

TEST REPORT

MOBILE MICROWAVE BOOSTER AMP

FCC ID: FC3L32112GAMP

MODEL: L3211-2027

APPLICANT: VISLINK, Inc.

August 1, 2013

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SECTION 1 INTRODUCTION

GENERAL INFORMATION – 2.1033

Applicant:	Vislink, Inc. 101 Billerica Avenue, Building 6 North Billerica, MA 01862 Tel. 978-671-5700 Attn: Sal Blatti, Compliance Manager
FCC ID:	FC3L32112GAMP
Installation and Operating Manual:	User and Technical Manual
Equipment Description:	Mobile Video Booster Amp – see below
Block Diagram:	See Technical Description, below
Equipment model:	L3211-2027
Frequency Range:	2000 – 2700 MHz
FCC Part numbers:	§ 74; subpart F: 74.602 (a)(1), (a)(2), (a)(3).
Rated RF Power:	1W (+30dBm)
Frequency Tolerance:	0.0005 %
Emission Designators:	12M00D7W

The data provided in this document will show that the Vislink/Microwave Radio Communications L3211-2027 booster amp is in compliance with 47 CFR Parts 74, for use by eligible Broadcast Auxiliary, Operational Fixed Point-to-Point Radio Service licensees in the 2000 – 2700 MHz mobile band as provided for in the relevant FCC part number referenced above. Radiated emission tests were conducted by Curtis-Straus a Bureau Veritas Company in their laboratory facility in Littleton, MA, while the part 74 emission testing was conducted in the Vislink/Microwave Radio Communications facility in North Billerica, MA.

The L3211-2027 was designed to comply with applicable technical regulations of § 74 subpart F, for the transmission of video, audio, and data by a mobile transmitter. Typical applications may include surveillance, command center operations, emergency restoration, broadcast remote and news gathering, cable TV remote and news gathering, or other video, voice and data requirements as deemed necessary and appropriate for a specific task assignment.

Technical Description:

The L3211-2027 FC3L32112GAMP is a compact booster amp designed to be adaptable to a wide range of field applications. The booster amp accepts a low power RF signal for portable transmitter and amplifies this signal to the desired RF output in accordance with § 74 subpart F operating band from 2000 to 2700MHz at an RF power level of +30dBm.

The specific operating frequency is determined by a high stability wide band VCO in the low power portable transmitter. The VCO set-up voltage is controlled by a microprocessor that is factory programmed to provide channel plans in accordance with the rules as specified in § 74; subpart F: 74.602 (a)(1), (a)(2), (a)(3).

Channel	Center Frequency (MHz)
1	2031.500
2	2043.500
3	2055.500
4	2067.500
5	2079.500
6	2091.500
7	2103.500
8	2458.500
9	2475.250
10	2491.750

Table 1 - HDX-1100C3 Factory channel plan center frequencies

SECTION 2 - MEASUREMENTS

TECHNICAL DATA SUMMARY

Frequency band: Operating frequency range is 2000 – 2700 MHz

Licensed for: Broadcast Auxiliary Service under CFR 47 part § 74; subpart F: 74.602 (a)(1), (a)(2), (a)(3).

Maximum measured output power@ antenna port: + 30dBm (1.0 Watt)

FCC ID: FC3L32112GAMP

Equipment Description: Mobile Video Booster Amp

Equipment model: L3211-2027

Frequency Tolerance: 0.0005 %

Emission Designator: 12M00D7W

RF Power Output Measurement per 2.1046

Applicable specifications: 12 Watts (+ 40.8dBm) per §74.638(a)

The RF power measured at 12MHz channels, as required for this application, is shown below:

Frequency (MHz)	Transmit Power Conducted (part 74)	Channel Bandwidth
2031.5	28.54dBm	12 MHz
2043.5	28.61dBm	12 MHz
2055.5	28.59dBm	12 MHz
2067.5	28.48dBm	12 MHz
2079.5	28.53dBm	12 MHz
2091.5	28.47dBm	12 MHz
2103.5	28.50dBm	12 MHz
2458.5	28.62dBm	12 MHz
2475.25	28.65dBm	12 MHz
2491.75	28.73dBm	12 MHz

