FCC Test Report

FCC Part 22, 24 / RSS 132, 133

For the

Multi-Tech Systems, Inc.

Model Number:

MTSMC-G2-GP, MTSMC-G2, MTSMC-G2-V, MTSMC-G2-IP

FCC ID: AU792U09D24824
IC ID: 125A-0033

TEST REPORT #: EMC_MULTI_039_09001_FCC22_24
DATE: 2009-06-30

ilac-MRA 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

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Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May

Table of Contents

1 Assessment

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

Company	Description	Model #
Multi-Tech Systems, Inc.	**SocketModem GSM**	**MTSMC-G2-GP, MTSMC-G2, MTSMC-G2-V, MTSMC-G2-IP**

Technical responsibility for area of testing:

Date	Section	Name	Signature
2009-06-30	EMC & Radio	Marc Douat (EMC Project Engineer)	Marc Douat I am approving this document

This report is prepared by:

Date	Section	Name	Signature
2009-06-30	EMC & Radio	Ahmad Safdari (EMC Project Engineer)	Ahmad Safdari Digitally signed by Ahmad Safdari Reason: I am the author of this document

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.

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 and IC ID.

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
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Responsible Test Lab Manager:	Mar Douat
Responsible Project Leader:	Ahmad Safdari
Date of test:	2009-06-15 to 2009-06-17

2.2 Identification of the Client

Applicant's Name:	Multi-Tech Systems, Inc.
Address Line 1:	2205 Woodale Drive
Address Line 2:	
City/ Zip Code	Mounds View, MN 55112
Country:	U.S.A
Contact Person:	Thomas Hofstede
Phone No.:	763.717.5505
Fax:	763.717.5814
e-mail:	thofstede@multitech.com

2.3 Identification of the Manufacturer

Same as above client.

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name of EUT (if not same as Model No.)	**SocketModem GSM**
Description	**GSM/GPRS Modem**
Model No.	**MTSMC-G2-GP, MTSMC-G2, MTSMC-G2-V, MTSMC-G2-IP**
FCC-ID	**FCC ID: AU792U09D24824**
IC-ID (Industry Canada)	**IC ID: 125A-0033**
Frequency Range:	**824.2MHz – 848.8MHz for GSM 850** **1850.2MHz – 1909.8MHz for PCS 1900**
Type(s) of Modulation:	**GMSK**
Number of Channels:	**124 for GSM-850, 299 for PCS-1900**
Antenna Type:	**Quad Band 2.0dBi**
Max. Output Power:	**Radiated : see section 5.1.5 and 5.1.6.** **29.4**dBm (1.425W) @ GSM 848.8MHz **ERP values** **31.7**dBm (1.479W) @ PCS 1909MHz **EIRP values**

3.2 Identification of the Equipment Under Test (EUT)

EUT #	TYPE	MANF.	MODEL	SERIAL #
1	EUT	Multi-Tech Systems Inc	MTSMC-G2-GP, MTSMC-G2, MTSMC-G2-V, MTSMC-G2-IP	N/A

3.3 Identification of Accessory equipment

AE #	TYPE	MANF.	MODEL	SERIAL #
1	AC/DC ADAPTER	GlobTek Inc.	GT-410521509	N/A
2	Developer Board	Multi-Tech	MTSMI-UDK	13715986
3	Headset	Votronics	N/A	N/A

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 Quad band antenna used with 2dBi gain.

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 and Industry Canada rules RSS132 and RSS133.

This EUT contains an FCC approved module with the FCC ID: **09EWMP100** and IC ID: **3651C-WMP100.** This report refers mainly to the radiated measurements in GSM technology.

In addition, measurements are made at -40C, 60C, 70C, 80 and 85C to determine Frequency Stability under these conditions. Findings confirm that the EUT complies.

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.

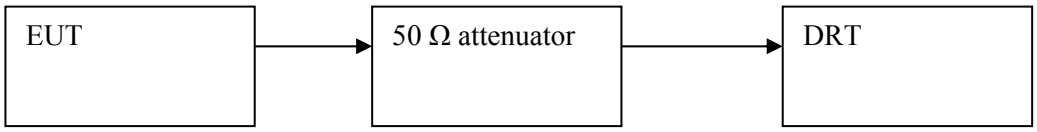
5.1.2.2 FCC 24.232 (b)(c) Power limits.

(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

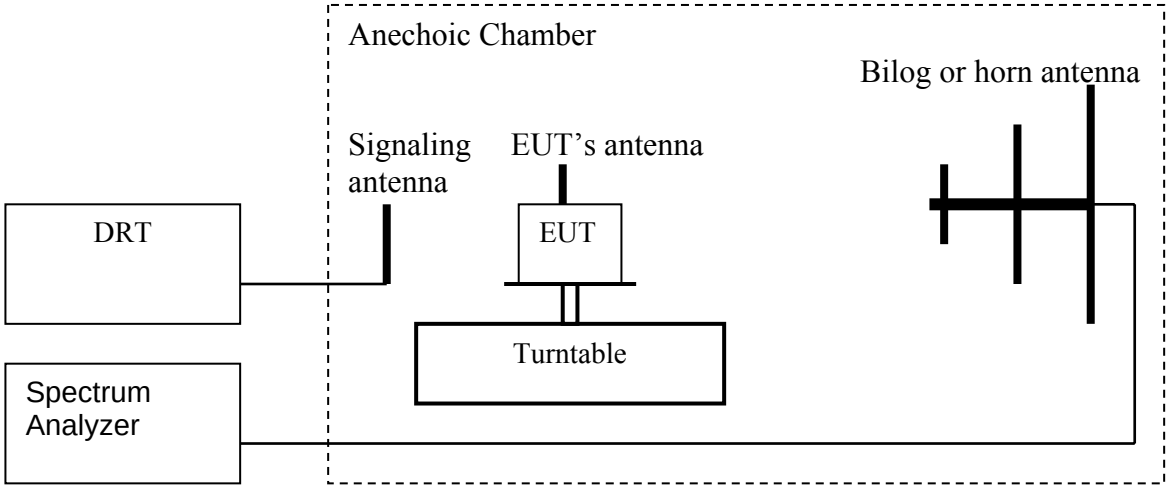
2.2.1 Conducted Carrier Output Power Rating



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.

5.1.4 Radiated Output Power Measurement procedure:

Based on TIA-603C 2004
2.2.17.2 Effective Radiated Power (ERP) or Effective Isotropic Radiated Power (EIRP)



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

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

5.1.5 ERP Results 850 MHz band:

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

Frequency (MHz)	Effective Radiated Power (dBm)
	GSM
824.2	28.9
836.6	29
848.8	29.4

5.1.6 EIRP Results 1900 MHz band:

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

Frequency (MHz)	Effective Isotropic Radiated Power (dBm)
	GSM
1850.2	27.1
1880.0	30.3
1909.8	31.7

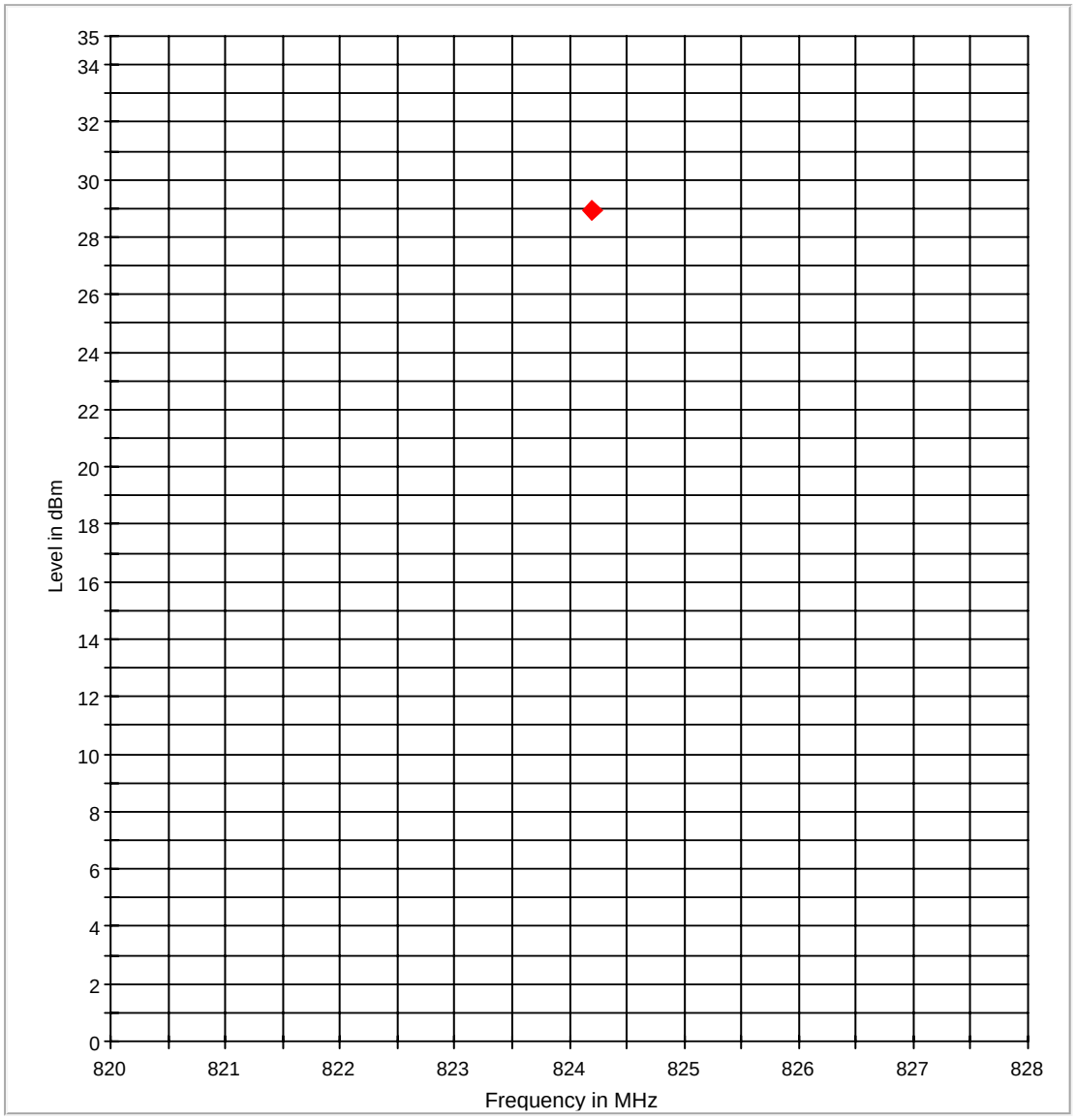
ERP (GSM 850) CHANNEL 128 GPRS §22.913(a)

Final Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Comment
824.200000	28.9	20.000	3000.000	120.0	H	263.0	-74.8	

ERP 850 CH128

ERP 850 CH128



Final Result 1

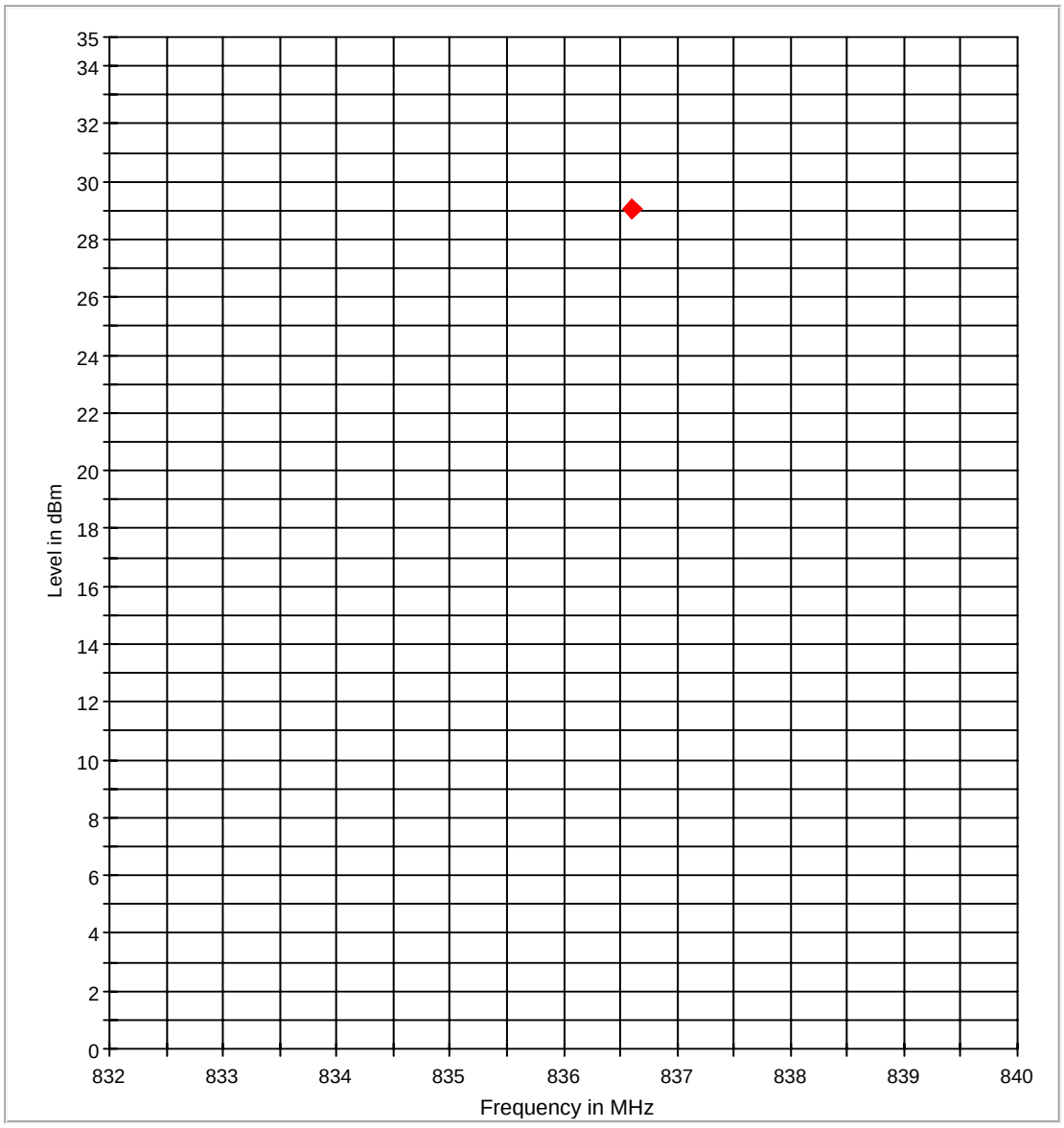
EIRP (GSM 850) CHANNEL 190 GPRS §22.913(a)

