



## **Exhibit 6 – Test Report**

### **Motorola Customer Premise Equipment (CPE)**

FCC ID: MIJZEPCPE-USB-01

Model No. LT 20M-00

## **6.0 Introduction**

### **6.0.1 Facility Description**

EMI testing of the Zephyr Outdoor Unit (ODU) was performed at the Motorola Systems Solutions Group's (SSG) EMI/TEMPEST Test Laboratory. This test laboratory is located in the southeast wing of the Hayden building at 8201 E. McDowell Road, Scottsdale, AZ. The EMI/TEMPEST Test Laboratory is certified and accredited through the National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP).

### **6.0.2 Quality System**

The EMI/TEMPEST Test Laboratory maintains a Quality Manual that describes the quality assurance program of the EMC/TEMPEST Facility to set forth procedures covering all quality assurance functions. This manual has been constructed to reflect a quality program in compliance with the requirements of the following:

- National Institute of Standards & Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP)
- NIST/NVLAP EMC MIL-STD 462 Program Handbook (Apr. 1994)
- NVLAP EMC and Telecommunications FCC Methods Handbook 150-11 (Apr. 1995)
- MIL-Q-9858A, MIL-STD 461, 462, 463, 461D, 462D
- National Security Agency Technical and Security Requirements Document for the Endorsed TEMPEST Test Services Program, NSA TSRD No. 88-8B, 5 Oct. 1993
- System Solution Group of Motorola Quality Six Sigma Program.

### 6.0.3 Standard References

- 47 CFR 2 Code of Federal Regulations, Title 47, Part 2, “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”
- 47 CFR 101 Code of Federal Regulations, Title 47, Part 101, “Fixed Microwave Devices”
- C63.4-1992 American National Standards Institute (ANSI), “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”
- NFPA-70 National Electric Code (1996)

## 6.1 Test Procedures

The transmitter portion of the Zephyr ODU is subject to FCC Part 101 and Part 2 for FCC Certification for units deployable in the United States. The following tests, as specified in FCC Part 2, with limits as defined in FCC Part 101, and shown in Table 6.1-1 below were performed on the Zephyr ODU. The transmitter was operated at its maximum rated output power (+12dBm) for all tests.

**Table 6.1-1 Tests Required for Certification of the Zephyr ODU**

Test Parameter	FCC Part 2 Paragraph Number	FCC Part 101 Paragraph Number	FCC Part 101 Limit
RF Power Output	2.1046	101.113	+55 dBW max. EIRP +42 dBW/MHz max. EIRP
Modulation Characteristics	2.1047	None	None
Occupied Bandwidth	2.1049	None	None
Spurious Emissions at Antenna Terminals	2.1051	101.111(a)(2) (ii) & (iii)	Refer to FCC Part 101
Field Strength of Spurious Emissions	2.1053	101.111(a)(2) (ii) & (iii)	Refer to FCC Part 101
Frequency Stability	2.1055	101.107	.001 %

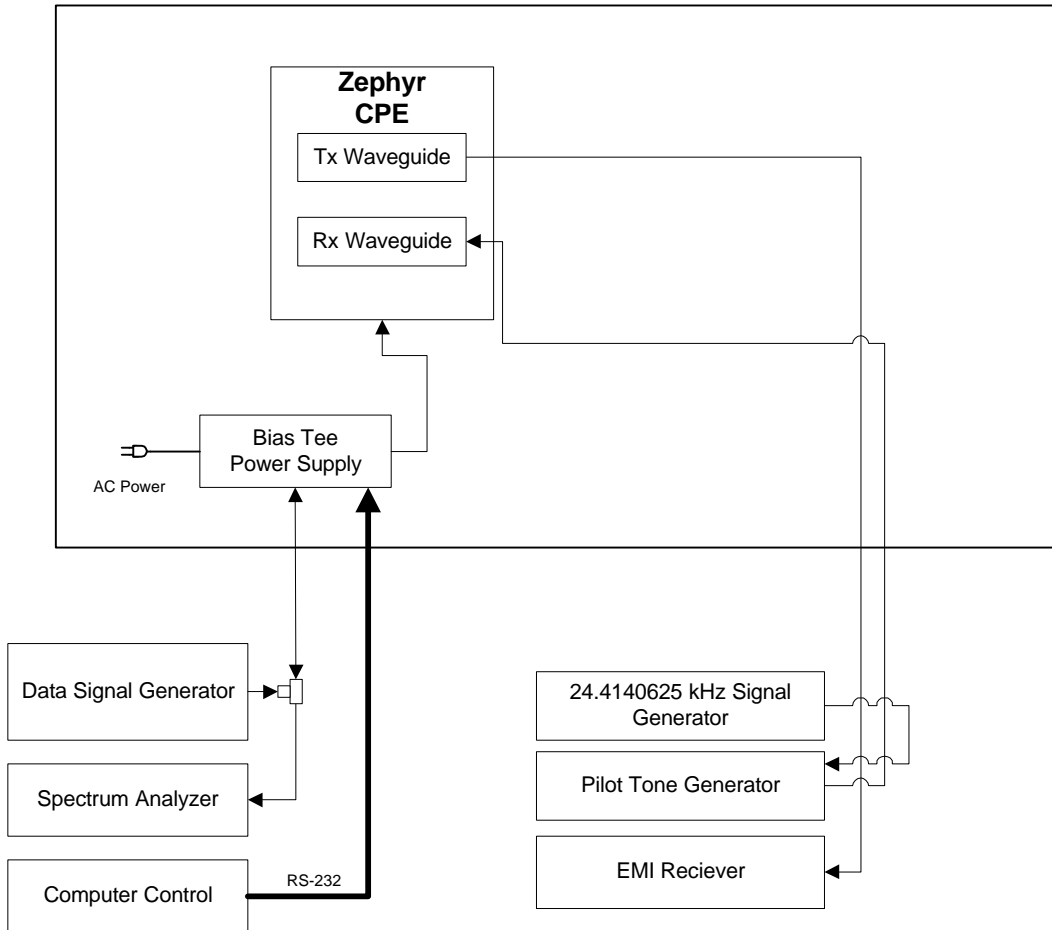
### 6.1.1 RF Power Spectral Density

**Table 6.1-2 IF Signal Input Parameters and Spectrum Analyzer Settings for Power Spectral Density and Occupied Bandwidth Tests**

<b>16QUAM Signal Source</b>	<b>Data Rate (Symbols/sec.)</b>	<b>IF Tuned Freq. (MHz)</b>	<b>RF Freq. (GHz)</b>	<b>Measurement Bandwidth RBW/VBW (kHz/kHz)</b>
Rohde & Schwarz	384k	18.192	31.226560	20/50
Rohde & Schwarz	384k	27.920	31.260889	20/50
Rohde & Schwarz	384k	40.032	31.298400	20/50

RF power spectral density is calculated by dividing the maximum rated output power by the 99% occupied bandwidth. The measurement is performed in a conducted mode using the setup of Figure 6.1-1.

