FCC Test Report

FCC Part 22, 24

Model #: H913ET

Sage Co.,Ltd.
Bentendori Naka-ku 7F
4-59
Yokohama City, Kanagawa Pref, 231-0007
Japan

FCC ID: VRBH913ET

TEST REPORT #: EMC_CET10_042_08501_FCC22_24_rev3
DATE: 2008-10-23

ilac-MRA A2LA ACCREDITED Certificate # 2135.01

Bluetooth

Bluetooth Qualification Test Facility (BQTF)

CTIA Authorized Test Lab
LAB CODE 20020328-00

FCC listed: A2LA accredited

IC recognized # 3462B

***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: info@cetecomusa.com ◆ http://www.cetecom.com
CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686
Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May
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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.

Company	Model #
Sage Co.,Ltd.	**H913ET**

Technical responsibility for area of testing:

Date	Section	Name	Signature
2008-10-23	**EMC & Radio**	**Peter Mu (EMC Project Engineer)**	Peter Mu

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 Mu**
Date of test:	**2008-9-23 to 2008-10-21**

2.2 Identification of the Client

Applicant's Name:	**Sage Co.,Ltd.**
Address Line 1:	**Bentendori Naka-ku 7F**
Address Line 2:	**4-59**
City/ Zip Code	**Yokohama City, Kanagawa Pref 231-0007**
Country:	**Japan**
Contact Person:	**Masaki Mori**
Phone No.:	**+81-45-650-6840**
Fax:	**+81-45-650-6841**
e-mail:	**m-mori@jsage.co.jp**

2.3 Identification of the Manufacturer

Same as above applicant

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3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name of EUT (if not same as Model No.)	**H913ET**
Model No.	**H913ET**
FCC-ID	**VRBH913ET**
Frequency Range:	**824.2MHz – 848.8MHz for GSM 850** **1850.2MHz – 1909.8MHz for PCS 1900**
Type(s) of Modulation:	**GMSK, 8PSK**
Number of Channels:	**GSM: 124 for GSM-850, 299 for PCS-1900**
Antenna Type:	**Windows mount external.**
Max. Output Power:	**Peak Conducted GSM850: 33.03dBm, 2009mW** **Peak Conducted GSM1900: 30.17dBm, 1040mW** **ERP GSM850: 27.66dBm,583mW** **EIRP GSM1900: 27.38dBm, 547mW**

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3.2 Identification of the Equipment Under Test (ET)

EUT #	TYPE	MANF.	MODEL	SERIAL #
1	**EUT**	**Sage Co.,Ltd.**	**H913ET**	**C-GSM03**

3.3 Identification of Accessory equipment

None

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4 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 test results of this test report relate exclusively to radiated measurement only. Radio module used in this product has been previously certified under its own FCC ID.

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5 Measurements

5.1 RF Power Output

5.1.1 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.

5.1.2 Limits:

5.1.2.1 FCC 22.913 (a) Effective radiated power limits.

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

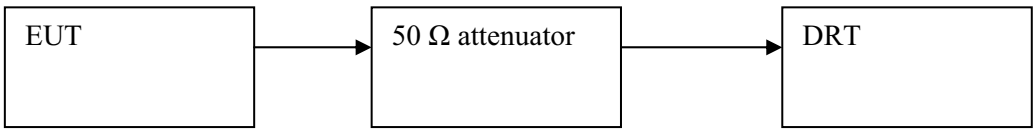
5.1.2.2 FCC 24.232 (b)(c) Power limits.

(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.

5.1.3 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.

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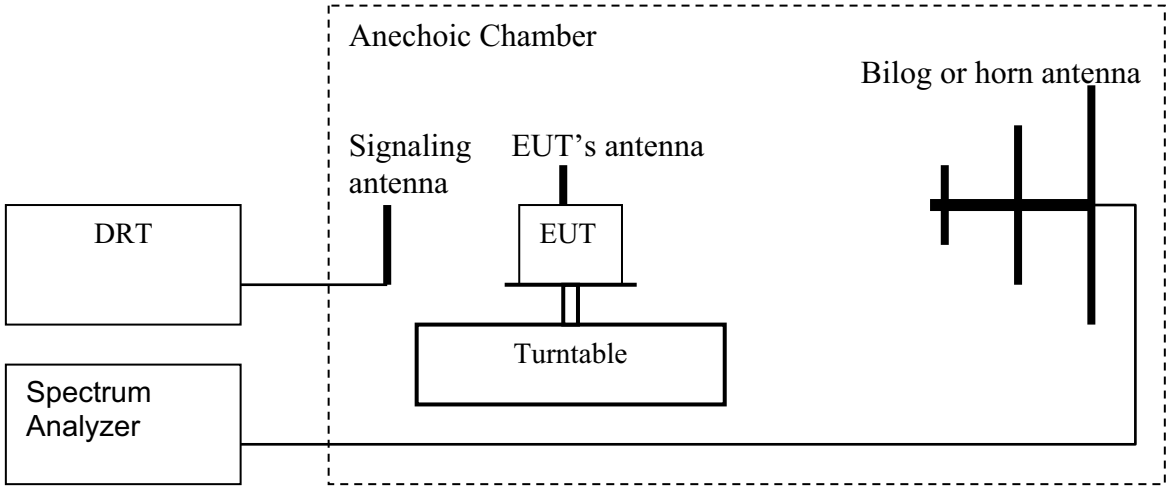
5.1.4 Radiated Output Power Mmeasurement procedure:

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.)

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5.1.5 Conducted Peak Power 850MHz band

Frequency (MHz)	Conducted Peak Power (dBm)	
	GMSK	8PSK
824.2	32.82	30.25
836.6	33.01	30.59
848.8	33.06	30.60

5.1.6 Conducted Peak Power 1900 MHz band

Frequency (MHz)	Conducted Peak Power (dBm)	
	GMSK	8PSK
1850.2	29.28	28.47
1880.0	30.67	29.73
1909.8	30.52	29.69

5.1.7 ERP Results 850MHz band:

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

Frequency (MHz)	Effective Radiated Power (dBm)	
	GMSK	8PSK
824.2	25.54	23.05
836.6	26.73	24.26
848.8	27.66	25.37

5.1.8 EIRP Results 1900 MHz band:

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

Frequency (MHz)	Effective Isotropic Radiated Power (dBm)	
	GMSK	8PSK
1850.2	22.25	21.56
1880.0	25.5	24.58
1909.8	27.38	25.24

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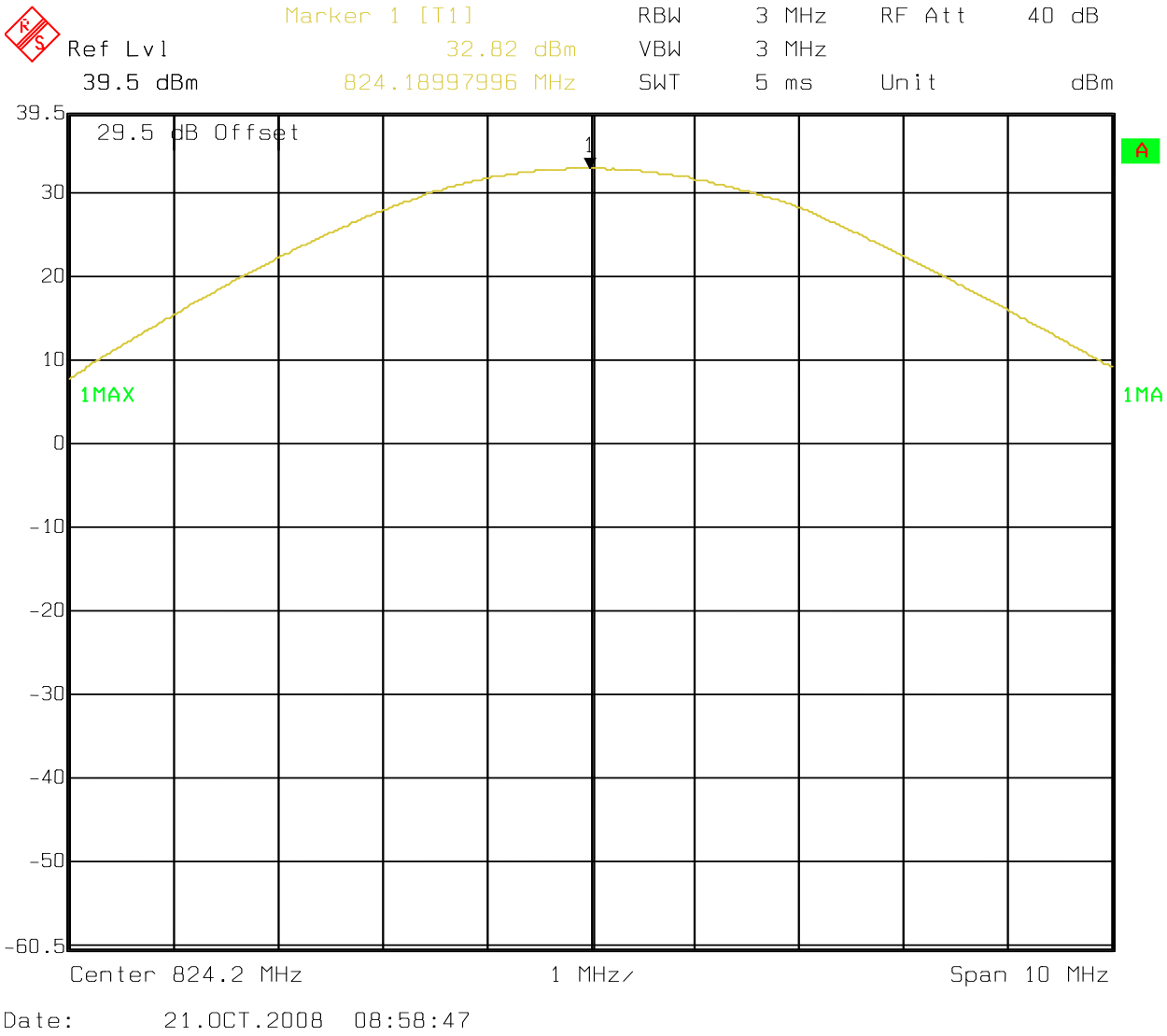
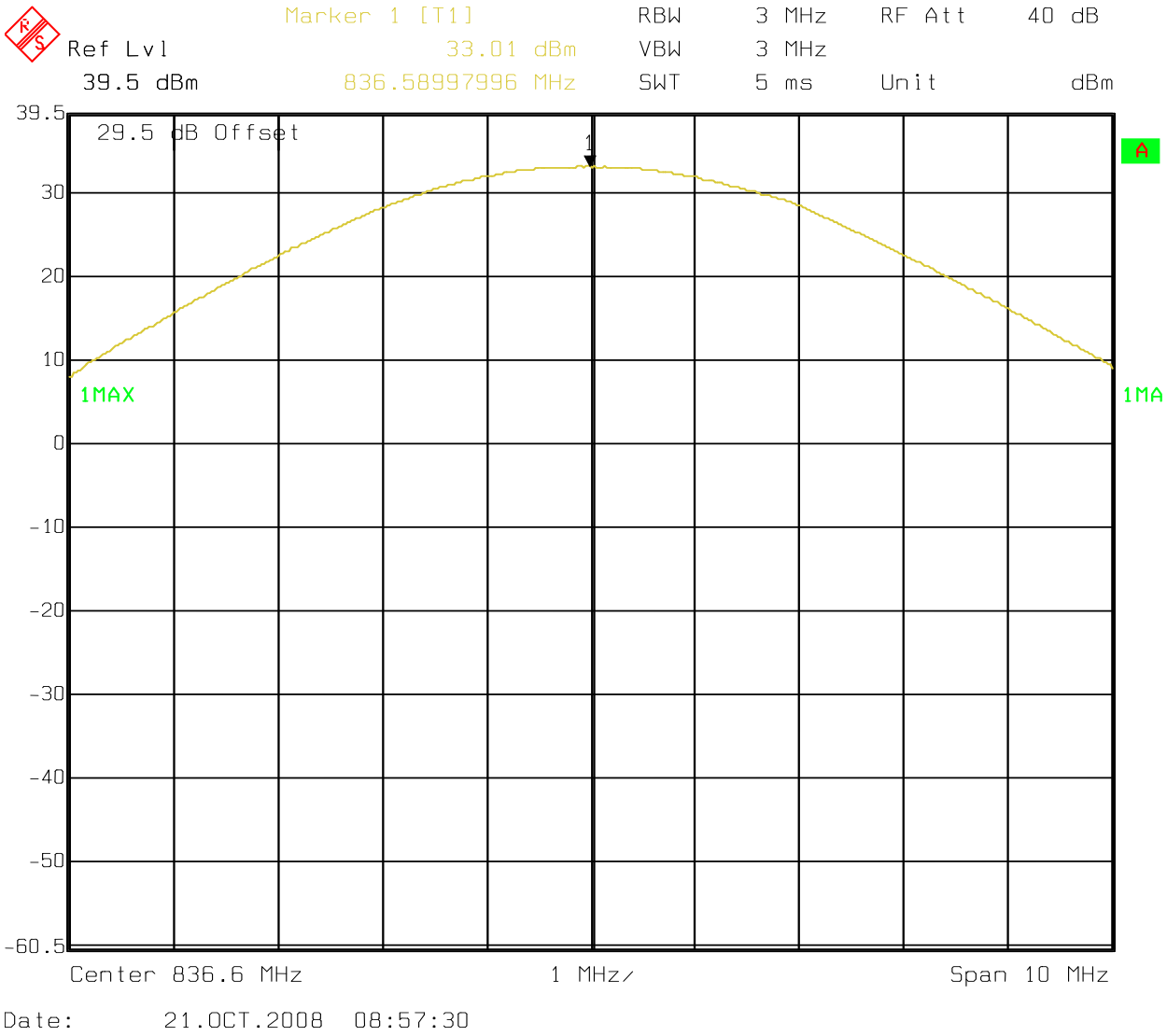
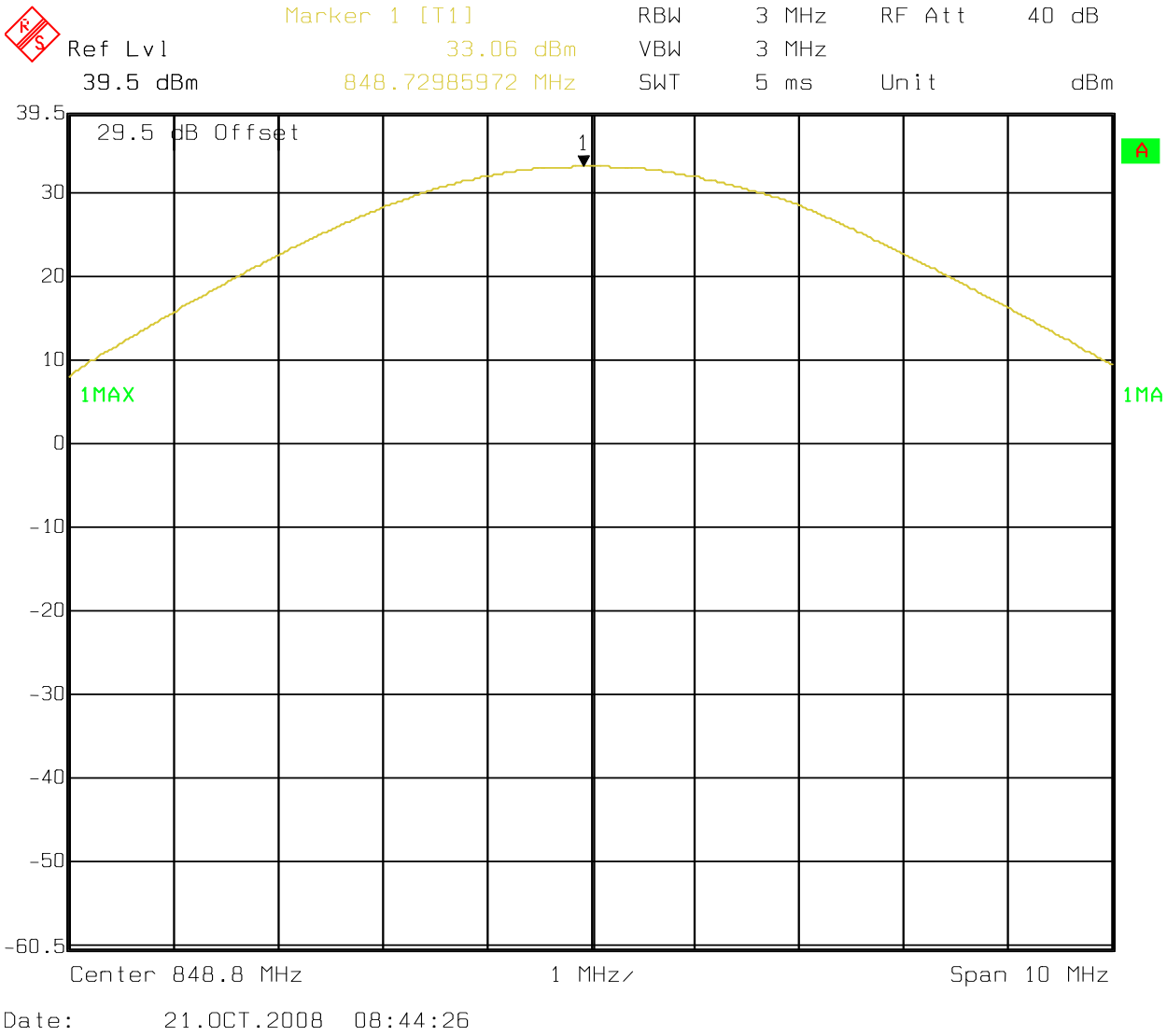
Conducted Peak Power GMSK 850 channel 128



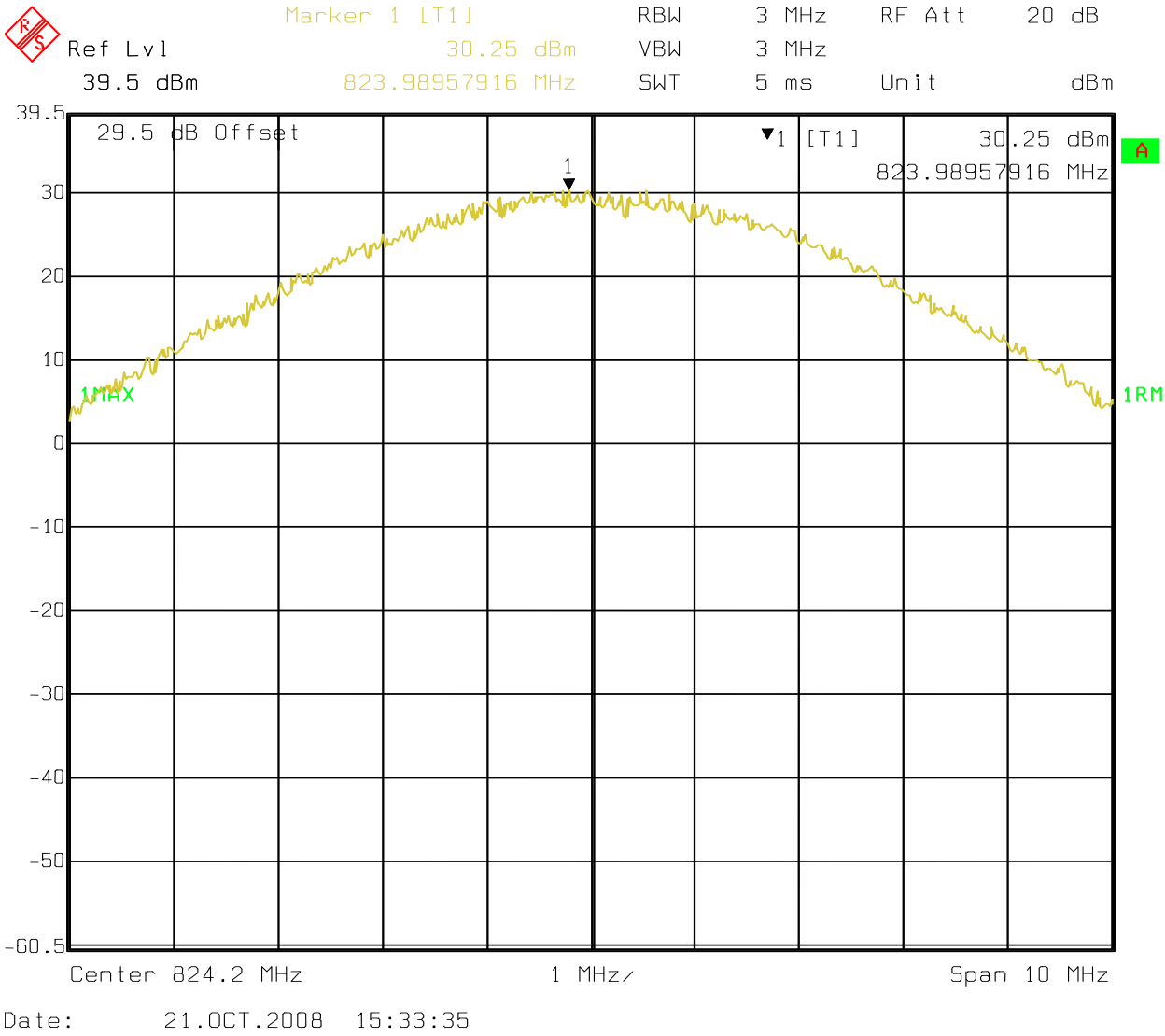
Conducted Peak Power GMSK 850 channel 190



Conducted Peak Power GMSK 850 channel 251



Conducted Peak Power 8PSK 850 channel 128



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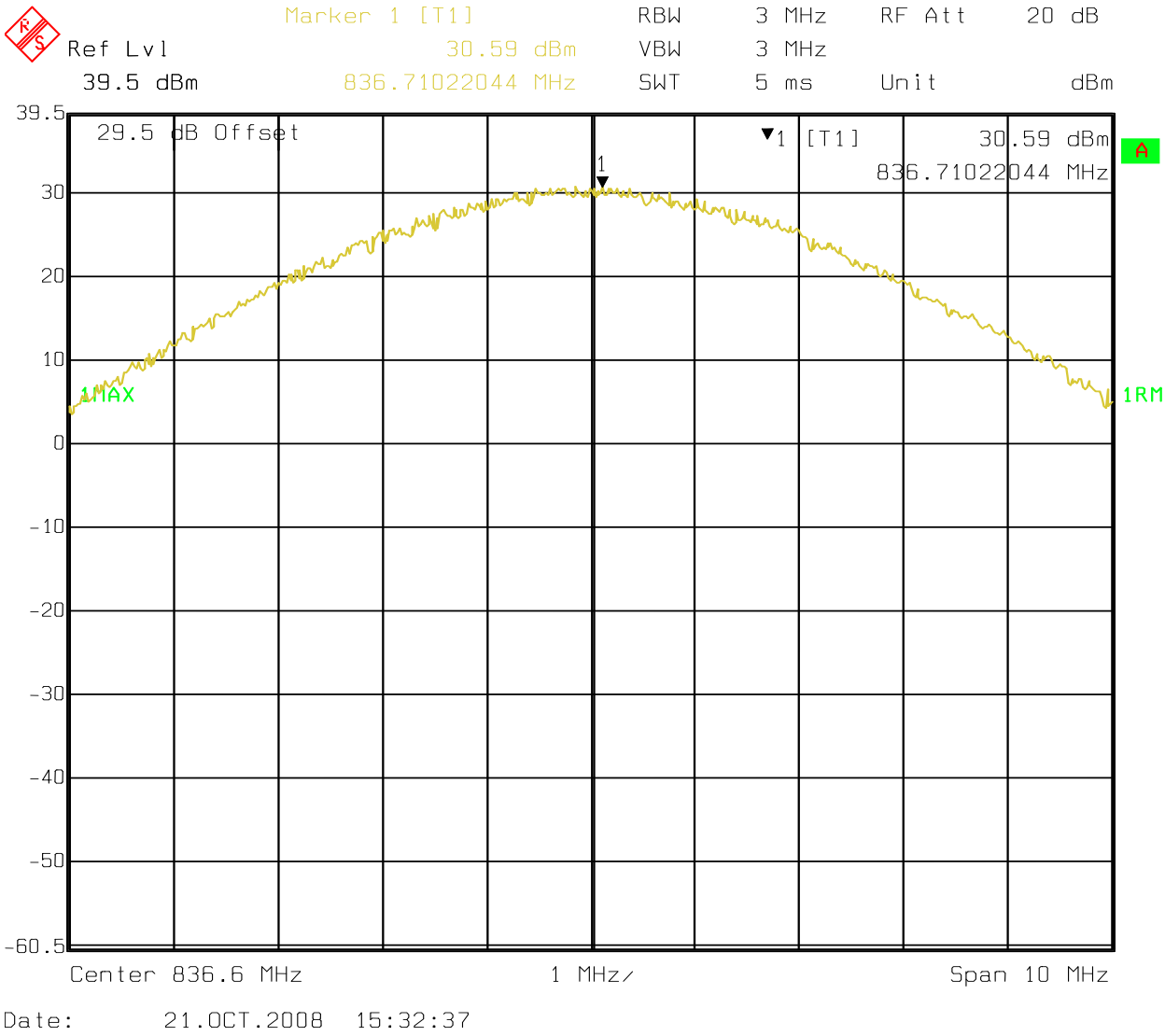
Conducted Peak Power 8PSK 850 channel 190



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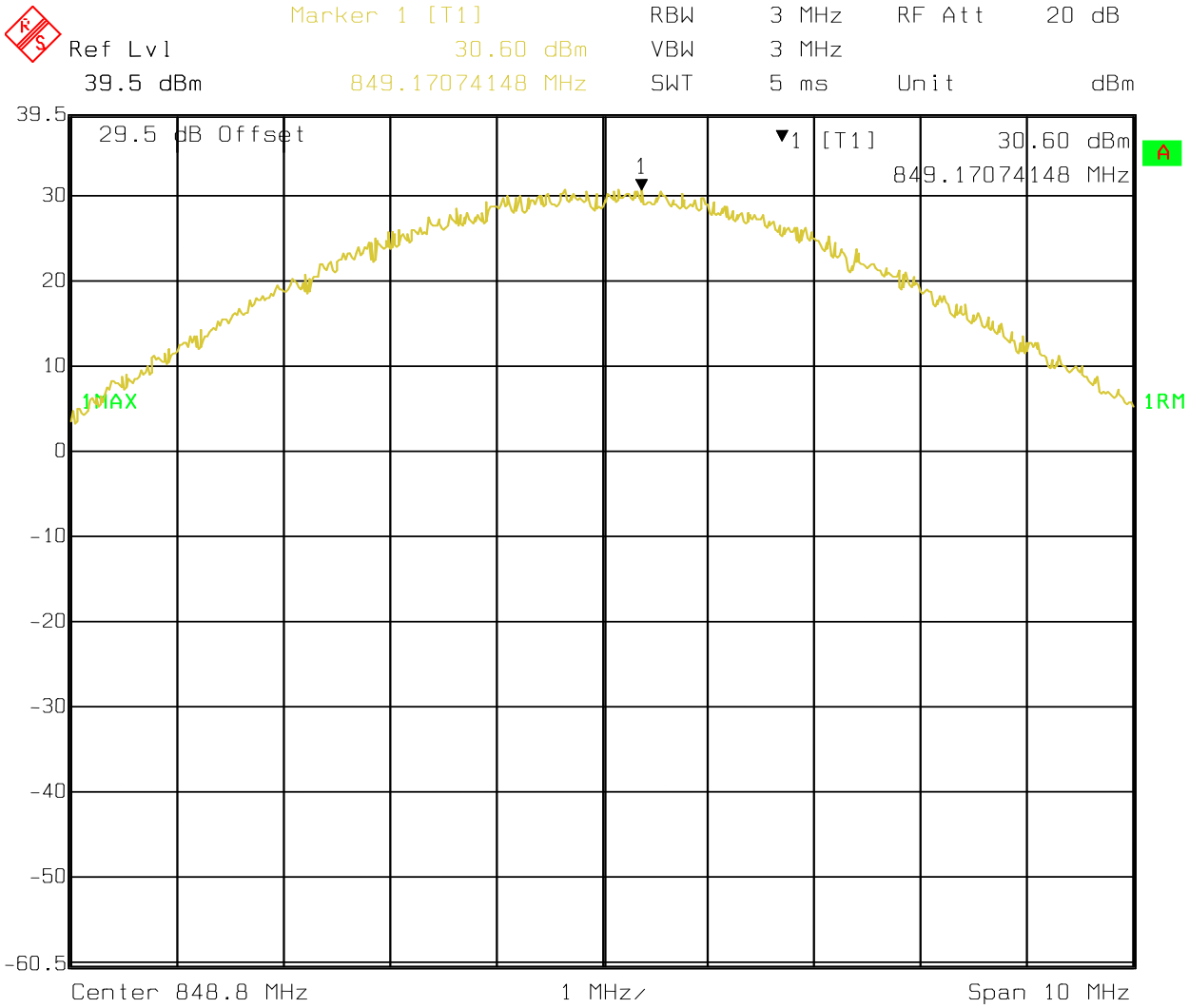
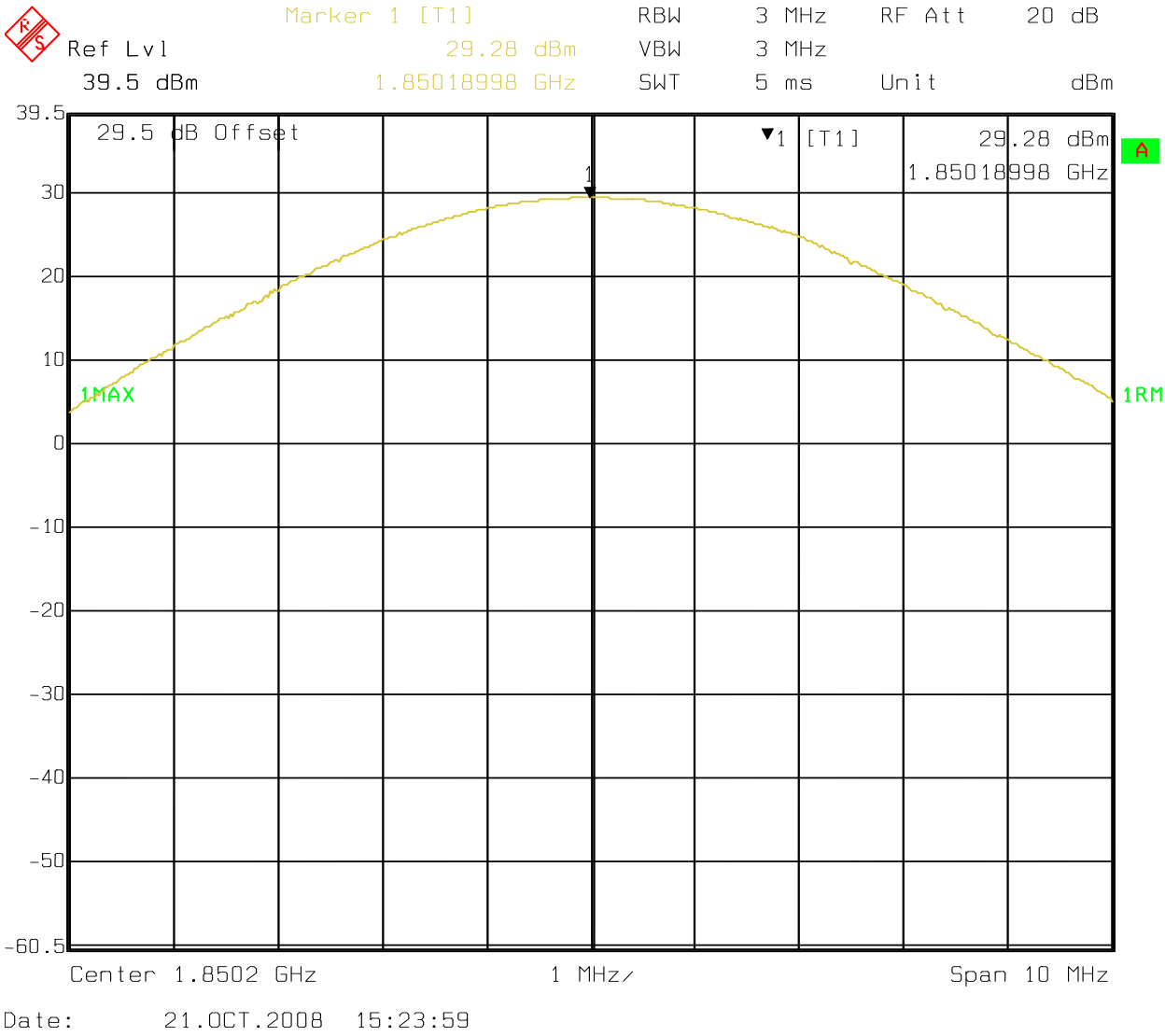
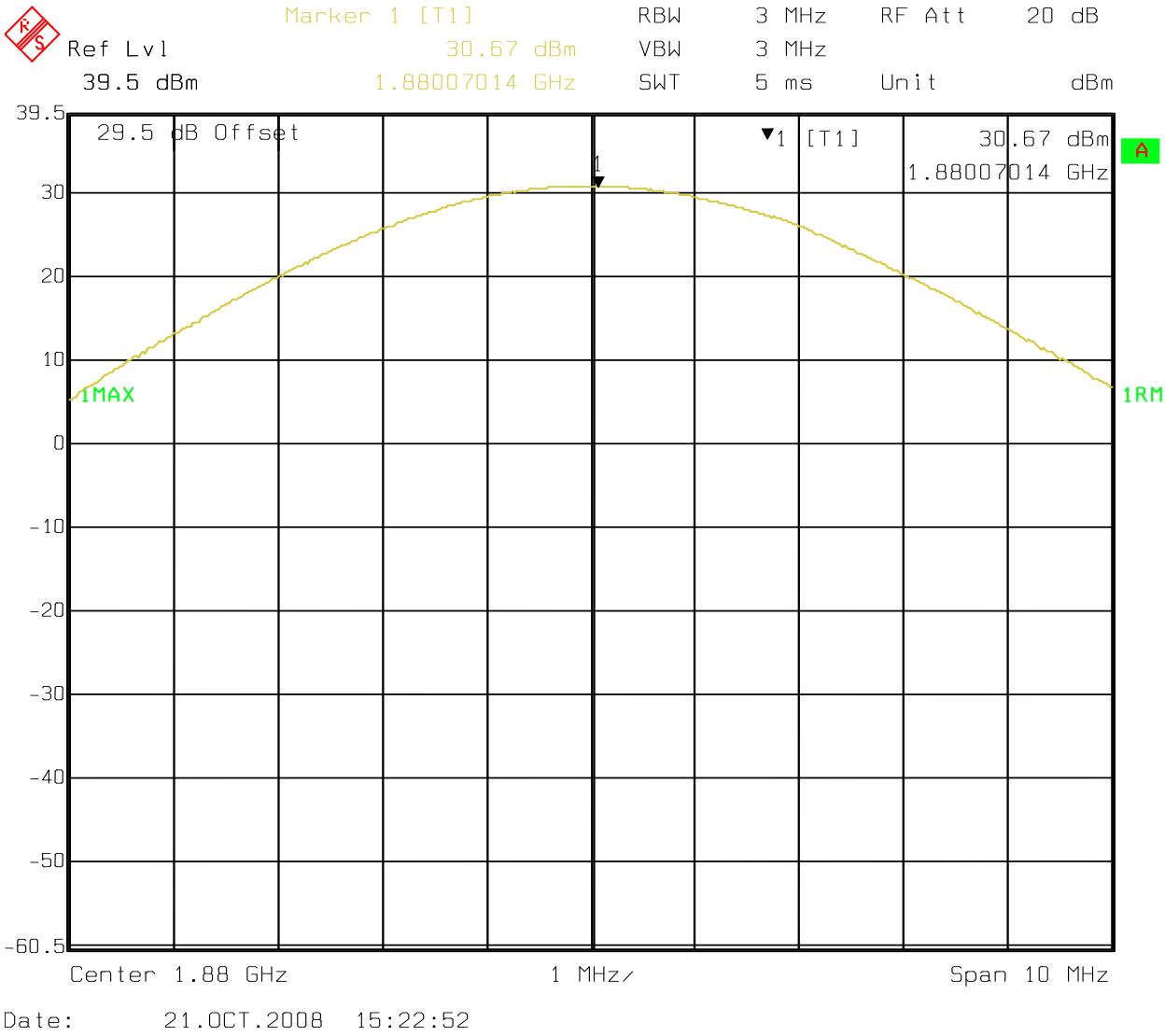
Conducted Peak Power 8PSK 850 channel 251



Conducted Peak Power GMSK 1900 channel 512



Conducted Peak Power GMSK 1900 channel 661



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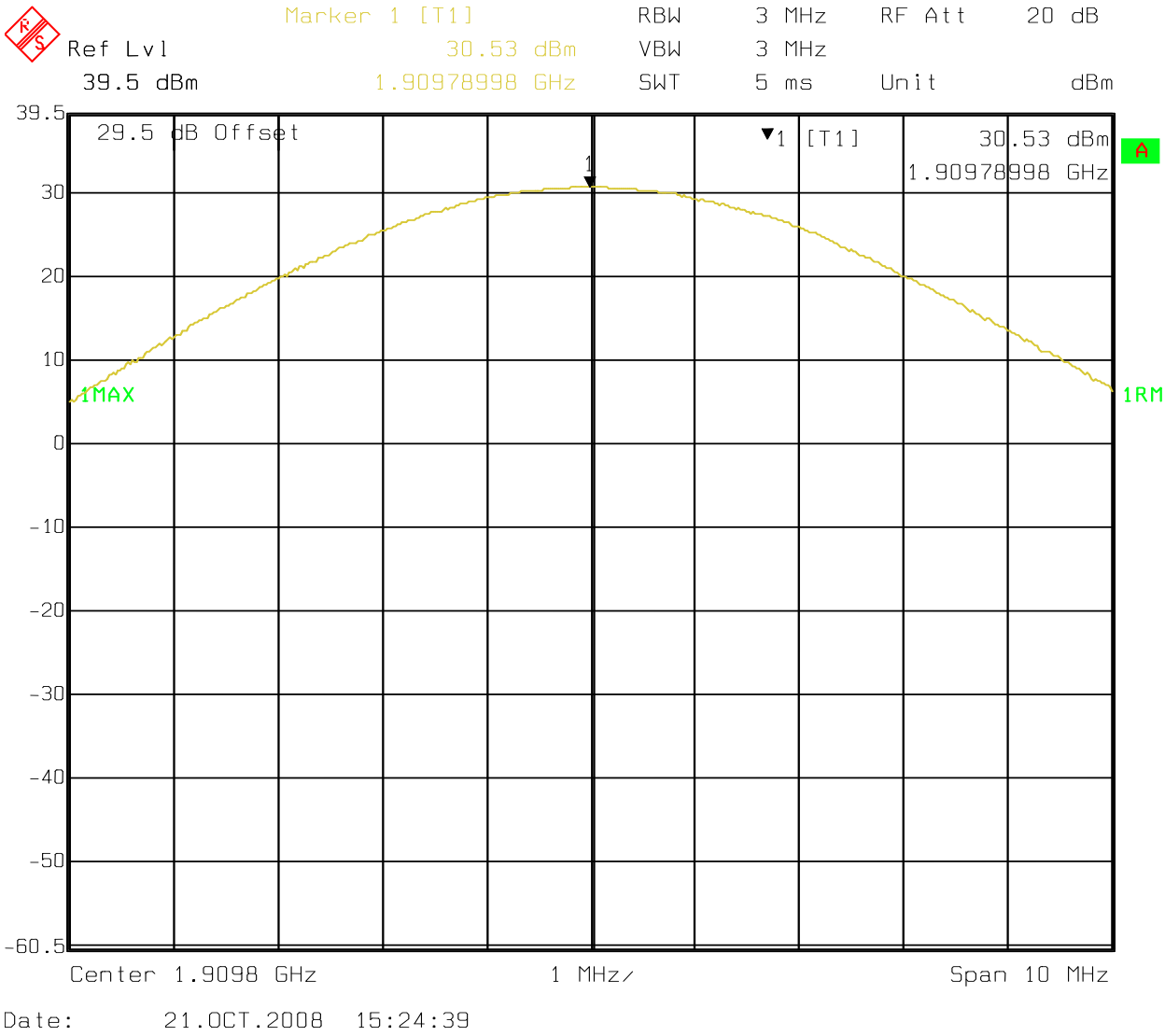
Conducted Peak Power GMSK 1900 channel 810



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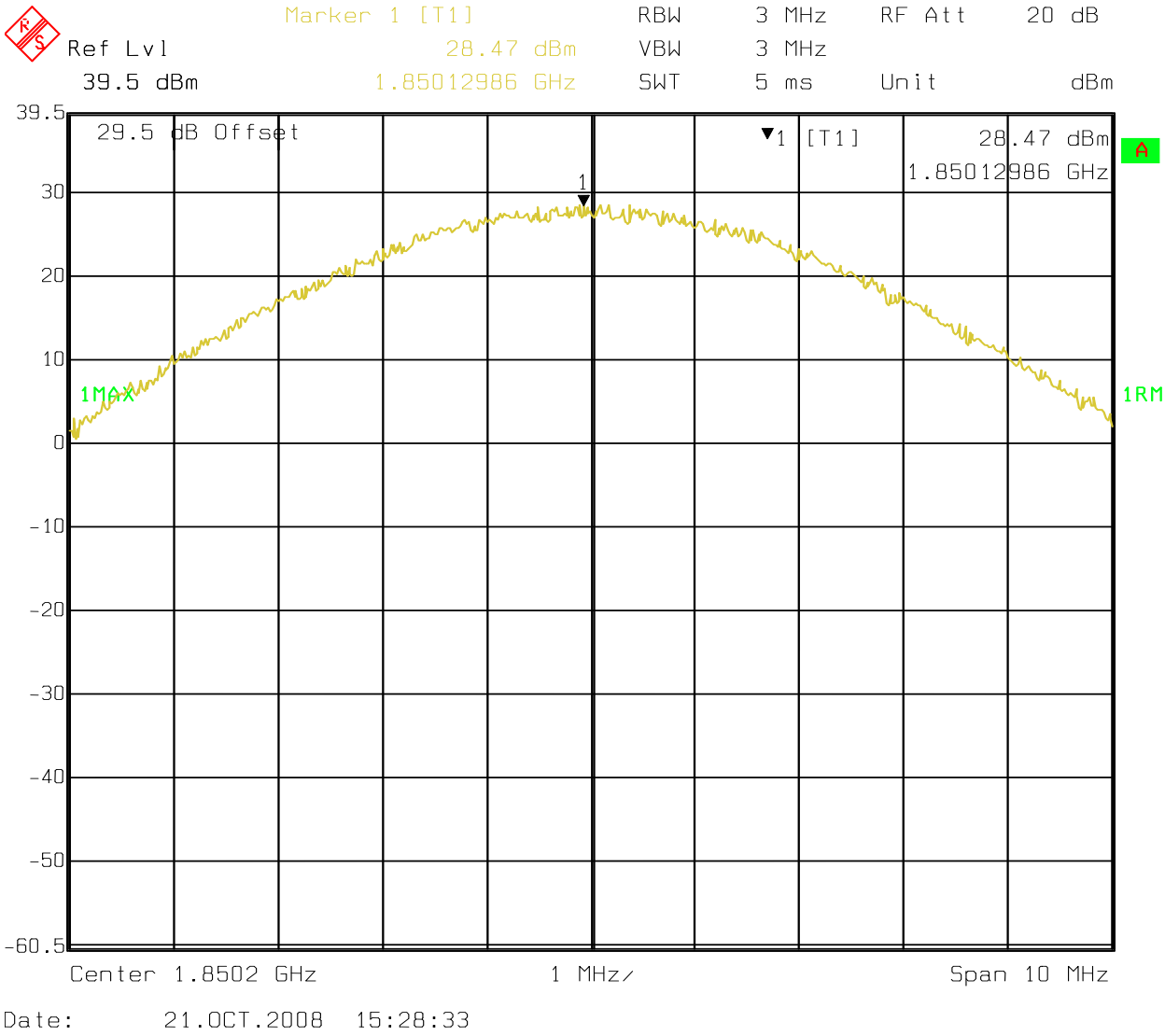
Conducted Peak Power 8PSK 1900 channel 512



