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800 MHz: AMPS RF POWER OUTPUT

Para. 2.1033 (c)(6)(7), 2.1046 and 22.913 (a)

For Canada use only (6A2 and 6A3): The RF power measured at the output terminal (antenna connector) is plotted against supply voltage variations and temperature variations at the highest levels.

Exhibit	Voltage (V)	Temperature	TX Freq	Power Level
6A2	Nominal Volt.	Varied	Mid-Band	0
6A3	Varied	+25 C	Mid-Band	0

Note: The manufacturers rated voltage for the battery is 4.3 VDC to 5.3 VDC.

The measurements were made per IS 137 using a Hewlett Packard 8953DT North American Dual Mode Cellular Test System which includes the following equipment:

HP EPM-441A Power Meter
HP 66309B Dual Output Mobile Comm. DC Source
Thermotron SM-8C Temperature Chamber

EFFECTIVE RADIATED POWER

The following is a description of the substitution method used in accordance with IS-137A to obtain accurate EDRP readings at the carrier fundamental frequency:

- (1) The unit under test is placed 3 m away from the measurement antenna in vertical position. The measurements are made by using calibrated antennas and equipment with known cable losses.
- (2) A maximized measurement is made by raising and lowering the measurement antenna and rotating the EUT 360 degrees. Horizontal and vertical polarization data is recorded as reference.
- (3) A generator, an amplifier, and a half-wave dipole antenna are then substituted for the EUT.
- (4) Data obtained with known power levels into the substitution antenna are then compared to the reference reading. The EDRP of the product is calculated.

Table: EDRP

Mode	f (MHz)	Radiated (dBm/mW)
AMPS	824	24.3/269.2 EDRP
	836	23.4/218.8 EDRP
	849	23.6/229.1 EDRP

Exhibit 6A2

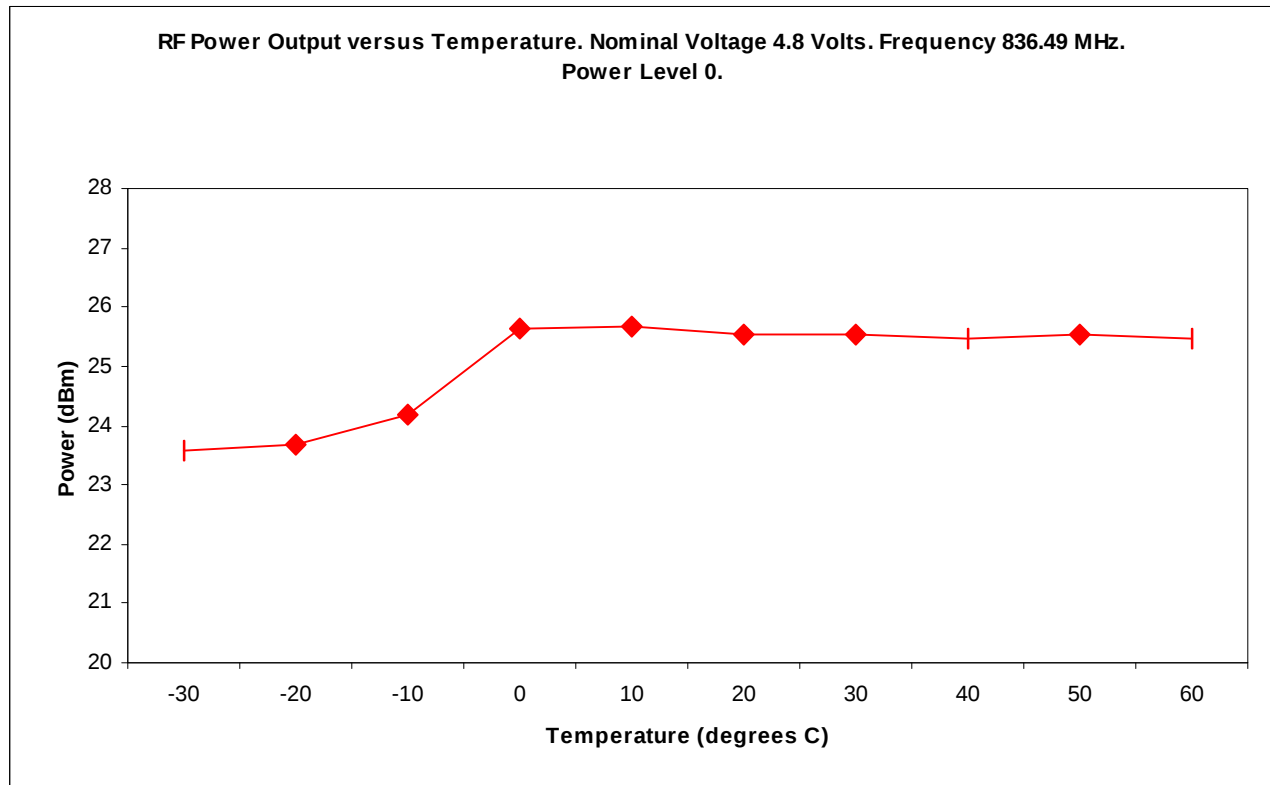


Exhibit 6A3

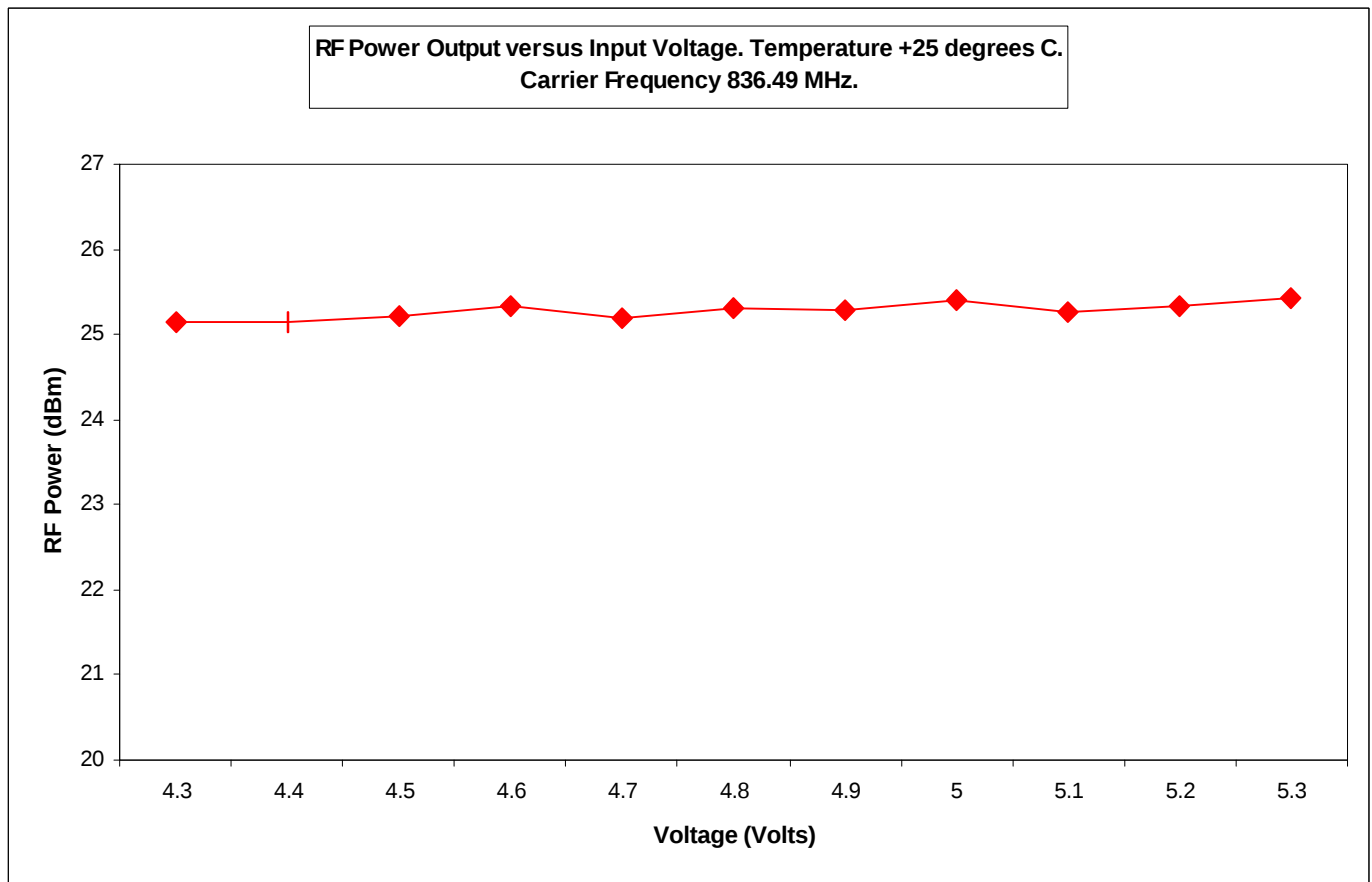


EXHIBIT 6B1

800 MHz AMPS MODULATION CHARACTERISTICS

Part 2.1047 and 22.915

The frequency and amplitude response to audio inputs measured per IS-137A shown on the following diagrams:

<u>Exhibit #</u>	<u>Description</u>	<u>Clause</u>
6B2	Transmit Audio Frequency Response	2.1047 (a,b)
6B3	Post Limiter Filter Attenuation	22.915 (d)
6B4	Modulation limiting vs. modulation Input Voltage	2.1047, 22.915 (b)(1)

The measurements were made per IS-137A using a Hewlett Packard 8953DT North American Dual Mode Cellular Test System which includes the following equipment:

HP 8901B Modulation Analyzer
HP 8903B Audio Analyzer
HP 8593E Spectrum Analyzer 9 kHz – 22 GHz
HP EPM-441A Power Meter
Anritzu 35665A Dynamic Signal Analyzer

