Test and Measurement Report
In support of
APPLICATION FOR CERTIFICATION
AirNet Communications Corporation
Model: Adaptasite Remote Radio

FCCID: MZKADS3000-1ABC

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1.0 Test Lab

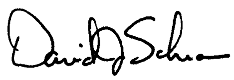
1.1 Statement of Certification

The technical data supplied with this application, having been taken under my supervision is hereby duly certified. The following is a statement of my qualifications:

1) BSEE from Auburn University, Alabama

2) Over 5 years of experience in the field of electromagnetic emissions testing

I certify that the above application was prepared under my direction and that to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.



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David J. Schramm
Position: Technical Supervisor
ITS Duluth, GA

Date: January 8, 2001

1.2 Site Description

The semi-anechoic test site and conducted measurement facility used to collect the emission data is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia, USA. This test facility and site measurement data have been placed on file with the FCC.

2.0 General Information

2.1 Production plans following 2.981 (c)

Quantity Production of this device is planned.

2.2 Application References following 2.1061

Reference is made to the following:

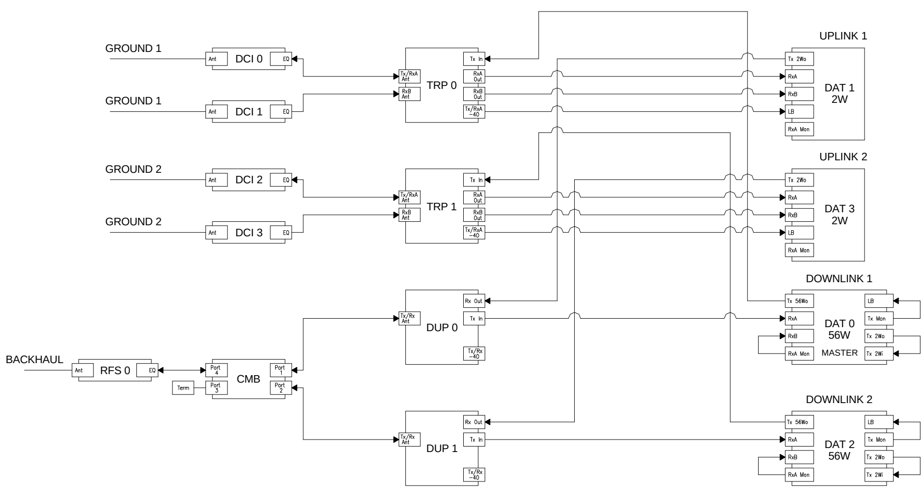
1. PCS1900 Air Interface Specification - JCT (AIR)/94.08.04-231R4
2. Similar application: FCCID: MZKADS3000-1ABC

2.3 Data Submittal Procedure:

Data is supplied according to Part 2, Sub-part J of CFR 47.

2.4 Description of EUT Configuration and Test Setup:

The EUT can be configured as either a single capacity (1A), double capacity (1B), or triple capacity (1C) system. Based upon the internal RF pluming and similarities between configurations The configuration selected for testing was the 1B (Bi-Sectored) Configuration . This configuration represents the "Worst Case" configuration and allows for variants of vendors for duplexer and triplexer filters, combiners, and amplifiers as shown below:



3.0 Measured Data

3.1 RF Power output data

The RF power output was measured with the indicated voltage and current applied into the final stage of the RF amplifying device. The outputs of the Adaptasite were measured at each transmit antenna port using the HP 8593E Spectrum Analyzer in conjunction with a 30 dB attenuator.

Detection: Peak

RBW: 1 MHz

VBW: 3 MHz

Table 3.1-1: RF Power Output

Port	Channel	Frequency, MHz	Power, dBm
Backhaul (set to 2 Watts)	737	1895.2	32.9
Backhaul (set to 2 Watts)	773	1902.4	33.3
Backhaul (set to 2 Watts)	810	1909.8	33.1
Backhaul (set to 1 Watt)	737	1895.2	30.3
Backhaul (set to 1 Watt)	773	1902.4	30.1
Backhaul (set to 1 Watt)	810	1909.8	30.2
TXRX1 (set to 20 Watts)	737	1975.2	43.1
TXRX1 (set to 40 Watts)	738	1975.4	46.4
TXRX1 (set to 40 Watts)	773	1982.4	46.6
TXRX1 (set to 40 Watts)	809	1989.6	46.1
TXRX1(set to 20 Watts)	810	1989.8	43.1
TXRX2 (set to 20 Watts)	737	1975.2	43.2
TXRX2 (set to 40 Watts)	738	1975.4	46.0
TXRX2 (set to 40 Watts)	773	1982.4	46.1
TXRX2 (set to 40 Watts)	809	1989.6	46.2
TXRX2 (set to 20 Watts)	810	1989.8	43.0

3.2 Occupied Bandwidth

The industry accepted emission designator for GMSK signaling is 300KGXW.

