IEEE P802.15
Wireless Personal Area Networks

Project	IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)
Title	**Coexistence assurance**
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Re:	[]
Abstract	[Analyze the coexistence of 802.15.3c with other systems in the band.]
Purpose	[Address coexistence capabilities of 802.15.3c.]
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Release	The contributor acknowledges and accepts that this contribution becomes the property of IEEE and may be made publicly available by P802.15.

1. Introduction

Describe the overall characteristics of the 60 GHz band, regulatory information, our channelization, expected transmit power, antenna gain, etc.

(JPKG)

1.1 Regulatory information

(Abbie)

1.2 Overview of 802.15.3c

RF and MAC charaterisitics (summary) including the time used for beam forming or any omni-directional communication (including quasi-omni).

(Lan, Wang, Baykas)

1.3 Charateristics of typical implementations

(add disclaimer that these are expected numbers, actual implementations will vary)

TX power - 10 dBm (0 dBm for hand held portable devices, i.e., ncluding laptops)

TX antenna gain - 10 dB (use HPBW 60 degrees for 9 dBi)

RX antenna gain - 10 dB

receiver sensitivity - From draft

Assumption: For fixed devices and laptops, steerable antennas, for hand held portable devices, fixed direction antennas

Sum: Integrated TX power in adjacent channel, worst case.

1.4 Other systems using the 60 GHz band

(JPKG) - Unknown, but should have similar constaints. Assume essentially same chanelization and occupied bandwidth. Similar sensitivity and antenna patterns.

802.11ad

2. Coexistence scenarios

Describe typical usage scenarios. This includes the relative placement of the devices, the type of traffic carried, throughput used by the application, latency sensitivities, etc.

Scenario 1: Room in home, one WPAN streaming HD content from source to display, 3 Gb/s (1080p, 24 bit color, 60 Hz refresh rate, uncompressed). Second network - one portable hand held device with TCP/IP connection to GigE full-duplex connected data network and/or laptop/PC in room. Assume data throughput is 3Gb/s download or upload, asymmetric data path with ACK/NACK in reverse direction.

Start with different channels, use CMS beacon to avoid. Then same RF channel show that performance is adequate.

Metric will be FER for video and throughput reduction for data (e.g., 10 s download is increased by??)

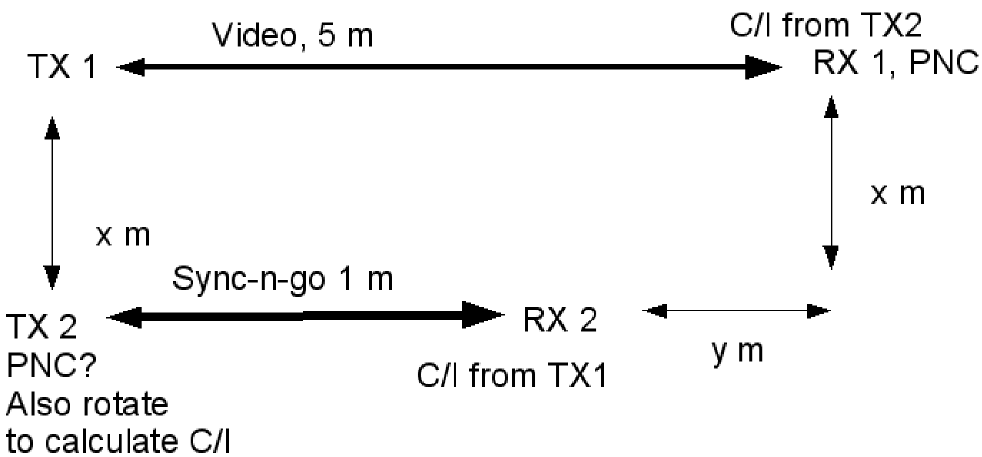
3 Gbps traffic for all

Video transmission: 5 m (NLOS, 13 dBi, 10 dBM TX power, FER and pixel error rate)

PC peripheral: 2-3 m (LOS and NLOS, 10 dBi, 10 dBm, throughput)

Sync-n-go: 1 m (LOS, 10 dBi, 0 dBm, throughput)

Positions: As shown below.



3. 802.15.3c coexistence capabilities

(The following are general charateristics of the 802.15.3 MAC, see Annex C in IEEE Std 802.15.3-2003).

3.1 Passive scanning

All 802.15.3c PNC capable DEVs (i.e. ACs) are required to passively scan, as described in 8.2.1, a potential channel before attempting to start a piconet, as described in 8.2.2. The PNC capable DEV will, at a minimum, be looking for a channel that is relatively quiet. Passive scanning implies that the PNC capable DEV, when starting a piconet, or other DEVs that wish to join an existing piconet will not cause inteference while searching the channels.

3.2 Dynamic channel selection

The PNC will periodically request channel status information, as described in 8.9.4, from the DEVs in the piconet via the Channel Status Request command, as described in 7.5.7.1. If the PNC determines, from the number of lost frames, that the channel is having problems then it would search for a new channel, as described in 8.11.1, that had a lower level of interference. If the PNC finds a channel with less interference then the PNC uses the Piconet Parameter Change IE in the beacon, as described in 7.4.6, to move the piconet to a quieter channel.

Thus, if another network is present, the 802.15.3c piconet would change channels to avoid interfering with the other network.

3.3 The ability to request channel quality information

Dynamic channel selection, as described in 8.11.1, requires the ability to obtain an estimate of the interference in a channel. In the case of 802.15.3, not only does the DEV sense the channel in its area, but it is also capable of asking any other DEV to respond with its own estimate of the channel status, as described in 8.9.4. These commands indicate the frame error rate at a remote DEV. This command is useful for detecting coexistence problems in remote DEVs by the PNC or other DEVs that are unable to detect an interference environment (for example during a passive scan).

3.4 Link quality and RSSI

The mmWave PHY specifies that a DEV returns the received signal strength indication relative to the sensitivity (RSSIr), signal and interference to noise ratio (SINR), and frame error ratio (FER) as described in 12.1.8.3. The RSSIr provides an estimate of the strength of the received signal relative to the DEV's sensitivity, which is useful for transmit power control. The RSSI combined with SINR, provides a method to differentiate between low signal power and interference causing the loss of frames. For example, if the RSSIr is low and frames are being lost, then the cause is low receive power. On the other hand, if the RSSIr is relatively high, but the SINR is low, that would indicate the possibility of interference in the channel.

3.5 Neighbor piconet capability

The neighbor piconet capability, as described in 8.2.6, allows a DEV, which may not be fully 802.15.3s compliant, to request time to operate a network that is co-located in frequency with the 802.15.3c network. This allows a dual mode (e.g., 802.15.3c/802.11ad) device to cooperatively share the time in the channel.

3.6 (capabilities unique to 802.15.3c)

(JPKG)

Sync frame

CMS beacon.

Directional antenna/beam forming

Limitations by walls (Abbie to help with cube wall absorption) in room technology.

4. Coexistence analysis

Here we provide numbers that indicate the impact of the systems on each other.

Metrics (potential):

- Throughput reduction
- Latency increase
- SNR impact
- Range reduction

Tuncer, Sum and Kato