



SECT A3 - HFC

EXAM TELECOM CAI Projecteren Wijknet

Case exam (version 1)

Exam duration: 180 minutes

Assignment booklet

Exam information:

- During the exam you are allowed to use a curvimeter, a scale ruler and a non-programmable calculator. You have to provide these items yourself.
- It is forbidden to bring notes, elaborations of (example) exam questions or elaborations of cases. During the exam it is expressly forbidden to use digital media such as laptops, telephones, PDAs, photographic equipment and other data carriers.
- For each question, the maximum points that can be obtained are stated.
- For this exam you can achieve a maximum of 50 points.
- The assignment booklet consists of 16 pages (including the cover).
- The exam has 3 separate attachments :
 - Attachment 2: "KLIC-melding" (9 pages A4-format)
 - Attachment 3a: Map of the existing situation, scale 1:1000 (A3-format)
 - Worksheet 3b: Map of the new situation, scale 1:500 (A3-format)
- Check the assignment booklet and the attachments for completeness.
- Answer all questions completely, this means, with unit if applicable.
- You work out your exam in **this booklet**. Note your answers **within the text boxes**. Only the answers that are written in this booklet within the text boxes are submitted for correction. The scrap paper will be destroyed after the exam. Elaborations on scrap paper are not assessed! Some of the assignments have to be elaborated on the worksheets. This is stated with the relevant assignments.
- Write clearly and with a black or blue pen. Drawings may be made in pencil.
- At the end of the exam, you hand in all the exam material.

You will receive an unsatisfactory score with a score of 35 points or less.
You will receive a satisfactory score at more than 35 points.

ANY FRAUD WILL RESULT IN IMMEDIATE EXCLUSION FROM THE EXAM.

Do not open this booklet until permission has been given.

Assignment

In an existing situation, some of the homes will be demolished and replaced by low-rise and high-rise buildings (see attachment 3a and worksheet 3b). The HFC network has a range of 5 MHz up to 1200 MHz (1.2 GHz).

1. 3 points

View the technical data in attachment A.

Calculate the minimum and maximum cable lengths and fill in worksheet 1a.

Check out the “mini-ster” list on worksheet 1b. Fill in the corrected “mini-ster” list as efficiently as possible

2. 2 points

View the “KLIC-melding” at attachment 2.

Fill in on worksheet 2 which cables, ducts and pipes are on point A (owner and function).

3. 14 points

View the map of the existing (old) situation in attachment 3a and the block diagram in attachment 4a.

Engineer the cable network for the new building on worksheet 3b (map new situation) according to the engineering instructions (attachment B).

Note: Only draw the infrastructure to be constructed.

The Durgerdamstraat, Gaasperdamstraat and Nieuwendamstraat are asphalted.

4. 14 points

The block diagram of the existing (old) situation is drawn on attachment 4a.

Enter on worksheet 4b:

- The block diagram of (all) the new situation;
- The lengths of the cables to the amplifiers in the block diagram;
- The input levels of all amplifiers at 1000 MHz in the block diagram;
- Show your calculation for one end amplifier (of your choice).

5. 3 points

Use worksheet 4b also for:

- Calculate the current through the power inserter(s) at the node of the new situation and show your calculation.
- Calculate the voltage for one end amplifier (your choice) and show your calculation.

6. 3 points

- Work out the complete “mini-ster” list of the end amplifier to which property Nieuwendamstraat 228 is connected on worksheet 6.

7. 6 points

At property Nieuwendamstraat 228, a source is connected directly to the groundblock with a return transmission level of 44 dBmV at 65 MHz.

Use worksheet 7 for:

- Draw schematically the components used.
- Calculate the level (65 MHz) of the fed-in return signal, measured at point A of the TIP01/N of the node. Show your calculation clearly.

8. 5 points

Fill in the calculation on worksheet 8. Calculate the total drop cable length of the new coax 9 cables to be laid using the average of the “mini-ster” list from worksheet 6.

