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CDMA TEST REPORT

Report Number: 101549076LEX-004
Project Number: G101549076

Report Issue Date: 6/3/2014

Product Name: rCell – Intelligent Wireless Router
FCCID: AU792U13A16855
Standards: FCC Part 22 Subpart H
FCC Part 24 Subpart E

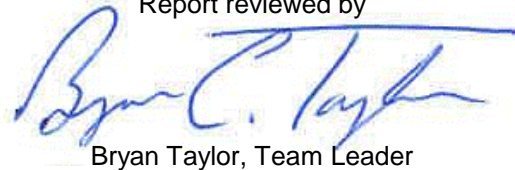
Tested by:
Intertek Testing Services NA, Inc.
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Lexington, KY 40510

Client:
MultiTech Systems, Inc.
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Mounds View, MN 55112

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1 Introduction and Conclusion

The tests indicated in section 2 were performed on the product constructed as described in section 3. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test method, a list of the actual test equipment used, documentation photos, results and raw data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complied with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

The INTERTEK-Lexington is located at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1 and ANSI C63.4. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters. The test site is listed with the FCC under registration number 485103. The test site is listed with Industry Canada under site number IC 2042M-1.

2 Test Summary

Page	Test full name	FCC Reference	IC Reference	Result
-	Conducted Output Power	§2.1046 §24.232(d)	RSS-129 (9.2.2) RSS-133 (4.1) RSS-133 (6.4)	Pass ¹
-	Occupied Bandwidth	§2.1049, §22.917(b)(d), and §24.238(a)	RSS-GEN (4.6.1) RSS-133 (2.3)	Pass ¹
-	Conducted Spurious Emissions	§2.1049, §2.1051, §22.917(a)(b), and § 24.238(a)(b)	RSS-129 (8.1.1), RSS-129 (9.3), RSS-129 (9.4), RSS-133 (6.5.1)	Pass ¹
6	Radiated Output Power	§ 22.913(a) and § 24.232(c)	RSS-129 (9.1), RSS-133 (6.4)	Pass
7	Radiated Spurious Emissions (Transmitter)	§2.1053, §22.917(a)(b), and §24.238(a)(b)	RSS-129 (8.1.1), RSS-133 (6.5)	Pass
-	Frequency Stability	§2.1055, §22.355, and §24.235	RSS-129 (9.2.1), RSS-133 (6.3)	Pass ¹

¹ See module report also included in this filing.

3 Description of Equipment Under Test

Equipment Under Test	
Manufacturer	MultiTech Systems, Inc.
Model Number	MTR-EV3-B10
Serial Number	5227149K
FCC Identifier	AU792U13A16855
Receive Date	3/31/2014
Test Start Date	3/31/2014
Test End Date	3/31/2014
Device Received Condition	Good
Test Sample Type	Production
Frequency Band	824MHz - 849MHz (CDMA Cell Band) 1850MHz – 1910MHz (CDMA PCS Band)
Modulation Type	CDMA
Transmission Control	Base Station Simulator
Test Channels	1013, 384, and 777 (CDMA Cell Band) 25, 600, and 1075 (CDMA PCS Band)
Antenna Type	External antenna with 2.0dBi Gain
Operating Voltage	115VAC/60Hz (Via AC/DC Power Adapter)

Description of Equipment Under Test

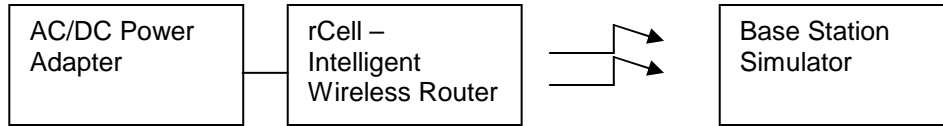
The MTR-EV3-B10 is an M2M Cellular Modem

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Transmitting a CDMA signal
2	Receive / idle mode

3.1 System setup including cable interconnection details, support equipment and simplified block diagram

3.2 EUT Block Diagram:



Block Diagram for Radiated Spurious Tests

3.3 Cables:

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
DB9 Serial Cable	1m	Yes	No	Serial Port	Unterminated
Ethernet	3m	None	None	Ethernet Port	Ethernet Hub
GPS Antenna Cable	1m	Yes	No	GPS Port	GPS Antenna
DC Power Cable	1m	No	No	DC Input	AC/DC Power Adapter

4 Radiated Output Power

4.1 Test Limits

§ 22.913

The effective radiated power (ERP) of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

- (a) Maximum ERP. In general, the effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts.

§ 24.232

- (c) Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

4.2 Test Procedure

The radiated output power was calculated by adding the maximum antenna gain to the maximum conducted output power measured in each band. The conducted power measurements were taken from the module report which is also included in this filing.

