FCC Test Report

FOR:

Manufacturer: Biomedical Systems, Inc
Model Name: HAA

FCC ID: YCVBRHA02

47 CFR Part 2, 22, 24

TEST REPORT #: EMC_BIOMED_004_12001_FCC_22_24_rev1
DATE: 2012-05-11

ACCREDITED
TESTING LABORATORY
Certificate #2135.01

CTIA Authorized Test Lab
LAB CODE 20020328-00

FCC listed:
A2LA Accredited

IC recognized #
3462B-1

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

Table of Contents

1 Assessment

The following device was tested against the applicable criteria specified in FCC rules Parts 2, 22 and 24 of Title 47 of the Code of Federal Regulations and no deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Biomedical Systems, Inc	Handheld Mobile Telemetry device	HAA

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2012-05-11	Compliance	Sajay Jose (Test Lab Manager)	

Responsible for the Report:

Date	Section	Name	Signature
2012-05-11	Compliance	Josie Sabado (Project Engineer)	

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the 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
Test Lab Director:	Heiko Strehlow
Responsible Project Leader:	Chris Torio, Rami Saman

2.2 Identification of the Client

Applicant's Name:	Biomedical Systems, Inc
Street Address:	77 Progress Parkway
City/Zip Code	St. Louis, MO 63043
Country	USA
Contact Person:	Eric Baumann
Phone No.	(619) 537-9125
Fax:	(858) 366-4993

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:	TruVue
Model No:	HAA
Product Type:	Portable
Prototype/Production:	Pre-Production
FCC-ID:	YCVBRHA02
Module Information:	Sierra Wireless Q2687 FCC ID: N7NQ2687
Frequency band of operation tested:	GSM 850: 824.2-848.8MHz PCS 1900: 1850.2-1909.8MHz
Type(s) of Modulation:	GMSK; 8-PSK
Number of channels:	GSM850: 125 PCS 1900: 300
Antenna Type:	Internal planar inverted F, PCB-mounted antenna
Power Supply:	3.2 – 4.2 VDC
Temperature Range:	0 – 45 °C

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Comments
1	HAA1689	HAA	0.41.0	Radiated Unit
2	HAA1693	HAA	0.41.0	Conducted Unit

3.3 Identification of Accessory equipment

No accessory equipment

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

This test report is to support a request for new equipment authorization under the FCC ID **YCVBRHA02**
All testing was performed on the product referred to in Section 3 as EUT.

5 Summary of Measurement Results

850 Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §22.913 (a)	RF Output Power	Nominal	GSM 850	■	☐	☐	☐	Complies
§2.1055 §22.355	Frequency Stability	Nominal	GSM 850	☐	☐	☐	■	See Note 1
§2.1049 §22.917(b)	Occupied Bandwidth	Nominal	GSM 850	☐	☐	☐	■	See Note 1
§2.1051 §22.917	Band Edge Compliance	Nominal	GSM 850	☐	☐	☐	■	See Note 1
§2.1051 §22.917	Conducted Spurious Emissions	Nominal	GSM 850	☐	☐	☐	■	See Note 1
§2.1053 §22.917	Radiated Spurious Emissions	Nominal	GSM 850	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.

1. Measurements are leveraged from the module's test report with FCC ID: N7NQ2687. Refer to test report number SHEMO10030019402 issued by SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. on March 15, 2010 for test data.

1900 Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP[1]	Result
§2.1046 §24.232 (a)	RF Output Power	Nominal	GSM 1900	■	☐	☐	☐	Complies
§2.1055 §24.235	Frequency Stability	Nominal	GSM 1900	☐	☐	☐	■	See Note 1
§2.1049 §24.238(b)	Occupied Bandwidth	Nominal	GSM 1900	☐	☐	☐	■	See Note 1
§2.1051 §24.238	Band Edge Compliance	Nominal	GSM 1900	☐	☐	☐	■	See Note 1
§2.1051 §24.238	Conducted Spurious Emissions	Nominal	GSM 1900	☐	☐	☐	■	See Note 1
§2.1053 §24.238	Radiated Spurious Emissions	Nominal	GSM 1900	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.

1. Measurements are leveraged from the module's test report with FCC ID: N7NQ2687. Refer to test report number SHEMO10030019402 issued by SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. on March 15, 2010 for test data.

6 Measurements

6.1 RF Power Output

6.1.1 References

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

6.1.2 Measurement requirements:

6.1.2.1 FCC 2.1046: 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.

6.1.3 Limits:

6.1.3.1 FCC 22.913 (a) Effective radiated power limits.

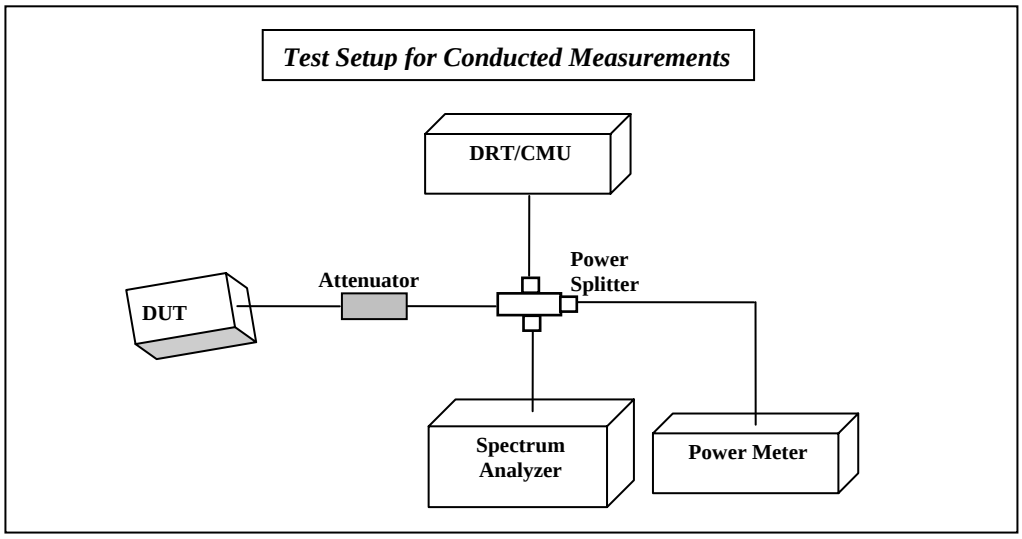
The effective radiated power (ERP) of mobile transmitters must not exceed 7 Watts.

6.1.3.2 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.

6.1.4 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 Radio Communication Tester (DRT- CMU200 here) 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.

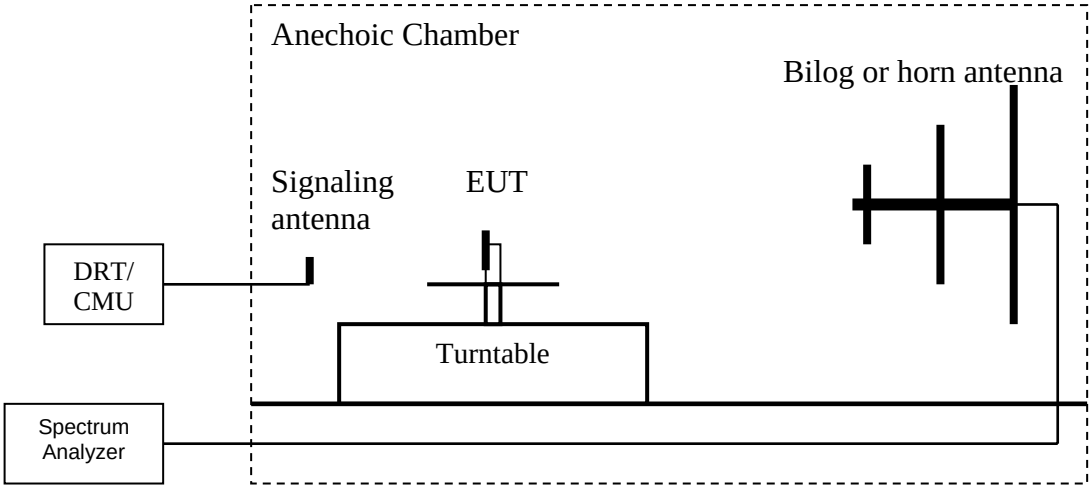
Measurement Uncertainty (Conducted): ±0.5 dB

Spectrum Analyzer Settings:
GSM: RBW=3MHz; VBW=10MHz; Span=10MHz; Detector: Peak- Max Hold;
Sweep time: Auto.

Average measurements performed using RMS detector functionality of the Spectrum Analyzer.

6.1.5 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 center of the turn table.
2. Adjust the settings of the Digital Radio Communication 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=3 MHz
(**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.)
Measurement Uncertainty (Radiated): ±3.0 dB

6.1.6 RF Power Output 850MHz band

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

GSM 850: GMSK Mode			
Frequency (MHz)	**Measured Conducted Power**	**Measured Radiated Power**	**Calculated antenna gain**
	Peak Power (dBm)	**ERP (dBm)**	
824.2	32.6	33.364	0.764
836.6	32.4	32.658	0.258
848.8	32.3	32.658	0.358

EGPRS 850: 8PSK Mode			
Frequency (MHz)	**Measured Conducted Power**	**Measured Radiated Power**	**Calculated antenna gain**
	Peak Power (dBm)	**ERP (dBm)**	
824.2	29.2	27.028	-2.172
836.6	29.2	27.162	-2.038
848.8	29.2	27.265	-1.935

6.1.6.1 Measurement Result

Pass.

