Intertek ETL SEMKO

Testing everywhere for markets anywhere.

June 27, 2006

Mr. Ernest Von Holten
nTAG Interactive
311 Summer Street, 5th Floor
Boston, MA 02210

Mr. Von Holten;

Enclosed you will find our test report covering testing on the nTAG Access Point, Model: AP1000.

If there are any questions regarding this report, please contact the undersigned or your account representative.

Sincerely,

Nicholas Abbondante
Project Engineer

Jeff Goulet
Engineering Team Leader, EMC

Enclosure

Intertek Testing Services NA, Inc.
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Telephone: +1 978-263-2662 Fax: +1 978-263-7086 Web: www.etlsemko.com

Intertek ETL SEMKO

EMISSIONS TEST REPORT

Report Number: 3097602BOX-012
Project Number: 3097602

Testing performed on the

Access Point

Model: AP1000

To

FCC Part 15 Subpart C 15.247
Industry Canada's RSS-210 Issue 6 September 2005, Annex 8
FCC Part 15 Subpart B and ICES-003 Issue 4 February 2004

For

nTAG Interactive

Test Performed by:	Test Authorized by:
Intertek – ETL SEMKO	nTAG Interactive
70 Codman Hill Road	311 Summer Street, 5th Floor
Boxborough, MA 01719	Boston, MA 02210

Prepared by: _____ Date: 6/4/06
Nicholas Abbondante

Reviewed by: Roland W. Gubisch Date: 6-6-2006
Roland W. Gubisch

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1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of:

Company:	nTAG Interactive 311 Summer Street, 5th Floor Boston, MA 02210
Contact:	Ernest Von Holten
Telephone:	617-451-7768
Fax:	617-451-7769
Email:	evonholten@ntag.com

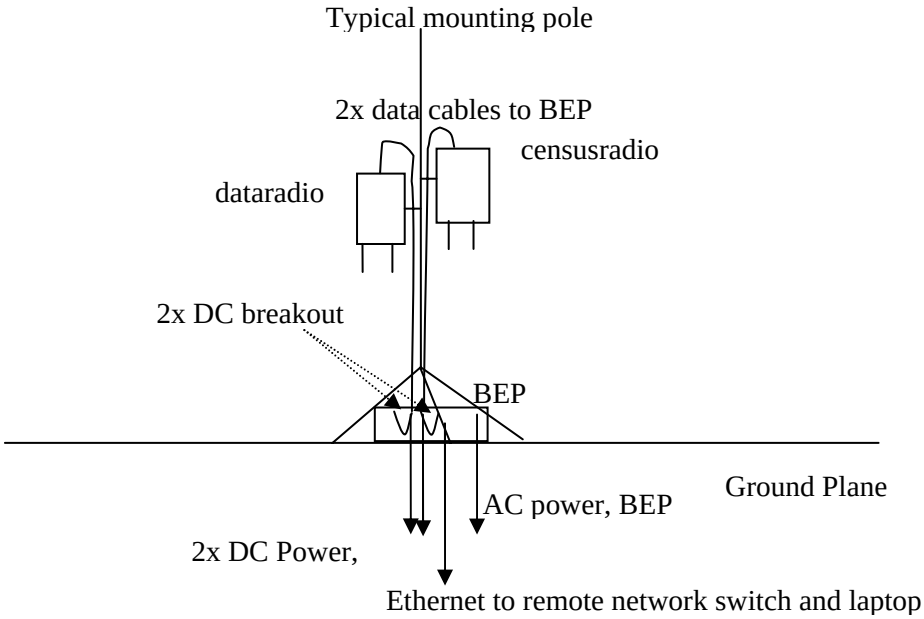
1.2 Equipment Under Test

Equipment Type:	nTAG Access Point (see section 1.4.3 for individual items)
Model Number(s):	AP1000 (see section 1.4.3 for individual items)
Serial number(s):	see section 1.4.3
Manufacturer:	see section 1.4.3
EUT receive date:	05/01/2006
EUT received condition:	Prototypes in Good Condition
Test start date:	05/01/2006
Test end date:	05/31/2006

1.3 Test Plan Reference: Tested according to the standards listed, ANSI C63.4:2003, and RSS-Gen Issue 1 September 2005.

1.4 Test Configuration

1.4.1 Block Diagram



1.4.2. Cables:

Cable	Shielding	Connector	Length (m)	Qty.
Cross-Over Ethernet	None	RJ45 to RJ45	3.0	1
Data Cable	None	RJ45 to DB9	3.0	2
AC Power	None	Plastic (IEEE)	1.8	3
DC Power	None	Molded Plastic to Metal Jack	1.7	2
DC Breakout	None	DB9 to DB9	0.15	2
DC Breakout	None	DB9 to Metal Jack	0.20	2

1.4.3. Support Equipment & Equipment Under Test:

Support Equipment:

Name: Ault, Inc., DC Power Supply (Qty. 2)
Model No.: PW117
Serial No.: N/L

Name: IBM Thinkpad Laptop PC
Model No.: 2672-4BU
Serial No.: 78-BAG48

Name: IBM AC Adapter
Model No.: 92P1016
Serial No.: 11S92P1016Z1ZAC662M5HB Rev03

Name: Netgear Fast Ethernet Switch
Model No.: FS605 v2
Serial No.: 11E26137057E4

Name: nTAG Radio
Model No.: 400-00200-00
Serial No.: 3 (censusradio)

Name: Antenna Factor Whip Antenna, 2.2dBi gain (qty. 4)
Model No.: ANT-2.4-CW-RCT-RP
Serial No.: N/L

Equipment Under Test:
Name: nTAG Radio Module
Model No.: 400-00200-00
Serial No.: 69 (dataradio)

Name: Axiomtek BEP
Model No.: eBOX746-EFL1G A (nTAG P/N: 67-00100)
Serial No.: E6160745FC00107

1.5 Mode(s) of Operation:

The BEP was activated from nominal 120V/60Hz AC power and was feeding random data into the Radio Module during testing. The Radio Module was fed 5VDC power through the data cable from the Ault, Inc. AC-DC power converter, which was powered from nominal 120V/60Hz AC power. The Radio Module was transmitting a modulated carrier at low, mid, and high channels as near to continuously as possible. The Radio Module was tested in three orthogonal axes by rotation of the Radio Module's mounting bracket. Note that there were two Radio Modules mounted on the standard mounting pole during testing. These radios contain identical hardware and are designated 'censusradio' and 'dataradio', differentiated only by their function in the overall AP1000 system. As the operation of the censusradio occurs with a much lower duty cycle than that of the dataradio, the dataradio was tested as representative of worst case operation. In normal operation, the radios are required to be mounted at least 20 cm apart on the mounting pole.

1.6 Floor Standing Equipment: Applicable:__X__ Not Applicable:___

1.7 Modifications Required for Compliance:

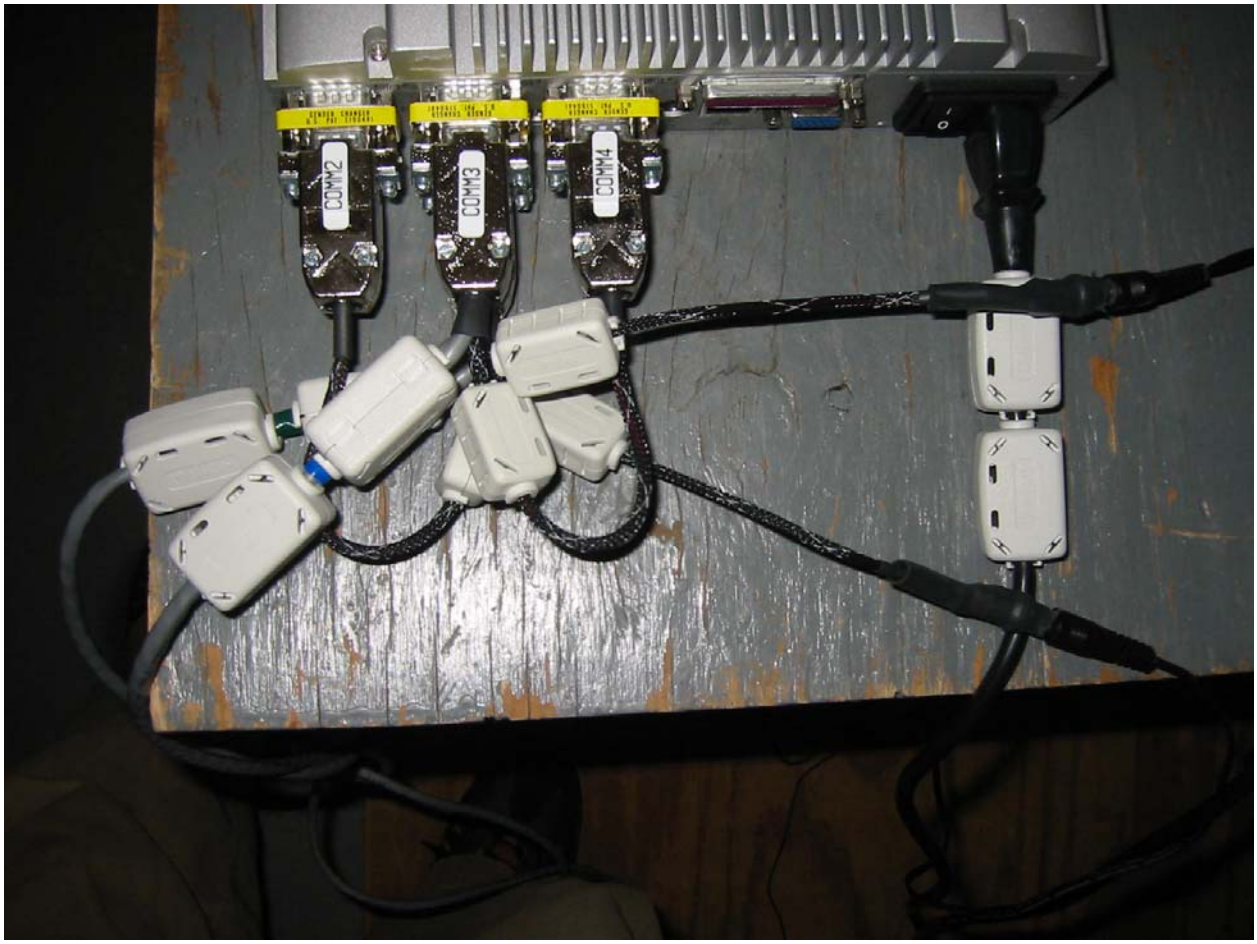
The Radio Modules must be deployed with reverse-polarity SMA connectors (RP-SMA).

The following filtration components were added to reduce harmonic signal levels and must be included on deployed Radio Modules:
L1006 is 8.2nH
C1010 is 0.5pF

WE# XXX XXX XX denotes a Wurth Elektronik ferrite with the corresponding part number.

Two WE# 742 711 12 ferrites in single pass configuration at AC input to BEP, as close to BEP as possible
Two WE# 742 711 12 ferrites in single pass configuration on ethernet/data cable to dataradio, as close to BEP as possible
Two WE# 742 711 12 ferrites in single pass configuration on ethernet/data cable to censusradio, as close to BEP as possible
One WE# 742 711 42 ferrite in single pass configuration on COMM2 cable, as close to ethernet/data cable as possible
One WE# 742 711 42 ferrite in single pass configuration on COMM4 cable, as close to ethernet/data cable as possible
One WE# 742 711 42 ferrite in single pass configuration on censusradio DC power input, as close to BEP as possible
One WE# 742 711 42 ferrite in single pass configuration on dataradio DC power input, as close to BEP as possible

The following photos show placement of the ferrites as they were during testing, from two angles.


COMM2
COMM3
COMM4

2.0 Test Summary

TEST STANDARD	RESULTS	
FCC Part 15 Subpart C 15.247, Industry Canada's RSS-210 Issue 6 September 2005 Annex 8, FCC Part 15 Subpart B, and Industry Canada's ICES-003 Issue 4 February 2004		
SUB-TEST	**TEST PARAMETER**	**COMMENT**
Maximum Peak Conducted Output Power and Human RF Exposure FCC 15.247(b)(3-5), RSS-210 A8.4, RSS-102 4.3	The output power of the Radio Module must not exceed 1 Watt (30 dBm) and 36 dBm EIRP. The human RF Exposure limit is 1 mW/cm^2.	Pass
Occupied Bandwidth FCC 15.247(a)(2), RSS-210 A8.2	The 6 dB bandwidth of the Radio Module must be at least 500 kHz.	Pass
Antenna Port Conducted Spurious Emissions FCC 15.209, 15.247(d), RSS-210 A8.5	The spurious emissions of the Radio Module must be attenuated below the level of the fundamental by at least 20 dBc.	Pass
Radiated Spurious Emissions FCC 15.205, 15.209, 15.247(d), 15.109, RSS-210 2.2, 2.7, A8.5, ICES-003	The spurious emissions of the Radio Module must be attenuated below the level of the fundamental by at least 20 dBc. Emissions which fall in the restricted bands must meet the general limits of 15.209 and RSS-210 2.7 Table 2. The spurious emissions of the BEP must not exceed the limits of 15.109 Class A and ICES-003 Class A.	Pass
Peak Power Spectral Density FCC 15.247(e), RSS-210 A8.2	The peak power spectral density of the Radio Module must not exceed 8 dBm / 3 kHz.	Pass
Band Edge Compliance FCC 15.215, RSS-210 2.1, A8.5	The fundamental frequency of the Radio Module must stay within the assigned frequency band.	Pass
AC Line-Conducted Emissions FCC 15.207, 15.107, RSS-Gen 7.2.2, ICES-003	The AC line-conducted emissions of the Radio Module must not exceed the limits of 15.207 and RSS-Gen 7.2.2 Table 2. The AC line-conducted emissions of the BEP must not exceed the limits of 15.107 Class A and ICES-003 Class A.	Pass

Notes: The BEP subcomponent was tested as a Class A digital device to FCC Part 15 Subpart B and ICES-003, while the Radio Module was tested as a transmitter to the requirements of FCC Part 15 Subpart C 15.247 and RSS-210 Annex 8. Channels selected for test were:
Channel 0 2405 MHz, Channel 7 2440 MHz, Channel 15 2480 MHz

REVISION SUMMARY – The following changes have been made to this Report:

Date	Project No.	Project Handler	Page(s)	Item	Description of Change

3.0 Sample Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

Level in μV/m = [10(32 dBμV/m)/20] = 39.8 μV/m

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF

Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(48.1\ dB\mu V / 20)}$ = 254 μV/m

3.1 Measurement Uncertainty

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.
The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be:
±3.5 dB at 10m, ±3.8 dB at 3m

The expanded uncertainty (k = 2) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:
±2.6 dB

The expanded uncertainty (k = 2) for telecom port conducted emissions from 150 kHz to 30 MHz has been determined to be:
±3.2 for ISN and voltage probe measurements
±3.1 for current probe measurements

3.2 Site Description

Test Site(s): 2

Our OATS are 3m and 10m sheltered emissions measurement ranges located in a light commercial environment in Boxborough, Massachusetts. They meet the technical requirements of ANSI C63.4-2003 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity (12,000 lb. in Site 3) is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

The EMC Lab has two Semi-anechoic Chambers and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference groundplanes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Test Results: Pass

Test Standard: FCC 15.247(b)(3-5), RSS-210 A8.4, RSS-102 4.3

Test: Transmitter Output Power and EIRP, and Human RF Exposure

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	N/A	Pressure (hPa):	N/A	Ambient (°C):	N/A
Pretest Verification Performed	N/A		Equipment under Test:		nTAG Access Point	

Maximum Test Parameters: The output power of the Radio Module must not exceed 1 Watt (30 dBm) and 36 dBm EIRP. The human RF Exposure limit is 1 mW/cm^2.

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Spectrum Analyzer	Agilent	E7405A	US40240205	08/09/2006
2	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 197	CBL028	12/12/2006

Test Results:

Notes: The cable loss was compensated for in the spectrum analyzer. The EUT is exempt from SAR and RF evaluation as referenced in RSS-102 4.3 because the operating frequency is above 1.5 GHz and the EIRP does not exceed 5 watts.

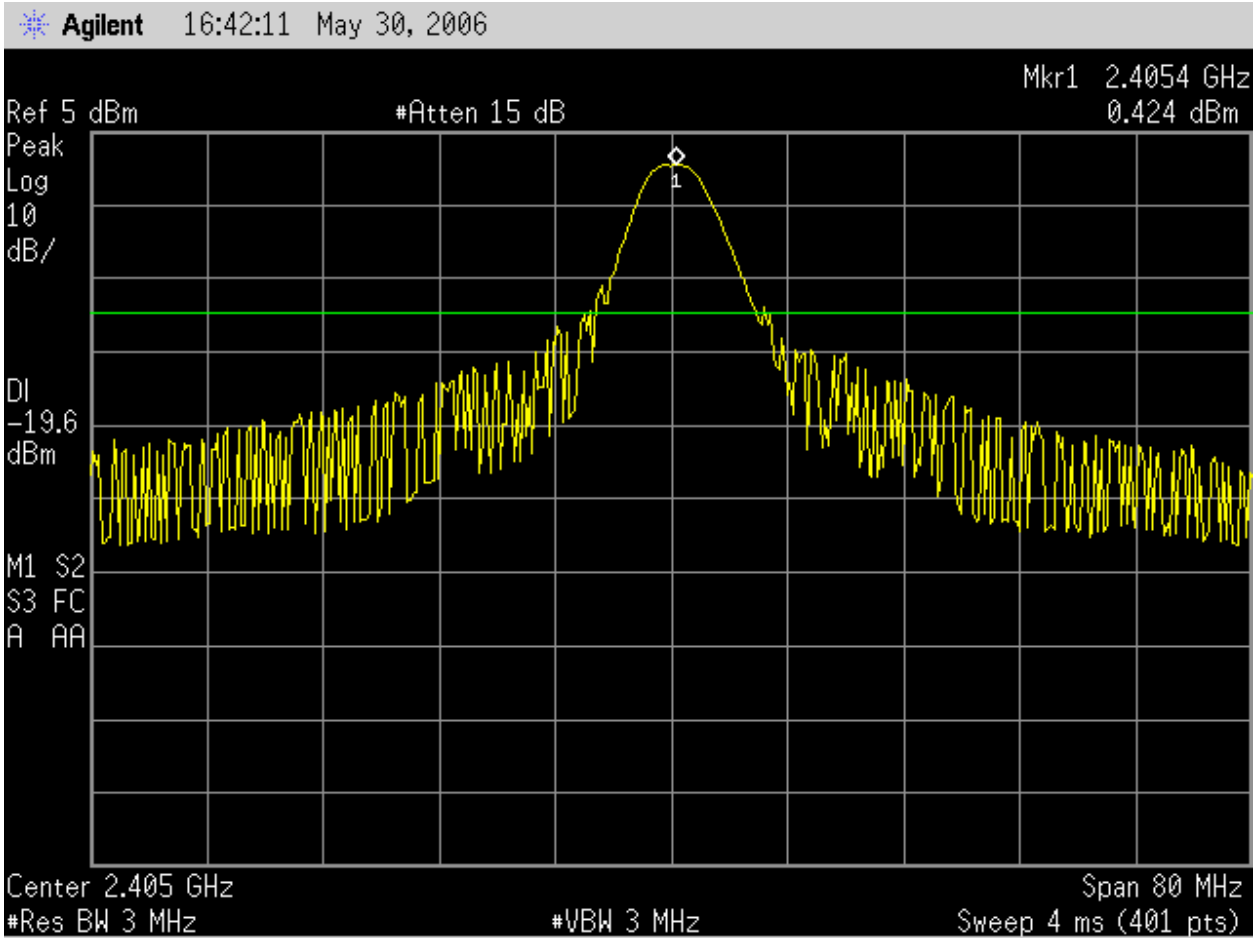
The FCC human RF exposure limit is 1 mW/cm^2. The power density S generated by some value of EIRP at a given distance d is related by the equation:

$$S=EIRP / (4\pi d^2)$$

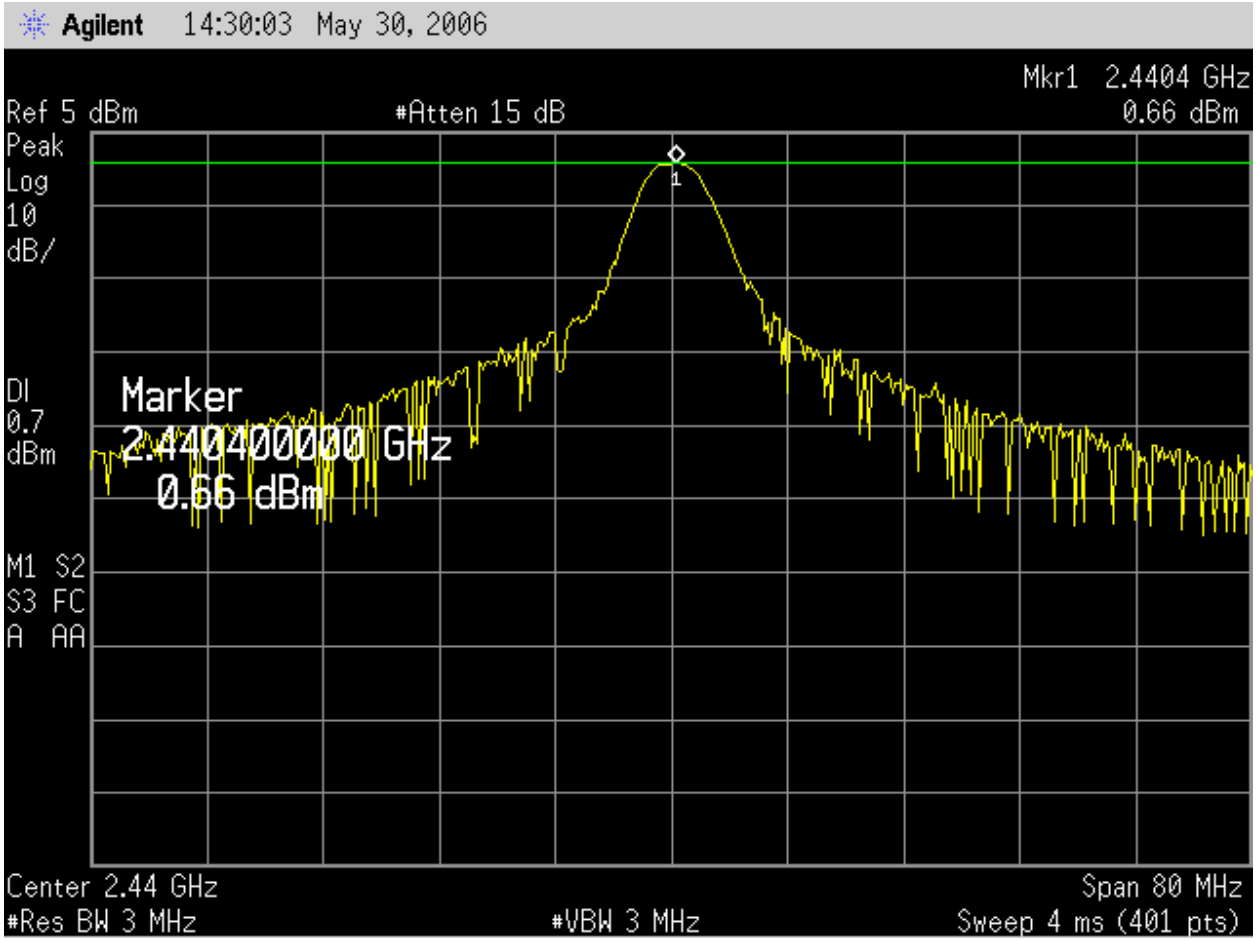
The distance, given a maximum EIRP of 2.86 dBm (1.93 mW) at which the radiated power density of the EUT is equal to the human RF exposure limit is 0.39 cm from the antenna.

Antenna	Type	Model	Connector	Gain
Antenna Factor Whip Antenna	Whip	ANT-2.4-CW-RCT-RP	Reverse-SMA	2.2 dBi

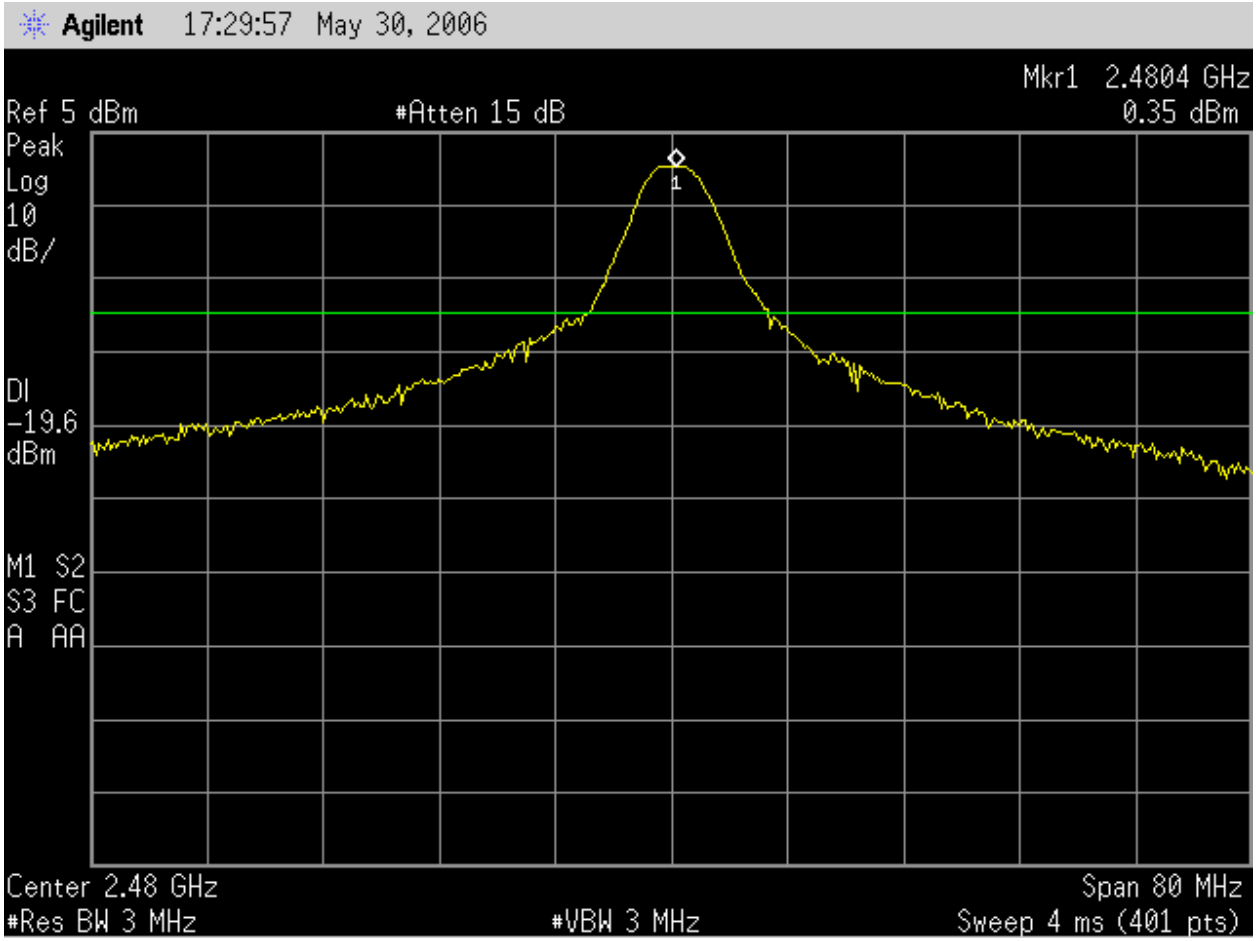
Channel	Frequency	Power	Limit	EIRP	EIRP Limit
0	2405 MHz	0.42 dBm	30.0 dBm	2.62 dBm	36.0 dBm
7	2440 MHz	0.66 dBm	30.0 dBm	2.86 dBm	36.0 dBm
15	2480 MHz	0.35 dBm	30.0 dBm	2.55 dBm	36.0 dBm


Agilent 16:42:11 May 30, 2006
Mkr1 2.4054 GHz
0.424 dBm
Ref 5 dBm
#Atten 15 dB
Peak
Log
10
dB/
Dl
-19.6
dBm
M1 S2
S3 FC
A AA
Center 2.405 GHz
Span 80 MHz
#Res BW 3 MHz
#VBW 3 MHz
Sweep 4 ms (401 pts)

Channel 0


Agilent 14:30:03 May 30, 2006
Mkr1 2.4404 GHz
0.66 dBm
Ref 5 dBm
#Atten 15 dB
Peak
Log
10
dB/
Dl
0.7
dBm
Marker
2.440400000 GHz
0.66 dBm
M1 S2
S3 FC
A AA
Center 2.44 GHz
#Res BW 3 MHz
#VBW 3 MHz
Span 80 MHz
Sweep 4 ms (401 pts)

Channel 7


Agilent 17:29:57 May 30, 2006
Mkr1 2.4804 GHz
0.35 dBm
Ref 5 dBm
#Atten 15 dB
Peak
Log
10
dB/
Dl
-19.6
dBm
M1 S2
S3 FC
A AA
Center 2.48 GHz
Span 80 MHz
#Res BW 3 MHz
#VBW 3 MHz
Sweep 4 ms (401 pts)

Channel 15

Test Results: Pass

Test Standard: FCC 15.247(a)(2), RSS-210 A8.2

Test: Occupied Bandwidth

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	N/A	Pressure (hPa):	N/A	Ambient (°C):	N/A
Pretest Verification Performed	N/A		Equipment under Test:		nTAG Access Point	

Maximum Test Parameters: The 6 dB bandwidth of the Radio Module must be at least 500 kHz.

