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Title	Correction of RS Preamble Configuration Request (RS_Config-REQ) Message
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Re:	Call for Technical Comments regarding IEEE Project P802.16j (IEEE 802.16j-07/013r2)
Abstract	In this contribution, we propose a correction of RS preamble configuration request to avoid the problem of low power-amplifier (PA) efficiency at a RS
Purpose	To incorporate the proposed change into the P802.16j Baseline Document (IEEE 802.16j-06/026r3)
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Correction of RS Preamble Configuration Request (RS_Config-REQ) Message

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1. Statement of the Problem

In Section 6.3.2.3.69 in [1], RS preamble configuration request (RS_Config-REQ) message is specified for a MR-BS (or parent RS) to send configuration information to its subordinate RSs. The 2-bits parameter N_Preamble indicates the number of preambles assigned to the potential RS, to be transmitted simultaneously. When N_Preamble is equal to 2 or 3, the RS will transmit 2 or 3 sets of preambles with different segment numbers simultaneously.

Sending 2 or 3 sets preamble subcarriers simultaneously will cause serious problems, as follows:
1. Average preamble related RF symbol power increase.
The RF transmit-power at the output of the RF PA is increased, during the transmission of the access preamble. Specifically, the average transmit-power for the preamble symbol will increase by 3 dB and 4.8 dB for N_Preamble of 2 and 3, respectively.

2. PAPR preamble related degradation
The Peak-to-Average-Power-Ratio (PAPR) performance gets degraded, when more than one set of preamble gets transmitted during the same symbol. . It could be seen from Table 2, that in a conservative case, the maximum PAPR performance gets degraded by 2.8 dB and 4.3 dB for N_Preamble of 2 and 3, respectively (2k FFT).

In other words, for FFT size of 2048 , when N_preamble (number of simultaneous transmissions) is 2 or 3, the average and PAPR RF transmit power will be about 5.8 dB or 9.0 dB higher than a regular single-preamble transmission, respectively.. To maintain linearity of transmission, higher back-off factors are required for the RF PA, as presented in Table 2.

This increase in the back-off RF power factor is unacceptable due to lower power amplifier efficiency at the RS and poor relay performance at RSs caused by the lower transmit power available for each segment (assuming amplifier size remains unchanged). It should be also noted that the resulting service area for the related network synchronization will get decreased under the size of the MAPs coverage area (assuming repetition rate 1) and in the same service area (assuming QPSK1/2 data coverage area), which is a significant functional and performance decrease for a mobile OFDMA network, requesting the increase of the BS density in order to properly provide the network coverage, thus triggering significant cost increases in the network infrastructure.

$N_{preamble}$		**2048**	**1024**	**512**
1	PAPR dB]	4.9113 dB	4.4924 dB	4.4450 dB
2	PAPR [dB]	7.7079 dB	7.1161 dB	6.9343 dB
	Power increase [dB]	3	3	3
	Overall RF power back-off factor [dB]	10.71	10.12	9.93
	Overall back-off factor degradation [dB]	**5.80**	**5.62**	**5.49**
3	PAPR [dB]	9.1988	8.6532	8.3600
	Power increase [dB]	4.7	4.7	4.7
	Overall RF power back-off factor [dB]	13.90	13.35	13.06
	Overall back-off factor degradation [dB]	**8.99**	**8.86**	**8.61**

Table 2—Overall back-off factor degradation for the RS RF Power Amplifier when multiple preamble transmissions are used

In other words, we can state that for a regular OFDM amplifier, with an efficiency of 10%, the overall efficiency of the OFDM RF power amplifier will get degraded to 2.5% (when 2 preambles are concurrently transmitted) or 1.25% (when 3 preambles are concurrently transmitted).

3. Receiver AGC-related issues

Even if the RS RF PA has enough headroom to accommodate the supplementary back-off factor requested by Table 2, a multiple preamble transmission will no longer be able to be used as a received power reference level, meaning that normalization of the received signal into the PHY (by using Automatic Gain Control) will not be able to be optimized, and this will cause increased degradation.

4. HO scanning related issues

Any mobile RS or MS scanning a neighborhood and executing RSSI scanning measurements on a multiple preamble will report artificially increased values accordingly with the overall back-off factor degradation, presented in Table 2. It is assumed that the related RS RF PA has enough RF power headroom to accommodate the artificial increase due to the multiple preambles transmission. Accordingly the roaming RS or MS will detect a strong RSSI signal from the respective RS and it will try to execute a hard HO procedure accordingly attempting to get connected to the RS transmitting multiple preambles, disregarding the other neighboring RSs (assuming the RS transmitting multiple preambles has the strongest RX signal) . Therefore the hard HO

procedures and scanning neighborhood results will get impacted significantly by any RS transmitting multiple preambles.

5. Preamble Coarse Synchronization

An MS or roaming RS relying on the preamble sequence during the synchronization process (implementation specific), generated by a parent RS shifting its preamble sequence from a legacy preamble set to a multiple one ($N_{preamble}$=2 or 3) , will be caused preamble detection issues, triggering a failure of the synchronization process.

Following the technical rationale presented in the items #1 to 5, it clearly appears that an RS transmitting more than one set of preamble subcarriers will trigger significant functional and performance issues for the child RSs and MSs connected to that RS.

2. Proposed Remedy

The multiple preamble transmission at a single RS shall not be supported. In other words, N_Preamble shall be 0 (transparent mode) or 1 (non-transparent mode).

3. Proposed text change

++++++++++++++ Start Text ++

6.3.2.3.69 RS preamble configuration request (RS_Config-REQ) message

Syntax	**Size**	**Notes**
N_Preamble	~~2~~ 1 bit~~s~~	N_Preamble = 0 specifies NULL preamble (e.g., Transparent RS), N_Preamble = 1 assigns one preamble to the RS ~~N_Preamble=2 assigns two preambles on different segments to the RS N_Preamble=3 assigns three preambles on different segments to the RS~~
Reserved	~~6~~ 7 bits	Reserved
for (i=0, i<N_Preamble; i++){		
Preamble index	8 bits	Assign a preamble index value to the potential RS
}		
TLV Encoded Information	Variable	TLV specific

4. References

[1] IEEE P802.16j-06/026r3