MOTOROLA

PERSONAL COMMUNICATIONS SECTOR

PRODUCT SAFETY AND COMPLIANCE EMC LABORATORY

EMC TEST REPORT

Test Report Number – 15835-1

Report Date – April 5, 2005

The test results contained herein relate only to the model(s) identified. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.

As the responsible EMC Engineer, I hereby declare that the equipment tested as specified in this report conforms to the requirements indicated.

Signature Mark Sidlow Name: Mark Sidlow

Title: Senior Electrical Engineer Date : April 22, 2005

A2LA Certificate Number: 1846-01

ACCREDITED

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Test Report Details

Tests Performed By:	Motorola Personal Communications Sector Product Safety and Compliance Group 600 North US Hwy 45 Libertyville, IL 60048 PH (847) 523-6167 Fax (847) 523-4538 Motorola PCS FRN: 0004321311 FCC Registration Number: 316588 Industry Canada Number: IC3908
Tests Requested By:	Motorola Inc. Personal Communications Sector 600 North US Hwy 45 Libertyville, IL 60048
Product Type:	Cellular Phone
Signaling Capability:	GSM 850, 1900
Model Number:	E398
Version:	SJUG0687AA
Serial Numbers:	TA59200216, TA59200216 TA59200217
Testing Complete Date:	April 4*, 2005*

Applicable Standards

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

__X__ Part 15 Subpart B – Unintentional Radiators
__X__ Part 22 Subpart H - Public Mobile Services
__X__ Part 24 - Personal Communications Services
_____ Part 90 - Private Land Mobile Radio Service

Applicable Standards: TIA EIA 137-A, TIA EIA 98-C, ANSI 63.4 2001, RSS-118 (AMPS), RSS-128 (TDMA), RSS-129 (CDMA), RSS-133 (PCS)

Summary of Testing

Test #	Test Name	Pass/Fail
1	RF Power Output	NA
2	ERP (Effective Radiated Power)	Pass
3	Modulation Characteristics	NA
4	Occupied Bandwidth	Pass
5	Spurious Emissions at Antenna Terminal	Pass
6	Field Strength of Spurious Emissions	Pass
7	Frequency Stability	Pass
8	Field Strength of Spurious Emissions from Unintentional Radiators	Pass

Test #	Test Name	Margin with respect to the Limit
1	RF Power Output	NA
2	ERP (Effective Radiated Power)	2.81
3	Modulation Characteristics	NA
4	Occupied Bandwidth	See Plots
5	Spurious Emissions at Antenna Terminal	16.2 dB
6	Field Strength of Spurious Emissions	5.7 dB
7	Frequency Stability	63 Hz
8	Field Strength of Spurious Emissions from Unintentional Radiators	Below noise floor

The margin with respect to the limit is the minimum margin for all modes and bands. ( ) indicates the margin at which the product exceeds the limit.

General and Special Conditions

The EUT was tested using a fully charged battery when applicable. Where a battery could not be used due to the need for a controlled variation of input voltage, an external power supply was utilized.

All testing was done in an indoor controlled environment with an average temperature of 22º C and relative humidity of 50%.

Equipment and Cable Configurations

The EUT was tested in a stand-alone configuration that is representative of typical use.

Measuring Equipment and Calibration Information

Manufacturer	Equipment Type	Model No.	Serial Number	Cal. Due Date
Rohde & Schwarz	Receiver	ESI26	838786/010	5/17/2005
Hewlett-Packard	EMC Analyzer	8593EM	3536A00118	10/2/2005
Hewlett-Packard	EMC Analyzer	7405	US39440191	11/13/2005
Miteq	Preamplifier 0.1-26.5GHz	NSP2650-NF-S	966350	1/8/2006
ETS	DRG Horn Antenna	3115	6222	10/4/2005
A.H. Systems Inc.	DRG Horn Antenna	SAS-2--/571	265	5/5/2005
ETS	Log-Periodic Antenna	3148	1189	7/15/2005
ETS	Biconical Antenna	3110B	3370	11/14/2005
Attenuator	Weinschel	AS-6	6675	10/14/2005
Attenuator	Weinschel	AS-6	6677	11/4/2005
Rohde & Schwarz	Mobile Test Set	CMD 80	DE29008	N/A
Hewlett-Packard	Signal Generator	83623B	3844A01195	6/20/2005
Thermotron	Environmental Chamber	S-4	31580	1/18/2006
Giga-Tronics	Power Meter	8651A	8650508	12/27/2005
Hewlett-Packard	Pre-Amplifier	8447F	2805A03419	5/19/2005

All equipment is on a one-year calibration cycle.

Measurement Procedures and Data

RF POWER OUTPUT

Measurement Procedure

The RF output port of the equipment under test is directly coupled to the input of a HPE4406A Vector Signal Analyzer through a 10dB passive attenuator, adaptor (if needed), and specialized RF connector. The peak power output is measured for all channels.

CFR47 Part 2.1046

Measurement Results

GSM 850

Frequency (MHz)	Power (dBm)
824.2	32.97
836.6	32.92
848.8	32.88

GSM 1900

Frequency (MHz)	Power (dBm)
1850.20	30.43
1880.00	30.46
1909.80	30.49

RADIATED POWER (ERP)

Measurement Procedure

The phone was tested in a 16' anechoic chamber with a 2-axis position system that permits complete spherical scans of the EUT's radiation patterns. For all tests, the phone was supported in a free space type environment, vertically oriented in the chamber.

GSM measurements were made with the phone placed in a call using the HP8922M mobile station test set. The phone was weakly coupled to the test set and configured to transmit in full data rate mode. Radiated power was measured at each 15 degree step. The radiated power was measured using a Gigatronics 8542C power meter in "Burst Avg" mode. From these measurements, the software calculates the angle at which maximum radiated power occurs, and the radiated power at this angle was extracted from the data. The max radiated power follows, referenced as EIRP in dBm. To get ERP (effective radiated power referenced to a half-wave dipole), subtract 2.1 dB from these values.

Measurement Results

Data not supplied by EMC Lab

GSM 850:

824.2 MHz	31.44 dBm
836.6 MHz	31.47 dBm
848.8 MHz	30.92 dBm

GSM 1900:

1850.2 MHz:	31.48 dBm
1880.0 MHz:	31.53 dBm
1909.8 MHz:	32.29 dBm

For all measurements, calibration was performed via gain substitution with a half-wave dipole.

