Recent History, Current Status, and Latest PT Results of ACE-PT Inc. EMC Proficiency Testing (PT) Programs

Presented to the **Accredited National Standards Committee C63®**
during the 30 September through 04 October 2024 Meetings

By:
Harry H. Hodes, NCE
Life Member, IEEE
ACE-PT Inc. EMC PT Program Technical Manager

Presentation Outline

- Why we should care about EMC Proficiency Testing [PT]
- Brief History & Current Status of the ACIL / ACE-PT Inc. EMC PT Program
- EMC PT Test Artifacts
- Technical Approach & Statistical Methods used in all EMC PT Schemes
- Participation Profiles
- Results of the 150 kHz to 1 GHz EMC PT Scheme
- Results of the 1 GHz to 18 GHz EMC PT Scheme
- Observations and Conclusions

Why should a Test Lab care about doing EMC Proficiency Testing? - I

From a Quality System Management Standpoint:

- ➔ **Except for Clause 7.7.2, all other Clauses of ISO/IEC 17025:2017 concern themselves with *process*, not with actual results!**

- ➔ **The underlying presumption of ISO/IEC 17025:2017 is that if you properly control the processes, the outcomes (i.e., the results) will also be controlled. This presumption is almost a dogma and is easily rebutted by the facts.**

- ➔ **An across-the-board "Passing" result of a Proficiency Test provides the strongest proof (i.e., directly relevant objective evidence, rather than indirect evidence) that the Test Lab can get the correct results. Such evidence fully satisfies Clause 7.7.2 of ISO/IEC 17025:2017.**

Why should a Test Lab care about doing EMC Proficiency Testing? - II

From a Technical Standpoint:

➔It is not possible for a single EMC Test Lab to assess its own *Bias.* In other words, a Test Lab cannot (by its own efforts) determine whether it is *consistently* measuring amplitudes that are "hot" or "cold" as a function of frequency.

➔It is quite difficult for a single EMC Test Lab to assess (by its own efforts) whether or not its test processes are *fully "in control"* (i.e., Are the variations in measured amplitude as a function of frequency reasonable, given their Measurement Uncertainties?) *[Note: Daily confidence checks help, and trending analysis helps even more, but this is far from a formal inter-lab comparison].*

➔ "Failing" EUTs that should pass (i.e., making a Type I Error) and/or "Passing" EUTs that should fail (i.e., making a Type II Error) is not good for an EMC Lab's Customers, nor for the specific EMC Lab that made the Pass/Fail Classification Error, nor for the reputation of the EMC Test Laboratory industry as a whole.

Technical Conclusion:

Participating in, and "passing" a well-run EMC PT Program provides objective (and comprehensive) proof that an EMC Test Lab is competent – i.e., that it can consistently make "good" measurements, and thus, can be relied upon to correctly classify EUT's as having "Passed" or "Failed". *["Good Measurements" are measurements made with acceptable bias and with a process that is "In Control"].*

Why should an *Independent* Test Lab care about doing EMC Proficiency Testing?

In addition to the reasons given in the last two Slides, it can offer a competitive advantage:

"Ask our competitors if they can show you objective evidence of competency (e.g., in the form of *EMC Statement of Performance Letter* or a *Formal EMC PT Analysis Report* from an ISO/IEC 17043-accredited EMC PT Provider).

We can prove ours!

Why should a Test Lab's Customers care about doing EMC Proficiency Testing?

If a manufacturer or supplier is going to have to pay to get their product(s) tested for compliance, it would be wise to select a Test Lab that can provide *objective evidence* of its ability to make correct measurements.

Why should an AB care about requiring EMC Proficiency Testing?

THE "USES" OF PT ANALYSIS RESULTS TO ACCREDITING BODIES (ABs)

1. Adherence to ILAC Policy (ILAC P9:01/2024)

The **mandated** use (when available, appropriate and deemed necessary) of the PT Analysis Results for evaluating the competence of EMC testing laboratories as part of the accreditation process of laboratories is stated in ILAC Policy P9:01/2024 which is **imposed** upon all ABs that are signatories to the ILAC Multilateral Recognition Arrangement (MRA). ***[Emphasis Added].***

2. Adherence to ISO/IEC 17011:2017

ISO/IEC 17011:2017 requires ABs to accept that one of the techniques for performing assessments of conformity assessment bodies (e.g., Test Laboratories) is a review of performance in proficiency testing and other interlaboratory comparisons

HISTORY - I

- ACIL's EMC Proficiency Testing (PT) Program dates from 1999.

- Two EMC PT Test Artifacts were ultimately acquired in late 2003.
  - a York CNE III Broadband Noise Source (frequency range: 150 kHz to 1 GHz), and,
  - a WD Test Solutions EM-18 Spectrally Broadened Comb Generator (frequency range: 1 GHz to 18 GHz).

The York CNE III is still in use, and still has essentially identical RF Outputs to what it had when it was new!
The WD Test Solutions EM-18 was destroyed by a customer in late 2021.
In late December 2022, the WD Test Solutions EM-18 was replaced by an EMC Instruments Corp. Model CG118-250C Comb Generator (frequency range: 1 GHz to 18 GHz).

- Preliminary experiments with EMC PT Testing began in 1999 using borrowed Test Artifacts..

- Formal EMC PT Testing began in 2004 used ACIL-owned Test Artifacts. An outside contractor (statistician) was paid to perform elementary statistical analyses on the PT Data received from the Participating Labs.

- Between 2004 and 2009, ACIL made numerous modifications to its User Instructions, Test Procedures, and Data Collection Procedures for the purpose of improving the usefulness of its program.

- In 2009, it was recognized that the statistical analyses being provided were technically inadequate. Acme Testing Co. (an ACIL Member Laboratory) volunteered to take over the *technical management* of the ACIL PT Program.

To preserve confidentiality, the procedures were changed such that Participants sent their PT Data to the ACIL Section Executive Officer, who then "anonymized" their data and gave each data set a unique 3-character Lab Code as an identifier *before* sending the data to Acme Testing Co.'s statistician for analysis.

HISTORY - II

- Acme Testing Co.'s statistician immediately realized that the analytical methods used up to that point were unsatisfactory and needed to be replaced. Several significant improvements were made, including:

  - A rigorous statistical analysis methodology was developed and implemented, based upon the guidance given in ISO 13528. In particular:
    - *the "Assigned Values" (i.e., the robust estimators of the "true values") are determined by "consensus of participants" using the so-called "Robust Average" Method per Algorithm A of ISO 13528, and,*
    - *the Performance Evaluation Parameters used for "Pass/Fail" determination are based upon the applicable $U_{CISPR\ (k=2)}$ values (from CISPR 16-4-2) [and $U_{ETSI\ (k=2)}$ Values from ETSI TR 100 028]*
  - Standardized Data Collection Templates were developed, introduced and mandated for use, to ensure that all participants provide data in the same format, to allow for faster and more accurate data analysis); and,
  - Updated User Instruction Manuals [UIMs] were developed and provided with the PT Test Artifacts. These UIMs covered the setup and operation of the Test Artifacts, the procedures to be used for PT Data Collection, and a summary of the Data Analysis Techniques to be used to analyze PT data).
  - Rigorous procedures for periodic (annual) re-characterizations of the Test Artifacts were developed and implemented, to confirm the stability and repeatability of their RF Outputs.

➔ The result of these changes was that ACIL's EMC PT Program achieved the status of a "well-organized inter-laboratory comparison (ILC)".

HISTORY - III

- In 2011, it was decided that ACIL would try to obtain ISO/IEC 17043 Accreditation for its EMC PT Program.

- To that end, ACIL created a wholly-owned subsidiary, called the *ACIL Corporation for EMC Proficiency Testing Inc.* ("ACE-PT Inc."), and transferred EMC PT–related assets and responsibilities to it.

- On 12 July 2012, ACE-PT Inc. became the worlds only ISO/IEC 17043-accredited provider of EMC PT Services. ACE-PT Inc. was accredited by A2LA, under Certificate # 3360.01.

  - The ACE-PT Inc. EMC PT Program was organized into two basic "PT Schemes" one from 150 kHz to 1 GHz (using the York CNE III Test Artifact), and the other from 1 GHz to 18 GHz (using the WD Test Solutions EM-18 Test Artifact).

  - Each PT Scheme operated continuously, but PT Analysis Results were originally generated only at the end of each PT Scheme "Round". A "Round" was typically declared after about 15 Participating Laboratories had submitted measurements for the Scheme. This resulted in very lengthy delays.

  - Starting in mid 2015, ACE-PT Inc. was authorized to issue Participants "Interim Statement of Performance Letters", using Assigned Values and Control Limits derived from consolidated measurement data from from the previous "Rounds". Since this change was made, Participants get their Results within 7 days after they submit their PT measurements.

Continuity – I

Since 2012, ACE-PT Inc, has operated two EMC PT Schemes

- Since 2012, ACE-PT Inc, has operated two EMC PT Schemes.
- The “Below 1 GHz” Scheme (150 kHz to 1 GHz) has spanned 13 complete “rounds” (~325 participants) and is now in its 12^{th} Continuation Round). It employs the York CNE III Serial Number 0372 Test Artifact.
- This PT Scheme collects data from the following “disciplines”:

Discipline A (ANSI C63.10-2013 Clause 6.7 Antenna Port Conducted Emissions):

- Direct Antenna Conducted Emissions made over the RF Frequency range 0.15 MHz to 30 MHz;

- Direct Antenna Conducted Emissions made over the RF Frequency range 30 MHz to 1000 MHz;

Discipline B (ANSI C63.4-2014 Clause 8 Radiated Emissions at a 3 m measurement distance):

- Radiated Emissions in Horizontal Polarization at a 3-meter distance over the RF Frequency range 30 MHz to 1000 MHz;

- Radiated Emissions in Vertical Polarization at a 3-meter distance over the RF Frequency range 30 MHz to 1000 MHz;

Discipline C (ANSI C63.4-2014 Clause 8 Radiated Emissions at a 10 m measurement distance):

- Radiated Emissions in Horizontal Polarization at a 10-meter distance over the RF Frequency range 30 MHz to 1000 MHz;

- Radiated Emissions in Vertical Polarization at a 10-meter distance over the RF Frequency range 30 MHz to 1000 MHz.

- After the completion of each round of PT, the analysis always consists of the most recent 55 participants. Specifically, in each round, 15-20 new participants are added, and the same number (of the oldest participants) are aged out.

Continuity – II

Since 2012, ACE-PT Inc, has operated two EMC PT Schemes

- The “Above 1 GHz” Scheme (1 to 18 GHz) spanned 9 complete “rounds” using the WD Test Solutions EM-18 Test Artifact Serial Number 5002003 (~225 Participants). This Scheme was ended when the Test Artifact was destroyed by a customer. This PT Scheme collected (and continues to collect) data from the following “disciplines”:

  Discipline D (ANSI C63.10-2013 Clause 6.7 Antenna Port Conducted Emissions):

  - **Antenna Port Conducted Emissions Peak measurements (from 1 GHz to 18 GHz);**
  - **Antenna Port Conducted Emissions Average measurements (from 1 GHz to 18 GHz).**

  Discipline E (ANSI C63.4-2014 Clause 8 Radiated Emissions at a 3 m measurement distance):

  - **Radiated Emissions Peak measurements from 1 GHz to 18 GHz at a 3 m distance in Horizontal Polarization;**
  - **Radiated Emissions Average measurements from 1 GHz to 18 GHz at a 3 m distance in Horizontal Polarization;**
  - **Radiated Emissions Peak measurements from 1 GHz to 18 GHz at a 3 m distance in Vertical Polarization.**
  - **Radiated Emissions Average measurements from 1 GHz to 18 GHz at a 3 m distance in Vertical Polarization.**

- After the completion of each round of PT, the analysis always consisted of the most recent 55 participants. Specifically, in each round, 15-20 new participants were added, and the same number (of the oldest participants) were aged out.

- The “Above 1 GHz” Scheme (1 GHz to 18 GHz) using the WD test Solutions EM-18 Test Artifact was replaced at the beginning of 2023 by the EMC Instrument Corp. Model CG118-250C Test Artifact. So far, the “Initial Round” has been completed with 25 participants, and the “1st Continuation Round” is ongoing,

CURRENT STATUS

- **Since 2012, ACE-PT Inc. has been re-accredited by A2LA under Certificate # 3360.01 on an ~ four-year cycle as an ISO/IEC 17043:2010 Proficiency Testing Provider.**

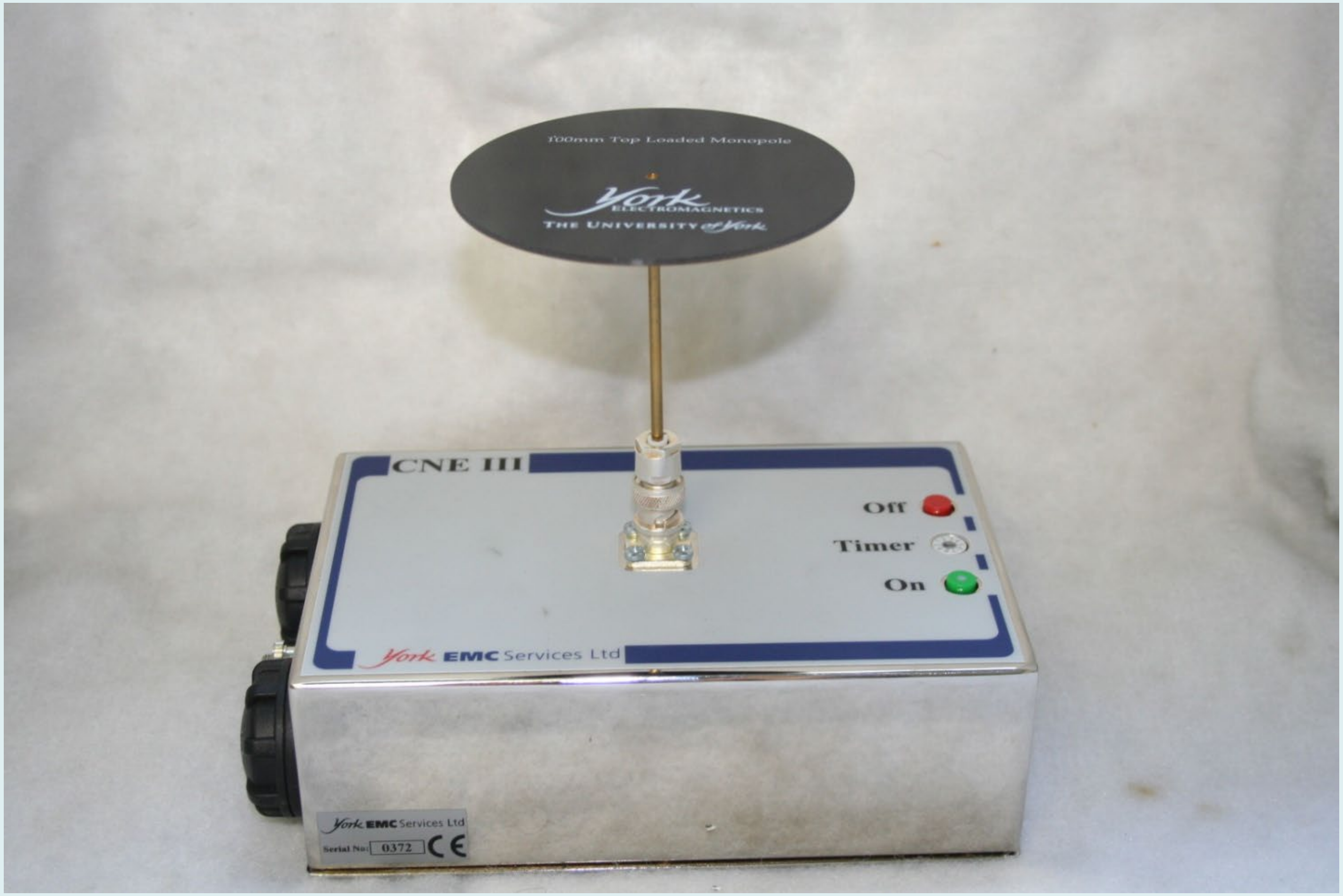
  It is still the worlds only ISO/IEC 17043-accredited PT Provider of EMC PT Services.

- **ACE-PT Inc. is scheduled to be assessed against the newly-mandated ISO/IEC 17043:2017 Standard sometime in the next two months.**
  ➔ ***This change will NOT alter the EMC PT Schemes that we currently offer.***

- **ACE-PT Inc.'s two EMC PT Schemes are available on a world-wide basis to any EMC and/or Wireless/RF Test Lab that has (or wants to have) ANSI C63.4 and/or ANSI C63.10 in their ISO/IEC 17025 Scope of Accreditation.**

- **ACE-PT inc.'s scholarly paper entitled "*On the Correct Approach to the Modeling and Analysis of Quantitative EMC Proficiency Testing (PT) Data for the Purpose of Evaluating Test Laboratory Claims of Competency*", TEMC-297-2024, was accepted for publication in the IEEE Transactions on Electromagnetic Compatibility on 14 September 2024.**
  ➔ **This paper will serve as a primary technical reference to the planned ANSI C63.11 "American National Standard for Inter-lab Comparison EMC Testing"**

ANSI C63.10-2013 / ANSI C63.4-2014 (150 kHz – 1 GHz) EMC PT Scheme
York CNE III Test Artifact configured for
Radiated Emissions V Polarization EMC PT Measurements



ANSI C63.10-2013 / ANSI C63.4-2014 (150 kHz – 1 GHz) EMC PT Scheme
York CNE III Test Artifact configured for
Radiated Emissions H Polarization EMC PT Measurements

ANSI C63.10-2013 / ANSI C63.4-2014 (1 GHz – 18 GHz) EMC PT Scheme
EMC Instruments Corp. Model CG118-250C with Stub Antenna Test Artifact
configured for Radiated Emissions V Polarization EMC PT Measurements

ACIL

ACE-PT INC.
The Diamond Standard in EMC PT®

ANSI C63.10-2013 / ANSI C63.4-2014 (1 GHz – 18 GHz) EMC PT Scheme
EMC Instruments Corp. Model CG118-250C with Stub Antenna Test Artifact
configured for Radiated Emissions H Polarization EMC PT Measurements

The Canonical Question

Q: If we distributed an EUT to a series of Test Labs, and then somehow aggregated all their measurements, could we collectively estimate what God would have measured?

A. YES!

Using many (sufficiently large number) independent measurements, and the appropriate statistical techniques, we can *estimate* the "true answer" (i.e., the value of the correct, error-free measurement). Additionally, we can estimate the *uncertainty of our estimate* of the "true answer".

➔ **The estimate of the "true answer" is called the "Assigned Value".**

➔ **The estimate of the uncertainty of the "Assigned Value" is called the "Standard Uncertainty of the Assigned Value".**

Basic Concepts about EMC PT Data

- PT measurements from participating Test Labs are ***NOT*** in any way "random samples" drawn from some assumed normally-distributed population.
- PT measurements from participating Test Labs are a "population" (albeit a small one).
- **➔ This implies the need to use population parameters and not sample statistics in the evaluation of Test Lab performance.**
- PT measurements from participating Test Labs are ***NOT*** normally-distributed. Indeed, they typically are multi-model, severely skewed in either or both directions.

The Technical Approach - I

- **All the EMC PT Schemes operated by ACE-PT Inc. employ the ISO 13528 *Consensus of Participants Method, using the* ISO 13528 "Algorithm A" Procedure for determining the *"Assigned Value for Proficiency Testing Assessment"*.**
- **ISO 13528 states that when the Assigned Value is to be determined as a "Consensus Value from the Participants", the ISO 13528 "Algorithm A" is an appropriate method for determining the Assigned Value.**
- **ISO 13528 "Algorithm A" specifies the method to be used to compute the:**
  - **"Robust Average" , X* (i.e., the Assigned Value),**
  - **"Standard Deviation of the Robust Average", S***
  - **Standard Uncertainty of the Assigned Value, u_x**

Important Note:

In EMC PT Programs, the Standard Uncertainty of the Assigned Value is almost always significant, and thus cannot be ignored.

The Technical Approach - II

- **All the EMC PT Schemes operated by ACE-PT Inc. employ Bayesian Analysis (which incorporates the Maximum Permissible Error, U_p) and the Hypothesis Testing approach for the performance evaluation of participants:**

  - ***Null Hypothesis:*** ***(denoted by H_o): To hold as true, that a Test Lab's Measurement Process Error ≤ U_p***

    NOTE: In commercial EMC testing, the ***Maximum Permissible Error*** values are effectively mandated by the CISPR 16-4-2 and ETSI TR 100 028 Standards. When the Expanded Uncertainty (using, typically, a k=2 Coverage Factor) is applied, the ***Maximum Permissible Error,*** denoted as U_p is obtained.

    Thus, if H_0 is true, then the claim of competency is proved.

  - ***Alternative Hypothesis:*** **(denoted by H_a):** ***To hold as true, that a Test Lab's Measurement Process Error > U_p***

    Thus, if H_a is true, then the claim of competency is disproved.

NOTE: Bayesian Analysis is diagnostic, descriptive of the current measurement procedure in place within a Test Laboratory.

It is NOT predictive. In other words, ACE-PT Inc. does NOT use the Bayesian Inference model (which is for predicting or forecasting future events).

Procedure for computing the Control Limits in "natural" dB Units

In all of ACE-PT Inc.'s EMC Standards-based EMC PT Schemes, when using "natural" dB units (i.e., either dBμV or dBμV/m as applicable), each Upper Control Limit [UCL] and each Lower Control Limit [LCL] is computed as follows:

$$UCL = X^* + (U_p + u_x)$$

$$LCL = X^* - (U_p + u_x)$$

where (in a given PT Data Set),

X^* *is the Robust Average derived using Algorithm A from ISO 13528 for the* i^{th} *RF Frequency; and,*

U_p *is the Maximum Permissible Error for a specific EMC PT Test Process; and,*

u_x *is the Standard Uncertainty of the Assigned Value (i.e., of the Robust Average) for a specific EMC PT Test Process being examined.*

Procedure for determining Laboratory Performance (in dB Units)

In all of ACE-PT Inc.'s EMC PT Schemes, the evaluation of participants is done by comparing each participant's measurement with the computed UCL and LCL values, as follows:

$$LCL \leq X_i \leq UCL \rightarrow PASS$$

$$X_i > UCL \rightarrow \text{FAIL on the "hot side"}$$

$$X_i < LCL \rightarrow \text{FAIL on the "cold side"}$$

where, X_i is the measurement made at i^{th} RF Frequency for a given PT Data Set

Any measurements which are between the UCL and the LCL are defined as being "acceptable" measurements and are therefore deemed to have "Passed".

Any measurements which are either above the UCL or are below the LCL are defined as being "*Unacceptable*". *"Unacceptable" Measurements are also defined to be "outliers" and are therefore deemed to have "Failed".*

Procedure for evaluation of Laboratory Bias (using D-Statistics)

In all of ACE-PT Inc.'s EMC PT Schemes, the Bias (denoted as "D") of the measurement made at the i^{th} RF Frequency for a given EMC PT Data Set from a given "round" of a given EMC PT Program is evaluated as follows:

$$D = X_i - X^*$$

where,

D *is the Bias;*

X_i *is the measurement made at i^{th} RF Frequency, and*

X^* *is the Robust Average derived using Algorithm A from ISO 13528*

Bias is most easily visualized by plotting the computed Bias values (for a given EMC PT Data Set) as a function of RF Frequency, with Bias = 0.00 being in the middle of the Y-Axis of each plot. (In other words, the plots are formatted like those used in plotting the Deviations from Zero Normalized Site Attenuation).

Procedure for evaluation of Laboratory Ranking (using Z-Scores)

In all of ACE-PT Inc.'s EMC Standards-based EMC PT Schemes, the performance of each EMC Laboratory can be ranked against all other participating EMC laboratories by standardizing each participating EMC Laboratory's Bias (i.e., $D = X_i – X^*$), as follows:

Z-Score = $(X_i – X^*) / S^*$

where:

- X_i *is the measurement made at* i^{th} *RF Frequency;*
- X^* *is the Robust Average derived using Algorithm A from ISO 13528 for the* i^{th} *RF Frequency;*
- S^* *is the std deviation of the assigned value (the Robust Average) for the* i^{th} *RF Frequency.*

Note: **the Z-Score (Z-Score = Bias/S*) is the standardization procedure for a given dataset (*for scoring participants against each other*); *there is no underlying normality assumption*.**

In contrast, the Z-Value [i.e., Z-Value = $(X_i – X^*)/\sigma_x$] is the standardization procedure for a perfectly normally distributed population. ***Care should be taken to avoid confusing the term "Z-Score" with the term "Z-Value".***

Consistency of Performance Evaluation Results

It is important to note that all three methods just described (i.e., computation of results in "natural units", computation of results using D-statistics, and computation of results using Z-Scores) for evaluating participant performance MUST yield the same (qualitative) "Pass / Fail" results.

