EMC Measurement / Technical Report

FCC Test Specification	**:**	FCC Part 24 - Personal Communications Services Subpart E – Broadband PCS
Equipment Authorization	**:**	Certification
Manufacturer	**:**	Littlefeet, Inc.
Equipment Under Test	**:**	Small Profile Intelligent Coverage Element Model bSPICE Model cSPICE
Test Report No.	**:**	FR1526
Purchase Order No.	**:**	E2072781A

Document History					
Revision	***Issue Date***	***Affected Pages***	***Description of Modifications***	***Revised By***	***Approved By***
N/C	January 2, 2001		Initial release		
1.	March 15, 20001	p. 44	Clause 6.3 Intermodulation Attenuation data sheets were inserted in Appendix C – Attachment Section.	J.C.	

EMC Measurement / Technical Report
Document No. FR1526
From
Garwood Laboratories, Inc.
World Compliance Division

Test for
Littlefeet, Inc.
Small Profile Intelligent Coverage Element
Model bSPICE / cSPICE

WRITTEN BY	REVIEWED BY	REVIEWED BY
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EMC Sr. Technician	*Lab Manager*	*NARTE Certified*

Test Personnel	***Test Dates***
Kieth Vu - EMC Test Engineer	24, 26, 27, 31 October 2000

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MEASUREMENT / TECHNICAL REPORT SUMMARY

Manufacturer Company ***Address*** ***City, State, Zip*** ***Country*** ***Contact Name*** ***Phone*** ***Fax***	Littlefeet, Inc. 13000 Gregg Street Poway, CA 92064 USA Dave Seden 858-375-6450 Not Available
Type of Authorization	Certification for Intentional Radiator
Applicable FCC Rules	This technical report is to certify that Equipment Under Test (EUT) complied with the requirements of: FCC Pt.24 – Personal Communications Services Subpart E – Broadband PCS All the tests necessary to show compliance to the requirements were performed and are listed below. RF Power Output Spurious Radiation Emissions Spurious RF Conducted Emissions Frequency Stability Power Line Conducted Emissions The test data presented in this report has been acquired using the guidelines set forth in: FCC Pt.2 §2.1046, §2.1047, §2.1049, §2.1053
Test Results	The EUT complied with the applicable FCC requirements. The test results presented in this document are valid only for the equipment identified herein under the test conditions described. Repeatability of these test results will only be achieved with similar measurement conditions.
Equipment Under Test	Small Profile Intelligent Coverage Element Model bSPICE Model cSPICE
Identification of EUT	FCC ID: (will be generated by the manufacturer)
Production Quantity	Multiple Units

EMC Test Laboratory ***Facility*** ***Address*** ***City, State, Zip Code*** ***Country*** ***Contact Name*** ***Title*** ***Phone*** ***Fax***	Garwood Laboratories, Inc. -OC World Compliance Division 565 Porter Way Placentia, CA 92870 USA Tony Masone General Manager (714) 572-2027 (714) 572-2025

1. General Information

1.1 Product Description

Equipment Under Test: Small Profile Intelligent Coverage Element
Model Number: bSPICE / cSPICE

Description of EUT:

The EUTs are 'Small Profile Intelligent Coverage Element' with the model numbers 'bSPICE' and 'cSPICE'. The products are 1800/1900MHz transceivers for mobile phone telecommunication use.

The bSPICE unit interfaces directly with a third-party Base Transceiver Station (BTS) via cables; it can accommodate both duplexed and separate TX & RX connections. It translates the signal received from the Base Transceiver Station (BTS) to a link frequency, usually a channel within the operator's band allocation. A mobile handset (or equivalent chipset, such as a wireless model) is located within the bSPICE to allow setup, monitoring, and reconfiguration. The maintenance and supervision of a network of SPICE units will be performed by the OMC system, resident at the network operator's central office.

The cSPICE unit uses a similar bSPICE unit for direct coupling to the BTS with many cSPICE units in the field. It provides coverage to the subscriber's handset and is located in the footprint of the coverage area. It may be part of a cluster of units that are simulating the same carriers, from the same BTS. The cSPICE unit receives its input signal on a link frequency from the bSPICE unit and translates to the coverage frequency. No decoding is performed in the main signal path, only RF translation. A mobile handset (or equivalent chipset) is also located within the cSPICE unit to allow two-way communications.

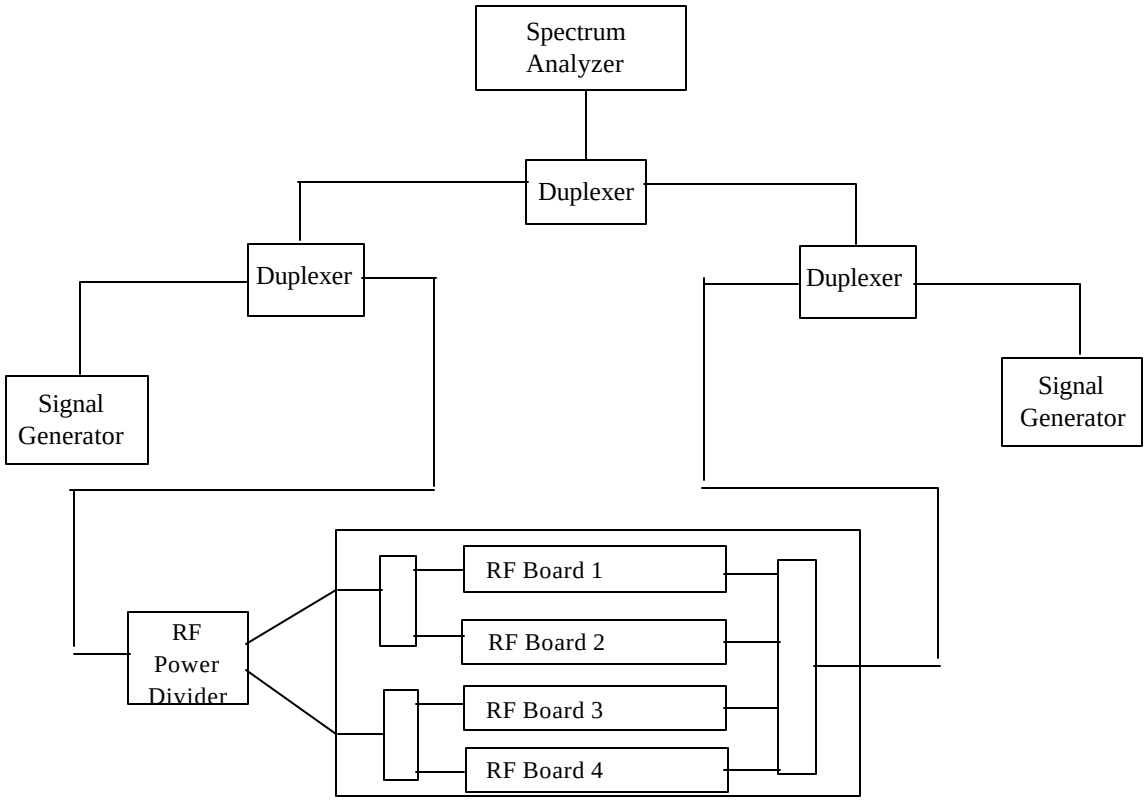
Each SPICE unit uses four identical 'RF Boards' and two 'LNA Boards'. The 'LNA Boards' in the bSPICE unit are identical, but the 'LNA Boards' in the cSPICE unit are both different. One is an Uplink (518-051-01) and the other is a Downlink (518-051-02), but they both utilize the same bare board (919-051-01). The Controller board in each unit is the same at this time. There is a single duplexer from Teledyne Electronic Technologies in the bSPICE. Both units contain an identical custom design power supply from Mesa Power Systems. Furthermore, the bSPICE contains a 'BTS Interface Board' and a 'Power Combiner Board'. The cSPICE has an additional 'Modem Attenuator Board'. The internal power supplies have an input range of 20-48 VAC or DC.

The bSPICE unit has antenna ports, whereas the cSPICE unit contains an integral antenna. Both SPICE units are clearly defined as 'Frequency Translating Repeater Systems'.

1.2 Configuration of Tested System

The following table lists the support equipment used during testing of the EUT. FCC ID numbers are included if available for a tested system component.

Tested System Details					
Item	***Manufacturer***	***Description***	***Model No.***	***Serial No.***	***FCC ID***
1	Hewlett Packard	Spectrum Analyzer	HP 8563		Not Applicable
2	Teledyne	Duplexer	4778	Not Available	Not Applicable
3	Hewlett Packard	Signal Generator	HP E4437B	US39260475	Not Applicable
4	Hewlett Packard	Signal Generator	HP E4437B	US39260179	Not Applicable
5	Mini-Circuits	RF Power Divider	ZN2PD-20	Not Available	Not Applicable



Spice Unit

1.3 Test Facility

The Open Area Test Site (OATS) and measurement facilities used to collect the test data are located at Garwood Laboratories, Inc. World Compliance Division test facility in Placentia, CA. This facility has been fully described in a report submitted to the FCC and accepted in a letter dated 28 January 2000 (31040/SIT 1300F2) registration #90681.

The test facility is also recognized and accredited from following accreditation organizations:

NVLAP

Garwood Laboratories, Inc. is recognized under the National Voluntary Laboratory Accreditation Program (*NVLAP/NIST*) for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. NVLAP Code: 200119-0, Effective through December 31, 2000.

FCC

This site has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Reference : 31040/SIT 1300F2, Registration #90681, January 28, 2000. With the above and NVLAP, Garwood Laboratories is an authorized test laboratory for the DoC process.

Technology International (I^2T)

Garwood Laboratories, Inc. has been assessed in accordance with ISO Guide *25* and with ITI's assessment criteria. Based upon this assessment, Technology International (Europe), Ltd. Has granted approval for specifications implementing the EU Directive on EMC (89/336/EEC). The scope of the approval was provided on a Schedule of Assessment supplied with a certificate and is available upon request. Certificate #99-051, Dated: May 9, 2000.

ACA

Garwood Laboratories, Inc. can also perform testing for the Australian C-Tick mark as a result of our NVLAP accreditation and the MRA (Mutual Recognition Agreement) between the US and Australia.

VCCI

Garwood Laboratories, Inc. has been accepted as a member to the VCCI. Our conducted and radiated measurement facilities have been registered in accordance with Regulations for Voluntary Control Measures.
Registration C574, C575, C576, R561.

Industry Canada

Garwood Laboratories, Inc. is registered by Industry Canada for performance of measurements and complies with RSP 100. Reference IC 3298, Dated: March 11, 1999.

BSMI (Formerly known as BCIQ)

Garwood Laboratories, Inc. can perform testing for Taiwan to the CNS requirements. This is as a result of our NVLAP accreditation and the MRA (Mutual Recognition Agreement) between the US and Taiwan.

Nmi (Nederlands Meetinstituut)

Garwood Laboratories, Inc. has entered into a cooperative agreement with Nmi Certin B.V. of the Netherlands. Ther are a Notified Body for the RATTE Directive and Maritime Directive as well as a Competent Body for the EMC Directive.

2. Product Labeling

2.1 FCC ID Label

All devices authorized under the certification procedures are required to display an identification label showing the FCC Identifier (FCC ID) under which they are authorized.
Example:

FCC ID: XXX123

XXX = Indicates manufacturer's Grantee Code
123 = Indicates manufacturer's Equipment Product Code

In addition, the manufacturer (or importer) is responsible for having the compliance label produced, and for having it affixed to each unit that is marketed or imported.

FCC Compliance Label:

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference including interference that may cause undesired operation.

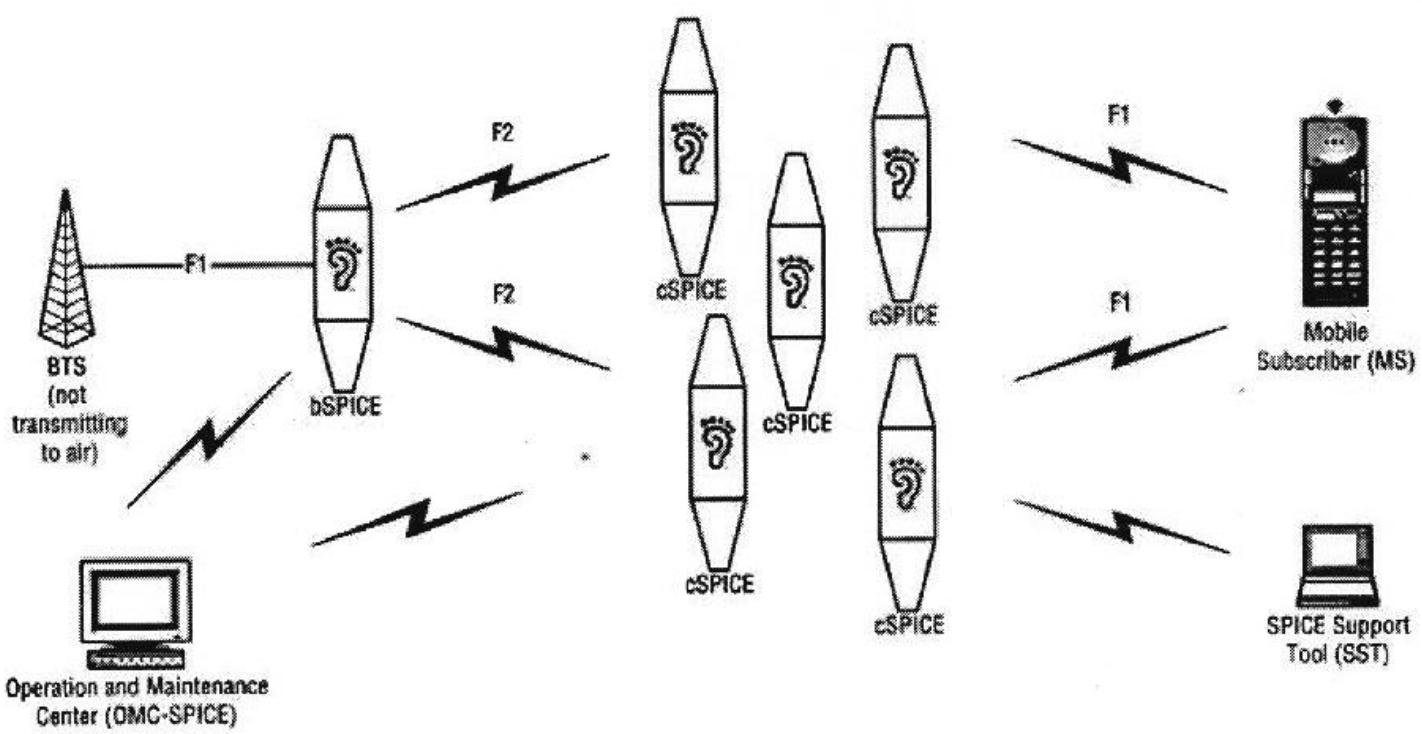
2.2 Location of Label on the EUT

As stated in §15.19, the label shall be located in a conspicuous location on the device. When the device is so small or for such use that it is not practicable to place the compliance label on it, the information required should be placed in a prominent location in the instruction manual or pamphlet supplied to the user. Alternatively, the compliance label can be placed on the container in which the device is marketed. However, the FCC identifier must be displayed on the device.

