FCC Test Report

FCC Part 22,24 / RSS 132,133

FOR:

GSM Cellular Telephone with Bluetooth and WiFi

Model #: A1203

Apple Inc.
1 Infinite Loop Mail Stop26A
Cupertino, California 95014
U.S.A

FCC ID: BCGA1203

TEST REPORT #: EMC_ACIHO-010-06001 _FCC22_24
DATE: 2007-02-06

ACCREDITED
Certificate # 2135.01

Bluetooth Qualification Test Facility (BQTF)

Authorized Testing Laboratory

FCC listed# 101450

IC recognized # 3925

***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
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CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686
Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May

Table of Contents

1 Assessment

The following is in compliance with the applicable criteria specified in FCC rules Parts 2, 22 and 24 of Title 47 of the Code of Federal Regulations and in compliance with the applicable criteria specified in Industry Canada rules RSS132 and RSS133.

Company	Description	Model #
Apple Inc.	**GSM Cellular Telephone with Bluetooth and WiFi**	**A1203**

Technical responsibility for area of testing:

Date	Section	Name	Signature
2006-02-06	**EMC & Radio**	**Lothar Schmidt (Test Lab Manager)**	

The test results of this test report relate exclusively to the test item specified in Identification of the Equipment under Test. The CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	**CETECOM Inc.**
Department:	**EMC**
Address:	**411 Dixon Landing Road Milpitas, CA 95035 U.S.A.**
Telephone:	**+1 (408) 586 6200**
Fax:	**+1 (408) 586 6299**
Responsible Test Lab Manager:	**Lothar Schmidt**
Responsible Project Leader:	**Peter Krebill**
Date of test:	**1/26/2006 to 2/5/2007**

2.2 Identification of the Client

Applicant's Name:	**Apple Inc.**
Street Address:	**1 Infinite Loop Mail Stop26A**
City/Zip Code	**Cupertino, California 95014**
Country	**USA**
Contact Person:	**Robert Steinfeld**
Phone No.	**408-974-2618**
Fax:	**408-862-5061**
e-mail:	**steinfe1@apple.com**

2.3 Identification of the Manufacturer

Manufacturer's Name:	**Same as applicant**

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	**A1203**
Description:	**GSM Cellular Telephone with Bluetooth and Wifi**
Model No:	**A1203**
Hardware Revision :	**M68 DVT**
Software Revision :	**M68 DVT**
FCC ID:	**BCGA1203**
Frequency Range:	**824.2MHz – 848.8MHz for GSM 850** **1850.2MHz – 1909.8MHz for PCS 19002**
Type(s) of Modulation:	**GMSK**
Number of Channels:	**124 for GSM-850, 299 for PCS-1900**
Antenna Type:	**Patch Antenna**
Max. Output Power:	**Conducted : see page 9, please** **Radiated : see page 17, please** **ERP 25.95dBm (0.394W) @ 824.2MHz** **EIRP 31.86dBm (1.535W) @1880MHz**

3.2 Identification of the Equipment Under Test (EUT)

EUT #	TYPE	MANF.	MODEL	SERIAL #
1	A1203	Apple Inc.	A1203	UNIT 1
2	A1203	Apple inc.	A1203	UNIT 2

Subject of Investigation

All testing was performed on the EUT listed in Section 3. The EUT was maximized in the X,Y, Z positions , all data in this report shows the worst case between horizontal and vertical polarization for above 1GHz.

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in FCC rules Parts 2, 22 and 24 of Title 47 of the Code of Federal Regulations. The maximization of portable equipment is conducted in accordance with ANSI C63.4.

4 Measurements

4.1 RF Power Output

4.1.1 FCC 2.1046 Measurements required: RF power output.

Power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on circuit elements as specified. The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

4.1.2 Limits:

4.1.2.1 FCC 22.913 (a) Effective radiated power limits.

The effective radiated power (ERP) of mobile transmitters must not exceed 7 Watts.

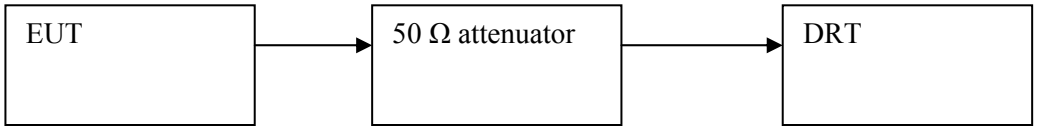
4.1.2.2 FCC 24.232 (b)(c) Power limits.

(b) Mobile/portable stations are limited to 2 Watts effective isotropic radiated power (EIRP).
(c) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms equivalent voltage. The measurement results shall be properly adjusted for any limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement over the full bandwidth of the channel.

4.1.3 Conducted Output Power Measurement procedure:

Based on TIA-603C 2004

2.2.1 Conducted Carrier Output Power Rating



1. Connect the equipment as shown in the above diagram. A Digital Radiocommunication Tester (DRT) is used to enable the EUT to transmit and to measure the output power.
2. Adjust the settings of the DRT to set the EUT to its maximum power at the required channel.
3. Record the output power level measured by the DRT.
4. Correct the measured level for all losses in the RF path.
5. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

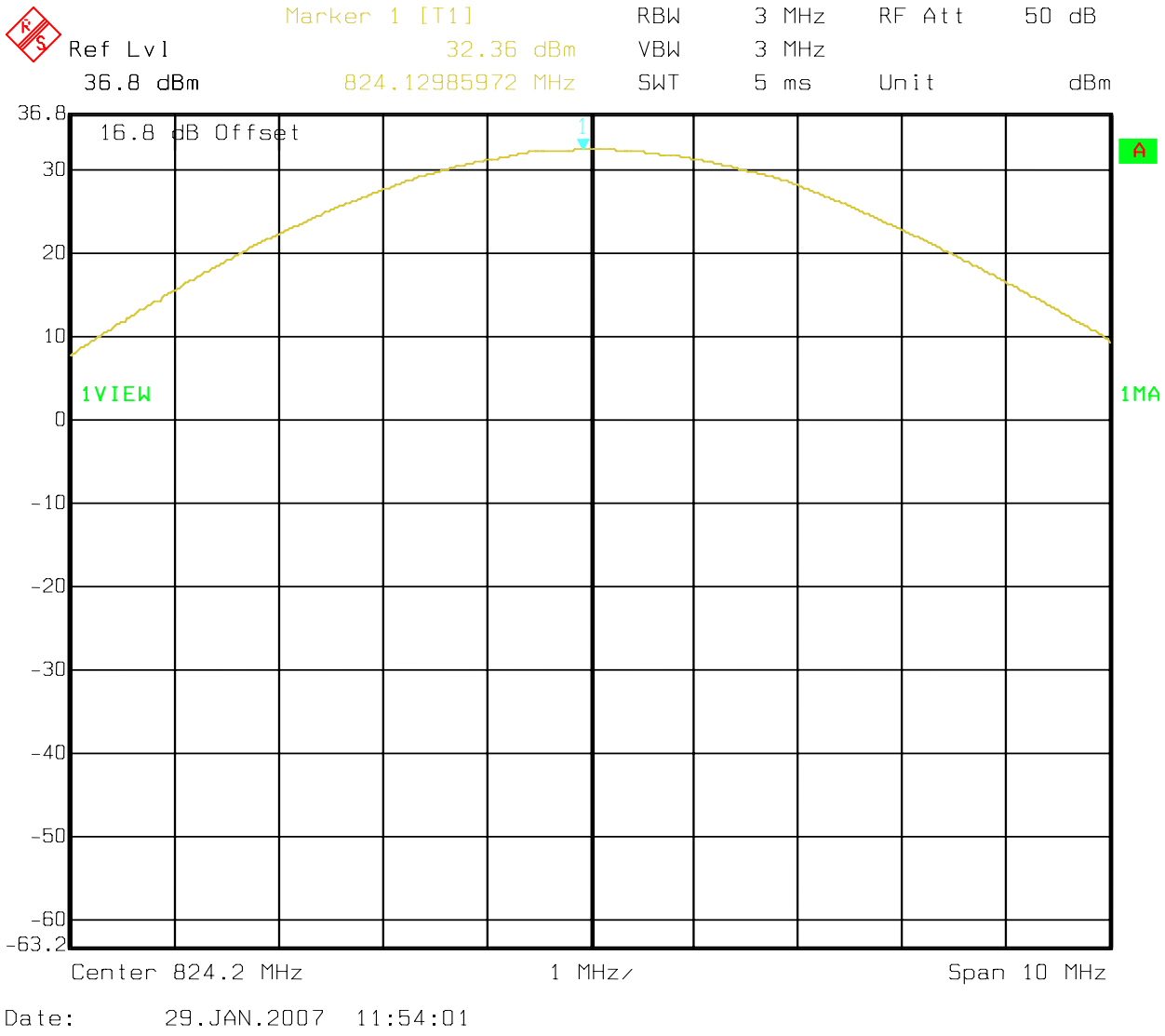
4.1.4 Results 850 MHz band (conducted):

Frequency (MHz)	Conducted Output Power (dBm)
	GPRS
824.2	32.36
836.6	32.38
848.8	32.25

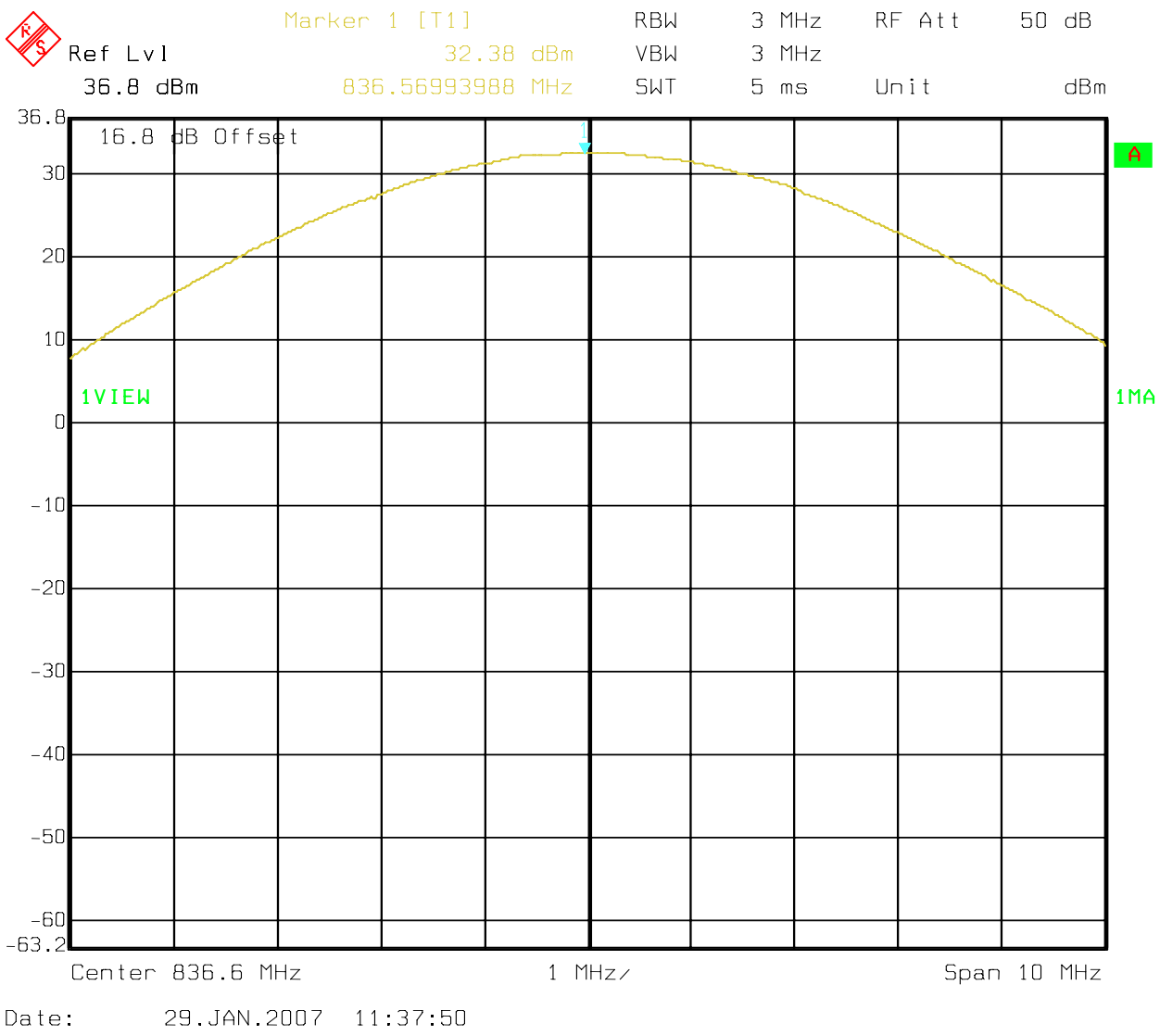
4.1.5 Results 1900 MHz band (conducted):

Frequency (MHz)	Conducted Output Power (dBm)
	GPRS
1850.2	29.48
1880.0	29.39
1909.8	29.08

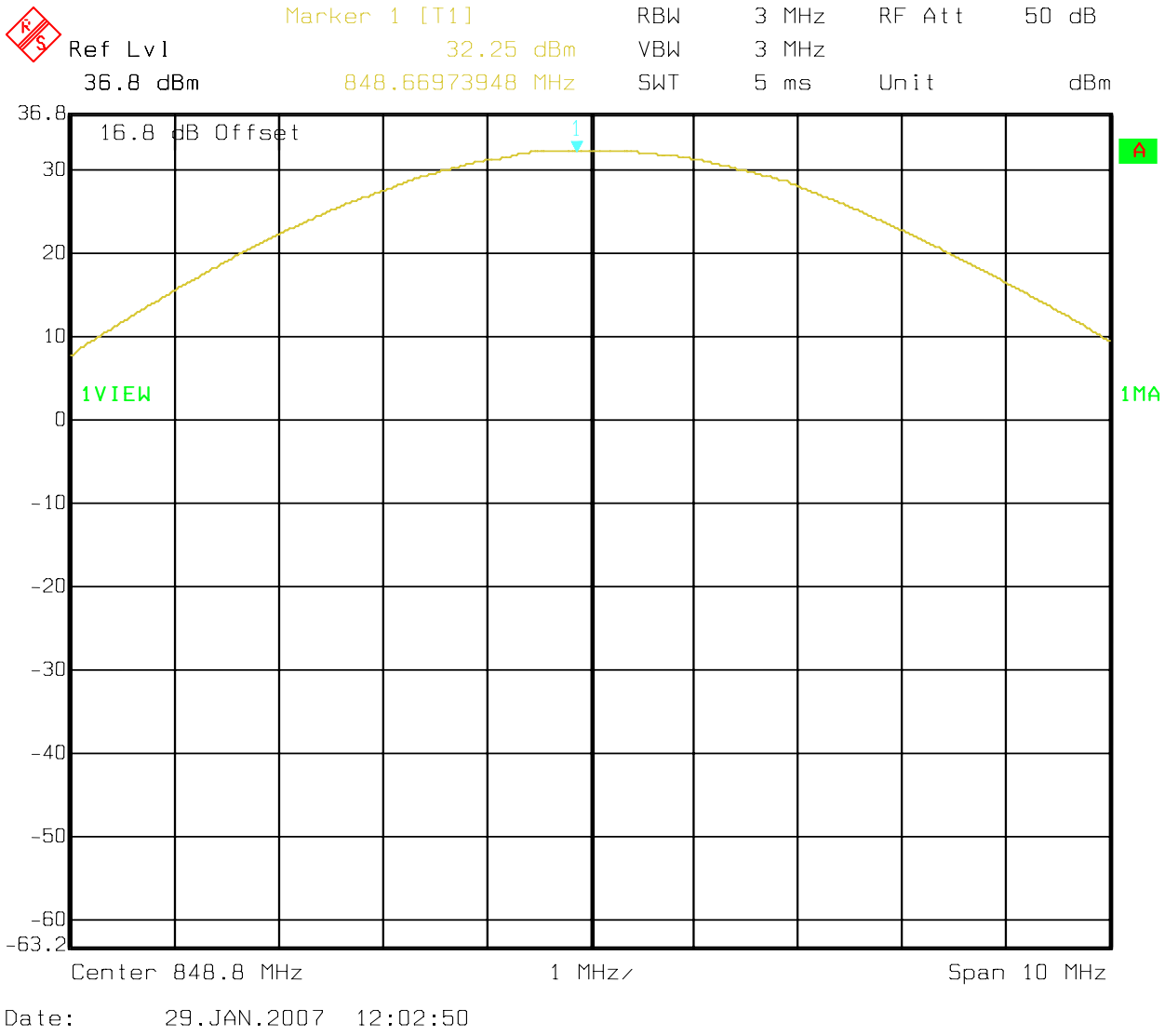
RF OUTPUT POWER (GSM-850)
CHANNEL 128 GPRS



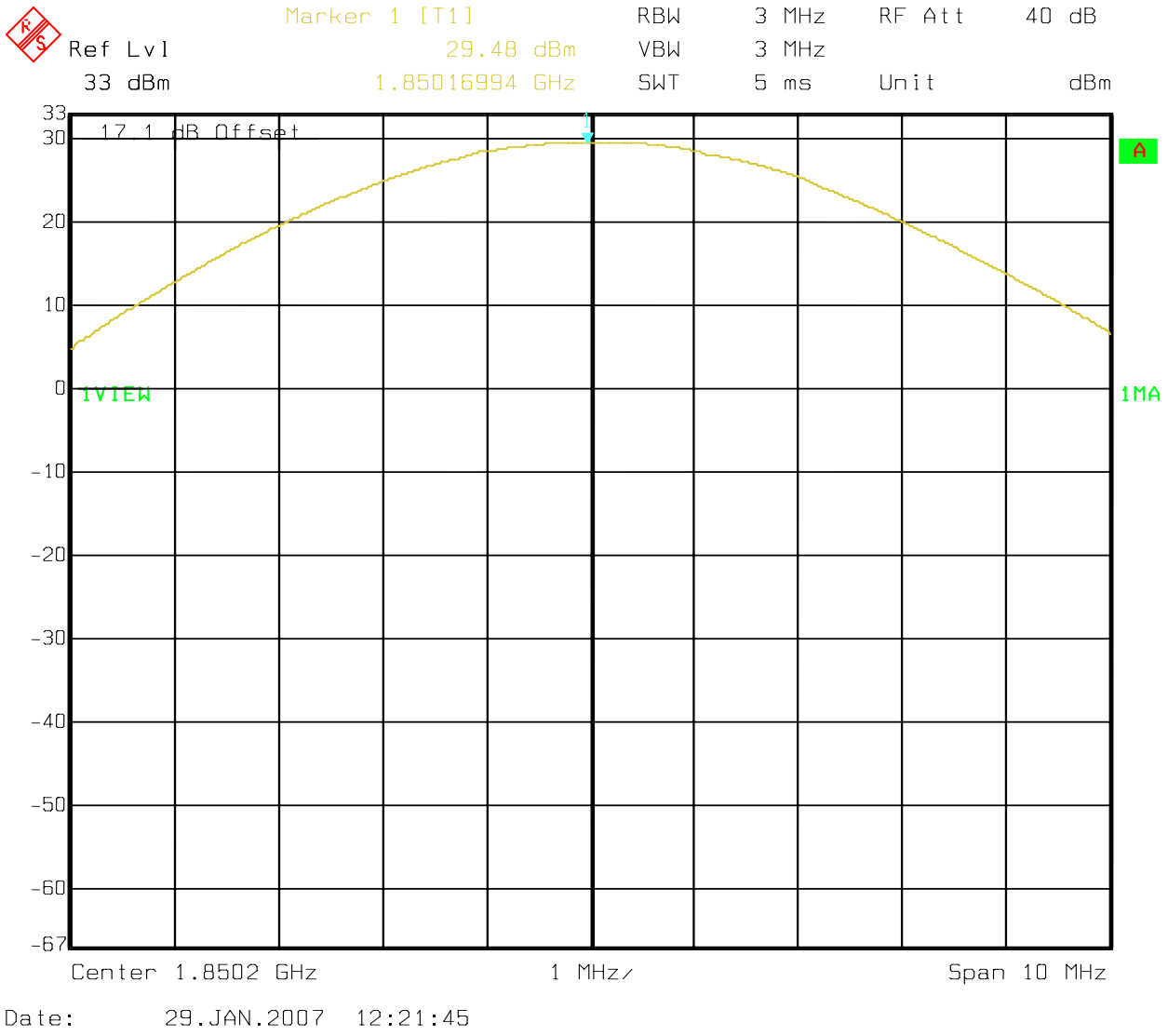
RF OUTPUT POWER (GSM-850)
CHANNEL 190 GPRS



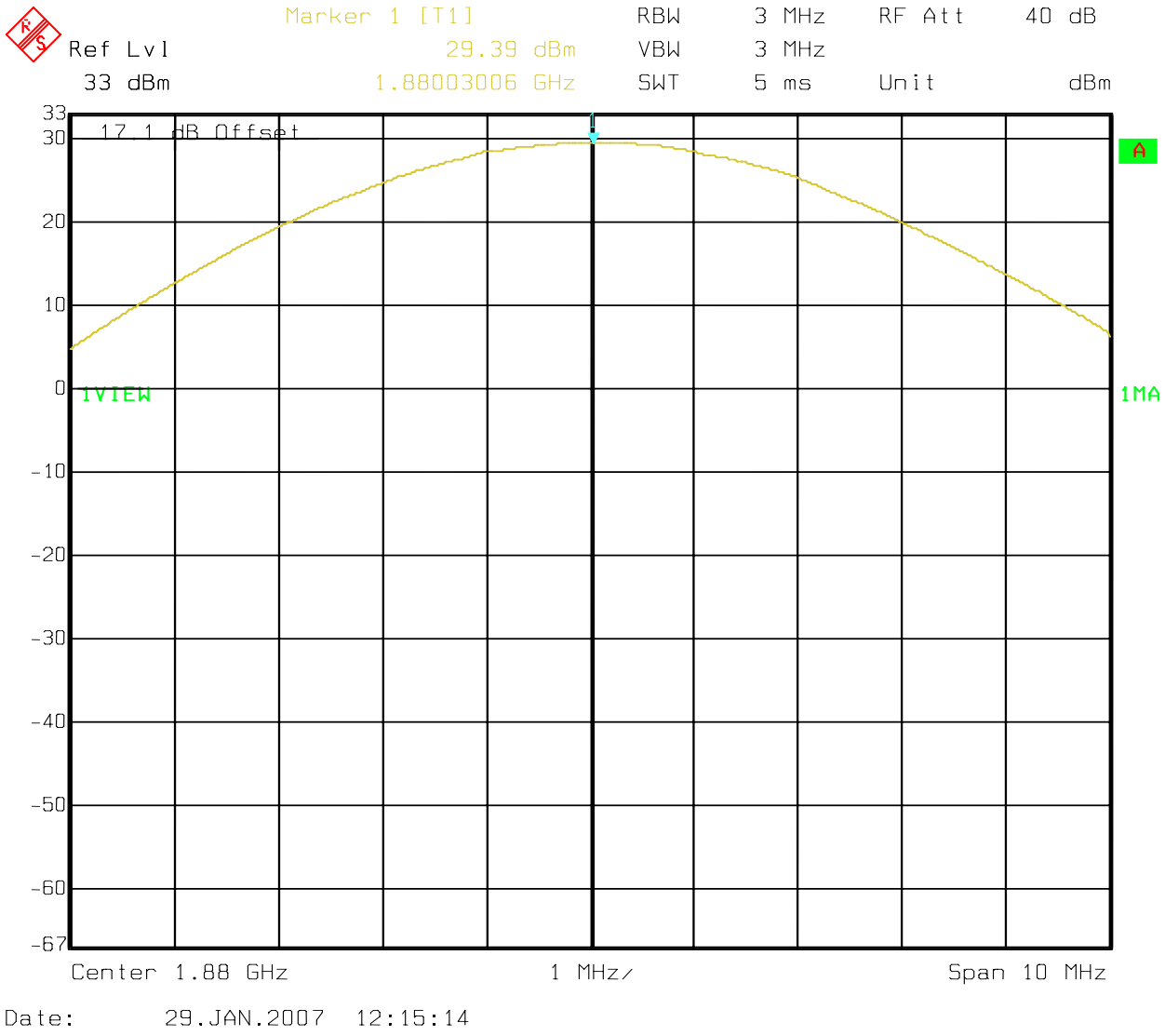
RF OUTPUT POWER (GSM-850)
CHANNEL 251 GPRS



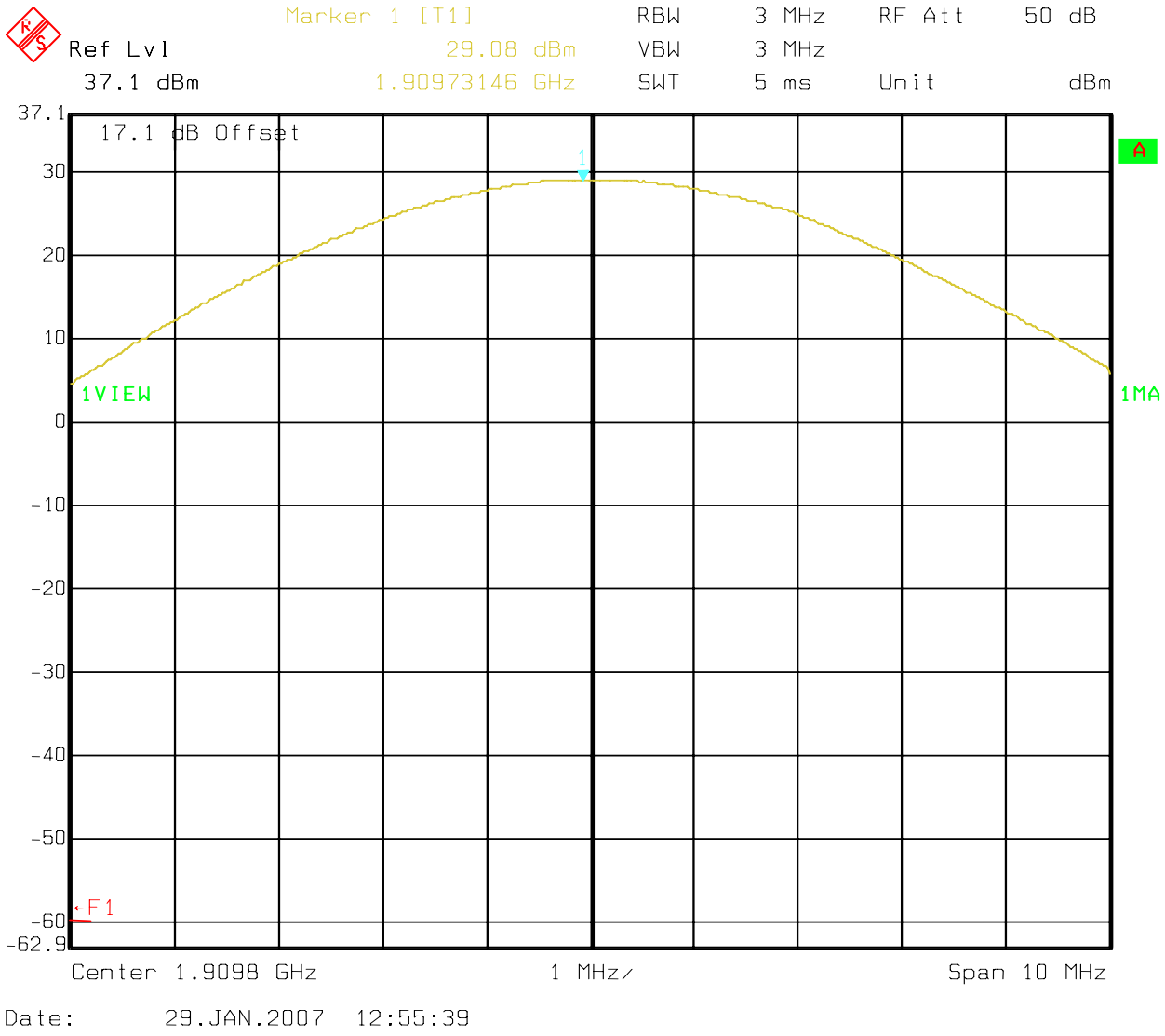
RF OUTPUT POWER (PCS-1900)
CHANNEL 512 GPRS



RF OUTPUT POWER (PCS-1900)
CHANNEL 661 GPRS



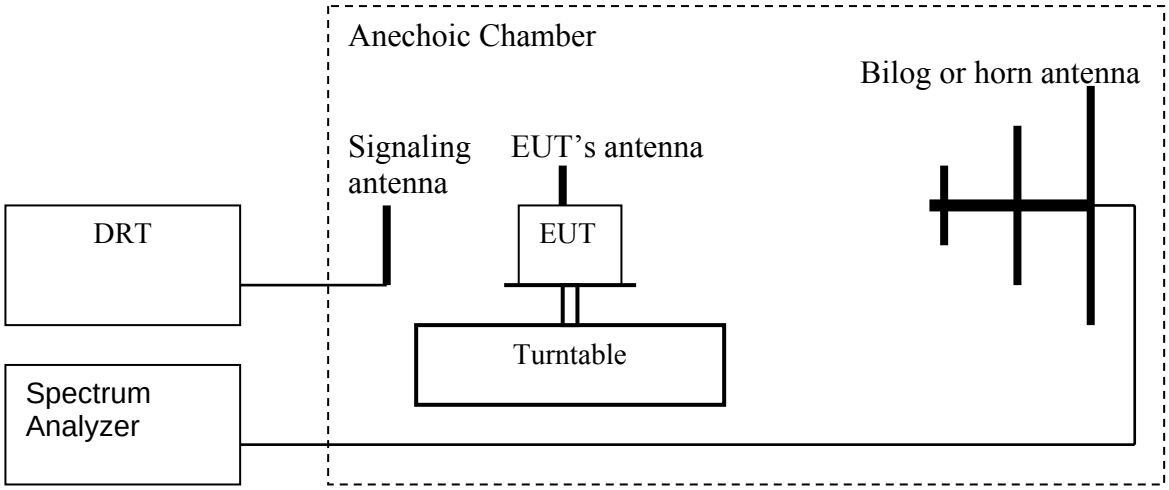
RF OUTPUT POWER (PCS-1900)
CHANNEL 810 GPRS



4.1.6 Radiated Output Power measurement procedure:

Based on TIA-603C 2004

2.2.17.2 Effective Radiated Power (ERP) or Effective Isotropic Radiated Power (EIRP)



1. Connect the equipment as shown in the above diagram with the EUT's antenna in a vertical orientation.
2. Adjust the settings of the Digital Radiocommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to the channel frequency. Set the analyzer to measure peak hold with the required settings.
4. Rotate the EUT 360°. Record the peak level in dBm (**LVL**).
5. Replace the EUT with a vertically polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS)**. **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the ERP using the following equation:
   ERP (dBm) = **LVL** (dBm) + **LOSS** (dB)
8. Determine the EIRP using the following equation:
   EIRP (dBm) = **ERP** (dBm) + 2.14 (dB)
9. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band. **Spectrum analyzer settings = rbw=vbw=3MHz**

(**note:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4, 7 and 8 above are performed with test software.)