## Environmental Chamber



### Data Generator settings:

Frequency: 27.3 MHz  
Data source: PRBS  
Modulation: 16QUAM  
Symbol Rate: 384kSps  
Filter: SQR COS / 0.35

### Pilot Tone Generator settings:

Frequency: 31.0015 GHz  
Data source: External 24.4140625 kHz  
Coupling: 100 kHz  
Modulation: FM 1 MHz/V Deviation

**Figure 6.1-1 Setup for All Antenna Terminal Conducted Tests**

### **6.1.2 Modulation Characteristics**

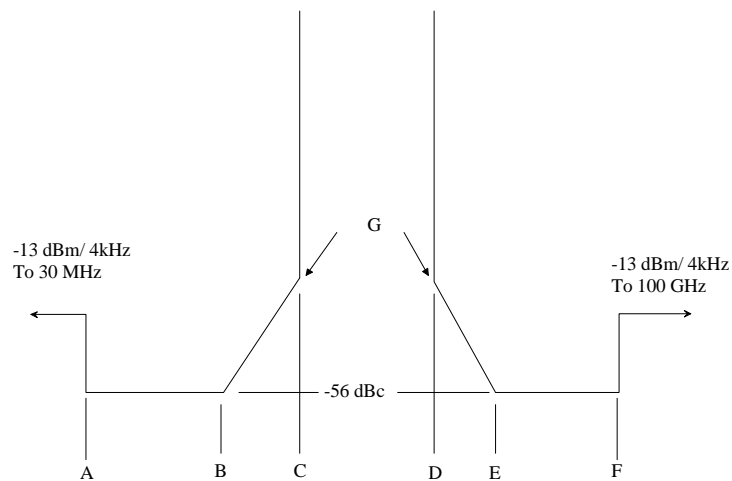
There is no specification limit on Modulation Characteristics except that the modulation source shall be representative of that used in an actual installation. Commercial test equipment (Rohde and Schwarz AMIQ Modulation Generator) was used to generate the modulated IF input signal.

### 6.1.3 Occupied Bandwidth

The occupied bandwidth measurement is performed in a conducted mode. See the RF power spectral density measurement paragraph (6.1.1) for the appropriate bandwidths. The 99% occupied bandwidth measurement is an automated measurement performed by the analyzer.

### 6.1.4 Conducted Spurious Emissions – Antenna Port

Conducted emissions at the antenna port were measured over the frequency range of 10 to 40 GHz. Refer to Figure 6.1-1 for test setup and Figure 6.1-2 for test limits. For frequencies  $\pm 250\%$  of the allocated bandwidth centered at 31.2625 GHz spectrum analyzer plots were made with the emission mask shown in Figure 6.1-2 loaded into the Limit Lines function of the spectrum analyzer with correction for Resolution Bandwidth relative to 1 MHz.



	A	B	C	D	E	F	G
Band B 75 MHz Upstream (MHz)	31075	31175.73	31225	31300	31349.28	31450	-29.75 dBc

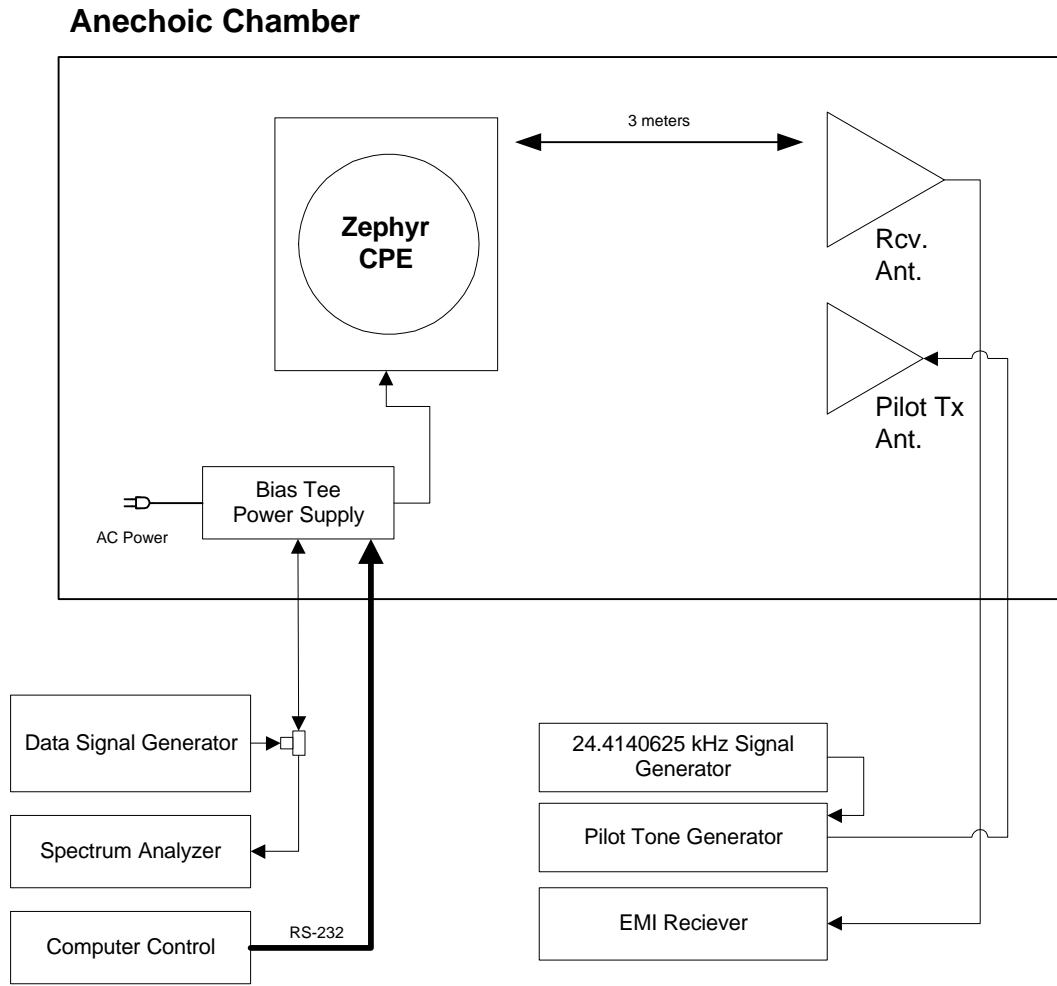
**Figure 6.1-2 Conducted Spurious Emissions Mask**

### 6.1.5 Radiated Spurious Emissions

Radiated spurious emission were measured over the frequency range of 30 MHz to 100 GHz in an anechoic chamber (20ft x 24ft x 16ft). Refer to Figure 6.1-3 for test setup. The Zephyr ODU transmit output was routed to the transmit antenna.

For all emissions, measurements were made at a distance of 3 meters. All four sides of the EUT and both vertical and horizontal polarizations were tested for maximum radiated levels. Due to the operational frequency of the EUT and the fact that no emissions were detected, no Open Area Test Site (OATS) measurements were made.

For frequencies greater than 40 GHz, measurements were limited to harmonics of the local oscillator and the transmitter fundamental frequency.



Data Generator settings:

Frequency: 27.3 MHz  
 Data source: PRBS  
 Modulation: 16QUAM  
 Symbol Rate: 384kSps  
 Filter: SQR COS / 0.35

Pilot Tone Generator settings:

Frequency: 31.0015 GHz  
 Data source: External 24.4140625 kHz  
 Coupling: 100 kHz  
 Modulation: FM 1 MHz/V Deviation

**Figure 6.1-3 Radiated Spurious Emissions Test Setup**

### **6.1.6 Frequency Stability**

The Zephyr ODU was tested for frequency stability when operated in a CW mode at maximum rated power over the temperature range of  $-30^{\circ}$  to  $+50^{\circ}$  C and over an input power voltage range of  $\pm 15\%$ . Refer to Figure 6.1-1 for test setup.

## 6.2 Test Results

### 6.2.1 RF Power Spectral Density Measurement Test Results

All measurements were made at the Zephyr ODU maximum rated output power of +12 dBm at the transmit port of the roof unit. With an antenna gain of 35 dBi, the maximum EIRP of the Zephyr ODU, when operated at maximum rated output of +12 dBm, is 17 dBW which is within the limit specified in Part 101 Paragraph 101.113 of 55 dBW. RF power spectral density was calculated by dividing the maximum rated output power by the 99% occupied bandwidth of the Zephyr ODU.