2.3 Information to the user

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

3. Block Diagrams of the EUTs



cSPICE & bSPICE Operation Diagram

4. Test Results

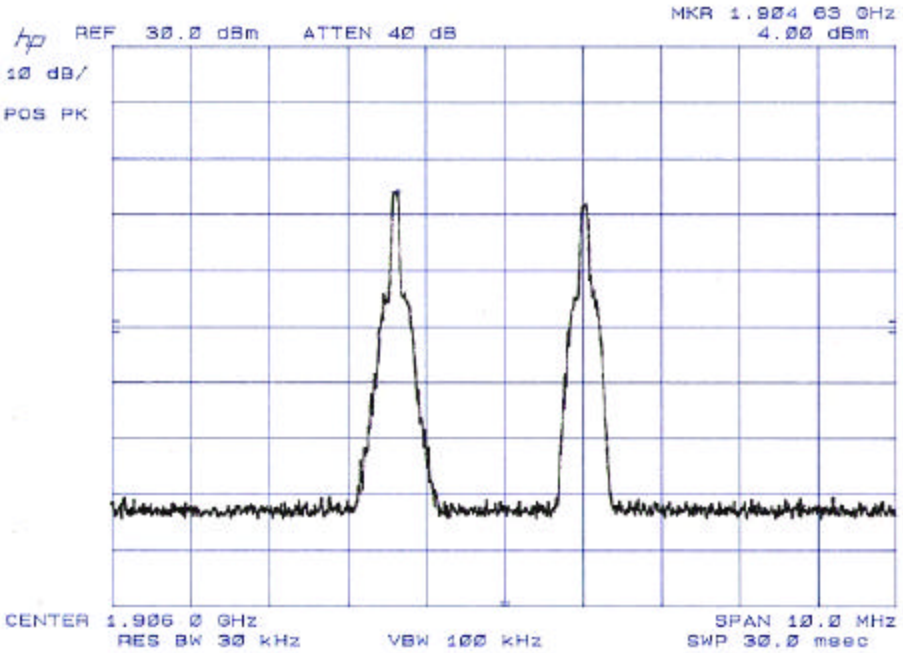
4.1 Output Power

The output power was found by connecting the output of the EUT directly into the Spectrum Analyzer's RF input. The marker-to-peak function was used to set the marker to the peak of the emission. The indicated level is the peak output power after the reading is corrected for any external attenuation and/or cable loss.

CFR 47 Part 24 Subpart E §24.232:
The power limit for mobile/portable stations is limited to 2 watts E.I.R.P peak power and the equipment must employ means to limit the power to the minimum necessary for successful communication.

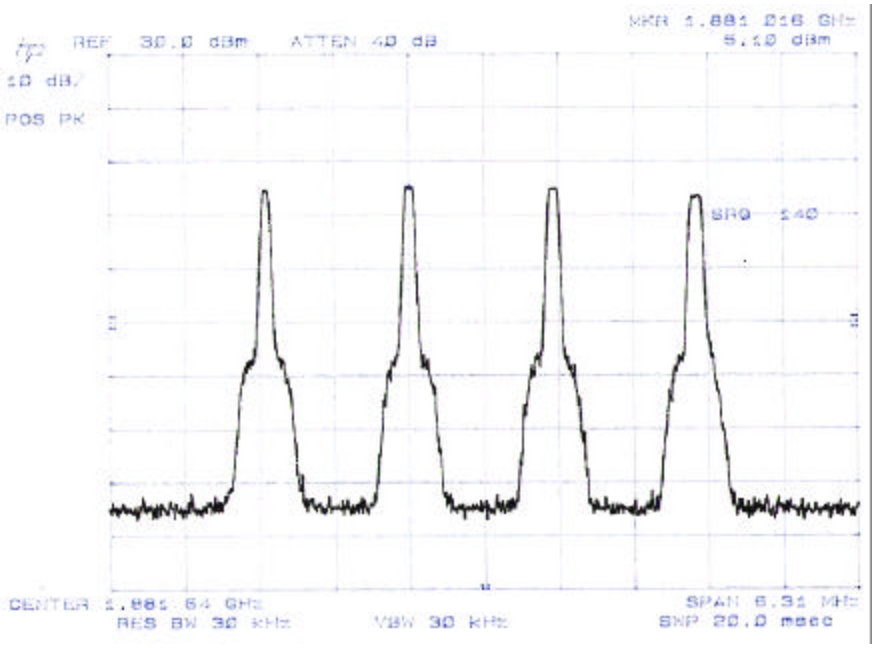
Test Results cSPICE:
The cSPICE complied with the FCC requirements. The frequency range over which the device operates is more than 10MHz; therefore, three frequencies were measured (one near top, one near middle, and one near bottom). The following plots show the test results.

cSPICE Uplink (top frequency)



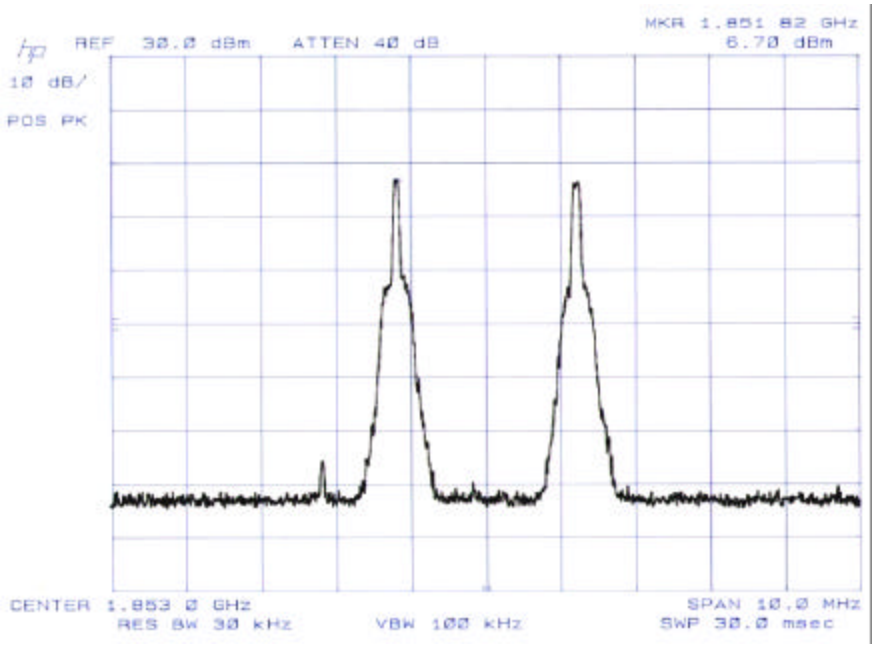
Peak SA Reading + correction factor = Peak Output power
4dBm + 9.0dB = 13.0 dBm (or 0.01995W)

cSPICE Uplink (middle frequency)



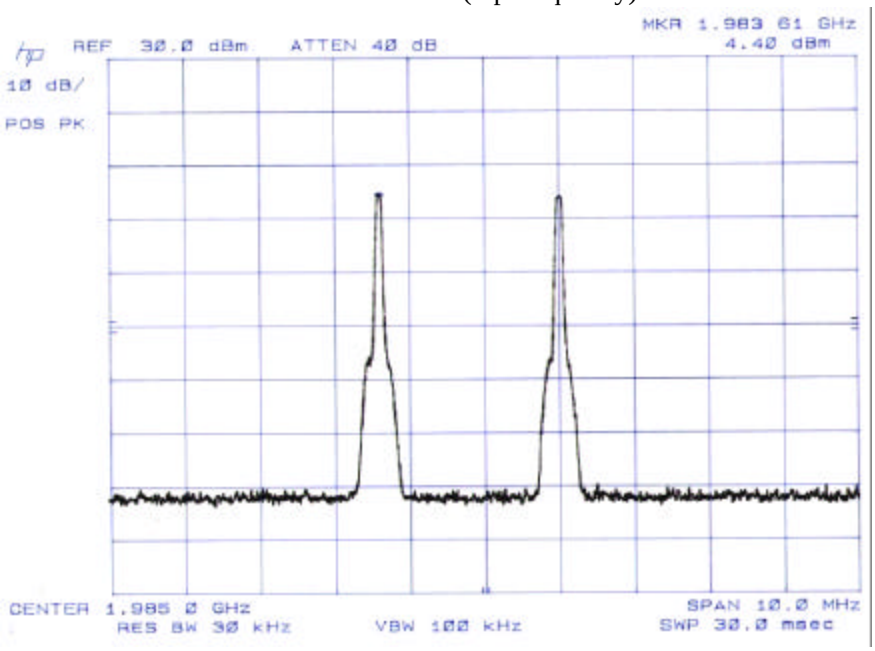
Peak SA Reading + correction factor = Peak Output power
5.1dBm + 9.0dB = 14.1dBm (or 0.02570W)

cSPICE Uplink (bottom frequency)



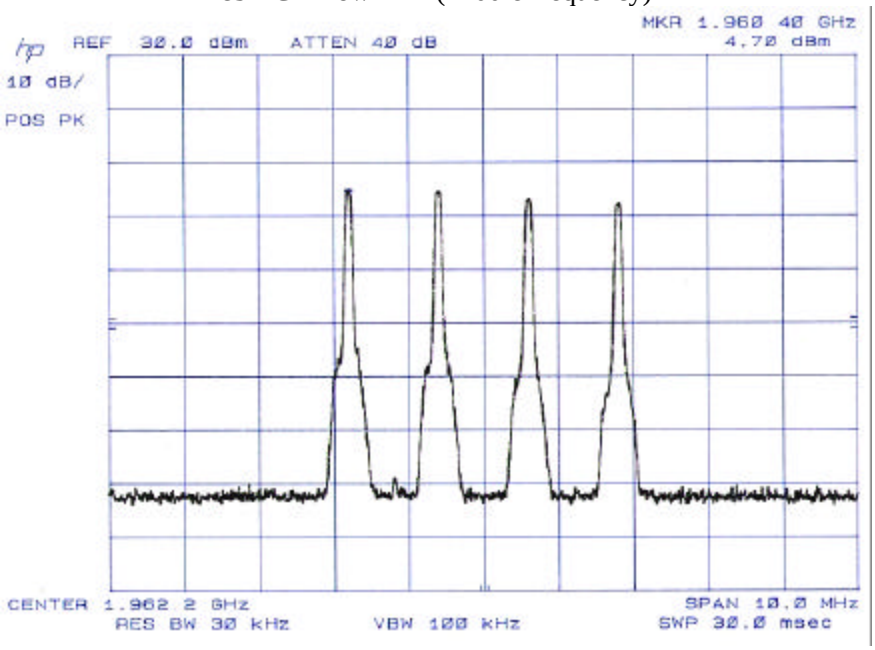
Peak SA Reading + correction factor = Peak Output power
6.70dBm + 9.0dB = 15.7dBm (or 0.03715W)

cSPICE Downlink (top frequency)



