# INTERFERENCE TO 447.700 MHZ AMATEUR REPEATERS FROM COMPUSTAR 2-WAY CAR ALARM

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# Abstract

FCC and IC rules allow low power devices to operate on many frequencies as long as the radiated field strengths do not exceed prescribed limits. Between 260 and 470 MHz, up to 12,500 microvolts/m at 3m is allowed. Despite limited field strengths, under the right circumstances low power unlicensed devices can cause harmful interference to established radio communications systems.

# **Background Case Study**

A Toronto area repeater VA3BMC has been operating for many years on an output frequency of 442.700 MHz and input frequency of 447.700 MHz. The repeater requires CTCSS tone 103.5 Hz to be present on the input audio is protect from unintentional operation.

# Particulars of VA3BMC

The City of Toronto, Ontario has a population of two and a quarter million. Another two million inhabitants live outside of Toronto within an approximate 60 mile radius. This would include the much of what is known as the "Golden Horseshoe" around the western end of Lake Ontario, from Niagara Falls to Oshawa.

VA3BMC is situated in Toronto on top of a 30-story apartment building close to the Weston Road and Finch Avenue intersection. Portable and pager grade coverage of the north west quadrant of Toronto is possible. Mobile grade coverage exists over much of the Golden Horseshoe.

The area immediately under the repeater can be characterized as dense urban, with many apartment buildings and malls mixed with single detached dwellings. Two multi-lane highways 400 and 401 pass within a few miles. Commercial/Industrial properties also exist within two miles.

Repeater equipment is a Motorola Micor base station, with a Power Amplifier adjusted for 60W RF output. This passes through a C3037 multicoupler before being radiated by a Sinclair 335-2, 6 dBd omni antenna. Effective Radiated Power is 120W. Controller is a Zetron model 48B with a 2-line telephone interconnect. The phone patch is currently private. To access the repeater, a PL tone of 103.5 Hz must be used. Other PL tones are occasionally activated or cross-coded for experimentation.

# Interference Issue from the Compustar Car Alarm

During the summer of 1999, the odd digital burst was heard during a conversation. It's occurrence was infrequent and was not pursued. Eventually, the emissions could be heard more often and would vary in strength. It was thought that a transmitter somewhere in the city, perhaps a mobile was intermittently spurious. Once spring 2000 came, the digital emissions became virtually continuous, prompting us to investigate. The digital bursts can also be heard at the end of a legitimate transmission but before the controller audio gate closes as CTCSS is lost.

As the interference became worse, the repeater VA3BMC 442.700+ PL 103.5 Hz was rendered unusable. The repeater has always been PL access, which hid the interference to the point that it was unavoidable.

A car security alarm called Compustar (Firstech, Inc. an Alaska company is the importer, Canadian distributor in Calgary) was found to be the source of interference. It intentionally operates on 447.700 MHz as the telemetry link between key fob and car. It boasts a range of a <sup>1</sup>/<sub>4</sub> mile and can also be used as a remote car starter.

Compustar is supposed to be momentary, active only when there are changes in status or an alarm condition. Perhaps due to the Korean-English instruction manual, or inexperienced installers, a few Toronto area firms have been installing the alarm device mis-wired to the brake circuit, so that they transmit continuously while the vehicle brakes are depressed. For a repeater in a large city, there are always many cars to be heard. In Toronto, due to dysfunctional traffic patterns, brake pedal application can exceed throttle application. The Compustar effects are audibly worst during "rush hour" when most traffic isn't moving.

#### **Industry Canada Investigation**

Industry Canada's Toronto District Office was notified about this interference. IC has confirmed the emissions and note that the Compustar device has not been submitted to IC for approval under RSS-210. Its operation in Canada is, at the time of this memorandum, illegal. The distributor has voluntarily ceased further importation into Canada until the device gains IC approval. However, this is usually a formality. Submission of the FCC lab report often provides all the necessary information for a rubber stamp approval in Canada.

The Ottawa certification lab has been made aware of the potential for continuous transmission and will examine it further. Once the instruction manual is clarified, and steps are taken by Compustar distributors to ensure miswiring doesn't occur, this alarm will likely be granted Canadian approval and will continue to proliferate. Compustar's use of a ham frequency is legal under Industry Canada RSS-210 and FCC part 15 due to its low radiated field strength.

Regarding momentary operation, FCC documents stipulate:

15.231(a3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

and,

15.231(a4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

FCC web pages provide the test report and approvals on this device (as well as pictures, schematics, certificate), and list it as compliant.

Unfortunately, while the signal strength qualifies under the specification as unlicensed, it is strong enough to be heard through a repeater from random cars in the vicinity of a couple miles. Most time of the day or night, the data bursts from one car or another can be heard. While weak interference can be labeled a nuisance, the Compustar has been observed as strong as -75 dBm at the repeater, more than strong enough to cause harmful interference.

#### **Discussion and Further Action**

The interpretation of the alarm's "momentary" nature is one issue and the way it can be erroneously installed to cause near continuous operation. Amateurs can also make issue about the use of the amateur band for unlicensed apparatus or the way frequencies are chosen. Firstech/Compustar could have legally picked a public safety frequency too. While regulations prohibit harmful interference to a licensed service, remedy is more complicated once devices proliferate in the hands of unsuspecting consumers. Once there are enough of these alarms in existence, the frequency becomes unusable for incumbent applications.

