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MEMBER ACIL

REPORT OF MEASUREMENTS
for

CELLULAR SPECIALTIES, INC.
CHANNELIZED SINGLE BAND DIGITAL REPEATER

MODEL: CS17-145-410

FCC ID: NVRCS17-145-410

Company Name:	Cellular Specialties, Inc.
Date of Report:	March 11, 2011
Test Report No:	R-5441N
Test Start Date:	February 24, 2011
Test Finish Date:	February 28, 2011
Test Technician:	M. Seamans
Laboratory Supervisor:	T. Hannemann
Report Prepared By:	J. Ramsey

Certification and Signatures

We certify that this report is a true report of the results obtained from the tests of the equipment stated and relates only to the equipment tested. We further certify that the measurements shown in this report were made in accordance with the procedures indicated and vouch for the qualifications of all Retlif Testing Laboratories personnel taking them.

Scott Wentworth
Branch Manager
NVLAP Approved Signatory

Todd Hannemann
Laboratory Supervisor
iNARTE Certified ATL-0255-T

Non-Warranty Provision
The testing services have been performed, findings obtained, and reports prepared in accordance with generally accepted testing laboratory principles and practices. This warranty is in lieu of all other warranties, either express or implied.

Non-Endorsement
This test report contains only findings and results arrived at after employing the specific test procedures and standards listed herein. It is not intended to constitute a recommendation, endorsement, or certification of the product or material tested. This report must not be used by the client to claim product endorsement by NVLAP, NIST or any agency of the U.S. Government.

CERTIFICATION APPLICATION SUMMARY

Applicant/Manufacturer:	Cellular Specialties 670 North Commercial Street Manchester, NH 03101
Equipment under Test (EUT):	The EUT is a Channelized Digital Repeater System (Cellular Amplifier) operating in the LTE 700MHz Upper C Block.
Model:	CS17-145-410
FCC ID Number:	FCC ID: NVRCS17-145-410
Applicable Test Standard:	FCC Parts 2 & 27
Measurement Procedure:	ANSI/TIA-603-C-2004
Device Classification:	Mobile
EUT Frequency Range Band:	Uplink: 776 MHz to 787 MHz Downlink: 746 MHz to 757 MHz
Power Output Rating for Certification Grant	Uplink: +24.53dBm = 0.284W Downlink: +24.25dBm = 0.266W
Modulation Type:	LTE (F9W)
RF Exposure + Antenna Installation:	See Attached Installation/Users Manual and MPE Evaluation
Measurements Required by FCC:	See Report Section 1 (Summary of Test Program) and the following Test Report Data Attachments: -RF Power Output (27.50) -Occupied Bandwidth (2.1049) -Spurious Emissions at Antenna Terminals (27.53) -Effective Radiated Power of Spurious Radiation (27.53) -Frequency Stability (27.54)

]

SECTION 1
SUMMARY OF TEST PROGRAM

RF POWER OUTPUT (Composite Power)

The RF Power Output test was performed using RMS channel power measurements of a single LTE channel. The measurements were taken with the AGC turned off at maximum output power with all spurious emissions below the -13dBm limit. The measured output power matched the manufacturer's rated output power. See attached test data.

OCCUPIED BANDWIDTH

Measurement Procedure:

For Occupied Bandwidth, measurements were made to compare the input signal to the output signal. The signal generator output was connected to the spectrum analyzer. A LTE modulated signal was then applied to the carrier. Waveforms were then noted on an X-Y plot. Next, the signal generator was connected to the EUT and the output of the EUT was connected to the spectrum analyzer. The output waveform after amplification was then compared to the original input signal to ensure that no significant differences occurred between the input signal and the amplified signal. Testing was performed at one frequency within each passband (uplink and downlink). See Occupied Bandwidth Data.

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Measurement Procedure:

The signal generator output was connected in turn to the uplink and downlink input ports of the EUT. The input power level was at the maximum level which was ascertained during the Power Output test. A spectrum analyzer was connected to the output of the EUT. The input test frequency used was one frequency (mid) within each passband (uplink and downlink). The level of any spurious emission was recorded. Testing was performed in the frequency range of 30MHz to 8GHz. Testing was performed with LTE modulation type. The spurious emissions limit is -13dBm as specified in FCC Part 27. All emissions were below the specified -13dBm limit. See attached test data.

EFFECTIVE RADIATED POWER OF SPURIOUS RADIATION

Measurement Procedure:

The test sample was placed on an 80cm high wooden test stand which was located 3 meters from the test antenna on an FCC listed test site. A signal generator was connected to the input of the amplifier. The signal generator output was set to provide the input power level necessary to achieve maximum output power of the amplifier at 1 frequency (mid) within each passband (uplink and downlink). The effective radiated power of each out of band spurious emission was measured using the substitution method specified in ANSI/TIA-603-C-2004. The frequency range of the test was 30MHz – 8GHz. The limit for out of band spurious emissions is -13dBm as specified in Part 27. All emissions were below the specified -13dBm limit. See attached test data.