Data Rate (Symbols per sec.)	RF Freq. (GHz)	Measured RF Power (dBm)	99% Occupied BW (MHz)	Antenna Gain. (dBi)	Corrected RF Power Density (dBW /MHz)	Limit (dBW /MHz)
384k	31.226560	12	0.446	35	24.0	42
384k	31.260889	12	0.446	35	24.0	42
384k	31.298400	12	0.452	35	23.9	42



### 6.2.2 Occupied Bandwidth Measurement Tests Results

All measurements were made at the Zephyr ODU maximum rated output power of +23 dBm at the transmit port of the ODU.

Data Rate (Symbols per sec.)	RF Frequency (GHz)	99% Occupied Bandwidth (MHz)	Measurement Bandwidth RBW/VBW (MHz/MHz)	Reference Figure
384k	31.226560		0.5/2.0	A - 1
384k	31.260889		0.5/2.0	A - 2
384k	31.298400		0.5/2.0	A - 3

Refer to Figure A-4 for a photograph of the Occupied Bandwidth measurement test setup.

### 6.2.3 Conducted Spurious Emissions – Antenna Port Measurement Test Results

All measurements were made at the Zephyr ODU maximum rated output power of +12 dBm at the transmit port of the ODU.

Data Rate (Symbols per sec.)	RF Transmit Frequency (GHz)	Test Frequency Range (GHz)	Pass /Fail	Reference Figure
384k	31.226560	10 – 25.8	Pass	B – 1 and 2
		25.8 – 30.05	Pass	
		30.05 – 40	Pass	
384k	31.260889	10 – 25.8	Pass	B - 3
		25.8 – 30.05	Pass	
		30.05 – 40	Pass	
384k	31.298400	10 – 25.8	Pass	B – 4 and 5
		25.8 – 30.05	Pass	
		30.05 – 40	Pass	

Refer to Figure B-6 for a photograph of the Antenna Terminal Conducted Spurious Emissions measurement test setup. Figures B – 2 and B – 5 are expanded views of the conducted emission mask at the allocated band edges (31.225 and 31.300 GHz). These measurements were made with a 500 kHz resolution bandwidth and the mask was adjusted (-3dB) to correct to the 1 MHz reference bandwidth.

### 6.2.4 Radiated Spurious Emissions Measurement Test Results

All measurements were made at the Zephyr ODU maximum rated output power of +12 dBm with the antenna installed and transmitting as in a normal installation

16 QUAM Data Rate (Symbols per second)	RF Transmit Frequency (GHz)	Test Frequency Range (GHz)	Measuring Instrument	Pass /Fail	Refer to Data Sheet
384k	31.226560	.03 – 40.0	Rohde & Schwartz EMI Receiver	Pass	C - 1
		40.0 – 100	Rohde & Schwartz with mixers	Pass	C - 1
384k	31.260889	.03 – 40.0	Rohde & Schwartz EMI Receiver	Pass	C - 2
		40.0 – 100	Rohde & Schwartz with mixers	Pass	C - 2
384k	31.298400	.03 – 40.0	Rohde & Schwartz EMI Receiver	Pass	C - 3
		40.0 – 100	Rohde & Schwartz with mixers	Pass	C - 3

Refer to Figure C-4 for a photograph of the Zephyr ODU as set up and to Figure C-5 for a photograph of the BiConilog antenna, one of the antennas used for the Radiated Spurious Emissions measurement test.

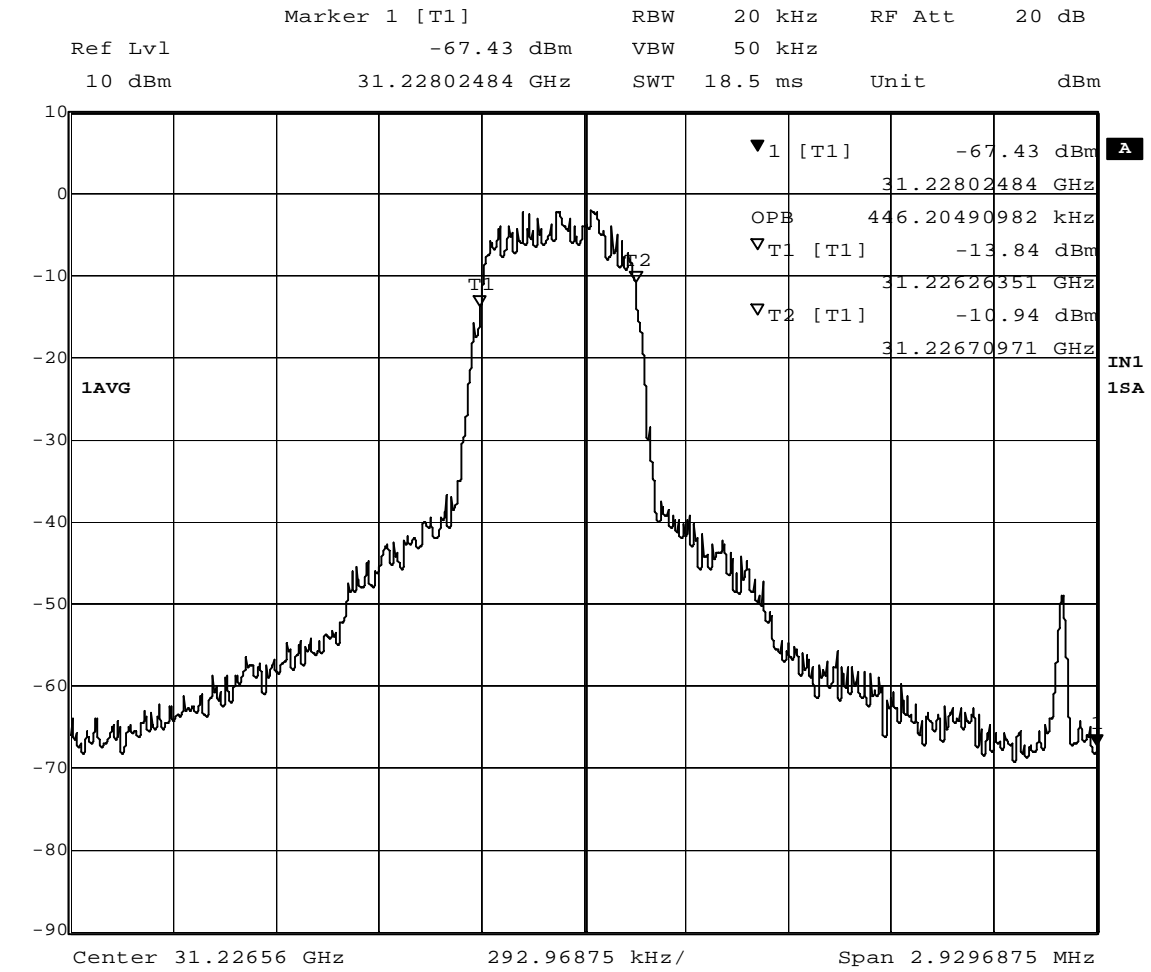
#### 4.5 Frequency Stability Measurement Test Results

$f_0$	31.260938 GHz		% Error		FCC Limit
°C	f @ -15% rated voltage in GHz	f @ +15% rated voltage in GHz	% Error @ -15% rated voltage	% Error @ +15% rated voltage	
-30	31.26093520	31.26093520	-0.00000896%	-0.00000896%	0.001%
-20	31.26093520	31.26093520	-0.00000896%	-0.00000896%	0.001%
-10	31.26093520	31.26093520	-0.00000896%	-0.00000896%	0.001%
0	31.26093520	31.26093520	-0.00000896%	-0.00000896%	0.001%
10	31.26093520	31.26093520	-0.00000896%	-0.00000896%	0.001%
20	31.26093520	31.26093520	-0.00000896%	-0.00000896%	0.001%
30	31.26093520	31.26093520	-0.00000896%	-0.00000896%	0.001%
40	31.26093520	31.26093520	-0.00000896%	-0.00000896%	0.001%
50	31.26093520	31.26093520	-0.00000896%	-0.00000896%	0.001%

All measurements were taken on December 21, 1999. Results from this test are plotted in Appendix D, Figure D-1. Refer to Figure D-2 for a photograph of the Zephyr ODU as set up in the Temperature Chamber and to Figure D-3 for a photograph of the test equipment used in support of the Temperature Stability test on the ODU.

