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Testing of

Electromagnetic Emissions

per

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

are herein reported for

Unwired Technology LLC
003291 Headset

Test Report No.: 20120431-01r1

Applicant/Provider:
Unwired Technology LLC
245 Newtown Road, Unit 200, Plainview New York 11803 USA
Phone: 248-475-2210, Fax: -
Contact Person: Don Priemer; don@unwiredtechnology.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:	April 31, 2012

Results of equipment under test (EUT) testing completed before April 31, 2012 are as follows.

Emissions The transmitter fundamental emission meets the regulatory limit(s) by no less than 25.0 dB. Transmit chain spurious harmonic emissions comply by no less than 1.9 dB. Radiated spurious emissions associated with the receive chain of this device meet the regulatory limit(s) by no less than 20 dB. Unintentional spurious emissions from digital circuitry comply with the radiated emission limit(s) by more than 20 dB.

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1 Test Specifications, General Procedures, and Location

1.1 Test Specification and General Procedures

The ultimate goal of Unwired Technology LLC is to demonstrate that the EUT complies with the Rules and/or Directives below. Detailed in this report are the results of testing the Unwired Technology LLC 003291 Headset 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, 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 (2012)	"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 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-2013

* Verification Only - Standard Gain Horn Antennas

2 Configuration and Identification of the Equipment Under Test

2.1 Description and Declarations

The EUT is a wireless headset for receiving digitized audio broadcast in the 2.4 GHz band from a transceiver in a motor vehicle. The equipment under test (EUT) is approximately 6 x 6 x 3 cm (muffs) in dimension, and is depicted in Figure 1. It is powered by a 3 VDC alkaline AAA batteries. In use, this headset is intended for use by passengers to listen to audio inside a motor vehicle.Table 2 outlines provider declared EUT specifications.

Figure 1: Photos of EUT.

Table 2: EUT Declarations.

General Declarations			
Equipment Type:	Audio Transceiver	**Country of Origin:**	China
Nominal Supply:	3 VDC	**Oper. Temp Range:**	-20^o C to $+55^o$ C
Frequency Range:	2403 to 2478 MHz	**Antenna Dimension:**	20 mm
Antenna Type:	chip	**Antenna Gain:**	2.5 dBi (declared)
Number of Channels:	16	**Channel Spacing:**	5 MHz
Alignment Range:	N/A	**Type of Modulation:**	DTS
United States			
FCC ID Number:	O6D130008003291	**Classification:**	DTS
Canada			
IC Number:	10386A-13008003291	**Classification:**	Spread Spectrum/Digital Device (2400-2483.5 MHz)

2.1.1 EUT Configuration

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

2.1.2 Modes of Operation

The EUT is capable of only one normal mode of operation, as Digital Transmission System operating in the 2400 to 2483.5 MHz frequency band. In use, the EUT links with a transceiver included in the vehicle (certified separately), then receives streamed digital audio over 16 channels from 2403 MHz to 2478 MHz. The EUT will actively switch

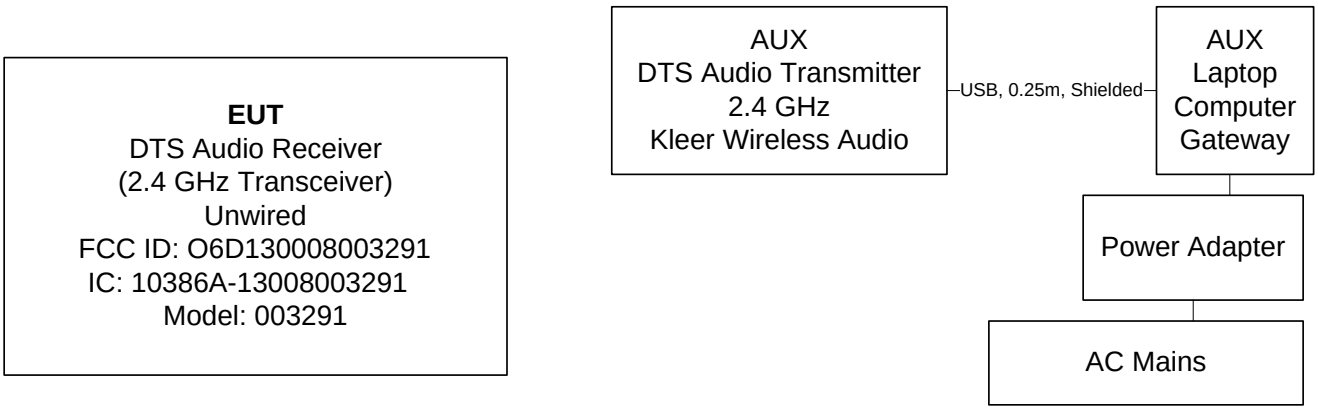


Figure 2: EUT Test Configuration Diagram.

between two built-in chip antennas. Proprietary modulation and encoding is used that allows the system to change operating frequencies and antennas during operation for optimal performance. While streamed audio is received, error correction transmissions are sent back by the EUT to the transceiver in the vehicle.

2.1.3 Variants

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

2.1.4 Test Samples

Three samples of the EUT were provided. One normal operating sample with the power button jumped for continuous operation, along with software to set continuous transmission modes, normal operating modes, and receive only modes on each of the two antennas. A second sample was provided to be dismantled for photographs. In addition to these three samples, a laptop, programming board, and a paired DTS audio transmitter were provided to aid in testing.

2.1.5 Functional Exerciser

Not Applicable.

2.1.6 Modifications Made

There were no modifications made to the EUT by this laboratory.

2.1.7 Production Intent

The EUT appears to be a production ready sample.

2.1.8 Declared Exemptions and Additional Product Notes

The EUT is for permanent use in a transportation vehicle. As such, digital emissions may be exempt from US and Canadian digital emissions regulations (per FCC 15.103(a) and IC correspondence on ICES-003). However, given the portable nature of the EUT, digital emissions have been measured to confirm compliance with Class B residential emission limits. No emissions from digital circuitry within 20 dB of the regulatory limit were observed.

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.