Final Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Comment
836.600000	29.0	20.000	3000.000	120.0	H	264.0	-74.6	

ERP 850 CH190

ERP 850 CH190



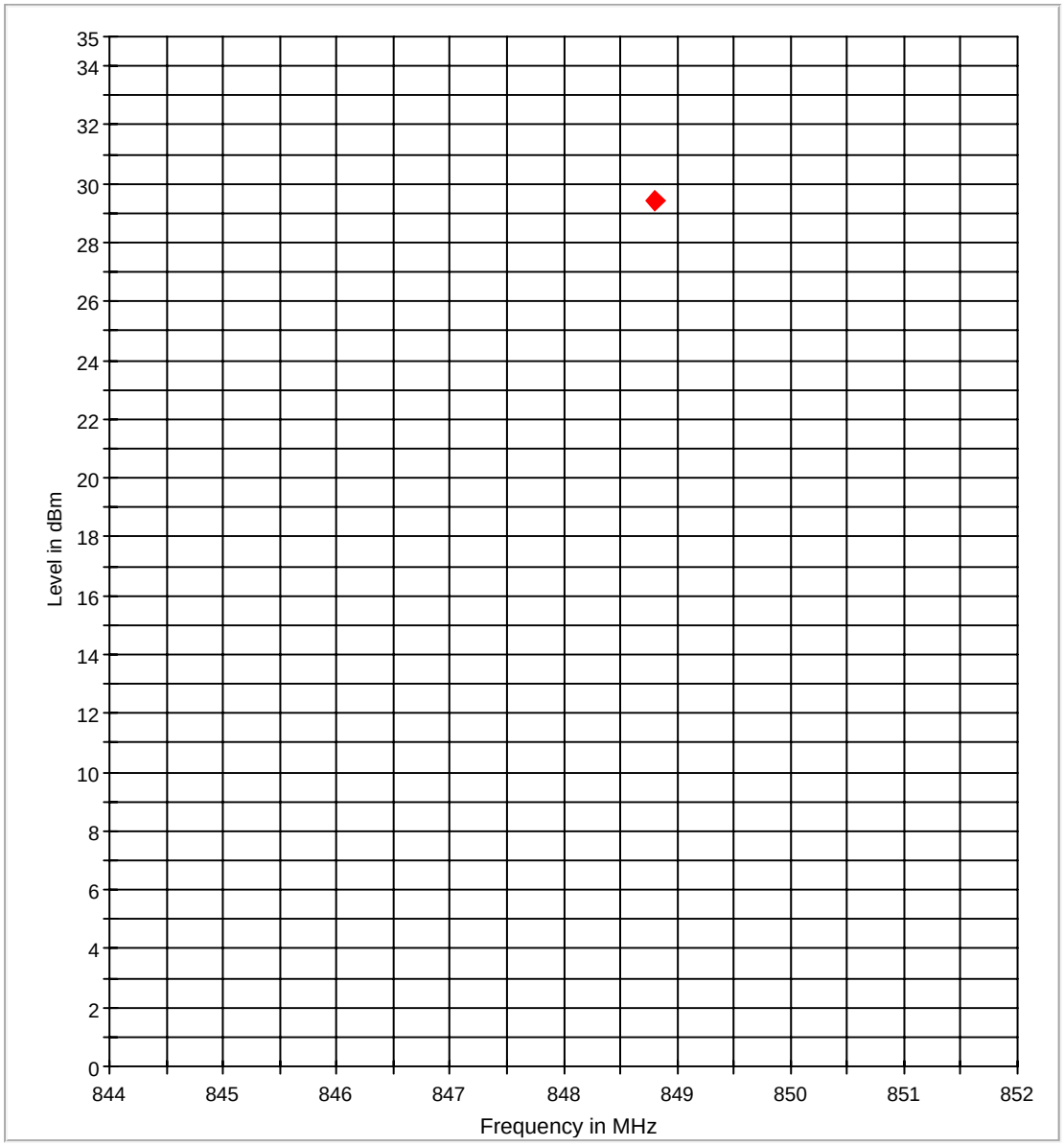
EIRP (GSM 850) CHANNEL 251 GPRS §22.913(a)

Final Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Comment
848.800000	29.4	20.000	3000.000	120.0	H	265.0	-74.4	

ERP 850 CH251

ERP 850 CH251



Final Result 1

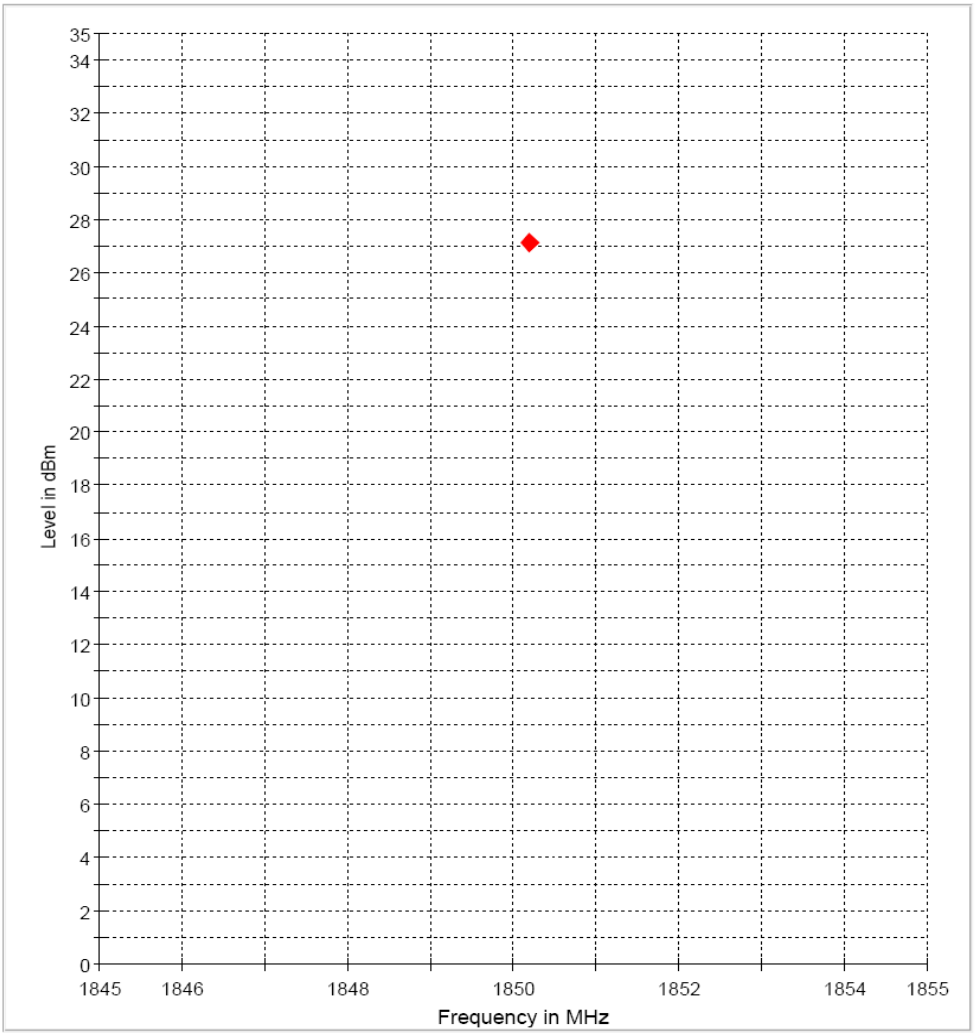
EIRP (PCS-1900) CHANNEL 512 GPRS §24.232(b)

EIRP CH512 1 / 1

Final Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Comment
1850.200000	27.1	20.000	3000.000	120.0	H	42.0	-72.4	

EIRP 1900 CH512



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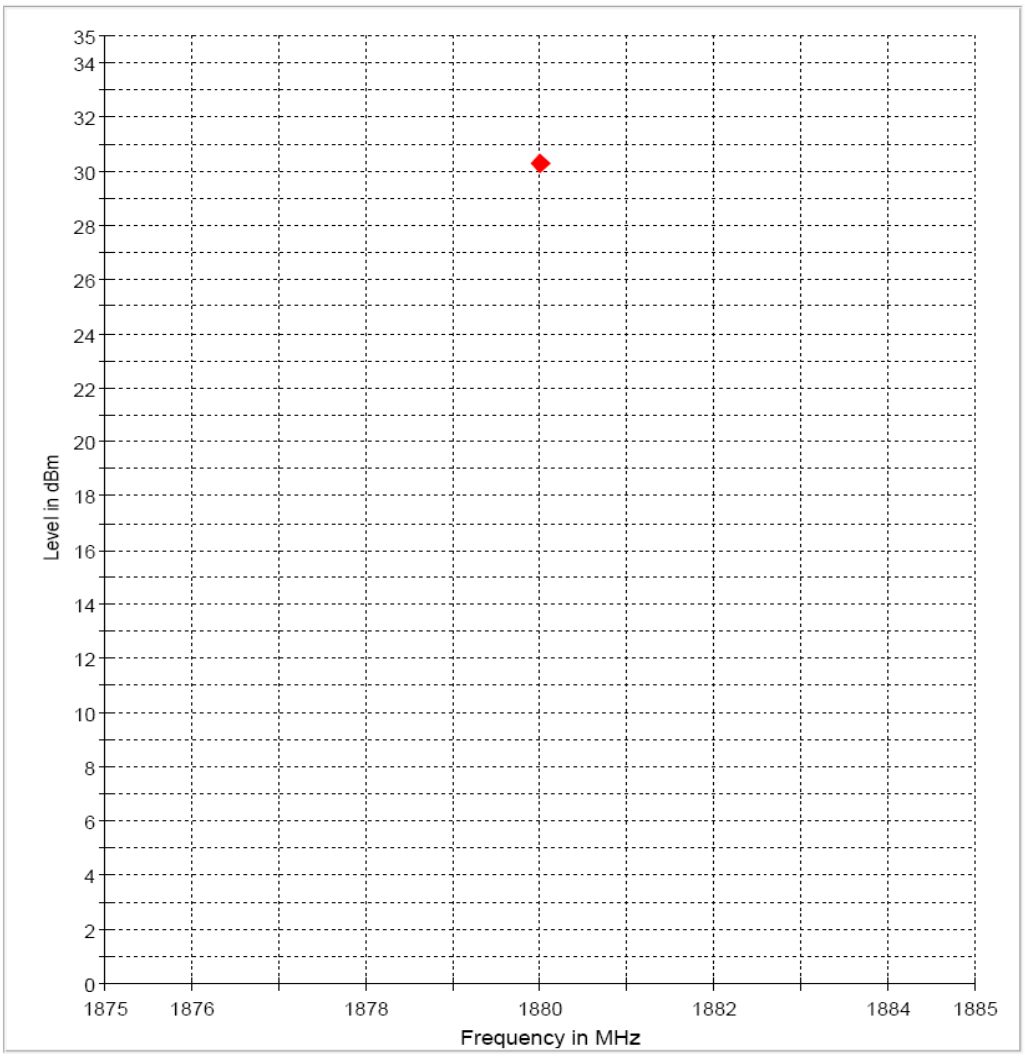
EIRP (PCS-1900) CHANNEL 661 GPRS §24.232(b)

EIRP CH661 1 / 1

Final Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Comment
1880.000000	30.3	20.000	3000.000	120.0	H	32.0	-72.0	

EIRP 1900 CH661



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

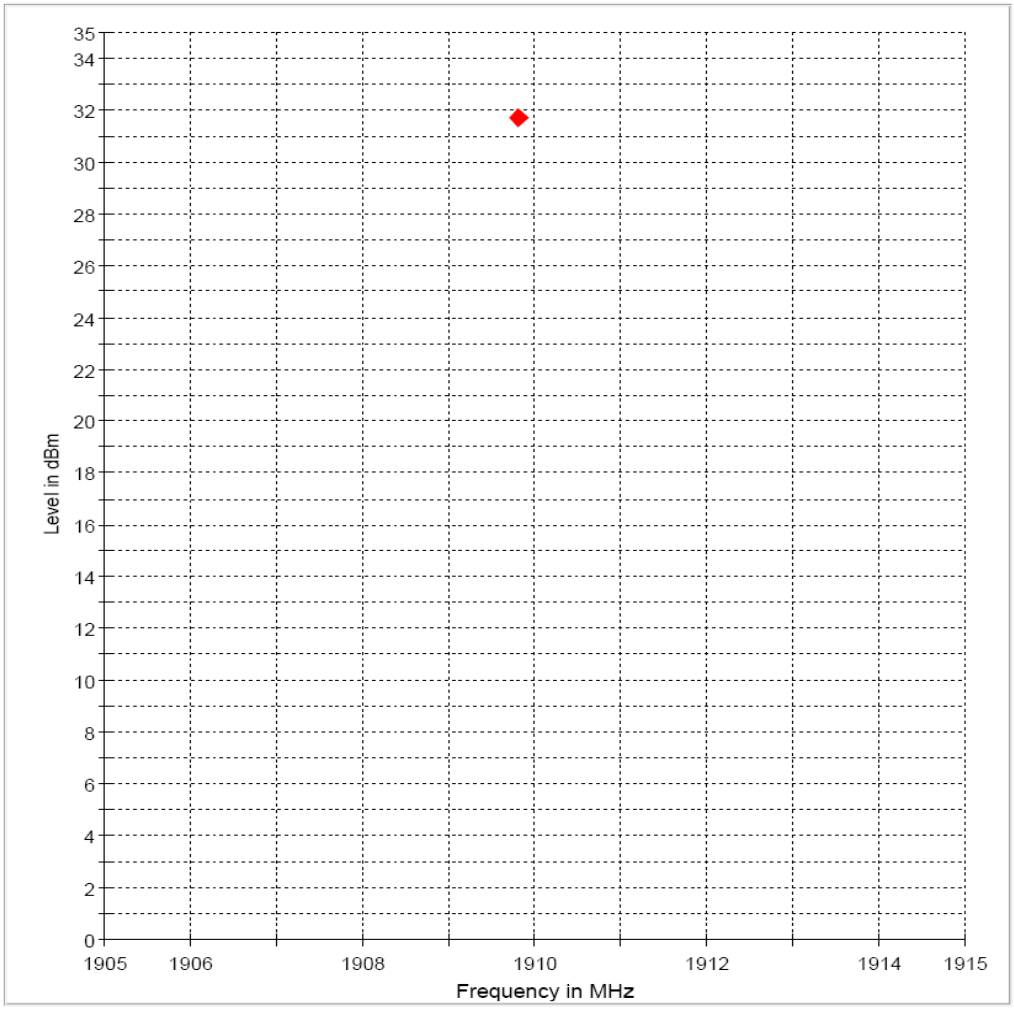
EIRP CH810 1 / 1

Final Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Comment
1909.800000	31.7	20.000	3000.000	120.0	H	41.0	-72.0	

EIRP 1900 CH810

EIRP 1900 CH810



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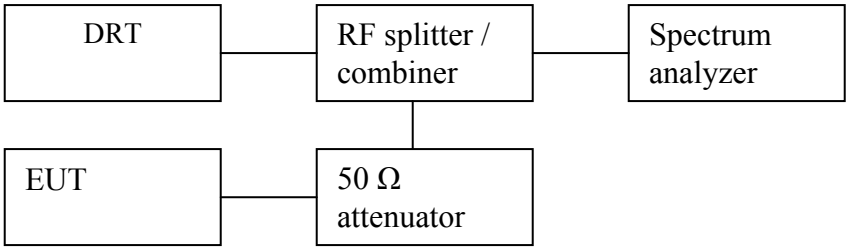
5.2 Occupied Bandwidth/Emission Bandwidth

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.

