Cover Letter

Federal Communications Commission
Authorization and Evaluation Division

Re: Application for Cellular Transceiver Type Acceptance

QUALCOMM herein submits the Application for Equipment Authorization (FCC Form 731) and Exhibits for Type Acceptance of a Cellular Transceiver, FCC ID J9CPDQ-800.

Applicant: QUALCOMM, INC.
6455 Lusk Blvd.
San Diego, California 92121

Manufacture: QUALCOMM, INC.
10300 Campus Point Drive
San Diego, California 92121

The equipment, QUALCOMM model # PDQ-800, is for mobile station cellular system use, and is in full compliance with all parts of EIA/TIA/IS-98-A Mobile Station-Land Station Compatibility Specification, issue July 1996.

Information about how the ESN protection requirements are met is provided in Exhibit 3.

Request of Confidentiality

Federal Communications Commission
Authorization and Evaluation Division

Re: Request of Confidentiality

Pursuant to Sections 0.457 and 0.459 of the Commission's Rules, the Applicant hereby requests confidential treatment of information accompanying this Application as outlined below:

Description

All schematics/block diagrams
All parts lists

The above materials contain trade secrets and proprietary information not customarily released to the public. The public disclosure of these matters might be harmful to the Applicant and provide unjustified benefits to its competitors.

The Applicant understands that pursuant to Rule 0.457, disclosure of this Application and all accompanying documentation will not be made before the date of the Grant for this Application.

QUALCOMM, INC.

Jay Moulton
Director, Engineering

List of Exhibits

Exhibit	Description	FCC Reference
1	Certification of Test Data	2.911
2	General Information	2.983(c), (d), 2.1061,
3	ESN Protection	22.919
4	List of Semiconductor Devices	2.983(d)(6)
5	RF Output Power Measured Data	2.985
6	Modulation Audio Response Measured Data	2.987(a), 22.907(a)
7	Modulation Limiting Measured Data	2.987(b),
8	Occupied Bandwidth Measured Data	2.989, 22.917
9	Conducted Spurious Emissions Measured Data	2.991
10	Radiated Spurious Emissions Measured Data	2.993
11	Frequency Stability vs. Temperature and Voltage Measured Data	2.995
12	Measurement Procedures and Techniques	
13	FCC Letter of Site Recognition	
14	Circuit Diagram	2.983(d)(7)
15	Identification (Labels) Information	2.983(f)
16	Photographs	2.983(g)
17	User's Manual	2.983(d)(8)
18	SAR data	

Exhibit 1

Certification of Test Data

The data , data evaluation and equipment configuration represented herein are a true and accurate representation of the measurements of the sample's radio frequency interference emissions characteristics as of the dates and at the times of the test under the conditions herein specified. This applies to all tests that where performed that did not require an Open Area Test Site (OATS). Test that required an OATS site were performed by TUV Product Services.

Equipment Tested:

Dates of Test: November 12 – December 10 1998

Test Performed by:

Engineer: Robert J. Scodellaro,

Exhibit 2

General Information

1. Production Plans - Section 2.983 (c)

   Quantity Production Planned

2. Technical Description - Section 2.983 (d)

   (1) Types of emission

   40K0F8W
   40K0F1D
   1M25F9W

   F3E voice
   F3D supervisory audio tones, signaling tones
   F1D wideband data signal

   (2) Frequency range

   The frequency range of the equipment if Domestic Public Cellular Radio Telecommunications Service bands, 824 - 849 MHz and 869 - 894 MHz regardless of whether in cellular system operation for FM or CDMA modulation. The channel spacing is 30 kHz for FM and 1.25 MHz for CDMA.

   (3) Operating power levels

   The transmitter output power is independent of whether the equipment operates in the cellular system FM or CDMA mode. The equipment supports Class 3 Mobile Station Power Class, and its power output capability is reported to the Land Station via Station Class Mark. The equipment will respond to commands from the Land Station to change power levels as defined in the EIA/TIA/IS-98 Specification.

   (4) Maximum output power

   The equipment supports the maximum output power for Class 3 Mobile Station which is -2 dBW ERP, and meets the 7 W ERP (+8 dBW) maximum power limitation of Section 22.904.

   (5) DC supply voltage and current range

   The equipment is powered by lithium ion rechargeable batteries which have a voltage range of 6.6 to 8.6 Vdc.

   (6) List of semiconductor active devices

   Separate attachment.

(7) Circuit diagram

Separate attachment.

(8) User's manual

Separate attachment.

(9) Transmitter adjustment procedure

All frequency adjustments are set at the factory and there are no frequency field adjustments for this product. Under digital mode, frequency is locked to the base station and controlled by VCTCXO adjustments to offset any possible errors.

(10) Frequency stability device

A voltage controlled, temperature compensated, crystal oscillator (VCTCXO) is employed as a frequency reference for all of the transceiver local oscillators. This crystal oscillator is specified to remain within +/- 2.5 ppm over temperature and voltage variations. The lock status indicator of all synthesizers is monitored by the microprocessor and an out of lock condition will inhibit transmission. In FM and CDMA modes, the mobile receiver monitors the received signal and adjusts the frequency of the VCTCXO, this corrects any errors between the mobile frequency and the base station transmitter. The mobile is locked to the base station.

(11) Spurious radiation suppression devices

Reference Designator	Part Name	Function
FL6	duplexer	Provides protection against transmitter spurious emissions and receiver local oscillator leakages.
FL5	ceramic filter	Provides suppression of spurious energy and transmitter harmonics.
FL4	TX SAW filter	Provides protection against transmitter spurious emissions.

(12) Modulation techniques

AMPS Mode

The F3E audio modulation is accomplished through the use of Digital Signal Processor (DSP). The audio signal is converted to digital samples at 8 kHz sample rate. The samples are filtered, integrated, interpolated, and phase modulated at a 40 kHz rate. The resulting signal is then decomposed into I and Q signals, oversampled again at 160 kHz rate, and then sent to the digital-to-analog converter after proper filtering. The transmit audio modulation limiting function is performed digitally in the DSP. The pre-emphasis is performed through an IIR filter and the filtering of audio frequencies is performed through an FIR filter in DSP. The combined performance of these filters is shown in Exhibit 6 along with the actual audio frequency response of the modulated carrier signal. The DSP clocks are locked to the reference VCTCXO output signal, and maintained within $\pm$ 2.5 ppm tolerance.

CDMA Mode

The CDMA mode is described in the following pages from the TIA/EIA /IS-95 Standard. The justification for the CDMA bandwidth of 1.25 MHz is that the chip rate is 1.228 MHz (see page 6-10 of IS-95). When we look 3 dB down from the signal we find 1.25 MHz. Channel spacing is normally set at this 1.25 MHz. Also, one can reference baseband filtering requirements (page 6-27 TIA/EIA/IS-95) for filtering frequency response limits.

6.1.3 Modulation Characteristics

6.1.3.1 Reverse CDMA Channel Signals

The Reverse CDMA Channel is composed of Access Channels and Reverse Traffic Channels. These channels shall share the same CDMA frequency assignment using direct-sequence CDMA techniques. Figure 6.1.3.1-1 shows an example of all of the signals received by a base station on the Reverse CDMA Channel. Each Traffic Channel is identified by a distinct user long code sequence: each Access Channel is identified by a distinct Access Channel long code sequence. Multiple Reverse CDMA Channels may be used by a base station in a frequency division multiplexed manner.

The Reverse CDMA Channel has the overall structure shown in Figure 6.1.3.1-2. Data transmitted on the Reverse CDMA Channel is grouped into 20 ms frames. All data transmitted on the Reverse CDMA Channel is convolutionally encoded, block interleaved. modulated by the 64-ary orthogonal modulation. and direct-sequence spread prior to transmission.

