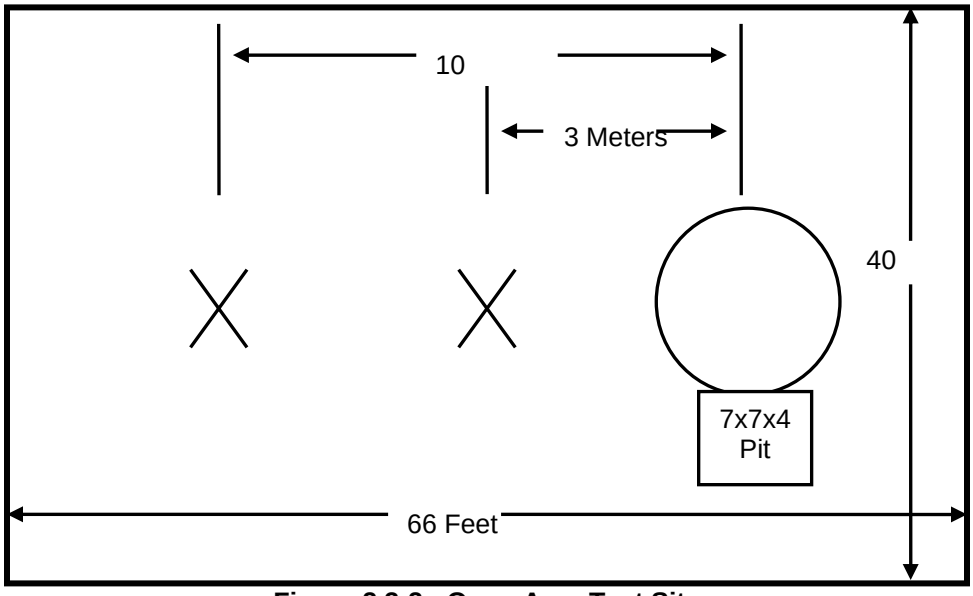

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal group reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

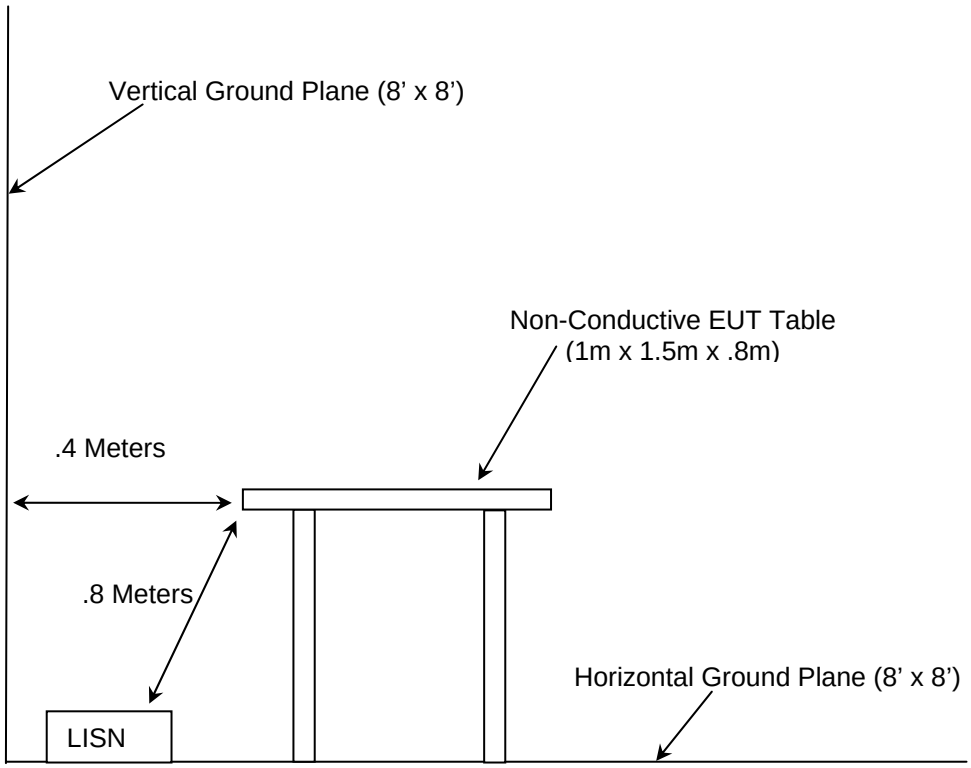

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2006
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2006
- FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, 2001
- FCC KDB Publication No. 558074 - Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247), March 2005
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 7 June 2007

