MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372

October 6, 2008

Ubiquiti Networks
495-499 Montague Expressway
Milpitas, CA 95035

Dear Robert Pera,

Enclosed is the EMC test report for compliance testing of the Ubiquiti Networks, b2 (2.4GHz), tested to the requirements of ETSI EN 300 328 V1.7.1 (2006-10) (Article 3.2(b) of R&TTE Directive).

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\ Ubiquiti Networks \ EMCS80983-ETS328)

DOC-603 9/11/2007

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Electromagnetic Compatibility Test Report

For the

Ubiquiti Networks
b2 (2.4GHz)

Tested for Compliance with

ETSI EN 300 328 V1.7.1 (2006-10)

MET Report: EMCS80983-ETS328

October 6, 2008

Prepared For:

Ubiquiti Networks
495-499 Montague Expressway
Milpitas, CA 95035

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave.
Baltimore, MD 21230

Electromagnetic Compatibility Criteria
Test Report

For the

Ubiquiti Networks
b2 (2.4GHz)

Tested for Compliance with

ETSI EN 300 328 V1.7.1 (2006-10)

MET Report: EMCS80983-ETS328

Anderson Soungpanya
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of ETSI EN 300 328 under normal use and maintenance.

Shawn McMillen
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	October 6, 2008	Initial Issue.

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
CISPR	**C**omite **I**nternational **S**pecial des **P**erturbations **R**adioelectriques (International Special Committee on Radio Interference)
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**H**ert**z**
kPa	**k**ilo**Pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**H**ertz
µH	**micro**H**enry
µF	**micro**F**arad
µs	**micros**econds
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

1.0 Introduction

1.1 Overview

MET Laboratories, Inc. was contracted by Ubiquiti Networks to perform testing on the b2 (2.4GHz), under Ubiquiti Networks purchase order number 806018.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the b2 (2.4GHz).

1.2 Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick Street, Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

1.3 Testing Summary

ETSI EN 300 328-2 Section Number	Descriptive Name	Compliance			Comments
		Yes	No	N/A	
Sections 4.2.1	Effective Radiated Power	✓			EUT emissions were below applicable limits.
Sections 4.2.2	Peak Power Density	✓			EUT emissions were below applicable limits.
Sections 4.2.3	Frequency Range	✓			EUT emissions were below applicable limits.
Sections 4.3.5	Medium Access Protocol	✓			Compliant
Sections 4.2.4	Transmitter Spurious Emissions	✓			EUT emissions were below applicable limits.
Sections 4.2.5	Receiver Spurious Emissions	✓			EUT emissions were below applicable limits.

Table 1. Summary of Compliance Testing

1.4 Modifications to the Test Standard

No modifications were made to the test standard.

1.5 References

ETSI EN 300 328 V1.7.1 (2006-10)	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband Transmission systems; data transmission equipment in the 2.4 GHz ISM band and using spread spectrum modulation techniques; Part1: Technical characteristics and test conditions

Table 2. Test References

2.0 Equipment Under Test

2.1 Description of Test Sample

The results obtained relate only to the item(s) tested.

Model(s) Tested:	b2 (2.4GHz)
Model(s) Covered:	b2 (2.4GHz)
EUT Specifications:	Primary Power: 120/230VAC, 60/50Hz
	Secondary Power: N/A
	Equipment Emissions Class: The radio equipment and/or associated ancillary equipment under test are classified as equipment for fixed (e.g. base station equipment use)
Lab Ambient (Normal) Test Conditions:	Temperature: 15-35º C
	Relative Humidity: 30-60%
	Atmospheric Pressure: 860-1060 mbar
Extreme Test Conditions:	Temperature: 15-35º C
	Relative Humidity: 30-60%
Evaluated by:	Anderson Soungpanya
Date(s):	October 6, 2008

The b2 (2.4GHz), Equipment Under Test (EUT) for the remainder of this document, is a high performance 802.11 outdoor point to point device specifically designed for optimized performance at 2.4 GHz.

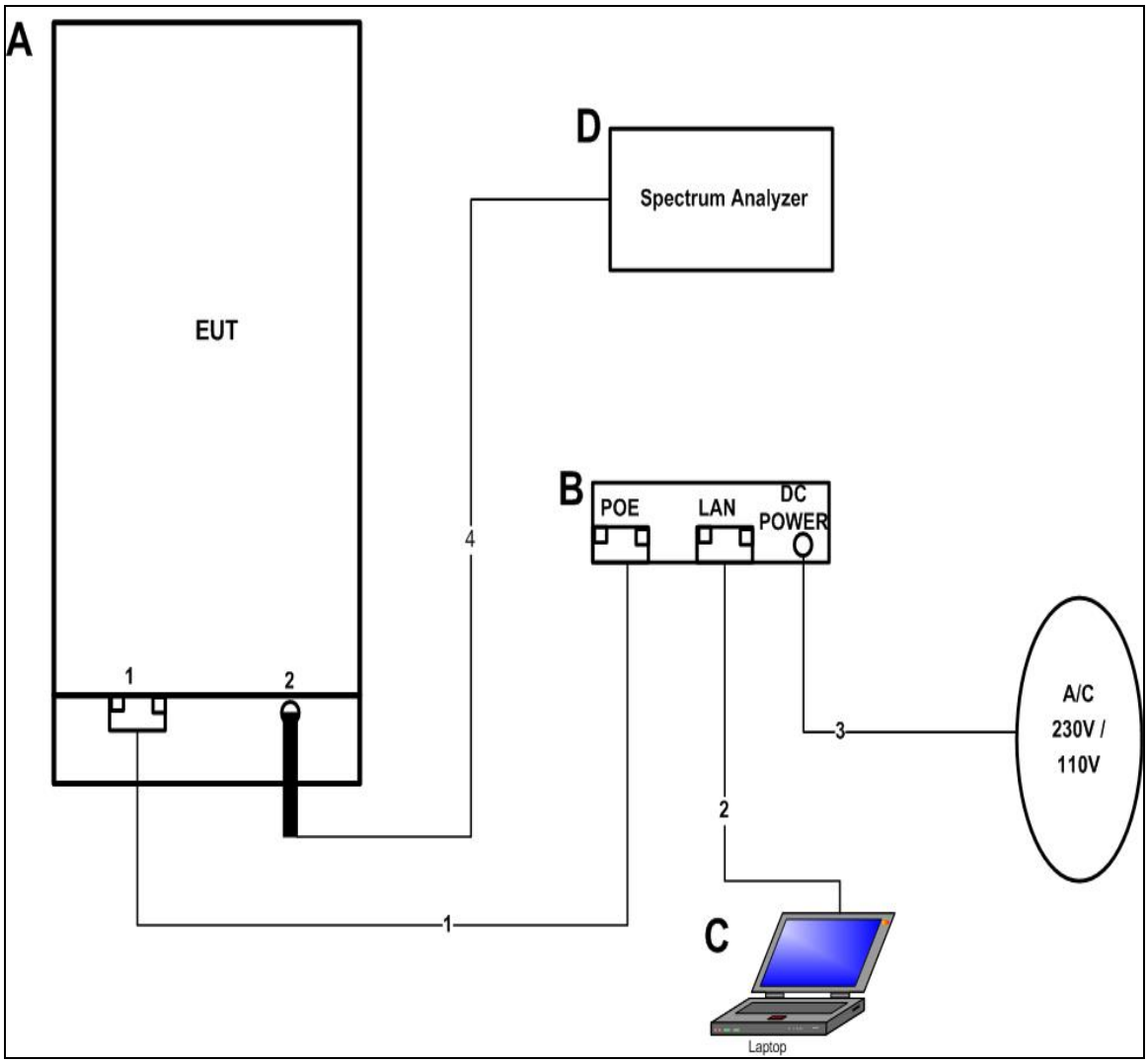


Figure 1. Block Diagram of Test Configuration, Conducted Measurement

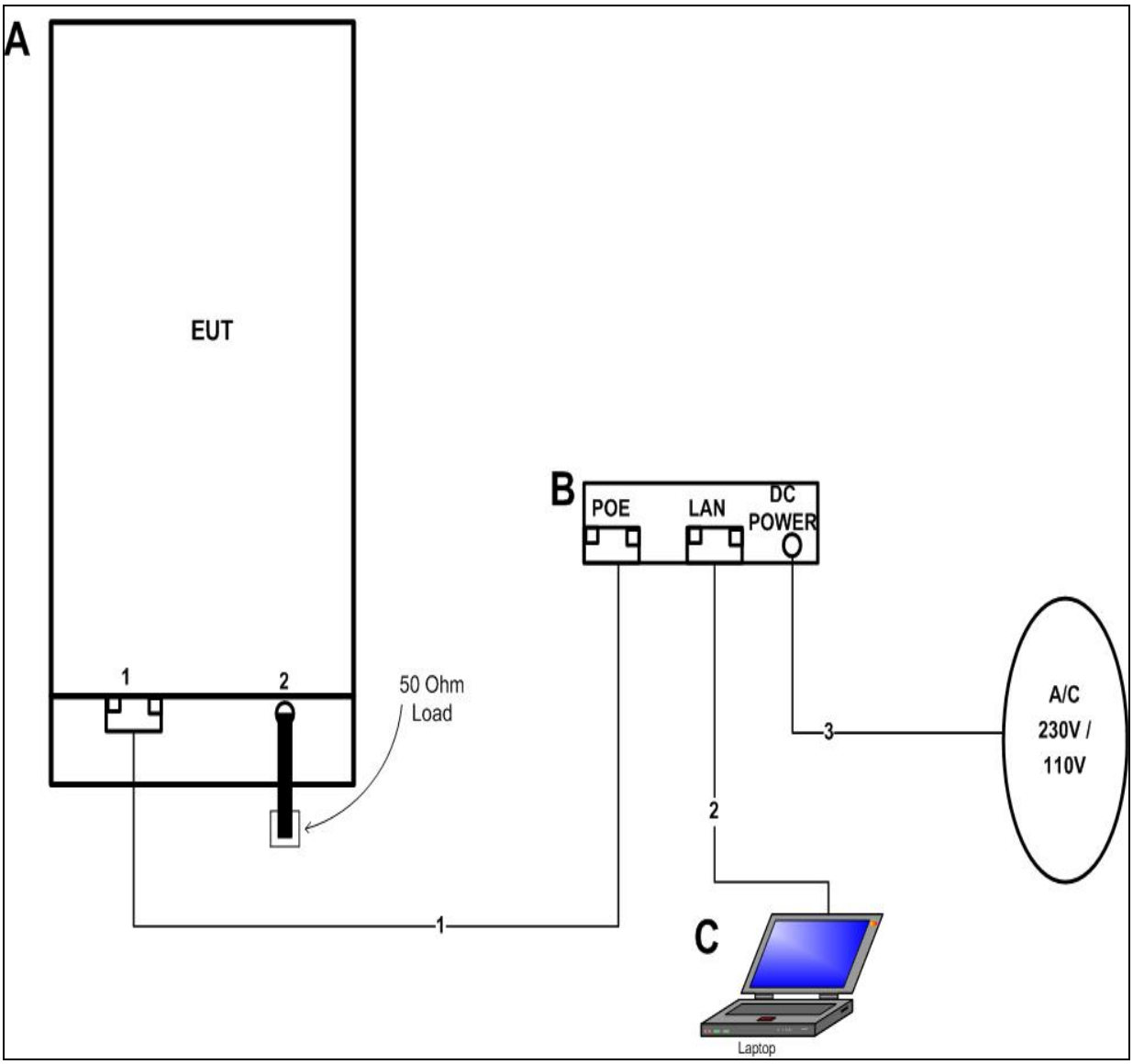


Figure 2. Block Diagram of Test Configuration, Radiated Measurement

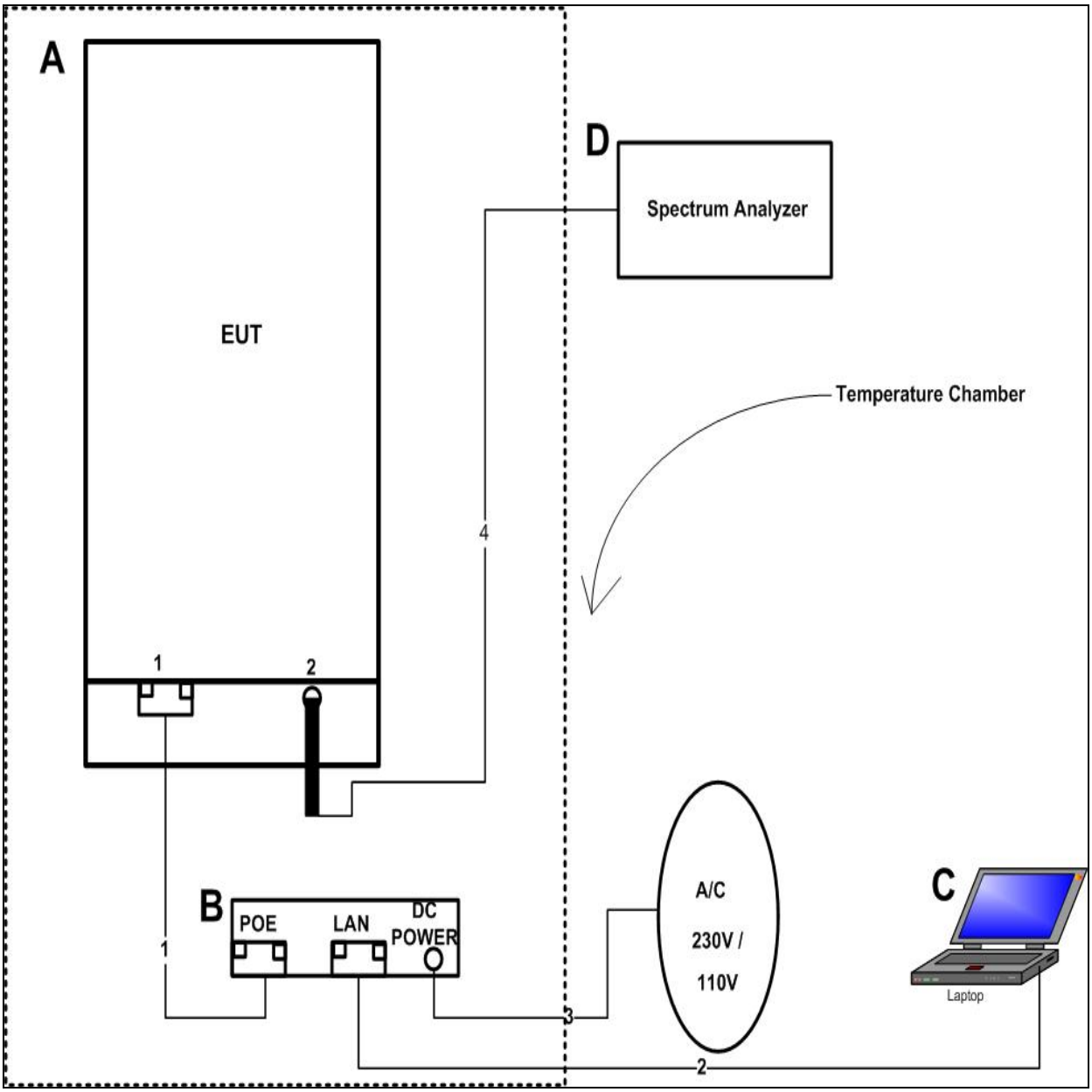


Figure 3. Block Diagram of Test Configuration, b2 Temperature Chamber

2.2 Equipment Configuration

The EUT was set up as outlined in Figure 1. All equipment incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Serial Number
Radiated Emission			
A	AC/DC ADAPTOR (B2)	GFP1210-1210B	0711-0012761
B	B2	BULLET-2H	C-9668003
D	6DBI OMNI ANTENNA	N/A	N/A
Conducted Measurement			
A	AC/DC ADAPTOR (B2)	GFP1210-1210B	0771-0012761
B	B2	BULLET-2H	C-9668003

Table 3. Equipment Configuration

2.3 Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number
Conducted Emission			
C	LAPTOP	DELL	INSPIRON/1501
D	SPECTRUM ANALYZER	AGILENT	E4407B
N/A	TEMPERATURE CHAMBER	TENNY ENGINEERING	163C
Radiated Emission			
C	LAPTOP	DELL	INPIRON/1501

Table 4. Support Equipment

2.4 Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
Conducted Measurements						
1	A, 1	CAT 5	1	3M	Y	B, POE
2	B, LAN	CAT 5	1	3M	Y	C, LAPTOP
3	B, DC POWER	POWER CHORD	1	2M	N	AC 110V/230V
4	A, 2	COAXIAL CABLE	1	3M	Y	D, SPECTRUM ANALYZER
Radiated Measurements						
1	A, 1	CAT 5	1	3M	Y	B, POE
2	B, LAN	CAT 5	1	3M	Y	C, LAPTOP
3	B, DC POWER	POWER CHORD	1	2M	N	AC 110V/230V
4	A, 2	COAXIAL CABLE	1	3M	Y	D, OMNI ANTENNA 6DBI

Table 5. Ports and Cabling Information

2.5 Mode of Operation

The EUT operates in OFDM & DSSS mode.

2.6 Method of Monitoring EUT Operation

A Spectrum Analyzer was used to monitor the EUT's transmitter channel and power output.

2.7 Modifications to the EUT

No modifications were made to the EUT.

2.8 Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Ubiquiti Networks upon completion of testing.

3.0 Conformance Requirements

4.2.1 Effective Radiated Power

Test Requirement(s): **ETSI EN 300 328-1, Clause 4.3.1:**

4.3.1.1 Definition

The effective radiated power is defined as the total power of the transmitter.

4.3.1.2 Limit

The effective radiated power shall be equal to or less than -10 dBW (100 mW) e.i.r.p. This limit shall apply for any combination of power level and intended antenna assembly.

Test Procedure: The EUT was placed on a non-metallic table located in a shielded enclosure. The measurement was performed using normal operation of the equipment. The method of testing, test conditions, and test procedures of *EN 300 328*were used.

Test Results: The EUT as tested was compliant with the specified requirements of Clause 4.2.1.

Test Engineer(s): Anderson Soungpanya

Test Date(s): 07/25/08

Conformance Requirements

4.2.1 Effective Radiated Power

Channel	Temperature	Voltage	Mode	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP
Low	Nominal	Nominal	OFDM	12.12	6	18.12
Mid	Nominal	Nominal	OFDM	11.48	6	17.48
High	Nominal	Nominal	OFDM	11.44	6	17.44
Low	Maximum	Minimum	OFDM	13.07	6	19.07
Low	Maximum	Maximum	OFDM	13.42	6	19.42
Mid	Maximum	Minimum	OFDM	12.77	6	18.77
Mid	Maximum	Maximum	OFDM	12.05	6	18.05
High	Maximum	Minimum	OFDM	11.96	6	17.96
High	Maximum	Maximum	OFDM	11.8	6	17.8
Low	Minimum	Minimum	OFDM	13.41	6	19.41
Low	Minimum	Maximum	OFDM	13.26	6	19.26
Mid	Minimum	Minimum	OFDM	11.8	6	17.8
Mid	Minimum	Maximum	OFDM	12.74	6	18.74
High	Minimum	Minimum	OFDM	11.87	6	17.87
High	Minimum	Maximum	OFDM	11.89	6	17.89

Table 6. Effective Radiated Power, Test Results, 1

Conformance Requirements

4.2.1 Effective Radiated Power

Channel	Temperature	Voltage	Mode	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP
Low	Nominal	Nominal	DSSS	12.67	6	18.67
Mid	Nominal	Nominal	DSSS	12.51	6	18.51
High	Nominal	Nominal	DSSS	9.55	6	15.55
Low	Maximum	Minimum	DSSS	11.7	6	17.7
Low	Maximum	Maximum	DSSS	11.17	6	17.17
Mid	Maximum	Minimum	DSSS	11.89	6	17.89
Mid	Maximum	Maximum	DSSS	11.97	6	17.97
High	Maximum	Minimum	DSSS	9.07	6	15.07
High	Maximum	Maximum	DSSS	9.5	6	15.5
Low	Minimum	Minimum	DSSS	12.6	6	18.6
Low	Minimum	Maximum	DSSS	12.7	6	18.7
Mid	Minimum	Minimum	DSSS	11.2	6	17.2
Mid	Minimum	Maximum	DSSS	11.1	6	17.1
High	Minimum	Minimum	DSSS	9.15	6	15.15
High	Minimum	Maximum	DSSS	9.08	6	15.08

Table 7. Effective Radiated Power, Test Results, 2

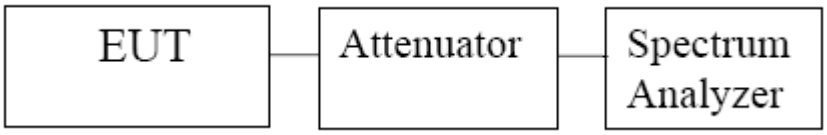


Figure 4. Effective Radiated Power Block Diagram

Conformance Requirements

4.3.2 Maximum Spectral Power Density

Test Requirement(s): **ETSI EN 300 328 Section 4.3.2:**

4.3.2.1 Definition
The maximum spectral power density is defined as the highest level of power in Watts per Hertz generated by the transmitter within the power envelope.

4.3.2.2 Limit
For equipment using FHSS modulation, the maximum spectral power density shall be limited to -10 dBW (100mW) per 100 KHz EIRP. For equipment using other types of modulation than FHSS (e.g. DSSS, OFDM, etc), the maximum spectral power density shall be limited to 10mW per MHz EIRP.

Test Procedure: The EUT was connected directly to a spectrum analyzer through an attenuator. The EUT was set to transmit at the highest power level in the appropriate modulation. For DTS modulations, the spectrum analyzer was set with a resolution band width of 1MHz, a positive peak detector, max hold function and a span three times the Occupied Band width. The frequency which produced the highest output across the channel bandwidth was recorded. The spectrum analyzer was then set to this frequency and the channel power/MHz was measured using the spectrum analyzer's channel power function. The maximum spectral power density EIRP was determined using the following equation:
P = A + G + 10 log (1/x); where A is the measured power, x is the duty cycle and G is the antenna assembly gain.

Test Results: The EUT as tested was found compliant with the specified limits of Clause 4.3.2.2.

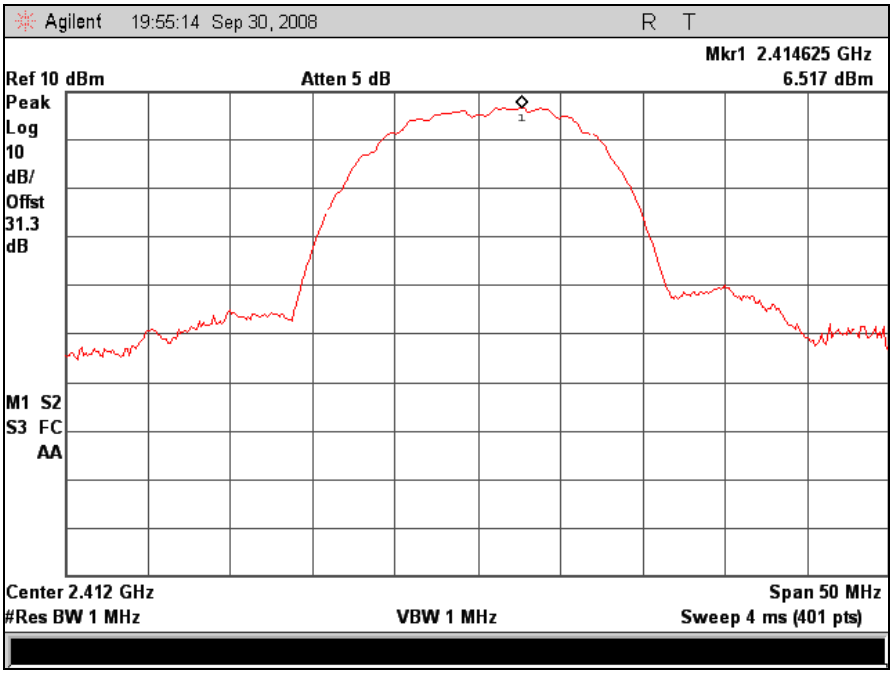
Maximum SPD <= 10mW (10 dBm) per MHz EIRP in Normal Test Condition, SPD = Spectral Power Density.

