





Practical Principle and Technical Standards for Digital Radio Planning

NBTC Thailand – 11.05.2015

T-DAB+ Planning – Scope of Digital Radio Planning

- The Assignment 'Practical Principle and Technical Standards for Digital Radio Planning' includes the following work packages:
 - Trial T-DAB+ Plan
 - Final National T-DAB+ Plan
 - Recommendation for T-DAB+ Technical Receiver Specifications
 - Recommendation for T-DAB+ Technical Transmitter Specifications
 - Call Signs and Service IDs

Part - 1



Presentation of the results from the Trial T-DAB+ Plan

Part 1 – Trial T-DAB+ Plan Assessment of Site / Frequency Availability

The following methodology has been applied to assess the availability of the frequency and the sites for a T-DAB+ trial:

- Analysis of all existing VHF television stations as listed in the transmitter database provided by the NBTC.
- Verification of spectrum availability based on ITU Recommendation ITU-R SM.851-1 "Sharing between the broadcasting service and the fixed and/or mobile services in the VHF and UHF bands".
- Calculation of the maximum permissible co-channel ERP from incoming T-DAB+ stations into existing ATV (analogue TV) service
 - A receiving antenna 14 dB directivity and 10 dB cross-polarisation has been considered for the evaluation of the potential interference in accordance with best practises (ITU Recommendations usually considers 12 dB of directivity and 16 dB of cross-polarisation)
 - Calculation of the maximum permissible first adjacent (lower and upper) channel between T-DAB+ service and ATV service
- Evaluation of the 3 best channels/ERP for each of the selected city

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Part 1 – Trial T-DAB+ Plan Simulation Parameters Used



The following lists the simulation parameters that were used to evaluate the ATV service coverage:

- CHIRplusBC Version 5.8.0 r1
 - Wave propagation model: ITU-R 370-7 Terrain Mode Model (50%,50%)
 - Receiving antenna height for fixed reception: 10m
 - Usage of DTM-data (digital terrain model) resolution 200m
 - Usage of Clutter-data (land use data) resolution 200m

The following lists the simulation parameters that were used to evaluate the T-DAB+ interference on the ATV service:

- CHIRplusBC Version 5.8.0 r1
 - Wave propagation model: ITU-R 1546 Terrain Mode Model (10%,50%)
 - Receiving antenna height for fixed reception: 10m (considering the interference to TV)
 - Usage of DTM-data (digital terrain model) resolution 200m
 - Usage of Clutter-data (land use data) resolution 200m

Part 1 – Trial T-DAB+ Plan Simulation Parameter Set – T-DAB+ System

The following table lists the simulation parameter set that was used to evaluate the T-DAB+ coverage:

Parameter	Value
Planning Tool	LS telcom CHIRplus_BC
Propagation model	CRC-Predict
Terrain and clutter Database	NBTC Thailand Database
Population Database	Provided by NBTC
Equivalent Median Reception Level	44.093 dBµV/m
Receiving Antenna height above ground level	1.5 m
Coverage Area Simulation Size	200 X 200
Coverage Area Target Service Availability	95%; Sigma: 5.5 dB
T-DAB+ Transmission mode	Mode I
T+ DAB+ Emission Mask Considered for Coordination	Critical Mask (see section 2.6.2 of report)

Part 1 – Trial T-DAB+ Plan Coverage Objectives

The following table lists the coverage objective levels for a mobile reception (95%):

Coverage Reserve	Service Quality			
0.1-3 dB	Marginal Operation			
3-10 dB	Outside Aerial Operation			
10 - 20 dB	Good Mobile Operation / Basic Indoor Operation			
20 dB+	Good Indoor Operation			

Example in Bangkok illustrating the reason for the choice of Coverage Reserve:

Coverage Reserve Co (Mobile)		Coverage / (Mol	Availability bile)	Coverage Availability (Portable Indoor)	
0 dB+	10,067,546	70%	10,919,504	70%	9,668,318
3 dB+	9,652,759	90%	10,339,359	90%	8,938,246
10 dB+	8,460,080	95%	10,067,546	95%	8,481,119
20 dB+	5,476,131	99%	9,523,561	99%	7,495,788