Unfortunately, the damage has been done. Many mis-wired alarm units are already in the hands of consumers. They will not be removed from service unless they fail. This issue won't be isolated to Toronto. Other North American repeaters on 442/447.700 will also be affected.

Digital emissions don't mix with voice and are a nuisance if infrequent. In this case, harmful conditions exist due to both interferer strength and recurrence. It seems prudent that the long process of requesting a new repeater frequency (in Toronto, there aren't any available) is undertaken. There are also no guarantees that any other ham frequency may someday fall prey to such a device!

If the repeater is carrier squelch only, as many amateur repeaters are, every Compustar transmission within a couple of miles of the repeater site would be heard. Should enough companies feel that the 445 to 450 MHz spectrum is a great place for their low power devices, in time amateurs may have no choice but to reverse their repeater inputs to reduce their interference levels. This would cause the Compustars out there some grief in returned product and customer dissatisfaction. Their low power device would be competing with a 125W ERP transmitter! Failing regulatory mediation, how else can amateurs protect their spectrum but through threat of lost profit and risk of interference for those considering amateur spectrum? It is hoped that this type of scenario can be avoided. Vigilante behavior is a downward spiral for all concerned.

# If You Operate a Repeater on 442.700+ MHz

The amount of interference you hear will depend on the location of your repeater (urban vs. rural), the density of housing, existence of malls or parking lots around your repeater, local distribution activity (proliferation) of the Compustar product and finally installer competence putting the product properly into the vehicle. For mild interference, using CTCSS may hide it or even make it a non-issue depending on the above factors.

For ground level monitoring of 447.700 MHz, hearing a properly functioning Compustar is rare unless one is within a mile of it at best. It can be found most commonly in large parking areas like malls or apartment buildings. When installed correctly, it's emits a short data burst and it's gone. It will transmit continuously during an alarm condition. The miswired Toronto units that transmit continuously can be heard *anytime* when driving into the quadrant of the city where the errant installers operate (that wired the Compustar to the brake circuit).

The frequency 442/447.700 may remain useful as a rural linking pair or perhaps as a packet or other ham digipeater application. Use of this frequency by hams in a popular digital application would be ideal. To give up this frequency to the car alarm device, in essence providing them with a private frequency, would be precedence setting and unfortunate for the entire 445 to 450 band. The way they take over this frequency with their operation and device proliferation is very unfair to the incumbent amateur radio community. The UHF amateur band can slowly become a new ISM band.

Consider also that there are many DGPS, crane control, telemetry and security devices in the amateur band. Many are licensed, so there is some control where they go and to enable sharing of the band. The Firstech car alarm company simply picked a frequency in the repeater input side of the UHF amateur band. How convenient for them! Not FRS frequencies, 900 ISM, 390 MHz or even the common 433 MHz (also ham) frequency often used for low power telemetry.

# **Final Words**

It is important to note that an identical alarm device called MagiCar operating at 433 MHz is made by the same Korean manufacturer. This device has not been imported to North America and is considered the "international" version. Why did the "North American" version require the 447.700 MHz frequency?

Lobbying pressure from interested parties (including commercial entities and public safety) is required to ensure regulatory bodies are aware of unlicensed device harmful impact under the less than ideal conditions.

Ongoing lobbying from the amateur community is required to defend against further incursions into amateur radio spectrum.

Even if current regulations stand, companies producing unlicensed devices should seek the endorsement of their chosen frequency by representative organizations that hold status in that band. It is a shame if a damaging frequency is chosen due to convenience or lack of research on the part of the manufacturer. In the case of the amateur bands, repeater coordination councils, the American Radio Relay League, and others could carry out any frequency 'endorsement'.

# (Non) Endorsement

This email is not intended to solicit sales of the said alarm systems.

# <u>Links</u>

- An audio wave file is available as a demonstration of the interference through the repeater. Visit <a href="http://www.qsl.net/va3bmc/">www.qsl.net/va3bmc/</a> site for details
- The Firstech/Compustar alarm web page is <u>www.compustar2w.com</u>
- The similar MagiCar Alarm that operates on 433 MHz instead of 447.700 MHz can be found at <a href="https://www.gfgroup.com.tw/new.htm">www.gfgroup.com.tw/new.htm</a>
- To conduct your own search of FCC certification records, go to this site and enter in your search terms (example: Frequency Range 445 to 450 MHz, Grant Code N99 for Firstech) <u>https://gullfoss.fcc.gov/cgi-</u> bin/ws.exe/prod/oet/forms/reports/Search Form.hts?form=Generic Search
- IC document RSS-210 <u>strategis.ic.gc.ca/pics/sf/rss210.pdf</u> for License-Exempt Regs. Similar to FCC part 15.
- IC frequency search facility <u>apollo.ic.gc.ca/english/main.html</u> and type in 440 to 450 MHz to see LICENSED devices in the amateur band.
- See also <u>www.howard.co.kr</u> for another similar car alarm (operating frequency not known at this time... stay tuned).