Test Engineer(s): Anderson Soungpanya

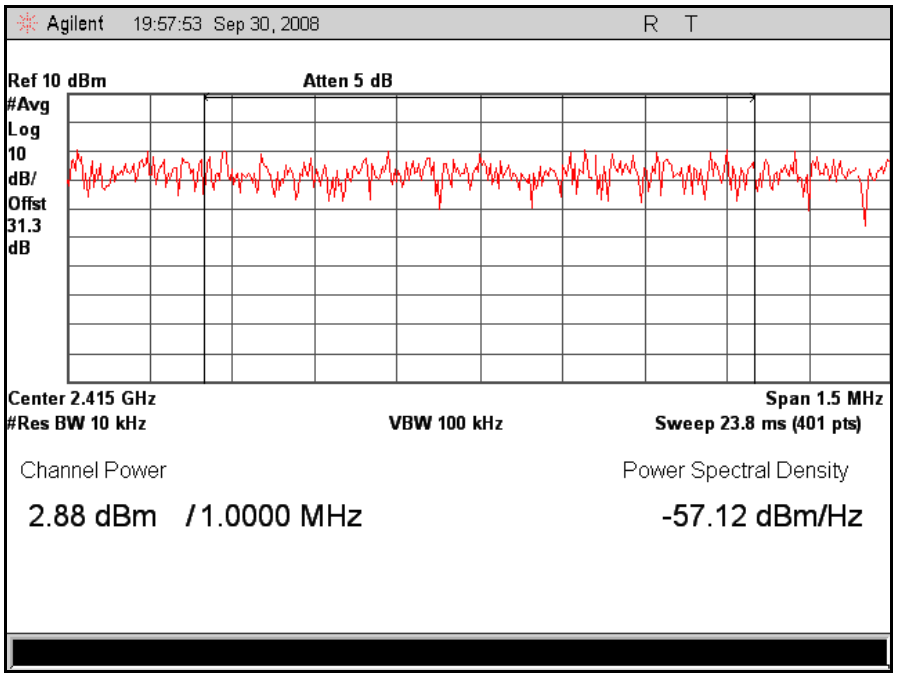
Test Date(s): 07/25/08

Conformance Requirements

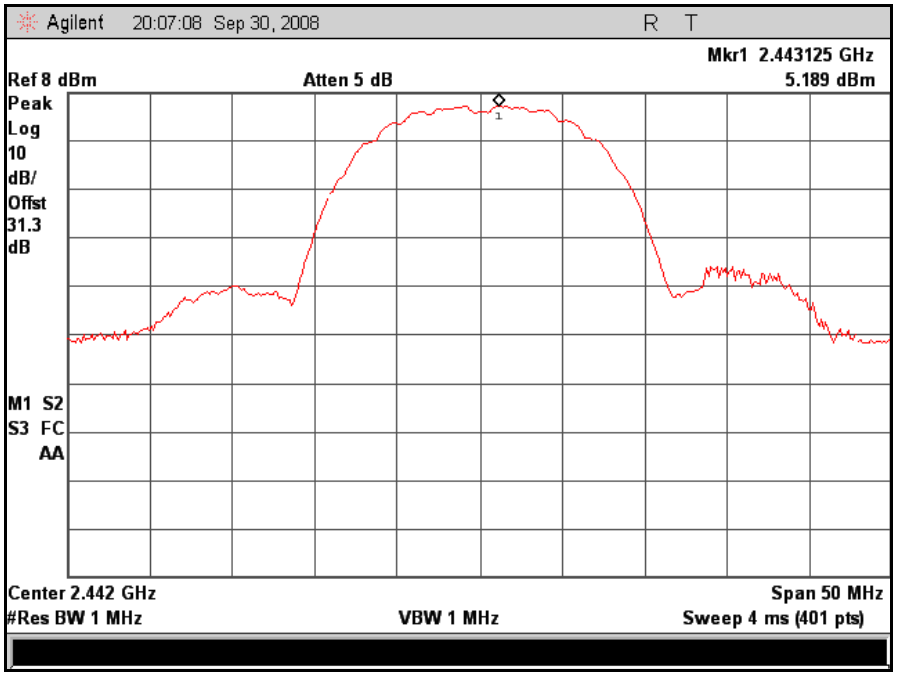
4.3.2 Peak Power Density



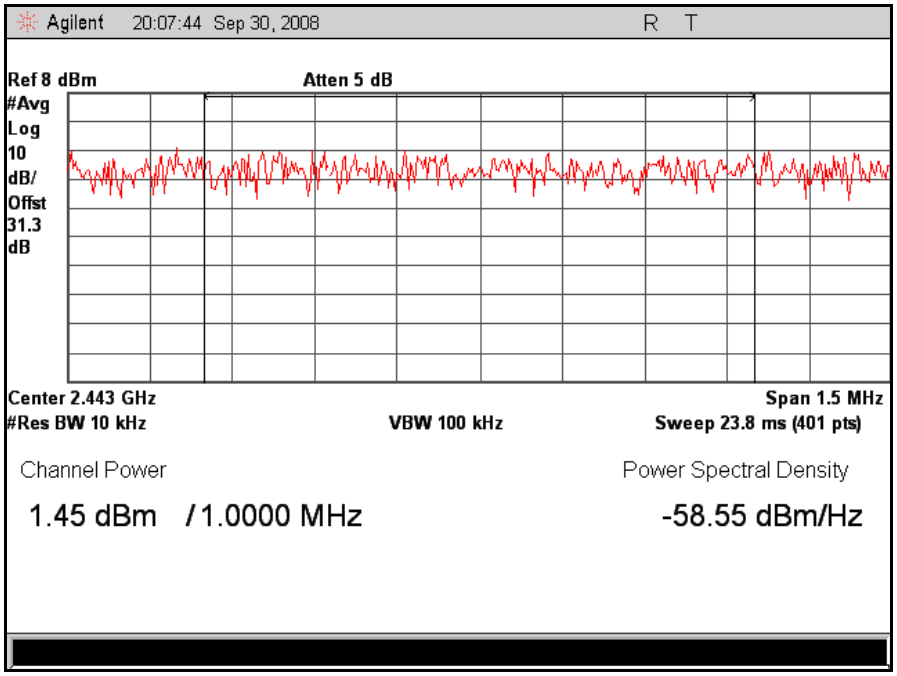
Plot 1. PSD Determination, b Mode, Low Channel



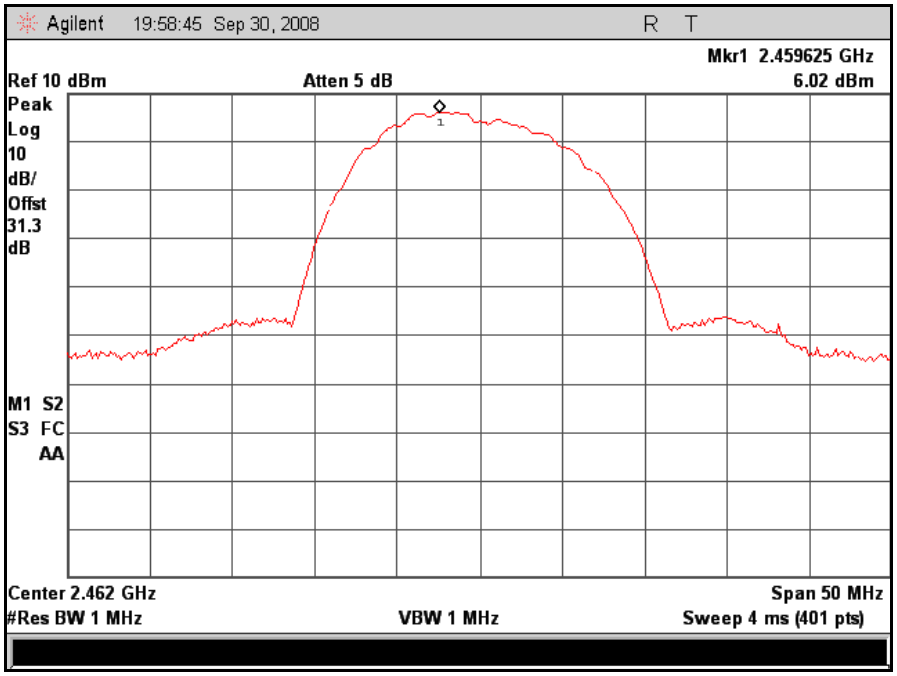
Plot 2. PSD, b Mode, Low Channel



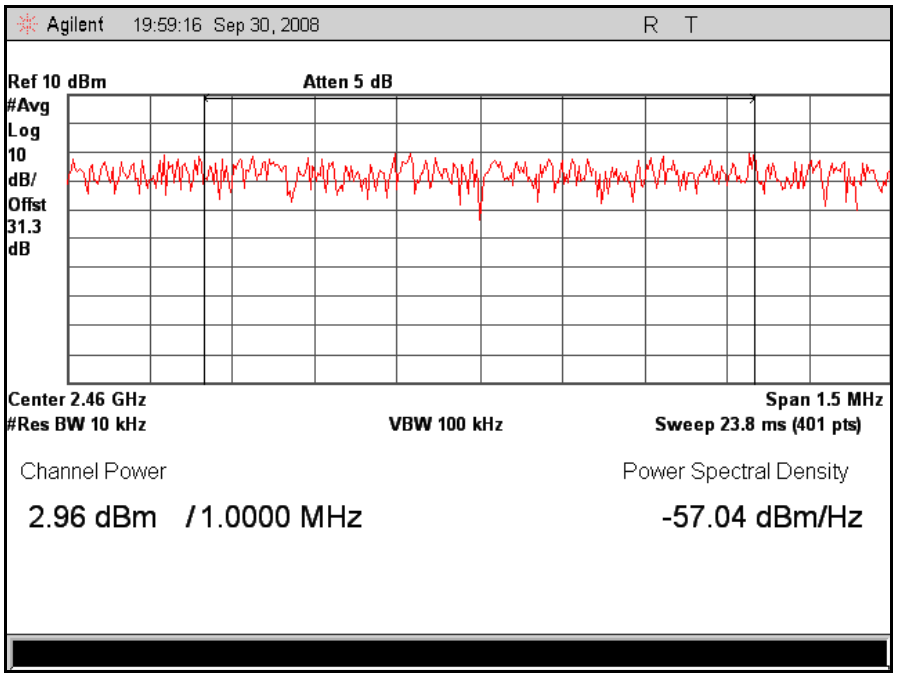
Plot 3. PSD Determination, b Mode, Mid Channel



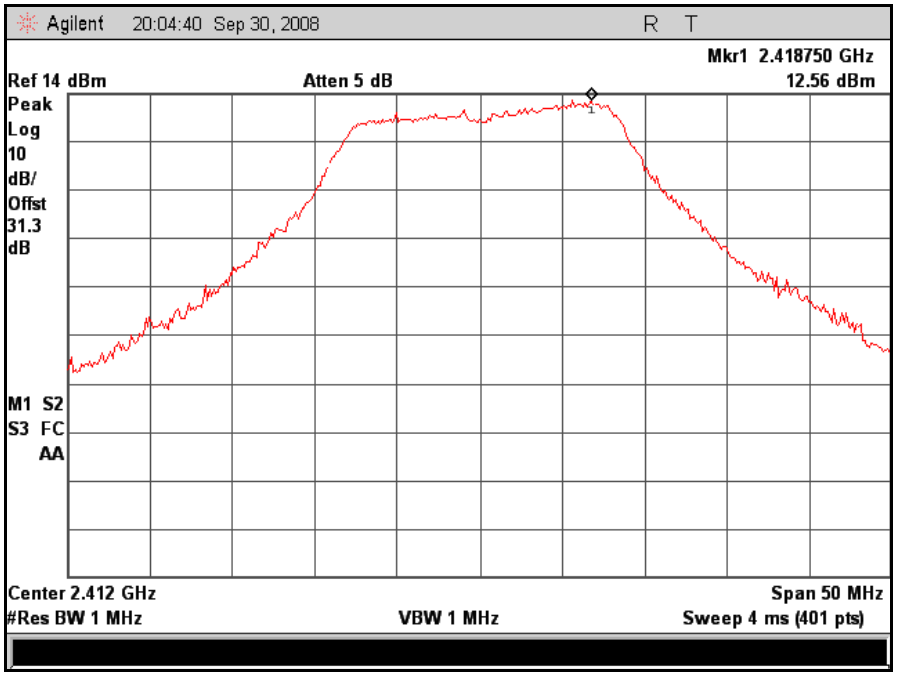
Plot 4. PSD, b Mode, Mid Channel



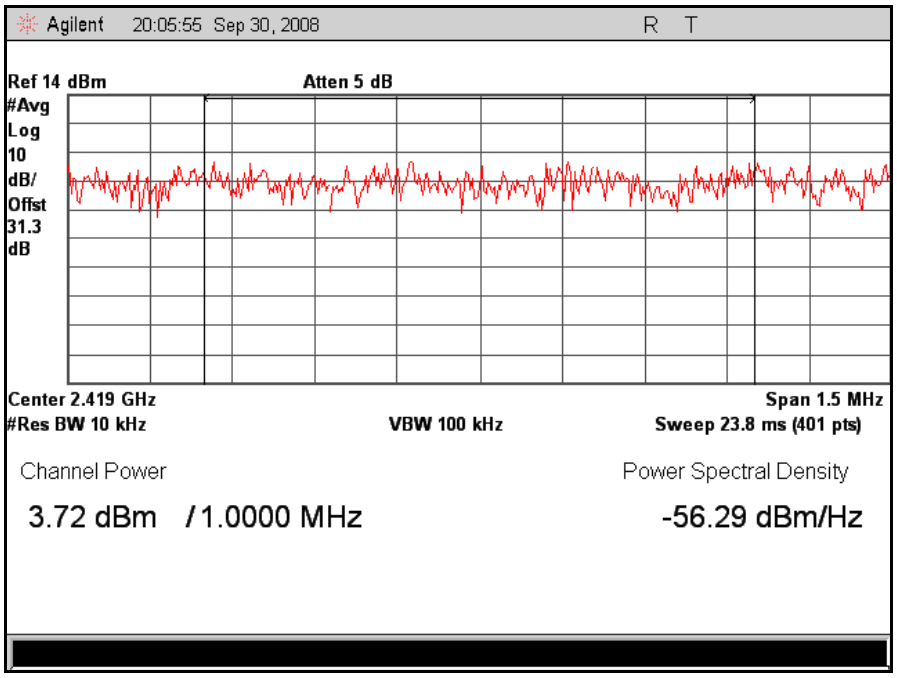
Plot 5. PSD Determination, b Mode, High Channel



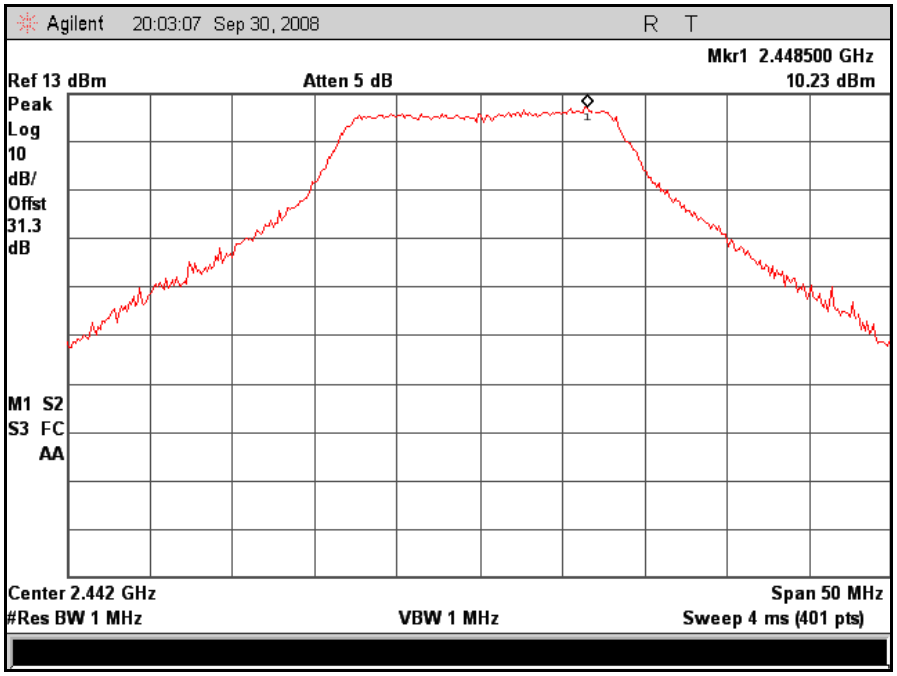
Plot 6. PSD, b Mode, High Channel



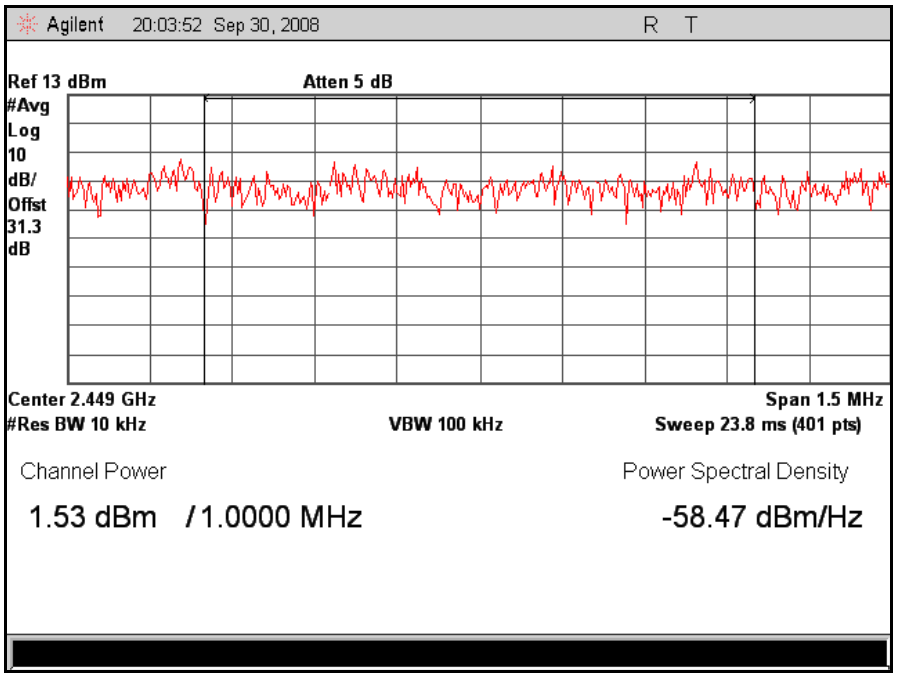
Plot 7. PSD Determination, g Mode, Low Channel



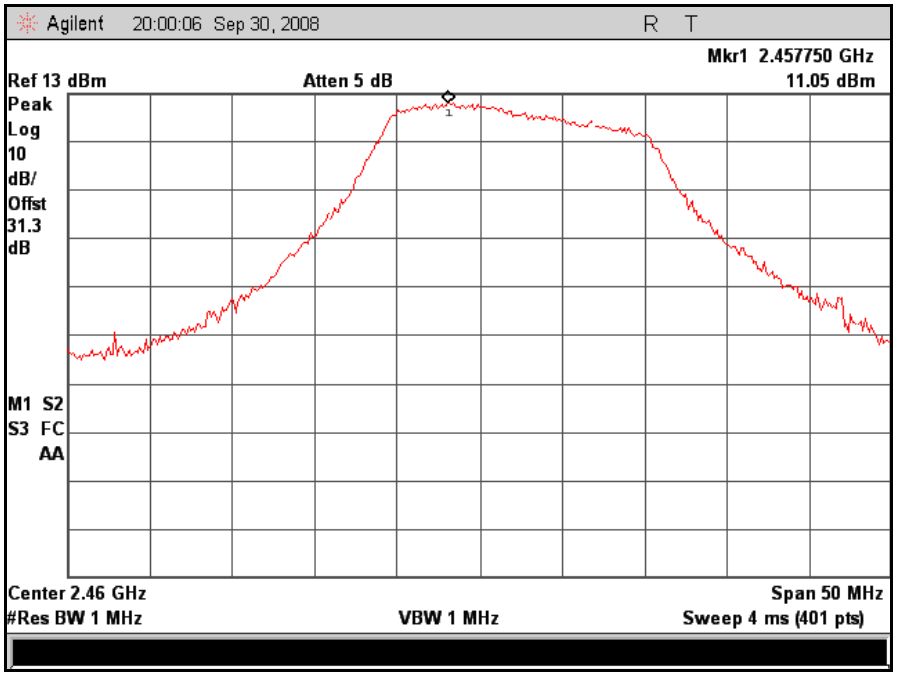
Plot 8. PSD, g Mode, Low Channel



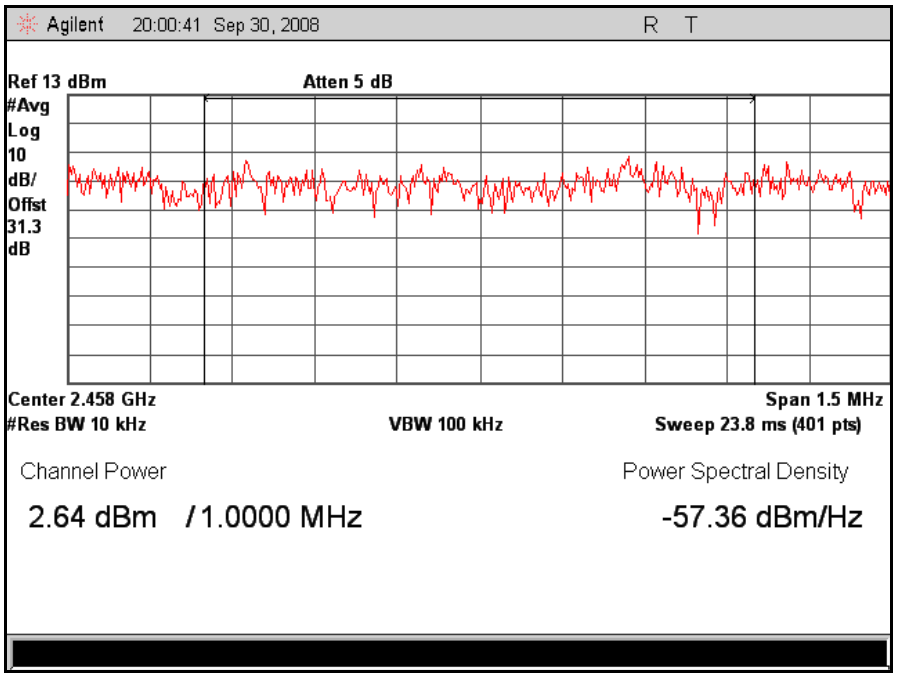
Plot 9. PSD Determination, g Mode, Mid Channel



Plot 10. PSD, g Mode, Mid Channel



Plot 11. PSD Determination, g Mode, High Channel



Plot 12. PSD, g Mode, High Channel

Conformance Requirements

4.3.3 Frequency Range

Test Requirement(s): **EN 300 328 Clause 4.3.3:**

4.3.3.1 Definition

The frequency range of the equipment is determined by the lowest and highest frequencies occupied by the power envelope. *fH* is the highest frequency of the power envelope: it is the frequency furthest above the frequency of maximum power where the output power drops below the level of -80 dBm/Hz e.i.r.p. spectral power density (-30 dBm if measured in a100 kHz bandwidth). *fL* is the lowest frequency of the power envelope; it is the frequency furthest below the frequency of maximum power where the output power drops below the level equivalent to -80 dBm/Hz e.i.r.p. spectral power density (or -30 dBm if measured in a 100 kHz bandwidth).

For a given operating frequency, the width of the power envelope is (*fH* - *fL*). In equipment that allows adjustment or selection of different operating frequencies, the power envelope takes up different positions in the allocated band. The frequency range is determined by the lowest value of *fL* and the highest value of *fH* resulting from the adjustment of the equipment to the lowest and highest operating frequencies.

4.3.3.2 Limit

For all equipment the frequency range shall lie within the band 2,4 GHz to 2,4835 GHz (*fL* > 2,4 GHz and *fH* < 2,4835 GHz).

Test Procedure: The EUT was connected directly to a spectrum analyzer through a attenuator. The resolution band width of the spectrum analyzer was set to 100 KHz with video averaging and a minimum of 50 sweeps. The lowest and highest carrier frequencies generated by all modulations was set to transmit at the highest rated power level of the EUT. The frequency at which the spectral density dropped by 30dBm from the maximum level measured was recorded for both the upper and lower frequencies of the transmit band. This procedure was carried out at both normal and extreme conditions.

Test Results: The EUT as tested was compliant with the specified requirements of Clause 4.3.3.

