Broadcast Signal Lab

Report on March 2006 Survey of the State of FM Broadcasting on Grand Cayman Island

April 10, 2006

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Executive Summary

This report by Broadcast Signal Lab builds on its 2005 report on the state of FM broadcasting on Grand Cayman island. A follow-on survey was conducted in March 2006 to evaluate interference issues and interference potential, to further pursue spectrum efficiency and frequency assignment concerns, and to identify other topics of value to the ICTA and its constituent FM licensees.

The 2006 survey includes field measurements of signal levels across the island to determine how fully stations serve the island, and to assess the effectiveness of coverage at certain power levels and locations. Field measurements were also made in search of any undesirable spurious emissions that might be polluting the FM band and potentially causing interference to the reception of other stations. A third set of field measurements was conducted to assess the areas in which receiver overload might be expected to occur near each station.

During Broadcast Signal Lab's week on the island, meetings were held with ICTA and government personnel, with several parties interested in a possible master tower site central to the island to hear a presentation by a broadcast facilities vendor, with the owner-operator of one station whose transmitter site happened to be manned during the field survey, and, culminating the week, with representatives of most of the station owners to discuss their interests and concerns.

Blanketing interference potential is substantially reduced with the re-location of numerous radio stations from their post-Ivan temporary facilities to permanent tower-mounted facilities. The concerns expressed by Radio Cayman, among others, about the blanketing interference caused by the operation of the three DMS facilities in George Town remain acute. DMS continues to operate at a reduced power to mitigate some of the difficulties. DMS is actively engaged in the process and participating in discussions on how a joint effort to combine broadcast facilities at a remote site could work. The report maps out in very general terms the areas near each tower within which blanketing interference could be expected. Around the DMS site, an estimated 500+ residential size buildings are within the blanketing area, in addition to numerous government and business-oriented buildings. The site with the least number of residences within

a normalized blanketing radius is Northward, where about 150 residences are within the zone, plus the prison complex.

Spectrum hygiene is improving. The facilities on the Avcom tower in Newlands were in the process of being equipped with proper filtering to eliminate unacceptable intermodulation products being broadcast off the stations' assigned channels. Their installation has not been confirmed. One of these stations was also found by Broadcast Signal Lab to have some defective equipment generating further inappropriate emissions, which was going to be removed and repaired by the licensee. The resolution of this issue has not been confirmed. Some emissions from the facility in Northward were out of acceptable bounds. New filtering should be installed at this facility as well.

Emissions from the facilities in George Town are acceptable, albeit with some emissions at the government tower having no room to spare before they exceed customarily acceptable levels.

No station fully serves the island with reliable coverage, contrary to the terms of their licenses. Coverage was modeled from various heights above ground from a facility central to the island. Significant improvement in island-wide coverage would be obtained by doubling the height of antennas to the 400-500 foot elevation on a new tower. Significant reduction in interference would be achieved by such a facility.

Several spectrum plans were created for discussion. With 15 existing stations in their current channel assignments, there are 7 vacancies available. Reconfiguring the band for more efficiency with conservative spacing every 4th channel, 11 vacancies would be available. With more compact channel spacing, and centralized transmission from a single site on the island, using spacing every 3rd channel, 19 vacancies could be created.

An innovative approach is proposed to set aside part of the FM band for "Neighborhood Radio" stations. This would be a compact band of low power ten-watt stations with antenna heights no greater than 50 feet that would be created to provide highly localized broadcasting to benefit local communities and institutions, and youth. It might also be expanded to provide resort, traffic, and special activity broadcasting in localized areas. By giving up 6 (Option A) or 7 (Option B) island-wide full power channels, a sub band of 10-11 frequencies could be partitioned, supporting perhaps 22 to 33 low power local radio stations.

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Introduction

In the aftermath of Hurricane Ivan, radio broadcasting on Grand Cayman was in disarray. Broadcasters were operating at reduced power levels, often from temporary facilities, pending the restoration of their normal broadcast facilities. In addition, a new three-station broadcast facility was licensed and constructed at a government-owned tower in George Town. Interference and reception complaints prompted the Information and Communication Technology Authority (ICTA) to seek the advice of an independent party with expertise in facility siting issues. In April 2005 Broadcast Signal Lab evaluated the radio broadcast environment and made recommendations for mitigating the interference and reception issues.

Following up on this study, ICTA brought Broadcast Signal Lab back in March 2006 to re-evaluate the situation following several changes in broadcasters' facilities. This report summarizes Broadcast Signal Lab's findings on its recent visit to the island.

Background

Several issues remain of interest to the broadcasting community, the ICTA, and island radio listeners. First, the concern that stations might be producing spurious emissions in the FM spectrum was raised, particularly with the new facilities that have been recently installed, and also with respect to the continuing operation of the DMS stations in George Town. Second, the issue of receiver-induced third order intermodulation caused by the overloading of receivers near transmitter sites remains a concern. Third, Broadcast Signal Lab suggested in its first report that the ideal way for all stations to fulfill their license requirements and cover the entire island with minimal interference would be to co-locate at one site central to the island and away from the most densely populated areas.

Broadcast Signal Lab's visit to Grand Cayman island involved field measurements of signal strength and potential spurious emissions and meetings and discussions with various stakeholders in FM broadcasting. The week-long visit was capped by an open meeting with representatives of FM licensees, the government, ICTA and Broadcast Signal Lab for a wide-ranging discussion of new and old issues and ideas.

Spurious Emissions

A table is appended to this report that shows the potential third order intermodulation frequencies upon which stations might emit spurious emissions. The most likely of these interference product frequencies were examined for spurious emissions during the field survey. Other spurious emissions, not predictable by this means, were sought during the survey, resulting in the identification of one faulty transmitter.

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DMS broadcasting's facility is operating at 20% of its licensed power from the government tower in George Town—a result of a temporary compromise solution to blanketing interference complaints in the center of George Town. It was observed, on the previous Broadcast Signal Lab survey, to emit measurable intermodulation products in the FM band. With respect to international consensus on permissible emissions, the DMS intermodulation products were just below the customary limit and were therefore not considered to be interfering emissions. Understandably, Radio Cayman, whose studios are in George Town directly beneath the DMS antennas, is especially sensitive to potential spurious emissions from the DMS facility. This is a particularly acute concern for its station transmitting on 105.3 MHz some eight miles away. 105.3 is one channel away from a third order intermodulation product on 105.1 generated by the DMS stations. If the DMS 105.1 intermodulation product were unreasonably strong, it could interfere with reception of 105.3 in George Town.

In March 2006, Broadcast Signal Lab made measurements of the emissions and potential spurious emissions of the DMS facilities. The DMS stations' emissions have not changed since the 2005 survey. The product on 105.1 remains measurable, and remains just at the threshold of acceptability. It is substantially lower than that which would be necessary to interfere with reception of 105.3 in the center of George Town.

Several stations were relocated from temporary rooftop facilities in or near Gerogetown to towers in the Newlands area of the island. Hurley stations "Rooster" (101.9) and "Z-99" (99.9) were installed on the Briggs tower. Also installed at this site is Cerentis Broadcasting "Ocean" 95.5. Being co-located, these three stations have the potential to produce interference products on certain frequencies. These frequencies were observed at the base of the tower, and at a location about 1/3 mile distant. The three stations' emissions on those frequencies were found to be compliant with customarily acceptable levels of spurious emissions.

Approximately 600 yards to the north on the Avcom tower, the facilities of Paramount Media (Spin 94.9 and Vibe 98.9) were recently relocated. Two issues were observed relating to these stations. First, even though there are separate antennas on the tower, the emissions of each of the two stations feed back into the other's transmitter. Intermodulation products at 90.9 and 102.9 were observed in excess of the customary limits. Coincidentally, there were personnel at the transmitter site who generously offered Broadcast Signal Lab a view of the facility. A pair of commercial quality bandpass filters new in the box was standing by waiting for installation, pending the arrival of the necessary jumper cables. We assume that they were installed by the time this report was written, and that the out of tolerance intermodulation products were therefore appropriately attenuated.

Second, one station, 94.9, was observed generating spurious emissions whose source was the fault of the transmission equipment—a component called the exciter. Assurances were given to Broadcast Signal Lab that this problem would be resolved rapidly. One of the spurious emissions fell partially on the frequency of Ocean 95.5. Fortunately, since Ocean 95.5 transmits from the nearby Briggs tower, it is unlikely that the spurious emission of 94.9 would have been strong enough to substantially interfere with reception of 95.5.[1]

At the Northward tower site, at which a government tower hosts Radio Cayman (89.9 and 105.3) and Cayman weather (107.9), some out of tolerance emissions were observed. There are reported to be notch filters protecting each Radio Cayman transmitter from the energy of the other. The weather transmitter emissions may not be filtered from the Radio Cayman transmitters. An intermodulation product was identified at 74.5 MHz, which is generated by the 89.9 transmitter from the ingress of the 105.3 signal. This product is on the borderline of

[1] This highlights one of the benefits of co-location of facilities—spurious emissions are generally lower in level than the fundamental signal, and if all fundamental signals are transmitted from the same site at similar power levels, any spurious emissions that may crop up from time to time will not obliterate reception of another station at the site. Nevertheless, such emissions are simply not good radio hygiene and should be resolved as quickly as possible. Each station deserves a clean channel and clean adjacencies.

acceptable limits, similar in magnitude to some DMS emissions that were identified as being close to the limit. Similarly, the product generated by the 105.3 transmitter from the ingress of 89.9 is close to the customary limit, and appears at 120.7 MHz. Obviously, these products are outside the FM broadcast band and would only be of concern if they were of sufficient level to interfere with other authorized communications. Airport tower approach is at 120.2 and international distress is at 121.5. The 120.7 spurious emission is approximately 200 kHz wide, from 120.6 to 120.8. Fortunately, this is clear of directly overlapping either of these aeronautical frequencies, but in the worst case, such a spur has the potential to affect a receiver seeking a weak signal from either of these frequencies.

One product generated by 105.3 is outside the acceptable range. It is the product generated in the 105.3 transmitter by the ingress of the 107.9 signal—emitted at 102.7. One might expect the same mechanism would cause 89.9 to produce a similar product on 71.1. Indeed it does, however the level of that product is well within the acceptable range. Because of the proximity of the frequencies and the antennas, 105.3 should install filtering to decouple 107.9 from its power amplifier. A bandpass filter should be considered, as this will provide more protection if in the future other transmitters are added to the site. The same is true for 89.9 as well.

The weather transmitter at 107.9 did not produce any measurable intermodulation products on the predicted frequencies. This may have been due in part to a lower broadcast power level that would result in proportionally lower intermodulation products, in comparison to other transmitters operating on the island. This transmitter, if not protected by bandpass filtering, should be; particularly if the power level were to be increased. Also, the weather station desperately needs to increase its modulation to be compatible with the audio levels of the other stations, to be audible over more of the island, and to be more resistant to interference and fading.

Overall, spurious emissions generated by the various FM stations on Grand Cayman are acceptable, as long as those emissions identified in this report are duly addressed.[2]

[2] While performing spectrum measurements at the ICTA offices in George Town, a curious array of spurious emissions was noted. The emissions appeared as pairs of spikes above the noise floor of the instrument. It may have been locally generated emissions from electronics; however, there was an intentional characteristic to them. The signal pairs were irregularly spaced in the spectrum, although there seemed to be some regularity at 60 kHz intervals. The two signals of a pair were approximately 7 kHz apart and modulated at a rate that appeared to be between 1 and 2 kHz. This is characteristic of a paging or other relatively slow data transmission signal. It is possible that there is a transmitter of such signals that is

Receiver Overload

Considerable attention has been paid to the issue of "blanketing interference." This condition is not officially defined, and probably has as many definitions as there are experts to define the term. In a general sense, the term arises from the concept that a radio transmitter can saturate (blanket) a small geographic area with signal power sufficient to cause receivers to simply fail to receive a desired signal. By analogy, when a photographer takes a picture with strong backlight, the iris closes, causing the desired image in the foreground to be underexposed, lacking in the useful information intended to be captured. Similarly, a radio signal can blanket a receiver by overloading its "front end" where it attempts to distinguish between wanted and unwanted signals.

