CFR 47 Part 2, 22, and 24 Test Report

Test Report Number: 02-RF-0211.002

Terminal device: FCC ID: GMLRH-14, Model 3560, HWID: 3.0/415f, SW: 2.07.03
(Detailed information is listed in section 4).

Originator:	Nerina Walton
Function:	TCC - Dallas – EMC
Version/Status:	1.0, Approved
Location:	TCC Directories
Date:	10-Feb-03

Change History:

Version	*Date*	*Status*	*Handled By*	*Comments*
0.1	09-Jan-03	Draft	Nerina Walton	
0.2	31Jan 03	Proposed	Mark Severson	
0.3	10-Feb-03	Reviewed	Nerina Walton	
1.0	10-Feb-03	Approved	Alan Ewing	

Testing laboratory:
Test & Certification Center (TCC) Dallas
Nokia Mobile Phones, Inc
6021 Connection Drive
Irving, Texas 75039
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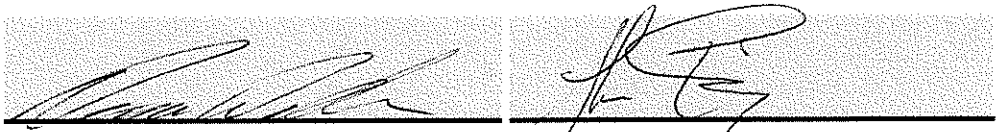
Client:
Nokia Mobile Phones, Inc.
FCC ID: GMLRH-14, Model 3560
6021 Connection Drive
Irving, Texas 75039
U.S.A.
Tel. 972-894-5000
Fax. 972-894-4988

Date and signatures: 10-Feb-03

For the contents:



Nerina Walton, EMC Engineer
Technical Review

Alan C. Ewing, General Manager
Manager Review

TABLE OF CONTENTS

1. GENERAL 4

1.1 QUALITY SYSTEM 4
1.2 LIST OF GENERAL INFORMATION REQUIRED FOR CERTIFICATION 4
1.3 OBJECTIVE 6
1.4 TEST SUMMARY 6

2. STANDARDS BASIS 7

3. LIST OF ABBREVIATIONS, ACRONYMS AND TERMS 8

3.1 ABBREVIATIONS 8
3.2 ACRONYMS 8
3.3 TERMS 8

4. EQUIPMENT-UNDER-TEST (EUT) 9

4.1 DESCRIPTION OF TESTED DEVICE(S): 9
4.2 PHOTOGRAPH OF TESTED DEVICE(S): 9

5. TEST EQUIPMENT LIST 10

6. RF POWER OUTPUT (CONDUCTED) 11

6.1 SETUP 11
6.2 PASS/FAIL CRITERIA 11
6.3 DETAILED TEST RESULTS 11

7. RF POWER OUTPUT (RADIATED) 12

7.1 SETUP 12
7.2 PASS/FAIL CRITERIA 12
7.3 DETAILED TEST RESULTS 13
7.4 MEASUREMENT UNCERTAINTY 14

8. TX AUDIO FREQUENCY RESPONSE 15

8.1 SETUP 15
8.2 PASS/FAIL CRITERIA 15
8.3 DETAILED TEST RESULTS 15

9. MODULATION LIMITING 17

9.1 SETUP 17
9.2 PASS/FAIL CRITERIA 17
9.3 DETAILED TEST RESULTS 17

10. MODULATION REQUIREMENTS (MEASUREMENT OF MAXIMUM DEVIATION) 20

10.1 SETUP 20
10.2 PASS/FAIL CRITERIA 20
10.3 DETAILED TEST RESULTS 20

11. OCCUPIED BANDWIDTH (EMISSIONS MASKS) 21

11.1 SETUP 21
11.2 PASS/FAIL CRITERIA 21
11.3 DETAILED TEST RESULTS 21

11.4 MEASUREMENT UNCERTAINTY 26

12. OCCUPIED BANDWIDTH (TRANSMITTER CONDUCTED MEASUREMENTS) 27

12.1 SETUP 27
12.2 PASS/FAIL CRITERIA 27
12.3 DETAILED TEST RESULTS 27
12.4 MEASUREMENT UNCERTAINTY 31

13. EMISSIONS IN RECEIVER CRITICAL BAND 32

13.1 SETUP 32
13.2 PASS/FAIL CRITERIA 32
13.3 DETAILED TEST RESULTS 32
13.4 MEASUREMENT UNCERTAINTY 36

14. SPURIOUS EMISSIONS AT ANTENNA TERMINALS 37

14.1 SETUP 37
14.2 PASS/FAIL CRITERIA 37
14.3 DETAILED TEST RESULTS 37
14.4 MEASUREMENT UNCERTAINTY 40

15. FIELD STRENGTH OF SPURIOUS RADIATION 41

15.1 SETUP 41
15.2 PASS/FAIL CRITERIA 41
15.3 DETAILED TEST RESULTS 42
15.4 MEASUREMENT UNCERTAINTY 43

16. FREQUENCY STABILITY (TEMPERATURE VARIATION) 44

16.1 SETUP 44
16.2 PASS/FAIL CRITERIA 44
16.3 DETAILED TEST RESULTS 44

17. FREQUENCY STABILITY (VOLTAGE VARIATION) 46

17.1 SETUP 46
17.2 PASS/FAIL CRITERIA 46
17.3 DETAILED TEST RESULTS 46

APPENDIX A: SCOPE OF ACCREDITATION FOR A2LA 47

1. GENERAL

1.1 Quality System

The quality system in place for TCC-Dallas conforms to ISO/IEC 17025 and has been audited to the standard by A2LA (American Association of Laboratory Accreditation). The appendix of this report contains the scope of accreditation for A2LA. TCC – Dallas has also been audited using the ISO 9000 Quality System, as part of Nokia Mobile Phones, Inc., by ABS (American Bureau of Shipping) Quality Evaluations Inc.

TCC-Dallas is a recognized laboratory with the Federal Communications Commission in filing applications for Certification under Parts 15 and 18,Registration Number 100060, and Industry Canada, Registration Number IC 661.

1.2 List of General Information Required for Certification

This list is in accordance with FCC Rules and Regulations, CFR 47, Part 2, and to 22H, 24E, Confidentiality.

1.2.1 Sub-part 2.1033(c)(1)

Name and Address of Applicant: Nokia Mobile Phones
6021 Connection Drive
Irving, Texas 75039 USA

Manufacturer: Nokia Mexico, S.A. DE C.V.
Ave. Ind. Rio Bravo s/n, Parque Ind. del Nte.
Cd. Reynosa, Tam. CP, 88730

OR

Nokia Do Brasil Tecnologia Ltda.
Rod. Torquato Tapajos, 7200 KM 12 Taruma
69048-660 Manaus - AM

1.2.2 Sub-part 2.1033(c)(2)

FCC ID: GMLRH-14

Model No: 3560

1.2.3 Sub-part 2.1033(c)(3)

Instruction Manual(s):
Refer to attached EXHIBITS

1.2.4 Sub-part 2.1033(c)(4)

Type of Emission: 40K0F1D, 40K0F8W, 30K0DXW

1.2.5 Sub-part 2.1033(c)(5)

Frequency Range, MHz: 824.04 to 848.97
1850.04 to 1909.92

1.2.6 Sub-part 2.1033(c)(6)

Power Rating, Watts: 0.3 EDRP AMPS
1.0 EDRP Cellular Band - TDMA
1.3 EIRP PCS - TDMA

☐ Switchable ☒ Variable ☐ N/A

FCC Grant Note: BC- The output power is continuously variable from the value listed in this entry to 5%-10% of the value listed.

1.2.7 Sub-part 2.1033(c)(7)

Maximum Power Rating, Watts: 1.3

1.2.8 Sub-part 2.1033(c)(8)

Voltages & Currents in all elements in final R.F. Stage, including final transistor or solid-state device:
Collector Current, A = per manual
Collector Voltage, Vdc = per manual
Supply Voltage, Vdc = 3.6

1.2.9 Sub-part 2.1033(c)(9)

Tune-up Procedure:
Refer to attached EXHIBITS

1.2.10 Sub-part 2.1033(c)(10)

Circuit Diagram/Circuit Description:
Including description of circuitry & devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation and limiting power.
Refer to attached EXHIBITS

1.2.11 Sub-part 2.1033(c)(11)

Label Information:
Refer to attached EXHIBITS

1.2.12 Sub-part 2.1033(c)(12)

Photographs:
Refer to attached EXHIBITS

1.2.13 Sub-part 2.1033(c)(13)

Digital Modulation Description:
N/A

1.2.14 Sub-part 2.1033(c)(14)

Test and Measurement Data:
FOLLOWS

1.3 Objective

All tests and measurement data shown was performed to determine whether the selected handset was in compliance as specified in FCC: CFR47 Parts 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, Part 22, and Part 24.

1.4 Test Summary

Test Results: *The test result relates only to those tested devices mentioned in Section 4 of this test report.*

Test Performed	Reference	Section of Report	Complies / Does not comply
RF Power Output (Conducted)	FCC Part 2.1046(a), 22.913(a), 24.232(b)(c)	6	Complies
RF Power Output (Radiated)	FCC Part 22.913(a) / 24.232(b)	7	Complies
Modulation Requirements: TX Audio Frequency Response	FCC Part 2.1047(a)	8	Complies
Modulation Requirements: Modulation Limiting	FCC Part 2.1047(b)	9	Complies
Modulation Requirements: Measurement of Maximum Deviation	FCC Part 22.915(a)(b)(c)(d)(1)	10	Complies
Occupied Bandwidth: RF Emissions Masks	FCC Part 2.1049(c)(1), 24.238(a)(b)	11	Complies
Occupied Bandwidth: Transmitter Conducted Measurements	FCC Part 2.1049(c)(1), 24.238(a)(b)	12	Complies
Emissions in Receiver Critical Band	FCC Part 22.917(f)	13	Complies
Spurious Emissions at Antenna Terminals	FCC Part 2.1051	14	Complies
Field Strength of Spurious Radiation	FCC Part 2.1053	15	Complies
Frequency Stability (Temperature Variation)	FCC Part 2.1055(a)(1)(b), 24.235	16	Complies
Frequency Stability (Voltage Variation)	FCC Part 2.1055(d)(1)(2), 24.235	17	Complies

2. STANDARDS BASIS

Testing has been carried out in accordance with:

REF.	Code of the standard	Name of the standard
1	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz.
2	ANSI/TIA/EIA 603-A	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3	FCC: CFR 47 Part 2	Code of Federal Regulations (CFR) Title 47, Part 2 – Frequency Allocations and Radio Treaty Matters; General Rules and Regulations: Subpart J – Equipment Authorization Procedures
4	FCC: CFR 47 Part 22	Code of Federal Regulations (CFR) Title 47, Part 22 – Public Mobile Services: Subpart H – Cellular Radiotelephone Service
5	FCC: CFR 47 Part 24	Code of Federal Regulations (CFR) Title 47, Part 24 – Personal Communications Services: Subpart E – Broadband PCS
6	ICES-003	Digital Apparatus, Industry Canada
7	RSS-128	800 MHz Dual-Mode TDMA Cellular Telephones, Industry Canada
8	RSS-132	800 MHz Cellular Telephones Employing New Technologies
9	RSS-133	2 GHz Personal Communications Services, Industry Canada
10	RSS-212	Test Facilities and Test Methods for Radio Equipment, Industry Canada (Provisional)
11	RSP-100	Radio Equipment Certification Procedure

Note: Unless otherwise stated, (by reference to a version number and a publication date), the latest version of the above documents applies.

Deviations:

Not Applicable.

3. LIST OF ABBREVIATIONS, ACRONYMS AND TERMS

3.1 Abbreviations

dB - decibel

dBm - decibels per milliwatt (absolute measurement)

GHz - gigahertz or 1000000000 hertz

kHz - kilohertz or 1000 hertz

MHz - megahertz or 1000000 hertz

3.2 Acronyms

AMPS - Advanced Mobile Phone System

BSS - Base Station Simulator

CDMA - Code Division Multiple Access

EDRP - Effective Dipole Radiated Power

EIRP - Effective Isotropic Radiated Power

EMC - Electromagnetic Compatibility

EUT - Equipment under Test

GSM - Global System for Mobile communications

PCS - Personal Communications Services

RF - Radio Frequency

TDMA - Time Division Multiple Access

3.3 Terms

Base Station Simulator (BSS) - simulates all the necessary signals that a phone would experience while on a live network. There are many types of base station simulators catering for all current protocols, i.e., GSM, AMPS, TDMA, and CDMA.

Cellular - refers to a frequency in the 800MHz band.

PCS - refers to a frequency in the 1900MHz band.

4. EQUIPMENT-UNDER-TEST (EUT)

The results in this report relate only to the items listed below:

4.1 Description of Tested Device(s):

Test Performed	Mode of Operation	Date of Receipt	Condition of Sample	Item	Identifying Information
22.913(a), 24.232(b)(c), 2.1053, 2.1046(a), 22.913(a), 24.232(b)(c), 2.1049(c)(1), 2.1051, 24.238(b), 22.917(f),	AMPS/TDMA 800/1900	20-Nov-02	Good	Phone	FCC ID: GMLRH-14 Model: 3560 HWID: 3.0/415f ESN: 23553165284
2.1047(a), 2.1047(b), 22.915(a)(b)(c)(d)(1), 2.1055(a)(1)(b), 2.1055(d)(1)(2)	AMPS/TDMA 800/1900	20-Nov-02	Good	Phone	FCC ID: GMLRH-14 Model: 3560 HWID: 3.0/415f ESN: 23514058932
22.913(a), 24.232(b)(c), 2.1053, 2.1046(a), 22.913(a), 24.232(b)(c), 2.1047(a), 2.1047(b), 22.915(a)(b)(c)(d)(1), 2.1049(c)(1), 2.1051, 24.238(b), 22.917(f), 2.1055(a)(1)(b), 2.1055(d)(1)(2)	AMPS/TDMA 800/1900	20-Nov-02	Good	Battery	Type: BLC-2 Other: 1000mAh

4.2 Photograph of Tested Device(s):

Refer to attached EXHIBITS

5. TEST EQUIPMENT LIST

The listing below indicates the test equipment utilized for the test (s). Calibration interval on all items listed can be obtained from the Engineering Services Group within NMP, Product Creation - Dallas. Where relevant, measuring equipment is subjected to in-service checks between testing. TCC - Dallas shall notify clients promptly, in writing, of identification of defective measuring equipment that casts doubt on the validity of results given in this report.