The measured bandwidths are located in the following table. Details of measurement procedure are located in Section 4.2.

Table 3.2-1: Occupied Bandwidth

Port	Center Frequency, MHz	Measured Bandwidth, kHz
Backhaul (set to 2 watts)	1902.4	225
TX1	1982.4	213
TX2	1982.4	228

3.3 Emissions at edge of Frequency Block

All plots were made using peak detection.

3.3.1 Downlink

The downlink path (AdaptaSite to mobile) transmit path is being qualified for a 40-Watt carrier at the antenna connection to the AdaptaSite Remote Radio. Due to the spectral re-growth in the final amplifier stage, the AdaptaSite Remote Radio cannot meet the FCC spurious emissions requirement of 43 + 10 log (P) at carrier frequencies adjacent to frequency block edges for output powers higher than 20 Watts. Note however, that the spectral mask still exceeds the requirements for a GMSK waveform as specified in J-STW-007, Personal Communications Services Air Interface Specification.

Table 3.3.1: Unused ARFCNs

Licensed Band	Unused ARFCNs
‘A’ Band: 1930-1945 MHz	511
‘D’ Band: 1945-1950 MHz	586
‘B’ Band: 1950-1965 MHz	611
‘E’ Band: 1965-1970 MHz	686
‘F’ Band: 1970-1975 MHz	711
‘C’ Band: 1975-1990 MHz	736, 811

Software resident at the AdaptaSite will make it impossible for these channels to be used as downlink carriers.

3.3.2 Uplink

The uplink path (AdaptaSite to serving basestation – a.k.a. Backhaul) is being qualified for a 2-Watt carrier at the antenna connection of the AdaptaSite Remote Radio. As shown in the following plots, at this power level, the AdaptaSite meets the FCC requirements for spurious emissions at carrier frequencies adjacent to the band edges. Therefore, no exclusion of channels will be required for AdaptaSite uplink carriers (1850.2-1909.8 MHz).

The plots on the following pages were made with the reference level set to the output power of the particular port (40 Watt, 46 dBm, for the downlink port and 2 W, 33 dBm, for the uplink port). A reference level offset was included to account for the cable loss and attenuation before the spectrum analyzer. The resolution bandwidth was set to 3 kHz and the video bandwidth was set to 3 MHz. A maker shows the level at the band edge. The span is set to show the spectrum 1 MHz below the bandedge.

Figure 3.3.1: Lower Band Edge Plot, Chesapeake and FSY 20 Watt Downlink Channel 737

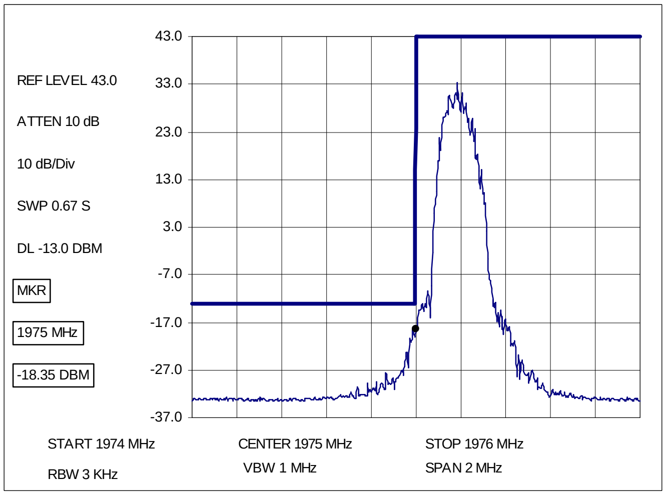


Figure 3.3.2: Lower Band Edge Plot, Chesapeake and FSY 40 Watt Downlink Channel 738

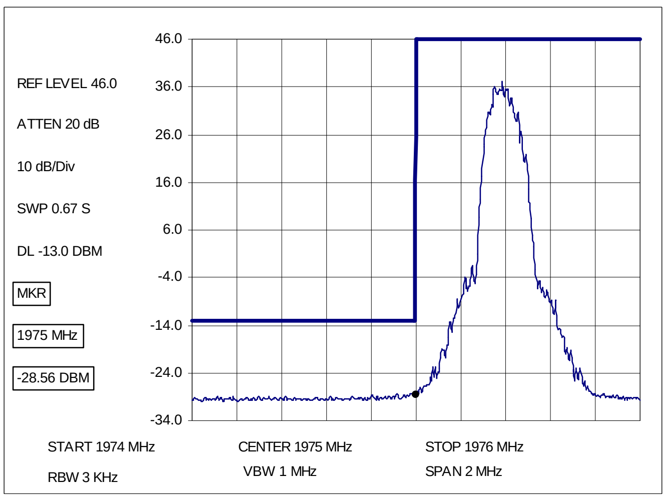


Figure 3.3.3: Lower Band Edge Plot, AML and Clearcomm 20 Watt Downlink Channel 737

