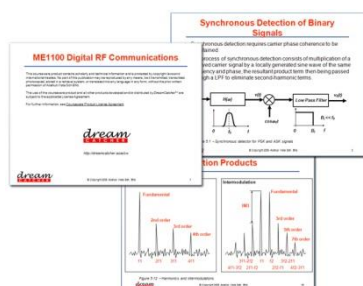


# ME1100

## Digital RF Communications Courseware

### Teaching slides

- Editable Microsoft® PowerPoint® slides
- Covers 45 hours of teaching



### Training kit

- Digital RF communications kit
- IQ signal generation software
- Lab sheets & model answers
- Problem-based assignments
- Covers 24 hours of labs



Target university subject	Target year of study	Prerequisite(s)
Digital RF Communications	2nd or 3rd year undergraduate	Principles of Communications

The ME1100 serves as a ready-to-teach package in the area of digital RF communications. This is a lecturer resource consisting of teaching slides, training kits, lab sheets, and problem-based assignments.

### Designed to impart knowledge in

- Digital communication fundamentals
- Digital modulation techniques
- Baseband and RF transceiver analysis
- Transceiver architectures
- Baseband generation software tools usage
- Measurement instruments usage

### Benefits of the ME1100 courseware

- The digital RF communications kit is divided into two separate modules—a low-frequency module and a high-frequency module—that can be used individually. Students are given the flexibility to mix and match various circuits to build a typical transmitter.
- Lab sheets are specially designed to allow students to gain exposure on the use of industry-grade instruments and to demonstrate an end-to-end digital RF communication system.
- Various digital modulation schemes can be easily simulated using the IQ signal generation software and generated through function generators.
- The courseware allows students to easily perform signal demodulation, spectrum analysis, and baseband signal quality evaluation using the VSA software. It can also serve as a troubleshooting tool.
- You can start up a lab with basic instruments, and add RF instruments later to enhance your lab coverage.





## Teaching Slides

More than 500 editable Microsoft PowerPoint teaching slides, covering 45 hours of teaching for one full semester are provided. The slides cover the following topics:

- Principles of Communications
- Amplitude Modulation
- Frequency Modulation
- Baseband Pulse Transmission and Digital Modulation Techniques
- Coherent/Non-Coherent Detection and Link Analysis
- Transmitter and Receiver Architectures
- Troubleshooting a Digital RF Communications Transceiver

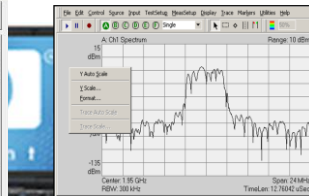
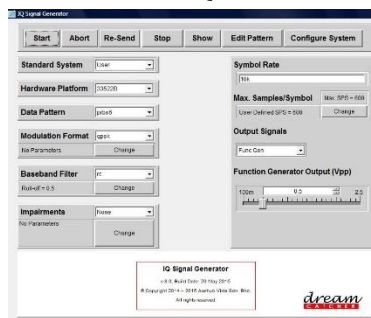


## Training Kit

### Experimental Setup

Mobile communication standard signals are generated by the provided IQG software through the recommended function generator. The I & Q signals are then fed into the IQ modulator (on board of the digital RF communications kit) to modulate and up-convert to 10MHz carrier.

#### DreamCatcher IQG



PC running IQG software and  
89601B VSA software

USB-to-USB  
connection

USB-to-USB  
connection

Function Generator



DSOX 1202A Oscilloscope



I-signal

Q-signal

Digital RF  
communications kit



The digital RF communications kit requires two function generators to provide the IQ baseband signals.

The low-frequency module contains a 10 MHz IQ modulator used to generate an IQ modulated RF signal, which is then analyzed by the VSA software on the oscilloscope.



## IQ signal generation (IQG) software

The IQ Signal Generator software is an Keysight VEE (Visual Engineering Environment) program that controls the function generators via USB to generate various IQ baseband signals. It requires the Keysight VEE runtime (downloadable from Keysight website) engine to be installed on the PC.

**IQG settings:**

**Modulation schemes:** BPSK, QPSK, OQPSK, 8PSK, 16QAM, 32QAM, 64QAM and MSK

**Filter types:** Raise Cosine, Root Raise Cosine, Gaussian, Chebyshev and Rectangular

**Data formats:** PRBS6, PRBS7, PRBS9, PRBS10 and PRBS11

**Impairments:** In-band noise, Wide-band noise, IQ imbalance, IQ offset, Quadrature error, IQ rotation, Interference tone, Quantization

Note: A PC with Windows® OS is required to run the IQ Signal Generator software and Keysight VSA software.

## Lab sheets

The training kit includes 8 lab sheets in editable Microsoft Word format. Each lab requires 3 hours to complete. Model answers are provided with all lab sheets. The required instruments for the labs are listed below.

Lab Sheet	Required Items
	Function Generator & Oscilloscope with VSA software
Maximum Output Power Verification	√
Occupied Bandwidth Measurement	√
Error Vector Magnitude Measurement with Noise & Interference	√
Spurious and Harmonic Signal Measurement	√
Adjacent Channel Power Ratio Measurement	√
Peak-to-Average Power Ratio and CCDF Measurement	√
Spectrum Analysis of CDMA Signals	√
I/Q Imbalance and Offset Analysis	√

## Problem-based assignments

The problem-based assignments below allow students to enhance their problem-solving skills.

- RF Transceiver Measurement and Analysis
- Digital Communication System Design
- IQ Modulator Performance Analysis



## Instruments

The recommended instruments and software from Keysight Technologies, to be purchased separately, are listed below.

Instrument / Software <sup>[1]</sup>	Model
Function Generator	1 unit of 33512B Dual-channel Function Generator [with option MEM]
Oscilloscope with VSA Software	Minimum 100 MHz Oscilloscope: DSOX1202A with option 100 PathWave VSA 89600C Custom Modulation Package includes 89601200C/89601AYAC/89601BHFC  For qualified education customers (check with your local Keysight office): 89600EDU-E01: 89600 VSA software, educational instructor license 89600EDU-E15 : 89600 VSA software, educational student license, 15 seats, floating license

[1] Refer to the Lab sheets section for the instrument selection.

[2] The DreamCatcher IQ Signal Generator software can only support these models of function generator



# Training Kit Hardware Specifications


	Low-Frequency Module	High-Frequency Module
<b>RF</b>		
IQ modulator conversion loss		
< 7.0 dB		
IQ modulator DC offset		
< 0.09 mV		
Filter passband (3 dB)		
5.4 MHz to 13.3 MHz		
794 MHz to 1233 MHz		
<b>General</b>		
Input voltage		
4.5 V (min)		
5.5 V (max)		
Input current		
22 mA (typical)		
EMC designed to		
IEC61326-1:2005 / EN61326-1:2006		
CISPR11:2003/EN55011:2007		
Group 1, Class A		
Warranty		
1 year		

## Ordering Information

Description	Package	Product Number
Teaching Slides	1 user license	ME1100-100
Training Kit (same HW kit as in ME1120)	1 set	ME1100-200
Teaching Slides + Training Kit	1 user license + 1 set	ME1100-300
Instruments	where applicable	Purchase separately from Keysight or its distributor

Note: Pictures in this document are for illustration purposes only, and they may be different from the actual product.

Training courses related to subject matter are available on request. Visit [dreamcatcher.asia](http://dreamcatcher.asia) for details.

<p>For more information or enquiries:</p> <p>Website: <a href="http://dreamcatcher.asia/cw">dreamcatcher.asia/cw</a> E-mail: <a href="mailto:cw.sales@dreamcatcher.asia">cw.sales@dreamcatcher.asia</a></p> <p>Acehub Vista Sdn Bhd (785702-P)</p> <p>70-03-79, D'Piazza Mall, Jalan Mahsuri 11900 Bayan Lepas, Penang Malaysia</p>	<p>© 2010-2011 Acehub Vista Sdn Bhd</p> <p>We reserve the right to change or alter the information in this material without prior notice. The information provided in this material is accurate as of the print date.</p> <p>Microsoft, Windows, and Office Programs are trademarks of Microsoft Corporation in the United States and/or other countries. All other copyrights and trademarks belong to their respective owners.</p> <p>Updated on 1<sup>st</sup> Feb 2024</p> <p></p>
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