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New Vision for Broadcasting Sector in Lebanon

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TRA

Mohamad Ayoub
Spectrum Affair
Telecommunications Technologies Unit

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Outline

General Overview

- Status and issues
- Challenges

Improving FM Broadcasting

- Strategic considerations
- Assumptions
- Improvement Approach

TV Migration from Analogue to Digital

- Obligations and Objectives
- Migration Approach

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Status and Issues

- Heavy use of spectrum
  - TV: Channel 21-26 is used by MoD, (27 - 69) is used for analog TV broadcast
  - Degradation in quality due to Interference especially in FM
- P2P links use Mobile and BWA bands (800 MHz – 4 GHz)
- Violation of international rules and International agreements
  - Lack of Coordination and registration
- Violation of National Rules and Regulations
  - Coverage, Frequency Trading, Out of band transmission, installation
- High Power of Transmission is being used
  - 40 sites with more than 17 sites located in Beirut
  - Compatibility between the FM transmission and ILS not considered
- Target date for completion of analogue switch-off is June 2015

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FM installations

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FM installations

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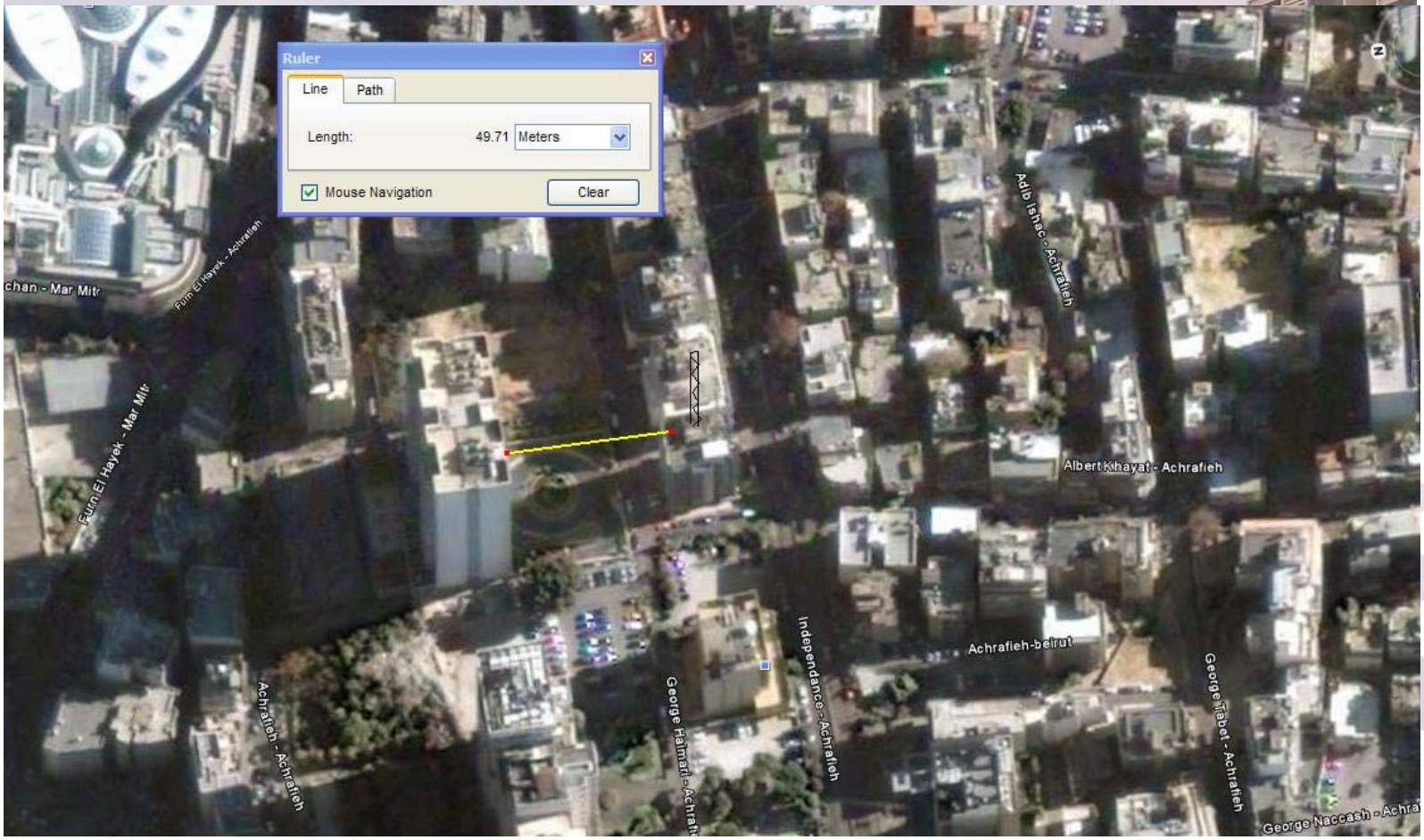
Horizontal Distance less than 50m to antenna propagation



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Challenges

- Minimise interference issues and improve quality of transmission
- Optimize spectrum usage
- Finalize coordination with neighbouring countries
- Register Frequencies in ITU
- Ensure public protection to electromagnetic field radiation Risk on Health
- Implementation of GE06 & finalize ASO by 2015
- Introduce new services
- Assure Competition

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Coordination with neighboring countries

- Coordination distance between BC and BT as defined by GE 84 Agreement

Coordination distances, D_L, in km, for propagation paths over land

Effective radiated power		Effective antenna height (m)							
		10	37.5	75	150	300	600	1200	1800
dBW	W	Coordination distances (km)							
55	300k	660	660	670	690	710	740	780	810
50	100k	600	600	620	630	650	680	720	760
45	30k	550	550	560	580	600	630	670	700
40	10k	500	500	510	520	540	570	610	650
35	3k	440	440	450	470	490	520	560	590
30	1k	390	390	400	410	430	460	500	530
25	300	330	330	340	360	370	410	450	480
20	100	280	280	290	300	320	360	390	430
15	30	200	230	240	250	270	300	340	380
10	10	110	170	190	200	220	260	300	330
5	3	60	130	150	160	180	210	260	280
0	1	45	90	110	120	140	170	220	240

