

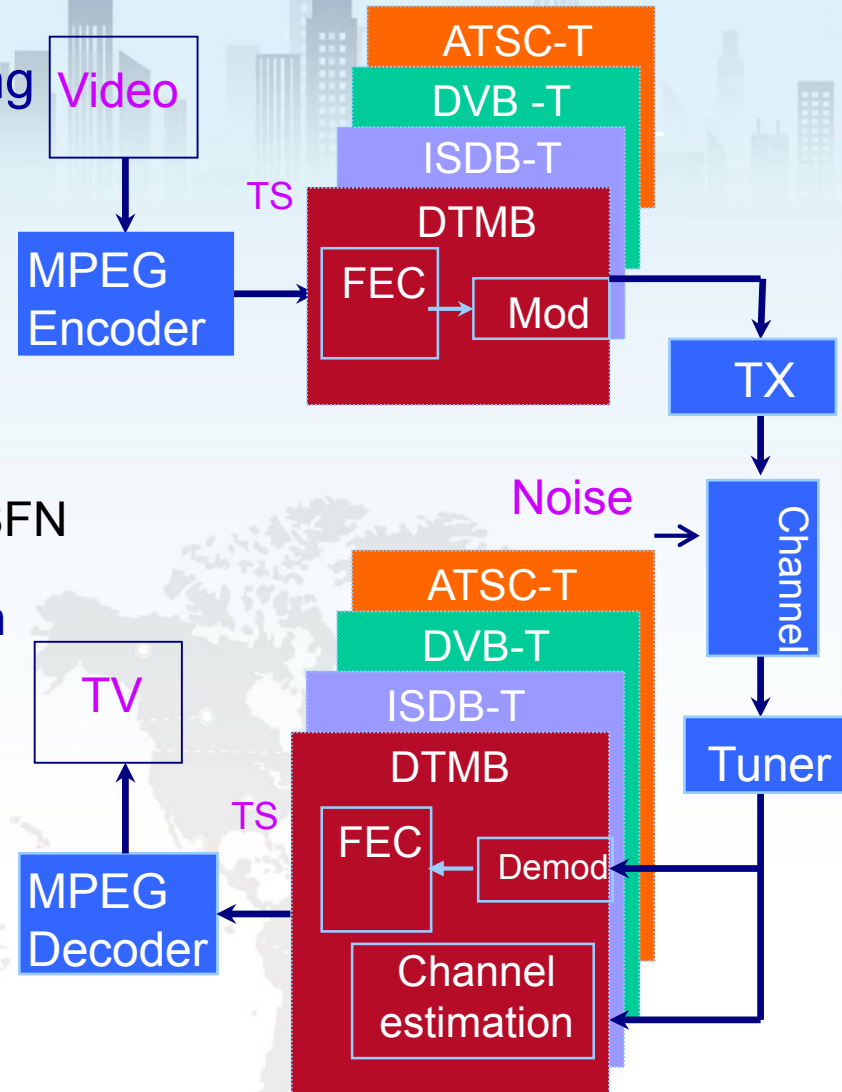


**DTMB-A, latest International  
Telecommunication Union  
Standard from China  
(DTMB: Digital Television/Terrestrial  
Multimedia Broadcasting)**

**Hanqi Zhang Ph.D**  
[Zhanghq.hys@haierhk.com](mailto:Zhanghq.hys@haierhk.com)

# 1st Generation DTTB Standards

- ATSC/8VSB, Timing domain processing
  - HD, stationary reception mainly, outdoor antenna
- DVB-T/C-OFDM, Frequency domain processing
  - Support HD, SD, stationary, mobile, and SFN
- ISDB/BST-C-OFDM, Frequency domain processing
  - Support HD, SD, stationary, mobile, and SFN
- DTMB/TDS-OFDM, Timing-Frequency domain joint processing
  - Support HD, SD, stationary, mobile, and SFN