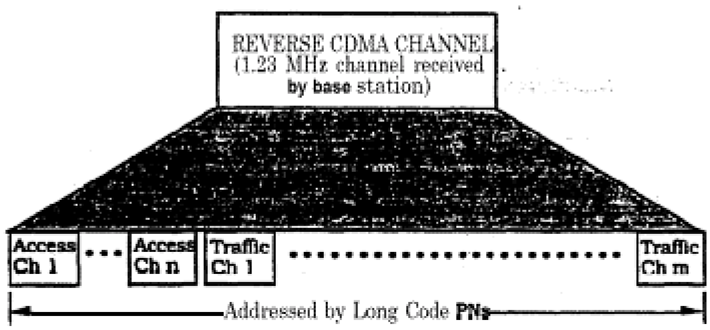


Figure 6.1.3.1-1. Example of Logical Reverse CDMA Channels Received at a Base Station

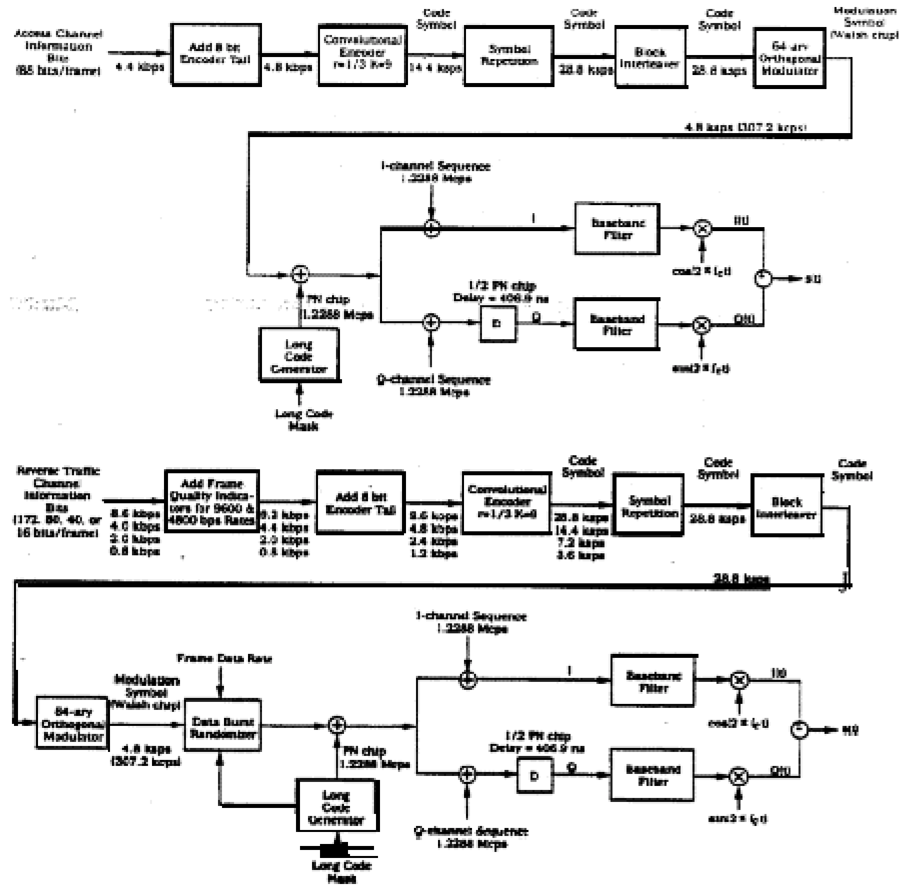


Figure 6.1.3.1-2. Reverse CDMA Channel Structure

After adding frame quality indicators for both the 9600 bps and 4800 bps rates (see 6.1.3.3.2.1) and adding eight Encoder Tail Bits (see 6.1.3.3.2.2), data frames may be transmitted on the Reverse Traffic Channel at data rates of 9600, 4800, 2400, and 1200 bps. The Reverse Traffic Channel may use any of these data rates for transmission. The transmission duty cycle on the Reverse Traffic Channel varies with the transmission data rate. Specifically, the transmission duty cycle for 9600 bps frames is 100 percent, the transmission duty cycle for 4800 bps frames is 50 percent, the transmission duty cycle for 2400 bps frames is 25 percent, and the transmission duty cycle for 1200 bps frames is 12.5 percent as shown in Table 6.1.3.1.1-1. As the duty cycle for transmission varies proportionately with the data rate, the actual burst transmission rate is fixed at 28.800

code symbols per second. Since six code symbols are modulated as one of 64 modulation symbols for transmission. the modulation symbol transmission rate is fixed at 4800 modulation symbols per second. This results in a fixed Walsh chip rate of 307.2 kcps. The rate of the spreading PN sequence is fixed at 1.2288 Mcps, so that each Walsh chip is spread by four PN chips. Table 6.1.3.1.1- 1 defmes the signal rates and their relationship for the various transmission rates on the Reverse Traffic Channel.

The numerology is identical for the Access Channel except that the transmission rate is fixed at 4800 bps after adding eight Encoder Tail Bits (see 6.1.3.2.2). Each code symbol is repeated once, and the transmission duty cycle is 100 percent. Table 6.1.3.1.1-2 defines the signal rates and their relationship on the Access Channel.

6.1.3.1.1 Modulation Parameters

The modulation parameters for the Reverse Traffic Channel and the Access Channel are shown in Table 6.1.3-1.1- 1 and Table 6.1.3.1.1-2, respectively.

Table 6.1.3.1.1-1. Reverse Traffic Channel Modulation Parameters

	Data Rate (bps)				
Parameter	**9600**	**4800**	**2400**	**1200**	**Units**
PN Chip Rate	1.2288	1.2288	1.2288	1.2288	Mcps
Code Rate	1/3	1/3	1/3	1/3	bits/code sym
Transmit Duty Cycle	100.0	50.0	25.0	12.5	%
Code Symbol Rate	28,800	28,800	28,800	28,800	sps
Modulation	6	6	6	6	code sym/mod symbol
Modulation Symbol Rate	4800	4800	4800	4800	sps
Walsh Chip Rate	307.20	307.20	307.20	307.20	kcps
Mod Symbol Duration	208.33	208.33	208.33	208.33	μs
PN Chips/Code Symbol	42.67	42.67	42.67	42.67	PN chip/code symbol
PN Chips/Mod symbol	256	256	256	256	PN chip/mod symbol
PN Chips/Walsh Chip	4	4	4	4	PN chips/Walsh chip

Table 6.1.3.1.1-2. Access Channel Modulation Parameters

	Data Rate (bps)	
Parameter	**4800**	**Units**
PN Chip Rate	1.2288	Mcps
Code Rate	1/3	bits/code sym
Code Symbol Repetition	2	symbols/code sym
Transmit Duty Cycle	100.0	%
Code Symbol Rate	28.800	sps
Modulation	6	code sym/mod symbol
Modulation Symbol Rate	4800	sps
Walsh Chip Rate	307.20	kcps
Mod Symbol Duration	208.33	μs
PN Chips/Code Symbol	42.67	PN chip/code sym
PN Chips/Mod symbol	256	PN chip/mod symbol
PN Chips/Walsh Chip	4	PN chips/Walsh chip

6.1.3.1.2 Data Rates

-The Access Channel shall support fixed data rate operation at 4800 bps.

The Reverse Traffic Channel shall support variable data rate operation at 9600.4800.2400. and 1200 bps.

6.1.3.1.3 Convolutional Encoding

The mobile station shall convolutionally encode the data transmitted on the Reverse Traffic Channel and the Access Channel prior to interleaving. The convolutional code shall be rate 1/3 and has a constraint length of 9. The generator functions for this code shall be go equals 557 (octal), g_1 equals 663 (octal). and g_2 equals 711 (octal). This is a rate 1/3 code generating three code symbols for each data bit input to the encoder. These code symbols shall be output so that the code symbol (c_0) encoded with generator function go shall be output first, the code symbol (c_1) encoded with generator function g_1 shall be output second. and the code symbol (c_2) encoded with generator function g_2 shall be output last. The state of the convolutional encoder. upon initialization, shall be the all-zero state. The first code symbol output after initialization shall be a codesymbol encoded with generator function g_0.

Convolutional encoding involves the modulo-2 addition of selected taps of a serially time-delayed data sequence. The length of the data sequence delay is equal to K- 1. where K is the constraint length of the code. Figure 6.1.3-1 .3- 1 illustrates the encoder for the code specified in this section.

6.1.3.1. 10 Baseband Filtering

Following the spreading operation, the I and Q impulses are applied to the inputs of the I and Q baseband filters as shown in Figure 6.1.3.1-Z. The baseband filters shall have a frequency response S(f) that satisfies the limits given in Figure 6.1.3.1. 10- 1. Specifically. the normalized frequency response of the filter shall be contained within $\pm\delta_1$ in the passband $0 \le f \le f_p$ and shall be less than or equal to -62 in the stopband $f \ge f_s$, The numerical values for the parameters are $\delta_1 = 1.5$ dB, $\delta_2 = 40$ dB, $f_p = 590$ kHz, and $f_s = 740$ kHz.

