



FCC/IC Test Report

FOR:

**Model Name: A1337
iPad
FCC ID: BCG-E2328A
IC ID: 579C-E2328A
47 CFR Part 2, 22, 24
RSS-132 Issue 2
RSS-133 Issue 5**

**TEST REPORT #: EMC_APPLE_055_FCC22_24_Rev1
DATE: 2010-03-01**



**FCC listed:
A2LA accredited**

**IC recognized #
3462B-1**

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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 and Industry Canada Standards RSS 132 and RSS 133.

Company	Description	Model #
Apple Inc.	iPad	A1337

Responsible for Testing Laboratory:

2010-03-01	Compliance	Heiko Strehlow (Director)	
Date	Section	Name	Signature

Responsible for the Report:

2010-03-01	Compliance	Marc Douat (Test Lab Manager)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3. 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:	Compliance
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:	Heiko Strehlow
Responsible Project Leader:	Marc Douat

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:	Bob Steinfeld
Phone No.	408-974-2618
Fax:	408-862-5061
e-mail:	steinfe@apple.com

2.3 Identification of the Manufacturer

Same as above applicant.

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	iPad
Model No:	A1337
Product Type:	Tablet
Hardware Revision :	A
Software Revision :	06.12.50 (7B293)
FCC-ID:	BCG-E2328A
IC-ID :	579C-E2328A
Frequency:	GPRS 850: 824.2-848.8MHz; PCS 1900: 1850.2-1909.8MHz FDD V: 826.4-846.6MHz; FDD II: 1852.4-1907.6MHz
Type(s) of Modulation:	GMSK; 8-PSK; Dual BPSK
Number of channels:	GPRS850: 125 and PCS 1900: 300 FDD II: 278/ FDD V: 103
Antenna Type:	PIFA
Power Supply:	4.2 VDC battery, 110VAC Adapter
Temperature Range:	0°C to 35°C

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version
1	YM003001EMB	A	06.12.50 (7B293)
2	YM003004EMB	A	06.12.50 (7B293)

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model
1	10W USB Power Adapter	Foxlink Technology, Ltd.	A1357 W010A051

4 Subject of Investigation

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in the following test standards:

- 47 CFR Part 2: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission Frequency allocations and radio treaty matters; general rules and regulations.
- 47 CFR Part 22: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 22- Public mobile services
- 47 CFR Part 24: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 24- Personal communication services
- RSS 132- Issue 2: Spectrum management and telecommunication policy- Radio Standards Specifications Cellular telephones employing new technologies operating in the bands 824-849MHz and 869-894MHz
- RSS 133- Issue 5: Spectrum management and telecommunication policy- Radio Standards Specifications- 2GHz personal communication services

5 Measurements

5.1 RF Power Output

5.1.1 References

FCC: CFR Part 2.1046, CFR Part 22.913, CFR Part 24.232

IC: RSS 132 Section 4.4 and 6.4; RSS 133 Section 4.3

5.1.2 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.

5.1.3 Limits:

5.1.3.1 **FCC 22.913 (a) Effective radiated power limits.**

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

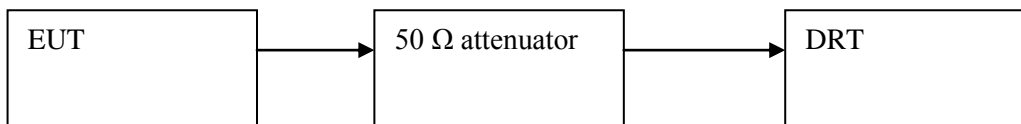
5.1.3.2 **FCC 24.232 (b)(c) Power limits.**

(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.

5.1.4 Conducted Output Power Measurement procedure

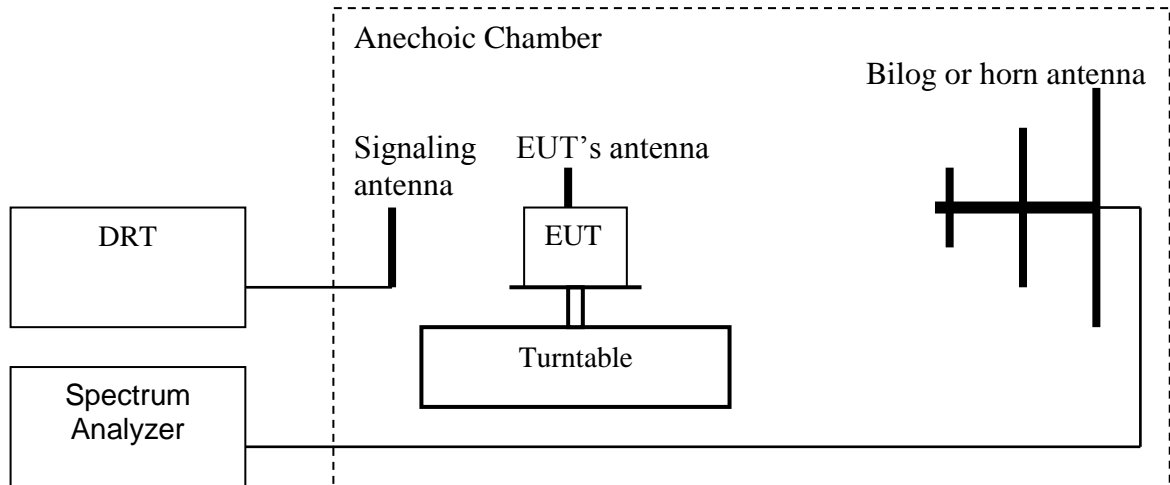
Ref: TIA-603C 2004 2.2.1 Conducted Carrier Output Power Rating



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.

5.1.5 Radiated Output Power Measurement procedure

Ref: 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.)

5.1.6 RF Power Output 850MHz band

Limit: Nominal Peak Output Power < 38.45 dBm (7W)

Measurement Uncertainty Conducted: ±0.5 dB

Measurement Uncertainty Radiated: ±3.0 dB

Conducted Peak Output Power (dBm)			
Frequency (MHz)	GPRS	EGPRS	UMTS
824.2	32.9	30	26.4
836.6	33	30.1	26.4
848.8	32.8	30	26.3

ERP Peak Output Power (dBm)			
Frequency (MHz)	GPRS	EGPRS	UMTS
824.2	28.9	26.2	23.8
836.6	29.8	27.3	24.0
848.8	29.6	27.8	23.2

5.1.7 RF Power Output 1900MHz band

Limit: Nominal Peak Output Power < 33 dBm (2W)

Measurement Uncertainty Conducted: ± 0.5 dB

Measurement Uncertainty Radiated: ± 3.0 dB

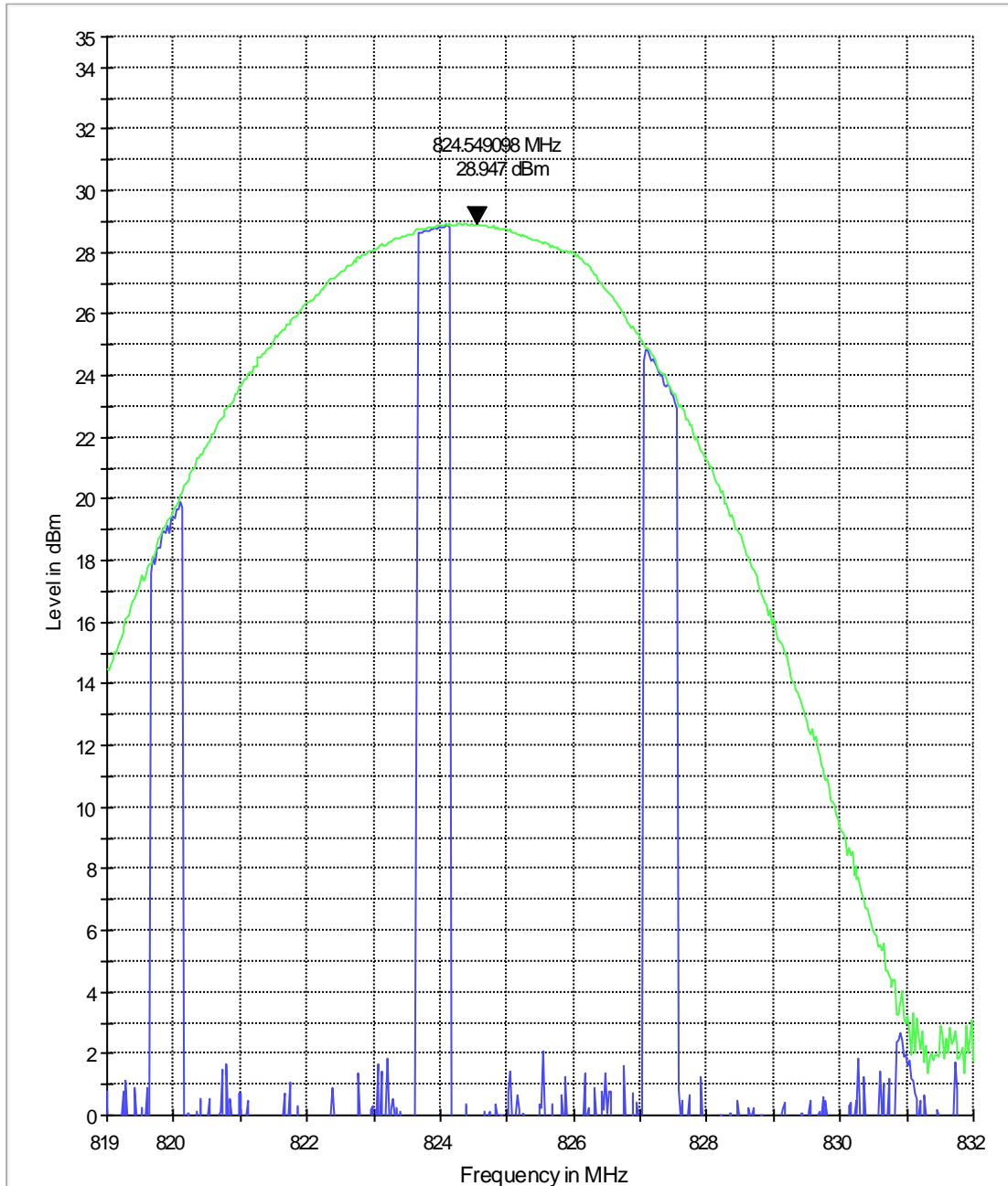
Conducted Peak Output Power (dBm)			
Frequency (MHz)	GPRS	EGPRS	UMTS
1850.2	30.5	29.1	24.9
1880	30.6	29	24.4
1909.2	30.4	29.2	24.1

EIRP Peak Output Power (dBm)			
Frequency (MHz)	GPRS	EGPRS	UMTS
1850.2	31.0	29.1	26.8
1880	31.3	28.9	27.5
1909.2	32.7	30.0	27.3

5.1.8 Results

ERP (GPRS 850) CHANNEL 128 §22.913(a)

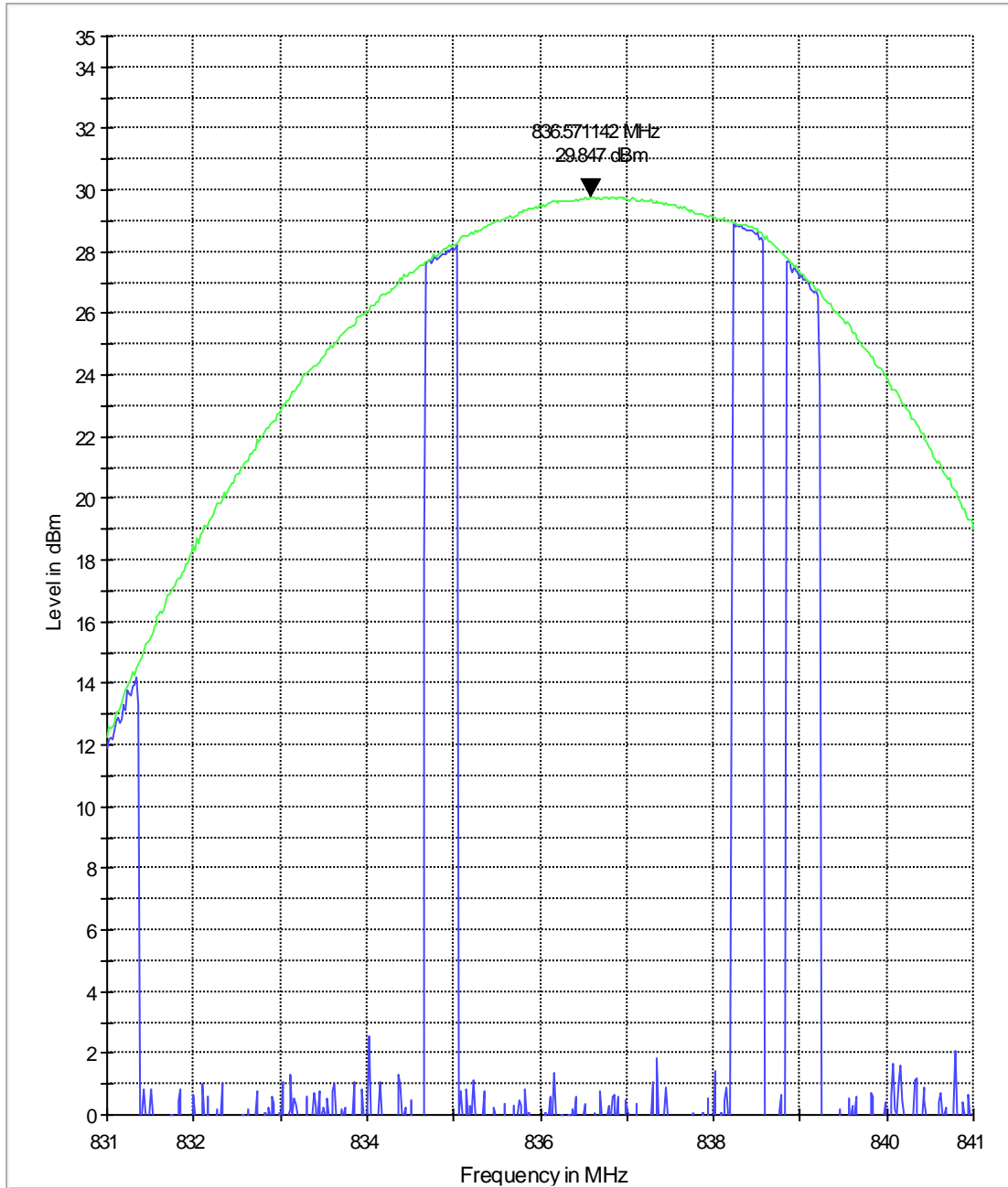
ERP850 L



— MaxPeak-ClearWrite — MaxPeak-MaxHdd

ERP (GPRS 850) CHANNEL 190 §22.913(a)

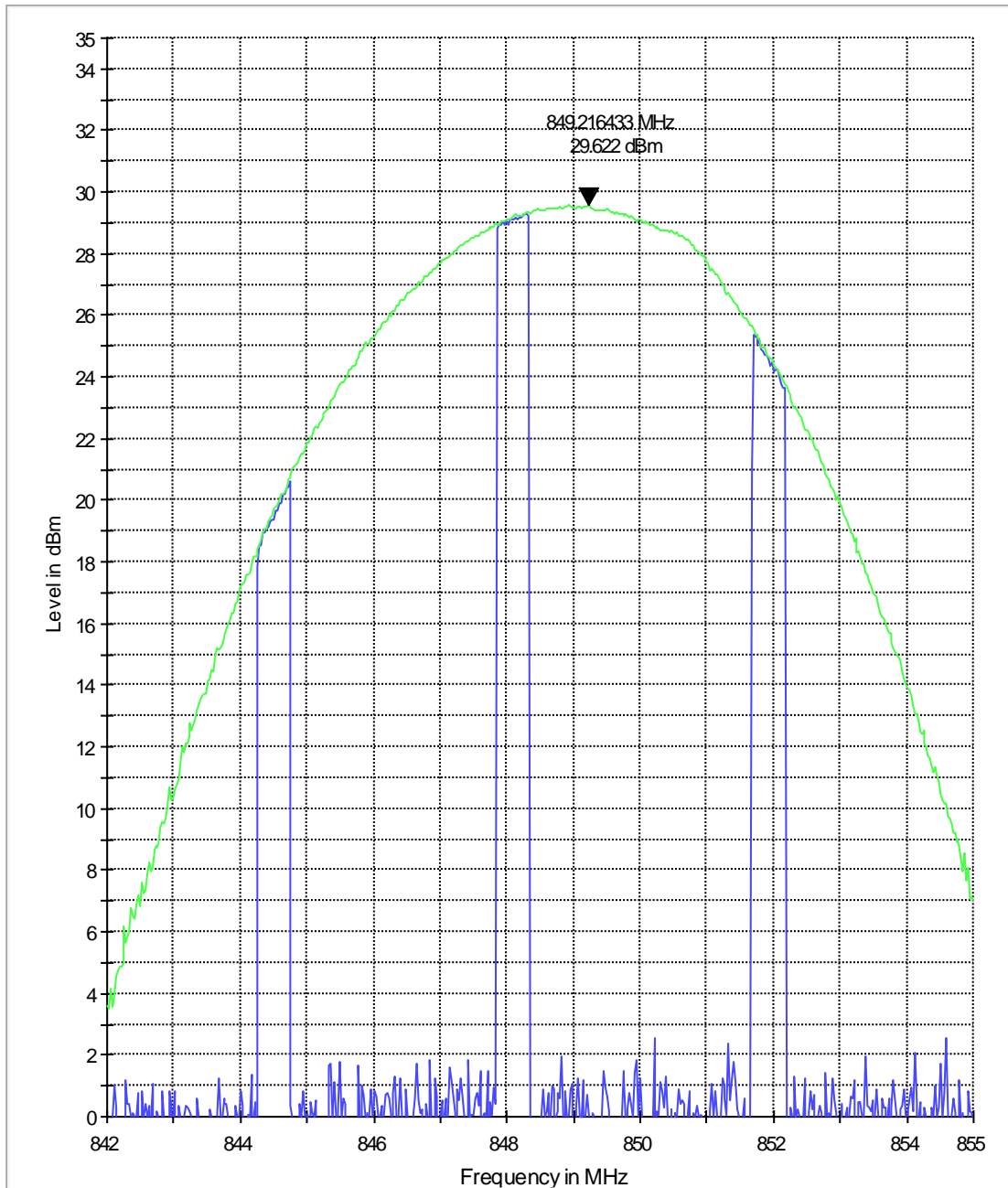
ERP850 M



— MaxPeak-ClearWrite — MaxPeak-MaxHdd

ERP (GPRS 850) CHANNEL 251 §22.913(a)

