



MOBILE DEVICES BUSINESS

**PRODUCT SAFETY AND COMPLIANCE
EMC LABORATORY**

EMC TEST REPORT

Test Report Number – 16799-1

Report Date – September 20, 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.

A handwritten signature in blue ink that reads 'Michael E. Hill'.

Signature

Name: Michael E. Hill

Title: Senior Staff Electrical Engineer

Date: September 20, 2005

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Test Report Details

Tests Performed By: Motorola Mobile Devices business
Product Safety and Compliance Group
600 North US Hwy 45
Libertyville, IL 60048
PH (847) 523-6167 Fax (847) 523-4538
Motorola MDB FRN: 0004321311
FCC Registration Number: 316588
Industry Canada Number: IC3908

Tests Requested By: Motorola Inc.
Mobile Devices business
600 North US Hwy 45
Libertyville, IL 60048

Product Type: Cellular Phone

Signaling Capability: GSM 1900, Bluetooth
Model Number: E770

Version: SJUG0722AA03
Serial Numbers: 004400016576355, 004400016576389,
004400016576330

Testing Complete Date: September 20, 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:

☒ Part 15 Subpart B – Unintentional Radiators
☐ Part 22 Subpart H - Public Mobile Services
☒ 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)	5.91
3	Modulation Characteristics	NA
4	Occupied Bandwidth	See Plots
5	Spurious Emissions at Antenna Terminal	30.9 dB
6	Field Strength of Spurious Emissions	10.1 dB
7	Frequency Stability	28.98 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 22° 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.

Manufacturer	Equipment Type	Model No.	Serial Number	Cal. Due Date
Rohde & Schwarz	Receiver	ESI26	838786/010	2/7/2006
Hewlett-Packard	EMC Analyzer	8593EM	3536A00118	10/2/2005
Hewlett-Packard	EMC Analyzer	7405	US39440191	11/13/2005
ETS	DRG Horn Antenna	265	2455	5/25/2006
ETS	DRG Horn Antenna	3115	6222	2/9/2006
ETS	Log-Periodic Antenna	3148	1188	6/14/2006
ETS	Biconical Antenna	3110B	3370	2/16/2006
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	5/23/2006
Thermotron	Environmental Chamber	S-4	31580	1/18/2006
Giga-Tronics	Power Meter	8651A	8650508	12/27/2005

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 1900

Frequency (MHz)	Power (dBm)
1850.20	29.93
1880.00	29.99
1909.80	29.98

RADIATED (ERP)

Measurement Procedure

The phone was tested in a 16' anechoic chamber with a 2-axis position system that permits taking 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. Tests were done for GSM 1900 three frequencies (1850.2, 1880.00, and 1909.80 MHz) with antenna stubby.

GSM measurements were made with the phone placed in a call using the Agilent 8960 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 for each case, and the radiated power at this angle was extracted from the data. The max radiated power results for IHDT6FJ1 follows, as EIRP in dBm. To get ERP (effective radiated power referenced to a half-wave dipole), subtract 2.1 dB from these numbers.

Measurement Results

Data not supplied by EMC Lab

GSM 1900:

1850.2 MHz: 29.19 dBm

1880.0 MHz: 29.11 dBm

1909.8 MHz: 27.75 dBm

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

The max EIRP in GSM 1900 mode is 29.19 dBm (max ERP is 27.09 dBm)

OCCUPIED BANDWIDTH

CFR Part 2.1049, 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.

The middle channel within the designated frequency block was measured. For digital modulation, the lower and upper band edge plots are displayed.