FREQUENCY STABILITY MEASUREMENTS

The test sample was placed into a temperature chamber with the DC input power supplied through a variable power source. A signal generator was used to provide the input signal and the output was measured with a frequency counter. With the test sample operating at maximum output power the test sample's output frequency was measured and recorded at the extremes of the temperature range and at 10 degree increments from -30 degrees C to +50 degrees C while the DC input voltage was varied from 85 to 115% of nominal. The output frequency for both the uplink and downlink stayed within the assigned frequency band. See attached test data.

SECTION 2
EQUIPMENT LISTS

Occupied Bandwidth & RF Power Output

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1345	NARDA	ATTENUATOR	DC - 18GHz	776B-30	8/10/2010	8/10/2011
5070	ROHDE & SCHWARZ	EMI TEST RECEIVER	20 Hz - 40 GHz	ESIB40	1/20/2011	1/20/2012
5134	NARDA	10DB ATTENUATOR	DC - 12.4 GHz	757C-10	8/10/2010	8/10/2011

Spurious Emissions at Antenna Terminals

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1345	NARDA	ATTENUATOR	DC - 18GHz	776B-30	8/10/2010	8/10/2011
5070	ROHDE & SCHWARZ	EMI TEST RECEIVER	20 Hz - 40 GHz	ESIB40	1/20/2011	1/20/2012
5134	NARDA	10DB ATTENUATOR	DC - 12.4 GHz	757C-10	8/10/2010	8/10/2011

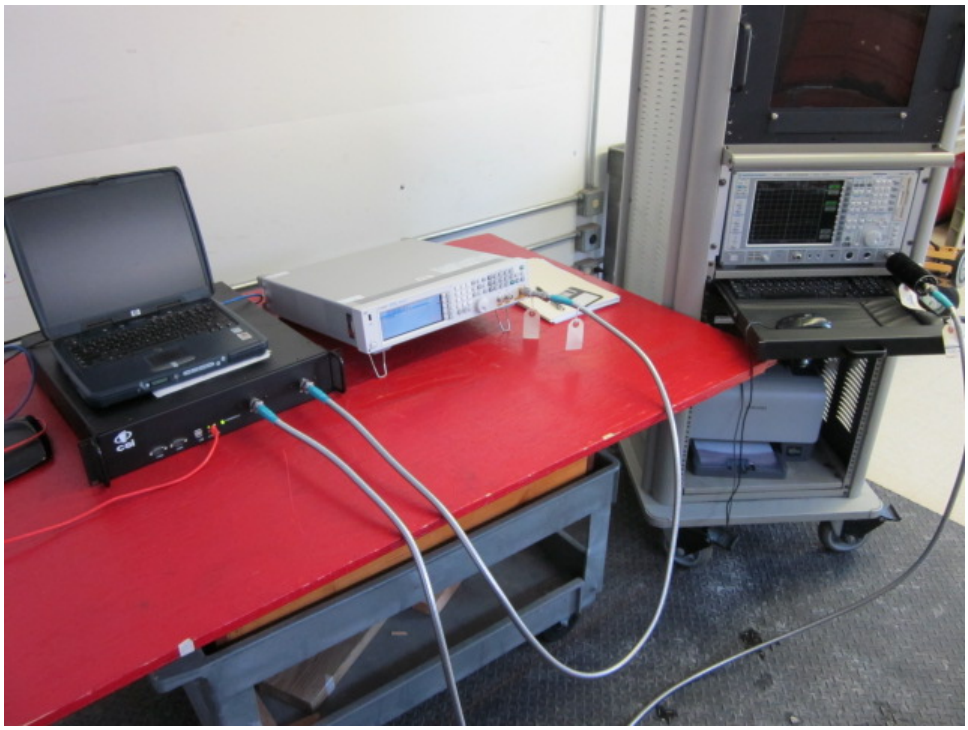
Effective Radiated Power of Spurious Radiation

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1232	AGILENT / HP	PRE-AMPLIFIER	1 - 26.5GHz	8449B	4/22/2010	4/22/2011
1345	NARDA	ATTENUATOR	DC - 18GHz	776B-30	8/10/2010	8/10/2011
3258	EMCO	DOUBLE RIDGED GUIDE ANTENNA	1 GHZ - 18GHZ	3115	1/12/2011	1/12/2012
4029	RETLIF	OPEN AREA TEST SITE	3 / 10 Meters	RNH	8/21/2009	8/21/2012
4029B	RETLIF	TEST SITE ATTENUATION	3 / 10 Meters	RNH	6/25/2010	6/25/2011
5053	EMCO	BICONILOG ANTENNA	26 MHz - 3 GHz	3142C	4/21/2010	4/21/2011
5070	ROHDE & SCHWARZ	EMI TEST RECEIVER	20 Hz - 40 GHz	ESIB40	1/20/2011	1/20/2012
5134	NARDA	10DB ATTENUATOR	DC - 12.4 GHz	757C-10	8/10/2010	8/10/2011
R425B	AGILENT / HP	SPECTRUM ANALYZER	100 Hz - 26.5 GHz	E7405A;A	5/28/2010	5/28/2011

