RadiGen®

Product Manual

RF Signal Generator

Plug-In Card for the Radi***C***entre®

Models:
RGN0230A
RGN6000A
RGN6000B

CERTIFIED
ISO 9001

Radi*G*en® Product Manual

This service and operating manual pertains to the Radi*G*en® plug-in card.
Models: RGN0230A, RGN6000A and RGN6000B.
Made by DARE!! Instruments.

We ask that you read this manual carefully before operating your new product and adhere to any safety instructions it might contain.

A Quick Start Guide has been added to this product for your convenience. This double printed A4 sheet contains the basic start-up steps and the safety warnings for the Radi*G*en®.

Please keep the Quick Start Guide (and this regular manual) close at hand when you operate your new Radi*G*en®.

Please contact DARE!! Instruments or your local reseller if you have any questions.

Supplier Information

DARE!! Products B.V.
Vijzelmolenlaan 3
3447 GX, Woerden
The Netherlands

Tel.:   +31 (0)348 41 65 92
Fax: +31 (0)348 43 06 45
Internet: www.dare.eu
Email: instruments@dare.eu

<div align="right">

Radi*G*en® manual v.2.6
Published on: 2019-08-12
By: DARE!! Instruments

</div>

Table of Content

WARNINGS & PRECAUTIONS

Read the contents of the product manual (including the manual for the RadiCentre® system) and become familiar with the safety markings, instructions, operation and handling of the system.

This equipment is designed to be used as a plug-in card for the RadiCentre®. Do not use this card in combination with any other main frame.

To make the RadiGen® as safe as possible, this plug-in card has its own safety interlock system that is designed to work with the RadiCentre®.

Only qualified service personnel is allowed to carry out adjustments, maintenance or repairs on the equipment.

The RadiGen® contains materials that can be recycled and reused to minimize material waste. At the 'end-of-life', specialized companies can dismantle the discarded system to collect the reusable and recyclable materials. If your product is discarded at its 'end-of-life', please return it to your local reseller for recycling.

1 Introduction

1.1 Product Introduction

The primary signal of an EMC immunity test system is generated by a RF signal generator. It produces a modulated or un-modulated RF signal at a certain frequency and signal level. The Radi*G*en® generators are designed for EMC test purposes in order to perform fast and accurate EMC tests without the need for external modulation sources.

1.2 Related Products

Radi*C*entre® system

The Radi*C*entre**®** is a modular EMC test system that serves as the user and computer interface for all the Radi*C*entre**®** plug-in cards and modules (such as the Radi*F*ield**®** system).

Radi*M*ation**®** software

Radi*M*ation**®** is the EMC software package from DARE!! Instruments used for remote control and automated testing of the Radi*C*entre**®** plug-in cards and modules (such as the Radi*F*ield**®** system).

2   The Radi*G*en®

2.1   Product Description

The Radi*G*en® RF signal generator is available in three models, covering a frequency range from 9 kHz to 6 GHz., offering the perfect solution for most conducted and radiated immunity test applications.

The generators provide CW, AM and pulse modulated signals, using an internal modulator. The on/off times of the pulses can be set individually from 200 nanoseconds to 100 seconds offering extremely flexible configuration. It is also possible to apply gating on the pulse modulation in order to test according to Automotive Radar Pulse Tests as prescribed in automotive standards such as Ford, GM and PSA.

The RGN6000B full range RF signal generator has two outputs (SMA connectors). One output for the low frequency band (9 kHz to 230 MHz, mostly used for conducted immunity measurements) and a second output for the higher frequencies (80 MHz to 6 GHz, mostly used for radiated immunity measurements). With these two outputs there is no need for an RF switch.

The Radi*G*en® is an accurate RF signal generator with a frequency error of less than 20 ppm and modulation accuracy of 2 %. These figures make it the perfect device for EMC immunity testing. Problems with non-monotone behavior and glitches in the output level are often encountered with generators using fixed step attenuators. The Radi*G*en® generator makes use of a full range, analogue output attenuator. This results in a complete monotone increase of the output level without any glitches. As a result, problems with leveling algorithms in EMC test software cannot occur with this generator. In addition, mechanical defects to the output attenuator cannot occur, resulting in a better Mean Time Between Failures.

All Radi*G*en® plug-in cards are intended to be used in the Radi*C*entre® CTR1004B and CTR1009B. It is not possible to use the Radi*G*en® plug-in cards in the CTR1001S model.

2.2   Components

The Radi***G***en® plug-in card is delivered with the following items:

- Radi***G***en® plug-in card, model: RGN0230A, RGN6000A or RGN6000B
  A RF signal generator plug-in card to be used in the Radi***C***entre® system.

Supporting documentation in the form of:

- USB stick containing the (digital) User Manual and Quick Start Guide
- Hardcopy of the Quick Start Guide

2.3   Different Models

The Radi***G***en® is available in 3 models; the RGN0230A, RGN6000A and RGN6000B. The differences between these models is the frequency range that each model covers.

- Radi***G***en® RGN0230A - 9 kHz to 230 MHz

- Radi***G***en® RGN6000A - 80 MHz to 6 GHz

- Radi***G***en® RGN6000B - 9 kHz to 6 GHz

3   Installation

3.1   Hardware Configuration[1]

The hardware configuration is carried out in the following 7 steps:

1. Choose the slot of the Radi**C**entre® system in which you want to install the plug-in card.

2. Remove the blind panel from this slot by removing the four screws of the panel (two on top and two at the bottom). See Figure 1.