Test/ Section of Report	NMP#	Test Equipment	Mfr. #	Model #
6	02549	Power Meter	Agilent	E4418B
6	02673	Power Sensor	Agilent	E9304A
6,16,17	02894	Base Station Simulator	Acterna	MMS 4305
7,15	02868	Biconilog Antenna	ETS	3142B
7,15	02846	Turntable and Tower Controller	Sunol	Turntable FM2022, Controller 2846
7,15	00065	Horn Antenna	EMCO	3115
7,15	00064	Horn Antenna	EMCO	3115
7,15	02671	Signal Generator	Agilent	83630B
7,15	0368/ 00367	EMI Receiver	Agilent	8546A, 85460A
11,12,13,14	02664/ 02665	EMI Receiver	Agilent	8546A, 85460A
15	02680	Spectrum Analyzer	Agilent	E7405A
14	02679	Spectrum Analyzer	Agilent	E7405A
11,12,13,14, 16,17	02830	Base Station Simulator	Acterna	MMS 4305
11,12,13,14	03155	Power Splitter (6 dB insertion loss)	Agilent	33120A
11,12,13,14	N/A	6dB Attenuator	Weinshcel	Model 2
11,12,13,14	N/A	3GHz High Pass Filter	Trilithic Inc.	4HC2900/18000-1.1-KK
11,12,13,14	N/A	2GHz High Pass Filter	Trilithic Inc.	3HC1900/18000-1-KK
11,12,13,14	N/A	1GHz High Pass Filter	Wainwright.	WHK949-9SS
15	00001	RF preamplifier	Agilent	HP8449B
16,17	00837	Temperature Chamber	Tenney Junior	TUJR
16,17	00627	Variable Power Supply	Agilent	E3631A
8,9,10	00075	Function Generator	Agilent	33120A
8,9,10	00510	Modulation Analyzer	Agilent	8901B

6. RF POWER OUTPUT (CONDUCTED)

Specification: FCC Part 2.1046(a), 22.913(a), 24.232(b)(c)

6.1 Setup

The EUT was setup using PC Locals and antenna port was connected to RF Power Meter (using a 10dB attenuator) to measure the conducted RF power output.

6.2 Pass/Fail Criteria

Not Applicable

6.3 Detailed Test Results

Test Technician / Engineer	Mark Severson	
Date of Measurement	6 November 2002	
Temperature / Humidity	21°C	49%RH
Test Result	FCC ID: GMLRH-14 was operated at max power and tested in accordance with FCC Part 2.1046(a), 22.913(a), 24.232(b)(c).	

RF Conducted Power			
AMPS Mode	**Channel**	**Max (mW)**	**Max (dBm)**
824.04 MHz	991	332.7	25.22
836.52 MHz	384	331.1	25.20
848.97 MHz	799	317.7	25.02

RF Conducted Power			
TDMA Mode	**Channel**	**Max (mW)**	**Max (dBm)**
824.04 MHz	991	543.3	27.35
836.52 MHz	384	518.8	27.15
848.97 MHz	799	507.0	27.05

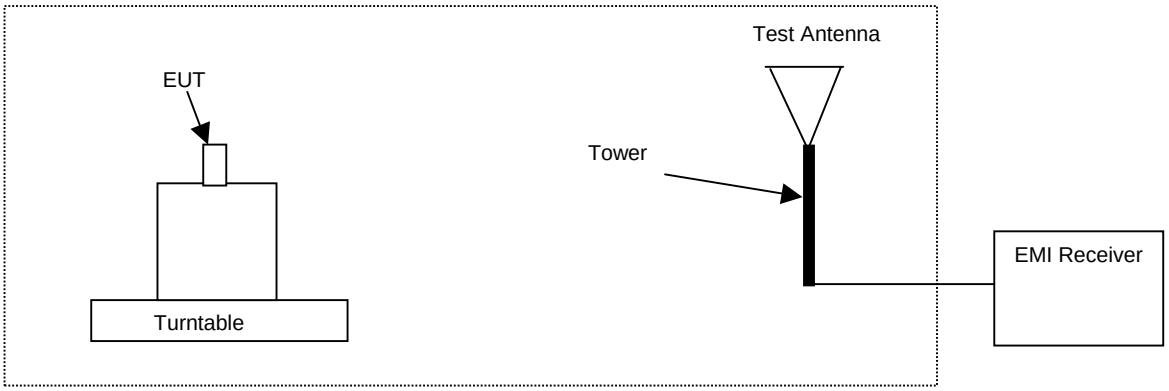
RF Conducted Power			
PCS Mode	**Channel**	**Max (mW)**	**Max (dBm)**
1850.04 MHz	2	598.4	27.77
1879.95 MHz	999	628.1	27.98
1909.92 MHz	1998	515.2	27.12

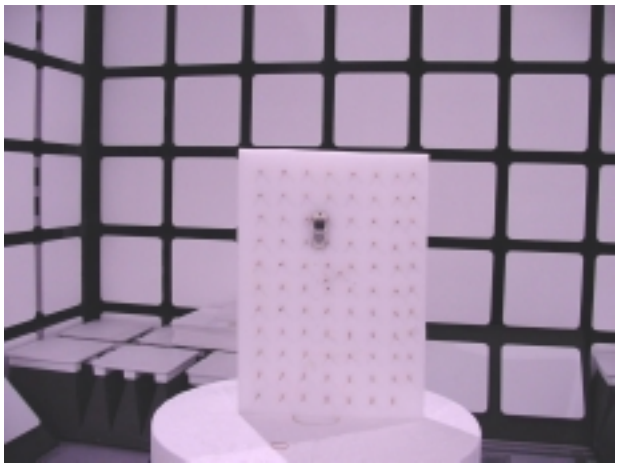
7. RF POWER OUTPUT (RADIATED)

Specification: FCC Part 22.913(a), 24.232(b)(c)

7.1 Setup

Testing was performed in accordance with document ANSI/TIA/EIA-603-A, section 2.2.17 Average Radiated Power Output.





7.2 Pass/Fail Criteria

Band	FCC Limit (dBm)
Cellular	38.5 (EDRP)
PCS	33.0 (EIRP)

7.3 Detailed Test Results

Test Technician / Engineer	Bob Alexander	
Date of Measurement	6-Dec-02	
Temperature / Humidity	24°C	31%RH
Test Result	FCC ID: GMLRH-14 complies with FCC Part 22.913(a) and FCC Part 24.232(b) when operated at max power.	

Cellular Band, AMPS

Channel 991

Freq Max (MHz)	EDRP EMI (dBm)	Pol.
824.04	23.16	V

Channel 384

Freq Max (MHz)	EDRP EMI (dBm)	Pol.
836.52	25.03	V

Channel 799

Freq Max (MHz)	EDRP EMI (dBm)	Pol.
848.97	23.45	V

Cellular Band, TDMA

Channel 991

Freq Max (MHz)	EDRP EMI (dBm)	Pol.
824.04	27.38	V

Channel 384

Freq Max (MHz)	EDRP EMI (dBm)	Pol.
836.52	30.15	V

Channel 799

Freq Max (MHz)	EDRP EMI (dBm)	Pol.
848.97	28.62	V

PCS Band, TDMA1900

Channel 2

Freq Max (MHz)	EIRP EMI (dBm)	Pol.
1850.04	29.84	V

Channel 999

Freq Max (MHz)	EIRP EMI (dBm)	Pol.
1879.95	30.98	V

Channel 1998

Freq Max (MHz)	EIRP EMI (dBm)	Pol.
1909.92	30.79	V

7.4 Measurement Uncertainty

The measurement uncertainty for this test is +/- 3.4dB.

8. TX AUDIO FREQUENCY RESPONSE

Specification: FCC Part 2.1047(a)

8.1 Setup

The audio signal generator was connected to the audio input circuit/microphone of the EUT.

The audio signal input was adjusted to obtain 20% modulation at 1kHz, and this point was taken as the 0dB reference level.

With input levels held constant and below limiting at all frequencies, the audio generator was varied from 100Hz to 50kHz.

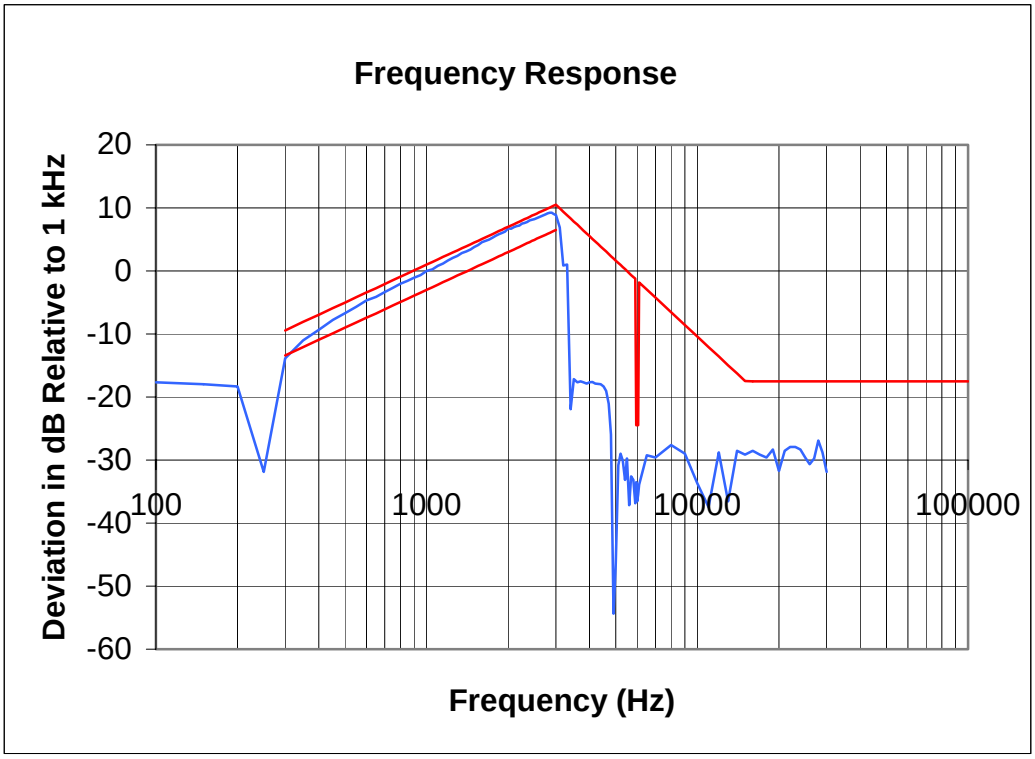
The response in dB relative to 1kHz was then measured, using the HP 8901B modulation analyzer.

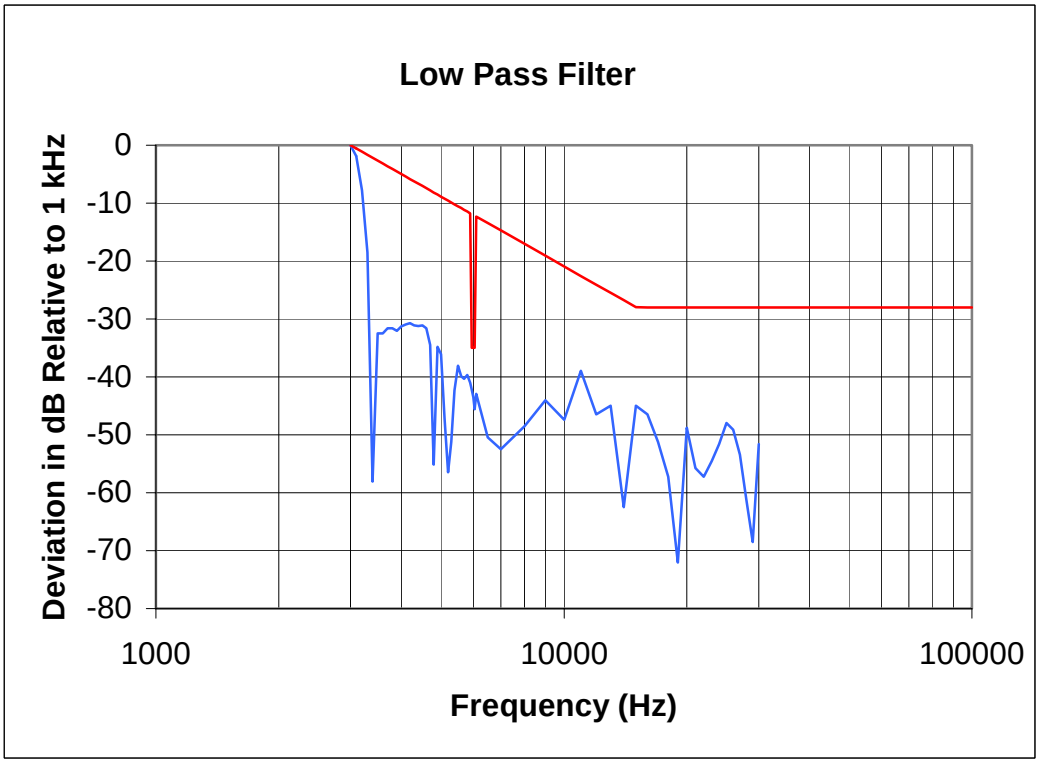
8.2 Pass/Fail Criteria

Emissions mask.