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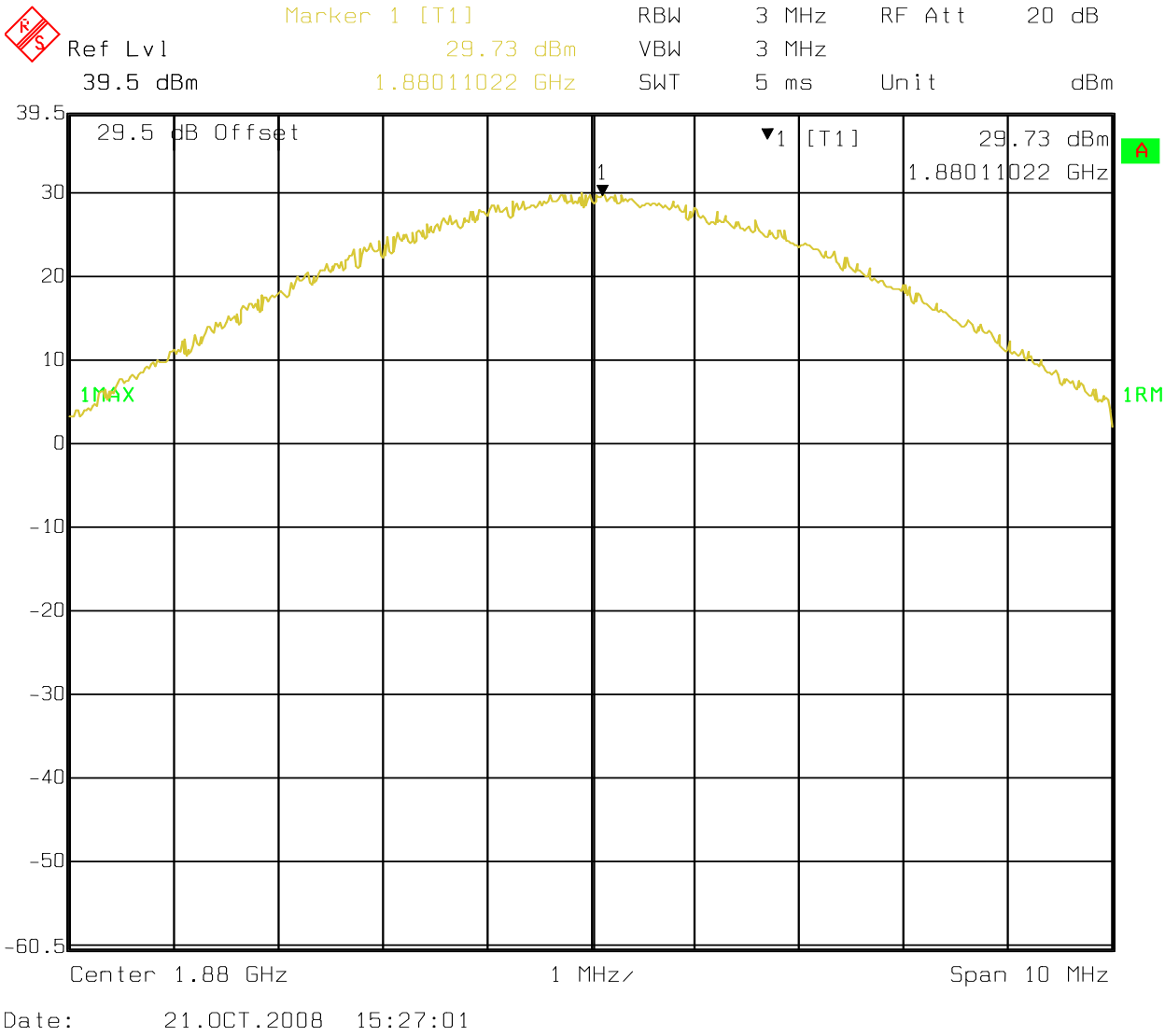
Conducted Peak Power 8PSK 1900 channel 661



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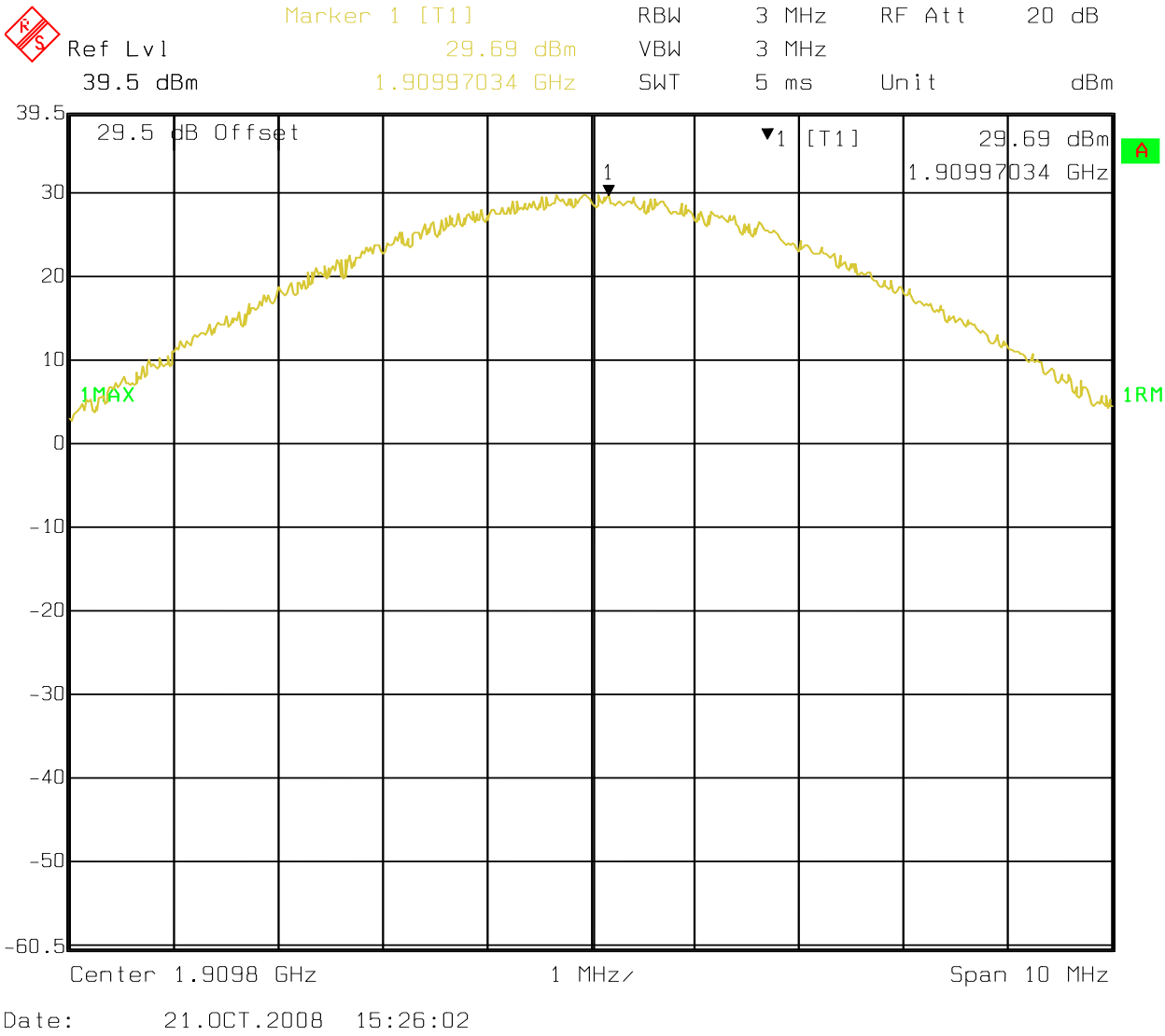
Conducted Peak Power 8PSK 1900 channel 810



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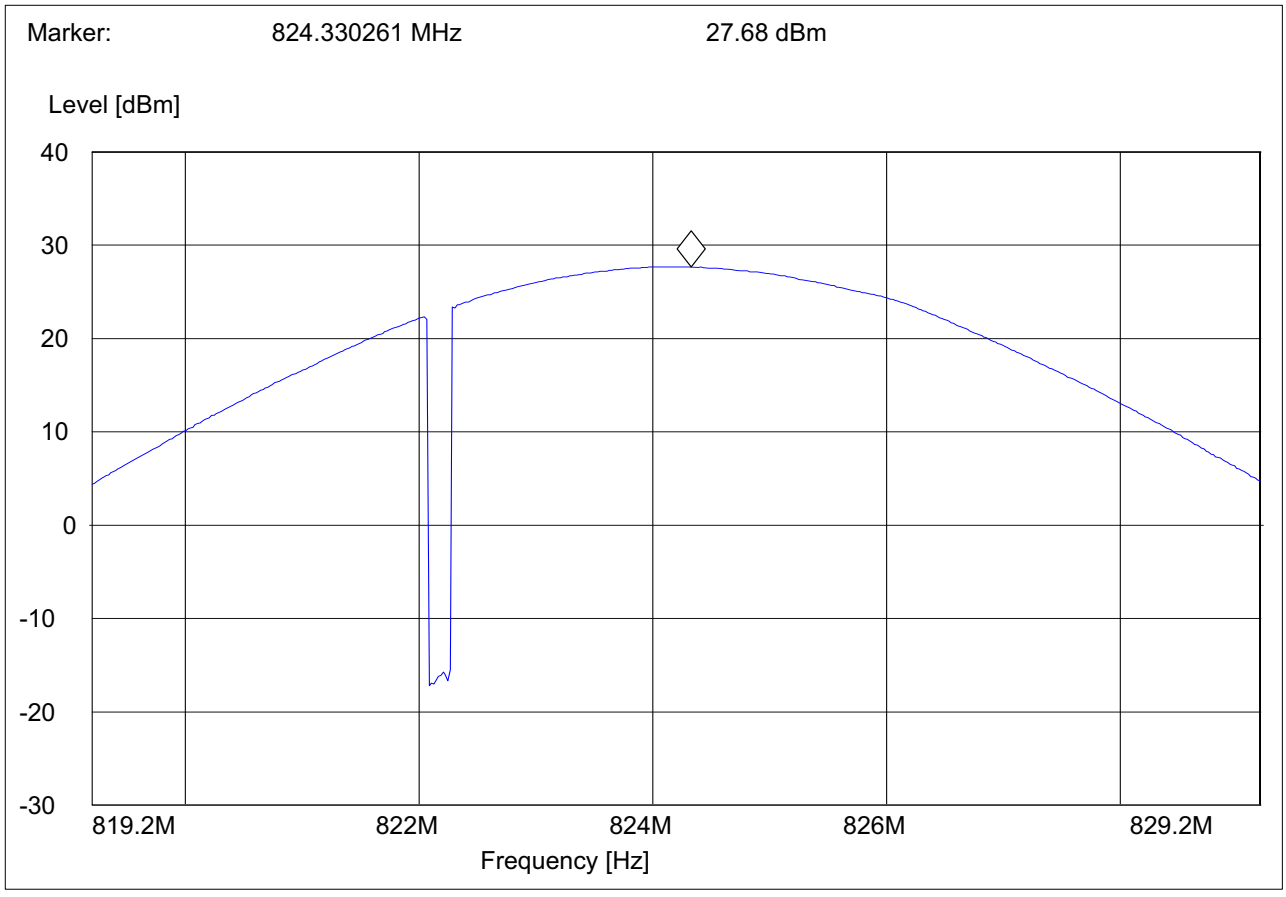
EIRP (GSM 850) CHANNEL 128 §22.913(a)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        GMSK 850
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 850 CH 128 H"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
819.2 MHz	829.2 MHz	MaxPeak MaxPeak	Coupled	3 MHz	DUMMY-DBM

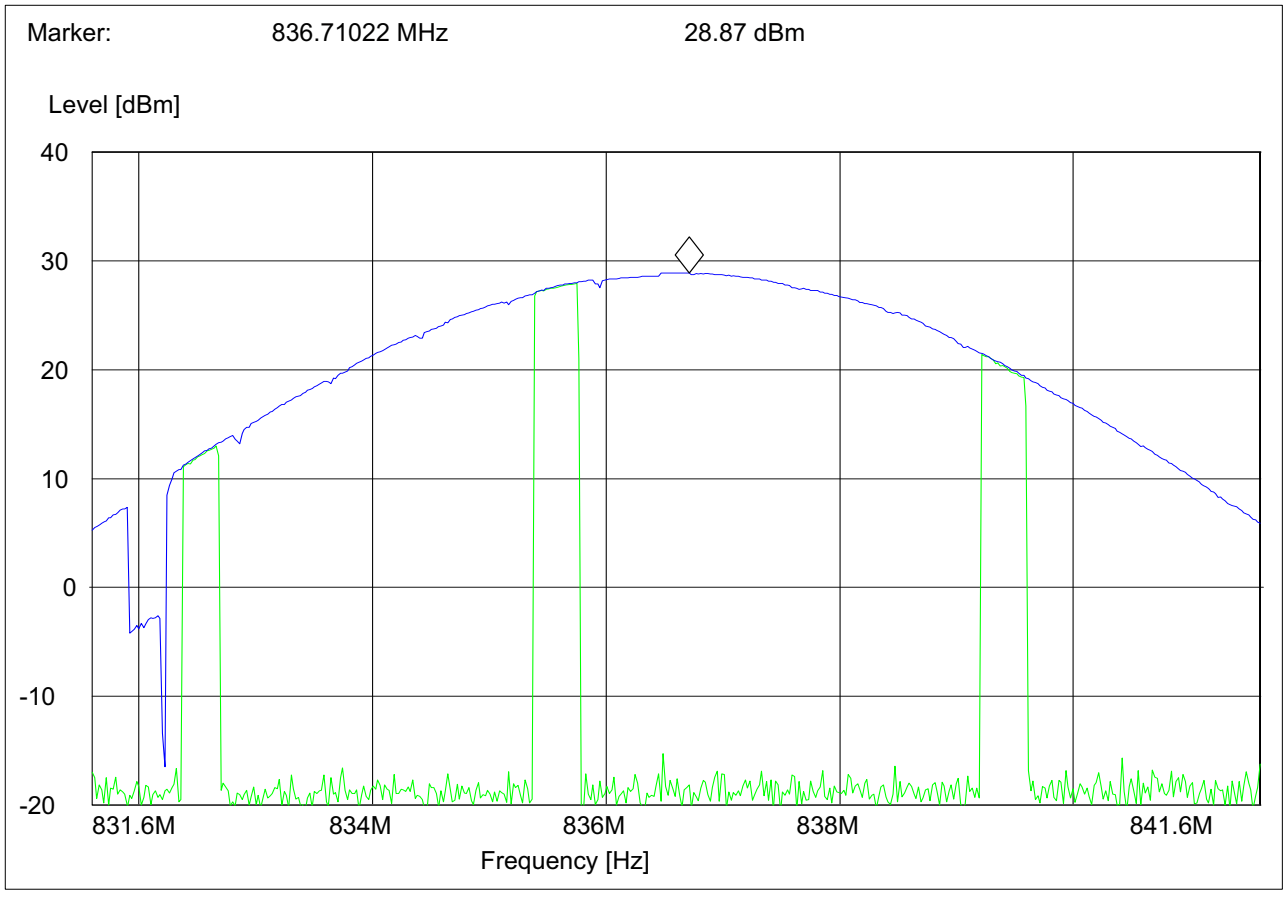


EIRP (GSM 850) CHANNEL 190 §22.913(a)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        GMSK 850
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 850 CH 190 H"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
831.6 MHz	841.6 MHz	MaxPeak MaxPeak	Coupled	3 MHz	DUMMY-DBM

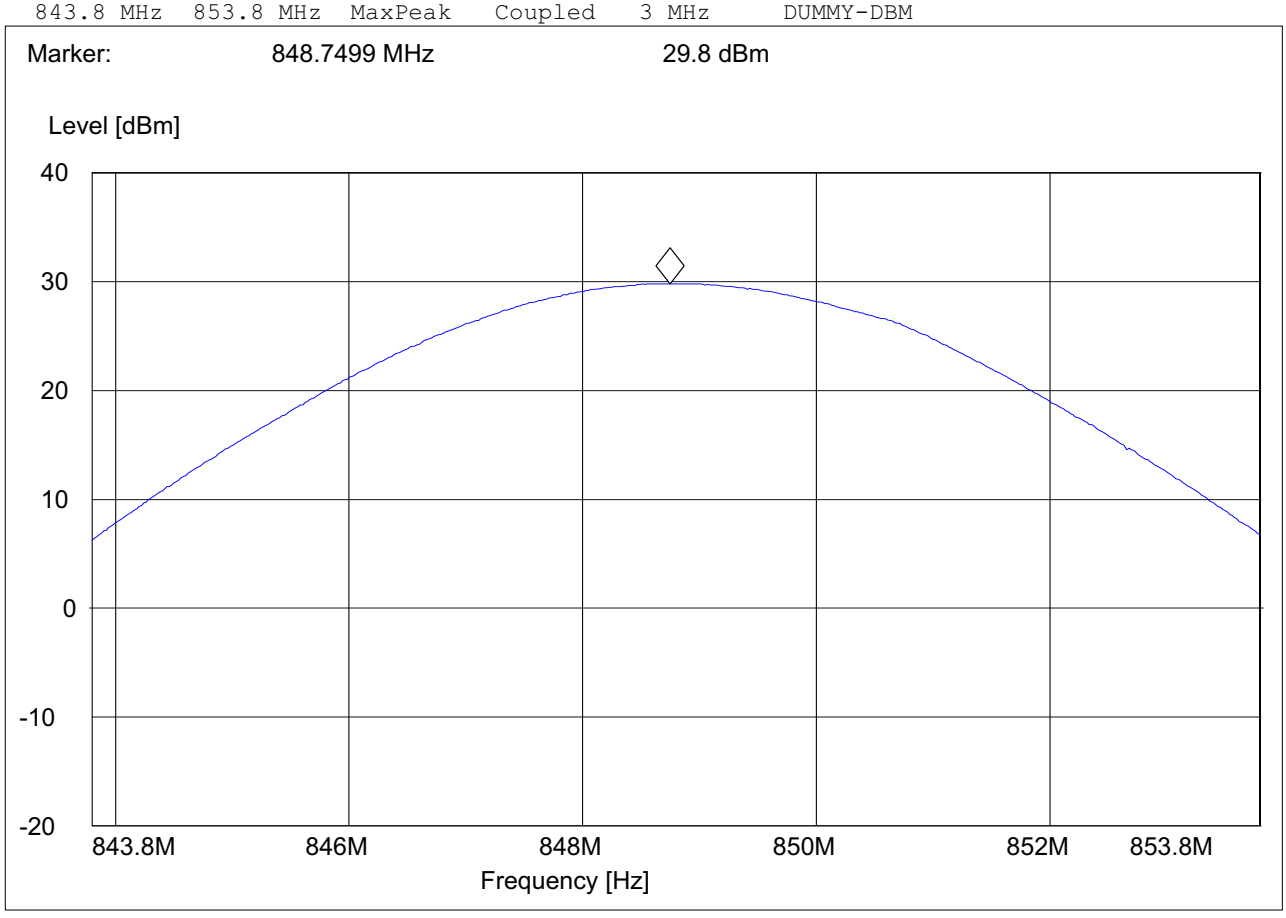


EIRP (GSM 850) CHANNEL 251 §22.913(a)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        GMSK 850
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 850 CH 251 H"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
843.8 MHz	853.8 MHz	MaxPeak	Coupled	3 MHz	DUMMY-DBM

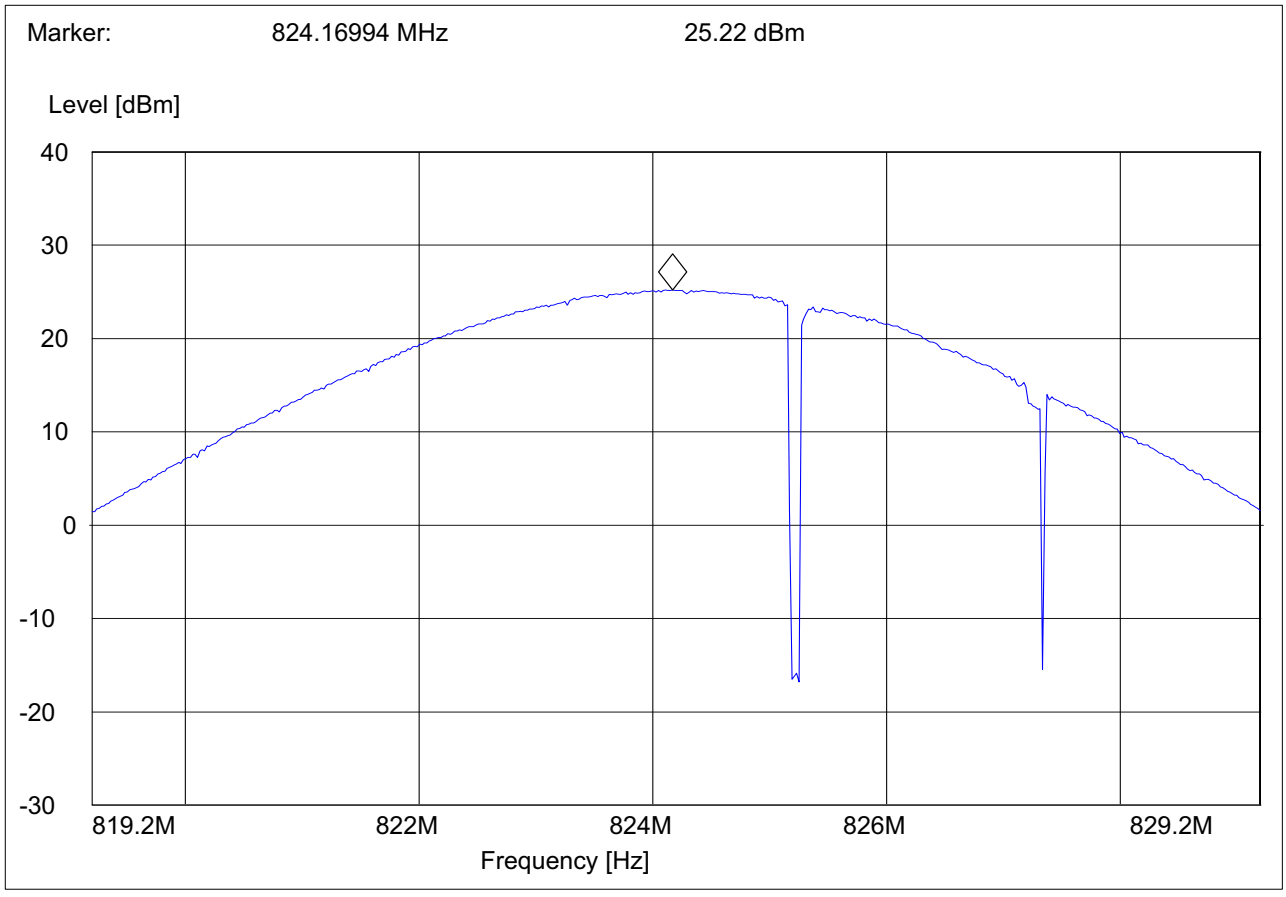


EIRP (EGPRS 850) CHANNEL 128 §22.913(a)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        8PSK 850
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 850 CH 128 H"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
819.2 MHz	829.2 MHz	MaxPeak MaxPeak	Coupled	3 MHz	DUMMY-DBM

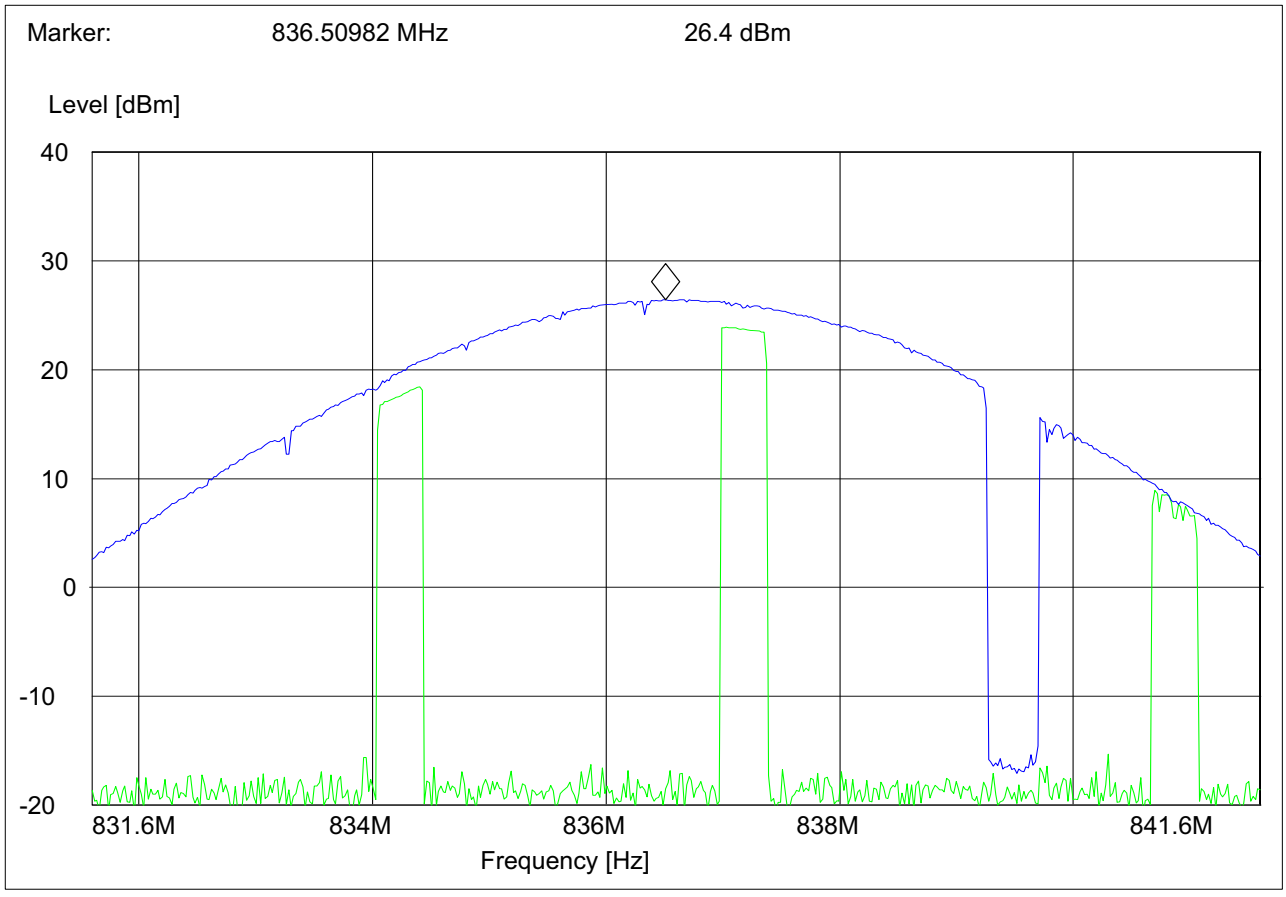


EIRP (EGPRS 850) CHANNEL 190 §22.913(a)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        8PSK 850
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 850 CH 190 H"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
831.6 MHz	841.6 MHz	MaxPeak MaxPeak	Coupled	3 MHz	DUMMY-DBM



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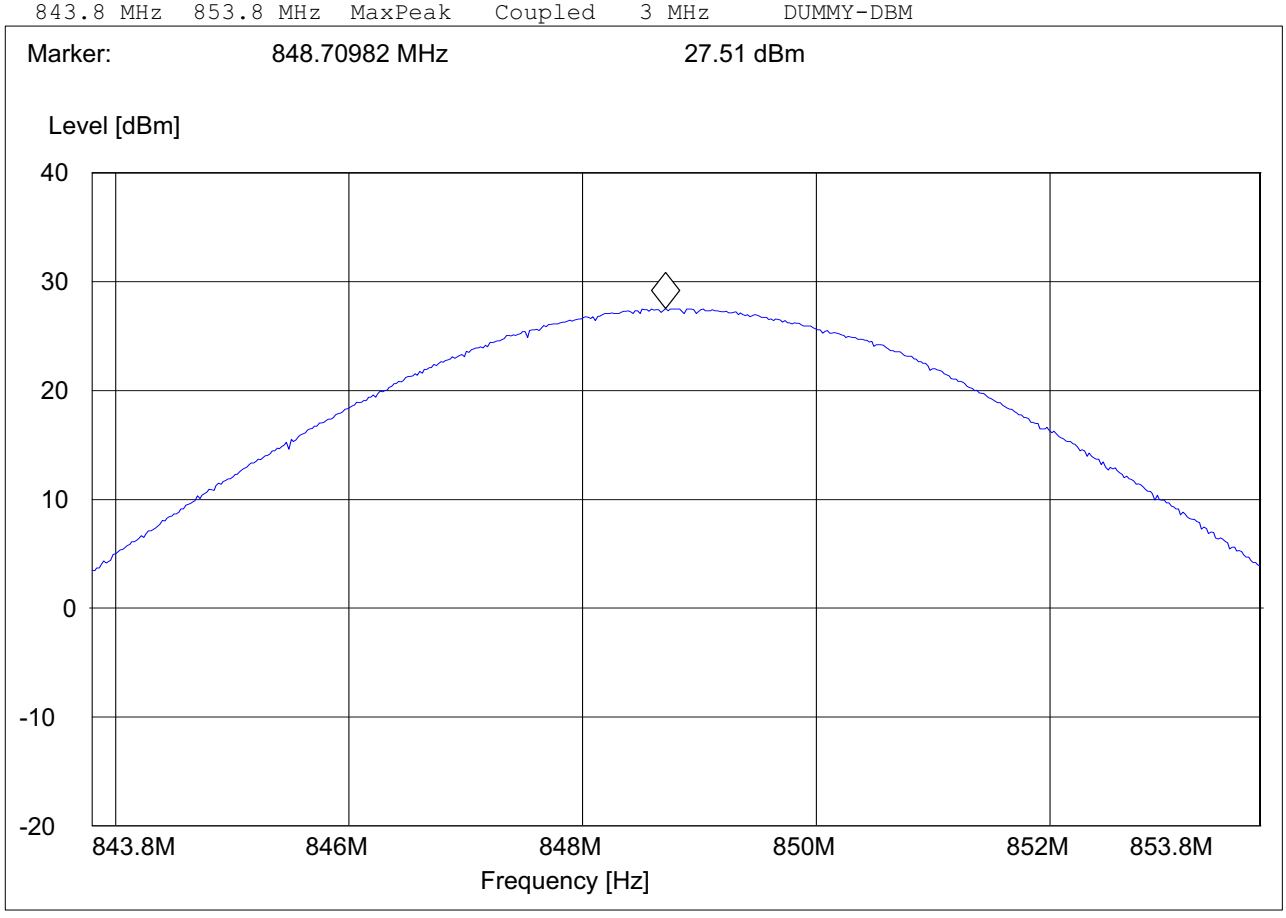
EIRP (EGPRS 850) CHANNEL 251 §22.913(a)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        8PSK 850
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 850 CH 251 H"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
843.8 MHz	853.8 MHz	MaxPeak	Coupled	3 MHz	DUMMY-DBM

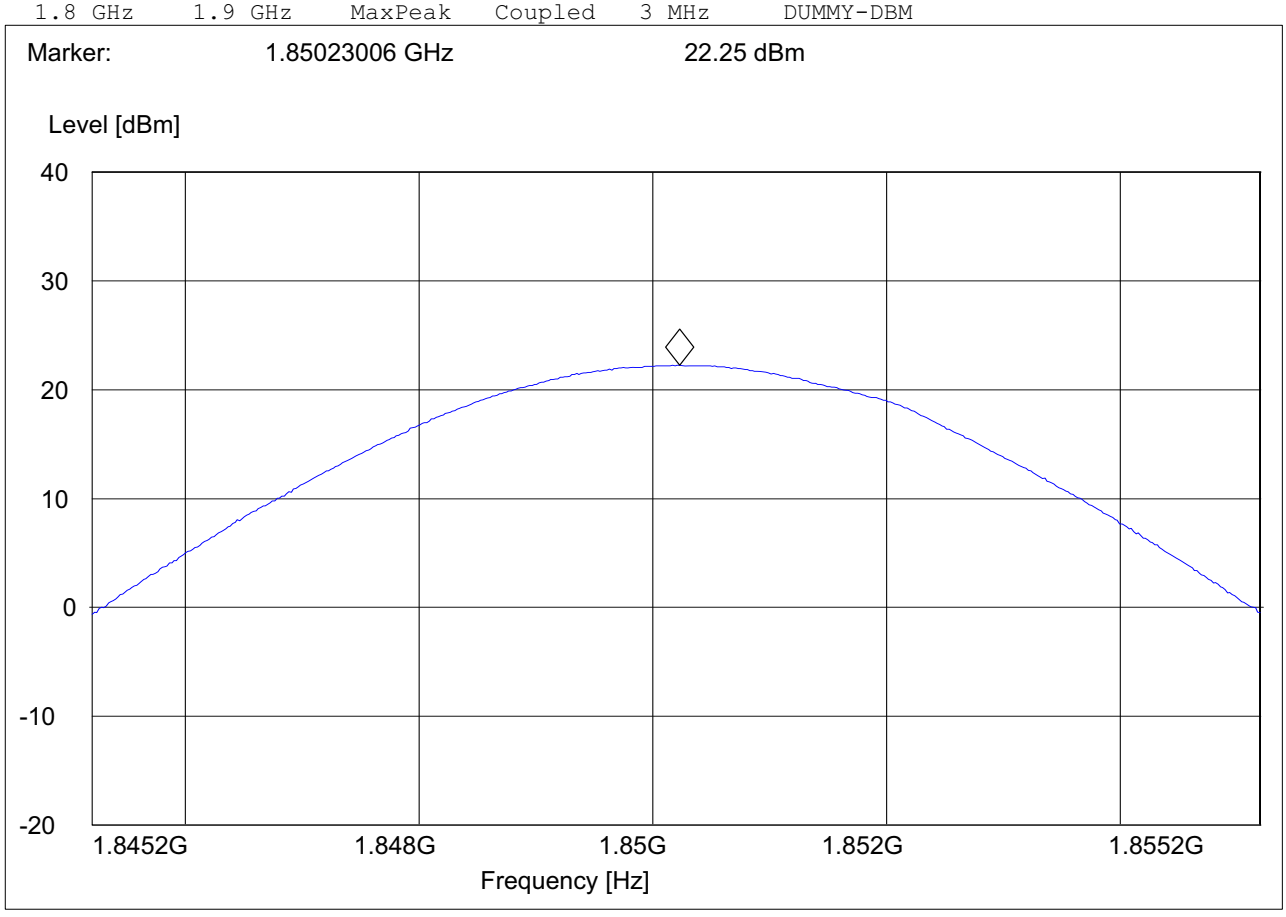


EIRP (PCS-1900) CHANNEL 512 §24.232(b)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        GMSK 1900
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 1900 CH512"

```
  Short Description:            EIRP PCS 1900 for channel-512
  Start       Stop        Detector  Meas.      IF         Transducer
  Frequency   Frequency             Time       Bandw.
  1.8 GHz     1.9 GHz     MaxPeak   Coupled    3 MHz      DUMMY-DBM
```



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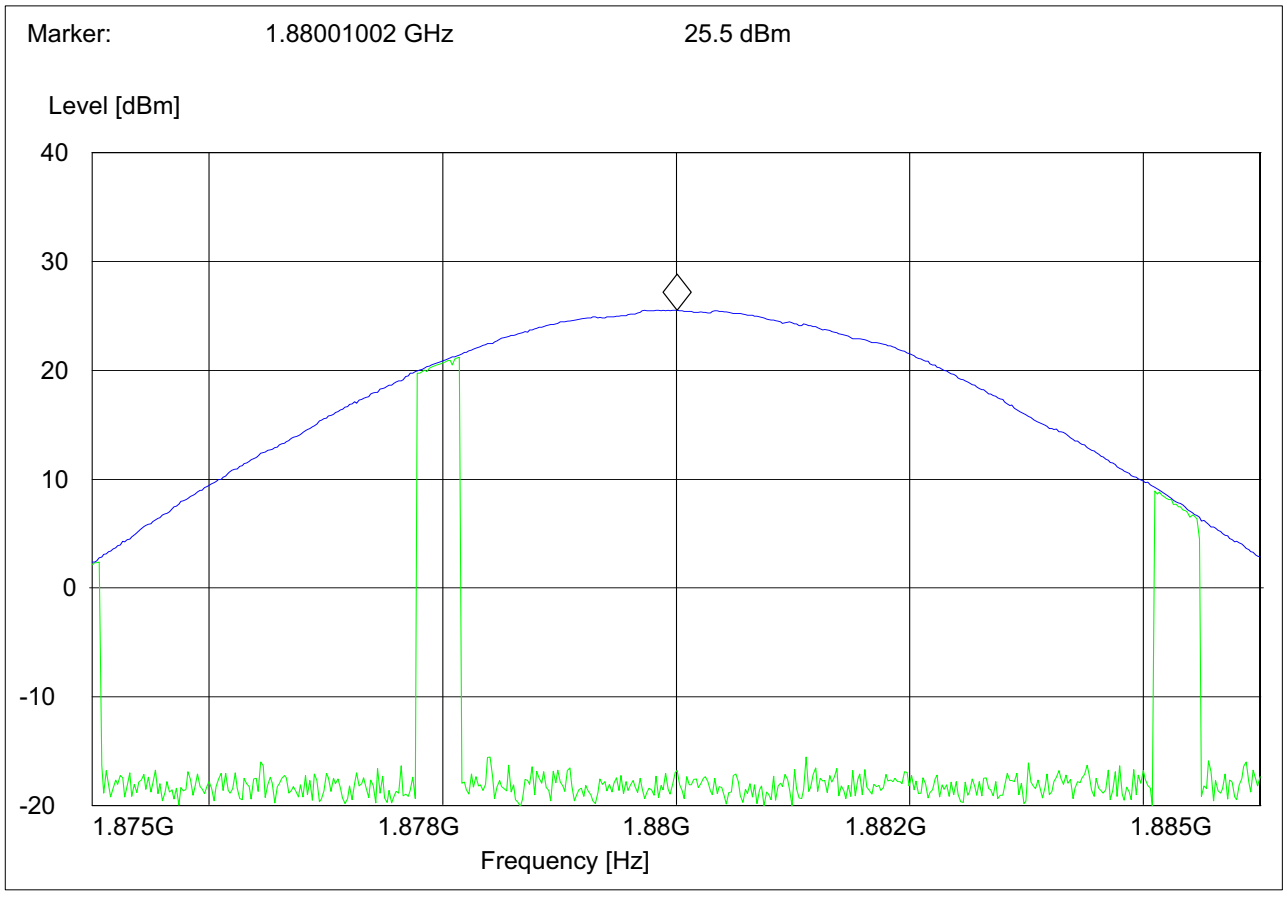
EIRP (PCS-1900) CHANNEL 661 §24.232(b)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        GMSK 1900
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 1900 CH661"

```
  Short Description:            EIRP PCS 1900 for channel-661
  Start      Stop       Detector  Meas.     IF        Transducer
  Frequency  Frequency            Time      Bandw.
  1.9 GHz    1.9 GHz    MaxPeak   Coupled   3 MHz     DUMMY-DBM
                        MaxPeak
```



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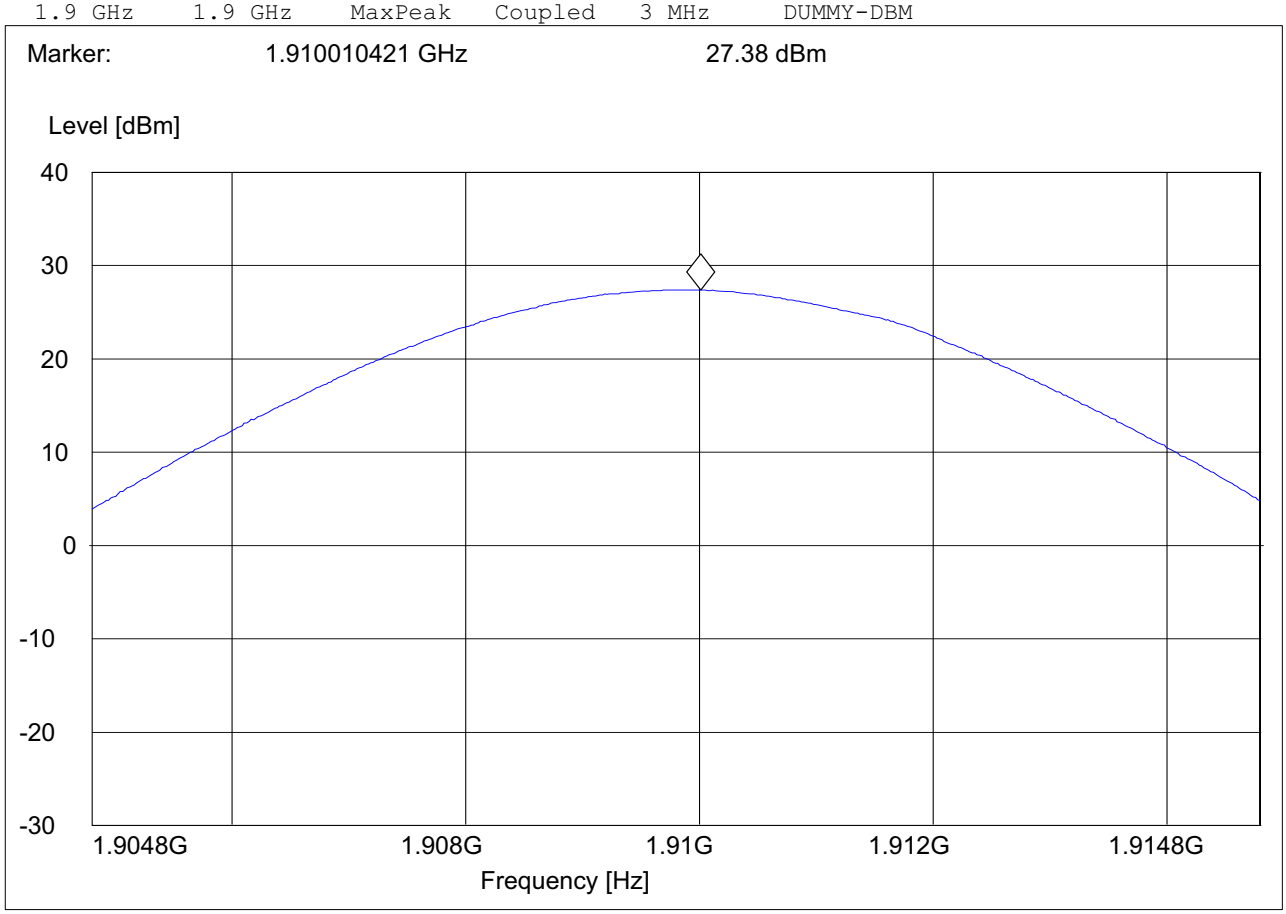
EIRP (PCS-1900) CHANNEL 810 §24.232(b)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        GMSK 1900
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 1900 CH810"

```
  Short Description:            EIRP PCS 1900 for channel-810
  Start       Stop        Detector  Meas.      IF         Transducer
  Frequency   Frequency             Time       Bandw.
  1.9 GHz     1.9 GHz     MaxPeak   Coupled    3 MHz      DUMMY-DBM
```