Coordination distances, D_{SC}, in km, for propagation paths over cold sea

Effective radiated power		Effective antenna height (m)							
		10	37.5	75	150	300	600	1200	1800
dBW	W	Coordination distances (km)							
55	300k	1160	1160	1190	1220	1240	1250	1270	1300
50	100k	990	990	1000	1040	1050	1070	1130	1160
45	30k	860	860	870	890	910	940	980	1010
40	10k	750	750	760	780	800	840	870	910
35	3k	640	640	660	680	700	730	780	810
30	1k	560	560	580	590	610	640	700	720
25	300	480	480	500	510	530	570	610	640
20	100	410	410	430	440	470	500	540	570
15	30	350	350	370	380	400	440	480	510
10	10	300	300	310	320	350	380	420	450
5	3	230	240	260	270	290	330	360	390
0	1	110	190	200	220	230	280	320	340

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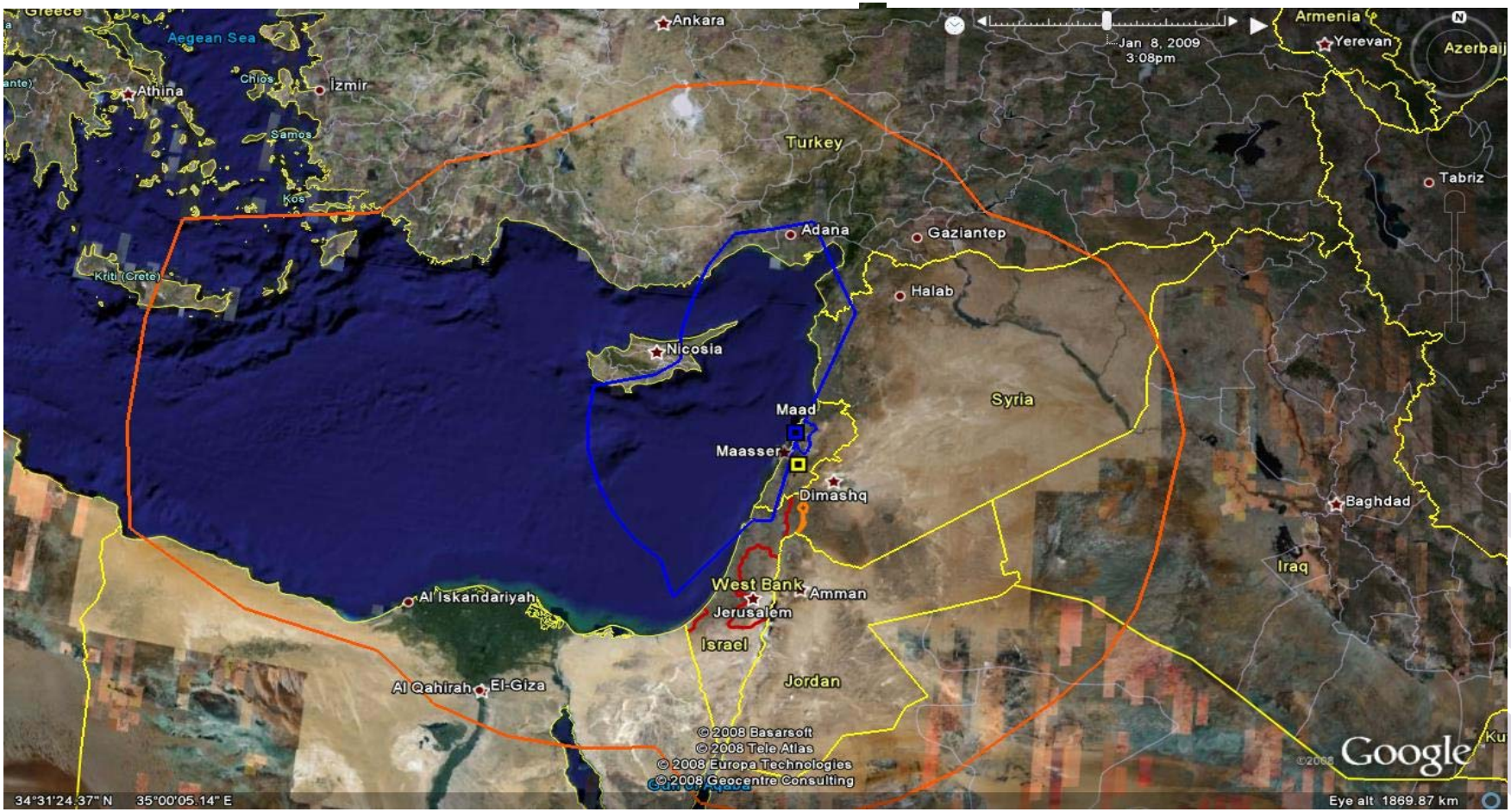
ITU Coordination Challenges

- ITU Coordination with 11 administrations for coordinating a typical mountain top station like Maasser/Barouk
- Coordination with 4 administration for a typical 1kW coastal station



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ITU Coordination Challenges

- FM Broadcasting station with 9 countries: Syria, Egypt, Iraq, Jordan, Turkey, Greece , Cyprus & Israel(occupied land)

Wanted Station :			
AssignID	Country	Coordinates	Name
97	LBN	035E5600 34N1800	AITO

GE84 BC to BC - Coordination Distance

No	P_Affected	Country	Coordinates	Azimuth(Deg)	Distance(km)	Cord_Dist(km)	Heff(m)	Band(MHz)	Region
1	+++	ARS	037E0333 31N3110	160.917	326.654	350.000	-624.9	87.5 - 108	1
2	+++	CYP	034E0541 34N5726	294.002	183.466	891.932	696.9	87.5 - 108	1
3	+++	EGY	034E1300 31N1924	206.328	367.917	532.322	-158.6	87.5 - 108	1
4	+++	GRC	029E3831 36N0629	291.174	605.988	860.379	685.5	87.5 - 108	1
5	+++	IRQ	038E4741 33N2238	110.418	283.575	350.000	-1348.2	87.5 - 108	1
6	+++	ISR	035E3449 33N1725	196.299	116.955	350.000	-350.2	87.5 - 108	1
7	+++	JOR	035E4749 32N4432	184.211	173.732	350.000	-406.7	87.5 - 108	1
8	+++	SYR	036E0131 34N3758	12.812	37.964	411.604	416.0	87.5 - 108	1
9	+++	TUR	036E0914 35N4910	6.714	170.197	453.469	507.5	87.5 - 108	1

