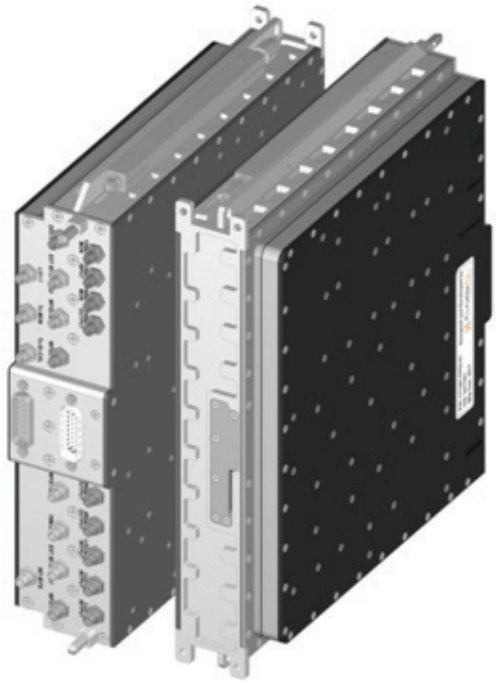
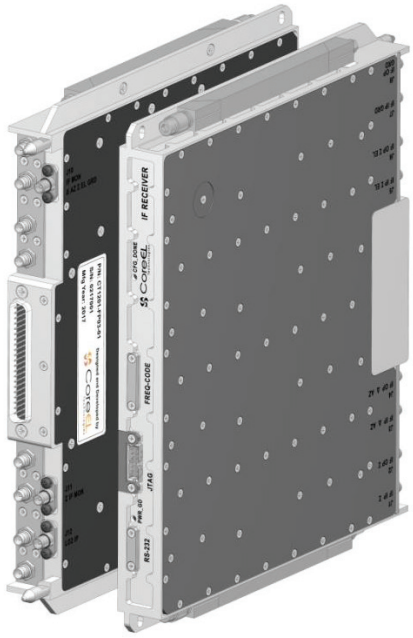
CoreEL Technologies
Enabling Excellence

AESA Exciter Receiver Modules (Synthesizer, IF Receiver and Waveform Generator)

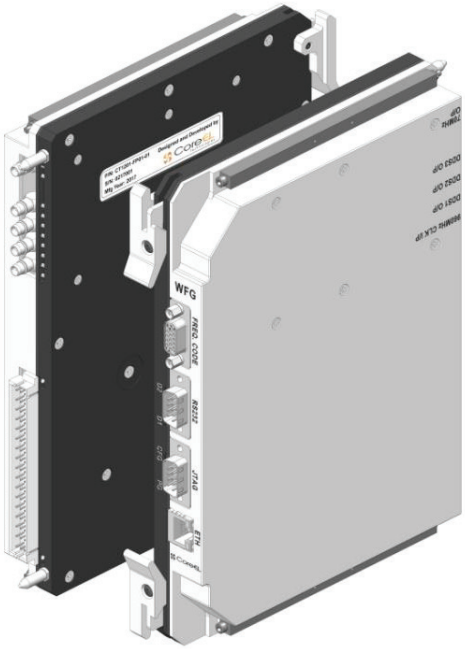
TheSynthesizer (SYNTH) Module, IF Receiver (IFRx) Module and Waveform generator (WFG) Module arede-signed and developed by CoreEL. These modules are developed in house using of-the-shelf commercially available components like Ceramic Filters, LC packaged filters, Semi-conductor devices, Chip Resistors, Chip capacitors, chip inductors etc. These Modules will be used in Exciter Receiver Processor Unit (ERPU) as part of AESA Radar. AESA is an X-band, solid-state active phased array radar. Active phased array technology enables the user to achieve a longer detection range, high mission reliability and multi-target tracking capa-bility. This radar is capable of adding new dimension to Air-to-Air (A/A), Air-to-Ground (A/G) and Air-to-Sea (A/S) operational modes of the fighter aircraft as compared to Mechanically Scanned Array (MSA) radar.



Synthesizer Module



IF Receiver Module



Waveform Generator Module

Parameter	Units	Specification
Transmit Drive		
Frequency	GHz	9.0 to 10.0
Phase Noise		Dynamic: Better then -70dBc/Hz@100Hz offset Static: Better then -80dBc/Hz@100Hz offset
Output Power and its ripple		15dBm±2.5dBm (over temperature & for CW spots over 9-10GHz) ±1.5dBm (Over temperature & w.r.t carrier over 240MHz BW)
Frequency switching time	uSec	<1
Spurious Levels		<-65dBc over 10MHz bandwidth <-55dBc over 9-10GHz
Harmonics Level	dBc	<-60
Carrier, LSB level	dBc	<-60
LO-1		
Frequency and BW		As per Table 1
Output Power and its ripple		+6dBm ±2.5dBm (over temperature & for CW spots over 7.37-8.37GHz) ±1.5dBm (Over temperature & w.r.t carrier over 300MHz BW).
Spurious Levels	dBc	<-55 for FL,FM,FH spots distributed over 7.37 to 8.37 GHz.
Harmonics Level	dBc	<-60
Spurious Levels		<-50dBc over 500MHz BW
Harmonics Level	dBc	<-60
LO2		
Frequency		As per Table 1
Output Power (Mon Port)		-10dBm ±2dBm (over temperature)
Spurious Levels		<-50dBc over 500MHz BW
Harmonics Level	dBc	<-60
Internal BITE		
Frequency	GHz	9.0 to 10.0
Level		0±2.5dBm (over temperature & BW)
Level Control		Through 7 bit Digital Attenuator with 1dB Step
Phase Control		Through QPSK modulator with 2 bit control