If the "Pass / Fail" Results are NOT identical, then a computational error has been made.

11th "Continuation Round" (Most Recent) PT Scheme Collateral Data (150 kHz – 1 GHz) 2022-2023

Note: Labs with Failing Results are shown in Salmon color.

Lab Code ID	Reporting of Dir Antenna Conducted Emissions		Radiated Emissions: Reportig of Radiated Emissions				Radiated Emissions				Radiated Emissions Detection System	
	.15-30 MHz	30-1000 MHz	3m H-Pol	3m V-Pol	10m H-Pol	10m V-Pol	EUT Support Table Type	Size & Type of Test Site	Antenna Type(s) used	Diff AFs used at H and V?	Make(s) & Model(s)	Type(s)
11A1-2	NO	NO	YES	YES	NO	NO	Plywood	3m (SAC)	Sunol JB6 (Hybrid)	NO	R&S ESR7	Time Domain EMI Test Receiver
11B1	YES	YES	NO	NO	YES	YES	Polypropylene	10m (SAC)	SunAR JB1 (Hybrid)	NO	R&S ESU w. Sonoma Instruments 310N Preamp	EMI Test Receiver w. Ext. Preamp
11C1	YES	YES	YES	YES	NO	NO	Styrofoam Block	3m OATS	EMCO 3104 (Bicon) Electro-Metrics LPA-25 (LPDA)	NO	R&S ESIB26	EMI Test Receiver
11D1-R	YES	YES	NO	NO	YES	YES	Styrofoam Block	10m (SAC)	Schwarzbeck VULB 9163 (Hybrid)	NO	Keysight N9038B MXE w. Schwarzbeck BBV9745 Preamp	EMI Test Receiver w. Ext. Preamp
11E1	NO	NO	YES	YES	YES	YES	Styrofoam Block	10m (SAC)	Schwarzbeck VULB 9163 (Hybrid)	NO; but 3 m & 10 m Factors were different	R&S ESW w. Com-Power PAM-103 Preamp	Time Domain EMI Test Receiver w. Ext. Preamp
11F1	YES	YES	YES	YES	NO	NO	Styrofoam Block	3m (SAC)	Chase CBL6111C (Hybrid)	NO	Keysight N9038A MXE w. Erevant SBB-01150340148-2F2F-E3 Preamp	EMI Test Receiver w. Ext. Preamp
11G1-2	NO	NO	YES	YES	NO	NO	Pine (Wood) Plank Tabletop	3m (SAC)	Schaffner CBL6143A (Hybrid)	NO	Agilent N9038A	EMI Test Receiver
11H1	NO	NO	YES	YES	NO	NO	Styrofoam Block	3m (SAC)	SunAR JB3 (Hybrid)	NO	R & S ESW44	Time Domain EMI Test Receiver
11I1	NO	NO	YES	YES	YES	YES	Styrofoam Block	2 Different 10m (SACs) [one used @ 10m & the other @ 3m]	2 different S/N Antennas: Schwarzbeck VULB 9163 (Hybrid)	NO	2 different sets of detection systems: R&S ESW w. AR LN1000B Preamp	Time Domain EMI Test Receivers w. Ext Preamps
11K1	YES	YES	YES	YES	NO	NO	Styrofoam Block	3m (SAC)	Sunol JB1 (Hybid)	NO	R&S ESU44 w. Sonoma Instr. 310N Preamp	Time Domain EMI Test Receiver w. Ext. Preamp
11K2	NO	NO	YES	YES	YES	YES	Styrofoam Block	10m (SAC)	Sunol JB1 (Hybid)	NO	\R&S ESU44 w. Sonoma Instruments 310N Preamp	Time Domain EMI Test Receiver w. Ext. Preamp
11L1-2	YES	YES	YES	YES	NO	NO	Unknown	3m (SAC)	ETS-Lindgren 3142D (Hybrid)	NO	Agilent E4446A w. MITEQ AM-1431-N-1197SC Preamp	Spectrum Analyzer w. Ext. Preamp
11M1	YES	YES	YES	YES	NO	NO	HDPE [High Density Polyethylene]	3m (SAC)	AH Systems SAS-540 (Bicon) / AH Systems SAS-512-2 (LPDA)	NO	Agilent N9038A	EMI Test Receiver
11N1	YES	YES	YES	YES	NO	NO	PVC Frame w. Plexiglass Top	3m (SAC)	Sunol JB1 (Hybid)	NO	Keysight N9020B MXA w. HP 8447D Preamp	Signal Analyzer w. Ext. Preamplifier
11O1	YES	YES	YES	YES	NO	NO	Plexiglass	3m (SAC)	AH Systems SAS-540 (Bicon) / EMCO 3148 (LPDA)	YES	R&S ESW8 w. HP 8447D Preamp	Time Domain EMI Test Receiver w. Ext. Preamp
11P1	YES	YES	YES	YES	NO	NO	Styrofoam Sheets	3m (SAC)	Sunol JB1 (Hybid)	NO	Agilent N9038A	EMI Test Receiver

10th "Continuation Round" PT Scheme Collateral Data – (150 kHz – 1 GHz) 2021-2022

Note: Labs with Failing Results are shown in Salmon color.

Lab Code ID	Reporting of Dir Antenna Conducted Emissions		Radiated Emissions								Radiated Emissions Detection System	
			Reportig of Radiated Emissions				EUT Support Table Type	Size & Type of Test Site	Antenna Type(s) used	Diff AFs used at H and V?		
	.15-30 MHz	30-1000 MHz	3m H-Pol	3m V-Pol	10m H-Pol	10m V-Pol					Make(s) & Model(s)	Type(s)
10A1	NO	NO	NO	NO	YES	YES	Wood	10m (SAC)	EMCO 3110B & EMCO 3148	NO	R&S ESW8 with AH Systems PAM-0101	Time Domain EMI Test Receiver w. Ext. Preamplifier
10B1	NO	NO	YES	YES	NO	NO	Acrylic	3m (SAC)	EMCO 3110B & EMCO 3148	NO	R&S ESW8 w. HP 8447D	Time Domain EMI Test Receiver w. Ext. Preamplifier
10C1	YES	YES	YES	YES	YES	YES	Styrofoam Block	10m (SAC)	SunAR JB6 [Diff. AFs @ 3m & 10m]	NO	R&S ESU26 [CE] / R&S ESU40 with Ext. R&S TS-PR-2 Preamp [RE]	EMI Receiver / EMI Receiver w. Ext. Preamplifier
10D1	YES	YES	YES	YES	YES	YES	Styrofoam Block	10m (SAC)	SunAR JB6 [Diff. AFs @ 3m & 10m]	NO	R&S ESU26 [CE] / R&S ESU40 with Ext. R&S TS-PR-2 Preamp [RE]	EMI Receiver / EMI Receiver w. Ext. Preamplifier
10E1	YES	YES	YES	YES	YES	YES	Styrofoam on top of Wood Base	3m / 10 m OATS	ETS-Lindgren 3142E	NO	HP 8546A / HP 85460A	EMI Receiver w. Ext. Preamplifier
10F1	NO	NO	YES	YES	NO	NO	Plywood	3m (SAC)	Sunol JB6	NO	R & S ESCI7	EMI Test Receiver
10F2	NO	NO	YES	YES	NO	NO	Plywood	3m (SAC)	Sunol JB6	NO	R & S ESCI7	EMI Test Receiver
10G1	YES*	YES*	YES	YES	NO	NO	Styrofoam	3m (SAC)	SunAR JB1	NO	Agilent N9038A	EMI Test Receiver
10H1	YES	YES	NO	NO	YES	YES	Styrofoam Block	10m (SAC)	TESEQ CBL6112D	NO	Agilent N9038A with Schwarzbeck BBV9745 Ext. Preamp	EMI Test Receiver w. Ext. Preamp
10I1	YES	YES	YES	YES	NO	NO	Polypropylene	3m (SAC)	Sunol JB6	NO	R & S ESW44 with R & S TS-PR-1 Ext. Preamp	EMI Test Receiver w. Ext. Preamp
10J1	YES	YES	YES	YES	YES	YES	Styrofoam Block	10m (SAC)	Sunol JB3	NO	R&S ESIB40 with HP 8447F Ext. Preamp	EMI Test Receiver w. Ext. Preamp
10K1	YES	YES	YES	YES	NO	NO	HDPE [High Density Polyethylene]	3m (SAC)	Sunol JB6	NO	R&S ESW44 with HP 8447D OPT H64 Ext. Preamp	Time Domain EMI Test Receiver w. Ext. Preamplifier
10L1	YES	YES	YES	YES	NO	NO	ETS-Lindgren Low Dielectric Foam, Model LTD-1.2	3m (SAC)	Schwarzbeck VULB 9168	NO	R&S ESW26	Time Domain EMI Test Receiver
10M1	YES	YES	YES	YES	NO	NO	Polyethylene	3m (SAC)	EMCO 3142	NO	Agilent E4446A w. Com-Power PAM-103 Ext. Preamp	Spectrum Analyzer w. Ext. Preamplifier
10N1	YES	YES	YES	YES	NO	NO	EPS [Expanded Polystyrene]	3m (SAC)	EMCO 3110B & EMCO 3148	NO	R&S ESR26	EMI Test Receiver
10O1	YES	YES	YES	YES	YES	YES	Styrofoam	10m (SAC)	Sunol JB1 (@ 3m) / Sunol JB3 (@ 10m)	YES / YES	Agilent E4440A with Sonoma 310 Ext. Preamp	Spectrum Analyzer w. Ext. Preamplifier
10P1	YES	YES	YES	YES	YES	YES	Styrofoam Block	10m (SAC)	Sunol JB1-UN	NO	Agilent N9030A-PXA [CE]/ Rohde & Schwarz ESCI [RE]	Signal Analyzer / EMI Test Receiver

* Corrected Entry

"Initial Round" PT Scheme Collateral Data – (1 GHz – 18 GHz) 2023-2024

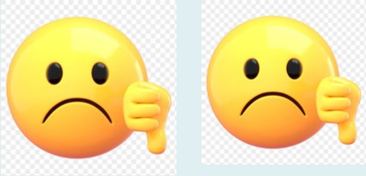
Lab Code ID	Reporting of Dir Antenna Conducted Emissions		Radiated Emissions @ 3m Distance								Radiated Emissions Detection System	
			Reportig of Radiated Emissions				EUT Support Table Type	Size & Type of Test Site	Antenna Type(s) used	Diff AFs used at H & V?		
	Peak	Avg	H Pol Pk	H Pol Avg	V Pol Pk	V Pol Avg					Make(s) & Model(s)	Type(s)
A1	YES	YES	YES	YES	YES	YES	Styrofoam with PVC cover	10m (SAC)	ETS-Lingren 3117 [DRG Horn]	NO	R&S ESW with Advanced Microwave WLA614.4 Preamplifier	Time Domain EMI Test Receiver w. Preamplifier
A2	NO	NO	YES	YES	YES	YES	Styrofoam with PVC cover	10m (SAC)	ETS-Lingren 3117 [DRG Horn]	NO	R&S ESW with Advanced Microwave WLA614.4 Preamplifier	Time Domain EMI Test Receiver w. Preamplifier
A3	NO	NO	YES	YES	YES	YES	Styrofoam with PVC cover	10m (SAC)	ETS-Lingren 3117 [DRG Horn]	NO	R&S ESW with Miteq TT1800-30-HG-S	EMI Receiver w. Preamplifier
B	YES	YES	YES	YES	YES	YES	Styrofoam Block	10m (SAC)	ETS-Lingren 3117-PA [Pre-amplified DRG Horn]	NO	R&S FSQ26 [Antenna Conducted] / Agilent E4446A [Radiated]	Signal Analyzer [Conducted] / Spectrum Analyzer
C	YES	YES	YES	YES	YES	YES	EPS (Styrofoam) Block	3m (SAC)	Com-Power AHA-118 [Pre-amplified DRG Horn]	NO	R & S ESR 26	EMI Test Receiver
D	YES	YES	YES	YES	YES	YES	Wood	3m (SAC)	Com-Power AHA-118 [Pre-amplified DRG Horn]	NO	Agilent N9030A	Signal Analyzer
E	YES	YES	YES	YES	YES	YES	PVC Table	5m (SAC)	EMCO 3115 [DRG Horn]	NO	Agilent E4440A w. AH Systems PAM-0118 Pre-amplifier	Spectrum Analyzer w. Preamplifier
F	YES	YES	YES	YES	YES	YES	Styrofoam Block	3m (SAC)	ETS-Lindgren 3117 [DRG Horn]	NO	R&S ESW with HP 8449B Pre-Amplifier	Time Domain EMI Test Receiver w. Preamplifier
G1	NO	NO	YES	YES	YES	YES	EPS (Styrofoam) Block	3m (SAC)	EMCO 3115 [DRG Horn]	NO	Agilent N9038A	EMI Test Receiver
G2	NO	NO	YES	YES	YES	YES	EPS (Styrofoam) Block	3m (SAC)	EMCO 3115 [DRG Horn]	NO	Agilent N9038A	EMI Test Receiver
H	YES	YES	YES	YES	YES	YES	EPS (Styrofoam) Block	10m (SAC)	ETS-Lindgren 3117 [DRG Horn]	NO	Agilent N9038B with Mini-Circuits ZVA-183-S+ Pre-amplifier	EMI Test Receiver w. Preamplifier
I	YES	YES	YES	YES	YES	YES	Styrofoam Block	3m (SAC)	EMCO 3115 [DRG Horn]	NO	Agilent N9020A w. Miteq AMF-7D-01001800-22-10P Pre-amplifier	Signal Analyzer w. Preamplifier
J	YES	YES	YES	YES	YES	YES	Styrofoam & Other Plastics Table	10m (OATS)	EMCO 3115 [DRG Horn]	NO	R&S ESW26 [Conducted] / R&S ESIB 26 with HP 8449B Pre-amplifier [Radiated]	EMI Test Receiver / EMI Test Receiver w. Preamplifier
K1	NO	NO	YES	YES	YES	YES	Styrofoam Block	3m (SAC)	ETS-Lindgren 3160-10 [Standard Gain Horn]	NO	R&S ESU26	EMI Test Receiver
K2	NO	NO	YES	YES	YES	YES	Styrofoam Block	3m (SAC)	ETS-Lindgren 3160-10 [Standard Gain Horn]	NO	R&S ESU26	EMI Test Receiver
L	YES	YES	YES	YES	YES	YES	Styrofoam Block	3m (SAC)	ETS / EMCO 3115 & 3117 [DRG Horns]	NO	R&S ESW44	Time Domain EMI Test Receiver
M	NO	NO	YES	YES	YES	YES	Styrofoam	10m (SAC)	ETS-Lindgren 3117 [DRG Horn]	NO	R&S ESIB40 w. Miteq NSP1800-S Pre-amplifier	EMI Test Receiver w. Preamplifier
N	YES	YES	YES	YES	YES	YES	Styrofoam Block	3m (SAC)	ETS-Lindgren 3117 [DRG Horn]	NO	R&S ESW44 w. HP 8449B Preamplifier	Time Domain EMI Test Receiver w. Preamplifier
O	YES	YES	YES	YES	YES	YES	Solid Styrofoam - ETS-Lindgren Table (LDT-15)'	5m (SAC)	AH Systems SAS-571 [DRG Horn] w. Miteq AMF-6D-00501800 Pre-amplifier	NO	R&S ESW26	Time Domain EMI Test Receiver
P	YES	YES	YES	YES	YES	YES	Styrofoam Table	3m (SAC)	EMCO 3115 [DRG Horn]	NO	Agilent N9030A w. Miteq JS43-01001800-21-5P Pre-amplifier	Signal Analyzer w. Preamplifier
Q1	NO	NO	YES	YES	YES	YES	Styrofoam Block	3m (SAC)	ETS-Lindgren 3160-10 [Standard Gain Horn]	NO	R&S ESU26	EMI Test Receiver
Q2	NO	NO	YES	YES	YES	YES	Styrofoam Block	3m (SAC)	ETS-Lindgren 3160-10 [Standard Gain Horn]	NO	R&S ESU26	EMI Test Receiver
R	NO	NO	YES	YES	YES	YES	Fiberglass Table	3m (SAC)	EMCO 3115 [DRG Horn]	NO	R&S ESW44 w. Com-Power PAM-118 Pre-amplifier	Time Domain EMI Test Receiver w. Preamplifier
S1	YES	YES	YES	YES	YES	YES	Styrofoam Block	5m (SAC)	EMCO 3115 [DRG Horn]	Not Specified	HP 84125C [HP 8564E with HP 8449B Pre-amplifier	Portable Spectrum Analyzer w. Preamplifier
S2	NO	NO	YES	YES	YES	YES	Not Specified	5m (SAC)	Com-Power AHA-118 [Pre-amplified DRG Horn]	Not Specified	Agilent N9030A	Signal Analyzer

“Below 1 GHz” PT Scheme (150 kHz – 1 GHz) Results

Subjective Rankings for the measurement process as an industry


= OK (as an industry the process is in-control)


= Poor (as an industry, the process not very well controlled)


= Very Poor (as an industry, the process is poorly controlled)

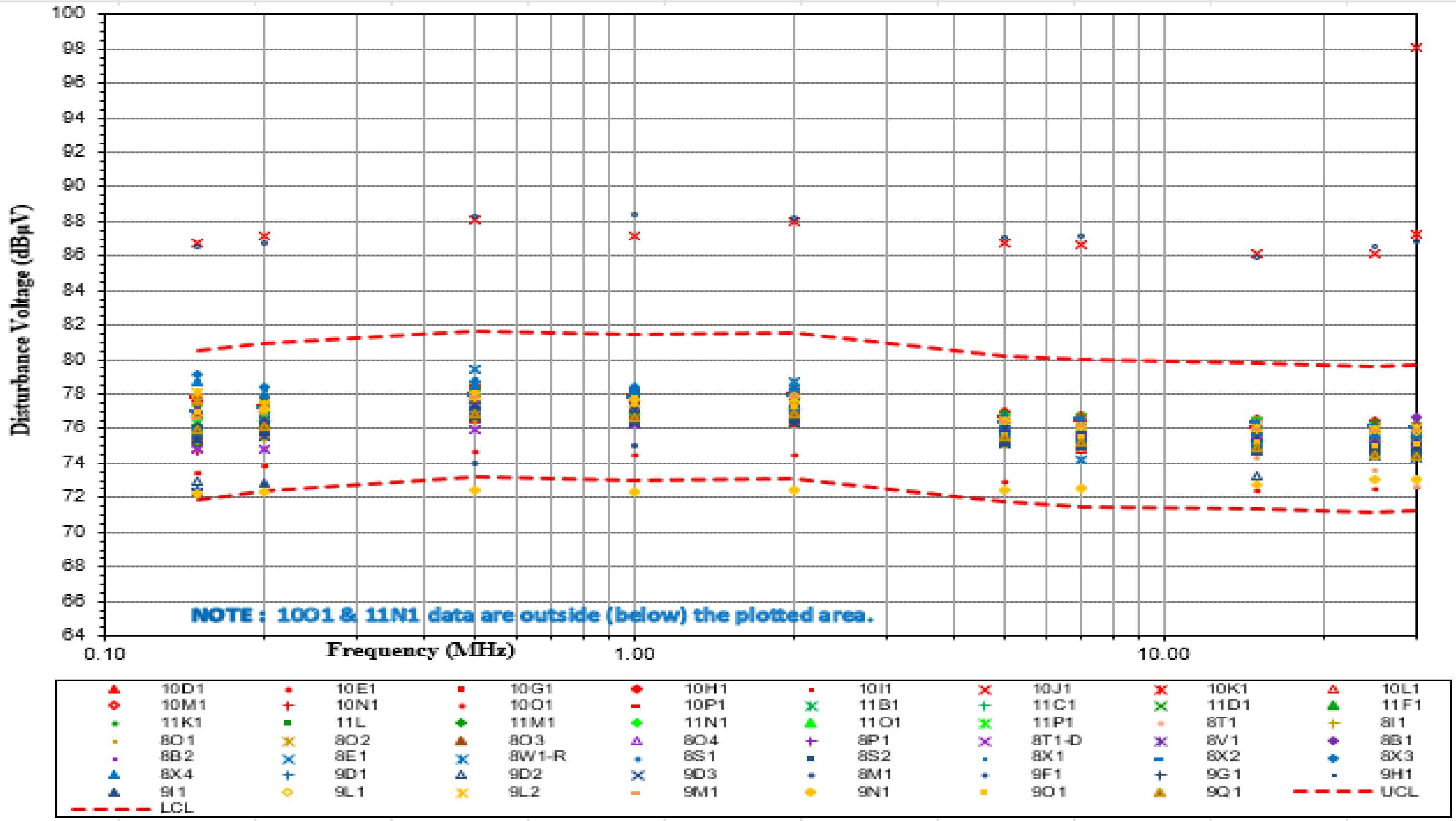

= Miserable (as an industry, the process is out of control)

Consolidated PT Results – 8th thru 11th Continuation Rounds (dB units)
(150 kHz to 30 MHz, QP) Direct Antenna Conducted Emissions

Consolidated (8th through 11th Cont. Rnds) Measurement Data Scatter Plot & Control Limits (2018-2023)

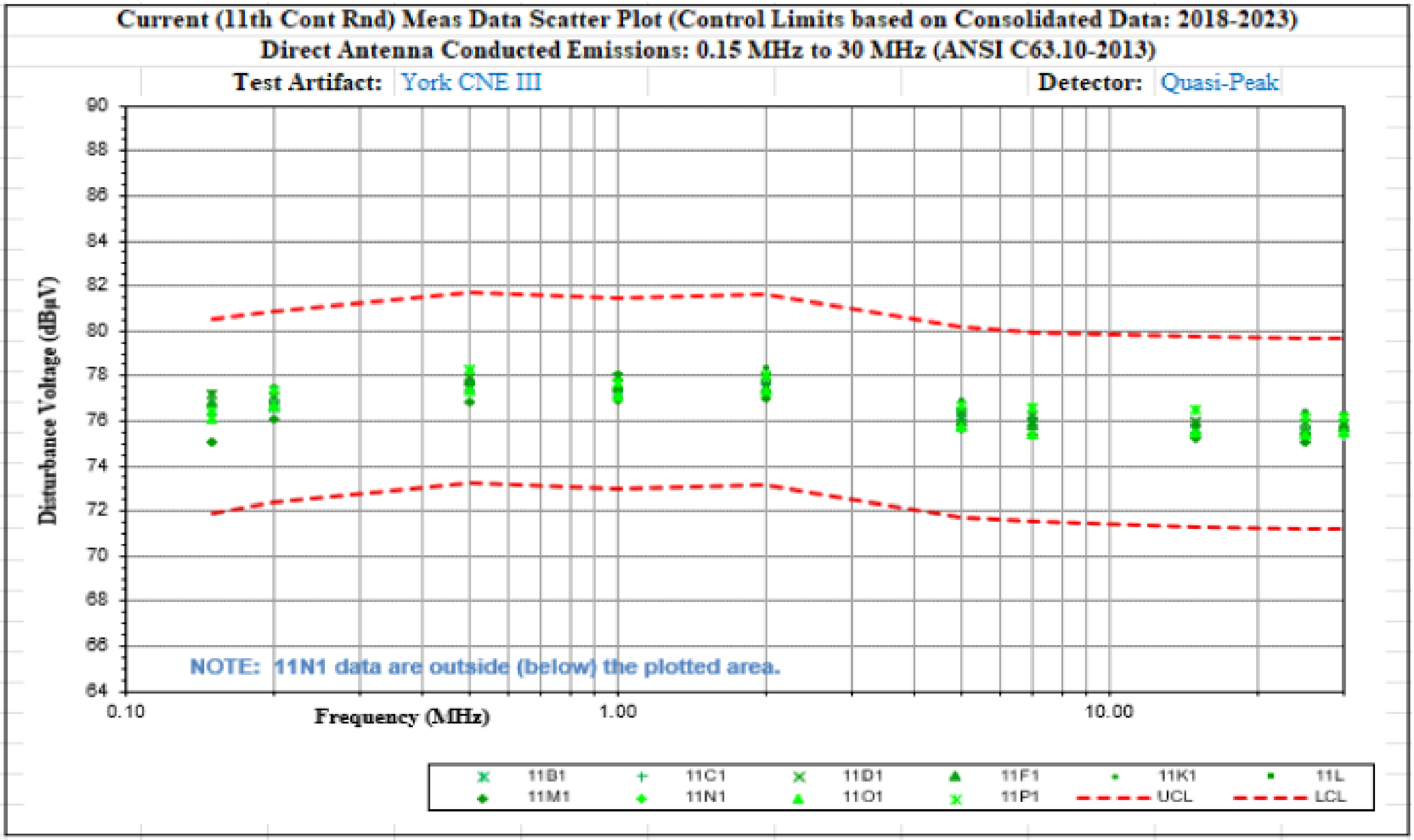
Direct Antenna Conducted Emissions: 0.15 MHz to 30 MHz (ANSI C63.10-2013)