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Improving FM Transmission

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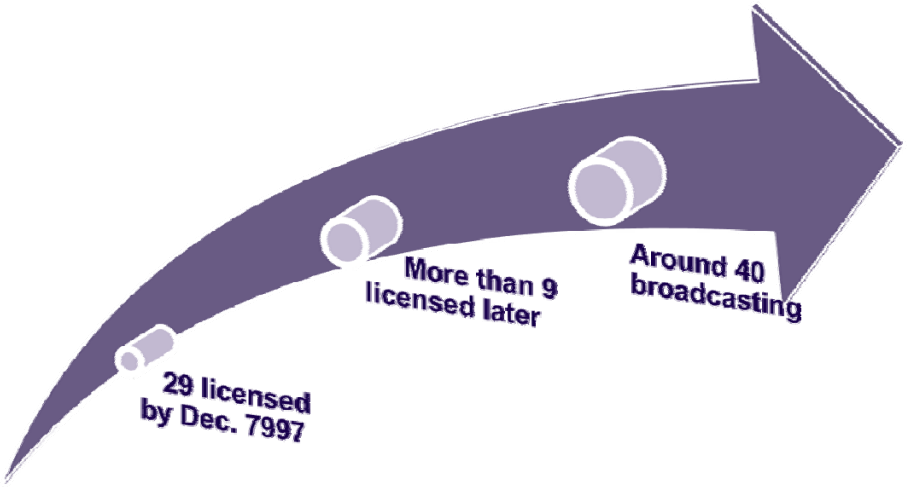
Current Status of FM Broadcasting



- Usage of channels on national basis is interfering and overlapping
- Stations not registered nor coordinated hence no protection for Lebanon
- Cross border coordination & registration not completed with neighboring countries
- Quality of reception and coverage requires improvement
- Usage of channels is not efficient resulting in wasted frequencies

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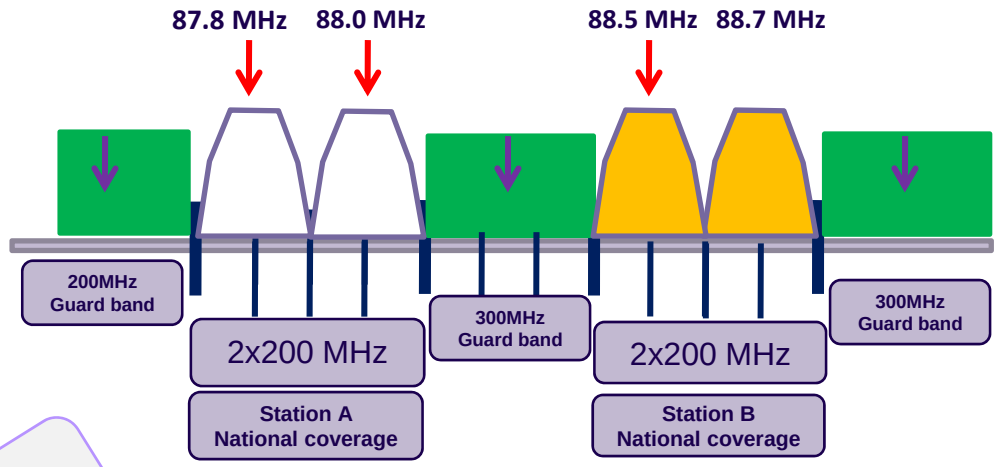
Current Status of FM Broadcasting

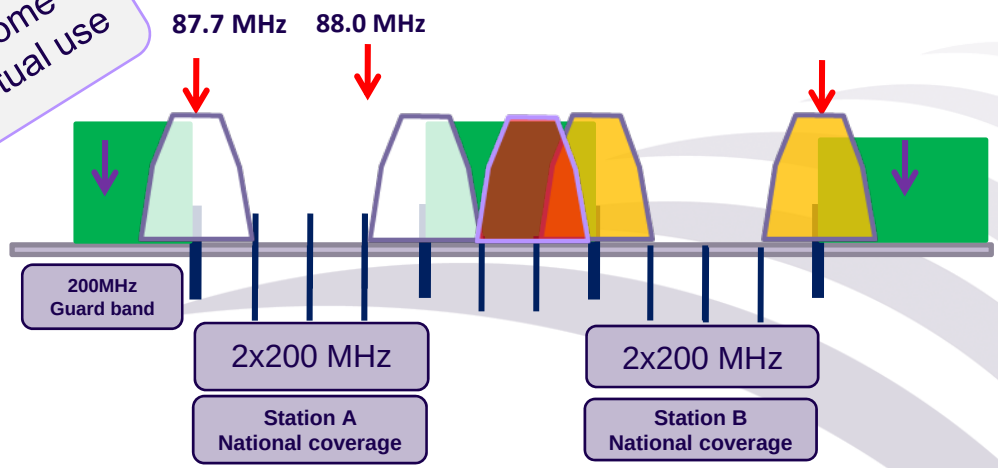
MPT Channel Plan of Dec. 7997

One channel block per station (2 channels)

Channel Block 1	Guard band	Channel Block 2
400 KHz	300 KHz	400 KHz



Some actual use



- Stations are deviating from original plan and actual frequency usage is different.
- Broadcasters used the 400 kHz in various ways including transmission at the band edges & in Guard bands overlapping with assigned blocks

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Rules & Conditions for Protection and Reception

Protection Ratio

Carrier Spacing	Mono	Stereo	
0	36	45	Wanted must be 45 dB stronger than unwanted signal for stereo reception and 33 dB for Mono reception
100	12	33	
200	6	7	
270	0	0	Wanted and un-Wanted may be equal
300	-7	-7	
400	-20	-20	UN-wanted can be 20 dB stronger than Wanted signal

