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Test Report

Prepared for: Space Data Corporation

Model: SKS-900-MK2

Description: Narrowband PCS, Multi-Protocol SkySite

FCC ID: RY9SKS900MK2

To

FCC Part 15.247 DTS

Date of Issue: April 15, 2013

On the behalf of the applicant:	**Space Data Corporation** **2535 W. Fairview Street** **Suite 101** **Chandler, AZ 85224**
Attention of:	**Jerry Knoblach, Chairman/CEO** **Ph: (480) 722-2100** **E-mail: knoblach@spacedata.net**

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Project No: p1330009

Greg Corbin
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	April 15, 2013	Greg Corbin	Original Document
2.0	May 10th, 2013	Karen Springer	Added FCC ID to Test Report Cover page

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ILAC / A2LA

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The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

Testing Certificate Number: **2152.01**

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IC Reg. #2044A-1

Non-accredited tests contained in this report:

N/A

The applicant has been cautioned as to the following

15.21 - Information to User

The user's manual or instruction manual for an intentional 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.

15.27(a) - Special Accessories

Equipment marked to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing.

The procedures from KDB 558074 D01 DTS Measurement Guidance v03r01 were used to record the test data in this report.

In accordance with ANSI C63.10-2009 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (º C)	**Humidity (%)**	**Pressure (mbar)**
23.3 – 28.0	17.5 – 27.7	950.7 – 970.8

EUT Description

Model: SKS-900-MK2
Description: Narrowband PCS, Multi-Protocol SkySite
Firmware:
Code revision for the AS_1947 board: **V1.00**
Code revision for the AS_1953 board: **V1.00**

Additional Information

The SKS-900-MK2 transmits in the unlicensed ISM band on a single channel at 915 MHz at an effective radiated power of less than 10 dBm. This wireless channel is used to transmit to the balloon vent and the ballast assembly which are up to 100 feet away from the SKS-900-MK2. The vent and/or ballast assembly receive digital packets from the SKS-900-MK2 on the 915 MHz channel which instruct the vent how many seconds to open the vent or how many seconds of ballast to release.

EUT Operation during Tests

The EUT is battery powered.
For conducted tests, the antenna was replaced with a short coax cable and SMA connector.
The EUT only operates at 915 MHz.
When the EUT is powered on it is tuned to 915 MHz and operating at full power.
The antenna is a quarter-wave length piece of wire soldered to the transmitter output.

Accessories: None

Cables: None

Modifications: None

15.203: Antenna Requirement:

X	The antenna is permanently attached to the EUT
	The antenna uses a unique coupling
	The EUT must be professionally installed
	The antenna requirement does not apply

Test Reports Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(d)	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Emissions At Band Edges	Pass	
15.247(a)(2)	Occupied Bandwidth	Pass	
15.247(e)	Transmitter Power Spectral Density	Pass	
15.207	A/C Powerline Conducted Emissions	N/A	Battery powered with no connection to AC

Peak Output Power

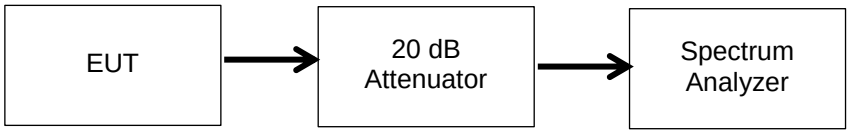
Name of Test: Peak Output Power **Engineer:** Greg Corbin

Test Equipment Utilized: i00379 **Test Date:** 4/4/2013

Test Procedure

The EUT was connected directly to a spectrum analyzer
The peak readings were taken and the result was then compared to the limit.
RBW = 1 MHz
VBW = 3 MHz

Test Setup



Transmitter Peak Output Power

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
915	9.4	1 W (30 dBm)	Pass

Conducted Spurious Emission

Name of Test: Conducted Spurious Emissions **Engineer:** Greg Corbin

Test Equipment Utilized: i00364, i00379 **Test Date:** 4/4/2013

Test Procedure

The EUT was connected to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed. Only detectable spurious emissions were recorded and plotted. The peak output power is subtracted to the recorded measurement to provide the corrected spurious level dBc.

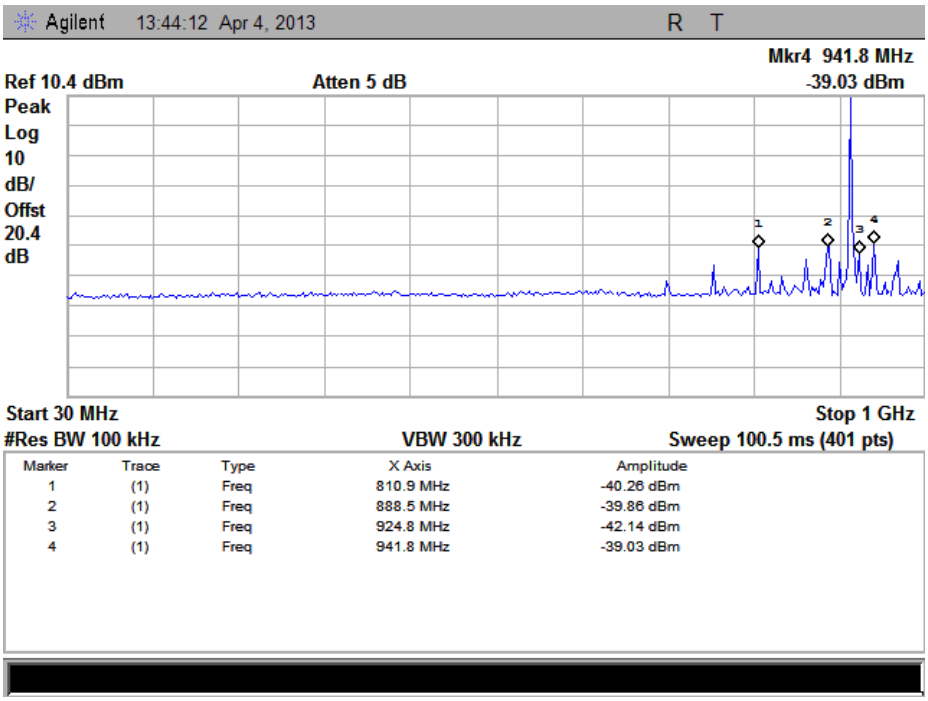
Only the worst case is recorded in the Conducted Spurious Emissions Summary Test Table.