6.1.7 RF Power Output 1900MHz band

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

GSM 1900: GMSK Mode			
Frequency (MHz)	**Measured Conducted Power**	**Measured Radiated Power**	**Calculated antenna gain**
	Peak Power (dBm)	**EIRP (dBm)**	
1850.2	28.9	30.670	1.77
1880.0	28.9	31.158	2.258
1909.8	29.0	29.670	0.670

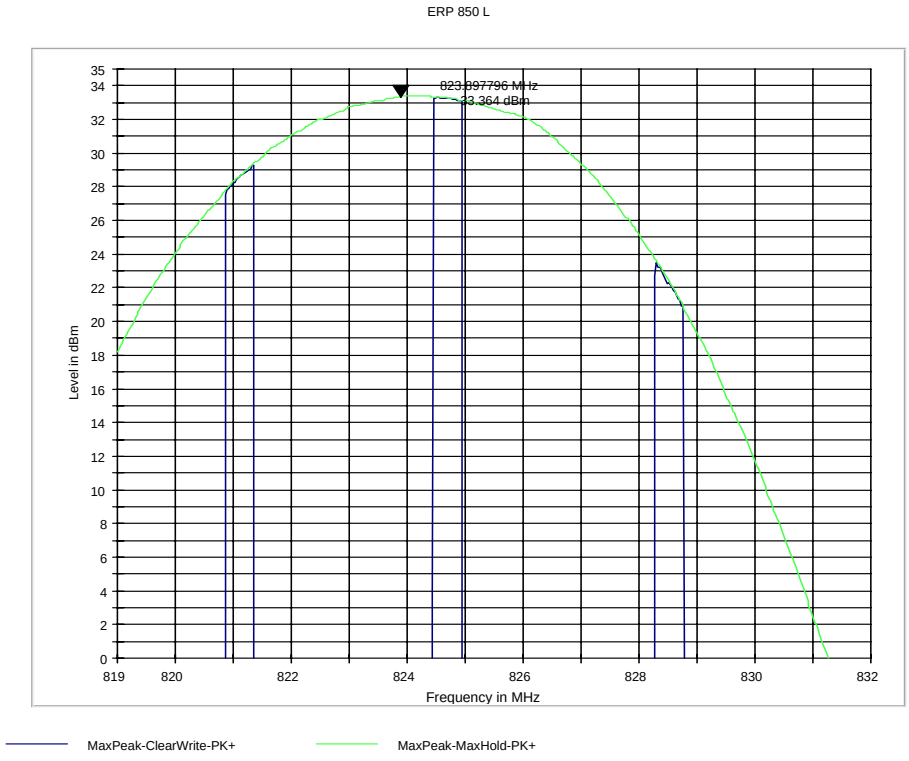
EGPRS 1900: 8PSK Mode			
Frequency (MHz)	**Measured Conducted Power**	**Measured Radiated Power**	**Calculated antenna gain**
	Peak Power (dBm)	**EIRP (dBm)**	
1850.2	28.6	27.163	-1.437
1880.0	28.4	28.012	-0.388
1909.8	28.3	29.496	1.196

6.1.7.1 Measurement Result

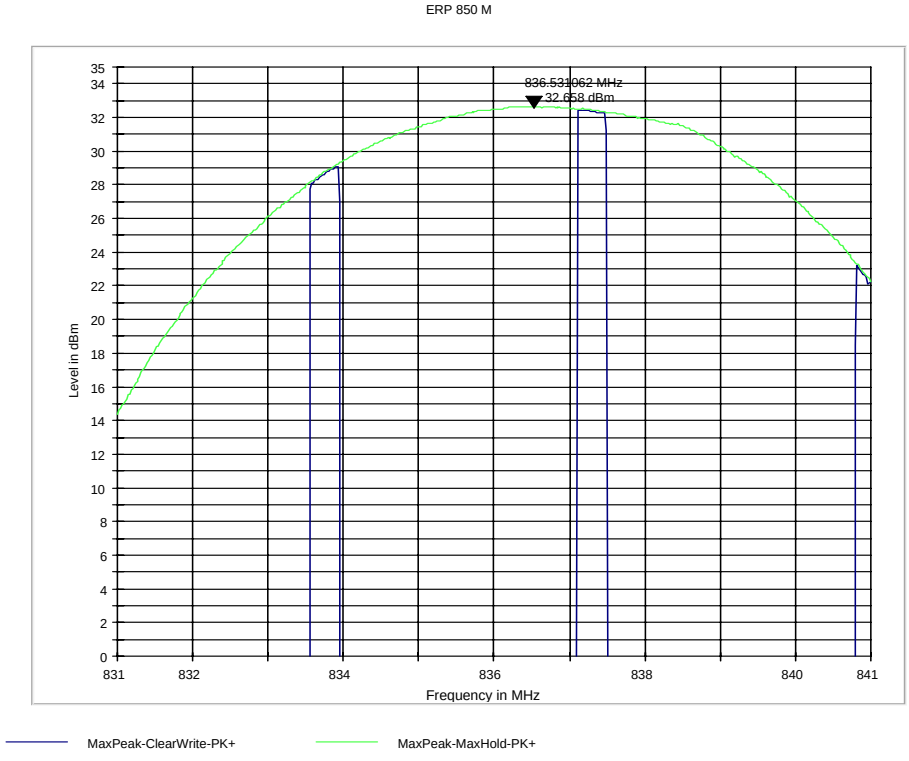
Pass.