Areas	Mono dB (mV/m)	Stereo dB (mV/m)
Rural	48	54
Urban	60	66
Large cities	70	74

Minimum usable field strength

Coverage is limited by the topography and not by transmit power

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Basic Assumption for FM Planning

- 400 KHz raster has to be maintained
- Transmit power should be related to the coverage area of the site
- Synchronization must be maintained for co-channel transmission
- Comparable power levels must be maintained within same area
- Filtering of FM transmitters is crucial to prevent interference especially in aeronautical band
- Co-location will be required to prevent (near-far) problems
- Human safety protection rules, as ICNIRP standards, to be applied
- ITU-R SM 1009 should be applied to protect aeronautical band

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Option 1: Zero Base

Theoretically 51 Channels

Cons:

- Max number of channels
- Optimal use of spectrum

Pros:

- High cost of Implementation
- Complicated and time consuming
- Major changes in the broadcast infrastructure
- All listeners are affected

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Option 2: Improve Existing Frequency Plan

Fixing the current plan is feasible, it provides enough channels and could result in substantial improvement of FM broadcast

Adjust the frequency plan to maintain 400 KHz separation in each site and in associated area

Maintain two interlaced frequency plans

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Option 2: Frequency Plan Adjustment

Theoretically 44 Channels

Cons:

- Actual implementation can be done in steps
- Minimal impact on broadcasters and users

Pros:

- Less number of channels available

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Interleaved Frequency Plan

Frequency		Interleaved Plan		Theoratical Plan	
		Site #1#	Site #2#	Site #1#	Site #2#
87.5	87.5				
87.6		87.6		87.6	
87.7	87.7				
87.8			87.8		87.8
87.9	87.9				
88.0				88.0	
88.1	88.1	88.1			
88.2					88.2
88.3	88.3		88.3		
88.4				88.4	
88.5	88.5	88.5			
88.6					88.6
88.7	88.7		88.7		
88.8				88.8	
88.9	88.9				
89.0		89.0			89.0
89.1	89.1				
89.2			89.2	89.2	
89.3	89.3				
89.4					89.4
89.5	89.5	89.5			
89.6				89.6	
89.7	89.7		89.7		
89.8					89.8
89.9	89.9	89.9			

- Develop the initial plan 700 kHz raster to maintain two interlaced frequency plans:
  - 400 KHz, 2 channels + 300 kHz “GB”
  - utilize the GB for 1 channel but maintain average 450 KHz separation
  - Actual allocation would result in 400 and 500 KHz separation at a single transmit location
- Available No. of Channels is 44:
  - 29-30 channels in initial plan,
  - 14-15 channels in interlaced plan

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Other parallel steps

1. Synchronization each broadcast network to allow effective co-channel broadcasting
2. Adjust frequency relevant to the interleaved frequency plan
3. Reduce transmit powers to levels suitable with the intended coverage
4. Concentrate transmission locations as much as possible (near co-location
5. Adjust transmit power to be within the same range
6. Add joint low-power fill-in sites where needed
7. Migrate gradually to a joint broadcast infrastructure with co-located transmitters
8. Coordinate lower power FM networks with neighboring countries
9. Use good filters to prevent inter-modulation issues and to protect the air navigation

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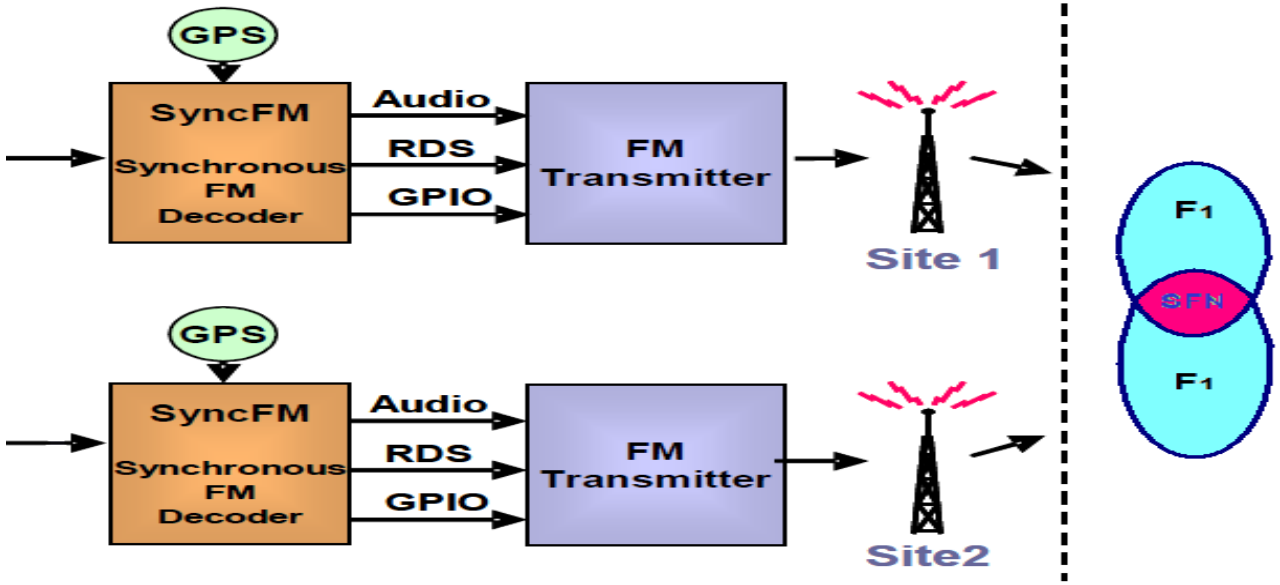
Synchronization



Time delay (ms)		Stereo	mono
steady	Carrier Spacing (KHz)	Steady	Steady
15 (2-25)*	0	45	36
5	100	33	12
-5	200	7	6
-15	300	-7	-7
-25	400	-20	-20