Test Setup

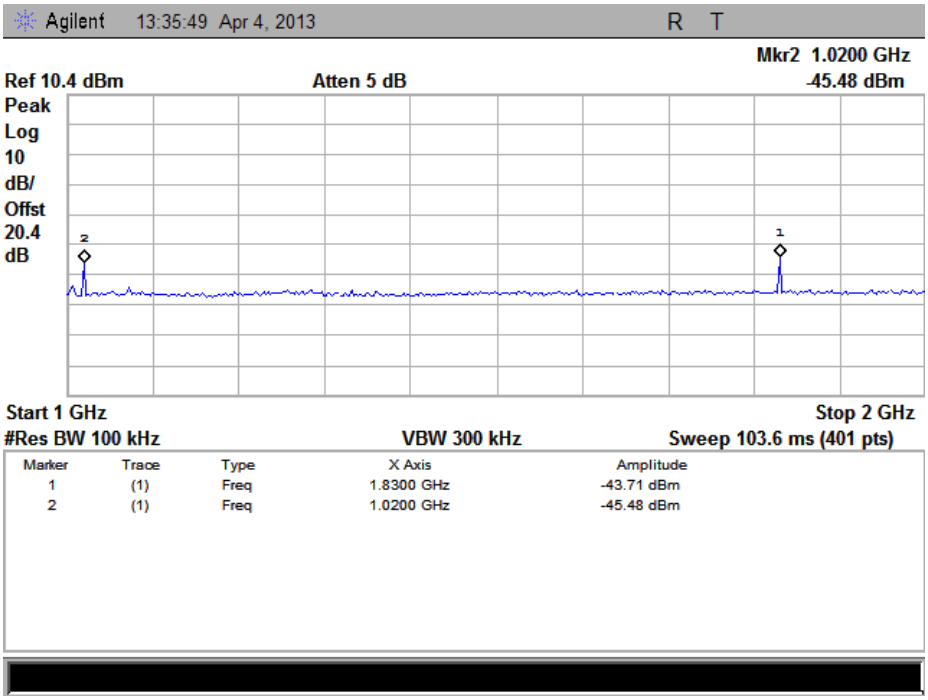
Conducted Spurious Emissions Summary Test Table

Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Value (dBm)	Reference Level (dBm)	Corrected Measurement (dBc)	Specification Limit (dBc)	Result
915 MHz	941.8	-39.0	9.4	-48.4	-20	Pass

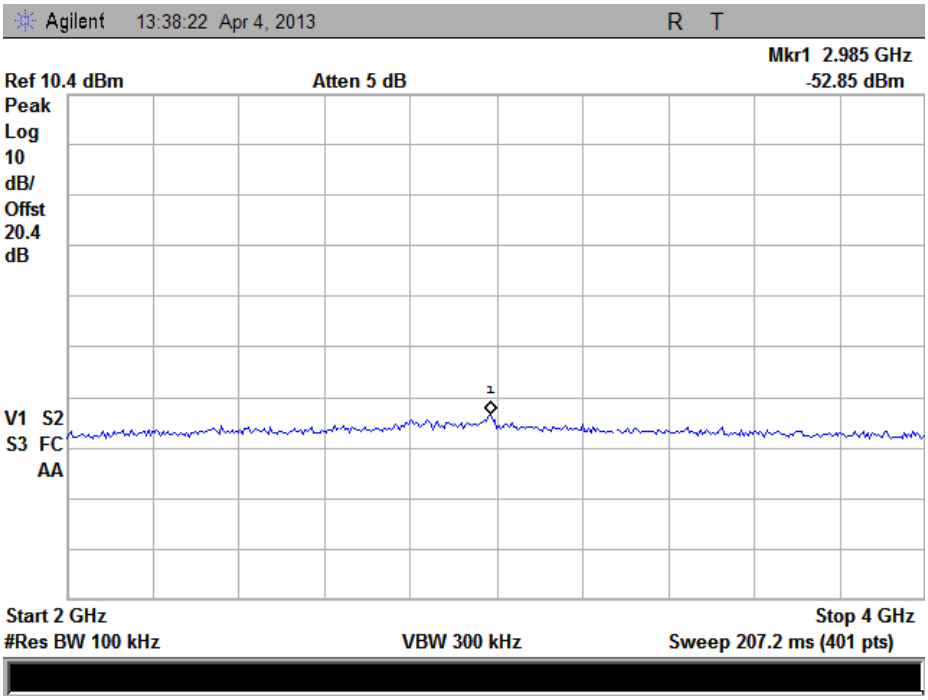
Conducted Spurious Emissions
30 – 1000 MHz



