



FCC CFR 47 Part 15 Subpart C ISED RSS-216 Certification Test Report

For the

Product : Elements™ IC Obturation System
Model : Elements™ IC Single Charger
FCC ID : 2AQVD-9730612
ISED Cert. Number : IC: 24715-9730612
Applicant : META SYSTEMS CO., LTD.
FCC Rule : CFR 47 Part 15 Subpart C
ISED Rule : RSS-216 Issue 2

We hereby certify that the above product has been tested by us with the listed rules and found in compliance with the regulation. The test data and results are issued on the test report no. TR-W1901-023

Signature

A handwritten signature in black ink, appearing to read 'Choi, Yeong-min', is written over a horizontal line.

Choi, Yeong-min / Technical Manager

Date: 2019-01-29

Test Laboratory: ENG Co., Ltd.

It shall not be reproduced except in full, without the written approval of the ENG Co., Ltd. This document may be altered or revised by the ENG Co., Ltd. personnel only, and shall be noted in the revision section of the document. The test results in the report only apply to the tested sample.

Report No.: TR-W1901-023



ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942

Report Form_01 (Rev.0)

FCC/ISED CERTIFICATION TEST REPORT

Project Number : EA1807C-145
Test Report Number : TR-W1901-023
Type of Equipment : Elements™ IC Obturation System
Model Name : Elements™ IC Single Charger
FCC ID : 2AQVD-9730612
ISED Cert. Number : IC: 24715-9730612
Multiple Model Name : N/A
Applicant : META SYSTEMS CO., LTD.
Address : #1214-18, Sicox tower 12F, 484, Dunchon-daero, Jungwon-gu,
 Seongnam-si, Gyeonggi-do, 13229, Korea
Manufacturer : META SYSTEMS CO., LTD.
Address : #1214-18, Sicox tower 12F, 484, Dunchon-daero, Jungwon-gu,
 Seongnam-si, Gyeonggi-do, 13229, Korea
Regulation : FCC Part 15 Subpart C Section 15.209, ISED RSS-216 Issue 2
Total page of Report : 34 Pages
Date of Receipt : 2018-07-30
Date of Issue : 2019-01-29
Test Result : PASS

This test report only contains the result of a single test of the sample supplied for the examination.
 It is not a generally valid assessment of the features of the respective products of the mass-production.

Prepared by	Song, In-young / Senior Engineer		
		_____ Signature	_____ Date
		2019-01-29	
Reviewed by	Choi, Yeong-min / Technical Manager		
		_____ Signature	_____ Date
		2019-01-29	

CONTENTS

Page

1. TEST SUMMARY	4
1.1 REGULATIONS AND RESULTS	4
1.2 TEST METHODOLOGY	4
1.3 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS.....	4
1.4 PURPOSE OF THE TEST	4
1.5 TEST FACILITY.....	5
2. EUT (EQUIPMENT UNDER TEST) INFORMATION.....	6
2.1 GENERAL DESCRIPTION	6
2.2 ADDITIONAL MODEL.....	6
3. TEST CONDITION.....	7
3.1 EQUIPMENT USED DURING TEST	7
3.2 MODE OF OPERATION DURING THE TEST	7
3.3 PRELIMINARY TESTING FOR WORST CASE CONFIGURATION	7
3.4 TEST SETUP DRAWING	8
3.5 EUT MODIFICATIONS	8
4. ANTENNA REQUIREMENT	9
4.1 CONCLUSION.....	9
5. TEST RESULT	10
5.1 RADIATED EMISSIONS	10
5.2 20 DB BANDWIDTH.....	21
5.3 99% POWER BANDWIDTH	23
5.4 AC POWER LINE CONDUCTED EMISSION	25
APPENDIX I – TEST INSTRUMENTATION	34

Release Control Record

Issue Report No.	Issued Date	Details/Revisions
TR-W1901-023	2019-01-29	Initial Release
-	-	-

1. TEST SUMMARY

1.1 Regulations and results

The sample submitted for evaluation (Hereafter referred to as the EUT) has been tested in accordance with the following regulations and/or standards.

