Thales Broadcast & Multimedia, Inc.
104 Feeding Hills Road
Southwick, MA 01077-9350

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1 PARTS LIST/TUNE UP INFO

1.1 Parts List (active components only)

The RF chain within the transmitter system can be broken down into several smaller sub-systems including: Exciter, Synthesizer, Upconverter, Detector, and Power Amplifier. The following table lists the active components within these sub-systems that ultimately define the frequency stability, RF power regulation, power limiter, and spectral purity of the Thales DVB-H, L-band digital transmitter system. This table should be used along with the block diagrams and/or schematics enclosed to identify location and function of each.

47267381.01	EXITER,SIRIUS,DVB-H,UHF	
45321633.01	EXCITER,PLATFORM,DVB-H	
45324498	PCB-ASSY,LED DISPLAY	
45335416	MOD ASSY, TS	
45324480	PCB-ASSY,TS	
45324492	PCB-ASSY,TX	
45324501	PCB-ASSY,IF FILTER	
45324491	PCB-ASSY,3M-GATE DIGITAL	
45324497	PCB-ASSY, QOS	
45324540	PCB-ASSY,FILTER	

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47267211.01 SYNTHESIZER MODULE, 30-900MHz

47267206 PCB ASSY, UHF SYNTHESIZER

754552-01	AMP, MONO 50-1000 MHz SOT-89	U27
751440-01	AMP, MONO .052W DC 4GHz 13.5dB	U1
751487-01	AMP, MONO .060W DC-4GHz 12.2dB	U13,U26
754300-01	DIODE, 40-214AC 1A GP	D4,D6,D8-11
750249-01	DIODE, 2.5V PREC VOLT REF SMT	Z9
750098-01	RECTIFIER, SCHOTTKY PWR 1A 30V	D7
754588-01	DIODE, ZENER 3.3V 200mW SOD323	Z1-8
750013-01	DIODE, HI SPEED SWITCH SOT-23	D1-3,D5
750809-01	DIODE, PIN ATTENUATOR SMT	D12,D13
751648-01	AMP, MONO WW107.065W DC-4GHz	U19,U25
754224-01	IC, GAAS HBT PROG 5BIT COUNTER	U21
754530-01	OSCILLATOR, SAW 1000.0MHz	Y4
750863-01	IC, LOG AMP DC 500MHz 92dB	U6
607784-01	IC, ACTIVE DETECTOR	U28
754528-01	IC,DDS 1GHz CLK Fo=40MHz	U7
754252-01	IC, PLL TSSOP SGL 16-P CLOCK	U3,U8,U14
754554-01	IC, PRESCALER 1.1GHz MC12080D	U18
754182-01	REGULATOR	U4
750108-01	IC, SWITCHING REG 1.5A HI-EFF	U9
750109-01	DRIVER/RECEUVER, +5V RS-232	U11
754584-01	IC, AND GATE SINGLE SOT-353	U5
754565-01	OSC, OCXO 10MHz w/ADJ	Y3
754586-01	REG, FIXED 7V 1.5A SWITCHING	U33
754585-01	REG, FIXED 3.3V 1.5A SWITCHING	U29
750001-01	SWITCH, SPDT	U22-24
754520-01	IC, OP-AMP LOW NOISE 1 SUPPLY	U2,10,12,16,17,20,32
750166-01	IC, 12-BIT DAC 4-OUTPUT	U30
750011-01	TRANSISTOR, NPN SWITCH SOT-23	Q1,Q4,Q5,Q7-10
750797-01	TRANSISTOR, NPN 6GHz BFR93A	Q2
750293-01	TRAN, SMD NPN SOT223 SIGNAL	Q11
750730-01	MOSFET, ZVN3320FTR	Q3,Q6
754329-01	IC, PRESCALER DIV-2 FIN=3GHz	U15
754531-01	OSC, VCO 430-900MHz V-TUNE1-18	Y1

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47267228.01 UPCONVERTER, L-BAND

47267238 CONVERTER MODULE, L-BAND

47267292 PCB ASSY, UP-CONVERTER (LO)

750259-01	IC, AMP LOG .1-2.2GHZ 70dB DR	U8,U9
750014-01	AMPLIFIER, +36dBm IP3 SOT-89	U4,U5
751440-01	AMP, MONO .052W DC 4GHz 13.5dB	U2
750035-01	MMIC POWER AMPLIFIER, 0.8-3GHz	U11,U12
750005-01	IC, V-REG +5V .1AMP SOT-89	U7,U10
750276-01	FREQUENCY MIXER, SMT	U1

