CATV /DBS Taps

HRT*, HRvT*, HRTw HRvT2*, HRT2*

SITUATION

DBS Ka/Ku or **ATSC** off-air signals are required at multiple locations connected via coax cable. Signal must be directional coupled from the trunk to conserve trunk signal level while providing sufficient tap levels.

SOLUTION

Models **HRT***, **HRvT*, & HRwT*** placed in the trunk "tap" a portion of the signal from the trunk while isolating the tap port from the trunk.

RELATED CONSIDERATIONS

Tap input and output return loss is critical to maintain signal integrity. **SONORA** taps feature high return loss for excellent match.

Tap isolation is critical in large distribution systems to prevent reflections from exiting the tap port. **SONORA** taps feature isolation.

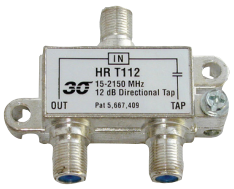
FEATURES

- *CATV / Ka/Ku bandwidth..... 15 to 2150 MHz*
- *High Return Loss..... > 14 dB*
- *High Isolation .....Output to Tap*
- *Indoor / Outdoor case ..... die cast*
- *IN / OUT DC pass..... tap: DC blocking*

APPLICATION NOTES

Model **LAL20a** and **LAL204a** amplifiers have 20 dB automatic gain input windows to provide a clean fixed output. Model **HRT106, HRT109, HRT112, HRT116** and **HRT120** directional couplers tap a portion of the signal to feed distribution nodes. The trunk level is indicated on the left and the tap level output is indicated on the right.

Vertical versions of the taps **HRvT106, 109, 112, 116** and **HRvT120** are available.

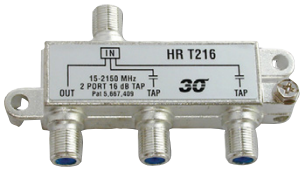


HRT*,6,9,12,16,20

HRvT*,6,9,12,16,20

HRTw*,6,9,12,16

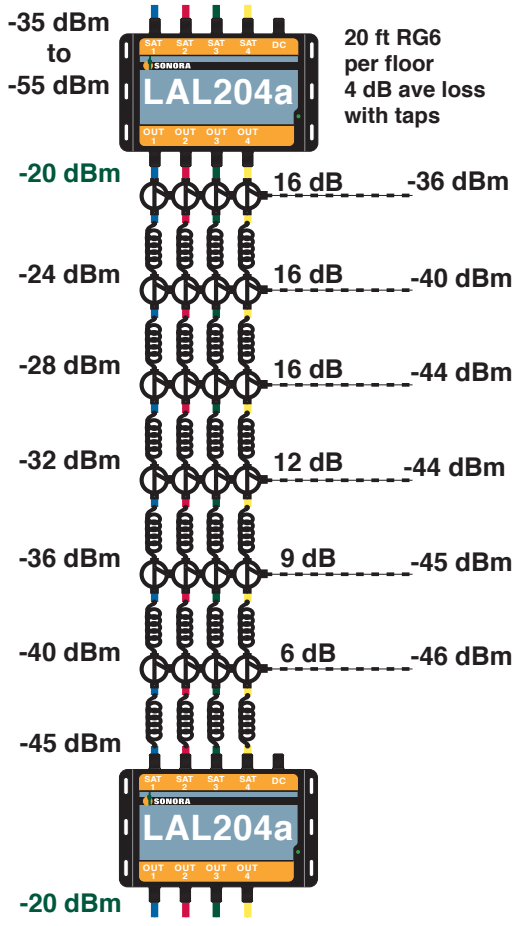
HRvT2*,12, 16



HRT2*,12, 16

DESCRIPTION

Indoor / Outdoor 175 to 2150 MHz DBS / ATSC line powered amplifiers with 14 dB gain and optional external powering.



