HITS®/WS-NET® Applications Note

GENERAL DESCRIPTION

This Application Note provides information for configuring Drake Digital Headend Products for QPSK to QAM transmodulation and specifically for HITS and WS-Net programming.

Drake offers two solutions for QPSK to QAM transmodulation, often referred to as a transcoder function. The first offering is the Drake Component series where the following modules will be interconnected: SDQPSK - satellite demodulator, TMQAM - QAM modulator, DUC860 or DUC550 – up-converter, and a PS8 power supply. The DRMM12 rack mounting assembly will be used to house two transcoders per DRMM12.

The second offering is the SCT860 Transcoder System. This system utilizes SCT860 transcoder modules with the satellite demod, QAM modulator, and up-converter all in one package. The PS100 power supply can power up to six SCT860s and the six SCT860s and one PS100 all mount in the model SCTR rack mounting tray. Remote control capability is provided with the SCT860 transcoder system. EAS is easily accommodated by either system utilizing the IF loop on the component series or the EAS input on the SCT860.

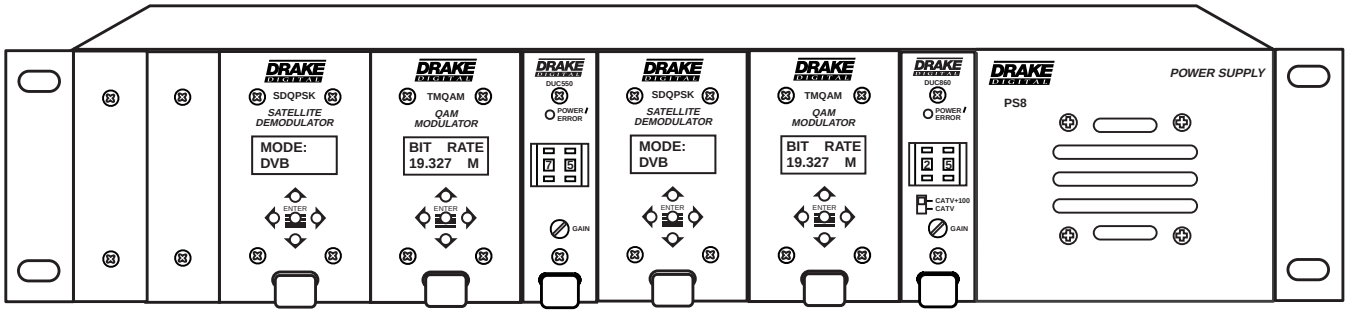


FIGURE 1 - Drake Component Series

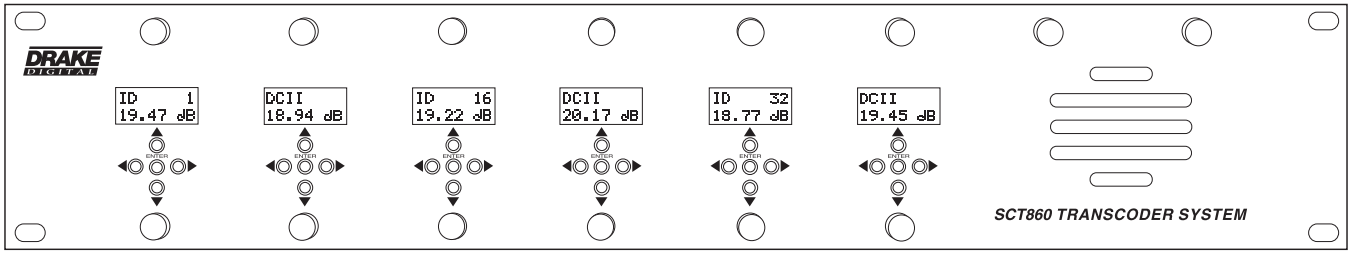


FIGURE 2 - Drake SCT860 Transcoder System

DESCRIPTION – DRAKE COMPONENT SERIES

When configured as shown in Figure 3 and Figure 4, and setup for HITS or WS-Net operation, the following functions are provided.

SDQPSK: This module contains the L band satellite front end and QPSK demodulator. Output is a MPEG2 transport stream via the SPI, LVDS output DB25 connector.

TMQAM: This module accepts the incoming transport stream via its DB25 input connector. It provides the QAM modulation function. Output is a 6 MHz wide IF signal centered at 44 MHz. This is to be connected to the DUC module input.

DUC860 or DUC550: These modules are the RF up-converters that convert the 44 MHz IF output from the TMQAM to the actual desired output channel for distribution to the set top boxes. The DUC860 is for output channels between 550 and 860 MHz.

The DUC550 is used when the desired channel falls between 54 and 550 MHz. One or the other will be used depending upon your QAM output channel mapping. The output channel is selected by the front panel switches on the DUC module. The maximum RF output level from this module is +45 dBmV.