Master Oscillator		
Frequency		120 MHz
Stability		Better than 0.1 ppm
Phase Noise (static)		Better than -130dBc/Hz @100 Hz offset
ADC Clock		
Frequency	MHz	160
Level		2 dBm ± 1 dB over temp @ 50 Ohm, Sine Wave
Jitter		< 1 p sec rms Integrated over Nyquist bandwidth
Clock for Waveform Generator		
Frequency	MHz	480
Level		+2 dBm ± 1 dB (over temperature)

Table 1: Specification of Wideband and Narrowband Mode

	WIDEBAND MODE	NARROWBAND MODE
Transmit Drive	LFM Signal 9 to 10GHz Carrier spots BW Varies as per *Table 2* 1 to 100 µ Sec	LFM/Poly phase/Barker signal 9 to 10GHz Carrier spots BW : 5 MHz 1 to 100 µ Sec
LO1	7360-8360 MHz LFM BW Varies as per *Table 2* 25 to 130 µ Sec	7360-8360 MHz CW
LO2	1440 MHz CW	1560 MHz CW
IF1	1640 MHz, BW = 60 MHz	1630 MHz, BW = 5 MHz
IF2	200 MHz, BW = 60 MHz	70 MHz, BW = 5 MHz
Sampling Clock for ADC	160 MHz	160 MHz
Doppler Compensation	N.A	70 MHz ± 40 KHz
Doppler Resolution	N.A	2 Hz
Number of Waveforms	Always LFM BW Varies as per Table 6	256

Table 2: Modes of SAR

Modes of SAR	Transmit Drive (9 – 10 GHz)	LO1 (7.360 – 8.360 GHz)
Mode-1	BW = 180 MHz	BW = 240 MHz
Mode-2	BW = 240 MHz	BW = 300 MHz

IF Receiver Specifications

Parameters	Units	Specifications
RF Input frequency range	MHz	1630 (Narrow Band) and 1640 (Wide Band)
Number of Channels		4
Nominal Conversion Gain over channel and over temp		15 ± 2.0 dB (with AGC = 15 dB) 30 ± 2.0 dB (with AGC = 0 dB)
Input VSWR		1:1.8 (max.)
Maximum Input Power (No damage)		+15dBm
IF Output Frequency	MHz	200
IF Filter bandwidth	MHz	60 MHz (1 dB)
IF Filter Rejection		-50 dBc at 70 MHz away from center freq.
Phase Linearity over IF bandwidth		± 5°(max)
LO2 Frequency	MHz	1440
Spectral purity		-55 dBc over 100 MHz bandwidth
IF Output Frequency	MHz	70 MHz
IF Filter Bandwidth		6.5 ± 0.5MHz (1 dB) in narrowband mode
IF Filter Rejection		-40 dBc at 7 MHz away from center freq.
Phase Linearity over IF bandwidth		± 5°(max)
LO2 Frequency	MHz	1560
Spectral purity		-70 dBc over 10 MHz bandwidth
Output VSWR		1:1.8 (max.)
Second Image Rejection		60 dB
Maximum Output level		+11 dBm
Gain variation in all conditions	dBm	± 2
Isolation between Channels	dB	60
Gain matching between Channels	dBm	±1 (with cal attn. at center value)
Phase matching between Channels	Degree	±5 (with cal phase. at center value)
Gain control (GC) attenuation range	dB	31
GC attenuation resolution	dB	1.0
Gain Attenuation switching speed	ns	200 Max
GC attenuation control		5 bit common to all receivers
GC attenuation matching between	dB	± 1
GC setting for nominal conversion gain	dB	15
There is one digital attenuator for gain calibration facility at 1630MHz. Digital attenuator resolution is 0.5dB and the control bits for each of 4 channels are 4 bit (LVTTL) independent.		
There is one Digital phase shifter for phase calibration facility at 1630MHz. The Digital phase shifter resolution is 5.6 degree with 4 bit (LVTTL) independent for all receiver channels		

Specifications
The WFG Module will receive the below mentioned frequencies. • 960 MHz = Level 1dBm ± 1dB • 480 MHz = Level 1dBm ± 1dB
The WFG Module generates the below mentioned IF frequencies. • Waveform 1 = 70MHz (± 2.5 MHz) • DDS1 ((WFG-1) = 203.75 (± 11.25 MHz)/ 203.75 (± 15 MHz) • DDS2 (WFG-2) = 201.25 (± 15 MHz)/ 201.25 (± 18.75 MHz) • DDS3 = 148.75 – 193.75 MHz
The Waveform1 DAC (70MHz) is used in sweep mode for WB mode.
The Waveform2 DAC (for LO1 generation) is used in sweep mode.
The Part number for the FPGA used is XC7K325T-1FFG900I.
Interfaces LAN, JTAG, RS 232.

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