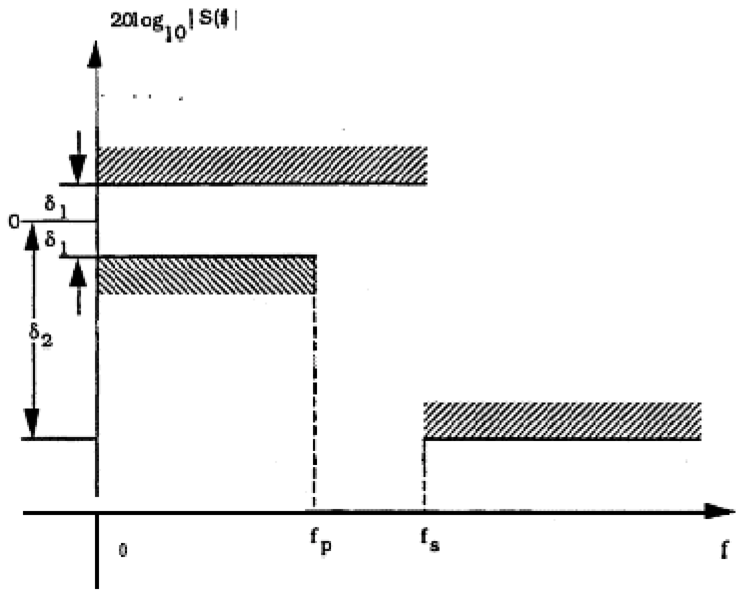


Figure 6.1.3.1.10-L Baseband Filters Frequency Response Limits

Let s(t) be the impulse response of the baseband filter. Then s(t) should satisfy the following equation:

$$\text{Mean Squared Error} = \sum_{k=0}^{\infty} |\alpha s(kT_s - \tau) - h(k)|^2 \le 0.03,$$

where the constants a and τ are used to minimize the mean squared error. The constant T_s is equal to 203.451... ns. which equals one quarter of a PN chip. The values of the coefficients h(k). for k c 48. are given in Table 6.1.3.1.10-l: h(k) = 0 for k ≥ 48. Note that h(k) equals h(47 - k).

Exhibit 3

ELECTRONIC SERIAL NUMBERS (ESN) Protection

The Cellular Portable Phone, FCC ID: J9CPDQ-800 use ESN. The ESN is a unique identification number to each phone which is contained in the Numeric Assignment Module and is automatically transmitted to the base station whenever a cellular call is placed. The ESN is stored in a EEprom and is isolated from fraudulent contact and tampering. Any attempt to change the ESN will render the portable phone inoperative.

The phone complies with all requirements for ESN under Part 22.919.

Exhibit 4

List of Semiconductor Devices

Separate attachment.

Exhibit 5

Transmitter RF Power - FCC part 2.985 (a)

Transmitter RF Conducted Power Output - FCC part 2, Paragraph 2.985 (a)

11/12/98

The RF output power was measured using the HP 8920B Communications Analyzer for AMPS mode and the HP 8594 Spectrum Analyzer with CDMA personality for CDMA mode.

		RF output power (W)	
carrier frequency (MHz)	channel	AMPS	CDMA
		measured	measured
824.04	991	0.36	0.24
836.49	383	0.37	0.24
848.97	799	0.37	0.23

Transmitter RF Radiated Power Output - FCC part 2, Paragraph 2.985 (a)

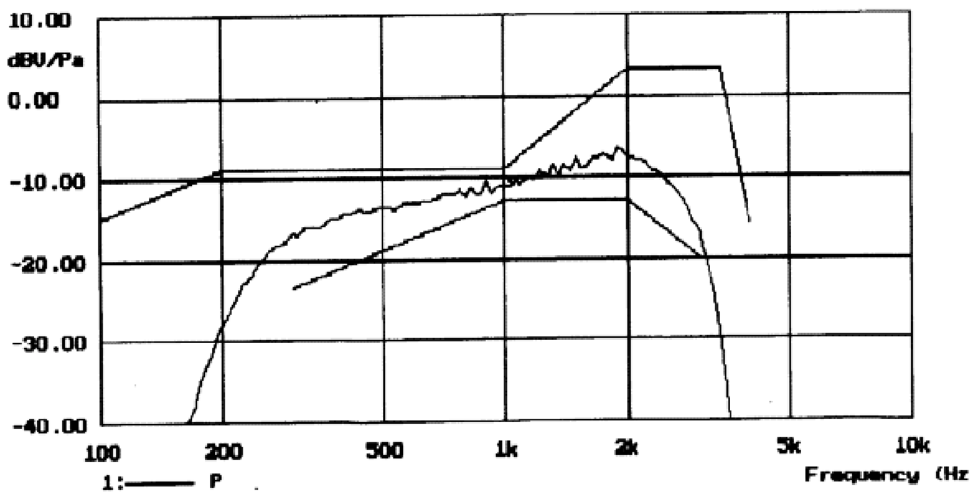
The RF output power was measured using the dipole equation, P=(ExD)squared/49.2,
where E is the field strenght in V/m, D is the distance at 3 meters and P is the output power in watts.

		RF output power (W)	
carrier frequency (MHz)	channel	AMPS	CDMA
		measured	measured
824.04	991	0.59	0.40
836.49	383	0.61	0.39
848.97	799	0.60	0.35

Exhibit 6

Modulation Audio Response Measured Data

Baseband Audio Response



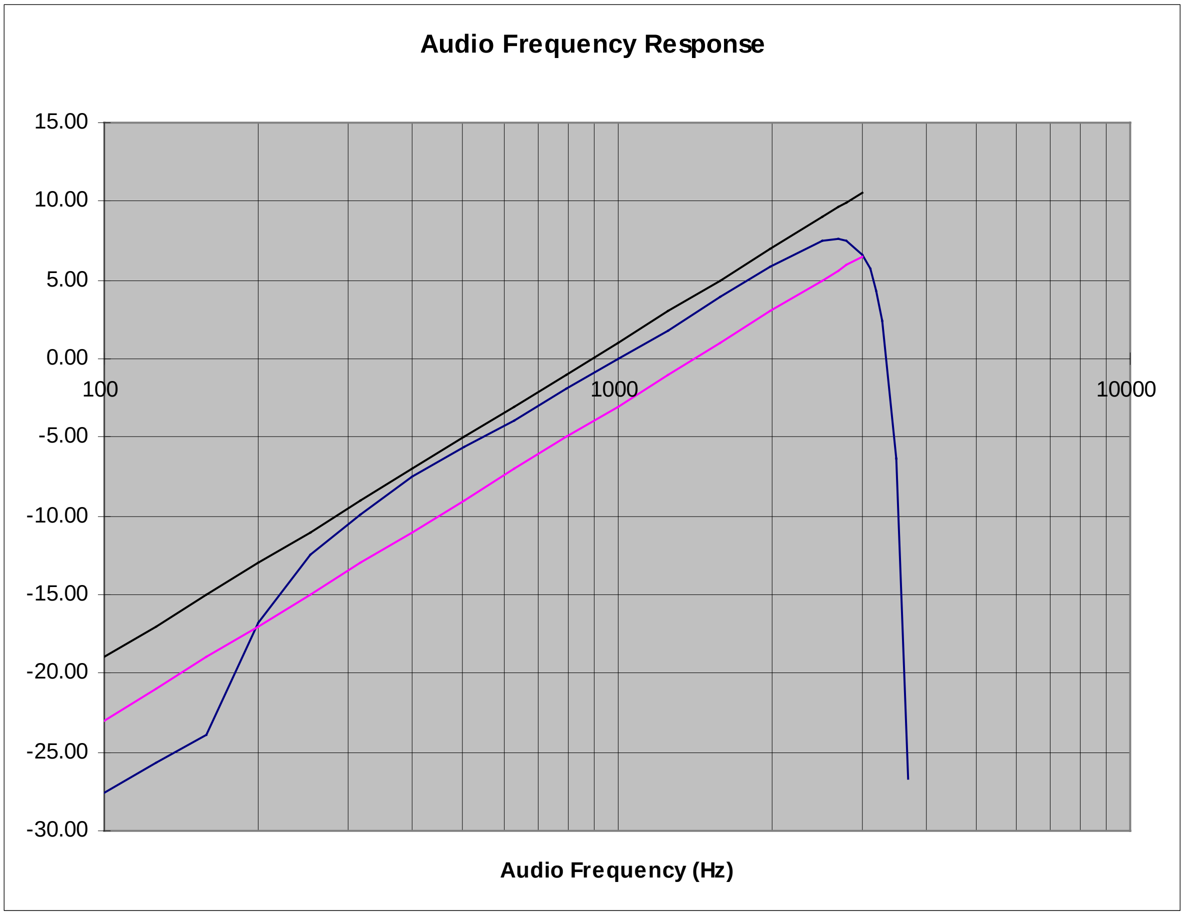
FCC ID:J9CPDQ-800 Transmit Frequency Response and TOLR (Reverse Link)
Modulation Audio Response–Baseband Response Reference 2.987

Transmitter Modulation Requirement - FCC part 2, Paragraph 2.987 (a)

Measured with HP8920 RF communication analyzer & HP 3588A spectrum analyzer
Measurements above 3,700 Hz were not possible due to excessively high audio tone.

