Use of the click emulator embedded in the Narda Click Analyzer CA0010

An instrument that can generate known, repeatable sequences of clicks is indispensable for testing click analyzers in accordance with CISPR 16-1-1 and CISPR 14-1

Introduction

PMM CA0010 is the full compliance click analysis companion for the 9010F, ER8000 and ER9000 FFT EMI receivers. Used in conjunction with any of the above receivers, the CA0010 can make four simultaneous measurements at 150 kHz, 500 kHz, 1.4 MHz and 30 MHz. With the PMM 9010F receiver, it is fully compliant with all old and new click standards: CISPR 16-1-1:2019 Ed. 5 and previous editions, CISPR 14-1:2020 Ed. 7 and previous editions, and the CENELEC equivalents EN 55016-1-1 and EN 55014-1. With the PMM ER8000 or ER9000, it is fully compliant with the latest click standards: CISPR 16-1-1:2019 Ed. 5, CISPR 14-1:2020 Ed. 7, and CENELEC EN 55016-1-1/EN 55014-1.

The system includes PMM Click Generation (PCG) software, designed to operate the PMM CA0010 as a powerful instrument that can also generate the discontinuous disturbances (clicks) dictated by CISPR 16-1-1.

The user can set all the click-relevant parameters, such as their amplitude, duration, spacing, number, repetitions and, last but not least, the amplitude of CISPR pulses. The CA0010 is the only click analyzer on the market that embeds a full compliance B-Band CISPR 16-1-1 pulse generator so that tests #2 and #3 of CISPR 16-1-1 Table 14 can be performed without an external generator. The internal click generator is fully compliant with the requirements specified in CISPR 16-1-1 and can be used to self-calibrate the CA0010 or check any other external click meter.

The PCG software will generate all CISPR 16-1-1 standard tests and Annex-F tests. Users can also generate an arbitrary sequence of pulses.

Signal generator

The internal signal generator is a highly stable and accurate 50 Ohm RF generator ranging from 150 kHz to 30 MHz. Much more than a single generator, it's actually three in one: it can generate CW signals in addition to On-Off-Keyed signals and CISPR pulses.

It covers all four frequencies used for discontinuous disturbance measurements: 150 kHz, 500 kHz, 1.4 MHz and 30 MHz.

It can also produce OOK modulated signals and CISPR pulses simultaneously. This way, the unit can satisfy all of the standard's tests in Table 14 and Annex F.

Levels, ON duration and OFF duration (separation) can be set as desired, by entering the values in the corresponding boxes.

The internal generator, besides being useful for aligning the system thanks to the automatic internal routines specifically developed for this extension, can also be used to check any click meter test set.

Custom signals

In addition to generating all of the standard tests, the system allows users to create an arbitrary sequence of disturbances.

The high-performance internal generator produces pulsed signals whose duration and level can be set with optimal accuracy and resolution.

It is also possible to generate, simultaneously, wideband CISPR pulses at the standard repetition frequency, whose level can be adjusted independently.