47267240 INTERMEDIATE PWR AMP

47267297 PCB ASSY, INTERM 1.8-3.6GHZ

750259-01	IC, AMP LOG .1-2.2GHZ 70dB DR	U2
750005-01	IC, V-REG +5V .1AMP SOT-89	U3
750515-01	GAaS FET,	Q1,Q2

47267375 ALC MODULE ASSY, L-BAND

47267368 PCB ASSY, LO MONITORING L-BAND

750004-01	IC, DUAL OP AMP 8PIN SMT	U3
750005-01	IC, V-REG +5V .1AMP SOT-89	U4
750011-01	TRANSISTOR, NPN SWITCH SOT-23	Q1
750012-01	TRANSISTOR, PNP SWITCH SOT-23	Q2
750259-01	IC, AMP LOG .1-2.2GHZ 70dB DR	U2
751538-01	AMP, MONO .065W DC-4GHz 16.1dB	U1

47267366 PCB ASSY, ALC L-BAND

750013-01	DIODE, HI SPEED SWITCH SOT-23	D3
750016-01	DIODE, PIN DUAL CATHODE SOT-23	D1,D2
750110-01	QUAD 2-CH ANALOG MUX/DEMUX	U3,U4
750293-01	TRAN, SMD NPN SOT223 SIGNAL	Q1
750327-01	REGULATOR, +8V	U5
750439-01	AMP, QUAD OP	U1,U2

47267377 MODULE, ENV DETECTOR TRUE-RMS

47267376 PCB ASSY, TRUE-RMS DETECTOR

750409-01	REGULATOR, VOLTAGE +5 .5A	U1
750964-01	IC, QUAD OP AMP	U2,U3
607784-01	IC, ACTIVE DETECTOR	U6,U7,U8

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47267227.01 AMPLIFIER ASSY, L-BAND

47267226 POWER AMP SUB-ASSY, L-BAND

47267231 PCB ASSY, PWR AMP L-BAND

750071-01	SENSOR, VOLT OUTPUT TEMP W/SIG	U2
750015-01	DIODE, RF SCHOTTKY BARRIER SMT	D3
750658-01	DIODE,COMMON,CATHODE,SMT	D1
750016-01	DIODE, PIN DUAL CATHODE SOT-23	D2
750168-01	TRANSISTOR,GAAS FET	Q3
750602-01	TRANSISTOR, GAAS FET	Q1,Q2
754548-01	TRANSISTOR, GAAS FET	Q4,Q5

1.2 Tune-up Information

Each Thales transmitter is factory calibrated, and requires only a minimum start-up procedure to ensure proper operation. The normal start up precedure for installation and operation of the Thales transmitter can be found in the equipment manual. The guidelines below offer additional setups beyond those required to normally operate the transmitter and are viewed as maintenance routinues. In most cases the calibration process involves a software tool running on a laptop computer. The user should be familiar with this software prior to attempting calibrations.

1.2.1 Power Limiter & Manual Gain Calibration

- Start with amplifiers switched off via their front panel key switches
- Using the software GUI, Set ALC MODE SELECT = 0
- Connect a cable to the preamplifier's front panel RF Sample Output
- Set POWER LIMITER value to zero (at this point, maximum output power should be +9dBm from preamplifier direct output; Measured at front panel sample would be -21dBm max.)
- Set ALC MODE SELECT = 1
- Set ALC AUTO REF to 4095
- Switch on power amplifiers via their front panel key switches.
- Raise the POWER LIMITER value until power is 1db above the nominal power
- Set ALC MODE SELECT back to 0:
- Raise ALC MANUAL REF from parameter value of zero until nominal power achieved.
- Set HEALTH SNAPSHOT 65535 to clear any faults

1.2.2 Forward Power Calibration

- Using the software GUI, Refresh the monitored variables under normal debug mode 1
- Under monitored variables frame; Read values displayed in the second row. The value in the cell titled LOW is first multiplied by 256 then that result is added to the value in the cell titled HIGH. The value determine from this operation is now entered into SYSTEM FORWARD POWER REFERENCE parameter.
- Using the software GUI, again set ALC AUTO REF until the transmitter output power is 6dB +/- 0.1dB lower than nominal output power. This -6dB setting is critical for the front panel display accuracy.
- Using NORM DEBUG MODE 1 again read values displayed in the second row. The value in the cell titled LOW is first multiplied by 256 then that result is added to the value in the cell titled HIGH. Record this value.
- See figure 13 below, locate the write setting partition , you should see two fields one named address, the other named Data. Enter 65 into the address field

- Now enter the recorded value from the step above into data, then click send. At this point the scale factor will be incorporated into the meter system.
- Confirm that 25% is displayed on the front panel meter under SYSTEM FORWARD POWER.
- Raise ALC AUTO REF until system reaches nominal power and 100% on the front panel meter.
- This completes the forward power meter calibration.
- Set HEALTH SNAPSHOT 65535 to clear any faults