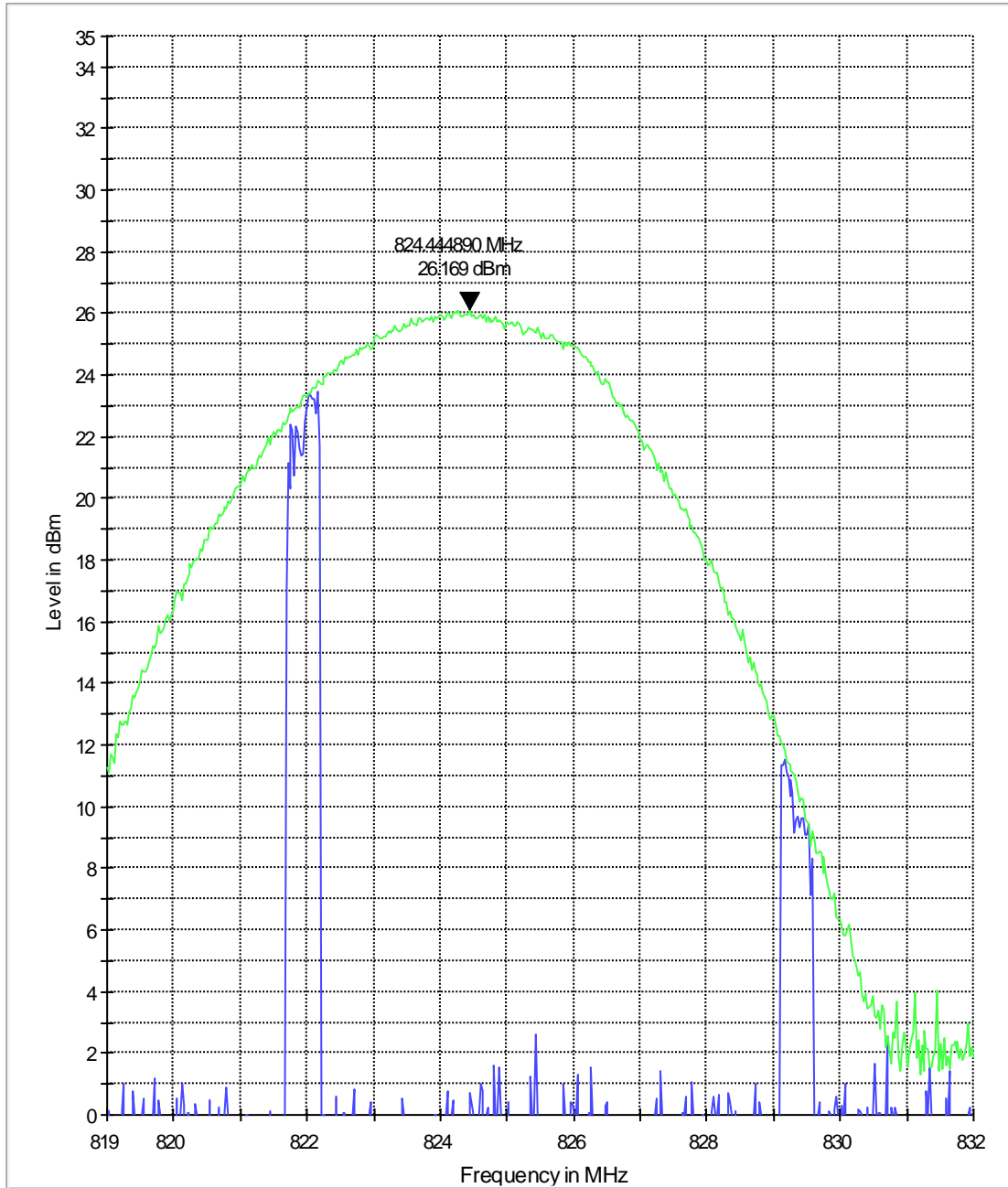
ERP850 H



— MaxPeak-ClearWrite — MaxPeak-MaxHdd

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

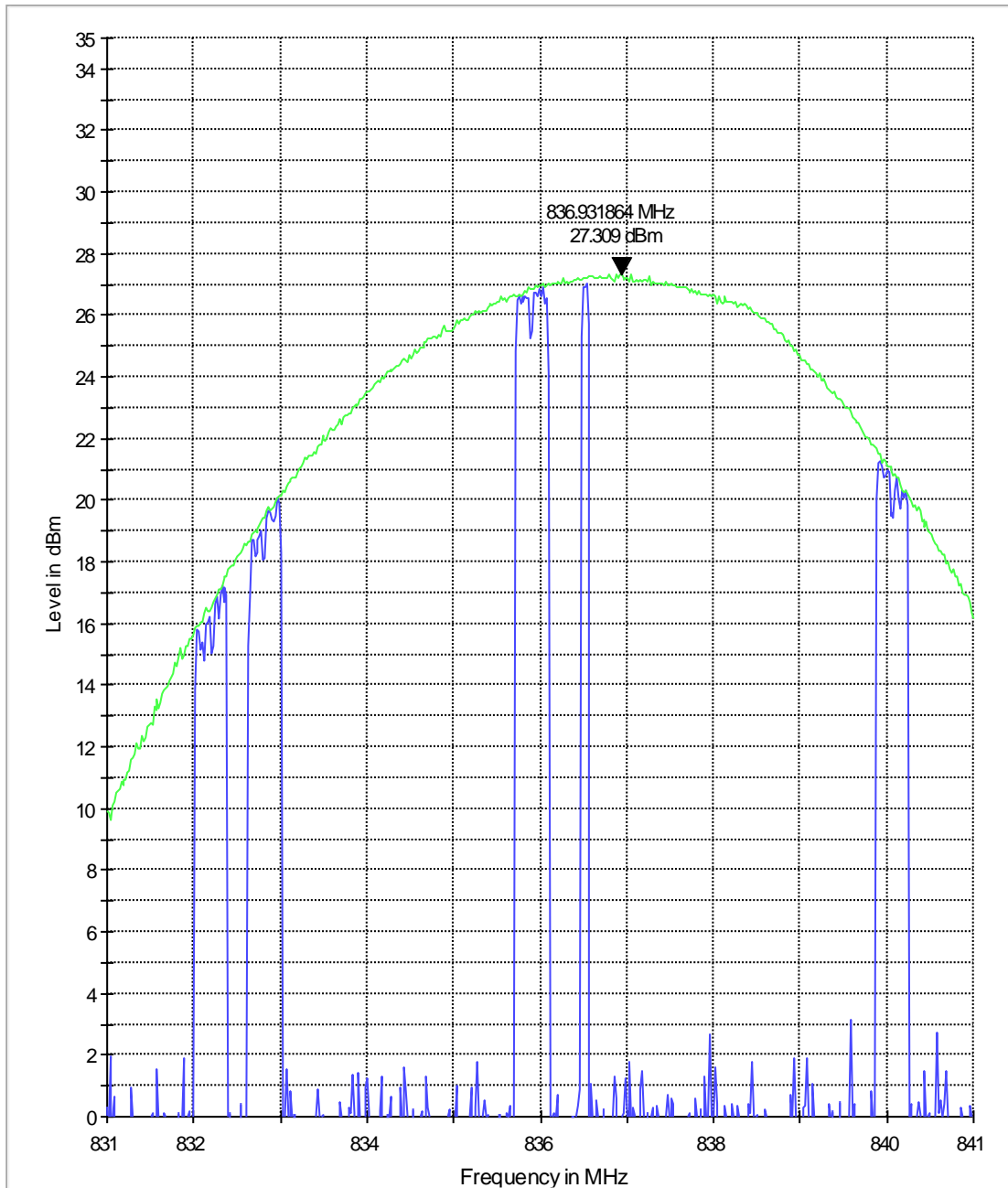
ERP850 L



— MaxPeak-ClearWrite — MaxPeak-MaxHold

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

ERP850 M

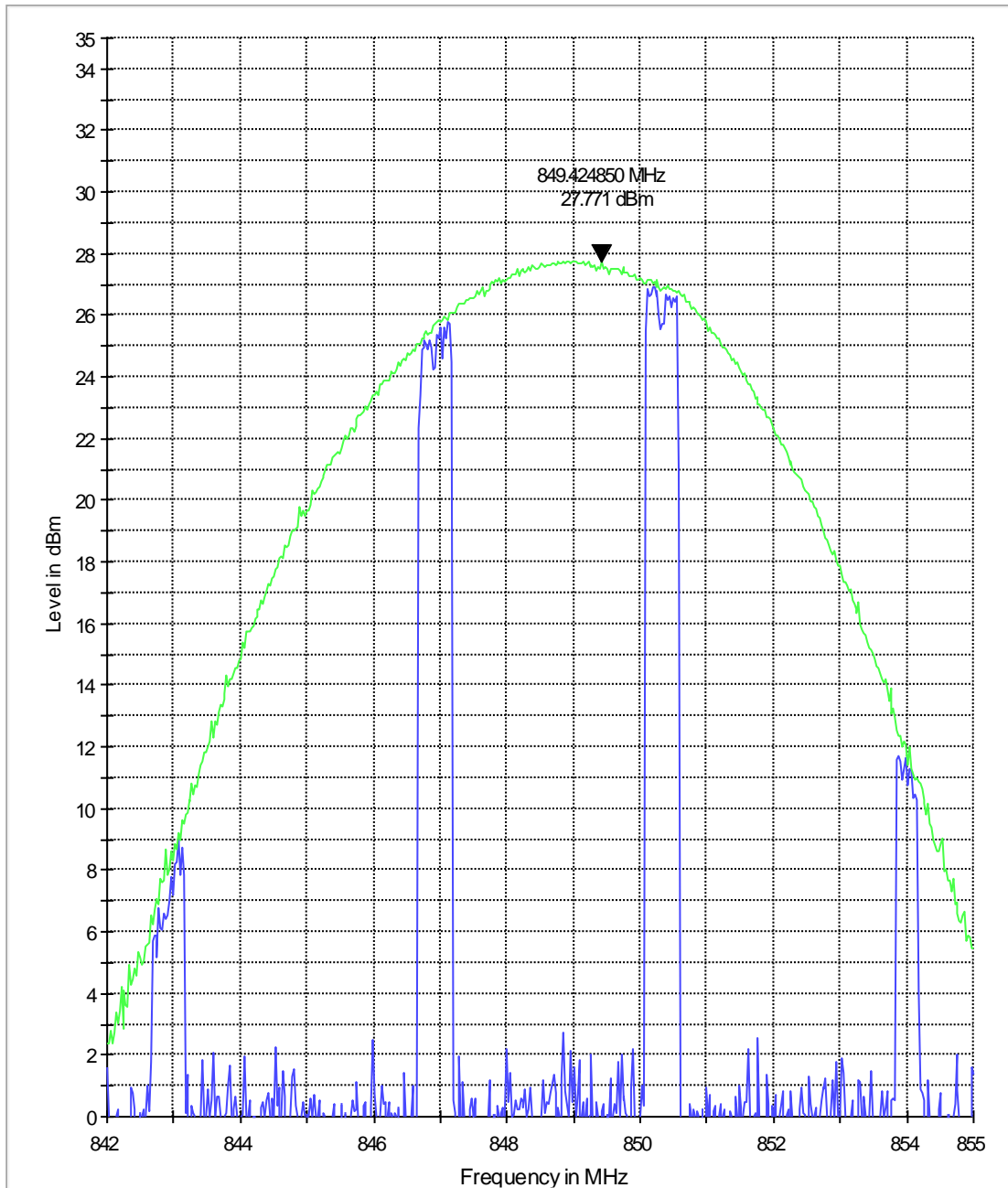


MaxPeak-ClearWrite

MaxPeak-MaxHdd

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

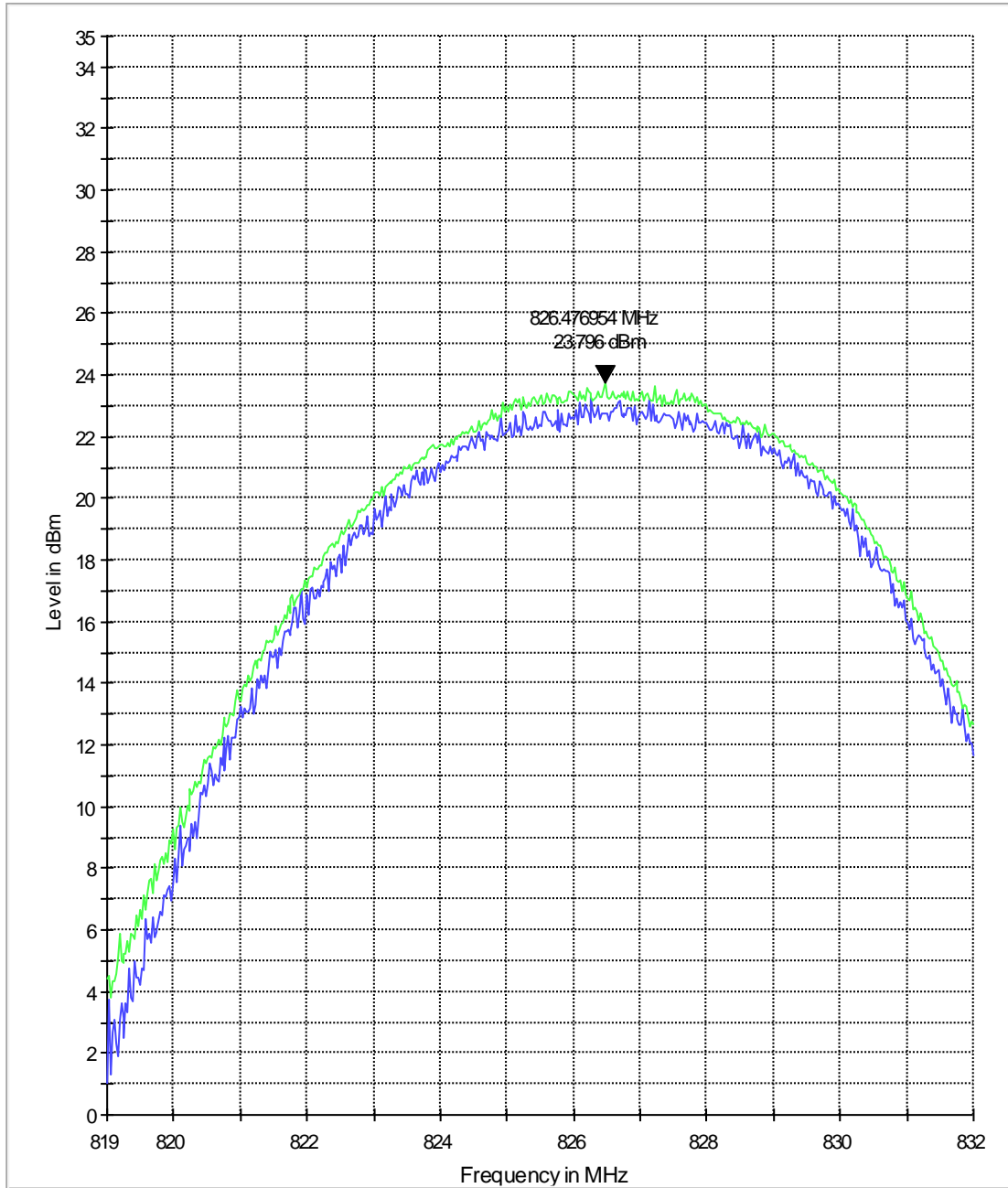
ERP850 H



— MaxPeak-ClearWrite — MaxPeak-MaxHdd

ERP (UMTS FDD5) CHANNEL 4132 §22.913(a)

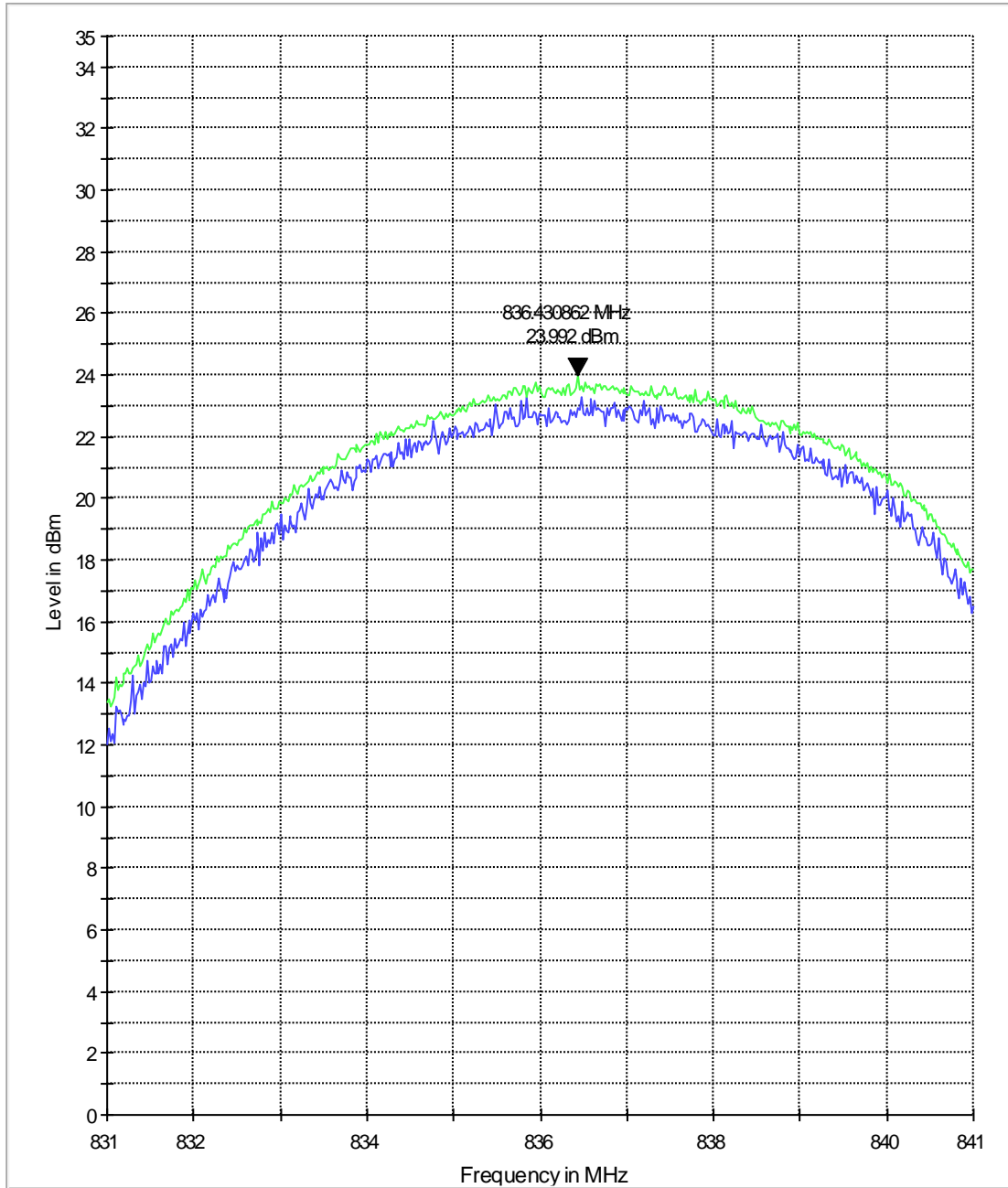
ERP850 L



— MaxPeak-ClearWrite — MaxPeak-MaxHdd

ERP (UMTS FDD5) CHANNEL 4183 §22.913(a)

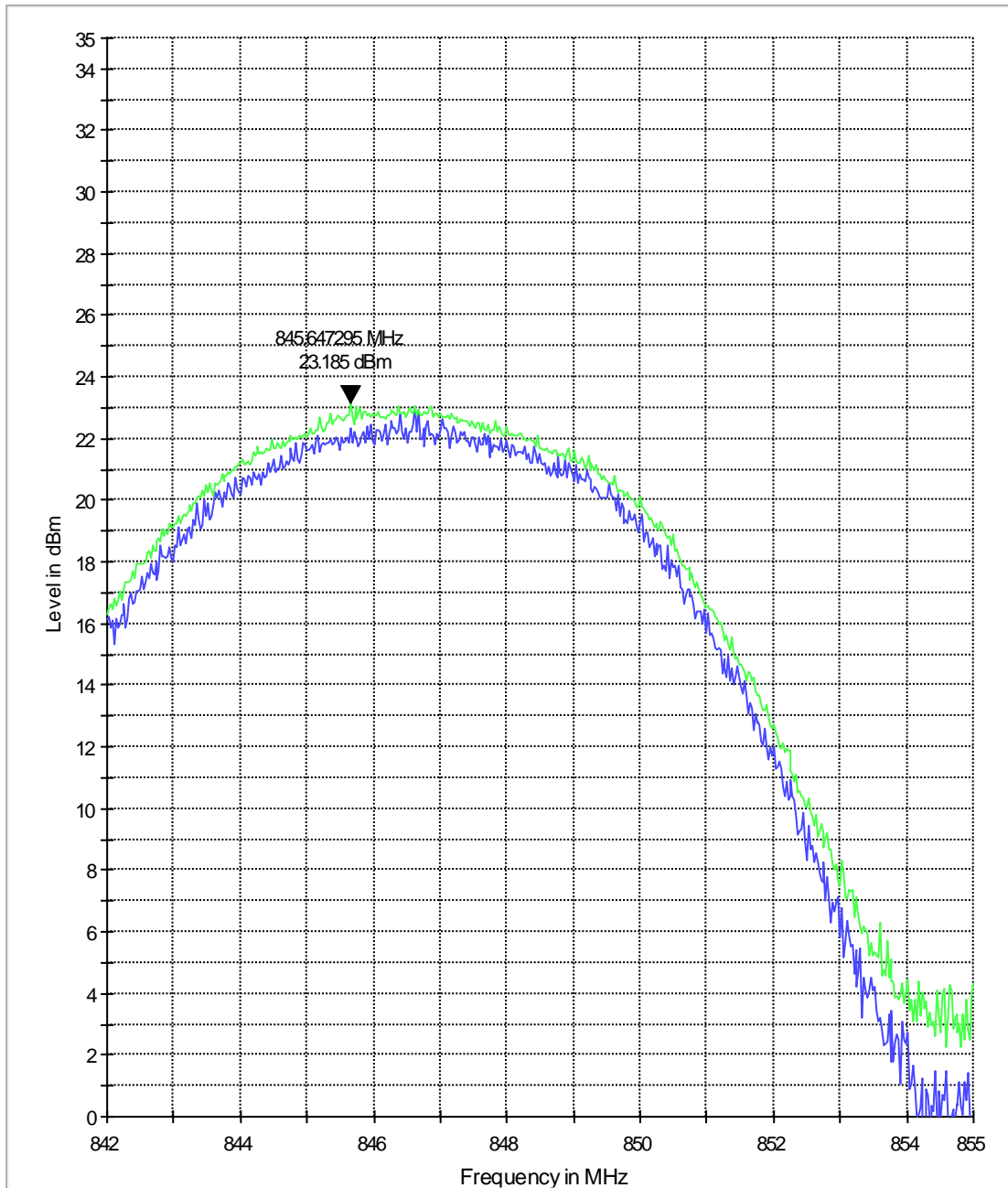
ERP850 M



— MaxPeak-ClearWrite — MaxPeak-MaxHdd

ERP (UMTS FDD5) CHANNEL 4233 §22.913(a)