Max EIRP in GSM 850 mode is 31.47 dBm **(max ERP is 29.37 dBm)**
Max EIRP in GSM 1900 mode is 32.29 dBm (max ERP is 30.19 dBm)

OCCUPIED BANDWIDTH

CFR Part 2.1049, 22.917, 24.238

Measurement Procedure

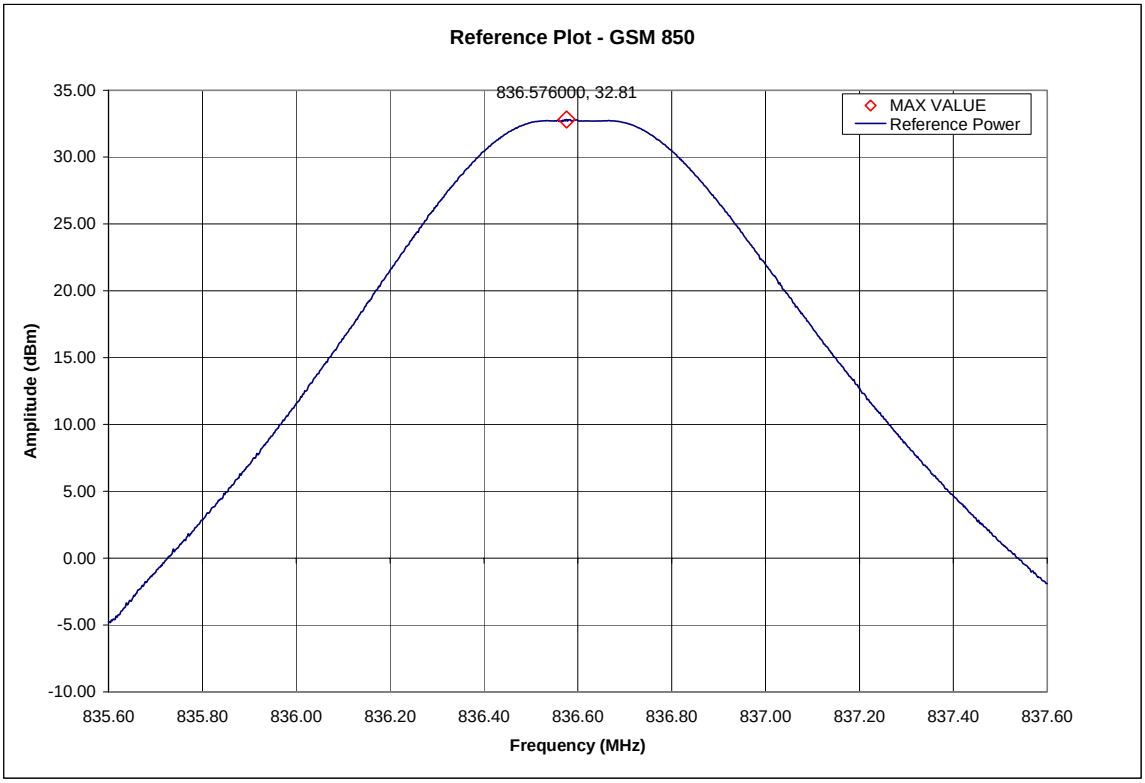
The RF output port of the equipment under test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. The amplitude of the spectrum analyzer is corrected for the attenuator and any other applicable losses. The analyzer is set for Peak Detector and each trace is set for Max Hold. A fully charged battery was used for the supply voltage.

