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TECHNICAL NOTE

NanoPulse ESD Detector

Novx 7000

General Sensitivity

The NanoPulse can detect CDM, MM and HBM ESD events, depending upon application setup and antenna proximity. In general, metal contact created ESD events produce more radiated energy relative to the source voltage and greater field oscillation due to differences in impedance. The NanoPulse can detect HBM events (1.5 kΩ model) down to 50V at 5 cm and down to 5V reliably for MM and CDM. By contrast the MiniPulse product can detect events down to 1V or less for all discharge models.

Radiated ESD Event Detection Test Example

An Oryx device tester was used to create semi-calibrated low-level ESD pulse events. ESD events were measured simultaneously with two antennas. Oscilloscope measurements were converted using an FFT of 200 MHz center pulse bandwidth and appropriate antenna factor (AF).

Setup

1. Oryx System 700 IC Tester
2. LeCroy WP7300 DSO (3GHz/20GS/s)
3. ETS 7405 E-field Probe (isotropic)
4. Novx 7000 with NanoPulse
5. Linx FH916 antenna (monopole)
6. Distance to ESD source (socket): 30.4 cm (12")
7. 20 pulse sequence, 50ms pulse interval
8. NanoPulse AF = 1.6

Results

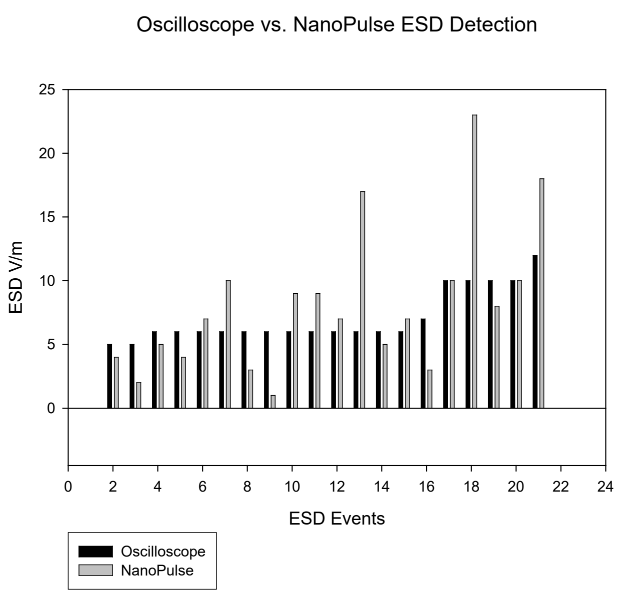
Test results show a typical response for the NanoPulse ESD detector. It should be noted that there is a significant difference between the reference antenna (E-field probe) and the monopole. Antenna form factor exerts a very large influence on measurements of any type relating to electromagnetic fields. Though, as can be seen, the NanoPulse can use antenna factors to correlate to known reference antennas, differences do add variation to measurements. In addition, the digital oscilloscope is a pure time domain instrument with very high bandwidth and sample rate, yielding much higher pulse waveform and power content resolution.

By contrast, the NanoPulse uses a combination of time domain and spectral domain measurements at a much lower sampling rate to determine ESD pulse qualification and relative amplitude. Where the oscilloscope makes pure time domain measurements of peak waveform amplitude, the NanoPulse uses spectral content (demodulation) to determine total peak pulse power (dBm) and converts back to EM field potential on a log scale.

In addition, for the test presented here, the Oryx tester periodically produces unintentional multiple pulses within the time discrimination range of the NanoPulse (see oscilloscope screenshots below). Since the NanoPulse is performing power transforms, both events are taken together (summing) which produces a higher peak amplitude reading. The Novx 7000 reports both of these events via the PEMS and Calibrator Reader software and database as separate ESD events (from the NanoPulse time domain function) but produces a joint amplitude due to summing across the power function. This sometimes contrasts with the oscilloscope representation which tracks only highest peak amplitude for the dominant waveform (you have to measure each other waveform separately).