CATV /DBS Taps

HRT*, HRVT*, HRTW

Model	IN /OUT Loss (QC dB)					INPUT Return Loss (QC dB Min)				
Frequency (MHz)	15-47	250	950	1450	2150	15-47	250	950	1450	2150
HR T106	2.6 ± 0.3	2.5 ± 0.3	2.9 ± 0.3	3.3 ± 0.3	3.6 ± 0.4	13 dB	15 dB	15 dB	15 dB	13 dB
HR Tw6	2.6 ± 0.4	2.5 ± 0.3	2.9 ± 0.3	3.3 ± 0.3	3.3 ± 0.4	13 dB	16 dB	18 dB	16 dB	14 dB
HRvT106	2.5 ± 0.4	2.5 ± 0.3	2.7 ± 0.3	3.0 ± 0.3	3.2 ± 0.4	13 dB	16 dB	16 dB	16 dB	15 dB
HR T108	2.2 ± 0.4	1.9 ± 0.3	2.2 ± 0.3	2.7 ± 0.3	2.9 ± 0.4	13 dB	16 dB	16 dB	16 dB	15 dB
HR Tw9	2.2 ± 0.4	1.9 ± 0.3	2.0 ± 0.3	2.1 ± 0.3	2.3 ± 0.4	13 dB	15 dB	15 dB	15 dB	14 dB
HRvT109	1.6 ± 0.4	1.8 ± 0.3	1.9 ± 0.3	2.0 ± 0.3	2.2 ± 0.4	13 dB	15 dB	15 dB	15 dB	15 dB
HR T112	1.5 ± 0.4	1.6 ± 0.3	1.7 ± 0.3	1.9 ± 0.3	2.1 ± 0.4	14 dB	15 dB	16 dB	15 dB	14 dB
HR Tw12	1.5 ± 0.4	1.6 ± 0.3	1.8 ± 0.3	1.9 ± 0.3	2.2 ± 0.4	14 dB	16 dB	16 dB	16 dB	15 dB
HRvT112	1.5 ± 0.4	1.6 ± 0.3	1.8 ± 0.3	1.9 ± 0.3	2.0 ± 0.4	14 dB	16 dB	16 dB	16 dB	15 dB
HR T116	1.4 ± 0.4	1.5 ± 0.3	1.6 ± 0.3	1.7 ± 0.3	1.8 ± 0.4	13 dB	15 dB	15 dB	15 dB	14 dB
HR Tw16	1.4 ± 0.4	1.5 ± 0.3	1.6 ± 0.3	1.7 ± 0.3	1.8 ± 0.4	13 dB	15 dB	15 dB	15 dB	14 dB
HRvT116	1.4 ± 0.4	1.5 ± 0.3	1.6 ± 0.3	1.7 ± 0.3	1.8 ± 0.4	13 dB	15 dB	15 dB	15 dB	14 dB
Model	**IN / Tap Loss (QC dB)**					**TAP Return Loss (QC dB Min)**				
HR T106	6.6 ± 0.4	6.3 ± 0.4	6.6 ± 0.4	7.0 ± 0.5	7.6 ± 0.5	14 dB	15 dB	16 dB	16 dB	14 dB
HR Tw6	6.5 ± 0.5	6.6 ± 0.4	6.9 ± 0.4	7.5 ± 0.5	8.0 ± 0.6	14 dB	16 dB	16 dB	16 dB	15 dB
HRvT106	6.5 ± 0.5	6.6 ± 0.5	6.7 ± 0.5	7.2 ± 0.5	7.4 ± 0.6	14 dB	16 dB	16 dB	16 dB	15 dB
HR T108	8.5 ± 0.5	9.0 ± 0.5	9.0 ± 0.5	9.5 ± 0.5	10.0 ± 0.6	14 dB	15 dB	16 dB	15 dB	14 dB
