Excellence in Compliance Testing

Certification Test Report

FCC ID: R7PEG6R3S2
IC: 5294A-EG6R3S2

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

ACS Report Number: 08-0459 - 15C

Manufacturer: Cellnet Technology, Inc.
Model: 25-1078

Test Begin Date: December 10, 2008
Test End Date: December 10, 2008

Report Issue Date: February 3, 2009

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 16 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 25-1078 is a stand-alone RF module used in gas meter automatic meter reading applications. The 25-1078 is one-way radio frequency device that uses Cellnet RF technology and protocol to transmit data over the Cellnet LAN. These end-points operate in the unlicensed 902-928 frequency range using Direct Sequence Spread Spectrum (DSSS) modulation. The 25-1078 is specifically designed for integration into the Cellnet Pulse Recorder (CPR) host as defined in this report.

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

Test Sample Serial Number(s):
C513TTEST0000003 and C513T460802750510

Test Sample Condition:
Sample was provided in good working condition with no visible defects.

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

1.3 Test Methodology and Considerations

The 25-1078 does not meet all requirements of CFR 47 Part 15.212 for single modular approval therefore limited single modular approval is applicable and the 25-1078 was evaluated in a representative host device. The 25-1078 module was tested as installed in the Cellnet Pulse Recorded (CPR) endpoint with a Badger Meter Absolute Digital Encodder serial number 00000006.

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/IEC 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:

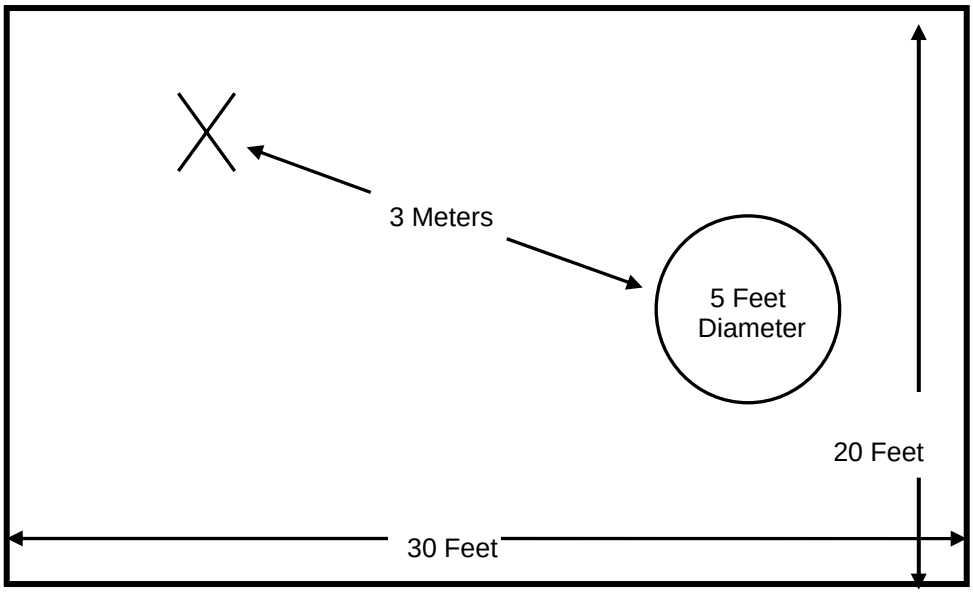

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

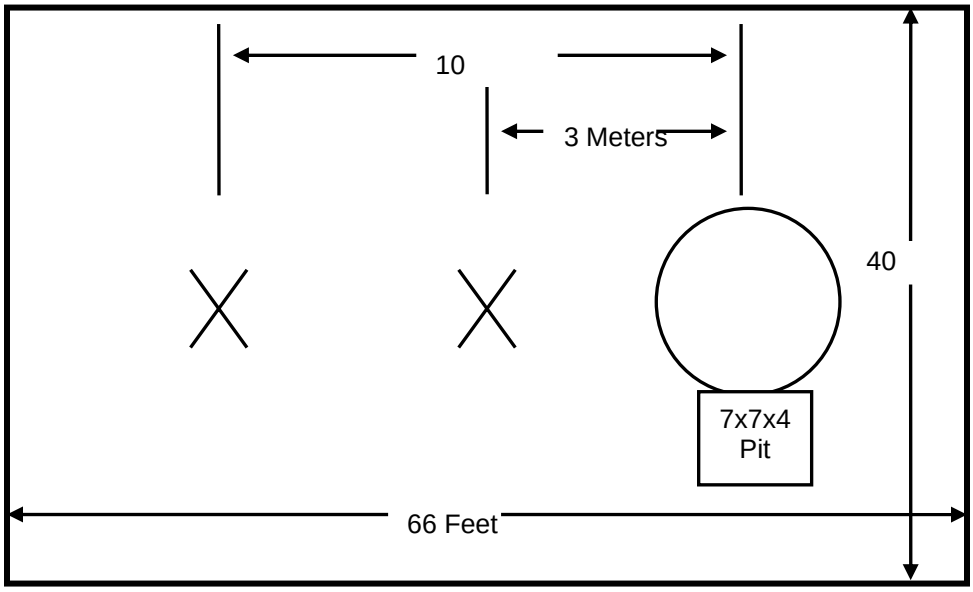

Figure 2.3-2: Open Area Test Site

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:

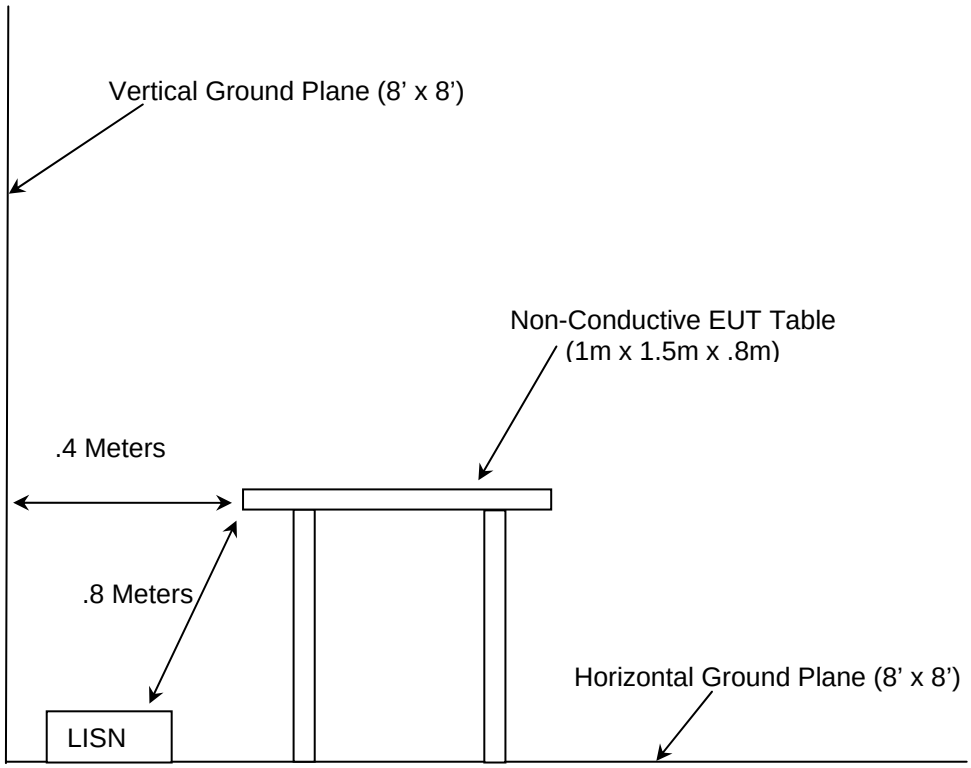

Figure 2.4-1: AC Mains Conducted EMI Site

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, 2008
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2008
- 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
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue2, 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	09-19-2009
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	09-19-2009
22	Agilent	Amplifiers	8449B	3008A00526	10-22-2009
25	Chase	Antennas	CBL6111	1043	08-22-2009
30	Spectrum Technologies	Antennas	DRH-0118	970102	05-07-2009
167	ACS	Cable Set	Chamber EMI Cable Set	167	01-04-2009
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	09-19-2009
291	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	None	11-24-2009
292	Florida RF Cables	Cables	SMR-290AW-480.0-SMR	None	11-24-2009
321	Hewlett Packard	Amplifiers	HPC 8447D	1937A02809	10-08-2009
337	Microwave Circuits	Filters	H1G513G1	282706	04-08-2009
338	Hewlett Packard	Amplifiers	8449B	3008A01111	10-22-2009
340	Aeroflex/Weinschel	Attenuators	AS-20	7136	10-22-2009
422	Florida RF	Cables	SMS-200AW-72.0-SMR	805	02-25-2009