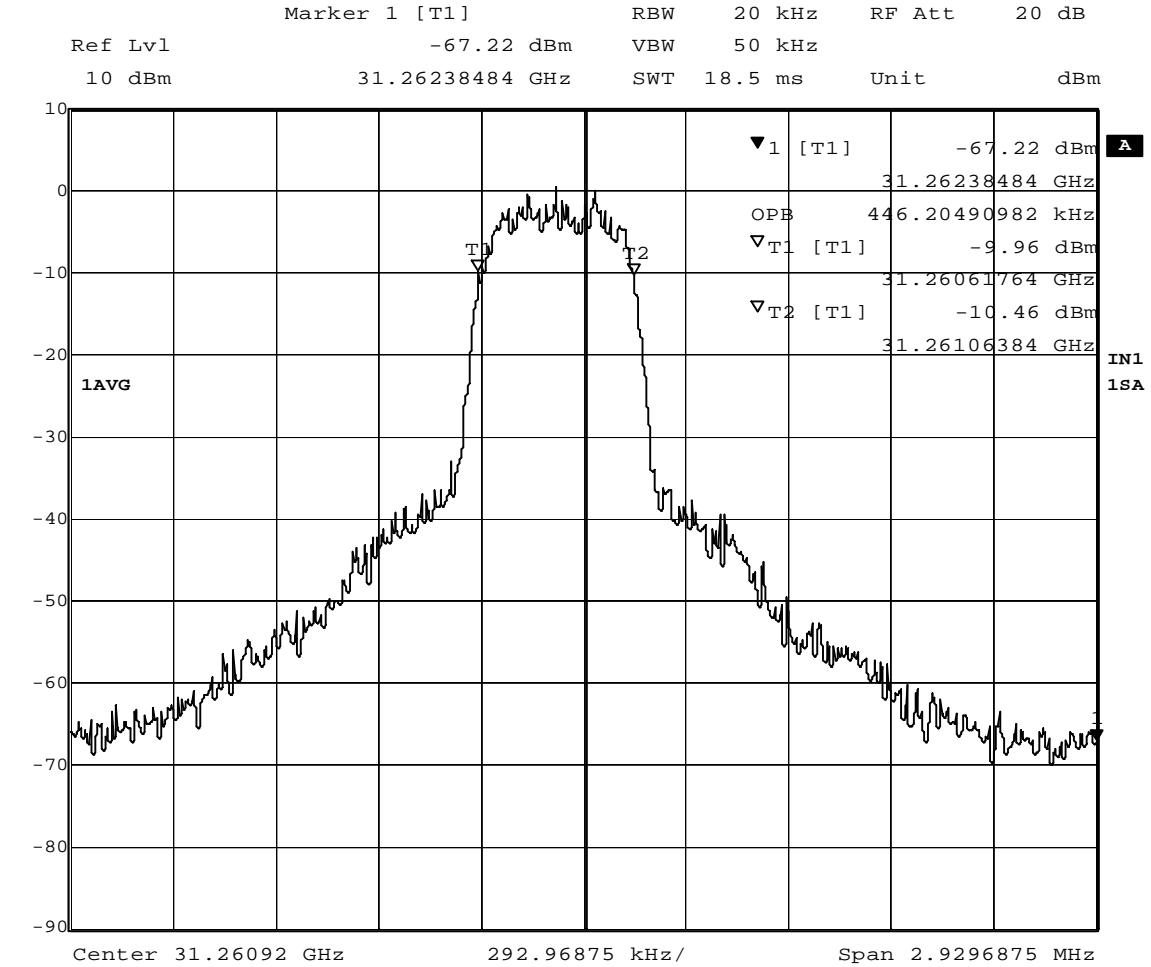
## **Appendix A**

### **Occupied Bandwidth Measurements**



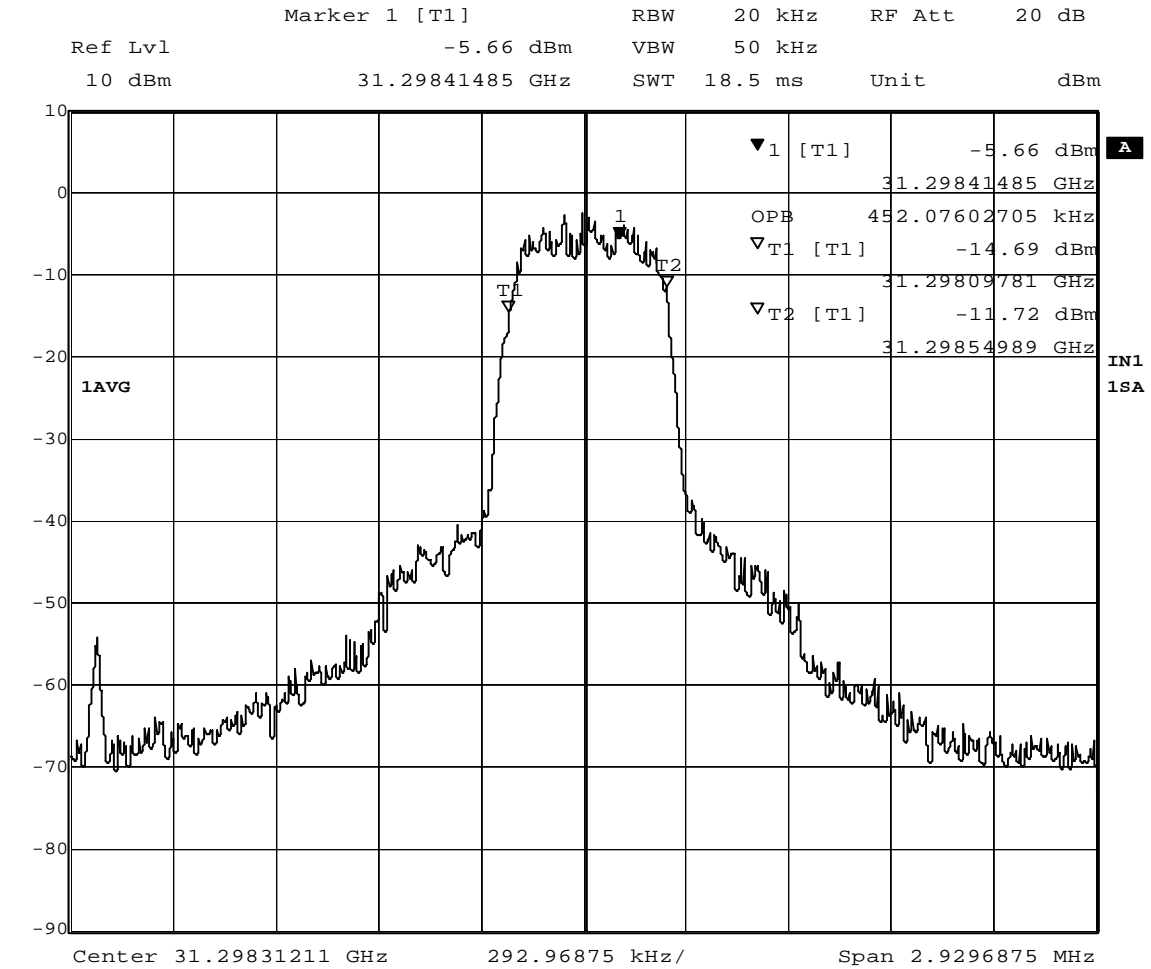
Date: 9.DEC.1999 13:54:28

**Figure A – 1 Occupied Bandwidth Measurement at 31.22656 GHz**



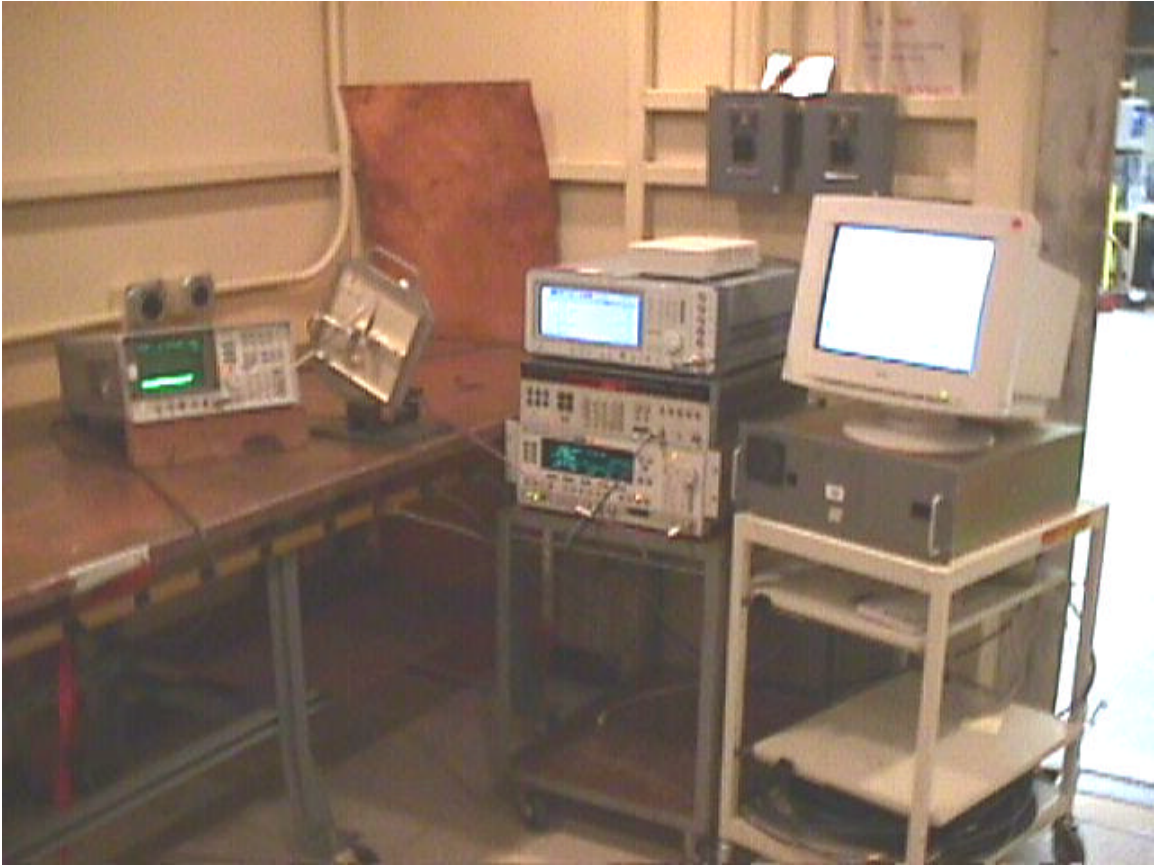