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
1	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	833771/007	3/5/2008
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	3/5/2008
22	Agilent	Amplifiers	8449B	3008A00526	10/25/2008
25	Chase	Antennas	CBL6111	1043	6/6/2008
30	Spectrum Technologies	Antennas	DRH-0118	970102	5/10/2008
73	Agilent	Amplifiers	8447D	2727A05624	12/19/2008
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	11/9/2008
290	Florida RF Cables	Cables	SMSE-200-72.0-SMRE	None	5/15/2008
291	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	None	5/15/2008
292	Florida RF Cables	Cables	SMR-290AW-480.0-SMR	None	5/24/2008
329	A.H.Systems	Antennas	SAS-571	721	8/13/2008
331	Microwave Circuits	Filters	H1G513G1	31417	8/27/2008
338	Hewlett Packard	Amplifiers	8449B	3008A01111	9/26/2007
339	Aeroflex/Weinschel	Attenuators	AS-18	7142	8/20/2008
343	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	N/A	11/21/2007
344	Florida RF Cables	Cables	SMS-290AW-480.0-SMR	N/A	1/16/2009

5.0 SUPPORT/HOST EQUIPMENT

Table 5-1: Support/Host Equipment

Item	Manufacturer	Equipment Type	Model Number	Serial Number
1	Elster American	Utility Gas Meter	AC-250	N/A
2	Actaris	Utility Gas Meter	250	N/A
3	Sensus	Utility Gas Meter	R-275	N/A

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

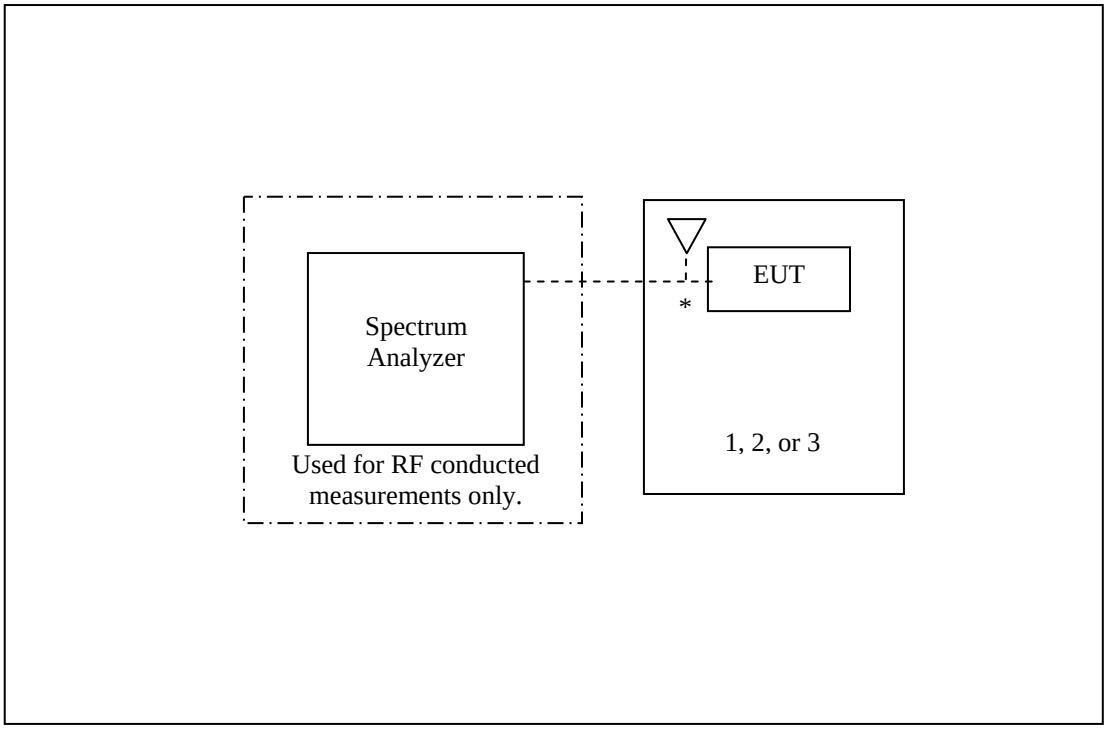

Figure 6-1: EUT Test Setup

The host equipment used for testing was dependant on the radio module being evaluated. See section 1.3 and test setup photographs for more details.