Audio Frequency Response (< 3 kHz)

	audio freq (Hz)	audio level (mV)	dB relative to 1 kHz	lower limit	upper limit
1	100	1790	-27.54	-23	-19
2	126	1436	-25.63	-21	-17
3	158	1169	-23.84	-19	-15
4	200	520	-16.81	-17	-13
5	251	317	-12.51	-15	-11
6	316	236	-9.95	-13	-9
7	398	179	-7.54	-11	-7
8	501	144	-5.65	-9	-5
9	631	118	-3.92	-7	-3
10	794	93.7	-1.92	-5	-1
11	1000	75.1	0.00	-3	1
12	1259	61	1.81	-1	3
13	1585	48	3.89	1	5
14	1995	38.1	5.89	3	7
15	2512	31.6	7.52	5	9
16	2700	31.2	7.63	5.63	9.63
17	2800	31.5	7.55	5.94	9.94
18	3000	35.2	6.58	6.54	10.54
19	3100	39	5.69		
20	3200	45.5	4.35		
21	3300	56.7	2.44		
22	3500	157	-6.41		
23	3700	1627	-26.71		


Audio Frequency Response
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
100
1000
10000
Audio Frequency (Hz)

Audio Frequency Response (> 3 kHz)

freq	dev (dB)	dB from 3 kHz	upper limit
3000	-15.44	0.00	0.00
3500	-25.55	-10.11	-2.68
4000	-45.35	-29.91	-5.00
4500	-32.45	-17.01	-7.04
5000	-50.9	-35.46	-8.87
5900	-62.22	-54.00	-11.75
5900	-62.22	-54.00	-35.00
6000	-59.12	-54.00	-35.00
6100	-64.31	-54.00	-35.00
6100	-64.31	-54.00	-12.33
7000	-62.23	-46.79	-14.72
8500	-52.01	-36.57	-18.09
10000	-57.7	-42.26	-20.92
12000	-54.29	-38.85	-24.08
15000	-62.65	-47.21	-27.96
20000	-55.37	-39.93	-28.00
25000	-56.62	-41.18	-28.00
30000	-64.41	-48.97	-28.00

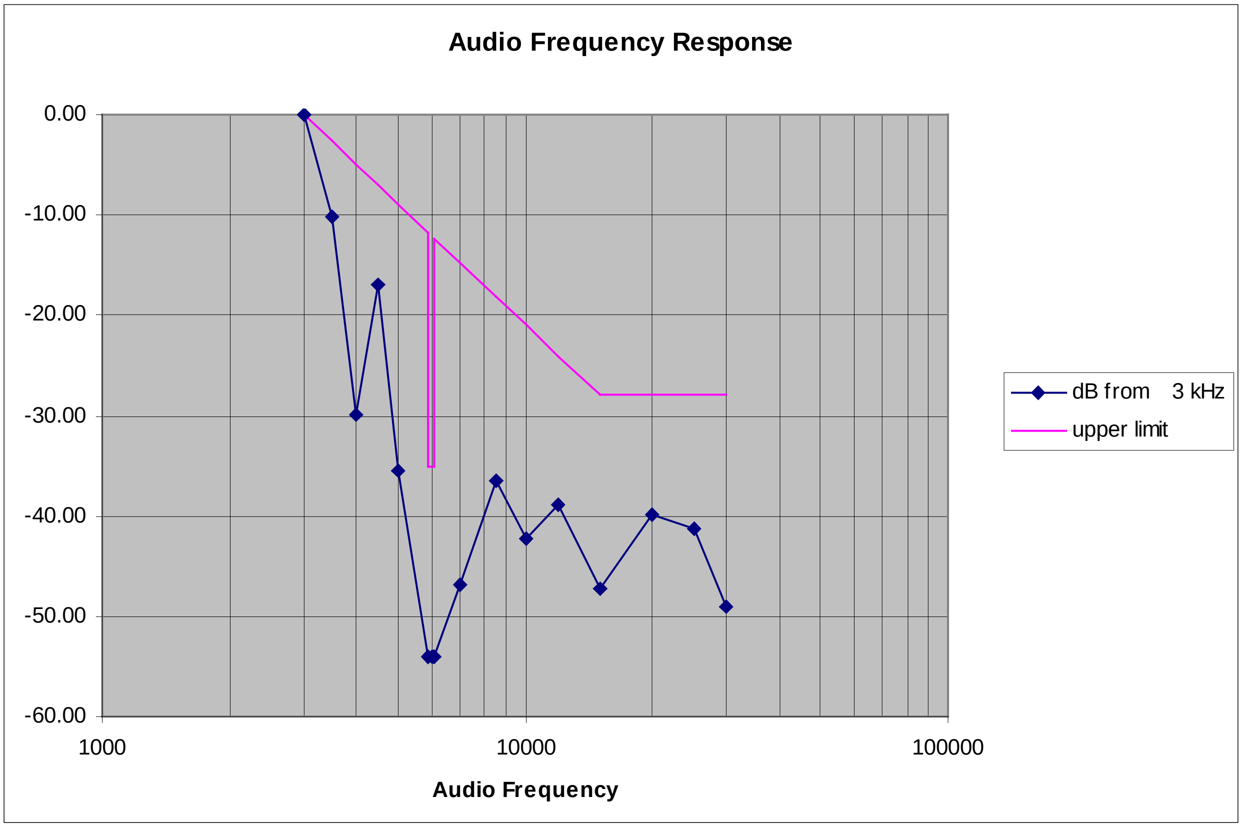

Audio Frequency Response
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
1000
10000
100000
Audio Frequency
dB from 3 kHz
upper limit

Exhibit 7

Transmitter Modulation Requirement - FCC Part 2, Paragraph 2.987 (b)

Modulation Limiting

audio input level (dB)	FM deviation (kHz peak)		
	modulation frequency		
(0dB=8kHz dev)	400 Hz	1 kHz	2.7 kHz
-25	1.11	2.12	5.11
-20	1.34	2.74	6.71
-15	1.61	3.49	7.91
-10	2.10	4.59	8.56
-5	2.61	6.02	8.69
0	3.34	8.00	8.92
5	4.94	10.10	8.97
10	7.98	10.83	8.99
15	9.65	10.71	8.98
20	9.72	10.48	8.99