Date: 9.DEC.1999 13:52:54

**Figure A – 2 Occupied Bandwidth Measurement at 31.260889 GHz**



Date: 9.DEC.1999 13:51:34

**Figure A – 3 Occupied Bandwidth Measurement at 31.29840 GHz**

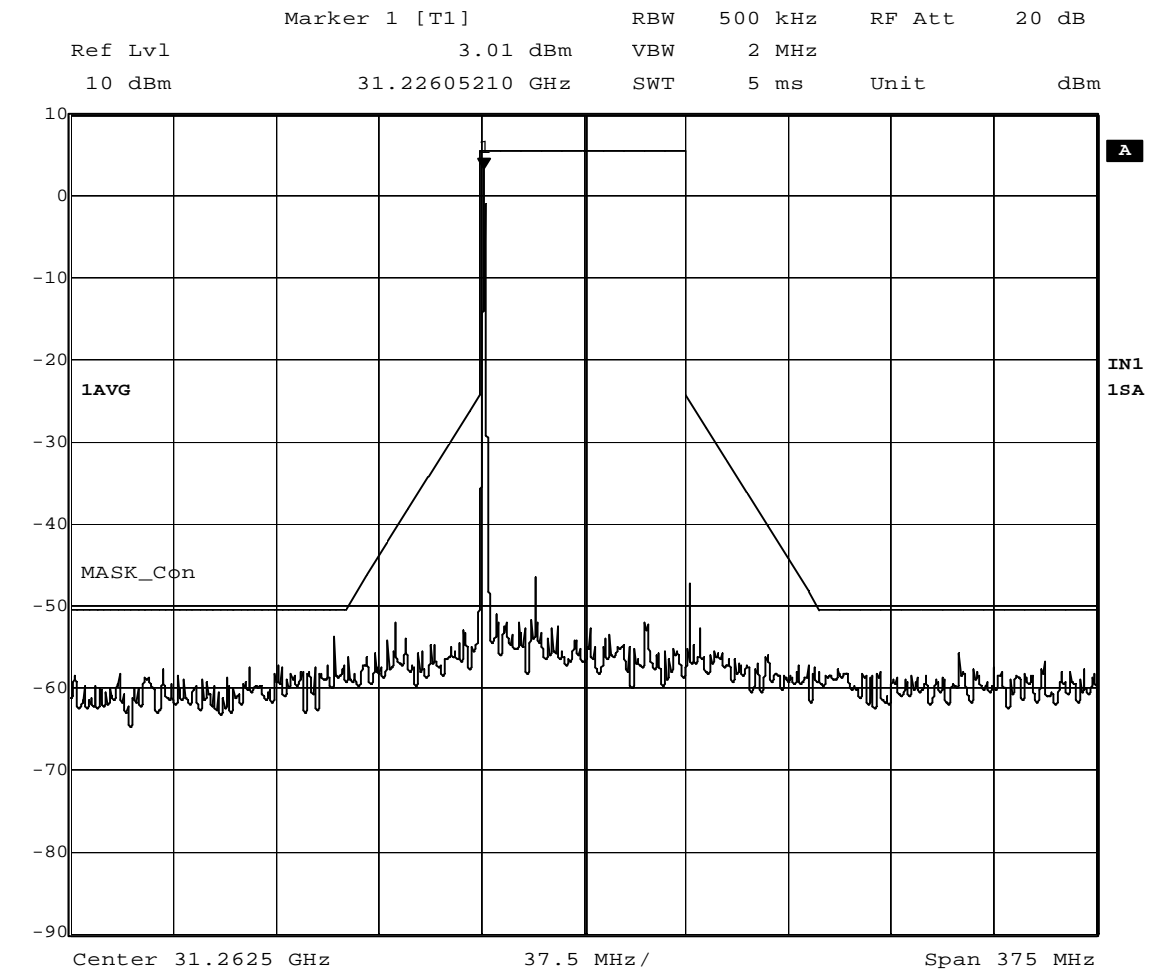


**Figure A – 4 Occupied Bandwidth Measurement Test Setup**



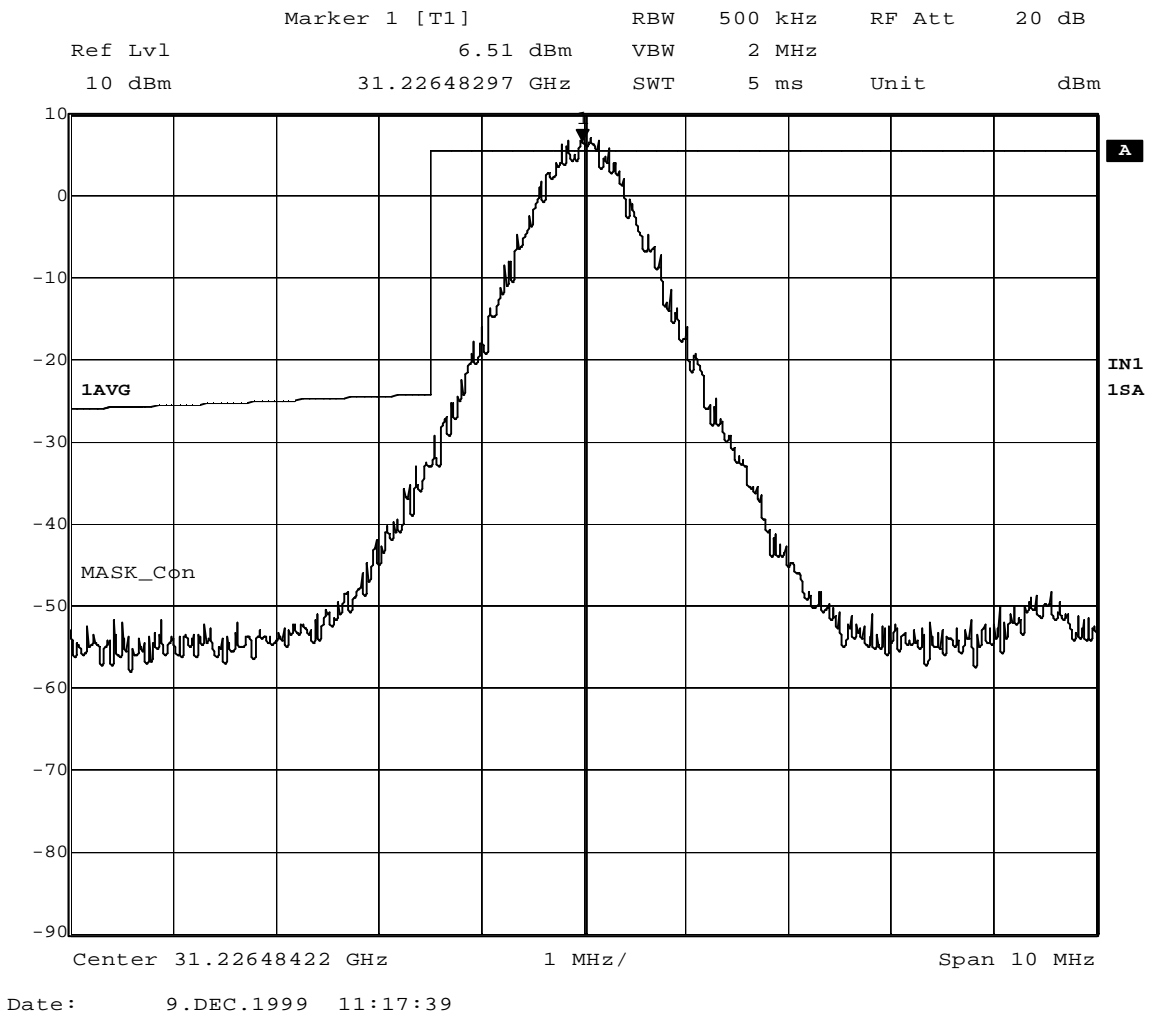