HR Tw9	9.0 ± 0.5	9.0 ± 0.5	9.1 ± 0.5	9.5 ± 0.5	10.0 ± 0.6	14 dB	15 dB	16 dB	16 dB	14 dB
HRvT109	9.0 ± 0.5	8.5 ± 0.5	8.5 ± 0.5	8.5 ± 0.6	8.8 ± 0.7	14 dB	15 dB	15 dB	15 dB	14 dB
HR T112	12.5 ± 0.5	12.6 ± 0.5	12.6 ± 0.5	13.1 ± 0.6	13.5 ± 0.6	14 dB	15 dB	16 dB	16 dB	15 dB
HR Tw12	12.5 ± 0.5	12.6 ± 0.5	13.0 ± 0.5	13.5 ± 0.5	14.0 ± 0.6	14 dB	15 dB	16 dB	16 dB	14 dB
HRvT112	12.2 ± 0.5	12.2 ± 0.5	12.2 ± 0.5	12.4 ± 0.6	12.6 ± 0.7	14 dB	16 dB	16 dB	16 dB	15 dB
HR T116	16 ± 0.5	16.2 ± 0.5	16.5 ± 0.5	17 ± 0.6	17.4 ± 0.7	13 dB	15 dB	15 dB	15 dB	14 dB
HR Tw16	16 ± 0.5	16.2 ± 0.5	16.3 ± 0.5	16.5 ± 0.6	16.6 ± 0.7	14 dB	16 dB	16 dB	16 dB	15 dB
HRvT116	16 ± 0.5	16.2 ± 0.5	16.3 ± 0.5	16.5 ± 0.6	16.6 ± 0.7	14 dB	16 dB	16 dB	16 dB	15 dB
Model	**Isolation Tap to Output (QC dB Min)**					**OUTPUT Return Loss (QC dB Min)**				
HR T106	24 dB	18 dB	20 dB	16 dB	15 dB	13 dB	15 dB	15 dB	15 dB	14 dB
HR Tw6	24 dB	22 dB	23 dB	19 dB	18 dB	15 dB	18 dB	18 dB	18 dB	15 dB
HRvT106	24 dB	24 dB	23 dB	20 dB	18 dB	15 dB	16 dB	16 dB	16 dB	15 dB
HR T108	18 dB	18 dB	18 dB	19 dB	18 dB	15 dB	16 dB	16 dB	16 dB	15 dB
HR Tw9	18 dB	19 dB	20 dB	19 dB	18 dB	13 dB	15 dB	15 dB	15 dB	14 dB
HRvT109	18 dB	18 dB	20 dB	19 dB	18 dB	14 dB	16 dB	16 dB	16 dB	15 dB
HR T112	22 dB	24 dB	23 dB	20 dB	20 dB	14 dB	16 dB	16 dB	16 dB	15 dB
HR Tw12	22 dB	24 dB	23 dB	20 dB	20 dB	14 dB	16 dB	16 dB	16 dB	15 dB
HRvT112	22 dB	24 dB	23 dB	20 dB	20 dB	14 dB	16 dB	16 dB	16 dB	15 dB
HR T116	22 dB	21 dB	25 dB	25 dB	25 dB	13 dB	15 dB	15 dB	15 dB	14 dB
HR Tw16	26 dB	26 dB	28 dB	28 dB	28 dB	13 dB	15 dB	15 dB	15 dB	14 dB
HRvT116	26 dB	26 dB	28 dB	28 dB	28 dB	13 dB	15 dB	15 dB	15 dB	14 dB

