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2001325 / PO 0070020947
December 24, 2001 thru January 8, 2002
FCC Part 22 Certification &
Industry Canada RSS-128

CERTIFICATE OF COMPLIANCE
FCC PART 22 CERTIFICATION & INDUSTRY CANADA CERTIFICATION

Test Lab:	Applicant Information
Rhein Tech Laboratories, Inc. 360 Herndon Parkway Suite 1400 Herndon, VA 20170 Phone: 703-689-0368 Fax: 703-689-2056 Web Site: www.rheintech.com	Sony Ericsson Mobile Communications (USA, Inc.) 7001 Development Drive P.O. Box 13969 Research Triangle Park, NC 27709 USA Phone: 919-472-1697 (Pierre Chery)

FCC Classification:	☐ TBC – Licensed Broadcast Station Transmitter ☐ TBF – Licensed Broadcast Transmitter Held to Face ☐ TBT – Licensed Broadcast Transmitter Worn on Body ☐ TNB – Licensed Non-Broadcast Station Transmitter ☒ TNE – Licensed Non-Broadcast Transmitter Held to Ear ☐ TNF – Licensed Non-Broadcast Transmitter Held to Face ☐ TNT – Licensed Non-Broadcast Transmitter Worn on Body
FCC Rule Part(s):	Part 22: Public Mobile Services ☐ Subpart E – Paging and Radiotelephone Services ☐ Subpart F – Rural Radiotelephone Services ☐ Subpart G – Air-Ground Radiotelephone Services ☒ Subpart H – Cellular Radiotelephone Services ☐ Subpart I – Offshore Radiotelephone Services
Industry Canada Standard:	☐ RSS-118: Land and Subscriber Stations: Voice, Data and Tone Modulated, Angle Modulation Radiotelephone Transmitters and Receivers Operating in the Cellular Mobile Bands 824-849 MHz and 869-894 MHz ☒ RSS-128: 800 MHz Dual-Mode TDMA Cellular Telephones ☐ RSS-129: 800 MHz Dual Mode CDMA Cellular Telephones

FCC ID:	AXATR-422-A2	**Max. RF Output Power:**	0.404 W
Equipment Type:	TDMA/AMPs	**Frequency Tolerance:**	2.5 ppm
Tx Frequency Range:	824 - 849 MHz	**Emission Designator:**	31K5DXW; 40K0F1D; 40K0F8W
Rx Frequency Range:	869 - 894 MHz	**Date of Test Report:**	March 13, 2002
Model(s):	T60ds		

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to or exclusions from the FCC Part 2, FCC Part 15, FCC Part 22, FCC Part 24, Industry Canada RSS-128, ANSI C63.4, ANSI/TIA/EIA603 and ANSI/TIA/EIA 603-1.

Signature: _____ Date: March 13, 2002

Typed/Printed Name: Bruno Clavier Position: Vice President of Operations

Signature: _____ Date: March 13, 2002

Typed/Printed Name: Daniel W. Baltzell Position: EMC Test Engineer

Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

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1 GENERAL INFORMATION

1.1 SCOPE

FCC Rules Part 22.901: The rules in this subpart govern the licensing and operation of cellular radiotelephone systems.

IC RSS-128: This Radio Standards Specification (RSS) and the TIA/EIA-627 Compatibility Standard referred to in section 3.10 set out the minimum requirements for the certification (type-approval) of transmitters and receivers for the dual-mode (AMPs and digital TDMA) cellular telephone system in the 824-849 MHz and 869-894 MHz paired bands.

All measurements contained in this application were conducted in accordance with the FCC Rules and Regulations CFR47, Industry Canada RSS-128 and ANSI/TIA/EIA603-1992/-1-1998 Land Mobile FM or PM Communications Equipment Measurement and Performance Standards. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

1.2 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

1.3 RELATED SUBMITAL(S)/GRANT(S)

This is an original application for Certification.

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2 EQUIPMENT INFORMATION

2.1 APPLICANT AND EQUIPMENT INFORMATION

Sony Ericsson Mobile Communications (USA, Inc.)
7001 Development Drive
P.O. Box 13969
Research Triangle Park, NC 27709 USA
Phone: 919-472-1697 (Pierre Chery)

FCC Classification:	☐ TBC – Licensed Broadcast Station Transmitter ☐ TBF – Licensed Broadcast Transmitter Held to Face ☐ TBT – Licensed Broadcast Transmitter Worn on Body ☐ TNB – Licensed Non-Broadcast Station Transmitter ☒ TNE – Licensed Non-Broadcast Transmitter Held to Ear ☐ TNF – Licensed Non-Broadcast Transmitter Held to Face
FCC Rule Part(s):	Part 22: Public Mobile Services ☐ Subpart E – Paging and Radiotelephone Services ☐ Subpart F – Rural Radiotelephone Services ☐ Subpart G – Air-Ground Radiotelephone Services ☒ Subpart H – Cellular Radiotelephone Services ☐ Subpart I – Offshore Radiotelephone Services
Industry Canada Standard:	☐ RSS-118: Land and Subscriber Stations: Voice, Data and Tone Modulated, Angle Modulation Radiotelephone Transmitters and Receivers Operating in the Cellular Mobile Bands 824-849 MHz and 869-894 MHz ☒ RSS-128: 800 MHz Dual-Mode TDMA Cellular Telephones ☐ RSS-129: 800 MHz Dual Mode CDMA Cellular Telephones

FCC ID:	AXATR-422-A2	**Max. RF Output Power:**	0.404 W
Equipment Type:	TDMA/AMPs	**Frequency Tolerance:**	2.5 ppm
Tx Frequency Range:	824 - 849 MHz	**Emission Designator:**	31K5DXW; 40K0F1D; 40K0F8W
Rx Frequency Range:	869 - 894 MHz	**Date of Test Report:**	January 8, 2002
Model(s):	T60ds		

2.2 JUSTIFICATION

To complete the test configuration required by the FCC, the receiver was connected to an external antenna, which receives a signal from a signal generator output. With the antenna installed, the receiver indicator was used to determine optional reception. The EUT's Intermediate Frequencies (IF), Local Oscillators (LO), crystal oscillators and harmonics of each were investigated. All modes were investigated and tested including standby mode and receiving mode. The final radiated data was taken with the EUT locked to a set frequency in receive mode for Part 15 data, and as a computer peripheral, and found to be compliant with Part 15 (receiver and digital interface).

The transmitter was tested at a high, mid, and low channel in the following frequency range (824 – 849 MHz). The following frequencies were tested: 824.04, 836.49, 848.97 MHz. Each transmitter frequency was measured independently in 3 orthogonal planes at 360º rotation.

The final radiated data was taken with the EUT locked to a set frequency.

2.3 EXERCISING THE EUT

The T60ds was tested using client based software to set all the parameters required for testing, such as power level, frequency, and receive modes.

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2.4 TEST SYSTEM DETAILS

The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system are:

TABLE 2-1: EQUIPMENT UNDER TEST (EUT)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
MOBILE PHONE	SONY ERICSSON MOBILE COMMUNICATIONS	T60ds	UA2020LW03	AXATR-422-A2	UNSHIELDED	014105
MOBILE PHONE	SONY ERICSSON MOBILE COMMUNICATIONS	T60ds	UA2020LVST	AXATR-422-A2	UNSHIELDED	014013

2.5 CONFIGURATION OF TESTED SYSTEM

PHOTOGRAPH 1: CONFIGURATION OF TESTED SYSTEM (FRONT VIEW)

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PHOTOGRAPH 2: CONFIGURATION OF TESTED SYSTEM (REAR VIEW)

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3 DC VOLTAGES AND CURRENTS - PART §2.1033(C)(8)

The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range.

The DC voltage and total input current of the entire final power amplifier module is 3.8 VDC and 380 mA in the highest level to 100 mA in the lowest power level.

4 RF POWER OUTPUT - §2.1046

4.1 POWER OUTPUT TEST PROCEDURES

4.1.1 ANSI/TIA/EIA-603-1992, SECTION 2.2.1 TEST PROCEDURE

Connect the equipment as illustrated below. Measure the transmitter output power during the defined duty cycle. The EUT was connected to a coaxial attenuator having a 50 Ω load impedance.

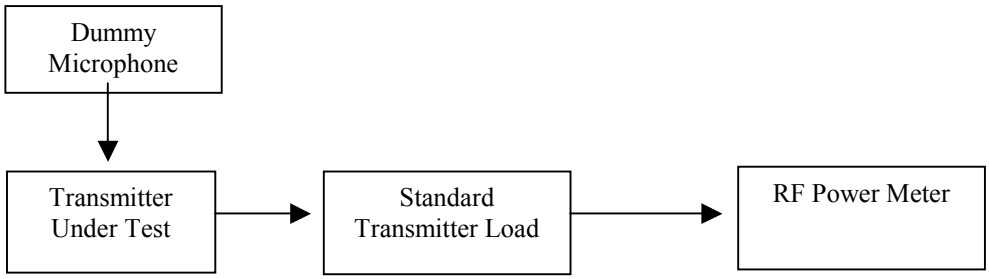

FIGURE 4-1: ILLUSTRATION OF HOW THE EQUIPMENT IS CONNECTED

4.1.2 MEASUREMENTS REQUIRED: RF POWER OUTPUT - §2.1046

Transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, 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 the circuit elements specified in §2.1033(c)(8) of the FCC rules and regulations. The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

In addition, transmitters that are single sideband, independent sideband and controlled carrier radiotelephone the transmitter shall be modulated during the test as follows. In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

4.1.3 EFFECTIVE RADIATED POWER LIMITS - §22.913

Maximum ERP – The ERP of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

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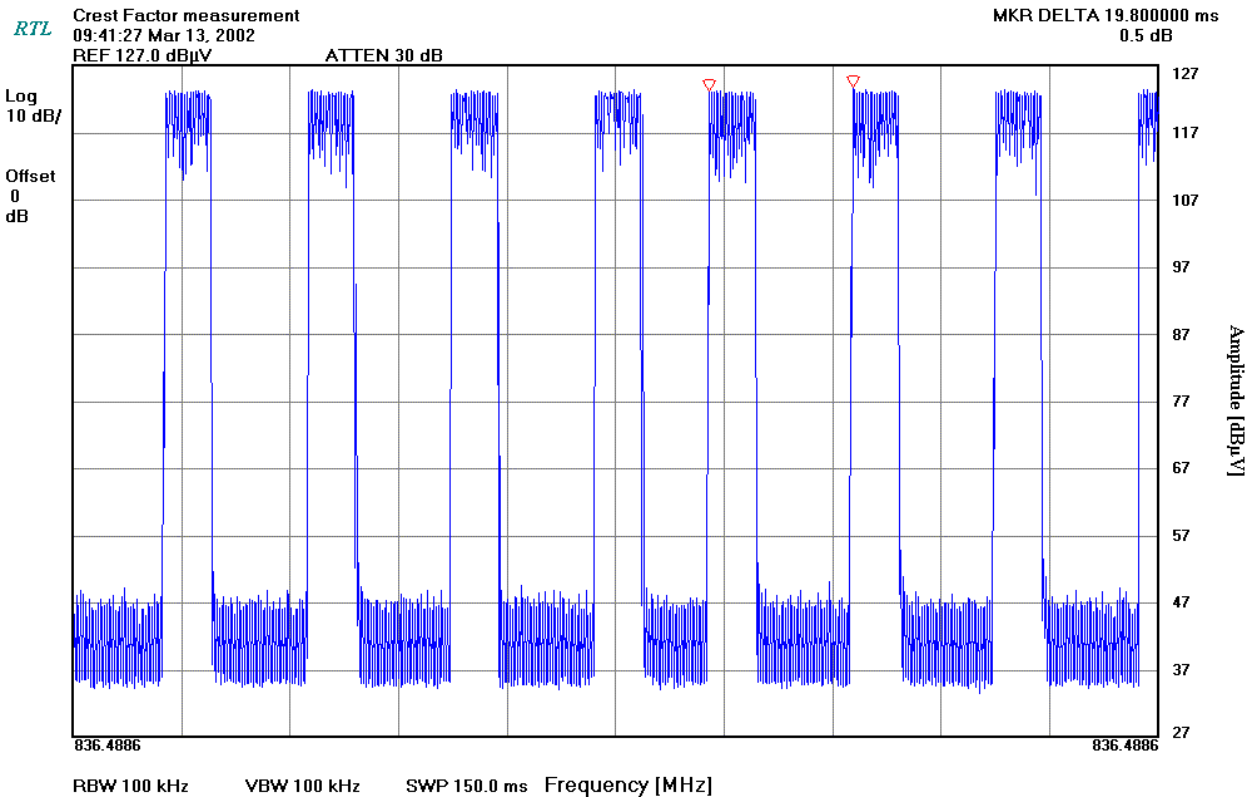
4.2 RF POWER OUTPUT TEST EQUIPMENT

TABLE 4-1: RF POWER OUTPUT TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901053	Schaffner Chase	CBL6112B	Bi-Log Antenna (20 MHz – 2 GHz)	2648	5/22/02
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	7/5/02
901186	Agilent Technologies	E9323A (50MHz-6GHz)	Peak & Avg. Power Sensor	US40410380	6/25/02
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	5/16/02
900917	Hewlett Packard	8648C	Signal Generator (100kHz – 3200 MHz)	3537A01741	4/10/02
900928	Hewlett Packard	83752A	Synthesized Sweeper (0.01 GHz – 20 GHz)	3610A00866	5/11/02