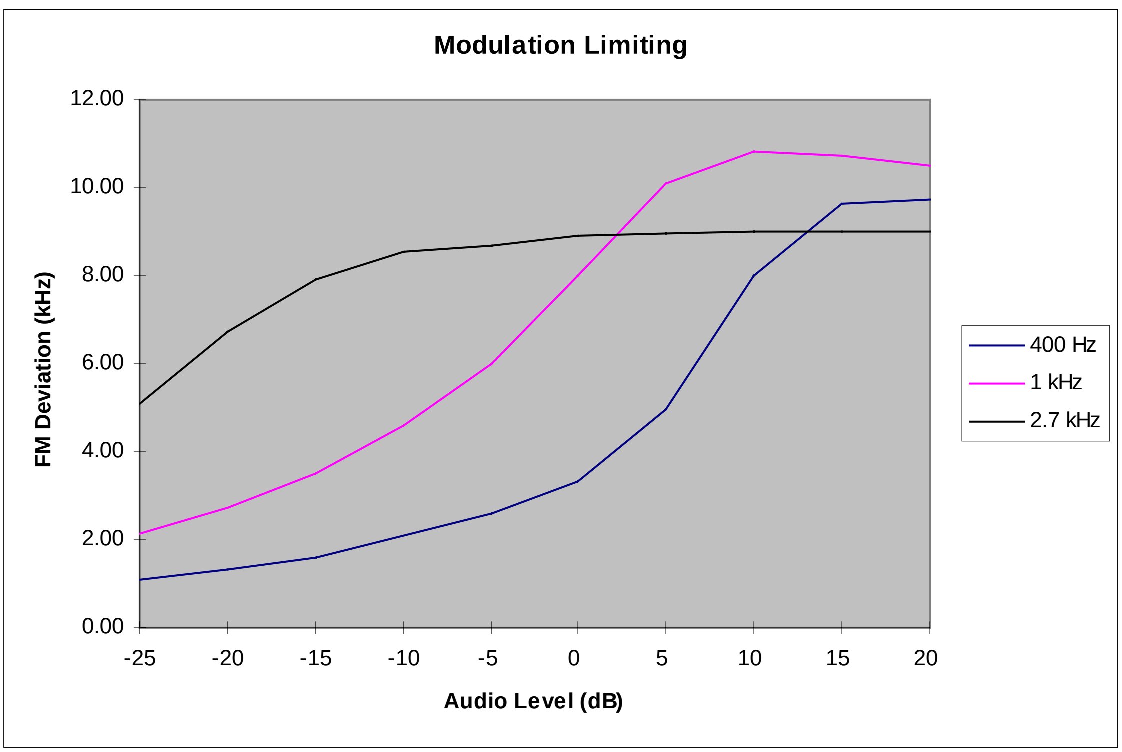


Exhibit 8

Occupied Bandwidth Measured

Separate attachment.

Exhibit 9

Conducted Emissions Test Results - FCC Part 22, Paragraph 2.991

Conducted Emission Test Results - FCC Part 2.991

Measured with 10 dB fixed attenuator in front of HP8593E spectrum analyzer.
Total measured cable/attenuator loss in front of spectrum analyzer : 10.5 dB

FM high power **fundamental levels**

	mid band - channel 383				low band - channel 991			
	freq (MHz)	measured level (dBm)	actual level (dBm)	specification limit (dBm)	freq (MHz)	measured level (dBm)	actual level (dBm)	specificati limit (dBm
1	836.49	15.1	25.6	-	824.04	15	25.5	-
2	1672.98	-81	-70.5	-13	1648.08	-86.4	-75.9	-13
3	2509.47	-90.2	-79.7	-13	2472.12	-86	-75.5	-13
4	3345.96	-83.8	-73.3	-13	3296.16	-85.6	-75.1	-13
5	4182.45	-83.1	-72.6	-13	4120.2	-81.5	-71.0	-13
6	5018.94	-83.3	-72.6	-13	4944.24	-67.4	-56.9	-13
7	5855.43	-83.9	-73.4	-13	5768.28	-85.9	-75.4	-13
8	6691.92	<-98.5	<-88.0	-13	6592.32	<-95.1	<-84.7	-13
9	7528.41	<-96.8	<-86.3	-13	7416.36	<-92.8	<-82.8	-13
10	8364.9	<-96.3	<-85.8	-13	8240.4	<-93.7	<-83.2	-13

CDMA high power

	mid band - channel 383				low band - channel 991			
	freq (MHz)	measured level (dBm)	actual level (dBm)	specification limit (dBm)	freq (MHz)	measured level (dBm)	actual level (dBm)	specificati limit (dBm
1	836.49	13.3	23.8	-	824.04	13.4	23.9	-
2	1672.98	-88.8	-78.3	-13	1648.08	-89.6	-79.1	-13
3	2509.47	-89.2	-78.7	-13	2472.12	-89.1	10.5	-13
4	3345.96	-89.3	-78.8	-13	3296.16	89.8	100.3	-13
5	4182.45	-90.4	-79.9	-13	4120.2	90.2	100.7	-13
6	5018.94	-88.4	-77.9	-13	4944.24	77.4	87.9	-13
7	5855.43	-89.6	-79.1	-13	5768.28	-90.4	-79.9	-13
8	6691.92	<-94.4	<-83.9	-13	6592.32	<-94.6	<-84.1	-13
9	7528.41	<-92.8	<-82.3	-13	7416.36	<-92.8	<-82.3	-13
10	8364.9	<-92.3	<-81.8	-13	8240.4	<-94.1	<-83.6	-13

Exhibit 10

Radiated Spurious Emissions Measured Data - FCC Part 2, Paragraph 2.993

Separate attachment.

Exhibit 11

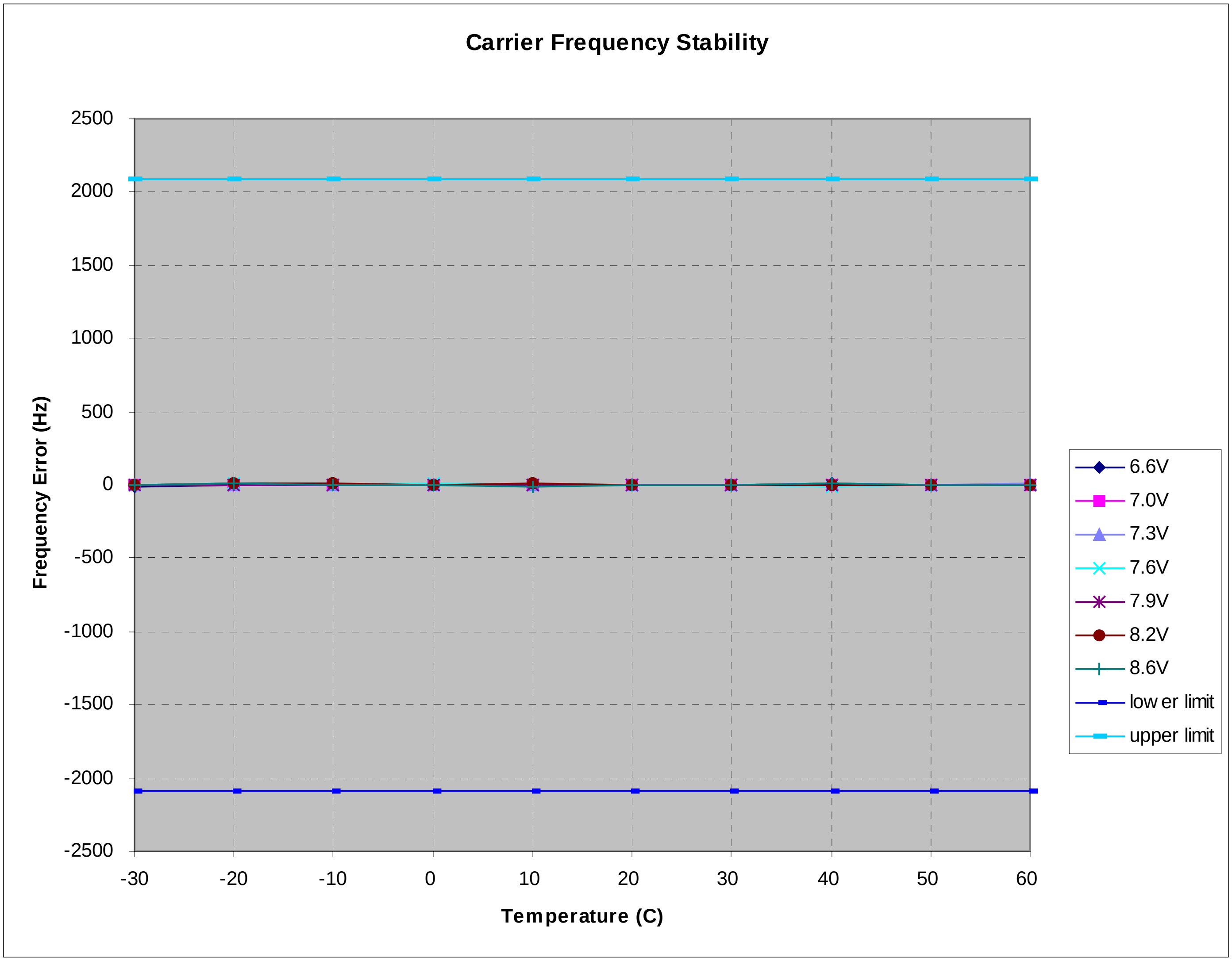
Transmitter RF Carrier Frequency Stability - FCC Part 2, Paragraph 2.995

Transmitter RF Carrier Frequency Stability - FCC part 2, Paragraph 2.995
Phone transmitting in FM mode, but with no modulation on the carrier