ERP850 H

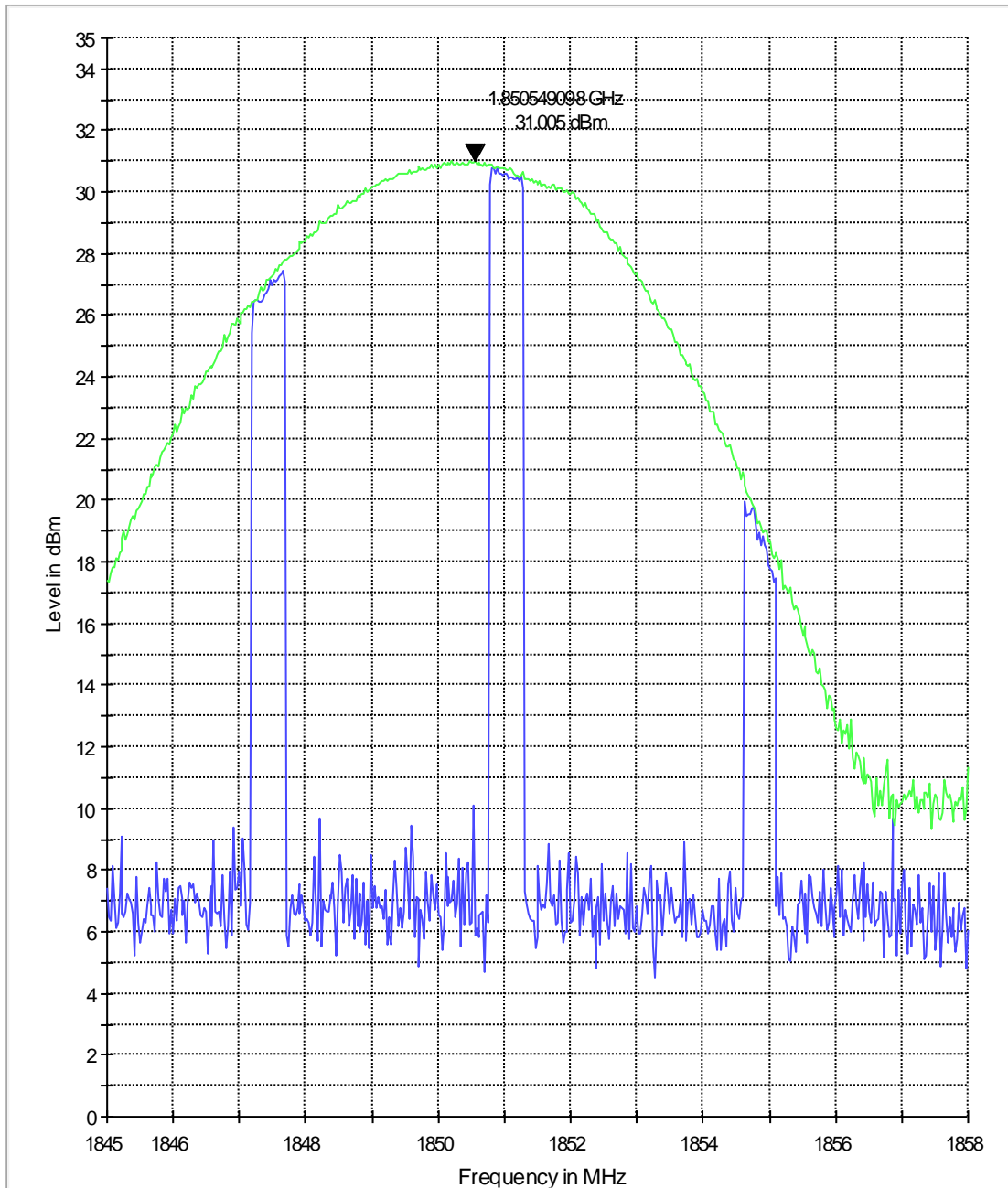


— MaxPeak-ClearWrite

— MaxPeak-MaxHdd

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

EIRP1900L

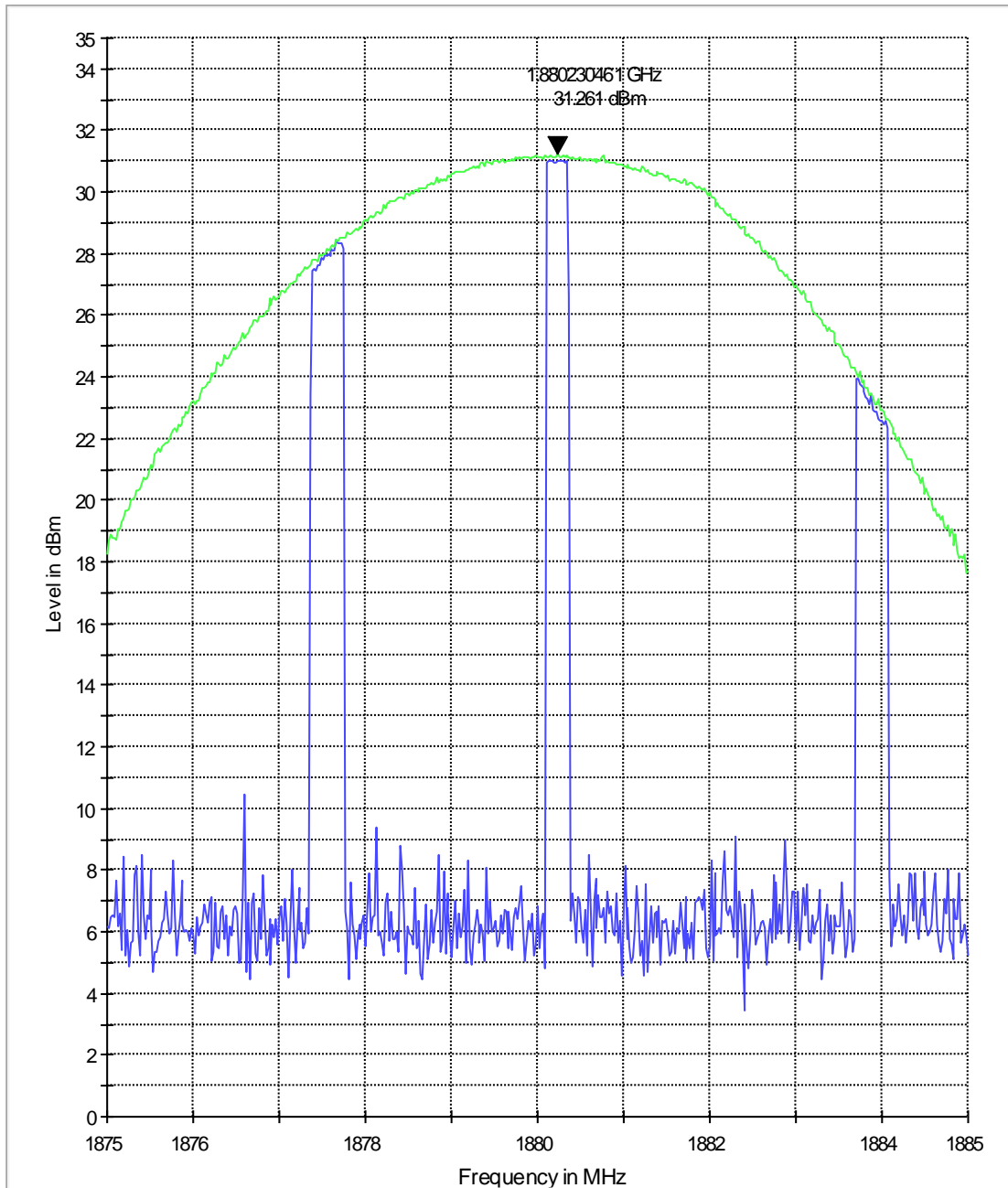


MaxPeak-ClearWrite

MaxPeak-MaxHdd

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

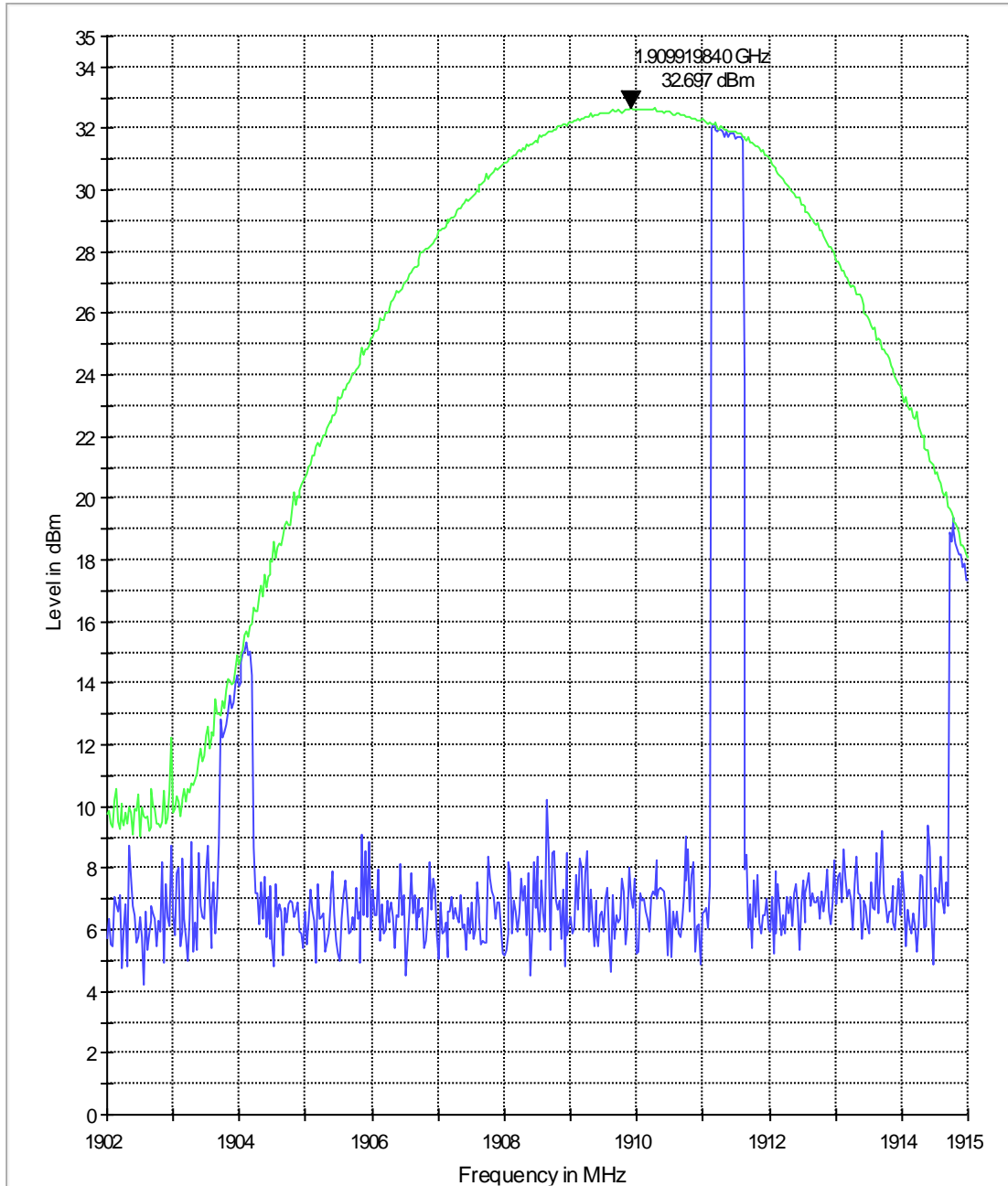
EIRP1900M



— MaxPeak-ClearWrite — MaxPeak-MaxHdd

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

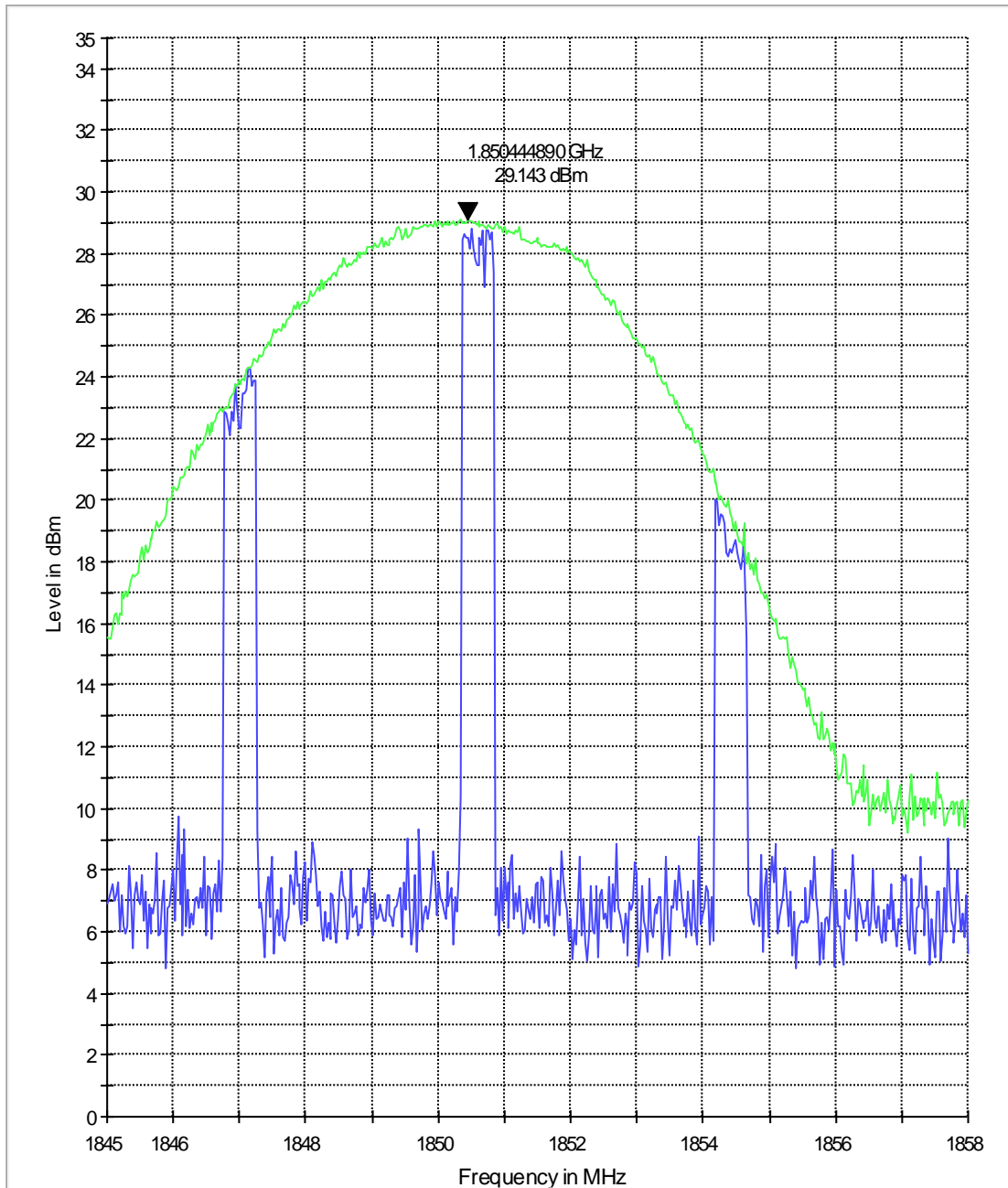
EIRP 1900H



— MaxPeak-ClearWrite — MaxPeak-MaxHold

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

EIRP1900L

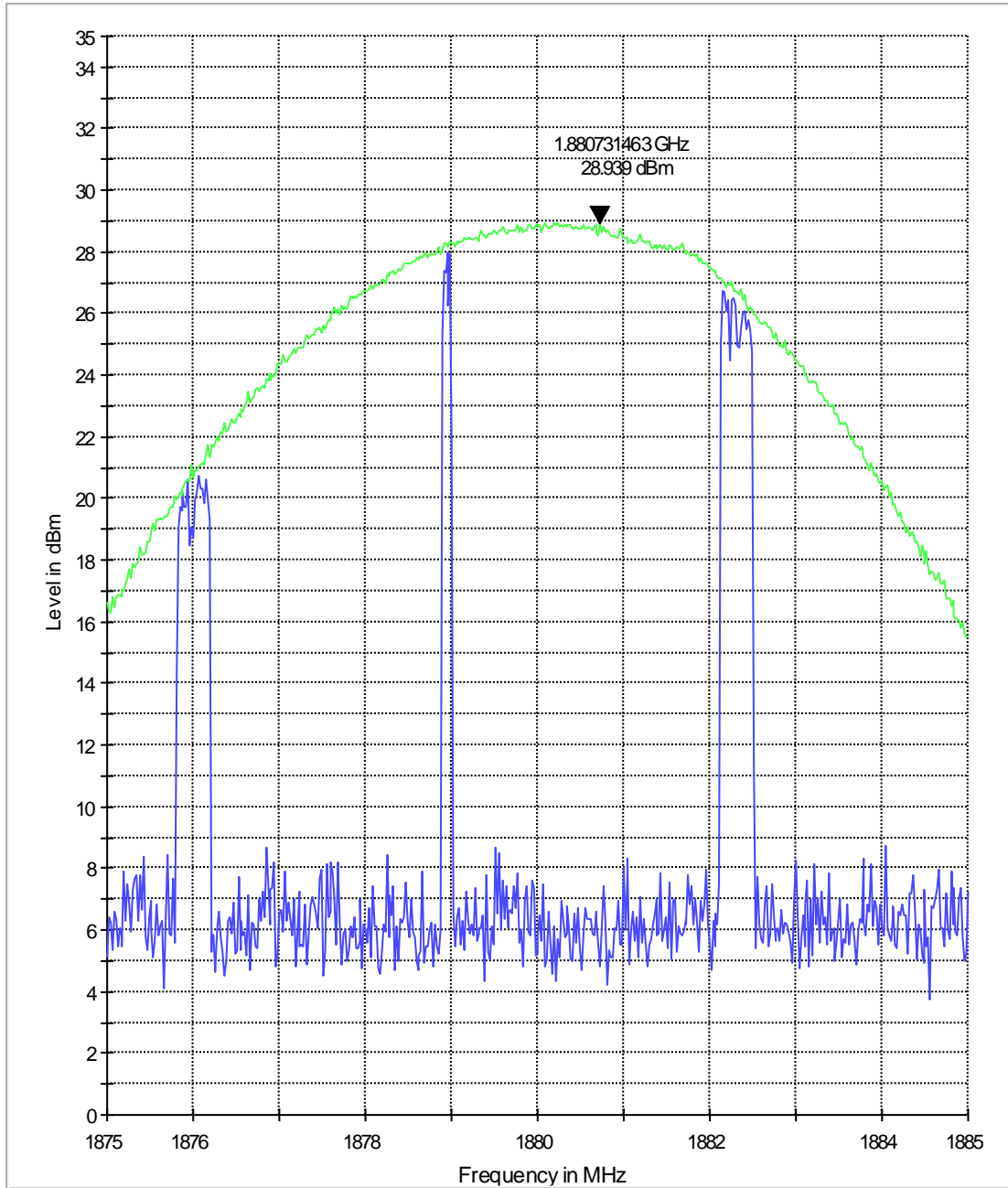


MaxPeak-ClearWrite

MaxPeak-MaxHdd

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

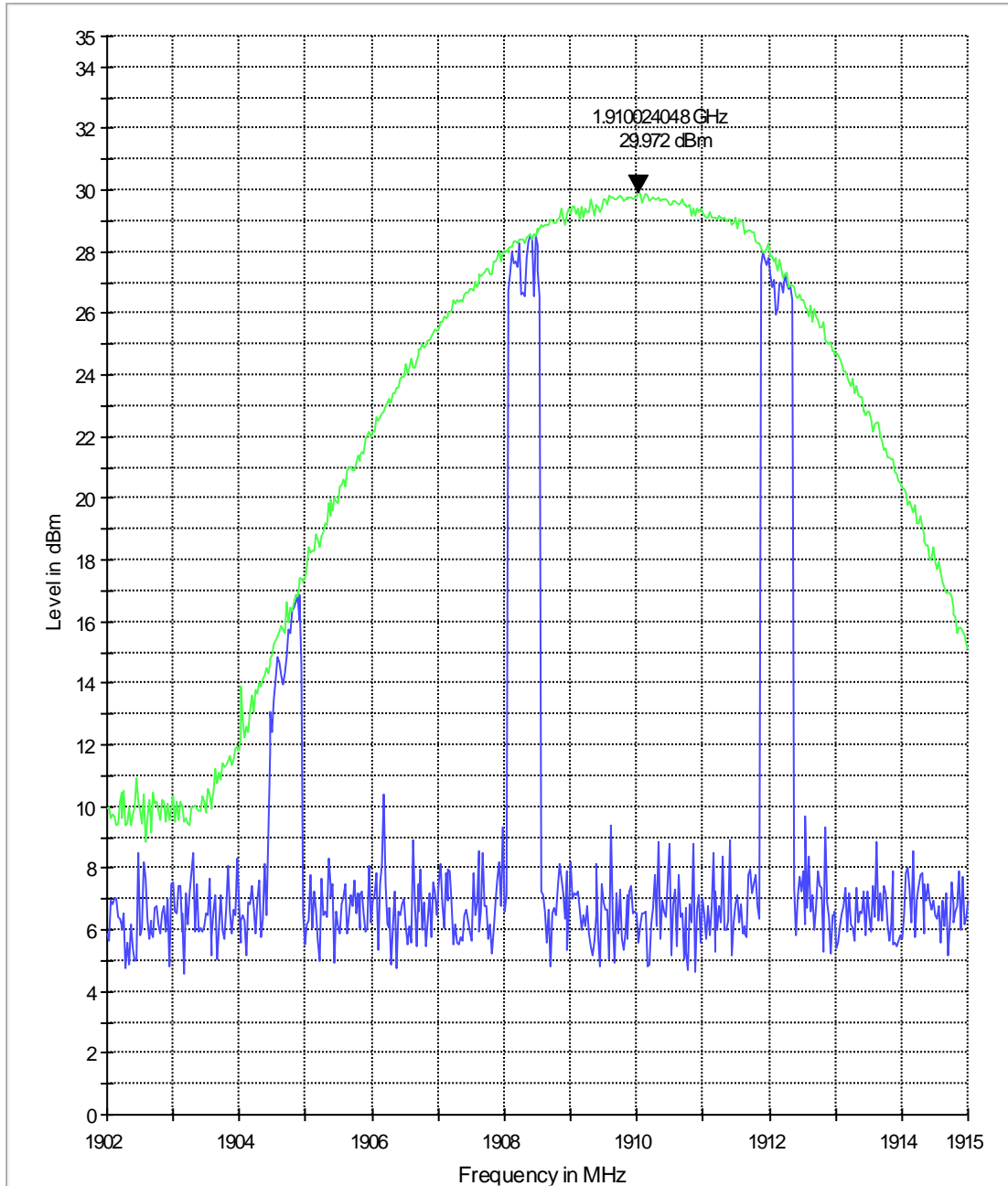
EIRP1900M



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

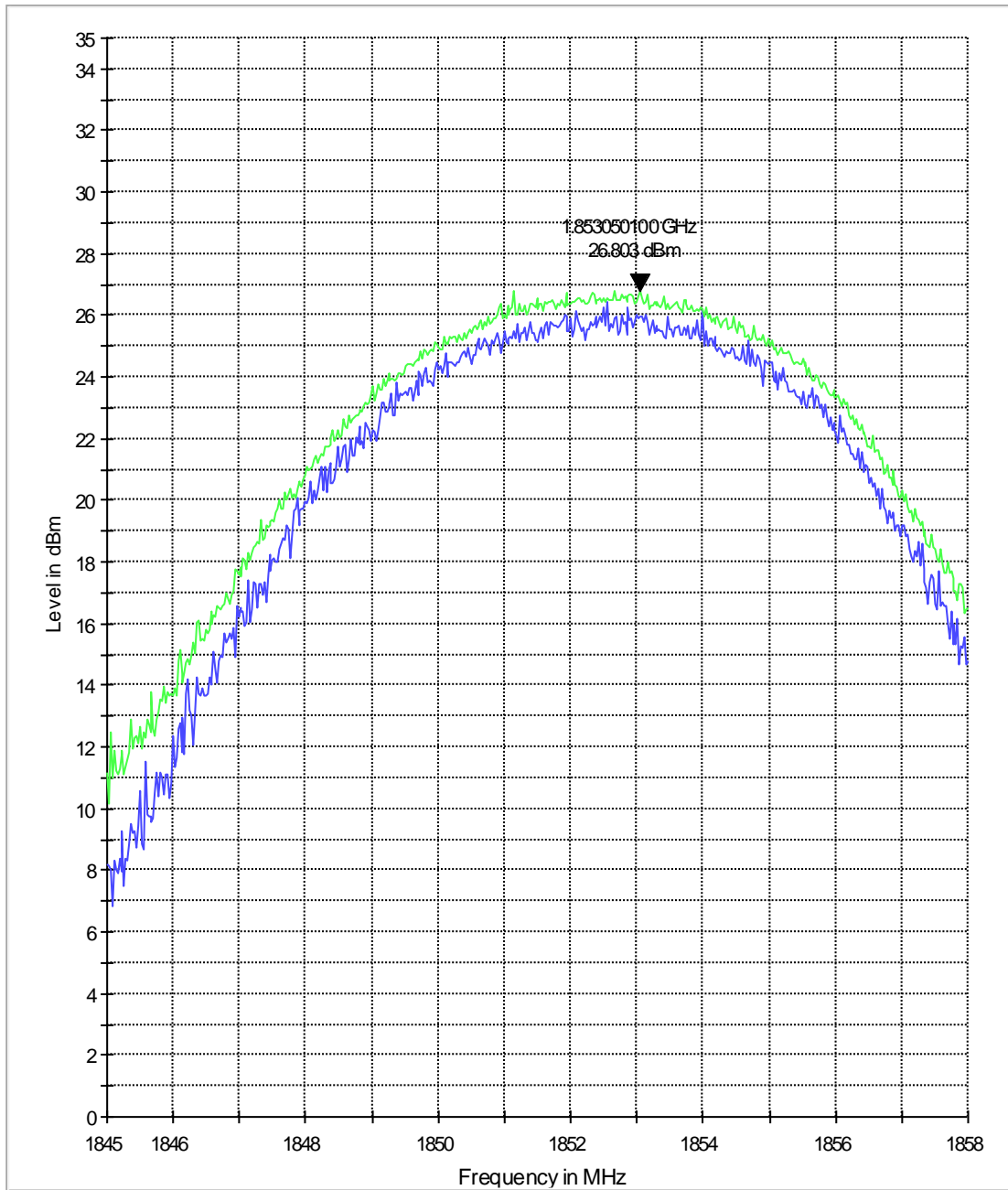
EIRP 1900H



— MaxPeak-ClearWrite — MaxPeak-MaxHold

EIRP (UMTS FDD2) CHANNEL 9262 §24.232(b)

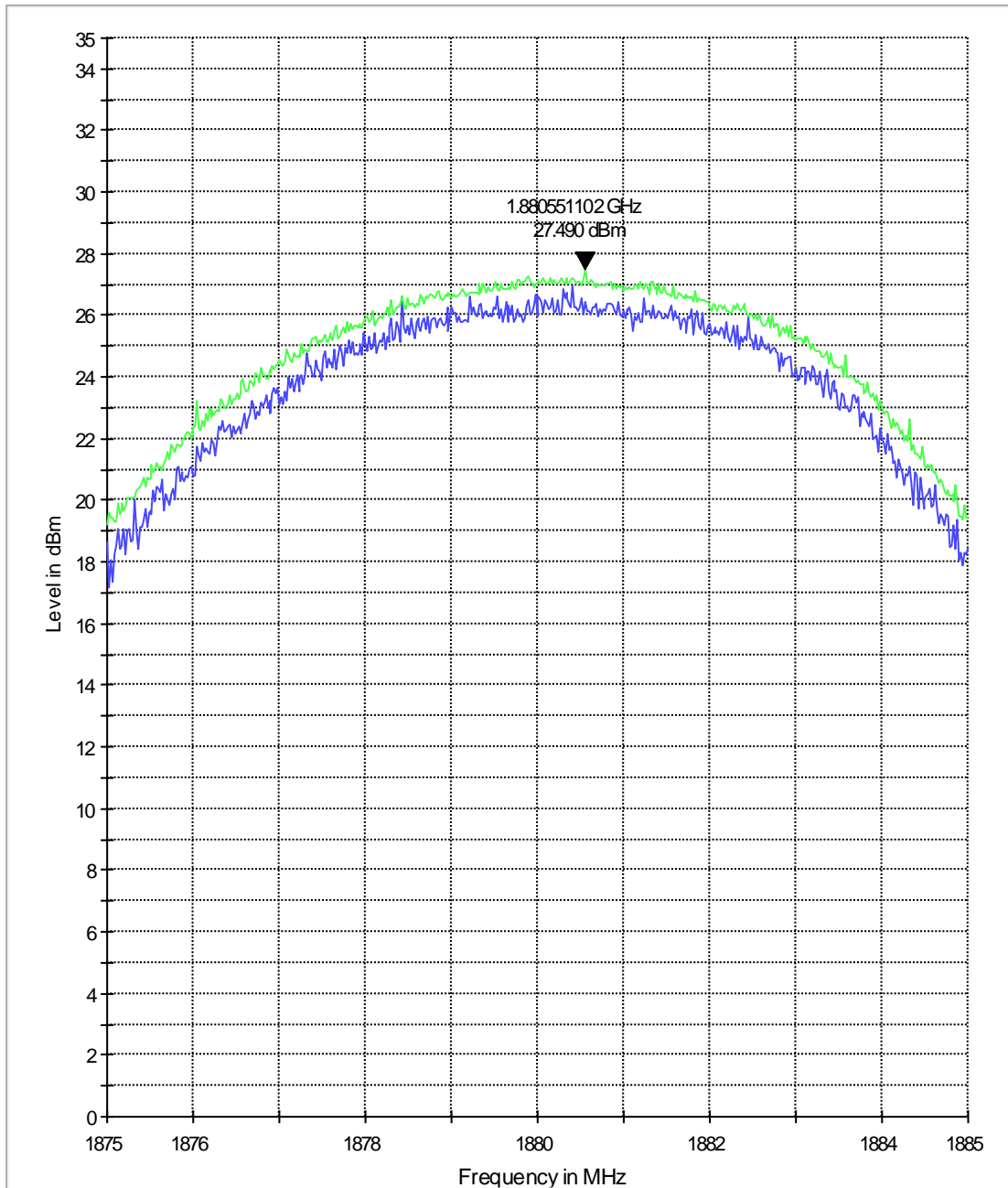
EIRP1900L



— MaxPeak-ClearWrite — MaxPeak-MaxHdd

EIRP (UMTS FDD2) CHANNEL 9400 §24.232(b)

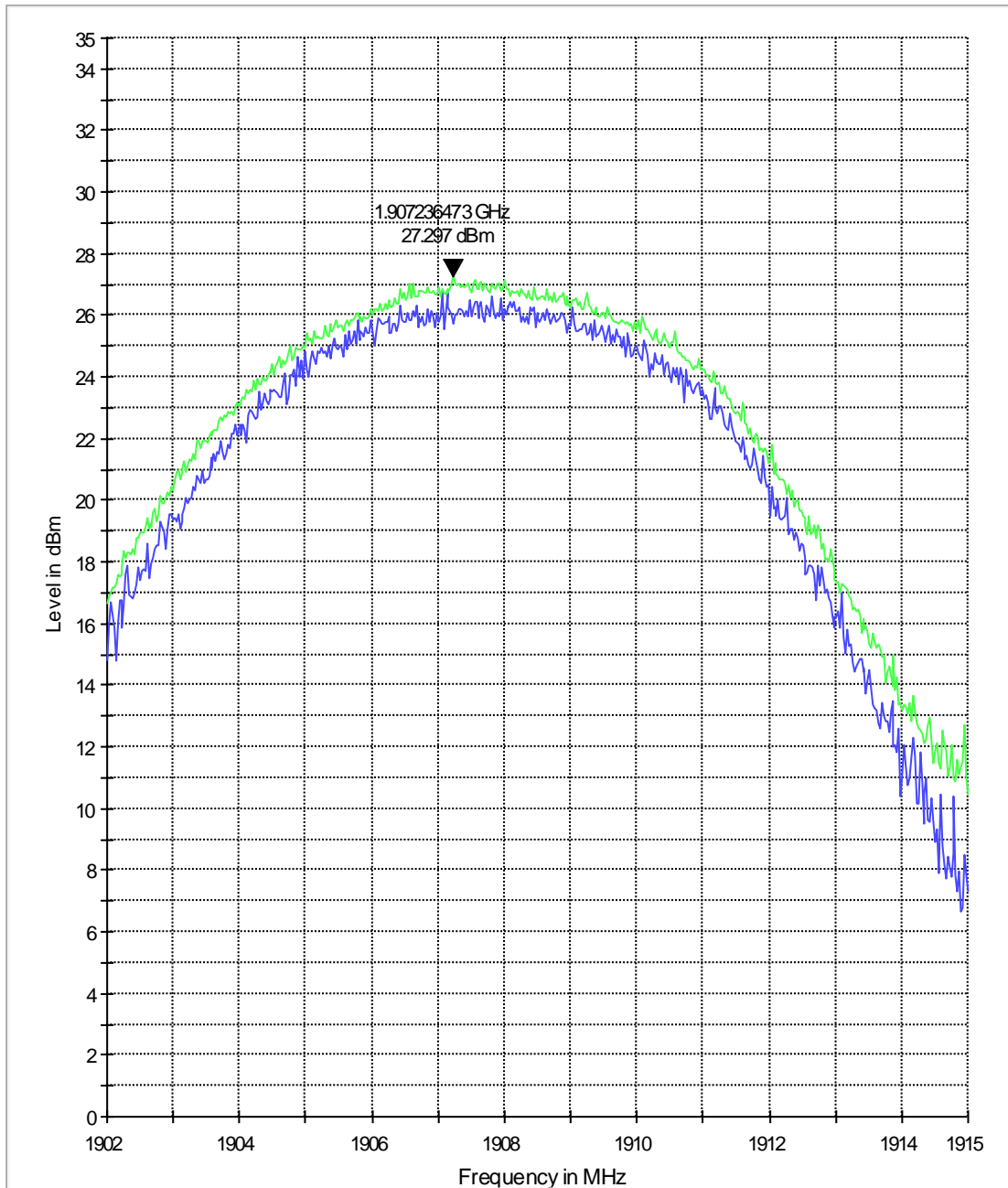
EIRP1900M



— MaxPeak-ClearWrite — MaxPeak-MaxHdd

EIRP (UMTS FDD2) CHANNEL 9538 §24.232(b)

EIRP 1900H



MaxPeak-ClearWrite

MaxPeak-MaxHdd

5.2 Occupied Bandwidth/Emission Bandwidth

5.2.1 References

FCC: CFR Part 2.1049, CFR Part 22.917, CFR Part 24.238

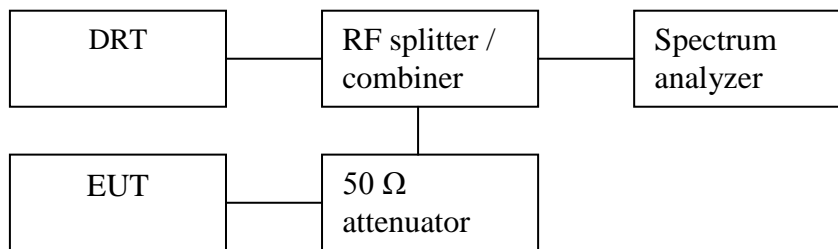
IC: RSS 132 Section 4.2; RSS 133 Section 6.5

5.2.2 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.