Equipment Settings

Plot	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Sweep Points (#)	Trace Mode	Detector	Samples (≥ #)
Reference Plot - GSM 850	300	Auto	1001	Max Hold	Peak	30
OCBW - GSM 850	3	Auto	1001	Max Hold	Peak	30
Lower Band Edge - GSM 850	1	Auto	2004	Max Hold	Peak	30
Upper Band Edge - GSM 850	1	Auto	2004	Max Hold	Peak	30
Reference Plot - GSM 1900	300	Auto	1001	Max Hold	Peak	30
OCBW - GSM 1900	3	Auto	1001	Max Hold	Peak	30
Lower Band Edge - GSM 1900	1	Auto	2004	Max Hold	Peak	30
Upper Band Edge - GSM 1900	1	Auto	2004	Max Hold	Peak	30

Notes: 1) When the video bandwidth is set to Auto the video bandwidth self adjusts for ³ the resolution bandwidth.

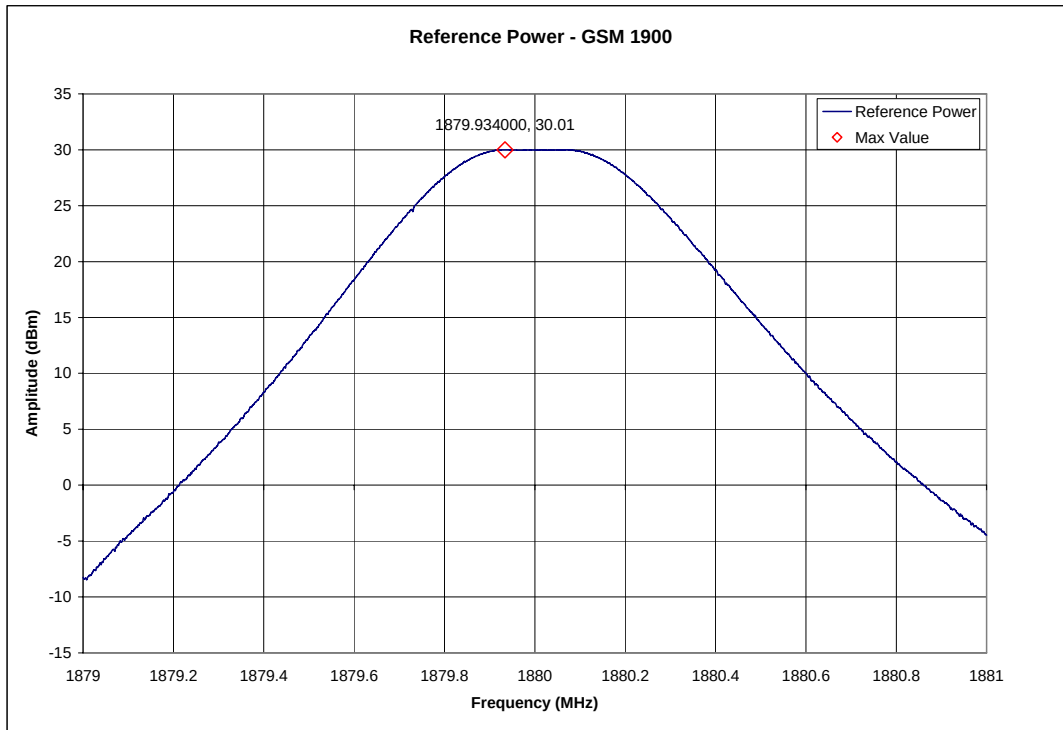
2) The plotted data shown for the band edge measurements is representative of data taken with a true 3 kHz resolution bandwidth filter. The raw data was taken using a 1 kHz resolution bandwidth and was integrated to produce a response representative of data taken using a true 3 kHz resolution bandwidth filter.