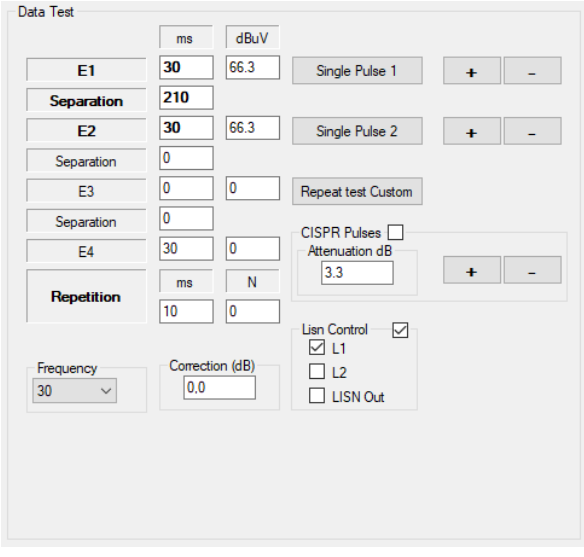

Fig. 1 - Custom signal table

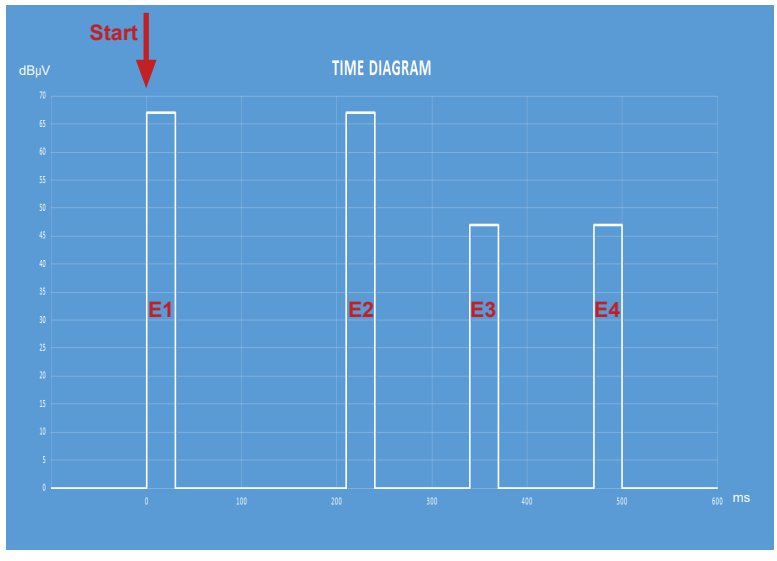

Fig. 2 - Time diagram of the IF detected level for the 500 kHz

In the data test frame (Fig. 1), users can generate custom disturbances by setting the duration of up to 4 events, each with its own amplitude and separation interval.

The Repetition box can be set to repeat the depicted sequence N times, with a customized pace T in milliseconds. In the example shown above (Figs. 1 and 2), the generated disturbance will be as follows:

– The carrier frequency will be 500 kHz (Frequency tab)
– External correction factor (for cables, attenuators etc.) will be zero
– Wideband CISPR pulses are switched OFF
– At first the carrier will be ON for 30 ms, with an amplitude of 66.3 dBµV (Event 1)
– Then it will be OFF for 180 ms (Separation)
– ON again for 30 ms with an amplitude of 66.3 dBµV (Event 2)
– OFF again for 100 ms (Separation)
– ON for 30 ms, with an amplitude of 46.3 dBµV (Event 3)
– OFF for 100 ms (Separation)
– ON for 30 ms, with an amplitude of 46.3 dBµV (Event 4)
– The sequence will be repeated 10 times, every 3 seconds (Repetition)

CISPR Pulses

The internal generator, compliant with CISPR 16-1-1, can produce wideband CISPR pulses without the need for expensive additional equipment.

The amplitude attenuation for CISPR pulses can be set within the software.

The maximum output level is available for 0.0 dB attenuation. When a lower amplitude is needed, the user can simply enter the attenuation value.

The + and – soft buttons fine-tune the level with maximum precision.

Level alignment file

The user can retrieve and save a level alignment file, specific to the analyzer in use, for quick and easy setup

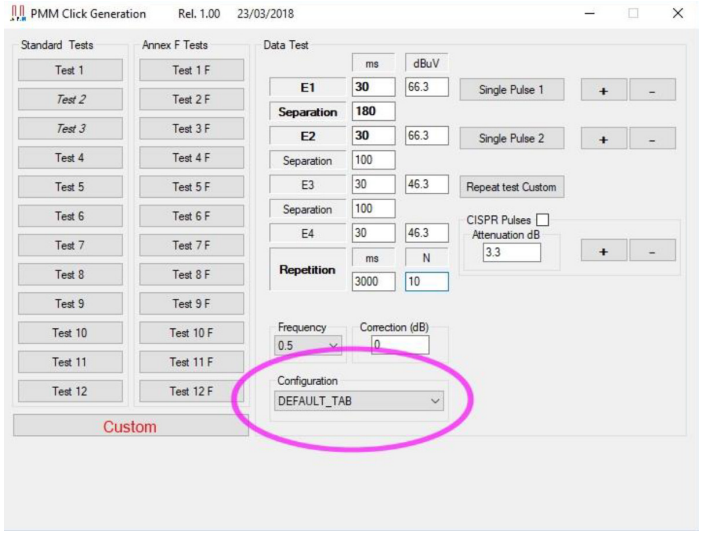

Fig. 3 – Level alignment

EUT discontinuous disturbance emulation

With the internal generator all points of the standard can be tested, including exceptions.