Frequency Stability

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1345	NARDA	ATTENUATOR	DC - 18GHz	776B-30	8/10/2010	8/10/2011
4997	OMEGA	DIGITAL THERMOMETER		UNKNOWN	8/11/2010	8/11/2011
5013	POWERSTAT	VARIAC	0-140 V, 10 A, 60 Hz	116B	No Calibration Required	
5049B	FLUKE	DIGITAL MULTIMETER	True RMS Multimeter	111	8/9/2010	8/9/2011
5077	ASSOCIATED ENVIRONME	TEMPERATURE CHAMBER	-50 to 150 C	ZFD-531	8/11/2010	8/11/2011
5134	NARDA	10DB ATTENUATOR	DC - 12.4 GHz	757C-10	8/10/2010	8/10/2011
R425B	AGILENT / HP	SPECTRUM ANALYZER	100 Hz - 26.5 GHz	E7405A;A	5/28/2010	5/28/2011

SETUP PHOTOGRAPH
OCCUPIED BANDWIDTH
& RF POWER OUTPUT



Test Setup

SETUP PHOTOGRAPHS
EFFECTIVE RADIATED POWER OF SPURIOUS RADIATION

Test Setup

SETUP PHOTOGRAPHS
EFFECTIVE RADIATED POWER OF SPURIOUS RADIATION

Horizontal Antenna Polarization, 30 to 1000 MHz

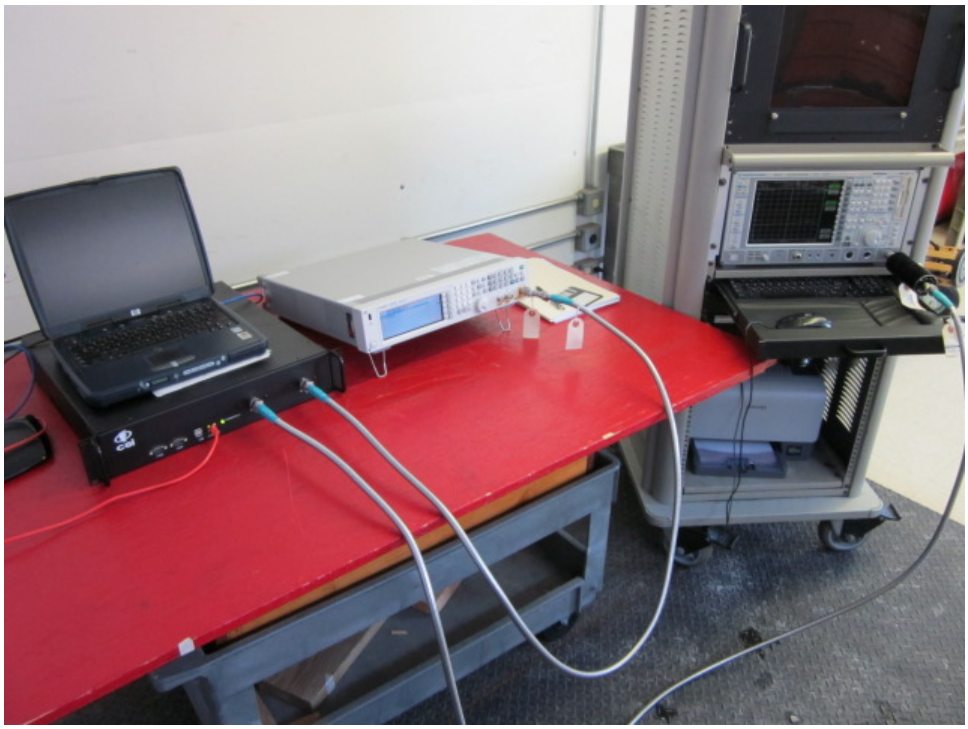
Vertical Antenna Polarization, 30 to 1000 MHz

SETUP PHOTOGRAPHS
EFFECTIVE RADIATED POWER OF SPURIOUS RADIATION

Horizontal Antenna Polarization, 1 to 8 GHz

Vertical Antenna Polarization, 1 to 8 GHz

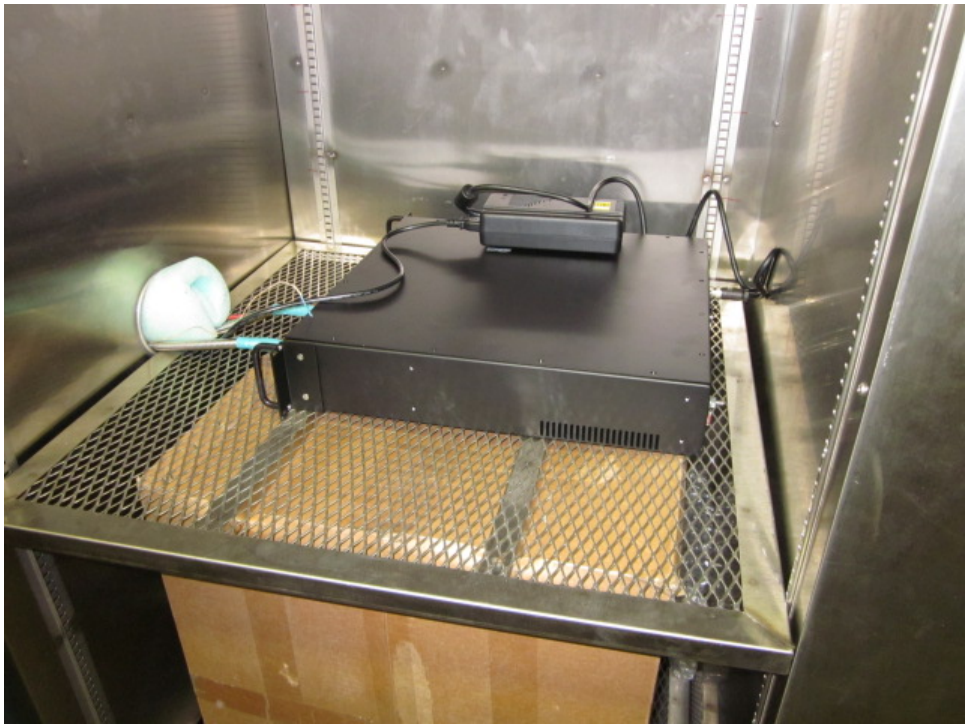
SETUP PHOTOGRAPH
SPURIOUS EMISSIONS AT ANTENNA TERMINALS