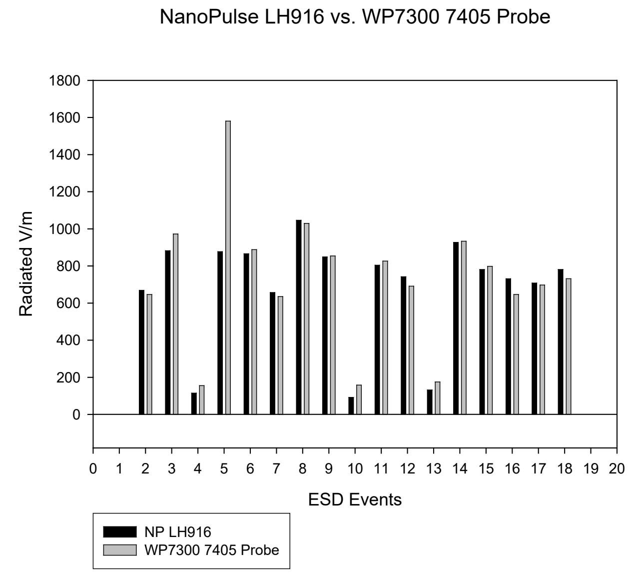
Example Test Data

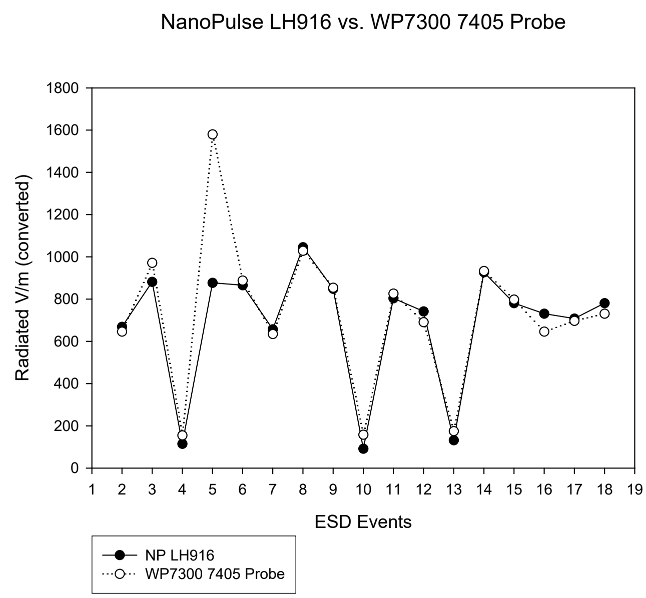
TEST	Scope(mV)	Scope/Antenna V/m	NP/Monopole
1	31	10	10
2	30	10	23
3	19	6	5
4	18	6	4
5	20	6	7
6	32	10	8
7	18	6	10
8	20	6	3
9	16	5	4
10	22	7	3
11	30	10	10
12	20	6	1
13	20	6	9
14	20	6	9
15	17	5	2
16	20	6	7
17	37	12	18
18	19	6	17
19	19	6	5
20	20	6	7



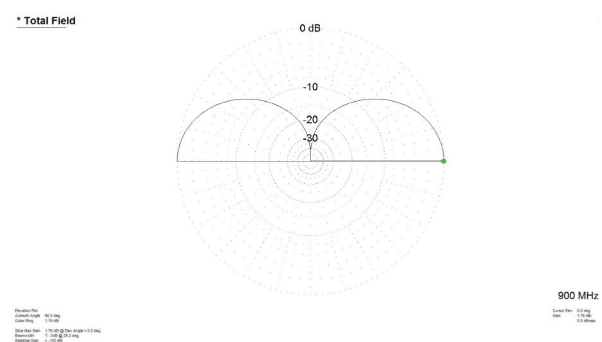
Comparative histogram of small ESD event detected amplitudes

	Oscilloscope (7405 Ant)	**NanoPulse** (FH916 Ant)
Mean	7.0	8.1
Median	6.0	7.0
Stdev	2.01	5.5

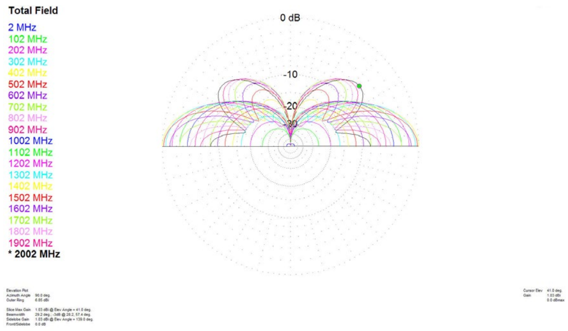




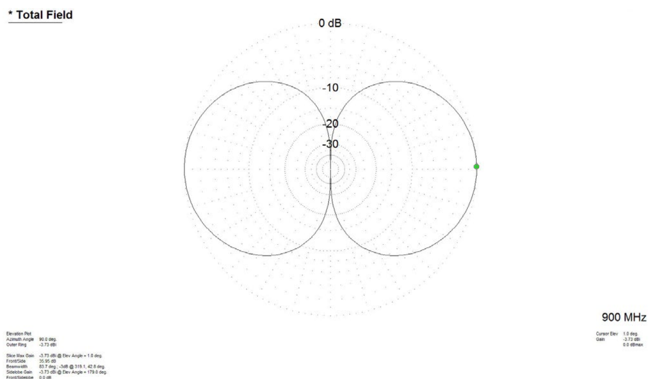
Second Series of large ESD event comparisons
(non-Oryx generated)