5.2.3 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.

Spectrum analyzer settings: Measurement bandwidth of at least 1% of the occupied bandwidth.

5.2.4 Occupied/Emission Bandwidth- 850 MHz band

GPRS 850: GMSK Mode		
Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26dBc Bandwidth (kHz)
824.2	244.39	308.49
836.4	244.39	313.3
848.8	243.59	314.1

EGPRS 850: 8PSK Mode		
Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26dBc Bandwidth (kHz)
824.2	245.19	307.69
836.4	249.2	314.1
848.8	245.19	313.3

FDD V: UMTS Mode		
Frequency (MHz)	99% Occupied Bandwidth (MHz)	-26dBc Bandwidth (MHz)
826.4	4.13	4.66
836.0	4.13	4.66
846.6	4.15	4.66

5.2.5 Occupied/Emission Bandwidth- 1900 MHz band

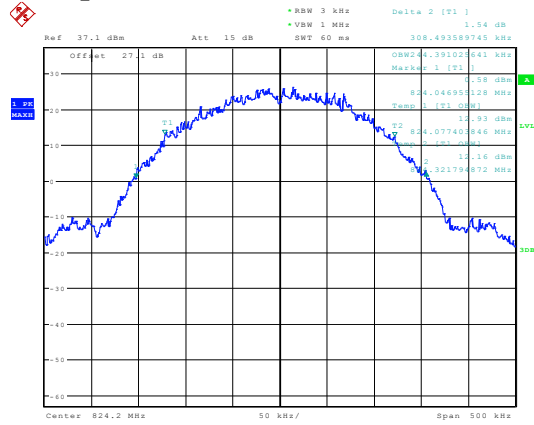
GPRS 1900: GMSK Mode		
Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26dBc Bandwidth (kHz)
1850.2	243.59	315.7
1880.0	241.98	316.5
1909.8	245.19	314.1

EGPRS 1900: 8PSK Mode		
Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26dBc Bandwidth (kHz)
1850.2	243.59	299.68
1880.0	245.19	304.49
1909.8	244.39	308.49

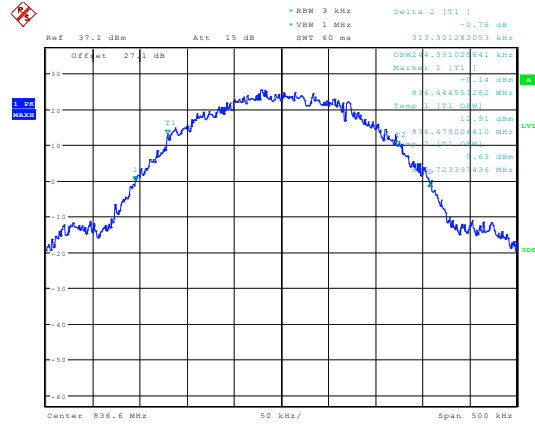
FDD II: UMTS Mode		
Frequency (MHz)	99% Occupied Bandwidth (MHz)	-26dBc Bandwidth (MHz)
1852.4	4.15	4.65
1880.0	4.13	4.68
1907.6	4.17	4.68

5.2.6 Results

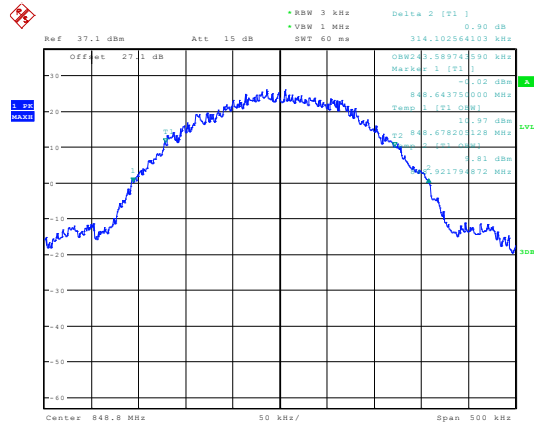
Occupied band Width GPRS850 MHz



Date: 11.JAN.2010 09:46:18

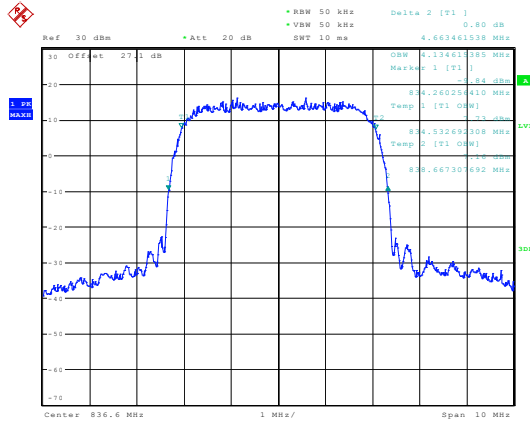
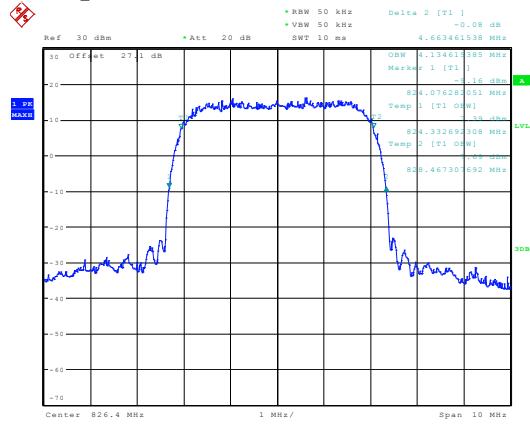


Date: 11.JAN.2010 09:55:42



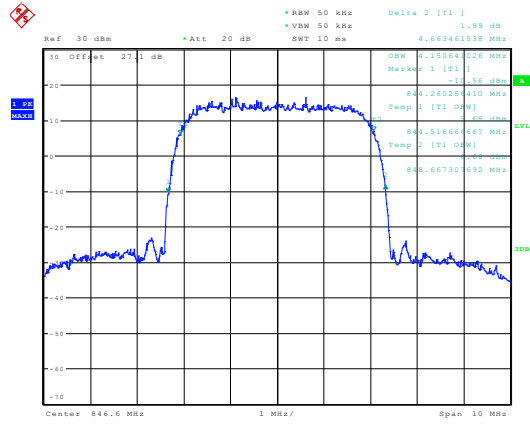
Date: 11.JAN.2010 09:57:57

Occupied band Width UMTS FDD5



Date: 11.JAN.2010 11:00:45

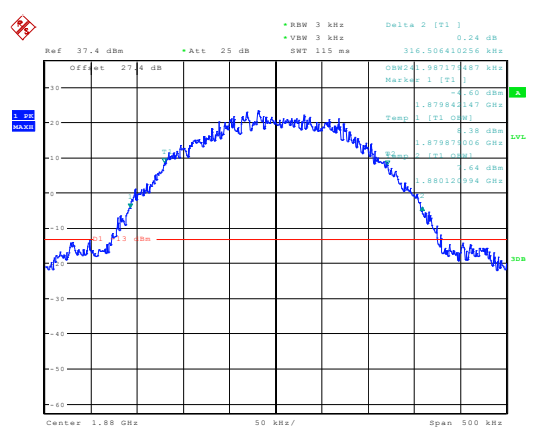
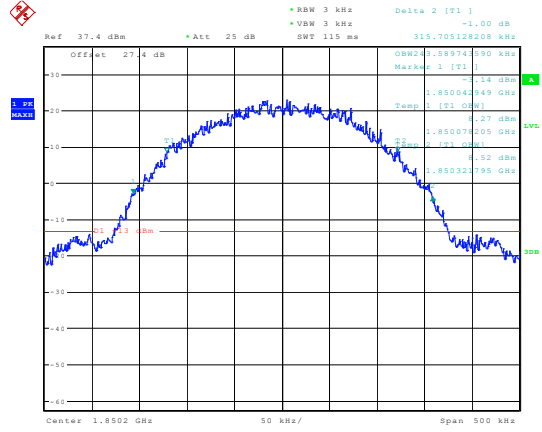
Date: 11.JAN.2010 11:02:35



Date: 11.JAN.2010 11:03:19

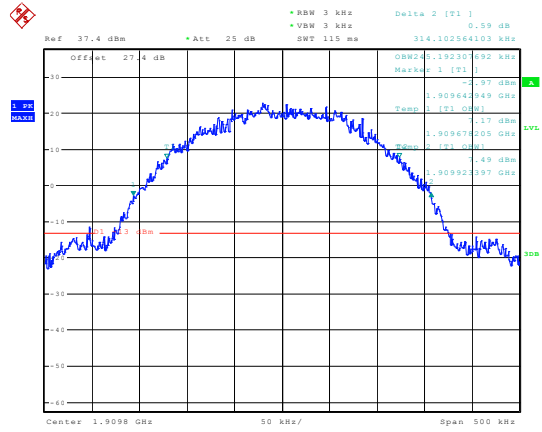


Occupied band Width PCS1900 MHz



Date: 11.JAN.2010 10:28:38

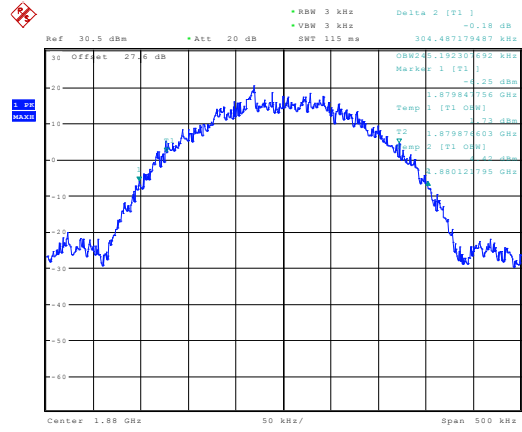
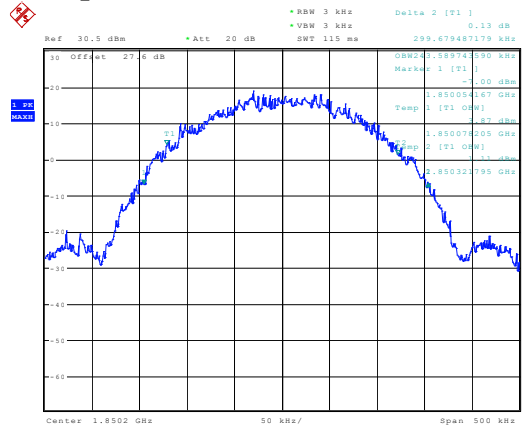
Date: 11.JAN.2010 10:30:08



Date: 11.JAN.2010 10:31:28

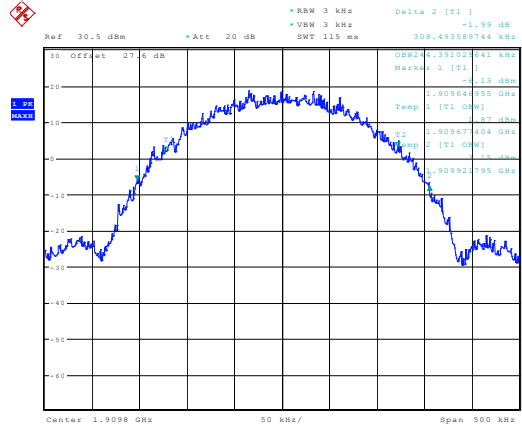


Occupied band Width EGPRS1900 MHz



Date: 11.JAN.2010 11:44:11

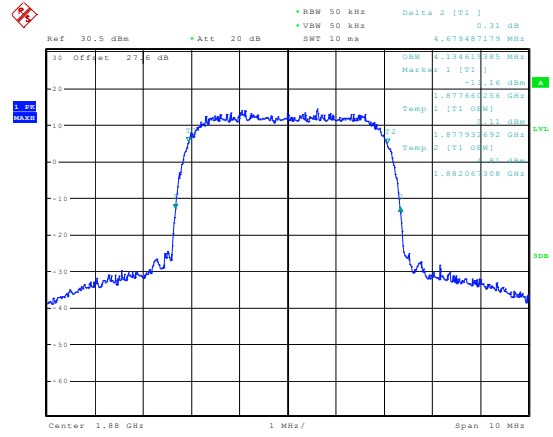
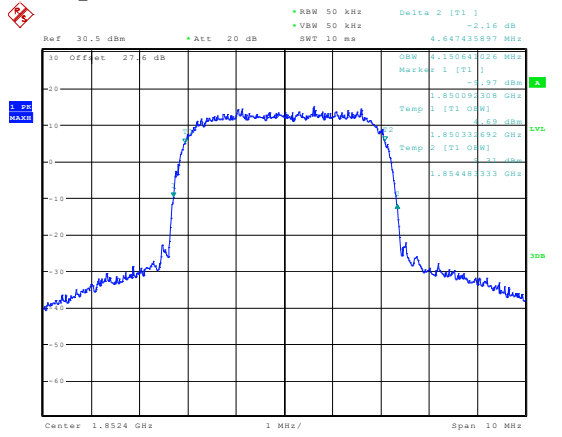
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Date: 11.JAN.2010 11:46:55

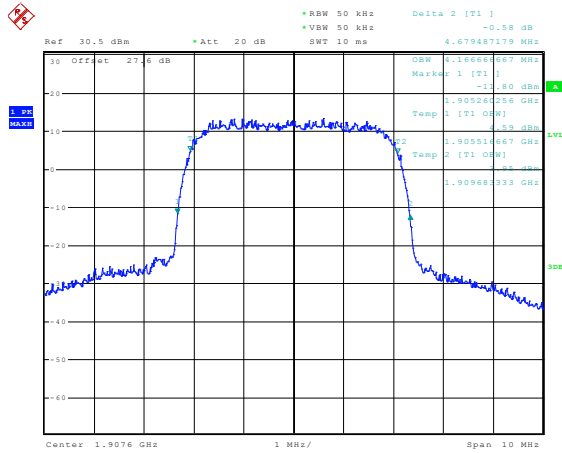


Occupied band Width UMTS FDD2



Date: 11.JAN.2010 11:30:36

Date: 11.JAN.2010 11:32:29



Date: 11.JAN.2010 11:33:36

Frequency Stability

5.2.7 References

FCC: CFR Part 2.1055, CFR Part 22.355, CFR Part 24.235

IC: RSS 132 Section 4.3 and 6.3; RSS 133 Section 4.2

5.2.8 Limits

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. 24.235/22.355 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 3.4VDC and 4.2VDC, 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 -8.1% and +13.51%. For the purposes of measuring frequency stability these voltage limits are to be used.

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. 24.235/22.355 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.

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 GPRS 850 & 4183 for FDD5 & 661 for PCS1900 & 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. Re-measure carrier frequency at low and high 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 GPRS 850 & 4183 for FDD5 & 661 for PCS1900 & 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.

5.2.9 Test Results Frequency Stability (GPRS-850): Channel 190 (836.6 MHz)

Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Low V: 3.4	7	0.008
High V: 4.2	-12	-0.014

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
-30	-26	-0.031
-20	21	0.025
-10	-23	-0.027
0	23	0.027
+10	-22	-0.026
+20	-12	-0.014
+30	-19	-0.023
+40	-14	-0.017
+50	18	0.022

§2.1055 (b)(2) Battery end point

Battery End Point (V DC)	Frequency Error (Hz)	Frequency Error (ppm)
3.2	7	0.008

5.2.10 Test Results Frequency Stability (GPRS-1900): Channel 661 (1880.0 MHz)

Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Low V: 3.4	62	0.033
High V: 4.2	50	0.027

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
-30	68	0.036
-20	58	0.031
-10	53	0.028
0	46	0.024
+10	58	0.031
+20	50	0.027
+30	46	0.024
+40	31	0.016
+50	39	0.021

§2.1055 (b)(2) Battery end point

Battery End Point (V DC)	Frequency Error (Hz)	Frequency Error (ppm)
3.2	62	0.033

5.2.11 Test Results Frequency Stability (FDD V): Channel 4183 (836.6 MHz)

Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Low V: 3.4	12	0.014
High V: 4.2	12	0.014

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
-30	13	0.016
-20	11	0.013
-10	13	0.016
0	11	0.013
+10	13	0.016
+20	12	0.014
+30	13	0.016
+40	11	0.013
+50	11	0.013

§2.1055 (b)(2) Battery end point

Battery End Point (V DC)	Frequency Error (Hz)	Frequency Error (ppm)
3.2	12	0.014

5.2.12 Test Results Frequency Stability (FDD II): Channel 9400 (1880.0 MHz)

Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Low V: 3.4	-8	-0.004
High V: 4.2	-22	-0.012

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

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
-30	-27	-0.014
-20	-25	-0.013
-10	-24	-0.013
0	-22	-0.012
+10	-27	-0.014
+20	-22	-0.012
+30	-24	-0.013
+40	-26	-0.014
+50	-23	-0.012

§2.1055 (b)(2) Battery end point

Battery End Point (V DC)	Frequency Error (Hz)	Frequency Error (ppm)
3.2	-8	-0.004

5.3 Conducted Spurious Emissions

5.3.1 References

FCC: CFR Part 2.1051, CFR Part 22.917, CFR Part 24.238

IC: RSS 132 Section 4.5 and 6.5; RSS 133 Section 4.4

5.3.2 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.

5.3.3 Limits

(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.

For all power levels +30dBm to 0dBm, this becomes a constant specification of -13dBm.

5.3.3.1 **FCC 22.917 Emission limitations for cellular equipment.**

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

(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.

5.3.3.2 **FCC 24.238 Emission limitations for Broadband PCS equipment.**

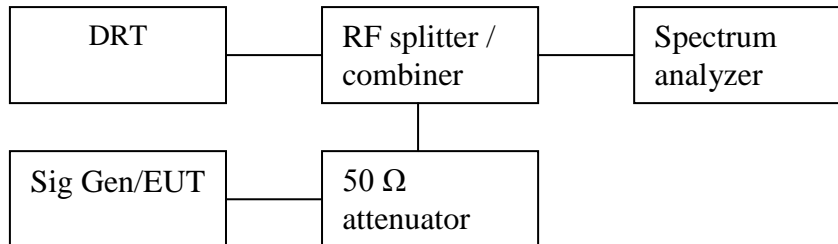
The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(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.

5.3.4 Measurement Procedure -Conducted Out of band Emissions

Ref: 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.)

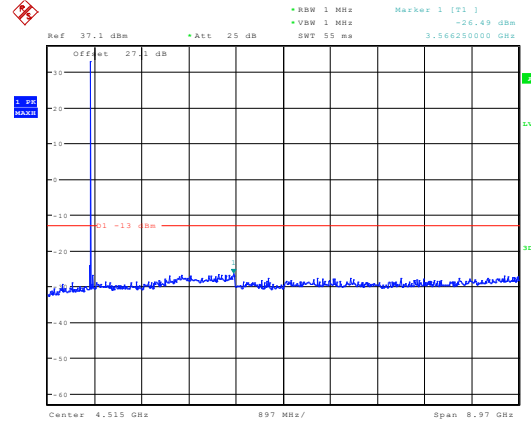
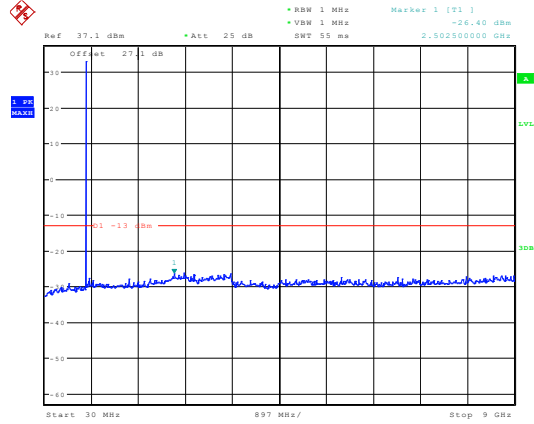
5.3.5 Test Results- Conducted Out of band Emission

No measurable spurious emissions noted. Emission above the limit in the plots is from EUT uplink.

All measurement conducted in GPRS and UMTS mode with highest power settings. Plots here show worse case emission for each channel under any modulation.

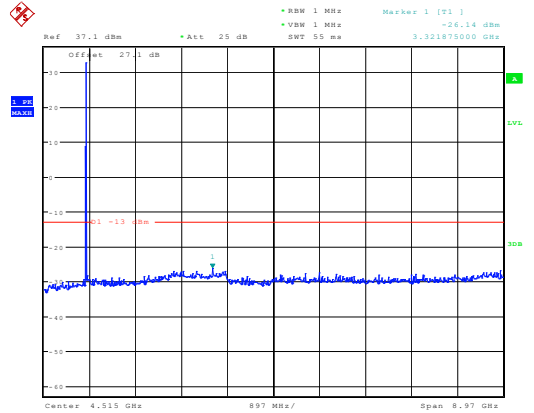


Conducted Out of band Emission GPRS850



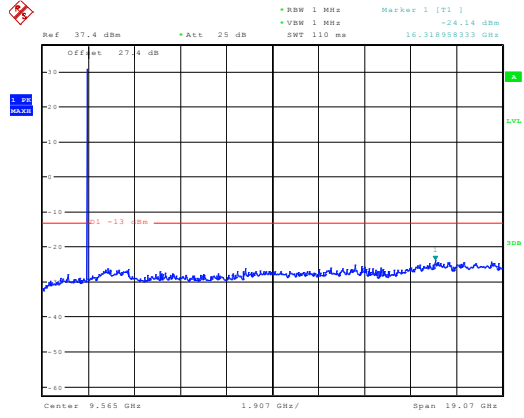
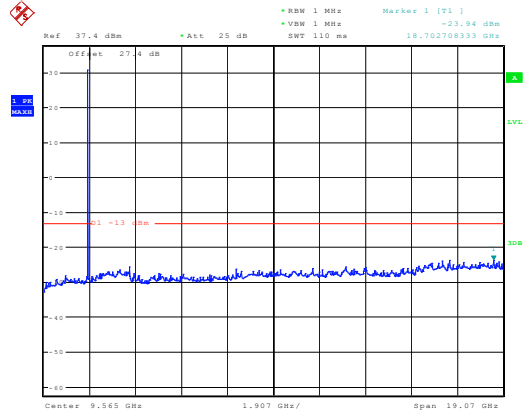
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Date: 11.JAN.2010 10:14:15



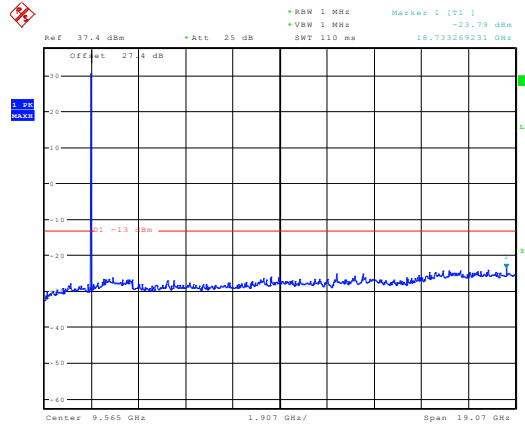
Date: 11.JAN.2010 10:14:37

Conducted Out of band Emission GPRS1900



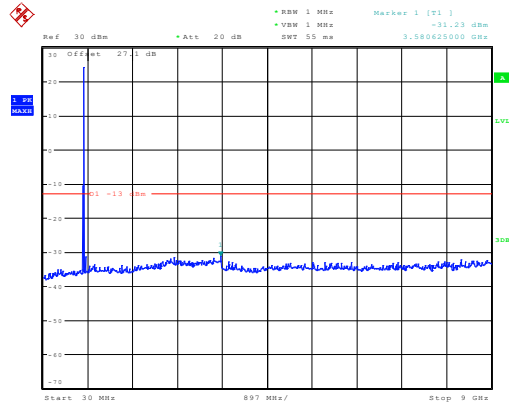
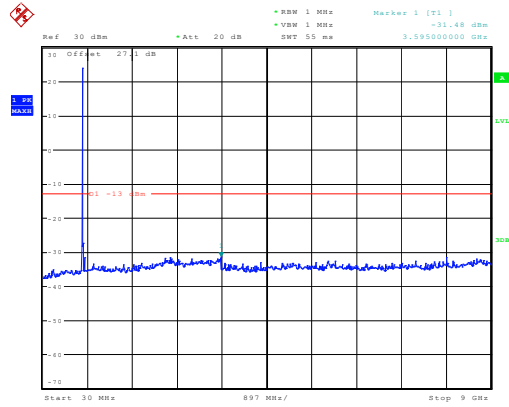
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Date: 11.JAN.2010 10:33:43