EXHIBIT 6B2

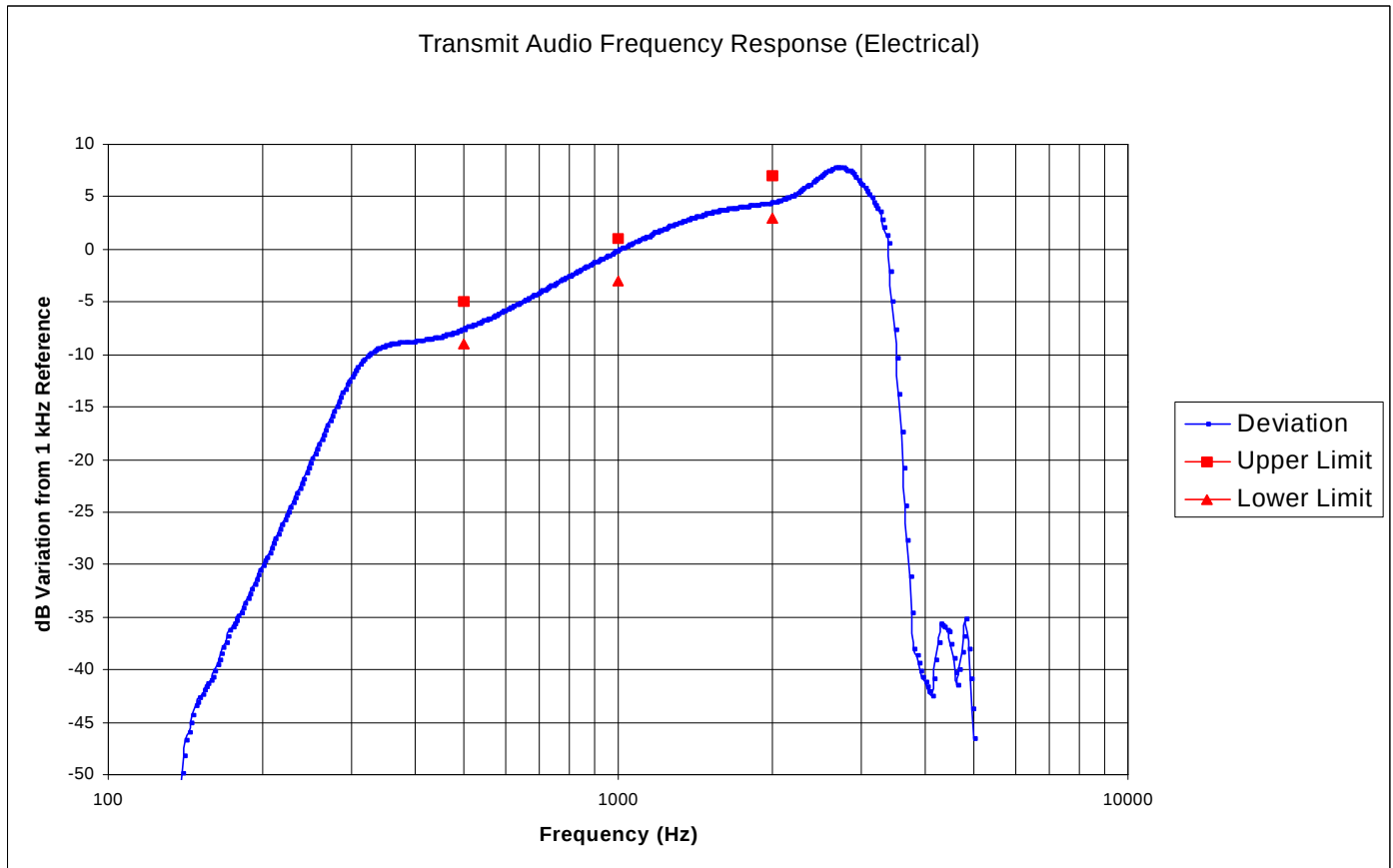
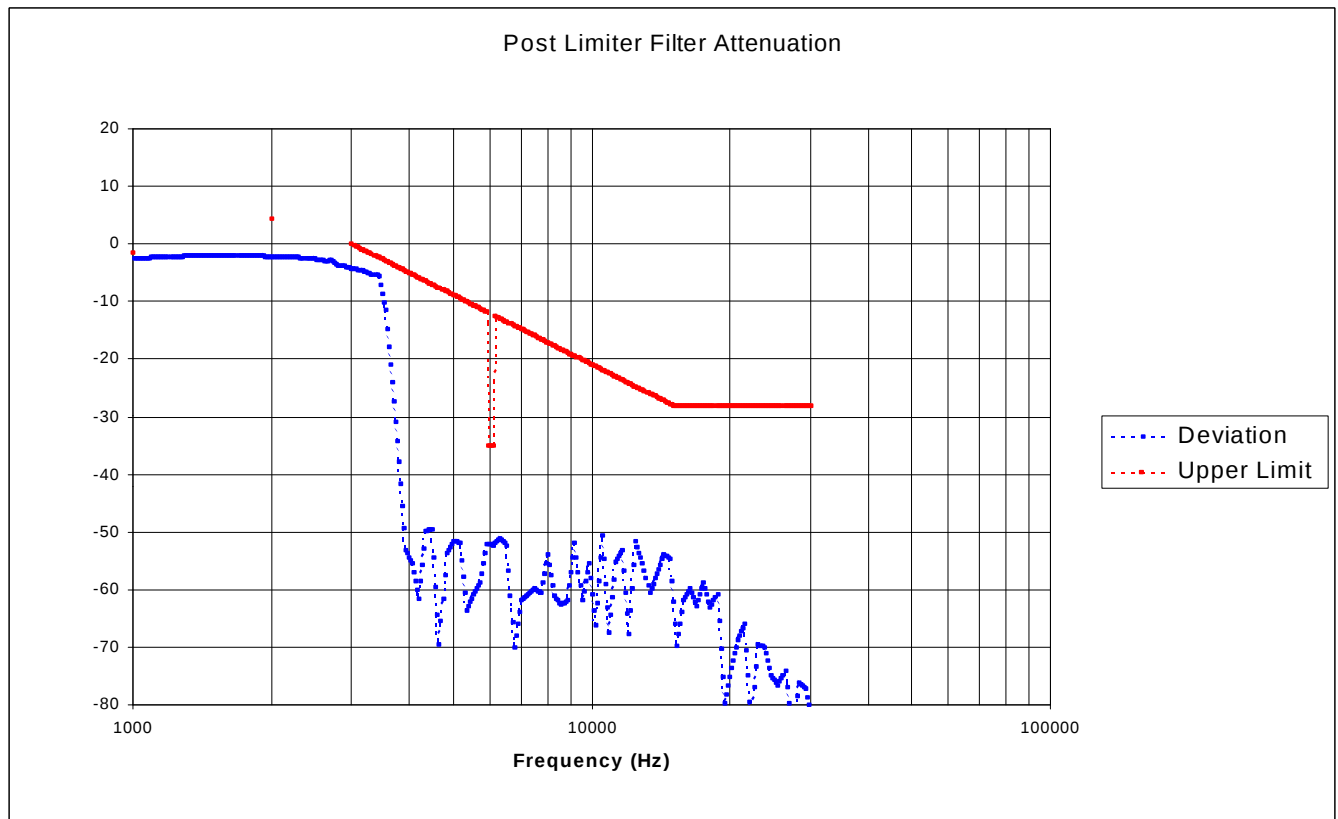
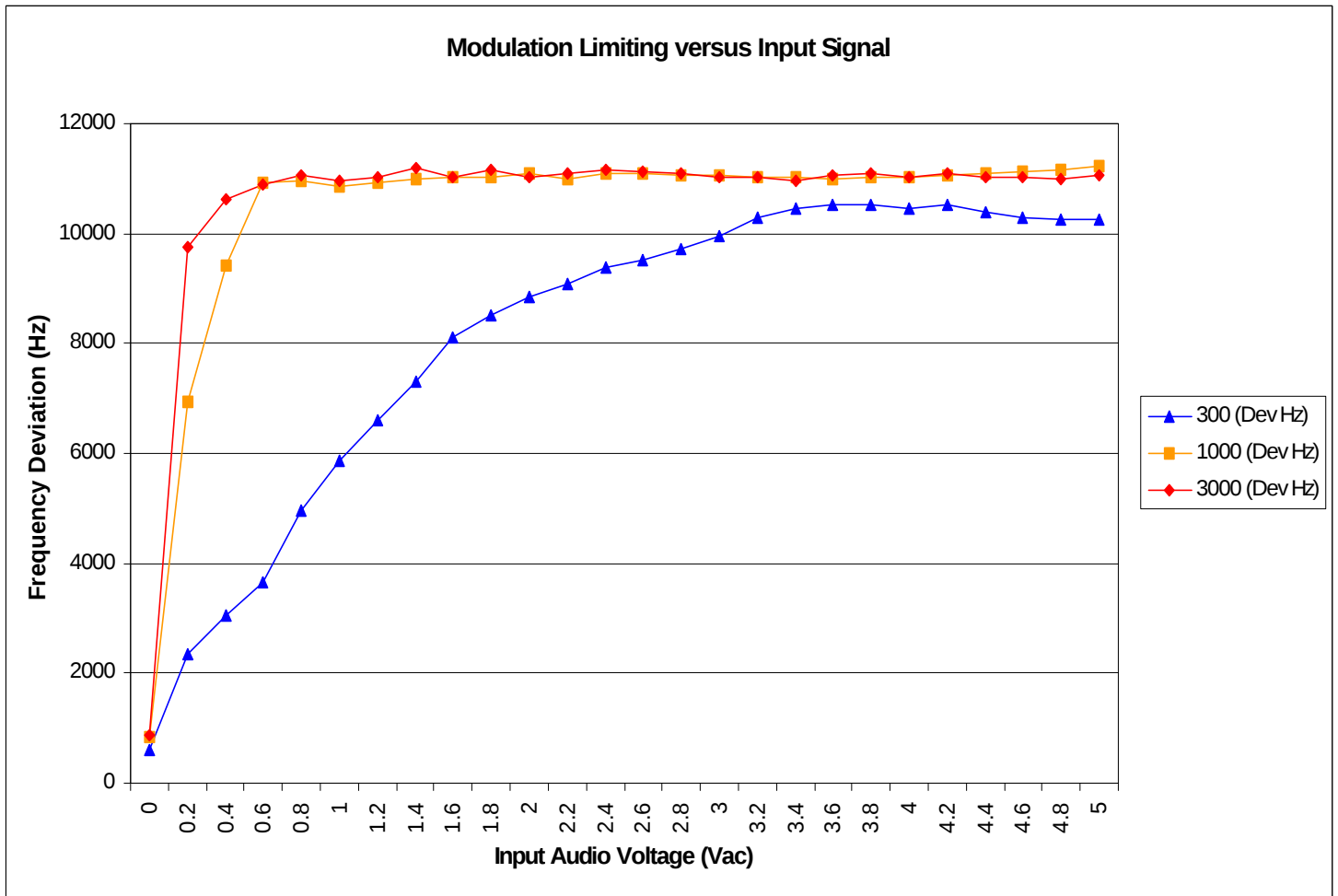


EXHIBIT 6B3





800 MHz AMPS OCCUPIED BANDWIDTH

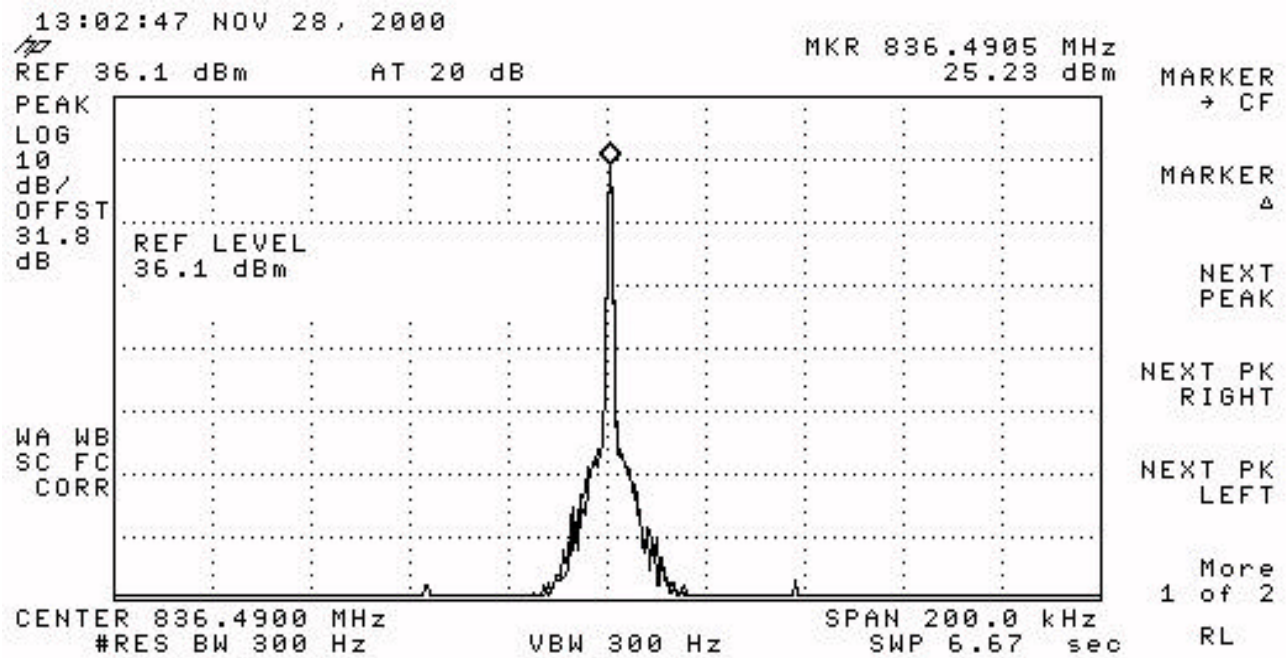
Part 2.1049 and 22.917 (b)(d) the exhibits presented below illustrate the modulations that co-exist in a cellular system:

<u>Exhibit #</u>	<u>Description</u>	<u>Power Level</u>	<u>Clause</u>
6C2	Unmodulated Carrier	0	
6C3	SAT w/ Carrier	0	22.917(b)
6C4	Signal Tone w / Carrier	0	22.917(b)
6C5	Voice w / Carrier	0	22.917(b)
6C6	10kb/s Wideband Data w/ Carrier	0	22.917(d)

These measurements were made per IS-137A using a Hewlett Packard 8953DT North American Dual Mode Cellular Test System which includes the following equipment:

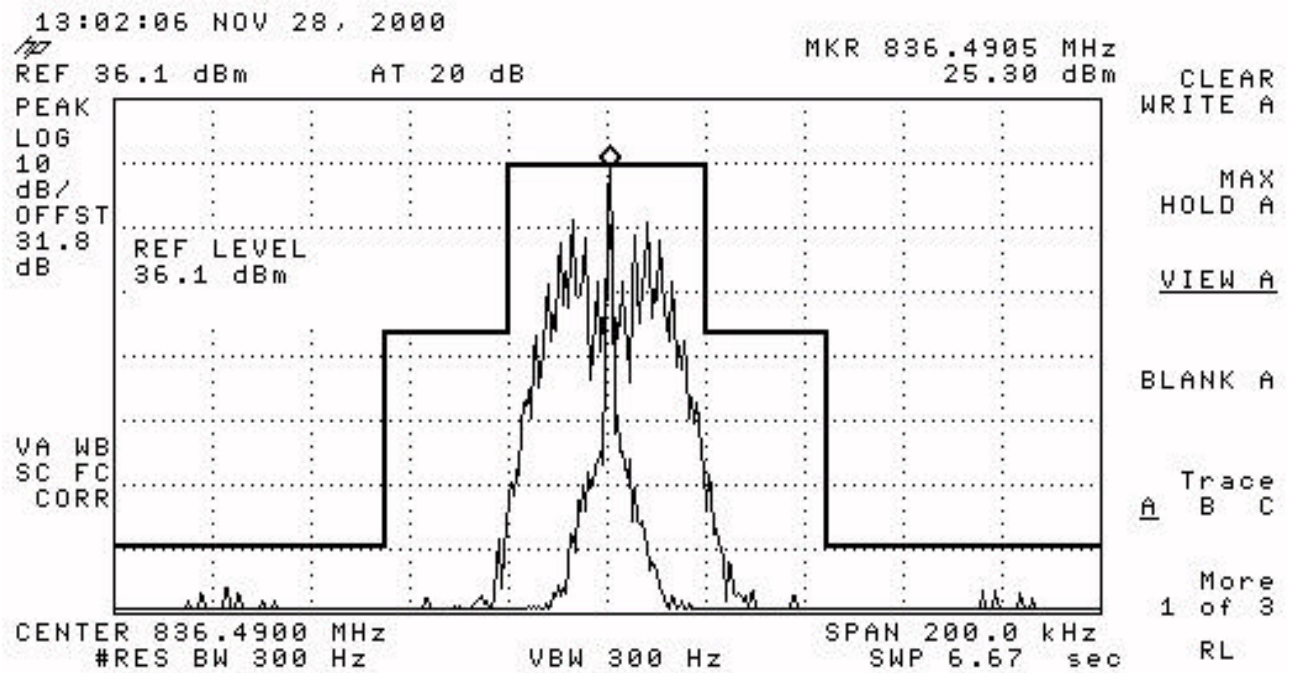
HP E7405A	EMC Spectrum Analyzer 9 kHz – 26.5 GHz
HP EPM-441A	Power Meter
HP 66309B	Dual Output Mobile Comm. DC Source
HP 8901B	Modulation Analyzer
HP 8903B	Audio Analyzer

Exhibit 6C2



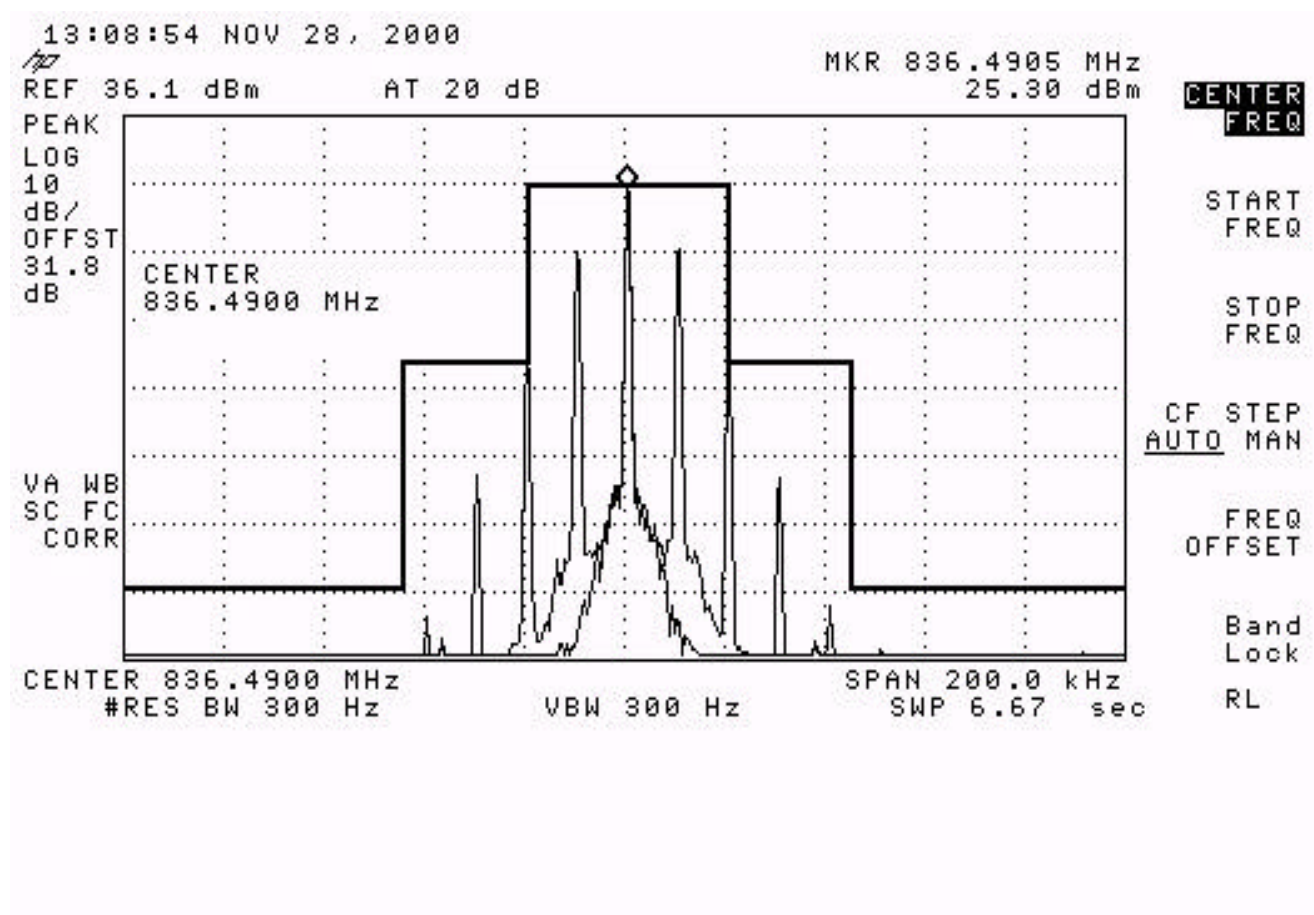
Unmodulated Carrier, Power Level 0

Exhibit 6C3



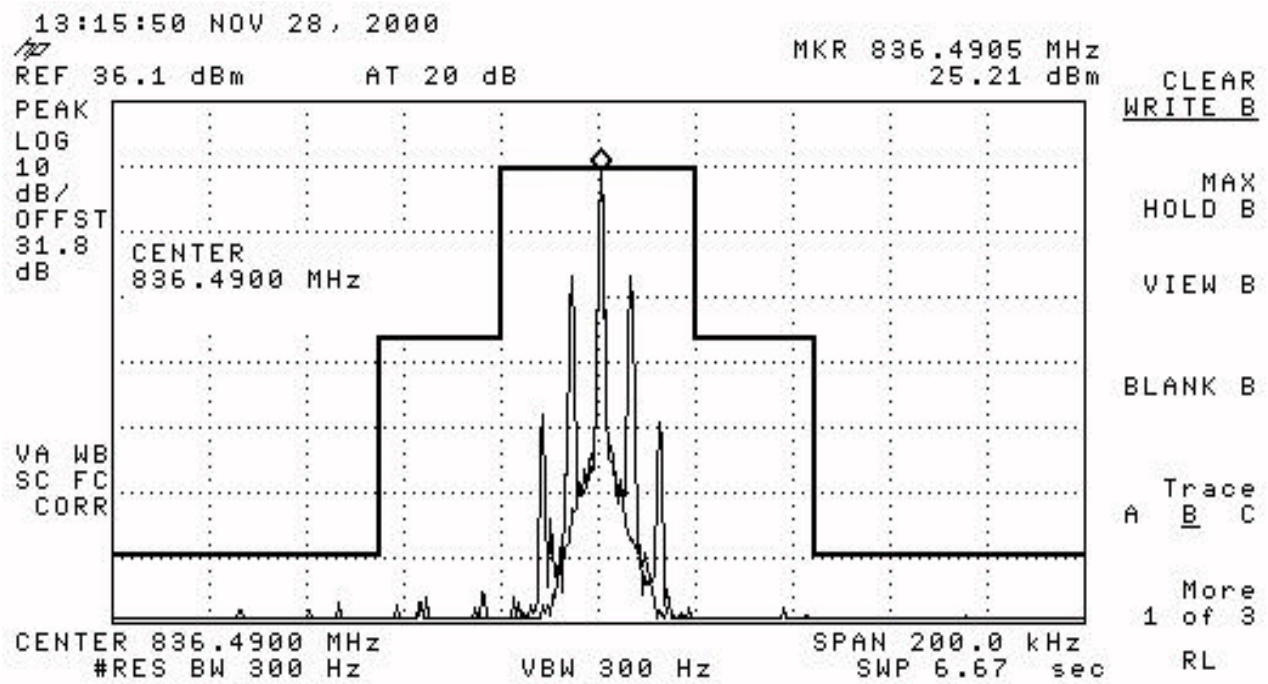
SAT with Unmodulated Carrier, Power Level 0