Test Setup

SETUP PHOTOGRAPHS
FREQUENCY STABILITY

Test Setup



Test Setup

RETLIF TESTING LABORATORIES

TABULAR DATA SHEET

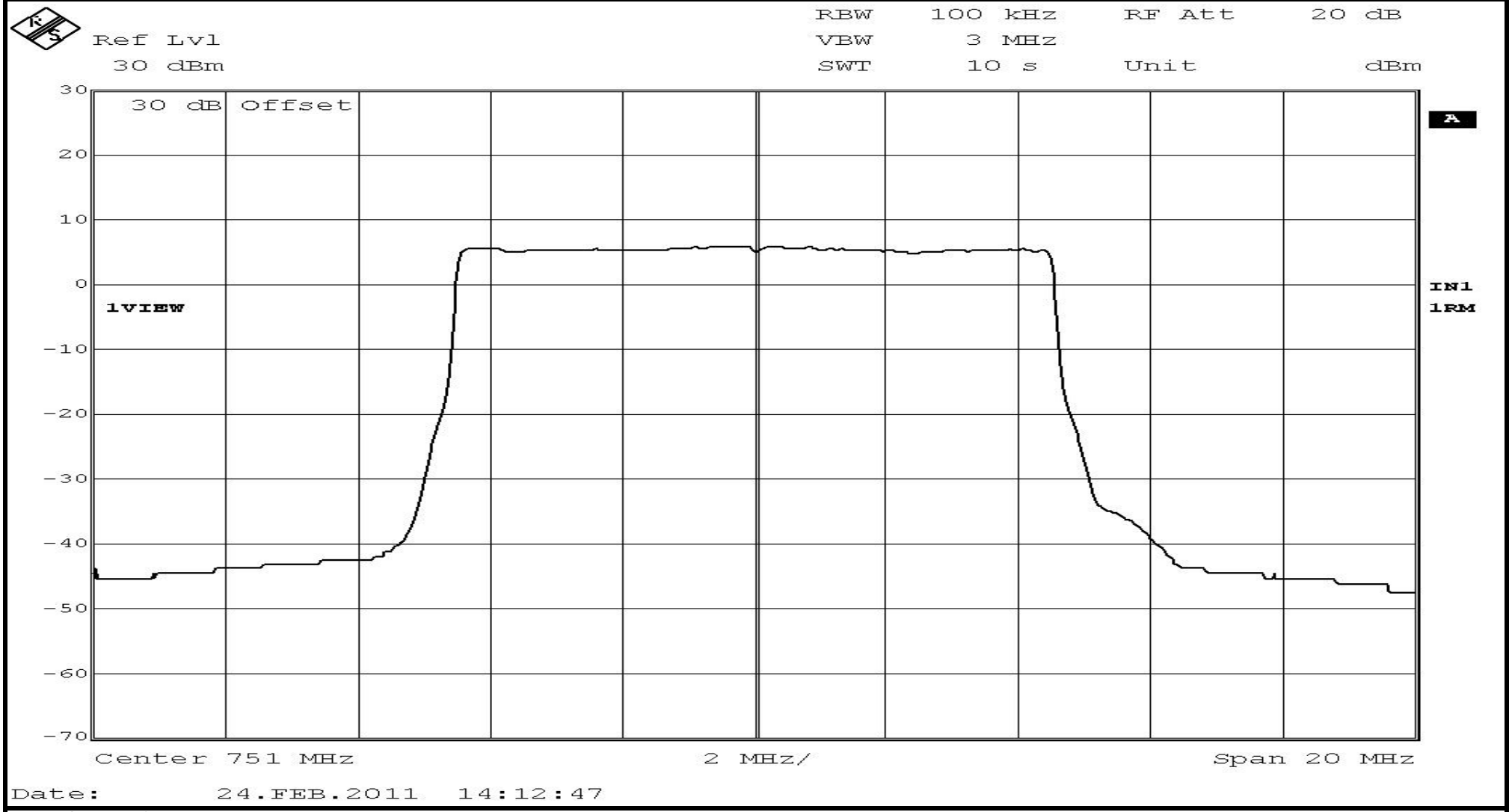
Test Method:	**RF Power Output**		
Customer:	Cellular Specialties, Inc.	**Job No:**	R-5441N
Test Sample:	Single Band Repeater		
Model No:	CS17-145-410	**Serial No:**	L-10120002
Test Specification:	FCC Part 2 Paragraph: 2.1046		
Operating Mode:	Amplifying a signal in the LTE upper C block		
Technician:	M.Seamans	**Date:**	2/24/2011
Notes:	Uplink Frequency: 776 - 787 MHz Downlink Frequency: 746 - 757 MHz RF Power Output Data - measured composite power of a 9.5 MHz LTE modulated signal with amplifier driven at maximum input single channel.		