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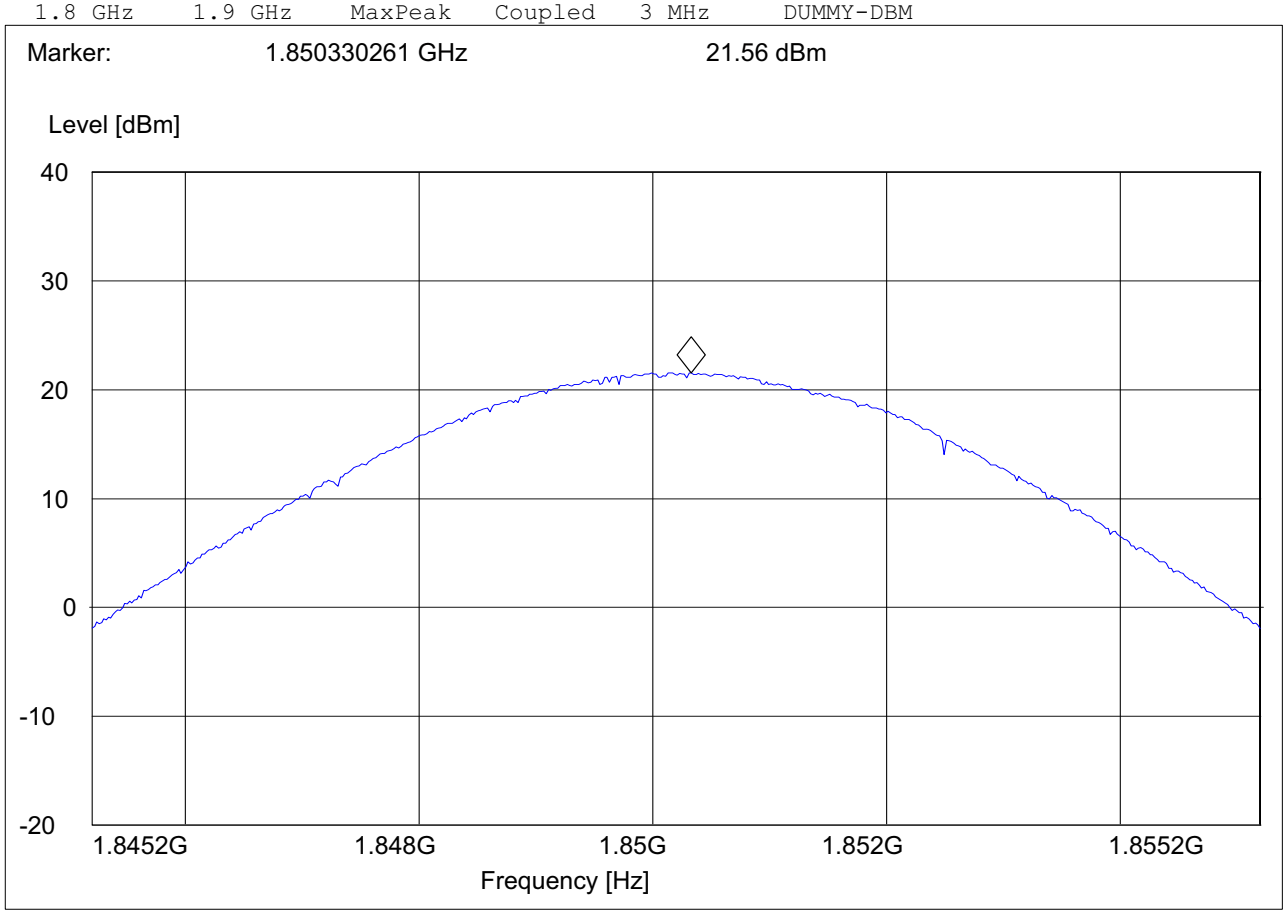
EIRP (EGPRS-1900) CHANNEL 512 §24.232(b)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        8PSK 1900
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 1900 CH512"

```
  Short Description:              EIRP PCS 1900 for channel-512
  Start       Stop        Detector  Meas.      IF         Transducer
  Frequency   Frequency             Time       Bandw.
  1.8 GHz     1.9 GHz     MaxPeak   Coupled    3 MHz      DUMMY-DBM
```



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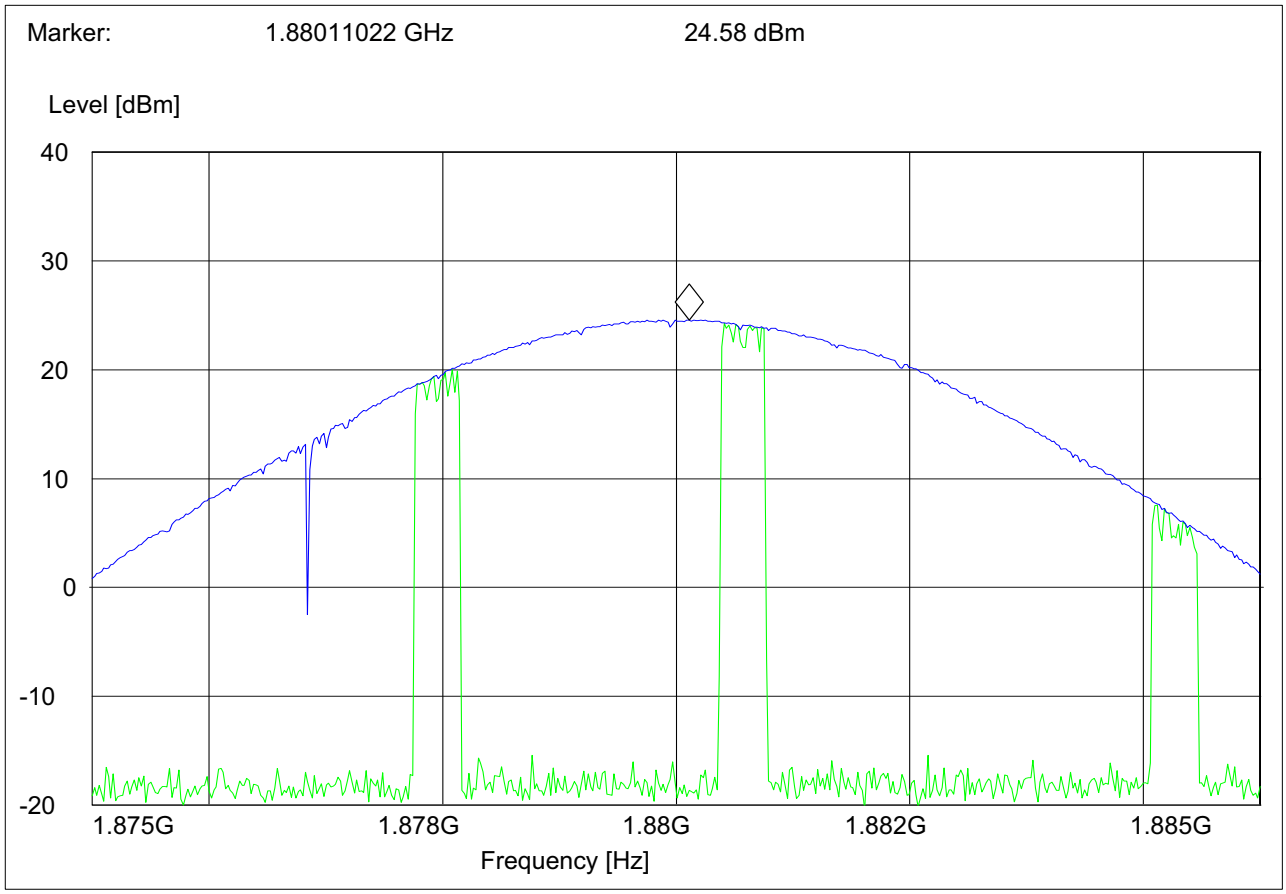
EIRP (EGPRS -1900) CHANNEL 661 §24.232(b)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        8PSK 1900
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 1900 CH661"

```
  Short Description:              EIRP PCS 1900 for channel-661
  Start       Stop        Detector  Meas.      IF         Transducer
  Frequency   Frequency               Time       Bandw.
  1.9 GHz     1.9 GHz     MaxPeak   Coupled    3 MHz      DUMMY-DBM
                          MaxPeak
```

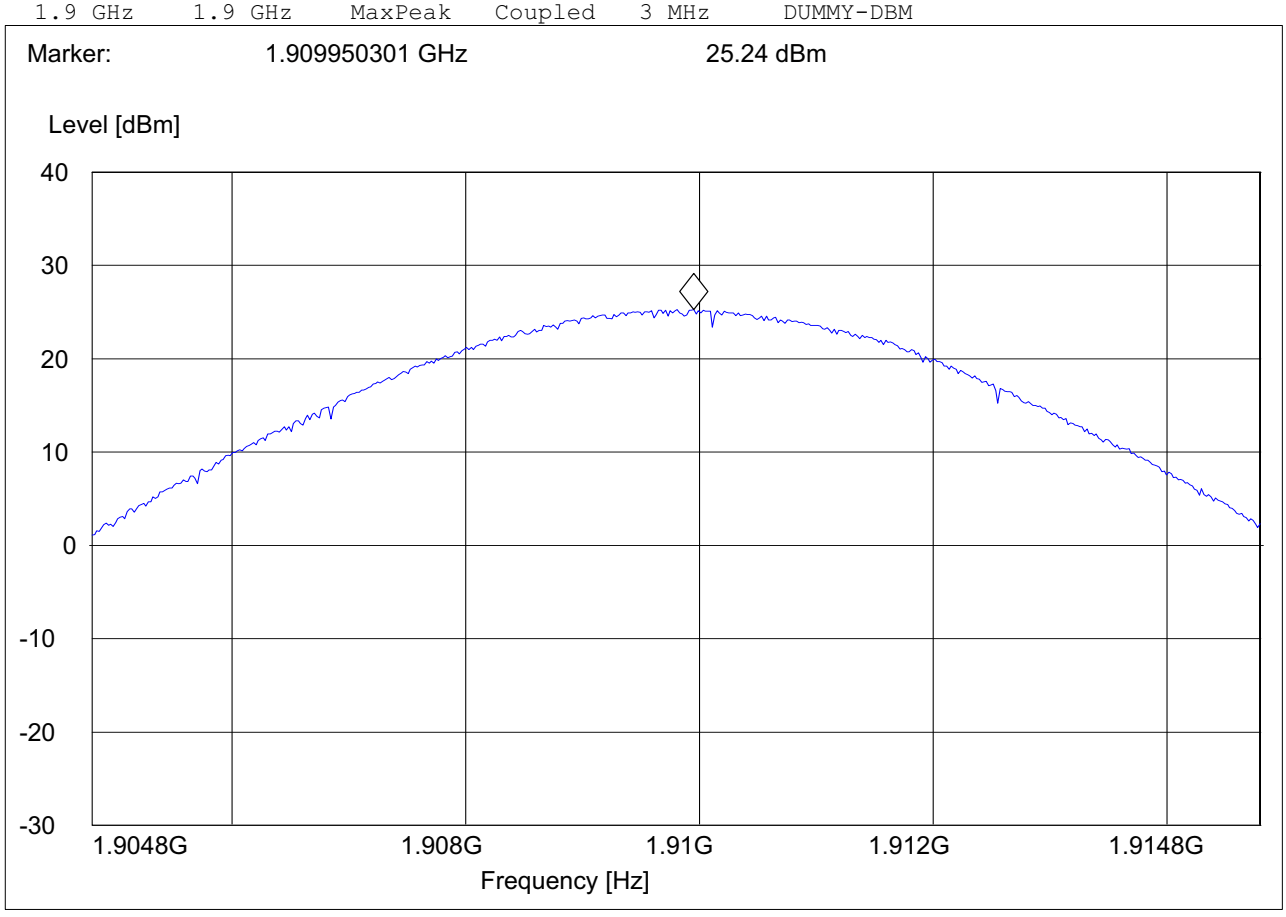


EIRP (EGPRS -1900) CHANNEL 810 §24.232(b)

```
EUT:              E SERIES
Customer::        SAGE
Test Mode:        8PSK 1900
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    PETER
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "EIRP 1900 CH810"

