Satlabs Symposium
DVB-S2/RCS Transparent Mesh Overlay Network

ESA / ESTEC, Noordwijk
September 11, 2007

ADVANTECH SATELLITE NETWORKS

SatLabs Group™

Contents

- Markets and applications
- DVB-S(2)/RCS mesh deployments
- DVB-S2/RCS mesh overlay architecture
- Mesh technology rollout
- Mesh networking
- Mesh link budget
- Mesh overlay signalling
- SatNet mesh product

ADVANTECH
SATELLITE NETWORKS

Markets and Applications

- A significant market demand is seen for satellite based mesh networking for the peer-to-peer applications where :
  - Double hop time delay is too long and
  - Double hop bandwidth utilisation is excessive
- Key applications include:
  - Collaborative conferencing for video /audio/data
  - Satellite telephone networks
  - Corporate Intranets and VPNs
  - Public Safety, Law enforcement and First responder
  - Distance learning; corporate and education networks
  - US Dod / DISA global information grid (GIG)

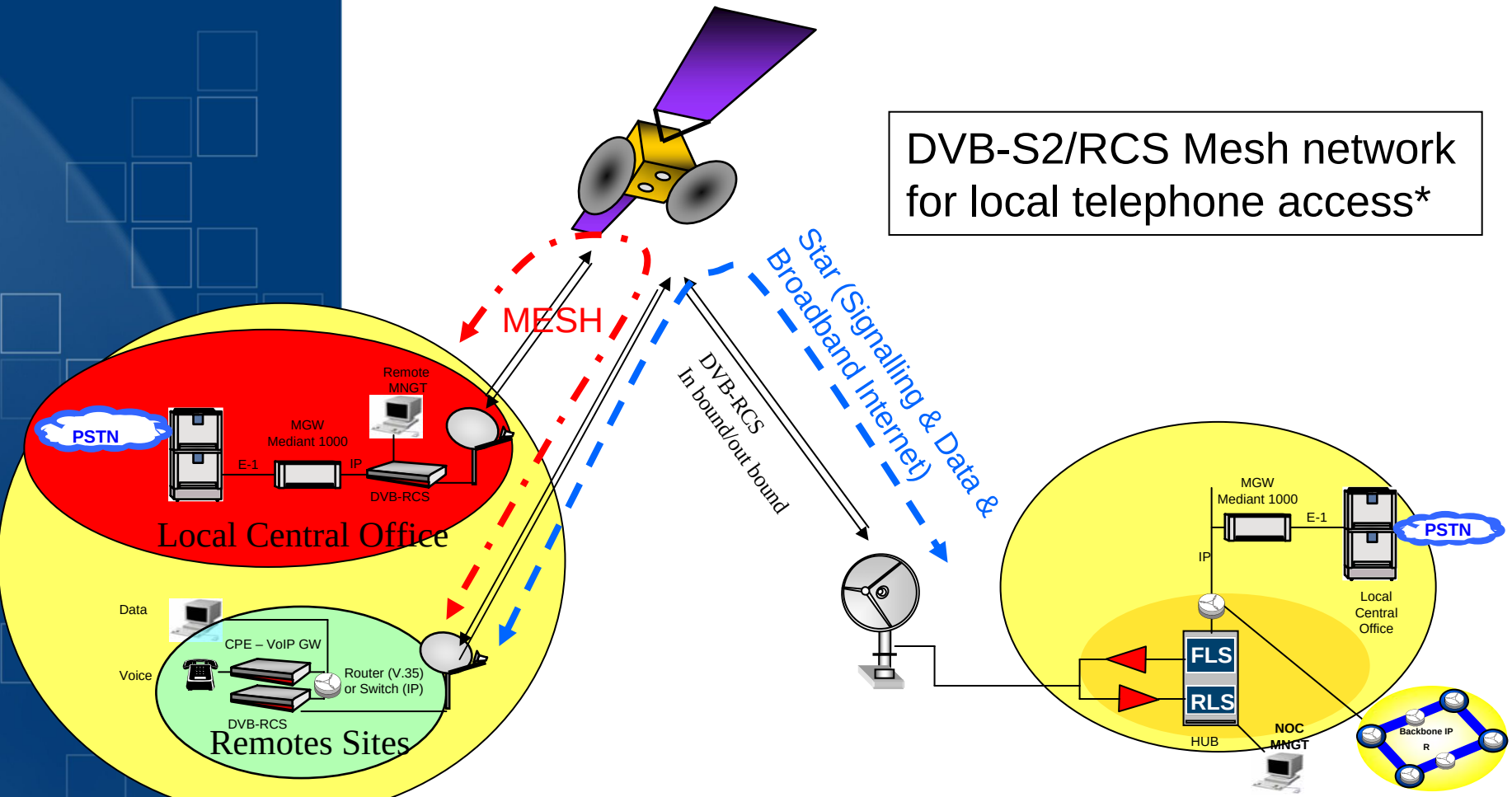
ADVANTECH SATELLITE NETWORKS

Mesh Deployments

- DVB-S(2)/RCS Mesh Deployments
  - Two types of S2/RCS mesh networks are already deployed, regenerative (OBP) and transparent, which both achieve single hop interconnectivity
  - OBP based DVB-RCS mesh network already in operation as the AmerHis system onboard Amazonas satellite
  - Transparent Mesh Overlay network for small Hakusan Education network in Japan (pre-C2P)
  - Example: Proposed transparent mesh deployment to support “payphone” access in rural regions to a local telephone switching office.

ADVANTECH SATELLITE NETWORKS

DVB-S2/RCS Mesh network for local telephone access*



DVB-S2/RCS Mesh Terminals

DVB-S2/RCS Hub Station

ADVANTECH SATELLITE NETWORKS

* recently proposed network

DVB-S2/RCS Transparent Mesh Architecture

- mesh overlay architecture for combined star (access) and mesh networking
- mesh air interface utilizes same RCS return link transmission
- RCS Hub station for RCS signalling, synchronisation and mesh connection control /bandwidth allocation
- enhanced RCS terminals equipped with mesh demodulator
- full mesh capability based on Connection Control protocol (C2P) soon to be standardised by TIA and ETSI BSM group