Not all receivers are blanketed by the same signal conditions. In some cases receivers are not entirely shut down by the blanketing signal, but develop interference phenomena that behave unpredictably. Continuing the photograph analogy, in addition to background light overload causing underexposure of the photograph's foreground, there can also be lighting "flare" in the lens. This is a distortion of the desired scene by artificial interactions between camera, film, and light source. Similarly, in addition to a receiver being desensitized by a strong signal, akin to the backlit photograph, receiver overload can produce artifacts in the received signal not unlike the artificial starbursts and light spots in a picture containing a bright light. In a receiver this condition that creates these unwanted artifacts is referred to with various acronyms, such as ROITOI—Receiver Overload Induced Third Order Intermodulation (pronounced ROY-toy).

The electrical phenomena that create interfering signals, whether in the transmitter or in the receiver, are the same. The difference simply is that the broadcaster has control over his transmitted signal, and no control over the ROITOI of the listener's receiver. In both cases, unwanted signals mix inappropriately within the receiver (or transmitter) and various sum and difference signals may appear on or near the wanted signal, appearing to the observer as interference.

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generating spurious emissions or is ingressing into another transmitter that is producing the products. It would be helpful for the maintenance of a clean FM band if broadcasters would consider whether there are any such services transmitting from or near George Town sites and inquire about their performance.

To regulate blanketing interference problems in the USA, the FCC establishes a "blanketing area" around a radio station's transmitter. The blanketing area is the area within which a radio station must resolve interference complaints for one year from initiating transmissions, and provide technical advice to complainants after that time. The blanketing area is defined by a simple calculation based entirely on the station's power output (effective radiated power—"ERP"). The height and type of antenna used by the station is not considered in this calculation, meaning the blanketing area is primarily an administrative means for defining an area of responsibility, and is not an actual predictor of potential interference.

The FCC blanketing area is defined by the theoretical 115 dBμ contour (about 0.6 V/m). The FCC equation for computing the blanketing radius is

0.245 x SQRT(Power in kW) = radius in miles

The computed theoretical 115 dBμ contour is simply the administrative radius, within which signal strengths are usually lower than this hypothetical level but still strong enough to affect reception.

Field Survey, Receiver Overload

To characterize blanketing potential on Grand Cayman, Broadcast Signal Lab took field measurements of radio signals near their respective transmitter sites. Field measurements must be related to real-world performance of receivers. Some valuable insights into receiver performance are found in ITU Recommendation BS 412-9 *Planning Standards for Terrestrial FM Sound Broadcasting at VHF.* For instance a set of car receivers was tested for ROITOI behavior. Complex curves were produced based on frequency separation of undesired signals, power level of desired signal, and power levels of undesired signals.

To derive a target field strength level for predicting potential interference, the information in the ITU Recommendation is extrapolated as follows: The highest desired signal level employed in the ITU study was 70 dBpw, which is -20 dBm, at the receiver input. A rough translation from power input to field intensity equates this to 95 dBμ. That is to say, with a 95 dBμ field strength, receivers subjected to undesired signals at 1.5 MHz separation and at anything higher than 95 dBµ could exhibit receiver-induced intermodulation interference. 95 dBµ translates to slightly under 0.1 V/m.

While the 0.1 V/m area is a reasonable indicator of potential receiver intermodulation problems for stations separated by 1.5 MHz, stations closer in frequency are more challenging and stations more separated are less challenging to receivers. The strength of the desired signal in comparison to the undesired signals is also a factor. The weaker a desired signal is, the more it may be susceptible to ROITOI from local undesired signals.

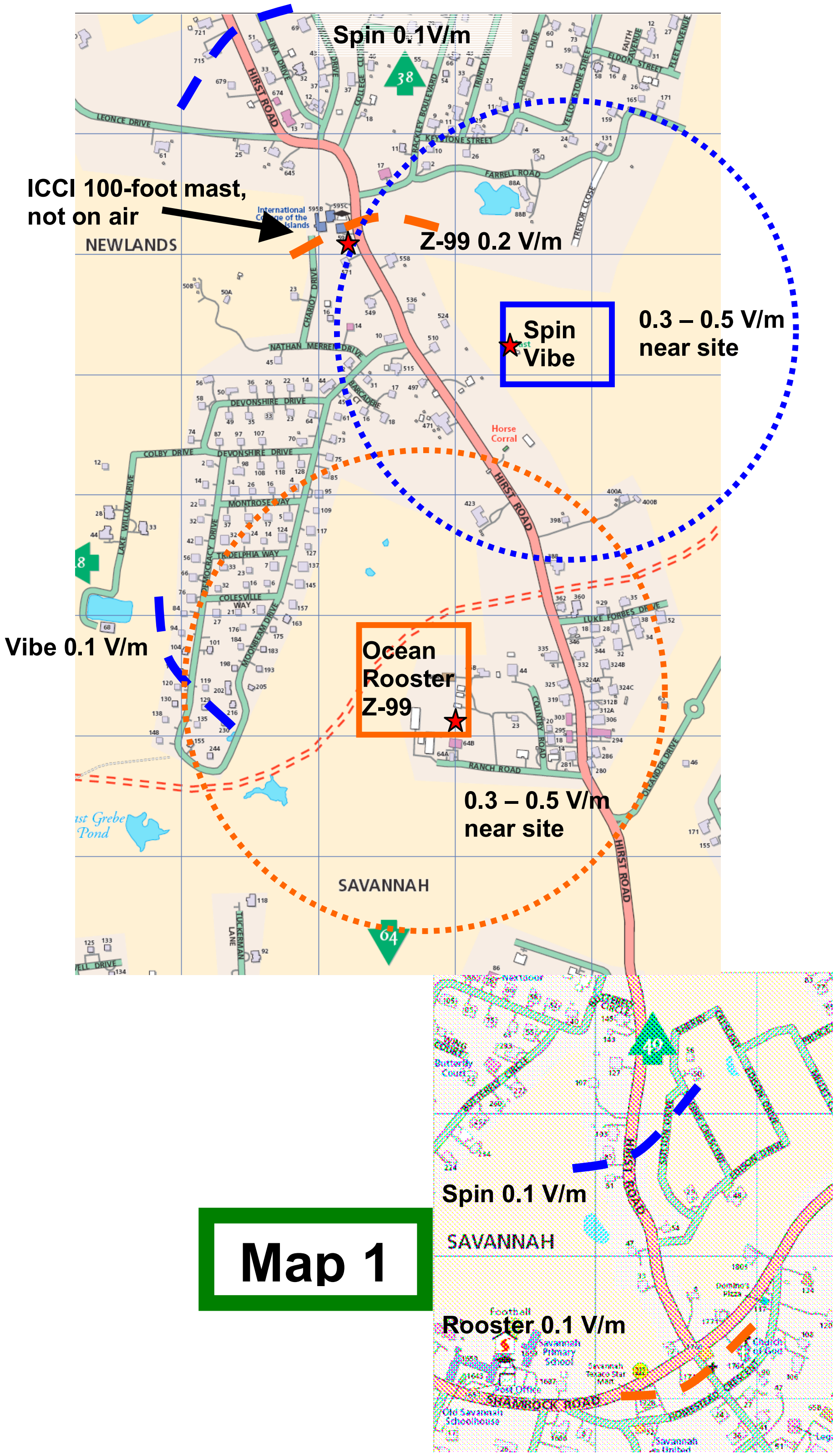
As the following survey results suggest, the measured 0.1 V/m area of a station is comparable in size to the FCC blanketing area. Only rarely was a signal level even close to an actual 115 dBµ level measured near any of the stations. Still, the FCC-computed blanketing area covers a radius of almost 1000 yards from a 5 kW station, no matter how high its antenna. Thus, radius of responsibility for broadcasters established by the 115 dBµ computation is a satisfactory radius, although 115 dBµ is not a good figure for predicting interference. This report will rely on a per-station value of 0.1 V/m as a general guide.

General Blanketing Observations

It was reconfirmed that the cause of Radio Cayman's interference complaints at the Radio Cayman studios in George Town is blanketing interference, which at the very least manifests as a receiver-induced product on 105.1 that interferes with reception of Radio Cayman's 105.3. At worst, receivers at or near the DMS site will be desensitized by the strong DMS signals and receive few to no other signals satisfactorily.

Confirming that blanketing interference is not localized to the DMS stations in George Town, DMS indicated at the broadcaster meeting on March 10, 2006 that it has received similar complaints about blocked reception of DMS stations near the Radio Cayman transmitter in Northward.

The blanketing interference problems from low-height, building-mounted antennas in George Town were resolved when Vibe, Spin, Rooster, Z-99, and Ocean moved from temporary post-Ivan facilities to towers at the Newlands area. Reception of Radio Cayman and the George Town stations may be subject to blanketing in the Newlands area. No doubt, signal reception in nearby Newlands neighborhoods is affected by the recent occupation of the towers with FM transmitters. These five stations might be listenable in this neighborhood, but reception of distant signals could be compromised for listeners with some receivers at some of the locations in the neighborhood.

