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1. *What was the approximate distance between the receiver and the interfering site or sites when the "R.F. Power - 851-869 MHZ" levels were measured?*

The power levels reported were the highest found for that site in a brief site survey. The ranges varied from approximately 100' to 350' from the CMRS tower base.

2. *Who was the licensee or licensees of the interfering site or sites?*

Because we were not attempting to work with the interfering licensees to mitigate the interference, no attempt was made to identify the interfering licensees. However, it should be possible to determine the licensees through a database search.

3. *What were the operating parameters (antenna height AGL, ERP, number of channels, operational frequencies, modulation (e.g. iDEN, GSM, etc) of the interfering site or sites?*

We did not determine the antenna height or ERP of the sites. We did record the frequencies used at the sites, but not which sector or what type of modulation was used on them except for the CDMA channels.

CMRS and Cellular Channel Table (frequency list may not be exhaustive):

L.V. Conv. Center	Wells & Palm	Ramrod Road	Green Valley Road	Mission Bay & Garnett	Ingraham	4665 Cass
851.9375	852.3875	855.3875	852.1125	856.850	856.800	861.575
853.0625	855.8875	855.6875	852.1875	857.675	857.875	861.900
854.0875	861.8125	858.6625	856.4375	857.700	860.850	862.425
860.3125	862.7125	859.3375	856.4875	859.600	861.325	862.900
860.3875	863.7125	862.5375	856.5875	859.675	862.700	863.800
862.2125	870.750	864.2625	859.2625	865.325	863.850	865.750
862.2625	872.610	865.9125	861.6625	870.390	864.700	
862.2875	873.720		862.0125	870.720	869.090	
863.6125	874.560		862.0375	871.020	874.150	
863.6375	878.310		862.0625	871.440	877.290	
863.6875	879.600		862.7375	871.650	891.060	
864.1375	890.850			872.010		
864.6875				872.070		
864.9125				872.160		
864.9875				872.700		
865.1375				873.330		
865.1625				873.960		
865.2125				874.590		
865.4375				875.760		
865.4875				878.540		
865.5125				879.100		
				879.660		
				890.070		
				890.850		
CDMA :	880 to 885 MHz	880 to 885 MHz	880 to 885 MHz	881 to 887.3 MHz	881 to 887.3 MHz	881 to 887.3 MHz

4. *What were the operating parameters (antenna height AGL, ERP, number of channels, operational frequencies, and modulation) of the affected Public Safety system?*

We also did not attempt to determine the antenna height or ERP of these systems, either. The modulation type was analog FM for the systems reported on in the update letter. Since then two digital systems have been evaluated. The results of those evaluations follow the question response portion of this document.

Public Safety Channel Table:

SNACC (Las Vegas)	San Diego
855.7125	856.025
856.2625	856.050
856.4375	856.075
856.7125	857.000
856.7625	857.025
857.4875	857.050
857.7625	857.075
858.7625	858.000
859.2625	858.025
859.4625	858.050
859.9375	858.075
860.2625	859.000
860.4375	859.025
860.4875	859.050
860.9375	859.075
	860.000
	860.025
	860.050
	860.075
	861.100
	862.050
	862.100
	863.050
	864.050
	865.050

5. *What instrument(s) were used in the measurements and at what settings (bandwidth, etc.)?*

The signal strength measurements were made using a thermocouple power meter (HP438A power meter) hooked up to a car-top quarter-wave antenna. A low-loss bandpass filter was inserted into the antenna cable to select the LMR band.

Prototype portables with RF attenuators and software algorithms to automatically engage the attenuator were used to measure SINAD with and without the RF attenuator technique enabled. The bandwidth of the receiver was set to the standard bandwidth for 25 kHz channel analog operation, which is about 12 kHz. SINAD was measured with a Motorola R2001 service monitor.

6. *If a spectrum analyzer was used in the power measurements, did the waveform at the public safety frequency suggest uncorrelated noise or discrete carriers or sidebands?*

A spectrum analyzer was used to find the frequencies in use at a site but the resolution was not sufficient to determine the spectrum within a particular channel.

7. *How was the interference area determined?*

The interference area was determined by working with users who, through experience, had found areas of interference. They brought the Motorola team to these areas and measurements were made at a number of locations in and around the interference areas. The GPS coordinates were taken and the locations were plotted on a map along with whether interference existed at that location or not. The locations where interference was experienced defined the perimeter of the interference area.

