TESTIMONIAL

ST Teleport Validates the Technical & Business Case for Deploying the Bandwidth-Efficient CDM-Qx with DoubleTalk™ Carrier-in-Carrier®

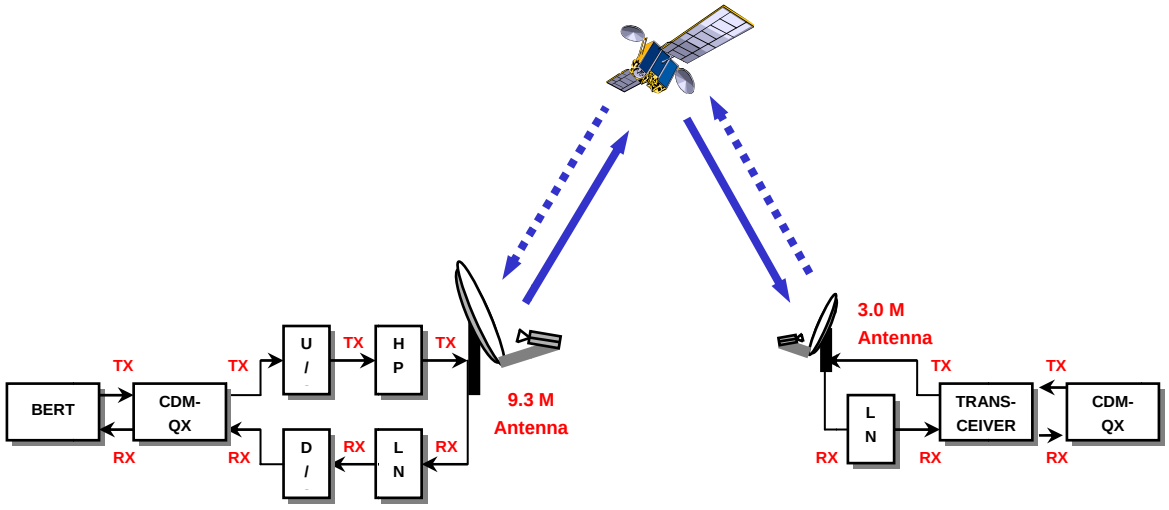
ST Teleport is a full-service satellite communications solution provider that connects businesses seamlessly and reliably through a diverse network of major satellite systems, terrestrial network infrastructures and Internet exchanges. Operational since 1994, the company serves Asia's broadcasting, telecommunications and corporate markets.

ST Teleport operates an earth station complex in Singapore with comprehensive coverage of the Indian and Pacific Ocean regions. More than twenty antennae of various diameters up to 9.3 meters provide uplink and downlink services for L-, C- and Ku-band communications.

PERFORMANCE TESTING

ST Teleport conducted performance measurement testing of the CDM-Qx Satellite Modem with the DoubleTalk™ Carrier-in-Carrier® technology. The purpose of the testing was to study the bandwidth and power efficiency of the CDM-Qx Satellite Modem with DoubleTalk Carrier-in-Carrier in a SCPC link. The tested network configuration included:

- Hub – 9.3 meter antenna with 2.25 kW TWTA
- Remote – 3.0 meter antenna with 20W ODU
- Modems – Both modems were transmitting and receiving 512 kbps data with required Bit Error Rate (BER) of 1.0E-9



The specifc test parameters and results in the following pages are courtesy of ST Teleport.

Satellite Parameters

Satellite Name	MEASAT-2	Satellite Beam	C-Band
Longitude	148 E	Saturated EIRP	37.7 dBW
SFD	-88.5 dBW/m2	G/T	1.5 dB/k
Input Backoff	6 dB	Output Backoff	4 dB
Transponder BW	72 MHz		