# DTMB Payload Data Rate for 6/8 MHz

- Formula to calculate payload

$$Rate = \frac{3744}{PN + 3780} \times Ri \times Rm \times Fb(Mbps)$$

Fb (BW) , Fb=5.67/7.56

PN (GI) , PN=420/945

Rm ( Efficiency ) , Rm=2/4/5/6

Ri (FEC) , 0.4≈3008/7488, 0.6≈ 4512/7488, 0.8≈6016/7488

FEC Rate		0.4		0.6		0.8	
BW		6MHz	8MHz	6MHz	8MHz	6MHz	8MHz
PN 420	4QAM	4.061	5.414	6.092	8.122	8.122	10.829
	16QAM	8.122	10.829	12.281	16.243	16.244	21.658
	64QAM	12.281	16.243	18.274	24.365	24.365	32.486
PN 945	4QAM	3.610	4.813	5.414	7.219	7.219	9.626
	16QAM	7.220	9.626	10.829	14.438	14.438	19.251
	64QAM	10.829	14.438	16.244	21.658	21.658	28.877

# Protection Ratio (6MHz)

Co-channel protection ratios (dB) for a DTMB 6 MHz signal interfered with by a DTMB 6MHz signal

<u>Modulation</u>	<u>Code rate</u>	<u>Gaussian channel</u>	<u>Ricean channel</u>	<u>Rayleigh channel</u>
<u>4-QAM</u>	<u>0.4</u>	<u>3</u>	<u>4</u>	<u>5</u>
<u>16-QAM</u>	<u>0.4</u>	<u>9</u>	<u>10</u>	<u>11</u>
<u>64-QAM</u>	<u>0.4</u>	<u>15</u>	<u>16</u>	<u>17</u>
<u>4-QAM</u>	<u>0.6</u>	<u>5</u>	<u>6</u>	<u>8</u>
<u>16-QAM</u>	<u>0.6</u>	<u>12</u>	<u>13</u>	<u>15</u>
<u>64-QAM</u>	<u>0.6</u>	<u>17</u>	<u>18</u>	<u>20</u>
<u>4-QAM-NR</u>	<u>0.8</u>	<u>3</u>	<u>4</u>	<u>5</u>
<u>4-QAM</u>	<u>0.8</u>	<u>7</u>	<u>8</u>	<u>13</u>
<u>16-QAM</u>	<u>0.8</u>	<u>14</u>	<u>15</u>	<u>19</u>
<u>32-QAM</u>	<u>0.8</u>	<u>16</u>	<u>17</u>	<u>21</u>
<u>64-QAM</u>	<u>0.8</u>	<u>20</u>	<u>23</u>	<u>27</u>

# Protection Ratio (6MHz)

Protection ratios (dB) for a DTMB 6 MHz signal interfered with by a DTMB 6 MHz signal in the lower ( $N - 1$ ) and upper ( $N + 1$ ) adjacent channels

<u>Modulation</u>	<u>Code rate</u>	<u>Gaussian channel</u>	<u>Ricean channel</u>	<u>Rayleigh channel</u>
<u>4-QAM</u>	<u>0.4</u>	<u>-38</u>	<u>-37</u>	<u>-35</u>
<u>16-QAM</u>	<u>0.4</u>	<u>-34</u>	<u>-33</u>	<u>-31</u>
<u>64-QAM</u>	<u>0.4</u>	<u>-31</u>	<u>-30</u>	<u>-28</u>
<u>4-QAM</u>	<u>0.6</u>	<u>-37</u>	<u>-36</u>	<u>-34</u>
<u>16-QAM</u>	<u>0.6</u>	<u>-32</u>	<u>-30</u>	<u>-29</u>
<u>64-QAM</u>	<u>0.6</u>	<u>-30</u>	<u>-29</u>	<u>-27</u>
<u>4-QAM-NR</u>	<u>0.8</u>	<u>-38</u>	<u>-37</u>	<u>-35</u>
<u>4-QAM</u>	<u>0.8</u>	<u>-34</u>	<u>-33</u>	<u>-31</u>
<u>16-QAM</u>	<u>0.8</u>	<u>-31</u>	<u>-30</u>	<u>-27</u>
<u>32-QAM</u>	<u>0.8</u>	<u>-29</u>	<u>-28</u>	<u>-26</u>
<u>64-QAM</u>	<u>0.8</u>	<u>-23</u>	<u>-22</u>	<u>-20</u>