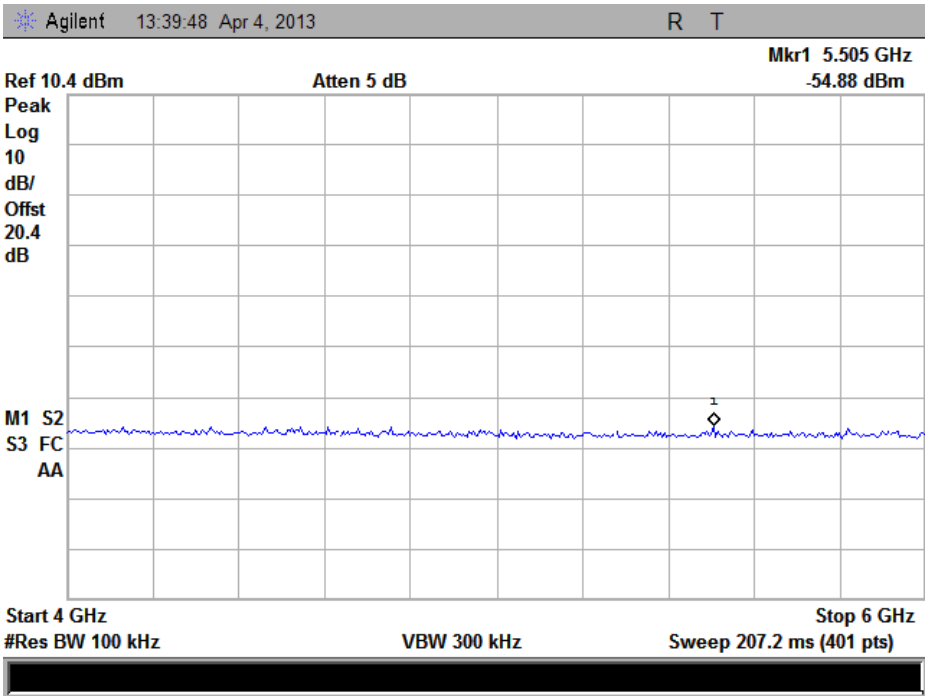
Conducted Spurious Emissions
1 – 2 GHz



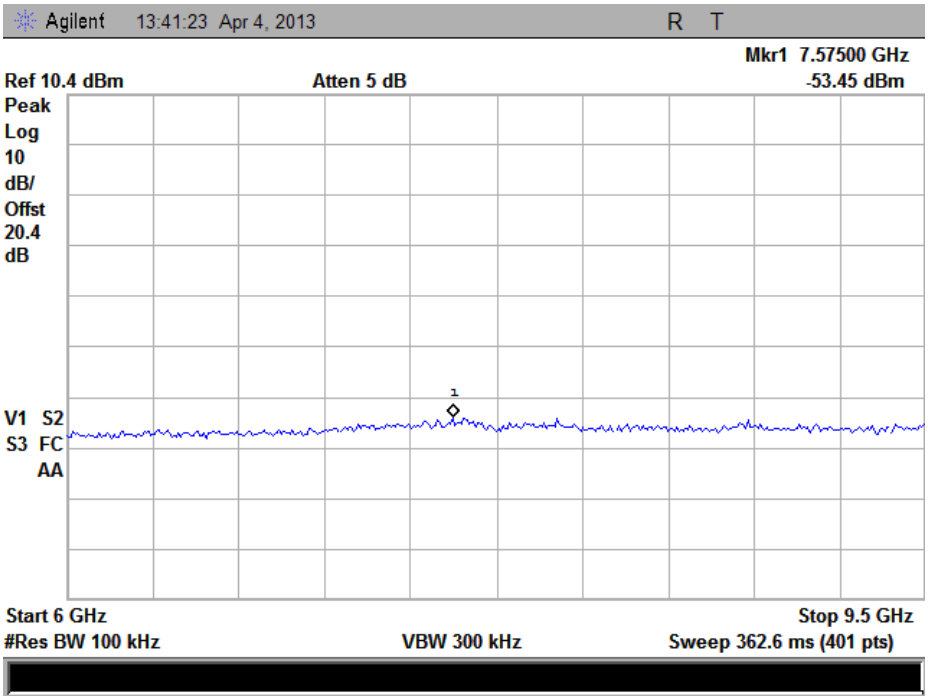
Conducted Spurious Emissions
2 – 4 GHz



Conducted Spurious Emissions
4 – 6 GHz



Conducted Spurious Emissions
6 – 9.5 GHz



Radiated Spurious Emissions

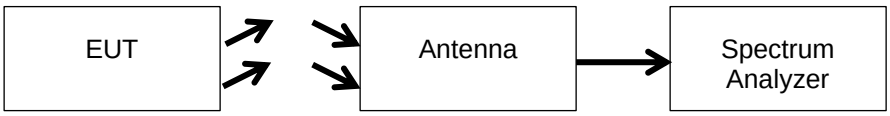
Name of Test:	Radiated Spurious Emissions	**Engineer:** Greg Corbin
Test Equipment Utilized:	I00033, i00267,i00271, i00364, i00379	**Test Date:** 4/8/2013

Test Procedure
Radiated Spurious Emissions: 30 – 1000 MHz

The EUT was tested in an Open Area Test Site (OATS) set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized. All emissions from 30 MHz to 1 GHz were examined.
Measured Level includes antenna and receiver cable correction factors.
Correction factors were input into the spectrum analyzer before recording “Measured Level”.