Measurement Results

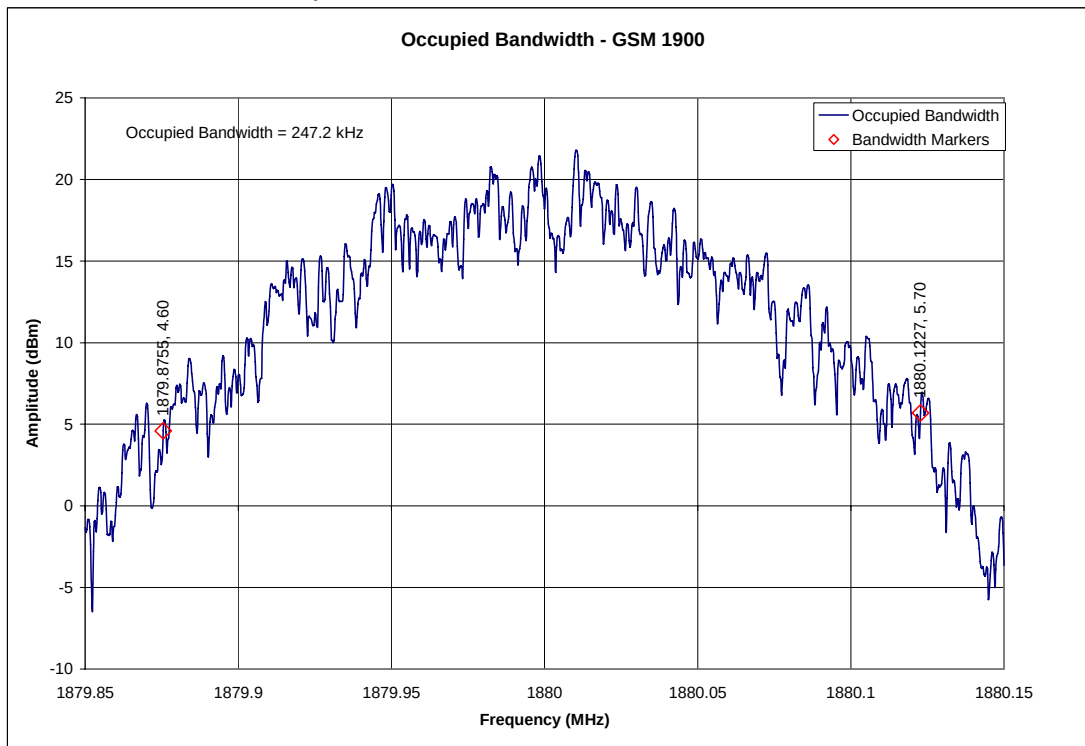
Attached

Measurement Results – GSM 1900

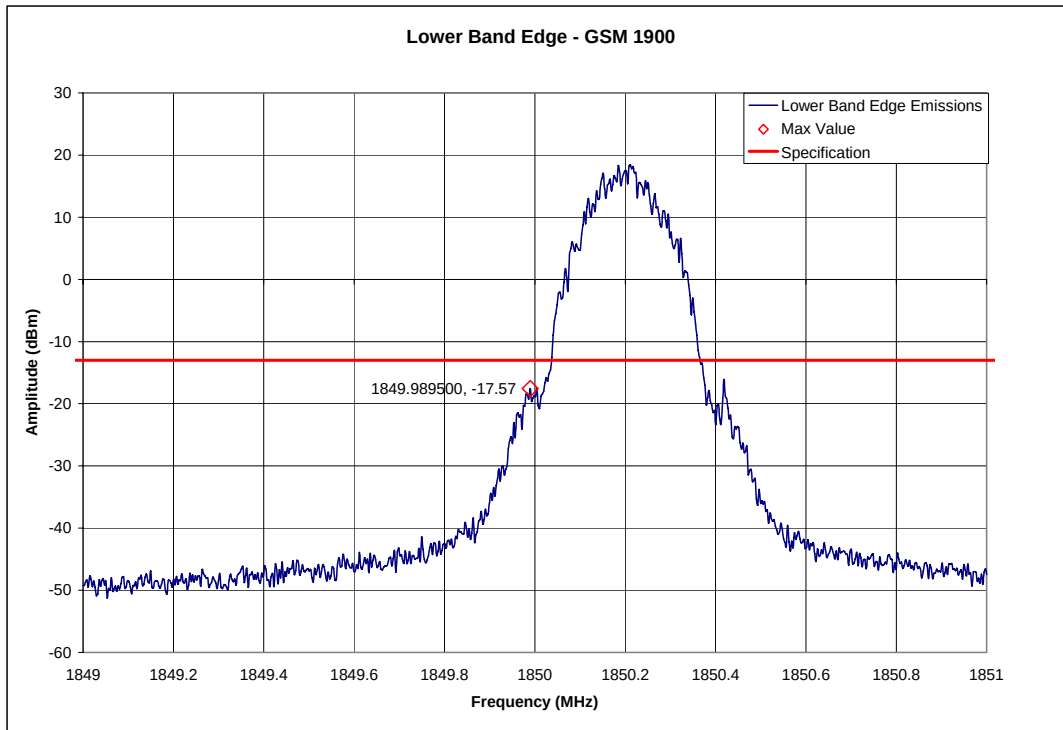
GSM/PCS 1900 Reference Level



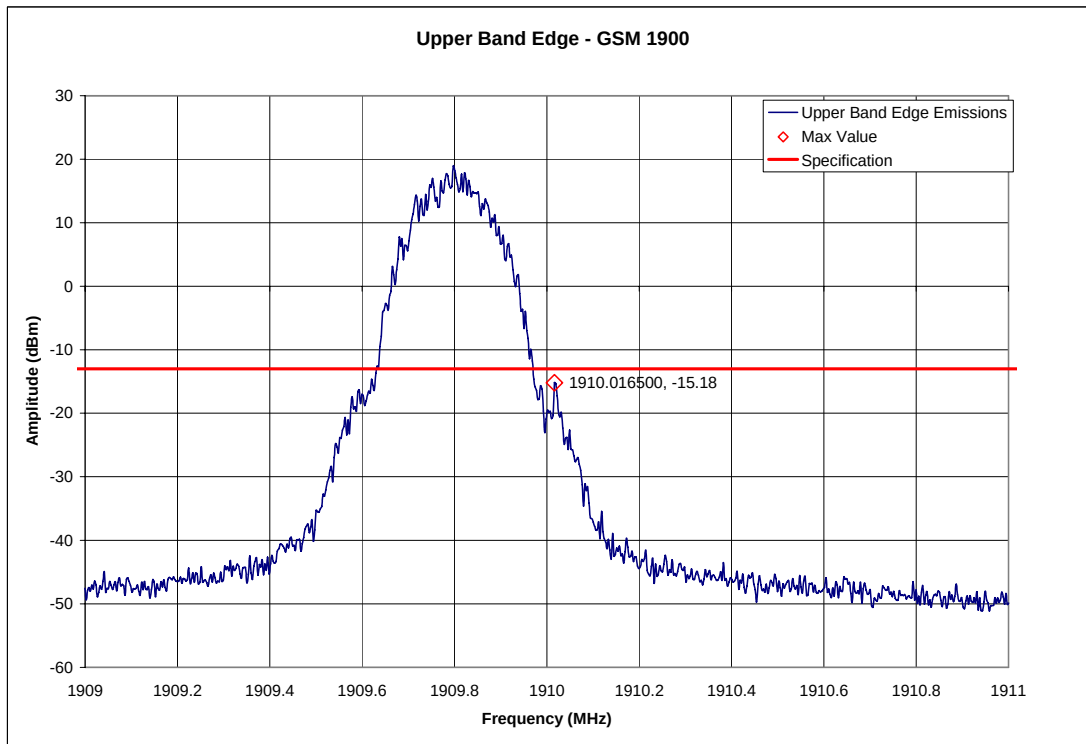
GSM/PCS 1900 Occupied Bandwidth



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

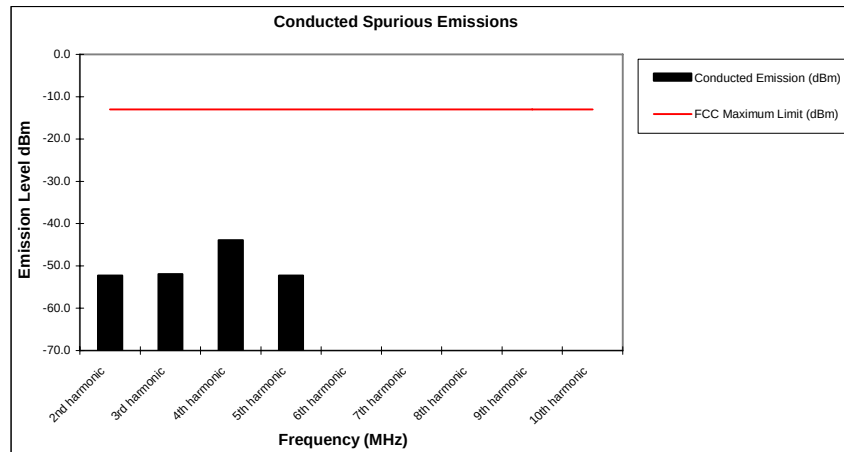