Measured with HP 8920 RF Communications Analyzer and HP 8560A Spectrum Analyzer

Carrier Frequency : 836.49 MHz FM

	transmitter carrier frequency							specification	
temperature (C)	6.6V	7.0V	7.3V	7.6V	7.9V	8.2V	8.6V	lower limit	upper l
-30	-13	6	-1	3	5	-3	4	-2091	2
-20	4	-5	0	8	-4	7	13	-2091	2
-10	5	3	-6	-2	3	8	5	-2091	2
0	0	-2	-5	9	-2	5	3	-2091	2
10	3	0	5	4	-6	10	-8	-2091	2
20	4	-3	-6	0	5	-2	2	-2091	2
30	2	6	-6	1	-6	3	-6	-2091	2
40	12	4	8	-10	4	-3	7	-2091	2
50	5	3	3	0	-2	-6	-4	-2091	2
60	2	4	13	-5	2	-4	2	-2091	2

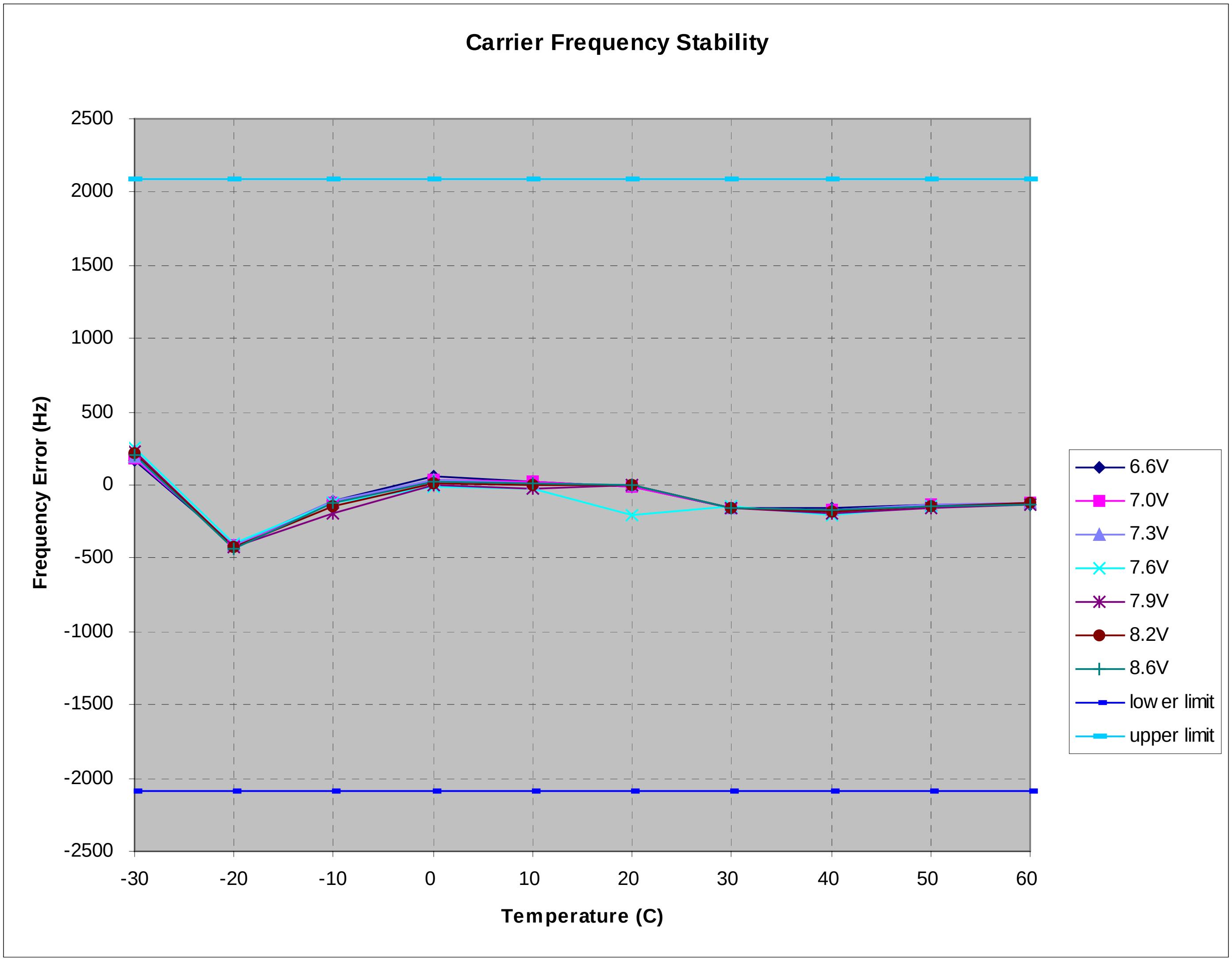

Carrier Frequency Stability
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
Frequency Error (Hz)
-30
-20
-10
0
10
20
30
40
50
60
Temperature (C)
6.6V
7.0V
7.3V
7.6V
7.9V
8.2V
8.6V
low er limit
upper limit

Transmitter RF Carrier Frequency Stability - FCC part 2, Paragraph 2.995
Phone transmitting in CDMA mode, but with no modulation on the carrier

Measured with HP8920 RF communication analyzer and HP8560A Spectrum Analyzer

Carrier Frequency : 836.49 MHz CDMA

	transmitter carrier frequency							specification	
temperature (C)	6.6V	7.0V	7.3V	7.6V	7.9V	8.2V	8.6V	lower limit	upper l
-30	172	185	198	251	226	213	206	-2091	2
-20	-413	-415	-416	-399	-418	-424	-430	-2091	2
-10	-104	-115	-112	-117	-189	-148	-125	-2091	2
0	56	42	31	-10	-5	7	20	-2091	2
10	27	21	17	-28	-21	-2	8	-2091	2
20	-10	-8	-4	-205	2	-2	-4	-2091	2
30	-158	-152	-160	-143	-154	-156	-160	-2091	2
40	-163	-165	-170	-202	-192	-181	-174	-2091	2
50	-129	-132	-135	-147	-152	-146	-140	-2091	2
60	-127	-122	-124	-132	-130	-120	-128	-2091	2



Carrier Frequency Stability
Frequency Error (Hz)
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
-30
-20
-10
0
10
20
30
40
50
60
Temperature (C)
6.6V
7.0V
7.3V
7.6V
7.9V
8.2V
8.6V
low er limit
upper limit

Exhibit 12

Measurement Procedures and Techniques

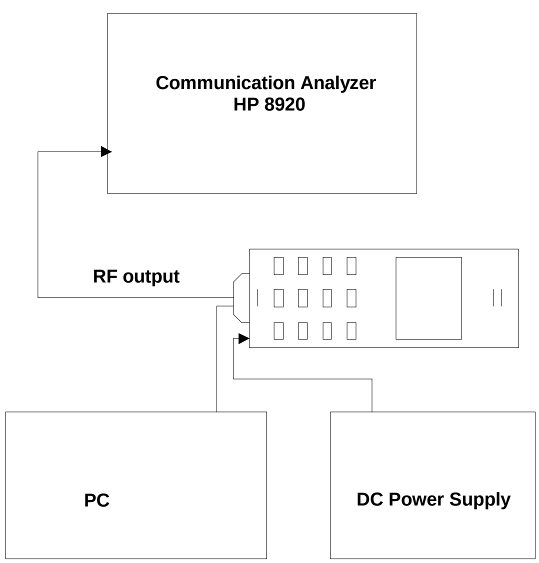
List of Equipment

Computer with Phone_T software

Spectrum Analyzers
HP8560E, S/N 3643A0680, CAL DUE 8/99
HP8594E, S/N 3710A04900, CAL DUE 12/17/99
HP8593E, S/N 3501A01547, CAL DUE 2/23/99
Audio Spectrum Analyzer
HP3588A, S/N 3005A00111, CAL DUE 2/28/99
Communication Test Set
HP8920B, S/N US35320824, CAL DUE 7/99
DC Power Supply