Test Artifact: York CNE III **Detector:** Quasi-Peak



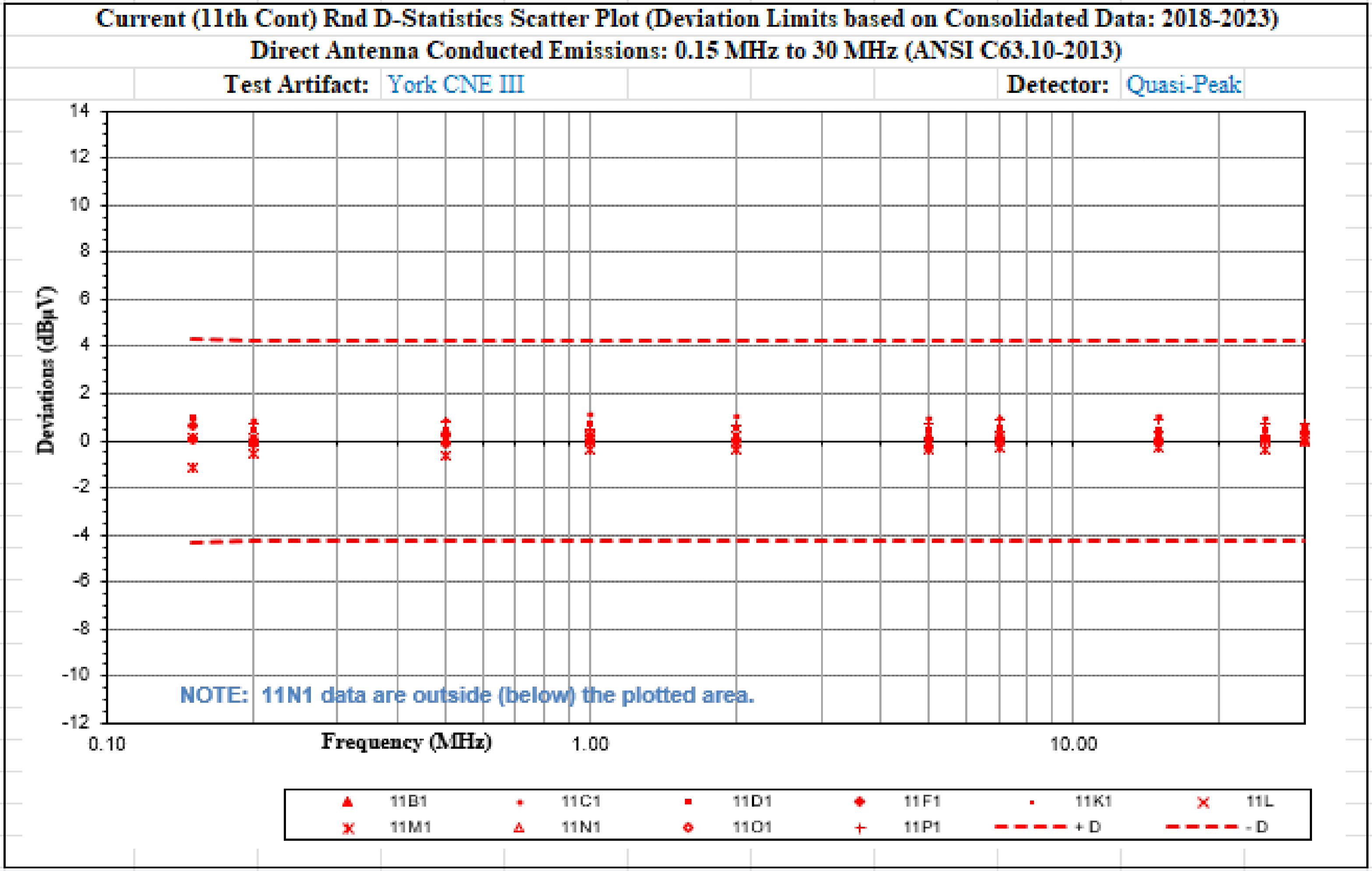
Participants: 55 **Overall failure rate (%):** 10.91 **Acrossboard failure rate (%):** 7.27

PT Results – 11th Continuation Round (dB units)
(150 kHz to 30 MHz, QP) Direct Antenna Conducted Emissions



Participants: 10 Overall failure rate (%): 10.00 Acrossboard failure rate (%): 10.00

PT Results – 11th Continuation Round (D-Statistics)
(150 kHz to 30 MHz, QP) Direct Antenna Conducted Emissions



PT Results – 11th Continuation Rounds
(Performance Eval Statistics) (150 kHz to 30 MHz, QP)
Direct Antenna Conducted Emissions

Current (11th Cont.) Rnd Performance Evaluation Statistics derived from Consolidated data: 2018-2023

Direct Antenna Conducted Emissions: 0.15 MHz to 30 MHz (ANSI C63.10-2013)

Test Artifact: York CNE III **Detector:** Quasi-Peak

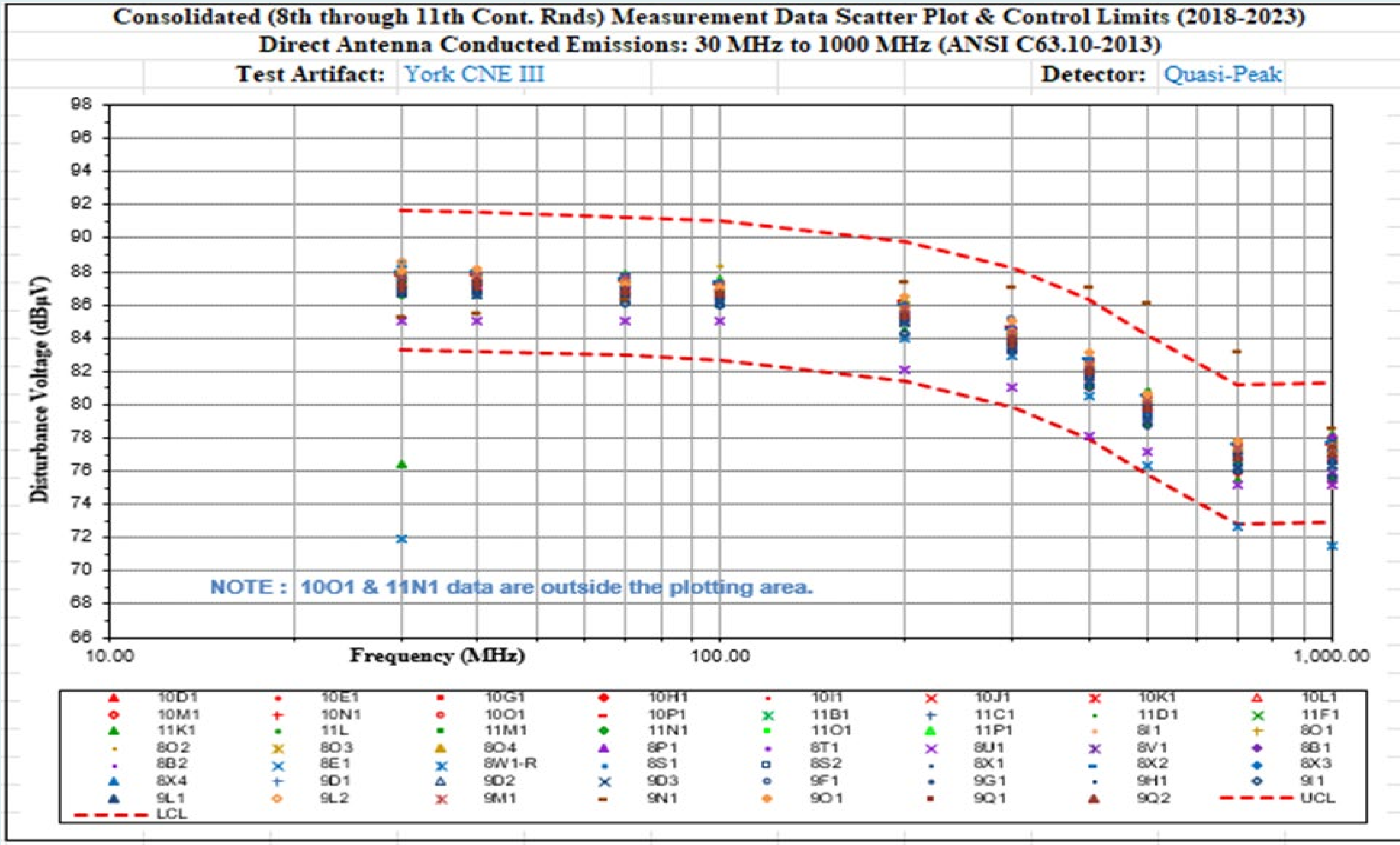
Summary Statistics	Frequencies (MHz)									
	0.15	0.20	0.50	1.00	2.00	5.00	7.00	15.00	25.00	30.00
X*	76.22	76.63	77.47	77.25	77.36	75.97	75.74	75.55	75.41	75.46
S*	1.382	0.938	0.797	0.783	0.838	0.699	0.756	0.728	0.762	0.779
0.3S*	0.414	0.281	0.239	0.235	0.251	0.210	0.227	0.218	0.229	0.234
p	55	55	55	55	55	55	55	55	55	55
U_p	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10
u_x	0.233	0.158	0.134	0.132	0.141	0.118	0.127	0.123	0.128	0.131
UCL	80.55	80.89	81.70	81.48	81.60	80.19	79.97	79.77	79.64	79.69
LCL	71.89	72.37	73.23	73.02	73.11	71.76	71.51	71.33	71.19	71.23

X* = Robust Average
S* = Robust Std Deviation
p = No. of Valid Participants

UCL = Upper Control Limit
LCL = Lower Control Limit

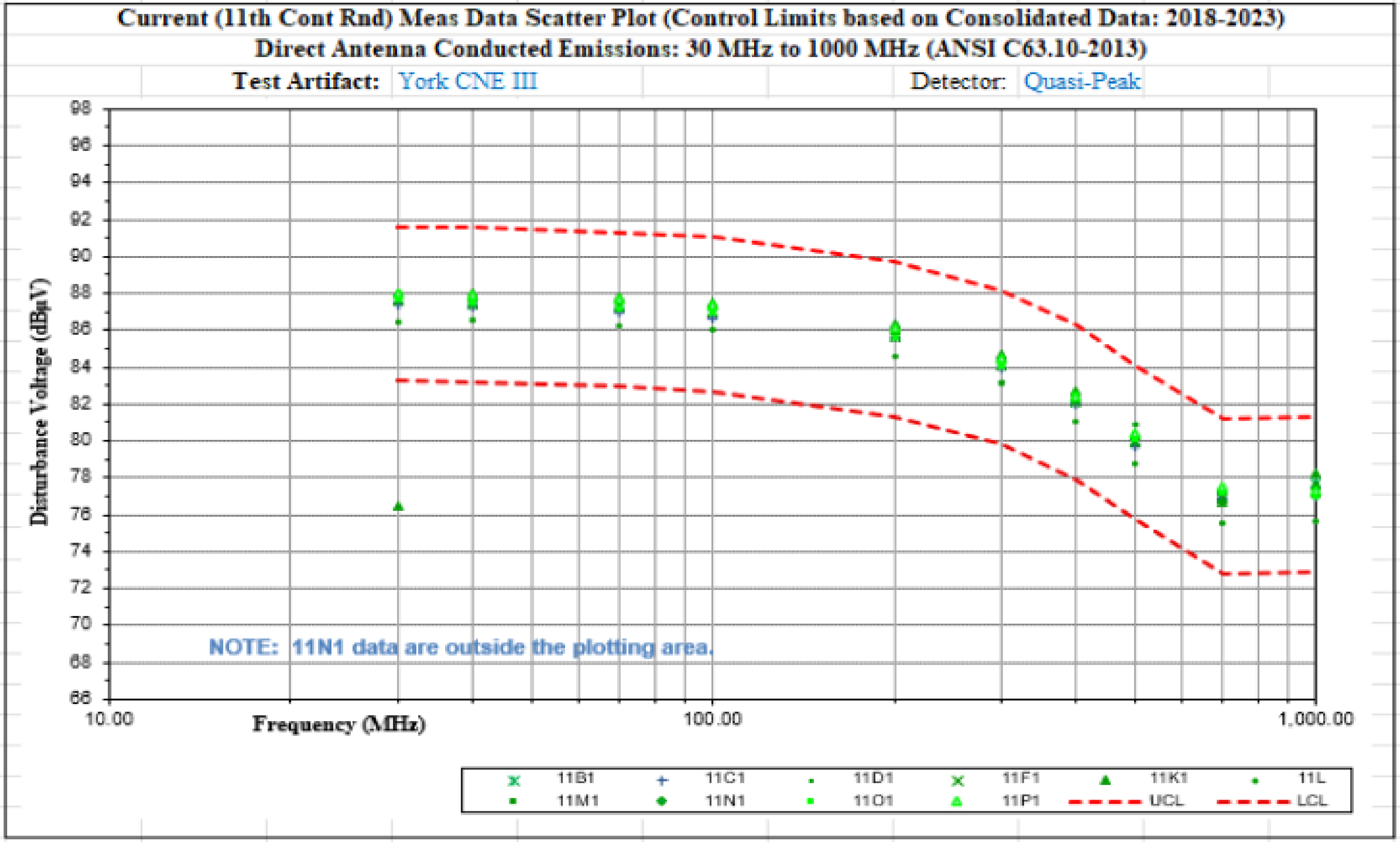
U_p: $U_{ETSI\ TR\ 100\ 028\text{-}1\ V1.4.1(k=2)}$ = 4.10
Std Uncertainty of X*: u_x = 1.25 (S*/√p)
Upper & Lower Control Limits = X*± (U_p + u_x)

Consolidated PT Results – 8th thru 11th Continuation Rounds (dB Units) (30 MHz to 1000 MHz, QP) Direct Antenna Conducted Emissions



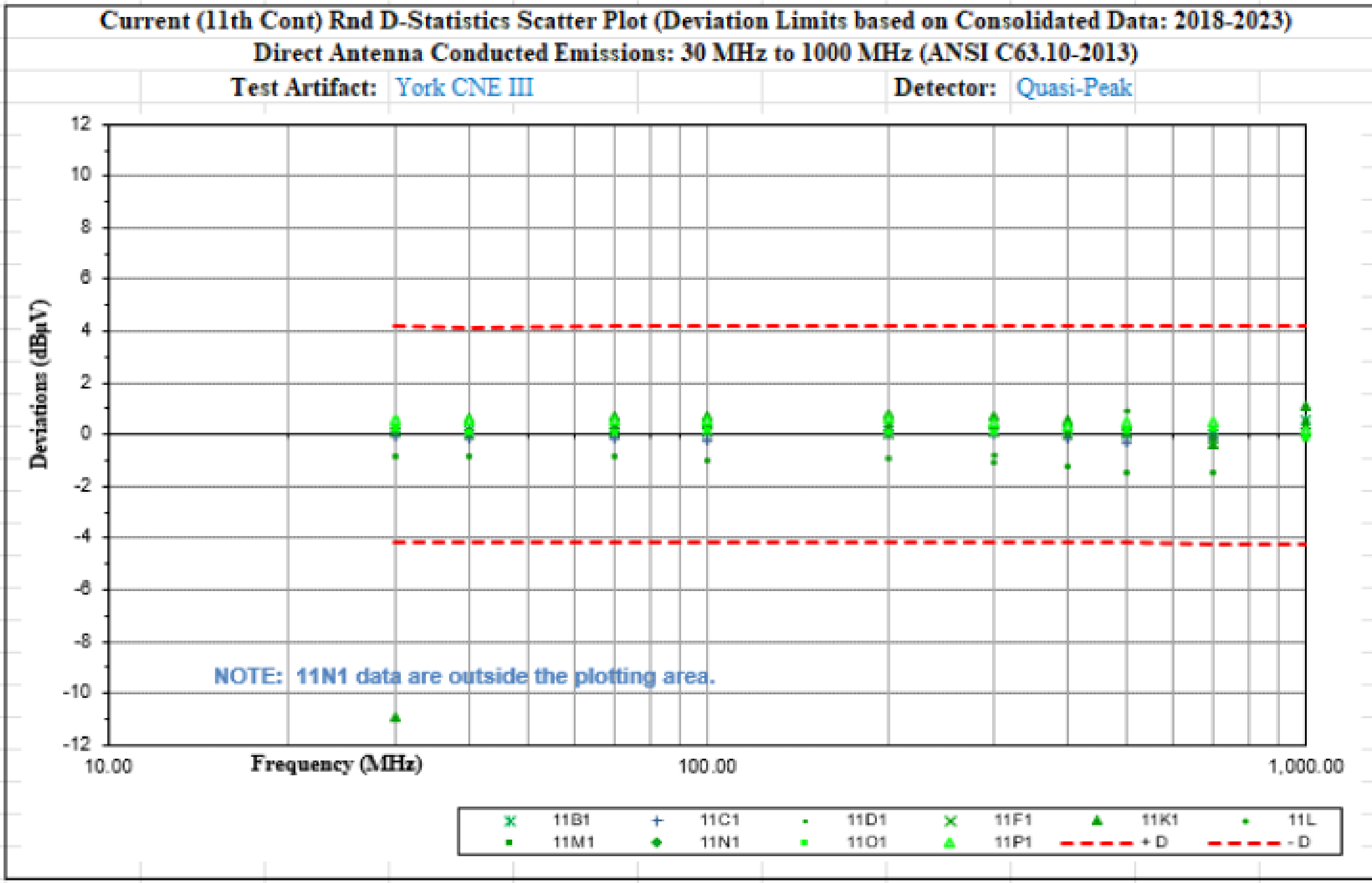
Participants: 55 **Overall failure rate (%):** 9.09 **Acrossboard failure rate (%):** 3.64

PT Results – 11th Continuation Round (dB Units)
(30 MHz to 1000 MHz, QP) Direct Antenna Conducted Emissions



Participants: 10 | Overall failure rate (%): 20.00 | Acrossboard failure rate (%): 10.00

PT Results – 11th Continuation Round (D-Statistics)
(30 MHz to 1000 MHz, QP) Direct Antenna Conducted Emissions



PT Results – 11th Continuation Round
(Performance Eval Statistics) (30 MHz to 1000 MHz, QP)
Direct Antenna Conducted Emissions

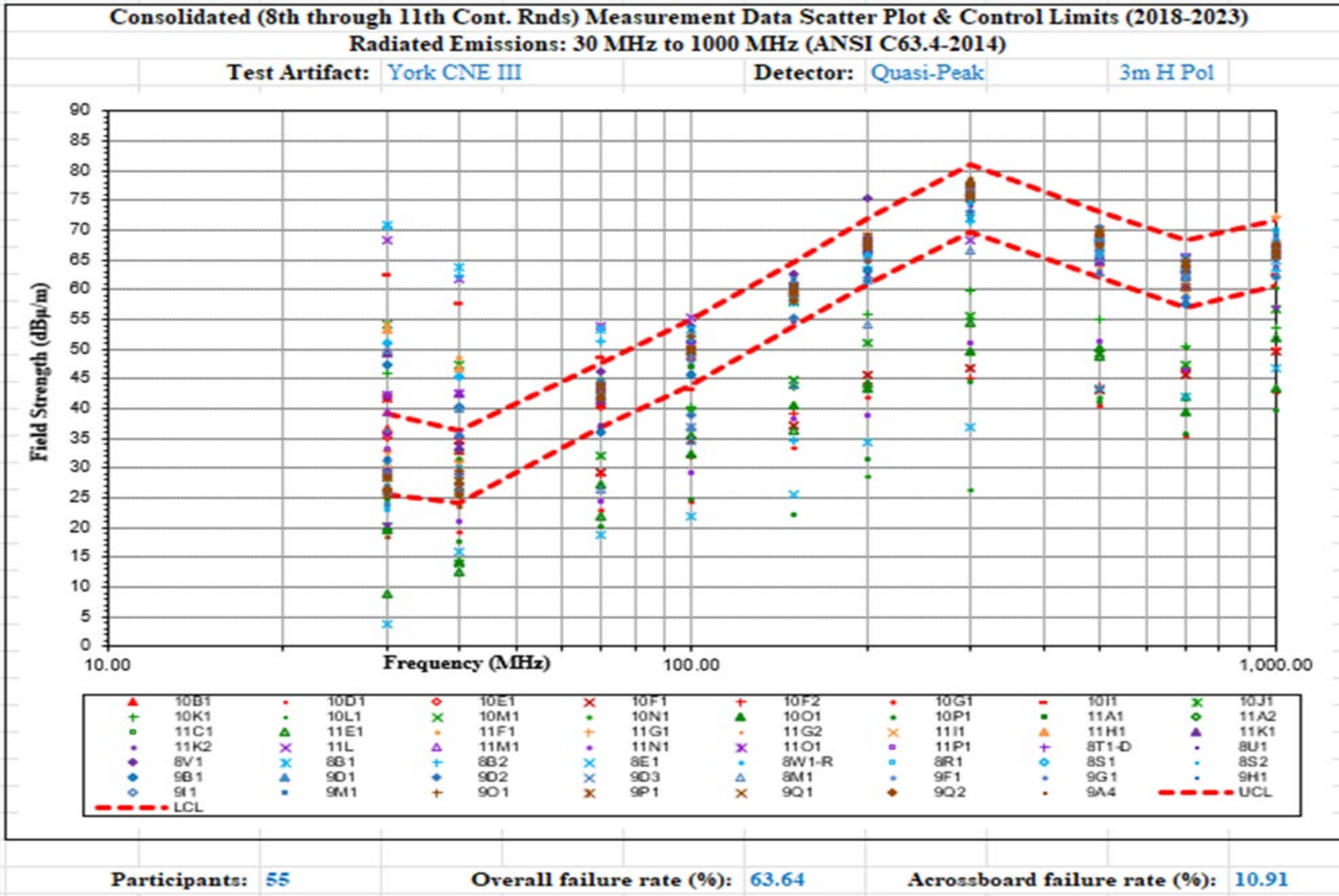
Current (11th Cont.) Rnd Performance Evaluation Statistics derived from Consolidated data: 2018-2023										
Direct Antenna Conducted Emissions: 30 MHz to 1000 MHz (ANSI C63.10-2013)										
	Test Artifact:	York CNE III				Detector:	Quasi-Peak			
Summary Statistics	Frequencies (MHz)									
	30.0	40.0	70.0	100.0	200.0	300.0	400.0	500.0	700.0	1000.0
X*	87.44	87.39	87.12	86.84	85.55	84.00	82.11	79.94	77.00	77.12
S*	0.557	0.447	0.459	0.454	0.550	0.601	0.542	0.563	0.624	0.770
0.3S*	0.167	0.134	0.138	0.136	0.165	0.180	0.163	0.169	0.187	0.231
p	55	55	55	55	55	55	55	55	55	55
U_p	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10
u_x	0.094	0.075	0.077	0.076	0.093	0.101	0.091	0.095	0.105	0.130
UCL	91.63	91.56	91.30	91.02	89.74	88.20	86.30	84.14	81.20	81.35
LCL	83.25	83.21	82.94	82.67	81.36	79.80	77.92	75.75	72.79	72.89

X* = Robust Average; UCL = Upper Control Limit; U_p: $U_{ETSI\ TR\ 100\ 028\text{-}1\ V1.4.1(k=2)}$ = 4.10