Attachment A: Technical data

passive components

	Insertion loss out (dB)		Insertion loss tap (dB)		max. current
	5-65 MHz.	85-1000 MHz.	5-65 MHz.	85-1000 MHz.	
2-way splitter	4	4,5			
3-way splitter	6,5	7			
4-way splitter	7,8	8,5			
1-way tap 11 dB	2	2	10,5	10,5	
Wall outlet	1	1			
Power inserter	1	1			7,5

	Insertion loss out (dB)		Insertion loss tap (dB)		
	5-1000 MHz.		5-1000 MHz.		
TIP01/N	1,5		Injectionpoint (ip)	11 (A)	out → ip
			Testpoint (tp)	20 (B)	in → tp

AOP	Min. Level (dBmV@256QAM)	Max. level (dBmV@256QAM)
	-2	12

	Min. inputlevel (dBmV@256 QAM)	Max. inputlevel (dBmV@256 QAM)	Outputlevel (dBmV@256 QAM)		Return path gain per output (dB)	Current consumption
	85-1000 MHz	85-1000 MHz	85 MHz	1200 MHz	5-65 MHz.	mA
End amplifier	8	30	2x27	2x36	5	250
Group amplifier	8	28	2x25	2x33	7	250
Node			2x36	2x36		1000
wifi-AP	1					1200

Supply voltage	63 V AC
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Specifications multi-tap (values in dB)

pos.	Insertion loss 5-1000 MHz.
01	11
02	12
03	13
04	14
05	15
06	16
07	17
08	18
09	19
10	20
11	21
12	22
13 (connection for WiFi AP)	20

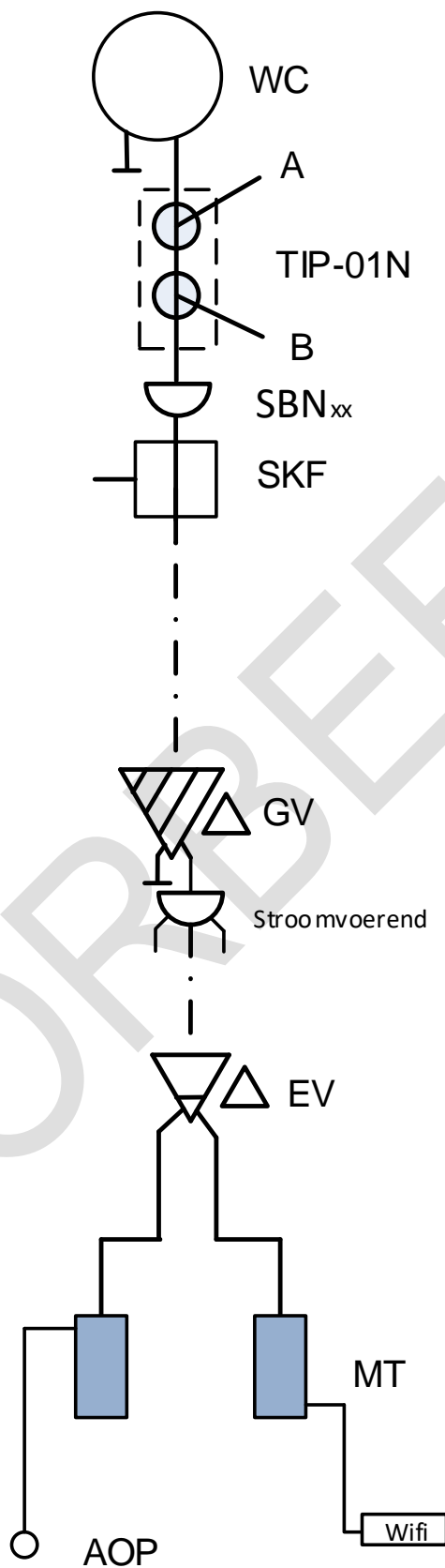
Specifications coaxial cable

	65 MHz.	85 MHz.	1000 MHz.	DC resistance 2-way
coax 3	1,6 dB	1,9 dB	6,4 dB	0,5 Ohm/ 100 m
coax 9	4,9 dB	5,6 dB	19,4 dB	-

Note: All coaxial losses are in dB/100 m.