PS8 Power Supply: The PS8 supplies +12 V and +5 V power to all of the above modules. Connect the power cables, supplied with each module, to any one of the output connectors on the PS8.

DRMM12: The DRMM12 rack mounting assembly is used to house all of the above modules used to make up the transcoder. Two complete transcoder configurations can be installed in this assembly with two empty slots remaining.

Figure 3 - Front view of one DRMM12 rack with two transcoder channels installed

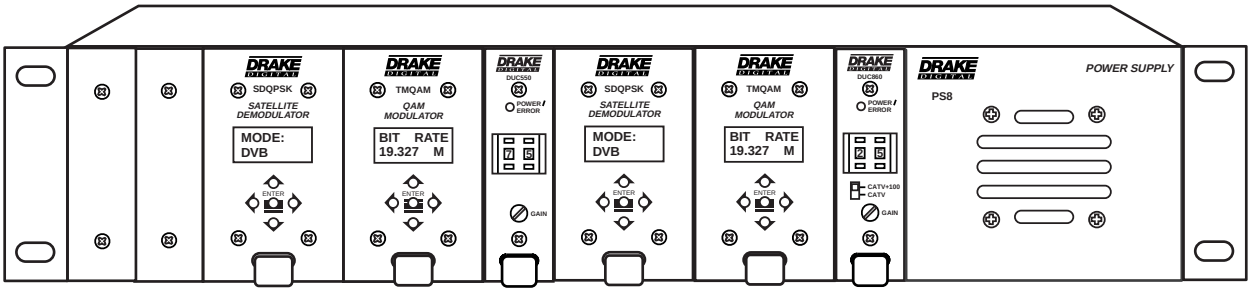
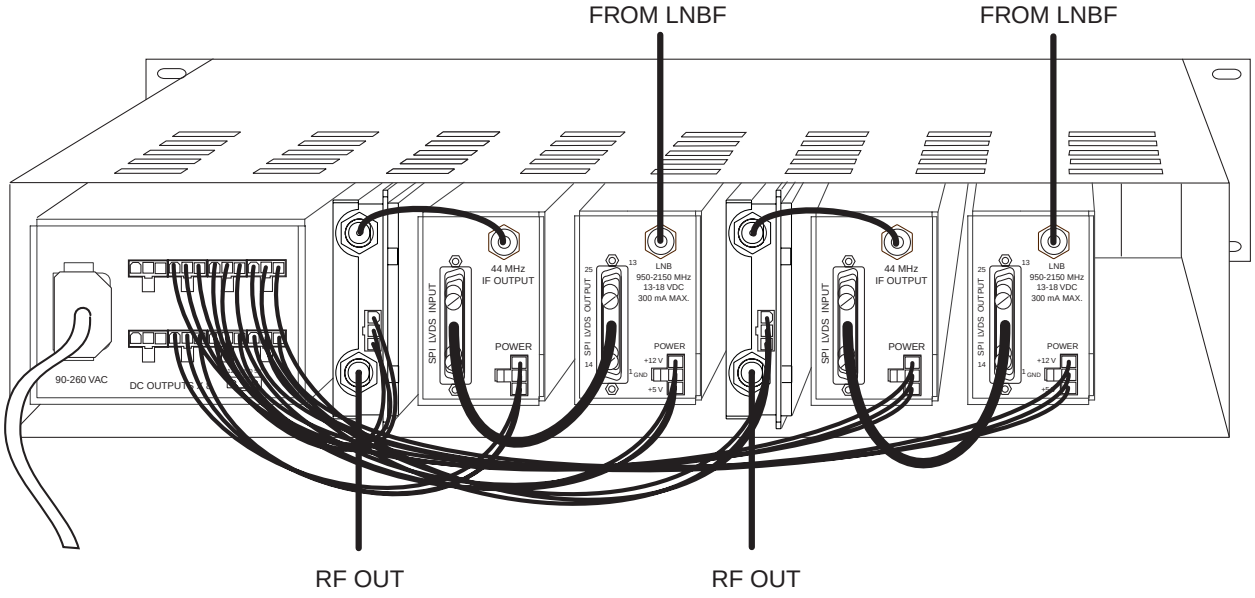


Figure 4 - Rear view of the wiring of one DRMM12 rack with two transcoder channels installed



DESCRIPTION – SCT860 TRANSCODER SYSTEM

The *SCT860* system provides the L band tuner, demodulation, QAM modulation and RF up-conversion functions all in one module. Up to six of these modules can be powered by one PS100 power supply and mounted in a 2U high, SCTR rack mounting tray.