6.1.8 Results

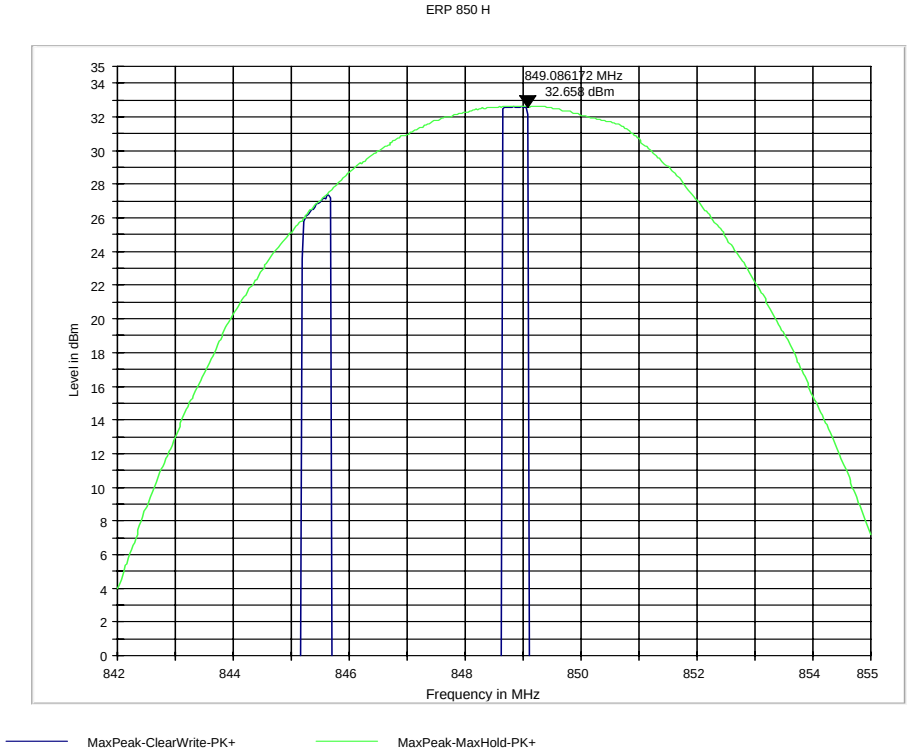
ERP (GSM 850) CHANNEL 128



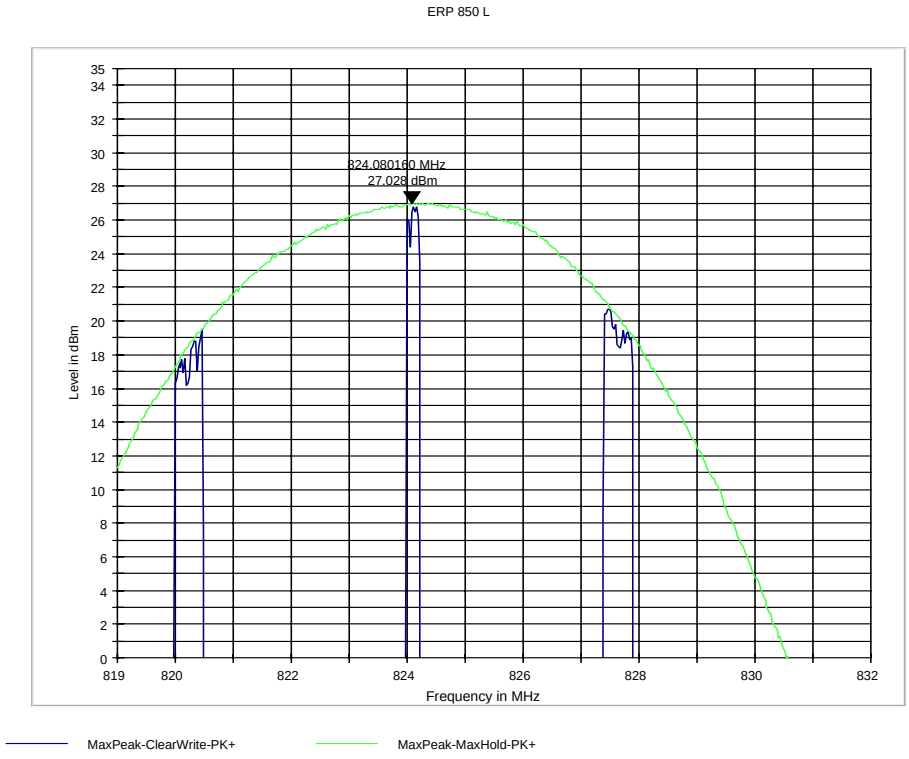
ERP (GSM 850) CHANNEL 190



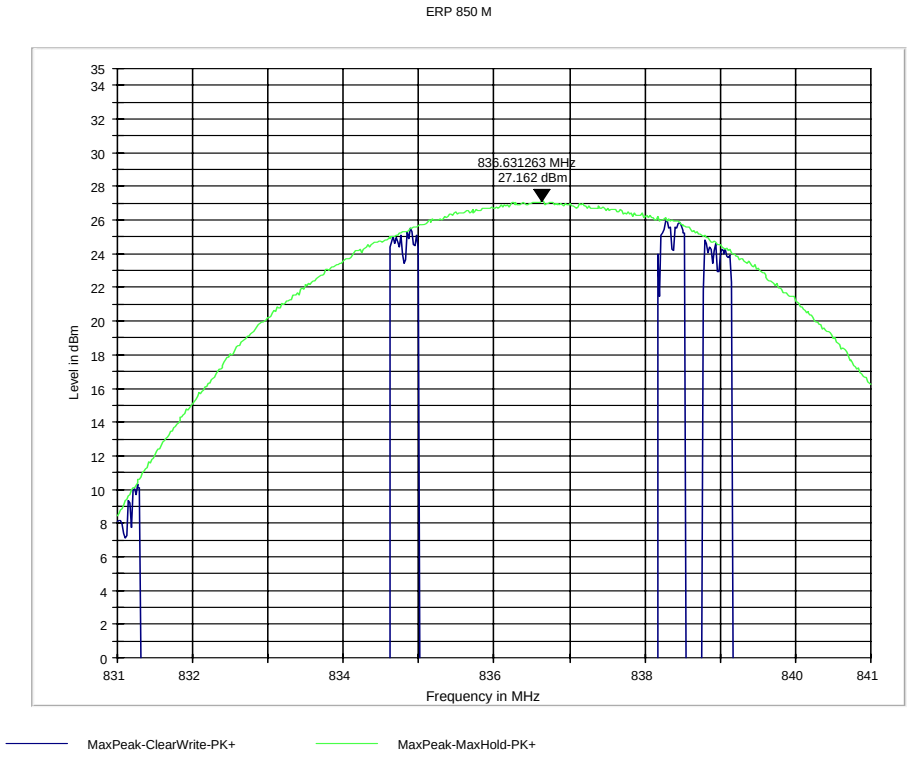
ERP (GSM 850) CHANNEL 251



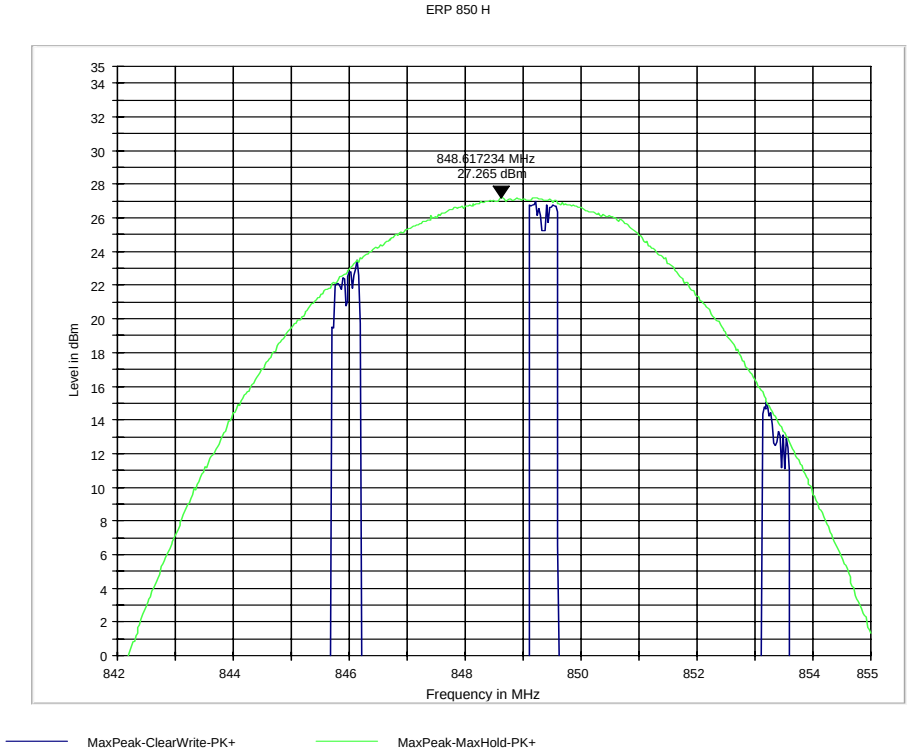
ERP (EGPRS 850) CHANNEL 128



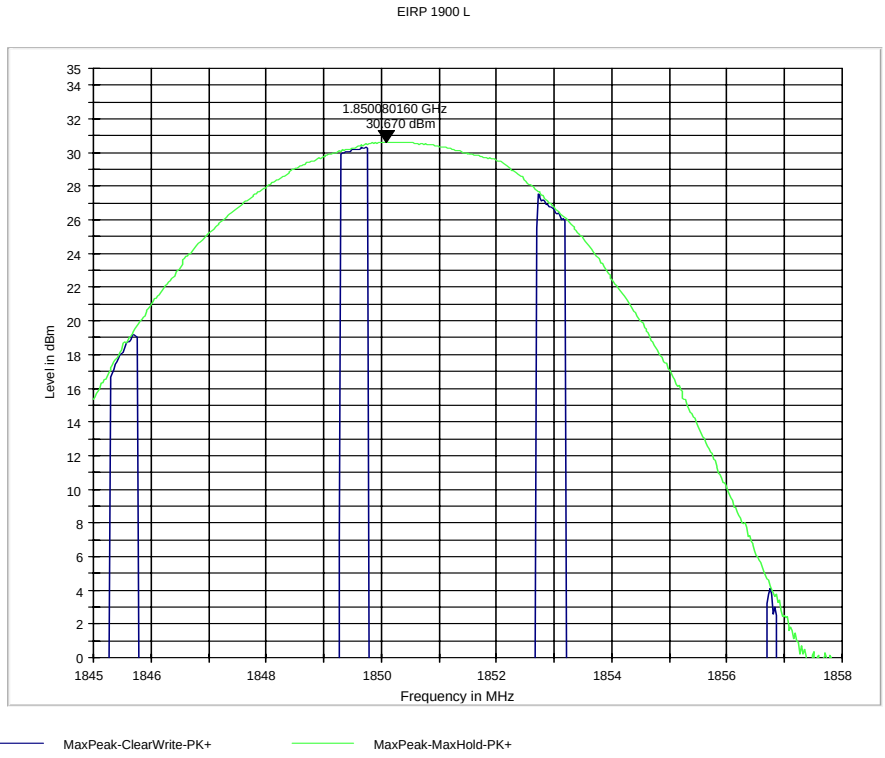
ERP (EGPRS 850) CHANNEL 190



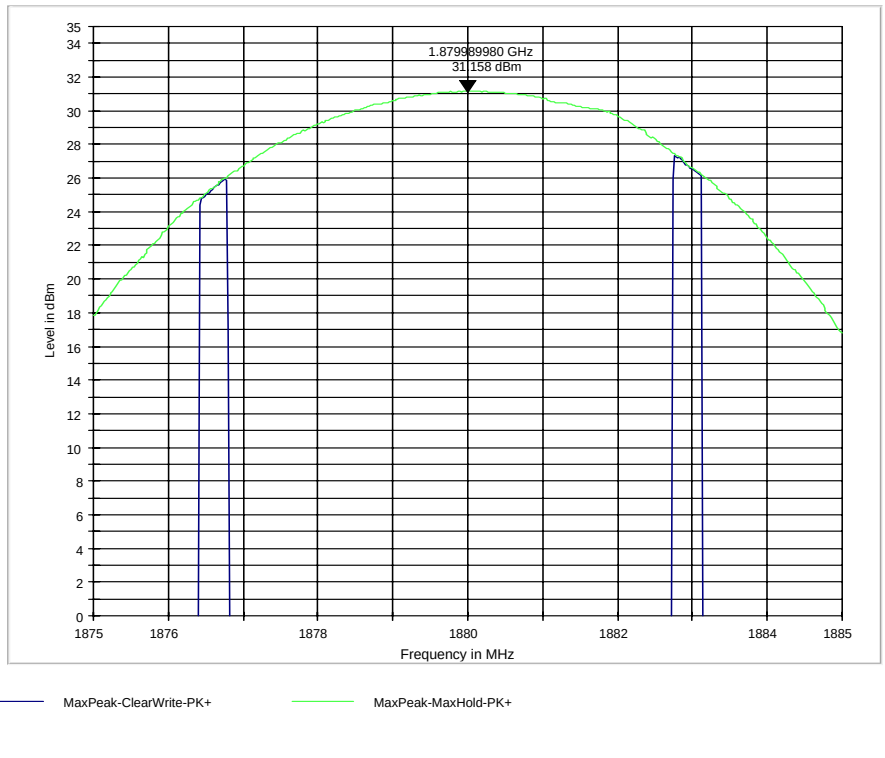
ERP (EGPRS 850) CHANNEL 251



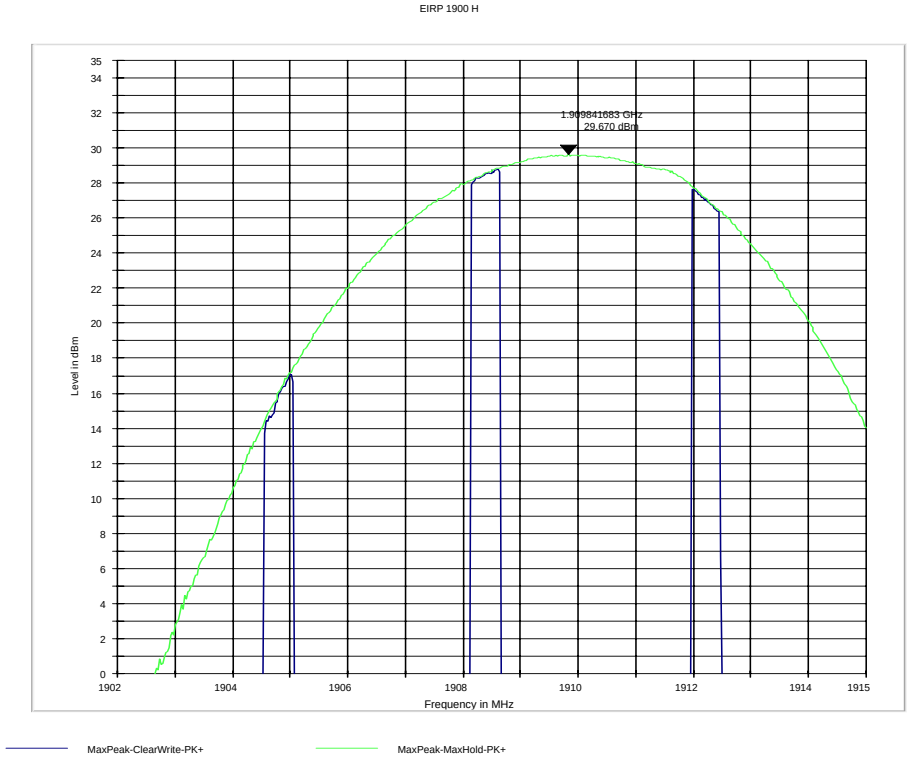
EIRP (PCS-1900) CHANNEL 512



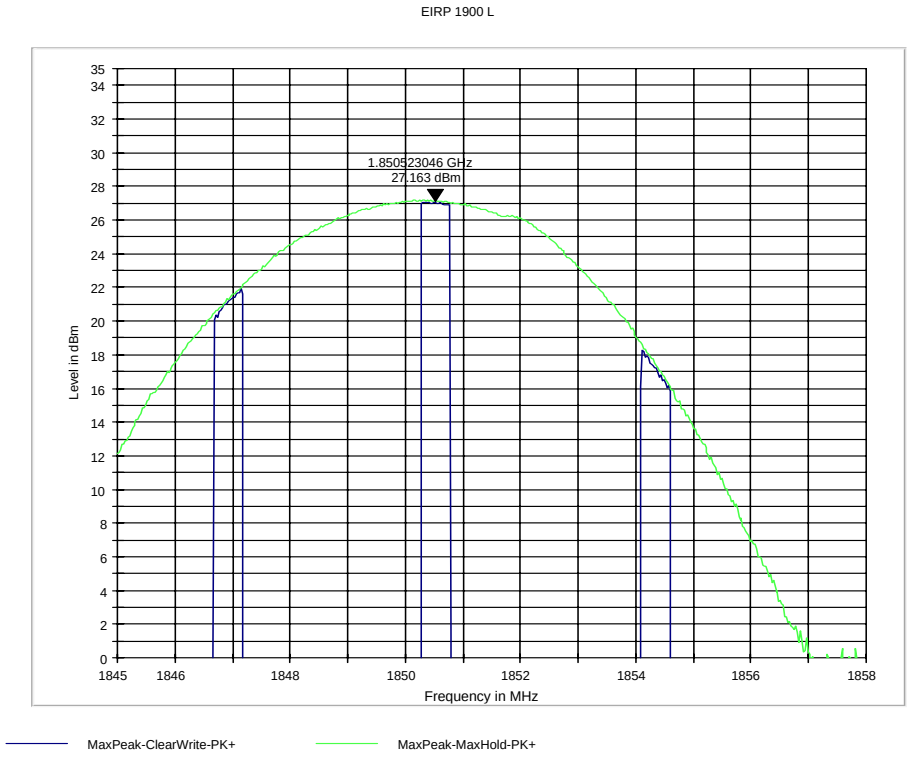
EIRP (PCS-1900) CHANNEL 661



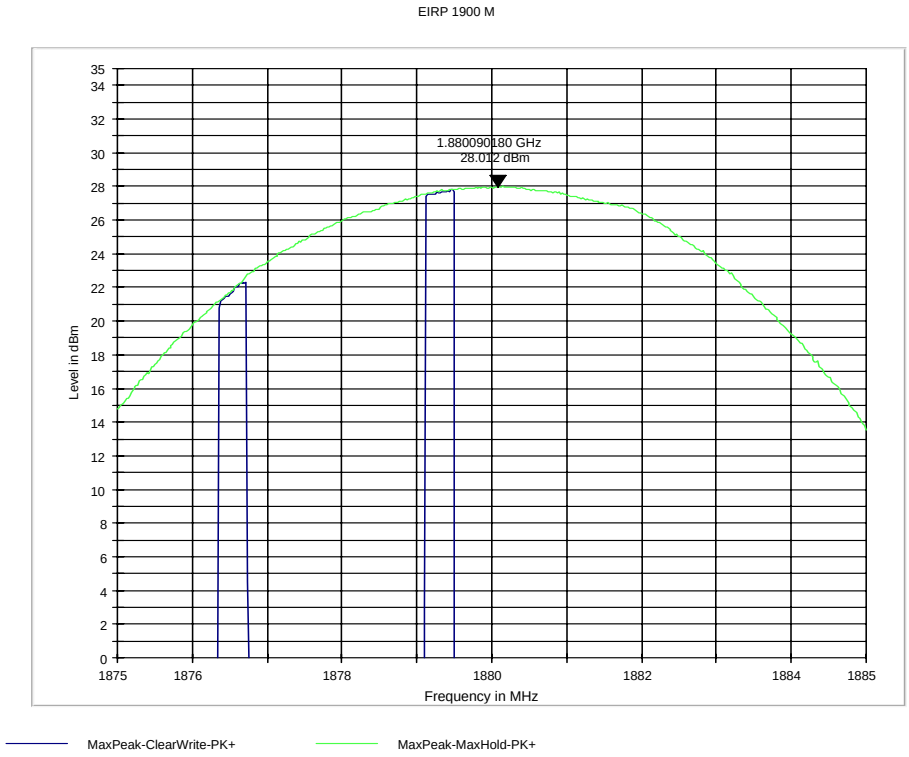
EIRP (PCS-1900) CHANNEL 810



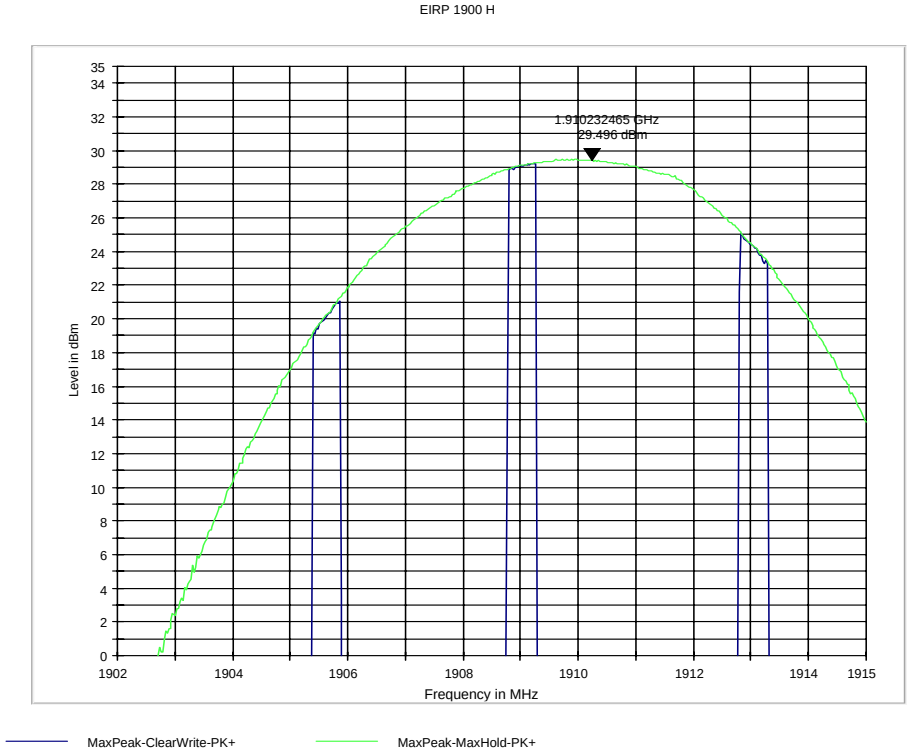
EIRP (EGPRS 1900) CHANNEL 512



EIRP (EGPRS 1900) CHANNEL 661



EIRP (EGPRS 1900) CHANNEL 810



6.2 Spurious Emissions Radiated

6.2.1 References

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

6.2.2 Measurement requirements:

6.2.2.1 FCC 2.1053: 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.

6.2.3 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.

6.2.3.1 FCC 22.917 Emission limitations for cellular equipment.

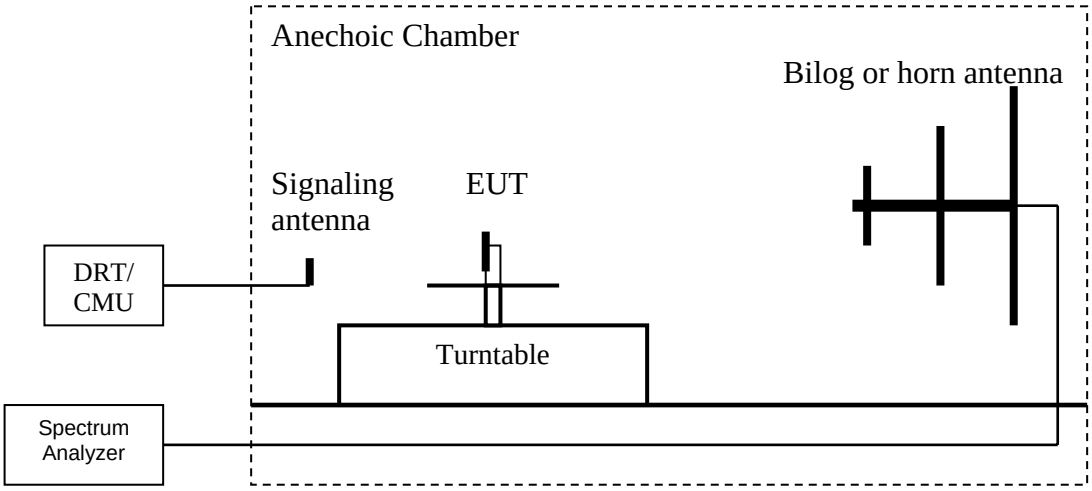
The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.
(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands 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.

6.2.3.2 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.

6.2.4 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.
    (N**ote:** 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

6.2.5 Sample Calculations for Radiated Measurements

6.2.5.1 Power Measurements using Substitution Procedure:

The measurement on the Spectrum Analyzer is used as a basis for the Substitution procedure.
The EUT is replaced with a Signal Generator and an antenna. The setting on the Signal Generator is varied until the Spectrum Analyzer displays the original reading. EIRP is calculated as-

EIRP (dBm)= Signal Generator setting (dBm)- Cable Loss (dB)+ Antenna Gain (dBi)
Eg:

Frequency (MHz)	Measured SA (dBµV)	Signal Generator setting (dBm)	Antenna Gain (dBi)	Dipole Gain (dBd)	Cable Loss (dB)	EIRP (dBm)
1000	95.5	24.5	6.5	0	3.5	27.5

Measurement Summary:

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

Radiated emission measurements were made only with Circuit Switched mode GMSK modulation because this mode represents the worse case emission for all the modulations for GSM. All measurements are done in horizontal and vertical antenna polarization; and on three orientations of the EUT. 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.

