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Test report

FCC 15B -ICES 003 ESTeem 217ES

Date of issue: December 27, 2016

Applicant:

Electronic Systems Technology, Inc.

Product:

Wireless Modem (902-928 MHz)

Model

Edge 900MHz 217ES

Specifications:

- FCC 47 CFR Part 15, Subpart B – Verification
- ICES-003 Issue 6 January 2016

Lab and test locations

Company name	Nemko USA, Inc.
Address	2210 Faraday Ave, Suite 150
City	Carlsbad
Province	California
Postal code	92008
Country	USA
Telephone	+1 760 444 3500
Website	www.nemko.com
Site number	FCC: US5058; IC: 2040B
Company name	Nemko USA, Inc.
Website	www.nemko.com

Tested by	Feng You, Sr. Wireless Engineer
Reviewed by	Jim Morris, EMC & Wireless Divisions Manager
Review date	January 5, 2017
Reviewer signature	James E Morris

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15, Subpart B – Verification	Title 47: Telecommunication; Part 15—Radio Frequency Devices
ICES-003 Issue 6 January 2016	Information Technology Equipment (ITE) – Limits and methods of measurement

1.2 Exclusions

None.

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.2 above. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.4 Test report revision history

Table 1.4-1: *Test report revision history*

Revision #	Details of changes made to test report
1	Original report issued

Notes: None

Section 2 Summary of test results

2.1 International test results

2.2 North America test results

Table 2.2-1: *FCC 47 CFR Part 15, Subpart B and ICES-003 Issue 6 results*

Test description	Verdict
Radiated disturbance [1]	Pass
Conducted disturbance at mains port [1]	Pass [2]

Notes: [1] Product classification B
[2] AC Powered through PoE

Section 3 Equipment under test (EUT) details

3.1 Applicant

Company name	Electronic Systems Technology, Inc.
Address	415 N. Quay Street, Bldg. B-1
City	Kennewick
Province/State	WA
Postal/Zip code	99336
Country	U.S.A.

3.2 Manufacturer

Company name	Electronic Systems Technology, Inc.
Address	415 N. Quay Street, Bldg. B-1
City	Kennewick
Province/State	WA
Postal/Zip code	99336
Country	U.S.A.

3.3 Sample information

Receipt date	December 19, 2016
Nemko sample ID number	320137-1

3.4 EUT information

Product name	Wireless Modem (902-928 MHz)
Model	Edge 900 217ES
Serial number	D-25120
Part number	Edge 900MHz
Power requirements	AC power Supply through PoE, 100-250V 50-60Hz to 48V DC PoE
Description/theory of operation	EUT is 900MHz DTS wireless modem.
Operational frequencies	Highest 928MHz receiver.
Software details	N/A

3.5 EUT exercise and monitoring details

EUT is powered on in idle mode.

3.6 EUT setup details

Table 3.6-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number	Rev.
EUT	ESTeem	Edge 900MHz / 217ES	D-25120	N/A
PoE Supply	SL Power Electronics	PW183RB4800F01	N/A	N/A
	ESTEEM	7ft AA09.2	N/A	N/A
Yagi Antenna	Astron Wireless 918-3	AA203Es	N/A	N/A

Table 3.6-2: *EUT interface ports*

Description	Qty.
R-TNC Antenna Connector	1
RJ-45 Ethernet/PoE	1
RJ-45 (RS-232 DATA)	1