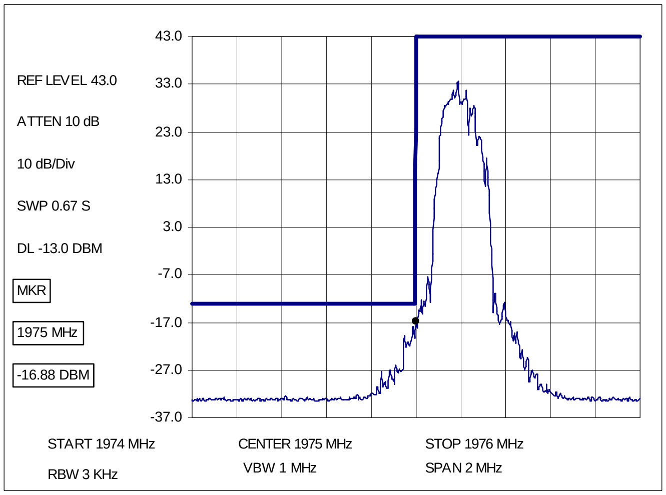


Figure 3.3.4: Lower Band Edge Plot, AML and Clearcomm 40 Watt Downlink Channel 738

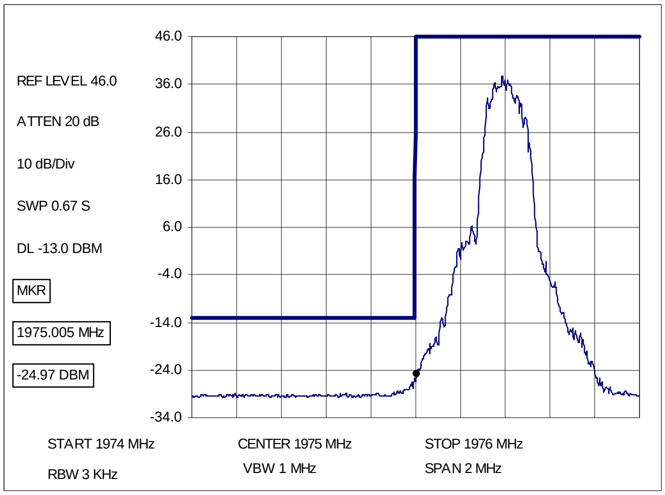


Figure 3.3.5: Upper Band Edge Plot, Chesapeake and FSY 20 Watt Downlink Channel 810

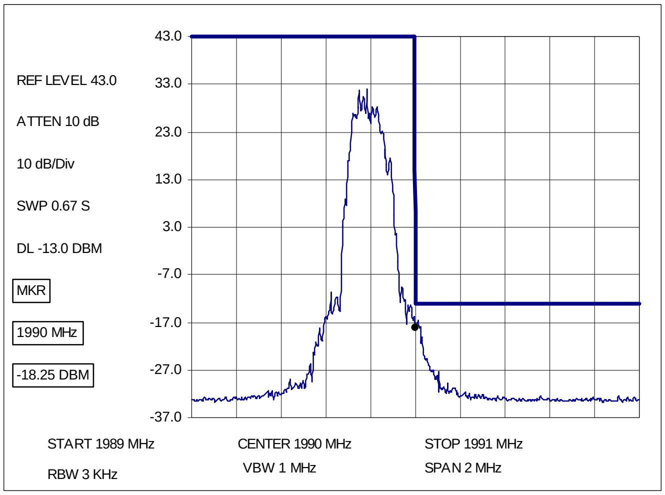


Figure 3.3.6: Upper Band Edge Plot, Chesapeake and FSY 40 Watt Downlink Channel 809

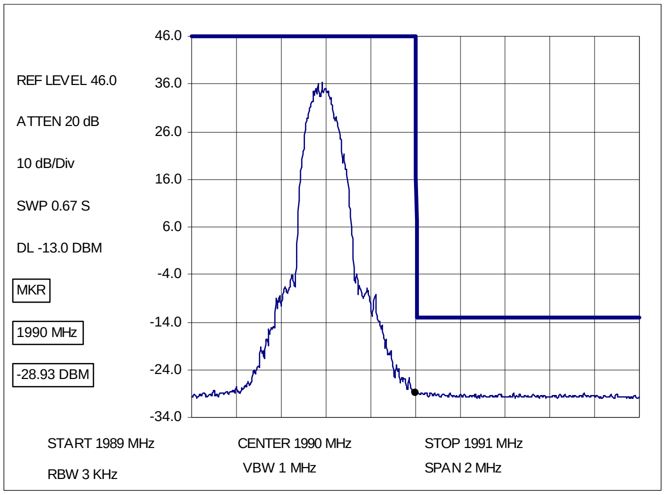


Figure 3.3.7: Upper Band Edge Plot, AML and Clearcomm 40 Watt Downlink Channel 809