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

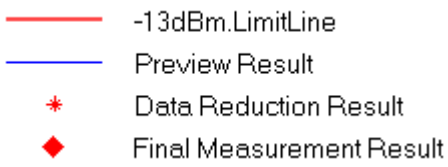
6.2.6.1 Test Results Transmitter Spurious Emission GSM850:

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**	-34.154	**1673.2**	-37.998	**1697.6**	-38.072
3	**2472.6**	NF	**2509.8**	-40.122	**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 Measurement Uncertainty: ±3dB						

6.2.6.2 Measurement Result

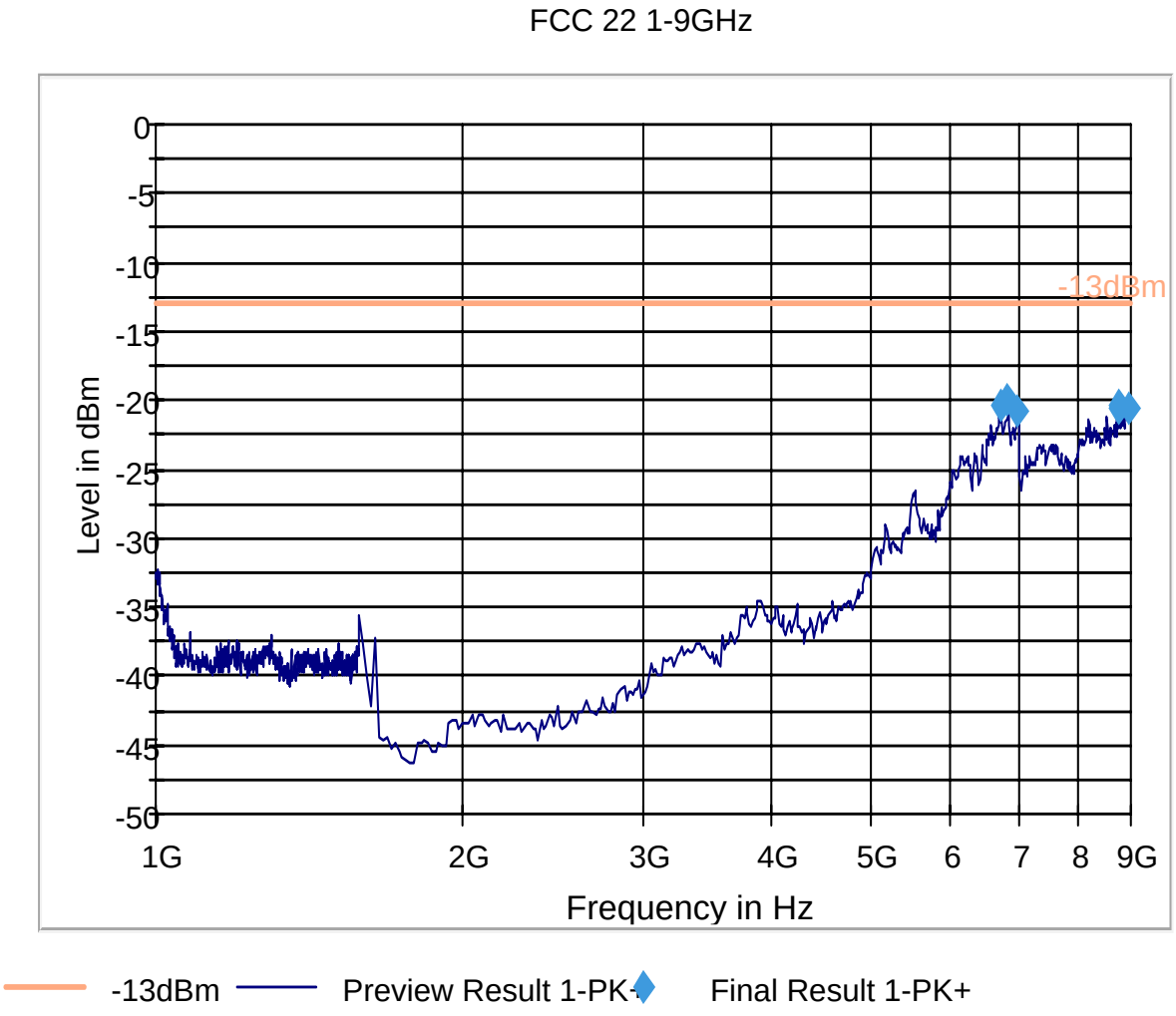
Pass.

Legend for the plots:



Radiated Spurious Emissions (GSM-850) Tx: Low Channel

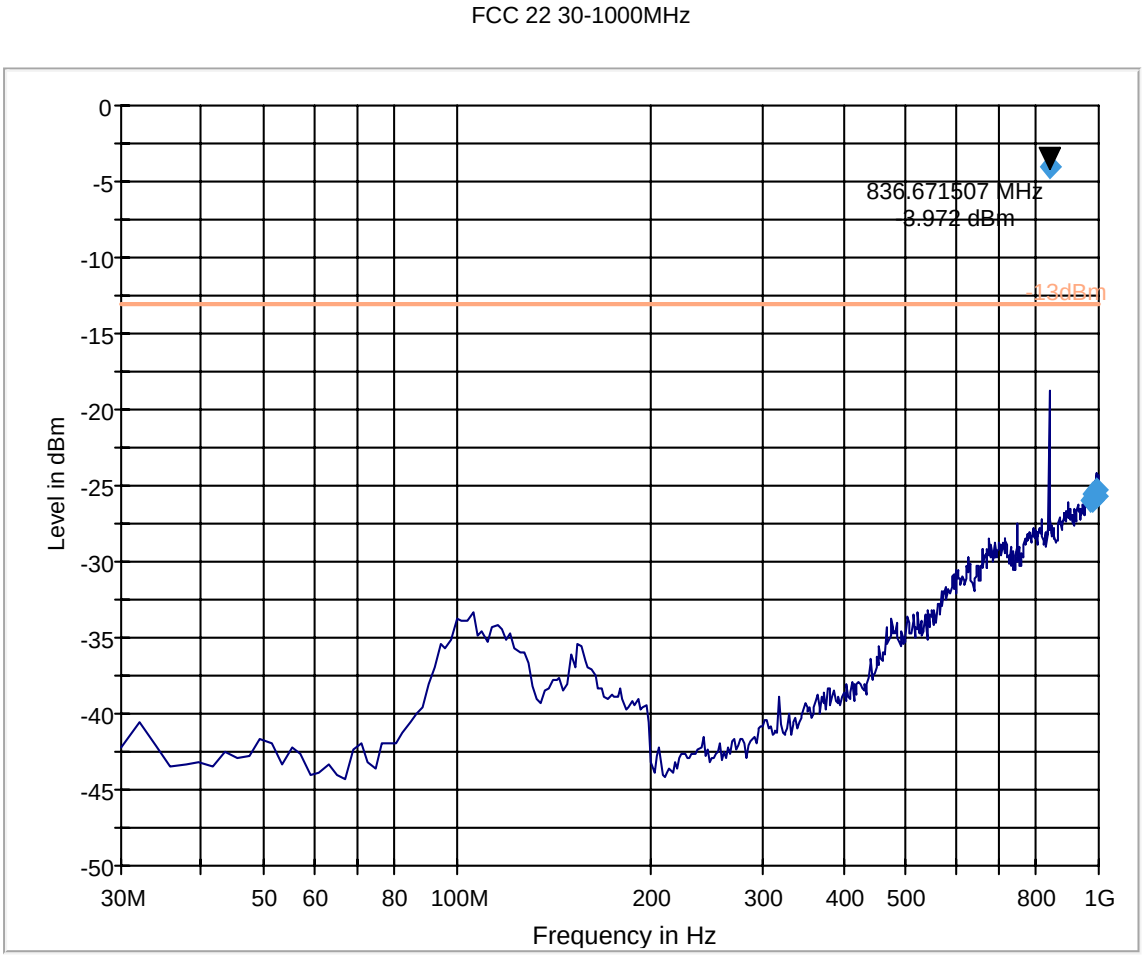
Test results: 1GHz-9GHz



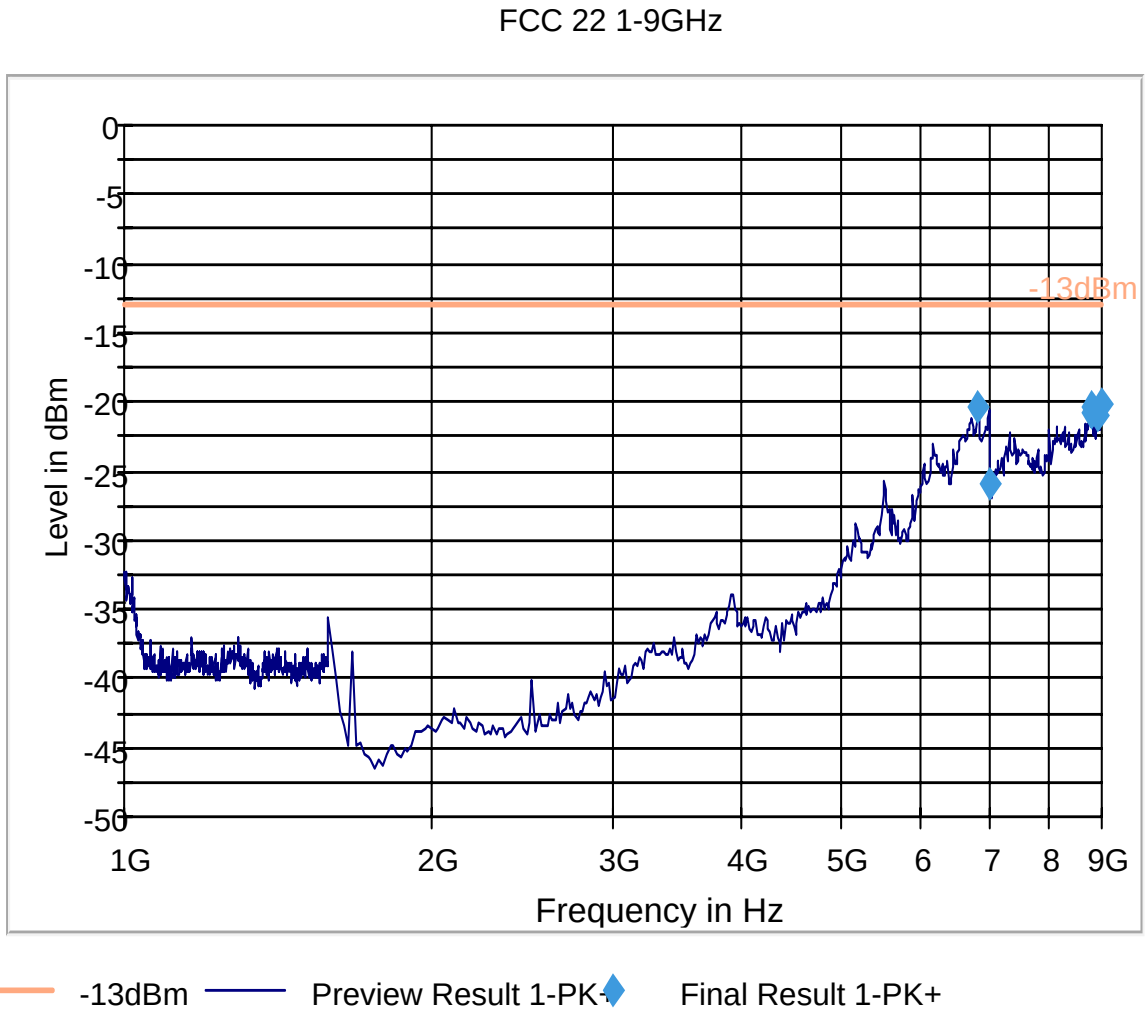
Radiated Spurious Emissions (GSM-850) Tx: Mid Channel

Test Results: 30M-1GHz –

Worst case representation for all channels in this frequency range.