## **Appendix B**

### **Antenna Terminal Conducted Spurious Emissions Measurement**

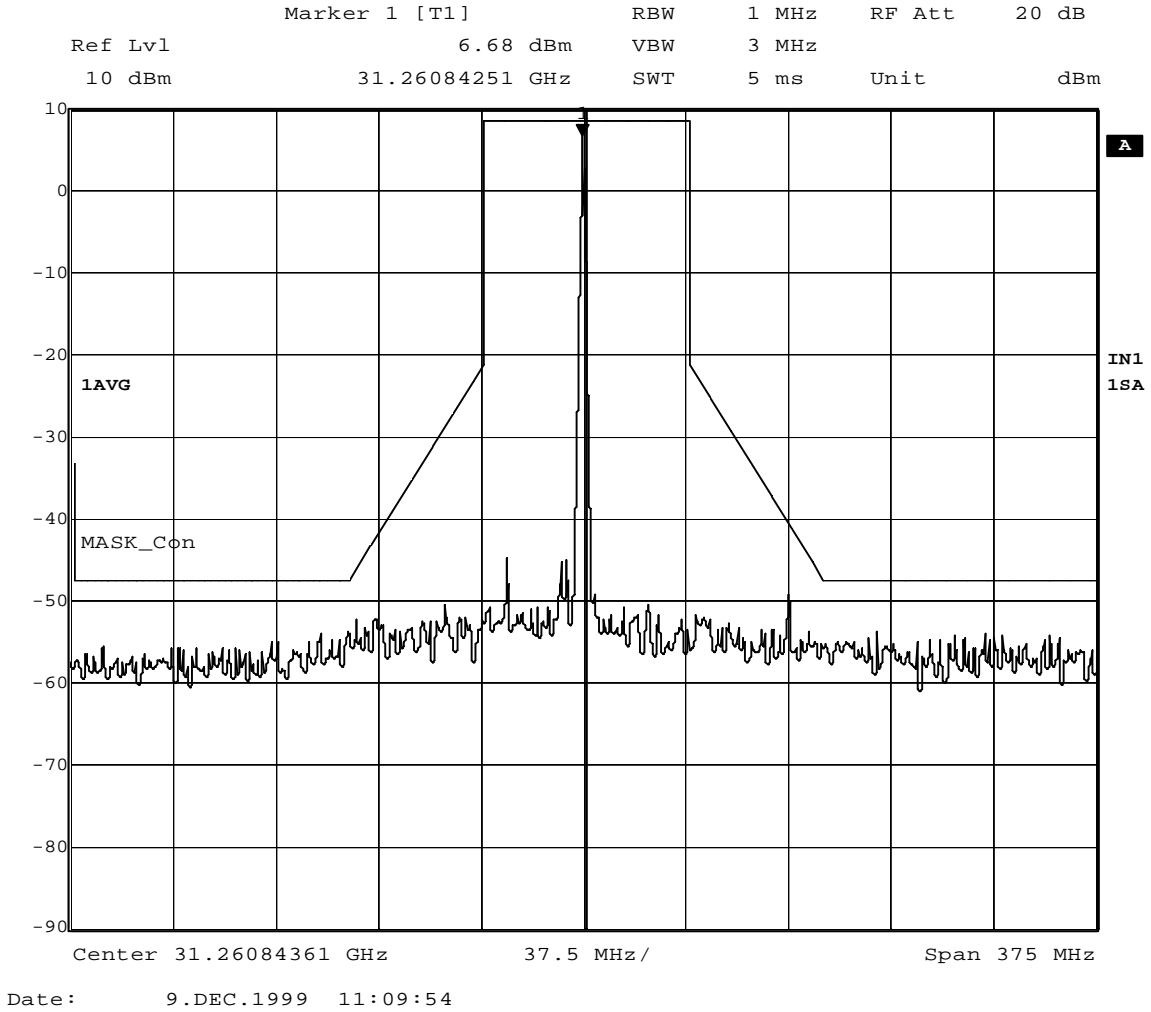


Date: 9.DEC.1999 11:18:16

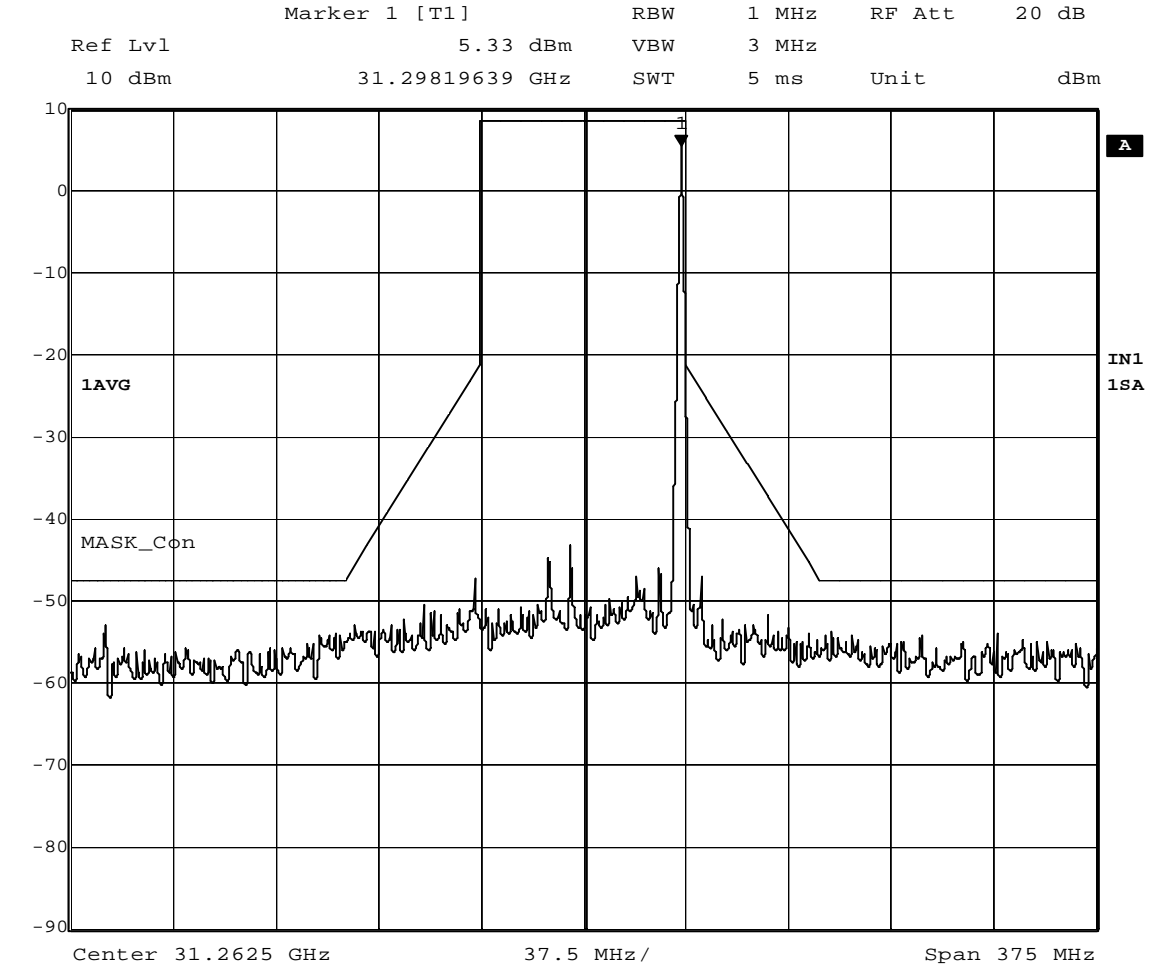
**Figure B – 1 Spurious Emissions at 31.260889 GHz**



