



How to use the RF Path Calculator Tool

Target

- It is a very evolved version of the [PIM & VSWR Calculator](#), created by Lou Meyer
- Tool available at the [Resources-Calculators page](#). Download [here](#).
- Addressed to RF engineers or Cell Site designers
- Provides system calculations for:
 - Passive InterModulation (PIM)
 - Voltage Standing Wave Ratio (VSWR)
 - Effective Isotropic Radiated Power (EIRP)
 - Noise Figure
 - Third Order Intercept Point (IP3)
- Various components can be selected to be included in the RF path for analysis at a given frequency
- Vector addition calculations are performed for both typical and worst-case results

Please note that:

- Calculations that use the downlink (Tx) path use the Tx filter loss in the TMA. These include RL/VSWR and EIRP.
- Calculations that use the uplink (Rx) path use the amplifier gain in the TMA. These include PIM, Noise Figure and Third Order Intercept Point.

So please use TMA gain for PIM calculations and TMA Tx loss for RL/VSWR calculations

Main Form Layout

Main parameters

Units and Commands Ribbon

RF Components and Configuration

Values for Components' parameters

Results Pane

The screenshot shows the RF Path Calculator software interface. The top ribbon contains 'Main parameters' (Frequency: 2140 MHz, PIM Power: 40 watts each Carrier, Test Equipment Noise Floor: -130 dBm), 'Length Units' (meters), and 'View' (VSWR). The main area is divided into 'Components to Select' (Antenna or Load, TMA or Bias Tee, Combiner, Main Feed Line, Bias Tee, Surge Suppressor, Bottom Combiner, Radio or Tester) and a table for component parameters. The table has columns for Cable Type or, Loss, Gain, Noise Figure, Intercept Point, Length (m), Max VSWR, and Comp. PIM Spec (dBc, 2x20 watts). The right pane shows 'Results' including Loss Results, VSWR Results, PIM Results, EIRP Results, and NF & IIP3 Results.

Cable Type or:	Loss	Gain	Noise Figure	Intercept Point	Length (m)	Max VSWR	Comp. PIM Spec (dBc, 2x20 watts)
Antenna or Load	16				1,5	150	
LDF4-50A SureFlex - 1/2 inch Fo.			1,3	15	3	1,06	159
LDF4-50A SureFlex - 1/2 inch Fo.			1,3	15	3	1,06	159
LDF4-50A SureFlex - 1/2 inch Fo.			-0,2		3	1,06	159
LDF4-50A SureFlex - 1/2 inch Fo.			-0,2		3	1,06	159
LDF2-50 SureFlex - 3/8 inch foam					10	1,06	160
LDF4-50A SureFlex - 1/2 inch Fo.					3	1,06	159
LDF4-50A SureFlex - 1/2 inch Fo.			-0,1		1,17	160	
LDF4-50A SureFlex - 1/2 inch Fo.			-0,1		1,07	160	
LDF4-50A SureFlex - 1/2 inch Fo.			-0,2		3	1,06	159
LDF4-50A SureFlex - 1/2 inch Fo.			-0,2		3	1,06	159
Output Power (Watts)	40		Noise Figure (dB)	5	Intercept Point (dBm)	3	

Results

Loss Results

Typical Conn Loss (2 per cable): 0,044

Total Insertion Loss (dB): -6,61

VSWR Results

Typical System VSWR: 29,43

Typical System Return Loss (dB): 0,6

Worst System Reflection: 1,3993

Worst System VSWR: -6,01

Worst System Return Loss (dB): -2,9

PIM Results

Worst Case Syst. PIM (dBm): -72,3

Worst Case Syst. PIM (dBc): -118,3

EIRP Results

EIRP (dB): 68,6

EIRP (Watts): 7294,9

NF & IIP3 Results

Noise Figure (dB): 3,24

IIP3 (dBm): -3,67

Easy start

Click on the components icons and add them to the Path, from top to bottom

A jumper is automatically added below each component

Performance values for the new components are defaulted

Results are re-calculated in real time

COMMScope RF Path Calculator

Main parameters

Frequency (MHz): 2140 PIM Power (watts each Carrier): 40

Length Units: ☒ meters ☐ feet View: ☒ VSWR ☐ RL

Components to Select

- Antenna or Load
- TMA or Bias Tee
- Top Combiner*
- Main Feed Line
- Bias Tee
- Surge Suppressor
- Bottom Combiner*
- Generic Comp.
- Radio or Tester