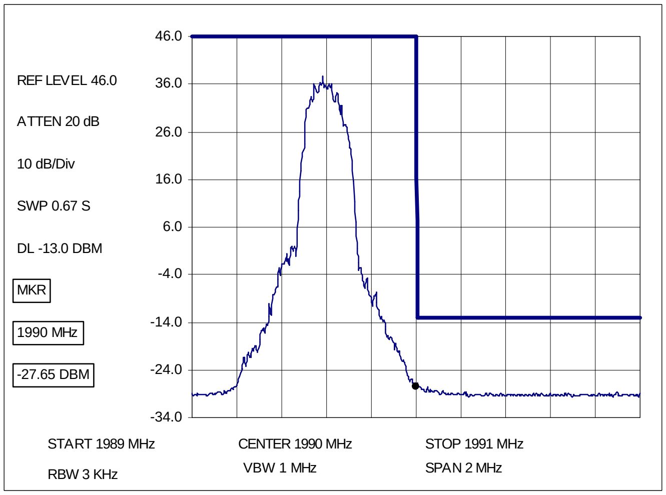
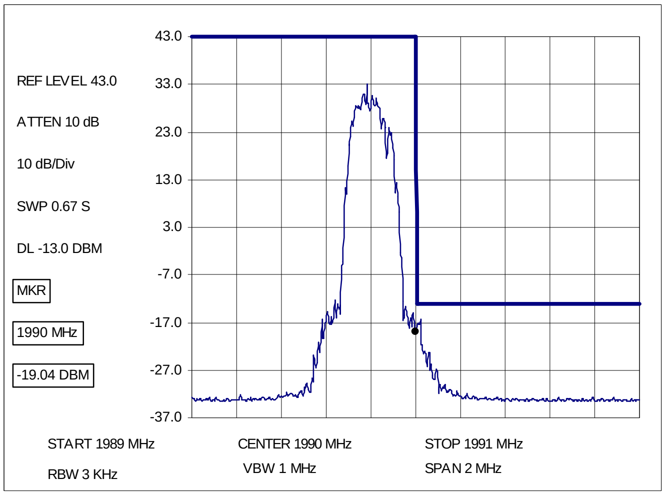


Figure 3.3.8: Upper Band Edge Plot, AML and Clearcomm 20 Watt Downlink Channel 810



3.4 Antenna Conducted Spurious Emissions

The following data tables and figures show the conducted spurious emissions for each amplifier tested in the DANGER Adaptasite DAS System. All measurements above 1 GHz were made with a RBW of 1 MHz and a VBW of at least 1 MHz. All measurements below 1 GHz were made with a quasi-peak detector, a RBW of at least 120 kHz, a VBW of at least 1 MHz.

The uplink and downlink ports were fitted with a C-Band notch filter to prevent the spectrum analyzer from overloading. For the measurement of a spurious signal, the notch filter was removed. The reference level offset was set to the worst case over the frequency range shown.