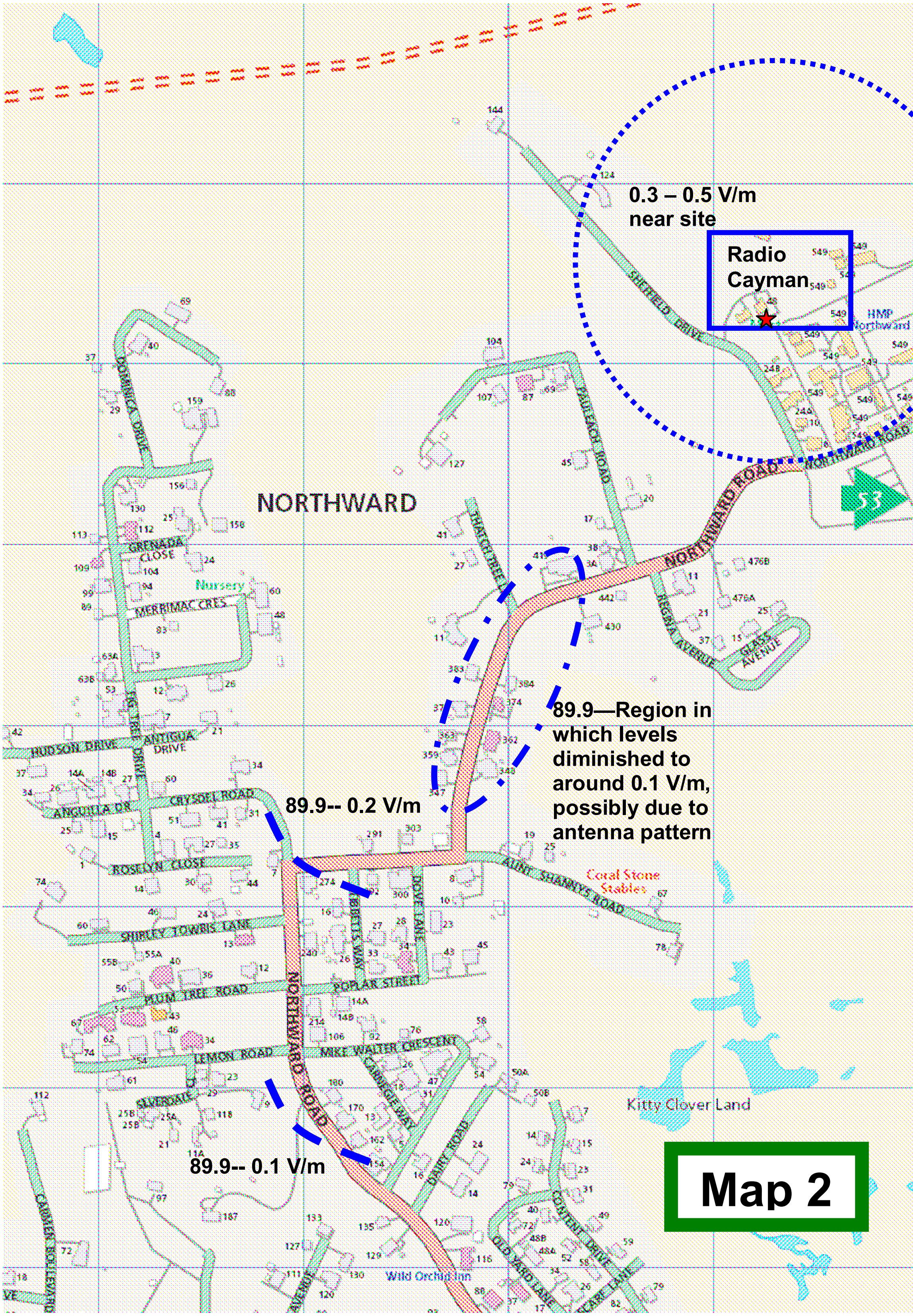


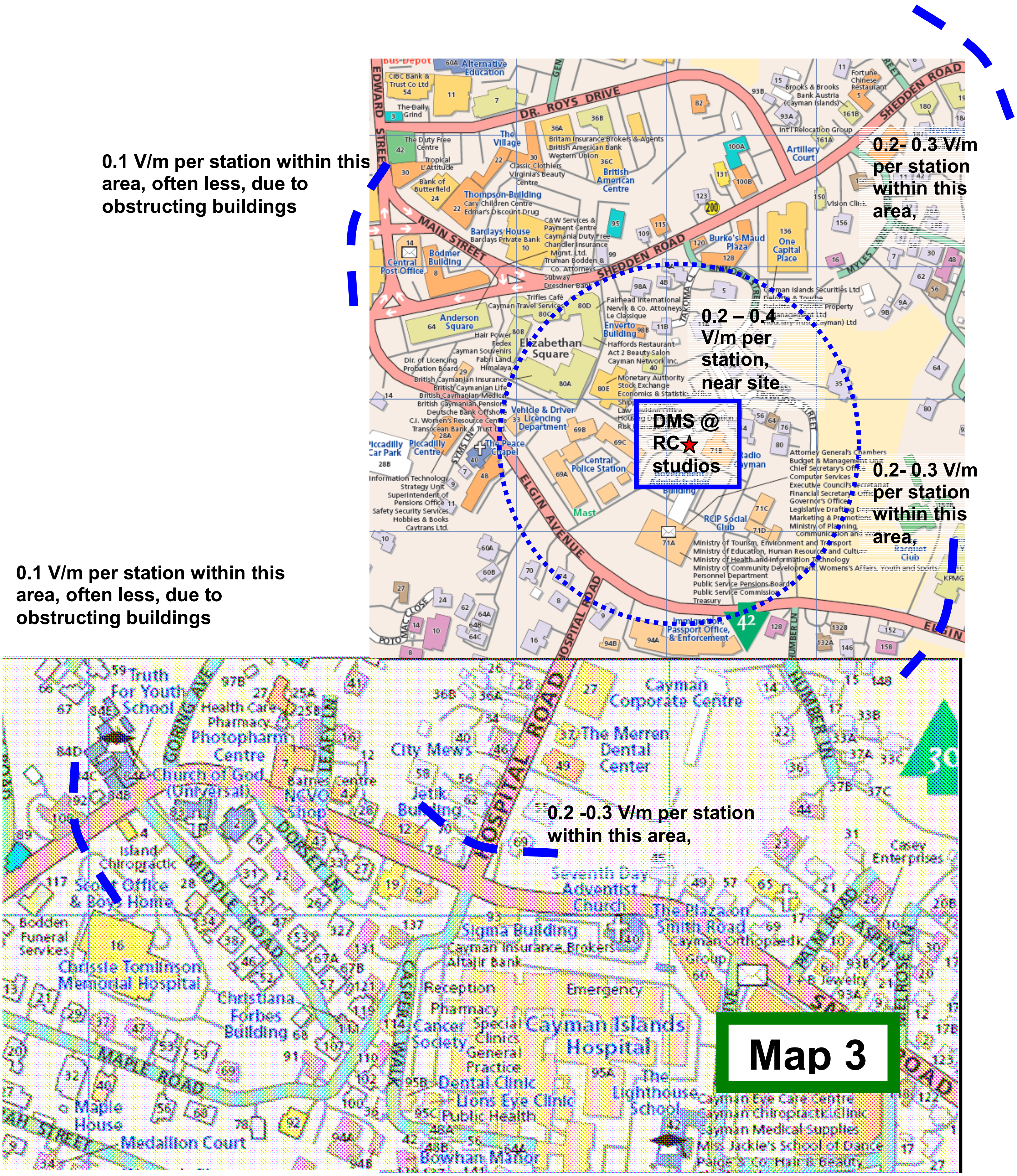
Newlands

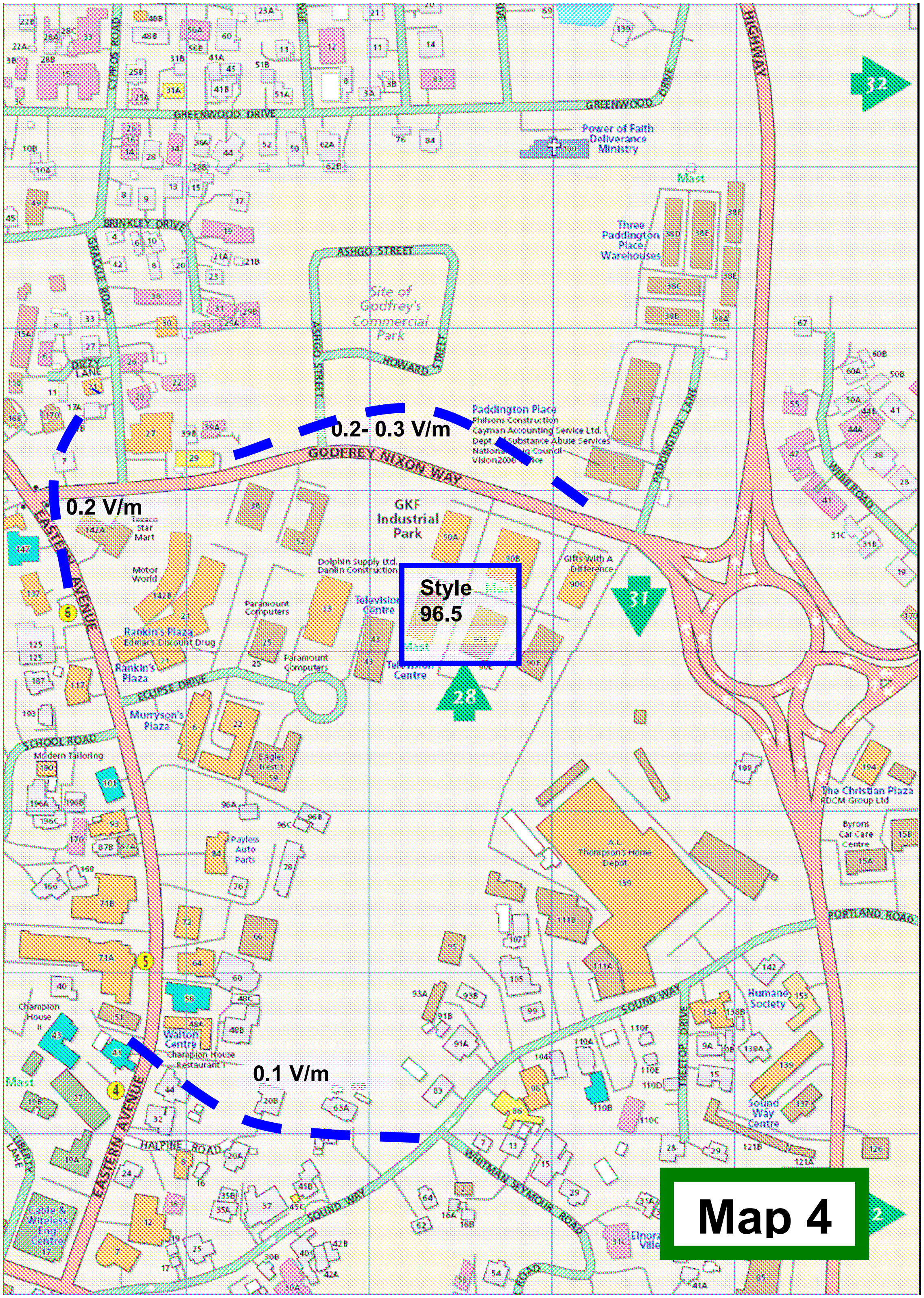
Map 1 is a map of the Newlands area where two towers are located. It is annotated with signal strength measurements. These plots are not statistically validated and represent general levels observed through a series of spot measurements and measurements with the vehicle in motion. The distance of about 1000 yards from transmitter sites seems to approximate the distances to where the signal levels would be found at 0.1 V/m, more or less. Ocean 95.5 appeared to be operating at substantially lower power than Rooster and Z-99, so it is not included in this plot.

Northward, George Town

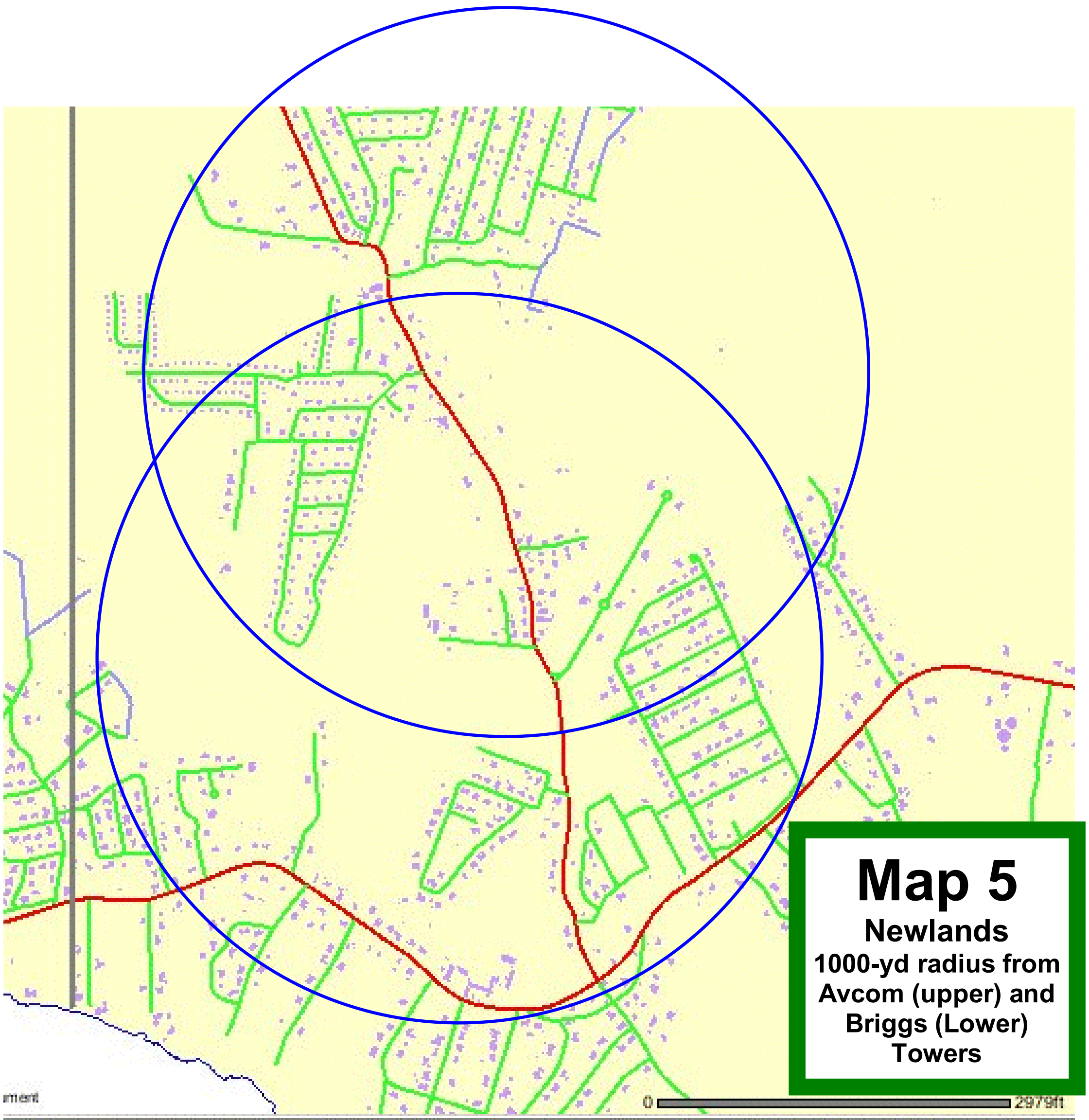
Performance at the Northward site of Radio Cayman was similar to the Newlands towers, as shown in Map 2. Differences occur from the various power levels used at each facility. Map 3 shows similar results for the DMS facility in George Town. Map 4 shows the results of a few measurements near Style 96.5 in George Town. Map Scales are not consistent among the maps. However, the map grids on Maps 1, 2 and the bottom of Map 3 represent the same area per grid cell. The map grids on the top of Map 3 and all of Map 4 represent equivalent areas per cell, and four of these cells equal one of the cells on the other maps.