5.2.3 Occupied / Emission bandwidth results 850 MHz band:

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 and IC ID. For results of the conducted measurement please refer to the conducted test report.

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, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments remeasuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50 C.
7. With the EUT, powered via nominal voltage, connected to the CMU 200 and in a simulated call on mid channel (190 for GSM 850 & 4183 for FDD5 & 661 for PCS-1900&9400 for FDD2), measure the carrier frequency. These measurements should be made within 2 minutes of powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 C increments from +50 C to -30 C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5 C during the measurement procedure.

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

5.3.2 Test Results GSM850

Temperature	Frequency Error (Hz)	Frequency p.p.m	Verdict
-40	13	0.015540	Pass
60C	7	0.008368	Pass
70C	10	0.011954	Pass
80C	15	0.017931	Pass
85C	-15	-0.01793	Pass

5.3.3 Test Results GSM1900

Temperature	Frequency Error (Hz)	Frequency p.p.m	Verdict
-40C	12	0.006386	Pass
60C	23	0.012240	Pass
70C	-10	-0.00532	Pass
80C	15	0.00798	Pass
85C	-14	-0.00745	Pass

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.

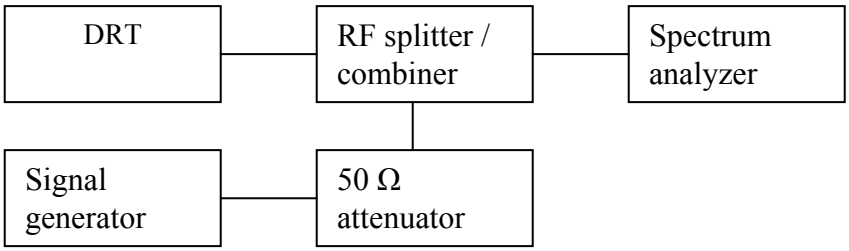
(a) *Out of band emissions*. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(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

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 Emission:

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 and IC ID. For results of the conducted measurement please refer to the conducted test report.

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.

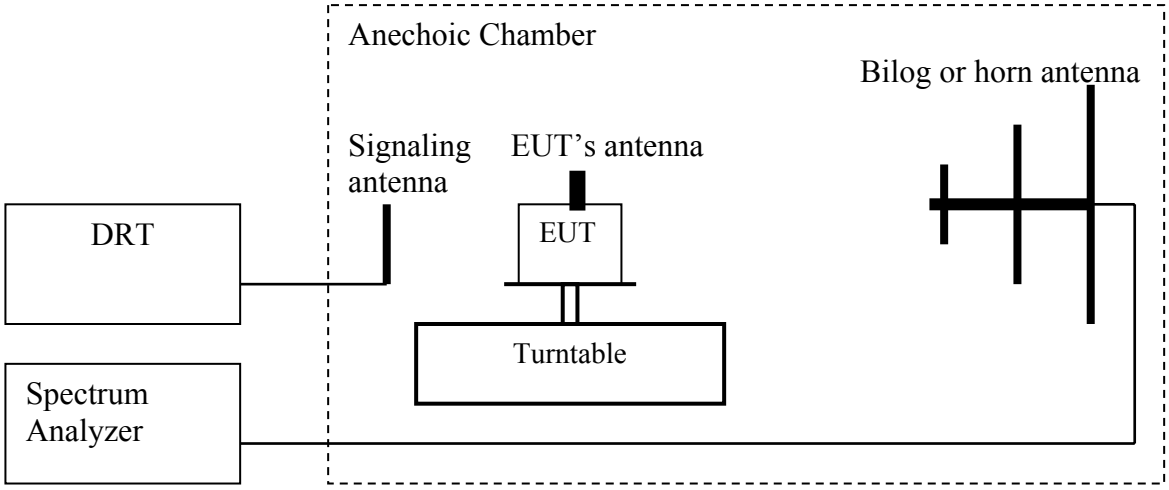
(b) Measurement procedure. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the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

(**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 GPRS 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

5.5.4 Radiated out of band emissions results on EUT:

5.5.4.1 RESULTS OF RADIATED SPURIOUS EMISSIONS TESTS GSM-850:

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

RADIATED SPURIOUS EMISSIONS (GSM-850/1900) TX: 30MHz - 1GHz
Spurious emission limit –13dBm
Antenna: Vertical/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)

Test Sequence(1) 1 / 8

GSM Radiated Spurious Emissions

Common Information

EUT / Config:	MTSMC-G2-GP
Serial Number / Model:	
HW / SW versions:	
Manufaturer:	Multitech
Orientation / Voltage:	AC
Comment:	

Result Table

Test Name	Test Type	Test Method	Start Time	Close Time
FCC 22 30-1000MHz Low Channel	EMI radiated	EMI Auto Test	06-09-2009 11:36:21	06-09-2009 11:39:58
FCC 22 30-1000MHz Mid Channel	EMI radiated	EMI Auto Test	06-09-2009 11:40:26	06-09-2009 11:42:39
FCC 22 30-1000MHz High Channel	EMI radiated	EMI Auto Test	06-09-2009 11:42:40	06-09-2009 11:46:35
FCC 24 30-1000MHz Low Channel	EMI radiated	EMI Auto Test	06-09-2009 11:52:06	06-09-2009 11:53:46
FCC 24 30-1000MHz Mid Channel	EMI radiated	EMI Auto Test	06-09-2009 11:53:48	06-09-2009 11:55:57
FCC 24 30-1000MHz High Channel	EMI radiated	EMI Auto Test	06-09-2009 11:55:59	06-09-2009 11:58:08

(continuation of the "Result Table" table from column 5 ...)

Test Name	Test Verdict	Comment
FCC 22 30-1000MHz Low Channel	Passed	
FCC 22 30-1000MHz Mid Channel	Passed	
FCC 22 30-1000MHz High Channel	Passed	
FCC 24 30-1000MHz Low Channel	Passed	
FCC 24 30-1000MHz Mid Channel	Passed	
FCC 24 30-1000MHz High Channel	Passed	

FCC 22 30-1000MHz Low Channel

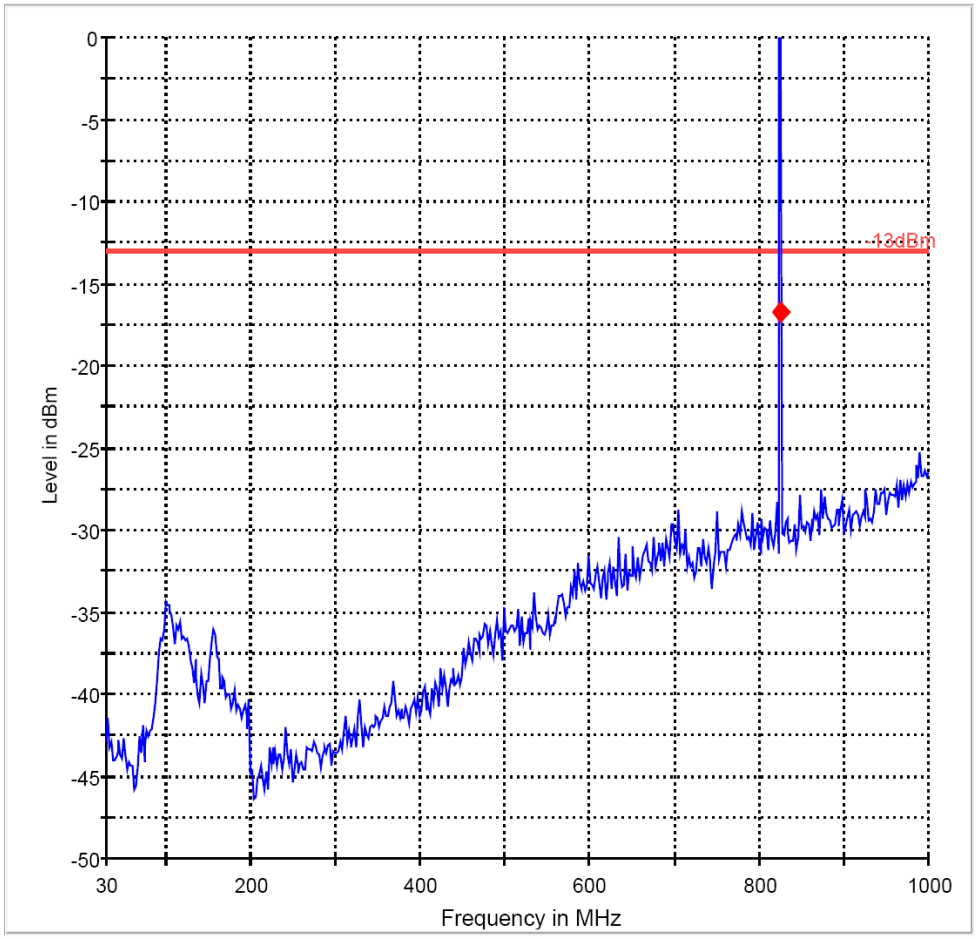
Final Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)
824.656312	-16.7	20.000	100.000	120.0	H	268.0	-71.3	3.7	-13.0