Bijlage B: Engineering instruction

Current conducting splitters



- The design is assessed on economic aspects and must be optimal with regard to low costs (see calculation worksheet 8) and small deviation in signal levels on the groundblocks;
- If possible, use the existing infrastructure;
- Cascading group amplifiers is not allowed;
- Combination cabinets (end- and group amplifier in one cabinet) are not allowed;
- Looping through of group- and end amplifiers is not allowed;
- Applying multitaps outside the end amplifier cabinet is not allowed;
- Maximum 2 multi-taps per end amplifier;
- One Wi-Fi AP is connected per new end amplifier;
- After renovation, a maximum of 72 homes passed per group amplifier;
- Only the splitters and taps in group amplifier cabinets are current-carrying. The insertion losses of connectors and connection cables in the amplifier cabinets is negligible;
- Unused outputs must be de-energized and RF terminated;
- The cables must be located in public land (outside the property boundary);
- Breaking up asphalted roads is not allowed;
- The connections must be projected up to the meter cupboard at the front of the house/apartment;
- The length of the drop cables from the building entry to the ground block in the first meter cupboard is 20 meters in high-rise buildings and 5 meters in low-rise buildings;
- The distance between floors in a high-rise building is 3 meters;
- The locations of the amplifiers can be chosen freely, but attention must be paid to the lowest possible exposure to solar radiation and the accessibility of the cabinets (not in front of exits and garages).

Uitwerkblad 1a: Kabellengten

tap	Insertion loss 85 MHz.	Insertion loss 1000 MHz.	cablelength coax 9 minimum length (m)	cablelength coax 9 maximum length (m)
01	11	11	...	134
02	12	12	57	128
03	13	13	52	123
04	14	14	47	118
05	15	15	42	113
06	16	16	37	108
07	17	17	31	...
08	18	18	26	97
09	19	19	21	92
10	20	20	16	86
11	21	21	11	82
12	22	22	6	77
13	n.v.t.			

Calculate the maximum length for tap 7. Show your calculation.

Calculate the minimum length for tap 1. Show your calculation.

Worksheet 1b: "Mini-ster" list

End Amplifier number : 03-04				
MT 1			MT 2	
Tap	House number	Length (m)	House number	Length (m)
1	23	80	69	65
2	21	75	67	60
3	19	70	65	55
4	17	65	63	50
5	15	60	61	45
6	13	55	59	40
7	11	50	57	35
8	9	45	55	30
9	7	40	53	25
10	5	35		
11	3	30		
12	1	25		
13	n/a			

Gecorrigeerde versie:

End Amplifier number : 03-04				
MT 1			MT 2	
Tap	House number	Length (m)	House number	Length (m)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Worksheet 2: KLIC-melding

See separate attachment 2: KLIC-melding.

Which cables, ducts and pipes are on point A (owner and function)?