Test Engineer(s): Anderson Soungpanya

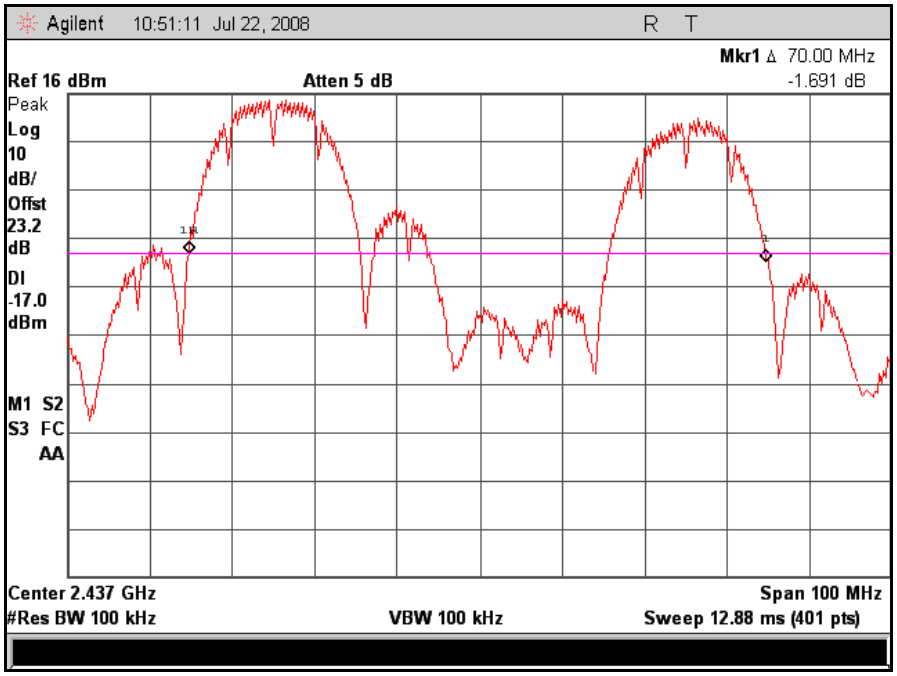
Test Date(s): 07/25/08

Temperature	Voltage	Mode	Limit MHz	Frequency Range MHz	Margin MHz
Nominal	Nominal	DSSS	83.5	69.75	13.75
Nominal	Maximum	DSSS	83.5	69.75	13.75
Nominal	Minimum	DSSS	83.5	69.75	13.75
Maximum	Nominal	DSSS	83.5	70.00	13.50
Maximum	Maximum	DSSS	83.5	69.75	13.75
Maximum	Minimum	DSSS	83.5	69.75	13.75
Minimum	Nominal	DSSS	83.5	70.00	13.50
Minimum	Maximum	DSSS	83.5	70.00	13.50
Minimum	Minimum	DSSS	83.5	70.00	13.50
Nominal	Nominal	OFDM	83.5	72.50	11.00
Nominal	Maximum	OFDM	83.5	72.00	11.50
Nominal	Minimum	OFDM	83.5	72.00	11.50
Maximum	Nominal	OFDM	83.5	71.25	12.25
Maximum	Maximum	OFDM	83.5	72.25	11.25
Maximum	Minimum	OFDM	83.5	72.75	10.75
Minimum	Nominal	OFDM	83.5	75.25	8.25
Minimum	Maximum	OFDM	83.5	75.00	8.50
Minimum	Minimum	OFDM	83.5	76.25	7.25

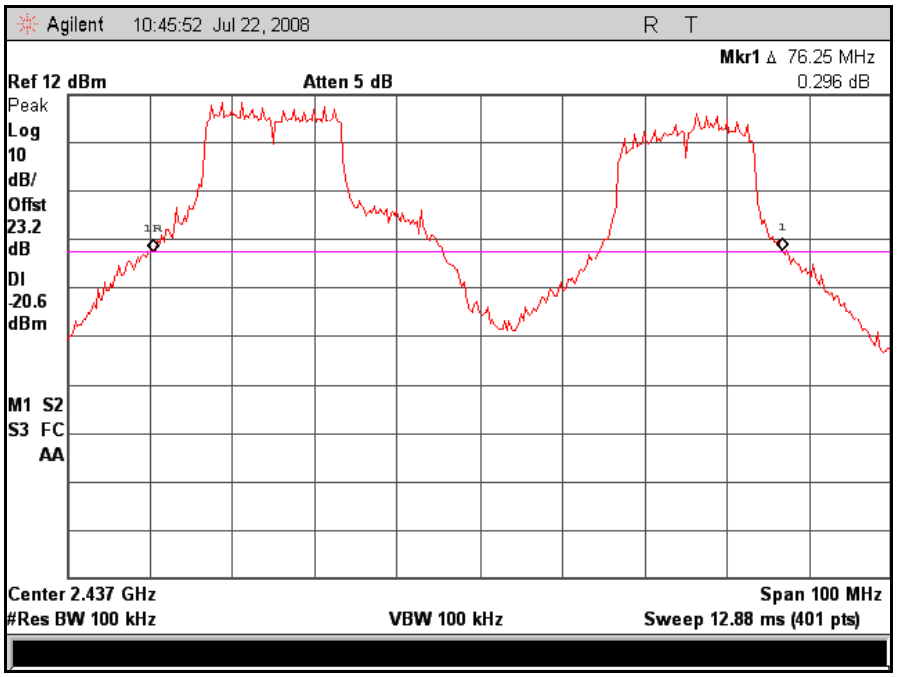
Table 8. Frequency Range, Test Results

Conformance Requirements

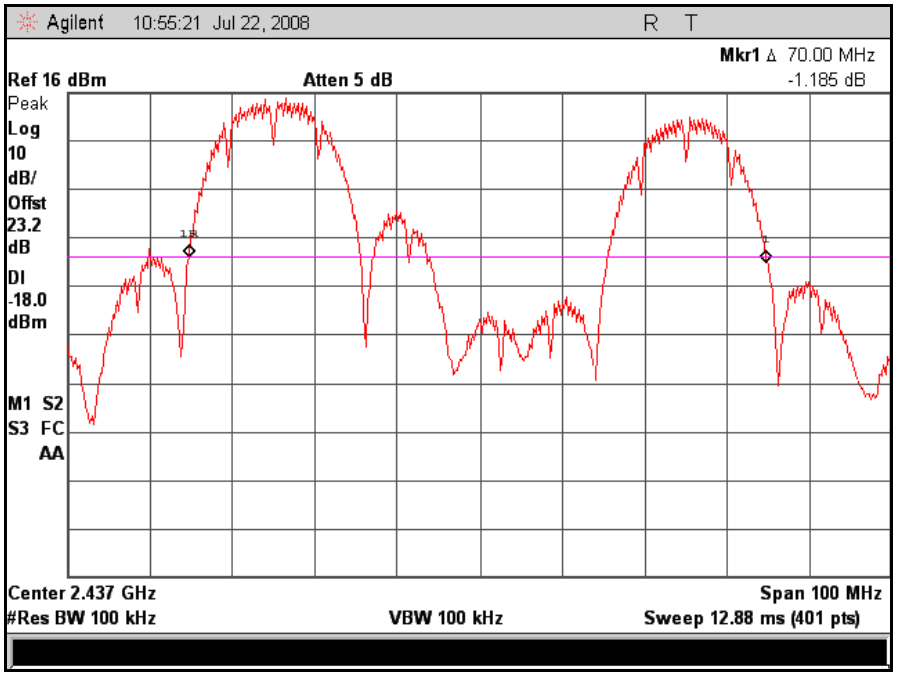
4.3.3 Frequency Range



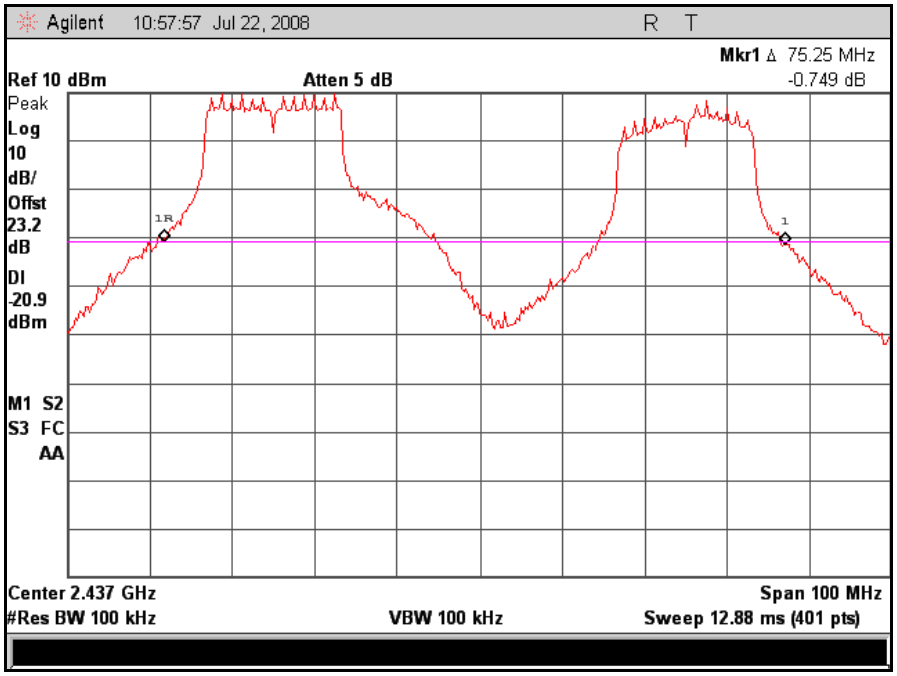
Plot 13. Frequency Range, Low Temperature, Low Voltage, b Mode



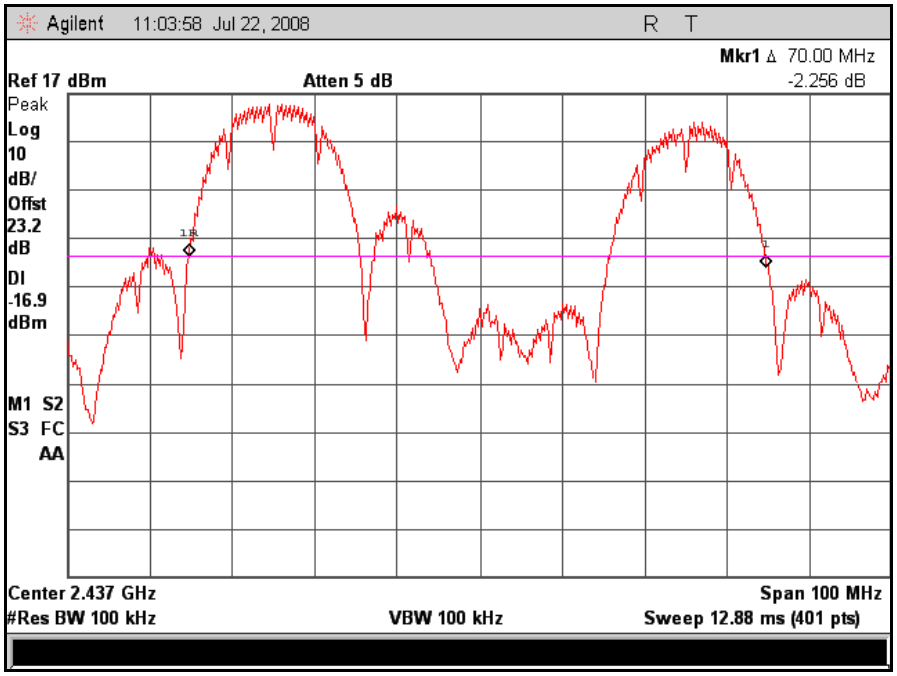
Plot 14. Frequency Range, Low Temperature, Low Voltage, g Mode



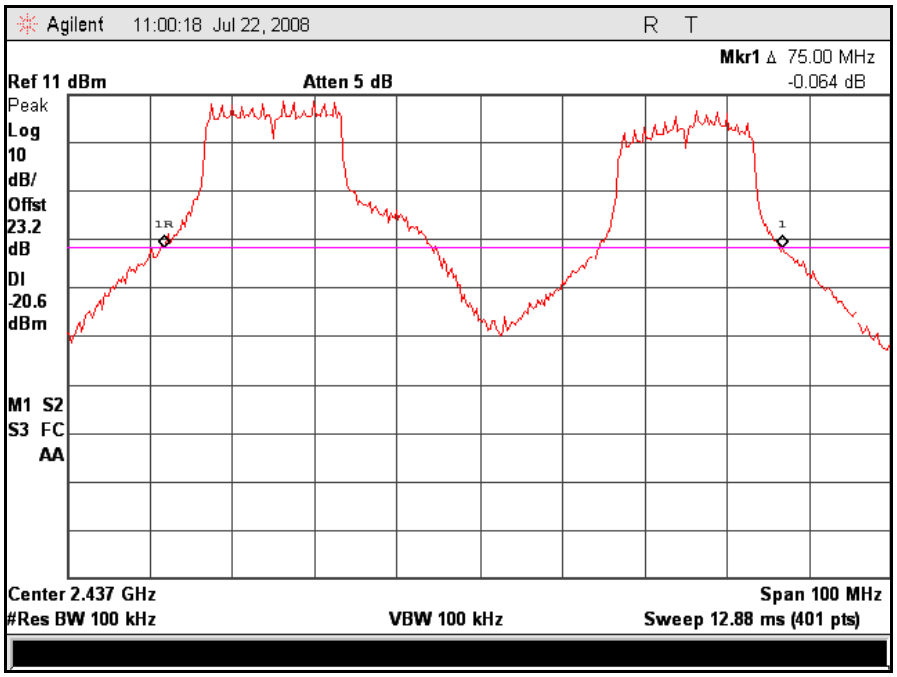
Plot 15. Frequency Range, Low Temperature, Normal Voltage, b Mode



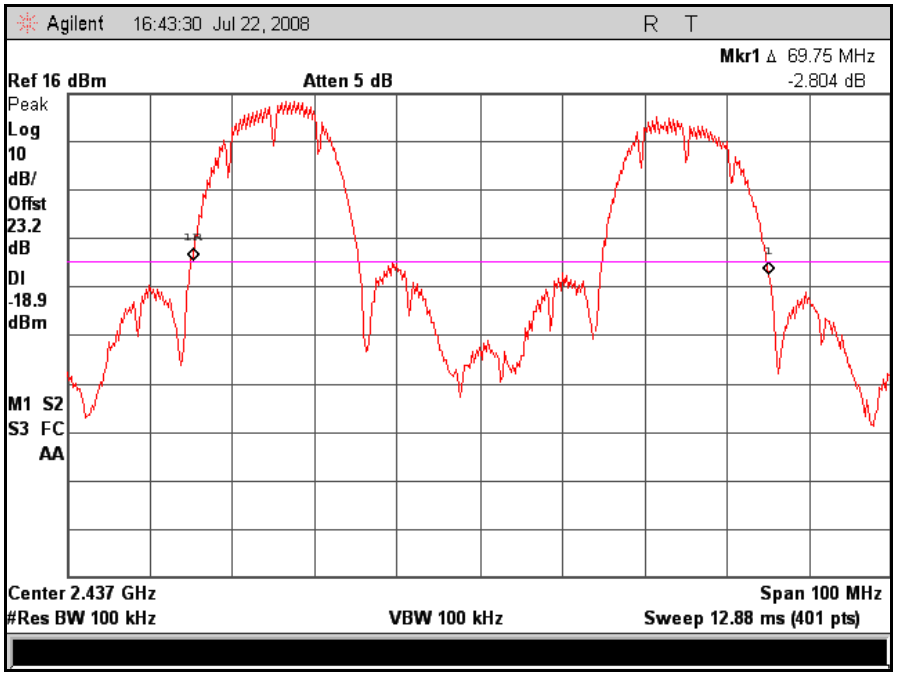
Plot 16. Frequency Range, Low Temperature, Normal Voltage, g Mode



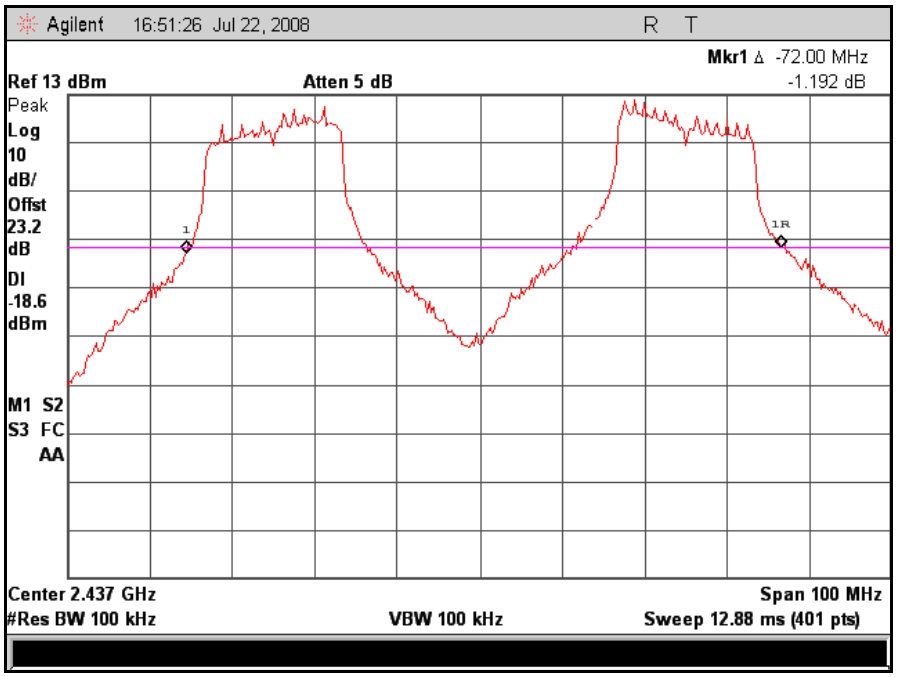
Plot 17. Frequency Range, Low Temperature, High Voltage, b Mode



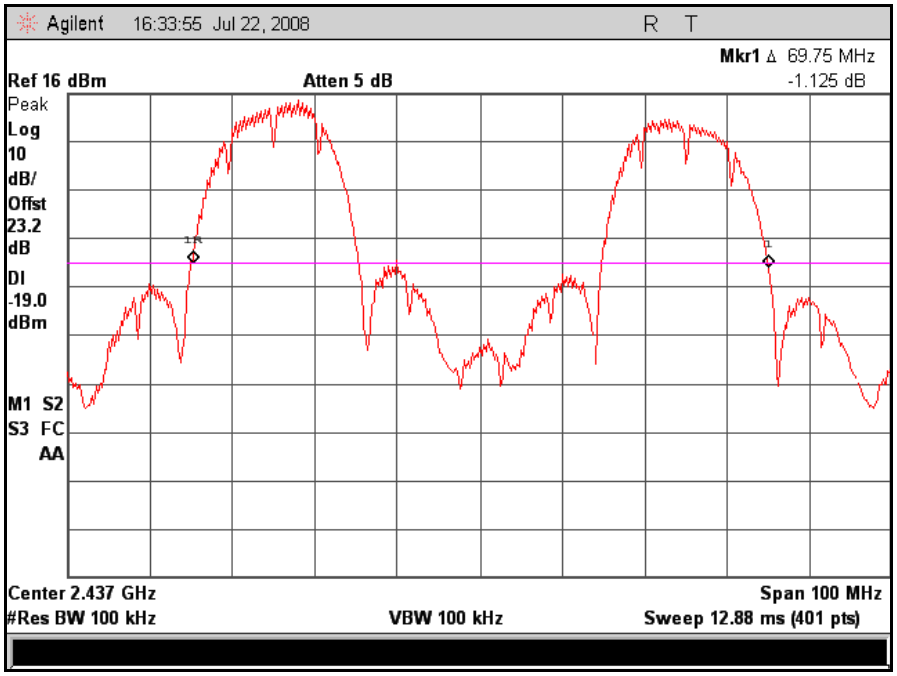
Plot 18. Frequency Range, Low Temperature, High Voltage, g Mode



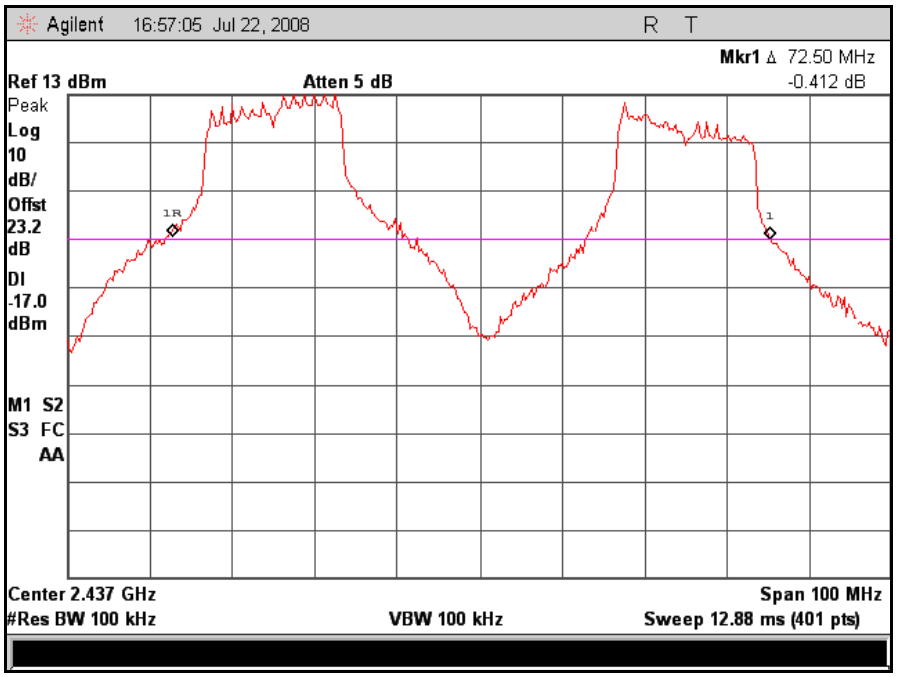
Plot 19. Frequency Range, Normal Temperature, Low Voltage, b Mode



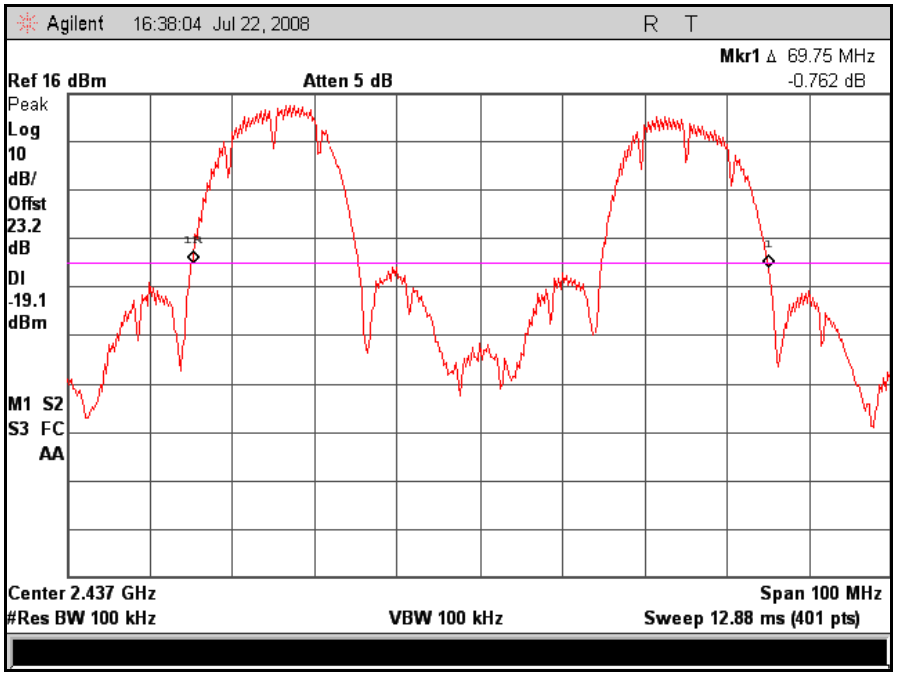
Plot 20. Frequency Range, Normal Temperature, Low Voltage, g Mode



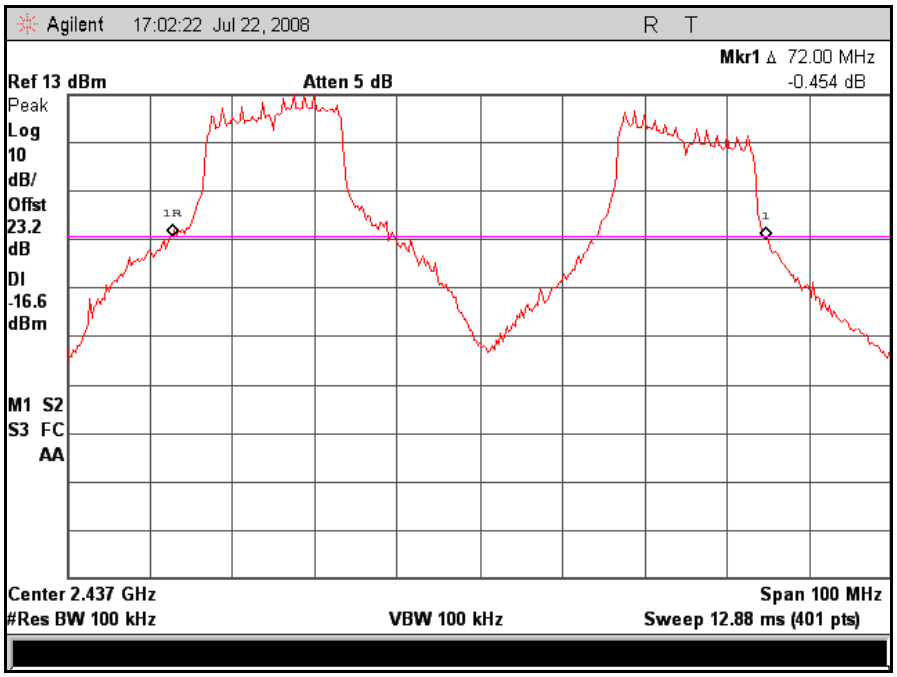
Plot 21. Frequency Range, Normal Temperature, Normal Voltage, b Mode



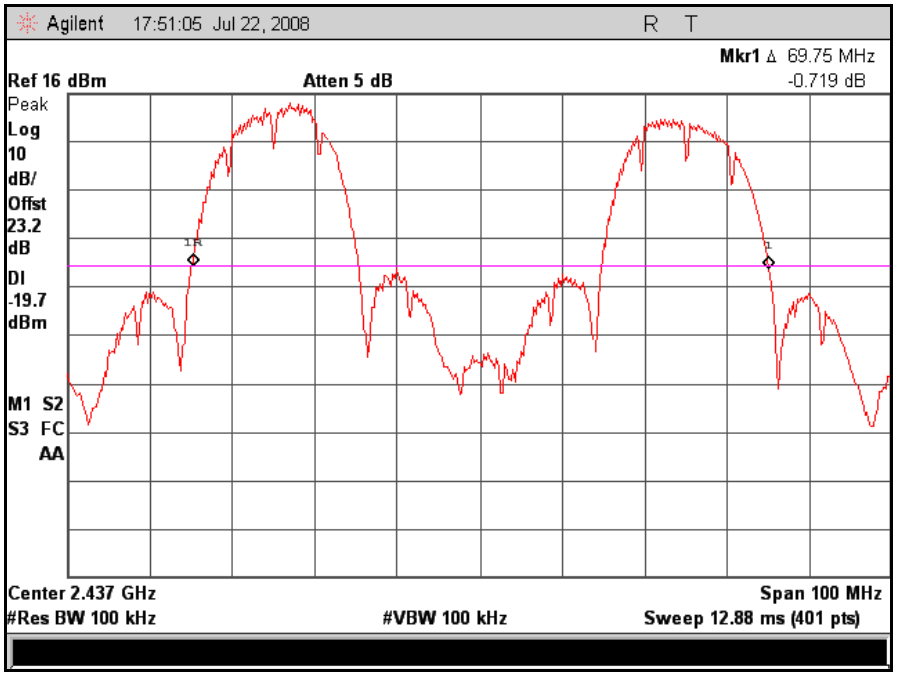
Plot 22. Frequency Range, Normal Temperature, Normal Voltage, g Mode