Figure 5 - Front view of one SCT860 Transcoder rack with six transcoder modules installed

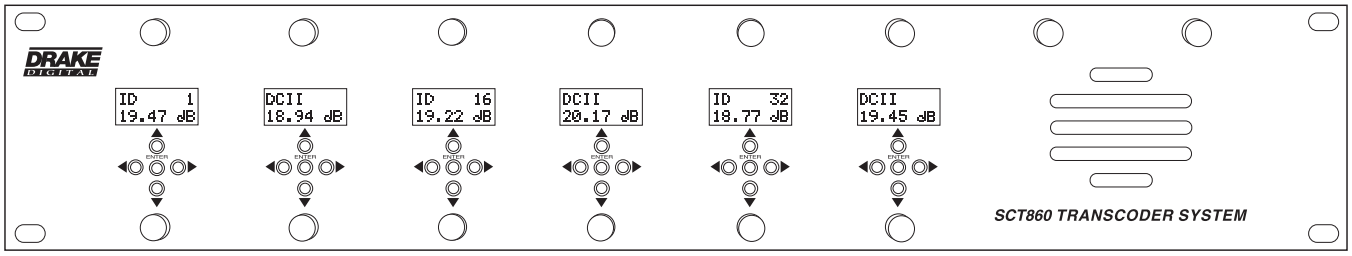
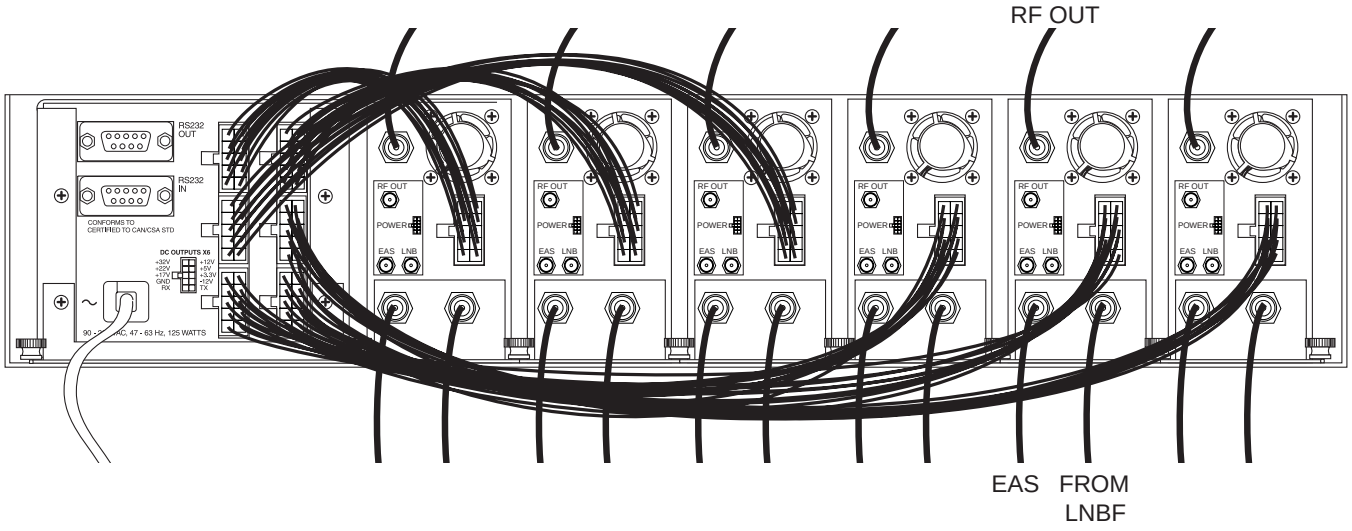


Figure 6 - Rear view of the wiring of one SCT860 rack with six transcoder modules installed



HITS AND WSNET FREQUENCIES

Figure 7 shows the IF frequencies which are present at the LNB output. These will be connected to the transcoder IF input. These are sometimes referred to as the L band frequencies. Note that if a stacked type LNB is used, the horizontally polarized signals will be shifted 575 MHz higher than for the dual polarity type. The paragraphs immediately following provide additional information.

HITS and WS-Net TRANSPONDER FREQUENCIES and POLARIZATIONS CHART

L BAND LNBF OUTPUT					
Transponder		**Sat.**	**DPS* Freq.**	**Polarization**	**Stacked Freq.**
WSNET	1	T6	1241	V	1241
	2	T6	1427	V	1427
	3	T6	1278	H	1853
	4	T6	1154	H	1729
	5	T6	1123	H	1698
	6	T6	1148	V	1148
HITS	1	G4	1170	H	1745
	2	G4	1150	V	1150
	3	G4	1130	H	1705
	4	C4**	1410	H	
	5	G4	1030	V	1030
	6	G4	1050	H	1625
	7	G4	1390	V	1390
	8	G4	1190	V	1190
	9	G4	1290	H	1865
	10	G4	1310	V	1310
	11	G4	1070	V	1070
	12	C4**	1130	H	
	13	G4	1410	H	1985
	15	G4	1090	H	1665