ADVANTECH
SATELLITE NETWORKS

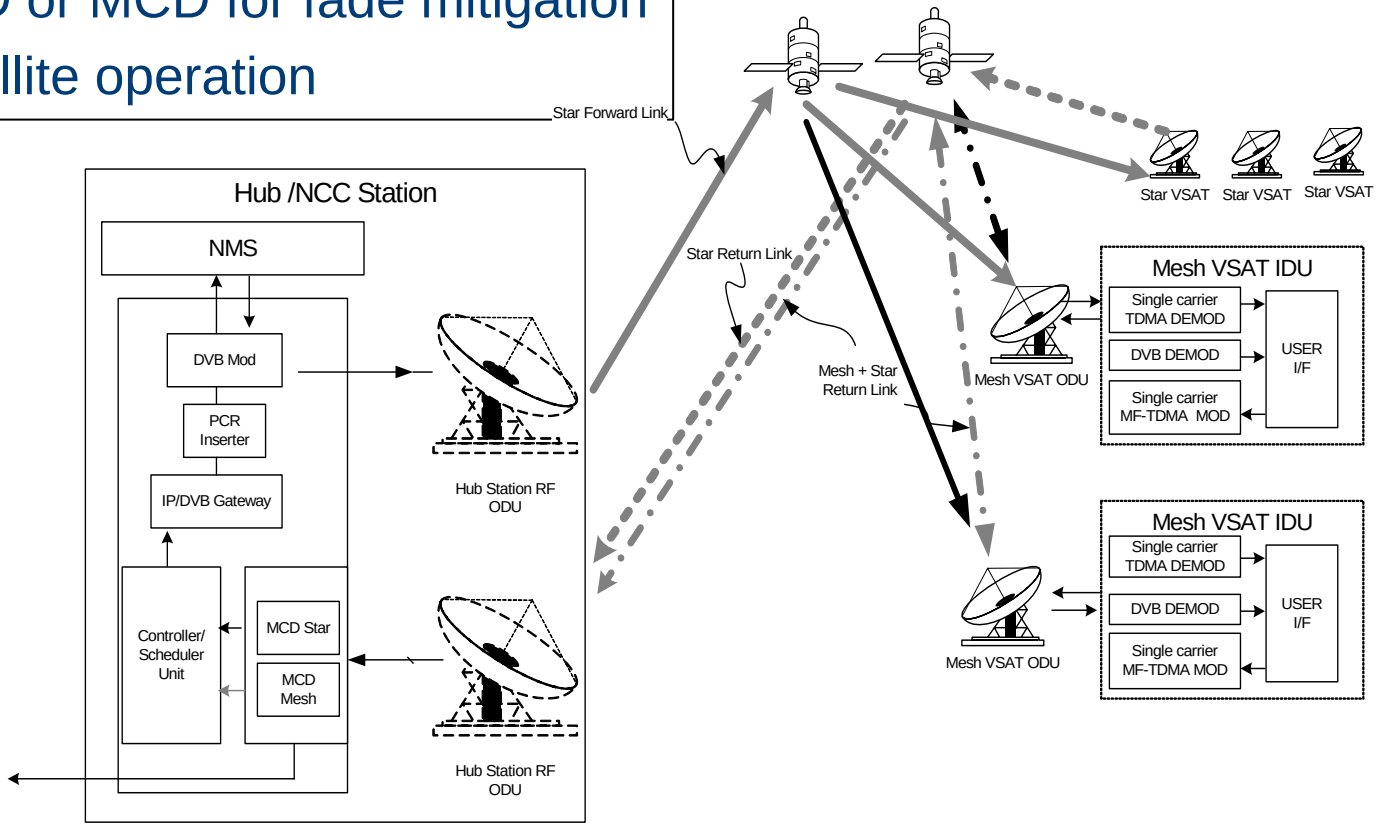
Mesh Technology Rollout

- The Advantech rollout of Mesh has already begun with a pre-C2P version for the Japanese Hakusan Education network using fixed DVB-like mesh signalling tables and proprietary connection control
- Once C2P is standardised, mesh will be upgraded for C2P
- Initial basic mesh physical layer employs single mesh TDMA carrier in MF-TDMA superframe at fixed rate and no carrier hopping

ADVANTECH SATELLITE NETWORKS

Mesh Technology Rollout

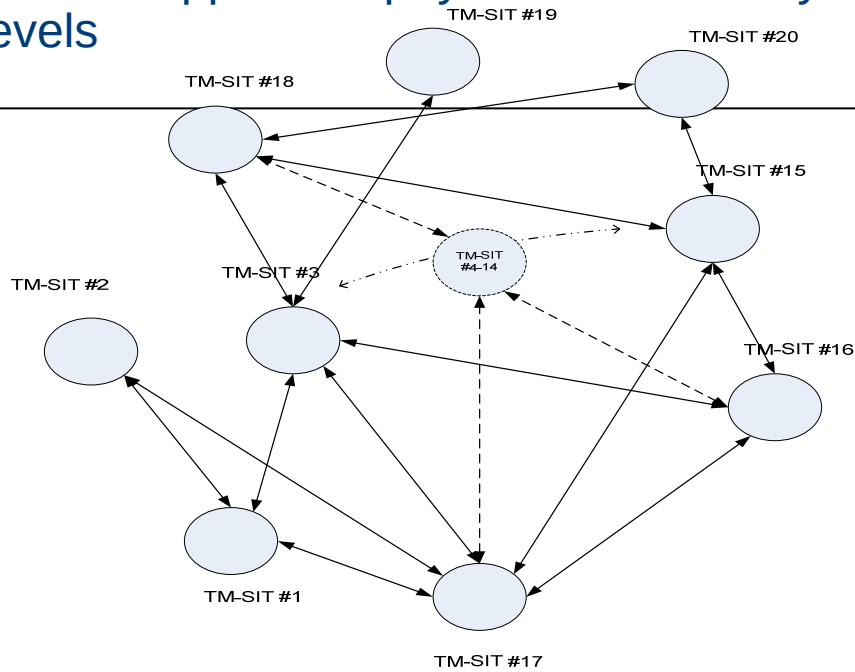
- Advanced mesh capability to include:
  - MF-TDMA carrier hopping
  - Dynamically tunable mesh SCD
  - Multiple SCD or MCD for fade mitigation
  - Multiple satellite operation



ADVANTECH SATELLITE NETWORKS

Mesh Networking

- Mesh connections can be various types: uni and bi-directional and multicast
- Mesh networking requires additional mesh traffic VCCs and channel IDs to tag capacity requests and assignments associated with different physical connections and QoS levels
- Connections identified by VCC (VPI/VCI) for ATM profile, PIDs for MPEG profile
- In general mesh networks can be fully or partially meshed
- Degree of mesh connectivity determined by the number of queues that can support the physical connectivity as well as any QoS levels



ADVANTECH SATELLITE NETWORKS

Mesh Link Budget

- Another impact of transparent mesh networks is the increased terminal size as revealed by the link budget analysis
- The mesh link between terminals is the same as the star return path to a hub station except:
  - The other end is another terminal with smaller dish, so about 3 dB added thermal noise re. hub return link
  - Link availability at terminal is increased 99.75% from 99.5% to maintain end-to-end availability of 99.5 %
- In addition, for a single carrier TDMA basic mesh system a higher data rate is required to support a given number of terminals for a given average data rate /terminal; i.e 2.048 Mbps versus 512 kbps for MF-TDMA
- Total dB difference between star and mesh transmissions amounts to about 10 dB; for true MF-TDMA mesh this difference will be reduced to about 4–6 dB.

