National Certification Laboratory

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FCC REPORT OF RADIO INTERFERENCE

FOR

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FCC ID: K5B-CANBRIDGE

December 8, 2000

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TABLES

EXHIBITS

NCL PROJ.# MATRIC-563

1.0 Introduction:

This report has been prepared on behalf of **Matric Limited**, to support the attached Application for a Certification of a Part 15 Spread Spectrum Transmitter module. The Equipment Under Test (EUT) was the Model: **Wireless CAN BridgeTransceiver.**

Radio-Noise Emissions tests were performed according to ***FCC Public Notice 54797, titled "Guidance on Measurement for Direct Sequence SST"***. The measuring equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

Testing was performed at National Certification Laboratory in Ellicott City, MD. Site description and site attenuation data have been placed on file with the FCC's sampling and Measurements Branch. FCC acceptance was granted on May 26, 1993.

1.1 Summary:

The Matric Limited **Wireless CAN BridgeTransceiver** complies with the FCC limits (15.247) for a Direct Sequence SST.

2.0 Description of Equipment Under Test (EUT):

The EUT features:

Reverse Polarity SMA Antenna Connector per 15.203

+10 dBm Max. RF Output

2410.50 MHz Center Frequency

13.2 MHz 6 dB Emission Bandwidth

Single Channel

1 Mbps Max. Data Rate (DBPSK)

4 inch Monopole External Antenna (2.5 dBi)

3.0 Test Program:

This report contains measurement charts and data as evidence for the following tests performed:

1. (15.247b) Peak RF output power.
2. (15.247c) Field Strength of harmonics and spurious out-of-band emissions.
3. (15.247c) RF Antenna Conducted of harmonics and spurious out-of-band emissions.
4. (15.247a) 6 dB Emission Bandwidth.
5. (15.207) Power Line Conducted Emissions.
6. (15.247d) Power Spectral Density.

4.0 Test Configuration:

RF antenna output tests such as Bandwidth, Spurious/Harmonics, Power output, were taken with the transmitter antenna connector feeding directly into the spectrum analyzer via external 30 db attenuator, or into the Peak RF Power meter as appropriate. The analyzer's internal attenuator was adjusted to prevent overloading of the front end. The transmitter is modulated at 1 Mbps which is the highest available data rate.

Field strength measurements were taken with the transmitter feeding a 2.5 dBi monopole omni antenna aligned with the measurement horn antenna. No other antennas are provided with the EUT. Testing was performed at maximum RF power output.

PEAK POWER TEST RESULTS

Limit: 1 watt (30 dBm)

Condition: Transmitter is set to a single modulated channel at full RF power.

Reading from Peak RF Power meter:

Channel : 2410.50 MHz - (+9.9 dBm)

6 dB EMISSION BANDWIDTH

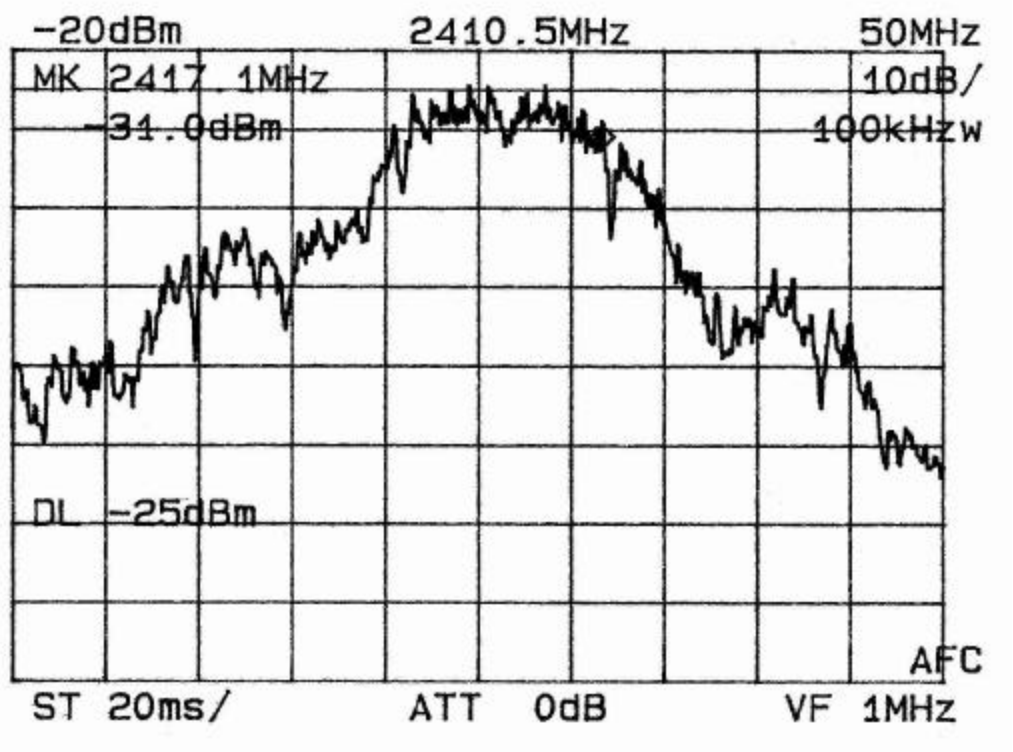
Minimum 6 dB BW: 500 kHz
RBW Setting on S.A.: 100 kHz

Condition: Transmitter is set to a single channel modulated at 1 Mbps at full RF power

Reading from Spectrum Analyzer:

Channel : 2410.50 MHz - (13.2 MHz)

6 dB EMISSION BANDWIDTH – (100 kHz RES. BW)



POWER SPECTRAL DENSITY

Limit: 8 dBm
Resolution Bandwidth: 3 kHz
Average Time Interval: 1 second/3 kHz

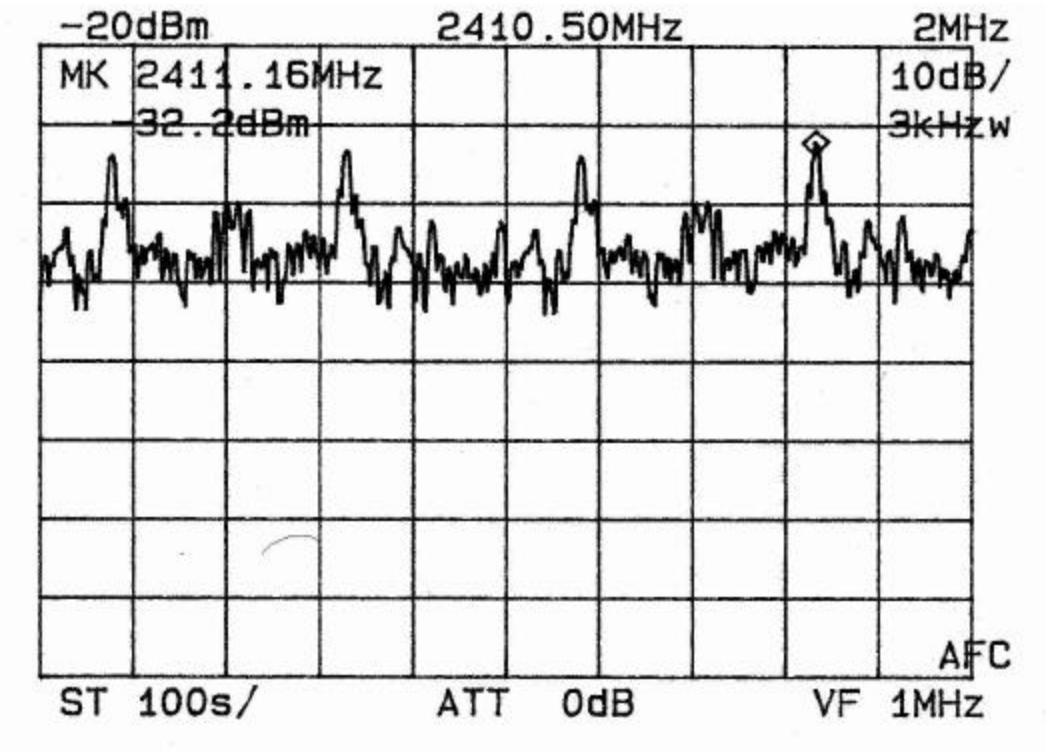
Actual Time Interval used
for testing: 1.5 seconds/3 kHz

Condition: Transmitter is set to a single channel modulated at 1 Mbps at full RF power.

Note: 30 dB front-end attenuator on analyzer

Reading from spectrum analyzer:

Channel: **2410.50 MHz - -2.2 dBm**



RF ANTENNA CONDUCTED SPURIOUS/HARMONICS EMISSIONS

Limit below Fc level: 20 dB below Carrier Level Measured with 100 kHz RBW
RBW Setting on S.A.: 100 kHz

Condition: Transmitter is set to a single modulated channel at full RF power.

FCC Part 15.247(c) – Conducted Spurious Emissions

Frequency of Carrier = 2410.50 MHz
Limit = 20 dBc

TEST RESULTS

Component	Frequency (MHz)	Result (dB Below Peak)
Harmonic	4821.00	-57.0
Harmonic	7231.50	-59.0
Harmonic	9642.00	-64.0
Harmonic	12052.50	-69.0
Harmonic	14463.00	-71.0
Harmonic	16873.50	-74.0
Harmonic	19284.00	-75.0
Harmonic	21694.50	-75.0
Harmonic	24105.00	-75.0

5.0 Test Configuration for Conducted and Radiated Emissions:

The EUT was set up on the center of the test table, in a manner which follows the general guidelines of ANSI C63.4, Section 6 **"General Operating Conditions and Configurations"**. A 4 inch monopole antenna is attached to the transmitter via reverse polarity SMA connector. The transmitter is turned on and automatically begins transmission at full RF power output, once initialized.

6.0 Conducted Emissions Scheme:

The EUT is placed on an 80 cm high X 1.5 m non-conductive table. Power to the RF modem is provided through a Solar Corporation 50 ohm/50 uH Line Impedance Stabilization Network bonded to a 2.2 X 2 meter horizontal ground plane, and a 2.2 X 2 meter vertical ground plane. The LISN has its AC input supplied from a filtered AC power source. A separate LISN provides AC power to the peripheral equipment. I/O cables are moved about to obtain maximum emissions.

The 50 ohm output of the LISN is connected to the input of the spectrum analyzer and emissions in the frequency range of 450 kHz to 30 MHz are searched. The detector function is set to Quasi-Peak and the resolution bandwidth is set at 9 kHz, with all post detector filtering no less than 10 times the resolution bandwidth for final measurements. All emissions within 20 dB of the limit are recorded in the data tables.

7.0 Radiated Emissions Scheme:

The EUT is placed on an 80 cm high X 1.5 meter non-conductive motorized turntable for radiated testing on the 3 meter open area test site. The emissions from the EUT are measured continuously at every azimuth by rotating the turntable. Standard gain horn and log periodic broadband antennas are mounted on an antenna mast to determine the height of the maximum emissions. The heights of the antennas are varied between 1 and 4 meters. Both the horizontal and vertical field components are measured.

The RF spectrum is searched from 30 MHz to 24 GHz.

The output from the antenna is connected to the input of the preamplifier. The pre-amp out is connected to the spectrum analyzer. The detector function is set to PEAK. The resolution bandwidth of the spectrum analyzer is set at 120kHz for the frequency range of 30-1000 MHz, and 1 MHz for the frequency range of 1-24 GHz. A 10Hz video BW setting is used to average readings above 1 GHz. All emissions within 20 dB of the limit are recorded in the data tables.

To convert the spectrum analyzer reading into a quantified E-field level to allow comparison with the FCC limits, it is necessary to account for various calibration factors. These factors include cable loss (CL) and antenna factors (AF). The AF/CL in dB/m is algebraically added to the Spectrum Analyzer Voltage in dBµV/m. This level is then compared to the FCC limit.

EXAMPLE:

Spectrum Analyzer Voltage: **VdBmV**

Composite Factor: **AF/CL dB/m**

Electric Field: **E dBmV/m = V dBmV + AF/CL dB/m**

Linear Conversion: **E mV/m = Antilog (E dBmV/m ¸ 20)**

FCC CLASS "B" CONDUCTED EMISSIONS DATA

CLIENT: **MATRIC LTD.**
EUT: **CAN BRIDGE**

MODE: **TRANSMIT**

LINE 1-Neutral: **Quasi-Peak Level** **Date: 12/08/2000**

FREQUENCY MHz	SPEC. Ana dBuV	Calc. Volt. uV	FCC LIMIT uV	MARGIN dB	CONDITION
0.47	36.00	63.10	250.00	11.96	PASS
6.20	35.00	56.23	250.00	12.96	PASS
7.20	38.20	81.28	250.00	9.76	PASS
27.50	30.80	34.67	250.00	17.16	PASS

LINE 2-Phase: **Quasi-Peak Level**

FREQUENCY MHz	SPEC. Ana dBuV	Calc. Volt. uV	FCC LIMIT uV	MARGIN dB	CONDITION
0.52	35.60	60.26	250.00	12.36	PASS
4.80	34.60	53.70	250.00	13.36	PASS
6.20	34.80	54.95	250.00	13.16	PASS
23.90	33.40	46.77	250.00	14.56	PASS
28.40	32.00	39.81	250.00	15.96	PASS

TEST ENGINEER:

Brian Haghtalab

FCC RADIATED EMISSIONS DATA

CLIENT: MATRIC LTD.
EUT: CAN BRIDGE

FREQ.: 2410.50 MHZ
POWER: 10 dBm

3 METER TEST **DETECTOR - PEAK** **DATE: 12/08/2000**

FREQUENCY MHz	POLARITY H	POLARITY V	SPEC A dBuV	AF/C dB/m	AMP Gain dB	Average Factor dB	PEAK E-Field dbuV/m	Average Limit dBuV/m	MARGIN dB	CONDITION
4,821.00		V	40.00	35.00	25.00	0.00	50.00	54.00	4.00	PASS
12,052.50	H		32.00	40.00	25.00	0.00	47.00	54.00	7.00	PASS
14,463.00		V	30.00	43.00	25.00	0.00	48.00	54.00	6.00	PASS
19,284.00	H		25.00	36.00	25.00	0.00	36.00	54.00	18.00	PASS

TEST ENGINEER:

Brian Haghtalab

Table 1

Support Equipment

1. A.C. adapter – 24 VDC Linear type.

Table 2

Interface Cables Used

None used.

Table 3

Measurement Equipment Used

The following equipment is used to perform measurements:

HP 435A RF Peak Power Meter	- Serial No. 1362016
EMCO Model 3110 Biconical Antenna	- Serial No. 1619
Antenna Research MWH-1825B Horn Antenna	- Serial No. 1005
EMCO Model 3115 Ridged Horn Antenna	- Serial No. 3007
HP 8348A Preamplifier	- Serial No. 197-2564A
Solar 8012-50-R-24-BNC LISN	- Serial No. 924867
Bird 8306-300-N 30dB Attenuator	- S/N: 29198391515
HP 14IT w/8555A Spectrum Analyzer	- Serial No. 6-95-1124
4 Meter Antenna Mast	
Motorized Turntable	
Heliax FSJ1-50A 1/4" Superflex Coax Cable (12 Ft.)	