Sent in by Peter VK2EHQ

Testing the losses of Multi-coupler's, Splitter & Low Pass Filter

My Stridsberg (USA) Receiver 8 port multi-coupler failed and being unsure of where to procure the LNA replacement and unable to find information, I replaced the unit with a substantially more affordable 5 port unit from the UK manufacturer Cross Country Wireless.

I then emailed the manufacturer of the Stridsberg (USA) unit and was surprised when the owner promised to send a free replacement LNA and impressed when a few months later, I received several LNAs, including the pinout diagram of the surface mount component. I then repaired the Stridsberg (USA) unit and now have two working units. Happy days!

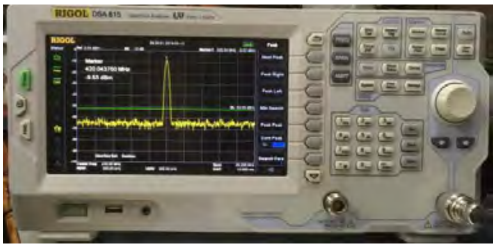
I now had two units from different manufacturers which prompted my curiosity. I wanted to know if the units were equal or different. I cracked out the test equipment and carried out a comparison of the units overall losses (or gains) compared to a direct receiver connection. I also tested an F-type 2-way splitter and Karen's Kenwood Low Pass Filter Model LF-30A

The equipment tested:
Above left: Stridsberg (USA) 8 port coupler 25MHz to 1GHz
Above right: Cross Country Wireless (UK) 5 port coupler 500KHz to 1350MHz.
Left: Satellite Splitter - typical domestic 2 port F type 5MHZ to 2GHz.
Below: Kenwood Low Pass Filter Model LF-30A with a
cut-off frequency of 30 MHz

Testing equipment:

Signal display and injection — Rigol DSA-815 spectrum analyser
DSG815 RF signal generator

Originally, to find what component had failed in the multi-coupler, I was using the tracking generator of the analyser into a high bandwidth Tektronix scope. It did the task, but was not an ideal method, hence, I purchased an RF signal generator.



I tested ten frequency points across the spectrum. Starting at 2 MHz and going up to 1300 MHz.

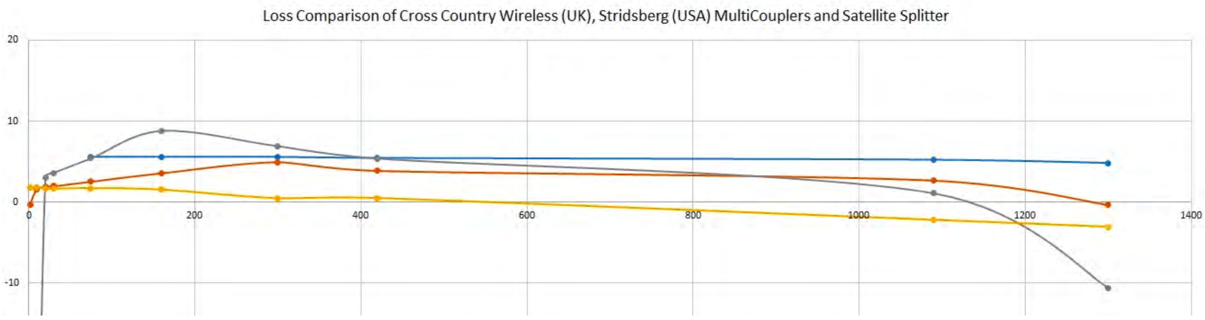
The reasons these frequency points were chosen:

1. The performance at frequencies of interest, i.e. VHF low band, marine and marine AIS, UHF military air, GRN trunking, aircraft ADSB
2. 23cm, just for the heck of it.
3. 2-30Mhz points, for losses at frequencies the multi-couplers were not designed to accommodate (or otherwise) and being the same points used to check the performance of a Kenwood LF-30A Low Pass Filter with a 30MHz cut-off. You DO use a LPF don't you!!! Now they're available with a 54MHz cut-off to accommodate a typical modern HF transceiver.

The first tests carried out were on the multi-couplers and splitter:

Stridsberg (USA) 8 port coupler — design frequency range 25MHz – 1GHz
Cross Country Wireless (UK) 5 port coupler — design frequency range 500KHz – 1350MHz.
Satellite Splitter - typical domestic 2 port F type — design frequency range 5MHZ – 2GHz
Kenwood Low Pass Filter Model LF-30A. — Cut-off **frequency of** 30 MHz

Frequency Mhz	Direct signal (6dBm)	English MCplr dBm	USA MCplr dBm	F type 2 way Sat splitter
2		-0.28		1.73
10		1.56	-41	1.8
20		1.9	3	1.64
30		1.97	3.6	1.63
75	5.61	2.53	5.4	1.71
160	5.61	3.57	8.8	1.52
300	5.6	4.93	6.9	0.46
420	5.47	3.87	5.38	0.48
1090	5.23	2.67	1.07	-2.21
1300	4.82	-0.33	-10.6	-3.07



6dBm signal inputted from Sig-Gen

Cross Country Wireless (UK) 5 port coupler 500KHz—1350MHz.

Stridsberg (USA) 8 port coupler 25MHz – 1GHz

Satellite Splitter - typical domestic 2 port F type 5MHZ to 2GHz.

The graphed results are shown above. On the left is the dB in steps of 10 starting at the bottom with
-10dB (vertical graph). Frequency is horizontal on the line graph at 200 MHz intervals. The frequency points are marked on the graphed test results.

Overall I found the USA multi-coupler was the better performer, with dB loss and gain consistent between the output ports. This unit developed gain between 75Mhz and 400Mhz, peaking with 3dB of gain at 160Mhz.

The English multi-coupler had more signal loss overall but still outperformed the 2 port Satellite Splitter.
I found some other interesting results during the testing:

1. The UK unit (English Multi-coupler) had inconsistent levels between the output ports of up to 3dB
2. The US unit (USA Multi-coupler) at 2 MHz, produced a 22MHz spurious emission

The second test carried out was on the Low Pass Filter:
Kenwood Low Pass Filter Model LF-30A with has a cut-off frequency of 30 MHz. This filter is used to attenuate transmitted signals greater than 30MHz that would cause television interference known as TVI.

Right: Frequency points and results of LPF testing

Frequency Mhz	Direct (6 dBm)	LPF in dBm
2	5.61	5.29
10	5.35	5.32
20	5.35	5.27
30	5.3	5.06
35	5.63	0.76
40	5.65	-17.79

These days with digital TV, the LPF is not as essential. Although, as a strict condition of our Amateur Radio Licences, we must not cause ‘harmful interference’ to others and mostly to other services
de Peter VK2EHQ