Measurement Procedures

RF Output Power

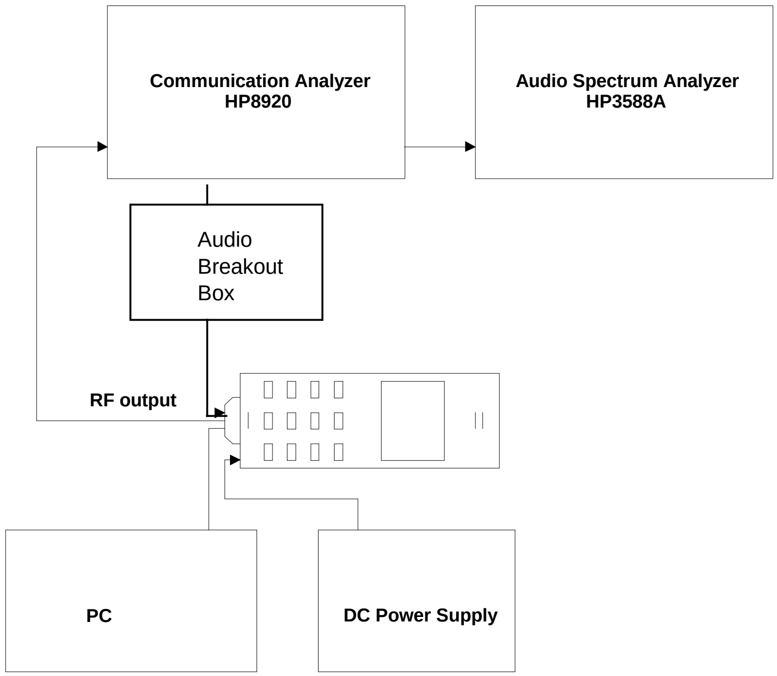


Definition - The output power rating of the transmitter is the power available at the output terminal of the transmitter when the terminal is connected to the normal load.

Method of Measurement - Measure the transmitter output carrier power without modulation using a communication test set for FM which has an RF wattmeter. An HP 8594E spectrum analyzer with the CDMA personality was used to measure CDMA mode.

Minimum Standard - The transmitter output power shall be maintained within +2 / -4 dB.

Modulation Audio Response



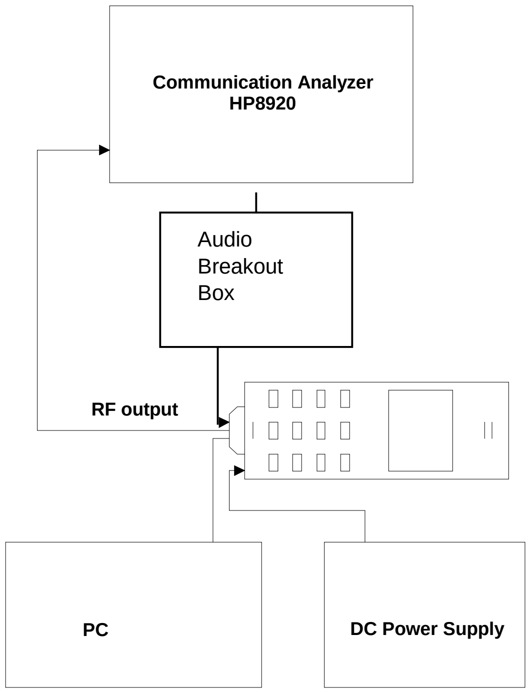
Definition - The transmitter audio frequency response is defined in terms of the degree of closeness with which the frequency deviation of the transmitter follows the prescribed 6 dB/octave pre-emphasis characteristic over a specified continuous audio frequency range while conforming to the required band-limiting conditions outside of that range.

Method of Measurement - Operate the transmitter with the compressor disabled, and monitor the output with HP8920 test receiver without de-emphasis. Apply a sine wave audio input to the transmitter external audio input port, vary the modulating frequency from 100 to 5000 Hz, and observe the input levels necessary to maintain a constant ± 2.9 kHz system deviation. Record the results. Adjust the audio input level to 20 dB greater than that required to produce ± 8 kHz deviation with 1 kHz tone. Vary the modulation frequency from 3 kHz to 30 kHz and observe the deviation while maintaining a constant audio input level. Use the audio spectrum analyzer to measure the output deviation at the same frequency as the input signal.

Minimum Standard - From 300 to 3000 Hz, the audio frequency response shall not vary more than +1 to -3 dB from a true 6 dB/octave pre-emphasis characteristic as referred to the 1000 Hz level (with the exception of a permissible 6 dB/octave roll-off from 2500 to 3000 Hz). Between 3 kHz to 30 kHz, the response shall not exceed that defined by the following table:

Frequency Range (f in kHz)	Attenuation Relative to 3 kHz (dB)
3 kHz ≤ f ≤ 5.9 kHz	40 log (f/3)
5.9 kHz ≤ f ≤ 6.1 kHz	35
6.1 kHz ≤ f ≤ 15 kHz	40 log (f/3)
15 kHz ≤ f ≤ 30 kHz	28

Modulation Limiting

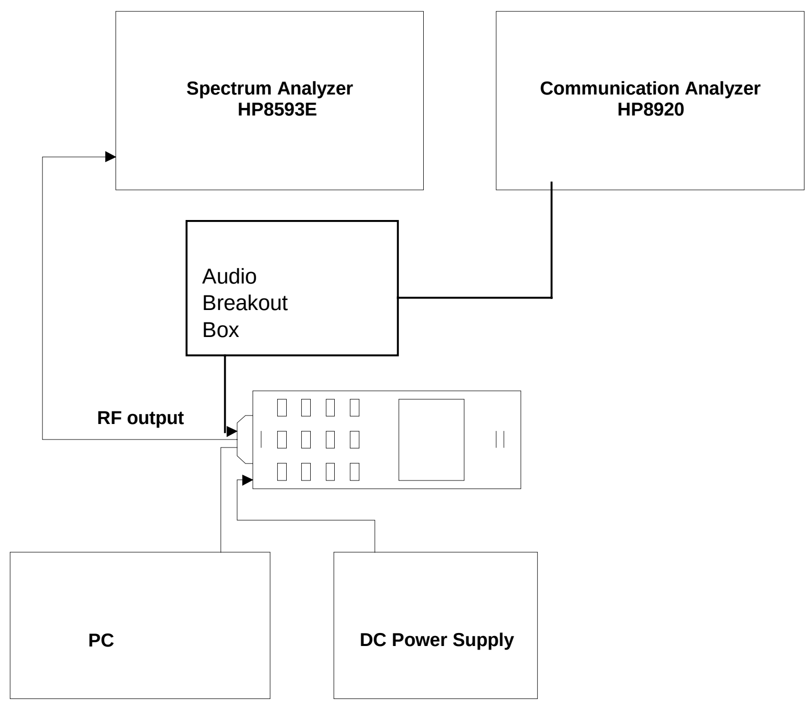


Definition - Modulation limiting refers to the ability of the transmitter circuits to prevent the transmitter from producing deviation in excess of rated system deviation.

Method of Measurement - With the compressor enabled and the SAT disabled, adjust the audio input for ± 8 kHz peak deviation at 1000 Hz. Increase the audio input level by 20 dB. With the input level held constant at the 20 dB, and observe the deviation for 400 Hz, 1000 Hz, and 2.7 kHz.

Minimum Standard - The peak deviation shall not exceed the rated system peak frequency deviation of ± 12 kHz at any time.

Occupied Bandwidth



Definition - The occupied bandwidth is defined as the spectrum noise produced at discrete frequency separations from the carrier due to all sources of unwanted noise within the transmitter in a modulated condition.

Method of Measurement - Use the spectrum analyzer and measure the following 8 modulating conditions: (1) For combined voice and SAT, disable the compressor, modulate with a 2500 Hz sine wave 13.5 dB greater than that required to produce ± 8 kHz peak deviation at 1000 Hz and a 6000 Hz SAT with ± 2.0 kHz peak deviation. (2) For combined Signaling Tone and SAT, modulate with a 10 kHz ST with ± 8 kHz peak deviation and a 6000 Hz SAT with ± 2.0 kHz peak deviation. (3) For wideband data, modulate with a quasi-random 10 kbps data pattern with ± 8 kHz peak deviation. (4) For CDMA, modulate with full rate. (5) For voice only, disable the compressor, modulate with a 2500 Hz sine wave 13.5 dB greater than that required to produce ± 8 kHz peak deviation at 1000 Hz. (6) For SAT only, modulate with a 6000 Hz SAT with ± 2.0 kHz peak deviation. (7) For ST only, modulate with a 10 kHz ST with ± 8 kHz peak deviation. (8) For combined SAT and DTMF, modulate with a 6000 Hz SAT with ± 2.0 kHz peak deviation and one of the DTMF tones.

Minimum Standard - The mean power of emissions from the transmitter with modulated carrier shall be attenuated below the mean power of the unmodulated carrier in accordance with the following.