Exhibit 6C4



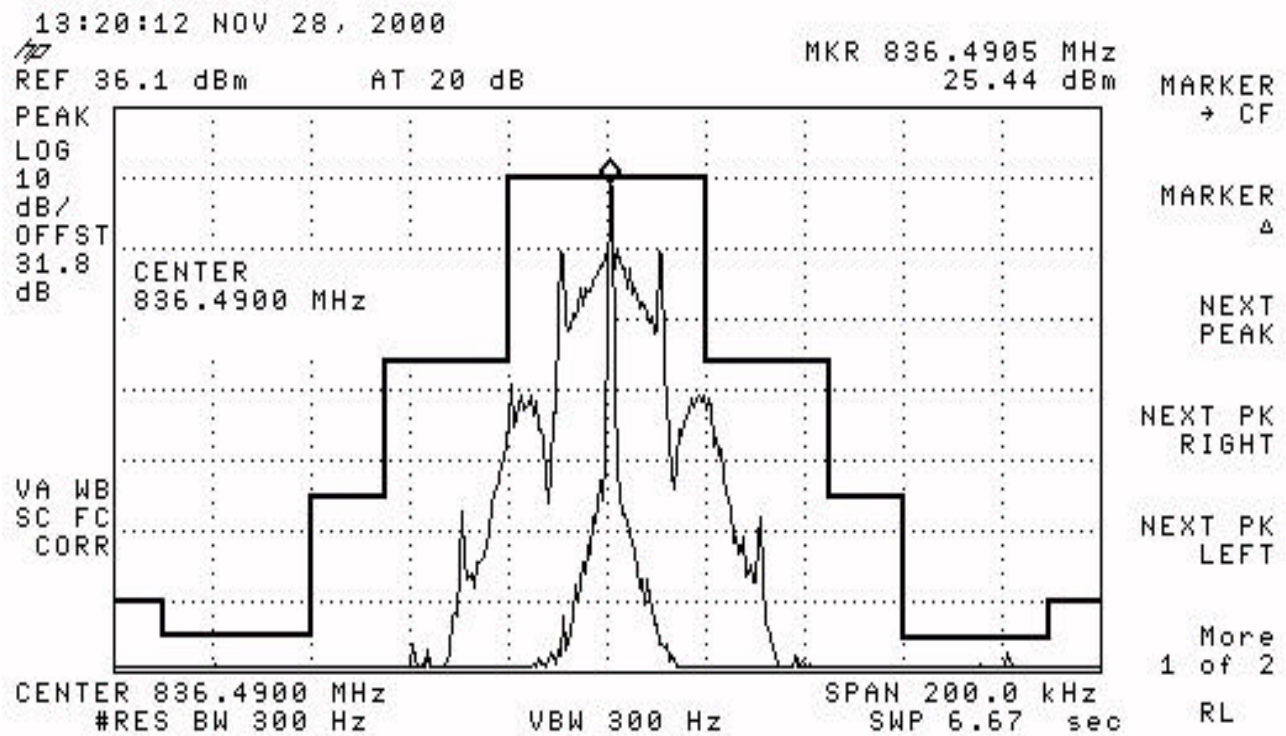
Signaling Tone with Unmodulated Carrier, Power Level 0

Exhibit 6C5



Voice with Unmodulated Carrier, Power Level 0

Exhibit 6C6



10kb/s Wideband Data with Unmodulated Carrier, Power Level 0

EXHIBIT 6D1

800 MHz AMPS SPURIOUS EMISSIONS (CONDUCTED)

Per 2.1051, 22.917(e) Spurious emissions at the antenna terminals (conducted) when properly loaded with an appropriate artificial antenna were measured per IS-137A.

Per 22.917f, the mean power of any emissions from the mobile's transmit antenna connector does not exceed the - 80dBm level in the base station frequency range of 869MHz to 894MHz.

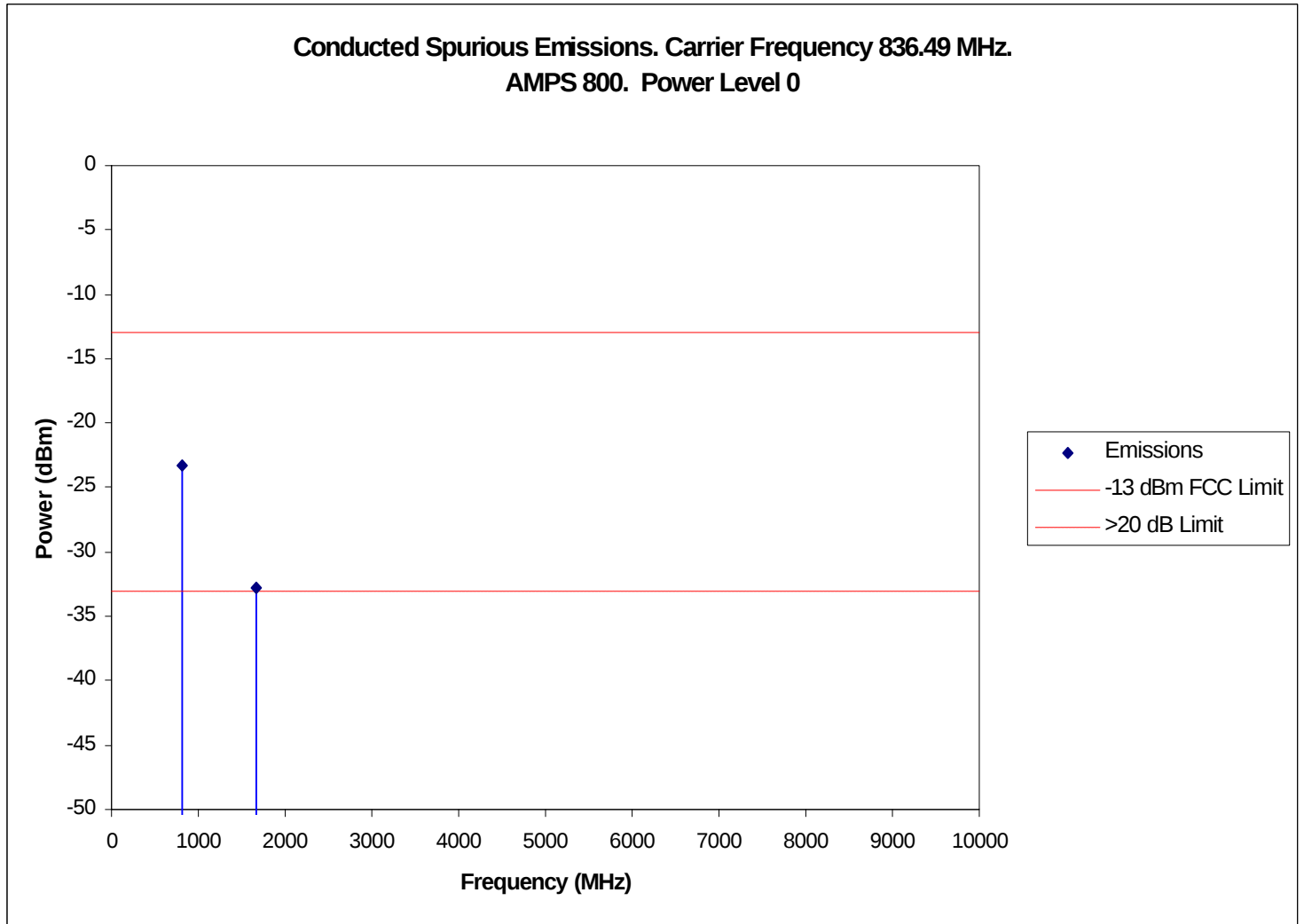
<u>EXHIBIT #</u>	<u>FREQUENCY</u>	<u>Output Power level</u>
6D2	Mid-Band	0
6D3	Mid-Band	7
6D4	Base Band	0; -80dBm per 22.917(f)

Note: The spectrum was examined through the 10th harmonic of the carrier. Measurements recorded are peak measurements.

The measurements were made per IS-137A using the following equipment:

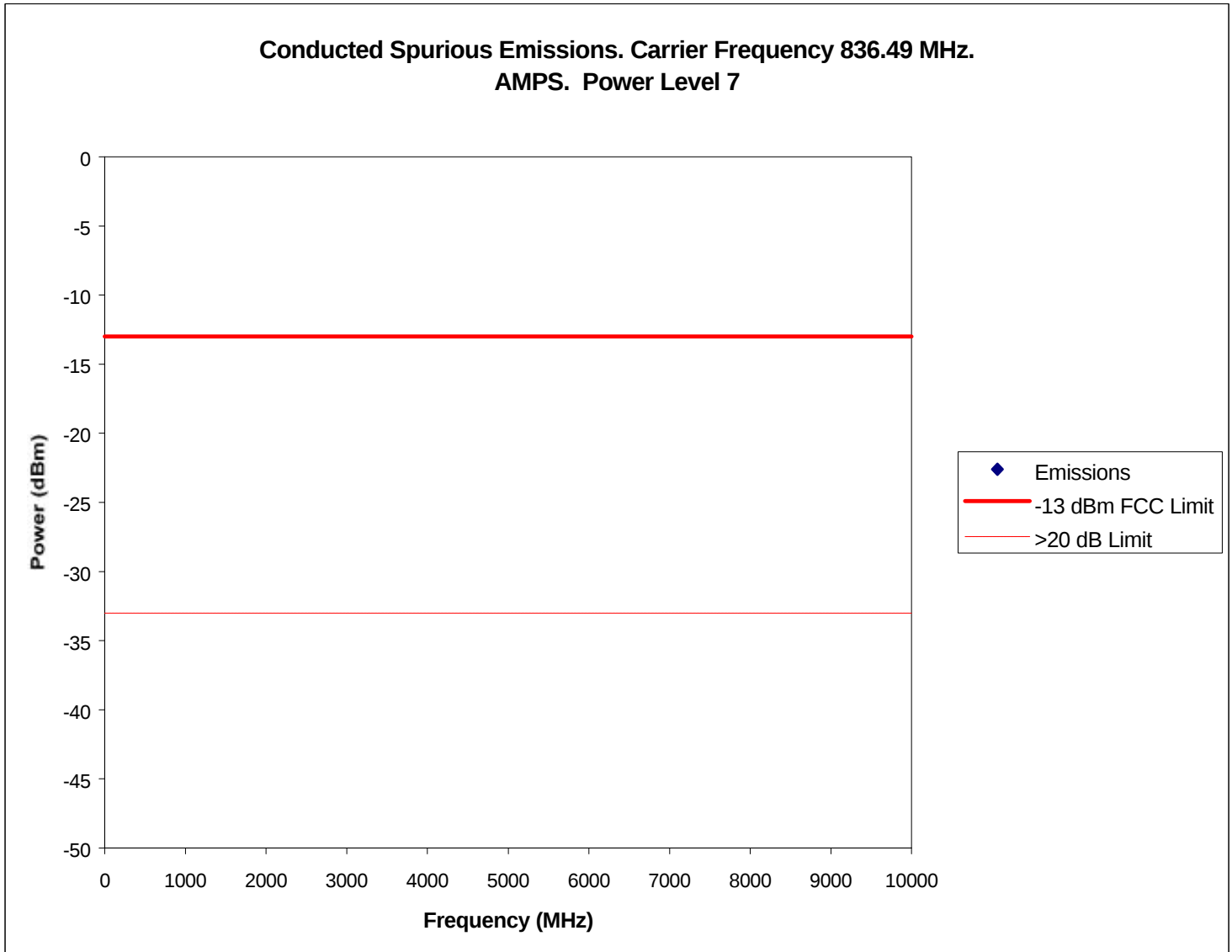
HP E7405A EMC Spectrum Analyzer 9 kHz – 26.5 GHz
HP EPM-441A Power Meter
HP 66309B Dual Output Mobile Comm. DC Source

Exhibit 6D2



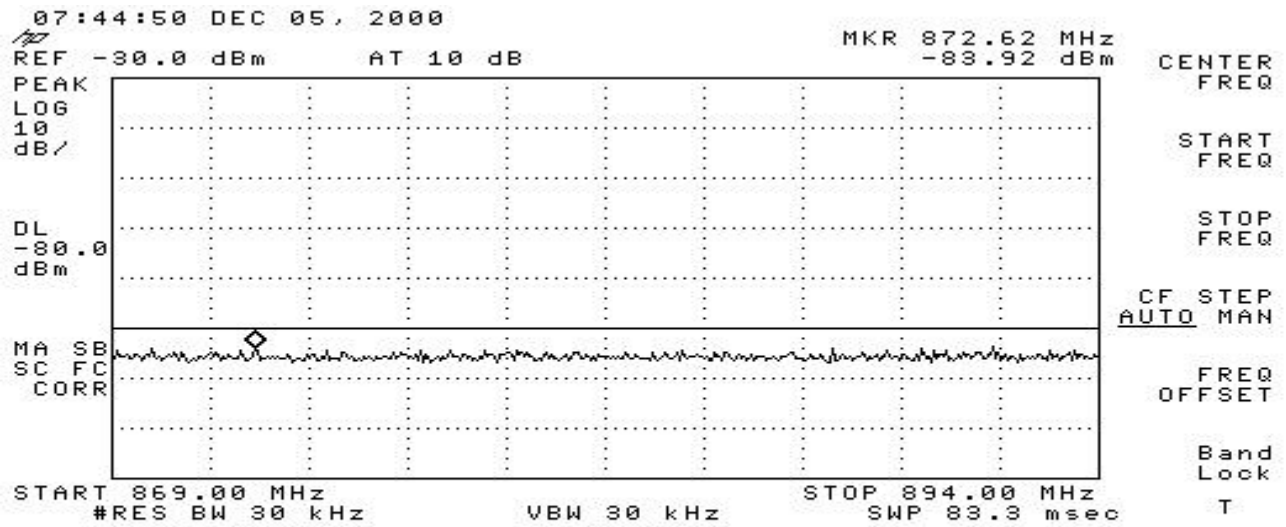
No other spurious emissions found within 20dB of limit

Exhibit 6D3



No spurious emissions found within 20dB of limit

Exhibit 6D4



AMPS Baseband Spurious Emissions

EXHIBIT 6E1

800 MHz AMPS SPURIOUS EMISSIONS (Radiated)

Per 2.1053 and 22.917 (e), field strength of spurious radiation was measured at Underwriters Laboratories Inc. Research Triangle Park, NC site. The measurement procedure is per EIA IS-137 conducted on a 3-meter test site. Results are shown on the following exhibits.

