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Re:	Call for Technical Proposals regarding IEEE project P802.16j
Abstract	Propose demodulation and forwarding method within a single frame in RS and change the technical tables.
Purpose	Adoption of the proposed text and tables
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Demodulation and Forwarding Method in Relay Station

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1. Introduction

We propose the demodulation and forwarding method in RS. The demodulation and forwarding method means that RS performs only demodulation without channel decoding for received signals and then modulation only without channel encoding procedure while forwarding the data in modem of RS.

We are expected to use this demodulation and forwarding method assuming simple RS optionally. If we may use this forwarding method, we can also change modulation order of forwarded data by RS. This forwarding method can change only modulation order without changing of channel coding rates. Therefore, all of the modulation types of BS-to-RS should include a variety of channel coding rates of RS-to-MS.

Finally, we would like to change the technical tables of UCD and DCD burst profile encoding tables and CTC channel coding per modulation tables.

2. Suggested Remedy

2.1 Demodulation and Forward

There have two methods to forward data in RS, which are decoding and forwarding method and demodulation and forwarding method. We may apply decoding and forwarding method to the full functional RS in the figure1, demodulation and forwarding method to simple RS in the figure2. And also, we may apply decoding and forwarding method to channel status such as coverage extension and demodulation and forwarding method to channel status such as coverage hole in the figure3.

We would like to consider only demodulation and forwarding method in RS. Demodulation and forwarding method have main procedural blocks of FFT, QAM de-mapping, QAM mapping and IFFT without channel decoding and encoding procedures. But, we can change the modulation order in QAM mapping block prior to regeneration to forward data. For example, received data of having a 16QAM and 1/2 code rate can be changed to QPSK, 1/2 without changing code rate of 1/2.

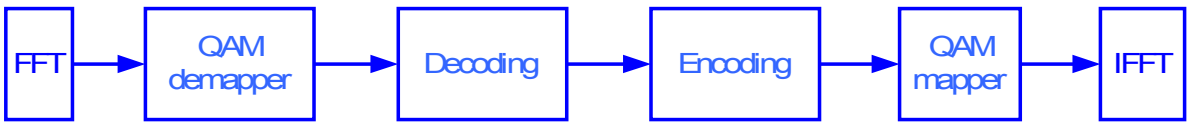

Figure1. Decoding and Forwarding method in full functional RS

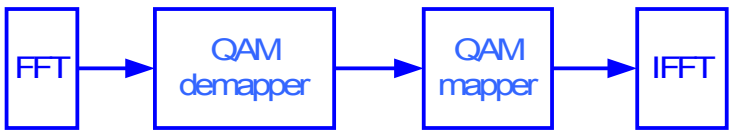

Figure2.Demodulation and Forwarding method in simple RS

2.2 Usage Scenario

Figure3 shows you usage scenario considering MS's position.

There are three kinds of MS which are in the good channel, coverage hole and coverage extension area. MS in the good channel can be directly communicated with MMR-BS. MS in the coverage hole can be applied to demodulation and forwarding method in RS. And coverage extension can be applied to decoding and forwarding method in RS.

For example, in the case of using the demodulation and forwarding in RS for downlink, you can see that dark blue colored line indicates a BS-to-RS link and light blue colored line indicates a RS-to-MS link. It has not change code rate and encoding packet size, but modulation order of 64 QAM has changed by QPSK which can be forwarded to MS. Then, all of the MS should have channel decoding procedure.