8. *What accounts for the fact that the interference power measurements at a given site are fixed, whereas the public safety received power levels have significant variation?*

The interference signal powers are line of sight, broadband and experience little or no fading phenomenon. The public safety signal source is much further from the measurement location and the signal is simulcast from several sites. Thus the amplitude is affected by summation of several source signals and fading.

9. *What is the difference between the RF measurements in the 3rd and 4th columns of the Table?*

The third column is the RF power measured at the output of a quarter wave antenna using a HP438A power meter. The fourth column is the RF power measured at the output of a bandpass filter with a passband of 851 MHz to 869 MHz that is in series with antenna output.

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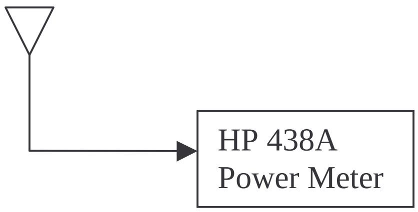
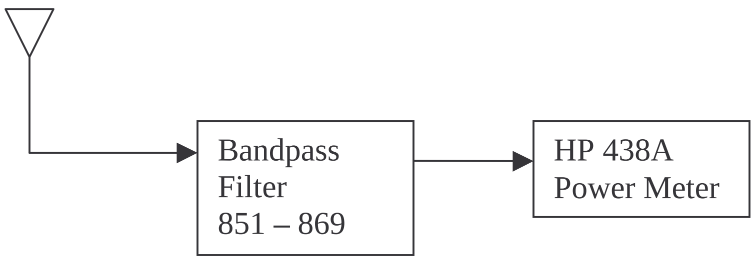
Total RF Power Measurement System Block Diagram



LMR RF Power Measurement System Block Diagram



10. *If intermodulation could not be correlated with the interference, do you know, or suspect, what interference mechanism was at work other than, in general, "non-linearity?" For example, was the receiver driven into gain compression?*

Bench measurements indicate that gain compression does not seem to be an issue. Field measurements indicate that the interference is due to third and fifth order intermodulation products. Wideband signals composed of several contiguous CDMA carriers create spectral spreading around narrowband band carriers, land mobile or cellular A band. This spectral spreading can cause third order or fifth order IM in the victim receiver, depending on the signal power of the narrowband and wideband signals.   The spectral growth is 2 or 3 times the bandwidth of the wideband signal.

11. *Please define and quantify Attenuator Effectiveness in the last column. Assuming that 100% effective means seizing a control channel, what was the quality on the traffic channel thereafter? Were any BER or SINAD measurements done on the traffic channel?*

The attenuator effectiveness is determined by taking the ratio of the square feet affected by interference with the attenuator technique enabled to the square feet affected by interference with the attenuator technique disabled.

Listening to the control channel was one step in the process, used mainly to quickly find the area affected by interference. Our testing also involved taking a channel off the air and putting a 1 kHz test tone or digital test pattern out on the channel. When practical, we stepped through all the channels. At least 12 dB SINAD or less than 2.6% BER was needed to call coverage at a point acceptable.

12. *Please provide more specifics regarding the statements in the letter that possible best practices include modifying antenna patterns to reduce signal strength on the ground.*

Most of the interference is occurring "on-street", within a few hundred yards of low CMRS sites where the CMRS signal levels are very high. One possible way to lower the CMRS signals levels may be to reduce the antenna radiation pattern directed at area experiencing interference. Each case must be evaluated to determine if such antennas can be deployed and what benefits may be realized by their use.

There are several ways to reduce the antenna gain directed at a particular area. Reducing the gain in the particular area may be possible by selecting an antenna with a pattern that provides a null in that azimuth and elevation. Reducing downtilt may result in lower gain towards the interference area. Rotating sectored antennas slightly may provide some relief if the area is near a sector boundary. Many options can be evaluated for effectiveness.

Some antennas suppress radiation above the main beam to control signal radiated towards co-channel sites. The APX856513-42T0 from RFS is an example of such an antenna. It may be possible to invert such a design to suppress lower side-lobe radiation below the main beam. Several antenna manufacturers have created antennas that suppress the lower side-lobes. Some examples include the DB845N65ZAXY and DB846G90A-XY from Decibel products and the LV90-12-XXDA and LV90-12-XXDA4 antennas from EMS Wireless. Antenna manufacturers may be able to design and provide a variety of antennas with these characteristics but that is an issue best addressed by the antenna manufacturers themselves.