The first example describes testing a click analyzer for compliance with section 5.4.3.4 of CISPR 14-1:2020 Ed. 7, “Instantaneous switching.”

Before running the test, the measurement system is set as shown in the user manual. The only additional step is to connect CAL OUT to RF INPUT with a BNC-BNC cable.

The trial is designed to generate a sequence of signals, of a level and duration such that they will be detected as click disturbances, distributed so as to produce a click rate N of just under 5 clicks per minute. At a frequency of 150 kHz, there are 36 pulses with a duration of 9.5 ms and 4 with a duration of 19 ms, so that 90% of them overall do not exceed 10 ms. At 500 kHz there are 39 clicks with a duration of 190 ms and at the other frequencies there are 40 clicks of 190 ms.

Under these conditions, the determining rate stage carried out with the settings shown in Fig. 4 will produce a report like the one in Fig. 5. There is no need to proceed with the general assessment, as the requirements of section 5.4.3.4 of the standard are satisfied.

The rules of syntax for writing these simple scripts are available on request.

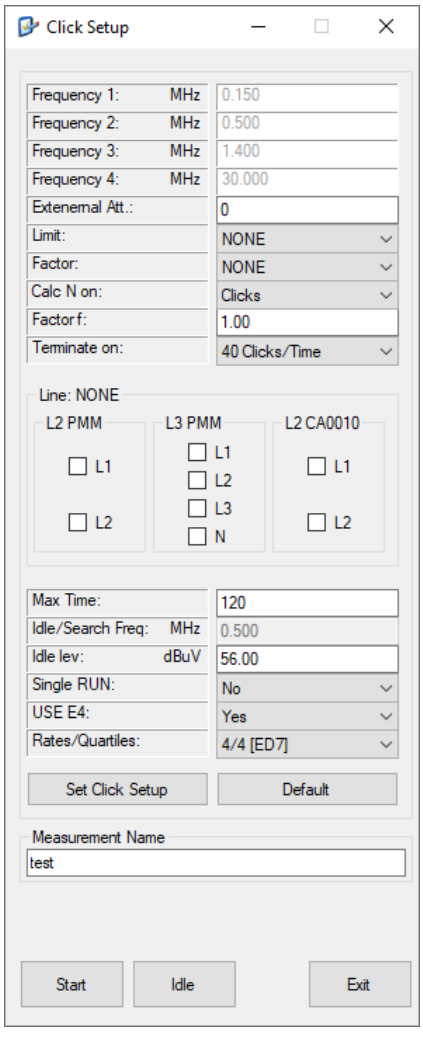

Fig. 4 – Measurement setup

```
*Freq,Test#,pause(ms)

#CORRECTION 0
#DO
.15, 22, 500
.5 , 26, 500
1.4, 26, 500
30 , 26, 10800
#LOOP 36
#DO
.15, 23, 500
.5 , 26, 500
1.4, 26, 500
30 , 26, 10800
#LOOP 3
30 , 26, 500
1.4, 26, 500
.15, 23, 500
```

Fig. 5 – Script 1

Lq Calculation

Frequency MHz	Limit dBµV	<=10ms	<=20ms	<=0.2s	From Exception E4	Other than click ms	Total Clicks	Time min.	N rate	+Lq dB
0.15	56.0	0	8	0	0	0	8	3.0	2.7	21.0
0.50	56.0	0	7	0	0	0	7	3.0	2.3	22.2
1.40	56.0	0	7	0	0	0	7	3.0	---	22.2
30.00	56.0	0	7	0	0	0	7	3.0	---	22.2

Fig. 6 – Click measurement report

In the second example, a sequence of disturbances is generated in order to check whether a click analyzer complies with various aspects of the standard.

Similar to the first example, the script is written to generate 36 clicks (90%) of short duration and 4 clicks (10%) of no longer than 20 ms at each of the four frequencies. The only difference is that in this case, the rate of the first channel (150 kHz) is greater than 5. Since the standard assumes the testing time of the first channel that reaches 40 clicks, it will take the 150 kHz rate, which is 5.1.

Under these conditions, though very similar to our first example, the standard requires the test to be carried out. This test – the actual measurement – occurs with the second run, which will allow up to one quarter of the clicks detected in the first run (40/4=10) with a relaxed threshold of 15.4 dB, calculated with the formula Lq=20 LOG (30/N).