*Dual Polarity System
**C Band

FIGURE 7

POLARIZATION and LNB TYPES

When signals are uplinked and downlinked through a satellite it is important to make as efficient use of spectrum as possible in order to pass the maximum possible number of signals in the allocated bandwidth. In order to do this, half of the satellite transponders are transmitted with horizontal polarity and half with vertical polarity. The inherent isolation between polarities allows some frequency overlap between signals of opposite polarities thus permitting more bandwidth to be utilized.
At our receiving dish, we must be able to separate the horizontal signals from the vertical signals and feed each polarity to the appropriate transcoders. The most common type of dish installation uses two LNBs - one LNB for each polarity. This is a **DUAL POLARITY** system. Thus there are two IF cables coming from the dish, each with 950 – 1450 MHz energy. Usually each of these cables will be connected to a splitter, which in turn passes the signals of that polarity to the connected transcoders. Make sure that each transcoder is connected to the splitter providing the correct polarity for that transcoder as shown in Figure 7.

There is another way to send all signals of both polarities to the transcoders with only one common IF cable. To do this, a **STACKED** LNB/feedhorn is required. In this type of installation, there are still two LNBs (one for each polarity) on the dish, although they may be contained in a single housing. The horizontal LNB uses a local oscillator frequency that has been shifted 575 MHz higher from the normally used frequency for the LNB. Thus the output IF range of the horizontal transponders is 575 MHz higher than it would be in a standard dual polarity system and it is shifted completely above the range of the vertical polarity LNB output. The two LNB IF outputs are combined on one cable and the entire range of signals fits in the 950 to 2050 MHz frequency range. This allows a single cable to serve the headend. Any transcoder can then tune to any transponder instead of being limited to the polarity based on the connected cable. A disadvantage of the stacked system is that there is more cable loss due to the higher frequencies used (up to 2050 MHz). Be sure to use cable, line amps, splitters, etc that are specified to 2050 MHz if you are using the stacked LNB type.

After determining which LNB configuration you are using, refer to Figure 7 to find the correct frequency for a given transponder when programming the SDQPSK. SCT860 users need to be sure to select the correct LNB type in the LNB menu.

LNB POWERING OPTIONS

The LNBs must receive power through the IF coaxial cable. The SDQPSK module or the SCT860 can be set to provide a range of DC output voltage at the IF input connector to power LNBs. However, because multiple transcoders are usually connected to any one LNB, it is necessary for the L band splitter that is used to have a power passing port to the transcoder that is supplying the power. If you use a splitter that provides power passing from all ports, power can come from any transcoder but it is recommended that only one transcoder per splitter be set to power the LNB. The other transcoder's LNB power setting should be set to OFF. Many times the LNB power is supplied from a separate power supply and power inserter connected between the LNB and the L band splitter. When this is the case, the transcoder LNB voltage should be set to OFF.

RECEIVING PROGRAMMING FROM BOTH HITS and WS-NET

Most HITS transponders can be found on satellite G-4R, Ku band. Several are located on C4, C band. The WS-Net transponders are located on satellite T-6. Thus, in order to receive both services, you will need either two separate dishes, one pointed at each satellite, OR one oval dish with provisions to mount LNBs at two mounting points, one for each satellite. The LNBs can be either dual polarity types or stacked types. If you use the dual polarity system, you will have at least four coax cables going to the headend – H and V polarities (950 – 1450 MHz on each cable) for each satellite. If you use stacked type LNBs, you will have just two coax cables, one for each service with all signals present between 950 and 2050 MHz on each coax. If HITS services on C band are desired, an additional cable for the C band LNB will be needed. Each transcoder must be connected to the output of the splitter or switch that contains the correct satellite feed and polarity.

HOT STAND-BY

The SCT860 transcoder system is particularly suited for hot standby applications. A spare stand-by transcoder can be connected using either a stacked LNB system or one of the switch configurations discussed in the "LNB SWITCHING OPTIONS / BACK-UP TRANSCODERS" section . This gives it access to any input polarity or satellite. The output RF can be set to STANDBY, which is off. When it is desired to switch on the spare, the transcoder OUTPUT is reprogrammed (via remote control if desired) to NORMAL. The SCT860 that is going offline can be switched to STANDBY.

LNB SWITCHING OPTIONS / BACK-UP TRANSCODERS

Normally, a particular transcoder will be cabled to the splitter output providing the required signal for that transcoder, and once connected it does not need to be changed. If it is desired to provide a spare transcoder as a back up and not require recabling if it is put in service, an L band switch or multiswitch will be required. The Drake transcoder solutions allow this to be done in a cost effective manner because the Drake SDQPSK module or SCT860 transcoder both provide the necessary LNB voltage switching and 22 kHz control tone signal. This permits a single back up transcoder to be easily put on line in place of any other transcoder, even in a dual polarity and dual satellite HITS/WS-NET LNB installation. If the SCT860 transcoder system is used, this can all be controlled remotely via the RS232 link, if desired.