4.1.7 ERP Results 850 MHz band:

Power Control Level	Burst Peak ERP
5	≤38.45dBm (7W)

Frequency (MHz)	Effective Radiated Power (dBm)
	GPRS
824.2	25.95
836.6	25.73
848.8	25.95

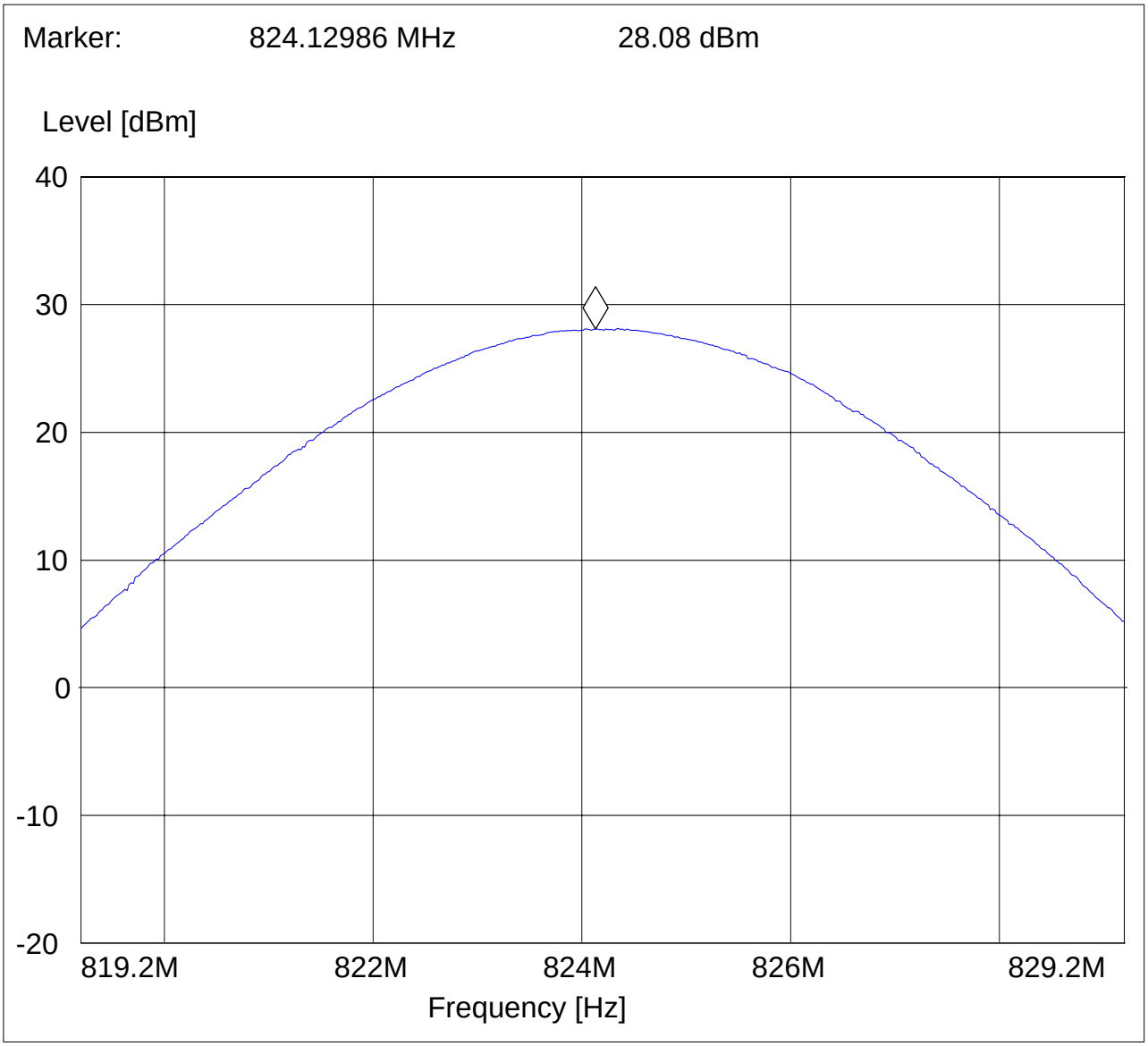
4.1.8 EIRP Results 1900 MHz band:

Power Control Level	Burst Peak EIRP
0	≤33dBm (2W)

Frequency (MHz)	Effective Isotropic Radiated Power (dBm)
	GPRS
1850.2	29.47
1880.0	31.86
1909.8	30.94

EIRP (GSM 850) **§22.913(a)**
CHANNEL 128 GPRS

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA
EUT::
Customer:: ACI
Test Mode: GSM 850 ch 128
Ant Orientation: V
EUT Orientation: V
Test Engineer: Ed
Voltage:: AC Adapter
Comments:: 108° rotation

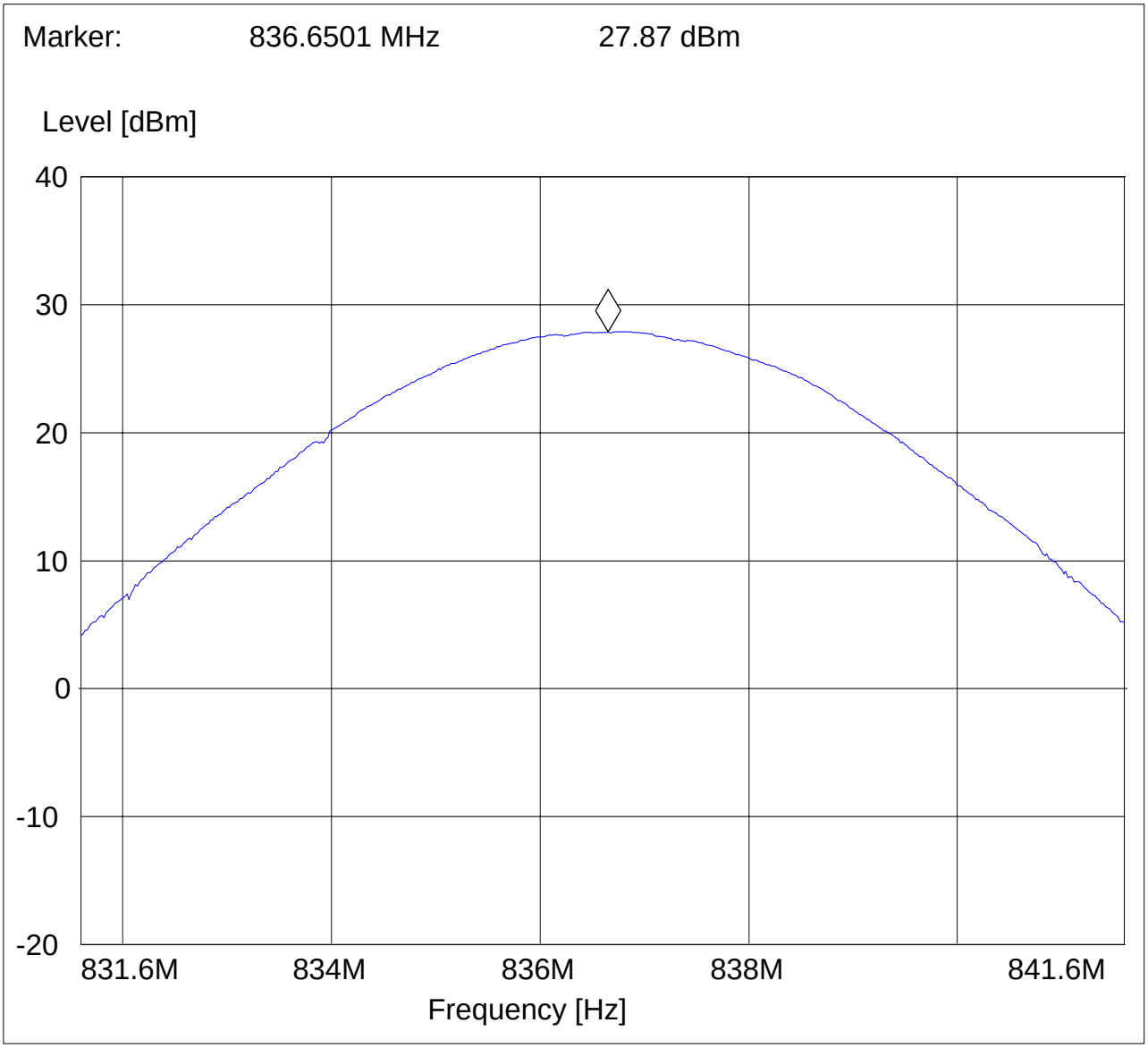


EIRP (GSM 850) **§22.913(a)**
CHANNEL 190 GPRS

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM 850 ch 190
Ant Orientation: V
EUT Orientation: V
Test Engineer: Ed
Voltage:: AC Adapter
Comments:: 108° rotation

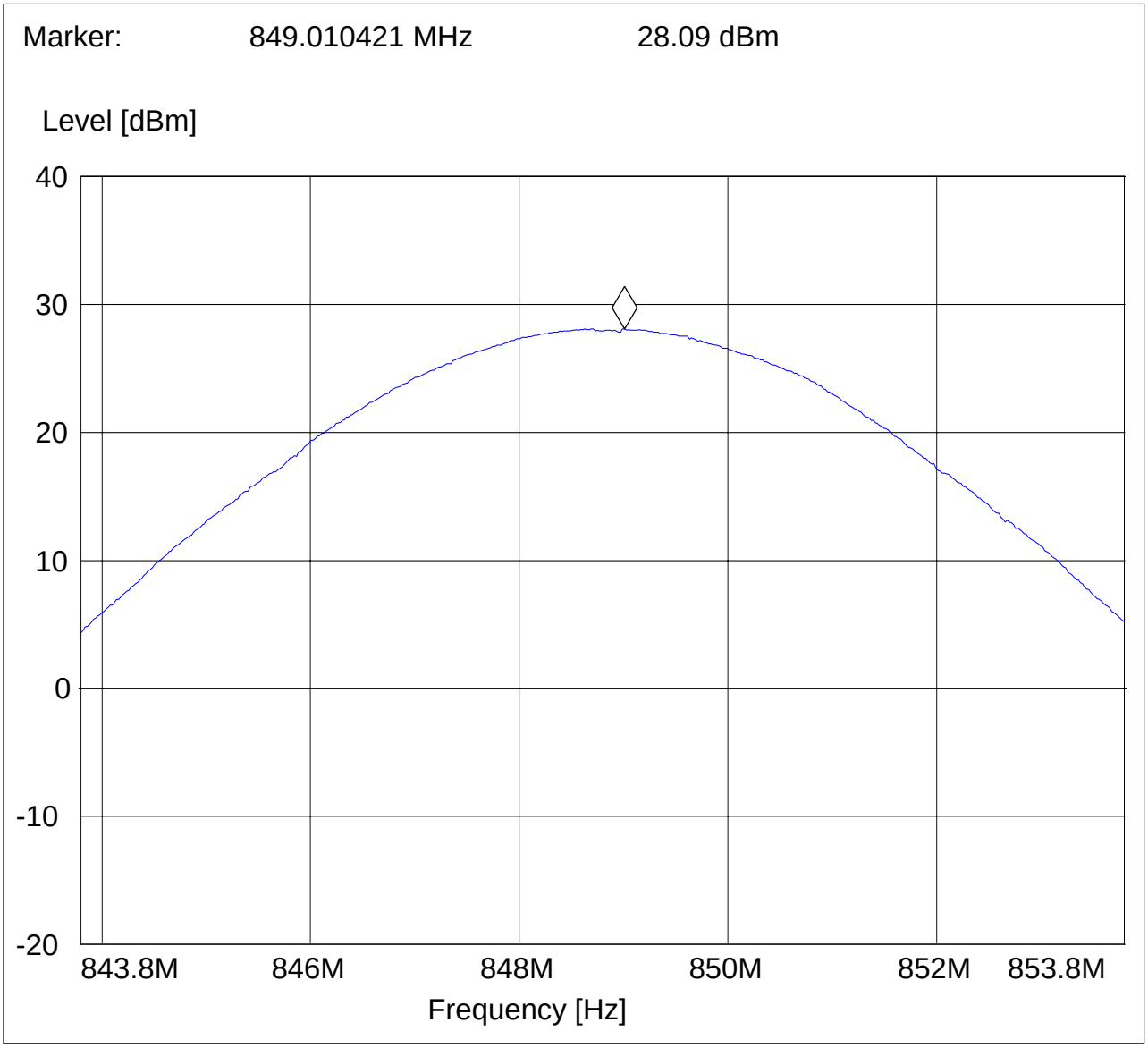
SWEEP TABLE: "EIRP 850 CH 190 V"



EIRP (GSM 850) **§22.913(a)**
CHANNEL 251 GPRS

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA
EUT::
Customer:: ACI
Test Mode: GSM 850 ch 251
Ant Orientation: V
EUT Orientation: V
Test Engineer: Ed
Voltage:: AC Adapter
Comments:: 108° rotation

SWEEP TABLE: "EIRP 850 CH 251 V"

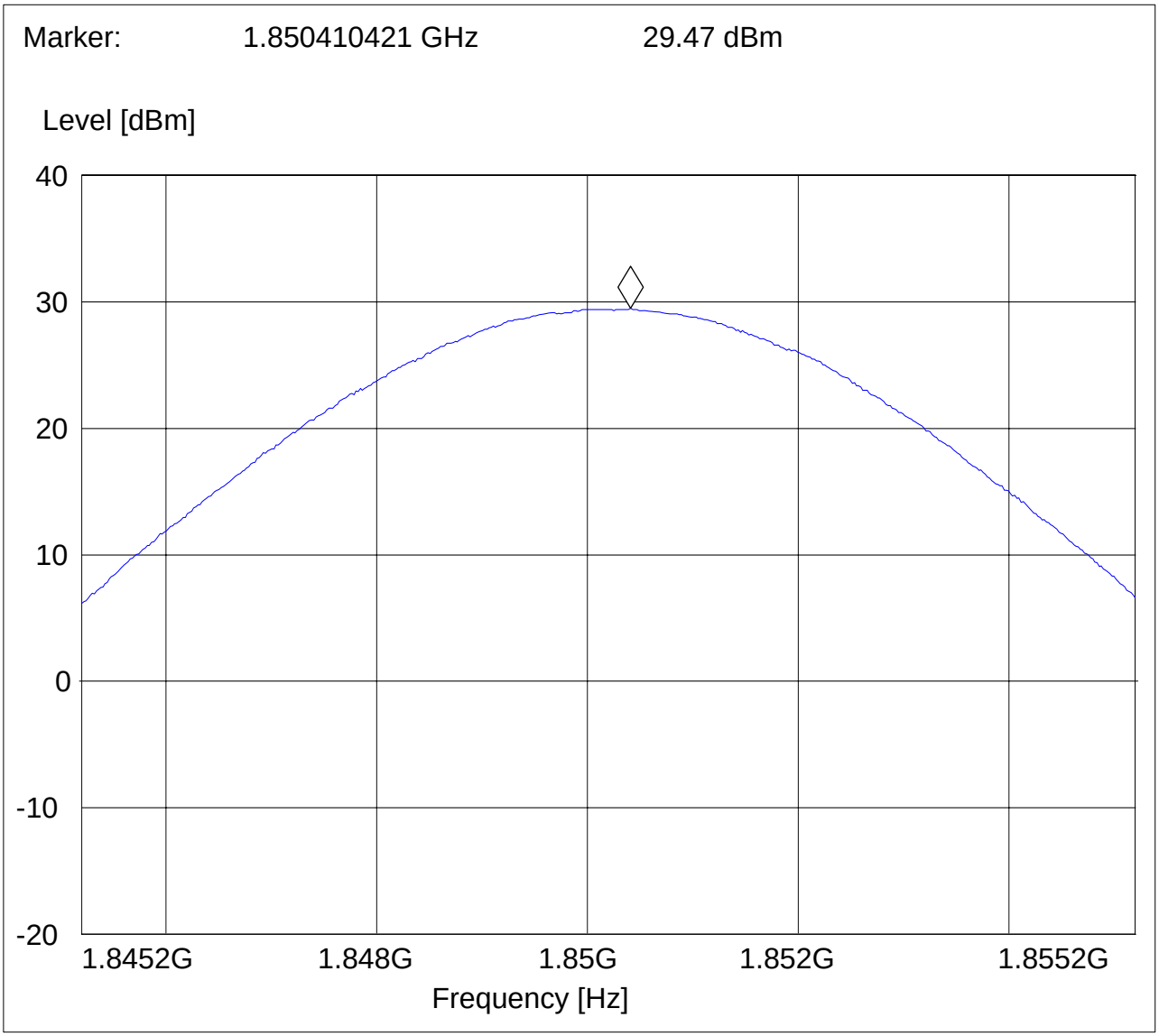


EIRP (PCS-1900) **§24.232(b)**
CHANNEL 512 GPRS

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM1900 CH 512
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "EIRP 1900 CH512"

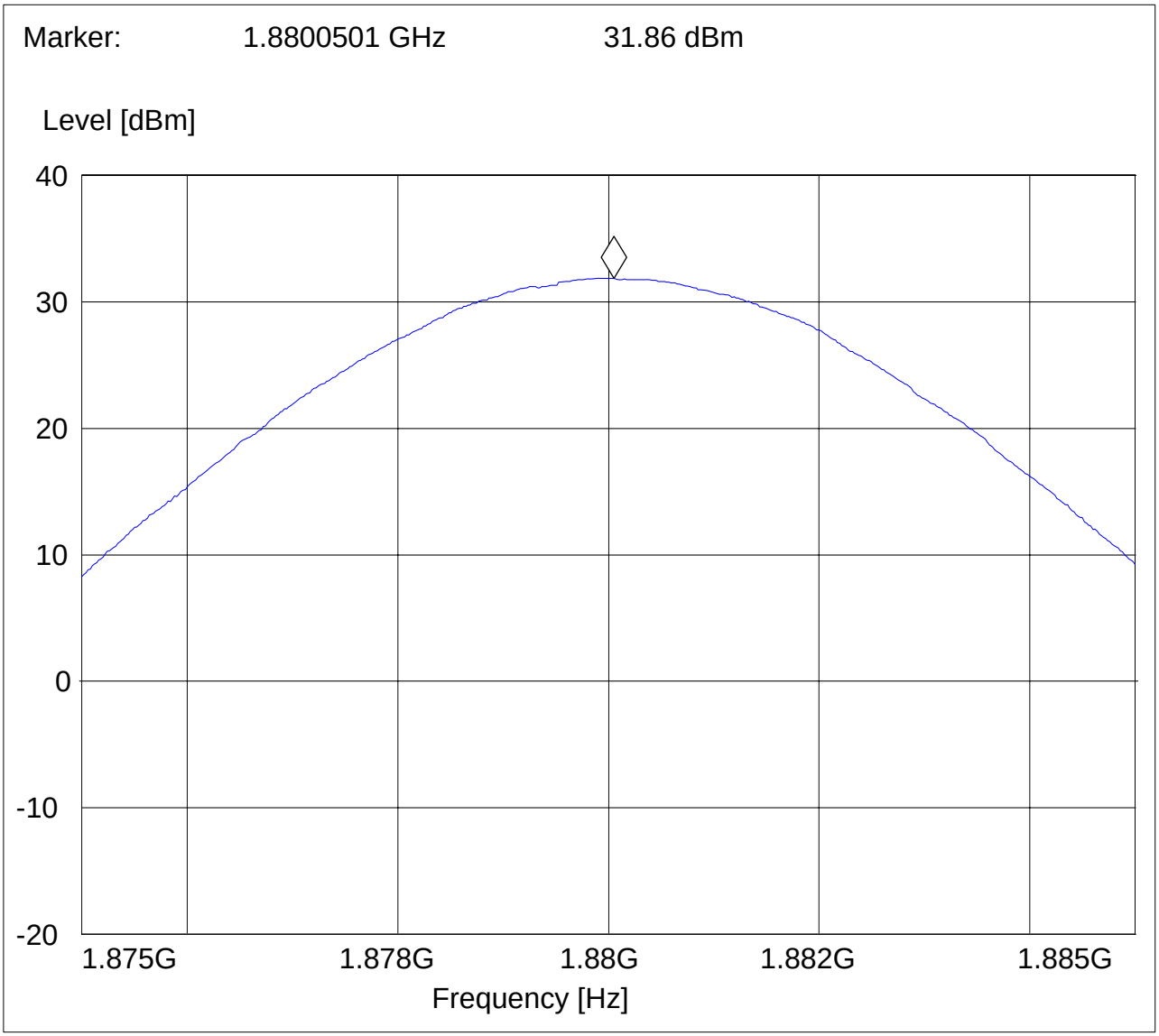


EIRP (PCS-1900) **§24.232(b)**
CHANNEL 661 GPRS

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM1900 CH 661
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "EIRP 1900 CH661"

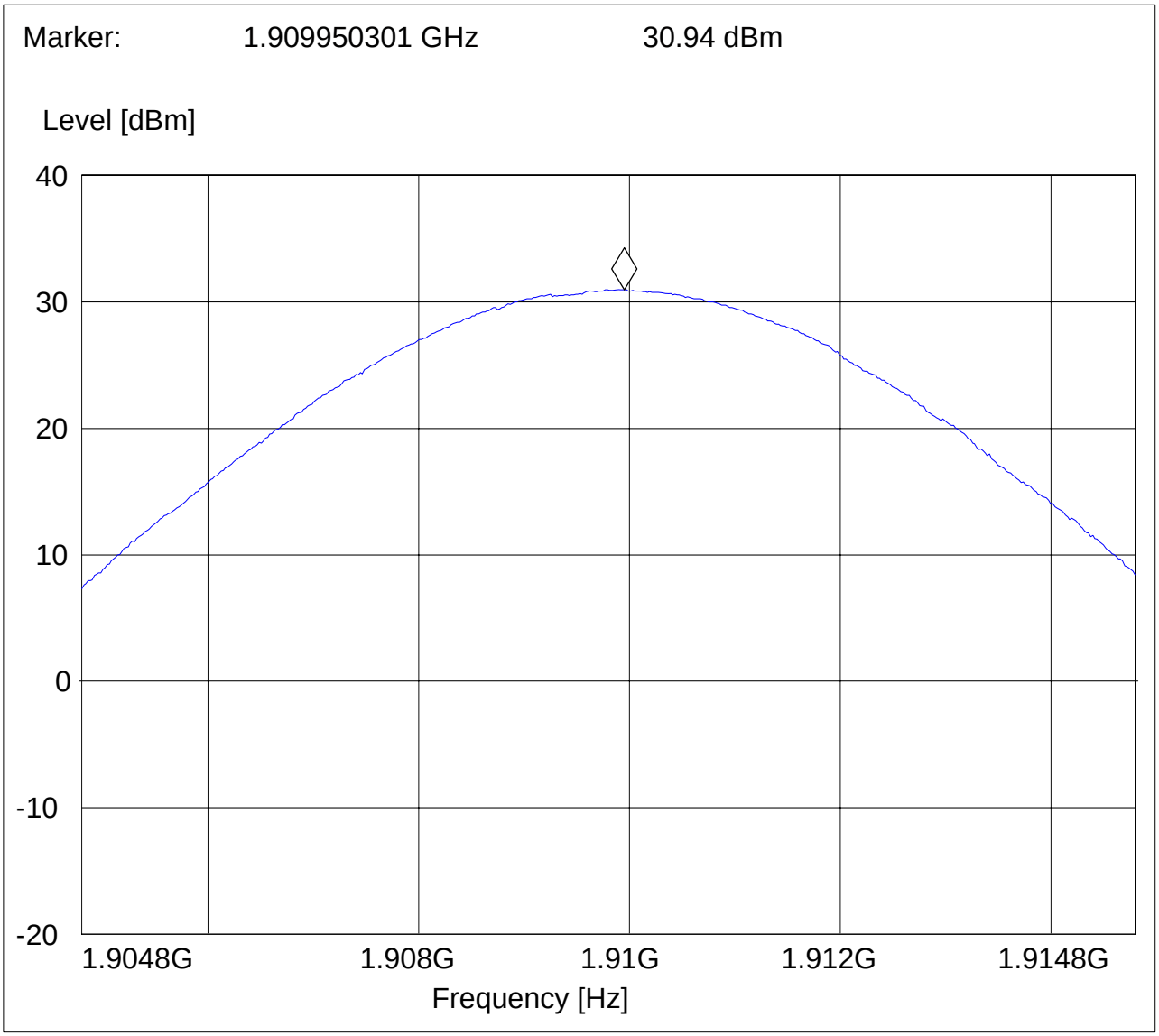


EIRP (PCS-1900) **§24.232(b)**
CHANNEL 810 GPRS

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM1900 CH 810
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "EIRP 1900 CH810"

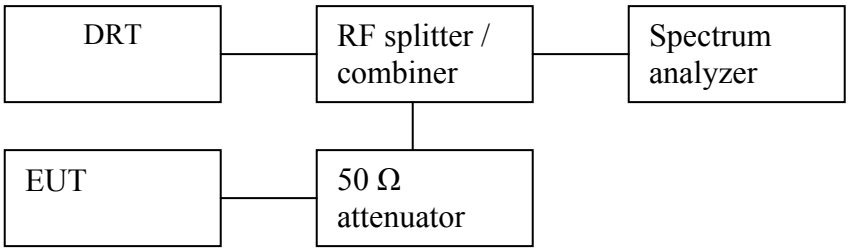


4.2 Occupied Bandwidth/Emission Bandwidth

4.2.1 FCC 2.1049 Measurements required: Occupied bandwidth

The occupied bandwidth, that is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable.
(h) Transmitters employing digital modulation techniques-when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated.