4.3 CREST FACTOR PLOTS



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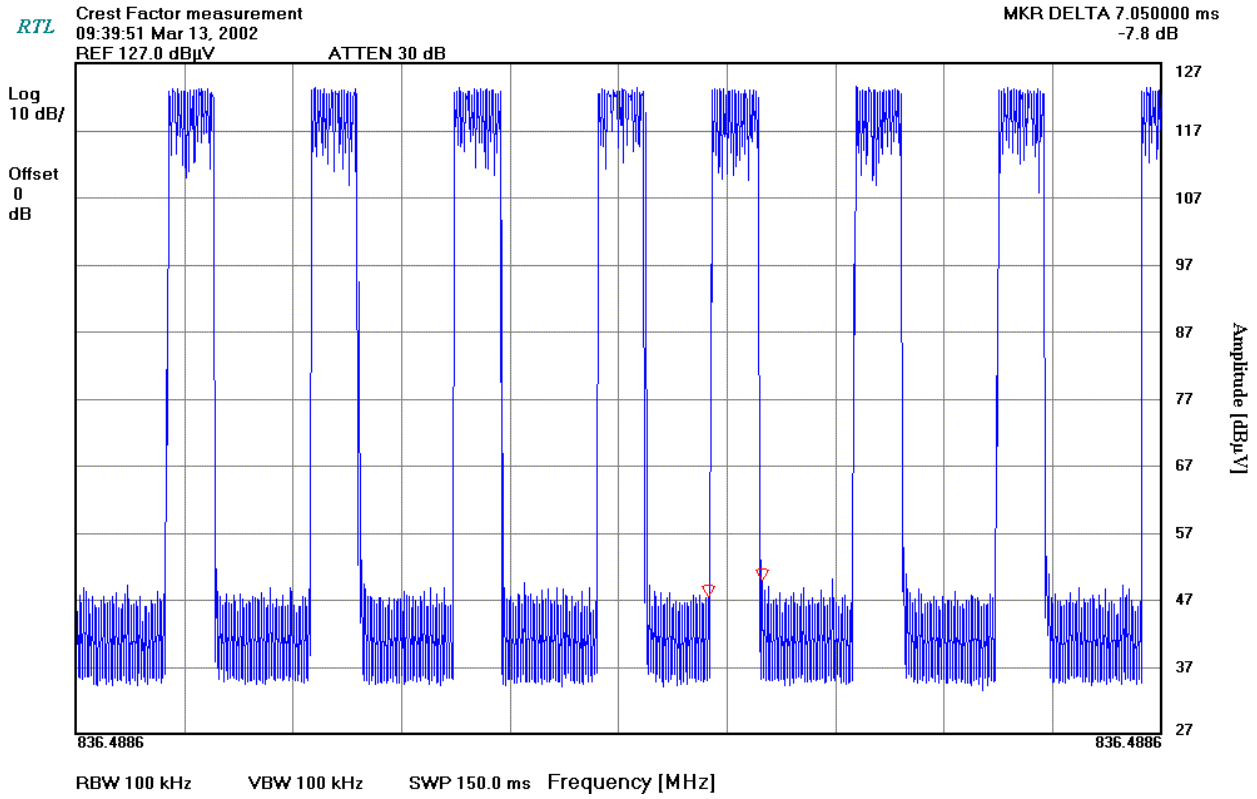

7.05 ms/19.8 ms = 0.36 or 36 % duty cycle
1/.36= 2.8 crest factor
10Log(0.36)= -4.5 dB correction factor

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4.4 POWER OUTPUT TEST DATA- §2.1046

TABLE 4-2: ANTENNA CONDUCTED POWER OUTPUT DATA - §2.1046

(800 MHz TDMA mode)

Channel Number	Frequency Tuned (MHz)	EUT Conducted Power (dBm)	EUT Conducted Power (W)
991	824.04	25.94	0.393
383	836.49	26.06	0.404
799	848.97	25.76	0.375

(800 MHz AMPs mode)

Channel Number	Frequency Tuned (MHz)	EUT Conducted Power (dBm)	EUT Conducted Power (W)
991	824.04	26.00	0.398
383	836.49	25.74	0.375
799	848.97	25.61	0.364

5 PART 2.1046 (A); RF POWER OUTPUT: RADIATED ERP PER PART 22.913

5.1 TEST PROCEDURE

Substitution Method:

The EUT was setup at an antenna to EUT distance of 3 meters on an open area test site. The EUT was placed on a nonconductive turntable 1.0 meter above the ground plane.

The physical arrangement of the EUT was varied through three orthogonal planes in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations.

The worst-case, maximum radiated emission was recorded and used as reference for the measurement.

The EUT was then replaced by a ½ wave dipole antenna and polarized in accordance with the EUT's antenna polarization. The ½ wave dipole antenna was connected to a RF signal generator with a coaxial cable.

The search antenna height, and search antenna polarity was set to levels that produced the maximum reading obtained. The signal generator was adjusted to a level that produced that maximum radiated emission level.

The signal generator level was recorded and corrected by the power loss in the cable between the generator and the antenna and further corrected for the gain of the substitution antenna used relative to an ideal ½ wave dipole antenna. The signal generator corrected level is the ERP level.

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TABLE 5-1: RADIATED POWER OUTPUT DATA - §2.1046

(800 MHz TDMA mode)

Channel Number	Frequency (MHz)	Signal Generator (dBm)	Cable Loss* (dB)	TX Antenna Gain (dBd)	Corrected Signal Generator (dBm)	ERP (mW)
991	824.04	28.0	0.7	-1.3	26.0	398.1
383	836.49	27.8	0.7	-1.2	25.9	398.0
799	848.97	27.3	0.7	-1.2	25.4	346.7

(800 MHz AMPs mode)

Channel Number	Frequency (MHz)	Signal Generator (dBm)	Cable Loss* (dB)	TX Antenna Gain (dBd)	Corrected Signal Generator (dBm)	ERP (mW)
991	824.04	27.9	0.7	-1.3	26.0	398.1
383	836.49	27.5	0.7	-1.2	25.6	363.0
799	848.97	27.4	0.7	-1.2	25.6	363.0

*cable loss from transmitting antenna to signal generator
Measurement accuracy is +/- .5 dB

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6 OCCUPIED BANDWIDTH - §2.1049

6.1 OCCUPIED BANDWIDTH - §2.1049 TEST PROCEDURE

The antenna output terminal of the EUT was connected to the input of a 50W spectrum analyzer through a matched 30dB attenuator. The radio transmitter was operating at maximum output power with and without internal data modulation. 100% of the in-band modulation was below the specified mask per §22.917 (C). Specified Limits:

A. On any frequency removed from the assigned carrier frequency by more than 20kHz, up to and including 45kHz, the sideband was at least 26dB below the carrier.
B. On any frequency removed from the assigned carrier frequency by more than 45kHz, up to and including 90kHz, the sideband was at least 45dB below the carrier.
C. On any frequency removed from the assigned carrier frequency by more than 90kHz, up to the first multiple of the carrier frequency, the sideband was at least 60dB below the carrier of 43 + log10 (mean power output in Watts) dB, whichever was the smaller attenuation.

6.2 OCCUPIED BANDWIDTH TEST EQUIPMENT

TABLE 6-1: OCCUPIED BANDWIDTH TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9kHz – 40 GHz)	3943A01719	6/7/02

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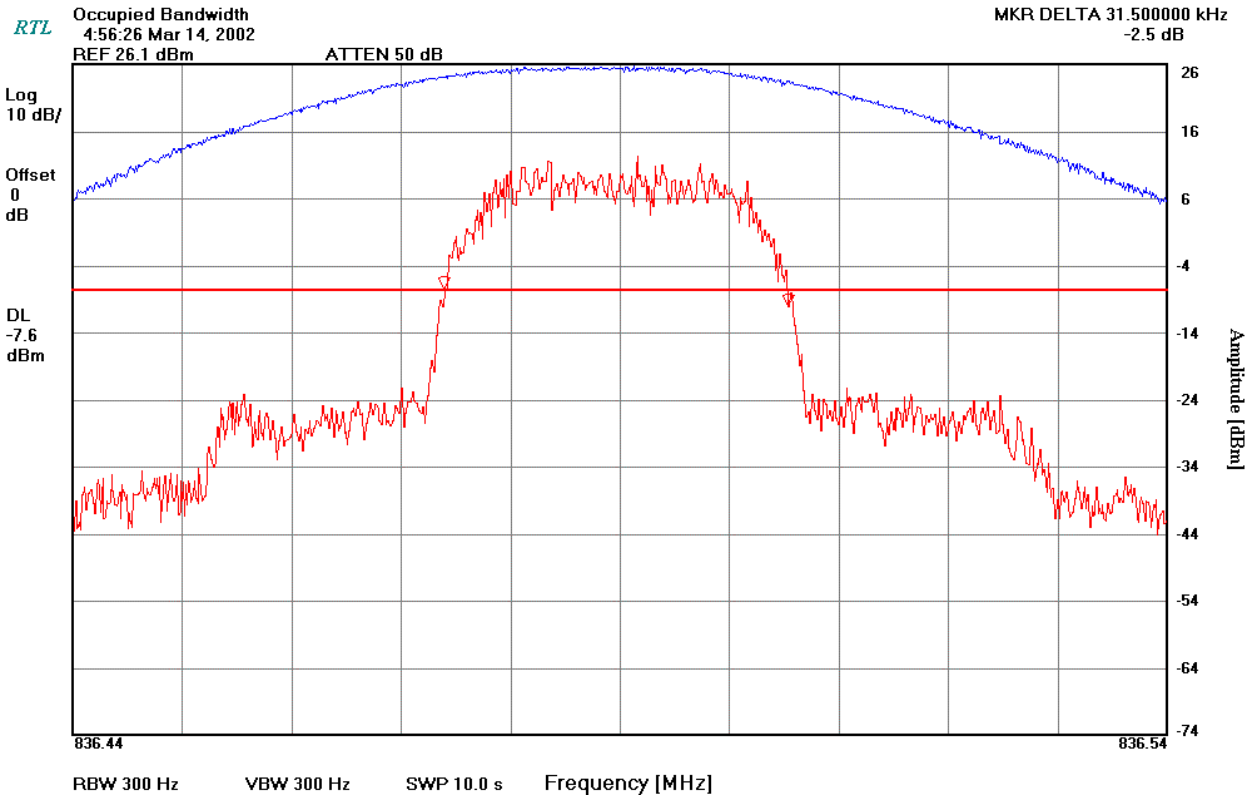
6.3 OCCUPIED BANDWIDTH TEST DATA

TDMA Occupied Bandwidth (31.5 kHz): 836.49 MHz ; 99% bandwidth (-20 dB)



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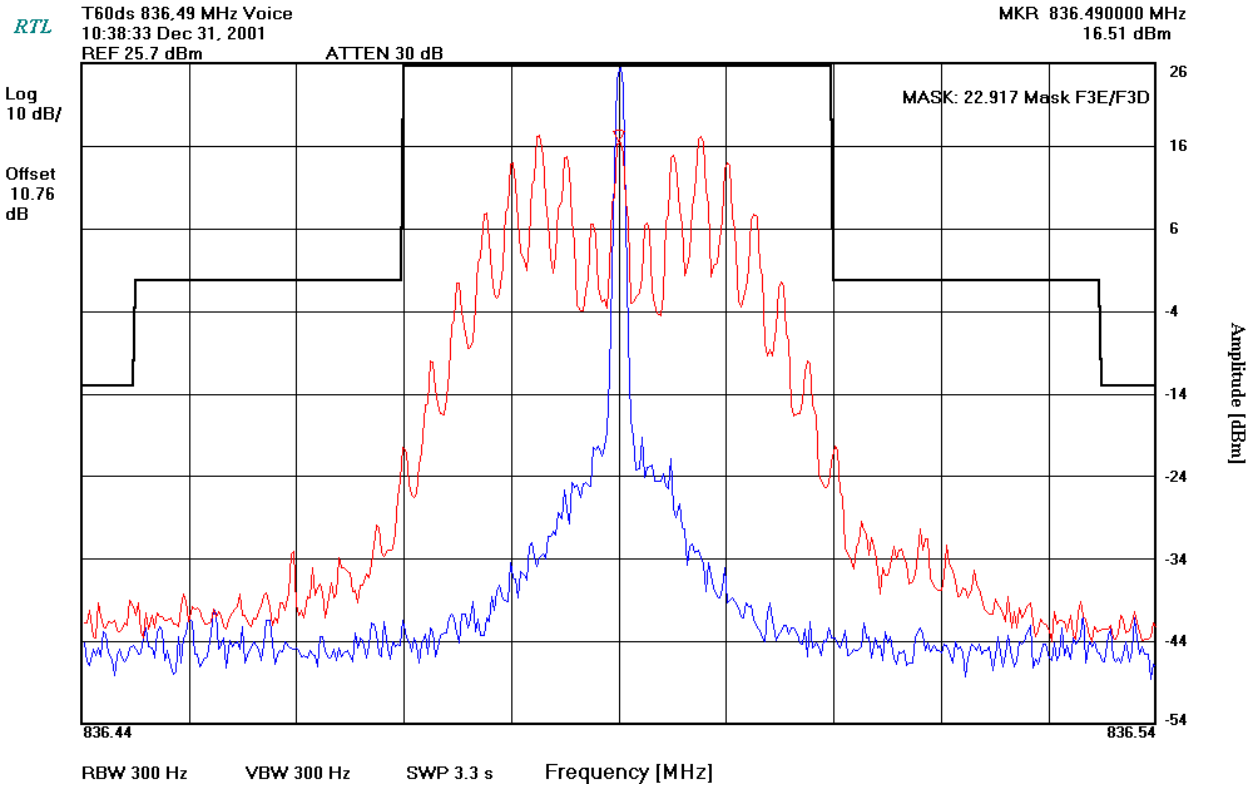
Voice 836.49 MHz; 11.2 kHz deviation measured