Table 3.6-3: *Support equipment*

Table 3.6-4: *Inter-connection cables*

Cable description	From	To	Length (m)
Ethernet Cable	EUT	PoE Adaptor	2.1

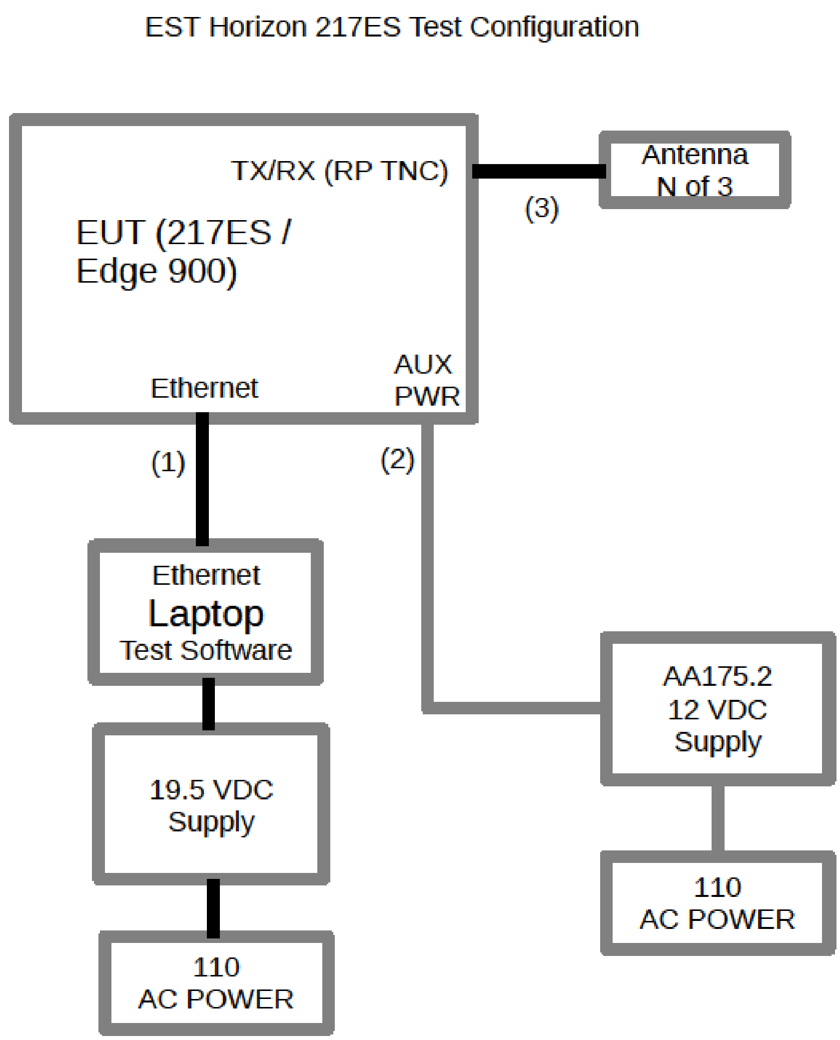


Figure 3.6-1: *Setup diagram*

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.
120V 60Hz AC

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Nemko USA Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 “Uncertainty in EMC measurements.” Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Section 7 Terms and definitions

7.1 Product classifications definitions

7.1.1 Title 47: Telecommunication – Part 15-Radio Frequency devices, Subpart A – General

Class A digital device	A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.
Class B digital device	A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public. Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

7.1.2 ICES-003

Class B ITE	limits of radio noise for ITE for residential operation
Class A ITE	limits of radio noise for ITE for non-residential operation
Conditions	Only ITE intended strictly for non-residential use in commercial, industrial or business environments, and whose design or other characteristics strongly preclude the possibility of its use in a residential environment, shall be permitted to comply with the less stringent Class A limits. All ITE that cannot meet the conditions for Class A operation shall comply with the Class B limits. The ITE shall comply with both the power line – conducted and the radiated emissions limits within the same Class, with no intermixing.

7.2 General definitions

7.2.1 Title 47: Telecommunication – Part 15-Radio Frequency devices, Subpart A – General

Digital device (Previously defined as a computing device)	An unintentional radiator (device or system) that generates and uses timing signals or pulses at a rate in excess of 9,000 pulses (cycles) per second and uses digital techniques; inclusive of telephone equipment that uses digital techniques or any device or system that generates and uses radio frequency energy for the purpose of performing data processing functions, such as electronic computations, operations, transformations, recording, filing, sorting, storage, retrieval, or transfer. A radio frequency device that is specifically subject to an emanation requirement in any other FCC Rule part or an intentional radiator subject to subpart C of this part that contains a digital device is not subject to the standards for digital devices, provided the digital device is used only to enable operation of the radio frequency device and the digital device does not control additional functions or capabilities. Note: Computer terminals and peripherals that are intended to be connected to a computer are digital devices.

7.2.2 ICES-003

Information technology equipment (ITE)	Information Technology Equipment (ITE) is defined as devices or systems that use digital techniques for purposes such as data processing and computation. ITE is any unintentional radiator (device or system) that generates and/or uses timing signals or pulses having a rate of at least 9 kHz and employs digital techniques for purposes such as computation, display, data processing and storage, and control.

Section 8 Testing data

8.1 Radiated disturbance

8.1.1 References

ANSI C63.4-2014

8.1.2 Test summary

Verdict	Pass		
Test date	December 22, 2016	Temperature	21 °C
Test engineer	Feng You, Sr. Wireless Engineer	Air pressure	1001 mbar
Test location	10m semi anechoic chamber	Relative humidity	58 %

8.1.3 Notes

None

8.1.4 Setup details

EUT setup configuration	Table top
Test facility	10 m Semi anechoic chamber
Measuring distance	3 m
Antenna height variation	1–4 m
Turn table position	0–360°
Measurement details	A preview measurement was generated with receiver in continuous scan or sweep mode while the EUT was rotated and antenna adjusted to maximize radiated emission. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/spectrum analyzer settings for frequencies below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	– Peak (Preview measurement) – Quasi-peak (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 1000 ms (Quasi-peak final measurement)

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (Preview measurement) Peak and Average (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 1000 ms (Peak and Average final measurement)

8.1.4 Setup details, continued

Table 8.1-1: *Radiated disturbance equipment list*

Asset Tag	Description	Manufacturer	Model	Serial #	Next Cal
529	Antenna, DRWG	EMCO	3115	2505	01-Feb-2017
815	Multimeter	Fluke	111	78130066	02-Feb-2017
E1035	Variac (Variable Transformer) 3KVA	Shanghai China	TDGC	N/A	VOU
1480	Antenna, Bilog	Schaffner-Chase	CBL6111C	2572	21-Jul-2017
E1120	Signal and Spectrum Analyzer	Rohde & Schwarz	FSV40	101395	25-May-2017
E1121	EMI Test Receiver	Rohde & Schwarz	ESU 40	100064	28-Apr-2017