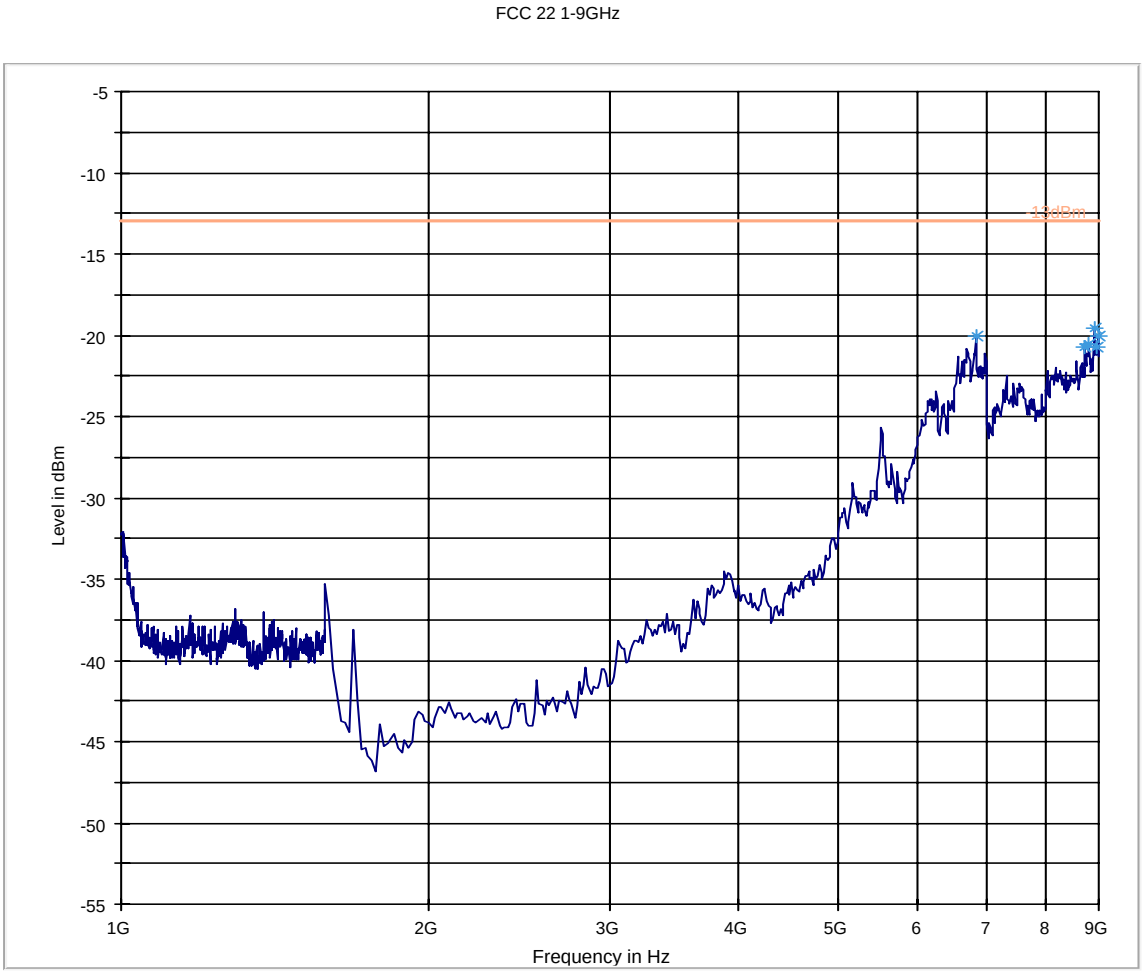


Test results: 1GHz-9GHz



Radiated Spurious Emissions (GSM-850) Tx: High Channel

Test results: 1GHz-9GHz



6.2.6.3 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**	-43.287	**3760**	NF	**3819.6**	NF
3	**5550.6**	-42.821	**5640**	-37.674	**5729.4**	-36.190
4	**7400.8**	NF	**7520**	-38.639	**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 Measurement Uncertainty: ±3dB						

6.2.6.4 Measurement Result

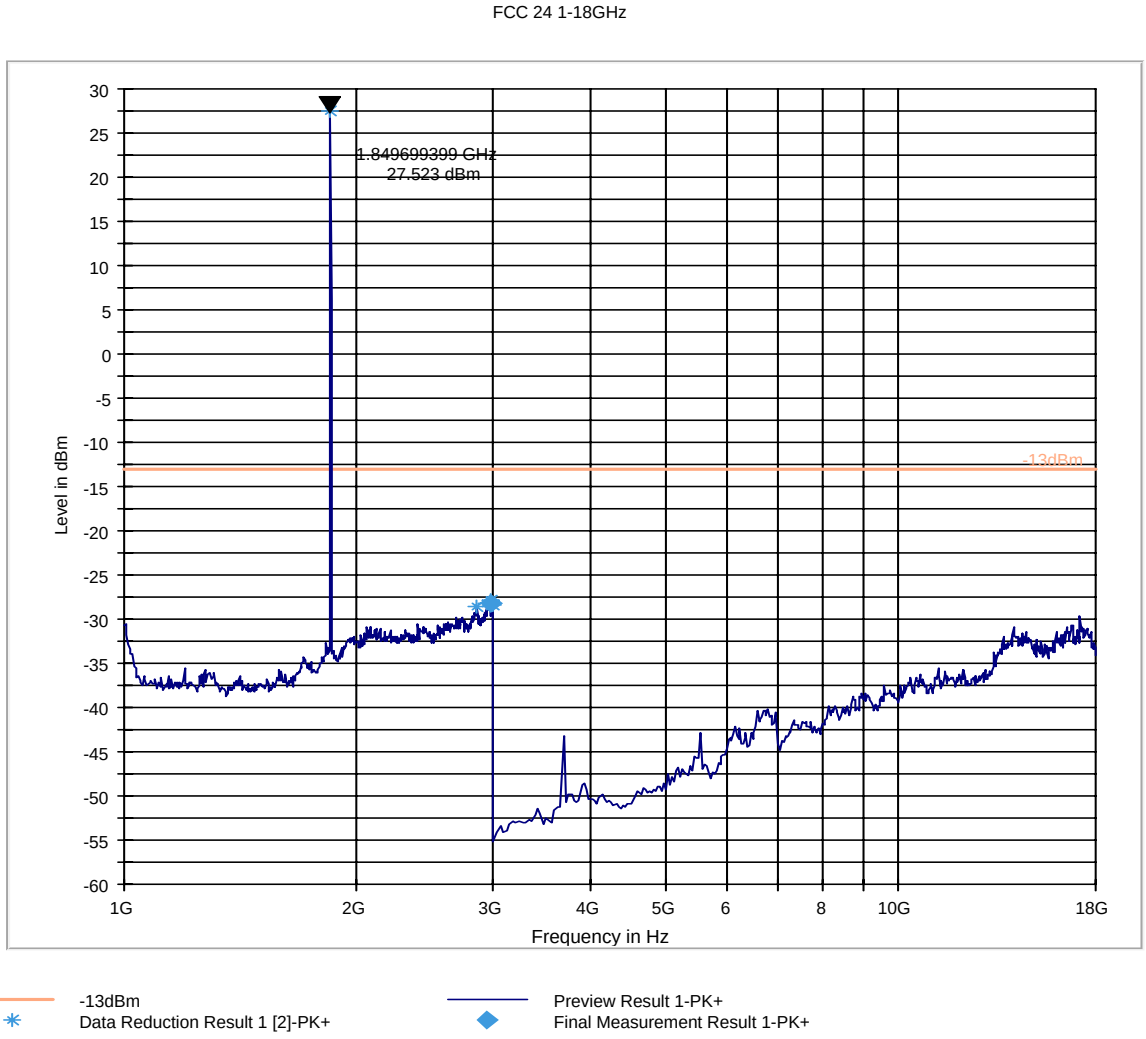
Pass.

Legend for the plots:

-13dBm.LimitLine
Preview Result
Data Reduction Result
Final Measurement Result

Radiated Spurious Emissions (GSM-1900) Tx: Low Channel

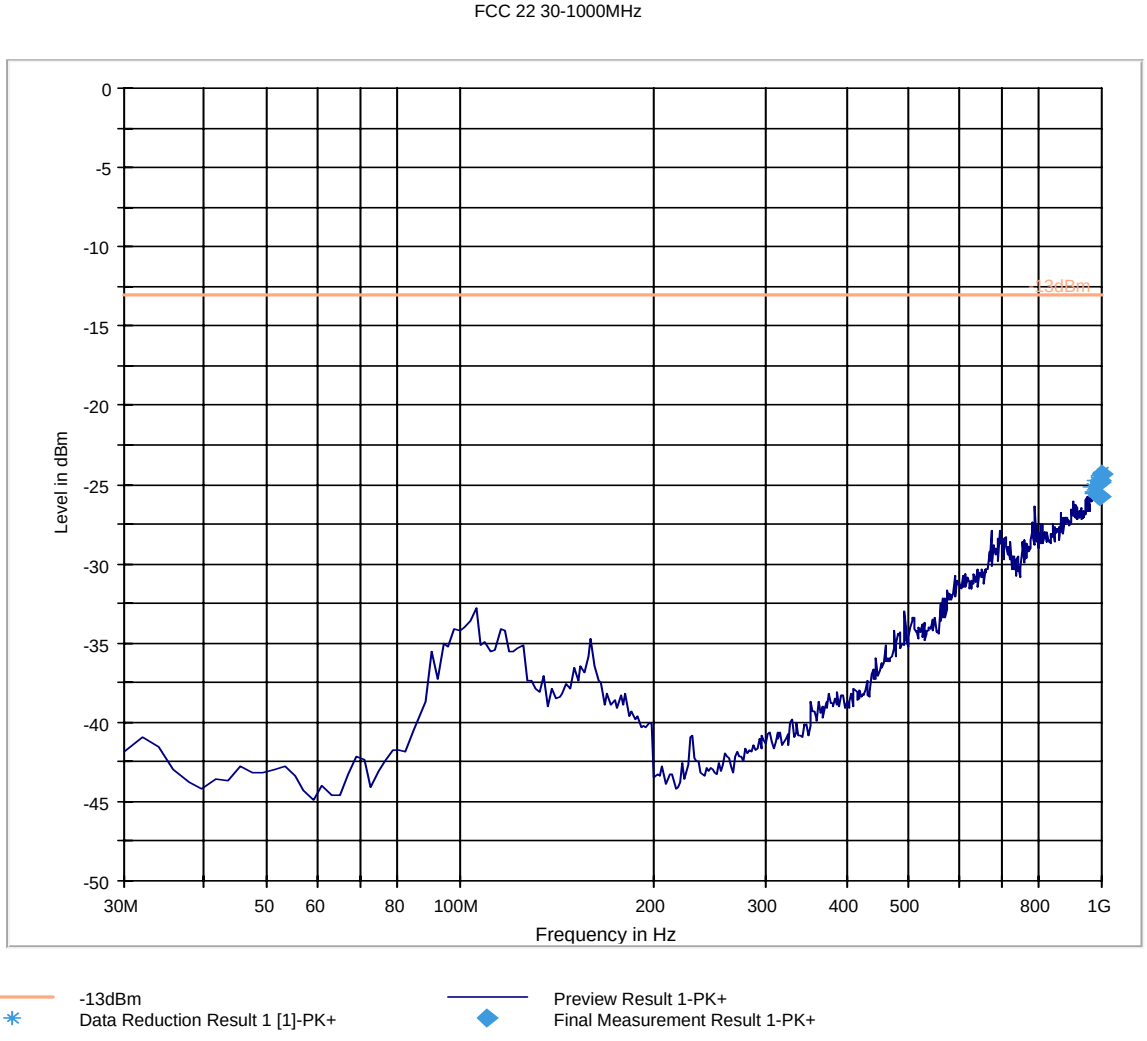
Test results: 1GHz-18GHz



Radiated Spurious Emissions (GSM-1900) Tx: Mid Channel

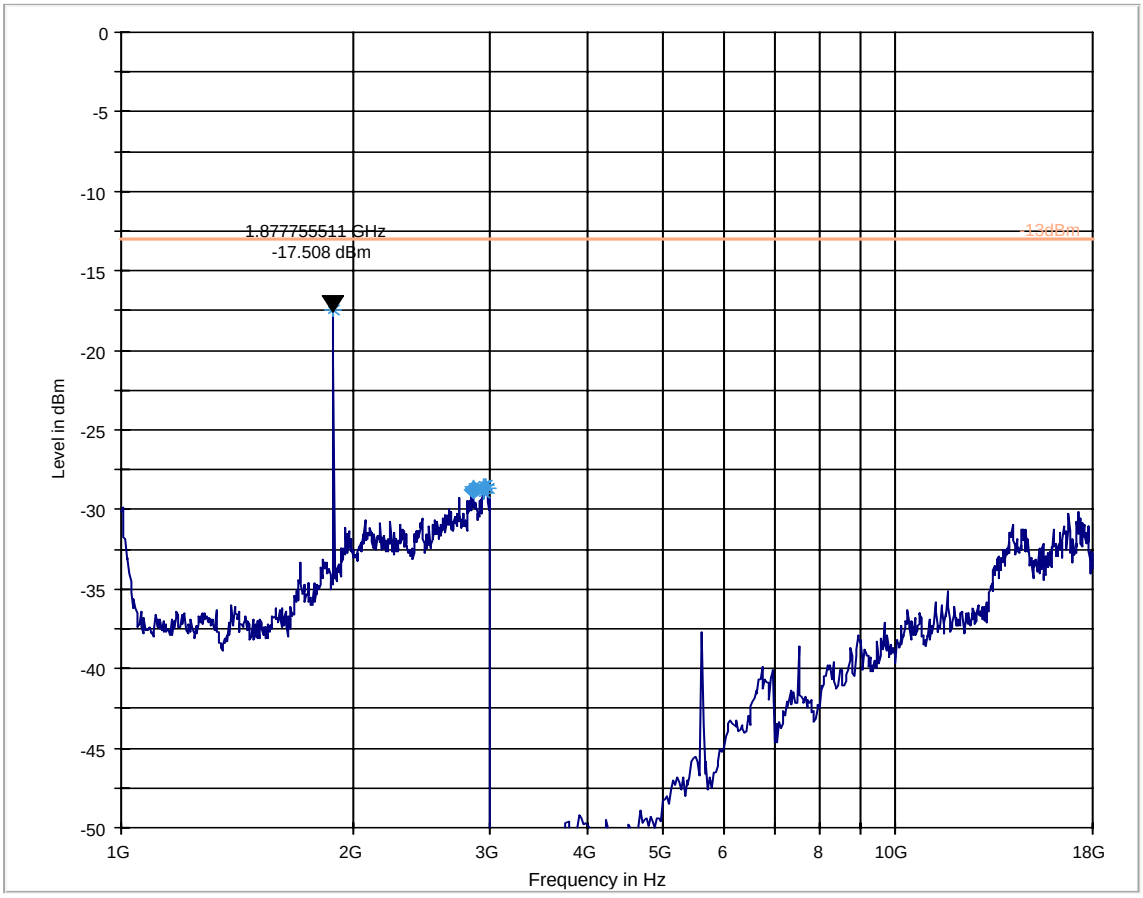
Test results: 30M-1GHz

Worst case representation for all channels in this frequency range.



Test results: 1GHz-18GHz

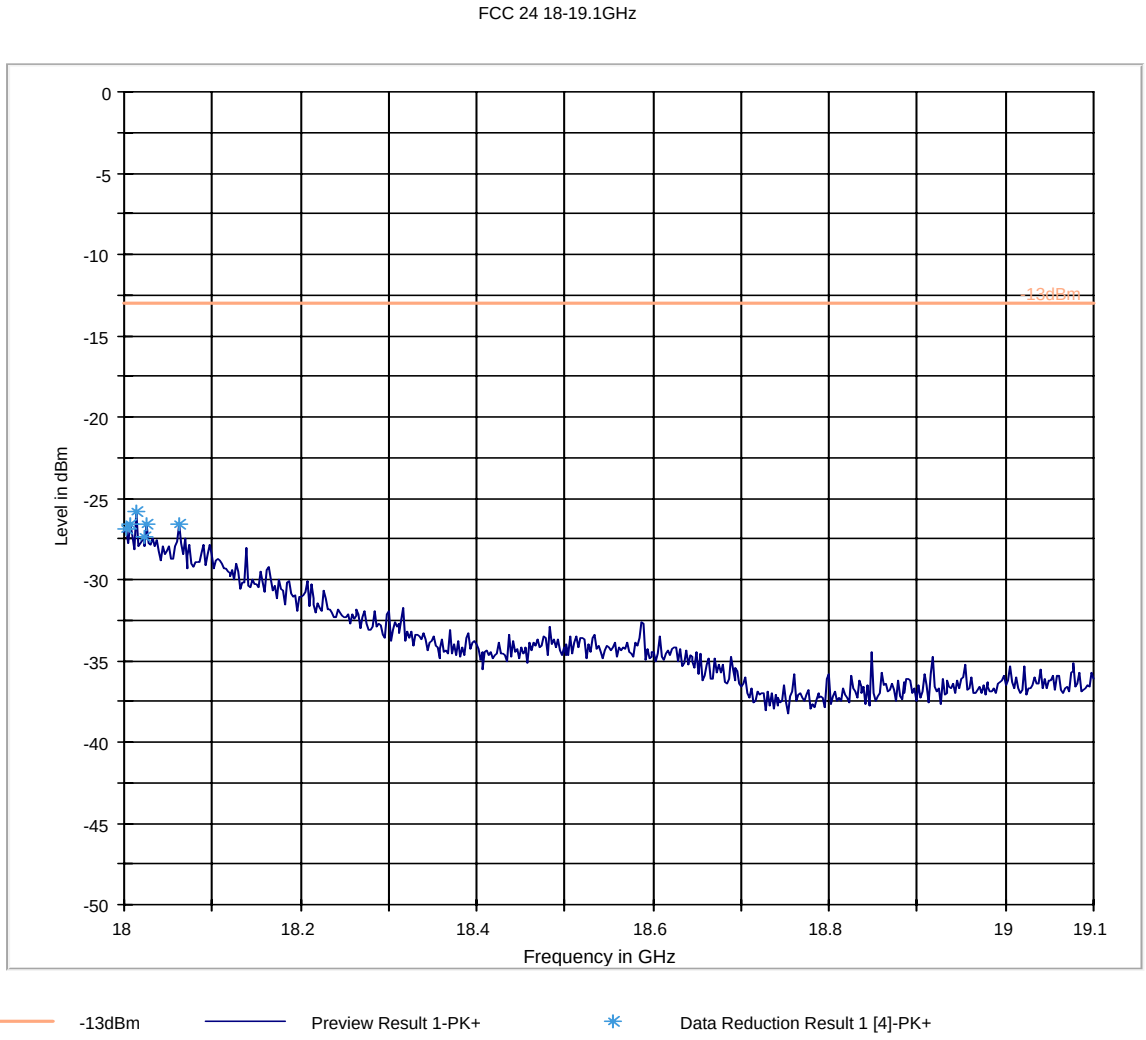
FCC 24 1-18GHz



-13dBm
Data Reduction Result 1 [2]-PK+
Preview Result 1-PK+
Final Measurement Result 1-PK+