Figure 3.4.1: Conducted Spurious, Downlink, 30 to 1000 MHz

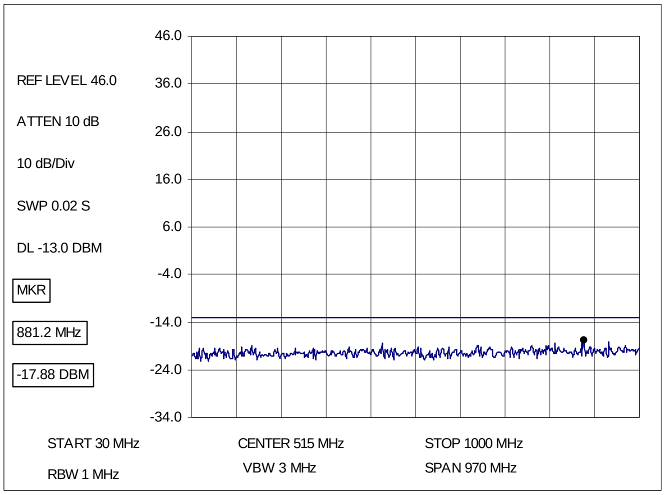


Figure 3.4.2: Conducted Spurious, Downlink, 1 to 2.75 GHz

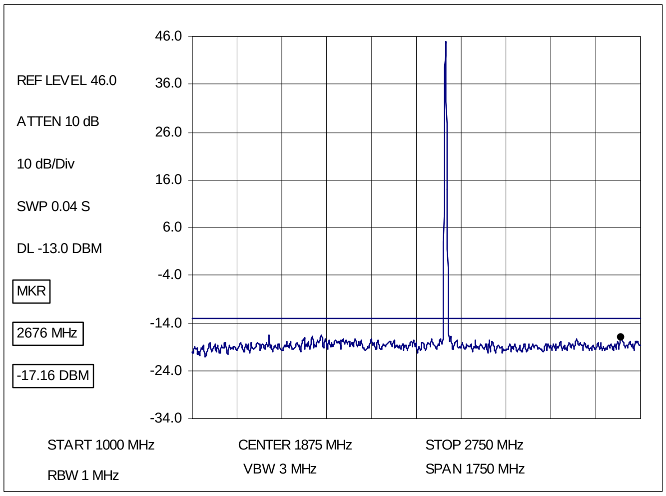


Figure 3.4.3: Conducted Spurious, Downlink, 2.75 to 10 GHz

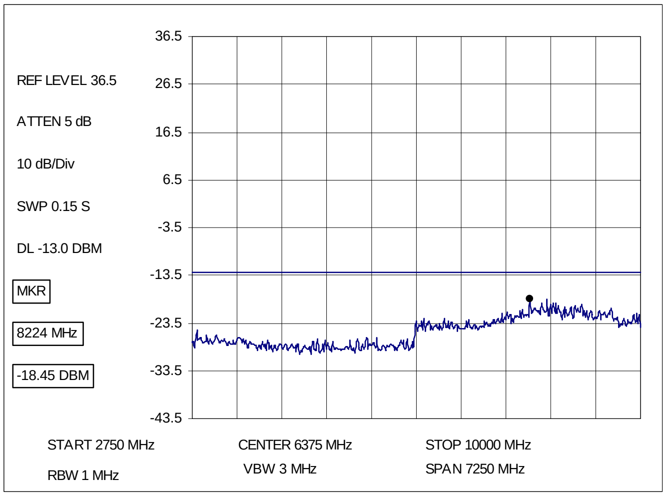


Figure 3.4.5: Conducted Spurious, Downlink, 10 to 20 GHz

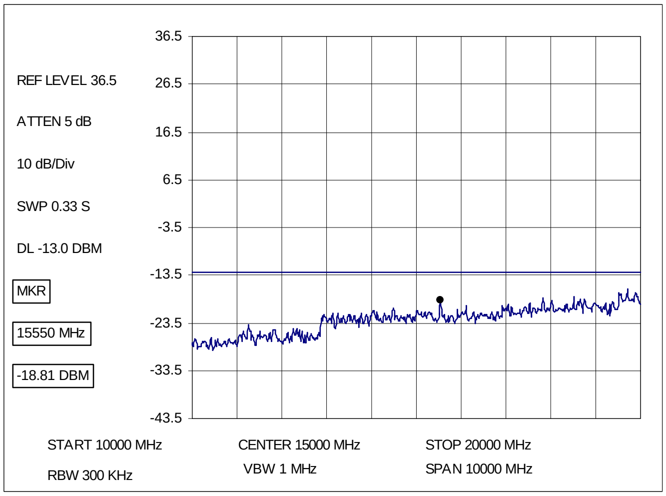


Figure 3.4.6: Conducted Spurious, Uplink, 30 to 1000 MHz

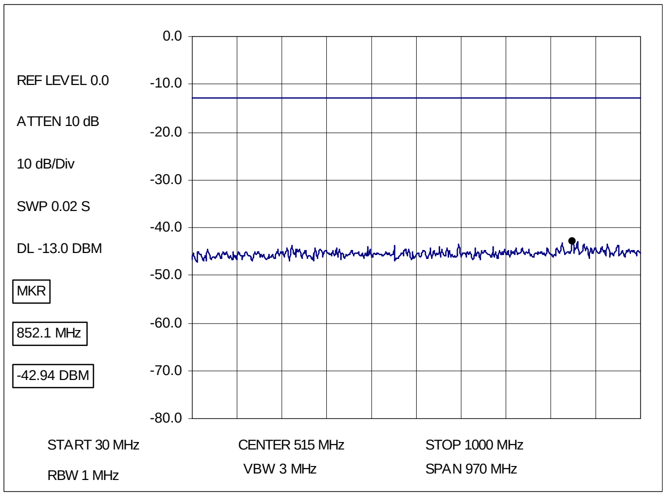


Figure 3.4.7: Conducted Spurious, Uplink, 1 to 2.75 GHz

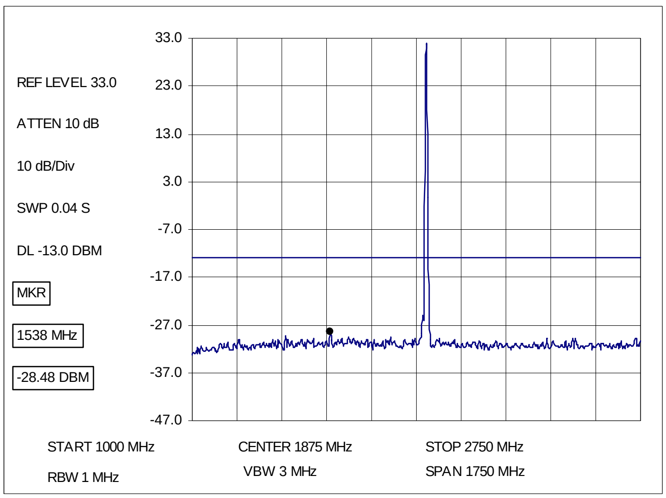


Figure 3.4.7: Conducted Spurious, Uplink, 2.75 to 10 GHz

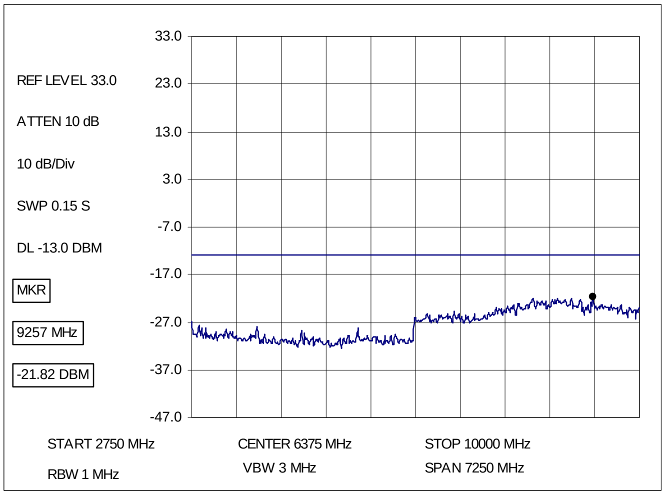
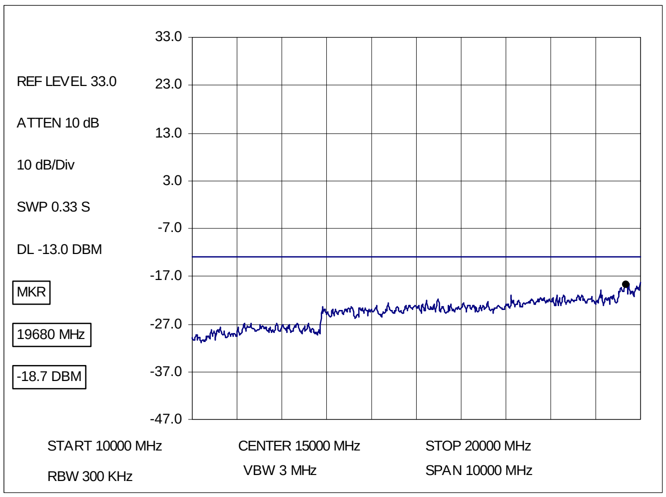


Figure 3.4.8: Conducted Spurious, Uplink, 10 to 20 GHz



3.5 Radiated Spurious Emissions

The following tables show the radiated spurious emissions for each amplifier tested in the AdaptaSite Digital Transceiver System. All measurements above 1 GHz were made with a RBW of 1 MHz and a VBW of at least 1 MHz. All measurements below 1 GHz were made with a quasi-peak detector, a RBW of 120 kHz, a VBW of 1 MHz. The measurement distance was 10 meters unless otherwise specified.

Net Reading is the measured field strength in dB (μV/m). Limit is calculated by subtracting 43-10LogP, in dB, from the theoretical field strength of the EUT's output power through a tuned dipole measured at 10 meters (Friss transmission formula). Margin is Net Reading minus the Limit.

Table 3.5.1: Radiated Spurious Emissions

Antenna Polarity	Frequency MHz	Net Reading dB (μV/m)	Limit dB (μV/m)	Margin dB
Horizontal	784.2	33.2	73.9	-40.7
Vertical	46.97	30.0	73.9	-43.9

There were no other emissions detected for this enclosure.