FCC Reference Section	ISED Reference Section	Description	P	F	N.T.	Note
15.209	RSS-GEN 6.5 RSS-GEN 6.6 RSS-GEN 8.10 RSS-216 6.2.2.2	Radiated emissions	P			
15.215	RSS-GEN 6.7	20 dB Bandwidth, 99 % Bandwidth	P			
15.205	RSS-216 6.2.3	Restricted Bands	P			Note 1
15.207(a)	RSS-GEN 8.8 RSS-216 6.2.2.1	AC power line conducted emissions	P			

Remark:

P means Passed F means Failed N.T. means Not Tested

Note 1: Transmitting Frequency for the EUT is (140 - 148.5) kHz and harmonic and spurious emissions fall in restricted bands met the general radiated emission limit, so the EUT met this requirement.

1.2 Test Methodology

The tests mentioned in clause 1.1 in this test report were performed according to FCC CFR 47 Part 2, CFR 47 Part 15 and ANSI C63.10-2013, RSS-GEN Issue 5, RSS-216, and ICES-001

1.3 Additions, deviations, exclusions from standards





No additions, deviations or exclusions have been made from standard.

1.4 Purpose of the test

The test was performed to determine whether the equipment under test fulfills the requirements of the regulation stated in FCC Part 15 Subpart C, RSS-GEN, and RSS-216.

1.5 Test Facility


The measurement facilities are located at 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do 12813, Korea. Description details of test facilities were submitted to the FCC and IC, designated by the RRA (Radio Research Agency), and accredited by Korea and accredited by KOLAS (Korea Laboratory Accreditation Scheme) in Korea according to the requirement of ISO 17025.

Agency Name	Registration No.	Mark
FCC	KR0160	
ISED(Canada)	IC 12721A	
RRA	KR0160	
Korean Agency for Technology and Standards	KT733	

2. EUT (Equipment Under Test) INFORMATION

2.1 General Description

The META SYSTEMS CO., LTD., Model Elements™ IC Single Charger (Hereafter referred to as the EUT in this report) is a part of Elements™ IC Obturation System, which is consist of Downpack device, Backfill device, Dual charger, and an AC/DC Adapter. The Downpack device provides instantaneous heating and cooling of the heat plugger with precisely controlled temperature and timing, making it perfect for single motion downpack obturation of the apical portion of the root canal. Utilizing single-use gutta percha needle cartridges, the ergonomic Backfill device has a motorized extruder system for precise temperature and speed control for a 3-dimensional obturation of the root canal system. The product specification described herein was obtained from product data sheet or user's manual. The product specification described herein was obtained from product data sheet or user's manual.

Trade mark	
Kind of Class acc. to FCC	DCD- Part 15 Low Power Transmitter Below 1 705 kHz
Kind of Type acc. to ISED	Type 3 (Category I)
WPT(Wireless Power Transfer) Frequency	140 kHz – 148.5 kHz
Power Transfer Function	Single fixed power transfer zone, single client
Modulation Types	Amplitude Modulation (AM)
Generated or used Freq. in EUT	8 MHz
Type of Antenna	<input checked="" type="checkbox"/> Integrated Type (Loop Coil Type) <input type="checkbox"/> Dedicated Type 40 x 40 mm, 8 turns
Operating Temperature	-20 °C ~ + 55 °C
Normal Test Voltage	DC 9 V (powered by AC/DC adapter)
Adapter	Input: 100-240 V, 50/60 Hz, Output: 9 V, 2 A
Maximum Power Consumption	5 W
Software Version	Ver 1.00
Hardware Version	Ver 1.0

2.2 Additional Model

None

3. TEST CONDITION

3.1 Equipment Used During Test

The following peripheral devices and/or interface cables were connected during the measurement:

Description		Model No.	FCC/ISED ID	Serial No.	Manufacturer.
Elements™ IC Obturation System	Single Charger	Elements™ IC Single Charger	FCC ID: 2AQVD-9730612 ISED ID: IC:24715-9730612	N/A	META SYSTEMS CO., LTD
	Downpack Device	Elements™ IC Downpack	N/A	N/A	META SYSTEMS CO., LTD
	Backfill Device	Elements™ IC Backfill	N/A	N/A	META SYSTEMS CO., LTD
	AC/DC Adapter	BPM020S09F04	N/A	N/A	Wendeng Jell Elec

3.2 Mode of operation during the test

The EUT consists of WPT source and receive-only WPT clients together, so the client device, Elements™ IC Backfill, Elements™ IC Downpack with dummy load was inserted into charging dock of WPT source, single charger. Single charger continuously transmitted maximum power for charging client device.