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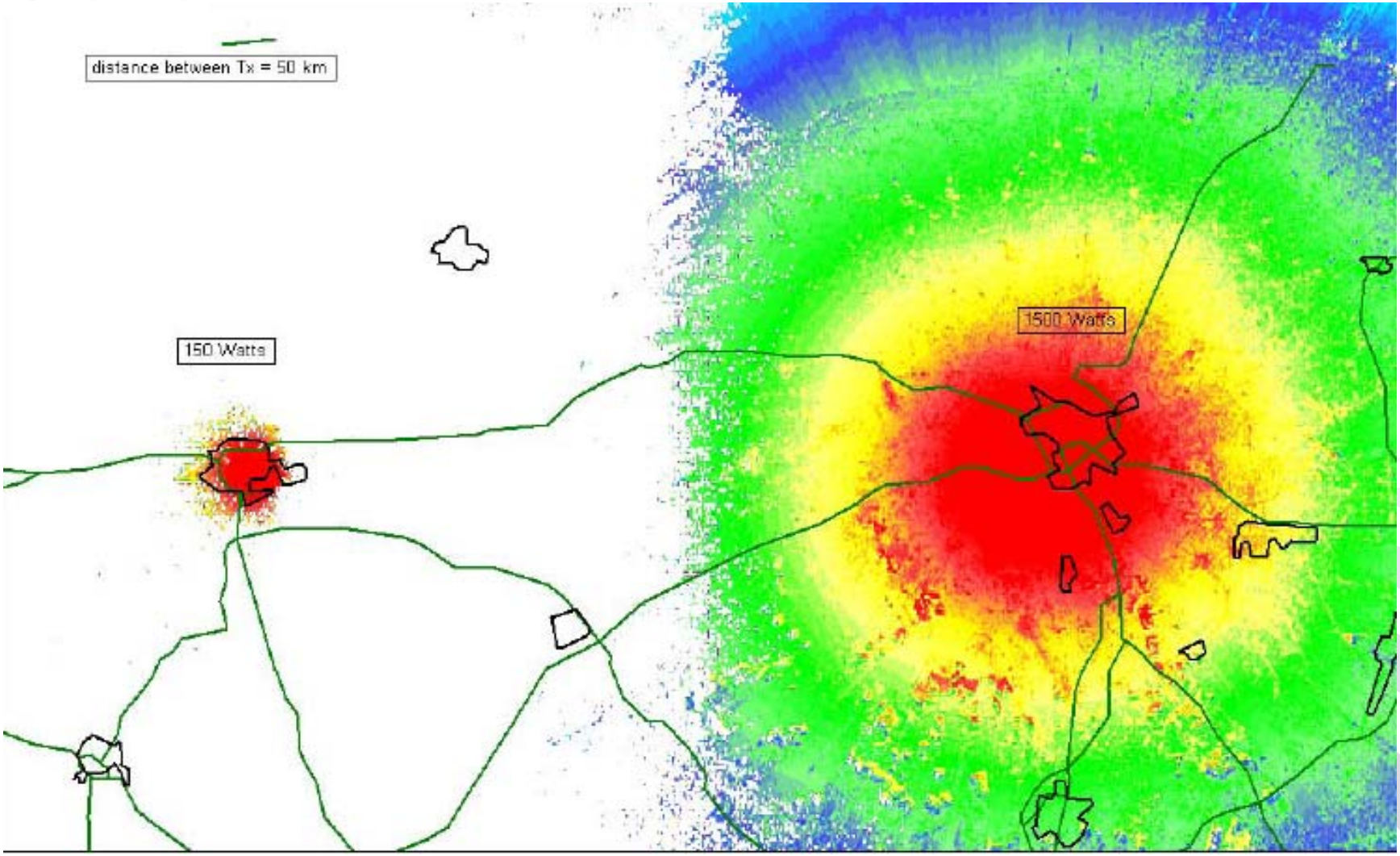
Standard Protection Criteria for co-channel



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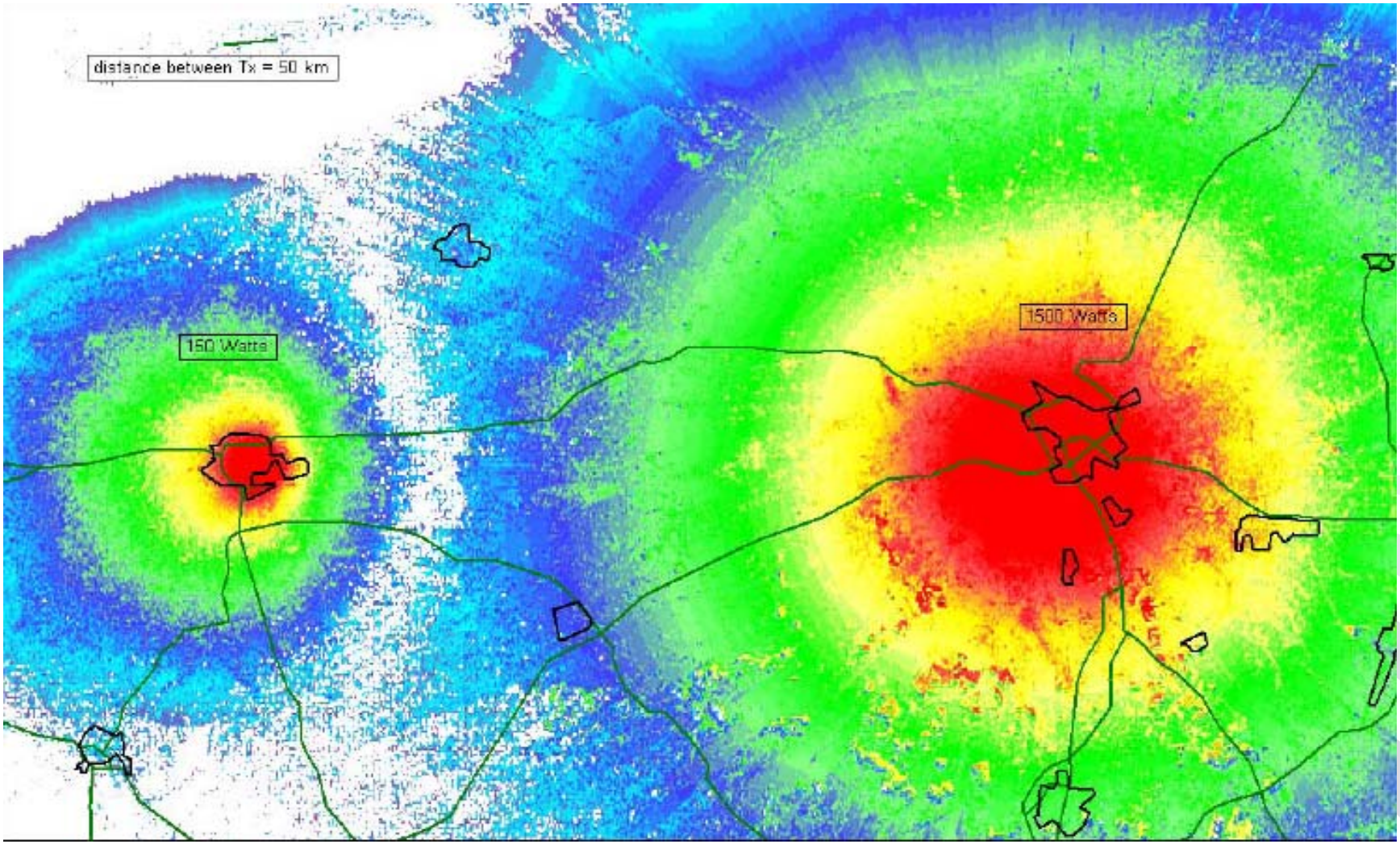
Full protection with 2dB protection Ratio