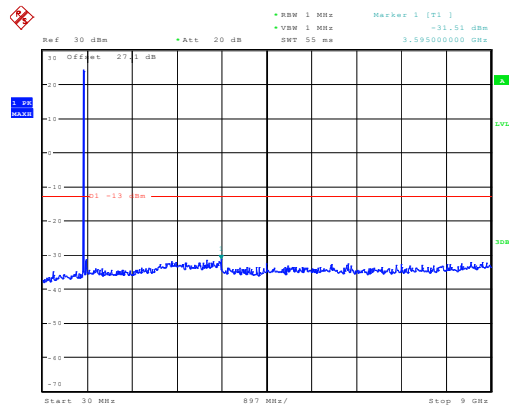
Date: 11.JAN.2010 10:33:11

Conducted Out of band Emission UMTS FDD5



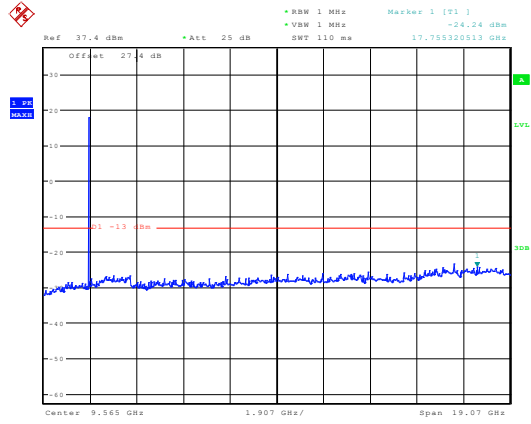
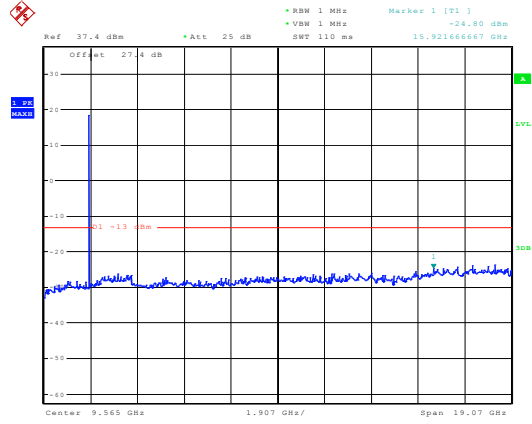
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Date: 11.JAN.2010 11:09:33



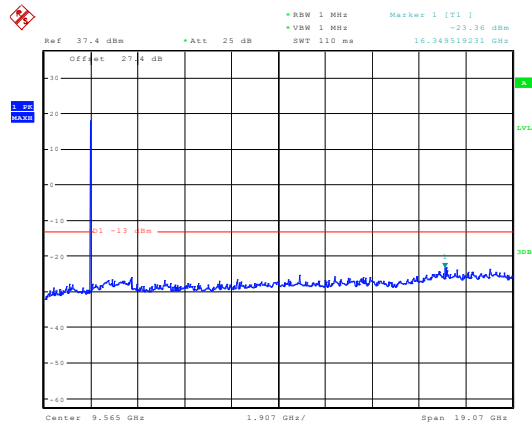
Date: 11.JAN.2010 11:10:31

Conducted Out of band Emission UMTS FDD2



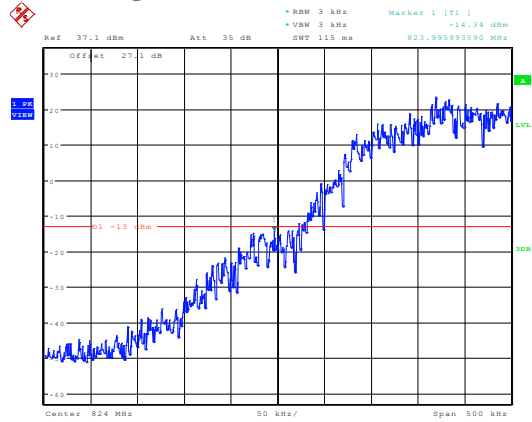
Date: 11.JAN.2010 10:39:24

Date: 11.JAN.2010 10:40:11

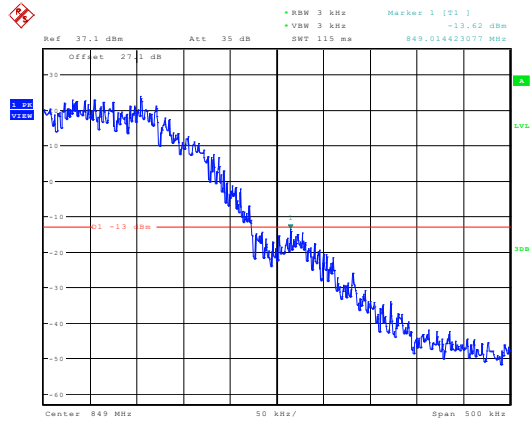


Date: 11.JAN.2010 10:40:49

Band Edge GPRS850 GPRS

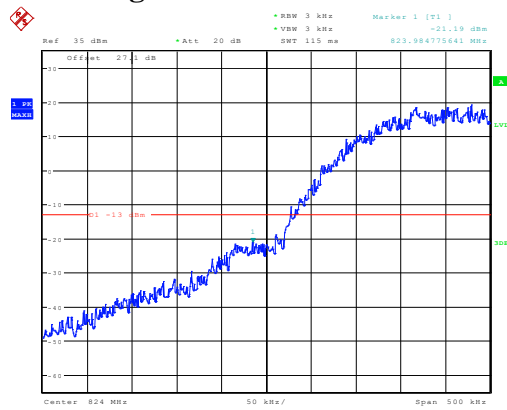


Date: 11.JAN.2010 10:05:14

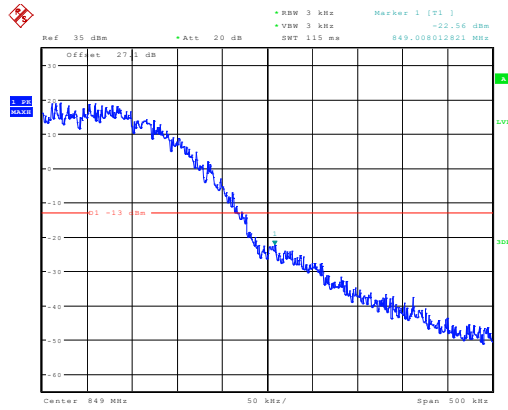


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Band Edge GPRS850 EGPRS

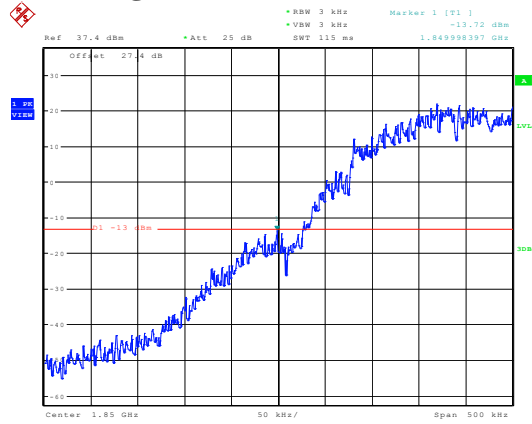


Date: 11.JAN.2010 12:00:49

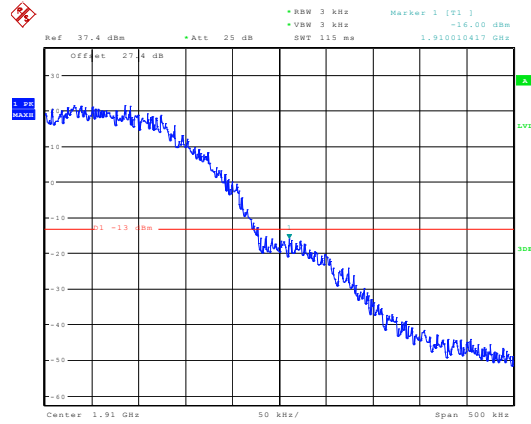


Date: 11.JAN.2010 12:01:28

Band Edge GPRS1900 GPRS

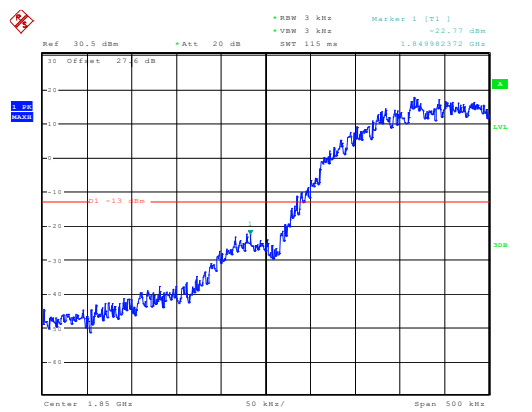


Date: 11.JAN.2010 10:27:06

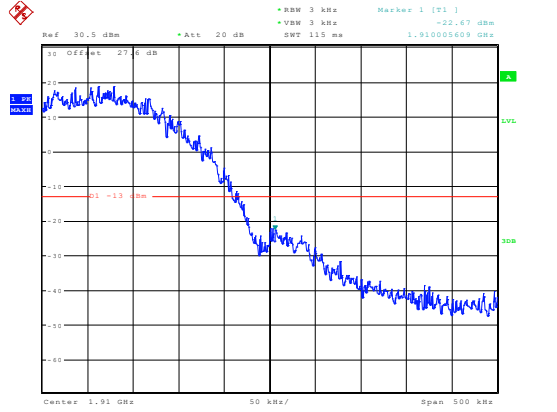


Date: 11.JAN.2010 10:25:56

Band Edge GPRS1900 EGPRS



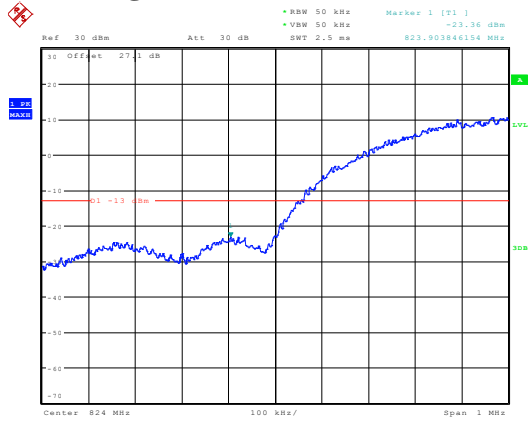
Date: 11.JAN.2010 11:48:32



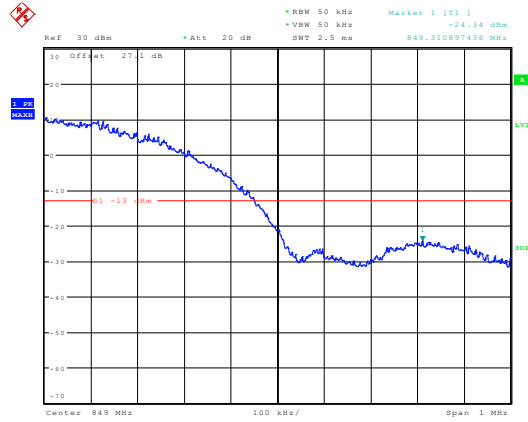
Date: 11.JAN.2010 11:47:56



Band Edge UMTS FDD5

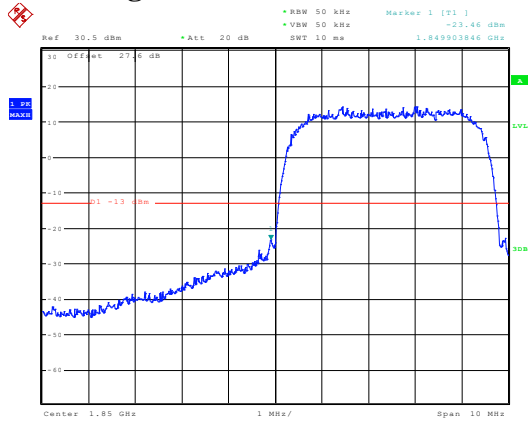


Date: 11.JAN.2010 11:07:37

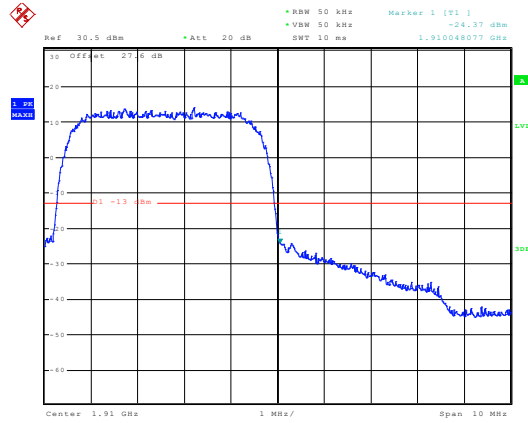


Date: 11.JAN.2010 11:04:48

Band Edge UMTS FDD2



Date: 11.JAN.2010 11:28:59



Date: 11.JAN.2010 11:28:25

5.4 Spurious Emissions Radiated

5.4.1 References

FCC: CFR Part 2.1053, CFR Part 22.917, CFR Part 24.238

IC: RSS 132 Section 4.5 and 6.5; RSS 133 Section 4.4

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

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.

5.4.3 Limits:

(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.

For all power levels +30dBm to 0dBm, this becomes a constant specification of -13dBm.

5.4.3.1 **FCC 22.917 Emission limitations for cellular equipment.**

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

(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.

5.4.3.2 **FCC 24.238 Emission limitations for Broadband PCS equipment.**

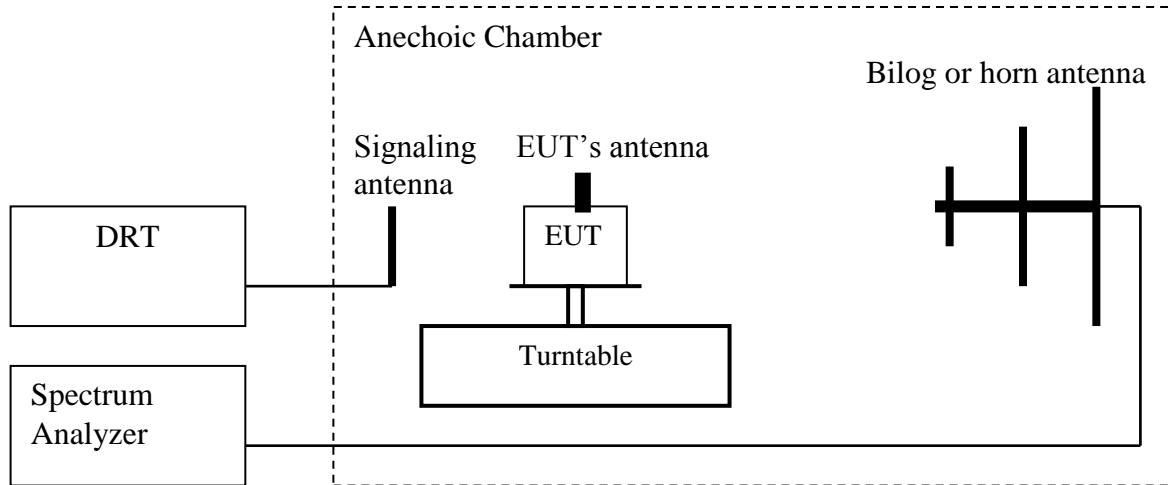
The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(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.

5.4.4 Radiated out of band measurement procedure:

Ref: 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: RBW=VBW=1MHz

Measurement Survey:

The site is constructed in accordance with ANSI C63.4 requirements and is recognized by the FCC to be in compliance for a 3m site. The spectrum is scanned from 30MHz to the 10th harmonic of the highest frequency generated by the EUT.

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the GPRS-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 GPRS-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 Packet Data mode GMSK modulation because this mode represents the worse case emission for all the modulations for GPRS. All measurements are done in horizontal and vertical polarization; the plots show the worst case where it is not indicated otherwise.

Unless mentioned otherwise, the peaks in the plots are from the carrier frequency.

Radiated emissions measurements were made also with UMTS FDD mode.

5.4.5 Radiated out of band emissions results on EUT- Transmit Mode:

5.4.5.1 Test Results Transmitter Spurious Emission GPRS850:

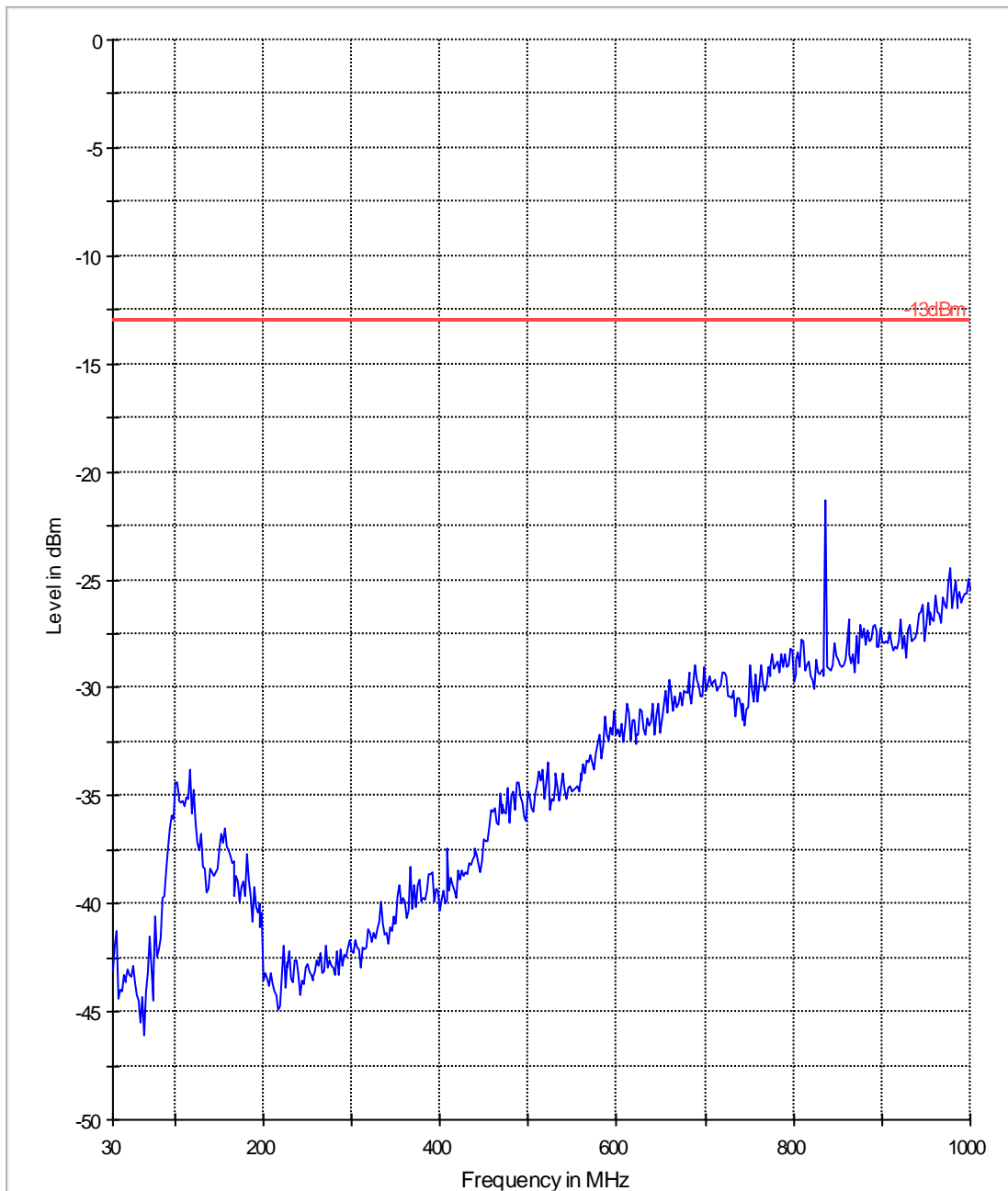
Harmonic	Tx ch-128 Freq. (MHz)	Level (dBm)	Tx ch-190 Freq. (MHz)	Level (dBm)	Tx ch-251 Freq. (MHz)	Level (dBm)
1	824.2	-	836.6	-	848.8	-
2	1648.4	NF	1673.2	NF	1697.6	NF
3	2472.6	NF	2509.8	NF	2546.4	NF
4	3296.8	NF	3346.4	NF	3395.2	NF
5	4121	NF	4183	NF	4244	NF
6	4945.2	NF	5019.6	NF	5092.8	NF
7	5769.4	NF	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						

Radiated Spurious Emissions (GPRS-850)

Note – Worst case plot

FCC 22 30-1000MHz Mid Channel

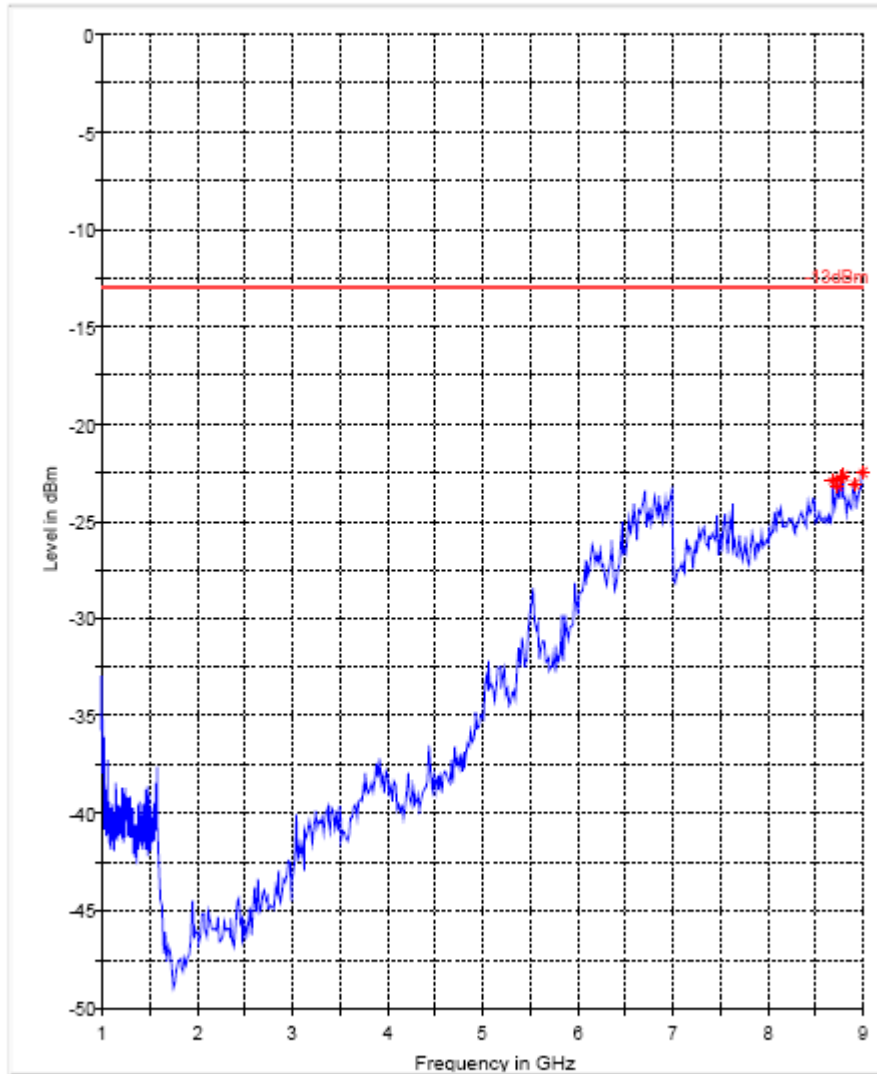
FCC 22 30-1000MHz



— -13dBmLimitLine — PreviewResult 1

FCC 22 1-9GHz Low Channel

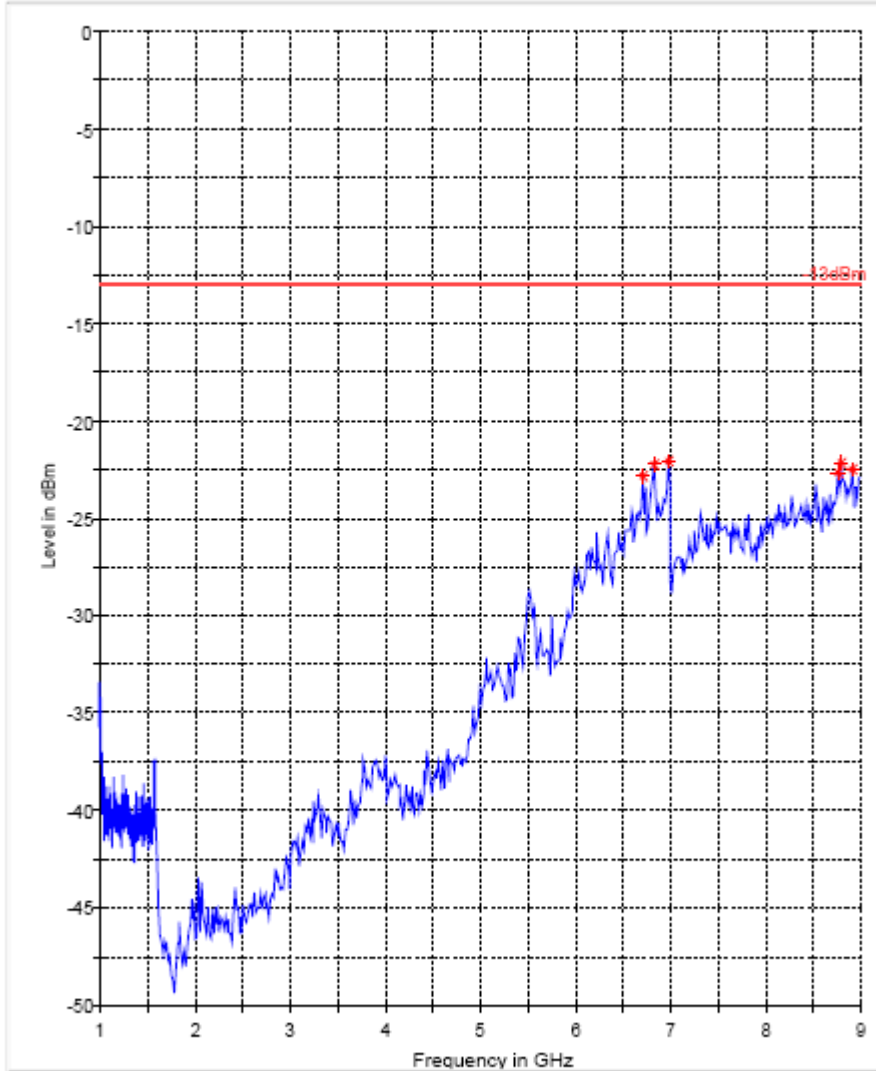
FCC 22 1-9GHz



— -13dBm.LimitLine — Preview Result 1 * Data Reduction 1 [2]