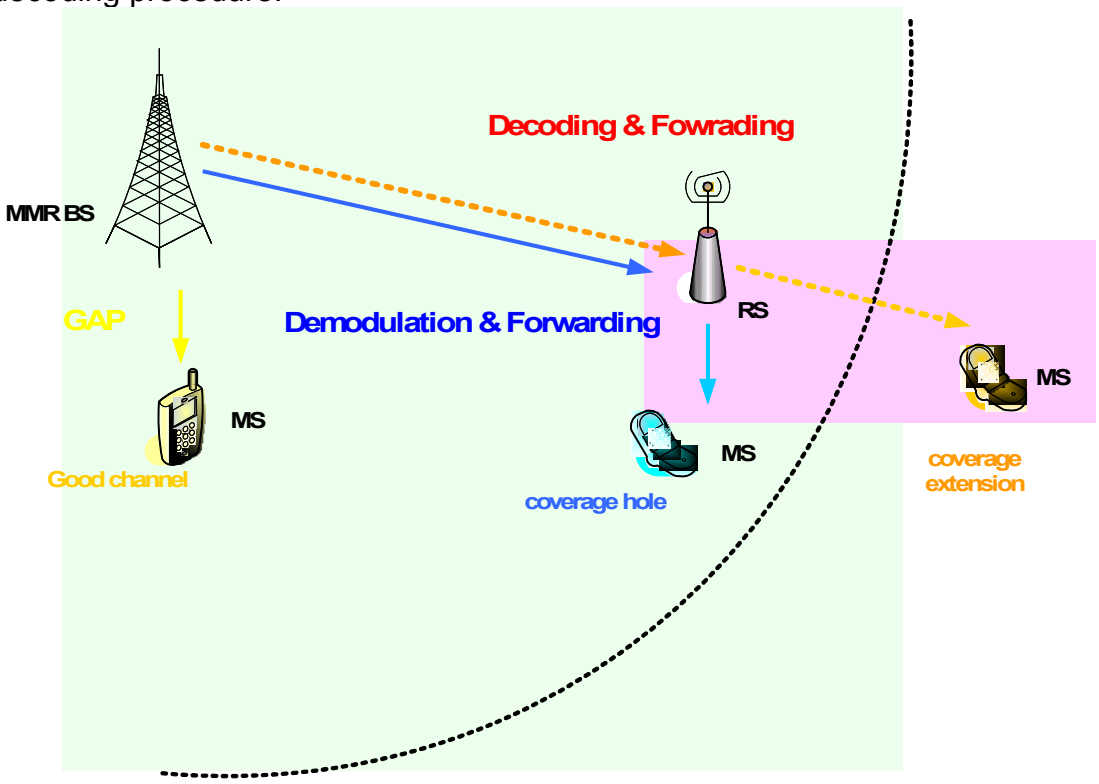

Figure3. Usage Scenario for Demodulation and Forwarding Method

2.3 Operation Scenario

The figure4 depicts that burst#1 at the BS-to-RS region can be forwarded to burst#2 at the RS-to-MS region and burst#3 at the BS-to-RS region can be forwarded to burst#4 at the RS-to-MS region.

If burst#2's MCS should have QPSK, 1/2 code rate, burst#1's MCS may have 16QAM or 64QAM without changing of code rates. And also, if legacy MS should have MCS of 64QAM, 5/6 code rate at the RS-to-MS, burst#3's MCS may have 16QAM, 5/6. However, the legacy specifications of MS have not defined 5/6 code rate for 16QAM modulation type.

Finally, we may define all of the modulation types and channel coding rate for BS-to-RS to include a variety of modulation type and channel coding rates specifying for the legacy MS.

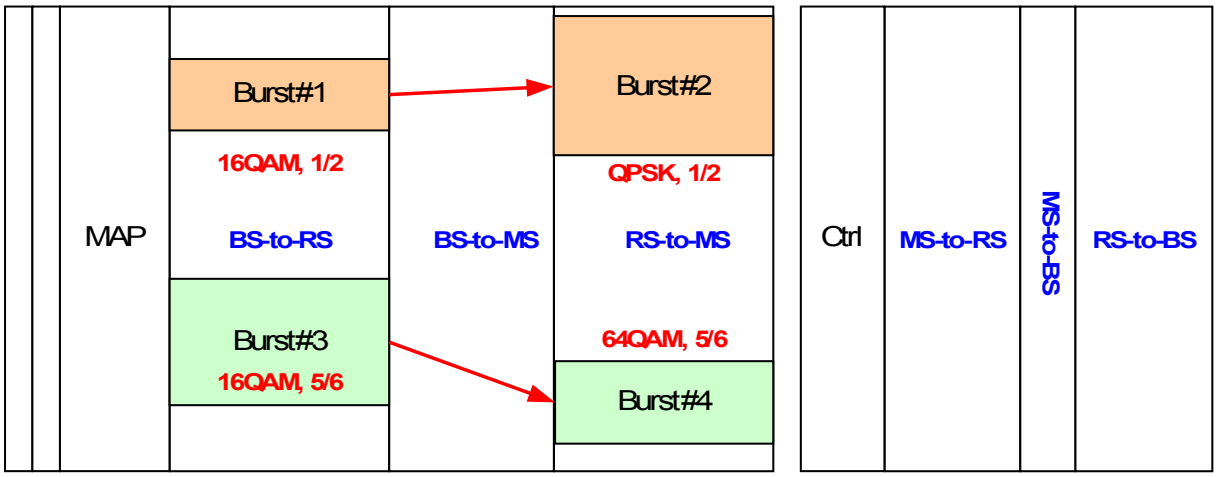

Figure4. Burst allocation for Demodulation and Forwarding

3. Proposed Text Change

[Insert the following this entry at TLV Encoding wirelessMAN-OFDMA]