4.2.2 Occupied / emission bandwidth measurement procedure:



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the Digital Radiocommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to measure the 99% (-20 dB) occupied bandwidth. Record the value.
4. Set the spectrum analyzer to measure the 99.5% (-26 dB) emission bandwidth. Record the value.
5. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

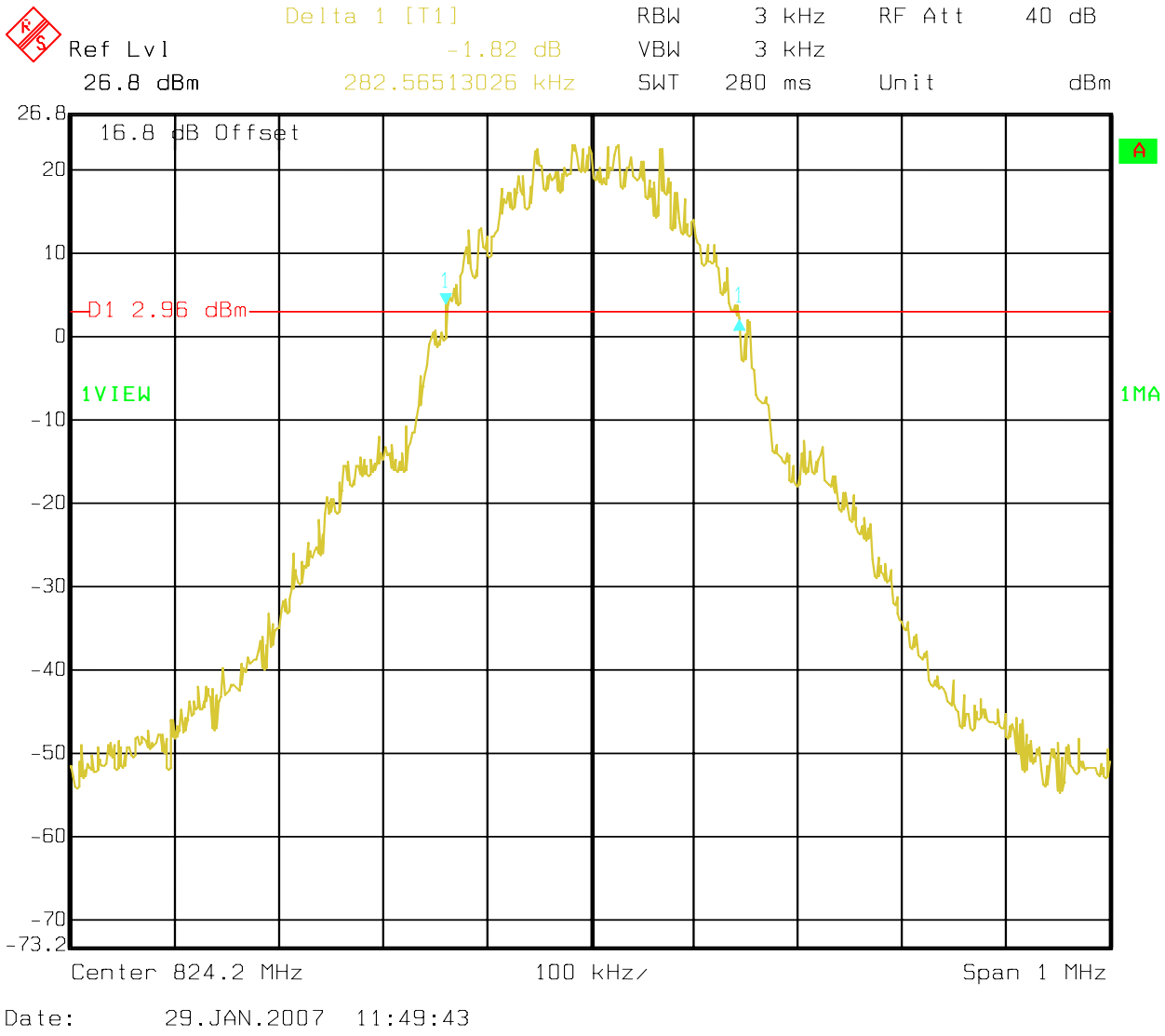
4.2.3 Occupied / Emission bandwidth results 850 MHz band:

Frequency (MHz)	Occupied B/W -20 dB (KHz)	Emission B/W -26 dB (KHz)
	GPRS	GPRS
824.2	282.57	316.63
836.6	276.55	314.63
848.8	276.55	314.63

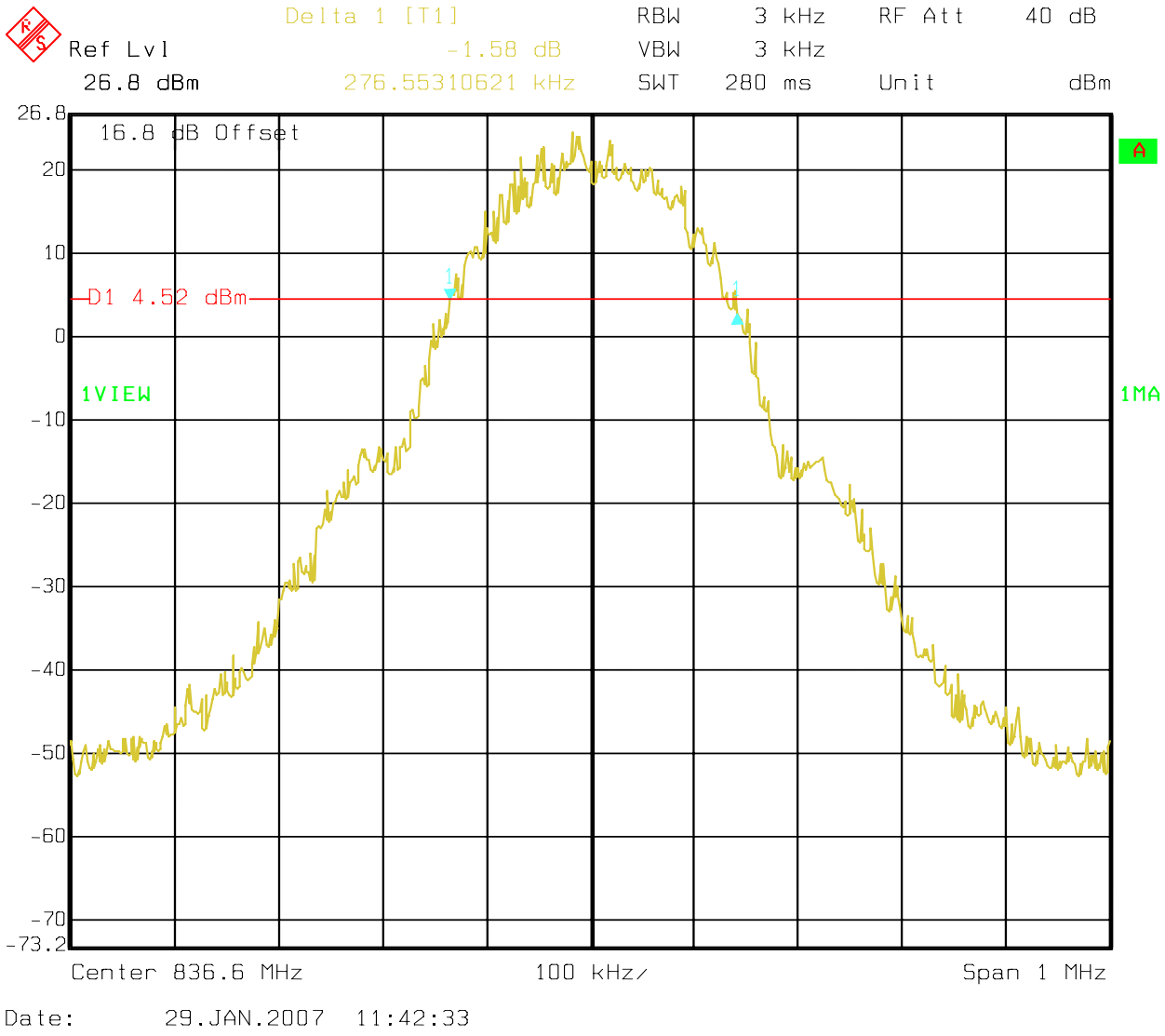
4.2.4 Occupied / Emission bandwidth results 1900 MHz band:

Frequency (MHz)	Occupied B/W -20 dB (KHz)	Emission B/W -26 dB (KHz)
	GPRS	GPRS
1850.2	284.57	318.64
1880.0	278.56	312.63
1909.8	280.56	312.63