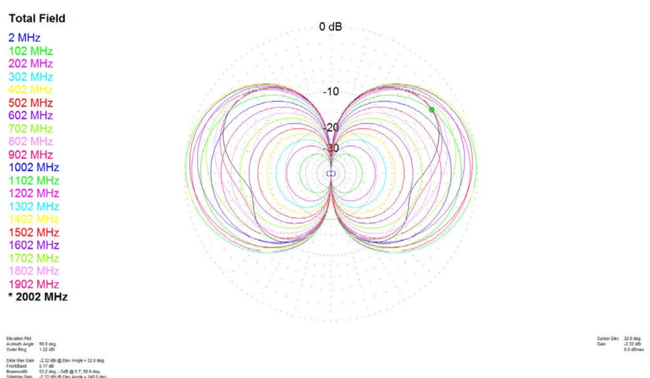
FH916 monopole 900MHz signal acquisition
(sitting vertical on ground plane)



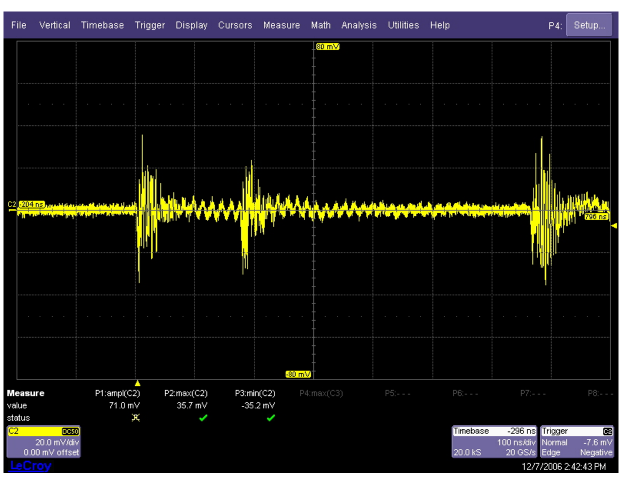
FH916 monopole antenna showing frequency range gain (on ground plane)



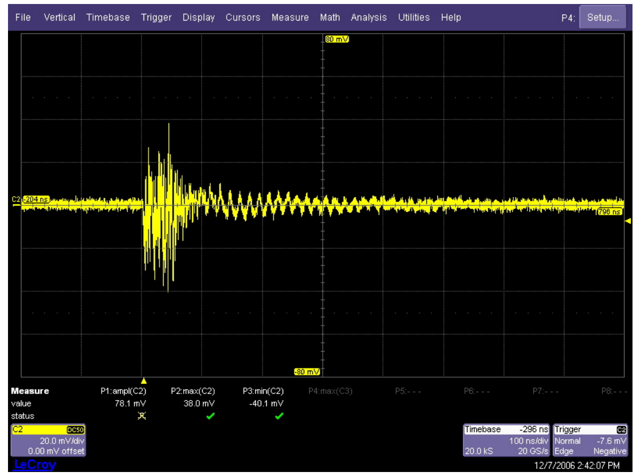
FH916 monopole antenna freespace 900MHz frequency



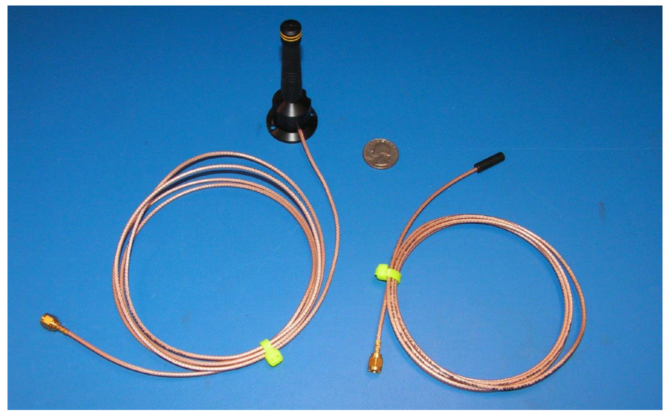
FH916 monopole antenna freespace wide spectrum gain pattern



Tester-caused example of unintended double ESD pulse; NP processes this as combined pulse power since they occur within the time discrimination buffer period



Example of tester produced single ESD event



FH916 monopole antenna (standard), left; MicroESD proximity monopole antenna, right; standard Linx FH916 antenna is 6.35 cm tall, not including the base (overall height is 10.16 cm) and MicroESD antenna is 2 cm x 0.5 cm

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