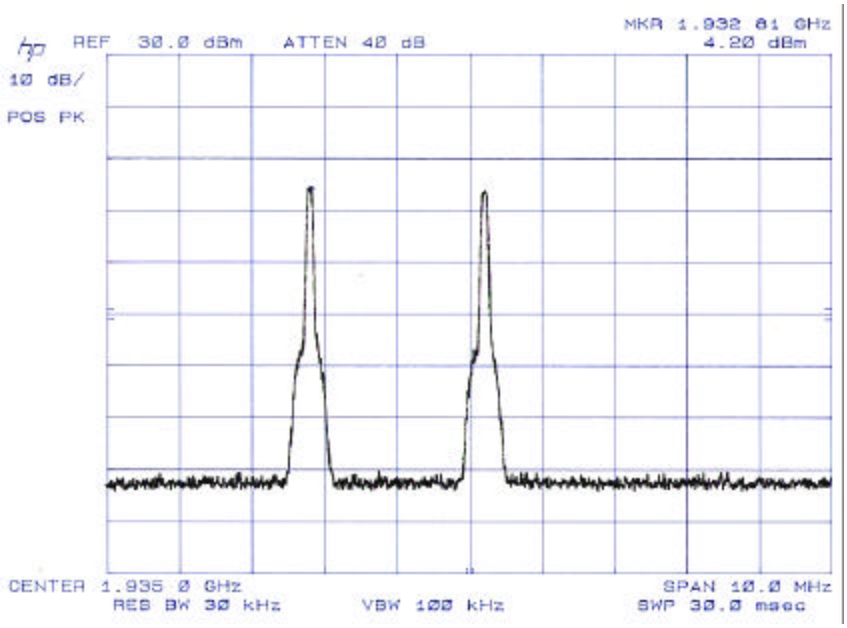
Peak SA Reading + correction factor = Peak Output power
4.40dBm + 18.0dB = 22.4dBm (or 0.17378W)

cSPICE Downlink (middle frequency)



Peak SA Reading + correction factor = Peak Output power
4.70dBm + 18.0dB = 22.7dBm (or 0.18621W)

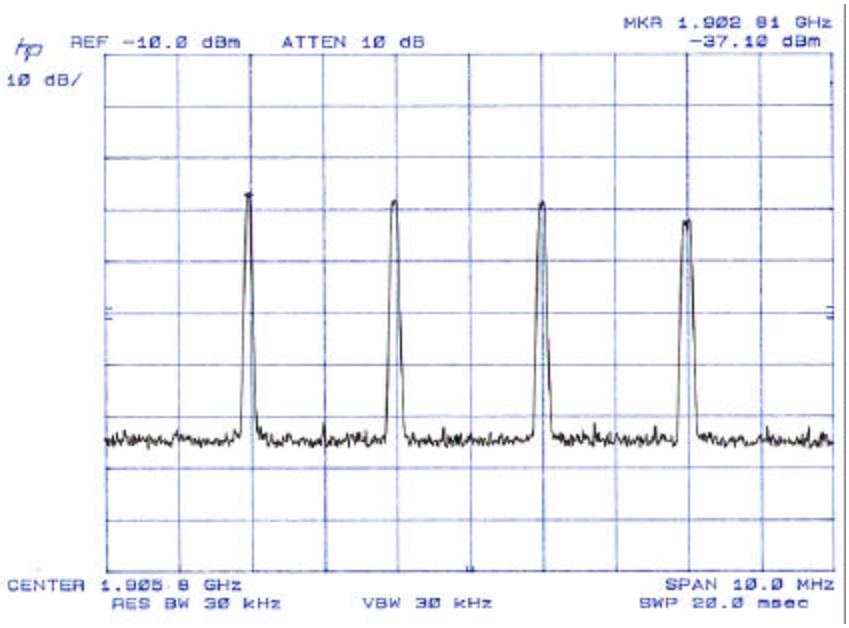
cSPICE Downlink (bottom frequency)



Peak SA Reading + correction factor = Peak Output power
4.20dBm + 18.0dB = 22.2dBm (or 0.16596W)

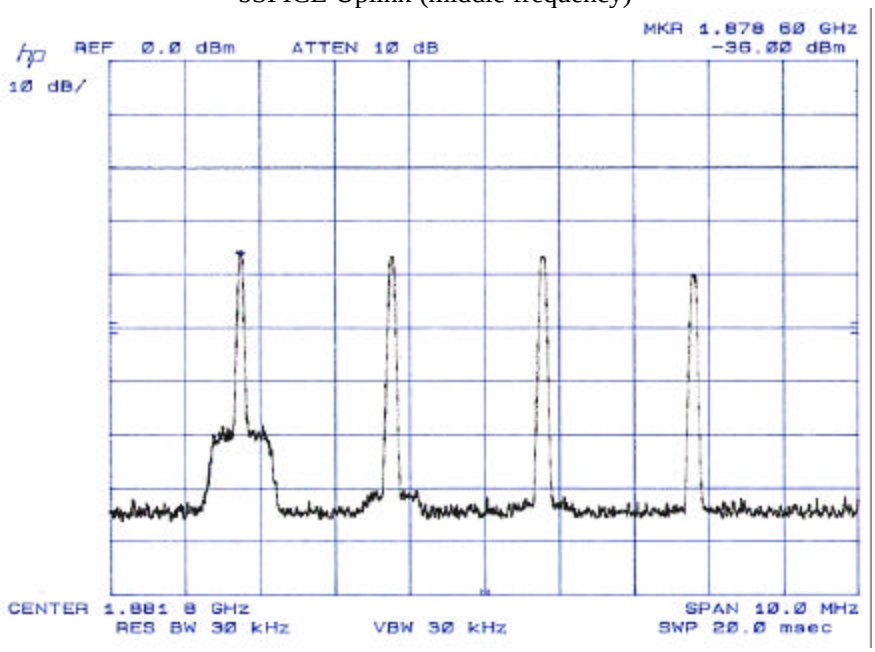
Test Results bSPICE:
The bSPICE complied with the FCC requirements. The frequency range over which the device operates is more than 10MHz; therefore, three frequencies were measured (one near top, one near middle, and one near bottom). The following plots show the test results.

bSPICE Uplink (top frequency)



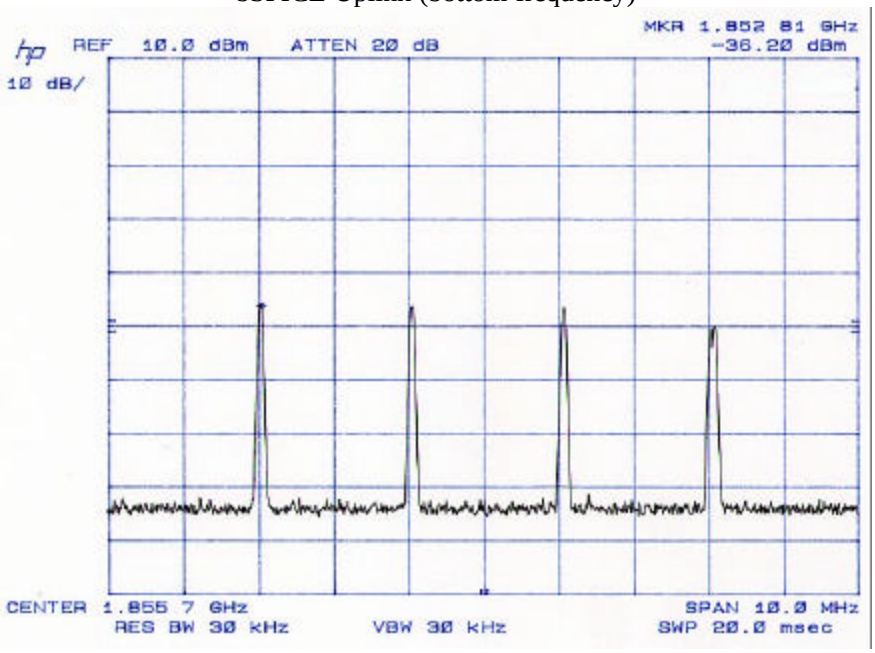
Peak SA Reading + correction factor = Peak Output power
-37.10dBm + 3.0dB = -34.1dBm (or 389nW)

bSPICE Uplink (middle frequency)



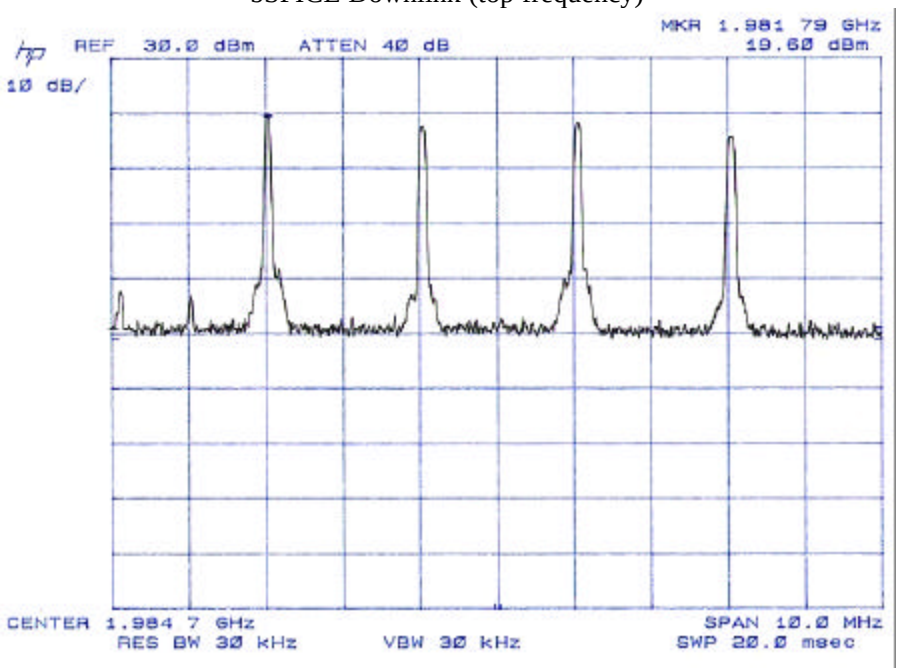
Peak SA Reading + correction factor = Peak Output power
-36.0dBm + 3.0dB = -33.0dBm (or 501nW)

bSPICE Uplink (bottom frequency)



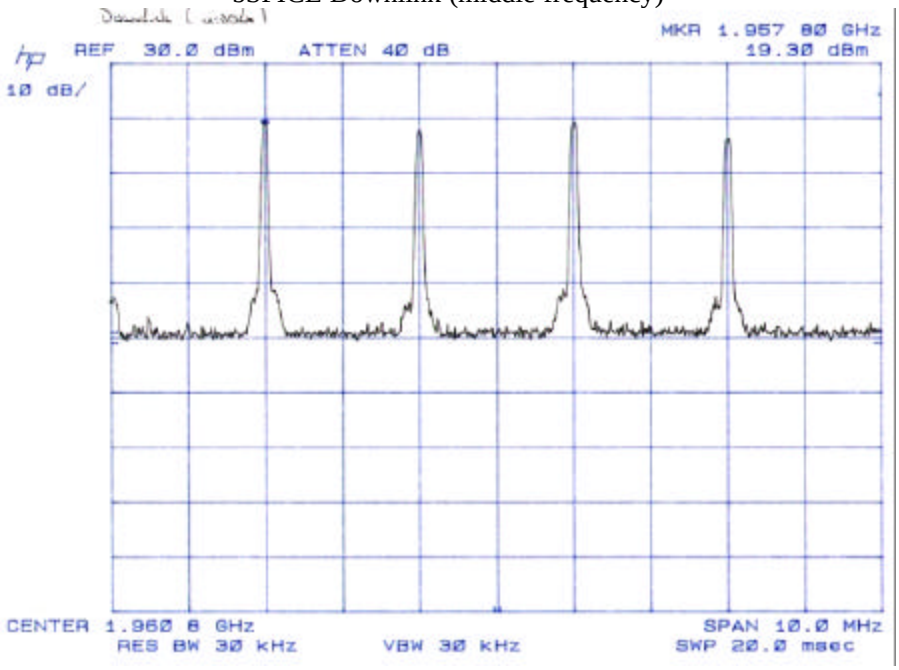
Peak SA Reading + correction factor = Peak Output power
-36.20dBm + 3.0dB = 33.2dBm (or 479nW)

bSPICE Downlink (top frequency)



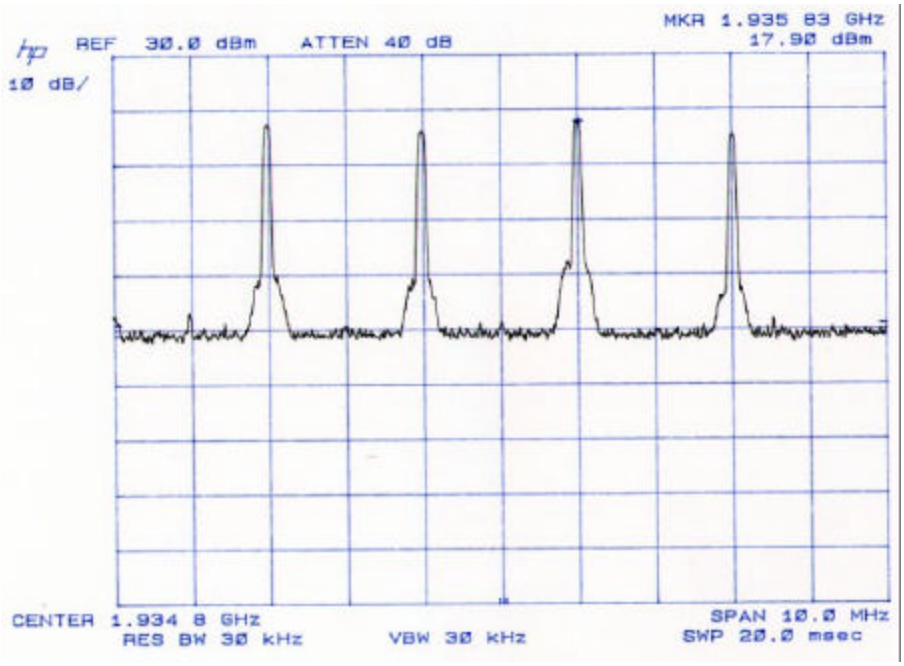
Peak SA Reading + correction factor = Peak Output power
19.60dBm + 3.0dB = 22.6dBm (or 0.18197W)

bSPICE Downlink (middle frequency)