3.6 Frequency Stability

Table 3.6.1: Frequency Stability vs. Temperature, AdaptaSite

Temperature, Celsius	TXRX1 Peak frequency error, ppm	TXRX2 Peak frequency error, ppm	Backhaul Peak frequency error, ppm
-30.00	0.01	0.01	0.03
-20.00	0.01	0.01	0.03
-10.00	0.02	0.01	0.03
0.00	0.01	0.01	0.03
10.00	0.01	0.01	0.02
20.00	0.02	0.01	0.04
30.00	0.01	0.01	0.02
40.00	0.12	0.01	0.03
50.00	0.01	0.02	0.03

Figure 3.6.1: Frequency Stability vs. Temperature, AdaptaSite

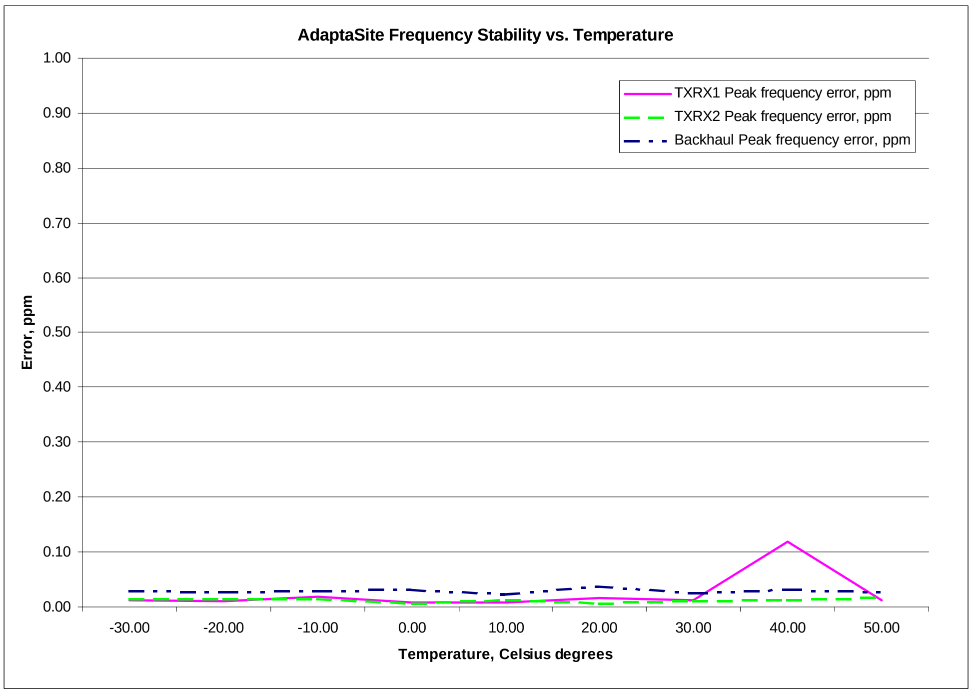
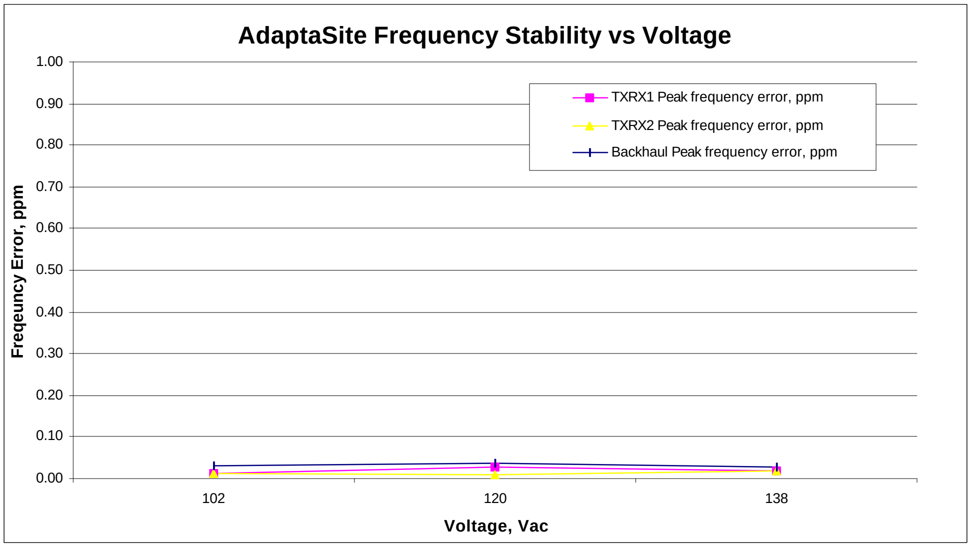


Table 3.6.2: Frequency Stability vs. Input Voltage, AdaptaSite

Voltage, Vac	TXRX1 Peak frequency error, ppm	TXRX2 Peak frequency error, ppm	Backhaul Peak frequency error, ppm
102	0.01	0.01	0.03
120	0.03	0.01	0.04
138	0.02	0.02	0.03

Figure 3.6.2: Frequency Stability vs. Input Voltage, AdaptaSite



4.0 Measurement Procedure and Test Equipment

This Exhibit provides a brief summary of the methods used for the indicated measurements. A full list of all test equipment is provided.