Note: The spectrum was examined through the 10th harmonic of the carrier. Maximum radiated emissions are recorded.

<u>EXHIBIT</u>	<u>FREQUENCY</u>	<u>OUTPUT POWER LEVEL</u>
6E2	824.04 MHz	0

The measurements were made per IS 137 using a Hewlett Packard 8953DT North American Dual Mode Cellular Test System which includes the following equipment:

HP8566B Spectrum Analyzer 100Hz 25GHz / 2 – 22GHz
HP 83752A Signal Generator (S/N: 361DA01426)
30dB Amplifier - Amplifier Research (AR) (S/N: 23413)
Power Meter - Rhode & Schwartz (S/N: DE21529)
Power Sensor (S/N: 8479771011)
2 Test Cables (S/N's: ZATA21, ATA055)
20dB Pad (S/N: ATA005)
EMCO 3115 Double Ridge Horn Antenna
Test Fixture (Fixture provides height adjustment for mobiles and antennas according to FCC requirements)

EXHIBIT 6E2

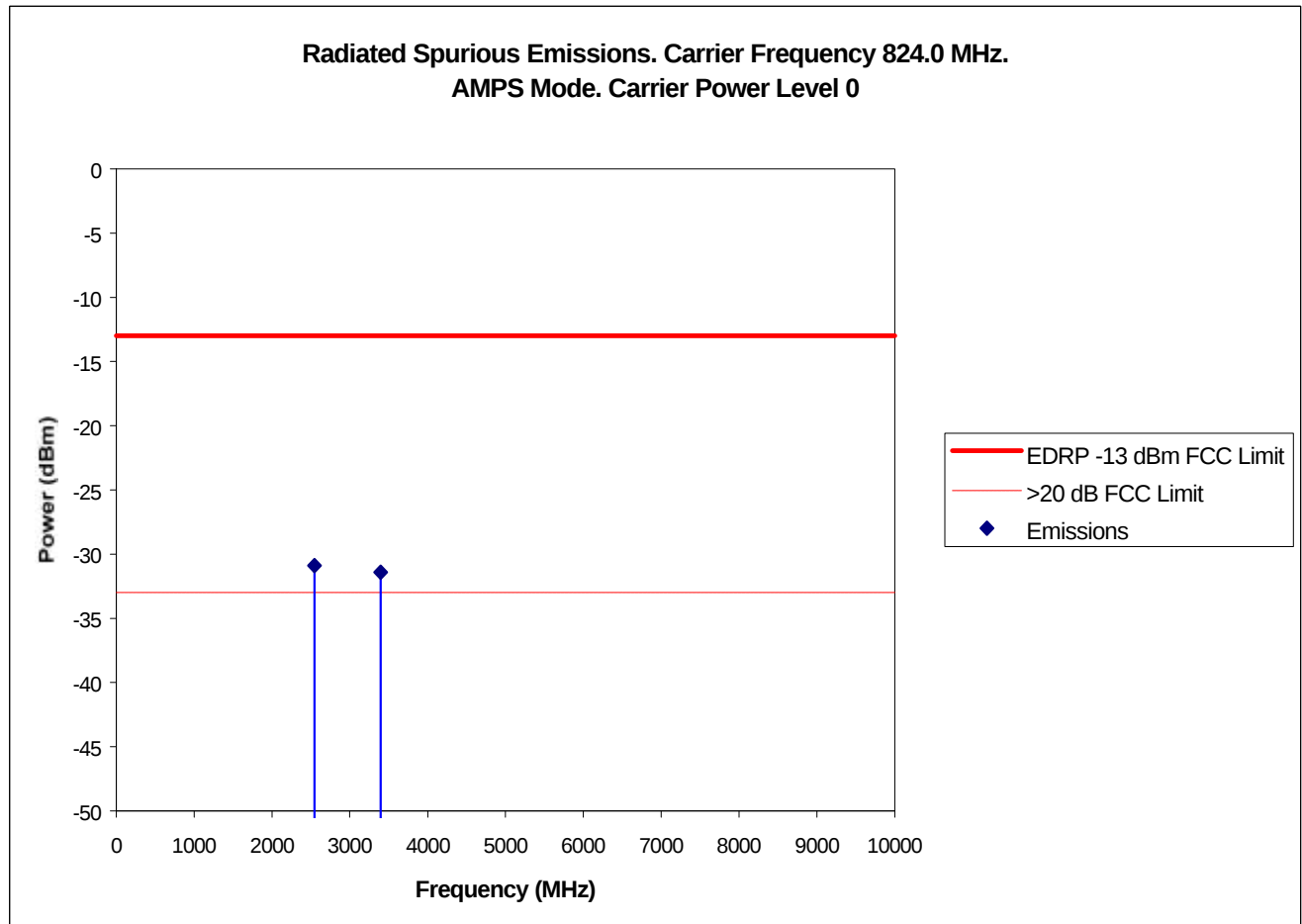


EXHIBIT 6F1

800 MHz AMPS FREQUENCY STABILITY

Per 2.1055 (a)(1)(b)(d)(2), 22.355

<u>EXHIBIT #</u>	<u>Voltage</u>	<u>Temperature</u>
6F2	4.3 to 5.3 (varied)	+25 C
6F3	4.8	Varied (10 C increments)

Note: The manufacturers rated voltage for the battery is 4.3 VDC to 5.3 VDC.

The measurements were made per IS-137A using a Hewlett Packard 8953DT North American Dual Mode Cellular Test System which includes the following equipment:

HP 66309B Dual Output Mobile Comm. DC Source
HP 83712B CW Signal Generator 10 MHz – 20 GHz
Anritzu MT 8802A Radio Communications Analyzer 300 kHz – 3 GHz

EXHIBIT 6F2

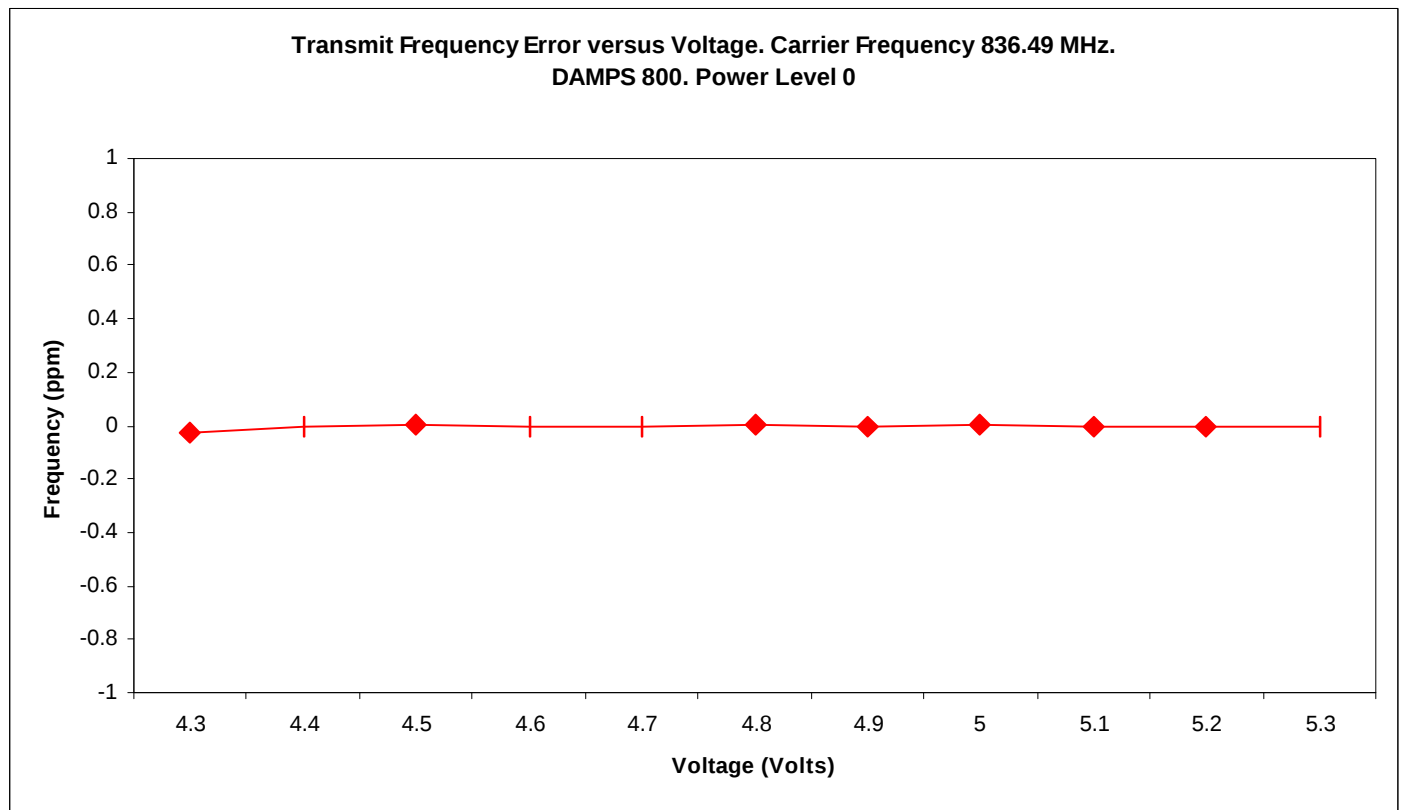
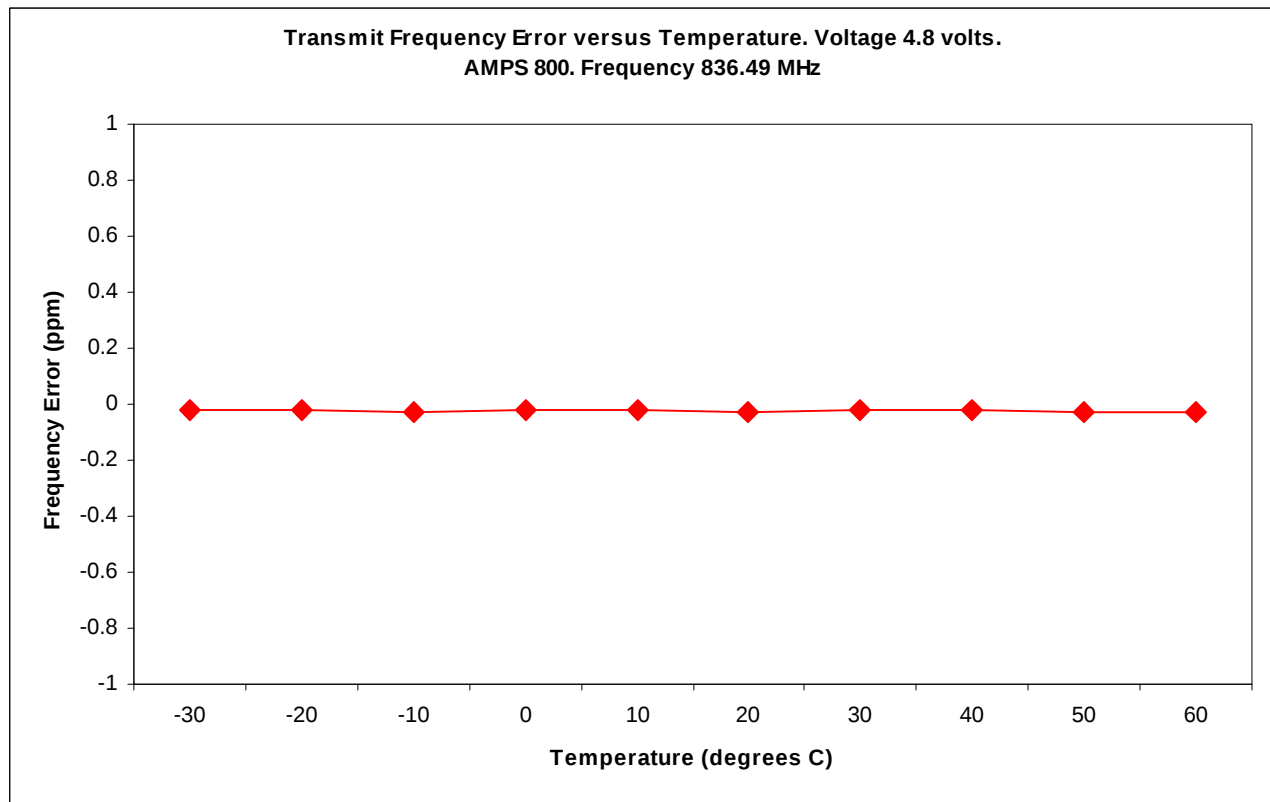