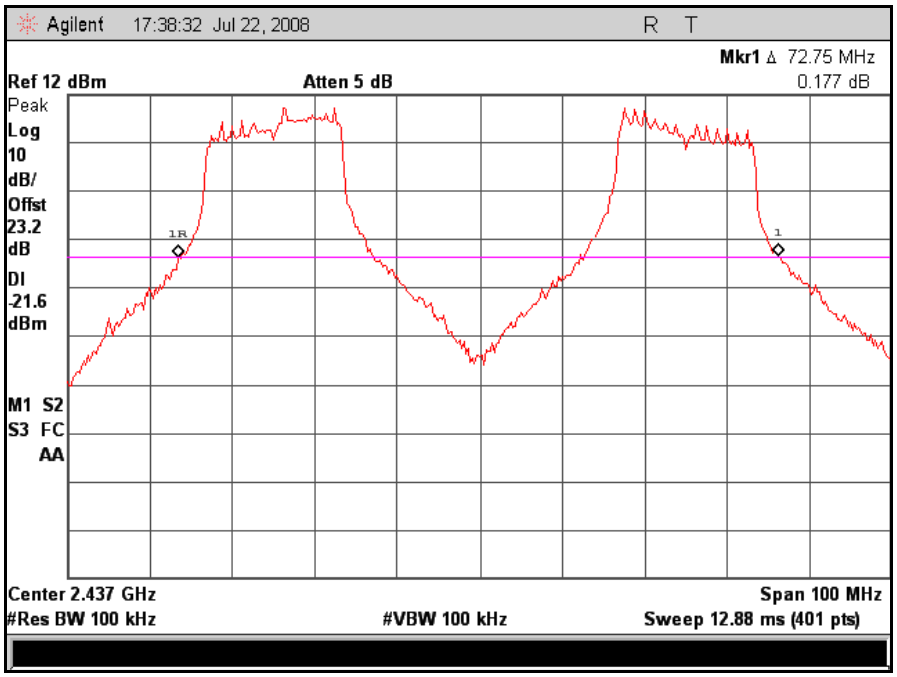
Plot 23. Frequency Range, Normal Temperature, High Voltage, b Mode



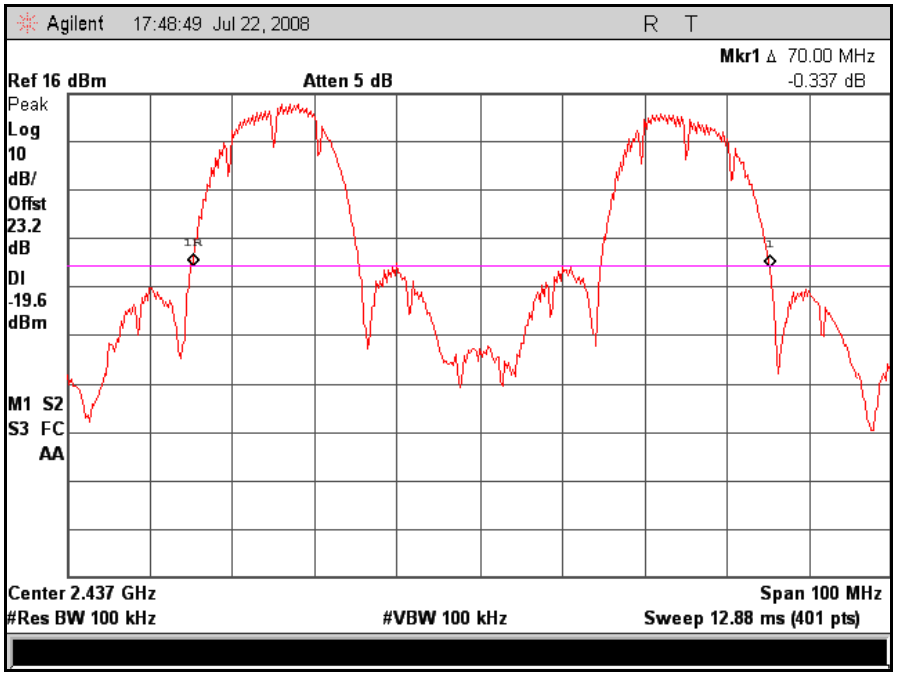
Plot 24. Frequency Range, Normal Temperature, High Voltage, g Mode



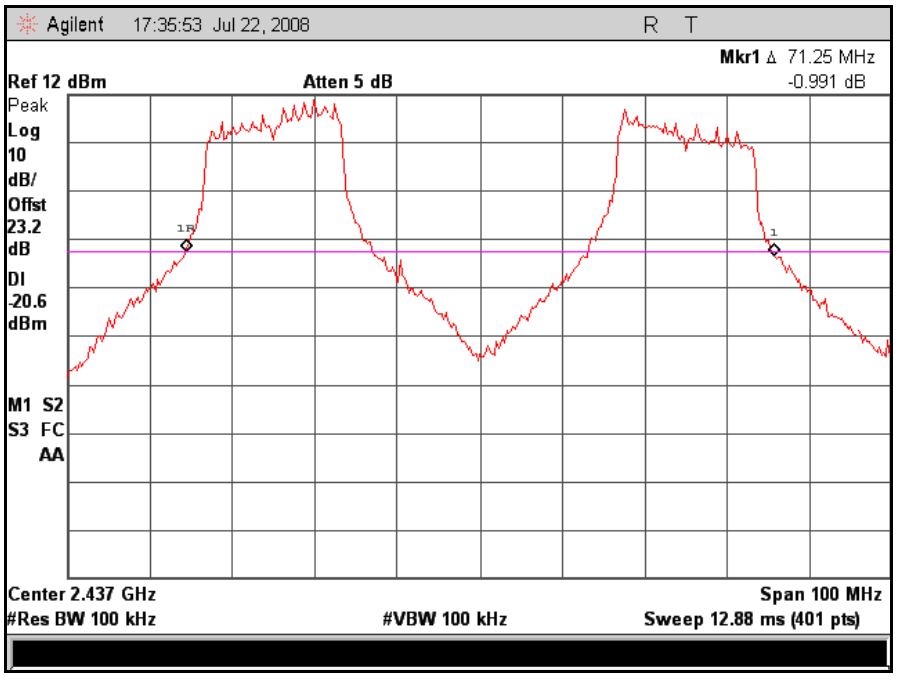
Plot 25. Frequency Range, High Temperature, Low Voltage, b Mode



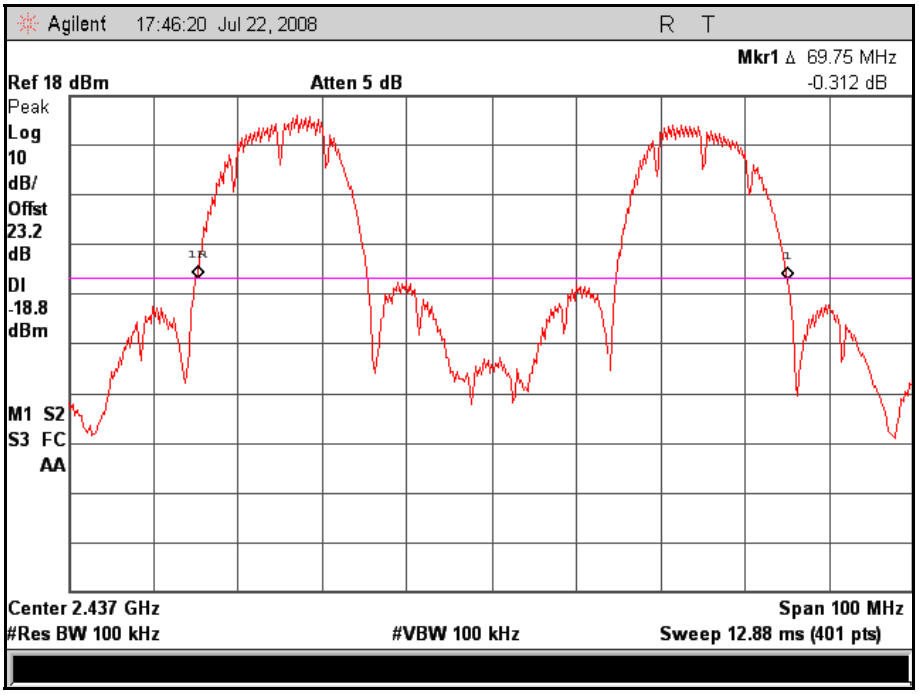
Plot 26. Frequency Range, High Temperature, Low Voltage, g Mode



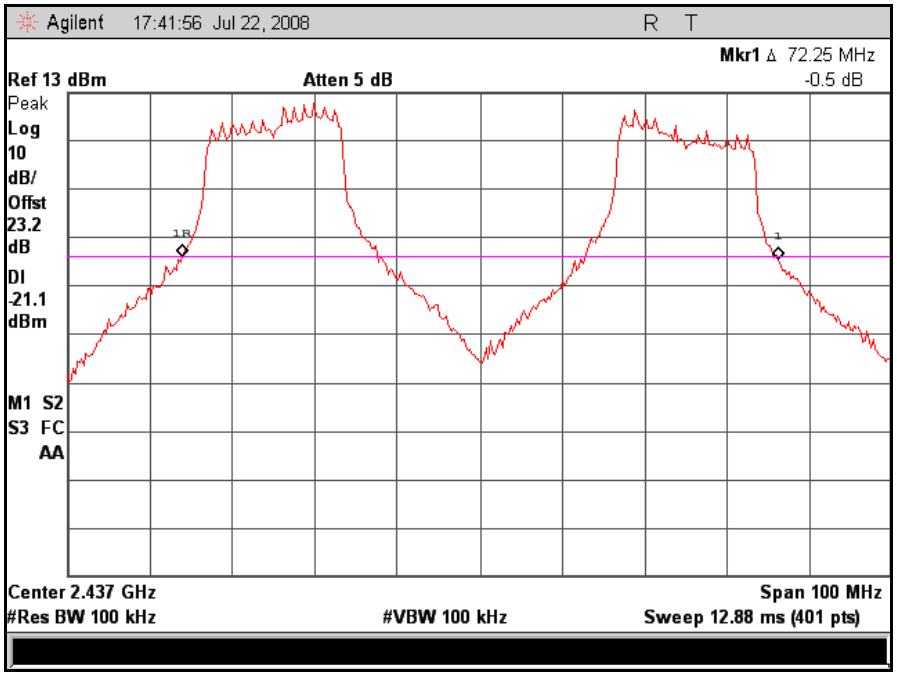
Plot 27. Frequency Range, High Temperature, Normal Voltage, b Mode



Plot 28. Frequency Range, High Temperature, Normal Voltage, g Mode



Plot 29. Frequency Range, High Temperature, High Voltage, b Mode



Plot 30. Frequency Range, High Temperature, High Voltage, g Mode

Conformance Requirements

4.3.6 Transmitter Spurious Emissions - Conducted

Test Requirement(s): **EN 300 328, Clause 4.3.6:**

4.3.6.1 Definition

Transmitter spurious emissions are emissions outside the frequency range(s) of the equipment as defined in *Clause 4.3.3.1* when the equipment is in Transmit mode and/or in Standby mode.

4.3.6.2 Limit

The spurious emissions of the transmitter shall not exceed the values in Table 9 and Table 10 and in the indicated bands.

Frequency Range	Limit when operating	Limit when in standby
30 MHz to 1 GHz	-36 dBm	-57 dBm
above 1 GHz to 12,75 GHz	-30 dBm	-47 dBm
1,8 GHz to 1,9 GHz 5,15 GHz to 5,3 GHz	-47 dBm	-47 dBm

Table 9. Transmitter limits for narrowband spurious emissions

The above limit values apply to narrowband emissions, e.g. as caused by local oscillator leakage. The measurement bandwidth for such emissions may be as small as necessary to achieve a reliable measurement result.

Wideband emissions shall not exceed the values given in Table 10.

Frequency Range	Limit when operating	Limit when in standby
30 MHz to 1 GHz	-80 dBm	-107 dBm
above 1 GHz to 12,75 GHz	-80 dBm	-97 dBm
1,8 GHz to 1,9 GHz 5,15 GHz to 5,3 GHz	-97 dBm	-97 dBm

Table 10. Transmitter limits for wideband spurious emissions

Conformance Requirements

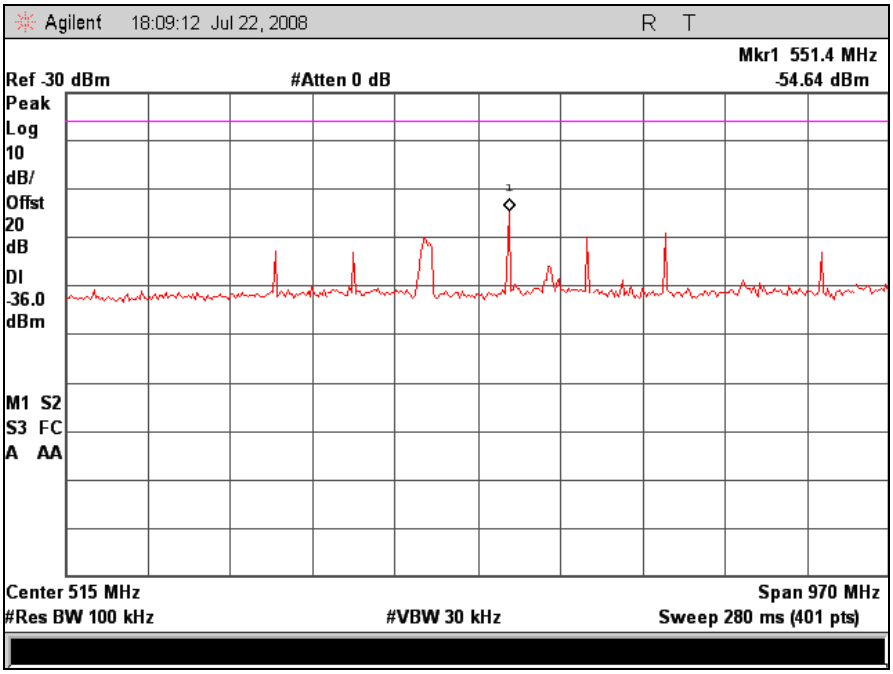
4.3.6 Transmitter Spurious Emissions - Conducted

Test Procedure: The EUT was connected directly to a spectrum analyzer through an attenuator. The resolution band width of the spectrum analyzer was set to 100 KHz and the video band width set to 30 KHz. A positive peak detector was used along with peak hold function. The measurement was performed using normal operation of the equipment.

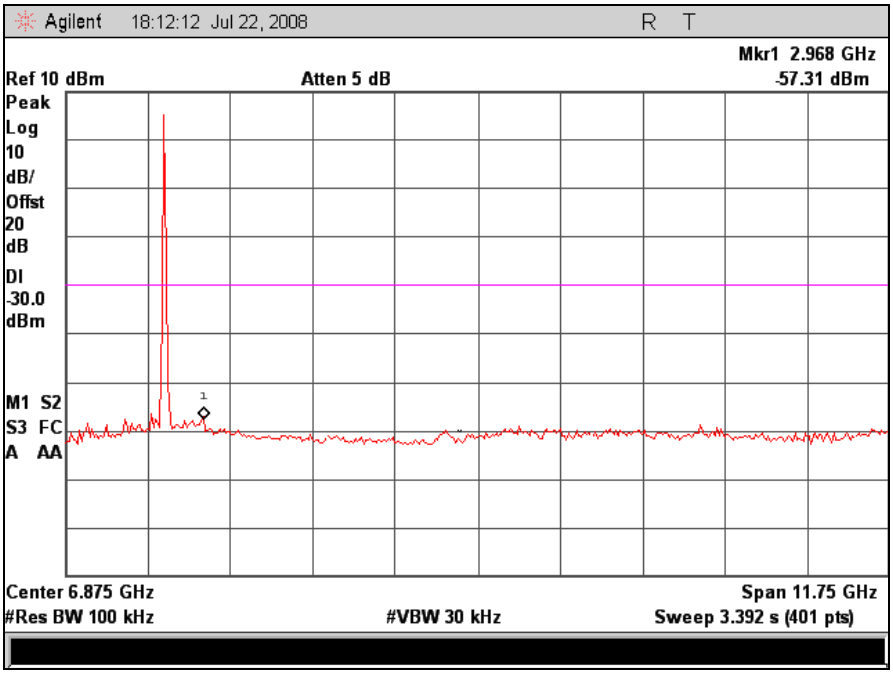
Test Results: The EUT as tested was found compliant with the specified requirements of Clause 4.3.6.

Test Engineer(s): Anderson Soungpanya

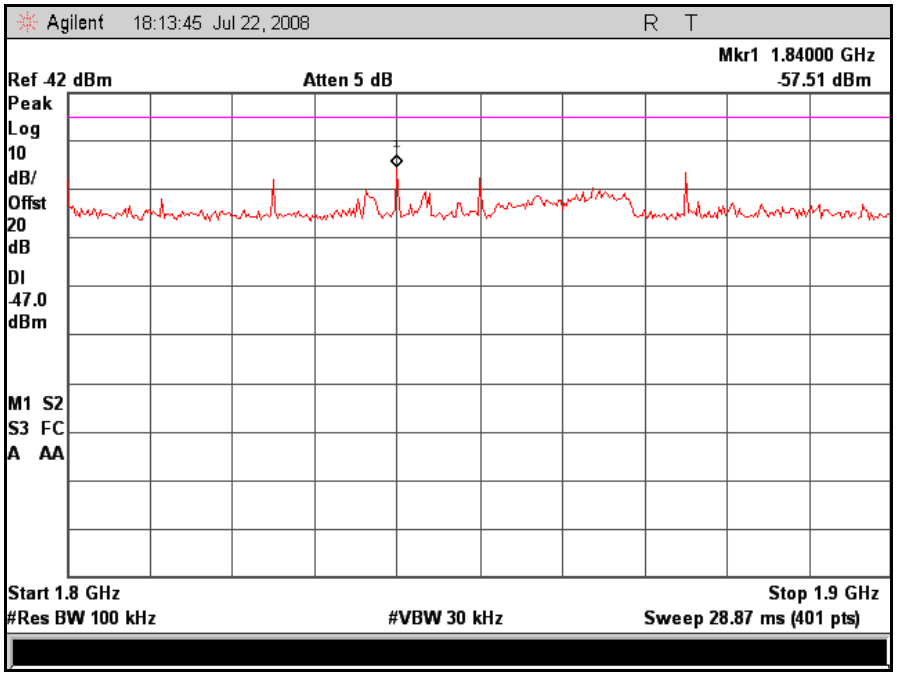
Test Date(s): 07/25/08



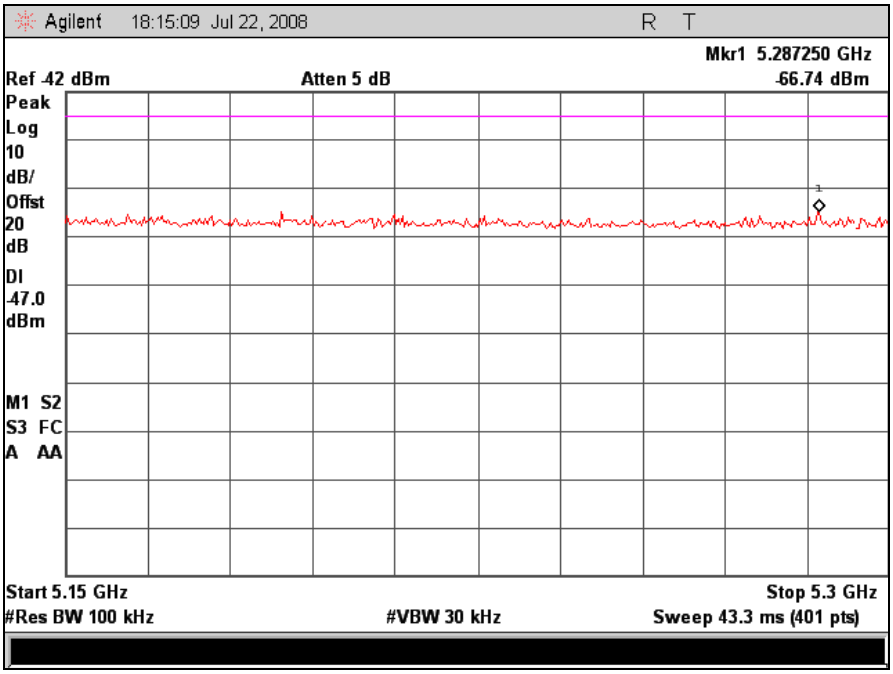
Plot 31. Conducted Emission, Low Channel, b Mode, 30 MHz - 1GHz



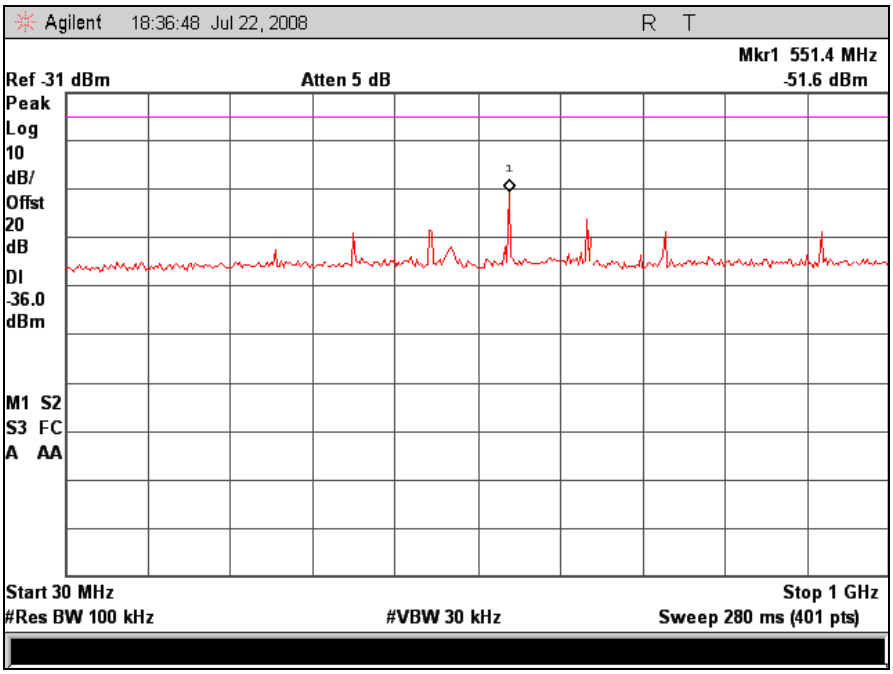
Plot 32. Conducted Emission, Low Channel, b Mode, 1 GHz - 12.75 GHz



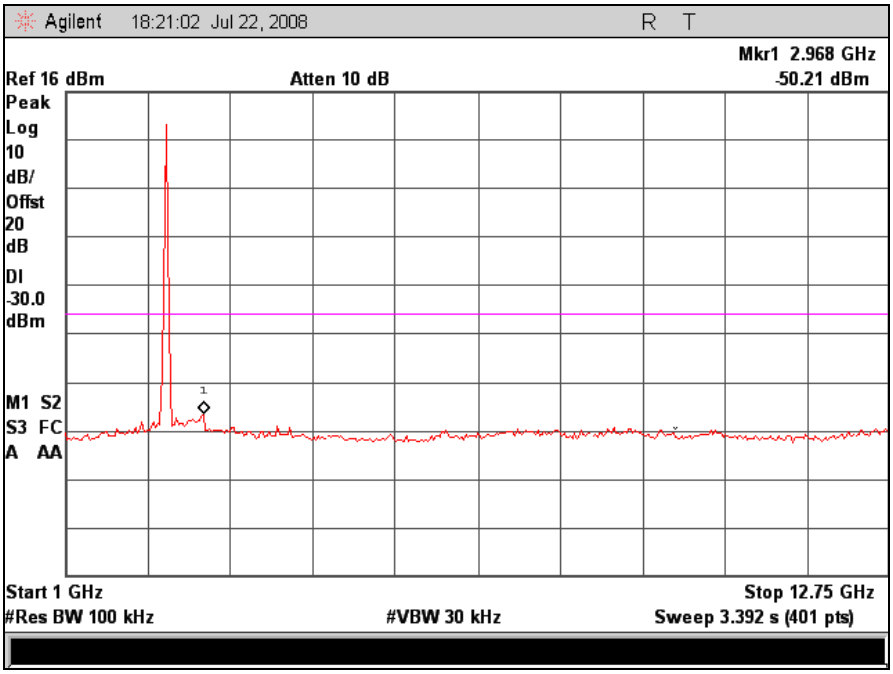
Plot 33. Conducted Emission, Low Channel, b Mode, 1.8 GHz – 1.9 GHz