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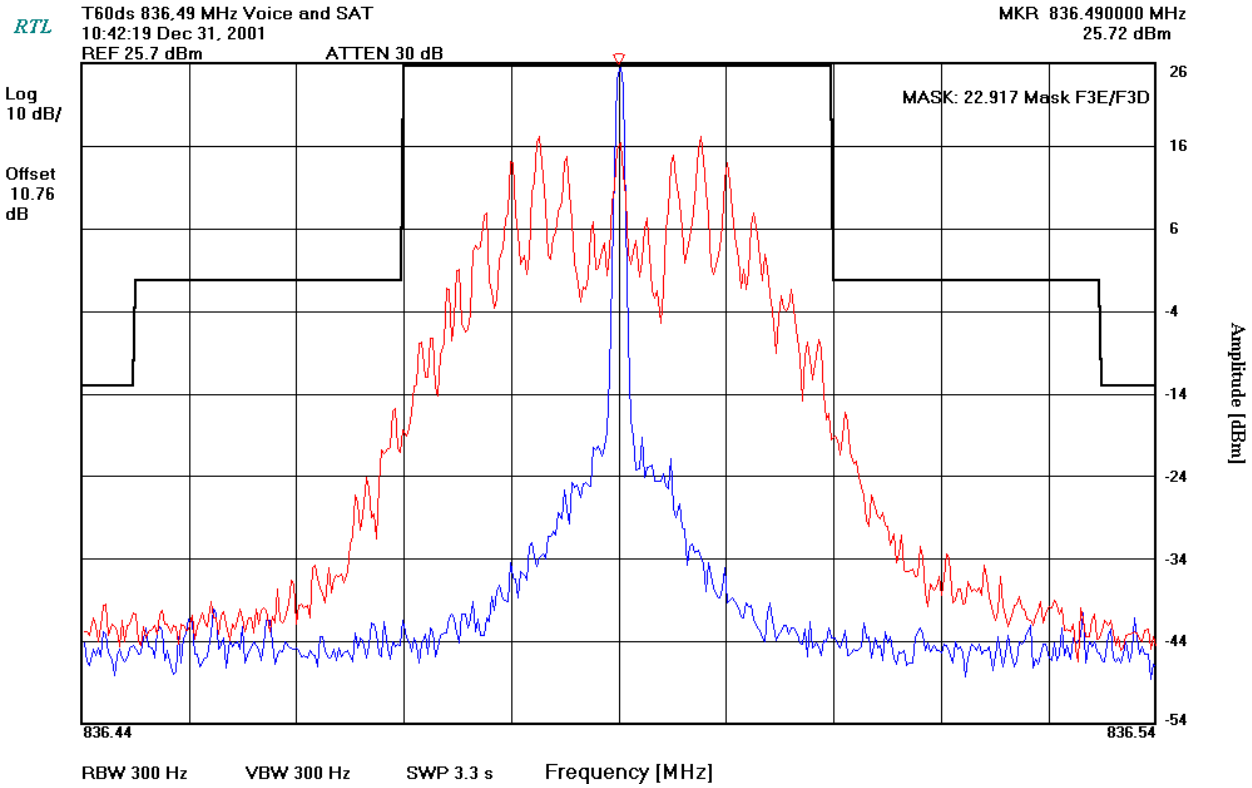
Voice and SAT 846.49 MHz; 13.8 kHz deviation



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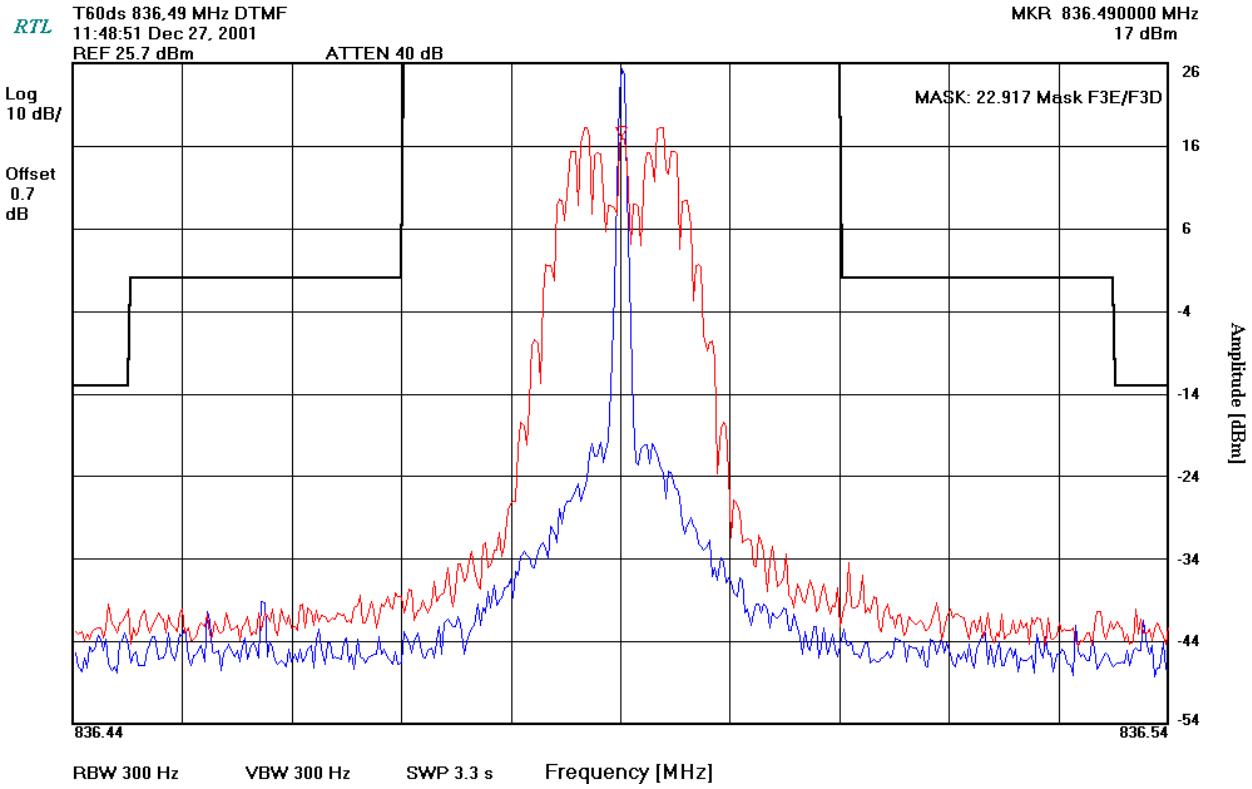
DTMF 836.49 MHz; 6.6 kHz peak deviation; 4.3 kHz rms/radian deviation; 1143 Hz tone



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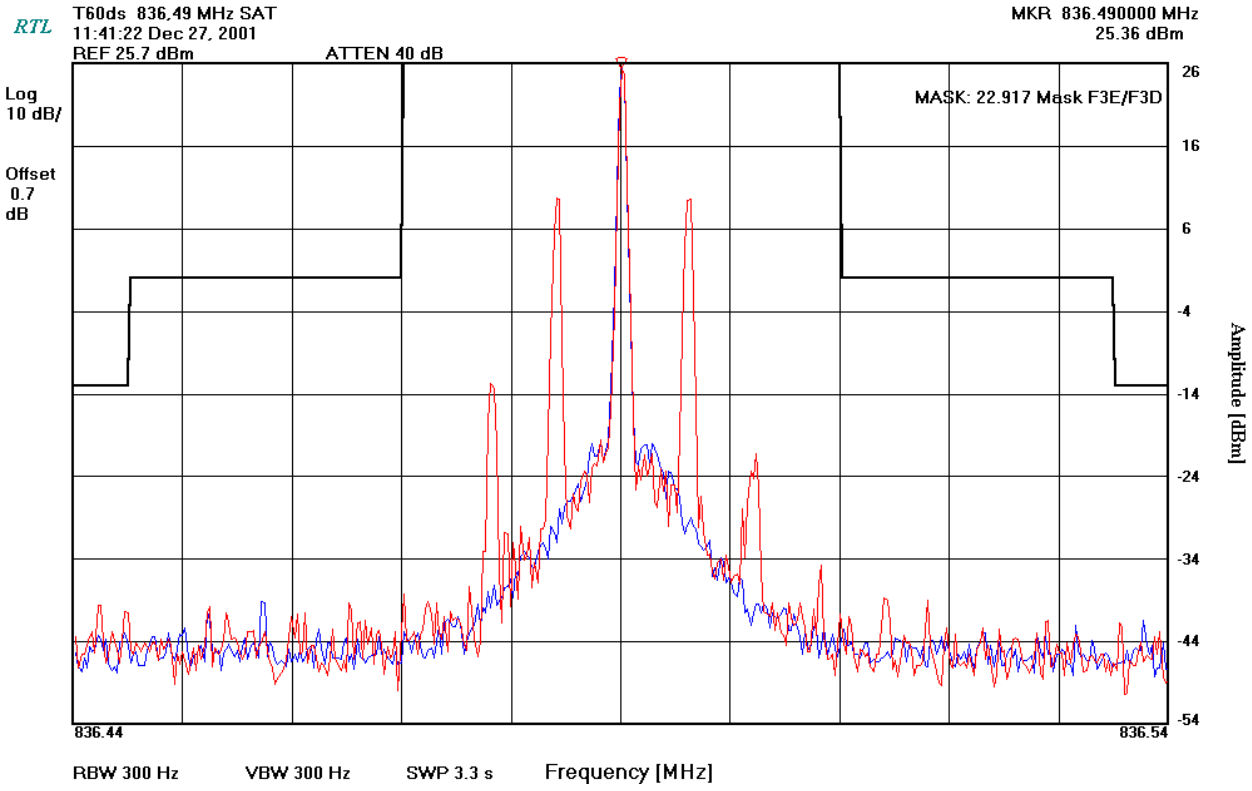
SAT 836.49 MHz; 1.95 kHz deviation measured



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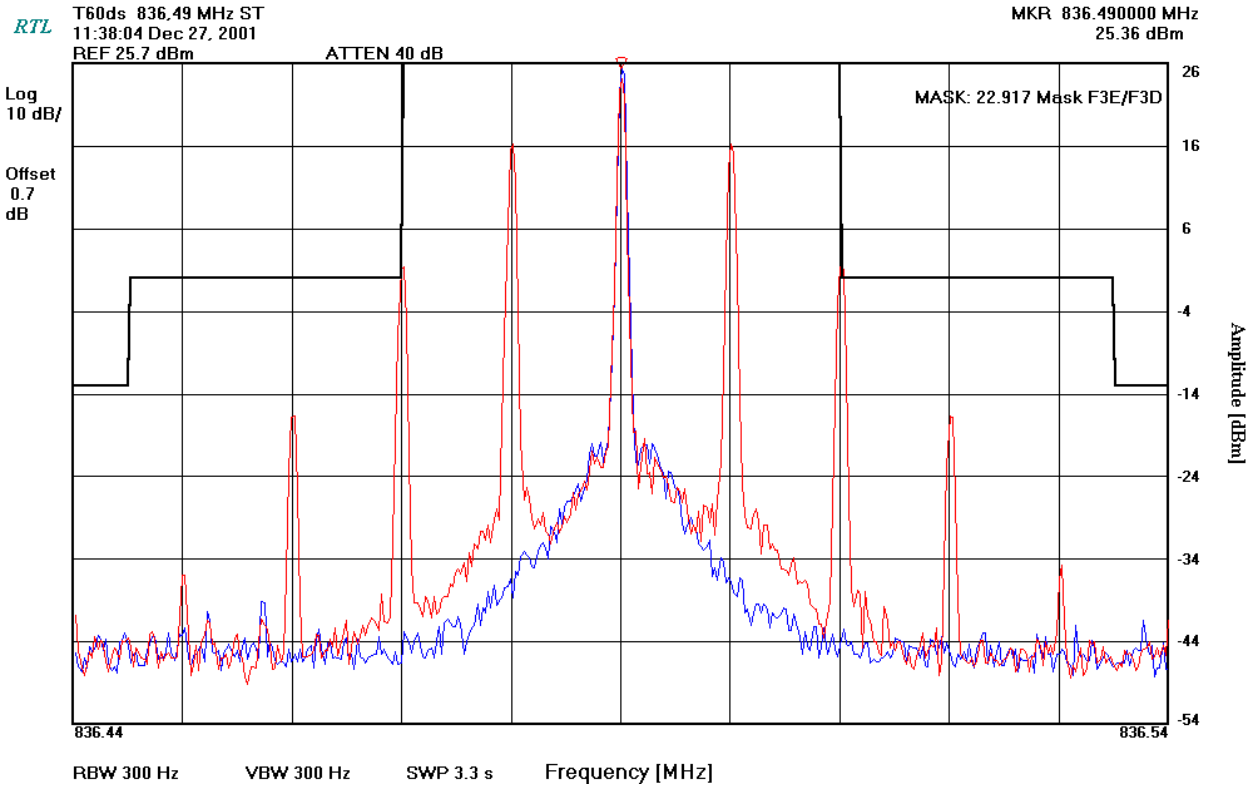
ST 836.49 MHz; 7.59 kHz deviation measured