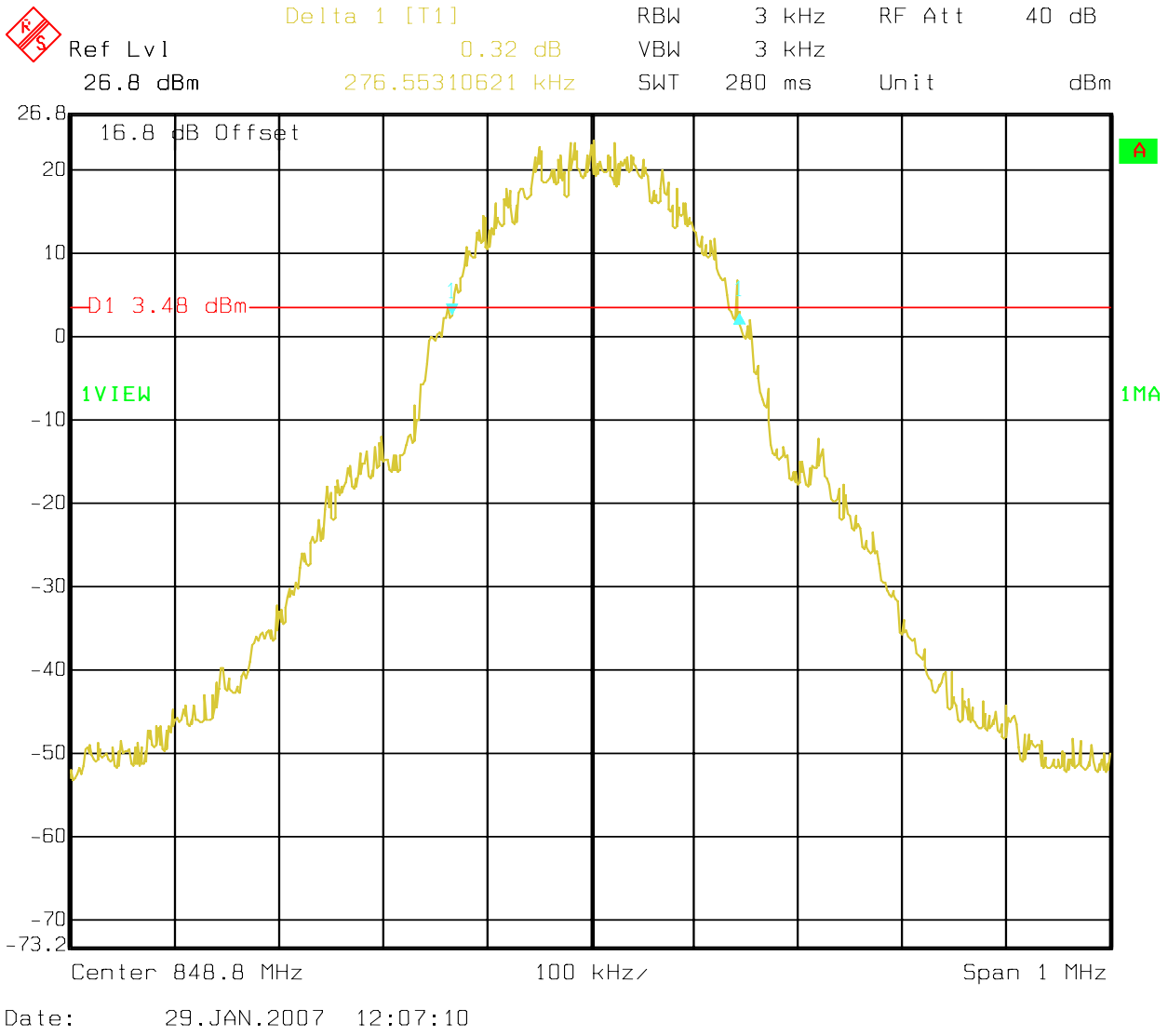
-20dB (GSM-850)
CHANNEL 128 GPRS



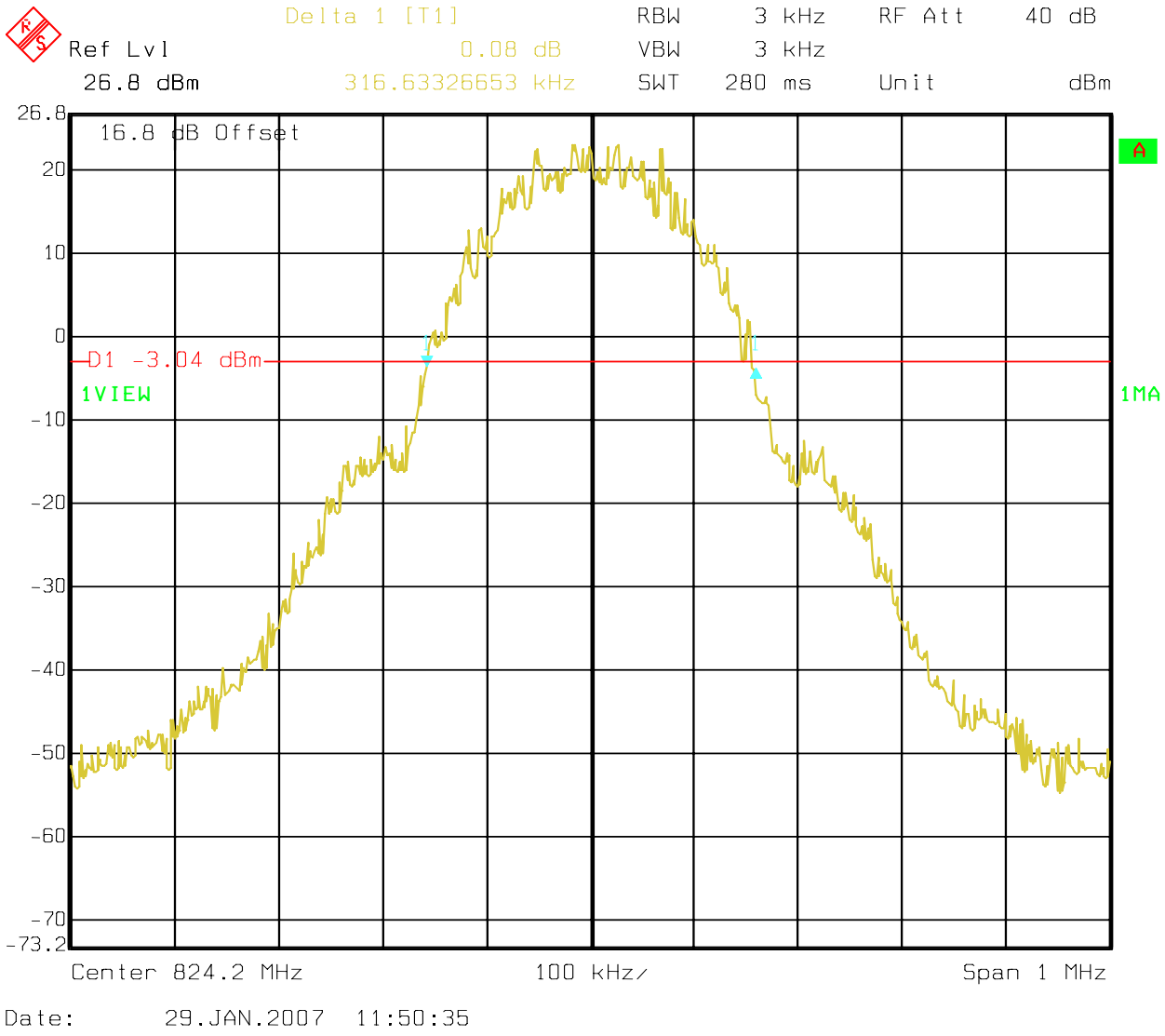
-20dB (GSM-850)
CHANNEL 190 GPRS



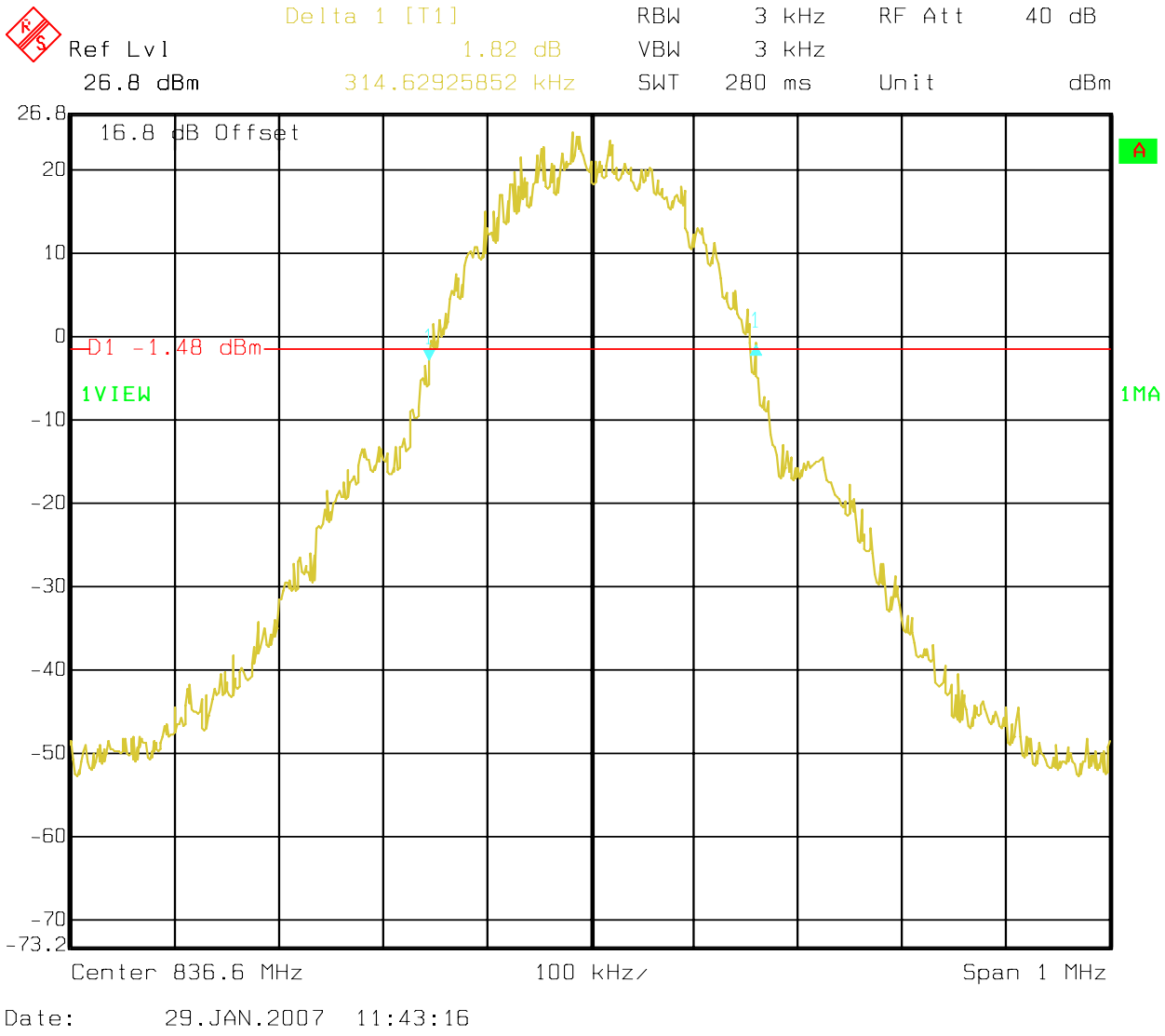
-20dB (GSM-850)
CHANNEL 251 GPRS



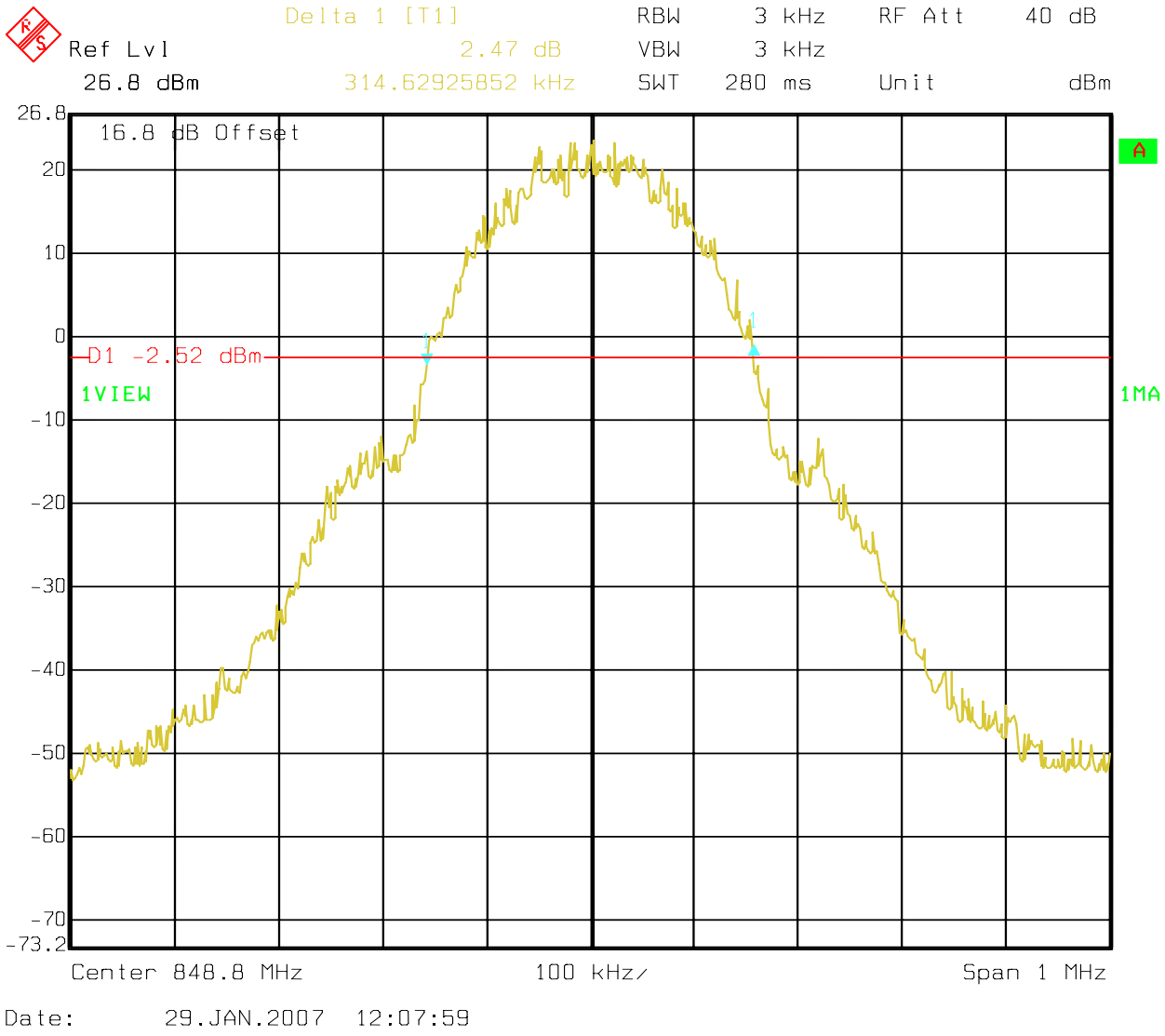
-26dB (GSM-850)
CHANNEL 128 GPRS



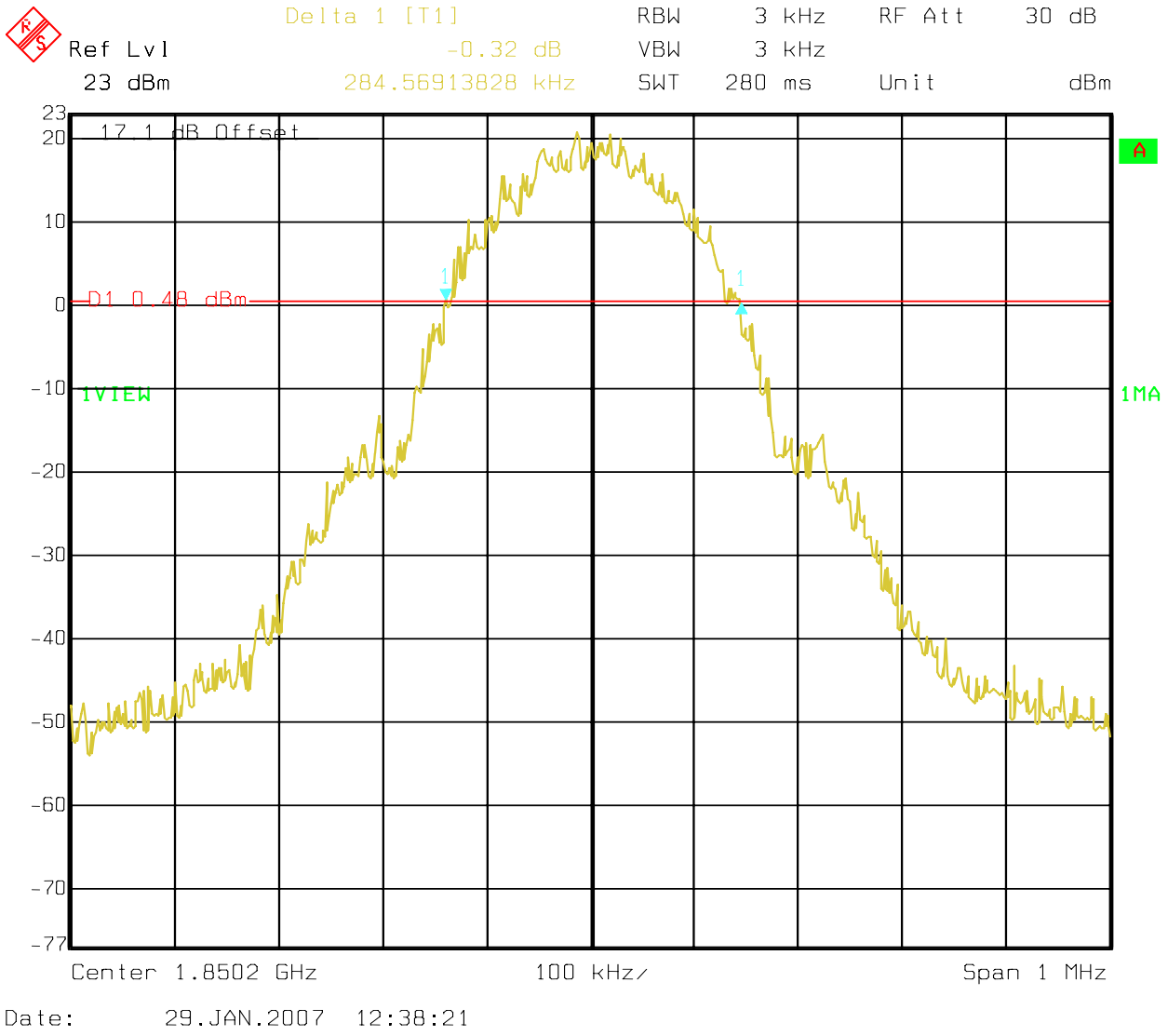
-26dB (GSM-850)
CHANNEL 190 GPRS



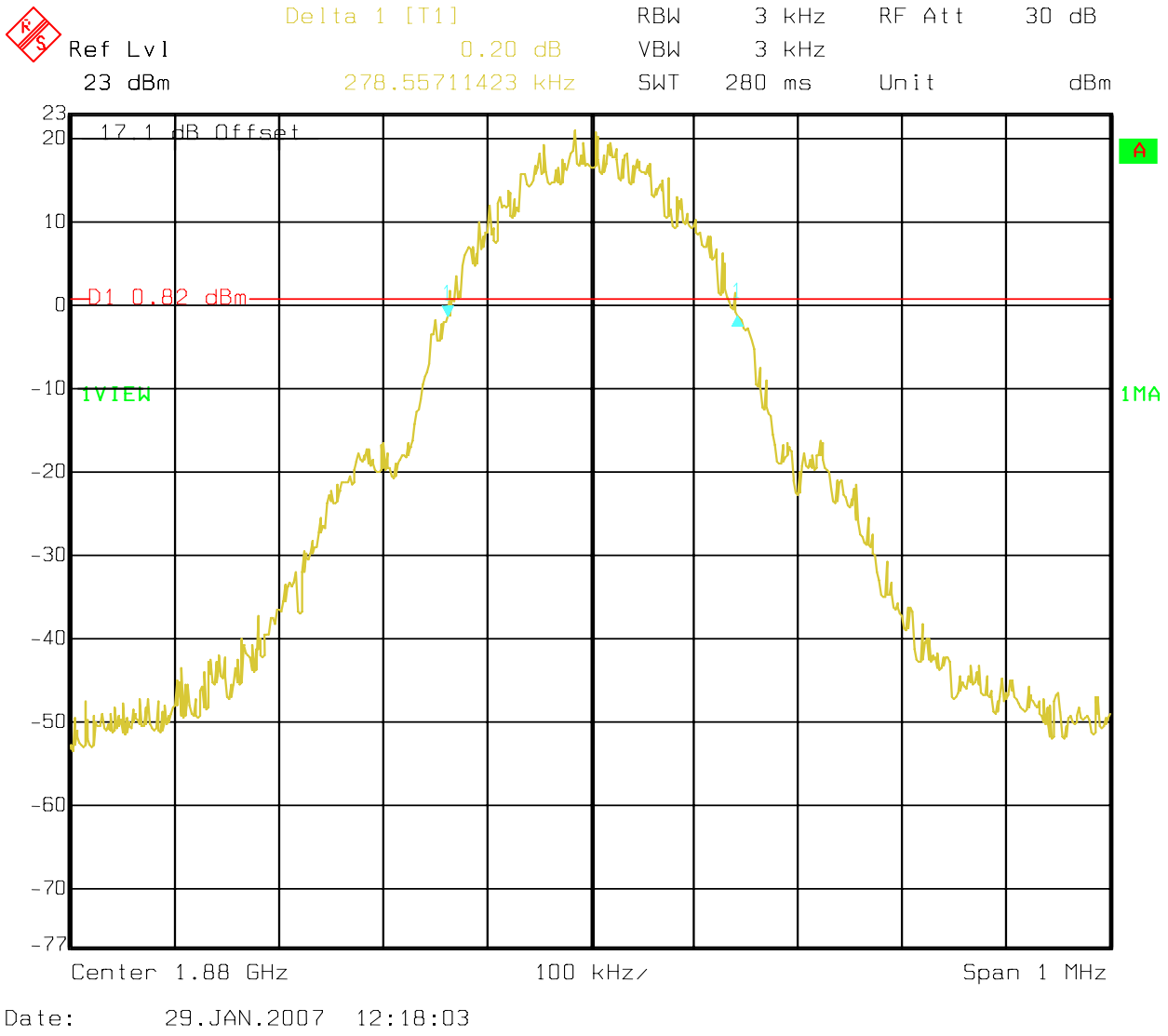
-26dB (GSM-850)
CHANNEL 251 GPRS



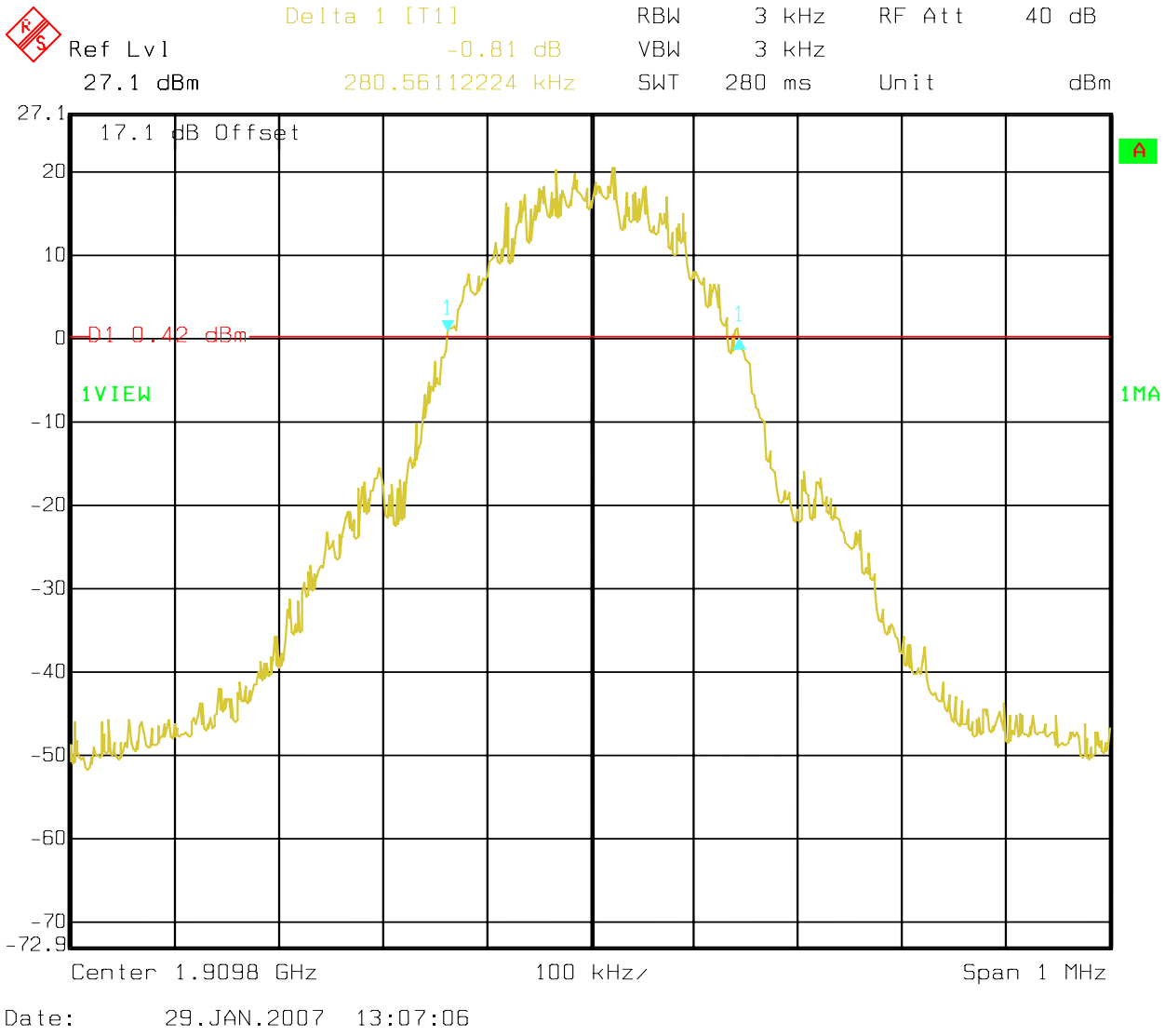
-20dB (PCS-1900)
CHANNEL 512 GPRS



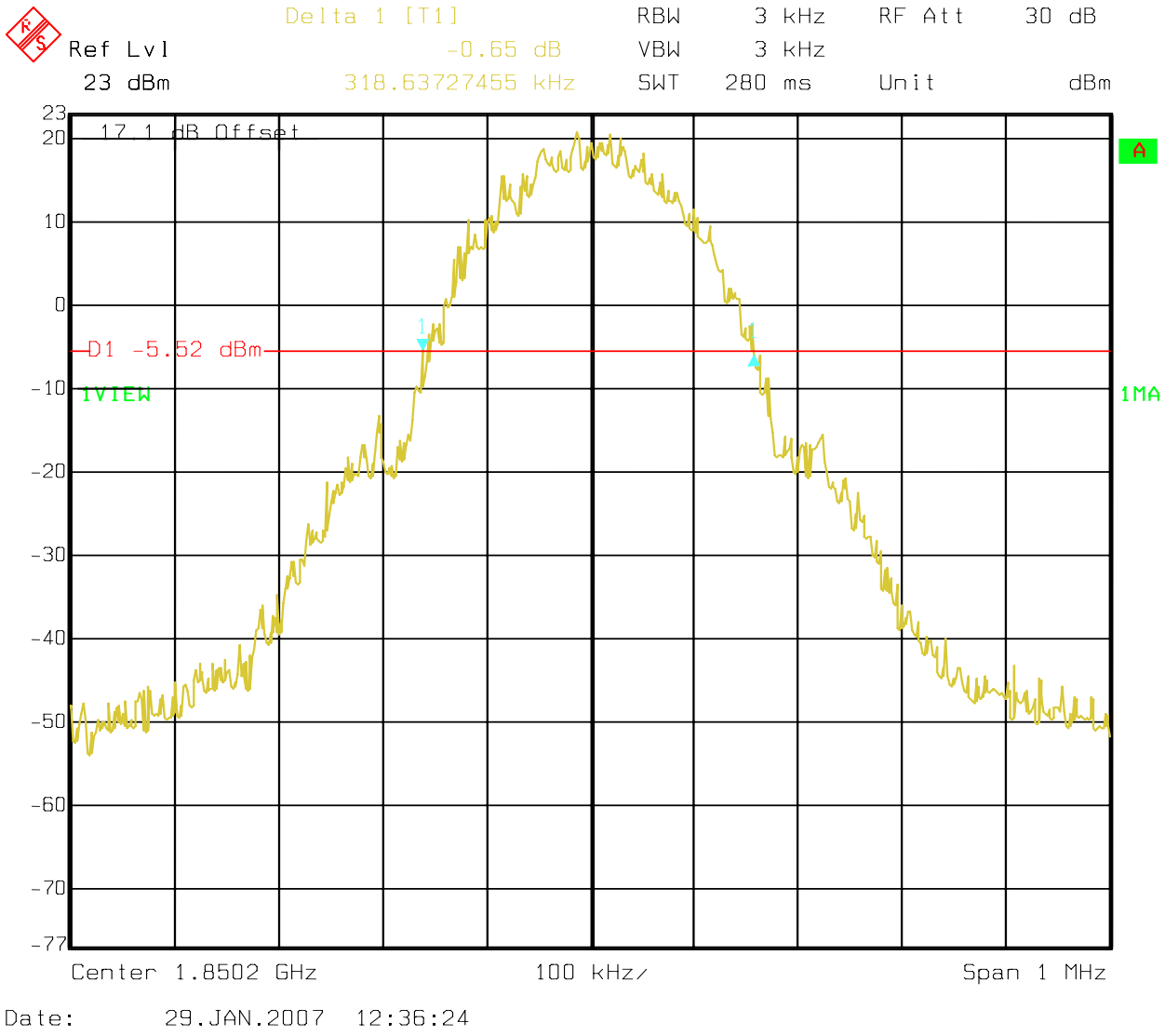
-20dB (PCS-1900)
CHANNEL 661 GPRS



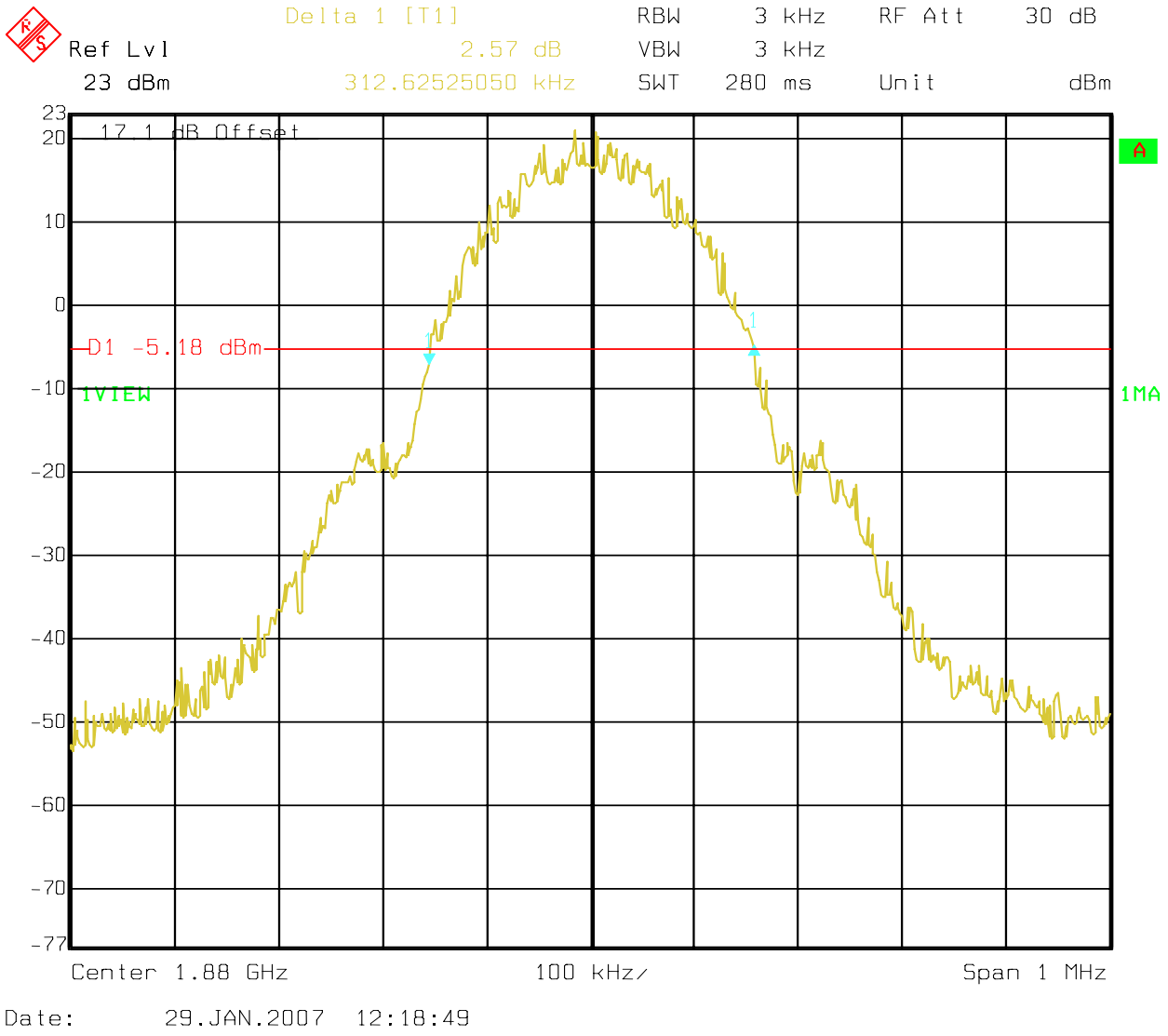
-20dB (PCS-1900)
CHANNEL 810 GPRS



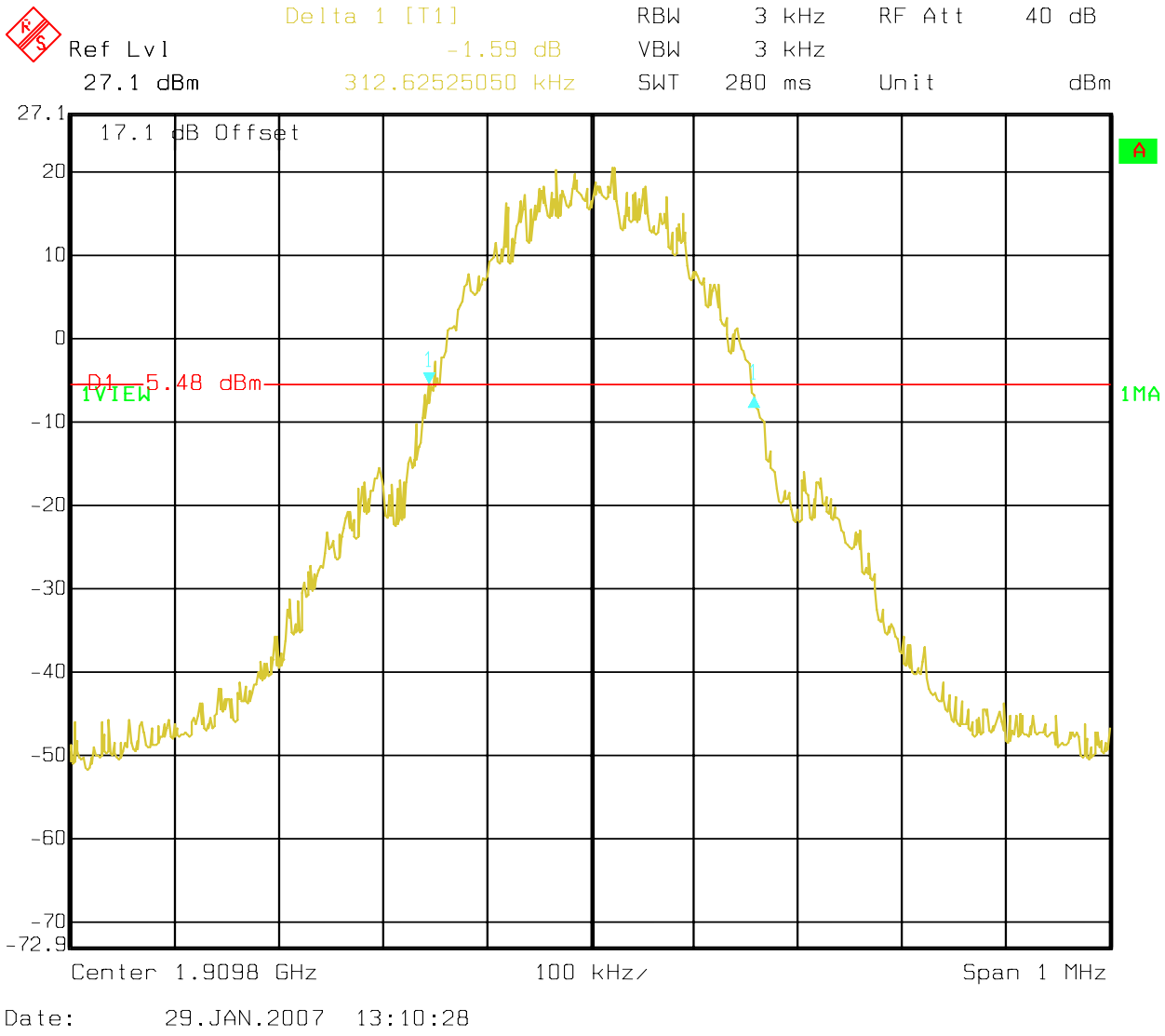
-26dB (PCS-1900)
CHANNEL 512 GPRS



-26dB (PCS-1900)
CHANNEL 661 GPRS



-26dB (PCS-1900)
CHANNEL 810 GPRS



4.3 Frequency Stability

4.3.1 Limit

For Hand carried battery powered equipment:
According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.2VDC and 4.5VDC, with a nominal voltage of 3.7VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance of –2.7% and +21.62%. For the purposes of measuring frequency stability these voltage limits are to be used.

Method of Measurement:
In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMU 200 UNIVERSAL RADIO COMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30 C.
3. With the EUT, powered via nominal voltage, connected to the CMU 200 and in a simulated call on mid channel (190 for GSM 850 & 4183 for FDD5 & 661 for PCS-1900&9400 for FDD2), measure the carrier frequency. These measurements should be made within 2 minutes of powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10 C increments from -30 C to +50 C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments remeasuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50 C.
7. With the EUT, powered via nominal voltage, connected to the CMU 200 and in a simulated call on mid channel (190 for GSM 850 & 4183 for FDD5 & 661 for PCS-1900&9400 for FDD2), measure the carrier frequency. These measurements should be made within 2 minutes of powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 C increments from +50 C to -30 C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5 C during the measurement procedure.

For equipment powered by primary supply voltage:
According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.
For this EUT section 2.1055(d)(1) applies. This requires to vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

4.3.2 FREQUENCY STABILITY (GSM-850)

Channel No. : 190 at 836.6 MHz

§2.1055 AFC FREQ ERROR VS. VOLTAGE

NOTE: Freq. Error (ppm) = Freq. Error (Hz) / 836.6

Voltage (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
3.3	-11	0.013
4.2	-21	0.025

AFC FREQ ERROR vs. TEMPERATURE

TEMPERATURE (°C)	Frequency Error (Hz)	Frequency Error (ppm)
-30	-37	0.044
-20	-13	0.016
-10	-11	0.013
0	-11	0.013
+10	-11	0.013
+20	-7	0.008
+30	15	0.018
+40	-11	0.013
+50	18	0.022

4.3.3 FREQUENCY STABILITY (PCS-1900)

Channel No. : 661 at 1880 MHz

§2.1055 / §24.235 AFC FREQ ERROR vs. VOLTAGE

NOTE: Freq. Error (ppm) = Freq. Error (Hz) / 1880

Voltage (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
3.3	-17	0.009
4.2	-11	0.006

AFC FREQ ERROR vs. TEMPERATURE

TEMPERATURE (°C)	Frequency Error (Hz)	Frequency Error (ppm)
-30	-22	0.012
-20	-13	0.007
-10	-11	0.006
0	-11	0.006
+10	-11	0.006
+20	-13	0.007
+30	19	0.010
+40	17	0.009
+50	18	0.010

4.4 Spurious Emissions Conducted

4.4.1 FCC 2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in FCC 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

4.4.2 Limits:

4.4.2.1 FCC 22.917 Emission limitations for cellular equipment.

The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(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 provisions 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 of 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.

4.4.2.2 FCC 24.238 Emission limitations for Broadband PCS equipment.

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(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.

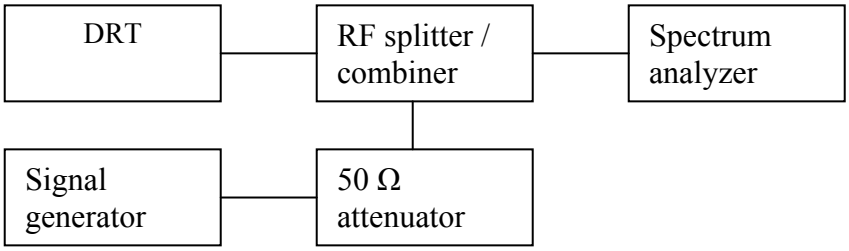
(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of 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.* 100 kHz of 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.

4.4.3 Conducted out of band emissions measurement procedure:

Based on TIA-603C 2004

2.2.13 Unwanted Emissions: Conducted Spurious

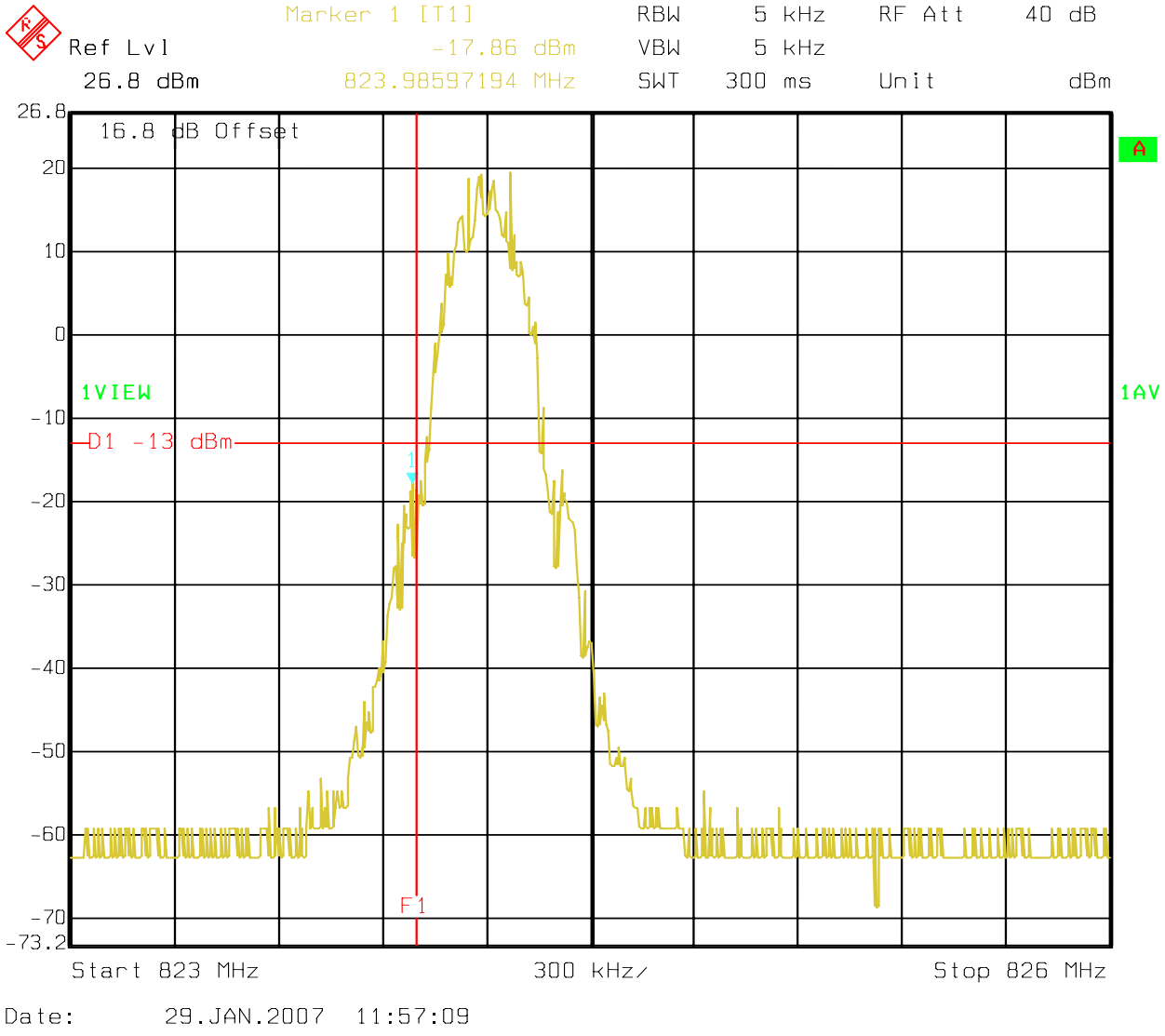


1. Connect the equipment as shown in the above diagram.
2. Set the spectrum analyzer to measure peak hold with the required settings.
3. Set the signal generator to a known output power and record the path loss in dB (**LOSS)** for frequencies up to the tenth harmonic of the EUT's carrier frequency. **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
4. Replace the signal generator with the EUT.
5. Adjust the settings of the Digital Radiocommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
6. Set the spectrum analyzer to measure peak hold with the required settings. Offset the spectrum analyzer reference level by the path loss measured above.
7. Measure and record all spurious emissions up to the tenth harmonic of the carrier frequency.
8. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.
9. If necessary steps 6 and 7 may be performed with the spectrum analyzer set to average detector.

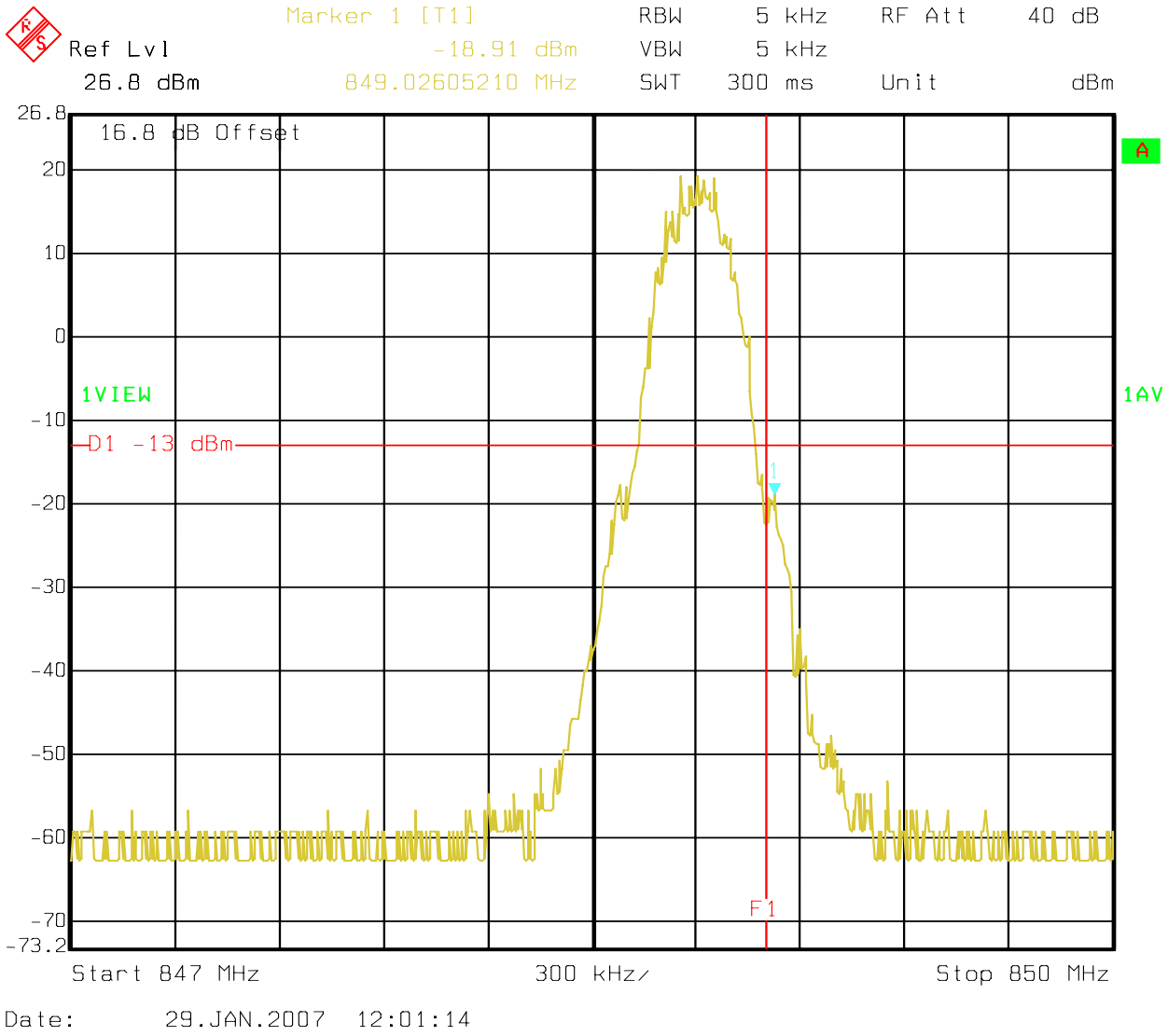
(**note:** Step 3 above is performed prior to testing and **LOSS** is recorded by test software. Steps 2, 6, and 7 above are performed with test software.)