# Protection Ratio (6MHz)

Co-channel protection ratios (dB) for DTMB 6 MHz signal interfered with by analogue television (M/NTSC) signals

<u>Modulation</u>	<u>Code rate</u>	<u>Gaussian channel</u>	<u>Ricean channel</u>	<u>Rayleigh channel</u>
<u>4-QAM</u>	<u>0.4</u>	<u>-8</u>	<u>-7</u>	<u>-6</u>
<u>16-QAM</u>	<u>0.4</u>	<u>-6</u>	<u>-5</u>	<u>-3</u>
<u>64-QAM</u>	<u>0.4</u>	<u>-4</u>	<u>0</u>	<u>2</u>
<u>4-QAM</u>	<u>0.6</u>	<u>-5</u>	<u>-4</u>	<u>-3</u>
<u>16-QAM</u>	<u>0.6</u>	<u>-4</u>	<u>-2</u>	<u>3</u>
<u>64QAM</u>	<u>0.6</u>	<u>2</u>	<u>5</u>	<u>10</u>
<u>4-QAM-NR</u>	<u>0.8</u>	<u>-8</u>	<u>-7</u>	<u>-6</u>
<u>4-QAM</u>	<u>0.8</u>	<u>-1</u>	<u>0</u>	<u>1</u>
<u>16-QAM</u>	<u>0.8</u>	<u>2</u>	<u>3</u>	<u>5</u>
<u>32-QAM</u>	<u>0.8</u>	<u>4</u>	<u>5</u>	<u>7</u>
<u>64-QAM</u>	<u>0.8</u>	<u>11</u>	<u>14</u>	<u>20</u>

# DTMB Is One of ITU-R Standards

International Telecommunication Union

**ITU-R**  
Radiocommunication Sector of ITU

**Recommendation ITU-R BT.1306-6**  
(12/2011)

**Error-correction, data framing, modulation  
and emission methods for digital  
terrestrial television broadcasting**

**BT Series  
Broadcasting service  
(television)**



International Telecommunication Union

**ITU-R**  
Radiocommunication Sector of ITU

**Recommendation ITU-R BT.1368-9**  
(12/2011)

**Planning criteria, including protection  
ratios, for digital terrestrial television  
services in the VHF/UHF bands**

**BT Series  
Broadcasting service  
(television)**



# Requirements on 2<sup>nd</sup> DTTB Standards

- ❑ Higher spectrum efficiency (30% or more)
- ❑ Better receiver sensitivity
- ❑ Better mobile reception performance
- ❑ Multi-service support
- ❑ Diversity to improve the converge of SFN
- ❑ Interactive broadcasting service support

⇒ Efficient usage of spectrum released from analog broadcasting systems



The ComSoc Guides to Communications Technologies  
Nim K. Cheung, Series Editor



# Digital Terrestrial Television Broadcasting

## Technology and System

EDITED BY  
Jian Song  
Zhixing Yang  
Jun Wang



WILEY

International Telecommunication Union

**ITU-R**  
Radiocommunication Sector of ITU

Recommendation ITU-R BT.1306-7  
(06/2015)