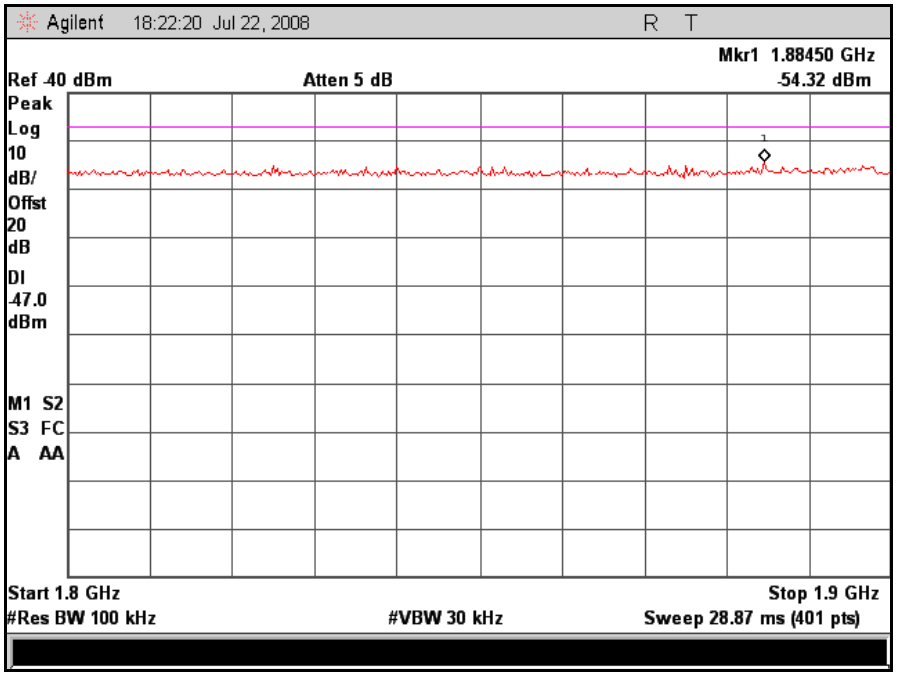
Plot 34. Conducted Emission, Low Channel, b Mode, 5.15 GHz - 5.3 GHz



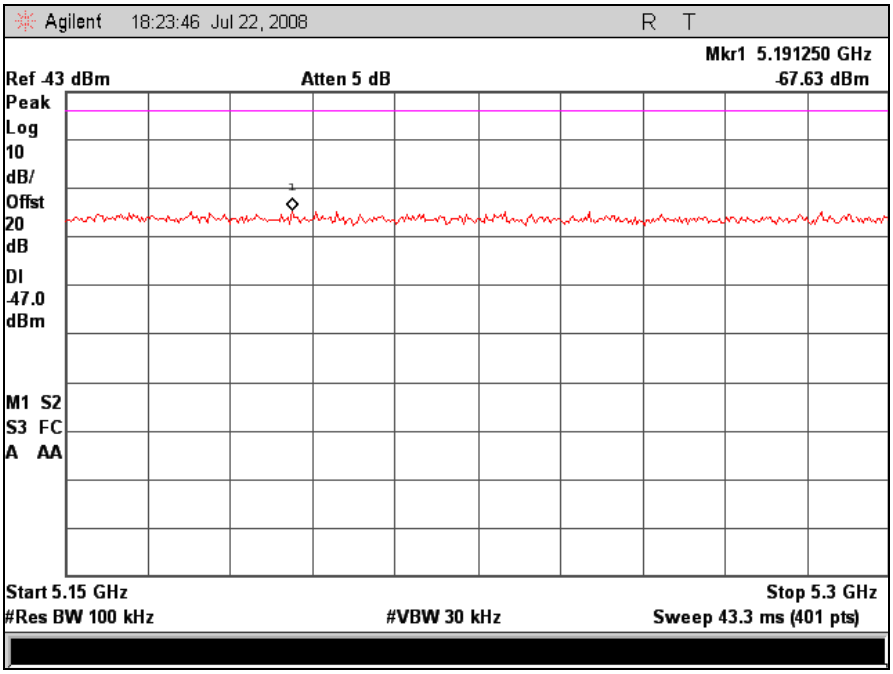
Plot 35. Conducted Emission, Mid Channel, b Mode, 30 MHz - 1 GHz



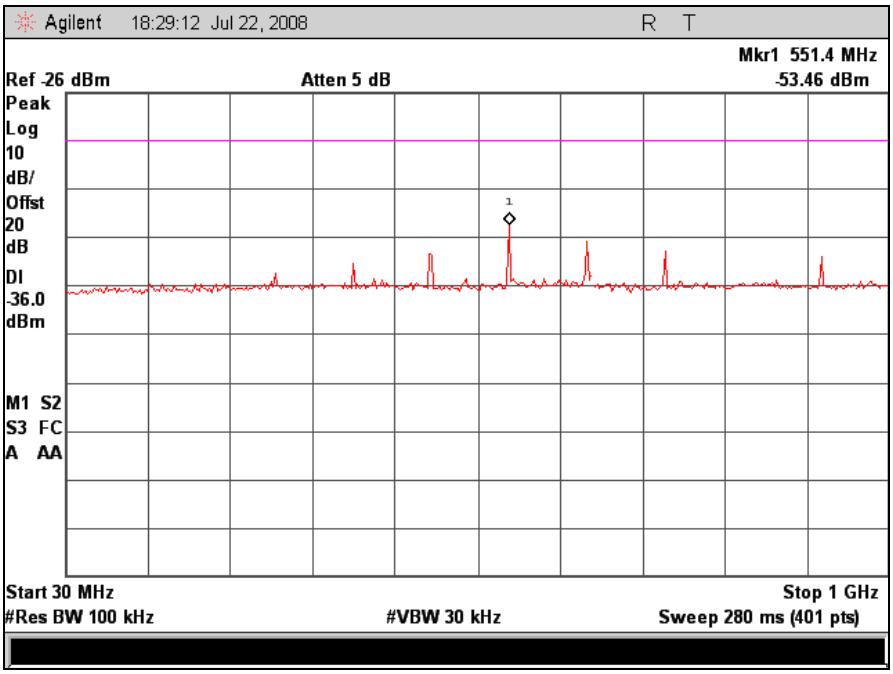
Plot 36. Conducted Emission, Mid Channel, b Mode, 1 GHz - 12.75 GHz



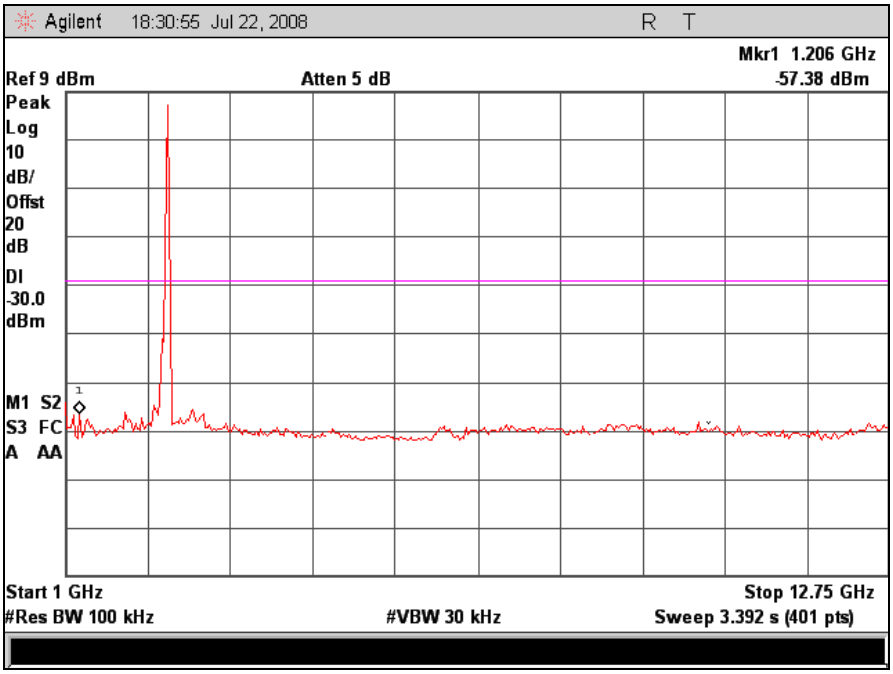
Plot 37. Conducted Emission, Mid Channel, b Mode, 1.8 GHz - 1.9 GHz



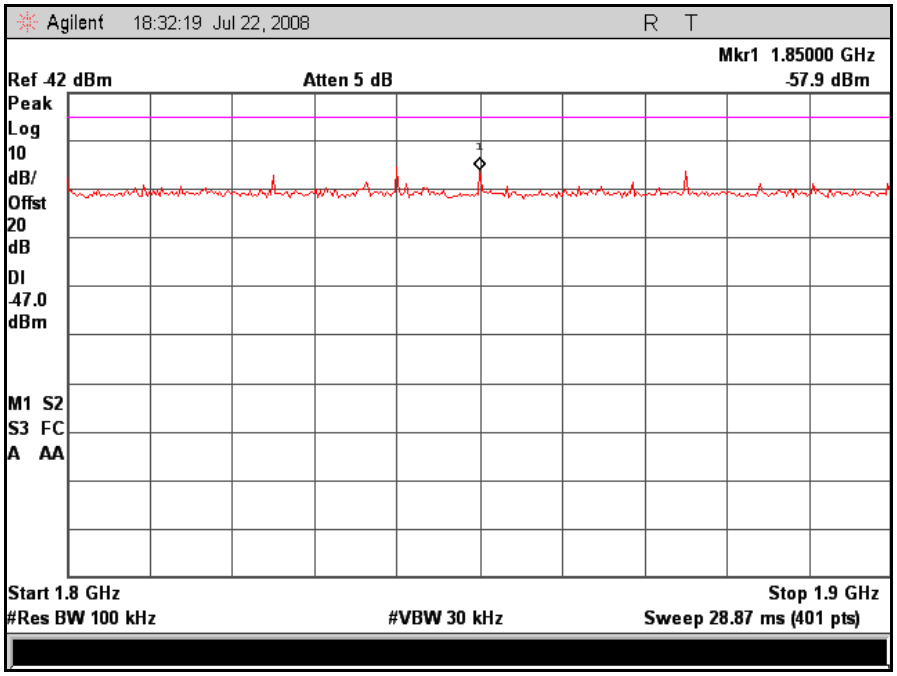
Plot 38. Conducted Emission, Mid Channel, b Mode, 5.15 GHz - 5.3 GHz



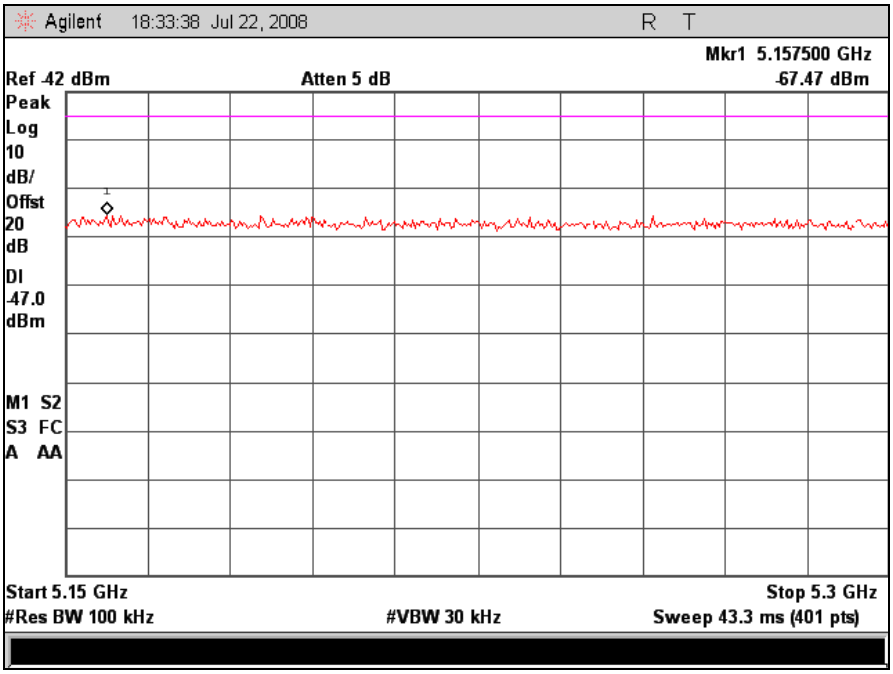
Plot 39. Conducted Emission, High Channel, b Mode, 30 MHz - 1 GHz



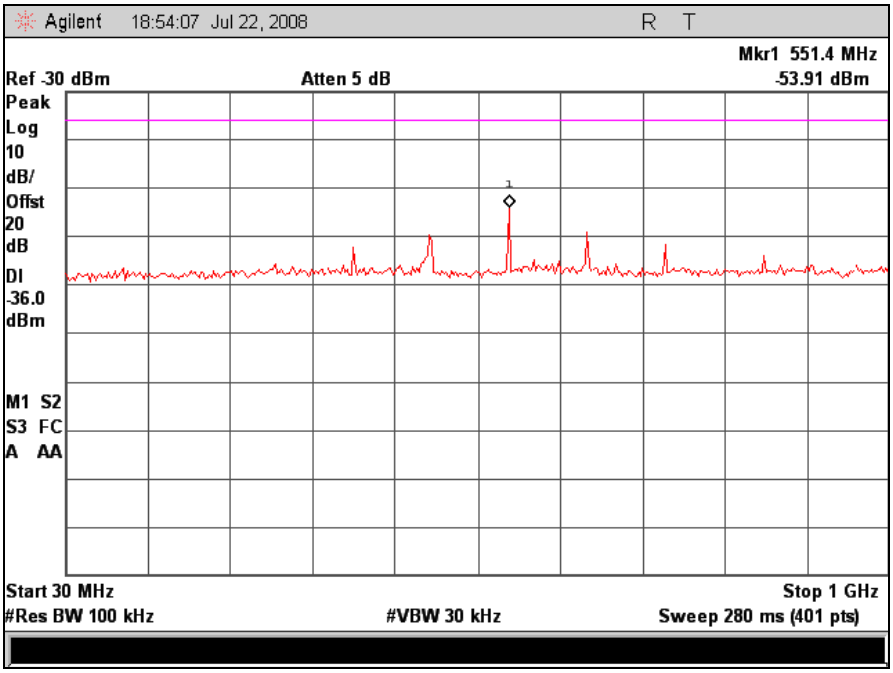
Plot 40. Conducted Emission, High Channel, b Mode, 1 GHz - 12.75 GHz



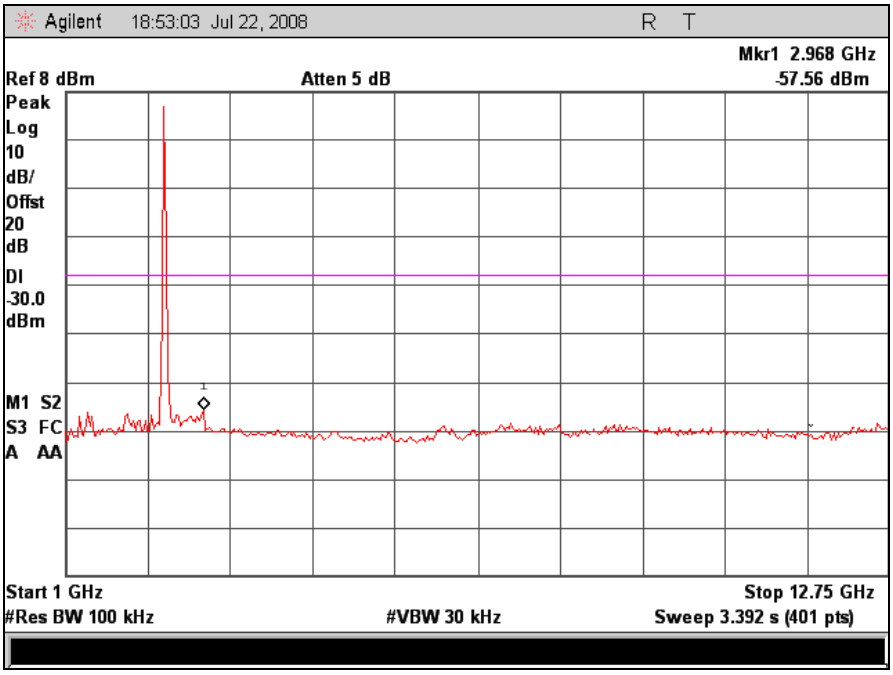
Plot 41. Conducted Emission, High Channel, b Mode, 1.8 GHz – 1.9 GHz



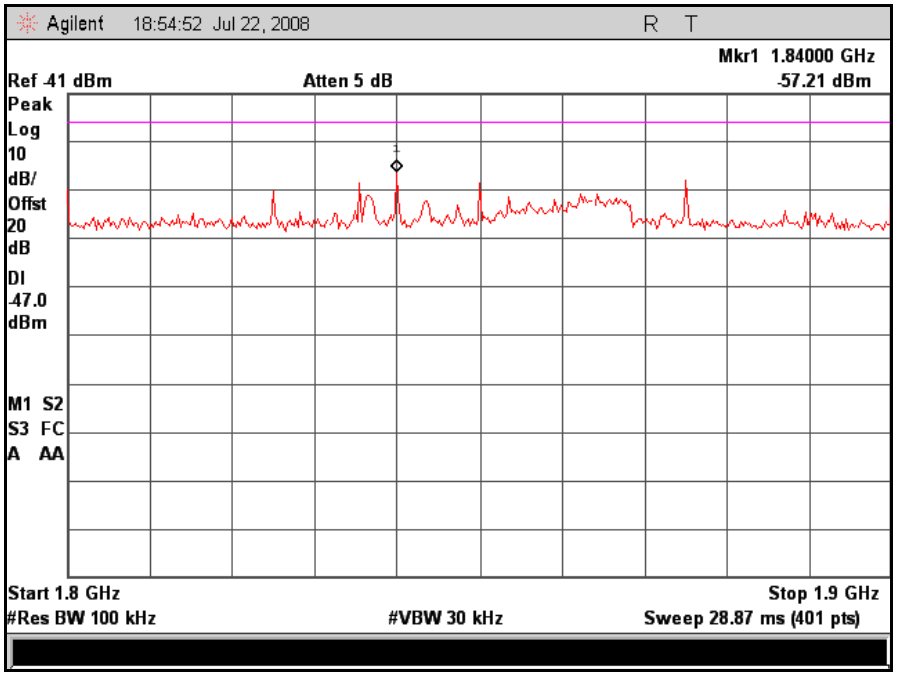
Plot 42. Conducted Emission, High Channel, b Mode, 5.15 GHz - 5.3 GHz



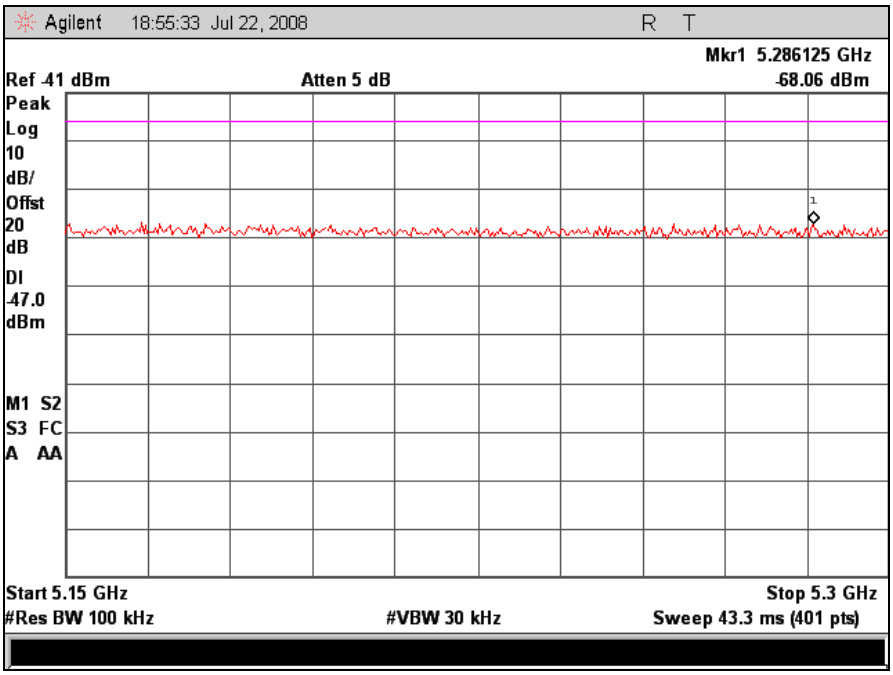
Plot 43. Conducted Emission, Low Channel, g Mode, 30MHz – 1 GHz



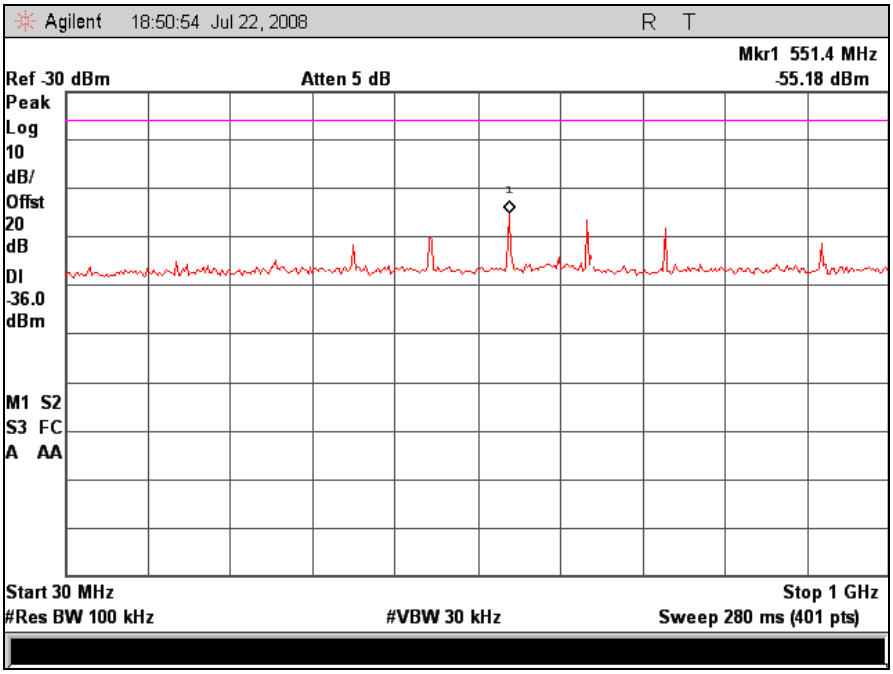
Plot 44. Conducted Emission, Low Channel, g Mode, 1 GHz - 12.75 GHz



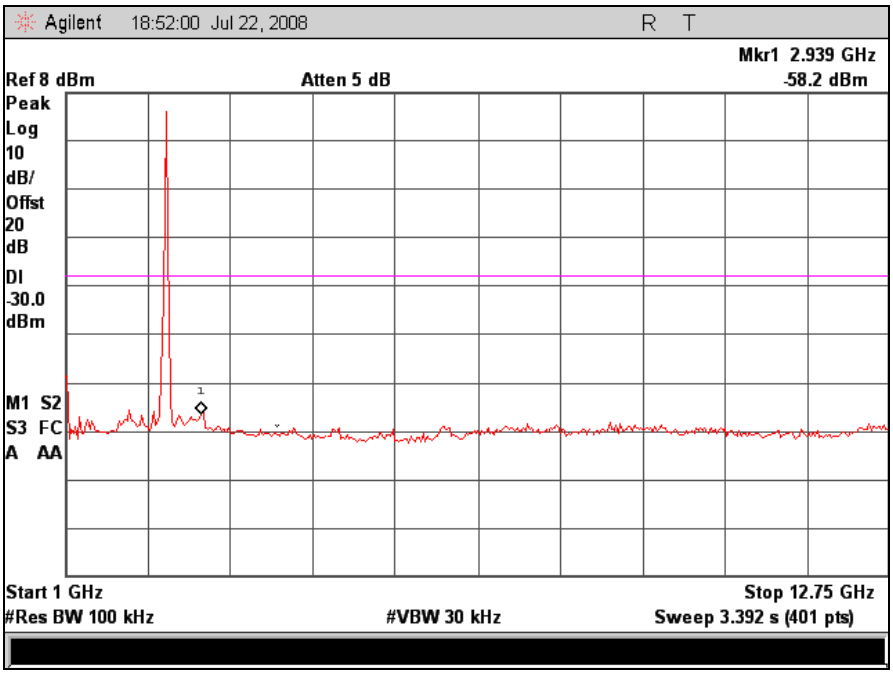
Plot 45. Conducted Emission, Low Channel, g Mode, 1.8 GHz – 1.9 GHz



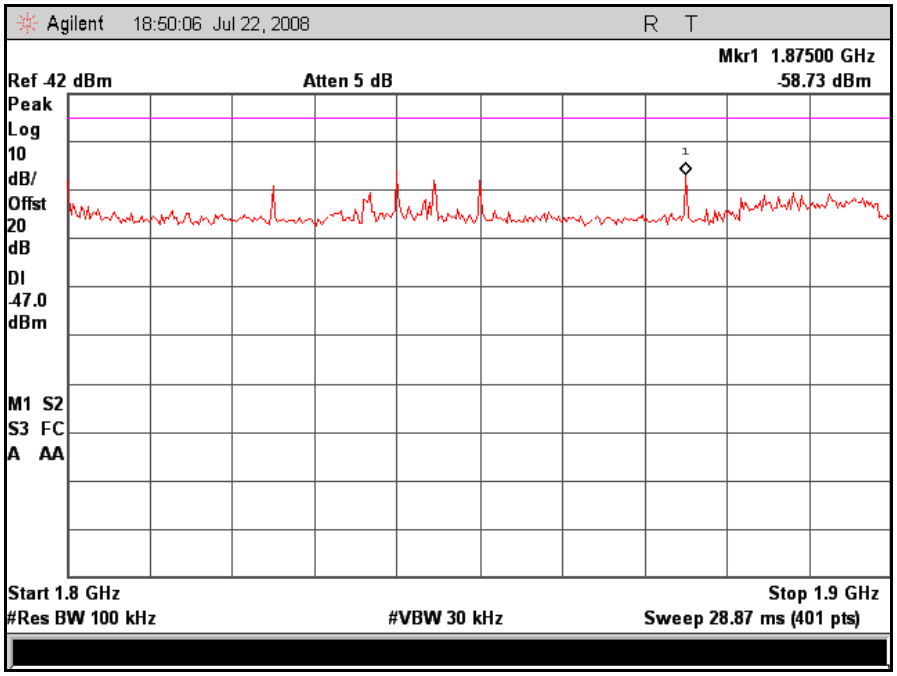
Plot 46. Conducted Emission, Low Channel, g Mode, 5.15 GHz - 5.3 GHz