**Figure B – 2 Emission Mask at 31.260889 GHz**

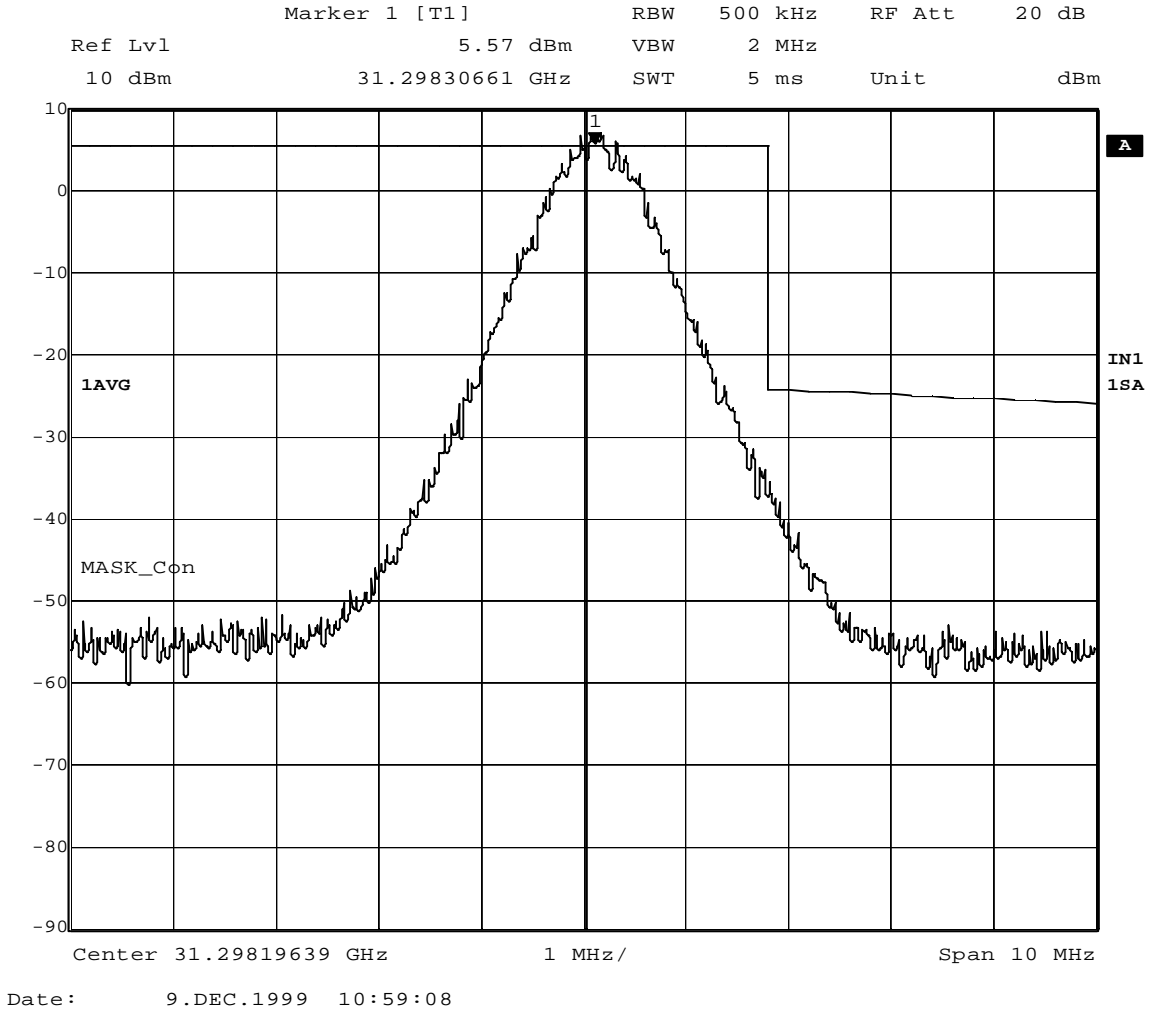


**Figure B – 3 Spurious Emissions at 31.260889 GHz**



Date: 9.DEC.1999 10:57:15

**Figure B – 4 Spurious Emissions at 31.298400 GHz**



**Figure B – 5 Emissions Mask at 31.298400 GHz**

## **Appendix C**

### **Radiated Spurious Emission Measurement**

Client : Motorola

Date : 12/8/99

EUT Model : Zephyr ODU

S/N : P-004

EUT Configuration : Tx 31.226560 GHz; Maximum Output Power; 384kSps

For frequencies with $\pm 250\%$ of allocated bandwidth excluding intentional transmit frequency								
Frequency (GHz)	Meter Reading (dB $\mu$ V)	Measurement Bandwidth RBW/VBW (MHz)	Bandwidth Correction Factor (dB)	Cable Loss* (dB)	Antenna Factor (dB)	Corrected Level (dB $\mu$ V/m /MHz)	Limit (dB $\mu$ V/m /MHz)	Comments
		<b>No emissions detected.</b>						
For frequencies < -250% and > 250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dB $\mu$ V)	Measurement Bandwidth RBW/VBW (kHz)	Bandwidth Correction Factor (dB)	Cable Loss* (dB)	Antenna Factor (dB)	Corrected Level (dB $\mu$ V/m /4kHz)	Limit (dB $\mu$ V/m /4kHz)	Comments
62.45312	5	30/30	-8.75	22.0	43.4	61.6	84.4	Tx 2nd Harmonic; <b>Rev. Noise</b>
93.67968	5	30/30	-8.75	40.0	46.8	83.0	84.4	Tx 3rd Harmonic; <b>Rev. Noise</b>

\* Cable loss includes external mixer loss and cable loss

**Figure C – 1 Zephyr ODU Setup, Radiated Spurious Emissions,  $F_o = 31.226560$  GHz**



Client : Motorola

Date : 12/8/99

EUT Model : Zephyr ODU

S/N : P-004

EUT Configuration : Tx 31.260938 GHz; Maximum Output Power; 384kSps

For frequencies with $\pm 250\%$ of allocated bandwidth excluding intentional transmit frequency								
Frequency (GHz)	Meter Reading (dB $\mu$ V)	Measurement Bandwidth RBW/VBW (MHz)	Bandwidth Correction Factor (dB)	Cable Loss* (dB)	Antenna Factor (dB)	Corrected Level (dB $\mu$ V/m /MHz)	Limit (dB $\mu$ V/m /MHz)	Comments
		<b>No emissions detected.</b>						