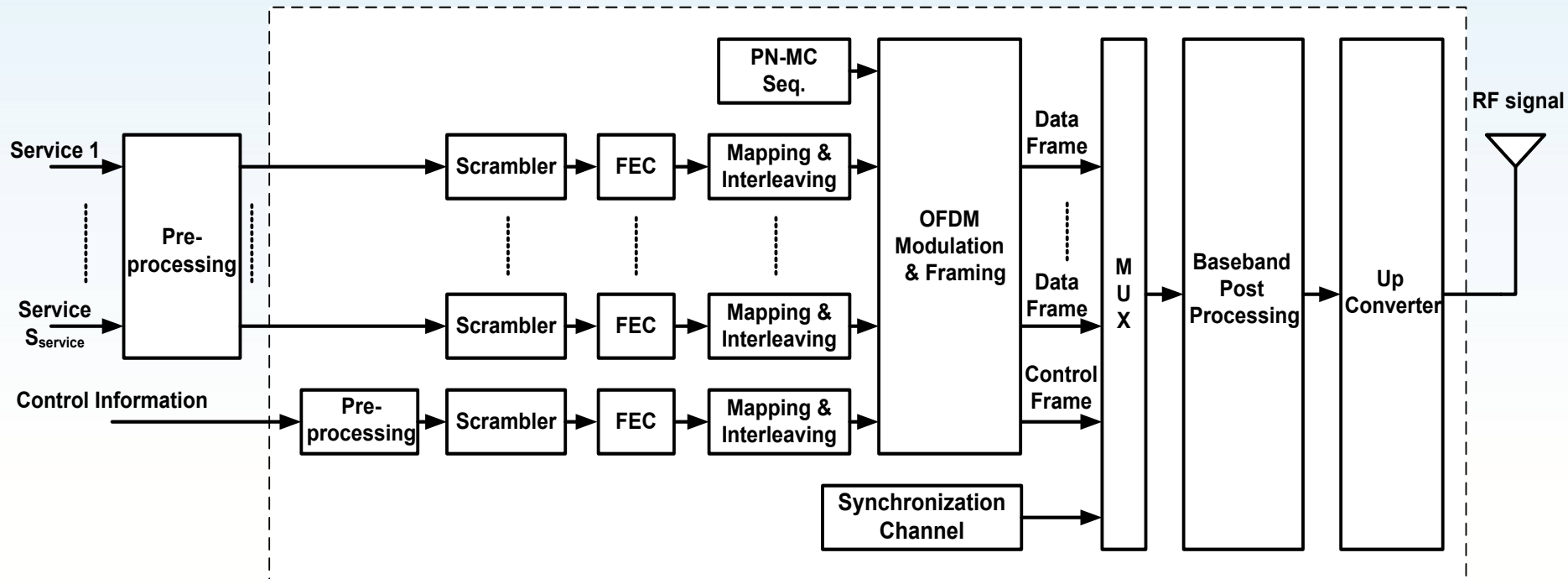
**Error-correction, data framing, modulation  
and emission methods for digital  
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**BT Series  
Broadcasting service  
(television)**



<http://as.wiley.com/WileyCDA/WileyTitle/productCd-1118130537.html>

# Function Block Diagram of DTMB-A



# Original Contributions of DTMB-A

- ❑ Flexible frame structure
- ❑ Newly proposed Gray-APSK modulation scheme
- ❑ Advanced multi-rate LDPC code
- ❑ Newly proposed P1 signaling
- ❑ Multi-service support incorporating various FFT sizes and guard interval sizes
- ❑ Transmit diversity based on TDS-OFDM

# Payload data rate (typical mode with symbol rate of 5.67Msps @ 6MHz)

Mapping	LDPC code rate	N=4096			N=8192			N=32768		
		K=256	K=512	K=1024	K=256	K=512	K=1024	K=256	K=512	K=1024
QPSK	1/2	5.03	4.53	3.78	5.33	5.03	4.53	5.58	5.49	5.33
	2/3	6.71	6.04	5.03	7.11	6.71	6.04	7.44	7.32	7.10
	5/6	8.39	7.55	6.29	8.88	8.39	7.55	9.29	9.15	8.88
16APSK	1/2	10.07	9.06	7.55	10.66	10.07	9.06	11.15	10.98	10.66
	2/3	13.43	12.08	10.07	14.21	13.42	12.08	14.87	14.64	14.21
	5/6	16.78	15.10	12.59	17.77	16.78	15.10	18.59	18.30	17.76
64APSK	1/2	15.10	13.59	11.33	15.99	15.10	13.59	16.73	16.47	15.99
	2/3	20.14	18.13	15.10	21.32	20.14	18.12	22.31	21.96	21.31
	5/6	25.17	22.66	18.88	26.65	25.17	22.65	27.88	27.46	26.64
256APSK	1/2	20.14	18.13	15.10	21.32	20.14	18.12	22.31	21.96	21.31
	2/3	26.85	24.17	20.14	28.43	26.85	24.16	29.74	29.29	28.42
	5/6	33.57	30.21	25.17	35.54	33.56	30.20	37.18	36.61	35.52