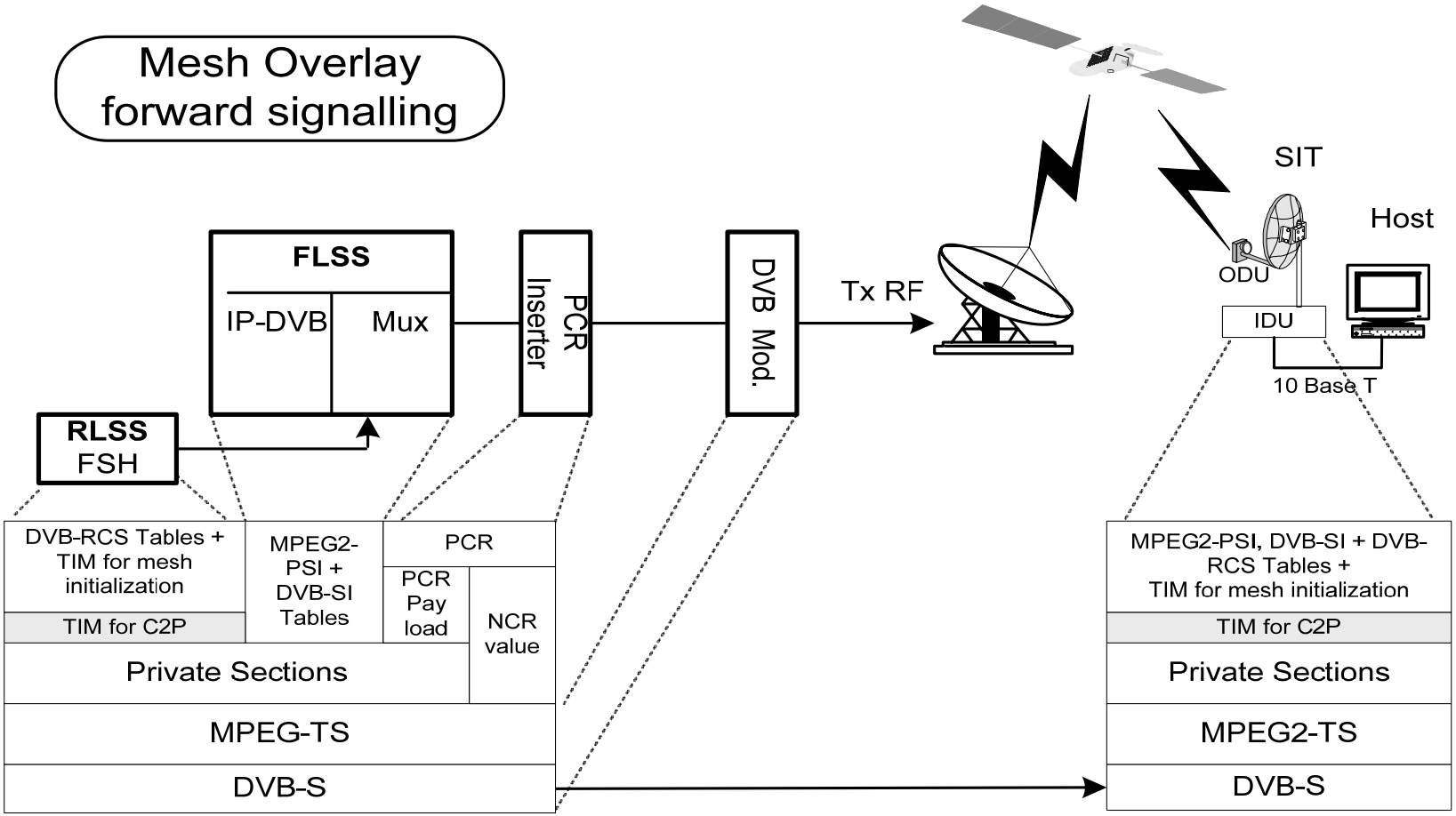
ADVANTECH SATELLITE NETWORKS

Mesh Overlay Signalling

- In general, additional signalling messages are required to configure and control the mesh network from the hub station as determined by the mesh C2P protocol
- For the forward path, the mesh configuration and permanent C2P connection setup is done via the Connection Control Descriptor in the unicast TIM
- For the return path, the mesh signalling is carried by the various information elements in the DULM signalling channel