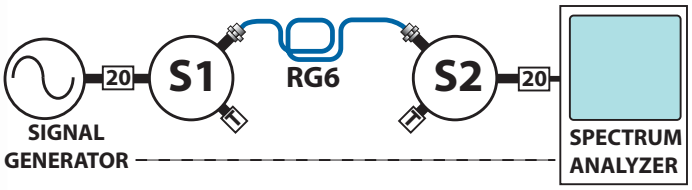
CATV /DBS Taps

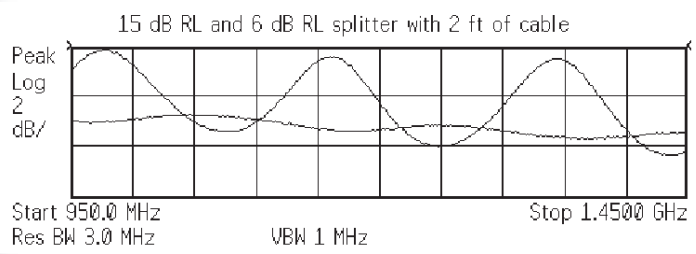
HRvT2*, HRT2*

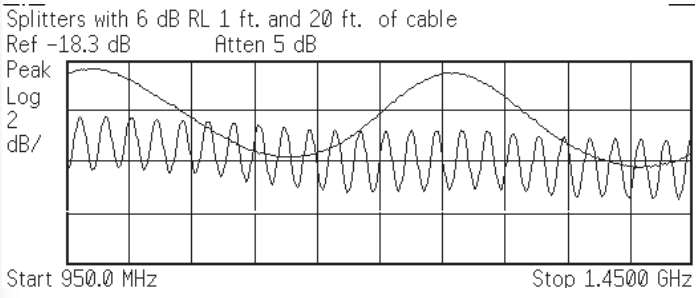
Model	IN / OUT Loss (QC dB)					INPUT Return Loss (QC dB Min)				
Frequency (MHz)	15-47	250	950	1450	2150	15-47	250	950	1450	2150
HRT212	2.5 dB ± 0.3 dB	2.7 dB ± 0.3 dB	3.0 dB ± 0.3 dB	3.3 dB ± 0.3 dB	3.5 dB ± 0.3 dB	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min
HRvT212	2.5 dB ± 0.3 dB	2.7 dB ± 0.3 dB	3.0 dB ± 0.3 dB	3.3 dB ± 0.3 dB	3.5 dB ± 0.3 dB	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min
HRT216	1.5 dB ± 0.3 dB	1.5 dB ± 0.3 dB	1.6 dB ± 0.3 dB	1.7 dB ± 0.3 dB	1.8 dB ± 0.3 dB	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min
HRvT216	1.5 dB ± 0.3 dB	1.5 dB ± 0.3 dB	1.6 dB ± 0.3 dB	1.7 dB ± 0.3 dB	1.8 dB ± 0.3 dB	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min
Model	Isolation Tap to Tap (QC dB Min)					OUTPUT Return Loss (QC dB Min)				
HRT212	20 dB Min	20 dB Min	20 dB Min	18 dB Min	16 dB Min	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min
HRvT212	20 dB Min	20 dB Min	20 dB Min	18 dB Min	16 dB Min	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min
HRT216	24 dB Min	24 dB Min	23 dB Min	20 dB Min	18 dB Min	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min
HRvT216	20 dB Min	20 dB Min	20 dB Min	18 dB Min	16 dB Min	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min
Model	IN / Tap Loss (QC dB)					TAP Return Loss (QC dB Min)				
HRT212	11 dB ± 0.5 dB	11 dB ± 0.5 dB	11 dB ± 0.5 dB	11.5 dB ± 0.5 dB	12 dB ± 0.5 dB	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min
HRvT212	11 dB ± 0.5 dB	11 dB ± 0.5 dB	11 dB ± 0.5 dB	11.5 dB ± 0.5 dB	12 dB ± 0.5 dB	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min
HRT216	16 dB ± 0.5 dB	16 dB ± 0.5 dB	16.5 dB ± 0.5 dB	17.2 dB ± 0.5 dB	17.6 dB ± 0.5 dB	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min
HRvT216	11 dB ± 0.5 dB	11 dB ± 0.5 dB	11 dB ± 0.5 dB	11.5 dB ± 0.5 dB	12 dB ± 0.5 dB	13 dB Min	15 dB Min	15 dB Min	15 dB Min	14 dB Min