Test Mode	Description
# 1	The client device, <u>Downpack Device</u> with dummy load was inserted into charging dock on single charger and then continuously charged with maximum power.
# 2	The client device, <u>Backfill Device</u> was inserted into charging dock on single charger and then continuously charged with maximum power.

3.3 Preliminary Testing for Worst case configuration

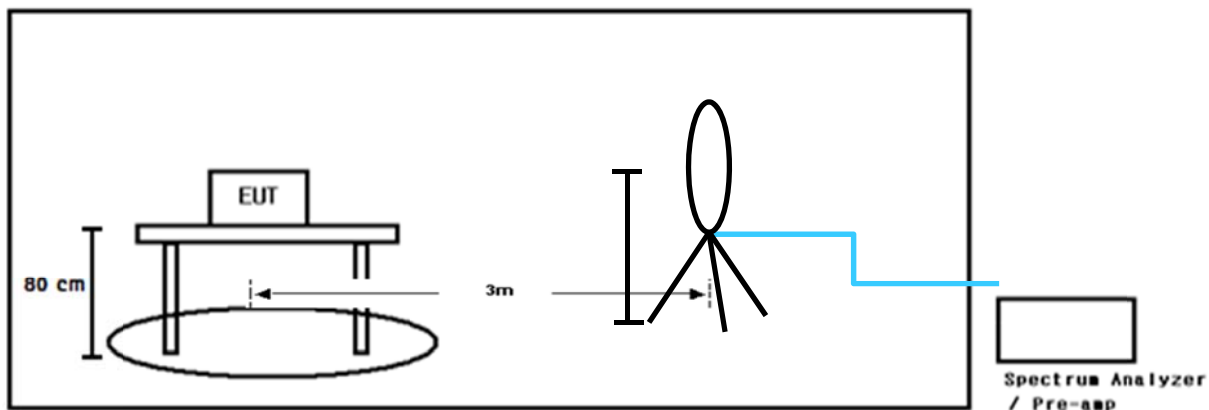
For making charging receive-only WPT client device, the client device shall be inserted into charging dock of the WPT source, so the EUT was tested as normal operation acc. to manufacturer's guidance, and the EUT is a fixed type device, all spurious emission tests were performed in one axis direction.

3.3.1 Test Channel and Frequency

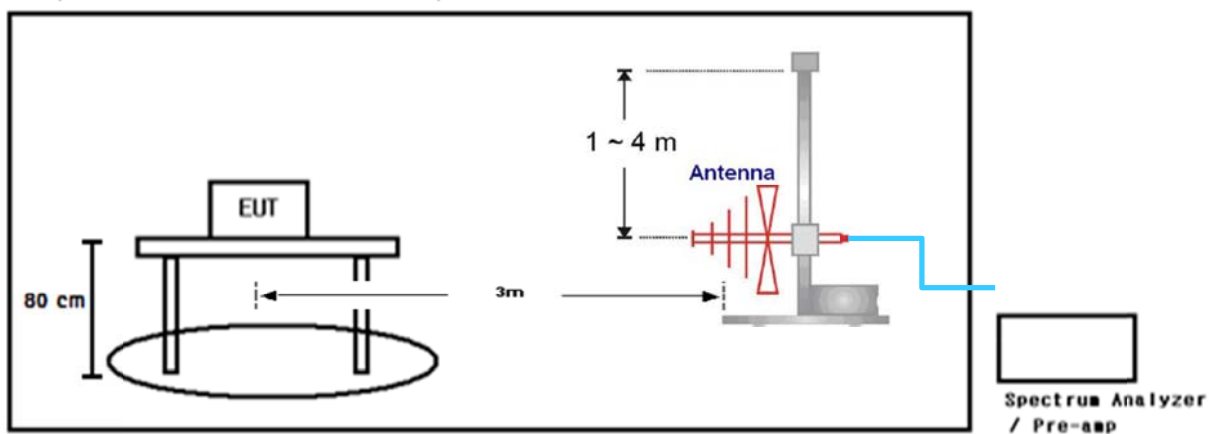
Kind of Client Device	Measured Frequency
Elements™ IC Backfill	146.7 kHz
Elements™ IC Downpack	147.2 kHz

3.4 Test Setup Drawing

(Radiated Test below 30 MHz)



(Radiated Test below 1 GHz)



3.5 EUT Modifications

- No EMC Relevant Modifications were performed by this test laboratory.