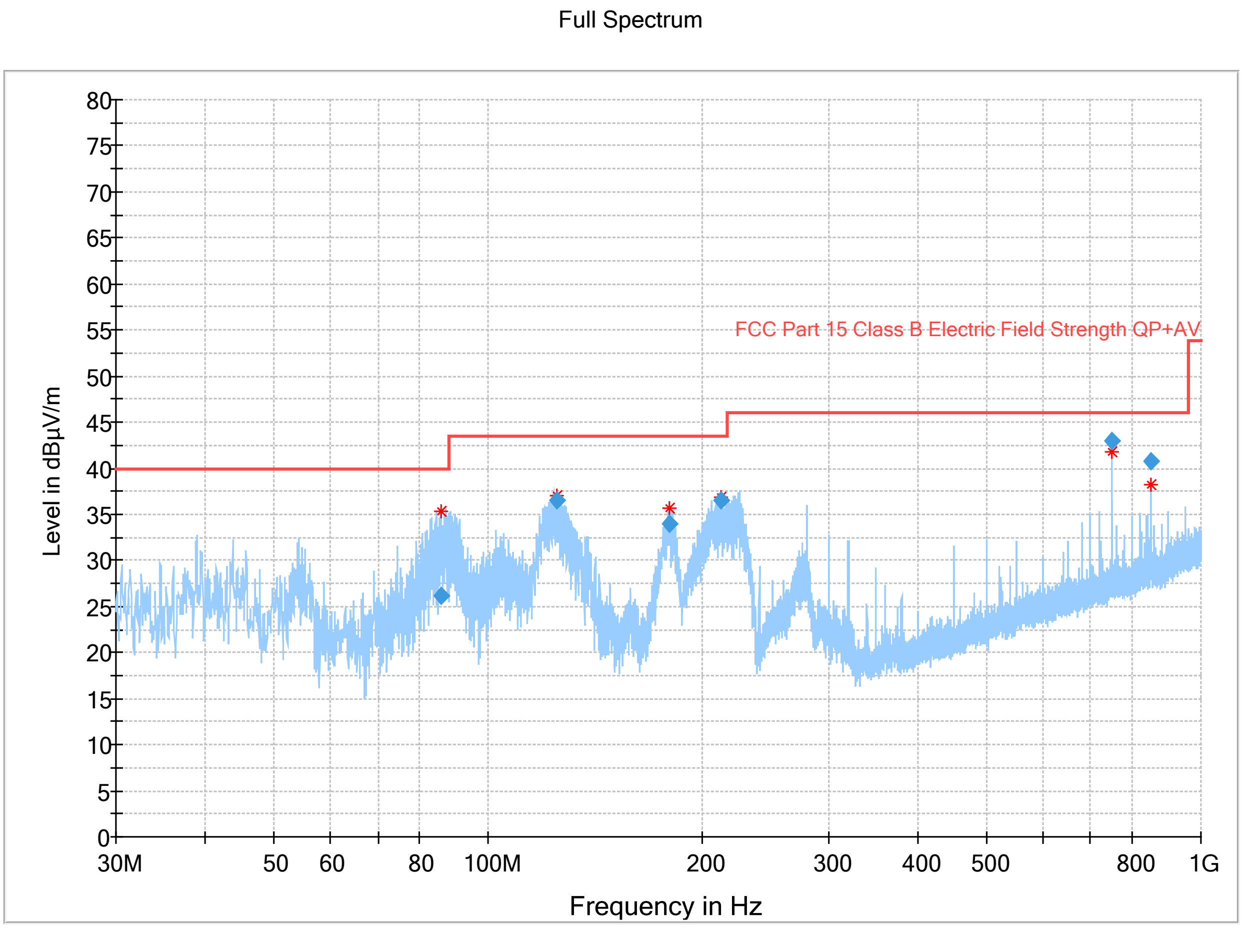
Notes: VOU - verify on use

Table 8.1-2: *Radiated disturbance test software details*

Manufacturer of Software	Details
R&S	EMC32 V10.00.00

Notes: None

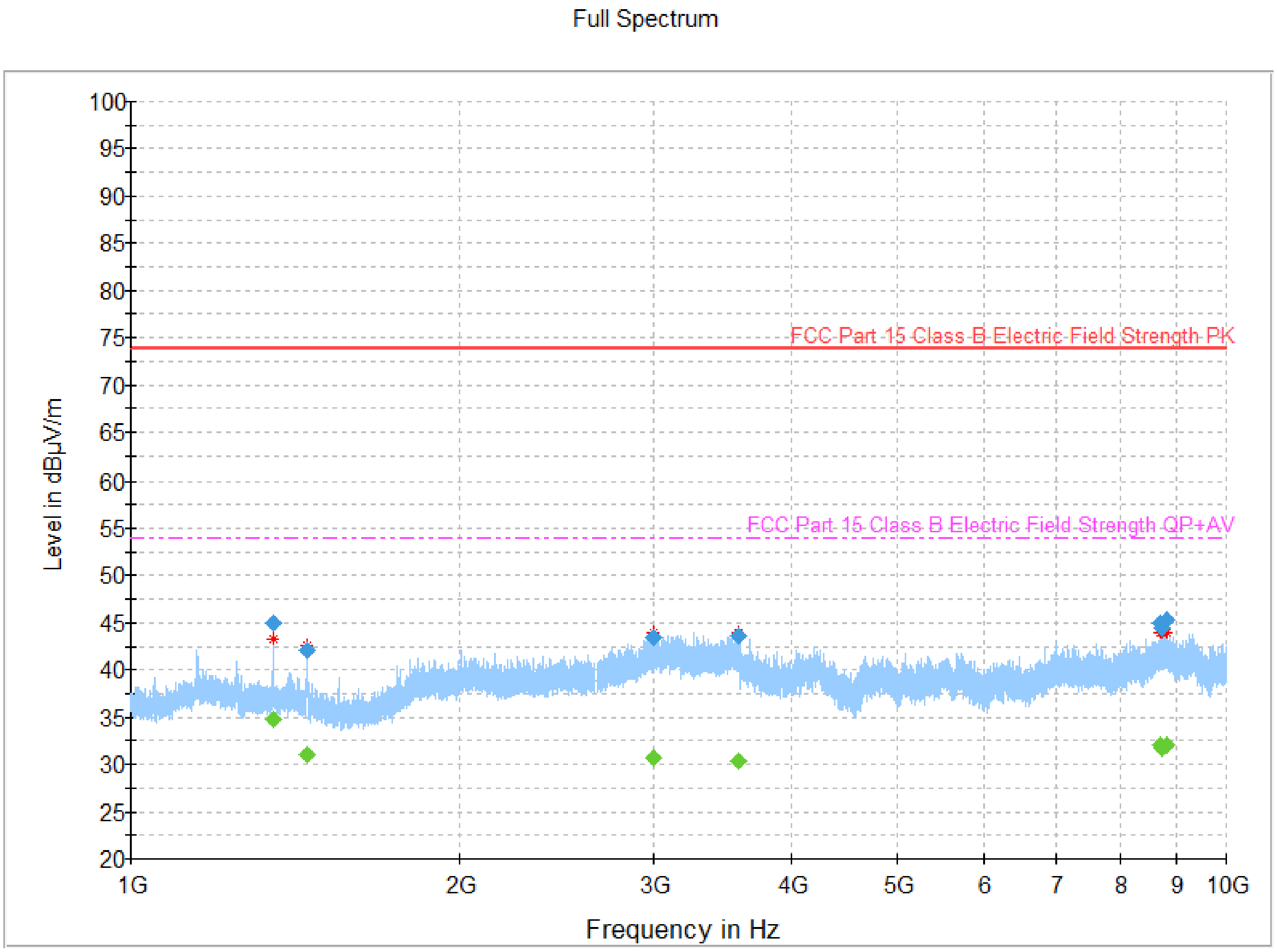
8.1.5 Test data



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-1: *Radiated disturbance spectral plot (30 to 1000 MHz)*

8.1.5 Test data, continued



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-2: *Radiated disturbance spectral plot (1 to 10X GHz)*

8.1.5 Test data, continued

Table 8.1-3: *Radiated disturbance (Quasi-Peak) results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
85.678000	26.10	40.00	13.90	5000.0	120.000	109.2	V	302.0
124.518000	36.44	43.50	7.06	5000.0	120.000	99.0	V	340.0
179.730500	33.96	43.50	9.54	5000.0	120.000	103.6	V	169.0
212.334500	36.59	43.50	6.91	5000.0	120.000	99.0	V	154.0
750.039500	42.96	46.00	3.04	5000.0	120.000	105.4	H	220.0
850.038000	40.81	46.00	5.19	5000.0	120.000	103.2	H	20.0

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)