Part 1 – Trial T-DAB+ Plan Discussion on Simulation Parameters

SIMULATION RECOMMENDATIONS

- The Consultant recommends the usage of ITU-1546 propagation model in combination with a 200m DTM resolution map, which provide the best results in order to meet the general objectives of:
 - Providing a National and Local Frequency Plan (11 Cities) for Thailand
 - Providing an estimation of covered population, when using the existing broadcasting and telecommunication infrastructure as requested by the NBTC
 - Providing the most accurate and stable results, when most parameters (tower availability, antenna height, final transmitter power, etc.) are still unclear
 - Providing the most versatile, rapid and accurate simulation tool
 - Staying compatible with other international T-DAB+ plans
- This plan will allow the NBTC and other Stakeholders to:
 - Have a frequency planning basis for the deployment of T-DAB+ National and Local multiplexes.
 - Allow for a deployment and test of T-DAB+ services (planned trail)
 - Proceed with detailed coverage analysis vs measurements studies in small areas in order to build over the years a network to achieve a complete coverage reception (95% Population of Thailand).

Part 1 – Trial T-DAB+ Plan Compatibility Analysis Example



Part 1 – Trial T-DAB+ Plan Resulting Coverages for Trial T-DAB+ Plan for Best Transmitter ERP for each Channel



Part 1 – Trial T-DAB+ Plan Resulting Coverages for Trial T-DAB+ Plan for Best Transmitter ERP for each Channel - 2





CHIRplus_BC V 5.8.1 r5 @LS telcom AG

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Part 1 – Trial T-DAB+ Plan Resulting Coverages for Trial T-DAB+ Plan for Best Transmitter ERP for each Channel - 3





Part 1 – Trial T-DAB+ Plan Population Coverage Objectives

- In order to provide an equal service coverage (same ERP for each T-DAB+ ensemble) for the introduction of the Trail T-DAB+ Plan, the table below highlights the population that will be covered if:
 - 1 ensemble is used in the trial: the best TX ERP can be considered
 - 2 ensembles are used in the trial: the 2nd best TX ERP is used for both channels, leading to a reduced coverage
 - 3 ensembles are used in the trial: the 3rd best TX ERP is used for the 3 channels

Number of Multiplex	Population 20 dB+	Percentage of Total Thai Population	Population 10 dB+	Percentage of Total Thai Population
1 for Sc. 1 (5 Cities)	7,882,470	12%	11,629,986	18%
2 for Sc. 1 (5 Cities)	6,845,801	11%	10,873,962	17%
3 for Sc. 1 (5 Cities)	4,831,679	7%	9,120,936	14%

Part 1 – Trial T-DAB+ Plan Population Coverage Objectives - 2

 When considering an additional margin for Bangkok at 20 dB+ and considering the required margin for the cities at 10 dB+ (due to the build-up density) the results are as follows:

Number of Multiplex	Hybrid (Bangkok 20 dB+; rest at 10 dB+)	Percentage of Total Thai Population	
1 for Sc. 1 (5 TX)	8,926,842	14%	
2 for Sc. 1 (5 TX)	7,889,731	12%	
3 for Sc. 1 (5 TX)	5,736,251	9%	

Part 1 – Trial T-DAB+ Plan Key Findings for the Trial T-DAB+ Plan

The original request from NBTC included the study of 11 cities in Thailand, for which the Consultant derived the following plan:

- The desired number of multiplex (3) could be realized for the Trial Plan.
- The first 4 cities identified in the ITU document "Roadmap for the introduction of DAB in Thailand" are all located in the Bangkok metropolitan area (Bangkok, Nonthaburi, Samut Prakarn and Pathumthani); only one transmission site was useable (Bangkok) in order to adequately protect the Analogue Television (ATV) first adjacent channels;
- The Chonburi and Hua Hin cities are not co-sited with the adjacent ATV channels from the same region. Therefore, overloading interference will occur to the adjacent ATV channels in the vicinity of the T-DAB+ transmitter. No solution was found to avoid the interference on ATV and to provide usable allotments in Chonburi and Hua Hin for the Scenario 1. Therefore, implementation of T-DAB+ allotments in Chonburi and Hua Hin will not be possible for Scenario 1.
- All selected T-DAB+ channels are either on VHF III band channel 7 or on channel 8. This configuration will allow for an easy migration to one single channel (channel 8) when deriving the National SFN Plan for Scenario 3.
- The Nakhon Ratchasima site, if implemented, will have to use channel 7, but will be changed to channel 8 in Scenario 3 to be part of the National Multiplex. It was therefore decided not to be implemented during in the trial period.
- The Songkhla site will also use channel 7, but will stay on channel 7 in Scenario 3 to allow for the coordination with Malaysia.

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Presentation of the results from the Final National and Local T-DAB+ Plan

Part 2 – National and Local T-DAB+ Plan Objectives

- The objective of this report is to present the proposed T-DAB+ National Coverage ("Scenario 3") as part of the Report Interim Milestone IB. The Scenario 3 is defined as follows:
 - Provide a National DAB+ SFN coverage for 4 multiplexes considering a full analogue television (ATV) switch-off situation. This plan will also include an additional 4 multiplexes for the 39 local areas as defined by the ITU and accepted by NBTC.

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Part 2 – National and Local T-DAB+ Plan Table of Content

- Planning Tool Parameters and Settings
- Planning Methodology
- Results:
 - National T-DAB+ SFN Coverage and Population
 - National T-DAB+ SFN interference between channels 7 and 8
 - Local T-DAB+ SFN Channel Assignment
 - Local T-DAB+ SFN interference discussion
 - Local T-DAB+ SFN Coverage and Population
- Key Findings

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Part 2 – National and Local T-DAB+ Plan Planning Tool Parameters and Settings

 The following table describes how the planning tool (CHIRplus_BC) has been configured in order to derive the Thai T-DAB+ Plan. These parameters are identical for those proposed for the Trial Plan, and are based on GE06.

Parameter	Value
Propagation Model	ITU 1546 Terrain (50%,50%)
Network Parameters	GE06 Mobile E-Min (44.0 dBu)
Terrain and clutter database	NBTC Thailand Database at 200m
Population Database	Provided by NBTC
Receiving Antenna height	1.5 m
Coverage Simulation Area Size	200m x 200m
Coverage target service availability	95%; sigma 5.5 dB

Part 2 – National and Local T-DAB+ Plan Parameters: Coverage Reserve



The results are displayed in terms of coverage reserve are:

Coverage Reserve	Service Quality
0 – 3 dB	Marginal Operation
3 – 10 dB	Outside Aerial Operation
10 – 20 dB	Perfect Mobile / Basic Indoor
20 dB+	Perfect Indoor

- The population objective for Indoor Portable has been derived by considering a coverage reserve of 10 dB, with the exception of Bangkok, where a coverage reserve of 20 dB was considered.
- For more information on the selection of this result display methodology, please refer to the presentation "Milestone IA and IB – Simulation Parameters".

Part 2 – National and Local T-DAB+ Plan Planning Methodology

- In order to derive the National T-DAB+ plan, the Consultant has developed the following methodology:
 - Utilization of channel 8 for all of Thailand with the exception of channel 7 in vicinity to the Malaysian border.
 - Analysis of the best located transmission sites, listed in the analogue television and FM database provided by NBTC, in order to provide the coverage to all regions.
 - Considering all regions currently covered by broadcast services (FM or TV) will have T-DAB+ service coverage.
 - Determination of the resulting T-DAB+ service coverage.
 - Evaluation of the feasibility of the population coverage objective of 95% of the total population of Thailand as defined in the document "ITU – Roadmap Report for the transition from analogue to digital broadcasting services based on the T-DAB+ standard".
 - Consideration of available T-DAB+ capacity in Thailand, final rev 1, 22 November, 2013; T-DAB+ service & planning requirements, version 2.3, 21 February 2014