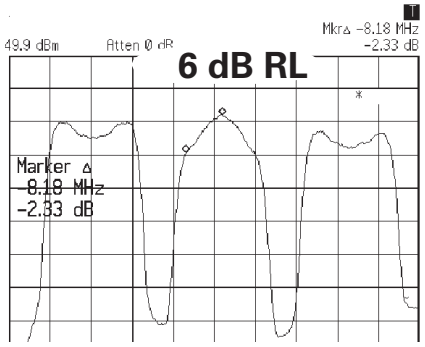
CATV /DBS Taps

RETURN LOSS REFLECTIONS





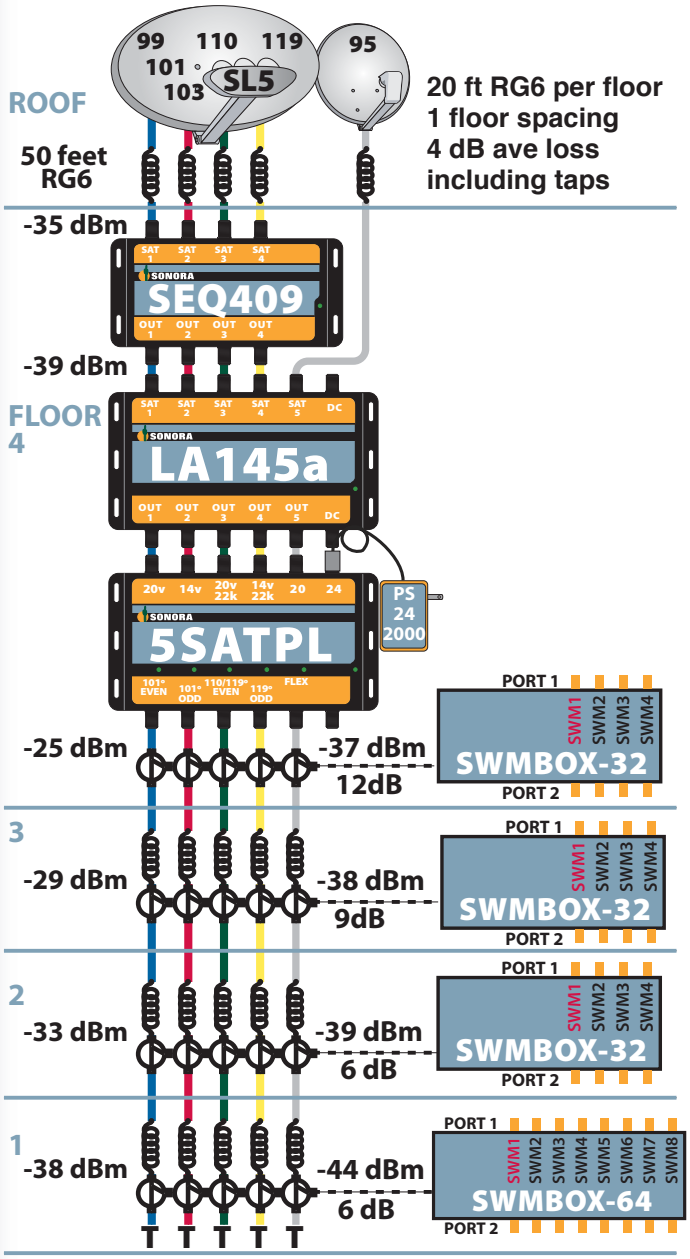




Device 1 Return Loss	Device 2 Return Loss	RIPPLE
15 db	15 dB	0.5 dB
15 dB	12 dB	0.8 dB
15 dB	10 dB	1.0 dB
12 db	12 db	1.1 dB
12 dB	10 dB	1.4 dB
12 dB	8 dB	1.7 dB
10 dB	10 dB	1.7 dB
10 dB	8 dB	2.2 dB
10 dB	6 dB	2.8 dB
6 dB	8 dB	3.5 dB
6 dB	6 db	4.5 db

- Signal inserted into the first device passes to the the second device connected via a 20 dB pad to a spectrum analyzer.
- Devices not equaling 75 ohms reflect part of the signal back to the source. Standing waves are created.
- The top plot compares the difference between (2) 15 dB return loss devices and (2) 6 dB return loss devices.
- The frequency of the standing waves is proportional to the spacing between devices.
- The second plot shows (2) 6 dB return loss devices spaced at 1 ft and at 20 feet of coax.
- Transponders passing between the devices are distorted by the standing waves. Note the un-distorted 15 dB return Loss signal vs the signal passing through (2) 6 dB RL devices.
- The reflection amplitude table is created with equations provided by **Hewlett Packard**. **SONORA** confirmed the table using known return loss devices.
- CATV systems require 20 dB return loss for devices connected to the trunk.
- Consumer grade products like TV's have from 6 dB to 10 dB return loss.
- Ripple greater than 2 dB peak amplitude can freeze digital signals.

4FL_LA145A_1FS



Bill of Materials

- (1) SEQ409
- (1) LA145a
- (1) 5SATPL
- (5) HRvT112
- (5) HRvT109
- (10) HRvT106

An **AU9 SL5S** signal consisting of the 99º,101º,103º, 110º and 119º is supplemented with a single dish focused on the 95º satellite.

Model **SEQ409**, **LA145a** and **5SATPL** start the distribution located 50 feet from the dishes.