* For RF conducted measurements the integral antenna is disconnected and a 50-Ohm cable is soldered (with the appropriate ground connection) to the PCB.

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement

The modular transmitters utilize integral PCB antennas which can not be removed without damaging the device.

7.2 Power Line Conducted Emissions

Models 25-1075, 25-1080, 25-1081 are battery power and therefore power line conducted emissions are not required.

7.3 Radiated Emissions - Unintentional Radiation

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 5GHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements above 30MHz and below 1GHz were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz using a Quasi-peak detector. Above 1GHz, average measurements are taken with the RBW and VBW were set to 1MHz and 10 Hz respectively.

7.3.2 Test Results

Results of the test are given in Table 7.3-1 below:

Table 7.3-1: Radiated Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
30	---------	20.11	H	-7.20	---------	12.91	--------	40.0	---------	27.09
42.93	---------	20.44	H	-13.55	---------	6.89	--------	40.0	---------	33.11
81.73	---------	20.34	H	-18.29	---------	2.05	--------	40.0	---------	37.95
100.05	---------	20.42	V	-14.20	---------	6.22	--------	43.5	---------	37.28
137.77	---------	20.19	V	-13.00	---------	7.19	--------	43.5	---------	36.31
213.22	---------	20.80	V	-13.83	---------	6.97	--------	43.5	---------	36.53
347.94	---------	20.72	H	-8.74	---------	11.98	--------	46.0	---------	34.02
492.36	---------	22.22	H	-5.95	---------	16.27	--------	46.0	---------	29.73
679.9	---------	22.02	H	-2.40	---------	19.62	--------	46.0	---------	26.38
959.04	---------	21.51	H	3.17	---------	24.68	--------	46.0	---------	21.32

* Note: No emissions above the noise floor of the measurement system were detected. Emissions reported above are measurements of the noise floor.

7.4 6dB Bandwidth

7.4.1 Test Methodology

The 6dB bandwidth was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz. Span was set large enough to capture the entire emissions and >> RBW.

7.4.2 Test Results

Results are shown below in table 7.4.2-1 and figure 7.4.2-1:

Table 7.4.2-1: 6dB Bandwidth

Frequency [MHz]	Bandwidth [MHz]
917.58	1.25

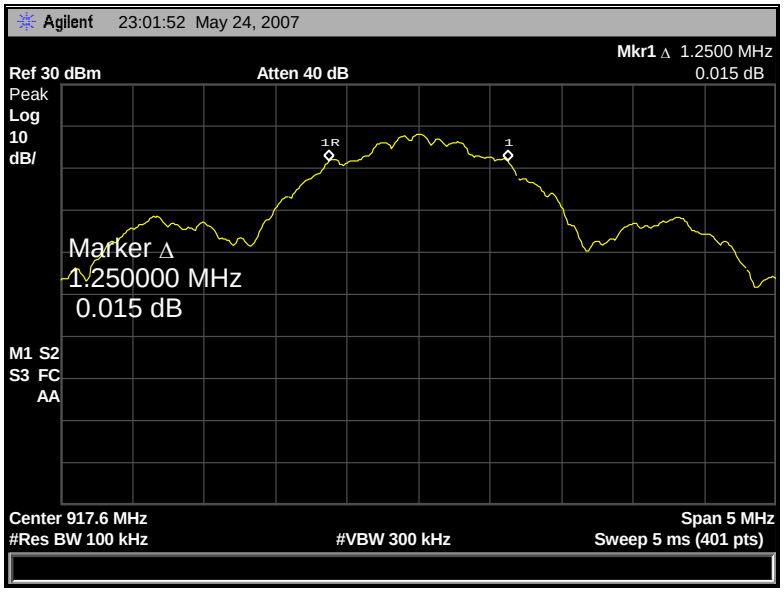

Figure 7.4.2-1: 6dB Bandwidth Plot

7.5 Peak Output Power Requirement

7.5.1 Test Methodology

The Peak Output Power was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)" Power Option 1. The RF output of the equipment under test was directly connected to the input of the Power Meter.

Data was collected with the EUT operating at maximum power.

7.5.2 Test Results

Results are shown below in Table 7.5.2-1 and Figure 7.5.2-1.