Measurement Results

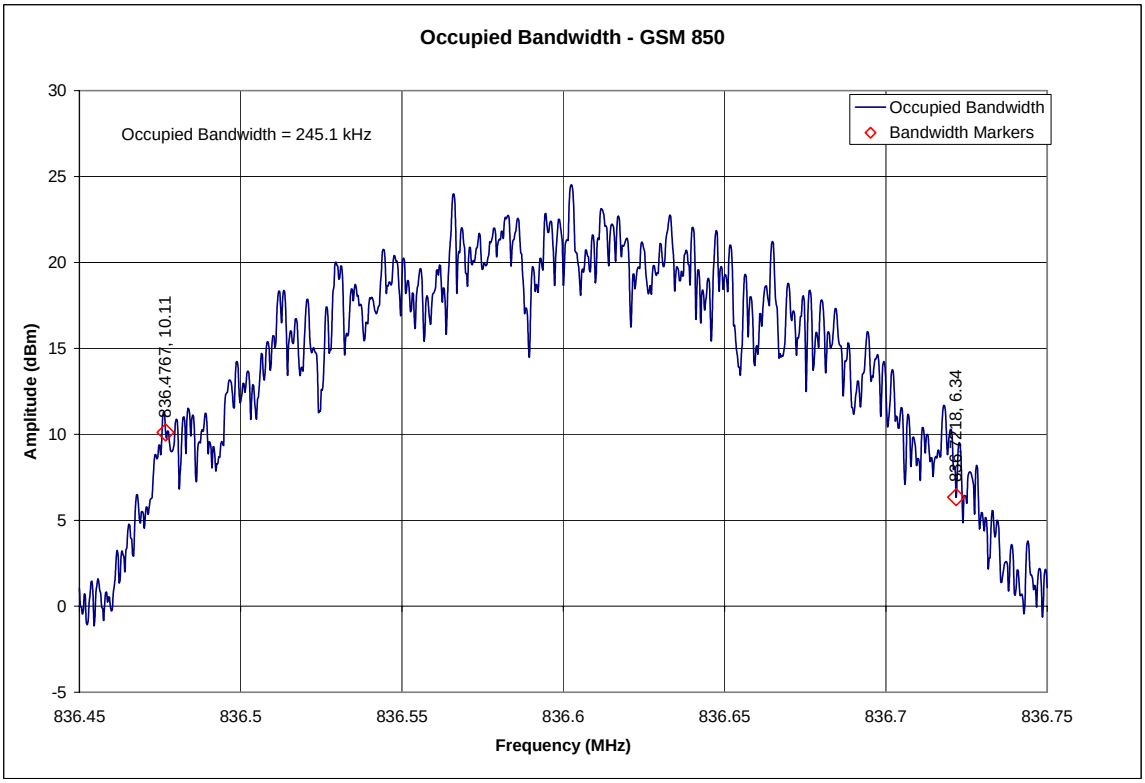
Attached

Measurement Results – GSM 850

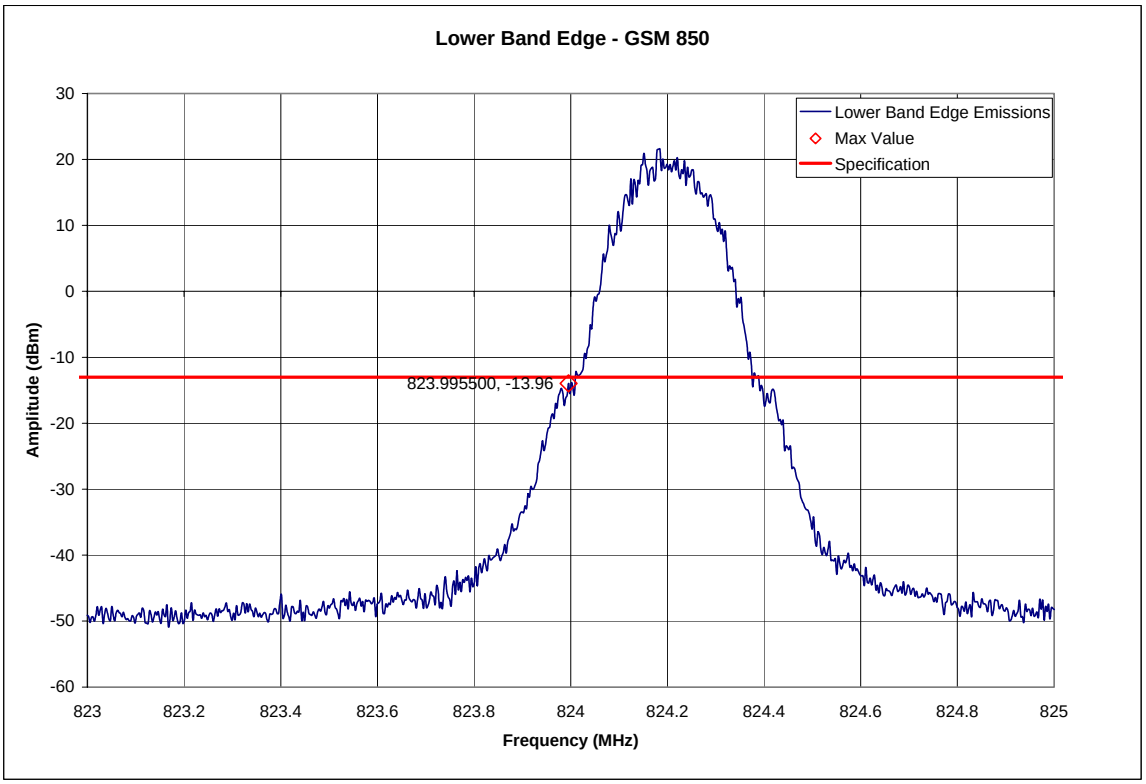
GSM 850 Reference Level



GSM 850 Occupied Bandwidth