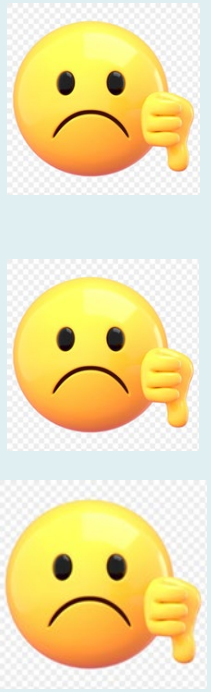
S* = Robust Std Deviation; LCL = Lower Control Limit; Std Uncertainty of X*: u_x = 1.25 (S*/√p)

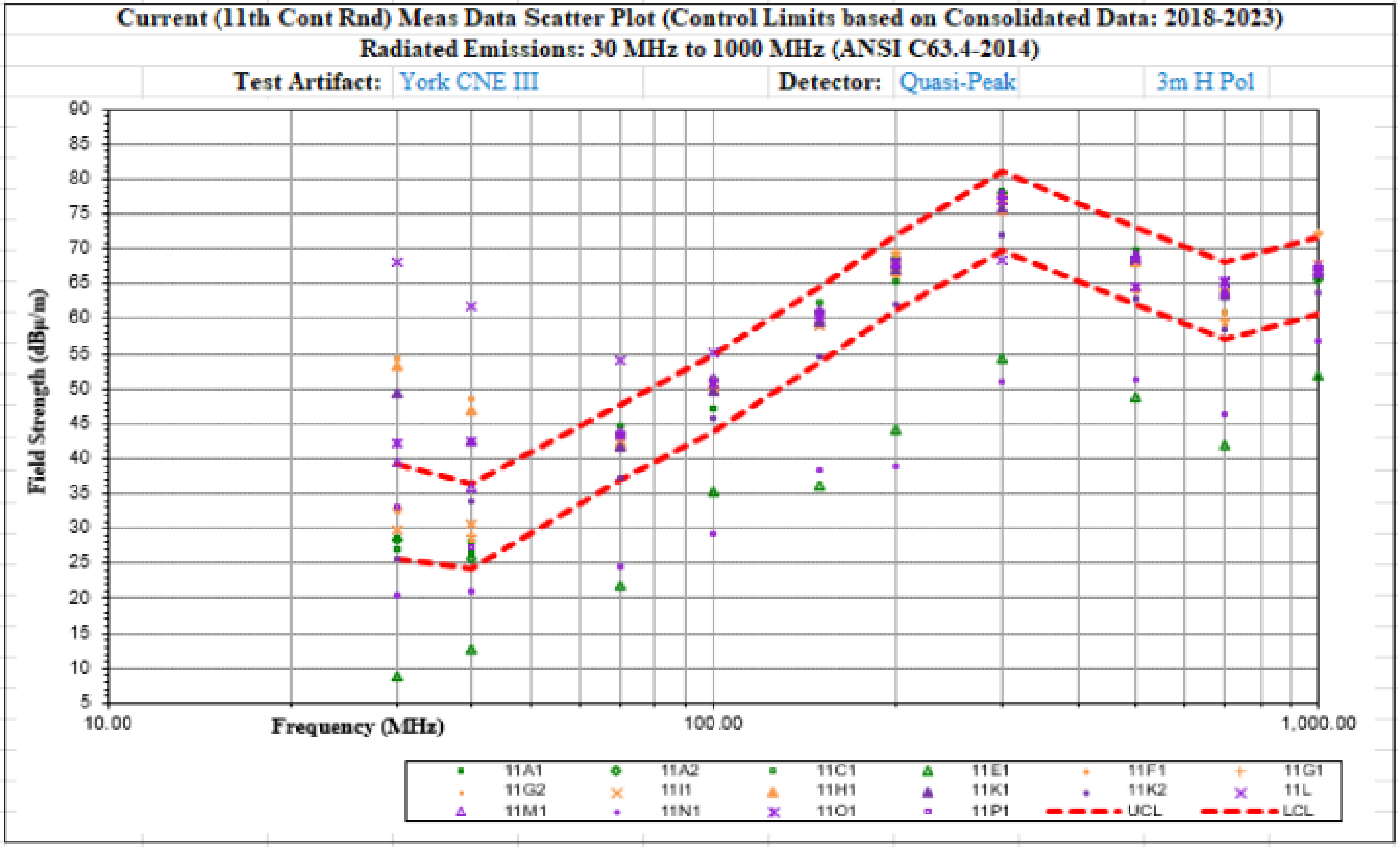
p = No. of Valid Participants; Upper & Lower Control Limits = X*± (U_p + u_x)

Consolidated PT Results – 8th thru 11th Continuation Rounds (dB Units)
Radiated Emissions (3m H Pol, QP, 30 MHz to 1000 MHz)



PT Results – 11th Continuation Round (dB Units)
Radiated Emissions (3m H Pol, QP, 30 MHz to 1000 MHz)

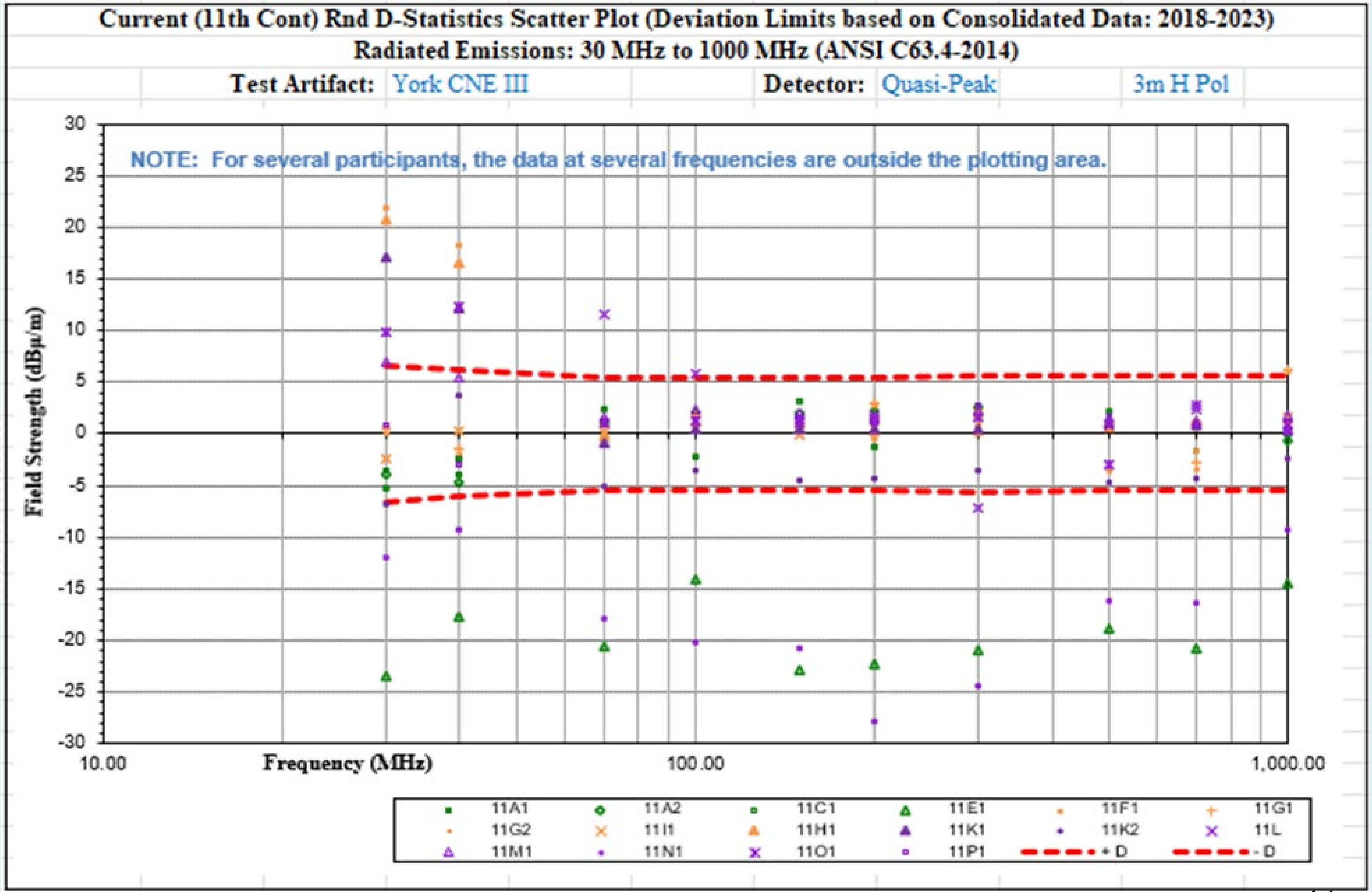




Participants: 16 Overall failure rate (%): 68.75 Acrossboard failure rate (%): 12.50



11th Continuation Round (D-Statistics)
Radiated Emissions (3m H Pol, QP, 30 MHz to 1000 MHz)



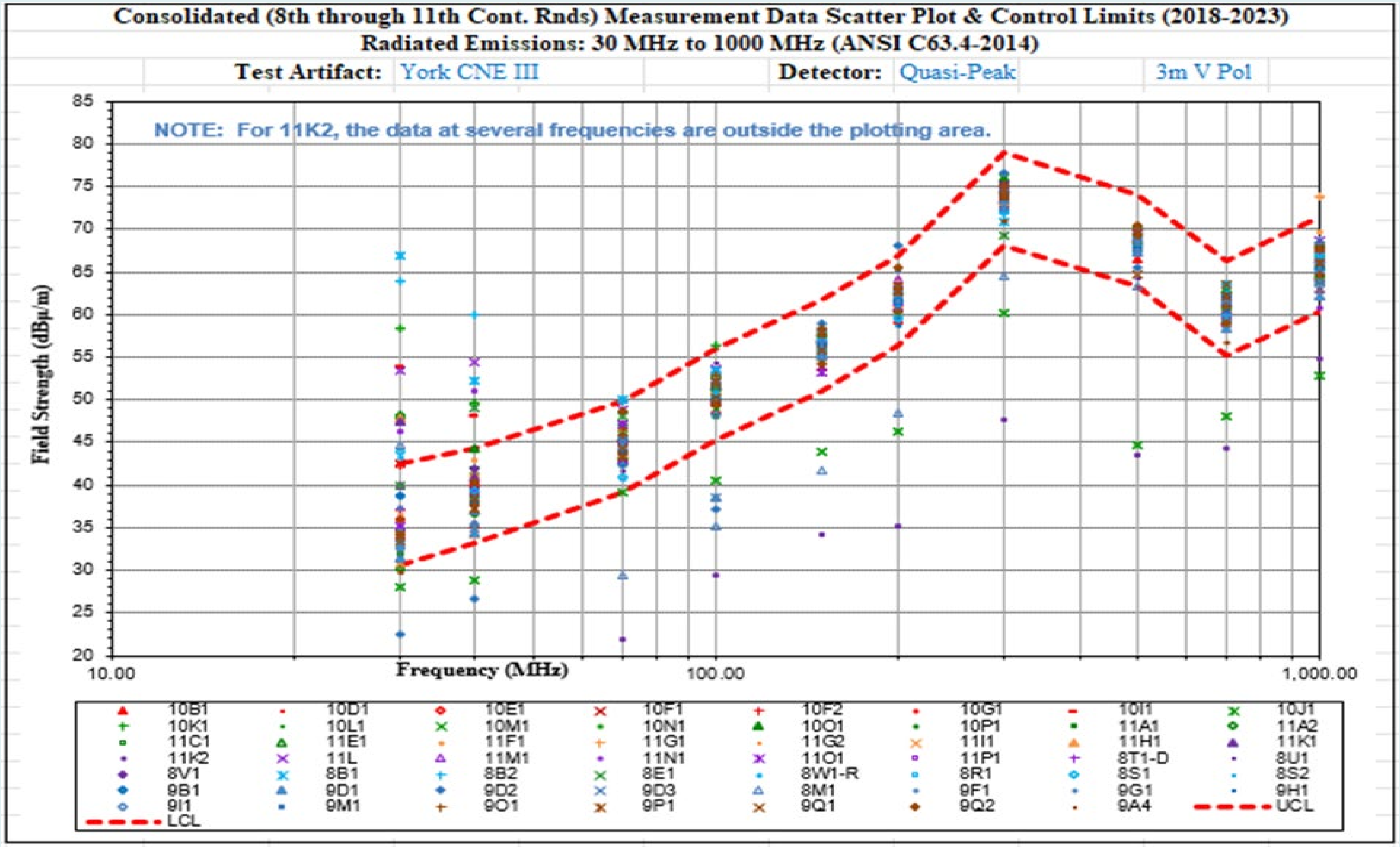
PT Results – 11th Continuation Round
(Performance Eval Statistics)
Radiated Emissions (3m H Pol, QP, 30 MHz to 1000 MHz)

Current (11th Cont.) Rnd Performance Evaluation Statistics derived from Consolidated data: 2018-2023										
Radiated Emissions: 30 MHz to 1000 MHz (ANSI C63.4-2014)										
	Test Artifact:		York CNE III			Detector:	Quasi-Peak		3m H Pol	
Summary Statistics	Frequencies (MHz)									
	30.0	40.0	70.0	100.0	150.0	200.0	300.0	500.0	700.0	1000.0
X*	32.37	30.37	42.40	49.38	59.13	66.52	75.40	67.55	62.67	66.18
S*	9.505	6.214	1.897	2.640	1.865	2.161	2.645	1.741	1.854	1.804
0.3S*	2.851	1.864	0.569	0.792	0.560	0.648	0.794	0.522	0.556	0.541
p	55	55	55	55	55	55	55	55	55	55
U_p	5.06	5.06	5.06	5.06	5.06	5.06	5.24	5.24	5.24	5.24
u_x	1.602	1.047	0.320	0.445	0.314	0.364	0.446	0.293	0.313	0.304
UCL	39.04	36.48	47.78	54.89	64.51	71.95	81.08	73.09	68.23	71.73
LCL	25.71	24.26	37.02	43.88	53.76	61.10	69.71	62.02	57.12	60.64

X* =	Robust Average	UCL =	Upper Control Limit	U_p: $U_{CISPR(k-2)}$ =	5.06 dB (30 -200 MHz)
S*=	Robust Std Deviation	LCL =	Lower Control Limit	U_p: $U_{CISPR(k-2)}$ =	5.24 dB (200 -1000 MHz)
p =	No. of Valid Participants	u_x=	1.25 (S*/√p)	Control Limits =	$X^* \pm [U_p + u_x]$

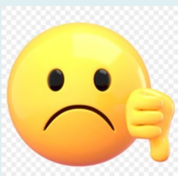


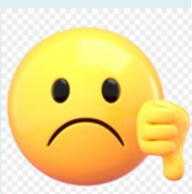
Consolidated PT Results – 8th thru 11th Continuation Rounds (dB Units)
Radiated Emissions (3m V Pol, QP, 30 MHz to 1000 MHz)

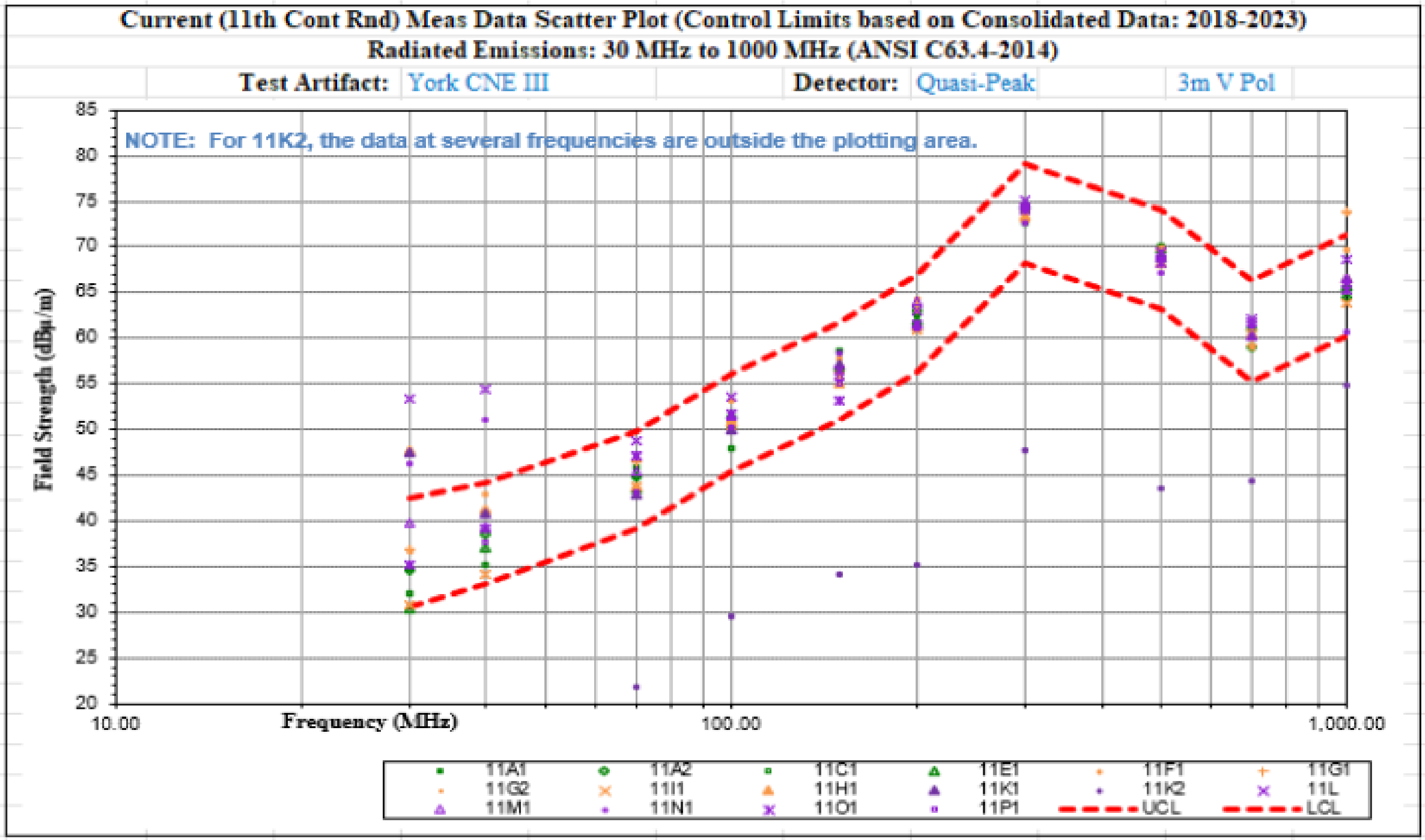


Participants: 55 | Overall failure rate (%): 43.64 | Acrossboard failure rate (%): 1.82

PT Results – 11th Continuation Round (dB Units)
Radiated Emissions (3m V Pol, QP, 30 MHz to 1000 MHz)

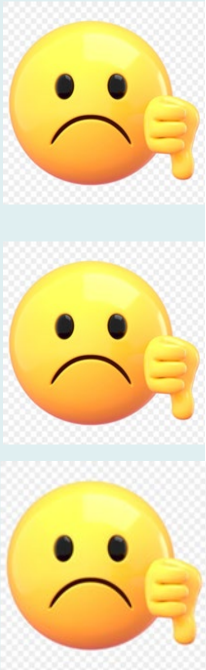


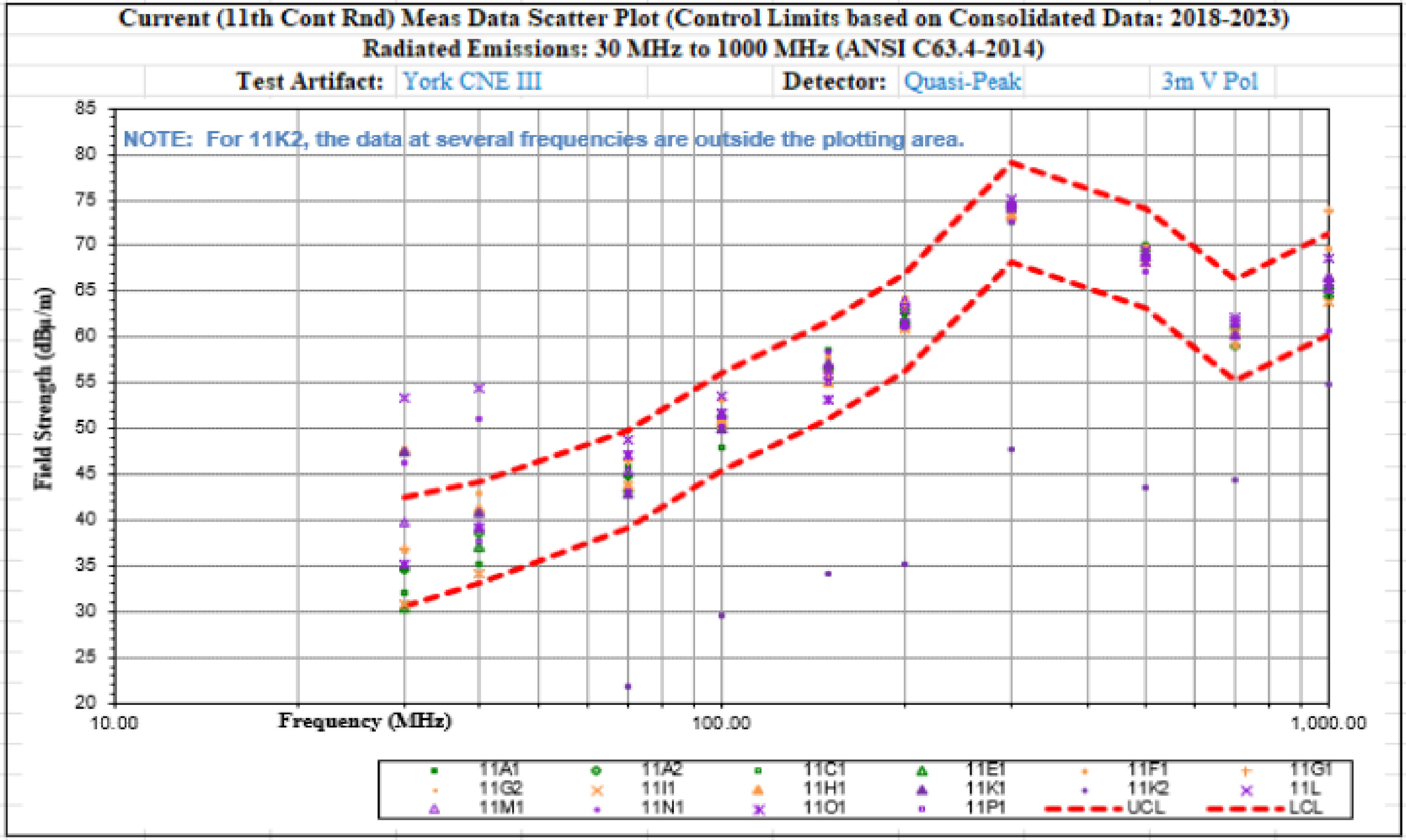




Participants: 16 Overall failure rate (%): 56.25 Acrossboard failure rate (%): 6.25

PT Results – 11th Continuation Round (D-Statistics)
Radiated Emissions (3m V Pol, QP, 30 MHz to 1000 MHz)





Participants:	16	Overall failure rate (%):	56.25	Acrossboard failure rate (%):	6.25

PT Results – 11th Continuation Round
(Performance Eval Statistics)
Radiated Emissions (3m V Pol, QP, 30 MHz to 1000 MHz)

Current (11th Cont.) Rnd Performance Evaluation Statistics derived from Consolidated data: 2018-2023

Radiated Emissions: 30 MHz to 1000 MHz (ANSI C63.4-2014)

