

 Coordinator	 TEKNIILLINEN KORKEAKOULU TEKNISKA HÖGSKOLAN HELSINKI UNIVERSITY OF TECHNOLOGY	 Antti Räisänen (TKK)								
Involved institutions	TKK (ID 5)									
Name of the course	Antenna measurements at millimetre and submillimetre wavelengths			Type						
				M	D	A/D	A			
Place	TKK (formerly HUT) - Helsinki			Date: 23-27 May, 2005						
Summary (2000 words)	<p>Testing of large (high-gain) satellite antennas at submillimetre wavelengths is a formidable task. The classical far-field method has two major obstacles at submm wavelengths: impractically large measurement distance and high atmospheric loss.</p> <p>The near-field scanning method has been used with some success up to 650 GHz. The applied near-field methods give useful information only on the main beam and its vicinity, because the field-sampling is typically very sparse. Reflector-based compact antenna test range (CATR) measurements have been carried out up to 500 GHz. Recently, also hologram-based CATR measurements have been carried at 322 GHz. This short course discusses the techniques and limitations of the various test methods, and introduces the participants to the hologram-based CATR and near-field scanning also through laboratory demonstrations/exercises. The participants have a choice to study a related specific topic prior to the short course, write a brief report and present that to other participants during the course.</p> <p>The lectures include the following: introduction, mm- and submm-wave instrumentation, near-field scanning, near field to far field transformation, compact antenna test range (CATR), CATR based on reflectors, CATR based on a lens, CATR based on a hologram, site definition, hologram design, hologram fabrication, construction of a hologram based CATR, quiet-zone testing, antenna testing in a hologram based CATR, analysis of measurement results, future developments.</p> <p>The laboratory demonstrations (exercises) include the following:</p> <ul style="list-style-type: none"> - measurement of a horn antenna - scanning of near field or quiet zone field - antenna measurement in a hologram CATR - elimination of disturbing scatterer effect in a CATR 									
Structure of the course	Lectures	Experimental labs.	Computer exercise	Total	Credits	Assessment typology				
	16	8	-	24	1 - 3	attendance – 1cr special assignment - 1 or 2 cr				
Teachers	Name			Organization			Title			
	Antti Räisänen			TKK			Prof.			
	Arto Lehto			TKK			Adjunct Prof.			
	Juha Ala-Laurinaho			TKK			Dr.			
	Juha Mallat			TKK			Dr.			
	Janne Häkli			TKK			Mr., Lic.Sci.			
	Tomi Koskinen			TKK			Mr., Lic.Sci.			
	Anne Lönnqvist			TKK			Ms., Lic.Sci.			
	Ville Viikari			TKK			Mr., Ms.Sci.			
Availability of dedicated structures	College rooms		Dedicated Labs		Classrooms		Computer rooms		Canteen	
	yes	not	yes	not	yes	not	yes	not	yes	not
■		■		■		■		■		

ACE short course: Antenna measurements at submillimeter wavelengths

SCHEDULE:

Monday 23 May 2005: Introduction to submm-wave measurements

Hour	Topic	Teacher
9-10	Presentation and introduction	A. Räisänen
10-11	Antenna measurements; general	A. Räisänen
11-12	Specific aspects at mm- and submm-wavelengths	A. Räisänen
12-13	Lunch	
13-14	Submm-wave instrumentation	J. Mallat
14-16	Laboratory: Measurement of a horn antenna at 310 GHz using VNA	J. Mallat

Tuesday 24 May 2005: Near-field measurement

Hour	Topic	Teacher
9-10	Near-field measurements; general	J. Ala-Laurinaho
10-12	Near-field scanning and transformation from near-field to far-field	J. Ala-Laurinaho
12-13	Lunch	
13-14	Instrumentation aspects	J. Ala-Laurinaho
14-16	Laboratory: Near-field scanning	A. Lönnqvist, T. Koskinen

Wednesday 25 May 2005: Compact antenna test ranges (CATR)

Hour	Topic	Teacher
9-10	CATR in general; reflector and lens CATR	A. Lehto
10-11	Radar cross section measurement in CATR	A. Lehto
11-12	Hologram CATR: amplitude and phase holograms	J. Häkli
12-13	Lunch	
13-14	RCS measurement in a phase-hologram CATR	A. Lönnqvist
14-16	Laboratory: Antenna measurement in a hologram CATR	V. Viikari
19-22	Dinner	

Thursday 26 May 2005: Hologram CATR

Hour	Topic	Teacher
9-10	Computer-generated hologram: design	T. Koskinen
10-11	Hologram fabrication and construction of a hologram CATR	A. Lönnqvist
11-12	CATR quiet-zone testing and antenna measurement	J. Häkli
12-13	Lunch	
13-14	Antenna pattern correction and range evaluation techniques	V. Viikari
14-16	Laboratory: Elimination of disturbing scatterer effect in a CATR	V. Viikari

Friday 27 May 2005: Student seminar and exam

Hour	Topic	Teacher
9-12	Seminar with student presentations. Conclusions	A. Räisänen et al.
12-13	Lunch	
13-15	Exam	A. Räisänen

Special assignment

Topics for special assignment:

- 1) Antenna measurement campaigns at frequencies above 100 GHz
- 2) Effects of atmosphere in THz antenna testing
- 3) Mechanical problems in near-field scanning
- 4) Comparison between different near-field facilities
- 5) Horn antennas at submm-wavelengths
- 6) Antenna elements for antenna arrays at submm-wavelengths
- 7) Suggest your own topic!

If a student is interested in a special assignment worth of extra ECTS points, he/she must select a topic from the list above or suggest his/her own topic to the course coordinator, and write a report of 5-15 pages (based on the available literature), and make a PowerPoint presentation of 20 minutes in the seminar on Friday, 27th of May. The report and PowerPoint presentation must be submitted to the course coordinator through email by Friday, 20th of May.