```
  Short Description:            EIRP PCS 1900 for channel-810
  Start      Stop       Detector  Meas.     IF        Transducer
  Frequency  Frequency            Time      Bandw.
  1.9 GHz    1.9 GHz    MaxPeak   Coupled   3 MHz     DUMMY-DBM
```



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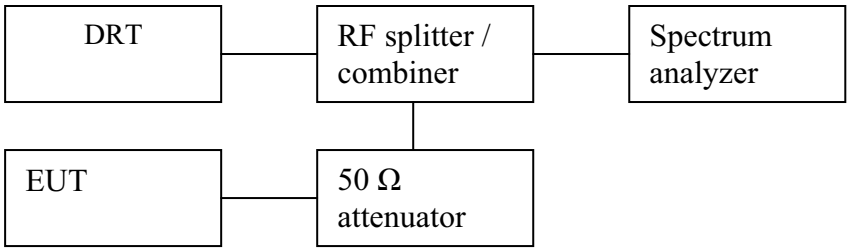
5.2 Occupied Bandwidth/Emission Bandwidth

5.2.1 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.

5.2.2 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.

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5.2.3 Occupied bandwidth results 850 MHz band.

Frequency (MHz)	Occupied Bandwidth (kHz)	
	GPRS	EGPRS
824.2	245.5	242.5
836.6	245.5	240.5
848.8	243.5	239.5

5.2.4 Occupied bandwidth results 1900 MHz band:

Frequency (MHz)	Occupied Bandwidth (kHz)	
	GPRS	EGPRS
1850.2	240.5	238.5
1880.0	243.5	239.5
1909.8	245.5	238.5

5.2.5 Emission bandwidth results 850 MHz band.

Frequency (MHz)	Emission Bandwidth (kHz)	
	GPRS	EGPRS
824.2	317.6	306.6
836.6	313.6	311.6
848.8	317.6	308.6

5.2.6 Emission bandwidth results 1900 MHz band:

Frequency (MHz)	Emission Bandwidth (kHz)	
	GPRS	EGPRS
1850.2	321.6	310.6
1880.0	319.6	306.6
1909.8	316.6	307.6

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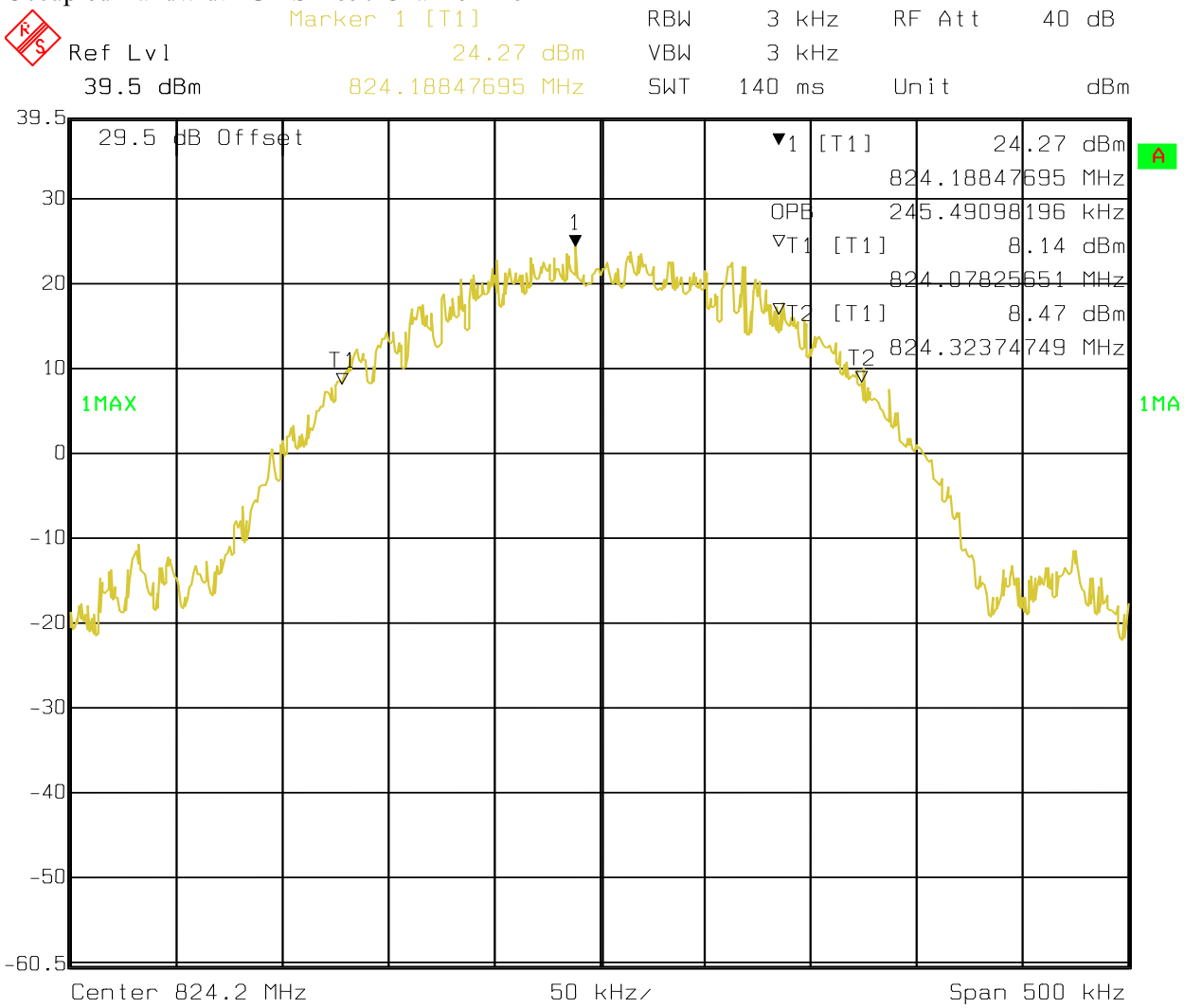
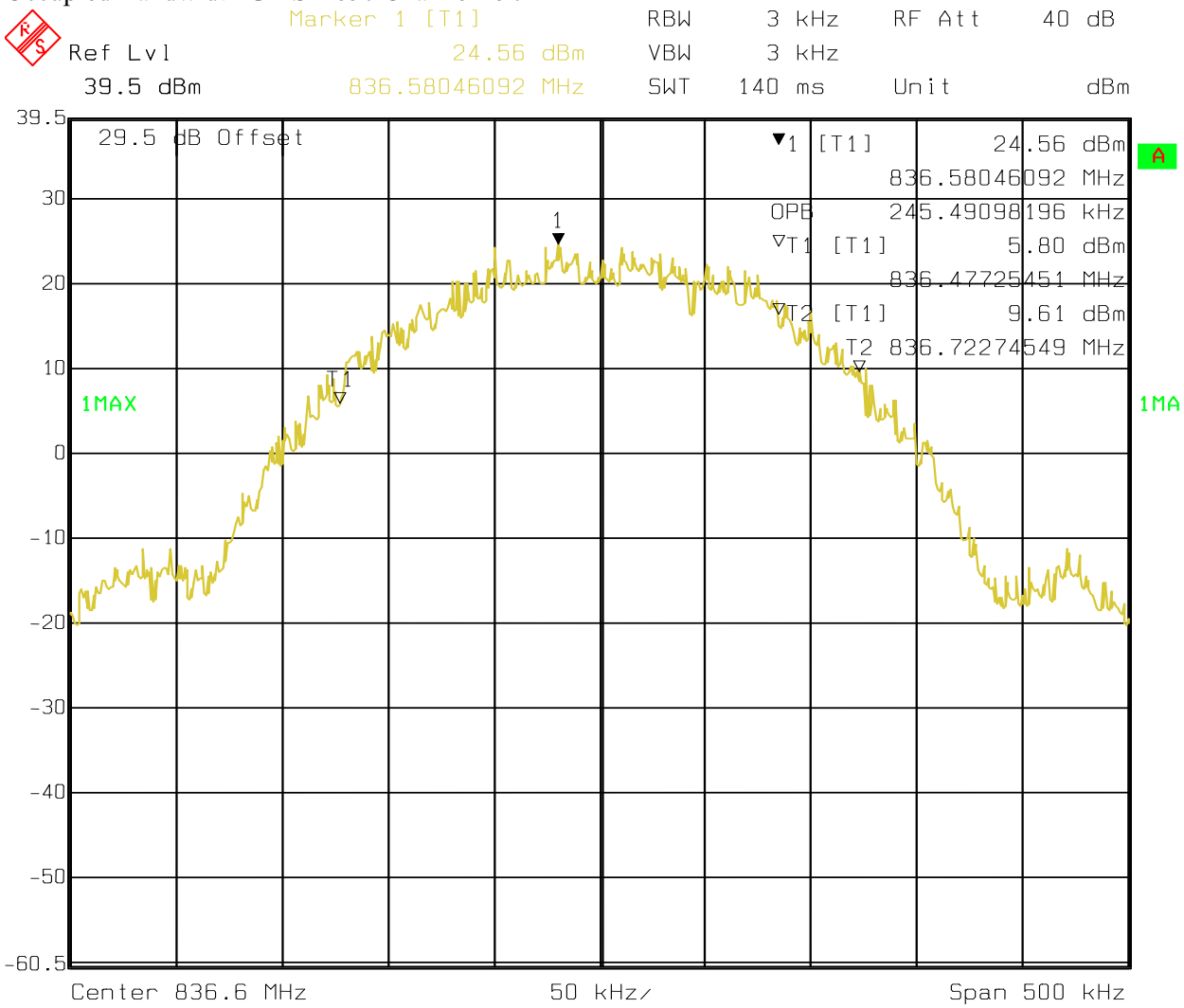
Occupied Bandwidth GMSK 850 Channel 128



Occupied Bandwidth GMSK 850 Channel 190



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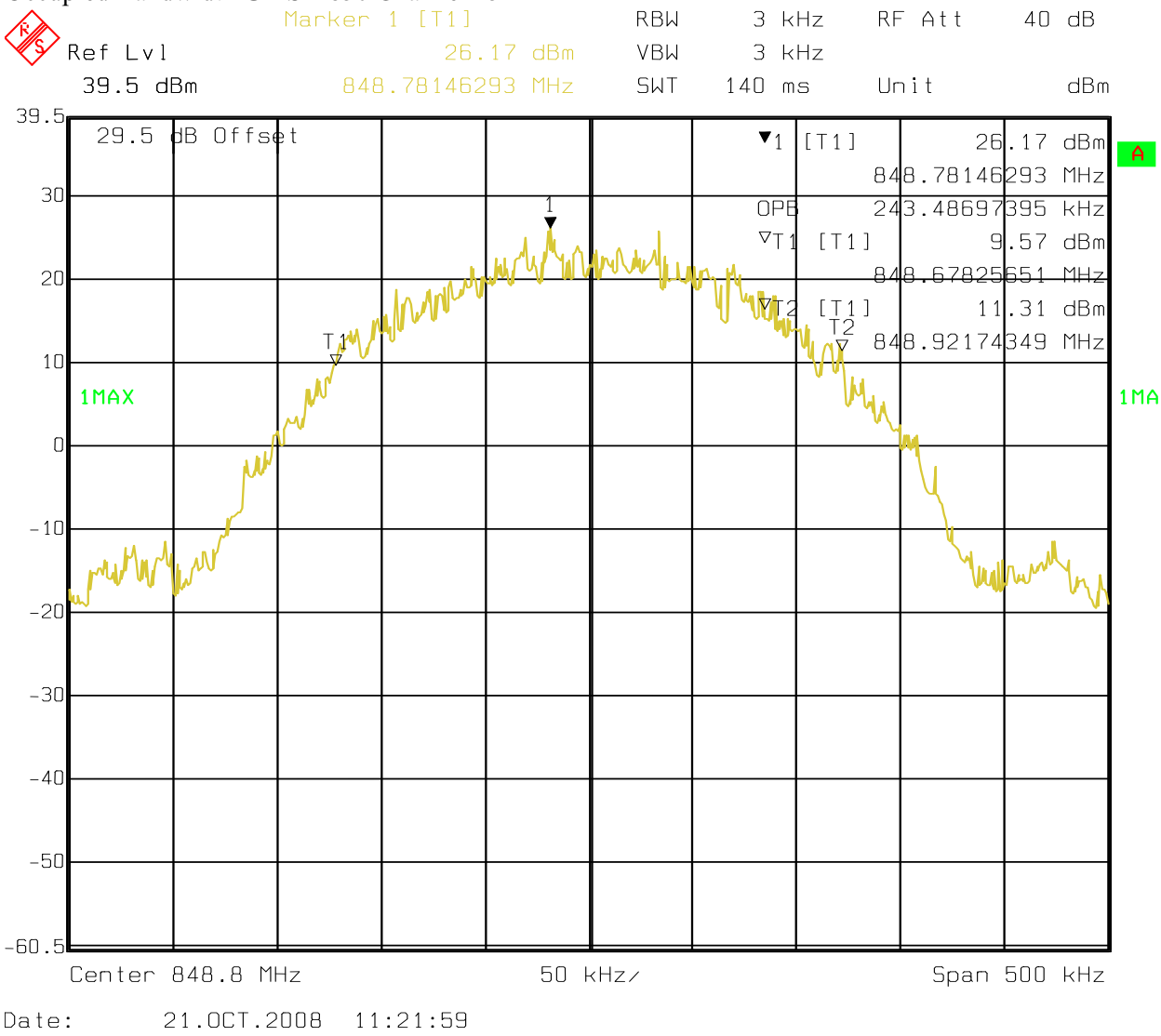
Occupied Bandwidth GMSK 850 Channel 251



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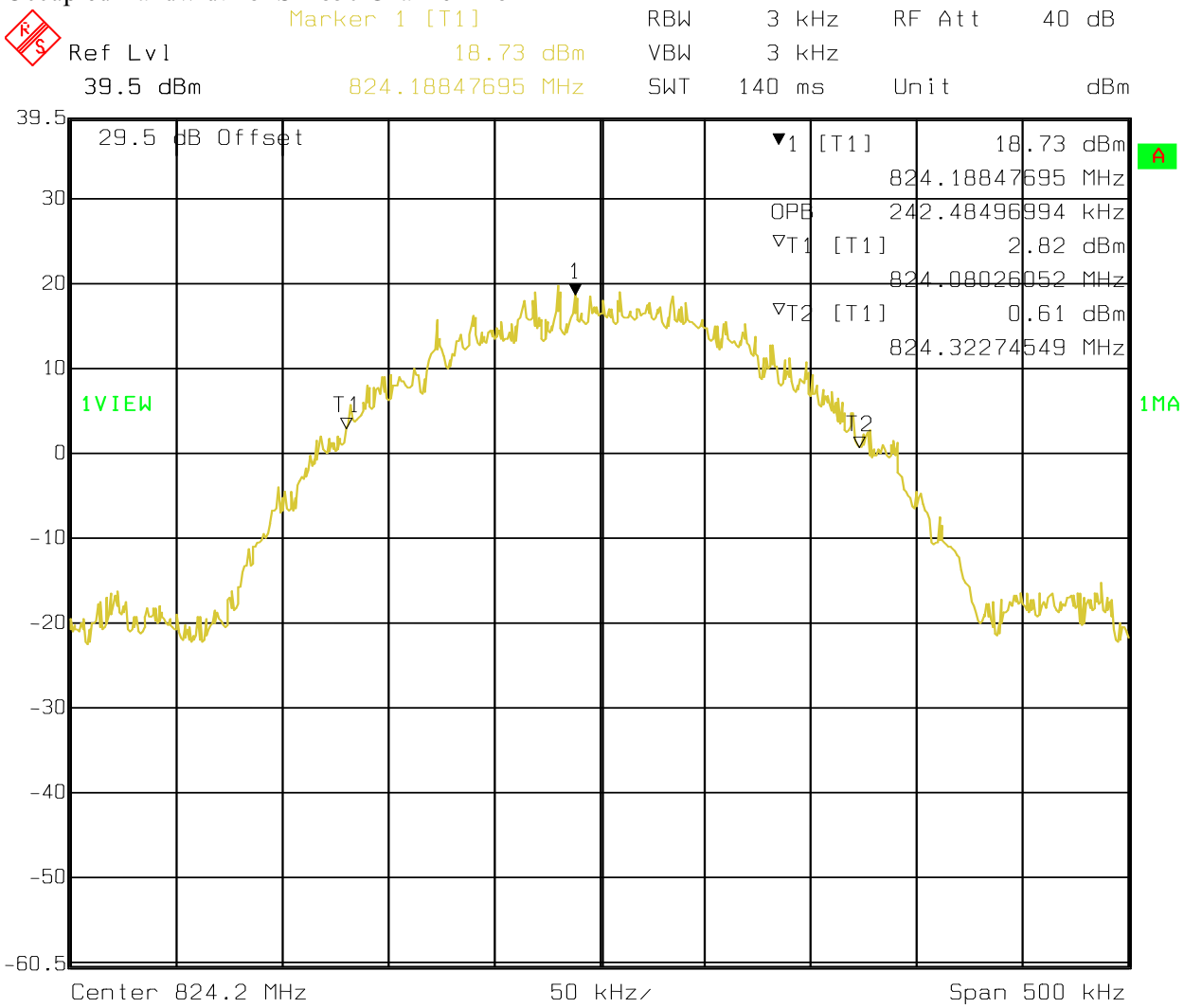
Occupied Bandwidth 8PSK 850 Channel 128



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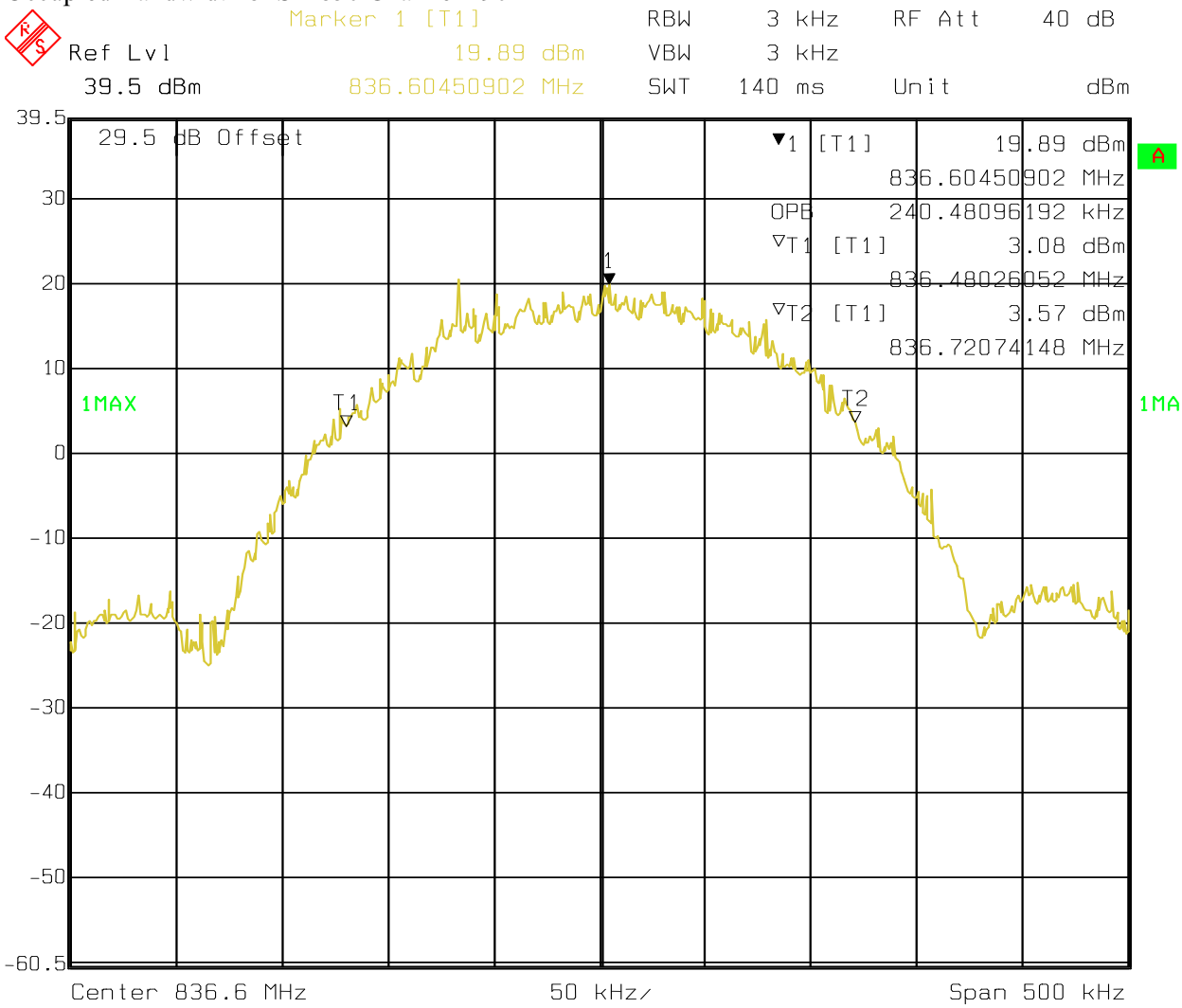
Occupied Bandwidth 8PSK 850 Channel 190



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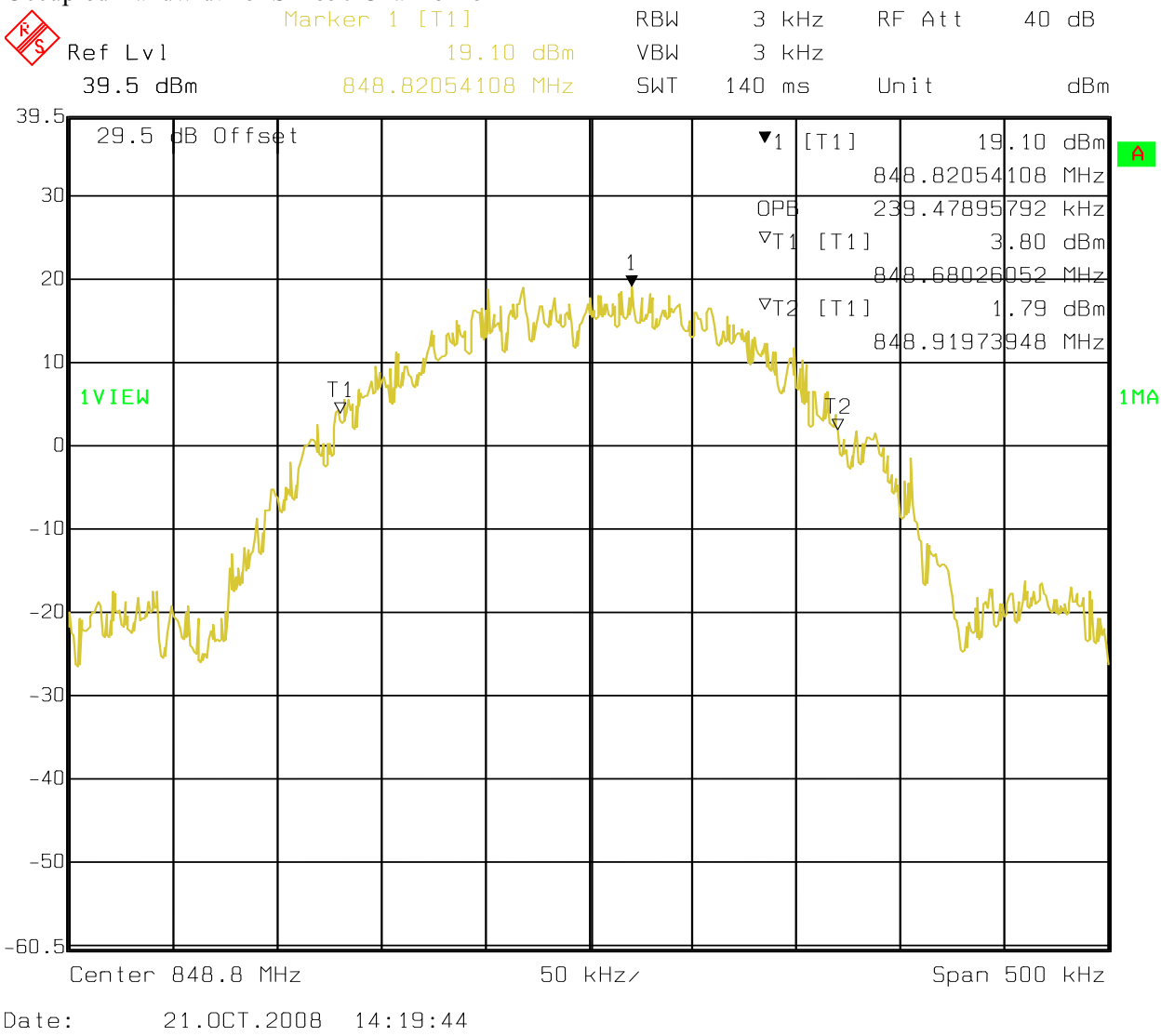
Occupied Bandwidth 8PSK 850 Channel 251



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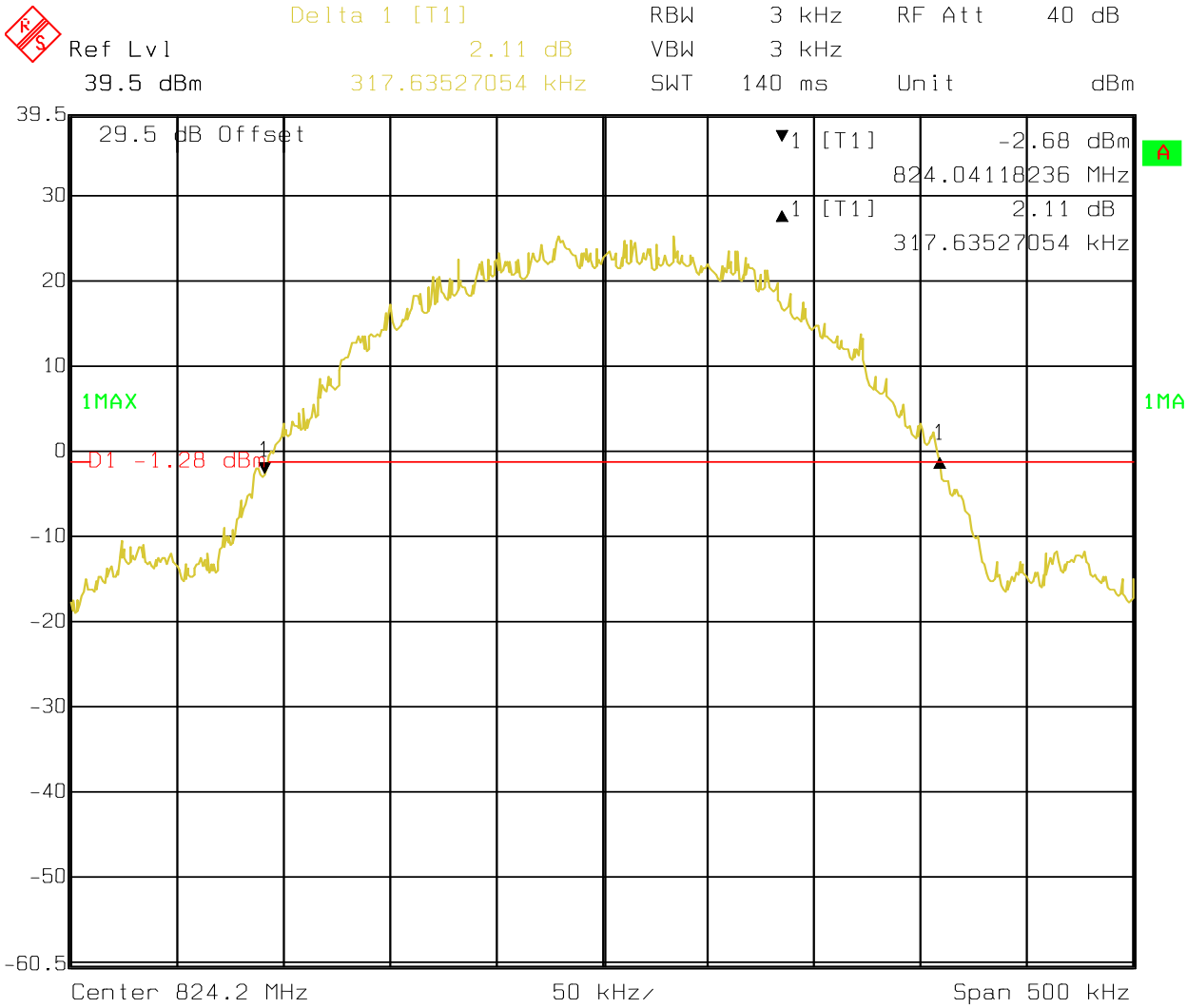
Emission Bandwidth GMSK 850 Channel 128



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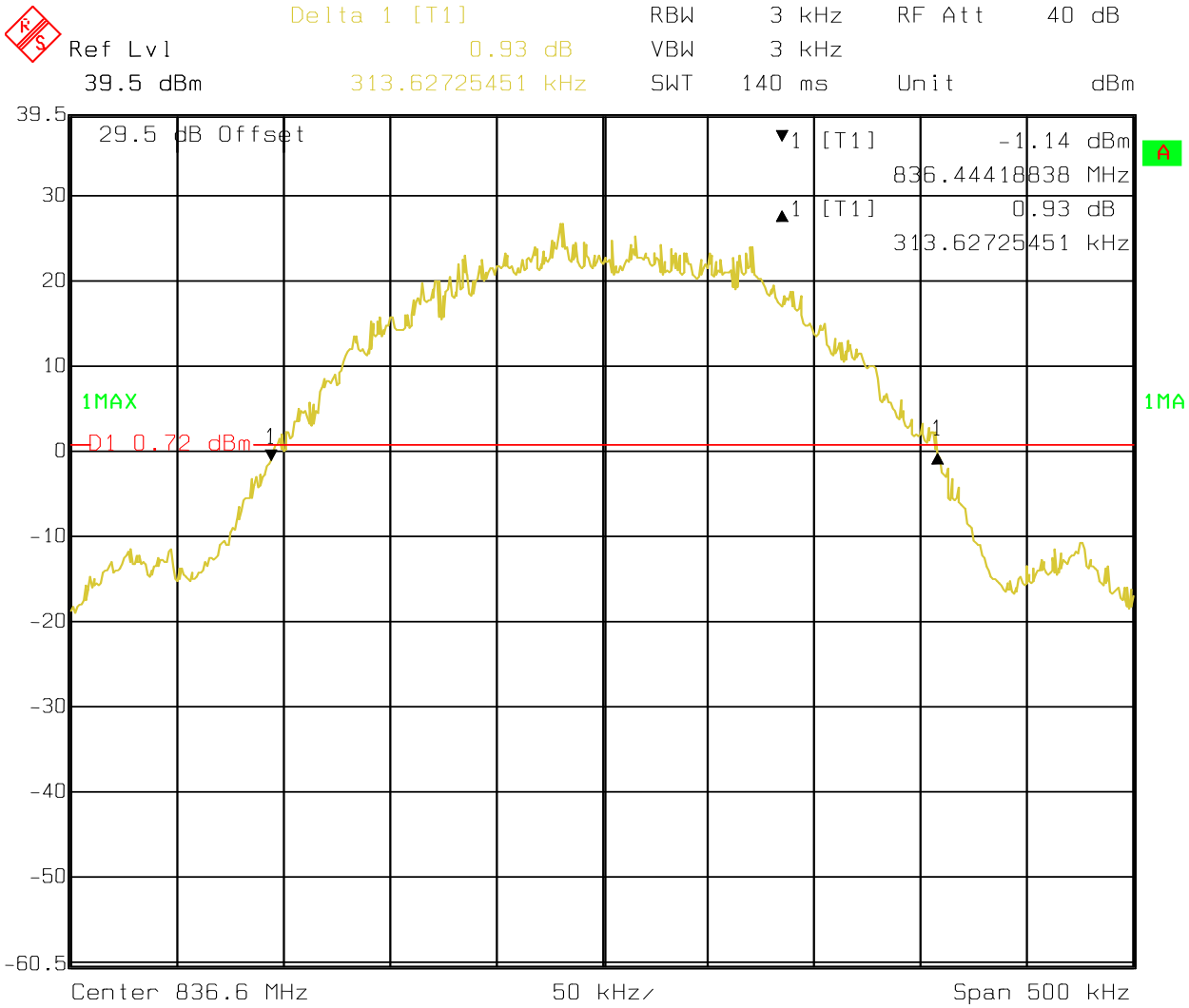
Emission Bandwidth GMSK 850 Channel 190



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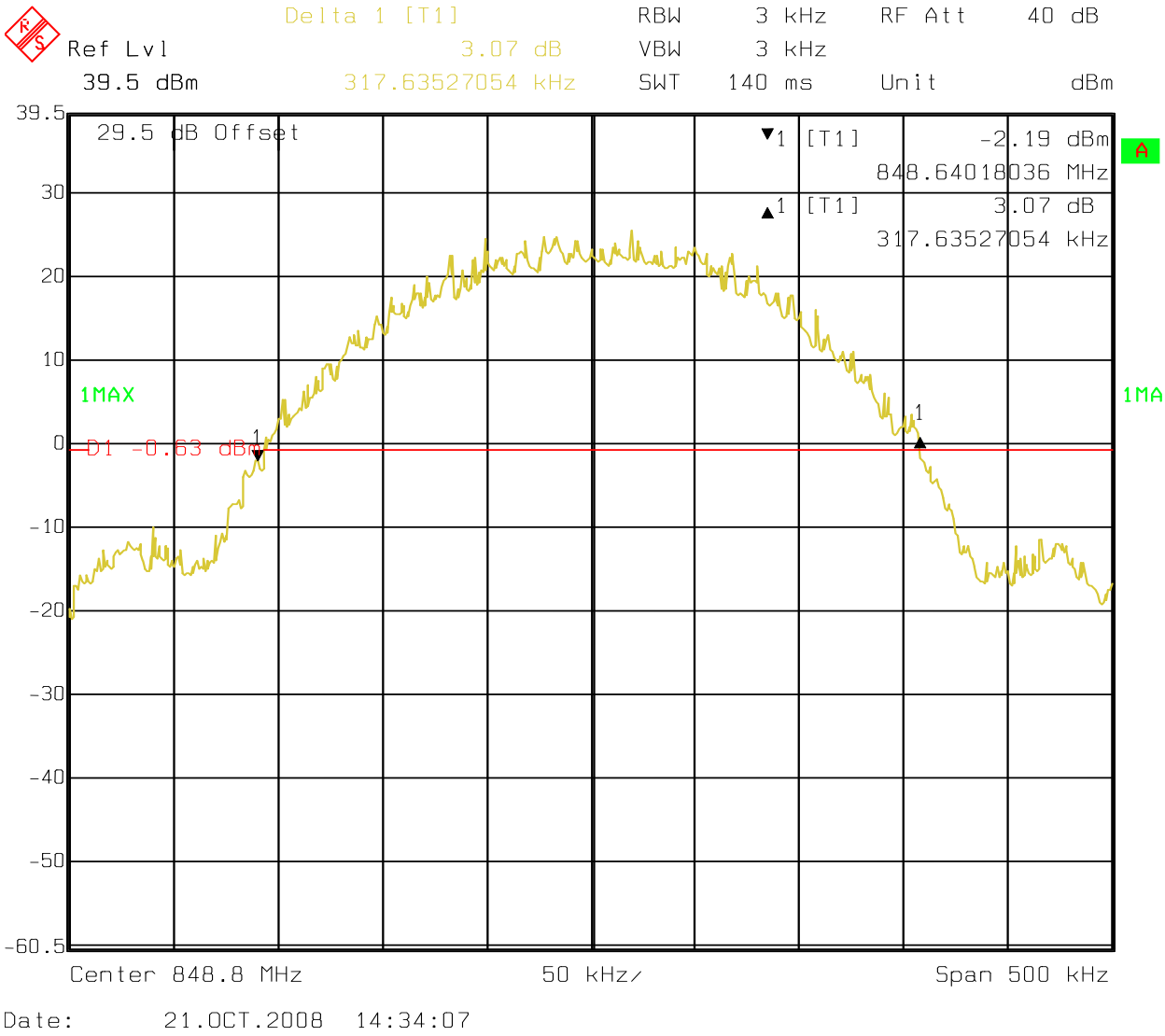
Emission Bandwidth GMSK 850 Channel 251



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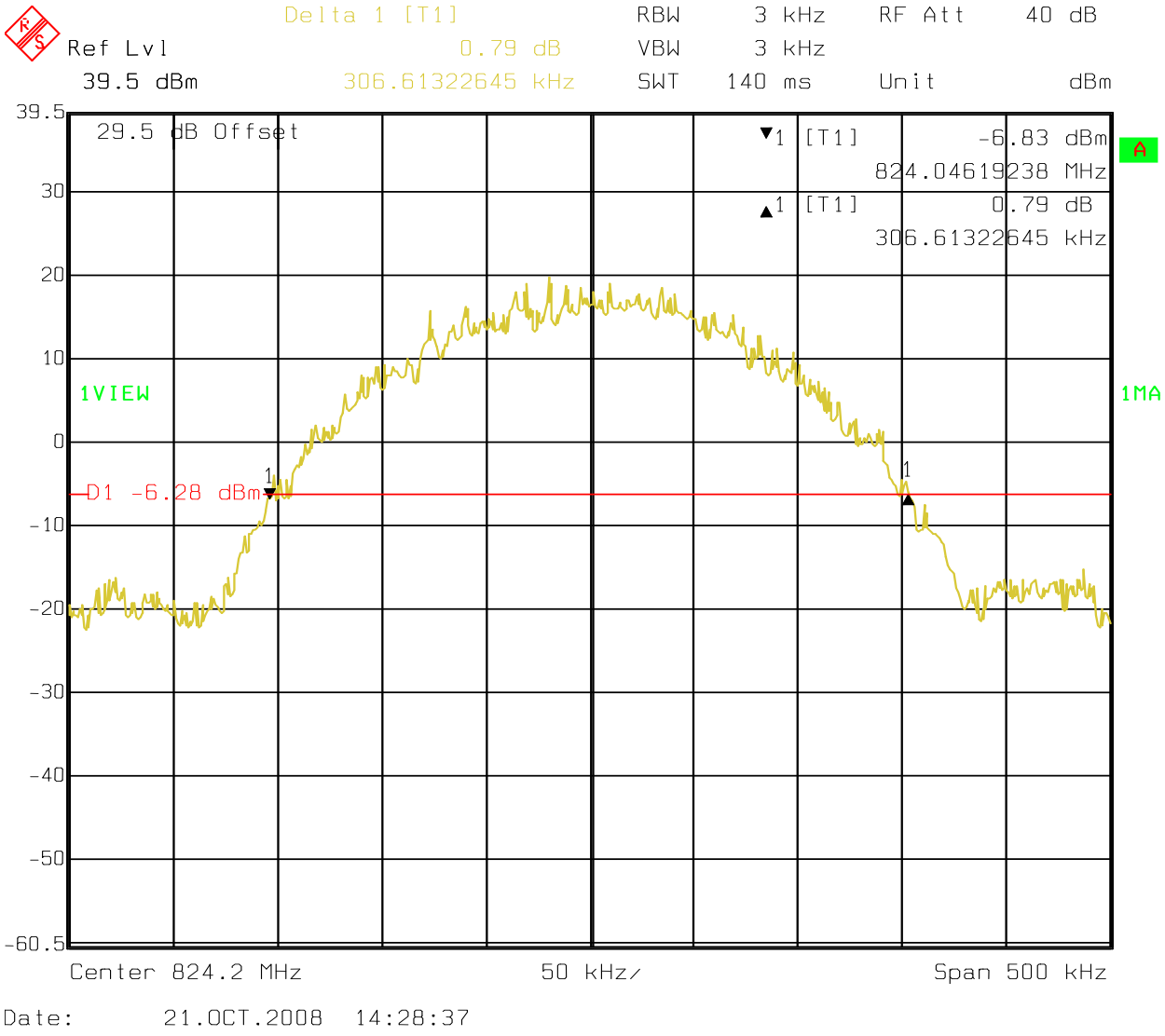
Emission Bandwidth 8PSK 850 Channel 128



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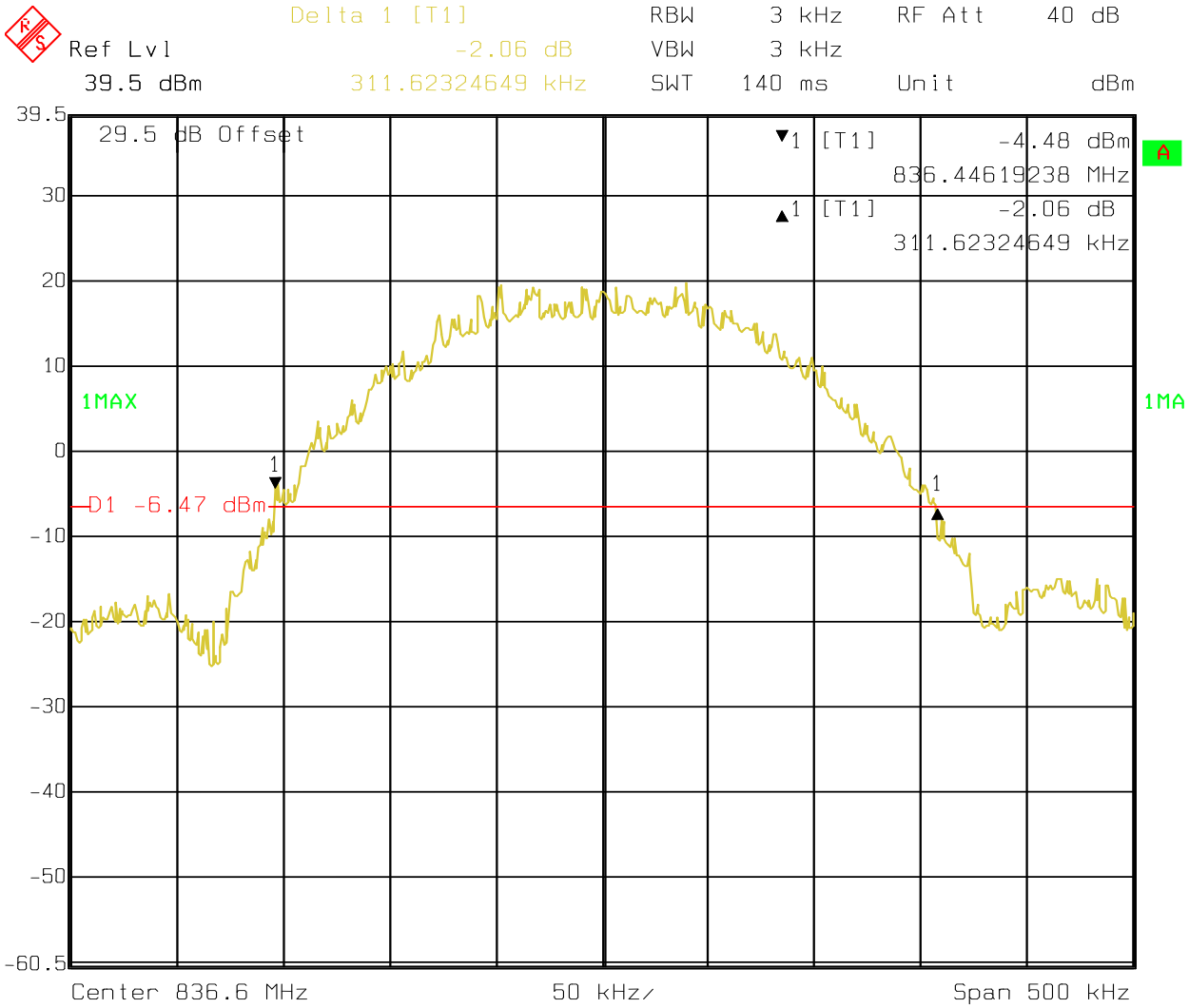
Emission Bandwidth 8PSK 850 Channel 190



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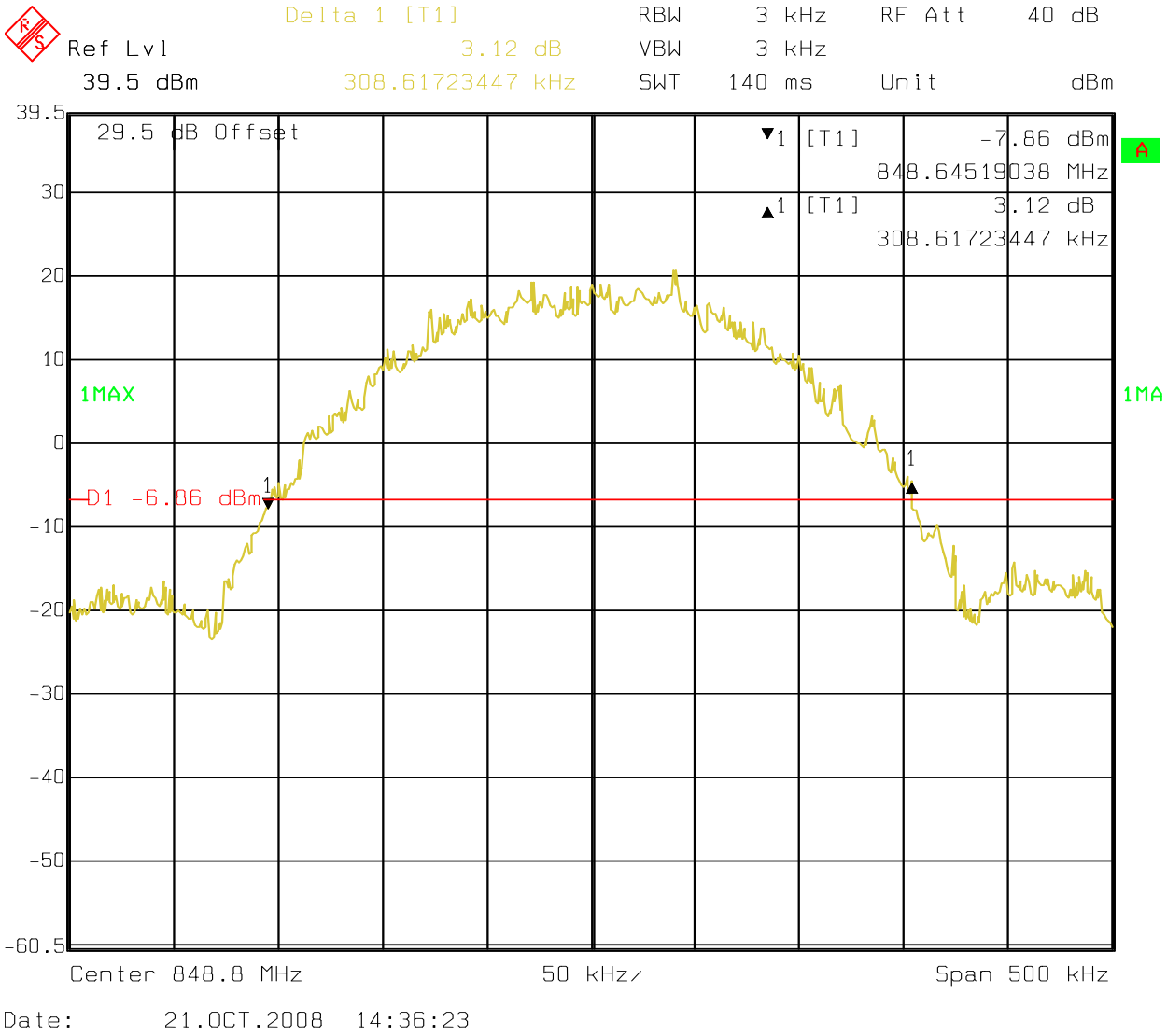
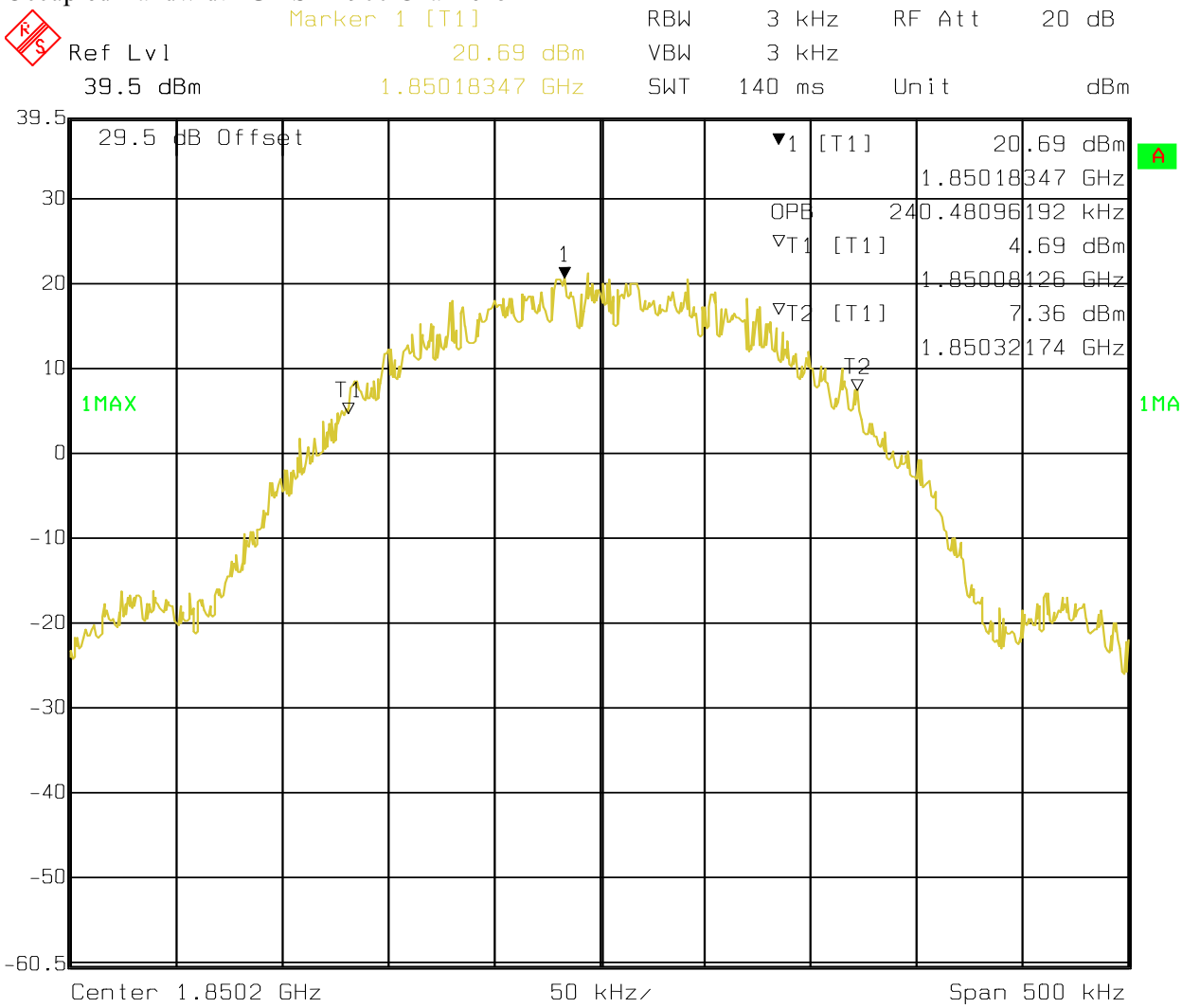
Emission Bandwidth 8PSK 850 Channel 251



Occupied Bandwidth GMSK 1900 Channel 512



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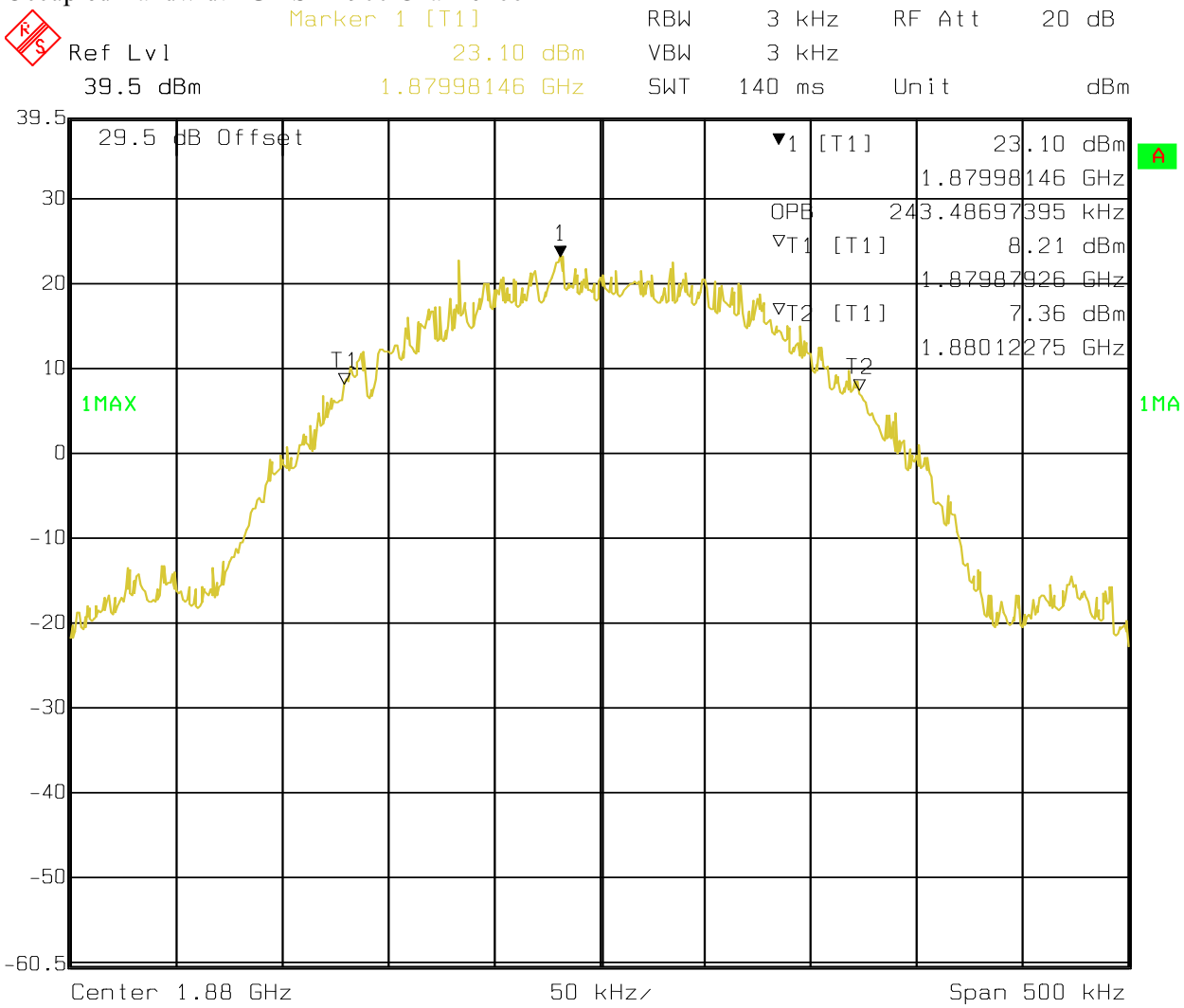
Occupied Bandwidth GMSK 1900 Channel 661



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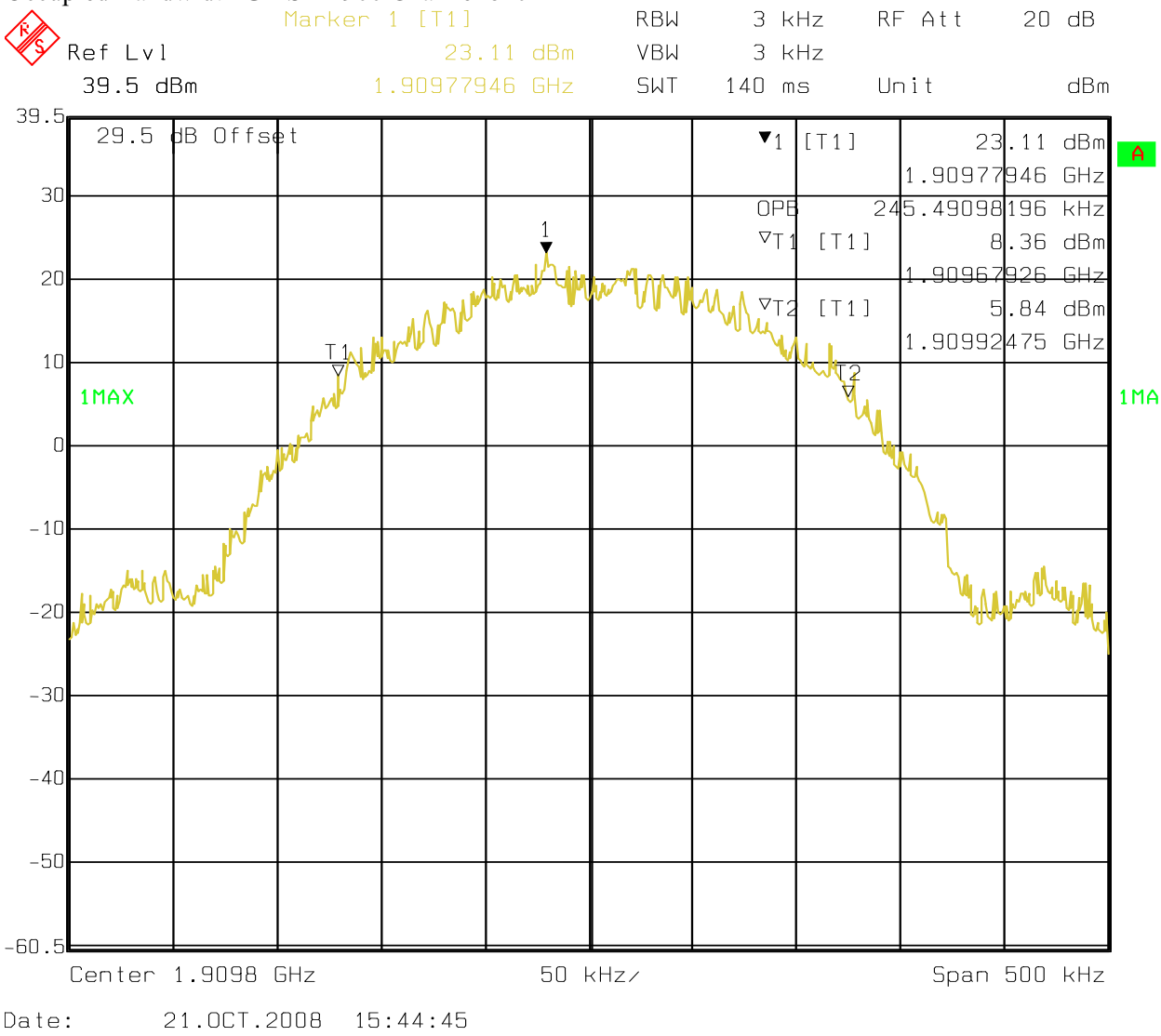
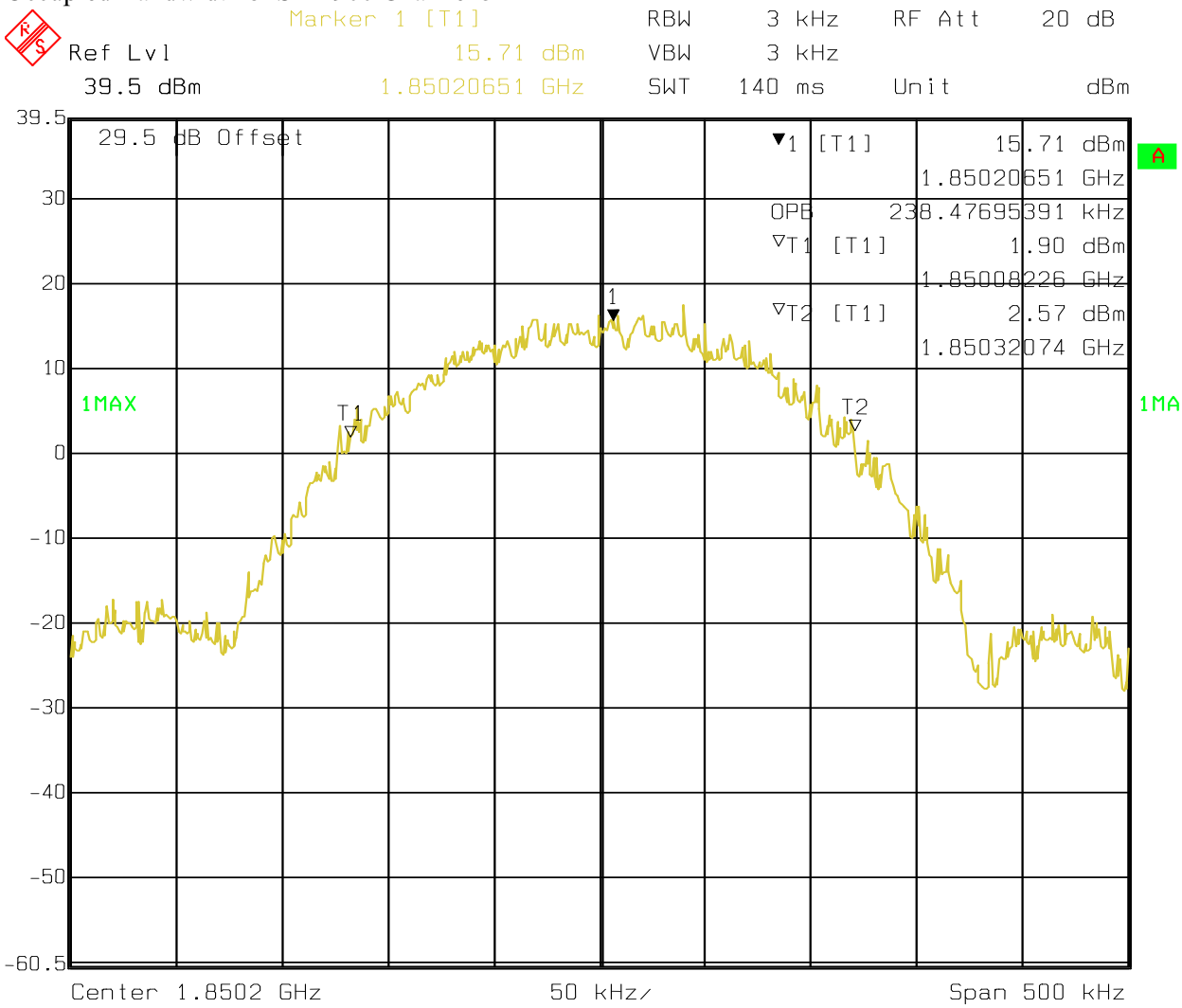
Occupied Bandwidth GMSK 1900 Channel 810



Occupied Bandwidth 8PSK 1900 Channel 512



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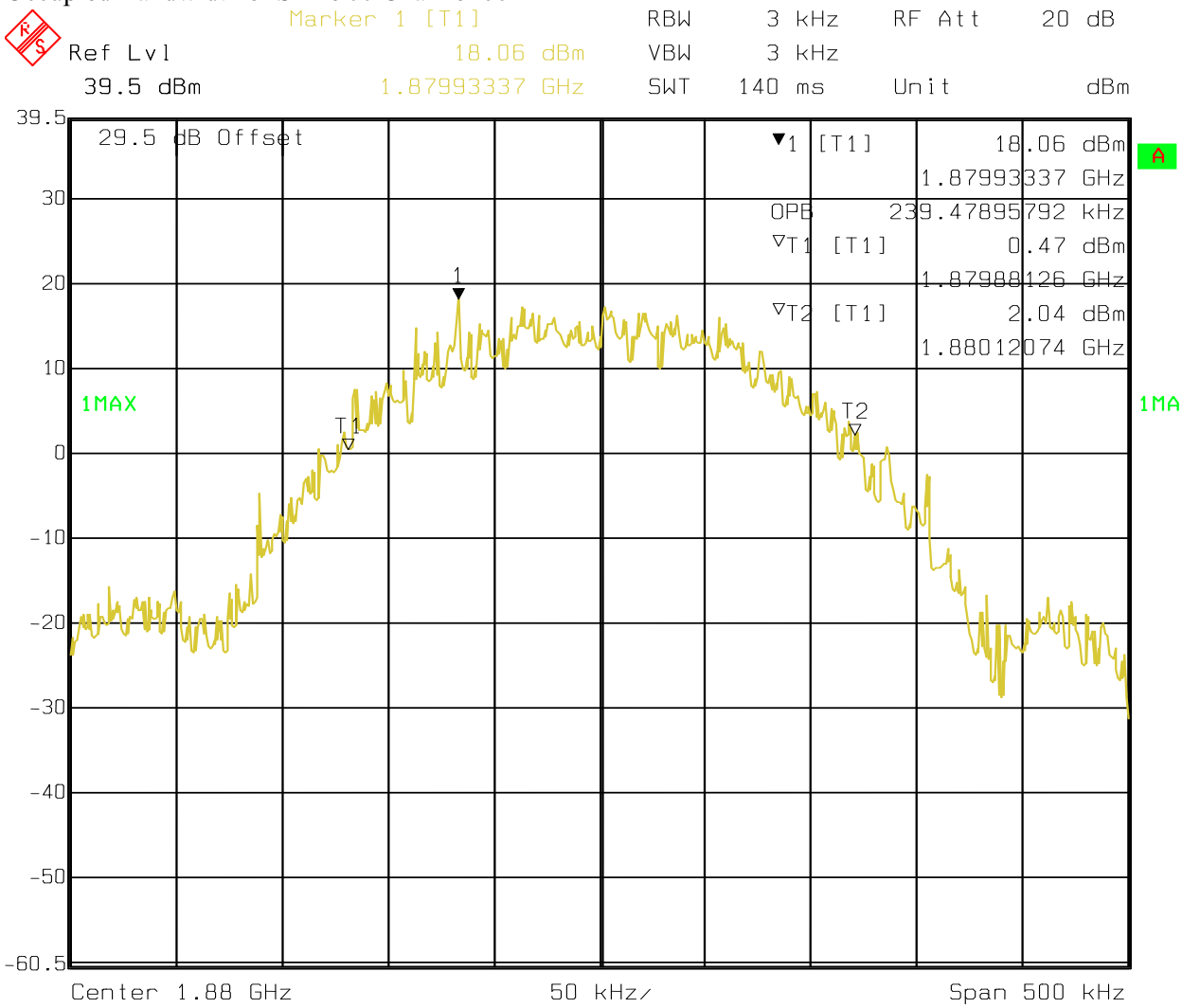
Occupied Bandwidth 8PSK 1900 Channel 661



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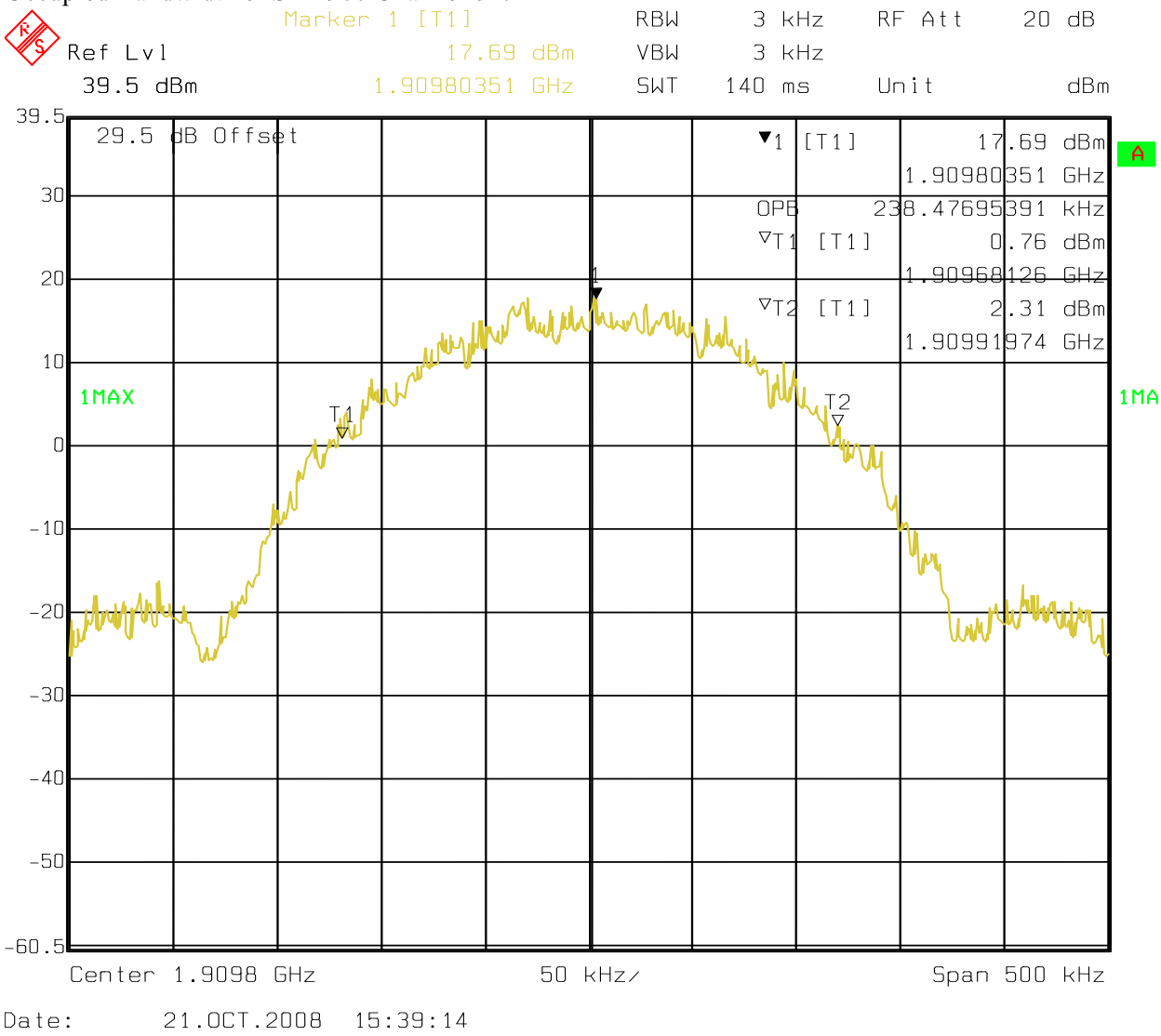
Occupied Bandwidth 8PSK 1900 Channel 810



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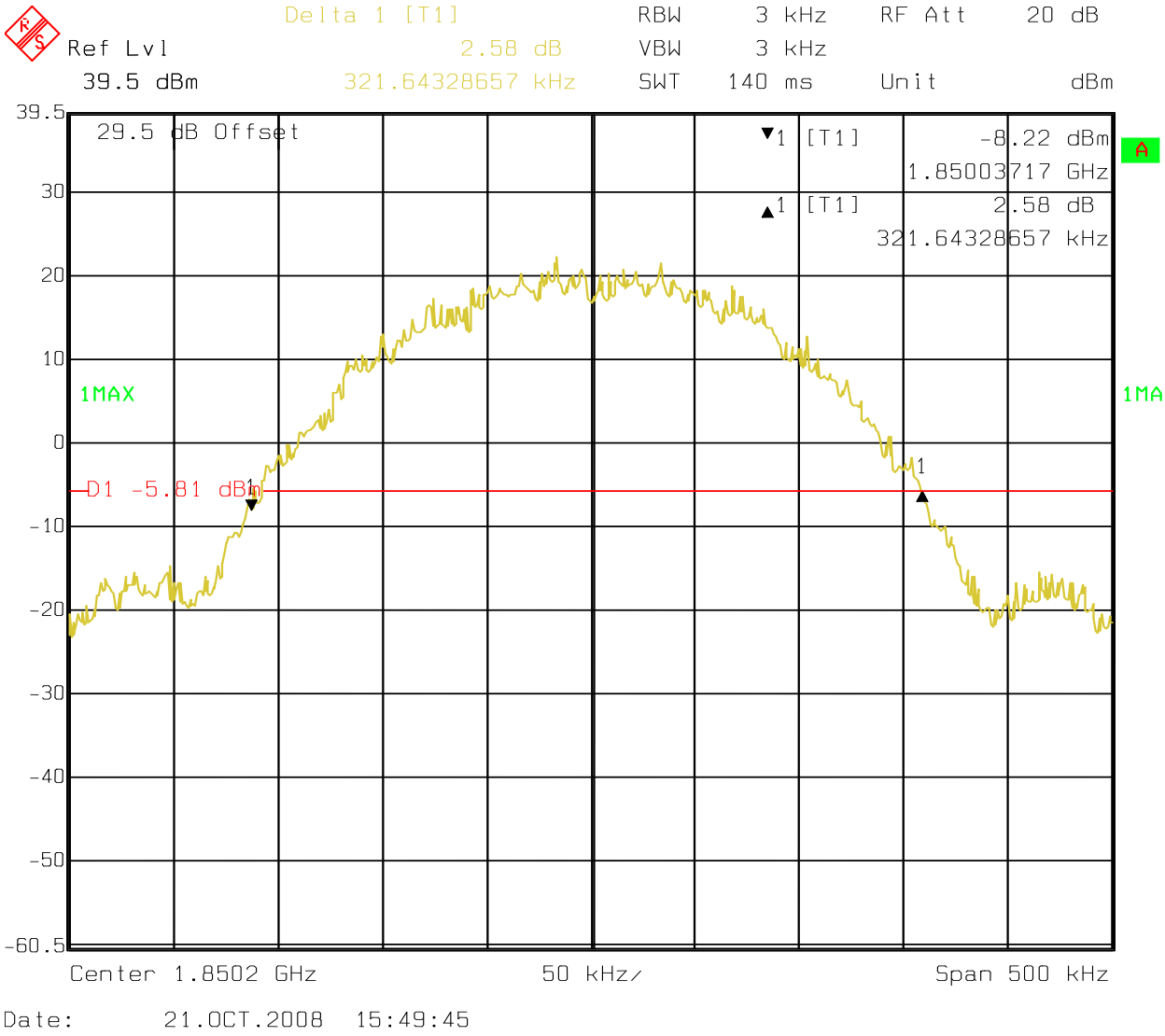
Emission Bandwidth GMSK 1900 Channel 512



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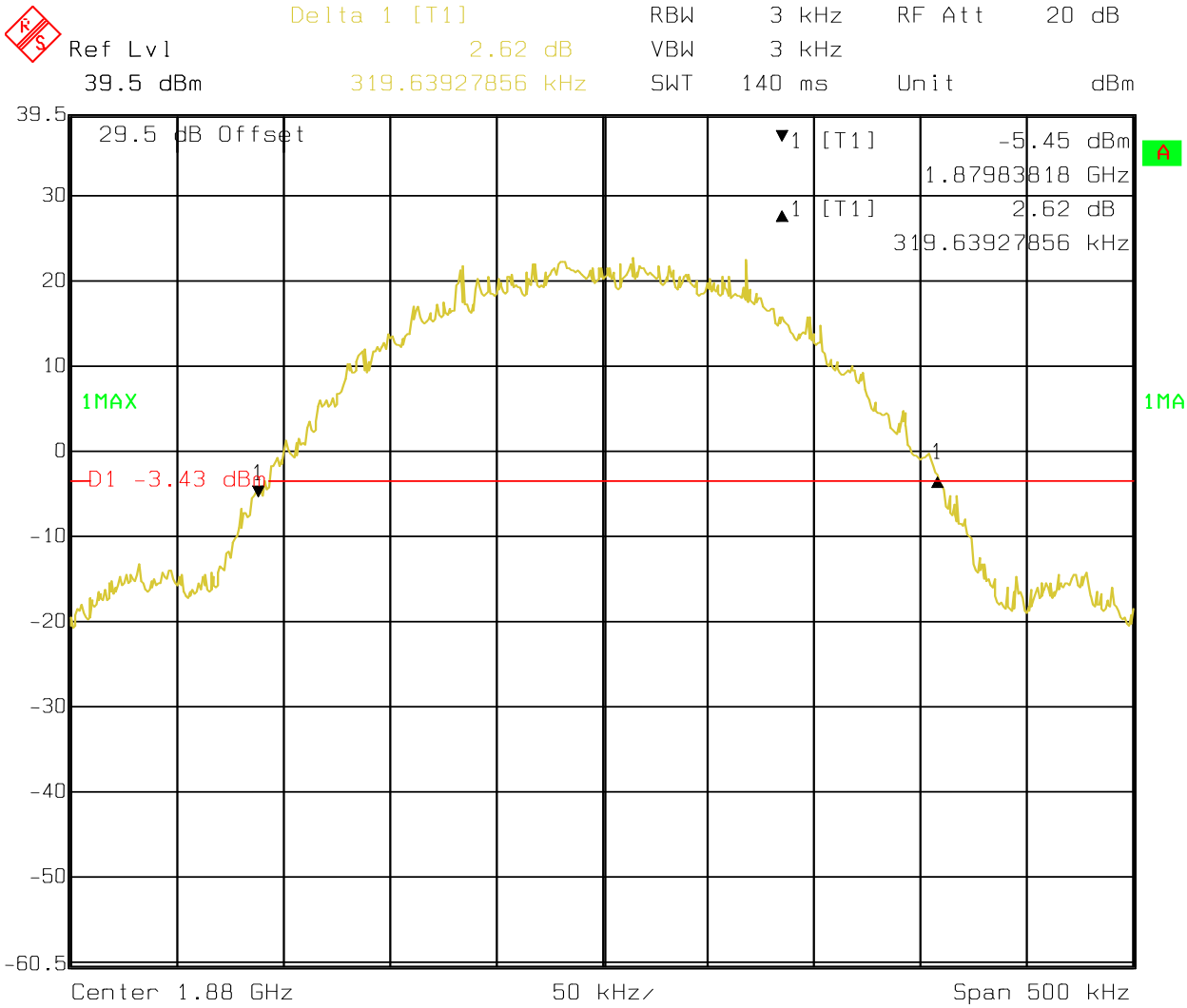
Emission Bandwidth GMSK 1900 Channel 661



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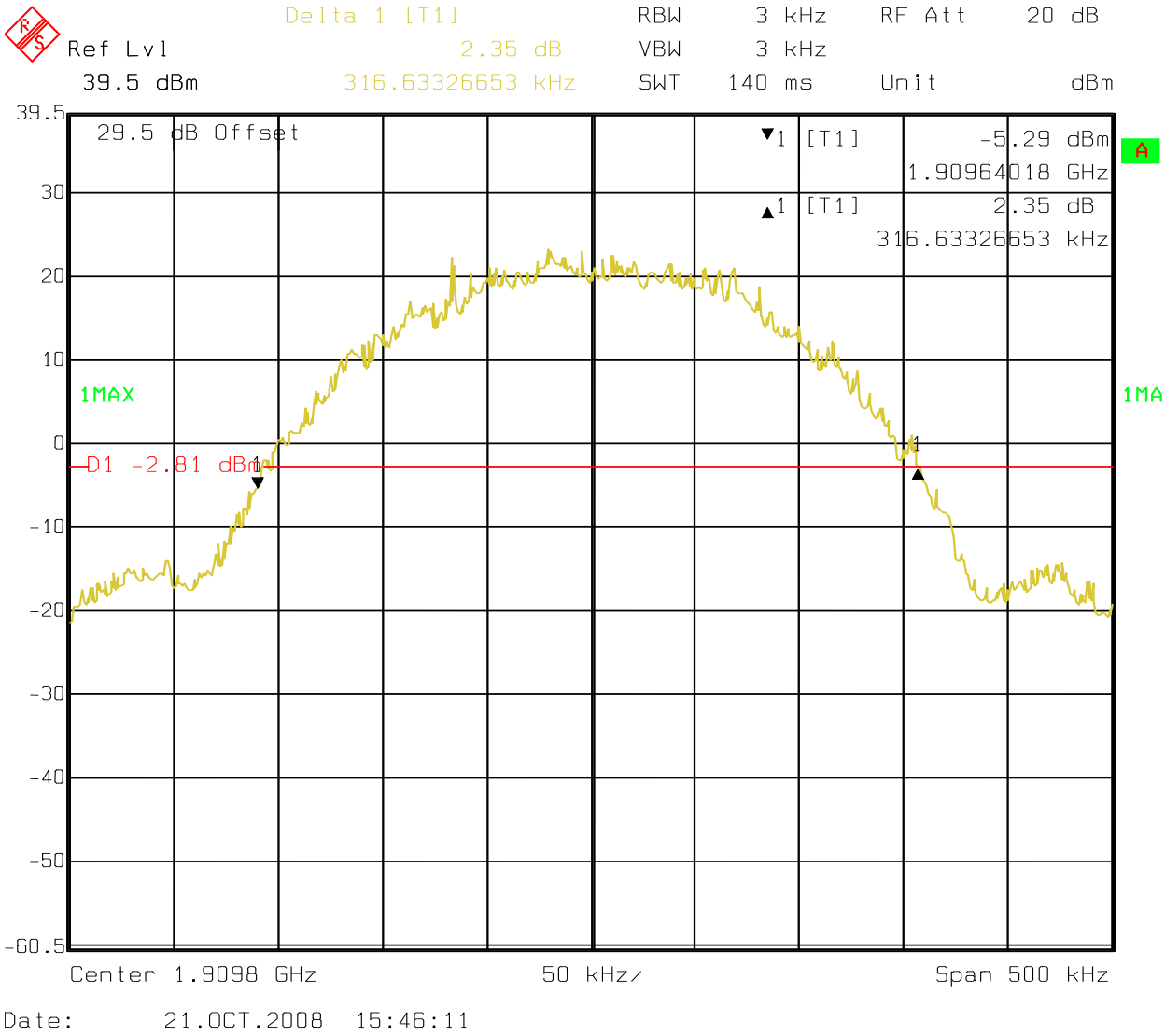
Emission Bandwidth GMSK 1900 Channel 810



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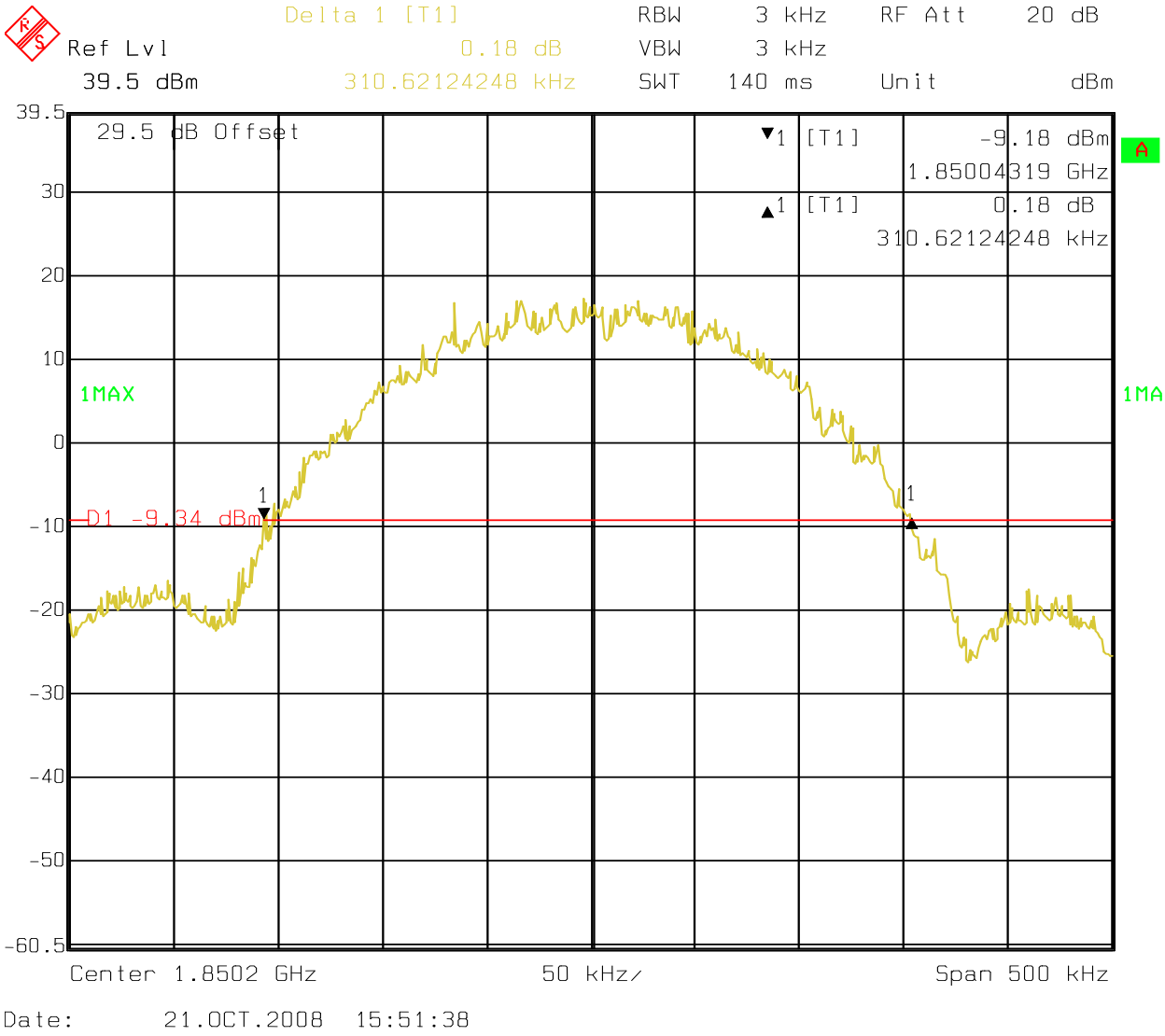
Emission Bandwidth 8PSK 1900 Channel 512



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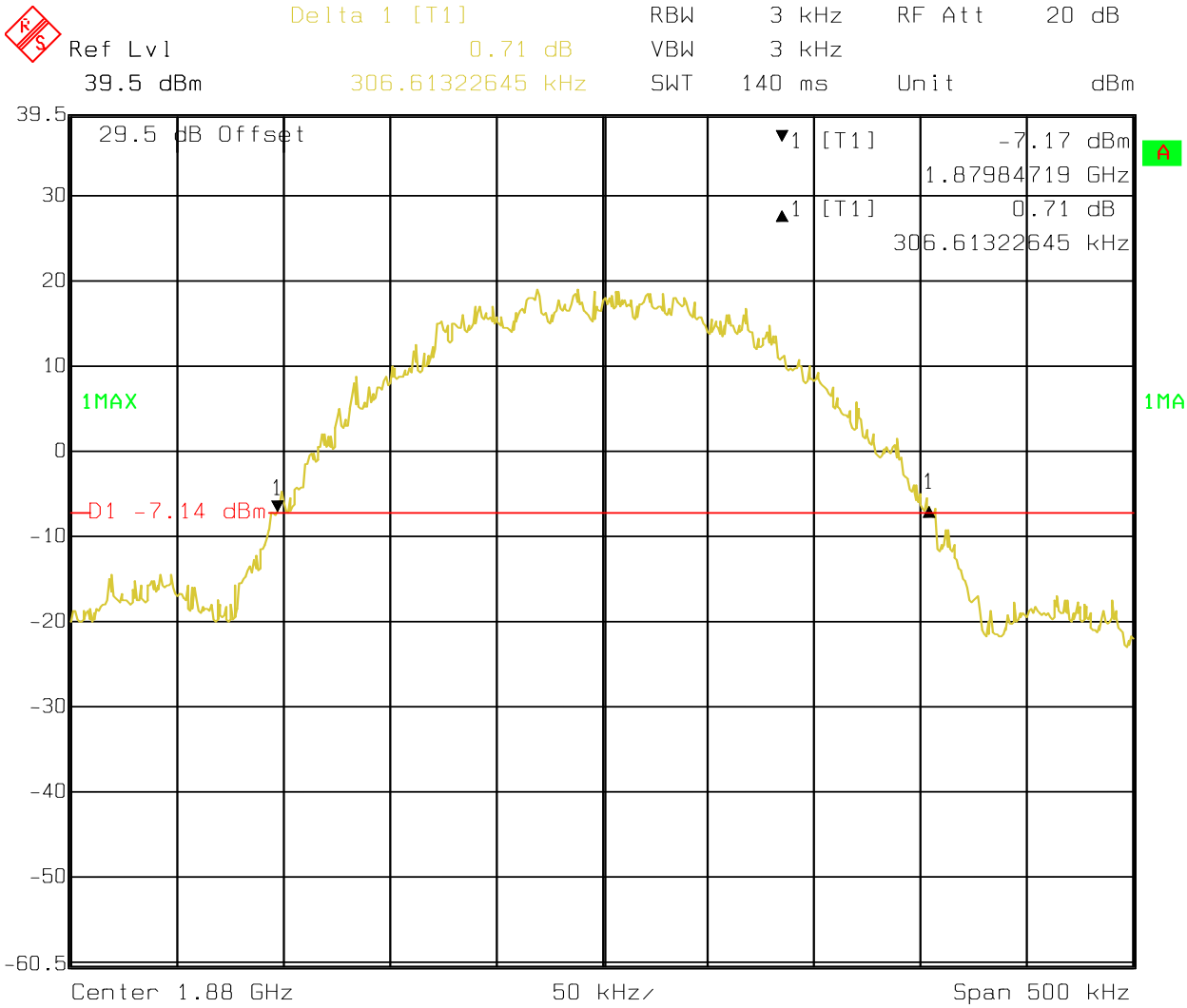
Emission Bandwidth 8PSK 1900 Channel 661



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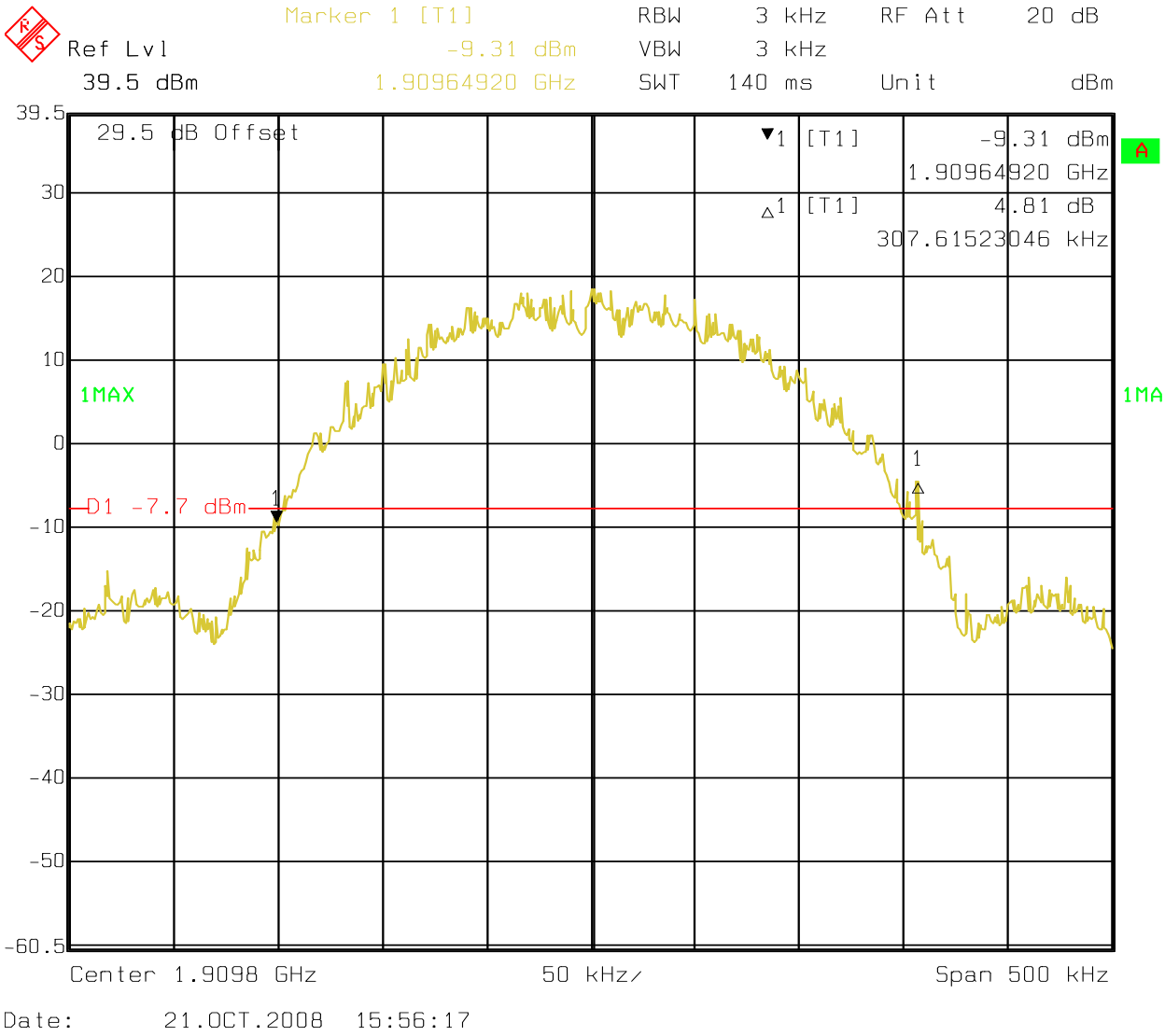
Emission Bandwidth 8PSK 1900 Channel 810



5.3 Frequency Stability

5.3.1 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, un-powered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours un-powered, 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, un-powered, 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.

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5.3.3 Test Results Frequency Stability (GSM-850)

§2.1055 (a)(1)
AFC FREQ ERROR vs. TEMPERATURE

Test specification:	**Section 22.355, Frequency stability test**		
Test procedure:	FCC part 22, Section 22.355, part 2 section 2.1055		
Test mode:	Compliance	**Verdict:**	PASS
Date:	4/21/2006		
Temperature: 22ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3.8 VDC
Remarks:			

Table 7.5.2 Frequency stability test results

OPERATING FREQUENCY:	824.2 – 848.8 MHz
NOMINAL POWER VOLTAGE:	3.8 Vdc
TEMPERATURE STABILIZATION PERIOD:	20 min
POWER DURING TEMPERATURE TRANSITION:	Off
SPECTRUM ANALYZER MODE:	Counter
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	100 kHz
MODULATION:	8PSK

T, ºC	Voltage, V	Frequency, MHz							Max frequency drift, Hz	
		Start up	1st min	2nd min	3rd min	4th min	5th min	10th min	Positive	Negative
Low carrier frequency, limit 2060 Hz										
-30	nominal	824.199977	824.199990	824.199988	824.199976	824.199989	824.199986	824.199987	13	-1
-20	nominal	824.199977	NA	NA	NA	NA	NA	824.199994	17	0
-10	nominal	824.199971	NA	NA	NA	NA	NA	824.199990	13	-6
0	nominal	824.200022	824.200107	824.200001	824.200000	824.200001	824.199991	824.200009	130	0
10	nominal	824.199950	NA	NA	NA	NA	NA	824.200009	32	-27
20	+15%	824.199980	NA	NA	NA	NA	NA	824.200022	45	0
20	nominal	824.199978	NA	NA	NA	NA	NA	824.199977*	1	0
20	-15%	824.200081	NA	NA	NA	NA	NA	824.200081	104	0
30	nominal	824.200021	824.200061	824.200006	824.199990	824.199993	824.200006	824.200070	93	0
40	nominal	824.200028	NA	NA	NA	NA	NA	824.200023	51	0
50	nominal	824.199972	NA	NA	NA	NA	NA	824.199988	11	-5
Mid carrier frequency, , limit 2090 Hz										
-30	nominal	836.399989	836.399979	836.399991	836.400007	836.399989	836.399987	836.399979	30	0
-20	nominal	836.400026	NA	NA	NA	NA	NA	836.399993	49	0
-10	nominal	836.400022	NA	NA	NA	NA	NA	836.400015	45	0
0	nominal	836.399982	836.400022	836.400010	836.399988	836.399992	836.400000	836.400010	45	0
10	nominal	836.400024	NA	NA	NA	NA	NA	836.400017	47	0
20	+15%	836.399977	NA	NA	NA	NA	NA	836.400027	50	0
20	nominal	836.399981	NA	NA	NA	NA	NA	836.399977*	4	0
20	-15%	836.400019	NA	NA	NA	NA	NA	836.399980	42	0
30	nominal	836.399920	836.399981	836.399986	836.399990	836.399986	836.400015	836.399986	38	-57
40	nominal	836.399978	NA	NA	NA	NA	NA	836.399976	1	-1
50	nominal	836.399981	NA	NA	NA	NA	NA	836.399985	8	0
High carrier frequency, , limit 2120 Hz										
-30	nominal	848.800018	848.799992	848.799950	848.800001	848.799990	848.799986	848.799950	41	-27
-20	nominal	848.800034	NA	NA	NA	NA	NA	848.799988	57	0
-10	nominal	848.799982	NA	NA	NA	NA	NA	848.799982	5	0
0	nominal	848.800020	848.799989	848.799981	848.800014	848.800009	848.800000	848.800014	43	0
10	nominal	848.800017	NA	NA	NA	NA	NA	848.799993	40	0
20	+15%	848.800018	NA	NA	NA	NA	NA	848.799979	41	0
20	nominal	848.799982	NA	NA	NA	NA	NA	848.799977*	5	0
20	-15%	848.799979	NA	NA	NA	NA	NA	848.799979	2	0
30	nominal	848.799960	848.799986	848.799990	848.799990	848.799987	848.799981	848.799993	16	-17
40	nominal	848.799976	NA	NA	NA	NA	NA	848.799974	0	-3
50	nominal	848.799971	NA	NA	NA	NA	NA	848.799981	4	-6

* - Reference frequency

Verdict: Pass

Reference numbers of test equipment used

HL 0278	HL 0493	HL 1097	HL 1204	HL 1653			

Full description is given in Appendix A.

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5.3.5 Test Results Frequency Stability (GMSK-1900)

§2.1055 (a)(1)
AFC FREQ ERROR vs. TEMPERATURE

Test specification:	**Section 24.235, Frequency stability test**		
Test procedure:	FCC part 24, Section 24.235, part 2 section 2.1055		
Test mode:	Compliance	**Verdict:**	PASS
Date:	4/21/2006		
Temperature: 22ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 43 %	**Power Supply:** 3.8 VDC
Remarks:			

Table 8.5.2 Frequency stability test results

OPERATING FREQUENCY:	1850.2 – 1909.8 MHz
NOMINAL POWER VOLTAGE:	3.8 Vdc
TEMPERATURE STABILIZATION PERIOD:	20 min
POWER DURING TEMPERATURE TRANSITION:	Off
SPECTRUM ANALYZER MODE:	Counter
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	100 kHz
MODULATION:	8PSK

T, ºC	Voltage, V	Frequency, MHz							Max frequency drift, Hz	
		Start up	1st min	2nd min	3rd min	4th min	5th min	10th min	Positive	Negative
Low carrier frequency										
-30	nominal	1850.199947	1850.199987	1850.199982	1850.199910	1850.200013	1850.199985	1850.199993	119	0
-20	nominal	1850.199924	NA	NA	NA	NA	NA	1850.199987	93	0
-10	nominal	1850.199945	NA	NA	NA	NA	NA	1850.200017	123	0
0	nominal	1850.200074	1850.200014	1850.200024	1850.200018	1850.199991	1850.200021	1850.199990	180	0
10	nominal	1850.200106	NA	NA	NA	NA	NA	1850.200210	316	0
20	+15%	1850.199932	NA	NA	NA	NA	NA	1850.199932	38	0
20	nominal	1850.199931	NA	NA	NA	NA	NA	1850.199894*	37	0
20	-15%l	1850.200034	NA	NA	NA	NA	NA	1850.200046	152	0
30	nominal	1850.200000	1850.200107	1850.199972	1850.199970	1850.199975	1850.199973	1850.199970	213	0
40	nominal	1850.200092	NA	NA	NA	NA	NA	1850.199967	198	0
50	nominal	1850.200108	NA	NA	NA	NA	NA	1850.200027	214	0
Mid carrier frequency										
-30	nominal	1879.999966	1879.999977	1879.999988	1879.999978	1880.000014	1879.999979	1879.999981	48	0
-20	nominal	1880.000028	NA	NA	NA	NA	NA	1879.999987	62	0
-10	nominal	1880.000032	NA	NA	NA	NA	NA	1880.000020	66	0
0	nominal	1880.000036	1880.000025	1880.000025	1880.000013	1880.000017	1880.000022	1880.000035	70	0
10	nominal	1880.000051	NA	NA	NA	NA	NA	1880.000017	85	0
20	+15%	1879.999965	NA	NA	NA	NA	NA	1879.999965	0	-1
20	nominal	1879.999975	NA	NA	NA	NA	NA	1879.999966*	9	0
20	-15%l	1880.000031	NA	NA	NA	NA	NA	1880.000051	85	0
30	nominal	1879.999967	1879.999977	1879.999982	1879.999983	1879.999981	1879.999978	1879.999979	17	0
40	nominal	1879.999953	NA	NA	NA	NA	NA	1879.999980	14	-13
50	nominal	1879.999954	NA	NA	NA	NA	NA	1879.999964	0	-12
High carrier frequency										
-30	nominal	1909.799961	1909.799981	1909.799987	1909.799980	1909.799983	1909.799977	1909.799983	17	-9
-20	nominal	1909.800034	NA	NA	NA	NA	NA	1909.800020	64	0
-10	nominal	1909.800038	NA	NA	NA	NA	NA	1909.800016	68	0
0	nominal	1909.800038	1909.800022	1909.800021	1909.800037	1909.800031	1909.800000	1909.800018	68	0
10	nominal	1909.800066	NA	NA	NA	NA	NA	1909.800018	96	0
20	+15%	1909.800036	NA	NA	NA	NA	NA	1909.799958	66	-12
20	nominal	1909.800023	NA	NA	NA	NA	NA	1909.799970*	53	0
20	-15%l	1909.799997	NA	NA	NA	NA	NA	1909.800035	65	0
30	nominal	1909.799970	1909.799980	1909.799976	1909.799981	1909.799978	1909.799972	1909.799986	16	0
40	nominal	1909.799952	NA	NA	NA	NA	NA	1909.799947	0	-23
50	nominal	1909.799930	NA	NA	NA	NA	NA	1909.799948	0	-40

* - Reference frequency

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5.4 Spurious Emissions Conducted