Table 4.1: Measurement Equipment - ITS

Description	Manufacturer	Model Number	Calibration Date
Spectrum Analyzer	Hewlett Packard	8593E	6/17/2000
Spectrum Analyzer, with PCS Personality	Hewlett Packard	8594E	Under AirNet calibration control
Receiver	Hewlett Packard	8546A	7/3/2000
Temperature Chamber	Thermotron	F110-CHV-25-25	
Signal Generator	Marconi	2031	Under AirNet calibration control
Attenuator	Weinschel	68-30-43	10/16/2000
Cables, 1.5 m	Huber Suhner	1500NN	10/1/2000

4.1 RF Output Power - CFR 47 Part 2.1046

RF output power is measured with the transmitter adjusted to the specified ratings. A 50-ohm coaxial attenuator of proper power rating in conjunction with the 50-ohm input impedance of the spectrum analyzer was used as a load for making the measurements. The output power measurements were made using an HP8593E. Note that the resolution bandwidth of the spectrum analyzer was greater than the bandwidth of the signal measured to ensure that the total power level was measured. Pulse desensitization of the spectrum analyzer was not present.

4.2 Occupied Bandwidth - CFR 47 Part 2.1049

Occupied bandwidth measurements were made with the HP8593E using a resolution bandwidth of 3 kHz, which is approximately 1% of the emission bandwidth. The bandwidth was measured at the points 26 dB down from the output power as referenced in FCC Part 24.238(b). All eight time-slots were exercised with pseudo random data. Diagnostic testing showed that this setting was representative of lesser duty cycle modes and produced the worst-case occupied bandwidth. The bandwidth plots show a bandwidth of approximately 228 kHz; however, there is an industry-accepted bandwidth for GMSK signaling (300 kHz) that the FCC has instructed us to use in past applications.

4.3 Conducted Spurious Emissions - CFR 47 Part 2.1051

The transceiver was terminated into a 50-ohm input of a spectrum analyzer with appropriate attenuation. All spurious emissions greater than 20 dB below the specified value shall be recorded.

The conducted spurious emissions shall be attenuated below the maximum level of the carrier in accordance with the following formula: 43 + log (P), where P is the output power in Watts. This level is computed to be – 13 dBm.

4.4 Radiated Spurious - CFR 47 Part 2.1053

Radiated spurious measurements were made at the ITS Semi-anechoic chamber in Duluth, Georgia. The characteristics of this site are filed with the FCC.

The EUT was placed on a wooden table on a flush mounted metal turntable. A 50-ohm coaxial load was connected to the transmitter output. The transmitter was set to radiate at its maximum power levels and measurements were performed using an HP 8546A EMI receiver and an HP 8593E spectrum analyzer. The maximum signal was detected by varying the receive antenna in height and rotating the transmitter on a turntable. Measurements were made in both horizontal and vertical polarizations of the receiving antenna.

Cabinet radiation must be at least 43 + 10 Log (P) dB below the fundamental per CFR 47 Part 24.238(a). For a worst case calculation, the radiated field strength at the fundamental frequency can be calculated assuming the power is radiated from a theoretical dipole antenna with a gain of 1.64. With an output power of 40 Watts and a test distance of 3 meters, the field strength can be calculated using the Friss Transmission Formula. This limit for the given power level calculated to be 84.4 dB(μV/m) at 3m and 73.9 dB(μV/m) at 10m.

4.5 Frequency Stability - CFR 47 Part 2.1055

Frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For the 40-watt downlink channels, center frequencies nearest the band edges are no closer than 400 kHz. For the 20-watt downlink channels, center frequencies nearest the band edges are no closer than 200 kHz. For the 2-watt uplink channels, center frequencies nearest the band edges are no closer than 200 kHz. The industry accepted bandwidth of the transmitted signal is 300 kHz (150 kHz above and below the center frequency). The center frequency can deviate more than ±20 kHz and at all times, the emissions will be within the band.

Frequency Stability versus Temperature

The transmitter was placed in an environmental chamber and tested in the range of -30 to +50 degrees Celsius. The environmental chamber temperature was stabilized at each temperature setting. The center frequency of the transmitter was measured. This procedure was repeated for each 10 degree step up to +50 degrees Celsius.

Frequency Stability versus Power Supply Voltage

The supply voltage was varied from 85% to 115% of the normal supply voltage. The normal supply voltage is 120 Vdc. Frequency deviation was measured at the low end with an input voltage of 102 Vac and at the high end with an input voltage of 138 Vac. The voltage was measured at the dc input to the device.