13. *Please explain the significance of your advanced receiver technology in addressing intermodulation interference issues in light of your statement on page 3 that you are unaware of "any intermodulation interference being reported for the current 800 MHz mobile units meeting TIA class A specifications."*

The statement on page 3 is compares the performance of portable vs. mobile radio units. Portable units are hand held units generally powered by a battery source internal to the radio. Mobile units are vehicle-mounted units powered by the vehicle's electrical system. Vehicle-mounted mobile units are less sensitive to current drain issues because they have a constant and renewable source of power.

TIA standards for Class A radios require intermodulation performance of 70 dB and 75 dB for portable and mobile radios respectively. Motorola is not aware of any intermodulation interference being reported for Class A mobiles, which must meet the 75 dB IM specification. With the attenuator engaged in portable units, the IM performance of the portables exceeds that of the mobile units by approximately 5 dB. Accordingly, the statement on page 3 is intended to illustrate that portable radios with the attenuator should prove effective at mitigating intermodulation interference.

Additional Test Results

Subsequent to our letter dater June 20, 2003, Motorola conducted testing of two additional regions where interference was reported to 800 MHz digital systems. A total of 12 sites were visited in Broward County Florida and in the Northwest Central Dispatch area of Illinois, but interference was only evident at seven sites. At these seven sites, multiple data samples and interference in all of these areas was found to be due to either 3rd or 5th order intermodulation. The signal strength of the public safety systems in these areas was sufficient to allow use of the attenuator and the attenuator was successful at fully mitigating the interference in every case.

Broward County

The Broward system is an eight-site, 28 channel Astro Widepulse simulcast system. The system is a digital simulcast system, so a system-wide V.52 test pattern was used on one of its digital channels to allow BER measurements. A single NPSPAC channel (868.7625 MHz) was evaluated.

At the four sites described in the table below interference was generally severe enough that a receiver without the attenuator was completely unable to synchronize to the desired signal. The greatest level of interference was experiences at the Nova Drive & College Avenue and North Hiatus Rd. locations. Both of these sites had 3rd order direct hits from Nextel and 5th order hits involving Nextel and the A Band carriers. The attenuator was 100% effective at each site in reducing BER from unacceptable levels (including complete inability to sync to the desired signal) to acceptable BER levels (under 3% and usually under 1% BER).

Broward County Site	Interf. Area (Sq Ft)	Total RF Power (800 MHz qtr wave)	RF Power 851-869 MHz	Public Safety Signal Strength (25 kHz)	Interference Mechanism	Attenuator Effective-ness
Nova Drive & College Road	347K	-14 dBm	-15 dBm	-75 dBm to -70.9 dBm	3rd-Order IM	100%
4600 N Hiatus Road	175K	-19 dBm	-22 dBm	-86 dBm to -75 dBm	3rd-Order IM	100%
Stirling Road & N56/SW40 Avenue	19K	-21.1 dBm	-28.3 dBm	-78 dBm to -72 dBm	5th-Order IM	100%
Orange Drive & State Road 441	_	-21 dBm	-22 dBm	-78 dBm to -64 dBm	5th-Order IM	100%

Northwest Central Dispatch System

Of the five sites examined, only two had detectable interference at the time of testing. The sites where interference was experienced are described in the table below. At both areas the signal strength of the public safety system was sufficient to allow use of the attenuator and the attenuator was effective at fully mitigating the interference.

NWCD Site	Interf. Area (Sq Ft)	Total RF Power (800 MHz qtr wave)	RF Power 851-869 MHz	Public Safety Signal Strength (25 kHz)	Interference Mechanism	Attenuator Effective-ness
Schaumburg Rd & Illinois Ave	350k	-19.4 dBm	-26.1 dBm	-91 dBm to -84 dBm	3rd-Order IM Product	100%
Ill-83 & Greenleaf	<10k	-	-	-40 dBm	-	100%

The Schaumburg Rd. & Illinois Ave. site was a tall tripod with six operators on it. We found that one channel had interference and another did not. Frequency analysis indicated that the problem frequency had 3rd-order IM products to only to Nextel frequencies. The other frequency also had 3rd-order IM products landing on it, but they were products of Nextel and CMRS frequencies and, evidently, were not a severe as the Nextel-only hits. The CMRS operators were running more power than Nextel, but were also using wideband modulations (GSM and CDMA).