5.4.1 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.

5.4.2 Limits:

5.4.2.1 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.

5.4.2.2 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

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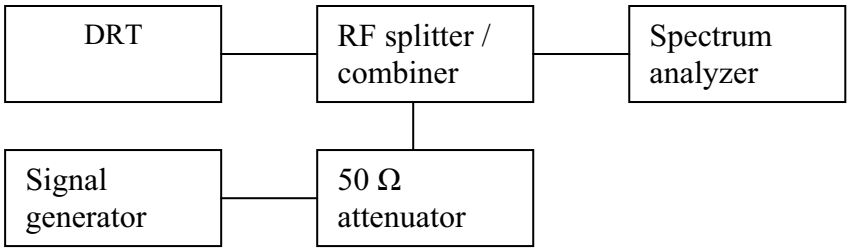
transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined 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.

5.4.3 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.)

5.4.4 Test Results: Conducted Out of band Emission:

Not measurable emission captured. See plots below.

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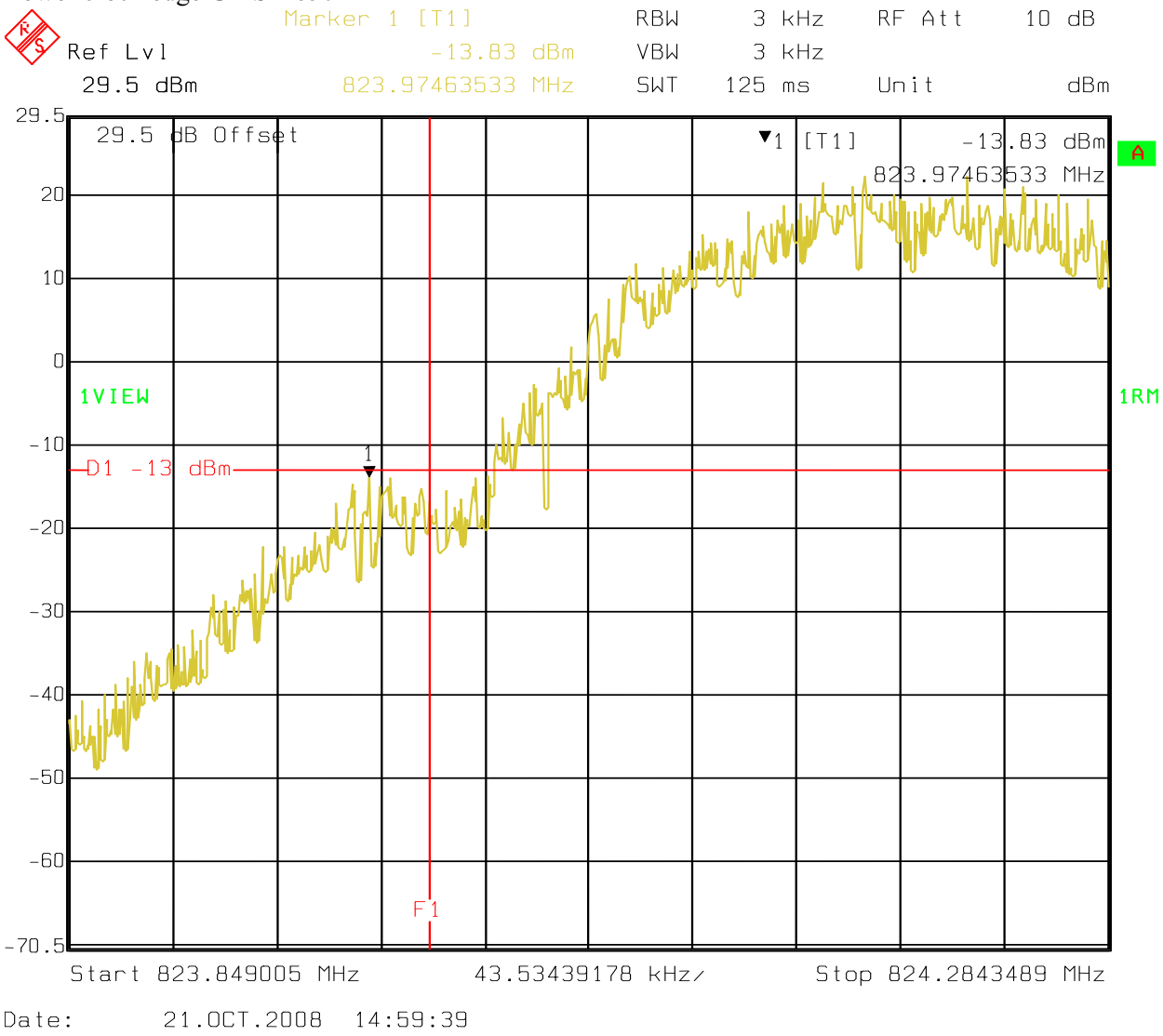
Lower block edge GMSK 850



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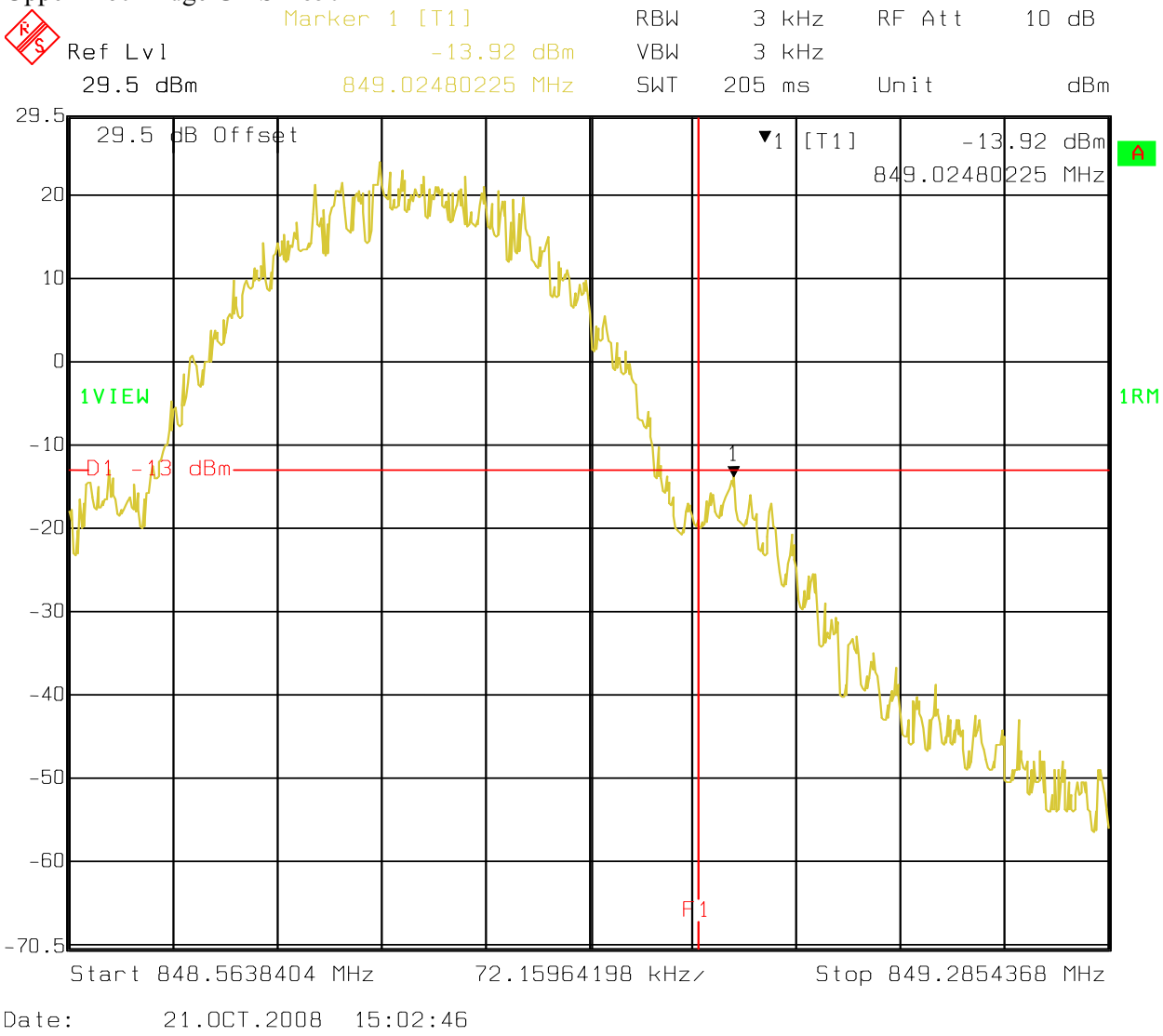
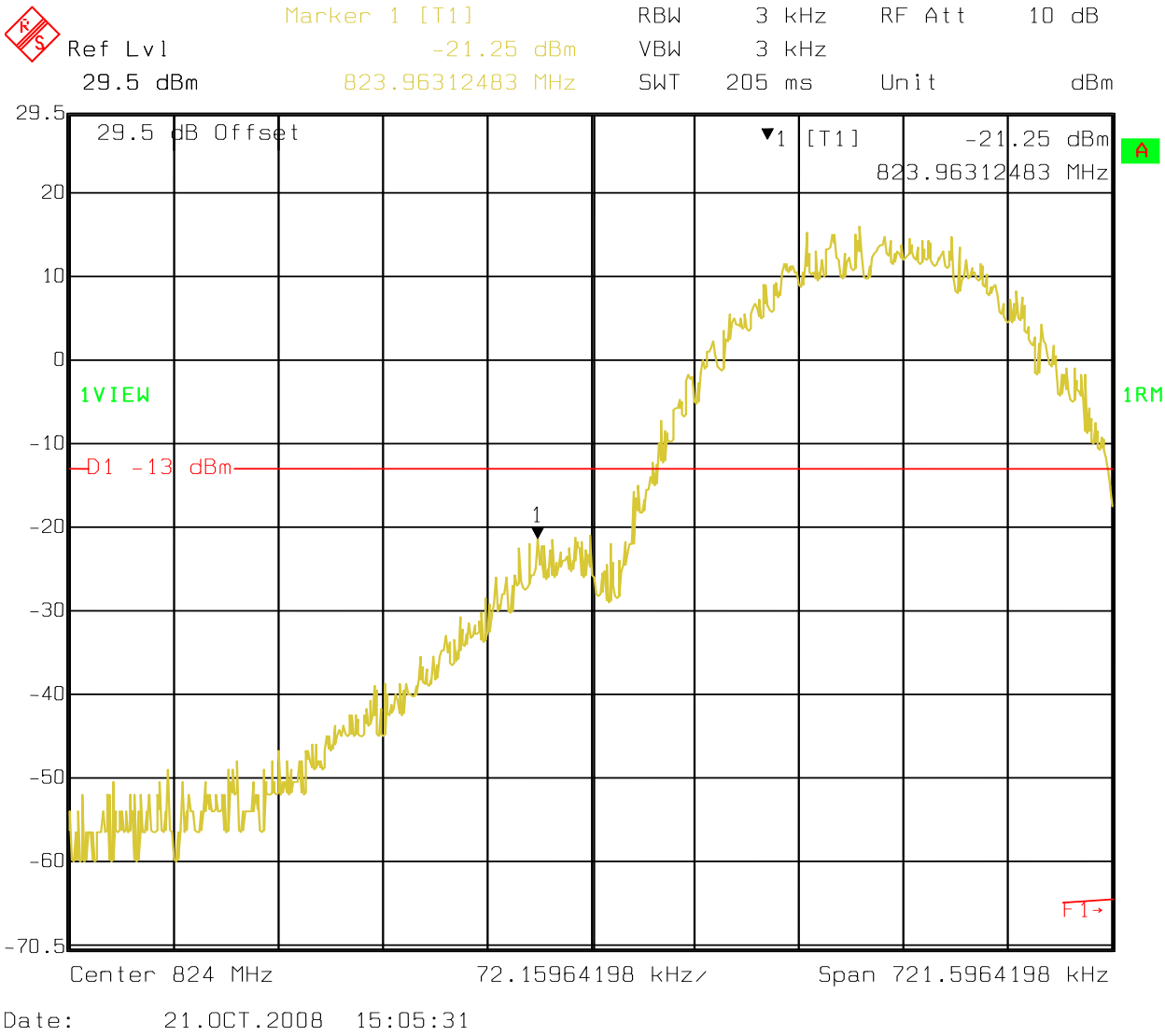
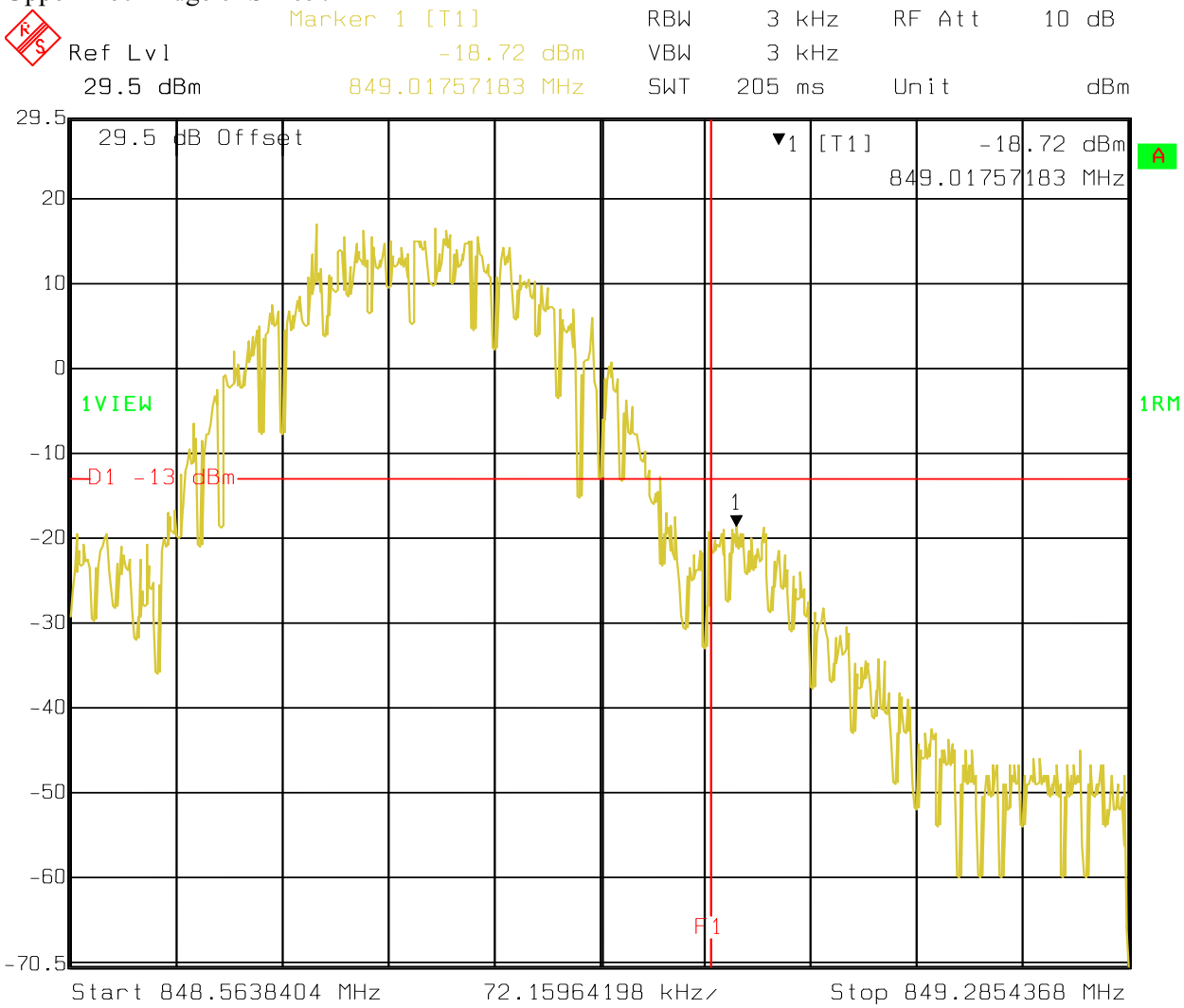
Upper Block Edge GMSK 850



Lower block edge 8PSK 850



Upper Block Edge 8PSK 850



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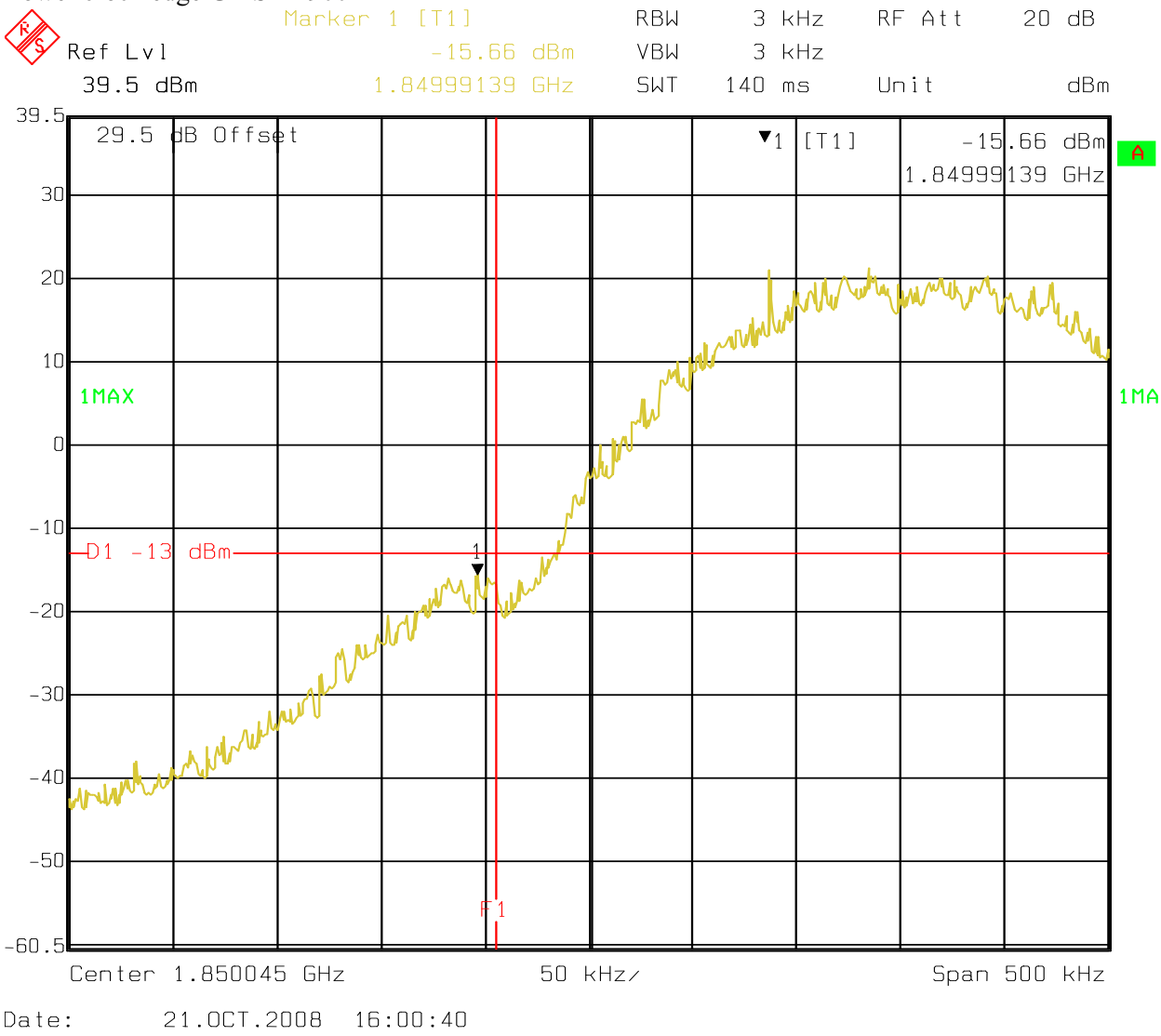
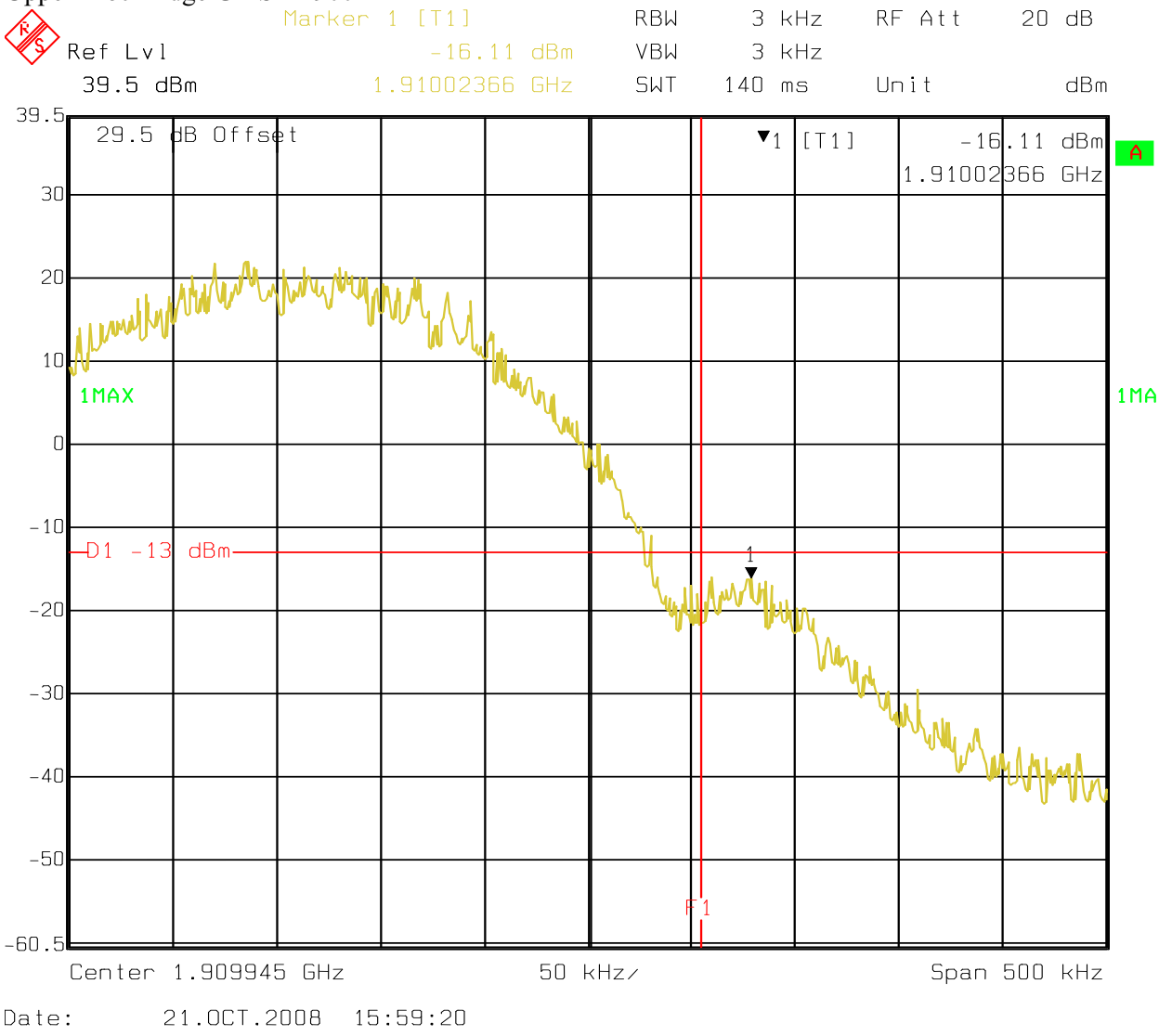
Lower block edge GMSK 1900



Upper Block Edge GMSK 1900



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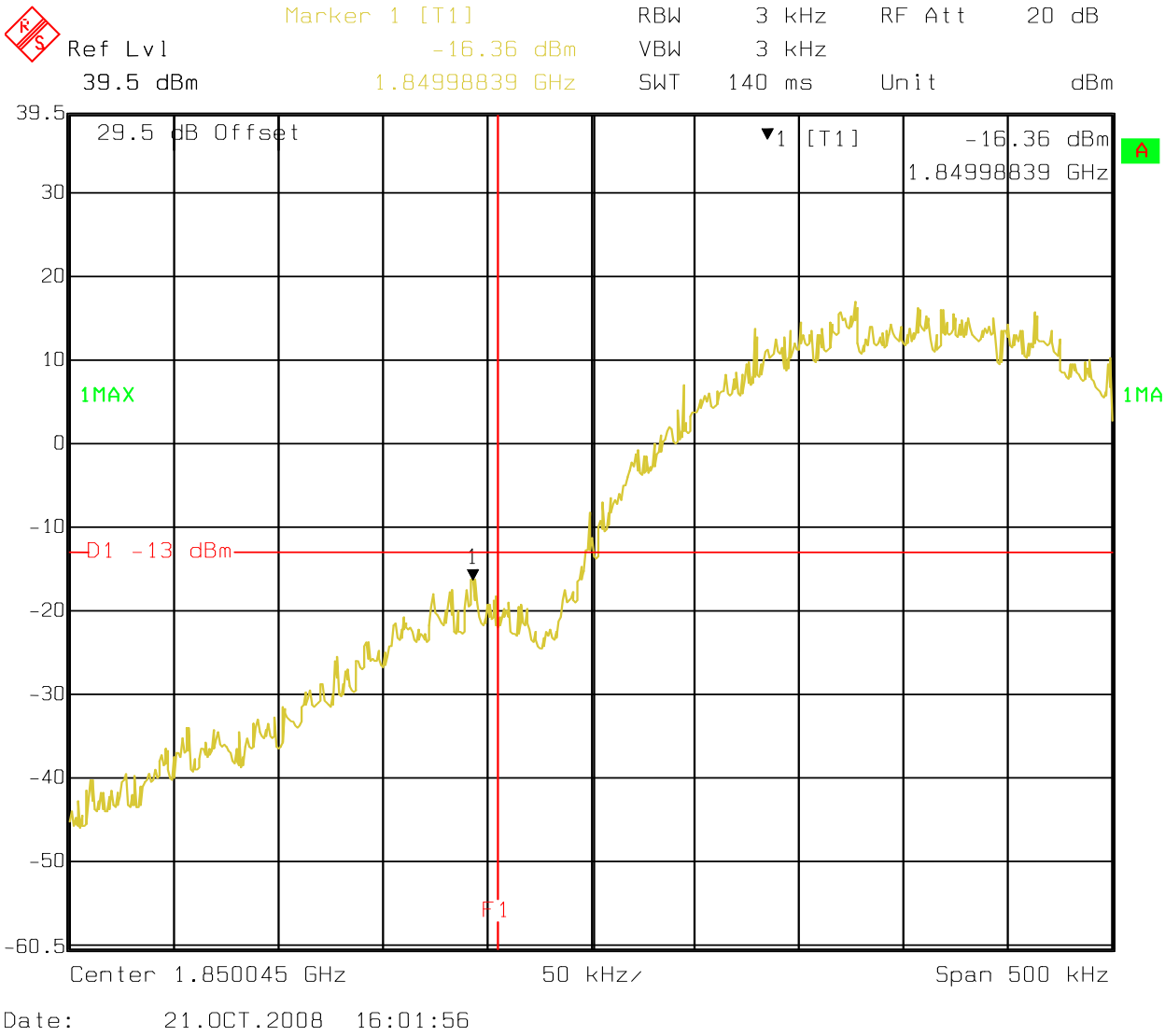
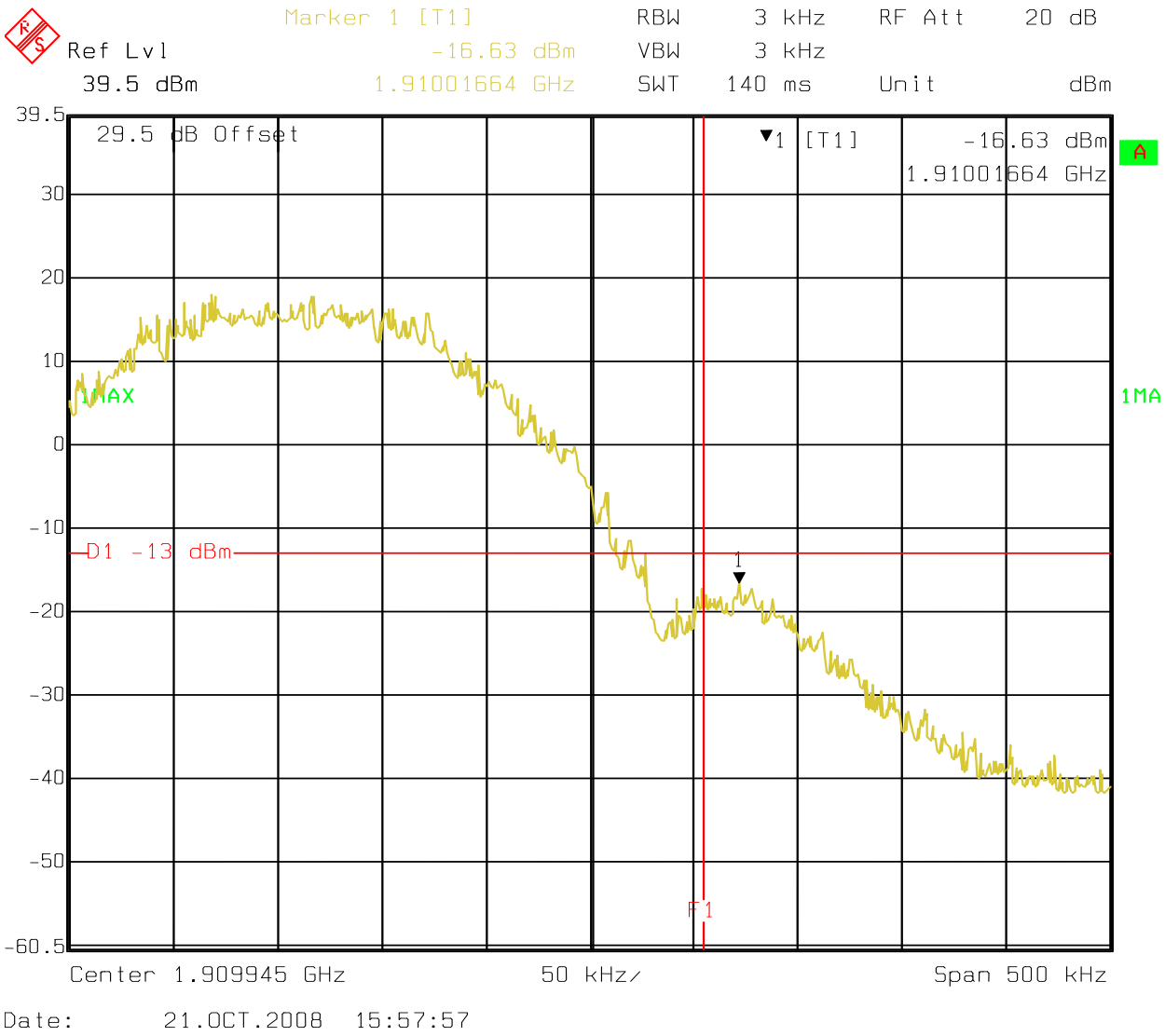
Lower block edge 8PSK 1900



Upper Block Edge 8PSK 1900



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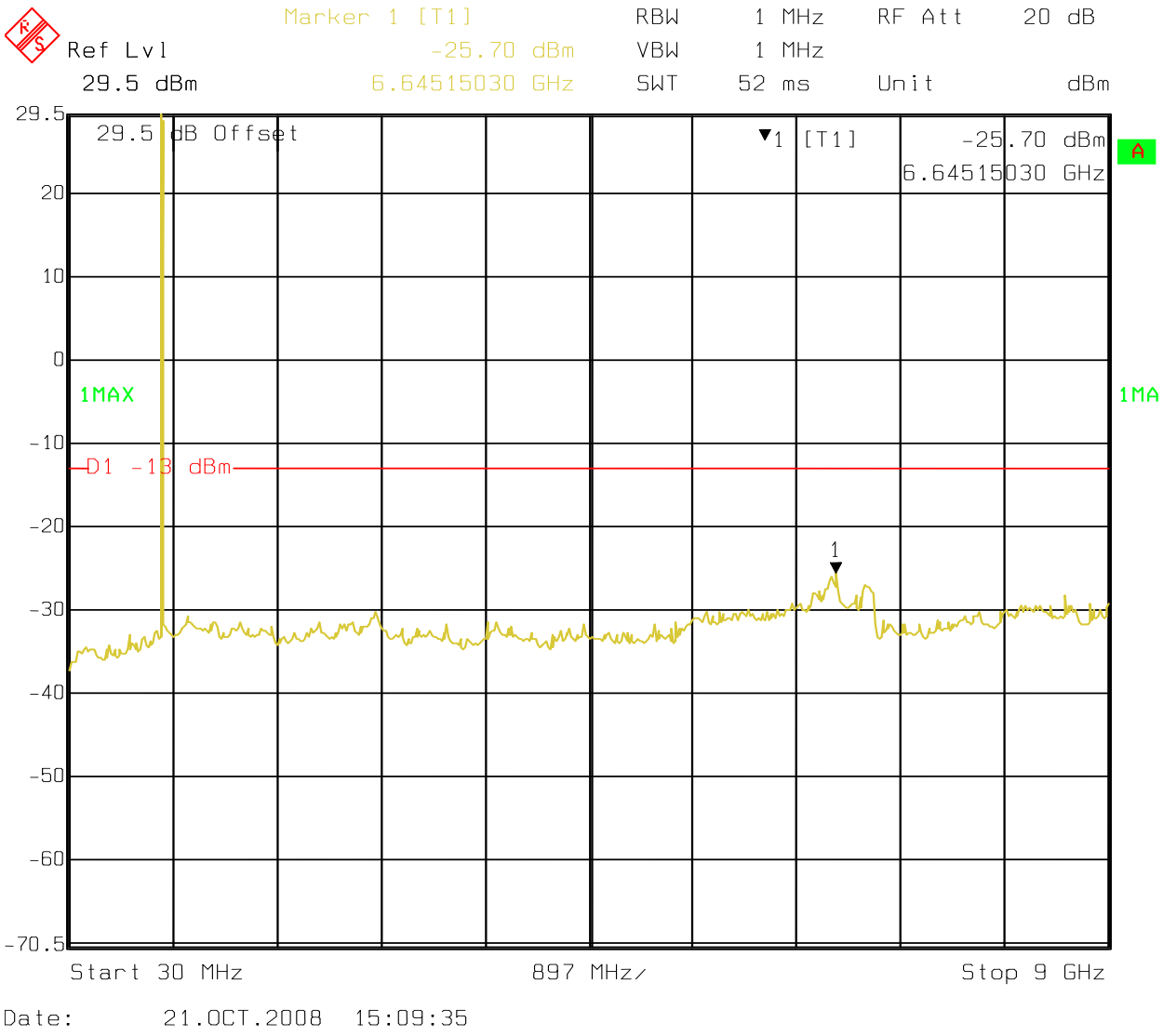
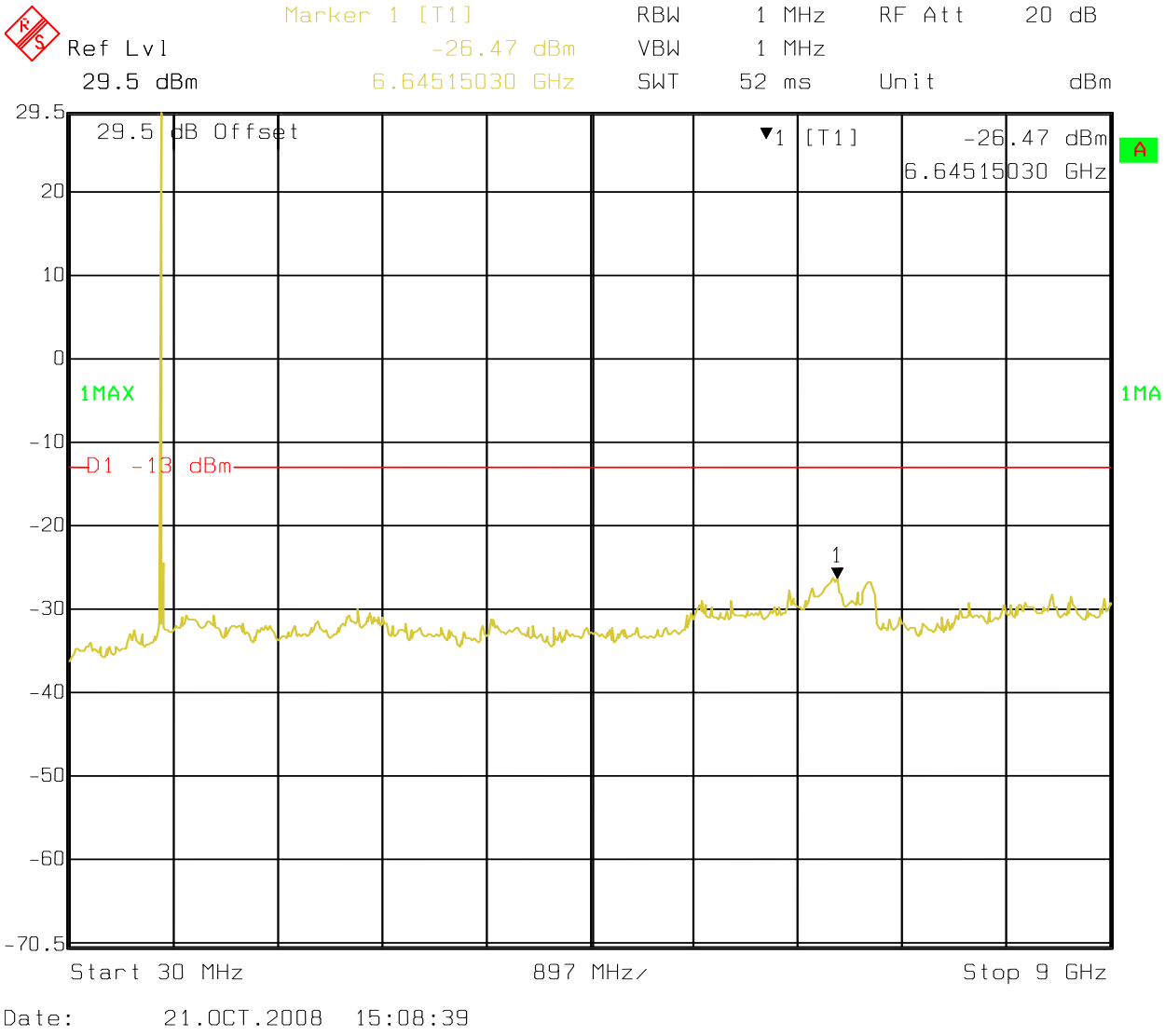
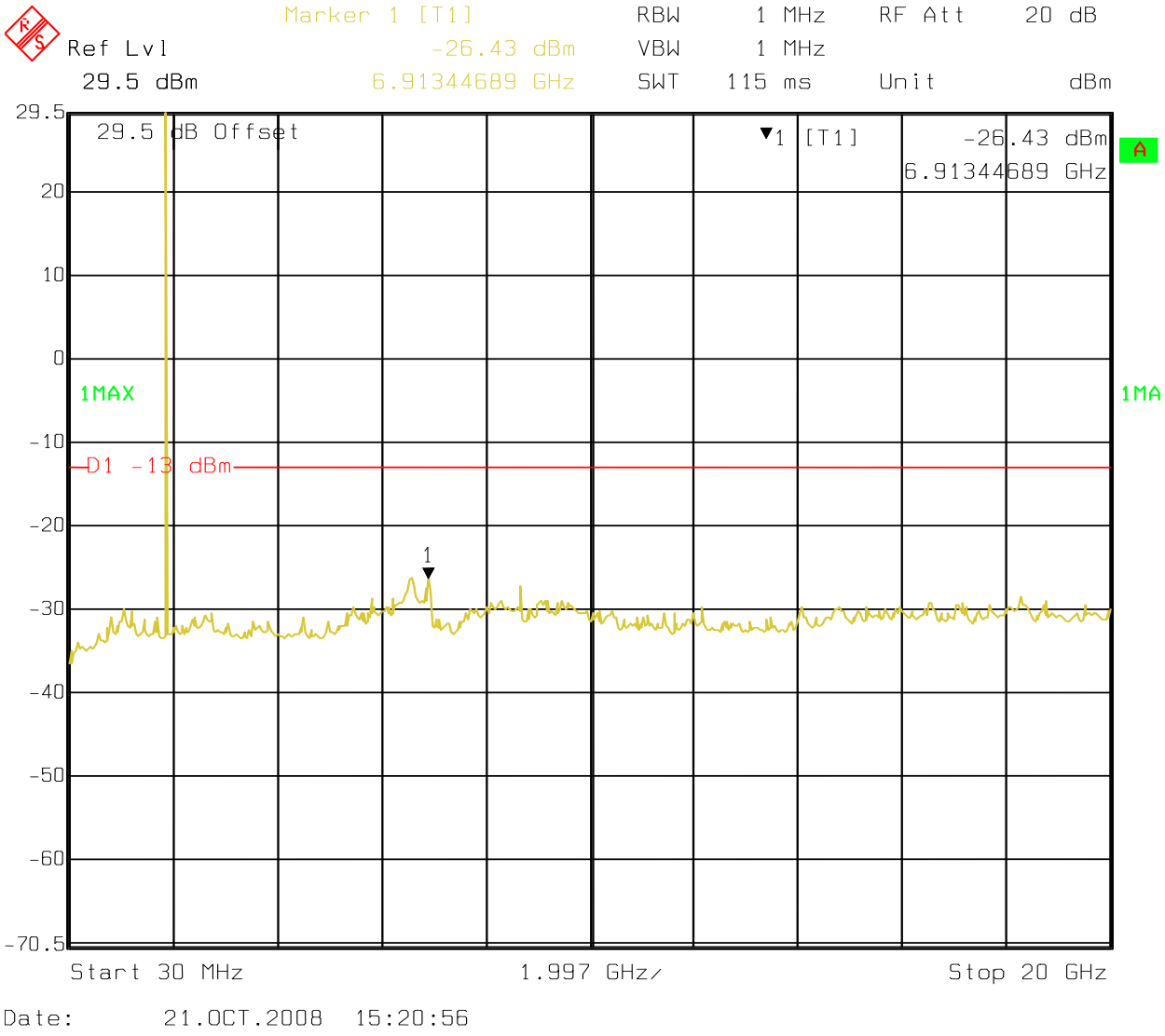
Conducted Spurious Emissions GMSK 850
This is worse case representation for low, mid, and high transmitting channels.
Emission over the limit line is identified as mobile station uplink.



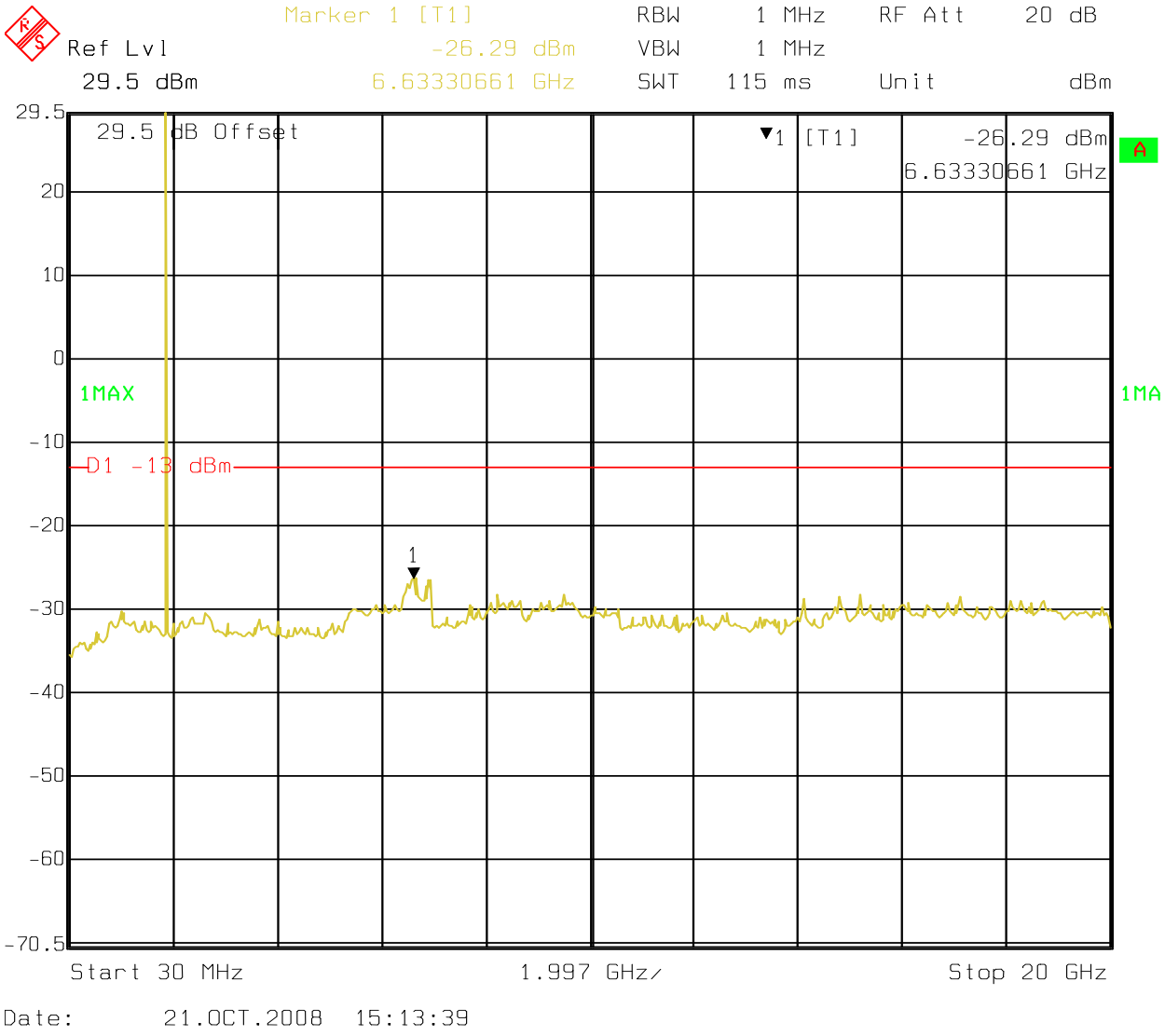
Conducted Spurious Emissions 8PSK 850
This is worse case representation for low, mid, and high transmitting channels.
Emission over the limit line is identified as mobile station uplink.



Conducted Spurious Emissions GMSK 1900
This is worse case representation for low, mid, and high transmitting channels.
Emission over the limit line is identified as mobile station uplink.



Conducted Spurious Emissions 8PSK 1900
This is worse case representation for low, mid, and high transmitting channels.
Emission over the limit line is identified as mobile station uplink.



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5.5 Spurious Emissions Radiated

5.5.1 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.

5.5.2 Limits:

5.5.2.1 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.

5.5.2.2 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

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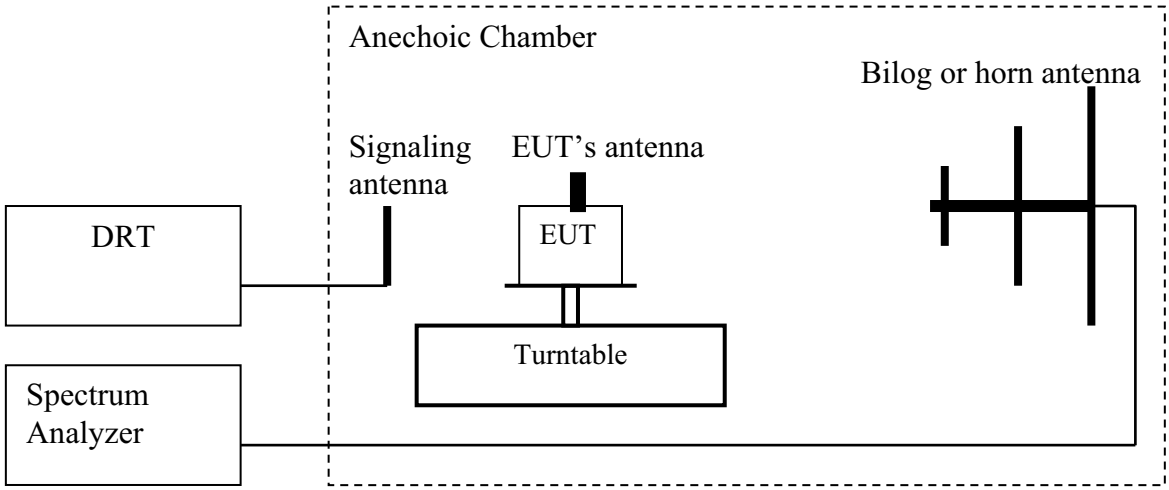
emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

5.5.3 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.

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(**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.

Radiated emission measurements were made only with Circuit Switched mode GMSK modulation because this mode represents the worse case emission for all the modulations for GSM. See section 5.5.4.1 and 5.5.4.3

Radiated emissions measurements were made also with UMTS FDD mode. See section 5.5.4.2 and 5.5.4.4

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5.5.4 Radiated out of band emissions results on EUT:

5.5.4.1 Test Results Transmitter Spurious Emission GSM850:

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						

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RADIATED SPURIOUS EMISSIONS (GSM-850) TX: 30MHz - 1GHz
Spurious emission limit –13dBm
Antenna: vertical

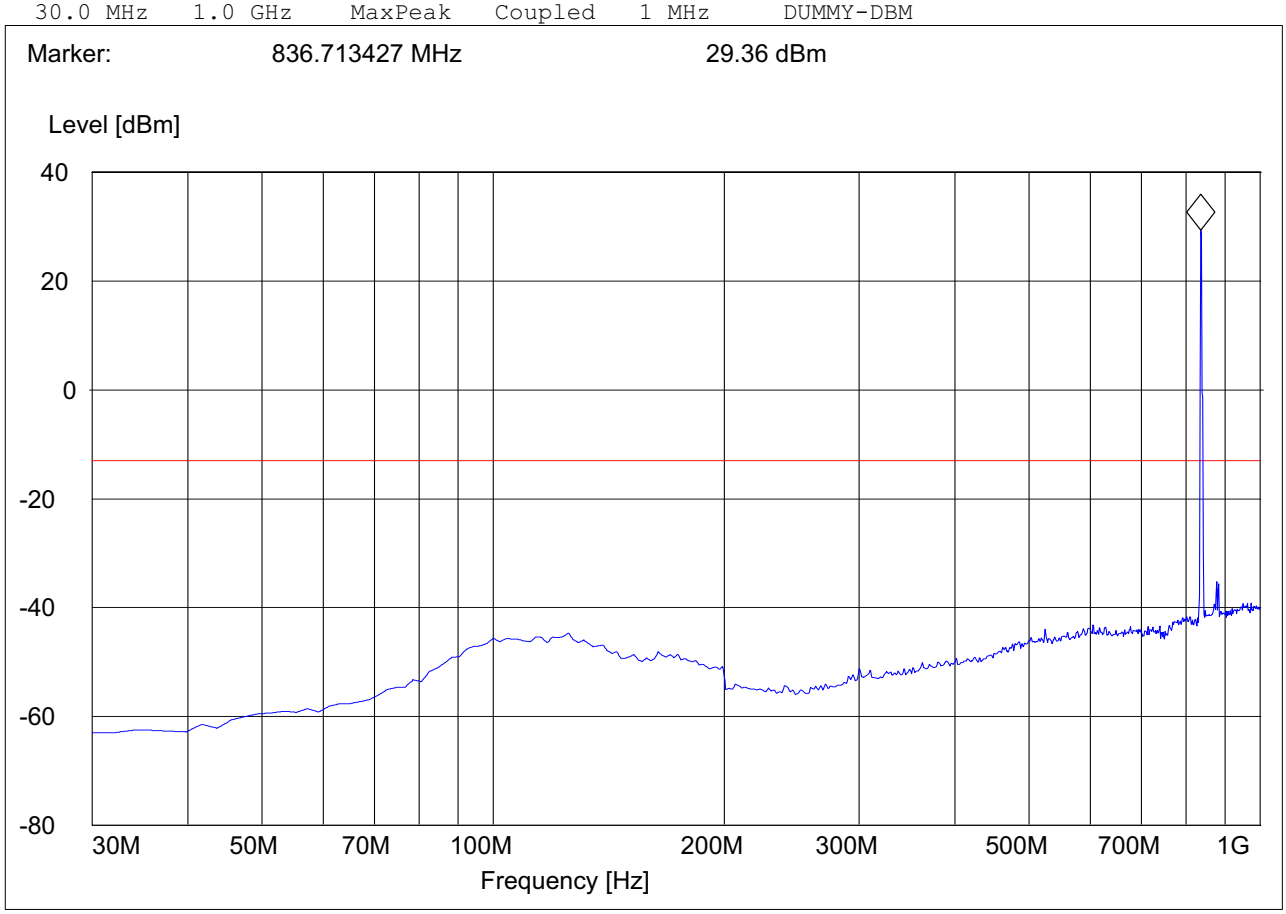
Note:

1.The peak above the limit line is the carrier freq.
2.This plot is valid for low, mid & high channels (worst-case plot)

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM850, CH190
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



RADIATED SPURIOUS EMISSIONS (GSM-850)TX: 30MHz - 1GHz
Spurious emission limit –13dBm
Antenna: horizontal

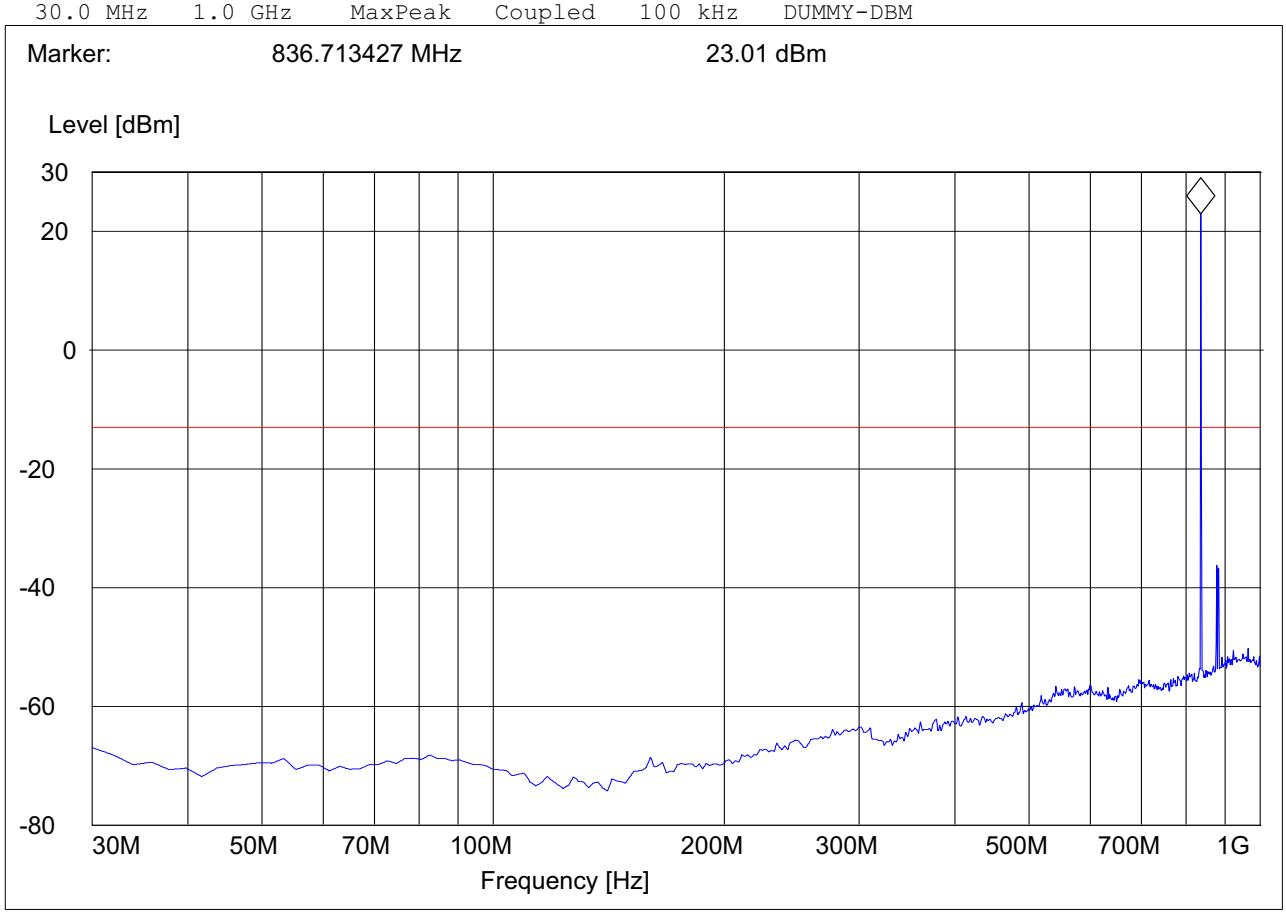
Note:

1.The peak above the limit line is the carrier freq.
2.This plot is valid for low, mid & high channels (worst-case plot)

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM850, CH190
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	DUMMY-DBM

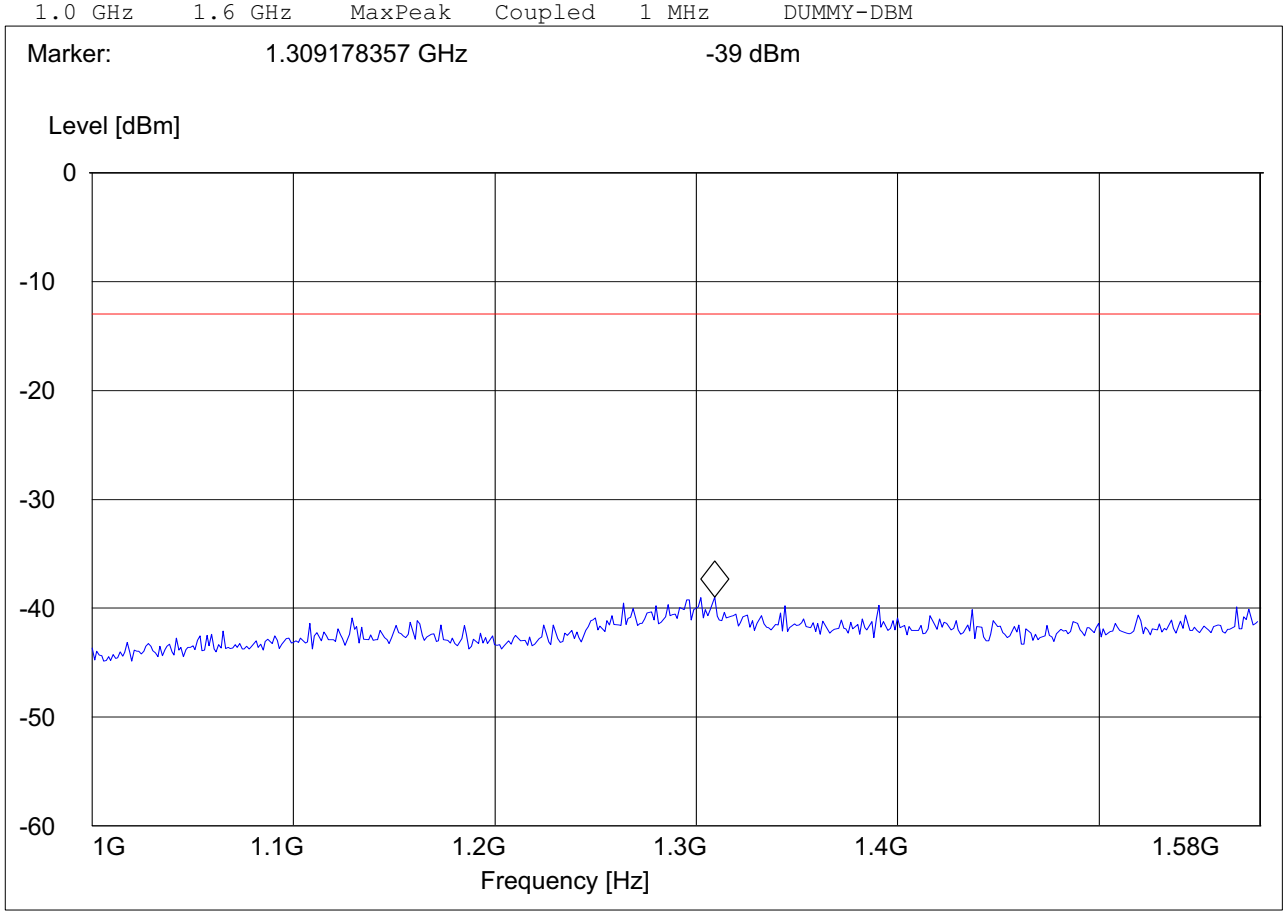


RADIATED SPURIOUS EMISSIONS (GSM-850) CHANNEL 128 Tx : 1GHz – 1.58GHz

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM850, CH128
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	1.6 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM

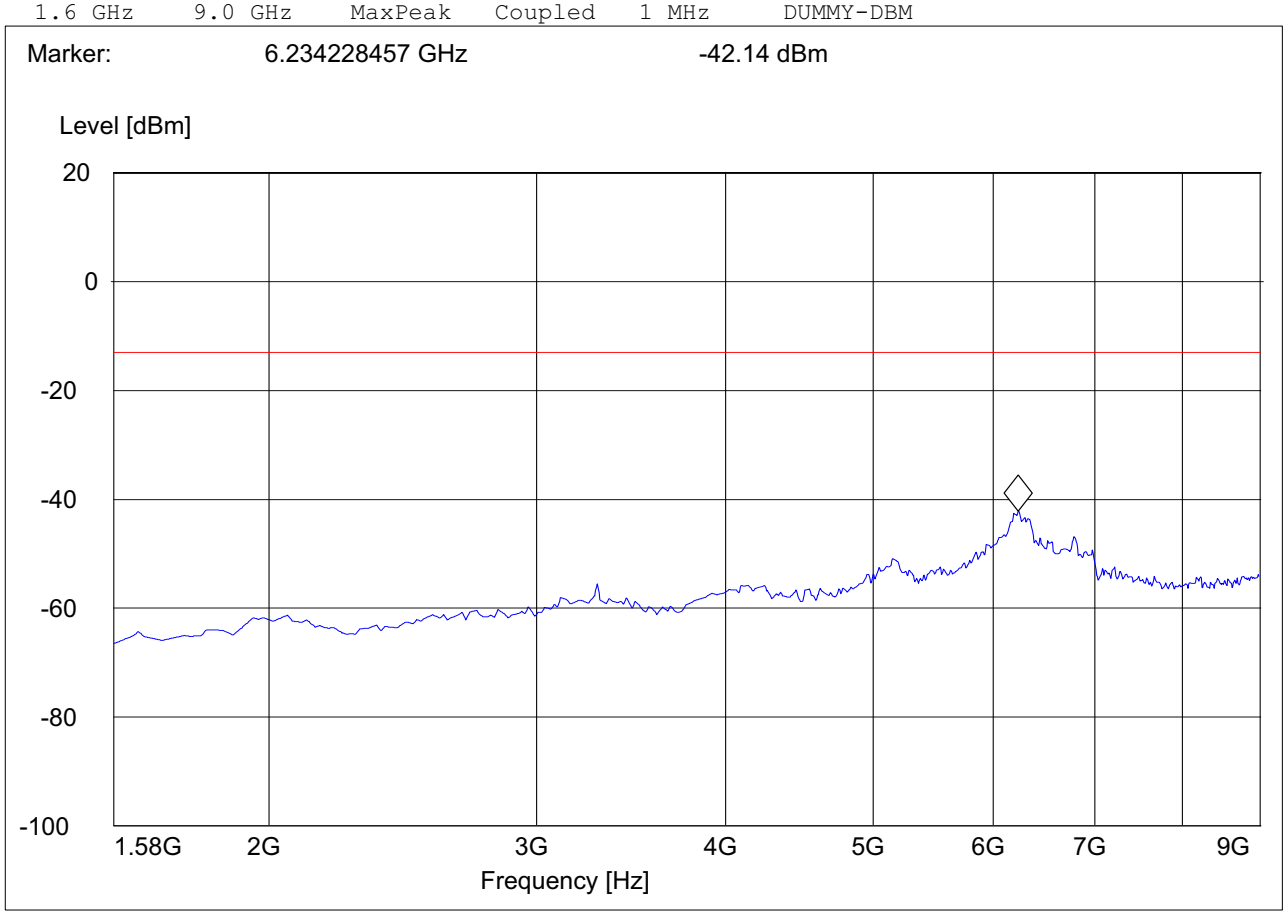


RADIATED SPURIOUS EMISSIONS (GSM-850) Tx CHANNEL 128: 1.58GHz – 9GHz

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM850, CH128
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "FCC 22Spuri 1.58-9G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.6 GHz	9.0 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



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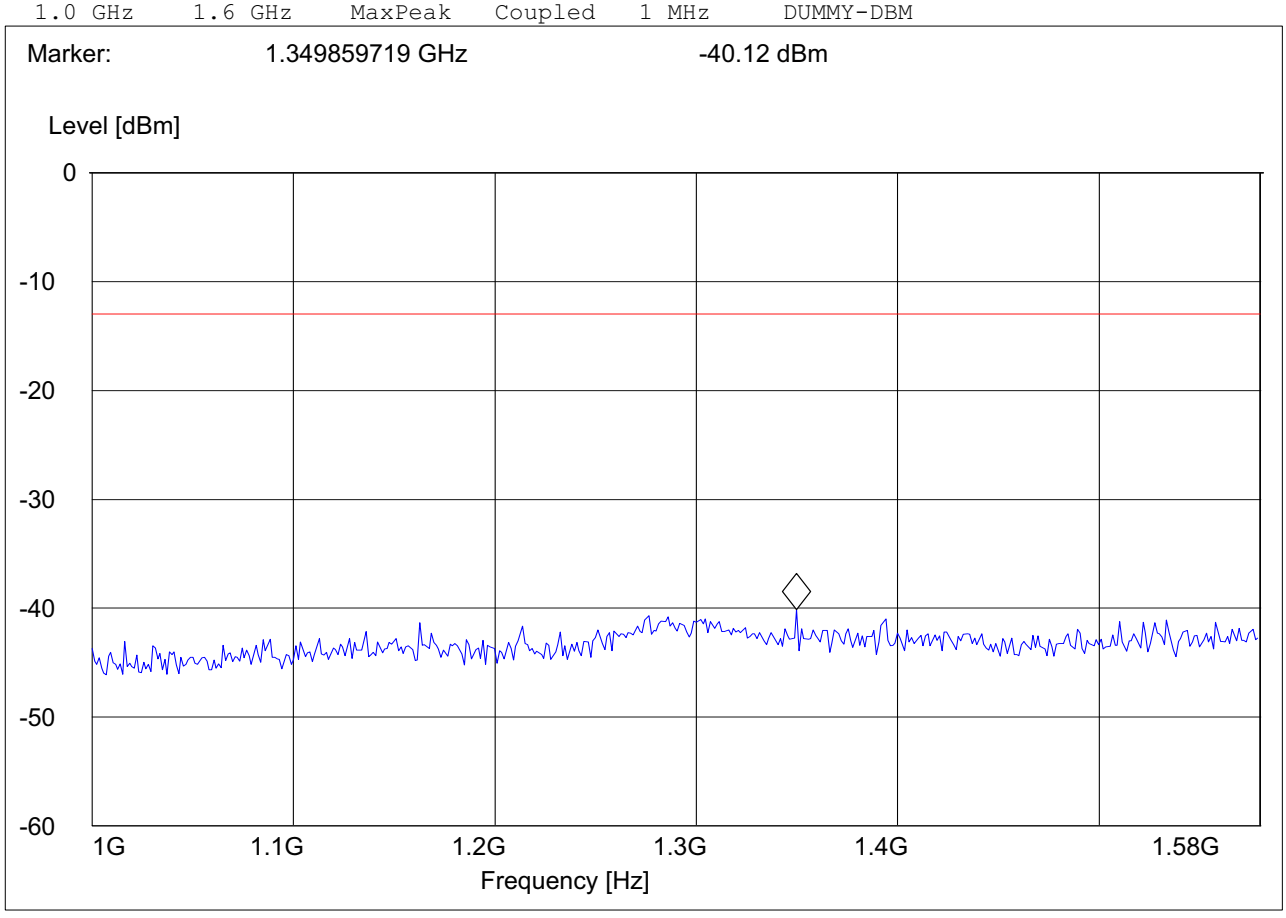
RADIATED SPURIOUS EMISSIONS (GSM-850) Tx CHANNEL 190: 1GHz – 1.58GHz

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM850, CH190
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	1.6 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



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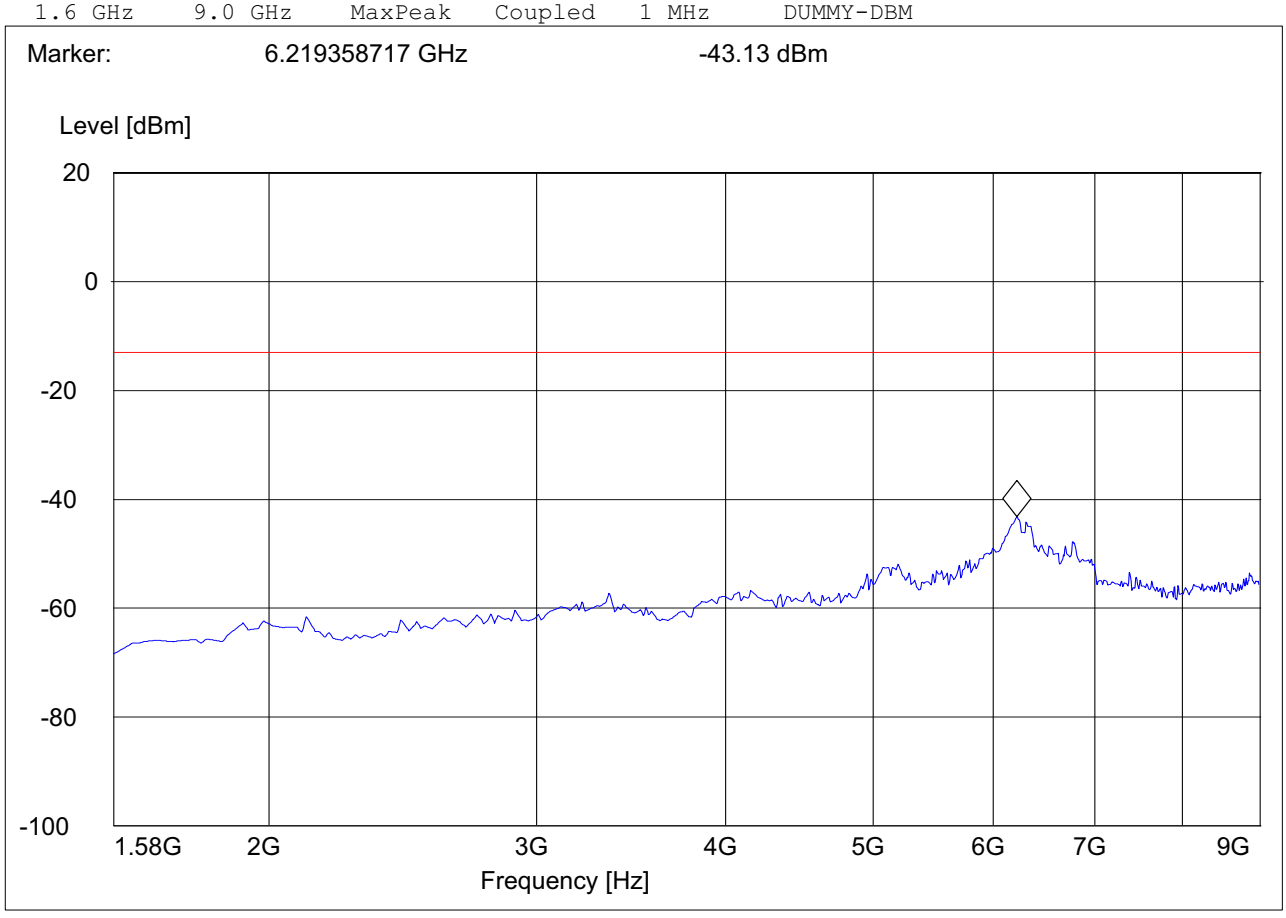
RADIATED SPURIOUS EMISSIONS (GSM-850) Tx CHANNEL 190: 1.58GHz – 9 GHz

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM850, CH190
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "FCC 22Spuri 1.58-9G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.6 GHz	9.0 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



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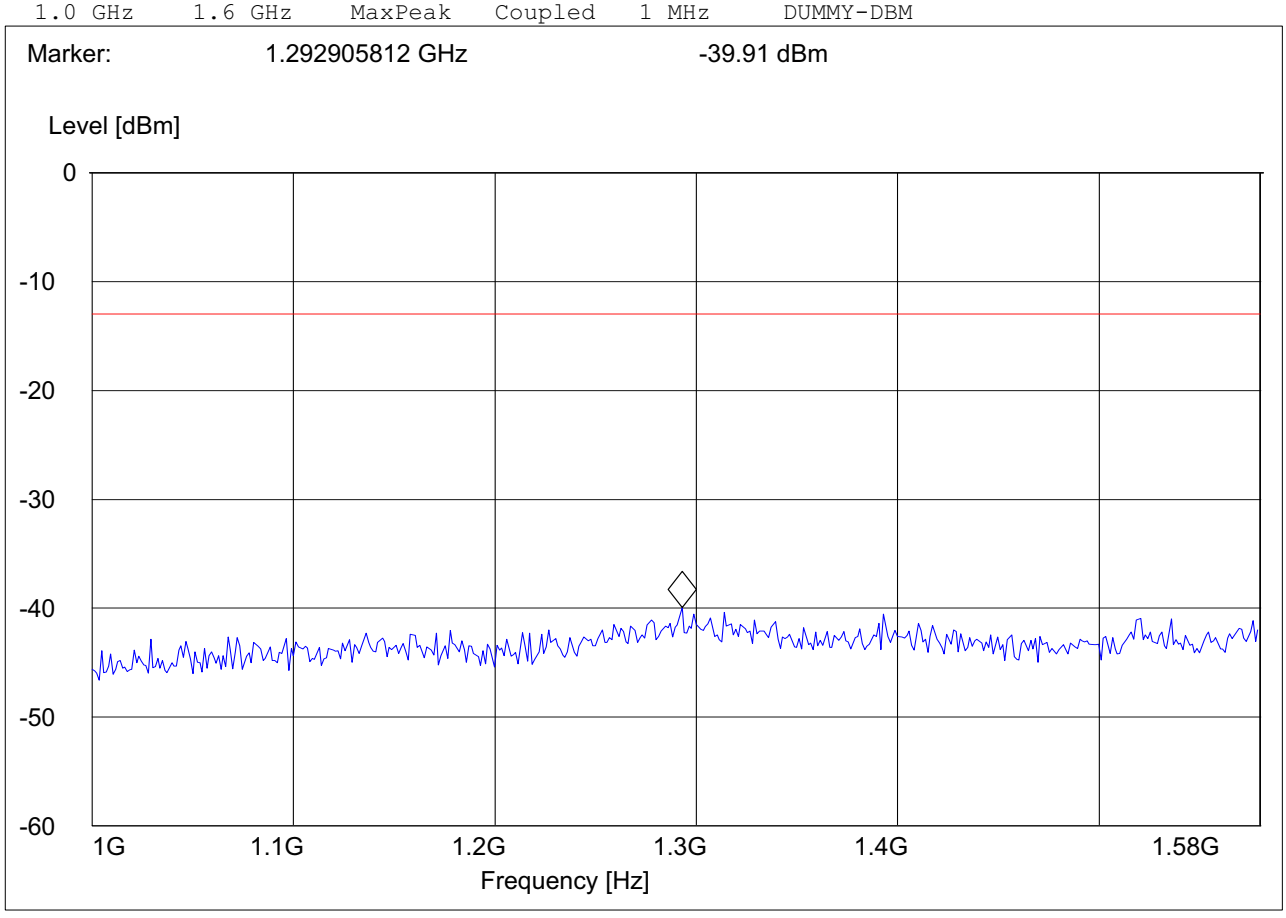
RADIATED SPURIOUS EMISSIONS (GSM-850) Tx CHANNEL 251: 1GHz – 1.58GHz

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM850, CH251
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	1.6 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM

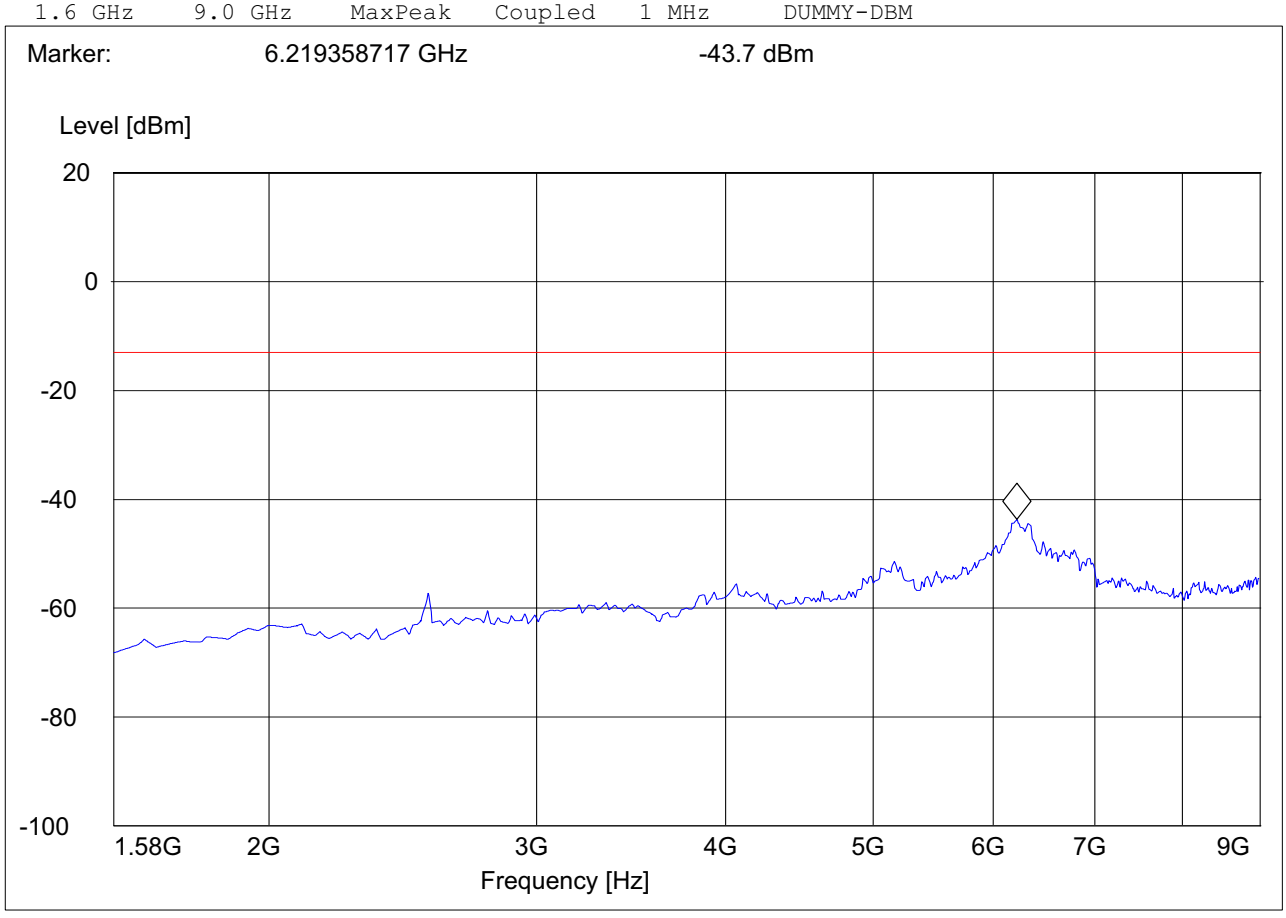


RADIATED SPURIOUS EMISSIONS (GSM-850) Tx CHANNEL 251: 1.58GHz – 9GHz

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM850, CH251
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "FCC 22Spuri 1.58-9G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.6 GHz	9.0 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



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5.5.4.2 Test Results Transmitter Spurious Emission 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						

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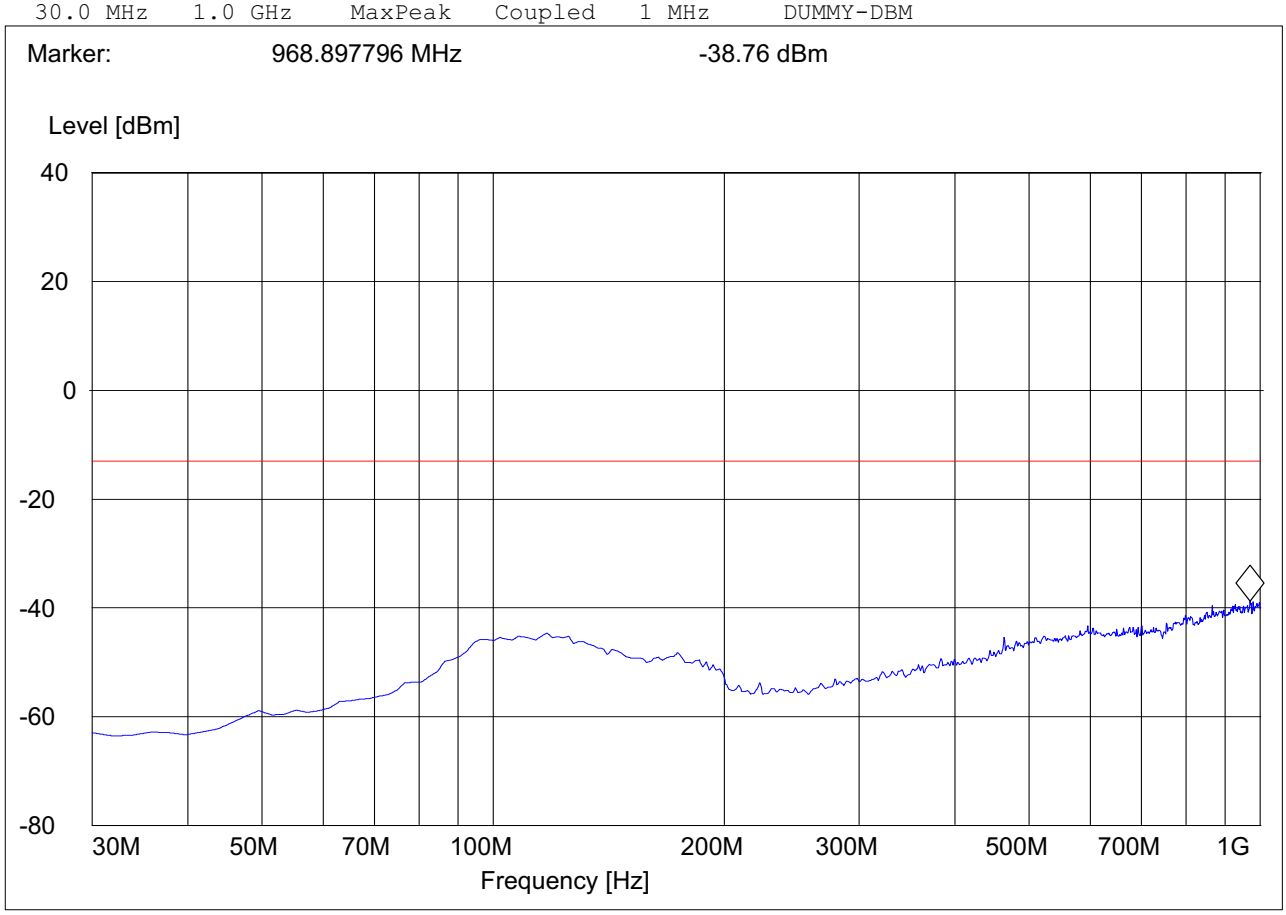
RADIATED SPURIOUS EMISSIONS(PCS 1900) TX: 30MHz - 1GHz
Antenna: Vertical
Note:

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

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM1900 CH661
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



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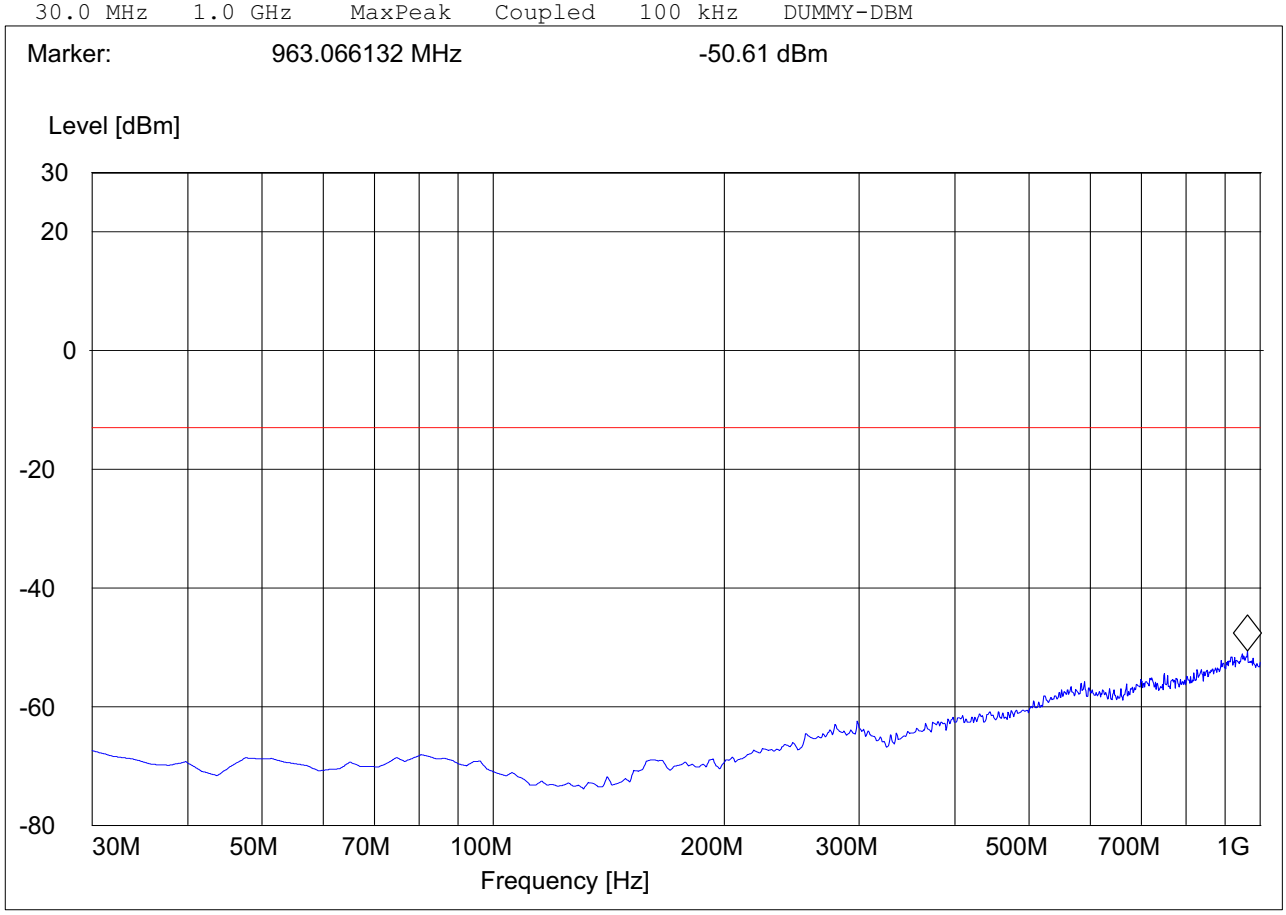
RADIATED SPURIOUS EMISSIONS(PCS 1900) TX: 30MHz - 1GHz
Antenna: Horizontal
Note:

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

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM1900 CH661
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	DUMMY-DBM

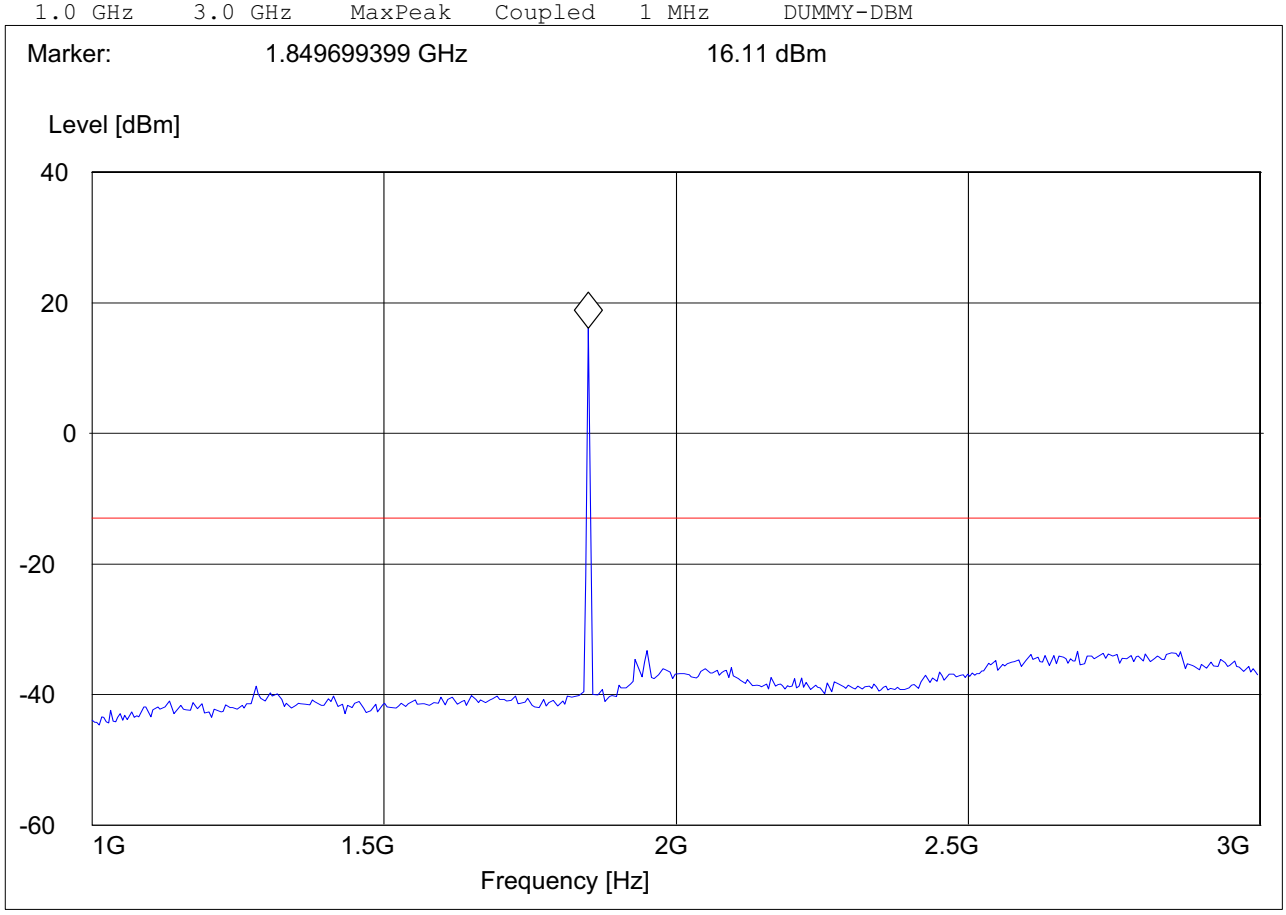


RADIATED SPURIOUS EMISSIONS(PCS 1900) Tx CHANNEL 512: 1GHz – 3GHz
Note:
1.The peak above the limit line is the carrier freq.

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM1900, CH512
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



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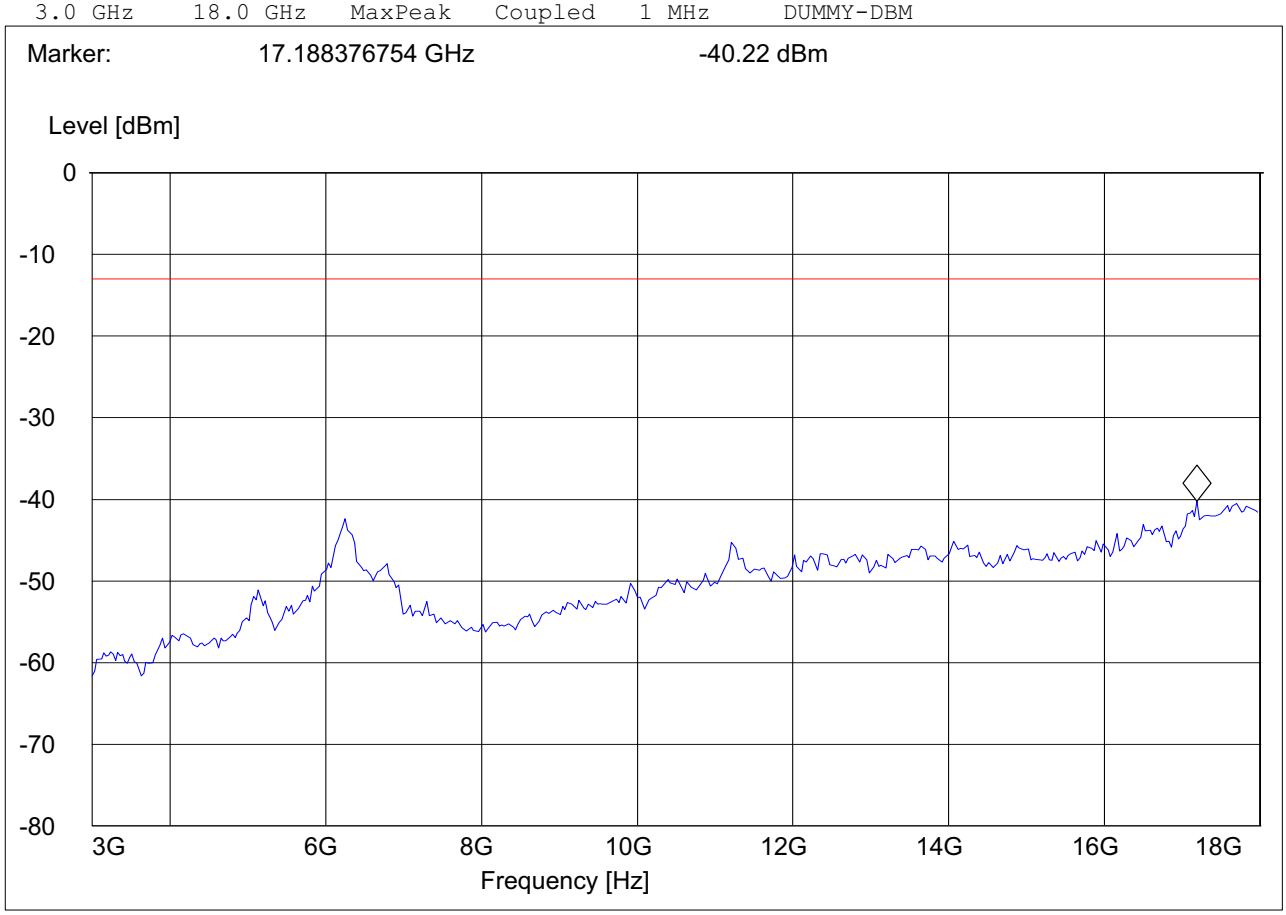
RADIATED SPURIOUS EMISSIONS(PCS 1900) Tx CHANNEL 512: 3GHz – 18GHz

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM1900, CH512
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
3.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



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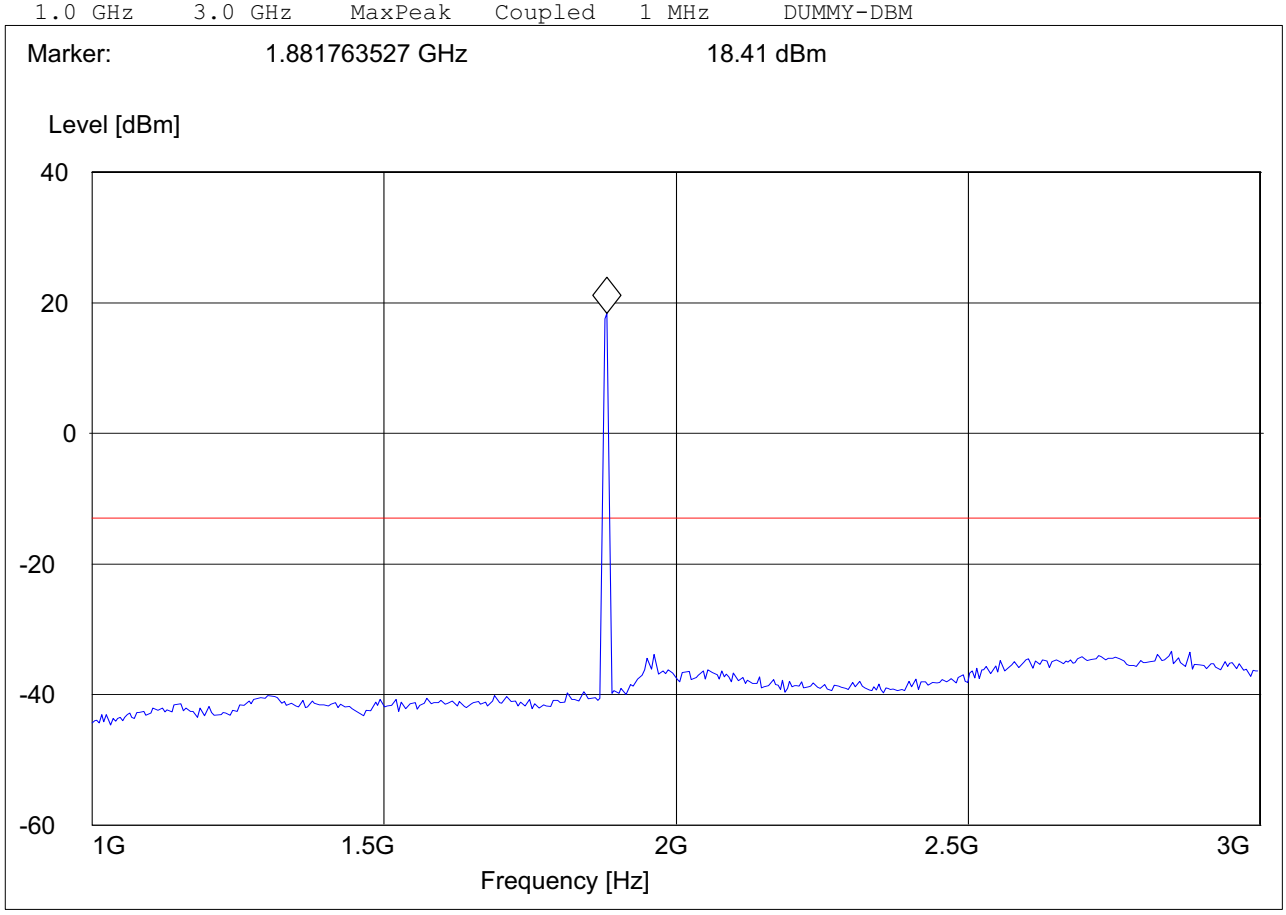
RADIATED SPURIOUS EMISSIONS(PCS 1900) Tx CHANNEL 661: 1GHz – 3GHz
Note:
1.The peak above the limit line is the carrier freq.

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM1900, CH661
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



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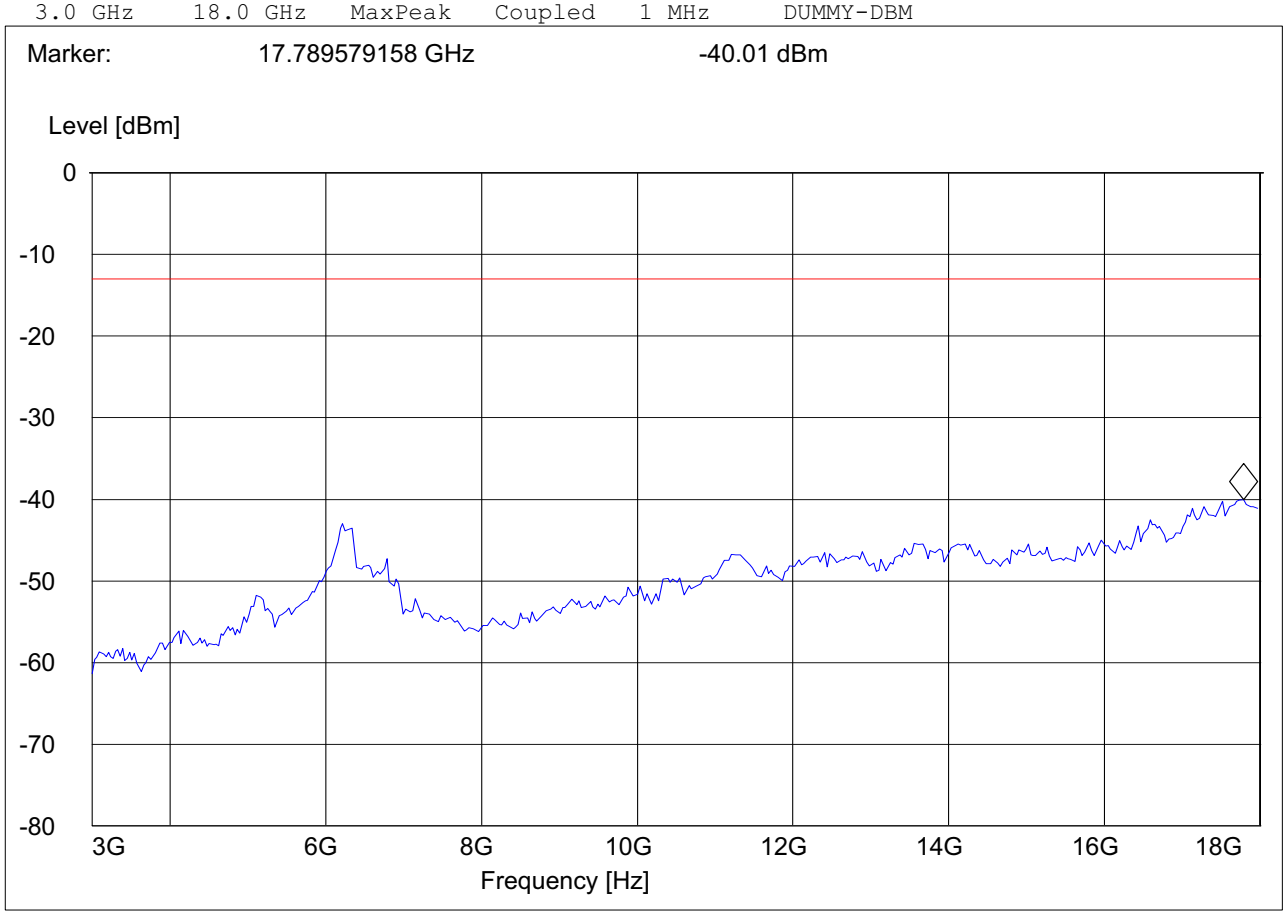
RADIATED SPURIOUS EMISSIONS(PCS 1900) Tx CHANNEL 661: 3GHz – 18GHz

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM1900, CH661
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
3.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



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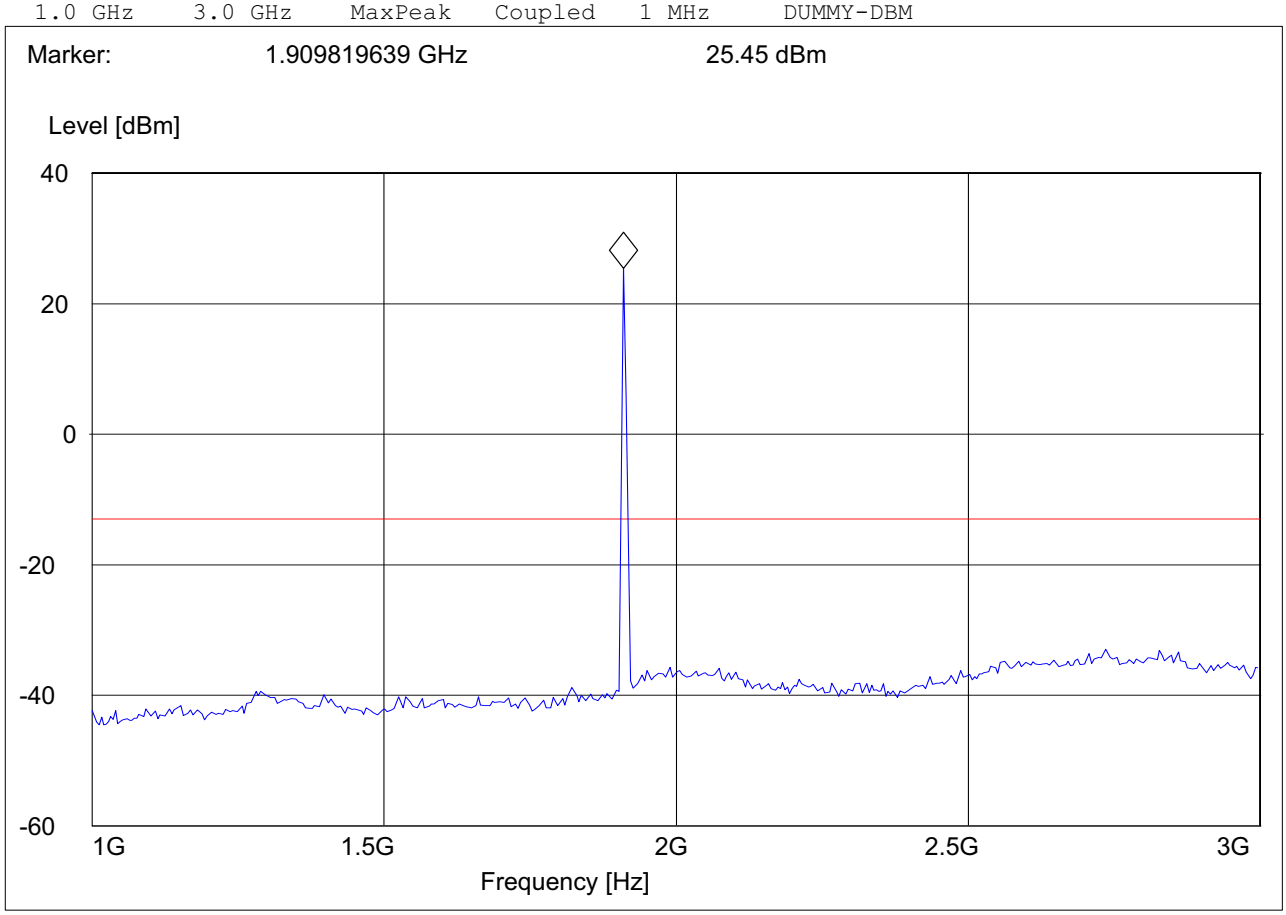
RADIATED SPURIOUS EMISSIONS(PCS 1900) Tx CHANNEL 810: 1GHz – 3GHz

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

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM1900, CH810
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



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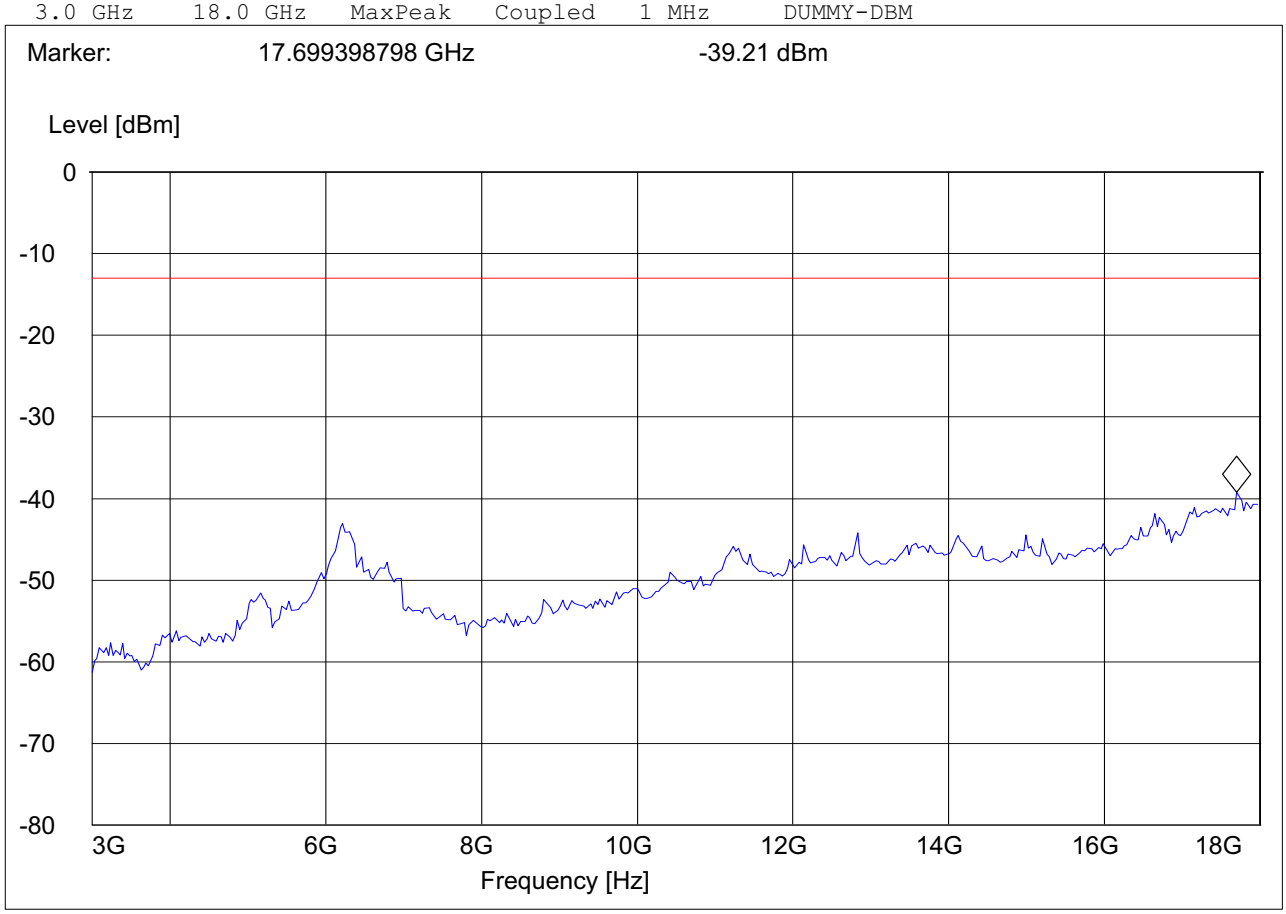
RADIATED SPURIOUS EMISSIONS(PCS 1900) Tx CHANNEL 810: 3GHz – 18GHz

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM1900, CH810
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
3.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	DUMMY-DBM



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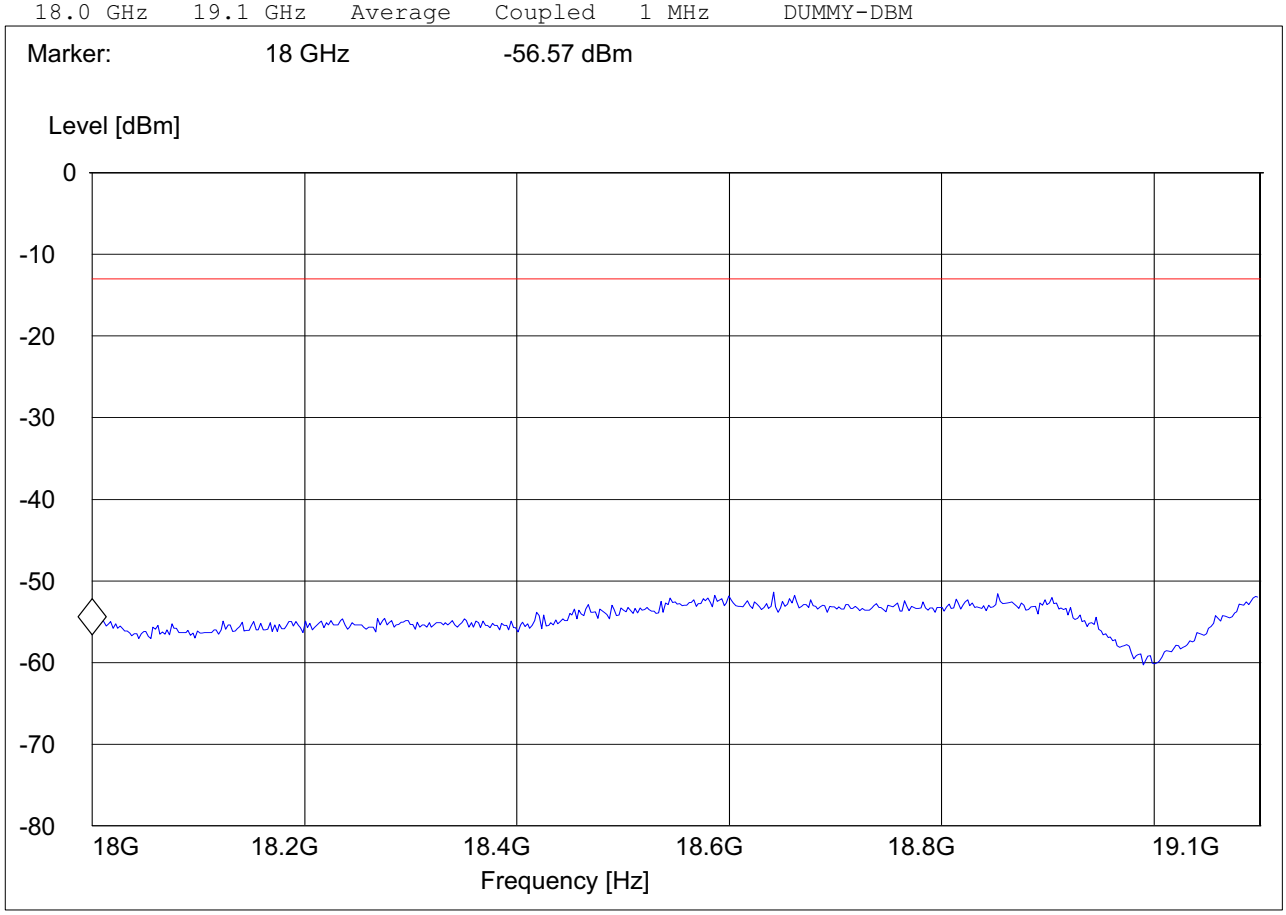
RADIATED SPURIOUS EMISSIONS(PCS 1900) 18GHz – 19.1GHz
Note:

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

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM1900, CH661
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
18.0 GHz	19.1 GHz	Average	Coupled	1 MHz	DUMMY-DBM



5.5.5 RECEIVER RADIATED EMISSIONS § 2.1053 / RSS-132 & 133

NOTE:

1. **The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3GHz and 26.5GHz very short cable connections to the antenna was used to minimize the noise level.**

Limits **SUBCLAUSE § RSS-133**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

No significant emissions measurable. Plots reported here represent the worse case emissions.

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5.5.5.1 Test Results Receiver Spurious Emission GSM850

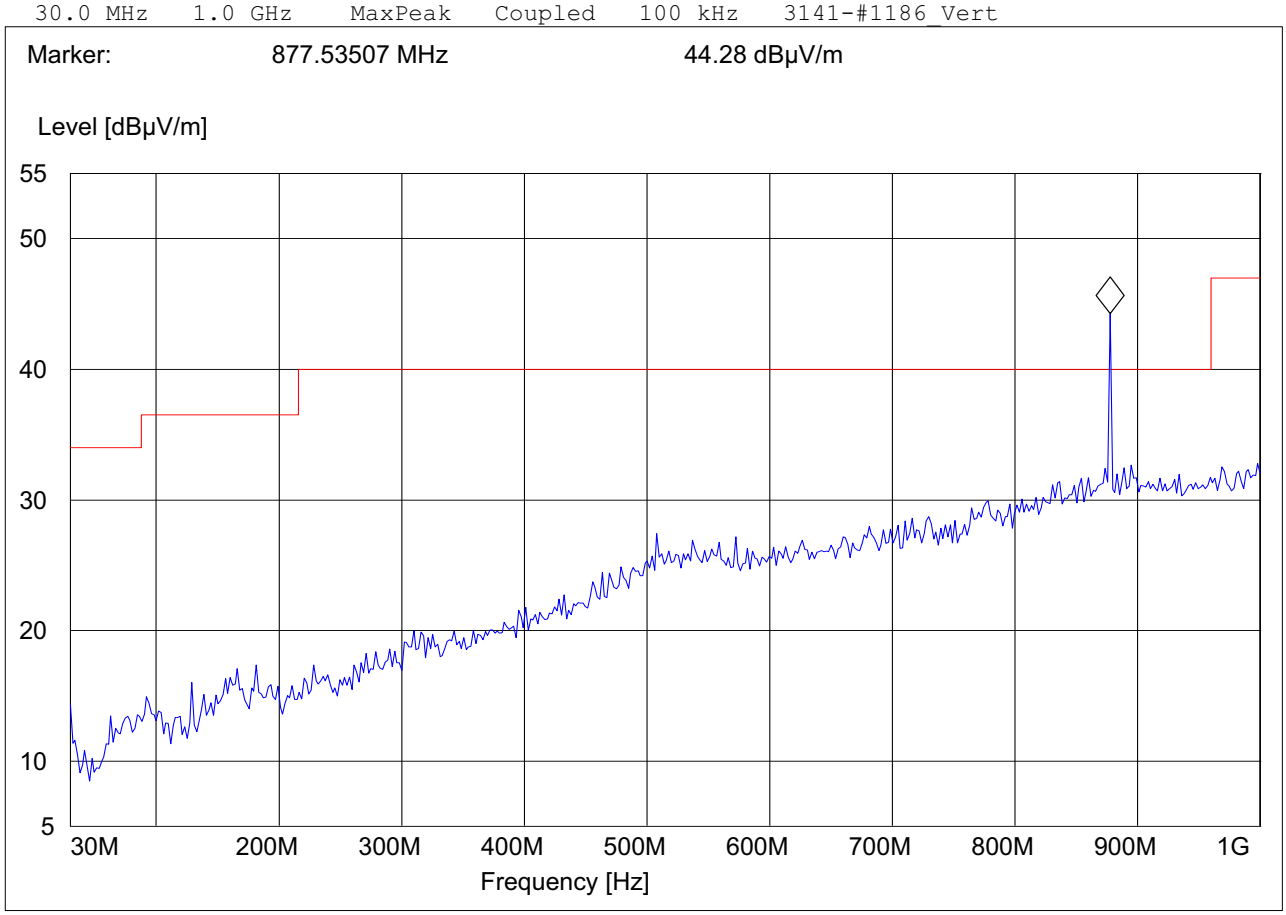
30M-1GHz, Antenna Vertical
This plot is valid for low, mid & high channels (worst-case plot)

Note: Emission over the limit at the marker is base station downlink.

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM850 RX
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "CANADA RE_30M-1G_Ver"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186_Vert



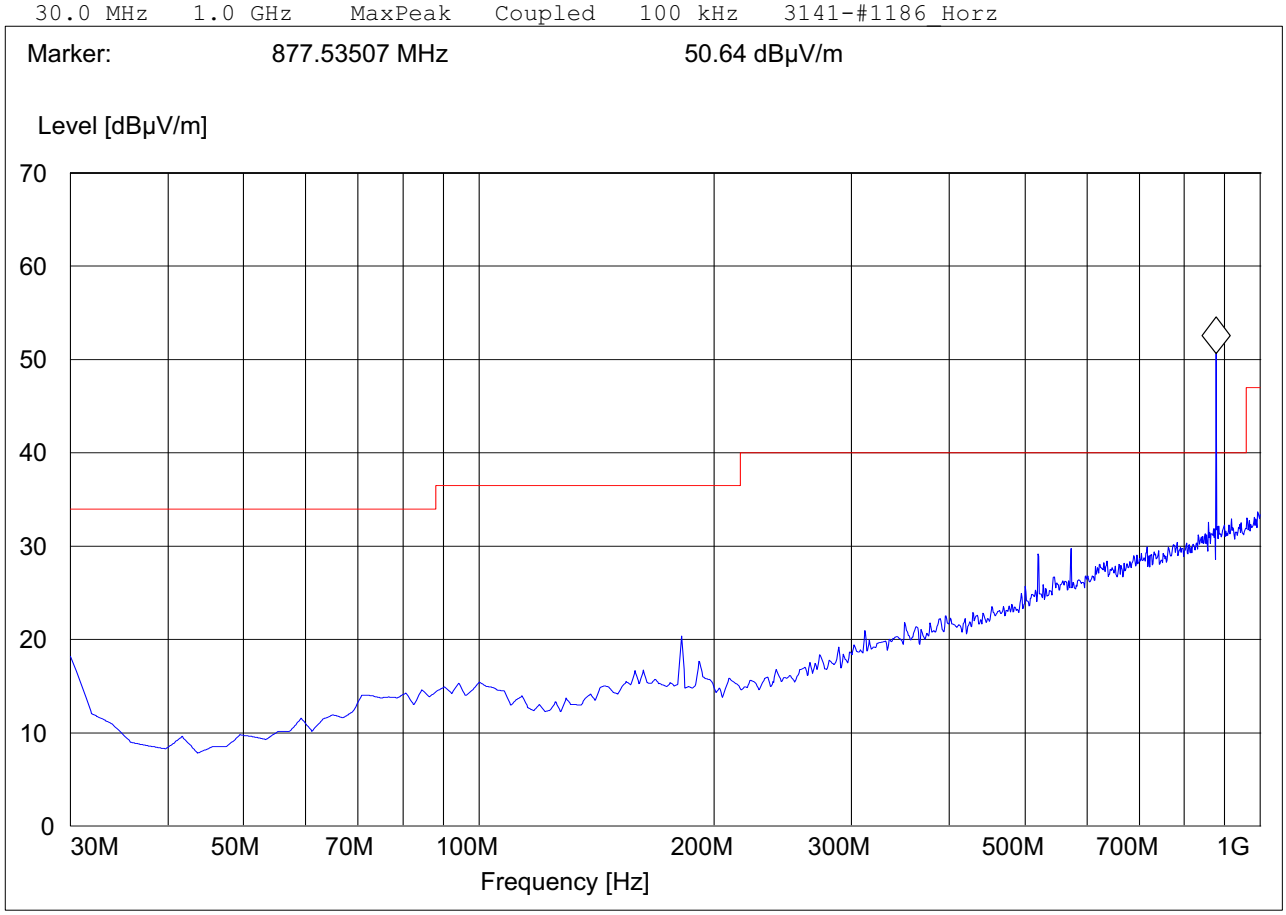
Receiver Spurious Emission GSM850 30M-1GHz, Antenna Horizontal
This plot is valid for low, mid & high channels (worst-case plot)

Note: Emission over the limit at the marker is base station downlink.

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM850 RX
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "CANDA RE_30M-1G_Hor"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186_Horz



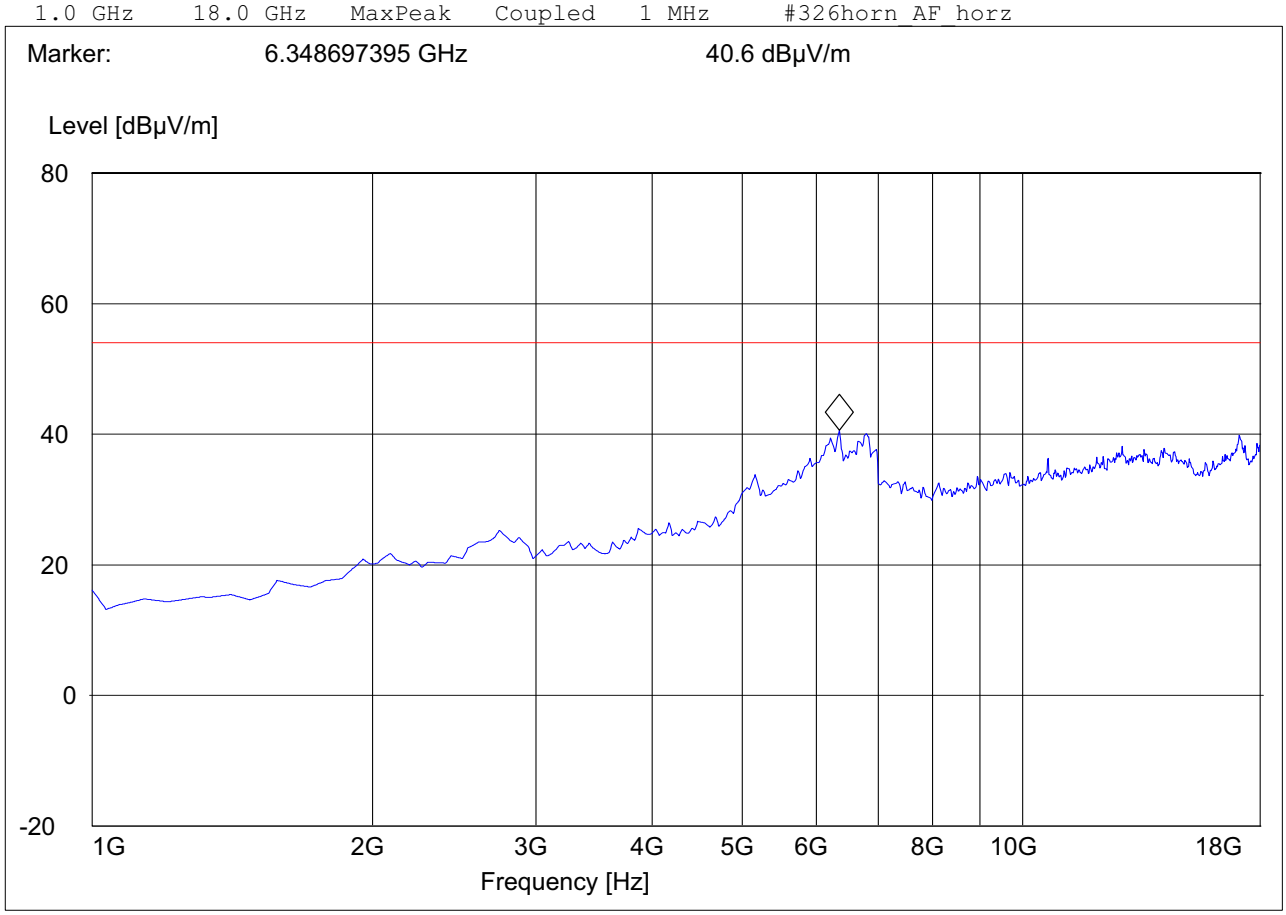
Receiver Spurious Emission GSM850 1-18GHz

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

