

**IEEE P802.20**  
**Mobile Broadband Wireless Access**

Project IEEE P802.20 Working Group for Mobile Broadband Wireless Access (MBWA)

Title **802.20 Technical Requirements – Coexistence Background**

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 Submitted

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Re: 802.20 Technical Requirements and Evaluation Criteria

Abstract This contribution establishes some background for technical work related to the co-existence portion of the 802.20 Technical Requirements Draft. Currently the section (in outline form) exists as an “appendix” to the draft requirements document. .

Purpose The intent of this contribution is to establish a framework for coexistence activities within 802.20. The authors request that 802.20 discuss and affirm the inclusion of coexistence as part of the 802.20 workplan.

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# Coexistence Issues for 802.20

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# Co-Existence and Interference Resistance (From Doc 802.20-03/55)

- **Let's Not Do It as an Afterthought!!**
  - Remember the “Alligator” Story!!
- **Approach**
  - Define Baseline Scenarios
  - Co-existence against the “obvious” services
  - Evaluate Projected Impacts of Traditional Technologies on MBWA and Vice Versa
  - Co-Channel Interference Models
  - Adjacent Channel Interference Models
  - Impacts of TDD in Traditionally FDD Bands
  - **Let's Identify Issues and Solve Them Before we Create Them**

# Coexistence – First Thoughts

- Where does Coexistence “Fit” Within the 802.20 Project
  - Initially Thought to be Requirements Issue
  - Is it part of Evaluation Criteria or Requirements?
- Coexistence is a “HUGE” (and Important) Area
  - Many Technologies are in Licensed Bands Below 3Ghz
  - A Partial List of the Technologies:
    - Legacy Cellular: AMPS, TDMA, GSM, IS-95
    - 3G Cellular: CDMA-2000, WCDMA
    - Data Over Cellular: 1xEV-DV, 1xEV-DO, HSDPA, EDGE
    - Miscellaneous: LMR, GPS, Others??
  - Both TDD and FDD Technologies Have Been Planned by 802.20

# Coexistence Standards Work

- IEEE 802:
  - Coexistence has become a Major Part of 802's Standards Development Process
  - 802 Is Developing Coexistence Scenarios for Unlicensed Technologies (802.11n and 802.15.3a)
- Telecommunications Industry Association (TIA)
  - TSB-84A(1999) – “Licensed PCS to PCS Interference”
    - Develops a Framework for Coexistence Studies
    - Develops a “Simplified” and a “Detailed” Approach
    - Agreed Upon as a Basis for Studies, Planning, Resolution in the PCS Industry
- 3GPP and ETSI
  - Coexistence is regularly included
  - May Have Published Coexistence Framework –
    - Need to Investigate Further
- Others (802.16.2, 802.11g Adj. Channel Interference Study)

# Coexistence and 802.20

- Possible 802.20 Air Interface Styles
  - OFDM (?)
  - OFDMA (?)
  - Single Carrier (?)
  - UWB (?)
  - Something Else?
- Most are Very Different From Existing Air Interfaces
- Commercial Spectrum Operators Could Deploy Mixed Technologies
  - Different Technologies for Different Services
  - Different Availability, Error Rates, etc...
- Conclusion: To Avoid Developing a Something Non-Viable, 802.20 Should Address how the Proposed Technology/ies Interacts With Other Technologies
  - Intent is a “First Estimate Effort”
  - Based on Standards-Type (Not Field, Necessarily) Information

# TIA TSB84A

- Multiple Technologies Addressed (8 of Them!)
- Establishes a Framework for CoExistence Studies
  - Definitions
  - General Interference Estimation Procedure
  - Interference Estimation Methodologies
    - Simplified Methodology
    - Detailed Methodology
  - Performance/Degradation Metrics
  - Generic Receivers and Transceivers and Characteristics
  - Propagation Models and Technology Specific Information