EXHIBIT 6F3



800 MHz DAMPS RF POWER OUTPUT

Para.2.1033 (c)(6)(7) 2.1046 (a) 22.913(a).

For Canada use only (6G2 and 6G3): The RF power measured at the output terminals (antenna connector) is plotted against supply voltage variations at the highest levels.

Exhibit	Voltage (V)	Temperature	TX Freq	Power Level
6G2	Nominal Volt.	Varied	Mid-Band	0
6G3	Varied	+25 C	Mid-Band	0

Note: The manufacturers rated voltage for the battery is 4.3 VDC to 5.3 VDC.

The measurements were made per IS 137 using a Hewlett Packard 8953DT North American Dual Mode Cellular Test System which includes the following equipment:

HP EPM-441A Power Meter
HP 66309B Dual Output Mobile Comm. DC Source
Thermotron SM-8C Temperature Chamber

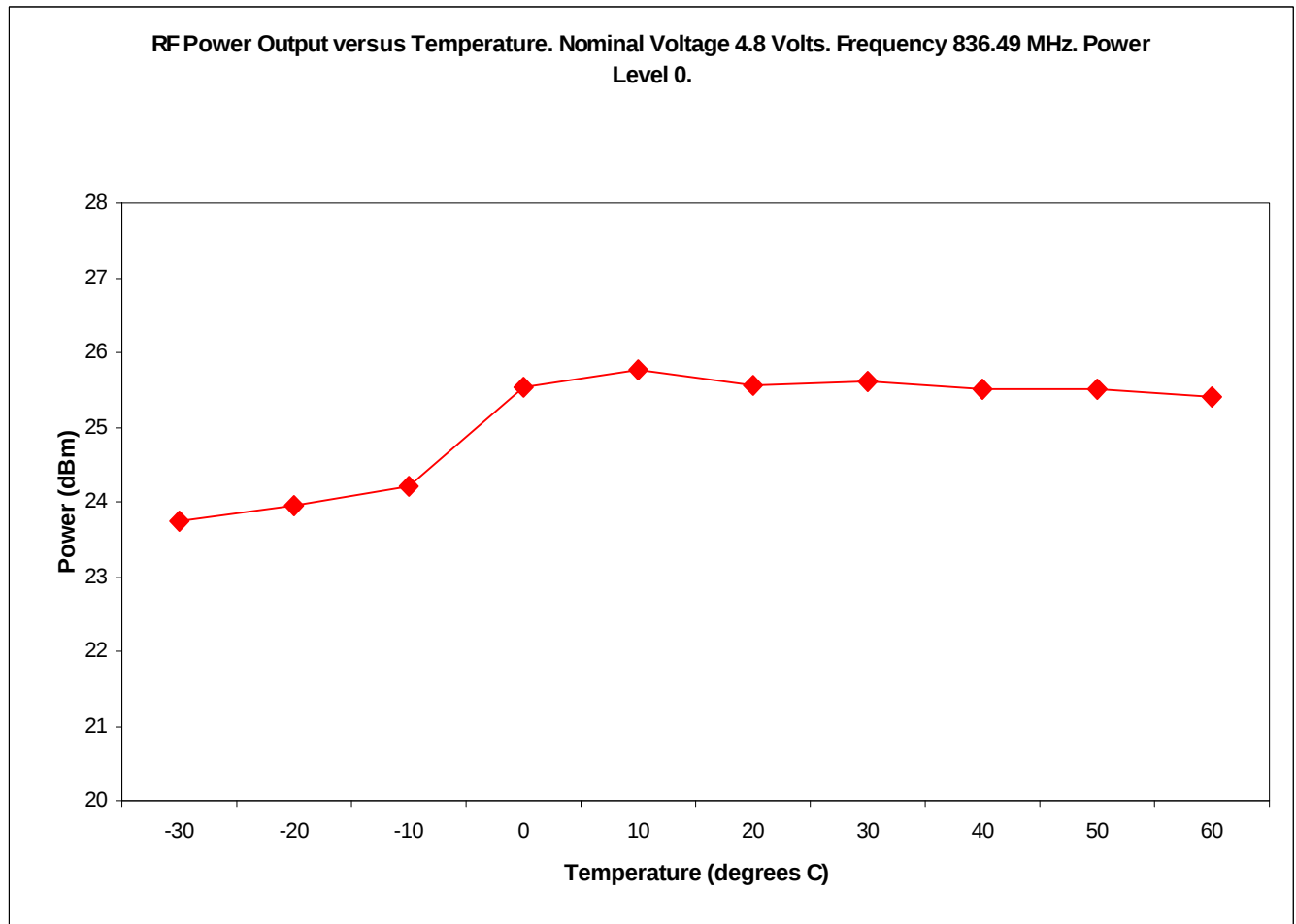
EFFECTIVE RADIATED POWER

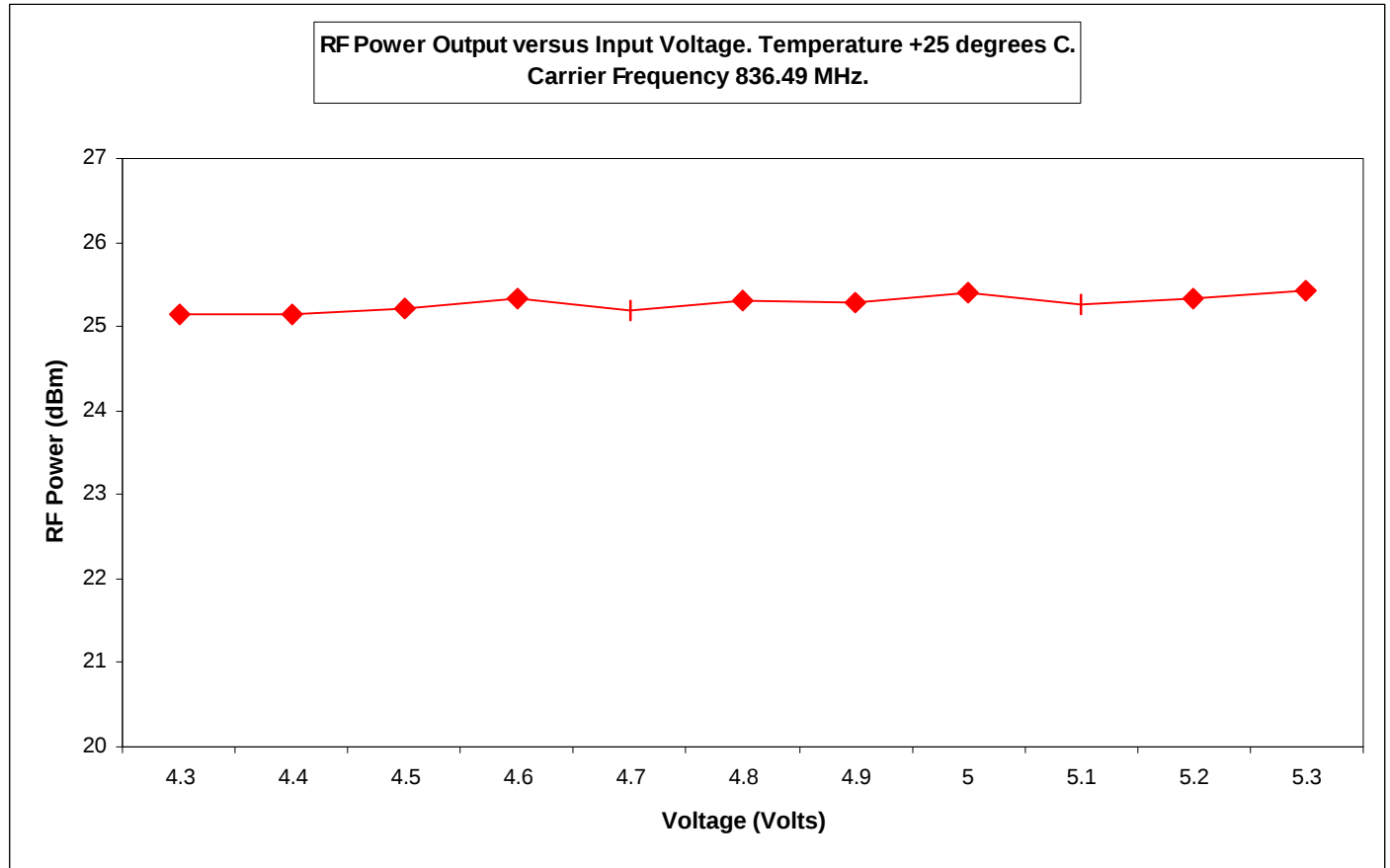
The following is a description of the substitution method used in accordance with IS-137A to obtain accurate EDRP readings at the carrier fundamental frequency:

1. The unit under test is placed 3 m away from the measurement antenna in vertical position. The measurements are made by using calibrated antennas and equipment with known cable losses.
2. A maximized measurement is made by raising and lowering the measurement antenna and rotating the EUT 360 degrees. Horizontal and vertical polarization data is recorded as reference.
3. A generator, an amplifier, and a half-wave dipole antenna are then substituted for the EUT.
4. Data obtained with known power levels into the substitution antenna are then compared to the reference reading. The EDRP of the product is calculated.