Part 2 – National and Local T-DAB+ Plan Network Architecture Concept

- Tower Selection Concept:
 - Priority to existing broadcasting tower infrastructure: FM first, then TV
 - Maximum power 50 kW (applied to very few towers only)
 - Typical power: 10 kW for major broadcasting towers
 - When coverage improvement was possible, telecom towers were added to the plan
 - Typical power: 5 kW (range from 1 kW to 10 kW)
 - Using broadcasting and telecom towers could not meet the overall population coverage objectives of 95%, therefore 4 additional studies have been proposed and executed to evaluate the required density of Greenfield towers for meeting the coverage objective:
 - Bangkok, Chiang Mai, Khon Kaen and Songkhla
 - Greenfield towers had the following characteristics:
 - Height: 120m maximum (depending on terrain)
 - Typical Power: 5 kW (could be from 1kW to 10 kW, depending on other factors: terrain, close proximity to 1st adjacent, synchronisation)
 - Anticipated tower separation :

10-20 km for 20 dB+ of Coverage Reserve

- 40-60 km for 10 dB+ of Coverage Reserve
- Difficulties: non uniform population distribution

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Part 2 – National and Local T-DAB+ Plan Coverage Results – National CH7 South





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Part 2 – National and Local T-DAB+ Plan Coverage Results – National Ch8 South



Part 2 – National and Local T-DAB+ Plan Coverage Results – National Ch8 South Central





Part 2 – National and Local T-DAB+ Plan Coverage Results – National Ch8 Central Bangkok



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Part 2 – National and Local T-DAB+ Plan Coverage Results – National Ch8 Western Central



Part 2 – National and Local T-DAB+ Plan Coverage Results – National Ch8 Northwest



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Part 2 – National and Local T-DAB+ Plan Coverage Results – National Ch 8 Eastern





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Part 2 – National and Local T-DAB+ Plan Results – National T-DAB+ SFN

 Utilizing all existing broadcasting (108) and telecom towers (92) provided by the NBTC, the Consultant designed a T-DAB+ network that achieved the following population coverage:

Coverage Reserve	Population Coverage	% of Thai Population (cumulative)	
0-3 dB	4 061 179	77.47 %	
3-10 dB	11 068 214	71.17 %	
10-20 dB	14 854 811	54.00 %	
20 dB+	19 952 499	30.95 %	
Total Objective Achievement	33 421 865	51.85 %	
Total Thai Population	64 456 693		

 The Total Objective Achievement considers 10dB+ of coverage for all provinces with the exception of Bangkok where 20 dB+ was considered.

Part 2 – National and Local T-DAB+ Plan Coverage Target of 95%

- Since the coverage target of 95% of the population of Thailand could not be achieved when using all relevant broadcasting and telecommunication towers as provided by the NBTC, the Consultant studied the possibility of adding Greenfield towers in order to reach the 95% target.
- Four target regions were jointly identified with NBTC in order to evaluate the number of additional towers required to meet the requirements:
 - Bangkok: Urban region
 - Chiang Mai: Mountainous region
 - Khon Kaen: inland region
 - Songkhla: seaside region
- An additional study was conducted with the objective to evaluate how many towers would be required to reach about 70%-75% of the population target for each area.

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Part 2 – National and Local T-DAB+ Plan Example: Bangkok 95% Population Coverage



