

Versatile, low-cost RF equipment.

Description

Moreph30-Amber is a 2.4Ghz WiFi Traffic Generator based on the software defined radio platform Moreph30. It is capable of simultaneously generating a multitude of b/g/n WiFi signals in 2.4 GHz band. The signals may be placed on arbitrary channels and may overlap on the same channel. The signals are parameterized in terms of their transmission time, power, modulation/coding scheme and duration. The packets generated contain the correct synchronisation/training sequences, but the data contained within them is random. Both DSSS and OFDM phys are supported. STBC and beamforming are not supported. Data defining the scenario to be generated is downloaded to the Moreph30 in the form of a csv file. The file can either be generated using the Moreph30-Amber GUI or a spreadsheet application. The unit can either be operated from a controlling host or run standalone with the scenario definition being read from a USB memory stick.

Specifications

- Supported 802.11 b/g/n (2.4Ghz)
- Supported Host OS: Windows7, 10. Linux or macOS on request.

Features

- Host Interfaces: USB & Ethernet
- Input Power: 12 VDC, 2A
- Dimensions: 158.5 x 160.0 x 47.0 mm
- Weight: 1.3 kg (2.87 lb)
- Multiple channel signals generated simultaneously
 - ✓ Max 12 OFDM PHY signals simultaneously
 - ✓ Max 10 DSSS PHY signals simultaneously
 - ✓ Max 2 CW signals simultaneously
 - ✓ 1 white ground noise signals
- Thermal Shutdown

Use Cases

- Anti-Interference Testing. Allow the developer to build up a WiFi (2.4Ghz) Interference Testing scenario and support 802.11 b/g/n (2.4Ghz)
- Interoperability testing
- Receiver testing
- Bluetooth AFH testing.



Technical specification.

| Simultaneous signal generation | |
|--------------------------------|----------------------------------|
| OFDM phy | x 12 |
| DSSS phy | x 10 |
| CW | x 2 |
| AWGN | x 1, covering 2395MHz to 2485MHz |

| Supported packet types | |
|------------------------|---------------------|
| OFDM (802.11g/n) | 20MHz non-HT |
| | 20MHz HT |
| | 40MHz HT |
| DSSS (802.11b) | 1, 2, 5.5 & 11 Mbps |

| RF generation | |
|-------------------------|--------------------|
| Frequency range | 2395MHz to 2485MHz |
| Instantaneous bandwidth | 90MHz |
| IP3 @ max output | +30dBm typical |
| Maximum peak output | >0dBm |

| RF connector | |
|--------------------|-----|
| Connector type | SMA |
| Impedance | 50Ω |
| Coupling | AC |
| Maximum DC voltage | 50V |

| Power | |
|-----------------------------|------------|
| Connector type | 2.5mm jack |
| Input voltage | 12V DC |
| Power | 10W typ |
| Reverse polarity protection | Yes |
| Over voltage protection | Yes |
| Under voltage protection | Yes |

| General | |
|----------------------|---|
| Supported hosts | Windows 7 or higher Linux on request macOS on request |
| Regulatory approvals | CE, EN55032, EN61326, FCC |

Description

The Moreph30-Amber application generates a sequence of representative WiFi (2.4Ghz) signals from a script. Multiple WiFi packets can be active at the same time. Each line in the script describes a single WiFi packet. Each line is composed of a number of parameters:

| Parameters | Units | Description |
|-------------|---|--|
| Start time | 100ns | Time at which first bit in packet will be transmitted. Only <i>Start Time</i> or <i>Delta Time</i> need be specified. |
| Delta time | 100ns | Interval between the start of this packet and the start of the previous packet. Only <i>Start Time</i> or <i>Delta Time</i> need be specified. |
| Channel | Integer 1 to 13 | WiFi channel on which packet shall be transmitted. |
| Power | 0.1 dBm | The output power for the packet. |
| b/g/n | - | Determines whether the packet is an 802.11b, 802.11g or 802.11n packet. |
| PSDU length | µs | The length of the PSDU. The actual transmitted length may be slightly different to ensure that a complete number of octets are transmitted. |
| Modulation | DBPSK/DQPSK/CCK5.5/CCK11 BPSK/QPSK/16QAM/64QAM | The modulation which will be employed for the PSDU part of the packet. |
| Short | Yes/No | For 802.11b packets this indicates whether a long or short PPDU should be transmitted. For 802.11n packets this indicates whether a short guard interval should be used. |
| Bandwidth | 20MHz/40MHz | For 802.11n packets, this indicates whether the packet should be transmitted in a 20MHz or 40MHz bandwidth. |
| Mixed | Yes/No | For 802.11n packets this indicates whether the mixed format or greenfield format PPDU should be used. |
| Repeats | Forever/Integer 1 to 65535 | The number of times the packet described on this line should be repeated. |
| Interval | 100ns | The interval between repeats of the packet. The repeat interval is defined as the time between the start of one transmission and the start of the next transmission. This parameter is only valid if <i>Repeats</i> is not equal to 1. |

The data contained within the packets is obtained from a pseudo-random number generator. The preamble, training sequences and pilot carrier insertion for the packet is as per the specification. Any CRCs are randomly generated.

The script may either be read in from a file or created directly in the GUI. Scripts generated or edited in the GUI may be saved to file.

The file format is a simple csv file:

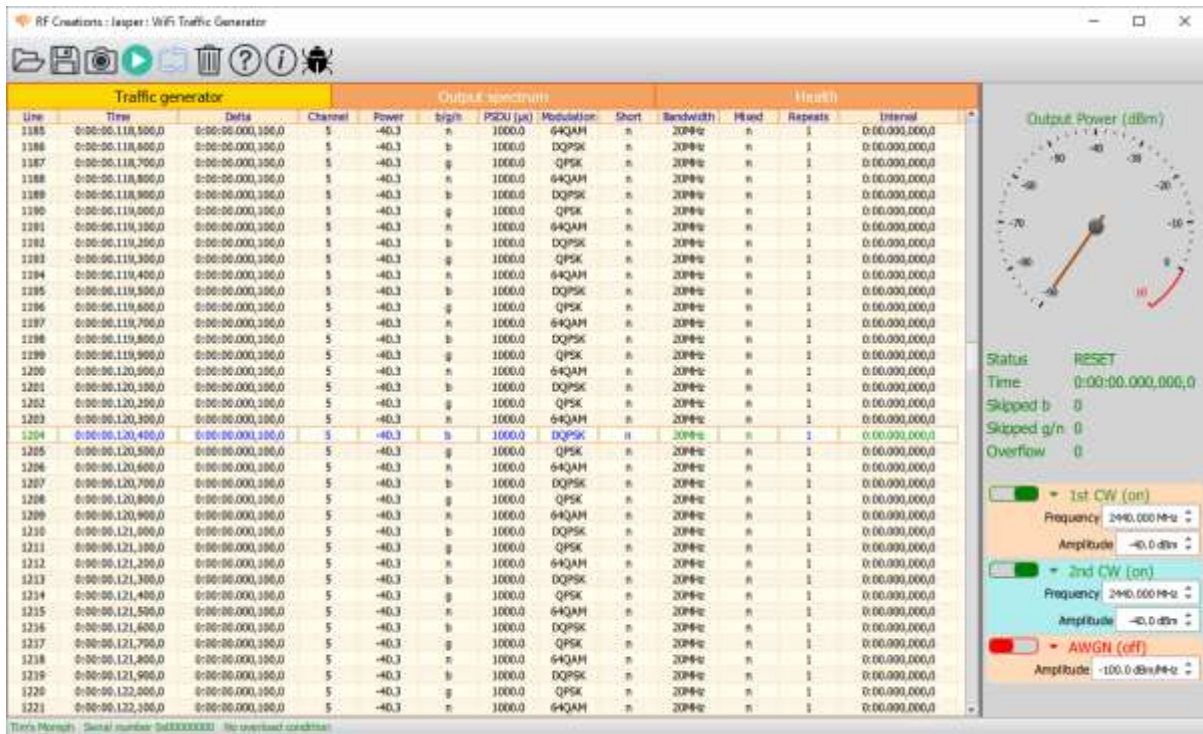
Time,Channel,Power,b/g/n,PSDUlength,Modulation,Short,Bandwidth,Mixed,Repeats,Interval