To determine what type of L band switch is needed, proceed as follows:
If you have a single service (HITS or WS-NET) from one satellite, with a stacked LNB, you need no switch. All channels are present from the splitter output between 950 and 2050 MHz.

If you have a single service with a dual polarity system in use, then you have you have two possible inputs to switch between – one horizontal and one vertical splitter output. Use a voltage controlled (13V/18V) L band switch. This switch only needs to cover 950 to 1450 MHz (or higher) and is readily available in DBS equipment catalogs. Use the 13V/18V LNB voltage selection on the transcoder to select a a polarity. Common practice is to use 13V for vertical and 18V for horizontal polarity.

If you have both HITS and WS-NET services and each feed is from a stacked LNB, then you can switch between services using a 2-way L band switch with 13V/18V switch control. This is similar to the set up for a dual polarity single service connection except that in the dual services case, there will be stacked signals between 950 and 2050 MHz present on each input. The switch must be rated for use up through 2050 MHz.

If you have both HITS and WS-NET services and there is a horizontal and vertical feed used from each service, then you have four possible inputs (950 to 1450 MHz) to choose among. This switching can be accomplished with a multiswitch or a "magic" switch with 4 LNB inputs. Follow the switch manufacturer's instructions. A typical magic switch will use the 13V/18V switching from the transcoder to select vertical (13V) or horizontal (18V) polarity and the 22 kHz tone will be used to switch between satellites – for example 22kHz off for HITS and 22 kHz on for WS-NET.

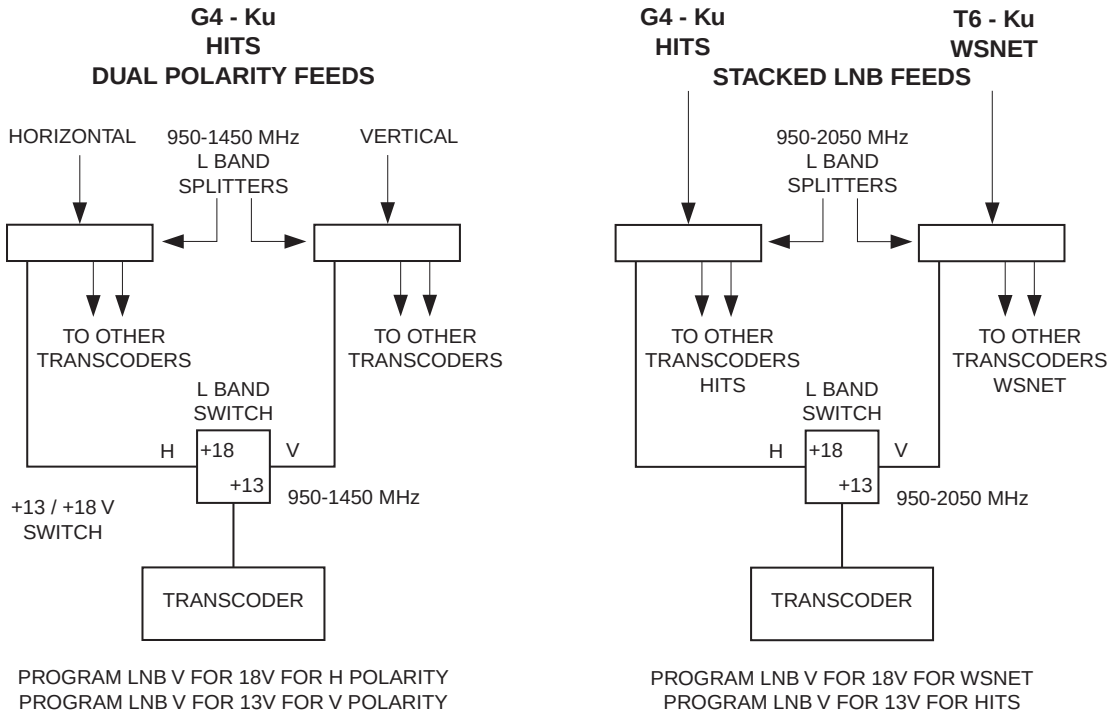


FIGURE 8 - L Band Switch Applications for +13V / +18V Voltage Controlled Switches