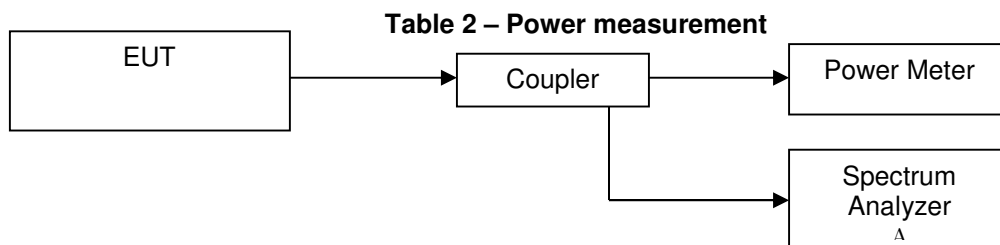
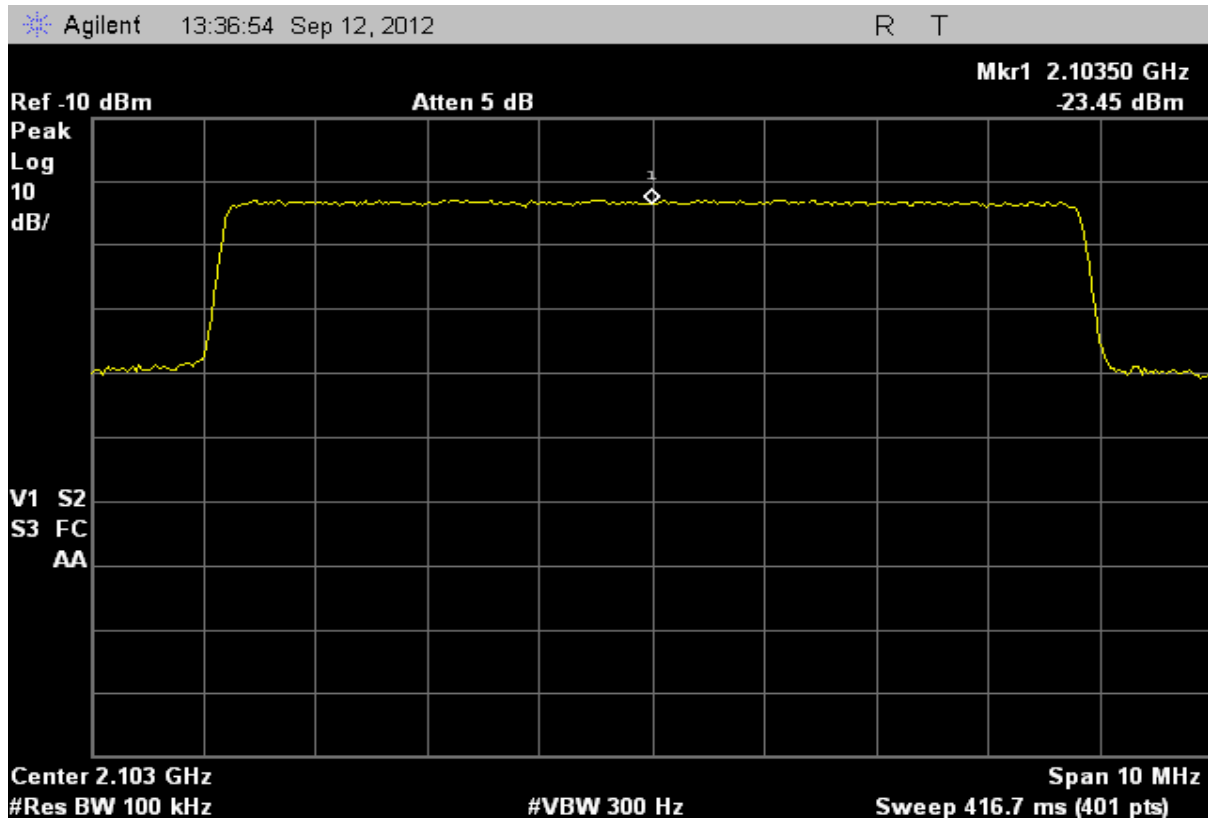


Figure 1 - Test Setup for Power Measurements

SECTION 2 A – MODULATION CHARACTERISTICS PER 2.1047

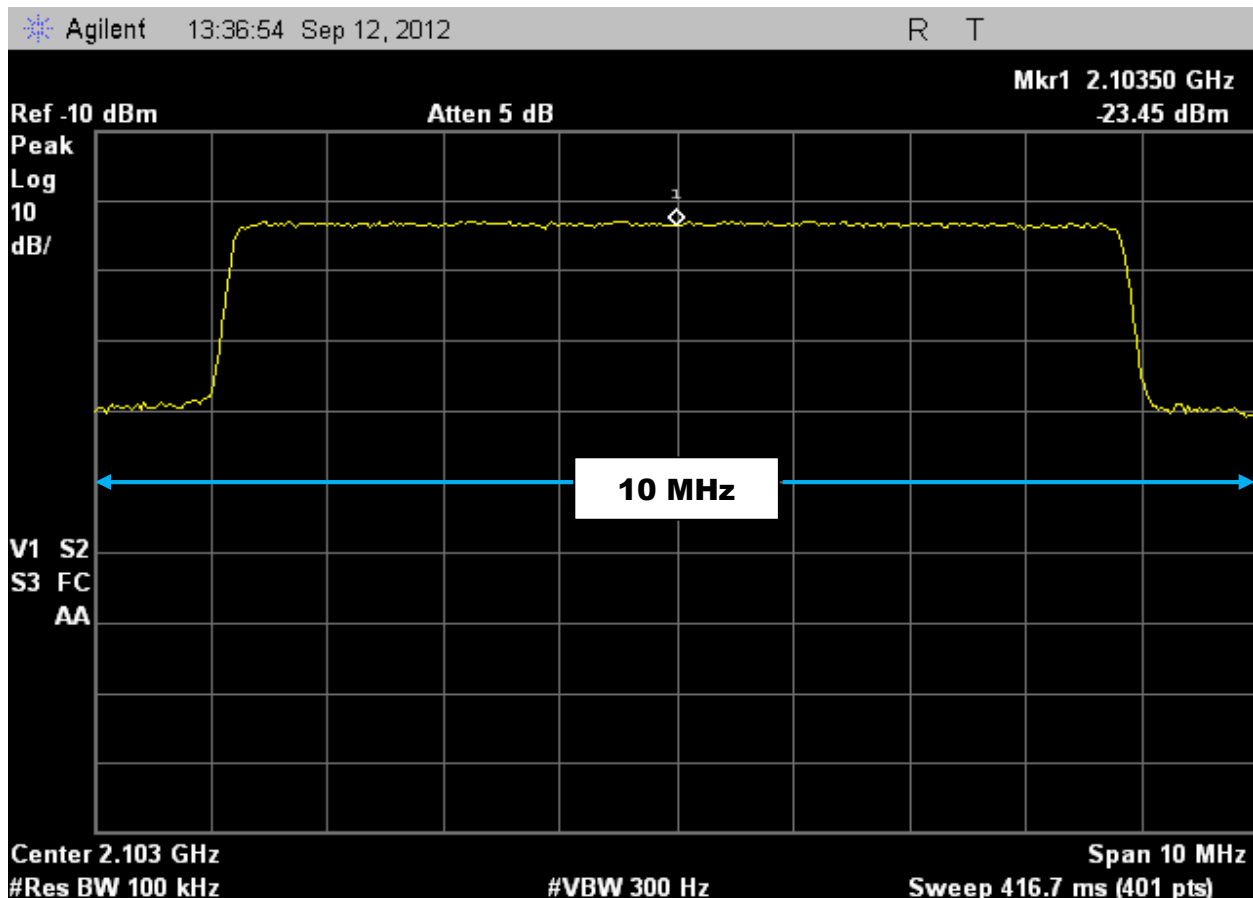
Measurement Frequency: 2103.0 MHz

Data: The unit under test is designed to be modulated by a combination of digital video, audio, and auxiliary data. The COFDM modulated spectrum shown in the image below shows compliance with the 8 MHz pedestal option in the DVB-T standard for the 2K carrier mode, per ETSI EN 300 744 V1.51. These carriers may be modulated in QPSK, 16QAM, or 64 QAM formats with no change in occupied bandwidth, as the symbol rate is fixed to maintain the same bandwidth.



SECTION 2B - OCCUPIED BANDWIDTH 2.1049

To measure the occupied bandwidth, the equipment was set up as shown below, and the transmitter was modulated with a digital COFDM pedestal of 7.61MHz (8MHz). The output of the transmitter was viewed on a spectrum analyzer. The current COFDM standard adopted by Vislink is the ETSI EN 300 744 V1.2.1 (2001-01) for framing structure, channel coding and modulation. Since the spectrum is digitally modulated, at the center frequency, calculations were performed by establishing a reference at FO (2103.0 MHz).



Occupied Bandwidth with 8MHz COFDM Pedestal

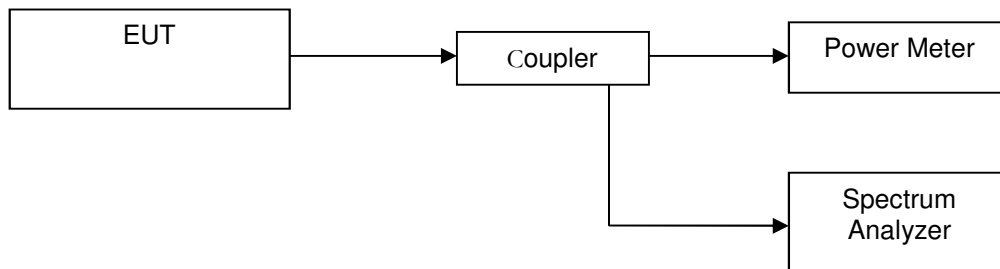


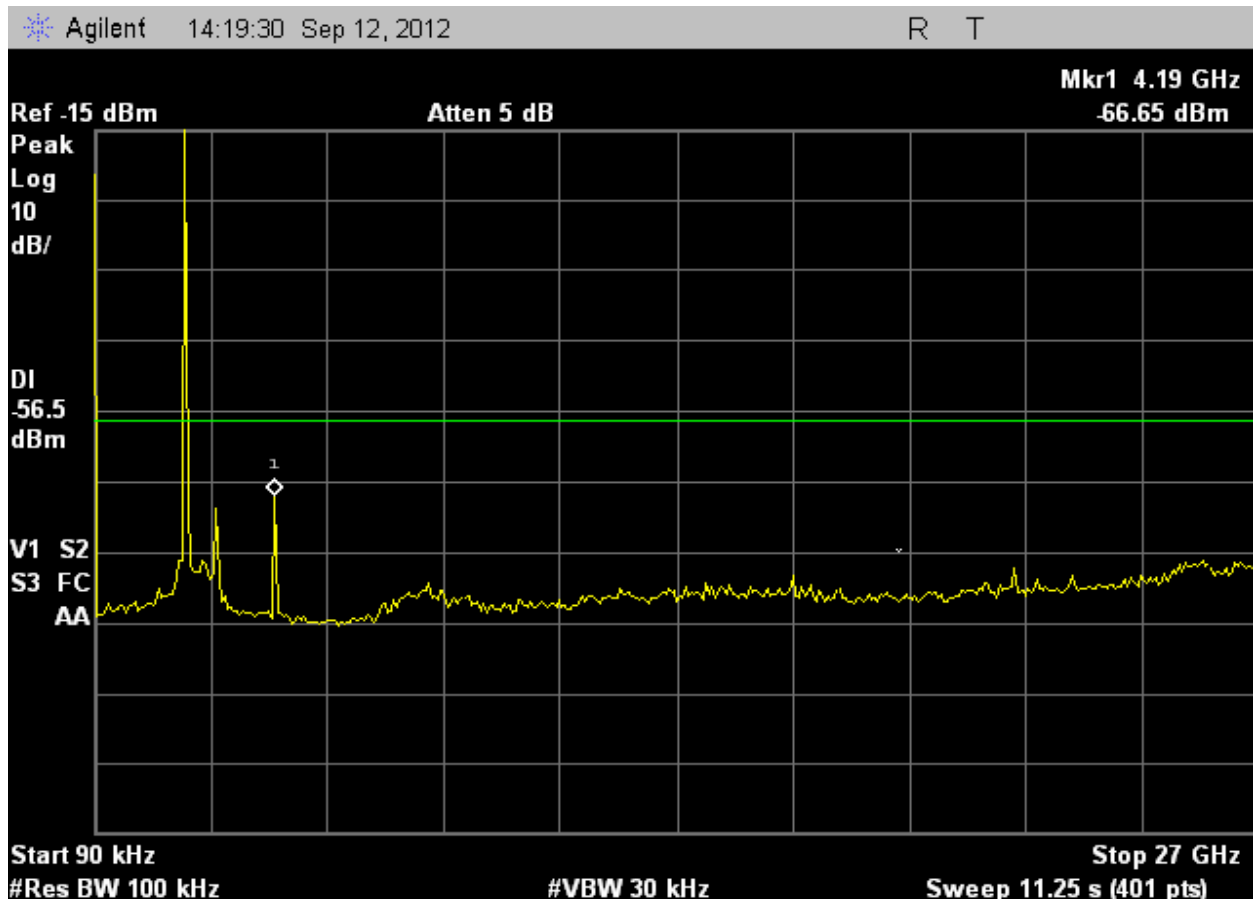
Figure 2 - Test Setup for Emission Mask, Occupied Bandwidth, and Spurious Emission Measurements

SECTION 2C SPURIOUS EMISSIONS AT THE ANTENNA TERMINAL: 2.1051

Applicable Specifications: §74.637(a)(2)(i)

On any frequency removed from the assigned frequency above 250% of the authorized bandwidth: 80 dB or $43 + 10 \log (P) \text{ w}$, whichever is the lesser attenuation.

The Antenna conducted spurious emissions test were performed with the transmitter frequency set to 2103.5MHz, and with a measured output power of (+28.5dBm). The spectrum analyzer was first tuned to a reference carrier level at the fundamental operating frequency. The output spectrum was then slowly scanned from 90KHz to 27GHz. Special attention was given to those frequencies that correspond to the possible harmonic and sub – harmonics.



L3211-2027 Spurious Emission Plot RF Power = 28.5dBm

NOTE: Display line @ -56.5 dB represents the spurious limit.

The FCC limits for Spurious emissions conducted at the antenna port per CFR 47 §2.1051 has been met.

SECTION 2D CONTINUED- EMISSION MASK PER 90.210(m)

Applicable Specifications: §74.637(a)(2)(i)

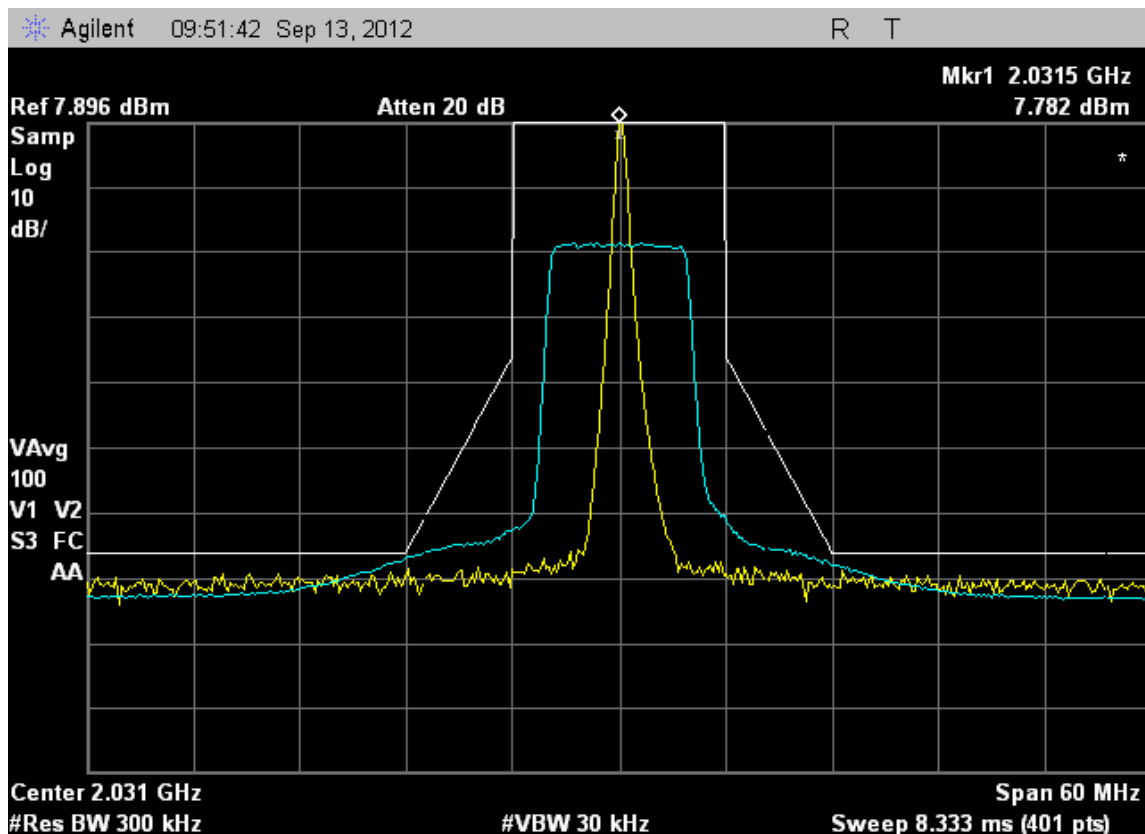
(i) For operating frequencies below 15 GHz, in any 4 KHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth: As specified by the following equation but in no event less than 50 decibels:

$A = 35 + 0.8(P - 50) + 10 \log_{10} B$. (Attenuation greater than 80 decibels or to an absolute power of less than -- 13dBm/1MHz is not required.) where:

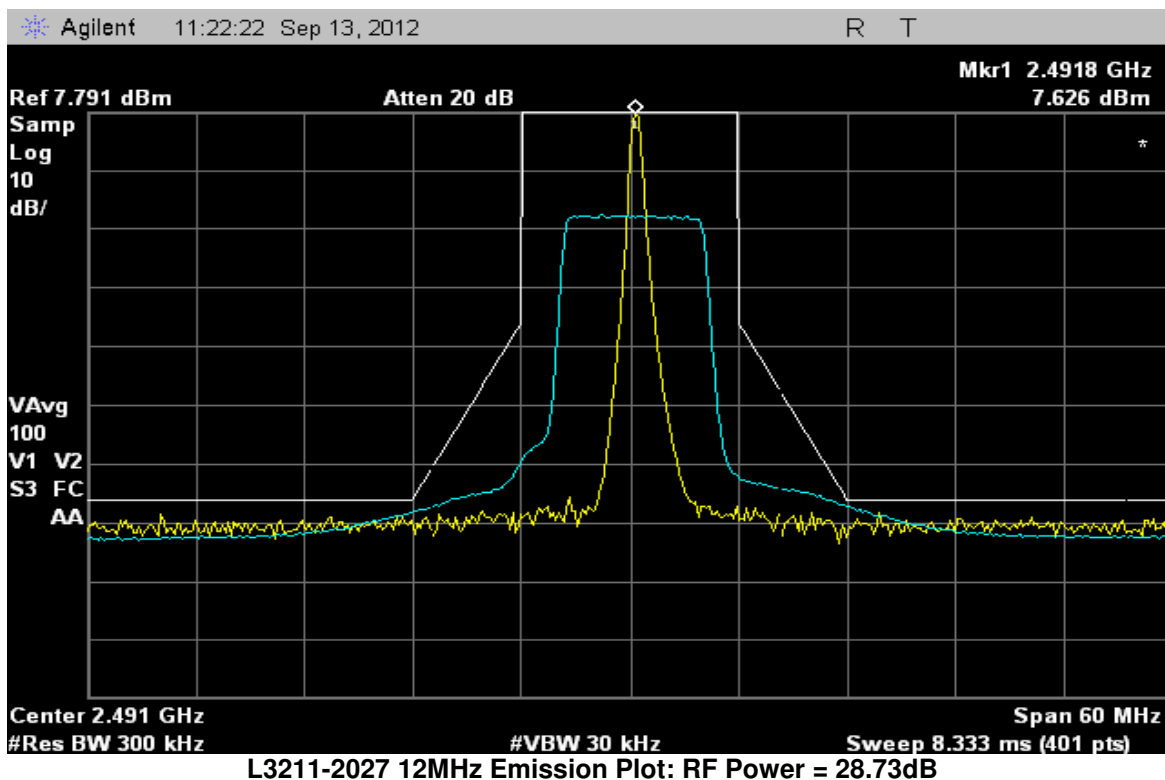
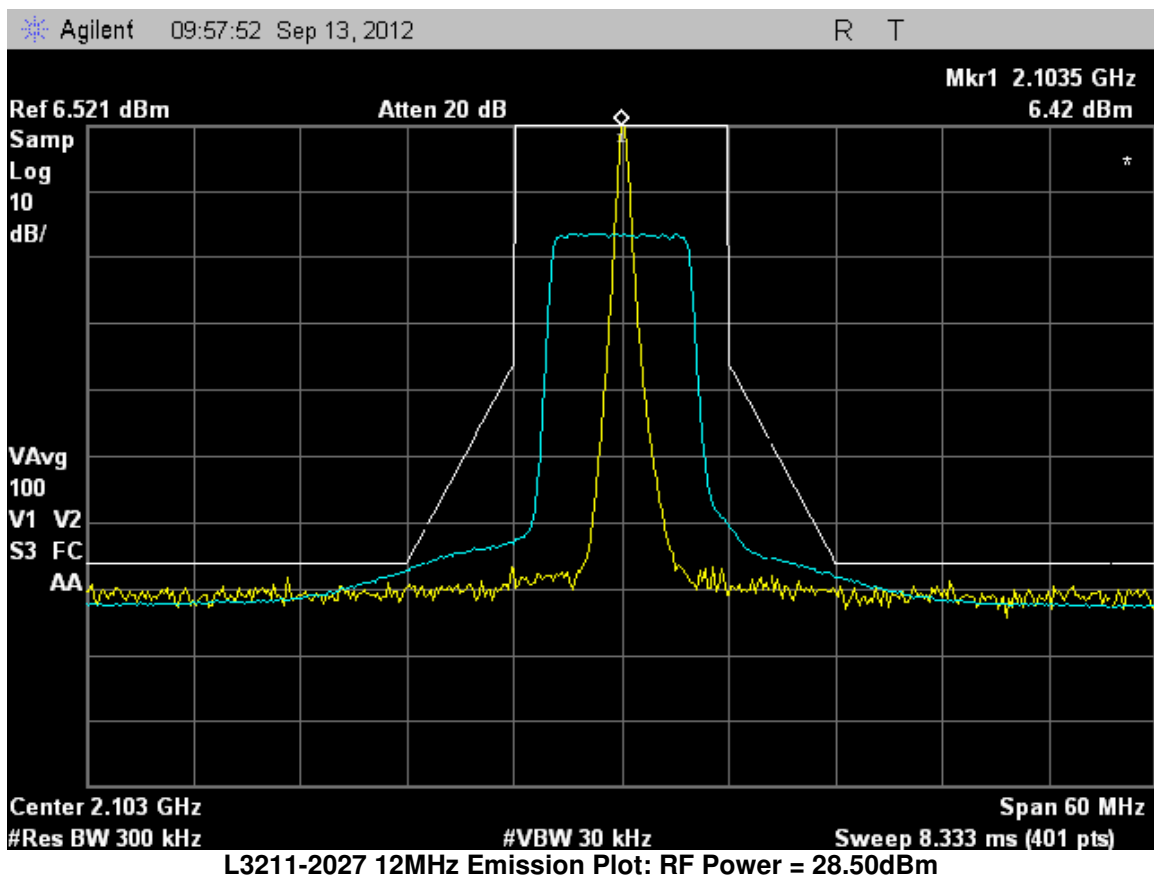
A = Attenuation (in decibels) below the mean output power level.

P = Percent removed from the center frequency of the transmitter bandwidth.

B = Authorized bandwidth in MHz



L3211-2027 12MHz Emission Plot: RF Power = 28.54dBm



SECTION 2D - FIELD STRENGTH OF SPURIOUS RADIATION 2.1053

The case radiated spurious emission tests were conducted by Curtis-Straus a Bureau Veritas Company. Please refer to the attached report document, EM1580-1. This report represents spurious emissions observed and calculated to be acceptable according to rule part: 2.153 and FCC Part 15, subpart B.

SECTION 2E - FREQUENCY STABILITY OVER TEMPERATURE & VOLTAGE- 2.1055

The L1500 transmitter with L3211-2027 Booster Amp was set-up to transmit CW signal. The measurement was made at the antenna port using a microwave frequency counter. Measurements were made to determine the transmitter frequency stability over the temperature range -20° C to +50 °C. The transmitter was allowed to stabilize a minimum of 30 minutes before measurement.

Measurements were also made to determine transmitter frequency stability versus primary supply variation of the DC input voltage range of 9V to 28V.

- The Measurement Frequency was 2103500000 (Hz)

Temperature	Measure Frequency (Hz)	Δ (PPM)	Δ (%)
-20° C	2103500600	0.09	0.000009
-10° C	2103500400	0.06	0.000006
0° C	2103500300	0.05	0.000005
+10° C	2013500200	0.03	0.000003
+20° C	2103500100	0.02	0.000002
+30° C	2013499900	0.02	0.000002
+40° C	2103499800	0.03	0.000003
+50° C	2103499600	0.06	0.000006

Voltage	Measure Frequency (Hz)	Δ (PPM)	Δ (%)
9	2103500200	0.03	0.000003
10	2103500200	0.03	0.000003
11	2103500200	0.03	0.000003
12	2103500200	0.03	0.000003
13	2103500100	0.02	0.000002
14	2103500100	0.02	0.000002
15	2103500100	0.02	0.000002
16	2103500100	0.02	0.000002
17	2103500100	0.02	0.000002
18	2103500100	0.02	0.000002
19	2103500100	0.02	0.000002
20	2103500100	0.02	0.000002
21	2103500100	0.02	0.000002
22	2103500100	0.02	0.000002
23	2103500100	0.02	0.000002
24	2103500100	0.02	0.000002
25	2103500000	0.00	0.000000
26	2103499900	0.02	0.000002
27	2103499900	0.02	0.000002
28	2103499900	0.02	0.000002

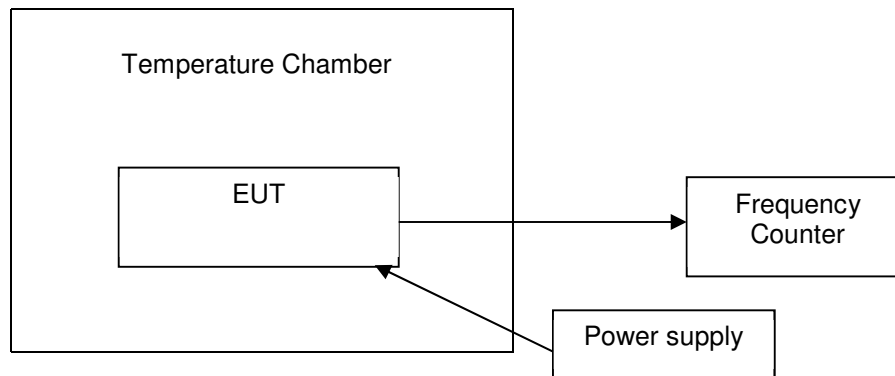


Figure 3 - Test Setup for Frequency Stability Measurements

SECTION 3 - QUALITY DECLARATION

QUALITY SYSTEM ISO 9001



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This approval is subject to the company maintaining its system to the required standard, which will be monitored by NQA, USA, an accredited organization under the ANSI-ASQ National Accreditation Board.

SECTION 4 TRANSMITTER DESCRIPTION

The L3211 Barrel Booster has been specifically tailored for wireless camera back applications. Designed to fit directly onto the RF output from the Link range of transmitters, this unit is small, lightweight and easy to use. This amplifier includes ALC (Automatic Level Control) in order to provide a constant RF output power for all transmitter power level settings. The L3211 has a wide DC operating range (9-28V) and can be powered via the RF input connector* or using the Lemo power cables supplied with the unit. These power cables allow the option to connect to the Lemo power socket on the wireless transmitter or to the D-Tap adaptor from an IDX or Anton Bauer battery plate.



SECTION 4B TRANSMITTER PHOTOS



FCC LABEL LOCATION



SECTION 5 - RADIO CHARACTERISTICS

RF SPECIFICATIONS

The RF specifications of the L3211-2027 Booster Amp:

- Input connector: Type N male
- Output connector: Type N female
- Impedance: 50 Ohms
- Return loss: 10 dB minimum
- Output stability: ± 1.0 dB, - 20° to + 55° C
- Harmonics: ≤ 60 dBc
- PA protection: Capable of operation into infinite VSWR, no time limit.
- Frequency Step Size: 250 KHz
- DC Voltage: 9 – 28 VDC
- Power Consumption: 14W
- RF Power Output: 710mW (28.5dBm) (typical)
- RF power output: 1W max

NOTE: Additional details are in the User and Technical Manual, attached to this report

SECTION 6 - TEST EQUIPMENT

TEST EQUIPMENT LIST

MODEL	SERIAL #	DESCRIPTION	MANUFACTURER
FLK52	33624-65	THERMOMETER	FLUKE
E4419B	MY45101749	POWER METER	HP
8481B	00389	POWER SENSOR	HP
T30C	22779-06	TEMP. CHAMBER	TENNEY
FLK177	95210385	MULTIMETER	FLUKE
5350B	33625-269	FREQ. COUNTER	HP
E4407B	MY44210942	SPECTRUM ANALYZER	HP

Temperature chamber output power and frequency stability



SECTION 7 MPE CALCULATIONS

6 Operating in Safety

Guidelines for safe operation are derived from OET bulletin 65, August 1997, as recommended by the Federal Communications Commission (FCC).

WARNING

High levels of RF power are present in the unit. Exposure to RF or microwave power can cause burns and may be harmful to health. Remove power from the unit before disconnecting any RF cables and before inspecting damaged cables and/or antennas. Avoid standing in front of high gain antennas (such as a dish antenna) and never look into the open end of a waveguide or cable where RF power may be present.

The L3211-2027, operated without an antenna will not create RF energy exceeding 1.0 mW/cm², the FCC limit for exposure. Connecting an antenna to the unit greatly enhances the potential for harmful exposure, and you must maintain a certain distance from the radiator. The following table shows the Maximum Permissible Exposure (MPE) safe distances from the antenna when operating at normal RF power level (710mW).

Antenna Gain (dBi)	0	2	4	6	8
Safe Distance (cm)	8	9	12	15	18
Safe Distance (in)	3.05	3.54	4.72	5.90	7.08

Note Hazardous RF radiation limits and recommended distances may vary by country. Observe all applicable state and federal regulations when using this transmitter.

To perform calculations to understand the safe exposure margin (MPE), use the following formula suggested by OET 65. The calculations provided are for common antennas often used in the mobile microwave environment.

Calculating MPE

$$\text{EIRP} = P * (10 ^ { (G / 10)}) = (\text{antilog of } G/10) * P$$

P = RF power delivered to the antenna in mW

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 in centimeters

S = MPE in mW/cm² (milliwatts per square centimeters)

Conversions

dBi to numeric gain = Antilog (dBi/10)

Feet to centimeters = Feet * 30.48

Centimeters to Feet = cm * .0328

4 π = 12.57

User Input

RF power delivered to the antenna = Watts

Antenna gain (referenced to isotropic antenna) = dBi

Distance from the center of radiation = Feet

Calculation steps:

1. [P] RF power input. Watts to milliwatts = Watts * 1000
2. [G] Antenna gain dBi. Numeric gain = Antilog (dBi/10)
3. [EIRP] Multiply P * G
4. [R] Centimeters to feet = Centimeters * .0328
5. Square R
6. Multiply $R^2 * 4\pi$
7. [S] Divide $(R^2 * 4\pi)$ into EIRP
S = Power Density in milliwatts per square centimeters.

Note At frequencies above 1500 MHz, S must not be greater than 1.

Reference

FCC OET Bulletin 65, August 1997 - Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields

Vislink, in accordance with the requirements set forth by the FCC, provides this information as a guide to the user and assumes the users of this equipment are licensed and qualified to operate the equipment per the guidelines and recommendations contained within the product user guides and in accordance with any FCC rules that may apply.

SECTION 8 TEST FACILITIES

TEST FACILITIES:

MICROWAVE RADIO COMMUNICATIONS 978-671-5700
101 Billerica Avenue
N. Billerica, MA. 01862

Curtis-Straus
1 Distribution Center 978-430-8880
Littleton, MA 01460

Prepared by: _____ Sal Blatti
Manager

Authorized by: _____ John Wood
Director

THE MANUFACTURER HEREBY DECLARES THAT IT WILL TAKE ALL MEASURES TO
INSURE THE COMPLIANCE OF THE PRODUCT DETAILED IN THIS TECHNICAL FILE WITH
THE FCC

Sal Blatti
Compliance Manager