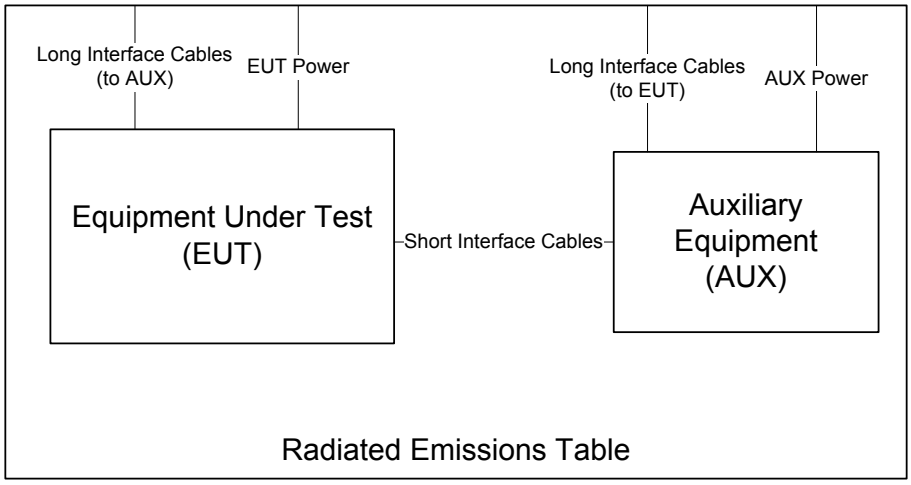


Figure 3: Radiated Emissions Diagram of the EUT.

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

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 allow 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.

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

3.1.2 Conducted Emissions Test Setup and Procedures

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 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 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 Peak to Average Ratio

For the measurements presented here, the EUT was set to transmit with the shortest available packet length and minimum packet spacing (i.e. maximum on time) allowed by the radio software for each operating mode. The following modes were measured with the test receiver set to zero-span (time-domain). The results of this testing are summarized in Table 3. Plots showing the measurements made to obtain these values are provided in Figure 5.

Table 3: Intentional Emission Characteristics (Duty).

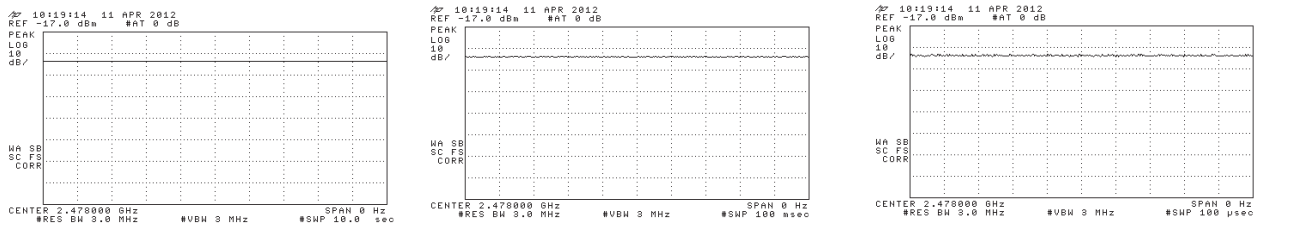
Frequency Range	**Detector**	**IF Bandwidth**	**Video Bandwidth**
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz
f > 1 000 MHz	Pk/Avg	3 MHz	3 MHz/10 kHz

Test Date: 11-Apr-12
Test Engineer: Joseph Brunett
EUT Mode: Normal Operating

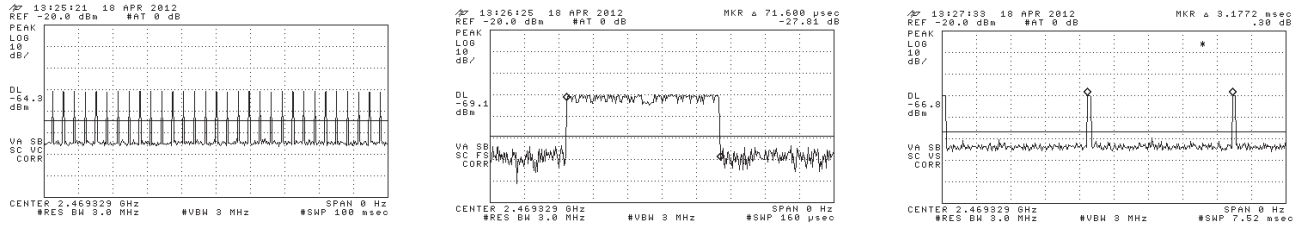
Unwired Headset; FCC/IC

Mode	Data Rate	Channel	Frequency (MHz)	Maximum Packet Length (t) (ms)	Minimum Packet Period (T) (ms)	Duty Cycle (%)	Duty Cycle (dB)
Contious TX Test Mode (see figure (a))	Maximum	15	2478	-	-	100	0
Normal Mode (see figure (b))	Maximum	13	2468.0	0.0716	3.1772	2.3	-20

NOTE: In normal operating mode the EUT channel cannot be fixed. The EUT selected this operating channel, and the duty cycle at this channel was measured when both a 1 kHz continous tone and a rock/jazz compilation were continuously streamed to the assocated transmitter. In both cases, the duty was observed to be the same, where the headphones transmit back to the base module only error correction packets. This represents the worst recorded duty cycle observed, and is applied only to spurious out-of-band emissions arrising from the transmit chain.



(a) Continous Tx Mode



(b) Normal Operating Mode

Figure 5: Intentional Emission Characteristics (Duty).

3.2.2 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 is 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 4. Plots showing measurements employed obtain the emission bandwidths reported are provided in Figure 6.

Table 4: Intentional Emission Bandwidth.

Frequency Range	**Detector**	**IF Bandwidth**	**Video Bandwidth**	**Test Date:**	11-Apr-12
f > 1 000 MHz	Pk	100 kHz	>100 kHz	**Test Engineer:**	Joseph Brunett
				EUT Mode:	Continuous Tx.