GSM 850 Ch128 Lower Band Edge



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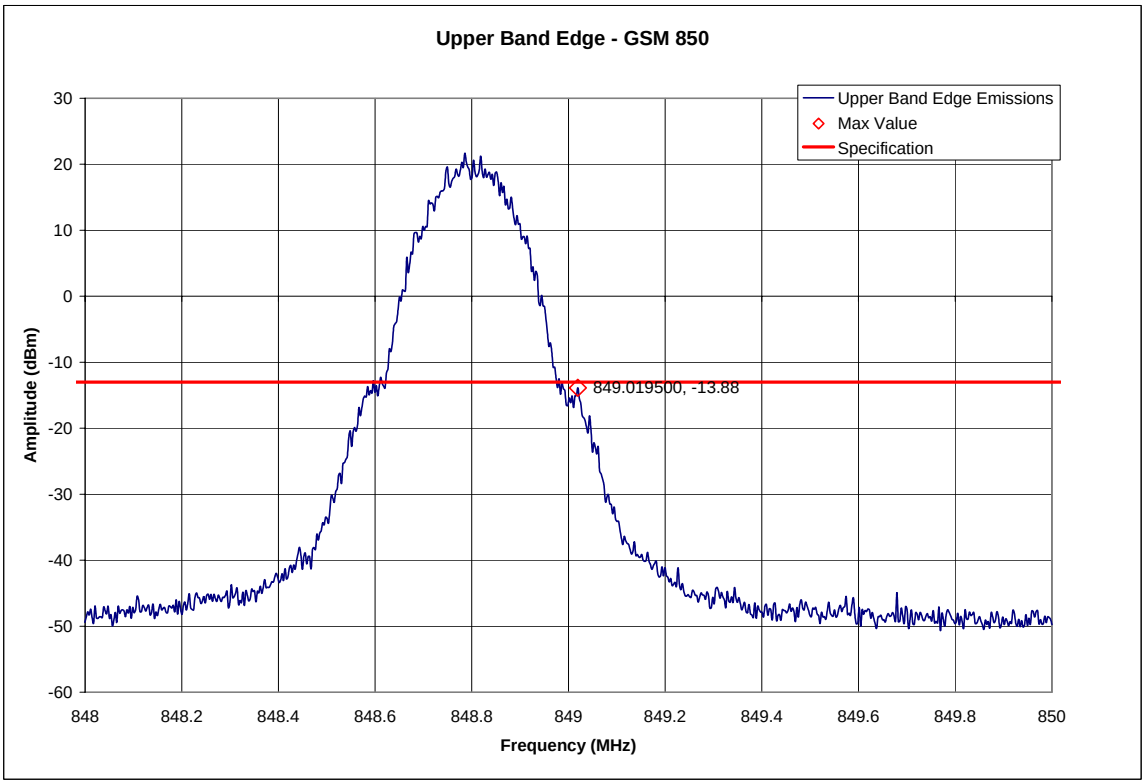
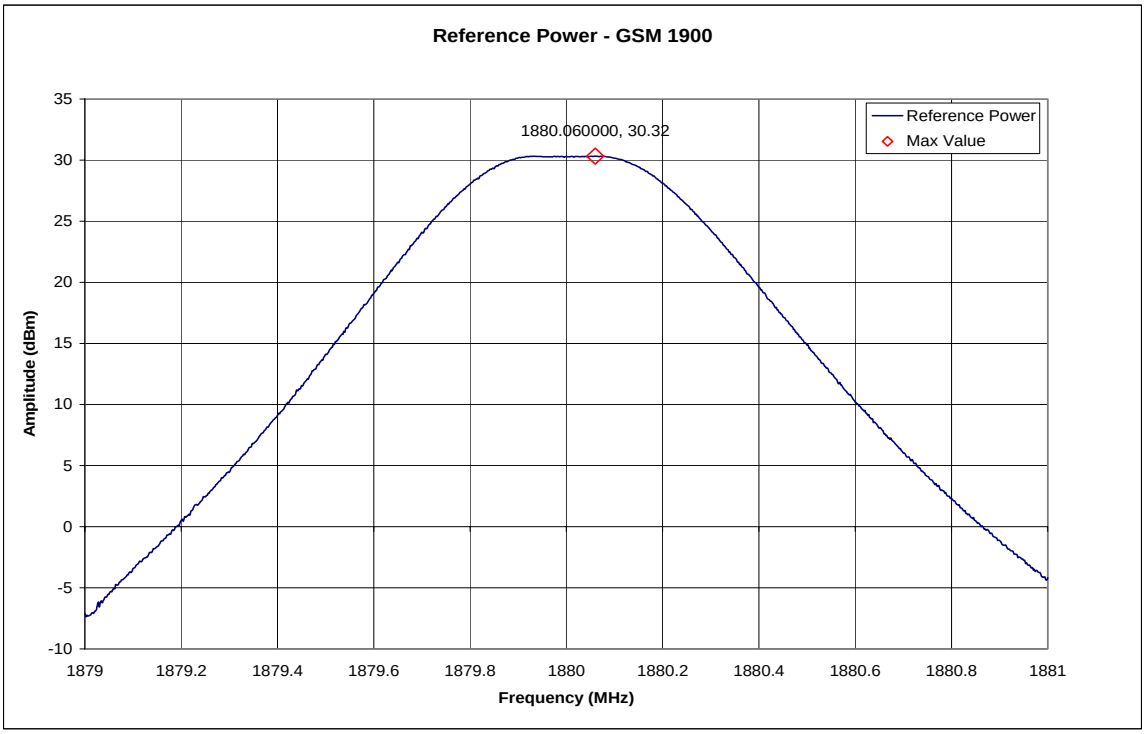
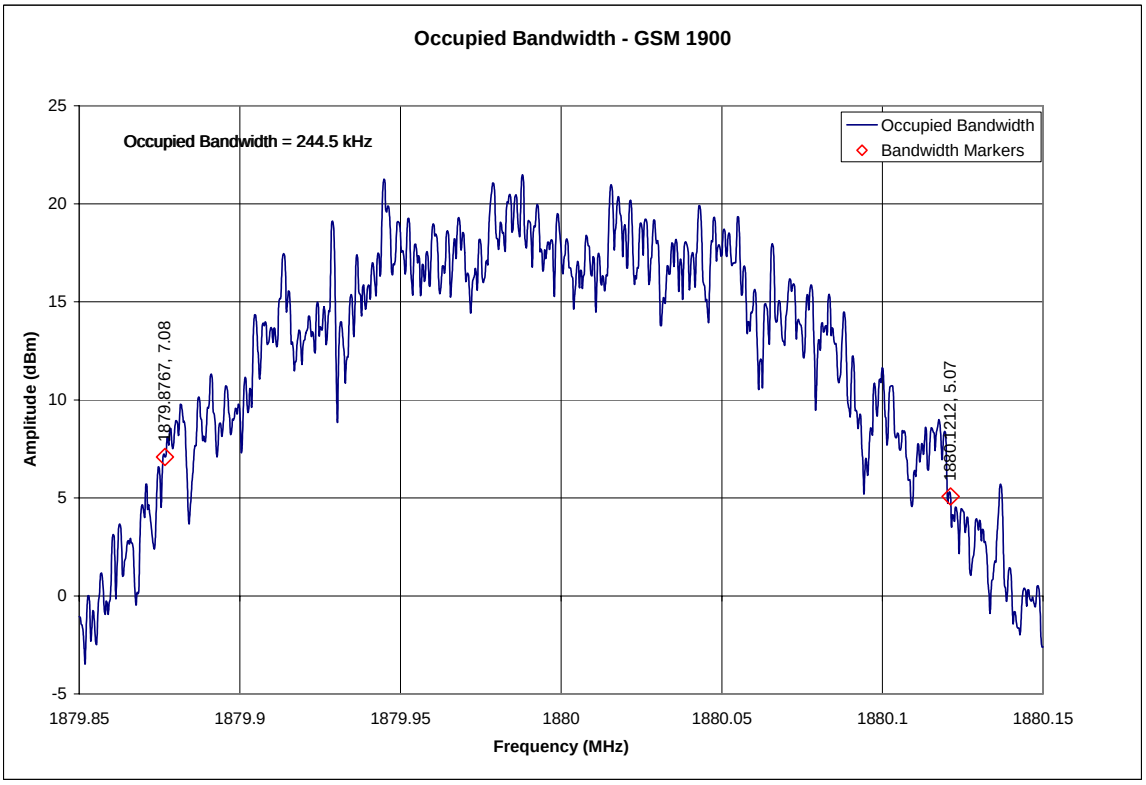


