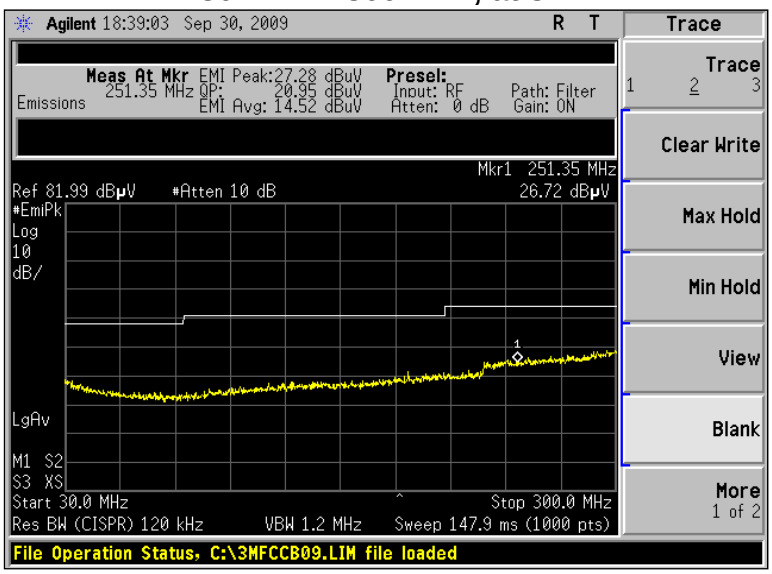
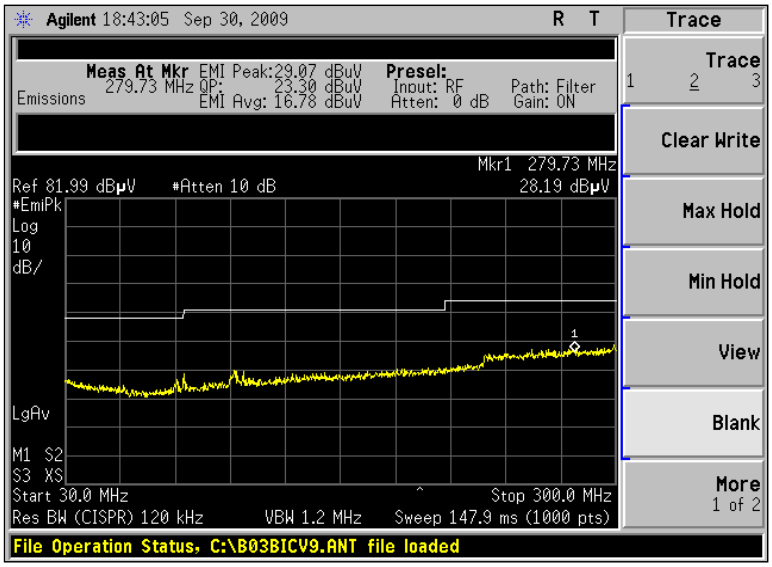
Screen Captures - Radiated Emissions Testing – Receive Mode on Unit with Heat Shrink Dipole Antenna

Channel 8, Antenna Horizontally Polarized, EUT Vertical
30 MHz – 300 MHz, at 3m

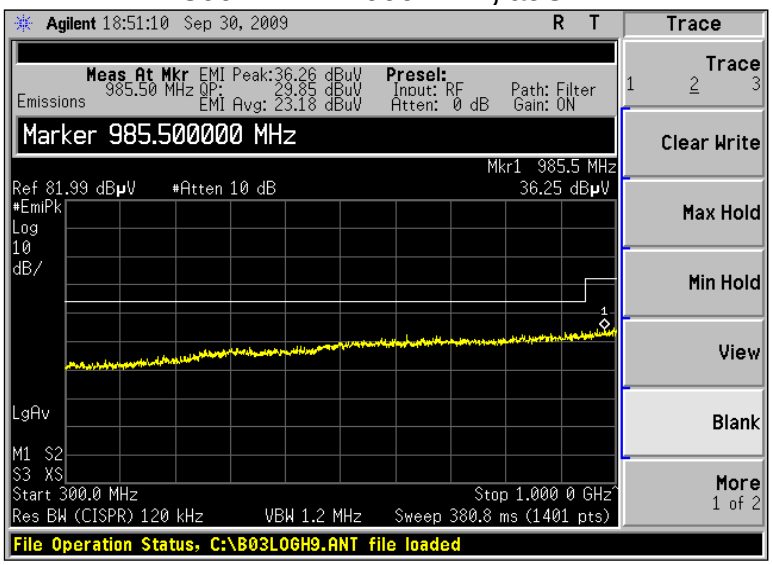


Channel 8, Antenna Vertically Polarized, EUT Vertical
30 MHz – 300 MHz, at 3m

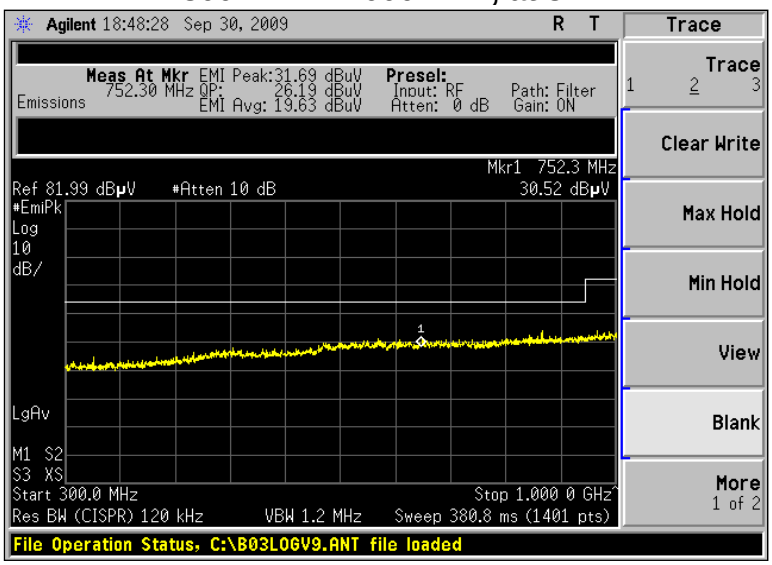


Screen Captures - Radiated Emissions Testing – Receive Mode on Unit with Heat Shrink Dipole Antenna (continued)

Channel 8, Antenna Horizontally Polarized, EUT on Side
300 MHz – 1000 MHz, at 3m

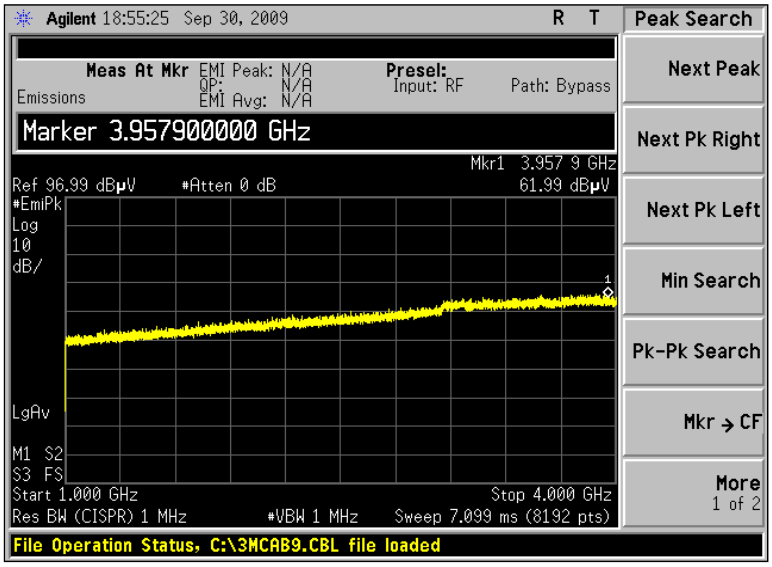


Channel 8, Antenna Vertically Polarized, EUT on Side
300 MHz – 1000 MHz, at 3m



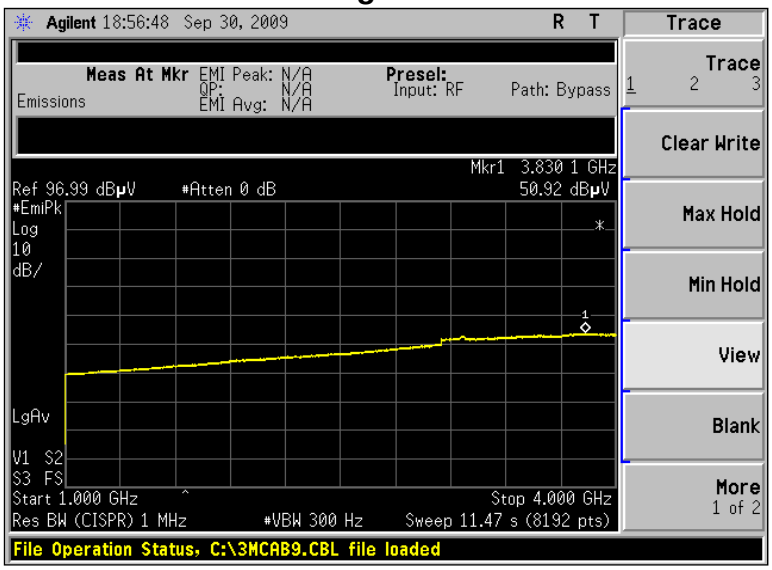
Screen Captures - Radiated Emissions Testing – Receive Mode on Unit with Heat Shrink Dipole Antenna (continued)

Channel 8, Antenna Horizontally Polarized, EUT Vertical
1000 MHz – 4000 MHz, at 3m
Peak Values



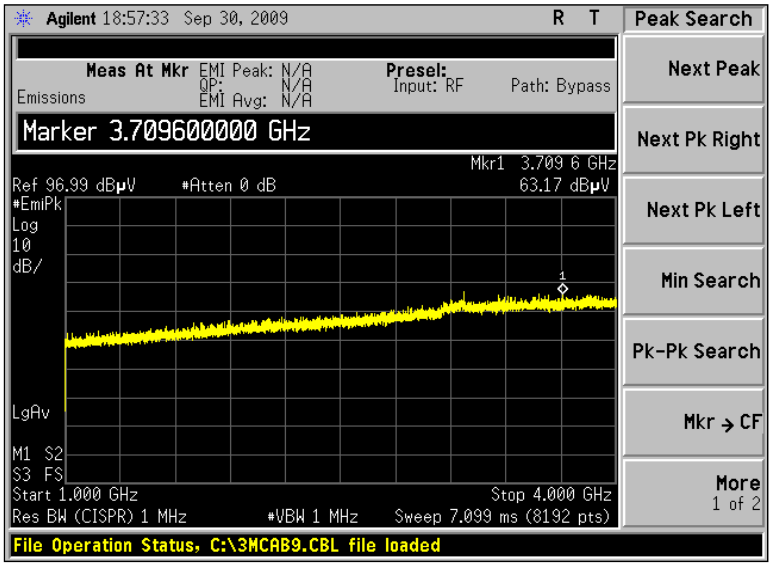
Note: because the peak value (of the noise floor) was above the average limit, the video average bandwidth was decreased to demonstrate that the video-averaged signal is below the radiated limit.

Channel 8, Antenna Horizontally Polarized, EUT Vertical
1000 MHz – 4000 MHz, at 3m
Average Values



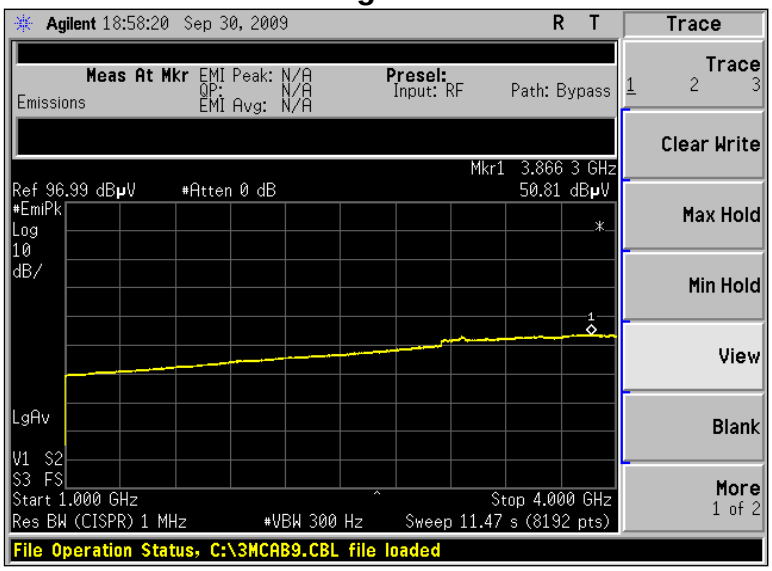
Screen Captures - Radiated Emissions Testing – Receive Mode on Unit with Heat Shrink Dipole Antenna (continued)

Channel 8, Antenna Vertically Polarized, EUT Vertical
1000 MHz – 4000 MHz, at 3m
Peak Values



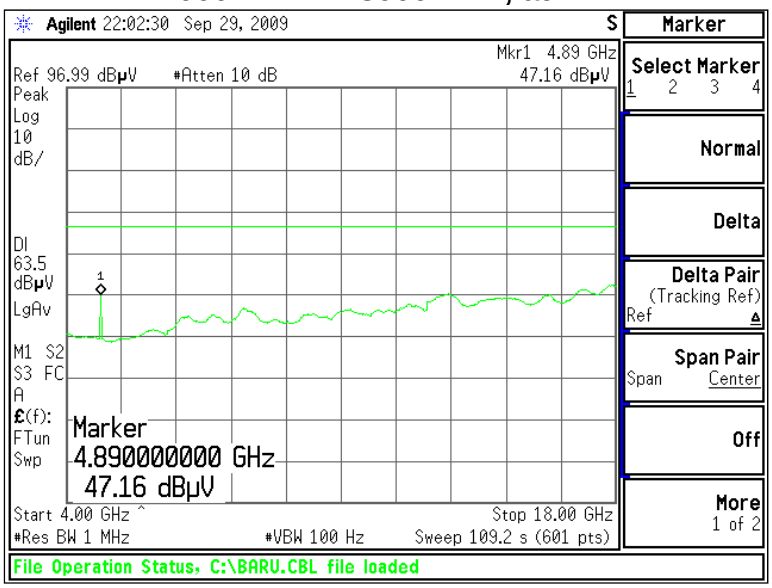
Note: because the peak value (of the noise floor) was above the average limit, the video average bandwidth was decreased to demonstrate that the video-averaged signal is below the radiated limit.

Channel 8, Antenna Vertically Polarized, EUT Vertical
1000 MHz – 4000 MHz, at 3m
Average Values

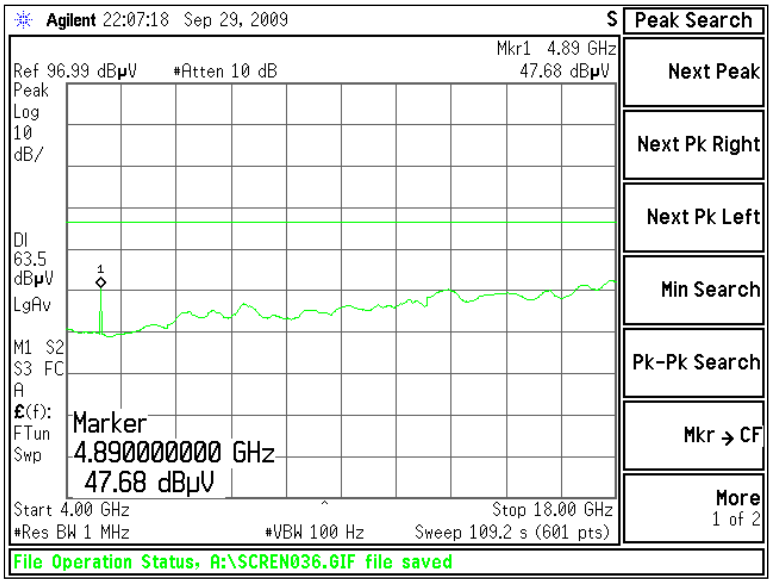


Screen Captures - Radiated Emissions Testing – Receive Mode on Unit with Heat Shrink Dipole Antenna (continued)

Channel 8, Antenna Horizontally Polarized, EUT Vertical
4000 MHz – 18000 MHz, at 1 m

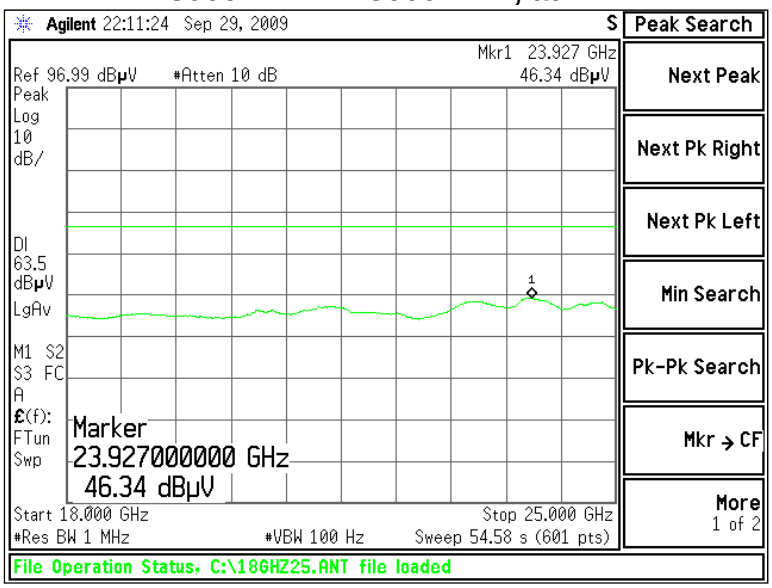


Channel 8, Antenna Vertically Polarized, EUT Vertical
4000 MHz – 18000 MHz, at 1 m



Screen Captures - Radiated Emissions Testing – Receive Mode on Unit with Heat Shrink Dipole Antenna (continued)

Channel 8, Antenna Horizontally Polarized
18000 MHz – 25000 MHz, at 1 m



Channel 8, Antenna Vertically Polarized
18000 MHz – 25000 MHz, at 1 m

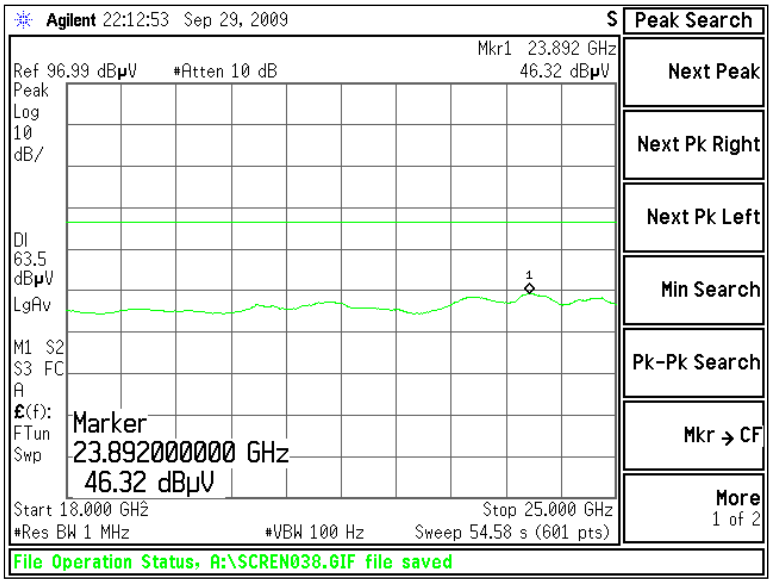


EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE:

6.1 Test Setup

The test area and setup are in accordance with ANSI C63.4-2003 and with Title 47 CFR, FCC Part 15, Industry Canada RSS-210 and RSS GEN. The EUT was placed on a non-conductive wooden table, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a 50Ω (ohm), 50/250 μH Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided to the bench immunity area just outside the 3 Meter Semi-Anechoic Chamber via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the HP 8546A EMI Receiver. The EMCO LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

6.2 Test Procedure

The EUT was investigated in continuous modulated transmit and receive modes with each antenna configuration for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in CISPR 16-1, Section 1, Table 1, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30 MHz. Final readings were then taken and recorded.

6.3 Test Equipment Utilized

A list of the test equipment and accessories utilized for the Conducted Emissions test is provided in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. Calibrations of the LISN and Limiter are traceable to N.I.S.T. All cables are calibrated and checked periodically for conformance. The emissions are measured on the HP 8546A EMI Receiver, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

A complete list of test equipment used may be found in Appendix A

6.4 Test Results

The EUT was found to meet the Conducted Emission requirements of FCC Part 15.207 Conducted Emissions for an Intentional Radiator. See the Data Charts and Graphs for more details of the test results.

6.5 FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBµV)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz VBW ≥ 9 kHz for QP VBW = 1 Hz for Average
0.5 – 5.0	56	46	
5.0 – 30	60	50	
* The limit decreases linearly with the logarithm of the frequency in this range.			

6.6 CONDUCTED EMISSIONS TEST DATA CHART

Frequency Range inspected: 150 kHz to 30 MHz
Test Standard: FCC 15.207: Class B
IC RSS GEN 7.2.2

Manufacturer:	Niles Audio Corporation					
Date(s) of Test:	August 31, 2009					
Test Engineer:	Laura Bott, Shane Rismeyer					
Voltage:	3.3 VDC					
Operation Mode:	Normal, continuous transmit, modulated or C.W. mode					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
Test Location:						Chamber
EUT Placed On:	√	40cm from Vertical Ground Plane				10cm Spacers
	√	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary	√	Final
Detectors Used:	√	Peak	√	Quasi-Peak	√	Average

6.7 Test Data on Inverted F Unit

Frequency (MHz)	Line	Q-Peak Reading	Q-Peak Limit	Margin	Average Reading	Average Limit	Margin
0.151	1	50.80	65.94	15.14	19.20	55.94	36.74
0.188		43.50	64.12	20.62	12.50	54.12	41.62
4.000		33.60	56.00	22.40	32.20	46.00	13.80
0.150	2	51.00	66.00	15.00	17.00	56.00	39.00
0.178		44.40	64.58	20.18	19.90	54.58	34.68
4.000		33.70	56.00	22.30	32.20	46.00	13.80

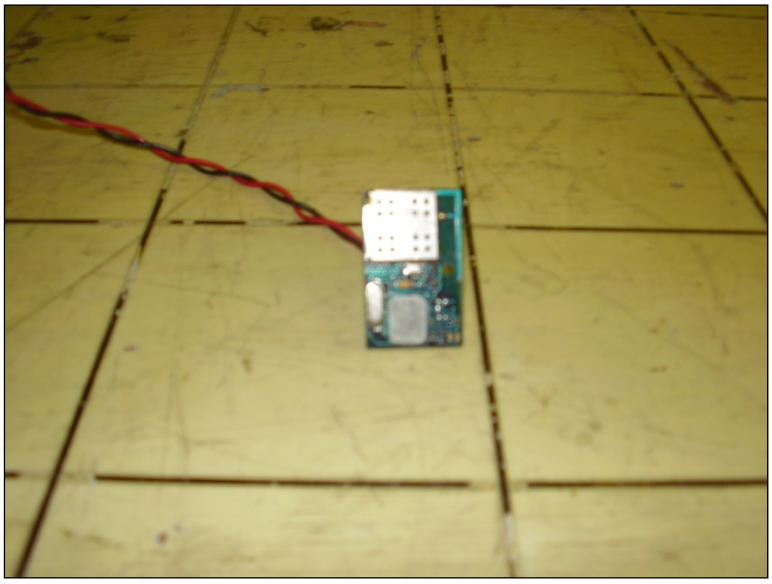
Notes:

1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.

2) All other emissions were better than 20 dB below the limits.

3) The EUT exhibited similar emissions in transmit and receive modes, and across the Low, Middle and High channels tested.

Test Setup Photo(s) – Conducted Emissions Test on Inverted F Unit

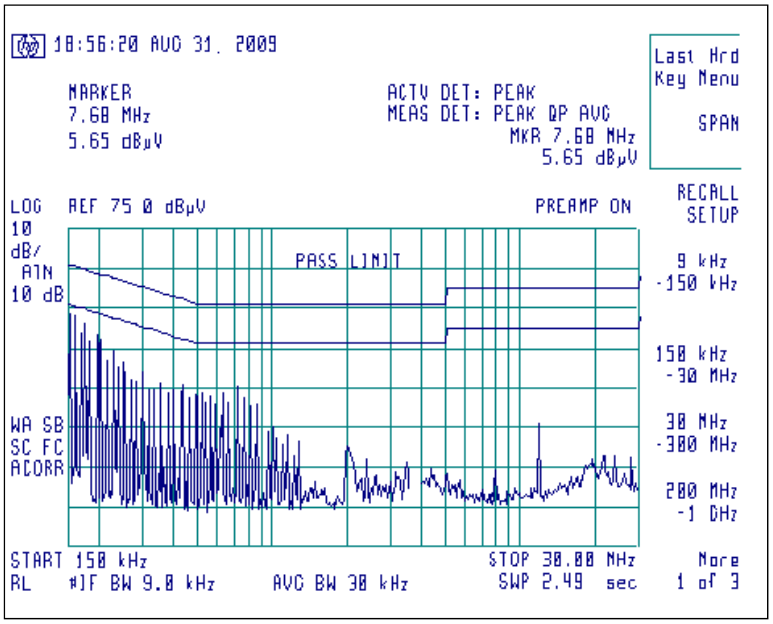


6.8 Screen Captures – Conducted Emissions Test on Inverted F Unit

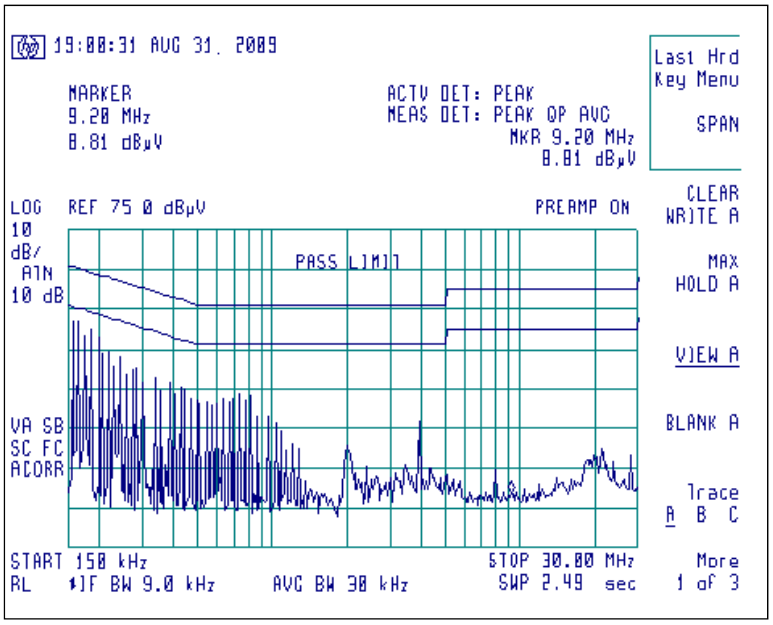
These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.207 and RSS GEN 7.2.2 (Table 2).

The signature scans shown here are from channel 8 (2445 MHz), chosen as being a good representative of channels.

Channel 8, 2445 MHz, Line 1



Channel 8, 2445 MHz, Line 2



6.8 Test Data on Unit with SMA Antenna

Frequency (MHz)	Line	Q-Peak Reading	Q-Peak Limit	Margin	Average Reading	Average Limit	Margin
0.153	1	41.20	65.84	24.64	9.40	55.84	46.44
0.213		40.00	63.09	23.09	9.00	53.09	44.09
4.000		32.20	56.00	23.80	30.80	46.00	15.20
0.164	2	42.00	65.24	23.24	11.20	55.24	44.04
0.181		44.00	64.44	20.44	21.60	54.44	32.84
0.217		39.50	62.93	23.43	8.90	52.93	44.03

Notes:

1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.

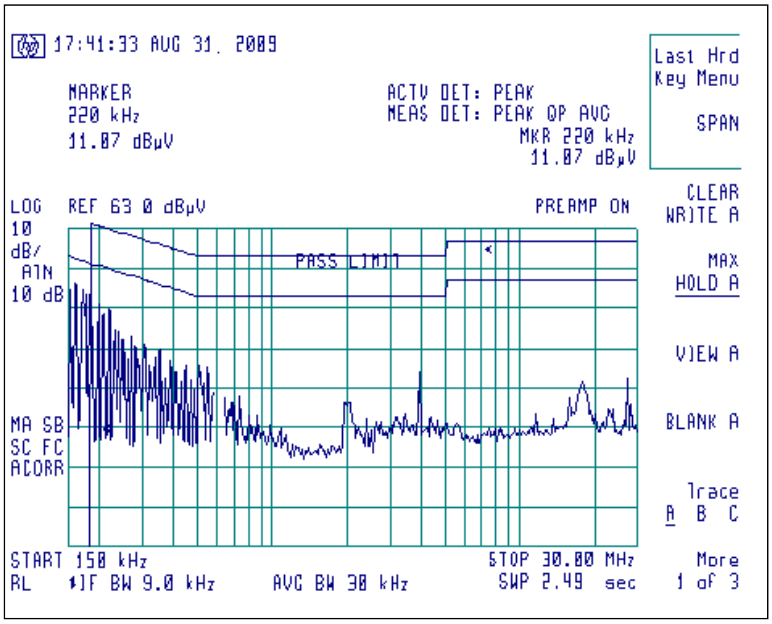
2) All other emissions were better than 20 dB below the limits.

3) The EUT exhibited similar emissions in transmit and receive modes, and across the Low, Middle and High channels tested.

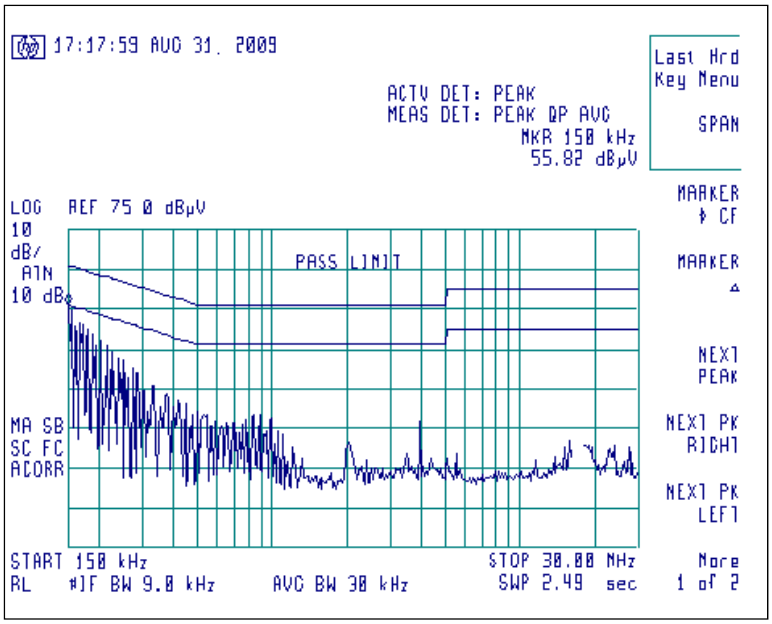
Test Setup Photo(s) – Conducted Emissions Test on Unit with SMA Antenna

Screen Captures – Conducted Emissions Test on Unit with SMA Antenna

Channel 8, 2445 MHz, Line 1



Channel 8, 2445 MHz, Line 2



6.9 Test Data on Unit with Heat Shrink Dipole Antenna

Frequency (MHz)	Line	Q-Peak Reading	Q-Peak Limit	Margin	Average Reading	Average Limit	Margin
0.152	1	50.20	65.89	15.69	19.30	55.89	36.59
0.186		44.00	64.21	20.21	13.00	54.21	41.21
4.000		33.50	56.00	22.50	32.10	46.00	13.90
0.152	2	50.10	65.89	15.79	18.70	55.89	37.19
0.278		34.20	60.88	26.68	8.80	50.88	42.08
4.000		32.90	56.00	23.10	31.50	46.00	14.50

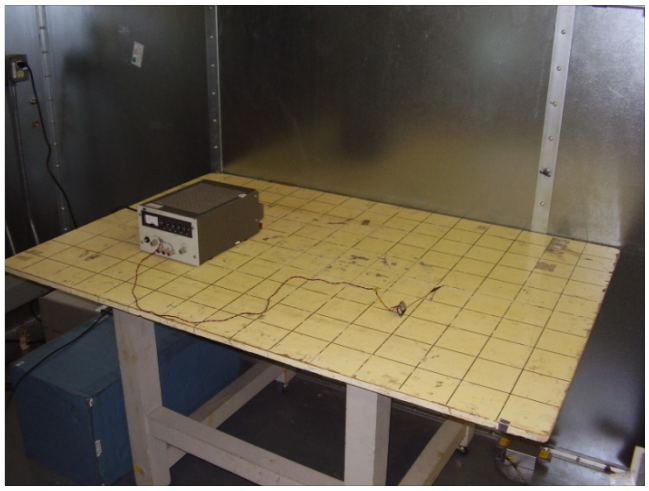
Notes:

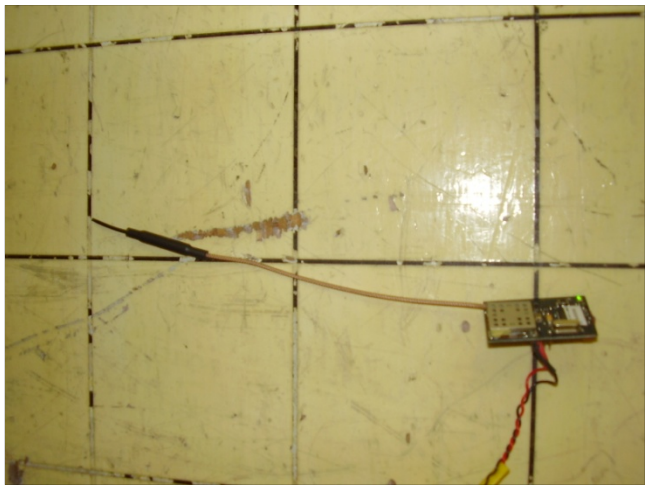
1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.

2) All other emissions were better than 20 dB below the limits.

3) The EUT exhibited similar emissions in transmit and receive modes, and across the Low, Middle and High channels tested.

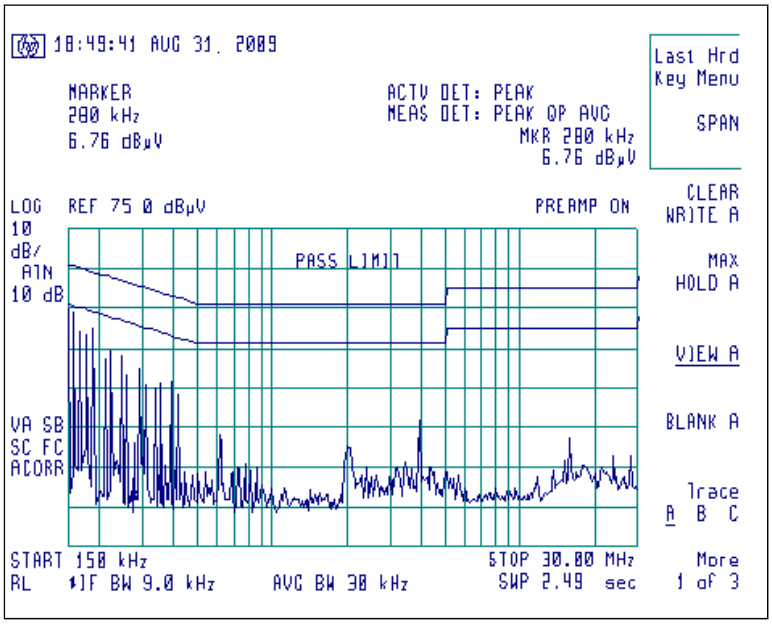
Test Setup Photo(s) – Conducted Emissions Test on Unit with Heat Shrink Dipole Antenna



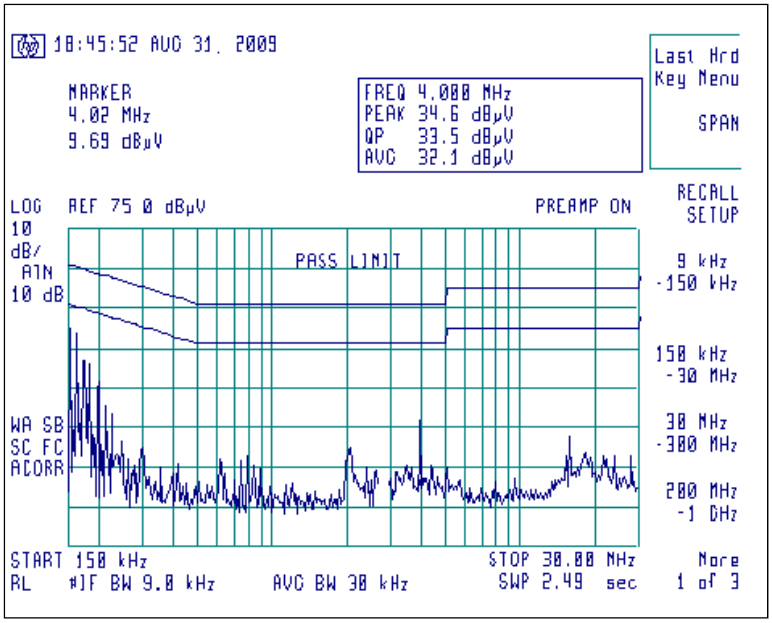


Screen Captures – Conducted Emissions Test on Unit with Heat Shrink Dipole Antenna

Channel 8, 2445 MHz, Line 1



Channel 8, 2445 MHz, Line 2



6.10 Test Data on Unit with BNC Antenna

Frequency (MHz)	Line	Q-Peak Reading	Q-Peak Limit	Margin	Average Reading	Average Limit	Margin
0.152	1	50.40	65.89	15.49	19.00	55.89	36.89
0.233		37.90	62.35	24.45	6.90	52.35	45.45
4.000		33.10	56.00	22.90	31.80	46.00	14.20
0.152	2	50.50	65.89	15.39	19.00	55.89	36.89
0.239		37.90	62.13	24.23	14.90	52.13	37.23
4.000		33.50	56.00	22.50	32.10	46.00	13.90

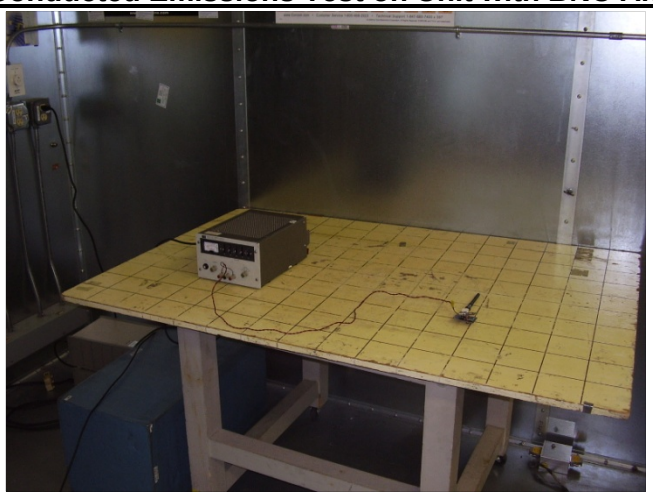
Notes:

1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.

2) All other emissions were better than 20 dB below the limits.

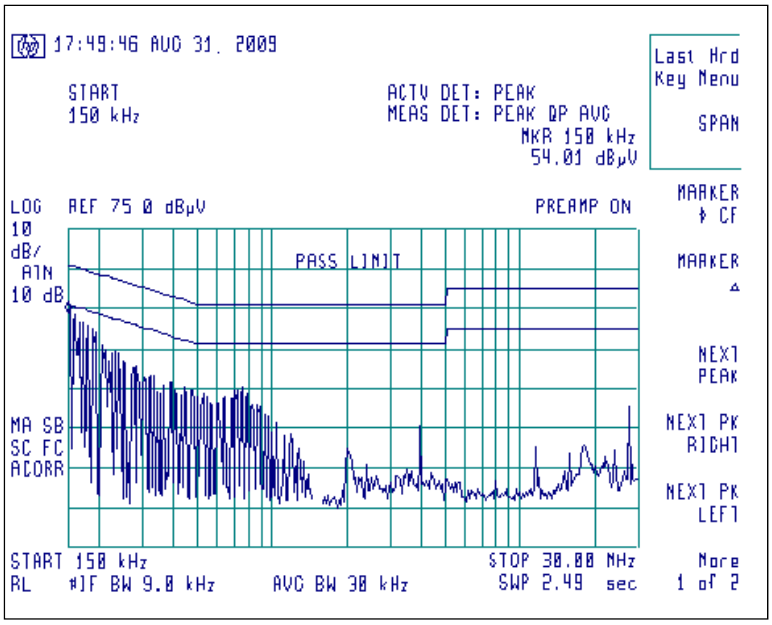
3) The EUT exhibited similar emissions in transmit and receive modes, and across the Low, Middle and High channels tested.

Test Setup Photo(s) – Conducted Emissions Test on Unit with BNC Antenna

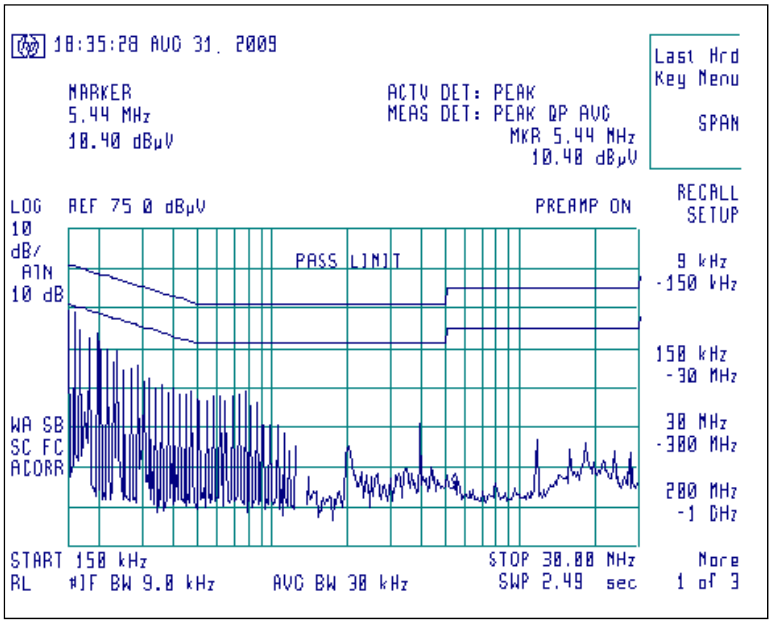


6Screen Captures – Conducted Emissions Test on Unit with BNC Antenna

Channel 8, 2445 MHz, Line 1



Channel 8, 2445 MHz, Line 2



6.11 Test Data on Unit with Wire Antenna

Frequency (MHz)	Line	Q-Peak Reading	Q-Peak Limit	Margin	Average Reading	Average Limit	Margin
0.152	1	50.50	65.89	15.39	19.10	55.89	36.79
0.185		44.00	64.26	20.26	13.40	54.26	40.86
4.000		33.70	56.00	22.30	32.30	46.00	13.70
0.151	2	50.60	65.94	15.34	16.60	55.94	39.34
0.183		44.20	64.35	20.15	16.60	54.35	37.75
4.000		33.40	56.00	22.60	32.00	46.00	14.00

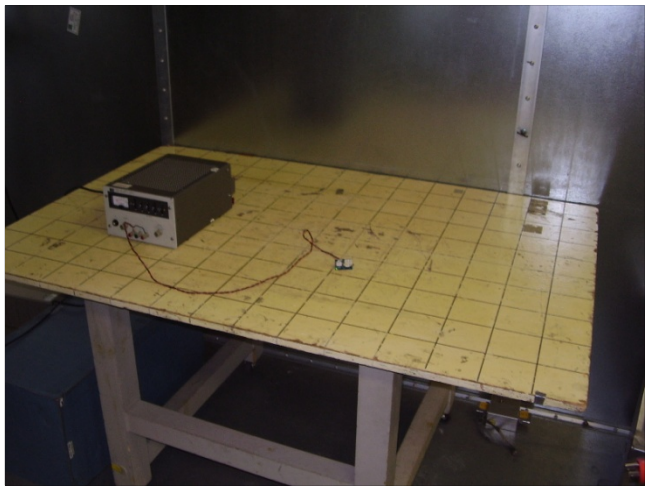
Notes:

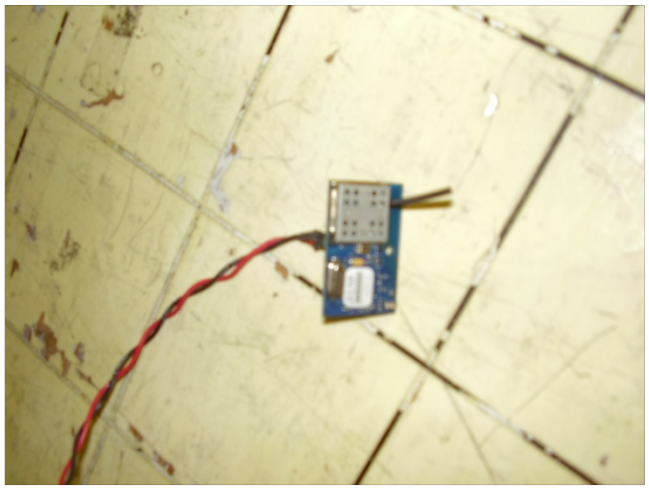
1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.

2) All other emissions were better than 20 dB below the limits.

3) The EUT exhibited similar emissions in transmit and receive modes, and across the Low, Middle and High channels tested.

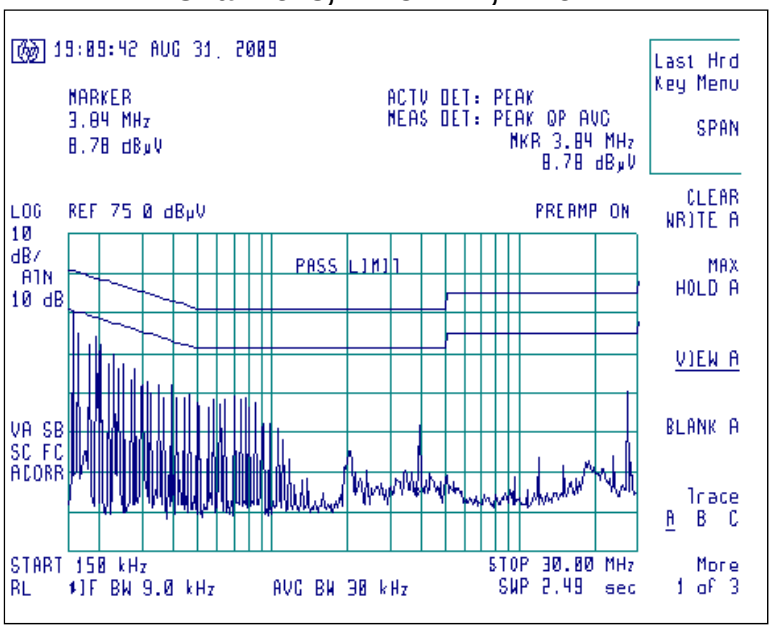
Test Setup Photo(s) – Conducted Emissions Test on Unit with Wire Antenna





Screen Captures – Conducted Emissions Test on Unit with Wire Antenna

Channel 8, 2445 MHz, Line 1



Channel 8, 2445 MHz, Line 2

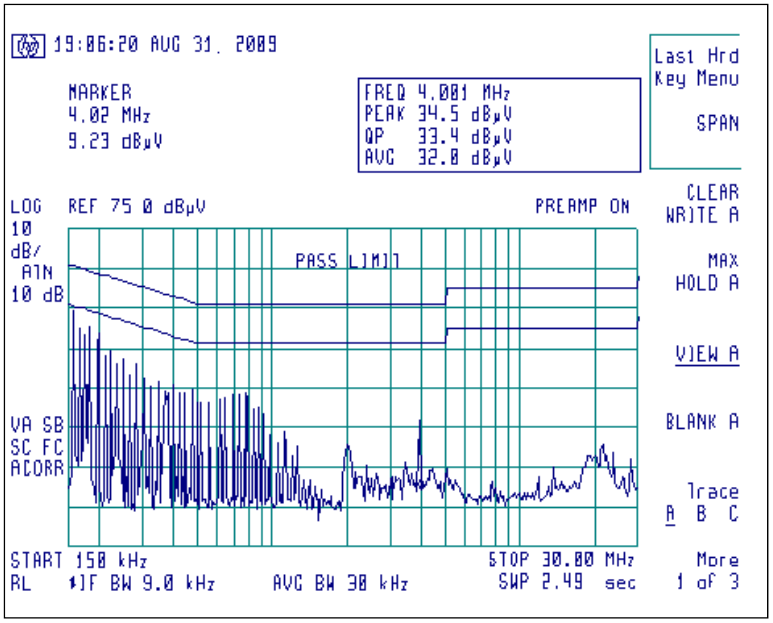


EXHIBIT 7. OCCUPIED BANDWIDTH:

7.1 Limits

For a Digital Modulation System, the 6 dB bandwidth shall be at least 500 kHz.

7.2 Method of Measurements

Refer to ANSI C63.4 (2003) and FCC Procedures (2007) for Digital Transmission Systems operating under 15.247.

The transmitter output was connected to the Spectrum Analyzer. The bandwidth of the fundamental frequency was measured with the Spectrum Analyzer where the RBW and VBW were set to 100 kHz.

The bandwidth requirement found in FCC Part 15.247(a)(2) and RSS 210 A8.2(a) requires a minimum -6dBc occupied bandwidth of 500 kHz. In addition, Industry Canada (IC RSS GEN 4.6.1) requires the measurement of the -20dBc occupied bandwidth. For this portion of the tests, a direct measurement of the transmitted signal was performed at the antenna port of the EUT, via a cable connection to the HP 4446A spectrum analyzer. The loss from the cable was added on the analyzer via a correction factor file, thereby allowing direct measurements, without the need for any further corrections. A Hewlett Packard model E4407B spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The EUT was configured to run in a continuous transmit mode. The spectrum analyzer was used in peak-hold mode while measurements were made, as presented in the chart below.

7.3 Test Equipment List

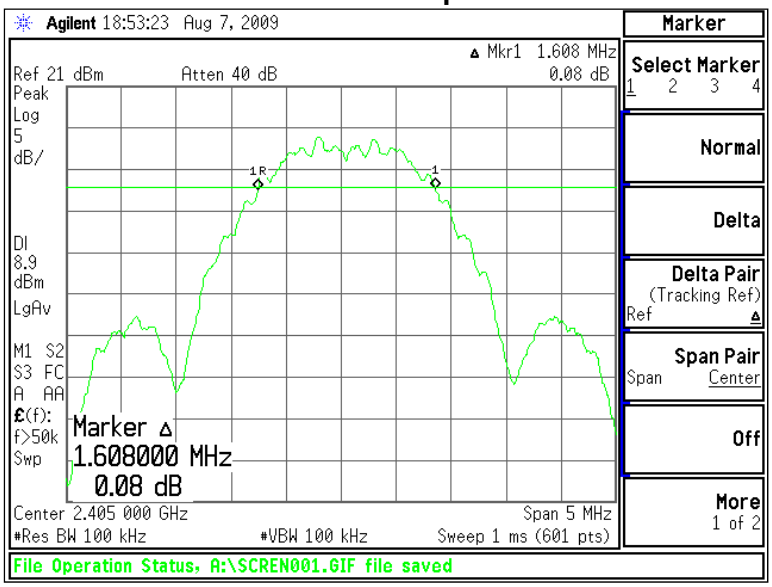
Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564

7.4 Test Data

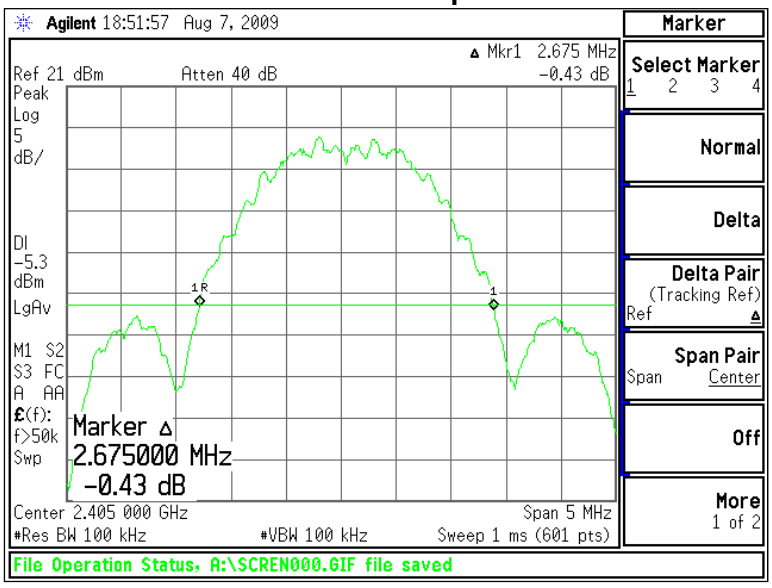
Channel	Center Frequency (MHz)	Measured -6 dBc Occupied Bandwidth (kHz)	Minimum -6 dBc Limit (kHz)	Measured -20 dBc Occupied Bandwidth (kHz)
0	2405	1608	500	2675
8	2445	1608	500	2667
14	2475	1592	500	2667

7.5 Screen Captures - OCCUPIED BANDWIDTH

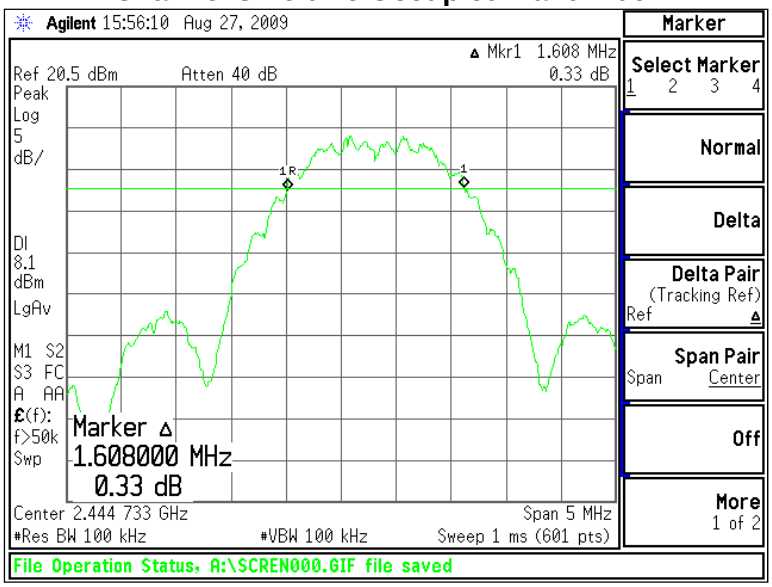
Channel 0: -6 dBc Occupied Bandwidth



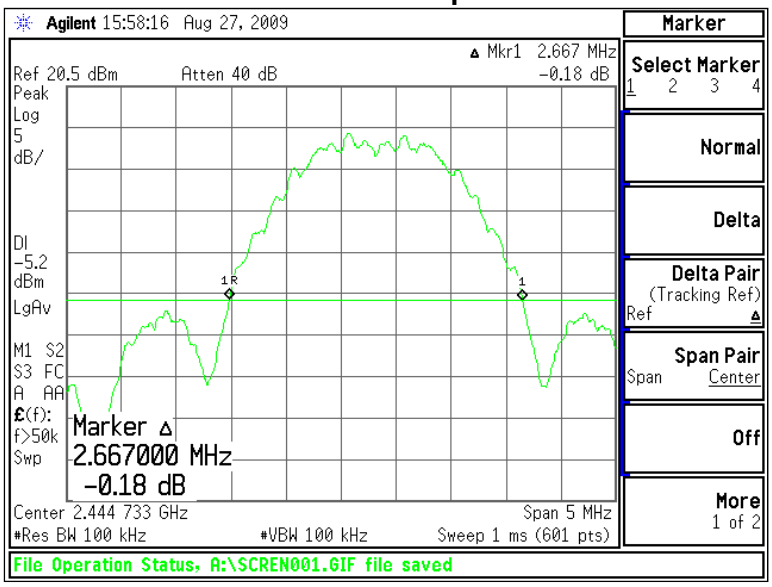
Channel 0: -20 dBc Occupied Bandwidth



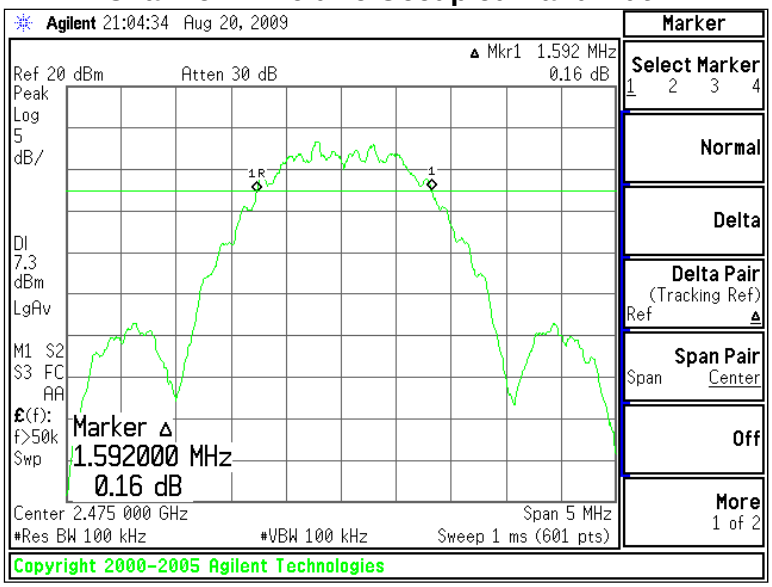
Channel 8: -6 dBc Occupied Bandwidth



Channel 8: -20 dBc Occupied Bandwidth



Channel 14: -6 dBc Occupied Bandwidth



Channel 14: -20 dBc Occupied Bandwidth

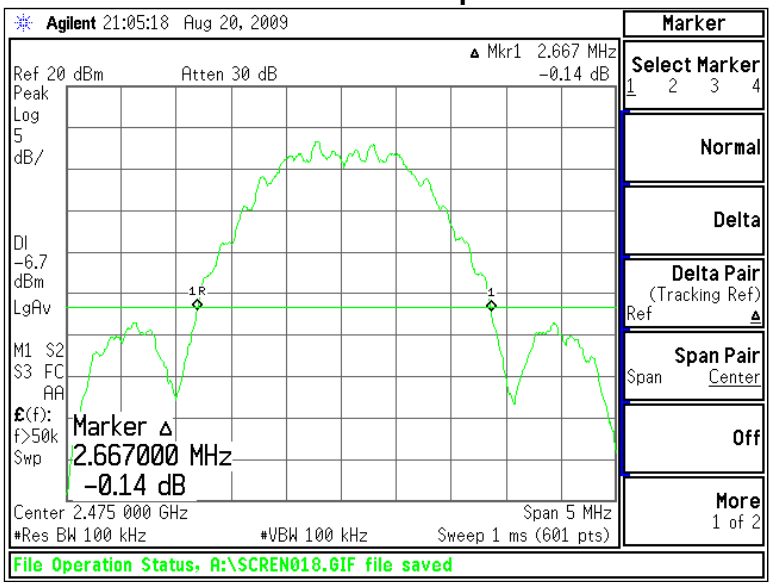


EXHIBIT 8. BAND-EDGE MEASUREMENTS

8.1 Method of Measurements

FCC 15.209(b) and 15.247(d) require a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band-Edges where the intentional radiator operates. Also, RSS 210 Section 2.2 requires that unwanted emissions meet limits listed in tables 2 and 3 of the same standard and also to the limits in the applicable annex. The following screen captures demonstrate compliance of the intentional radiator at the 2400-2483.5 MHz Band-Edges. The EUT was operated in continuous transmit mode with continuous modulation, with internally generated data as the modulating source. The EUT was operated at the lowest channel for the investigation of the lower Band-Edge, and at the highest channel for the investigation of the higher Band-Edge.

The Lower Band-Edge limit is -20 dBc with respect to the fundamental level at the lowest frequency in the band of operation, and +54 dBµV/m at 3m at 2390 MHz, where the restricted band ends.

The Upper Band-Edge limit, is, would be + 54 dBµV/m at 3m.

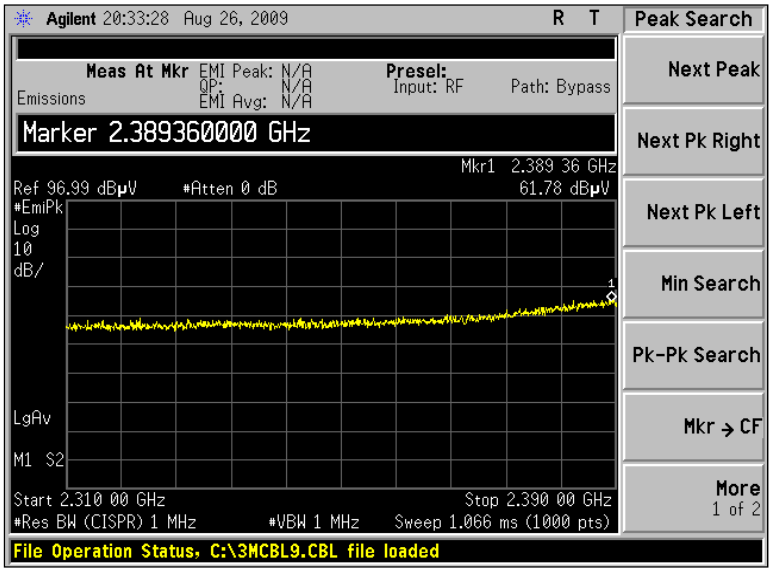
8.2 Inverted F Antenna

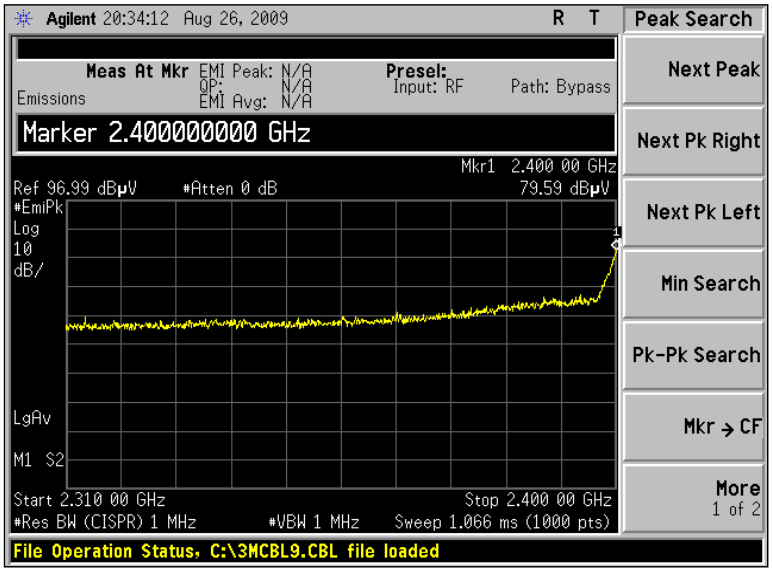
Data:

Frequency (MHz)	Limit (dBµV/m)	Peak Reading (dBµV/m)	Peak with Relaxation (dBµV/m)	Margin	Pass/Fail
2390	54	61.78	46.98	7.02	Pass
2400	105.6	79.59	64.79	40.81	Pass
2483.5	54	63.54	48.74	5.26	Pass

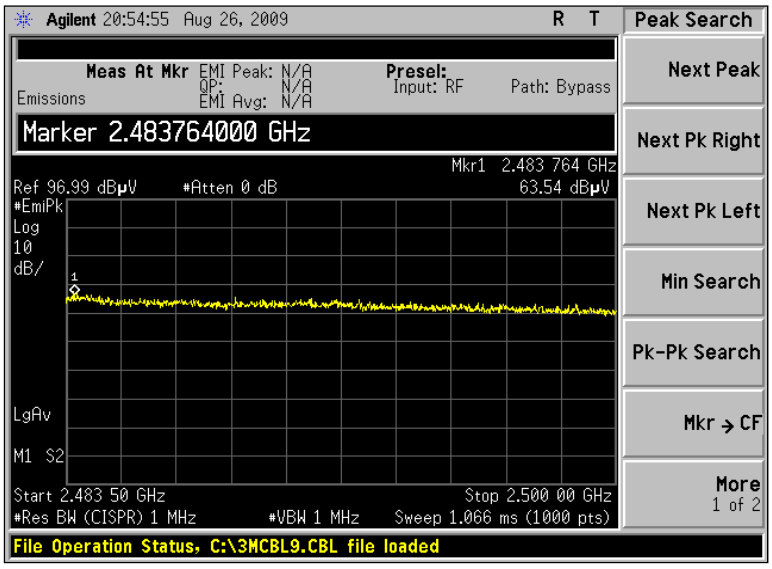
Screen Captures Demonstrating Compliance at the Low Band-Edge

Inverted F Antenna





Screen Capture Demonstrating Compliance at the High Band-Edge
Inverted F Antenna



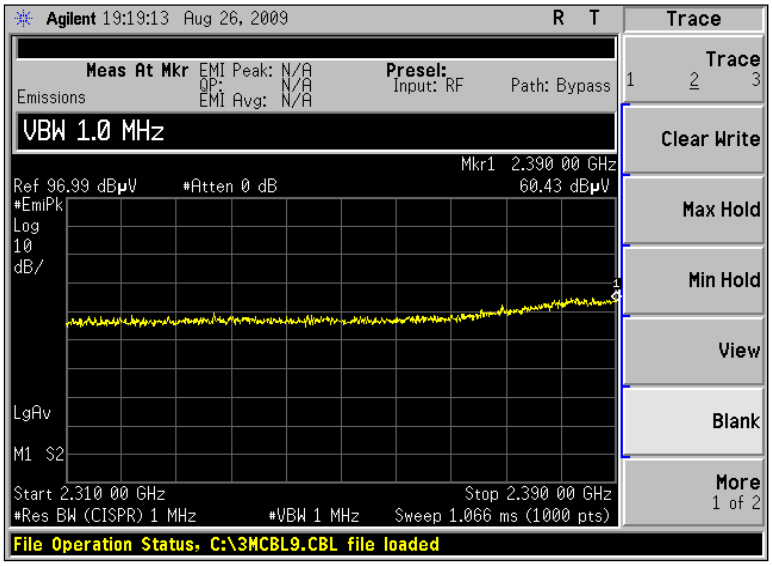
8.3 SMA Straight Antenna

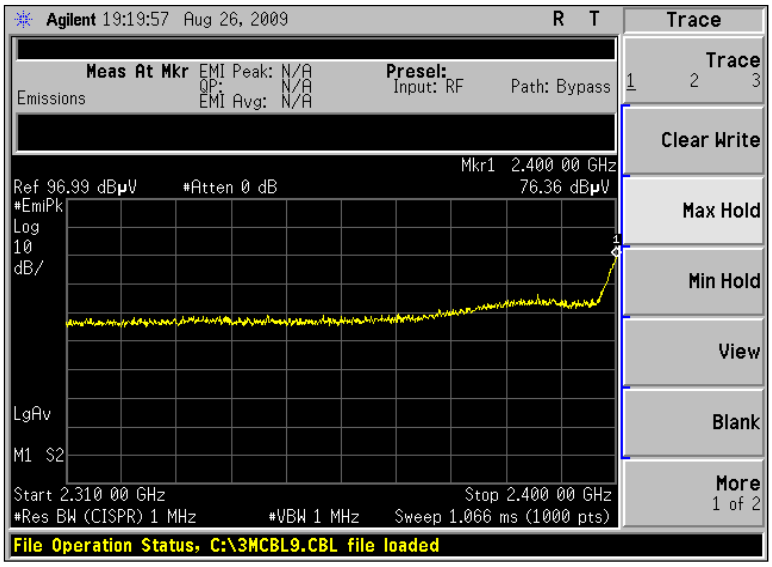
Data:

Frequency (MHz)	Limit (dBµV/m)	Peak Reading (dBµV/m)	Peak with Relaxation (dBµV/m)	Margin	Pass/Fail
2390	54.0	60.4	45.6	8.4	Pass
2400	109.2	76.4	61.6	47.6	Pass
2483.5	54.0	65.4	50.6	3.4	Pass

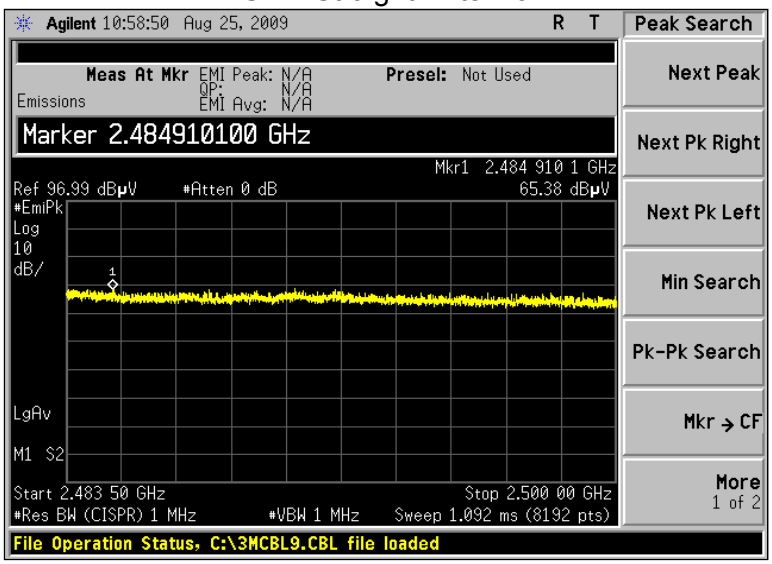
Screen Captures Demonstrating Compliance at the Low Band-Edge

SMA Straight Antenna





Screen Capture Demonstrating Compliance at the High Band-Edge
SMA Straight Antenna



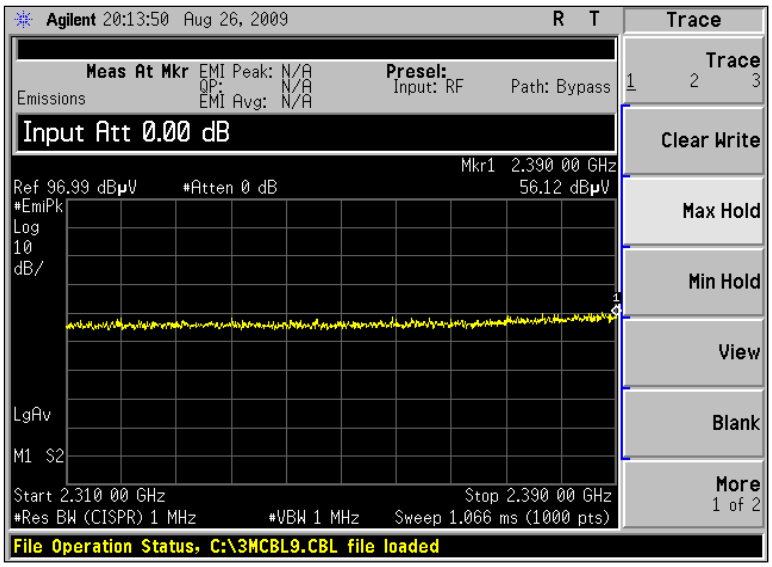
8.4 SMA Bent Antenna

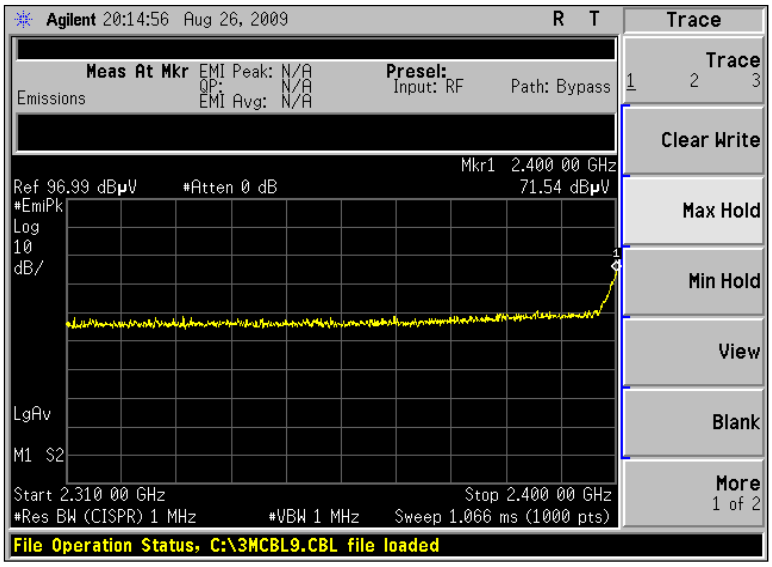
Data:

Frequency (MHz)	Limit (dBµV/m)	Peak Reading (dBµV/m)	Peak with Relaxation (dBµV/m)	Margin	Pass/Fail
2390	54.0	56.1	41.3	12.7	Pass
2400	108.6	71.5	56.7	51.9	Pass
2483.5	54.0	64.8	50.0	4.0	Pass

Screen Captures Demonstrating Compliance at the Low Band-Edge

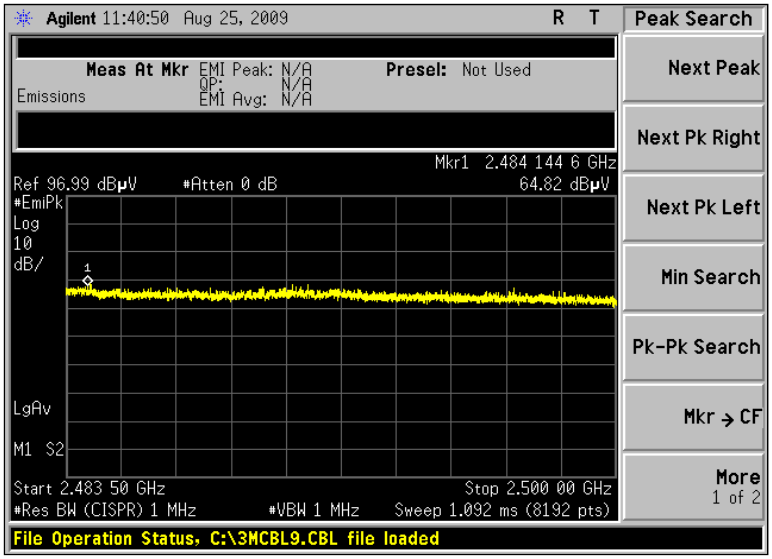
SMA Bent Antenna





Screen Captures Demonstrating Compliance at the High Band-Edge

SMA Bent Antenna



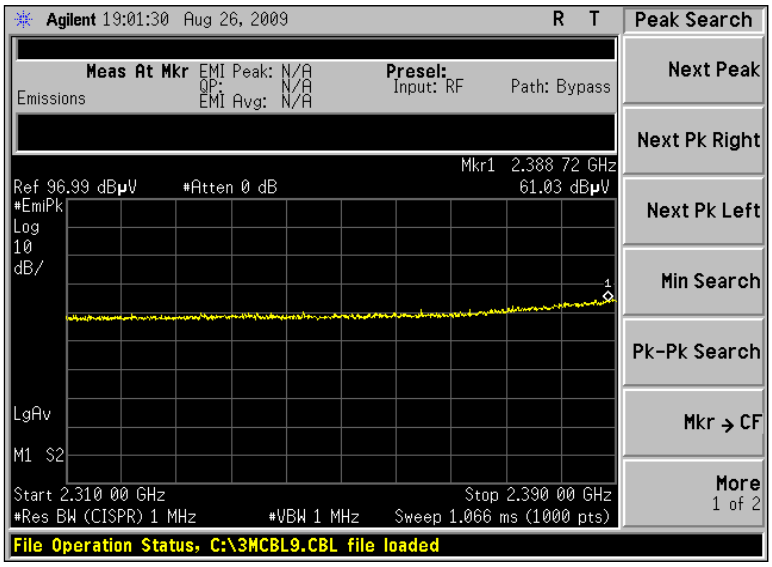
8.5 BNC Antenna

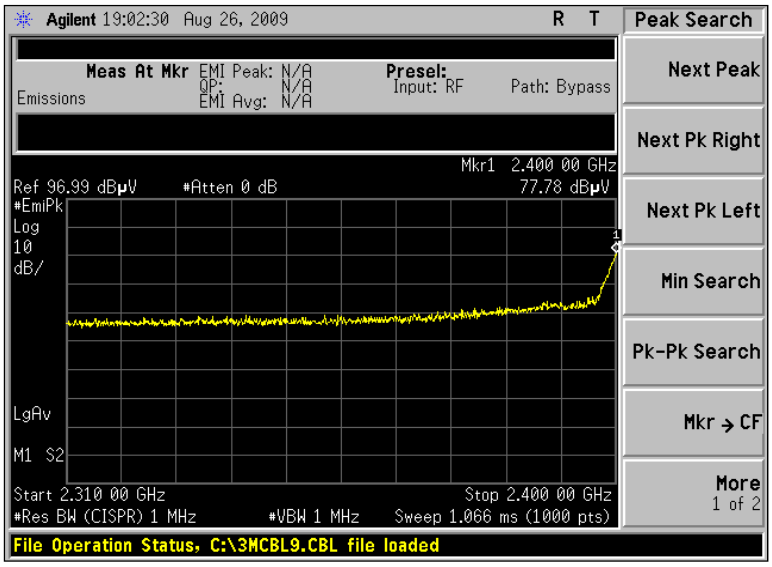
Data:

Frequency (MHz)	Limit (dBµV/m)	Peak Reading (dBµV/m)	Peak with Relaxation (dBµV/m)	Margin	Pass/Fail
2390	54.0	61.0	46.2	7.8	Pass
2400	107.5	77.8	63.0	44.5	Pass
2483.5	54.0	61.9	47.1	6.9	Pass

Screen Captures Demonstrating Compliance at the Low Band-Edge

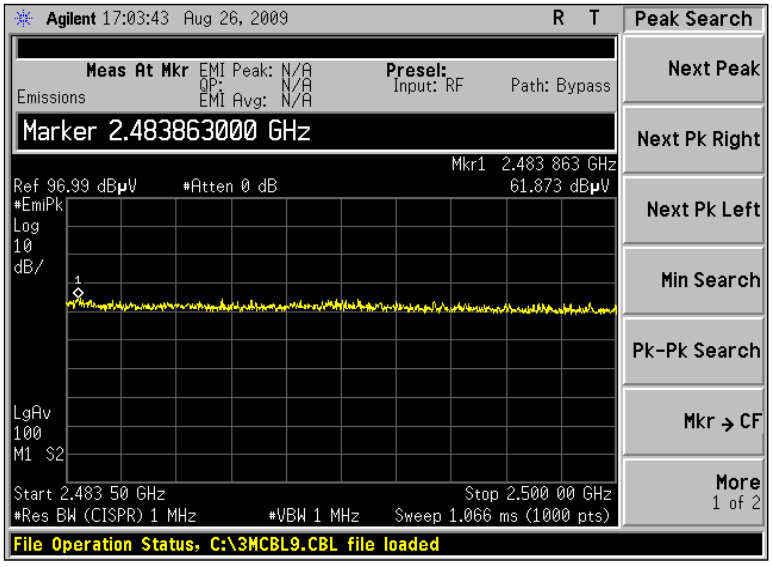
BNC Antenna





Screen Capture Demonstrating Compliance at the High Band-Edge

BNC Antenna



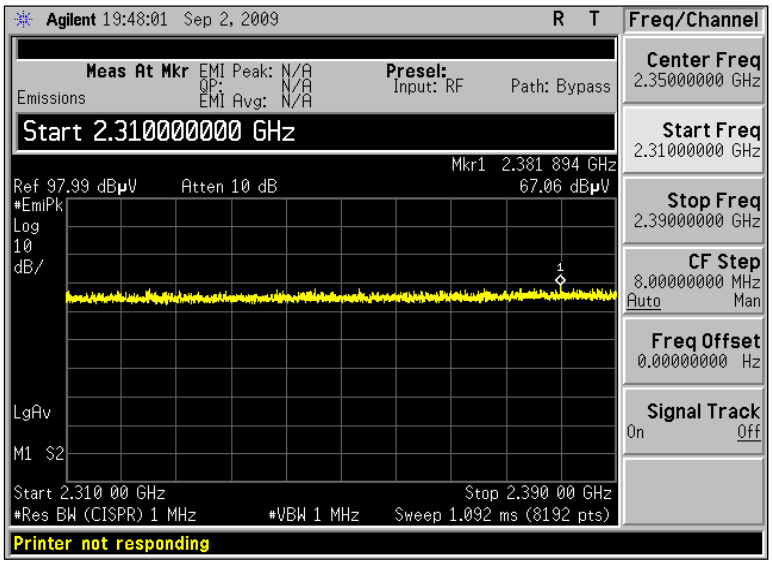
8.6 Wire Antenna

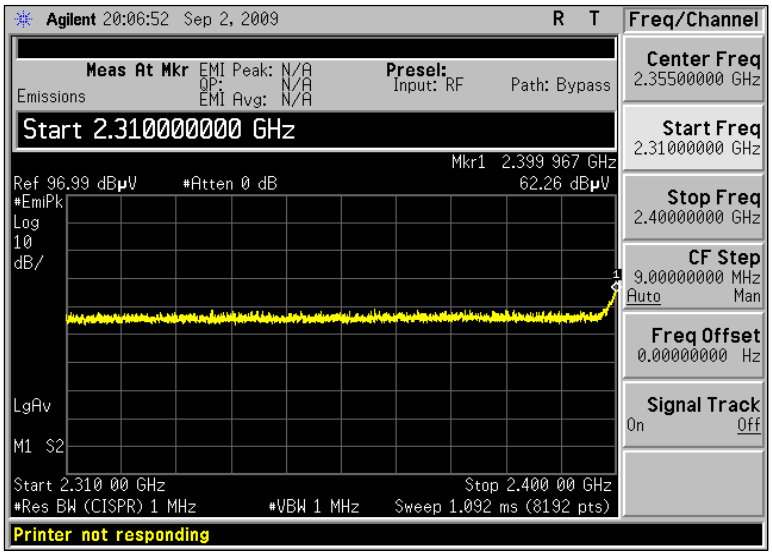
Data:

Frequency (MHz)	Limit (dBµV/m)	Peak Reading (dBµV/m)	Peak with Relaxation (dBµV/m)	Margin	Pass/Fail
2390	54	67.06	52.26	1.74	Pass
2400	105.5	62.26	47.46	58.04	Pass
2483.5	54	60.33	45.53	8.47	Pass

Screen Captures Demonstrating Compliance at the Low Band-Edge

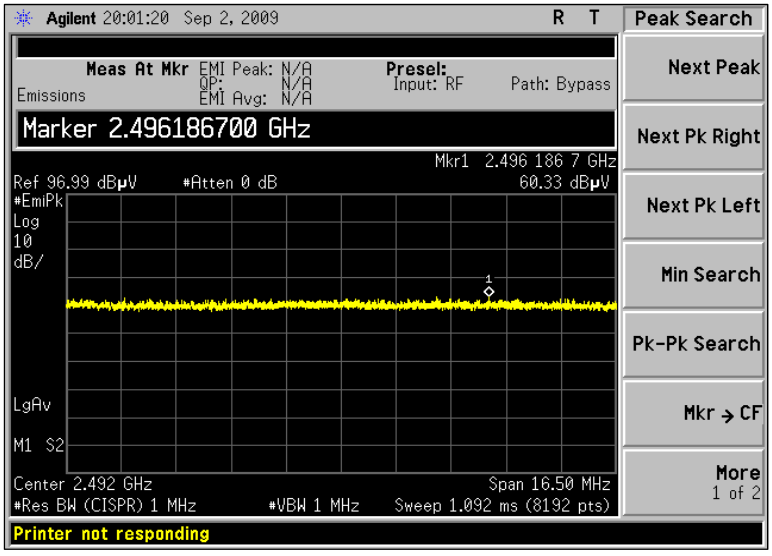
Wire Antenna





Screen Capture Demonstrating Compliance at the High Band-Edge

Wire Antenna



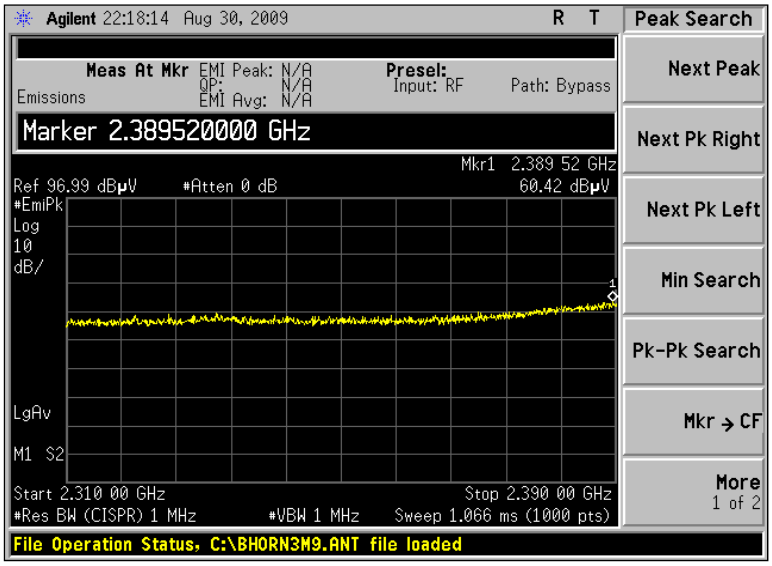
8.7 Heat Shrink Dipole:

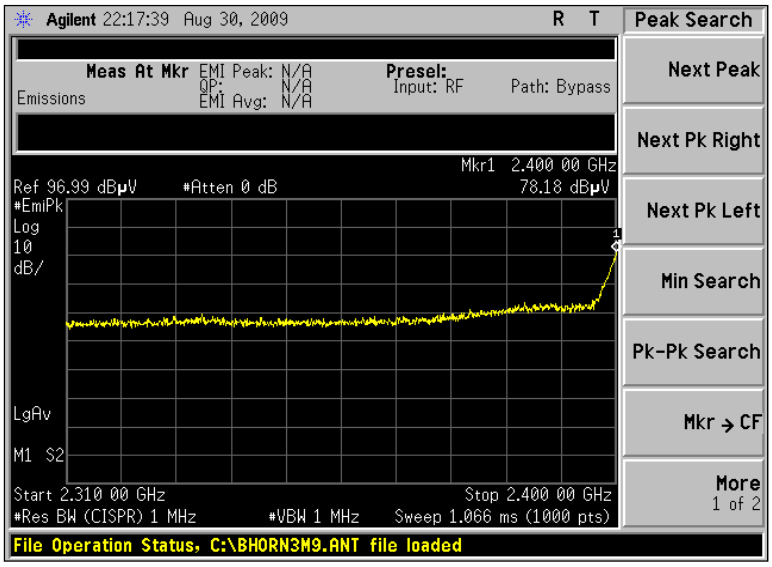
Data:

Frequency (MHz)	Limit (dBµV/m)	Peak Reading (dBµV/m)	Peak with Relaxation (dBµV/m)	Margin	Pass/Fail
2390	54.0	60.4	45.6	8.4	Pass
2400	104.3	78.2	63.4	40.9	Pass
2483.5	54.0	56.9	42.1	11.9	Pass

Screen Captures Demonstrating Compliance at the Low Band-Edge

Heat Shrink Dipole Antenna





Screen Captures Demonstrating Compliance at the High Band-Edge

Heat Shrink Dipole Antenna

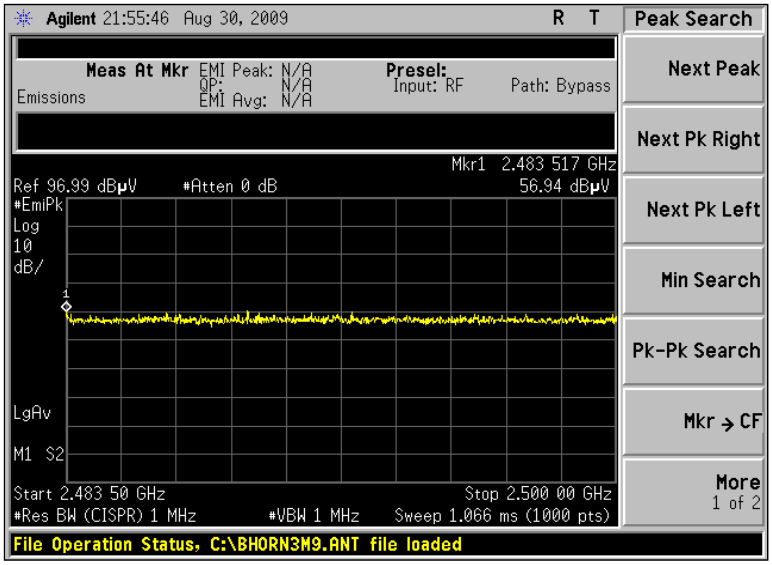


EXHIBIT 9. POWER OUTPUT (CONDUCTED): 15.247(b)

9.1 Method of Measurements

The conducted RF output power of the EUT was measured at the antenna port using a short RF cable to the spectrum analyzer. The loss from the cable was added on the analyzer as gain offset settings, thereby allowing direct measurements without the need for any further corrections. The unit was configured to run in a continuous transmit mode. The spectrum analyzer was used with resolution and video bandwidths set to 3 MHz, and 50 MHz respectively and a span of 20 MHz, with measurements from a peak detector presented in the chart below.

9.2 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564

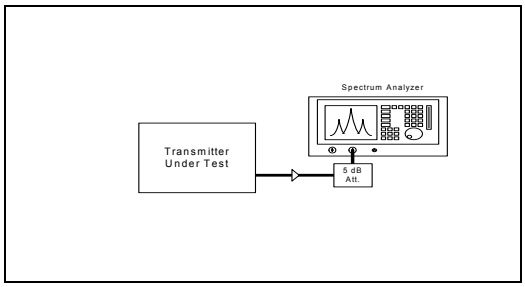
9.3 Test Data

Channel	Center Frequency (MHz)	Measured Power (dBm)	Limit (dBm)	Margin (dB)	Calculated EIRP (dBm)	EIRP Limit (dBm)	Calculated EIRP (mw)
0	2405	18.40	30	11.6	25.36	36.0	343.56
8	2445	18.41	30	11.59	25.37	36.0	344.35
14	2475	17.21	30	12.79	24.17	36.0	261.22

(1) EIRP Calculation:

EIRP = (Peak power at antenna terminal in dBm) + (EUT Antenna gain in dBi)

(2) The Antenna Gain used for calculating EIRP was 6.96 dBi, which was the greatest gain calculated among all of the antennas tested.

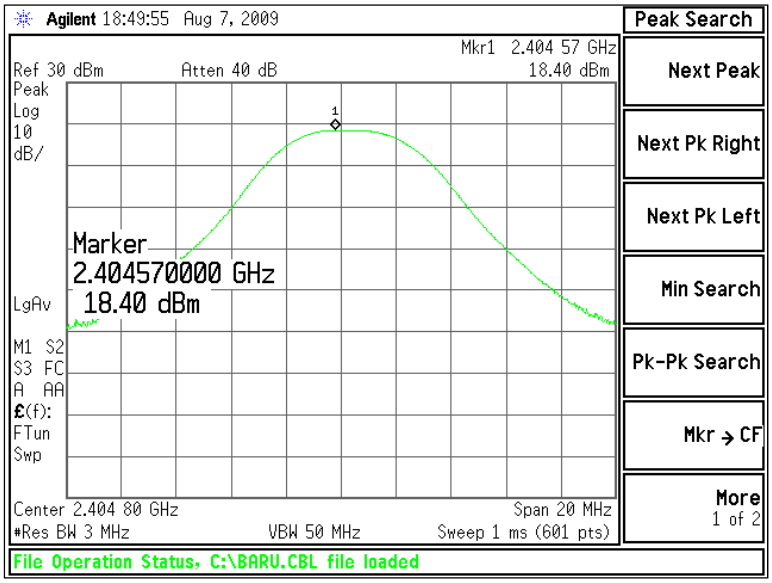


Rated RF power output (in watts): 0.1 Watts

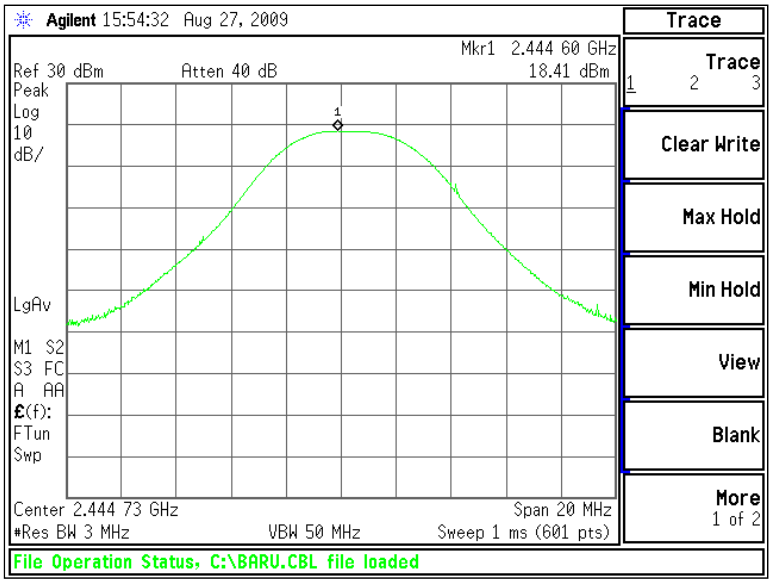
Measured RF Power Output (in Watts): 0.06934 Watts
Declared RF Power Output (in Watts): .1 Watts

9.4 Screen Captures – Power Output (Conducted)

Channel: 0



Channel: 8



Channel: 14

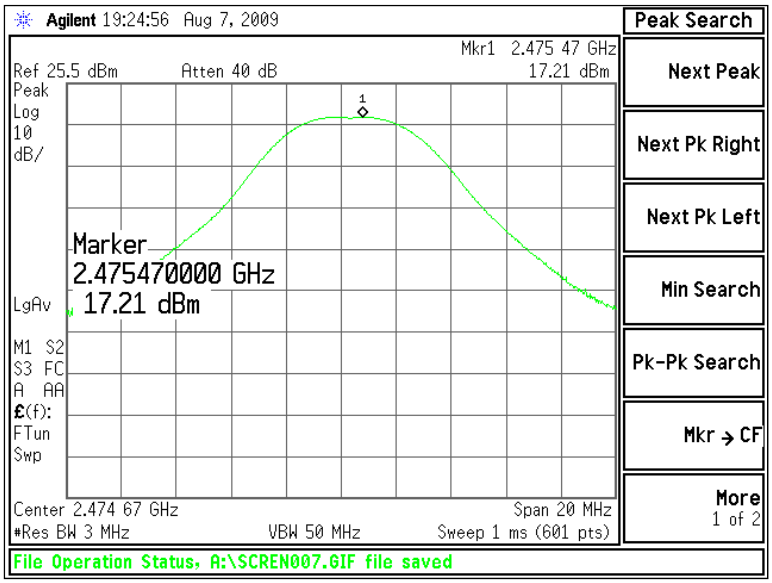

Agilent 19:24:56 Aug 7, 2009
Peak Search
Mkr1 2.475 47 GHz
Ref 25.5 dBm
Atten 40 dB
17.21 dBm
Next Peak
Peak
Log
10
dB/
Next Pk Right
Next Pk Left
Marker
2.475470000 GHz
17.21 dBm
LgAv
Min Search
M1 S2
S3 FC
A AA
£(f):
FTun
Swp
Pk-Pk Search
Mkr → CF
Center 2.474 67 GHz
Span 20 MHz
More
1 of 2
#Res BW 3 MHz
VBW 50 MHz
Sweep 1 ms (601 pts)
File Operation Status, A:\SCREN007.GIF file saved

EXHIBIT 10. POWER SPECTRAL DENSITY: 15.247(e)

10.1 Limits

For digitally modulate systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

In accordance with FCC Part 15.247(e) and RSS 210 A8.2(b), the peak power spectral density should not exceed +8 dBm in any 3 kHz band. This measurement was performed along with the conducted power output readings performed as described in previous sections. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed using the utility built into the HP Analyzer. The resultant density was then corrected to a 3 kHz bandwidth.

10.2 Test Equipment List

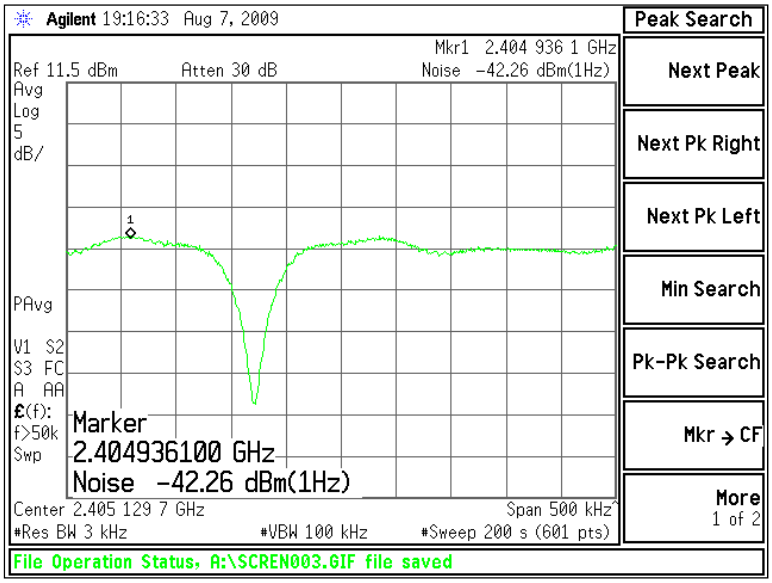
Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564

10.3 Test Data

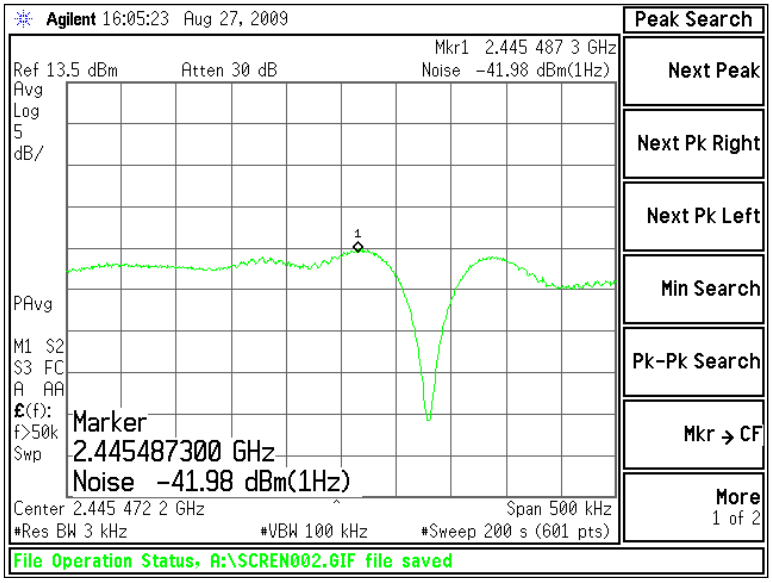
Channel	Center Frequency (MHz)	Measured Channel Power (dBm/1Hz)	3 kHz Correction (dB)	Corrected Power Measurement (dBm/3kHz)	Limit (dBm)	Margin
0	2405	-42.26	34.77	-7.49	8.0	15.5
8	2440	-41.98	34.77	-7.21	8.0	15.2
14	2475	-42.43	34.77	-7.66	8.0	15.7

10.4 Screen Captures – Power Spectral Density

Channel: 0



Channel: 8



Channel: 14

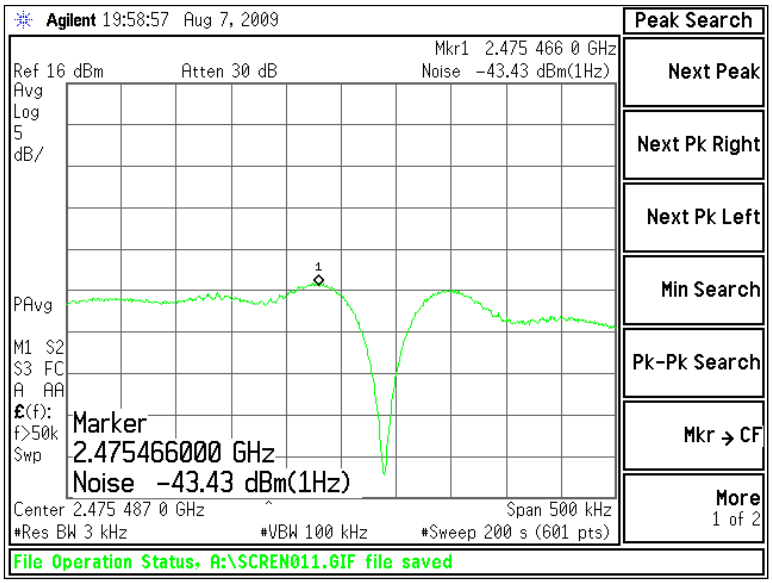

Agilent 19:58:57 Aug 7, 2009
Peak Search
Mkr1 2.475 466 0 GHz
Ref 16 dBm
Atten 30 dB
Noise -43.43 dBm(1Hz)
Next Peak
Avg
Log
5
dB/
Next Pk Right
Next Pk Left
Min Search
PAvg
M1 S2
S3 FC
A AA
£(f):
f>50k
Swp
Pk-Pk Search
Mkr → CF
Marker
2.475466000 GHz
Noise -43.43 dBm(1Hz)
More
1 of 2
Center 2.475 487 0 GHz
Span 500 kHz
#Res BW 3 kHz
#VBW 100 kHz
#Sweep 200 s (601 pts)
File Operation Status, A:\SCREN011.GIF file saved

EXHIBIT 11. SPURIOUS CONDUCTED EMISSIONS: 15.247(d)

11.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 db below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

In addition, radiated emissions, which fall in the restricted band, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(e)

FCC Part 15.247(d) and IC RSS 210 A8.5 requires a measurement of conducted harmonic and spurious RF emission levels, as reference to the carrier level when measured in a 100 kHz bandwidth. For this test, the spurious and harmonic RF emissions from the EUT were measured at the EUT antenna port using a short RF cable. The loss from the cable was added on the analyzer as correction factor files. A Hewlett Packard model E4446A spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The unit was configured to run in a continuous transmit mode. The spectrum analyzer was used with measurements from a peak detector presented in the chart below. Screen captures were acquired and any noticeable spurious and harmonic signals were identified and measured.

No significant emissions could be noted within -50 dBc of the fundamental level for this product.

11.2: Data

	Channel 0	Channel 8	Channel 14
	Power in dBm		
Fundamental	13.51	13.76	12.19
2nd Harmonic	-53.59	-55.99	-55.98
3rd Harmonic	*Note 1*	*Note 1*	*Note 1*
4th Harmonic	*Note 1*	*Note 1*	*Note 1*
5th Harmonic	*Note 1*	*Note 1*	*Note 1*
6th Harmonic	*Note 1*	*Note 1*	*Note 1*
7th Harmonic	*Note 1*	*Note 1*	*Note 1*
8th Harmonic	*Note 1*	*Note 1*	*Note 1*
9th Harmonic	*Note 1*	*Note 1*	*Note 1*
10th Harmonic	*Note 1*	*Note 1*	*Note 1*

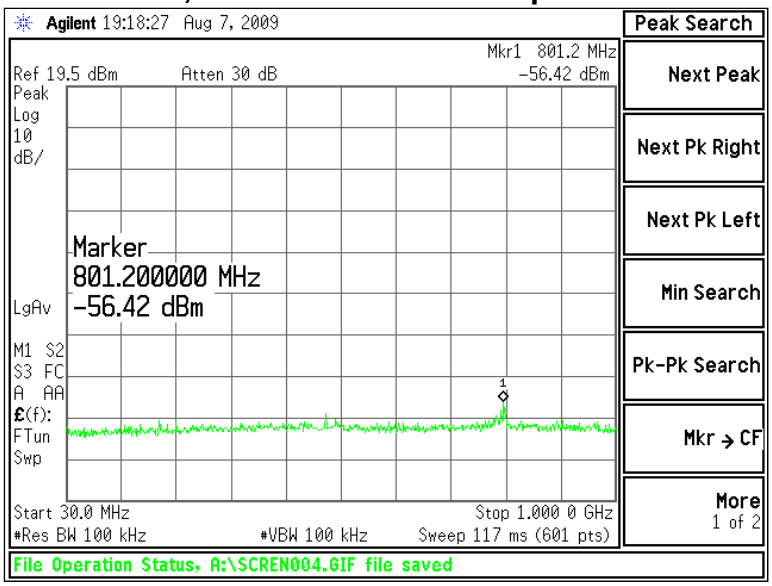
Notes:
(1) Measurement at system noise floor.

11.3 Test Equipment List

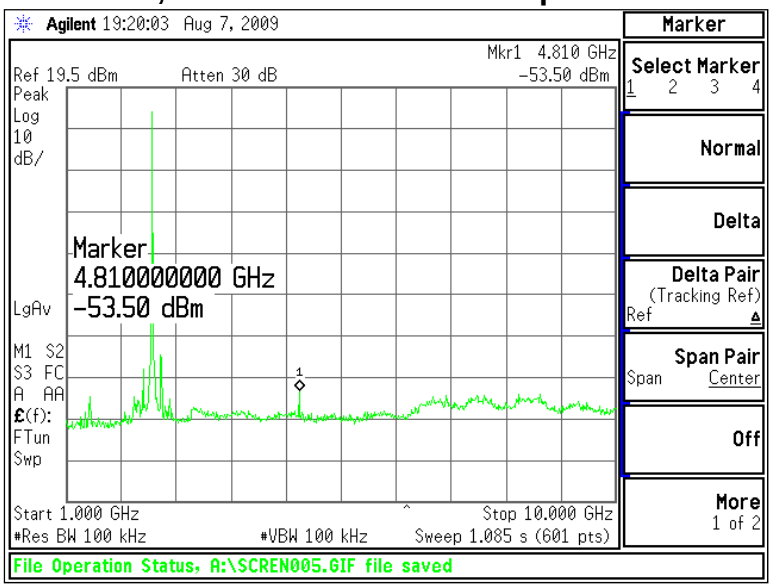
Test Equipment	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Agilent	E4446A	US45300564	To 44 GHz

11.4 Screen Captures – Spurious Conducted Emissions

Channel 8, shown from 30 MHz up to 1000 MHz



Channel 8, shown from 1000 MHz up to 10000 MHz



Channel 8, shown from 10000 MHz up to 25000 MHz

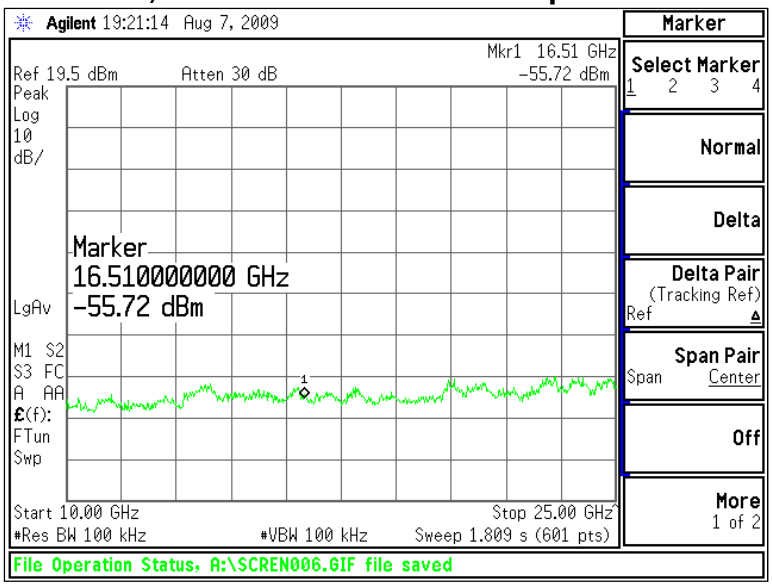


EXHIBIT 12. MPE CALCULATIONS

The following MPE calculations are based on the SMA straight antenna, with a measured ERP of 119.7 dBµV/m, at 3 meters (at 2405 MHz), and conducted RF power of +18.4 dBm as presented to the antenna. The calculated gain of this antenna, based on the ERP measurements is 6.96 dBi.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	18.40	(dBm)
Maximum peak output power at antenna input terminal:	69.183	(mW)
Antenna gain(typical):	6.96	(dBi)
Maximum antenna gain:	4.966	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2400	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.068349	(mW/cm^2)
Maximum allowable antenna gain:	18.6	(dBi)
Margin of Compliance at 20 cm =	11.7	dB

APPENDIX A

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 14-Aug-2009 Type Test : Radiated Emissions (109) Job # : C-690

Prepared By: L Bott Customer : Niles Audio Quote #: 309028

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	12/23/2008	12/23/2009	Active Calibration
2	AA 960077	Bicon Antenna	EMCO	93110B	9702-2918	11/24/2008	11/24/2009	Active Calibration
3	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	10/20/2008	10/20/2009	Active Calibration
4	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	9/26/2008	9/26/2009	Active Calibration
5	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	9/23/2008	9/23/2009	Active Calibration
6	EE 960156	100kHz-1GHz Analog Signal Generator	Agilent	N5181A	MY49060062	3/7/2009	3/7/2010	Active Calibration
7	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	3/17/2009	3/17/2010	Active Calibration
8	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	7/2/2009	7/10/2010	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 14-Aug-2009 Type Test : Conducted Power Output Job # : C-690

Prepared By: L Bott Customer : Niles Audio Quote #: 309028

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960144	Phaseflex	Gore	EkD01D010720	5800373	6/25/2009	6/25/2010	Active Calibration
2	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 14-Aug-2009 Type Test : Occupied Bandwidth (20dB) Job # : C-690

Prepared By: L Bott Customer : Niles Audio Quote #: 309028

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960144	Phaseflex	Gore	EkD01D010720	5800373	6/25/2009	6/25/2010	Active Calibration
2	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 14-Aug-2009 Type Test : Conducted Emissions Job # : C-690

Prepared By: L Bott Customer : Niles Audio Quote #: 309028

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960144	Phaseflex	Gore	EkD01D010720	5800373	6/25/2009	6/25/2010	Active Calibration
2	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 14-Aug-2009 Type Test : Band-Edge Job # : C-690

Prepared By: L Bott Customer : Niles Audio Quote #: 309028

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	12/23/2008	12/23/2009	Active Calibration
2	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	9/23/2008	9/23/2009	Active Calibration
3	EE 960156	100kHz-1GHz Analog Signal Generator	Agilent	N5181A	MY49060062	3/7/2009	3/7/2010	Active Calibration
4	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	3/17/2009	3/17/2010	Active Calibration
5	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	7/2/2009	7/10/2010	Active Calibration

APPENDIX B
TEST STANDARDS – CURRENT PUBLICATION DATES RADIO

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2003		
CISPR 11	2009-05		
CISPR 12	2007-05		
CISPR 14-1	2005-11	2008-11	
CISPR 14-2	2001-11	2001-11	2008-05
CISPR 16-1-1 Note 1	2006-03	2006-09	2007-07
CISPR 16-1-2 Note 1	2003	2004-04	2006-07
CISPR 22	2008-09		
CISPR 24	1997-09	2001-07	2002-10
EN 55011	2007-05		
EN 55014-1	2006		
EN 55014-2	1997		
EN 55022	2006	2007	
EN 60601-1-2	2007-03		
EN 61000-3-2	2006-05		
EN 61000-3-3	2008-12		
EN 61000-4-2	2001	1998	2001
EN 61000-4-3	2006-07	2008-05	
EN 61000-4-4	2004		
EN 61000-4-5	2006-12		
EN 61000-4-6	2007-08		
EN 61000-4-8	1993	1994-01	
EN 61000-4-11	2004-10		
EN 61000-6-1	2007-02		
EN 61000-6-2	2005-12		
EN 61000-6-3	2007-02		
EN 61000-6-4	2007-02		
FCC 47 CFR, Parts 0-15, 18, 90, 95	2008		
FCC Public Notice DA 00-1407	2000		
FCC ET Docket # 99-231	2002		
FCC Procedures	2007		
ICES 001	2006-06		
ICES 002	2007-02		
ICES 003	2004-02		
IEC 60601-1-2 Note 1	2007-03		
IEC 61000-3-2	2005-11	2008-03	
IEC 61000-3-3	2008-06		
IEC 61000-4-2	2008-12		
IEC 61000-4-3	2008-04	incl in 2006	
IEC 61000-4-4	2004-07		
IEC 61000-4-5	2005-11		
IEC 61000-4-6	2008-06		
IEC 61000-4-8	2001-03		
IEC 61000-4-11	2004-03		
IEC 61326-1	2006-06		
ISO 14082	1998-07		
MIL Std. 461E	1999-08		
RSS GEN	2007-06		
RSS 119	2007-06		
RSS 123	1999-11		
RSS 125	2000-03		
RSS 131	2003-07		
RSS 136	2002-10		
RSS 137	2009-02		
RSS 210	2007-06		
RSS 213	2005-12		
RSS 243	2005-11		
RSS 310	2007-06		

Note 1: Test not on LSR Scope of Accreditation.

Updated on 6-26-09

APPENDIX C
Uncertainty Statement

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k=2.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V

Appendix D

Antenna Specification(s)

Heat Shrink Dipole

Product Number: AN2400-0652BO
Product Name: Antenna

1. Specification

Sample Photo	
	
A. Electrical Characteristics	
Frequency	2400 ~ 2500 MHz
S.W.R.	<= 2.0
Antenna Gain	2.0 ± 0.7dBi @ 2450MHz
Polarization	Linear
Impedance	50 Ohm
B. Material & Mechanical Characteristics	
Material of Radiator	Cu
Material of Plastic	/
Cable Type	RG178
Connector Type	/
Connector Pull Test	/
Connector Torque Test	/
C. Environmental	
Operation Temperature	- 40 °C ~ + 65 °C
Storage Temperature	- 40 °C ~ + 80 °C

SMA Antenna

Product Number: R-AN2400-5801RS
Product Name: Antenna

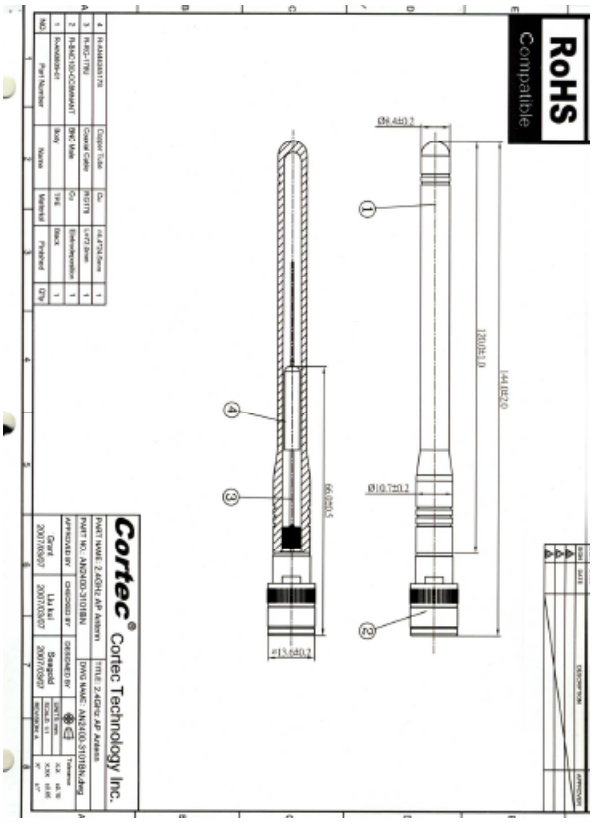
1. Specification

Sample Photo	
	
A. Electrical Characteristics	
Frequency	2400 ~ 2500 MHz
S.W.R.	<= 2.0
Antenna Gain	2.0 ± 0.7 dBi
Polarization	Linear
Impedance	50 Ohm
B. Material & Mechanical Characteristics	
Material of Radiator	Cu
Material of Plastic	Body: TPE Hinge: PA+ABS Holder: PA+ABS
Cable Type	RG-178
Connector Type	SMA Male Reverse
Connector Pull Test	>= 3 Kg
Connector Torque Test	200 ~ 500 g.cm
C. Environmental	
Operation Temperature	- 40 °C ~ + 65 °C
Storage Temperature	- 40 °C ~ + 80 °C

BNC Antenna

2. Specification

A. Electrical Characteristics	
S.W.R.	<= 2.0 @ 2400~2500 MHz
Antenna Gain	2.0 ± 0.5 dBi (*Depends on Product Mechanical Environment*)
Impedance	50 Ohm 56Ω resistive at 2.4
B. Material	
Material of Radiator	Cu (Plated)
Connector Type	50 Ohm BNC Male
C. Environmental	
Operation Temperature	- 30 °C ~ + 85 °C
Storage Temperature	- 30 °C ~ + 85 °C

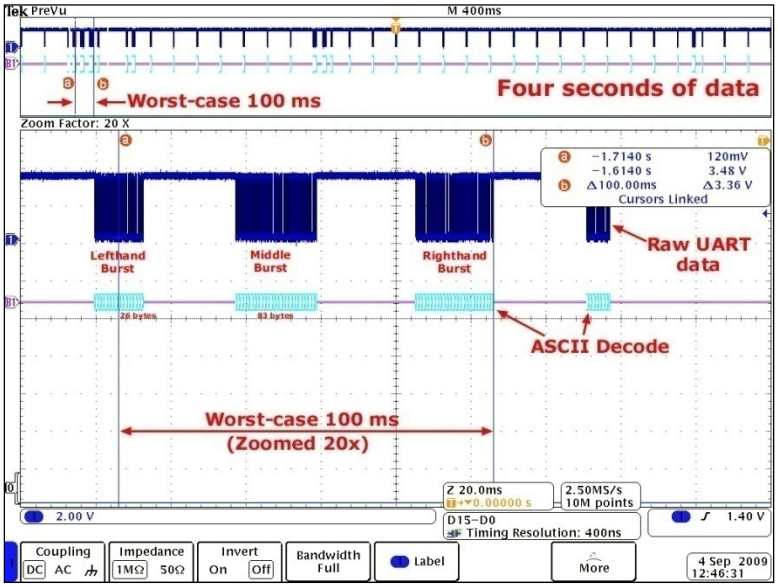


Appendix E

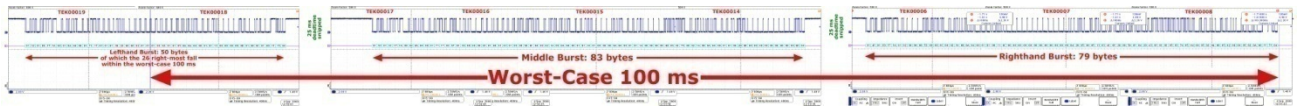
Duty Cycle Relaxation Justification

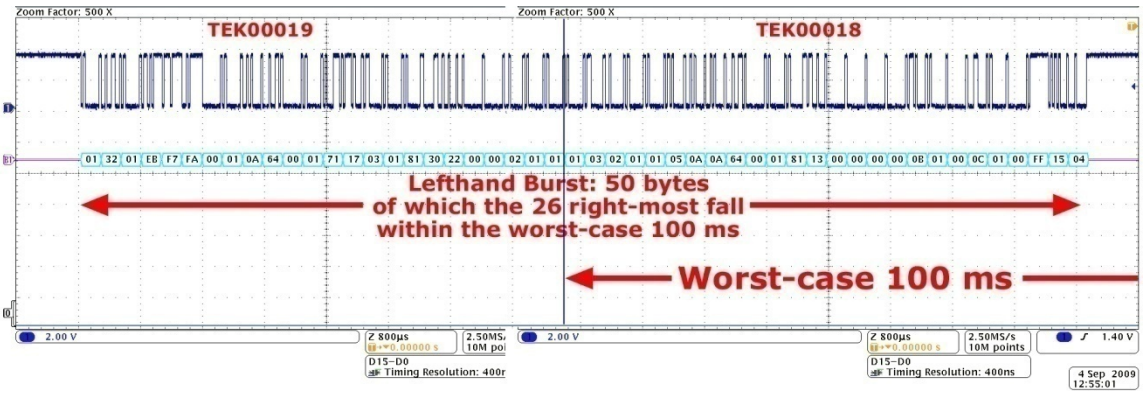
The packet traffic was observed during a special RF signal strength/quality of service mode, in which the ZigBee end device (remote control) pings the ZigBee coordinator at the rate of about 10 packets per second, with the bursts observed every 1 or 2 seconds due to the normal system heartbeat and handshake. This service mode is normally only used during system setup so what you see in these scope pictures is very much a rare worst-case scenario.

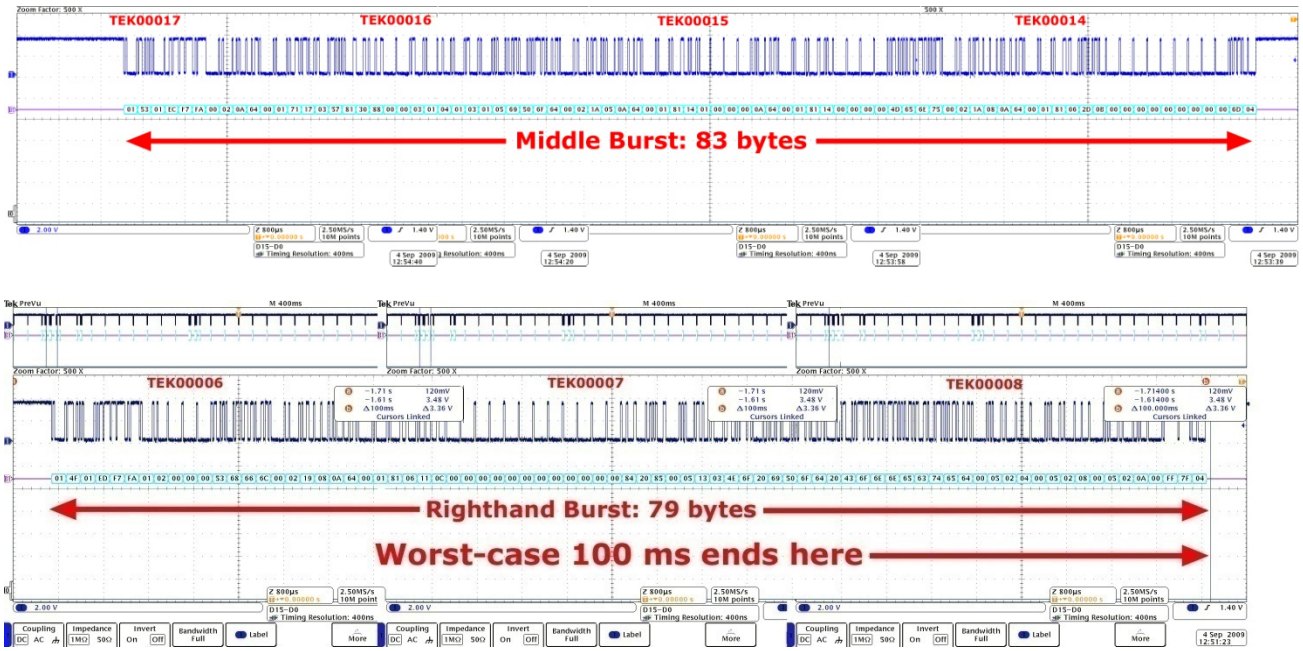
The plot below shows 4 seconds of data that includes the worst-case 100 ms packet burst observed over about a minute of prior data. The worst 100 ms segment is marked.



The following plots zoom in on the above data by a factor of 500x over the entire 4 seconds shown in the previous picture, and a further 25x over the 20x zoomed view in the bottom of that picture.







Entire 100 ms burst detail" zooms in on the above data by a factor of 500x over the entire 4 seconds shown in the previous picture, and a further 25x over the 20x zoomed view in the bottom of t hat picture.

"lefthand burst", "middle burst", and "righthand burst" zoom in at 500x on the three individual packets that make up the entire burst.

The left-hand packet extends outside the 100 ms measurement period, so is split, as marked. However, rather than pro-rate the 13 byte packet overhead, I have added it in full. This will slightly disadvantage the calculations, but keeps the analysis simple.

There are three packets (one of which is partial because it extends outside the 100 ms measurement interval), totaling about 26+13 + 83+13 + 79+13 at 38400 bps in the worst case 100 ms.

This gives Ton = 227 bytes x 10 bits/byte x 8 us/bit = 18.160 ms. [This is about 3x the worst case, which just shows that due to the somewhat stochastic nature of a multi-threaded embedded system, one has to make sure that a good margin for error is allotted for.

Therefore, Emission relaxation factor = 20 log (18.16/100) = -14.8 dB.