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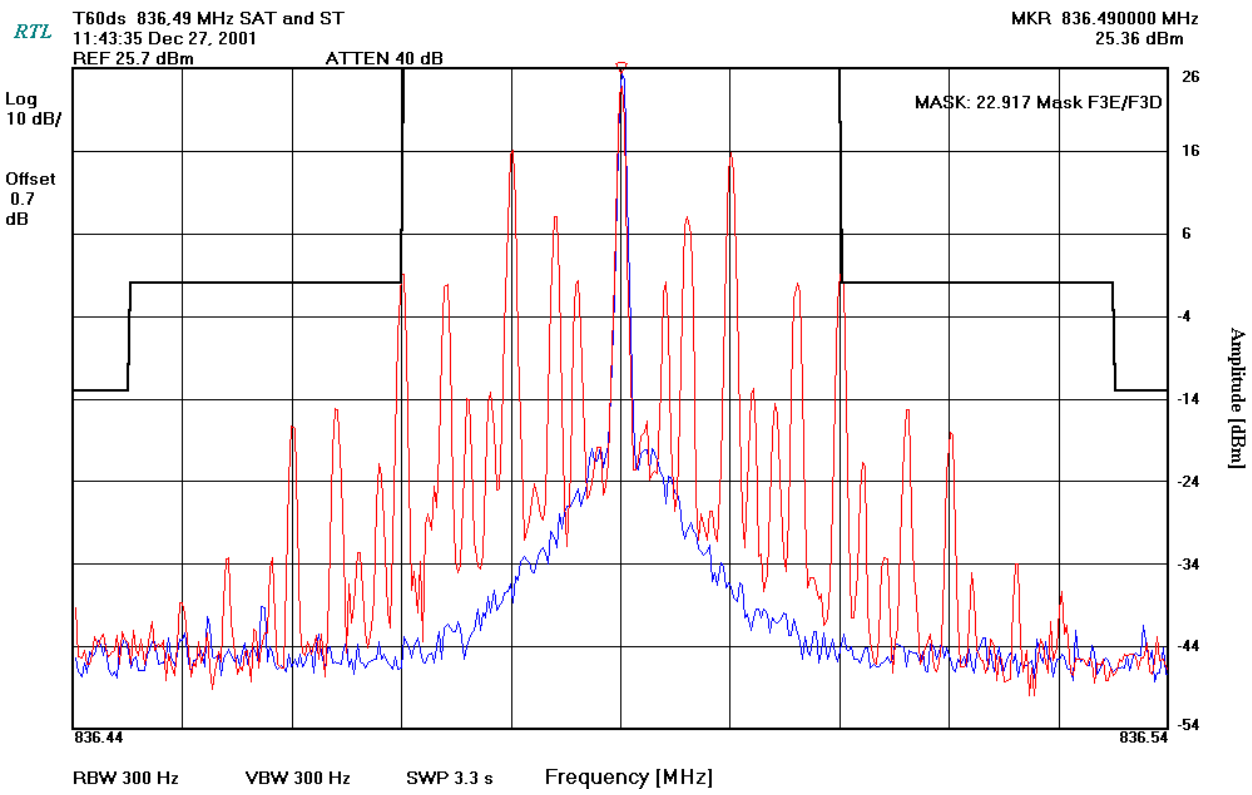
SAT and ST 836.49 MHz



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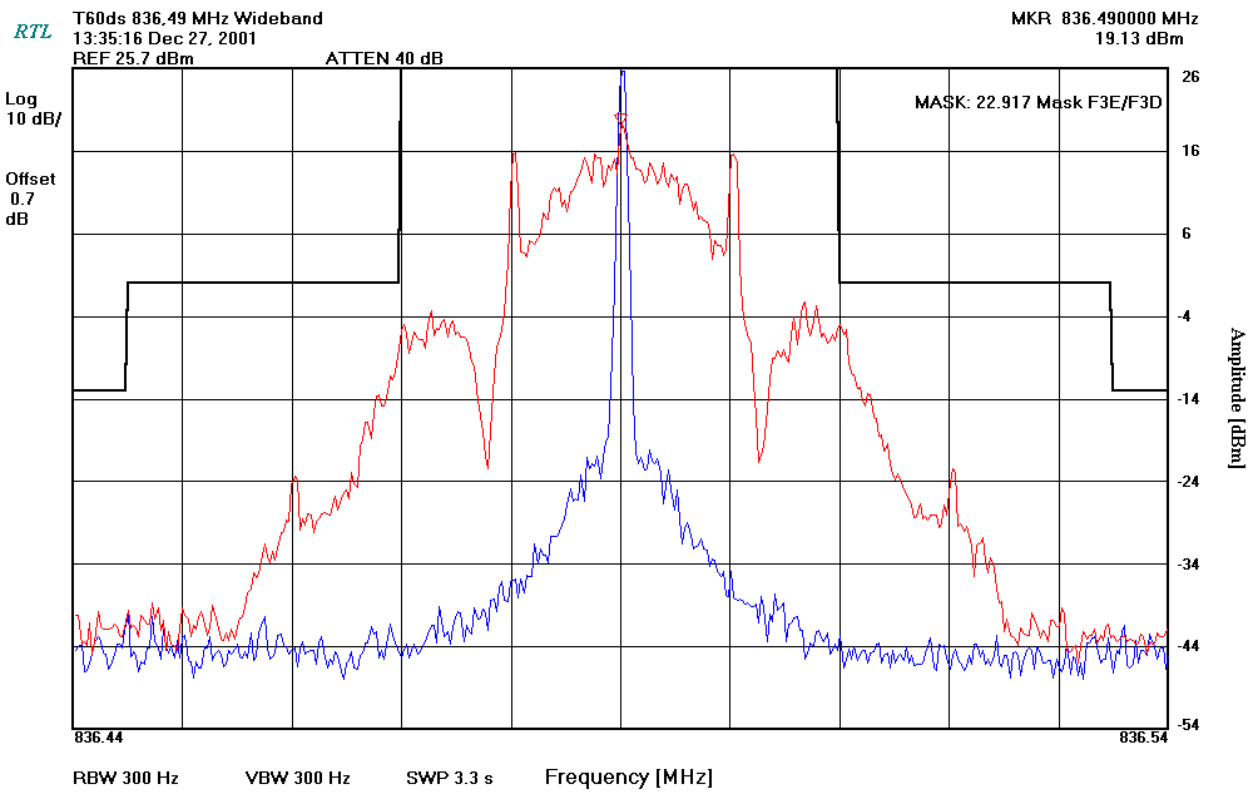
Wideband 836.49 MHz; 8.44 kHz deviation measured



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7 SPURIOUS EMISSIONS AT ANTENNA TERMINAL - §2.1051

7.1 SPURIOUS EMISSIONS TEST PROCEDURES

7.1.1 SPURIOUS EMISSIONS AT ANTENNA TERMINAL - §2.1051

The level of the carrier and the various conducted spurious frequencies was measured by means of a calibrated spectrum analyzer. The antenna output terminal of the EUT was connected to the input of a 50 Ω spectrum analyzer through a matched 30dB attenuator and coaxial cable. The transmitter was operating at maximum power with internal data modulation.

7.1.2 EMISSION LIMITATIONS FOR CELLULAR - §22.917

(d) *F1D emission mask.* For F1D emissions, the mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) as follows:

(1) On any frequency removed from the carrier frequency by more than 20 kHz but not more than 45 kHz: at least 26 dB;

(2) On any frequency removed from the carrier frequency by more than 45 kHz, up to the first multiple of the carrier frequency: at least 60 dB or 43 + 10 log P dB, whichever is the lesser attenuation.

7.1.3 MEASUREMENT PROCEDURE

The following spectrum analyzer bandwidth settings should be used for measurement of spurious emissions. When operating in the radiotelephony mode or the supervisory audio tone mode: (1) Any emission not more than 45 kHz removed from the carrier frequency, 300 Hz. (2) Any emission more than 45 kHz removed from the carrier frequency, 30 kHz. When operating in the wideband data mode or the signaling tone mode: (1) Any emission not more than 60 kHz removed from the carrier frequency, 300 Hz. (2) Any emission more than 60 kHz removed from the carrier frequency, 30 kHz.

7.2 SPURIOUS EMISSIONS AT ANTENNA TERMINAL TEST EQUIPMENT

TABLE 7-1: SPURIOUS EMISSIONS AT ANTENNA TERMINAL TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	6/7/02
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	7/13/02
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159	12/5/02
901137	PAR Electronics	N/A	Notch Filter	N/A	N/A

\

7.3 SPURIOUS EMISSIONS TEST DATA

Cellular AMPs
824.04 MHz
Channel 991
Conducted power = 26.00 dBm
Limit = 39.0 dBc

Frequency (MHz)	Level Measured (dBm)	Notch Insertion Loss (dB)	Corrected Level (dBc)	Margin (dB)
1648.080	-43.4	-0.78	68.57	-29.57
2472.120	-44.6	-5.16	65.44	-26.44
3296.160	-50.6	-0.14	76.47	-37.47
4120.200	-70.3	-0.23	96.11	-57.11
4944.240	-59.3	-0.41	84.92	-45.92
5768.280	-62.3	-4.54	83.73	-44.73
6592.320	-61.8	-1.99	85.8	-46.8
7416.360	-64.2	-0.83	89.35	-50.35
8240.400	-76.8	-0.81	101.99	-62.99

Cellular AMPs
836.490 MHz
Channel 383
Conducted power = 25.74 dBm
Limit = 38.74 dBc

Frequency (MHz)	Level Measured (dBm)	Notch Insertion Loss (dB)	Corrected Level (dBc)	Margin (dB)
1672.980	-45.5	-1.0	70.2	-31.5
2509.470	-47.9	-4.7	69.0	-30.3
3345.960	-43.4	-0.4	68.8	-30.1
4182.450	-80.0	-0.9	104.9	-66.1
5018.940	-59.0	0.0	84.8	-46.0
5855.430	-66.0	-3.3	88.5	-49.8
6691.920	-68.3	-9.7	84.4	-45.6
7528.410	-64.3	-1.3	88.7	-50.0

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8364.900	-72.9	-2.3	96.3	-57.6

Cellular AMPs
848.97 MHz
Channel 799
Conducted power = 25.61 dBm
Limit = 38.61 dBc

Frequency (MHz)	Level Measured (dBm)	Notch Insertion Loss (dB)	Corrected Level (dBc)	Margin (dB)
1697.940	-42.2	-1.0	66.8	-28.2
2546.910	-50.3	-4.9	71.0	-32.4
3395.880	-44.0	-0.1	69.6	-31.0
4244.850	-68.4	-1.4	92.6	-54.0
5093.820	-52.1	0.0	77.7	-39.1
5942.790	-52.5	-3.7	74.4	-35.8
6791.760	-68.2	-15.0	78.8	-40.2
7640.730	-63.3	-0.5	88.4	-49.8
8489.700	-80.1	-3.3	102.4	-63.8

Cellular TDMA
824.04 MHz
Channel 991
Conducted power = 25.94 dBm
Limit = 38.94 dBc

Frequency (MHz)	Level Measured (dBm)	Notch Insertion Loss (dB)	Corrected Level (dBc)	Margin (dB)
1648.080	-76.2	-5.2	97.0	-58.1
2472.120	-81.9	-0.1	107.7	-68.8
3296.160	-83.6	-0.2	109.3	-70.4
4120.200	-88.0	-0.4	113.6	-74.6
4944.240	-87.7	-4.5	109.1	-70.1
5768.280	-84.8	-2.0	108.7	-69.8
6592.320	-82.9	-0.8	108.0	-69.1
7416.360	-84.3	-0.8	109.4	-70.5
8240.400	-76.2	-5.2	97.0	-58.1

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Cellular TDMA
836.490 MHz
Channel 383
Conducted power = 26.06 dBm
Limit = 39.06 dBc

Frequency (MHz)	Level Measured (dBm)	Notch Insertion Loss (dB)	Corrected Level (dBc)	Margin (dB)
1672.980	-76.9	-1.0	102.0	-62.9
2509.470	-78.9	-4.7	100.3	-61.2
3345.960	-79.7	-0.4	105.4	-66.3
4182.450	-83.8	-0.9	108.9	-69.8
5018.940	-89.0	0.0	115.1	-76.0
5855.430	-86.3	-3.3	109.1	-70.0
6691.920	-87.9	-9.7	104.3	-65.2
7528.410	-81.6	-1.3	106.3	-67.3
8364.900	-84.7	-2.3	108.5	-69.4

Cellular TDMA
848.970 MHz
Channel 799
Conducted power = 25.76 dBm
Limit = 38.76 dBc

Frequency (MHz)	Level Measured (dBm)	Notch Insertion Loss (dB)	Corrected Level (dBc)	Margin (dB)
1697.940	-70.8	-1.0	95.5	-56.8
2546.910	-74.1	-4.9	94.9	-56.2
3395.880	-81.6	-0.1	107.3	-68.5
4244.850	-79.3	-1.4	103.7	-64.9
5093.820	-96.0	0.0	121.8	-83.0
5942.790	-90.0	-3.7	112.0	-73.3
6791.760	-91.2	-15.0	102.0	-63.2
7640.730	-84.6	-0.5	109.8	-71.0
8489.700	-87.6	-3.3	110.0	-71.2