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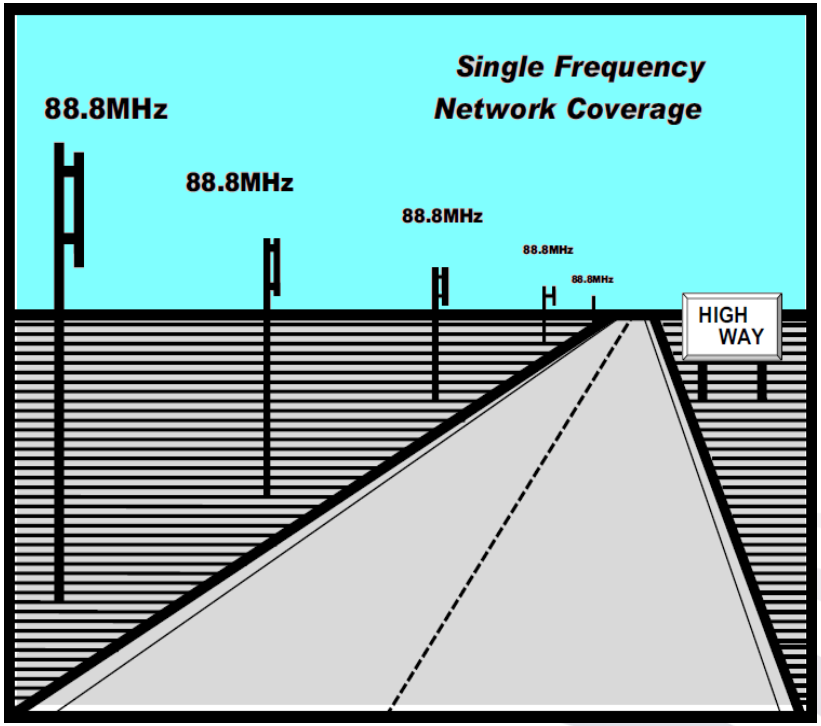
Synchronization Benefits

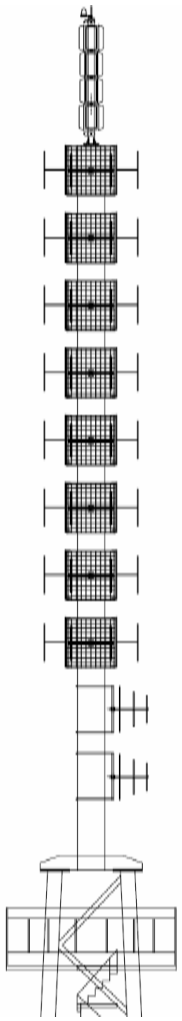
- Single Frequency Network Coverage
- Elimination of co-channel interference
- Improved reception
- Optimal use of Spectrum
- Highway coverage
- Small power of transmitters using solar supply power



In Italy along a mountainous road (Bologna - Florence, 85 km) a new FM monophonic synchronized broadcast service was implemented

Common Transission Sites and Co-location

- 4 towers per site, each one carry up to 12 Channels
- 2 Antennas on each tower
- 6 channels per antenna
- 800 kHz minimum Combination spacing
- Distance between towers between 30 and 50 meters



Site
4 Towers

Ti		T2		T3		T4	
A1	A2	A1	A2	A1	A2	A1	A2
6 Ch	6 Ch	6 Ch	6 Ch	5 Ch	5 Ch	5 Ch	5 Ch
87.6	93.2	88.1	93.7	98.8	103.5	99.3	103.9
88.5	94.1	89.0	94.6	99.7	104.4	100.2	104.9
89.5	95.1	89.9	95.5	100.7	105.3	101.1	105.8
90.4	96.0	90.9	96.5	101.6	106.3	102.1	106.7
91.3	96.9	91.8	97.4	102.5	107.2	103.0	107.7
92.3	97.9	92.7	98.3				

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Joint broadcast infrastructure

- A joint broadcast infrastructure will provide the following benefits:
  - Better spectrum use
  - Better coverage with less interference
  - Reduced long-term CAPEX and OPEX for broadcasters
  - Potential use of a shared backhaul transmission network
- A split between the broadcast transmission network & media/content license would be a logical next step.