FCC 22 1-9GHz Mid Channel

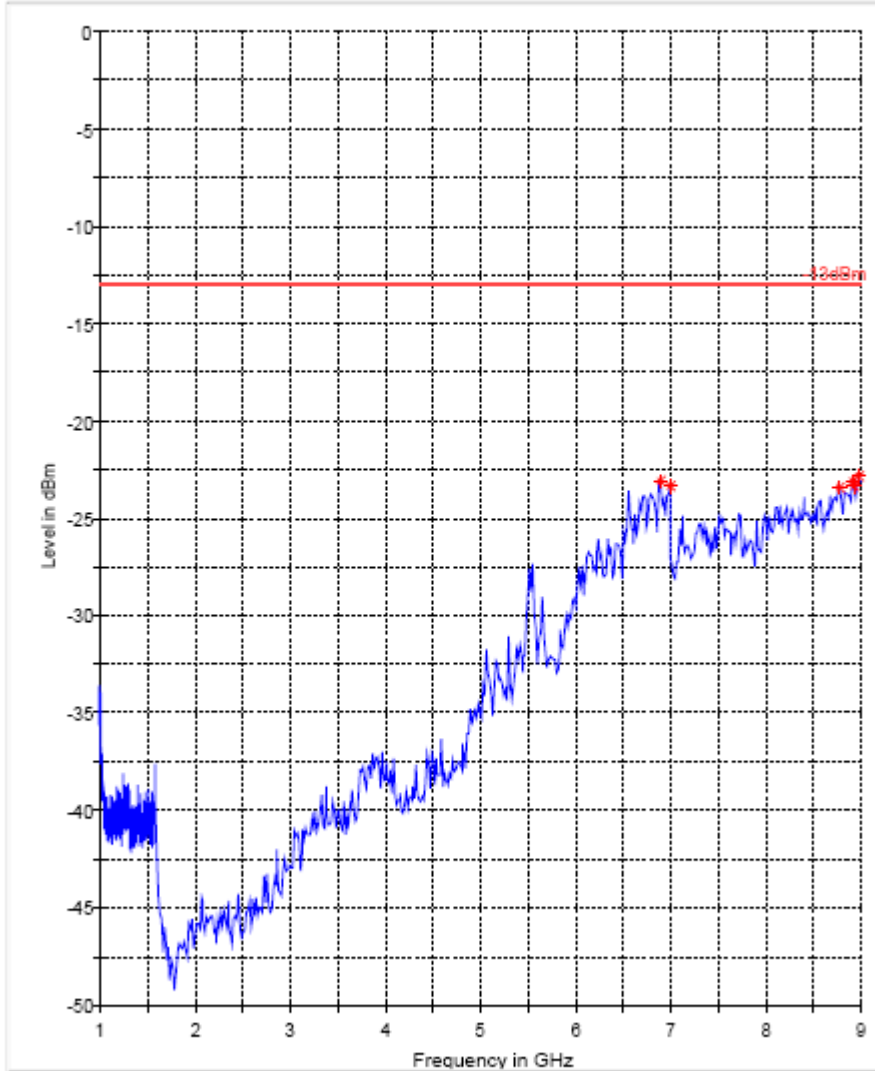
FCC 22 1-9GHz



— -13dBm.Limit.Line — Preview Result 1 * Data Reduction 1 [2]

FCC 22 1-9GHz High Channel

FCC 22 1-9GHz



— -13dBm.Limit.Line — Preview Result 1 * Data Reduction 1 [2]

5.4.5.2 Test Results Transmitter Spurious Emission UMTS FDDV

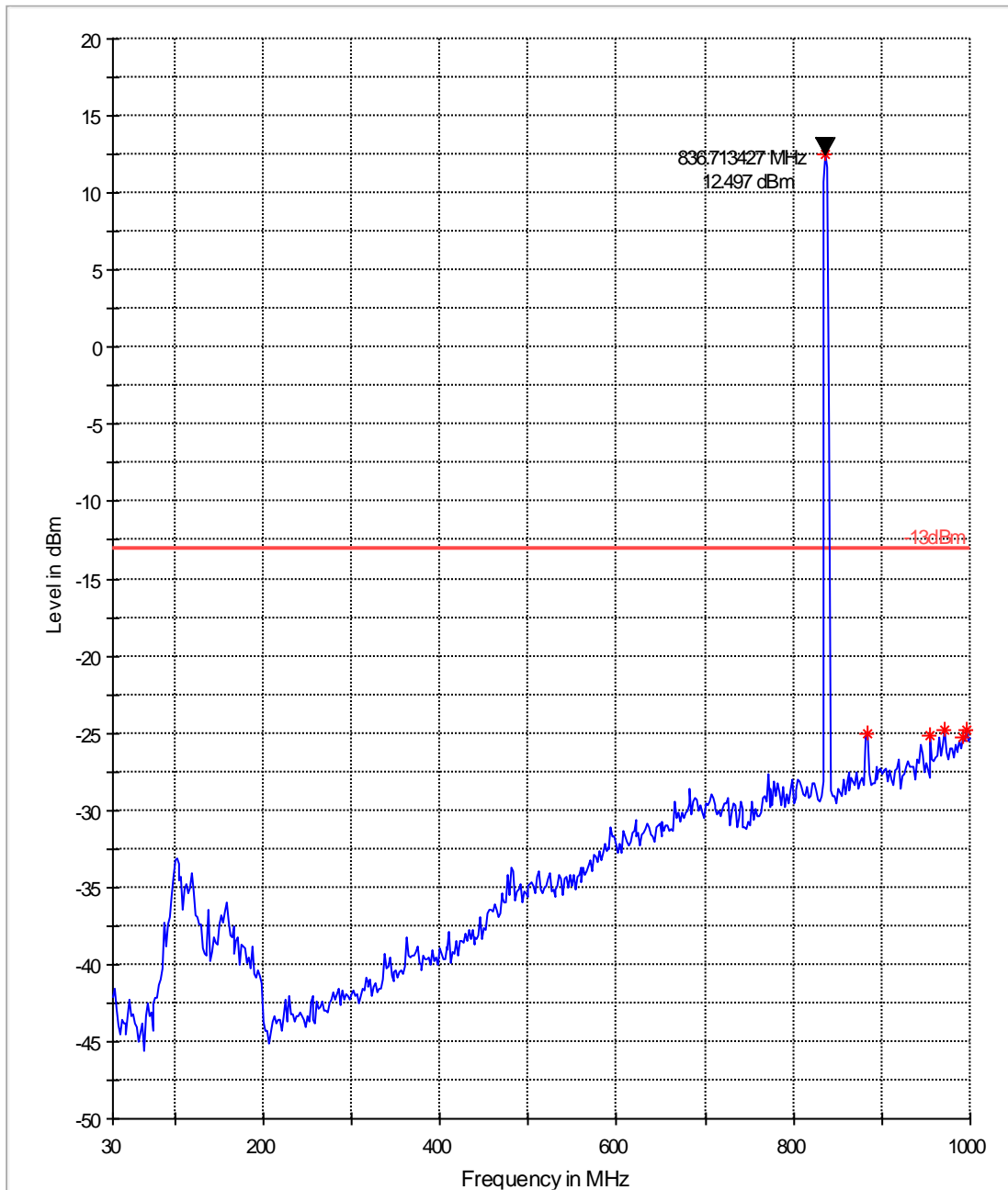
Harmonic	Tx ch-4132 Freq. (MHz)	Level (dBm)	Tx ch-4183 Freq. (MHz)	Level (dBm)	Tx ch-4233 Freq. (MHz)	Level (dBm)
1	826.4	-	836.6	-	846.6	-
2	1652.8	NF	1673.2	NF	1693.2	NF
3	2479.2	NF	2509.8	NF	2539.8	NF
4	3305.6	NF	3346.4	NF	3386.4	NF
5	4132	NF	4183	NF	4233	NF
6	4958.4	NF	5019.6	NF	5079.6	NF
7	5784.8	NF	5856.2	NF	5926.2	NF
8	6611.2	NF	6692.8	NF	6772.8	NF
9	7437.6	NF	7529.4	NF	7619.4	NF
10	8264	NF	8366	NF	8466	NF
NF= Noise Floor						

Radiated Spurious Emissions (UMTS FDDV)

Note – Worst case plot

FCC 22 30-1000MHz Mid Channel

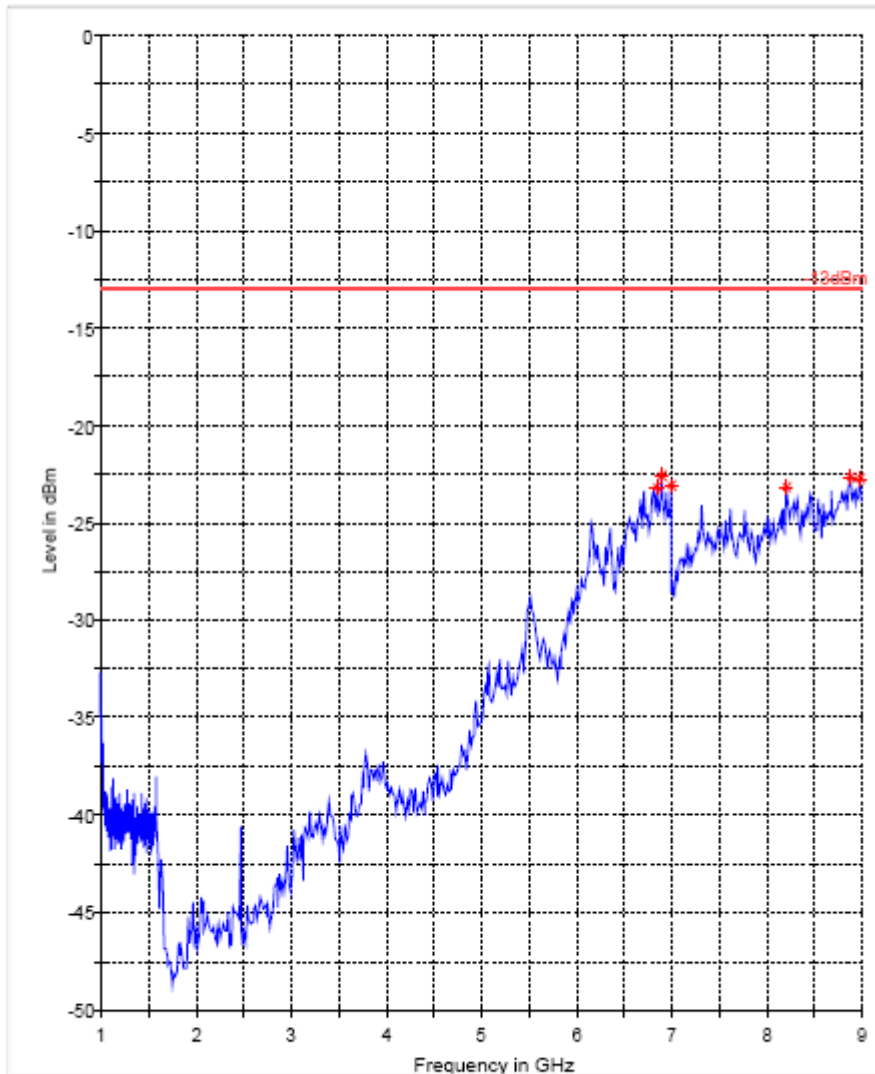
FCC 22 30-1000MHz



— -13dBmLimitLine — PreviewResult 1 * Data Reduction 1 [1]

FCC 22 1-9GHz Low Channel

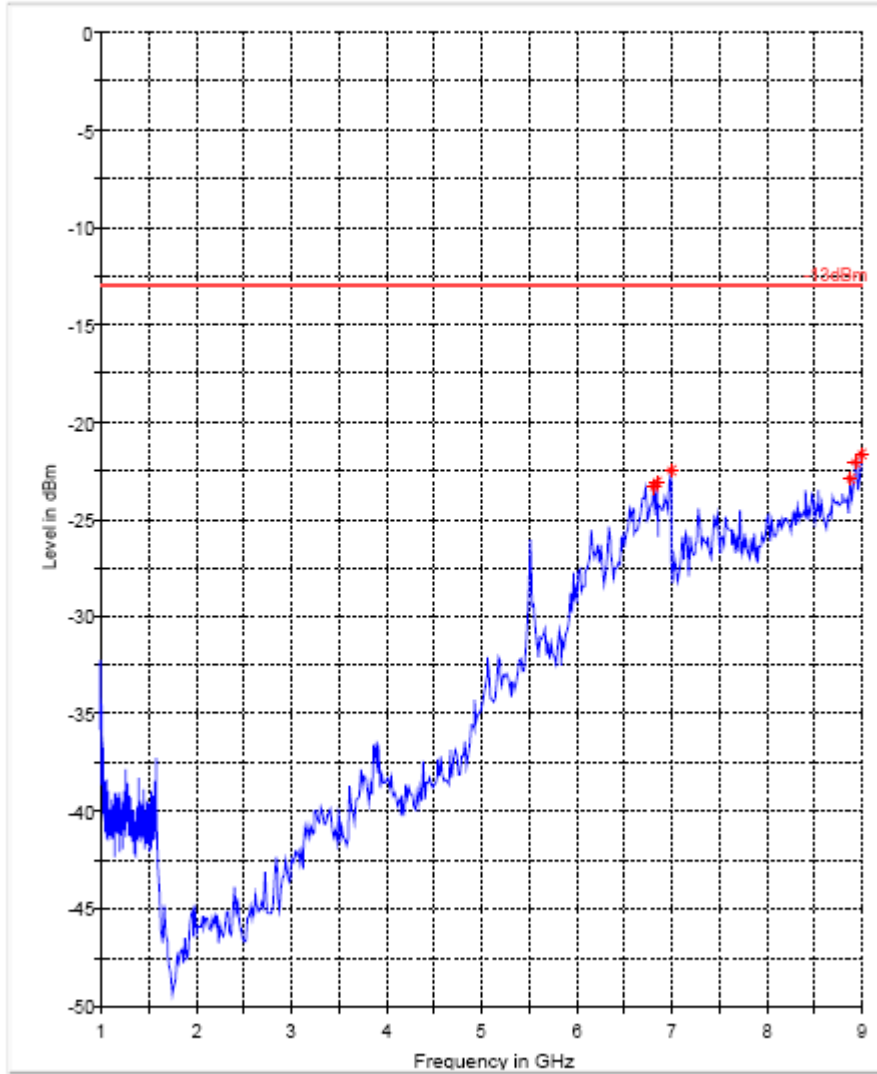
FCC 22 1-9GHz



-13dBm.LimitLine Preview Result 1 * Data Reduction 1 [2]

FCC 22 1-9GHz Mid Channel

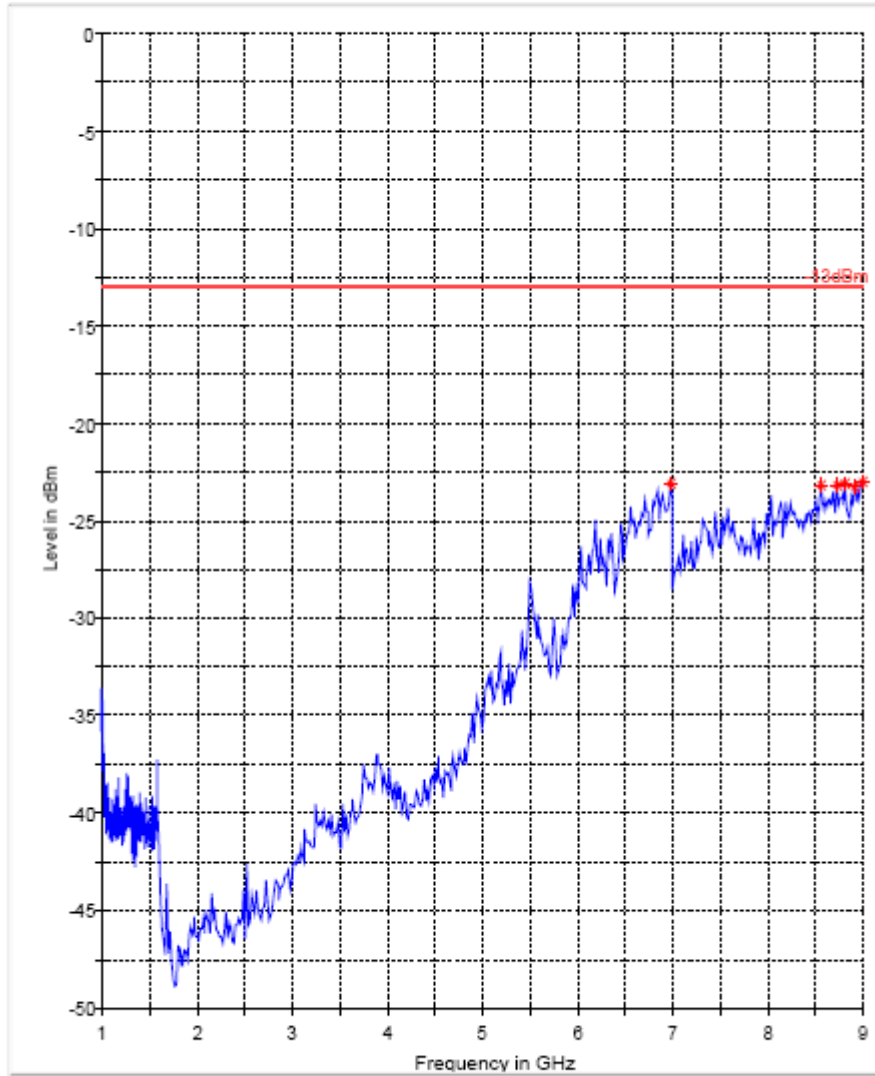
FCC 22 1-9GHz



— -13dBm.Limit.Line — Preview Result 1 * Data Reduction 1 [2]

FCC 22 1-9GHz High Channel

FCC 22 1-9GHz



— -13dBm.LimitLine — Preview Result 1 * Data Reduction 1 [2]

5.4.5.3 Test Results Transmitter Spurious Emission PCS-1900:

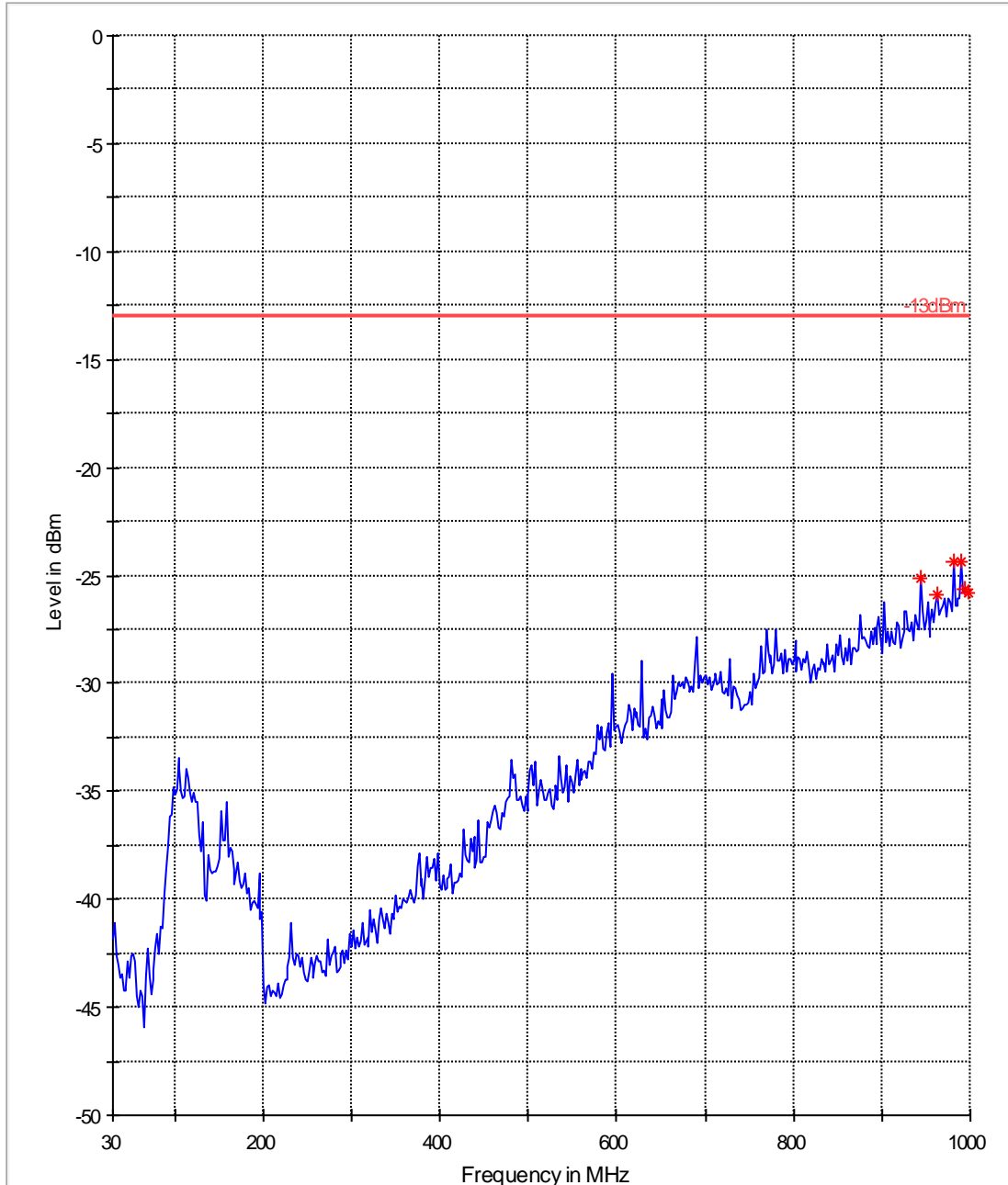
Harmonic	Tx ch-512 Freq.(MHz)	Level (dBm)	Tx ch-661 Freq. (MHz)	Level (dBm)	Tx ch-810 Freq. (MHz)	Level (dBm)
1	1850.2	-	1880.0	-	1909.8	-
2	3700.4	NF	3760	NF	3819.6	NF
3	5550.6	NF	5640	NF	5729.4	NF
4	7400.8	NF	7520	NF	7639.2	NF
5	9251	NF	9400	NF	9549	NF
6	11101.2	NF	11280	NF	11458.8	NF
7	12951.4	NF	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						

Radiated Spurious Emissions (PCS 1900) Tx:

Note – Worst case plot

FCC 24 30-1000MHz Mid Channel

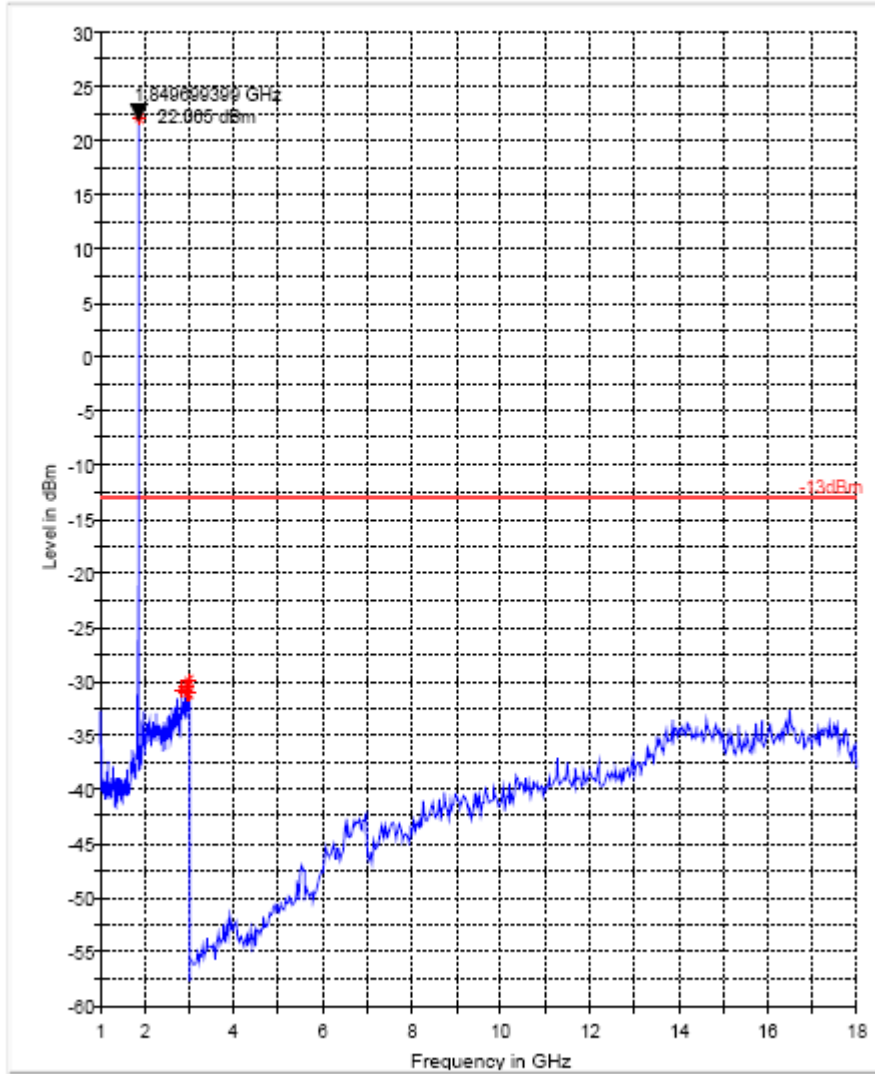
FCC 22 30-1000MHz



— -13dBmLimitLine — PreviewResult 1 * Data Reduction 1 [1]