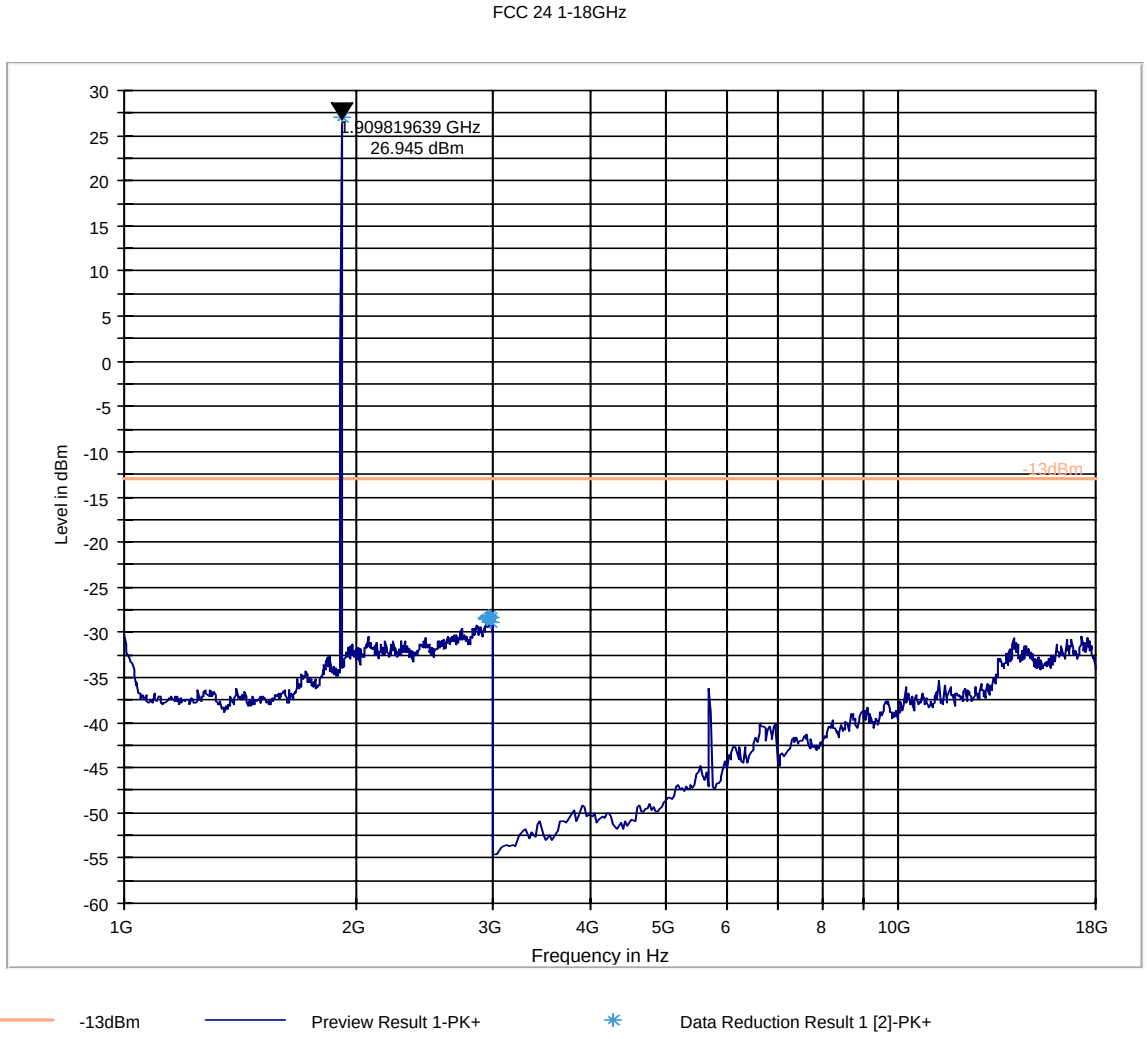
Test results: 18GHz-19.1GHz

Worst case representation for all channels in this frequency range.



Radiated Spurious Emissions (GSM-1900) Tx: High Channel

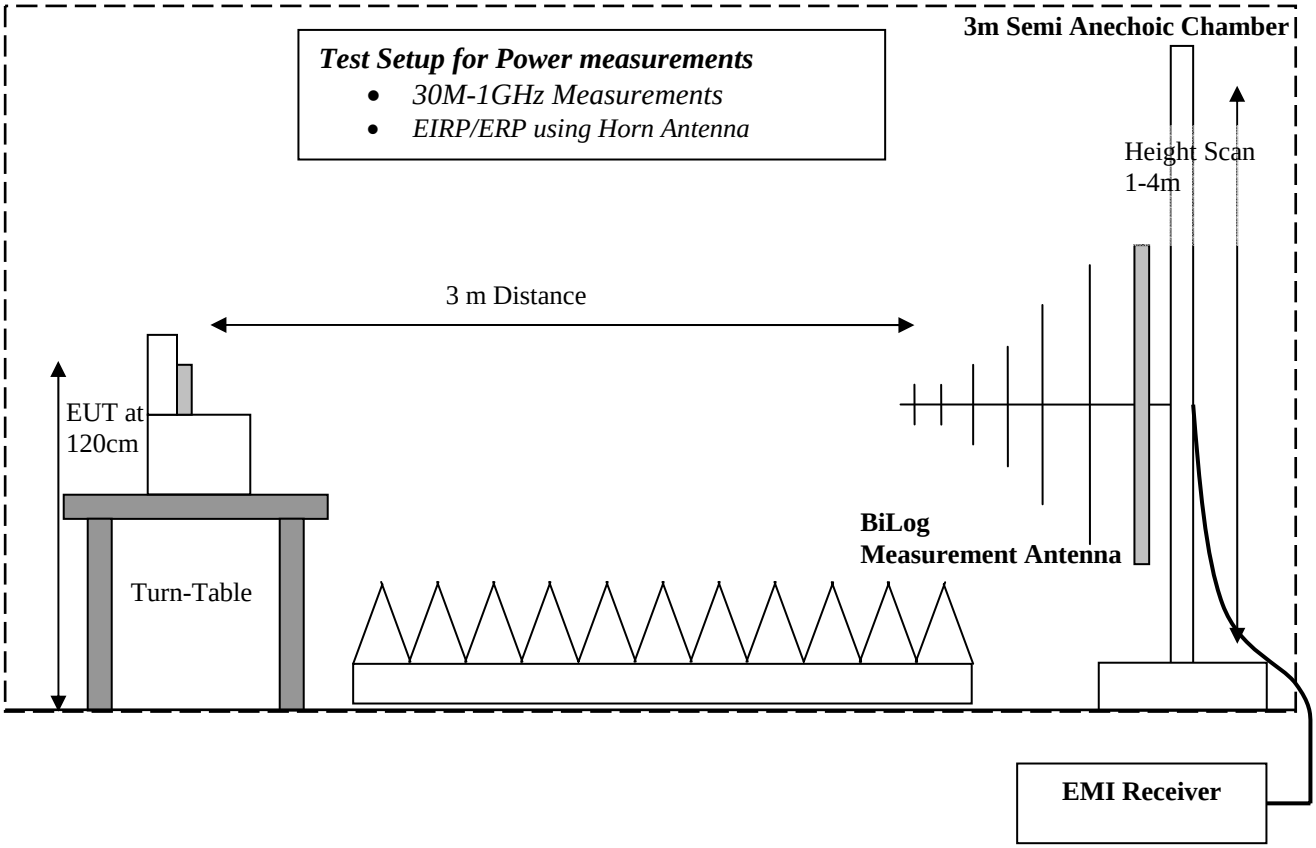
Test results: 1GHz-18GHz

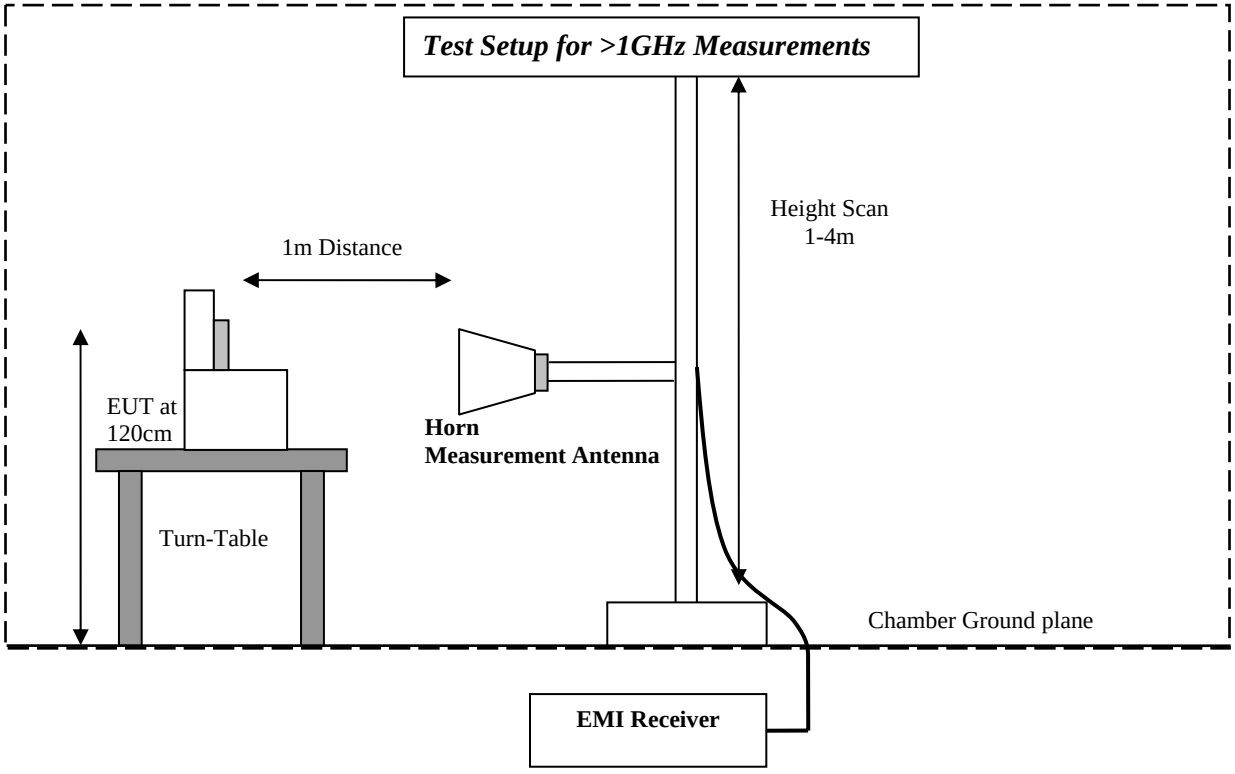


7 Test Equipment and Ancillaries used for tests

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
Radio Communication Tester	CMU 200	Rohde & Schwarz	110759	May 2011	2 Years
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2011	2 Years
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	May 2011	2 Years
Loop Antenna	6512	EMCO	00049838	Aug 2011	3 years
Biconilog Antenna	3141	EMCO	0005-1186	Apr 2012	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035111	Apr 2012	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035114	Mar 2012	3 years
Horn Antenna (18-40GHz)	3116	ETS	00070497	Aug 2011	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
6GHz High Pass Filter	HPM50106	Microtronics	001	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
LISN	50-25-2-08	FCC	08014	Jan 2012	1 year
Power Smart Sensor	R&S	NRP-Z81	100161	May 2011	2 Years
Multimeter	MM200	Klein	N/A	Apr 2011	2 Years
Temp Hum Logger	TM320	Dickson	03280063	Feb 2012	1 Year
Temp Hum Logger	TM325	Dickson	5285354	Feb 2012	1 Year

8 Block Diagrams





9 Revision History

Date	Report Name	Changes to report	Report prepared by
2012-05-02	EMC_BIOMED_004_12001_FCC_22_24	First Version	J Sabado
2012-05-11	EMC_BIOMED_004_12001_FCC_22_24_rev1	Replaces previous test report number. Removed AC Line Conducted Emissions	J Sabado