Peak SA Reading + correction factor = Peak Output power
19.30dBm + 3.0dB = 22.3dBm (or 0.16982W)

bSPICE Downlink (bottom frequency)



Peak SA Reading + correction factor = Peak Output power
17.90dBm + 3.0dB = 20.9dBm (or 0.12303W)

4.2 Spurious Radiated Emissions

Measurements were made to detect spurious emissions in the Open Air Test Site (OATS). The EUT was placed 80 centimeters above the ground plane on a non-conductive tabletop 1.0-meter width by 1.5-meter length. The configuration of the EUT and its cables were varied to maximize the amplitude level of the emissions, when applicable. In addition, rotating the turntable 360 degrees and varying the antenna height from 1 to 4 meters maximized the emissions. Measurements were made with a Horn antenna up to the 10th harmonic of the fundamental in both vertical and horizontal polarization. The distance between the EUT and the measuring antenna was 3 meters. On any frequency outside a licensee's frequency block, the power of any emissions should be attenuated below the transmitter power (P) by at least 43 + 10log (P) dB. The following table contains the results:

Test Results cSPICE:
Tuned Frequency: Uplink – 1.877GHz
Downlink – 1.958GHz
Measurement Distance: 3m

Frequency (MHz)	Emission Level (dBmV)	Correction Factor (dB)	Corrected Reading (dBmV/m)	FCC Limit @ 3 meters (dBmV/m)	Delta to FCC Limit (dB)
-	NDS	-	-	-	-
-	NDS	-	-	-	-

There were no detectable spurious emissions from the cSPICE. The measurement frequency range investigated was up to the EUT's 10th harmonic.

Test Results bSPICE:
Tuned Frequency: Uplink – 1.886GHz
Downlink – 1.968GHz
Measurement Distance: 3m

Frequency (MHz)	Emission Level (dBmV)	Correction Factor (dB)	Corrected Reading (dBmV/m)	FCC Limit @ 3 meters (dBmV/m)	Delta to FCC Limit (dB)
-	NDS	-	-	-	-
-	NDS	-	-	-	-

There were no detectable spurious emissions from the bSPICE. The measurement frequency range investigated was up to the EUT's 10th harmonic.

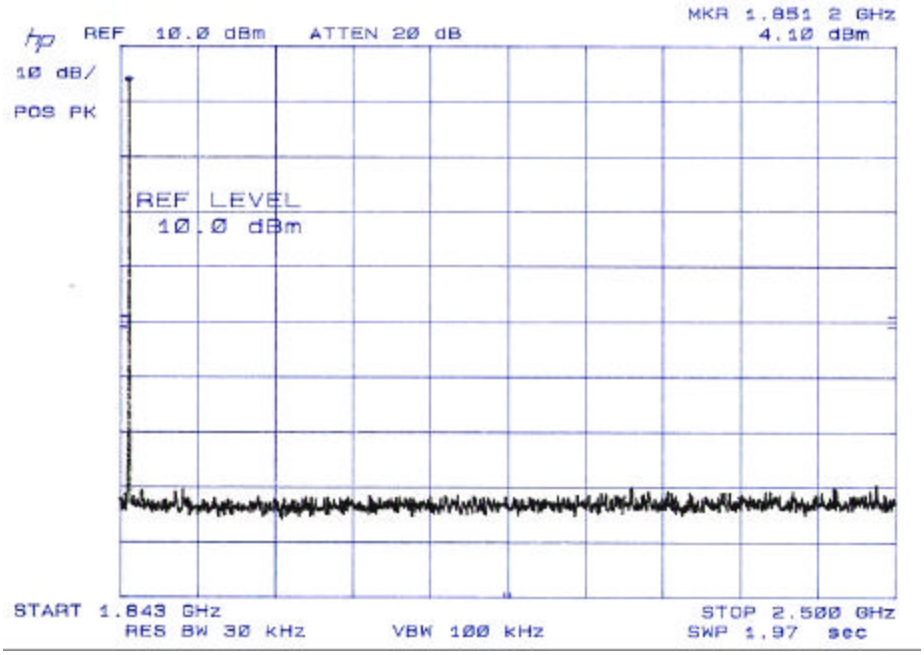
Test Personnel:
Kieth Vu – EMC Test Engineer

4.3 Spurious RF Conducted Emissions

Measurements were performed to detect spurious RF conducted emissions. The measurements were made by connecting the output of the EUT directly into the RF input of the Spectrum Analyzer. The frequency span of the Spectrum Analyzer was set wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic. The following plots show the test results.

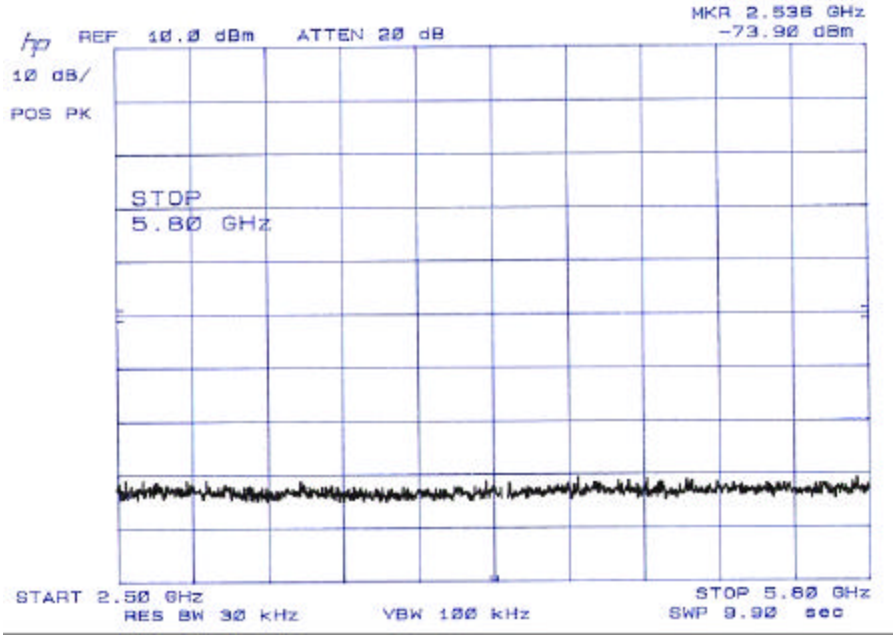
Test Results cSPICE:
The frequency range over which the device operates is more than 10MHz; therefore, the spurious RF conducted emissions test was performed with the EUT tuned to three frequencies (one near top, one near middle, and one near bottom). The cSPICE complied with the FCC requirements at all three tuned frequencies. The following plots show the test results. Only the data for the bottom frequency is displayed.

cSPICE Uplink (bottom frequency)



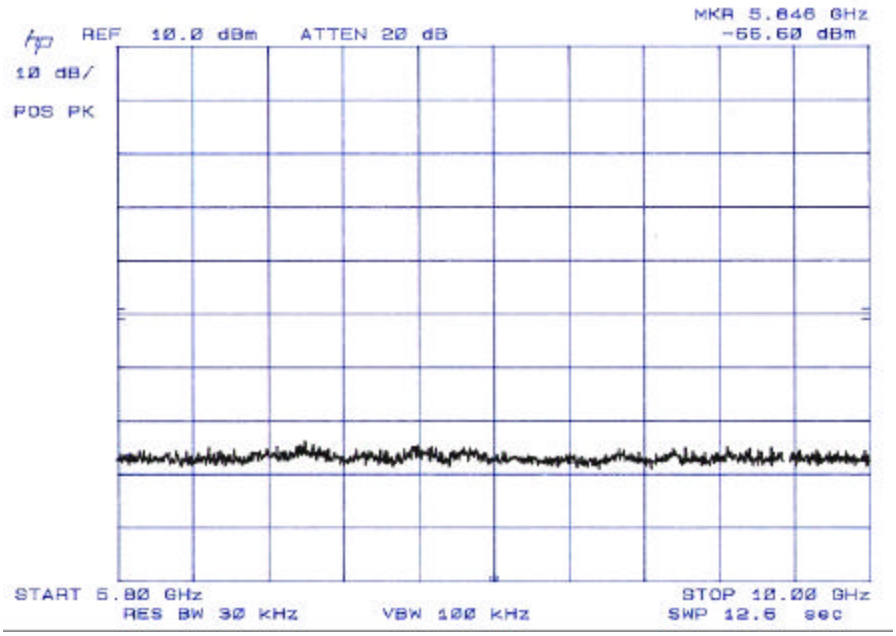
Spurious RF Conducted Emissions: 1.843GHz to 2.5GHz

cSPICE Uplink (bottom frequency)



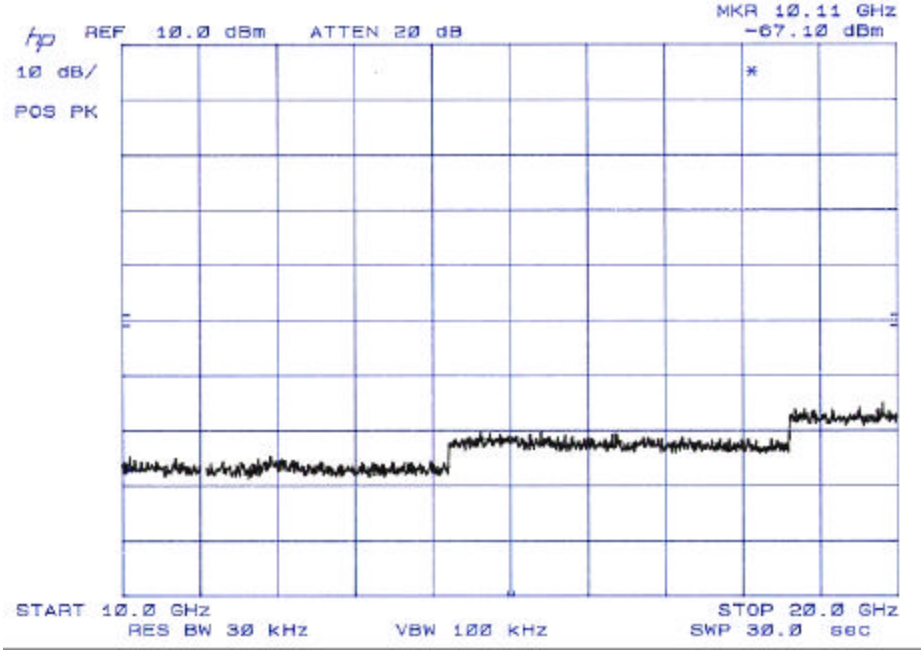
Spurious RF Conducted Emissions: 2.5GHz to 5.8GHz

cSPICE Uplink (bottom frequency)



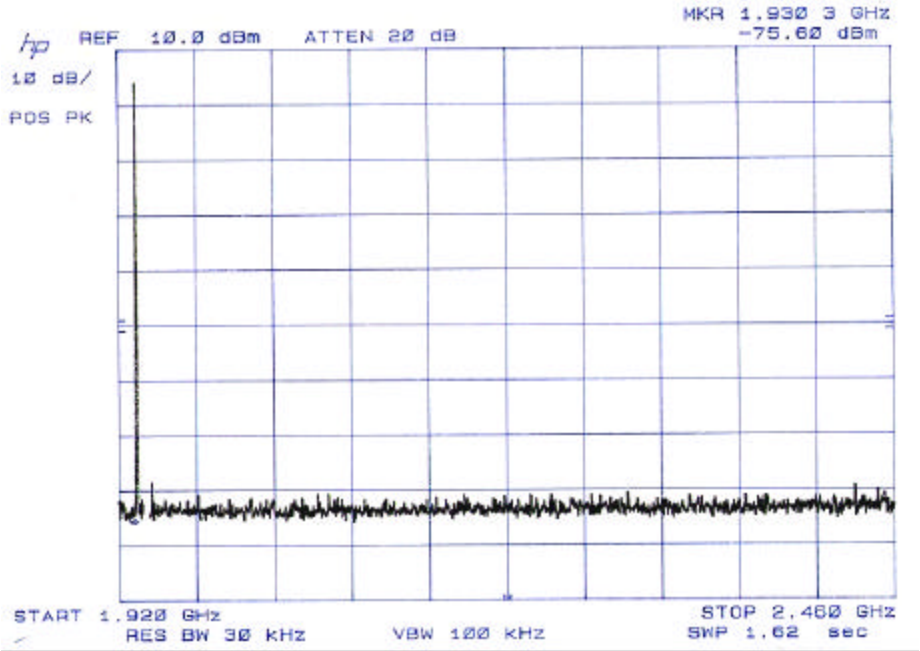
Spurious RF Conducted Emissions: 5.8GHz to 10.0GHz

cSPICE Uplink (bottom frequency)