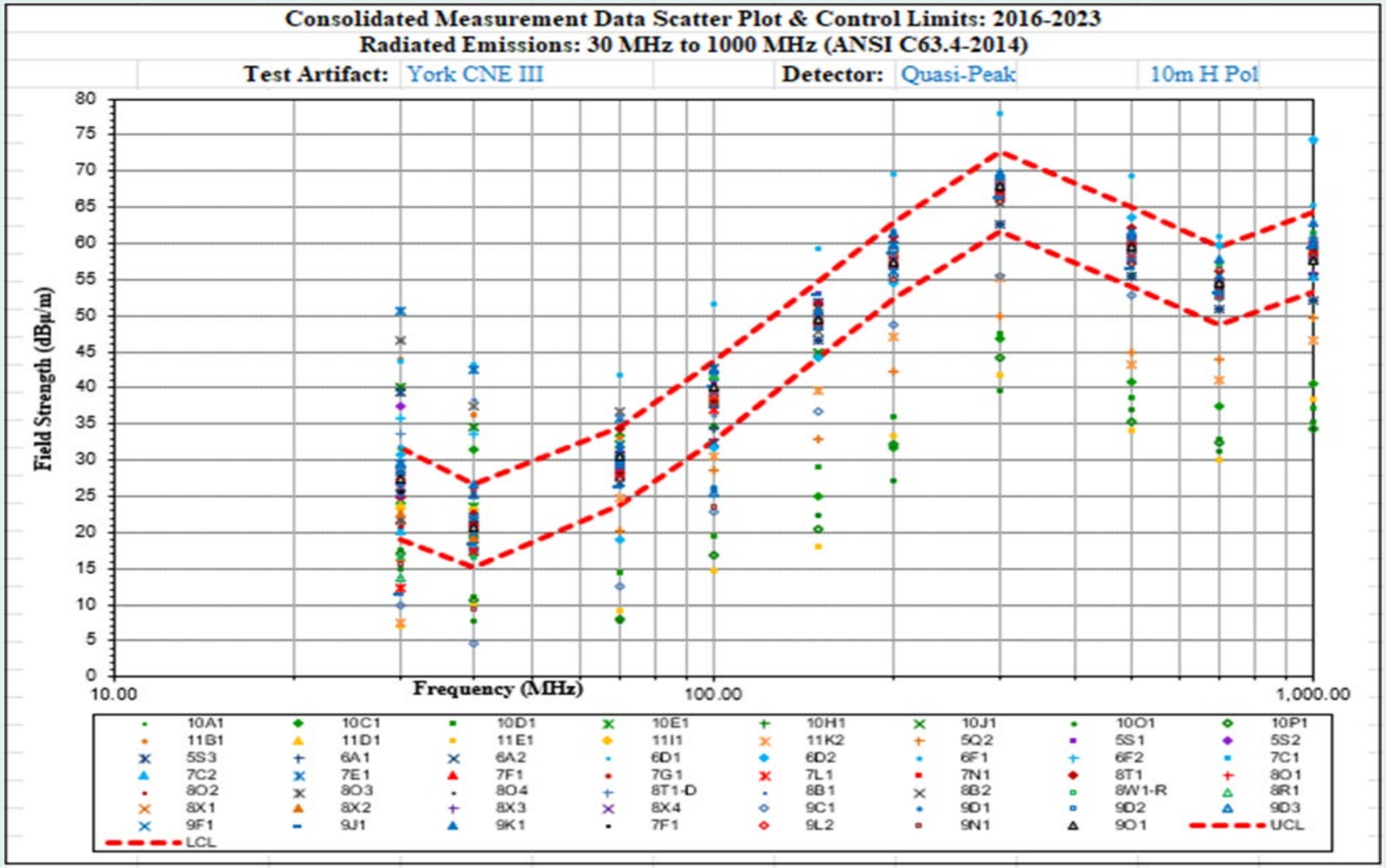
Test Artifact: York CNE III **Detector:** Quasi-Peak 3m V Pol

Summary Statistics	Frequencies (MHz)									
	30.0	40.0	70.0	100.0	150.0	200.0	300.0	500.0	700.0	1000.0
X*	36.61	38.70	44.49	50.69	56.46	61.66	73.60	68.70	60.76	65.82
S*	5.479	2.944	1.962	1.685	1.573	1.657	1.237	0.969	1.530	1.890
0.3S*	1.644	0.883	0.589	0.506	0.472	0.497	0.371	0.291	0.459	0.567
p	55	55	55	55	55	55	55	55	55	55
U_p	5.06	5.06	5.06	5.06	5.06	5.06	5.24	5.24	5.24	5.24
u_x	0.923	0.496	0.331	0.284	0.265	0.279	0.208	0.163	0.258	0.318
UCL	42.59	44.25	49.88	56.03	61.79	67.00	79.05	74.11	66.25	71.38
LCL	30.63	33.14	39.10	45.34	51.14	56.32	68.15	63.30	55.26	60.26

X* =	Robust Average	UCL =	Upper Control Limit	U_p: $U_{CISPR(k=2)}$ =	5.06 dB (30 -200 MHz)
S*=	Robust Std Deviation	LCL =	Lower Control Limit	U_p: $U_{CISPR(k=2)}$ =	5.24 dB (200 -1000 MHz)
p =	No. of Valid Participants	u_x=	1.25 (S*/√p)	Control Limits =	$X^* \pm [U_p + u_x]$



Consolidated PT Results – 8th thru 11th Continuation Rounds (dB Units)
Radiated Emissions (10 m H Pol, QP, 30 MHz to 1000 MHz)



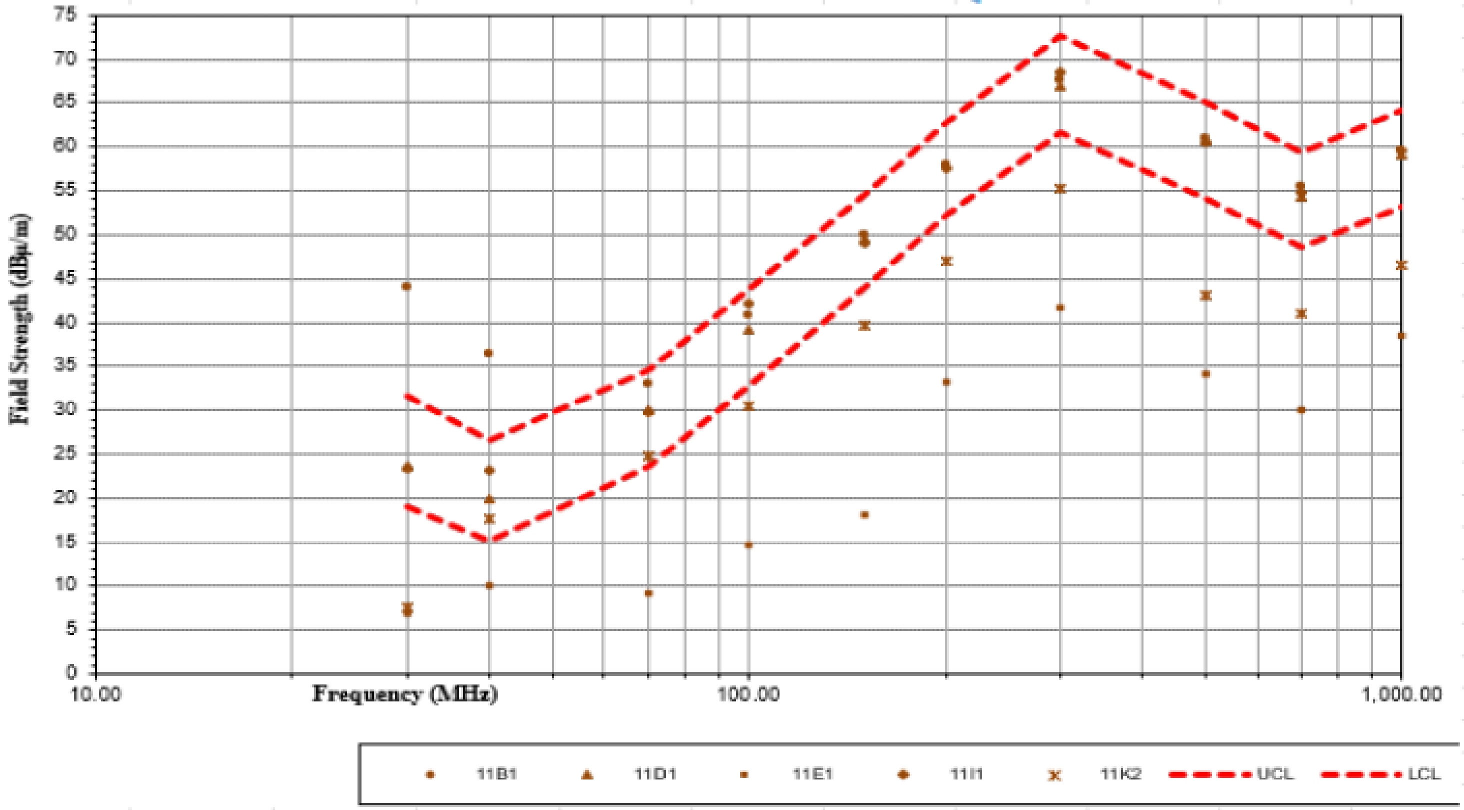
Participants: 55 | Overall failure rate (%): 54.55 | Acrossboard failure rate (%): 9.09

PT Results – 11th Continuation Round (dB Units)
Radiated Emissions (10 m H Pol, QP, 30 MHz to 1000 MHz)



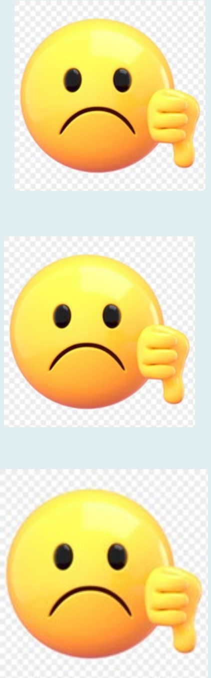
Current (11th Cont) Rnd Data Scatter Plot (Control Limits based on Consolidated Data: 2016-2023)
Radiated Emissions: 30 MHz to 1000 MHz (ANSI C63.4-2014)

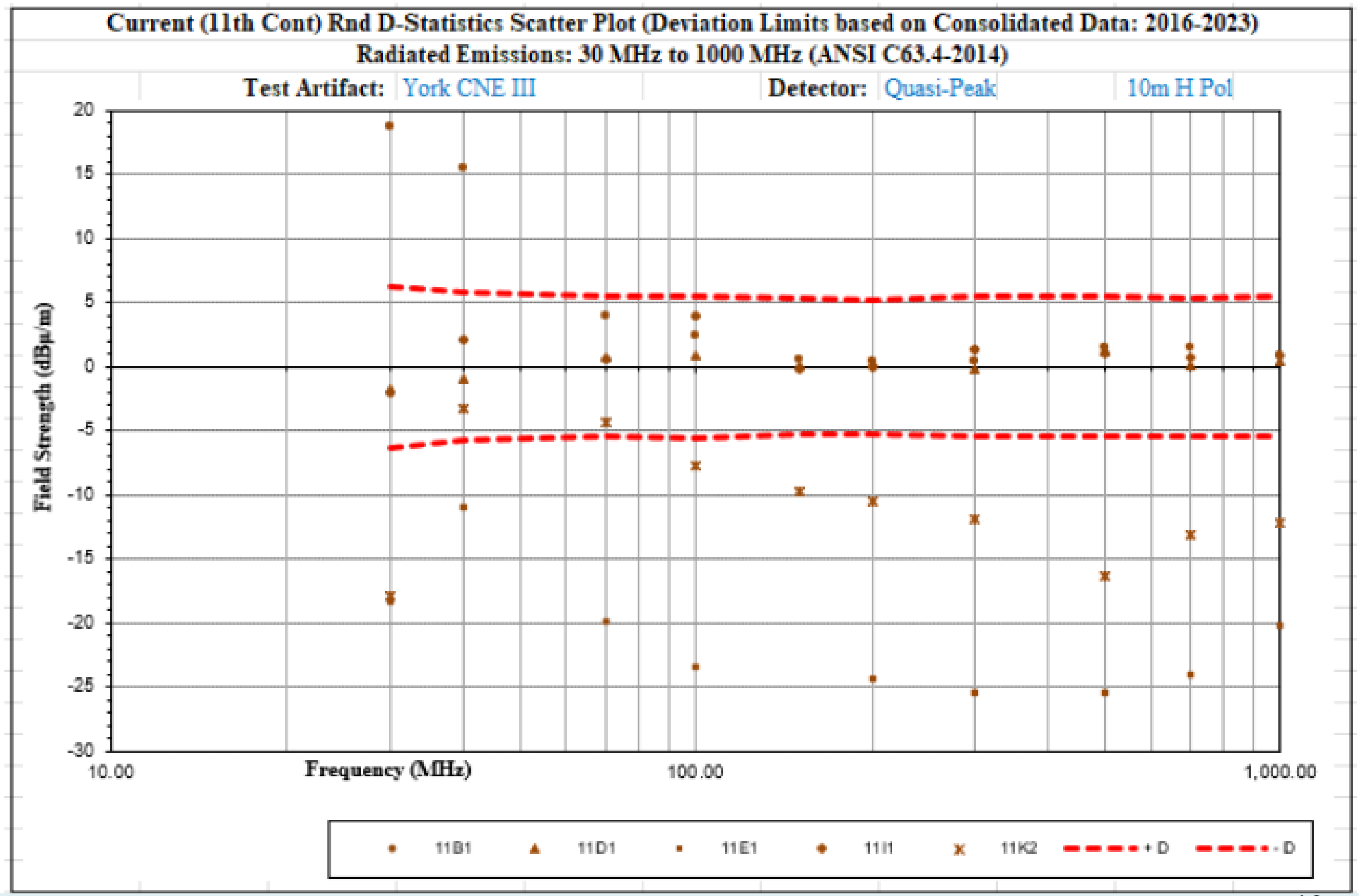
Test Artifact: York CNE III **Detector:** Quasi-Peak 10m H Pol



Participants: 5 **Overall failure rate (%):** 60.00 **Acrossboard failure rate (%):** 20.00
(at all 10 frequencies)

PT Results – 11th Continuation Round (D-Statistics)
Radiated Emissions (10 m H Pol, QP, 30 MHz to 1000 MHz)





PT Results – 11th Continuation Round
(Performance Eval Statistics)
Radiated Emissions (10 m H Pol, QP, 30 MHz to 1000 MHz)

Current (11th Cont) Rnd Performance Evaluation Statistics derived from Consolidated Meas data: 2016-2023
Radiated Emissions: 30 MHz to 1000 MHz (ANSI C63.4-2014)

Test Artifact: York CNE III — **Detector:** Quasi-Peak — 10m H Pol

Summary Statistics	Frequencies (MHz)									
	30.0	40.0	70.0	100.0	150.0	200.0	300.0	500.0	700.0	1000.0
X*	25.38	20.94	29.15	38.21	49.34	57.59	67.16	59.56	54.07	58.73
S*	7.729	4.293	2.347	2.904	1.407	1.306	1.515	1.513	1.057	1.666
0.3S*	2.319	1.288	0.704	0.871	0.422	0.392	0.454	0.454	0.317	0.500
p	55	55	55	55	55	55	55	55	55	55
U_p	5.03	5.03	5.03	5.03	5.03	5.03	5.22	5.22	5.22	5.22
u_x	1.303	0.724	0.396	0.489	0.237	0.220	0.255	0.255	0.178	0.281
UCL	31.71	26.70	34.58	43.73	54.61	62.84	72.64	65.04	59.47	64.23
LCL	19.05	15.19	23.73	32.69	44.07	52.34	61.69	54.09	48.67	53.23

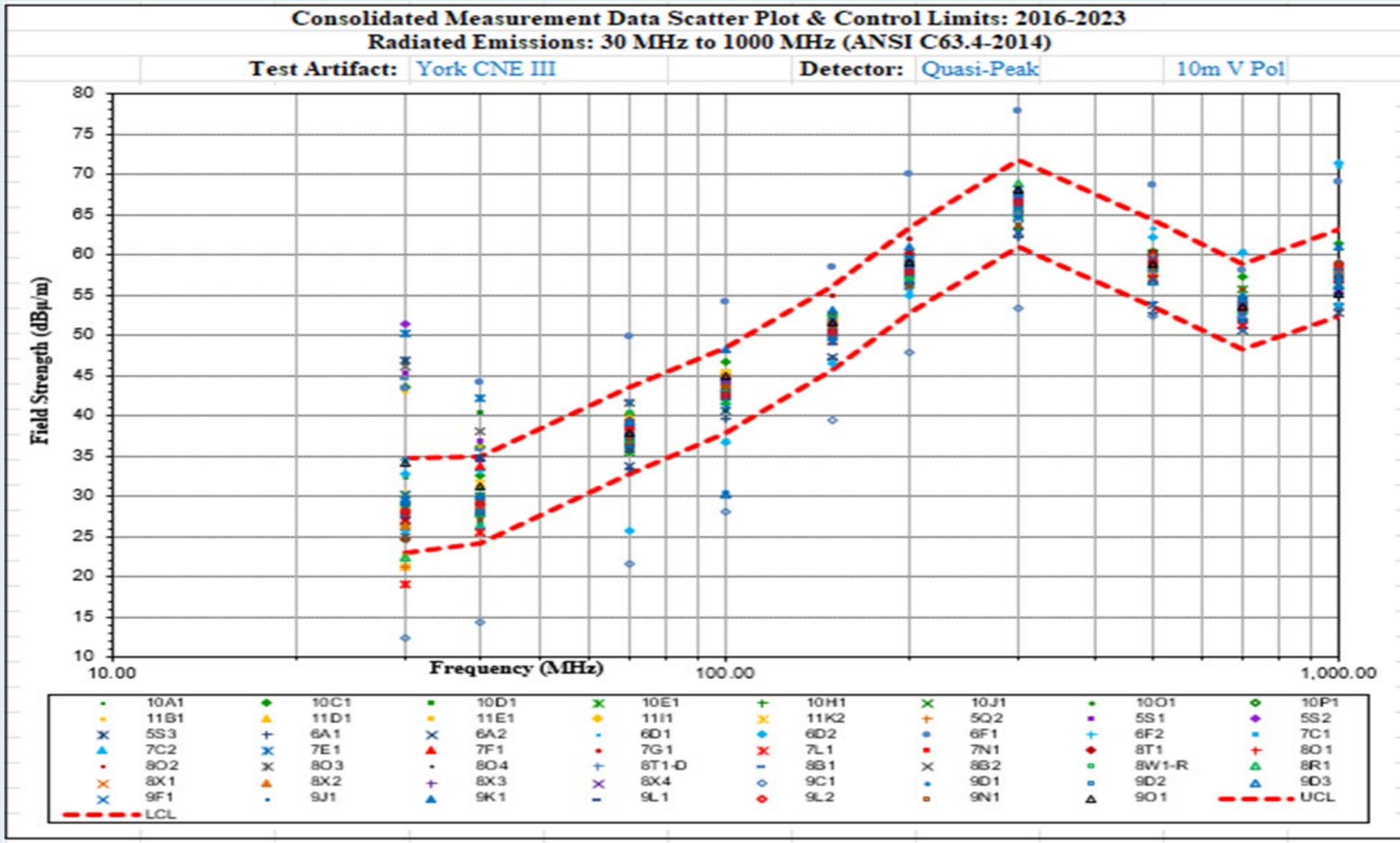
X* = Robust Average — UCL = Upper Control Limit — U_p: $U_{CISPR(A-2)}$ = 5.03 dB (30 MHz to 200 MHz)

S* = Robust Std Deviation — LCL = Lower Control Limit — U_p: $U_{CISPR(A-2)}$ = 5.22 dB (200 MHz to 1000 MHz)

p = No. of Valid Participants — u_x = 1.25 (S*/√p) — Control Limits = $X^* \pm [U_p + u_x]$

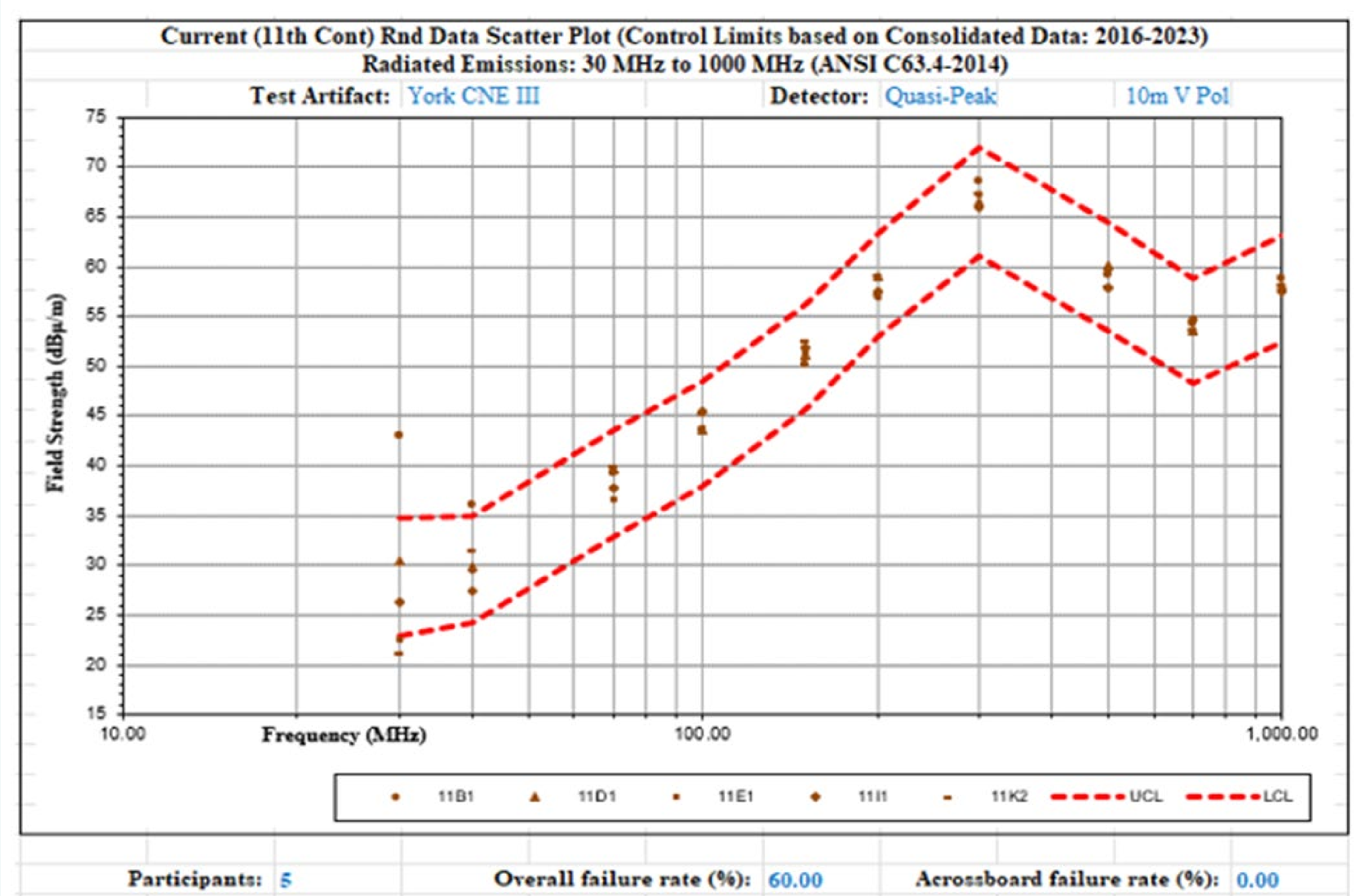


Consolidated PT Results – 8th thru 11th Continuation Rounds (dB Units)
Radiated Emissions (10 m V Pol, QP, 30 MHz to 1000 MHz)