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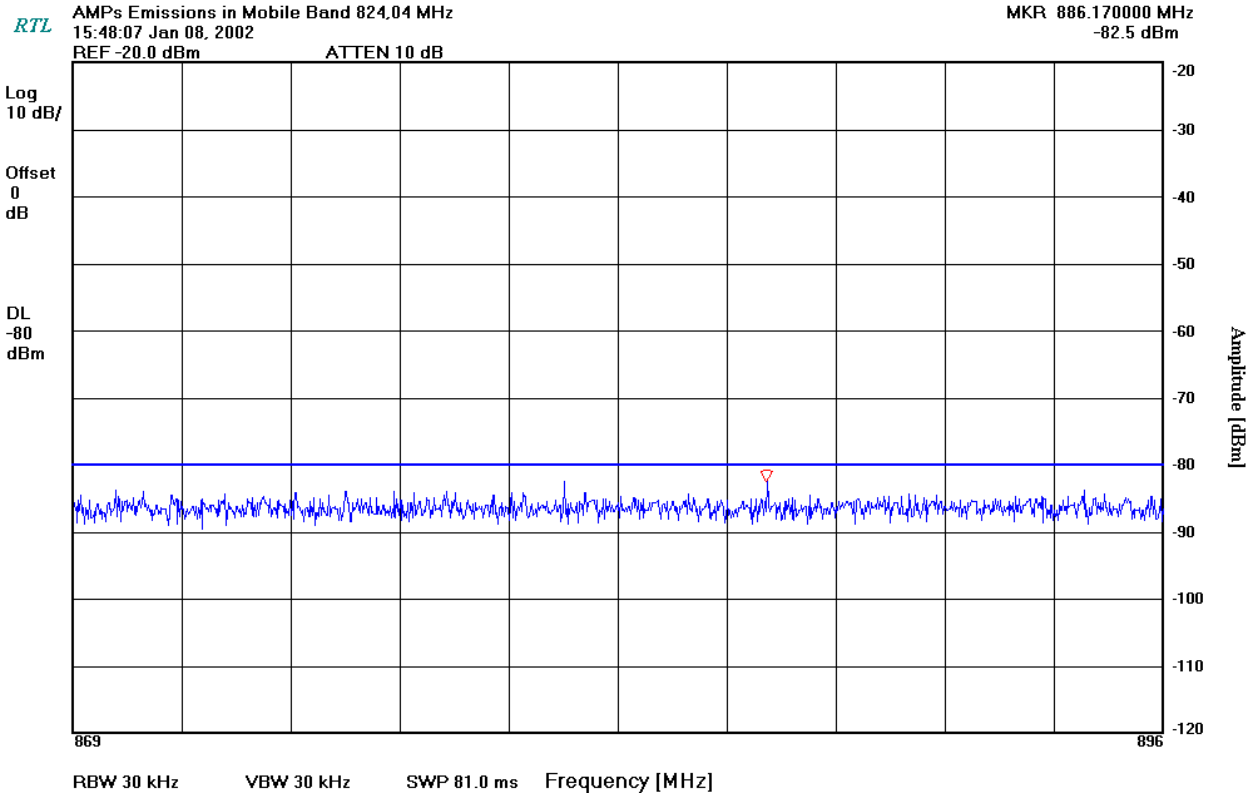
7.4 FCC PART 22.917 (F) MOBILE EMISSIONS IN BASE FREQUENCY RANGE

*Mobile emissions in base frequency rang*e. The mean power of any emissions appearing in the base station frequency range from cellular mobile transmitters operated must be attenuated to a level not to exceed 80 dBm at the transmit antenna connector.

AMPS 824.04 MHz



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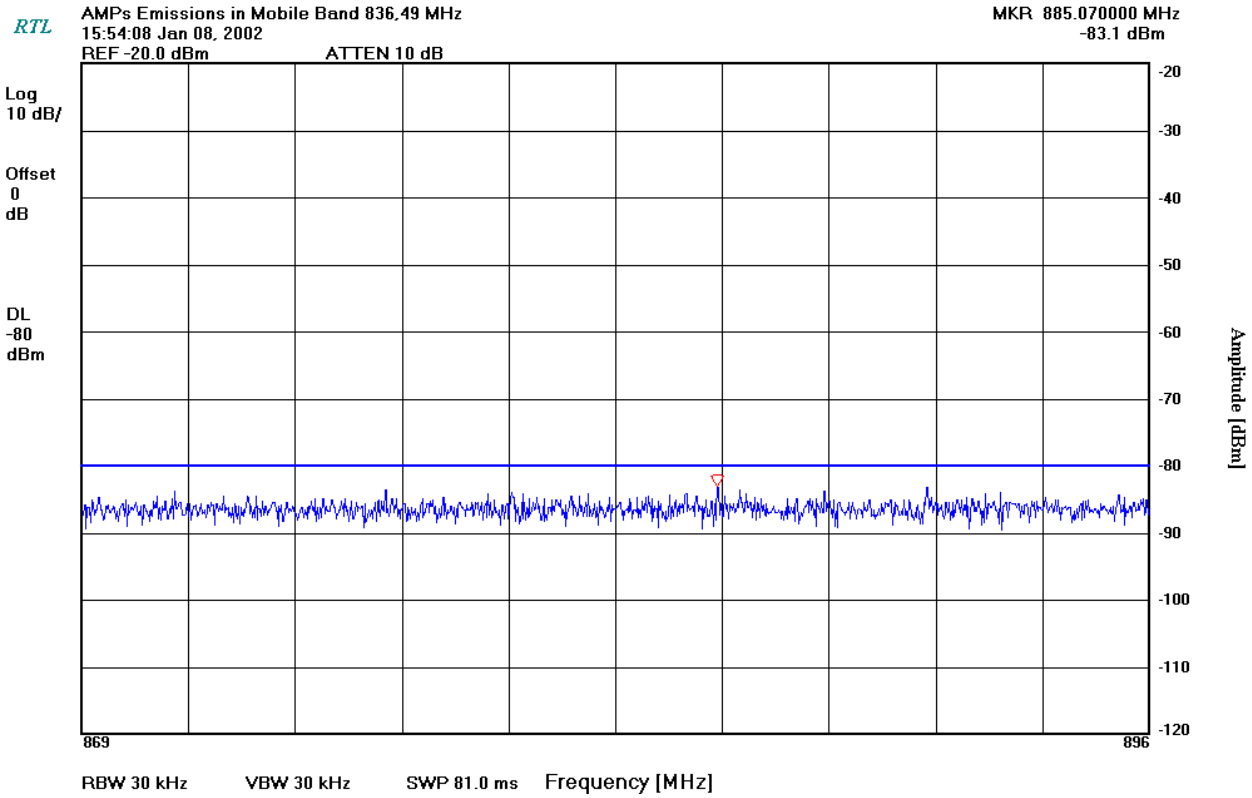
AMPS 836.49 MHz



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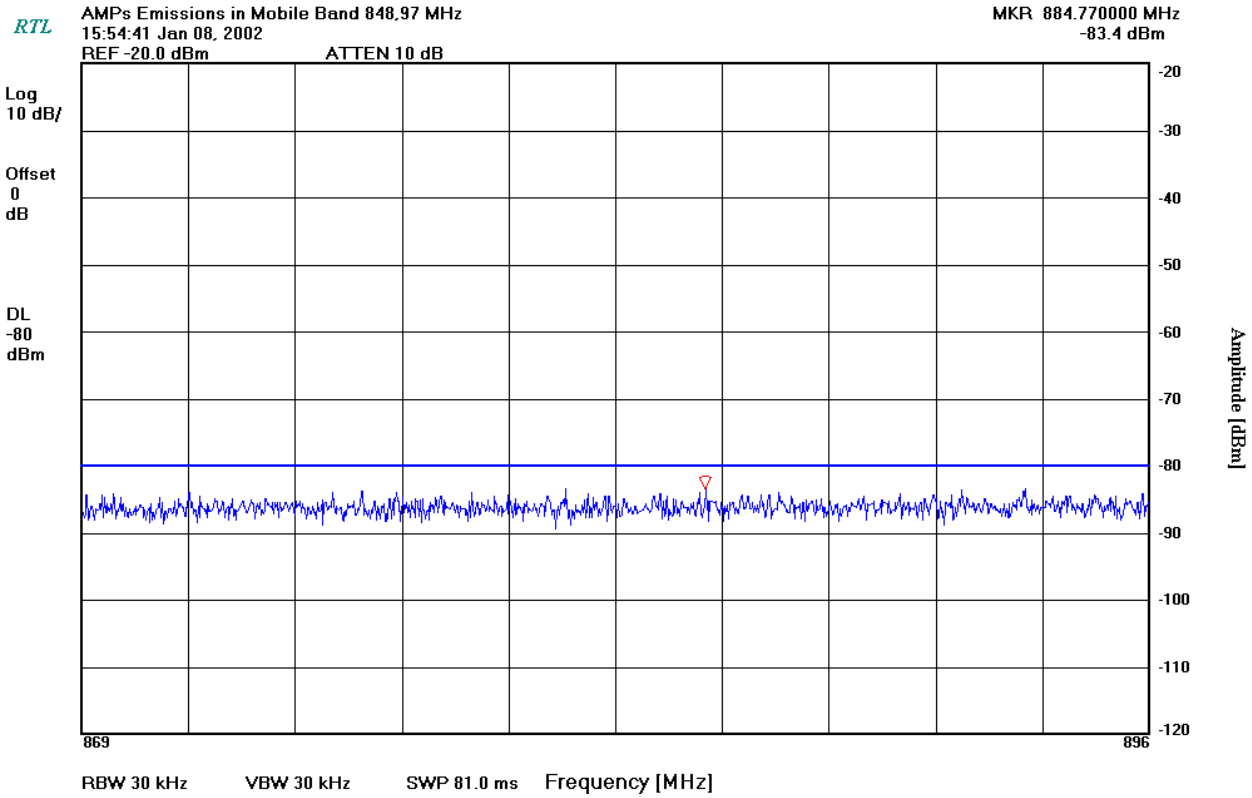
AMPS 848.97 MHz



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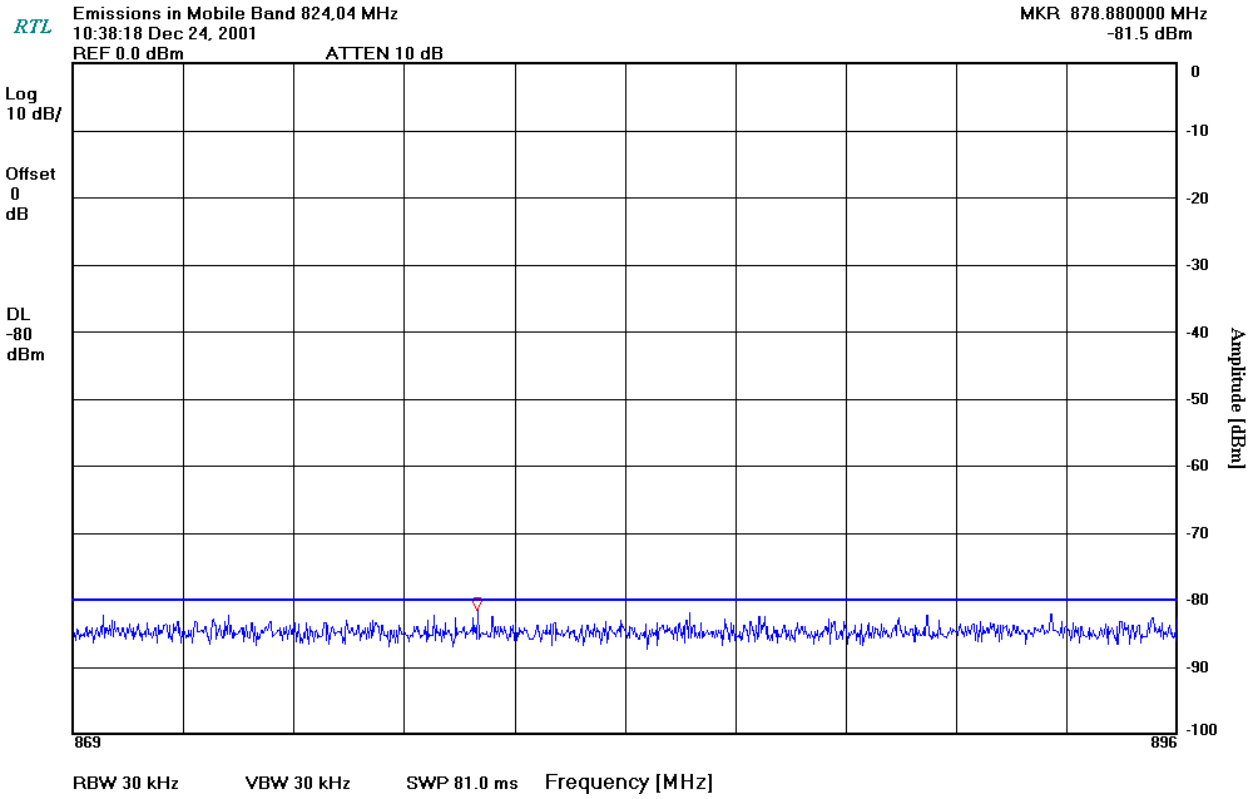
TDMA 824.04 MHz