```
EUT / Description: Sage
Customer:          NTT DoCoMo
Operation Mode:    GSM850 RX
ANT Orientation: : V
EUT Orientation::  H
Test Engineer:     Chris
Voltage:           12VDC
Comments::
```

SWEEP TABLE: "CANADA RE_1-18G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_horz



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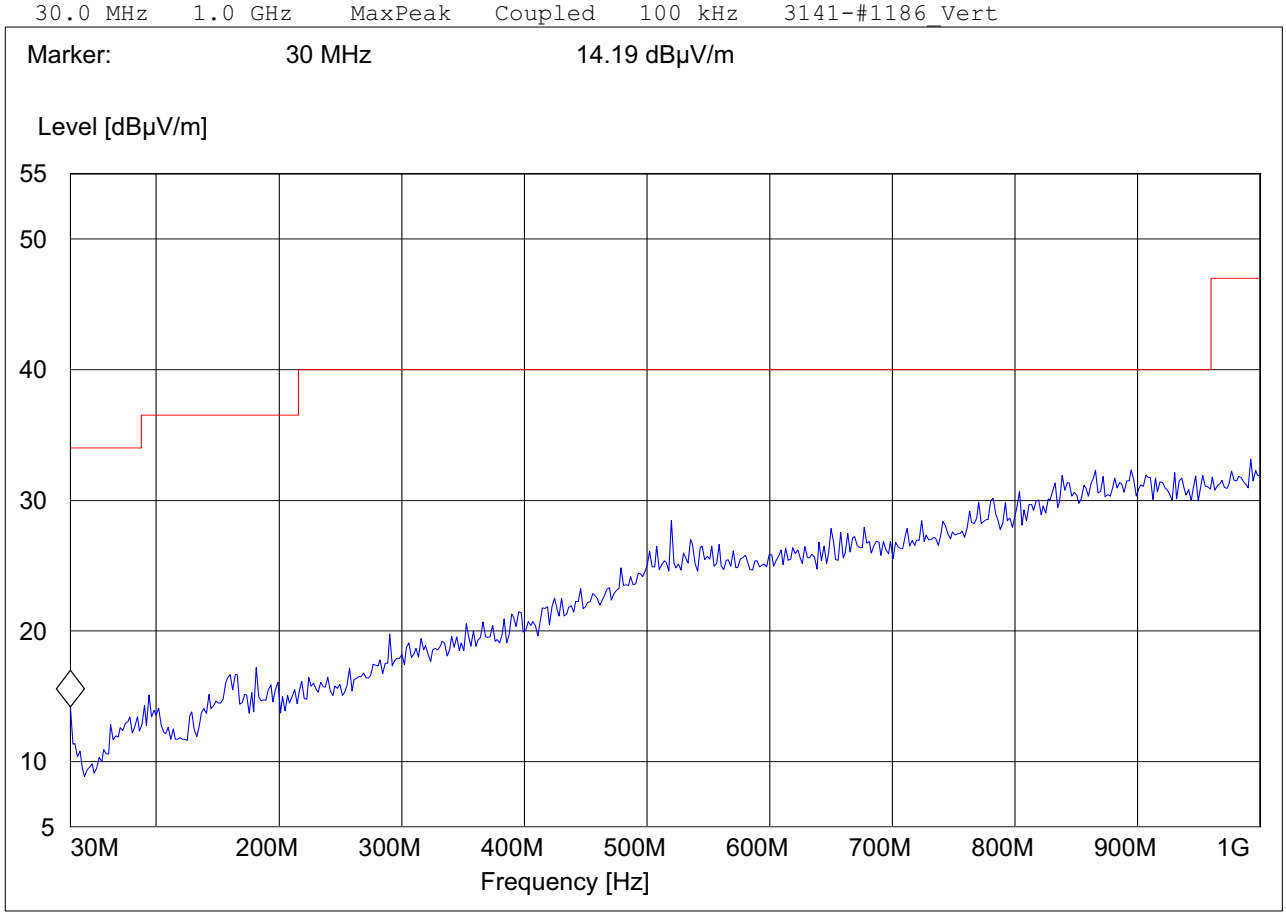
5.5.5.2 Test Results Receiver Spurious Emission GSM1900

30M-1GHz, Antenna Vertical
This plot is valid for low, mid & high channels (worst-case plot)

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM1900 RX
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "CANADA RE_30M-1G_Ver"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186_Vert

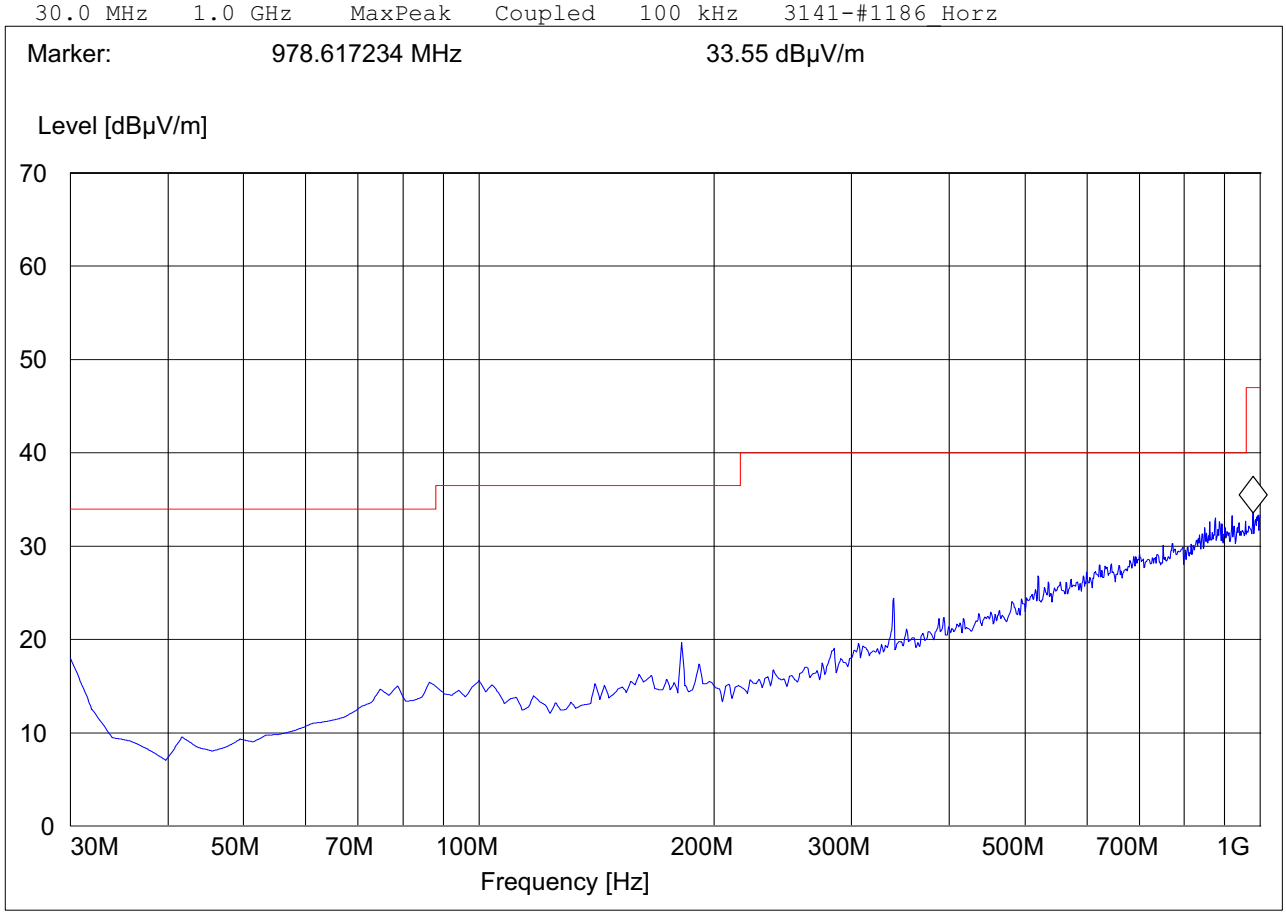


Receiver Spurious Emission GSM1900 30M-1GHz, Antenna Horizontal
This plot is valid for low, mid & high channels (worst-case plot)