4.3 Results:

Cell Band:

$$24.74\text{dBm} + 2\text{dBi} - 2.15 = 24.59\text{dBm (ERP)}$$

PCS Band:

$$24.37\text{dBm} + 2\text{dBi} = 26.37\text{dBm (EIRP)}$$

5 Radiated Spurious Emissions (Transmitter)

5.1 Test Limits

§ 2.1053

- (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

§ 22.917

- (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.
- (b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

§ 24.238

- (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.
- (b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

5.2 Test Procedure

The EUT was placed on a non-conductive turntable. The measurement antenna was placed at a distance of 3 meters from the EUT. The EUT was forced to transmit at its maximum output power setting. During the tests, the antenna height and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic was investigated in order to identify the spurious emission. Once the spurious emissions were identified, the power of the emission was determined using the substitution method described in TIA-603-C. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and at the spurious emissions frequency.

5.1 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	1302.6005.40	Rohde & Schwarz	ESU40	9/11/2013	9/11/2014
Preamplifier	122005	Rohde&Schwarz	TS-PR18	9/19/2013	9/19/2014
Biconnilog Antenna	00051864	ETS	3142C	12/17/2013	12/17/2014
Bilog Antenna	2362	ETS	3142B	12/2/2013	12/2/2014
Horn Antenna	00156319	ETS	3117	4/24/2013	4/24/2014
Horn Antenna	00154521	ETS	3117	10/10/2013	10/10/2014
Signal Generator	3915	Rohde&Schwarz	SMB100A	9/16/2013	9/16/2014
System Controller	121701-1	Sunol Sciences	SC99V	Time of Use	Time of Use

5.2 Results:

All radiated spurious emissions were attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB which is equivalent to -13dBm. Emissions were investigated with the test sample positioned in 3 orthogonal axis and the worst case reported.

Worst Case Spurious Measurements (Cell Band)

Radiated Spurious Emissions Measurement									
Test Engineer: Bryan Taylor									
Test Date: 3/31/2014									
Temp. / Humidity / Pressure: 24.2C/20.1%/996.6mbar									
Bandwidth Settings: RBW = VBW = 1MHz									
Notes: CDMA Cell Band									
Band/Channel	Spurious Frequency (MHz)	Polarity	Device Reading (dBm)	Signal Generator Level (dBm)	Cable Loss (dB)	Tx Antenna Gain (dBd)	Limit (dBm)	Radiated Spurious Emission Level (dBm)	
Cell Band Ch 1013	1649.4	H	-60.33	-56.71	2.84	3.49	-13	-56.05	
	1649.4	V	-52.59	-46.38	2.84	3.49	-13	-45.72	
	2474.1	H	-63.91	-55.35	3.78	3.72	-13	-55.42	
	2474.1	V	-60.11	-49.99	3.78	3.72	-13	-50.06	
	3298.8	H	-69.13	-60.04	4.42	5.17	-13	-59.29	
	3298.8	V	-66.91	-56.33	4.42	5.17	-13	-55.58	
	4123.5	H	-61.23	-49.82	5.66	6.76	-13	-48.72	
	4123.5	V	-56.43	-44.8	5.66	6.76	-13	-43.70	
	4948.2	H	-56.84	-43.58	6.19	7.75	-13	-42.02	
	4948.2	V	-54.43	-40.85	6.19	7.75	-13	-39.29	
	5772.9	H	-69.77	-54.43	6.54	8.51	-13	-52.46	
	5772.9	V	-71.58	-56.89	6.54	8.51	-13	-54.92	
	6597.6	H							
	6597.6	V							
	7422.3	H							
7422.3	V								
8247	H								
8247	V								
Cell Band Ch 384	1673.04	H	-61.42	-57.37	2.93	3.49	-13	-56.81	
	1673.04	V	-56.84	-49.87	2.93	3.49	-13	-49.31	
	2509.56	H	-65.43	-57.02	3.69	3.50	-13	-57.21	
	2509.56	V	-66.12	-55.74	3.69	3.50	-13	-55.93	
	3346.08	H	-68.16	-59.2	4.53	5.52	-13	-58.21	
	3346.08	V	-66.34	-55.58	4.53	5.52	-13	-54.59	
	4182.6	H	-58.66	-47.37	5.36	6.76	-13	-45.97	
	4182.6	V	-56.09	-44.4	5.36	6.76	-13	-43.00	
	5019.12	H	-61.89	-48.46	6.29	7.84	-13	-46.91	
	5019.12	V	-55.38	-41.5	6.29	7.84	-13	-39.95	
	5855.64	H	-71.59	-55.48	6.44	8.45	-13	-53.47	
	5855.64	V	-69.65	-54.17	6.44	8.45	-13	-52.16	
	6692.16	H							
	6692.16	V							
	7528.68	H							
7528.68	V								
8365.2	H								
8365.2	V								
Cell Band Ch 777	1696.62	H	-60.67	-55.9	2.95	3.49	-13	-55.36	
	1696.62	V	-64.68	-56.67	2.95	3.49	-13	-56.13	
	2544.93	H	-61.67	-52.79	3.79	3.50	-13	-53.09	
	2544.93	V	-59.76	-49.24	3.79	3.50	-13	-49.54	
	3393.24	H	-68.49	-59.02	4.58	5.52	-13	-58.08	
	3393.24	V	-68.79	-57.67	4.58	5.52	-13	-56.73	
	4241.55	H	-63.6	-52.96	5.48	6.86	-13	-51.58	
	4241.55	V	-68.41	-57.19	5.48	6.86	-13	-55.81	
	5089.86	H	-77.46	-63.68	6.45	7.84	-13	-62.29	
	5089.86	V	-79.44	-65.33	6.45	7.84	-13	-63.94	
	5938.17	H	-70.44	-54.77	6.66	8.36	-13	-53.08	
	5938.17	V	-71.69	-56.57	6.66	8.36	-13	-54.88	
	6786.48	H							
	6786.48	V							
	7634.79	H							
7634.79	V								
8483.1	H								
8483.1	V								
								F=B-C+D	