RBW = 100 KHz
VBW = 300 KHz
Detector – Quasi Peak

Test Setup



Radiated Spurious Emissions Test Data: 30 MHz – 1000 MHz

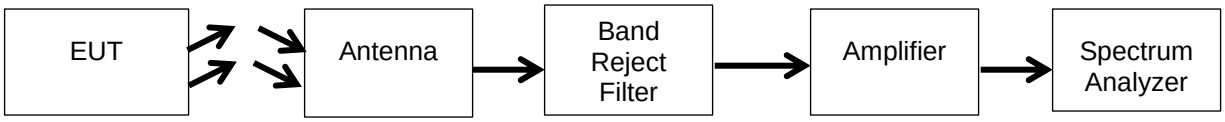
Note: Reference Output Power = 9.4 dBm or 116 dBuV

Emission Frequency (MHz)	Measured Value (dBuV)	Reference Level (dBuV)	Corrected Measurement (dBc)	Specification Limit (dBc)	Result
46.7	12.1	116	-103.9	-20	Pass
168.4	15.0	116	-101	-20	Pass
251.4	14.3	116	-101.7	-20	Pass
363.9	27.1	116	-88.9	-20	Pass
576.5	34.4	116	-81.6	-20	Pass
785.0	25.4	116	-90.6	-20	Pass

Test Procedure
Radiated Spurious Emissions above 1 GHz

The EUT was tested in a semi anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions including the Restricted Bands. The antenna, band reject filter, amplifier and cable correction factors were input into the spectrum analyzer before recording the Measured Level to ensure accurate readings. The spectrum for each tuned frequency was examined to the 10th harmonic.

Test Setup



Detector Settings	RBW	VBW	Span
Peak	1 MHz	3 MHz	As Necessary
Average	1 MHz	3 MHz	As Necessary

Radiated Spurious Emissions except for Restricted Bands

Note: Reference Output Power (Peak) = 9.4 dBm or 116 dBuV

Tuned Freq (MHz)	Emission Freq (GHz)	Measured Value (dBuV)	Reference Level (dBuV)	Corrected Measurement (dBc)	Specification Limit (dBc)	Result
915	1.829	50.9	116	-65.1	-20	Pass
915	2.745	38.6	116	-77.4	-20	Pass
915	3.659	47.2	116	-68.8	-20	Pass
915	4.575	51.5	116	-64.5	-20	Pass
915	5.490	43.4	116	-72.6	-20	Pass

No other emissions were detectable. All emissions were greater than -20 dBc.

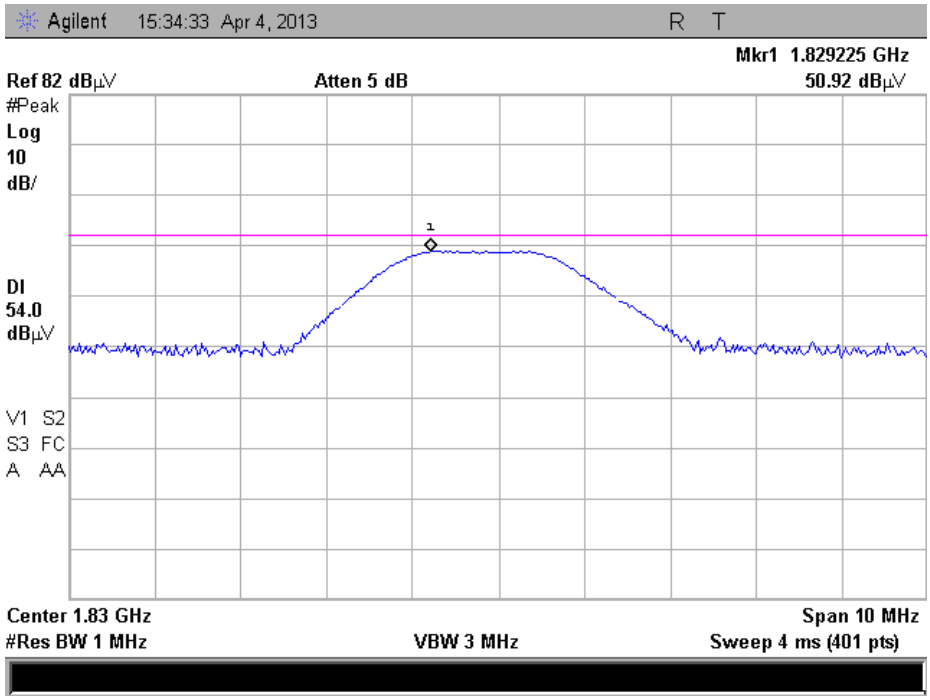
Radiated Spurious Emissions in the Restricted Bands

Note: There was only 1 spurious emission in a restricted band.

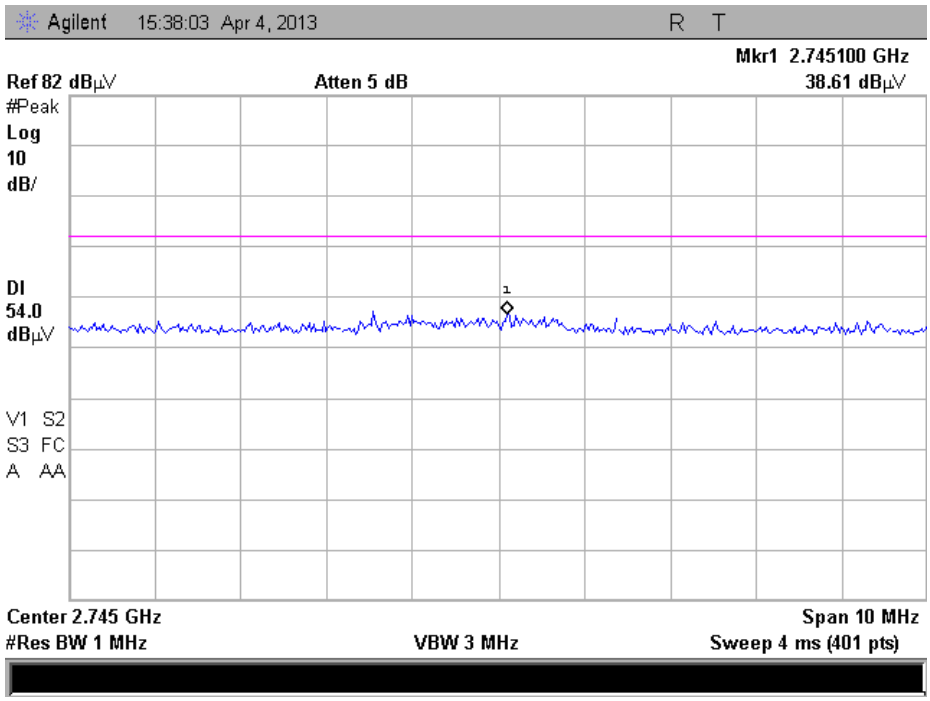
Tuned Frequency (MHz)	Emission Frequency (MHz)	Peak Measured Value (dBuV/m)	Peak Limit (dBuV/m)	Average Measured Value (dBuV/m)	Average Limit (dBuV/m)	Result
915	1018	35.0	74.0	37.3	54.0	Pass