ADVANTECH SATELLITE NETWORKS

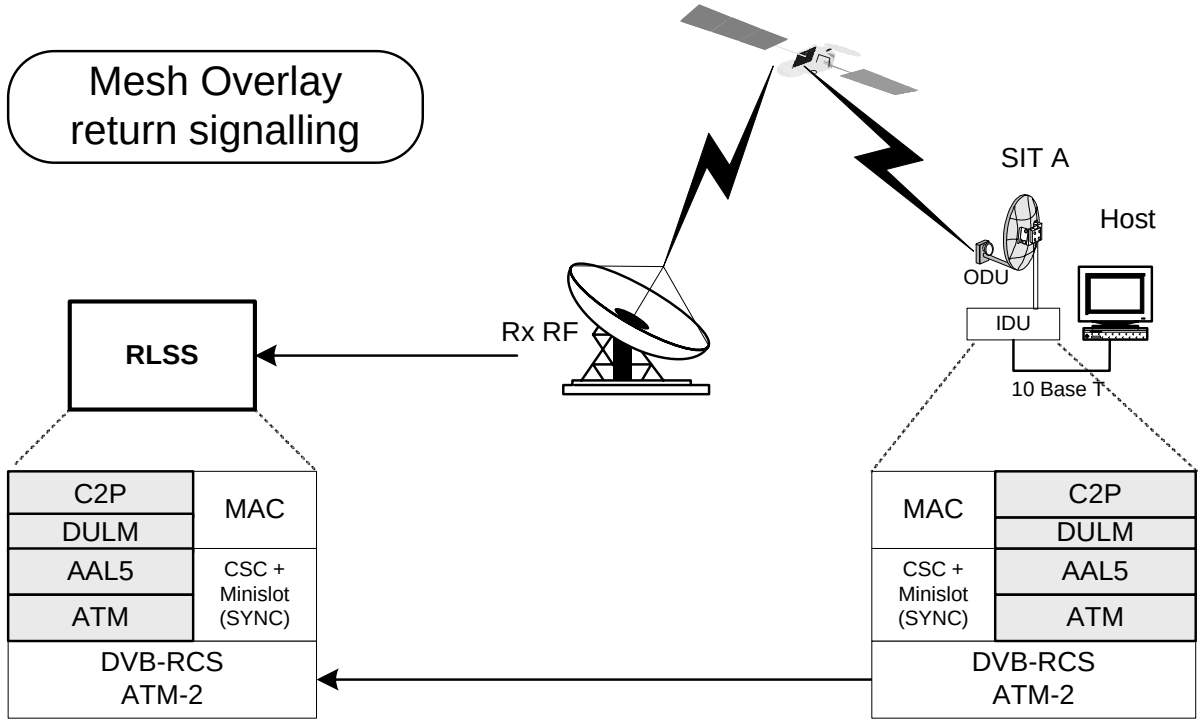
Mesh Overlay Signalling: Forward Link



Mesh Overlay Forward Signalling Stack

Mesh Overlay Signalling: Return Link

- For the return path, the mesh terminals:
  - Supports C2P for on-demand connections
  - signals the C2P messages using the DULM method for encapsulation of information elements in traffic cells



Mesh Overlay Return Signalling Stack

SatNet DVB-S2/RCS Mesh Product

- The SatNet Mesh-IDU consists of:
  - S4100 IDU modem card,
  - Mesh Burst Demodulator Card (MBD),
  - and additional adapter board and cables.
  - All enclosed in the S5200 chassis shown below:

ADVANTECH
SATELLITE NETWORKS

S5200 Mesh IDU
Summary Data Sheet

ADVANTECH SATELLITE NETWORKS

Parameters	Description
Functional	
Supported Traffic	1 ATM, 2 ATM, (MPEG for future versions)
Decoder	Turbo Code 1/2, 2/3, 3/4, 4/5, 6/7
Supported Symbol Rates:	128 to 4096 ksps
Roll-off :	0.35
Modulation:	QPSK
Access Scheme	TDMA
Analogue Tuner Step Size	26 KHz (Finer control digital)
Performance	
Acquisition	Blind Search
Adjacent Channel level	Up to 10 dB higher
Burst to Burst Power Variation	Up to 6dB
Frequency Acquisition Range	+/- 650 Hz
Threshold Es/No @ Turbo rate 2/3 and PER=10-7	ATM-1 6.8 dB, ATM-2 6.5 dB, MPEG 6.4 dB
Interface	
Freq. Range	950 – 2100 MHz
Return Loss:	10 dB min
Connector Type	F-connector Female
Load	75 Ohm
Min/Max Power	-65/-25 dBm
LNB Power and Control	22 kHz on/off, 13/18 Vdc, 10 MHz reference
Phase Noise Requirements (SSB Spectral Density)	100 Hz -62 dBc/Hz 1 kHz -72 dBc/Hz 10 kHz -77 dBc/Hz 100 kHz -87 dBc/Hz