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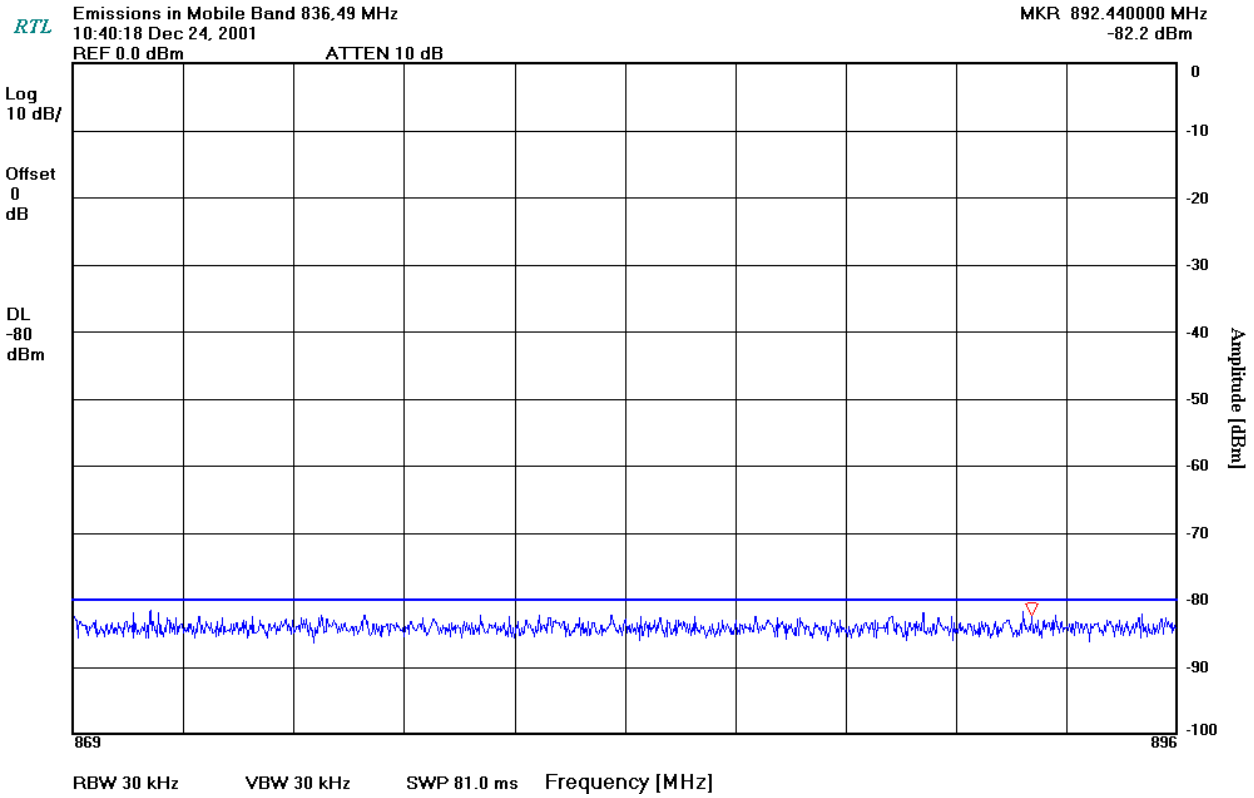
TDMA 836.49 MHz



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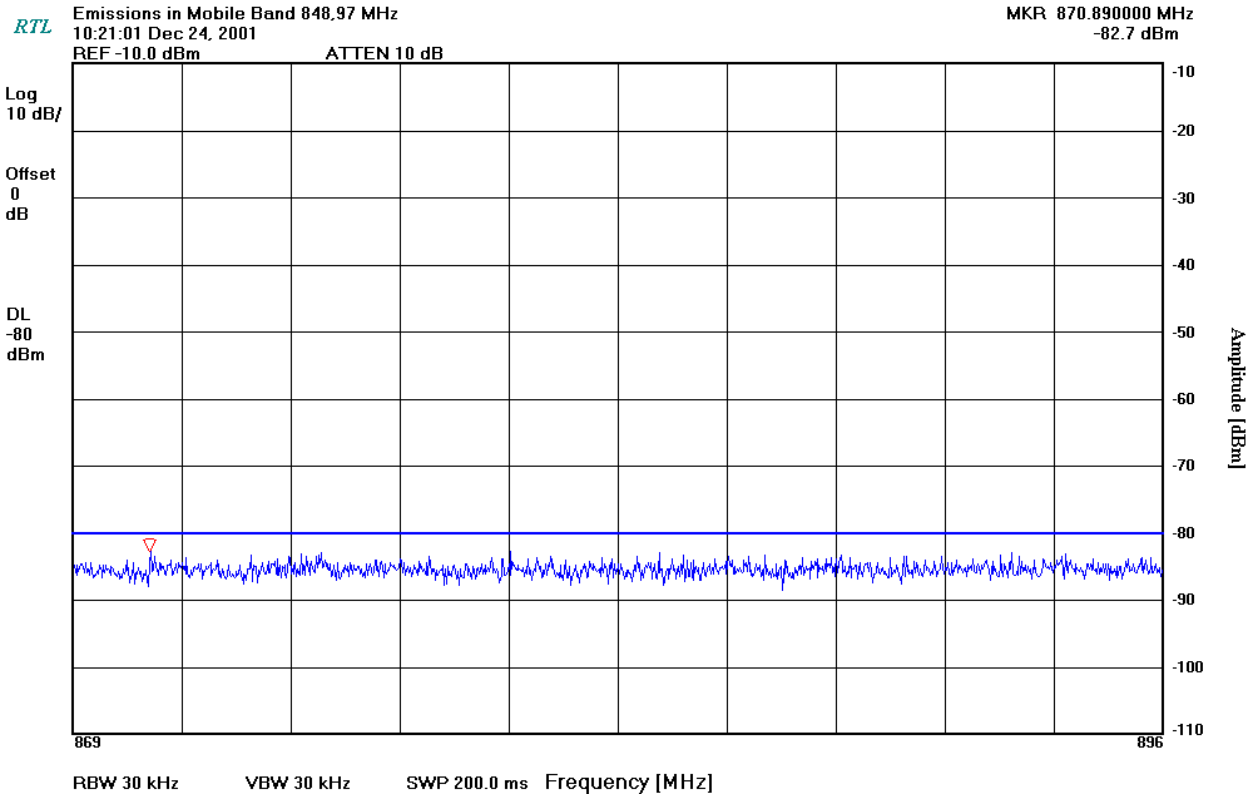
TDMA 848.97 MHz



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8 RADIATED SPURIOUS AND HARMONIC EMISSIONS - §2.1053

8.1 RADIATED SPURIOUS AND HARMONIC EMISSIONS - §2.1053

The EUT was placed on a turntable 3-meters from the receive antenna transmitting into a non-radiating load. The field of maximum intensity was found by rotating the EUT approximately 360 degrees and changing the height of the receive antenna from 1 to 4 meters in three orthogonal planes. The field strength was recorded from a calibrated spectrum analyzer for each channel being tested. A horn antenna was substituted in place of the EUT. The horn was fed from a signal generator, and the level was adjusted to the same field strength level as the EUT. The conducted power from the signal generator was recorded. The final ERP level was determined by subtracting the cable loss and adding the dipole gain in dBd.

8.2 RADIATED SPURIOUS TEST EQUIPMENT

TABLE 8-1: RADIATED SPURIOUS TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901053	Schaffner Chase	CBL6112B	Bi-Log Antenna (20 MHz – 2 GHz)	2648	5/22/02
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	7/5/02
901186	Agilent Technologies	E9323A (50MHz-6GHz)	Peak & Avg. Power Sensor	US40410380	6/25/02
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	5/16/02
900917	Hewlett Packard	8648C	Signal Generator (100kHz – 3200 MHz)	3537A01741	4/10/02
900928	Hewlett Packard	83752A	Syntesized Sweeper (0.01 GHz – 20 GHz)	3610A00866	5/11/02

8.3 FIELD STRENGTH OF SPURIOUS RADIATION TEST DATA - §2.1053

TABLE 8-2: FIELD STRENGTH DATA §2.1053 (AMPS 824.04 MHZ)

Operating Frequency (MHz): 824.04
Channel: 991
Measured Cond. Pwr. (dBm): 26.0
Measured ERP (dBm): 26.0
Modulation: AMPs
Distance: 3
Limit: 39.0 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Horn Antenna Gain (dBd)	POL (H/V)	ERP (dBc)	Margin (dB)
1648.080	38.9	-30.7	0.9	4.7	H	52.9	-13.9
2472.120	26.3	-57.3	1.4	5.1	H	79.6	-40.6
3296.160	23.9	-53.9	1.5	6.1	H	75.3	-36.3
4120.200	15.1	-59.4	0.8	6.1	H	80.1	-41.1
4944.240	10.2	-64.6	1.3	7.0	H	84.9	-45.9
5768.280	14.0	-45.2	3.0	6.6	H	67.6	-28.6
6592.320	13.5	-52.2	3.4	7.8	H	73.8	-34.8

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7416.360	<10						
8240.400	<10						

TABLE 8-3: FIELD STRENGTH DATA §2.1053 (AMPS 836.49 MHZ)

Operating Frequency (MHz): 836.49
Channel: 383
Measured Cond. Pwr. (dBm): 25.74
Measured ERP (dBm): 25.6
Modulation: AMPs
Distance: 3
Limit: 38.6 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Horn Antenna Gain (dBd)	POL (H/V)	ERP (dBc)	Margin (dB)
1672.980	32.6	-37.3	0.9	4.7	H	59.1	-20.5
2509.470	27.6	-54.1	1.6	5.2	H	76.1	-37.5
3345.960	19.2	-65.1	1.6	6.0	H	86.3	-47.7
4182.450	15.1	-58.7	0.7	6.3	H	78.7	-40.1
5018.940	14.3	-60.0	0.8	7.0	H	79.4	-40.8
5855.430	16.2	-49.4	1.5	6.6	H	69.9	-31.3
6691.920	13.1	-50.2	3.1	7.7	H	71.2	-32.6
7528.410	<10						
8364.900	<10						

TABLE 8-4: FIELD STRENGTH DATA §2.1053 (AMPS 848.97 MHZ)

Operating Frequency (MHz): 848.97
Channel: 799
Measured Cond. Pwr. (dBm): 25.61
Measured ERP (dBm): 25.6
Modulation: AMPs
Distance: 3
Limit: 38.6 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Horn Antenna Gain (dBd)	POL (H/V)	ERP (dBc)	Margin (dB)
1697.940	24.5	-45.2	0.9	4.7	H	67.0	-28.4
2546.910	28.5	-51.5	1.7	5.3	H	73.5	-34.9
3395.880	27.0	-56.5	1.6	6.0	H	77.7	-39.1
4244.850	24.3	-49.6	1.1	6.4	H	69.9	-31.3
5093.820	28.7	-46.8	1.9	6.9	H	67.4	-28.8
5942.790	19.9	-48.0	2.0	6.6	H	69.0	-30.4
6791.760	21.6	-45.8	3.1	7.7	H	66.8	-28.2
7640.730							
8489.700							

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TABLE 8-5: FIELD STRENGTH DATA §2.1053 (TDMA 824.04 MHZ)

Operating Frequency (MHz): 824.04
Channel: 991
Measured Cond. Pwr. (dBm): 25.94
Measured ERP (dBm): 26.0
Modulation: TDMA
Distance: 3
Limit: 39.0 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Horn Antenna Gain (dBd)	POL (H/V)	ERP (dBc)	Margin (dB)
1648.080	28.8	-50.3	0.9	4.7	H	72.5	-33.5
2472.120	18.9	-66.4	1.4	5.2	H	88.6	-49.6
3296.160	<15						
4120.200	<15						
4944.240	<15						
5768.280	<15						
6592.320	<15						
7416.360	<15						
8240.400	<15						

TABLE 8-6: FIELD STRENGTH DATA §2.1053 (TDMA 836.49 MHZ)

Operating Frequency (MHz): 836.49
Channel: 383
Measured Cond. Pwr. (dBm): 25.74
Measured ERP (dBm): 25.9
Modulation: TDMA
Distance: 3
Limit: 38.9 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Horn Antenna Gain (dBd)	POL (H/V)	ERP (dBc)	Margin (dB)
1672.980	40.2	-74.6	0.9	4.7	H	96.7	-57.8
2509.470	31.5	-74.7	1.6	5.2	H	97.0	-58.1
3345.960	<15						
4182.450	<15						
5018.940	<15						
5855.430	<15						
6691.920	<15						
7528.410	<15						
8364.900	<15						

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TABLE 8-7: FIELD STRENGTH DATA §2.1053 (TDMA 848.97 MHZ)

Operating Frequency (MHz):	848.97
Channel:	799
Measured Cond. Pwr. (dBm):	25.61
Measured ERP (dBm):	25.4
Modulation:	TDMA
Distance:	3
Limit:	38.4 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Horn Antenna Gain (dBd)	POL (H/V)	ERP (dBc)	Margin (dB)
1672.980	40.2	-58.2	.9	4.7	H	79.8	-41.4
2509.470	31.5	-75.2	1.9	5.2	H	97.3	-58.9
3345.960	<15						
4182.450	<15						
5018.940	<15						
5855.430	<15						
6691.920	<15						
7528.410	<15						
8364.900	<15						

The spectrum analyzer was set to the following settings:

1. Resolution Bandwidth ≤1 MHz
2. Video Bandwidth 10 Hz
3. Sweep Speed 5 Second
4. Detector Mode = Positive Peak

Notes:

Measurements by Substitution Method:

The EUT was placed on a turntable 3-meters from the receive antenna. The field of maximum intensity was found by rotating the EUT approximately 360 degrees and changing the height of the receive antenna from 1 to 4 meters in three orthogonal planes. The field strength was recorded from a calibrated spectrum analyzer for each channel being tested. A horn antenna was substituted in place of the EUT. The horn was fed from a signal generator, and the level was adjusted to the same field strength level as the EUT. The conducted power from the signal generator was recorded. The final ERP level was determined by subtracting the cable loss and adding the dipole gain in dBd.