8.3 Detailed Test Results

Test Technician / Engineer	Anu Balijepalli	
Date of Measurement	12 December 2002	
Temperature / Humidity	22°C	44%RH
Test Result	FCC ID: GMLRH-14 complies with FCC Part 2.1047(a)	





9. MODULATION LIMITING

Specification: FCC Part 2.1047(b)

9.1 Setup

The audio signal generator was connected to the audio input circuit/microphone of the EUT.

The modulation response was measured for each of three tones (one of which was the frequency of maximum response), and the input voltage was varied and was observed on the HP 8901B modulation analyzer.

The audio input level was varied from 30% modulation (+/-3.6kHz deviation) to at least 20dB higher than the saturation point.

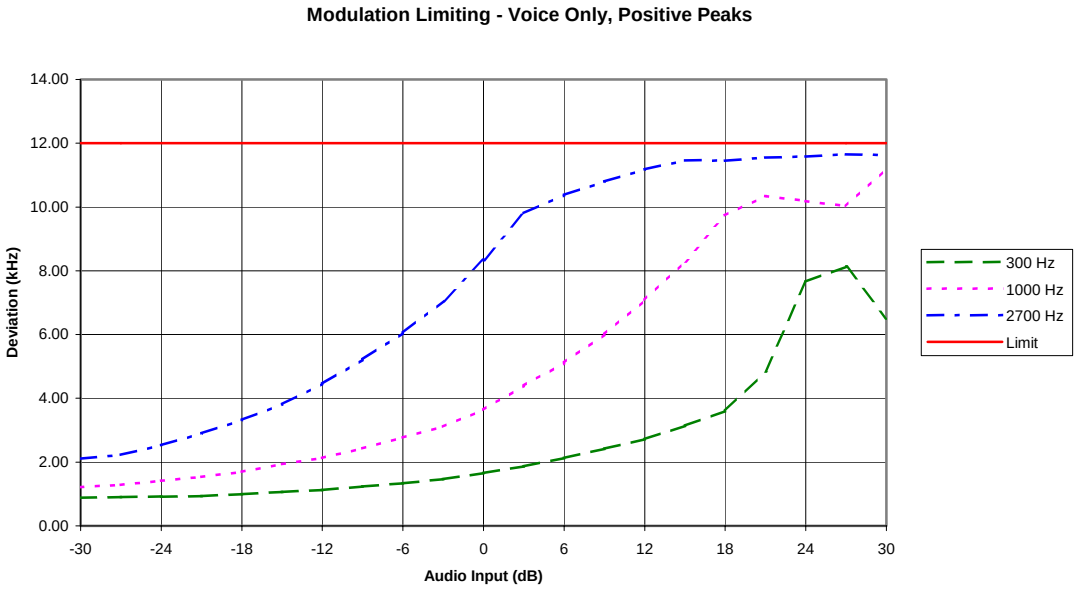
Measurements were performed for both negative and positive modulation and the respective results were recorded.

9.2 Pass/Fail Criteria

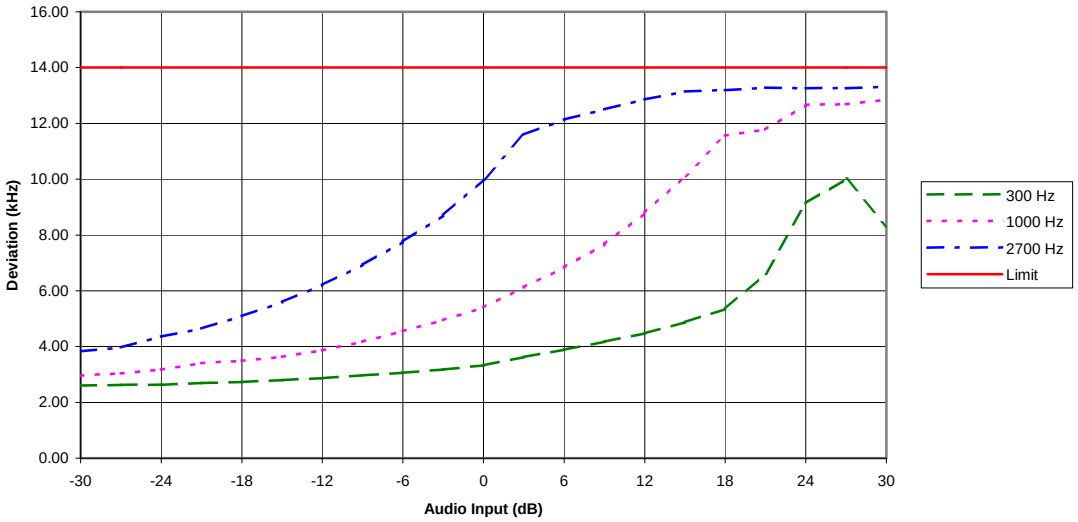
Less than +/-12kHz deviation.

9.3 Detailed Test Results

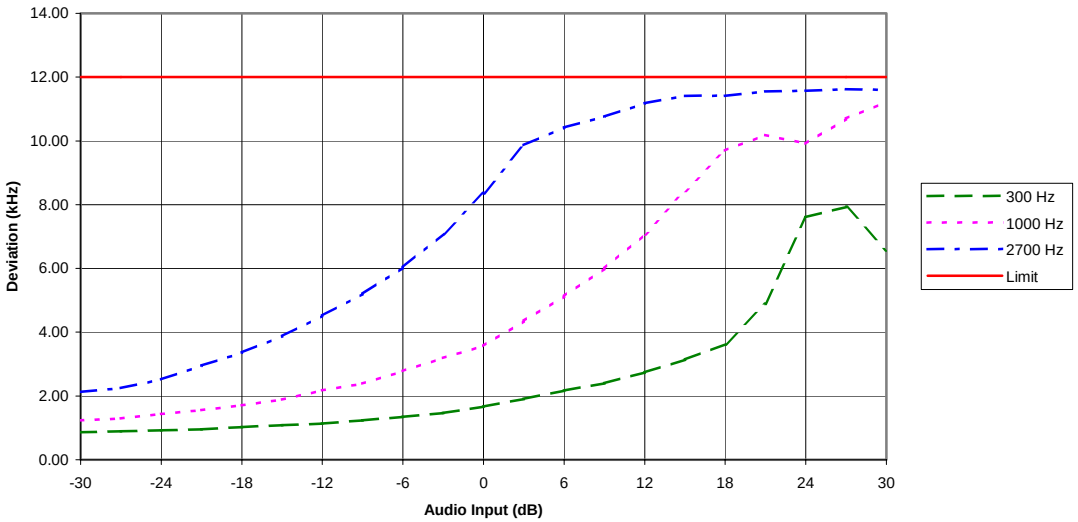
Test Technician / Engineer	Mark Severson	
Date of Measurement	8 January 2003	
Temperature / Humidity	23°C	38%RH
Test Result	FCC ID: GMLRH-14 complies with FCC Part 2.1047(b)	



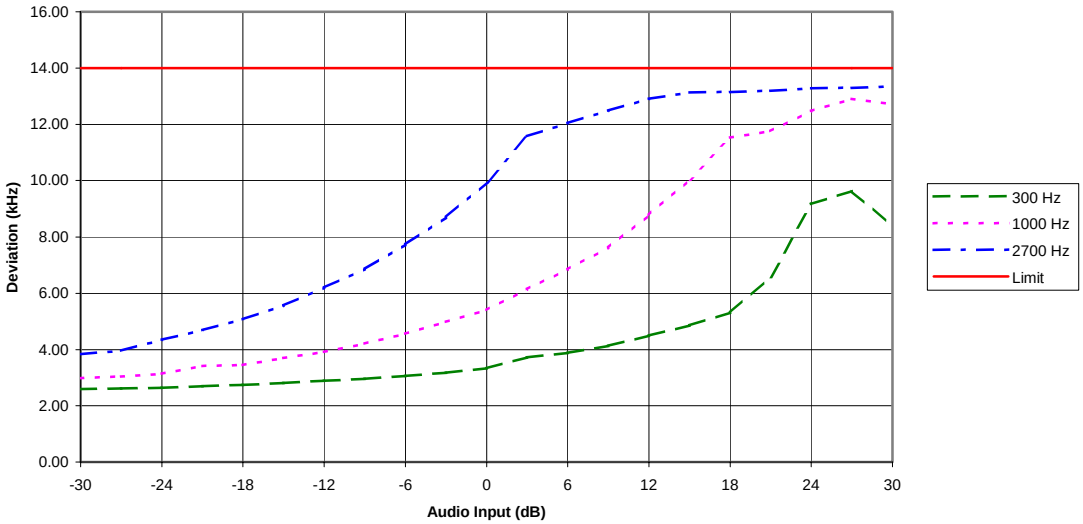
Modulation Limiting - Voice+SAT, Positive Peaks



Modulation Limiting - Voice Only, Negative Peaks



Modulation Limiting - Voice+SAT, Negative Peaks



10. MODULATION REQUIREMENTS (MEASUREMENT OF MAXIMUM DEVIATION)

Specification: FCC Part 22.915(a)(b)(c)(d)(1)

10.1 Setup

The presentation of tones was obtained by attaching the oscilloscope to the modulation output of the modulation analyzer.

The function generator and/or internally generated signals modulated the EUT.

Maximum deviation measurements were recorded for the various configurations.

10.2 Pass/Fail Criteria

Modulation	Low Limit (kHz)	High Limit (kHz)
Voice	10.8	13.2
Wideband Data	7.2	8.8
SAT	1.8	2.2
ST	7.2	8.8

10.3 Detailed Test Results

Test Technician / Engineer	Mark Severson	
Date of Measurement	08 January, 2003	
Temperature / Humidity	23°C	38°C
Test Result	FCC ID: GMLRH-14 complies with FCC Part 22.915(a)(b)(c)(d)(1)	

Modulation	Deviation (kHz)	Low Limit (kHz)	High Limit (kHz)
Voice	11.53	10.8	13.2
Wideband Data	8.03	7.2	8.8
SAT	2.09	1.8	2.2
ST	8.06	7.2	8.8
SAT + Voice	13.21	N/A	N/A
SAT + DTMF	11.84	N/A	N/A

11. OCCUPIED BANDWIDTH (EMISSIONS MASKS)

Specification: FCC Part 2.1049(c)(1), 24.238(a)(b)

11.1 Setup

Testing was performed with the EUT connected to a 6dB splitter, 6dB attenuator, filter bank and then to the EMI receiver. The base station simulator was connected to the other port of the splitter to establish a call.

For EUTs supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with the output level set for +/-2.5kHz deviation (or 50% modulation). With level constant, the signal level was increased 16dB.

For EUTs supporting digital modulation, the digital modulation mode was operated to its maximum extent.

11.2 Pass/Fail Criteria

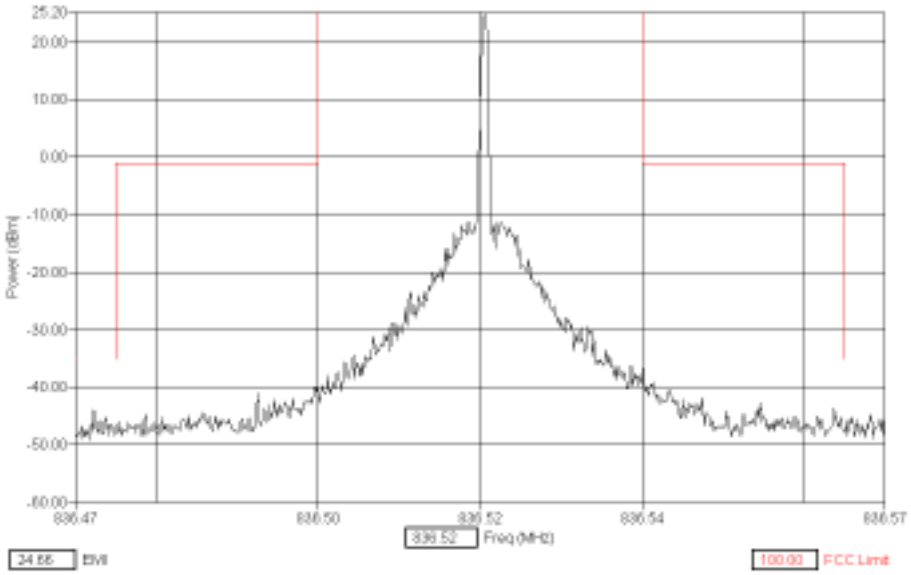
Modulation	Low Limit (kHz)	High Limit (kHz)
Voice	10.8	13.2
Wideband Data	7.2	8.8

11.3 Detailed Test Results

Test Technician / Engineer	Mark Severson	
Date of Measurement	December 10, 2002	
Temperature / Humidity	22°C	43%RH
Test Result	FCC ID: GMLRH-14 complies with FCC Part 2.1049(c)(1), 24.238(a)(b) when operated at max power.	