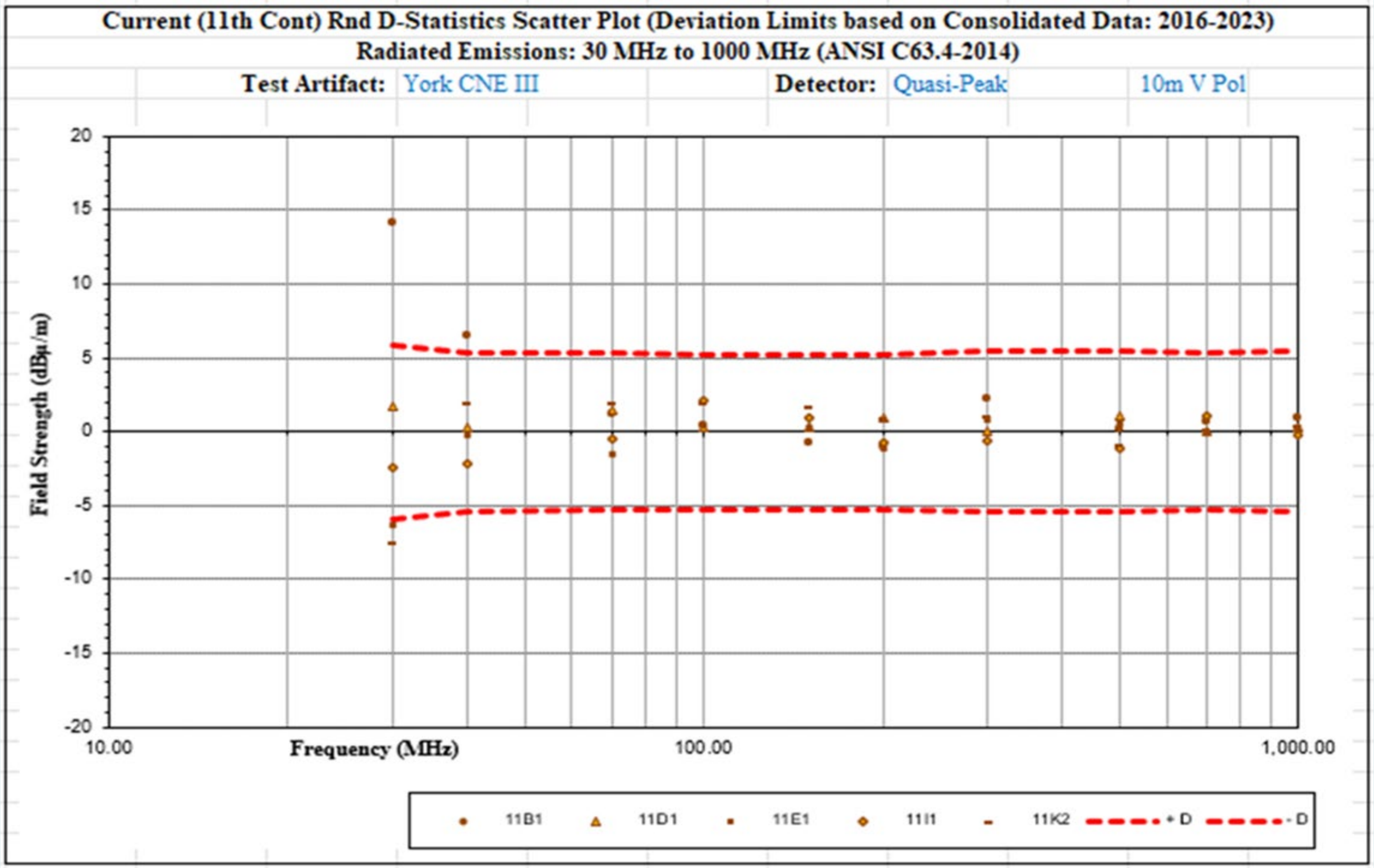


Participants: 55 **Overall failure rate (%):** 40.00 **Acrossboard failure rate (%):** 0.00

PT Results – 11th Continuation Round (dB Units)
Radiated Emissions (10 m V Pol, QP, 30 MHz to 1000 MHz)



PT Results – 11th Continuation Round (D-Statistics)
Radiated Emissions (10 m V Pol, QP, 30 MHz to 1000 MHz)



PT Results – 11th Continuation Round (Performance Eval Statistics) Radiated Emissions (10 m V Pol, QP, 30 MHz to 1000 MHz)

Current (11th Cont) Rnd Performance Evaluation Statistics derived from Consolidated Meas data: 2016-2023										
Radiated Emissions: 30 MHz to 1000 MHz (ANSI C63.4-2014)										
	Test Artifact:		York CNE III			Detector:	Quasi-Peak		10m V Pol	
Summary Statistics	Frequencies (MHz)									
	30.0	40.0	70.0	100.0	150.0	200.0	300.0	500.0	700.0	1000.0
X*	28.79	29.60	38.17	43.22	50.87	58.13	66.45	59.01	53.56	57.74
S*	5.043	1.886	1.807	1.332	1.096	1.278	1.184	1.149	0.598	1.236
0.3S*	1.513	0.566	0.542	0.400	0.329	0.383	0.355	0.345	0.179	0.371
p	55	55	55	55	55	55	55	55	55	55
U_p	5.03	5.03	5.03	5.03	5.03	5.03	5.22	5.22	5.22	5.22
u_x	0.850	0.318	0.305	0.224	0.185	0.215	0.200	0.194	0.101	0.208
UCL	34.67	34.95	43.50	48.47	56.09	63.37	71.87	64.42	58.88	63.17
LCL	22.91	24.25	32.83	37.97	45.66	52.88	61.03	53.59	48.24	52.31

X* = Robust Average	UCL = Upper Control Limit	U_p: $U_{CISPR(k=2)}$ =	5.03 dB (30 MHz to 200 MHz)
S* = Robust Std Deviation	LCL = Lower Control Limit	U_p: $U_{CISPR(k=2)}$ =	5.22 dB (200 MHz to 1000 MHz)
p = No. of Valid Participants	u_x = 1.25 (S*/√p)	Control Limits =	$X^* \pm [U_p + u_x]$



Consolidated Results (8th – 11th Rounds):
Direct Antenna Conducted Failure Rate Summary: 150 kHz – 1000 MHz

Direct Antenna Conducted Emissions (150 kHz - 30 MHz, QP)	
# participants	55
Overall Failure Rate (%)	10.91
Across-the-Board Failure Rate (%)	7.27

Direct Antenna Conducted Emissions (30 MHz - 1000 MHz, QP)	
# participants	55
Overall Failure Rate (%)	9.09
Across-the-Board Failure Rate (%)	3.64

11th Round Results
Direct Antenna Conducted Failure Rate Summary: 150 kHz – 1000 MHz

Direct Antenna Conducted Emissions (150 kHz - 30 MHz, QP)	
# participants	10
Overall Failure Rate (%)	10.00
Across-the-Board Failure Rate (%)	10.00

Direct Antenna Conducted Emissions (30 MHz - 1000 MHz, QP)	
# participants	10
Overall Failure Rate (%)	20.00
Across-the-Board Failure Rate (%)	10.00

➔ Possibly worse over time?

Consolidated Results (8th – 11th Rounds):
3m Radiated Emissions Failure Rate Summary: 30 MHz – 1000 MHz

Radiated Emissions (30 MHz - 1000 MHz) (3 m H Pol, QP)	
# participants	55
Overall Failure Rate (%)	63.64
Across-the-Board Failure Rate (%)	10.91

Radiated Emissions (30 MHz - 1000 MHz) (3 m V Pol, QP)	
# participants	55
Overall Failure Rate (%)	43.64
Across-the-Board Failure Rate (%)	1.82

11th Round Results
3m Radiated Emissions Failure Rate Summary: 30 MHz – 1000 MHz

Radiated Emissions (30 MHz - 1000 MHz) (3 m H Pol, QP)	
# participants	16
Overall Failure Rate (%)	68.75
Across-the-Board Failure Rate (%)	12.50

Radiated Emissions (30 MHz - 1000 MHz) (3 m V Pol, QP)	
# participants	16
Overall Failure Rate (%)	56.25
Across-the-Board Failure Rate (%)	6.25

➔ Possibly worse over time?

Consolidated Results (8^{th} – 11^{th} Rounds): 10 m Radiated Emissions Failure Rate Summary: 30 MHz – 1000 MHz

Radiated Emissions (30 MHz - 1000 MHz) (10 m H Pol, QP)	
# participants	55
Overall Failure Rate (%)	54.55
Across-the-Board Failure Rate (%)	9.09

Radiated Emissions (30 MHz - 1000 MHz) (10 m V Pol, QP)	
# participants	55
Overall Failure Rate (%)	40.00
Across-the-Board Failure Rate (%)	0.00

11^{th} Round Results 10 m Radiated Emissions Failure Rate Summary: 30 MHz – 1000 MHz

Radiated Emissions (30 MHz - 1000 MHz) (10 m H Pol, QP)	
# participants	5
Overall Failure Rate (%)	60.00
Across-the-Board Failure Rate (%)	20.00

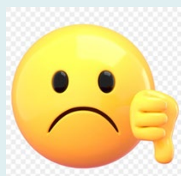
Radiated Emissions (30 MHz - 1000 MHz) (10 m V Pol, QP)	
# participants	5
Overall Failure Rate (%)	60.00
Across-the-Board Failure Rate (%)	0.00

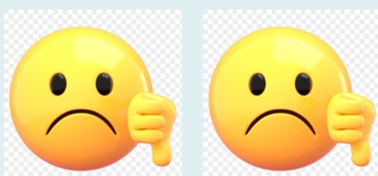
➔ Definitely worse over time

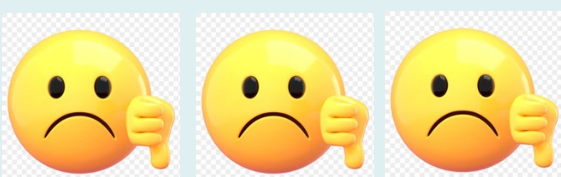
“Above 1 GHz” PT Scheme (1 GHz – 18 GHz) Results

Subjective Rankings for the measurement process as an industry

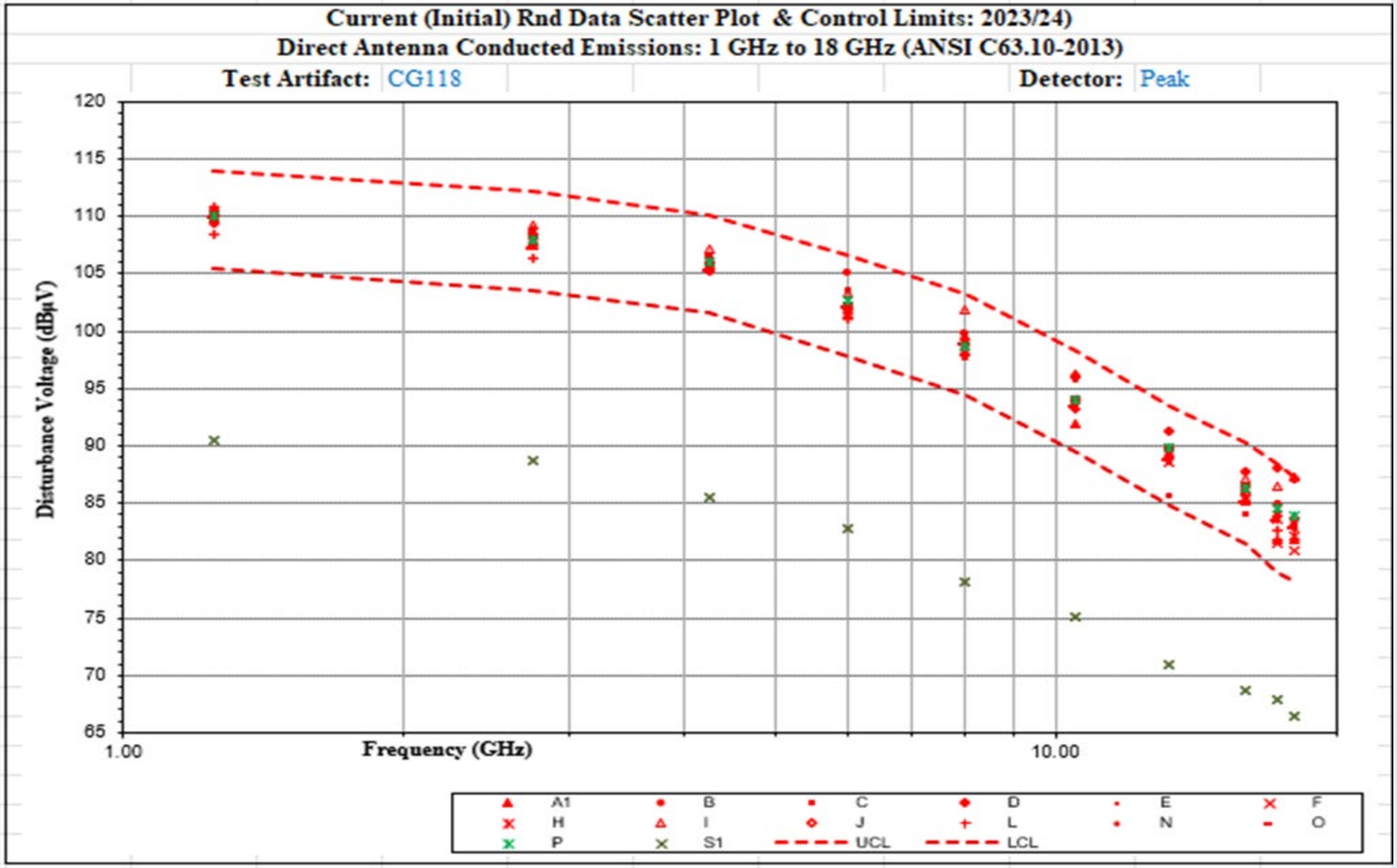

= OK (as an industry the process is in-control)


= Poor (as an industry, the process not very well controlled)


= Very Poor (as an industry, the process is poorly controlled)

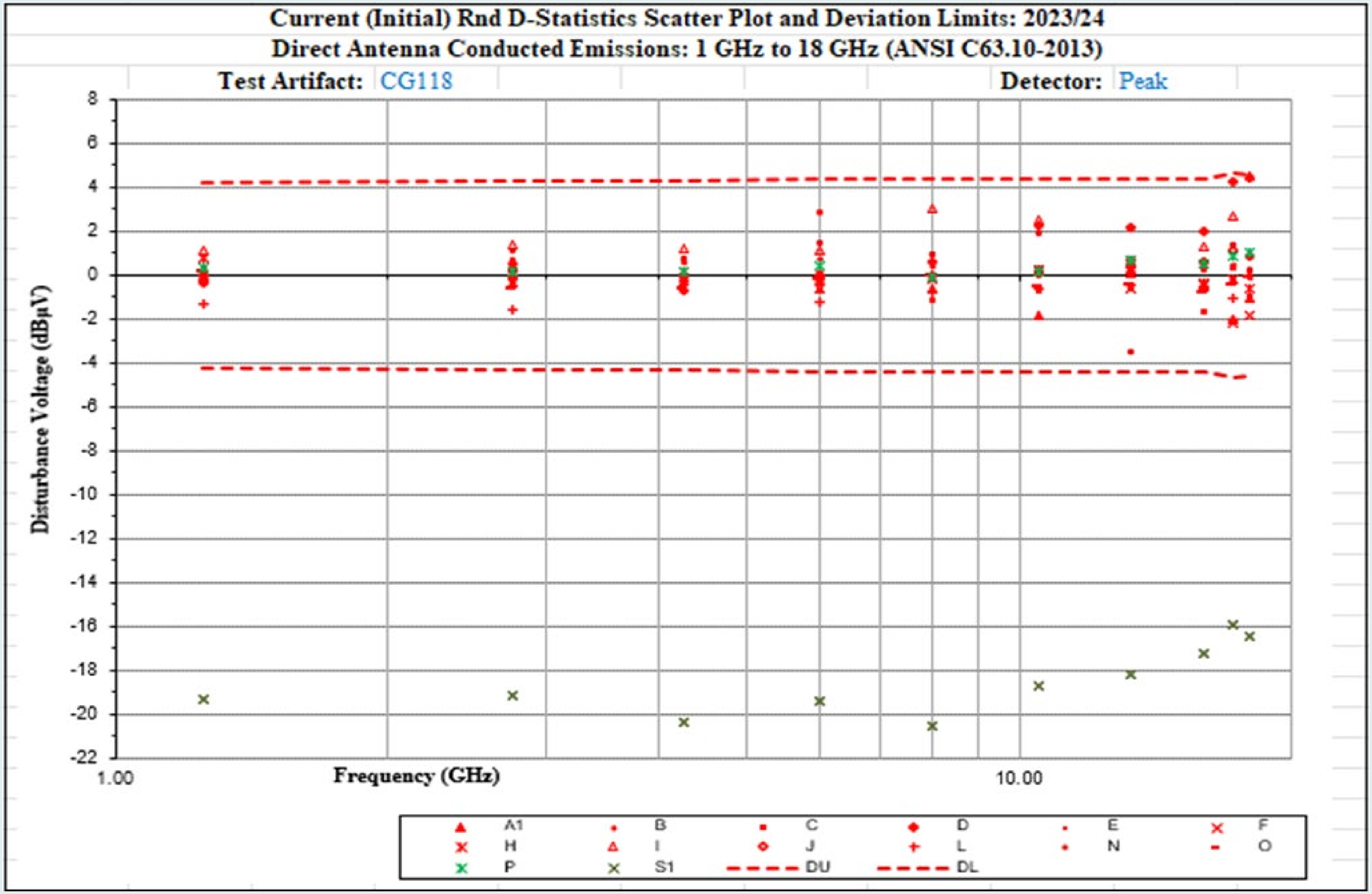

= Miserable (as an industry, the process is out of control)

Initial Round PT Results (1 GHz to 18 GHz) – (dB Units)
Direct Antenna Conducted Emissions (Peak)



Participants:	14	Overall failure rate (%):	7.14	Acrossboard failure rate (%):	7.14

Initial Round PT Results (1 GHz to 18 GHz) – (D-Statistics)
Direct Antenna Conducted Emissions (Peak)



Initial Round PT Results (1 GHz to 18 GHz) – (Performance Eval Statistics)
Direct Antenna Conducted Emissions (Peak)

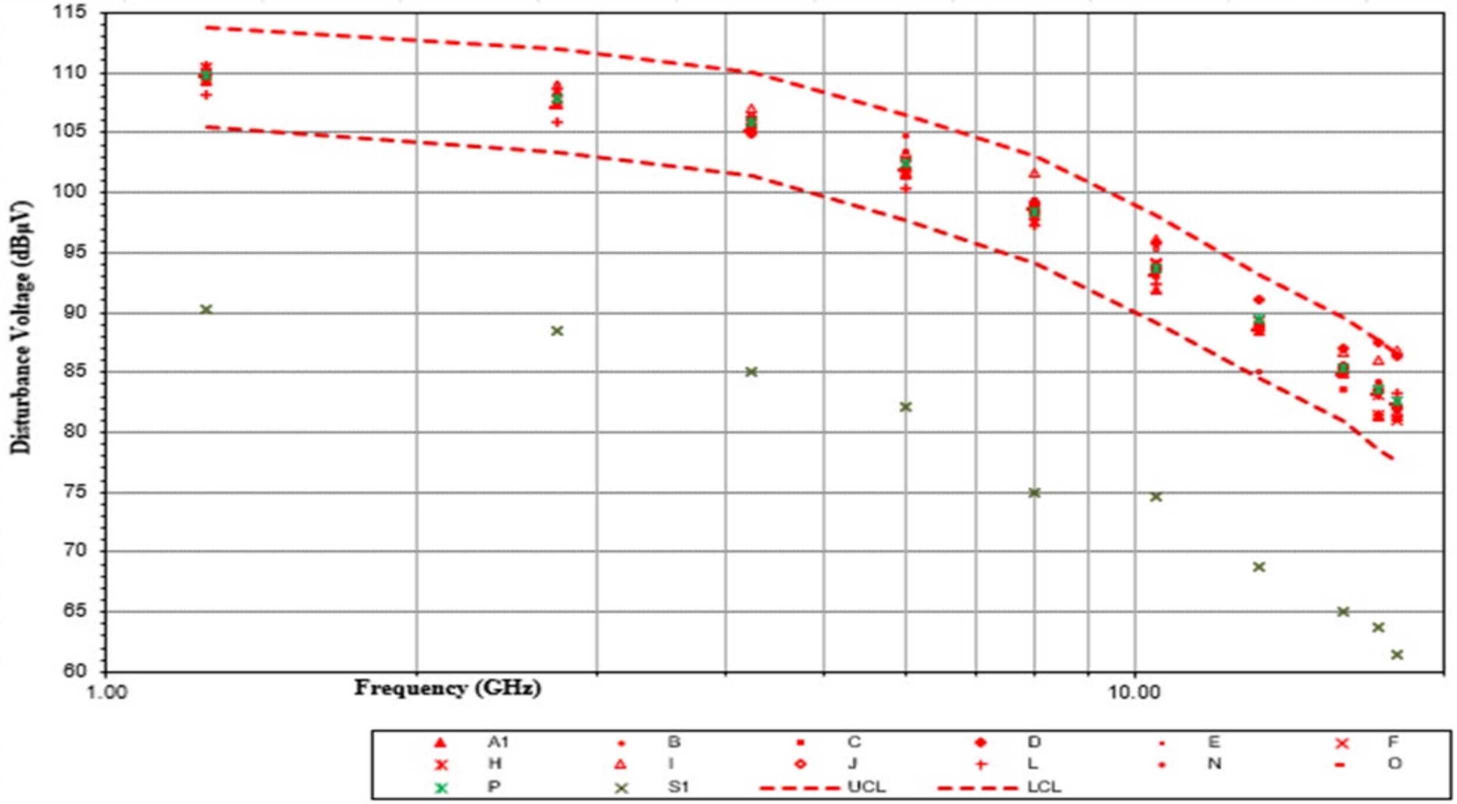
Current (Initial) Rnd Performance Evaluation Statistics/Parameters derived from Consolidated data: 2023-2024										
Direct Antenna Conducted Emissions: 1 GHz to 18 GHz (ANSI C63.10-2013)										
	Test Artifact:	CG118						Detector:	Peak	
Labs	Frequencies (GHz)									
	1.25	2.75	4.25	6.00	8.00	10.50	13.25	16.00	17.25	18.00
X*	109.73	107.83	105.89	102.19	98.77	93.81	89.12	85.80	83.76	82.80
S*	0.448	0.675	0.645	0.964	0.855	0.829	0.811	0.955	1.710	1.384
0.3S*	0.134	0.202	0.193	0.289	0.256	0.249	0.243	0.287	0.513	0.415
p	14	14	14	14	14	14	14	14	14	14
U_p	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10
u_x	0.150	0.225	0.215	0.322	0.285	0.277	0.271	0.319	0.571	0.462
UCL	113.98	112.16	110.20	106.61	103.16	98.19	93.49	90.22	88.43	87.36
LCL	105.48	103.50	101.57	97.77	94.39	89.44	84.75	81.38	79.09	78.24
X* =	Robust Average		UCL =	Upper Control Limit		U_p: $U_{ETSI\ TR\ 100\ 028\text{-}1\ V1.4.1(k=2)}$ =			4.10	
S*=	Robust Std Deviation		LCL =	Lower Control Limit		Std Uncertainty of X*: u_x=			1.25 (S*/√p)	
p =	# of Valid Participants		$S^*=1.134\,[\sum(xi-x^*)^2/(p-1)]^{1/2}$			Upper & Lower Control Limits =			X*± (U_p + u_x)	

Initial Round PT Results (1 GHz to 18 GHz) – (dB Units)
Direct Antenna Conducted Emissions (Average)

Current (Initial) Rnd Data Scatter Plot & Control Limits: 2023/24)