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Diagram #	Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
1	Badger Meter	Meter	Absolute Digital Encoder	00000006	NA
2	Belden	Cable	YM46370	NA	NA
3	Belden	Cable	9770	NA	NA
4	FerriShield	Ferite	CS0612	NA	NA
5	Cellnet	Host Enclosure	Type 3R	NA	NA

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

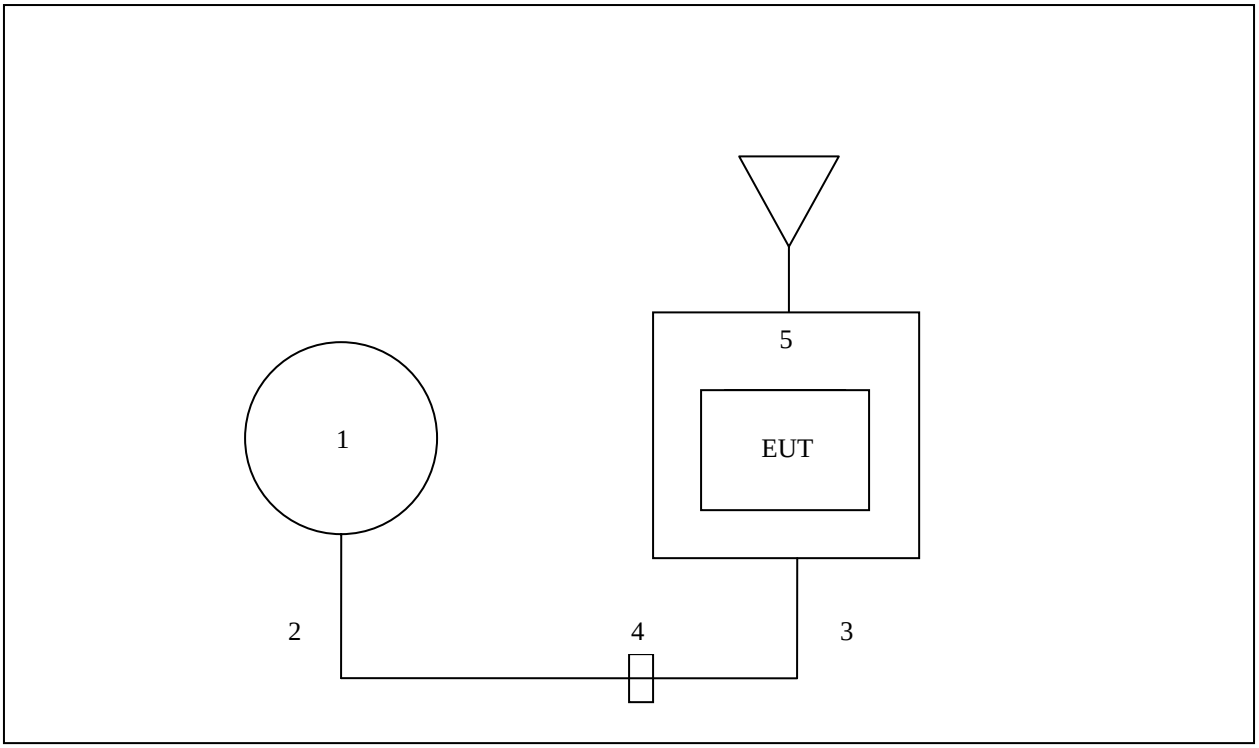

Figure 6-1: EUT Test Setup

*See Test Setup photographs for additional detail.

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 – FCC: Section 15.203

The EUT utilizes loop antenna with a -3dBi gain which can not be removed or modified without damaging the device.

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.2

The EUT is powered by an internal battery and is therefore not designed to be connected to the public utility (AC) power line. No Power line conducted emissions testing was performed.

7.3 Radiated Emissions – FCC: Section 15.109(Unintentional Radiation) IC: RSS-210 2.6

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 were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz for measurements from 30-1000MHz. Average and peak measurements are taken with the RBW and VBW set to 1MHz for measurements above 1000MHz.

7.3.2 Test Results

Results of the test are given in Table 7.3.2-1 below:

Table 7.3.2-1: 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	---------	21.14	v	-8.50	---------	12.64	--------	40.0	---------	27.36
96.82	---------	30.20	v	-14.35	---------	15.85	--------	43.5	---------	27.65
333.93	---------	25.51	v	-10.35	---------	15.16	--------	46.0	---------	30.84
475.12	---------	21.93	v	-6.65	---------	15.28	--------	46.0	---------	30.72
673.43	---------	22.10	v	-2.13	---------	19.97	--------	46.0	---------	26.03
953.65	---------	21.55	v	3.51	---------	25.06	--------	46.0	---------	20.94

* Note: All emissions above 953.65 MHz were attenuated below the permissible limit.