Differentiate between Broadcast Transmission License and Media Broadcast License

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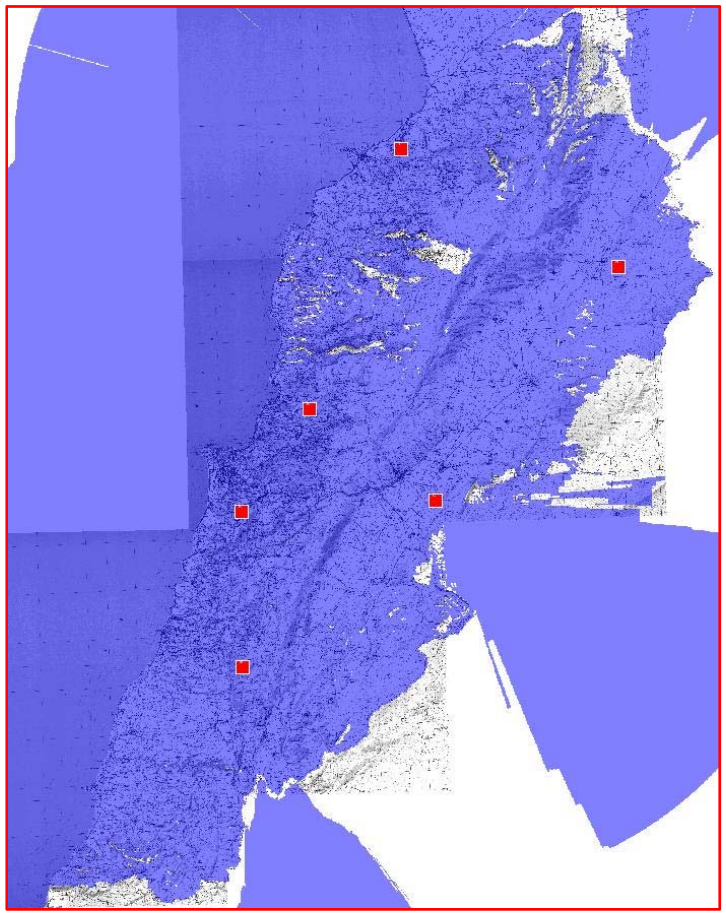
Coverage for 10 KW and 100 KW ERP

The following plots show the FM coverage at 54 dBuV/m for 100W, and 1 KW ERP:

10 KW ERP



100 KW ERP

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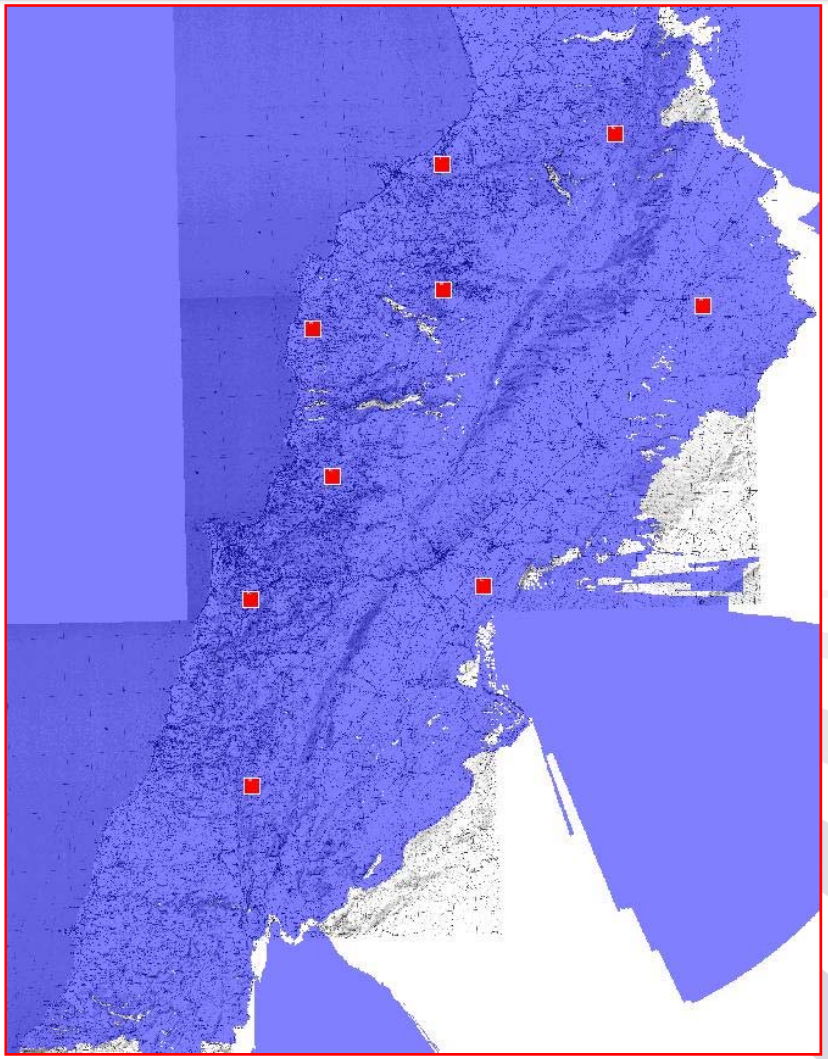
Example of 6 main sites and 3 fill-in sites

- In this plot, we used:
  - 6 main sites at 10 KW ERP
  - 3 fill-in sites at 1 KW ERP.
  - 2 valleys could be covered with small fill-in sites.
- Better coverage:
  - Good signal instead of just Marginal signal.
  - Much lower transmit power has been used.



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TV Broadcasting
Migration Plan from Analog to Digital

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Geneva 2006 Agreement (GE 06)

- Regulates in Europe, Africa and parts of Asia frequency usage in bands (III, IV/V)
- Establishes two plans for analogue and digital environment in these regions
- GE-06 replaces part of the existing Stockholm 1961 (ST-61) Agreement
- It is a binding int'l treaty signed by administrations & registered with the UN
- Addressed 72,761 country requirements for the transmission of DVB-T & T-DAB services
- Generally, countries have been allocated:
  - 3 T-DAB and 1 DVB-T "coverage layers" in the Band III and 7-8 DVB-T layers in Bands IV/V.
- GE-06 sets "17 June 2015 at 00.01 hr UTC" as the end of the transition period
- Countries can begin implementing the GE-06's digital plan as of 17 June 2006
- Analogue services will no longer be protected or available along borders as of June 2015
- The date of 2020 has been set for the end of the transition period in some African and Arab countries for analogue services in Band III

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Countries announced ASO

Country	DTT Launch	ASO Date
Netherlands	2003	Completed
Finland	2001	Completed
Sweden	1999	Completed
Switzerland	2001	Completed
Germany	2002	Completed
Belgium	2002	Completed
Denmark	2006	2009
Norway	2007	2009
Austria	2006	2010
Spain	2000/2005	2010
France	2005	2011
Czech Republic	2005	2011
UK	1998	2012
Italy	2003	2012

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Digital switch over and Digital divident

- DVB-T is an ITU standard and widely deployed
- Digital switchover will increase the spectrum usage efficiency.
- The analog terrestrial television channels use nearly 90% of the most valuable bands of spectrum below 1GHz.
- A large amount of spectrum can be released for new services (Broadcast, Mobile Telecom and Public Safety).
- WRC 2007 enables use of the “Digital Dividend”
  - (790 – 862 MHz) to be used for other services, like mobile.