4. ANTENNA REQUIREMENT

According to FCC CFR 47 Part 15 section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provision of this section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31 (d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

4.1 Conclusion

The EUT has an integral loop coil antenna, so there is no consideration of replacement by the user.

5. TEST RESULT

5.1 Radiated emissions

5.1.1 Regulation

FCC LIMIT

FCC § 15.209(a); Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field strength limit ($\mu\text{V/m}$)	Field strength limit ($\text{dB}\mu\text{V/m}$)	Measurement Distance (m)
0.009 – 0.490	$2400/F$ (kHz) = 266.7 – 4.9	48.5 – 13.8	300
0.490 – 1.705	$24000/F$ (kHz) = 49.0 – 14.1	33.8 - 23.0	30
1.705 – 30.0	30	29.5	30
30 – 88	100	40.0	3
88 - 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54.0	3

Note: The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector. For the frequency bands (9 – 90) kHz, (110 – 490) kHz and above 1000 MHz, the radiated emission limits are based on measurements employing an average detector.

ISED Canada LIMIT

For frequency ranges between 9 kHz to 30 MHz, CISPR11 Induction cooking (group 2) limits (3 m measurement distance) was applied acc. to ICES-001.

Frequency Range (MHz)	Limit in $\text{dB}(\mu\text{A/m})$ at 3 m distance Quasi-peak	Limit in $\text{dB}(\mu\text{V/m})$ at 3 m distance Quasi-peak
0.009 - 0.070	69	120.5
0.070 - 0.1485	69 Decreasing linearity with the logarithm of frequency to 39	120.5 Decreasing linearity with the logarithm of frequency to 90.5
0.1485 - 4.0	39 Decreasing linearity with the logarithm of frequency to 3	90.5 Decreasing linearity with the logarithm of frequency to 54.5
4.0 - 30	3	54.5

The limits of this table apply to induction cooking appliances intended for commercial use and those for domestic use with a diagonal diameter of more than 1,6 m.

As alternative method, measurement was performed at 3 m distance with 0.6 m loop antenna.

The antenna shall be vertically installed, with the lower edge of the loop at 1 m height above the floor.

For frequency ranges between 30 MHz to 1 000 MHz, CISPR 11: 2003, Table 12 was applied acc. to ICES-001.

Class B Group 2 equipment at measuring distance of 3 m			
Frequency range (MHz)	Electric Field limit		Magnetic Field limit
	Quasi-peak (dB μ V/m)	Average ^a (dB μ V/m)	Quasi-peak (dB μ A/m)
30 – 80.872	40	35	-
80.872 – 81.848	60	55	-
81.848 – 134.786	40	35	-
134.786 – 136.414	60	55	-
136.414 – 230	40	35	-
230 - 1000	47	42	-

a. The average limits apply to magnetron driven equipment and microwave ovens only. If magnetron driven equipment or microwave ovens exceed the quasi-peak limit at certain frequencies, then the measurement shall be repeated at these frequencies with the average detector and the average limits specified in this table apply

5.1.2 Method of Measurement

The preliminary radiated emission test was performed using the procedure in ANSI C63.10 2013 to determine the worse operating conditions. The radiated emissions measurements were performed on the 10 m Semi Anechoic Chamber

Radiated Emissions Test, 9 kHz to 30 MHz (Magnetic Field Test)

For frequencies from 150 kHz to 30 MHz measurements were made of the magnetic H field. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. The measuring antenna is an electrically screened loop antenna. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

Radiated Emissions Test, below 1 000 MHz

The frequency spectrum from 30 MHz to 1 000 MHz was scanned and maximum emission levels maximized at each frequency recorded. The system rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna. The EUT is situated in three orthogonal planes (if appropriate).