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

Frequency (MHz)	Comment
824.656312	

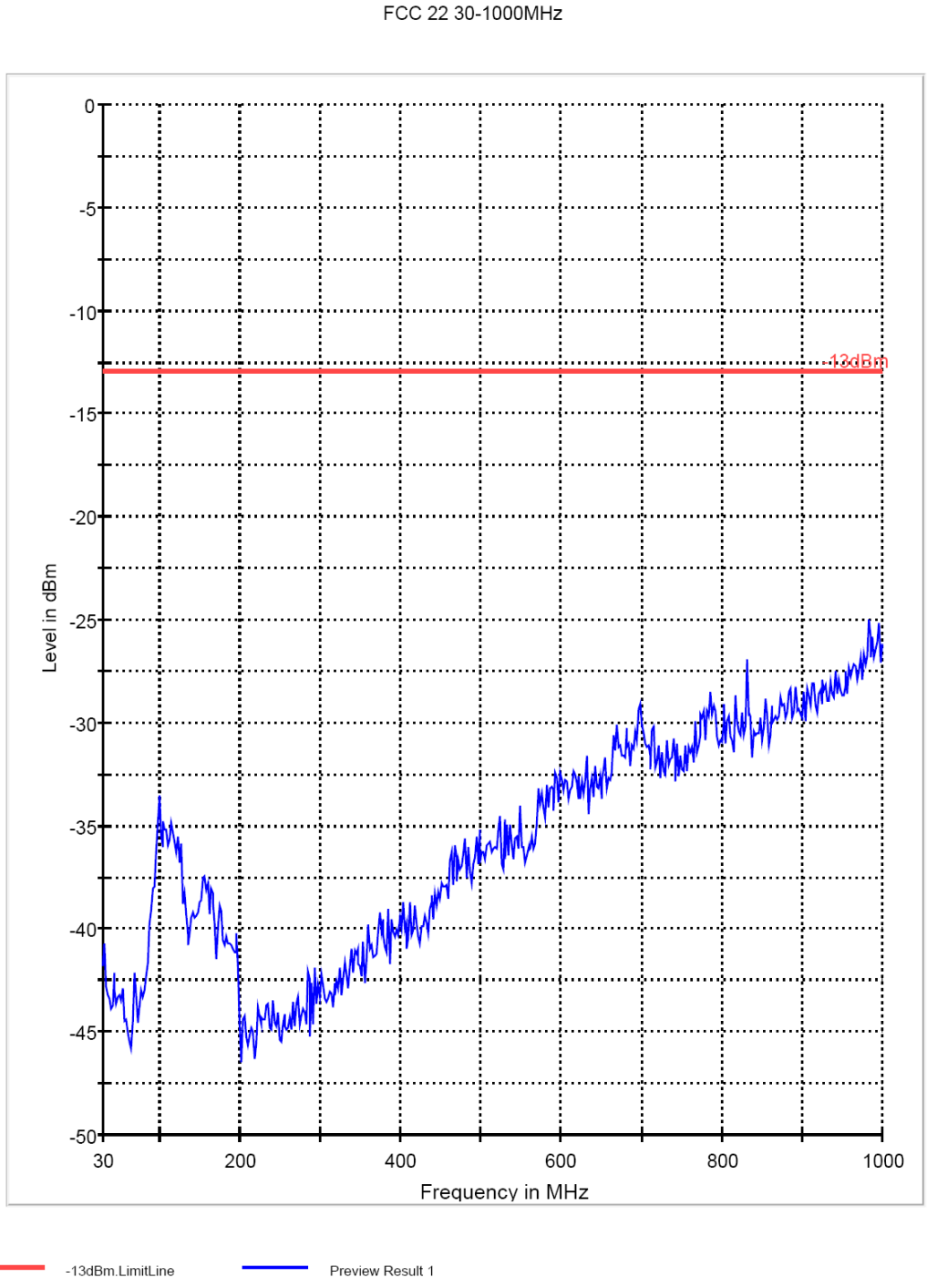
FCC 22 30-1000MHz



6/9/2009 mdouat EMC32 V8.10.10 11:58:10

Test Sequence(1) 3 / 8

FCC 22 30-1000MHz Mid Channel



6/9/2009 mdouat EMC32 V8.10.10 11:58:10

Test Sequence(1) 4 / 8

FCC 22 30-1000MHz High Channel

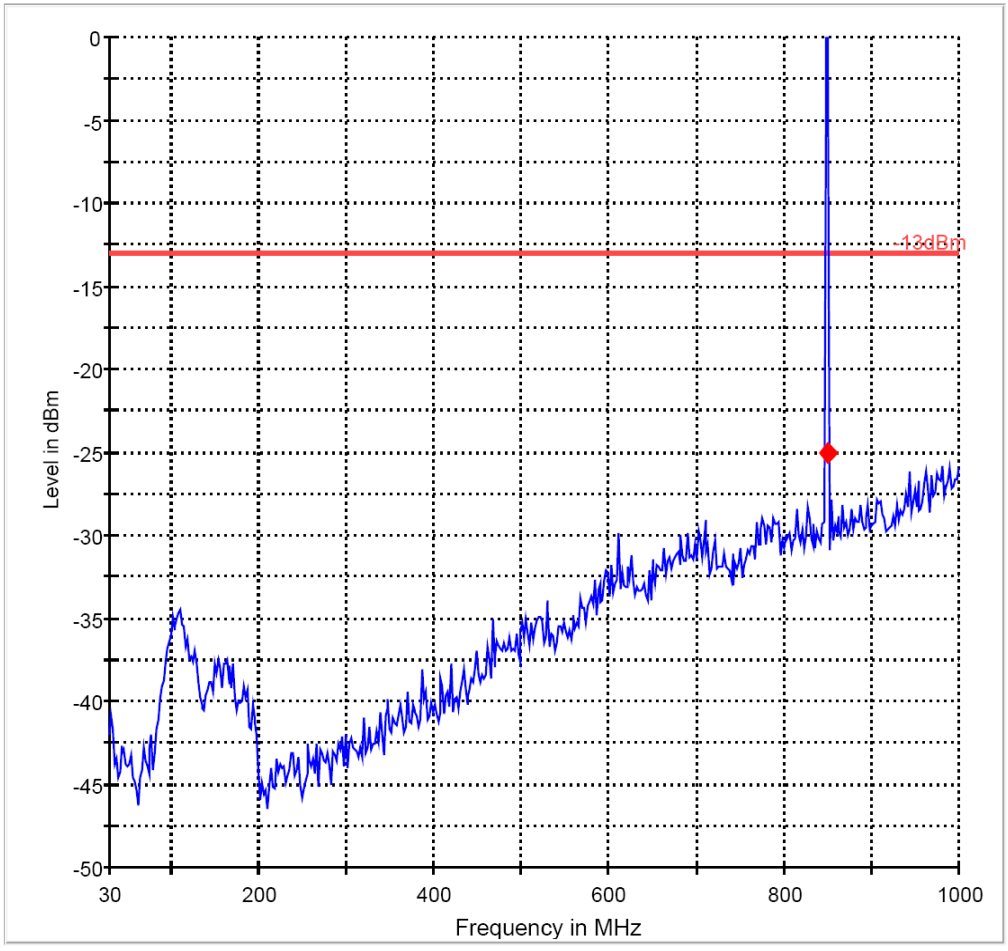
Final Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)
849.912825	-25.1	20.000	100.000	120.0	H	112.0	-70.9	12.1	-13.0

