# DVB-S2/S2X / DVB-RCS2 TESTING SATELLITE COMMUNICATION

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Make ideas real

# MILESTONES IN DVB SATELLITE STANDARDS

- DVB standards developed to provide highest efficiency for satellite communications.
  - DVB-S (1995) 1st digital satellite standard generation for broadcast
  - DVB-RCS (2001) 1st generation return channel satellite
  - DVB-S2 (2005) 2nd generation covering four services
    - Broadcast, DSNG, Interactive and Professional Services
  - DVB-RCS2 (2012) 2nd generation return channel satellite
  - DVB-S2X (2013) extension to the DVB-S2 standard
    - Beam Hopping (2020)

Designed for satellite

Perfect fit for a variety of applications

# DVB INVOLVEMENT AND SUPPORT

- Rohde & Schwarz is member of DVB (https://dvb.org/)
  - Involved in the DVB Technical Modules (e.g. DVB-RCS2)
  - Close co-operation with the industry on DVB-S2/S2X, -RCS2
  - Developed 1st DVB-S2 T&M signal generator
  - Implemented DVB-S2X in a very early stage
  - Added DVB-S2X Annex E Beam Hopping
  - Support of 500 MHz bandwidth for DVB-RCS2 even before the official standardization

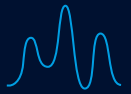
**Rohde & Schwarz is working closely with the industry and standardization organizations**

# SUCCESS OF DVB-S2X

- Standardized
- Existing eco system (chipsets, modulators, demodulators, …)
- Larger bandwidth than most other modulation schemes
- Designed for satellite communications
  - Enhanced efficiency
  - Flexibility
  - Robustness
  - Scalability
  - Backward Compatibility
  - High Throughput
  - Adaptive Coding and Modulation

Designed for satellite

Higher bandwidth requirements



Scalable on environment and demand

**DVB-S2X the preferred choice for modern satellite communication systems**

# DVB STANDARDS IN SPACE

- DVB satellite standards used in
  - Legacy space, new space and in mega constellations
  - GEO, MEO and LEO satellites
  - Variety of different applications

- Applications
  - Broadband Internet Services: High-speed internet access in remote and rural areas
  - VSAT (Very Small Aperture Terminal) Communications: Two-way satellite communication for businesses and individuals
  - Broadcasting: Television and radio services, including direct-to-home (DTH) broadcasting
  - Mobile Backhaul: Connecting remote cell sites to the core network
  - Maritime Communications: Internet and communication services for ships and vessels
  - Aerospace Communications: Aircraft connectivity, including in-flight entertainment and passenger internet services
  - Data Transmission: Transmitting large volumes of data for applications such as telemetry and remote sensing

# COMPONENTS OF DVB SATELLITE R&S SOLUTIONS

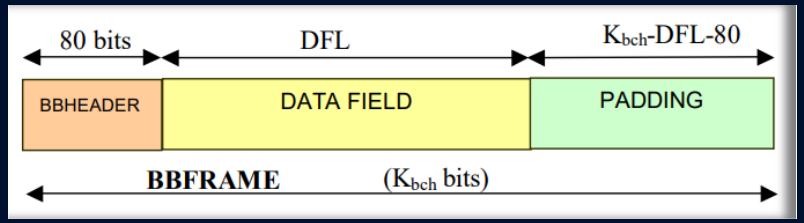
| | |
|---|---|
| DVB-S2 | ETSI standard EN 302 307-1<br>DVB-S2 is the basic standard for Satellite broadcasting that replaced DVB-S. It is also used in Satellite Communication due the great availability of its receivers. |
| DVB-S2X | ETSI standard EN 302 307-2<br>DVB-S2X is an optional extension to DVB-S2. It allows a greater performance compared to DVB-S2. |
| DVB-RCS2 | ETSI standard EN 301 545-2<br>DVB-RCS2 is its own standard used for the return link from the user to the ground station over the satellite. |