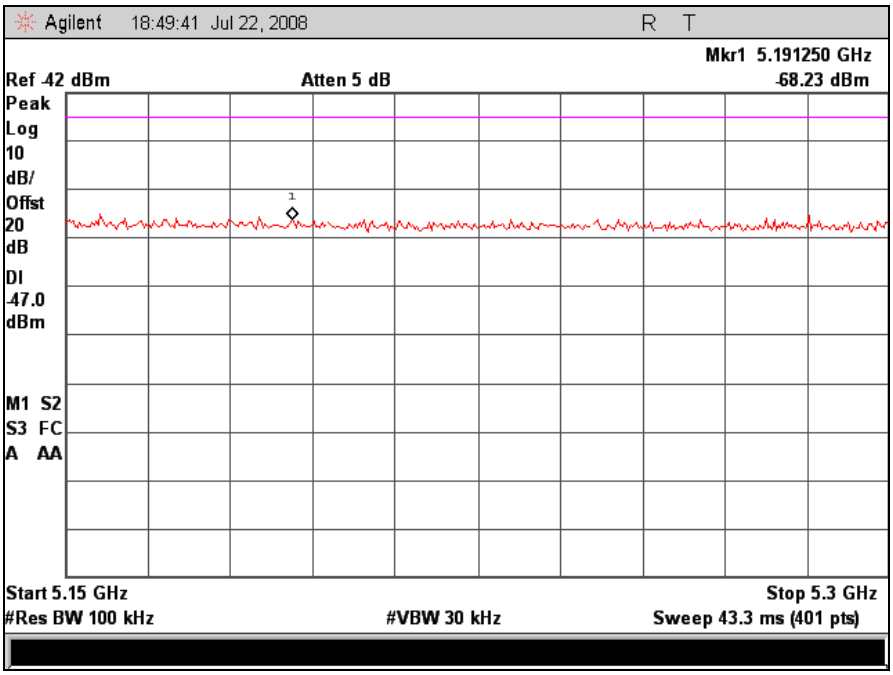
Plot 47. Conducted Emission, Mid Channel, g Mode, 30 MHz - 1 GHz



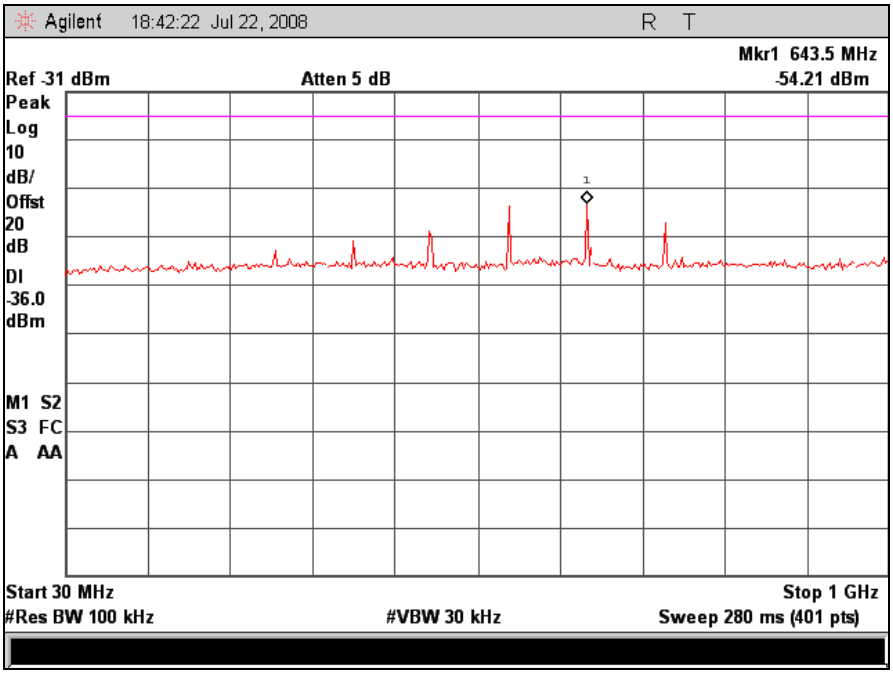
Plot 48. Conducted Emission, Mid Channel, g Mode, 1 GHz - 12.75 GHz



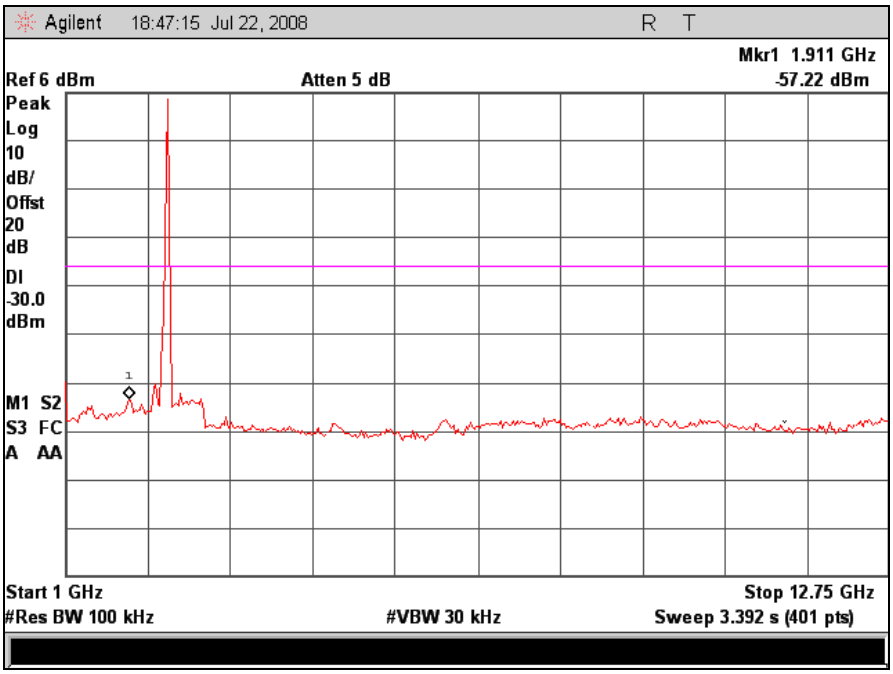
Plot 49. Conducted Emission, Mid Channel, g Mode, 1.8 GHz – 1.9 GHz



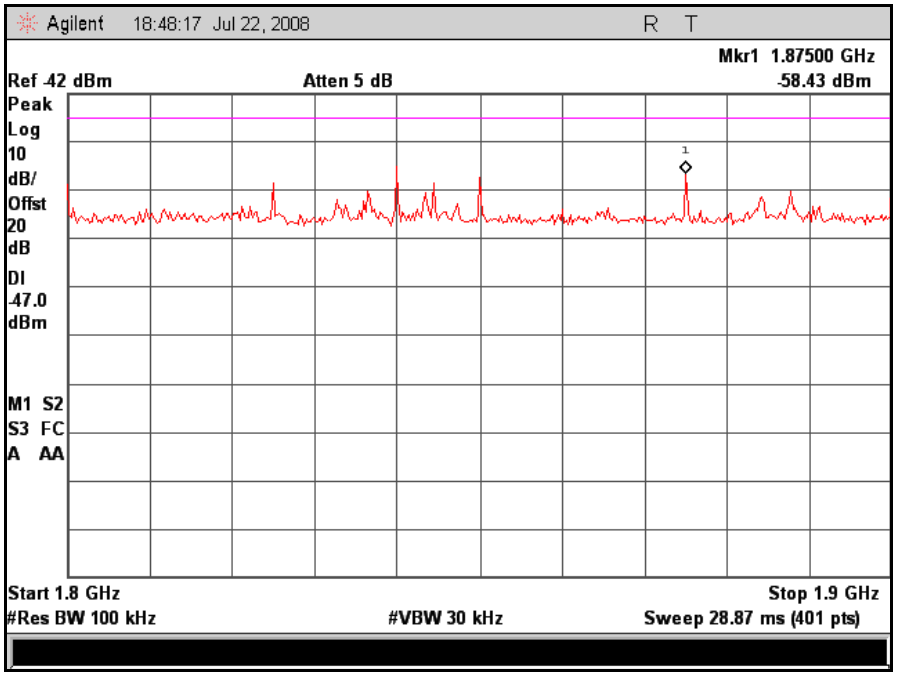
Plot 50. Conducted Emission, Mid Channel, g Mode, 5.15 GHz - 5.3 GHz



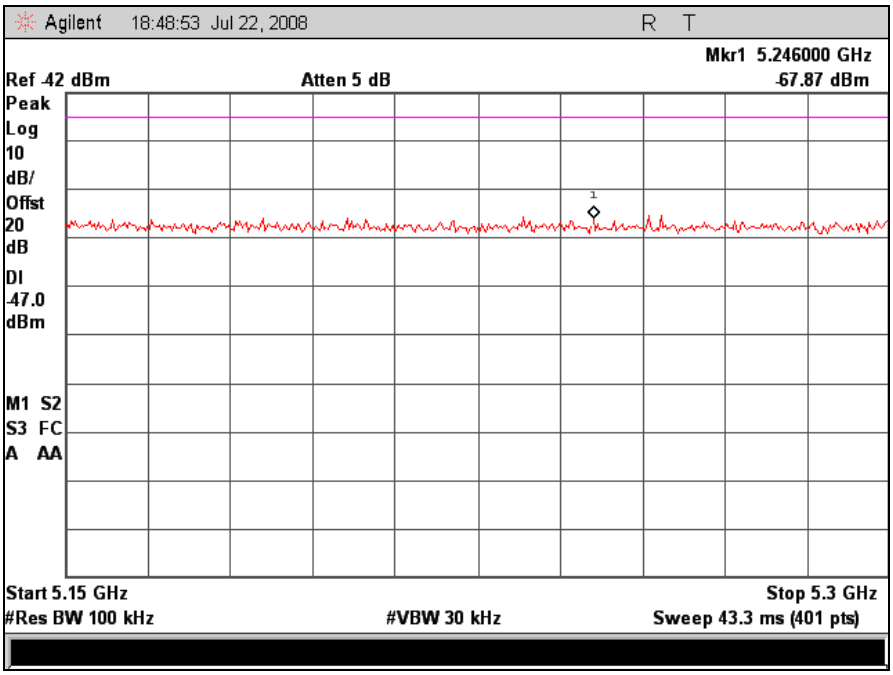
Plot 51. Conducted Emission, High Channel, g Mode, 30 MHz - 1 GHz



Plot 52. Conducted Emission, High Channel, g Mode, 1 GHz - 12.75 GHz



Plot 53. Conducted Emission, High Channel, g Mode, 1.8 GHz – 1.9 GHz



Plot 54. Conducted Emission, High Channel, g Mode, 5.15 GHz - 5.3 GHz

Conformance Requirements

4.3.6 Transmitter Spurious Emissions - Radiated

Test Requirement(s): **ETSI EN 300 328, Section 5.7.5:**

In accordance with *EN 300 328 Section 4.3.4*, the EUT shall meet the Spurious Emissions limits for emissions outside the transmit frequency band as shown in Table 11 and Table 12.

Frequency range	Limit when operating
30 MHz to 1 GHz	-36 dBm
above 1 GHz to 12,75 GHz	-30 dBm
1,8 GHz to 1,9 GHz 5,15 GHz to 5,3 GHz	-47 dBm

Table 11. Transmitter Limits for Narrowband Spurious Emissions

Frequency range	Limit when operating
30 MHz to 1 GHz	-86 dBm/Hz
above 1 GHz to 12,75 GHz	-80 dBm/Hz
1,8 GHz to 1,9 GHz 5,15 GHz to 5,3 GHz	-97 dBm/Hz

Table 12. Transmitter Limits for Wideband Spurious Emissions

Test Procedure: The EUT was placed on a 1.5m high wooden table inside a semi-anechoic chamber. The measurements were performed using normal operation of the equipment. The method of testing, test conditions, and test procedures of *Annex B* were used. The frequencies and amplitudes of field strengths were recorded for reference during final measurements.

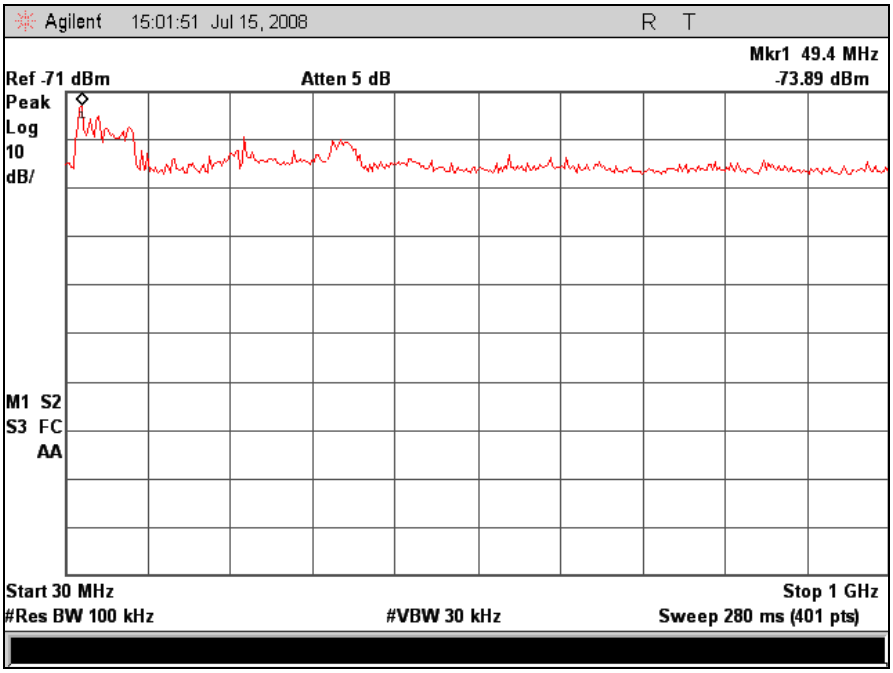
The EUT was set to transmit at its highest output power at both the low and high channels of the transmit band as well as all applicable modulations. The receive antenna was adjusted between 1 and 4 m in order to find the maximum emission. The table was also rotated about 360^0. Both vertical and horizontal polarizations were used to determine the maximum emission.

In order to determine the magnitude of each emission within 6dB of the limit, other than the noise floor of the spectrum analyzer, the signal substitution method was used as described in Annex B of *EN 300 328*.

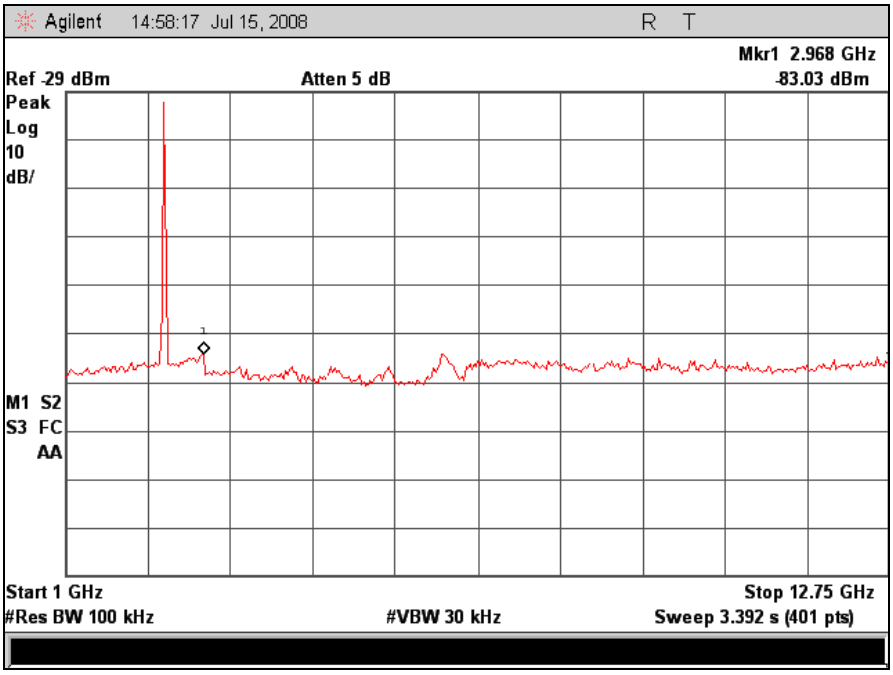
Test Results: The EUT as tested was found compliant with the specified limits of Clause 4.3.6.2.

Test Engineer(s): Anderson Soungpanya

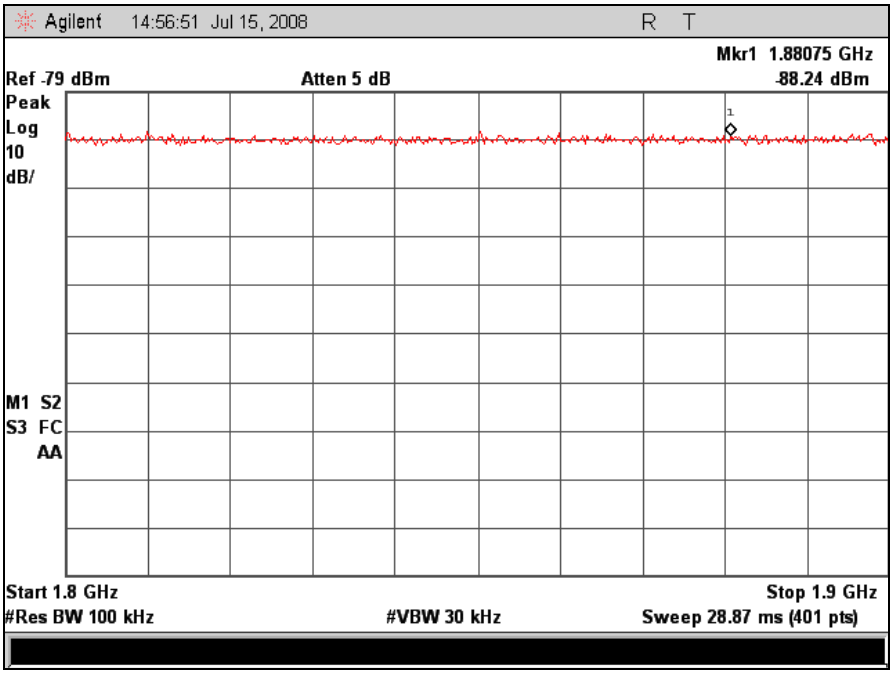
Test Date(s): 07/25/08



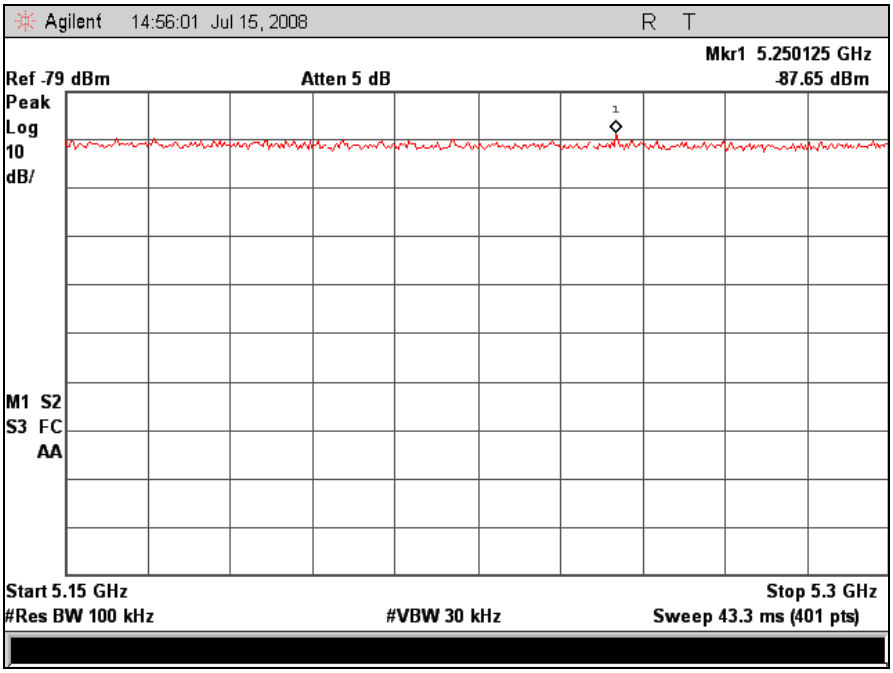
Plot 55. Radiated Emission, Low Channel, b Mode, 30 MHz – 1 GHz



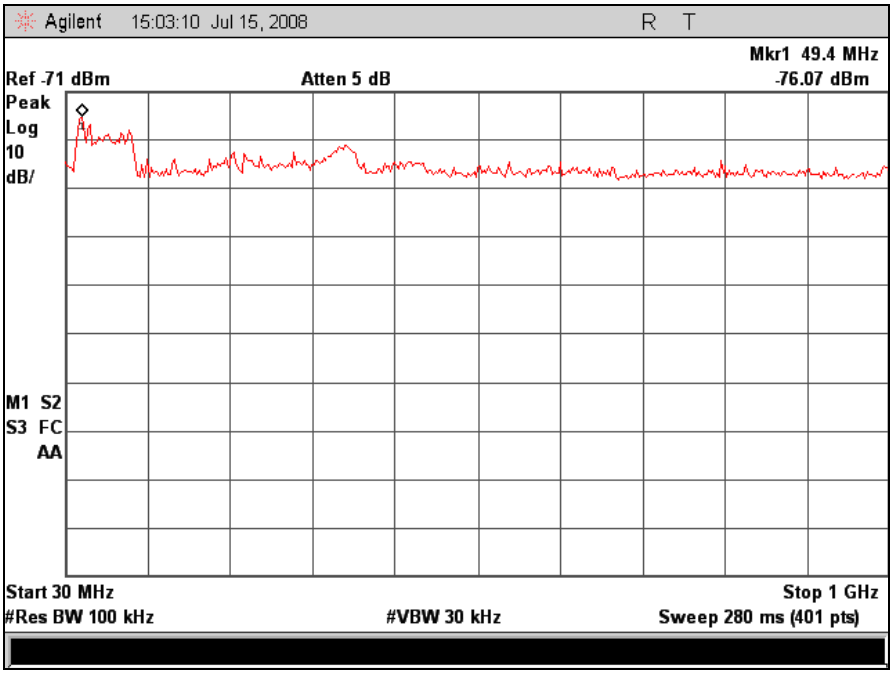
Plot 56. Radiated Emission, Low Channel, b Mode, 1 GHz - 12.75 GHz



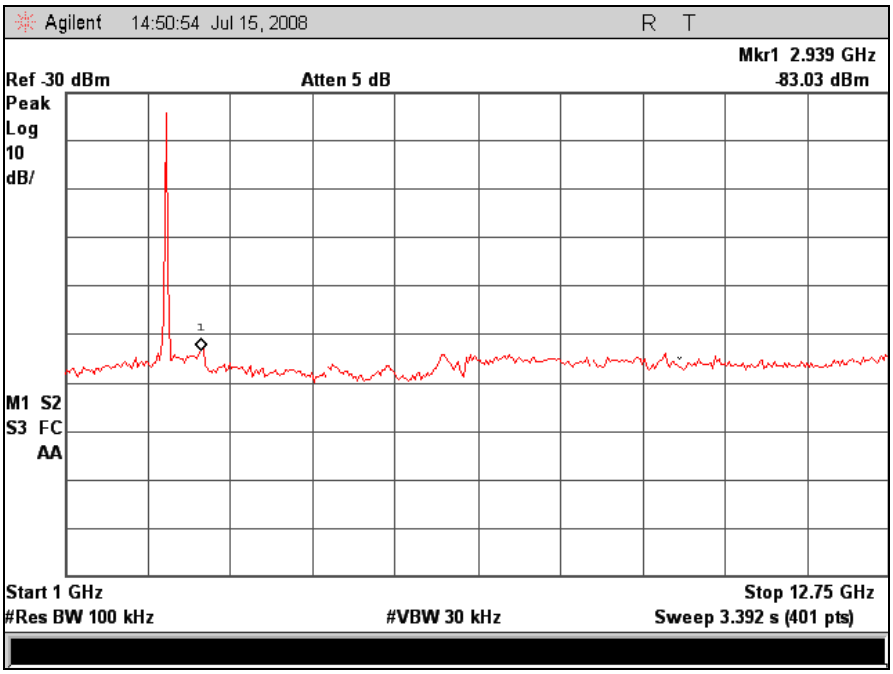
Plot 57. Radiated Emission, Low Channel, b Mode, 1.8GHz - 1.9 GHz



