# Application Note



## Using IQCreator® to Generate an Adjacent Channel Rejection Test on the ATB-7300 Avionics Test Bench

IQCreator is a powerful software tool that provides all the necessary features required for quick and easy generation of complex waveform files. The user can create any arbitrary waveform required for creating signals related to new avionics products. IQCreator can also be used to create signals which include noise, interference, or other flaws to support advanced testing.

This application note demonstrates how to create a multi-carrier wave form to test adjacent channel rejection on VHF Communications equipment with 8.33 kHz channel spacing.



IQCreator is available for free download from the Aeroflex Test Solutions web site: <u>http://www.aeroflex.com/iqcreator</u>. To learn how to install IQCreator on the ATB-7300, download <u>"Installing and Using IQCreator on the ATB-7300 Avionics Test Bench"</u>.

The following section will describe how to use IQCreator to generate a multi-carrier waveform. A user of the ATB-7300 may require two separate carrier frequencies to test specific functions of an LRU. For this example we will produce a multi-carrier waveform for testing adjacent channel rejection in VHF Communications equipment.

This process will create one carrier with single tone modulation on the channel frequency selected by the user and one carrier with single tone modulation 8.33 kHz (or one standard channel) below the first signal and 10 dBm down.

The first step will be to create the individual tones to be used for the multi-carrier. Different types of modulation can be mixed provided certain criteria are met. All files must have the same sampling rate or be integer multiples of each other and have the same file length in terms of time. For simplicity sake, this process will create similar single tone modulations.

From the IQCreator main screen select Modulation, then Tones.



In the New Tones Settings File window, select New Default Setting and click OK.



In the Settings window, ensure Auto Settings is selected and click Add.

✓ Auto Settings	Frequency (kHz)	Gain (dB)	Phase (*)	I/Q Channel
Eile Length: 100 ps 💌				
Sample Rate: 5 MHz 💌				
Number of Samples: 5000				
Random Phase Reset Phase	<u>A</u> dd	<u>E</u> dit.		<u>Hemove</u>

In the Tone Parameters window, select a tone frequency of 1.5 kHz. Since this is a simple single tone modulation, all other fields may be left at the default. Click OK

Parameters		
Frequency:	1.5	kHz 💌
<u>N</u> umber of Tones:	1	
<u>S</u> pacing:	0	Hz
<u>G</u> ain (dB):	0	
<u>P</u> hase (°):	0	□ <u>R</u> andom
Apply to Channels		
I and Q	🔍 <u>I</u> only	🖸 <u>Q</u> only

Save the created file in a user selected directory by clicking the disk icon in the upper left corner of the IQCreator window. The file will be saved as an .iqc file.

The next step is to generate the AIQ file. Select Generate AIQ File!

10 Creator					- 🗆 🔀
The Modulation Generate ADD File Deck Yew Tools Window Latip					
Settings1 Tooss Makers 10 Imperments Graphics  AlQ File Generation Wizard - Select an IQ source  Select IQ Source: Current Settings	irequency (KHz) Gain (d 1.5000 0.00 Add	49) Phase (*) 1 0 0.00	VQ Obennel I and Q		
Concerned Concerned					
Idle				1	NUM

Ensure Current Settings is displayed in the select IQ Source field and click Next>.

In the AIQ File Generation Wizard - AIQ File Parameters window, enter the user selected directory location and file name in the File Name field. In the Destination Hardware field, select Aeroflex 302XC Series. Click Finish.

AIQ File Generation Wizar	d - AIQ File Paı	ameters			×
<u>F</u> ile name:	C:\Program Files\	Aeroflex\IG	Creator\S	ettings1.aiq	<u>B</u> rowse
Destination <u>H</u> ardware:	Aeroflex 302xC S	eries	-		
Input File <u>S</u> ampling Rate (Hz):	50000	1			
Input File Oversampling Factor:	66	]			
<u>R</u> F Signal Bandwidth (Hz):	3000	]			
Scaling:	100	%			
Description:					
		< <u>B</u>	ack 🛛	Finish	Cancel

The following window will appear to confirm the file details. Click close.

	50 kHz		Close
nber of Samples:	3000		
S:	8191		
st Factor:	3.42e-007 dB		
aristian:			
arkers			
arkers			
arkers Marker Number	r Marker Type	Rise/Fall Profile Shape	: N/A
arkers Marker Number 1	r Marker Type N/A	Rise/Fall Profile Shape Rise Time:	: N/A N/A
arkers Marker Number 1 2	r Marker Type N/A N/A	Rise/Fall Profile Shape Rise Time:	: N/A N/A
arkers Marker Number 1 2 3	r Marker Type N/A N/A N/A	Rise/Fall Profile Shape Rise Time: Fall Time:	: N/A N/A N/A
arkers Marker Number 1 2 3 4	r Marker Type N/A N/A N/A N/A N/A	Rise/Fall Profile Shape Rise Time: Fall Time: Alternate Level:	: N/A N/A N/A N/A

To create the 2nd tone, repeat the steps used to create Tone 1 using a tone frequency of 1 kHz. Save the settings as before in a user defined directory and file name.

Once the tones are created and saved it is now time to create multi-carrier waveform.

From the IQCreator main screen select Modulation then Multi-Carrier.



In the New Multi-Carrier Settings File window, select New Default Setting and click OK.



In the Settings window click Add.

e name	Frequency Offset (Hz)	Gain (dB)	Delay (ms)	Phase (*)
Add	Bemove Random D	elay Re	eset Delay	
		nate ne	set Phase	

In the Waveform Mixing Parameters window, select the Tone 1 that was generated earlier from the user defined directory.

Waveform Mixing Pa	rameters		×
File name: C:\Program	Files\Aeroflex\IQ(	Creator\Exampl Browse	
Frequency <u>O</u> ffset:	0	Hz 💌	
<u>G</u> ain (dB):	0		
<u>D</u> elay:	0	s <b>v</b> Eandom	
Carrier <u>P</u> hase (*):	0	☐ R <u>a</u> ndom	
		OK Cancel	

This tone will be used to generate the first modulated carrier. The Frequency Offset and Gain (dB) fields should be left at 0. Click OK.

The first selected modulation tone will now be displayed in the Settings window. Click Add to set up Tone 2.

Add Edit. Bernove Reset Delay.	name	Frequency Offset (Hz)	Gain (dB)	Delay (ms)	Phase (*)
	\Program Files\Aeroflex\IQCreator\Example Files\M	0.000	0.00	0.000	0.00
Handom Phase Heset Phase	Add Edt. Ber	nove Random P	elay Re hase Re	eset Delay set Phase	

In the Waveform Mixing Parameters window, select the Tone 2 that was generated earlier from the user defined directory.

Waveform Mixing Pa	rameters		
<u>File name:</u> Parameters	rrier\IQC\multi_ca	arrier_tone1.aiq	Browse
Frequency Offset:	-8.33	kHz 🔻	
<u>G</u> ain (dB):	-10		
<u>D</u> elay:	0	s • -	<u>R</u> andom
Carrier <u>P</u> hase (*):	0		Random
		ОК	Cancel

This tone will be used to generate the second modulated carrier. Set the frequency Offset to -8.33 kHz (one standard channel space) and teh Gain to -10. Click OK.

The second selected modulation tone will now be displayed in the Settings window. Save the created file in a user selected directory by clicking the disk icon in the upper left corner of the IQCreator window. The file will be saved as an .iqc file.

10 IQC reator					
Ele Modulation Generate AIQ Fiel 21cc View Tools Window Help					
Settings2           MultiConier   Markers   10 Impaiments   Graphics	-	-	-		
File name	Frequency Offset (Hz)	Gain (dB)	Delay (ms)	Phase (*)	
CAProgram Files/Aeroflex/QCreator/Example Files/M. CAProgram Files/Aeroflex/QCreator/Example Files/M	0.000 8330.000	0.00	0.000	0.00 0.00	
AlQ File Generation Wizard Select an IQ source Select IQ Source: Current Setting: Cfirst Next > Cencel Cancel	novn Handon Pl Oversampin	eley Fre Jate Fre g Factor 1	tor Drieg	I⊽ Auto	
Ide					MUM

Ensure Current Settings is displayed in the Select IQ Source field and click Next>.

In the AIQ File Generation Wizard - AIQ File Parameters window, enter the user selected directory location and file name in the File Name field. In the Destination Hardware field select Aeroflex 302xC Series.

eator\Example	Files\Multi-Carrie	r/IQC/Settings/	2.aiq <u>B</u> rowse.
Aeroflex 302x0	Series	-	
100000			
2			
52000			
100	%		
[			
	eator\Example   Aeroflex 302xC 100000 2 52000 100	eator\Example Files\Multi-Carrie Aeroflex 302xC Series 100000 2 52000 100 %	eator\Example Files\Multi-Carrier\IQC\Settings: Aeroflex 302xC Series  100000 2 52000 100 %

Note: AlQ file generation has a parameter that requires the sampling rate must be 4 times the baseband width. As in this case, if the sampling rate is too slow an error will occur and the AlQ files will not be generated. To correct the error, cancel the AlQ File Generation and return to the Settings window.

Deselect the Auto setting next to the Oversampling Factor field and enter 2.

le name :\Program Files\Aeroflex\IQCreator\Example Files\M :\Program Files\Aeroflex\IQCreator\Example Files\M	Frequency Offset (Hz) 0.000 8330.000	Gain (dB) 0.00 -10.00	Delay (ms) 0.000 0.000	Phase (*) 0.00 0.00
Add	nove Random P	hase Re	set Delay	
	-			

Once the correction is made, select Generate AIQ File!; ensure Current Settings is displayed in the Select IQ Source field and click Next>.

In the AIQ File Generation Wizard - AIQ File Parameters window, enter the user selected directory location and file name in the File Name field. In the Destination Hardware field, select Aeroflex 302xC Series.

AIQ File Generation Wizar	d - AIQ File Pa	rameter	s		×
<u>File</u> name:	eator\Example Fil	es\Multi-(	Carrier\IQC	C\Settings2.aiq	<u>B</u> rowse
Destination <u>H</u> ardware:	Aeroflex 302xC S	eries	•		
Input File <u>S</u> ampling Rate (Hz):	200000	1			
Input File Oversampling Factor:	4				
<u>R</u> F Signal Bandwidth (Hz):	52000	1			
Scaling:	100	%			
<u>D</u> escription:					
	1				
			Paak	Finish	Canaal
			раск	FINISH	Lancel

Note that the Input File Oversampling Factor is now 4. Click Finish.

The following window will appear to confirm the file details. Click Close.

namg rieve.	200 kHz		Close
mber of Samples:	12000		
IS:	6527		
est Factor:	1.97 dB		
scription:			
farkers			
			NU/A
Marker Number	r Marker Type	Rise/Fall Profile Shape:	DVA
Marker Number 1	r Marker Type N/A	Rise/Fall Profile Shape: Rise Time:	N/A
Marker Number 1 2 3	r Marker Type N/A N/A N/A	Rise/Fall Profile Shape: Rise Time: Fall Time:	N/A N/A
Marker Number 1 2 3 4	r Marker Type N/A N/A N/A N/A N/A	Rise/Fall Profile Shape: Rise Time: Fall Time: Alternate Level:	N/A N/A N/A
Marker Number 1 2 3 4	r Marker Type N/A N/A N/A N/A N/A	Rise/Fall Profile Shape: Rise Time: Fall Time: Alternate Level:	N/A N/A N/A

The multi-carrier AIQ file is complete and can be used to generate the test signal.

To demonstrate the waveform, start the ATB-7300 application and select VHF-1 from the Generator-1 dropdown menu.

	N			
	Generator Settings: (12600000 Frequency (-20.00 RF Level	Hz dBm Generator Co Port Control • T/R Po	ntrok RF OFF t rt Ø GEN Port	
	AM Settings: Frequency (1000 Hz	Modulation ) (50.00 96	Enable 0 AN Only	
AVIO	(1000 Hz	) (30.00 % ) (30.00 %	) OFF Single Fill • Playlist • SELCAL	
	VHF Gen-1			

Set the Generator Frequency to 126 MHz, RF Level to -20 dBm, Port Control to GEN Port, and turn the RF ON.

In the Mode field, select Playlist.

Eir ei	šenerator-1 - Analyzer-1 -	Tools	Нер		
	Generator Settings: 126.00000 Frequency (-20.00 RF Level Single File Settings: B7300/Documents/8.33 khz	dBm Generator Control dBm Port Controls • T/R Port • thannel demo.aig File	RF ON Q GEN Port Mode: • AM Only • FM Only		J
AVIO	Loop Count	Play Stop	20 Single File Playlist SELCAL PlayMode: Single Loop Count 20 Continuous	DIO	
MENU	VHF Gen-1		0	ļ	

In the Playlist Setting field, select File...select the multi-carrier AIQ file from the user selected directory.

	Generato	or Settings:	Generator	Control:	
Open an AIO file	12600	0000	Hz	RF OFF	
🔾 🕥 + 📕 🦇 My Docu	iments 🕨 ATB Playlist files	<ul> <li>✓ <sup>€</sup> Search A7</li> </ul>	TB Playlist files 🔎 🛛	Port O CEN Port	
Organize 👻 New fold	er		E • 🗆 🛛	e ochron	
Desitop Downloads Recent Places Documents Documents Music Pictures Videos Computer Local Disk (C:)	ATB Playlist files	Date modifie	ed Type 4 PM AIQ File	File <ul> <li>A M Online</li> <li>FM Online</li> <li>Single File</li> <li>Single File</li> <li>SetCAI</li> <li>PlayMode: Time</li> <li>Single</li> <li>Loop C</li> <li>Single</li> <li>Loop C</li> <li>Single</li> <li>Single</li></ul>	v viie L
File n	ame: Raiq	✓ AIQ File (*	aiq) 🔹		lous

Once the file is opened in the Playlist Settings, select Add To List. In the PlayMode field, select Continuous, then Select Play.

	Generator Settings: (126.00000 MHz Frequency	Generator Control: RF ON	
	20.00 dBm RF Level	Port Control:	
AVI	Single File Settings: B7300/Documents/8.33 kluz cha 1 Count Loop Count	nnnel demo.aig File Play Stop Mode: • AM Only • FM Only © Single File • Playfist • SELCAL	DIO
		PlayMode: ● Single	

To monitor the multi-carrier waveform, connect the ATB-7300 GEN port to the ANT port. From the Analyzer-1 dropdown menu, select VHF-1. Select the ACP (Adjacent Channel Power) tab, set Port Control: to ANT Port and set the following inputs.

Frequency: 126.0 MHz RF Input Level: 0.00 dBm Span: 50.0 kHz RBW: 500 Hz

				ACP			Tooute	
	0 -10 -20 -30 -30 -30 -30 -30 -30 -30 -30 -30 -3	Ar. A. A.	126.0 Нески Кети Span Soo RBW (0.20 Swee Co Plot R Inpp	put Level put Level put Level pot Level p Trne Reference Level ut Setting	z) (50.000 PGLPwr Span n) (50.000 OBW Mea.WC OBW PGL (99.00 OBW PGL (50.00 RF Trig.Level SS		VDL Config. Pott Controls • T/R Port © ANI Port Nm: Single Cont.	
a na Canal II.	ACP Controls:	Hz	3330	TH2 (	-193	-754		
	Channel BW		Channel Spacing		Carrier Power(dBm	) Upper	ACP(dBm)	A CONTRACTOR OF A
	8330	Hz (	t			-29.7		
1000000	Adi Chan RW		Number of Avera	ides		Lower	ACP(dBm)	

Press the Red X to close the Inputs Selection Screen.

You can see the main carrier at 126.0 MHz with the second carrier at -8.33 kHz and -10 dBm from the main carrier.



The second carrier will move with the primary carrier as channels across the band are selected. This resource allows multi-channel testing without the necessity of two separate signal generators.

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Our passion for performance is defined by three attributes represented by these three icons: olution-minded, performance-driven and customer-focused.

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