Radiated Spurious Emissions except for Restricted Bands

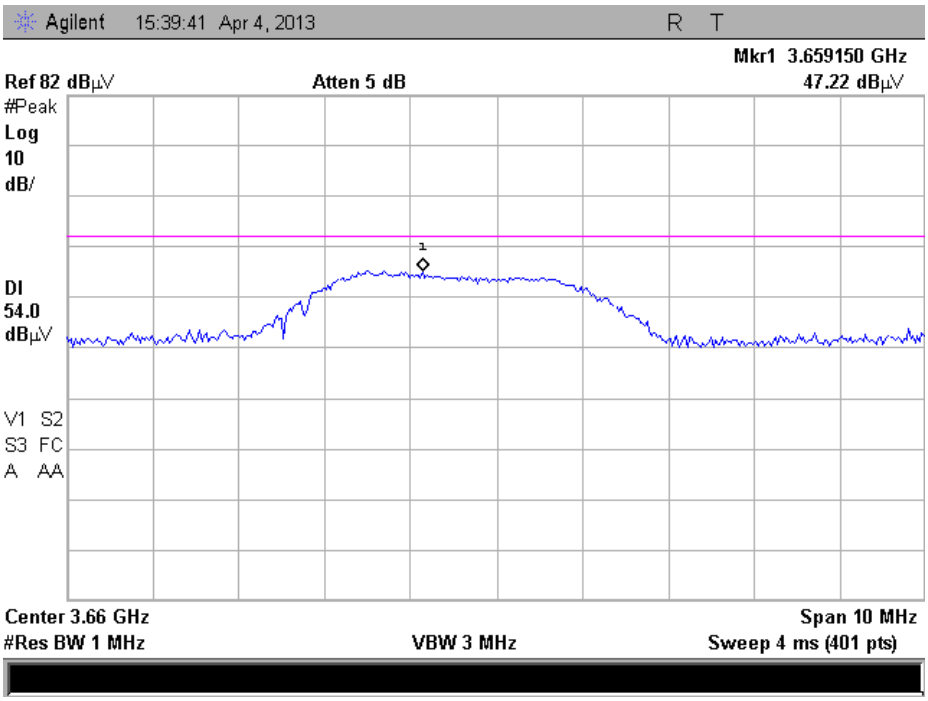
2nd Harmonic - Peak



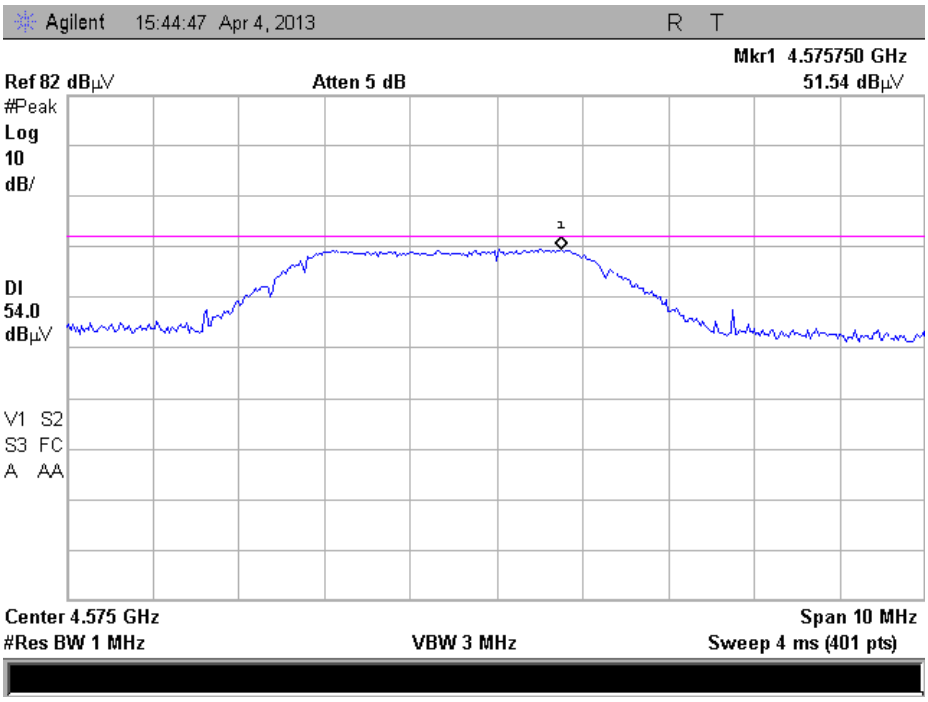
3rd Harmonic - Peak



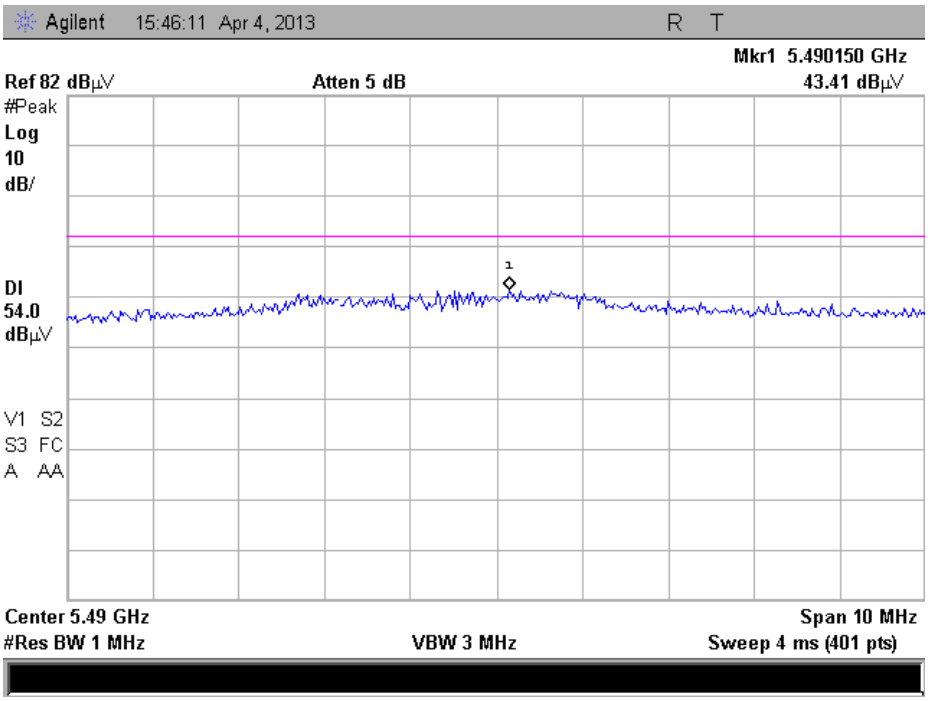
4th Harmonic - Peak



5th Harmonic – Peak

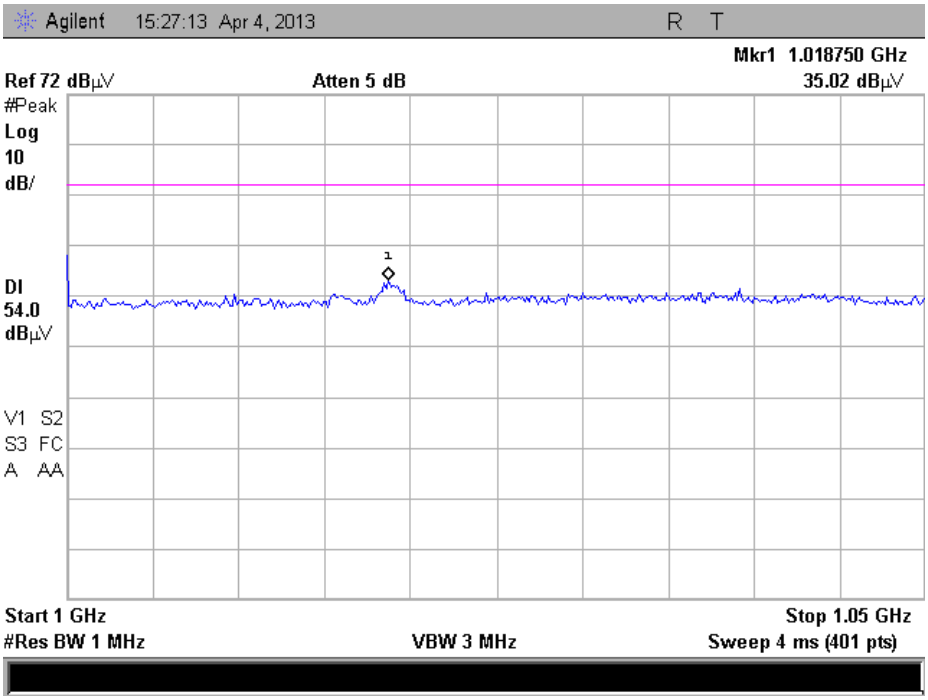


6th Harmonic - Peak

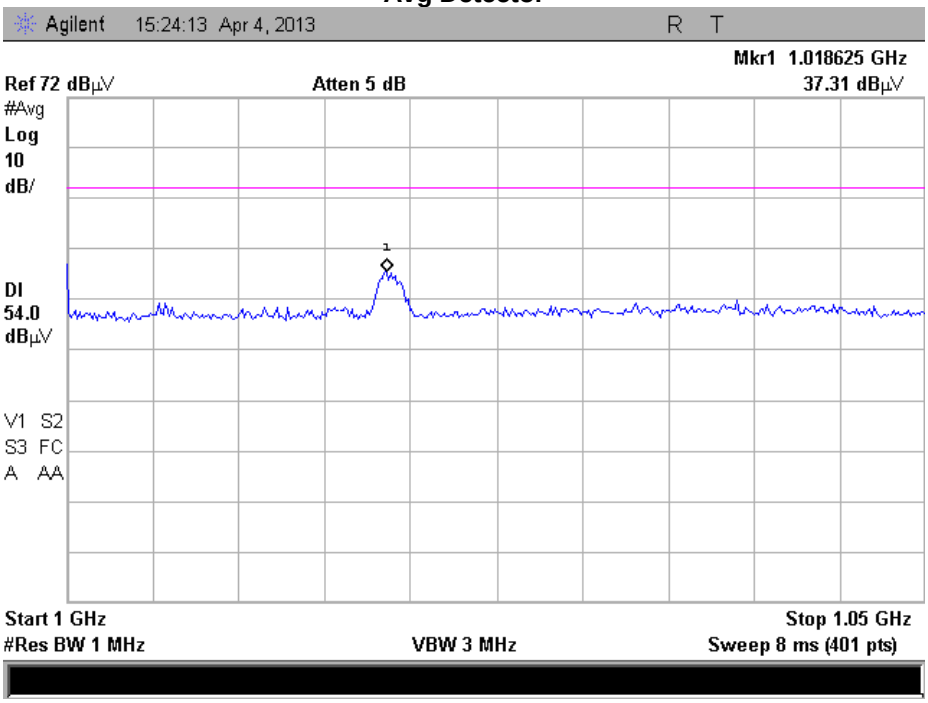


Radiated Spurious Emissions in Restricted Bands

Tuned Frequency = 915 MHz
Spurious Emission Freq = 1018 MHz
Peak Detector



Tuned Frequency = 915 MHz
Spurious Emission Freq = 1018 MHz
Avg Detector



Emissions at Band Edges