```
EUT:              Sage
Customer::        NTT DoCoMo
Test Mode:        GSM1900 RX
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    Josie
Voltage:          12VDC
Comments:
```

SWEEP TABLE: "CANDA RE_30M-1G_Hor"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186_Horz



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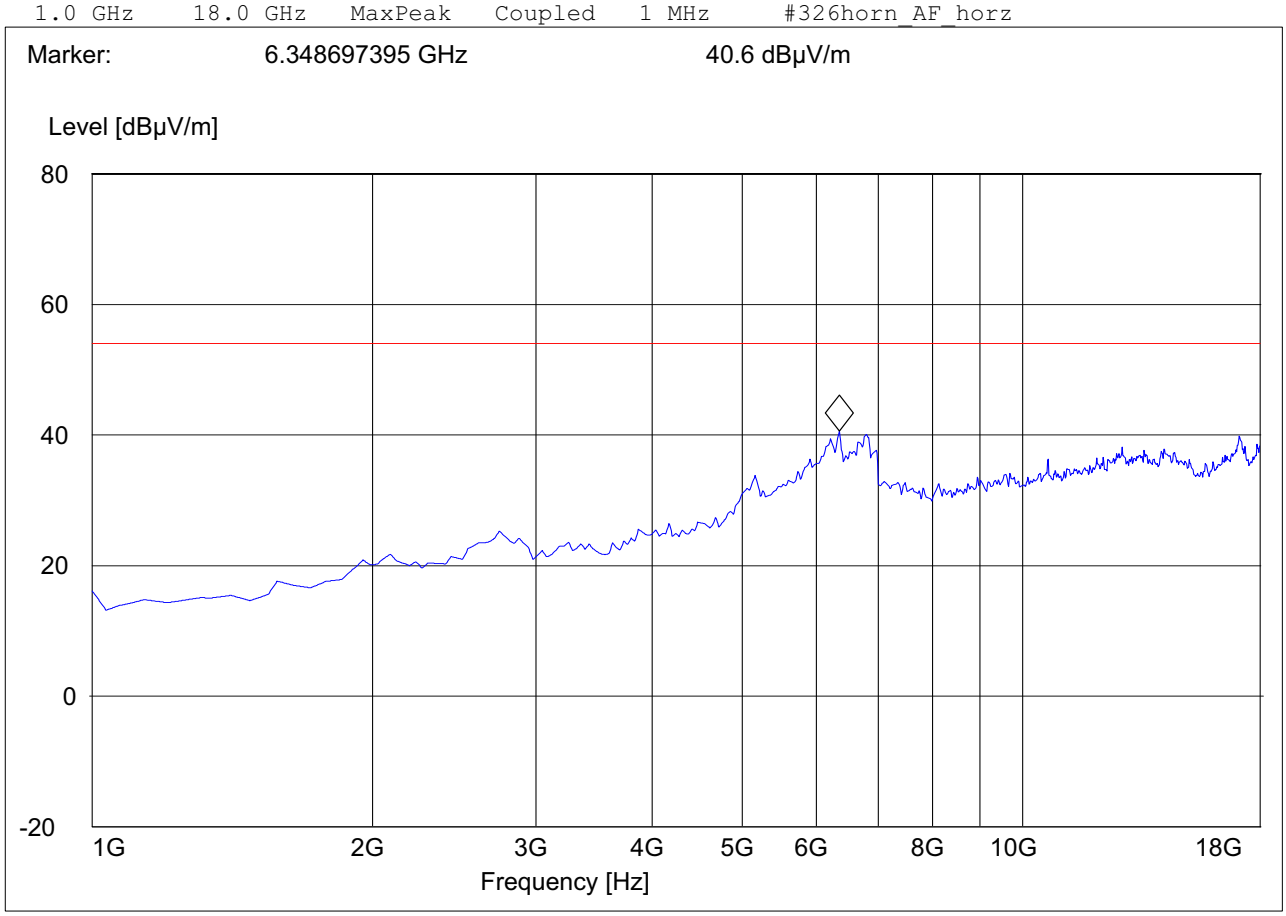
Receiver Spurious Emission GSM1900 1-18GHz

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