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

Frequency (MHz)	Comment
849.912825	

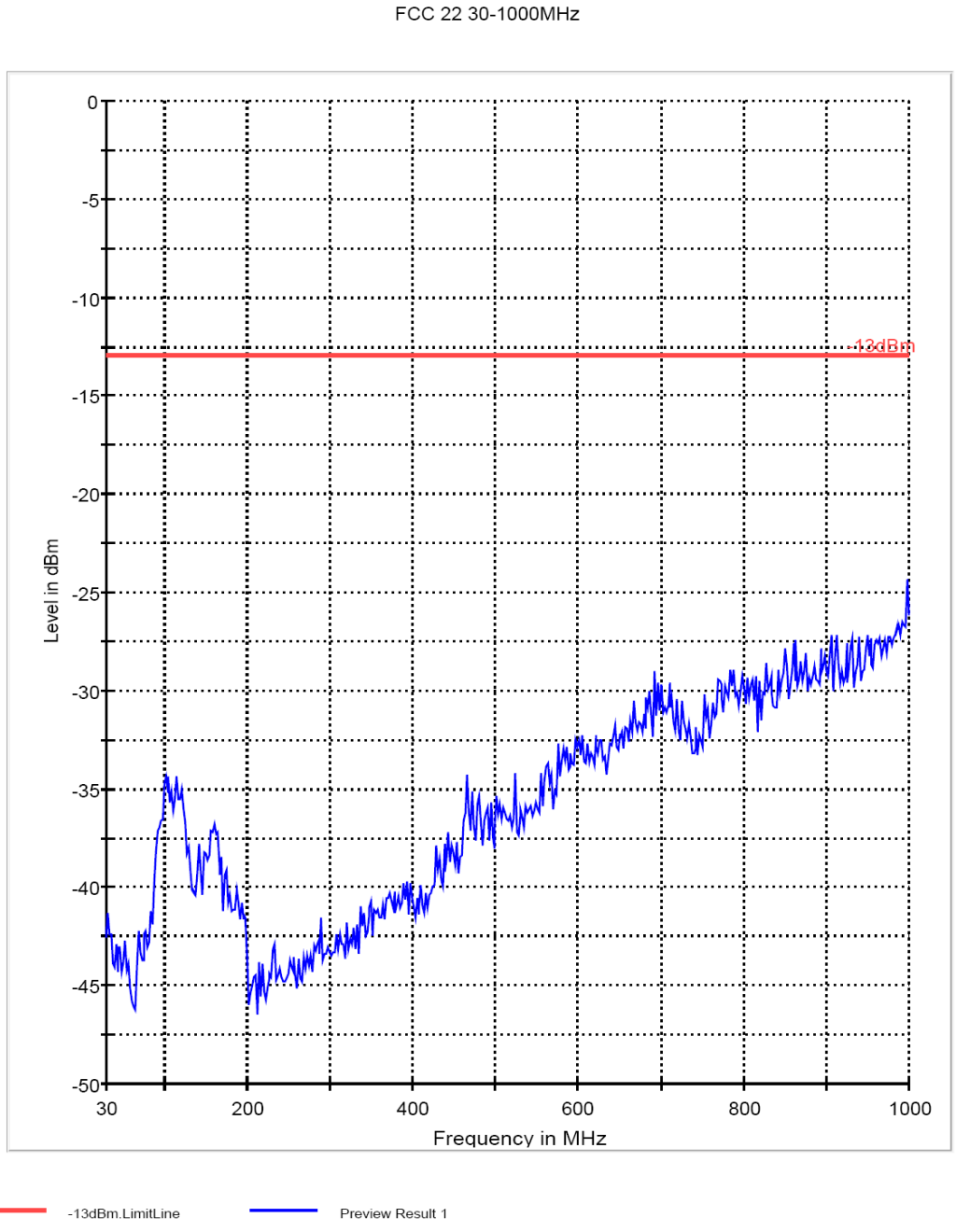
FCC 22 30-1000MHz



6/9/2009 mdouat EMC32 V8.10.10 11:58:10

Test Sequence(1) 5 / 8

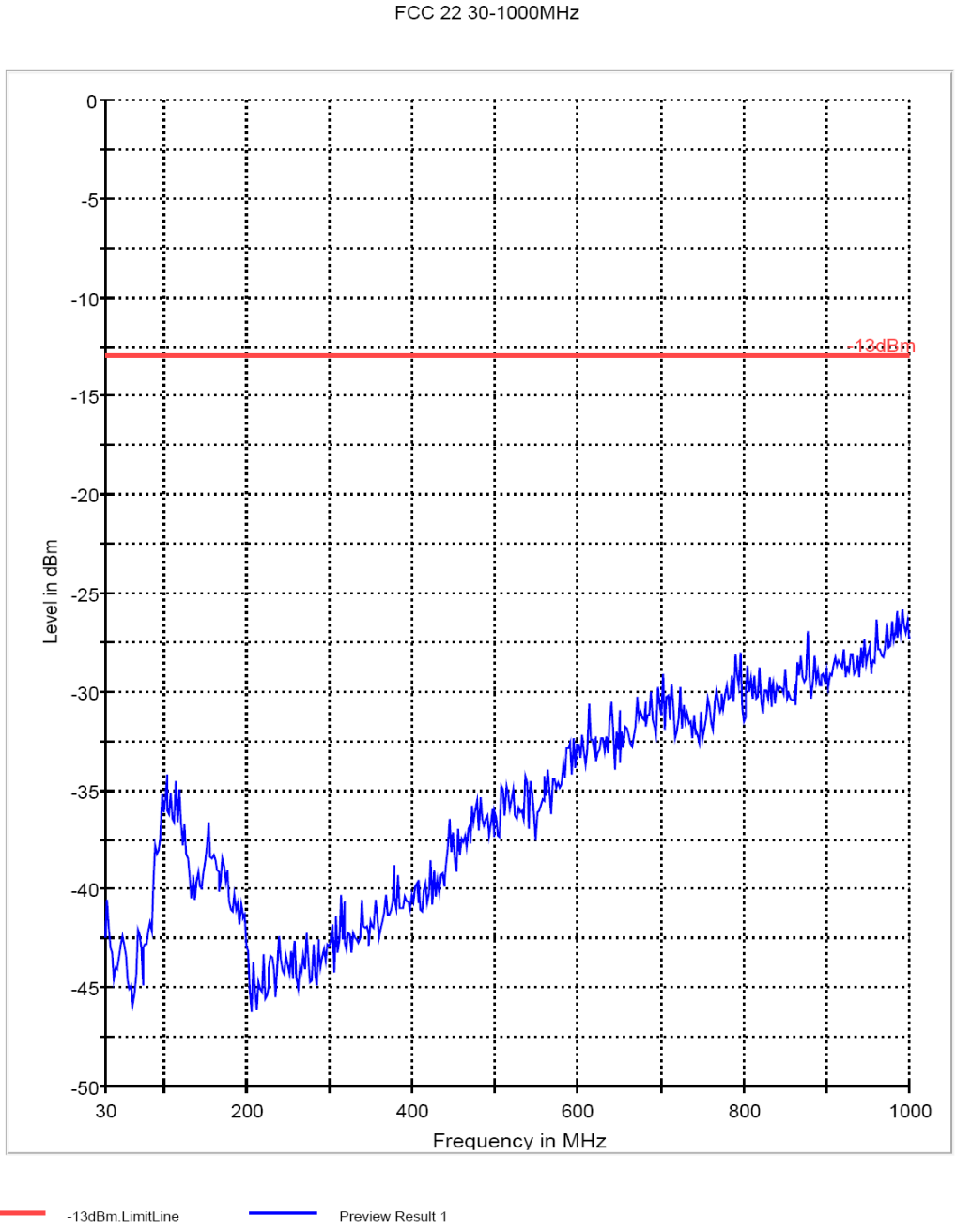
FCC 24 30-1000MHz Low Channel



6/9/2009 mdouat EMC32 V8.10.10 11:58:10

Test Sequence(1) 6 / 8

FCC 24 30-1000MHz Mid Channel

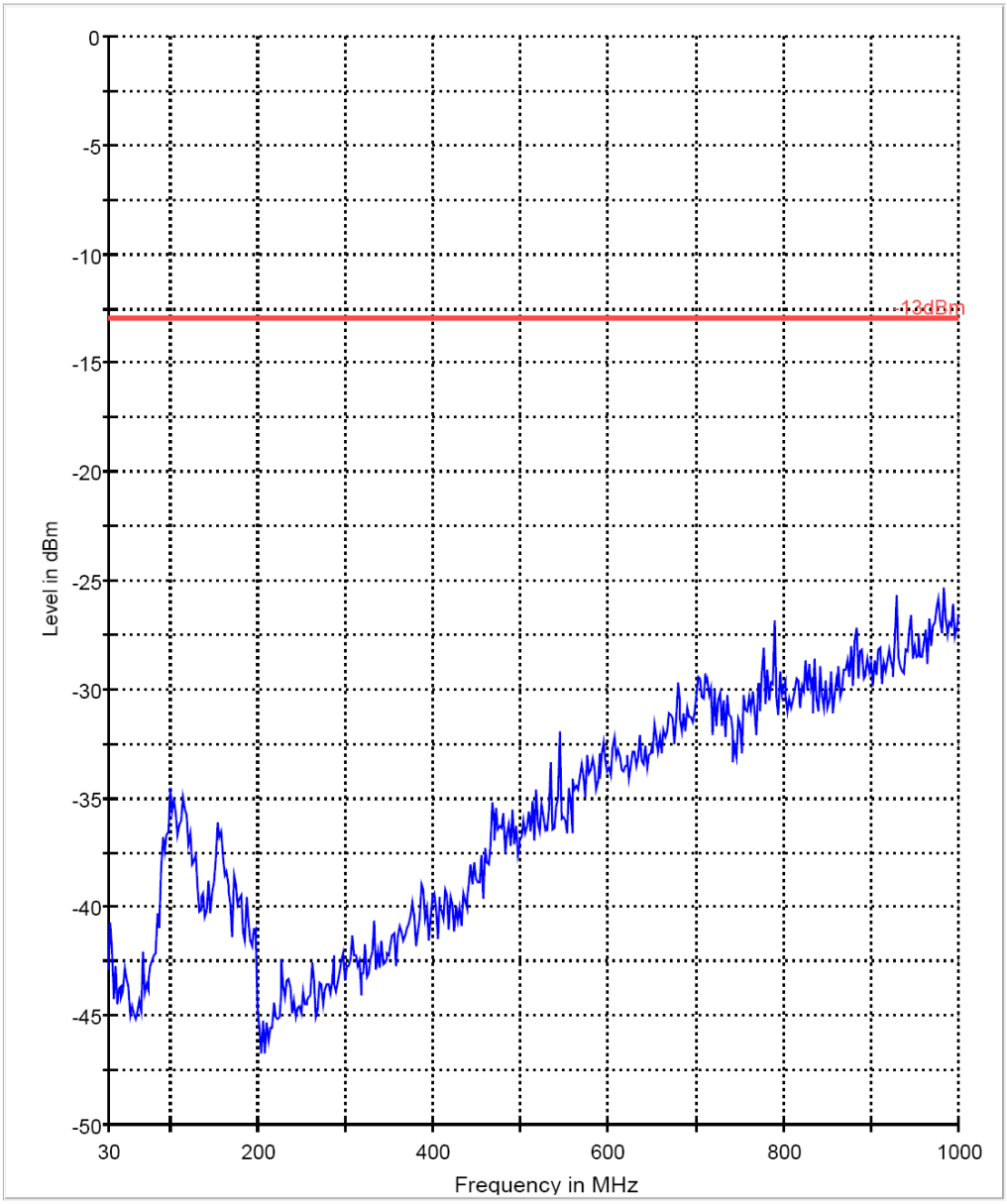


6/9/2009 mdouat EMC32 V8.10.10 11:58:10

Test Sequence(1) 7 / 8

FCC 24 30-1000MHz High Channel

FCC 22 30-1000MHz



6/9/2009 mdouat EMC32 V8.10.10 11:58:10

RADIATED SPURIOUS EMISSIONS (GSM-850) TX Low CH 128 1GHz – 9GHz

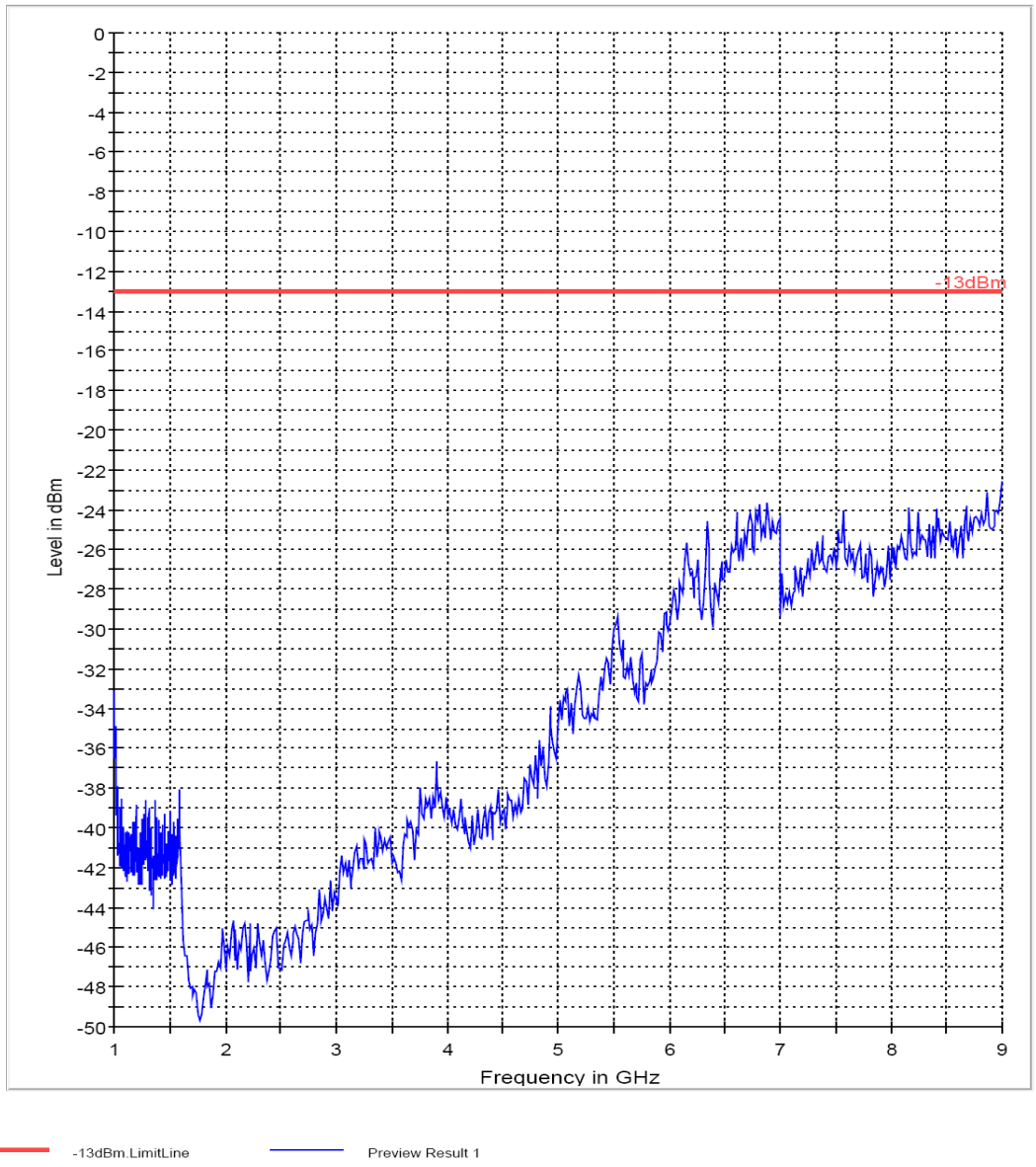
Antenna: Vertical/Horizontal

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)

FCC 22 1-9GHz Low Channel 1 / 1

FCC 22 1-9GHz

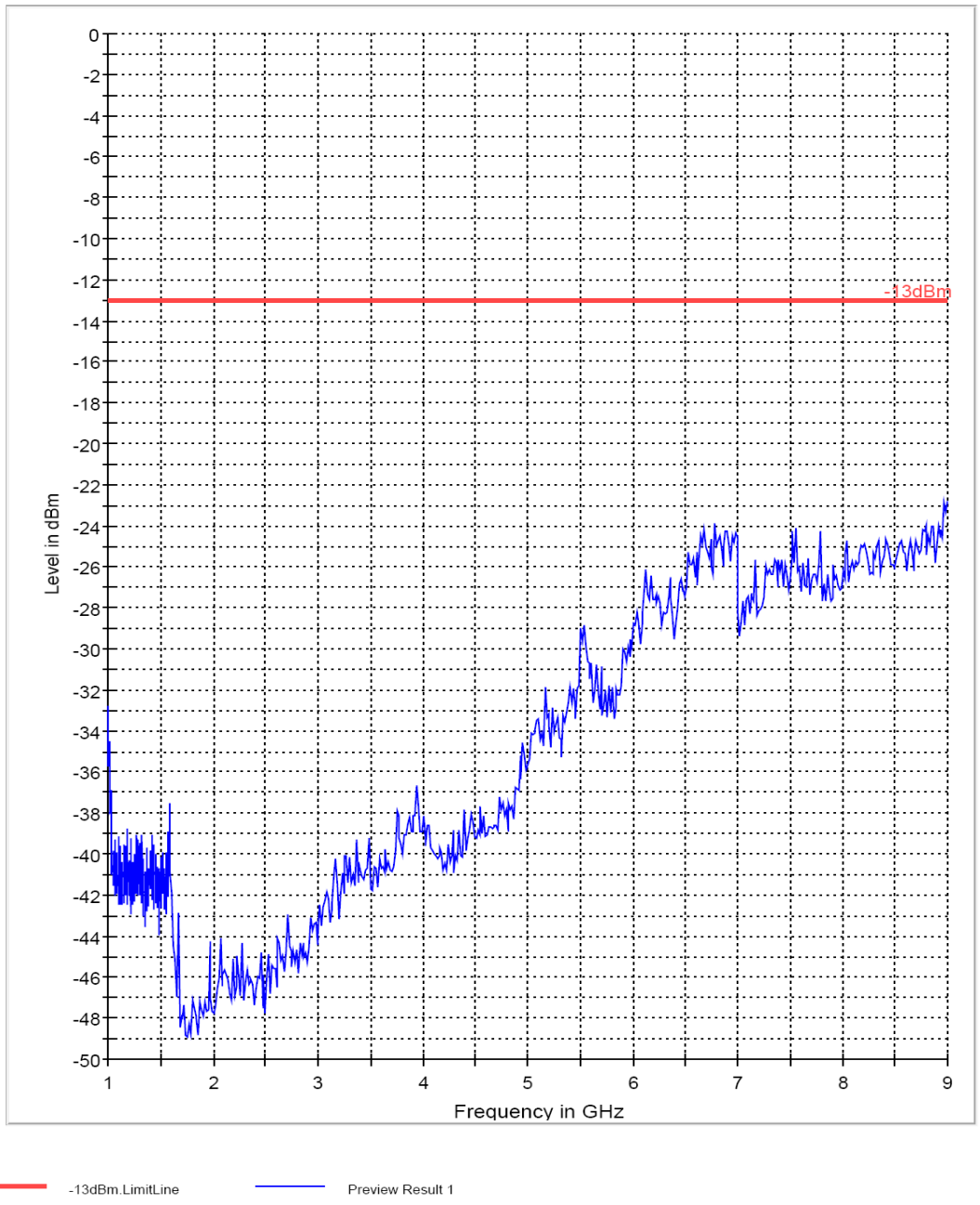


6/9/2009 mdouat EMC32 V8.10.10 1:55:20

RADIATED SPURIOUS EMISSIONS (GSM-850) TX Middle CH 190 1GHz – 9GHz

FCC 22 1-9GHz Mid Channel 1 / 1

FCC 22 1-9GHz

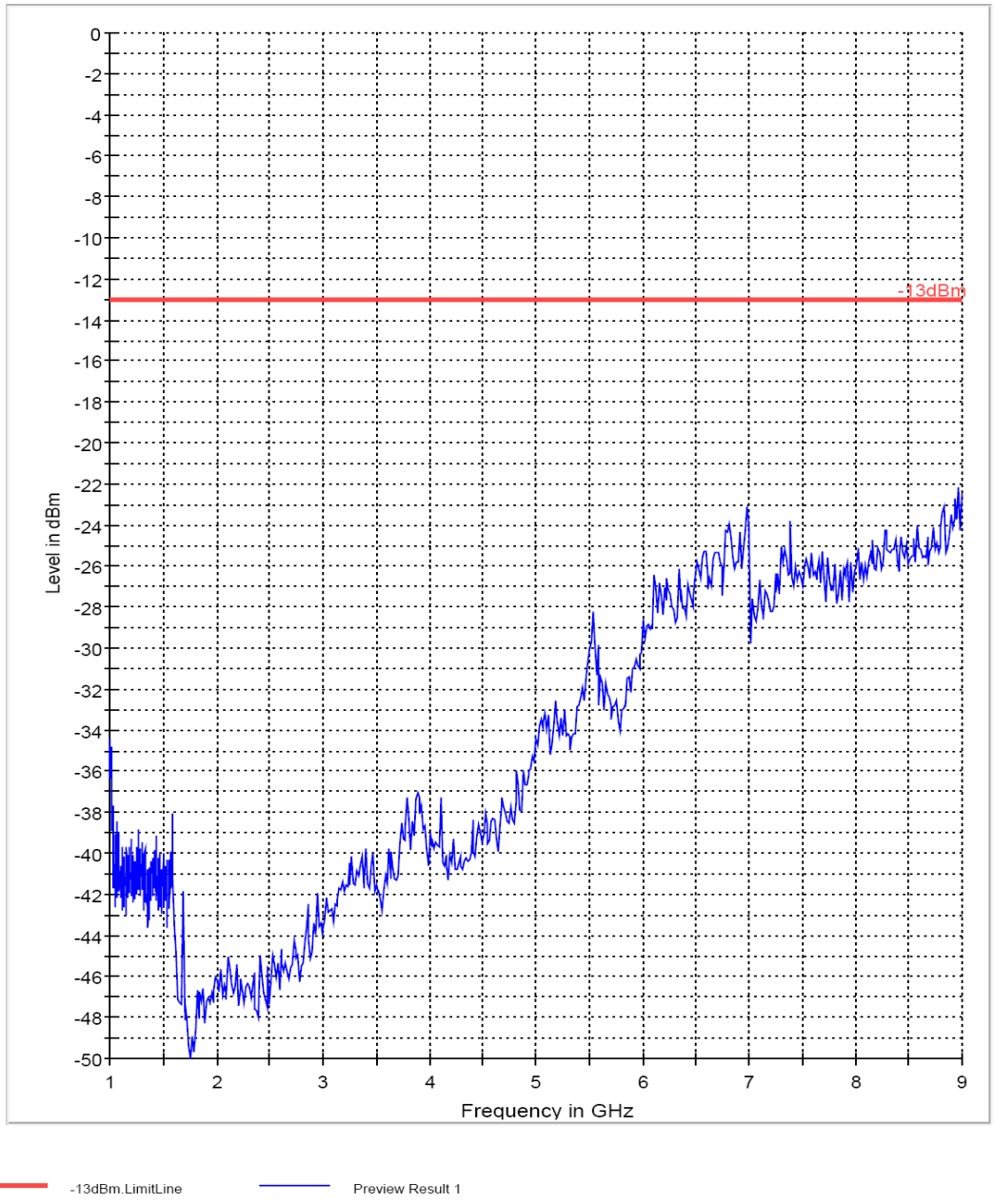


6/9/2009 mdouat EMC32 V8.10.10 1:57:39

RADIATED SPURIOUS EMISSIONS (GSM-850) TX High CH 251 1GHz – 9GHz

FCC 22 1-9GHz High Channel 1 / 1

FCC 22 1-9GHz



6/9/2009 mdouat EMC32 V8.10.10 1:59:39

5.5.4.2 RESULTS OF RADIATED SPURIOUS EMISSIONS TESTS (PCS-1900):

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

RADIATED SPURIOUS EMISSIONS(PCS 1900) TX: Low CH 512 1GHz - 18GHz
Antenna: Vertical/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)**