Attached

Measurement Results

Modulation: GSM 1900

Conducted Spurious and Harmonic Emissions

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-52.3
3rd harmonic	-13	-51.9
4th harmonic	-13	-43.9
5th harmonic	-13	-52.2
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 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

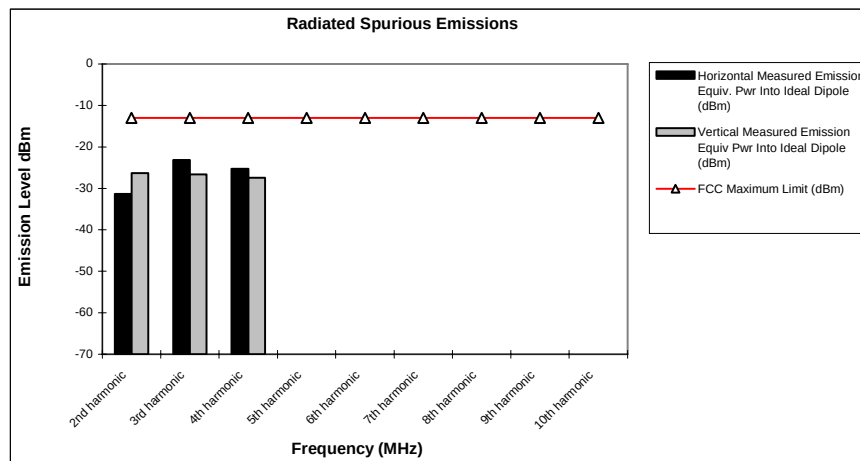
Attached

Measurement Results

Modulation: GSM 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	-31.3	-26.3
3rd harmonic	-13	-23.1	-26.6
4th harmonic	-13	-25.3	-27.4
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 -30° C to +60° C and at intervals of 10° 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: GSM1900