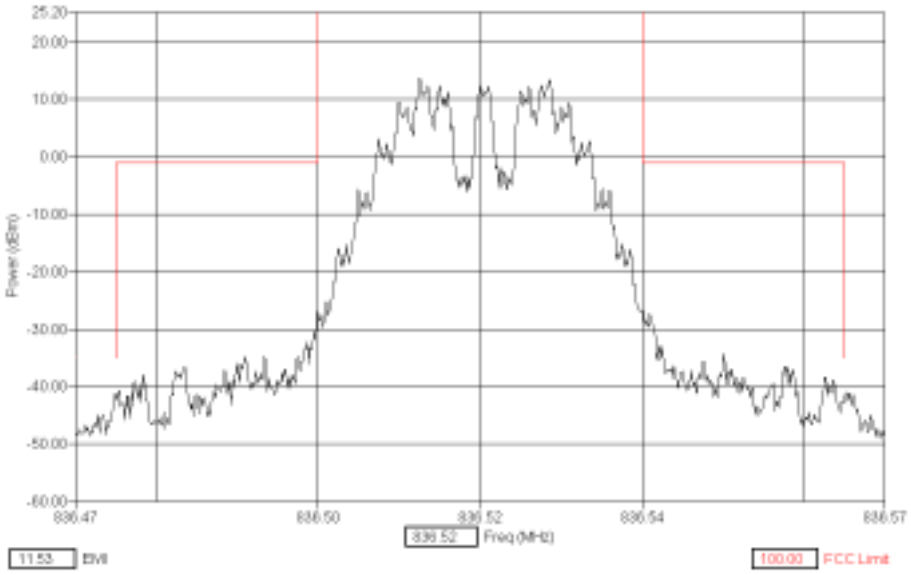
AMPS Max Power Measurements – No Modulation; Channel 384

100 kHz Span, 300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



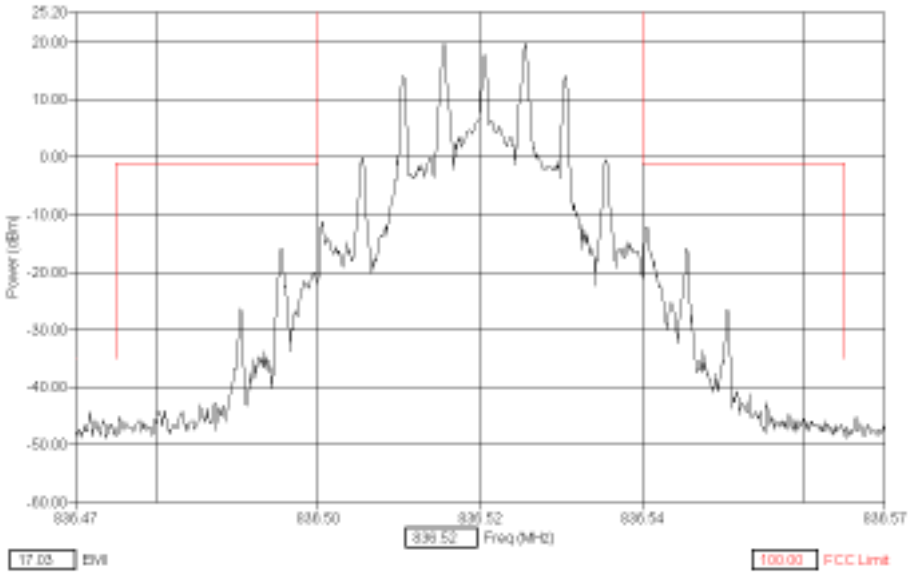
AMPS Max Power – Voice (2500 Hz Sine Wave); F3E/F3D mask, Channel 384

100 kHz Span, 300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



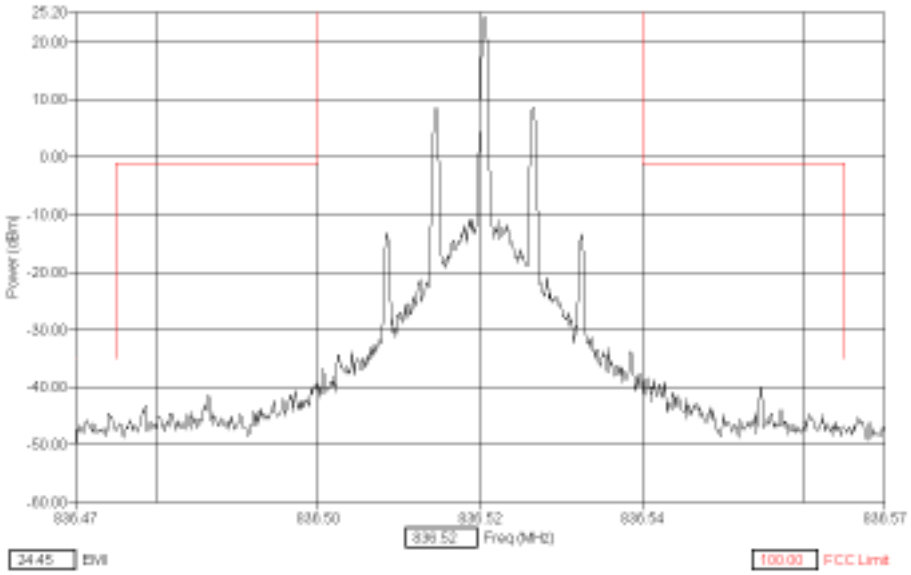
AMPS Max Power – Wideband Data; F3E/F3D mask, Channel 384

100 kHz Span, 300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



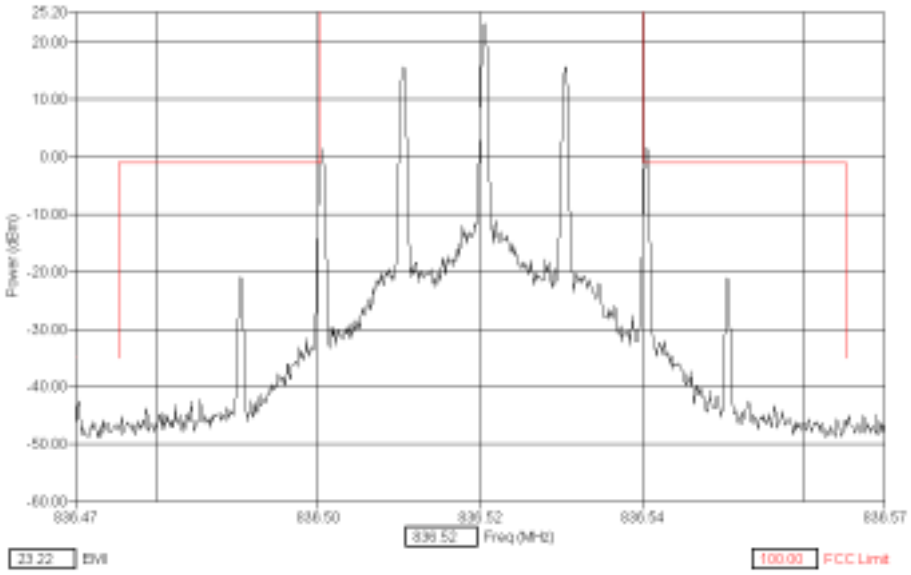
AMPS Max Power – SAT; F3E/F3D mask, Channel 384

100 kHz Span, 300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



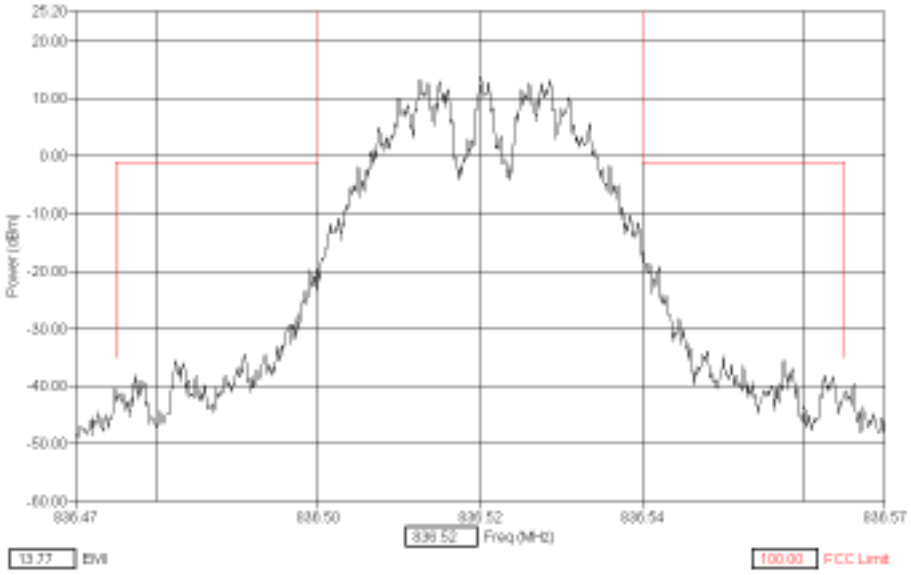
AMPS Max Power – ST; F3E/F3D mask, Channel 384

100 kHz Span, 300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



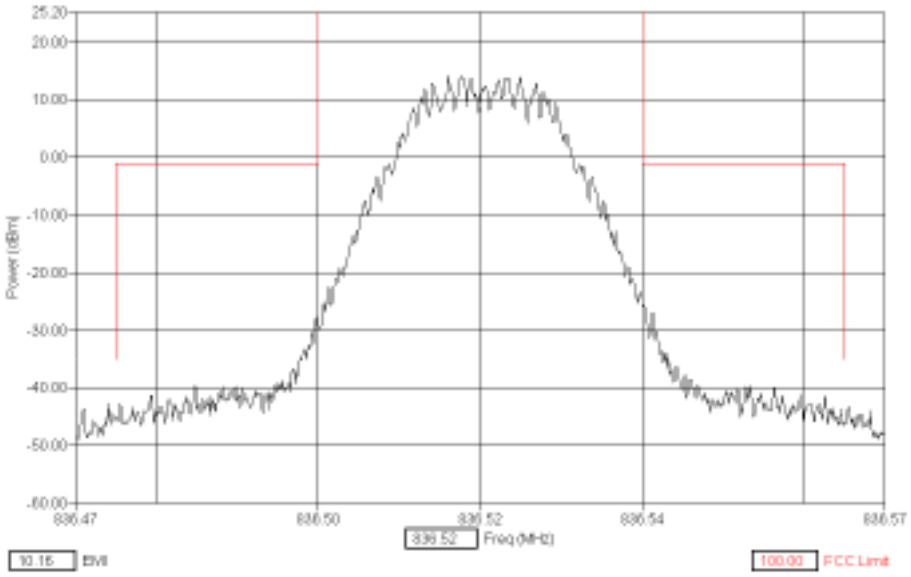
AMPS Max Power – SAT + Voice; F3E/F3D mask, Channel 384

100 kHz Span, 300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



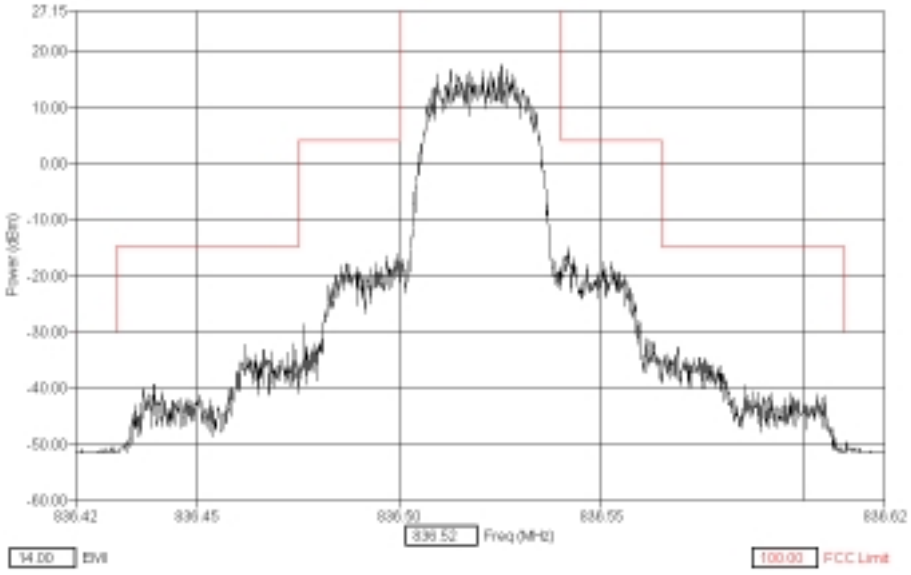
AMPS Max Power – SAT + DTMF; F3E/F3D mask, Channel 384

100 kHz Span, 300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



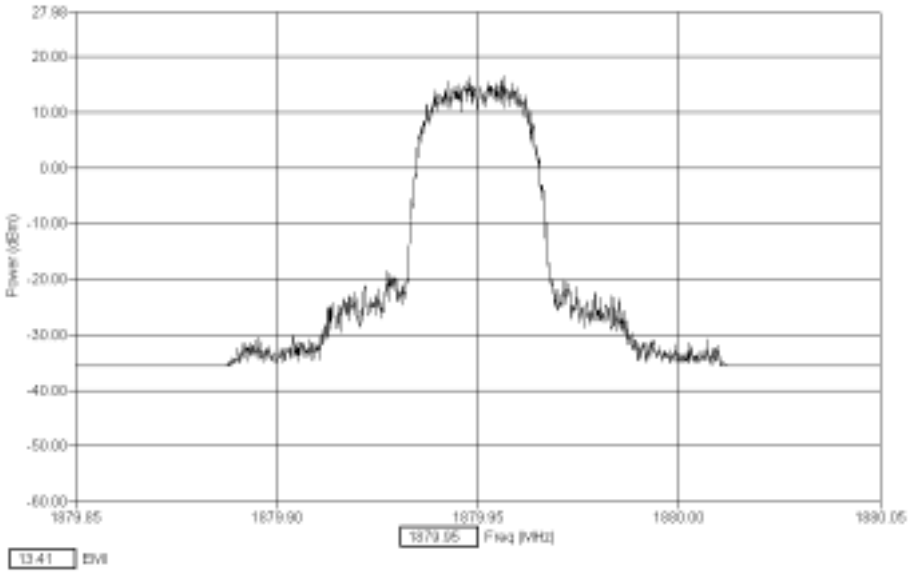
TDMA Cellular - Random Modulation; F1D, Channel 384

200 kHz Span, 300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



TDMA PCS – Channel 999, 1879.95 MHz

200 kHz Span, 300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



11.4 Measurement Uncertainty

The measurement uncertainty for this test is +/- 3.7dB for 100kHz - 1000MHz and +/- 5.3dB for 1 - 20GHz.