5.1.3 Test Site Requirement for KDB 414788

Acc. to KDB 414788, Semi Anechoic Chamber (SAC) shall be verified test results below 30 MHz with Open Area Test Site (OATS), so we compared test results between the measurements from our SAC and an OATS and found test results almost same, so we **declare test result for below 30 MHz from our SAC is valid and met the requirement acc. to KDB 414788.**

5.1.4 Measurement Uncertainty

Measurement uncertainties were not taken into account and following uncertainty levels have been estimated for tests performed on the apparatus. The measurement uncertainties are given with at least 95 % confidence.

Frequency Range	Uncertainty	Frequency Range	Uncertainty
9 kHz ~ 30 MHz	± 2.1 dB	30 MHz ~ 1 GHz	± 4.8 dB

5.1.5 Sample Calculated Example

At 80 MHz


Limit = 40.0 dBuV/m

Result = Receiver reading value + Antenna Factor - Corr. Factor (dB) = 30 dBuV/m

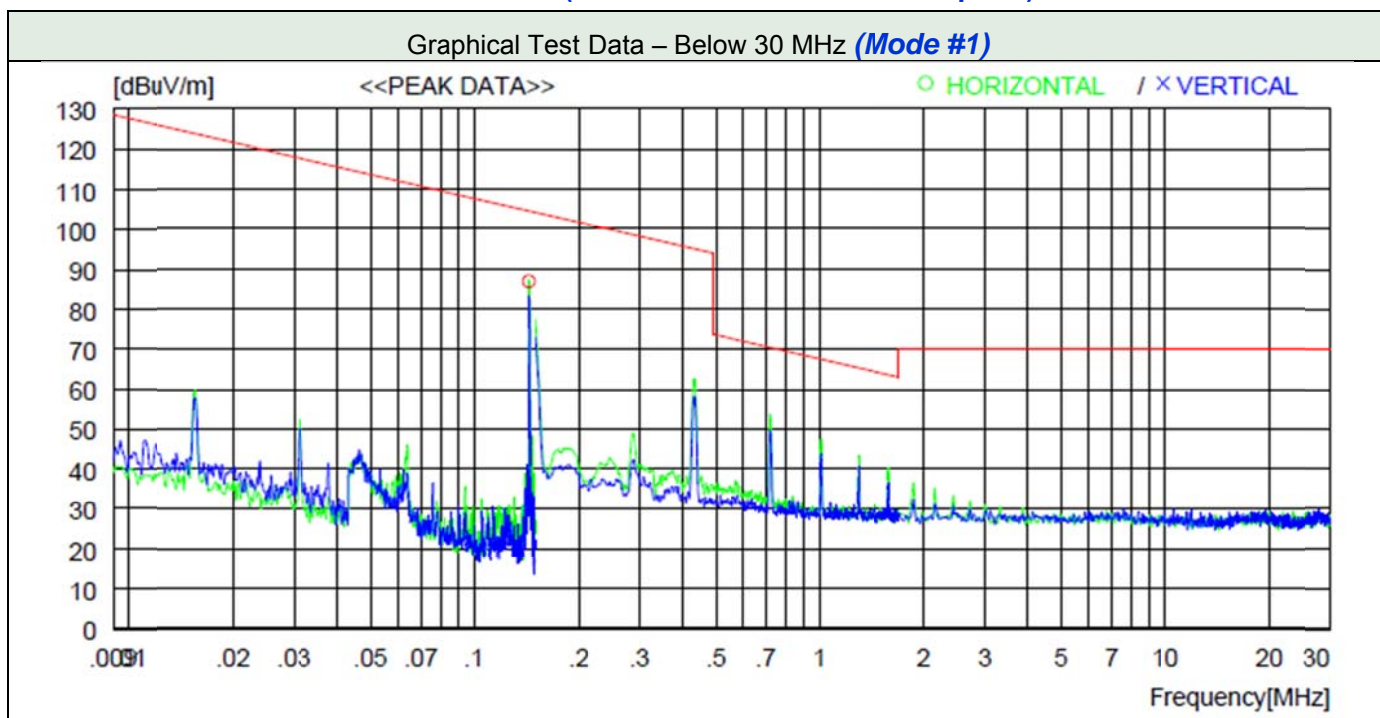
Where, Corr. Factor (dB) = Pre-amplifier (dB) – Cable loss (dB)