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Government Role in the Transition

- The Government role in the transition is necessary to:
  - Support Public broadcasting
  - Ensure protection of Households
  - Secure continuity of terrestrial TV broadcasting service
  - Allow sufficient transition period for simulcast transmission.
  - Assure the awareness of citizens on the transition
  - Assure availability of the receiving equipment at affordable prices.
  - Sustain a competitive market between the broadcasters.
  - Allow new entrants fair access to digital broadcasting infrastructure.
  - Efficient use of Spectrum
  - After analogue switch off, the unused spectrum can be reused for broadcasting capacity and/or other services (mobile/broadband)

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Key challenges of the digital switchover

- Technical Challenges – size of the conversion task
  - Analogue transmitters to be replaced with digital equipment
  - New frequency planning, new frequencies for many transmitters, coverage issues
  - Share spectrum with analogue television, protect analog services during transition
- Consumer related challenges
  - Viewers have to buy new receivers, to adapt receive antennas
  - Difficulties for elder and less wealthy population to accept new technology

Big Investment !

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Scenarios for the Digital implementation

- Implementation of digital TV network can be done using:
  - Single Frequency Network Concept (SFN)
  - Multiple Frequency Network (MFN)
  - Near-SFN
  - SFN/MFN
- Implementation of digital switchover program can be realized:
  - Phased shut – Off : UK, Germany, Switzerland, France , Italy, Sweden, Austria, Spain, Czech Republic
  - National Shut- Off (USA, Finland, Netherland, Andorra, Luxembourg)

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DVB-T planning considerations

- Spectrum of one analog TV channel (8 MHz) can be used for (4-6) TV channels
- DVB-T can be deployed as a Single Frequency Network (SFN). The topology of Lebanon is suitable for SFN deployment (Delay difference less than guard time”1/4”)
- In DVB-T, adjacent channels can be used in same location
- DVB-T can be deployed on a channel adjacent to Analog TV with much lower power
  - Transmit power should be 12-20 dB (15-100 times) lower to provide similar coverage and to prevent interference to and from the analog TV channel

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DVB-T planning considerations (2)

- Existing 8 TV networks can be accommodated in 2 Muxs
- According to the actual frequency use there are “free” frequencies :
  - 33, 34, 46, 48, 58, 64, 65, 66, 67, 68, 69
- As of GE06, the channels registered to Lebanon and coordinated with neighbouring countries during RRC06 for DVB-T are:
  - Band III: 11
  - Band IV\V: 24, 36, 40, 43, 55, 57, 58, 60
- Given adjacent channel issues it is important to co-locate with the Analog TV station on the adjacent channel
- Seeding “cheap” DVB-T STB should be triggered

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Accelerated migration to Digital TV

- 2 national SFN networks or a combination of regional SFN networks is sufficient to allow parallel Analog & Digital TV
- A mixed MFN/SFN scenario could be deployed as an intermediate stage in the migration period before reaching the final SFN topology
- A mixed MFN/SFN scenario could be deployed as an intermediate stage in the migration period before reaching the final SFN topology:
  - Lebanon can be divided to regions
  - Define the free channels in each region in accordance to GE 06 Plan
- SFN is far more spectrum efficient & better coverage than MFN (constructive interference in overlap area if $\tau < GT$)

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Accelerated migration to Digital TV (2)

- Channel 58 can be used for SFN network on national basis
- The second carrier there are different options:

1. Broadcasters who are using GE 06 frequencies should migrate to the unused frequencies and in this case another SFN network can be deployed
2. Use different frequencies as of GE-06 plan in the different regions and in this case we have SFN/MFN scenario

- Another frequency may be needed to overcome time delay issues in some regions

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Joint broadcast infrastructure

Typically DVB-T is deployed as a joint broadcast network

Multiple Ch / Mux /Tx	Efficient use of spectrum	Better coverage with less interference	Shared backhaul transmission network	Same type of STB (platform)

A split between the actual broadcast transmission network & the media/content program would be a logical next step

Separate licensing for media/content and for operating the joint transmission network could be considered

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Centralized transmission network

- Advantages of using common transmission sites :
  - insures efficient spectrum using SFN,
  - reduce analogue to digital CAPEX,
  - reduce OPEX, currently each operator is using his infrastructure on an average of 20 transmission sites. Upgrade and operation cost of these sites/operator is significant vs. Use of common site
  - CAPEX & OPEX of transmission and broadcasting sites could be split by 8 if a single broadcasting network is established
  - The TV operator has to invest in content and new programs

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Who will be interested in the realization of the migration plan?

- Government, MoI, MoT, TRA, Broadcaster, Public, Telco Operators, etc… are involved, each entity will have a certain interest and role in the implementation
  - Government to protect customer rights, implementation of international agreements
  - MoI, to maintain media policy
  - MoT to benefit from new services and applications
  - TRA to maintain efficient use of spectrum, digital dividend, implementation of GE 06 and sustain market competition
  - Broadcasters to maintain continuity of service
  - Telco Operators to integrate broadcast services in their networks

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Conclusions

- Consultation with broadcasters is taking place to:
  - Verify capability of using co-channel & synchronization for FM transmission
  - Analyze the co-location issues for the main broadcasting locations to resolve near-far issues
- Migration plan
  - Phase/one time shut-off and simulcast transmission and period
  - Network topology SFN, MFN or combination
  - MPEG-2 or MPEG-4
- A joint broadcast infrastructure has been proposed
- A split between the actual broadcast transmission network and the media/content side would be a logical next step

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Thank you for your attention !!