7.4 6dB / 99% Bandwidth – FCC: Section 15.247(a)(2) IC: RSS-210 A8.2(a)

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.

The 99% occupied bandwidth was also measured in accordance to the measurement guidelines provided by Industry Canada (The Measurement of Occupied Bandwidth).

7.4.2 Test Results

Results are shown below in table 7.4.2-1 and figures 7.4.2-1 and 7.4.2-2.

Table 7.4.2-1: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth [MHz]
917.58	1.18	1.926

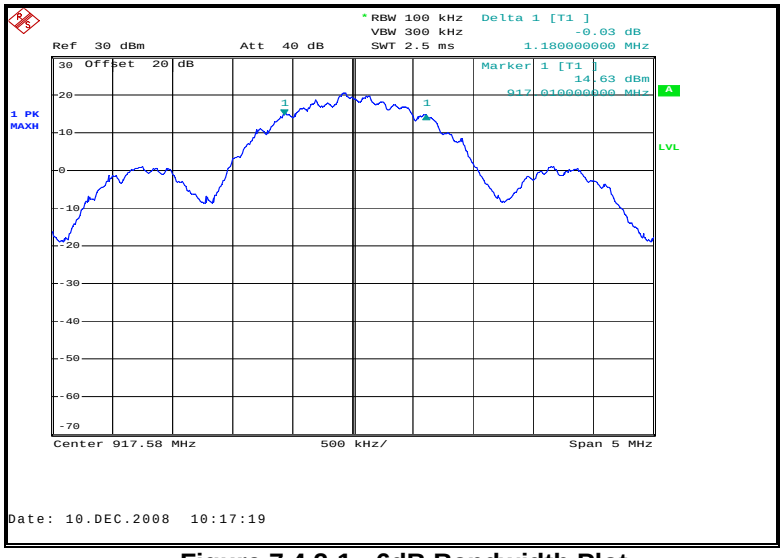

Figure 7.4.2-1: 6dB Bandwidth Plot

Figure 7.4.2-2: 99% Bandwidth Plot

7.5 Peak Output Power Requirement - FCC Section 15.247(b)(3) IC: RSS-210 A8.4(4)

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 Spectrum Analyzer with the RBW set to >> the emission bandwidth.

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	25.03

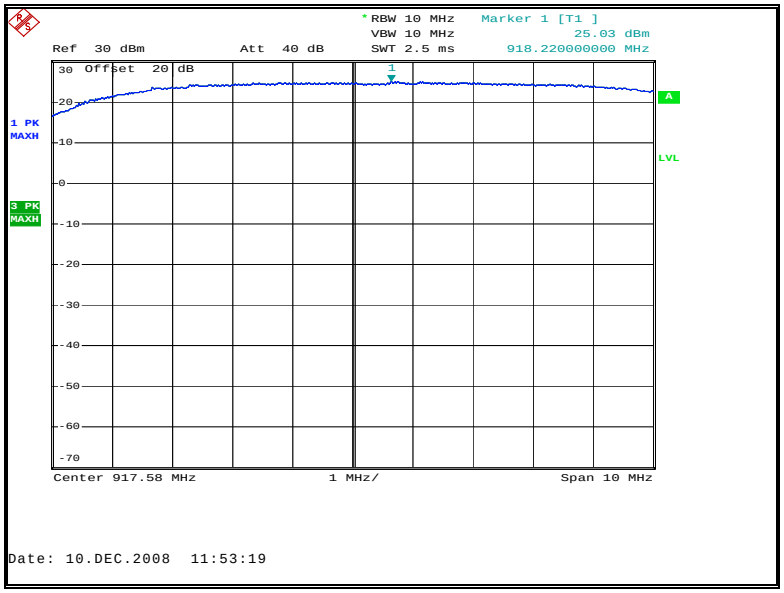

Figure 7.5.2-1: Output power – Low Channel

7.6 Band-Edge Compliance and Spurious Emissions - FCC Section 15.247(d) IC: RSS-210 2.6, A8.5

7.6.1 Band-Edge Compliance of RF Emissions

7.6.1.1 Test Methodology

In a 100 kHz bandwidth at the lower and upper band-edge, the radio frequency power that is produced by the EUT shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power.