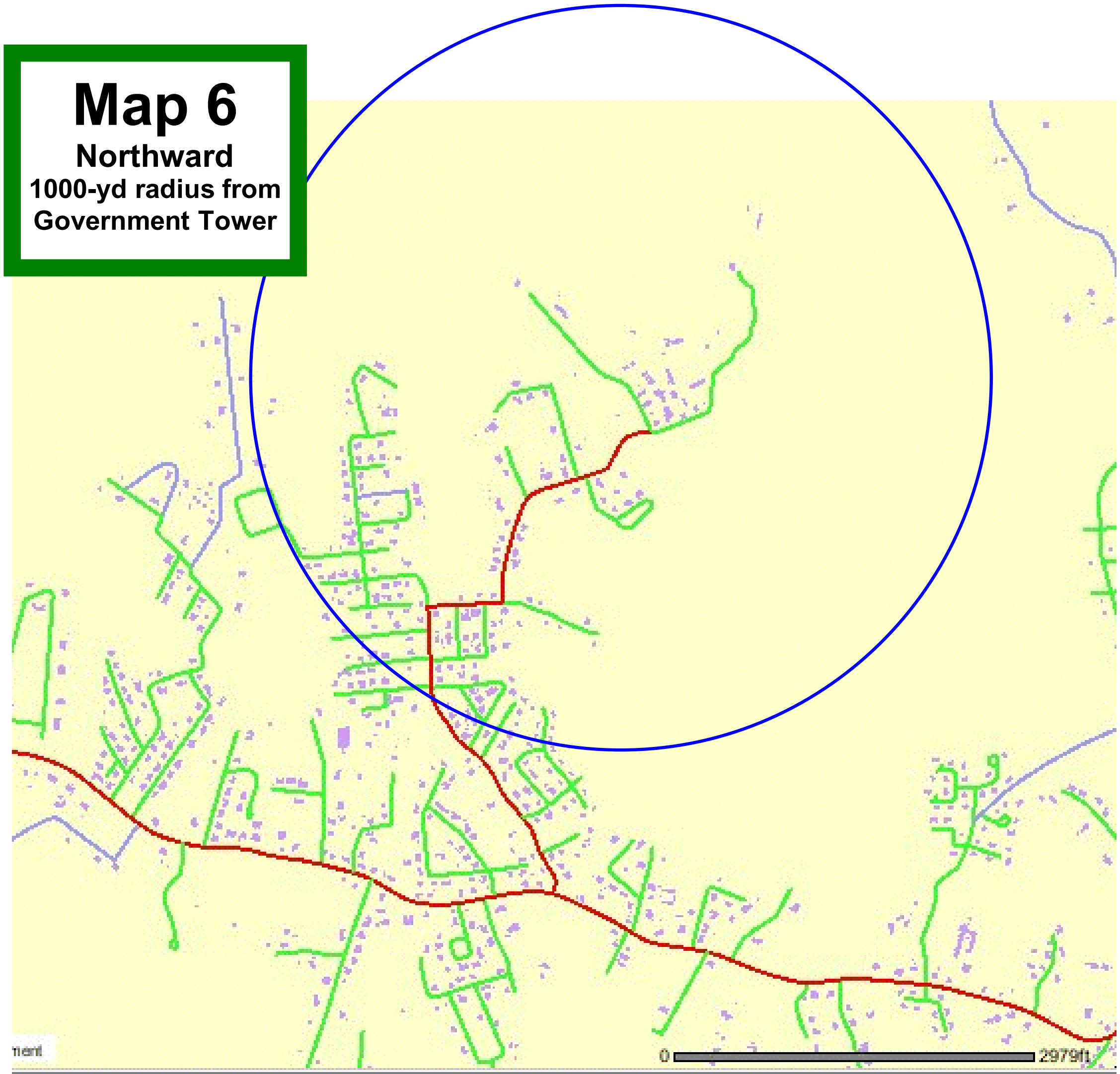

0.3 – 0.5 V/m
near site
Radio
Cayman
NORTHWARD
89.9—Region in
which levels
diminished to
around 0.1 V/m,
possibly due to
antenna pattern
89.9-- 0.2 V/m
89.9-- 0.1 V/m
Kitty Clover Land
Map 2


0.1 V/m per station within this area, often less, due to obstructing buildings
0.2- 0.3 V/m per station within this area,
0.2 – 0.4 V/m per station, near site
DMS @ RC studios
0.2- 0.3 V/m per station within this area,
0.1 V/m per station within this area, often less, due to obstructing buildings
0.2 -0.3 V/m per station within this area,
Map 3
DR. ROYS DRIVE
SHEDDEN ROAD
MAIN STREET
ELGIN AVENUE
Elizabethan Square
Central Police Station
Mast
HOSPITAL ROAD
Cayman Corporate Centre
The Merren Dental Centre
City Mews
Seventh Day Adventist Church
Sigma Building
Cayman Islands Hospital
The Lighthouse School
MIDDLE ROAD
MAPLE ROAD
Chrissie Tomlinson Memorial Hospital
Truth For Youth School
Church of God (Universal)
Medallion Court
Bowhan Manor
Maple House


0.2- 0.3 V/m
0.2 V/m
Style
96.5
0.1 V/m
Map 4
GODFREY NIXON WAY
EASTERN AVENUE
GKF
Industrial
Park
Site of
Godfrey's
Commercial
Park
GREENWOOD DRIVE
ASHGO STREET
SOUND WAY
PORTLAND ROAD
HALPIN ROAD
SCHOOL ROAD
Thompson's Home
Depot
Paddington Place
Three
Paddington
Place
Warehouses
Power of Faith
Deliverance
Ministry
Humane
Society
The Christian Plaza
Walton
Centre
Rankin's Plaza
Murryson's
Plaza
Motor
World
32
31
28

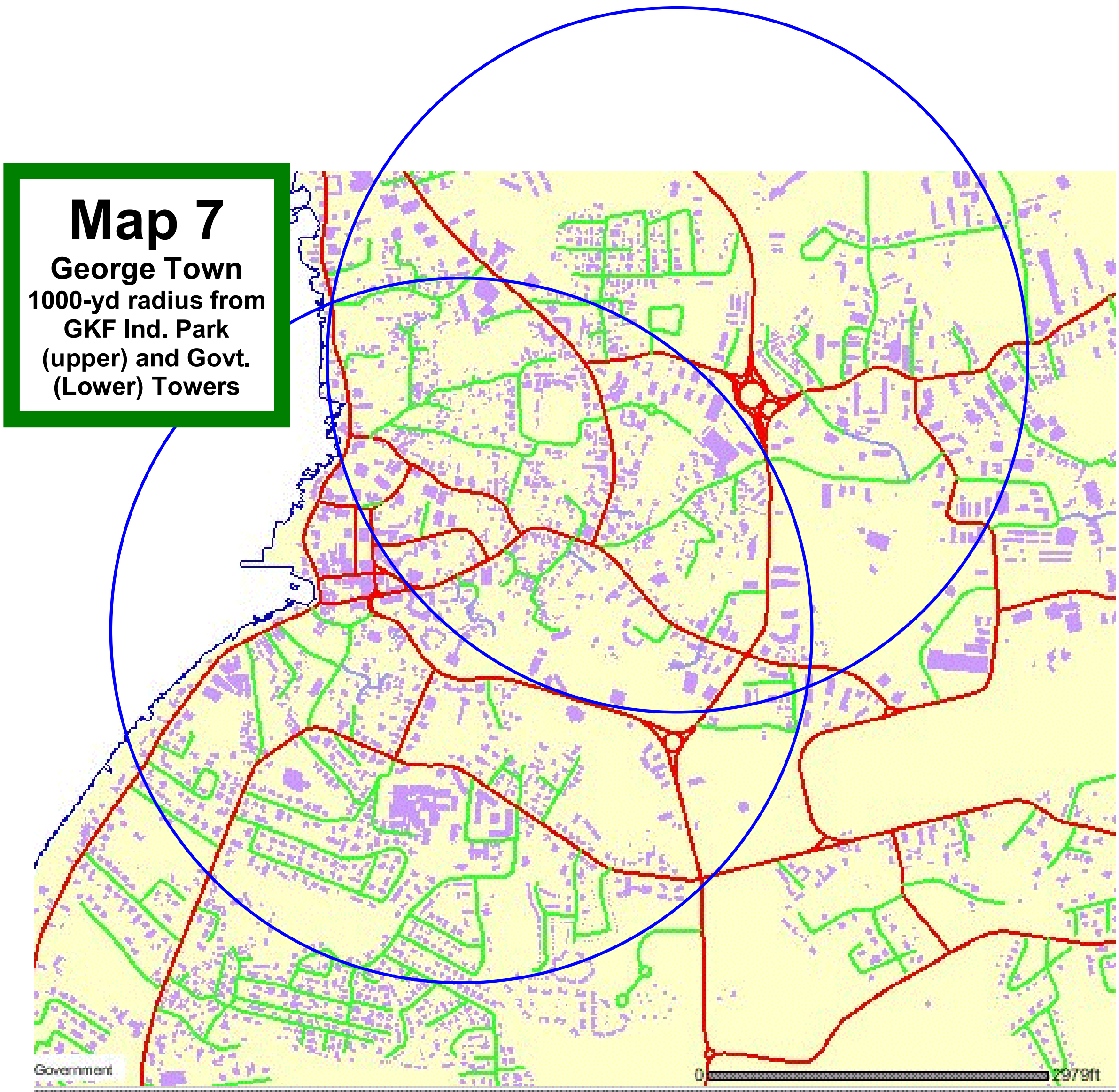
Maps 5, 6, and 7 show a 1000-yard radius from each of the tower sites to illustrate the FCC blanketing radius of a roughly 5000-watt station. These plots provide a comparison, normalized to the same transmitter power at each site, based on a single station at the site. They do not necessarily represent the actual blanketing radius of any particular station, because power levels differ among the stations. However, if in the future any station intends to fully serve the island, power levels similar to or greater than the 5 kW will be necessary.





Within the radius of each Newlands tower, an estimated 250-350 residential buildings are included. Within the same radius of the Northward tower approximately 150 residential buildings are included. Within the same radius of the government tower in George Town, the figure may be greater than 500, assuming that most small structures are residential, and the larger structures are commercial or industrial. The two towers at the GKF Industrial Park at Godfrey Nixon Way are more central to commercial and industrial activity and appear to include fewer residences, but the small-building count may still exceed 250-300. In urban areas, small-building counts understate the potential impact on reception because they overlook the impact on radio reception in the large quantity of commercial, industrial, and government buildings in George Town that are occupied daily.

At a minimum, then, some 1000-plus homes may be subjected to receiver overload throughout Grand Cayman, plus George Town's non-residential sites. With FM facilities consolidated at one site, such as Northward, the present 150- residence estimate might be increased slightly due to the combined powers of the multiple stations, but with the substantially lower development density, and the use of a single site instead of the current five sites, the population affected by receiver overload would still be significantly less than under the current arrangements.