Table 7.5.2-1: Peak Output Power

Frequency (MHz)	Output Power (dBm)
917.58	22.37

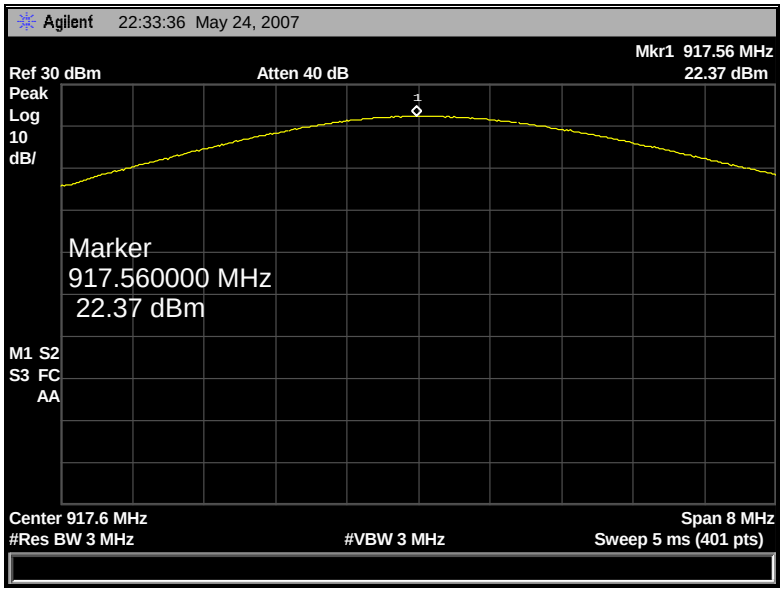

Figure 7.5.2-1: Output power

7.6 Band-Edge Compliance and Spurious Emissions

7.6.1 Band-Edge Compliance of RF Emissions

7.6.1.1 Test Methodology

The EUT was investigated to determine band-edge compliance. For this measurement the spectrum analyzer's RBW and VBW was set to 100 kHz and 300kHz respectively.

7.6.1.2 Test Results

In a 100 kHz bandwidth at the lower and upper band-edge, the radio frequency power that was produced by the EUT is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. Band-edge compliance is displayed in Figure 7.6.1.2-1.

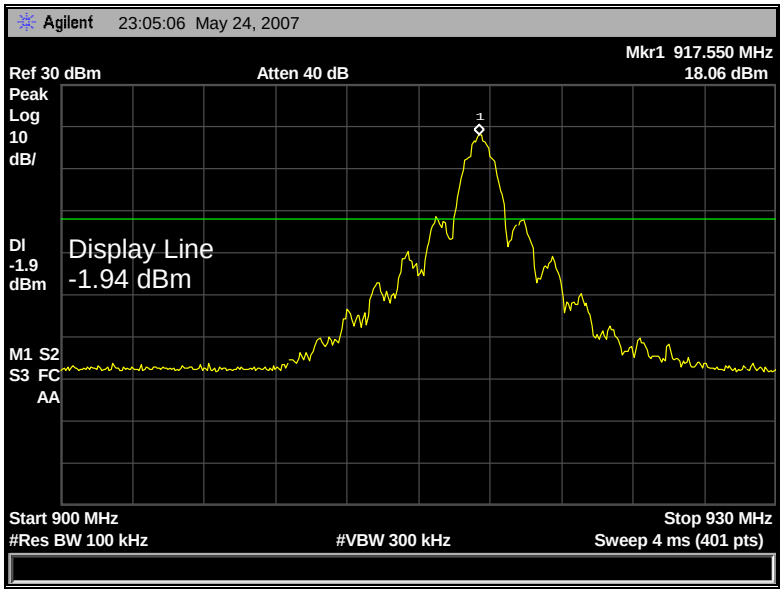

Figure 7.6.1.2-1: Band-edge

7.6.2 RF Conducted Spurious Emissions

The RF Conducted Spurious Emissions were measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 10GHz, 10 times the highest fundamental frequency. For each measurement, the spectrum analyzer's RBW was set to 100 kHz and the VBW was set to 300 kHz. The peak detector and Max Hold function of the analyzer were utilized.

7.6.2.2 Test Results

In a 100 kHz bandwidth, the radio frequency power that was produced by the EUT emissions is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. RF Conducted Emissions are displayed in Figures 7.6.2.2-1 through 7.6.2.2-2.