Part 2 – National and Local T-DAB+ Plan Example: Bangkok 70% Population Coverage



Part 2 – National and Local T-DAB+ Plan Study Results: Greenfield Towers



Local Area	Population Covered	% Population Covered	Area covered (sq.km)	# TX	Transmitter density (population)	Transmitter density (total area sq.km)
Bangkok*	9 250 396	63.38%	9230.498	9	1 027 821.78	1 025.61
Bangkok*	10 244 174	70.19%	8064	14	731 726.71	576.00
Bangkok*	14 264 081	97.73%	23347.3	41	347 904.41	569.45
Khon Kaen	1 528 756	41.26%	5299.2	7	218 393.71	757.03
Khon Kaen	2 734 980	73.82%	14707.75	19	143 946.32	774.09
Khon Kaen	3 607 746	92.39%	21433.57	38	94 940.68	564.04
Chiang Mai	1 572 525	76.32%	7613.55	12	131 043.75	634.46
Chiang Mai	1 861 527	90.35%	13493.39	35	53 186.49	385.53
Songkhla	1 374 675	72.62%	8653.28	5	274 935.00	1 730.66
Songkhla	1 757 304	92.83%	8814.08	14	125 521.71	629.58

Part 2 – National and Local T-DAB+ Plan National SFN – Interference between Ch7 and Ch8

 An evaluation of the potential interference between channel block 7D and 8A has been undertaken. The impact of 8A on 7D is minimal. The following shows the impact of 7D on 8A (but this zone is covered by 8A, so no coverage losses will results from this interference):



Part 2 – National and Local T-DAB+ Plan National SFN Interference - Discussion

- As it can be noted, the interference seen in the previous simulations are entirely contained in the "out of service coverage" area. Meaning that the interference of SFN 8 will be experienced in the SFN7 zone, around a transmitter of SFN7.
- The following table demonstrate the population that might suffer service degradation.

Affected Province	Population in study (no interference)	Population in study (with interference)	Population Interfered	Total Population in Study	% of interfered Population		
Interference Analysis Between 8A (Desired) and 7D (Undesired)							
KRABI	241 528	241 528	0	438 151	0.00%		
NAKHON SI THAMMARAT	1 220 501	1 220 501	0	1 264 677	0.00%		
Interference Analysis Between 7D (Desired) and 8A (Undesired)							
PHATTHALUNG	356 418	351 524	4 894	514 492	0.95%		
SONGKHLA	908 241	907 977	264	1 031 973	0.03%		
TRANG	300 573	300 191	382	631 920	0.06%		

Part 2 – National and Local T-DAB+ Plan Local T-DAB+ Network Principles

- To define the best channels that could be used for Local T-DAB+ transmitters, the Consultant has considered the following criteria:
 - For the areas located nearby the Malaysian border, only the channels 6, 7, 9 and 12 have been considered.
 - Channel 12 has not been used in this planning exercise, as requested by NBTC.
 - To minimise the interference, the Consultant recommends that all transmitters are co-located with the National SFN transmitters.
 - Protection of co-channels coverages were considered.
 - All simulations evaluate the co-channel and first adjacent channel interference based on GE06 criteria, as defined in the CHIRplus_BC software suite, for stations located within 100 km of the edge of the coverage.
 - As previously analyzed, the interference experienced across the 4 proposed blocks (A, B, C and D) of a given channel will be minimal (less than 1% in the worst case scenario), therefore only the coverage for the block A for each given channel has been provided, since the coverage of the other blocks will be similar.
 - All SFN synchronisations have been revised and therefore can be different from the National SFN DAB+ Plan, to ensure optimum reception of the local T-DAB+ signal.

Part 2 – National and Local T-DAB+ Plan Local T-DAB+ Frequencies



 Each local region is represented by a different colour

- The number represents the channel (based on TV channel raster) that will be used for the T-DAB+ local multiplexes
- Four multiplexes are available in each local region: block A, B, C and D
- Co-channel and 1st adjacent interference channel will be lower than 1% of the population (see report for detailed analysis)
- Individual coverage results are available in the Milestone IB Report
- Detailed local network topology is provided in Annex E of the report

Part 2 – National and Local T-DAB+ Plan Local SFN – Interference Discussion

- As demonstrated for the National SFN, the interference created by adjacent channels will be entirely contained around the interfering transmitter.
- This transmitter will, in all cases, be located outside the local coverage zone.
- Therefore, evaluations have been made for transmitters that are located at the edge of 2 zones and demonstrated that, in all situation, the interference will be less than 1%.
- An Aegis Study for OFCOM (UK) has also demonstrated the all tested T-DAB receivers subject to the AEGIS Study are out performing the required specification for 1st adjacent interference selectivity. Therefore, the proposed frequency plan yields a 1st adjacent channel interference that will be marginal to non-existing.