Table 8.1-4: *Radiated disturbance (Peak and Average) results*

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1349.846667	---	34.79	53.90	19.11	1000.0	1000.000	117.0	H	261.0
1349.846667	44.88	---	73.90	29.02	1000.0	1000.000	117.0	H	261.0
1450.066667	---	31.00	53.90	22.90	1000.0	1000.000	208.1	V	279.0
1450.066667	42.13	---	73.90	31.77	1000.0	1000.000	208.1	V	279.0
2991.166667	---	30.62	53.90	23.28	1000.0	1000.000	393.3	V	259.0
2991.166667	43.47	---	73.90	30.43	1000.0	1000.000	393.3	V	259.0
3582.426667	---	30.32	53.90	23.58	1000.0	1000.000	107.4	H	322.0
3582.426667	43.67	---	73.90	30.23	1000.0	1000.000	107.4	H	322.0
8710.360000	44.89	---	73.90	29.01	1000.0	1000.000	121.3	H	0.0
8710.360000	---	32.12	53.90	21.78	1000.0	1000.000	121.3	H	0.0
8748.706667	44.42	---	73.90	29.48	1000.0	1000.000	103.8	V	120.0
8748.706667	---	31.74	53.90	22.16	1000.0	1000.000	103.8	V	120.0
8835.880000	---	32.06	53.90	21.84	1000.0	1000.000	103.8	H	238.0
8835.880000	45.33	---	73.90	28.57	1000.0	1000.000	103.8	H	238.0