If the *Time* parameter is proceeded by '+', then it represents the delta time from the start of the previous packet. All entries in the script file must be in strict order of time transmission. The *Interval* parameter can be omitted if the number of repeats has been set to 1.

For example:

+1000,5,-40.3,b,1000,DQPSK,0,0,0,1,
 +1000,5,-40.3,g,1000,QPSK,0,0,0,1,
 +1000,5,-40.3,n,1000,64QAM,0,0,0,1,

The script file is displayed within the GUI, where individual parameters can be edited. Lines within the script can be copied, cut or pasted.



Controls to play, pause, reset or clear the script are available in the toolbar at the top of the window. A repeat button is also available which will cause the script to be continuously repeated once all the entries have been exhausted.

A monitor panel on the right-hand side contains a meter which indicates the current peak output power from the Moreph30 unit. It also provides a visual indication of overload conditions encountered by the transmitter. Below the meter are five status lines which indicate:

Status

Whether the script is playing, paused or has been reset to the beginning.

Time

The current transmission time. The line which is currently being transmitted is also highlighted in the script window.

Skipped b

The number of 802.11b packets that the Moreph30-Amber application was unable to transmit. Packets will be skipped if the number of simultaneous attempted DSSS transmissions exceeds 10.

Skipped g/n

The number of 802.11g packets that the Moreph30-Amber application was unable to transmit. Packets will be skipped if the number of simultaneous attempted OFDM transmissions exceeds 12.

Overflow

This is counter which provides an indication of the number of times the transmitter has been overloaded. Overload conditions occur when the peak output power from the Moreph30 exceeds 0dBm.

In addition to 802.11 packets, the Moreph30-Amber application is able to simultaneously generate three additional signals:

| Signal | Parameters | Units | Description |
|--------|--------------------|---------------|--|
| CW 1 | Frequency Power | kHz 0.1dBm | A continuous wave transmission |
| CW 2 | Frequency Power | kHz 0.1dBm | A continuous wave transmission |
| AWGN | Power | 0.1 dBm/MHz | Additive white gaussian noise covering 2495MHz to 2485MHz. |

Whilst the traffic script is playing, it is possible to display in the GUI the instantaneous output spectrum from the Moreph30.



Autonomous operation

The Moreph30-Amber application can be run on the Moreph30 without the need for a host to be connected. The application plus the traffic script must be copied onto a USB memory stick. The memory stick is then attached to the Moreph30 USB connector prior to the unit being powered on. The Moreph30-Amber application and traffic script will automatically be executed when power is applied.

Output power

The maximum peak RF output of the Moreph30 is 0dBm. The reason for this restriction is due to intermodulation requirements. When multiple signals are being generated, intermodulation products between them can arise. The Moreph30 has been specifically designed to minimise the level of these spurious signals. It is this feature which permits the Moreph30 to generate both the weak wanted signals and the strong interfering signals which are required for receiver testing. In the Moreph30-Amber application, it permits the Moreph30 to generate both strong and weak 802.11 transmissions simultaneously.

It becomes more challenging to control the spurious signals as the output power increases. Hence the Moreph30 output power has been capped at around 0dBm. If the output of the Moreph30-Amber application is injected via a cabled link or radiated immediately in the vicinity of the device being tested, then the 0dBm output will generally be adequate. However, in many applications additional amplification may be required. When selecting an external amplifier, it is important that it has a high IP3 figure, otherwise the individual signals generated by the Moreph30-Amber application will mix together generating unwanted spurious signals.