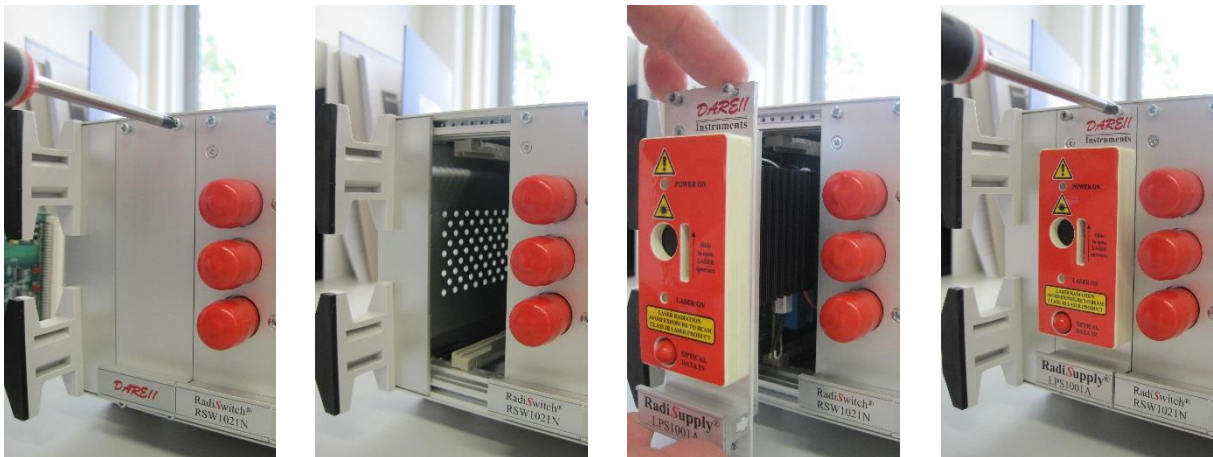3. Gently insert the plug-in card into the slot of the Radi**C**entre® and reinsert the four screws. See Figure 1.

Figure 1: Example of a (Radi*S*upply® LPS1001A) plug-in card installation

4. Switch on the Radi**C**entre® system. The new plug-in card will automatically be detected and initialized by the Radi**C**entre®.

5. Connect the plug-in card to the desired device(s).

Steps 6 and 7of the hardware configuration are visible on the next page.

---

[1] These are the basic steps in a plug-in card installation, the exact installation of your plug-in card might vary.

6. Connect the Radi*C*entre® system to your PC using any of the available interfaces of the Radi*C*entre® system; USB, RS232, Ethernet or IEEE-488 (optional).

7. Place the interlock plug of the plug-in card into the interlock connector of the Radi*C*entre®.

The hardware installation for the plug-in card is now complete. The user can control the plug-in card either through the touchscreen on the Radi*C*entre® system (only available for the 2 and 7-slot versions), or by using the control commands in combination with an external software package such as the Radi*M*ation® EMC test software.

3.2 Software Configuration

In order to control the Radi**G**en® from a computer, one can use either custom made software or the Radi**M**ation® EMC software package from DARE!! Instruments (to be purchased separately). If the Radi**G**en® is operated manually, this chapter can be skipped.

If Radi**M**ation**®** software is used; select the required device driver for the Radi**G**en®.

3.2.1   Radi**M**ation® software

1. Configure the Radi**M**ation® software for a Radi**G**en® / Radi**C**entre® signal generator. Configure a device driver and select the correct communication port.

2. In the 'equipment list' that you are using, select the 'signal generator' device driver.

Radi**M**ation® is now ready for use with the Radi**G**en® / Radi**C**entre® signal generator.

The Radi**M**ation® software package verifies the generator at the beginning of each test (if a signal generator is selected).

If you are using the Radi**G**en® / Radi**C**entre**®** signal generator system with any other EMC test software package, we refer you to chapter 5 'Radi**G**en® Command Set'.

4   Using the Radi*G*en®

4.1   Manual Control[2]

Once the Radi*C*entre® is switched on, the Radi*G*en® can be activated from the 'main' screen on the Radi*C*entre® touchscreen.

Use the Radi*G*en® 'status' button in the main screen to access the control screen of the Radi*G*en® (visible in Figure 2). Basic changes to the generator setting can be made in this screen. The buttons in this screen are divided over separate layers. The top row contains buttons regarding the frequency setting, output power and the 'Carrier' On/Off button.
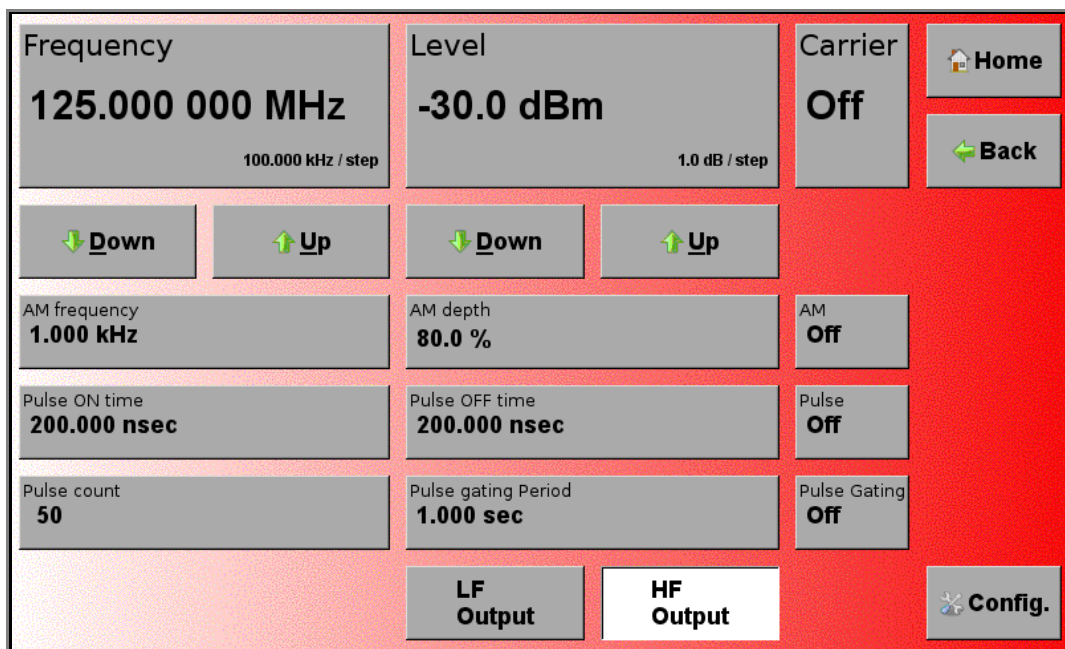