11.3.1.1 Uplink burst profile encodings

[Change Table 357 in 11.3.1.1 "Uplink burst profile encodings", as shown:]

Table 357-UCD burst profile encodings - WirelessMAN-OFDMA

Name	Type	Length	Value
FEC Code Type and modulation type	150	1	0=QPSK(CC) 1/2 1=QPSK(CC)3/4 2=16-QAM(CC)1/2 3=16-QAM(CC)3/4 4=64-QAM(CC)1/2 5=64-QAM(CC)2/3 6=64-QAM(CC)3/4 7=QPSK(BTC)1/2 8=QPSK(BTC)3/4 9=16-QAM(BTC)3/5 10=16-QAM(BTC)4/5 11=64-QAM(BTC)5/8 12=64-QAM(BTC)4/5 13=QPSK(CTC)1/2 14=QPSK(CTC)3/4 15=16-QAM(CTC)1/2 16=16-QAM(CTC)3/4 17=64-QAM(CTC)1/2 18=64-QAM(CTC)2/3 19=64-QAM(CTC)3/4

Name	Type	Length	Value
			20=64-QAM(CTC)5/6 21=QPSK(ZT CC) 1/2 22=QPSK(ZT CC)3/4 23=16-QAM(ZT CC)1/2 24=16-QAM(CC)3/4 25=64-QAM(ZT CC)1/2 26=64-QAM(ZT CC)2/3 27=64-QAM(ZT CC)3/4 28=QPSK(LDPC)1/2 29= QPSK(LDPC)2/3 A code 30=QPSK(LDPC)3/4 A code 31=16-QAM(LDPC)1/2 32=16-QAM(LDPC)2/3 A code 33=16-QAM((LDPC)3/4 A code 34=64-QAM(LDPC)1/2 35=64-QAM(LDPC)2/3 A code 36=64QAM(LDPC)3/4 A code 37=QPSK(LDPC)2/3 B code 38= QPSK(LDPC)3/4 B code 39=16-QAM((LDPC)2/3 B code 40=16-QAM((LDPC)3/4 B code 41=64-QAM(LDPC)2/3 B code 42=64QAM(LDPC)3/4 B code 43=QPSK(LDPC)5/6 44=16-QAM(LDPC)5/6 45=64-QAM(LDPC)5/6 46=QPSK(CTC)2/3 47=QPSK(CTC)5/6 48=16-QAM(CTC)2/3 49=16-QAM(CTC)5/6 50..255=*Reserved*

[Insert the following this entry at TLV Encoding wirelessMAN-OFDMA]

11.4.2 Downlink burst profile encodings

[Change Table 363 in 11.4.2 "Downlink burst profile encodings", as shown:]

Table 363-DCD burst profile encodings - WirelessMAN-OFDMA

Name	Type	Length	Value
FEC Code Type and modulation type	150	1	0=QPSK(CC) 1/2 1=QPSK(CC)3/4 2=16-QAM(CC)1/2 3=16-QAM(CC)3/4 4=64-QAM(CC)1/2 5=64-QAM(CC)2/3 6=64-QAM(CC)3/4 7=QPSK(BTC)1/2 8=QPSK(BTC)3/4 9=16-QAM(BTC)3/5 10=16-QAM(BTC)4/5 11=64-QAM(BTC)5/8 12=64-QAM(BTC)4/5 13=QPSK(CTC)1/2 14=QPSK(CTC)3/4 15=16-QAM(CTC)1/2 16=16-QAM(CTC)3/4 17=64-QAM(CTC)1/2 18=64-QAM(CTC)2/3 19=64-QAM(CTC)3/4 20=64-QAM(CTC)5/6 21=QPSK(ZT CC) 1/2 22=QPSK(ZT CC)3/4 23=16-QAM(ZT CC)1/2 24=16-QAM(CC)3/4 25=64-QAM(ZT CC)1/2 26=64-QAM(ZT CC)2/3 27=64-QAM(ZT CC)3/4 28=QPSK(LDPC)1/2 29= QPSK(LDPC)2/3 A code 30=QPSK(LDPC)3/4 A code 31=16-QAM(LDPC)1/2 32=16-QAM(LDPC)2/3 A code 33=16-QAM((LDPC)3/4 A code 34=64-QAM(LDPC)1/2 35=64-QAM(LDPC)2/3 A code 36=64QAM(LDPC)3/4 A code 37=QPSK(LDPC)2/3 B code 38= QPSK(LDPC)3/4 B code