```
EUT / Description: Sage
Customer:          NTT DoCoMo
Operation Mode:    GSM1900 RX
ANT Orientation: : V
EUT Orientation::  H
Test Engineer:     Josie
Voltage:           12VDC
Comments::
```

SWEEP TABLE: "CANADA RE_1-18G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_horz



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5.6 AC POWER LINE CONDUCTED EMISSIONS § 15.107/207

5.6.1 Limits

Technical specification: 15.107 / 15.207 (Revised as of August 20, 2002)

§15.107 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Limit

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50
* Decreases with logarithm of the frequency		

ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz

5.6.2 Test Results:

Test not conducted. The EUT is a DC powered devices intended for vehicular operations only.

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6 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 2008	1 year
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	August 2008	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2008	1 year
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02	May 2008	1 year
05	Biconilog Antenna	3141	EMCO	0005-1186	June 2008	1 year
06	Horn Antenna (1-18GHz)	SAS-200/571	AH Systems	325	June 2008	1 year
07	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240	June 2008	1 year
08	Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
09	Climatic Chamber	VT4004	Voltsch	G1115	May 2008	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 2008	1 year
13	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807	May 2008	1 year
14	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008	May 2008	1 year
15	Universal Radio Comm. Tester	CMU 200	Rohde & Schwarz	832221/06	May 2008	1 year
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2008	1 year
17	Loop Antenna	6512	EMCO	00049838	July 2008	2 years

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7 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.

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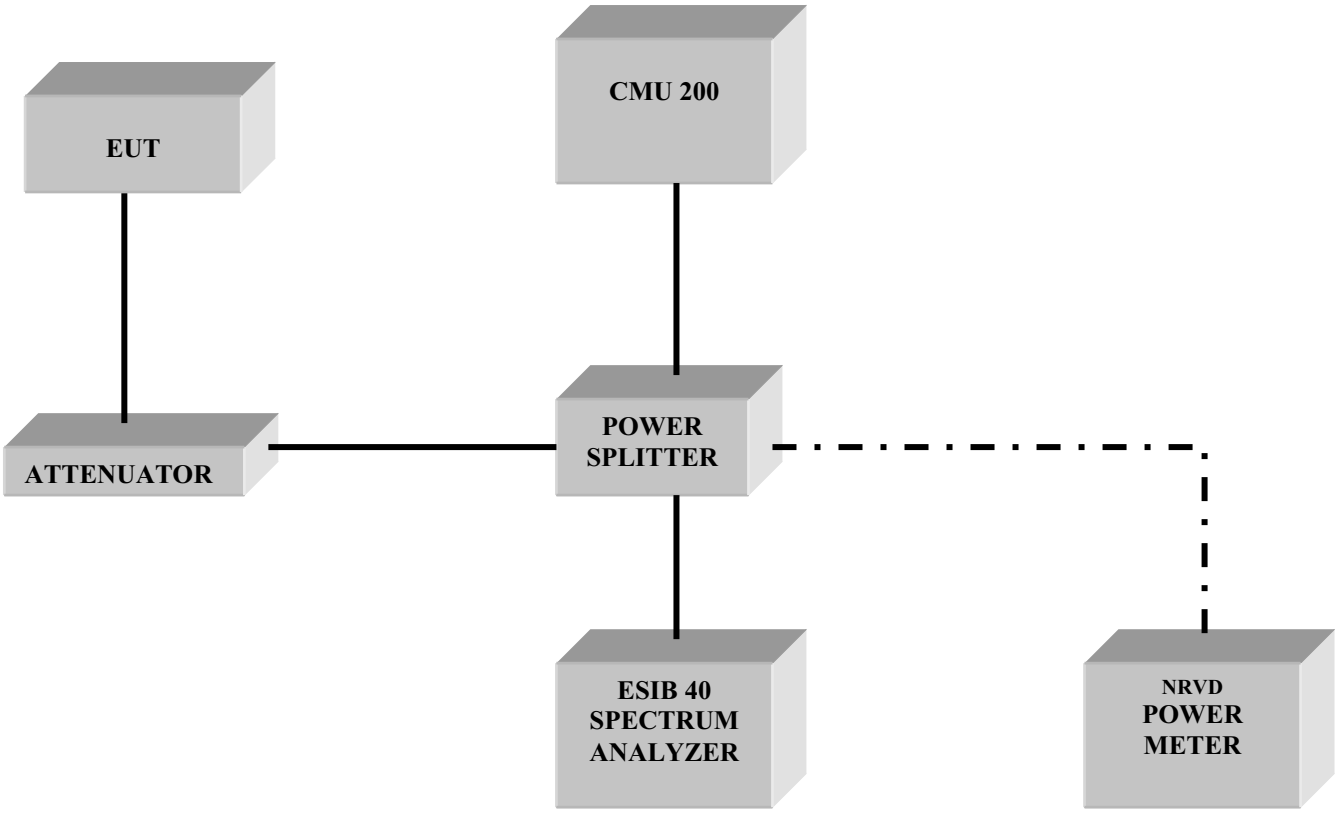
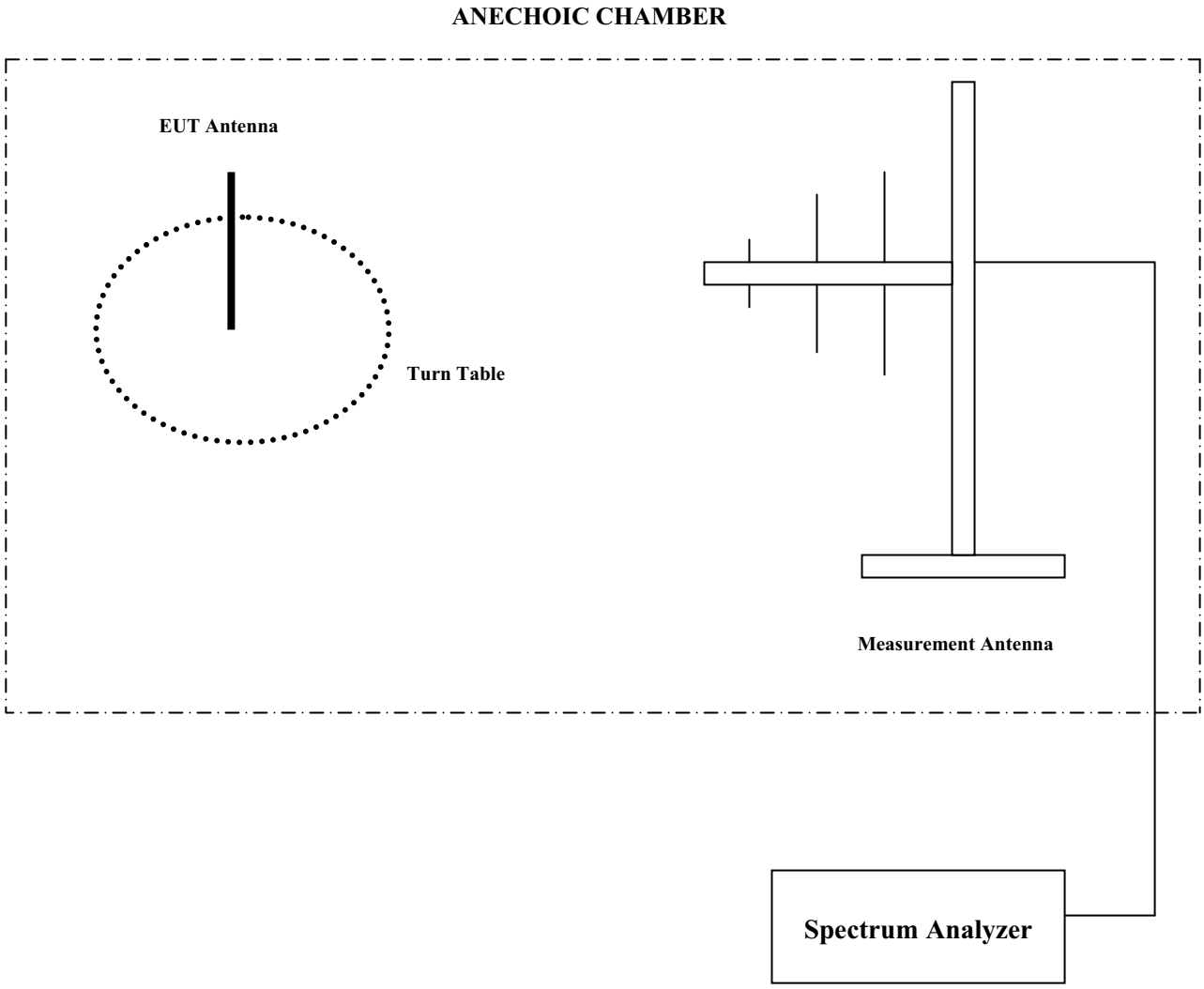
8 BLOCK DIAGRAMS

Conducted Testing



Radiated Testing



9 Revision History

2008-9-25: First Issue.

2008-9-30: Rev1, corrected FCC ID typo, added 8PSK power measurements. Replaces original titled *EMC_CET10_042_08501_FCC22_24* and dated 2008-9-25.

2008-10-21: Rev2, added conducted measurements and updated EIRP values. Replaces original titled *EMC_CET10_042_08501_FCC22_24_rev1* and dated 2008-9-30.

2008-10-23: Rev3, added frequency stability test result extracted from the original module conducted report. Replaces original titled *EMC_CET10_042_08501_FCC22_24_rev2* and dated 2008-10-21.

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