4.4.4 Band Edge Results GSM-850

GSM-850 Lower Band Edge
CHANNEL 128



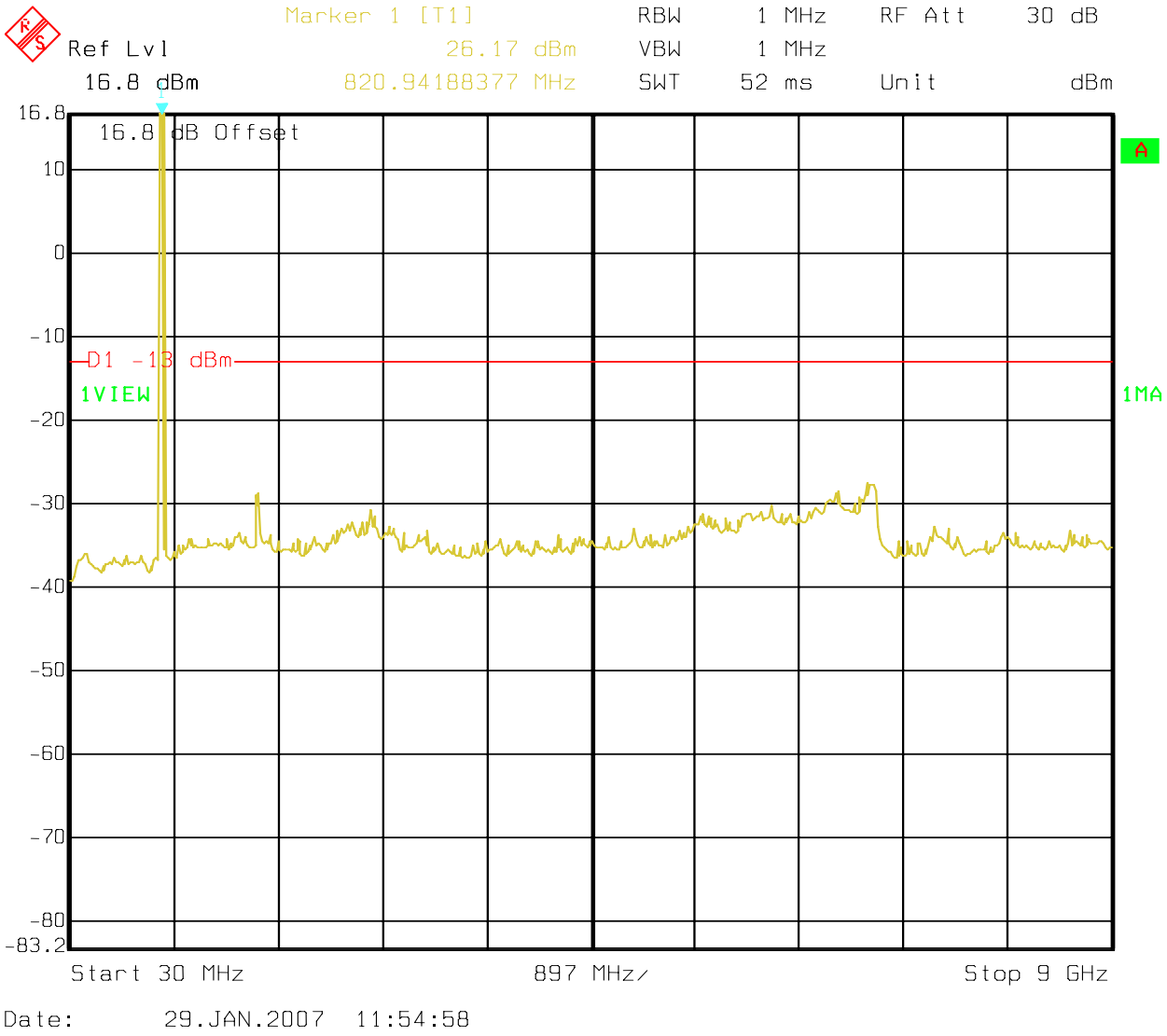
GSM-850 Higher Band Edge
CHANNEL 251



4.4.5 Conducted Spurious Results GSM-850

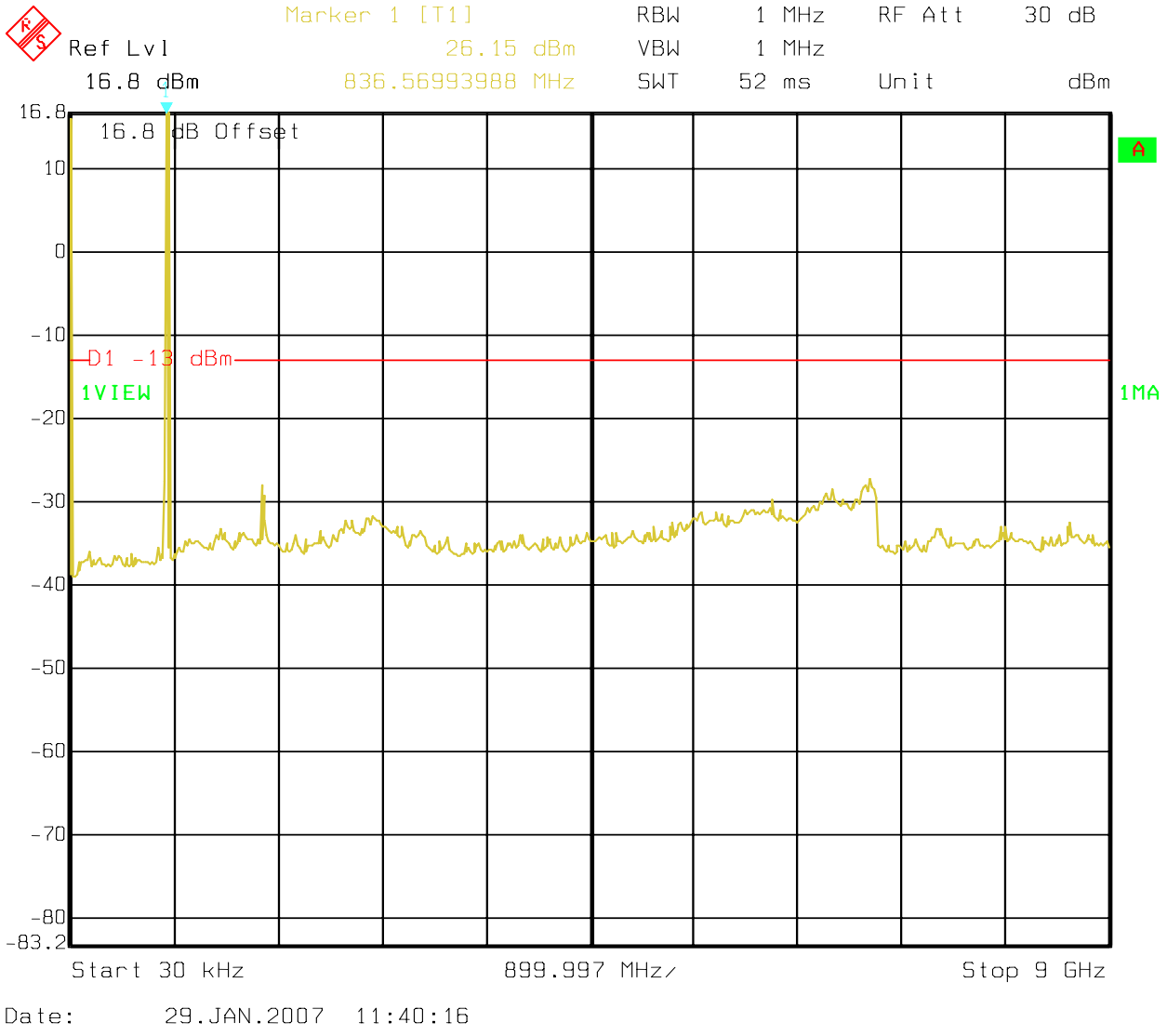
CHANNEL 128 (GSM-850)
30MHz – 9GHz

Note: The peak above the limit line is the carrier freq. at ch-128.



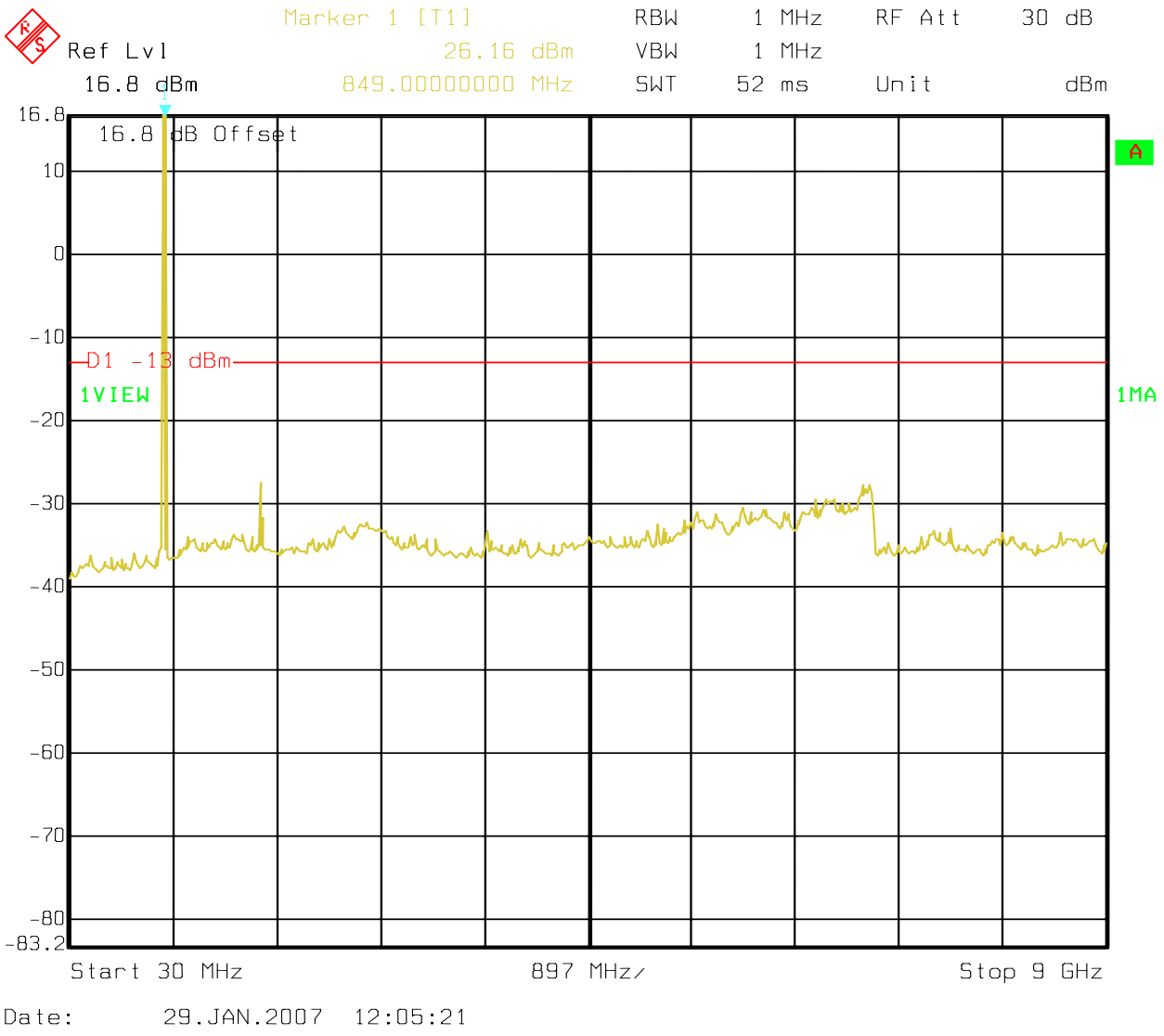
CHANNEL 190 (GSM-850)
30MHz – 9GHz

Note: The peak above the limit line is the carrier freq. at ch-190.



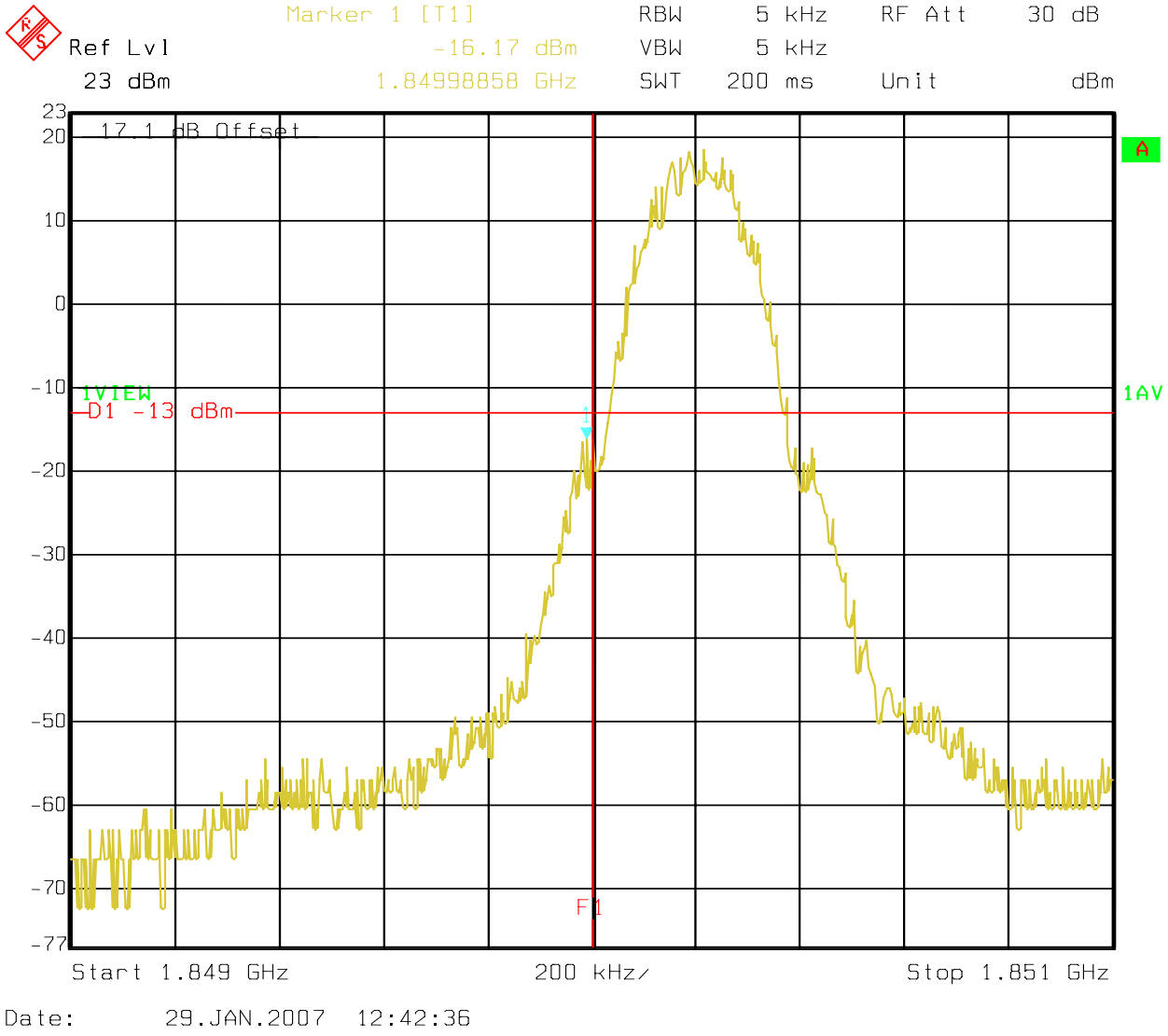
CHANNEL 251 (GSM-850)
30MHz – 9GHz

Note: The peak above the limit line is the carrier freq. at ch-251.

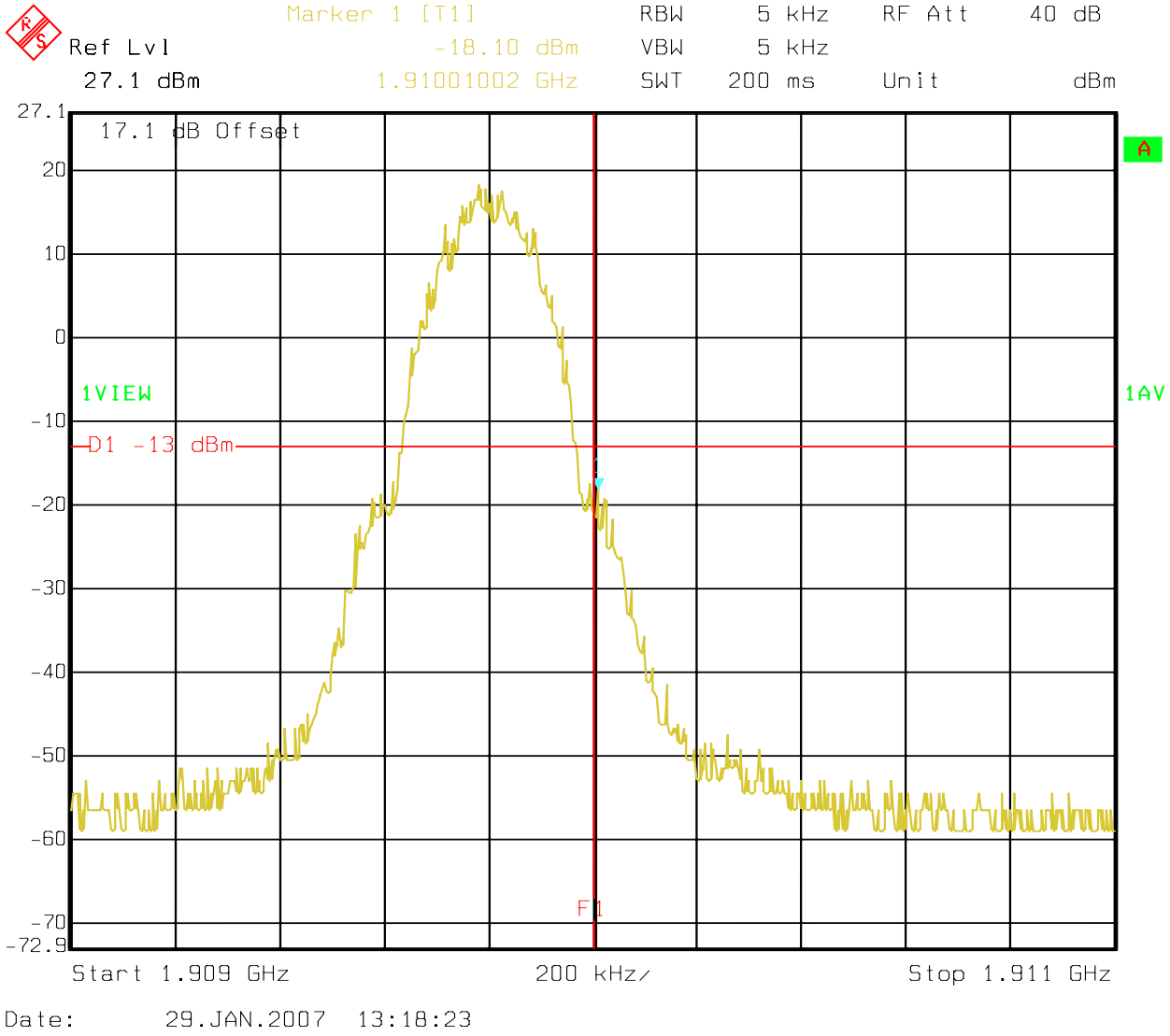


4.4.6 Band Edge Results PCS-1900

PCS-1900 Lower Band Edge
CHANNEL 512



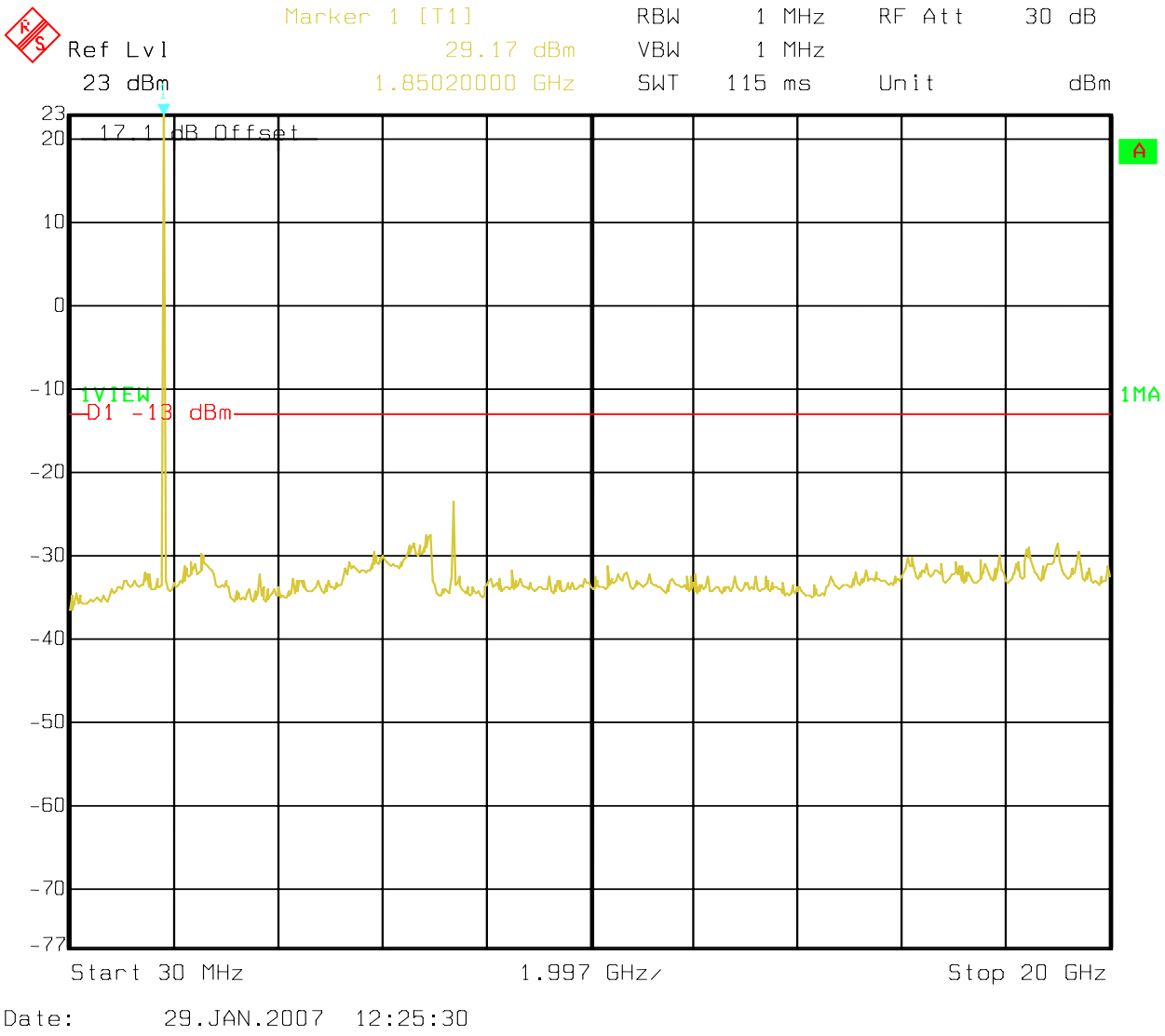
PCS-1900 Higher Band Edge
CHANNEL 810



4.4.7 Conducted Spurious Results PCS-1900

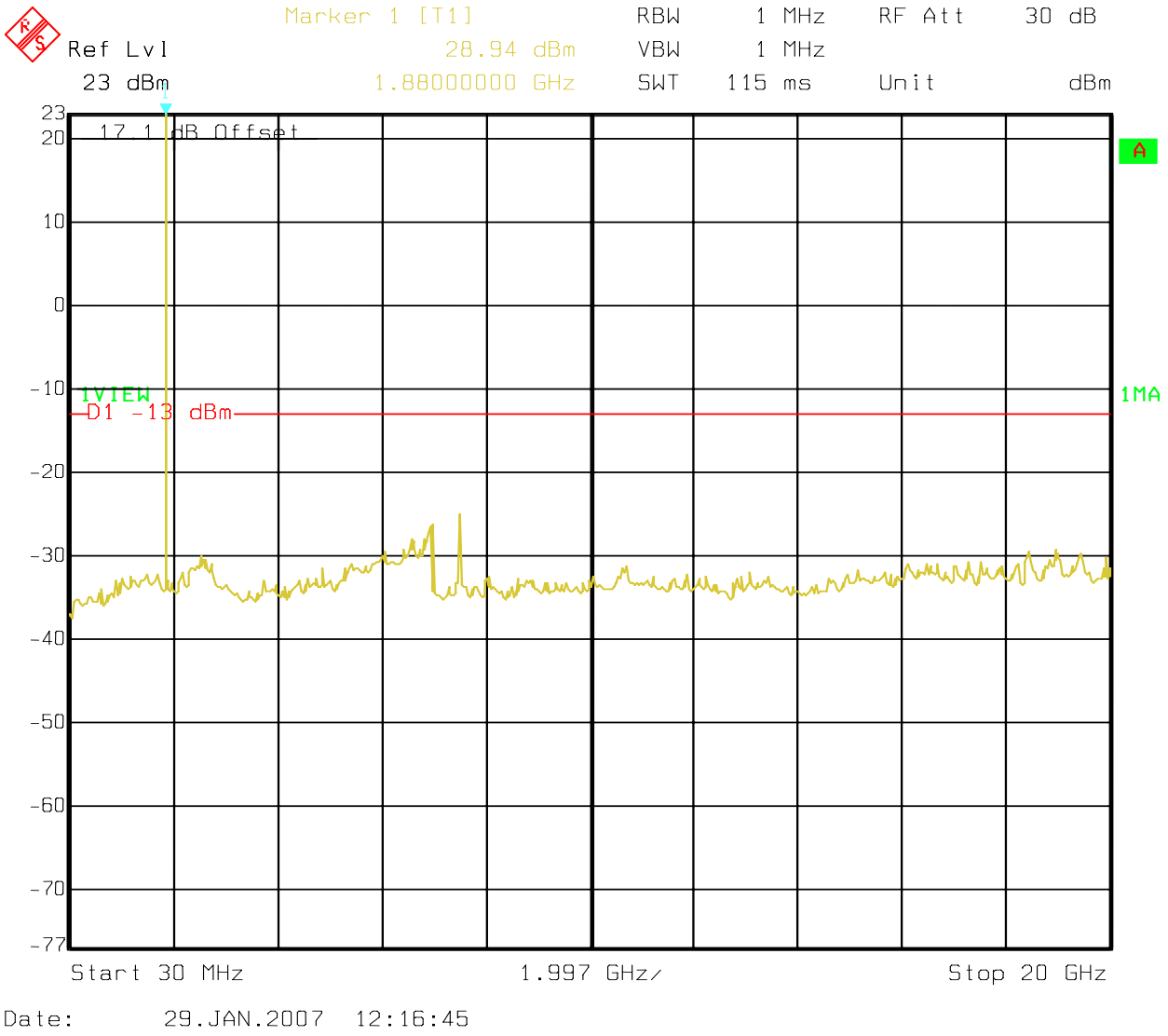
CHANNEL 512 (PCS-1900)
30MHz – 20GHz

Note: The peak above the limit line is the carrier freq. at ch-512



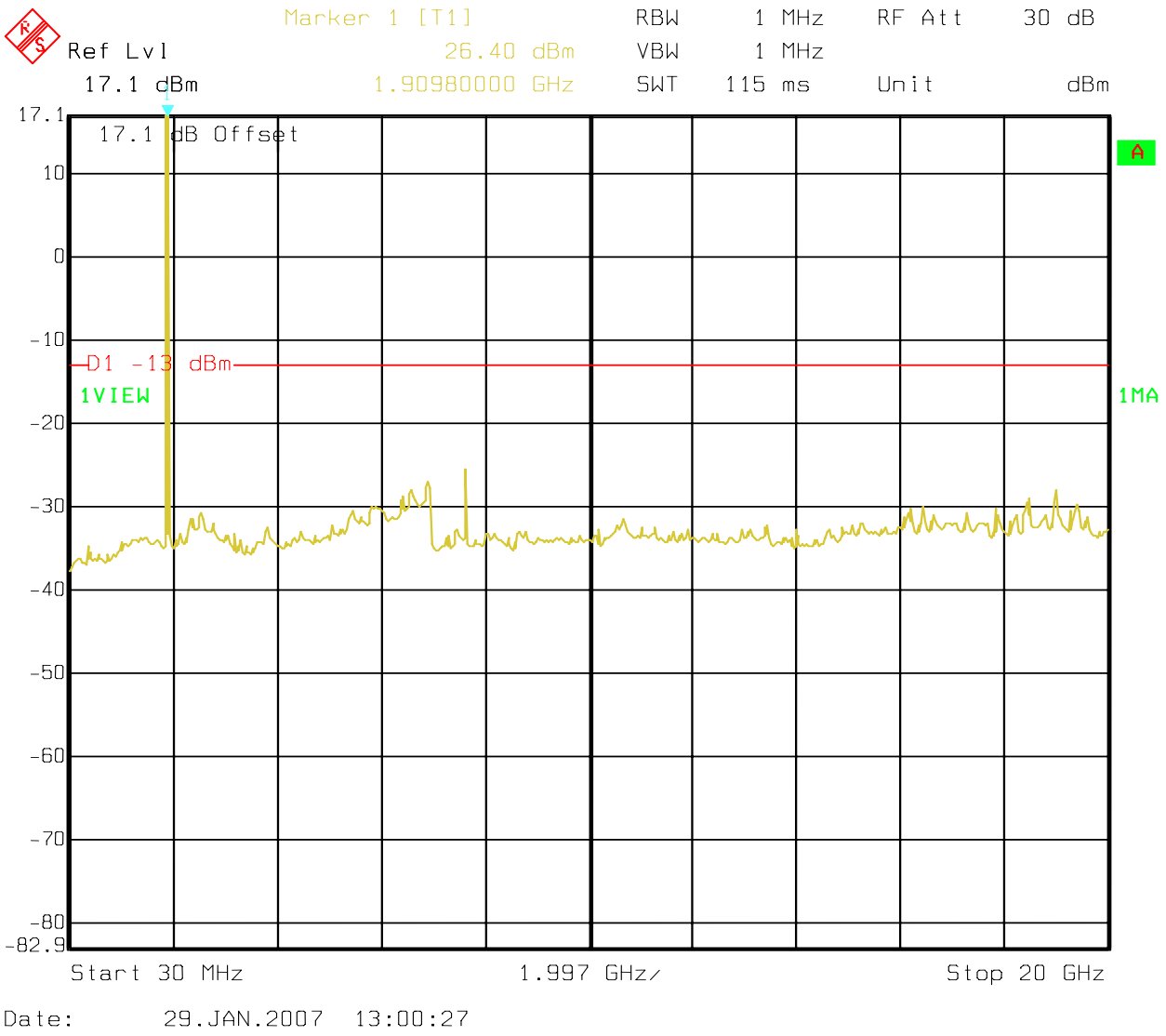
CHANNEL 661 (PCS-1900)
30MHz – 20GHz

Note: The peak above the limit line is the carrier freq. at ch-661



CHANNEL 810 (PCS-1900)
30MHz – 20GHz

Note: The peak above the limit line is the carrier freq. at ch-810



4.5 Spurious Emissions Radiated

4.5.1 FCC 2.1053 Measurements required: Field strength of spurious radiation.

(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.

4.5.2 Limits:

4.5.2.1 FCC 22.917 Emission limitations for cellular equipment.

The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(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 provisions 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 of 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.

4.5.2.2 FCC 24.238 Emission limitations for Broadband PCS equipment.

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(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.

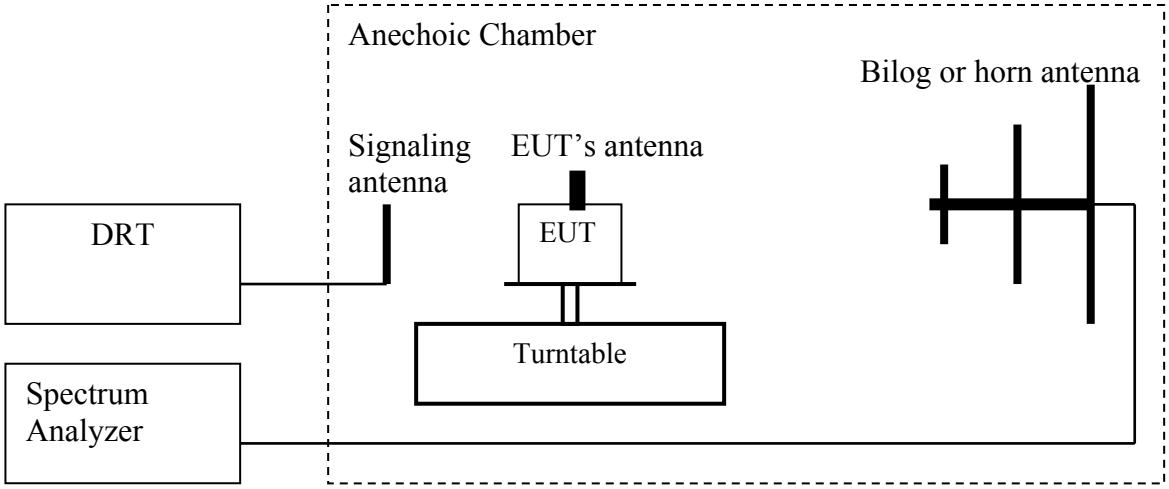
(b) Measurement procedure. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the 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.* 100 kHz of 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.