# Payload data rate (extended mode with symbol rate of $70/9 * 3/4$ Msps @ 6MHz)

Mapping	LDPC code rate	N=4096			N=8192			N=32768		
		K=256	K=512	K=1024	K=256	K=512	K=1024	K=256	K=512	K=1024
QPSK	1/2	5.18	4.66	3.88	5.48	5.18	4.66	5.74	5.65	5.48
	2/3	6.91	6.22	5.18	7.31	6.91	6.21	7.65	7.53	7.31
	5/6	8.63	7.77	6.47	9.14	8.63	7.77	9.56	9.42	9.14
16APSK	1/2	10.36	9.32	7.77	10.97	10.36	9.32	11.47	11.30	10.96
	2/3	13.81	12.43	10.36	14.62	13.81	12.43	15.30	15.07	14.62
	5/6	17.27	15.54	12.95	18.28	17.26	15.54	19.12	18.83	18.27
64APSK	1/2	15.54	13.99	11.65	16.45	15.54	13.98	17.21	16.95	16.45
	2/3	20.72	18.65	15.54	21.94	20.72	18.64	22.95	22.60	21.93
	5/6	25.90	23.31	19.42	27.42	25.90	23.30	28.68	28.25	27.41
256APSK	1/2	20.72	18.65	15.54	21.94	20.72	18.64	22.95	22.60	21.93
	2/3	27.63	24.86	20.72	29.25	27.62	24.86	30.60	30.13	29.24
	5/6	34.53	31.08	25.90	36.56	34.53	31.07	38.25	37.66	36.55