For frequencies < -250% and > 250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dB $\mu$ V)	Measurement Bandwidth RBW/VBW (kHz)	Bandwidth Correction Factor (dB)	Cable Loss* (dB)	Antenna Factor (dB)	Corrected Level (dB $\mu$ V/m /4kHz)	Limit (dB $\mu$ V/m /4kHz)	Comments
62.521876	5	30/30	-8.75	22.0	43.4	61.6	84.4	Tx 2nd Harmonic; <b>Rev. Noise</b>
93.782814	5	30/30	-8.75	40.0	46.8	83.0	84.4	Tx 3rd Harmonic; <b>Rev. Noise</b>

\* Cable loss includes external mixer loss and cable loss

**Figure C – 2 Zephyr ODU Setup, Radiated Spurious Emissions,  $F_0 = 31.260938$  GHz**

Client : Motorola

Date : 12/8/99

EUT Model : Zephyr ODU

S/N : P-004

EUT Configuration : Tx 31.298400 GHz; Maximum Output Power; 384kSps

For frequencies with $\pm 250\%$ of allocated bandwidth excluding intentional transmit frequency								
Frequency (GHz)	Meter Reading (dB $\mu$ V)	Measurement Bandwidth RBW/VBW (MHz)	Bandwidth Correction Factor (dB)	Cable Loss* (dB)	Antenna Factor (dB)	Corrected Level (dB $\mu$ V/m /MHz)	Limit (dB $\mu$ V/m /MHz)	Comments
		<b>No emissions detected.</b>						
For frequencies < -250% and > 250% of allocated bandwidth								
Frequency (GHz)	Meter Reading (dB $\mu$ V)	Measurement Bandwidth RBW/VBW (kHz)	Bandwidth Correction Factor (dB)	Cable Loss* (dB)	Antenna Factor (dB)	Corrected Level (dB $\mu$ V/m /4kHz)	Limit (dB $\mu$ V/m /4kHz)	Comments
62.5968	5	30/30	-8.75	22.0	43.4	61.6	84.4	Tx 2nd Harmonic; <b>Rev. Noise</b>
93.8952	5	30/30	-8.75	40.0	46.8	83.0	84.4	Tx 3rd Harmonic; <b>Rev. Noise</b>

\* Cable loss includes external mixer loss and cable loss

**Figure C – 3 Zephyr ODU Setup, Radiated Spurious Emissions,  $F_o = 31.298400$  GHz**



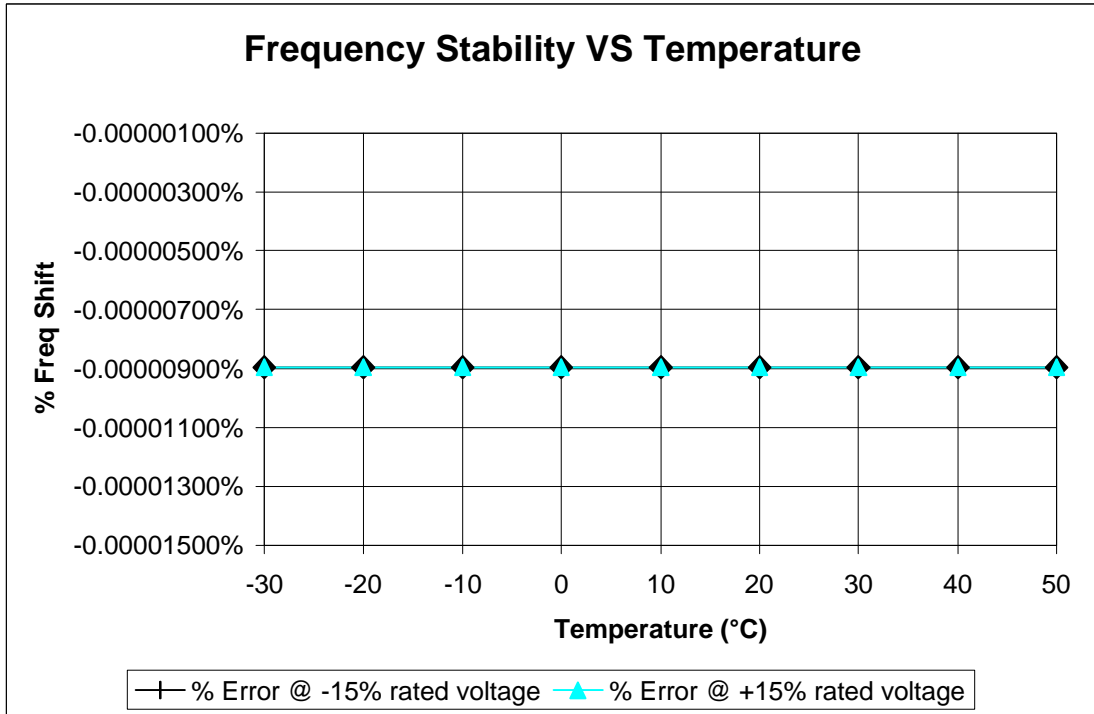
**Figure C – 4 Zephyr ODU Setup, Radiated Spurious Emissions**



**Figure C – 5 Receive Antenna, Radiated Spurious Emissions**

## Appendix D

### Frequency Stability Measurement



**Figure D – 1 Test Results, Frequency Stability Testing of the Zephyr ODU**



**Figure D – 2** Test Setup, Frequency Stability Testing of the Zephyr ODU





**Figure D – 3** Test Setup, Frequency Stability Testing of the Zephyr ODU