REPORT OF MEASUREMENTS

FOR

CELLULAR SPECIALTIES, INC.

BI-DIRECTIONAL AMPLIFIER

MODEL: CSI-BDA51080-P7

FCC ID: NVRCSI510-P7

CERTIFICATION APPLICATION

Applicant/Manufacturer:	**Cellular Specialties** **670 North Commercial Street** **Manchester, NH 03101**	
Equipment under Test (EUT):	**The EUT is a Bi-Directional Amplifier**	
Model:	**CSI-BDA51080-P7**	
FCC ID Number:	**FCC ID: NVRCSI510-P7**	
Applicable Test Standard:	**FCC Parts 2 & 90**	
Device Classification:	**Mobile**	
EUT Frequency Range Band:	**Uplink:** **Downlink:**	**764MHz TO 776MHz** **794MHz TO 806MHz**
EUT Gain:	**Uplink:** **Downlink:**	**78.51dB** **78.26dB**
Power Output Rating Based on max input single channel (For Certification Grant):	**Uplink:** **Downlink:**	**+25.34dBm = .342W** **+25.49dBm = .354W**
Modulation Type:	**FM (F1D), TDMA (DXW)**	
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** **-Intermodulation Characteristics (Two-Tone)** **-Occupied Bandwidth** **-Spurious Emissions at Antenna Terminals** **-Effective Radiated Power of Spurious Radiation** **-Frequency Stability (not required)**	

SECTION 1
SUMMARY OF TEST PROGRAM

INTERMODULATION CHARACTERISTICS (TWO TONE)

Measurement Procedure:

Two signals were injected, in turn, to each uplink and downlink frequency band via a two way power combiner. Testing was performed at both the low band edge and high band edge of each pass band. The output of each signal generator was adjusted so that the two output fundamental frequencies were equal in magnitude. Testing was performed for FM & TDMA Modulation type. At the maximum specified input power levels all intermodulation products were at -13dBm or below for each modulation. 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 TDMA modulation 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). Testing was repeated with FM Modulation. See Occupied Bandwidth Data. An explanation of the data is as follows: There are two signals superimposed on each plot, one signal is the waveform before modulation, the other is the modulated carrier. In each case the center of the grid shows a narrowband signal projecting out from the center of the modulation envelope. This signal is actually the stored unmodulated signal.

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 frequencies used were three frequencies within each passband (uplink and downlink). The level of any spurious emission was recorded. Testing was performed in the frequency range of 30MHz to 9GHz. Testing was performed for FM & TDMA modulation types. The spurious emissions limit is -13dBm as specified in FCC Part 90. 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 a 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 3 frequencies 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 TIA/EIA-603. The frequency range of the test was 30MHz – 9GHz. The limit for out of band spurious emissions is -13dBm as specified in Part 90. All emissions were below the specified -13dBm limit. See attached test data.

RF POWER OUTPUT

A signal generator was connected in turn to the uplink and downlink input ports of the test sample. The signal generator was set to maximum input rating and the amplifier was operating at maximum gain. The maximum single channel output power for both the uplink and downlink was measured with a spectrum analyzer connected to the output port. The measured output power was 0.342W for the uplink and 0.354W for the downlink which matched the manufacturer's rated output power. See attached test data.

FREQUENCY STABILITY MEASUREMENTS

The test sample does not contain any carrier frequency generation, translation or stabilizing circuitry and frequency stability measurements were not required/performed.

SECTION 2

EQUIPMENT LISTS

Spurious Radiated Emissions

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due
3116	Pre-Amplifier	Miteq	0.1 GHz - 18 GHz	AFS42-35	8/25/2006	8/25/2007
3117	Power Supply	B&K Precision	0-30 Vdc, 3.0 A	1630	1/23/2007	1/23/2008
3258	Double Ridge Guide	EMCO	1 - 18 GHz	3115	11/21/2006	11/21/2007
4029B	Test Site Attenuation	Retlif	3 / 10 Meters	RNH	5/24/2006	5/24/2007
5053	Biconilog	EMCO	26 MHz - 3 GHz	3142C	2/8/2006	6/8/2007
5070	EMI Test Receiver	Rohde & Schwarz	20Hz - 40GHz	ESIB40	11/22/2006	11/22/2007

RF Power Output/Occupied Bandwidth/Antenna Spurious/Intermodulation

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	2/13/2007	2/13/2008
5016	Attenuator	Narda	DC - 18 GHz	776B-30	1/25/2007	1/25/2008
5030B	10 DB Atten. (50 ohm)	Narda	DC - 12.4 GHz	757C-10	11/8/2006	11/8/2007
R420A	Signal Generator	Agilent	250kHz - 3GHz	AT-E4436B	9/29/2006	9/29/2008

SETUP PHOTOGRAPHS

SPURIOUS RADIATED EMISSIONS

SPURIOUS RADIATED EMISSIONS

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

OCCUPIED BANDWIDTH/RF POWER OUTPUT

INTERMODULATION (TWO TONE)

Test Report No. R-4816N
FCC ID: NVRCSI510-P7

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**RF Power Output**		
Customer:	Cellular Specialties, Inc.	**Job No:**	R-4816N
Test Sample:	Bidirectional Amplifier		
Model No:	CSI-BDA51080-P7	**Serial No:**	ENG
Test Specification:	FCC Part 2 Paragraph: 2.1046		
Operating Mode:	Amplifying input signal		
Technician:	M.Seamans	**Date:**	5/14/2007
Notes:	Uplink Frequency Range: 764-776 MHz Downlink Frequency Range: 794-806 MHz Input Signals: 770 MHz & 800 MHz Peak Detector Modulation: CW		

Input Frequency		Output Reading	Input Reading		Gain	Power				
MHz		dBm	dBm		dB	mW				
Uplink										
770.00		25.34	-53.17		78.51	342.0				
Downlink										
800.00		25.49	-52.77		78.26	354.0				

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Spurious Emissions at the Antenna Terminals 30 MHz to 9 GHz**
Customer:	Cellular Specialties, Inc. **Job No:** R-4816N
Test Sample:	Bidirectional Amplifier
Model No:	CSI-BDA51080-P7 **Serial No:** ENG
Test Specification:	FCC Part 2 Paragraph: 2.1051
Operating Mode:	Amplifying Input signal
Technician:	M.Seamans **Date:** 5/14/2007
Notes:	Uplink Frequency: 764-776 MHz Downlink Frequency: 794-806 MHz TDMA and FM modulations tested, no spurious emissions observed with any modulation type.

Uplink Input Signal	Test Frequency	Harmonic Frequencies	Reading	Limit	Downlink Input Signal	Test Frequency	Harmonic Frequencies	Reading	Limit
dBm	MHz	MHz	dBm	dBm	dBm	MHz	MHz	dBm	dBm
-44.80	765.00				-44.80	795.00			
"	"	1530.00	-	-13.0	"	"	1590.00	-	-13.0
"	"	2295.00	-	"	"	"	2385.00	-	"
"	"	3060.00	-	"	"	"	3180.00	-	"
"	"	3825.00	-	"	"	"	3975.00	-	"
"	"	4590.00	-	"	"	"	4770.00	-	"
"	"	5355.00	-	"	"	"	5565.00	-	"
"	"	6120.00	-	"	"	"	6360.00	-	"
"	"	6885.00	-	"	"	"	7155.00	-	"
-44.80	765.00	7650.00	-	-13.0	-44.80	795.00	7950.00	-	-13.0
-44.80	770.00				-44.80	800.00			
"	"	1540.00	-	-13.0	"	"	1600.00	-	-13.0
"	"	2310.00	-	"	"	"	2400.00	-	"
"	"	3080.00	-	"	"	"	3200.00	-	"
"	"	3850.00	-	"	"	"	4000.00	-	"
"	"	4620.00	-	"	"	"	4800.00	-	"
"	"	5390.00	-	"	"	"	5600.00	-	"
"	"	6160.00	-	"	"	"	6400.00	-	"
"	"	6930.00	-	"	"	"	7200.00	-	"
-44.80	770.00	7700.00	-	-13.0	-44.80	800.00	8000.00	-	-13.0
-44.80	775.00				-44.80	805.00			
"	"	1550.00	-	-13.0	"	"	1610.00	-	-13.0
"	"	2325.00	-	"	"	"	2415.00	-	"
"	"	3100.00	-	"	"	"	3220.00	-	"
"	"	3875.00	-	"	"	"	4025.00	-	"
"	"	4650.00	-	"	"	"	4830.00	-	"
"	"	5425.00	-	"	"	"	5635.00	-	"
"	"	6200.00	-	"	"	"	6440.00	-	"
"	"	6975.00	-	"	"	"	7245.00	-	"
-44.80	775.00	7750.00	-	-13.0	-44.80	805.00	8050.00	-	-13.0

No emissions observed above the test equipment noisefloor which was a minimum of 20dB below the limit

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Spurious Radiated Emissions (ERP) 30 MHz to 9GHz		
Customer:	Cellular Specialties, Inc.	**Job No:**	R-4816N
Test Sample:	Bidirectional Amplifier		
Model No:	CSI-BDA51080-P7	**Serial No:**	ENG
Test Specification:	FCC Part 2.1053 TIA/EIA-603 Paragraph: 2.1053		
Operating Mode:	Amplifying input signal		
Technician:	M.Seamans	**Date:**	5/14/2007
Notes:	Uplink Frequency Range: 764-776 MHz Testing performed at 3 input frequencies, 765 MHz, 770 MHz, 775 MHz Peak Detector Modulation: CW Testing performed at 3 and 1 meter test distances		

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
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
9000.00	-	-	-	-					-	-13.00

No emissions observed above the noisefloor 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 9 GHz		
Customer:	Cellular Specialties, Inc.	**Job No:**	R-4816N
Test Sample:	Bidirectional Amplifier		
Model No:	CSI-BDA51080-P7	**Serial No:**	ENG
Test Specification:	FCC Part 2.1053 TIA/EIA-603 Paragraph: 2.1053		
Operating Mode:	Amplifying input signal		
Technician:	M.Seamans	**Date:**	5/14/2007
Notes:	Downlink Frequency Range: 794-806 MHz Testing performed at 3 input frequencies 795 MHz, 800 MHz, 805 MHz Peak Detector Modulation: CW Testing performed at 3 and 1 meter test distances		

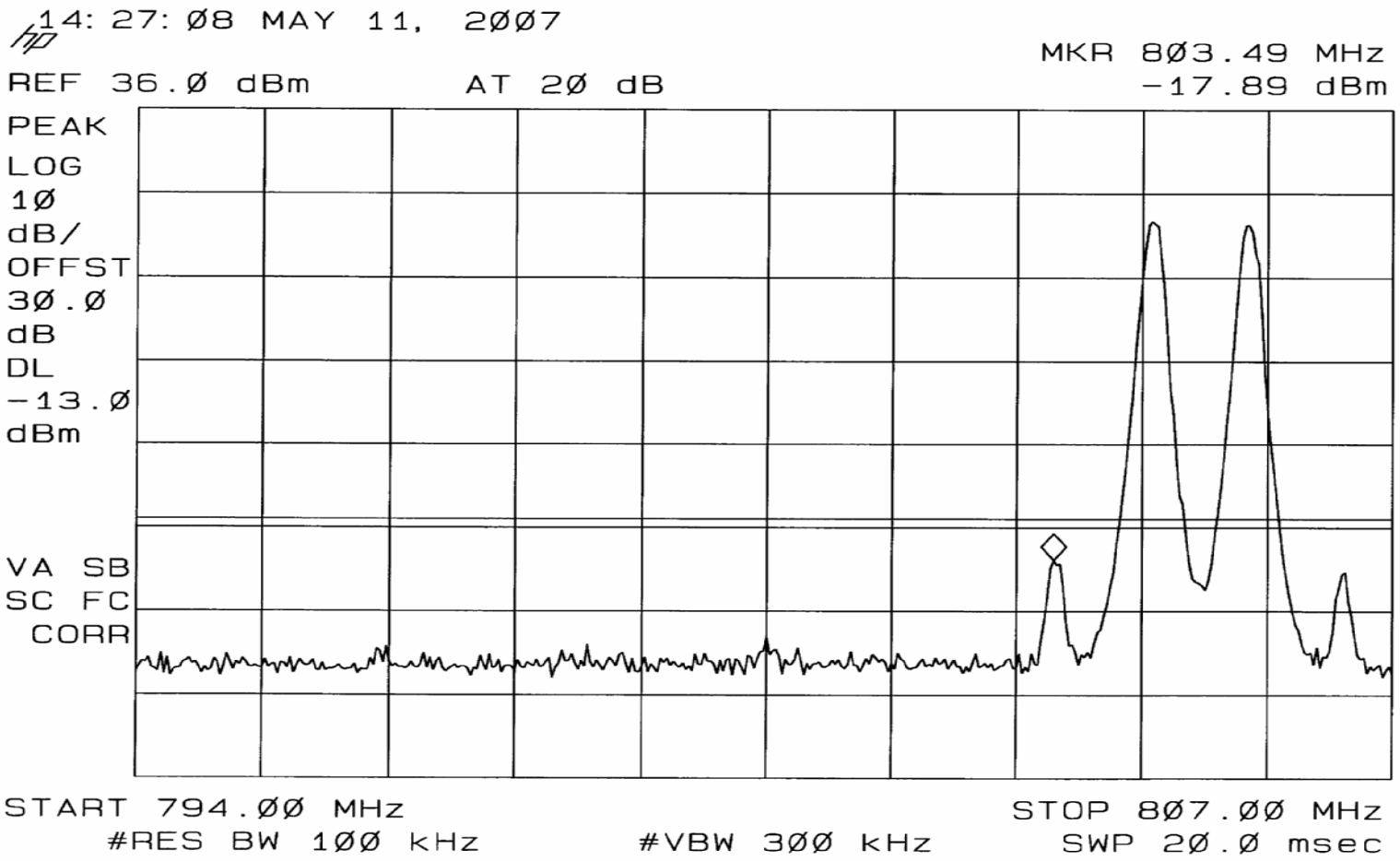
Test Frequency	Antenna Position	Reference Reading	Signal Gen Level	Reference Ant Gain					Corrected Reading	Spurious Limit
MHz	(H/V) - Height	dBuV	dBm	dBI					dBm	dBm
30.00	-	-	-	-					-	-13.00
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
"	-	-	-	-					-	"
9000.00	-	-	-	-					-	-13.00

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

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Intermodulation Characteristics**				
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
Model No:	CSI-BDA51080-P7	**Serial No:**	ENG	**Technician:**	M.Seamans
Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	TDMA - Downlink				



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Model No:	CSI-BDA51080-P7	**Serial No:**	ENG	**Technician:**	M.Seamans
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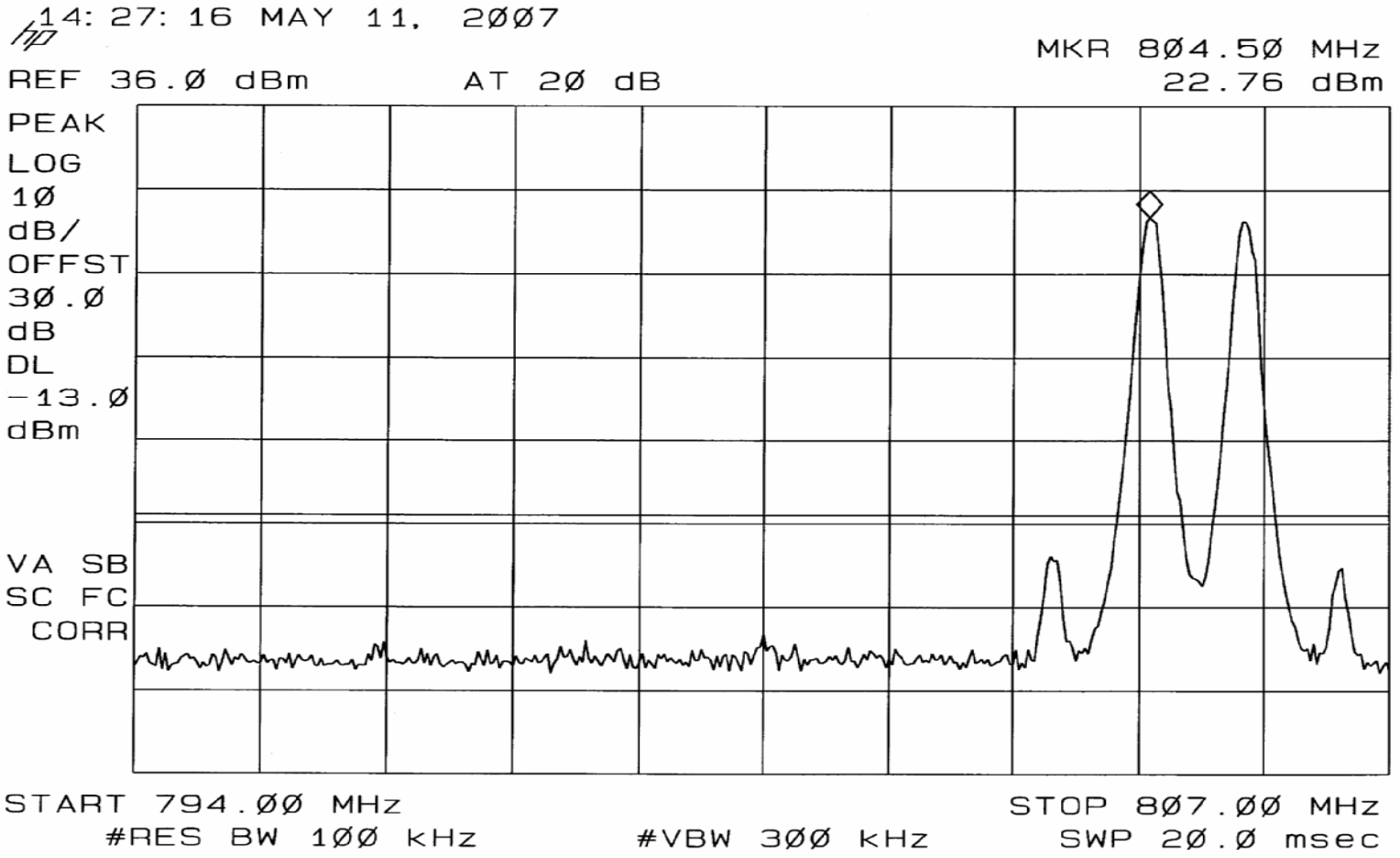

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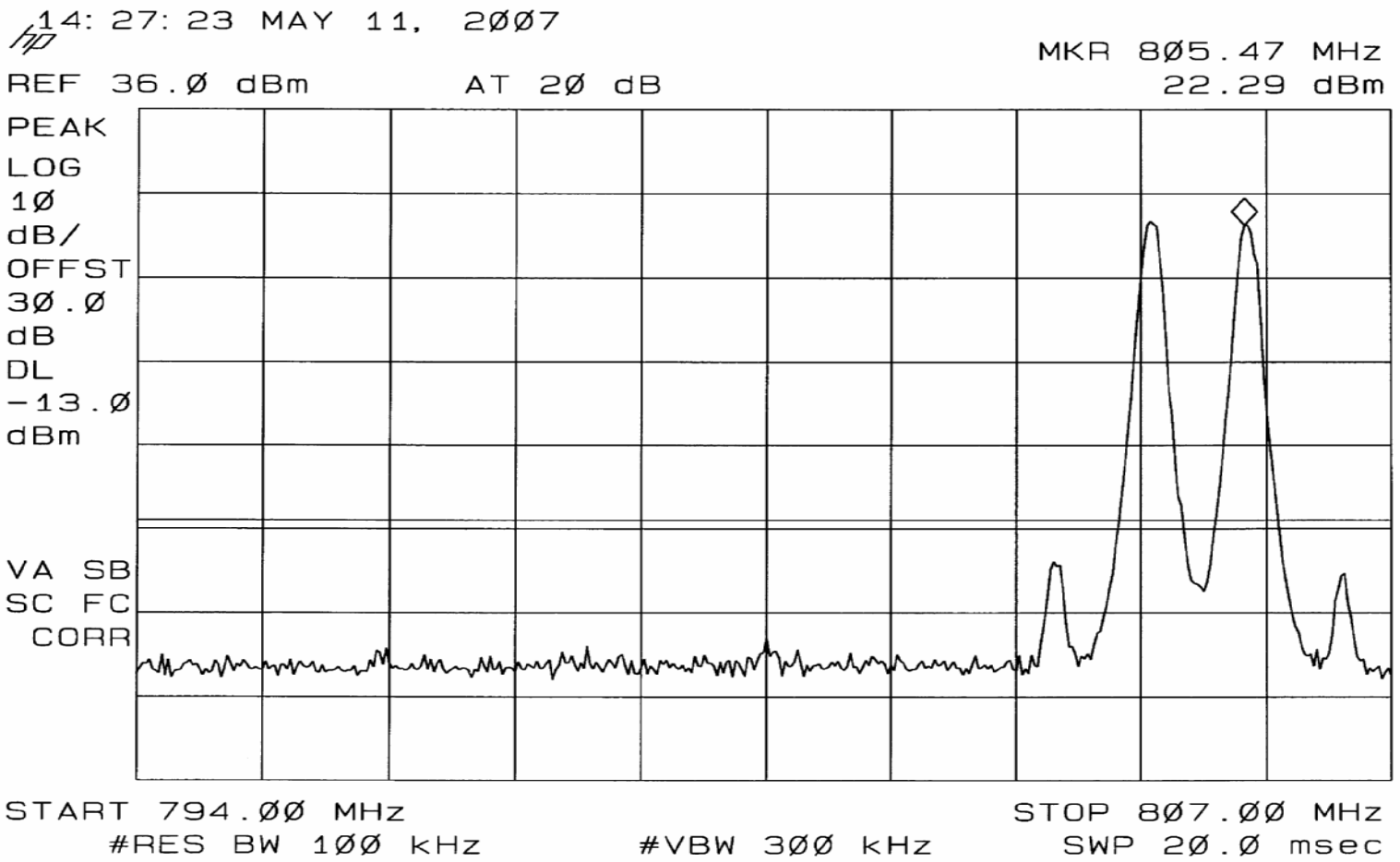

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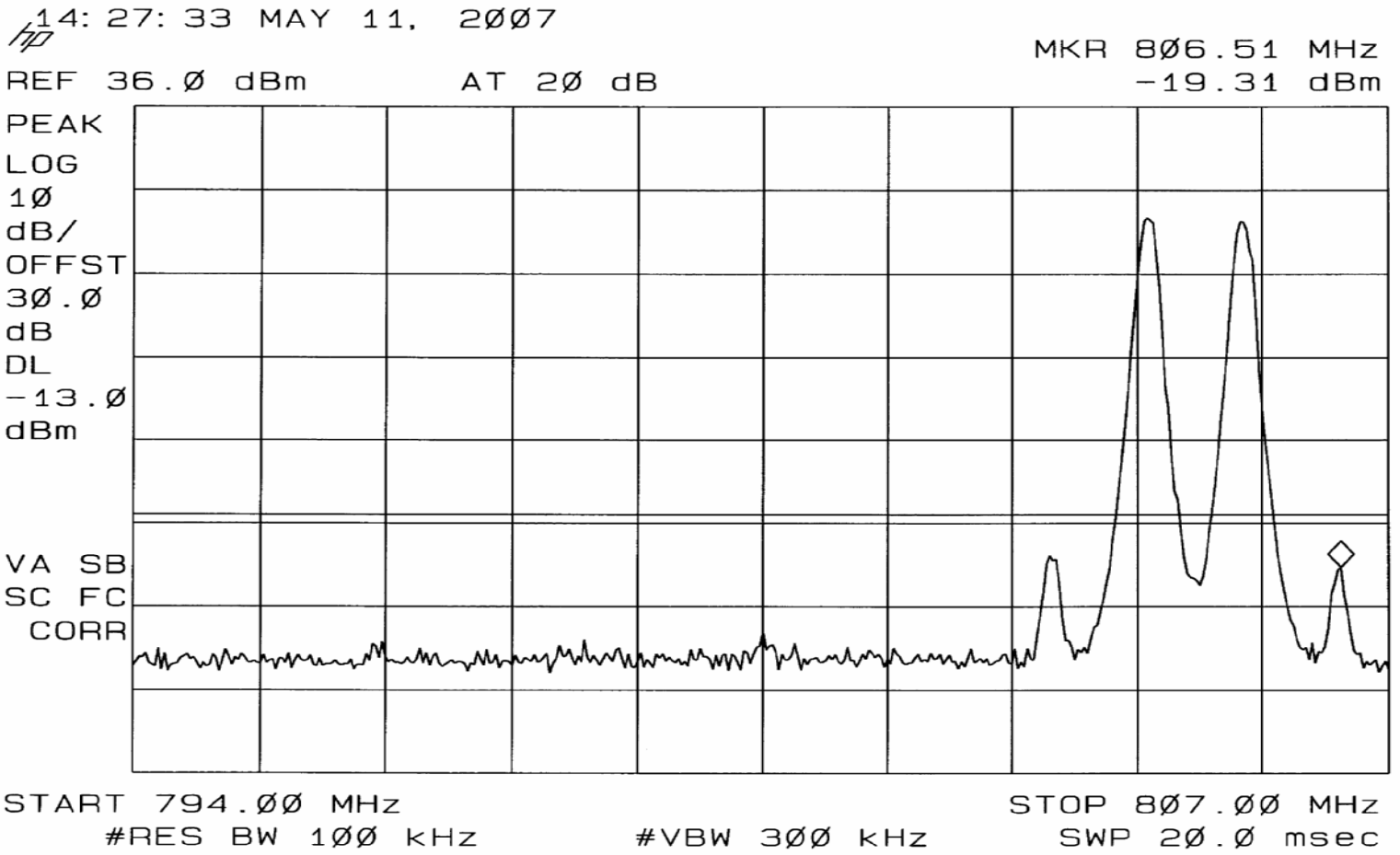

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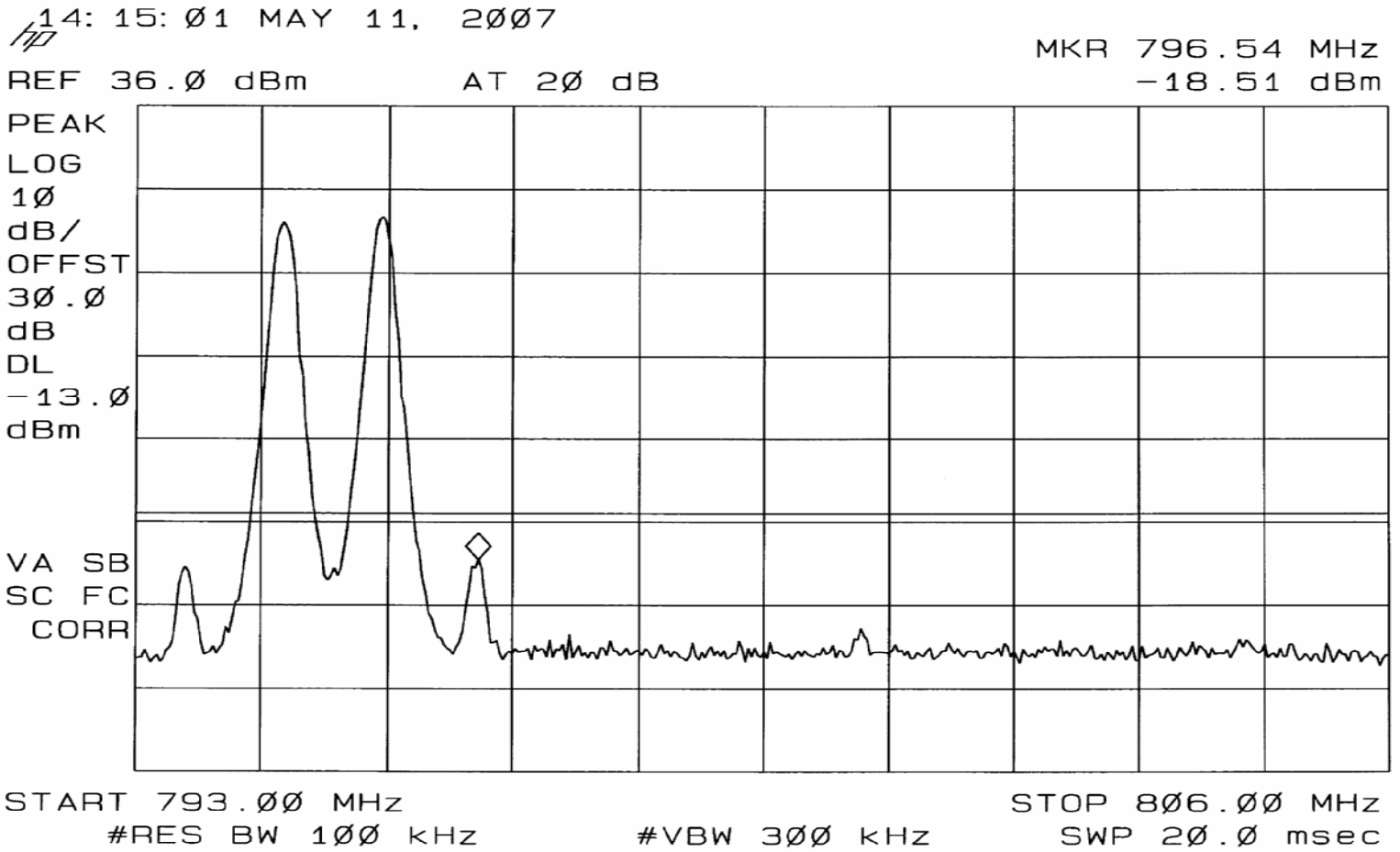

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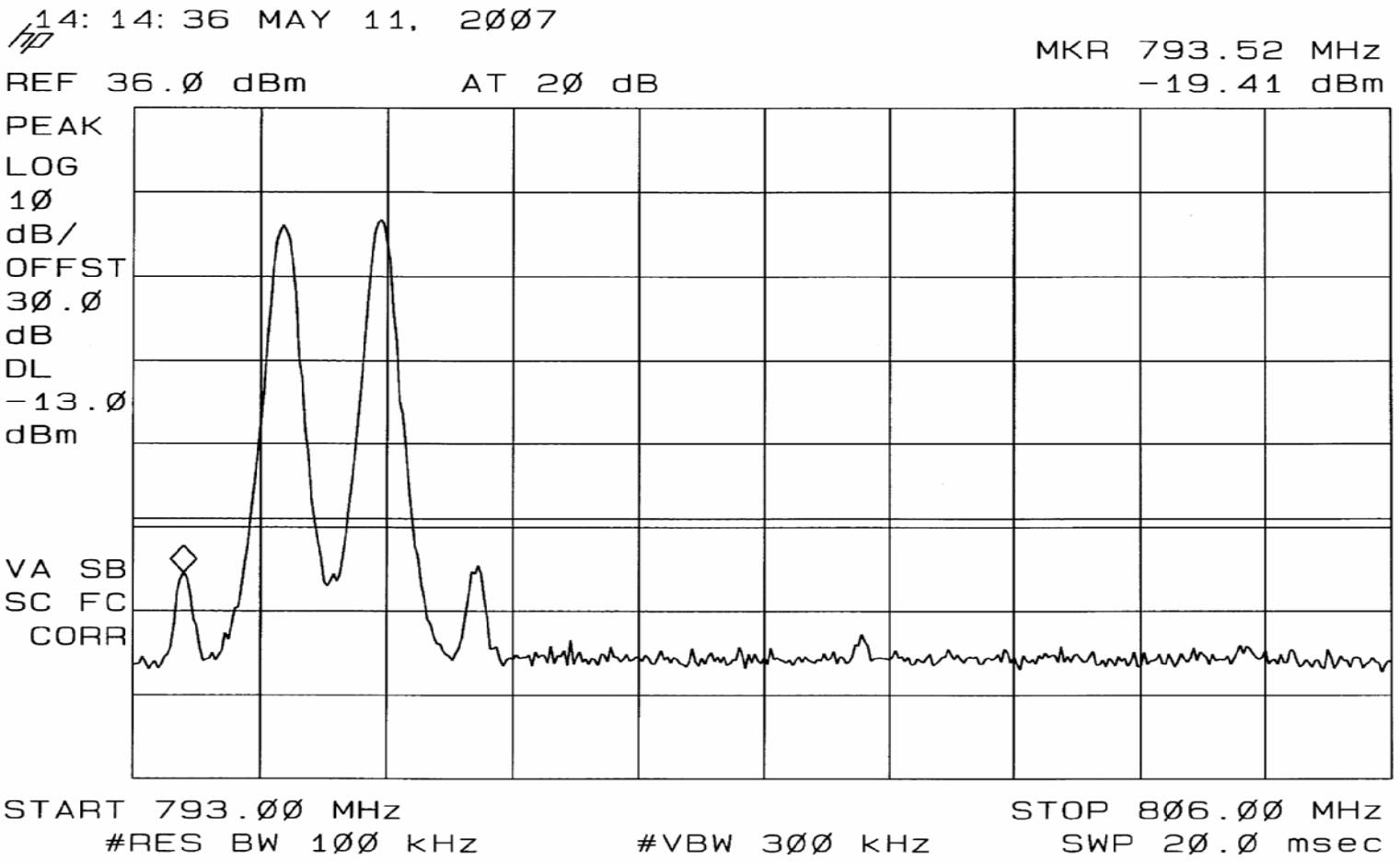
Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	TDMA - Downlink				



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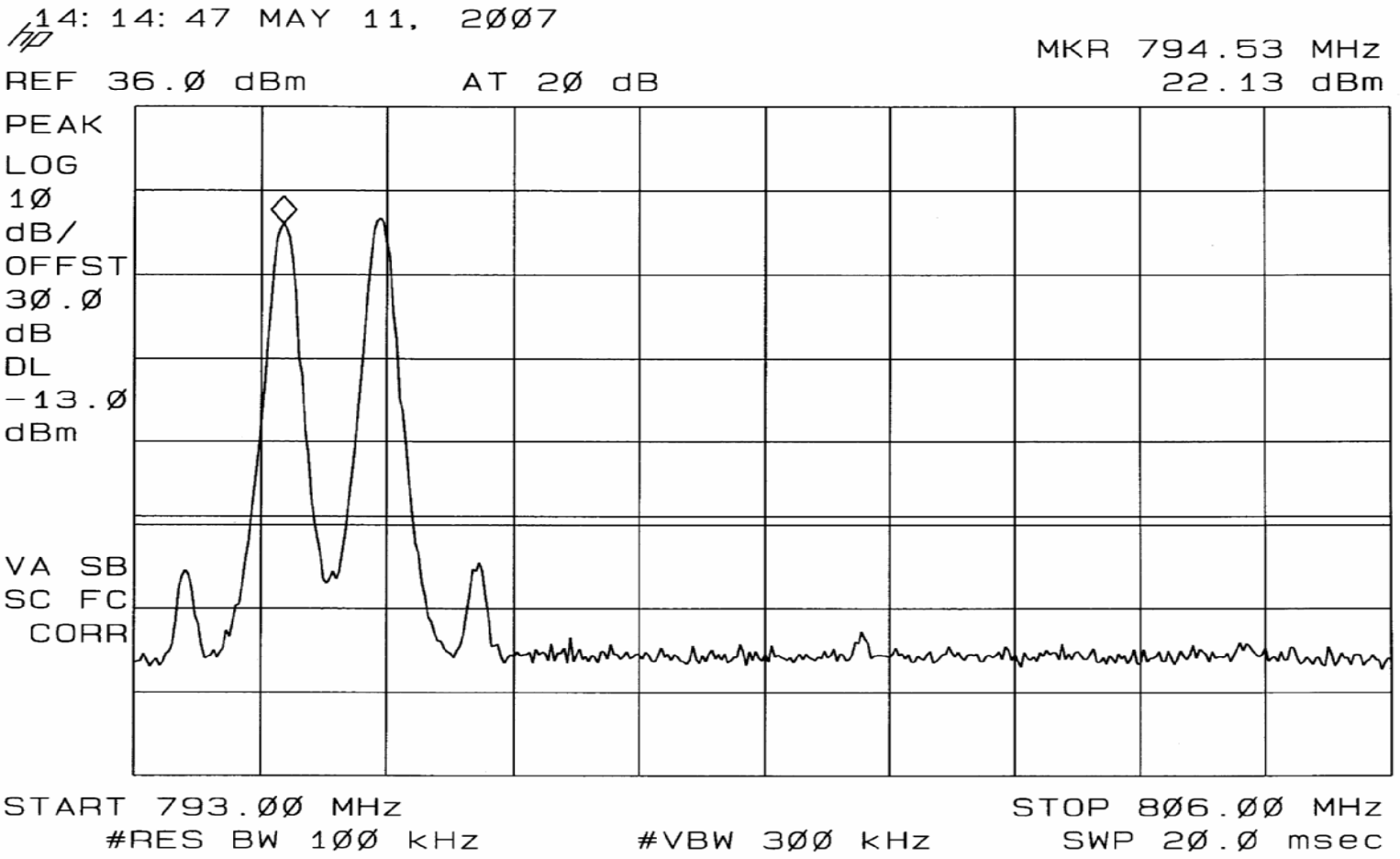
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
Model No:	CSI-BDA51080-P7	**Serial No:**	ENG	**Technician:**	M.Seamans
Test Specification:	FCC Part 2 Paragraph: 2.1047			**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	TDMA - Downlink				



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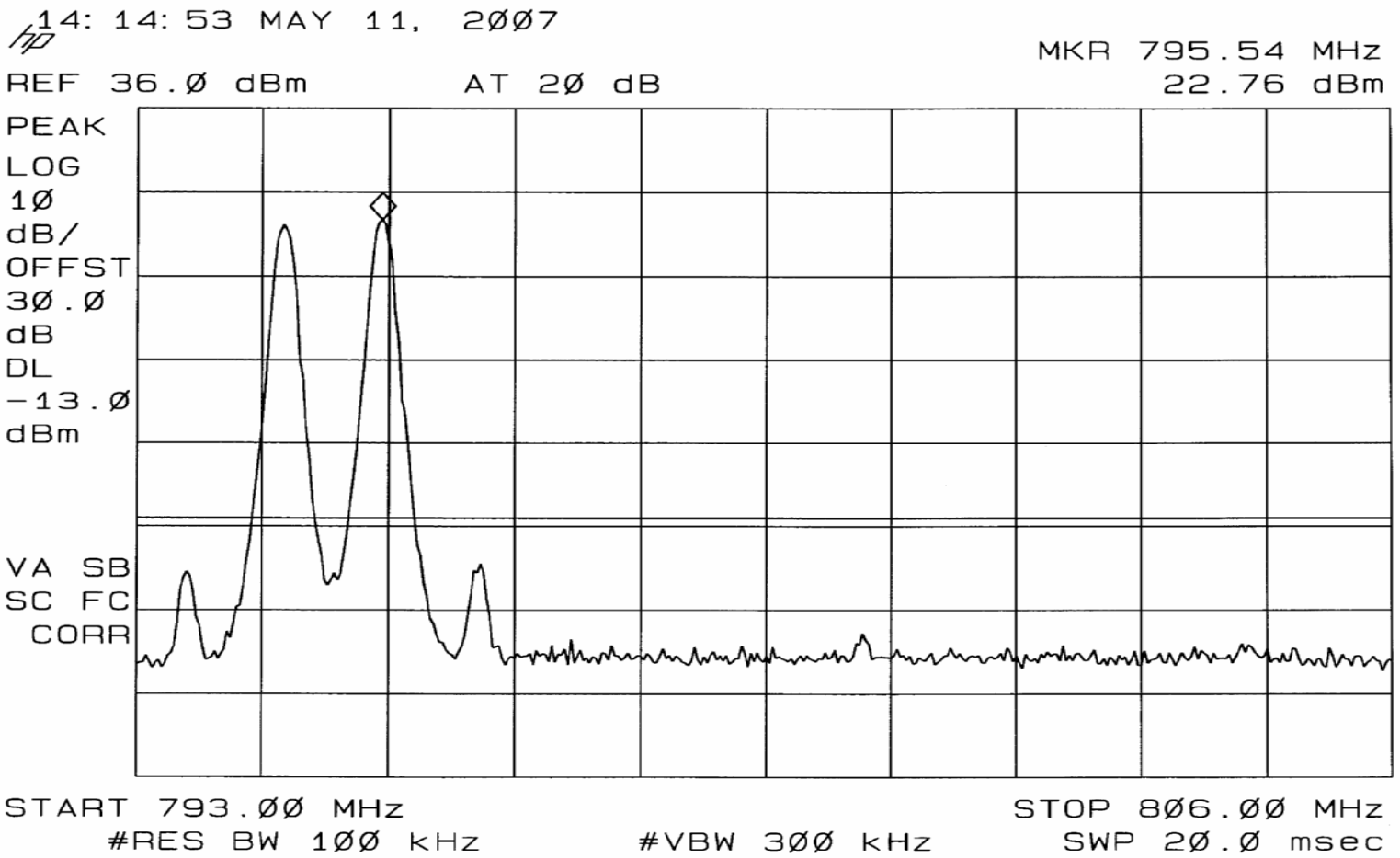
Operating Mode:	Amplifying input signal				
Notes:	TDMA - Downlink				



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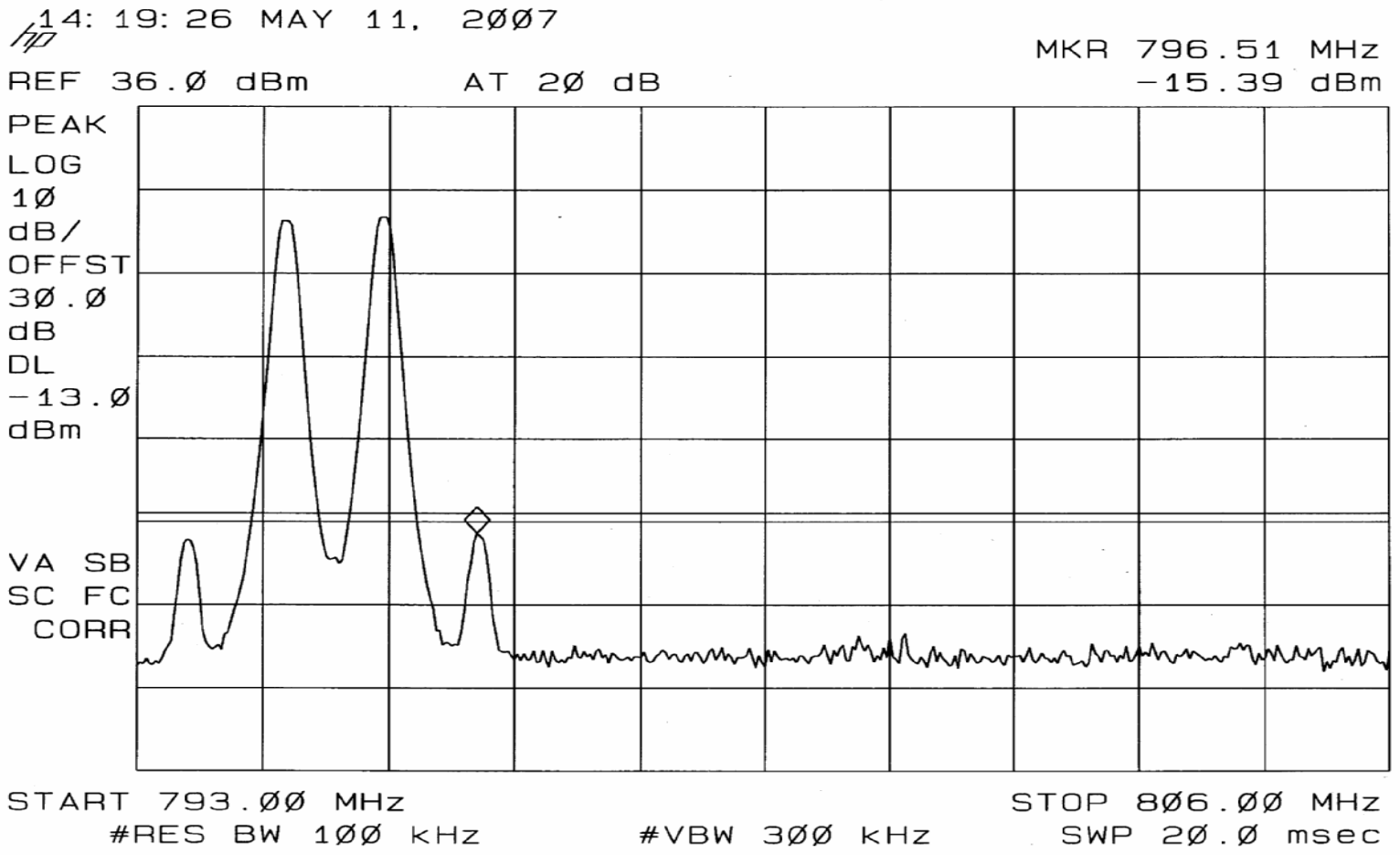
Model No:	CSI-BDA51080-P7	**Serial No:**	ENG	**Technician:**	M.Seamans
Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	FM - Downlink				



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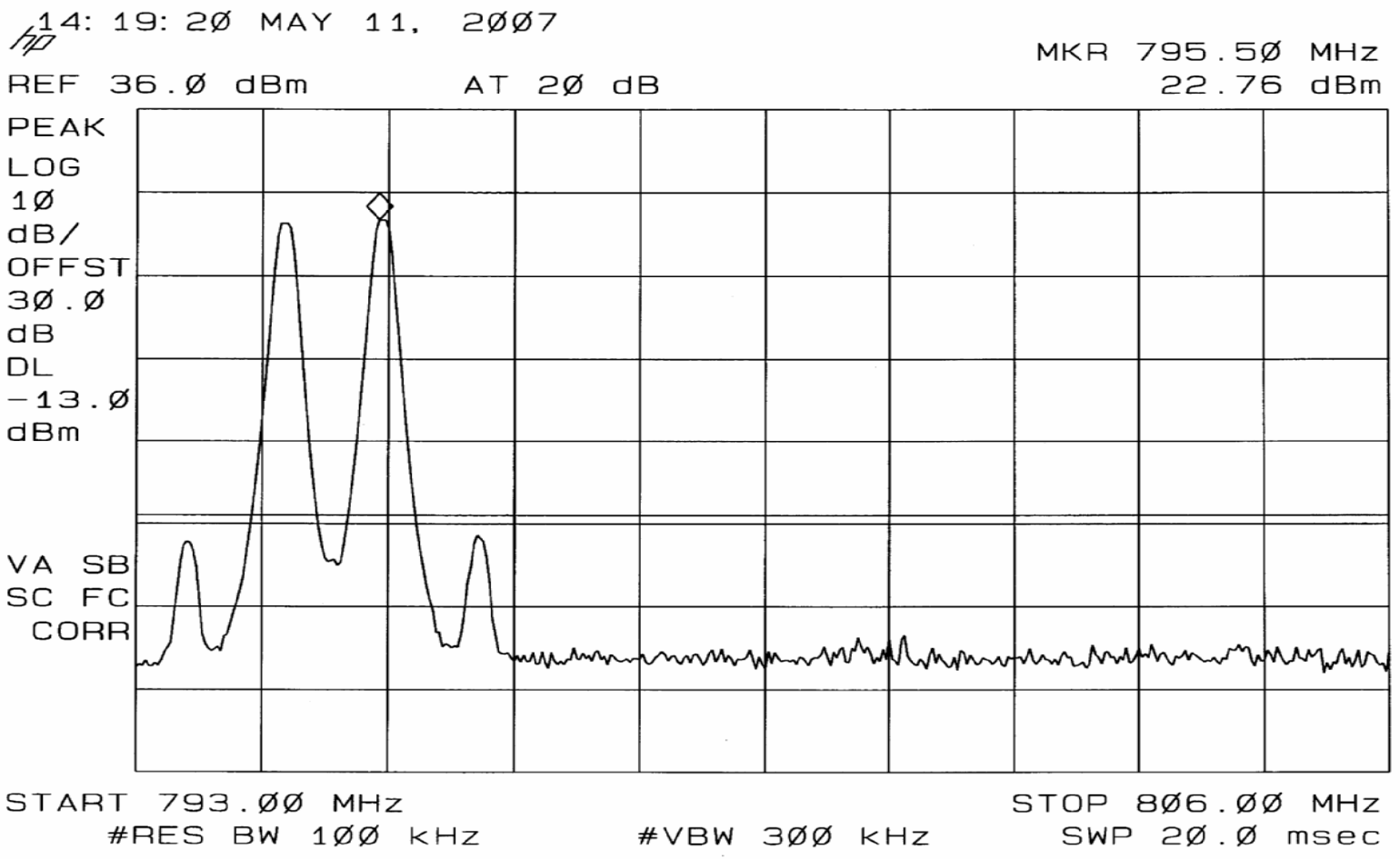
Notes:	FM - Downlink				



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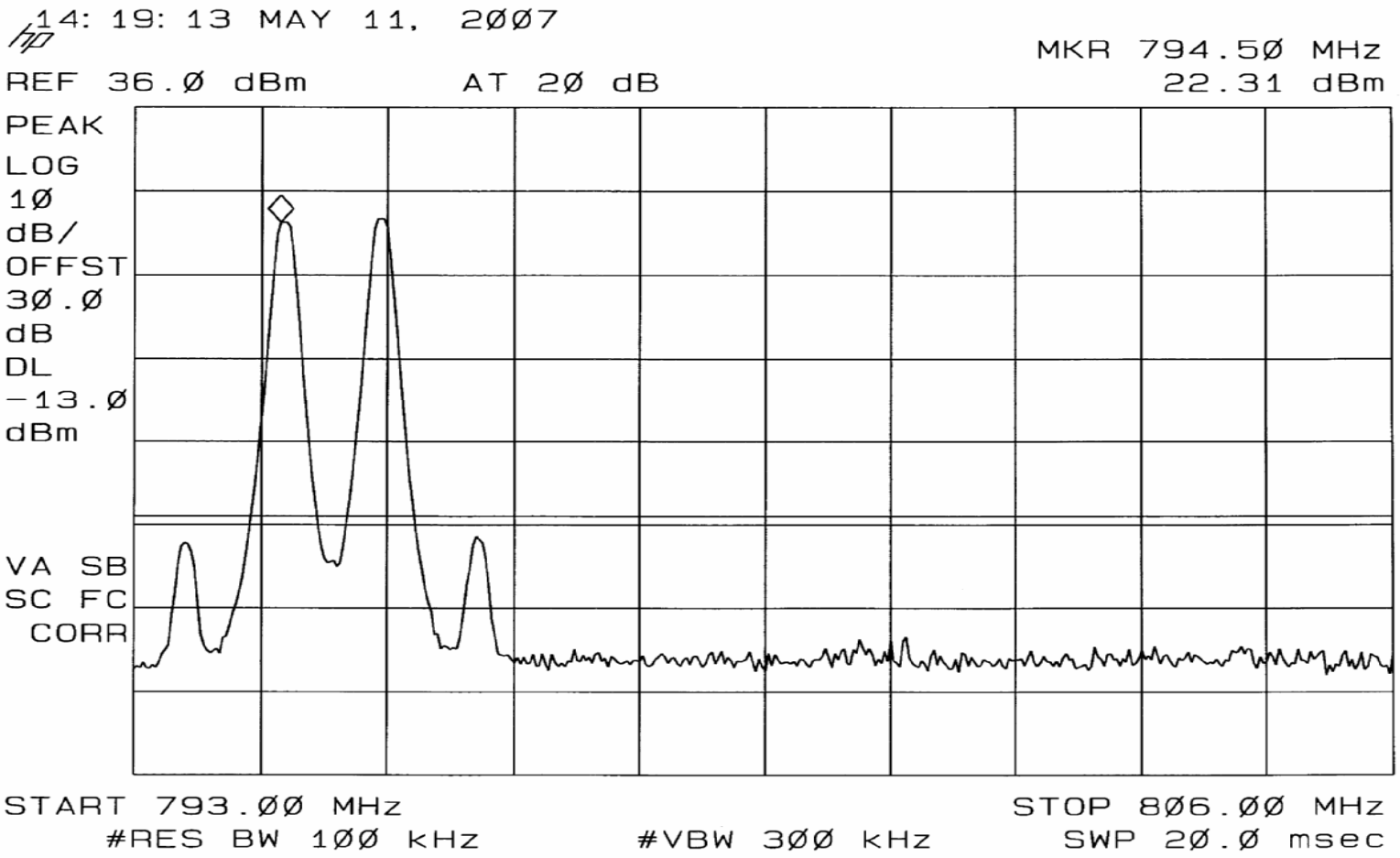

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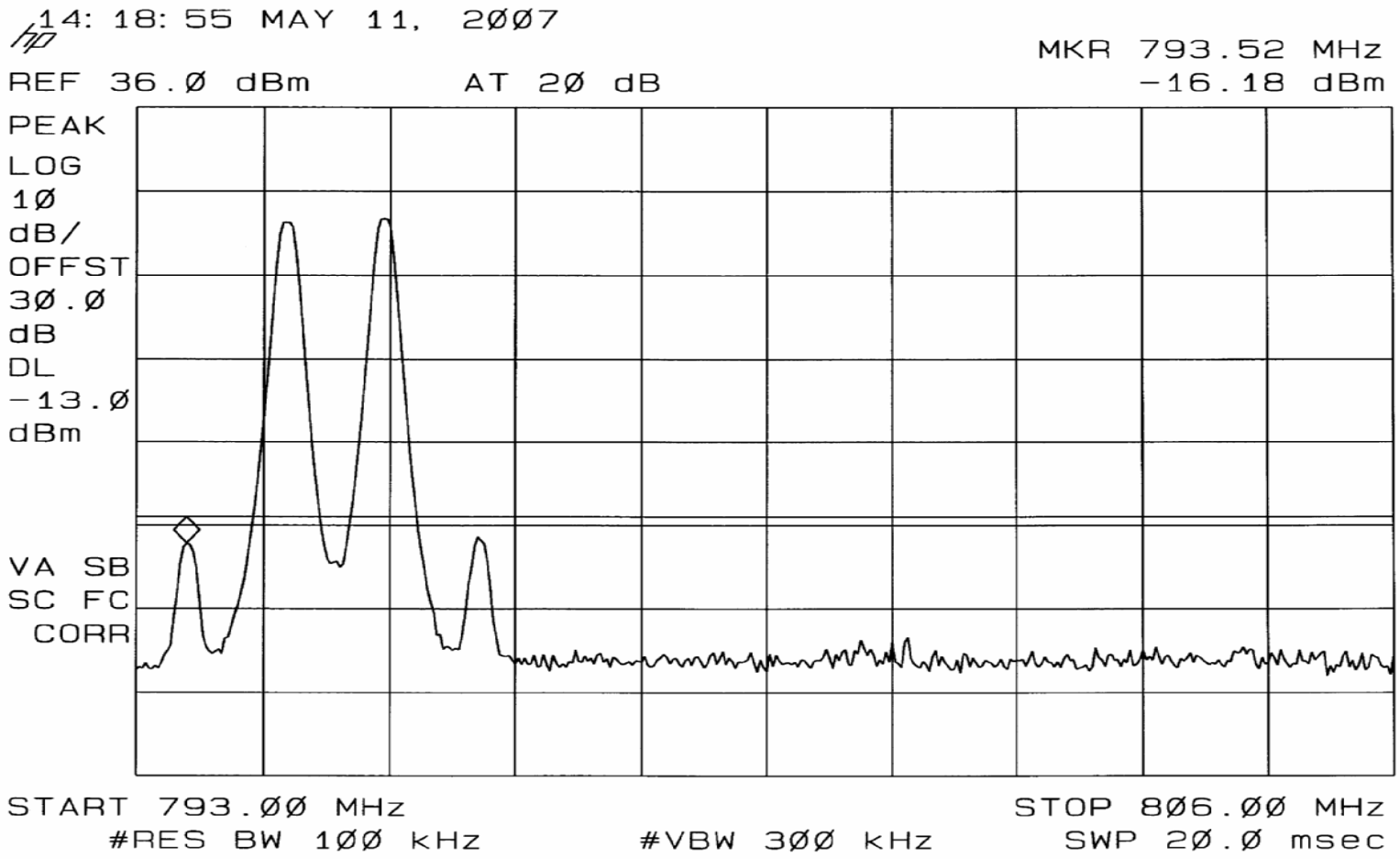
Operating Mode:	Amplifying input signal				
Notes:	FM - Downlink				



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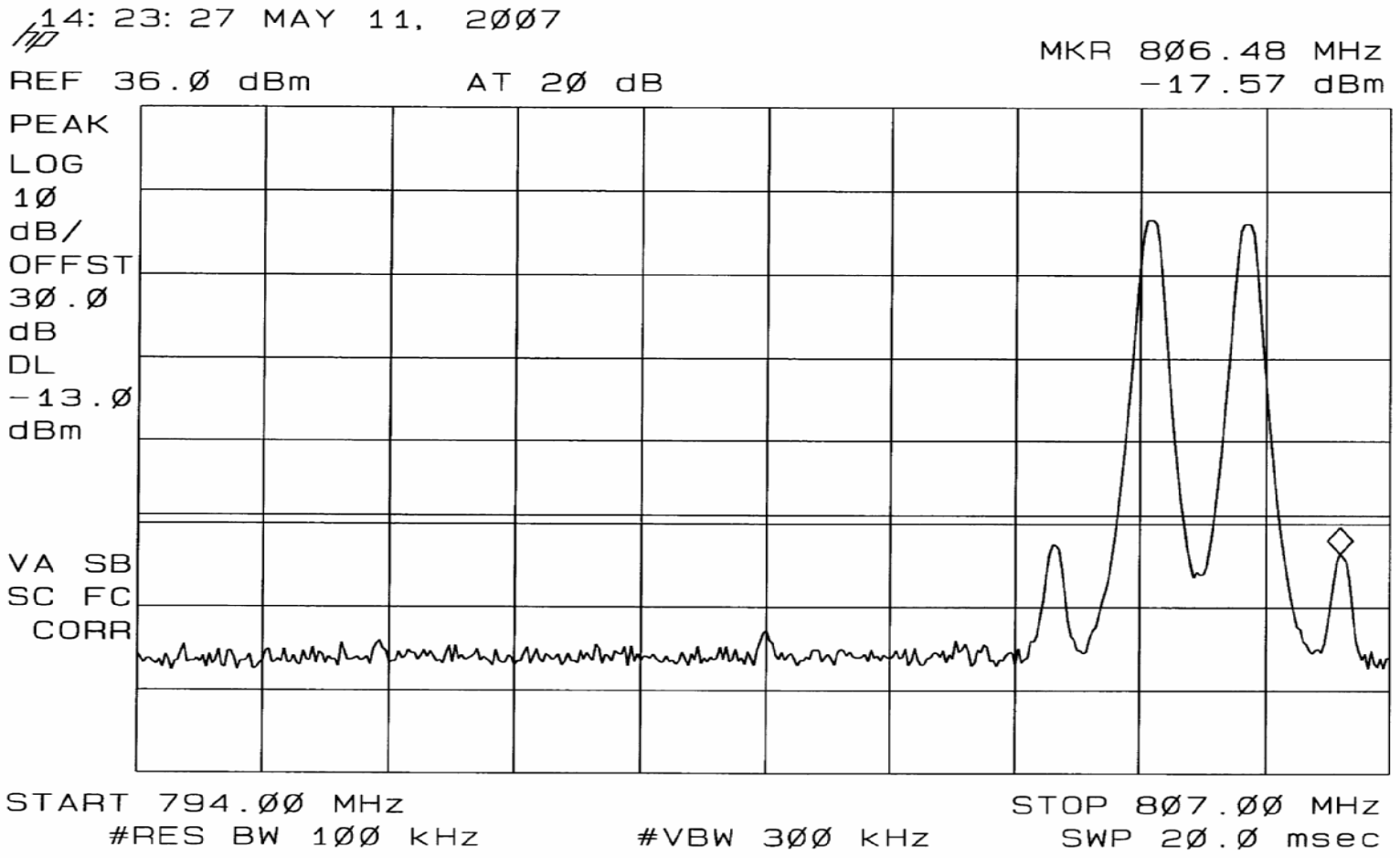
Operating Mode:	Amplifying input signal				
Notes:	FM- Downlink				



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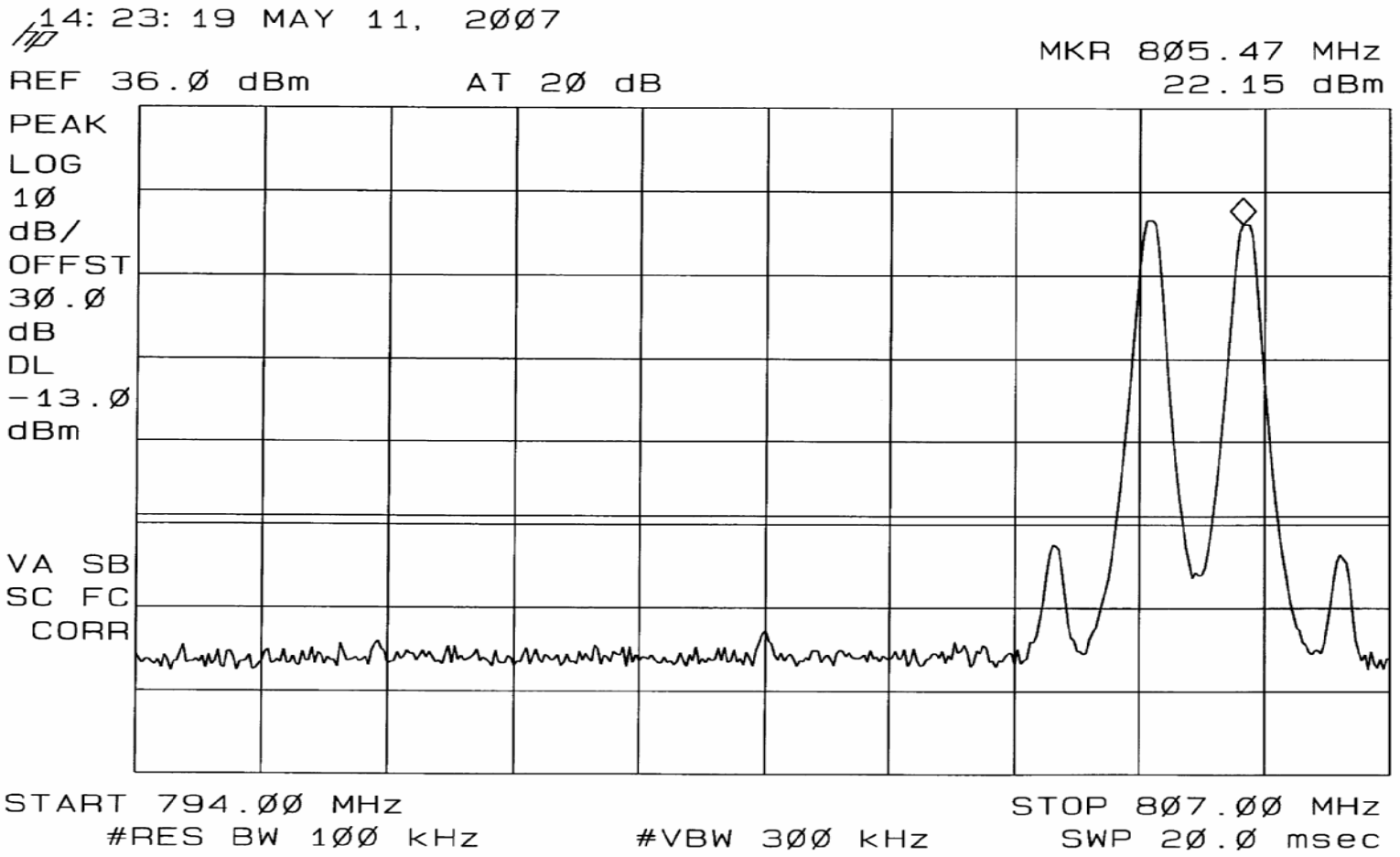
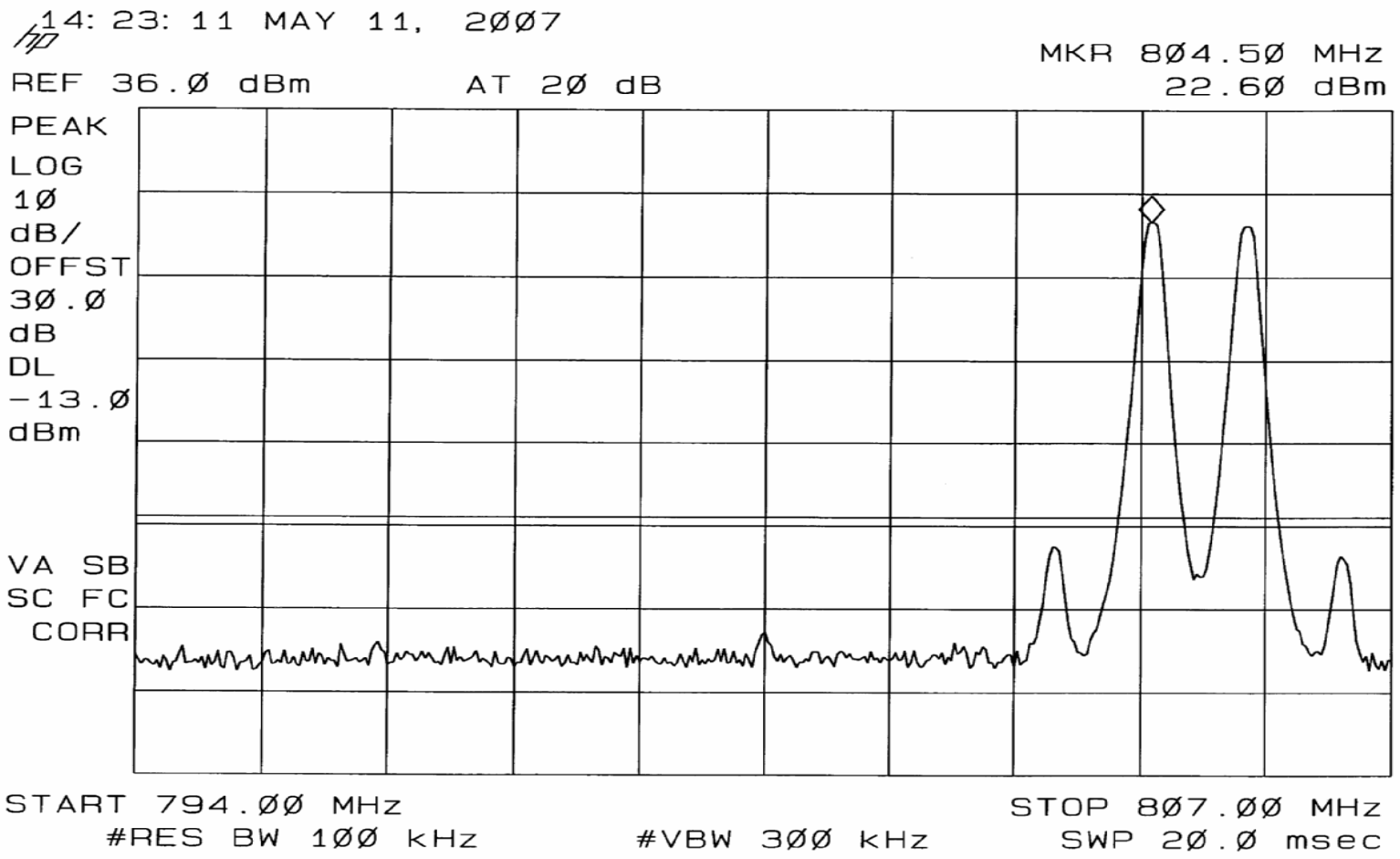
Notes:	FM - Downlink				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

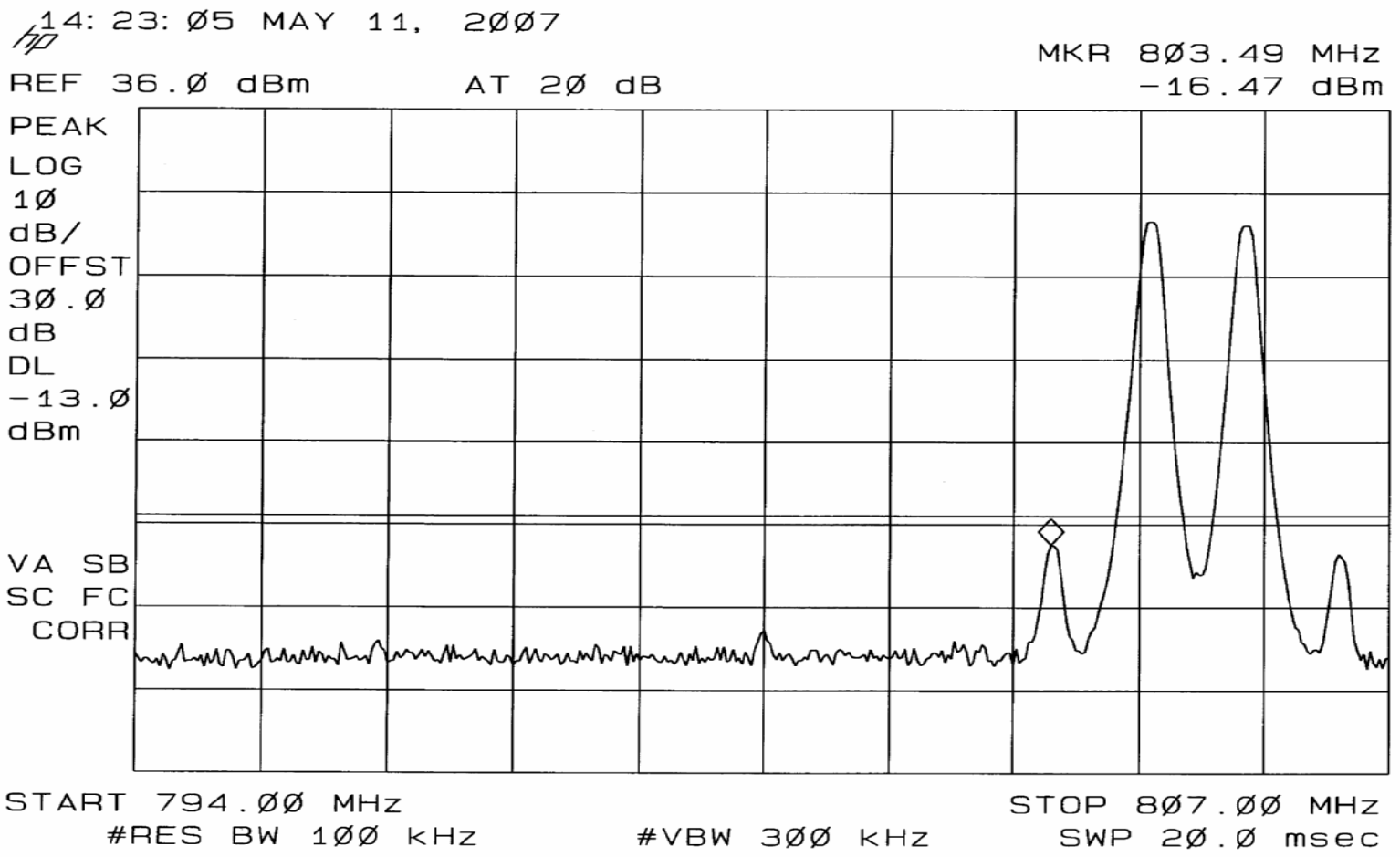
Test Method:	**Intermodulation Characteristics**				
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
Model No:	CSI-BDA51080-P7	**Serial No:**	ENG	**Technician:**	M.Seamans
Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	FM - Downlink				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Intermodulation Characteristics**				
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
Model No:	CSI-BDA51080-P7	**Serial No:**	ENG	**Technician:**	M.Seamans
Test Specification:	FCC Part 2 Paragraph: 2.1047			**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	FM - Downlink				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

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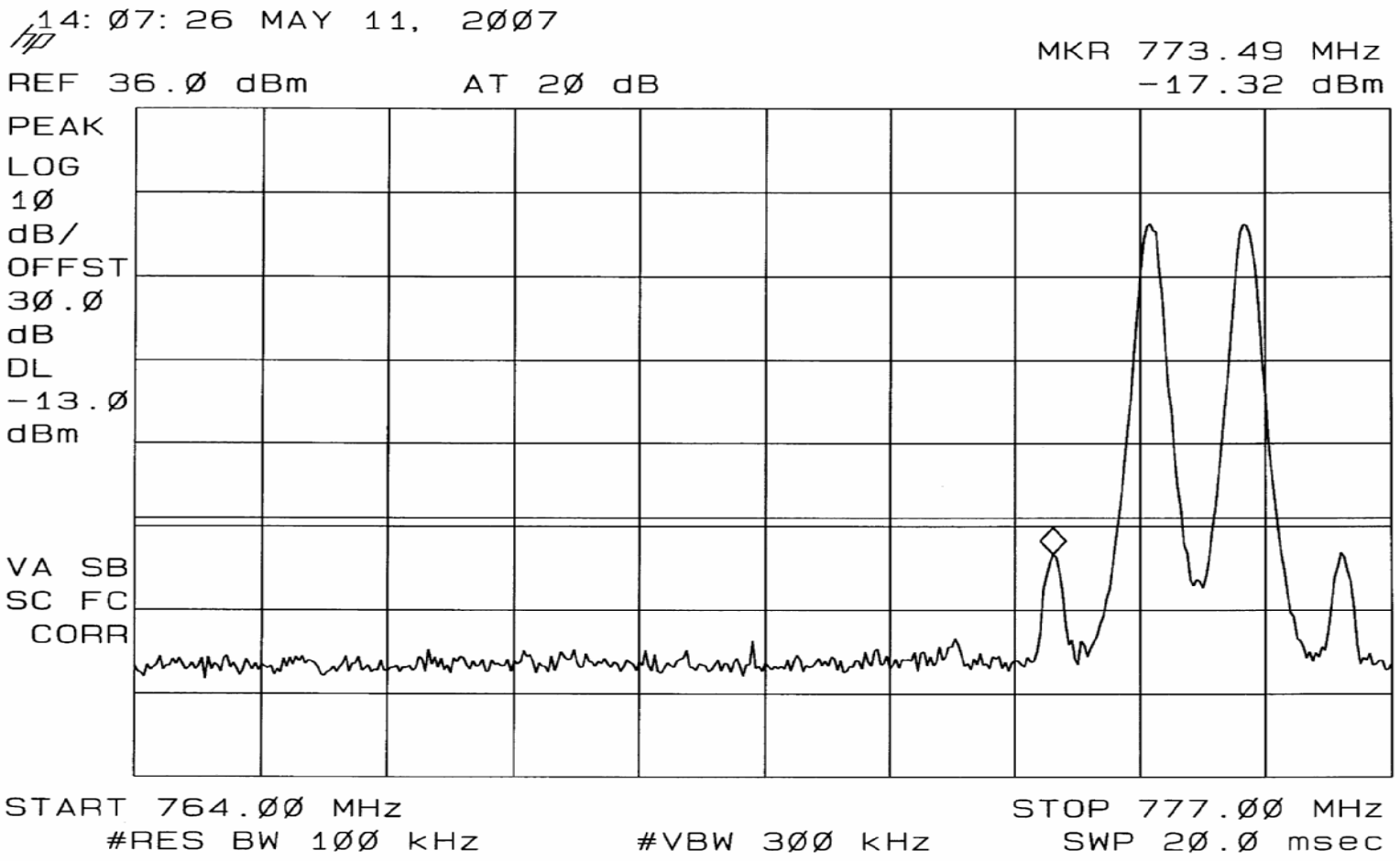
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
Model No:	CSI-BDA51080-P7	**Serial No:**	ENG	**Technician:**	M.Seamans
Test Specification:	FCC Part 2 Paragraph: 2.1047			**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	TDMA - Uplink				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

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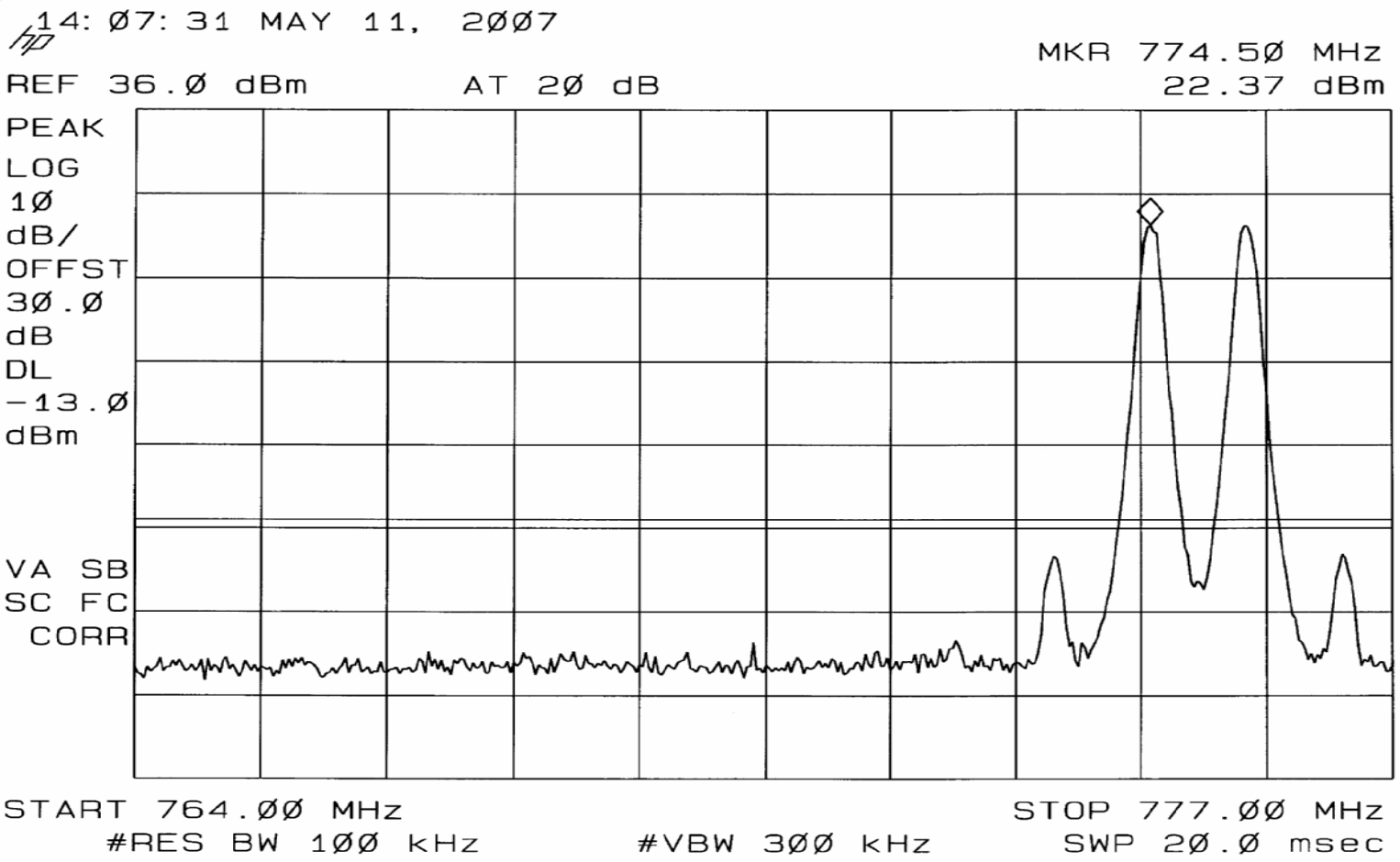
Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	TDMA - Uplink				



RETLIF TESTING LABORATORIES

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Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
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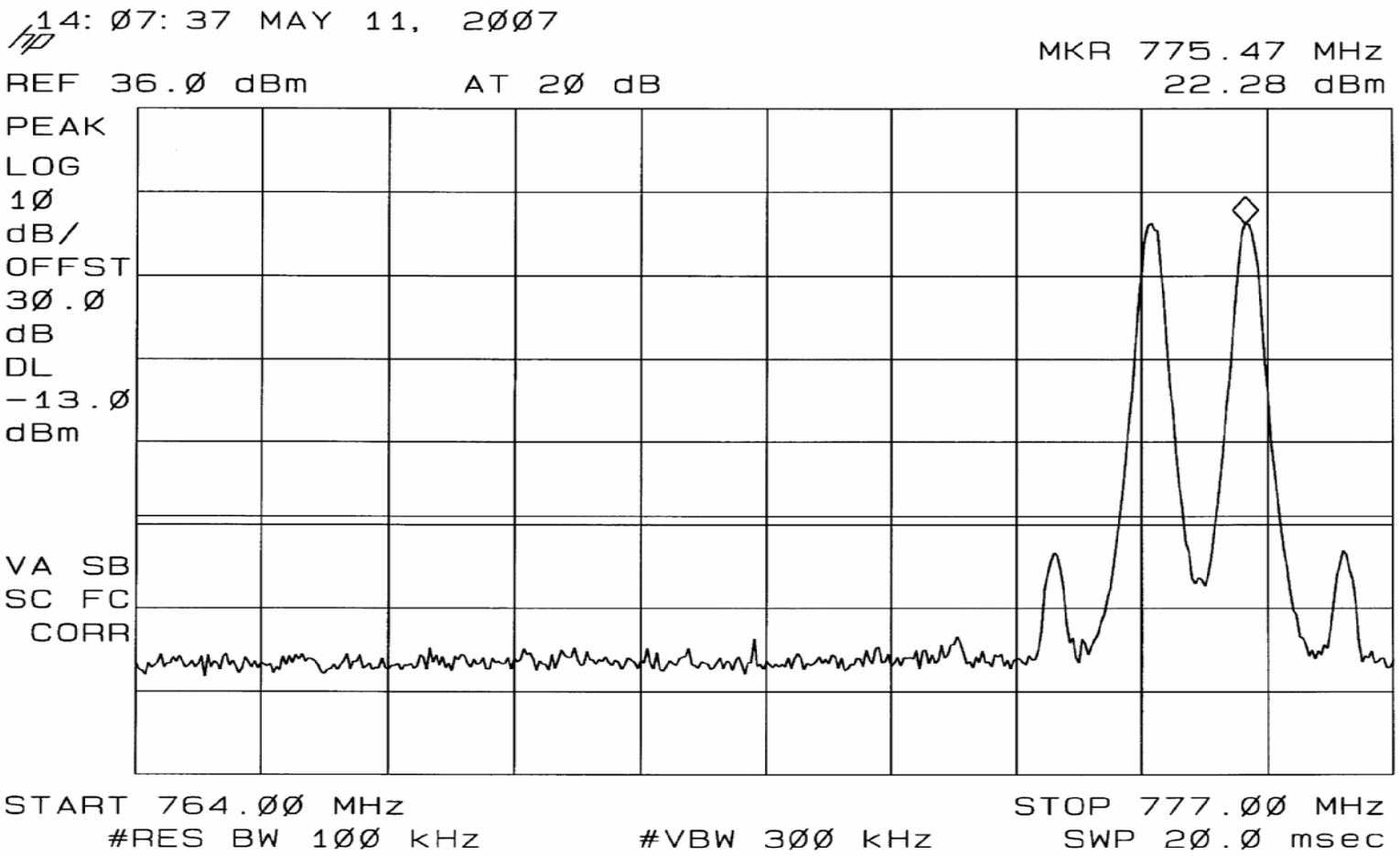

RETLIF TESTING LABORATORIES

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Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
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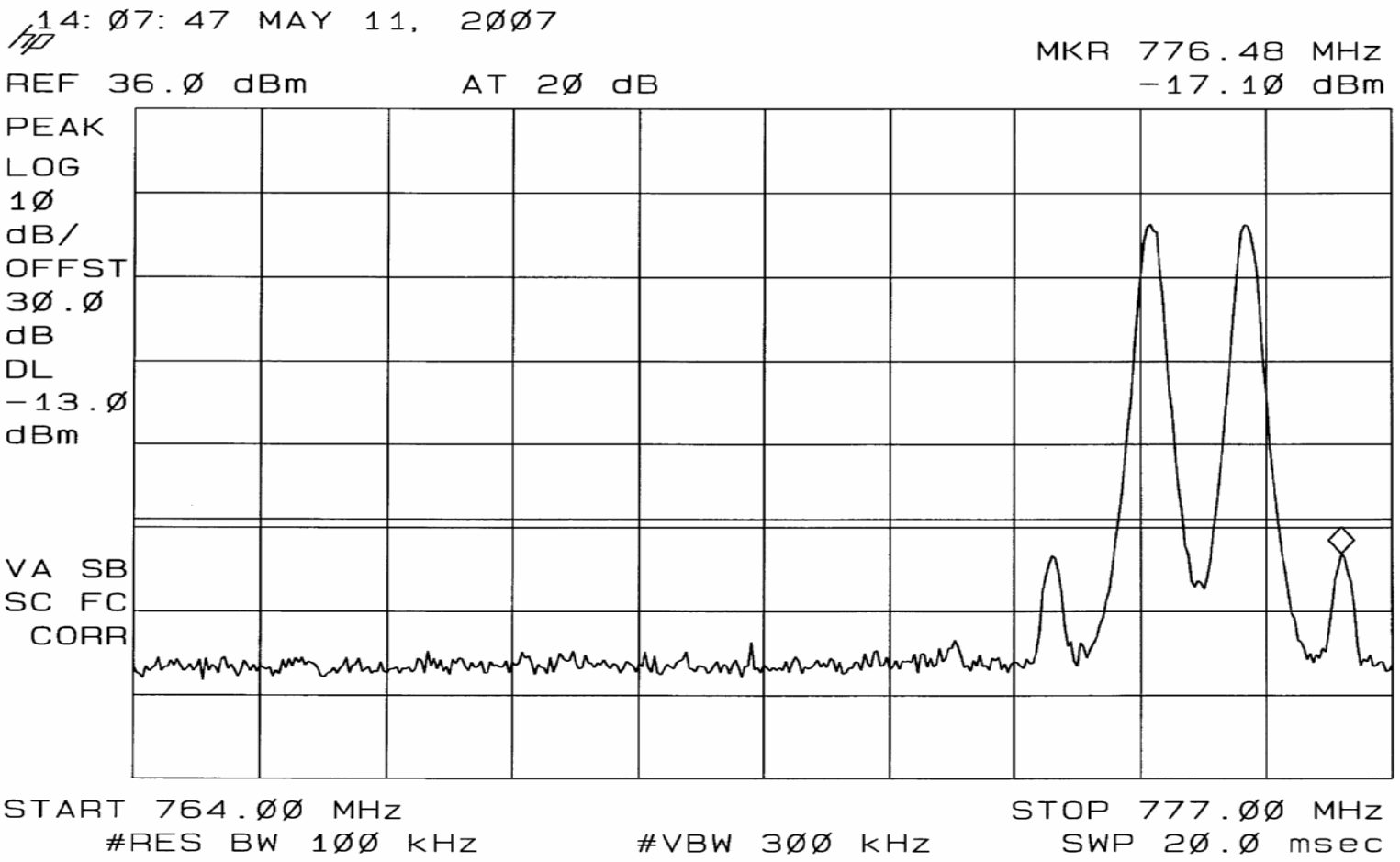

RETLIF TESTING LABORATORIES

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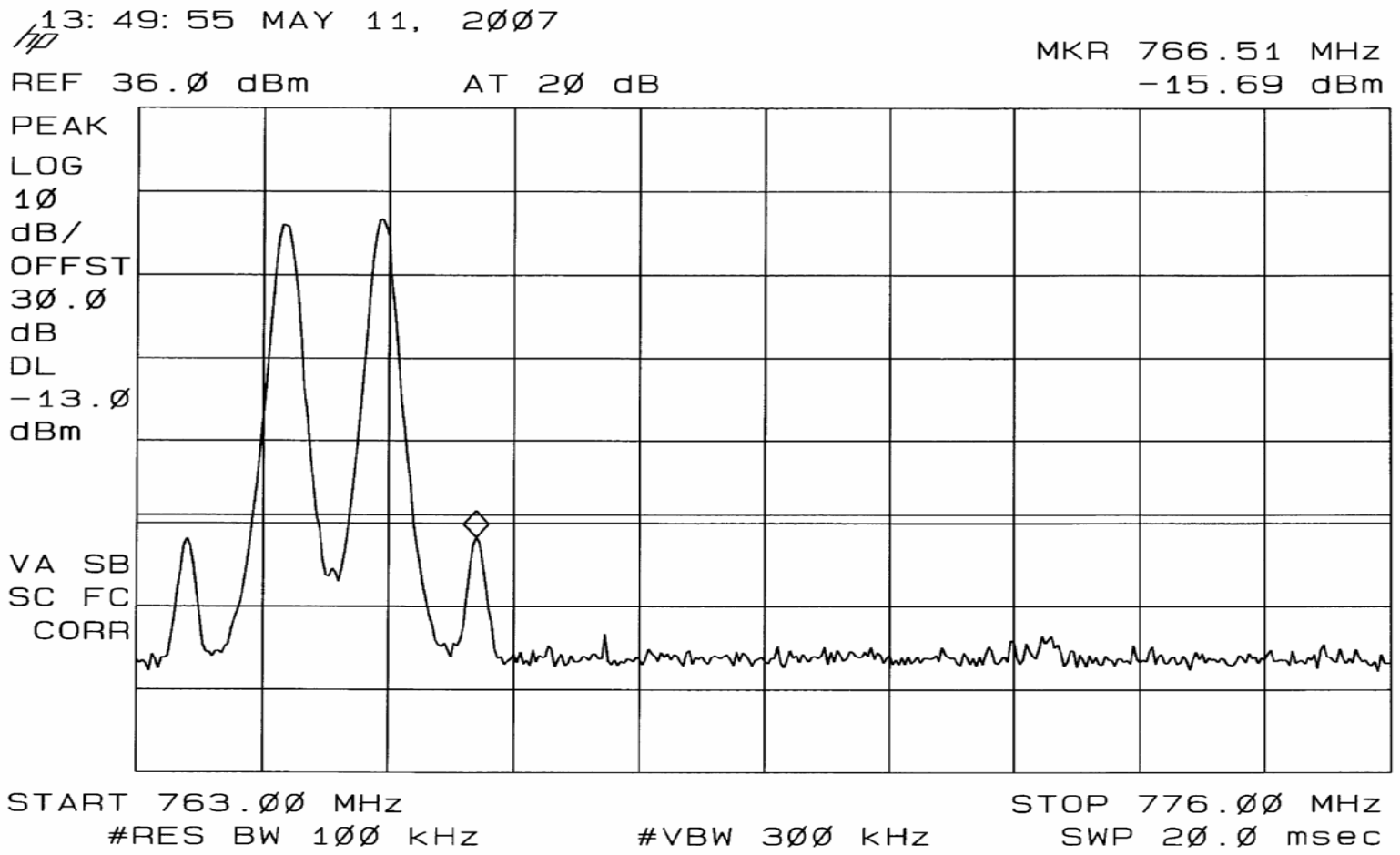

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Operating Mode:	Amplifying input signal				
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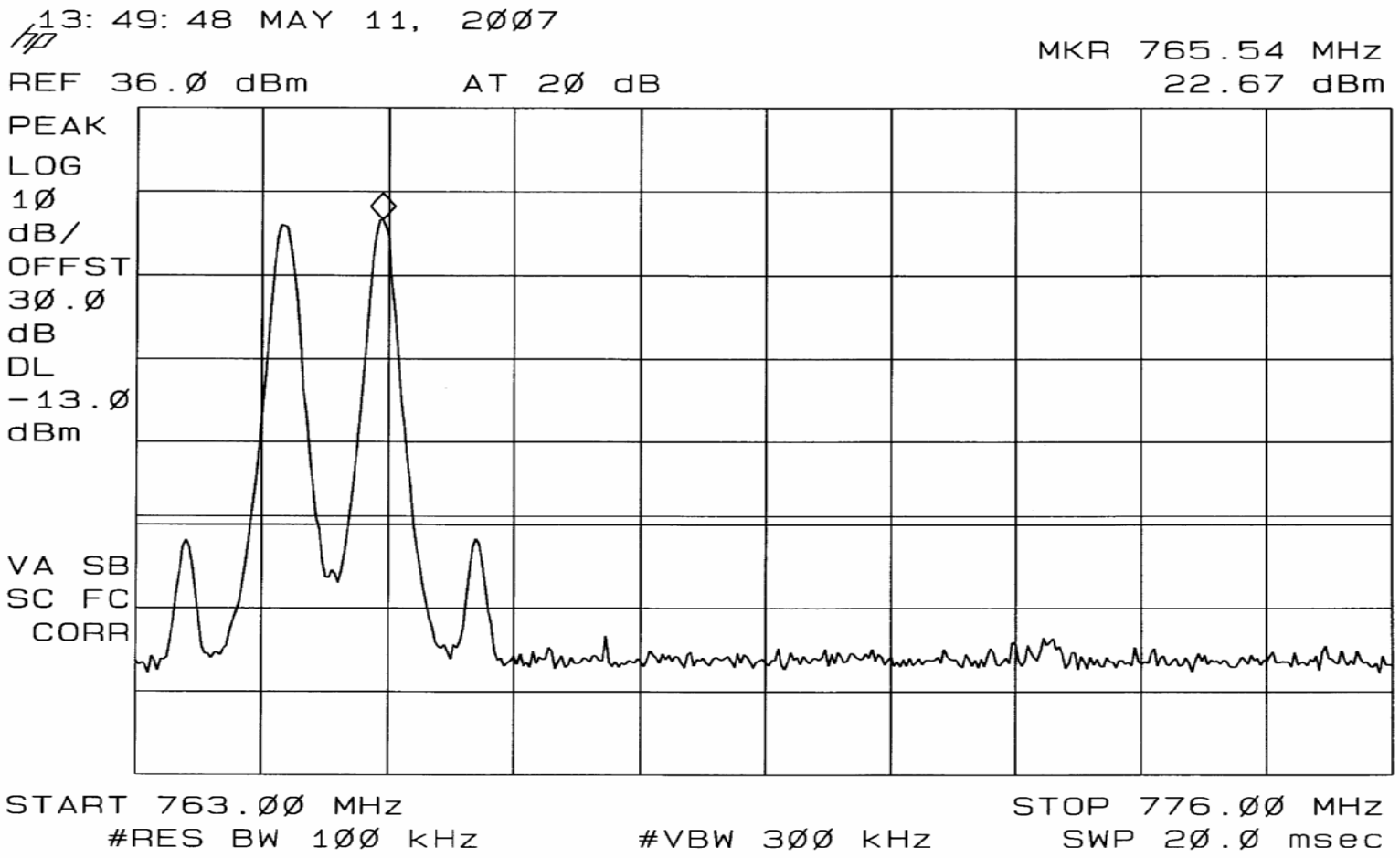

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Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
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Operating Mode:	Amplifying input signal				
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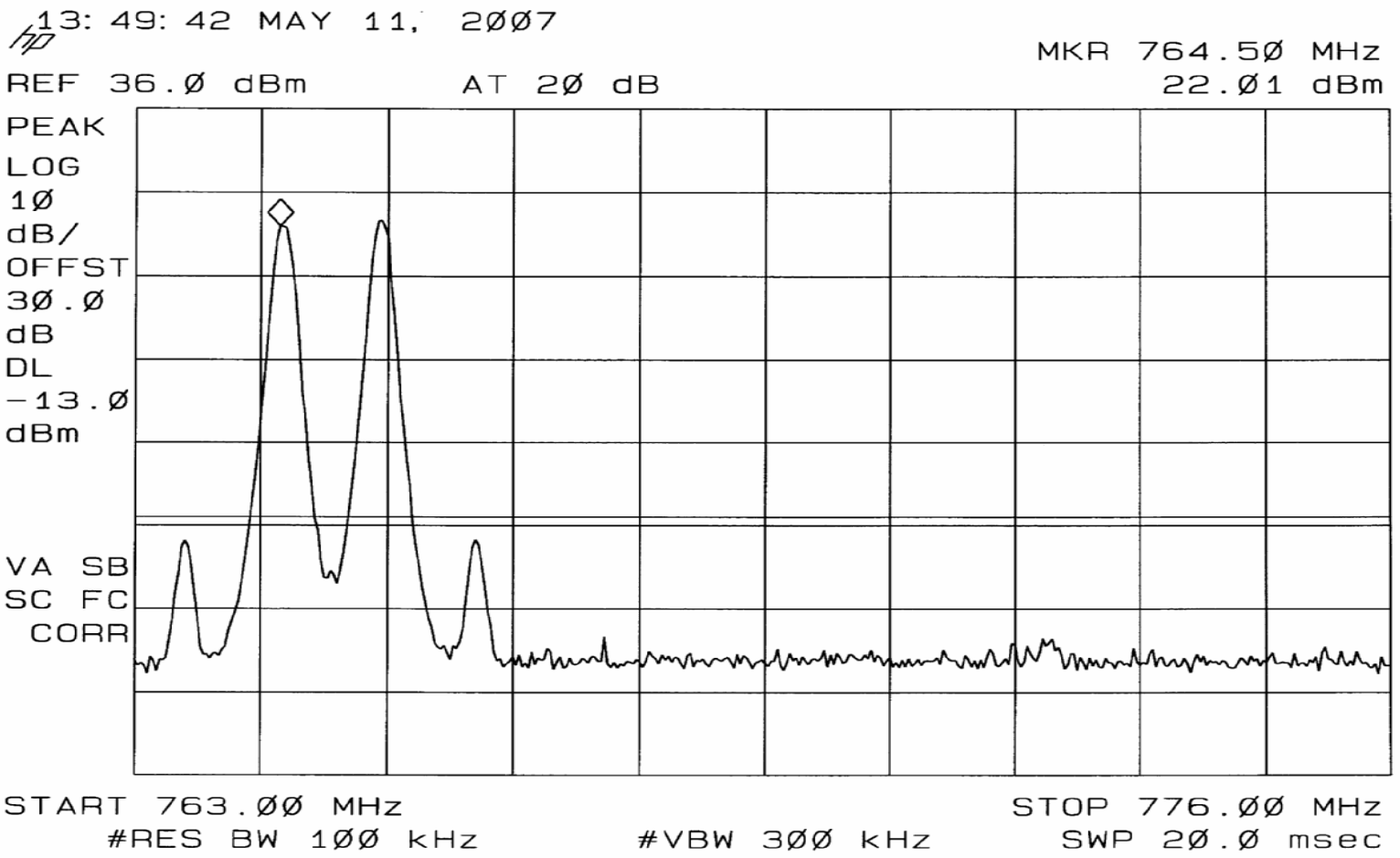

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Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
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Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
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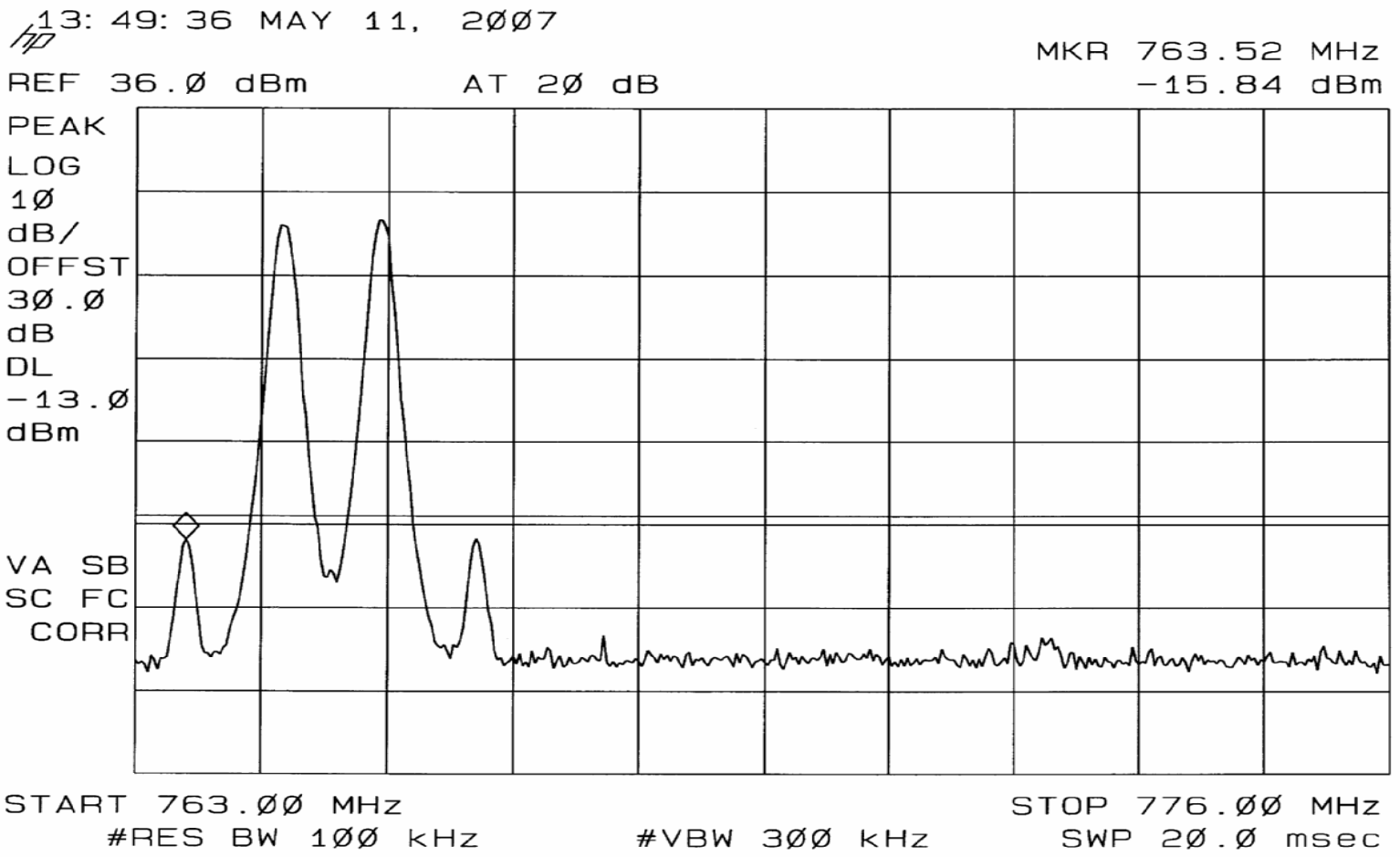

RETLIF TESTING LABORATORIES

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Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
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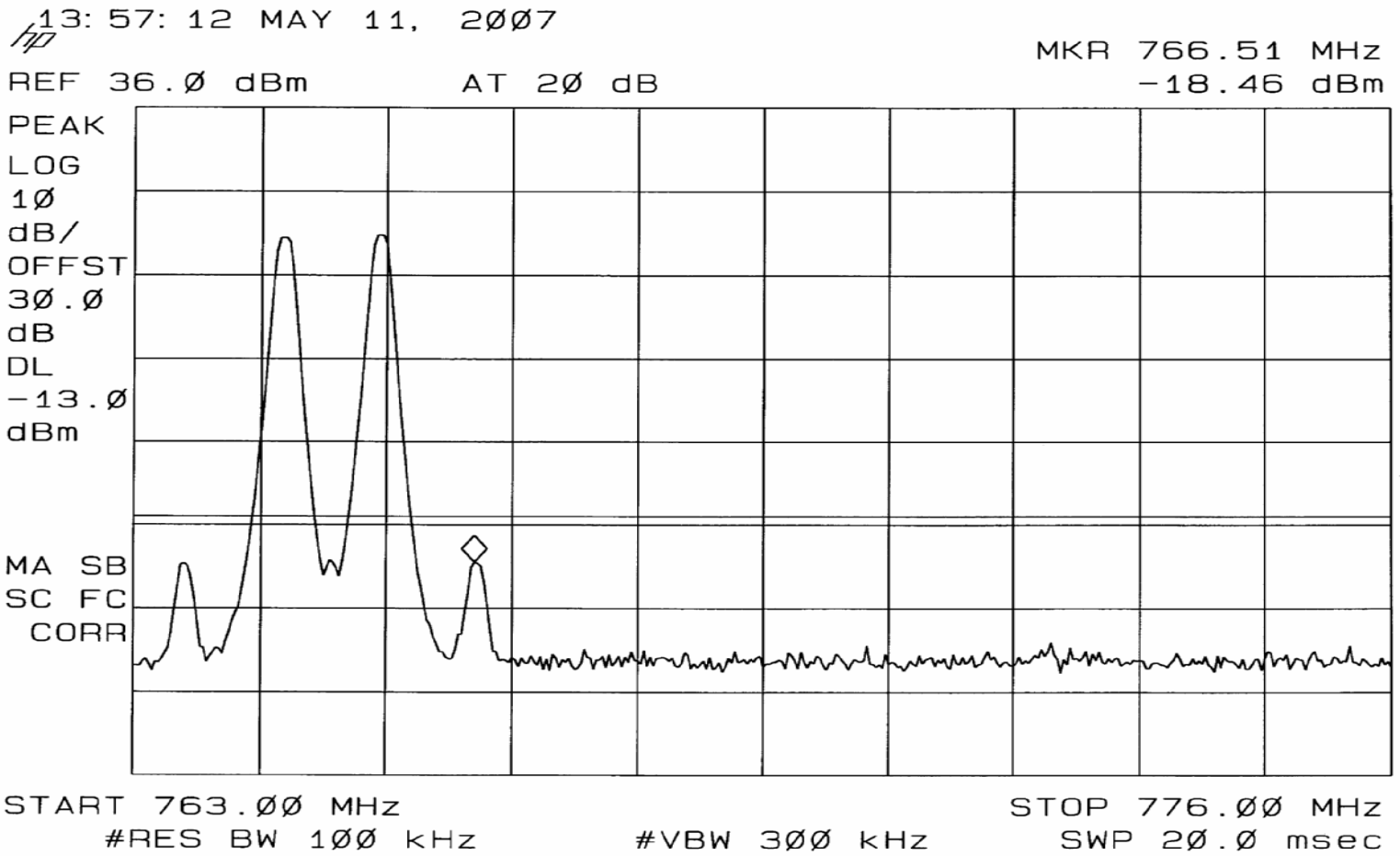
Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	FM - Uplink				



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Operating Mode:	Amplifying input signal				
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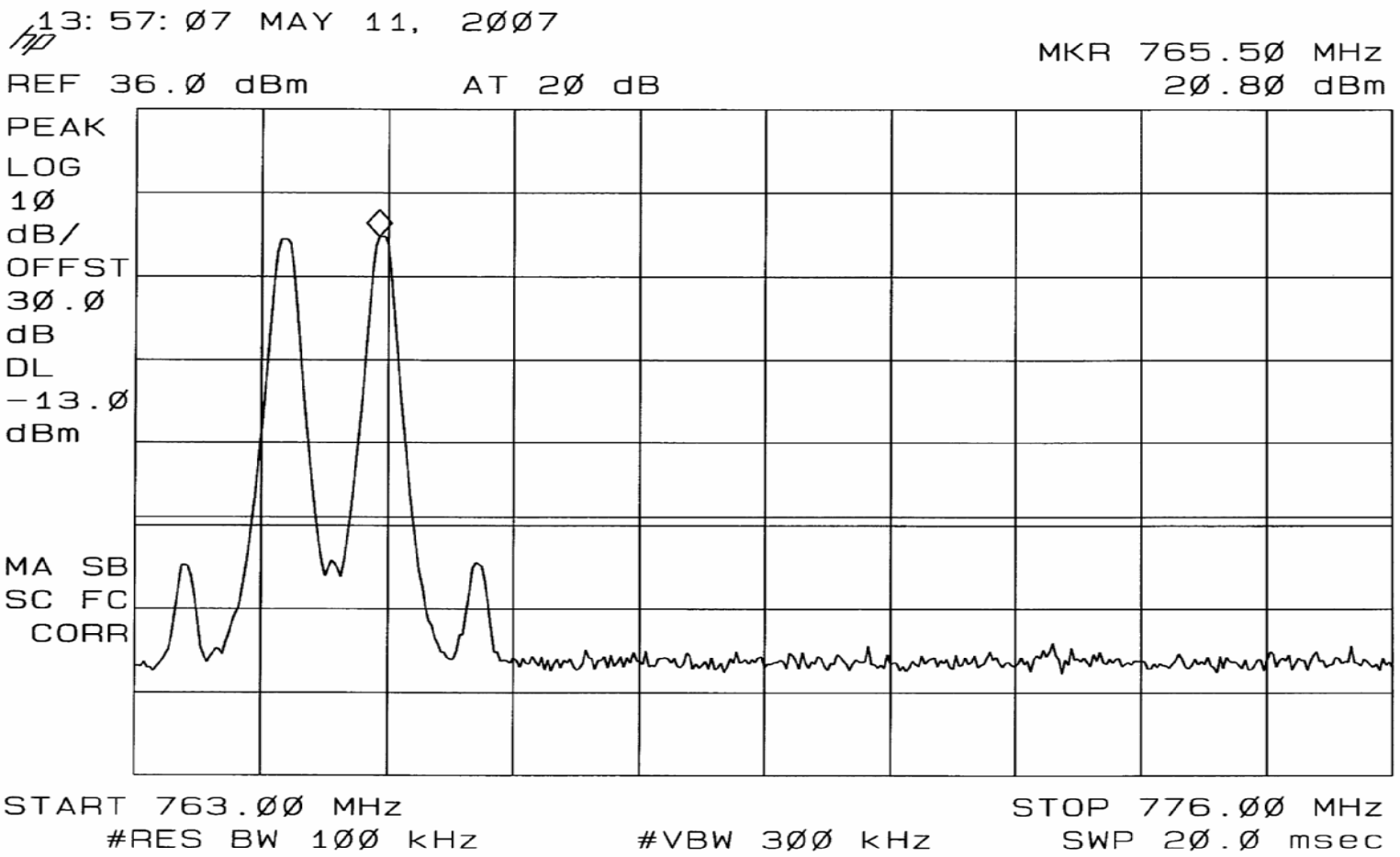

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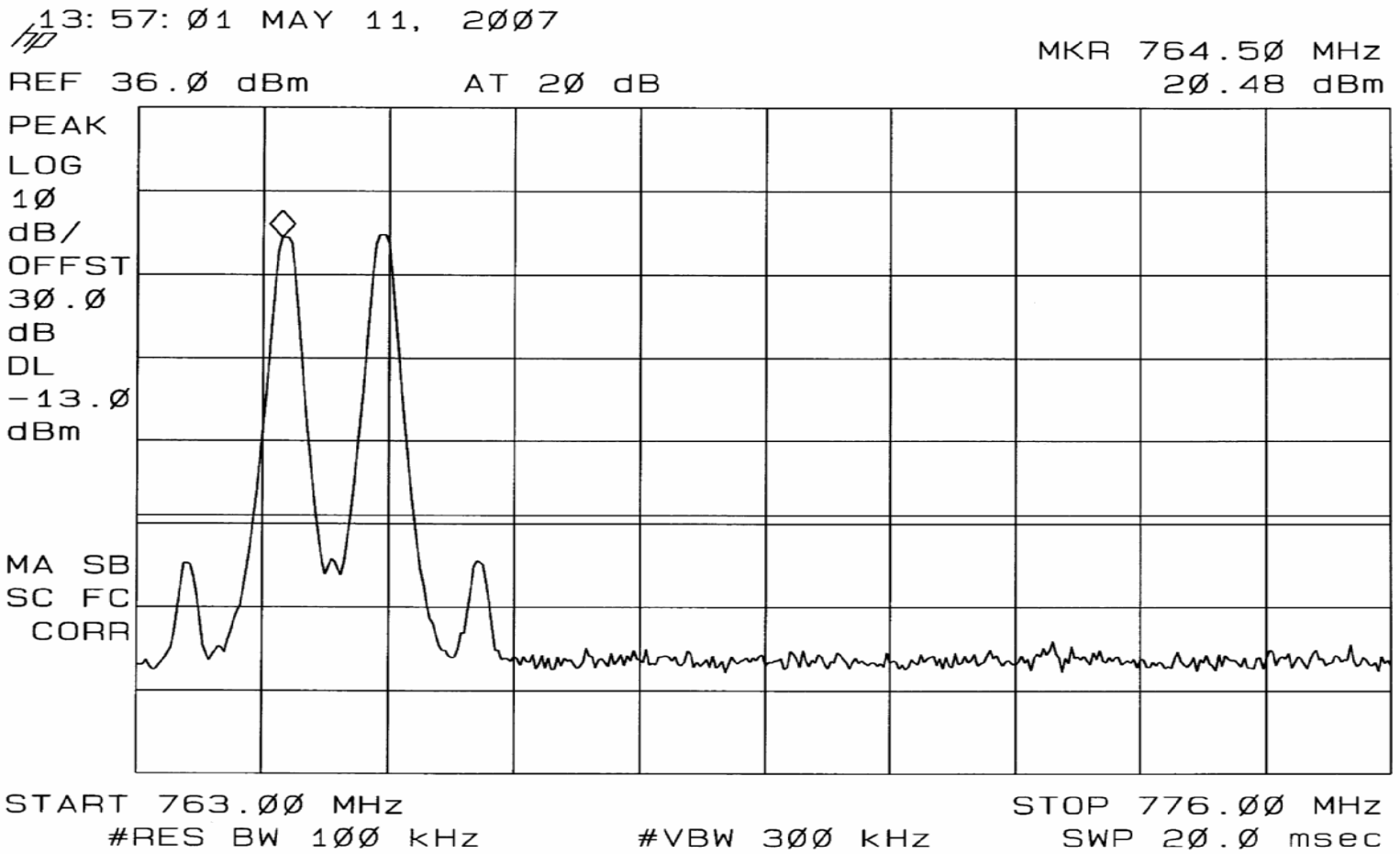

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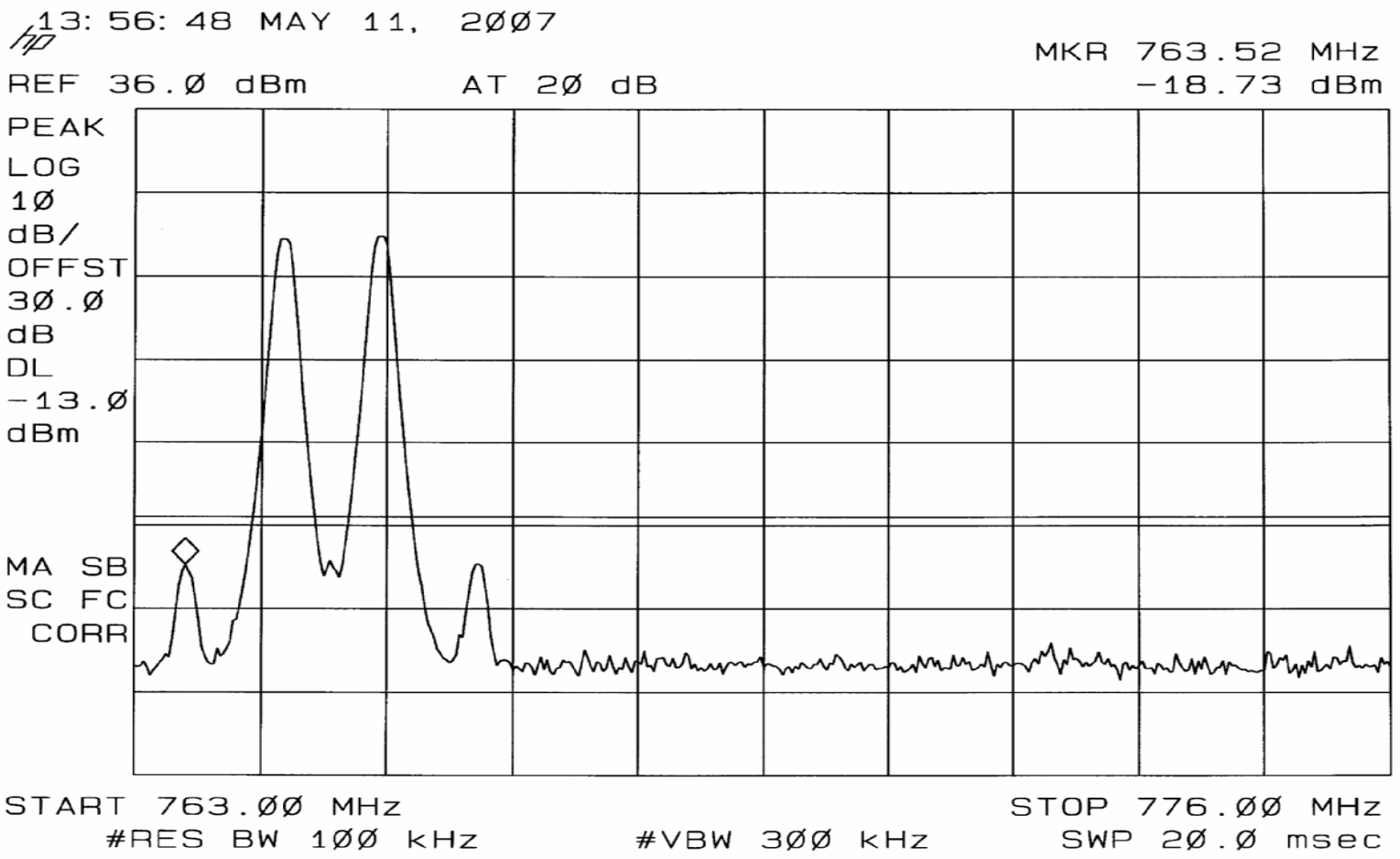

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Operating Mode:	Amplifying input signal				
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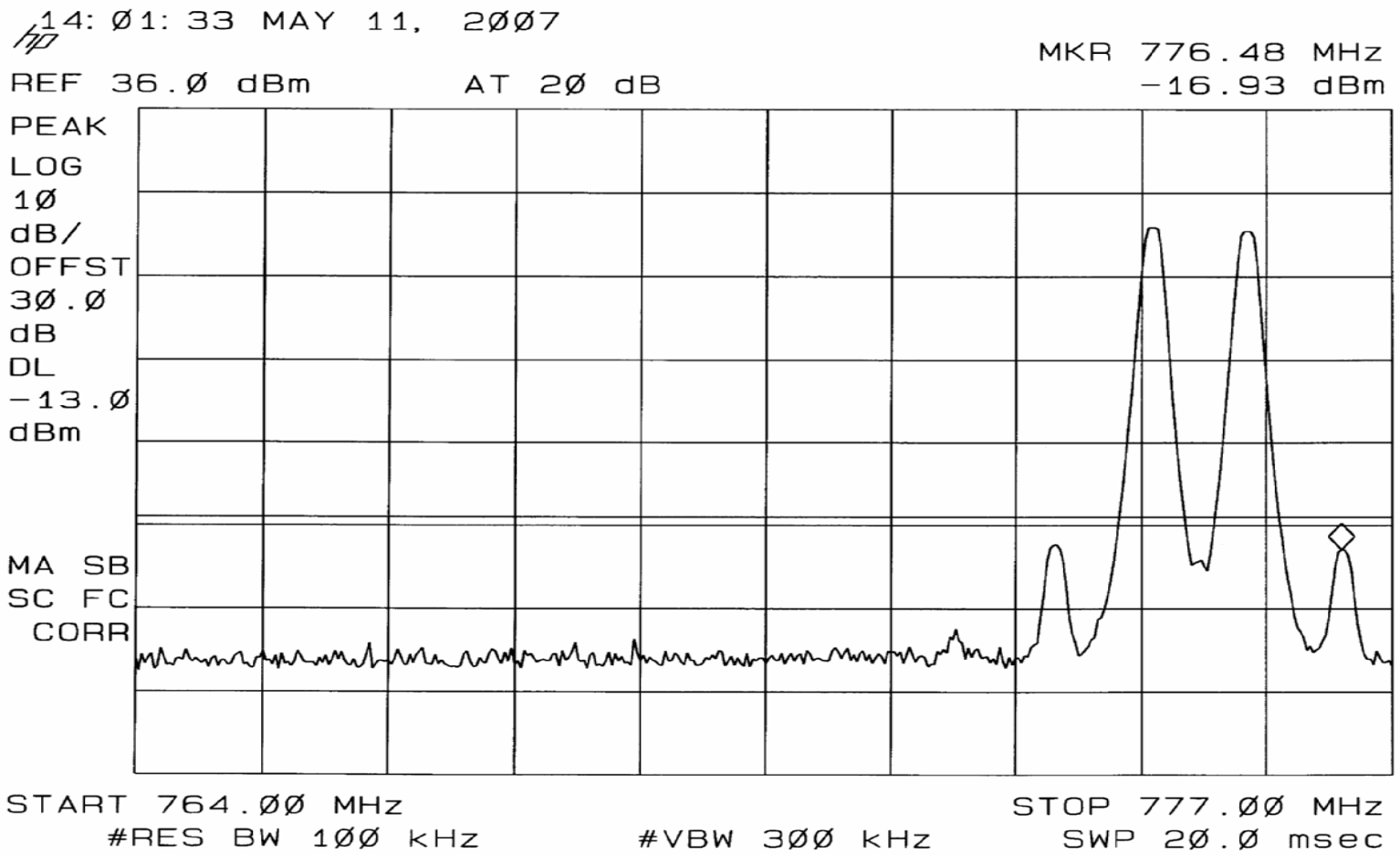

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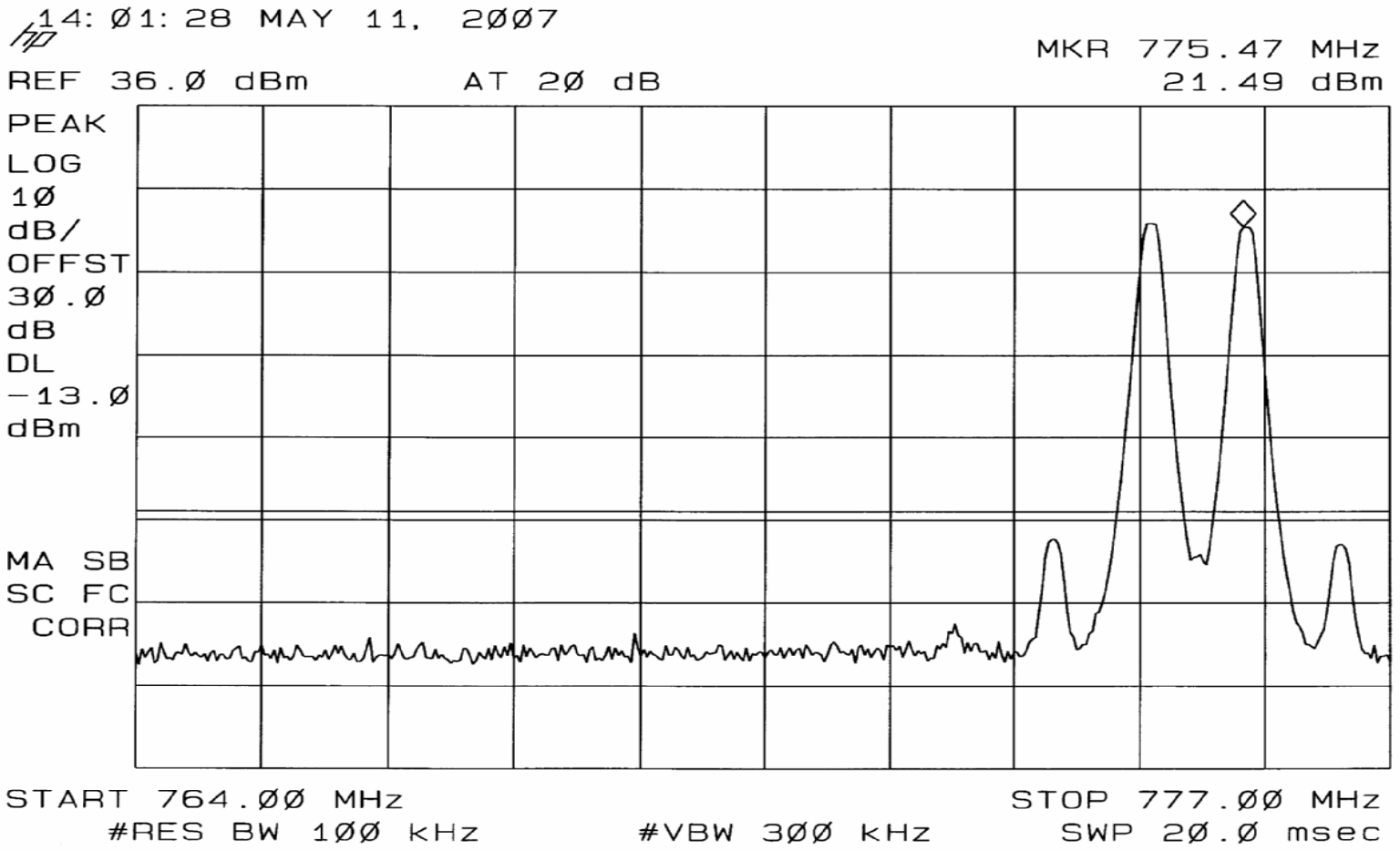
Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	FM - Uplink				



RETLIF TESTING LABORATORIES

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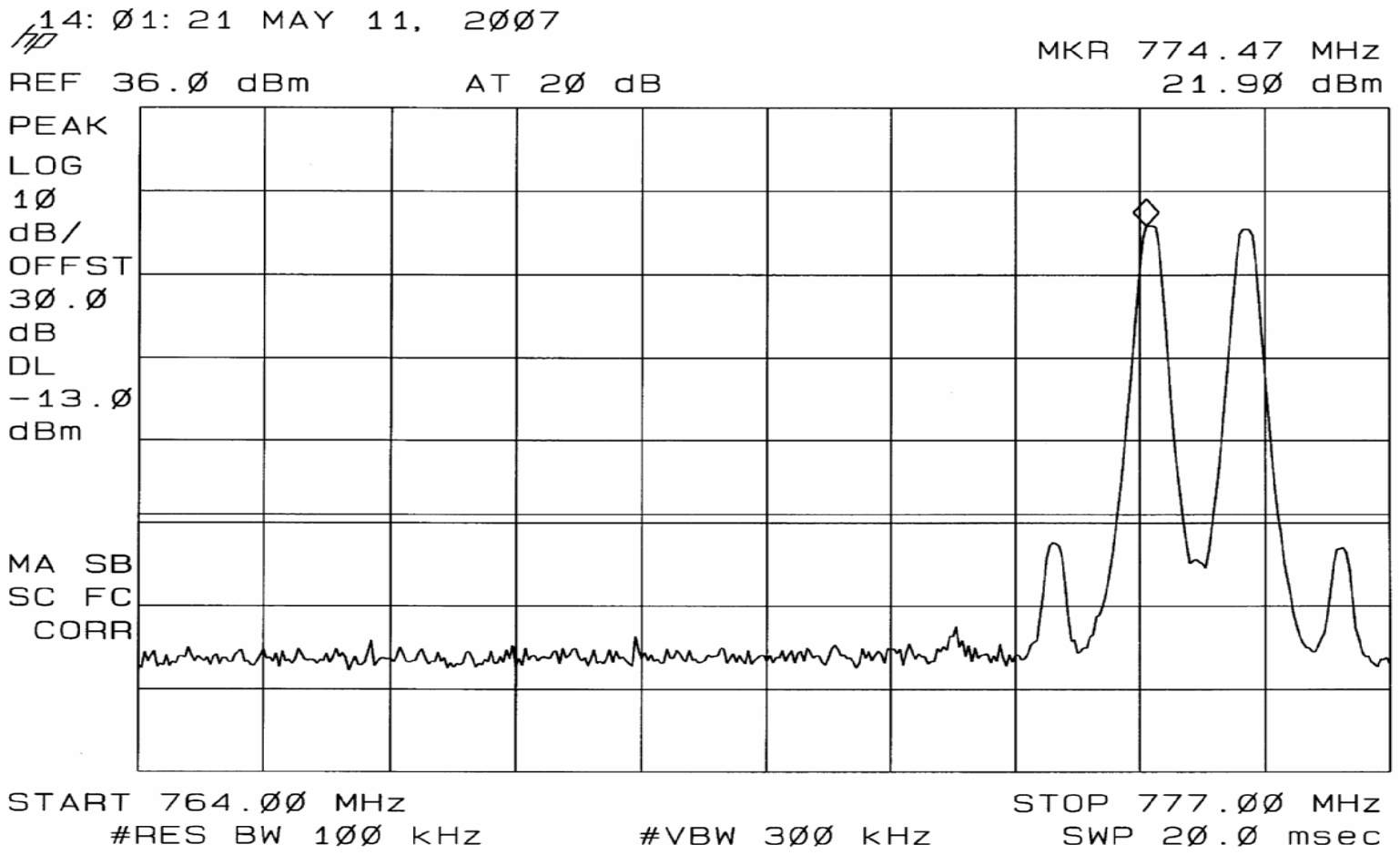
Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	FM - Uplink				



RETLIF TESTING LABORATORIES

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Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
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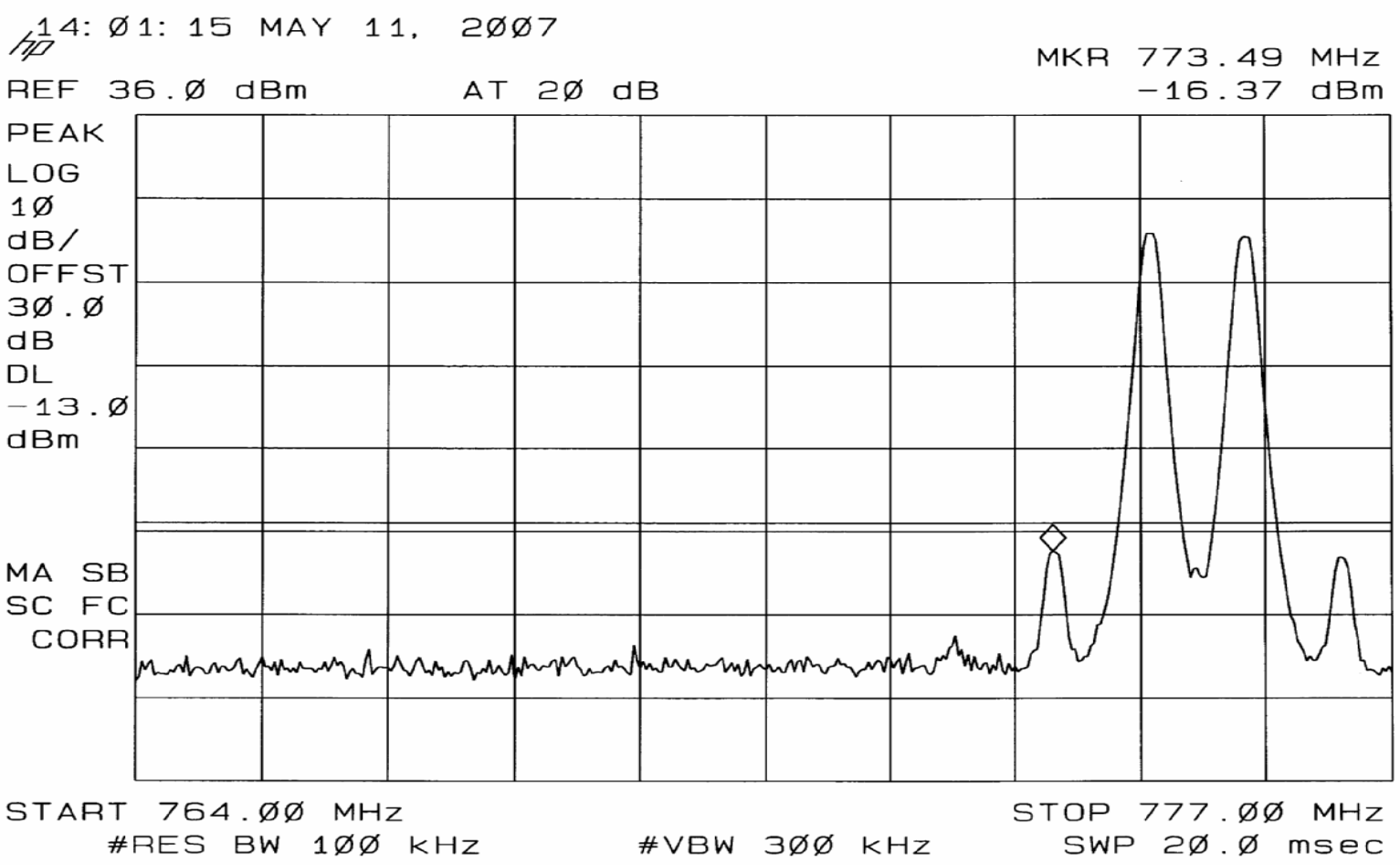
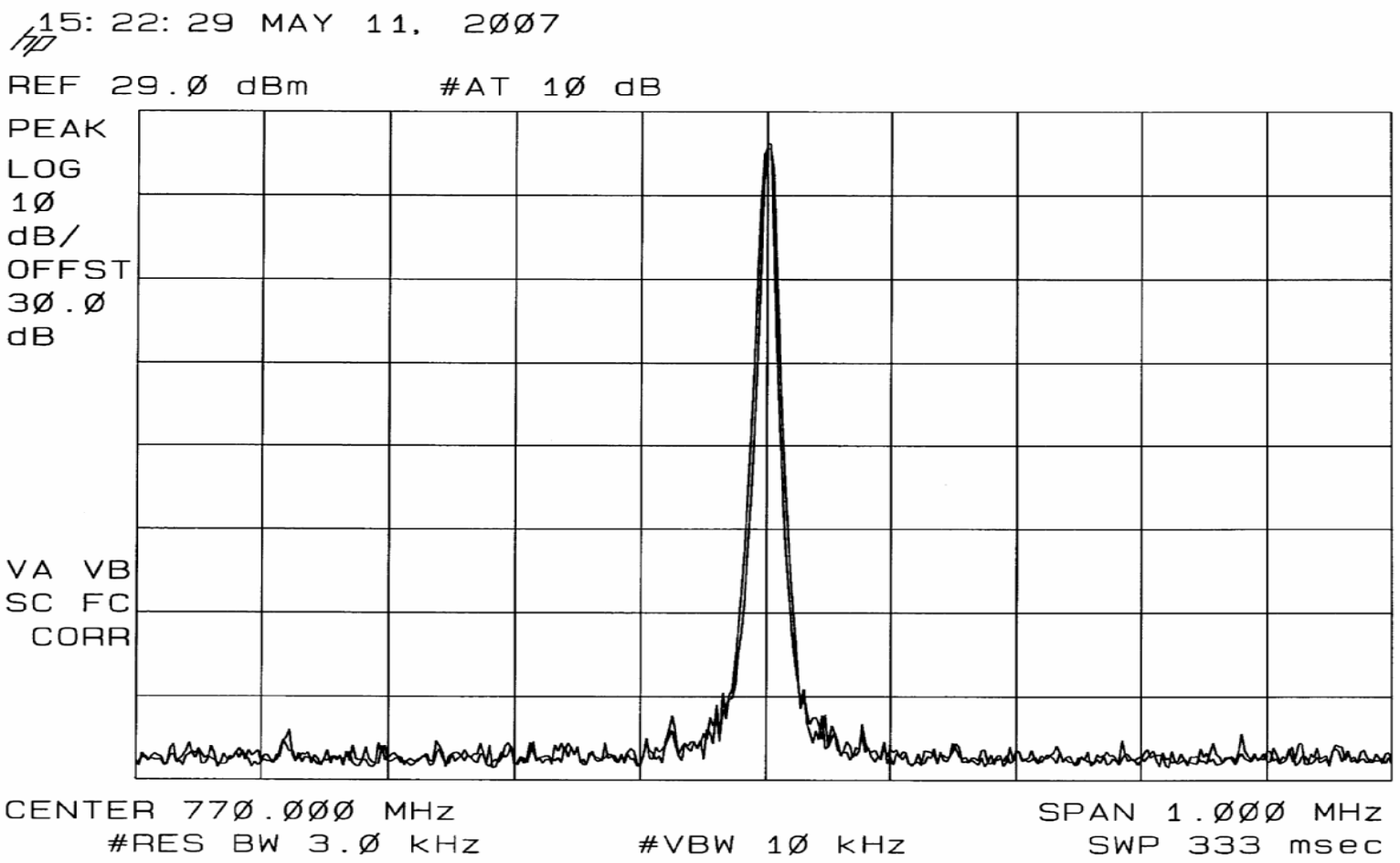
Test Specification:	FCC Part 2	Paragraph: 2.1047		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	FM - Uplink				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Occupied Bandwidth**				
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
Model No:	CSI-BDA51080-P7	**Serial No:**	ENG	**Technician:**	M.Seamans
Test Specification:	FCC Part 2	Paragraph: 2.1049		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	FM - Uplink - Output at 770 MHz				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Occupied Bandwidth**				
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
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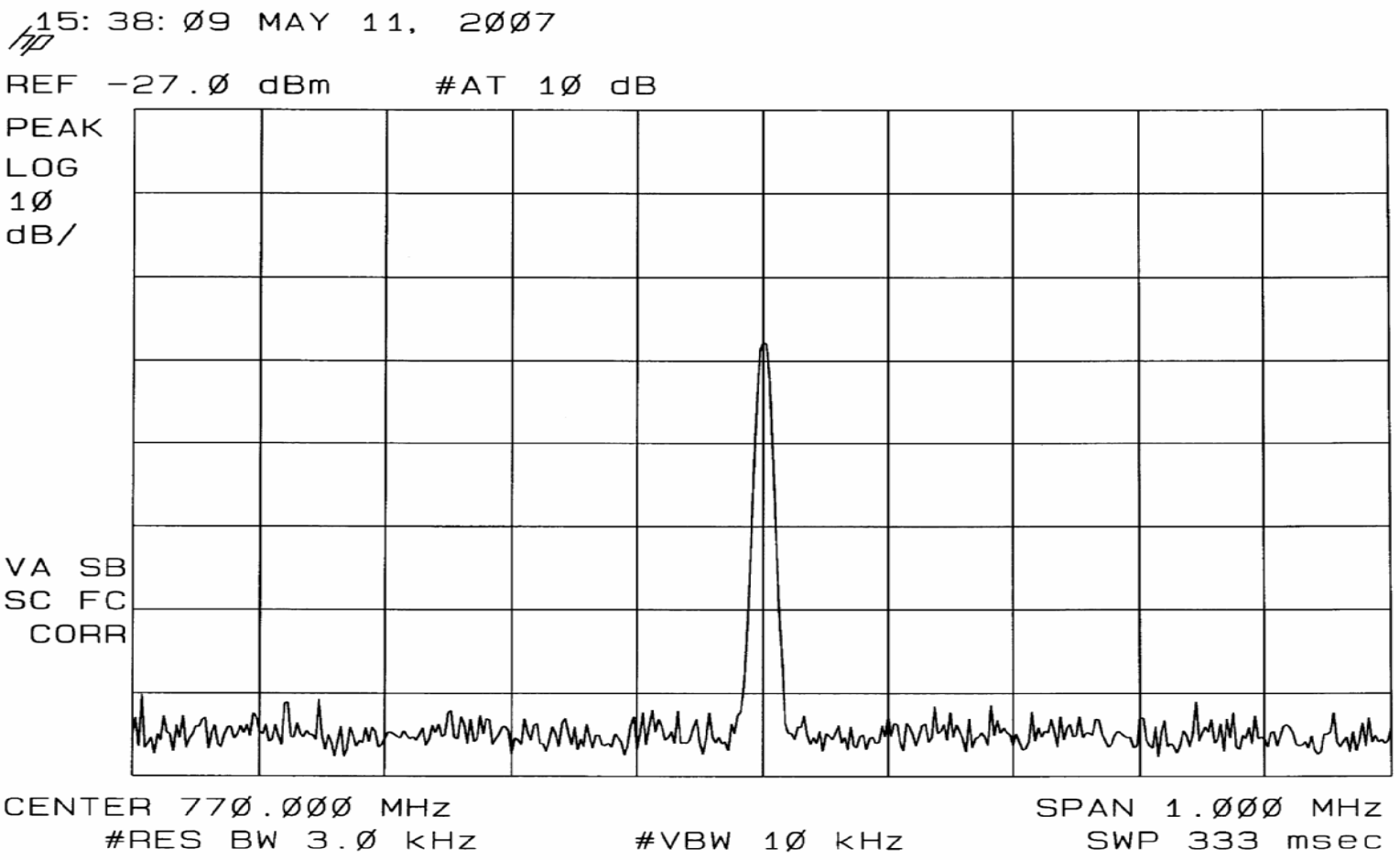
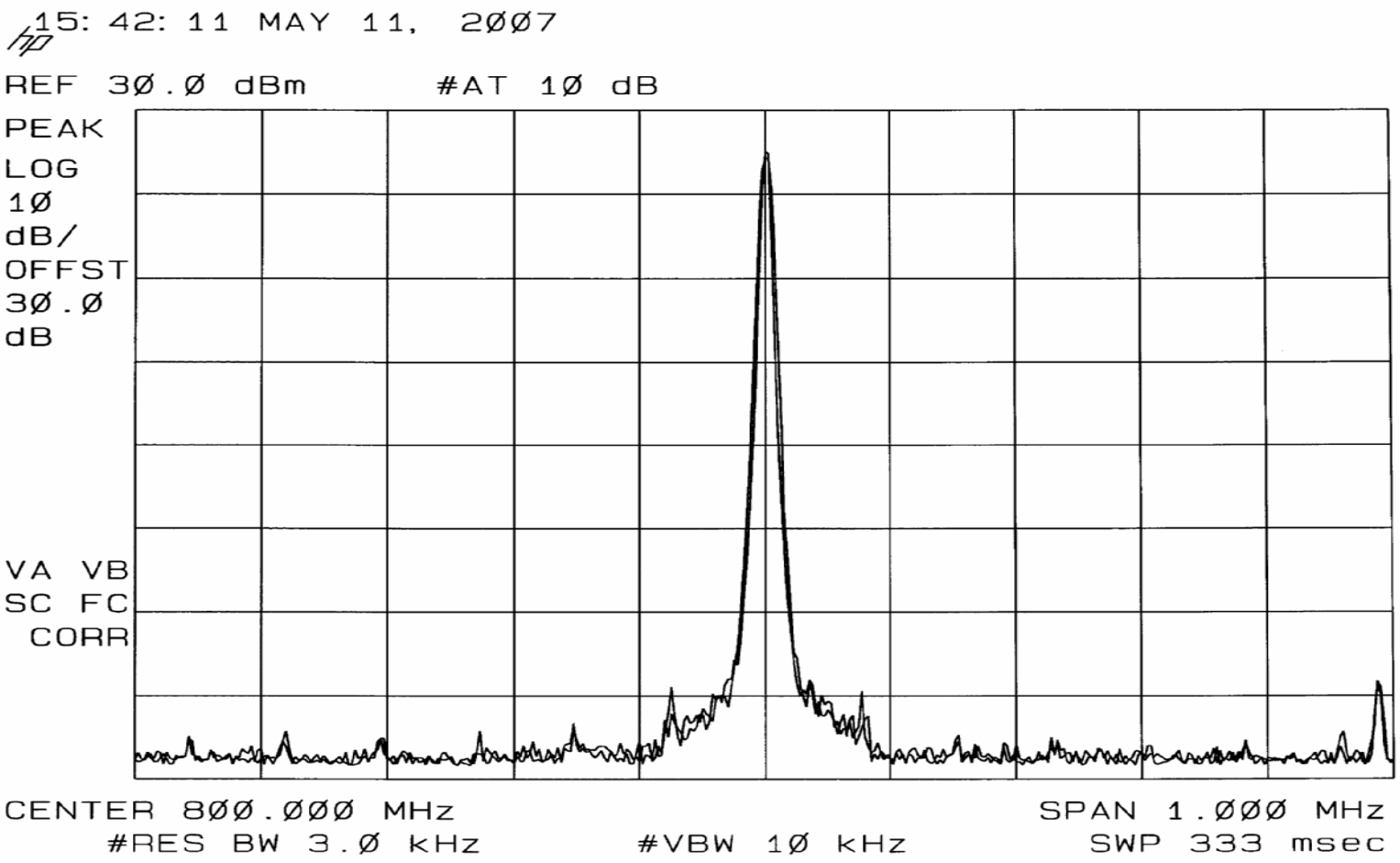
Test Specification:	FCC Part 2	Paragraph: 2.1049		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	FM - Uplink - Input at 770 MHz				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	**Occupied Bandwidth**				
Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
Model No:	CSI-BDA51080-P7	**Serial No:**	ENG	**Technician:**	M.Seamans
Test Specification:	FCC Part 2	Paragraph: 2.1049		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	FM - Downlink - Output at 800 MHz				



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

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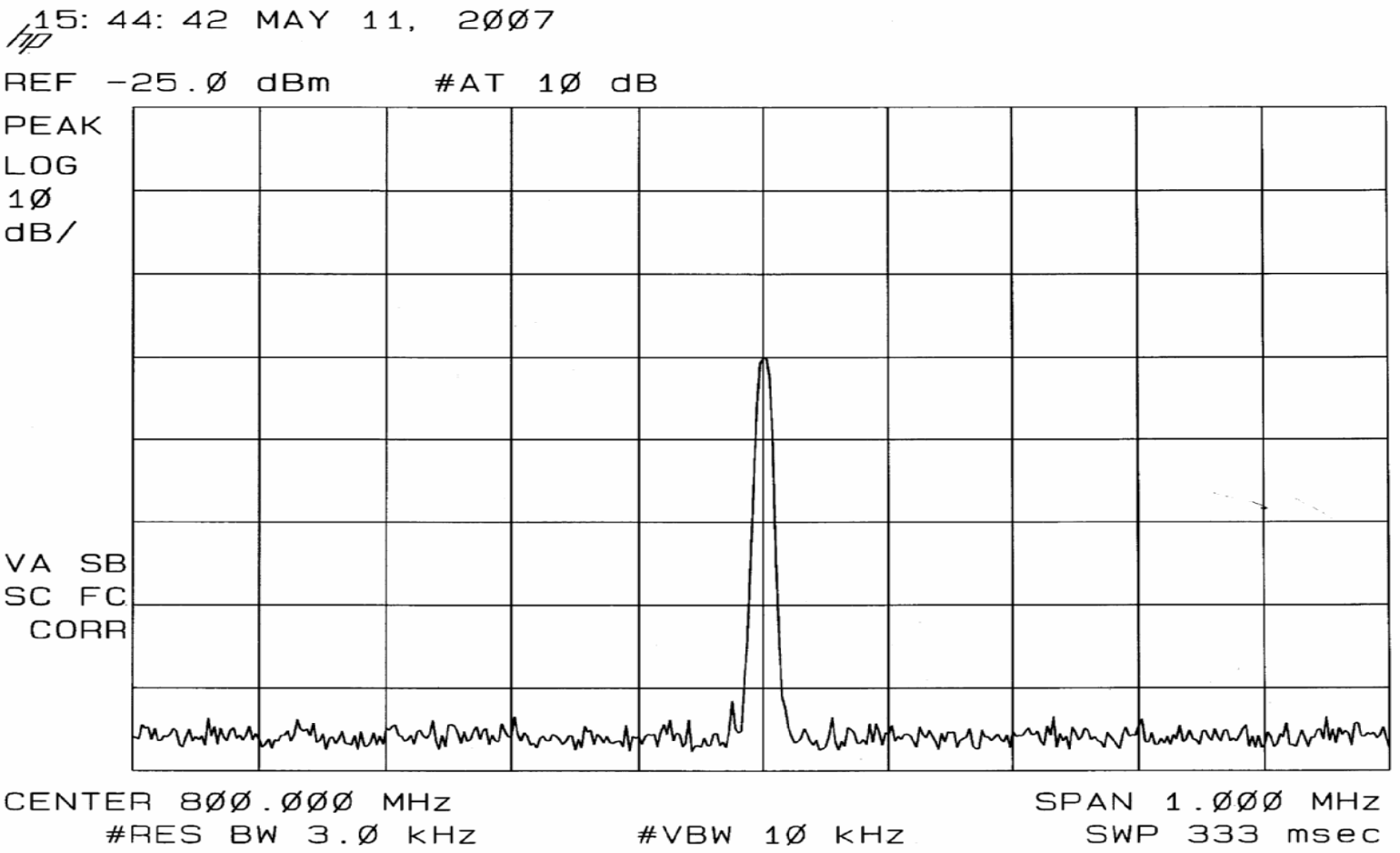
Test Specification:	FCC Part 2	Paragraph: 2.1049		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	FM - Downlink - Input at 800 MHz				



RETLIF TESTING LABORATORIES

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Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
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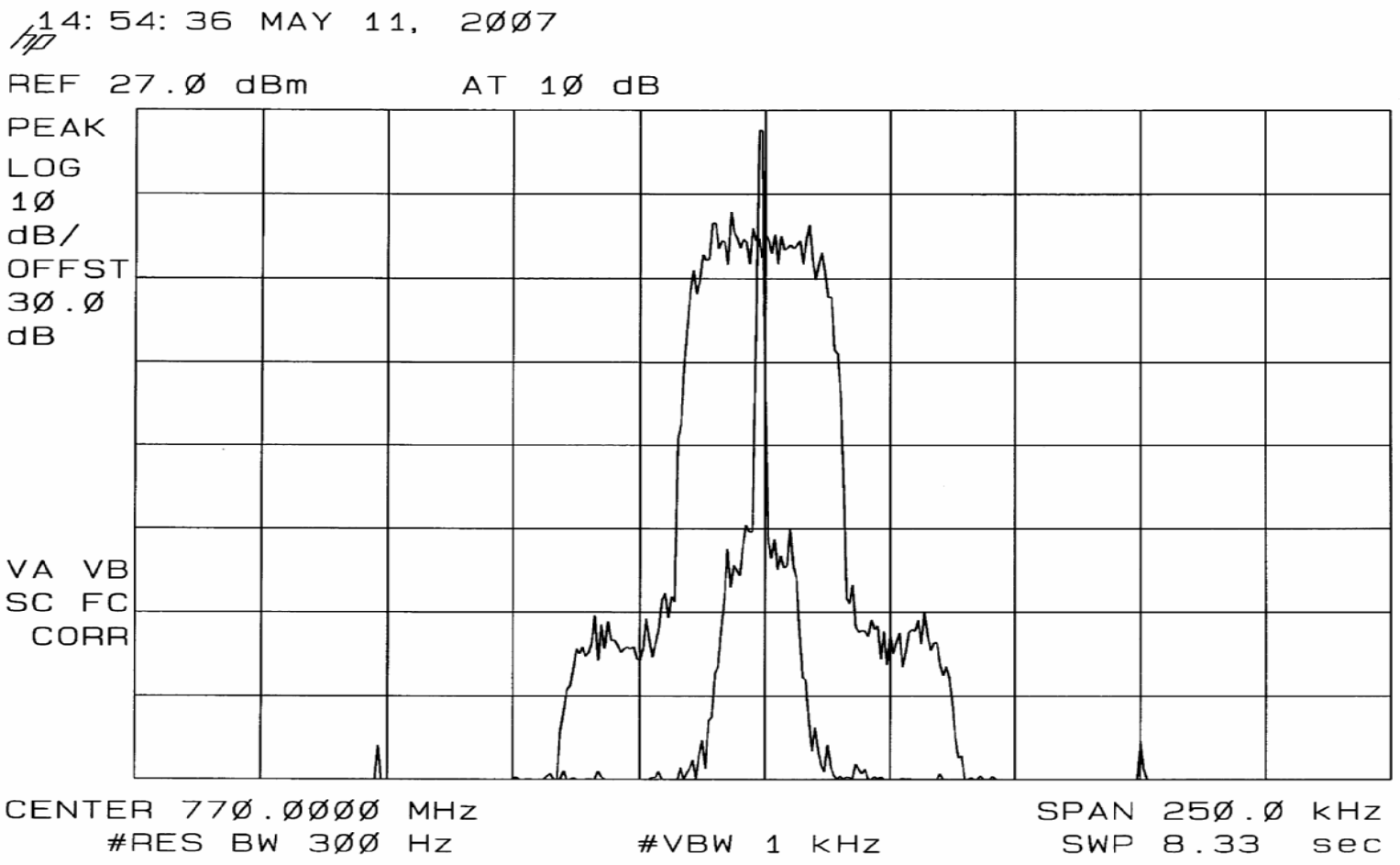
Test Specification:	FCC Part 2	Paragraph: 2.1049		**Date:**	5/14/2007
Operating Mode:	Amplifying input signal				
Notes:	TDMA - Uplink - Output at 770 MHz				



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Customer:	Cellular Specialties, Inc.	**Test Sample:**	Bidirectional Amplifier	**Job No:**	R-4816N
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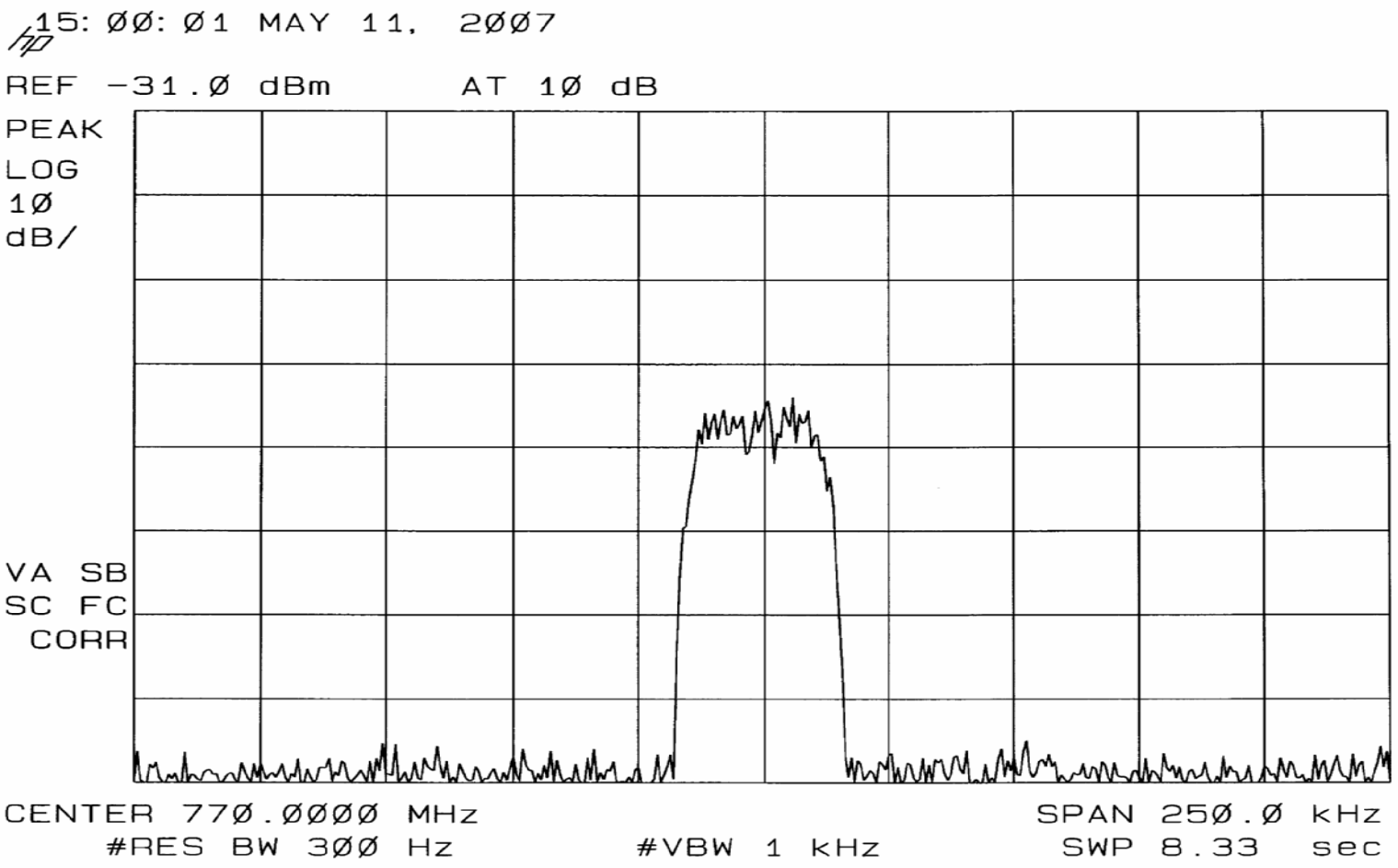

RETLIF TESTING LABORATORIES

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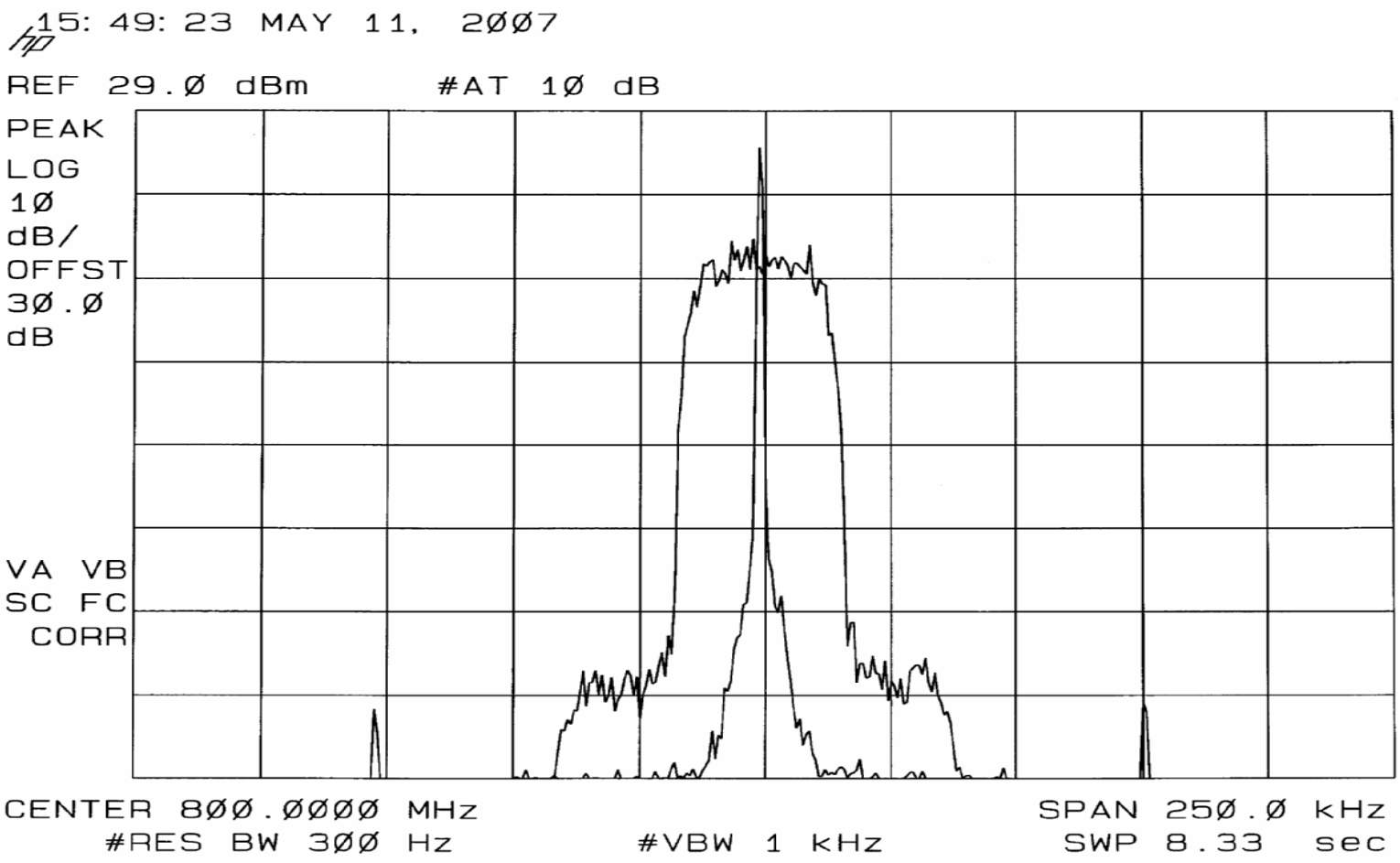

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