FCC 24 1-18GHz Low Channel

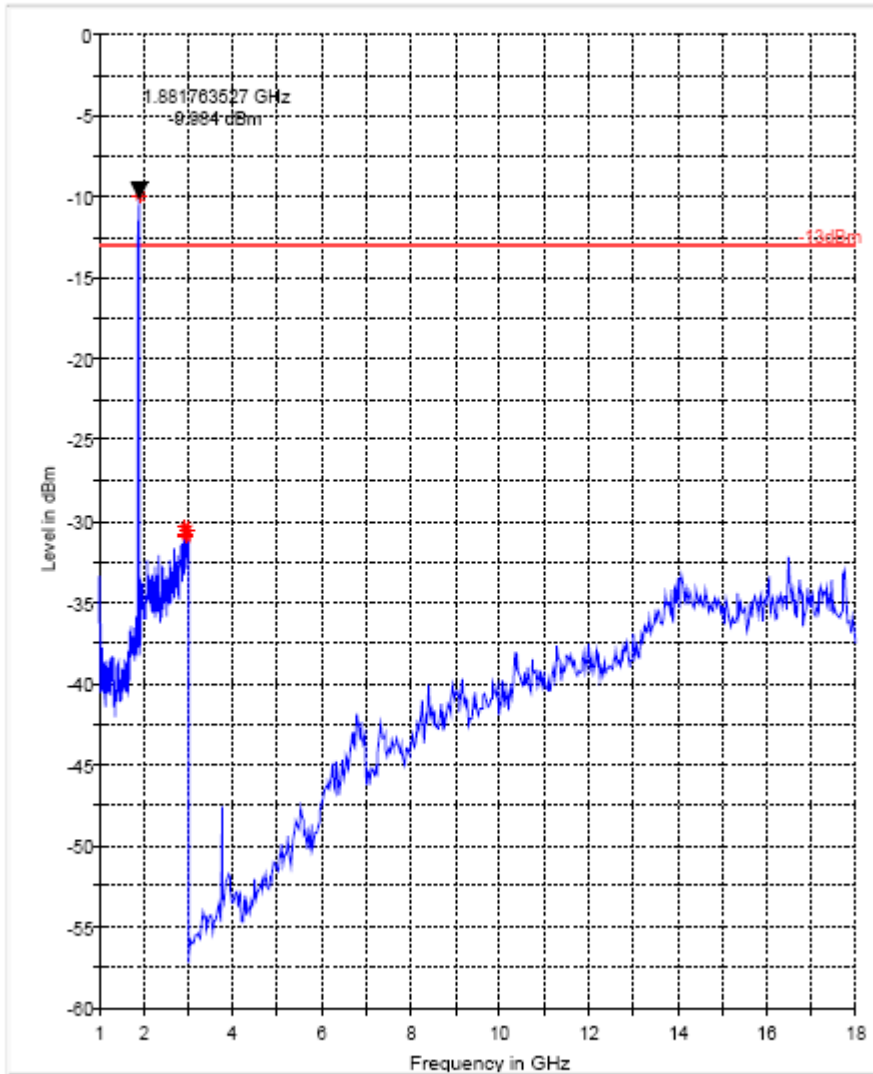
FCC 24 1-18GHz



-13dBm.Limit.Line Preview Result 1 * Data Reduction 1 [2]

FCC 24 1-18GHz Mid Channel

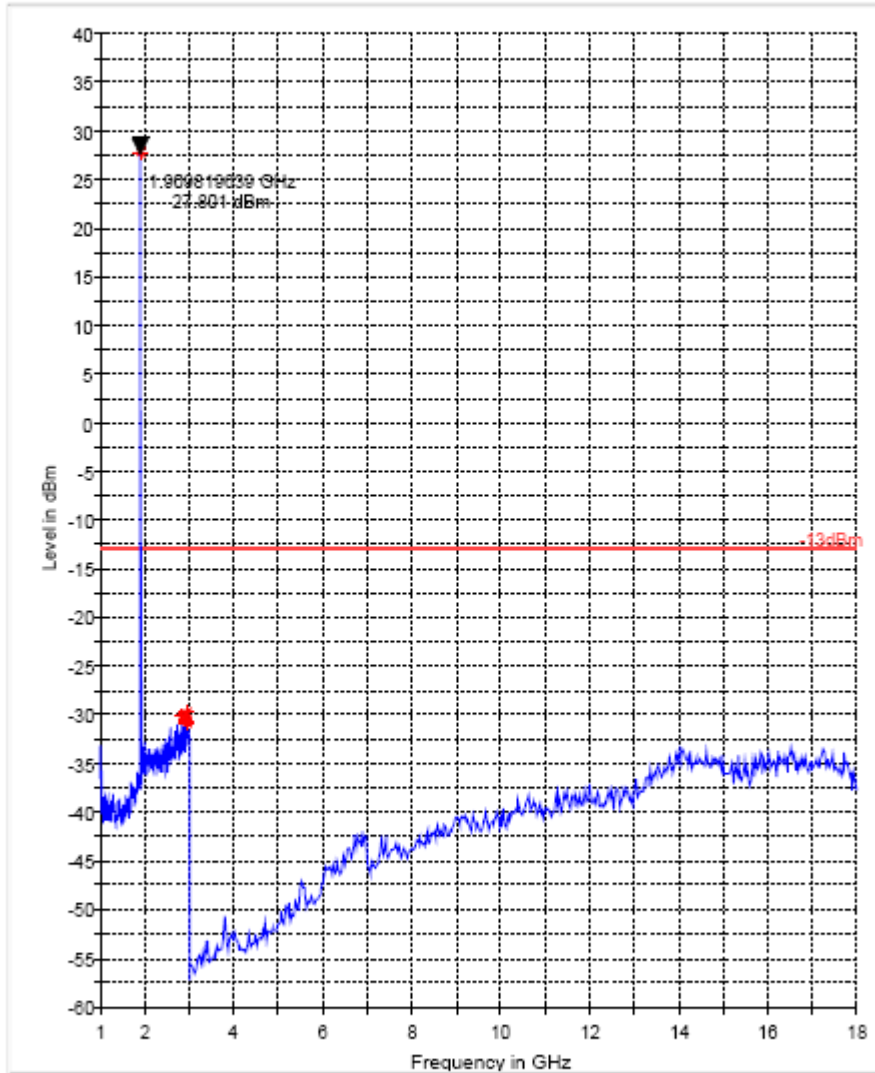
FCC 24 1-18GHz



— -13dBm.Limit.Line — Preview Result 1 * Data Reduction 1 [2]

FCC 24 1-18GHz High Channel

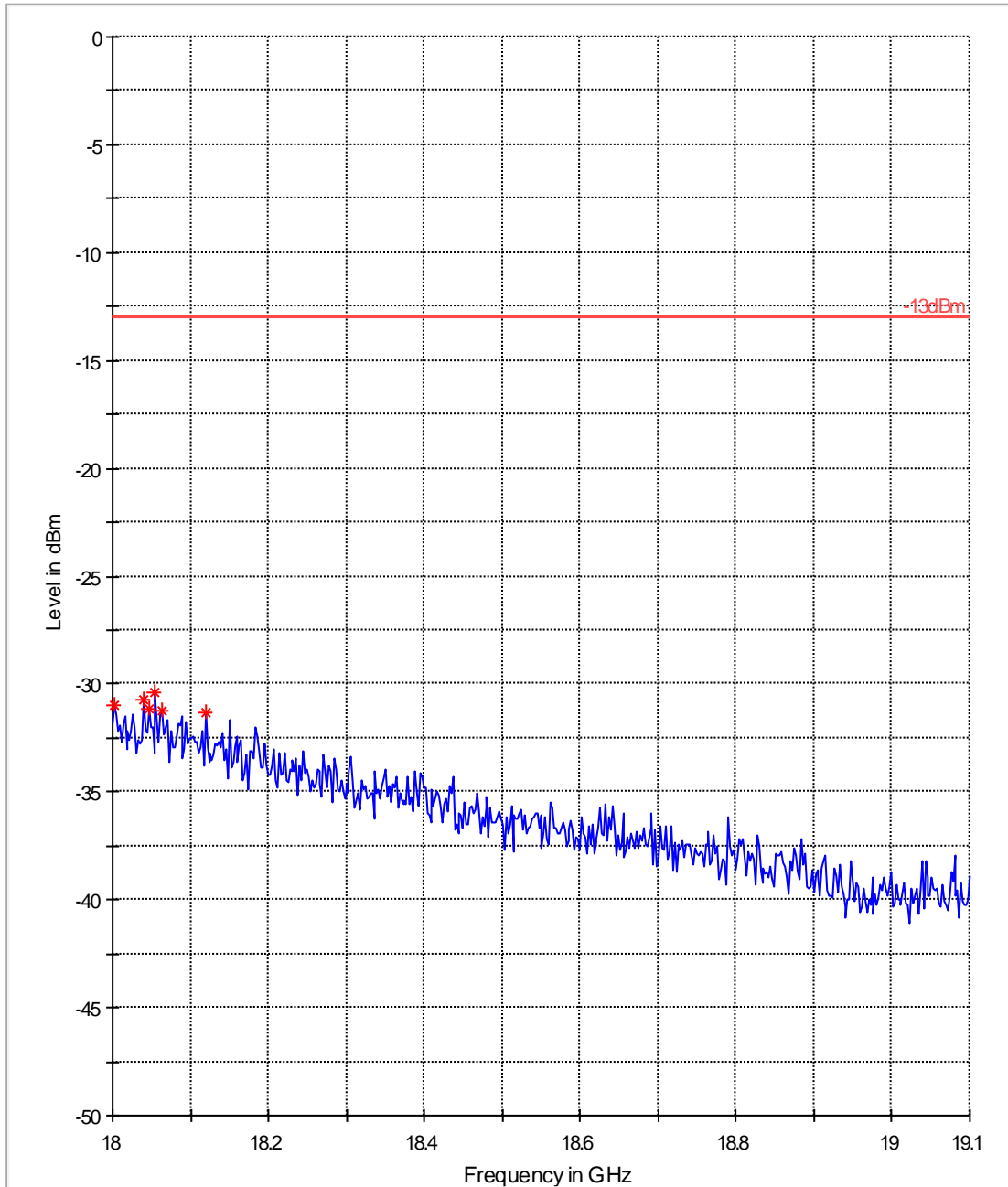
FCC 24 1-18GHz



— -13dBm.LimLine — Preview Result 1 * Data Reduction 1 [2]

FCC 24 18-19GHz Mid Channel

FCC 24 18-19.1GHz



— -13dBmLimitLine — PreviewResult 1 * Data Reduction1 [4]

5.4.5.4 Test Results Transmitter Spurious Emission UMTS FDD2:

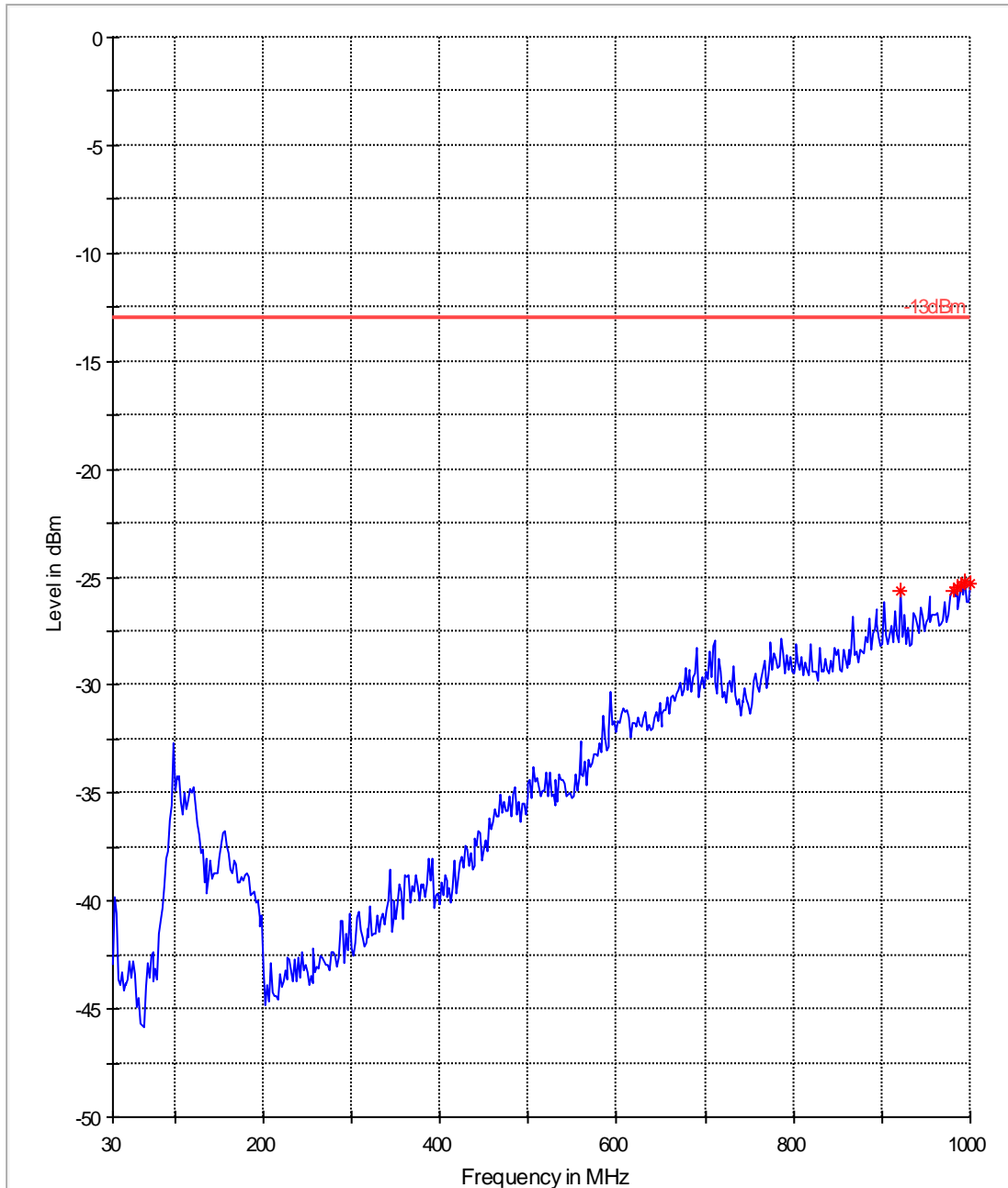
Harmonic	Tx ch-9262 Freq. (MHz)	Level (dBm)	Tx ch-9400 Freq. (MHz)	Level (dBm)	Tx ch-9538 Freq. (MHz)	Level (dBm)
1	1852.4	-	1880.0	-	1907.6	-
2	3704.8	NF	3760	NF	3815.2	NF
3	5557.2	NF	5640	NF	5722.8	NF
4	7409.6	NF	7520	NF	7630.4	NF
5	9262	NF	9400	NF	9538	NF
6	11114.4	NF	11280	NF	11445.6	NF
7	12966.8	NF	13160	NF	13353.2	NF
8	14819.2	NF	15040	NF	15260.8	NF
9	16671.6	NF	16920	NF	17168.4	NF
10	18524	NF	18800	NF	19076	NF
NF= Noise Floor						

Radiated Spurious Emissions (UMTS FDDII) Tx:

Note – Worst case plot

FCC 24 30-1000MHz Mid Channel

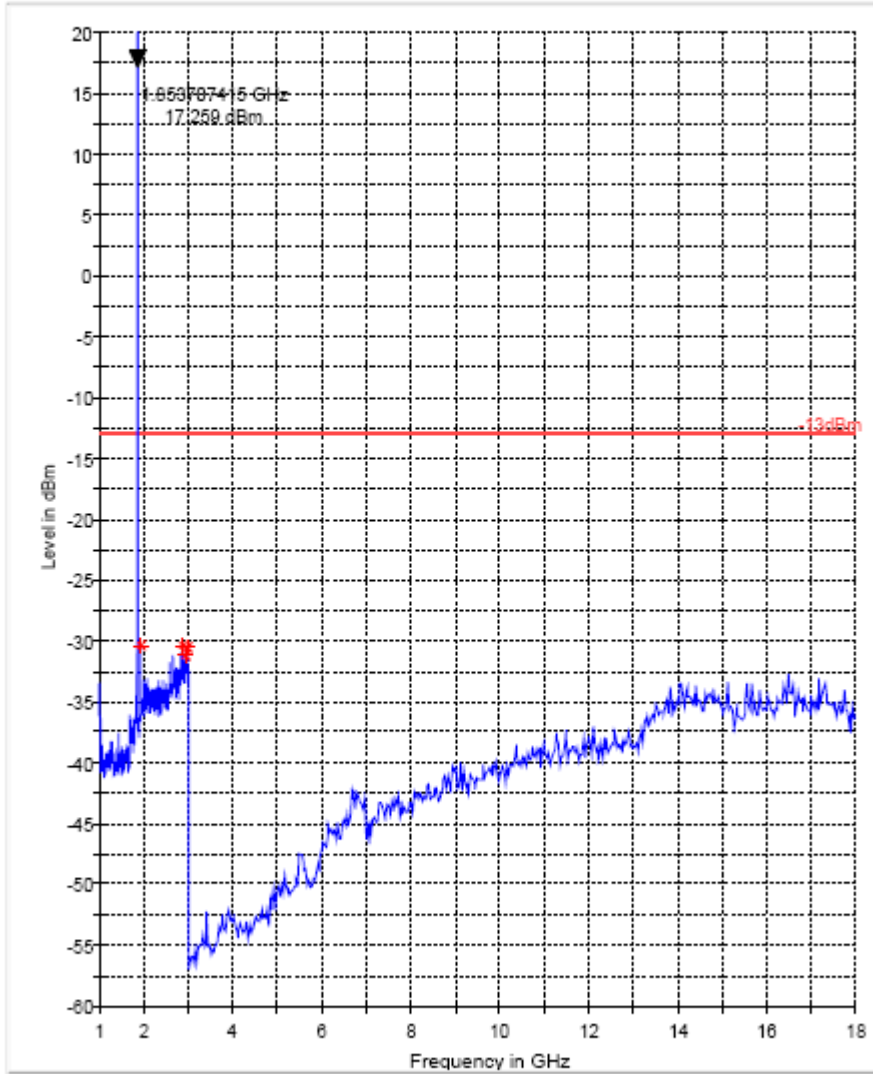
FCC 22 30-1000MHz



— -13dBmLimitLine — PreviewResult 1 * Data Reduction1 [1]

FCC 24 1-18GHz Low Channel

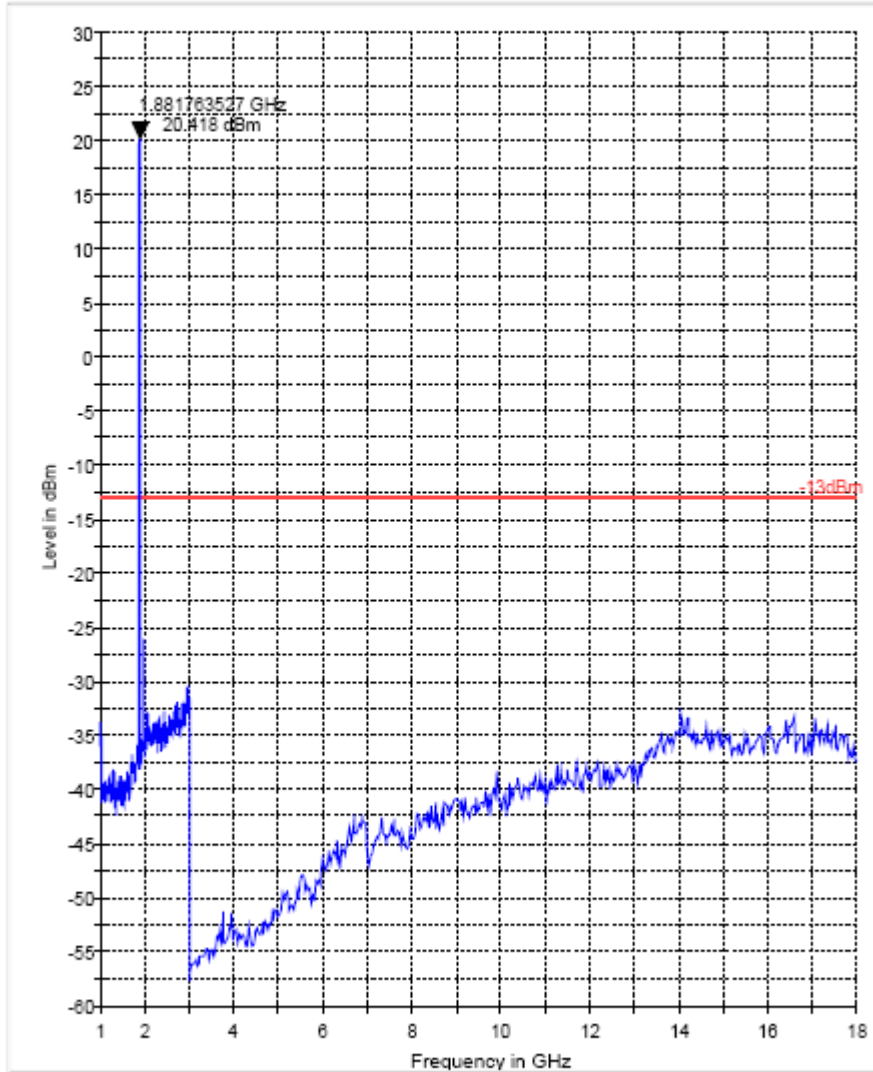
FCC 24 1-18GHz



— -13dBm.Limit.Line — Preview Result 1 * Data Reduction 1 [2]

FCC 24 1-18GHz Mid Channel

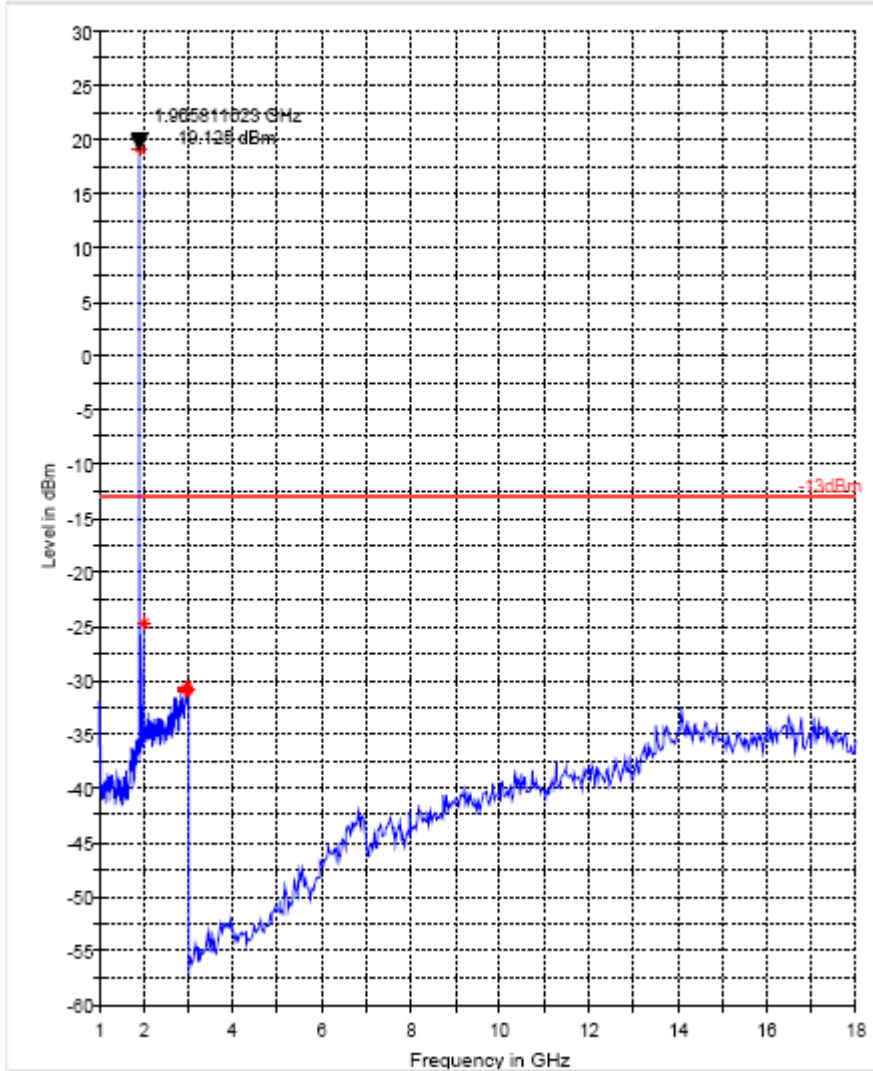
FCC 24 1-18GHz



— -13dBm Limit Line — Preview Result 1

FCC 24 1-18GHz High Channel

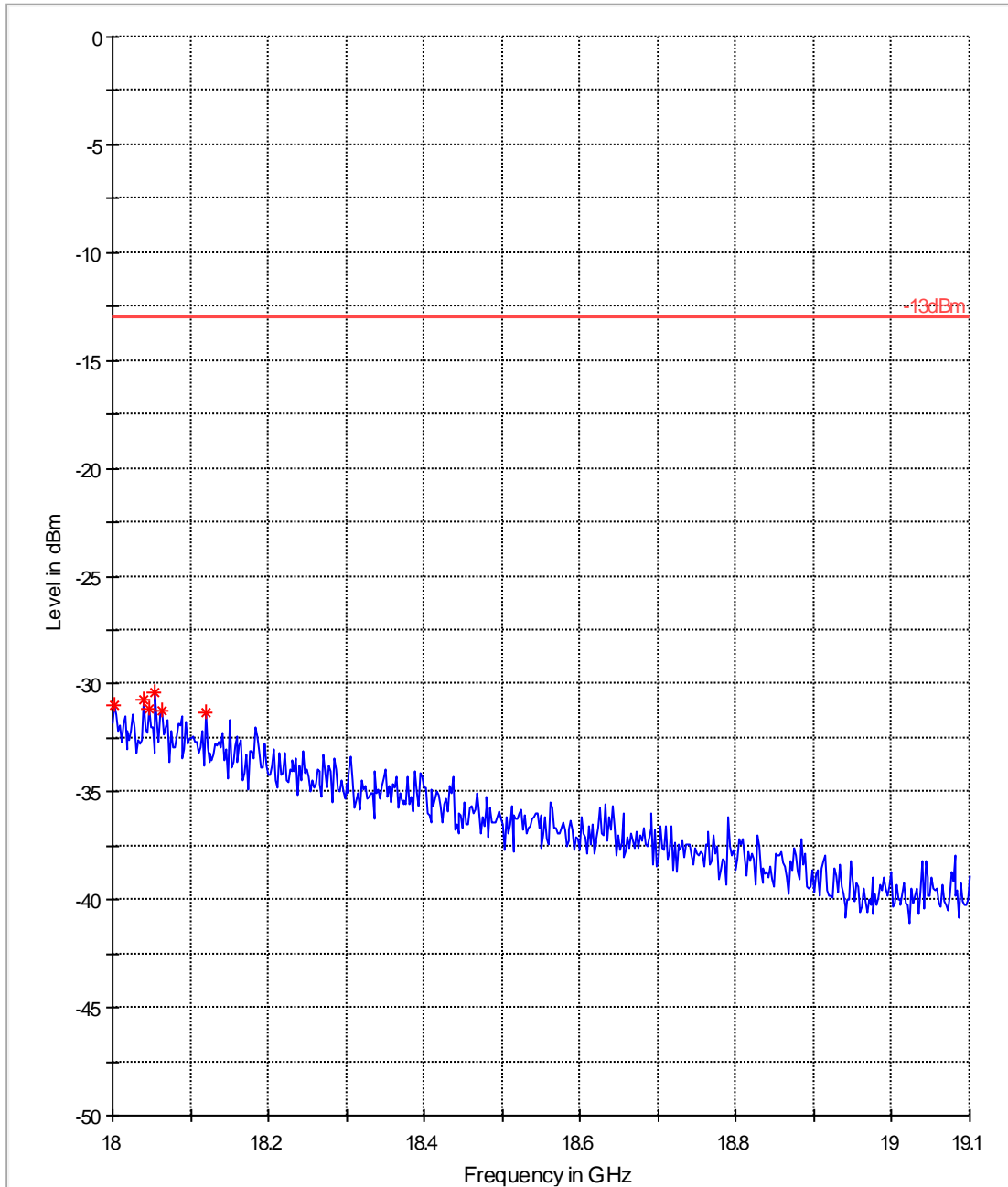
FCC 24 1-18GHz



— -13dBm Limit Line — Preview Result 1 * Data Reduction 1 [2]