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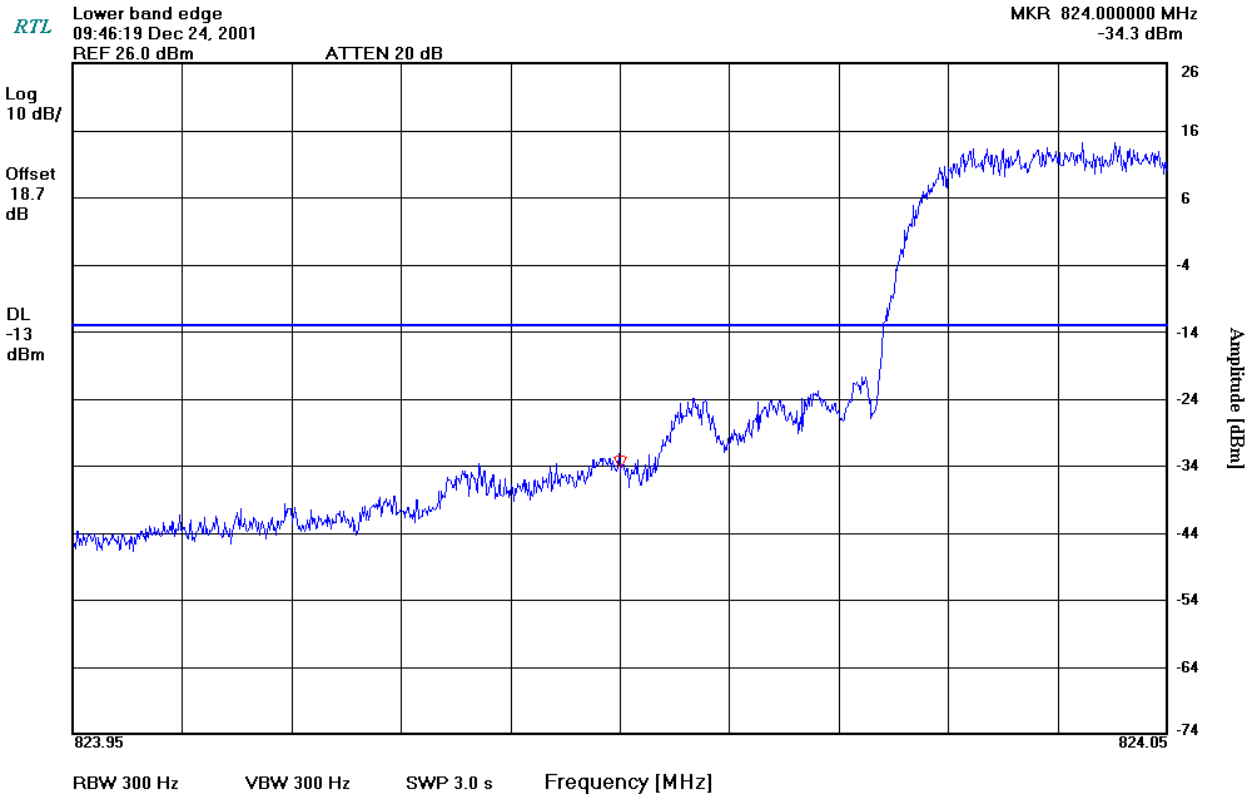
8.4 FCC PART 22.901(D) - BAND-EDGE COMPLIANCE

TDMA Lower bandedge



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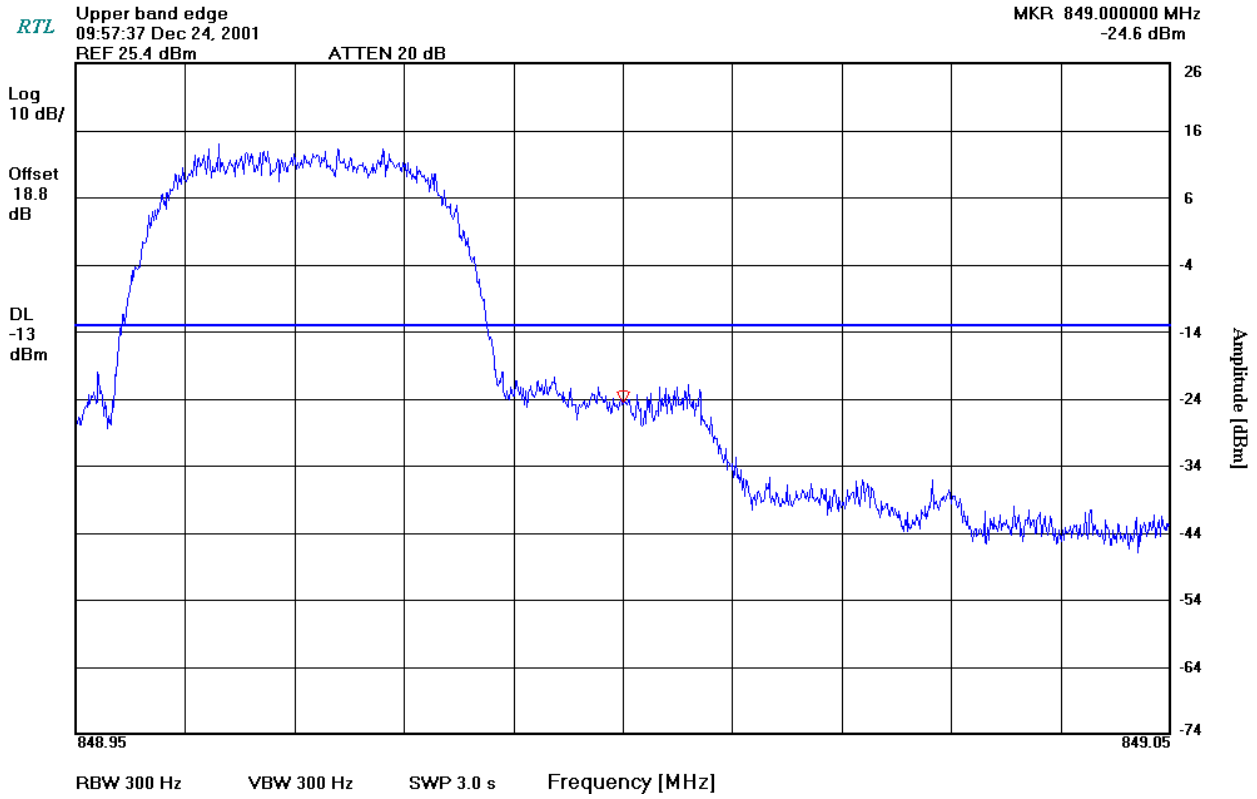
TDMA Upper bandedge



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9 FREQUENCY STABILITY / TEMPERATURE VARIATION - §2.1055

The frequency stability and RF power, measured at the antenna connector using a communications test set as the specified load, are plotted against supply voltage variations and temperature variations at the highest power levels for each modulation type. All measurements are made at the center of the frequency band.

9.1 MEASUREMENT METHOD:

The frequency stability of the transmitter was measured by:

1. Temperature: The temperature was varied from -30°C to +60°C at intervals no more than 10°C throughout the temperature range using an environmental chamber. A period of time sufficient to stabilize all of the components in the equipment shall be allowed prior to each frequency measurement.
2. Primary Supply Voltage: The primary supply voltage was varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied. The EUT was tested down to the battery endpoint.

9.2 FREQUENCY STABILITY TEST EQUIPMENT

TABLE 9-1: FREQUENCY STABILITY TEST EQUIPMENT

Manufacturer	Model	Part Type
Anritsu	MT8802A	Radio Communications Test Set
Hewlett Packard	E3631A	Power Supply
Hewlett Packard	E3610A	Power Supply
Hewlett Packard	E4418B	Power Meter
ESPEC	SH-240	Temperature Chamber
Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity
Rohde & Schwarz	FSIQ 3	Signal Analyzer 20Hz – 3.5GHz

9.3 TIME PERIOD AND PROCEDURE:

1. The carrier frequency of the transmitter was measured at room temperature (25°C to provide a reference).
2. The equipment was subjected to a “soak” at -30°C without any power applied.
3. After the “soak” at -30°C, the measurement of the carrier frequency of the transmitter was made within a three-minute interval after applying power to the transmitter.
4. Frequency measurements were made at 10°C intervals up to +60°C, then back to room temperature. A minimum period of one hour was provided to allow stabilization of the equipment at each temperature level.

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9.4 FREQUENCY TOLERANCE §22.355:

The minimum frequency stability shall be 2.5 ppm for this device

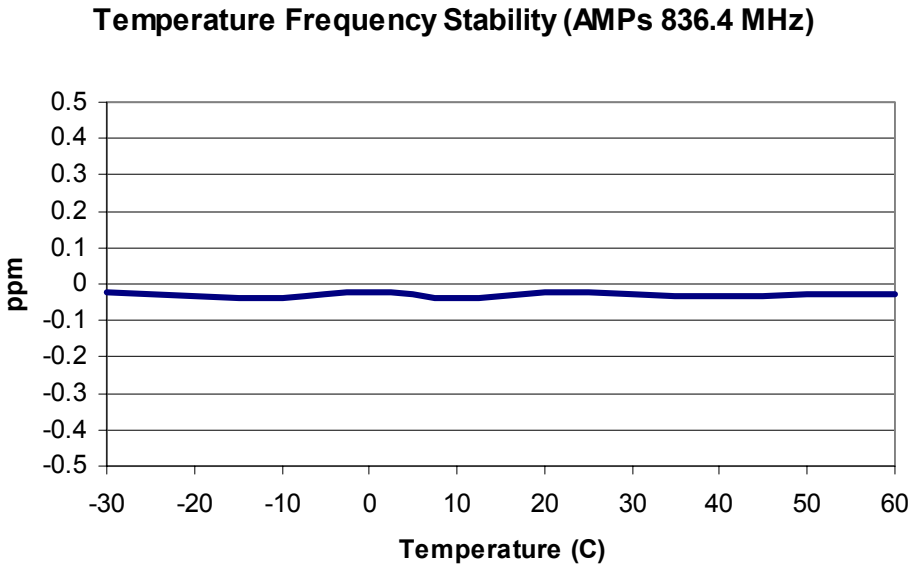
9.5 FREQUENCY STABILITY TEST DATA - §2.1055

Operating Frequency:	836.4	MHz		
Channel:	383			
Reference Voltage:	3.6	VDC		
Deviation Limit:	0.00025	%	or 2.5	ppm

TABLE 9-2: TEMPERATURE FREQUENCY STABILITY DATA - §2.1055

AMPs

Temperature (ºC)	Measured Frequency (MHz)	ppm
-30	836.399983	-0.02
-20	836.399971	-0.03
-10	836.399970	-0.04
0	836.399981	-0.02
10	836.399967	-0.04
20	836.399981	-0.02
30	836.399976	-0.03
40	836.399971	-0.04
50	836.399979	-0.03
60	836.399978	-0.03



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TDMA

Temperature (ºC)	Measured Frequency (MHz)	ppm
-30	836.399998	0.00
-20	836.400001	0.00
-10	836.399995	-0.01
0	836.400007	0.01
10	836.400005	0.01
20	836.400017	0.02
30	836.400004	0.01
40	836.399991	-0.01
50	836.400010	0.01
60	836.399992	-0.01

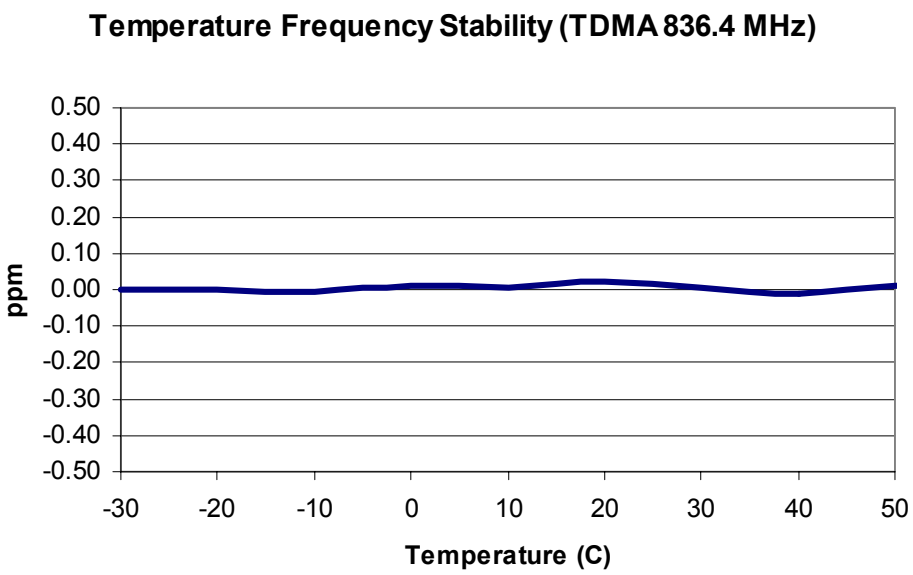

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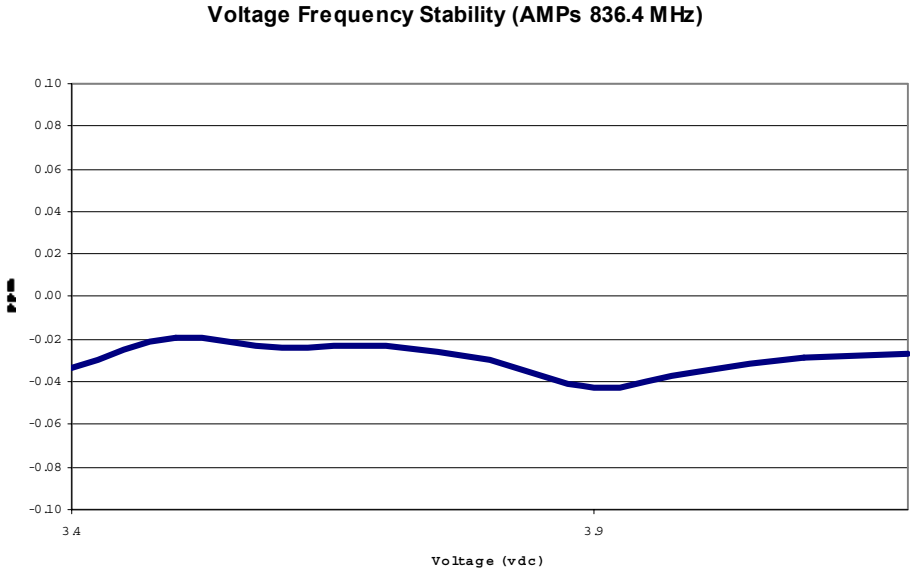
TABLE 9-3: VOLTAGE FREQUENCY STABILITY DATA - §2.1055