FCC 24 1-18GHz Low Channel 1 / 1

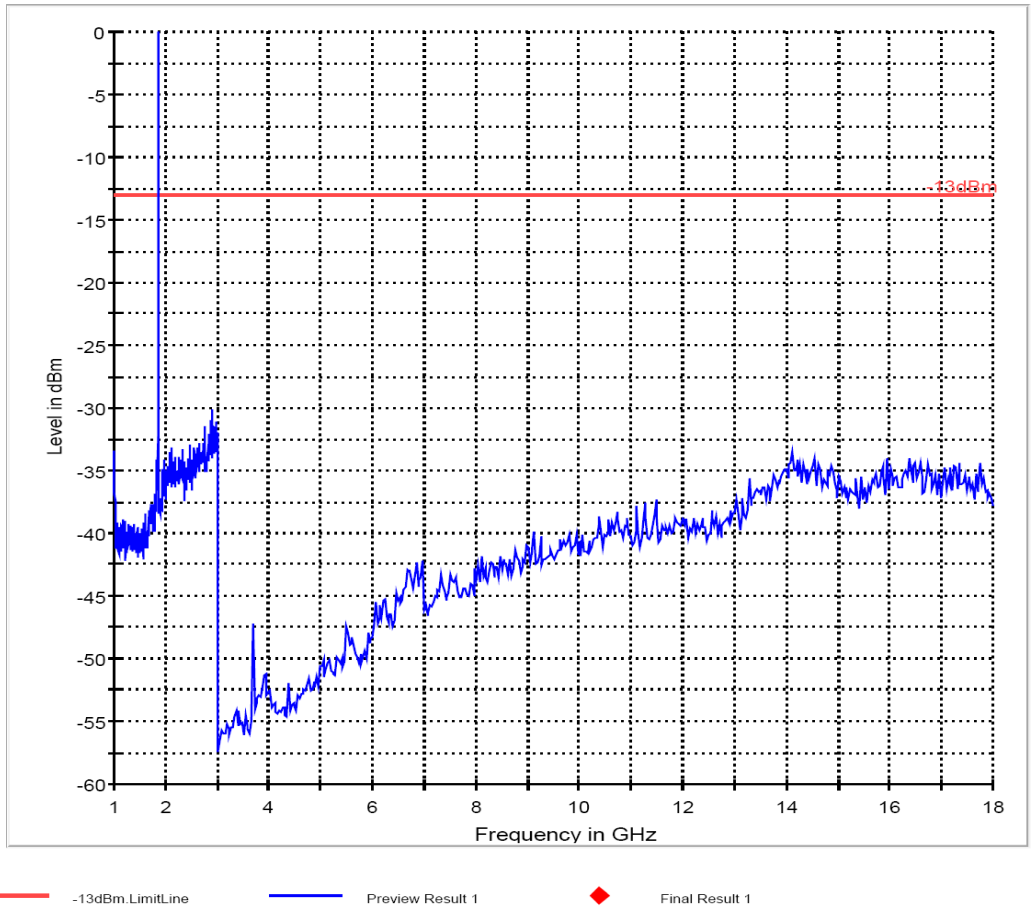
Final Result 1

Frequency (MHz)	MaxPeak (dBm)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)
1851.112225	8.7	1000.000	1000.000	120.0	V	253.0	-70.3	-21.7	-13.0

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

Frequency (MHz)	Comment
1851.112225	

FCC 24 1-18GHz

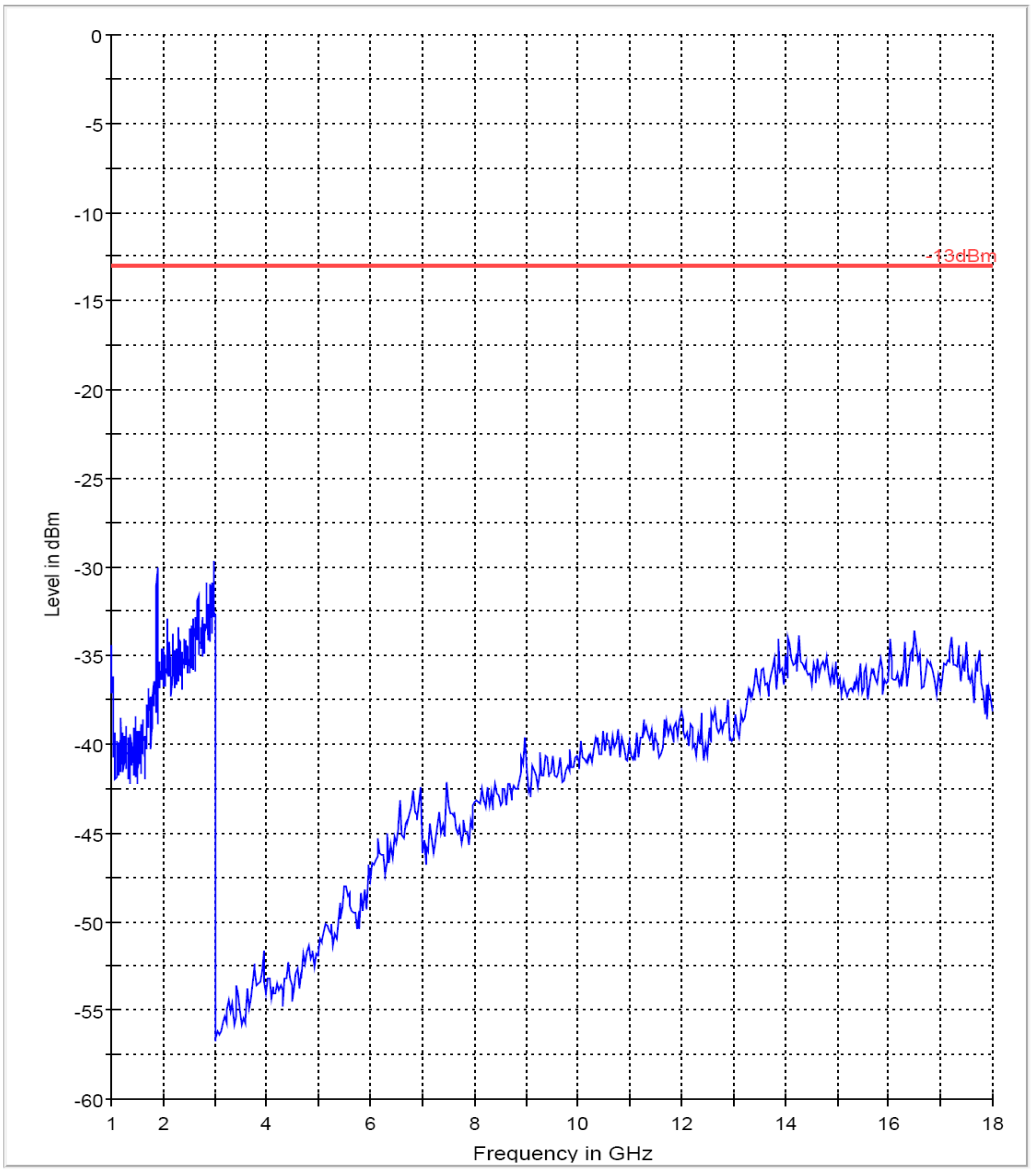


6/9/2009 mdouat EMC32 V8.10.10 2:11:49

RADIATED SPURIOUS EMISSIONS(PCS 1900) TX: Middle CH 661 1GHz - 18GHz
Antenna: Vertical/Horizontal

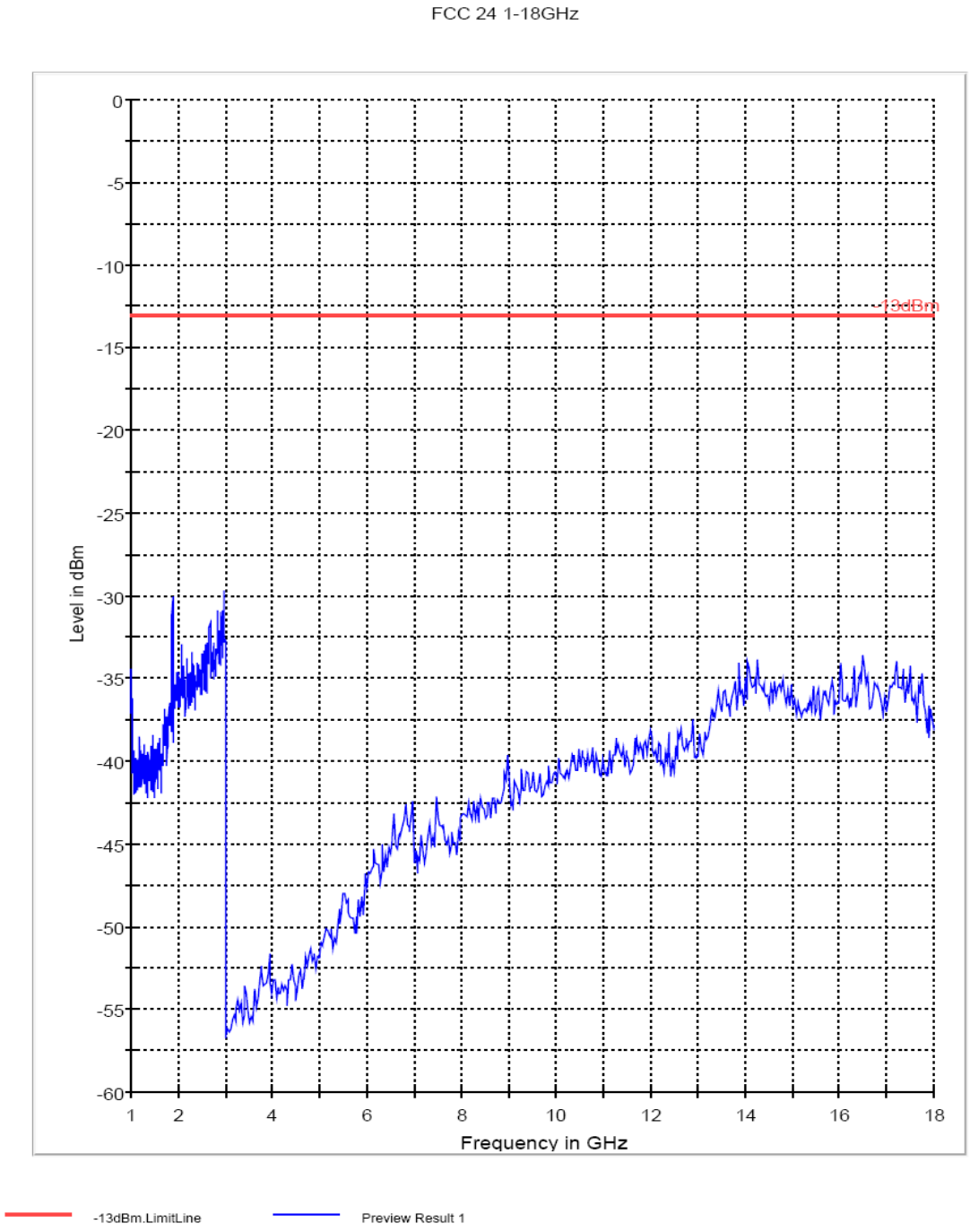
FCC 24 1-18GHz Mid Channel 1 / 1

FCC 24 1-18GHz



6/9/2009 mdouat EMC32 V8.10.10 2:16:12

RADIATED SPURIOUS EMISSIONS(PCS 1900) TX: High CH 810 1GHz - 18GHz
Note: The peak above the limit line is the carrier freq.



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

5.5.5.1 Test Results

No significant emissions measurable. Plots reported here represent the worse case emission for all bands.

RECEIVER SPURIOUS EMISSION 30M-1GHz

Antenna: Vertical/Horizontal

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

Test 1 / 1

Final Result 1

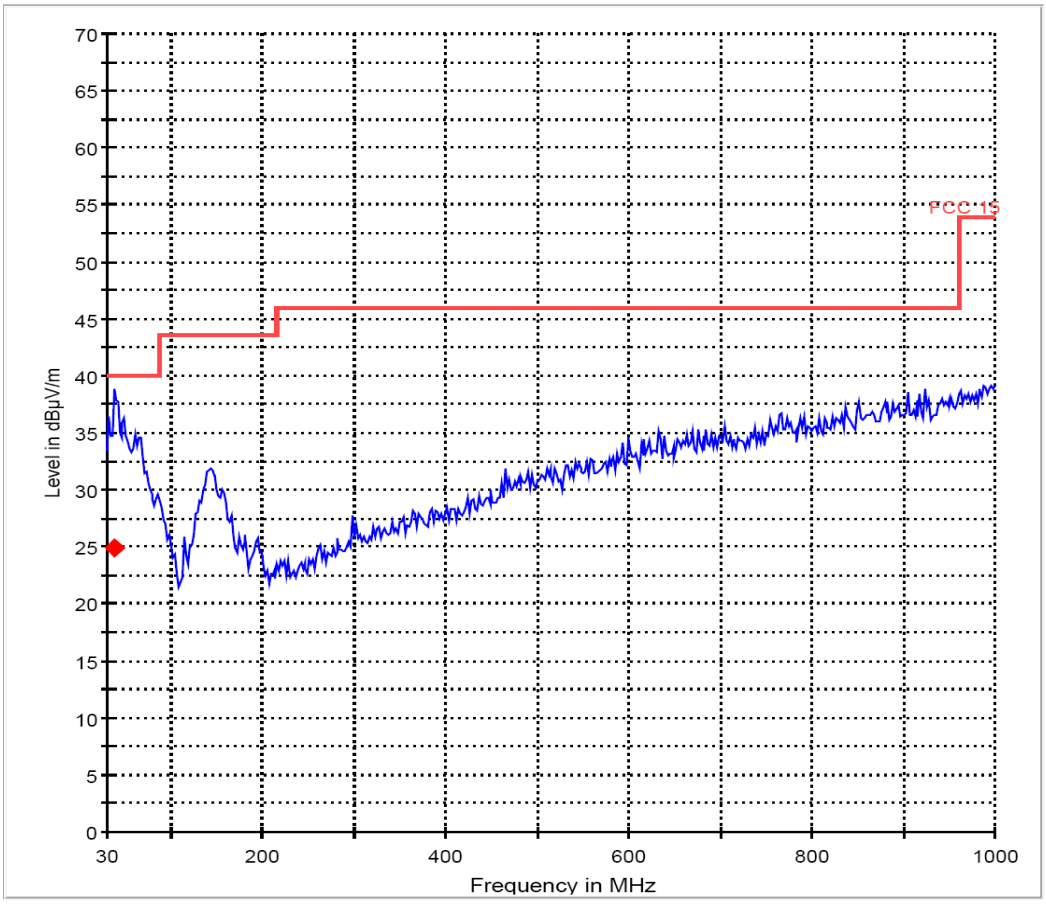
Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
38.226453	24.9	20.000	120.000	120.0	V	292.0	5.8	15.1	40.0