Test Frequency	Measured Level	Level								
MHz	dBm	mW								
Uplink										
781.00	24.53	283.79								
Downlink										
751.00	24.25	266.1								

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

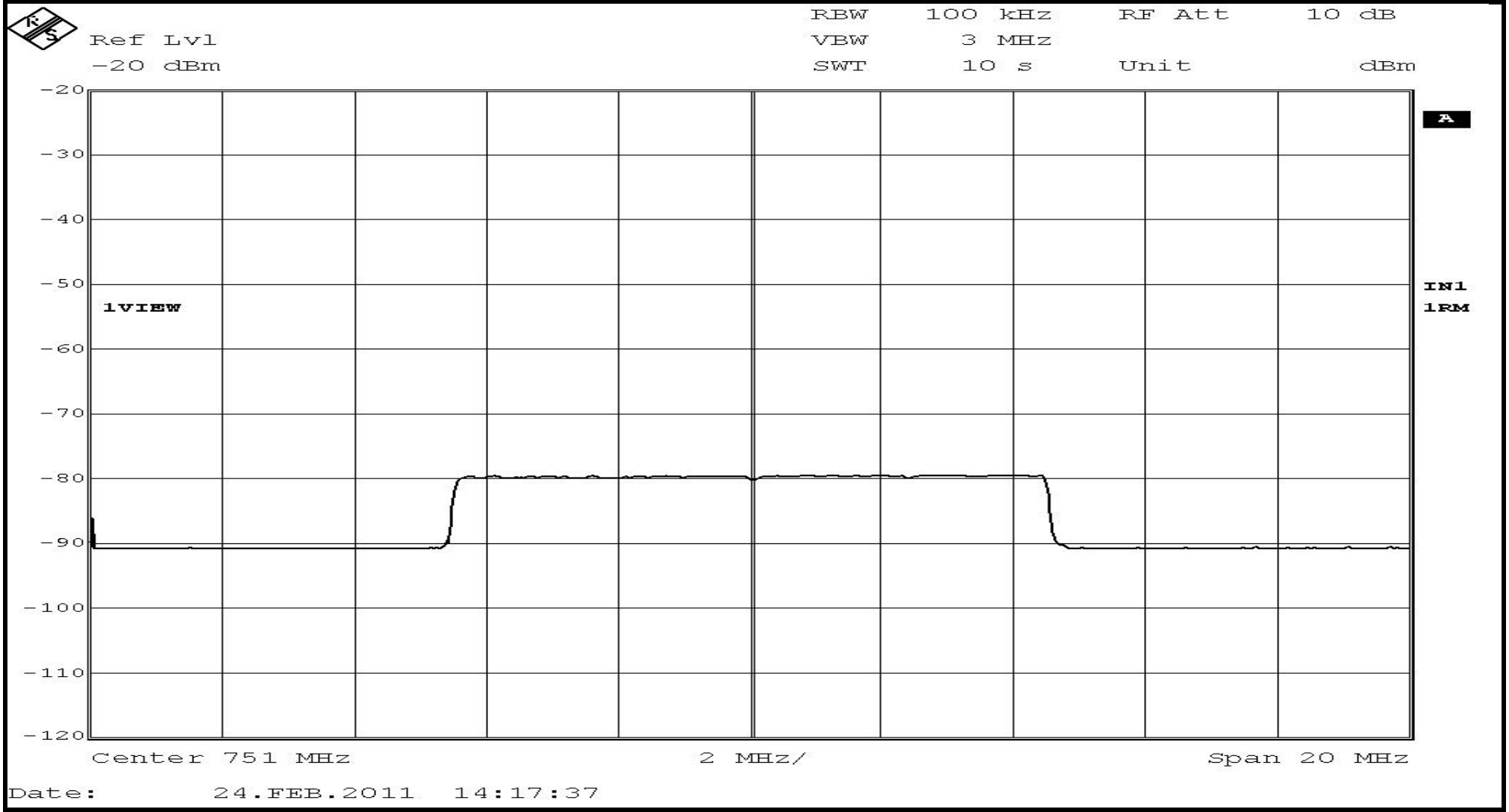
Test Method:	**Occupied Bandwidth**				
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Single Band Repeater	**Job No:**	R-5441N
Model No:	CS17-145-410	**Serial No:**	L-10120002	**Technician:**	M. Seamans
Test Specification:	FCC Part 2	Paragraph: 2.1049		**Date:**	2/24/2011
Operating Mode:	Amplifying a signal in the LTE upper C block				
Notes:	Downlink Output				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