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)

8.1.6 Setup photos

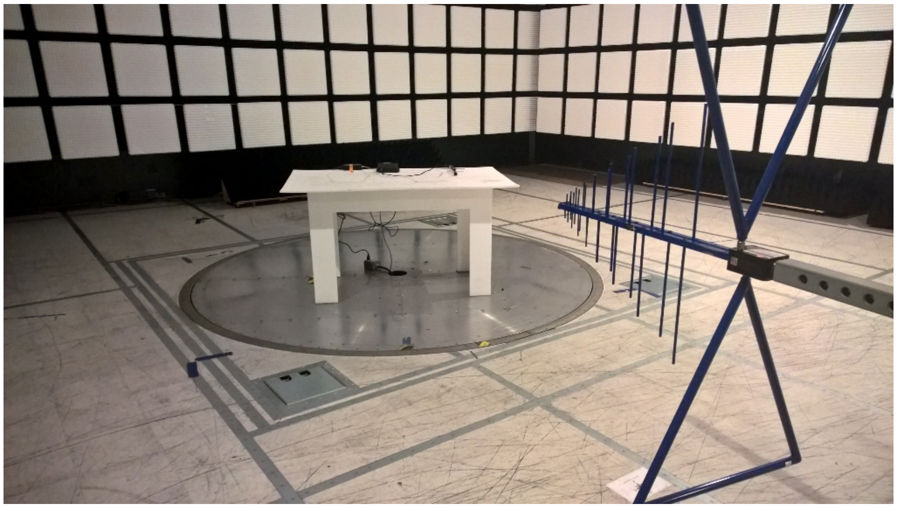


Figure 8.1-3: *Radiated disturbance setup photo, 30-1000MHz*

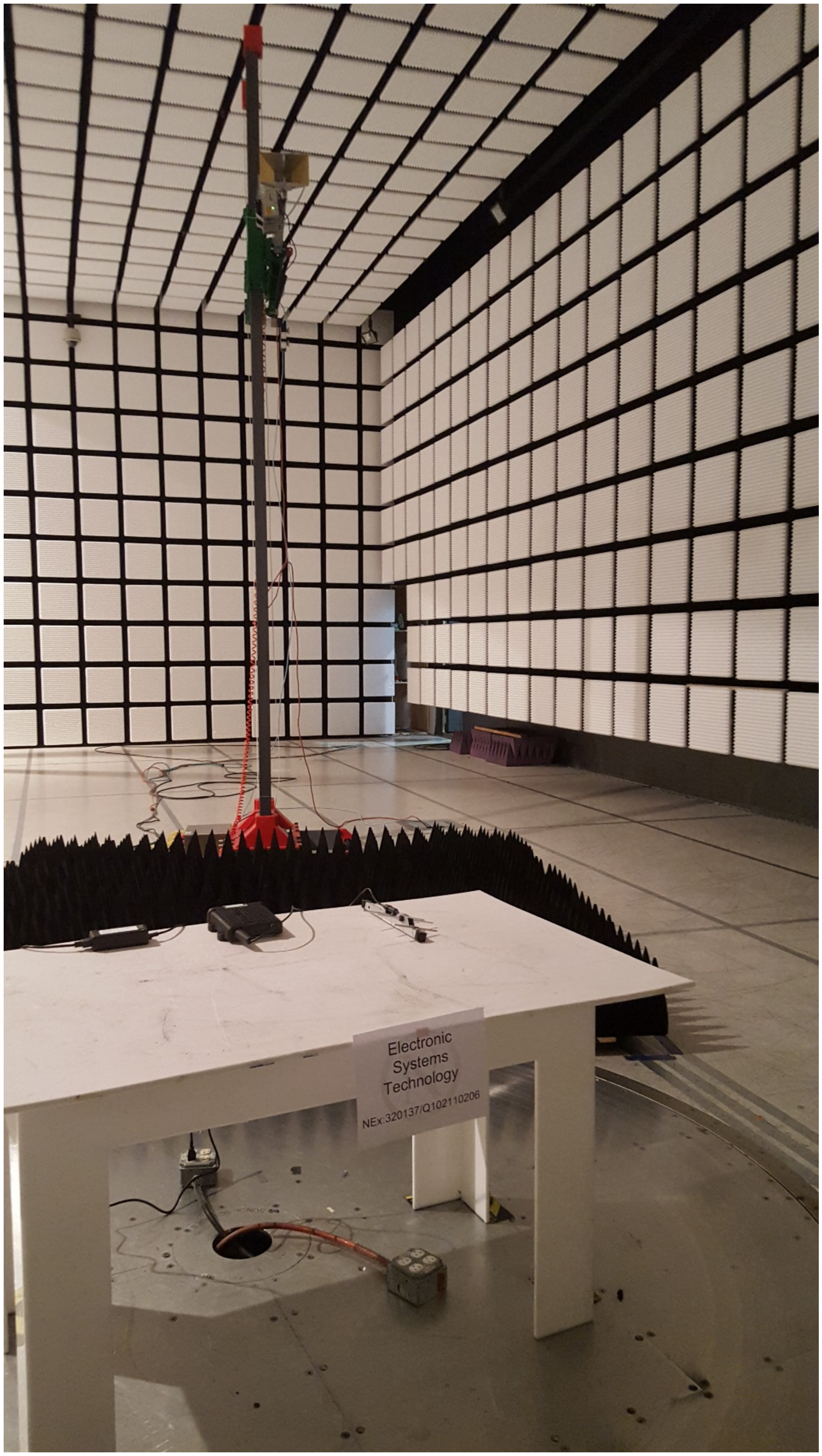


Figure 8.1-4: *Radiated disturbance setup photo, above 1GHz*

8.2 Conducted disturbance at mains port

8.2.1 References

CISPR 22 Edition 6.0 2008-09 and ANSI C63.4-2014

8.2.2 Test summary

Verdict	Pass		
Test date	December 21, 2016	Temperature	21 °C
Test engineer	Feng You, Sr. Wireless Engineer	Air pressure	1003 mbar
Test location	Ground Plane	Relative humidity	54 %

8.2.3 Notes

None

8.2.4 Setup details

Port under test	AC Main
EUT setup configuration	Table top