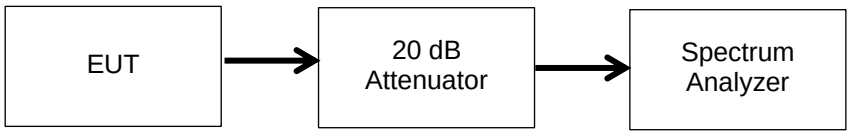
Name of Test: Emissions at Band Edges **Engineer:** Greg Corbin

Test Equipment Utilized: i00379 **Test Date:** 4/4/2013

Test Procedure

The EUT was connected as shown. A spectrum analyzer was used to verify that the EUT met the requirements for band edge. The cable and antenna correction factors were input into the analyzer as a reference level offset to ensure accurate readings were obtained

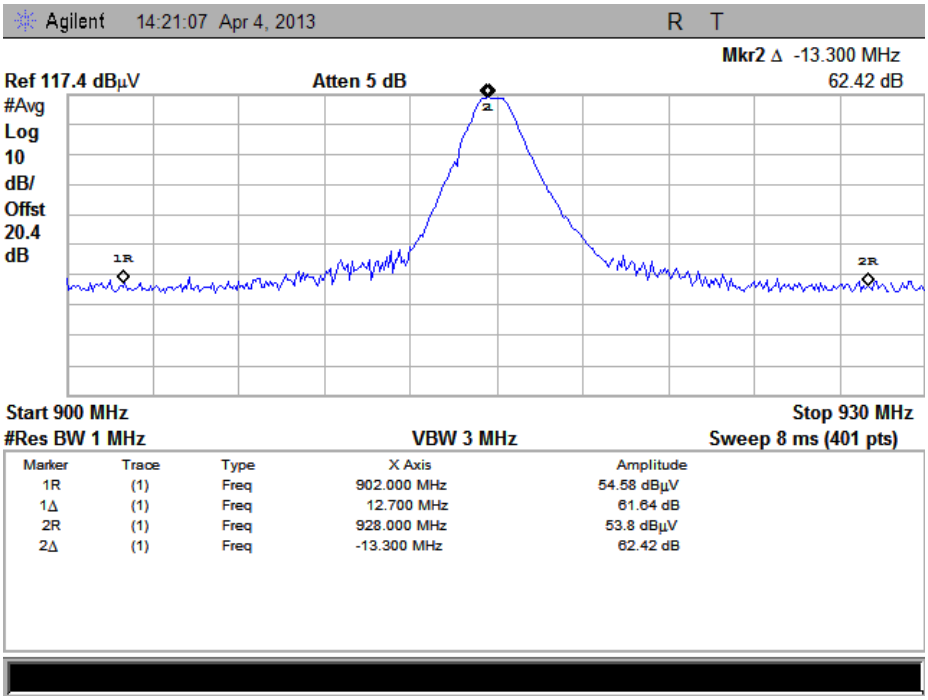
Band Edge Test Setup



Band Edge Emissions Summary

Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Value (dBc)	Detector	Limit (dBc)	Result
915	902	-61.4	Peak	-20 dBc	Pass
915	928	-62.4	Peak	-20dBc	Pass

Lower and Upper Band Edge
Tuned Frequency = 915 MHz



Occupied Bandwidth

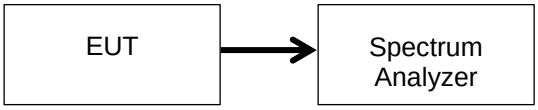
Name of Test: Occupied Bandwidth **Engineer:** Greg Corbin

Test Equipment Utilized: i00379 **Test Date:** 4/9/2013

Test Procedure

The EUT was connected directly to a spectrum analyzer. The Span was set wide enough to capture the entire transmit spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold and when the entire spectrum was captured the 6dB and 99% bandwidths were measured to verify the bandwidth met the specification.