1.2.3 Automatic Level Control

- Using the software GUI, Place system back to auto ALC mode by setting ALC MODE SELECT = 1
- Lower ALC AUTO REF until system reaches nominal power
- Perform linear and non-linear pre-correction of transmitter using the front panel menu via the Exciter (see below). After correction the exciter's output should be still at -18dBm output level, if not readjust output back to this nominal level.
- With the exciter now at -18dBm, If necessary go back to refine ALC AUTO REFERENCE to nominal power after correction.
- Set HEALTH SNAPSHOT 65535 to clear any faults

1.2.4 Upconverter Power Meter Calibration

- Refresh the monitored variables under normal debug mode 1
- Under monitored variables frame; Read values displayed in the eighth row The value in the cell titled LOW is first multiplied by 256 then that result is added to the value in the cell titled HIGH. The value determine from this operation is now entered into UPCONVERTER FORWARD POWER REFERENCE parameter. This completes the preamplifier meter calibration.
- Set HEALTH SNAPSHOT 65535 to clear any faults

1.2.5 Reverse Power Calibration

- Verify the level arriving to the TRU-RMS Detector is +5dBm +/- 2dbm, if not troubleshoot (the level is determined by a fixed coupling factor and fixed attenuation values based on transmitter output power rating; if the level is out of tolerance one should expect something wrong in the RF chain.)
- In order to calibrate the reflected meter; Swap the forward sample and reflected sample cables on detector module.
- Set NORMAL DEBUG MODE = 1(For a complete explanation of debug modes see 25-0021) screen will auto refresh. Note that the variable names no longer represent actual parameter DOC# 25-0021 explains the function of each parameter under the various debug modes. (Normal debug mode = 1 is used for meter calibration)
- Under monitored variables frame; Read values displayed in the third row The value in the cell titled LOW is first multiplied by 256 then that result is added to the value in the cell titled HIGH. The value determine from this operation is now entered into SYSTEM REFLECTED POWER REFERENCE parameter. This completes the reflect meter calibration.
- Return cables to normal position.
- Set HEALTH SNAPSHOT 65535 to clear any faults

1.2.6 Calibrate Fast Reflected Shut Down

- Sample TX output, use an inline variable attenuator. Set level to -5dBm, connect this signal to the reflected port of TRU RMS detector module.
- Raise level slowly until the preamplifier's LCD display of reflected power reads 15%

- Lower the FAST REFLECTED THRESHOLD until the power is reduced by approx. 6dB (this power reduction is pre determined) A typical value of fast reflected threshold = 1000 This threshold must be precise use smaller calibrations steps when reaching near the value of 1000
- Once tripped it will stay at reduced power to verify or to recalibrate lower the sample and reset the module, use the reset button on the SOFTWARE GUI window for this purpose.
- Verify that you can raise the reflected power percentage to at least 10% without the transmitter tripping into it's 6dB protection mode. Also exceed the 15% mark to active the protection system. Again reset the module back into normal operation when this test is completed.
- Now set system reflected power percent limit to = 25
- Return all cables to normal
- Set HEALTH SNAPSHOT 65535 to clear any faults

1.2.7 Non-linear precorrection

- Navigate to the menu for non-linear calibration on the exciter's front panel; this is located under the F5 button on the keypad located below the display window. [Press F5 once]
- The feedback sample should be connected prior to the channel filter (default location)
- Observe the feedback level is Normal; see feedback level indicator.(Typical level is –15dBm)
- Apply a one shot or place the correction in adaptive mode; allow few seconds for automatic correction.
- Observe the shoulder level; ensure it is within tolerable limits. (i.e. ≥34dB)

1.2.8 Linear Precorrection

- Navigate to the menu for linear calibration on the exciter's front panel; this is located under the F5 button on the keypad located below the display window. [Press F5 twice]
- The feedback sample should be connected after the channel filter
- Observe the feedback level is Normal; see feedback level indicator.
- Apply a one shot or place the correction in adaptive mode; allow few seconds for automatic correction.
- Observe the frequency response and group delay; ensure they are within tolerable limits.

1.2.9 Raise & lower power

- Navigate to the menu for POWER & CONTROL on the exciter's front panel; this is located under the F3 button on the keypad located below the display window. [Press F3 once]
- Change power by selecting the appropriate output power in a percent value. An increase or decrease can be achieved, so long as the maximum rating of the transmitter is not exceeded. Example to reduce the transmitter to 90% output select 90% in menu control.
- Observe the power adjustment. Note this step requires that transmitters meter calibration has been conducted or default factory cal has not been changed.