AMPs

Voltage (DC)	Measured Frequency (MHz)	ppm
3.4	836.399972	-0.03
3.5	836.399984	-0.02
3.6	836.399980	-0.02
3.7	836.399981	-0.02
3.8	836.399975	-0.03
3.9	836.399965	-0.04
4.0	836.399971	-0.03
4.1	836.399976	-0.03
4.2	836.399978	-0.03



TDMA

Voltage (DC)	Measured Frequency (MHz)	ppm
3.4	836.400034	0.04
3.5	836.400028	0.03
3.6	836.400015	0.02
3.7	836.400004	0.00
3.8	836.400008	0.01
3.9	836.400014	0.02
4.0	836.400020	0.02
4.1	836.400003	0.00
4.2	836.400001	0.00

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10 FCC PART 2 §2.1047 (A): MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE

10.1 TEST PROCEDURE

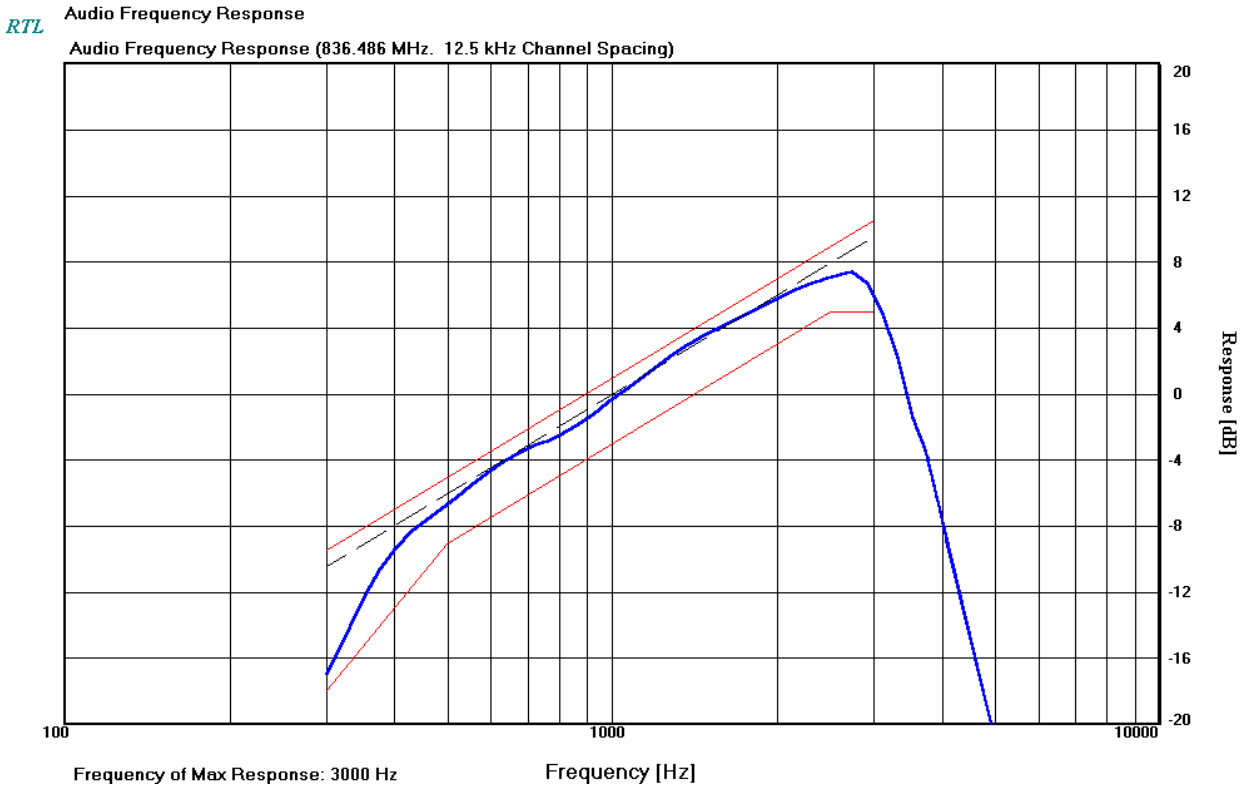
EIA/IS-19-B: 1988 Recommended Minimum Standards for 800MHz Cellular Subscriber Units

The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.

The input audio level at 1000 Hz is set to produce 20% of the rated system deviation. This point is shown as the 0 dB reference level, noted DEVref.
The audio signal generator was varied from 100Hz to 5kHz with the input level held constant.
The deviation in kHz was recorded using a modulation analyzer as DEVfreq.
The response in dB relative to 1 kHz was calculated as follows:

Audio Frequency Response = 20 LOG (DEVfreq/DEVref)

10.2 TEST DATA



10.3 TEST EQUIPMENT

Audio generator	HP3336B	s/n 2127A00559
Modulation analyzer	HP8901A	s/n 2545A04102

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11 FCC PART 2 §2.1047 (A): MODULATION CHARACTERISTICS - AUDIO LOW PASS FILTER RESPONSE

11.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, 2.2.15 and Part 22. 915(d)(1)

The Audio Low Pass Filter Response is the frequency response of the post limiter low pass filter circuit above 3000 Hz.

11.2 TEST DATA

11.3 TEST EQUIPMENT

Audio generator	HP3336B	s/n 2127A00559
Modulation analyzer	HP8901A	s/n 2545A04102
Selective level meter	HP3586B	s/n 1928A01892
Synthesizer/Level generator	HP3336B	s/n 2514A02585

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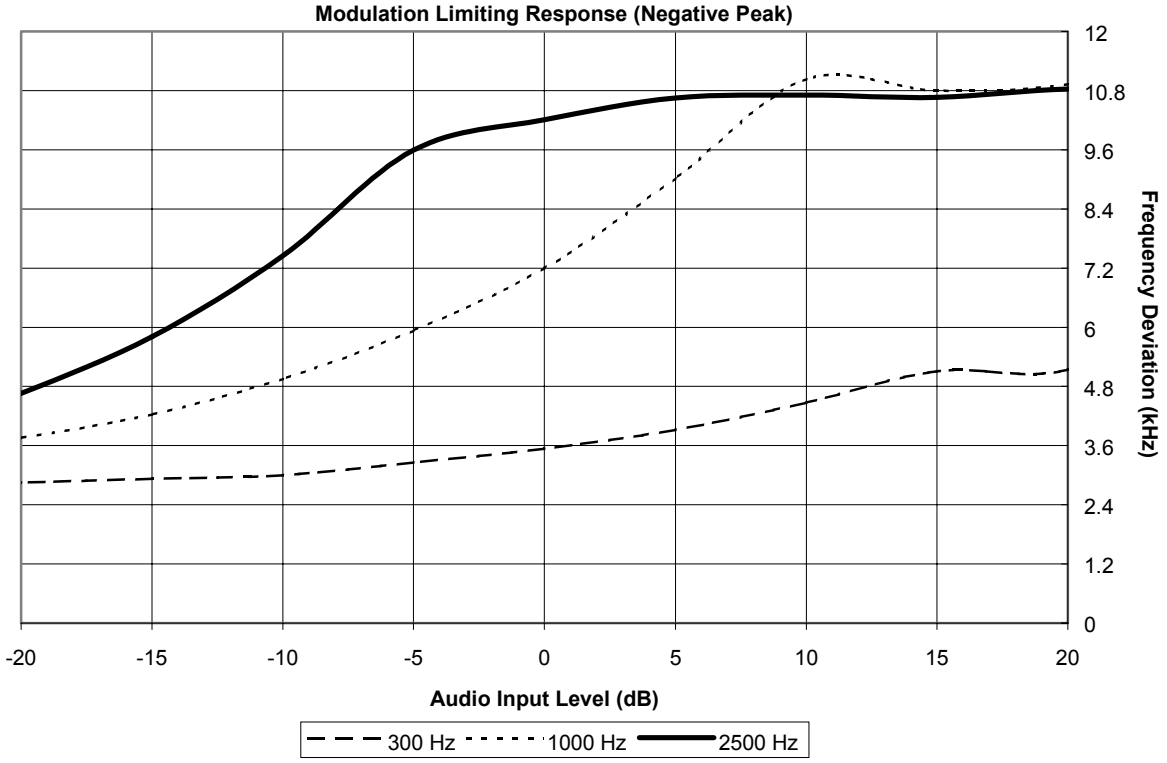
12 FCC PART 2 §2.1047 (B): MODULATION CHARACTERISTICS - MODULATION LIMITING

12.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.3 and Part 22.915 (B)

The transmitter is adjusted for full rated system deviation. The audio input level is adjusted for 60% of rated system deviation at 1000Hz. Using this level as a reference (0dB) the audio input level is varied from the reference to a level +25 dB above it and –25 dB under it, for modulation frequencies of 300Hz, 1,000Hz, and 2,500Hz. The system deviation obtained as a function of the input level is recorded.
Both Positive and Negative Peak deviations were recorded.

12.2 TEST DATA



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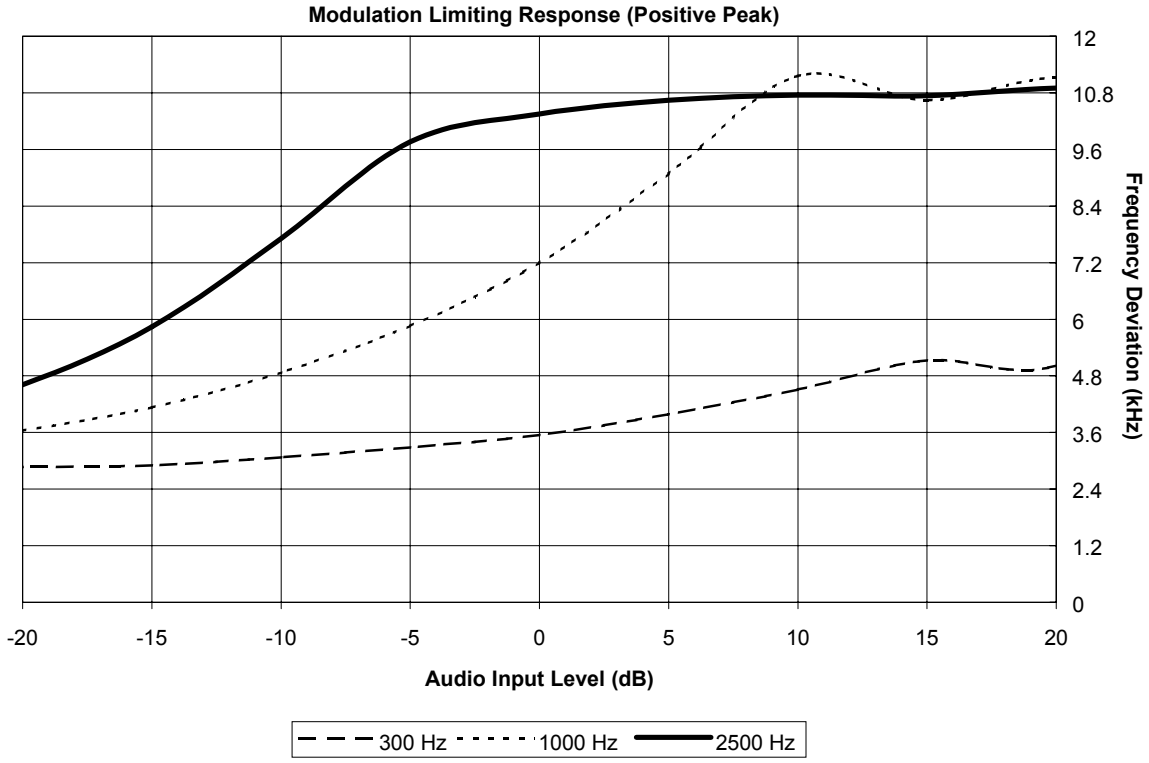

Measurement of Maximum Deviation

Type	Measured (kHz)	Rated (kHz)
Voice	11.2	12
Wideband	8.44	8
SAT	1.95	2
ST	7.59	8

12.3 TEST EQUIPMENT

Audio generator	HP3336B	s/n 2127A00559
Modulation analyzer	HP8901A	s/n 2545A04102

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13 NECESSARY BANDWIDTH AND EMISSION BANDWIDTH - § 2.202

Type of Emission: F8W, F1D

Necessary Bandwidth and Emission Bandwidth:
40K0F1D
40K0F8W

Emission Bandwidth measured from 99% (-20 dB) occupied bandwidth for DXW emission 31.5 kHz (ref. Occupied bandwidth plots).

Calculation for 40K0F8W

1/ Voice + SAT
Modulation: Voice is 2.5 kHz and SAT is 6 kHz, thus the maximum modulation is M = 6 kHz
Deviation: Voice is 12 kHz and SAT is 2 kHz, thus the maximum deviation is D= 12+2= 14 kHz
Bn = 2xM+2xDK with K =1
Bn= 40 kHz

2/ Signaling Tone (ST) + SAT
Modulation: ST is 10 kHz and SAT is 6 kHz, thus the maximum modulation is M = 10 kHz
Deviation: ST is 8 kHz and SAT is 2 kHz, thus the maximum deviation is D= 8+2= 10 kHz
Bn = 2xM+2xDK with K =1
Bn= 40 kHz

Calculation for 40K0F1D (wide Band Data)

1/ Voice + SAT
Modulation: Wideband Data is 10 kHz and SAT is 6 kHz, thus the maximum modulation is M = 10 kHz
Deviation: Wideband Data is 8 kHz and SAT is 2 kHz, thus the maximum deviation is D= 8+2 = 10 kHz
Bn = 2xM+2xDK with K =1
Bn= 40 kHz

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14 CONCLUSION

The data in this measurement report shows that the Sony Ericsson Mobile Communications (US, Inc.), T60ds FCC ID: AXATR-422-A2 complies with all the requirements of Parts 2 and 22.901 of the FCC Rules and Industry Canada .