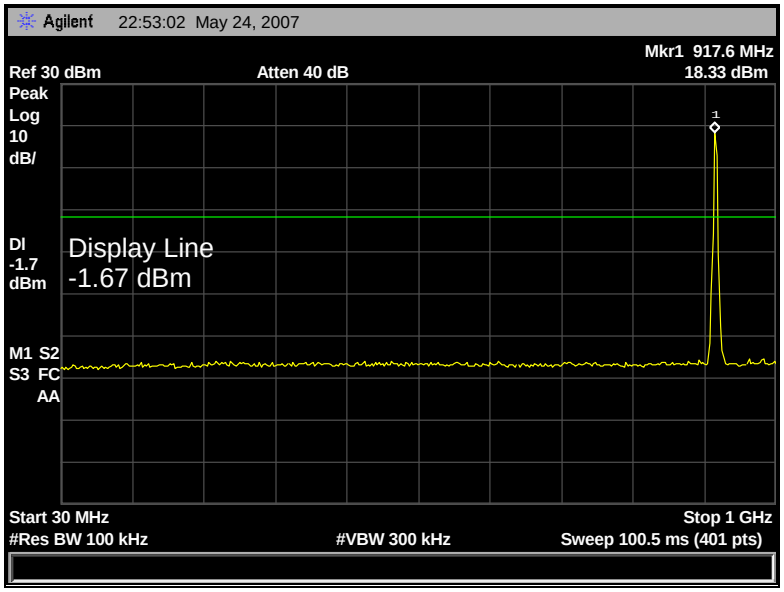

Figure 7.6.2.2-1: 30MHz – 1GHz

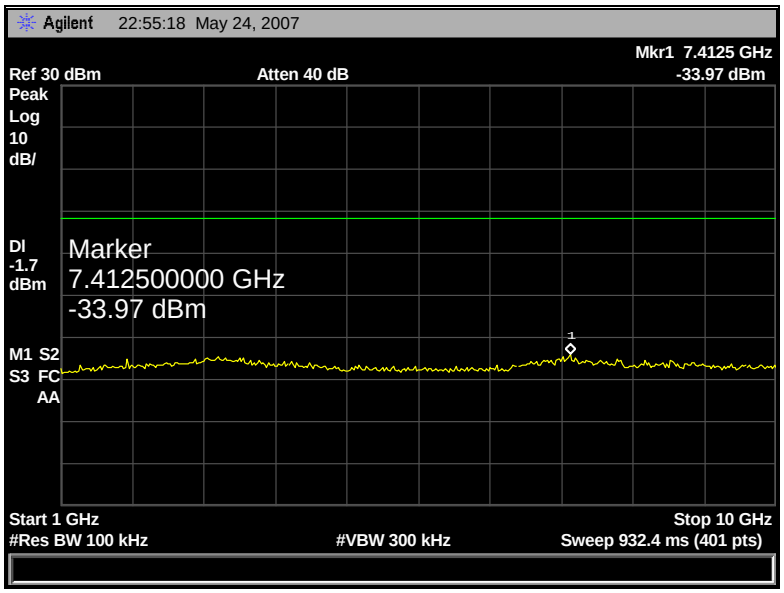

Figure 7.6.2.2-2: 1GHz – 10GHz

7.6.3 Radiated Spurious Emissions - Restricted Bands

7.6.3.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 10GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak measurements made with RBW and VBW of 1 MHz. The peak emissions were further corrected by applying the duty cycle correction of the EUT for comparison to the average limit.

7.6.3.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 18.42dB to account for the duty cycle of the EUT. The transmission length during a 100ms period is 12ms. The duty cycle correction factor is determined using the formula: 20log (12/100) = 18.42dB.

A detailed analysis of the duty cycle timing is provided in the Theory of Operation accompanying this report.

7.6.3.3 Test Results

Using the procedures set forth in the FCC KDB Publication No. 558074 “Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)”, radiated spurious emissions found in the band of 30MHz to 10GHz are reported in Table 7.6.3.3-1 to 7.6.3.3-3 for each module/host combination.. Each emission found to be in a restricted band as defined by section 15.205, was compared to the radiated emission limits as defined in section 15.209.