The signal levels expected are indicated on the left. A distance of 20 feet of RG-6 is assumed to determine the average loss per floor. (2 dB loss) A per floor loss is assumed to be 4 dB.

An AU9 dish typically has an output of -30 dBm.

After 50 feet of RG-6 the signal to the **SEQ409** equalizer is -35 dBm.

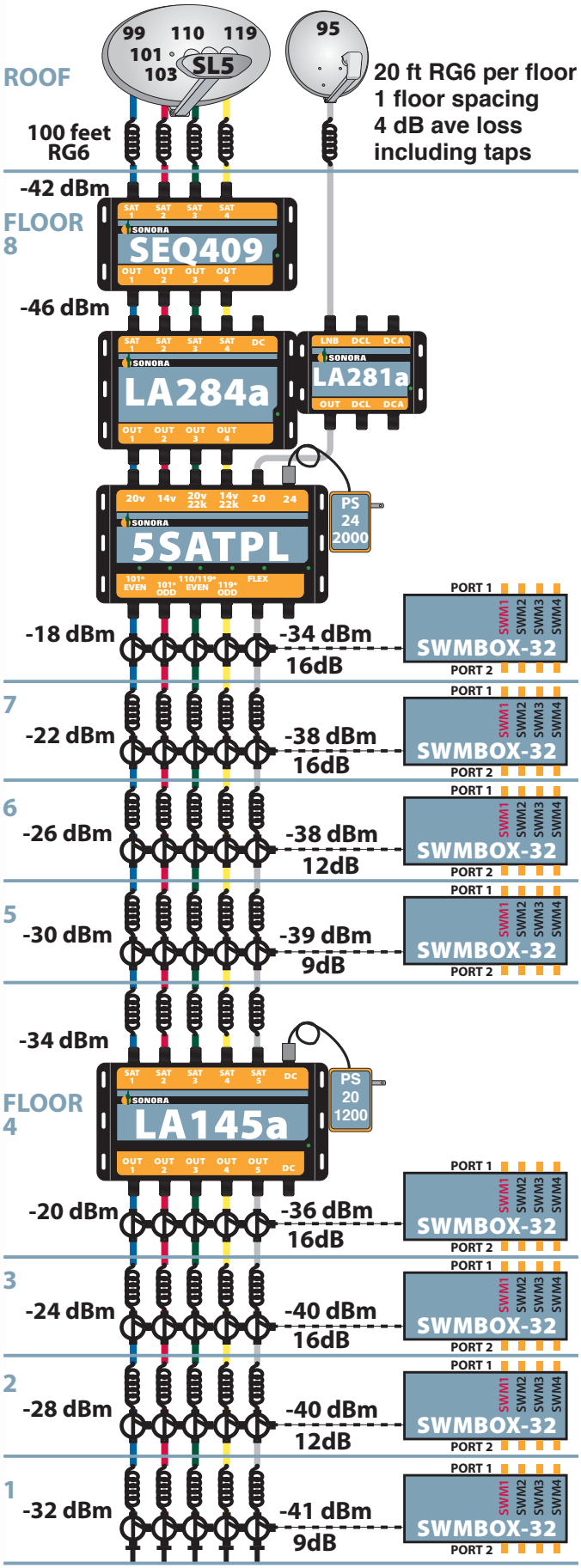
At the higher Ku frequency, the **SEQ409** insertion loss is 4 dB. The **LA145a** with 14 dB of gain has an output of -25 dBm.

Model **HRvTxx** taps are used to couple some of the signal to the IDF equipment. The insertion loss of the tap values is averaged. High value taps have less insertion loss than lower value taps. (1.5 dB to 3 dB)

Model **SWMBOX-64** hubs provide the signals to up to (8) SWM8 switches at zero loss. SWM8 switches have AGC simplifying the design. Inputs of -25 dBm to -55 dBm is required to each IDF.

Model **SWMBOX-32** hubs provide the signals to up to (4) SWM8 switches with 9 dB loss. A minimum input of -46 dBm is required to each IDF.

Note a **SWMBOX-64** is used in each case on floor 1. The signal level is at the low end to feed a **SWMBOX-32**.