Worst Case Spurious Measurements (PCS Band)

Radiated Spurious Emissions Measurement									
Test Engineer: Bryan Taylor									
Test Date: 3/31/2014									
Temp. / Humidity / Pressure: 24.2C/20.1%/996.6mbar									
Bandwidth Settings: RBW = VBW = 1MHz									
Notes: CDMA PCS Band									
Band/Channel	Spurious Frequency (MHz)	Polarity	Device Reading (dBm)	Signal Generator Level (dBm)	Cable Loss (dB)	Tx Antenna Gain (dBd)	Limit (dBm)	Radiated Spurious Emission Level (dBm)	
PCS Channel 25	3702.5	H	-58.09	-47.5	4.88	6.11	-13	-46.27	
	3702.5	V	-52.6	-41.15	4.88	6.11	-13	-39.92	
	5553.75	H	-60.38	-46.96	6.46	8.25	-13	-45.18	
	5553.75	V	-52.26	-39.19	6.46	8.25	-13	-37.41	
	7405	H	-65.43	-49.12	7.71	9.69	-13	-47.14	
	7405	V	-62.73	-47.17	7.71	9.69	-13	-45.19	
	9256.25	H	-67.26	-47.76	9.40	11.04	-13	-46.13	
	9256.25	V	-68.46	-49.35	9.40	11.04	-13	-47.72	
	11107.5	H	These frequencies were all below the measurement noise floor.						
	11107.5	V							
	12958.75	H							
	12958.75	V							
	14810	H							
	14810	V							
	16661.25	H							
16661.25	V								
18512.5	H								
18512.5	V								
PCS Channel 600	3760	H	-61.01	-50.69	4.87	6.11	-13	-49.45	
	3760	V	-56.62	-45.62	4.87	6.11	-13	-44.38	
	5640	H	-58.96	-45.61	6.45	8.41	-13	-43.65	
	5640	V	-57.65	-44.87	6.45	8.41	-13	-42.91	
	7520	H	-66.15	-49.31	7.62	9.78	-13	-47.15	
	7520	V	-63.12	-46.9	7.62	9.78	-13	-44.74	
	9400	H	-68.39	-47.86	9.50	10.97	-13	-46.39	
	9400	V	-68.12	-48.04	9.50	10.97	-13	-46.57	
	11280	H	These frequencies were all below the measurement noise floor.						
	11280	V							
	13160	H							
	13160	V							
	15040	H							
	15040	V							
	16920	H							
16920	V								
18800	H								
18800	V								
PCS Channel 1175	3817.5	H	-55.66	-44.81	5.00	6.10	-13	-43.71	
	3817.5	V	-49.75	-38.22	5.00	6.10	-13	-37.12	
	5726.25	H	-53.46	-38.22	6.89	8.51	-13	-36.60	
	5726.25	V	-54.32	-39.73	6.89	8.51	-13	-38.11	
	7635	H	-62.07	-45.33	7.43	9.83	-13	-42.93	
	7635	V	-59.39	-43.53	7.43	9.83	-13	-41.13	
	9543.75	H	-68.89	-47.56	9.61	10.94	-13	-46.23	
	9543.75	V	-68.76	-47.82	9.61	10.94	-13	-46.49	
	11452.5	H	These frequencies were all below the measurement noise floor.						
	11452.5	V							
	13361.25	H							
	13361.25	V							
	15270	H							
	15270	V							
	17178.75	H							
17178.75	V								
19087.5	H								
19087.5	V								
								F=B-C+D	

6 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of $k = 2$, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement uncertainty Table

Parameter	Uncertainty	Notes
Radiated emissions, 30 to 1000 MHz	+3.9dB	
Radiated emissions, 1 to 18 GHz	+4.2dB	
Radiated emissions, 18 to 40 GHz	+4.3dB	
Power Port Conducted emissions, 150kHz to 30 MHz	+2.8dB	

7 Revision History

Revision Level	Date	Report Number	Notes
0	6/3/2014	101549076LEX-004	Original Issue