7.6.1.2 Test Results

Band-edge compliance is displayed in Figure 7.6.1.2-1.

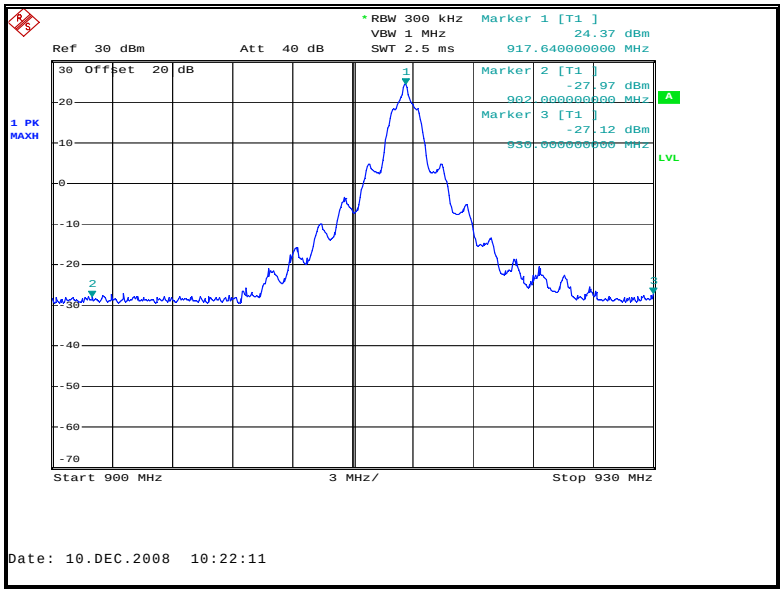

Figure 7.6.1.2-1: Band-edge

7.6.2 RF Conducted Spurious Emissions

7.6.2.1 Test Methodology

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.