Unwired Headset; FCC/IC

Mode	Data Rate	Channel	Frequency (MHz)	6 dB EBW (MHz)	IC 99% PWR BW (MHz)	Comments
ANT1 Transmit Chain	Maximum Continuous	0	2403.0	1.73	2.825	
		8	2443.0	1.64	2.813	
		15	2478.0	1.60	2.837	
ANT2 Transmit Chain	Maximum Continuous	0	2403.0	1.71	2.800	
		8	2443.0	1.81	2.813	
		15	2478.0	1.6	2.837	

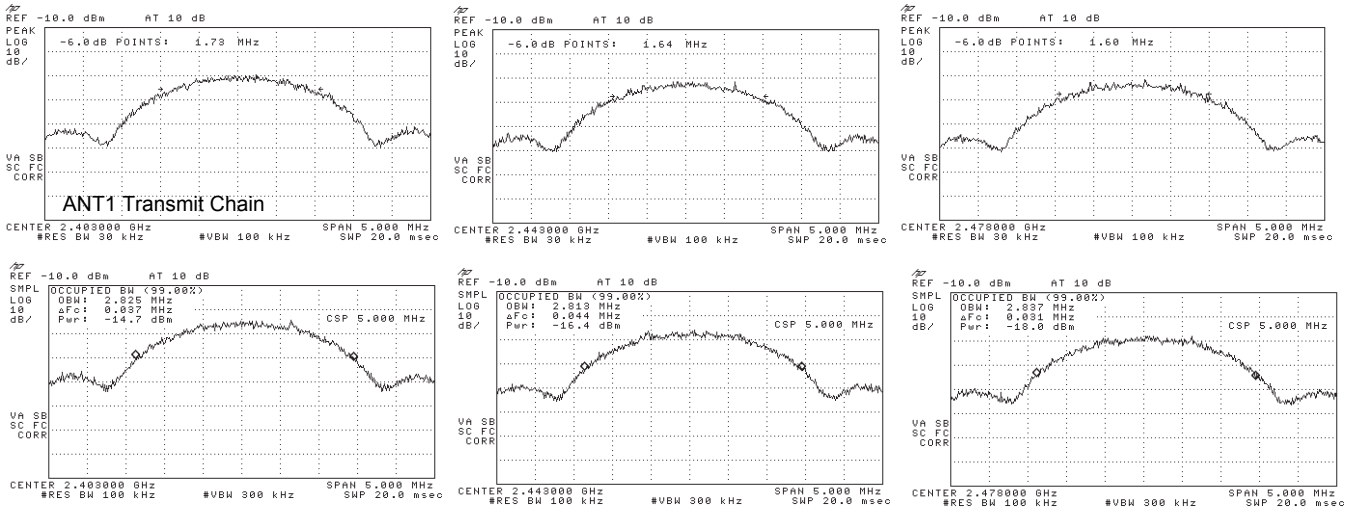


Figure 6(a): Intentional Emission Bandwidth.

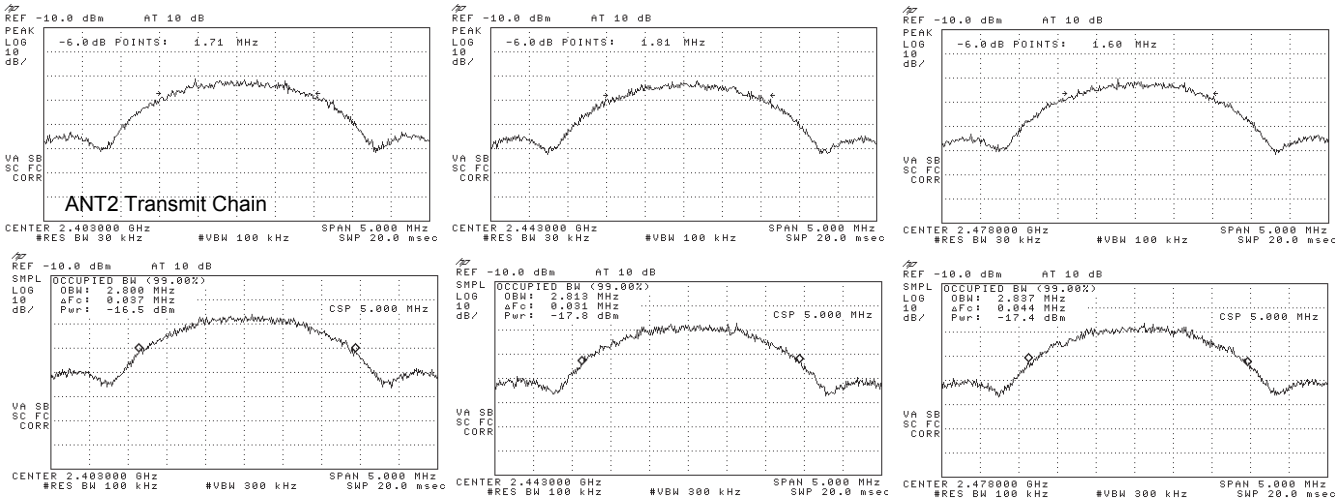


Figure 6(b): Intentional Emission Bandwidth.

3.2.3 Effective Isotropic Radiated Power

The EUT's radiated power is computed from field strength measurements made at 3 meters from the EUT. The test receiver bandwidth was set to be greater than the measured emission bandwidth of the EUT to capture the true peak. The results of this testing are summarized in Table 5.

Table 5: Effective Isotropic Radiated Power Results.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**	**Test Date:**	4/11-15/2012
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Engineer:**	Joseph Brunett
f > 1 000 MHz	Pk/Avg	3 MHz	3 MHz/10kHz	**EUT Mode:**	Continous Tx

Unwired Headset; FCC/IC

Mode	Channel	Freq. MHz	Ant. Used	Ant. Pol.	Pr (Pk)** dBm	Ka dB/m	Kg dB	EIRP (Pk) dBm	Pout (Pk)* dBm	Calc. Ant Gain dB	Pout Limit dBm
ANT1	0	2403.0	Horn LS	H/V	-31.8	21.4	-1.2	2.6	2.5	0.1	30.0
	8	2443.0	Horn LS	H/V	-33.4	21.5	-1.2	1.1	2.5	-1.4	30.0
	15	2480.0	Horn LS	H/V	-35.2	21.7	-1.2	- 0.5	2.5	-3.0	30.0
ANT2	0	2403.0	Horn LS	H/V	-30.5	21.4	-1.2	3.9	2.5	1.4	30.0
	8	2443.0	Horn LS	H/V	-30.2	21.5	-1.2	4.3	2.5	1.8	30.0
	15	2480.0	Horn LS	H/V	-29.7	21.7	-1.2	**5.0**	2.5	2.5	30.0

Mode	Channel	Freq. MHz	Supply Voltage	Pout (Pk)* dBm		
ANT1	8	2443.0	2.25	-30.8		
		2443.0	2.75	-31.0		
		2443.0	3.00	-30.9		
		2443.0	3.25	-30.9		
		2443.0	3.50	-30.9		

* Peal Output Power reported by manufacturer.