FCC 24 18-19GHz Mid Channel

FCC 24 18-19.1GHz



— -13dBmLimitLine — PreviewResult 1 * Data Reduction1 [4]

5.4.6 Radiated out of band emissions results on EUT- Receive Mode:

5.4.6.1 References

FCC: CFR Part 15.109, 2.1053

IC: RSS 132 Section 4.6 and 6.6

5.4.6.2 §15.109 Radiated emission limits- Unintentional Radiators:

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field strength ($\mu\text{V/m}$)
30–88	100 (40dB $\mu\text{V/m}$)
88–216	150 (43.5 dB $\mu\text{V/m}$)
216–960	200 (46 dB $\mu\text{V/m}$)
Above 960	500 (54 dB $\mu\text{V/m}$)

(b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of emission (MHz)	Field strength ($\mu\text{V/m}$)
30–88	90
88–216	150
216–960	210
Above 960	300

5.4.6.3 Results

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

5.4.6.4 Test Results Receiver Spurious Emission

Receive Mode: 30MHz-1GHz

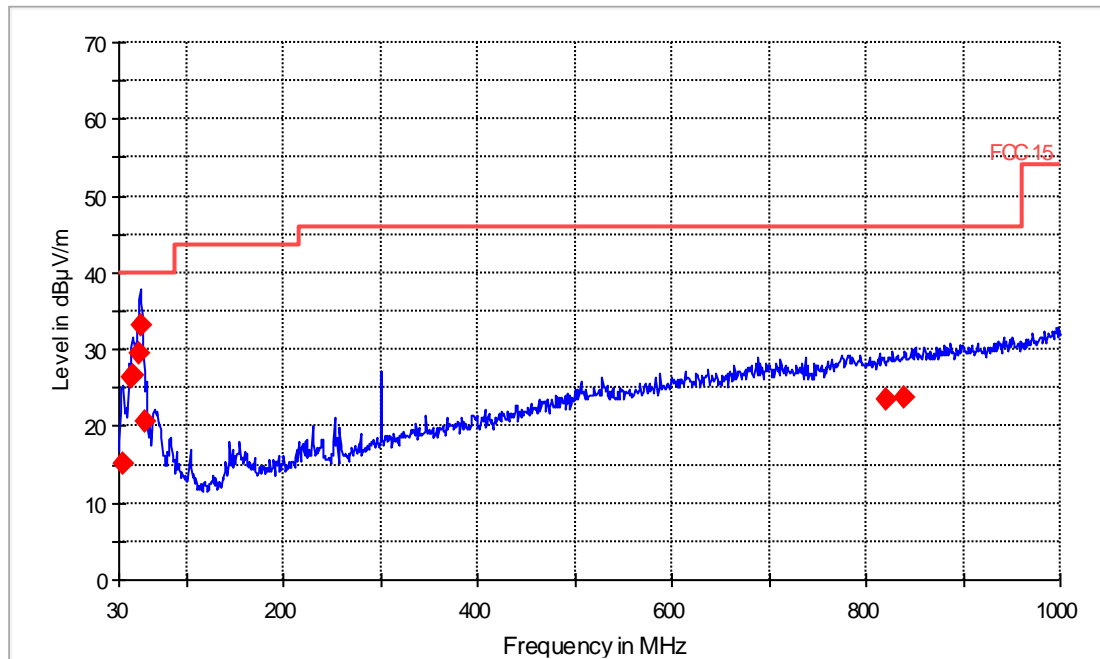
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
33.261812	15.2	20.000	120.000	120.0	V	30.0	6.8	24.8	40.0
41.383301	26.3	20.000	120.000	171.0	V	10.0	5.6	13.7	40.0
45.129578	26.7	20.000	120.000	120.0	V	0.0	6.1	13.3	40.0
49.828667	29.5	20.000	120.000	120.0	V	0.0	6.7	10.5	40.0
52.834479	33.2	20.000	120.000	120.0	V	0.0	7.1	6.8	40.0
56.887578	20.5	20.000	120.000	162.0	V	30.0	7.5	19.5	40.0
819.569454	23.5	20.000	120.000	120.0	V	128.0	25.4	22.5	46.0
839.553155	23.9	20.000	120.000	184.0	V	144.0	25.7	22.1	46.0

(continuation of the "Final Result 1" table from column 10 ...)

Frequency (MHz)	Comment
33.261812	
41.383301	
45.129578	
49.828667	
52.834479	
56.887578	
819.569454	
839.553155	

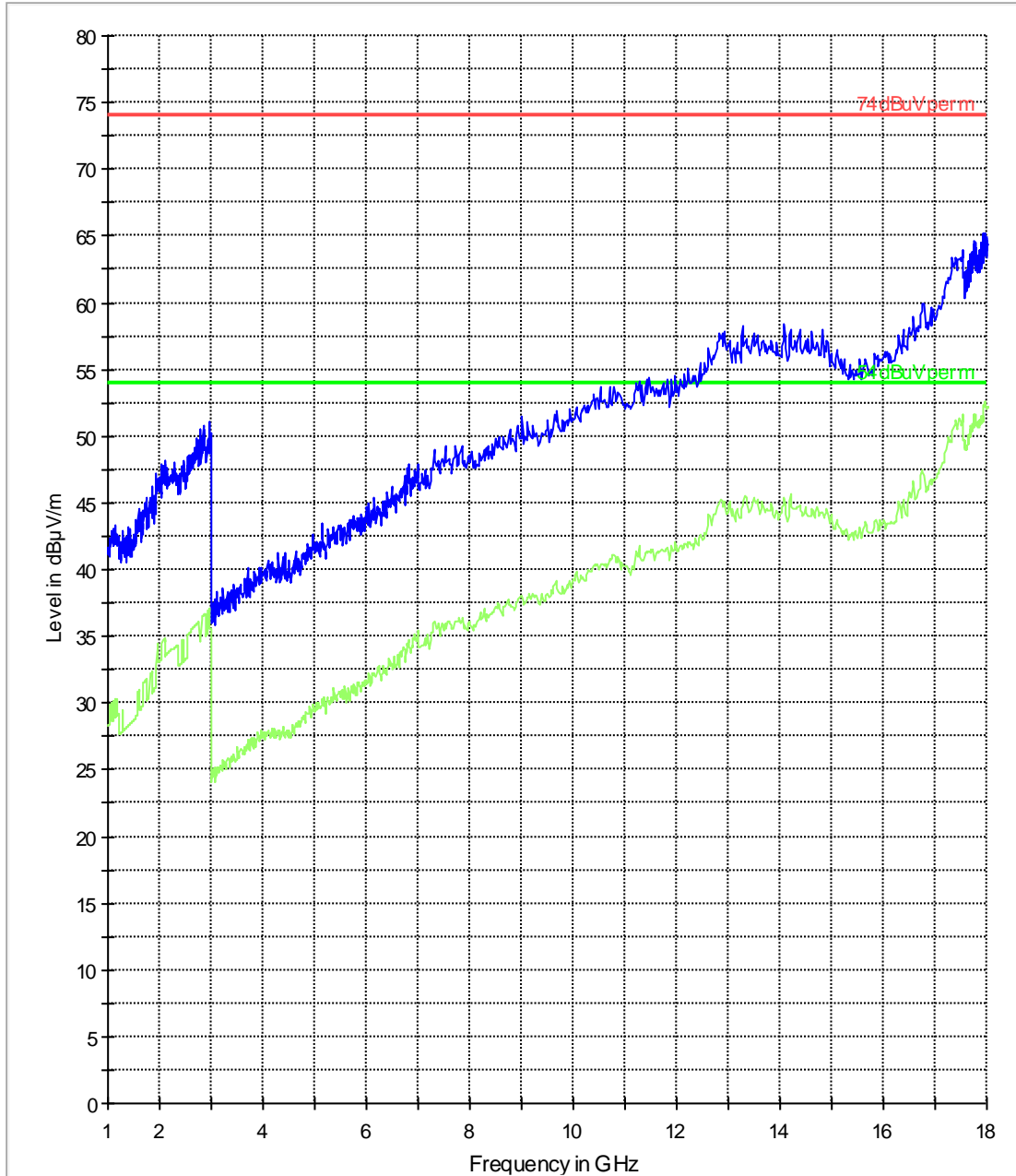
FCC 1530-1000MHz



— FCC 15 Limit Line — Preview Result 1 ◆ Final Result 1

Receive Mode: 1GHz-18GHz

FCC 151-18GHz



- 74 dBuV per mLimitLine
- 54 dBuV per mLimitLine
- Preview Result 1
- Preview Result 2

5.5 AC Power Line Conducted Emissions

5.5.1 §15.207 Conducted limits- Intentional Radiators:

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator 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 μ H/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.

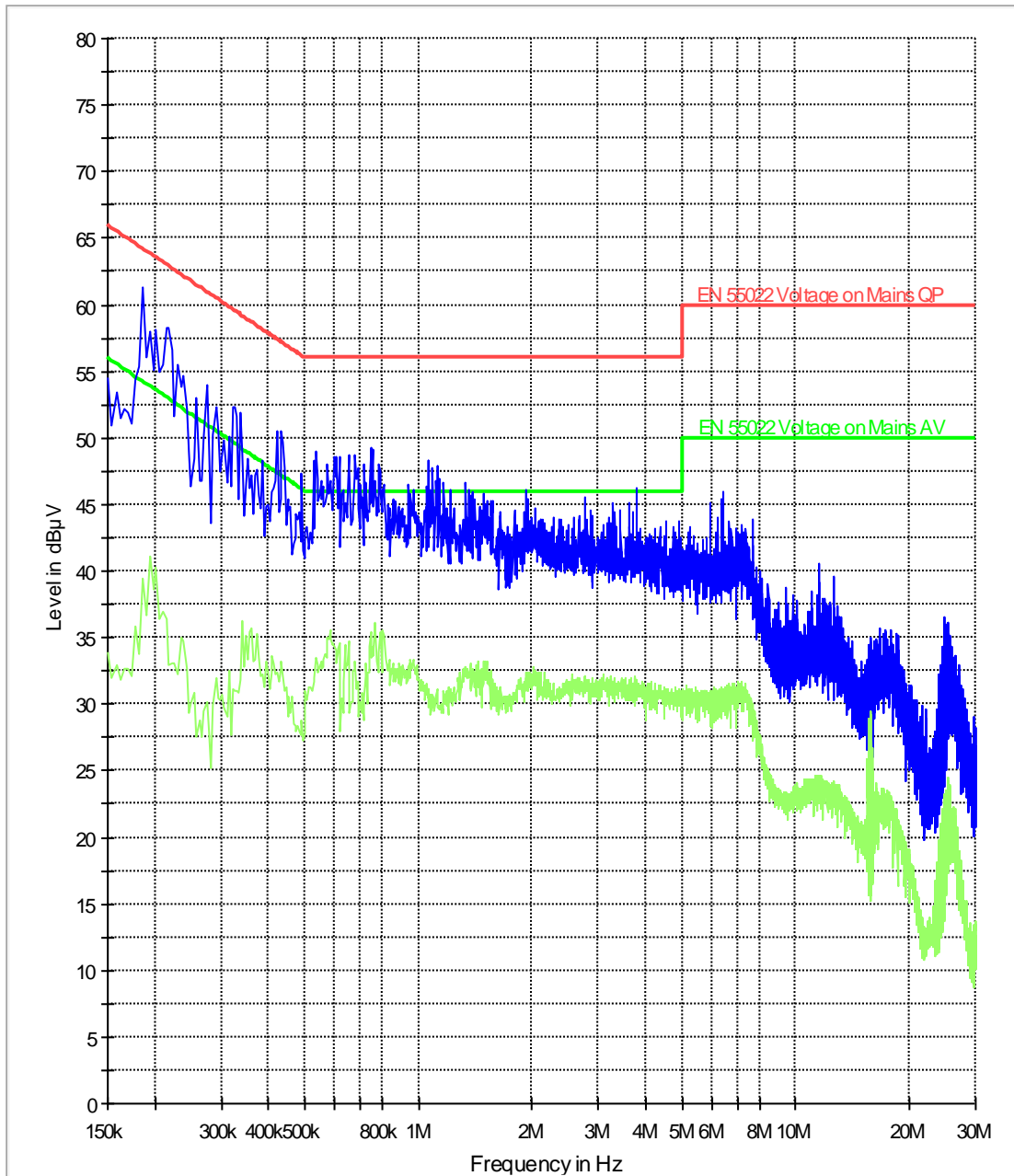
Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

Analyzer Settings: RBW = 10KHz; VBW = 10KHz

5.5.2 Test Results:

CISPR 22 Mains Conducted



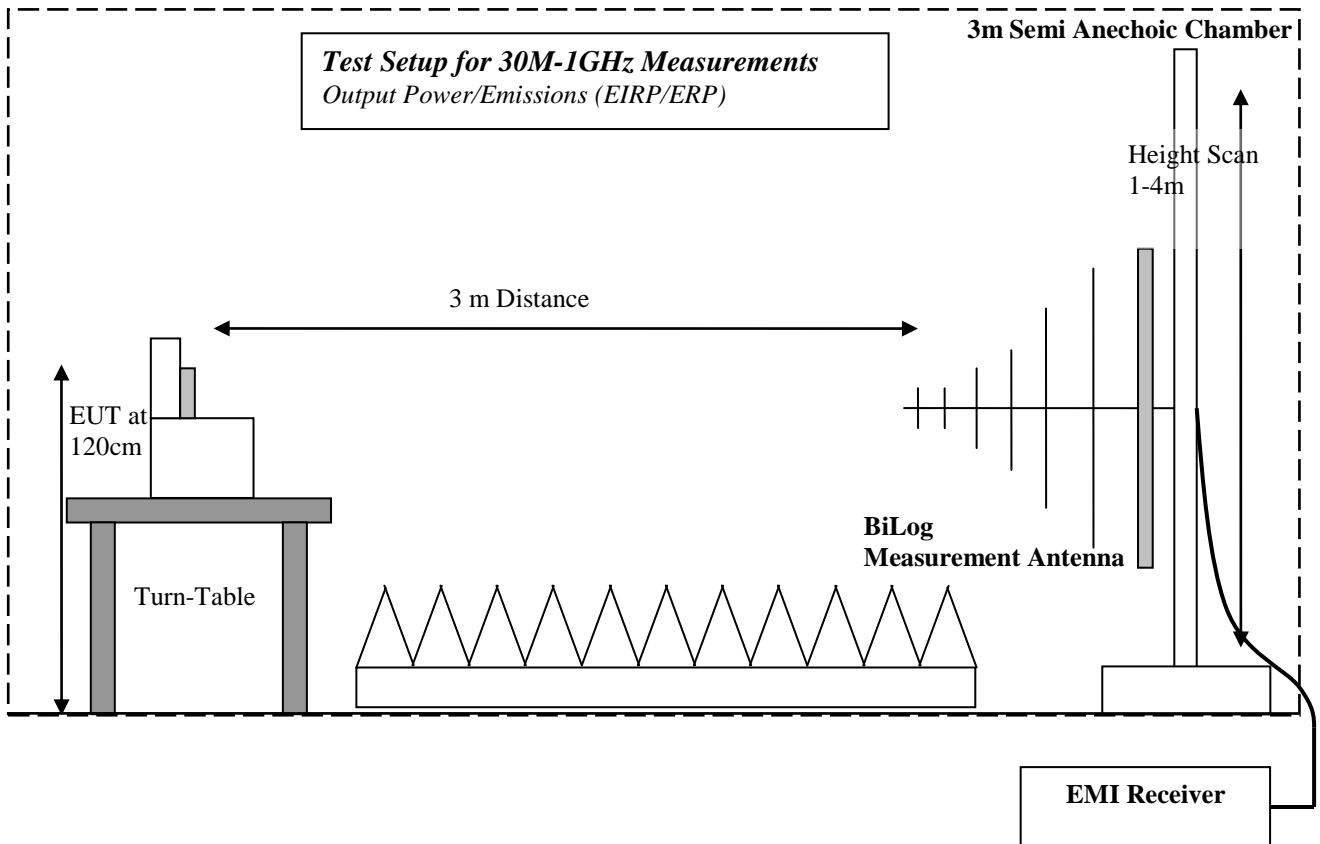
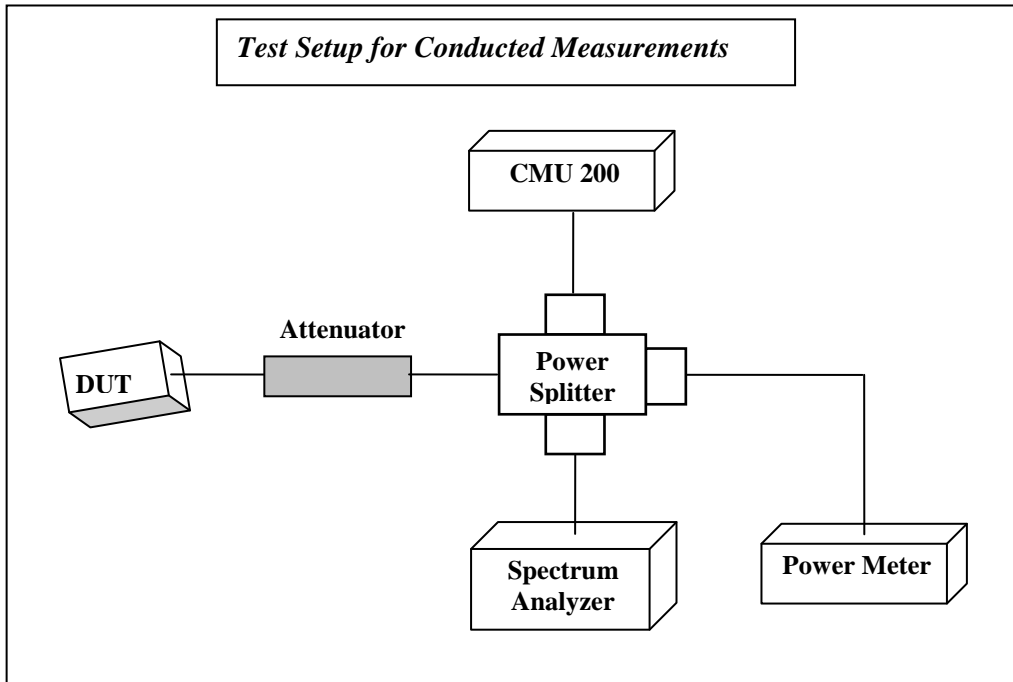
— EN 55022 Voltage on Mains QP Limit Line
— Preview Result 1

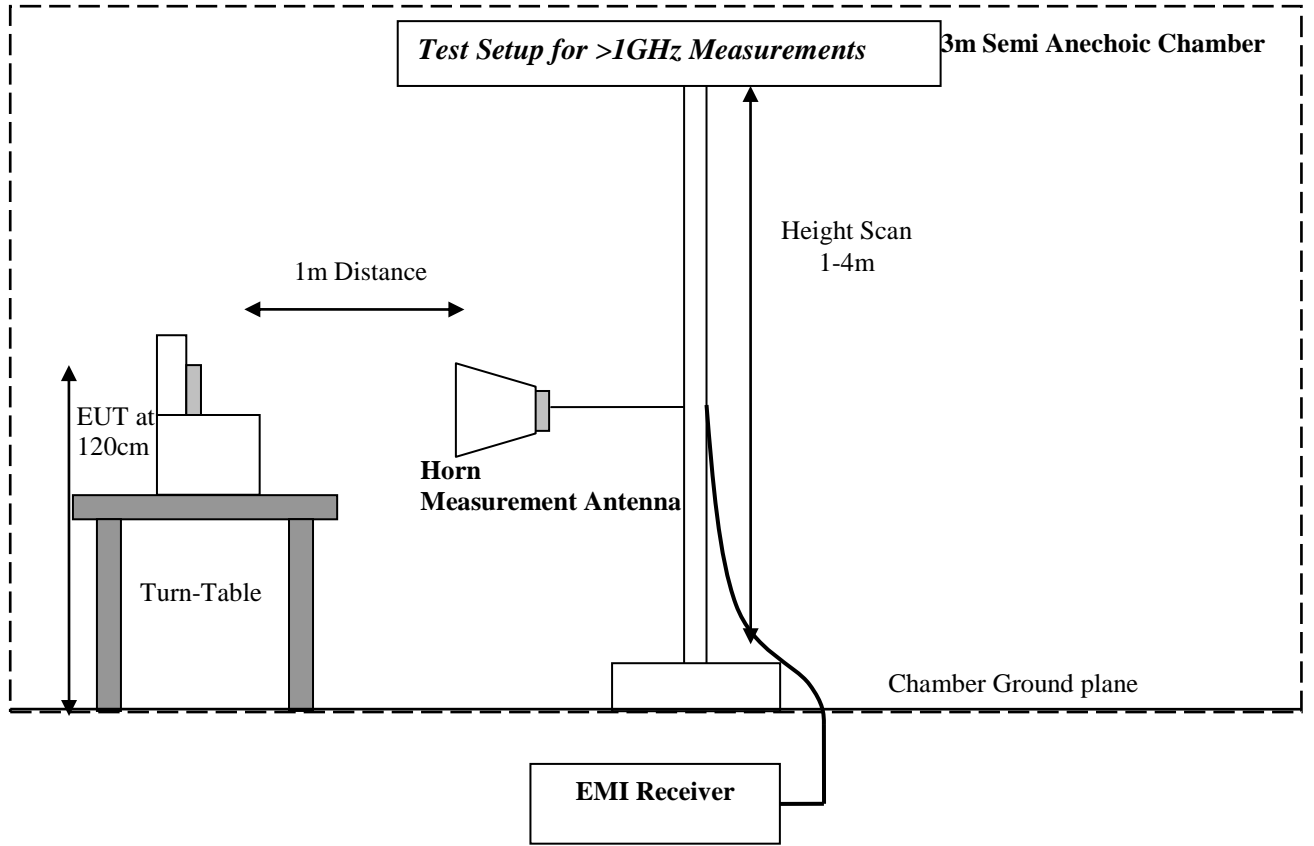
— EN 55022 Voltage on Mains AV Limit Line
— Preview Result 2

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 2010	1 year
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	May 2010	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2010	1 year
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02	May 2010	1 year
05	Biconilog Antenna	3141	EMCO	0005-1186	June 2010	1 year
06	Horn Antenna (1-18GHz)	SAS-200/571	AH Systems	325	June 2010	1 year
07	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240	June 2010	1 year
08	Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
09	Climatic Chamber	VT4004	Voltsch	G1115	May 2010	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 2010	1 year
13	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807	May 2010	1 year
14	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008	May 2010	1 year
15	Universal Radio Comm. Tester	CMU 200	Rohde & Schwarz	832221/06	May 2010	1 year
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2010	1 year
17	Loop Antenna	6512	EMCO	00049838	July 2010	2 years

7 Block Diagrams





8 Revision History

Date	Report Name	Changes to report	Report prepared by
2010-02-18	EMC_APPLE_055_FCC22_24	Original	Marc
2010-03-01	EMC_APPLE_055_FCC22_24_Rev1	Modulations updated. GSM replaced with GPRS. Plot on pg 35 updated. 19GHz plots added.	Marc