

1 **RADIO COMMUNICATIONS SYSTEMS COMMITTEE**

2
3 Sheriff's Office
4 West Bend, Wisconsin

February 6, 2014
1:00 p.m.

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6 Present: Daniel Goetz, Rick Gundrum, Brian Krebs, Dennis Myers, Thomas Niebler, Herbert Tennes,
7 Chief Groves, Chief Hoell, Chief Stephens, Captain Unertl, Lt. MacFarlan, Captain Horvath, Mayor
8 Dautemann

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10 Also present: Sheriff Schmidt, Captain Gonwa, County Attorney, County Purchasing Agent, and John
11 Schrader, Chief Schmidt, Jack Hart and Nick Tusa from Tusa Consulting Services.

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13 County Board Chair Tennes called the meeting to order at 1:00 p.m. and read the affidavit of posting

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15 **MINUTES**

16 Minutes for November 25, 2013 – Moved by Supervisor Myers and second by Supervisor Gundrum to
17 approve the minutes of November 25, 2013. Motion carried.

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19 **PRESENTATION OF RADIO SYSTEM STUDY – TUSA Consulting Services**

20 **Initial findings** were outlined as: 1) VHF is a difficult band to work with and can be inconsistent. 2) Time
21 Delay Interference (TDI) is less manageable with C4FM (MastrIII. 3) It is difficult to balance the system
22 from incoming and outgoing calls. 4) It is subject to co-channel interference and atmospheric anomalies.

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24 With the present setup, the portables need to be close to the tower from 2-3 miles, even though the towers
25 can transmit as far as 5 miles away. VHF is good for large areas, but when you add portables there may be
26 some unbalance. The higher number of channels being used, the more drop-off that can happen.

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28 **Questionnaires and Interviews** – It was noted that Germantown, Jackson, Hartford, Kewaskum, Slinger,
29 West Bend and the Sheriff's Office participated in survey questions and follow-up interviews. It was found
30 from the surveys that users felt the portables were inconsistent, in-building coverage was fair, poor or
31 inadequate and mobile radios were inconsistent but acceptable.

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33 **Test Results** – Although there is a good RF signal level, transmitter output power levels are low; probably
34 to manage co-channel interference, but impacts in-building signal. There is an imbalance between base
35 station and talk-out and user talk-in. Talk-in is impacting access, especially from inside of buildings.
36 Receiver noise floor degradation was found in varying degrees at all transmit and receive sites. There is a
37 shortfall of 10-18db in isolation/noise at receive frequencies.

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39 **Intermodulation** – Basically this is the mixing of radio frequencies. The most common intermodulation
40 problem is caused by improperly selected transmitter frequencies which mix and cause interference to
41 receive frequencies. Field tests supported this.

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43 **Antenna Configurations** – REC antenna types and locations are not consistent across sites; some are
44 above the transmitting antennas and some are below. Transmitter antennas have limited beam width;
45 probably selected to control TDI but limiting coverage.

46
47 **Frequency Plan** – Currently transmitters and receiver frequencies are inappropriately interspersed among
48 each other. There is a possibility of several strong intermodulation products created by the transmitting
49 frequency to be present on some of the receiver frequencies. This causes a high BER, dropped calls,
50 inconsistent system access, garbled audio and coverage degradation.

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Conceptual Solutions

Each of the first 4 solutions can be done in layers to offset costs.

- **Plan 1**

- Remove 4 channels causing highest intermodulation
- Rearrange transmitting and receiving pairs to provide “guard band”
- Acquire replacements for the 4 removed channels

Coverage System Maps were reviewed. This solution does well on portables but not with in-building coverage.

Cost: \$470,000

- **Plan 2 – Time Delay Interference (TDI) Optimization**

- Antenna types and placement would be changed
- Re-engineering of the loading time parameters installed with current system configuration
- Conduct follow up BER coverage with tests to insure the desired results have been achieved.

Cost: \$ 92,500

- **Plan 3 –**

- Add simulcast Sites
- Add full featured transmitter and receiver sites to improve:
 - ❖ Street/in-building coverage
 - ❖ Minimize system talk-in/talk-out imbalance (minimally Hartford).

This update will correct talk-in/talk-out for in-building coverage deficiencies within the municipality where this is placed. The sites do not impact user radio programming and simulcast sites would lessen the problem of Time Delay Interferences.

Cost per site: \$860,000

- **Plan 4 – Add Receive Only Sites**

- Some areas, such as Germantown and Newburg would find operation benefit through addition of receiver-only sites.

This concept will balance portable radio talk-in performance; improves in-bound/in-building audio quality and call reliability.

Cost per site: \$463,000

- **Plan 5 – (not truly recommended)**

- Replacement of MastrIII Equipment

This will improve simulcast TDI performance through the use of more advanced Harris Mastr VP 25 technology that involves CQPSK linear simulcast base station.

Cost: \$10,000,000

- **Plan 6 – Convert to 700-800 MHZ Trunked Network Reconfiguration**

- This will offer higher frequency radio signals, better penetration and fill in-building structures as compared to lower frequency channels.
- The migration to 700/800 MHZ would eliminate noise floor and self-interference issues due to the consistent band plan through the FCC.
- Portable radio performance would be hugely improved.