# COMPONENTS OF DVB SATELLITE R&S SOLUTIONS

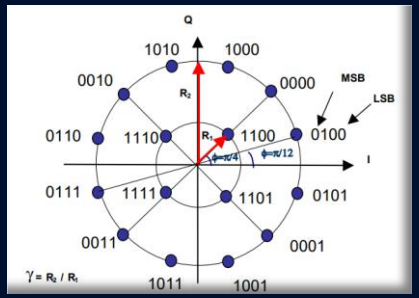
| | |
|---|---|
| Annex-E | DVB-S2X Annex-E is an optional transmission format that structures the data in super frames allowing the support of beam hopping. |
| Annex-M | Annex-M is an optional transmission format of DVB-S2 and S2X allowing the transmission of a single or few wide-band carrier for power and efficiency optimization. |
| VCM/ACM | Variable Coding & Modulation (VCM) and Adaptive Coding & Modulation are features of S2 and S2X allowing the dynamic change of transmission parameters, depending on channel quality. |

# WHAT IS SPECIFIED?

- Frame Structure



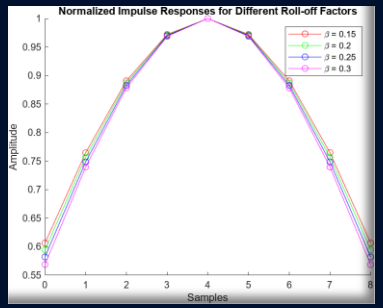

- Symbol Mapping




- Modulation and Coding (MODCODs)

| Mode | MOD COD | Mode | MOD COD | Mode | MOD COD | Mode | MOD COD |
|---|---|---|---|---|---|---|---|
| QPSK 1/4 | $1_D$ | QPSK 5/6 | $9_D$ | 8PSK 9/10 | $17_D$ | 32APSK 4/5 | $25_D$ |
| QPSK 1/3 | $2_D$ | QPSK 8/9 | $10_D$ | 16APSK 2/3 | $18_D$ | 32APSK 5/6 | $26_D$ |
| QPSK 2/5 | $3_D$ | QPSK 9/10 | $11_D$ | 16APSK 3/4 | $19_D$ | 32APSK 8/9 | $27_D$ |
| QPSK 1/2 | $4_D$ | 8PSK 3/5 | $12_D$ | 16APSK 4/5 | $20_D$ | 32APSK 9/10 | $28_D$ |
| QPSK 3/5 | $5_D$ | 8PSK 2/3 | $13_D$ | 16APSK 5/6 | $21_D$ | Reserved | $29_D$ |
| QPSK 2/3 | $6_D$ | 8PSK 3/4 | $14_D$ | 16APSK 8/9 | $22_D$ | Reserved | $30_D$ |
| QPSK 3/4 | $7_D$ | 8PSK 5/6 | $15_D$ | 16APSK 9/10 | $23_D$ | Reserved | $31_D$ |
| QPSK 4/5 | $8_D$ | 8PSK 8/9 | $16_D$ | 32APSK 3/4 | $24_D$ | DUMMY PLFRAME | $0_D$ |

- Pulls Shaping



# MEASUREMENT APPLICATIONS

- Receiver Test

DVB-S2/S2X Terminal

- Payload Test

Satellite Payload

- Transmitter Test

Ground Station

DVB-S2/S2X Signal

- Component Test

DUT

# DEMO

- The basic Demo Setup looks as follows

# DVB-S2/SX / DVB-RCS2 PRODUCT PORTFOLIO

## Signal Generators

- VSG - ARB based

R&S®SMW200A

R&S®SMM100A

R&S®SMBV100B

R&S®SFI100A

- Real time

R&S®SMCV100B

## Signal and Spectrum Analyzer

- Signal Analysis

R&S®FSW

R&S®FSVA

R&S®FSV

## Satellite Monitoring

- Satellite Receiver

R&S®MSR4

- System Monitoring

R&S®GSACSM

# ROHDE & SCHWARZ IN THE SATELLITE ECO CHAIN

Satellite payload testing

Satellite user terminal testing

Satellite in-orbit testing

Satellite ground station testing

5G NTN satellite testing

Navigation testing

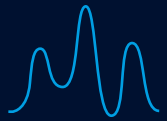
# SUMMARY

- DVB satellite standards trusted by New Space and legacy players around the world
- DVB-S2/S2X and DVB-RCS2 are preferred standards today
- DVB-S2/S2X and DVB-RCS2 usage is continuously growing

**R&S offers the perfect solution fit for DVB satellite standards**

Designed for satellite

Higher bandwidth requirements



Perfect fit for a huge variety of applications

Scalable on environment and demand

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