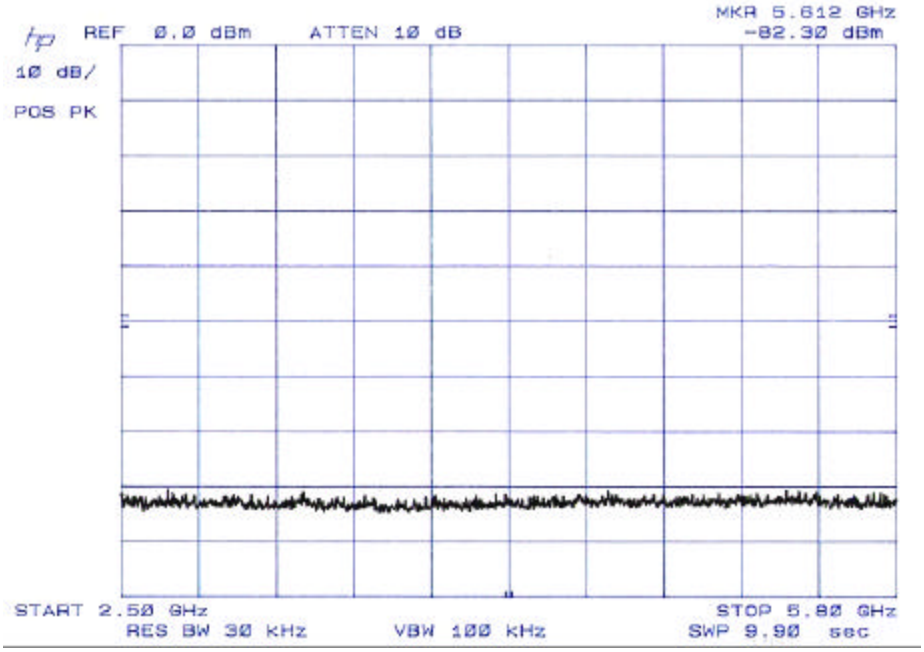
Spurious RF Conducted Emissions: 10.0GHz to 20.0GHz

cSPICE Downlink (bottom frequency)



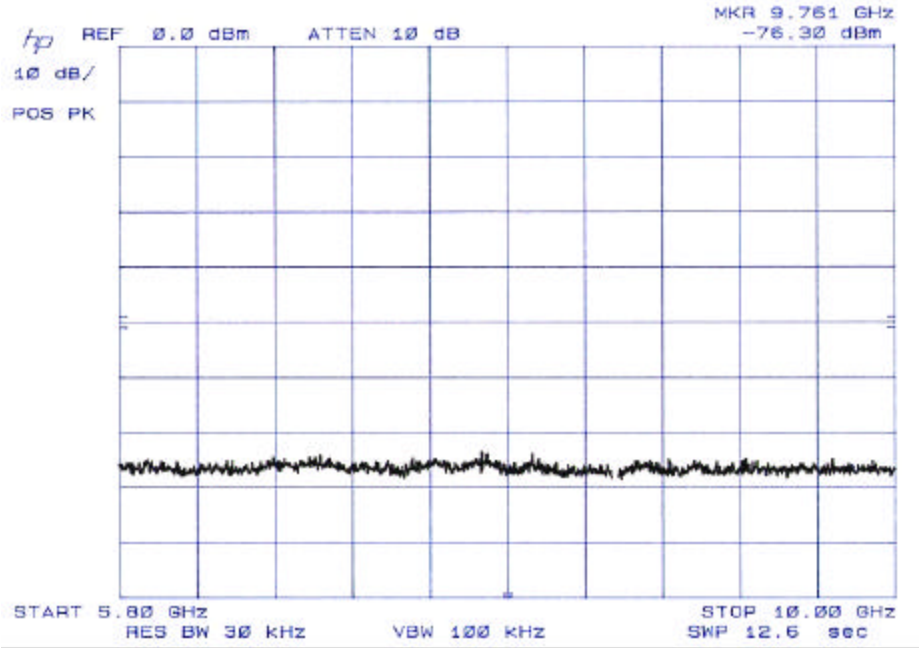
Spurious RF Conducted Emissions: 1.92GHz to 2.46GHz

cSPICE Downlink (bottom frequency)



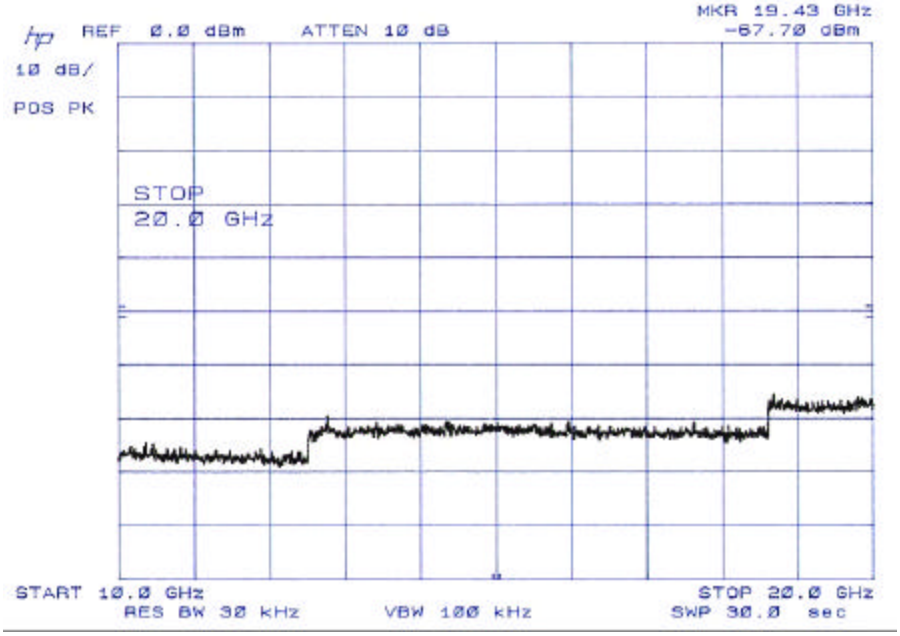
Spurious RF Conducted Emissions: 2.5GHz to 5.8GHz

cSPICE Downlink (bottom frequency)



Spurious RF Conducted Emissions: 5.8GHz to 10.0GHz

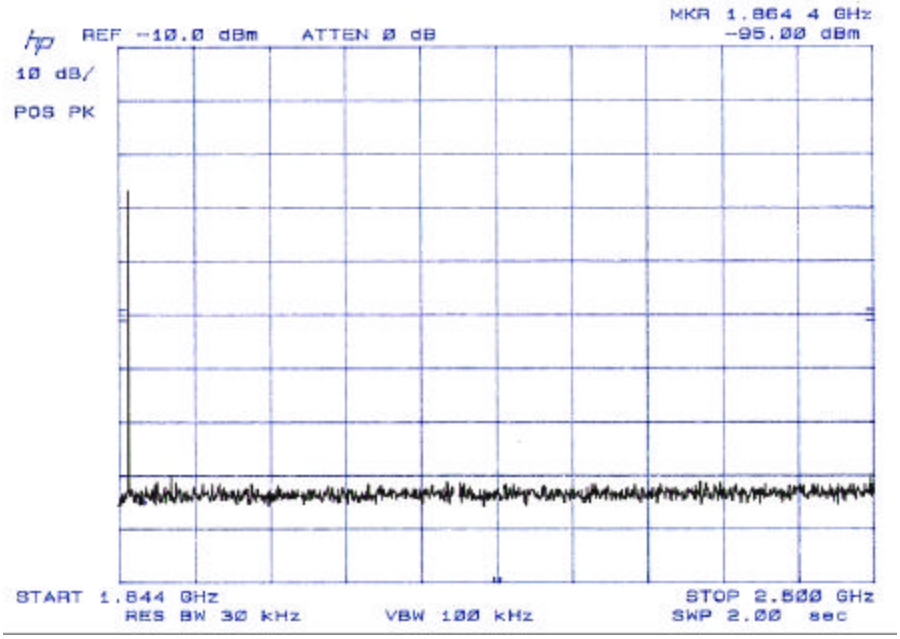
cSPICE Downlink (bottom frequency)



Spurious RF Conducted Emissions: 10.0GHz to 20.0GHz

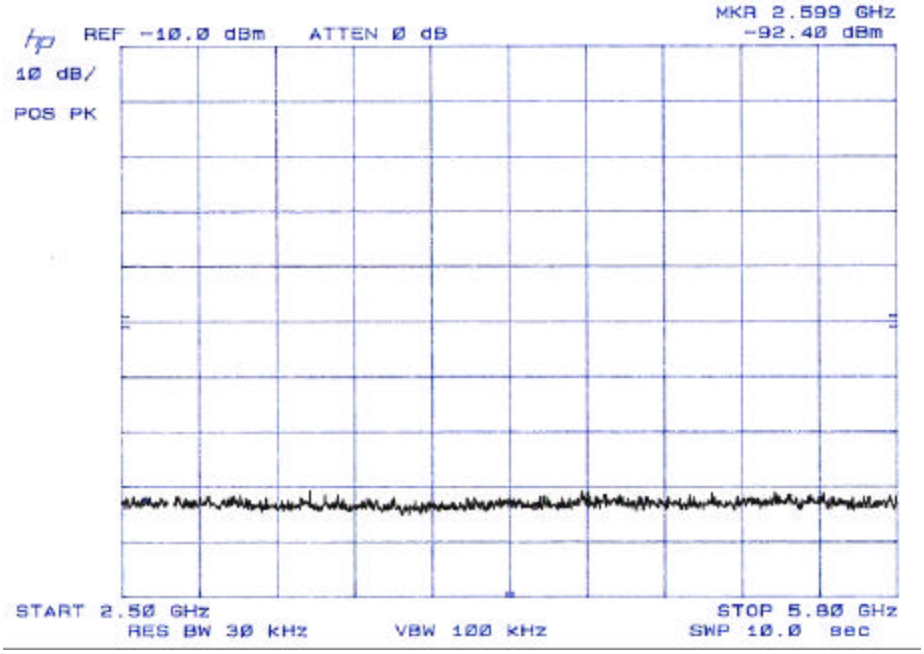
Test Results bSPICE:
The frequency range over which the device operates is more than 10MHz; therefore, the spurious RF conducted emissions test was performed with the EUT tuned to three frequencies (one near top, one near middle, and one near bottom). The bSPICE complied with the FCC requirements at all three tuned frequencies. The following plots show the test results. Only the data for the bottom frequency (uplink and downlink) is displayed.

bSPICE Uplink (bottom frequency)



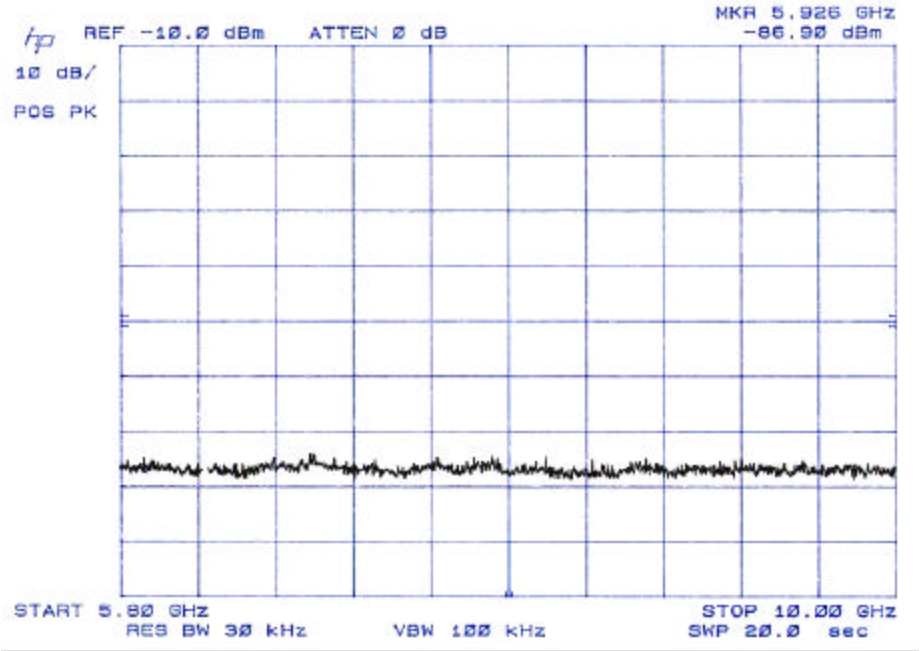
Spurious RF Conducted Emissions: 1.844GHz to 2.5GHz

bSPICE Uplink (bottom frequency)



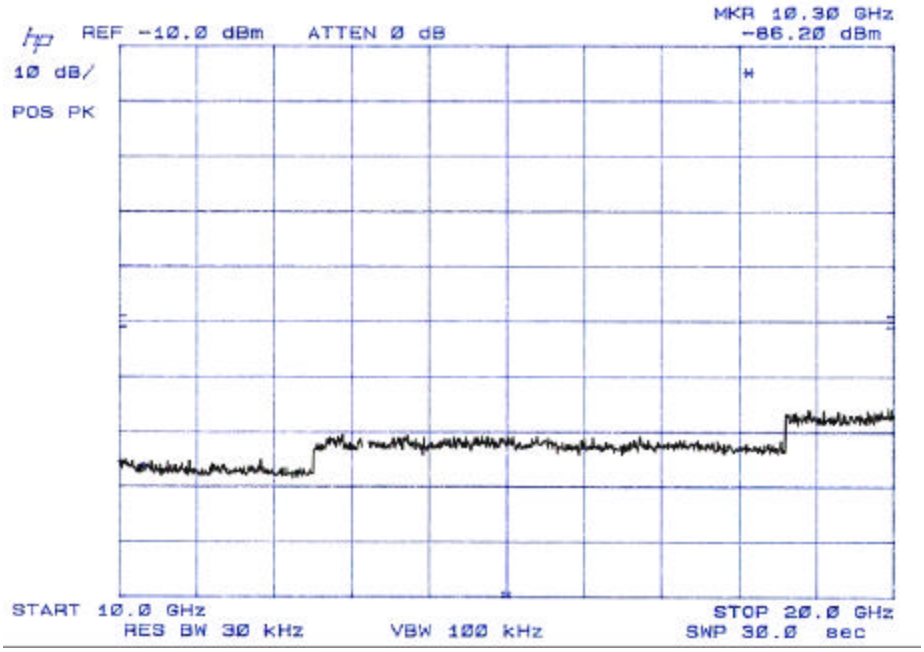
Spurious RF Conducted Emissions: 2.5GHz to 5.8GHz

bSPICE Uplink (bottom frequency)