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

Frequency (MHz)	Comment
38.226453	

FCC 15 30-1000MHz

FCC 15 30-1000MHz



6/9/2009 smoon EMC32 V8.10.10 3:38:35

RECEIVER SPURIOUS EMISSION 30M-1GHz

Antenna: Horizontal/Vertical

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

Test 1 / 1

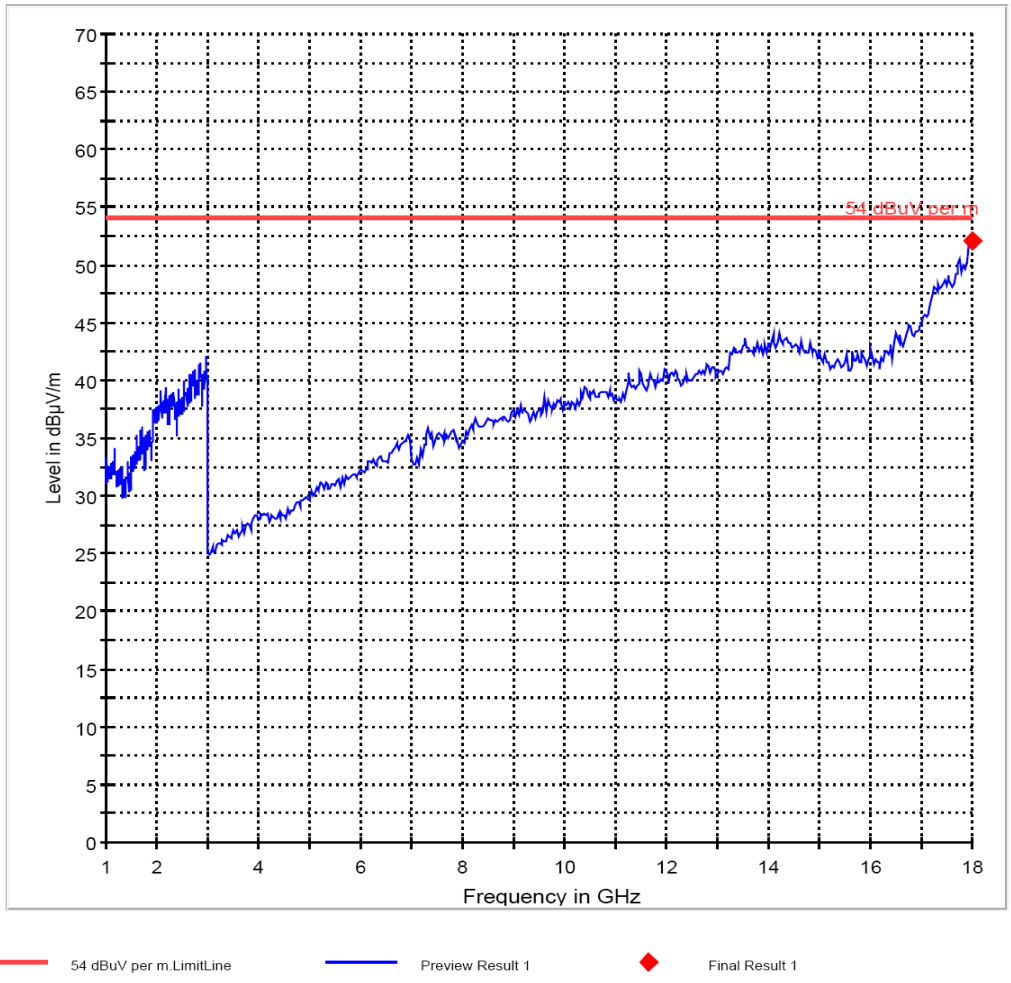
Final Result 1

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
17999.428858	52.0	20.000	1000.000	120.0	H	249.0	29.3	2.0	54.0

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

Frequency (MHz)	Comment
17999.428858	

FCC 15 1-18GHz



6/9/2009 smoon EMC32 V8.10.10 2:37:52

AC POWER LINE CONDUCTED EMISSIONS § 15.107/207

5.5.6 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

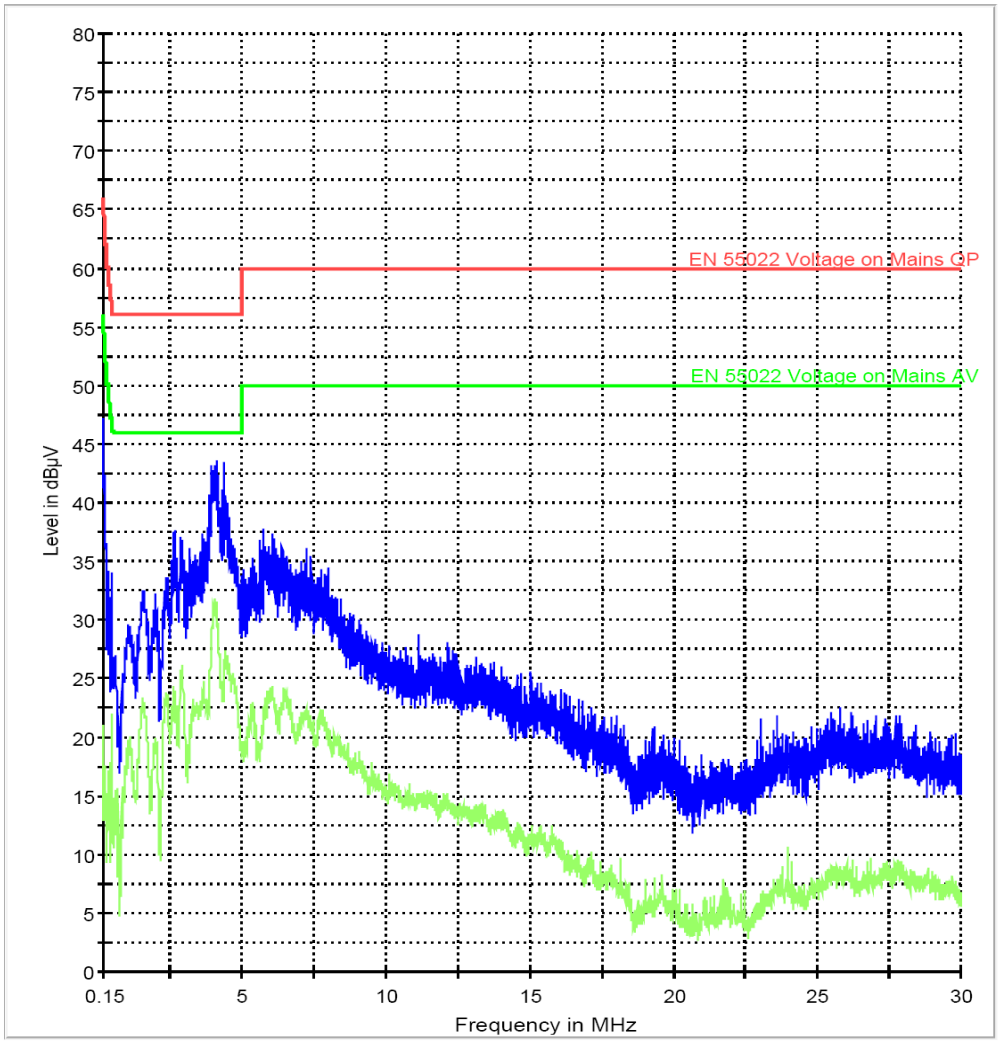
Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50
* Decreases with logarithm of the frequency		

ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz

5.5.7 Results, Line: GSM 850/GPS_TX

Line 1 / 1

Line



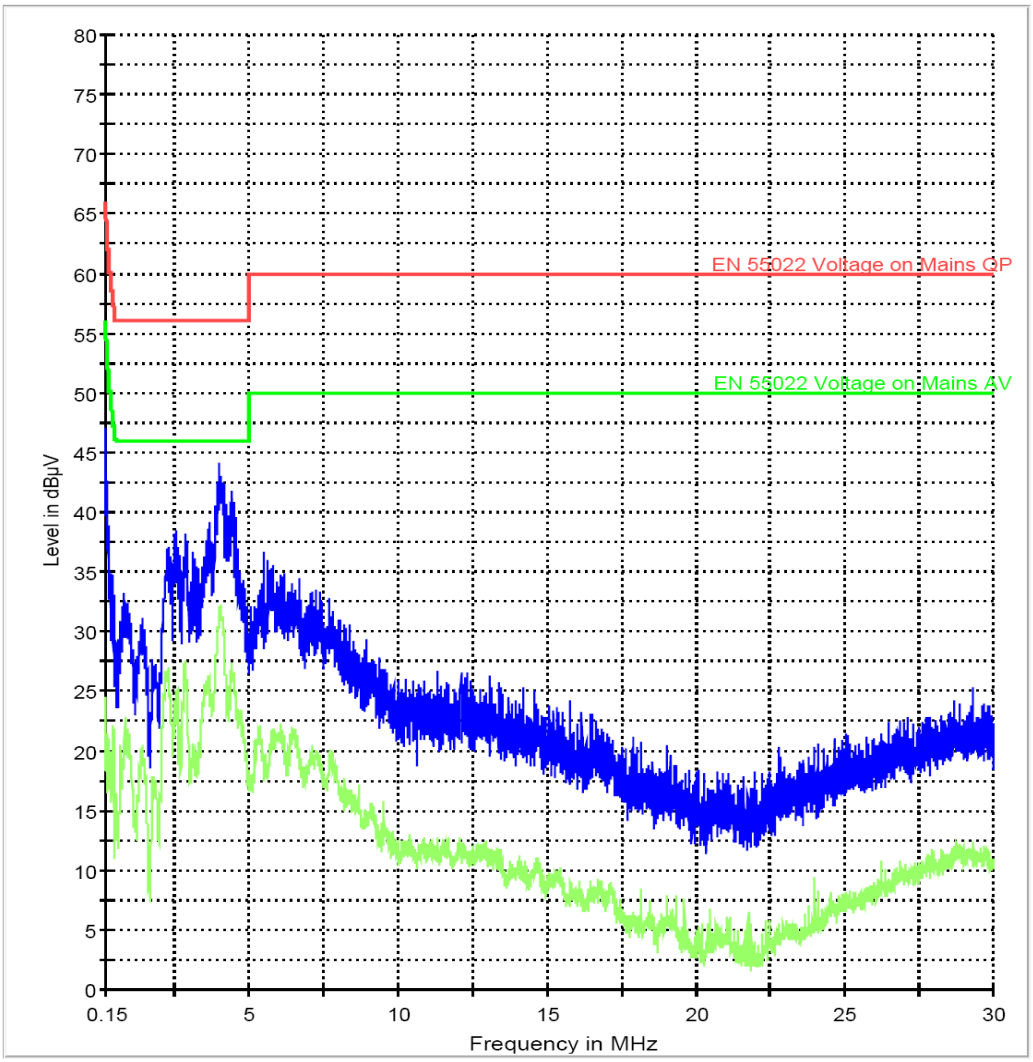
6/16/2009 mdouat EMC32 V8.10.10 4:14:59

Results, Netural: GSM 850/GPS TX

Neutral 1 / 1

Neutral

CISPR 22 Mains Conducted - N



EN 55022 Voltage on Mains QP.LimitLine
Preview Result 1
EN 55022 Voltage on Mains AV.LimitLine
Preview Result 2

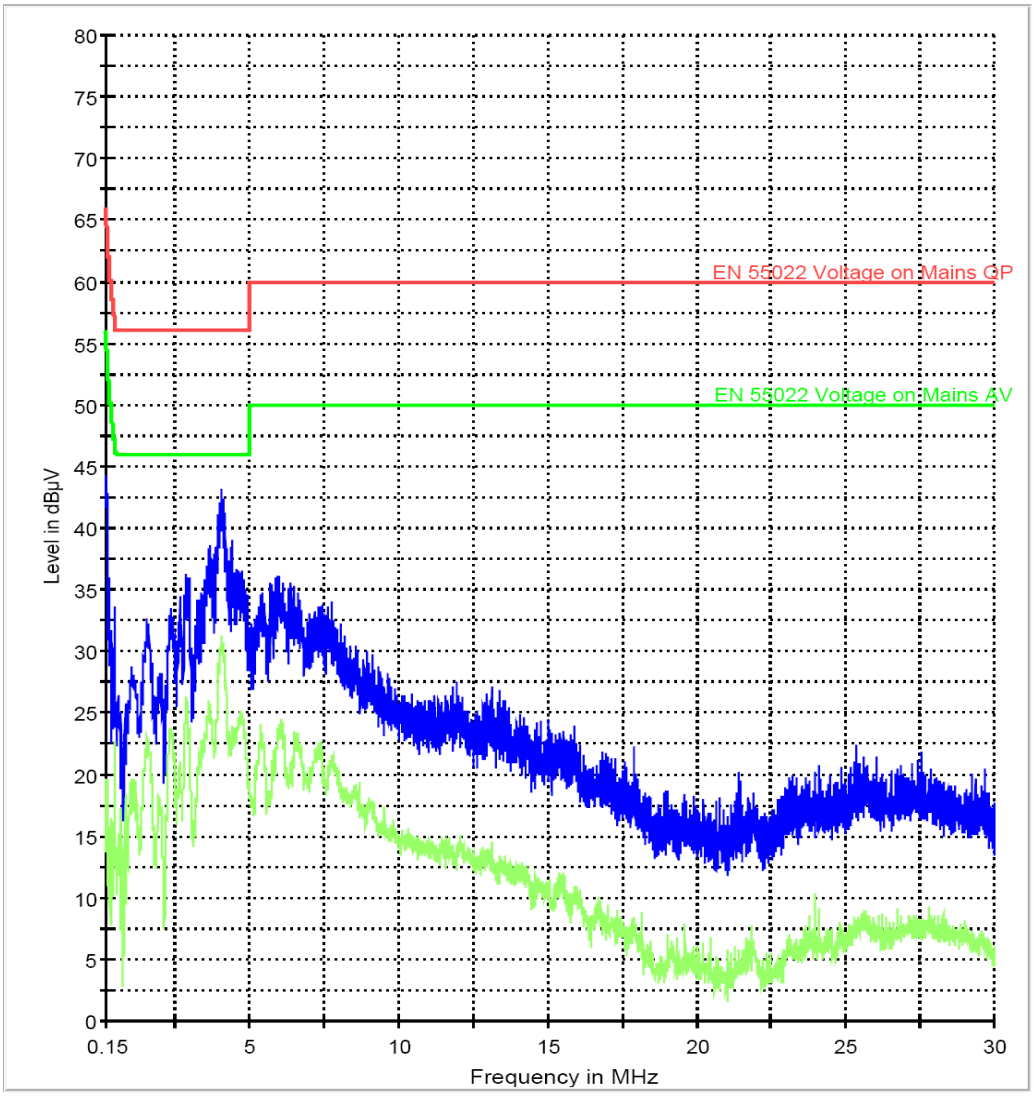
6/16/2009 mdouat EMC32 V8.10.10 4:18:03

Results, Line: GSM 1900/GPS TX

Line 1 / 1

Line

CISPR 22 Mains Conducted - L



EN 55022 Voltage on Mains QP.LimitLine
Preview Result 1
EN 55022 Voltage on Mains AV.LimitLine
Preview Result 2