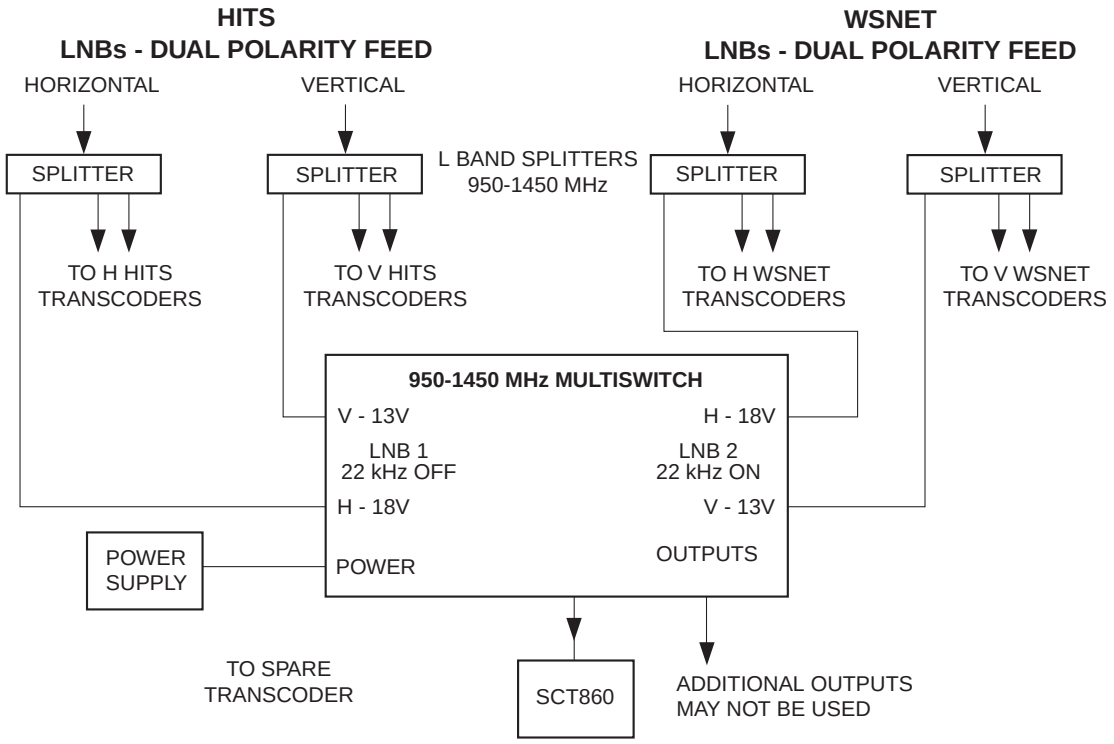


FIGURE 9 - Multiswitch Application, HITS and WSNET

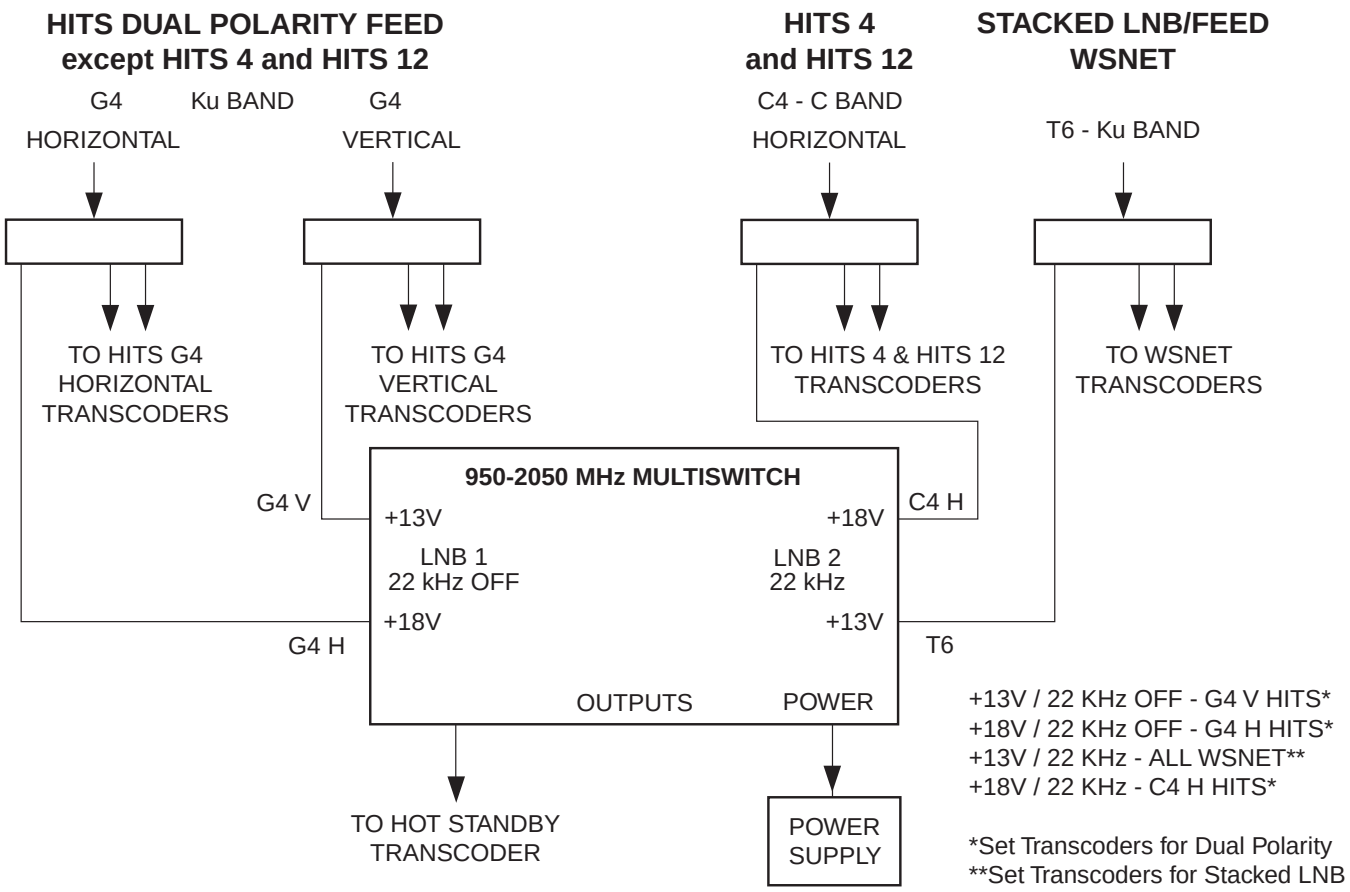


FIGURE 10 - HITS Ku and C Band, and WSNET Multiswitch Application

SET UP OF TRANSCODER PARAMETERS FOR HITS OR WS-NET

See instruction manuals for the individual component modules or the SCT860 for full programming instructions.
It is possible to eliminate the need to manually setup many of the parameters for HITS or WS-NET because these have been preloaded at the factory into a preset memory. You can use the presets for faster installation but be assured that the Drake transcoder solutions still allow you to return to the setup menus at any time and adjust a particular individual parameter if required. The following chart gives instructions for loading the presets for HITS and WS-NET, and other additional installation information.

INSTALLATION INFORMATION AND INSTRUCTIONS CHART

TOPIC	DRAKE COMPONENT SERIES MPEG2 MODULES	DRAKE SCT860 TRANSCODER SYSTEM
Modules:	SDQPSK + TMQAM + DUC(550 or 860)	SCT860 transcoder.
Power Supply:	PS8	PS100.
Rack Mounting:	RMM12 - holds two transcoders with PS8 in 2U space.	SCTR - holds up to six SCT860s and PS100 in 2U space.
Ventilation:	Provide 1.75" space above and below each RMM12	No space required between SCTRs due to fans. Leave 1.75" space above top and below lowest SCTR.
Presets:	Factory stored parameters for HITS and WS-NET.	Factory stored presets for HITS, WS-NET and others.
Preset Function:	Sets up SDQPSK and TMQAM for preset service. User must then program input IF freq., LNB voltage or tone & output channel.	Sets up demod and QAM mod. and up-converter parameters including IF frequency. User must then program LNB info and output channel.
Warning:	Loading the preset data will overwrite current settings. LNB settings are not changed. Output channel is not affected.	Advancing to the next screen after selecting a preset will change parameters for that transcoder. Current settings will be replaced. Output channel, output level and LNB settings are not changed.