Frequency Stability

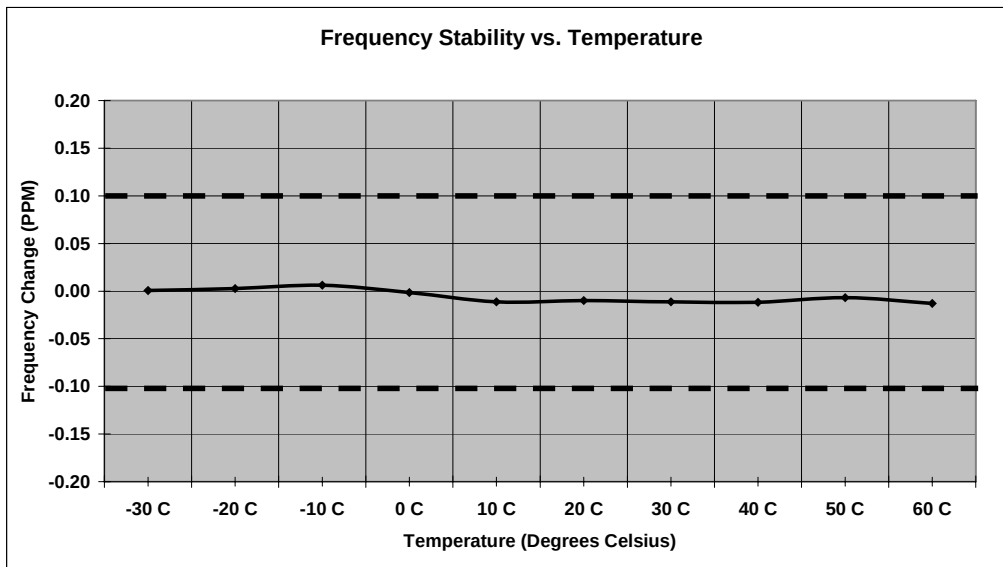
Mode: GSM 1900

Operating Frequency: 1880

Channel: 661

Deviation Limit (PPM): 0.1 ppm

Temperature	Frequency Error	Frequency Error	Voltage	Voltage
C	HZ	(PPM)	(%)	(VDC)
-30 C	1.00	0.001	100%	3.70
-20 C	4.86	0.003	100%	3.70
-10 C	11.62	0.006	100%	3.70
0 C	-2.91	-0.002	100%	3.70
10 C	-21.00	-0.011	100%	3.70
20 C	-18.54	-0.010	100%	3.70
30 C	-21.09	-0.011	100%	3.70
40 C	-21.90	-0.012	100%	3.70
50 C	-12.71	-0.007	100%	3.70
60 C	-24.30	-0.013	100%	3.70
20 C	-28.98	-0.015	Battery Endpoint	3.20



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)

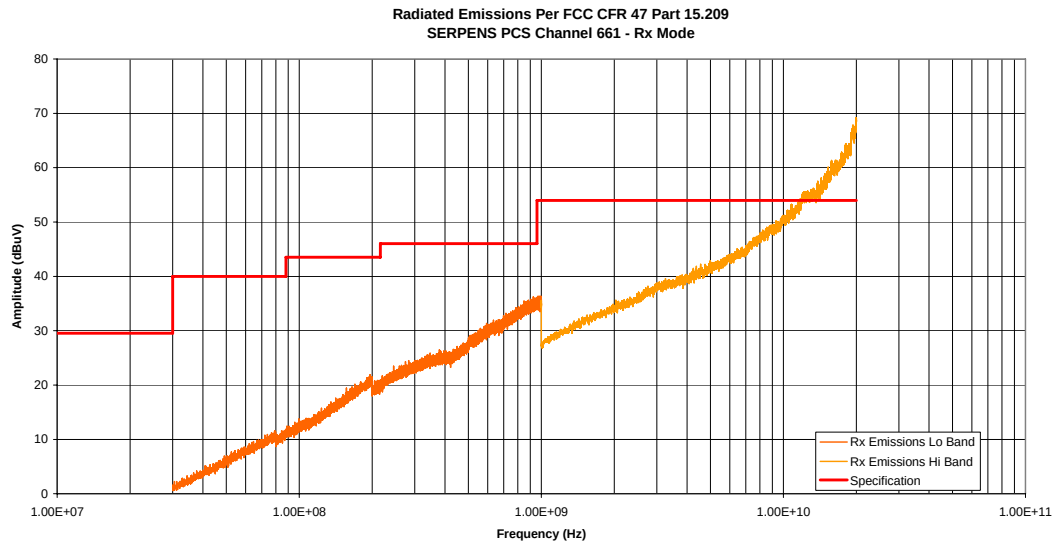
The receiver settings were as follows:

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

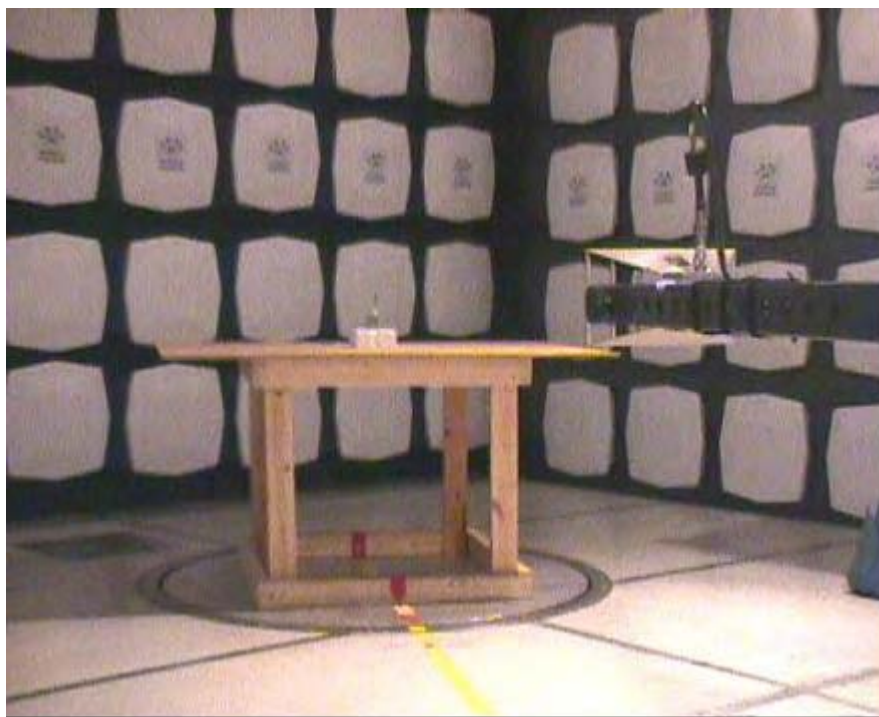
Measurement Results

Attached

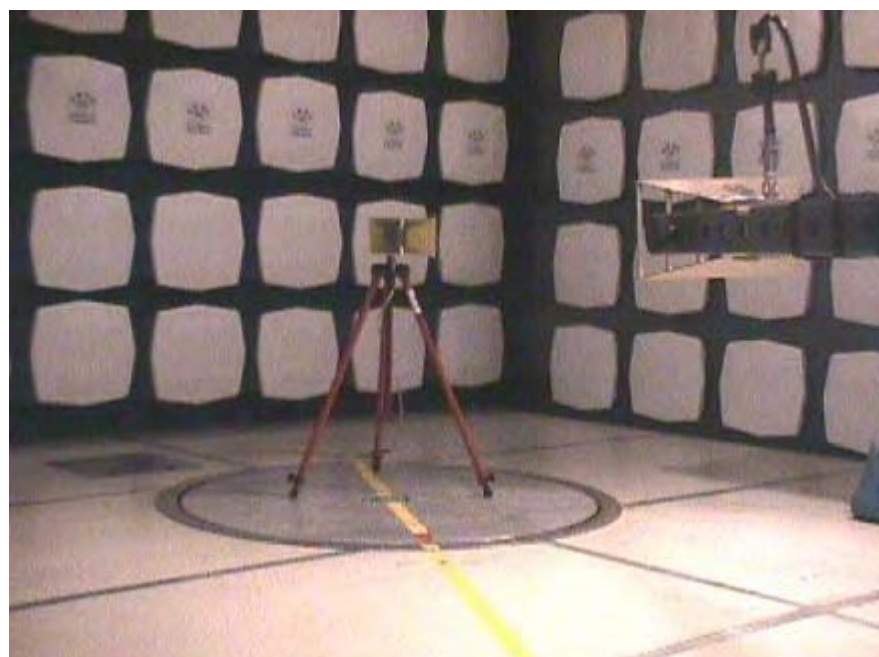
Measurement Results Modulation: GSM 1900



Appendix A – Radiated Emissions Test Setup Photos



A.1 Radiated Emissions Measurement



A.2 Substitution Measurement

End of Test Report