Figure 2: Example of the Radi*G*en® control screen

By pressing the 'Frequency' or 'Level' button, a numeric window (visible in Figure 3) will appear in which the new value can be entered. After selecting the desired unit (for example "dBm"), the control screen will appear again.

The third row (below the up and down buttons) of the control screen contains buttons regarding the main parameters for the amplitude modulation; the AM frequency and modulation depth. By pressing the 'AM Frequency' or 'AM Depth' button, a new numeric window (specific to the chosen parameter) will appear in which the new settings can be entered. After selecting the desired unit, the Radi**G**en ® control screen will appear again. The modulation can be switched on and off with the 'AM' On/Off button.
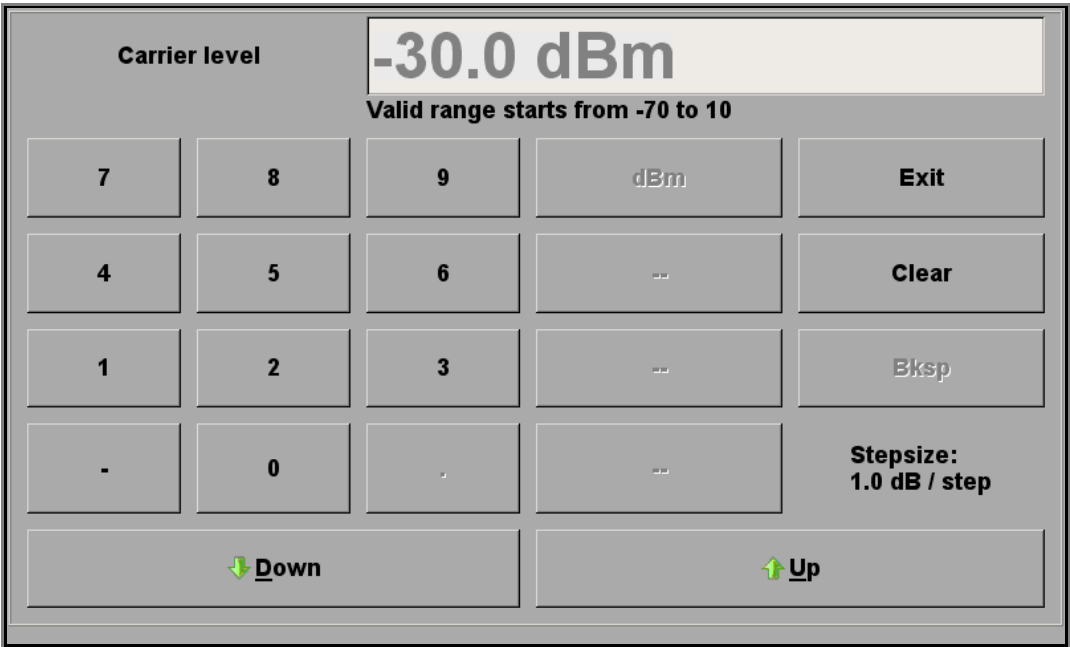

Figure 3: Example of the 'carrier level' numeric window

The fourth row (underneath the AM settings) of the control screen contains buttons to control the pulse modulation. The pulse modulation can be set by entering values for the on- and off-time of the pulse. By pressing the 'Pulse ON time' or 'Pulse OFF time' button, the related numeric window will appear in which the desired values can be entered. After selecting the desired unit (for example "nsec"), the control screen will appear again. The pulse modulation can be enabled or disables by the 'Pulse' On/Off button.
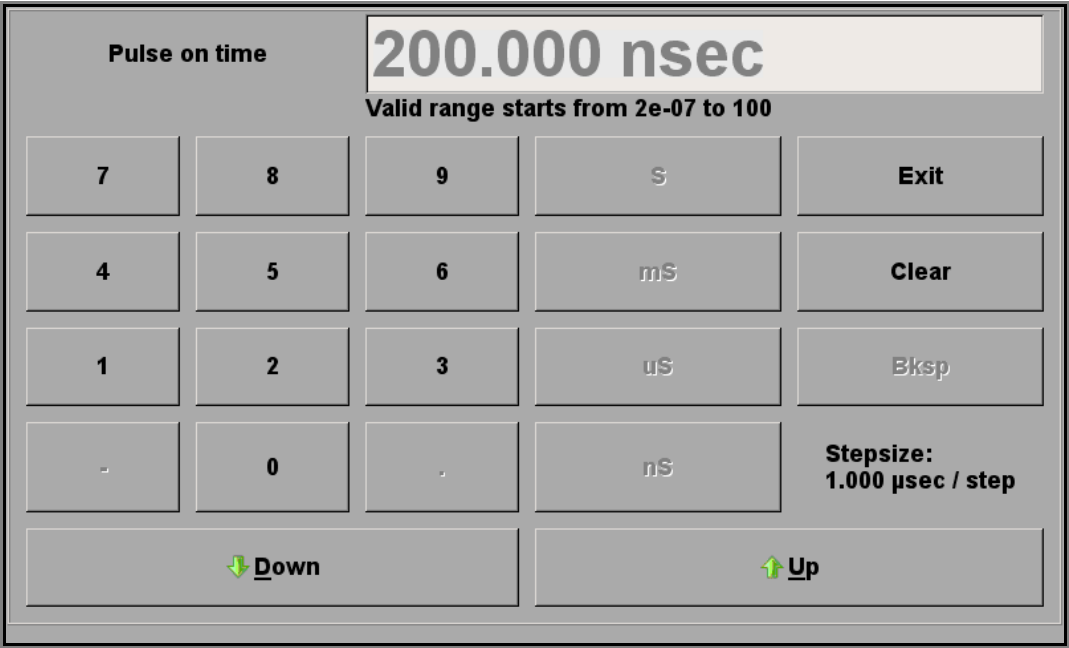
Figure 4: Example of the 'pulse on time' numeric window