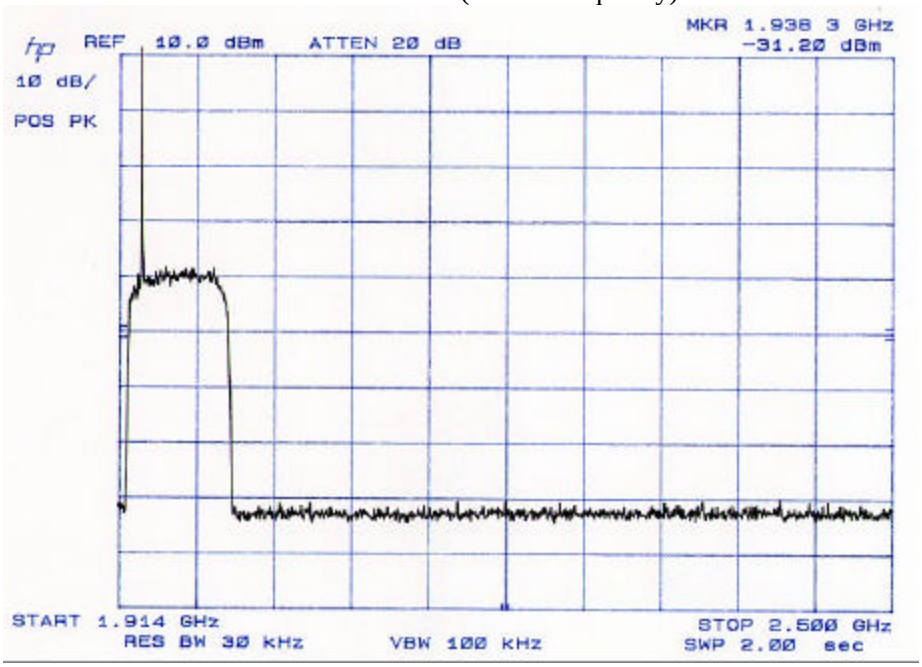
Spurious RF Conducted Emissions: 5.8GHz to 10.0GHz

bSPICE Uplink (bottom frequency)



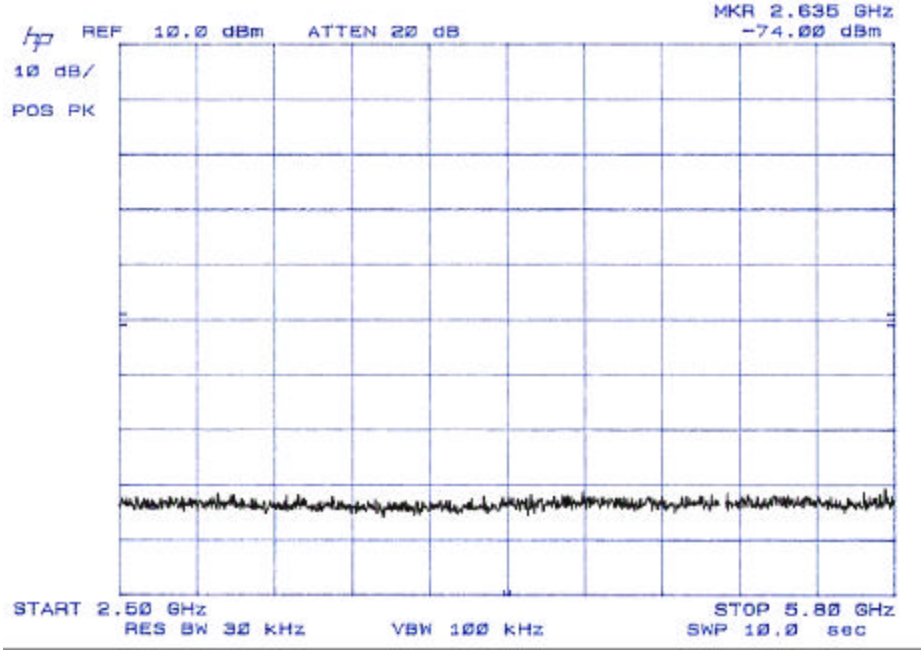
Spurious RF Conducted Emissions: 10.0GHz to 20.0GHz

bSPICE Downlink (bottom frequency)



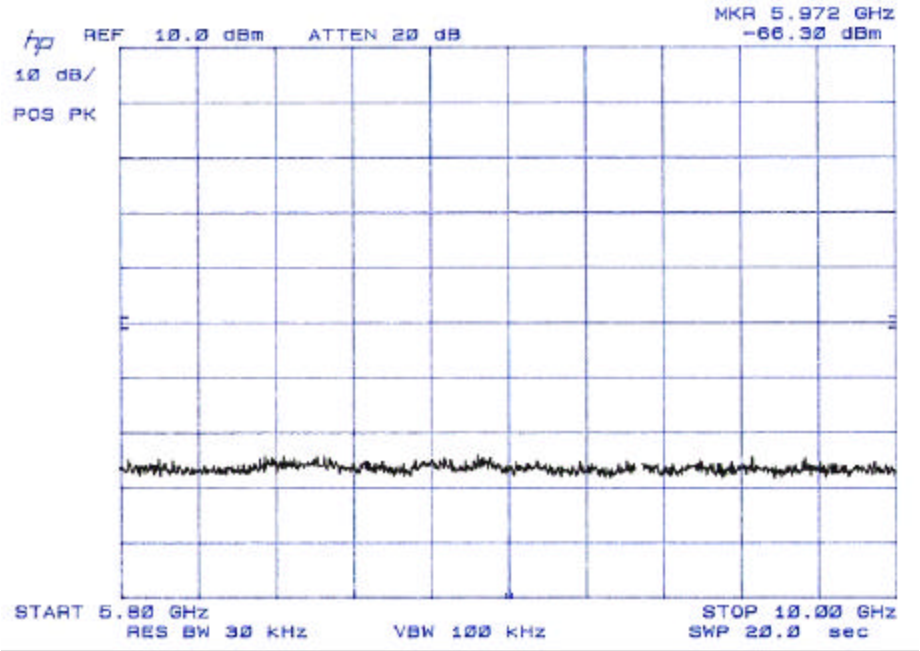
Spurious RF Conducted Emissions: 1.914GHz to 2.50GHz

bSPICE Downlink (bottom frequency)



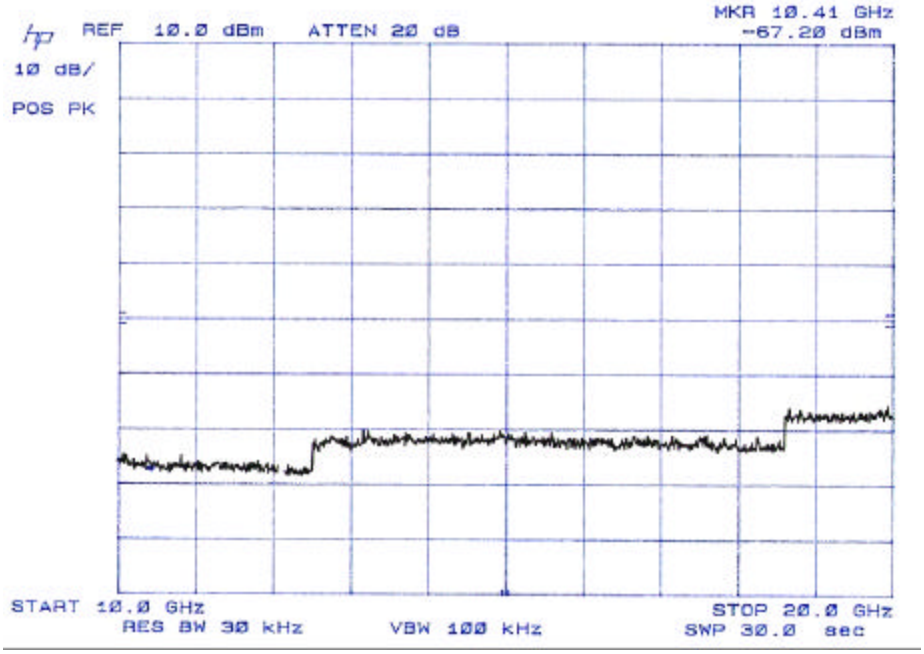
Spurious RF Conducted Emissions: 2.5GHz to 5.8GHz

bSPICE Downlink (bottom frequency)



Spurious RF Conducted Emissions: 5.8GHz to 10.0GHz

bSPICE Downlink (bottom frequency)



Spurious RF Conducted Emissions: 10.0GHz to 20.0GHz

4.4 Frequency Stability

Frequency stability is a measure of the frequency drift due to temperature variations, with reference to the frequency measured at 20°C and the rated supply voltage.

Test Requirement (CFR47 Part 24 Subpart E §24.235):
The frequency stability should be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Results cSPICE:
The manufacturer, Littlefeet Inc, performed the frequency stability test. The data below shows that the cSPICE complied with the frequency stability requirements.

Frequency Stability vs. Temperature

Frequency tuned: Downlink – 1958800000 Hz
Uplink – 1877800000 Hz

Temperature (°C)	Downlink Frequency (MHz)	Frequency Deviation (Hz)	Frequency Deviation (%)	Uplink Frequency (MHz)	Frequency Deviation (Hz)	Frequency Deviation (%)
-30	1958800003	-3	1.532E-09	1877800018	-18	9.586E-09
-20	1958800002	-2	1.021E-09	1877800017	-17	9.053E-09
-10	1958800003	-3	1.532E-09	1877800018	-18	9.586E-09
0	1958800002	-2	1.021E-09	1877800020	-20	1.065E-08
+10	1958800002	-2	1.021E-09	1877800020	-20	1.065E-08
+20	1958800002	-2	1.021E-09	1877800022	-22	1.172E-08
+30	1958800002	-2	1.021E-09	1877800022	-22	1.172E-08
+40	1958800002	-2	1.021E-09	1877800022	-22	1.172E-08
+50	1958800002	-2	1.021E-09	1877800025	-25	1.331E-08

Frequency Stability - continued

Test Results bSPICE:
The manufacturer, Littlefeet Inc, performed the frequency stability test. The data below shows that the bSPICE complied with the frequency stability requirements.

Frequency Stability vs. Temperature

Frequency tuned: Downlink – 1968800000 Hz
Uplink – 1886800000 Hz

Temperature (°C)	Downlink Frequency (MHz)	Frequency Deviation (Hz)	Frequency Deviation (%)	Uplink Frequency (MHz)	Frequency Deviation (Hz)	Frequency Deviation (%)
-30	1968800006	-6	3.048E-09	1886800002	-2	1.060E-09
-20	1968800006	-6	3.048E-09	1886800005	-5	2.650E-09
-10	1968800001	-1	5.079E-10	1886800001	-1	5.300E-10
0	1968800001	-1	5.079E-10	1886800001	-1	5.300E-10
+10	1968800002	-2	1.016E-09	1886800002	-2	1.060E-09
+20	1968800002	-2	1.016E-09	1886800002	-2	1.060E-09
+30	1968800002	-2	1.016E-09	1886800002	-2	1.060E-09
+40	1968800002	-2	1.016E-09	1886800003	-3	1.590E-09
+50	1968800002	-2	1.016E-09	1886800003	-3	1.590E-09

4.5 Power Line Conducted Emissions

4.5.1 Conducted Emissions Limits

FCC Class A		
Frequency (MHz)	***Quasi Peak Limit (dBuV)***	***Remarks***
0.45 – 1.705	60	None
1.705 - 30.0	69.5	None

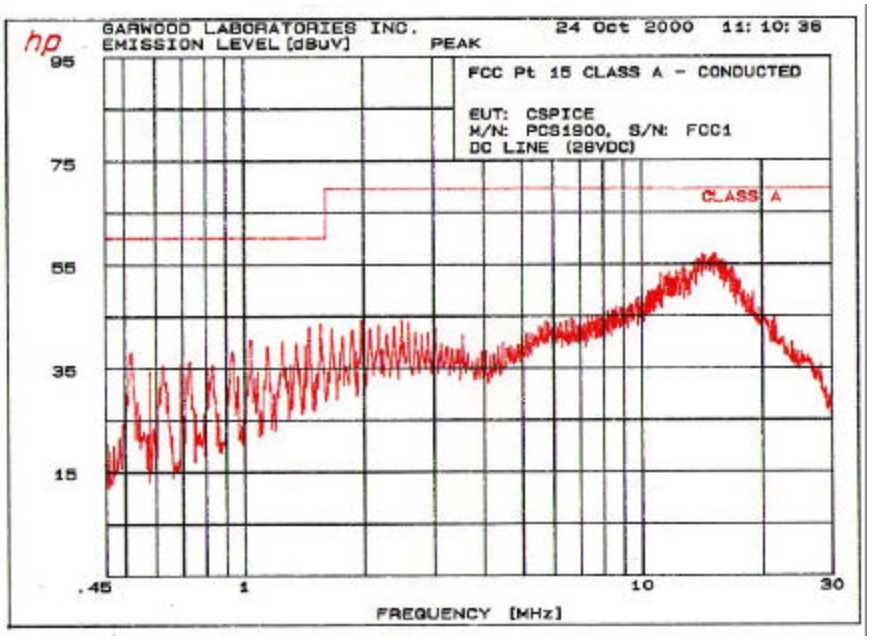
4.5.2 Summary Table for Highest Conducted Emissions Levels

The initial step in collecting data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the data page, and these signals are then quasi-peaked if necessary. The following data lists the significant emission frequencies and measured levels measured from the EUT.