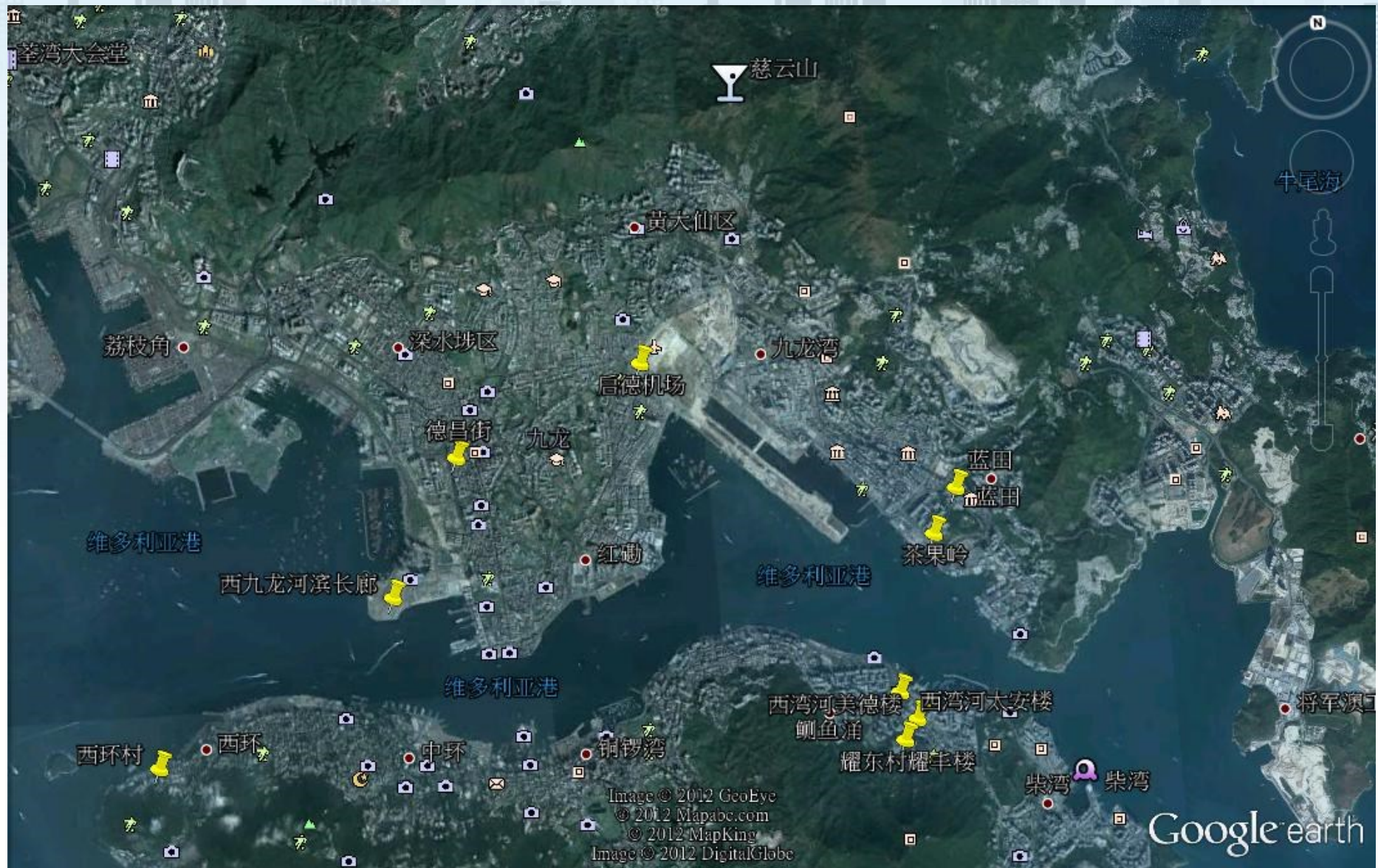
# Test of DTMB-A

<b>Item</b>	<b>Measurement category under different condition</b>	<b>DTMB-A</b>
<b>1</b>	Ground level under line of sight	X
<b>2</b>	Ground level under building shadow	X
<b>3</b>	Ground level under hill shadow	X
<b>4</b>	Roof level under building shadow	X
<b>5</b>	IBCCDS in head-end and sample TV outlet	X
<b>6</b>	Indoor reception	X
<b>7</b>	Tidal fading	X
<b>8</b>	Mobile reception	X

# Parameters for Testing

- DTMB-A:
  - Mobile reception:  
64 APSK  
FEC 2/3  
Maximum bit-rate is 24Mbps
  - Stationary reception:  
256 APSK  
FEC 2/3  
Maximum bit-rate is 38Mbps