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	– Peak (Preview measurement) – Quasi-peak and Average (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 5000 ms (Quasi-peak final measurement) – 5000 ms (Average final measurement)

***Table 8.2-1:** Conducted disturbance at mains port equipment list*

Asset Tag	Description	Manufacturer	Model	Serial #	Next Cal
815	Multimeter	Fluke	111	78130066	02-Feb-2017
E1019	Two Line V-Network	Rohde & Schwarz	ENV216	101045	15-Jun-2017
E1026	EMI Test Receiver 9kHz to 7GHz	Rohde & Schwarz	ESCI 7	100800	17-Mar-2017

Notes: VOU - verify on use

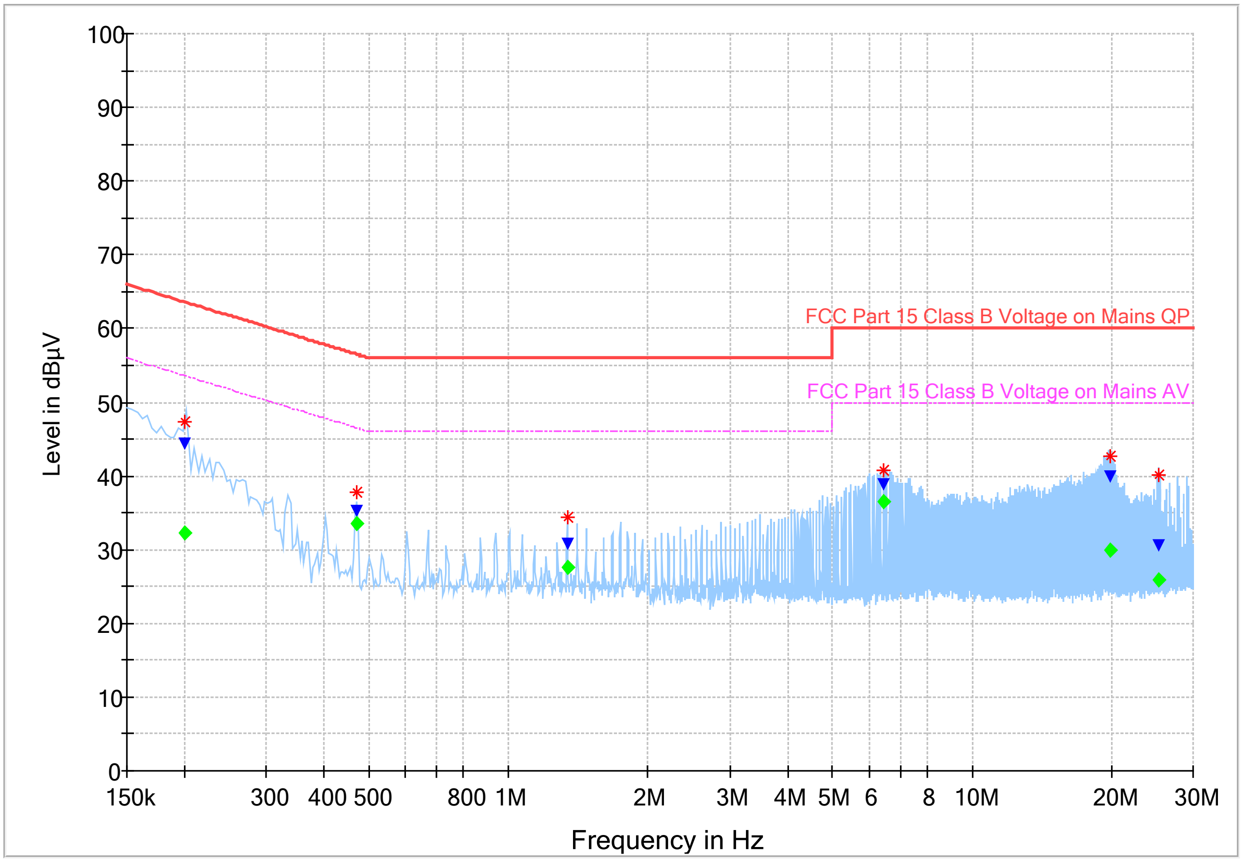
***Table 8.2-2:** Conducted disturbance at mains port test software details*