(1) For all modulation: In a 300 Hz bandwidth centered on any frequency removed from the carrier by greater than 20 kHz up to and including 45 kHz, at least 26 dB.

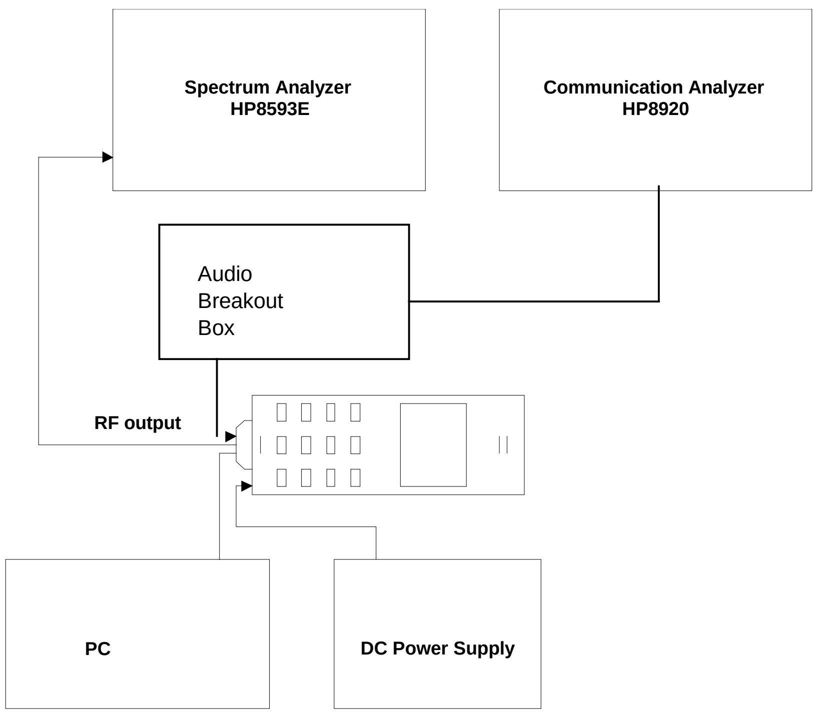
(2) For modulation by combined voice and SAT: In a 300 Hz bandwidth centered on any frequency removed from the carrier frequency by greater than 45 kHz, at least 63 + 10 log (mean output power in Watts) dB. Since the equipment is rated 0.6 W, the limit is 61 dB.

(3) For modulation by wideband data and combined ST and SAT: In a 300 Hz bandwidth centered on any frequency:

(a) More than 45 kHz up to and including 60 kHz, at least 45 dB.
(b) More than 60 kHz up to and including 90 kHz, at least 65 dB.
(c) More than 90 kHz up to the first multiple of the carrier frequency, at least 63 + 10 log (mean power in Watts) dB.

In addition, in a 30 kHz bandwidth centered anywhere between 869 and 894 MHz, the mean power of emissions from the transmitter with modulated carrier shall not exceed -80 dBm.

Conducted Spurious and Harmonic Emissions at Antenna Terminal



Definition - The conducted harmonic and spurious emissions are emissions at the antenna terminals on a frequency or frequencies that are outside the authorized bandwidth of the transmitter.

Method of Measurement - The transmitter shall be alternately modulated with combined voice and SAT and with wideband data. For combined voice and SAT measurements, diable the compressor, modulate with a 2500 Hz sine wave 13.5 dB greater than that required to produce ± 8 kHz peak deviation at 1000 Hz and a 6000 SAT with ± 2.0 kHz peak deviation. For wideband data measurements, the transmitter shall be modulated with a quasi-random 10 kbps data pattern with ± 8 kHz peak deviation. The measurement shall be made with a spectrum analyzer from the lowest radio frequency generated in the equipment to the 10th harmonic of the carrier except for that region within 75 kHz of the carrier frequency.

Minimum Standard - Conducted harmonic and spurious emissions shall be attenuated below the level of emissions of the carrier frequency by at least 43 + 10 log (mean output power in Watts) dB.

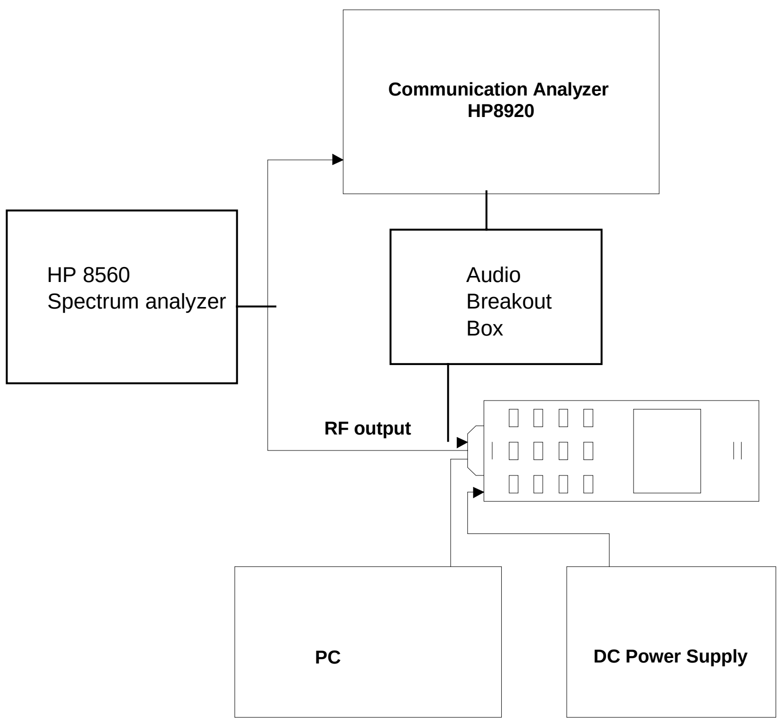
Radiated Spurious and Harmonic Radiation

Definition - The radiated spurious emissions are emissions from the subscriber unit with the attached antenna fully extended. The radiated spurious emissions include those emissions radiated from the attached antenna as well as the equipment cabinet and attached cables.

Method of Measurement - The measurement shall be conducted at standard radiation test site with a search antenna which is movable vertically and is rotatable 90 degrees for vertially and horizontally polarized signals.

Minimum Standard - Radiated spurious emissions shall be attenuated below the maximum level of emission of the carrier frequency by at least 43 + 10 log (mean output power in Watts) dB.

Frequency Stability



Definition - The frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

Method of Measurement - Use the communication tester to sample the transmitter RF output signal and measure its frequency. Very the ambient temperature from -30 to +60 °C, and also vary the DC supply voltage to the equipment from 6.6 to 8.6 V at each temperature.

Minimum Standard - The transmitter carrier frequency shall be maintained within ± 2.5 ppm.

Exhibit 13

FCC Letter of Site Recognition

Included in the radiated spurious emissions data.

Exhibit 14

Product Overview and Circuit Diagrams

Technical Description

The Dual Mode Phone consists of an Analog FM mode and Code Division Multiple Access (CDMA) mode. The analog transmitter is only for use in the Cellular Radiotelephone Service Part 22 of the CFR. The Portable Phone is designed to meet the requirements of TIA/EIA/IS-98-A standards for Dual-Mode Wideband Spread Spectrum Cellular Mobile Stations.

Frequency Range of operation: 824.04 - 848.97 MHz Transmitter and 869.04 - 893.07 Receiver. Max RF power output is 0.6W Max FM and 0.2W Max Digital.

Power Supply requirements: 7.2V DC Li-Ion battery.

Limiting modulation

The audio input is sampled, digitally limited, and then filtered to amplitude and frequency limit the signal applied to the modulator. The device supports the AMPS standard. The device has an operating temperature range of -30 to +60 C. The functions include Compandor, PLL lock detect for received data, audio signal filtering for signals.

Limiting Power

Transmitted power is monitored by an RF detector diode which is coupled from the Power Amplifier (PA) output. The detected DC voltage is fed into a processor which uses a calibration table along with an offset correction and temperature correction table to control power limits. When the RF power exceeds a predetermined limit the gain of the stage preceding the PA is reduced.

Block and Circuit Diagrams

Block and circuit diagrams are included in separate attachments.

Exhibit 15

FCC Identification Label Information

The label information is on a separate attachment.

Exhibit 16

Photographs

The photographs are in a separate attachment.

Exhibit 17

Users Manuel

The user’s guide is in a separate attachment.

Exhibit 18

SAR DATA

The SAR data is in a separate attachment.