** Peak measured radiated at 3 meter distance. IFBW > EBW.

3.2.4 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 6. Plots showing how these measurements were made are depicted in Figure 7.

Table 6: Power Spectral Density Results.

Frequency Range	**Detector**	**IF Bandwidth**	**Video Bandwidth**	**Test Date:**	11-Apr-12
2405-2480 MHz	Pk	3 kHz	300 kHz	**Test Engineer:**	Joseph Brunett
				EUT Mode:	Continuous Tx.

								Unwired Headset; FCC/IC
Mode	Data Rate	Channel	Frequency (MHz)	Pr (dBm/3kHz)	Ka (dB 1/m)	Kg (dB)	PSD (EIRP) (dBm/3kHz)	Comments
ANT1	ANT 1 Continous Tx	0	2403.0	-47.5	21.4	-1.2	-13.15	
		8	2443.0	-46.7	21.5	-1.2	-12.15	
		15	2478.0	-46.8	21.7	-1.2	-12.07	
ANT2	ANT 2 Continous Tx	0	2403.0	-48.2	21.4	-1.2	-13.84	
		8	2443.0	-48.5	21.5	-1.2	-13.95	
		15	2478.0	-50.3	21.7	-1.2	-15.57	

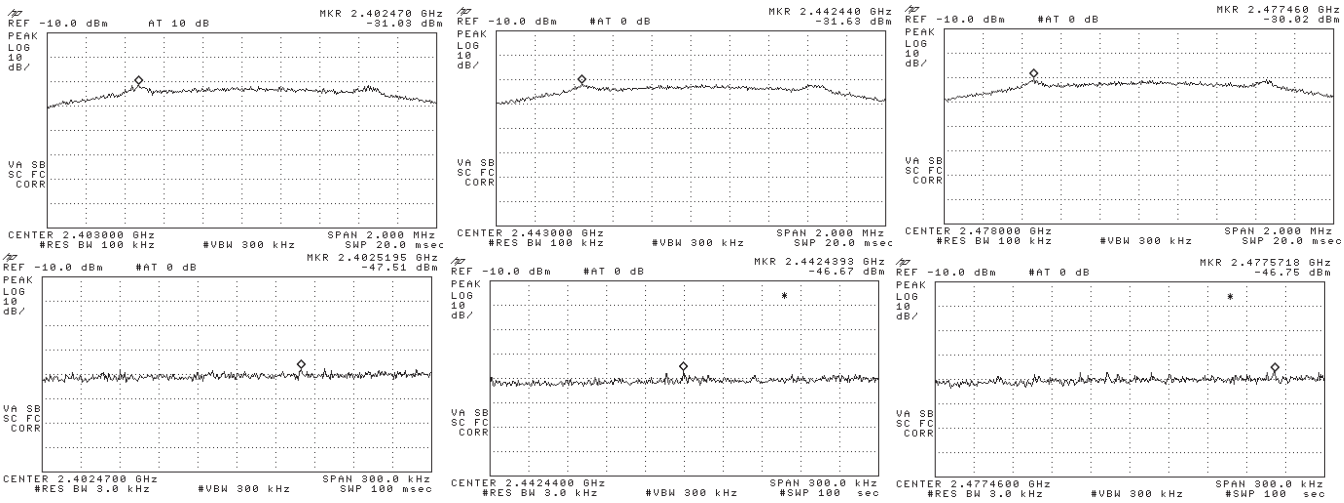


Figure 7(a): Power Spectral Density Plots.

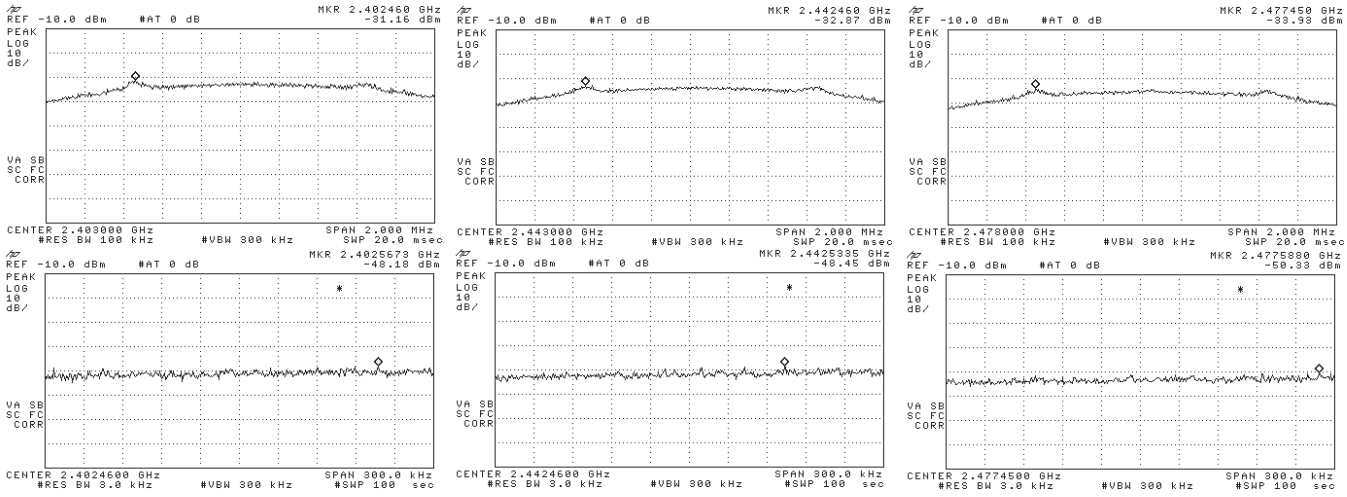


Figure 7(b): Power Spectral Density Plots.