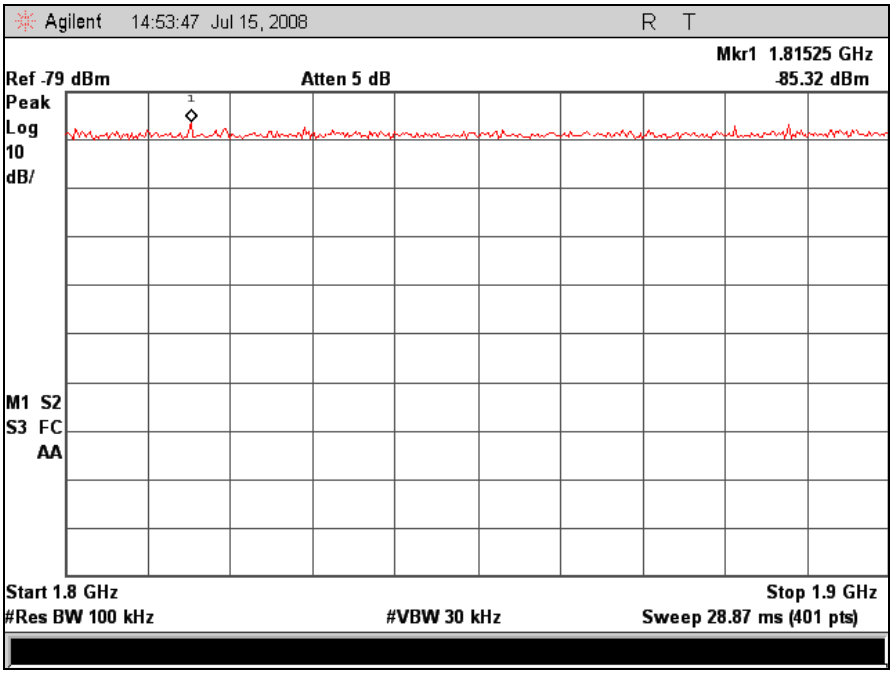
Plot 58. Radiated Emission, Low Channel, b Mode, 5.15 GHz - 5.3 GHz



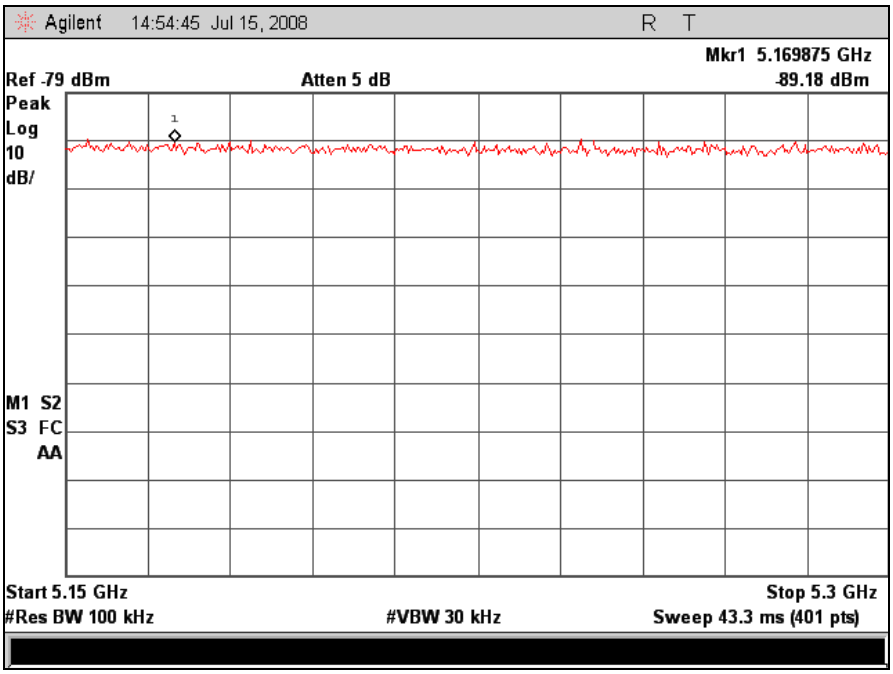
Plot 59. Radiated Emission, Mid Channel, b Mode, 30 MHz – 1 GHz



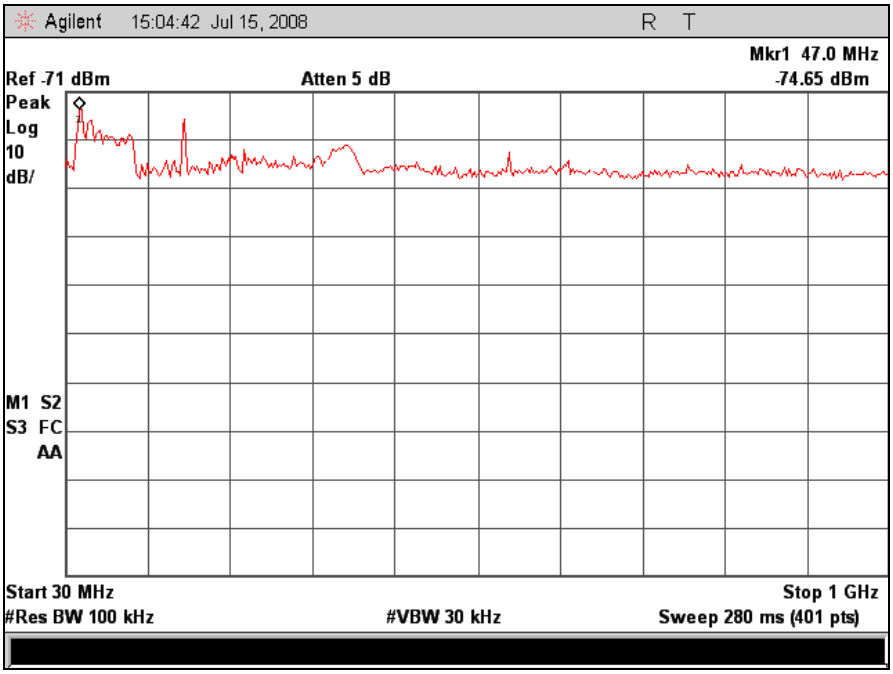
Plot 60. Radiated Emission, Mid Channel, b Mode, 1 GHz - 12.75 GHz



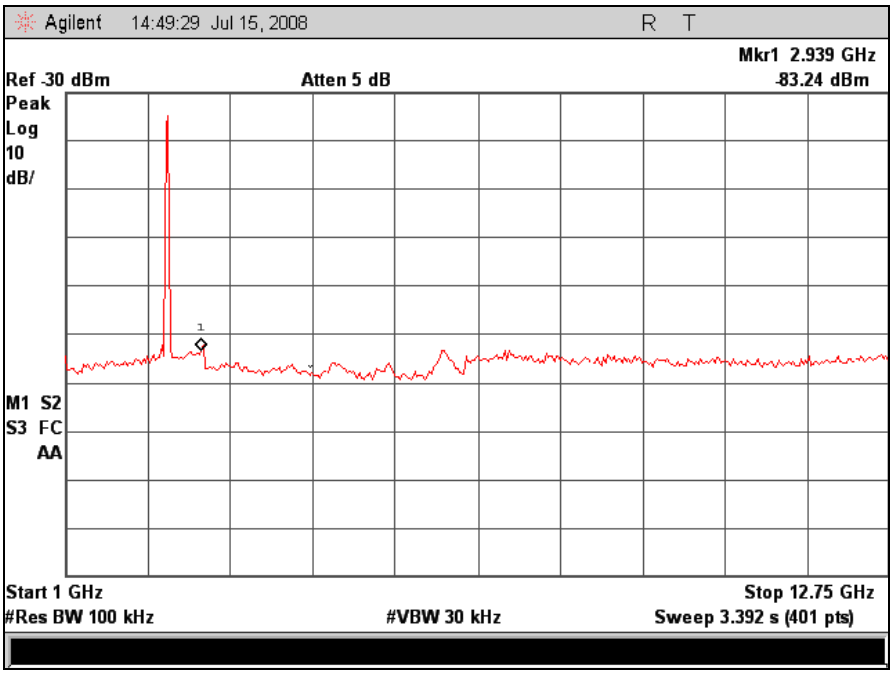
Plot 61. Radiated Emission, Mid Channel, b Mode, 1.8 GHz - 1.9 GHz



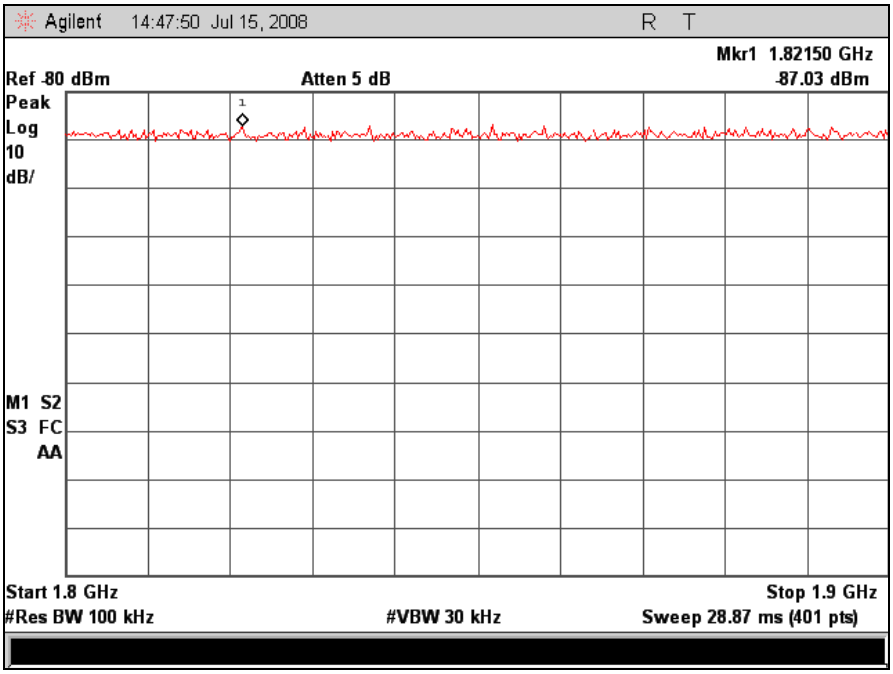
Plot 62. Radiated Emission, Mid Channel, b Mode, 5.15 GHz - 5.3 GHz



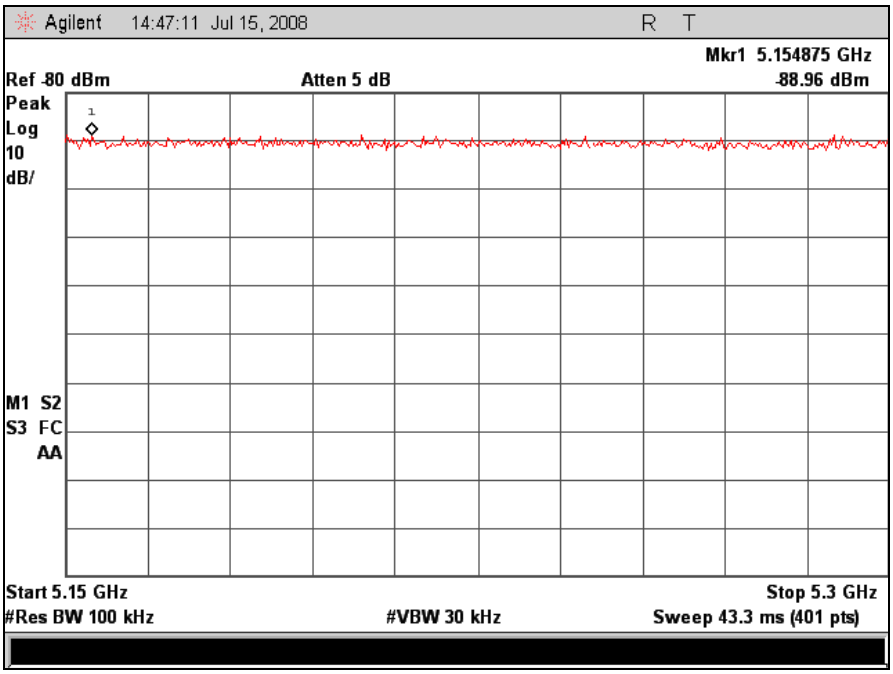
Plot 63. Radiated Emission, High Channel, b Mode, 30 MHz – 1 GHz



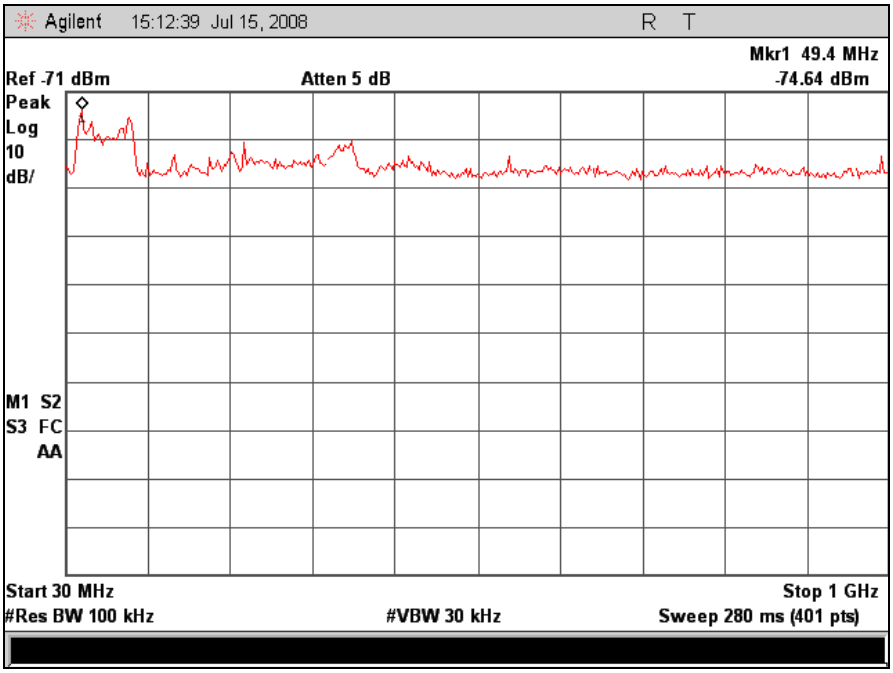
Plot 64. Radiated Emission, High Channel, b Mode, 1 GHz - 12.75 GHz



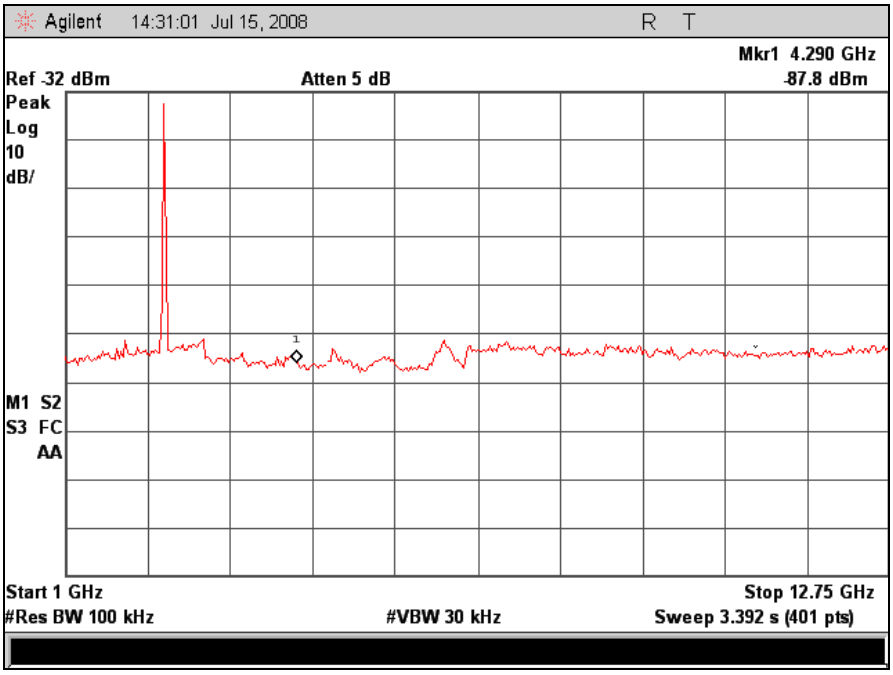
Plot 65. Radiated Emission, High Channel, b Mode, 1.8 GHz - 1.9 GHz



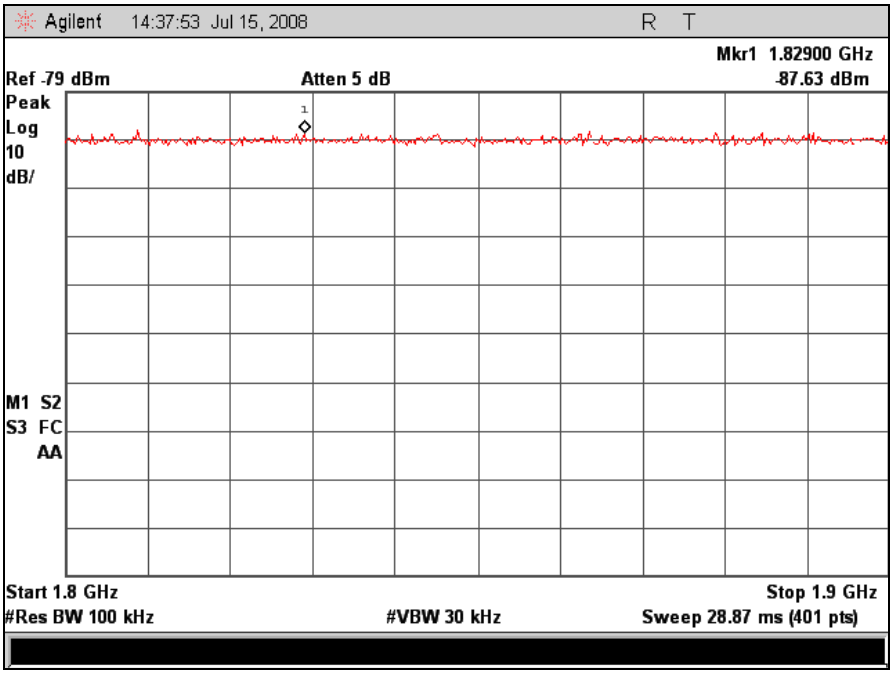
Plot 66. Radiated Emission, High Channel, b Mode, 5.15 GHz - 5.3 GHz



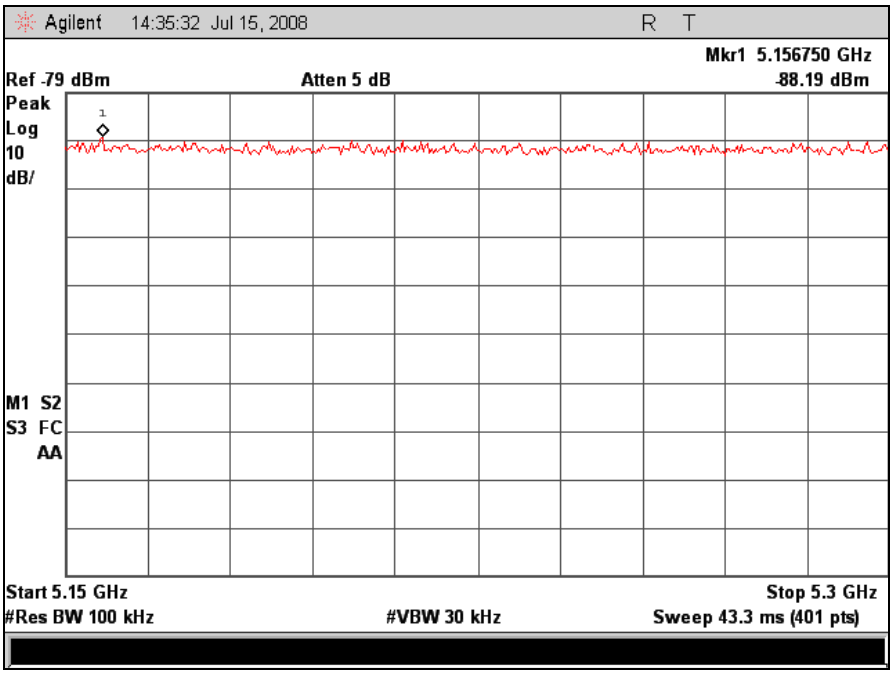
Plot 67. Radiated Emissions, Low Channel, g Mode, 30 MHz – 1 GHz



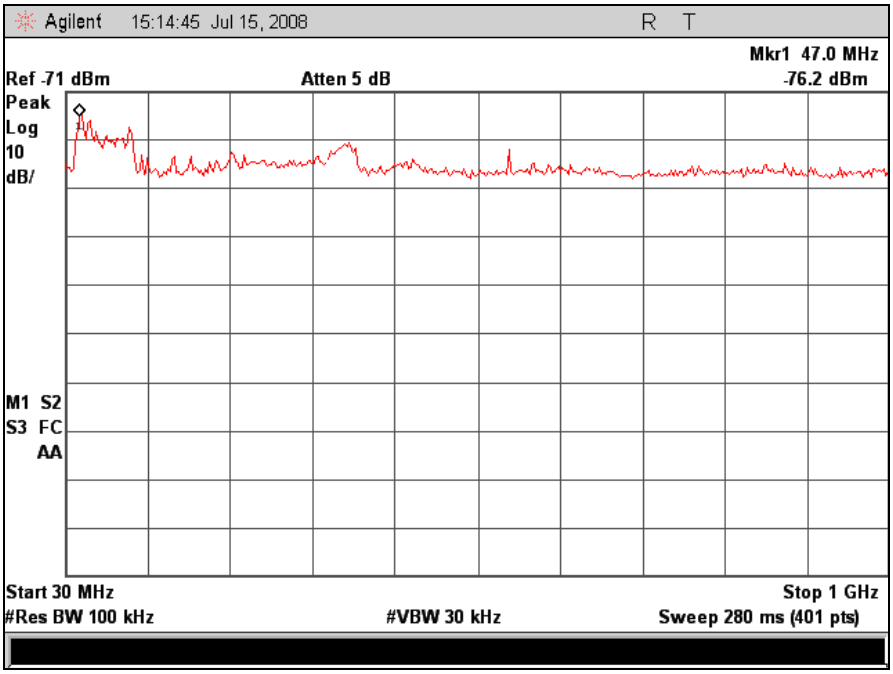
Plot 68. Radiated Emission, Low Channel, g Mode, 1 GHz - 12.75 GHz



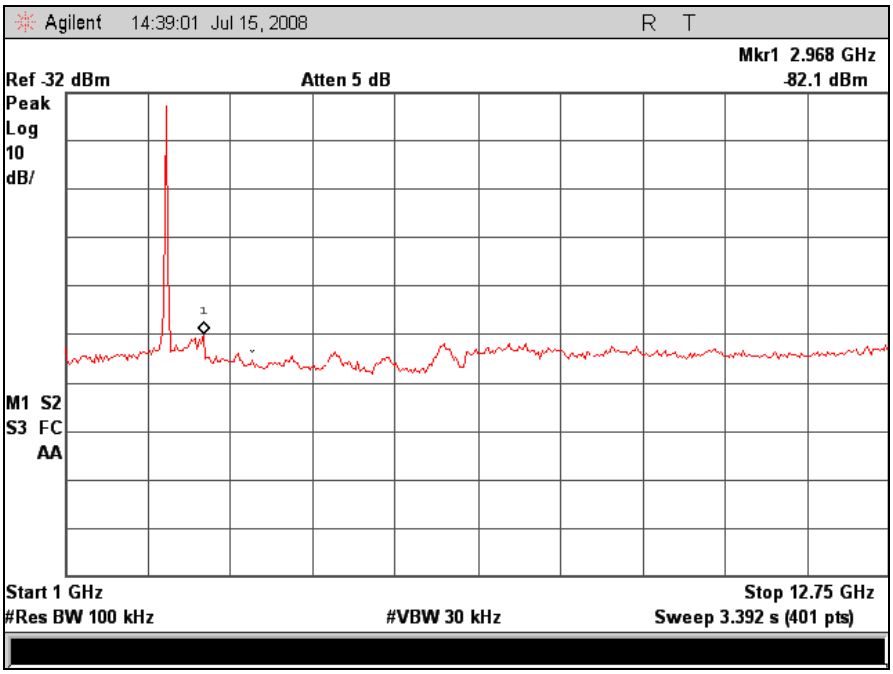
Plot 69. Radiated Emission, Mid Channel, g Mode, 1.8 GHz - 1.9 GHz



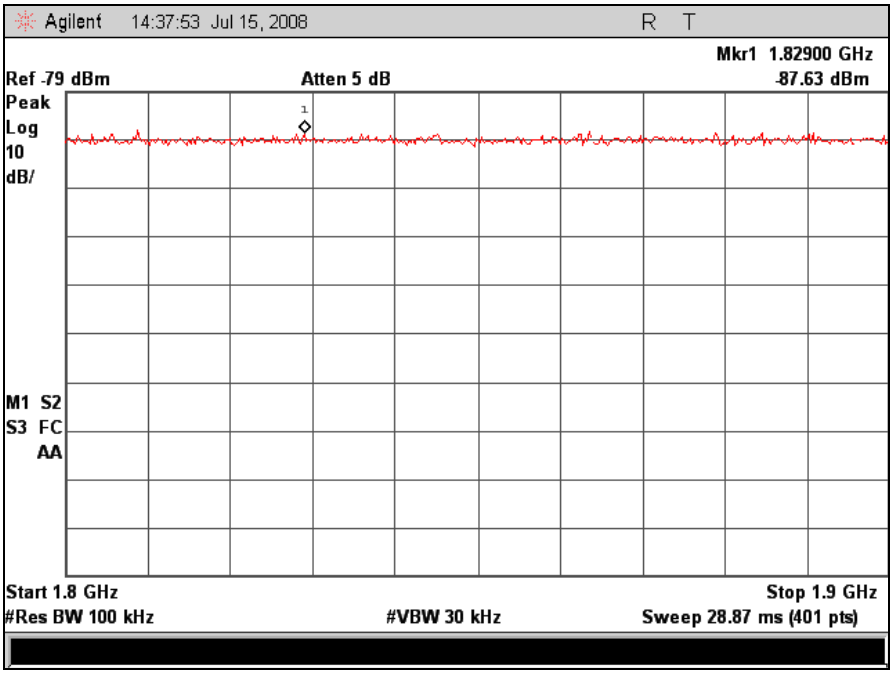
Plot 70. Radiated Emission, Low Channel, g Mode, 5.15 GHz - 5.3 GHz