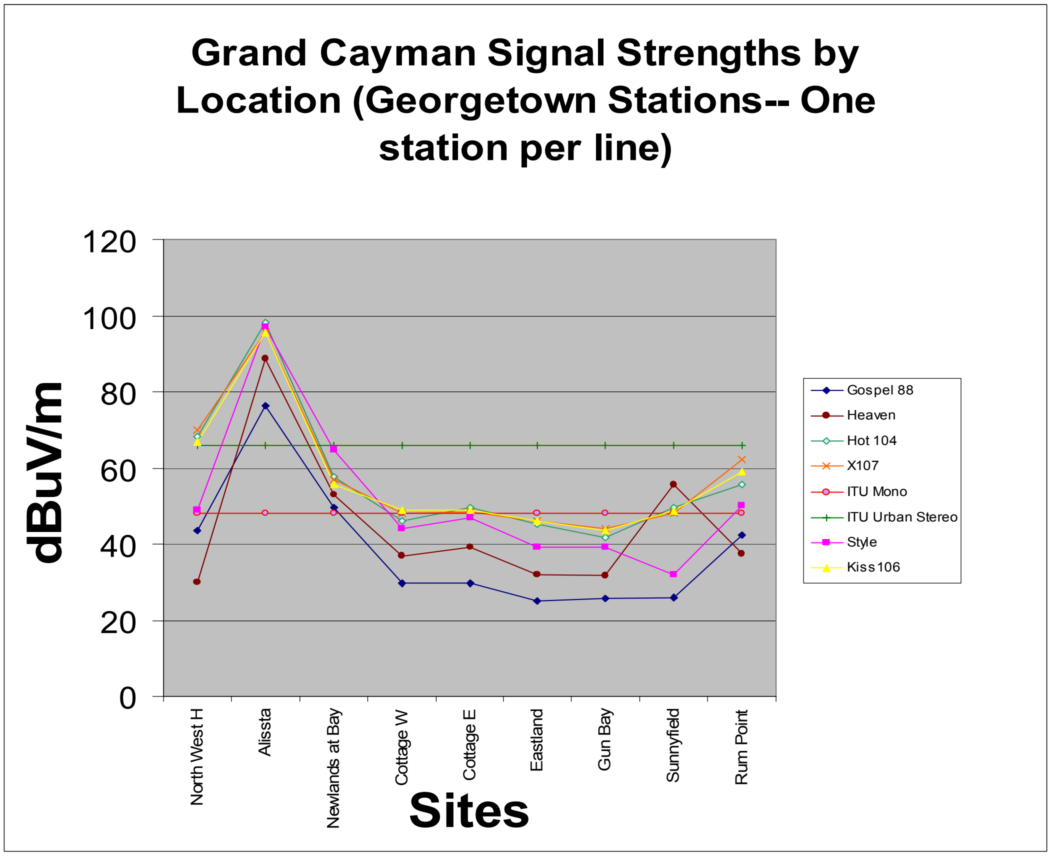
Field Survey, Island Coverage

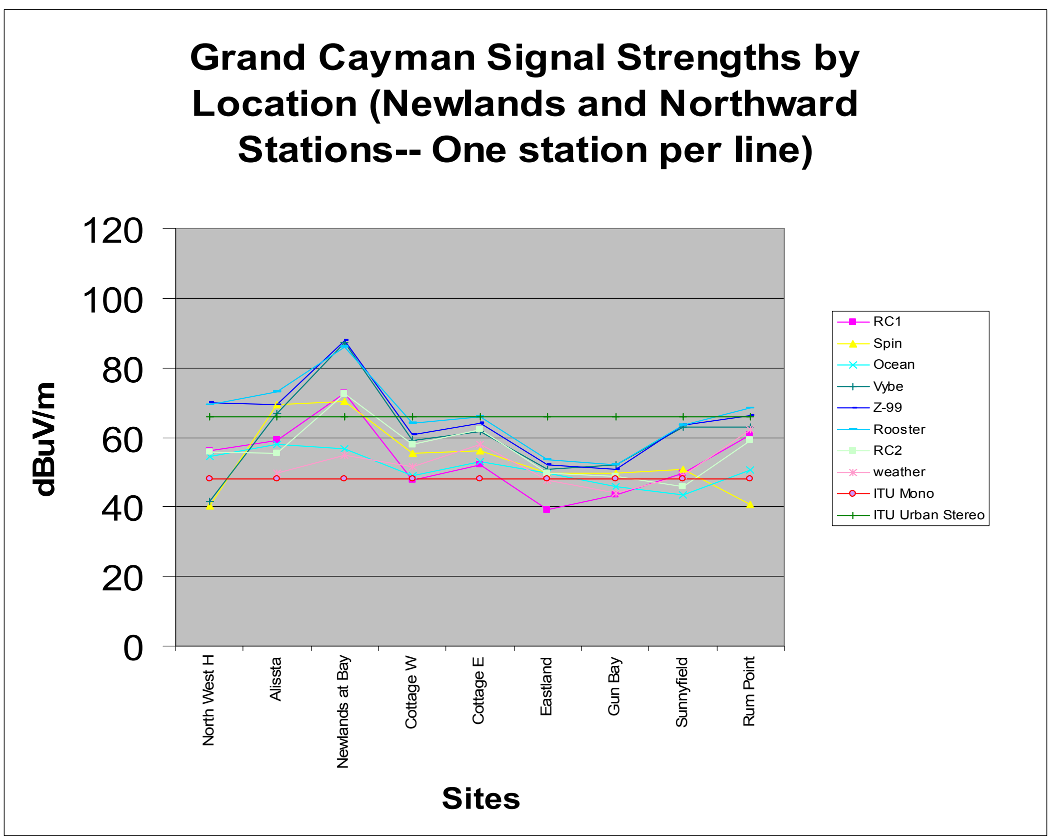
Another aspect of the Broadcast Signal Lab survey of FM broadcasting on Grand Cayman island relates to the ability of each station to be received throughout the island. As the island continues to be developed, a station's reach to the opposite ends of the island becomes more important in fulfilling its broadcasting mission. Field measurements were taken at various locations on the Island to create a snapshot of coverage of each station. Measurements were taken with a ¼-wavelength vertical whip magnetically mounted on the roof of a car. The mounted antenna's performance was compared with a calibrated dipole to ensure reasonable accuracy; it compared favorably.

The graphs below show the field strengths measured at each site. The sites are organized in the graph from left to right representing a counter-clockwise traverse of the island's coast, beginning in the northwest and ending at Rum Point. The connecting lines have no interpretive value except to ease the eye by linking the data points of one station's measurements across the island.

The first graph shows measurements of signal levels for each George Town station. The second does the same for the Newlands and Northward signals. The third takes the best overall data set of a George Town station and compares it to the best overall set from Newlands/Northward. Because this study consists of very few data points, it cannot be relied upon to determine the "best" signal on the island, and it would be irresponsible to interpret it that way. Rather, this graph shows the relative benefits of the use of each general location for providing service to the island.

Included on each graph are two horizontal lines. These represent two values obtained from ITU Recommendation BS 412-9 *Planning Standards for Terrestrial FM Sound Broadcasting at VHF,* Table 1, Minimum Useable Field Strength. This table presents the recommended minimum median field strength for certain conditions. Of most interest are the "urban" stereo and "rural" mono signals. Urban stereo reception is considered reliable if the median signal strength is 66 dBμ. This would be a desirable signal level for the more densely developed areas of the island, particularly George Town where there is a mix of smaller and larger structures closely spaced. The rural mono signal would apply to locations where the listener is using a "suitable antenna" to receive the signal. This would not be sufficient for portable or tabletop radio reception. This value is 48 dBμ.


Grand Cayman Signal Strengths by Location (Georgetown Stations-- One station per line)
dBuV/m
0
20
40
60
80
100
120
North West H
Alissta
Newlands at Bay
Cottage W
Cottage E
Eastland
Gun Bay
Sunnyfield
Rum Point
Sites
Gospel 88
Heaven
Hot 104
X107
ITU Mono
ITU Urban Stereo
Style
Kiss 106


Grand Cayman Signal Strengths by Location (Newlands and Northward Stations-- One station per line)
dBuV/m
0
20
40
60
80
100
120
North West H
Alissta
Newlands at Bay
Cottage W
Cottage E
Eastland
Gun Bay
Sunnyfield
Rum Point
Sites
RC1
Spin
Ocean
Vybe
Z-99
Rooster
RC2
weather
ITU Mono
ITU Urban Stereo

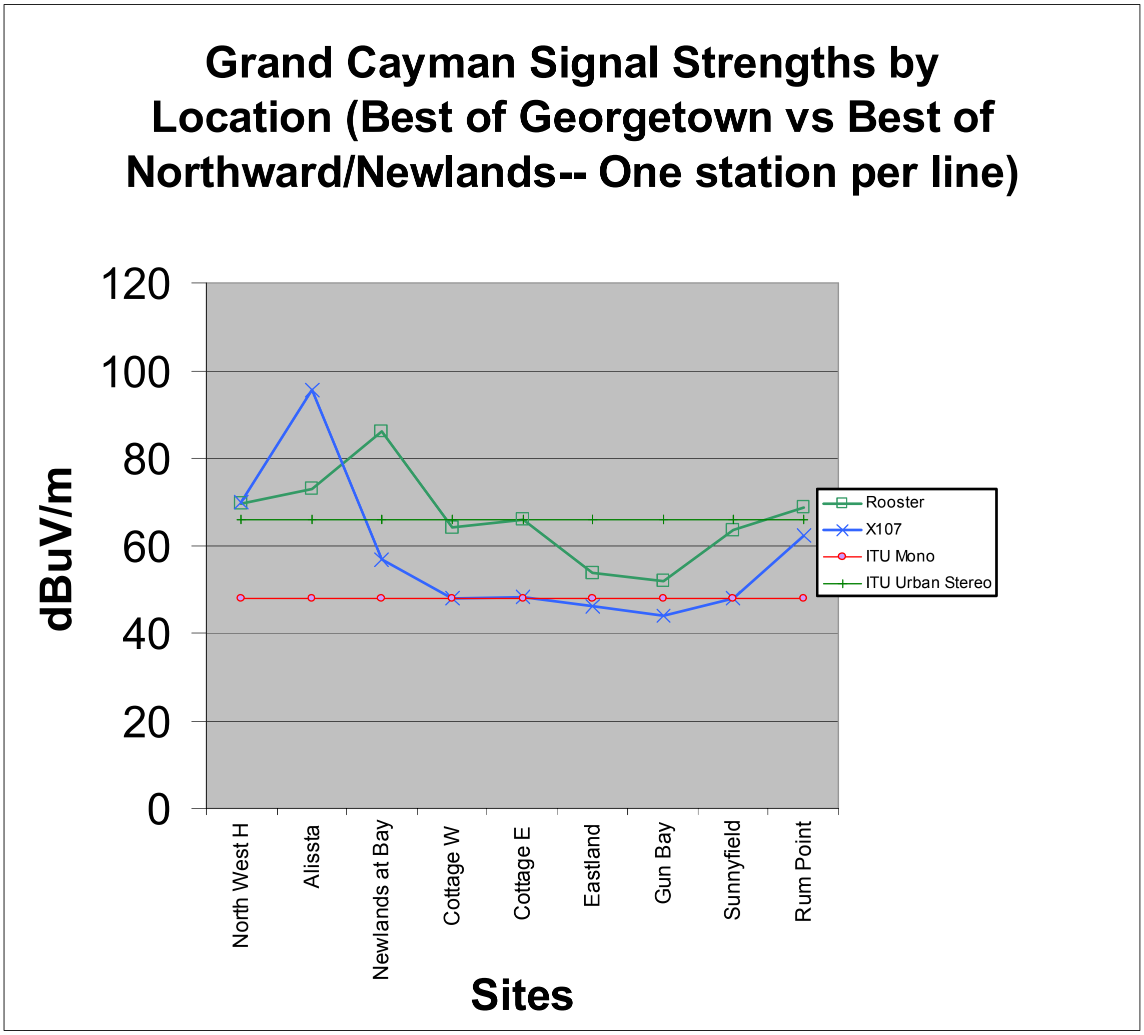


Table 1 - Measurement Locations

Site #	Site Name	Description
1	North West- Horizontal Polarization	Boatswains Bay: North West Point Road @ Dunlop Drive [This was the only measurement with horizontal antenna]
2	Alissta Towers building	Parking lot of ICTA offices
3	Newlands	End of Hirst Road at North Sound
4	Cottage West	Sea View Road near Tangelo Lane
5	Cottage East	Sea View Road near Cedar Lane (200 yds ± from above)
6	Eastland Dr (East End)	High Ground on Eastland Drive @ John McLean Drive
7	Gun Bay	High Ground of Turnpipe Lane
8	Sunnyfield	Queens Highway, 300 yd east of Sunnyfield Rd- line of sight across island.
9	Rum Point	Rum Point Road @ Water Cay Road

Rural Service

In an ideal scenario, a 54 to 60 dBμ signal throughout the island would provide good service. Overall, all stations project to eastern reaches of the island signal strengths that are unusable, or barely so at best. The Newlands/Northward facilities of course have a geographic advantage in being closer to the east, but are still challenged by the distance. The manner in which coastal terrain rolls drops to the sea creates an additional coverage challenge on the coast which we attempted to avoid by selecting high ground on the easterly coasts. For radio listeners on the coastal road or between it and the water, additional signal losses not accounted for in the graphs will occur from diffraction over that last terrain edge to the listener.