12. OCCUPIED BANDWIDTH (TRANSMITTER CONDUCTED MEASUREMENTS)

Specification: FCC Part 2.1049(c)(1), 24.238(a)(b)

12.1 Setup

Testing was performed with the EUT connected to a 6dB splitter, 6dB attenuator, filter bank and then to the EMI receiver. The base station simulator was connected to the other port of the splitter to establish a call.

12.2 Pass/Fail Criteria

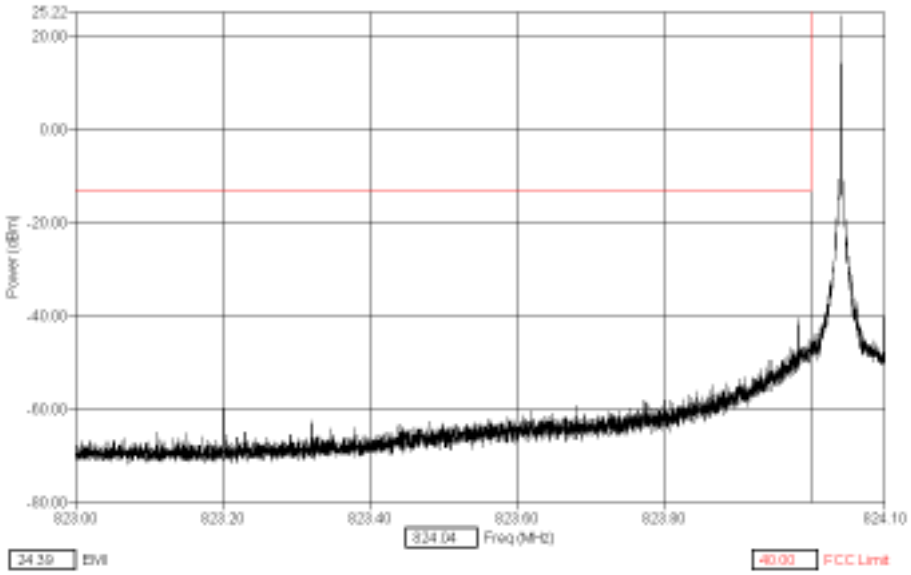
Band	Frequency Range (MHz)	FCC Limits (dBm)
Cellular 800 Low Channel	< 824	-13
Cellular 800 High Channel	> 849	-13
PCS 1900 Low Channel	< 1850	-13
PCS 1900 High Channel	> 1910	-13

12.3 Detailed Test Results

Test Technician / Engineer	Mark Severson	
Date of Measurement	December 09, 2002	
Temperature / Humidity	21°C	37%RH
Test Result	FCC ID: GMLRH-14 complies with FCC Part 2.1049(c)(1), 24.238(a)(b) when operated at max power.	

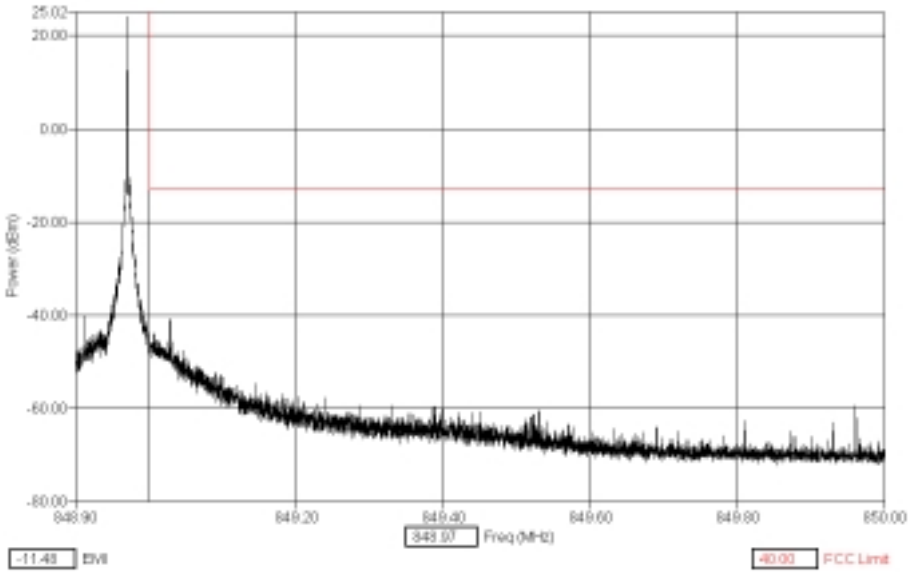
AMPS Max Power - Channel 991 (824.04 MHz) No Modulation

300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



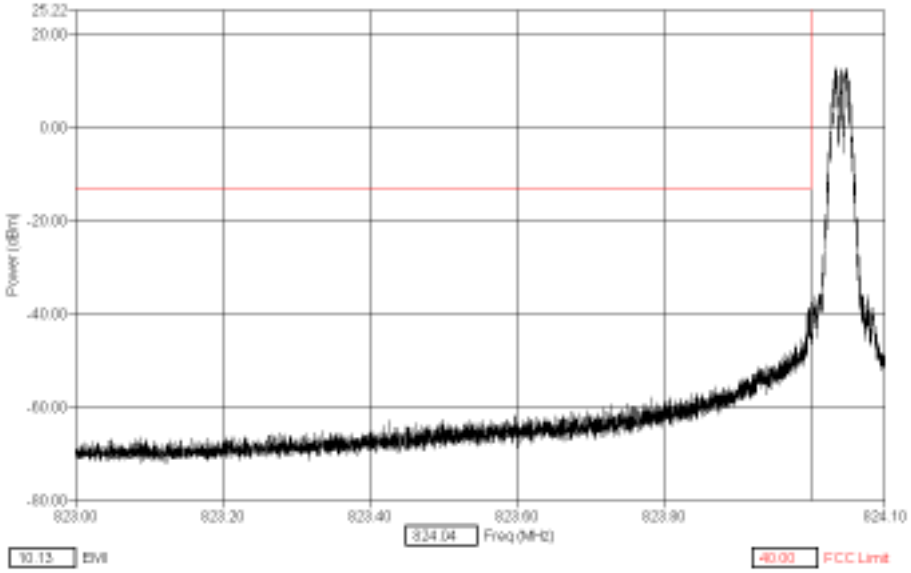
AMPS Max Power - Channel 799 (848.97 MHz) No Modulation

300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



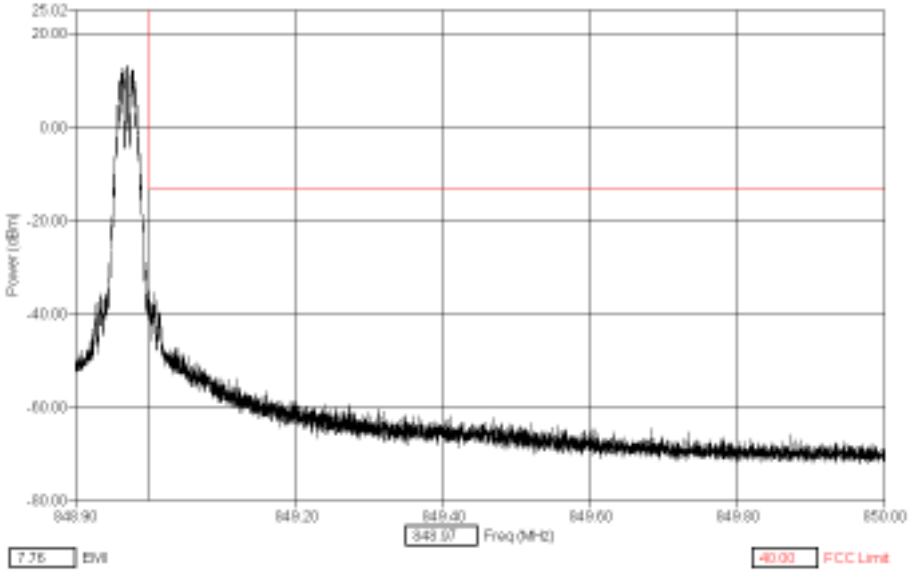
AMPS Max Power - Channel 991 (824.04 MHz) Voice + SAT Tone

300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



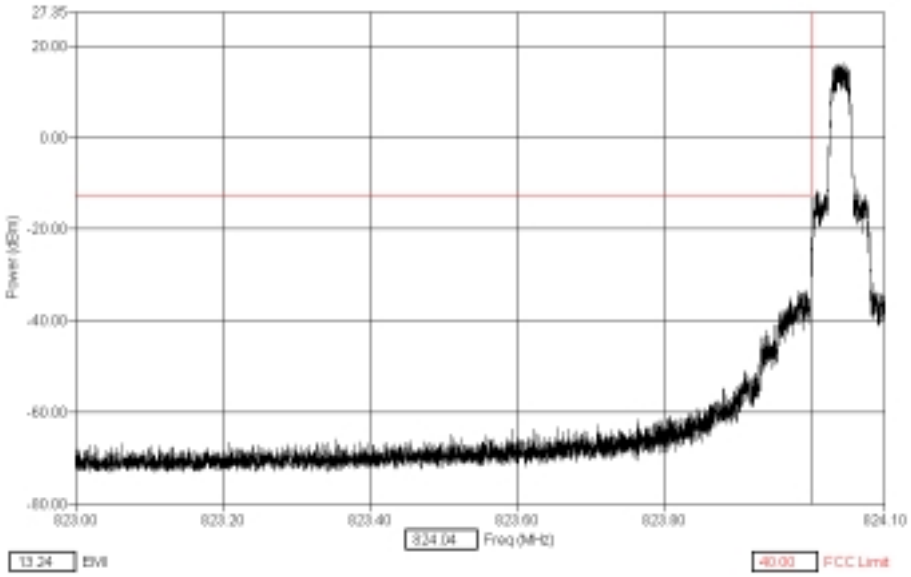
AMPS Max Power - Channel 799 (848.97 MHz) Voice + SAT Tone

300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



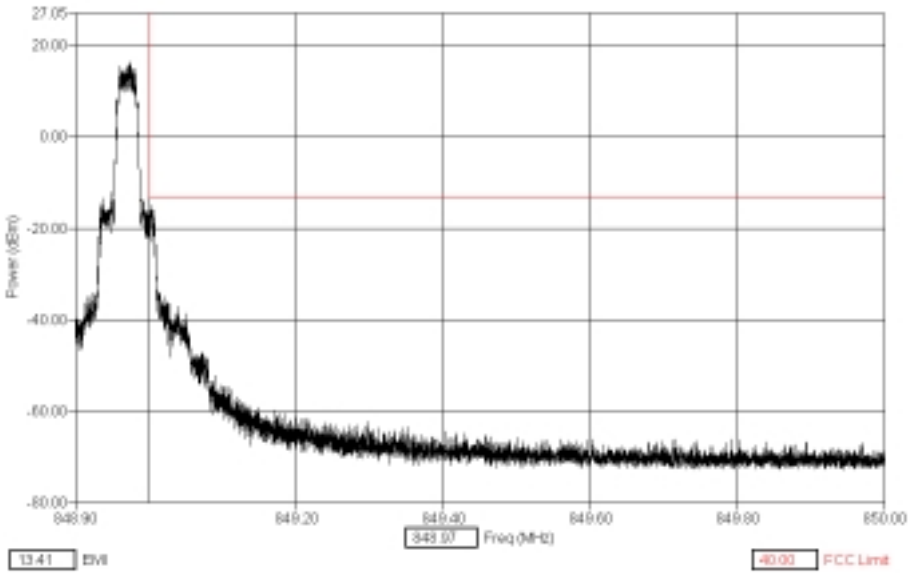
TDMA Cellular, Max Power - Channel 991 (824.04 MHz)

300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



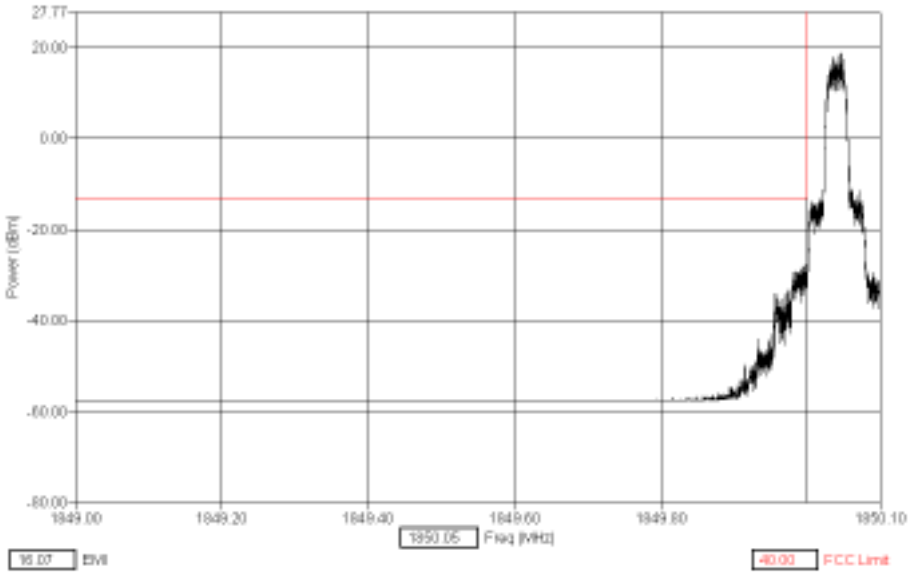
TDMA Cellular, Max Power - Channel 799 (848.97 MHz)