Part 2 – National and Local T-DAB+ Plan Key Findings

- Key Findings of National and Local T-DAB+ Plan
 - 4 National multiplexes have been identified:
 - Channel 8, block A, B, C, & D
 - Channel 7, block A, B, C & D (in the south of Thailand, to ensure compatibility with Malaysia)
 - This plan is compatible with the Trial T-DAB+ plan
 - 4 multiplexes in each local regions have been identified:
 - 1st adjacent interference will be minimal (less than 1% population)
 - Co-Channel interference has been avoided for the Local Multiplexes
 - Compatibility with Malaysia is considered and no problem will occur
 - All frequencies have been identified and listed in the report.
 - Using existing infrastructure, selected from the broadcasting and telecom tower database provided by the NBTC, have lead to a population coverage of 51%. Additional Greenfield towers will be required to reach 95%.

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Part 2 – National and Local T-DAB+ Plan Conclusions – National T-DAB+ Plan



- The Consultant has provided a T-DAB+ Plan that meets the following NBTC objectives:
 - 4 National Multiplexes
 - 4 Local Multiplexes in all regional market
 - Ensuring protection to surrounding countries (Malaysia, no other country information has been provided to the Consultant)
 - No usage of channel 12 according to NBTC's request
 - All available broadcasting and telecom towers provided by NBTC have been utilised, unless another tower was available in the immediate vicinity (less than 10 km)
 - The NBTC's population objectives of 95% cannot be achieved:
 - Unless additional towers (Greenfield) are made available

Please note:

- Existing broadcasting and telecom towers are not necessarily to most suitable towers
- Measurements shall be undertaken to validate the simulation parameter premises



Presentation of the Receiver Technical Specifications Recommendation

Part 3 - Receiver Technical Specification Recommendation

The Thai Receiver Technical Specification Recommendations are based on the document *IEC* 62104 – *Characteristics of DAB receivers, Second edition* 2003-03, for the following reason:

- Discussion with Thai receiver manufacturer representatives (January 2015) indicated that all T-DAB receivers are produced according to these specifications.
- The only country that has a different set of specification is United Kingdom. Here again, the Thai
 receiver manufacturers clearly stated that these specifications are more costly and more difficult to
 meet, which can slow down a deployment in Thailand. Also, United Kingdom is one of the few
 countries where T-DAB+ receivers are designed domestically.
- In the global economy, it is an objective that Consumer Electronics are generally produced in greater numbers in order to minimise production costs. This means, using agreed international standards to ensure lower prices, common functionality and performance.
- Until the T-DAB+ deployment in Thailand has proven being a real success, the Consultant recommends that only the IEC 62104 document is used for the Receiver Technical Specifications. This document provides all required specifications and test methodologies. The Consultant has provided additional non-mandatory specifications, such as: support of Thai language and other features in addition to the UK receiver specifications DRAP-TEG-002.
- The Consultant also notes that additional information has been provided in the Addendum to the report, that could be used at a later stage as a basis to create Thailand's own T-DAB+ receiver specification.



Presentation of the Transmitter Technical Specification Recommendation

Part 4 - Transmitter Technical Specification Recommendation

The Thailand Transmitter Technical Specification Recommendations are based on the following documents:

- EN 300 401: Digital Audio Broadcasting (DAB to mobile, portable and fixed receivers
- EN 302 077-1: Transmitting equipment for the Terrestrial Digital Audio Broadcasting (T-DAB) service; Part 1: Technical characteristics and test methods
- EN 302 077-2: Transmitting equipment for the Terrestrial Digital Audio Broadcasting (T-DAB) service; Part 2: Harmonized EN under article 3.2 of the R&TTE Directive
- TS 102 563: Transport of Advanced Audio Coding (AAC) audio
- TS 101 756: Registered Tables
- TS 102 427: Data Broadcasting MPEG-2 TS streaming

Additionally, information on the following topics is provided in the report:

- Health and Safety Specifications
- Frequency Range
- Emission Mask
- Frequency Accuracy
- Audio Encoding

As for the Receiver Technical Specifications, the Consultant recommends that Thailand should adopt existing standards (EN 302 077-1 and EN 302 077-2) that explain in details the test methodology and procedures to be adopted.