At the west end of the island, signal levels fell into three groups. Some Newlands signals (the Hurley stations Rooster and Z-99) and some George Town signals (DMS stations) were above the urban stereo threshold. Two Northward signals (Radio Cayman) and a Newlands signal (Ocean) were satisfactorily in the high 50's dBμ for rural stereo reception.

At the Boatswains Bay measurement location, three facilities in George Town, Style 96.5, Heaven 97.7, and Gospel 88.7, did not surpass the absolute minimum 48 dBμ threshold; however, they may have limited emissions to the west because of their antenna patterns and/or power levels. Comparing Style, Heaven, and Gospel signal levels in Boatswains Bay with some of the more distant Northward stations, Style, Heaven and Gospel clearly fell short. Similarly, the Spin and Vibe signals from Northward fell short. Measurements were made of these signals early in the week, and a power increase was made by Vibe later in the week. However this apparently would have been just a 3 dB increase; not enough to erase the measured differential between the Hurley signals and Vibe at this location.

To better reach the outer areas of the island, George Town stations would have to increase power perhaps 6 to 20 dB or more (6 dB is the same thing as multiplying the power by four; 20 dB is to multiply by 100). If the DMS stations were permitted to operate at full licensed power (they are reportedly running at 20 % power now), they might consistently exceed the 48 dBμ absolute rural minimum and approach, in some locations, the 54 dBμ rural stereo threshold. This would be at the expense of a larger interference footprint in George Town. Other George Town stations would likely need a combination of higher power and improved antennas.

Newlands and Northward facilities typically would need as little as three and as much as ten dB more ERP to serve the eastern portions of the island.

Urban Coverage

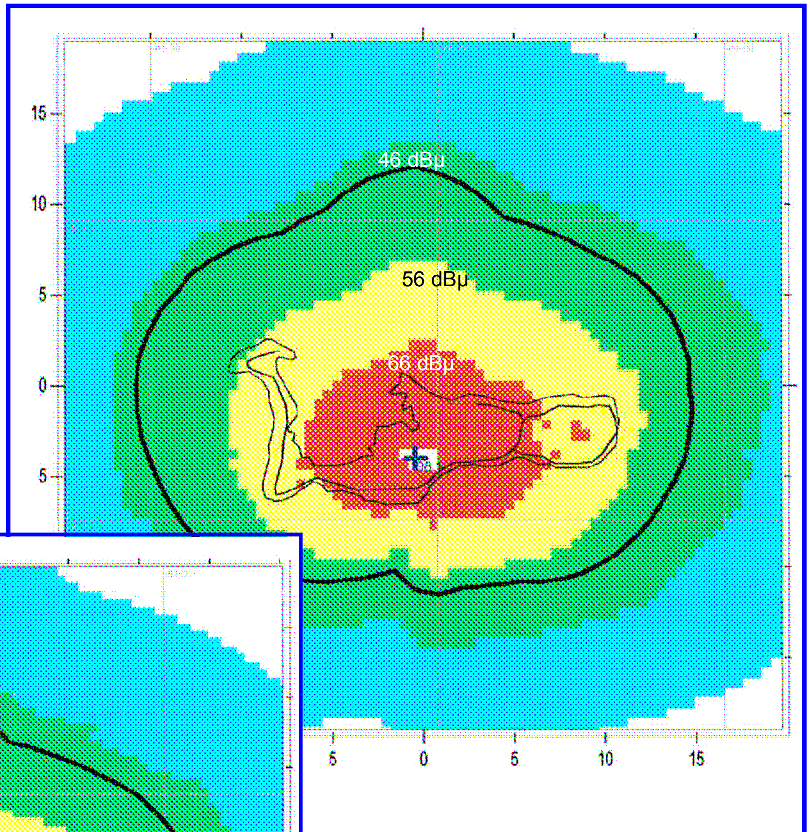
In terms of urban level reception in George Town and environs, of course the George Town signals are more than sufficient. Several Newlands stations, those operating at higher power levels, seem to be able to make the 66 dBµ urban target level, at least at the selected George Town test site. It appears the two higher power (Radio Cayman) stations at the Northward site could use a 6 dB boost, or more, to achieve a respectable urban stereo reception level in George Town. Such a boost could come in the form of increased power, or in combination with a height increase, that will be discussed further below.

Potential Coverage from a Common Site

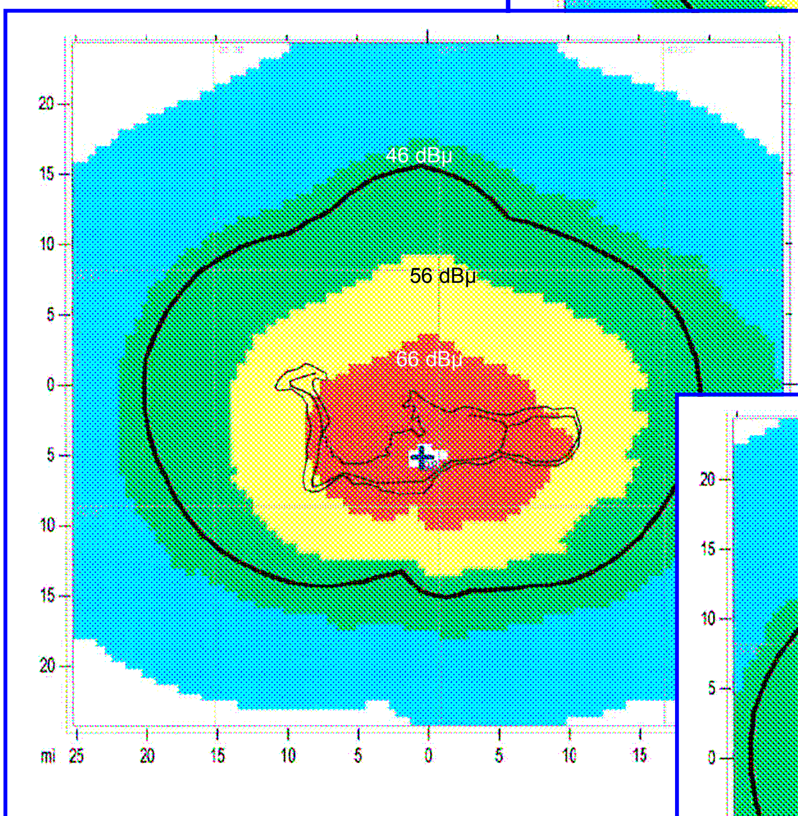
In considering the design of a new consolidated broadcast facility, the contributions of antenna height and effective radiated power (ERP) can be balanced for optimum coverage and efficiency. Below are plots indicating the predicted coverage from a 3.6 kW ERP facility with an antenna at 235, 400 and 600 feet above ground. The site is a very loose approximation of the Northward site (somewhat north of the actual site) and should be sufficient to study the relationships between antenna height and power. At 235 feet, the greatest shortcoming is insufficient urban stereo coverage in George Town. At 400 feet, urban stereo is probably obtained throughout George Town and along the Seven Mile Beach portion of West Bay. At 600 feet, the entire island is likely to obtain urban stereo performance.

The plots do not have the resolution to reveal any impacts on signals where the coastal terrain abruptly shadows the signals just where the coastal road and coastal development tend to reside, such as at Gun Bay. Any additional tower height above current heights would improve stations' reach over these edges of the island.

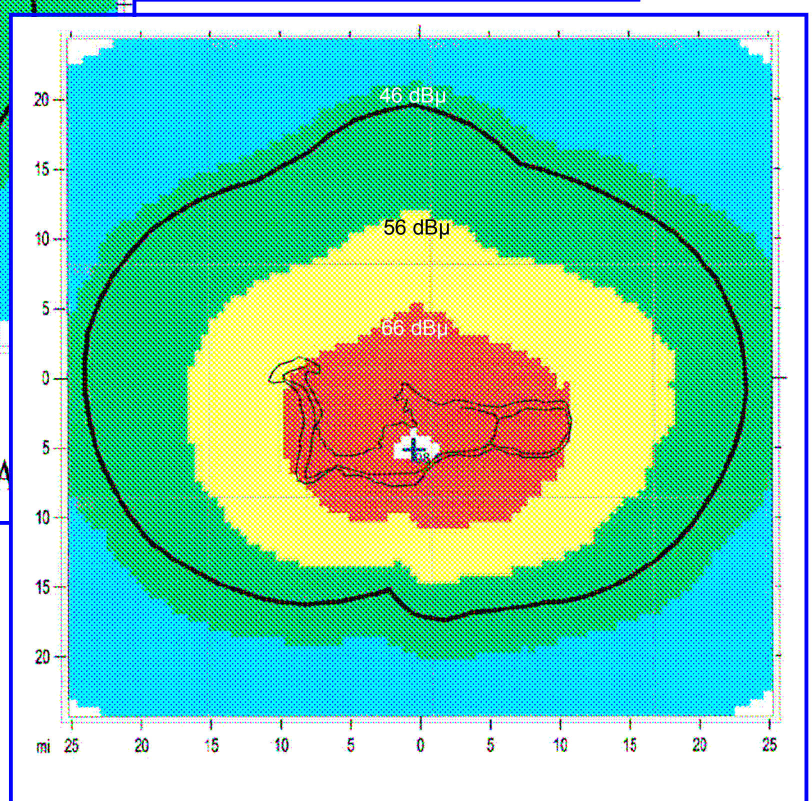
The boundary of red and yellow is 66 dBµ. The boundary of yellow and green is 56 dBµ. 46 dBµ is indicated at the boundary of green and blue.



HIVELY-6014-4/2 235-ft AGL



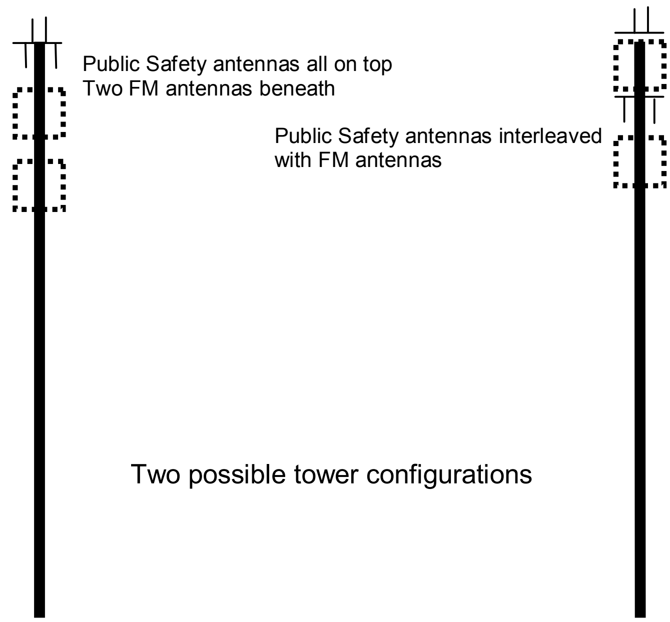
PATTERN SHIVELY-6014-4/2 400-ft A



PATTERN SHIVELY-6014-4/2 600-ft AGL

The black line is a superimposition of the shape of the antenna pattern, which shows the relationship between the antenna pattern to the predicted coverage.

These plots can be scaled for power, if desired. The 66 dBμ urban stereo contour (the edge between red and yellow) at 3.6 kW becomes the 70 dBμ contour at 9 kW. The cost of power can be balanced against the cost for tower height and for antenna gain to determine the optimal height/power/gain combination. Perhaps an optimum size would be a 500-foot tower that could provide about 20 feet at the top for public safety communications and two 50-foot apertures, each for a ten-station four-bay antenna. (Alternatively, top-mounted public safety receiving antennas, with an FM antenna beneath, followed by public safety transmitting antennas (20 feet) followed by a second FM antenna would provide valuable isolation between public safety transmitting and receiving antennas).



Spectrum Compatibility

Since radio waves travel long distances over water, it is wise to examine the potential to cause or receive interference from stations elsewhere in the region. Operating the stations at 3.6 to 9 kW ERP from this height places them in the FCC class B1. Since the nearest sources of terrestrial FM off-island are the sister islands some 89 miles distant, off-island interference protection is a trivial exercise. The FCC minimum distance separations for two class B1 facilities on adjacent channels is 71 miles. That is, if a station were transmitting a Class B1 equivalent 13 kW from 450 feet above sea level on Grand Cayman and a station were transmitting a Class B1 equivalent 25 kW 328 feet above sea level on a sister island, they would easily meet the distance separation requirements of such stations in the USA, with about 20 miles to spare. Some additional margin might be desirable to account for special propagation conditions that occur in tropical zones and over water. To this end, the actual ERP/antenna height combinations will likely be substantially lower than full class B1, affording an extra margin. Also, if stations on the sister islands were on second adjacencies to Grand Cayman stations, the minimum separation distances are 31 miles, providing ample protection between the islands.

