IEEE P802.11

Wireless Access Methods and Physical Layer Specifications

TITLE: **Proposal For The Specification Of: The FH PHY Adjacent Channel Filtering and Co Channel Performance**

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AUTHOR: Jerry Loraine
Symbionics Ltd
Cambridge, England.
Tel: +44 223 421025
Fax: +44 223 421031
Email: jl@symbionics.co.uk

ABSTRACT

This submission is intended to provide a specification for the adjacent channel filtering and co-channel performance for the FH PHY. The specification is based on making the receiver performance compatible with the transmitter performance, likely receiver LO performance and not incurring unnecessary expense in manufacturing the radio.

1. INTRODUCTION

This submission proposes the wording and values for the adjacent channel filtering performance of an FH WLAN. Currently the receiver adjacent channel filtering is specified such that it is not compatible with the transmitters, the transmissions of other FH systems will desensitise receivers, even with perfect filters. The receiver LO can also limit the performance and an estimation as to that reasonable possible is shown. Finally comment is made which shows the radio as specified puts products at a commercial disadvantage to other systems.

2. TECHNICAL CASE

In an ideal world, we would be unaffected by transmitters on other channels. However, the transmitter is not perfect and will generate noise within our channel. Secondly, perfect filtering is expensive and discussed further in section 3. Consider first the transmitter. The transmitter has both a modulation based mask and a transmitter transient based mask. A logical specification for the both is given below:

> The transmitter is set to transmit on channel M, the integrated power in 1MHz bands (using 100kHz resolution bandwidth measurement) shall be less than:

RF Channel	Level dBc
Y= M±1	Not specified
Y= M±2	-40dBc
Y= M±3	-50dBc
Y= M>±3	-55dBc

These are reasonable figures and are comparable to other like technology specifications.

It should be remembered that a transmitter at >3 channels away may produce a -55dBc signal relative to the transmitter wanted signal. If we are receiving >3 channels away, with an Eb/No is 19dB for the receiver, then the absolute best case (the wanted signal is well above the noise floor), is for the transmitter can be (55-19) 36dB above the wanted. With a realistic transmitter, the transmit noise floor limitations on the receiver I/C as a function of carrier offset is:

Interfering Transmitter	Transmitter Limited I/C
Y= M±2	21dBc
Y= M±3	31dBc
Y= M>±3	36dBc

If we allow for some transmitters being better than this and we say we wish to be transmitter noise limited, then a 6-10dB increase above these figures is a realistic specification.

Other technical parameters that degrade the performance on receive are of course the VCO phase noise. If the interferer is 2MHz offset, the receiver phase noise at 1.5MHz offset on receive will interact reciprocally mix with the interferer to fall in the receive filter band. With low cost, small and low voltage VCO will be of the order of -113dBc/Hz at this frequency (worse case). If this power is integrated in a 1MHz band, then this is -53dBc, which with a 19dB Eb/No makes the I/C limitation 34dB best case, not the 45dB currently specified for a 2MHz offset. This is a simplification, but it is necessary to integrate the phase noise profile of the LO with the spectrum profile of the modulated transmitter, but the result is similar. Further from the VCO centre frequency, the limit of the VCO phase noise would be -123dBc/Hz. This would limit the adjacent channel filtering to 44dB I/C best case.

To summarise, if realistic transmitters and low power VCOs are considered, the specification is technically difficult to meet.

3. COMMERCIAL CASE

These WLAN products are digital commercial radios, to be sold at prices comparable to digital cordless telephones. Secondly in some regions of the world there are competing standards, notably DECT in Europe, which has a raw data rate of 1.152Mb/sec and can be used for data applications. There are a number of applications where 1Mb/sec WLANs will compete with this technology, therefore the WLAN cannot be crippled with over specification.

If DECT is taken as an example, then the maximum alternate channel filtering required is given below. It must be remembered for DECT that the channel spacing is 1.5 times the bit rate, not 1 as in our products, so the FH PHY equivalent offset is shown below for comparison.

Interfering Transmitter	Transmitter Limited I/C	FH Equivalent Frequency Offset
Y= M±1	15dBc	Y=M±1.5
Y= M±2	34dB	Y=M±3
Y= M>±2	40dB	Y=M±4.5

DECT Channel Filtering Required and FH Equivalent Offset

We are proposing at least 5dB better for a similar system, and at much reduced frequency offsets. This effects both the VCO and the filter cost. It is believed that the specifications should be modified to enable it to compete with these systems on an even playing field.

4. THE TEXT

The receiver is set to receive a wanted signal on RF channel M at a signal level 6dB above the receiver sensitivity for a 1x10-5 BER.

An unwanted signal is introduced at RF channel Y. The unwanted signal has the same modulation characteristics as the wanted signal. The signal level of the unwanted signal is adjusted until the BER is 1x10-5. The unwanted signal level for channel Y shall be above the levels detailed below relative to the wanted signal:

Unwanted Signal Channel	Signal I/C minimum
Y=M	-12dB
Y=M±1	-12dB
Y=M±2	30dB
Y=M±3	35dB
Y=M>±3	40dB

Note this specification removes the need to specify the Eb/No required which is a problematic measurement.