Load Presets:	Press ENTER and DOWN ARROW front panel buttons simultaneously and hold for 3 seconds. Do this, one module at a time, on all SDQPSK and TMQAM modules in each rack. Return to SDQPSK modules to set LNB info and input IF frequency for desired transponder.	Select the preset service, such as HITS or WSNET, from the MODE menu. Advance to the next menu with the right arrow button. Select the specific HITS or WS-NET transponder. Advance to the LNB menu using the right arrow button. Select DUAL POL or STACKED. Repeat process for each SCT860.
IF FREQ Setting:	Refer to chart, Figure 7, and program each SDQPSK.	Preset procedure sets automatically. It is essential that the proper LNB type (DUAL Pol or Stacked) is selected from the LNB menu.
LNB Settings:	SDQPSK - Program LNB voltage for LNB or set to off if LNB power is not obtained from this module. 22 kHz tone is provided if needed to control LNB switching (see page 5) set to off if not used.	LNB menu - Select DUAL POL or STACKED. LNB V menu - Set as required if power is obtained from this transcoder or set to off if not needed. Choose a selection with 22 kHz tone if tone is needed for LNB switching. See page 5.
Output Channel:	Set CATV channel on DUC550 or DUC860.	CHANNEL menu - Set desired CATV output channel.
Output Level:	Screwdriver adjust, front panel setting on DUC module.	RF OUT menu - Select desired level in dBmV.

HITS AND WS-NET PARAMETER SUMMARY
After loading the factory preset parameters, the following values should be set. These settings were accurate as of May 2002. After presetting, these values should be displayed on the various menus of each module.

SDQPSK *settings:* MODE: DCII COM
IF FREQ: As required – see transponder list
BD RATE: 19.510
VITERBI: SCAN
LNB V: set to OFF if not needed to power LNB or set to required voltage.
22 kHz: set to OFF if not used for LNB switch control or ON if required.