Operation of facilities on Grand Cayman at a higher coverage class than presently employed will have no consequence to spectrum planning at the sister islands. Grand Cayman can make the fullest possible use of the FM spectrum.

Impact of Multiple Stations at a Master Site

The receiver overload areas around each facility are similar in size, depending on the power of the stations, the antenna heights and antenna patterns. When stations are co-located, the combined power levels of those stations can contribute to the overloading of receivers. The size of an interference area could be greater for several stations than it would be for one station at a site. For example, if four stations were to transmit from one site with identical power levels and antenna patterns, there would be a potentially 6-dB increase in the total received signal power. Translating to any of the Maps 1-4, if a single station places a 0.1 V/m contour at a certain distance, then four such stations combined could have a 0.2 V/m contour at that same point. In the case of the DMS facility shown on Map 3, the areas that receive 0.1 V/m from one station would receive about 0.17 V/m from the three combined. The 0.1 V/m nominal interference radius would extend 1.7 times farther for the three stations than for one. This could increase the effective radius of interference by a factor of 1.7.

To minimize the impact of having multiple stations at one site and transmitting sufficient power levels to cover the island, a location with low development density should be chosen. The more sparsely occupied an area near a tower is, the less potential there is for listeners to experience receiver overload problems, and the less impact a multi-station facility would have on population unable to receive distant stations. In the USA, the FCC encourages the use of less-developed areas for broadcast transmitter sites (47 CFR 73.315(b)):

> The transmitter location should be chosen to maximize coverage to the city of license while minimizing interference. This is normally accomplished by

locating in the least populated area available while maintaining [the coverage requirements for the city of license]… In general, the transmitting antenna of a station should be located in the most sparsely populated area available at the highest elevation available…

Spectrum Planning

The present arrangement of channel assignments on Grand Cayman Island is inefficient, as noted in the previous Broadcast Signal Lab report. To maximize spectrum efficiency, two scenarios are contemplated. First, if the entire FM band were divided into 26 4^{th}-adjacent channel assignments, some stations presently on air would have to move one or two channels to align with the assignments.

Broadcast Signal Lab has prepared two hypothetical frequency allotment plans, each with an optional variation on the low end of the FM band. The objectives of the hypothetical plan were to maximize spectrum utilization by creating as many frequency allotments as reasonably possible, reduce current interference conditions, avoid creating new interference phenomena, provide island-wide coverage for as many stations as possible, and maintain uncomplicated administration of technical aspects of station assignment.

Options A and B- Channel Spacing

As a hypothetical spectrum plan, Option A in Table 3 below shows fourth adjacent channel assignments. On the continent, it is customary to allot frequencies in a given market no closer than 4 channels apart. This creates the opportunity to geographically distribute stations on 3^{rd}, 2^{nd}, and 1^{st} adjacent channels and co-channel by providing enough geographic separation to prevent interference among the stations on nearby channels. On Grand Cayman, the geographic spacing of stations in a frequency allotment scheme is not practicable due to the size of the island. As long as stations are permitted in widely different locations, the 4^{th} adjacent protections are a conservative approach to spectrum utilization.

Experience with receiver analysis for third adjacent spacing suggests that spacing stations at 3^{rd} adjacent channels would be effective on Grand Cayman in preventing interference as well, particularly if stations are co-located at one site or on close sites. Option B is based on 3^{rd} adjacent channel spacing.

Impact of Channel Reassignment

Stations would be concerned about being moved to a new dial position, considering the marketing investments they have in brand recognition and dial position recollection. The integer value of a station's frequency (e.g. 104 or 89) may be the most important component of dial position recollection. In order to preserve the integer value of a station's frequency, any station that was moved off its current frequency was relocated to another frequency with the same integer value. For instance, Hot 104 might move from 104.1 to 104.3, retaining the 104 that is its brand identification. Stations that were repositioned are labeled in italics. This repositioning is only a suggestion, and if it were decided to adopt one of these plans, licensees should have the opportunity to consider available alternative dial positions.

If there were a desire to give priority to the dial position of one station that otherwise would have to change frequency under Option A or Option B, the allotment patterns could be shifted by one or two channel positions. This would result in the loss of one vacant full power channel.

Electronically, the change of a radio station frequency can be as simple as the flick of a few switches. In limited cases, if the move exceeds the bandwidth of the antenna, antenna modifications may be necessary. Vacuum tube transmitters are more difficult to tune to new frequencies and may require replacement of limited quantities of frequency determining parts or at least a little more engineering time and expertise than required for solid state transmitters. These are not expected to be significant impediments to implementing a new band plan.

Broadcaster Diversity

In the USA, the lower part of the FM band (up to 91.9) is reserved for Non-Commercial Educational ("NCE") stations. The rules for allotting frequencies, holding licenses, and programming the broadcasts of NCE's differ from the rules for the commercial band. It may be beneficial to allot a limited number of channels for non-commercial broadcasting to ensure a diversity of ownership and on-air voices, while providing a competitive marketplace for commercial broadcasting in which economically the highest and best use of the commercial spectrum can flourish.

In addition to full-power NCE broadcasting, radio broadcasting comes in other flavors. In the USA there has been a movement to enable low power radio stations to provide highly localized service. The audience for such stations is quite small, and so are the coverage areas. However, low power stations have been popular among certain constituencies. Schools enjoy the opportunity for students to get experience with broadcasting and for local residents to hear students' work. Local community groups (religious, civic, environmental, and others) enjoy the opportunity to bring community members together in a concerted effort to gather and disseminate information that raises community awareness, civic participation, and quality of life. Often, it is at least as much a) the collective effort to "do radio" that offers strong public benefits from these stations as it is b) the audience experience of the resulting broadcasts.

Low power broadcasting is also used to provide venue-related information to transient audiences. Traffic channels can be placed along major roads and provide up to date information. Resorts, parks, and the like provide repetitive information at the ready for a new arrival to listen and learn, including rules, schedules, contact information, safety information, and much more.

The Table 4 shows a creative plan to enable low power broadcasting named the Neighborhood Radio Band (NRB). This scheme allots a segment of the FM spectrum to ten-watt broadcasts from 50 feet above ground or less. This service could provide the following benefits: 1) eliminate a potential glut of full power frequencies, 2) provide for locally oriented radio low power broadcasting, 3) provide citizens with the opportunity to participate in radio, 4) provide youth with an activity that it is fun and educational, 5) provide, if not in conflict with the first four, informational broadcasts that are geographically targeted to traffic, resorts, and other centers of activity.

The Table 4 places the Neighborhood Radio Band at the bottom of the FM spectrum, where in the USA the NCE band exists. It is highlighted in the upper left of the table. The low power frequencies are spaced on second-adjacent channels, allowing stations on 2nd adjacent channels to be assigned geographically fairly close together. Because of their low power levels and limited coverage areas, the potential for interference among these stations is minimal.

Embedded in the center column of Table 4 is a cryptic key that presents another variation on the Neighborhood Radio Band plan. To preserve the frequency of the first radio station, Radio Cayman 1, the NRB was shifted up the band to the most vacant portion, displacing no current FM licensed stations. The disadvantage of this plan is that it segregates three or four full power radio channels to a region beneath the NRB—creating somewhat of a backwater of less desirable full power spectrum.

Table 2 summarizes key data about the options for allotting frequencies and subdividing the band. It lists the number of frequency allotments available in each plan, including the present scheme, and the number of stations that must change frequency to implement each plan. It also counts the available unlicensed frequencies as "vacant."

Table 2 - Characteristics of Each Frequency Allotment Plan

	Present	Option A	Option B
Full Power Assignments Across Band			
Allotments	22	26	34
Licensed	15	15	15
Change frequency	-	11	10
Vacant	7	11	19
Partial Band at Full Power With Low Power Neighborhood Radio Band			
Total frequency allotments		31	37
Full Power Allotments (1 license per frequency)		20	27
Licensed		15	15
Change frequency		12	10
Vacant		5	12
Neighborhood Allotments (Licenses assigned geographically. More than one station per frequency)		11	10
Required Distance to co-channel		13 mi	13 mi
Required Distance to 2nd or 3rd adjacency		none	none
Expected maximum number of NRB stations		22 to 33	20 to 30
Partial Band at Full Power With Low Power Neighborhood Radio Band With Radio Cayman 1 Dial Position Preserved			
Total frequency allotments		31	37
Full Power Allotments (1 license per frequency)		20	26
Licensed		15	15
Change frequency		11	8
Vacant		5	12
Neighborhood Allotments (Licenses assigned geographically. More than one station per frequency)		11	11
Required Distance to co-channel		13 mi	13 mi
Required Distance to 2nd or 3rd adjacency		none	none
Expected maximum number of NRB stations		22 to 33	22 to 33

Table 3- Channel Assignments with 4th Adjacent and 3rd Adjacent Channel Spacing

Present	Freq.	Option A – 4th	Option B – 3rd
	87.9		
	88.1		
	88.3		
	88.5		*Gospel 88*
Gospel 88	88.7	Gospel 88	
	88.9		
	89.1		
	89.3		
	89.5	*Radio Cmn 1*	
	89.7		*Radio Cmn 1*
Radio Cmn 1	89.9		
	90.1		
	90.3		
	90.5		
	90.7		
	90.9		
	91.1		
	91.3		
	91.5		
	91.7		
	91.9		
	92.1		
	92.3		
	92.5		
	92.7		
	92.9		
	93.1		
	93.3		
	93.5		
	93.7		
	93.9		
	94.1		
	94.3	*Spin*	
	94.5		*Spin*
	94.7		
Spin	94.9		
	95.1		
	95.3		
Ocean	95.5		
	95.7		*Ocean*
	95.9	*Ocean*	
	96.1		
	96.3		*Style*
Style	96.5		
	96.7	*Style*	
	96.9		
	97.1		
	97.3		
	97.5	*Heaven*	
Heaven	97.7		Heaven
	97.9		

Present	Freq.	Option A – 4th	Option B – 3rd
	98.1		
	98.3	*Vibe*	
	98.5		
	98.7		
Vibe	98.9		Vibe
	99.1		
	99.3		
	99.5		*Z-99*
	99.7		
Z-99	99.9	Z-99	
	100.1		
	100.3		
	100.5		
	100.7	*ICCI*	
	100.9		
ICCI	101.1		
	101.3		*ICCI*
	101.5	*Rooster*	
	101.7		
Rooster	101.9		Rooster
	102.1		
	102.3		
	102.5		
	102.7		
	102.9		
	103.1		
	103.3		
	103.5		
	103.7		
	103.9		
Hot 104	104.1		
	104.3		*Hot 104*
	104.5		
	104.7	*Hot 104*	
	104.9		
	105.1		
Radio Cmn 2	105.3		
	105.5	*Radio Cmn 2*	*Radio Cmn 2*
	105.7		
	105.9		
Kiss 106	106.1		Kiss 106
	106.3	*Kiss 106*	
	106.5		
	106.7		
	106.9		
X-107	107.1	X-107	
	107.3		*X-107*
	107.5		
	107.7		
Weather	107.9	Weather	Weather

Current airborne aeronautical image frequencies highlighted in the frequency columns

Table 4- Channel Assignments with 4th Adjacent and 3rd Adjacent Channel Spacing With Neighborhood Radio Sub-band

Neighborhood Radio Band

Present		Option A	Option B	*		Present		Option A	Option B
	87.9								
	88.1						98.1		
	88.3			G			98.3	*Vibe*	
	88.5						98.5		
Gospel 88	88.7			G			98.7		
	88.9					Vibe	98.9		Vibe
	89.1						99.1		
	89.3						99.3		
	89.5						99.5		*Z-99*
	89.7						99.7		
Radio Cmn 1	89.9			R	R	Z-99	99.9	Z-99	
	90.1						100.1		
	90.3						100.3		
	90.5						100.5		
	90.7						100.7	*ICCI*	*ICCI*
	90.9						100.9		
	91.1					ICCI	101.1		
	91.3						101.3		
	91.5						101.5	*Rooster*	
	91.7						101.7		
	91.9					Rooster	101.9		Rooster
	92.1		*Radio Cmn 1*				102.1		
	92.3						102.3		
	92.5						102.5		
	92.7	*Radio Cmn 1*					102.7		
	92.9						102.9		
	93.1						103.1		
	93.3		*Gospel 88*				103.3		
	93.5	*Gospel 88*					103.5		
	93.7						103.7		
	93.9						103.9		
	94.1					Hot 104	104.1		
	94.3	*Spin*					104.3		*Hot 104*
	94.5		*Spin*				104.5		
	94.7						104.7	*Hot 104*	
Spin	94.9						104.9		
	95.1			*S*			105.1		
	95.3					Radio Cmn 2	105.3		
Ocean	95.5						105.5	*Radio Cmn 2*	*Radio Cmn 2*
	95.7		*Ocean*				105.7		
	95.9	*Ocean*					105.9		
	96.1					Kiss 106	106.1		Kiss 106
	96.3		*Style*				106.3	*Kiss 106*	
Style	96.5						106.5		
	96.7	*Style*					106.7		
	96.9						106.9		
	97.1					X-107	107.1	X-107	
	97.3						107.3		*X-107*
	97.5	*Heaven*					107.5		
Heaven	97.7		Heaven				107.7		
	97.9					Weather	107.9	Weather	Weather

Intermediate Frequencies

Any system of station allotment and assignment must take into account the manner in which the radios receive their signals. Radios use a common "intermediate frequency" ("IF") internally to convert the desired incoming signal to a lower frequency with which it works to demodulate the audio. Combinations of transmitted over-the-air signals whose frequency differences equal the IF can cause reception difficulties by interfering with the performance of the IF stage of the receiver. The IF in FM radios is 10.7 MHz. This is equal to the difference in a 53 channel or 54 channel separation on the FM band (10.6 and 10.8 MHz).