Manufacturer of Software	Details
R&S	EMC32 V10.00.00

Notes: None

8.2.5 Test data

Full Spectrum



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-1: *Conducted disturbance at mains port spectral plot (combination of neutral and line 1)*

8.2.5 Test data, continued

Table 8.2-3: *Conducted disturbance at mains port (Quasi-Peak and Average) results*

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.200500	44.47	---	63.59	19.12	5000.0	9.000	N	ON
0.200500	---	32.23	53.59	21.36	5000.0	9.000	N	ON
0.468500	35.22	---	56.54	21.32	5000.0	9.000	L1	ON
0.468500	---	33.50	46.54	13.05	5000.0	9.000	L1	ON
1.340500	30.84	---	56.00	25.16	5000.0	9.000	L1	ON
1.340500	---	27.56	46.00	18.44	5000.0	9.000	L1	ON
6.424500	38.90	---	60.00	21.10	5000.0	9.000	L1	ON
6.424500	---	36.54	50.00	13.46	5000.0	9.000	L1	ON
19.880500	---	29.95	50.00	20.05	5000.0	9.000	N	ON
19.880500	39.85	---	60.00	20.15	5000.0	9.000	N	ON
25.311500	---	25.84	50.00	24.16	5000.0	9.000	N	ON
25.311500	30.58	---	60.00	29.42	5000.0	9.000	N	ON