# Procedures – Major Steps

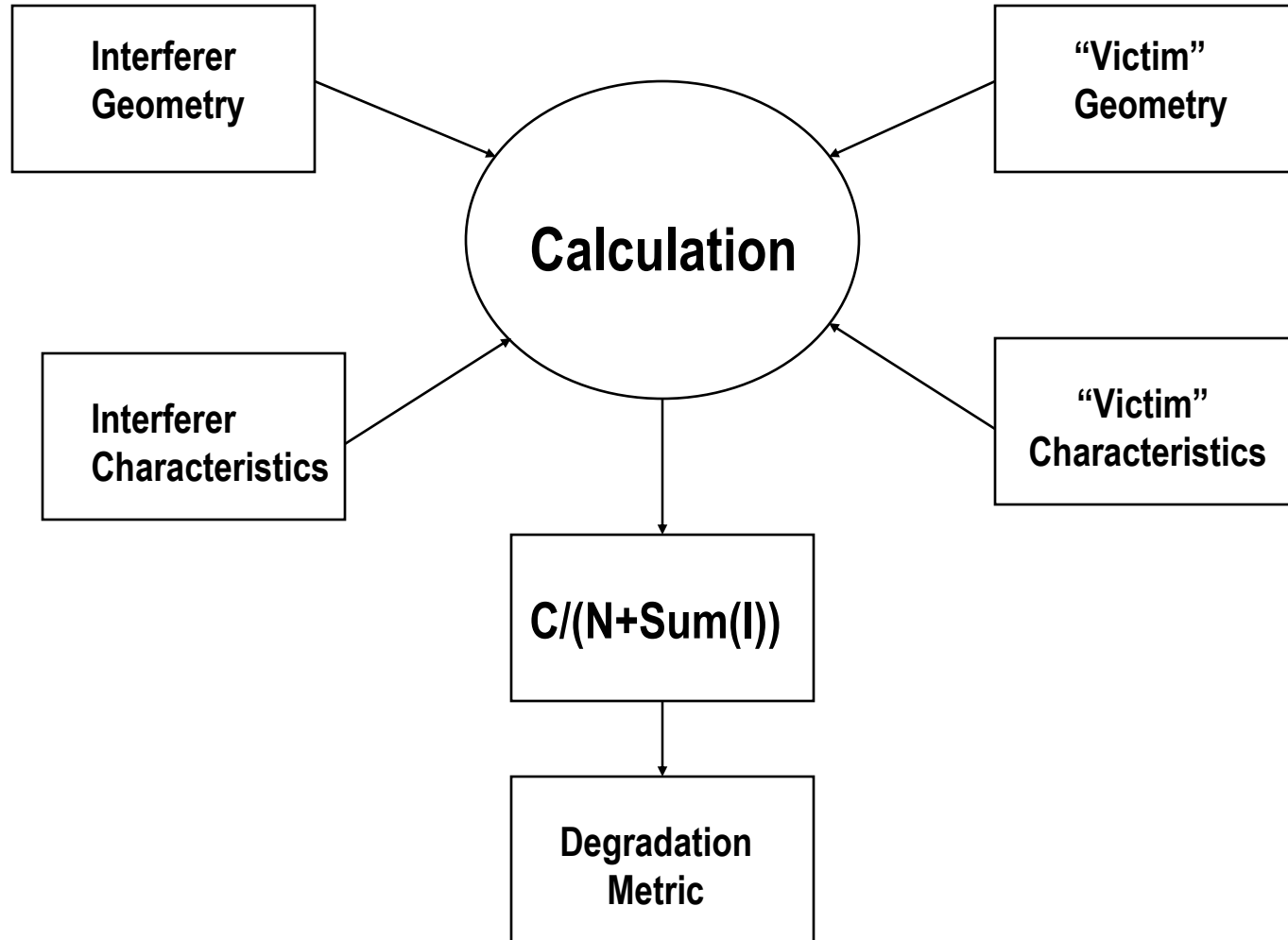
1. Determine Desired Accuracy
  - **First Estimates**, Field Estimates, System Planning, Resolution
2. Determine Performance Metric to Use
  - C/I, Receiver Desensitivity, Responses to Interference
3. Determine Available Input Data
  - **Standards Data**, Mfr's Data, Measurements
4. Simplified or Detailed Methodology?
  - ??
5. Perform Computation/Simulation
6. Verify Results



# Interference Estimation – Simplified Process

- Concepts: Interferer and Victim Systems
  - Interferer: Known number of interferers, locations
  - Victim: Known receiver characteristics, location
- Concepts: Victim Geometry and Interferer Geometry
  - Victim Geometry: Factors Related to Physical Layout of Victim Receiver
  - Interferer Geometry: geographic and physical factors representing the interfering source
- Concepts: Victim Characteristics and Interferer Characteristics
  - Victim Characteristics: factors related to victim's performance and reactions to interferers
  - Interferer Characteristics: Operating Parameters for Interference Source(s)
- Concepts: The Calculation
  - Algorithm to determine net values of signal strength of Noise, Desired Signal and Interference
- Concepts: Degradation Metric
  - Measure Chosen to Determine How Interference Affects the System
  - Several Examples Given (e.g. BER)

# Simplified Estimation Process



# Performance Metrics

- Two Methods Highlighted in TSB
- Carrier to Noise Plus Interference Ratio
  - Method Presumes that Link Performance is Directly Related to a Ratio of Desired Signal Strength to Unwanted Signal Strength
- Receiver Desensitivity Degradation
  - Presumes that Performance is Related to Increase in Receiver Noise Floor
- Others Mentioned
  - $E_b/N_o$ , BER, FER

# Station Characteristics

- TSB Develops Generic Receiver Structures for Both Base Station and Mobile Stations
  - Structures are Specific to the Interference Problem
  - Would have to specify common Front End Approach
- TSB Develops Generic Transmitter Characteristics for Base Stations and Mobile Stations
  - For the Modeled Transmitter Characteristics, Parameters are Provided
  - Would Need To Develop Candidate Transmitter Characteristics for New Technologies

# Summary and Next Steps

- Recommend that 802.20 Incorporate Coexistence as Part of the Air Interface Development Process
  - Technology Submissions Should Include Parameters to Allow Verification that the Candidate Will Integrate Well in Existing Bands
  - Goal is to Provide a First Look/Sanity Check on What's Developed
  - Simplified Process Recommended Where Possible
  - 802.20 Members Should Work Together to Develop a Common Simulation Approach
    - Provides Confidence that the 802.20 Technology Will Minimize Interference with Existing Systems
- Should 802.20 Investigate Other Approaches to Interference Estimation?
  - TSB 84A Provides an Accepted Framework that could be Leveraged
  - Detailed, Understood in the Industry
  - Needs Some Extension for Candidate Technologies and TDD