"IF taboos" are implemented to ensure stations are not accidentally assigned to cause excessive IF interference. When two undesired stations 53 or 54 channels apart are at about the same received level, and a desired station is substantially weaker than these, IF interference may occur on the reception of the desired station. If all stations are co-located, then the signal levels of the undesired IF-spaced stations will never be substantially greater than the desired station. The co-location scheme helps prevent IF interference. However, it still would be wise to minimize the number of IF-spaced station pairs emitted from the one site.

Presently, two pairs of stations are on IF channel spacing. Under FCC rules, class A stations on IF channel spacing should be at least 6 miles apart. Ocean and Kiss are about 5½ miles apart. Style and X-107 are about ½ mile apart. The closer they are, the more likely they are to produce IF interference in receivers, assuming they transmit similar power levels and the listener is seeking a third station that is weaker than the two IF stations. This type of interference may appear as the crosstalking of one or two unwanted audio channels into the desired channel's audio, or simply as increased noise and distortion of the desired signal. In addition to blanketing interference in George Town, it is possible that some difficulties receiving distant stations are caused by IF interference.

Option A completely avoids IF separation issues because stations are every fourth channel, and no pair of frequencies is spaced 53 or 54 channels. Similarly, Option B employs a break in the pattern at 97.3 which offsets lower and upper allotments in the band, preventing IF interference pairs from being assigned.

With the addition of the Neighborhood Radio Band, the question of IF interference should be reconsidered. First, with the short Neighborhood Radio Band, there would not be two low power stations at 53 or 54-channel spacing, so they could not create an IF interference pair and would not affect reception of a more distant high power station.[3]

Second, as for a low power station combining with a high power station to produce an IF-spaced station pair, both received IF-spaced signals would have to be of comparable strengths and stronger than a third desired signal to pose a threat of IF interference. If such interference were possible with a ten-watt facility in just the right location, the affected area would be negligible. Only half of the NRB frequencies could potentially be IF interference paired with full power stations in the upper portion of the FM band.

Third, there are no high power combinations in either option to cause IF interference to low power reception. Finally, there is the potential of another mechanism, called Local Oscillator ("LO") interference, in which two stations on an IF spaced pair of frequencies do not crosstalk to other received signals, but crosstalk to each other. This phenomenon is rare, and is managed by assigning only non-IF spaced Neighborhood channels within a few miles of the high power stations.

Aeronautical Image Frequencies

Radio transmissions from airborne vehicles use a portion of the radio spectrum above the FM band. In some circumstances an aircraft above the general area of an FM receiver can be heard by a receiver tuned to a certain station. Two general conditions must apply. First the frequency of the airborne transmission must be 21.4 MHz (plus or minus 100-200 kHz) above the frequency of the desired FM station. Second, the strength of the received aircraft emission must be comparable to or stronger than the desired FM signal strength such that it overcomes the image frequency rejection ratio of the listener's radio. This occurs more often when the signal strength of the received station is weak and the aircraft is flying within several miles of the receiver.

The aeronautical frequencies used on and around Grand Cayman Island are used for various purposes. Some of these are for airport operations on the ground and should not have a material effect on FM reception. Others are out of the image frequency range that would affect FM reception. Of those transmitted by airborne aircraft, the following have image frequencies in the FM band: Approach Control (image 98.8), Island Air (image 101.6), and Mosquito Control

[3] The blanketing interference potential of the low power station has not been addressed yet. It is trivial, with the blanketing area radius computing to about 24 feet.

(image 107.6). Mosquito Control, which flies at low altitudes across the island, is the most likely source of image interference. Fortunately, there is no interference potential because this image frequency is safely planted in a portion of the spectrum that will not have a radio station as long as the weather station remains on 107.9.

The other two frequencies are employed by aircraft that must follow designated approach paths to the island and the bulk of such communications are likely not to occur over the island as aircraft approach from the water. If there is an image problem it would most likely have been experienced by Vibe listeners (98.9), particularly while Vibe was operating at reduced power and reduced antenna heights post-Ivan. There has not been an image frequency complaint raised to Broadcast Signal Lab and it is assumed not to be an issue. If it is a significant issue, then care should be taken to avoid 98.7, 98.9, 101.5 and 101.7 in the assignment of licenses.

New Master Tower

Among the subjects of interest to licensees, there was continuing support in principle for a new common tower site and facility. It was discussed thoroughly at the March 10 meeting with licensees. Concerns about the cost and economic viability, plus the manner in which space would be equitably shared among the more well-to-do commercial operations and less profitable broadcast services must be ironed out in order to proceed. Without further economic study, it is not certain whether a public, private, or public-private initiative is appropriate for developing a tower. It is also not certain whether the concept is economically viable.

To move the process forward, the next steps for studying the feasibility of the common tower are:

Technically:

Agree on initial antenna scheme: two four-bay panel antenna arrays, on two faces of the tower. Balanced combiner. STL antennas at low elevations. Some government communications radio antennas.

Agree on station ERP and antenna height expectations.

Provide scheme to structural engineer to design tower at two optional heights.

After design is complete, obtain credible cost estimates for the various construction and materials requirements.

Public Policy:

Determine what new channel allotment scheme, if any, will be applied. Establish rules of engagement for licensees that are as equitable as reasonably achievable and support the mission of utilizing the FM spectrum effectively for the benefit of the island.

Establish timetable and cost-recovery/sharing program.

Conclusions and Recommendations

The condition of the FM spectrum has improved with the relocation of numerous stations to permanent facilities.

DMS continues to operate its stations at reduced power, pending resolution of the blanketing issue. Such resolution may be intractable unless a permanent relocation of the stations is made away from George Town.

Paramount stations should have installed their filters by now. This should be verified.

The replacement or repair of the Spin exciter should be confirmed.

Radio Cayman facilities should install additional filtering.

Each radio station does not presently serve the entire island.

The island-wide coverage requirements, and urban coverage requirements or guidelines for licensees should be established. This will inform the design of a master tower facility.

A credible cost estimate of a master tower facility should be obtained.

The public policy benefits of the following actions should be considered:

> Is it in the community interest to encourage and treat noncommercial stations differently than commercial ones? Would this mean creation of reserved channels for noncommercial stations (full power, or intermediate)? What is the best way to regulate noncommercial stations (or others) that are assigned full power frequencies but cannot afford to install and operate full power facilities?
>
> Is low power radio broadcasting beneficial to the community? Is there any reason to set aside otherwise viable full power frequencies for a separate low power radio service?

What is the best way to encourage a diverse and publicly beneficial FM service? Is the highest and best use obtained through economic competition for channels and audiences? What is the regulatory role in license renewal? Does a licensee have a reasonable expectation of renewal? Should there be ownership limits? Performance requirements to obtain a license? To renew?

Is it sufficient to have a consultant oversee technical matters relating to spectrum occupancy and apply rational or customary technical standards on a case by case basis, or should there be more technical regulations to guide broadcasters?

Broadcast Signal Lab is grateful for the opportunity to be of service to the stakeholders in the FM band on Grand Cayman. Grand Cayman is in the unique position of being able to provide a diverse, high channel count, reliable, island-wide, practically interference free FM service to its citizens.

David Maxson
Managing Partner

April 2006

Appendix

Third Order Intermodulation Frequencies by Generating Transmitter (columns) and Contributing Transmitter (rows)

Frequency of Station Generating Intermodulation Product (top of each column)

			88.7	89.9	94.9	95.5	96.5	97.7	98.9	99.9	101.9	104.1	105.3	106.1	107.1	107.9
Gospel 88	88.7	Christian Communications	88.7	91.1	101.1	102.3	104.3	106.7	109.1	111.1	115.1	119.5	121.9	123.5	125.5	127.1
RC1	89.9	Radio Cayman	87.5	89.9	99.9	101.1	103.1	105.5	107.9	109.9	113.9	118.3	*<u>120.7</u>*	122.3	124.3	125.9
Spin	94.9	Paramount Media	82.5	84.9	94.9	96.1	98.1	100.5	**102.9**	104.9	108.9	113.3	115.7	117.3	119.3	120.9
Ocean	95.5	Cerentis Broadcasting	81.9	84.3	94.3	95.5	97.5	99.9	102.3	104.3	108.3	112.7	115.1	116.7	118.7	120.3
Style	96.5	Panorama Productions	80.9	83.3	93.3	94.5	96.5	98.9	101.3	103.3	107.3	111.7	114.1	115.7	117.7	119.3
Heaven	97.7	Christian Communications	79.7	82.1	92.1	93.3	95.3	97.7	100.1	102.1	106.1	110.5	112.9	114.5	116.5	118.1
Vibe	98.9	Paramount Media	78.5	80.9	**90.9**	92.1	94.1	96.5	98.9	100.9	104.9	109.3	111.7	113.3	115.3	116.9
ZFZZ	99.9	Hurley's Entertainment	77.5	79.9	89.9	91.1	93.1	95.5	97.9	99.9	103.9	108.3	110.7	112.3	114.3	115.9
Rooster	101.9	Hurley's Entertainment	75.5	77.9	87.9	89.1	91.1	93.5	95.9	*<u>97.9</u>*	101.9	106.3	108.7	110.3	112.3	113.9
Hot 104	104.1	DMS	73.3	75.7	85.7	86.9	88.9	91.3	93.7	95.7	99.7	104.1	106.5	*<u>108.1</u>*	110.1	111.7
RC2	105.3	Radio Cayman	72.1	*<u>74.5</u>*	84.5	85.7	87.7	90.1	92.5	94.5	98.5	102.9	105.3	106.9	108.9	110.5
Kiss	106.1	DMS	71.3	73.7	83.7	84.9	86.9	89.3	91.7	93.7	97.7	*<u>102.1</u>*	104.5	106.1	*<u>108.1</u>*	109.7
X107	107.1	DMS	70.3	72.7	82.7	83.9	85.9	88.3	90.7	92.7	96.7	*<u>101.1</u>*	103.5	*<u>105.1</u>*	107.1	108.7
weather	107.9	RC Wx	69.5	71.9	81.9	83.1	85.1	87.5	89.9	91.9	95.9	100.3	**102.7**	104.3	106.3	107.9

The table is keyed with a color for each tower location. Two transmitters at the same tower location are most likely to produce third order intermodulation products. The frequencies of these predicted same-site products are highlighted in the body of the table by the corresponding colors. In the case of the Vibe/Spin facilities (orange) and the Rooster/Ocean/Z-99 (green) facilities, they are shown as separate towers, but the highlighting of IM product frequencies is expanded as if they were at the same site.

<u>Italics underlined</u> indicate products close to customary limits. **Bold** indicates products measured above customary limits.

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