Table: EDRP

Mode	f (MHz)	* Radiated (dBm/mW)
DAMPS	824	24.4/275.4EDRP
	837	27.0/501.2EDRP
	849	25.7/371.5EDRP





800 DAMPS MODULATION CHARACTERISTICS

2.1033 (c)(13)

The transceiver shall be capable of generating $\pi/4$ shifted differentially encoded quadrature phase shift keying signals. The transmitted signal is given by:

$$S(t) = \sum_n g(t-nT) \cos(\phi_n) \cos(\omega_c t) - \sum_n g(t-nT) \sin(\phi_n) \sin(\omega_c t)$$

where $g(t)$ is the pulse shaping function that corresponds to a square root raised cosine baseband filter with roll off factor of 0.35, ω_c is the radian carrier frequency, T is the symbol period, and ϕ_n is the absolute phase corresponding to the n th symbol interval. The symbol rate ($1/T$) is 24.3 k symbols /sec.}

The modulation accuracy requirement is specified by setting limits on the RMS difference between the actual transmitted signal waveform and the ideal signal waveform. The ideal waveform is derived mathematically from the specification of modulation shown above. The specified requirement is error vector magnitude.

For this measurement, frequency accuracy shall meet the requirements of Section 3.1 prior to measurement.

The average carrier frequency error is the difference between the average carrier frequency of the actual transmitted waveform and the average signal waveform carrier frequency.

The ideal modulation is defined above. The definition is such that, observing an ideal transmitter through an ideal root raised-cosine receiver filter at the correct sampling instants one symbol apart would result in the sequence of values given by:

$$S(k) = S(k-1)e^{j\{\pi/4 + B(k)*\pi/2\}}$$

where $B(k) = 0, 1, 2, 3$ according to the following table:

X _k	Y _k	B(k)
0	0	0
0	1	1
1	1	2
1	0	3

In the forward channel, $S(k)$ forms part of a continuous data stream. In the reverse channel, the transit bursts from the mobile are truncated by power up and down ramping. In this case, $S(6)$ is the first sample that enters into demodulation, which yields the first two information bits by comparing $S(6)$ with $S(7)$. The last information bits lie in the comparison of $S(162)$ and $S(161)$.

The ideal transmit and receive filters in cascade form a raised cosine Nyquist filter having an impulse response going through zero at symbol period intervals, so there is no inter-symbol interference at the ideal sampling points. The ideal signal sampler therefore, take on one of the eight values defined above, at the output of the receive filter.

This section defines how the output signal from a transmitter is to be evaluated against the ideal signal.

Let $Z(k)$ be the complex vectors produced by observing the real transmitter through an ideal measuring receive filter at instants k , one symbol period apart. With $S(k)$ defined as above, the transmitter is modeled as:

$$Z(k) = [C0 + C1 * [S(k) + E(k)]] * W^k$$

where:

$$k = n/24.3\text{KHz}$$

$$W = e^{j\phi}$$

accounts for both a frequency offset giving “ ϕ ” radians per symbol phase rotation and an amplitude changes of “ ϕ ” nepers per symbol:

$C0$ is a constant origin offset representing quadrature modulator imbalance,
 $C1$ is a complex constant representing the arbitrary phase and output power of the transmitter, and
 $E(k)$ is the residual vector error on sample $S(k)$

The sum square vector error is then:

$$\sum_{k=\text{MIN}}^{k=\text{MAX}} |E(k)|^2 \quad \sum_{k=\text{MIN}}^{k=\text{MAX}} |([Z(k) * W^{-C0}/C1] - S(k))|^2$$

$C0$, $C1$ and W shall be chosen to minimize this expression and are then used to compute the individual vector errors $E(k)$ on each symbol. The symbol timing phase of the receiver output samples used to compute the vector error shall also be chosen to give the lowest value.

The values of MAX and MIN for the reverse channel (mobile station transmitter) are:

$$\text{MIN} = 6$$

$$\text{MAX} = 162$$

The RMS vector error is then computed as the square root of the sum-square vector divided by the number of symbols in the slot, (157 in the reverse direction).

Method of Measurement

Connect the mobile station to the Standard Test Source and Modulation Accuracy Equipment. Modulate the Standard Test Source with pseudo-random Data Field bits. The mobile station shall transpond the Data Field bits using the TDMAON command. Use the Modulation Accuracy Measurement Equipment to measure the modulation accuracy of the mobile station.

Minimum Standard

The RMS vector error in any burst shall be less than 12.5%. In addition, the normalized error vector magnitude during the first 10 symbols (20 bits) of a burst following the ramp-up, must have an RMS value of less than 25% when averaged over 10 bursts within a 1 minute interval. The minimum standard for frequency offset is specified in section 3.1.2.2.3 of IS 137. The origin offset in any burst shall be less than -20 dBc.

800 MHz DAMPS OCCUPIED BANDWIDTH

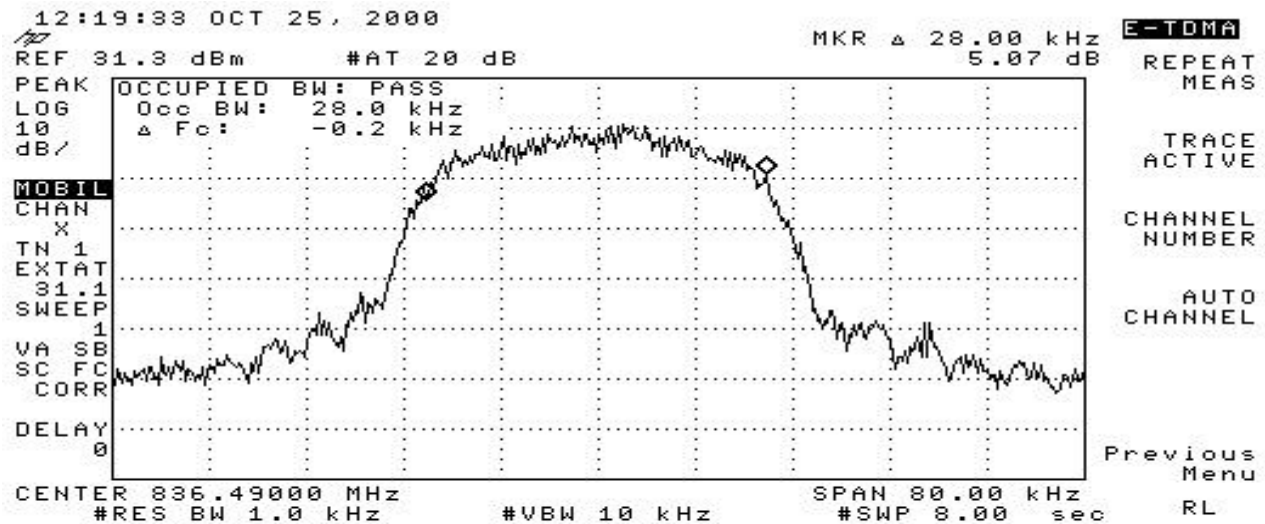
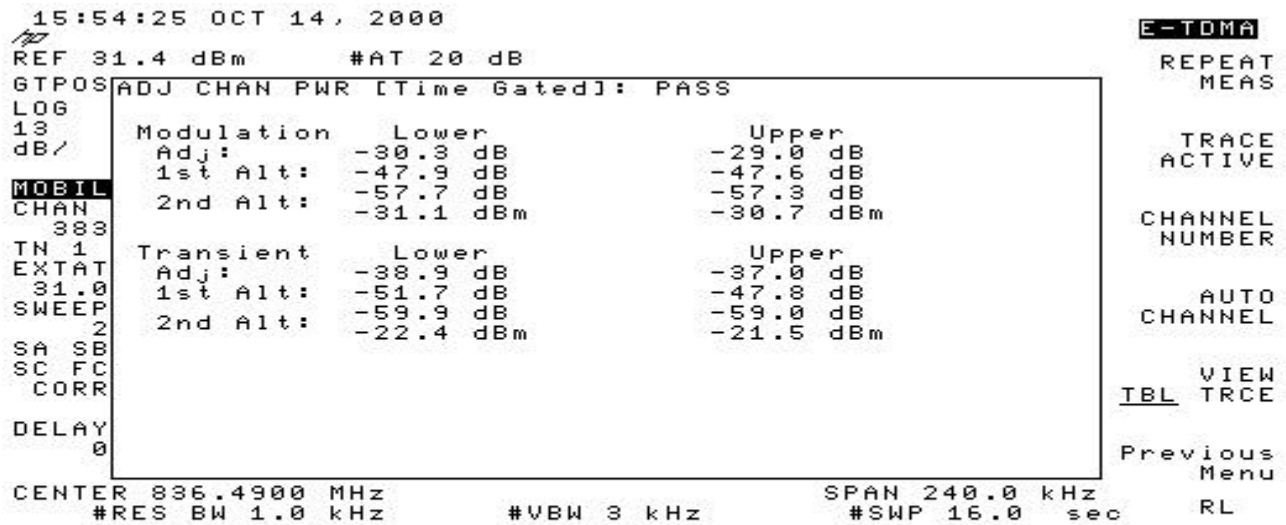
Part 2.1049 and 22.901 (d) the exhibit presented show the modulation that exist in a DAMPS cellular system:

<u>Exhibit #</u>	<u>Description</u>	<u>Power Level</u>
6I2	48.6kb/s Wideband Data	0

The measurements were made per IS-137A using a Hewlett Packard 8953DT North American Dual Mode Cellular Test System which includes the following equipment:

HP 8593E Spectrum Analyzer 9 kHz – 22 GHz
Anritzu MT 8802A Radio Communications Analyzer 300 kHz – 3 GHz
HP EPM-441A Power Meter

Exhibit 612



Plots showing occupied bandwidth of 28 kHz and alternate and adjacent power.

800 MHz DAMPS SPURIOUS EMISSIONS (CONDUCTED)

Per 2.1051, 22.917(e) Spurious emissions at the antenna terminals (conducted) when properly loaded with an appropriate artificial antenna were measured per IS-137A.

Per 22.917f, the mean power of any emissions from the mobile's transmit antenna connector does not exceed the - 80dBm level in the base station frequency range of 869MHz to 894MHz.

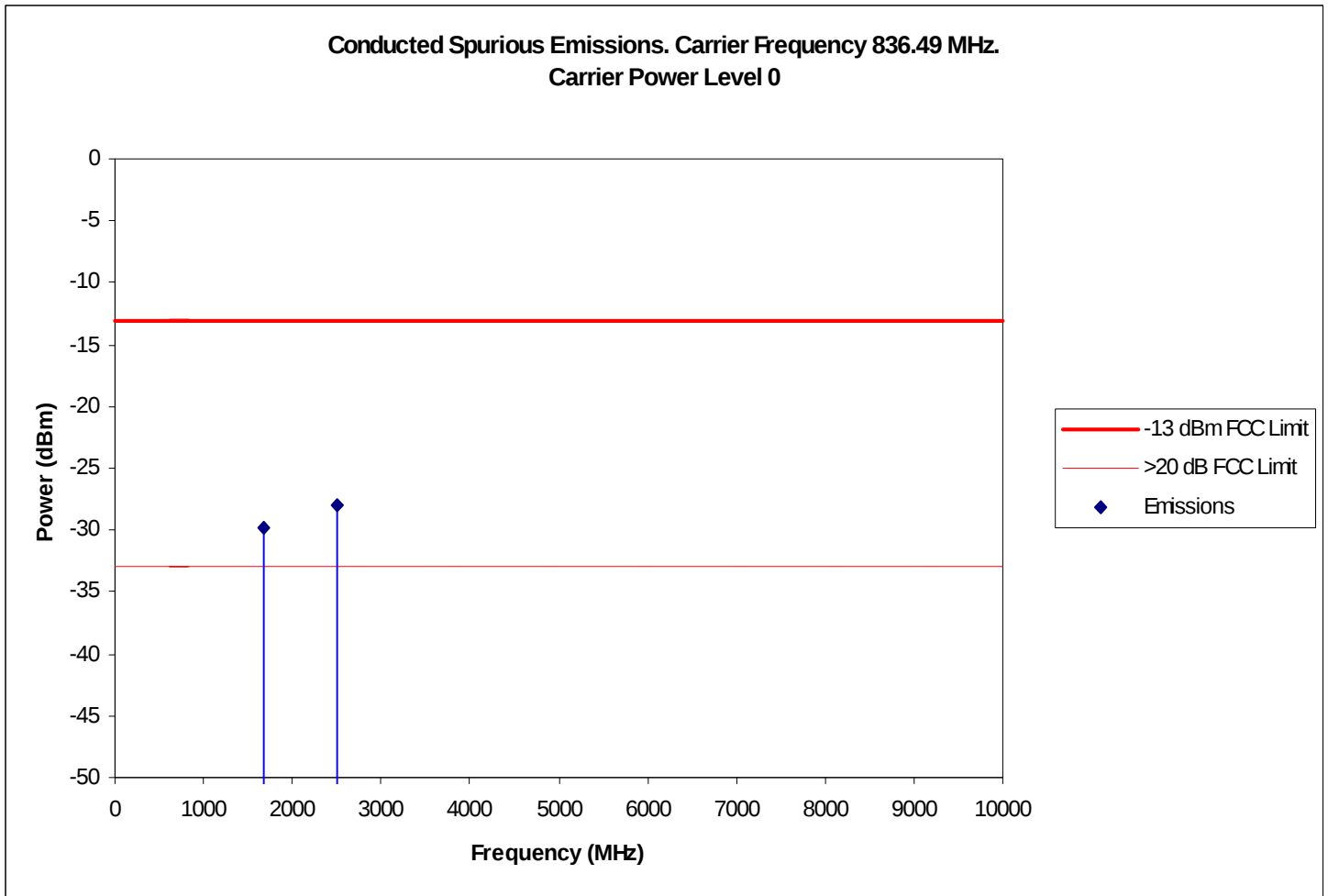
Note: The spectrum was examined through the 10th harmonic of the carrier. Measurements recorded are peak measurements.