4.5.3 Radiated out of band measurement procedure:

Based on TIA-603C 2004

2.2.12 Unwanted emissions: Radiated Spurious



1. Connect the equipment as shown in the above diagram with the EUT's antenna in a horizontal orientation.
2. Adjust the settings of the Digital Radiocommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to measure peak hold with the required settings.
4. Place the measurement antenna in a horizontal orientation. Rotate the EUT 360°. Raise the measurement antenna up to 4 meters in 0.5 meters increments and rotate the EUT 360° at each height to maximize all emissions. Measure and record all spurious emissions (**LVL**) up to the tenth harmonic of the carrier frequency.
5. Replace the EUT with a horizontally polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS)**. **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the level of spurious emissions using the following equation:
   Spurious (dBm) = **LVL** (dBm) + **LOSS** (dB):
8. Repeat steps 4, 5 and 6 with all antennas vertically polarized.
9. Determine the level of spurious emissions using the following equation:
   Spurious (dBm) = **LVL** (dBm) + **LOSS** (dB):
10. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

(**note:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4 and 7 above are performed with test software.)

Spectrum analyzer settings:
Res B/W: 1 MHz
Vid B/W: 1 MHz

Measurement Survey:

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the GSM-850 & PCS-1900 bands. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the GSM-850 & PCS-1900 band into any of the other blocks respectively. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

4.5.4 Radiated out of band emissions results on EUT:

4.5.4.1 RESULTS OF RADIATED TESTS GSM-850:

Harmonics	Tx ch-128 Freq. (MHz)	Level (dBm)	Tx ch-190 Freq. (MHz)	Level (dBm)	Tx ch-251 Freq. (MHz)	Level (dBm)
2	**1648.4**	NF	**1673.2**	NF	**1697.6**	NF
3	**2472.6**	NF	**2509.8**	NF	**2546.4**	NF
4	**3296.8**	NF	**3346.4**	NF	**3395.2**	NF
5	**4121**	NF	**4183**	NF	**4244**	NF
6	**4945.2**	NF	**5019.6**	NF	**5092.8**	NF
7	**5769.4**	NF	**5856.2**	NF	**5941.6**	NF
8	**6593.6**	NF	**6692.8**	NF	**6790.4**	NF
9	**7417.8**	NF	**7529.4**	NF	**7639.2**	NF
10	**8242**	NF	**8366**	NF	**8488**	NF
NF = NOISE FLOOR						

4.5.4.2 RADIATED SPURIOUS EMISSIONS (GSM-850)

TX: 30MHz - 1GHz

Spurious emission limit –13dBm

Antenna: vertical

Note:

1.The peak above the limit line is the carrier freq.

2.This plot is valid for low, mid & high channels (worst-case plot)

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::

Customer:: ACI

Test Mode: GSM850 CH190

EUT Orientation: 30° vert incline

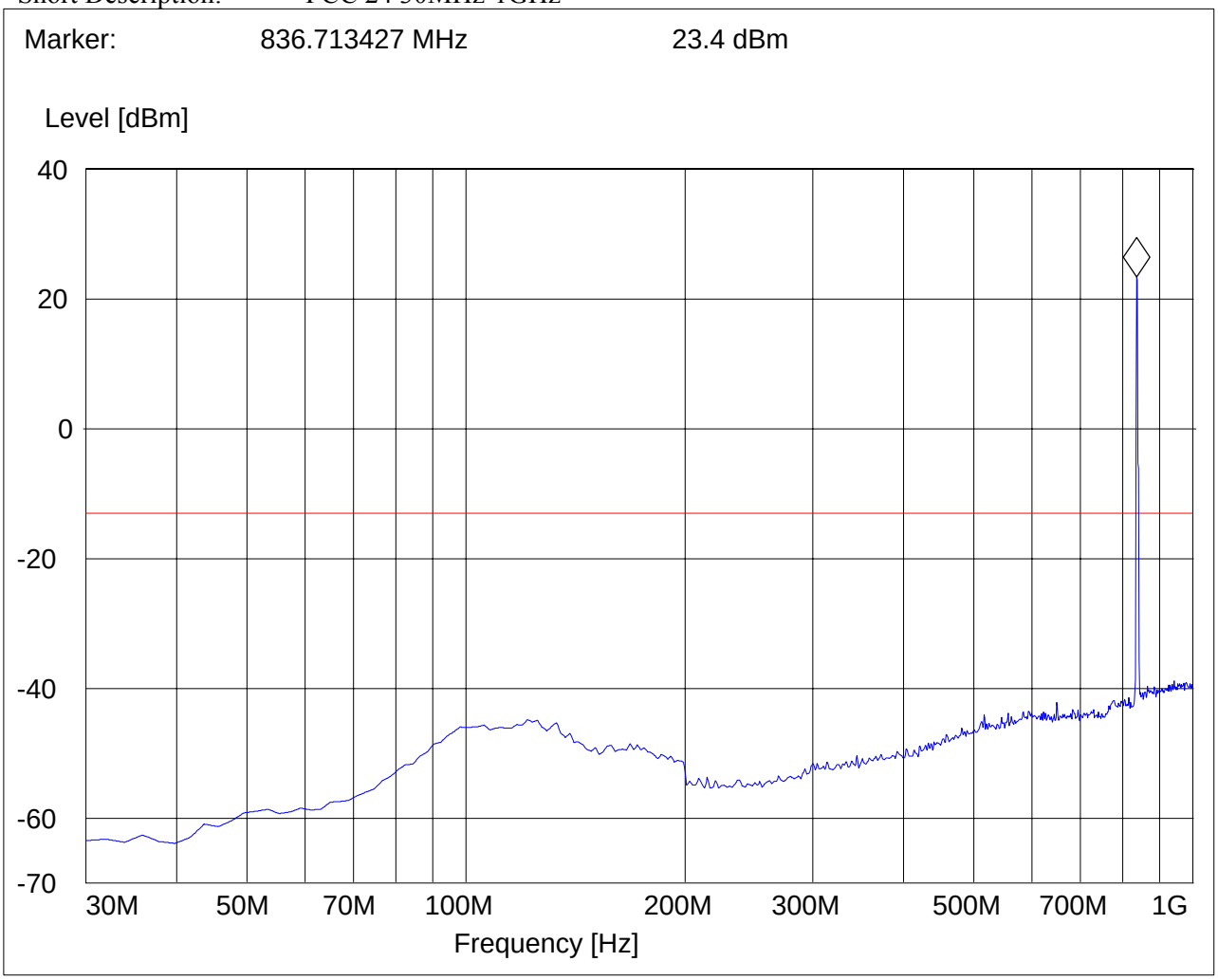
Test Engineer: Ed

Voltage:: battery

Comments:: 360°rotation, marker is on uplink sig.

SWEEP TABLE: "FCC 24 Spur 30M-1G_V"

Short Description: FCC 24 30MHz-1GHz

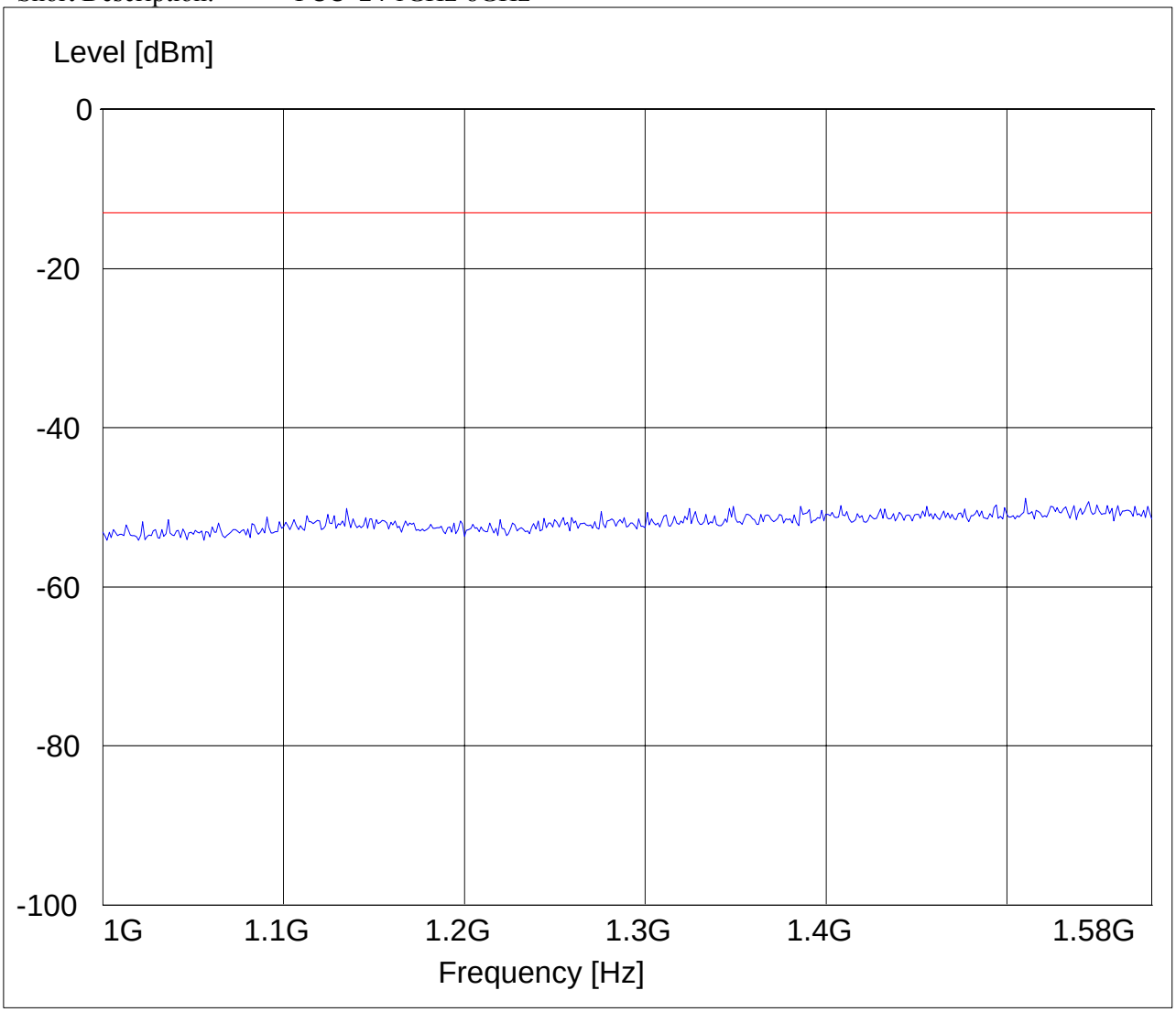


RADIATED SPURIOUS EMISSIONS (GSM-850)
Tx @ 824.2MHz: 1GHz – 1.58GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

Customer:: ACI
Test Mode: GSM850 CH128
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 22Spuri 1-1.58G"
Short Description: FCC 24 1GHz-8GHz

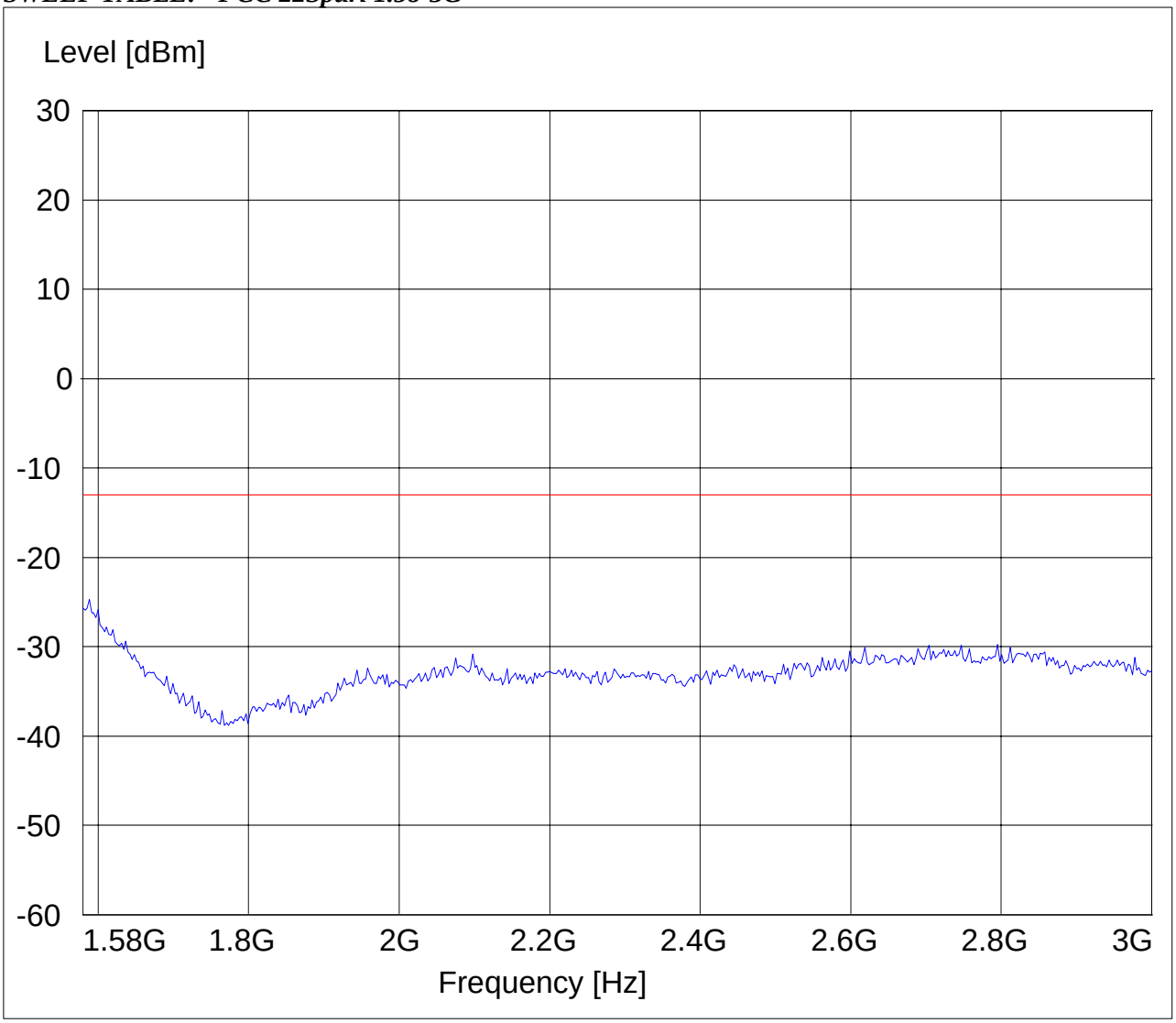


RADIATED SPURIOUS EMISSIONS (GSM-850)
Tx @ 824.2MHz: 1.58GHz – 3GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM850 CH128
Ant Orientation: H
EUT Orientation: H
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 22Spuri 1.58-3G"

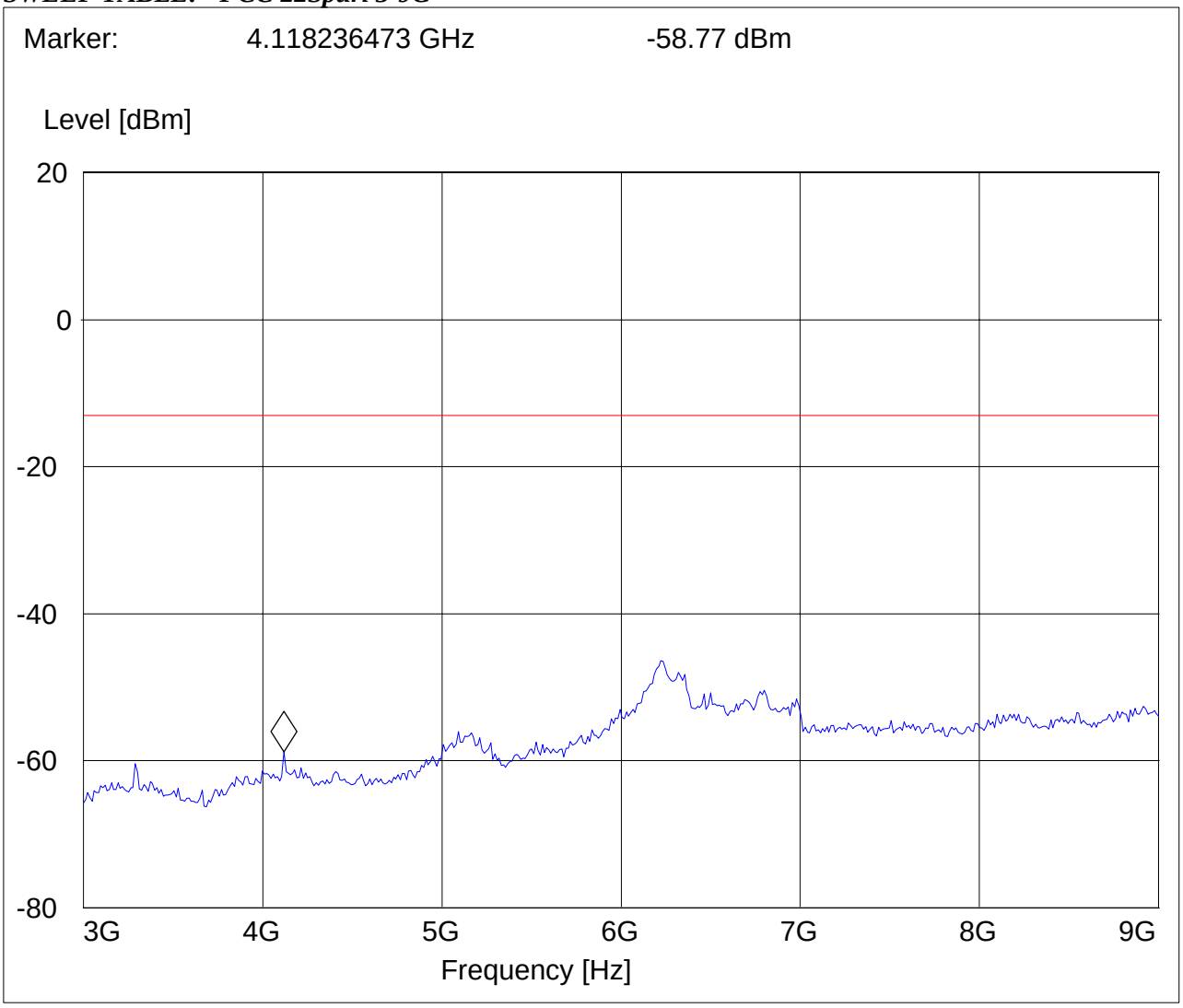


RADIATED SPURIOUS EMISSIONS (GSM-850)
Tx @ 824.2MHz: 3GHz – 9GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM850 CH128
Ant Orientation: H
EUT Orientation: H
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 22Spuri 3-9G"

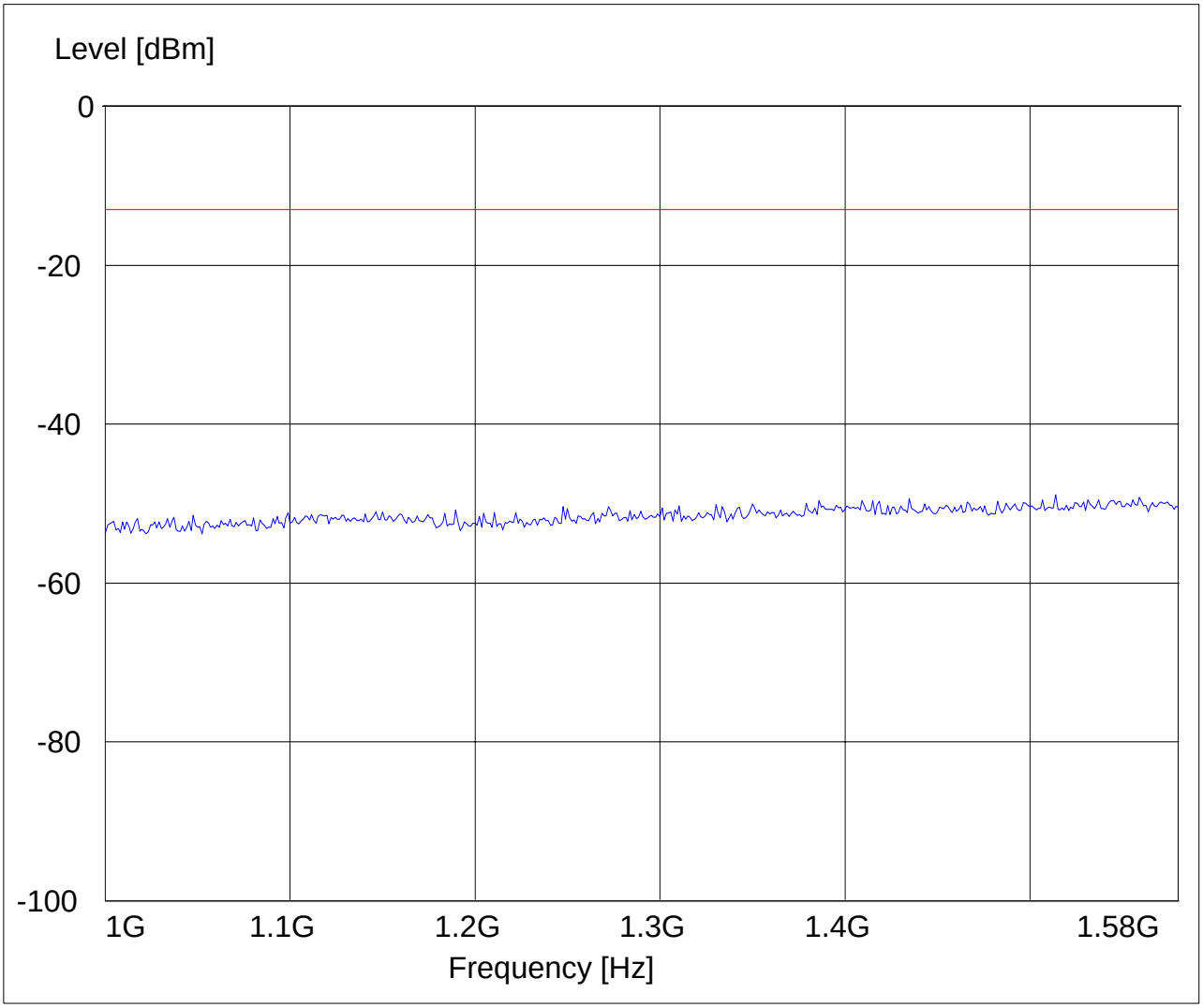


RADIATED SPURIOUS EMISSIONS (GSM-850)
Tx @ 836.6MHz: 1GHz – 1.58GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM850 CH190
Ant Orientation: H
EUT Orientation: H
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 22Spuri 1-1.58G"

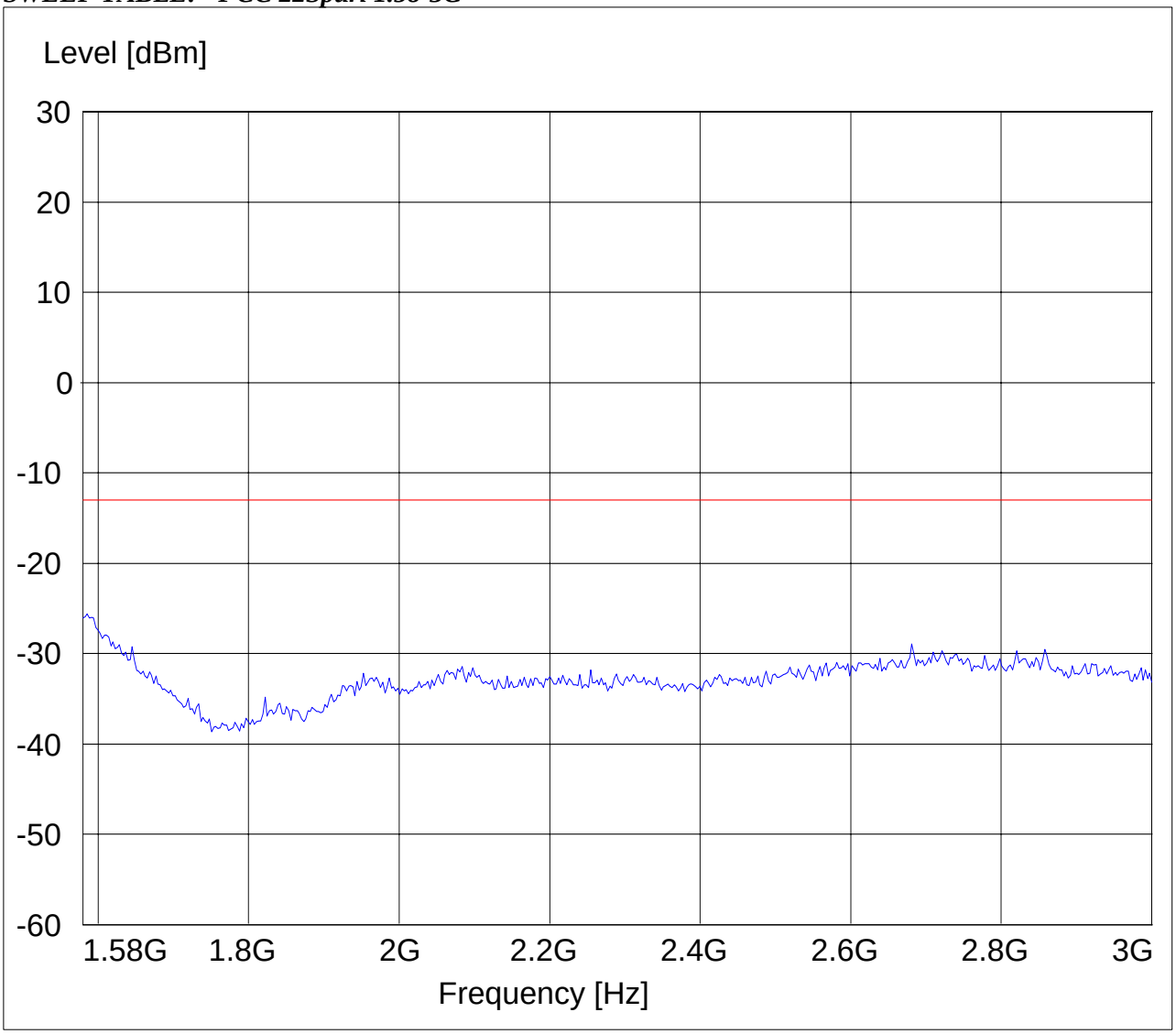


RADIATED SPURIOUS EMISSIONS (GSM-850)
Tx @ 836.6MHz: 1.58GHz – 3GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM850 CH190
Ant Orientation: H
EUT Orientation: H
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 22Spuri 1.58-3G"

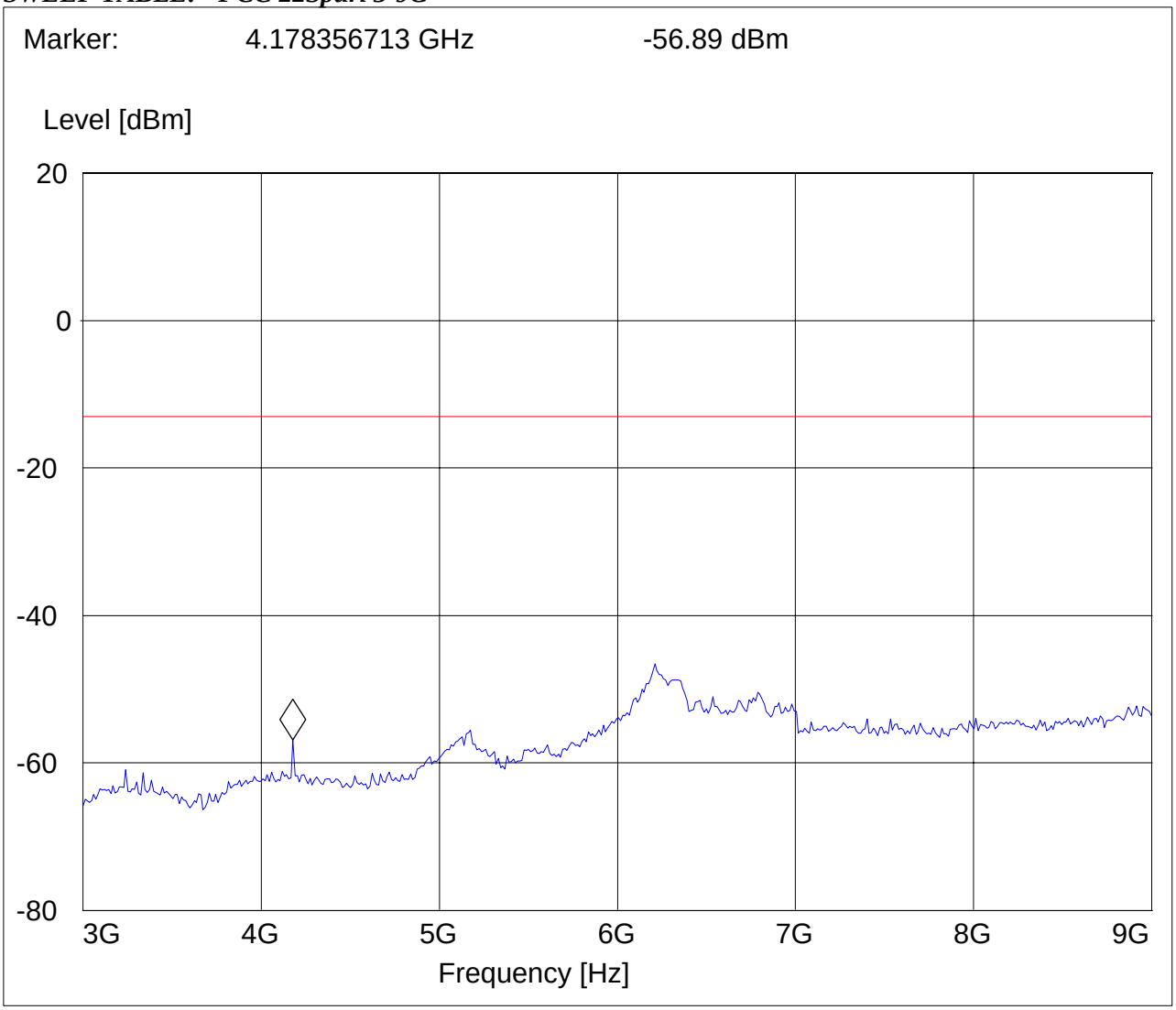


RADIATED SPURIOUS EMISSIONS (GSM-850)
Tx @ 836.6MHz: 3GHz – 9GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM850 CH190
Ant Orientation: H
EUT Orientation: H
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 22Spuri 3-9G"