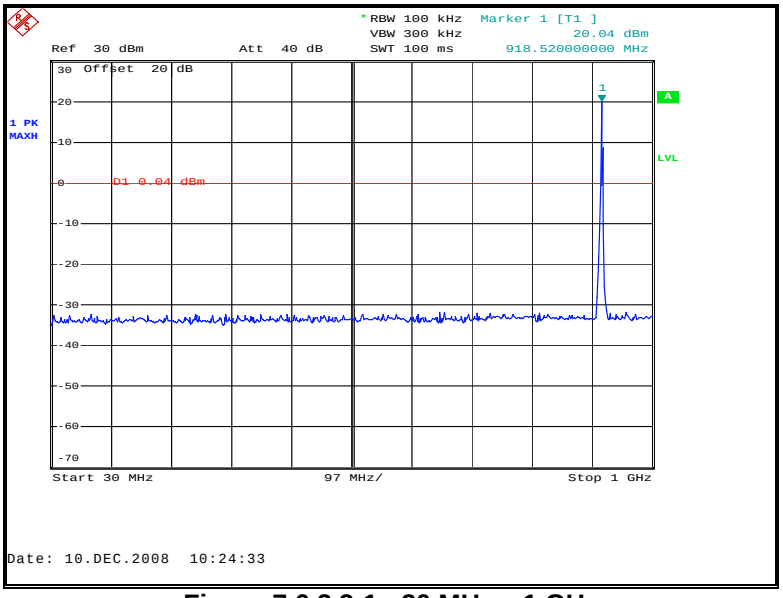

Figure 7.6.2.2-1: 30 MHz – 1 GHz

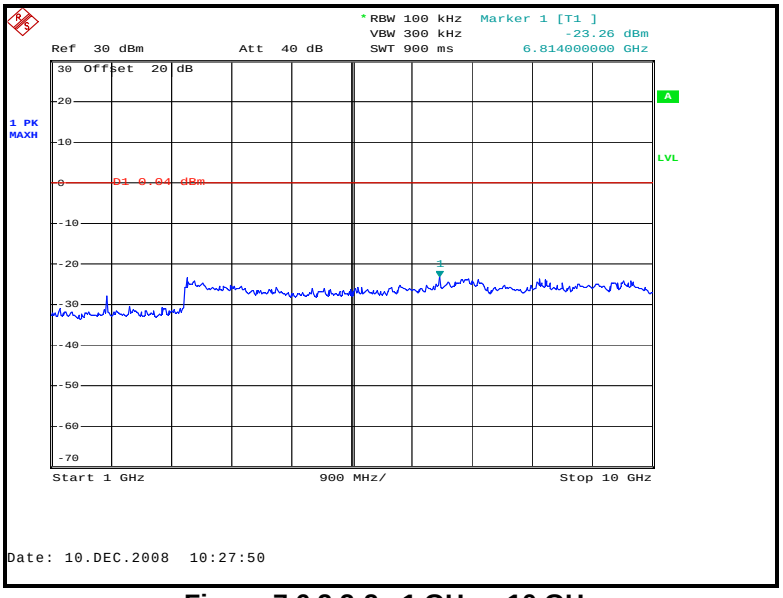

Figure 7.6.2.2-2: 1 GHz – 10 GHz

7.6.3 Radiated Spurious Emissions (Restricted Bands) - FCC Section 15.205 IC: RSS-210 2.6

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 were made using an RBW of 1 MHz and a VBW of 3 MHz and the average emission was calculated by correcting for the duty cycle of the EUT.

7.6.3.2 Duty Cycle Correction

For average radiated measurements in restricted bands, the measured level was reduced by a factor 18.41dB to account for the duty cycle of the EUT. The EUT transmits for approximately 12mS within a 100ms period. The duty cycle correction factor is determined using the formula: 20log (12/100) = 18.41dB.

A detailed analysis of the duty cycle timing is provided in the Theory of Operation provided with 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 and conducted spurious emissions found in the band of 30MHz to 10GHz are reported in Table 7.6.3.3-1 Each emission found to be in a restricted band, was compared to the radiated emission limits

Table 7.6.3.3-1: Radiated Spurious Emissions

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	69.64	69.64	H	-3.31	66.33	47.92	74.0	54.0	7.67	6.08
2752.74	69.50	69.50	V	-3.21	66.29	47.87	74.0	54.0	7.71	6.13
3670.32	66.36	66.36	H	-0.90	65.46	47.05	74.0	54.0	8.54	6.95
3670.32	65.67	65.67	V	-0.86	64.81	46.39	74.0	54.0	9.19	7.61
4587.9	58.28	58.28	H	1.84	60.12	41.71	74.0	54.0	13.88	12.29
4587.9	65.67	65.67	V	2.00	67.67	49.25	74.0	54.0	6.33	4.75

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: 69.64 - 3.31 = 66.33dBuV/m
Margin: 74dBuV/m – 66.33dBuV/m = 7.67dB

Example Calculation: Average

Corrected Level: 69.64 - 3.31 - 18.41 = 47.92dBuV
Margin: 54dBuV – 47.92dBuV = 6.08dB

7.7 Peak Power Spectral Density- FCC Section 15.247(e) IC: RSS-210 A8.2(b))

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 168s (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)	PSD Level (dBm)
917.58	7.62

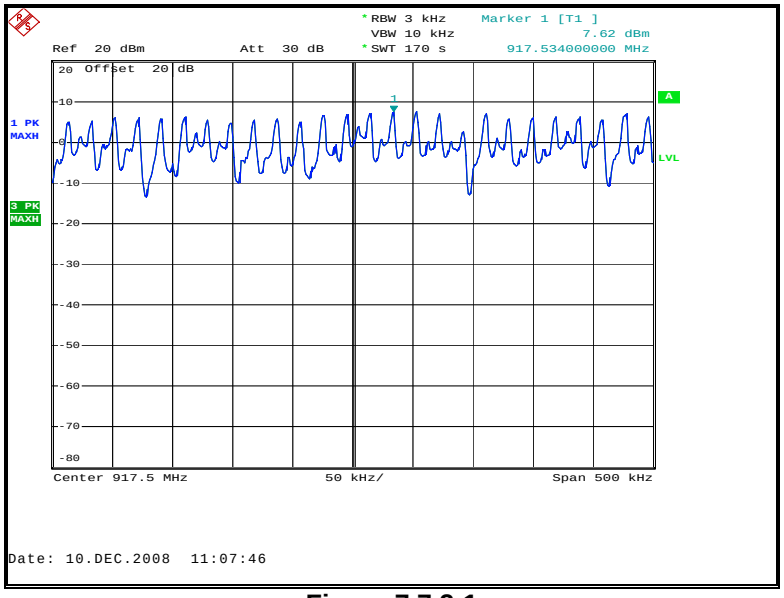

Figure 7.7.2-1

8.0 CONCLUSION

In the opinion of ACS, Inc. the 25-1078, 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