<u>EXHIBIT #</u>	<u>FREQUENCY</u>	<u>Output Power Level</u>
6J2	Mid-Band	0
6J3	Mid-Band	10
6J4	Base Band	0; -80dBm per 22.917(f)

The measurements were made per IS-137A using the following equipment:

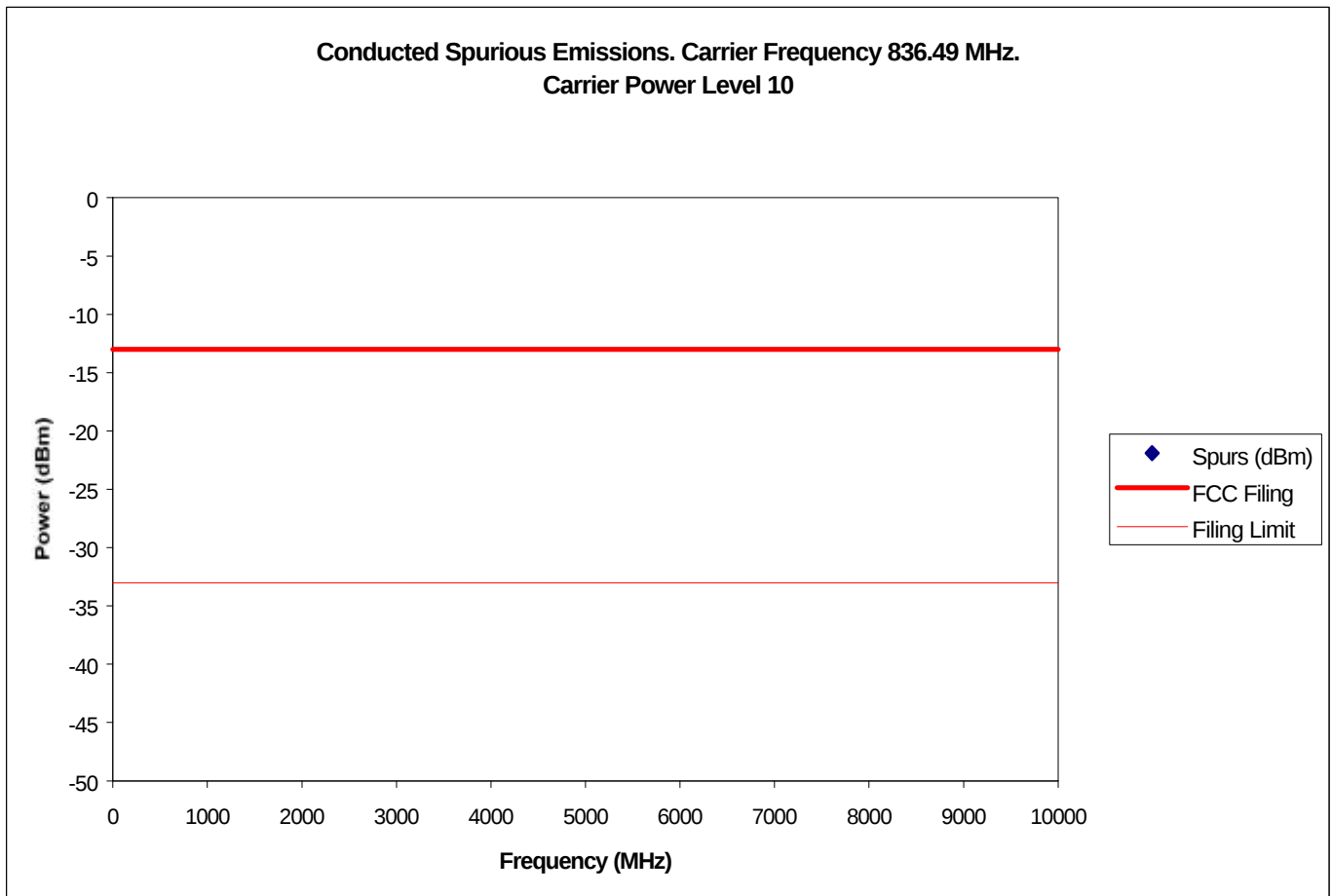
HP E7405A EMC Spectrum Analyzer 9 kHz – 26.5 GHz
HP EPM-441A Power Meter
HP 66309B Dual Output Mobile Comm. DC Source

EXHIBIT 6J2



No other spurious emissions found within 20dB of limit

EXHIBIT 6J3



No spurious emissions found within 20dB of limit

EXHIBIT 6K1

800 MHz DAMPS SPURIOUS EMISSIONS RADIATED

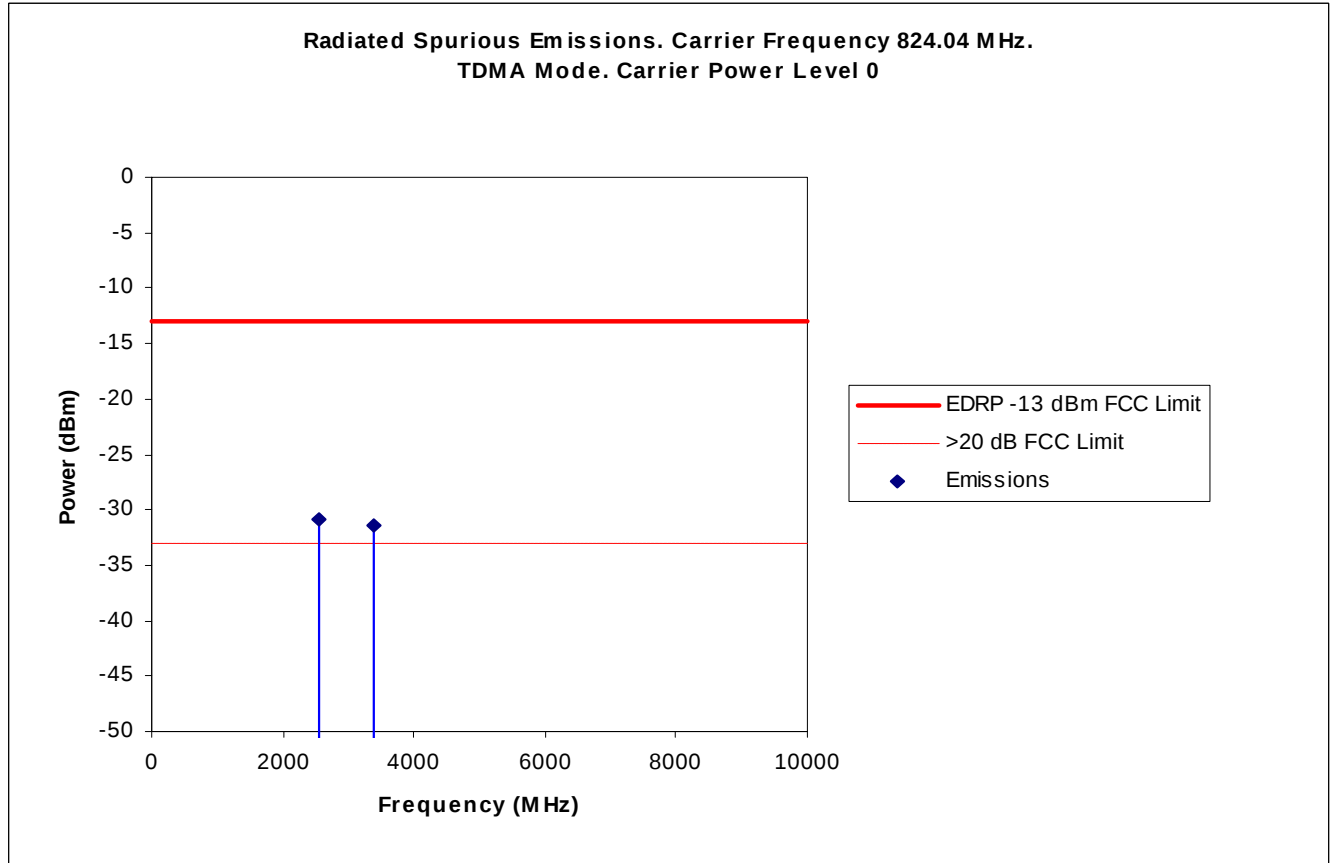
Per 2.1053 and 22.917 (e), field strength of spurious radiation was measured at Underwriters Laboratories Inc. Research Triangle Park, NC site. The measurement procedure is per EIA IS-137 conducted on a 3-meter test site. Results are shown on the following Exhibits.

Note: The spectrum was examined through the 10th harmonic of the carrier. Maximum radiated emissions were recorded.

<u>EXHIBIT</u>	<u>FREQUENCY</u>	<u>OUTPUT POWER LEVEL</u>
6K2	824.04 MHz	0

The measurements were made per IS 137 using a Hewlett Packard 8953DT North American Dual Mode Cellular Test System which includes the following equipment:

HP8566B Spectrum Analyzer 100Hz 25GHz / 2 – 22GHz
HP 83752A Signal Generator (S/N: 361DA01426)
30dB Amplifier - Amplifier Research (AR) (S/N: 23413)
Power Meter - Rhode & Schwartz (S/N: DE21529)
Power Sensor (S/N: 8479771011)
2 Test Cables (S/N's: ZATA21, ATA055)
20dB Pad (S/N: ATA005)
EMCO 3115 Double Ridge Horn Antenna
Test Fixture (Fixture provides height adjustment for mobiles and antennas according to FCC requirements)



800 MHz DAMPS FREQUENCY STABILITY

Per 2.1055 (a)(1)(b)(d)(2), 22.355

<u>EXHIBIT #</u>	<u>Voltage</u>	<u>Temperature</u>
6L2	4.3 to 5.3 Volts (varied)	+25 C
6L3	4.8	Varied (10 C increments)

Note: The manufacturers rated voltage for the battery is 4.3 VDC to 5.3 VDC.

The measurements were made per IS-137A using a Hewlett Packard 8953DT North American Dual Mode Cellular Test System which includes the following equipment:

HP 66309B Dual Output Mobile Comm. DC Source
HP 83712B CW Signal Generator 10 MHz – 20 GHz
Anritzu MT 8802A Radio Communications Analyzer 300 kHz – 3 GHz