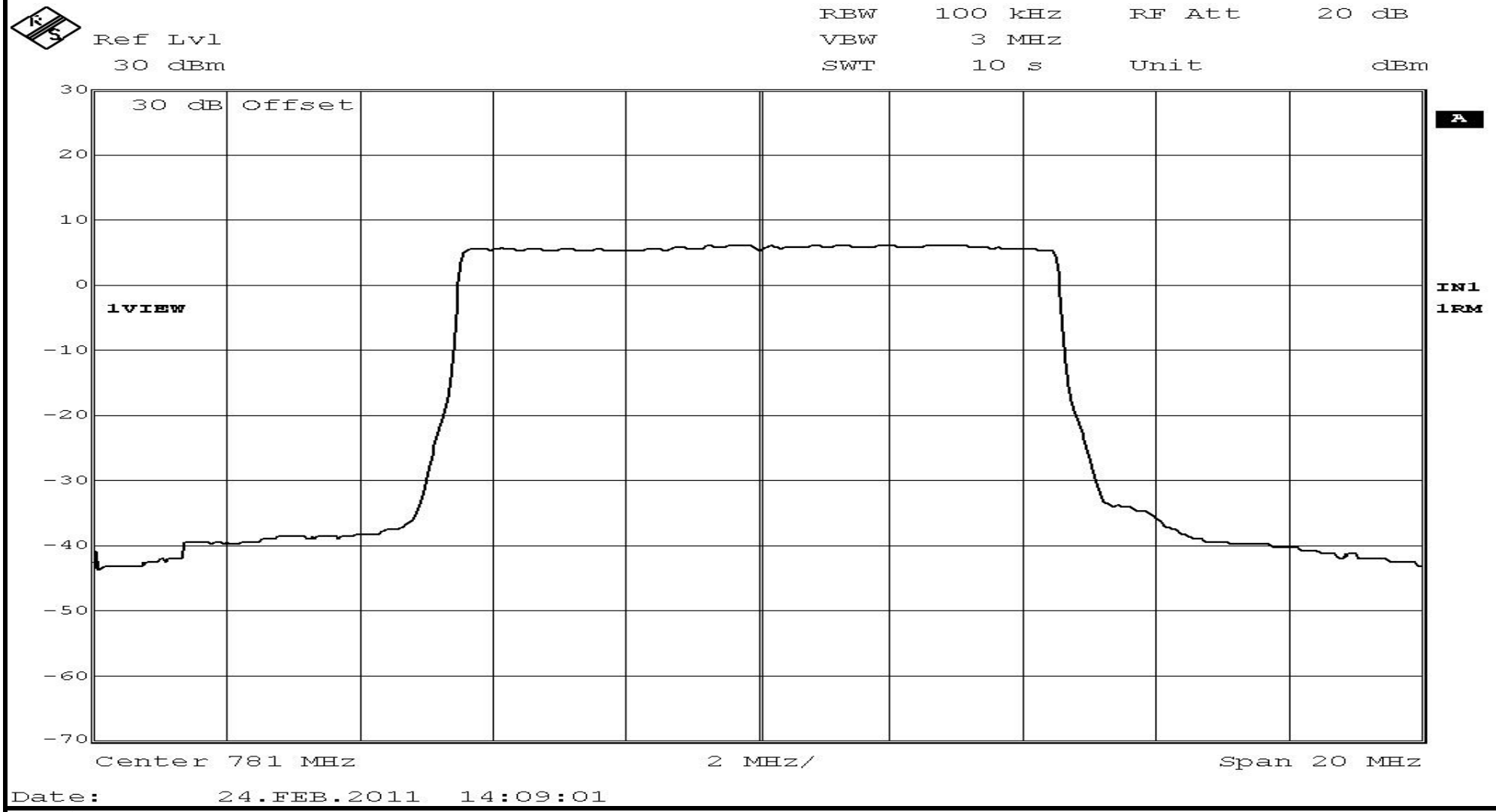
Test Method:	**Occupied Bandwidth**				
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Single Band Repeater	**Job No:**	R-5441N
Model No:	CS17-145-410	**Serial No:**	L-10120002	**Technician:**	M. Seamans
Test Specification:	FCC Part 2	Paragraph: 2.1049		**Date:**	2/24/2011
Operating Mode:	Amplifying a signal in the LTE upper C block				
Notes:	Downlink Input				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