Measurement Results – GSM 1900

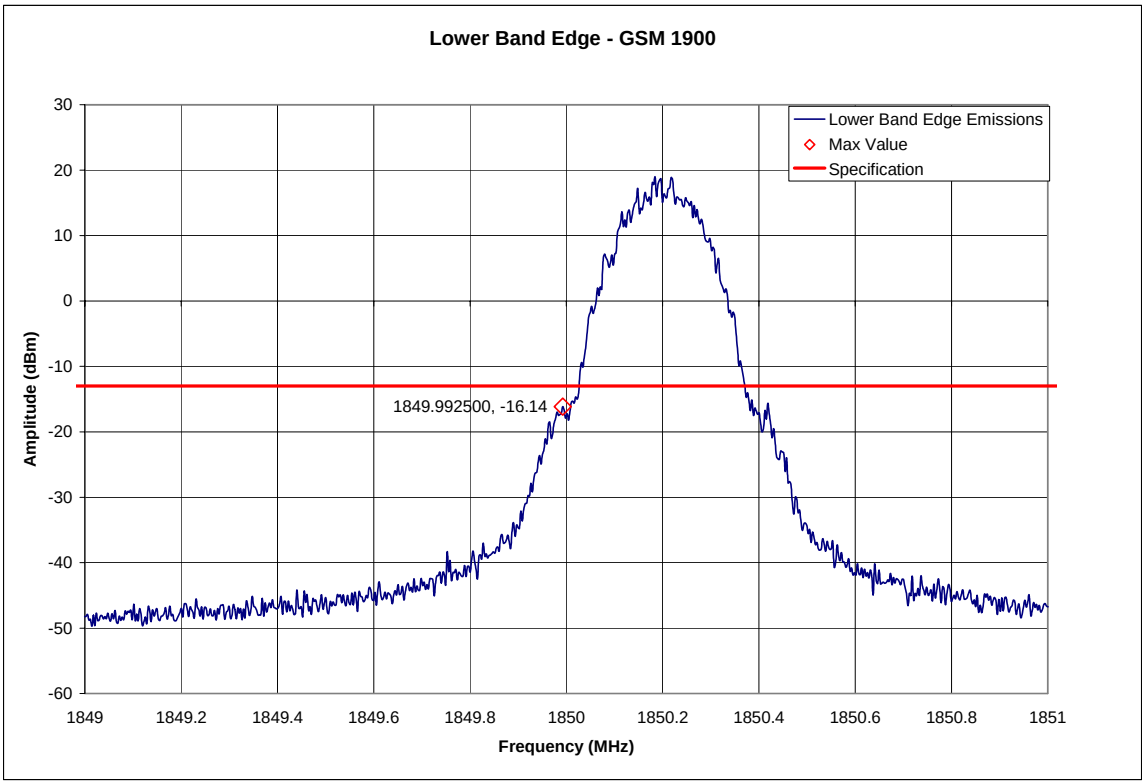
GSM/PCS 1900 Reference Level



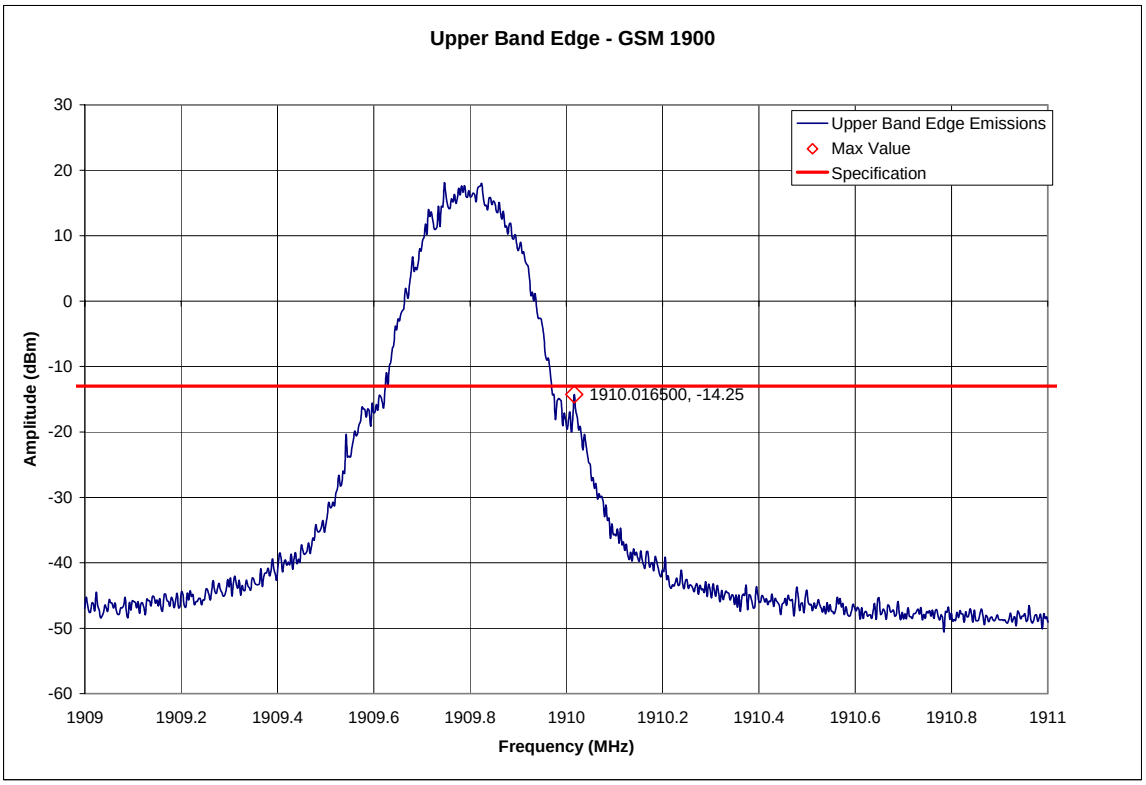
GSM/PCS 1900 Occupied Bandwidth



GSM/PCS 1900 Ch512 Lower Band Edge



GSM/PCS 1900 Ch810 Upper Band Edge



SPURIOUS EMISSIONS AT ANTENNA TERMINALS

CFR47 Part 2.1051, 24.238

Measurement Procedure

The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. A fully charged battery was used for the supply voltage.

The spectrum was investigated from the lowest frequency signal generated, without going below 9 kHz, up to at least the tenth harmonic of the fundamental or 40 GHz, whichever is lower.

Measurements were made at the middle channel within the frequency band and within the base station frequency range (869-894 MHz) for cellular.

The spectrum analyzer settings were as follows:

Units	dBm
Divisions	10 dB
Resolution Bandwidth	1 MHz
Video Bandwidth (AVG)	Auto
Sweep Time	Auto

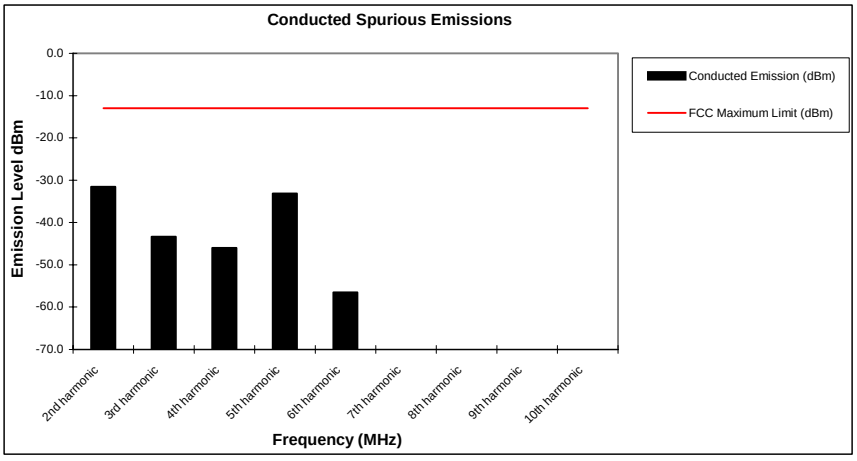
Measurement Results

Attached

Measurement Results
Modulation: GSM 850

Conducted Spurious and Harmonic Emissions

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-31.6
3rd harmonic	-13	-43.3
4th harmonic	-13	-46.0
5th harmonic	-13	-33.1
6th harmonic	-13	-56.5
7th harmonic	-13	*
8th harmonic	-13	*
9th harmonic	-13	*
10th harmonic	-13	*

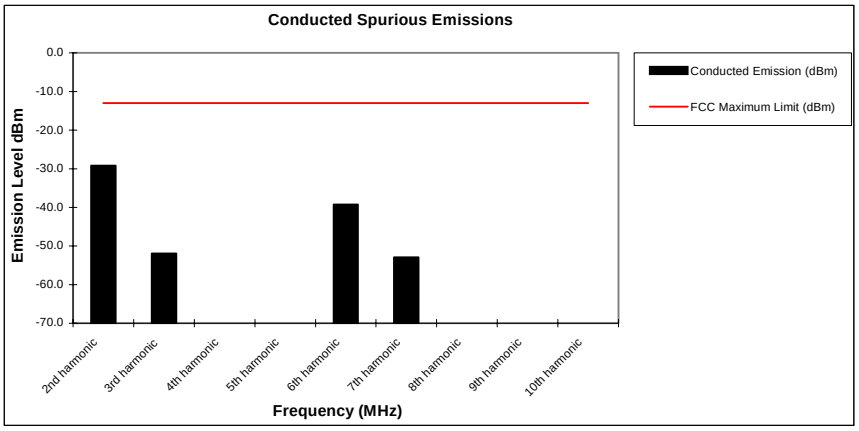


Notes:
1. * Indicates the spurious emission could not be detected due to noise limitations or ambients.
2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, mid, and high channels at maximum power.
3. The Spectrum was investigated from 9 kHz to the tenth harmonic of the fundamental.

Measurement Results
Modulation: GSM 1900

Conducted Spurious and Harmonic Emissions

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-29.2
3rd harmonic	-13	-52.0
4th harmonic	-13	*
5th harmonic	-13	*
6th harmonic	-13	-39.3
7th harmonic	-13	-52.9
8th harmonic	-13	*
9th harmonic	-13	*
10th harmonic	-13	*



Notes:
1. * Indicates the spurious emission could not be detected due to noise limitations or ambients.
2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, mid, and high channels at maximum power.
3. The Spectrum was investigated from 9 kHz to the tenth harmonic of the fundamental.

FIELD STRENGTH OF SPURIOUS EMISSIONS

CFR47 Part 2.1053, 22.917, 24.238

Measurement Procedure

The equipment under test is placed inside the semi-anechoic chamber on a wooden table at the turntable center. For each spurious frequency, the antenna mast is raised and lowered from 1 to 4 meters and the turntable is rotated 360 degrees to obtain a maximum reading on the spectrum analyzer. This is repeated for both horizontal and vertical polarizations of the receive antenna.

The equipment under test is then replaced with a substitution antenna fed by a signal generator. With the signal generator tuned to a particular spurious frequency, the antenna mast is raised and lowered from 1 to 4 meters to obtain a maximum reading at the spectrum analyzer. The output of the signal generator is then adjusted until a reading identical to that obtained with the actual transmitter is achieved.

The power in dBm of each spurious emission is calculated by correcting the signal generator level for cable loss and gain of the substitution antenna referenced to a dipole. A fully charged battery was used for the supply voltage.