Test Results cSPICE: Tested at 28VDC

Sensor Location	***Frequency Band (MHz)***	***Measured* (dBmV)***	***Delta To Limit (dB)***
DC Line	15.14	57.0	-12.5
	14.22	56.9	-12.6
	15.33	56.9	-12.6
	14.4	56.6	-12.9
	14.95	56.3	-13.2
	13.8	56.0	-13.5

* All readings are peak with specified CISPR bandwidth unless stated otherwise.



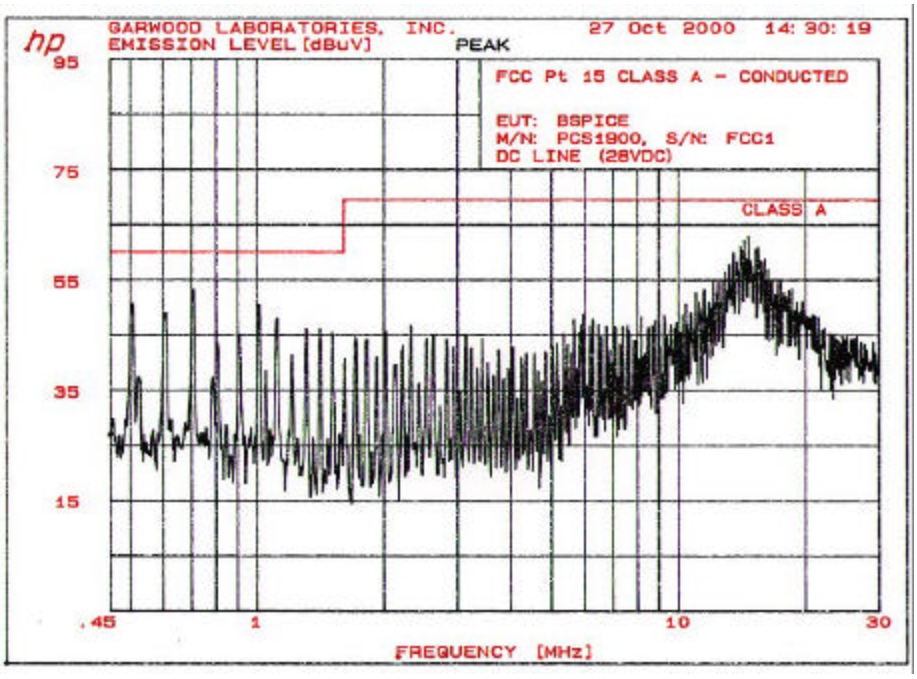
Test Personnel:
Kieth Vu – EMC Test Engineer

Summary Table for Highest Conducted Emissions Levels – continued –

Test Results bSPICE: Tested at 28VDC

Sensor Location	*Frequency Band (MHz)*	*Measured* (dBmV)*	*Delta To Limit (dB)*
DC Line	14.64	62.9	-6.6
	0.7109	53.1	-6.9
	14.34	62.2	-7.3
	14.04	61.1	-8.4
	15.46	60.8	-8.7
	15.27	60.5	-9.0

* All readings are peak with specified CISPR bandwidth unless stated otherwise.



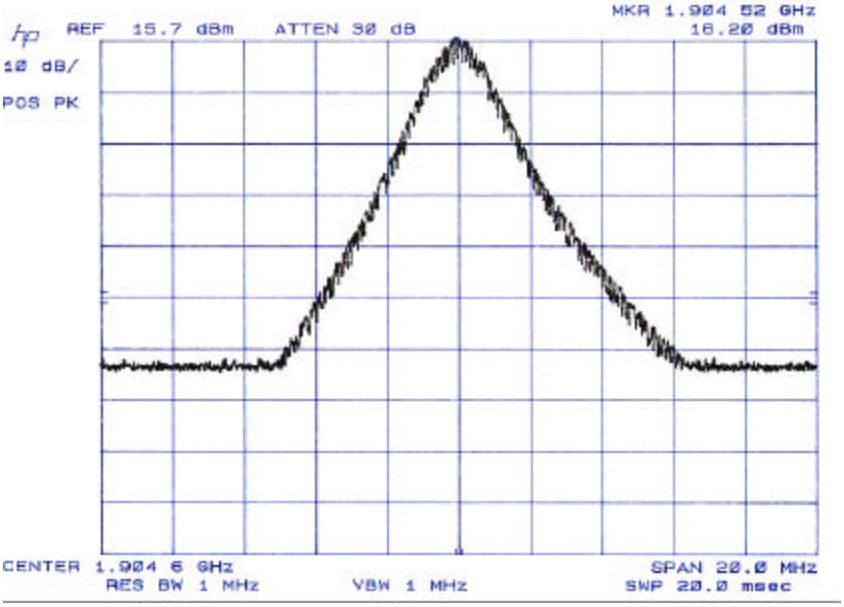
Test Personnel:
Kieth Vu – EMC Test Engineer

4.6 Occupied Bandwidth

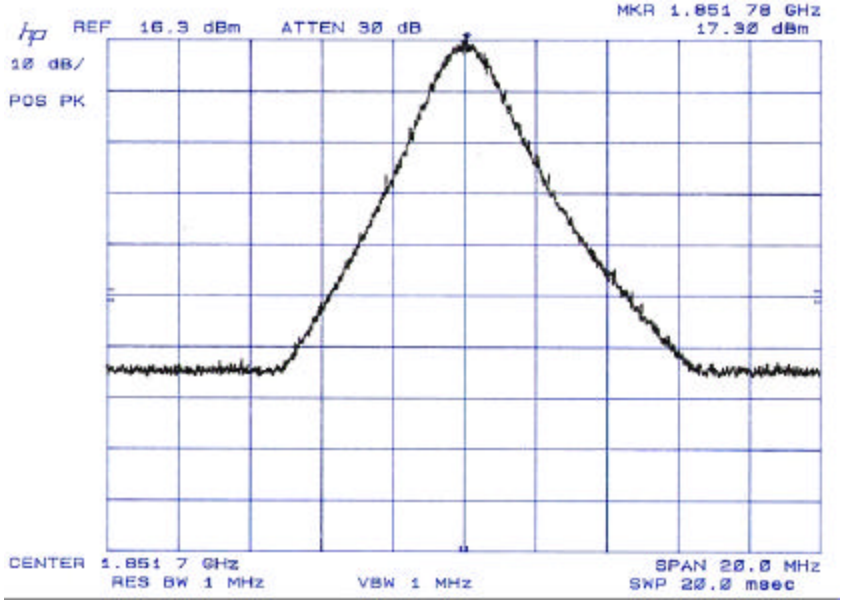
Occupied Bandwidth measurements were made. The measurements were made by connecting the output of the EUT directly into the RF input of the Spectrum Analyzer.

Test Results cSPICE:
The following plots show the test results for the cSPICE unit.

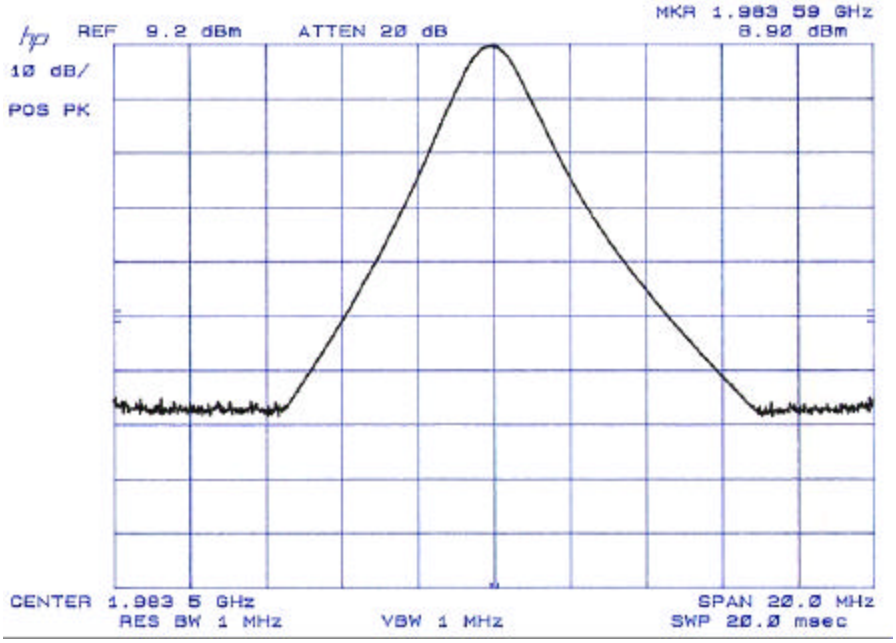
cSPICE Uplink (top frequency)



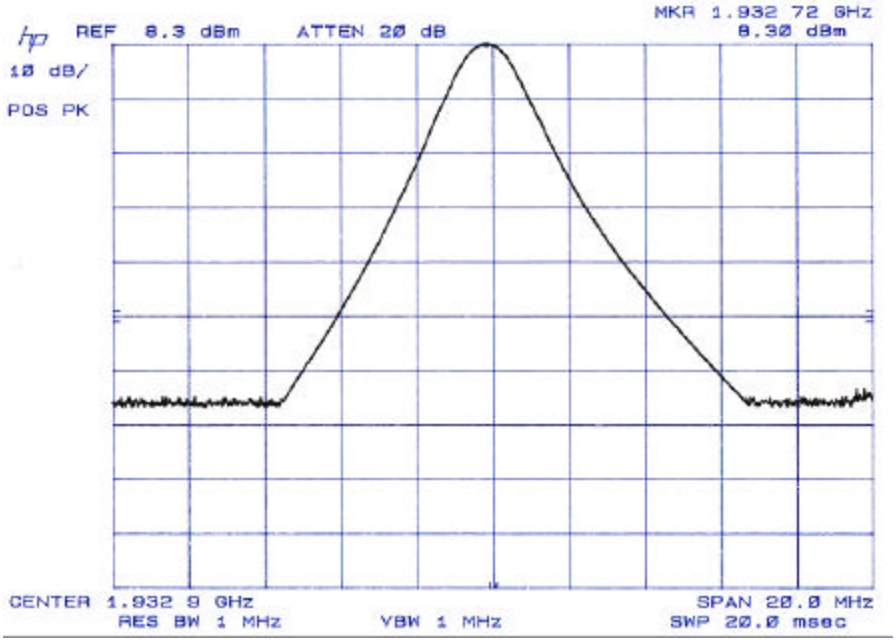
cSPICE Uplink (bottom frequency)



cSPICE Downlink (top frequency)

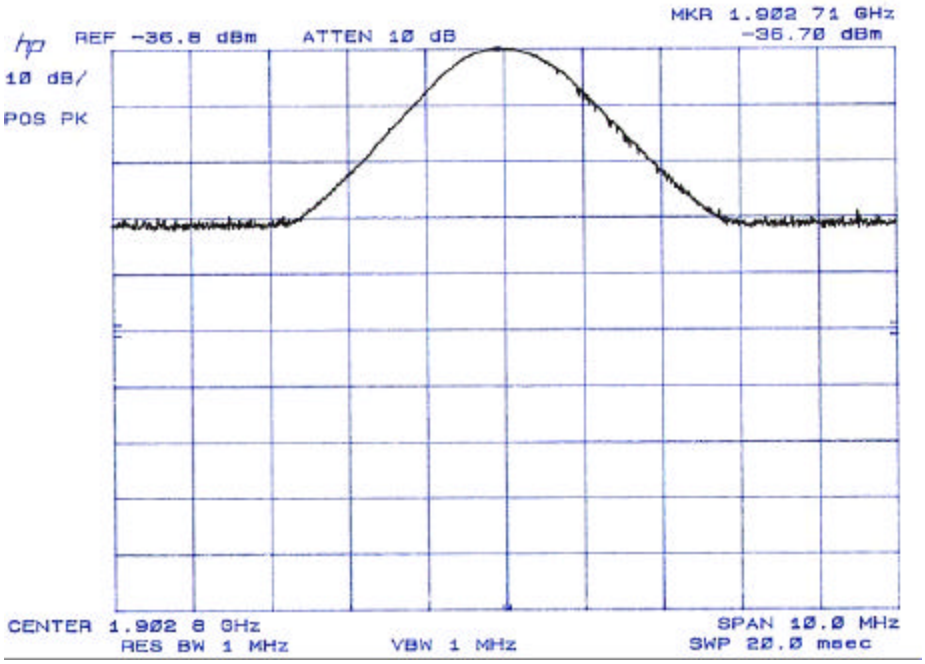


cSPICE Downlink (bottom frequency)