Margin (dB) = Limit (dBuV/m) – Result (dBuV/m) = 40 – 30 = 10 so the EUT has 10.0 dB margin at 80 MHz

5.1.6 FCC Test Data

Date of Test	2018-11-28 to	Temperature	(17.5 ± 2.0) °C		
	2018-12-03	Relative humidity	(49.0 ± 1.9) % R.H.		
Measurement Frequency Range		9 kHz ~ 1 GHz			
Test Result	PASS	Tested By	In Yong, Song 		
Frequency range	Detector Mode	Resolution BW	Video BW	Video Filtering	Measurement distance
9 kHz - 150 kHz	Peak or Q.P.	200 Hz	1 kHz	-	3 m
150 kHz - 30 MHz	Peak or Q.P.	9 kHz	30 kHz	-	3 m
30 MHz ~ 1 000 MHz	Peak or Q.P.	100 kHz	300 kHz	-	3 m

5.1.6.1 Test Data from 9 kHz to 30 MHz (Client: Elements™ IC Downpack)

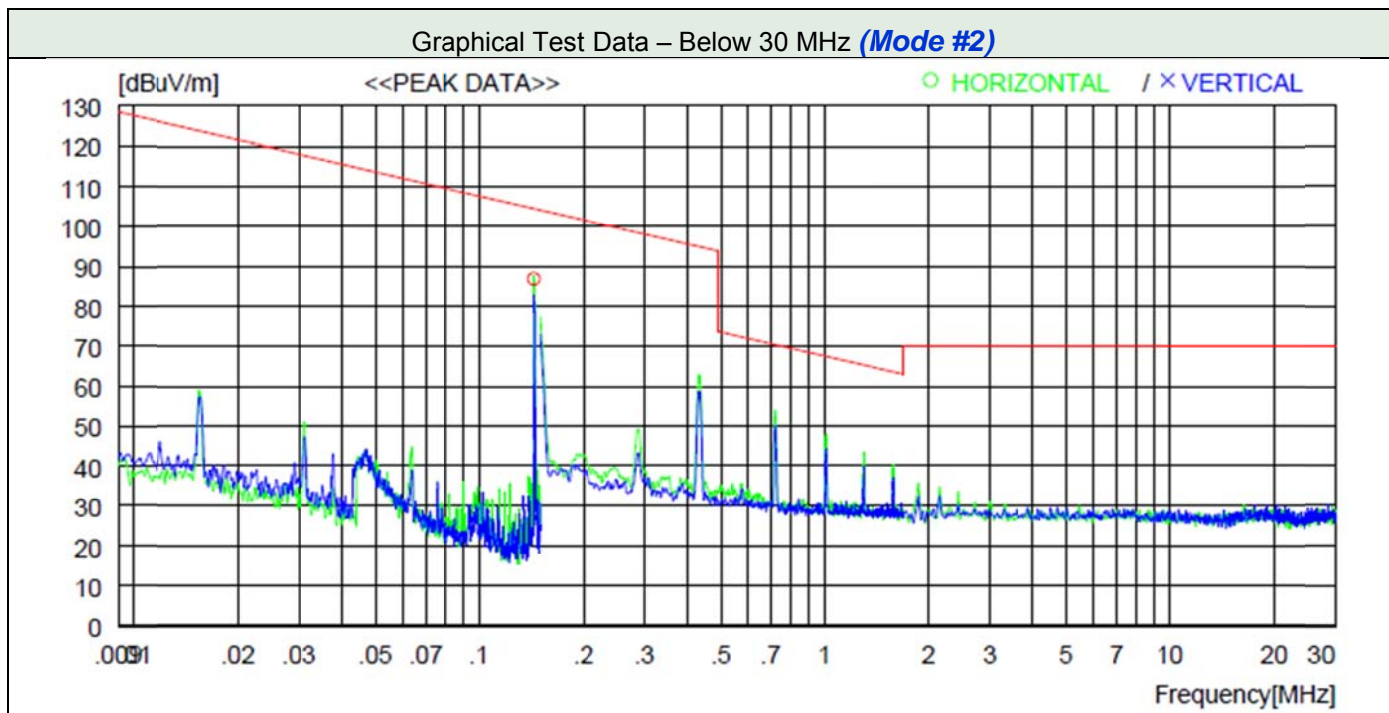


Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
0.144	100.0	Peak	H	19.4	32.8	86.6	104.4	17.8	100	192