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Attachment 3: Maps

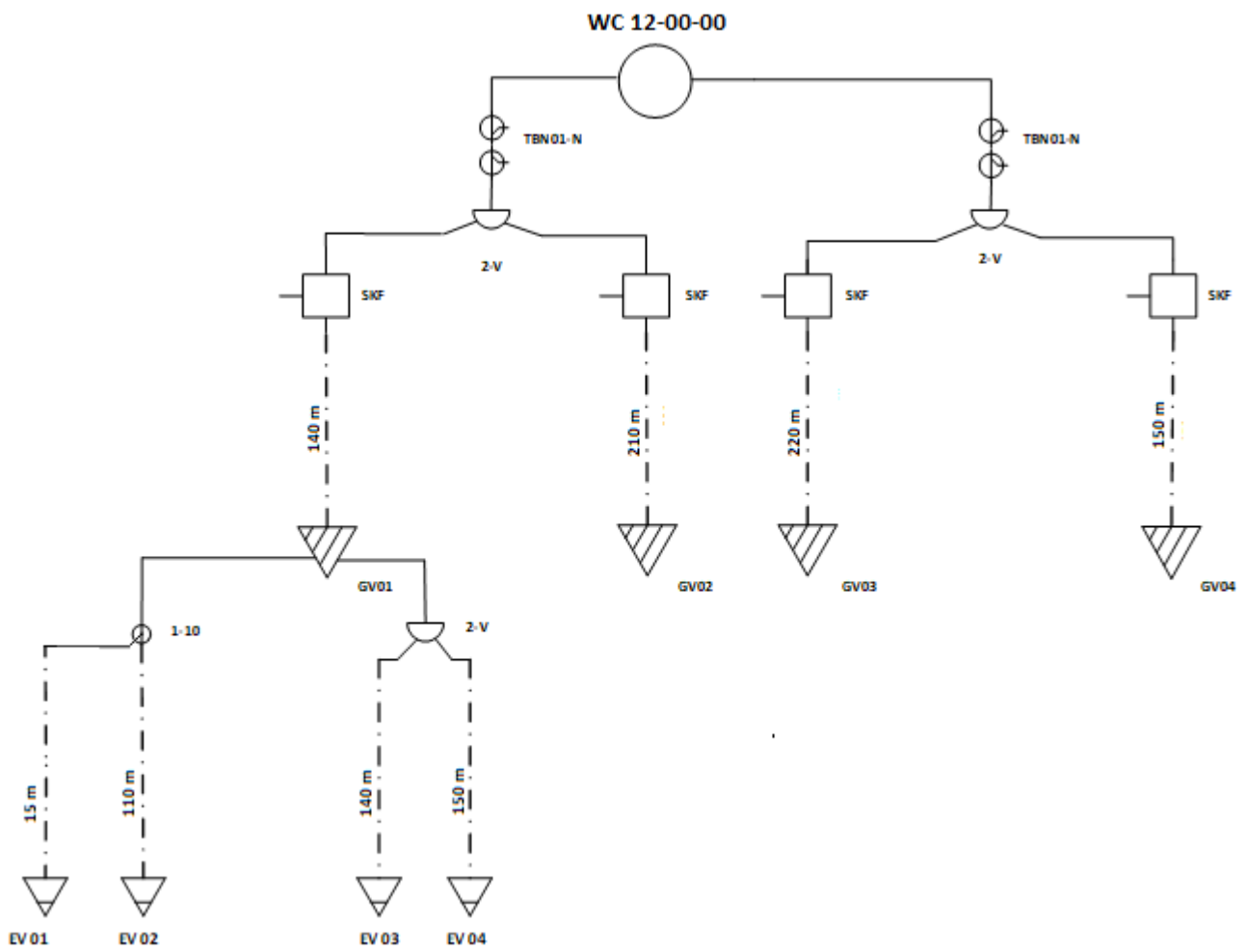
Attachment 3a: Map of the existing situation, scale 1:1000

Worksheet 3b: Map of the new situation, scale 1:500

See separate attached maps in A3 format of district WC0012.

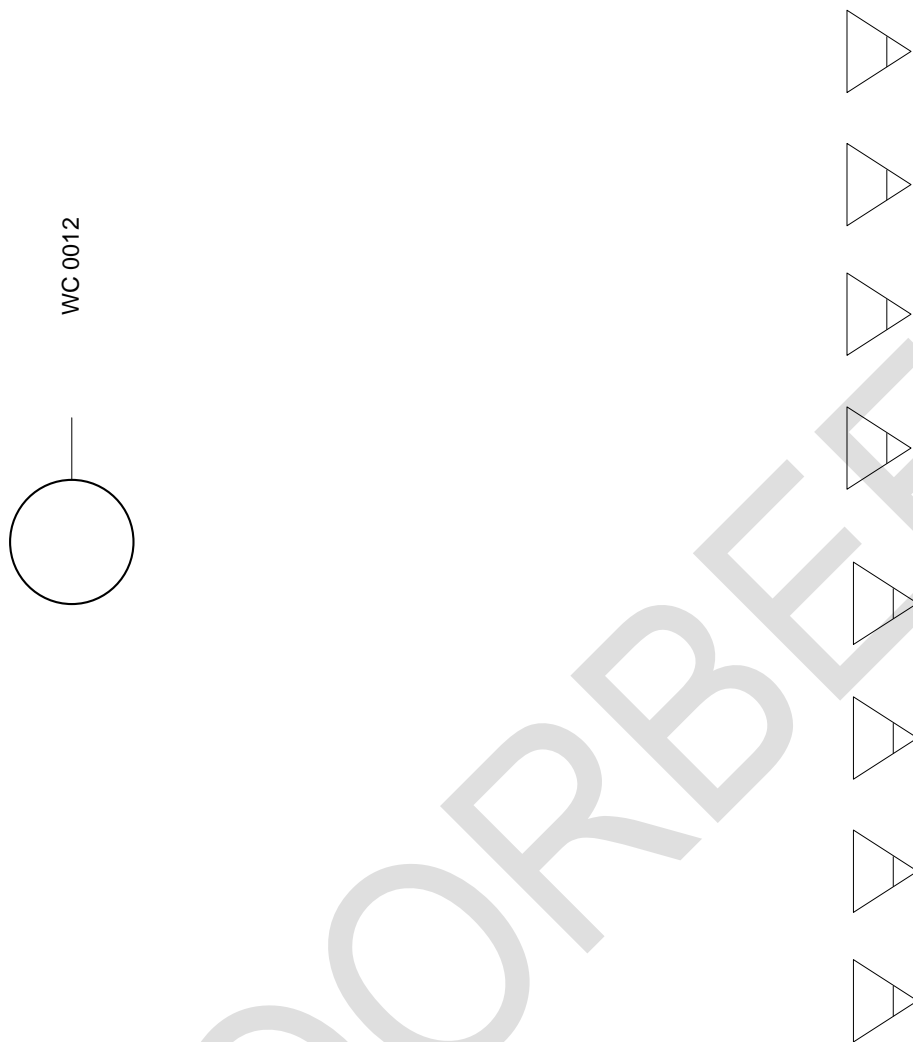
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Attachment 4a: Blockdiagram existing situation



Worksheet 4b: Block diagram new situation

(only RF downstream distribution)



Show your calculation of the input level at 1200 MHz of one End Amplifier (of your choice):

Show your calculation of the current through the power inserter(s) at the node in the new situation:

Show your calculation of the voltage at End Amplifier (of your choice):

Worksheet 6: "Mini-ster" list

Configuration of the ministar at end amplifier

	tap 1			tap 2		
tap	House number	Length (m)	Spare length (m)	House number	Length (m)	Spare length (m)
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13	n/a					

Worksheet 7: Schematic drawing

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Show your level calculation below:

Worksheet 8: Budget calculation

Please note: only fill in the parts you use.

Item description	amount	unit	Unit price (ex. VAT)	Total
Coax 3, unarmed, green		meter	€ 2,00	
Splice coax 3 - coax 3		piece	€ 20,00	
Coax 9 unarmed, green		meter	€ 0,50	
GA/EA cabinet		piece	€ 140,00	
Multitap flat(all ports connector type F)		piece	€ 24,00	
Multitap tilted (all ports connector type F)		piece	€ 25,00	
Power inserter (F-in/IEC-out)		piece	€ 20,00	
Group Amplifier (IEC)		piece	€ 145,00	
End Amplifier (IEC)		piece	€ 140,00	
Terminator F-male		piece	€ 0,50	
Current conducting divider/ tap (IEC)		piece	€ 27,00	
Terminator IEC-M14		piece	€ 1,50	
Non-current conducting divider/ tap (F)		piece	€ 1,50	
prefab cable IEC-IEC		piece	€ 8,00	
prefab cable IEC-F		piece	€ 7,50	
prefab cable IEC-C3		piece	€ 8,50	
prefab cable F-F		piece	€ 4,00	
Inhome wall-outlet complete		piece	€ 10,00	
artikelomschrijving arbeids-eenheden	amount			
Trenching price all-in		meter	€ 10,00	
Streetcrossing including duct		meter	€ 15,00	
“boogzinker”		meter	€ 150,00	
Installing and assembling GA/EA		piece	€ 260,00	
Adjusting GA/ EA		piece	€ 40,00	
Entering drop cable and assembling inhome wall-outlet		piece	€ 80,00	
Splicing coax 3 - coax 3		piece	€ 15,00	

Total price	
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