Name	Type	Length	Value
			39=16-QAM((LDPC)2/3 B code 40=16-QAM((LDPC)3/4 B code 41=64-QAM(LDPC)2/3 B code 42=64QAM(LDPC)3/4 B code 43=QPSK(LDPC)5/6 44=16-QAM(LDPC)5/6 45=64-QAM(LDPC)5/6 46=QPSK(CTC)2/3 47=QPSK(CTC)5/6 48=16-QAM(CTC)2/3 49=16-QAM(CTC)5/6 50..255=*Reserved*

[Insert the following this entry at PHY wirelessMAN-OFDMA]

8.4.9.2.3.1 CTC encoder

[Change Table 326 in 8.4.9.2.3.1 "CTC encoder", as shown:]

Table 326 CTC Channel coding per modulation

Modulation	Data block size (bytes)	Encoded data block size (bytes)	Code rate	N	P0	P1	P2	P3
QPSK	6	12	1/2	24	5	0	0	0
QPSK	12	24	1/2	48	13	24	0	24
QPSK	18	36	1/2	72	11	6	0	6
QPSK	24	48	1/2	96	7	48	24	72
QPSK	30	60	1/2	120	13	60	0	60
QPSK	36	72	1/2	144	17	74	72	2
QPSK	48	96	1/2	192	11	96	48	144
QPSK	54	108	1/2	216	13	108	0	108
QPSK	24	36	2/3	96	7	48	24	72
QPSK	48	72	2/3	192	11	96	48	144
QPSK	30	36	5/6	120	13	60	0	60
QPSK	60	72	5/6	240	13	120	60	180
16QAM	6	12	1/2	24	5	0	0	0
16-QAM	12	24	1/2	48	13	24	0	24
16-QAM	18	36	1/2	72	11	6	0	6
QPSK	60	120	1/2	240	13	120	60	180
16-QAM	30	60	1/2	120	13	60	0	60

QPSK	9	12	3/4	36	11	18	0	18
QPSK	18	24	3/4	72	11	6	0	6
16-QAM	54	108	1/2	216	13	108	0	108
QPSK	27	36	3/4	108	11	54	56	2
16-QAM	9	12	3/4	36	11	18	0	18
QPSK	36	48	3/4	144	17	74	72	2
16-QAM	27	36	3/4	108	11	54	56	2
QPSK	45	60	3/4	180	11	90	0	90
16-QAM	45	60	3/4	180	11	90	0	90
QPSK	54	72	3/4	216	13	108	0	108
16-QAM	24	36	2/3	96	7	48	24	72
16-QAM	48	72	2/3	192	11	96	48	144
16-QAM	30	36	5/6	120	13	60	0	60
16-QAM	60	72	5/6	240	13	120	60	180
64-QAM	6	12	1/2	24	5	0	0	0
64-QAM	12	24	1/2	48	13	24	0	24
QAM16	12	24	1/2	48	13	24	0	24
64-QAM	24	48	1/2	96	7	48	24	72
64-QAM	30	60	1/2	120	13	60	0	60
64-QAM	36	72	1/2	144	17	74	72	2
64-QAM	48	96	1/2	192	11	96	48	144
64-QAM	54	108	1/2	216	13	108	0	108
64-QAM	60	120	1/2	240	13	120	60	180
64-QAM	9	12	3/4	36	11	18	0	18
64-QAM	18	24	3/4	72	11	6	0	6
64-QAM	27	36	3/4	108	11	54	56	2
64-QAM	36	48	3/4	144	17	74	72	2
QAM16	24	48	1/2	96	7	48	24	72
QAM16	36	72	1/2	144	17	74	72	2
QAM16	48	96	1/2	192	11	96	48	144
QAM16	60	120	1/2	240	13	120	60	180
QAM16	18	24	3/4	72	11	6	0	6
QAM16	36	48	3/4	144	17	74	72	2
QAM16	54	72	3/4	216	13	108	0	108
QAM64	18	36	1/2	72	11	6	0	6
QAM64	36	72	1/2	144	17	74	72	2
QAM64	54	108	1/2	216	13	108	0	108
QAM64	24	36	2/3	96	7	48	24	72
QAM64	48	72	2/3	192	11	96	48	144

QAM64	27	36	3/4	108	11	54	56	2
QAM64	54	72	3/4	216	13	108	0	108
QAM64	30	36	5/6	120	13	60	0	60
QAM64	60	72	5/6	240	13	120	60	180

References

C802.16j-07_251r1, “Demodulation and Forwarding method in Relay Station”