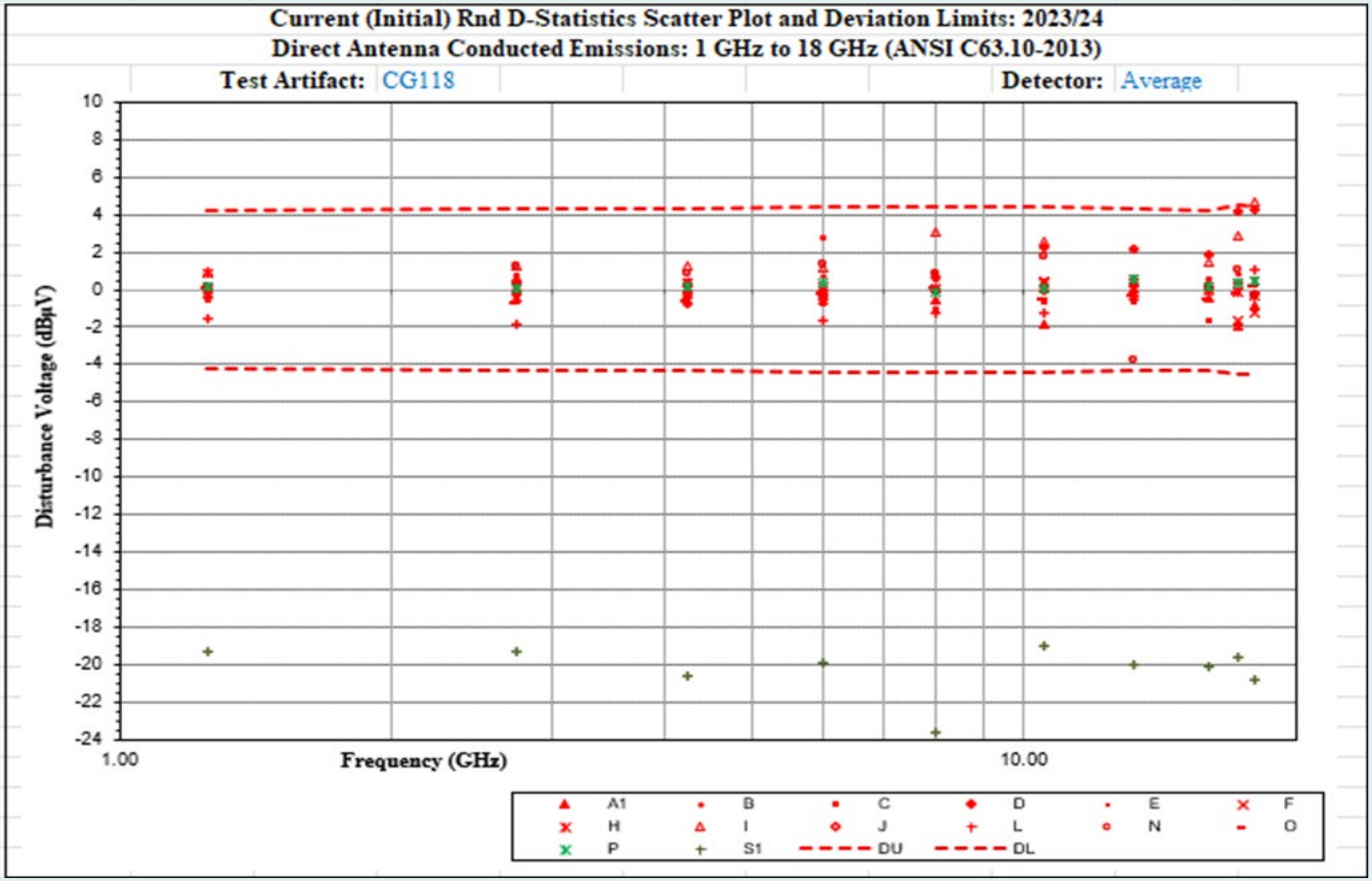
Direct Antenna Conducted Emissions: 1 GHz to 18 GHz (ANSI C63.10-2013)

Test Artifact: CG118 **Detector:** Average



Participants: 14 **Overall failure rate (%):** 14.29 **Acrossboard failure rate (%):** 7.14

Initial Round PT Results (1 GHz to 18 GHz) – (D-Statistics)
Direct Antenna Conducted Emissions (Average)



Initial Round PT Results (1 GHz to 18 GHz) – (Performance Eval Statistics)
Direct Antenna Conducted Emissions (Average)

Current (Initial) Rnd Performance Evaluation Statistics/Parameters derived from Consolidated data: 2023-2024

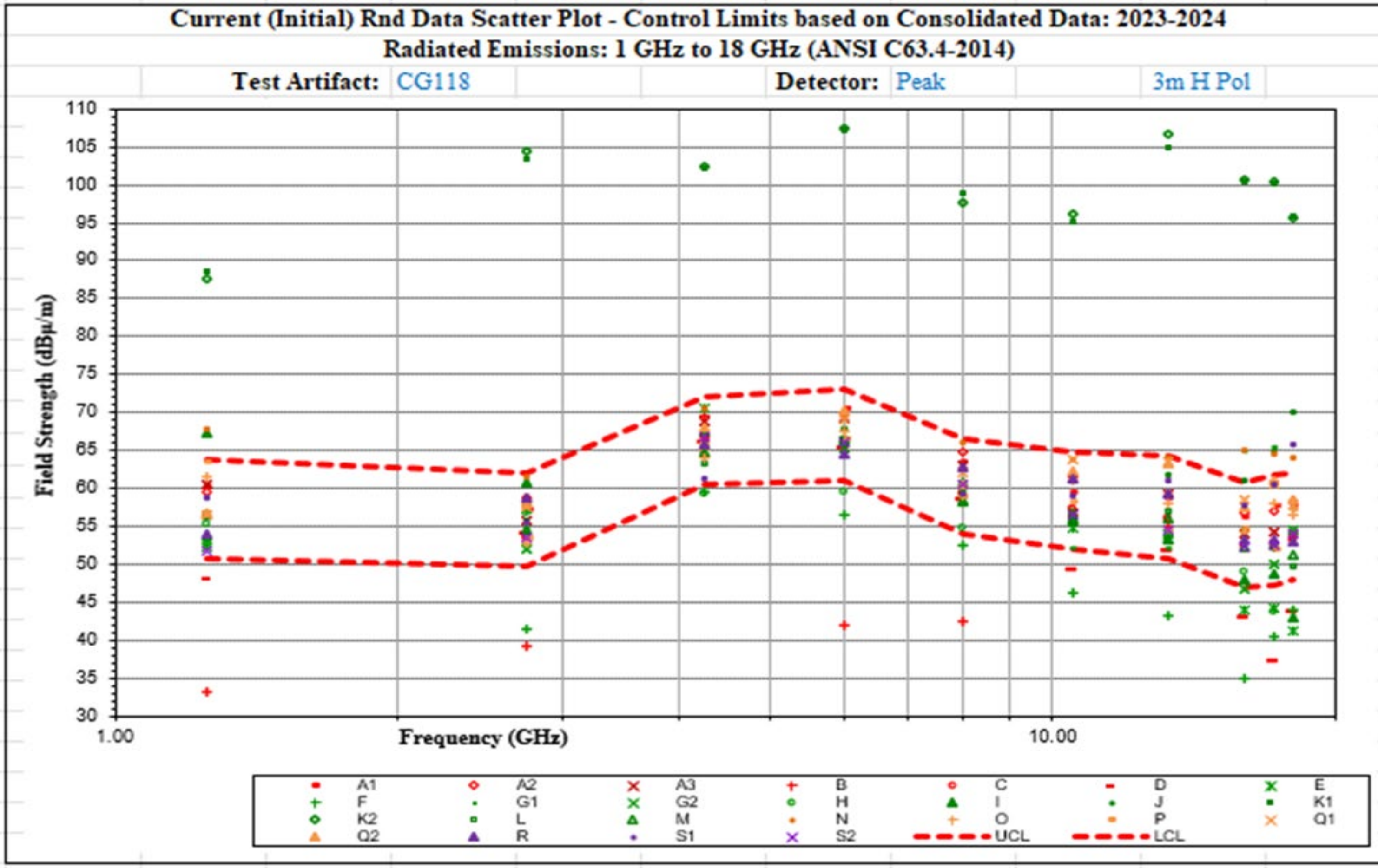
Direct Antenna Conducted Emissions: 1 GHz to 18 GHz (ANSI C63.10-2013)

Test Artifact: CG118 **Detector:** Average

Labs	Frequencies (GHz)									
	1.25	2.75	4.25	6.00	8.00	10.50	13.25	16.00	17.25	18.00
X*	109.63	107.70	105.67	102.05	98.56	93.62	88.86	85.24	83.23	82.16
S*	0.259	0.728	0.676	0.932	0.911	1.065	0.641	0.492	1.339	1.114
0.3S*	0.078	0.218	0.203	0.280	0.273	0.319	0.192	0.148	0.402	0.334
p	14	14	14	14	14	14	14	14	14	14
U_p	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10
u_x	0.087	0.243	0.226	0.311	0.304	0.356	0.214	0.164	0.447	0.372
UCL	113.81	112.04	110.00	106.46	102.96	98.07	93.17	89.51	87.78	86.63
LCL	105.44	103.36	101.35	97.63	94.15	89.16	84.54	80.98	78.69	77.69

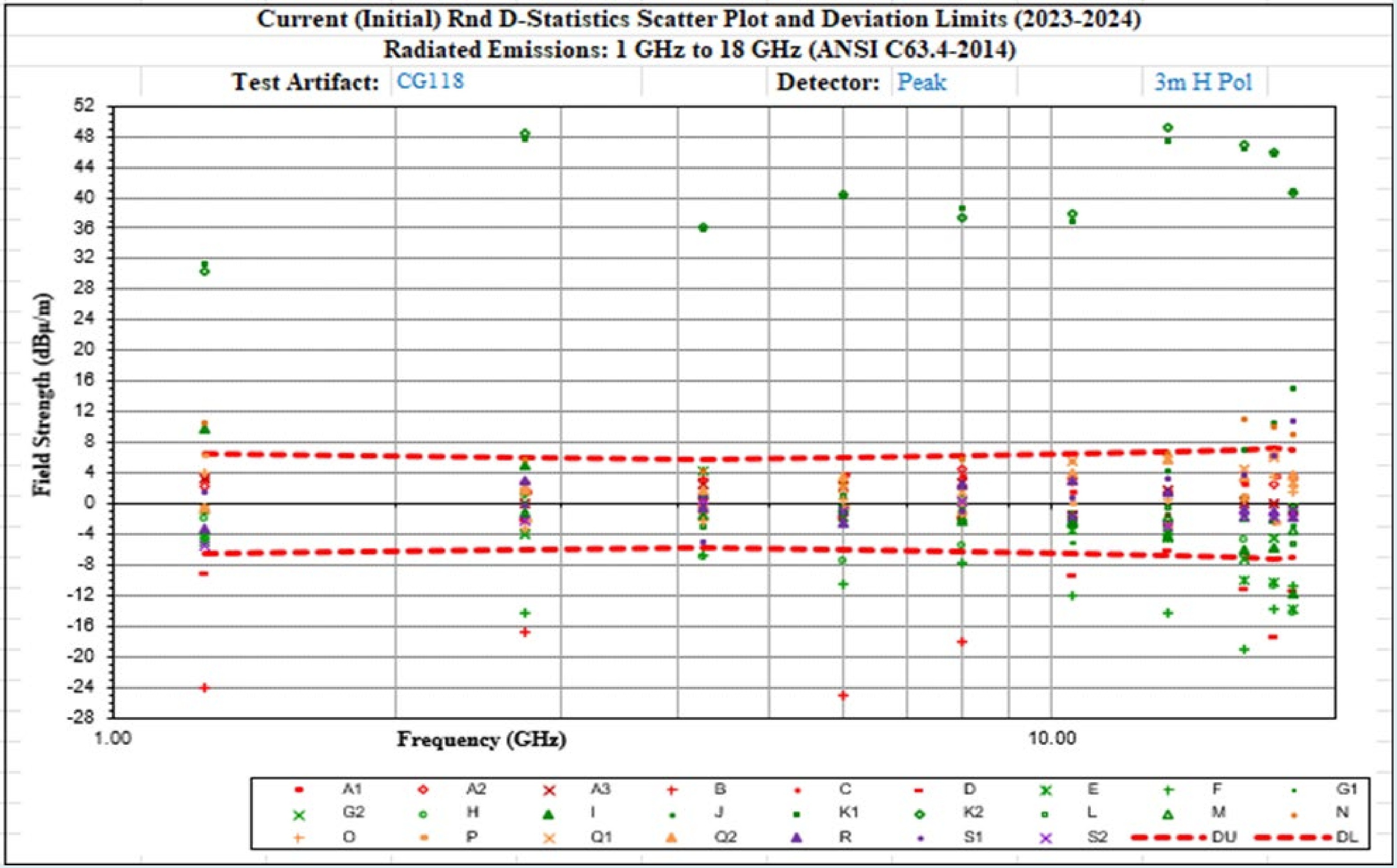
X* =	Robust Average	UCL =	Upper Control Limit	U_p: $U_{ETSI\ TR\ 100\ 028\text{-}1\ V1.4.1(k=2)}$ =	4.10
S*=	Robust Std Deviation	LCL =	Lower Control Limit	Std Uncertainty of X*: u_x=	1.25 (S*/√p)
p =	No. of Valid Participants		$S^*=1.134\,[\sum(xi-x^*)^2/(p-1)]^{1/2}$	Upper & Lower Control Limits =	$X^* \pm (U_p + u_x)$

Initial Round PT Results (dB Units)
Radiated Emissions (3 m H Pol, Peak, 1 GHz to 18 GHz)



Participants: 25 | Overall failure rate (%): 48.00 | Acrossboard failure rate (%): 8.00

Initial Round PT Results (D-Statistics)
Radiated Emissions (3 m H Pol, Peak, 1 GHz to 18 GHz)



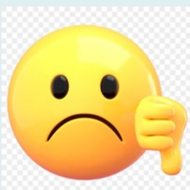
Initial Round PT Results (Performance Eval Statistics)
Radiated Emissions (3 m H Pol, Peak, 1 GHz to 18 GHz)

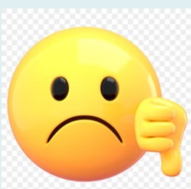
Current (Initial) Rnd Performance Evaluation Statistic/Parameterss derived from Consolidated data: 2023-2024										
Radiated Emissions: 1 GHz to 18 GHz (ANSI C63.4-2014)										
	Test Artifact:	CG118			Detector:	Peak		3m H Pol		
Summary Statistics	Frequencies (GHz)									
	1.25	2.75	4.25	6.00	8.00	10.50	13.25	16.00	17.25	18.00
X*	57.26	55.84	66.28	66.98	60.33	58.26	57.60	53.91	54.41	54.89
S*	5.767	3.544	2.504	3.211	3.130	3.690	5.162	5.805	7.181	6.200
0.3S*	1.730	1.063	0.751	0.963	0.939	1.107	1.549	1.742	2.154	1.860
p	25	25	25	25	25	25	25	25	25	25
U_p	5.18	5.18	5.18	5.18	5.48	5.48	5.48	5.48	5.48	5.48
u_x	1.442	0.886	0.626	0.803	0.783	0.923	1.291	1.451	1.795	1.550
UCL	63.88	61.91	72.09	72.96	66.59	64.67	64.37	60.84	61.68	61.92
LCL	50.64	49.78	60.48	61.00	54.06	51.86	50.83	46.98	47.13	47.86

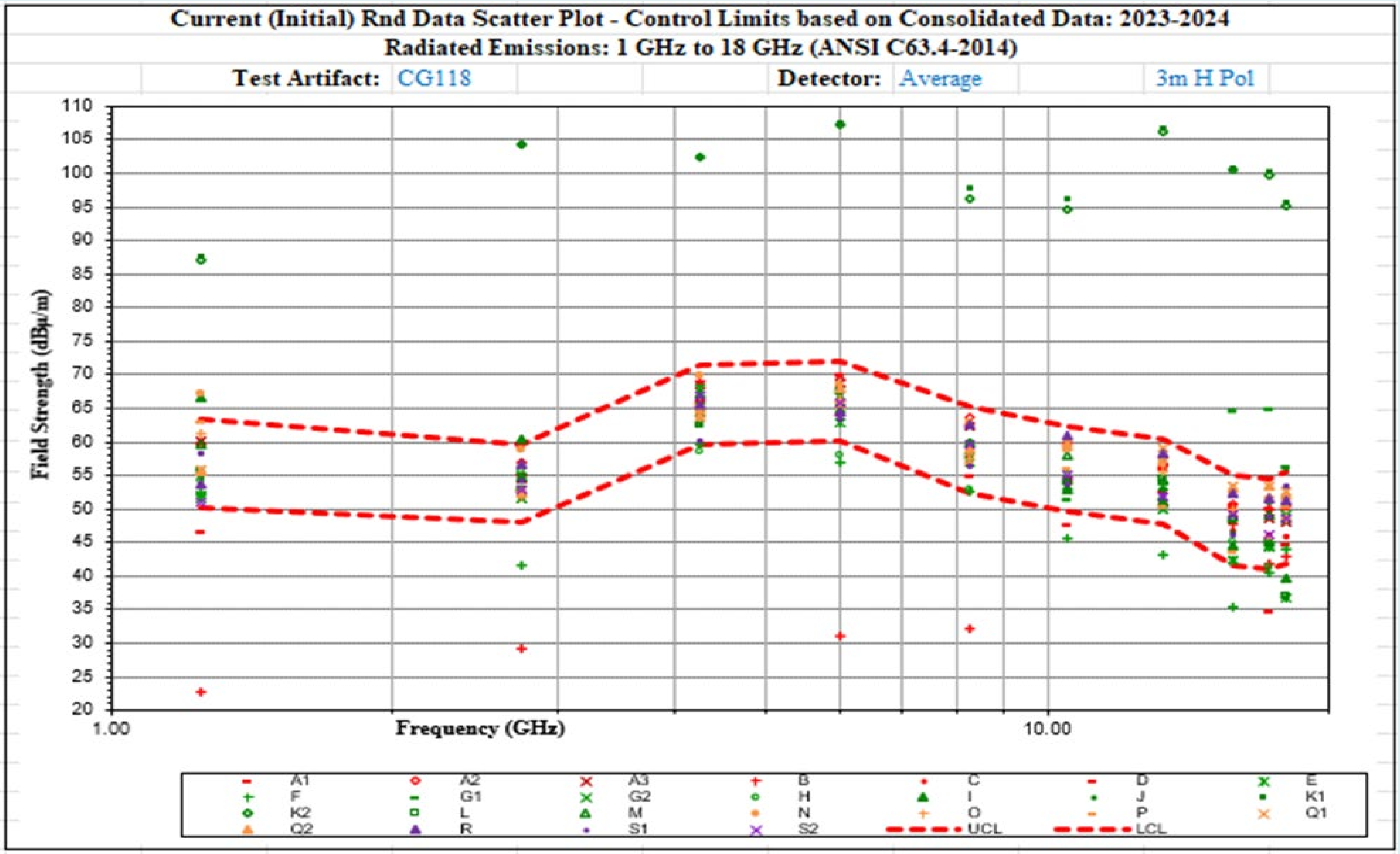
X* =	Robust Average	UCL =	Upper Control Limit	U_p: $U_{CISPR(k=2)}$ =	5.18 dB (1 - 6 GHz)
S*=	Robust Std Deviation	LCL =	Lower Control Limit	U_p: $U_{CISPR(k=2)}$ =	5.48 dB (7 -18 GHz)
p =	No. of Valid Participants	u_x=	1.25 (S*/√p)	Control Limits =	X* ± [U_p + u_x]



Initial Round PT Results (dB Units)
Radiated Emissions (3 m H Pol, Average, 1 GHz to 18 GHz)

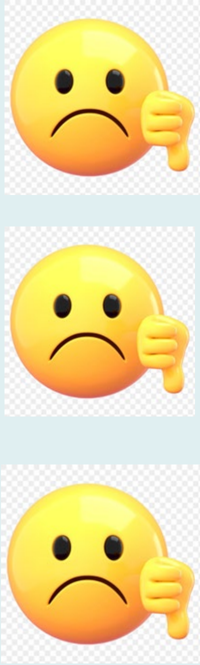


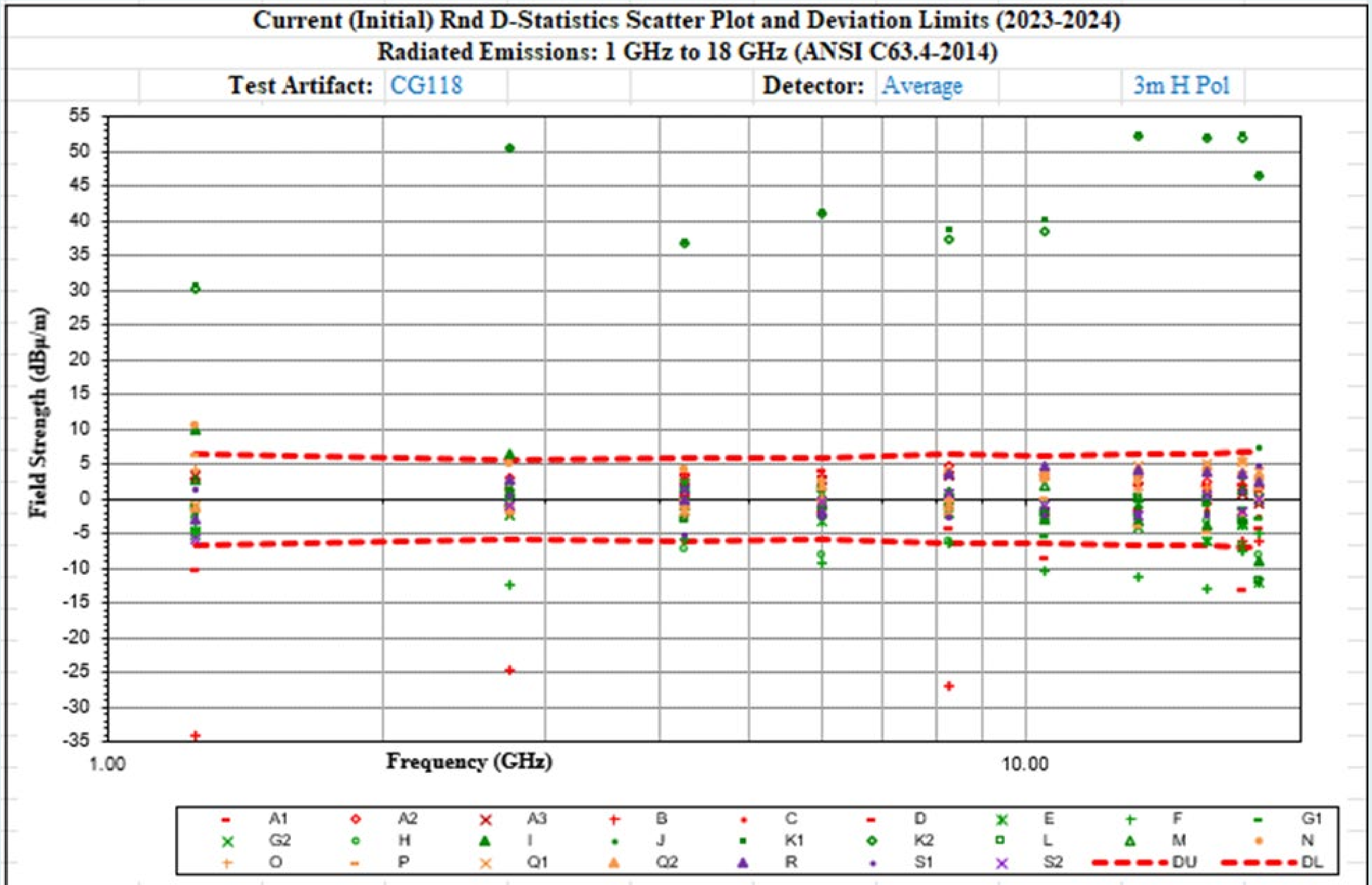




Participants: 25 Overall failure rate (%): 44.00 Acrossboard failure rate (%): 6.25

Initial Round PT Results (D-Statistics)
Radiated Emissions (3 m H Pol, Average, 1 GHz to 18 GHz)





Initial Round PT Results (Performance Eval Statistics)
Radiated Emissions (3 m H Pol, Average, 1 GHz to 18 GHz)

Current (Initial) Rnd Performance Evaluation Statistic/Parameterss derived from Consolidated data: 2023-2024

Radiated Emissions: 1 GHz to 18 GHz (ANSI C63.4-2014)