The settings of the receiver were as follows:

Units	dBm
Divisions	5 dB
Resolution Bandwidth	1 MHz
Video Bandwidth (AVG)	Auto
Sweep Time	Auto

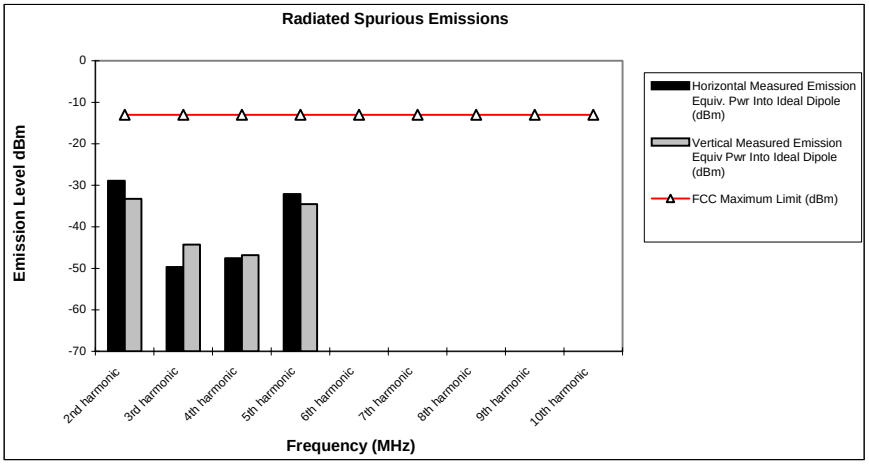
Measurement Results

Attached

Measurement Results
Modulation: GSM 850

Radiated Spurious and Harmonic Emissions

Frequency (MHz)	FCC Maximum Limit (dBm)	Horizontal Measured Emission Equiv. Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
2nd harmonic	-13	-28.9	-33.3
3rd harmonic	-13	-49.7	-44.3
4th harmonic	-13	-47.6	-46.8
5th harmonic	-13	-32.1	-34.5
6th harmonic	-13	*	*
7th harmonic	-13	*	*
8th harmonic	-13	*	*
9th harmonic	-13	*	*
10th harmonic	-13	*	*

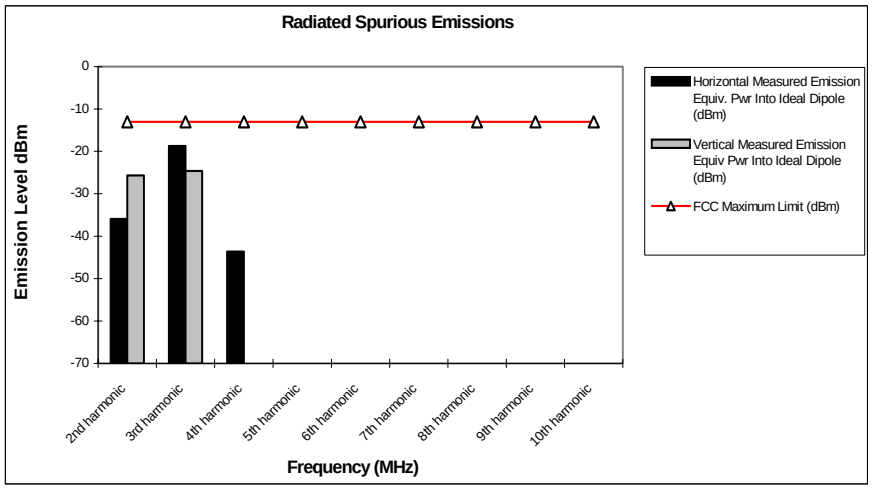


Notes:
1. * Indicates the spurious emission could not be detected due to noise limitations or ambients.
2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, mid, and high channels at maximum power.
3. The Spectrum was investigated from 30 MHz to the tenth harmonic of the fundamental.

Measurement Results
Modulation: GSM 1900

Radiated Spurious and Harmonic Emissions

Frequency (MHz)	FCC Maximum Limit (dBm)	Horizontal Measured Emission Equiv. Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
2nd harmonic	-13	-35.9	-25.7
3rd harmonic	-13	-18.7	-24.6
4th harmonic	-13	-43.7	*
5th harmonic	-13	*	*
6th harmonic	-13	*	*
7th harmonic	-13	*	*
8th harmonic	-13	*	*
9th harmonic	-13	*	*
10th harmonic	-13	*	*



Notes:
1. * Indicates the spurious emission could not be detected due to noise limitations or ambients.
2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, mid, and high channels at maximum power.
3. The Spectrum was investigated from 30 MHz to the tenth harmonic of the fundamental.

FREQUENCY STABILITY

CFR47 Part 2.1055, 24.235

Measurement Procedure

The equipment under test is placed in an environmental chamber. The antenna port of the Equipment Under Test is directly coupled to the input of the measurement equipment through a specialized RF connector. A power supply is attached as the primary voltage supply.

Frequency measurements are made at the extremes of the temperature range -30º C to +60º C and at intervals of 10º C with the primary supply voltage set to the nominal battery operating voltage. A period of time sufficient to stabilize all components of the equipment is allowed at each frequency measurement. The maximum variation of frequency is measured.

At room temperature, the primary supply voltage is reduced to the battery operating endpoint of the equipment under test. The maximum variation of frequency is measured. A battery eliminator was used for the input supply voltage.

Measurement Results

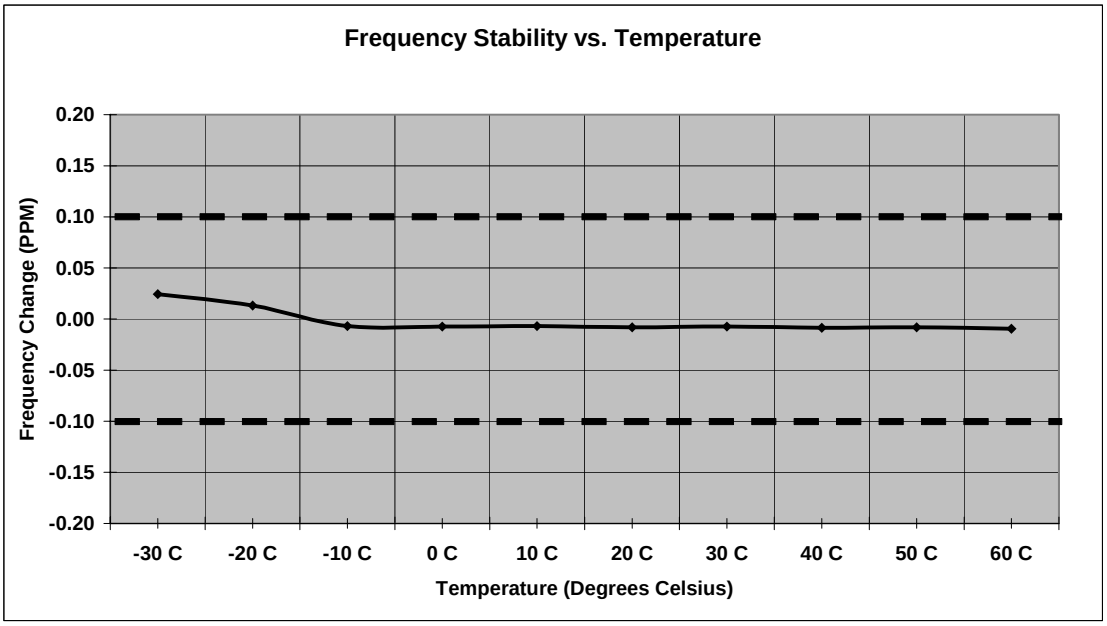
Attached

Measurement Results
Modulation: GSM850

Frequency Stability

Mode: GSM 850 **Operating Frequency:** 836.6 MHz
Channel: 190 **Deviation Limit (PPM):** 0.1 ppm