# Testing Sites





# Test Conclusion

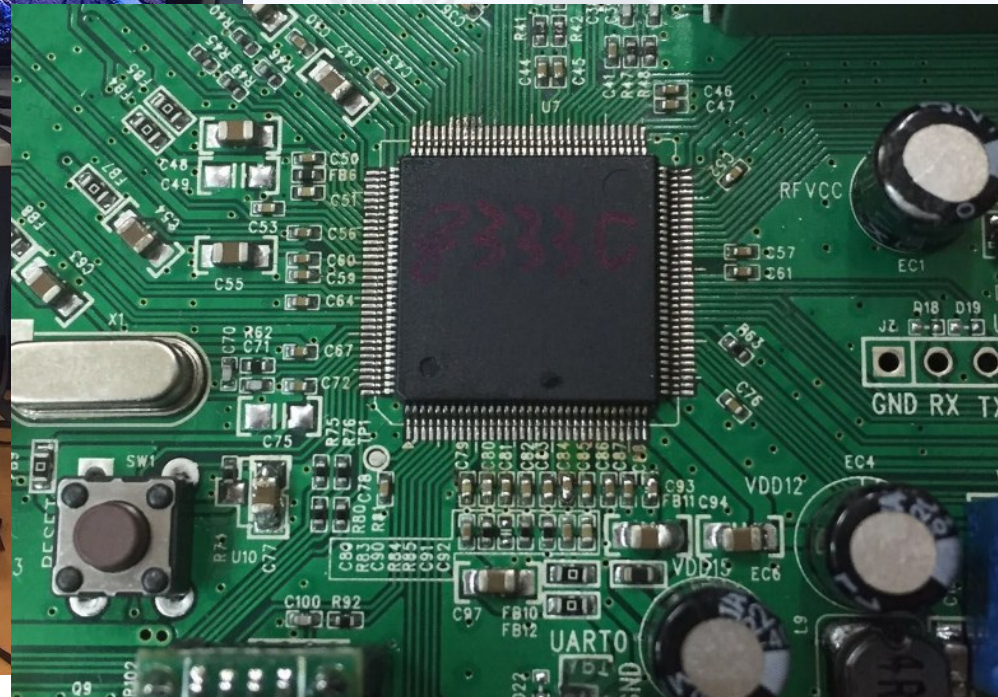
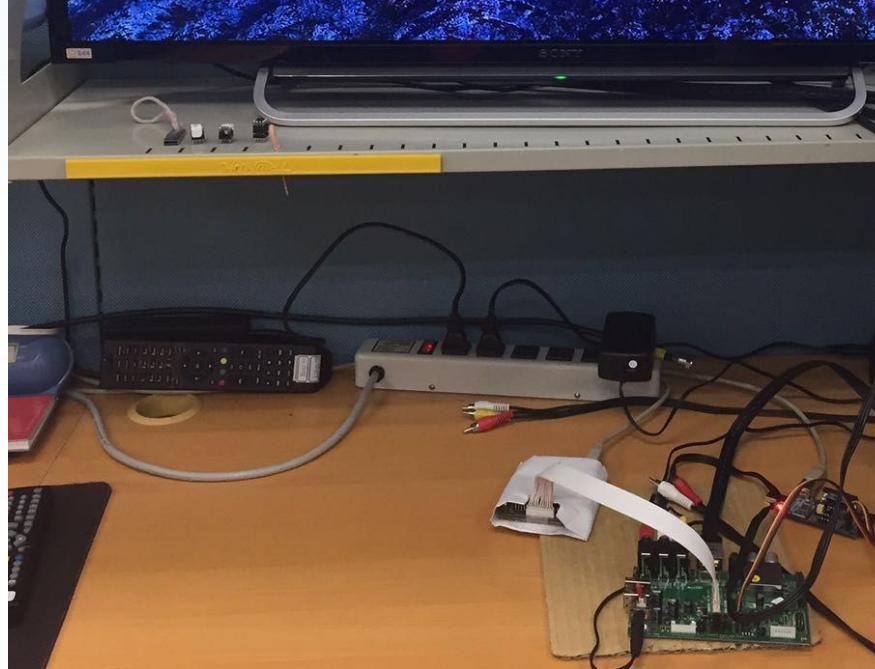
- For DTMB-A test
  - System capacity greatly improves with the exciter upgrade at the transmitter side
  - The reception performance is satisfactory, compared with DTMB:
    - Same coverage with higher data throughput
    - Same data throughput with better coverage

# DTMB-A Exciter



DTMB-A Exciter

# DTMB/DTMB-A HD Advanced SoC



# Cooperation Plan

- Provide engineering design, system equipment & software design
  - Comprehensive deployment of technique and products:
  - Best performance-price ratio
  - Best IPR terms: Easy to handle
- Key technology transfer, help Industrialization, free intellectual property right forever.
  - System product and related techniques of the DTV industry chain
  - Joint development of standard or system on new applications
  - Totally solution of system, software, and engineer training

# Cooperation Plan

- Joint venture company for production/service
  - Local manufacturing: design, manufacture, test & technique transfer
  - Help to define the manufacture flow, production measurement and application standard.
- Joint R&D Center for cooperation in DTV area
  - Assign experts to participate to the network planning, strategy and the standard defining in DTV deployment.
  - Setup up joint R&D center, developing DTV relates technique and equipment
  - University cooperation plan, DTV R&D engineer training course

# Conclusion

- DTTB can set free the delicious frequency resources.
- The key is to accomplish the switch-off as soon as possible.
- How to speed up the process of switch-off?
- Making the wise and adequate decision, getting the financial support, using the capital power. etc.

A stylized, light blue city skyline with various skyscrapers and buildings, set against a light blue background with soft, glowing circles.

**Thanks for your attention!**

A light gray world map showing the continents, with several small white dots indicating specific locations. The map is overlaid on a light blue background with soft, glowing circles.

**Any questions?**