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Presentation of the recommended Call Signs and Service ID for T-DAB+ Services

Part 5 - T-DAB+ Call Sign Recommendation

NBTC has requested the Consultant to provide a recommendation for the usage of Call Signs and Pi codes for T-DAB+ services in Thailand. The Consultant would like to note that these features are more relevant to the FM service.

The Call Signs can be used by individual licensees in the T-DAB+ ensemble and can be defined as per the following methodology:

- All broadcast station Call Signs should start with the prefix "HS".
- The next letter should usually be "A", but in a FIPS Code area where many stations are located (like in Bangkok), the Consultant recommends to also make use of the letter "B".
- The next field would represent the FIPS Code, e.g. "40" for the Bangkok province.
- The next following field would be a letter from "A" to "Z" representing the T-DAB+ service in the province defined by the previous field (this could also be linked to an existing simulcasting FM station). This letter is arbitrary and does not represent an increase or a position in the frequency band. Once 26 stations are present in the same Province, the 3rd letter (see point #2 above) should be incremented from "A" to "B" and the field following the FIPS Code restarted at "A" up to "Z". In the field following the FIPS Code, regular stations should use a letter from the range "A" to "F", while Community Stations should use "G" up to "Z". This will ensure that the station type can be rapidly identified.
- The unique Call Sign sequence should be completed with the suffix "-DAB".
- As an example, a station in Bangkok could have the following call sign number: **HSA40A-DAB**

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Part 5 T-DAB+ Service ID (SId)



One important feature of T-DAB receivers is the usage of unique Service IDs (or SId) for the tuning of audio services (radio stations). This feature is similar to the PI (Program Identifier) Code of the RDS system in FM broadcasting.

The Consultant has provided NBTC with an MS Excel based PI Code calculator to compute the FM PI Code, which is fully compatible for the T-DAB SId calculation.

Based on the Call Sign proposal, the Consultant has provided the following methodology to compute a unique SId:

- Since "HS" is constant, only the last 4 digit are used. An example for HSA40C-DAB would be: A40C.
- Using 7 bits (128 possibilities) to encode the province code "40".
 - 40 in binary = 0101 000
- Using 5 bits (32 possibilities) to encode the station specific code; applying this rule:
 - Use the 5 least significant bits for the last letter, where A = 0, B=1, ..., Z = 25
 - In our example: "C" = 00010

Part 5 T-DAB+ Service ID - Continued

- Only one province (Bangkok) has currently more than 26 stations. In order to ensure that each regular stations has its unique PI Code, the Consultant recommends that Bangkok is split into 2 province code areas:
 - 40: for "A" series (3rd digit of the call letter)
 - 80: for "B" series (80 in binary is: 101 0000)
 - If another province will have more than 26 stations in the future or if Bangkok will have more than 52 stations, the province codes 81 to 127 can be used as these codes are still unused.
- The complete PI Code for HSA40C would then be as follows:
 - 1010 0101 0000 0010 (bin) or A502 (hex) or 42242 (dec)
 - Where:
 - 1010 : First bit "1" for reserved bit usage & 010-> "2": reserved code for Extended Country Code usage (Thailand would be required to use F3 for ECC, as per table 7: ITU Region 3 (Asia and Pacific) of document ETSI TS 101 756 V1.6.1 (2014-05))
 - 0101 000 : 40, province code for Thailand
 - 0 0010 : 2, representing "C"
- Another example for HSB40E would be:
 - 1010 1010 0000 0100 (bin) or AA04 (hex) or 43524 (dec)

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