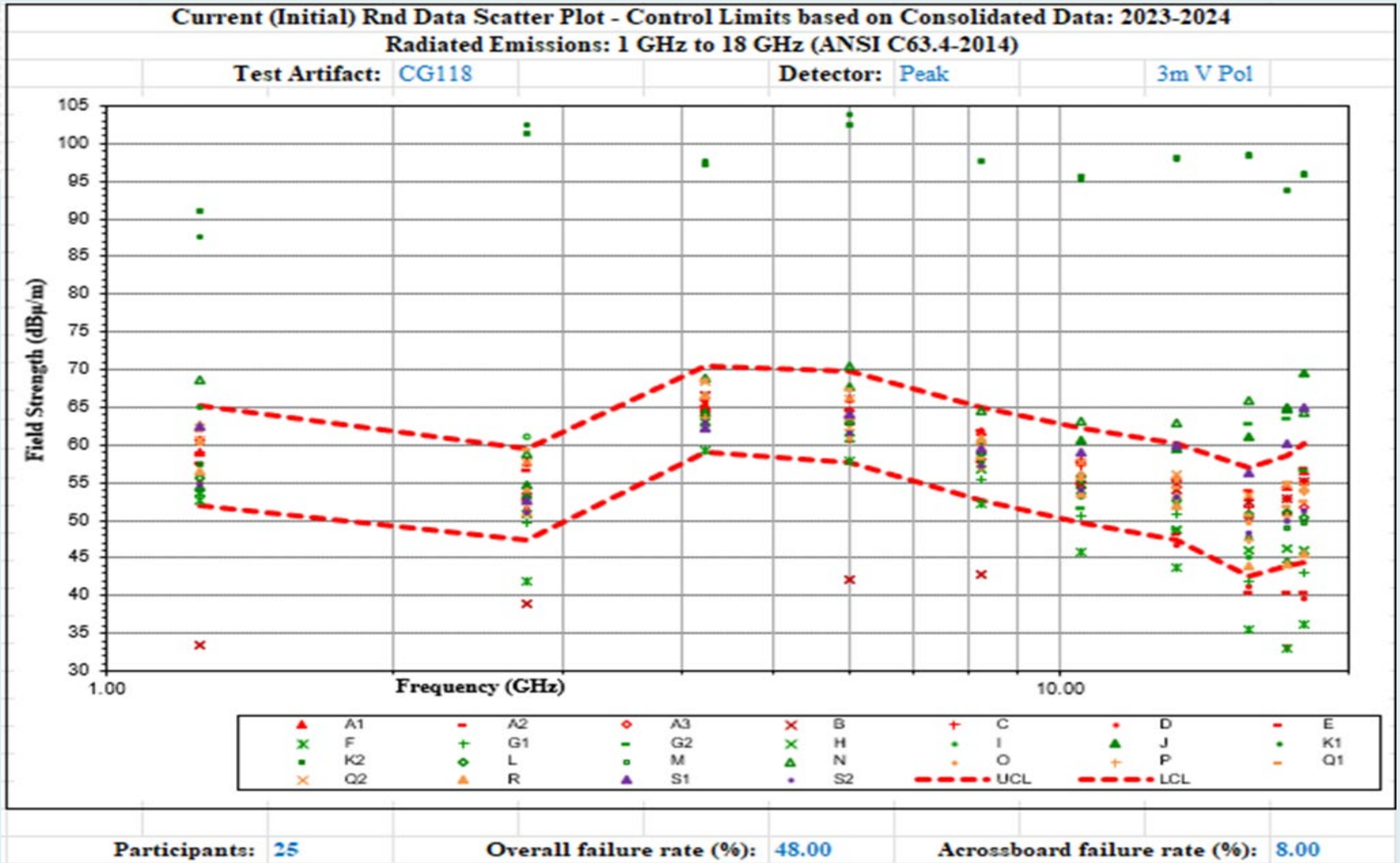
Test Artifact: CG118 | **Detector:** Average | 3m H Pol

Summary Statistics	Frequencies (GHz)									
	1.25	2.75	4.25	6.00	8.25	10.50	13.25	15.75	17.25	18.00
X*	56.75	53.70	65.50	66.04	58.88	55.94	54.09	48.34	47.86	48.72
S*	6.048	2.463	2.874	2.767	3.844	3.426	3.885	4.745	5.049	5.128
0.3S*	1.814	0.739	0.862	0.830	1.153	1.028	1.165	1.423	1.515	1.538
p	25	25	25	25	25	25	25	25	25	25
U_p	5.18	5.18	5.18	5.18	5.48	5.48	5.48	5.48	5.48	5.48
u_x	1.512	0.616	0.718	0.692	0.961	0.856	0.971	1.186	1.262	1.282
UCL	63.44	59.50	71.40	71.91	65.32	62.28	60.54	55.00	54.60	55.48
LCL	50.06	47.91	59.60	60.16	52.44	49.61	47.64	41.67	41.12	41.96

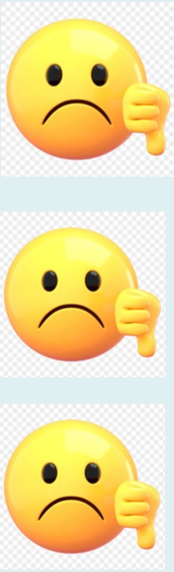
X* =	Robust Average	UCL =	Upper Control Limit	U_p: $U_{CISPR(k=2)}$ =	5.18 dB (1 - 6 GHz)
S*=	Robust Std Deviation	LCL =	Lower Control Limit	U_p: $U_{CISPR(k=2)}$ =	5.48 dB (7 -18 GHz)
p =	No. of Valid Participants	u_x=	1.25 (S*/√p)	Control Limits =	X* ± [U_p + u_x]

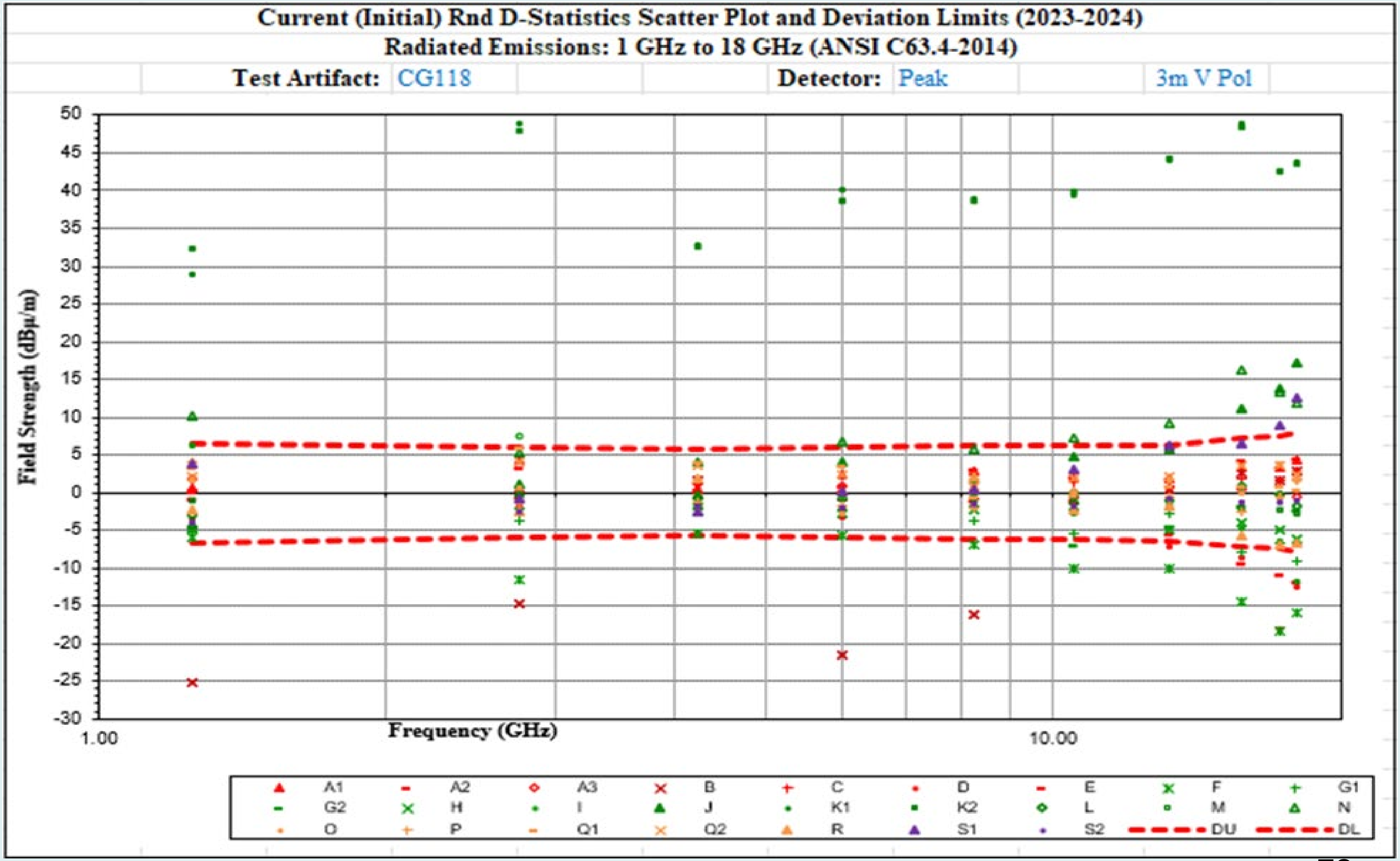


Initial Round PT Results (dB Units)
Radiated Emissions (3 m V Pol, Peak, 1 GHz to 18 GHz)



Initial Round PT Results (D-Statistics)
Radiated Emissions (3 m V Pol, Peak, 1 GHz to 18 GHz)





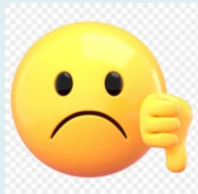
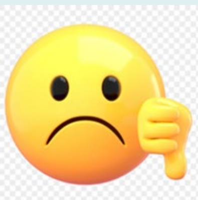
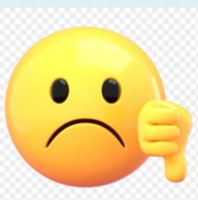
Initial Round PT Results (Performance Eval Statistics)
Radiated Emissions (3 m V Pol, Peak, 1 GHz to 18 GHz)

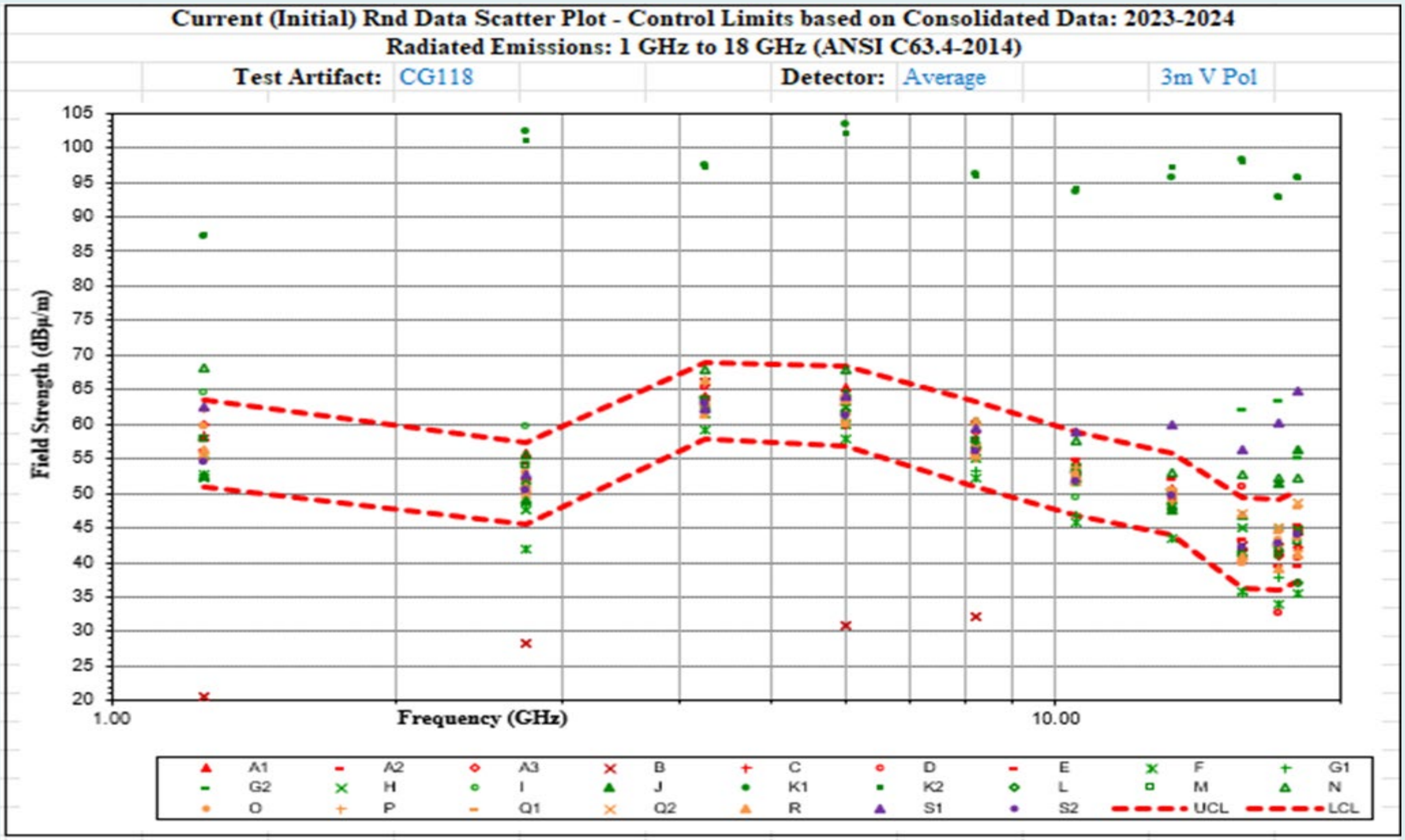
Current (Initial) Rnd Performance Evaluation Statistic/Parameterss derived from Consolidated data: 2023-2024										
Radiated Emissions: 1 GHz to 18 GHz (ANSI C63.4-2014)										
	Test Artifact:	CG118			Detector:	Peak		3m V Pol		
Summary Statistics	Frequencies (GHz)									
	1.25	2.75	4.25	6.00	8.25	10.50	13.25	15.75	17.25	18.00
X*	58.61	53.48	64.77	63.76	58.92	55.90	53.78	49.81	51.23	52.31
S*	5.592	3.540	2.407	3.475	2.762	3.067	3.482	6.845	7.582	9.899
0.3S*	1.677	1.062	0.722	1.042	0.829	0.920	1.045	2.053	2.275	2.970
p	25	25	25	25	25	25	25	25	25	25
U_p	5.18	5.18	5.18	5.18	5.48	5.48	5.48	5.48	5.48	5.48
u_x	1.398	0.885	0.602	0.869	0.691	0.767	0.871	1.711	1.896	2.475
UCL	65.19	59.54	70.55	69.80	65.09	62.15	60.13	57.00	58.60	60.27
LCL	52.04	47.42	58.99	57.71	52.75	49.66	47.43	42.62	43.85	44.36

X* =	Robust Average	UCL =	Upper Control Limit	U_p: $U_{CISPR(k=2)}$ =	5.18 dB (1 - 6 GHz)
S*=	Robust Std Deviation	LCL =	Lower Control Limit	U_p: $U_{CISPR(k=2)}$ =	5.48 dB (7 -18 GHz)
p =	No. of Valid Participants	u_x=	$1.25\ (S^*/\sqrt{p})$	Control Limits =	$X^* \pm [U_p + u_x]$



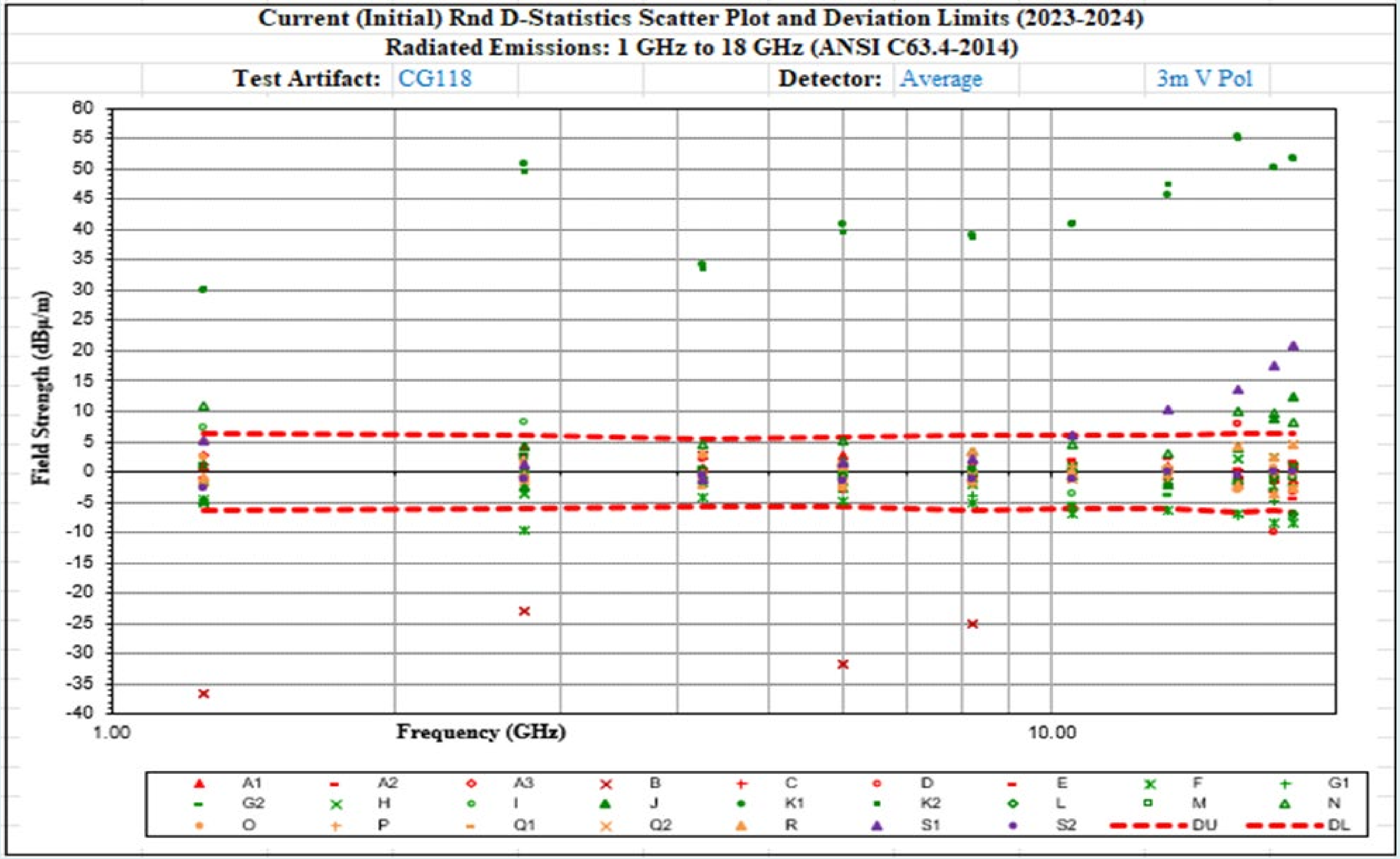
Initial Round PT Results (dB Units)
Radiated Emissions (3 m V Pol, Average, 1 GHz to 18 GHz)



Participants: 25 **Overall failure rate (%):** 48.00 **Acrossboard failure rate (%):** 8.00

Initial Round PT Results (D-Statistics)
Radiated Emissions (3 m V Pol, Average, 1 GHz to 18 GHz)



Initial Round PT Results (Performance Eval Statistics)
Radiated Emissions (3 m V Pol, Average, 1 GHz to 18 GHz)

Current (Initial) Rnd Performance Evaluation Statistic/Parameterss derived from Consolidated data: 2023-2024

Radiated Emissions: 1 GHz to 18 GHz (ANSI C63.4-2014)

Test Artifact: CG118 **Detector:** Average 3m V Pol

Summary Statistics	Frequencies (GHz)									
	1.25	2.75	4.25	6.00	8.25	10.50	13.25	15.75	17.25	18.00
X*	57.19	51.44	63.35	62.58	57.16	52.87	49.81	42.83	42.60	43.88
S*	4.658	3.140	1.631	2.640	2.868	1.844	1.791	4.095	3.927	4.066
0.3S*	1.397	0.942	0.489	0.792	0.860	0.553	0.537	1.228	1.178	1.220
p	25	25	25	25	25	25	25	25	25	25
U_p	5.18	5.18	5.18	5.18	5.48	5.48	5.48	5.48	5.48	5.48
u_x	1.165	0.785	0.408	0.660	0.717	0.461	0.448	1.024	0.982	1.016
UCL	63.54	57.40	68.94	68.42	63.35	58.81	55.74	49.33	49.06	50.38
LCL	50.85	45.47	57.76	56.74	50.96	46.93	43.88	36.32	36.14	37.38

X* = Robust Average	UCL = Upper Control Limit	U_p: $U_{CISPR(4-2)}$ =	5.18 dB (1 - 6 GHz)
S*= Robust Std Deviation	LCL = Lower Control Limit	U_p: $U_{CISPR(4-2)}$ =	5.48 dB (7 -18 GHz)
p = No. of Valid Participants	u_x= 1.25 (S*/√p)	Control Limits =	$X^* \pm [U_p + u_x]$



Consolidated Results (5th – 8th Rounds – Old PT Scheme): Direct Antenna Conducted Failure Rate Summary: 1 GHz - 18 GHz

Direct Antenna Conducted Emissions (1 - 18 GHz, Peak)	
# participants	55
Overall Failure Rate (%)	7.27
Across-the-Board Failure Rate (%)	3.64

Direct Antenna Conducted Emissions (1 - 18 GHz, Average)	
# participants	55
Overall Failure Rate (%)	9.09
Across-the-Board Failure Rate (%)	3.64

Initial Round Results (New PT Scheme): Direct Antenna Conducted Failure Rate Summary: 1 GHz - 18 GHz

Direct Antenna Conducted Emissions (1 - 18 GHz, Peak)	
# participants	14
Overall Failure Rate (%)	7.14
Across-the-Board Failure Rate (%)	7.14

Direct Antenna Conducted Emissions (1 - 18 GHz, Average)	
# participants	14
Overall Failure Rate (%)	14.29
Across-the-Board Failure Rate (%)	7.14

→ Possibly worse over time?

Consolidated Results (5th – 8th Rounds – Old PT Scheme):
3m H Pol Radiated Emissions Failure Rate Summary: 1 GHz - 18 GHz

Radiated Emissions (1 - 18 GHz) (3 m H Pol, Peak)	
# participants	55
Overall Failure Rate (%)	34.55
Across-the-Board Failure Rate (%)	1.82

Radiated Emissions (1 - 18 GHz) (3 m H Pol, Average)	
# participants	55
Overall Failure Rate (%)	38.18
Across-the-Board Failure Rate (%)	1.82

Initial Round Results (New PT Scheme):
3m H Pol Radiated Emissions Failure Rate Summary: 1 GHz - 18 GHz

Radiated Emissions (1 - 18 GHz) (3 m H Pol, Peak)	
# participants	25
Overall Failure Rate (%)	48.00
Across-the-Board Failure Rate (%)	8.00

Radiated Emissions (1 - 18 GHz) (3 m H Pol, Average)	
# participants	25
Overall Failure Rate (%)	44.00
Across-the-Board Failure Rate (%)	6.25

➔ Definitely worse over time

Consolidated Results (5th – 8th Rounds – Old PT Scheme):
3m V Pol Radiated Emissions Failure Rate Summary: 1 GHz - 18 GHz

Radiated Emissions (1 - 18 GHz) (3 m V Pol, Peak)	
# participants	55
Overall Failure Rate (%)	34.55
Across-the-Board Failure Rate (%)	0.00

Radiated Emissions (1 - 18 GHz) (3 m V Pol, Average)	
# participants	55
Overall Failure Rate (%)	38.18
Across-the-Board Failure Rate (%)	0.00

Initial Round Results (New PT Scheme):
3m V Pol Radiated Emissions Failure Rate Summary: 1 GHz - 18 GHz

Radiated Emissions (1 - 18 GHz) (3 m V Pol, Peak)	
# participants	25
Overall Failure Rate (%)	48.00
Across-the-Board Failure Rate (%)	8.00

Radiated Emissions (1 - 18 GHz) (3 m V Pol, Average)	
# participants	25
Overall Failure Rate (%)	48.00
Across-the-Board Failure Rate (%)	8.00

➔ Definitely worse over time

FINAL OBSERVATIONS AND CONCLUSIONS

Based on the EMC Proficiency Testing Results presented herein, it is clear that a large percentage of Test Laboratories still have very serious problems with making correct measurements. Specifically:

- **There is abundant objective evidence that many Test Labs are unable to verify the correctness of their end-to-end measurement chains.**
- **There is abundant objective evidence that a very considerable number of Test Labs exhibit severe and consistent bias errors in their measurements.**
- **There is abundant objective evidence that a very significant number of Test Labs have test processes that are out-of-control.**
  - **Below 1 GHz, most of the Test Labs whose processes were "out-of-control" were measuring "cold" [i.e., were likely to make Type II (False Pass) Errors].**
  - **Above 1 GHz, Test Labs whose processes were "out-of-control" were about equally likely to measure "hot" [i.e., were likely to make Type I (False Fail) Errors] as they were to measure "cold" [i.e., were likely to make Type II (False Pass) Errors].**
- **There is some objective evidence that the skill – levels at many test Labs are worse now then the were prior to the COVID-19 Pandemic.**

Any

Any Questions?

Contact Harry H. Hodes
ACE-PT Inc. PT Program Technical Manager
by telephone at :

1-360-303-4096

or by e-mail at:

hhhodes@yahoo.com