300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



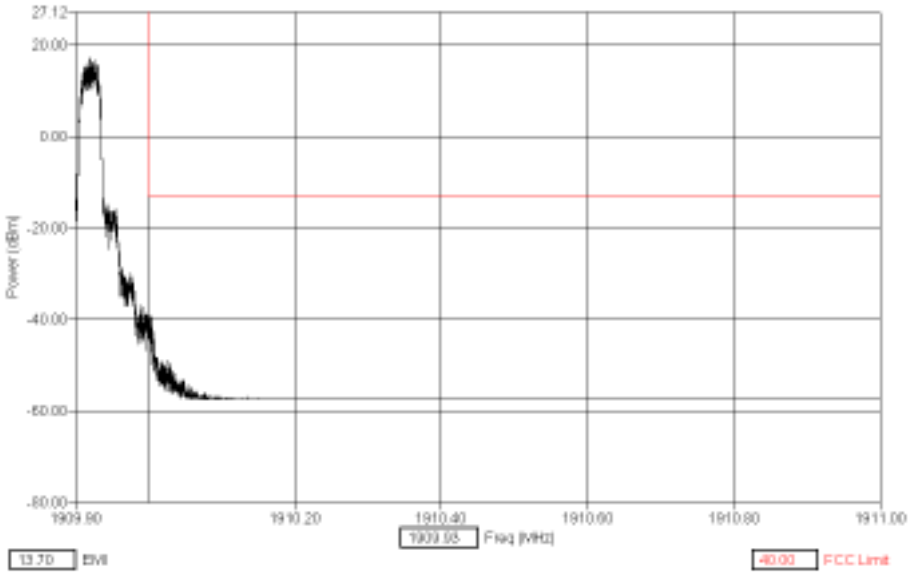
TDMA PCS, Max Power - Channel 2 (1850.04 MHz)

300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



TDMA PCS, Max Power - Channel 1998 (1909.92 MHz)

300 Hz RBW/VBW, 100ms Sweep Time, ref to power level



12.4 Measurement Uncertainty

The measurement uncertainty for this test is +/- 3.7dB for 100kHz - 1000MHz and +/- 5.3dB for 1 - 20GHz.

13. EMISSIONS IN RECEIVER CRITICAL BAND

Specification: FCC Part 22.917(f)

13.1 Setup

Testing was performed with the EUT connected to a 6dB splitter, 6dB attenuator, filter bank and then to the EMI receiver. The base station simulator was connected to the other port of the splitter to establish a call. Filters were introduced to reduce or eliminate spurious emission, which could be generated internally in the EMI receiver.

13.2 Pass/Fail Criteria

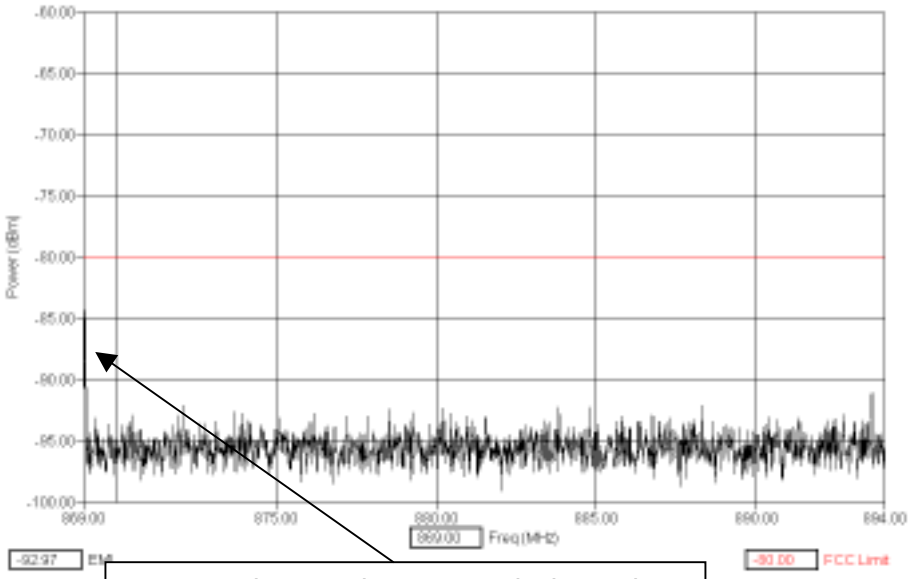
Band	Frequency Range (MHz)	FCC Limits (dBm)
Cellular	869 - 894	-80

13.3 Detailed Test Results

Test Technician / Engineer	Michael Sundstrom	
Date of Measurement	13 December 2002	
Temperature / Humidity	21-22°C	39-46%RH
Test Result	FCC ID: GMLRH-14 complies with FCC Part 22.917(f) when operated at max power.	

AMPS - Channel 991, 824.04MHz

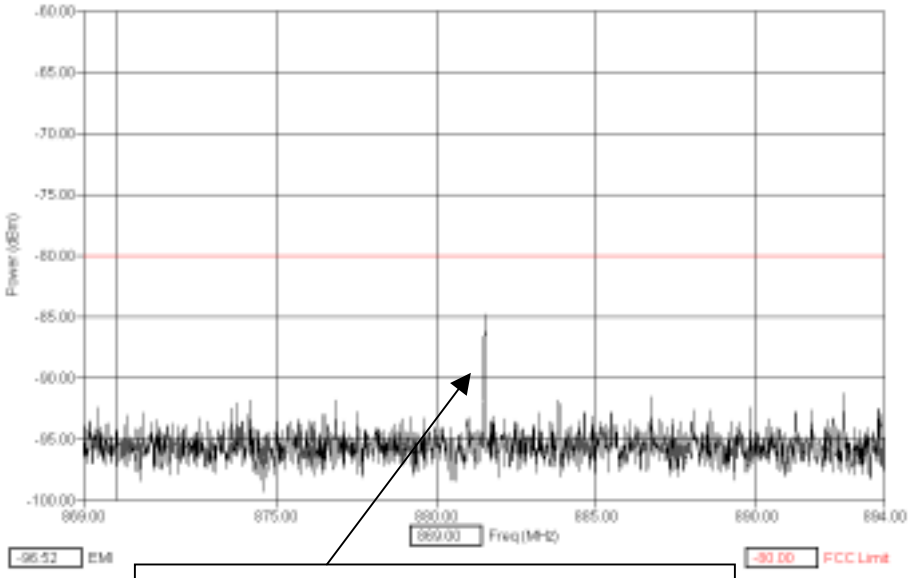
30 kHz RBW/VBW, 100ms Sweep Time



Base Station Emulator Control Channel
Channel 991 (869.04MHz)

AMPS - Channel 384, 836.52MHz

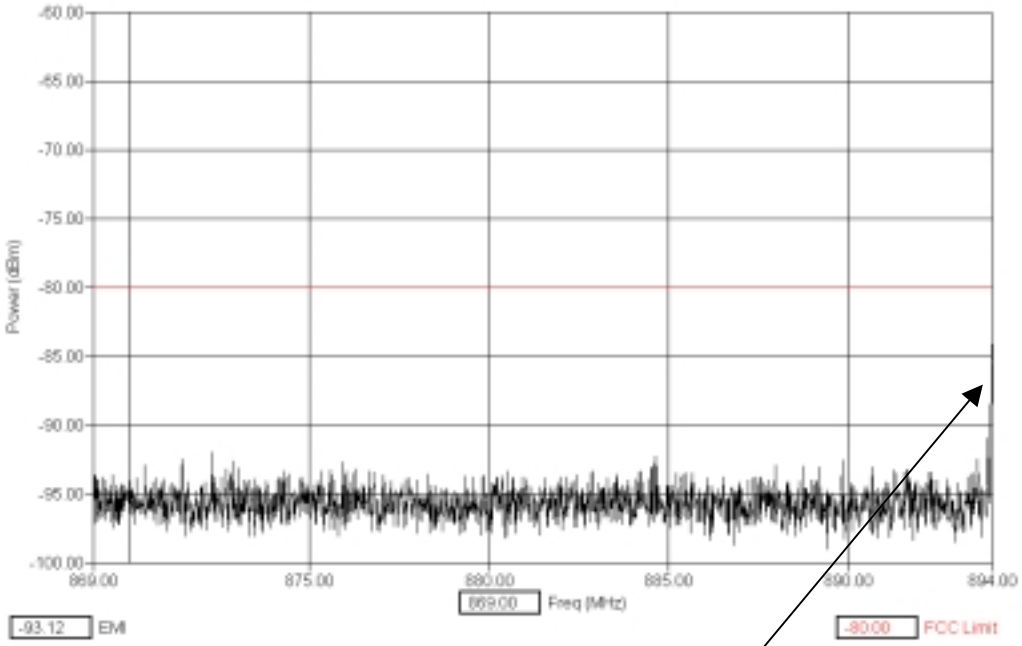
30 kHz RBW/VBW, 100ms Sweep Time



Base Station Emulator Control Channel
Channel 384 (881.52MHz)

AMPS - Channel 799, 848.97MHz

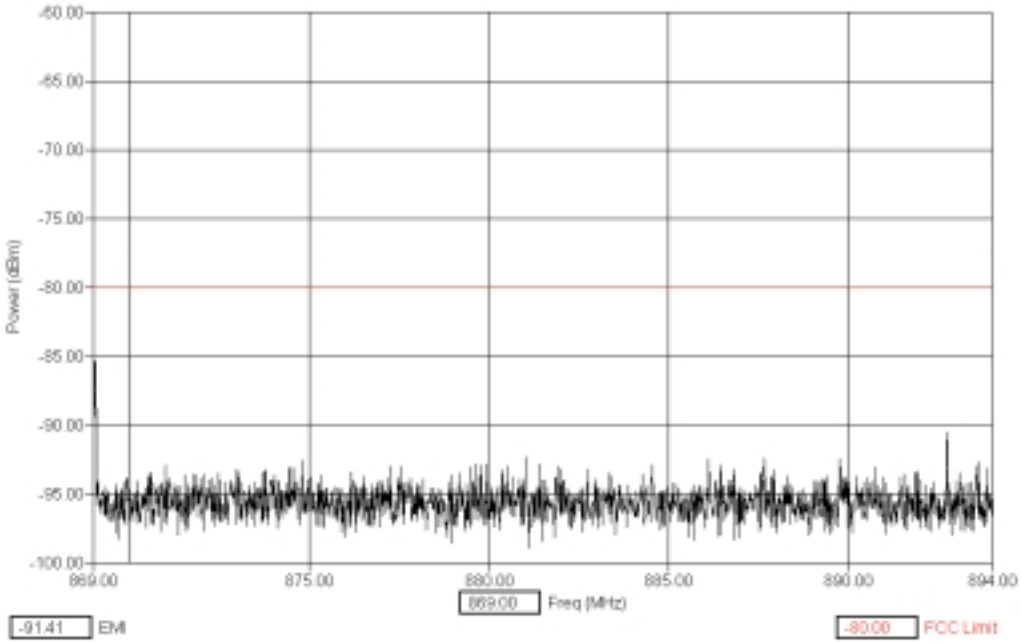
30 kHz RBW/VBW, 100ms Sweep Time



Base Station Emulator Control Channel
Channel 799 (893.97MHz)