8FL_LA284a_LA145A_1FS

A model **LA285a** amplifier is used to start the distribution due to the longer dish to floor 8 distance.

An AU9 dish typically has an output of -30 dBm.

After 100 feet of RG-6 the signal to the **SEQ409** equalizer is -42 dBm.

At the higher Ku frequency, the **SEQ409** insertion loss is 4 dB. The **LA285a** with 28 dB of gain has an output of -18 dBm.

Decreasing value tap values are used on sequential floors. Once the IDF level drops below -40 dBm, the next floor receives a **LA145a** amplifier.

A second series of sequential taps are used.

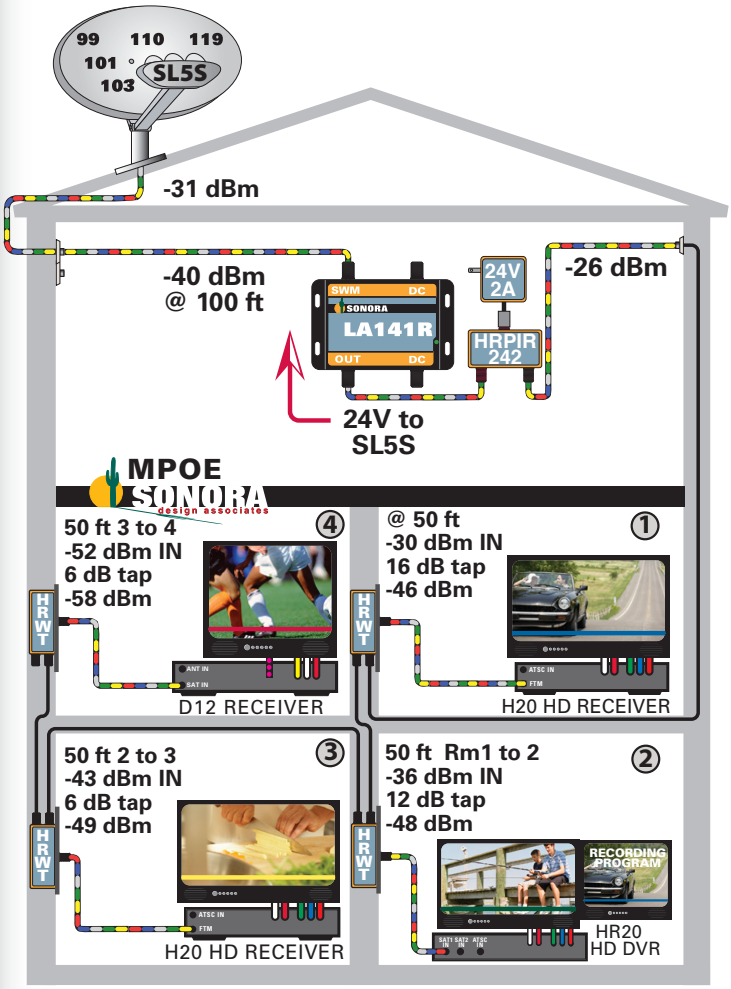
The insertion loss of the tap values is averaged. A per floor loss is assumed to be 4 dB.

Bill of Materials

- **(1) SEQ409**
- **(1) LA145a**
- **(1) LA145a-T**
- **(1) 5SATPL**
- **(5) HRvT116**
- **(10) HRvT112**
- **(10) HRvT109**
- **(10) HRvT106**

SWM8 switches are added as subscribers are added. Use SWMBOX-64 hubs for higher expected penetration.

CATV /DBS Taps



- Some homes have a single coax that loops from one room to another as opposed to one coax from each room back to the MPOE.
- Model **LA141R** is a line powered by model **HRPIR242** which provides voltage to the **LA141R** and **SL5S** dish.
- The amplified **SL5S** signal goes 50 feet to room 1 that has a model **HRwT116** tap. The input is -30 dBm, the tap output is -46 dBm and the thru output is -32 dBm. (2 dB insertion)
- From room 1 the signal goes another 50 feet to room 2. A model **HRwT112** tap is used.
- From room 2 the signal goes 50 feet to room 3. A model **HRwT106** tap is used.
- From room 3 the signal goes 50 feet to room 4. A model **HRwT106** tap is used.