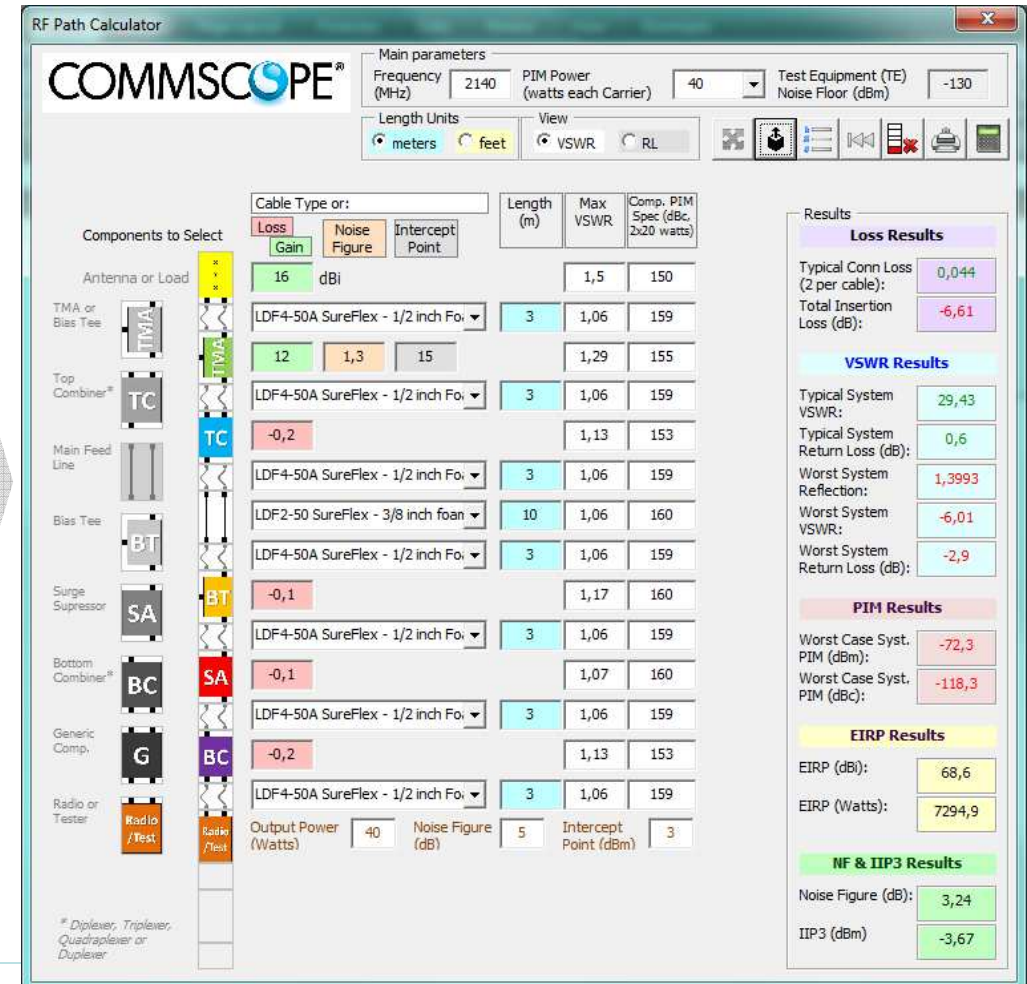
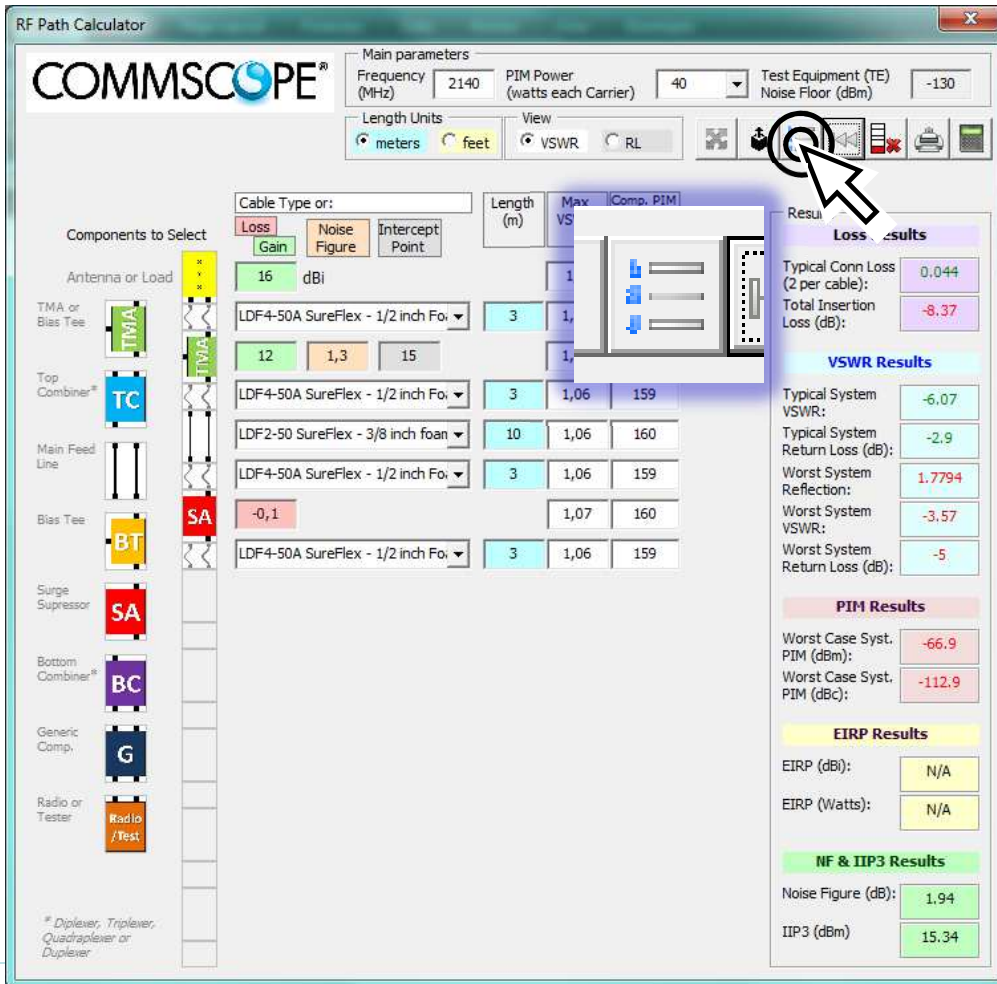
Path

Cable Type or:	Length (m)	Max VSWR	Comp. PIM Spec (dBc, 2x20 watts)
Loss			
Gain			
Intercept Point			
16 dBi		1,5	150
LDF4-50A SureFlex - 1/2 inch Fo	3	1,06	159
12		1,29	155
LDF4-50A SureFlex - 1/2 inch Fo	3	1,06	159
LDF2-50 SureFlex - 3/8 inch foan	10	1,06	160
LDF4-50A SureFlex - 1/2 inch Fo	3	1,06	159
-0,1		1,07	160
LDF4-50A SureFlex - 1/2 inch Fo	3	1,06	159

* Diplexer, Triplexer, Quadraplexer or Duplexer

Most components can be added multiple times, in any order. Exceptions are Feeder and Radio

How to See an Example (you can modify values)



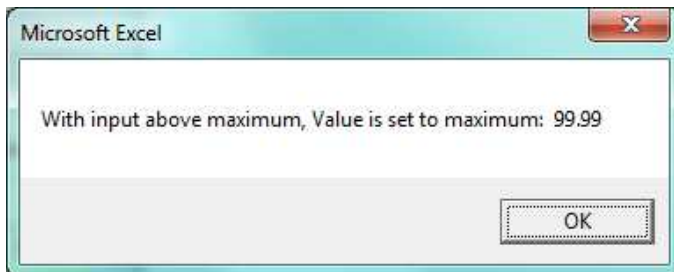
How to modify values for parameters

Main parameters

Click on the parameters, change the value and hit Enter or Tab

There are predefined minimum and maximum values for all fields

Values for Components' parameters



RF Path Calculator

COMMScope

Main parameters

Frequency (MHz): 2140 PIM Power (watts each Carrier): 40 Test Equipment (TE) Noise Floor (dBm): -130

Length Units: meters View: VSWR RL

Components to Select

Antenna or Load: TMA or Bias Tee: TMA Top Combiner: TC

Line: Bias Tee: BT Surge Suppressor: SA Bottom Combiner: BC Generic Comp.: G Radio or Tester: Radio / Test

* Diplexer, Triplexer, Quadraplexer or Duplexer

Cable Type or:	Loss	Noise Figure	Intercept Point	Length (m)	Max VSWR	Comp. PIM Spec (dBc, 2x20 watts)
16 dBi				1,5	150	
LDF4-50A SureFlex - 1/2 inch Fo...				3	1,06	159
12	1,3	15		1,29	155	
LDF4-50A SureFlex - 1/2 inch Fo...				3	1,06	159
				1,13	153	
LDF4-50A SureFlex - 1/2 inch Fo...				3	1,06	159
LDF2-50 SureFlex - 3/8 inch foan				10	1,06	160
LDF4-50A SureFlex - 1/2 inch Fo...				3	1,06	159
-0,1				1,17	160	
LDF4-50A SureFlex - 1/2 inch Fo...				3	1,06	159
-0,1				1,07	160	
LDF4-50A SureFlex - 1/2 inch Fo...				3	1,06	159
-0,2				1,13	153	
LDF4-50A SureFlex - 1/2 inch Fo...				3	1,06	159
Output Power (Watts): 40 Noise Figure (dB): 5 Intercept Point (dBm): 3						

Results

Loss Results

Typical Conn Loss (2 per cable): 0,044

Total Insertion Loss (dB): -6,61

VSWR Results

Typical System VSWR: 29,43

Typical System Return Loss (dB): 0,6

Worst System Reflection: 1,3993

Worst System VSWR: -6,01

Worst System Return Loss (dB): -2,9

PIM Results

Worst Case Syst. PIM (dBm): -72,3

Worst Case Syst. PIM (dBc): -118,3

EIRP Results

EIRP (dB): 68,6

EIRP (Watts): 7294,9

NF & IIP3 Results

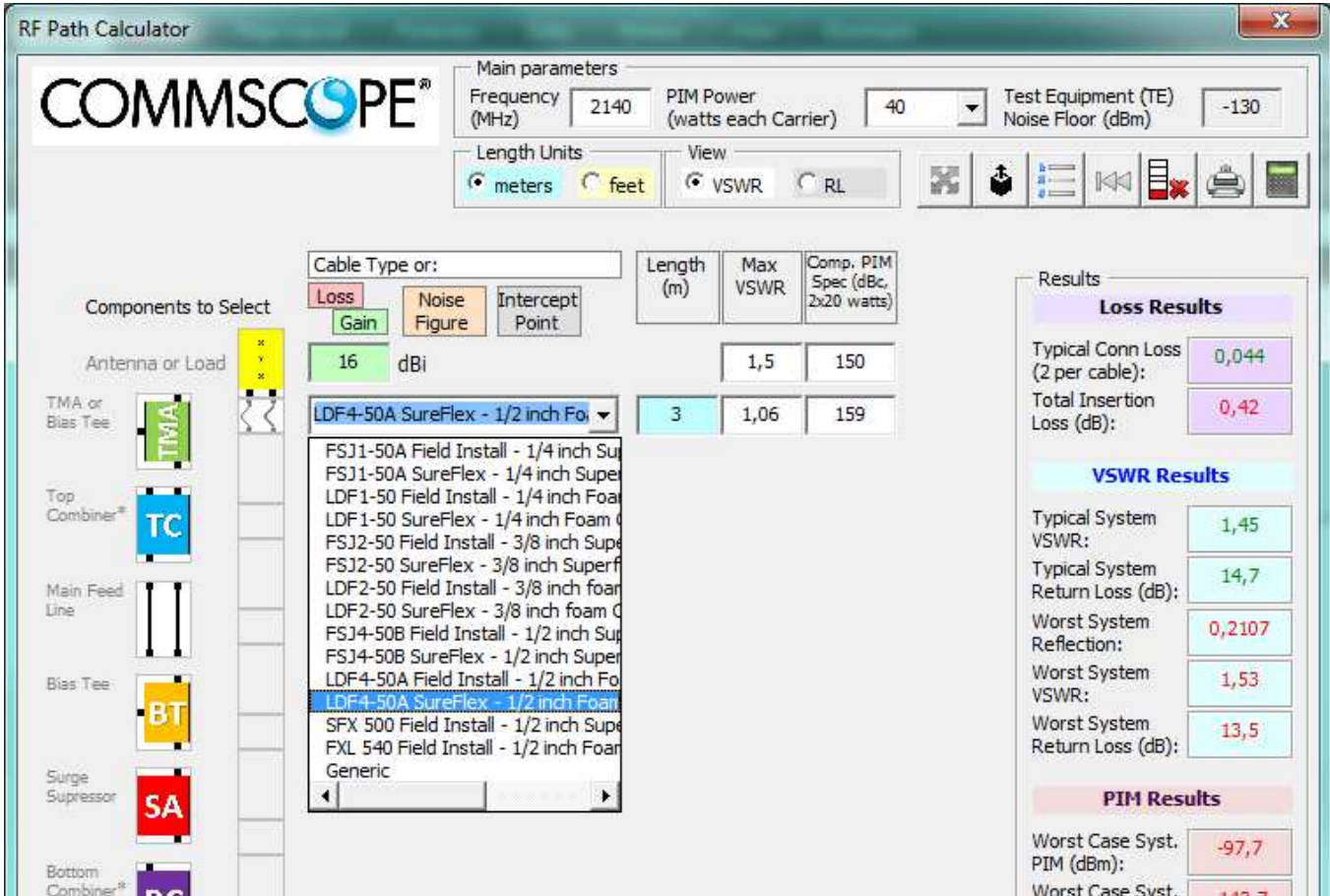
Noise Figure (dB): 3,24

IIP3 (dBm): -3,67

How to modify cable type for feeder and jumpers

Once the component is in place, click on the “Cable Type” dropdown

The relevant parameter values are changed for the new cable type



How to Restart with the Default Settings

RF Path Calculator

COMMScope®

Main parameters
Frequency (MHz): 2140 PIM Power (watts each Carrier): 40 Test Equipment (TE) Noise Floor (dBm): -130
Length Units: meters View: VSWR RL

Components to Select

Antenna or Load: 16 dBi
TMA or Bias Tee: TMA
Top Combiner*: TC
Main Feed Line: LDF4-50A SureFlex - 1/2 inch Fo...
Bias Tee: BT
Surge Suppressor: SA
Bottom Combiner*: BC
Generic Comp.: G
Radio or Tester: Radio / Test

Cable Type or:	Length (m)	Max VSWR	Comp. PIM Spec 2x20
LDF4-50A SureFlex - 1/2 inch Fo...	3	1,06	159
LDF2-50 SureFlex - 3/8 inch foan...	10	1,06	160
LDF4-50A SureFlex - 1/2 inch Fo...	3	1,06	159
LDF4-50A SureFlex - 1/2 inch Fo...	3	1,06	159

Loss Results
Typical Conn Loss (2 per cable): 0.044
Total Insertion Loss (dB): -8.37

VSWR Results
Typical System VSWR: -6.07
Typical System Return Loss (dB): -2.9
Worst System Reflection: 1.7794
Worst System VSWR: -3.57
Worst System Return Loss (dB): -5

PIM Results
Worst Case Syst. PIM (dBm): -66.9
Worst Case Syst. PIM (dBc): -112.9

EIRP Results
EIRP (dB): N/A
EIRP (Watts): N/A

NF & IIP3 Results
Noise Figure (dB): 1.94
IIP3 (dBm): 15.34

RF Path Calculator

COMMScope®

Main parameters
Frequency (MHz): 2140 PIM Power (watts each Carrier): 40 Test Equipment (TE) Noise Floor (dBm): -130
Length Units: meters View: VSWR RL

Components to Select

Antenna or Load: 16 dBi
TMA or Bias Tee: TMA
Top Combiner*: TC
Main Feed Line: LDF4-50A SureFlex - 1/2 inch Fo...
Bias Tee: BT
Surge Suppressor: SA
Bottom Combiner*: BC
Generic Comp.: G
Radio or Tester: Radio / Test

Cable Type or:	Length (m)	Max VSWR	Comp. PIM Spec 2x20
LDF4-50A SureFlex - 1/2 inch Fo...	3	1,06	159

Loss Results
Typical Conn Loss (2 per cable): 0.044
Total Insertion Loss (dB): 0.42

VSWR Results
Typical System VSWR: 1.45
Typical System Return Loss (dB): 14.7
Worst System Reflection: 0.2107
Worst System VSWR: 1.53
Worst System Return Loss (dB): 13.5

PIM Results
Worst Case Syst. PIM (dBm): -97.7
Worst Case Syst. PIM (dBc): -143.7

EIRP Results
EIRP (dB): N/A
EIRP (Watts): N/A

NF & IIP3 Results
Noise Figure (dB): 0
IIP3 (dBm): 0

How to Delete the last component

RF Path Calculator

COMMSCOPE®

Main parameters
Frequency (MHz): 2140 PIM Power (watts each Carrier): 40 Test Equipment (TE) Noise Floor (dBm): -130
Length Units: meters View: VSWR RL

Components to Select

Antenna or Load: 16 dBi

TMA or Bias Tee: TMA

Top Combiner*: TC

Main Feed Line: LDF4-50A SureFlex - 1/2 inch Fo

Bias Tee: BT

Surge Suppressor: SA

Bottom Combiner*: BC

Generic Comp.: G

Radio or Tester: Radio / Test

Loss Results
Typical Conn Loss (2 per cable): 0.044
Total Insertion Loss (dB): -8.37

VSWR Results
Typical System VSWR: -6.07
Typical System Return Loss (dB): -2.9
Worst System Reflection: 1.7794
Worst System VSWR: -3.57
Worst System Return Loss (dB): -5

PIM Results
Worst Case Syst. PIM (dBm): -66.9
Worst Case Syst. PIM (dBc): -112.9

EIRP Results
EIRP (dB): N/A
EIRP (Watts): N/A

NF & IIP3 Results
Noise Figure (dB): 1.94
IIP3 (dBm): 15.34

RF Path Calculator

COMMSCOPE®

Main parameters
Frequency (MHz): 2140 PIM Power (watts each Carrier): 40 Test Equipment (TE) Noise Floor (dBm): -130
Length Units: meters View: VSWR RL

Components to Select

Antenna or Load: 16 dBi

TMA or Bias Tee: TMA

Top Combiner*: TC

Main Feed Line: LDF4-50A SureFlex - 1/2 inch Fo

Bias Tee: BT

Surge Suppressor: SA

Bottom Combiner*: BC

Generic Comp.: G

Radio or Tester: Radio / Test

Loss Results
Typical Conn Loss (2 per cable): 0.044
Total Insertion Loss (dB): -8.89

VSWR Results
Typical System VSWR: -4.5
Typical System Return Loss (dB): -3.9
Worst System Reflection: 1.9383
Worst System VSWR: -3.13
Worst System Return Loss (dB): -5.7

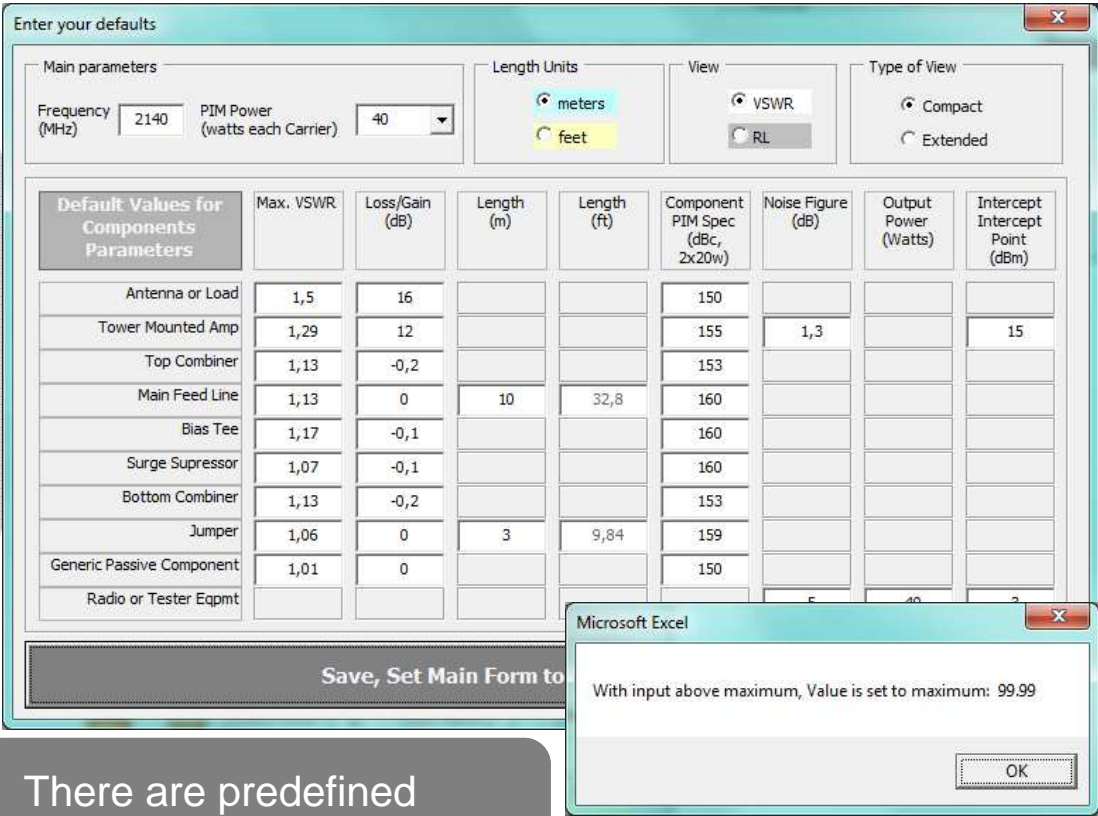
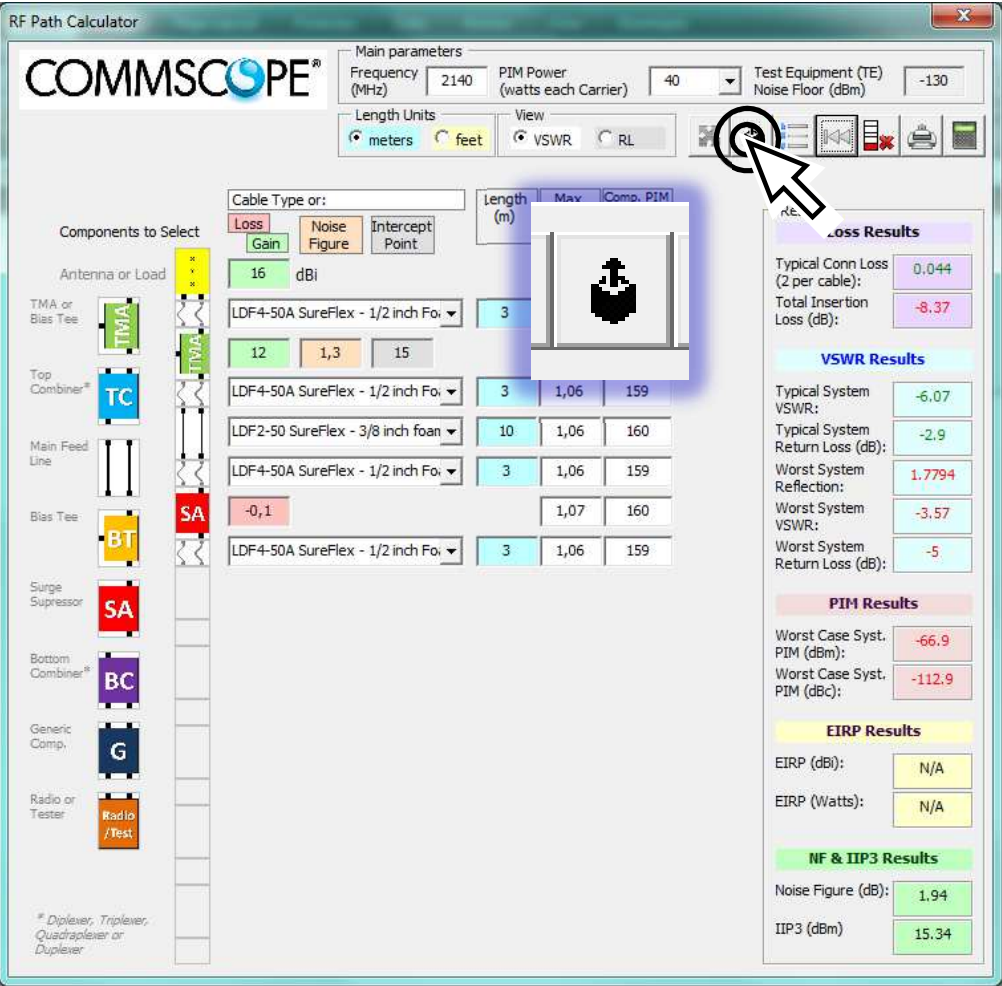
PIM Results
Worst Case Syst. PIM (dBm): -65.2
Worst Case Syst. PIM (dBc): -111.2

EIRP Results
EIRP (dB): N/A
EIRP (Watts): N/A

NF & IIP3 Results
Noise Figure (dB): 1.89
IIP3 (dBm): 15.36

You can click the “Delete Last” button many times (you can’t delete antenna and its jumper)

How to Change Default Values and Default Settings



There are predefined minimum and maximum values for all fields

How to View More Information

RF Path Calculator

COMMScope®

Main parameters
Frequency (MHz): 2140 PIM Power (watts each Carrier): 40 Test Equipment (TE) Noise Floor (dBm): -130

Length Units: meters View: VSWR RL

Components to Select

Component	Loss (dB)	Noise Figure (dB)	Intercept Point (dBm)	Length (m)	Max VSWR	Comp. PIM Spec (dBc)
Antenna or Load	16			1,5		
TMA or Bias Tee						
Top Combiner*						
Main Feed Line						
Bias Tee						
Surge Suppressor						
Bottom Combiner*						
Generic Comp.						
Radio or Tester						

Loss Results

Typical Conn Loss (2 per cable): 0,044

Total Insertion Loss (dB): -6,61

VSWR Results

Typical System VSWR: 29,43

Typ. Syst. RL (dB): 0,6

Typical System Reflection: 0,9343

Worst Syst. Reflection: 1,3993

Worst System VSWR: -6,01

Worst Syst. RL (dB): -2,9

PIM Results

Typical System PIM Voltage (uV): 36,9765

Typical System PIM Pass/Fail Level (dBm): -75,6

Typical System PIM Pass/Fail Level (dBc): -121,6

Worst Case Syst. PIM (dBm): -72,3

Worst Case Syst. PIM (dBc): -118,3

Worst Case System PIM Voltage: 54,2845

EIRP Results

EIRP (dB): 68,6

EIRP (Watts): 7294,9

NF & IIP3 Results

Noise Figure (dB): 3,24

IIP3 (dBm): -3,67

RF Path Calculator

COMMScope®

Main parameters
Frequency (MHz): 2140 PIM Power (watts each Carrier): 40 Test Equipment (TE) Noise Floor (dBm): -130 Value <10 dB above TE noise floor

Length Units: meters View: VSWR RL

Components to Select

Component	Loss (dB)	Noise Figure (dB)	Intercept Point (dBm)	Length (m)	Max VSWR	Comp. PIM Spec (dBc)
Antenna or Load	16			1,5		
TMA or Bias Tee						
Top Combiner*						
Main Feed Line						
Bias Tee						
Surge Suppressor						
Bottom Combiner*						
Generic Comp.						
Radio or Tester						

Loss Results

Typical Conn Loss: 0,044

Total Insertion Loss (dB): -6,61

VSWR Parameters

RL (dB)	IL (2 conn)	% of Est. SR	Reflects. at Input	Attn to bottom (dB)	Pwr to Comp. (dBm)	Effect. PIM (dBm)	PIM dBm @ bottom	% of Est. Sys PIM	PIM (pW) @ bottom
13,98	0	96,2%	0,9162	-6,61	52,61	-83	-76,4	84,7%	23,167
30,71	0,42	2,5%	0,147	-7,03	53,03	-90,9	-83,9	15%	4,0917
17,95	-12	2%	0,0403	4,97	41,03	-116,9	-121,9	0%	0,0006
30,71	0,42	0%	0,0102	4,55	41,45	-119,9	-124,4	0%	0,0004
24,29	0,2	0,1%	0,0224	4,35	41,65	-113,4	-117,7	0%	0,0017
30,71	0,42	0%	0,0118	3,93	42,07	-118,3	-122,3	0%	0,0006
30,71	1,85	0%	0,018	2,08	43,92	-114,7	-116,8	0%	0,0021
30,71	0,42	0%	0,0199	1,66	44,34	-112,7	-114,3	0%	0,0037
22,12	0,1	0,3%	0,0547	1,56	44,44	-113,4	-115	0%	0,0032
30,71	0,42	0,1%	0,0224	1,14	44,86	-111,4	-112,5	0%	0,0057
29,42	0,1	0,1%	0,0266	1,04	44,96	-112,1	-113,1	0%	0,0049
30,71	0,42	0,1%	0,0253	0,62	45,38	-110,1	-110,7	0%	0,0086
24,29	0,2	0,4%	0,0554	0,42	45,58	-103,6	-104	0,1%	0,0402
30,71	0,42	0,1%	0,0291	0	46	-108,5	-108,5	0,1%	0,0142

PIM Parameters

Typical System VSWR: 29,43

Typ. Syst. RL (dB): 0,6

Typical System Reflection: 0,9343

Worst Syst. Reflection: 1,3993

Worst System VSWR: -6,01

Worst Syst. RL (dB): -2,9

PIM Results

Typical System PIM Voltage (uV): 36,9765

Typical System PIM Pass/Fail Level (dBm): -75,6

Typical System PIM Pass/Fail Level (dBc): -121,6

Worst Case Syst. PIM (dBm): -72,3

Worst Case Syst. PIM (dBc): -118,3

Worst Case System PIM Voltage: 54,2845

EIRP Results

EIRP (dB): 68,6

EIRP (Watts): 7294,9

NF & IIP3 Results

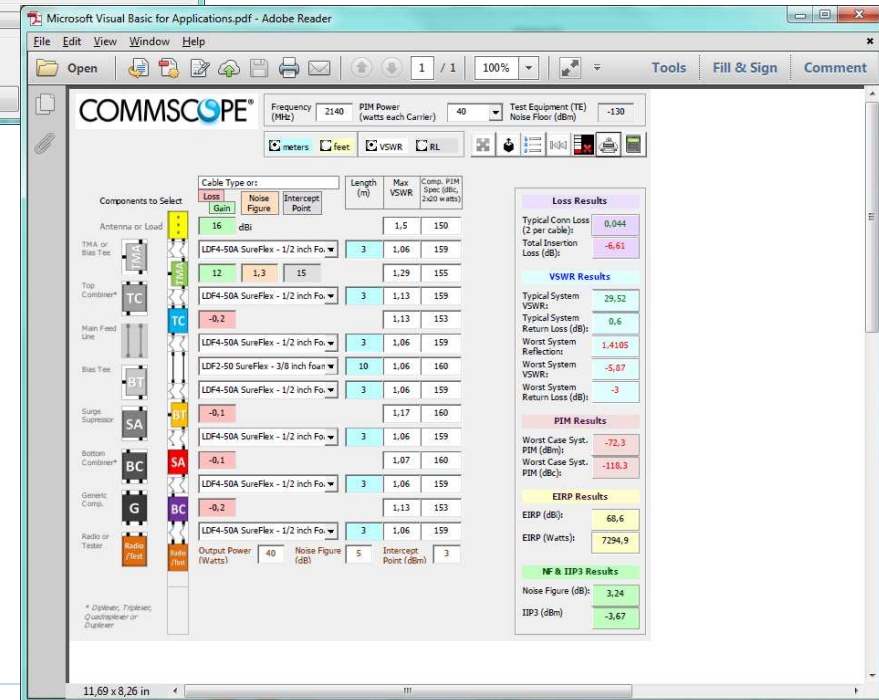
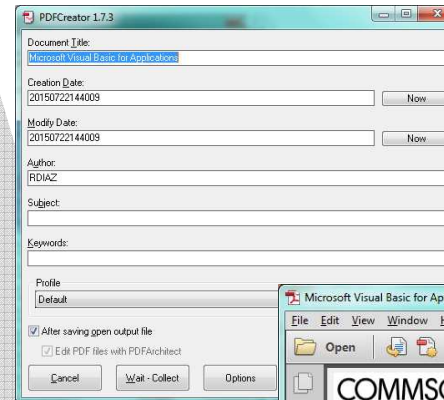
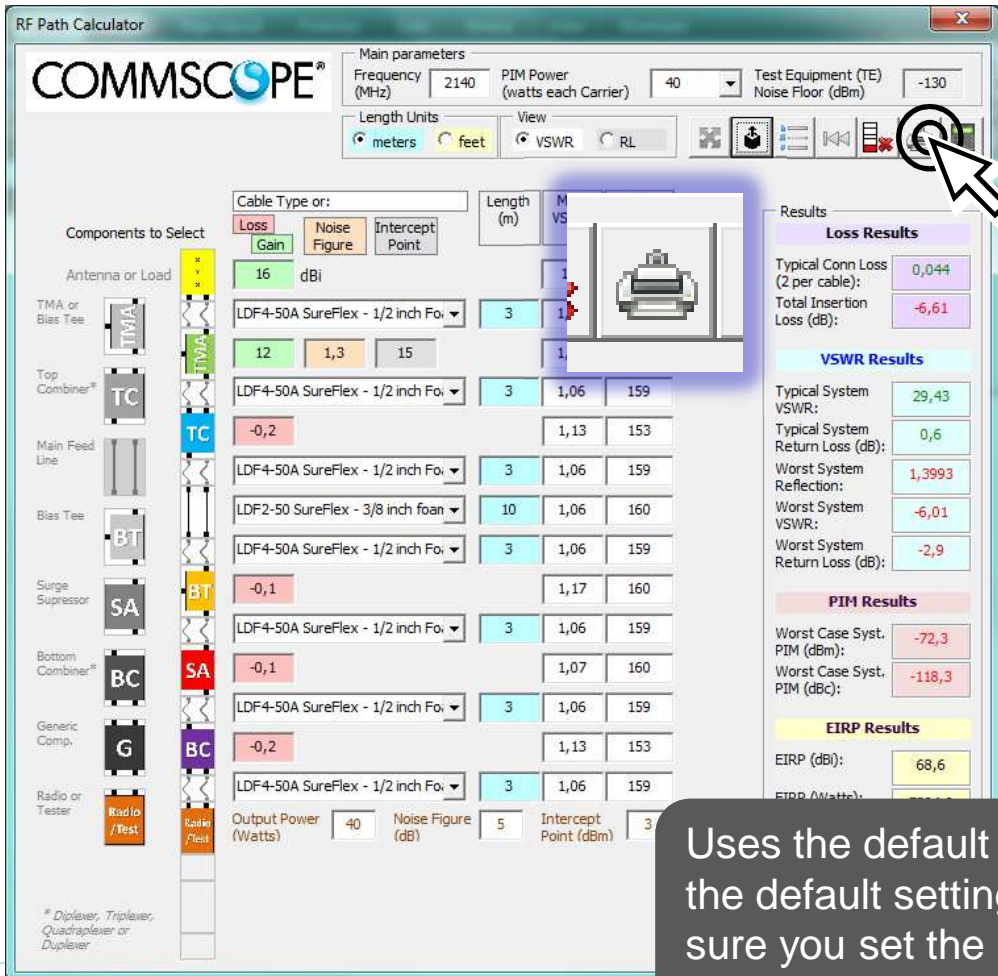
Noise Figure (dB): 3,24

IIP3 (dBm): -3,67

Shows intermediate calculations and a more complete set of results (Extended View)

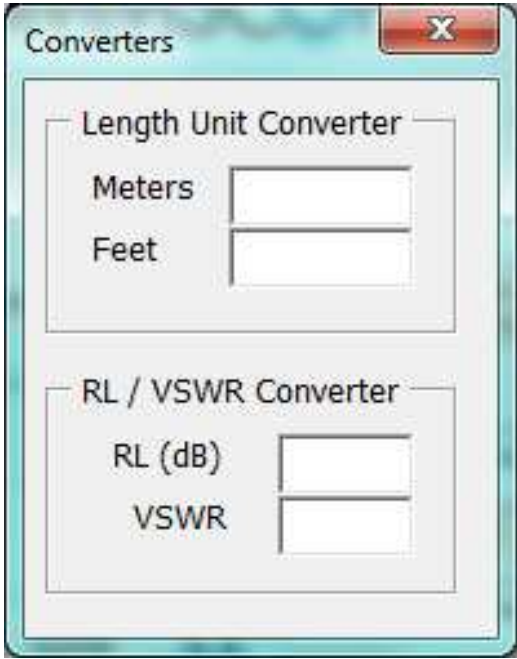
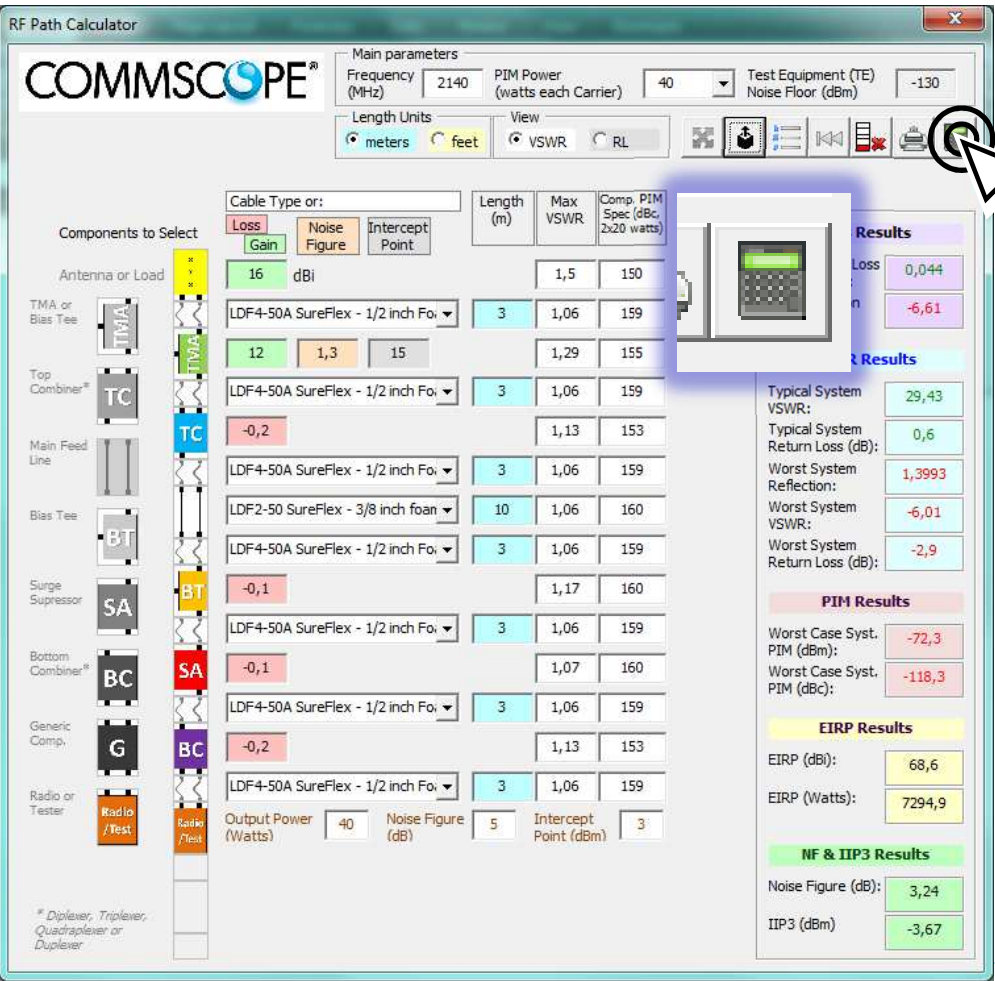
Click the same icon again to return to the Compact View

How to Print the Configuration and Results



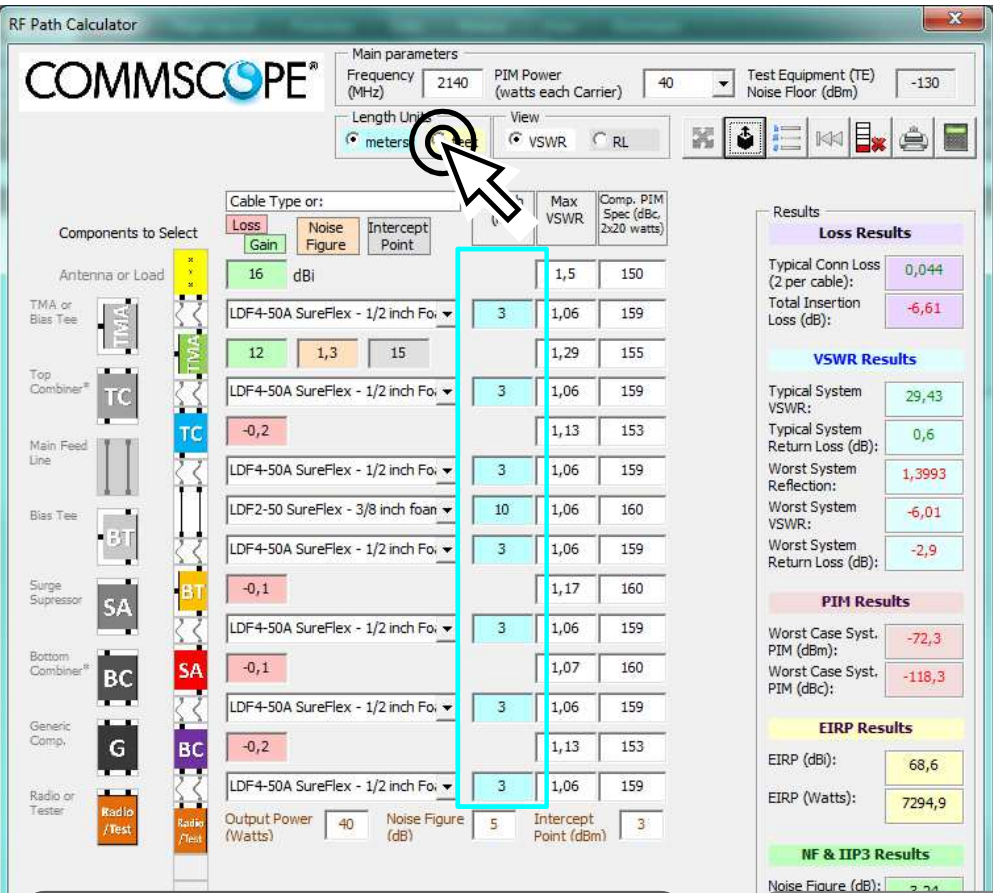
Uses the default printer with the default settings (make sure you set the printer up properly in advance)

How to open the converters (Meters ⇔ Feet, VSWR ⇔ RL)

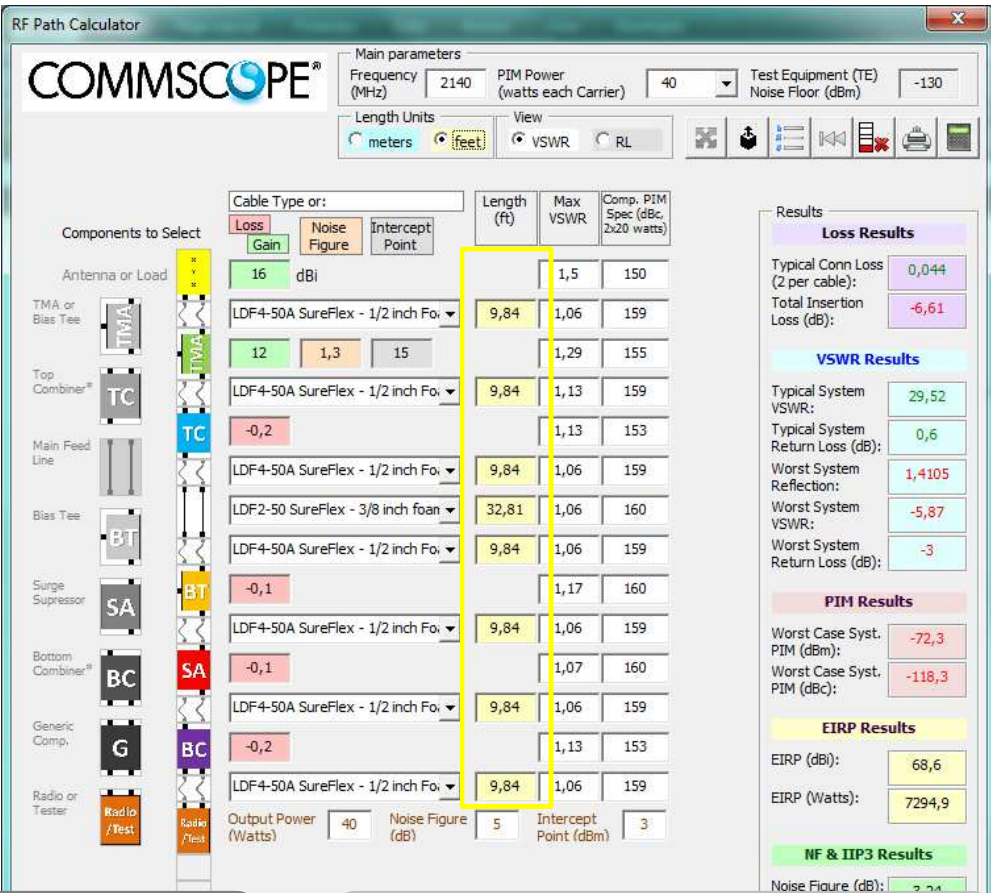


There are predefined minimum and maximum values for all fields

How to toggle the length units (meters ⇔ feet)



Select the “meters” or “feet” option button to display the desired length unit.



Values will be re-calculated, but the Physical length does not change

Calculated Results do not change after the length units toggle

How to toggle VSWR ↔ RL

RF Path Calculator

COMMSCOPE®

Main parameters
Frequency (MHz): 2140 PIM Power (watts each Carrier): 40 Test Equipment (TE) Noise Floor (dBm): -130
Length Units: meters View: **VSWR**

Components to Select

Component	Cable Type or:	Length (m)	Max VSWR	Comp. Spec. (dBc, 2x20 watts)
Antenna or Load	Loss: 16 dBi	1,5	150	
TMA or Bias Tee	Gain: 12	1,3	155	
Top Combiner®	Noise Figure: 1,3	1,29	155	
Main Feed Line	Intercept Point: 15	1,06	159	
Bias Tee		1,13	153	
Surge Suppressor		1,06	159	
Bottom Combiner®		1,06	159	
Generic Comp.		1,06	159	
Radio or Tester		1,06	159	

Results

Loss Results
Typical Conn Loss (2 per cable): 0,044
Total Insertion Loss (dB): -6,61

VSWR Results
Typical System VSWR: 29,43
Typical System Return Loss (dB): 0,6
Worst System Reflection: 1,3993
Worst System VSWR: -6,01
Worst System Return Loss (dB): -2,9

PIM Results
Worst Case Syst. PIM (dBm): -72,3
Worst Case Syst. PIM (dBc): -118,3

EIRP Results
EIRP (dB): 68,6
EIRP (Watts): 7294,9

NF & IIP3 Results
Noise Figure (dB): 2,24

Select the "VSWR" or "RL" option buttons to display the desired parameter

RF Path Calculator

COMMSCOPE®

Main parameters
Frequency (MHz): 2140 PIM Power (watts each Carrier): 40 Test Equipment (TE) Noise Floor (dBm): -130
Length Units: meters View: **RL**

Components to Select

Component	Cable Type or:	Length (m)	RL (dB)	Comp. PIM Spec (dBc, 2x20 watts)
Antenna or Load	Loss: 16 dBi	14	150	
TMA or Bias Tee	Gain: 12	30,71	159	
Top Combiner®	Noise Figure: 1,3	17,95	155	
Main Feed Line	Intercept Point: 15	24,29	159	
Bias Tee		24,29	153	
Surge Suppressor		30,71	159	
Bottom Combiner®		30,71	159	
Generic Comp.		30,71	159	
Radio or Tester		30,71	159	

Results

Loss Results
Typical Conn Loss (2 per cable): 0,044
Total Insertion Loss (dB): -6,61

VSWR Results
Typical System VSWR: 29,52
Typical System Return Loss (dB): 0,6
Worst System Reflection: 1,4105
Worst System VSWR: -5,87
Worst System Return Loss (dB): -3

PIM Results
Worst Case Syst. PIM (dBm): -72,3
Worst Case Syst. PIM (dBc): -118,3

EIRP Results
EIRP (dB): 68,6
EIRP (Watts): 7294,9

NF & IIP3 Results
Noise Figure (dB): 2,24

Values for the applicable column are shown

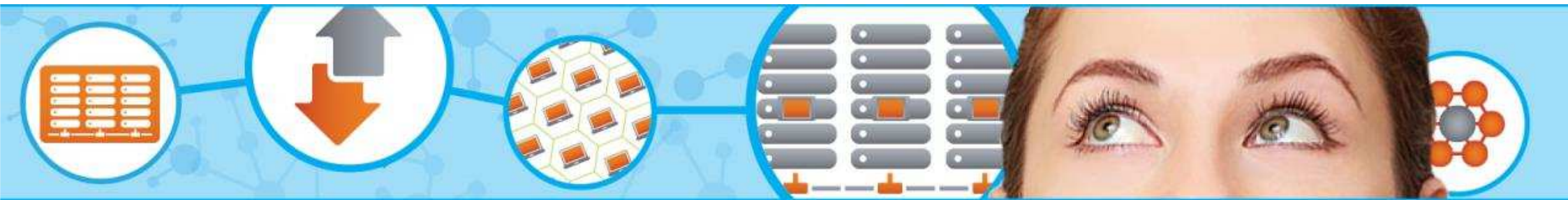
Calculated Results do not change afterwards, or do very slightly due to rounding calcs

Reporting Feedback

- Please report any bug or feedback about the tool to rdiaz@commscope.com



COMMScope[®]



Thank you