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 7. Measurements are performed to 10 times the highest fundamental operating frequency. Plots showing the measurements made to obtain these values are provided in Figure 8.

Table 7(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:**	21-Apr-12
f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz/100Hz	**Test Engineer:**	Joseph Brunett
				EUT Mode:	Continuous Tx. ANT 1

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	**Adjacent Restricted Band (Low Side)**											
2	2390.0	Horn LS	H/V	-76.5	-96.5	21.3	-1.5	53.3	33.3	54.0	20.7	Low; max all
3	2390.0	Horn LS	H/V	-77.1	-97.1	21.3	-1.5	52.7	32.7	54.0	21.3	Mid; max all
4	2390.0	Horn LS	H/V	-76.9	-96.9	21.3	-1.5	52.9	32.9	54.0	21.1	High; max all
5	**Adjacent Restricted Band (High Side)**											
6	2483.5	Horn LS	H/V	-76.2	-96.2	21.8	-1.5	54.1	34.1	54.0	19.9	Low; max all
7	2483.5	Horn LS	H/V	-76.8	-96.8	21.8	-1.5	53.5	33.5	54.0	20.5	Mid; max all
8	2483.5	Horn LS	H/V	-63.5	-83.5	21.8	-1.5	66.7	46.7	54.0	**7.3**	High; max all
9	**Harmonic Emissions**											
10	4806.0	Horn C	H/V	-58.0	-78.0	24.6	21.1	52.4	32.4	54.0	21.6	Low; max all
11	4886.0	Horn C	H/V	-54.1	-74.1	24.6	20.9	56.6	36.6	54.0	17.4	Mid; max all
12	4956.0	Horn C	H/V	-50.6	-70.6	24.6	20.7	60.4	40.4	54.0	13.6	High; max all
13	7209.0	Horn XN	H/V	-62.0	-82.0	25.1	21.7	48.4	28.4	54.0	25.6	Low; max all
14	7329.0	Horn XN	H/V	-59.1	-79.1	25.2	21.9	51.2	31.2	54.0	22.8	Mid; max all
15	7434.0	Horn XN	H/V	-58.3	-78.3	25.3	22.1	51.9	31.9	54.0	22.1	High; max all
16	9612.0	Horn X	H/V	-64.4	-84.4	27.8	18.0	52.4	32.4	54.0	21.6	Low; max all
17	9772.0	Horn X	H/V	-64.1	-84.1	27.9	17.9	52.9	32.9	54.0	21.1	Mid; max all
18	9912.0	Horn X	H/V	-63.2	-83.2	28.0	17.9	53.8	33.8	54.0	20.2	High; max all
19	12015.0	Horn X	H/V	-64.8	-84.8	31.7	17.0	56.9	36.9	54.0	17.1	Low; max all, noise
20	12215.0	Horn X	H/V	-65.1	-85.1	31.8	16.6	57.2	37.2	54.0	16.8	Mid; max all,noise
21	12390.0	Horn X	H/V	-66.1	-86.1	31.9	16.3	56.6	36.6	54.0	17.4	High; max all, noise
22	14418.0	Horn Ku	H/V	-65.2	-85.2	33.2	20.7	54.3	34.3	54.0	19.7	Low; max all, noise
23	14658.0	Horn Ku	H/V	-65.1	-85.1	33.3	20.9	54.3	34.3	54.0	19.7	Mid; max all,noise
24	14868.0	Horn Ku	H/V	-64.3	-84.3	33.4	21.1	55.0	35.0	54.0	19.0	High; max all, noise
25	16821.0	Horn Ku	H/V	-62.0	-82.0	34.6	21.9	57.7	37.7	54.0	16.3	Low; max all, noise
26	17101.0	Horn Ku	H/V	-62.4	-82.4	34.8	22.0	57.4	37.4	54.0	16.6	Mid; max all,noise
27	17346.0	Horn Ku	H/V	-61.9	-81.9	35.0	22.2	57.9	37.9	54.0	16.1	High; max all, noise
28	19224.0	Horn K	H/V	-60.7	-80.7	32.2	21.6	56.9	36.9	54.0	17.1	Low; max all, noise
29	19544.0	Horn K	H/V	-59.8	-79.8	32.3	20.1	59.4	39.4	54.0	14.6	Mid; max all,noise
30	19824.0	Horn K	H/V	-60.2	-80.2	32.3	18.0	61.2	41.2	54.0	**12.8**	High; max all, noise
31	21627.0	Horn K	H/V	-57.2	-77.2	32.7	40.0	42.5	22.5	54.0	31.5	Low; max all, noise
32	21987.0	Horn K	H/V	-57.6	-77.6	32.8	40.0	42.2	22.2	54.0	31.8	Mid; max all,noise
33	22302.0	Horn K	H/V	-56.2	-76.2	32.8	40.0	43.6	23.6	54.0	30.4	High; max all, noise
34	24030.0	Horn K	H/V	-57.0	-77.0	33.2	40.0	43.2	23.2	54.0	30.8	Low; max all, noise
35	24430.0	Horn K	H/V	-56.2	-76.2	33.3	40.0	44.1	24.1	54.0	29.9	Mid; max all,noise
36	24780.0	Horn K	H/V	-55.9	-75.9	33.3	40.0	44.4	24.4	54.0	29.6	High; max all, noise
37												

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

** Avg computed from peak measurement with duty cycle applied.

Table 7(b): 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:**	21-Apr-12
f > 1 000 MHz	Pk	100 kHz	3 MHz/100Hz	**Test Engineer:**	Joseph Brunett
				EUT Mode:	Continuous Tx. ANT 1

Tx Spurious Emissions - 20 dB down in 100 kHz Bandwidth												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 In-band Emission (in 100 kHz IFBW)**											
2	2403.0	Horn LS	H/V	-33.5		21.4	-1.5	96.4				Low; max all
3	2443.0	Horn LS	H/V	-35.1		21.5	-0.5	93.9				Mid; max all
4	2480.0	Horn LS	H/V	-36.9		21.7	0.5	91.3				High; max all
5	**Low Side Band Edge (in 100 kHz IFBW)**											
6	2400.0	Horn LS	H/V	-62.6		21.3	-1.5	67.3		76.4	9.1	max all channels, max all orient
7	**High Side Band Edge (in 100 kHz IFBW)**											
8	2483.5	Horn LS	H/V	-73.7		21.8	-1.5	56.5		76.4	19.8	max all channels, max all orient
9	**Harmonic Emissions**											
10	4806.0	Horn C	H/V	-59.3		24.6	21.1	51.1		76.4	25.2	Low; max all
11	4886.0	Horn C	H/V	-55.4		24.6	20.9	55.4		76.4	21.0	Mid; max all
12	4956.0	Horn C	H/V	-52.0		24.6	20.7	59.0		76.4	17.4	High; max all
13	7209.0	Horn XN	H/V	-63.3		25.1	21.7	47.1		76.4	29.3	Low; max all
14	7329.0	Horn XN	H/V	-60.6		25.2	21.9	49.7		76.4	26.6	Mid; max all
15	7434.0	Horn XN	H/V	-59.6		25.3	22.1	50.6		76.4	25.8	High; max all
16	9612.0	Horn X	H/V	-65.7		27.8	18.0	51.1		76.4	25.3	Low; max all
17	9772.0	Horn X	H/V	-65.6		27.9	17.9	51.4		76.4	24.9	Mid; max all
18	9912.0	Horn X	H/V	-64.6		28.0	17.9	52.5		76.4	23.9	High; max all
19	12015.0	Horn X	H/V	-71.5		31.7	17.0	50.2		76.4	26.1	Low; max all, noise
20	12215.0	Horn X	H/V	-71.9		31.8	16.6	50.4		76.4	26.0	Mid; max all,noise
21	12390.0	Horn X	H/V	-72.8		31.9	16.3	49.9		76.4	26.5	High; max all, noise
22	14418.0	Horn Ku	H/V	-71.9		33.2	20.7	47.5		76.4	28.8	Low; max all, noise
23	14658.0	Horn Ku	H/V	-72.0		33.3	20.9	47.3		76.4	29.0	Mid; max all,noise
24	14868.0	Horn Ku	H/V	-71.2		33.4	21.1	48.1		76.4	28.2	High; max all, noise
25	16821.0	Horn Ku	H/V	-68.7		34.6	21.9	51.0		76.4	25.3	Low; max all, noise
26	17101.0	Horn Ku	H/V	-69.1		34.8	22.0	50.6		76.4	25.7	Mid; max all,noise
27	17346.0	Horn Ku	H/V	-68.8		35.0	22.2	51.0		76.4	25.4	High; max all, noise
28	19224.0	Horn K	H/V	-67.7		32.2	21.6	50.0		76.4	26.4	Low; max all, noise
29	19544.0	Horn K	H/V	-66.5		32.3	20.1	52.7		76.4	23.7	Mid; max all,noise
30	19824.0	Horn K	H/V	-67.1		32.3	18.0	54.2		76.4	22.1	High; max all, noise
31	21627.0	Horn K	H/V	-64.0		32.7	40.0	35.7		76.4	40.7	Low; max all, noise
32	21987.0	Horn K	H/V	-64.3		32.8	40.0	35.4		76.4	41.0	Mid; max all,noise
33	22302.0	Horn K	H/V	-63.2		32.8	40.0	36.6		76.4	39.7	High; max all, noise
34	24030.0	Horn K	H/V	-63.9		33.2	40.0	36.3		76.4	40.1	Low; max all, noise
35	24430.0	Horn K	H/V	-63.0		33.3	40.0	37.2		76.4	39.2	Mid; max all,noise
36	24780.0	Horn K	H/V	-62.8		33.3	40.0	37.6		76.4	38.8	High; max all, noise
37	NOTE: No spurious emissions other than harmonics were observed from 30 MHz to 26.5 GHz.											

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

** Avg computed from peak measurement with duty cycle applied.

Table 7(c): 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:**	21-Apr-12
f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz/100Hz	**Test Engineer:**	Joseph Brunett
				EUT Mode:	Continuous Tx. ANT 2

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	**Adjacent Restricted Band (Low Side)**											
2	2390.0	Horn LS	H/V	-77.5	-97.5	21.3	-1.5	52.3	32.3	54.0	21.7	Low; max all
3	2390.0	Horn LS	H/V	-76.2	-96.2	21.3	-1.5	53.6	33.6	54.0	20.4	Mid; max all
4	2390.0	Horn LS	H/V	-76.1	-96.1	21.3	-1.5	53.7	33.7	54.0	20.3	High; max all
5	**Adjacent Restricted Band (High Side)**											
6	2483.5	Horn LS	H/V	-75.1	-95.1	21.8	-1.5	55.2	35.2	54.0	18.8	Low; max all
7	2483.5	Horn LS	H/V	-74.1	-94.1	21.8	-1.5	56.2	36.2	54.0	17.8	Mid; max all
8	2483.5	Horn LS	H/V	-58.2	-78.2	21.8	-1.5	72.1	52.1	54.0	**1.9**	High; max all
9	**Harmonic Emissions**											
10	4806.0	Horn C	H/V	-50.6	-70.6	24.6	21.1	59.9	39.9	54.0	14.1	Low; max all
11	4886.0	Horn C	H/V	-49.4	-69.4	24.6	20.9	61.3	41.3	54.0	12.7	Mid; max all
12	4956.0	Horn C	H/V	-49.3	-69.3	24.6	20.7	61.7	41.7	54.0	12.3	High; max all
13	7209.0	Horn XN	H/V	-63.0	-83.0	25.1	21.7	47.4	27.4	54.0	26.6	Low; max all
14	7329.0	Horn XN	H/V	-60.0	-80.0	25.2	21.9	50.3	30.3	54.0	23.7	Mid; max all
15	7434.0	Horn XN	H/V	-59.7	-79.7	25.3	22.1	50.5	30.5	54.0	23.5	High; max all
16	9612.0	Horn X	H/V	-63.9	-83.9	27.8	18.0	52.9	32.9	54.0	21.1	Low; max all
17	9772.0	Horn X	H/V	-65.0	-85.0	27.9	17.9	52.0	32.0	54.0	22.0	Mid; max all
18	9912.0	Horn X	H/V	-68.2	-88.2	28.0	17.9	48.8	28.8	54.0	25.2	High; max all
19	12015.0	Horn X	H/V	-65.3	-85.3	31.7	17.0	56.4	36.4	54.0	17.6	Low; max all, noise
20	12215.0	Horn X	H/V	-65.1	-85.1	31.8	16.6	57.2	37.2	54.0	16.8	Mid; max all,noise
21	12390.0	Horn X	H/V	-65.8	-85.8	31.9	16.3	56.9	36.9	54.0	17.1	High; max all, noise
22	14418.0	Horn Ku	H/V	-65.4	-85.4	33.2	20.7	54.1	34.1	54.0	19.9	Low; max all, noise
23	14658.0	Horn Ku	H/V	-65.4	-85.4	33.3	20.9	54.0	34.0	54.0	20.0	Mid; max all,noise
24	14868.0	Horn Ku	H/V	-65.0	-85.0	33.4	21.1	54.3	34.3	54.0	19.7	High; max all, noise
25	16821.0	Horn Ku	H/V	-63.1	-83.1	34.6	21.9	56.6	36.6	54.0	17.4	Low; max all, noise
26	17101.0	Horn Ku	H/V	-62.4	-82.4	34.8	22.0	57.4	37.4	54.0	16.6	Mid; max all,noise
27	17346.0	Horn Ku	H/V	-61.9	-81.9	35.0	22.2	57.9	37.9	54.0	16.1	High; max all, noise
28	19224.0	Horn K	H/V	-61.2	-81.2	32.2	21.6	56.4	36.4	54.0	17.6	Low; max all, noise
29	19544.0	Horn K	H/V	-60.1	-80.1	32.3	20.1	59.1	39.1	54.0	14.9	Mid; max all,noise
30	19824.0	Horn K	H/V	-60.3	-80.3	32.3	18.0	61.1	41.1	54.0	**12.9**	High; max all, noise
31	21627.0	Horn K	H/V	-58.2	-78.2	32.7	40.0	41.5	21.5	54.0	32.5	Low; max all, noise
32	21987.0	Horn K	H/V	-58.9	-78.9	32.8	40.0	40.9	20.9	54.0	33.1	Mid; max all,noise
33	22302.0	Horn K	H/V	-57.1	-77.1	32.8	40.0	42.7	22.7	54.0	31.3	High; max all, noise
34	24030.0	Horn K	H/V	-56.9	-76.9	33.2	40.0	43.3	23.3	54.0	30.7	Low; max all, noise
35	24430.0	Horn K	H/V	-57.0	-77.0	33.3	40.0	43.3	23.3	54.0	30.7	Mid; max all,noise
36	24780.0	Horn K	H/V	-56.1	-76.1	33.3	40.0	44.2	24.2	54.0	29.8	High; max all, noise
37												

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

** Avg computed from peak measurement with duty cycle applied.

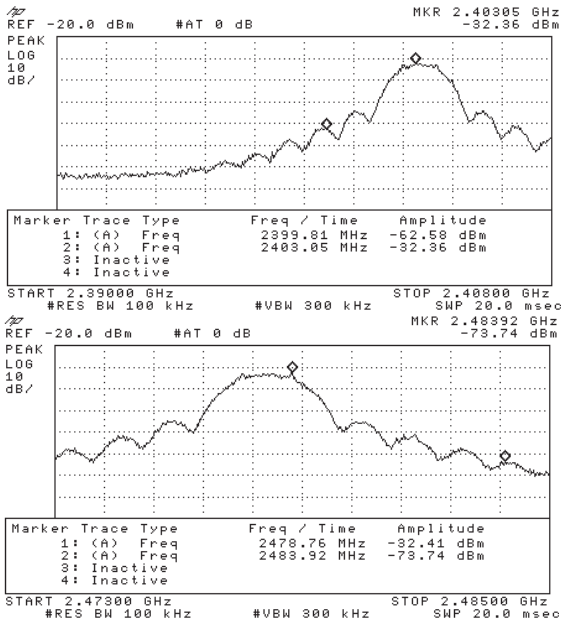
Table 7(d): Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth		
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Date:**	21-Apr-12
f > 1 000 MHz	Pk	100 kHz	3 MHz/100Hz	**Test Engineer:**	Joseph Brunett
				EUT Mode:	Continuous Tx. ANT 2

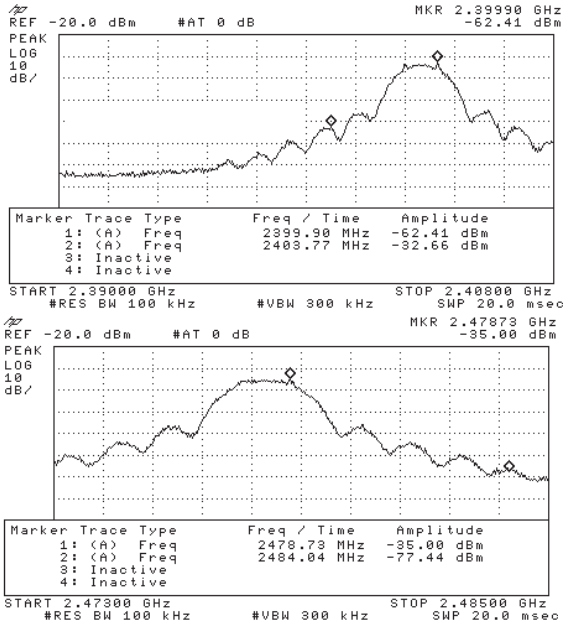
Tx Spurious Emissions - 20 dB down in 100 kHz Bandwidth												FCC/IC
#	Freq. MHz	Ant. Used	Ant. Pol.	Pr (Pk) dBm	Pr (Avg)** dBm	Ka dB/m	Kg dB	E3(Pk) dBµV/m	E3(Avg) dBµV/m	E3 Pk Lim dBµV/m	Pass dB	Comments
1	**Fundamental In-band Emission (in 100 kHz IFBW)**											
2	2403.0	Horn LS	H/V	-32.2		21.4	-1.5	97.7				Low; max all
3	2443.0	Horn LS	H/V	-31.9		21.5	-0.5	97.1				Mid; max all
4	2480.0	Horn LS	H/V	-31.4		21.7	0.5	96.8				High; max all
5	**Low Side Band Edge (in 100 kHz IFBW)**											
6	2400.0	Horn LS	H/V	-62.4		21.3	-1.5	67.4		77.7	10.2	max all channels, max all orient
7	**High Side Band Edge (in 100 kHz IFBW)**											
8	2483.5	Horn LS	H/V	-77.4		21.8	-1.5	52.8		77.7	24.8	max all channels, max all orient
9	**Harmonic Emissions**											
10	4806.0	Horn C	H/V	-52.0		24.6	21.1	58.4		77.7	19.2	Low; max all
11	4886.0	Horn C	H/V	-50.8		24.6	20.9	60.0		77.7	17.7	Mid; max all
12	4956.0	Horn C	H/V	-50.7		24.6	20.7	60.3		77.7	17.4	High; max all
13	7209.0	Horn XN	H/V	-64.3		25.1	21.7	46.2		77.7	31.5	Low; max all
14	7329.0	Horn XN	H/V	-61.3		25.2	21.9	49.0		77.7	28.6	Mid; max all
15	7434.0	Horn XN	H/V	-61.0		25.3	22.1	49.2		77.7	28.5	High; max all
16	9612.0	Horn X	H/V	-65.2		27.8	18.0	51.7		77.7	26.0	Low; max all
17	9772.0	Horn X	H/V	-66.3		27.9	17.9	50.7		77.7	27.0	Mid; max all
18	9912.0	Horn X	H/V	-69.7		28.0	17.9	47.3		77.7	30.3	High; max all
19	12015.0	Horn X	H/V	-72.1		31.7	17.0	49.6		77.7	28.0	Low; max all, noise
20	12215.0	Horn X	H/V	-71.9		31.8	16.6	50.4		77.7	27.2	Mid; max all,noise
21	12390.0	Horn X	H/V	-72.6		31.9	16.3	50.1		77.7	27.6	High; max all, noise
22	14418.0	Horn Ku	H/V	-72.3		33.2	20.7	47.1		77.7	30.5	Low; max all, noise
23	14658.0	Horn Ku	H/V	-72.3		33.3	20.9	47.1		77.7	30.6	Mid; max all,noise
24	14868.0	Horn Ku	H/V	-72.0		33.4	21.1	47.3		77.7	30.3	High; max all, noise
25	16821.0	Horn Ku	H/V	-70.1		34.6	21.9	49.7		77.7	28.0	Low; max all, noise
26	17101.0	Horn Ku	H/V	-69.1		34.8	22.0	50.7		77.7	27.0	Mid; max all,noise
27	17346.0	Horn Ku	H/V	-68.9		35.0	22.2	50.9		77.7	26.8	High; max all, noise
28	19224.0	Horn K	H/V	-67.9		32.2	21.6	49.7		77.7	28.0	Low; max all, noise
29	19544.0	Horn K	H/V	-67.1		32.3	20.1	52.1		77.7	25.5	Mid; max all,noise
30	19824.0	Horn K	H/V	-67.2		32.3	18.0	54.2		77.7	23.4	High; max all, noise
31	21627.0	Horn K	H/V	-65.1		32.7	40.0	34.6		77.7	43.1	Low; max all, noise
32	21987.0	Horn K	H/V	-65.6		32.8	40.0	34.1		77.7	43.5	Mid; max all,noise
33	22302.0	Horn K	H/V	-63.8		32.8	40.0	36.0		77.7	41.7	High; max all, noise
34	24030.0	Horn K	H/V	-63.7		33.2	40.0	36.4		77.7	41.2	Low; max all, noise
35	24430.0	Horn K	H/V	-63.9		33.3	40.0	36.4		77.7	41.3	Mid; max all,noise
36	24780.0	Horn K	H/V	-62.9		33.3	40.0	37.4		77.7	40.2	High; max all, noise
37	NOTE: No spurious emissions other than harmonics were observed from 30 MHz to 26.5 GHz.											

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

** Avg computed from peak measurement with duty cycle applied.



Out-of-band Spurious in 100 kHz IFBW (ANT1) Band Edges



Out-of-band Spurious in 100 kHz IFBW (ANT2) Band Edges

Figure 8: Out-of-Band Radiated Spurious Emissions Measurement Examples.

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 8. Receive chain emissions are measured to 5 times the highest receive chain frequency observed, or 4 GHz, whichever is higher. If no emissions are detected, only those noise floor emissions at the LO/VCO frequency are reported.

Table 8: Receiver Chain Spurious Emissions $\geq$ 30 MHz.

Frequency Range	Det	IF Bandwidth	Video Bandwidth		
25 MHz $\leq$ f $\leq$ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Date:**	2-May-12
f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz/10kHz	**Test Engineer:**	Joseph Brunett
				EUT Mode:	ANT1 & ANT2 RX Only Mod

Receive Chain Spurious Emissions Unwired; 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	2084.6	SL-Horn	H/V	-87.1		22.7	31.2	11.4		54.0		42.6	Low; max all
2	2119.3	SL-Horn	H/V	-87.4		22.8	31.1	11.2		54.0		42.8	Mid; max all
3	2149.6	SL-Horn	H/V	-93.1		22.9	31.1	5.7		54.0		48.3	High; max all
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													

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

** VCO/LO could only be detected with reduced receiver IFBW of 30 kHz. VCO/LO observed was CW.

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 9. Radiation from digital components has been measured to 4 GHz, or to five times the maximum digital component operating frequency, whichever is greater.

Table 9: Radiated Digital Spurious Emissions.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**	**Test Date:**	28-Apr-12
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Engineer:**	Joseph Brunett
f > 1 000 MHz	Pk	1 MHz	3 MHz	**EUT Mode:**	Normal Operating Mode
f > 1 000 MHz	Avg	1 MHz	10kHz	**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(Avg) dBµV/m	FCC/IC E3lim dBµV/m	CE E3lim dBµV/m	Pass dB	Comments
1													
2	NOTE: No digital spurious emissions withing 20 dB of the FCC/IC Regulatory Limit was detected in the frequency range of 30 MHz to 4 GHz.												
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													

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