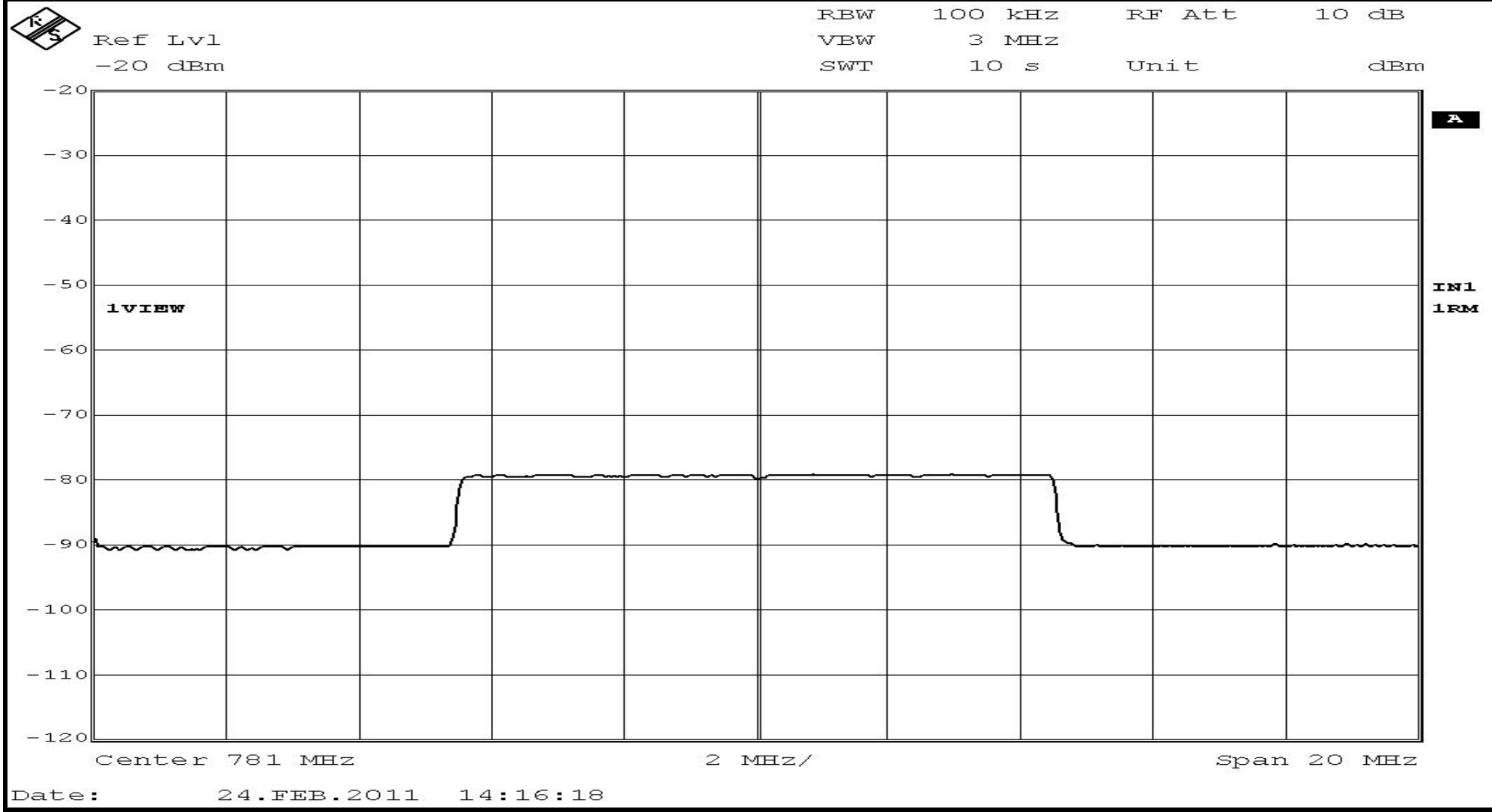
Test Method:	**Occupied Bandwidth**				
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Single Band Repeater	**Job No:**	R-5441N
Model No:	CS17-145-410	**Serial No:**	L-10120002	**Technician:**	M. Seamans
Test Specification:	FCC Part 2	Paragraph: 2.1049		**Date:**	2/24/2011
Operating Mode:	Amplifying a signal in the LTE upper C block				
Notes:	Uplink Output				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Occupied Bandwidth**				
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Single Band Repeater	**Job No:**	R-5441N
Model No:	CS17-145-410	**Serial No:**	L-10120002	**Technician:**	M. Seamans
Test Specification:	FCC Part 2	Paragraph: 2.1049		**Date:**	2/24/2011
Operating Mode:	Amplifying a signal in the LTE upper C block				
Notes:	Uplink Input				



Data Sheet 4 of 4 **R-5441N**

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Spurious Emissions at the Antenna Terminals 30 MHz to 8 GHz**		
Customer:	Cellular Specialties, Inc.	**Job No:**	R-5441N
Test Sample:	Single Band Repeater		
Model No:	CS17-145-410	**Serial No:**	L-10120002
Test Specification:	FCC Part 2 Paragraph: 2.1051		
Operating Mode:	Amplifying a signal in the LTE upper C block		
Technician:	M.Seamans	**Date:**	2/24/2011
Notes:	Uplink Frequency: 776 - 787 MHz Downlink Frequency: 746 - 757 MHz		

Uplink Input Signal	Test Frequency	Frequencies	Reading	Limit	Downlink Input Signal	Test Frequency	Frequencies	Reading	Limit	
dBm	MHz	MHz	dBm	dBm	dBm	MHz	MHz	dBm	dBm	
-60.00	781.00				-60.40	751.00				
I	I	1562.00	-31.54	-13.0	I	I	1502.00	-14.15	-13.0	
I	I	2343.00	-31.20	I	I	I	2253.00	-31.21	I	
I	I	3124.00	-29.04	I	I	I	3004.00	-27.73	I	
I	I	3905.00	-30.96	I	I	I	3755.00	-29.64	I	
I	I	4686.00	-30.66	I	I	I	4506.00	-30.98	I	
I	I	5467.00	-26.50	I	I	I	5257.00	-27.14	I	
I	I	6248.00	-28.23	I	I	I	6008.00	-28.97	I	
I	I	7029.00	-26.51	I	I	I	6759.00	-25.47	I	
-60.00	781.00	7810.00	-27.55	-13.0	-60.40	751.00	7510.00	-26.66	-13.0	