TMQAM *settings:*
SOURCE: EXTERNAL
INPUT: CLK-NORM
OUTPUT: MOD-INV
LOOP BW: 10 HZ
MODE: ITU B
QAM: 64
INTERL'V: I128, J1
CLOCK: FIXED
BD RATE: 5.057

DUC *settings:*
Set channel switches to desired output CATV channel. If a channel is higher than 99, on the DUC860, set the slide switch to CATV + 100 and the last two digits of the channel number on the channel switches. If the channel is a two-digit channel number in the DUC860 range, be sure the slide switch is in the CATV position. If a broadcast channel frequency is needed instead of CATV channel, an internal jumper can be set to provide this output frequency range.

SCT860 *settings:*

UNIT ID:	user selected
MODE:	HITS or WSNET
PRESET:	HITS1, etc as selected
LNB:	user selected type
LNB V:	user selected
IF FREQ:	based on preset and LNB. See Figure 7.
BD RATE:	19.510 M
ENCODER:	ITU-B
MODULAT:	64 QAM
INTERLV:	I128, J1
CLOCK*:	AUTO*
BD RATE*:	5.057*
OUTPUT:	NORMAL
RF OUT:	user selected
CHANNEL:	user selected per channel map

*CLOCK and BD RATE (QAM) menus are only present if a 1002365 option board has been installed.

SNR OPERATIONAL CHECK
After storing parameters, the LCD of the SDQPSK will default to a SNR display. The SCT860 will default to a screen where the SNR is displayed on the bottom line of the display. For either unit, the minimum SNR for lock is usually around 7 dB but this would leave no margin for fading. You must have several additional dB for reliable operation and to minimize rain fades, etc. Make sure your dish is peaked for maximum SNR on the SDQPSK satellite demod or the SCT860 or other L band signal strength meter made for that purpose. Do not try to peak the dish based on the signal strength reading on the set top box. The set top box reading is mainly determined by the QAM delivery plant and does not indicate a low SNR margin in the satellite path.

DATA RATE CHECK for SDQPSK MODULE
On the SDQPSK, while not in the adjust mode, push the down arrow to display output bit rate. This should read 26.969 Mbps (assuming an input symbol or baud rate of 19.51 Msps). If this display is not stable, there is a problem such as a signal level that is too low.

FIRMWARE VERSION READOUT
While not in the adjust mode, press the up arrow. The firmware version number will display on the front panel LCD. This applies to SDQPSK and the TMQAM modules as well as the SCT860 transcoders.

OUTPUT LEVEL / CW OUTPUT MODE
For proper operation, all of the QAM output channels should be the same level. Usually this level is set about 10 dB below the level of analog NTSC video carriers on the same cable plant. Because the QAM output signal is very broadband in nature, a spectrum analyzer usually does not operate at the correct bandwidth to provide an accurate amplitude display of the QAM signal. Other CATV level meters may also read inaccurately with a QAM input unless designed specifically for that purpose. If you want to set levels with a simple analog analyzer or meter, the TMQAM and the SCT860 provide an easy way to do that. Go to the OUTPUT screen on the TMQAM or the SCT860 and enter adjust mode. Select CW. Save this selection. Optionally, for the SCT860, if the RS232 remote control interface is used, you can program all controlled transcoders to switch to CW with a single command. In the CW mode, the transcoders will just output a single unmodulated CW carrier at the center frequency of the output channel. Use the meter or analyzer to monitor output levels after the headend combiner and adjust the DUC550/860 output level front panel adjustment or the SCT860 level from the RF OUT menu to the desired levels – equal to all other QAM channels using CW output also and usually 10 dB below any analog channels. **Measure the CW carrier at the center of the QAM channel not at the NTSC video carrier location for that channel.** After adjusting all of the output levels in the CW mode, return to each TMQAM and change the OUTPUT setting back to MOD – INV and save or on the SCT860, from the OUTPUT menu, return to NORMAL. If the SCT860 remote control software is used, all SCT860s can be switched back to NORMAL output with one command. Note: Maximum output from the TMQAM and DUC combination in the CW output mode will be +45 dBmV at the DUC output connector and maximum output from the SCT860 transcoder module is +50 dBmV. The QAM output power in normal QAM operation is equal to that of the CW carrier power in the CW mode.

MOTOROLA DSR-470 SET TOP BOX INITIALIZATION
The set top box usually comes from the factory with a default channel map with VCT ID = 4352. This factory default allows the selection of any EIA CATV channel by entering a three-digit channel number equal to 200 plus the EIA CATV channel number. Select an EIA channel, in the above manner that matches one of the EIA channels just programmed for the HITS or WS-Net digital channels. The green lock indicator on the Motorola DSR-470 should then be on. Call for the authorization trip. Follow Motorola authorization procedure instructions. When the box is authorized and has received the data download, the proper channel map will be stored in the set top box for future operation. Once the new channel map is loaded, the channel assignments for your system will apply and not the default 4352 map.

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