Test Equipment Used:

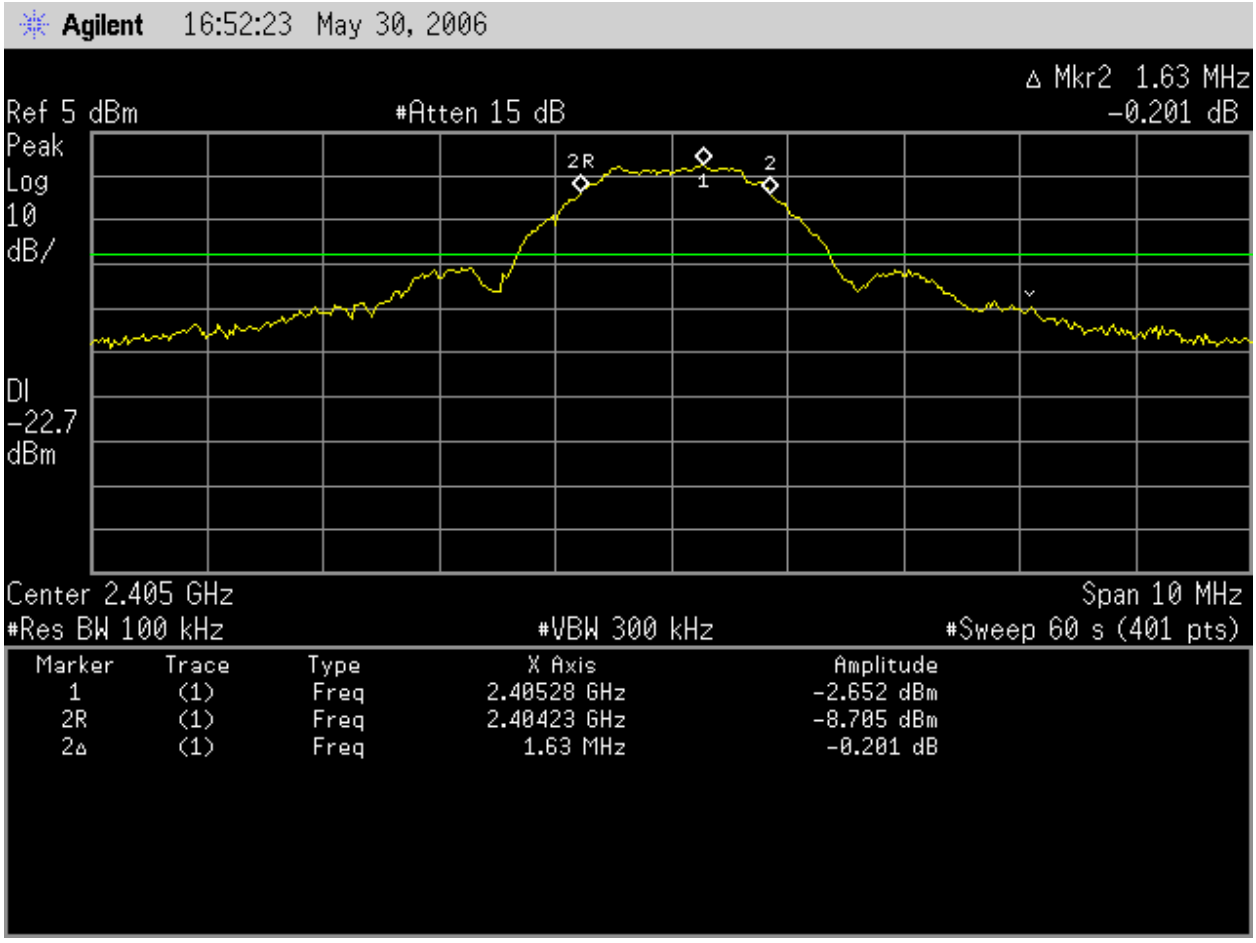
TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Spectrum Analyzer	Agilent	E7405A	US40240205	08/09/2006
2	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 197	CBL028	12/12/2006

Test Results:

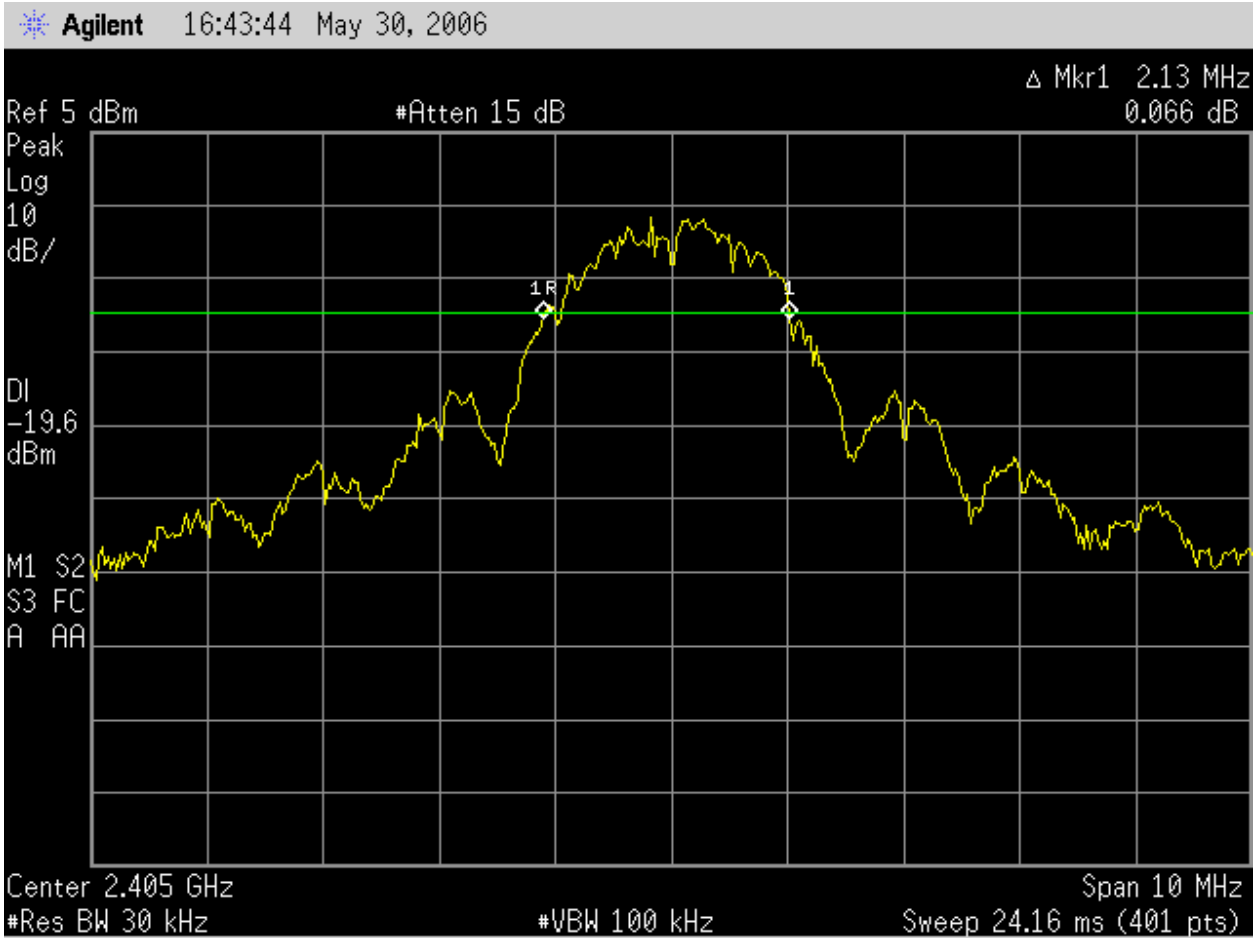
Notes: There is no limit on the 20 dB bandwidth, it is simply included for informational purposes. The 20 dB bandwidth is referenced to the actual RF output power.

Channel	Frequency	6 dB Bandwidth
0	2405 MHz	1.63 MHz
7	2440 MHz	1.63 MHz
15	2480 MHz	1.68 MHz

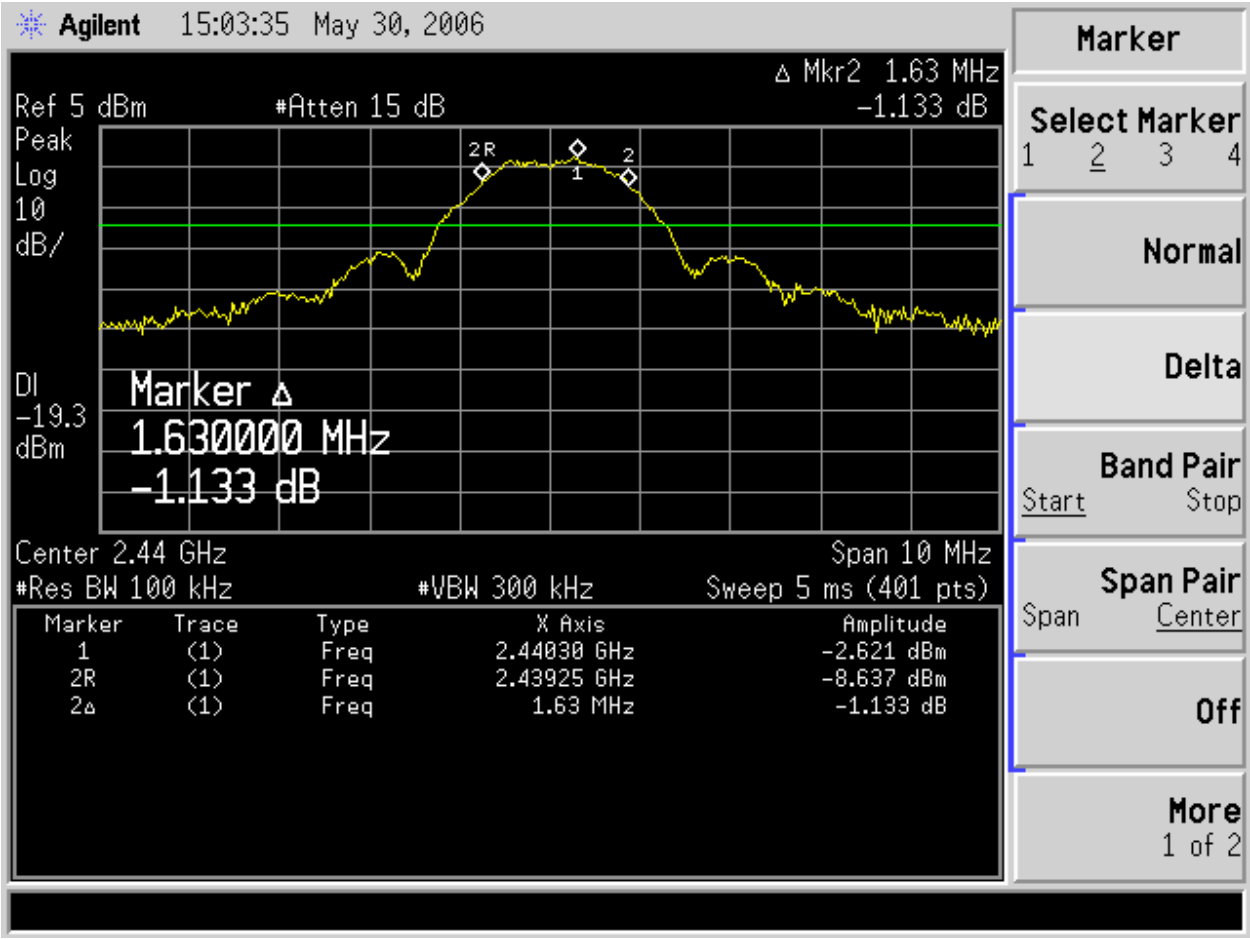
Channel	Frequency	20 dB Bandwidth
0	2405 MHz	2.13 MHz
7	2440 MHz	2.23 MHz
15	2480 MHz	2.20 MHz



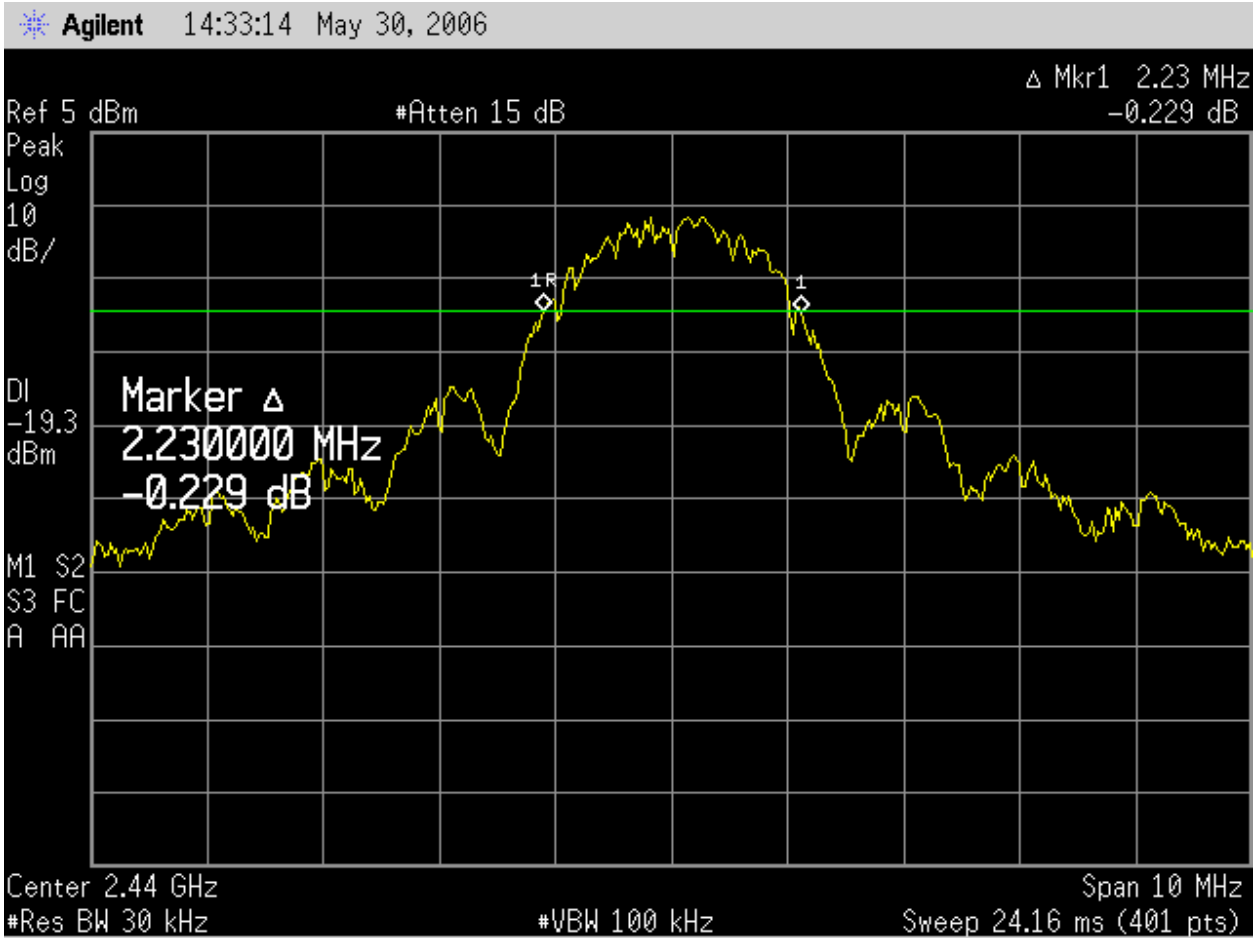
Channel 0 6dB Bandwidth



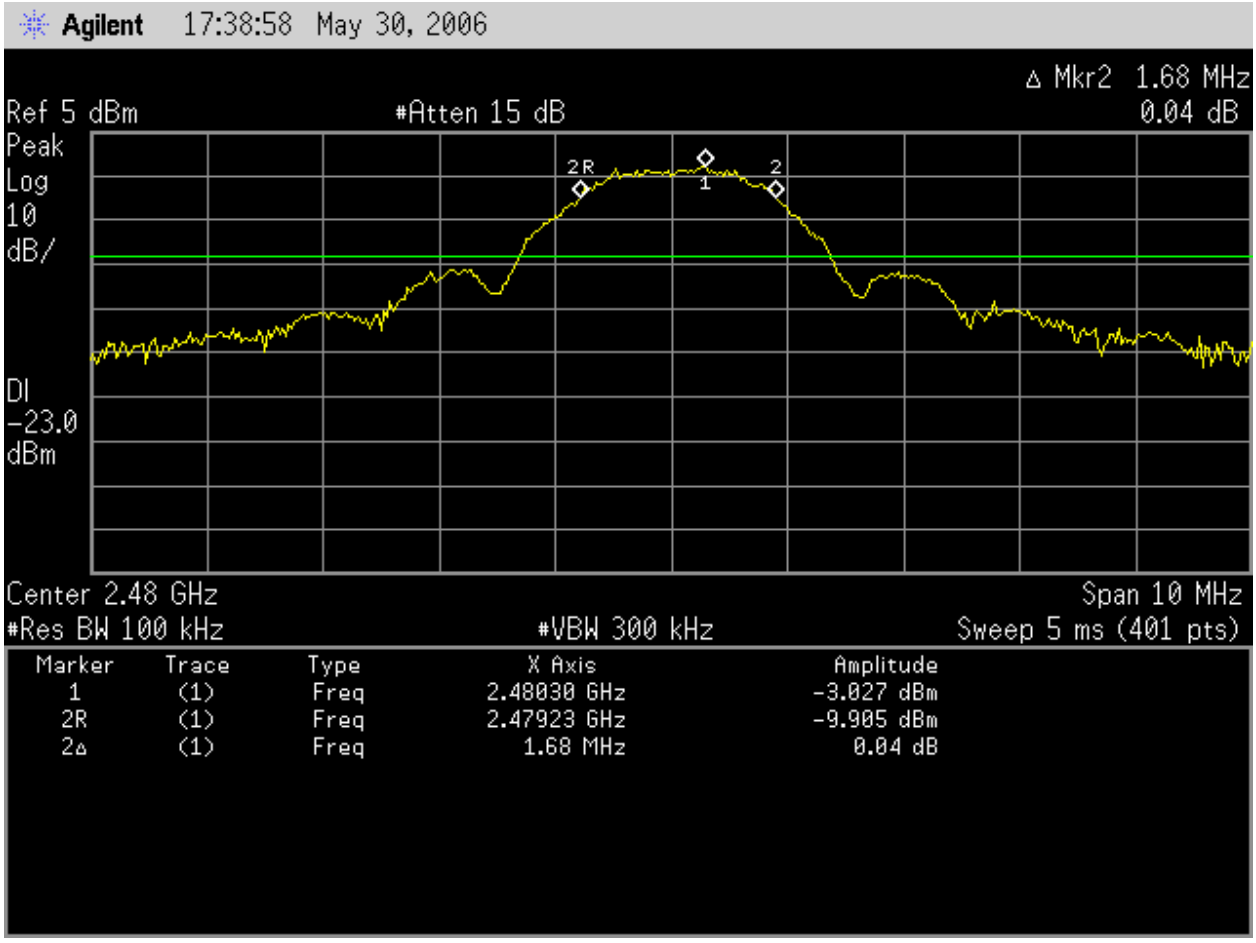
Channel 0 20 dB Bandwidth



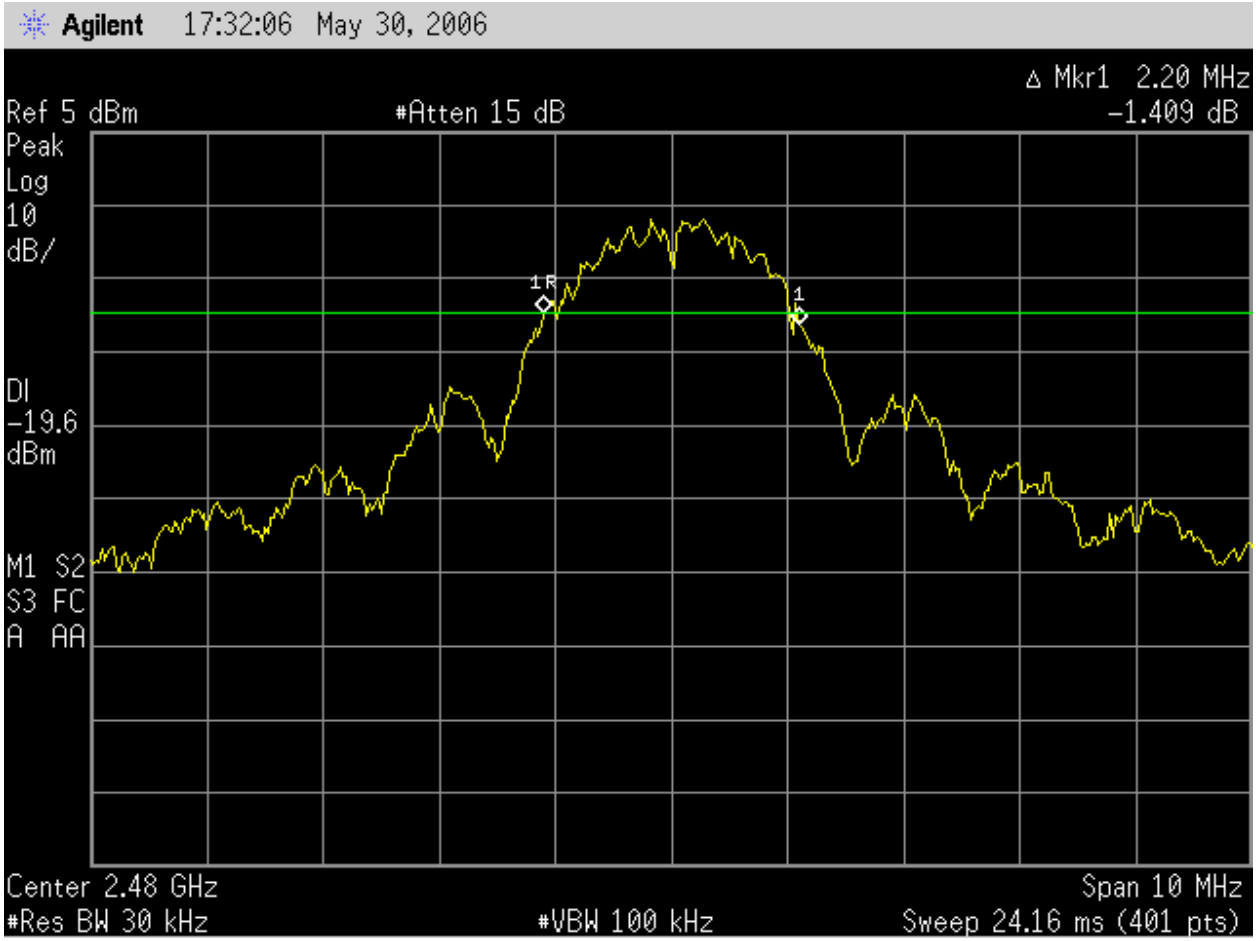
Channel 7 6 dB Bandwidth



Channel 7 20 dB Bandwidth



Channel 15 6 dB Bandwidth



Channel 15 20 dB Bandwidth

Test Results: Pass

Test Standard: FCC 15.209, 15.247(d), RSS-210 A8.5

Test: Antenna Port Conducted Spurious Emissions

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	N/A	Pressure (hPa):	N/A	Ambient (°C):	N/A
Pretest Verification Performed	N/A		Equipment under Test:		nTAG Access Point	

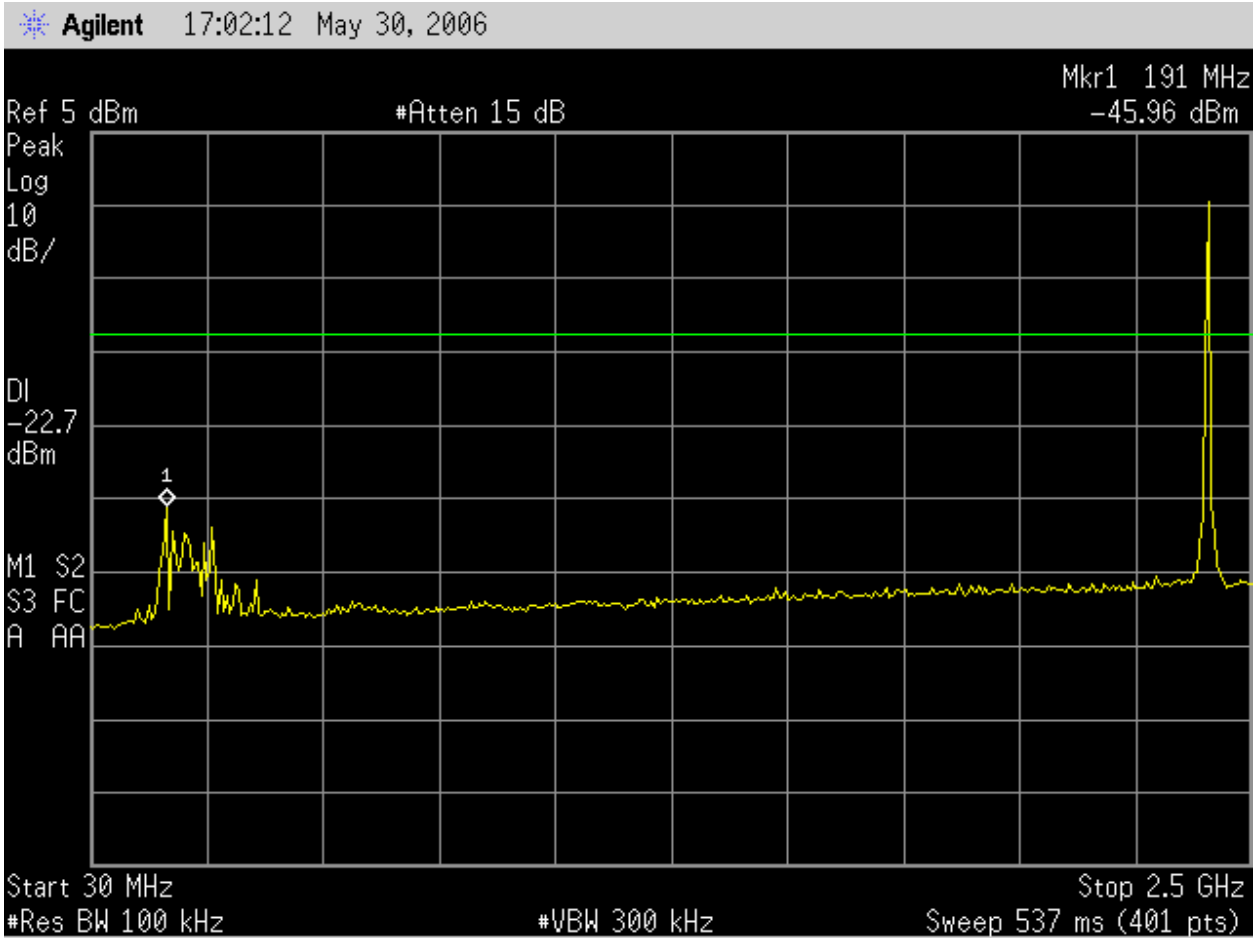
Maximum Test Parameters: The spurious emissions of the Radio Module must be attenuated below the level of the fundamental by at least 20 dBc.

Test Equipment Used:

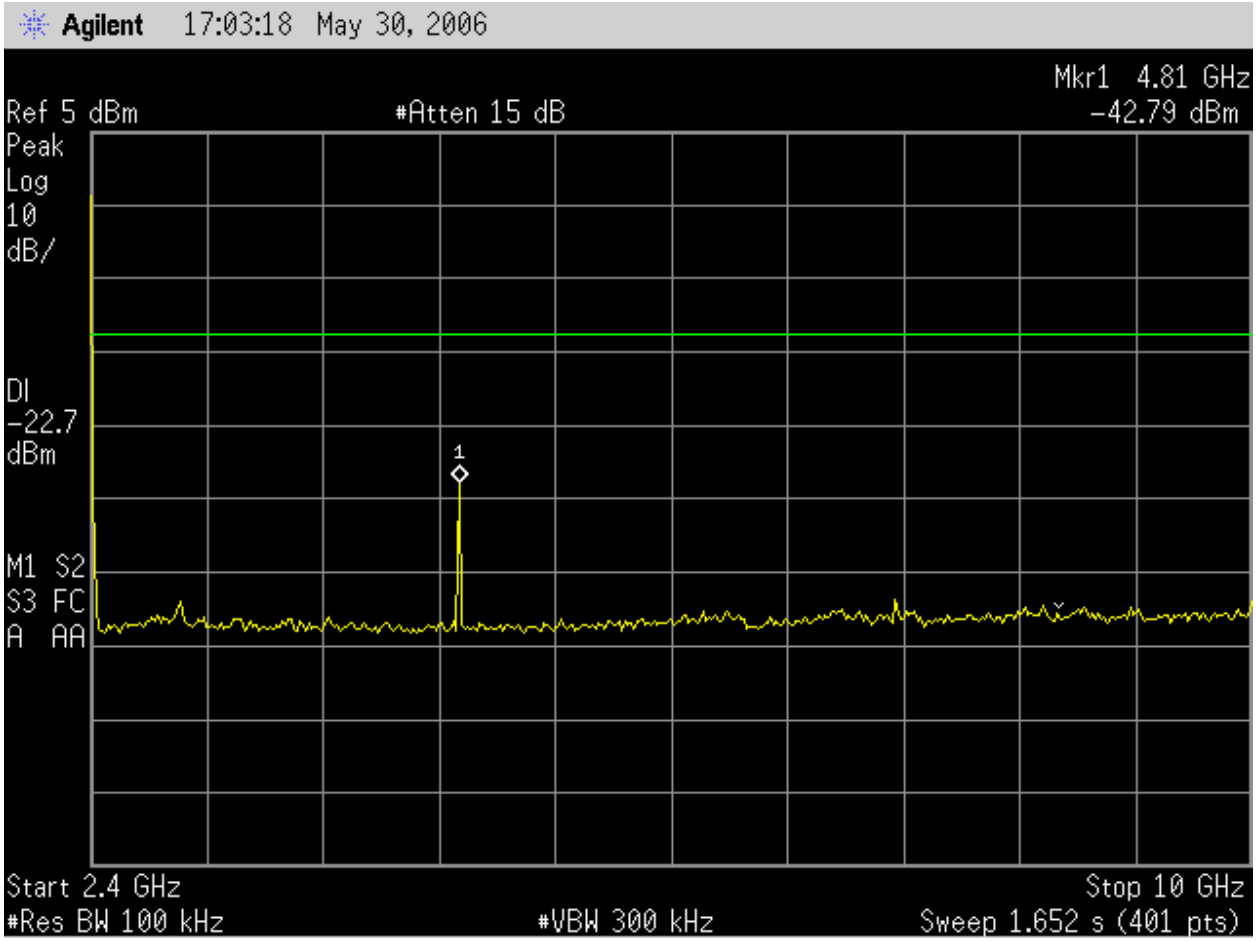
TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Spectrum Analyzer	Agilent	E7405A	US40240205	08/09/2006
2	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 197	CBL028	12/12/2006

Test Results:

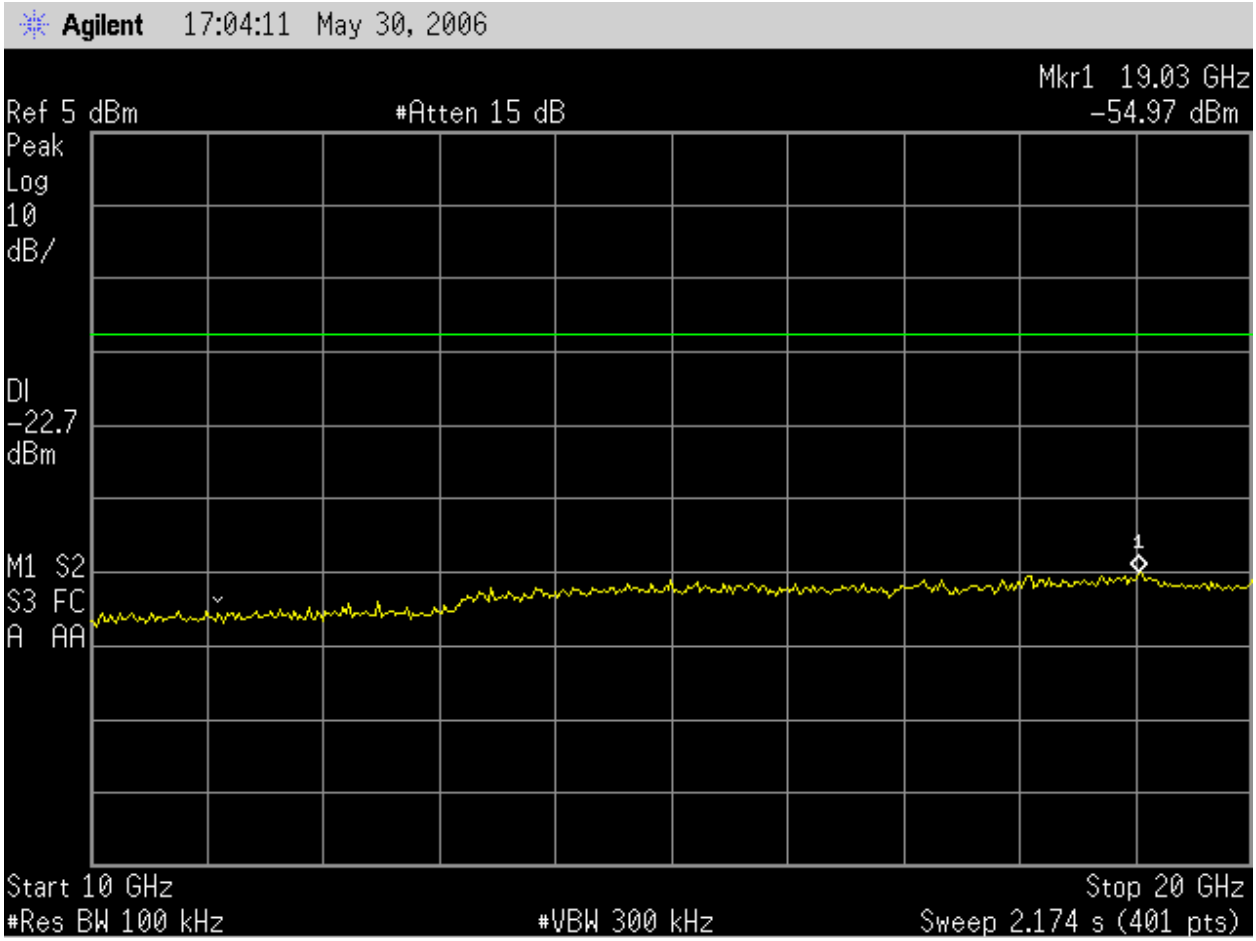
Notes: A display line was placed at the output power in a 100 kHz bandwidth of the channel under test, and a second display line was placed 20 dB below the first display line. The cable loss was compensated for in the spectrum analyzer. Both the transmit and receive ports were tested.



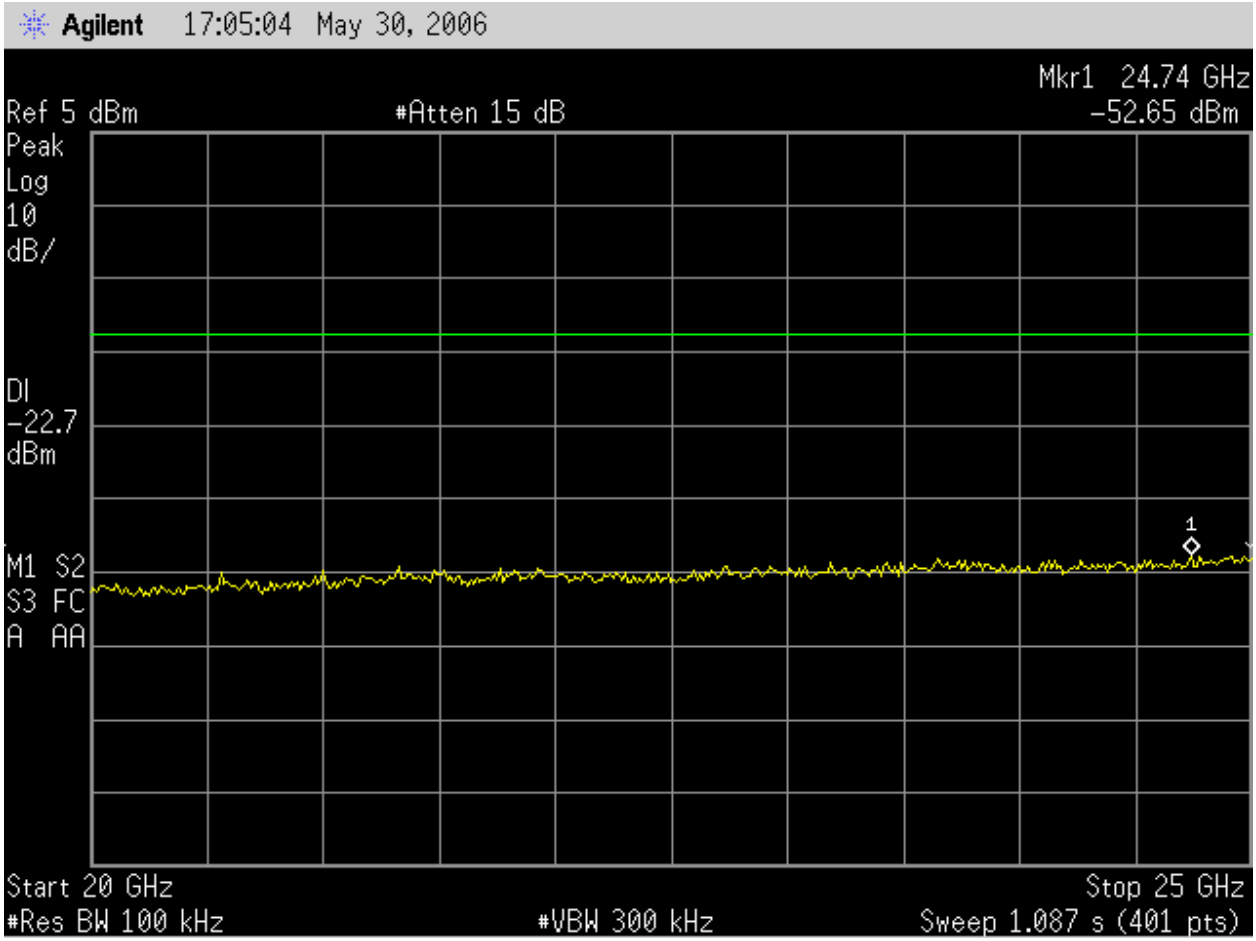
Channel 0 Tx Port 30-2500 MHz



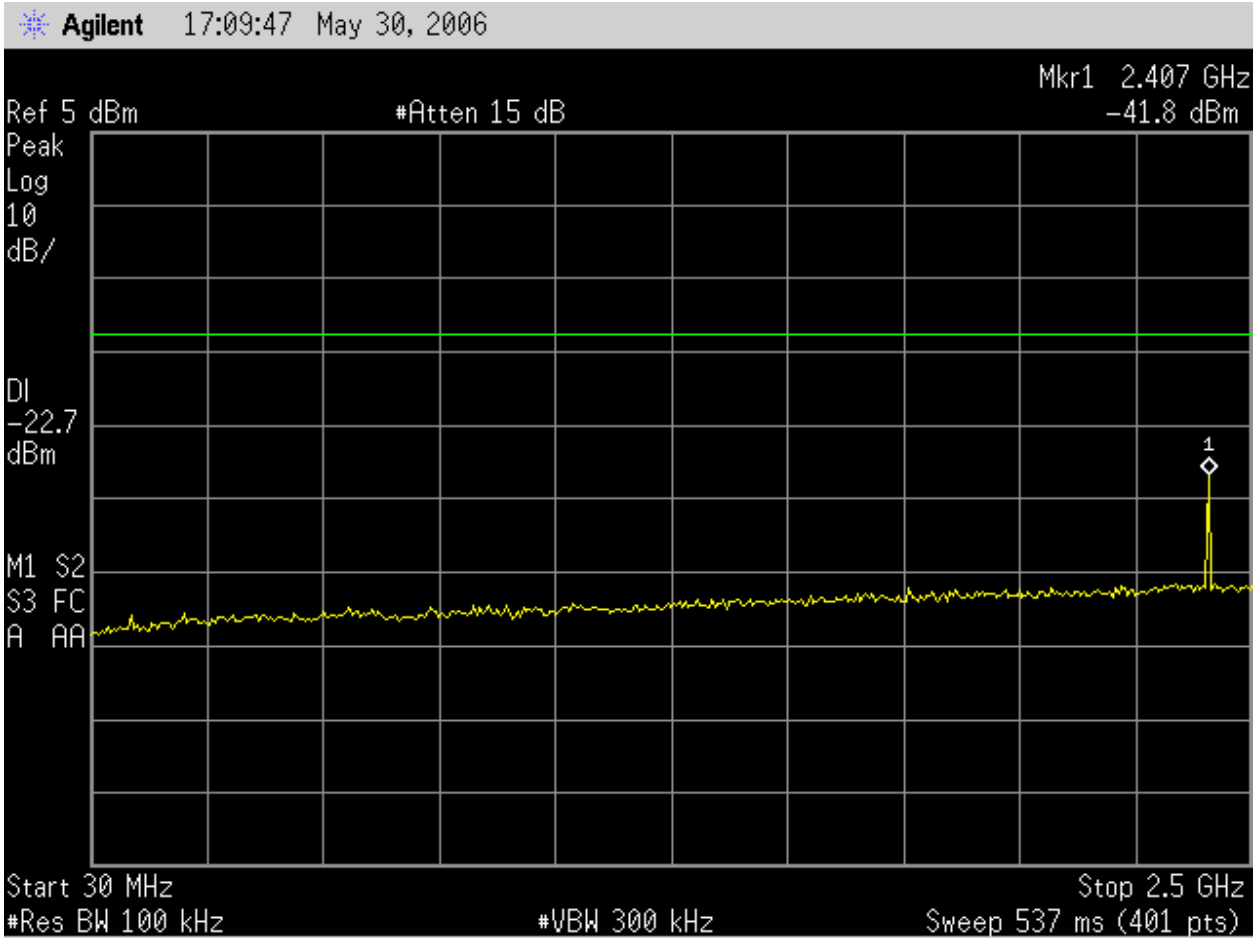
Channel 0 Tx Port 2.4-10 GHz



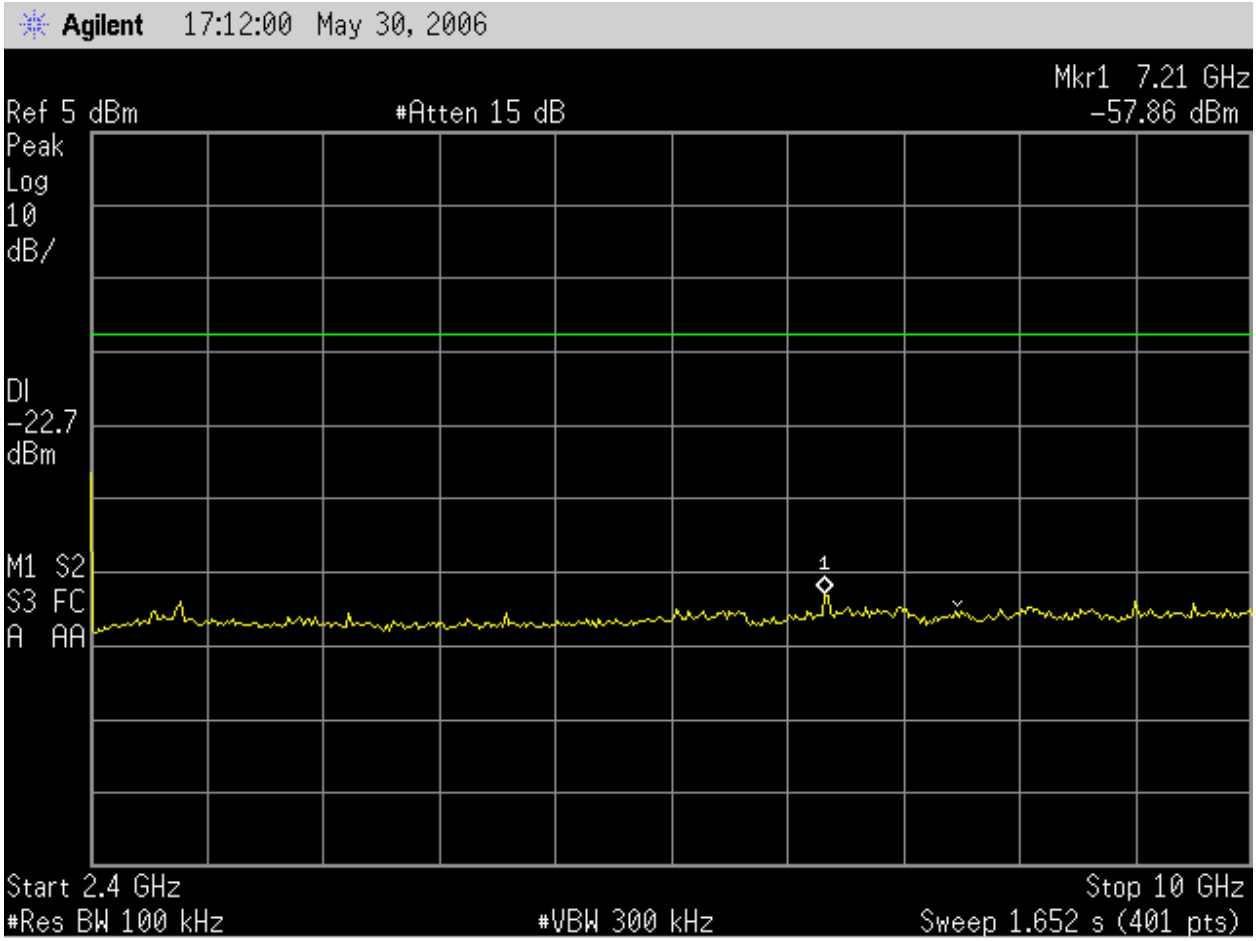
Channel 0 Tx Port 10-20 GHz



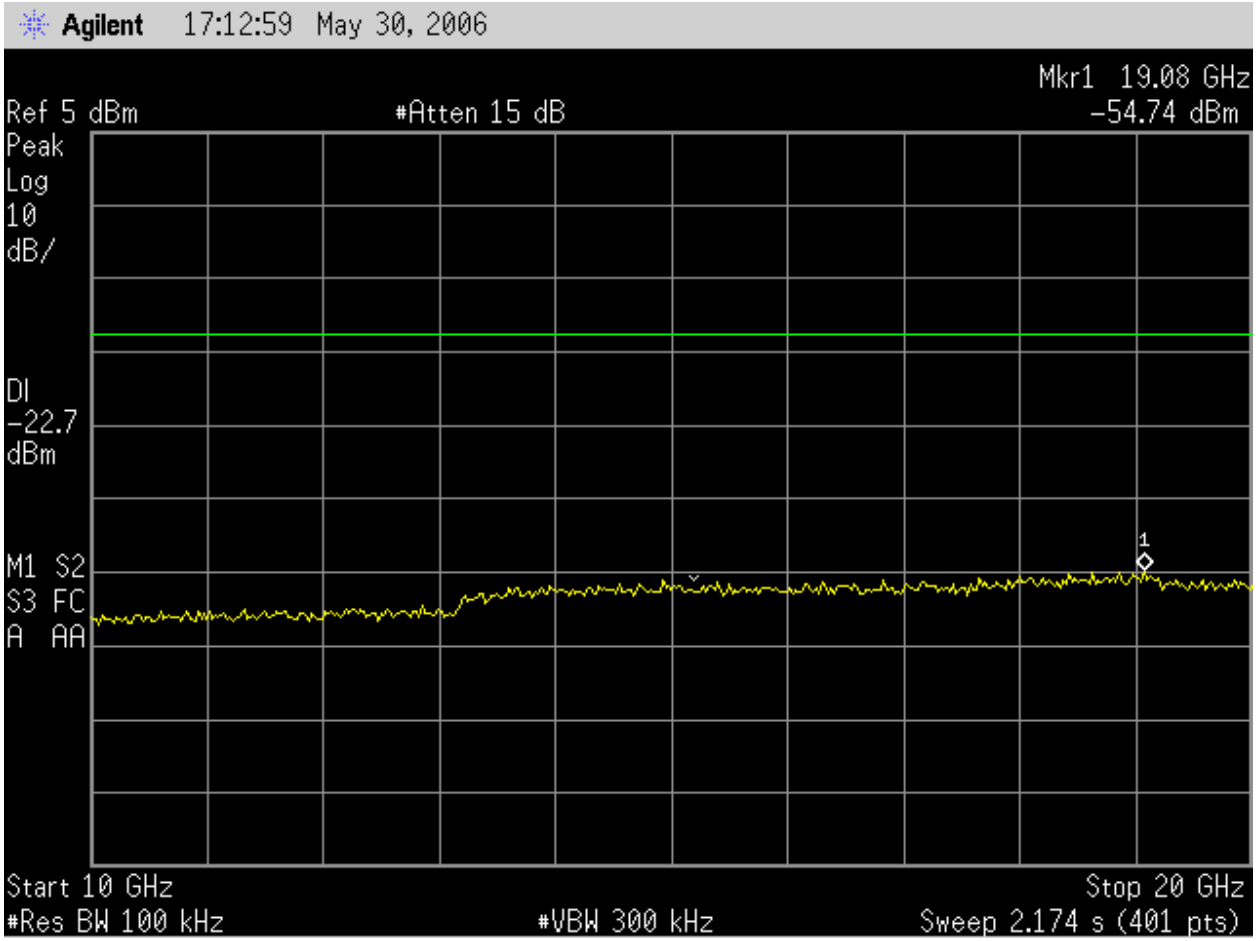
Channel 0 Tx Port 20-25 GHz



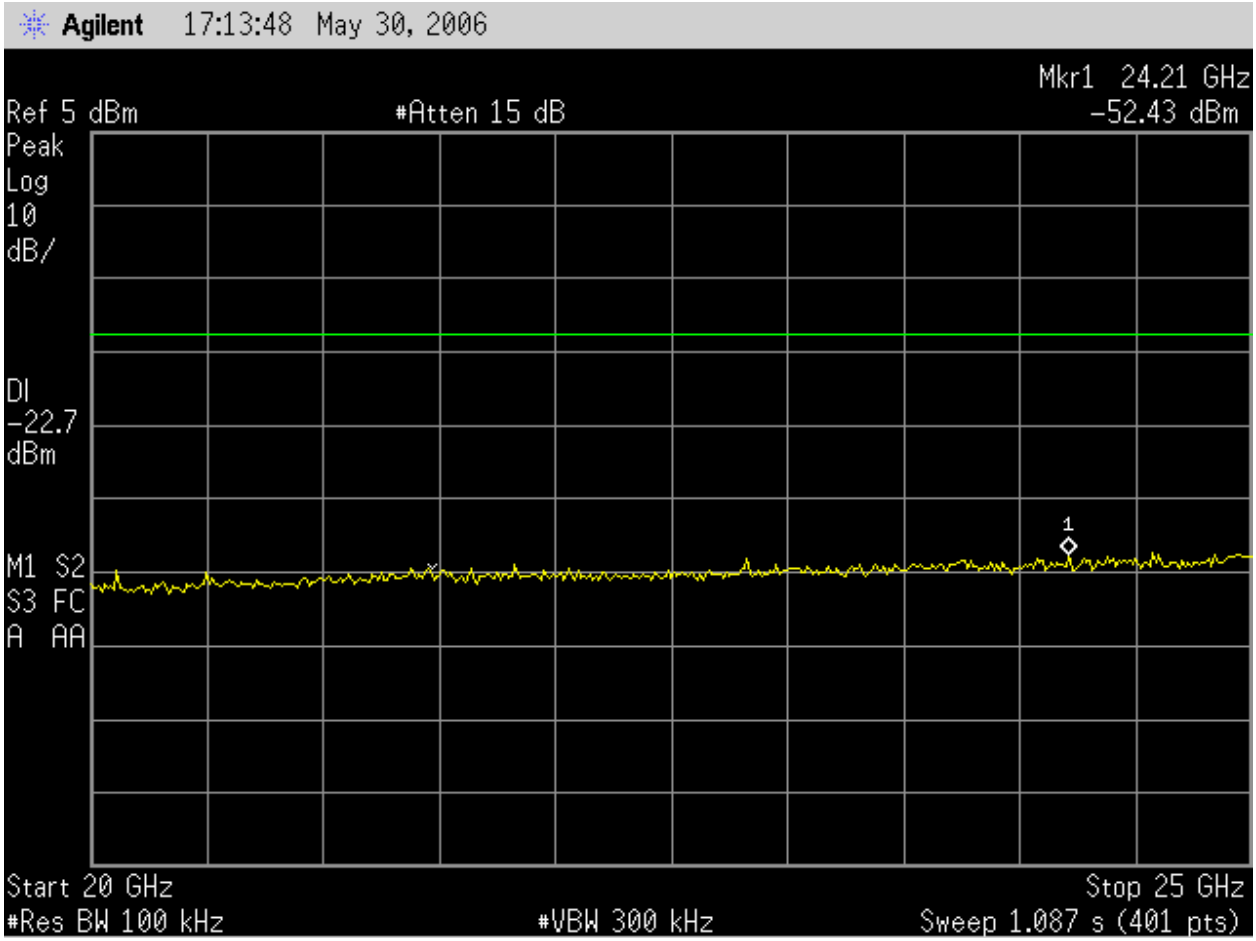
Channel 0 Rx Port 30-2500 MHz



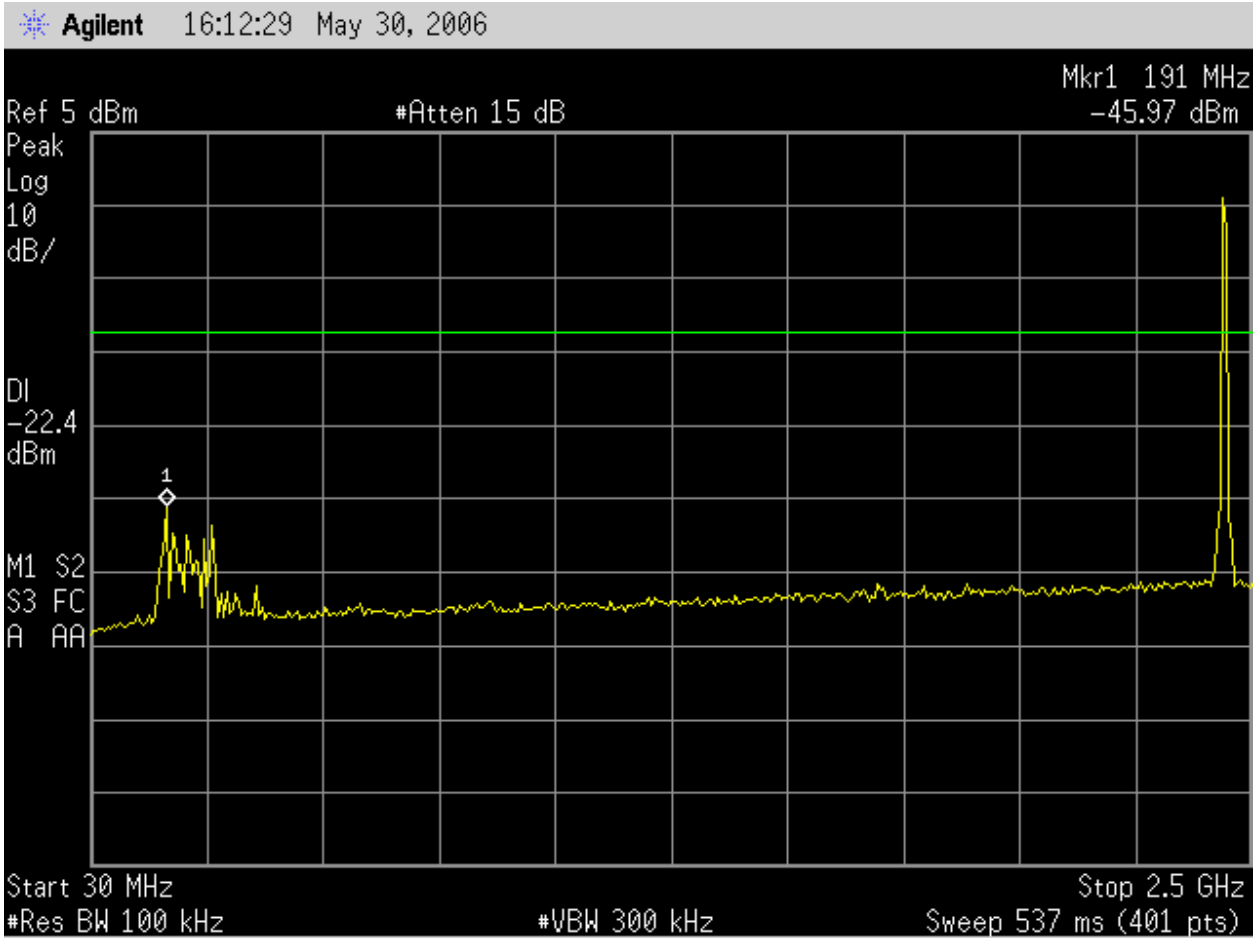
Channel 0 Rx Port 2.4-10 GHz



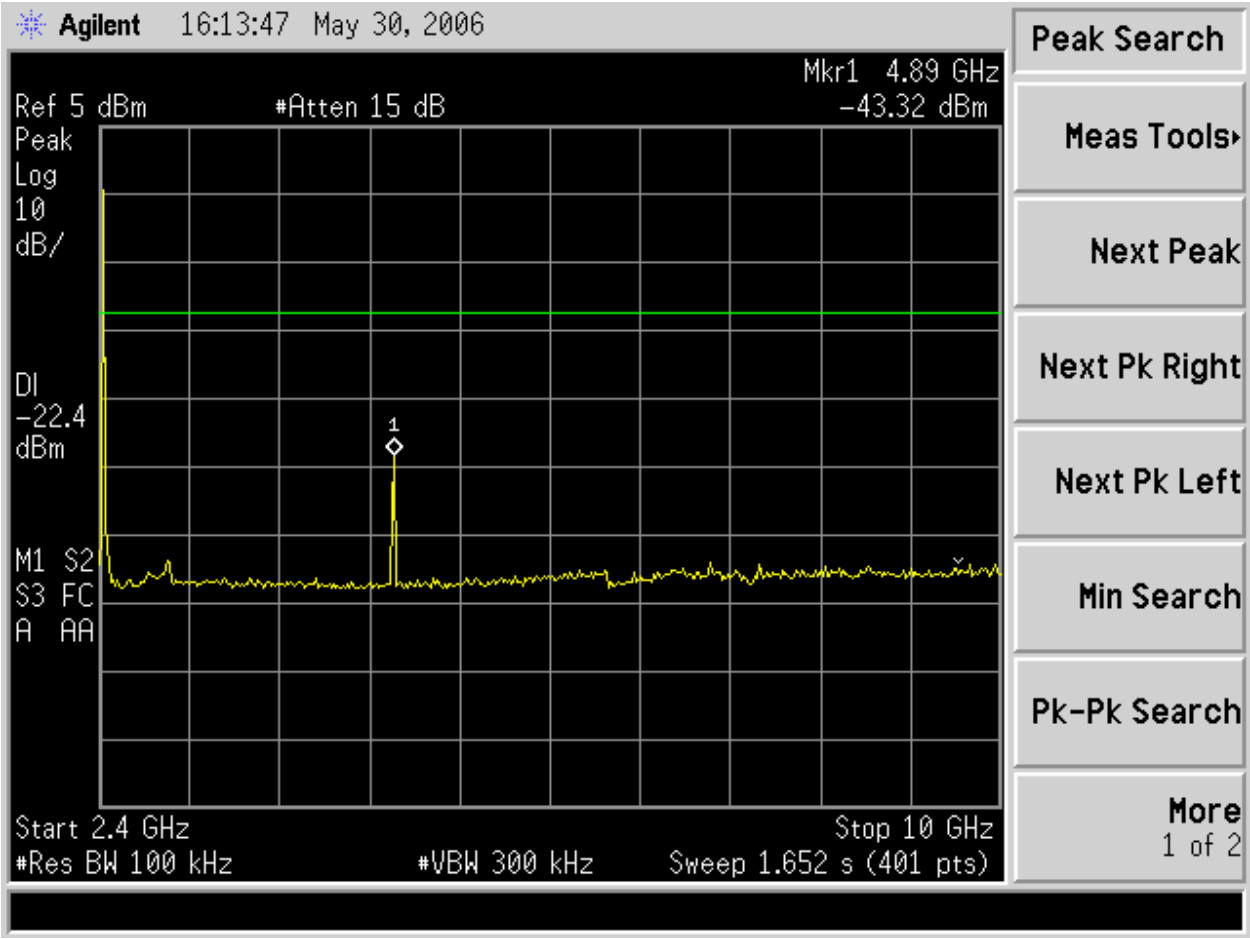
Channel 0 Rx Port 10-20 GHz



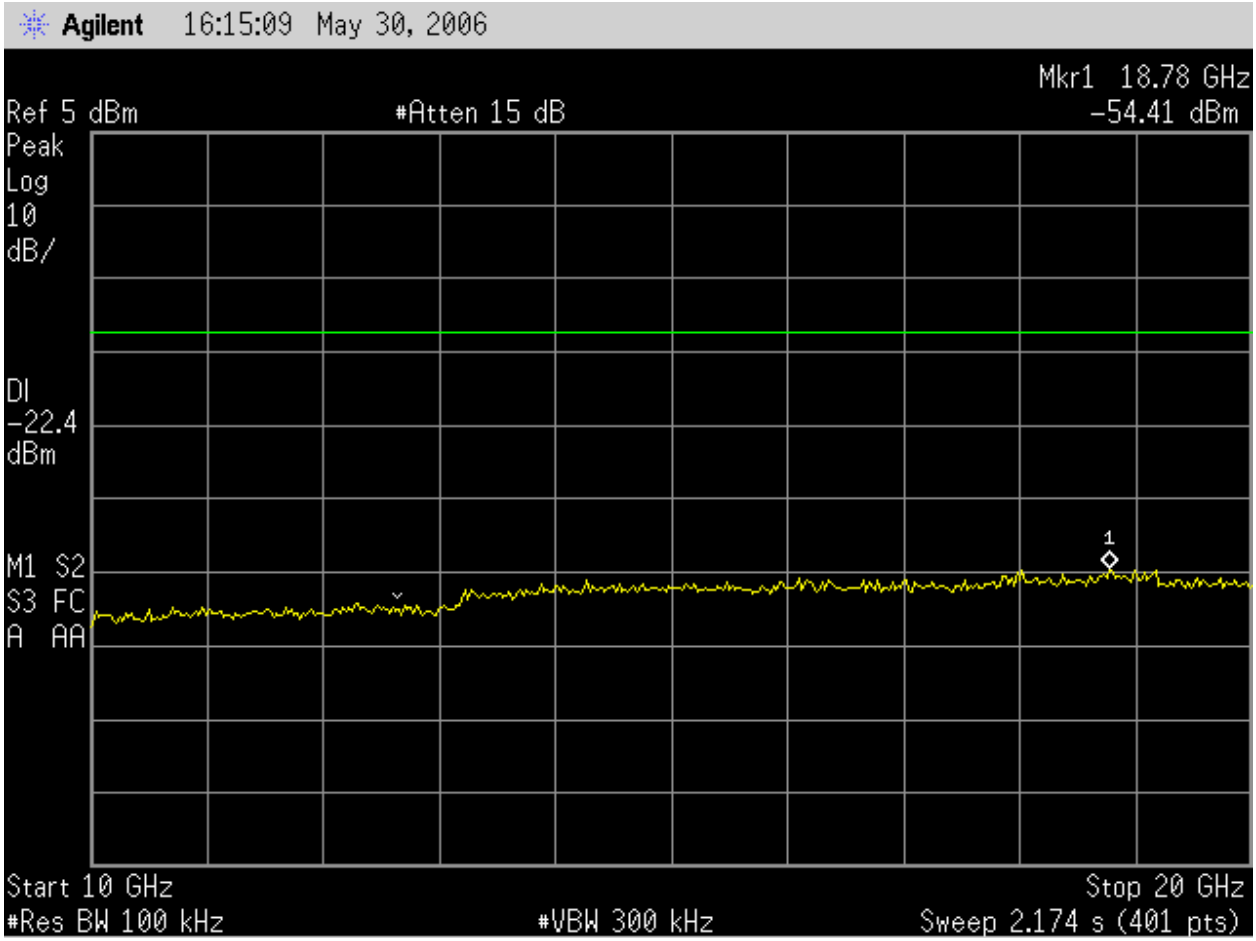
Channel 0 Rx Port 20-25 GHz



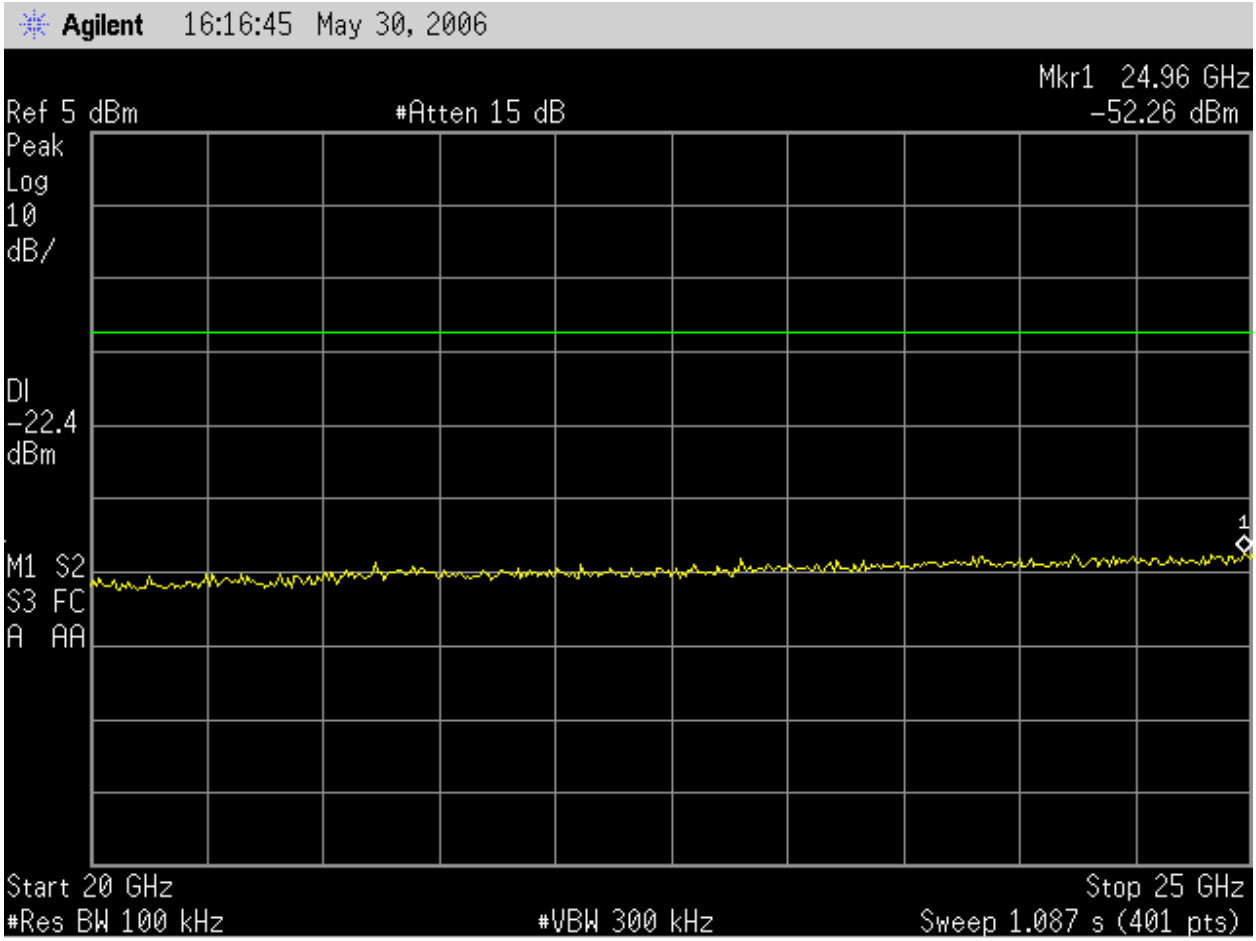
Channel 7 Tx Port 30-2500 MHz



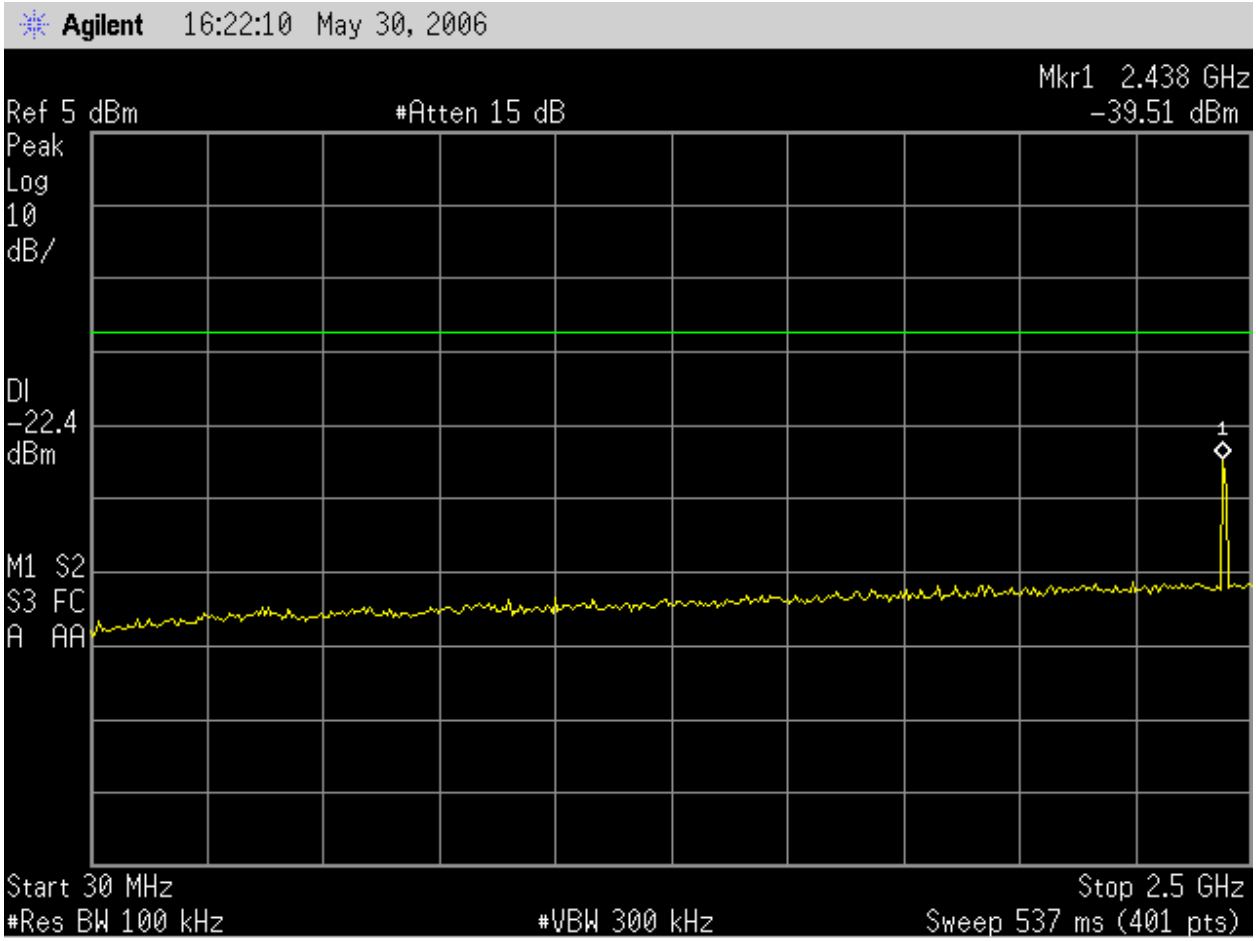
Channel 7 Tx Port 2.4-10 GHz



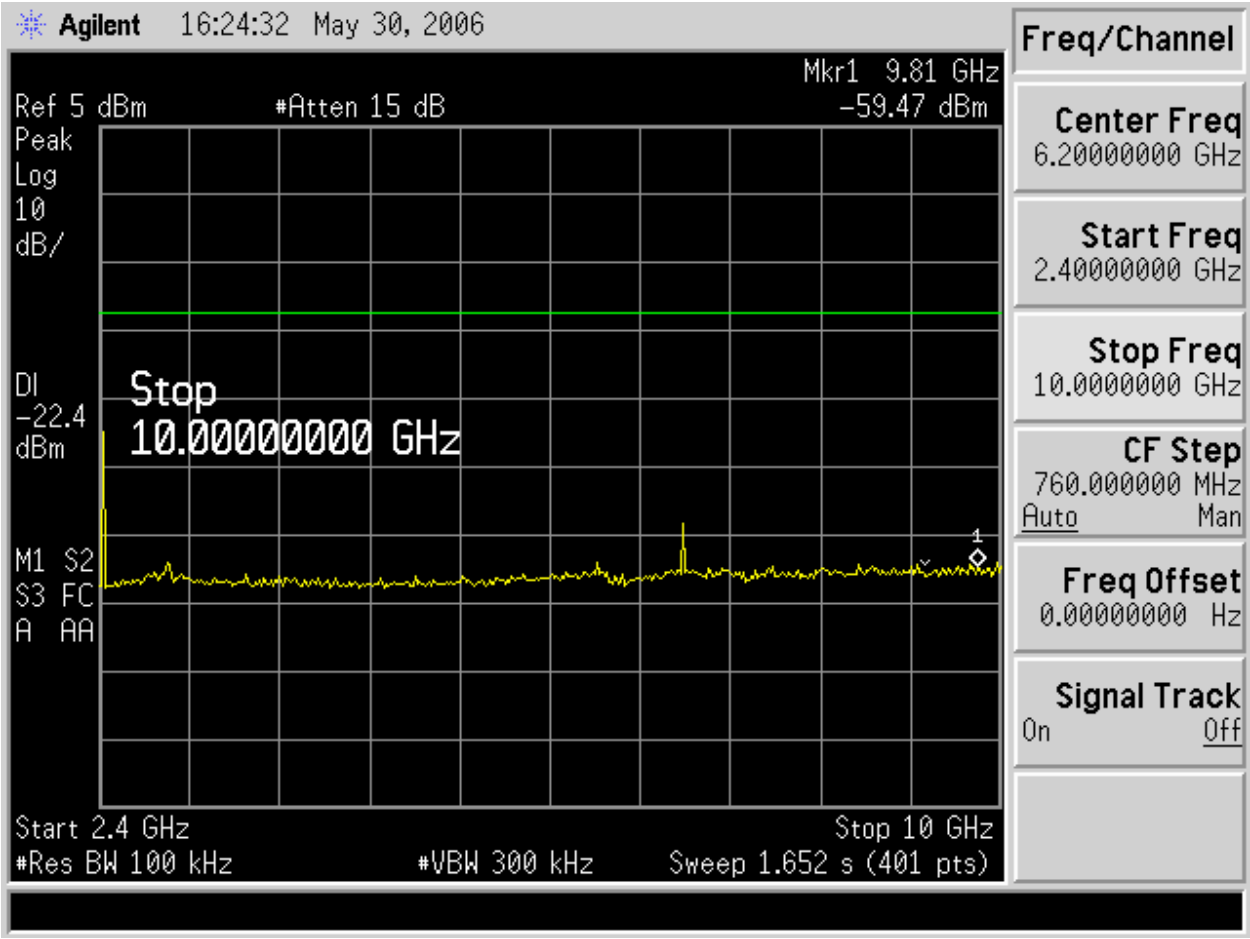
Channel 7 Tx Port 10-20 GHz



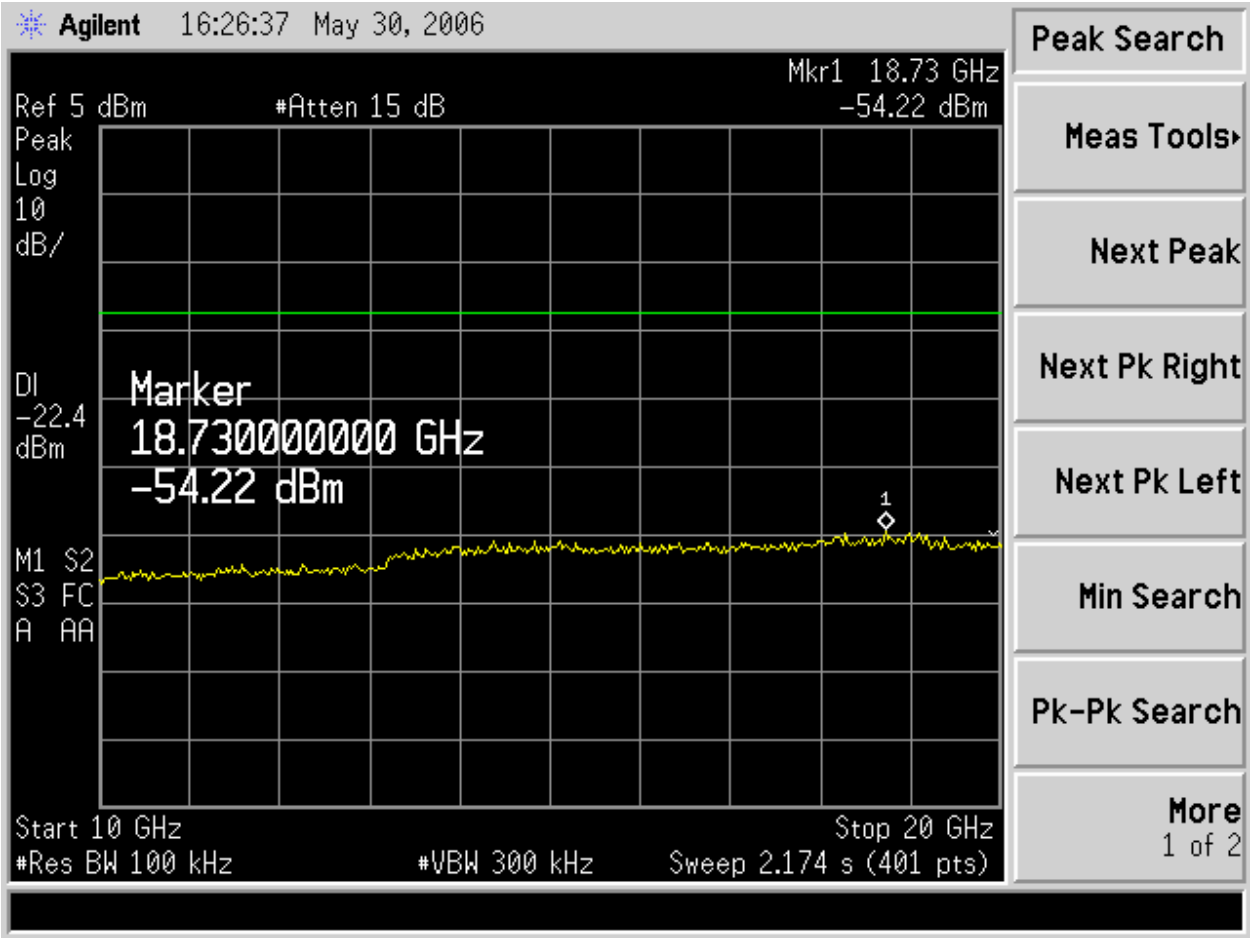
Channel 7 Tx Port 20-25 GHz



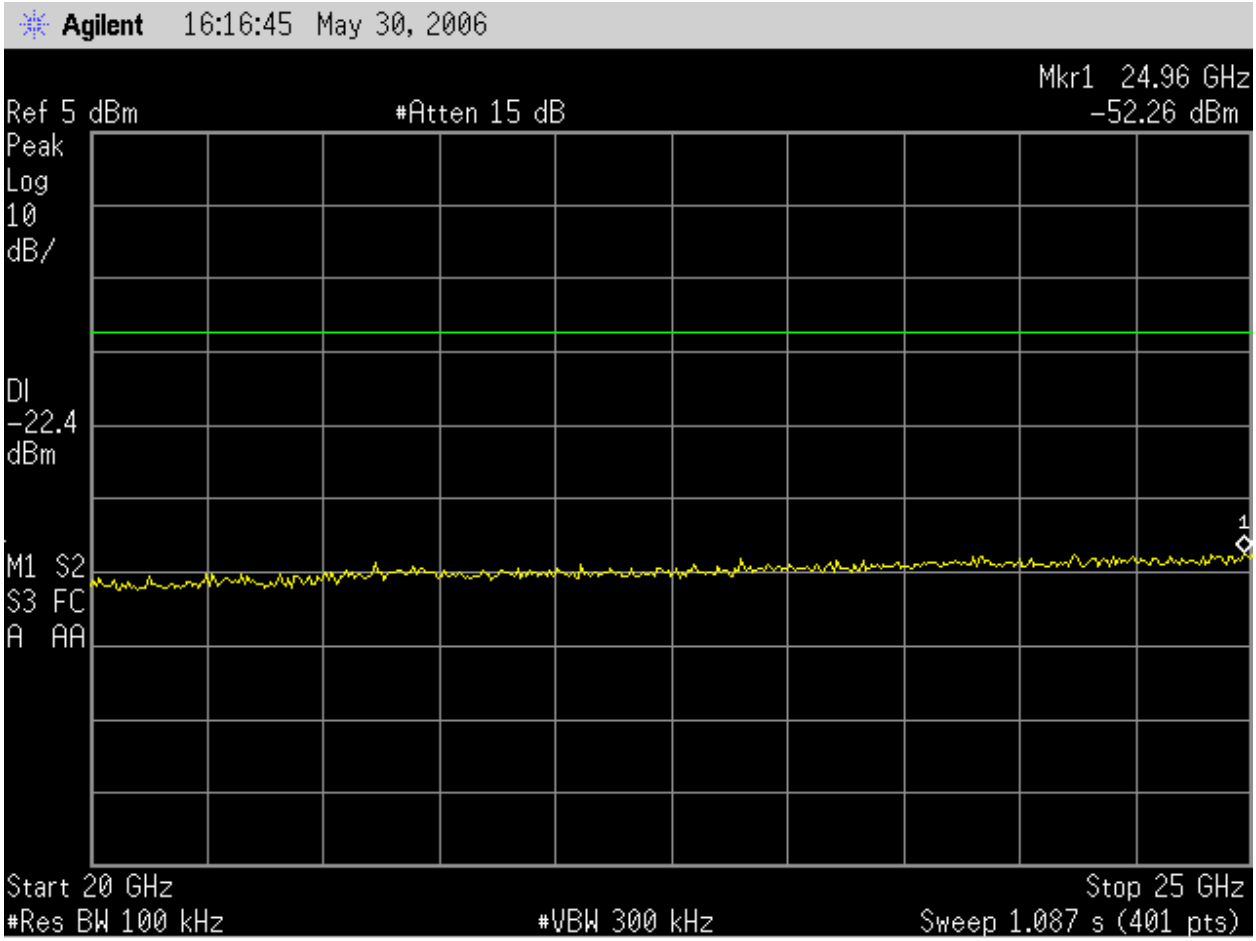
Channel 7 Rx Port 30-2500 MHz



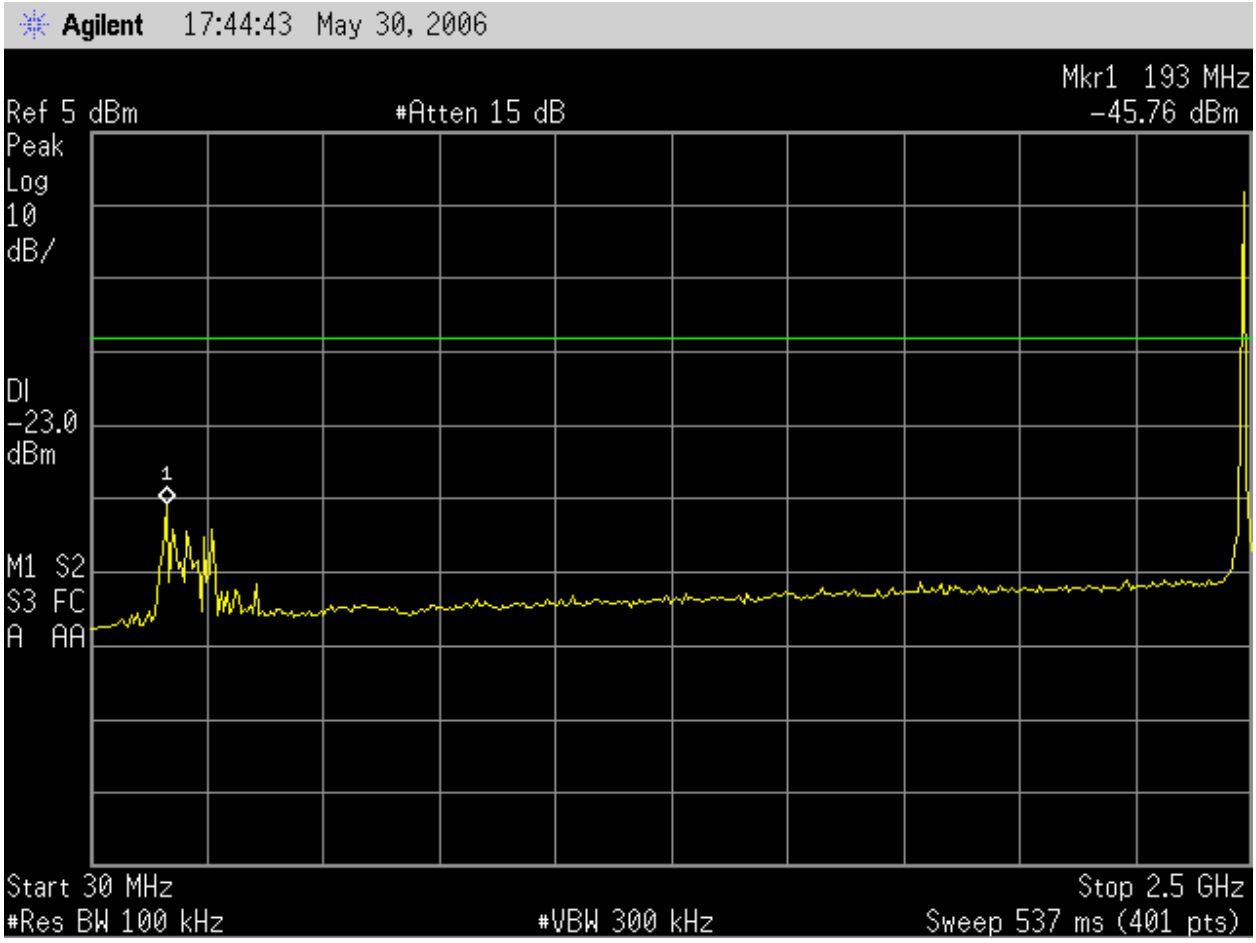
Channel 7 Rx Port 2.4-10 GHz



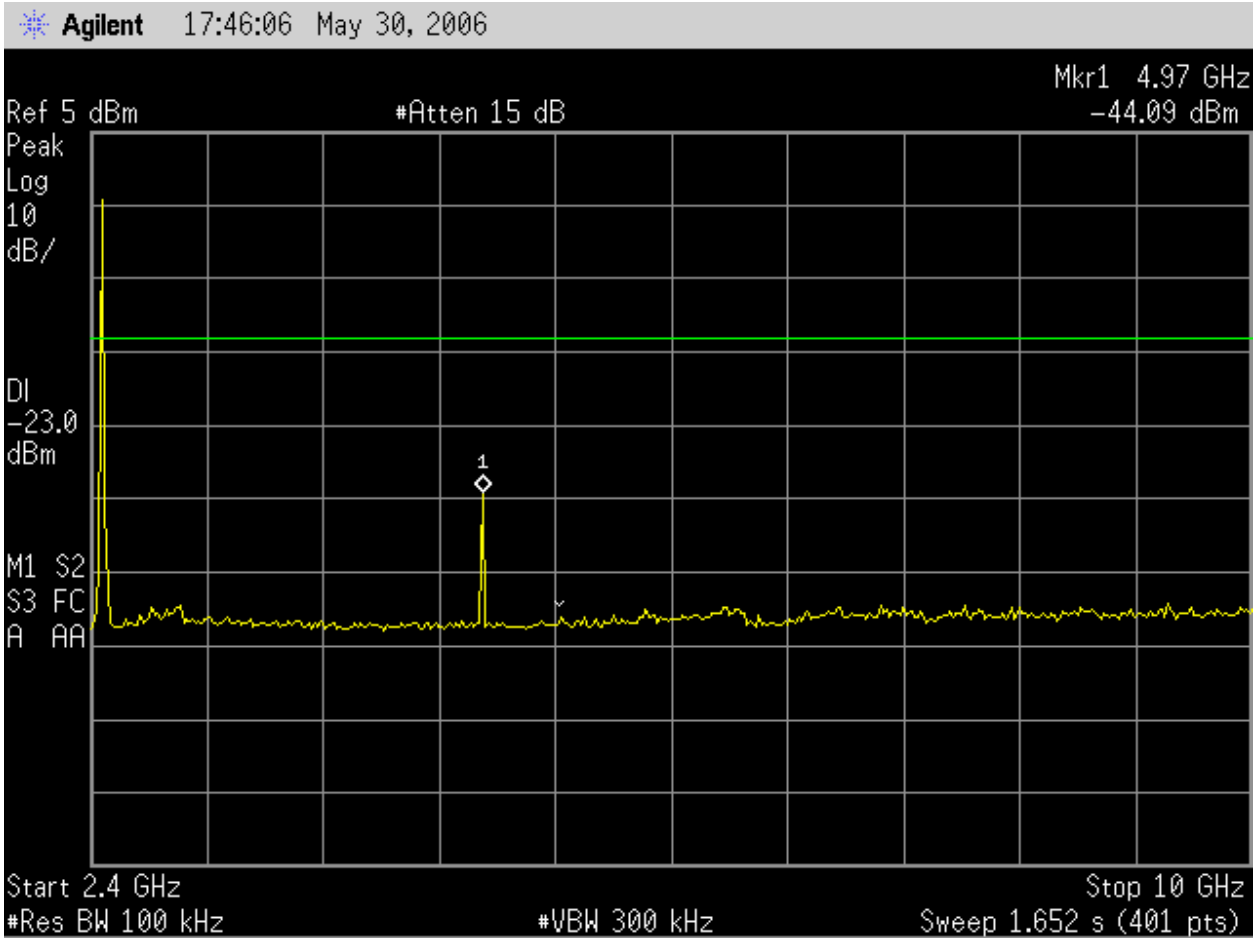
Channel 7 Rx Port 10-20 GHz



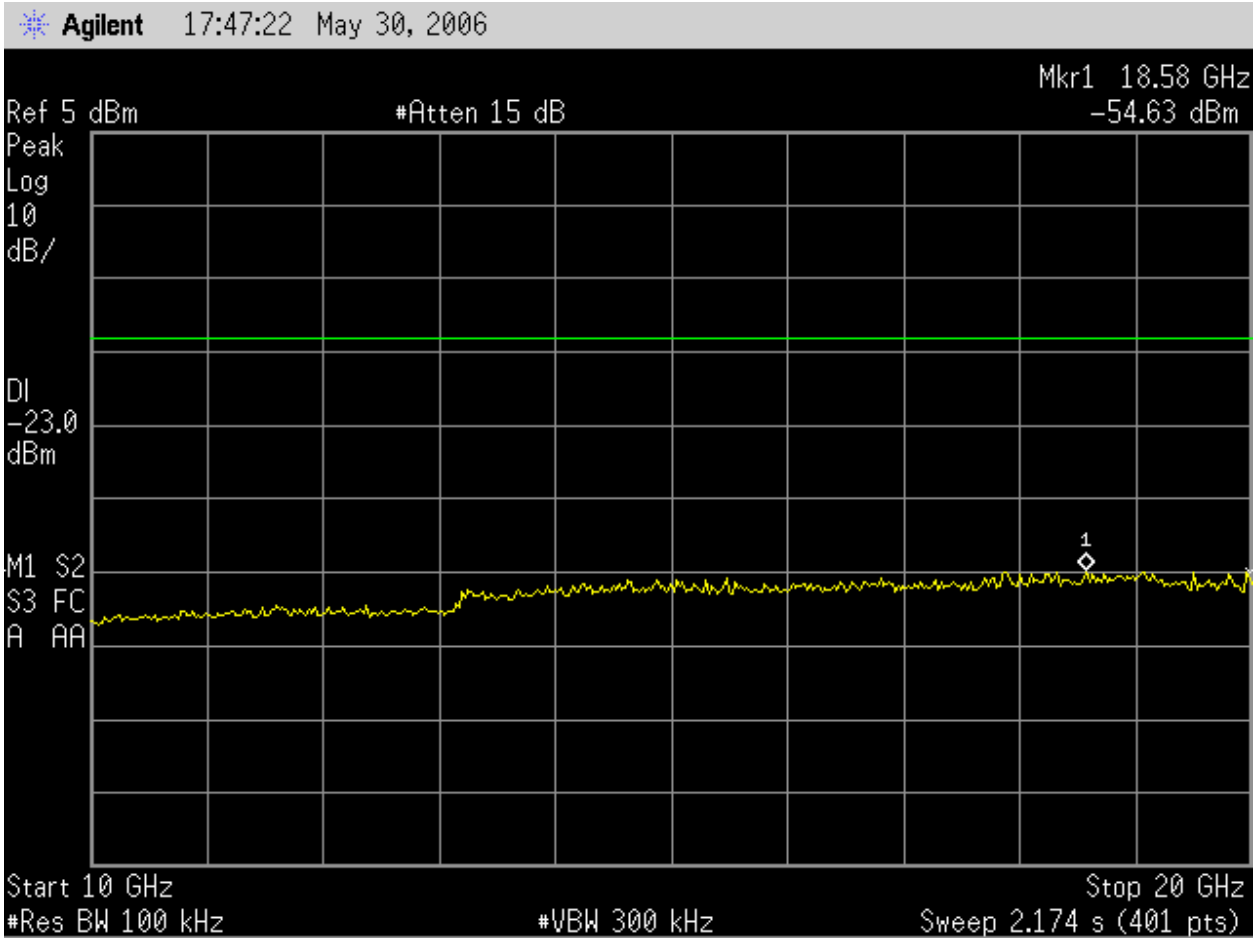
Channel 7 Rx Port 20-25 GHz



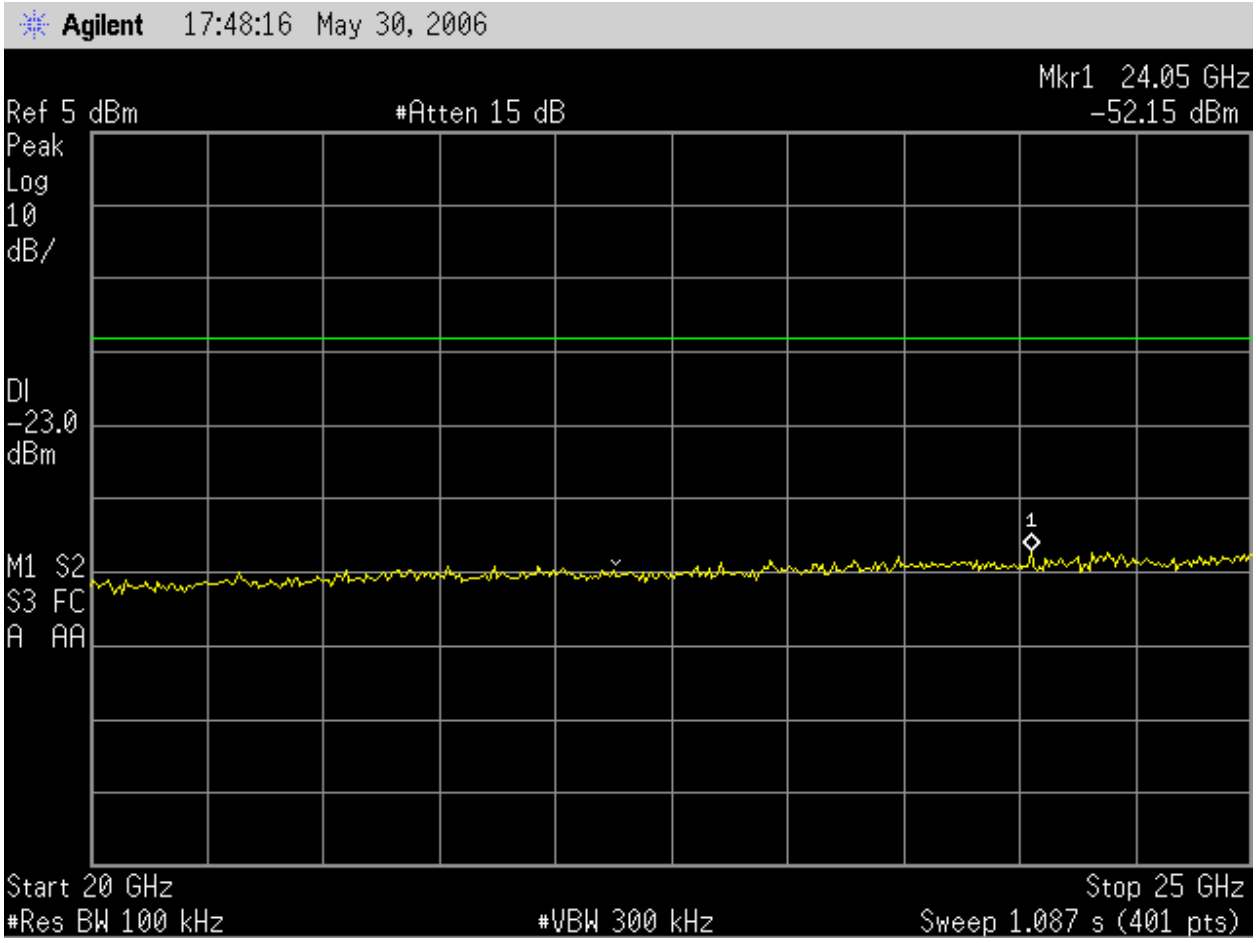
Channel 15 Tx Port 30-2500 MHz



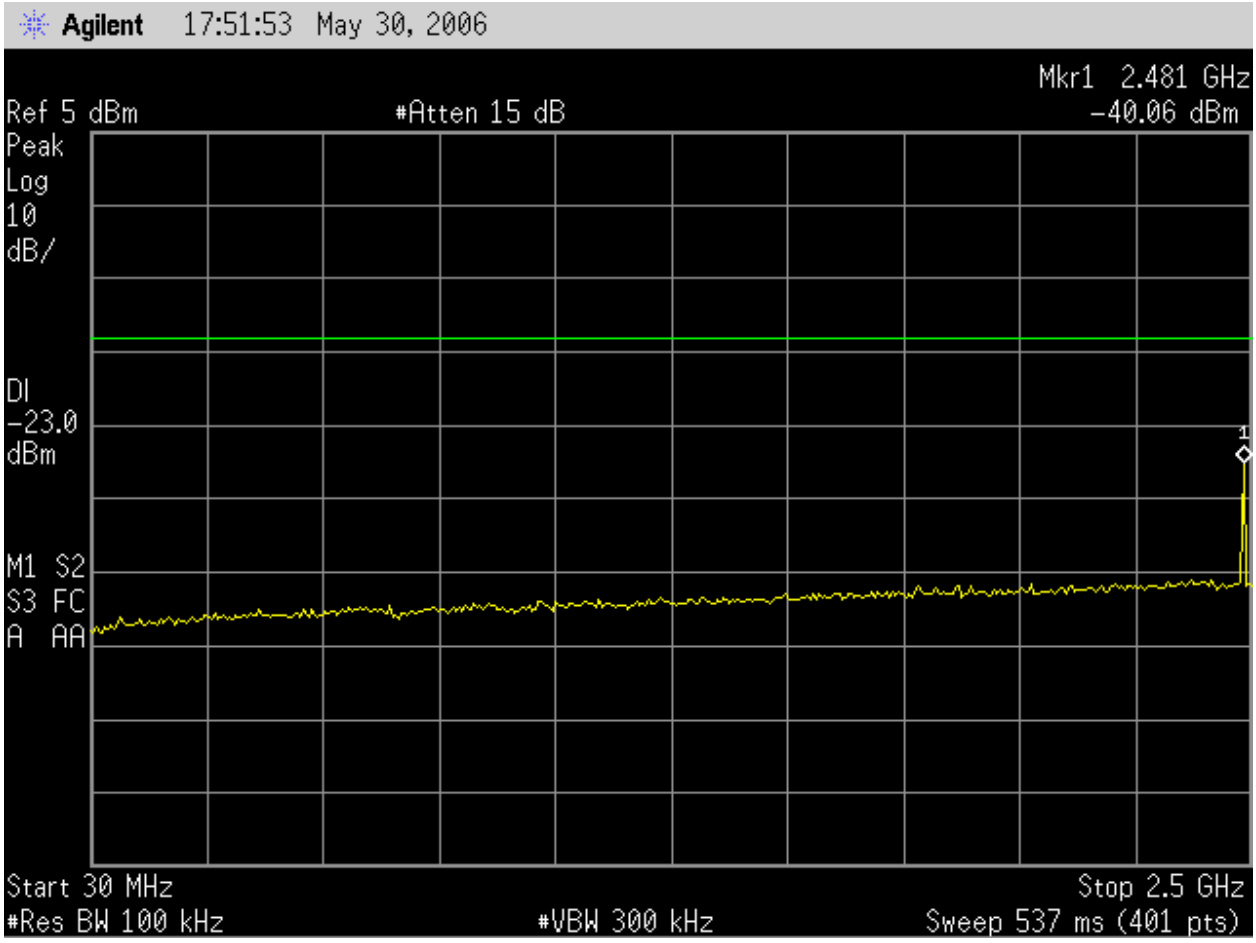
Channel 15 Tx Port 2.4-10 GHz



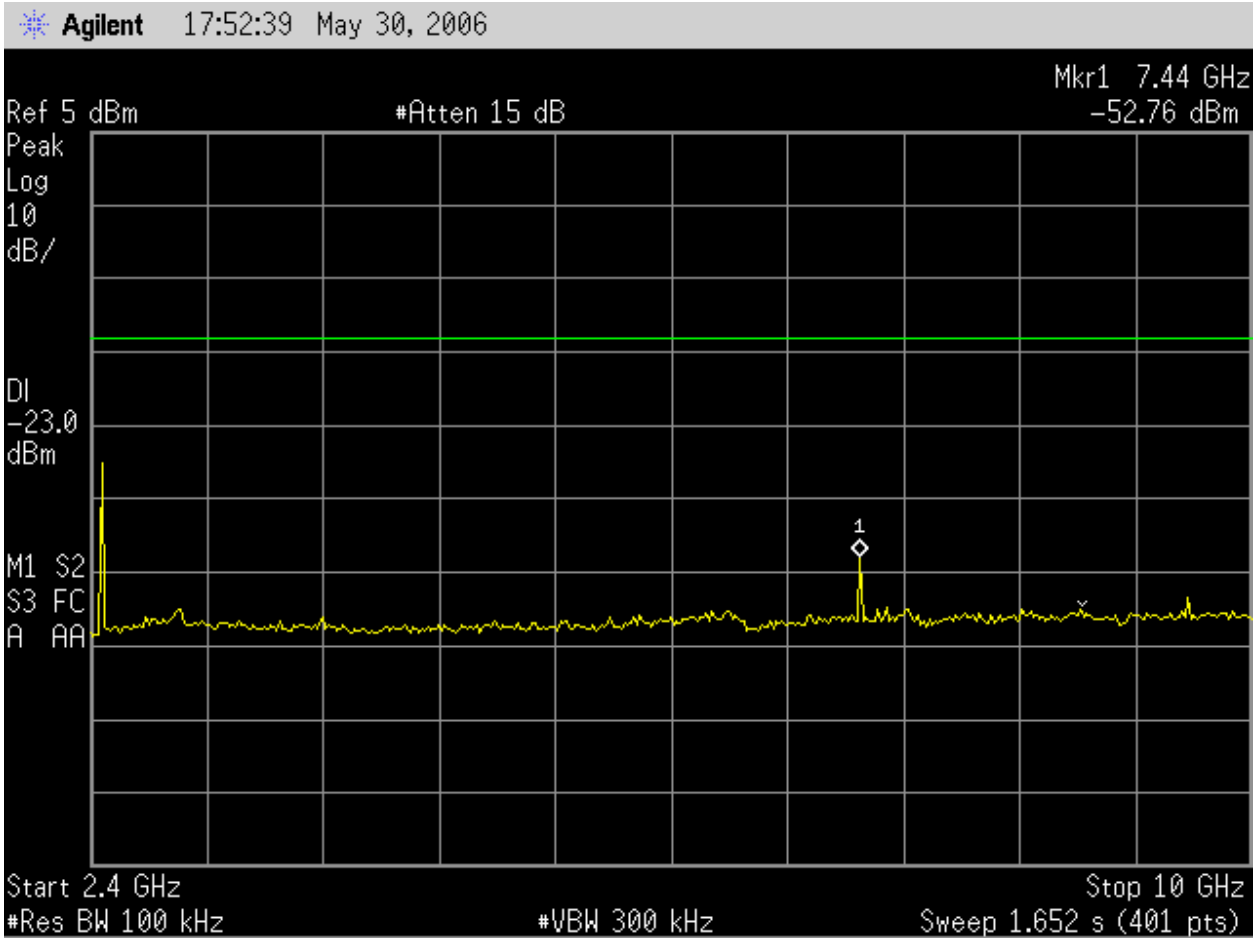
Channel 15 Tx Port 10-20 GHz



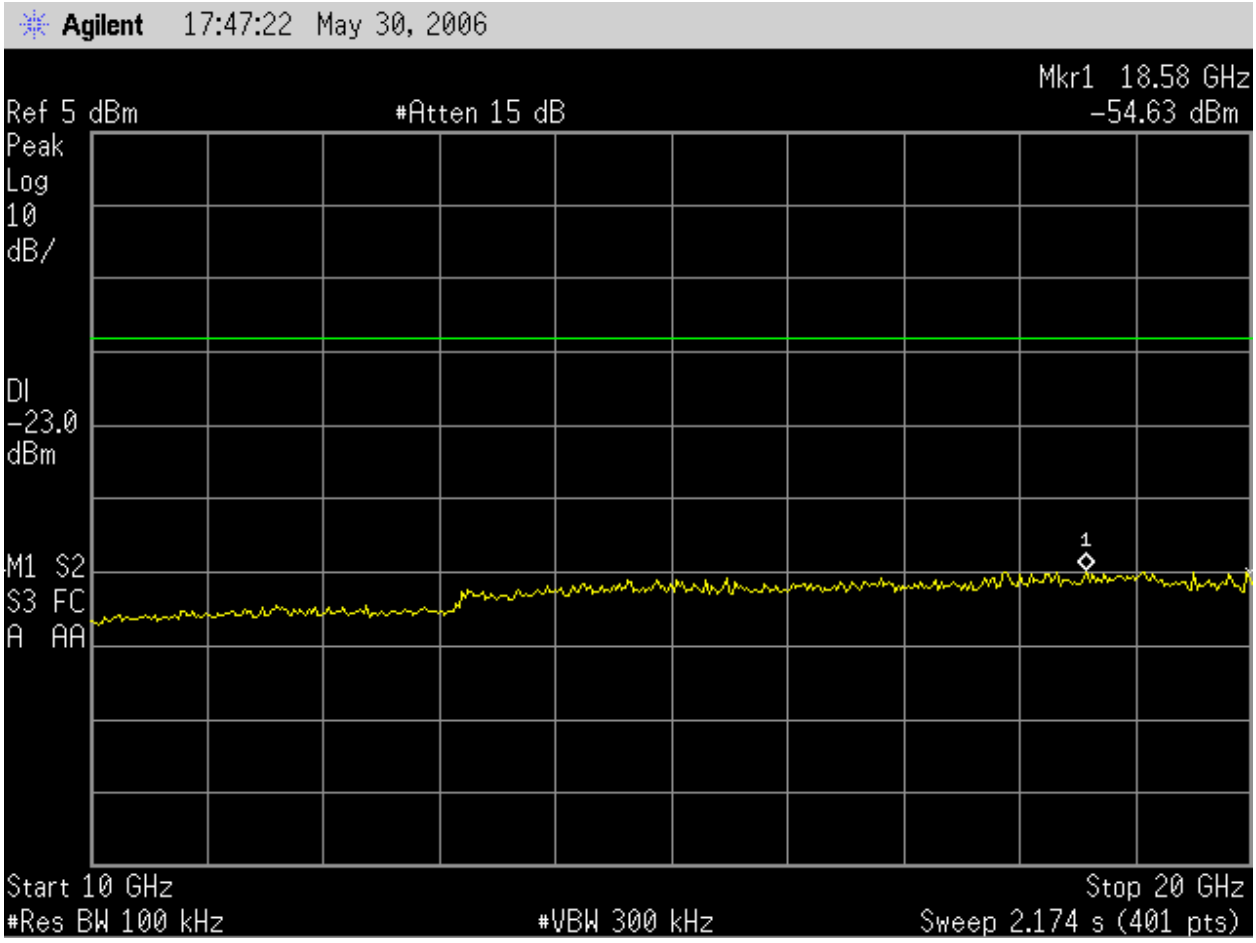
Channel 15 Tx Port 20-25 GHz



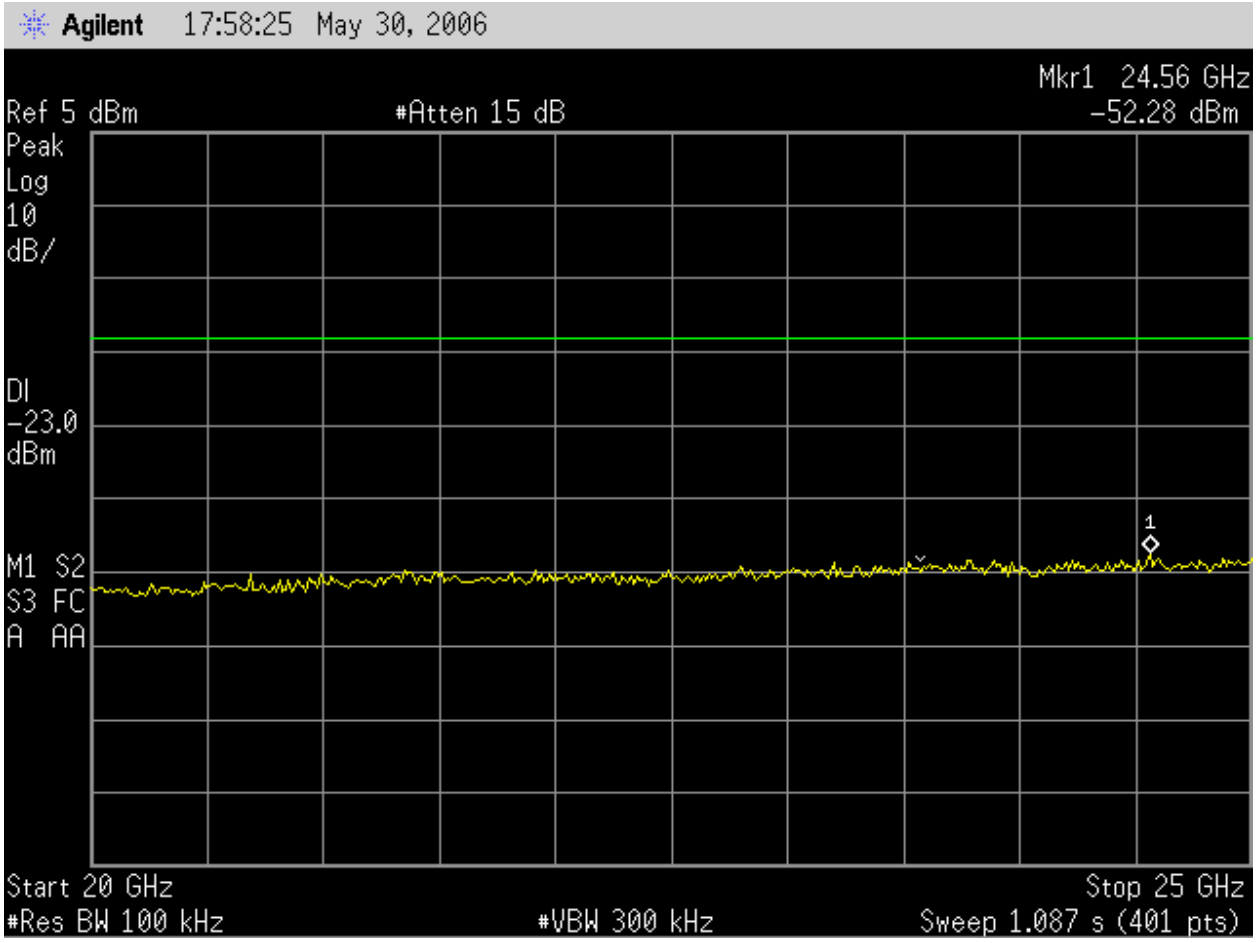
Channel 15 Rx Port 30-2500 MHz



Channel 15 Rx Port 2.4-10 GHz



Channel 15 Rx Port 10-20 GHz



Channel 15 Rx Port 20-25 GHz

Test Results: Pass

Test Standard: FCC 15.205, 15.209, 15.247(d), 15.109, RSS-210 2.2, 2.7, A8.5, ICES-003

Test: Radiated Spurious Emissions

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	See Tables	Pressure (hPa):	See Tables	Ambient (°C):	See Tables
Pretest Verification Performed	N/A		Equipment under Test:		nTAG Access Point	

Maximum Test Parameters: The spurious emissions of the Radio Module must be attenuated below the level of the fundamental by at least 20 dBc. Emissions which fall in the restricted bands must meet the general limits of 15.209 and RSS-210 2.7 Table 2. The spurious emissions of the BEP must not exceed the limits of 15.109 Class A and ICES-003 Class A.

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	08/02/2007
2	ANTENNA	EMCO	3142	9701-1116	11/10/2006
3	ANTENNA, RIDGED GUIDE, 1-18 GHZ	EMCO	3115	2784	08/11/2007
4	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	12/13/2007
5	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 197	CBL028	12/12/2006
6	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL029	12/20/2006
7	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	12/12/2006
8	3 Meter In floor cable for site 2	ITS	RG214B/U	S2 3M FLR	09/02/2006
9	PREAMPLIFIER 1- 40 GHz	MITEQ	NSP4000-NF	507145	11/21/2006
10	Spectrum Analyzer	Agilent	E7405A	US40240205	08/09/2006

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	1/17/06 Revision

Test Results:

Notes: Average values were obtained from peak readings using a 65% duty cycle factor (-3.7 dB). This is based on the indication from nTAG Interactive that the duty cycle depended on deployment circumstances and was not able to be simulated at the test laboratory. Please see Appendix A for a discussion of the maximum duty cycle conditions from which the 65% duty cycle factor was derived. Some average values shown are noise floor readings, using an average detector. Note that the nTAG BEP subcomponent was tested as a Class A digital device, while the nTAG Radio Module subcomponent was tested to FCC Part 15 Subpart C 15.247.

Special Radiated Emissions

Company: nTAG Interactive
Model #: eBOX746-EFL1G A (nTAG BEP P/N: 67-00100)
Serial #: E6160745FC00107
Engineers: Nicholas Abbondante Location: Site 2
Project #: 3097602 Date(s): 05/22/06 5/24-26/2006
Standard: FCC Part 15 Subpart B Class A
Receiver: Agilent E7405A (AGL001) Limit Distance (m): 10
PreAmp: PRE8 11-21-06.amp Test Distance (m): 3
Barometer: BAR2 Temp/Humidity/Pressure: 22c 32% 995mB

Antenna & Cables: N Bands: N, LF, HF, SHF
LF Antenna: EMC02 8-11-06 V3m.ant EMC02 8-11-06 H3m.ant
N Antenna: LOG1 11-10-06 V3.ant LOG1 11-10-06 H3.ant
HF Antenna: EMC02 8-11-06 V3m.ant EMC02 8-11-06 H3m.ant
SHF Antenna: EMC04 V 1m 12-13-2006.txt EMC04 H 1m 12-13-2006.txt
LF Cable(s): CBL028 12-12-2006.txt NONE.
N Cable(s): S2 3M FLR 9-2-2006.cbl NONE.
HF Cable(s): CBL029 12-20-2006.txt CBL030 12-12-2006.txt
SHF Cable(s): CBL029 12-20-2006.txt CBL030 12-12-2006.txt

PreAmp Used? (Y or N): N Voltage/Frequency: 120V/60Hz Frequency Range: 30-1000 MHz
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
QP	V	42.960	24.1	10.5	1.0	0.0	10.5	25.2	39.1	-13.9	120/300 kHz		
QP	V	52.850	12.9	8.1	1.0	0.0	10.5	11.5	39.1	-27.6	120/300 kHz		
QP	V	62.270	14.6	7.0	1.1	0.0	10.5	12.2	39.1	-26.9	120/300 kHz		
QP	V	109.000	12.4	8.9	1.3	0.0	10.5	12.1	43.5	-31.4	120/300 kHz	RB	RB
QP	V	144.000	22.7	8.5	1.5	0.0	10.5	22.1	43.5	-21.4	120/300 kHz		
QP	H	182.800	7.3	10.0	1.9	0.0	10.5	8.8	43.5	-34.7	120/300 kHz		
QP	H	186.100	14.4	10.3	2.0	0.0	10.5	16.2	43.5	-27.3	120/300 kHz		
QP	V	200.300	29.5	10.4	2.1	0.0	10.5	31.6	43.5	-11.9	120/300 kHz		
QP	V	214.800	19.2	11.2	2.1	0.0	10.5	22.1	43.5	-21.4	120/300 kHz		
QP	V	229.100	18.8	11.9	2.1	0.0	10.5	22.3	46.4	-24.1	120/300 kHz		
QP	V	233.400	20.1	12.0	2.1	0.0	10.5	23.8	46.4	-22.6	120/300 kHz		
QP	V	243.500	20.3	12.4	2.1	0.0	10.5	24.3	46.4	-22.1	120/300 kHz	RB	RB
QP	V	266.700	27.5	12.7	2.1	0.0	10.5	31.8	46.4	-14.6	120/300 kHz	RB	RB
QP	V	280.500	20.7	12.7	2.1	0.0	10.5	25.0	46.4	-21.4	120/300 kHz	RB	RB
QP	V	300.700	17.2	13.7	2.1	0.0	10.5	22.6	46.4	-23.8	120/300 kHz		
QP	V	360.400	16.5	15.6	2.4	0.0	10.5	24.1	46.4	-22.3	120/300 kHz		
QP	V	371.200	18.1	15.6	2.5	0.0	10.5	25.7	46.4	-20.7	120/300 kHz		
QP	V	384.000	15.5	15.4	2.6	0.0	10.5	23.0	46.4	-23.4	120/300 kHz		
QP	V	386.500	17.2	15.4	2.6	0.0	10.5	24.7	46.4	-21.7	120/300 kHz		
QP	V	400.000	27.6	14.9	2.7	0.0	10.5	34.7	46.4	-11.7	120/300 kHz	RB	RB
QP	V	133.000	33.2	7.5	1.4	0.0	10.5	31.6	43.5	-11.9	120/300 kHz	RB	RB
QP	V	240.300	24.0	12.4	2.1	0.0	10.5	28.0	46.4	-18.4	120/300 kHz	RB	RB
QP	V	241.100	24.5	12.4	2.1	0.0	10.5	28.5	46.4	-17.9	120/300 kHz	RB	RB
QP	V	408.000	12.3	15.2	2.7	0.0	10.5	19.7	46.4	-26.7	120/300 kHz	RB	RB
QP	V	415.500	7.8	15.5	2.7	0.0	10.5	15.6	46.4	-30.8	120/300 kHz		
QP	V	432.000	14.9	15.8	2.7	0.0	10.5	22.9	46.4	-23.5	120/300 kHz		
QP	V	440.500	14.7	16.1	2.7	0.0	10.5	23.1	46.4	-23.3	120/300 kHz		
QP	V	480.500	16.1	18.0	2.8	0.0	10.5	26.5	46.4	-19.9	120/300 kHz		
QP	V	533.500	17.9	18.3	3.4	0.0	10.5	29.1	46.4	-17.3	120/300 kHz		
QP	V	560.000	28.0	18.3	3.6	0.0	10.5	39.4	46.4	-7.0	120/300 kHz		
QP	V	592.000	26.8	19.5	3.5	0.0	10.5	39.4	46.4	-7.0	120/300 kHz		
QP	V	666.800	18.9	20.4	3.9	0.0	10.5	32.7	46.4	-13.7	120/300 kHz		
QP	V	773.200	9.3	21.4	4.1	0.0	10.5	24.3	46.4	-22.1	120/300 kHz		

Special Radiated Emissions

Company: nTAG Interactive
Model #: AP1000 (Radio Module, nTAG P/N: 400-00200-00)
Serial #: 69 (Dataradio)
Engineers: Nicholas Abbondante Location: Site 2
Project #: 3097602 Date(s): 05/22/06 5/24-26/2006
Standard: FCC Part 15 Subpart C 15.247
Receiver: Agilent E7405A (AGL001) Limit Distance (m): 3
PreAmp: PRE8 11-21-06.amp Test Distance (m): 3
Barometer: BAR2 Temp/Humidity/Pressure: 22c 32% 995mB

Antenna & Cables: N Bands: N, LF, HF, SHF
LF Antenna: EMC02 8-11-06 V3m.ant EMC02 8-11-06 H3m.ant
N Antenna: LOG1 11-10-06 V3.ant LOG1 11-10-06 H3.ant
HF Antenna: EMC02 8-11-06 V3m.ant EMC02 8-11-06 H3m.ant
SHF Antenna: EMC04 V 1m 12-13-2006.txt EMC04 H 1m 12-13-2006.txt
LF Cable(s): CBL028 12-12-2006.txt NONE.
N Cable(s): S2 3M FLR 9-2-2006.cbl NONE.
HF Cable(s): CBL029 12-20-2006.txt CBL030 12-12-2006.txt
SHF Cable(s): CBL029 12-20-2006.txt CBL030 12-12-2006.txt

PreAmp Used? (Y or N): N Voltage/Frequency: 120V/60Hz Frequency Range: 30-1000 MHz
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
PK	V	42.960	28.2	10.5	1.0	0.0	0.0	39.7	79.2	-39.5	120/300 kHz		
QP	V	42.960	24.1	10.5	1.0	0.0	0.0	35.6	79.2	-43.6	120/300 kHz		
PK	V	52.850	18.6	8.1	1.0	0.0	0.0	27.8	79.2	-51.4	120/300 kHz		
QP	V	52.850	12.9	8.1	1.0	0.0	0.0	22.0	79.2	-57.2	120/300 kHz		
PK	V	62.270	20.6	7.0	1.1	0.0	0.0	28.7	79.2	-50.5	120/300 kHz		
QP	V	62.270	14.6	7.0	1.1	0.0	0.0	22.7	79.2	-56.5	120/300 kHz		
QP	V	109.000	12.4	8.9	1.3	0.0	0.0	22.6	43.5	-20.9	120/300 kHz	RB	RB
PK	V	144.000	23.9	8.5	1.5	0.0	0.0	33.9	79.2	-45.3	120/300 kHz		
QP	V	144.000	22.7	8.5	1.5	0.0	0.0	32.6	79.2	-46.6	120/300 kHz		
PK	H	182.800	13.3	10.0	1.9	0.0	0.0	25.2	79.2	-54.0	120/300 kHz		
QP	H	182.800	7.3	10.0	1.9	0.0	0.0	19.3	79.2	-59.9	120/300 kHz		
PK	H	186.100	18.4	10.3	2.0	0.0	0.0	30.7	79.2	-48.5	120/300 kHz		
QP	H	186.100	14.4	10.3	2.0	0.0	0.0	26.7	79.2	-52.5	120/300 kHz		
PK	V	200.300	31.7	10.4	2.1	0.0	0.0	44.2	79.2	-35.0	120/300 kHz		
QP	V	200.300	29.5	10.4	2.1	0.0	0.0	42.1	79.2	-37.1	120/300 kHz		
PK	V	214.800	22.9	11.2	2.1	0.0	0.0	36.2	79.2	-43.0	120/300 kHz		
QP	V	214.800	19.2	11.2	2.1	0.0	0.0	32.5	79.2	-46.7	120/300 kHz		
PK	V	229.100	23.0	11.9	2.1	0.0	0.0	36.9	79.2	-42.3	120/300 kHz		
QP	V	229.100	18.8	11.9	2.1	0.0	0.0	32.8	79.2	-46.4	120/300 kHz		
PK	V	233.400	23.7	12.0	2.1	0.0	0.0	37.8	79.2	-41.4	120/300 kHz		
QP	V	233.400	20.1	12.0	2.1	0.0	0.0	34.2	79.2	-45.0	120/300 kHz		
QP	V	243.500	20.3	12.4	2.1	0.0	0.0	34.8	46.0	-11.2	120/300 kHz	RB	RB
QP	V	266.700	27.5	12.7	2.1	0.0	0.0	42.3	46.0	-3.7	120/300 kHz	RB	RB
QP	V	280.500	20.7	12.7	2.1	0.0	0.0	35.5	46.0	-10.5	120/300 kHz	RB	RB
PK	V	300.700	21.5	13.7	2.1	0.0	0.0	37.3	79.2	-41.9	120/300 kHz		
QP	V	300.700	17.2	13.7	2.1	0.0	0.0	33.0	79.2	-46.2	120/300 kHz		
PK	V	360.400	20.1	15.6	2.4	0.0	0.0	38.1	79.2	-41.1	120/300 kHz		
QP	V	360.400	16.5	15.6	2.4	0.0	0.0	34.5	79.2	-44.7	120/300 kHz		
PK	V	371.200	21.3	15.6	2.5	0.0	0.0	39.4	79.2	-39.8	120/300 kHz		
QP	V	371.200	18.1	15.6	2.5	0.0	0.0	36.2	79.2	-43.0	120/300 kHz		
PK	V	384.000	19.7	15.4	2.6	0.0	0.0	37.7	79.2	-41.5	120/300 kHz		
QP	V	384.000	15.5	15.4	2.6	0.0	0.0	33.4	79.2	-45.8	120/300 kHz		
PK	V	386.500	20.8	15.4	2.6	0.0	0.0	38.7	79.2	-40.5	120/300 kHz		
QP	V	386.500	17.2	15.4	2.6	0.0	0.0	35.2	79.2	-44.0	120/300 kHz		
QP	V	400.000	27.6	14.9	2.7	0.0	0.0	45.2	46.0	-0.8	120/300 kHz	RB	RB
QP	V	133.000	33.2	7.5	1.4	0.0	0.0	42.1	43.5	-1.4	120/300 kHz	RB	RB
QP	V	240.300	24.0	12.4	2.1	0.0	0.0	38.5	46.0	-7.5	120/300 kHz	RB	RB
QP	V	241.100	24.5	12.4	2.1	0.0	0.0	39.0	46.0	-7.0	120/300 kHz	RB	RB
QP	V	408.000	12.3	15.2	2.7	0.0	0.0	30.2	46.0	-15.8	120/300 kHz	RB	RB
PK	V	415.500	18.0	15.5	2.7	0.0	0.0	36.2	79.2	-43.0	120/300 kHz		
QP	V	415.500	7.8	15.5	2.7	0.0	0.0	26.1	79.2	-53.1	120/300 kHz		
PK	V	432.000	17.9	15.8	2.7	0.0	0.0	36.4	79.2	-42.8	120/300 kHz		
QP	V	432.000	14.9	15.8	2.7	0.0	0.0	33.4	79.2	-45.8	120/300 kHz		
PK	V	440.500	19.6	16.1	2.7	0.0	0.0	38.5	79.2	-40.7	120/300 kHz		
QP	V	440.500	14.7	16.1	2.7	0.0	0.0	33.5	79.2	-45.7	120/300 kHz		
PK	V	480.500	19.7	18.0	2.8	0.0	0.0	40.5	79.2	-38.7	120/300 kHz		
QP	V	480.500	16.1	18.0	2.8	0.0	0.0	36.9	79.2	-42.3	120/300 kHz		
PK	V	533.500	20.2	18.3	3.4	0.0	0.0	41.9	79.2	-37.3	120/300 kHz		
QP	V	533.500	17.9	18.3	3.4	0.0	0.0	39.6	79.2	-39.6	120/300 kHz		
PK	V	560.000	28.6	18.3	3.6	0.0	0.0	50.4	79.2	-28.8	120/300 kHz		
QP	V	560.000	28.0	18.3	3.6	0.0	0.0	49.9	79.2	-29.3	120/300 kHz		
PK	V	592.000	27.4	19.5	3.5	0.0	0.0	50.4	79.2	-28.8	120/300 kHz		
QP	V	592.000	26.8	19.5	3.5	0.0	0.0	49.8	79.2	-29.4	120/300 kHz		
PK	V	666.800	20.7	20.4	3.9	0.0	0.0	45.0	79.2	-34.2	120/300 kHz		
QP	V	666.800	18.9	20.4	3.9	0.0	0.0	43.2	79.2	-36.0	120/300 kHz		
PK	V	773.200	12.2	21.4	4.1	0.0	0.0	37.6	79.2	-41.6	120/300 kHz		
QP	V	773.200	9.3	21.4	4.1	0.0	0.0	34.8	79.2	-44.4	120/300 kHz		

Radiated Emissions

Company: nTAG Interactive
Model #: AP1000 (Radio Module, nTAG P/N: 400-00200-00)
Serial #: 69 (Dataradio)
Engineers: Nicholas Abbondante Location: Site 2
Project #: 3097602 Date(s): 05/19/06 05/22/06
Standard: FCC Part 15 Subpart C 15.247
Receiver: Agilent E7405A (AGL001) Limit Distance (m): 3
PreAmp: PRE8 11-21-06.amp Test Distance (m): 3
Barometer: BAR2 Temp/Humidity/Pressure: 22c 48% 988mB

Antenna & Cables: LF Bands: N, LF, HF, SHF
LF Antenna: EMC02 8-11-06 V3m.ant EMC02 8-11-06 H3m.ant
N Antenna: LOG1 11-10-06 V3.ant LOG1 11-10-06 H3.ant
HF Antenna: EMC02 8-11-06 V3m.ant EMC02 8-11-06 H3m.ant
SHF Antenna: EMC04 V 1m 12-13-2006.txt EMC04 H 1m 12-13-2006.txt
LF Cable(s): CBL028 12-12-2006.txt NONE.
N Cable(s): S2 3M FLR 9-2-2006.cbl NONE.
HF Cable(s): CBL029 12-20-2006.txt CBL030 12-12-2006.txt
SHF Cable(s): CBL029 12-20-2006.txt CBL030 12-12-2006.txt

PreAmp Used? (Y or N): N Voltage/Frequency: 120V/60Hz Frequency Range: 1 - 4 GHz

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
PK	H	2405.000	64.1	28.4	3.1	0.0	0.0	95.6	-	-	100/300 kHz		
PK	H	2440.000	64.0	28.5	3.2	0.0	0.0	95.6	-	-	100/300 kHz		
PK	H	2480.000	60.5	28.5	3.2	0.0	0.0	92.2	-	-	100/300 kHz		
PK	V	2405.000	64.6	28.3	3.1	0.0	0.0	96.1	-	-	100/300 kHz		
PK	V	2440.000	67.7	28.4	3.2	0.0	0.0	99.2	-	-	100/300 kHz		
PK	V	2480.000	66.2	28.5	3.2	0.0	0.0	97.8	-	-	100/300 kHz		
PK	V	1033.000	17.1	24.2	2.0	0.0	0.0	43.3	74.0	-30.7	1/3 MHz	RB	RB
AVG	V	1033.000	11.0	24.2	2.0	0.0	0.0	37.2	54.0	-16.8	1/3 MHz	RB	RB
PK	V	1066.000	26.5	24.3	2.0	0.0	0.0	52.8	74.0	-21.2	1/3 MHz	RB	RB
AVG	V	1066.000	10.8	24.3	2.0	0.0	0.0	37.1	54.0	-16.9	1/3 MHz	RB	RB
PK	V	1168.000	19.4	24.5	2.1	0.0	0.0	45.9	74.0	-28.1	1/3 MHz	RB	RB
AVG	V	1168.000	13.5	24.5	2.1	0.0	0.0	40.0	54.0	-14.0	1/3 MHz	RB	RB
PK	V	1200.000	28.7	24.6	2.1	0.0	0.0	55.3	74.0	-18.7	1/3 MHz	RB	RB
AVG	V	1200.000	26.2	24.6	2.1	0.0	0.0	52.9	54.0	-1.1	1/3 MHz	RB	RB
PK	V	1234.000	16.6	24.6	2.1	0.0	0.0	43.3	74.0	-30.7	1/3 MHz	RB	RB
AVG	V	1234.000	10.4	24.6	2.1	0.0	0.0	37.2	54.0	-16.8	1/3 MHz	RB	RB
PK	V	1334.000	24.7	24.8	2.2	0.0	0.0	51.8	74.0	-22.2	1/3 MHz	RB	RB
AVG	V	1334.000	21.3	24.8	2.2	0.0	0.0	48.3	54.0	-5.7	1/3 MHz	RB	RB
PK	V	1466.750	25.2	25.1	2.4	0.0	0.0	52.6	74.0	-21.4	1/3 MHz	RB	RB
AVG	V	1466.750	19.3	25.1	2.4	0.0	0.0	46.7	54.0	-7.3	1/3 MHz	RB	RB
PK	V	1880.000	20.4	26.8	2.7	0.0	0.0	50.0	79.2	-29.2	100/300 kHz		

Special Radiated Emissions

Company: nTAG Interactive
Model #: AP1000 (Radio Module, nTAG P/N: 400-00200-00)
Serial #: 69 (Dataradio)
Engineers: Nicholas Abbondante Location: Site 2
Project #: 3097602 Date(s): 05/19/06 05/22/06
Standard: FCC Part 15 Subpart C 15.247
Receiver: Agilent E7405A (AGL001) Limit Distance (m): 3
PreAmp: PRE8 11-21-06.amp Test Distance (m): 3
Barometer: BAR2 Temp/Humidity/Pressure: 21c 59% 987mB

Antenna & Cables: HF Bands: N, LF, HF, SHF
LF Antenna: EMC02 8-11-06 V3m.ant EMC02 8-11-06 H3m.ant
N Antenna: LOG1 11-10-06 V3.ant LOG1 11-10-06 H3.ant
HF Antenna: EMC02 8-11-06 V3m.ant EMC02 8-11-06 H3m.ant
SHF Antenna: EMC04 V 1m 12-13-2006.txt EMC04 H 1m 12-13-2006.txt
LF Cable(s): CBL028 12-12-2006.txt NONE.
N Cable(s): S2 3M FLR 9-2-2006.cbl NONE.
HF Cable(s): CBL029 12-20-2006.txt CBL030 12-12-2006.txt
SHF Cable(s): CBL029 12-20-2006.txt CBL030 12-12-2006.txt

PreAmp Used? (Y or N): Y Voltage/Frequency: 120V/60Hz Frequency Range: 4 - 18 GHz

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
PK	H	4880.000	39.7	33.2	3.8	22.5	0.0	54.1	74.0	-19.9	1/3 MHz	RB	RB
AVG	H	4880.000	36.0	33.2	3.8	22.5	0.0	50.4	54.0	-3.6	1/3 MHz	RB	RB
PK	H	7320.000	35.9	36.1	4.9	21.4	0.0	55.5	74.0	-18.5	1/3 MHz	RB	RB
AVG	H	7320.000	32.2	36.1	4.9	21.4	0.0	51.8	54.0	-2.2	1/3 MHz	RB	RB
PK	H	9760.000	20.6	38.1	5.8	19.0	0.0	45.4	79.2	-33.8	100/300 kHz		
PK	H	12200.000	30.1	38.9	6.6	19.4	0.0	56.2	74.0	-17.8	1/3 MHz	RB	RB
AVG	H	12200.000	19.4	38.9	6.6	19.4	0.0	45.5	54.0	-8.5	1/3 MHz	RB	RB
PK	H	14640.000	24.2	42.0	7.3	21.1	0.0	52.4	79.2	-26.8	100/300 kHz		
PK	V	4880.000	37.1	33.1	3.8	22.5	0.0	51.5	74.0	-22.5	1/3 MHz	RB	RB
AVG	V	4880.000	33.4	33.1	3.8	22.5	0.0	47.8	54.0	-6.2	1/3 MHz	RB	RB
PK	V	7320.000	35.5	36.1	4.9	21.4	0.0	55.1	74.0	-18.9	1/3 MHz	RB	RB
AVG	V	7320.000	31.8	36.1	4.9	21.4	0.0	51.4	54.0	-2.6	1/3 MHz	RB	RB
PK	V	9760.000	22.1	37.9	5.8	19.0	0.0	46.7	79.2	-32.5	100/300 kHz		
PK	V	12200.000	28.1	38.8	6.6	19.4	0.0	54.0	74.0	-20.0	1/3 MHz	RB	RB
AVG	V	12200.000	19.2	38.8	6.6	19.4	0.0	45.2	54.0	-8.8	1/3 MHz	RB	RB
PK	V	14640.000	23.9	41.8	7.3	21.1	0.0	52.0	79.2	-27.2	100/300 kHz		
PK	V	4960.000	35.6	33.3	3.9	22.6	0.0	50.2	74.0	-23.8	1/3 MHz	RB	RB
AVG	V	4960.000	31.9	33.3	3.9	22.6	0.0	46.5	54.0	-7.5	1/3 MHz	RB	RB
PK	V	7440.000	36.2	36.4	4.9	21.3	0.0	56.2	74.0	-17.8	1/3 MHz	RB	RB
AVG	V	7440.000	32.5	36.4	4.9	21.3	0.0	52.5	54.0	-1.5	1/3 MHz	RB	RB
PK	V	9920.000	19.9	38.0	5.8	18.9	0.0	44.8	79.2	-34.4	100/300 kHz		
PK	V	12400.000	29.1	38.5	6.6	19.5	0.0	54.8	74.0	-19.2	1/3 MHz	RB	RB
AVG	V	12400.000	19.2	38.5	6.6	19.5	0.0	44.9	54.0	-9.1	1/3 MHz	RB	RB
PK	V	14880.000	24.0	40.9	7.4	21.3	0.0	51.0	79.2	-28.2	100/300 kHz		
PK	H	4960.000	36.3	33.3	3.9	22.6	0.0	50.9	74.0	-23.1	1/3 MHz	RB	RB
AVG	H	4960.000	32.6	33.3	3.9	22.6	0.0	47.2	54.0	-6.8	1/3 MHz	RB	RB
PK	H	7440.000	36.4	36.3	4.9	21.3	0.0	56.4	74.0	-17.6	1/3 MHz	RB	RB
AVG	H	7440.000	32.7	36.3	4.9	21.3	0.0	52.7	54.0	-1.3	1/3 MHz	RB	RB
PK	H	9920.000	20.9	38.1	5.8	18.9	0.0	45.9	79.2	-33.3	100/300 kHz		
PK	H	12400.000	30.1	38.6	6.6	19.5	0.0	55.9	74.0	-18.1	1/3 MHz	RB	RB
AVG	H	12400.000	19.2	38.6	6.6	19.5	0.0	45.0	54.0	-9.0	1/3 MHz	RB	RB
PK	H	14880.000	23.1	41.0	7.4	21.3	0.0	50.1	79.2	-29.1	100/300 kHz		
PK	V	4810.000	40.9	33.0	3.8	22.5	0.0	55.2	74.0	-18.8	1/3 MHz	RB	RB
AVG	V	4810.000	37.2	33.0	3.8	22.5	0.0	51.5	54.0	-2.5	1/3 MHz	RB	RB
PK	V	7215.000	24.5	35.9	4.8	21.5	0.0	43.8	79.2	-35.4	100/300 kHz		
PK	V	9620.000	20.0	37.9	5.7	19.1	0.0	44.5	79.2	-34.7	100/300 kHz		
PK	V	12025.000	28.8	39.0	6.5	19.3	0.0	54.9	74.0	-19.1	1/3 MHz	RB	RB
AVG	V	12025.000	18.8	39.0	6.5	19.3	0.0	44.9	54.0	-9.1	1/3 MHz	RB	RB
PK	V	14430.000	24.0	42.2	7.3	20.8	0.0	52.6	79.2	-26.6	100/300 kHz		
PK	H	4810.000	41.7	33.0	3.8	22.5	0.0	56.0	74.0	-18.0	1/3 MHz	RB	RB
AVG	H	4810.000	38.0	33.0	3.8	22.5	0.0	52.3	54.0	-1.7	1/3 MHz	RB	RB
PK	H	7215.000	24.8	35.9	4.8	21.5	0.0	44.0	79.2	-35.2	100/300 kHz		
PK	H	9620.000	18.8	38.0	5.7	19.1	0.0	43.4	79.2	-35.8	100/300 kHz		
PK	H	12025.000	28.7	39.1	6.5	19.3	0.0	55.0	74.0	-19.0	1/3 MHz	RB	RB
AVG	H	12025.000	18.7	39.1	6.5	19.3	0.0	45.1	54.0	-8.9	1/3 MHz	RB	RB
PK	H	14430.000	23.8	42.4	7.3	20.8	0.0	52.7	79.2	-26.5	100/300 kHz		

Special Radiated Emissions

Company: nTAG Interactive
Model #: AP1000 (Radio Module, nTAG P/N: 400-00200-00)
Serial #: 69 (Dataradio)
Engineers: Nicholas Abbondante Location: Site 2
Project #: 3097602 Date(s): 05/22/06
Standard: FCC Part 15 Subpart C 15.247
Receiver: Agilent E7405A (AGL001) Limit Distance (m): 3
PreAmp: PRE8 11-21-06.amp Test Distance (m): 3
Barometer: BAR2 Temp/Humidity/Pressure: 22c 32% 995mB

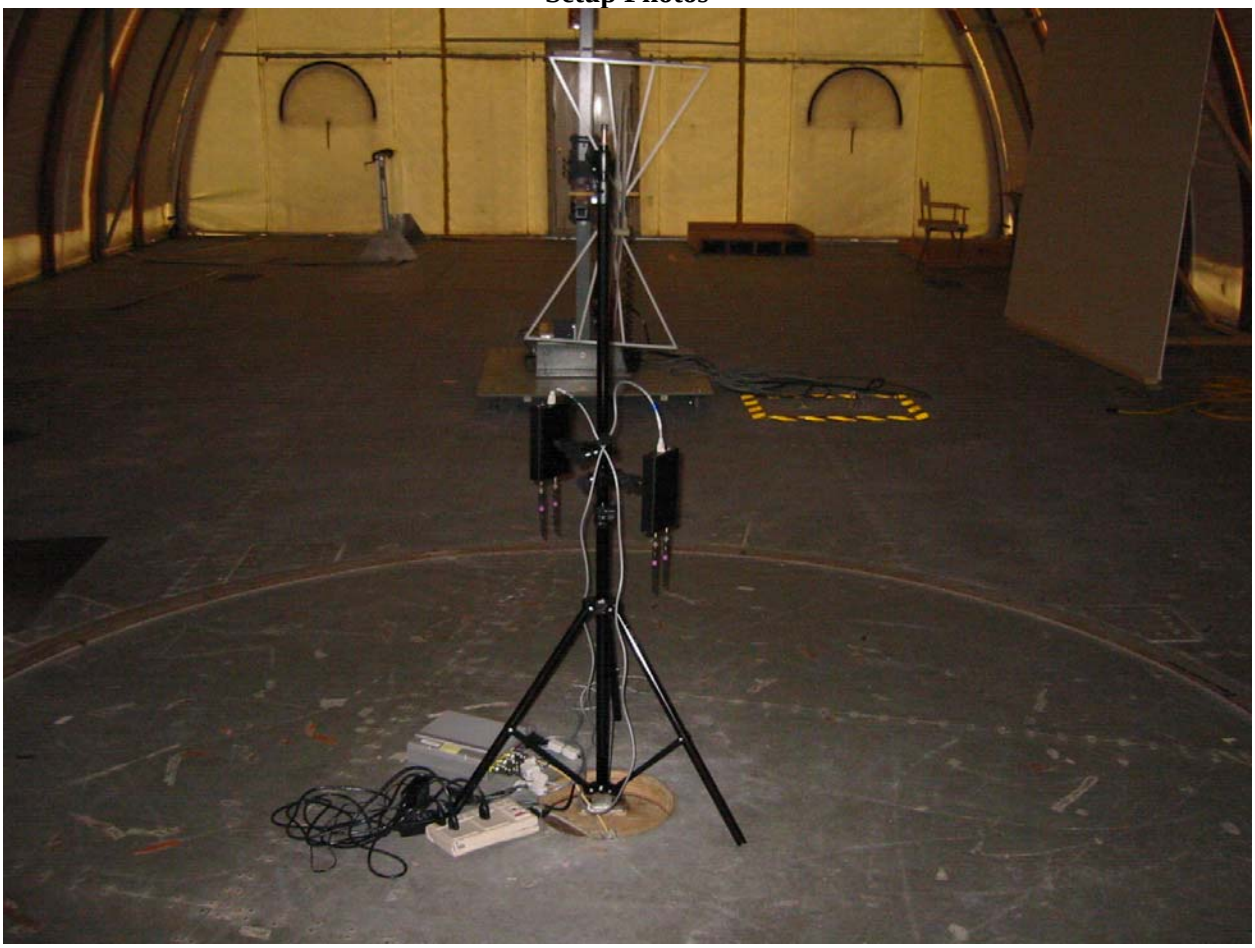
Antenna & Cables: SHF Bands: N, LF, HF, SHF
LF Antenna: EMC02 8-11-06 V3m.ant EMC02 8-11-06 H3m.ant
N Antenna: LOG1 11-10-06 V3.ant LOG1 11-10-06 H3.ant
HF Antenna: EMC02 8-11-06 V3m.ant EMC02 8-11-06 H3m.ant
SHF Antenna: EMC04 V 1m 12-13-2006.txt EMC04 H 1m 12-13-2006.txt
LF Cable(s): CBL028 12-12-2006.txt NONE.
N Cable(s): S2 3M FLR 9-2-2006.cbl NONE.
HF Cable(s): CBL029 12-20-2006.txt CBL030 12-12-2006.txt
SHF Cable(s): CBL029 12-20-2006.txt CBL030 12-12-2006.txt

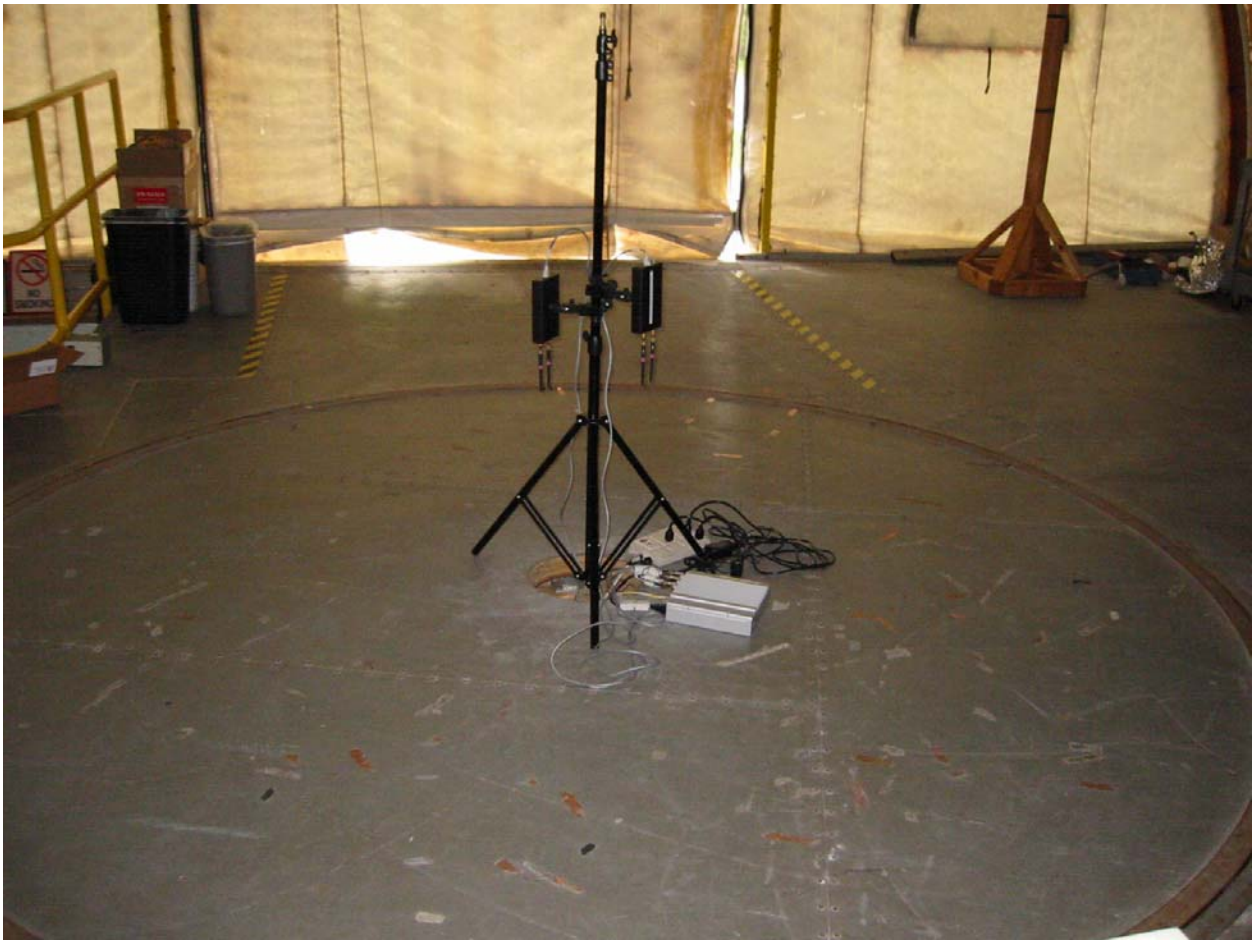
PreAmp Used? (Y or N): Y Voltage/Frequency: 120V/60Hz Frequency Range: 18 - 26 GHz

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
PK	H	19250.000	31.6	45.9	8.8	25.2	0.0	61.1	74.0	-12.9	1/3 MHz	RB	RB
AVG	H	19250.000	21.7	45.9	8.8	25.2	0.0	51.1	54.0	-2.9	1/3 MHz	RB	RB
PK	H	23500.000	23.3	46.1	9.9	20.5	0.0	58.8	79.2	-20.4	100/300 kHz		
PK	H	24500.000	23.6	46.3	10.2	21.0	0.0	59.1	79.2	-20.1	100/300 kHz		

Setup Photos





Test Results: Pass

Test Standard: FCC 15.247(e), RSS-210 A8.2

Test: Peak Power Spectral Density

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	N/A	Pressure (hPa):	N/A	Ambient (°C):	N/A
Pretest Verification Performed	N/A		Equipment under Test:		nTAG Access Point	

Maximum Test Parameters: The peak power spectral density of the Radio Module must not exceed 8 dBm / 3 kHz.

Test Equipment Used:

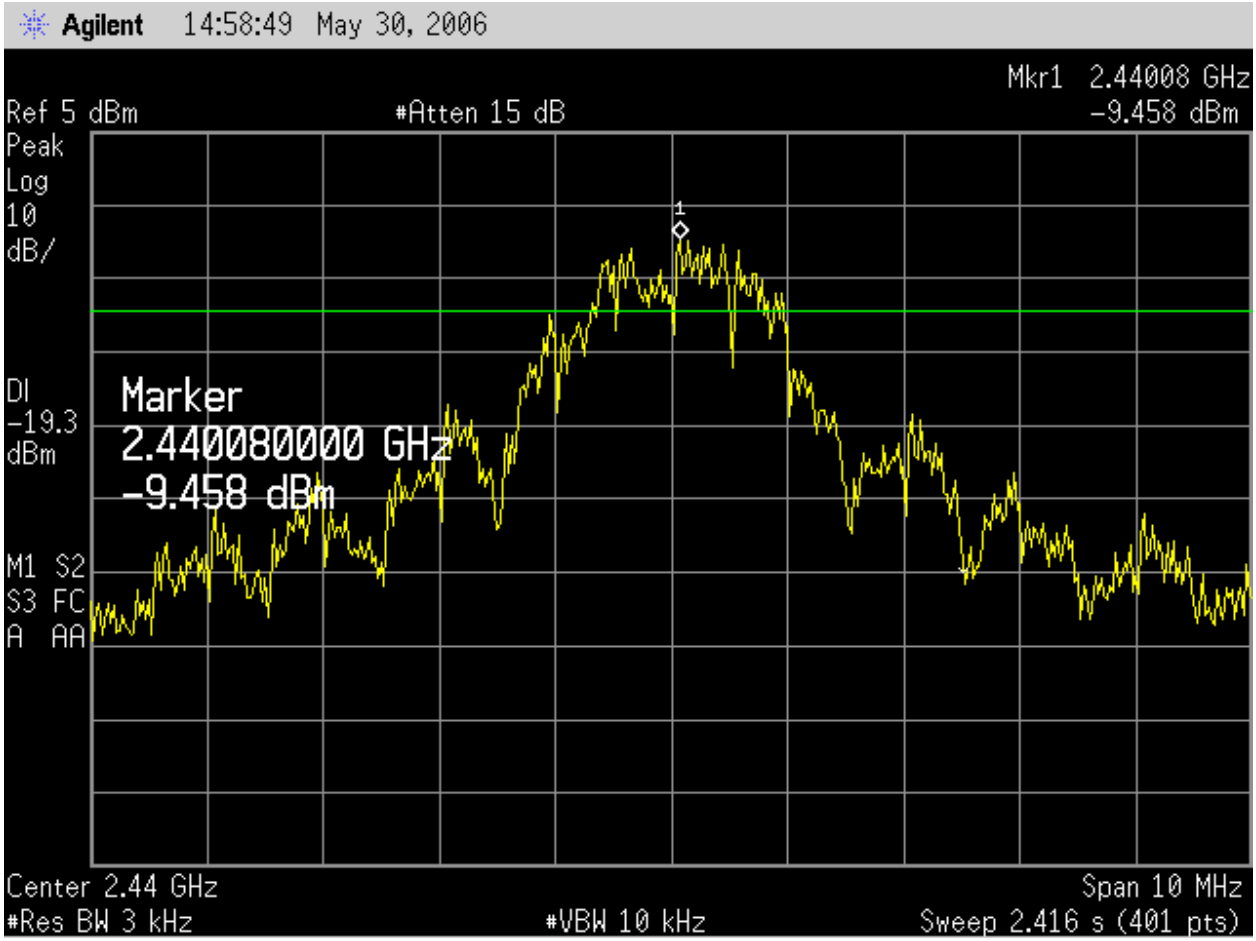
TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Spectrum Analyzer	Agilent	E7405A	US40240205	08/09/2006
2	High Frequency Cable 40Ghz	Megaphase	TM40 K1K1 197	CBL028	12/12/2006

Test Results:

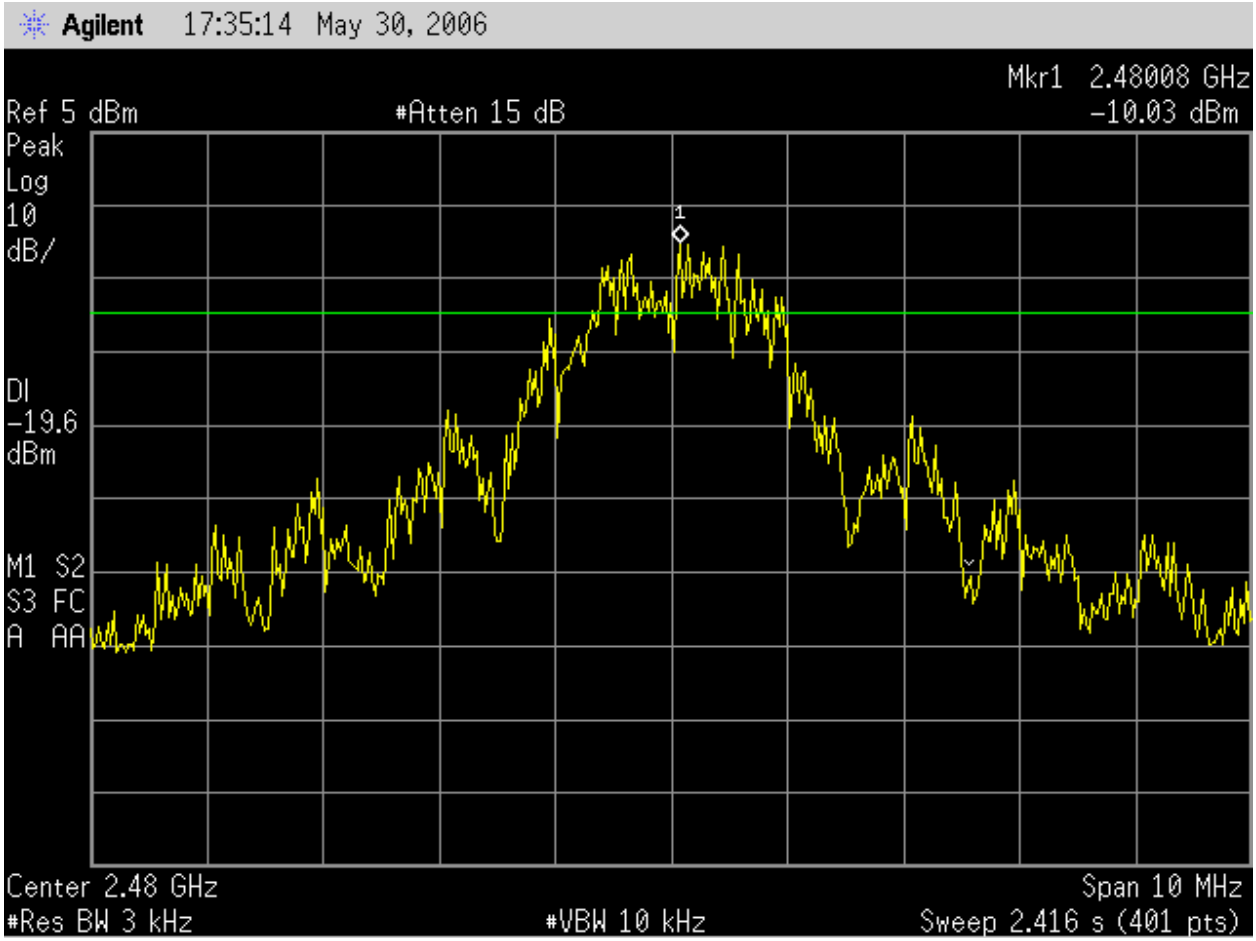
Notes: The cable loss was compensated for in the spectrum analyzer.

Channel	Frequency	Peak Power Spectral Density
0	2405 MHz	-10.27 dBm
7	2440 MHz	-9.46 dBm
15	2480 MHz	-10.03 dBm

Channel 0 Peak Power Spectral Density



Channel 7 Peak Power Spectral Density



Channel 15 Peak Power Spectral Density

Test Results: Pass

Test Standard: FCC 15.215, RSS-210 2.1, A8.5

Test: Band Edge Compliance

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	N/A	Pressure (hPa):	N/A	Ambient (°C):	N/A
Pretest Verification Performed	N/A		Equipment under Test:		nTAG Access Point	

Maximum Test Parameters: The fundamental frequency of the Radio Module must stay within the assigned frequency band.

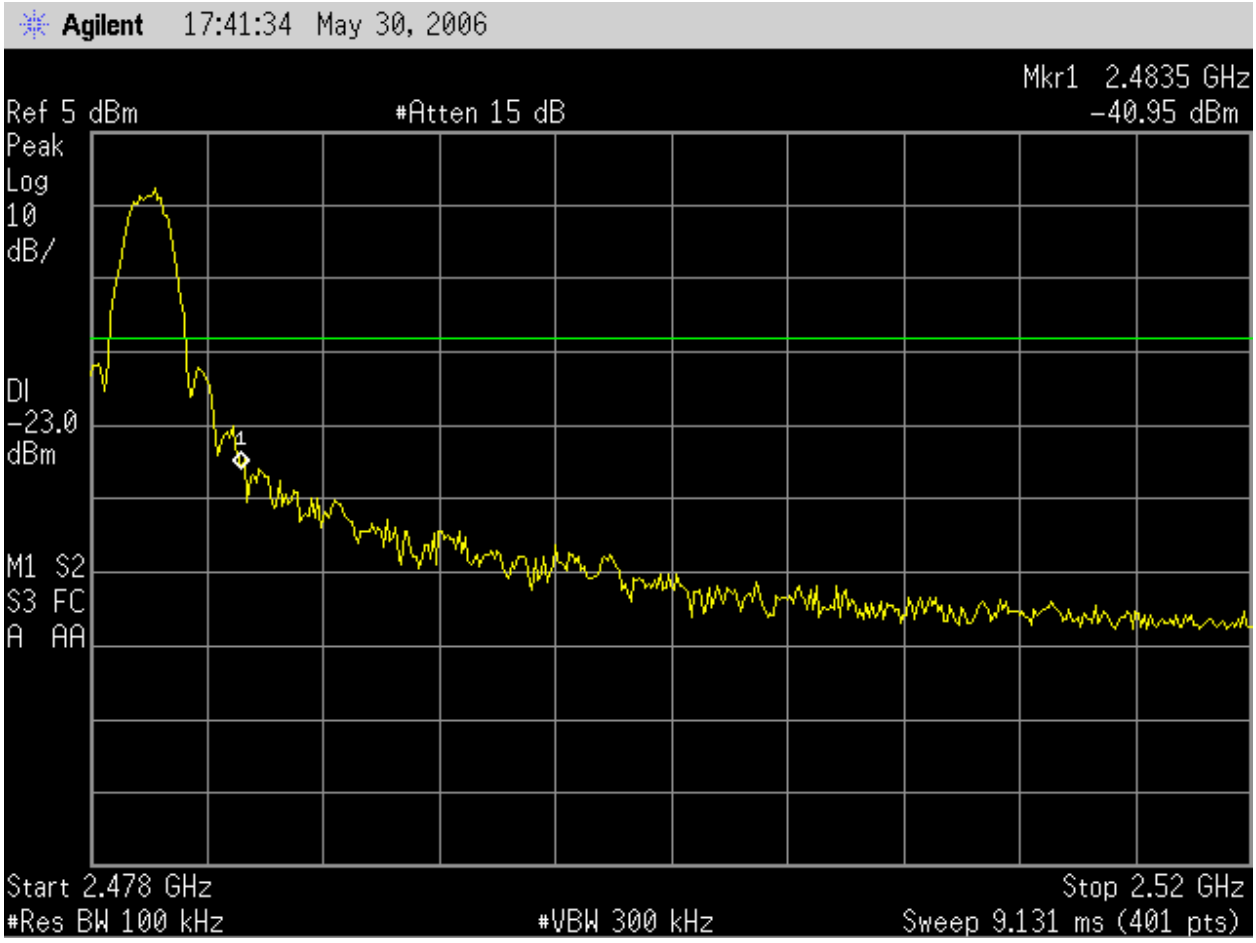
Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Spectrum Analyzer	Agilent	E7405A	US40240205	08/09/2006
2	High Frequency Cable 40Ghz	Megaphase	TM40 K1K1 197	CBL028	12/12/2006

Test Results:

Notes: The cable loss was compensated for in the spectrum analyzer. A 100 kHz bandwidth was used, and a display line was placed 20 dB down from the peak of the channel shown. A marker was placed at the band edge. Note that no signal level beyond the band edge exceeds the level of the display line, and therefore the band edge requirements are met.

Channel 0 Band Edge Compliance



Channel 15 Band Edge Compliance

Test Results: Pass

Test Standard: FCC 15.207, 15.107, RSS-Gen 7.2.2, ICES-003

Test: AC Line-Conducted Spurious Emissions

Test Environment:

Environmental Conditions During Testing:	Humidity (%):	See Tables	Pressure (hPa):	See Tables	Ambient (°C):	See Tables
Pretest Verification Performed	N/A		Equipment under Test:		nTAG Access Point	

Maximum Test Parameters: The AC line-conducted emissions of the Radio Module must not exceed the limits of 15.207 and RSS-Gen 7.2.2 Table 2. The AC line-conducted emissions of the BEP must not exceed the limits of 15.107 Class A and ICES-003 Class A.

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	LISN, 50uH, .01 - 50MHz, 24A	Solar Electronics	9252-50-R-24-BNC	941713	07/05/2007
2	LISN, 50uH, .01 - 50MHz, 24A	Solar Electronics	9252-50-R-24-BNC	955107	04/11/2007
3	LISN, 50uH, .01 - 50MHz, 24A	Solar Electronics	8012-50-R-24-BNC	934611	08/09/2007
4	Cable, BNC - BNC, 15' long	Belden	RG-58/U	CBL022	01/03/2007
5	Attenuator, 20dB	Mini Circuits	20dB, 50 ohm	DS24	08/12/2006
6	Spectrum Analyzer	Agilent	E7405A	US40240205	08/09/2006
7	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	08/02/2007

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	1/17/06 Revision

Test Results:

Notes: The nTAG BEP subcomponent was tested as a Class A digital device, while the nTAG Radio Module subcomponent was tested to the requirements of FCC Part 15 Subpart C 15.207.

Conducted Emissions

Company: nTAG Interactive
Model #: AP1000 (Radio Module nTAG P/N: 400-00200-00)
Serial #: 69 (Dataradio)
Engineer(s): Nicholas Abbondante Location: Site 2
Project #: 3097602 Date: 05/26/06
Standard: FCC Part 15 Subpart C 15.247
Barometer: BAR2 Temp/Humidity/Pressure: 24c 42% 995mB

Receiver: Agilent E7405A (AGL001)
Cable: CBL022 1-03-07.cbl
LISN 1: LISN11 [1] 7-05-07.lsn
LISN 2: LISN11 [2] 7-05-07.lsn
LISN 3: LISN13 [1] 4-11-07.lsn
LISN 4: LISN13 [2] 4-11-07.lsn
Attenuator: DS24 8-12-06.txt

Voltage/Frequency: 120V/60Hz Frequency Range: 150 kHz - 30 MHz

Net is the sum of worst-case lisn, cable, & attenuator losses, and initial reading, factors are not shown

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor; Bandwidth denoted as RBW/VBW

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Line 4 dB(uV)	Net dB(uV)	QP Limit dB(uV)	Margin dB	Bandwidth
Note: Dataradio									
QP	0.199	27.9	27.9			48.7	63.6	-15.0	9/30 kHz
QP	0.265	24.3	23.7			45.1	61.3	-16.1	9/30 kHz
QP	0.598	26.4	26.9			47.6	56.0	-8.4	9/30 kHz
QP	1.260	20.2	20.3			41.1	56.0	-14.9	9/30 kHz
QP	4.845	16.7	18.1			39.1	56.0	-16.9	9/30 kHz
QP	15.000	10.1	8.1			31.5	60.0	-28.5	9/30 kHz

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Line 4 dB(uV)	Net dB(uV)	Average Limit dB(uV)	Margin dB	Bandwidth
Note: Dataradio									
AVG	0.199	27.2	26.5			48.0	53.6	-5.7	9/30 kHz
AVG	0.265	22.9	22.2			43.7	51.3	-7.6	9/30 kHz
AVG	0.598	24.6	25.2			45.9	46.0	-0.1	9/30 kHz
AVG	1.260	18.4	18.5			39.3	46.0	-6.7	9/30 kHz
AVG	4.845	14.9	16.9			37.9	46.0	-8.1	9/30 kHz
AVG	15.000	7.8	6.0			29.2	50.0	-20.8	9/30 kHz

Conducted Emissions

Company: nTAG Interactive
Model #: eBOX746-EFL1G A (nTAG BEP P/N: 67-00100)
Serial #: E6160745FC00107
Engineer(s): Nicholas Abbondante Location: Site 2
Project #: 3097602 Date: 05/26/06
Standard: FCC Part 15 Subpart B Class A
Barometer: BAR2 Temp/Humidity/Pressure: 24c 42% 995mB

Receiver: Agilent E7405A (AGL001)
Cable: CBL022 1-03-07.cbl
LISN 1: LISN11 [1] 7-05-07.lsn
LISN 2: LISN11 [2] 7-05-07.lsn
LISN 3: LISN13 [1] 4-11-07.lsn
LISN 4: LISN13 [2] 4-11-07.lsn
Attenuator: DS24 8-12-06.txt

Voltage/Frequency: 120V/60Hz Frequency Range: 150 kHz - 30 MHz

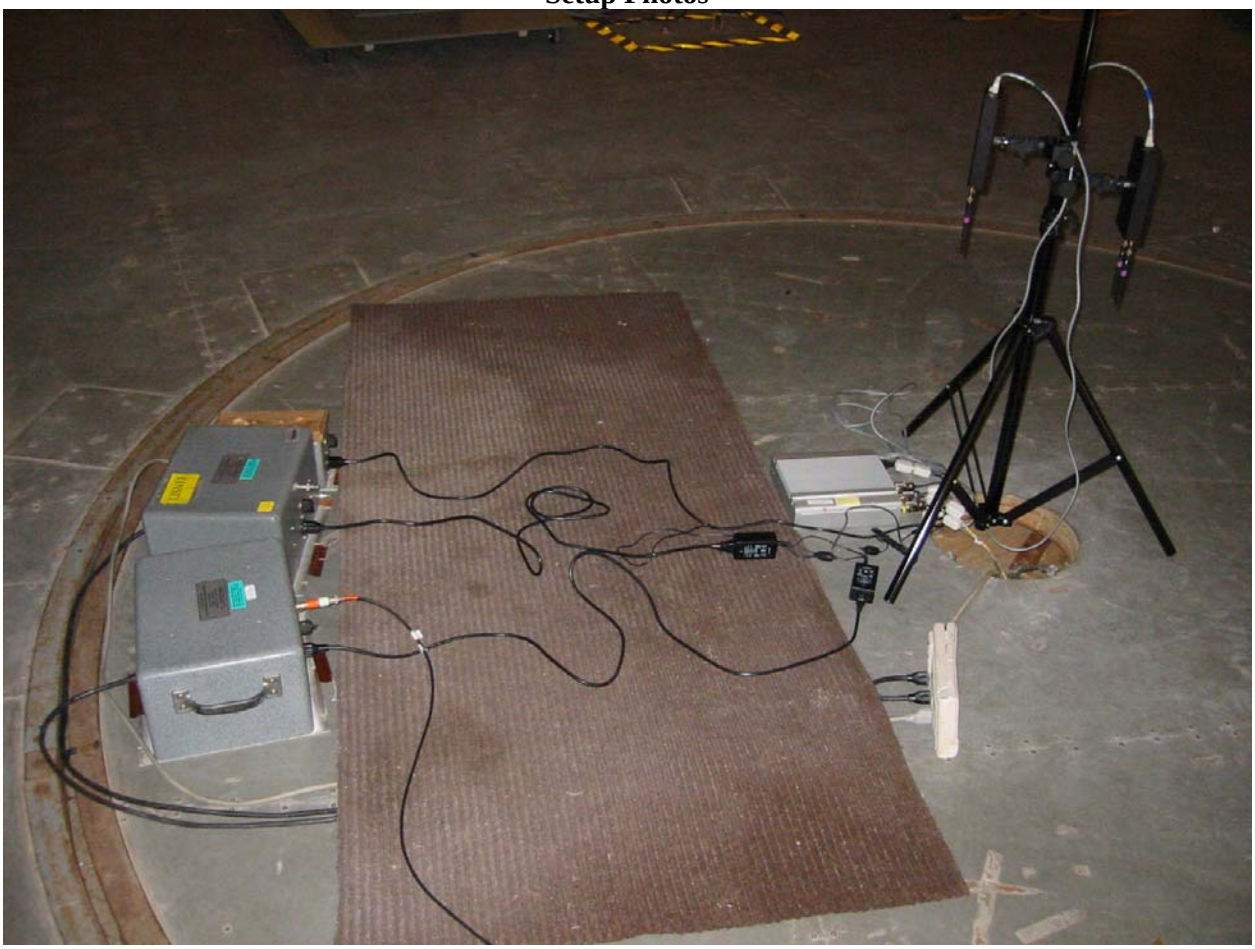
Net is the sum of worst-case lisn, cable, & attenuator losses, and initial reading, factors are not shown

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor; Bandwidth denoted as RBW/VBW

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Line 4 dB(uV)	Net dB(uV)	QP Limit dB(uV)	Margin dB	Bandwidth
Note: BEP									
QP	0.200			32.4	32.3	53.1	79.0	-25.9	9/30 kHz
QP	0.272			31.2	31.2	52.0	79.0	-27.0	9/30 kHz
QP	0.468			29.0	27.8	49.8	79.0	-29.2	9/30 kHz
QP	0.528			35.1	34.4	56.0	73.0	-17.0	9/30 kHz
QP	0.587			32.4	32.2	53.2	73.0	-19.8	9/30 kHz
QP	0.650			27.7	27.8	48.6	73.0	-24.4	9/30 kHz
QP	3.810			18.2	15.6	39.2	73.0	-33.8	9/30 kHz
QP	6.621			13.9	9.0	35.0	73.0	-38.0	9/30 kHz

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Line 4 dB(uV)	Net dB(uV)	Average Limit dB(uV)	Margin dB	Bandwidth
Note: BEP									
AVG	0.200			28.8	28.7	49.6	66.0	-16.4	9/30 kHz
AVG	0.272			27.9	27.8	48.7	66.0	-17.3	9/30 kHz
AVG	0.468			25.2	23.9	46.1	66.0	-19.9	9/30 kHz
AVG	0.528			33.2	32.6	54.0	60.0	-6.0	9/30 kHz
AVG	0.587			26.1	25.6	46.9	60.0	-13.1	9/30 kHz
AVG	0.650			26.1	26.1	47.0	60.0	-13.0	9/30 kHz
AVG	3.810			15.5	11.7	36.5	60.0	-23.5	9/30 kHz
AVG	6.621			8.7	4.8	29.9	60.0	-30.1	9/30 kHz

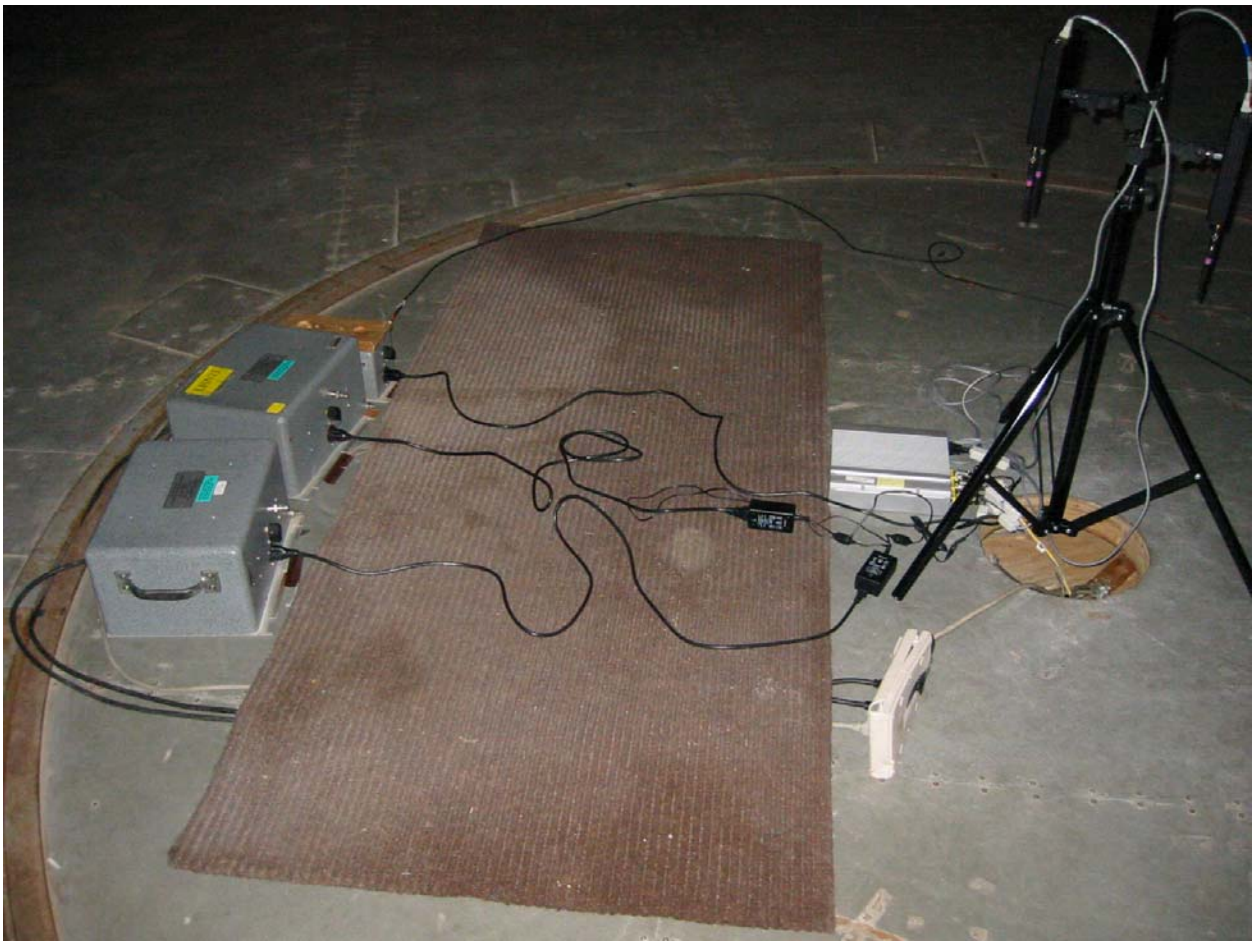
Setup Photos



Radio Module AC Line-conducted

Radio Module AC Line-conducted

BEP AC Line-conducted



BEP AC Line-conducted

Appendix A

RF Baseband Simplified Airtime Description -- Data Pole

2571-250-02

Prepared By:
Stuart Perry
Brandon Eash

Preparation Date:
19 May 2006

1.0 Summary **2**
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1.0 Summary

The worst-case transmit duty-cycle for the Data Pole is 65% (including some engineering margin).

2.0 Purpose / Overview

The purpose of this document is to Give a high-level description of the Airtime for the nTag system's Data Pole. We note that the 'access point' function of the system comprises two 'Poles': a census pole and a data pole. The data pole has a much higher duty cycle, so is the object of this description.

Operating the system under worst-case Airtime conditions is impractical since it requires complex Back-End Processor software to be configured to drive the radio channel to its fullest capacity, while not exceeding that capacity. Since in actual use, the Back-End processor would adjust its data rate to ensure the data channel capacity is not exceeded, a lower-than-worst-case data rate usually results. Additionally, the radio Airtime would need to be measured at a specific instant in time to obtain a valid worst-case result. This specific measurement is possible, but difficult to obtain practically.

The full description of the baseband firmware is contained in another document: 2571-201-01 Baseband_uP_FWdescription.doc

3.0 Data Channel RF messages

The data channel is the channel in which the following types of data are transmitted:

A. *Broadcast*: Data to be heard by all tags within RF range of the broadcast transmission..

B. *Unicast Upload*: Messages up to the server from individual tags.

C. *Unicast Download*: Messages down from the server to individual tags.

The worst-case data channel transmission airtime duty-cycle is represented by the Broadcast transmission. Unicast has a similar, but lower duty-cycle, transmission airtime.

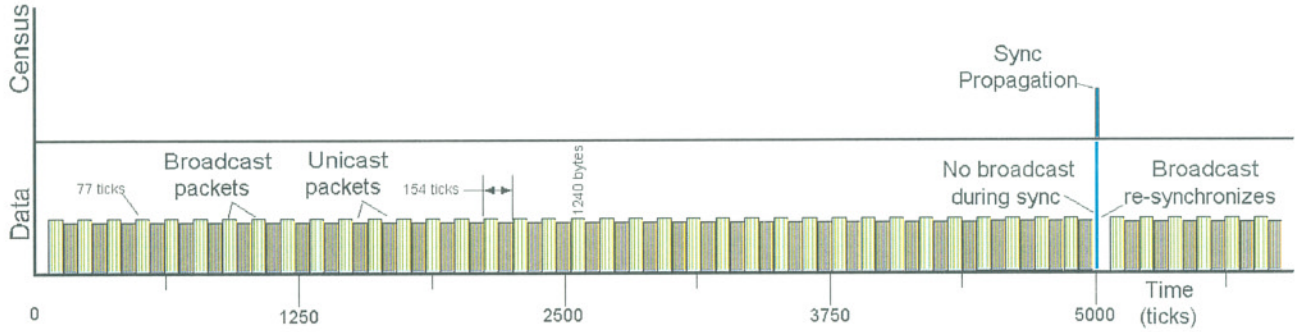
3.1 Broadcast Messaging

3.1.1 Timing of Broadcast Messages

Broadcast messages appear periodically. The broadcast messages are interleaved with unicast messages on the same data channel.

An example of a 5000 tick (approximately 5 msec) synchronization system with broadcast is shows in the figure.

Fig. 3.1.1.1 – Broadcast and Census co-existence:



The worst-case airtime duty cycle for the Broadcast Channel would be a series of "Over-Air Data Packet". In the figure below, the integers within the colored boxes represent time, in microseconds. The cyan boxes represent times when the data pole is transmitting. The worst-case duty cycle is 4400usec/7120usec = 62.4%. Two sources of engineering margin are included in this estimate: the times listed are based on measurements of hardware signals that control the radio, rather than a measurement of the RF output power; and the present system limits this sequence to 10 such packets, which extends less than 100 msec. However, the remainder of the airtime uses a lower duty cycle.

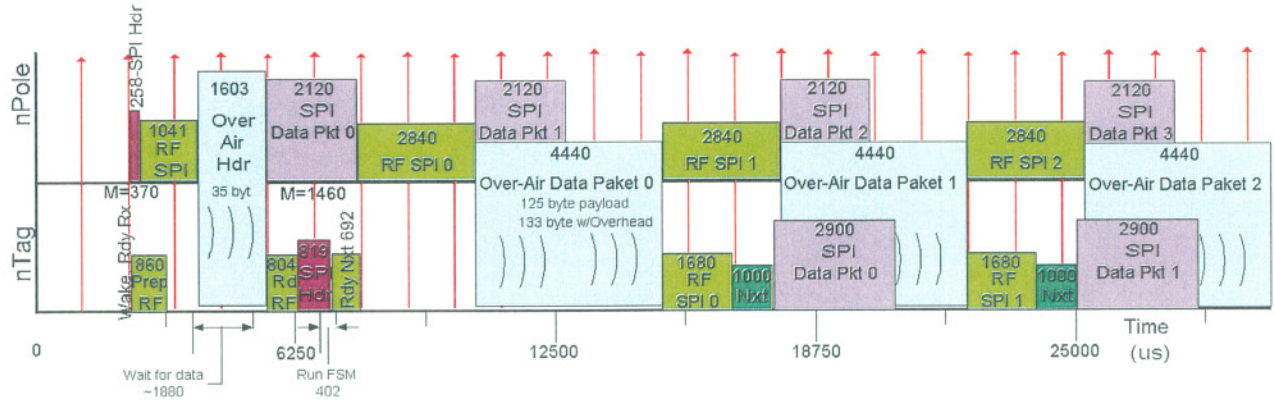



Fig. 3.1.1.2: Broadcast Timing