Data Sheet 1 of 1 **R-5441N**

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Spurious Radiated Emissions (ERP) 30 MHz to 8 GHz		
Customer:	Cellular Specialties, Inc.	**Job No:**	R-5441N
Test Sample:	Single Band Repeater		
Model No:	CS17-145-410	**Serial No:**	L-10120002
Test Specification:	FCC Part 2.1053 TIA/EIA-603 Paragraph: 2.1053		
Operating Mode:	Amplifying a signal in the LTE upper C block		
Technician:	M.Seamans	**Date:**	2/28/2011
Notes:	Uplink Frequency: 776 - 787 MHz 781 MHz Input frequency Peak Detector Modulation: CW		

Test Frequency	Antenna Position	Reference Reading	Signal Gen Level	Reference Ant Gain					Corrected Reading	Spurious Limit
MHz	(H/V) - Height	dBuV	dBm	dBI					dBm	dBm
30.00	-	-	-	-					-	-13.00
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
8000.00	-	-	-	-					-	-13.00

No emissions observed above the noise floor of the test equipment which was a minimum of 10dB below the limit.

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Spurious Radiated Emissions (ERP) 30 MHz to 8 GHz		
Customer:	Cellular Specialties, Inc.	**Job No:**	R-5441N
Test Sample:	Single Band Repeater		
Model No:	CS17-145-410	**Serial No:**	L-10120002
Test Specification:	FCC Part 2.1053 TIA/EIA-603 Paragraph: 2.1053		
Operating Mode:	Amplifying a signal in the LTE upper C block		
Technician:	M.Seamans	**Date:**	2/28/2011
Notes:	Downlink Frequency: 746 - 757 MHz 751 MHz Input frequency Peak Detector Modulation: CW		

Test Frequency	Antenna Position	Reference Reading	Signal Gen Level	Reference Ant Gain					Corrected Reading	Spurious Limit
MHz	(H/V) - Height	dBuV	dBm	dBI					dBm	dBm
30.00	-	-	-	-					-	-13.00
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
	-	-	-	-					-	
8000.00	-	-	-	-					-	-13.00

No emissions observed above the noise floor of the test equipment which was a minimum of 10dB below the limit.

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Frequency Stability**		
Customer:	Cellular Specialties, Inc.	**Job No:**	R-5441N
Test Sample:	Single Band Repeater		
Model No:	CS17-145-410	**Serial No:**	L-10120002
Test Specification:	FCC Part 2 Paragraph: 2.1055		
Operating Mode:	Amplifying a signal in the LTE upper C block		
Technician:	M.Seamans	**Date:**	2/25/2011
Notes:	Uplink Frequency 781 MHz Nominal Voltage = 120 VAC Downlink Frequency 751 MHz		

Temp	Test Frequency			Frequency @ 102 VAC	Frequency @ 108 VAC	Frequency @ 114 VAC	Frequency @ 120 VAC	Frequency @ 126 VAC	Frequency @ 132 VAC	Frequency @ 138 VAC
C	MHz			MHz	MHz	MHz	MHz	MHz	MHz	MHz
	(Downlink)									
-30	751.0000			751.00000	751.00000	751.00000	751.00000	751.00000	751.00000	751.00000
-20	|			751.00000	751.00000	751.00000	751.00000	751.00000	751.00000	751.00000
-10	|			751.00000	751.00000	751.00000	751.00000	751.00000	751.00000	751.00000
0	|			751.00000	751.00000	751.00000	751.00000	751.00000	751.00000	751.00000
10	|			751.00000	751.00000	751.00000	751.00000	751.00000	751.00000	751.00000
20	|			751.00000	751.00000	751.00000	751.00000	751.00000	751.00000	751.00000
30	|			751.00000	751.00000	751.00000	751.00000	751.00000	751.00000	751.00000
40	|			751.00000	751.00000	751.00000	751.00000	751.00000	751.00000	751.00000
50	751.0000			751.00000	751.00000	751.00000	751.00000	751.00000	751.00000	751.00000
	(Uplink)									
-30	781.0000			781.00000	781.00000	781.00000	781.00000	781.00000	781.00000	781.00000
-20	|			781.00000	781.00000	781.00000	781.00000	781.00000	781.00000	781.0000
-10	|			781.00000	781.00000	781.00000	781.00000	781.00000	781.00000	781.00000
0	|			781.00000	781.00000	781.00000	781.00000	781.00000	781.00000	781.00000
10	|			781.00000	781.00000	781.00000	781.00000	781.00000	781.00000	781.00000
20	|			781.00000	781.00000	781.00000	781.00000	781.00000	781.00000	781.00000
30	|			781.00000	781.00000	781.00000	781.00000	781.00000	781.00000	781.00000
40	|			781.00000	781.00000	781.00000	781.00000	781.00000	781.00000	781.00000
50	781.0000			781.00000	781.00000	781.00000	781.00000	781.00000	781.00000	781.00000

Data Sheet 1 of 1 **R-5441N**