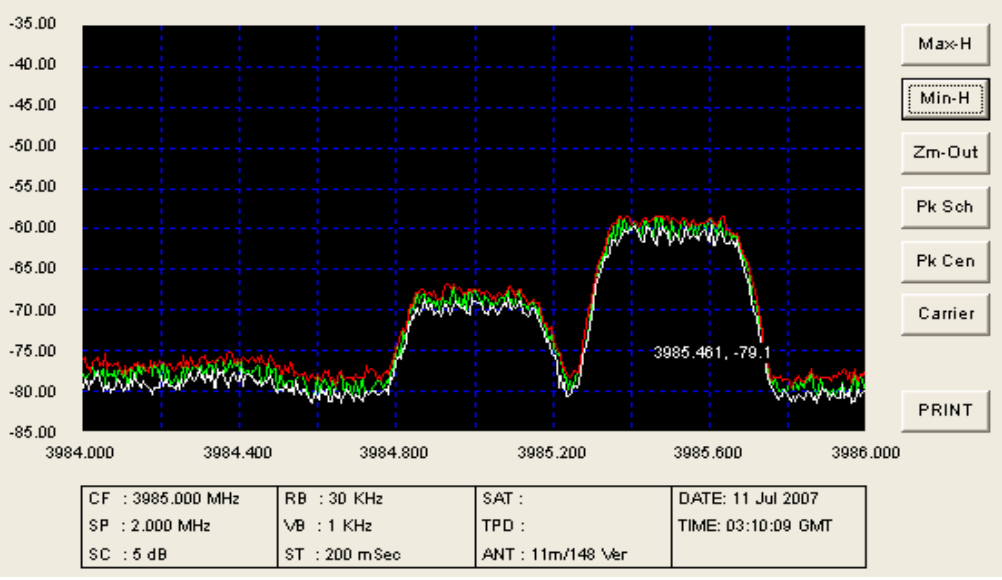
Earth Station Parameters

Hub		**Remote**	
Antenna Size	9.3m	Antenna Size	3.0m
Location	103.80E 1.35N	Location	103.80E 1.35N
G/T	30.33 dB/k	G/T	21.36 dB/k
TWTA kW	2.25 kW Multi Carrier	ODU Watt	20

Without Carrier-in-Carrier: RF/IF Settings and Readings

Hub		**Remote**	
Antenna Size	9.3m	Antenna Size	3.0m
Data Rate kbps	512 kbps	Data Rate kbps	512 kbps
Modulation	QPSK	Modulation	QPSK
Forward Error Correction	¾ TPC	Forward Error Correction	¾ TPC
Carrier-in-Carrier	No	Carrier-in-Carrier	No
Eb/No dB	5.7	Eb/No dB	4.7
BER	1.0E-9	BER	1.0E-9
Modem TX PWR dBm	-23.8	Modem TX PWR dBm	-18.8
Modem RSL dBm	-60	Modem RSL dBm	-36
IF TX Frequency MHz	70.5	IF TX Frequency MHz	70
IF RX Frequency MHz	70	IF RX Frequency MHz	70.5
RF TX Frequency MHz	6210.5	RF TX Frequency MHz	6210.0
RF RX Frequency MHz	3985.0	RF RX Frequency MHz	3985.5

Without Carrier-in-Carrier: Test Feed From MEASAT-2



1st carrier (3985 MHz) TX from 3.0m remote antenna and 2nd carrier (3985.5 MHz) TX from 9.3m hub antenna