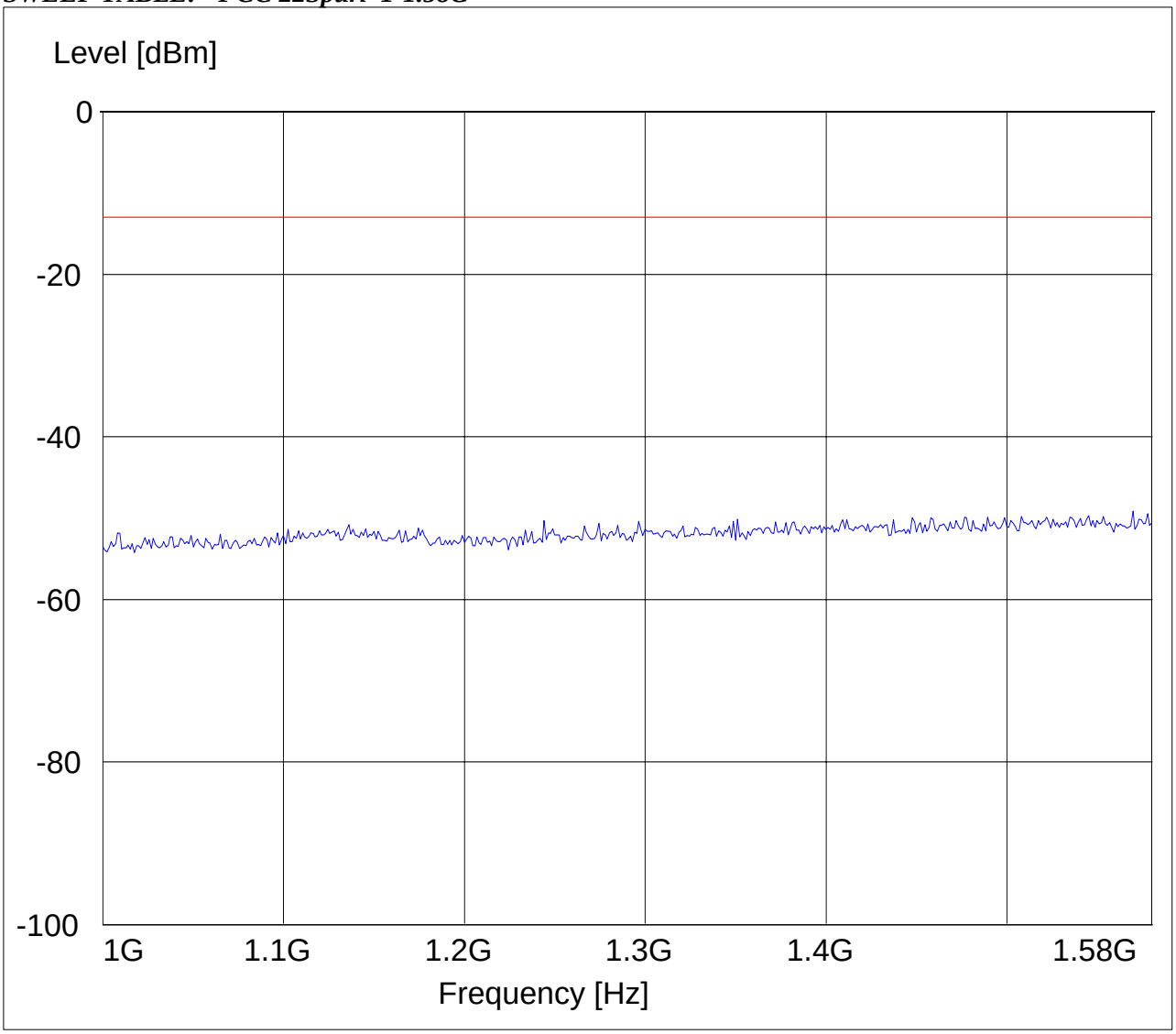


RADIATED SPURIOUS EMISSIONS (GSM-850)
Tx @ 848.8MHz: 1GHz – 1.58GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM850 CH251
Ant Orientation: H
EUT Orientation: H
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 22Spuri 1-1.58G"

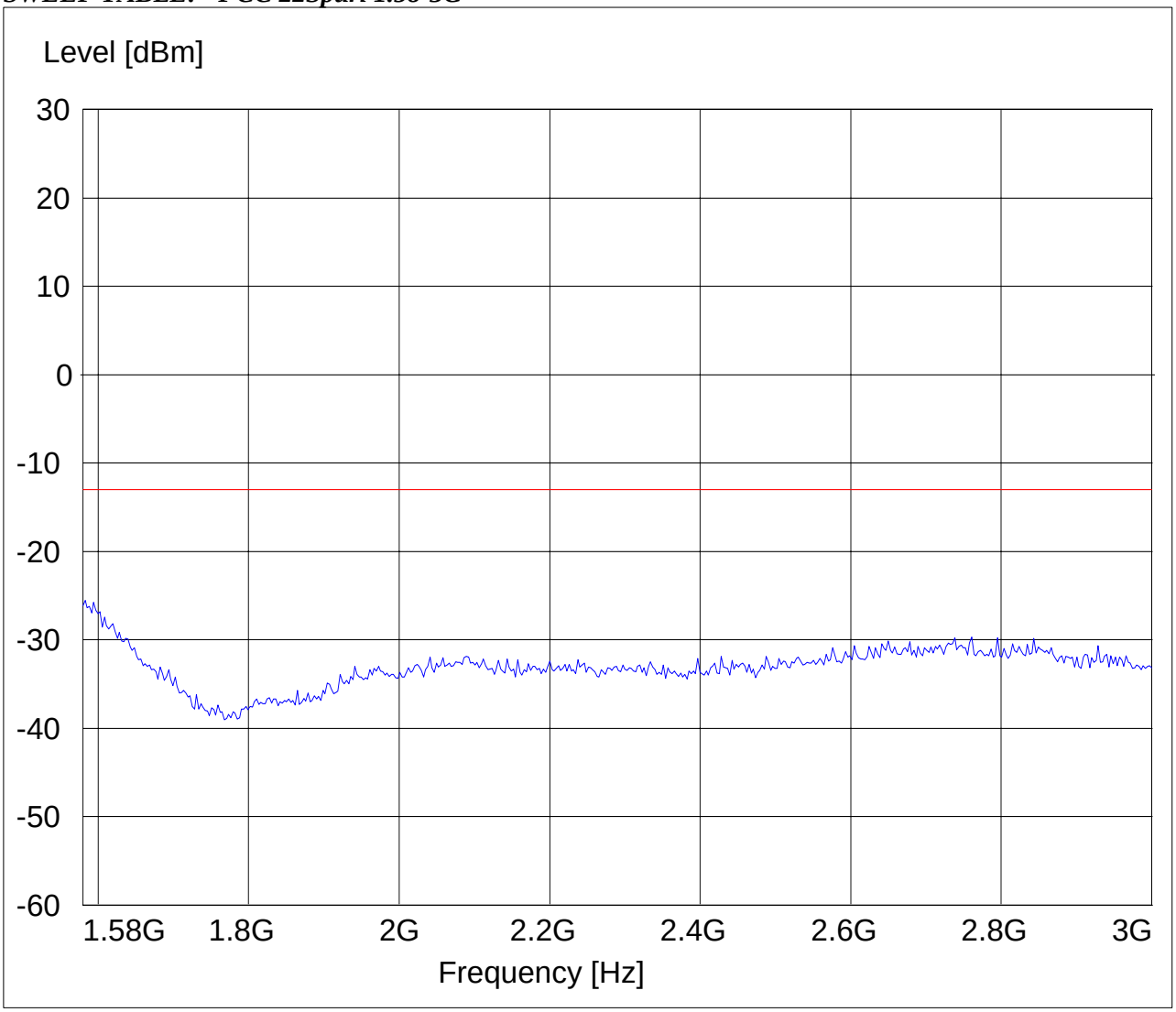


RADIATED SPURIOUS EMISSIONS (GSM-850)
Tx @ 848.8MHz: 1.58GHz – 3GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM850 CH251
Ant Orientation: H
EUT Orientation: H
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 22Spuri 1.58-3G"

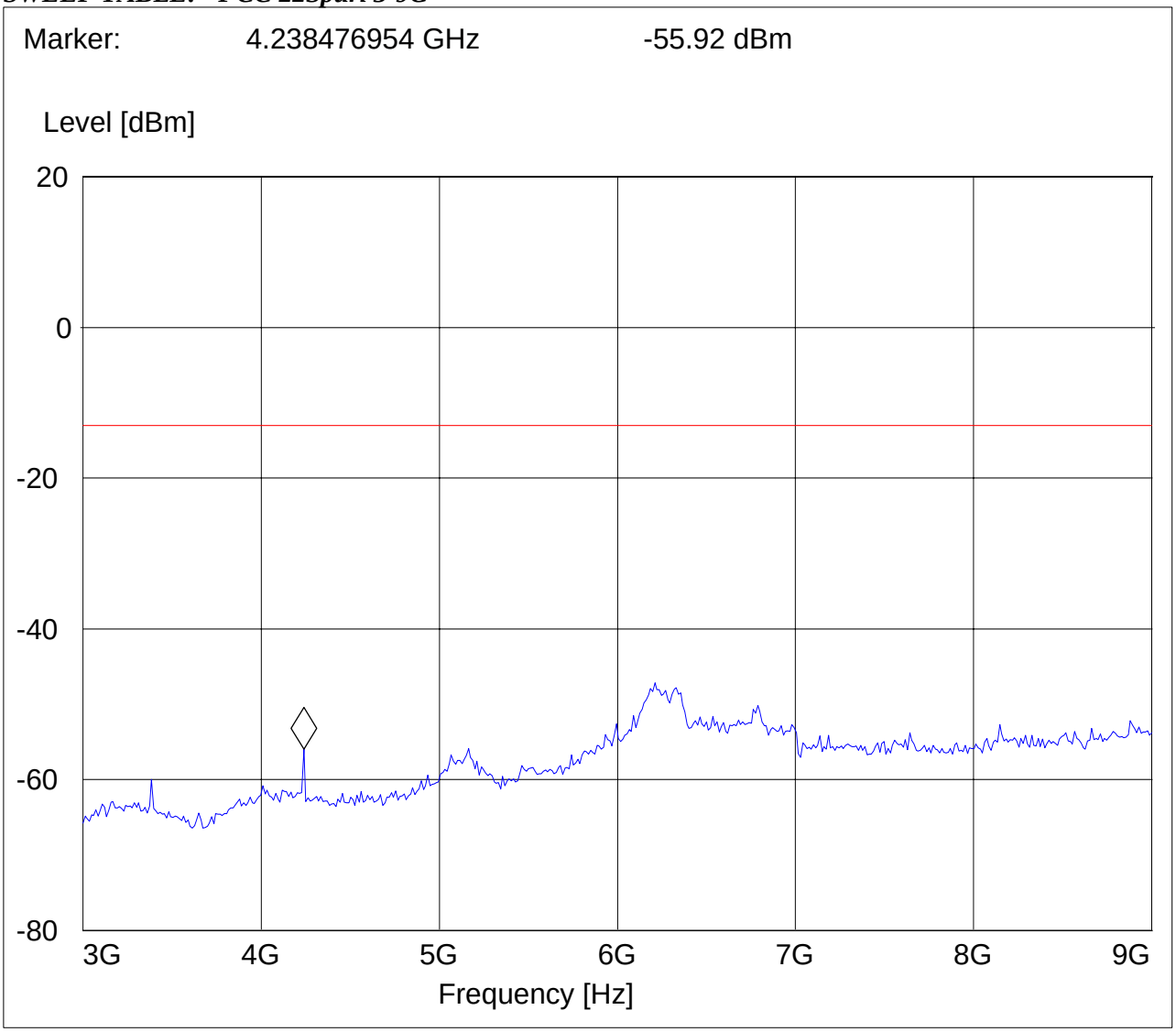


RADIATED SPURIOUS EMISSIONS (GSM-850)
Tx @ 848.8MHz: 3GHz – 9GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM850 CH251
Ant Orientation: H
EUT Orientation: H
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 22Spuri 3-9G"



4.5.4.3 RESULTS OF RADIATED TESTS PCS-1900:

Harmonic	Tx ch-512 Freq.(MHz)	Level (dBm)	Tx ch-661 Freq. (MHz)	Level (dBm)	Tx ch-810 Freq. (MHz)	Level (dBm)
2	**3700.4**	NF	**3760**	NF	**3819.6**	NF
3	**5550.6**	NF	**5640**	NF	**5729.4**	NF
4	**7400.8**	NF	**7520**	NF	**7639.2**	NF
5	**9251**	NF	**9400**	NF	**9549**	NF
6	**11101.2**	NF	**11280**	NF	**11458.8**	NF
7	**12951.4**	NF	**13160**	NF	**13368.6**	NF
8	**14801.6**	NF	**15040**	NF	**15278.4**	NF
9	**16651.8**	NF	**16920**	NF	**17188.2**	NF
10	**18502**	NF	**18800**	NF	**19098**	NF
NF = NOISE FLOOR						

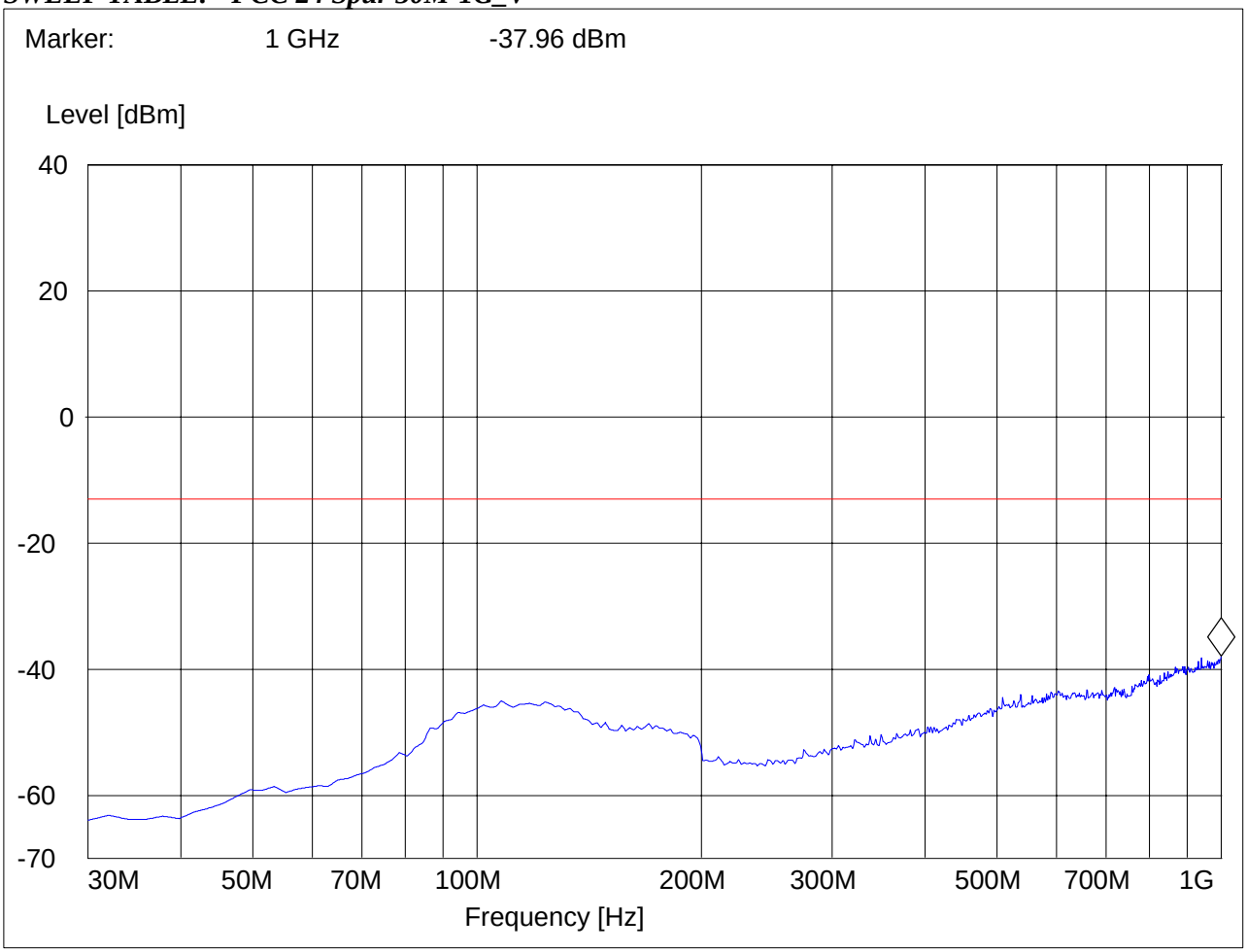
4.5.4.4 RADIATED SPURIOUS EMISSIONS(PCS 1900)

TX: 30MHz - 1GHz
Spurious emission limit –13dBm
Antenna: vertical

Note: This plot is valid for low, mid & high channels (worst-case plot)

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA
EUT::
Customer:: ACI
Test Mode: GSM1900 CH661
Ant Orientation: V
EUT Orientation: 30° vert incline
Test Engineer: Ed
Voltage:: battery
Comments:: 360°rotation

SWEEP TABLE: "FCC 24 Spur 30M-1G_V"



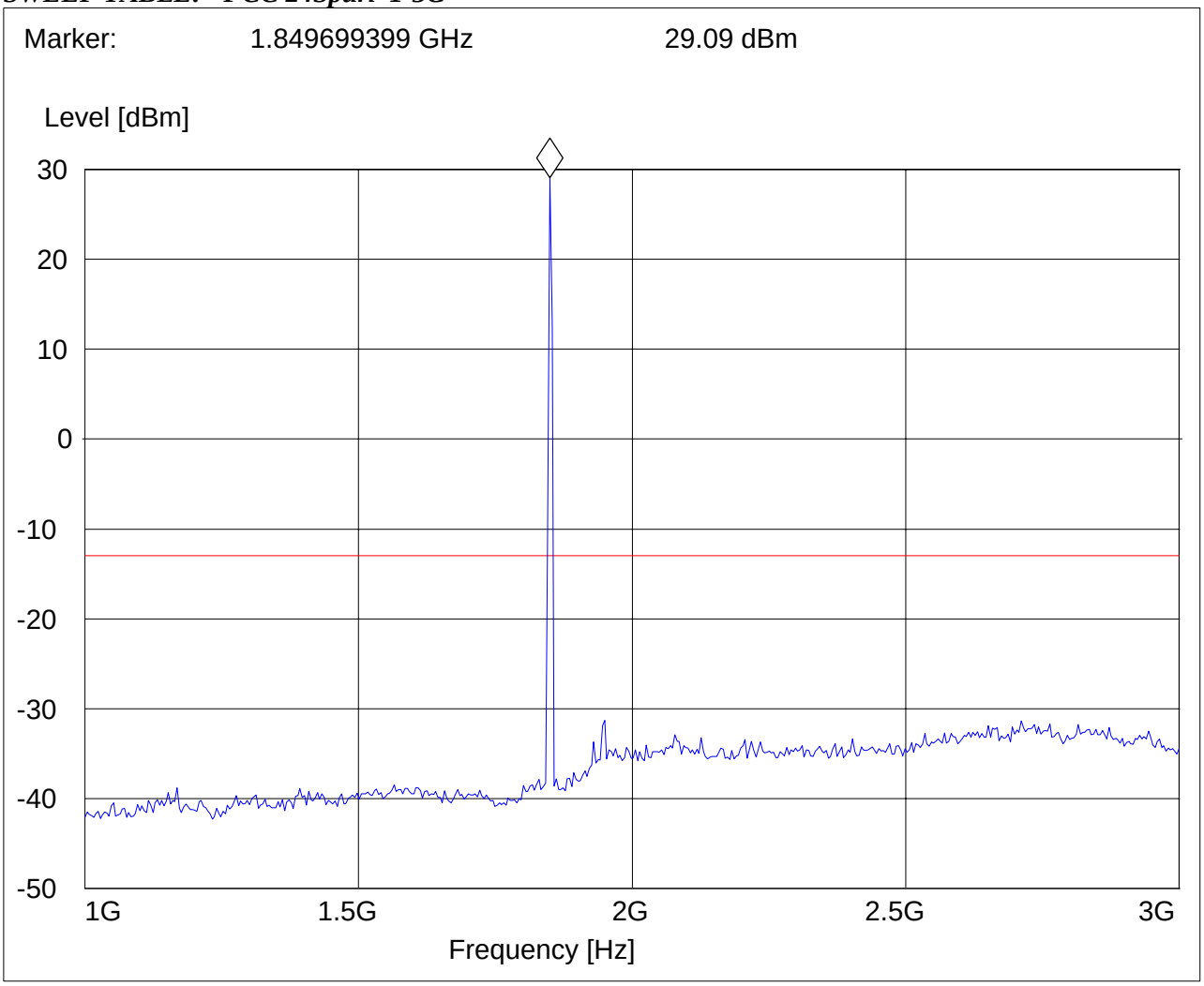
RADIATED SPURIOUS EMISSIONS(PCS 1900)
Tx @ 1850.2MHz: 1GHz – 3GHz
Spurious emission limit –13dBm

Note: The peak above the limit line is the carrier freq. at ch-512.

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM1900 CH 512
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 24Spuri 1-3G"

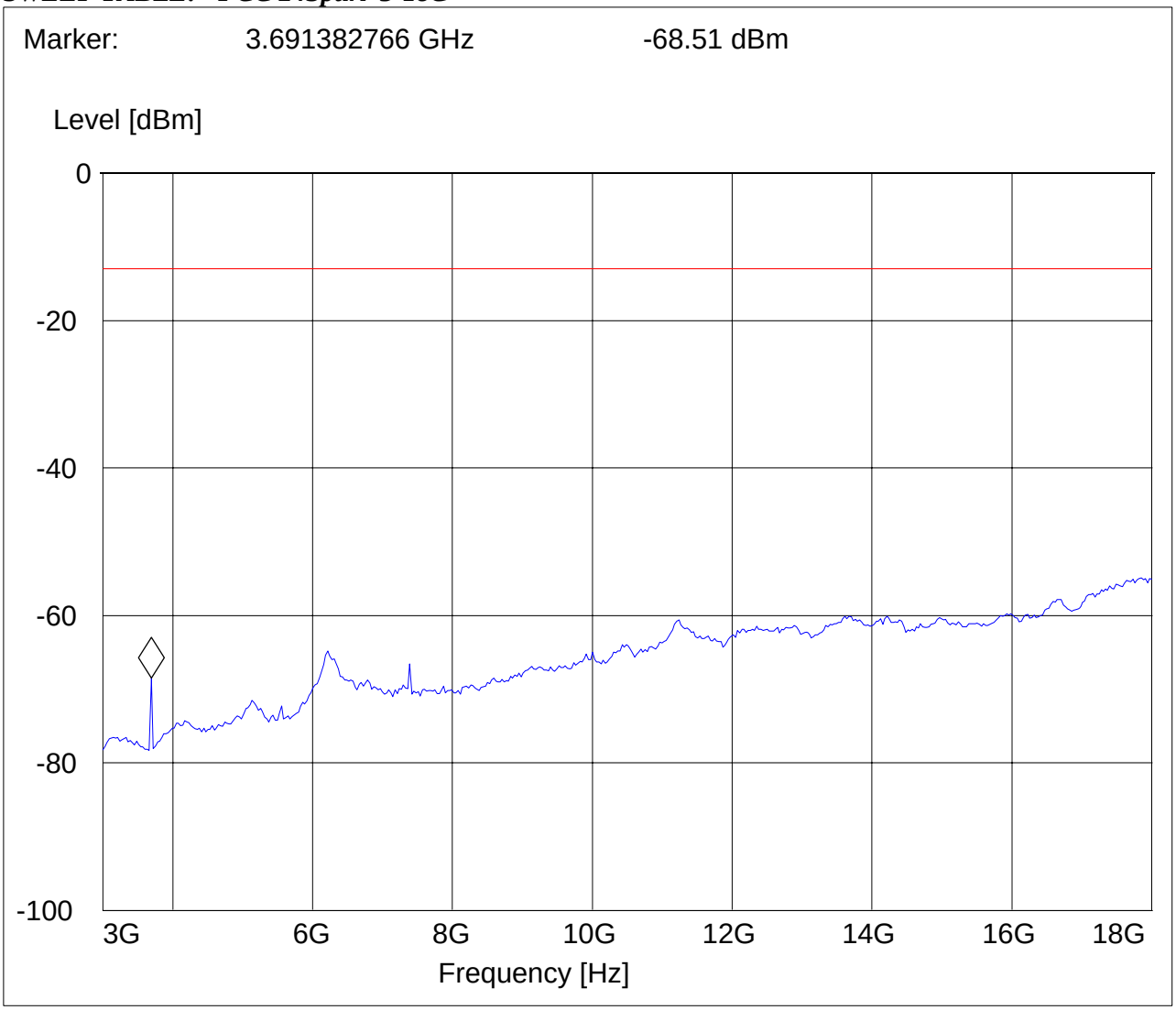


RADIATED SPURIOUS EMISSIONS(PCS 1900)
Tx @ 1850.2MHz: 3GHz – 18GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM1900 CH 512
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 24Spuri 3-18G"

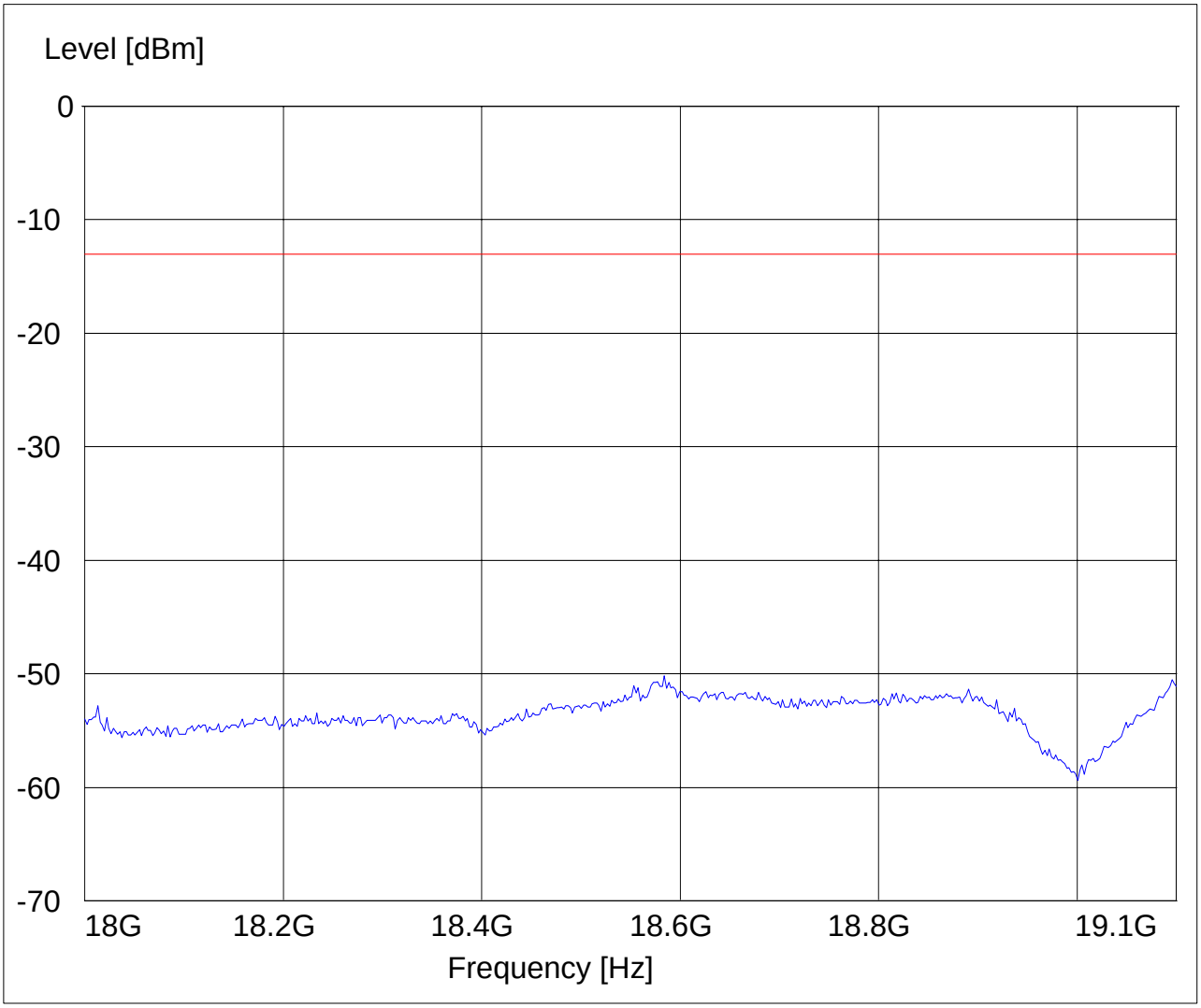


RADIATED SPURIOUS EMISSIONS(PCS 1900)
Tx @ 1850.2MHz: 18GHz – 19GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM1900 CH 512
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 24spuri 18-19.1G"



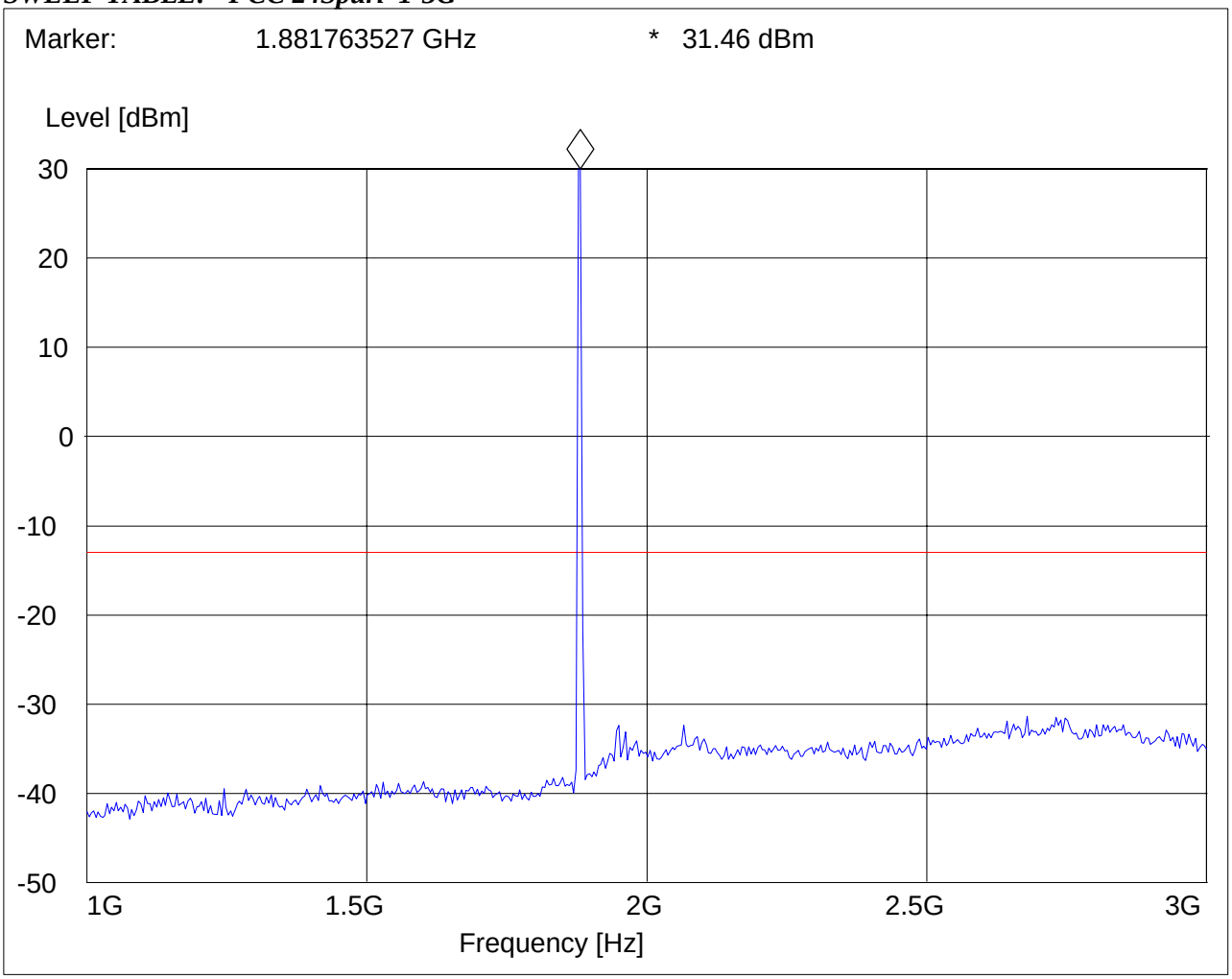
RADIATED SPURIOUS EMISSIONS(PCS 1900)
Tx @ 1880.0MHz: 1GHz – 3GHz
Spurious emission limit –13dBm

Note: The peak above/close to the limit line is the carrier freq. at ch-661.