6/16/2009 mdouat EMC32 V8.10.10 4:23:35

Results, Netural: GSM 1900/GPS TX

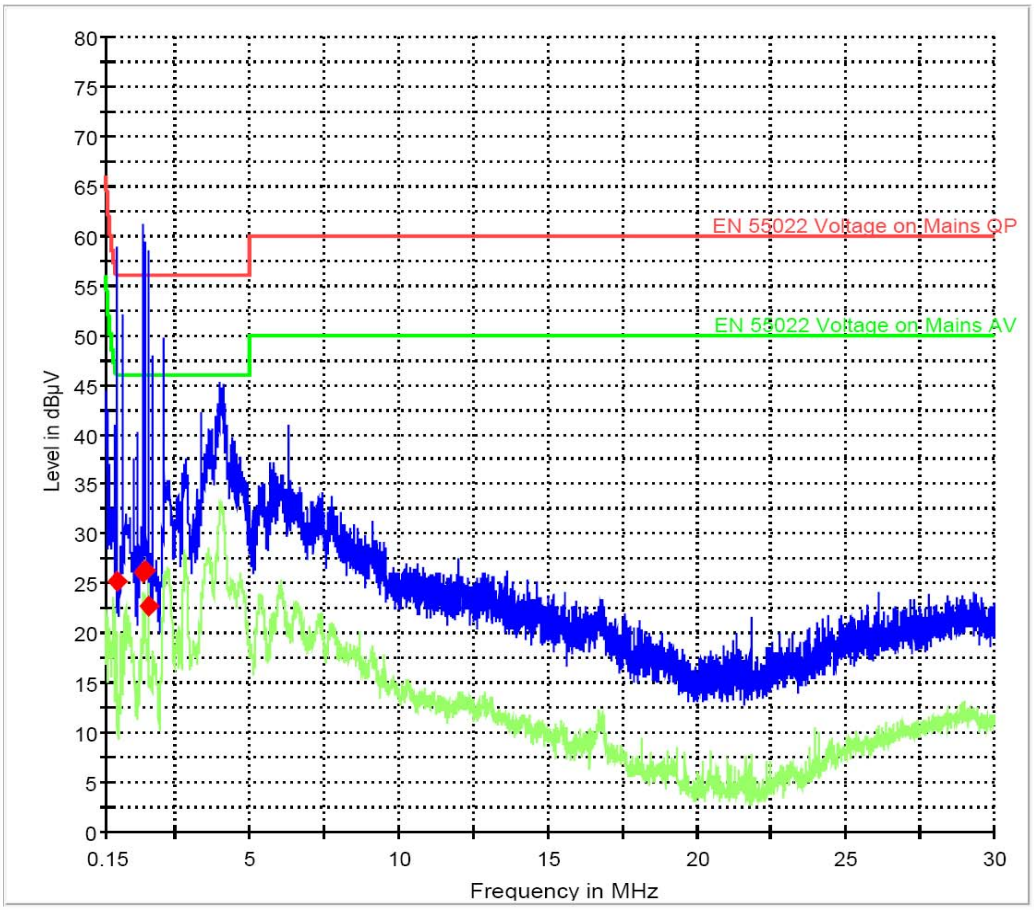
Neutral 1 / 1

Neutral

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.522000	25.3	5000.000	9.000	GND	N	0.4	30.7	56.0	
1.426000	26.1	5000.000	9.000	GND	N	0.5	30.0	56.0	
1.438000	26.3	5000.000	9.000	GND	N	0.5	29.7	56.0	
1.574000	22.8	5000.000	9.000	GND	N	0.5	33.2	56.0	

CISPR 22 Mains Conducted - N



EN 55022 Voltage on Mains QP.LimitLine
Preview Result 1
Final Result 1
EN 55022 Voltage on Mains AV.LimitLine
Preview Result 2

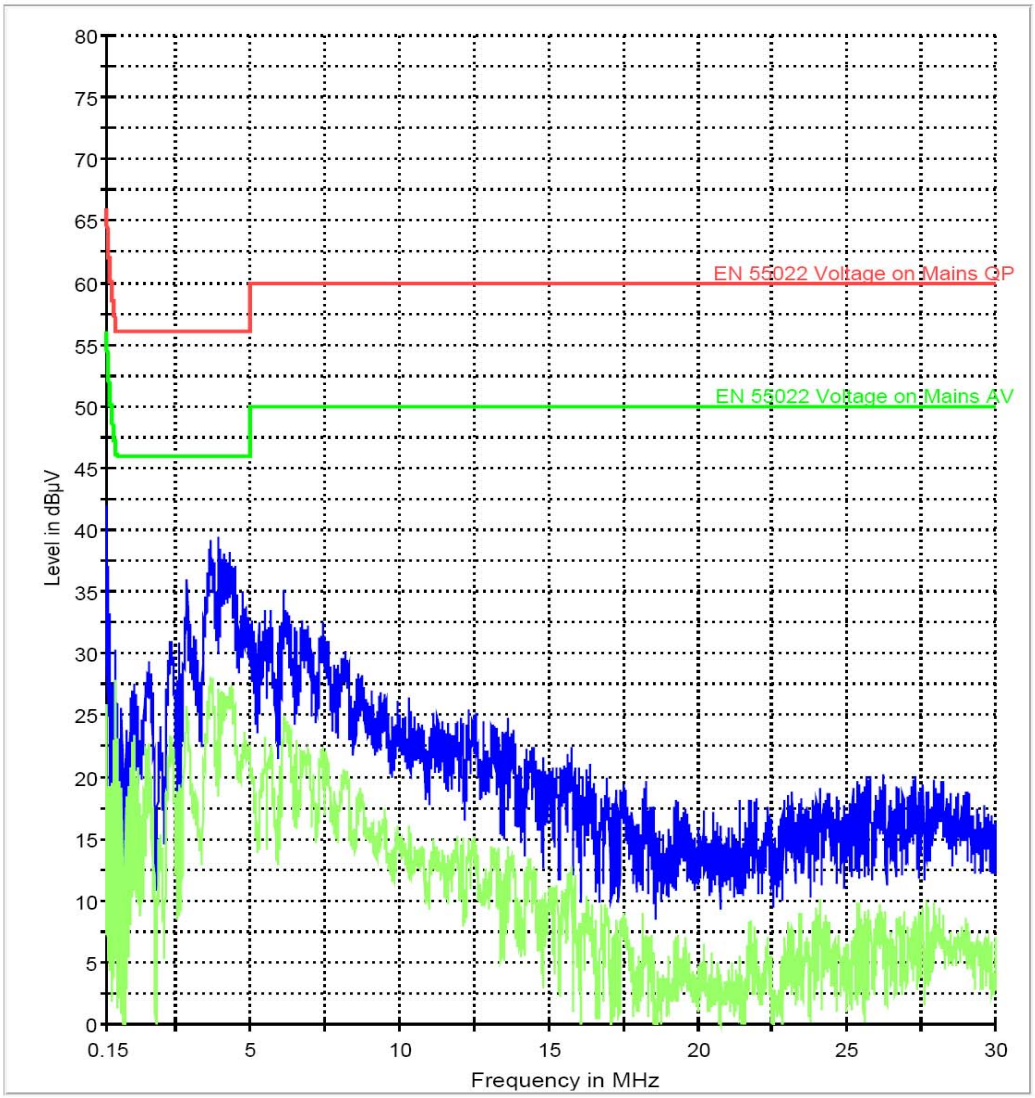
6/16/2009 mdouat EMC32 V8.10.10 4:26:37

Results, Line: GSM/GPS RX

Line 1 / 1

Line

CISPR 22 Mains Conducted - L



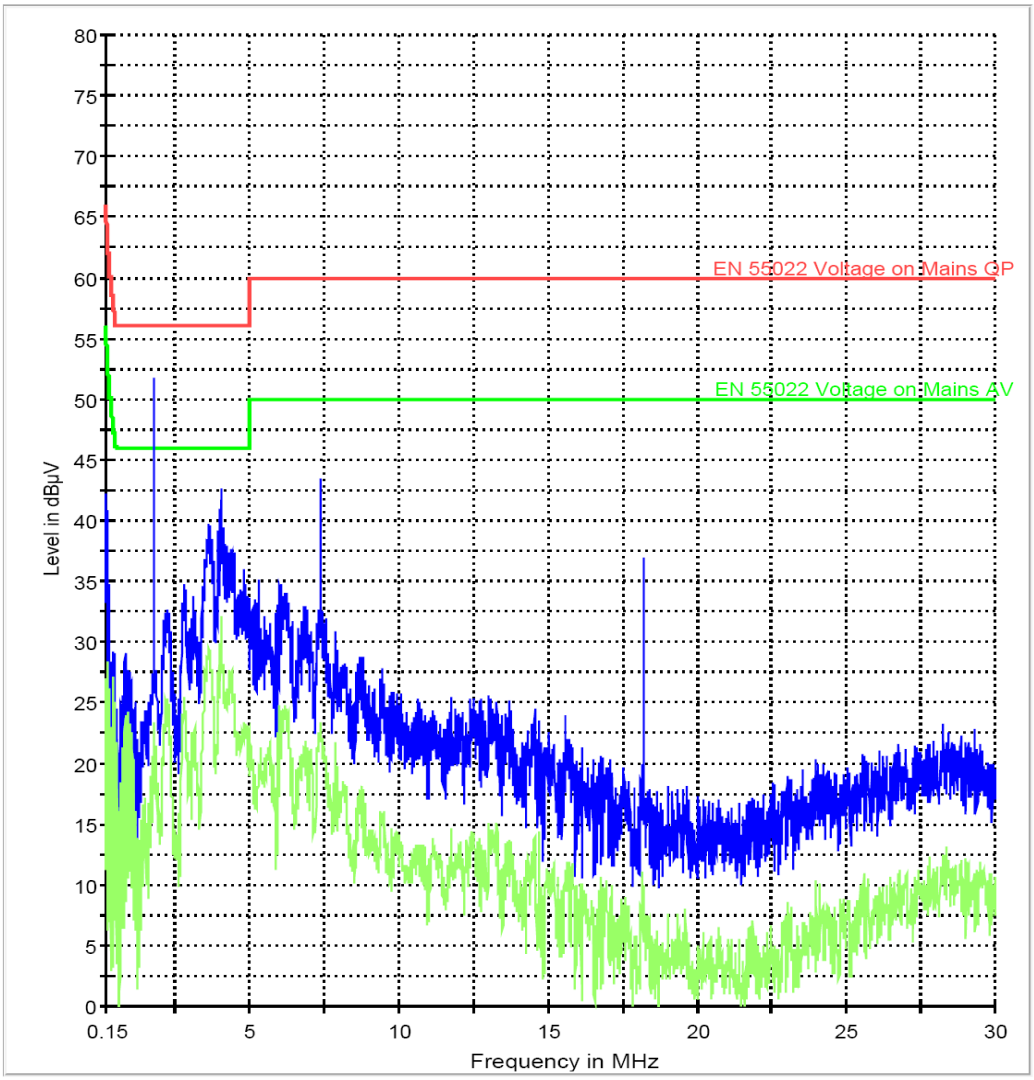
6/16/2009 mdouat EMC32 V8.10.10 4:32:22

Results, Netural: GSM/GPS RX

Neutral 1 / 1

Neutral

CISPR 22 Mains Conducted - N



6/16/2009 mdouat EMC32 V8.10.10 4:35:25

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

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.

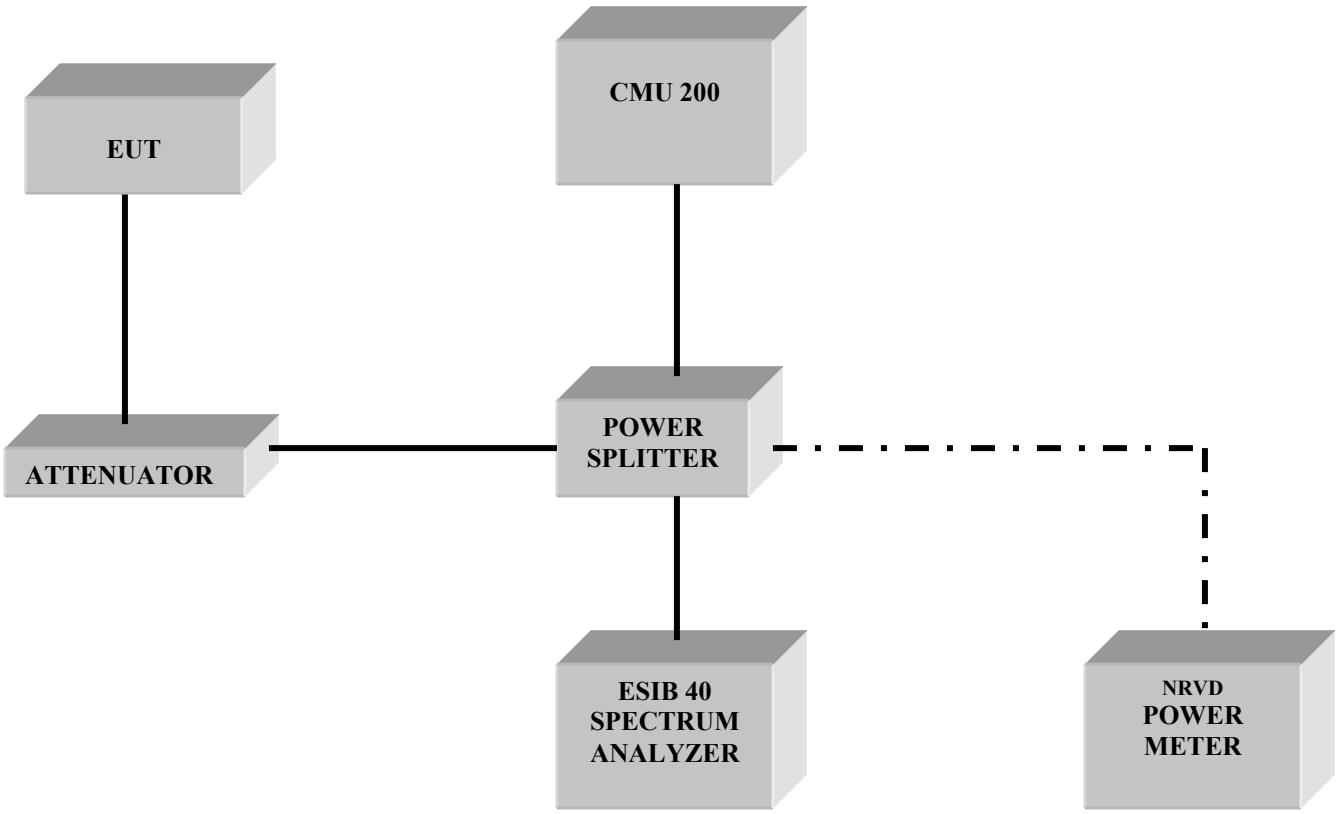
FCC Report and order 02-229 September 24, 2002.

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.

8 BLOCK DIAGRAMS

Conducted Testing



Radiated Testing