Temperature	Frequency Error	Frequency Error	Voltage	Voltage
C	HZ	(PPM)	(%)	(VDC)
-30 C	**46.00**	**0.024**	100%	3.60
-20 C	**25.00**	**0.013**	100%	3.60
-10 C	**-13.00**	**-0.007**	100%	3.60
0 C	**-14.00**	**-0.007**	100%	3.60
10 C	**-13.00**	**-0.007**	100%	3.60
20 C	**-15.00**	**-0.008**	100%	3.60
30 C	**-14.00**	**-0.007**	100%	3.60
40 C	**-16.00**	**-0.009**	100%	3.60
50 C	**-15.00**	**-0.008**	100%	3.60
60 C	**-18.00**	**-0.010**	100%	3.60
		0		
20 C	**-16.00**	**-0.009**	Battery Endpoint	3.35

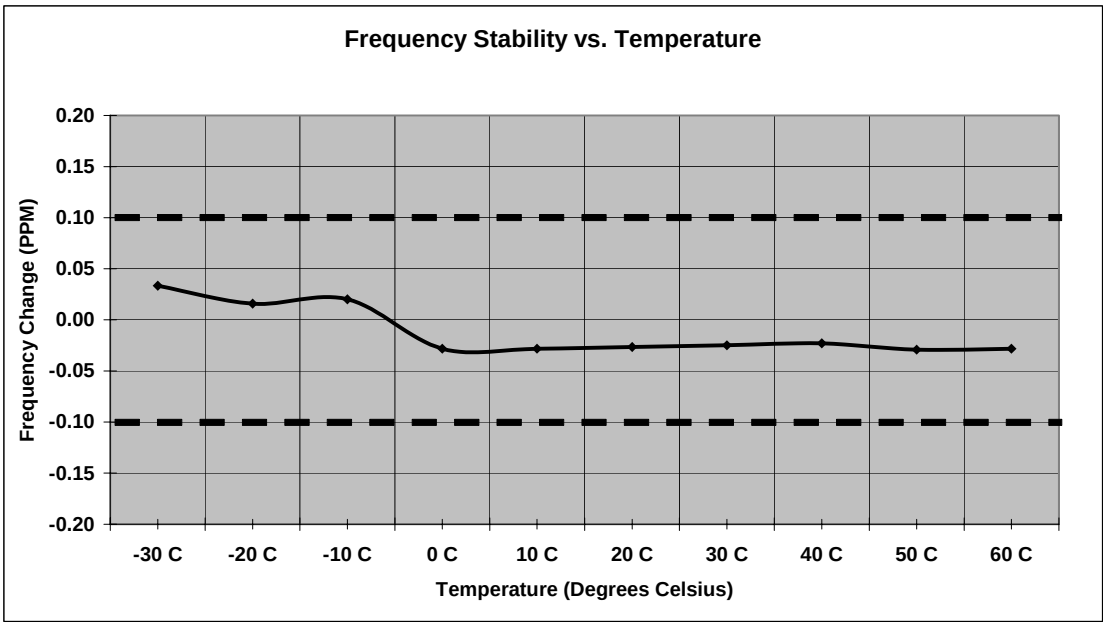


Measurement Results
Modulation: GSM1900

Frequency Stability

Mode: GSM 1900 **Operating Frequency:** 1880.0 MHz
Channel: 661 **Deviation Limit (PPM):** 0.1 ppm

Temperature	Frequency Error	Frequency Error	Voltage	Voltage
C	HZ	(PPM)	(%)	(VDC)
-30 C	**63.00**	**0.034**	100%	3.60
-20 C	**30.00**	**0.016**	100%	3.60
-10 C	**38.00**	**0.020**	100%	3.60
0 C	**-53.00**	**-0.028**	100%	3.60
10 C	**-53.00**	**-0.028**	100%	3.60
20 C	**-50.00**	**-0.027**	100%	3.60
30 C	**-47.00**	**-0.025**	100%	3.60
40 C	**-43.00**	**-0.023**	100%	3.60
50 C	**-55.00**	**-0.029**	100%	3.60
60 C	**-53.00**	**-0.028**	100%	3.60
20 C	**-48.00**	**-0.026**	Battery Endpoint	3.35



FIELD STRENGTH OF EMISSIONS FROM UNINTENTIONAL RADIATORS

CFR Part 15.109

Measurement Procedure

The equipment under test is placed inside the semi-anechoic chamber on a wooden table at the turntable center. For each radiated emission, the antenna mast is raised and lowered from 1 to 4 meters and the turntable is rotated 360 degrees to obtain a maximum peak reading on the spectrum analyzer. The radiated emissions are then measured using an EMI receiver employing a CISPR quasi-peak detector function below 1000 MHz and an average detector function above 1000 MHz. This is repeated for both horizontal and vertical polarizations of the receive antenna. A fully charged battery was used for the supply voltage.

The field strength of each radiated emission is calculated by correcting the EMI receiver level for cable loss, amplifier gain, and antenna correction factors.

Field Strength (dBuV/m) = EMI Receiver Level (dBuV) + Cable Loss (dB) - Amplifier Gain (dB) + Antenna Correction Factor (1/m)

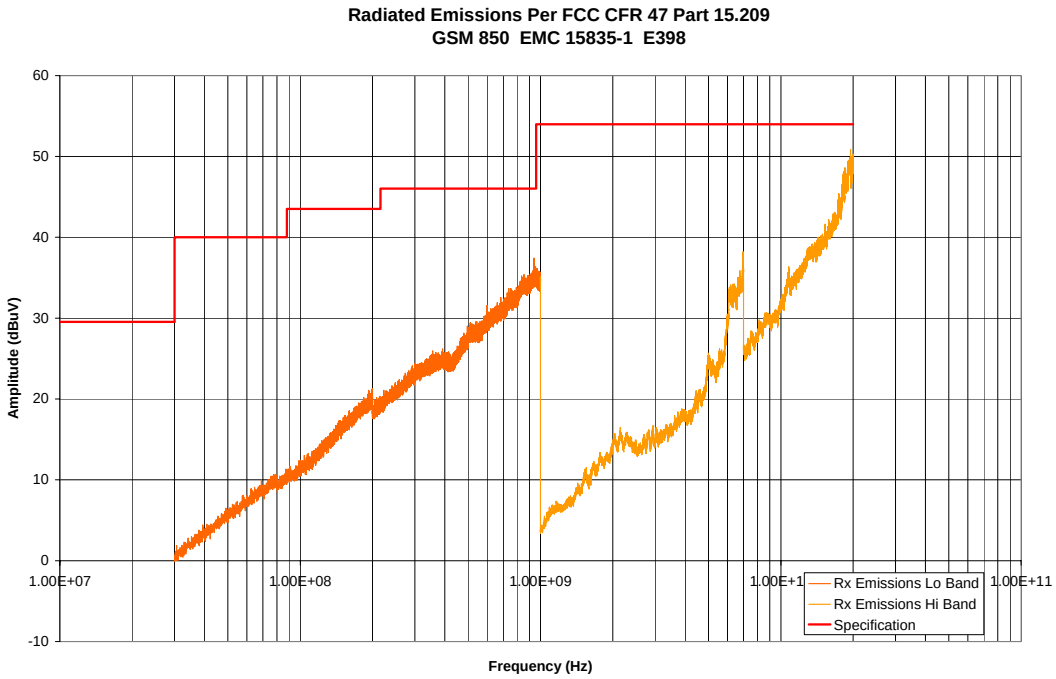
The receiver settings were as follows:

Units	dBuV
Resolution Bandwidth	30 kHz
Video Bandwidth (AVG)	Auto
Sweep Time	auto
Attenuation	10 dB
Detector	Peak

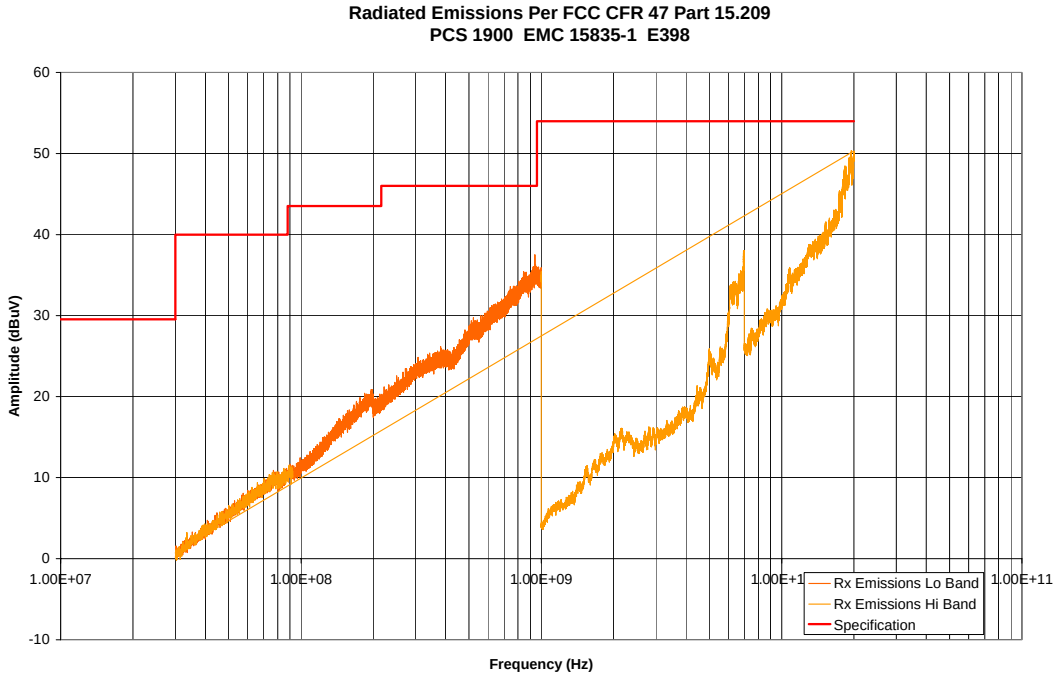
Measurement Results

Attached

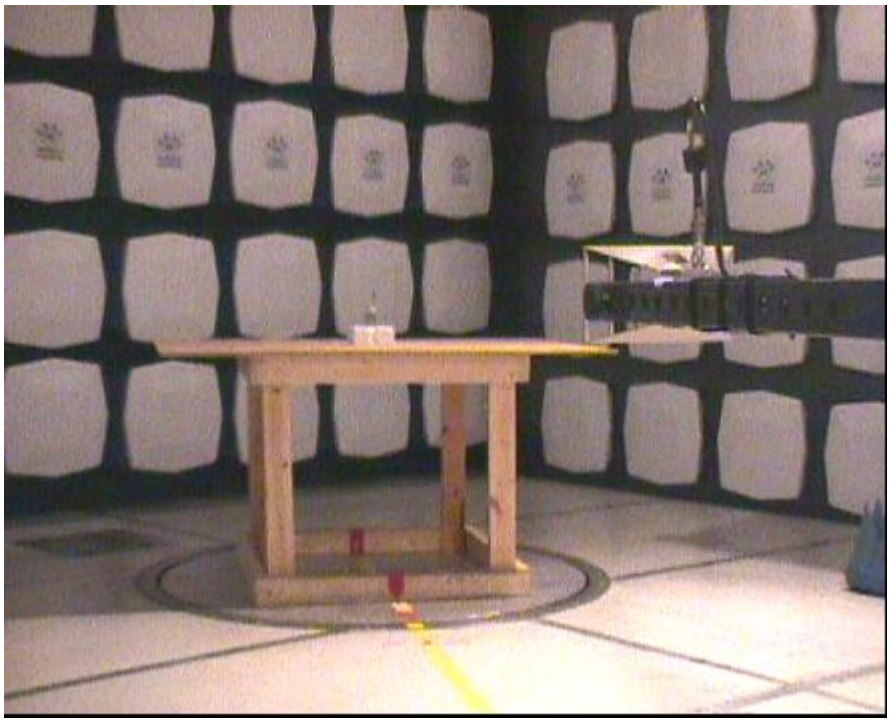
Measurement Results
Modulation: GSM 850



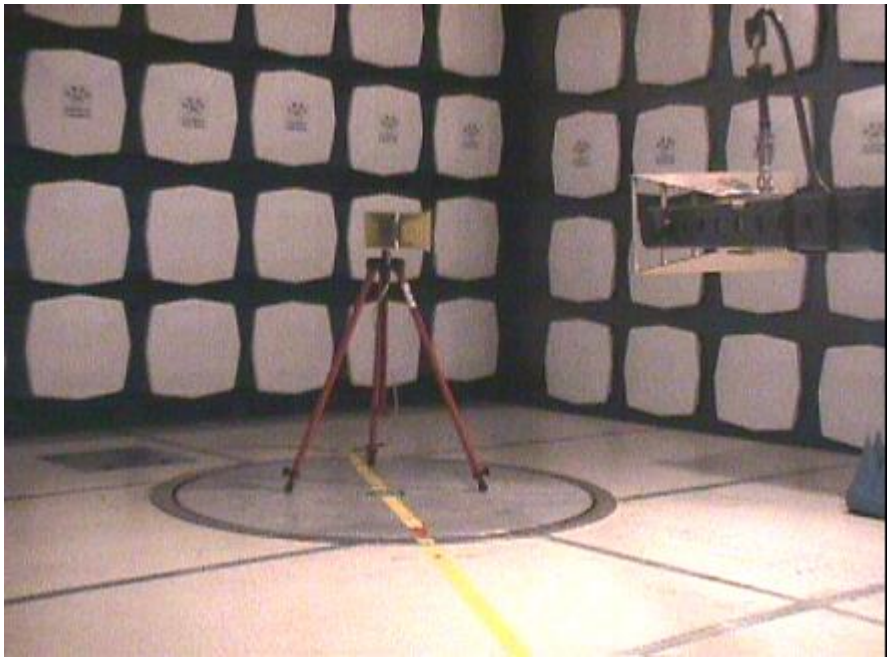
Measurement Results
Modulation: GSM 1900



Appendix A – Radiated Emissions Test Setup Photos



A.1 Radiated Emissions Measurement



A.2 Substitution Measurement

End of Test Report