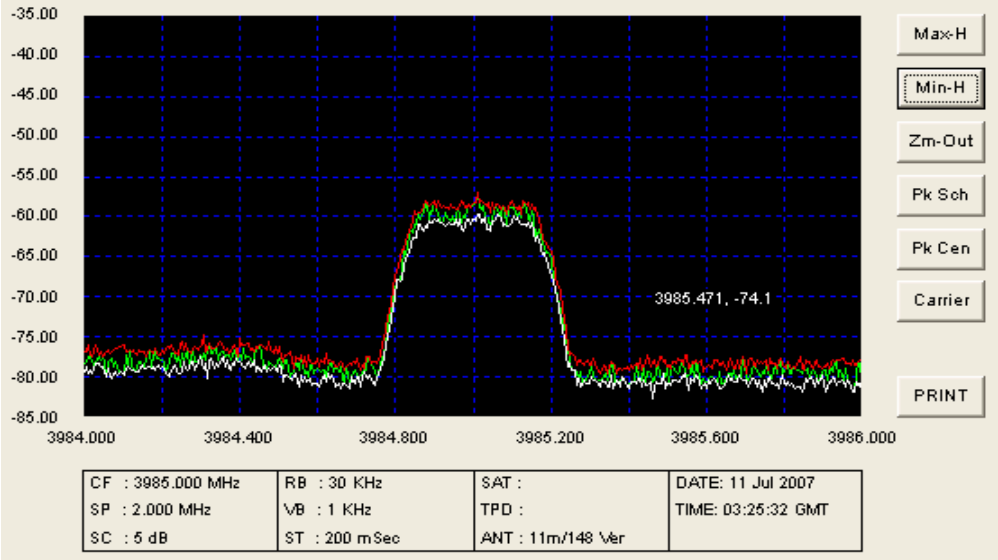
Without Carrier-in-Carrier: Satellite Resources Usage

	Hub to Remote	Remote to Hub	Total
Carrier Occupied BW kHz	453.6	468.0	921.6
Carrier Occupied BW %	0.63%	0.65%	1.28%
Carrier Used PWR %	0.18%	0.02%	0.20%

With Carrier-in-Carrier: RF/IF Settings and Readings

Hub		Remote	
Antenna Size	9.3m	Antenna Size	3.0m
Data Rate kbps	512 kbps	Data Rate kbps	512 kbps
Modulation	QPSK	Modulation	QPSK
Forward Error Correction	¾ TPC	Forward Error Correction	¾ TPC
Carrier-in-Carrier	Yes	Carrier-in-Carrier	Yes
Eb/No dB	5.7	Eb/No dB	4.7
BER	1.0E-9	BER	1.0E-9
Modem TX PWR dBm	-22	Modem TX PWR dBm	-18
RSL dBm	-60	RSL dBm	-36
IF TX Frequency MHz	70	IF TX Frequency MHz	70
IF RX Frequency MHz	70	IF RX Frequency MHz	70
RF TX Frequency MHz	6210	RF TX Frequency MHz	6210
RF RX Frequency MHz	3985	RF RX Frequency MHz	3985

With Carrier-in-Carrier: Test Feed From MEASAT-2



Carrier-in-Carrier at 3985 MHz (both carriers data rate 512 kbps)

With Carrier-in-Carrier: Satellite Resources Usage

	Total
Carrier Occupied BW kHz	453.6
Carrier Occupied BW %	0.63%
Carrier Used PWR %	0.18%

PERFORMANCE TESTING CONCLUSION

	No CnC	CnC	
Carrier Occupied BW kHz	921.6	453.6	
Carrier Occupied BW %	1.28%	0.63%	Saving 50%
Carrier Used PWR %	0.20%	0.18%	

The test results showed that a bi-directional SCPC link (with given transponder, modulation and forward error correction) with 512 kbps data rate will use 921 kHz of satellite bandwidth without CnC. With CnC, it used 453 kHz which represents 50% bandwidth savings. Both links are bandwidth limited.

Hence, for each 2.048 Mbps bi-directional SCPC link, total bandwidth savings will be 1.8 MHz. For any transponder charging by MHz and cost of US$2000 per MHz (and still on the rise due to its scarcity), the annual savings per 2.048 Mbps link is US$43,200 (US$2000x1.8x12).

Comparing setting up the 2.048 Mbps SCPC link with CDM-600 and CDM-Qx, the additional modems cost is US$10,000 per link. Hence, the payback period is 3 months. Thereafter, the operator will enjoy savings of US$43,200 annually.

Report Accepted By:

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MORE INFORMATION

For additional information about ST Teleport and their service offerings, visit **www. stteleport.com**.

To learn more about how your network can benefit from the CDM-Qx/L Satellite Modems with DoubleTalk Carrier-in-Carrier, please contact us. We offer complimentary tools to highlight the multi-dimensional optimization that can be achieved for new or existing satellite communications links. For more information, visit **www.comtechefdata.com**.