Table 7.6.3.3-1: Radiated Spurious Emissions – Model 25-0175 with Elster American Meter

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2752.74	64.98	64.98	H	-5.35	59.63	41.22	74.0	54.0	14.37	12.78
2752.74	67.02	67.02	V	-5.50	61.52	43.11	74.0	54.0	12.48	10.89
3670.32	50.75	50.75	V	-3.63	47.12	28.70	74.0	54.0	26.88	25.30
4587.9	52.33	52.33	H	-1.79	50.54	32.12	74.0	54.0	23.46	21.88
4587.9	51.31	51.31	V	-1.49	49.82	31.40	74.0	54.0	24.18	22.60

Table 7.6.3.3-2: Radiated Spurious Emissions – Model 25-1080 with Actaris Meter

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2752.74	70.95	70.95	H	-5.35	65.60	47.19	74.0	54.0	8.40	6.81
2752.74	74.95	74.95	V	-5.50	69.45	51.04	74.0	54.0	4.55	2.96
3670.32	59.66	59.66	H	-3.83	55.83	37.41	74.0	54.0	18.17	16.59
3670.32	53.40	53.40	V	-3.63	49.77	31.35	74.0	54.0	24.23	22.65
4587.9	58.18	58.18	H	-1.79	56.39	37.97	74.0	54.0	17.61	16.03
4587.9	57.49	57.49	V	-1.49	56.00	37.58	74.0	54.0	18.00	16.42

Table 7.6.3.3-3: Radiated Spurious Emissions – Model 25-1081 with Sensus Meter

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2752.74	66.02	66.02	H	-5.35	60.67	42.26	74.0	54.0	13.33	11.74
2752.74	67.91	67.91	V	-5.50	62.41	44.00	74.0	54.0	11.59	10.00
3670.32	58.37	58.37	H	-3.83	54.54	36.12	74.0	54.0	19.46	17.88
3670.32	52.07	52.07	V	-3.63	48.44	30.02	74.0	54.0	25.56	23.98
4587.9	61.10	61.10	H	-1.79	59.31	40.89	74.0	54.0	14.69	13.11
4587.9	56.21	56.21	V	-1.49	54.72	36.30	74.0	54.0	19.28	17.70

7.6.3.4 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: 64.98 - 5.35 = 59.63dBuV/m

Margin: 74dBuV/m – 59.63dBuV/m = 14.37dB

Example Calculation: Average

Corrected Level: 64.98 - 5.35 - 18.42 = 41.22dBuV

Margin: 54dBuV – 41.22dBuV = 12.78dB

7.7 Peak Power Spectral Density

7.7.1 Test Methodology

The power spectral density was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The emission peaks within the pass band were located and zoomed in on. The spectrum analyzer RBW was set to 3 kHz and VBW 10 kHz. Span was adjusted to 500 kHz and the sweep time was calculated to be 170s (Span/3 kHz).

7.7.2 Test Results

Results are shown below in table 7.7.2-1 and figure 7.7.2-1:

Table 7.7.2-1: Peak Power Spectral Density

Frequency [MHz]	Peak Power Density [dBm]
917.58	5.45

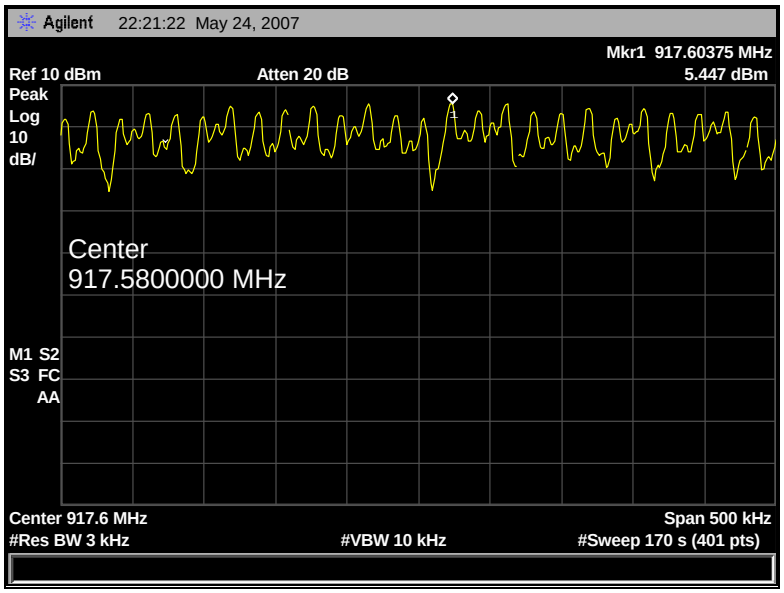

Figure 7.7.2-1: Power Spectral Density Plot

8.0 CONCLUSION

In the opinion of ACS, Inc. the 25-1075, 25-1080, 25-1081, manufactured by Cellnet Technology, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT