
MIRA Test Report



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On the Authority of: Order N^o: 13175

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Test Report No: 1012122

**Radio Frequency Emissions
of a Schrader Electronics Ltd
Volvo 315 AM Tyre Sensor Transmitter
to FCC Regulation Part 15**

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SUMMARY

A Schrader Electronics Ltd Volvo 315 AM Tyre Sensor Transmitter was tested in accordance with FCC Part 15, Subpart C and with RSS-210 of Industry Canada.

The Schrader Electronics Ltd Volvo 315 AM Tyre Sensor Transmitter met the limits for radiated emissions by 6.8 dB and by 3.9 dB at the harmonics. Beside the harmonics there were no other significant spurious emissions located.

The test results contained within relate only to the sample(s) identified in this report.

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1 Introduction

A Schrader Electronics Ltd Volvo 315 AM Tyre Sensor Transmitter was tested for compliance in accordance with FCC Regulations, part 15, adopted under Docket 87-389, April 18, 1989 and with Industry Canada RSS-210, Issue 5, dated November 1, 2001.

The tests were performed at MIRA Ltd Open Area Test Site following the procedures described in ANSI C63.4-1992 “Methods of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz’.

The Schrader Electronics Ltd Volvo 315 AM Tyre Sensor Transmitter MRXTG315AM04 was received at MIRA on 03/04/06. Tests were performed on 03/04/06 and 12/04/06. All equipment was returned to Schrader Electronics Ltd on 26/04/06.

No representative was present to witness the testing on behalf of Schrader Electronics Ltd.

The site description and attenuation characteristics of MIRA Ltd Open Area Test Site are on file with FCC Laboratory, Columbia, Maryland, USA (registration number 877566) and with Industry Canada, Ottawa, ON (File Ref. No: IC 6001).

2 Configuration and Equipment Under Test (EUT) Details

The EUT is a 3.5 x 7.0 x 1.5 cm size (including valve stem) potted tyre pressure sensor/transmitter that mounts on a rim inside the tyre. When the vehicle is in motion, the EUT transmits tyre pressure information to the receiver in the vehicle. The transmission consists of eight ASK encoded words of total duration of 0.928 seconds which repeat typically every 63 seconds. The 315 MHz carrier is generated by a SAW stabilised oscillator. The coding is performed by an ASCII timed by a 32.768 kHz crystal oscillator.

- Manufacturer: Schrader Electronics Ltd
- EUT ID: Schrader Remote Tyre Pressure Monitoring Transmitter
- Model: Volvo 315 AM Tyre Sensor
- Serial Number: No Number on EUT
- ITU Emission Code: 300KK1DAN
- FCC ID: MRXTG315AM04
- IC ID: 2564A-1022004
- MIRA IDs: E206-0185 & E206-0186

Two samples were provided; these consisted of a continuous sample used to maximise the emissions and a standard sample to be used for the pulse emission, correction for pulse operation and bandwidth measurements.

3 Radiated Emissions

The radiated emissions tests were carried out on the Open Area Test Site (OATS) at MIRA in accordance with FCC Regulation 47, Subpart C, Section 15.231 and ANSI Standard C63.4-1992 standard.

3.1 Test Method

The EUT was tested as a standalone unit (i.e. not mounted on a tyre rim)

The tests were performed on the EUT over the frequency range 30 MHz to the tenth harmonic of the EUT 315 MHz fundamental. This involved measuring the emissions from the EUT using an antenna, turntable and a receiver system. The EUT was placed on a 1 m by 1.5 m, 0.8 m table. Photographs showing the test configuration are shown in Appendix B.

Tests were conducted using both the vertical and horizontal polarisations of the antenna. Peak readings were taken in three orthogonal EUT planes (see figure 3.1). The highest readings were converted to average readings based on the duration of the EUT 'on' time. When an emission was located, the table was rotated to maximise the signal strength. When this signal strength was determined, the test antenna was raised and lowered from 1 m to 4 m to locate the maximum signal strength.

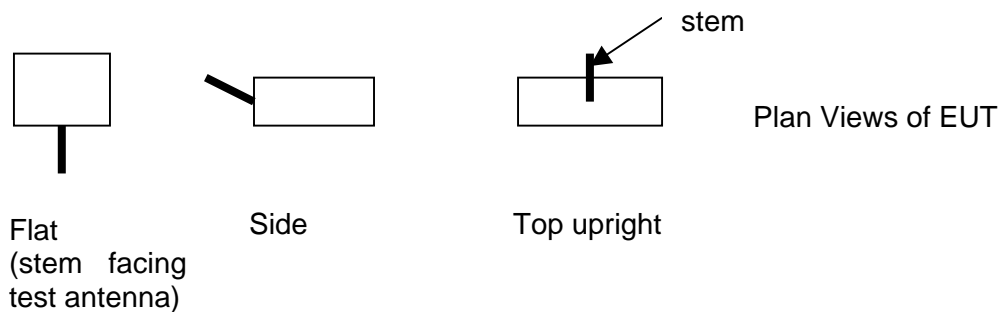


Figure 3.1 Plan View of EUT (not to scale)

3.2 Test Conditions

The EUT was tested in active roll mode where the EUT sends a transmission every 63 seconds.

3.3 Test Limits and Computations

The EUT is classified under the category of an Intentional Radiators and Digital Devices.

For FCC the EUT is subject to Subpart C, Sections 15.209 and 15.231; Subpart A, Section 15.33.

For Industry Canada the EUT is subject to RSS-210, Sections 6.1 and 6.3.

The applicable test frequencies with corresponding emission limits are given in Tables 3.3.1 and 3.3.2 below.

Table 3.3.1 - Radiated Emission Limits (FCC:15.231(e); IC:RSS-210; 6.1, 6.3 Table 4) Data Transmission

Frequency MHz	Fundamental µV/m	Ave. E _{lim} (3 m) dB (µV/m)	Spurious µV/m	Ave. E _{lim} (3 m) dB (µV/m)
260-470 315	1500-5000* 2418	67.7	150-500 241.8	47.7

* Linear interpolation formula: $E = -2833.2 + 16.67 \times F$ (MHz)

Table 3.3.2 - Radiated Emission Limits (FCC:15.33, 15.35, 15.109; IC:RSS-210; 6.2.2(r) Digital Class B

Frequency MHz	E _{lim} (3 m) µV/m	E _{lim} dB µV/m
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

3.4 Test Results

Table 3.4 - Highest Radiated Emission Measured

Emission Freq MHz	Test Antenna Polarity	Peak Field Strength dBµV/m	Average Field Strength dBµV/m*	Field Strength Limit dBµV/m	EUT Position
315.08	V	77.2	60.9	67.7	Top Upright
630.08	V	56.9	40.6	47.7	Top Upright
945.12	V	59.5	43.3	47.7	Top Upright
1260.40	V	55.0	38.7	54.0	Side
1575.20	H	63.7	47.4	54.0	Top Upright
1890.17	V	66.4	50.1	54.0	Side
2205.20	H	54.2	37.9	54.0	Side
2520.40	H	52.9	36.6	54.0	Top Upright
2835.20	V	61.6	45.3	54.0	Side

* The average field strength reading includes the antenna factor (dB/m), cable loss (dB) and the -16.29 dB pulse operation correction factor (see section 5.1).

The measured emissions from the EUT were shown to be below the limits at the fundamental by 6.8 dB and by 3.9 dB at the harmonics.

4 Conducted Emissions

The conducted emission tests are not required because the EUT is powered by a 3 V internal lithium battery.

5 Other Measurements and Computations

These measurements were performed to determine the measured value for pulse EUT operation as per FCC Part 15 Section 15.35 (c) and the bandwidth of the EUT fundamental emission as per FCC Part 15 Section 15.231 (c).

5.1 Correction for Pulse Operation

The EUT pulse sequence is shown in figure 1 of appendix C. The EUT pulse duration was measured at 15.33 ms with a time period less than 100 ms.

The averaging factor was calculated as:

$$K_E = (20 \text{ Log}_{10} (15.33\text{ms}/100\text{ms})) = -16.29 \text{ dB}$$

5.2 Bandwidth

The measured bandwidth of the EUT is shown in figure 2 of appendix C. The allowed (-20 dB) bandwidth is 0.25 % of 315 MHz or 768 kHz. The EUT 20 dB bandwidth measured was 341.7 kHz.

6 Conclusions

The Schrader Electronics Ltd Volvo 315 AM Tyre Sensor Transmitter met the FCC requirements for unlicensed transmitters in the following aspects:

Section 15.231 (e), radiated emissions for periodic operated equipment.

Section 15.231 (c) Bandwidth less than 0.25 % of the centre frequency.

The Schrader Electronics Ltd Volvo 315 AM Tyre Sensor Transmitter met the IC RSS-210, Issue 5 requirements for unlicensed pulsed transmitters.

Appendix A

Test Equipment

The Quality Assurance scheme at MIRA has been established to ensure that all equipment has a clearly identified calibration classification, calibration expiry date, and that all calibrations are traceable to national standards. All equipment within the scheme is given a Quality Assurance number of the form Qnnnnnn A DD/MM/YYYY where:

nnnnnn is a unique number assigned to the instrument
 A is the calibration category of the instrument e.g. A, A1 etc
 DD/MM/YYYY is the date on which the calibration expires

Test Equipment	N°	Classification	Calibration Due
R&S ESCS Test Receiver	Q025182	A	12/10/2006
Chase CBL6112 BiLog Antenna	Q013853	A	11/10/2006
Schwarzbeck BBHA 9120A	Q024341	A	30/03/2007
Horn Antenna (0.8-5GHz)			
Cables	Q019181	A	24/05/2006
	Q019190	A	24/05/2006
	Q025072	A	23/05/2006
Tape Measure Fisco FT30/79	Q022588	A1	10/09/2008
RH Turntable Controller	Q006878	A	16/01/2007
R&S 1008.8107.04/06 Mast	Q015174	A	16/01/2007
R&S 1008.8207.02 Mast Controller	Q015178	A	16/01/2007
Open Area Test Site	Q007015	A	29/09/2006

Classification A Item conforms to a MIRA QAM Performance Specification, which does not differ from the Manufacturer's Specification.

Classification A1 Item conforms to a MIRA QAM Performance Specification, which differs from the Manufacturer's Specification.

Appendix B

EUT Photographs

Photograph	Title	Negative N°
Plate 1	Test Configuration	IMG_0459
Plate 2	Close up of EUT	IMG_0458



Plate 1 General Set-up (IMG_0459)



Plate 2 Close up of EUT During Test (Top Upright) (IMG-0458)

Appendix C

Test Results

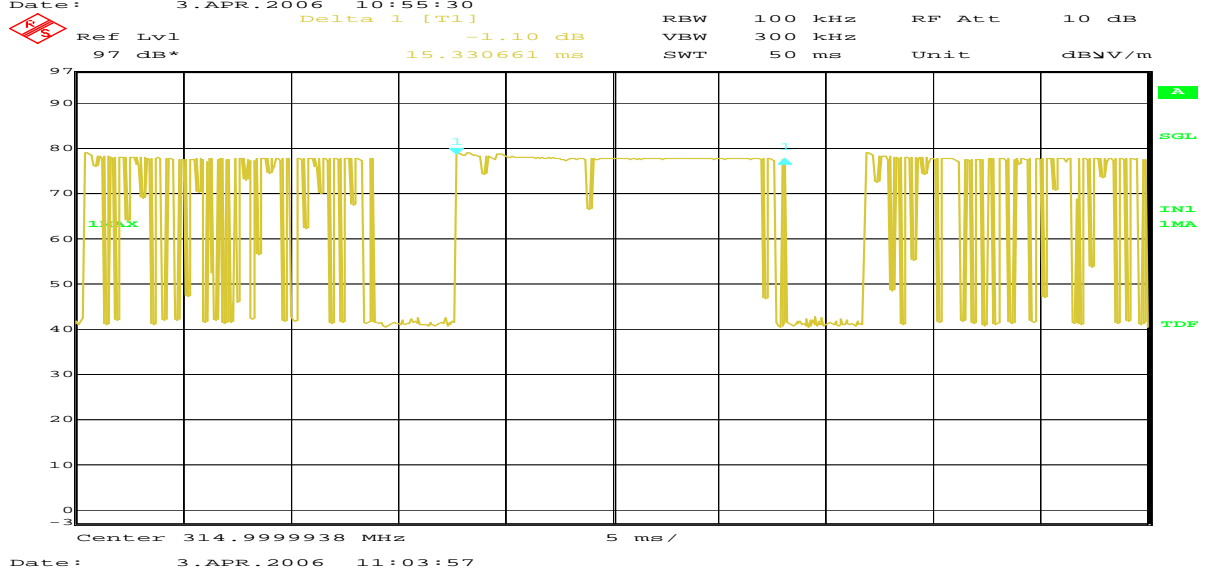
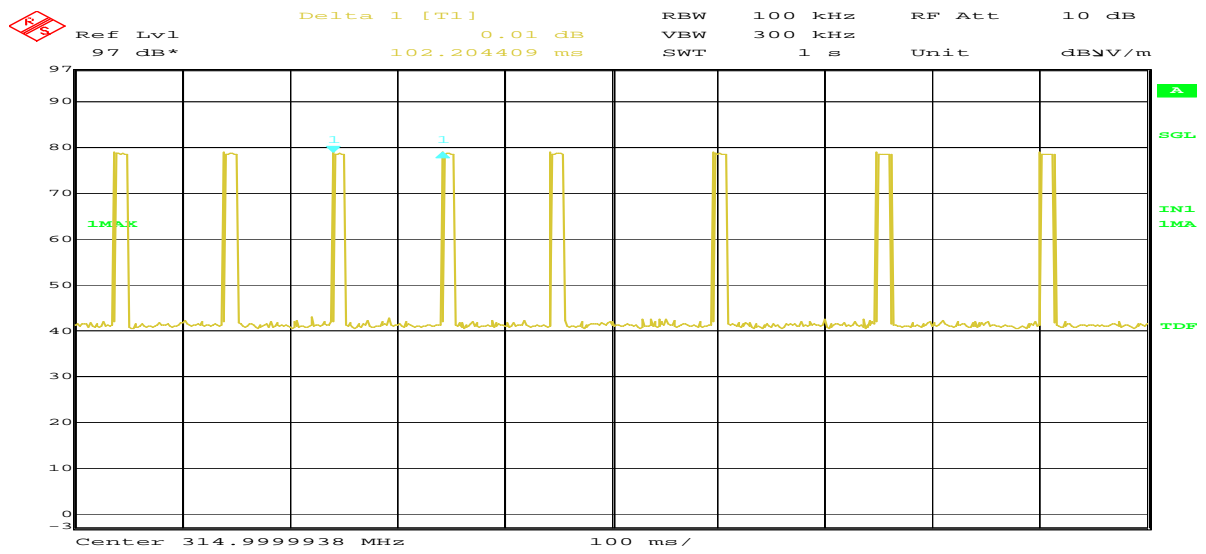
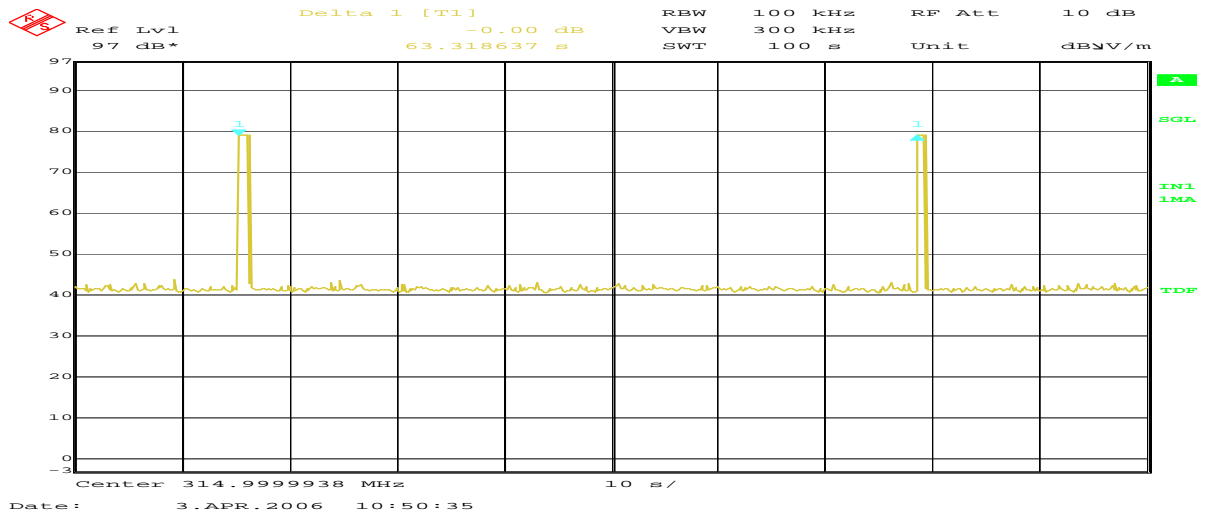


Figure1 Transmission Modulation Characteristics: (top) transmission repetition, (centre) transmission pulses, (bottom) pulse width (5 ms per division)

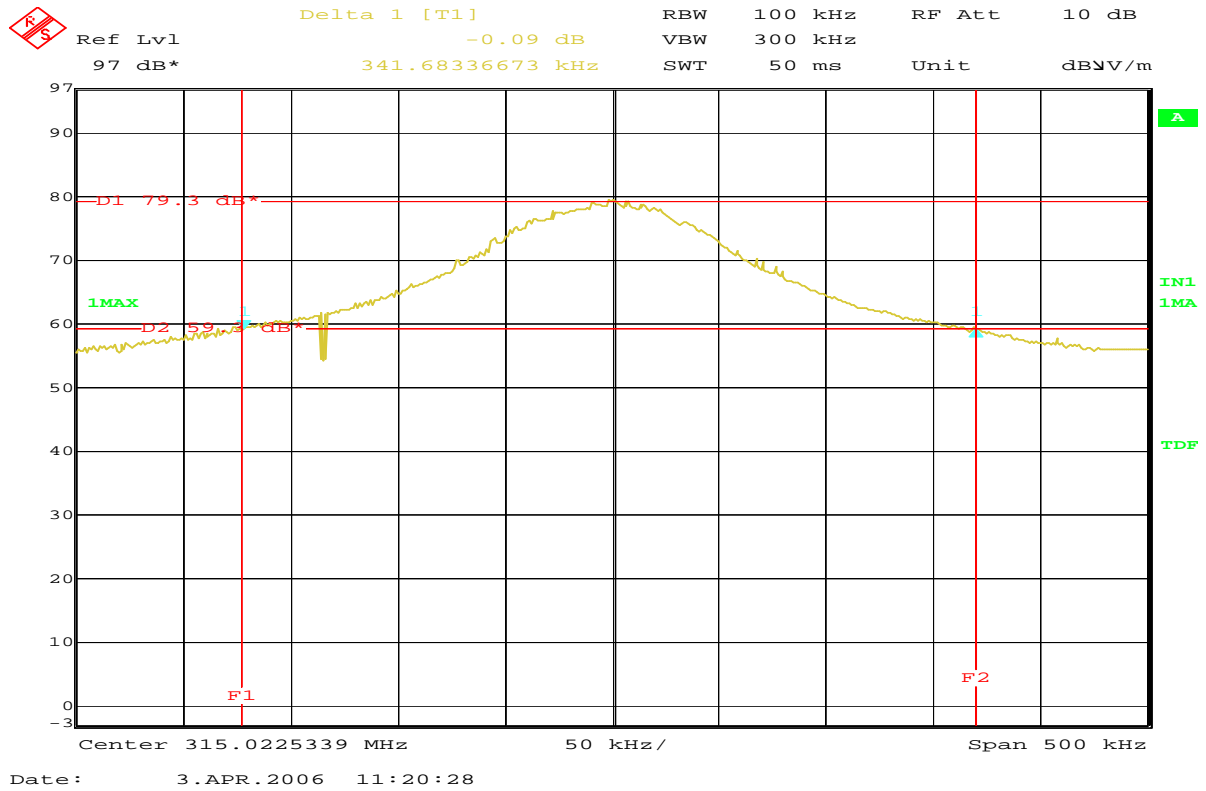


Figure 2 – Bandwidth Measurement

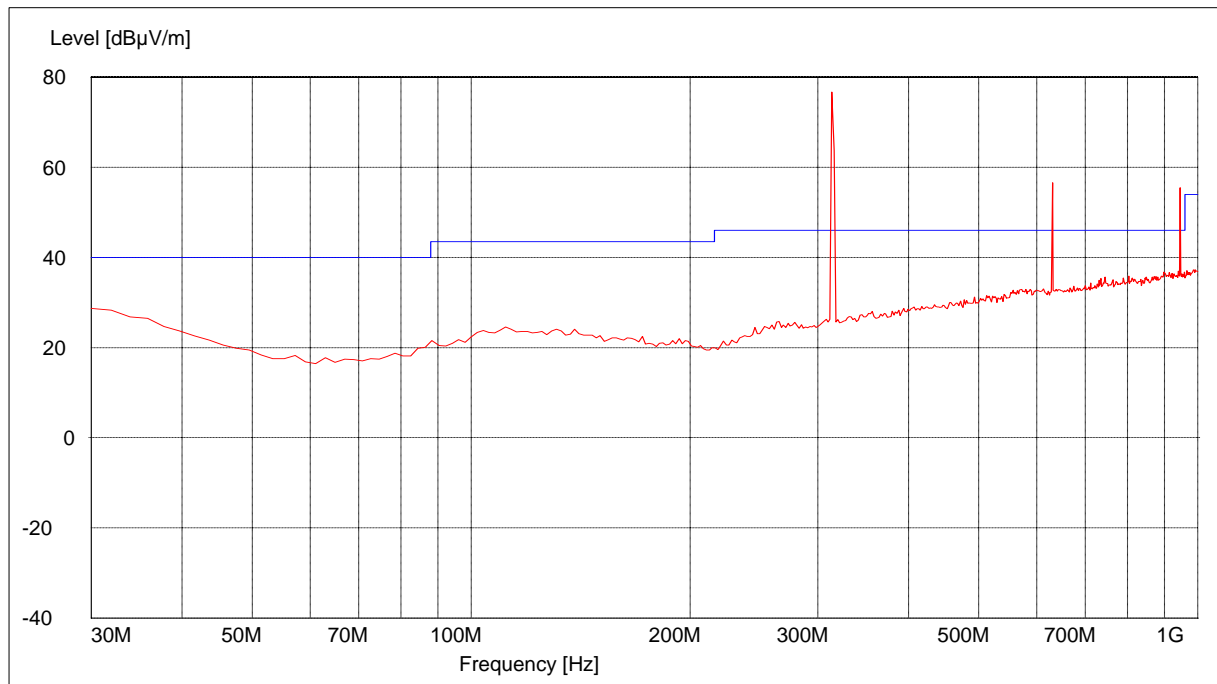


Figure 3 Identification of frequencies below 1 GHz Bi-Log Vertical

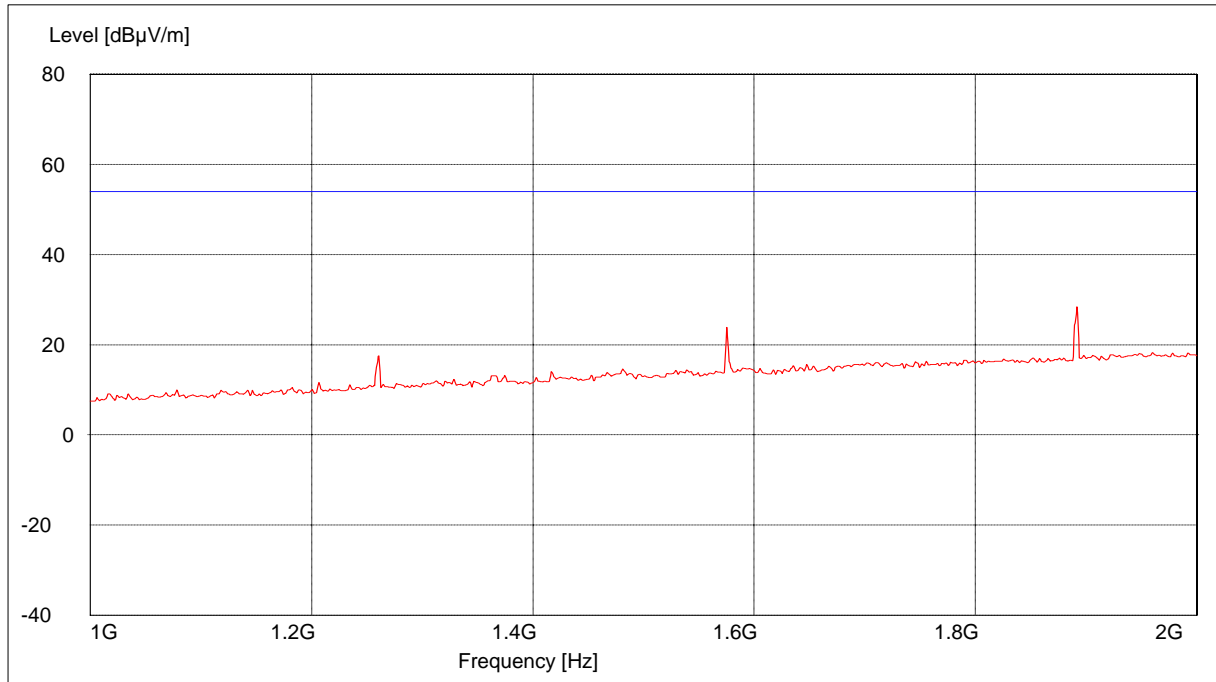


Figure 4 Identification of frequencies 1 GHz to 2 GHz Bi-Log Vertical

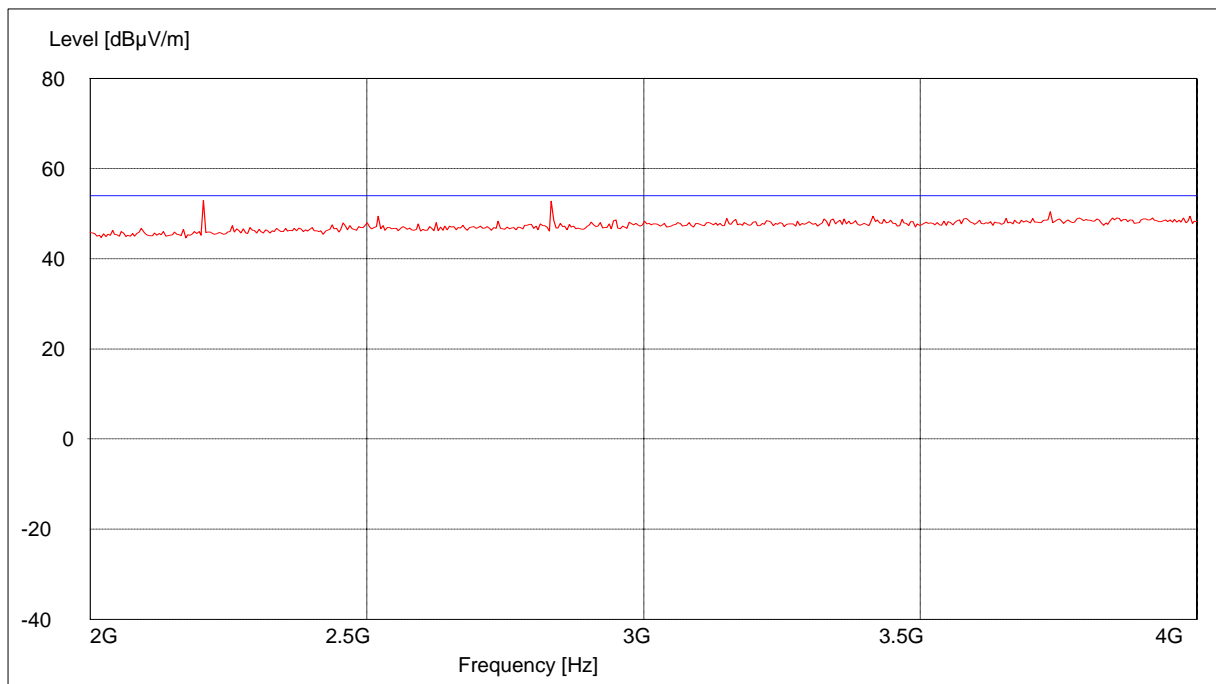


Figure 5 Identification of frequencies 2 GHz to 4 GHz Horn Vertical