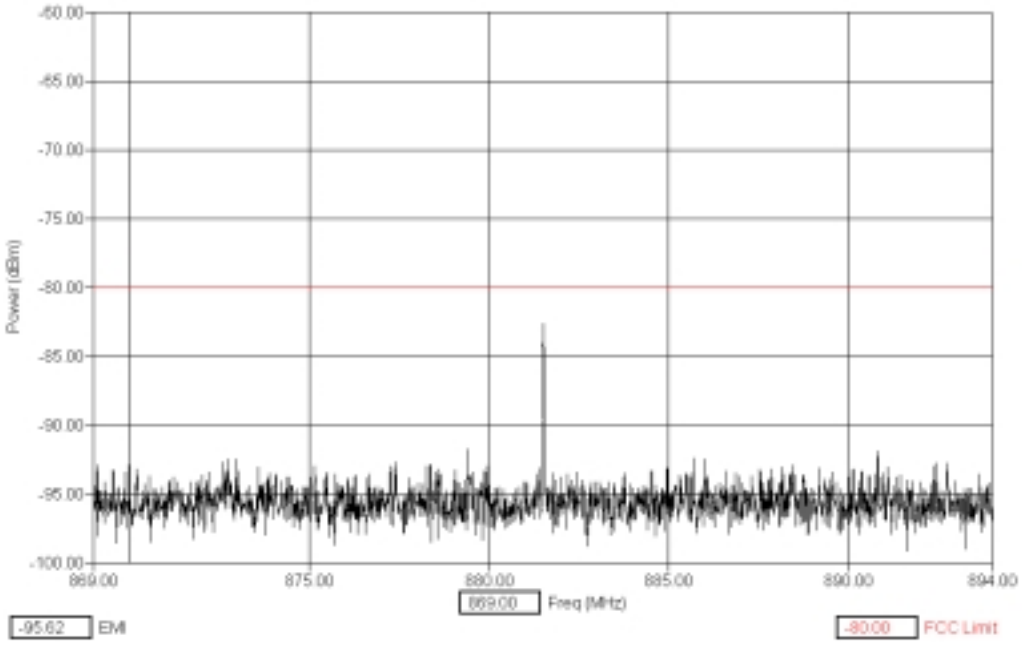
TDMA Cellular - Channel 991, 824.04MHz

30 kHz RBW/VBW, 100ms Sweep Time



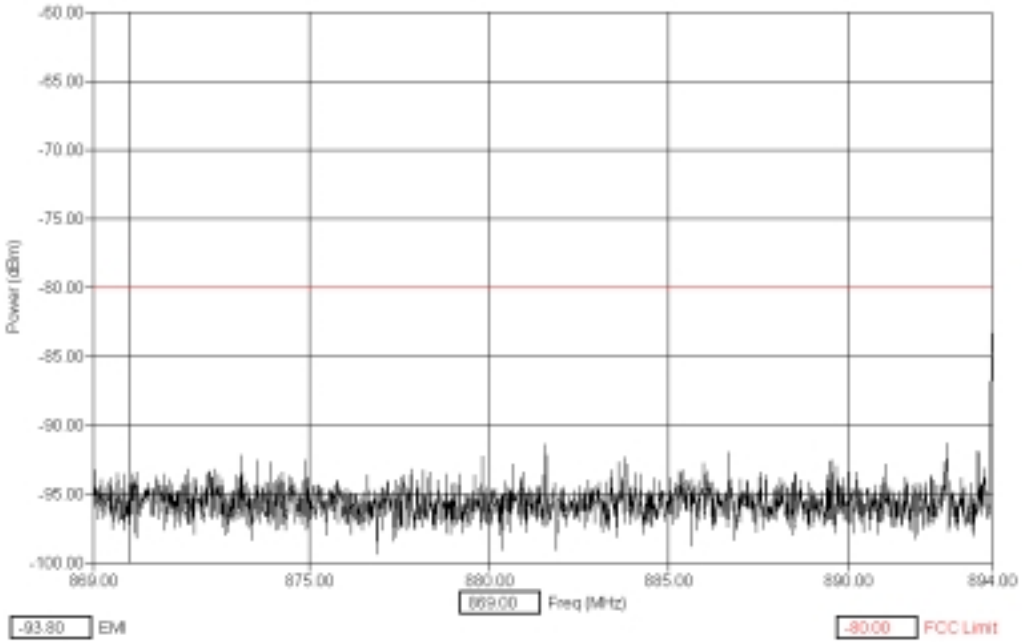
TDMA Cellular - Channel 384, 836.52MHz

30 kHz RBW/VBW, 100ms Sweep Time



TDMA Cellular - Channel 799, 848.97MHz

30 kHz RBW/VBW, 100ms Sweep Time



13.4 Measurement Uncertainty

The measurement uncertainty for this test is +/- 3.7dB for 100kHz - 1000MHz.

14. SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Specification: FCC Part 2.1051

14.1 Setup

Testing was performed with the EUT connected to a 6dB splitter, 6dB attenuator, filter bank and then to the EMI receiver. The base station simulator was connected to the other port of the splitter to establish a call. Filters were introduced to reduce or eliminate spurious emission, which could be generated internally in the EMI receiver.

14.2 Pass/Fail Criteria

Band	Frequency Range (MHz)	FCC Limits (dBm)
Cellular / PCS	30MHz - 20000 *	-13

* Frequency to be investigated up to the 10th harmonic of the highest clock or frequency used.

14.3 Detailed Test Results

Test Technician / Engineer	Michael Sundstrom	
Date of Measurement	12 December 2002	
Temperature / Humidity	19-23°C	29-47%RH
Test Result	FCC ID: GMLRH-14 complies with FCC Part 2.1051 when operated at max power.	

Note: EMI (dBm) = trace (dBuV) + cable loss (dB) + filter loss (dB).

AMPS - Channel 991, 824.04 MHz

Freq (Max) (MHz)	(PK) Trace (dBm)	Cable (dB)	Filter (dB)	(PK) EMI (dBm)	FCC Limit (dBm)
1647.0	-45.5	0.8	2.2	-42.5	-13.0
2471.3	-45.4	1.0	3.0	-41.4	-13.0
3296.9	-47.8	1.2	3.3	-43.4	-13.0
4120.5	-47.6	1.6	3.4	-42.6	-13.0
4943.9	-49.5	1.8	3.5	-44.2	-13.0
5767.1	-48.8	2.0	3.7	-43.1	-13.0
6591.1	-49.0	2.0	4.0	-43.0	-13.0
7413.9	-46.1	2.1	4.2	-39.8	-13.0
8240.9	-46.6	2.2	4.4	-40.0	-13.0

AMPS - Channel 384, 836.52 MHz

Freq (Max) (MHz)	(PK) Trace (dBm)	Cable (dB)	Filter (dB)	(PK) EMI (dBm)	FCC Limit (dBm)
1673.40	-42.3	0.8	2.3	-39.2	-13.0
2508.92	-45.5	1.1	3.0	-41.4	-13.0
3346.99	-46.9	1.3	3.3	-42.3	-13.0
4181.14	-48.8	1.6	3.4	-43.8	-13.0
5017.27	-49.9	1.8	3.5	-44.6	-13.0
5853.22	-49.7	2.0	3.8	-43.9	-13.0
6690.84	-48.8	2.0	4.0	-42.8	-13.0
7530.81	-45.4	2.1	4.2	-39.2	-13.0
8363.72	-45.7	2.3	4.4	-39.0	-13.0

AMPS - Channel 799, 848.97 MHz

Freq (Max) (MHz)	(PK) Trace (dBm)	Cable (dB)	Filter (dB)	(PK) EMI (dBm)	FCC Limit (dBm)
1697.58	-42.1	0.8	2.2	-39.1	-13.0
2547.38	-46.1	1.0	3.0	-42.0	-13.0
3398.42	-46.7	1.4	3.3	-42.1	-13.0
4243.83	-49.3	1.6	3.4	-44.3	-13.0
5091.47	-47.4	1.8	3.5	-42.0	-13.0
5939.85	-50.2	2.0	3.8	-44.4	-13.0
6793.13	-45.9	2.0	4.0	-39.8	-13.0
7641.61	-45.4	2.1	4.2	-39.1	-13.0
8491.62	-46.8	2.4	4.4	-40.0	-13.0

TDMA Cellular - Channel 991, 824.04 MHz

Freq (Max) (MHz)	(PK) Trace (dBm)	Cable (dB)	Filter (dB)	(PK) EMI (dBm)	FCC Limit (dBm)
1648.37	-39.4	0.8	2.2	-36.3	-13.0
2472.75	-30.8	1.0	3.0	-26.8	-13.0
3296.32	-45.8	1.2	3.3	-41.4	-13.0
4120.72	-38.6	1.6	3.4	-33.6	-13.0
4946.63	-49.9	1.8	3.5	-44.6	-13.0
5768.49	-50.6	2.0	3.7	-44.9	-13.0
6590.67	-49.3	2.0	4.0	-43.3	-13.0
7419.36	-45.9	2.1	4.2	-39.7	-13.0
8242.75	-47.1	2.2	4.4	-40.5	-13.0

TDMA Cellular - Channel 384, 836.52 MHz

Freq (Max) (MHz)	(PK) Trace (dBm)	Cable (dB)	Filter (dB)	(PK) EMI (dBm)	FCC Limit (dBm)
1672.95	-38.4	0.8	2.3	-35.3	-13.0
2509.62	-34.2	1.1	3.0	-30.1	-13.0
3347.05	-45.9	1.3	3.3	-41.4	-13.0
4182.97	-47.8	1.6	3.4	-42.8	-13.0
5019.70	-48.9	1.8	3.5	-43.6	-13.0
5857.62	-49.9	2.0	3.8	-44.1	-13.0
6690.49	-48.2	2.0	4.0	-42.2	-13.0
7530.57	-45.2	2.1	4.2	-38.9	-13.0
8365.62	-46.6	2.3	4.4	-39.9	-13.0
8939.41	-45.4	2.6	4.5	-38.2	-13.0

TDMA Cellular - Channel 799, 848.97 MHz

Freq (Max) (MHz)	(PK) Trace (dBm)	Cable (dB)	Filter (dB)	(PK) EMI (dBm)	FCC Limit (dBm)
1697.66	-35.5	0.8	2.2	-32.5	-13.0
2547.12	-37.6	1.0	3.0	-33.5	-13.0
3396.67	-43.6	1.4	3.3	-38.9	-13.0
4245.38	-48.6	1.6	3.4	-43.6	-13.0
5091.27	-50.2	1.8	3.5	-44.8	-13.0
5940.39	-50.1	2.0	3.8	-44.4	-13.0
6790.63	-46.1	2.0	4.0	-40.1	-13.0
7639.42	-46.2	2.1	4.2	-39.9	-13.0
8492.17	-45.7	2.4	4.4	-38.9	-13.0

TDMA PCS - Channel 2, 1850.04 MHz

Freq (Max) (MHz)	(PK) Trace (dBm)	Cable (dB)	Filter (dB)	(PK) EMI (dBm)	FCC Limit (dBm)
3700.80	-46.94	1.50	3.32	-42.12	-13.0
5549.68	-45.38	1.91	3.68	-39.79	-13.0
7399.45	-46.48	2.07	4.17	-40.24	-13.0
9252.81	-46.72	2.75	4.63	-39.35	-13.0
11103.18	-46.72	3.19	5.24	-38.30	-13.0
12947.54	-47.10	3.25	5.88	-37.97	-13.0
14798.89	-43.86	3.25	6.44	-34.16	-13.0
16651.45	-43.29	3.42	7.36	-32.51	-13.0
18497.68	-45.23	4.01	8.25	-32.96	-13.0

TDMA PCS - Channel 999, 1879.95 MHz

Freq (Max) (MHz)	(PK) Trace (dBm)	Cable (dB)	Filter (dB)	(PK) EMI (dBm)	FCC Limit (dBm)
3759.84	-48.41	1.57	3.33	-43.50	-13.0
5639.51	-45.00	1.93	3.70	-39.37	-13.0
7521.06	-46.37	2.08	4.19	-40.10	-13.0
9399.18	-46.90	2.82	4.66	-39.41	-13.0
11280.36	-46.54	3.20	5.30	-38.04	-13.0
13162.59	-46.07	3.25	5.95	-36.87	-13.0
15041.74	-42.86	3.25	6.52	-33.09	-13.0
16921.80	-44.62	3.49	7.49	-33.64	-13.0
18799.29	-45.13	4.16	8.40	-32.57	-13.0

TDMA PCS - Channel 1998, 1909.92 MHz

Freq (Max) (MHz)	(PK) Trace (dBm)	Cable (dB)	Filter (dB)	(PK) EMI (dBm)	FCC Limit (dBm)
3819.87	-44.17	1.39	3.34	-39.44	-13.0
5731.11	-47.48	1.95	3.73	-41.80	-13.0
7638.49	-45.69	2.08	4.22	-39.38	-13.0
9551.88	-47.17	2.89	4.70	-39.58	-13.0
11459.72	-46.68	3.21	5.37	-38.10	-13.0
13367.67	-42.63	3.25	6.02	-33.36	-13.0
15278.92	-43.48	3.25	6.65	-33.58	-13.0
17186.79	-44.92	3.55	7.62	-33.74	-13.0
19096.86	-43.99	4.31	8.55	-31.12	-13.0

14.4 Measurement Uncertainty

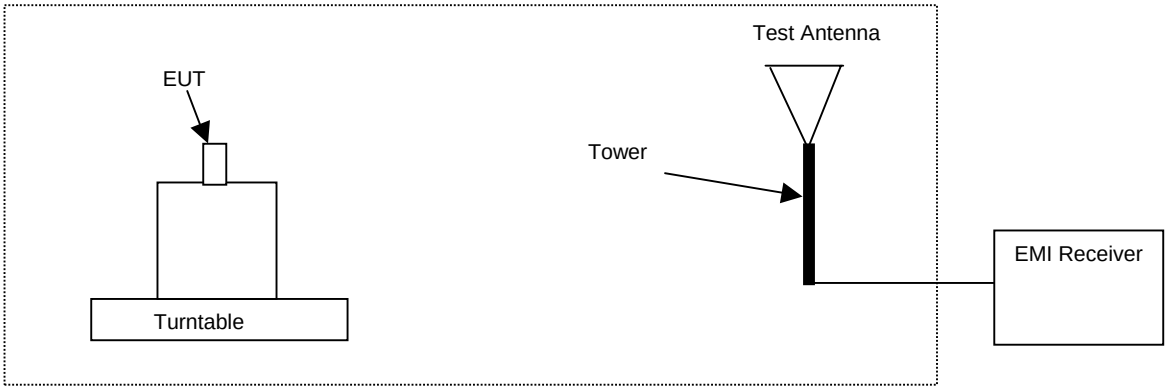
The measurement uncertainty for this test is +/- 3.7dB for 100kHz - 1000MHz and +/- 5.3dB for 1 - 20GHz.