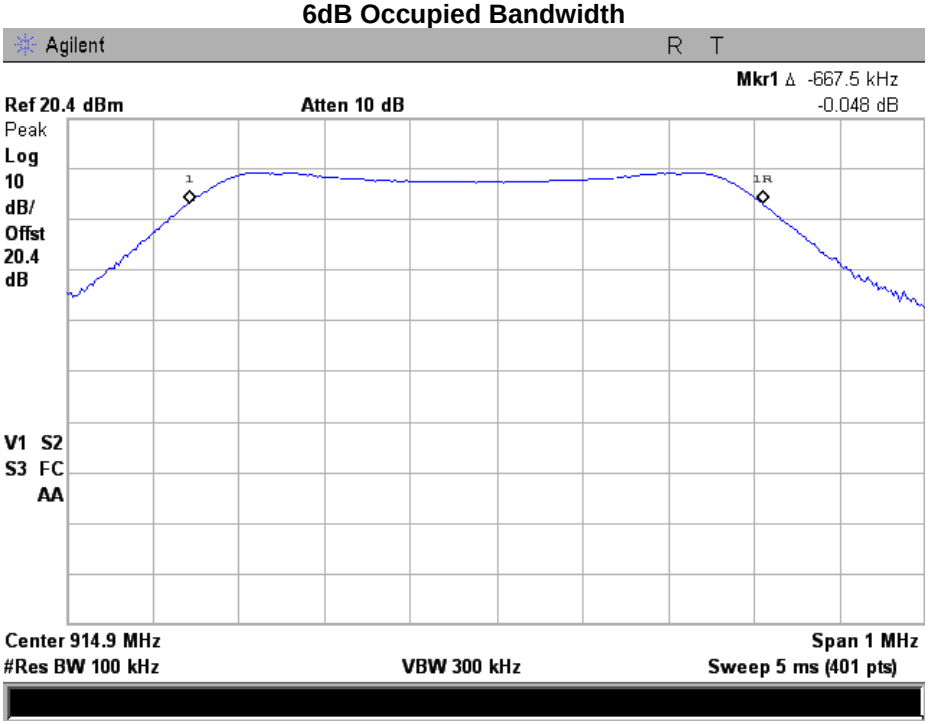
Test Setup



6 dB Occupied Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (kHz)	Specification Limit (kHz)	Result
915	667.5	≥ 500	Pass

6dB Occupied Bandwidth



Transmitter Power Spectral Density (PSD)

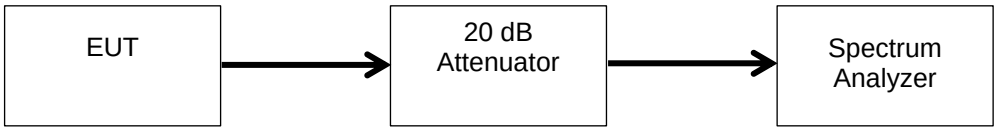
Name of Test: Transmitter Power Spectral Density (PSD) **Engineer:** Greg Corbin

Test Equipment Utilized: i00379 **Test Date:** 4/4/2013

Test Procedure

The EUT was connected directly to a spectrum analyzer.
The test was performed using the procedures from KDB 558074 D01 DTS Measurement Guidance v03r01 for DTS devices.

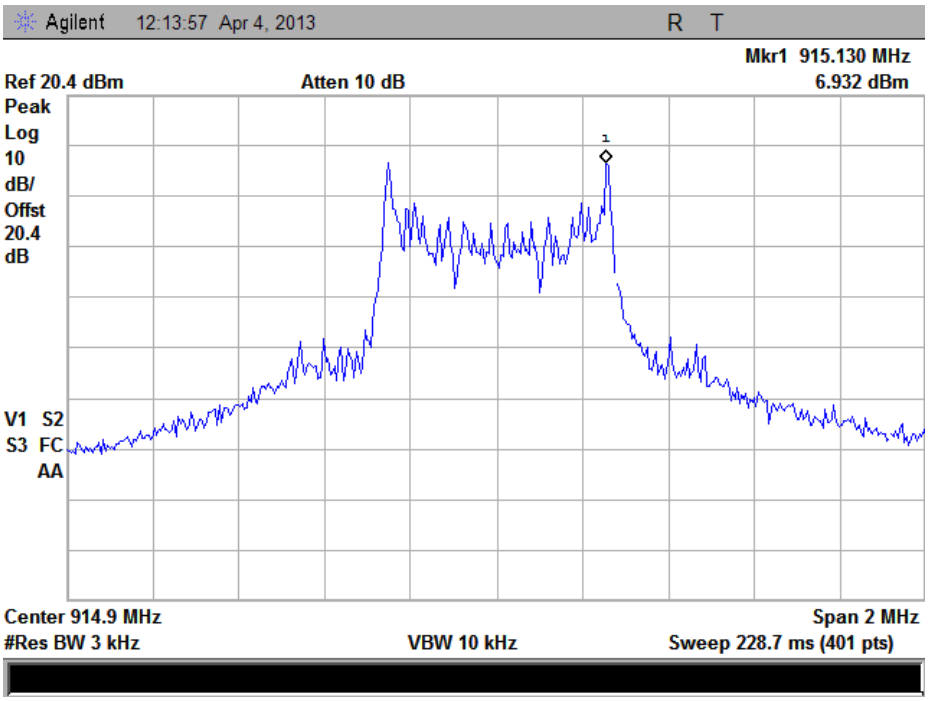
Test Setup



PSD Summary

Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
915	6.93	8	Pass

PSD



Test Equipment Utilized

Description	Manufacturer	Model Number	CT Asset #	Last Cal Date	Cal Due Date
EMI Receiver	HP	8546A	i00033	12/27/12	12/27/13
Bi-Log Antenna	Schaffner	CBL611C	i00267	12/19/11	12/19/13
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	4/19/12	4/19/14
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	12/4/12	12/4/13
Voltmeter	Fluke	87III	i00319	7/3/12	7/3/13
Tunable Notch Filter	Eagle	TNF-240MFMF	i00364	Verified on: 4/4/13	
EMI Analyzer	Agilent	E7405A	i00379	11/21/12	11/21/13
Attenuator – 20 dB	Mini-Circuits	ZX60-2531M-S+	N/A	Verified on: 4/4/13	

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT