Willow Run Test Labs, LLC
8501 Beck Road, Building 2227
Belleville, Michigan 48111 USA
Tel: (734) 252 9785
Fax: (734) 926 9785
e-mail: info@wrtest.com

Testing of

Electromagnetic Emissions

per

USA: CFR Title 47, Part 15.247
Canada: RSS-210 and RSS-GEN

are herein reported for

Perceptron, Inc.
BK8000-RX

Test Report No.: 20111206-01r2

Applicant/Provider:
Perceptron, Inc.
47827 Halyard Drive, Plymouth Michigan 48170-2461 USA
Phone: +1 (734) 414-4607, Fax: +1 (734) 414-4607
Contact Person: Jeff Schober; jschober@perceptron.com

Measured by:	Dr. Joseph Brunett, EMC-002790-NE	Report Approved by:	Dr. Joseph Brunett, EMC-002790-NE
Report by:	Dr. Joseph Brunett, EMC-002790-NE	Report Date of Issue:	December 27, 2011

Results of equipment under test (EUT) testing completed before December 27, 2011 are as follows.

Emissions The transmitter fundamental emission meets the regulatory limit(s) by no less than 30 dB. Transmit chain spurious harmonic emissions comply by no less than 12.5 dB. Radiated spurious emissions associated with the receive chain of this device meet the regulatory limit(s) by no less than 4.1 dB. Unintentional spurious emissions from digital circuitry comply with the radiated emission limit(s) by more than 4.2 dB. AC Power Line conducted emissions comply by more than 1.2 dB.

Contents

List of Tables

List of Figures

1 Test Specifications, General Procedures, and Location

1.1 Test Specification and General Procedures

The ultimate goal of Perceptron, Inc. is to demonstrate that the EUT complies with the Rules and/or Directives below. Detailed in this report are the results of testing the Perceptron, Inc. BK8000-RX for compliance to:

Country/Region	Rules or Directive	Referenced Section(s)
United States	Code of Federal Regulations	CFR Title 47, Part 15.247
Canada	Industry Canada	RSS-210 and RSS-GEN

In association with the rules and directives outlined above, the following specifications and procedures are followed herein.

ANSI C63.4-2003	"Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
FCC KDB 558074	"Measurement of Digital Transmission Systems Operating under Section 15.247"
FCC KDB 913591	"Measurement of radiated emissions at the edge of the band for a Part 15 RF Device"
Industry Canada	"The Measurement of Occupied Bandwidth"

1.2 Test Location and Equipment Used

Test Location The EUT was fully tested at **Willow Run Test Labs, LLC**, 8501 Beck Road, Building 2227, Belleville, Michigan 48111 USA. The **Open Area Test Site (OATS)** description and attenuation characteristics are on file with the FCC Laboratory, Columbia, Maryland (FCC Reg. No: 688478) and with Industry Canada, Ottawa, ON (File Ref. No: IC 8719A-1).

Test Equipment Pertinent test equipment used for measurements at this facility is listed in Table 1. The quality system employed at Willow Run Test Labs, LLC has been established to ensure all equipment has a clearly identifiable classification, calibration expiry date, and that all calibrations are traceable to the SI through NIST, other recognized national laboratories, accepted fundamental or natural physical constants, ratio type of calibration, or by comparison to consensus standards.

Table 1: Willow Run Test Labs, LLC Equipment List.

Description	Manufacturer/Model	SN	Quality Number	Last Cal By / Date Due
Antennas				
Shielded Loop (9 kHz - 50 MHz)	EMCO/6502	2855	UMLOOP1	UMRL / July-2012
Dipole Set (20 MHz - 1000 MHz)	EMCO/3121C	9504-1121	DIPEMC001	Liberty Labs / Sept-2012
Bicone (20 MHz - 250 MHz)	JEF	1	BICJEF001	UMRL / July-2012
Bicone (200 MHz - 1000 MHz)	JEF	1	SBICJEF001	UMRL / July-2012
Log-Periodic Array (200 MHz - 1000 MHz)	JEF/Isbell	1	LOGJEF001	UMRL / July-2012
Ridge-Horn Antenna	Univ. of Michigan	5	UMHORN005	UMRL / July-2012
L-Band	JEF		HRNL001	JEF / July-2012*
LS-Band Horns	JEF/NRL	001, 002	HRN15001, HRN15002	JEF / July-2012*
S-Band Horns	Scientific-Atlanta	1854	HRNSB001	JEF / July-2012*
C-Band	JEF/NRL	1	HRNC001	JEF / July-2012*
XN-Band Horns	JEF/NRL	001, 002	HRNXN001, HRNXN002	JEF / July-2012*
X-Band Horns	JEF/NRL	001, 002	HRNXB001, HRNXB002	JEF / July-2012*
Ku-Band Horns	JEF/NRL	001, 002	HRNKU001, HRNKU002	JEF / July-2012*
Ka-Band Horns	JEF/NRL	001, 002	HRNKA001, HRNKA002	JEF / July-2012*
Receiver's / Spectrum Analyzers				
Spectrum Analyzer	HP/8593E	3649A02722	HP8593E001	DTI / Sept-2012
Signal Generators				
Tracking Generator	HP/8593E	3649A02722	HP8593E001	DTI / Sept-2012
Line Impedance Stabilization Networks				
LISN	EMCO	9304-2081	LISNEM001	JEF / Jan-2012

* Verification Only - Standard Gain Horn Antennas

2 Configuration and Identification of the Equipment Under Test

2.1 Description and Declarations

The EUT is a 2.4 GHz Digital Spread Spectrum commercial video receiver with built-in camera and LCD display. The equipment under test (EUT) is approximately 18 x 10.5 x 5 cm in dimension, and is depicted in Figure 1. It is powered by a 3.7 VDC internal rechargeable battery. This device is envisioned to be a base video display used in conjunction with the BK8000-TX commercial video transmitter to aid in the inspection of combustion engines, braking systems, etc. The EUT also has its own built in camera to operate as a stand alone inspection device. Table 2 outlines provider

Figure 1: Photographs of the EUT.

declared EUT specifications.

2.1.1 EUT Configuration

The EUT is configured for testing as depicted in Figure 2.

2.1.2 Modes of Operation

In normal operation there is only a single mode of operation as an DSS video receiver at fixed data rate, as tested. For testing, the radio was placed into the maximum possible (continuous) data rate and maximum power setting using custom software provided by the radio manufacturer.

2.1.3 Variants

There is only a single variant of the EUT, as tested.

Table 2: EUT Declarations.

General Declarations			
Equipment Type:	DSS Video Receiver	**Country of Origin:**	US
Nominal Supply:	3.7 VDC	**Oper. Temp Range:**	-20^o C to $+55^o$ C
Frequency Range:	2412-2472 MHz	**Antenna Dimension:**	Integral
Antenna Type:	Integral Patch	**Antenna Gain:**	0 dBi (declared)
Number of Channels:	4	**Channel Spacing:**	20 MHz
Alignment Range:	N/A	**Type of Modulation:**	OFDM
United States			
FCC ID Number:	Z34-BK8000-RX	**Classification:**	DSS
Canada			
IC Number:	9935A-BK8000RX	**Classification:**	Spread Spectrum Device, Digital Device

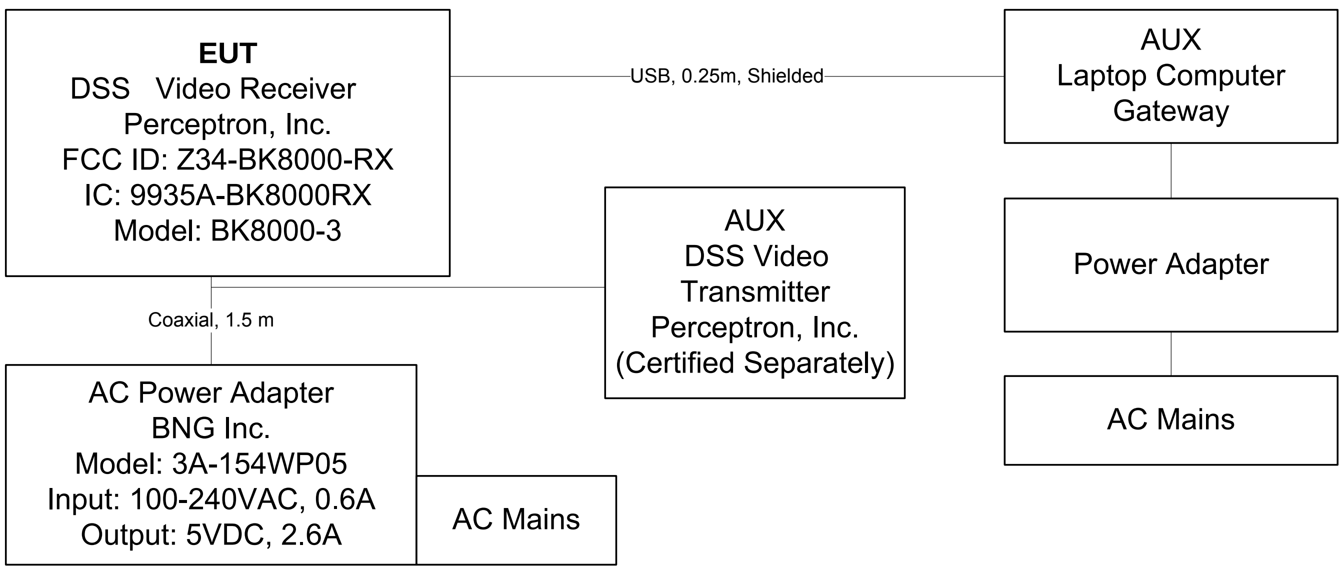

Figure 2: EUT Test Configuration Diagram.

2.1.4 Test Samples

The testing laboratory was supplied with one normal operating BK8000-RX and BK8000-TX (certified separately) pair, and one pair of the same units with custom software used to force the DSS radio into continuous transmit mode on low, middle, and high channels across the 2400-2483.5 MHz band at maximum possible data rate. (Note that the EUT does not employ a range of data rates or port configurations typically permitted by the 802.11n radio chipset employed. It utilizes only a single-stream fixed data rate (as tested). Radio parameters cannot be adjusted by the end user.

2.1.5 Functional Exerciser

Not Applicable.

2.1.6 Modifications Made

There were no modifications made to the EUT by this laboratory. The continous transmit mode sample was modified by the manufacturer after testing to confirm conducted power output level at the radio.

2.1.7 Production Intent

The EUT appears to a production ready sample.

2.1.8 Declared Exemptions and Additional Product Notes

The EUT employs only a single-stream fixed data rate communication on 4 user selectable channels (2412 MHz, 2432 MHz, 2452 MHz, and 2472 MHz). The radio parameters cannot be adjusted by the end user.

In addition, this is an expensive product sold through distribution channels via the Snap-on franchisee network, which consists of trucks that serve the automotive repair industry. As such is subject to digital emissions regulation as a Class A commercial product. The manufacturer states that it will not be sold for use by the general public.

3 Emissions

3.1 General Test Procedures

3.1.1 Radiated Test Setup and Procedures

Radiated electromagnetic emissions from the EUT are first evaluated in our shielded fully anechoic chamber. Spectrum and modulation characteristics of all emissions are recorded, and emissions above 1 GHz are fully characterized. The anechoic chamber contains a set-up similar to that of our outdoor 3-meter site, with a turntable and antenna mast. Instrumentation, including spectrum analyzers and other test equipment as detailed in Section 1.2 are employed. After indoor pre-scans, emission measurements up to 1 GHz are made on our outdoor 3-meter Open Area Test Site (OATS). If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.4 / CISPR 22 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed if the resulting emissions appear to be worst-case in such a configuration. See Figure 3.

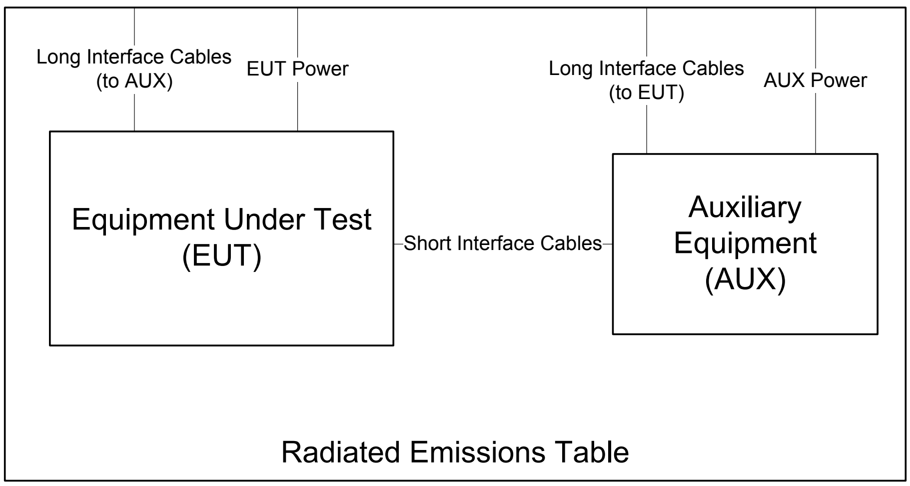

Figure 3: Radiated Emissions Diagram of the EUT.

All intentionally radiating elements are placed on the test table lying flat, on their side, and on their end (3-axes) and the resulting worst case emissions are recorded. For both horizontal and vertical polarizations, the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected. The EUT is then rotated through 360^o in azimuth until the highest emission is detected. The test antenna is then raised and lowered one last time from 1 to 4 m and the worst case value is recorded.

If the EUT exhibits spurious emissions due to internal receiver circuitry, such emissions are measured with an appropriate carrier signal applied. For devices with intentional emissions below 30 MHz, a shielded loop antenna is used as the test antenna. It is placed at a 1 meter receive height and appropriate low frequency magnetic field extrapolation to the regulatory limit distance is employed. Emissions between 30 MHz and 1 GHz are measured using tuned dipoles and/or calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Care is taken to ensure that test receiver resolution and video bandwidths meet the regulatory requirements, and that the emission bandwidth of the EUT is not reduced.

Where regulations call for direct measurement of field strength, power values (dBm) measured on the test receiver / analyzer are converted to dBμV/m at the regulatory distance, using

$$E_{dist} = 107 + P_R + K_A - K_G + K_E - C_F$$

where P_R is the power recorded on spectrum analyzer, in dBm, K_A is the test antenna factor in dB/m, K_G is the combined pre-amplifier gain and cable loss in dB, K_E is duty correction factor (when applicable) in dB, and C_F is a distance conversion (employed only if limits are specified at alternate distance) in dB. This field strength value is then compared with the regulatory limit. If effective isotropic radiated power (EIRP) is compute, it is computed as

$$EIRP(dBm) = E_{3m}(dB\mu V/m) - 95.2.$$

When presenting data at each frequency, the highest measured emission under all possible EUT orientations (3-axes) is reported.

Photographs of the test setup employed are depicted in Figure 4.

Figure 4: Radiated Emissions Test Setup Photograph(s).

3.1.2 Conducted Test Setup and Procedures

AC Port Conducted Spurious For this device, AC power line conducted emissions are measured in our screen room. If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.4 / CISPR 22 are employed. Alternatively, an on-table layout more representative of actual use may be employed if the resulting emissions appear to be worst-case in such a configuration. See Figure 5. Conducted

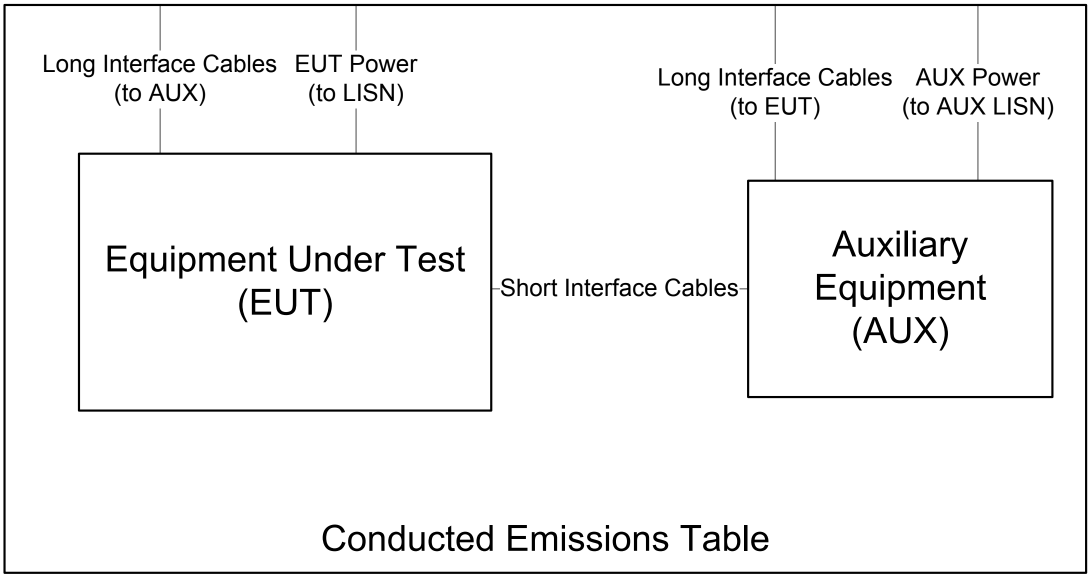

Figure 5: Conducted Emissions Setup Diagram of the EUT.

emissions are measured and recorded for each AC mains power source over the spectrum 0.15 MHz to 30 MHz for both the ungrounded (HI/PHASE) and grounded (LO/GRND) conductors with the EUT placed in its highest current draw operating mode(s). The test receiver is set to peak-hold mode in order to record the peak emissions throughout the course of functional operation. Only if an emission exceeds or is near the limit are quasi-peak and average detection applied. Photographs of the test setup employed are depicted in Figure 6.

Battery Power Conducted Spurious The EUT is not subject to power line conducted emissions measurements when it is powered solely by its internal battery.

3.1.3 Power Supply Variation

Tests at extreme supply voltages are made if required by the the procedures specified in the test standard, and results of this testing are detailed in this report.

In the case of this EUT, measurements of the worst-case radiated emissions are performed with the supply voltage varied by no less than 85% and 115% of the nominal rated value for devices connecting to AC power mains.

In the case the EUT is designed for operation from a lead-acid battery power source, the extreme test voltages are evaluated between 90% and 130% of the nominal battery voltage declared by the manufacturer. For float charge applications using gel-cell type batteries, extreme test voltages are evaluated between 85% and 115% of the nominal battery voltage declared. For all battery operated equipment, worst case intentional and spurious emissions are re-checked employing a new (fully charged) battery.

3.1.4 Thermal Variation

Tests at extreme temperatures are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report. The provider has declared that the EUT is designed for operation over the temperature range -20^o C to $+55^o$ C. Before any temperature measurements are made, the equipment is allowed to

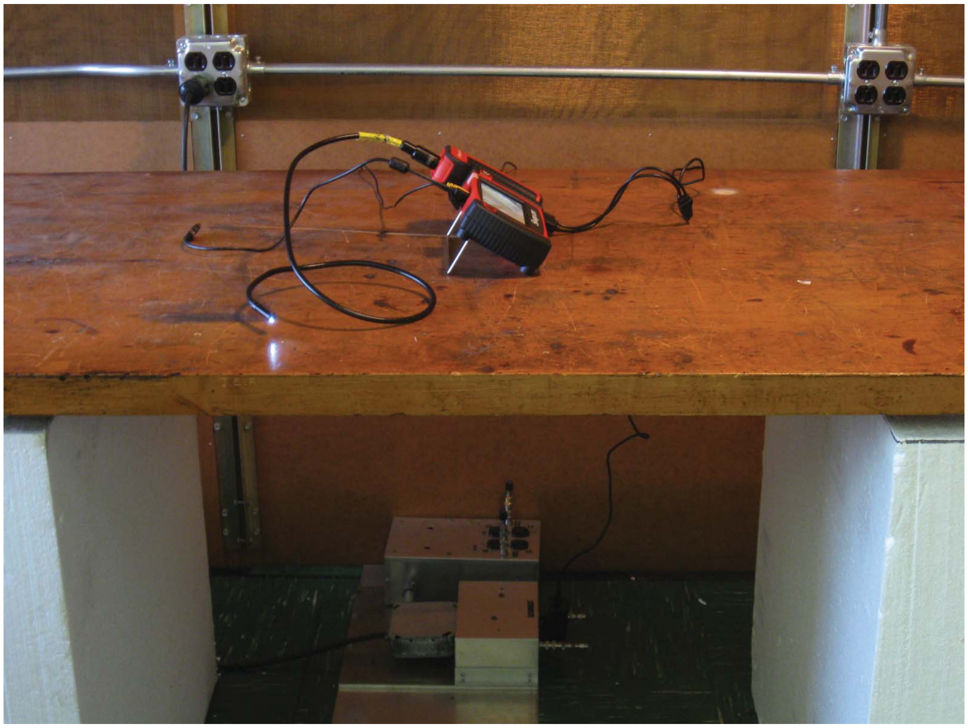

Figure 6: Conducted Emissions Test Setup Photograph(s).

reach a thermal balance in the test chamber, temperature and humidity are recorded, and thermal balance is verified via a thermocouple based probe.

3.2 Intentional Emissions

3.2.1 Fundamental Emission Bandwidth

Emission bandwidth (EBW) of the EUT is measured with the device placed in the test mode(s) with the shortest available packet length and minimum packet spacing. Radiated emissions are recorded following the test procedures listed in Section 1.1. The 6 dB bandwidth and 26 dB EBW are measured for the lowest, middle, and highest channels available. The 99% emission bandwidth per IC test procedures is also reported.The results of this testing are summarized in Table 3. Plots showing measurements employed obtain the emission bandwidths reported are provided in Figure 7.

Table 3: Intentional Emission Bandwidth.

Frequency Range	Detector	IF Bandwidth	Video Bandwidth	Test Date:	17-Oct-11
f > 1 000 MHz	Pk	30 kHz	> 3 x IFBW	Test Engineer:	Joseph Brunett
				EUT Mode:	BK8000RX Cont. Tx.

						FCC/IC
Mode	Data Rate	Channel	Frequency (MHz)	6 dB BW (MHz)	26 dB EBW (MHz)	IC 99% PWR BW (MHz)
802.11n	Continuous	1	2412.0	16.88	19.43	16.80
		2	2432.0	16.84	19.95	16.88
		4	2472.0	16.80	19.95	16.95

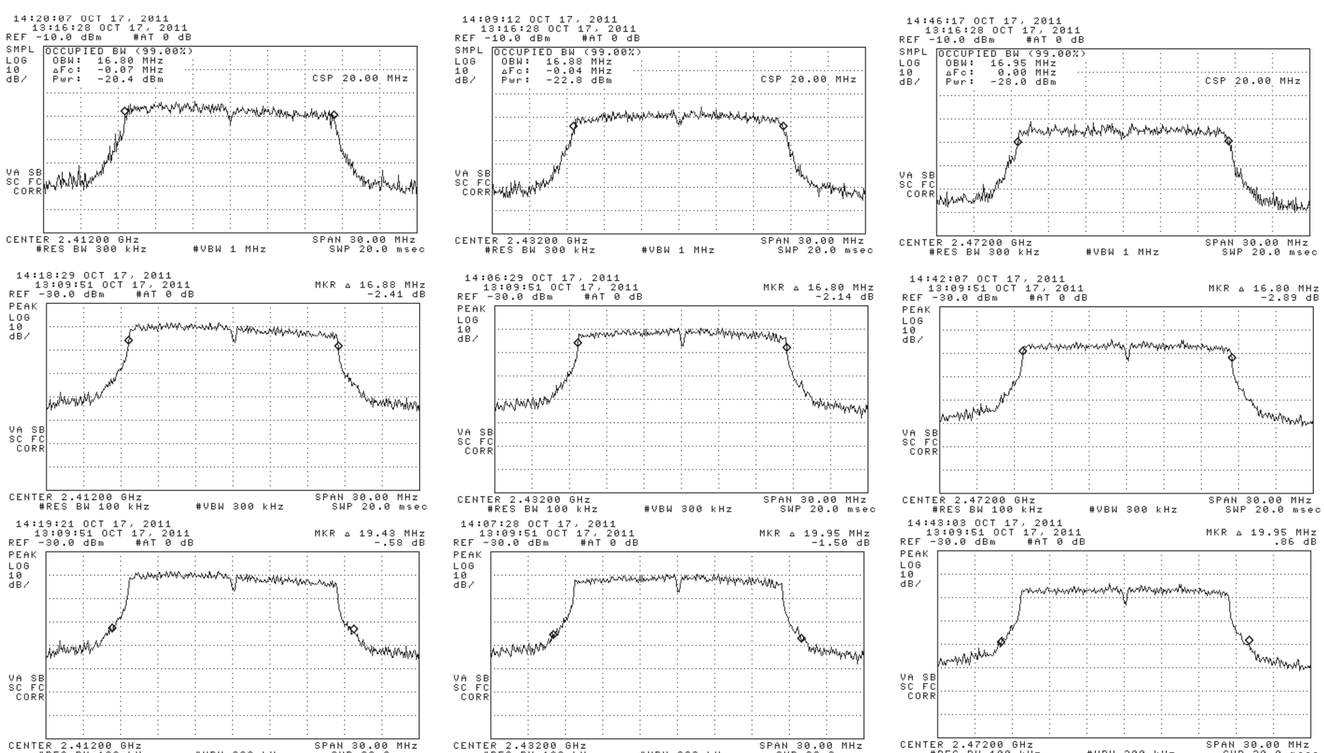

Figure 7: Intentional Emission Bandwidth.

3.2.2 Effective Isotropic Radiated Power

The EUT's radiated power is computed from field strength measurements made at 3 meters from the EUT. Since the emission bandwidth of this EUT is greater than the maximum test receiver bandwidth available, the FCCs DTS measurement procedures are employed in determining output power. The test receiver is set in linear mode, sample or peak detected (as depicted in the example plots provided). After data is collected, the scale is returned to log mode so that power is properly computed by the receiver's integration routine across no less than the 26 dB EBW. The results of this testing are summarized in Table 4. Plots showing how these measurements were made are depicted in Figure 8.

Table 4: Effective Isotropic Radiated Power Results.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**		
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Date:**	8-Dec-11
f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz/10kHz	**Test Engineer:**	Joseph Brunett
				EUT Mode:	BK8000RX Cont. Tx.

											FCC/IC
Mode	Channel	Freq. MHz	Ant. Used	Ant. Pol.	Pr ** dBm	Ka dB/m	Kg dB	EIRP (Pk) dBm	Pout* dBm	Calc. Ant Gain dB	EIRP Limit dBm
Cont. Tx.	1	2412.0	Horn LS	H/V	-30.0	16.8	-1.2	- 0.2	**14.9**	-15.1	30.0
	2	2432.0	Horn LS	H/V	-31.0	16.8	-1.2	- 1.2	14.5	-15.7	30.0
	4	2472.0	Horn LS	H/V	-33.7	16.8	-1.2	- 3.8	14.3	-18.1	30.0
Mode	Channel	Freq. MHz	Supply Voltage	Ant. Pol.	Pr ** dBm	Ka dB/m	Kg dB	EIRP (Pk) dBm			
Cont. Tx.	2	2432.0	4.1	H/V	-31.2	16.8	-1.2	- 1.4			
		2432.0	3.9	H/V	-31.0	16.8	-1.2	- 1.2			
		2432.0	3.7	H/V	-31.0	16.8	-1.2	- 1.2			
		2432.0	3.5	H/V	-31.5	16.8	-1.2	- 1.7			
		2432.0	3.3	H/V	-31.3	16.8	-1.2	- 1.5			

* Measured conducted from a modified EUT at the Radio Output pin.

** Measured radiated at 3 meter distance following Option 2, Method 1 of the FCC's DTS measurement procedures.

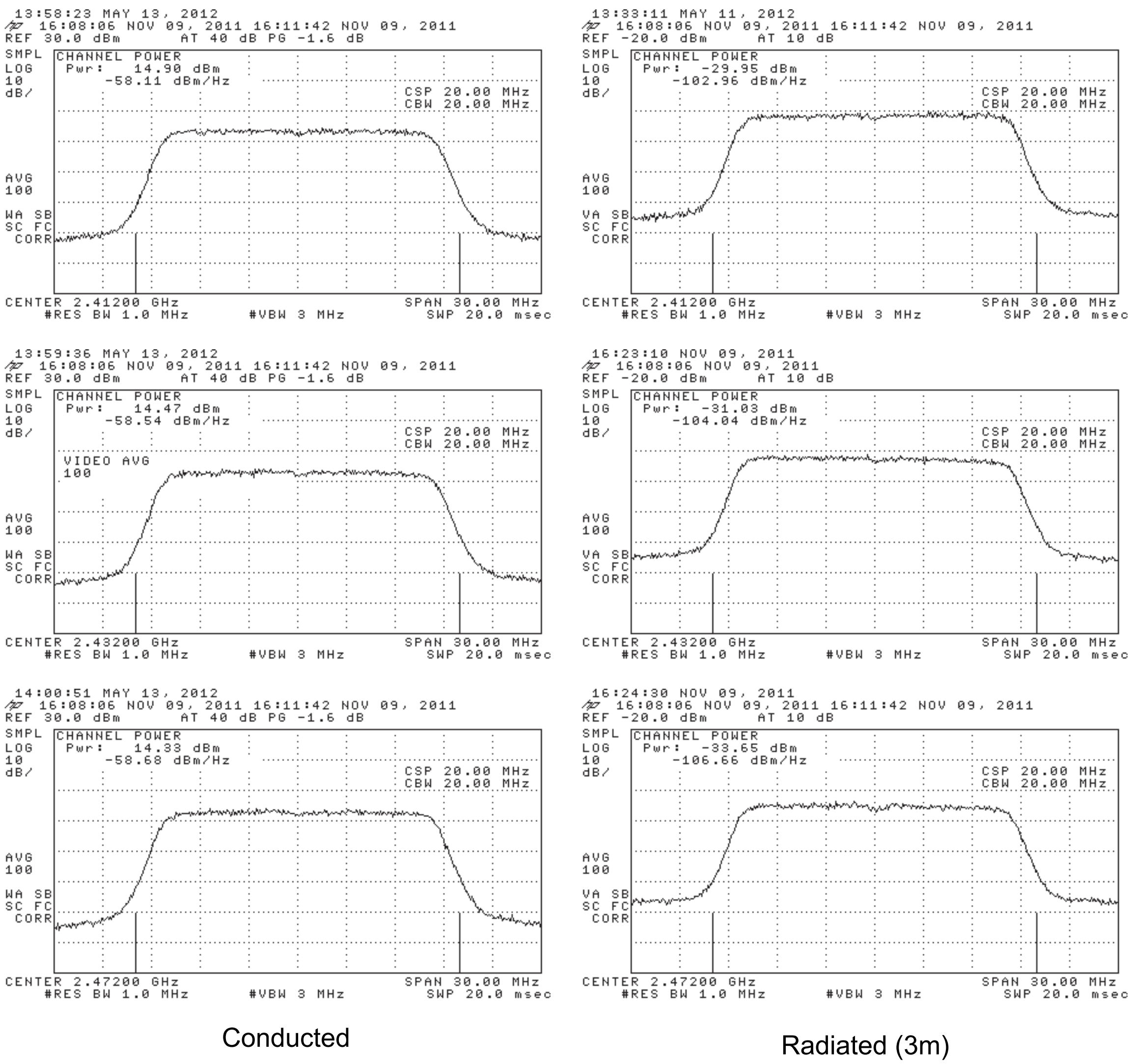

Figure 8: Effective Isotropic Radiated Power Example Plots.

3.2.3 Power Spectral Density

For this test, field strength emissions are made at 3 meters with the EUT oriented for maximum emission. The spectrum is first scanned for maximum spectral peaks, the span and receiver bandwidth are then reduced until the power spectral density in field strength is measured in the prescribed receiver bandwidth. A sweep time of 100 seconds is maintained to ensure peak signals are captured in each frequency bin. The results of this testing are summarized in Table 5. Plots showing how these measurements were made are depicted in Figure 9.

Table 5: Power Spectral Density Results.

Frequency Range	**Detector**	**IF Bandwidth**	**Video Bandwidth**		
2405-2480 MHz	Pk	3 kHz	300 kHz	**Test Date:**	5-Dec-11
				Test Engineer:	Joseph Brunett
				EUT Mode:	Cont. Tx.

								FCC/IC
Mode	Channel	Frequency (MHz)	Ant. Used	Pr @ 3m (dBm/3kHz)	Ka dB/m	Kg dB	EIRP / PSD (dBm/3kHz)	Line Spacing (kHz)
Continuous Tx.	1	2412.0	Horn LS	-52.4	21.4	-1.2	-17.95	10.0
	2	2432.0	Horn LS	-55.4	21.5	-1.2	-20.88	9.7
	4	2472.0	Horn LS	-55.9	21.7	-1.2	-21.17	10.0

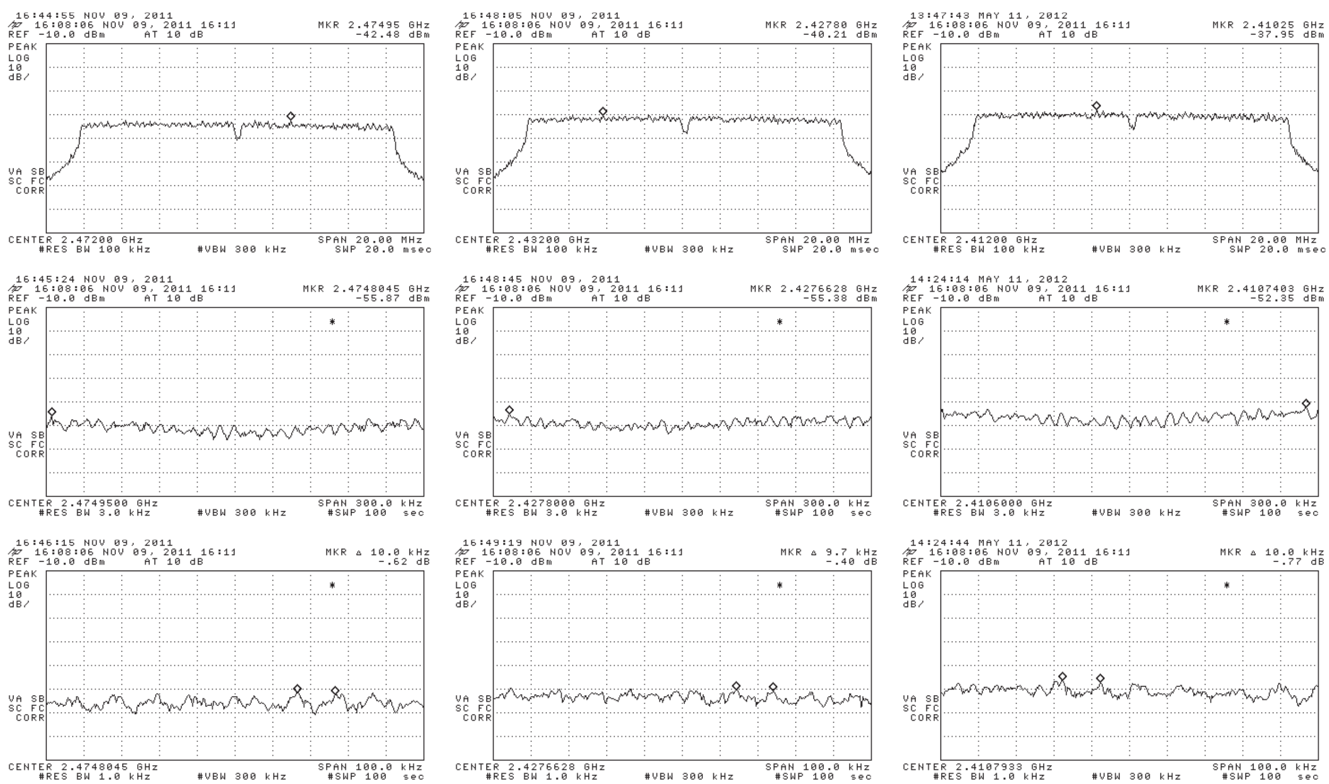

Figure 9: Power Spectral Density Plots.

3.3 Unintentional Emissions

3.3.1 Transmit Chain Spurious Emissions

The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 6. Measurements are performed to 10 times the highest fundamental operating frequency.

Table 6(a): Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth		
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Date:**	12-Oct-10
f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz/10kHz	**Test Engineer:**	Joseph Brunett
				EUT Mode:	Continous Tx CH 1,2,4

Tx Spurious Emissions												FCC/IC
#	Freq. MHz	Ant. Used	Ant. Pol.	Pr (Pk) dBm	Pr (Avg)* dBm	Ka dB/m	Kg dB	E3(Pk) dBμV/m	E3(Avg) dBμV/m	E3 Avg Lim dBμV/m	Pass dB	Comments
1	**Fundamental Restricted Band Edge (Low Side)**											
2	2412.0	Horn LS	H/V	-26.7	-36.9	16.8	-1.2	98.3	88.1			CH 1, 2412 MHz; max all
3	2390.0	Horn LS	H/V	**-65.7**	**-75.9**	16.7	-1.2	59.2	49.0	54.0	**5.0**	CH 1, 2412 MHz; ** See Below
4	2390.0	Horn LS	H/V	-73.4	-87.2	16.7	-1.2	51.5	37.7	54.0	16.3	CH2, 2432 MHz; max all
5	2390.0	Horn LS	H/V	-75.2	-87.2	16.7	-1.2	49.7	37.7	54.0	16.3	CH4, 2472 MHz,; max all
6	**Fundamental Restricted Band Edge (High Side)**											
7	2483.5	Horn LS	H/V	-78.2	-87.3	16.9	-1.2	46.9	37.8	54.0	16.2	CH 1, 2412 MHz; max all
8	2483.5	Horn LS	H/V	-77.7	-87.5	16.9	-1.2	47.4	37.6	54.0	16.4	CH2, 2432 MHz; max all
9	2472.0	Horn LS	H/V	-32.0	-44.4	16.8	-1.2	93.0	80.6			CH4, 2472 MHz,; max all
10	2483.5	Horn LS	H/V	**-76.4**	**-88.8**	16.9	-1.2	48.7	36.3	54.0	**17.7**	CH4, 2472 MHz,; ** See Below
11												
12	**Harmonic Emissions**											
13	4824.0	Horn C	H/V	-60.2	-71.0	24.6	21.1	50.3	39.5	54.0	14.5	Low, Max all
14	4874.0	Horn C	H/V	-61.7	-72.5	24.6	20.9	49.0	38.2	54.0	15.8	Mid, Max all
15	4944.0	Horn C	H/V	-62.2	-73.0	24.6	20.7	48.7	37.9	54.0	16.1	High, Max all
16	7236.0	Horn XN	H/V	-72.4	-83.2	25.1	21.7	38.0	27.2	54.0	26.8	Low, Max all
17	7311.0	Horn XN	H/V	-73.4	-84.2	25.2	21.9	36.9	26.1	54.0	27.9	Mid, Max all
18	7416.0	Horn XN	H/V	-73.6	-84.4	25.3	22.1	36.6	25.8	54.0	28.2	High, Max all
19	9648.0	Horn X	H/V	-72.4	-83.2	27.8	18.0	44.4	33.6	54.0	20.4	Low, Max all
20	9748.0	Horn X	H/V	-74.0	-84.8	27.9	17.9	43.0	32.2	54.0	21.8	Mid, Max all
21	9888.0	Horn X	H/V	-74.9	-85.7	28.0	17.9	42.2	31.4	54.0	22.6	High, Max all
22	12060.0	Horn X	H/V	-74.4	-85.2	31.8	16.9	47.5	36.7	54.0	17.3	Low, noise; max all
23	12185.0	Horn X	H/V	-74.8	-85.6	31.8	16.6	47.4	36.6	54.0	17.4	Mid, noise; max all
24	12360.0	Horn X	H/V	-74.6	-85.4	31.9	16.3	48.0	37.2	54.0	16.8	High, noise; max all
25	14472.0	Horn Ku	H/V	-71.4	-82.2	33.2	20.7	48.0	37.2	54.0	16.8	Low, noise; max all
26	14622.0	Horn Ku	H/V	-71.5	-82.3	33.3	20.9	47.9	37.1	54.0	16.9	Mid, noise; max all
27	14832.0	Horn Ku	H/V	-71.3	-82.1	33.4	21.1	48.0	37.2	54.0	16.8	High, noise; max all
28	16884.0	Horn Ku	H/V	-72.2	-83.0	34.7	21.9	47.6	36.8	54.0	17.2	Low, noise; max all
29	17059.0	Horn Ku	H/V	-73.5	-84.3	34.8	22.0	46.3	35.5	54.0	18.5	Mid, noise; max all
30	17304.0	Horn Ku	H/V	-72.7	-83.5	34.9	22.1	47.1	36.3	54.0	17.7	High, noise; max all
31	19296.0	Horn K	H/V	-60.3	-71.1	32.2	32.0	46.9	36.1	54.0	17.9	Low, noise; max all
32	19496.0	Horn K	H/V	-59.8	-70.6	32.3	32.0	47.5	36.7	54.0	17.3	Mid, noise; max all
33	19776.0	Horn K	H/V	-59.4	-70.2	32.3	32.0	47.9	37.1	54.0	16.9	High, noise; max all
34	21708.0	Horn K	H/V	-57.7	-68.5	32.7	32.0	50.0	39.2	54.0	14.8	Low, noise; max all
35	21933.0	Horn K	H/V	-57.6	-68.4	32.7	32.0	50.1	39.3	54.0	14.7	Mid, noise; max all
36	22248.0	Horn K	H/V	-58.1	-68.9	32.8	32.0	49.7	38.9	54.0	15.1	High, noise; max all
37	24120.0	Horn K	H/V	-55.9	-66.7	33.2	32.0	52.3	41.5	54.0	**12.5**	Low, noise; max all
38	24370.0	Horn K	H/V	-56.2	-67.0	33.2	32.0	52.0	41.2	54.0	12.8	Mid, noise; max all
39	24720.0	Horn K	H/V	-56.8	-67.6	33.3	32.0	51.5	40.7	54.0	13.3	High, noise; max all

*QPk detection below 1 GHz, Avg detection at or above 1 GHz with receiver bandwidth as specified at top of table.

** Meas. via "delta method", with intentional emission meas. in a 1MHz IFBW followed by band-edge delta in a 30kHz IFBW.

Table 6(b): Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth		
25 MHz ≤ f ≤ 25 GHz	Pk	100 kHz	300 kHz	**Test Date:**	17-Oct-10
				Test Engineer:	Joseph Brunett
				EUT Mode:	Continous Tx CH 1,2,4

Tx Out-of-Band Spurious Emissions (20 dB down confirmation) FCC/IC

#	Freq. MHz	Ant. Used	Ant. Pol.	Pr (Pk)* dBm	Pr (Avg) dBm	Ka dB/m	Kg dB	E3(Pk) dBμV/m	E3(Avg) dBμV/m	E3 Pk Lim** dBμV/m	Pass dB	Comments
1	**Fundamental Emission**											
2	2412.0	Horn LS	H/V	-35.5		16.8	-1.2	89.5			-	CH1, 2412 MHz
3	2432.0	Horn LS	H/V	-40.9		16.8	-1.2	84.1			-	CH2, 2432 MHz
4	2472.0	Horn LS	H/V	-42.2		16.8	-1.2	82.9			-	CH4, 2472 MHz
5												
6	**Band Edges**											
7	2400.0	Horn LS	H/V	-67.3		16.7	-1.2	57.6		69.5	**11.8**	Worst-case, all channels***
8	2483.5	Horn LS	H/V	-74.5		16.9	-1.2	50.6		69.5	18.9	Worst-case, all channels
9	**Harmonic Spurious Emissions**											
10	4824.0	Horn C	H/V	-65.6		24.6	21.1	44.9		69.5	24.6	Low, Max all
11	4874.0	Horn C	H/V	-68.8		24.6	20.9	41.9		69.5	27.6	Mid, Max all
12	4944.0	Horn C	H/V	-68.6		24.6	20.7	42.3		69.5	27.2	High, Max all
13	7236.0	Horn XN	H/V	-83.1		25.1	21.7	27.3		69.5	42.1	Low, Max all
14	7311.0	Horn XN	H/V	-83.4		25.2	21.9	26.9		69.5	42.6	Mid, Max all
15	7416.0	Horn XN	H/V	-83.4		25.3	22.1	26.8		69.5	42.7	High, Max all
16	9648.0	Horn X	H/V	-82.4		27.8	18.0	34.4		69.5	35.1	Low, Max all
17	9748.0	Horn X	H/V	-82.9		27.9	17.9	34.1		69.5	35.4	Mid, Max all
18	9888.0	Horn X	H/V	-82.2		28.0	17.9	34.9		69.5	34.6	High, Max all
19	12060.0	Horn X	H/V	-84.4		31.8	16.9	37.5		69.5	32.0	Low, noise; max all
20	12185.0	Horn X	H/V	-84.9		31.8	16.6	37.3		69.5	32.2	Mid, noise; max all
21	12360.0	Horn X	H/V	-84.6		31.9	16.3	38.0		69.5	31.5	High, noise; max all
22	14472.0	Horn Ku	H/V	-64.1		33.2	20.7	55.4		69.5	14.1	Low, noise; max all
23	14622.0	Horn Ku	H/V	-65.2		33.3	20.9	54.2		69.5	15.3	Mid, noise; max all
24	14832.0	Horn Ku	H/V	-64.7		33.4	21.1	54.6		69.5	14.9	High, noise; max all
25	16884.0	Horn Ku	H/V	-80.0		34.7	21.9	39.8		69.5	29.7	Low, noise; max all
26	17059.0	Horn Ku	H/V	-80.1		34.8	22.0	39.7		69.5	29.8	Mid, noise; max all
27	17304.0	Horn Ku	H/V	-80.7		34.9	22.1	39.1		69.5	30.4	High, noise; max all
28	19296.0	Horn K	H/V	-67.8		32.2	32.0	39.4		69.5	30.1	Low, noise; max all
29	19496.0	Horn K	H/V	-67.5		32.3	32.0	39.8		69.5	29.7	Mid, noise; max all
30	19776.0	Horn K	H/V	-66.9		32.3	32.0	40.4		69.5	29.1	High, noise; max all
31	21708.0	Horn K	H/V	-65.8		32.7	32.0	41.9		69.5	27.6	Low, noise; max all
32	21933.0	Horn K	H/V	-65.2		32.7	32.0	42.5		69.5	26.9	Mid, noise; max all
33	22248.0	Horn K	H/V	-64.9		32.8	32.0	42.9		69.5	26.6	High, noise; max all
34	24120.0	Horn K	H/V	-64.4		33.2	32.0	43.8		69.5	25.7	Low, noise; max all
35	24370.0	Horn K	H/V	-64.3		33.2	32.0	43.9		69.5	25.5	Mid, noise; max all
36	24720.0	Horn K	H/V	-63.9		33.3	32.0	44.4		69.5	25.1	High, noise; max all
37	NOTE: No other spurious emissions observed, other than band edge and harmonic emissions.											

*Pk detection in 100 kHz IFBW, as illustrate above to confirm all out of band spurious are > 20 dB down.

** Spurious Limit 20 dB down from maximum fundamental in-band emissions reported at top of this table.

*** Re-measured to confirm 30 dB down in the case of average integrated power of fundamental emission.

3.3.2 Radiated Receiver Spurious

The results for the measurement of radiated receiver spurious emissions (emissions from the receiver chain, e.g. LO or VCO) at the nominal voltage and temperature are reported in Table 7. Receive chain emissions are measured to 5 times the highest receive chain frequency employed or 4 GHz, whichever is higher. If no emissions are detected, only those noise floor emissions at the LO/VCO frequency are reported.

Table 7: Receiver Chain Spurious Emissions ≥ 30 MHz.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**		
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Date:**	17-Oct-11
f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz/10kHz	**Test Engineer:**	Joseph Brunett
				EUT Mode:	Receive Only - Standby

Receive Chain Spurious Emissions FCC/IC/CISPR

#	Freq. MHz	Ant. Used	Ant. Pol.	Pr (Pk) dBm	Pr (QPk/Avg) dBm*	Ka dB/m	Kg dB	E3(Pk) dBμV/m	E3(Avg) dBμV/m	FCC/IC E3lim dBμV/m	CE E3lim dBμV/m	Pass dB	Comments
1	2372.0	Horn LS	H/V	-75.0		16.7	-1.2	49.9		54.0		**4.1**	max all, noise
2	2392.0	Horn LS	H/V	-75.2		16.7	-1.2	49.7		54.0		4.3	max all, noise
3	2432.0	Horn LS	H/V	-76.4		16.8	-1.2	48.6		54.0		5.4	max all, noise
4	2452.0	Horn LS	H/V	-79.1		16.8	-1.2	45.9		54.0		8.1	max all, noise
5	2472.0	Horn LS	H/V	-77.2		16.8	-1.2	47.8		54.0		6.2	max all, noise
6	2512.0	Horn LS	H/V	-78.6		16.9	-1.2	46.5		54.0		7.5	max all, noise
7	NOTE: VCO/LO is 40 MHz offset from Rx Channel. Low, Middle and High Channels tested.												
8													
9													
10													
11													
12													
13													
14													
15													
16													

*QPk detection below 1 GHz, Avg detection at or above 1 GHz with receiver bandwidth as specified at top of table.

3.3.3 Radiated Digital Spurious

The results for the measurement of digital spurious emissions (emissions arising from digital circuitry) at the nominal voltage and temperature are provided in Table 8. Radiation from digital components has been measured to 4 GHz, or to five times the maximum digital component operating frequency, whichever is greater.

Table 8: Radiated Digital Spurious Emissions.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**		
MHz ≤ f ≤ 1 000 MH	Pk/QPk	120 kHz	300 kHz	**Test Date:**	26-Sep-11
f > 1 000 MHz	Pk	1 MHz	3 MHz	**Test Engineer:**	Joseph Brunett
f > 1 000 MHz	Avg	1 MHz	10kHz	**EUT Mode:**	BK8000RX+BK8000TX
				Meas. Distance:	3 meters

Digital Spurious Emissions FCC/IC/CISPR A

#	Freq. MHz	Ant. Used	Ant. Pol.	Pr (Pk) dBm	Pr (QPk/Avg) dBm*	Ka dB/m	Kg dB	E3(Pk) dBμV/m	E3(QPk/Avg) dBμV/m	FCC/IC E3lim dBμV/m	CE E3lim dBμV/m	Pass dB	Comments
1	60.0	Bic	H	-58.7		8.1	24.7	31.6		49.5	50.5	17.9	
2	72.0	Bic	H	-53.1		7.6	24.6	36.9		49.5	50.5	12.6	
3	72.0	Bic	V	-63.0		7.6	24.6	27.0		49.5	50.5	22.5	
4	84.0	Bic	H	-49.9		7.7	24.4	40.4		49.5	50.5	9.1	
5	84.0	Bic	V	-62.9		7.7	24.4	27.4		49.5	50.5	22.1	
6	108.0	Bic	H	-51.3		9.0	24.1	40.6		54.0	50.5	13.4	
7	109.4	Bic	H	-58.1		9.1	24.1	34.0		54.0	50.5	20.0	
8	116.0	Bic	H	-61.5		9.6	24.0	31.2		54.0	50.5	22.8	
9	120.4	Bic	H	-47.7		10.0	23.9	45.4		54.0	50.5	8.6	
10	144.0	Bic	H	-53.4		12.0	23.6	42.0		54.0	50.5	12.0	
11	144.0	Bic	V	-63.4		12.0	23.6	32.0		54.0	50.5	22.0	
12	156.0	Bic	H	-61.7		12.9	23.4	34.7		54.0	50.5	19.3	
13	162.5	Bic	H	-49.0		13.3	23.3	48.0		54.0	50.5	6.0	
14	162.5	Bic	V	-65.3		13.3	23.3	31.7		54.0	50.5	22.3	
15	180.0	Bic	H	-60.9		14.2	23.1	37.1		54.0	50.5	16.9	
16	192.0	Bic	H	-59.7		14.5	23.0	38.9		54.0	50.5	15.1	
17	204.0	Bic	H	-65.4		14.7	22.8	33.5		54.0	50.5	20.5	
18	216.0	Bic	H	-48.9	-49.3	14.8	22.7	50.2	49.8	54.0	50.5	**4.2**	
19	216.0	Bic	V	-57.9		14.8	22.7	41.2		54.0	50.5	12.8	
20	228.0	Bic	H	-57.1		14.7	22.5	42.1		56.9	50.5	14.8	
21	228.0	Bic	V	-67.3		14.7	22.5	31.9		56.9	50.5	25.0	
22	240.0	Bic	H	-54.8		14.7	22.4	44.5		56.9	57.5	12.4	
23	240.0	Bic	V	-68.8		14.7	22.4	30.5		56.9	57.5	26.4	
24	252.0	SBic	H	-55.9		15.7	22.2	44.6		56.9	57.5	12.3	
25	288.0	SBic	H	-55.9		17.4	21.8	46.7		56.9	57.5	10.2	
26	288.0	SBic	V	-59.2		17.4	21.8	43.4		56.9	57.5	13.5	
27	324.0	SBic	H	-65.7		18.8	21.4	38.7		56.9	57.5	18.2	
28	360.0	SBic	H	-58.5		20.0	21.0	47.5		56.9	57.5	9.4	
29	360.0	SBic	V	-65.0		20.0	21.0	41.0		56.9	57.5	15.9	
30	384.0	SBic	H	-63.3		20.7	20.7	43.7		56.9	57.5	13.2	
31	384.0	SBic	V	-64.9		20.7	20.7	42.1		56.9	57.5	14.8	
32	408.0	SBic	H	-62.0		21.3	20.5	45.9		56.9	57.5	11.0	
33	432.0	SBic	H	-58.4		21.9	20.2	50.3		56.9	57.5	6.6	
34	432.0	SBic	V	-64.9		21.9	20.2	43.8		56.9	57.5	13.1	
35	480.0	SBic	H	-63.1		22.9	19.7	47.0		56.9	57.5	9.9	
36	720.0	SBic	H	-65.5		26.2	17.7	50.0		56.9	57.5	6.9	
37													

*QPk detection below 1 GHz, Avg detection at or above 1 GHz with receiver bandwidth as specified at top of table.

3.3.4 Conducted Emissions Test Results - AC Power Port(s)

The results of emissions from the EUT's AC mains power port(s) are reported in Table 9.

Table 9: AC Mains Power Conducted Emissions Results.

Frequency Range	Det	IF Bandwidth	Video Bandwidth		
150kHz ≤ f ≤ 30 MHz	Pk/QPk/Avg	9 kHz	30 kHz	**Test Date:**	23-Nov-11
				Test Engineer:	Joseph Brunett
				EUT Mode:	Max Current Draw

												FCC/IC/CISPR B
	Freq.	Line	Peak Det., dBµV		Pass	QP Det., dBµV		Pass	Ave. Det., dBµV		Pass	
#	MHz	Side	Vtest	Vlim*	dB*	Vtest	Vlim	dB	Vtest	Vlim	dB	Comments
1	0.16	Lo	54.1	55.3	**1.2**		65.3			55.3		
2	0.20	Lo	48.4	53.6	5.2		63.6			53.6		
3	0.32	Lo	38.0	49.7	11.7		59.8			49.7		
4	0.46	Lo	36.8	46.6	9.8		56.7			46.6		
5	0.55	Lo	37.1	46.0	8.9		56.0			46.0		
6	0.86	Lo	34.8	46.0	11.2		56.0			46.0		
7	0.99	Lo	35.0	46.0	11.0		56.0			46.0		
8	1.21	Lo	36.3	46.0	9.7		56.0			46.0		
9	1.38	Lo	35.8	46.0	10.2		56.0			46.0		
10	2.28	Lo	35.3	46.0	10.7		56.0			46.0		
11	3.54	Lo	34.7	46.0	11.3		56.0			46.0		
12	5.08	Lo	33.6	50.0	16.4		60.0			50.0		
13	5.99	Lo	31.0	50.0	19.0		60.0			50.0		
14	7.25	Lo	32.1	50.0	17.9		60.0			50.0		
15	8.44	Lo	32.5	50.0	17.5		60.0			50.0		
16	10.05	Lo	31.8	50.0	18.2		60.0			50.0		
17	11.17	Lo	30.8	50.0	19.2		60.0			50.0		
18	14.88	Lo	30.7	50.0	19.3		60.0			50.0		
19	16.98	Lo	30.8	50.0	19.2		60.0			50.0		
20												
21												
22												
23	0.15	Hi	60.0	56.0	- 4.0	53.0	66.1	13.1	40.5	56.0	15.5	
24	0.20	Hi	49.4	53.6	**4.2**		63.6			53.6		
25	0.27	Hi	40.9	51.1	10.1		61.1			51.1		
26	0.48	Hi	35.9	46.2	10.4		56.3			46.2		
27	0.56	Hi	37.8	46.0	8.2		56.0			46.0		
28	0.62	Hi	34.5	46.0	11.5		56.0			46.0		
29	0.76	Hi	36.5	46.0	9.5		56.0			46.0		
30	0.93	Hi	35.9	46.0	10.1		56.0			46.0		
31	1.36	Hi	33.6	46.0	12.4		56.0			46.0		
32	2.28	Hi	36.7	46.0	9.3		56.0			46.0		
33	3.47	Hi	34.9	46.0	11.1		56.0			46.0		
34	4.66	Hi	32.4	46.0	13.6		56.0			46.0		
35	5.08	Hi	32.9	50.0	17.1		60.0			50.0		
36	8.51	Hi	33.3	50.0	16.7		60.0			50.0		
37	9.14	Hi	31.5	50.0	18.5		60.0			50.0		
38	10.89	Hi	31.6	50.0	18.4		60.0			50.0		
39	13.62	Hi	32.2	50.0	17.8		60.0			50.0		
40	14.46	Hi	33.1	50.0	16.9		60.0			50.0		
41	15.23	Hi	32.3	50.0	17.7		60.0			50.0		
42												