The last 4 clicks of the sequence, for each of the frequencies tested, are 12 dB higher than the previous ones. This way, on the second run, 4 clicks will be detected (out of a maximum of 10 allowed) as shown in the report in Fig. 8.

Because we have selected “Single Run: Yes” (Fig. 7), the analyzer, thanks to its particular characteristics, will be able to detect the 4 clicks exceeding the relaxed threshold with no need to perform the measurement. This saves time without compromising accuracy.

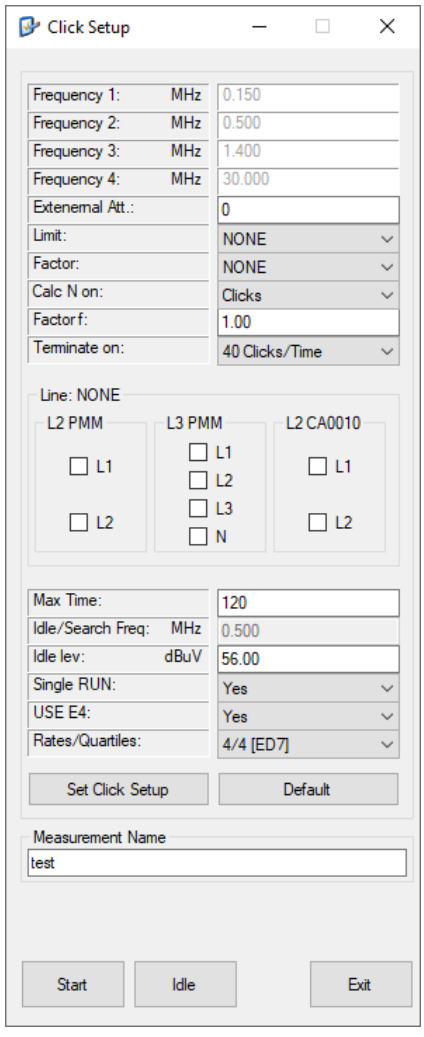

Fig. 7 – Measurement setup

```
*Freq, Test#, pause(ms)
#CORRECTION 12
#DO
.15, 22, 500
.5 , 22, 500
1.4, 22, 500
30 , 22, 10500
#LOOP 36
#CORRECTION 0
#DO
.15, 23, 500
.5 , 23, 500
1.4, 23, 500
30 , 23, 10400
#LOOP 3
30 , 23, 400
1.4, 23, 400
.15, 23, 400
.5 , 23, 400
```

Fig. 8 – Script 2

Lq Calculation

Frequency MHz	Limit dBµV	<=10ms	<=20ms	<=0.2s	From Exception E4	Other than click ms	Total Clicks	Time min.	N rate	+Lq dB
0.15	56.0	0	8	0	0	0	8	3.0	2.7	21.0
0.50	56.0	0	7	0	0	0	7	3.0	2.3	22.2
1.40	56.0	0	7	0	0	0	7	3.0	---	22.2
30.00	56.0	0	7	0	0	0	7	3.0	---	22.2

Final Test Report

Frequency MHz	Limit Quartile dBµV	<=10ms	<=20ms	<=0.2s	From Exception E4	Other than click ms	Total Clicks	Time min.	Max Click Allowed	Pass Fail
0.15	77.0	0	0	0	0	0	0	3.0	2	Pass
0.50	78.2	0	0	0	0	0	0	3.0	1	Pass
1.40	78.2	0	0	0	0	0	0	3.0	1	Pass
30.00	78.2	0	0	0	0	0	0	3.0	1	Pass

Fig. 9 – Click measurement report

Conclusion

The CA0010 system is not just an analyzer, but a click generator useful for checking the compliance of any click meter with the current standard. It allows the user to create the precise disturbances dictated by the standards and also to emulate an EUT with an arbitrary sequence of clicks. It features a sinusoidal generator, an On-Off-Keying modulator to create the desired clicks, a CISPR pulse generator, and a power combiner for adding signals together.

The CA0010 comes with free PCG software for the easy, intuitive management of its many functions. The software is pre-set for all CISPR 16-1-1 Standard tests and Annex-F tests. Users can also create their own tests, even with long and complex sequences.

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