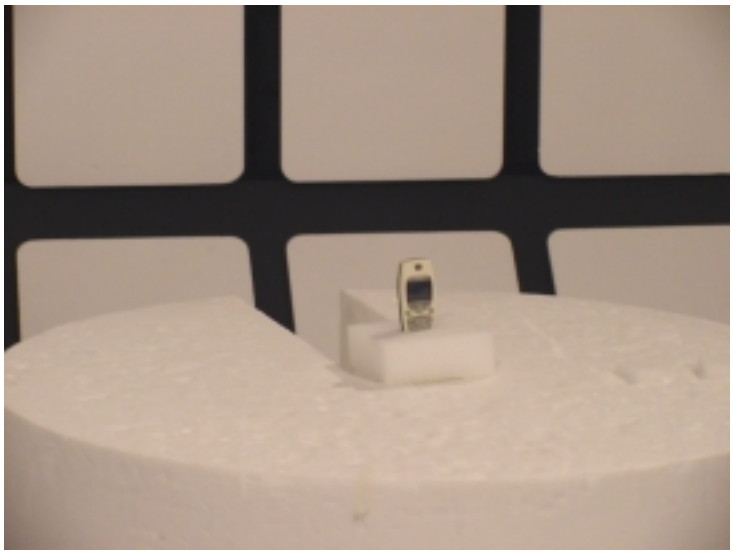
15. FIELD STRENGTH OF SPURIOUS RADIATION

Specification: FCC Part 2.1053

15.1 Setup

Test equipment set-up.





15.2 Pass/Fail Criteria

Band	Frequency Range (MHz)	FCC Limit (dBm)
Cellular / PCS	30 – 20000*	-13

* Frequency to be investigated up to the 10th harmonic of the highest clock or frequency used.

Substitution method according to ANSI/TIA/EIA 603-1 was used for final measurements

15.3 Detailed Test Results

Test Technician / Engineer	Bob Alexander	
Date of Measurement	9-Dec-02	
Temperature / Humidity	24°C	37%RH
Test Result	FCC ID: GMLRH-14 complies with FCC Part 2.1053 when operated at max power.	

Amps Max Power - Channel 384

Tuned Freq (MHz)	Freq Max (MHz)	(PK) EMI (dBm)	dBc	FCC Limit (dBm)	Pol.
836.52	1673.04	-39.81	-64.84	-13	H
836.52	1673.04	-39.47	-64.50	-13	V
836.52	2509.56	-35.39	-60.42	-13	H
836.52	2509.56	-35.16	-60.19	-13	V
836.52	3346.08	-31.73	-56.76	-13	H
836.52	3346.08	-31.17	-56.20	-13	V
836.52	4182.6	-28.55	-53.58	-13	H
836.52	4182.6	-28.41	-53.44	-13	V
836.52	5019.12	-24.48	-49.51	-13	H
836.52	5019.12	-24.62	-49.65	-13	V
836.52	5855.64	-22.51	-47.54	-13	H
836.52	5855.64	-23.41	-48.44	-13	V
836.52	6692.16	-43.14	-68.17	-13	H
836.52	6692.16	-41.43	-66.46	-13	V
836.52	7528.68	-38.88	-63.91	-13	H
836.52	7528.68	-39.56	-64.59	-13	V
836.52	8365.2	-38.22	-63.25	-13	H
836.52	8365.2	-38.37	-63.40	-13	V

TDMA Cellular Band, Max Power - Channel 384

Tuned Freq (MHz)	Freq Max (MHz)	(PK) EMI (dBm)	dBc	FCC Limit (dBm)	Pol.
836.52	1673.04	-38.61	-68.76	-13	H
836.52	1673.04	-39.00	-69.15	-13	V
836.52	2509.56	-33.97	-64.12	-13	H
836.52	2509.56	-32.32	-62.47	-13	V
836.52	3346.08	-31.96	-62.11	-13	H
836.52	3346.08	-29.52	-59.67	-13	V
836.52	4182.6	-27.30	-57.45	-13	H
836.52	4182.6	-27.82	-57.97	-13	V
836.52	5019.12	-25.19	-55.34	-13	H
836.52	5019.12	-24.15	-54.30	-13	V
836.52	5855.64	-22.25	-52.40	-13	H
836.52	5855.64	-22.99	-53.14	-13	V
836.52	6692.16	-41.86	-72.01	-13	H
836.52	6692.16	-42.24	-72.39	-13	V
836.52	7528.68	-38.36	-68.51	-13	H
836.52	7528.68	-40.64	-70.79	-13	V
836.52	8365.2	-38.29	-68.44	-13	H
836.52	8365.2	-37.93	-68.08	-13	V

PCS Band, TDMA1900, Max Power - Channel 999

Tuned Freq (MHz)	Freq Max (MHz)	(PK) EMI (dBm)	dBc	FCC Limit (dBm)	Pol.
1880.00	3760.0	-27.06	-58.04	-13	H
1880.00	3760.0	-28.78	-59.76	-13	V
1880.00	5640.0	-21.36	-52.34	-13	H
1880.00	5640.0	-21.17	-52.15	-13	V
1880.00	7520.0	-37.55	-68.53	-13	H
1880.00	7520.0	-33.97	-64.95	-13	V
1880.00	9400.0	-35.53	-66.51	-13	H
1880.00	9400.0	-36.47	-67.45	-13	V
1880.00	11280.0	-32.83	-63.81	-13	H
1880.00	11280.0	-34.14	-65.12	-13	V
1880.00	13160.0	-29.65	-60.63	-13	H
1880.00	13160.0	-28.52	-59.50	-13	V
1880.00	15040.0	-27.58	-58.56	-13	H
1880.00	15040.0	-27.89	-58.87	-13	V
1880.00	16920.0	-25.86	-56.84	-13	H
1880.00	16920.0	-26.94	-57.92	-13	V

15.4 Measurement Uncertainty

The measurement uncertainty for this test is +/- 2.7dB.

16. FREQUENCY STABILITY (TEMPERATURE VARIATION)

Specification: FCC Part 2.1055(a)(1)(b), 24.235

16.1 Setup

The EUT was connected to the base station simulator to measure the RF power output.

16.2 Pass/Fail Criteria

Not Applicable

16.3 Detailed Test Results

Test Technician / Engineer	Michael Sundstrom	
Date of Measurement	10-11January 2003	
Temperature / Humidity	15-30°C	45-75%RH
Test Result	FCC ID: GMLRH-14 was tested in accordance with 2.1055(a)(1)(b), 24.235	

AMPS MODE,
Channel # 380 (836.4 MHz)

Temp. (°C)	Change (Hz)
-30	298
-20	265
-10	261
0	267
10	318
20	351
30	347
40	351
50	256

TDMA MODE,
Channel # 380 (836.4 MHz)

Temp. (°C)	Change (Hz)
-30	-8.7
-20	-8.5
-10	-3.8
0	-8.2
10	-3.6
20	7.8
30	6.4
40	6.8
50	-7.1

PCS-TDMA MODE,
Channel # 1000 (1879.98 MHz)

Temp. (°C)	Change (Hz)
-30	-23.6
-20	-16.2
-10	-21.1
0	-21.7
10	-11.2
20	13.6
30	-14.2
40	-15.6
50	-22.5

17. FREQUENCY STABILITY (VOLTAGE VARIATION)

Specification: FCC Part 2.1055(d)(1)(2), 24.235

17.1 Setup

The EUT was connected to the base station simulator to measure the RF power output.

17.2 Pass/Fail Criteria

Not Applicable

17.3 Detailed Test Results

Test Technician / Engineer	Michael Sundstrom	
Date of Measurement	11January 2003	
Temperature / Humidity	22°C	48%RH
Test Result	FCC ID: GMLRH-14 was tested in accordance with 2.1055(d)(1)(2), 24.235	

AMPS MODE:
Channel # 380 (836.4 MHz)
Battery End Point (Voltage) = 3.55

% of STV	Voltage	Change (Hz)
100	3.8	250
115	4.4	250
B.E.P.	3.6	290

TDMA MODE:
Channel # 380 (836.4 MHz)
Battery End Point (Voltage) = 3.55

% of STV	Voltage	Change (Hz)
100	3.8	<10
115	4.4	<10
B.E.P.	3.6	<10

PCS-TDMA MODE:
Channel # 1000 (1879.98 MHz)
Battery End Point (Voltage) = 3.55

% of STV	Voltage	Change (Hz)
100	3.8	10
115	4.4	10
B.E.P.	3.6	20

APPENDIX A: SCOPE OF ACCREDITATION FOR A2LA

TCC-Dallas is accredited by the American Association for Laboratory Accreditation (A2LA) as shown in the scope below:

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

NOKIA MOBILE PHONES
Test & Certification Center - Dallas
Irving, TX

for technical competence in the field of

Electrical Testing

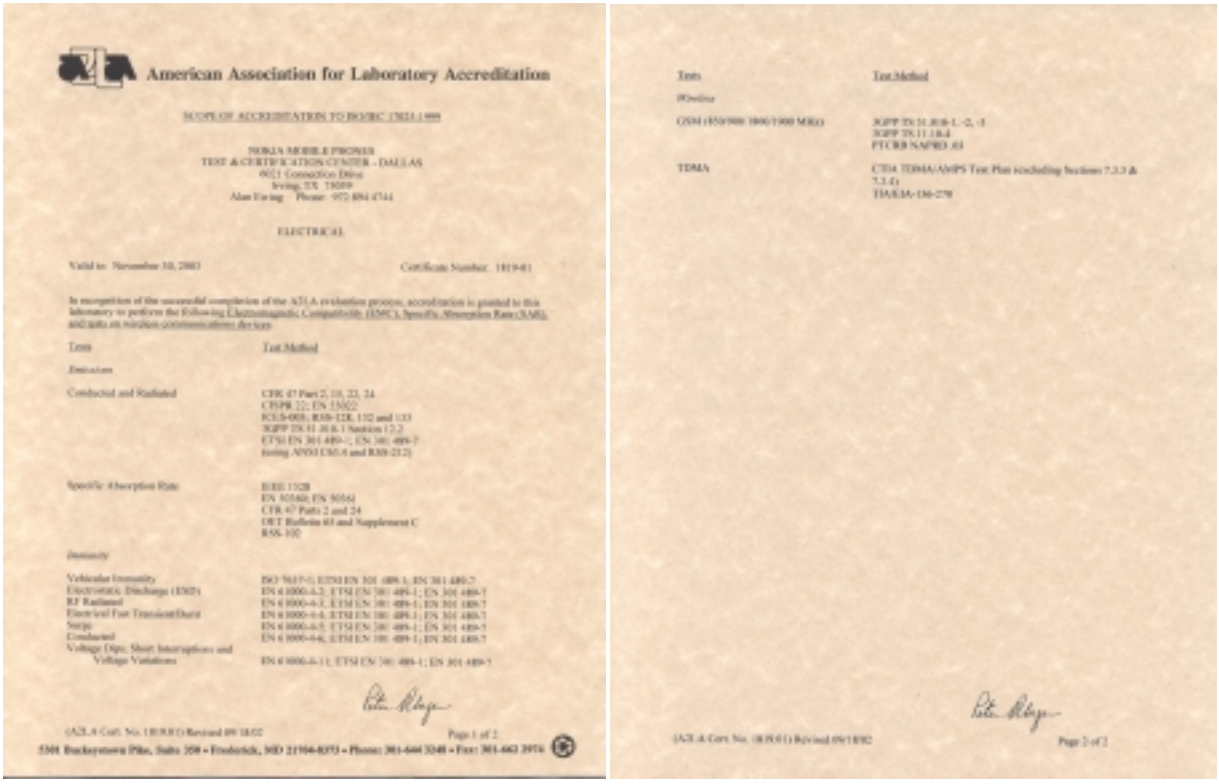
The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002.

Presented this 1st day of October, 2001.

SEAL

President
For the Accreditation Council
Certificate Number 1619.01
Valid to November 30, 2003

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.



American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:1999

NOKIA MOBILE PHONES
TEST & CERTIFICATION CENTER - DALLAS
6021 Connection Drive
Irving, TX 75039
Alan Ewing Phone: 972 894 4744

ELECTRICAL

Valid to: November 30, 2003 Certificate Number: 1819.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following Electromagnetic Compatibility (EMC), Specific Absorption Rate (SAR), and tests on wireless communications devices:

Tests	Test Method
Emissions	
Conducted and Radiated	CFR 47 Part 2, 10, 22, 24 CISPR 22; EN 55022 ICES-003; RSS-128, 132 and 133 3GPP TS 51.010-1 Section 12.2 ETSI EN 301 489-1; EN 301 489-7 Verizon AWSO UM1.4 and RSS-212)
Specific Absorption Rate	IEEE 1528 EN 50360; EN 50361 CFR 47 Parts 2 and 24 OET Bulletin 65 and Supplement C RSS-102
Immunity	
Vehicular Immunity Electrostatic Discharge (ESD) RF Radiated Electrical Fast Transient/Burst Surge Conducted Voltage Dips, Short Interruptions and Voltage Variations	ISO 7637-2; ETSI EN 301 489-1; EN 301 489-7 EN 61000-4-2; ETSI EN 301 489-1; EN 301 489-7 EN 61000-4-3; ETSI EN 301 489-1; EN 301 489-7 EN 61000-4-4; ETSI EN 301 489-1; EN 301 489-7 EN 61000-4-5; ETSI EN 301 489-1; EN 301 489-7 EN 61000-4-6; ETSI EN 301 489-1; EN 301 489-7 EN 61000-4-11; ETSI EN 301 489-1; EN 301 489-7

(A2LA Cert. No. 1819.01) Revised 09/18/02 Page 1 of 2

5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • Fax: 301-662 2974

Tests	Test Method
Wireless	
GSM (850/900/1800/1900 MHz)	3GPP TS 51.010-1, -2, -3 3GPP TS 11.10-4 FTCRB NAPRD .03
TDMA	CTIA TDMA/AMPS Test Plan (excluding Sections 7.3.3 & 7.3.4) TIA/EIA-136-270

(A2LA Cert. No. 1819.01) Revised 09/18/02 Page 2 of 2

"This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this report have been determined to be in accordance with the laboratory's terms of accreditation unless stated otherwise in the report."

Should this report contain any data for tests for which we are not accredited, such data would not be covered by this laboratory's A2LA accreditation.