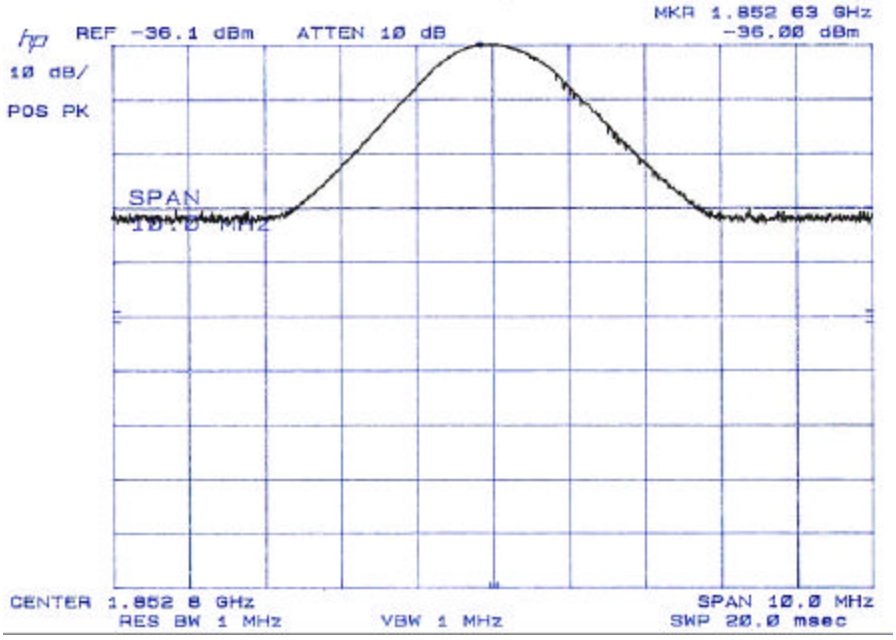


Test Results bSPICE:
The following plots show the test results for the bSPICE unit.

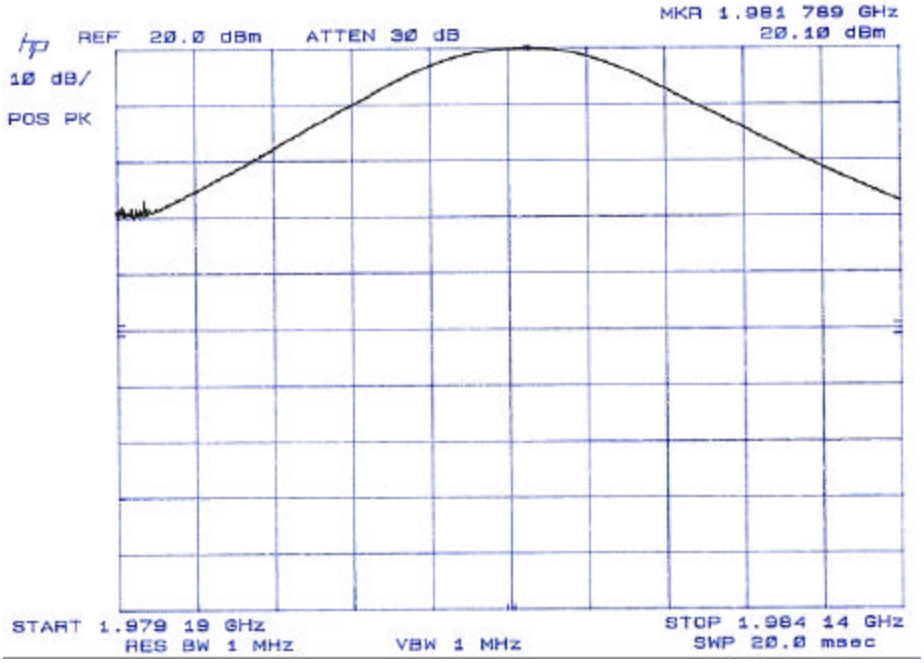
bSPICE Uplink (top frequency)



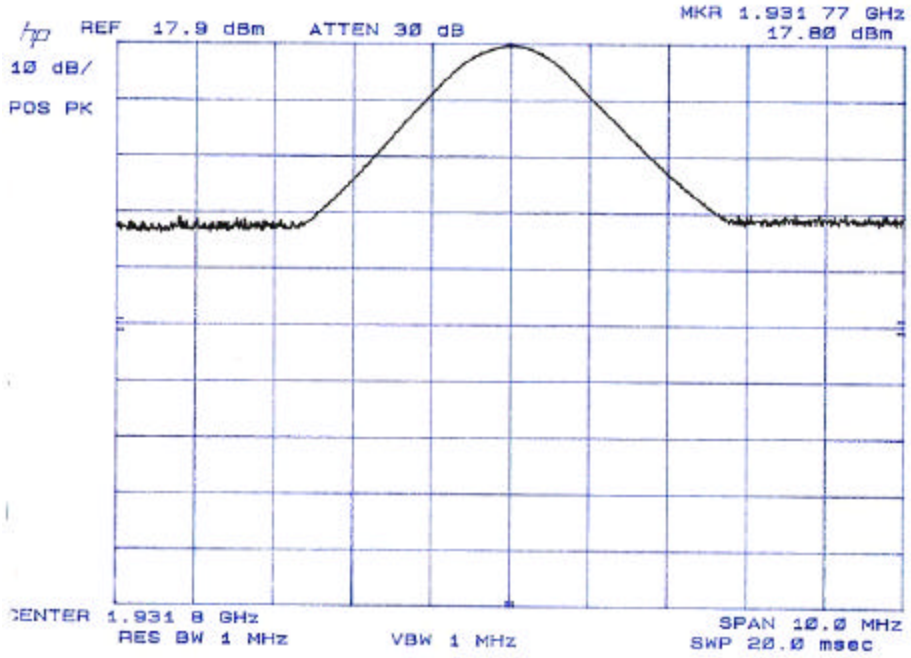
bSPICE Uplink (bottom frequency)



bSPICE Downlink (top frequency)



bSPICE Downlink (bottom frequency)



4.7 Crystal Access Restrictions

The EUT has no control knobs, switches, or other type of adjustments either on the operating front panel or on the exterior of the transmitter enclosure which when manipulated can result in violation of the rules.

5 Photographs of Test Arrangements

c SPICE Spurious Radiated Emissions (Front View)

cSPICE Spurious Radiated Emissions (Rear View)

c SPICE Test Setup (Front View)

cSPICE Test Setup (Rear View)

b SPICE Spurious Radiated Emissions (Front View)

bSPICE Spurious Radiated Emissions (Rear View)

b SPICE Test Setup (Front View)

bSPICE Test Setup (Rear View)

Appendix A - Test Equipment Used

The absolute performance calibration of equipment requiring calibration is performed on an as needed basis in accordance with MIL-STD 45662A. However, calibration periods do not exceed one (1) year. The test equipment is capable of making measurements within tolerances of at least +/- 2dB amplitude and +/- 2% frequency deviation. Equipment certifications showing traceability to NIST (National Institute of Standards and Technology) are maintained on file at Garwood Laboratories, Inc. Placentia, CA. All equipment is checked and verified for proper operation before and after each series of tests.

A.1 Specific Equipment Used

Test	*Instrument*	*MFG / Model No.*	*Asset No.*	*Cal. Due Date*
Conducted Emission Test				
	EMI Receiver System	Hewlett Packard	System 1	07/25/01
	RF Coax Cable	Pasternack / RG 223	20170	02/25/01
	Line Impedance Stabilization Network	ISCI/3PH-20A	20071	04/27/01
Radiated Emission Test				
	EMI Receiver System	Hewlett Packard	System 3	10/17/01
	RF Coax Cable	Times Microwave / LMR 600	20180	02/25/01
	BiLog Antenna	Chase / CBL6111A	20062	03/03/01
	Pre-Amplifier	ISCI / RFPA/Z FL-2000	20007	02/25/01
	Double Ridge Guide Horn Antenna	EMCO / 3115	20056	01/13/01
	High Frequency Preamplifier	Hewlett Packard / 8449B	20003	10/20/01
	Spectrum Analyzer	Hewlett Packard / 8566B	20258	01/04/01

APPENDIX B – SUPPLEMENTAL TEST DATA

Basic Standard	*Test Type*	*Data Format*	*Page No.*
FCC Part 24 Subpart E	No Supplemental Data	-	-

APPENDIX C - ATTACHMENTS

INDEX OF ATTACHMENTS

Clause 6.3 INTERMODULATION ATTENUATION

Normal Temperature: 22°C Humidity: 30-40% Date Tested: March 12, 2001

Software version: 0.5.20

Number of antenna ports of the repeater - 2

Test purpose
To verify that the level of Intermodulation products, generated in non-linear elements of the repeater, in the presence of two RF input signals do not exceed the specified limits.

Test Set up

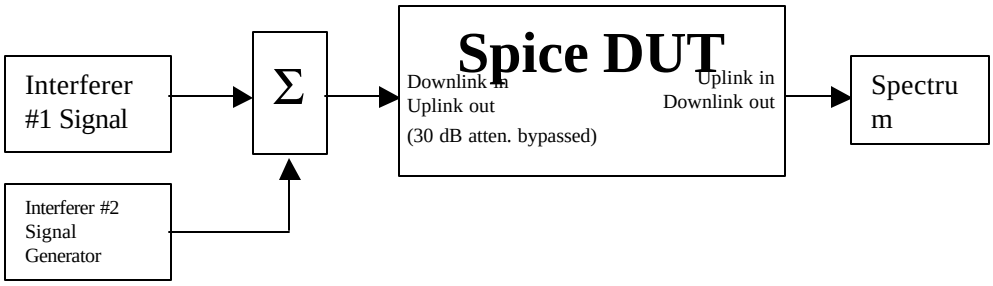
- The repeater shall be set to maximum gain. This is achieved by supplying the DCCH signal at the minimum level.
- The repeater shall be set to maximum power output per channel. This is set with the SST controller.
- Test environment – Normal temperature only.
- Two continuous sinusoidal RF signals (non modulated interferers) shall be fed to the input antenna port of the repeater using a combiner. The frequencies of both RF signals shall be within the repeater's operating band. The spacing between both RF signals shall be 600 kHz. This means signal #1 will be 600 kHz offset and #2 will be 1200 kHz offset from the test channel.
- The level of the third order Intermodulation product shall be measured with a spectrum analyzer using a resolution bandwidth of 3 kHz.
- The test shall be repeated with both RF input signals increased by 10 dB each.

Conformance requirement

≤-30dBm (1uW) in the DCS and PCS frequency bands (1 GHz to 12.75 GHz). Applies to all antenna ports of the repeater.

Clause 6.3 Intermodulation attenuation, cont.

DOWNLINK Block Diagram



Equipment Settings

Note: For the downlink test, the 30 dB internal attenuator must be bypassed. This is accomplished by removing the SMA coax at the duplex combiner. Feed the input (downlink in) into the duplex combiner.

Signals at Downlink in port:
Interferer #1 power = -47 dBm
Interferer #1 frequency = 1959.6 MHz
Interferer #2 power = -47 dBm
Interferer #2 frequency = 1960.2 MHz

SST Programming:
SST programmed output power = +25 dBm.
Channel 1 coverage = 656 = 1959 MHz.
Channel 1 link = 661 = 1960 MHz.

Spectrum Analyzer:
Center freq = 1959 MHz.
Span = 1 MHz.
Reference level = +25dBm
Resolution BW = 3 kHz.
Video BW = 100 Hz.
Amplitude offset = +1.0dB

DOWNLINK Data

IM_3 at nominal input	**IM_3 at 10dB higher input**	**Limit**
-33.7dBm	-33.0 dBm	≤ -30 dBm

Remarks: D/L F1 @ Ch: 656 (1959 MHz) Pin: -47 dBm

D/L F2 @ Ch: 661 (1960 MHz) Pout: 23.5 dBm

Pout w/2 tones (+600, +1200 kHz) -33.7 dBm

Pout w/2 tones (+600, +1200 kHz) @ +10 dB : -33.0 dBm

Clause 6.3 Intermodulation attenuation, cont.

UPLINK Block Diagram

Equipment Settings

Signals at each input port:
Interferer #1 power = -48 dBm
Interferer #1 frequency = 1879.6 MHz
Interferer #2 power = -48 dB
Interferer #2 frequency = 1880.2 MHz

SST Programming:
SST programmed output power = +25 dBm
Channel 1 coverage = 656 = 1879 MHz
Channel 1 link = 661 = 1880 MHz

Spectrum Analyzer:
Center freq = 1880 MHz
Span = 1 MHz
Reference level = +5 dBm
Resolution BW = 3 kHz
Video BW = 100 Hz
Amplitude offset = +4.3dB

UPLINK Data

IM_3 at nominal input	**IM_3 at 10dB higher input**	**Limit**
-97 dBm	-72.7 dBm	≤ -30 dBm

Remarks: U/L F1 @ Ch: 656 (1879 MHz) Pout: -28dBm

U/L F2 @ Ch: 661 (1880 MHz) Pin: -48 dBm

Pout w/2 tones (+600, +1200 kHz) : -97 dBm

Pout w/2 tones (+600, +1200 kHz) @ +10 dB : -72.7 dBm