When using Pulse modulation, in the fifth row, bursts of pulses can be created by enabling the gating function. This so called 'Gated pulse modulation[3], or burst mode, is used to generate RF bursts according to the Automotive Radar Pulse standards, like Ford and PSA. The number of pulses per burst and the total period time of the gate modulation can be set. Refer to the appendix (Explanation and Examples Regarding Gated Pulse Modulation) for further explanation and examples regarding the use of the Gated Pulse Modulation function.

---

[3] Gated Pulse Modulation is supported from firmware version 2.32 and later. Upgrade to this version to use this Modulation type.

The bottom row of the control screen contains an 'Up' and 'Down' button to 'step' through the range of the parameters on the screen. For example, if the 'Level' button is selected, pushing the 'Down' button will decrease the output level by one step. The step sizes can be set in the configuration screen. By pressing the 'Config' button from the control screen, the configuration screen is displayed (visible in Figure 5). The configuration options that will be displayed is dependable of the settings in the control screen.

The step size for the parameters switched on in the control screen can be set from this configuration screen. By selecting one of the step buttons, a numeric window appears where the new value can be entered. By pressing the unit, the value will be entered.
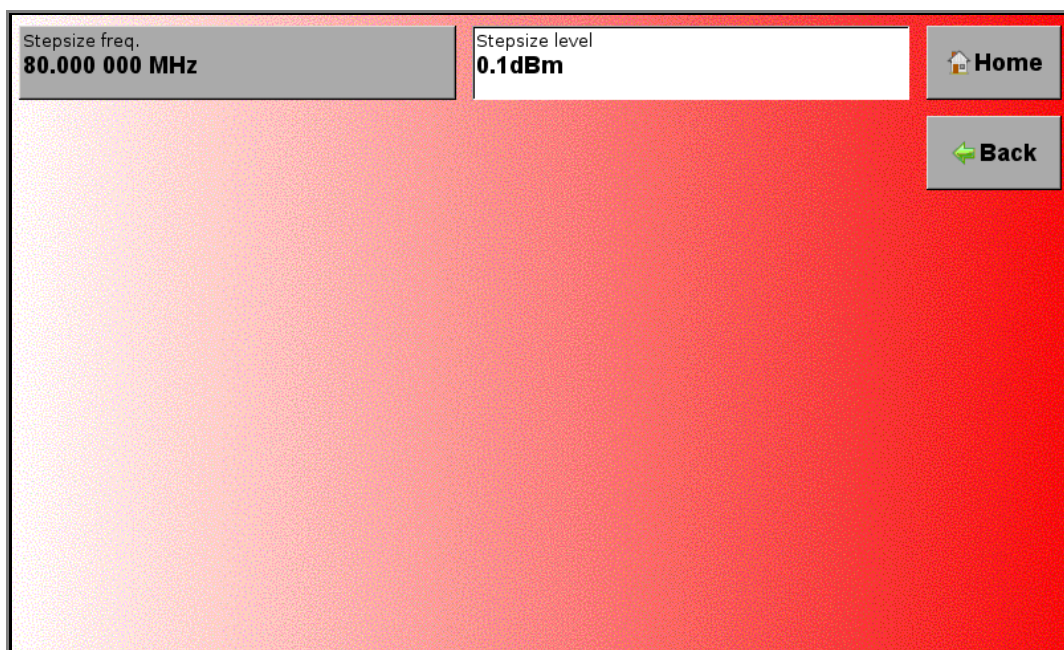

Figure 5: Example of the Radi*G*en® configuration screen

4.2   Remote Control

The Radi*G*en® can be controlled remotely through the interfaces of the Radi*C*entre®. The exact communication protocol can be found in the Radi*C*entre® manual. The specific commands for the Radi*G*en® are shown in chapter 5 'Radi*G*en® Command Set'.

5 Radi*G*en® Command Set

The commands listed in the following tables can be used to control the Radi*G*en® plug-in card. For use in the Radi*C*entre® CTR1004B or CTR1009B, a prefix must be used for each command. This prefix, or device number, corresponds with the slot number of Radi*C*entre®. Please refer to the Radi*C*entre® manual for more information on the 'Device number' of a module.

5.1 Understanding Command Set

The command tables contain the 'full' commands. These commands can also be entered in several shorter version.

Example 1 - **:[SOURce]:FREQuency?**
Requesting the state of the carrier frequency can be entered as followed:

- **:[SOURce]:FREQuency?**
- :[SOURce]:FREQ?
- :[SOUR]:FREQuency?
- :[SOUR]:FREQ?
- :FREQuency?
- :FREQ?

Example 2 - **:[SOURce]:FREQuency<space><value>**
Setting the state of the carrier frequency (to, for example: 50.000.000 Hz) can be entered as followed:

- **:[SOURce]:FREQuency 50000000**
- :[SOURce]:FREQ 50000000
- :[SOUR]:FREQuency 50000000
- :[SOUR]:FREQ 50000000
- :FREQuency 50000000
- :FREQ 50000000

5.2 Understanding Command Replies

The replies from the Radi*G*en® are always preceded by the command that they reply to.

Example 3 – reply to **:OUTPut:SELECTed?**
This command returns the current active output. The reply can be: '1' (= main output is selected) or '2' (= secondary output is selected). The reply will be given as:

- 'OUTPut:SELECTed 1' or 'OUTPut:SELECTed 2'

5.3 Commands

The following tables show the various commands for the Radi**G**en®.

5.3.1 SCPI commands

Command	Description & Reply
:*CLS	Clears the status byte and event status enable register. STB (Status Byte) and ESR (Event Status Enable Register) are set to 0.
:*ESE?	ESE (Event Status Enable). Returns the result of the standard event enable register. Reply: <value> = number from 0 - 128
:*ESE<space><value>	ESE (Event Status Enable). Set bits in the standard event status enable register. <value> = number from 0 - 128
:*ESR?	ESR (Event Status Enable Register). Returns the ESR. Reply: <value> = number from 0 - 128
:*IDN?	Get the device identification, this consists of: <company name>, <model number>, <firmware revision> For example: DARE!!, RadiGen RGN6000B, 2.1.5
:*OPC?	Query whether the last command has been executed. Reply: '0' = not executed Reply: '1' = executed
:*RST	Reset all parameters to their specified default values.
:*SRE?	SRE (Service Request Enable). Reads the current state of the service request enable register. Reply: <value> = number from 0 - 128
:*SRE<space><value>	SRE (Service Request Enable). This command enables bits in the service request register. <value> = number from 0 - 128
:*STB?	STB (Status Byte Query). Reads the value of the instrument status byte. Reply: <value> = number from 0 - 128

5.3.2 General commands

Command	Description & Reply
:SVERsion?	Get the current software version.
:HVERsion?	Get the current hardware version.
:[SENSe]:TEMPerature?	Get the current device temperature (in °C).
:[SENSe]:TEMPerature:MINimum?	Get the minimum temperature (in °C) under which the device can operate within specifications.
:[SENSe]:TEMPerature:MAXimum?	Get maximum temperature (in °C) under which the device can operate within specifications.
:SYSTem:PRESet	Reset all the user parameters. This command does the same as *RST.
:SYSTem:SAVECONfiguration	Save the current system parameters.
:ID_number?	Get the system ID number.
:SYSTem:VERSion?	Get the system version.

5.3.3 Carrier frequency commands

Command	Description & Reply
:[SOURce]:FREQuency?	Get the carrier frequency.
:[SOURce]:FREQuency?<space><value>	Set the carrier frequency. <value> = frequency (in Hz), for example: 50000000 <value> = UP <value> = DOWN
:[SOURce]:FREQuency:STARt?	Get the start frequency.
:[SOURce]:FREQuency:STARt<space><value>	This is the lowest carrier frequency that can be set. For frequency stepping, the generator is set to this frequency when the next step will be bigger than the stop frequency. <value> = start frequency (in Hz), for example: 80000000
:[SOURce]:FREQuency:STOP?	Get the stop frequency.
:[SOURce]:FREQuency:STOP<space><value>	This is the highest carrier frequency that can be set. For frequency stepping, the generator is set to this frequency when the next step will be smaller than the start frequency. <value> = stop frequency (in Hz), for example: 4200000000
:[SOURce]:FREQuency:STEP?	Get the step size of the carrier frequency.
:[SOURce]:FREQuency:STEP<space><value>	Set the step size of the carrier frequency. <value> = frequency step size (in Hz), for example: 1000
:[SOURce]:FREQuency:MINimum?	Get the minimum carrier frequency.
:[SOURce]:FREQuency:MAXimum?	Get the maximum carrier frequency.
:[SOURce]:FREQuency:STEP:MINimum?	Get the minimum step size of the carrier frequency step size.
:[SOURce]:FREQuency:STEP:MAXimum?	Get the maximum step size of the carrier frequency step size.

5.3.4 Carrier amplitude commands

Command	Description & Reply
:[SOURce]:POWer:[LEVel]:[IMMediate]: [AMPLitude]?	Get the carrier amplitude.
:[SOURce]:POWer:[LEVel]:[IMMediate]: [AMPLitude]<space><value>	Set the carrier amplitude. <value> = amplitude (in dBm), for example: 3 or -30
:[SOURce]:POWer:[LEVel]:[IMMediate]: [AMPLitude]:MINimum?	Get the minimum carrier amplitude.
:[SOURce]:POWer:[LEVel]:[IMMediate]: [AMPLitude]:MAXimum?	Get the maximum carrier amplitude.
:[SOURce]:POWer:[LEVel]:[IMMediate]: [AMPLitude]:STEP?	Get the step size of the carrier amplitude.
:[SOURce]:POWer:[LEVel]:[IMMediate]: [AMPLitude]:STEP<space><value>	Set the step size of the carrier amplitude. <value> = step size (in dB), for example: 3
:[SOURce]:POWer:[LEVel]:[IMMediate]: [AMPLitude]:STEP:MINimum?	Get the minimum step size of the carrier amplitude step size.
:[SOURce]:POWer:[LEVel]:[IMMediate]: [AMPLitude]:STEP:MAXimum?	Get the maximum step size of the carrier amplitude step size.

5.3.5 Output commands

Command	Description & Reply
:OUTPut1:STATe?	Get the state of the output signal for the main output. For RGN6000A and RGN6000B, the main output is the RF output. For the RGN0230A, the LF output is the main output.
:OUTPut1:STATe<space><value>	Set the output signal ON or OFF for the main output. <value> = ON <value> = OFF
:OUTPut2:STATe?	Get the state of the output signal for the secondary output. For the RGN6000B, the secondary output is the LF output. The RGN6000A and RGN0230A don't have a secondary output.
:OUTPut2:STATe<space><value>	Set the output signal ON or OFF for the secondary output. <value> = ON <value> = OFF
:OUTPut:SELECTed?	Returns the current active output. Reply: '1' = main output is selected Reply: '2'= secondary output is selected For RGN6000A and RGN6000B, the main output is the RF output. For the RGN0230A, the LF output is the main output. For the RGN6000B, the secondary output is the LF output. The RGN6000A and RGN0230A don't have a secondary output.

5.3.6 Amplitude modulation commands

Command	Description & Reply
:[SOURce]:AM:STATe?	Get the state of the amplitude modulation.
:[SOURce]:AM:STATe<space><value>	Set the amplitude modulation ON or OFF. <value> = ON <value> = OFF
:[SOURce]:AM:INTernal:FREQuency?	Get the amplitude modulation frequency.
:[SOURce]:AM:INTernal:FREQuency<space><value>	Set the amplitude modulation frequency. <value> = frequency (in Hz), for example: 1000 <value> = UP <value> = Down
:[SOURce]:AM:INTernal:FREQuency:STEP?	Get the step size of the amplitude modulation frequency.
:[SOURce]:AM:INTernal:FREQuency:STEP<space><value>	Set the step size of the amplitude modulation frequency. <value> = step size (in Hz), for example: 10
:[SOURce]:AM:INTernal:FREQuency:MINimum?	Get the minimum amplitude modulation frequency.
:[SOURce]:AM:INTernal:FREQuency:MAXimum?	Get the maximum amplitude modulation frequency.
:[SOURce]:AM:INTernal:FREQuency:STEP:MINimum?	Get the minimum step size of the amplitude modulation frequency.
:[SOURce]:AM:INTernal:FREQuency:STEP:MAXimum?	Get the maximum step size of the amplitude modulation frequency.
:[SOURce]:AM:[DEPTh]?	Get the amplitude modulation depth.
:[SOURce]:AM:[DEPTh]<space><value>	Set the amplitude modulation depth from 0 to 100%. <value> = percetage (in %), for example: 0, 40 or 54,3
:[SOURce]:AM:[DEPTh]:MINimum?	Get the minimum amplitude modulation depth.
:[SOURce]:AM:[DEPTh]:MAXimum?	Get the maximum amplitude modulation depth.
:[SOURce]:AM:OPT:2HZ	Set the preset for AM 2Hz, at 80% depth.

5.3.7 Pulse modulation commands

Command	Description & Reply
:[SOURce]:PULSe:STATe?	Get the state of the pulse modulation.
:[SOURce]:PULSe:STATe<space><value>	Set the pulse modulation ON or OFF. <value> = ON <value> = OFF
:[SOURce]:PULSe:WIDTh?	Get the width (ON-time) for the pulse modulation.
:[SOURce]:PULSe:WIDTh<space><value>	Set the width (ON-time) for the pulse modulation. <value> = time (in s), for example: 10
:[SOURce]:PULSe:WIDTh:MINimum?	Get the minimum width (ON-time) pulse modulation.
:[SOURce]:PULSe:WIDTh:MAXimum?	Get the maximum width (ON-time) pulse modulation.
:[SOURce]:PULSe:DELay?	Get the delay (OFF-time) for the pulse modulation.
:[SOURce]:PULSe:DELay<space><value>	Set the delay (OFF-time) for the pulse modulation. <value> = time (in s), for example: 10
:[SOURce]:PULSe:DELay:MINimum?	Get the minimum delay (OFF-time) pulse modulation.
:[SOURce]:PULSe:DELay:MAXimum?	Get the maximum delay (OFF-time) pulse modulation.

5.3.8   Pulse burst modulation commands

Command	Description & Reply
:[SOURce]:PULM:BURST:STATe?	Get the state of the pulse burst modulation.
:[SOURce]:PULM:BURST:STATe <space><value>	Set the pulse burst modulation ON or OFF. <value> = ON <value> = OFF
:[SOURce]:PULM:BURST:NUMber?	Get the number of pulses in a period for the pulse burst modulation.
:[SOURce]:PULM:BURST:NUMber <space><value>	Set the number of pulses in a period for the pulse burst modulation. <value> = number of pulses, for example: 50
:[SOURce]:PULM:BURST:PERiod?	Get the period time for the pulse burst modulation.
:[SOURce]:PULM:BURST:PERiod <space><value>	Set the period time for the pulse burst modulation. <value> = time (in s), for example: 1
:[SOURce]:PULM:BURST:PERiod: MINimum?	Get the minimum pulse burst modulation period.
:[SOURce]:PULM:BURST:PERiod: MAXimum?	Get the maximum pulse burst modulation period.
:[SOURce]:PULM:BURST:NUMber: MINimum?	Get the minimum pulse burst modulation number.
:[SOURce]:PULM:BURST:NUMber: MAXimum?	Get the maximum pulse burst modulation number.

5.3.9   Status commands

Command	Description & Reply
:STATus:PRESet	The Status Operation Enable and Status Questionable Enable registers are cleared.
:STATus:OPERation?	Replies the Status Operation Event register. Reply: <value> = number from 0 - 128
:STATus:OPERation:EVENt?	
:STATus:OPERation:CONDition?	Replies the Status Operation Condition register. Reply: <value> = number from 0 - 128
:STATus:OPERation:EVENt:CONDition?	
:STATus:OPERation:ENABle<space><value>	Sets the Status Operation Enable register. <value> = number from 0 - 128
:STATus:OPERation:EVENt:ENABle<space><value>	
:SYSTem:ERRor?	Get the first system error. When this command is send again the second/next error is replied. Etc. Reply: <command><space><errorcode> <comma><space>"<error text>" For example: :SYSTEM:ERROR? -222, "Data out of range"
:SYSTem:ERRor:[NEXT]?	

6   Radi*G*en® Specifications

Model	RGN0230A	RGN6000A	RGN6000B
Performance			
Frequency range	9 kHz – 230 MHz	80 MHz – 6 GHz	9 kHz – 6 GHz
Output connector	Output LF, SMA	Output HF, SMA	Output LF+HF, 2x SMA
Frequency resolution	1 Hz		
Frequency error[4]	+/- 20 ppm		
Minimum output level	-70 dBm		
Maximum output level	+10 dBm (+4,0 dBm when using AM)		
Amplitude resolution	0,1 dB		
Amplitude accuracy	+/- 1,5 dB		
Output level settling time	< 500 us		
Phase noise	Typical -110 dBc/Hz (LF and HF output)[5] Typical -70 dBc/Hz (HF output)[6]		
Harmonics	< -20 dBc		
Non-harmonic spurious[7]	< -50 dBc		
Dimensions			
Height	100 mm (3 U)		
Depth	220 mm		
Width	Fills one slot in the Radi*C*entre® system		

*This table continues on the next page.

---

[4] Measured 10 minutes after power on
[5] Measured with an RF signal of 125 MHz at 1 kHz, 10 kHz and 100 kHz from the carrier
[6] Measured with an RF signal of 1 GHz at 1 kHz, 10 kHz and 100 kHz from the carrier
[7] Measured at 0 dBm output level

RadiGen® Specifications, part 2

Model	RGN0230A	RGN6000A	RGN6000B
Modulation			
Modulation types	CW, AM, Pulse and Gated Pulse		
Modulation frequency range[8]	2 Hz (80%), 10 Hz – 100 kHz		
AM modulation depth	5 % - 95 % (usable from 0 % to 100 %)		
AM accuracy, Output LF[4]	< ± 3% (5 % to 95 % modulation depth), 2 Hz (80%) = ± 4%		
AM accuracy, Output HF[4]	< ± 2% (10 % to 90 % modulation depth) , 2 Hz (80%) = ± 3%		
	< ± 3 % (5 % to 10 % and 90 % to 95 % modulation depth)		
Pulse on time- range	200 ns – 100 s (in 100 ns steps)		
Pulse off time- range	200 ns – 100 s (in 100 ns steps)		
Pulse modulation On/Off ratio, Output LF	> 60 dB (9 kHz to 230 MHz)		
Pulse modulation On/Off ratio, Output HF	> 90 dB (80 MHz to 1 GHz) > 70 dB (1 GHz to 3 GHz) > 60 dB (3 GHz to 6 GHz)		
Environmental conditions			
Temperature range	10° C – 40° C		
Relative humidity	10% - 90% (non-condensing)		
Power consumption			
Supply voltage	12 VDC		
Power consumption	< 25 W		
Warranty			
Warranty	3 years (misuse excluded)		

---

[8] The 2 Hz preset is only available after factory calibration and is supported by firmware version 2.6.0 and up.
[4] Measured at 0 dBm output level

Explanation and Examples Regarding Gated Pulse Modulation

Several automobile manufactures have written standards in which they subscribe the Automotive Radar Pulse tests. These tests consist of a N-number of pulses in a certain period of time. When the number of pulses is reached, there must be no more output for the remaining time during that period.

Explanation of Automotive Pulse testing

Ford RI-114 Radar Pulse test (EMC-SC-2009) and PSA B21 7110 are using:

- Pulse Repetition Rate (PRR)   =   300 Hz
- Pulse duration (PD)   =   3 µs
- No. of pulses per second (N)   =   50

GM GMW3097-2012 uses:

- Pulse Repetition Rate (PRR)   =   300 Hz
- Pulse duration (PD)   =   6 µs
- No. of pulses per second (N)   =   50

The Radi*G*en ® plug-in card is capable of generating the necessary RF bursts according to these automotive standards, using the Gated Pulse Modulation. Normal pulse modulation must be used to set the Pulse ON and Pulse OFF times (these are called, respectively, PULSe:WIDTh and PULSe:DELay, in the command set of the Radi*C*entre® system user interface).

Pulse modulation

Width   Delay
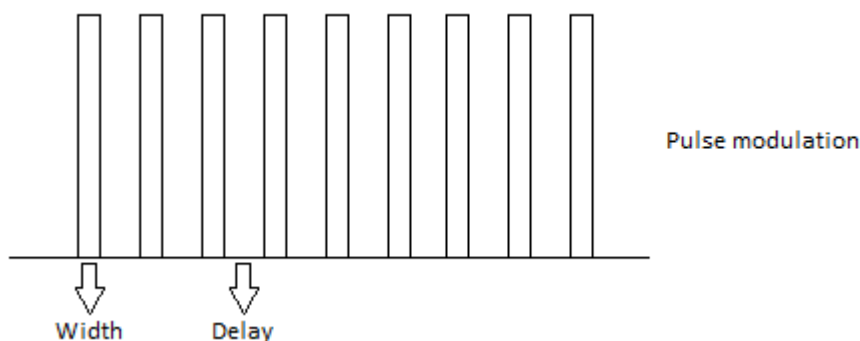
The standards describe the pulse waveform by means of a Pulse Repetition Rate (PRR) and Pulse Duration. Rhe Radi*G*en® plug-in card, on the other hand, uses Pulse ON and Pulse OFF (PULSe:WIDTh and PULSe:DELay) times. As a result the PD and PRR numbers must be calculated to Pulse ON and Pulse OFF (PULSe:WIDTh and PULSe:DELay) times, according to the example below:

Automotive Radar Pulse
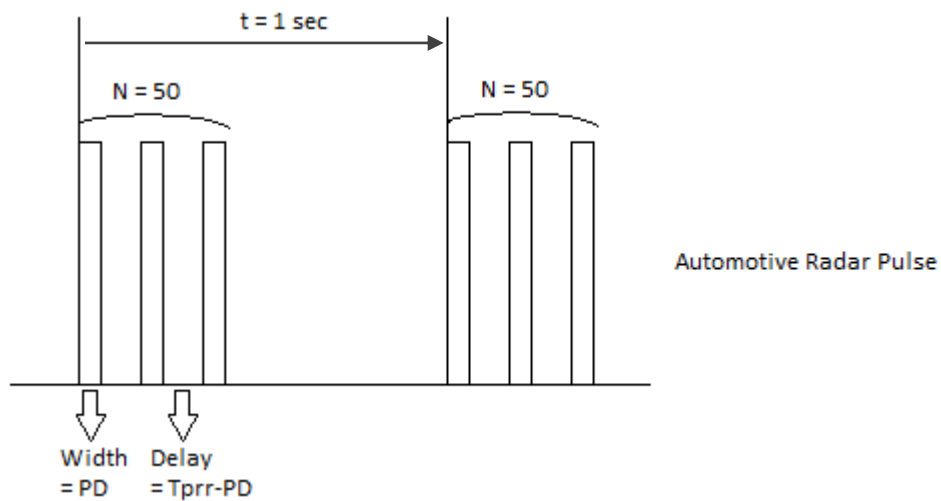
Example

The Ford standard EMC-SC-2009 describes:
PRR = 300 Hz, PD = 3 µs. N =50 pulses per second.
So the period time of the Pulse Modulation is T_{PRR} = 3,333 ms

For the Radi*G*en ® this means:
The Pulse ON time, or PULSe:WIDTh equals PD = 3 µs
The Pulse OFF time, or PULSe:DELay equals T_{PRR} – PD = 3,333 ms – 3 µs = 3,330 ms

Limitations

The Pulse ON and OFF times apply to the specific limitations to the number of pulses per period for the Gated Pulse Modulation. The Radi**C**entre® system user interface makes use of equations to intelligently adapt the buttons, prohibiting invalid settings. When the Radi**G**en® plug-in card is controlled externally by PC-software, this limitations must be controlled by the PC-software. The limitations are given by the following formulas;

$$N_{MAX} = \frac{Gateperiod - 1ms}{Pulse_{Width} + Pulse_{Delay}} - 1$$

The maximum number of pulses in one burst is limited by the settings of the pulse modulation. For example; using the Ford standard with a repetition rate of 300 Hz, a pulse width of 3µs and period time of 1 second, results in a maximum of 298 pulses.

The formula can also be rewritten to calculate the pulse parameters:

$$Pulse_{Width(MAX)} = \frac{(Gateperiod - 1ms) - (N \cdot Pulse_{Delay})}{N}$$

$$Pulse_{Delay(MAX)} = \frac{(Gateperiod - 1ms) - (N \cdot Pulse_{Width})}{N}$$

WARRANTY CONDITIONS

DARE!! Instruments offers a standard warranty term of three years on their products, starting from the shipping date. This warranty is applicable to all EMC test & measurement products, such as:

- Radi**C**entre® modular / multifunctional EMC test systems
- Radi**C**ontrol® antenna tower/turntable controllers
- Radi**F**ield® Triple A field generators
- Radi**G**en® signal generators
- Radi**P**ower® RF power meters
- Radi**S**ense® laser powered E-field probes
- Radi**S**witch® RF coaxial switches

If a defect occurs within the warranty term, a Return Material Authorization (RMA) 'Warranty Repair' request can be issued using the RMA link at http://rma.dare.eu. The defective product can then be shipped to DARE!! Instrument for repair by our service department.
There will be no charge for repair services (materials or labor) within the warranty term. The customer will need to cover the costs for returning the product to DARE!!, such as shipping and/or any applicable duties and taxes. DARE!! Instruments will arrange the courier and cover the costs for the return shipment.

These warranty terms are not applicable to:

- Fiber optic cables
- Products that have been improperly used
- Products that have been used outside their specified range
- Products that have been improperly installed and/or maintained
- Products that have been modified without approval of DARE!! Instruments
- Calibration and/or re-calibration of the product
- Consumable products such as batteries, ink etc.

Repair services on products that are not covered by the DARE!! warranty will be charged to the customer. If a defect occurs to our product outside the warranty period, a RMA repair and/or re-calibration request must be issued using the RMA link at http://rma.dare.eu.
The repairs (outside the original warranty period) have a warranty limited to six months. Shipping conditions are the same as with repairs within the original warranty period.

EUROPEAN DECLARATION OF CONFORMITY

We, DARE!! Instruments, declare under our sole responsibility that the product;

RadiGen®
Models RGN0230A, RGN6000A and RGN6000B

to which this declaration relates, is in accordance with the following Directives:

EMC-Directive: 2014/30/EU
RoHS-Directive: 2011/65/EG

Per the provisions of the applicable requirements of the following harmonized standards:

Emission: EN 61326-1:2013, Class B
                Electrical equipment for measurement, control and laboratory use.
Immunity: EN 61326-1:2013, Industrial level, performance criteria A
                Electrical equipment for measurement, control and laboratory use.
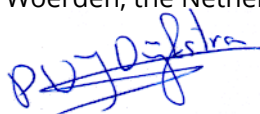
The Technical Construction Files are maintained at;

DARE!! Products B.V.
Vijzelmolenlaan 3
NL-3447 GX Woerden
The Netherlands
Tel: +31 348 416 592
Email: instruments@dare.eu

Date of issue: July 17th, 2017

Place of issue: Woerden, the Netherlands

Authorized by:

P.W.J. Dijkstra

Title of authority: Director