Notes: [1] Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

8.2.6 Setup photos

Figure 8.2-2: *Conducted disturbance at mains port setup photo*

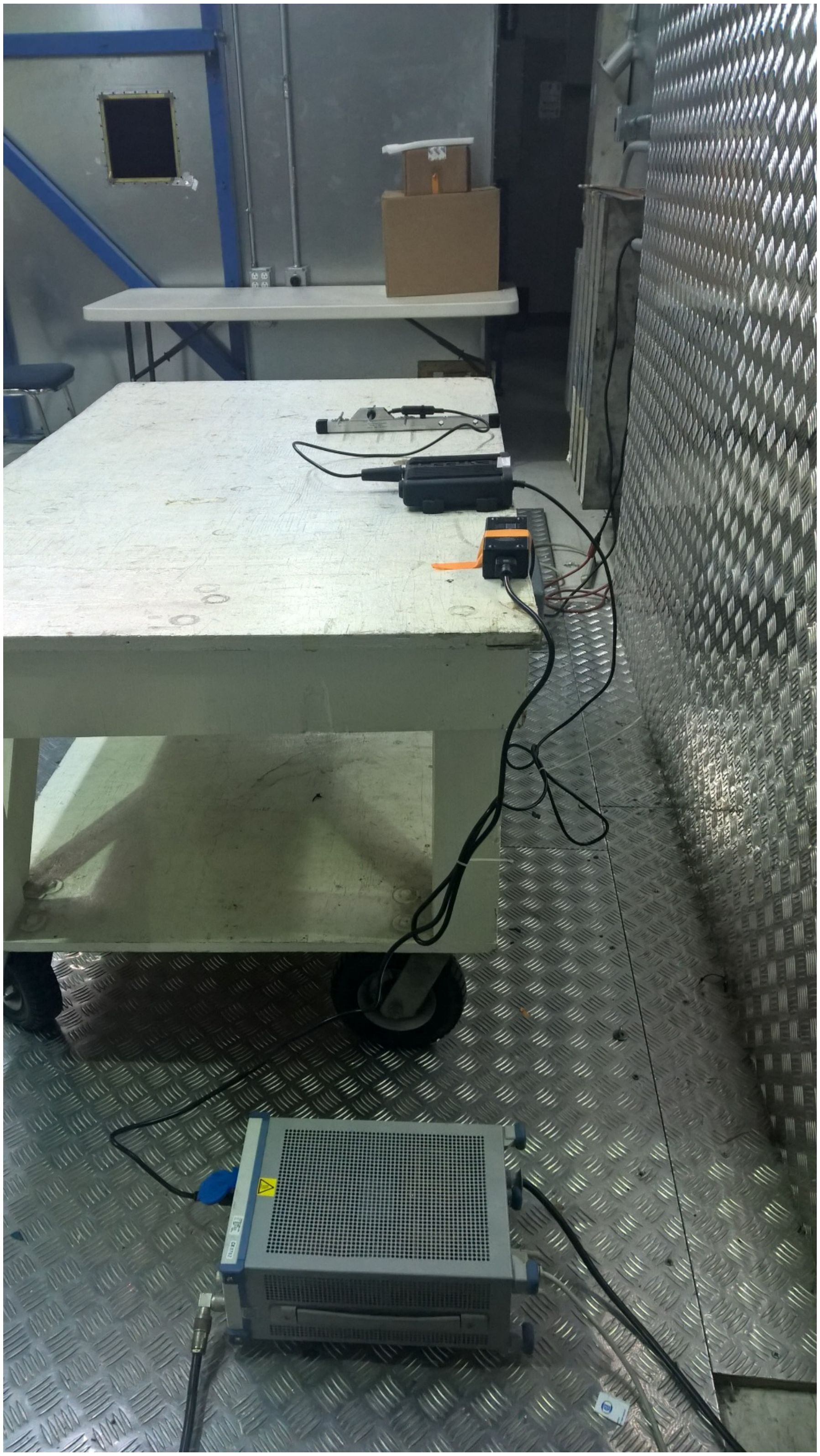


Figure 8.2-3: *Conducted disturbance at mains port setup photo*

Section 9 EUT photos

9.1 External photos

Figure 9.1-1: *Front view photo*

Figure 9.1-2: *Rear view photo*

Figure 9.1-3: *Side view photo*

Figure 9.1-4: *Bottom view photo*

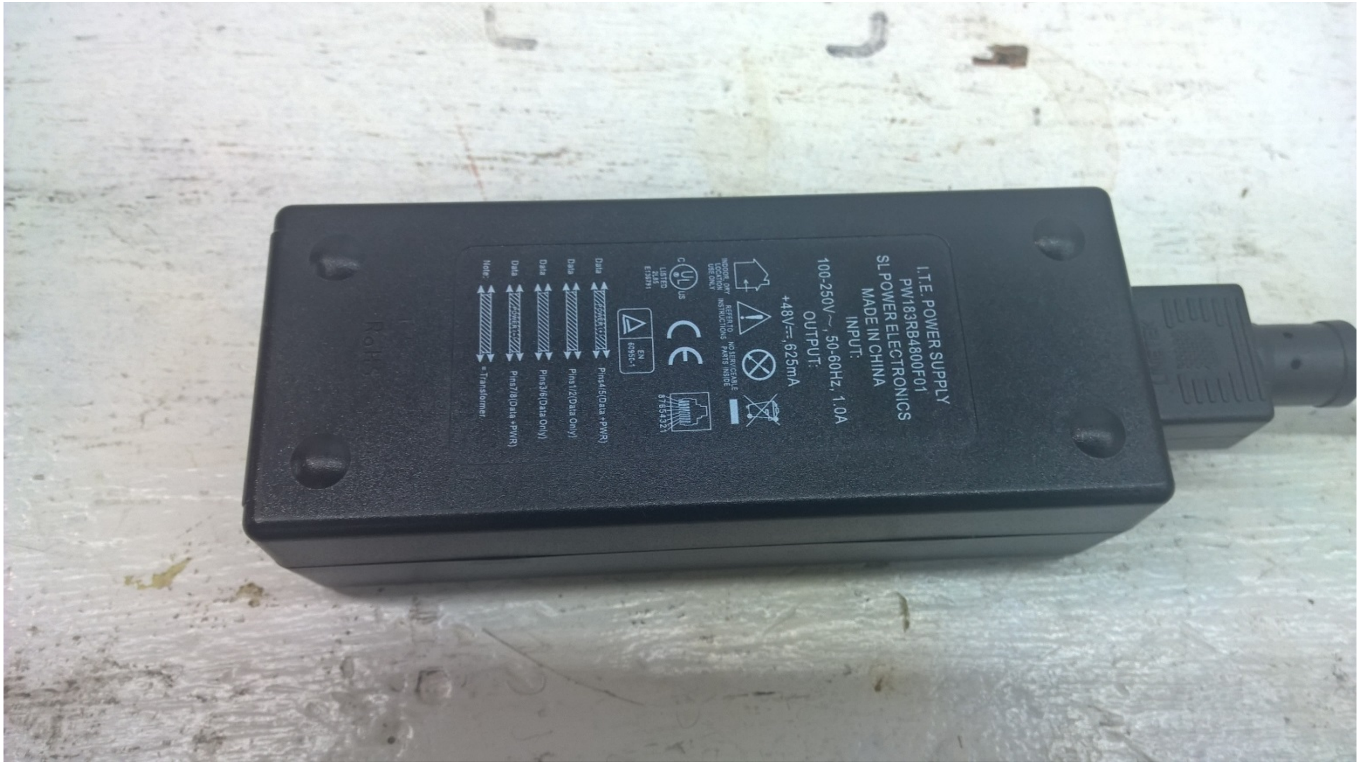


Figure 9.1-5: **Power Supply photo**