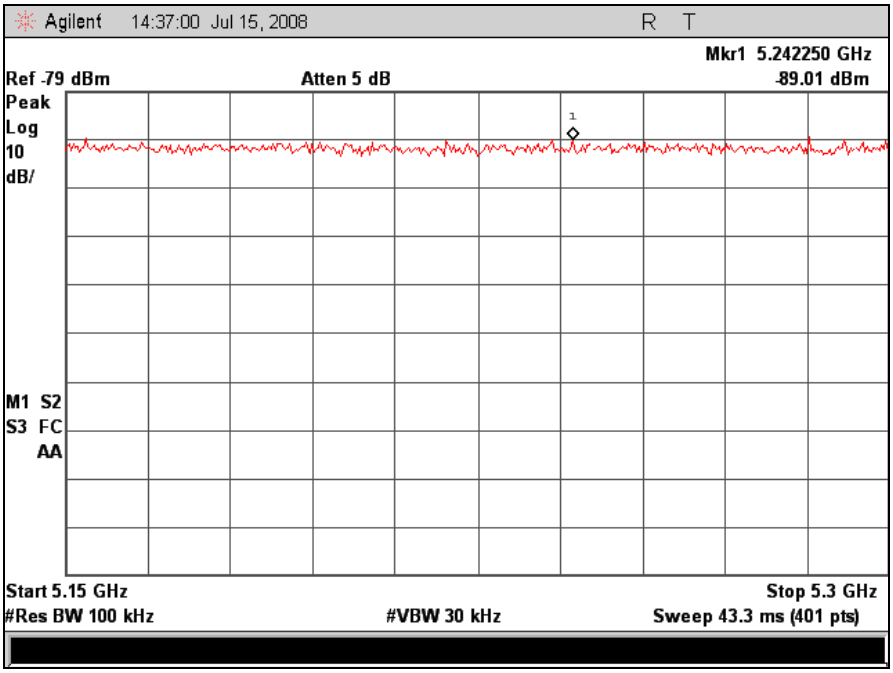
Plot 71. Radiated Emission, Mid Channel, g Mode, 30 MHz – 1 GHz



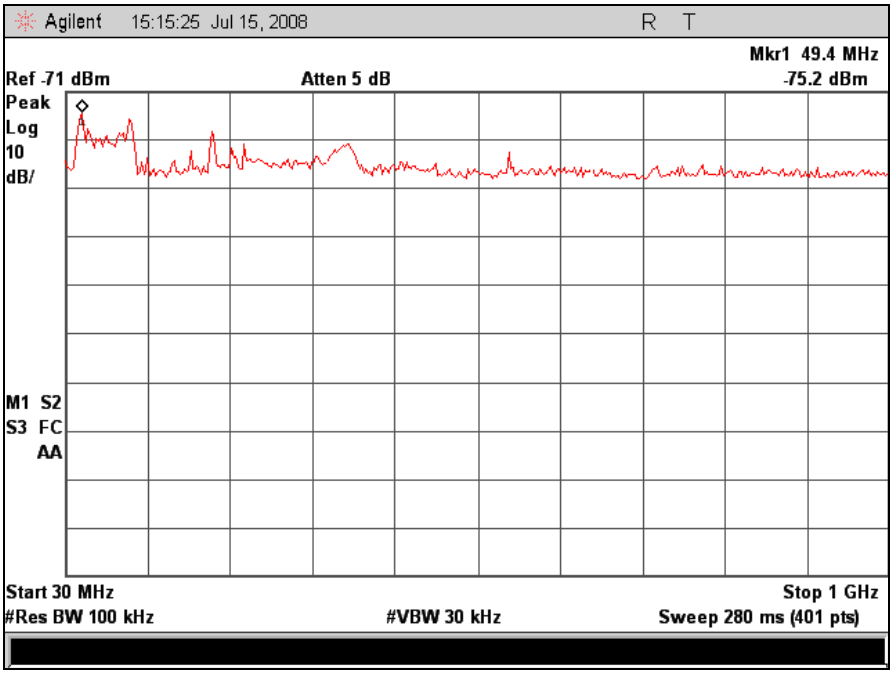
Plot 72. Radiated Emission, Mid Channel, g Mode, 1 GHz - 12.75 GHz



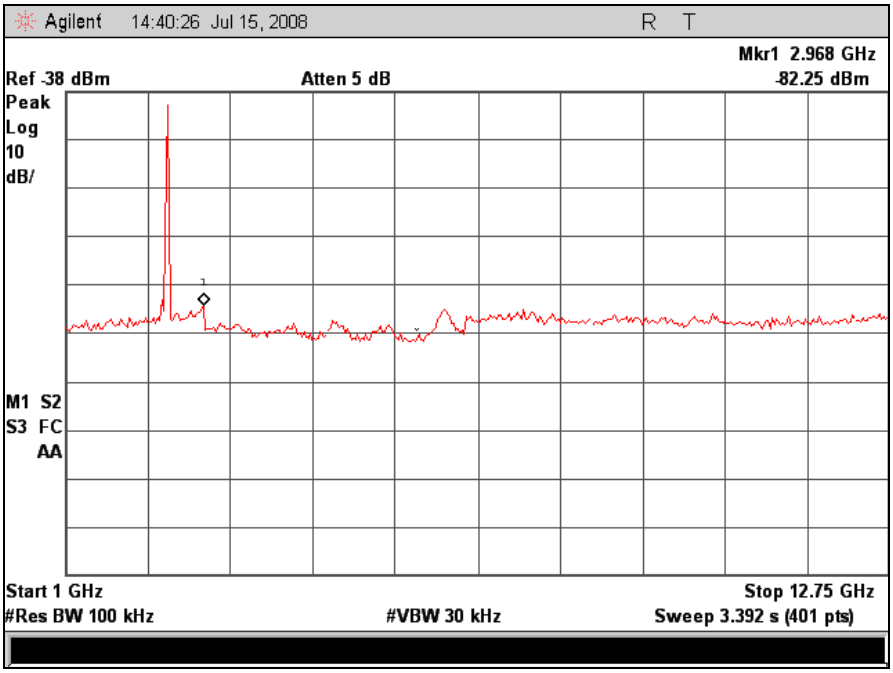
Plot 73. Radiated Emission, Mid Channel, g Mode, 1.8 GHz - 1.9 GHz



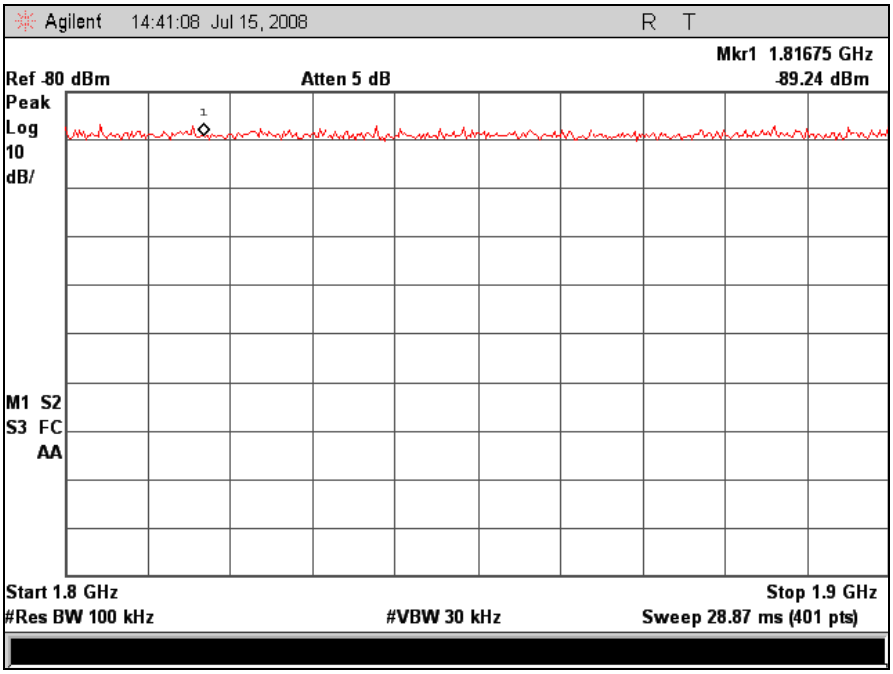
Plot 74. Radiated Emission, Mid Channel, g Mode, 5.15 GHz - 5.3 GHz



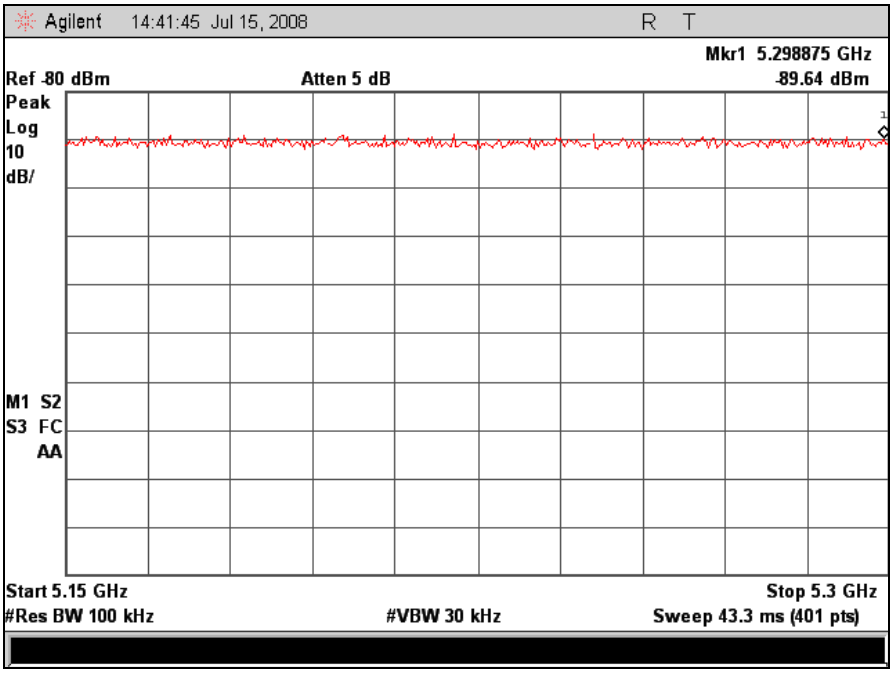
Plot 75. Radiated Emission, High Channel, g Mode, 30 MHz – 1 GHz



Plot 76. Radiated Emission, High Channel, g Mode, 1 GHz - 12.75 GHz



Plot 77. Radiated Emission, High Channel, g Mode, 1.8 GHz - 1.9 GHz



Plot 78. Radiated Emission, High Channel, g Mode, 5.15 GHz - 5.3 GHz

Conformance Requirements

4.3.7 Receiver Spurious Emissions

Test Requirement(s): 4.3.7.1 Definition

Receiver spurious emissions are emissions at any frequency when the equipment is in received mode.

4.3.7.2 Limit

The spurious emissions of the receiver shall not exceed the values in tables Table 13 and Table 14 and in the indicated bands.

Frequency Range	Limit
30 MHz to 1 GHz	-57 dBm
above 1 GHz to 12,75 GHz	-47 dBm

Table 13. Narrowband spurious emission limits for receivers

The above limit values apply to narrowband emissions, e.g. as caused by local oscillator leakage. The measurement bandwidth for such emissions may be as small as necessary to get a reliable measurement result.

Wideband emissions shall not exceed the values given in Table 14.

Frequency Range	Limit
30 MHz to 1 GHz	-57 dBm
above 1 GHz to 12,75 GHz	-47 dBm

Table 14. Wideband spurious emission limits for receivers

Test Procedure: The EUT was placed on a 1.5m high wooden table inside a semi-anechoic chamber. The measurements were performed using normal operation of the equipment. The method of testing, test conditions, and test procedures of *Annex B* were used. The frequencies and amplitudes of field strengths were recorded for reference during final measurements.

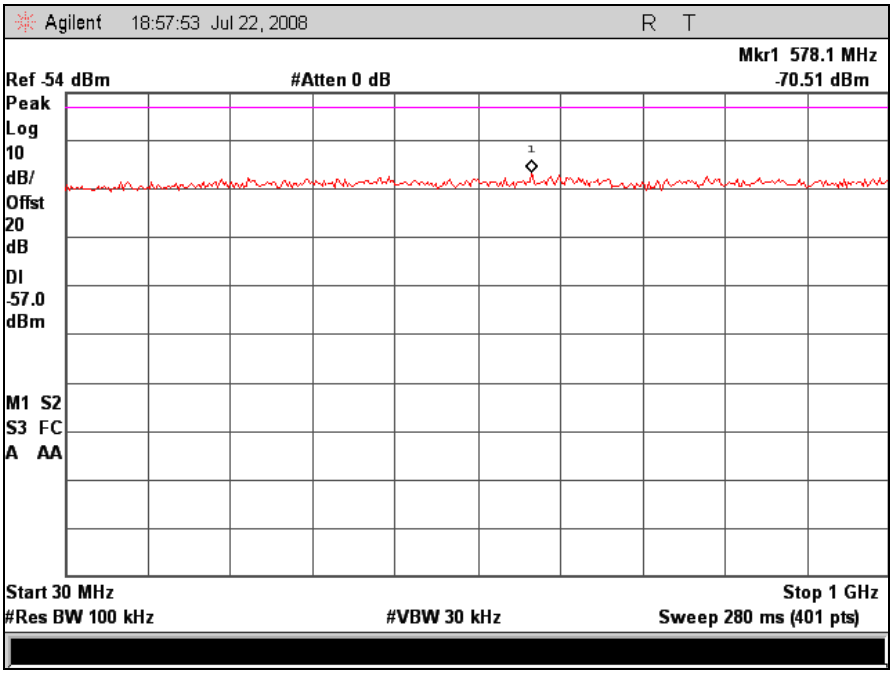
The EUT was set to transmit at its highest output power at both the low and high channels of the transmit band as well as all applicable modulations. The receive antenna was adjusted between 1 and 4 m in order to find the maximum emission. The table was also rotated about 360^0. Both vertical and horizontal polarizations were used to determine the maximum emission.

In order to determine the magnitude of each emission within 6dB of the limit, other than the noise floor of the spectrum analyzer, the signal substitution method was used as described in Annex B of *EN 300 328*.

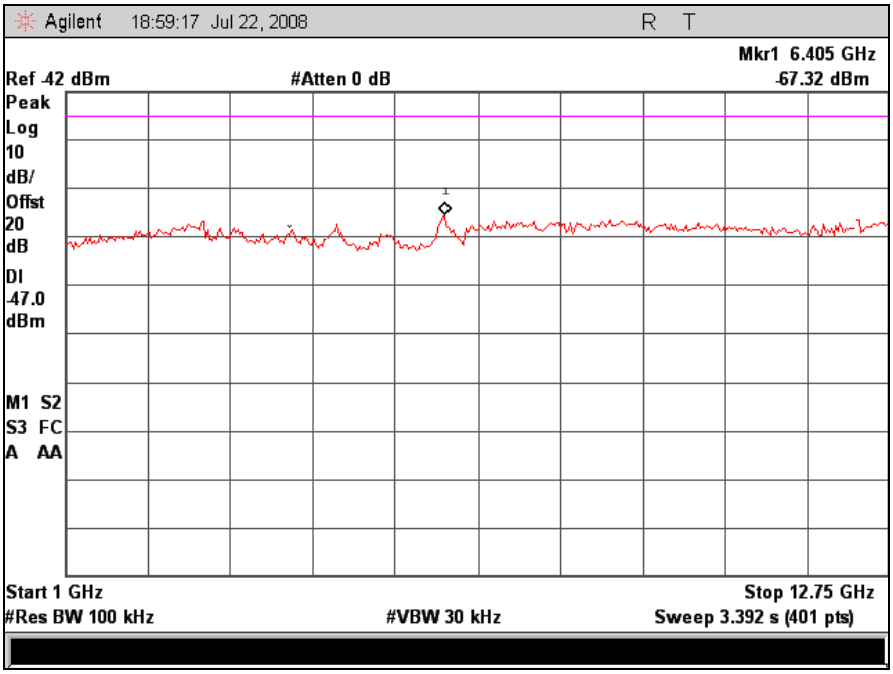
Test Results: The EUT as tested was found compliant with the specified requirements of Clause 4.3.7.2.

Test Engineer(s): Anderson Soungpanya

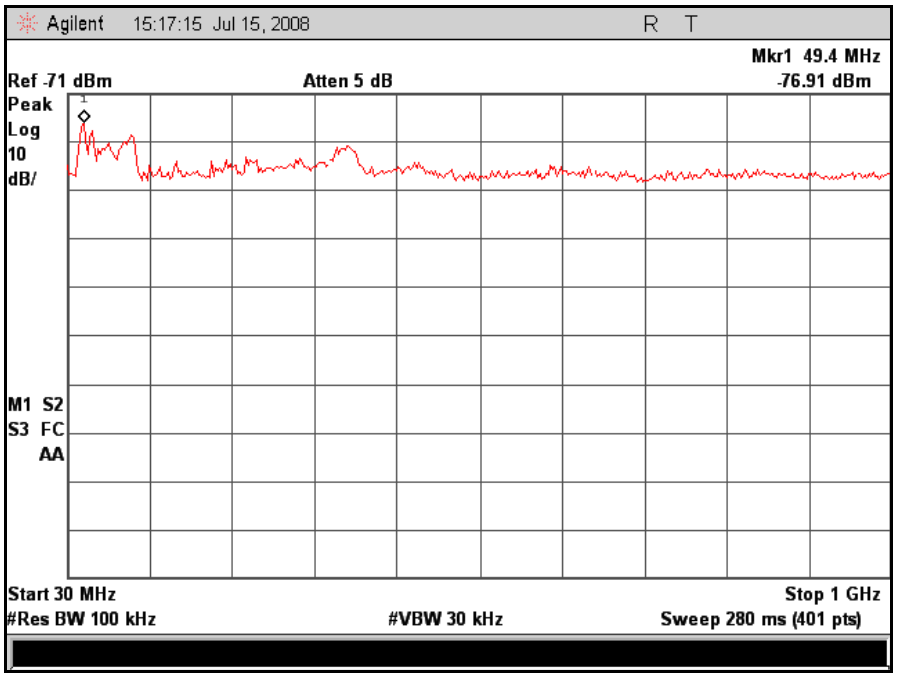
Test Date(s): 07/25/08



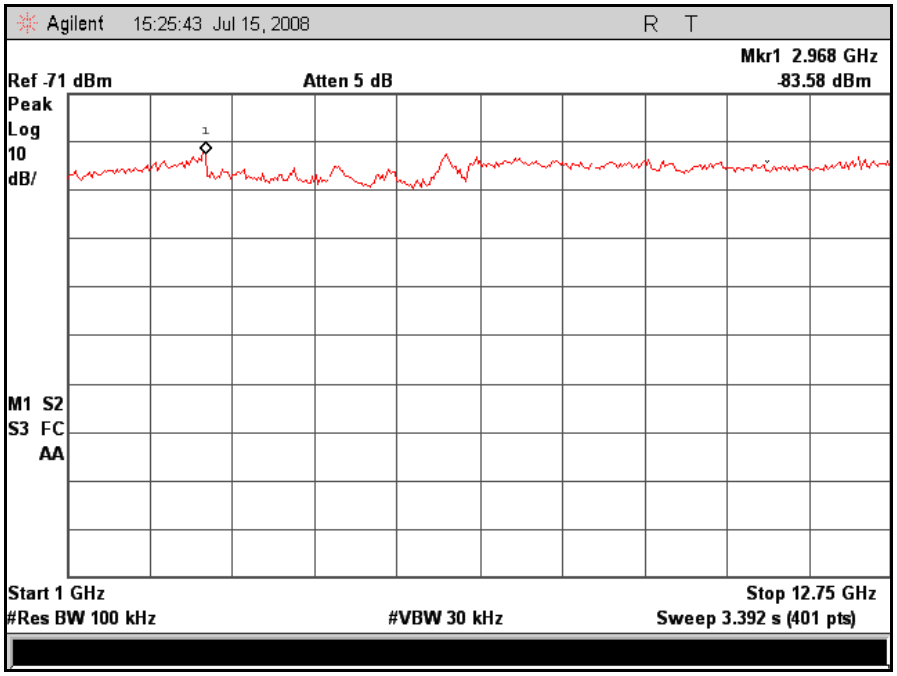
Plot 79. Conducted Emission RX Mode, 30 MHz – 1 GHz



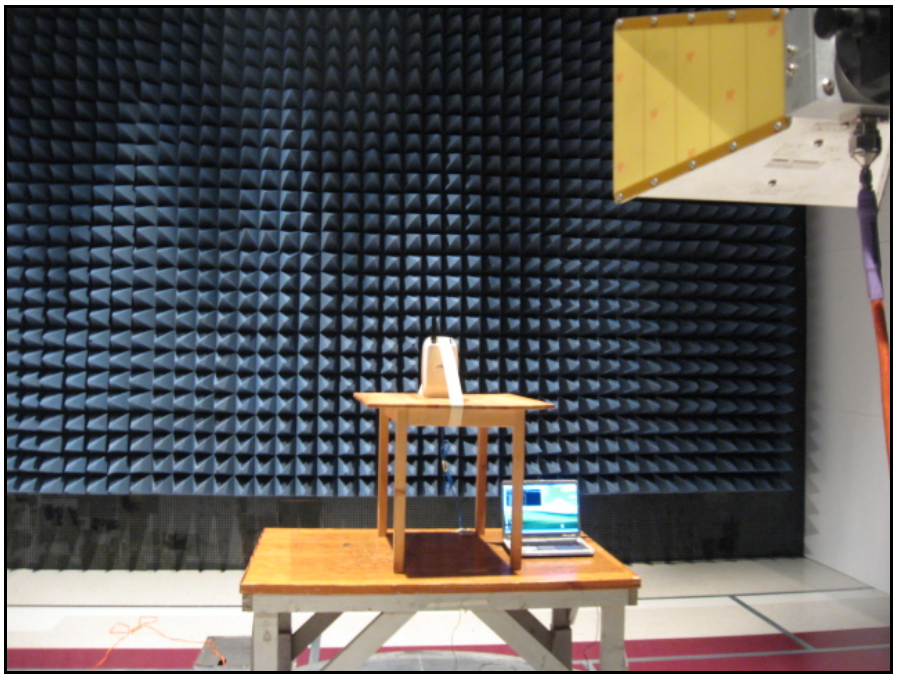
Plot 80. Conducted Emission RX Mode, 1 GHz - 12.75 GHz



Plot 81. Radiated Spurious RX Mode, 30 MHz – 1 GHz



Plot 82. Radiated Spurious RX Mode, 1 GHz – 12.75 GHz



Photograph 1. Radiated Emissions, Test Setup

4.0 Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

Test Name: 4.2.1 Effective Radiated Power					**Test Date(s): 10/30/08**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2460	SPECTRUM ANALYZER	AGILENT	E4407B	3/20/07	3/24/09
1S2229	TEMPERATURE CHAMBER	TENNY ENGINEERING	T630	1/31/08	1/31/09
1S2498	VARIABLE POWER SUPPLY	VARIAC	5021CT DVAM	SEE NOTE	
Test Name: 4.2.2 Peak Power Density					**Test Date(s): 10/30/08**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2460	SPECTRUM ANALYZER	AGILENT	E4407B	3/20/07	3/24/09
Test Name: 4.2.3 Frequency Range					**Test Date(s): 7/25/08**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2460	SPECTRUM ANALYZER	AGILENT	E4407B	3/20/07	3/24/09
1S2229	TEMPERATURE CHAMBER	TENNY ENGINEERING	T630	1/31/08	1/31/09
1S2498	VARIABLE POWER SUPPLY	VARIAC	5021CT DVAM	SEE NOTE	
Test Name: 4.2.4 Transmitter Spurious Emissions					**Test Date(s): 7/22/08**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2484	BILOG ANTENNA	TESEQ	CBL 6112D	1/21/2008	7/21/2009
1S2198	HORN ANTENNA	EMCO	3115	8/31/07	8/31/08
1S2460	SPECTRUM ANALYZER	AGILENT	E4407B	3/20/07	3/24/09
1S2482	5M CHAMBER	PANASHEILD	641431	11/18/2007	11/18/2008
1S2464	AC LISN	SOLAR ELECTRONICS	9252-50-R24-BNC	9/20/2007	9/20/2008
Test Name: 4.2.5 Receiver Spurious Emissions					**Test Date(s): 7/22/08**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2484	BILOG ANTENNA	TESEQ	CBL 6112D	1/21/2008	7/21/2009
1S2198	HORN ANTENNA	EMCO	3115	8/31/07	8/31/08
1S2460	SPECTRUM ANALYZER	AGILENT	E4407B	3/20/07	3/24/09
1S2482	5M CHAMBER	PANASHEILD	641431	11/18/2007	11/18/2008
1S2464	AC LISN	SOLAR ELECTRONICS	9252-50-R24-BNC	9/20/2007	9/20/2008

Note: Functionally verified test equipment is verified using calibrated instrumentation at the time of testing.