CETECOM Inc.411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM1900 CH 661
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 24Spuri 1-3G"

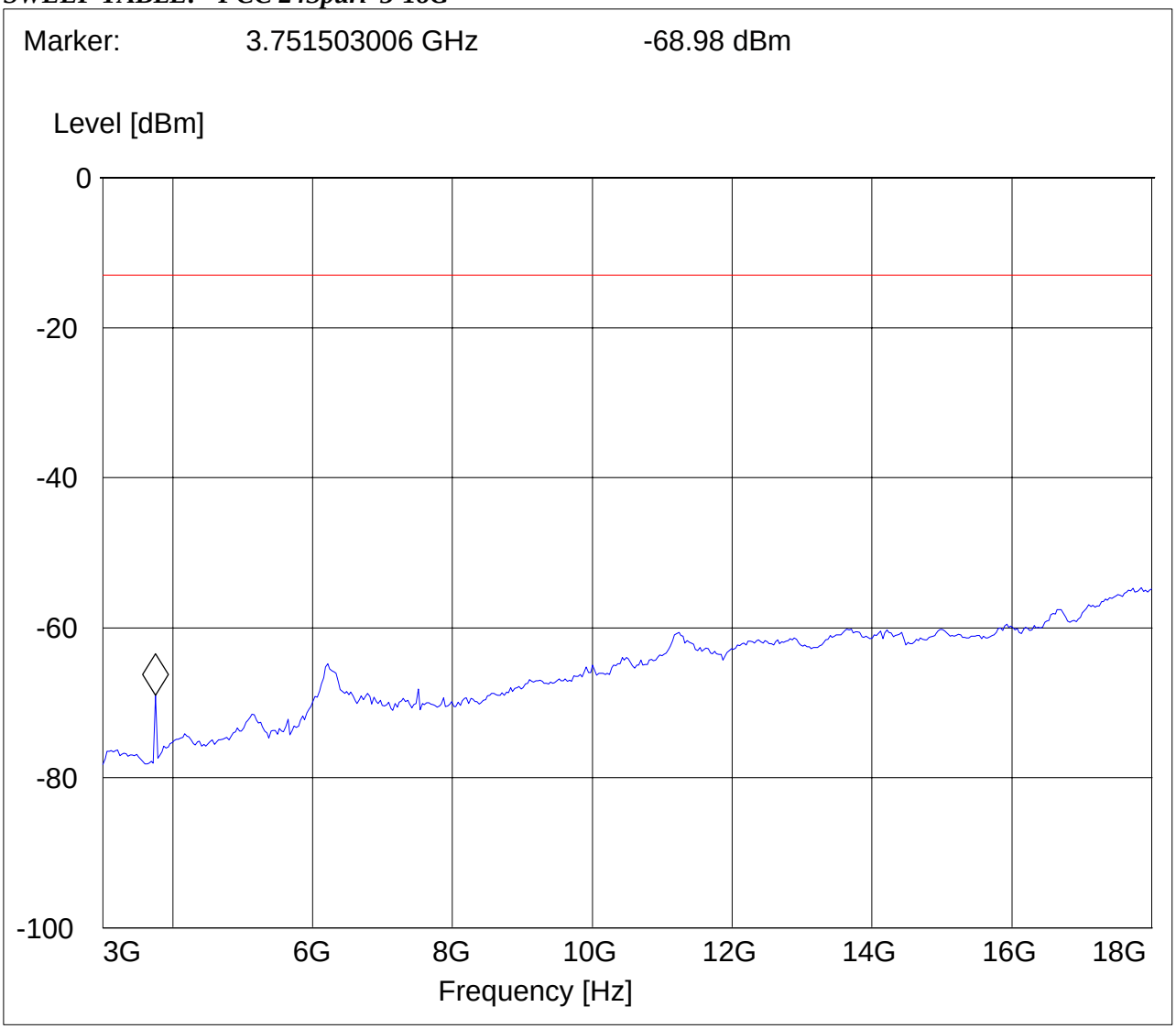


RADIATED SPURIOUS EMISSIONS(PCS 1900)
Tx @ 1880.0MHz: 3GHz – 18GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM1900 CH 661
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 24Spuri 3-18G"

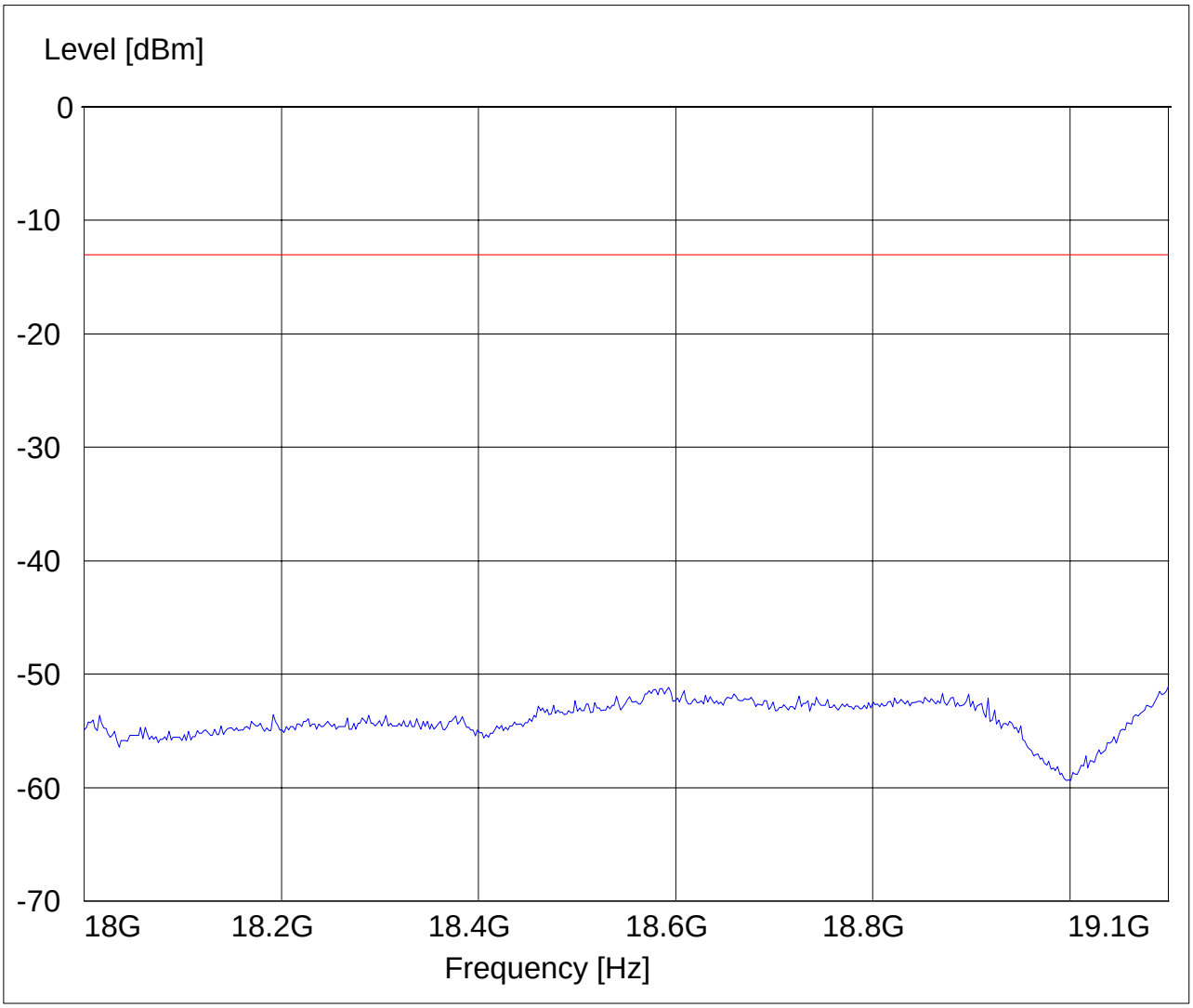


RADIATED SPURIOUS EMISSIONS(PCS 1900)
Tx @ 1880.0MHz: 18GHz – 19GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM1900 CH 661
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 24spuri 18-19.1G"

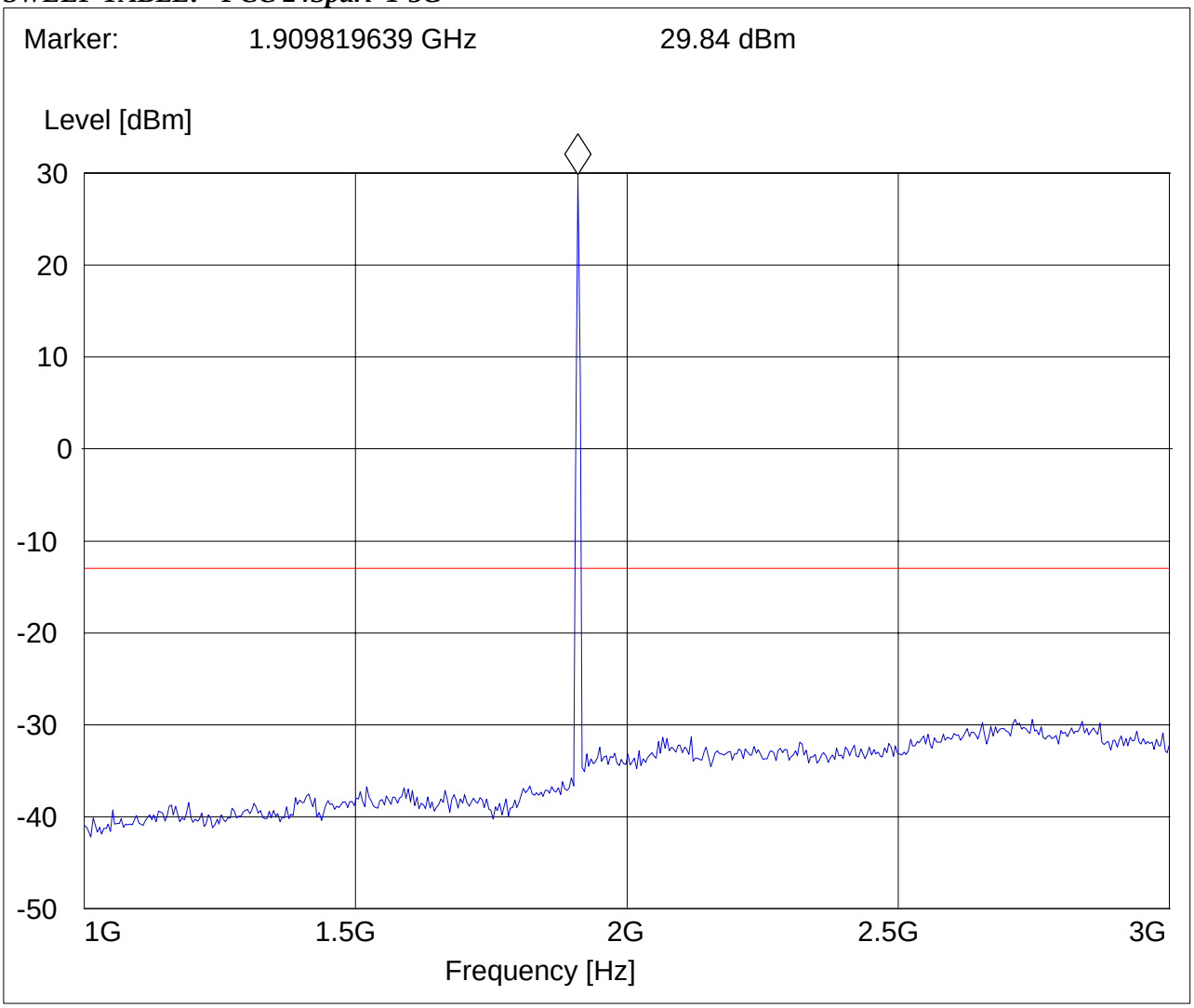


RADIATED SPURIOUS EMISSIONS(PCS 1900)
Tx @ 1909.8MHz: 1GHz – 3GHz
Spurious emission limit –13dBm

Note: The peak above the limit line is the carrier freq. at ch-810.

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA
EUT::
Customer:: ACI
Test Mode: GSM1900 CH 810
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 24Spuri 1-3G"

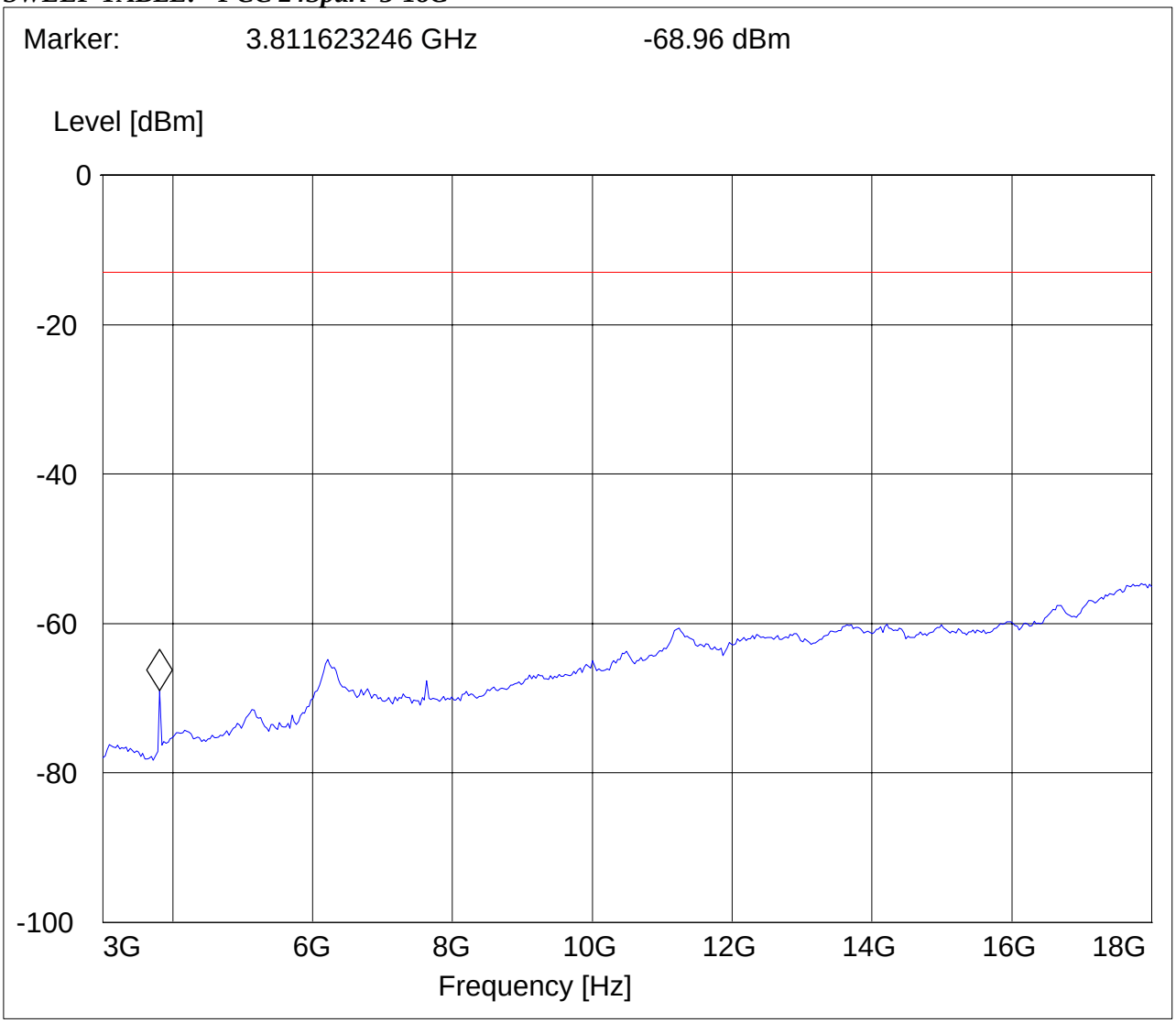


RADIATED SPURIOUS EMISSIONS(PCS 1900)
Tx @ 1909.8MHz: 3GHz – 18GHz
Spurious emission limit –13dBm

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM1900 CH 810
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 24Spuri 3-18G"

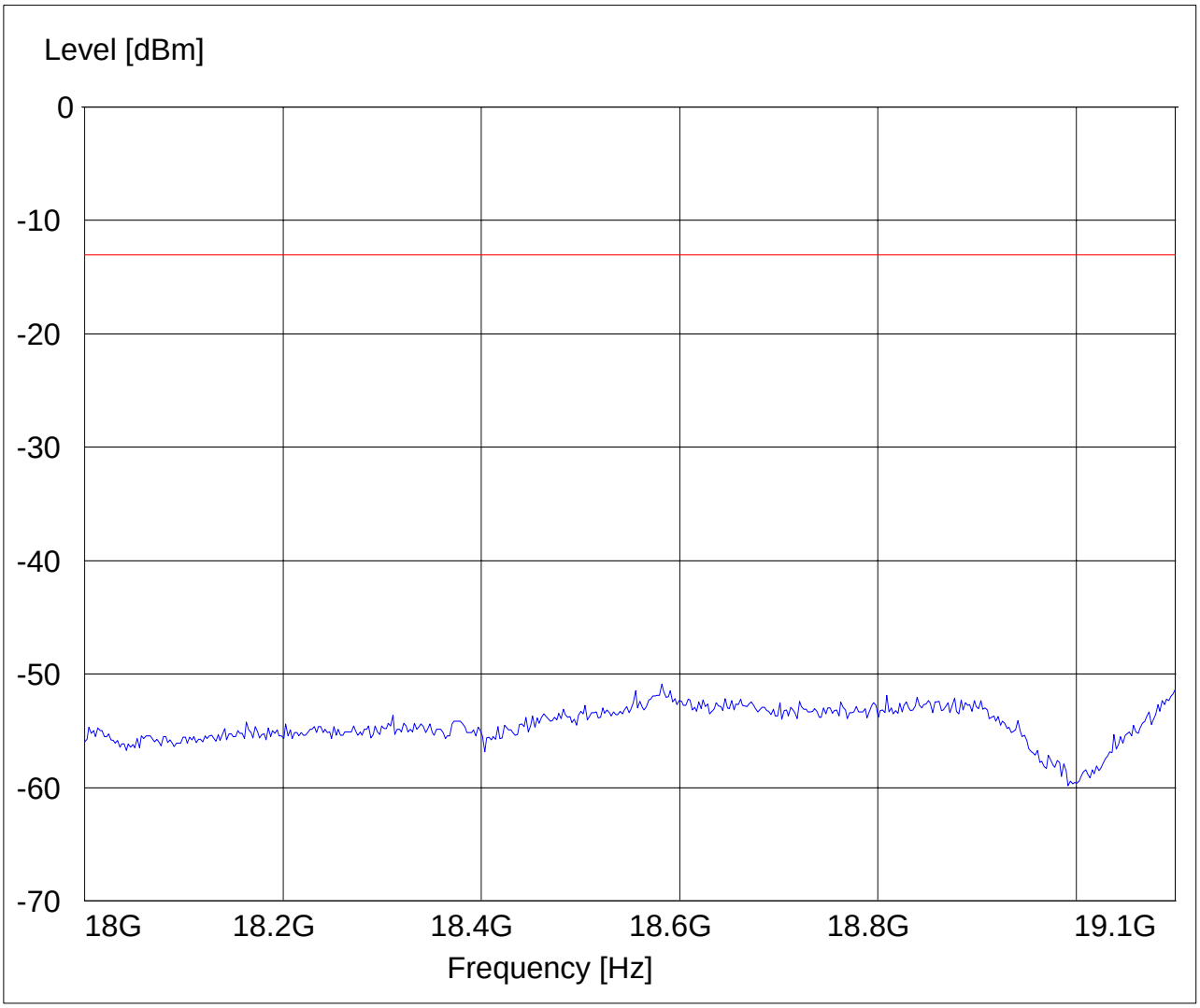


RADIATED SPURIOUS EMISSIONS(PCS 1900)
Tx @ 1909.8MHz : 18GHz – 19.1GHz
Spurious emission limit –13dBm

CETECOM Inc.411 Dixon Landing Road, Milpitas CA 95035, USA

EUT::
Customer:: ACI
Test Mode: GSM1900 CH 810
Ant Orientation: H
EUT Orientation: 30 degrees
Test Engineer: Pete Krebill
Voltage:: battery
Comments:: 360° ROTATION

SWEEP TABLE: "FCC 24spuri 18-19.1G"



TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Cal Due	Interval
01	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2007	1 year
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	August 2007	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2007	1 year
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02	May 2007	1 year
05	Biconilog Antenna	3141	EMCO	0005-1186	June 2007	1 year
06	Horn Antenna (1-18GHz)	SAS-200/571	AH Systems	325	June 2007	1 year
07	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240	June 2007	1 year
08	Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
09	Climatic Chamber	VT4004	Voltsch	G1115	May 2007	1 year
10	High Pass Filter	5HC2700	Trilithic Inc.	9926013	n/a	n/a
11	High Pass Filter	4HC1600	Trilithic Inc.	9922307	n/a	n/a
12	Pre-Amplifier	JS4-00102600	Miteq	00616	May 2007	1 year
13	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807	May 2007	1 year
14	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008	May 2007	1 year
15	Universal Radio Comm. Tester	CMU 200	Rohde & Schwarz	832221/06	May 2007	1 year
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2007	1 year
17	Loop Antenna	6512	EMCO	00049838	July 2007	2 years

5 References

Title 47—Telecommunication, CHAPTER I--FEDERAL COMMUNICATIONS COMMISSION,
PART 2--FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS October 1**,** 2001.

Title 47—Telecommunication, CHAPTER I--FEDERAL COMMUNICATIONS COMMISSION,
PART 22 PUBLIC MOBILE SERVICES October 1, 1998.

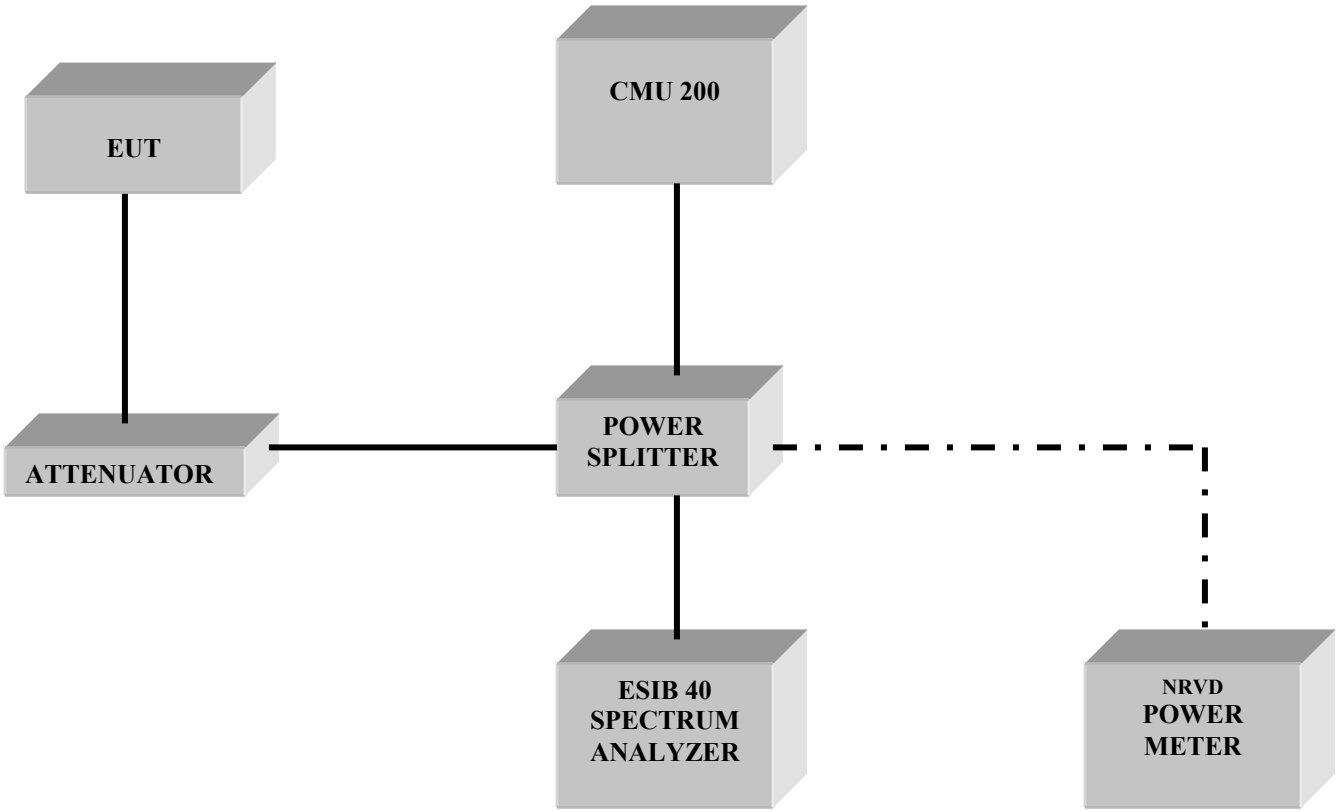
FCC Report and order 02-229 September 24, 2002.

Title 47—Telecommunication, CHAPTER I--FEDERAL COMMUNICATIONS COMMISSION,
PART 24 PERSONAL COMMUNICATIONS SERVICES October 1, 1998.

ANSI / TIA-603-C-2004 Land Mobile FM or PM Communications Equipment Measurement and Performance Standard November 7, 2002.

6 BLOCK DIAGRAMS

Conducted Testing



Radiated Testing