The EUT met the requirements for Restricted bands acc. to FCC 15.205 and RSS -216 section 6.2.3.

Note: “H” means Horizontal polarity, “V” means Vertical polarity

5.1.6.2 Test Data from 9 kHz to 30 MHz (Client: Elements™ IC Backfill)



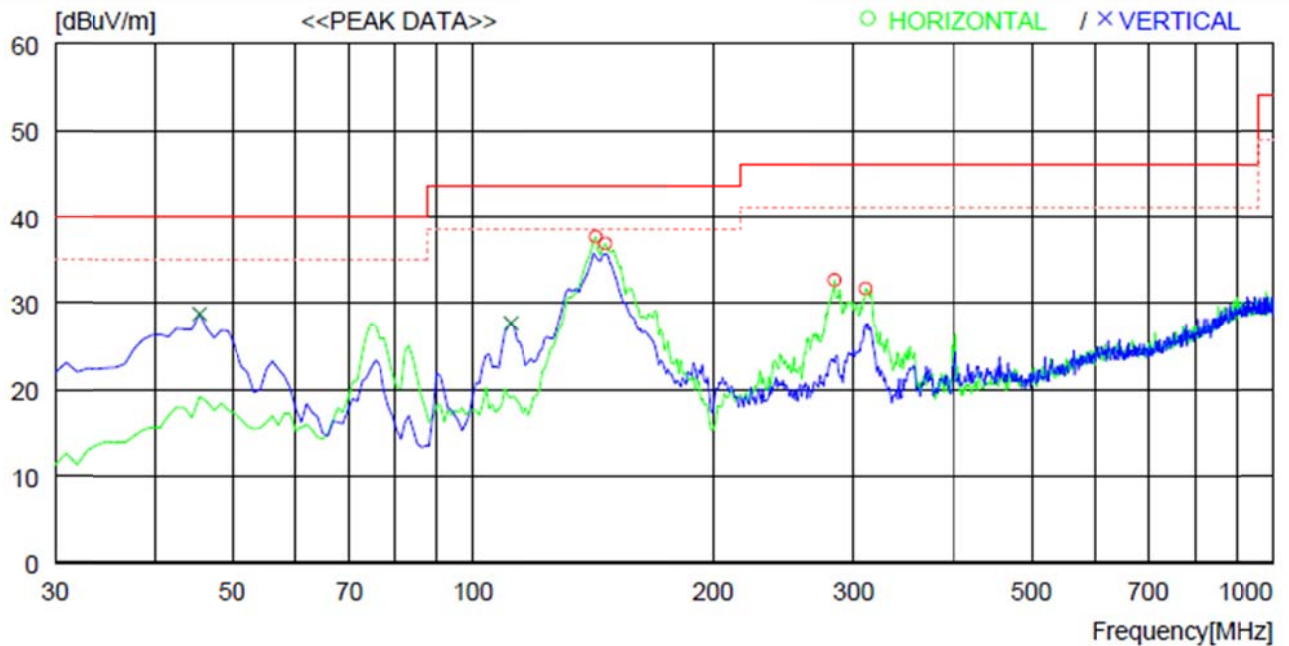
Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
0.144	101.6	Peak	H	19.4	32.8	88.2	104.4	16.2	100	359

The EUT met the requirements for Restricted bands acc. to FCC 15.205 and RSS -216 section 6.2.3.

Note: “H” means Horizontal polarity, “V” means Vertical polarity

5.1.6.3 Test Data from 30 MHz to 1 GHz (Client: Elements™ IC Downpack)

Graphical Test Data – Below 1 000 MHz (Mode #1)

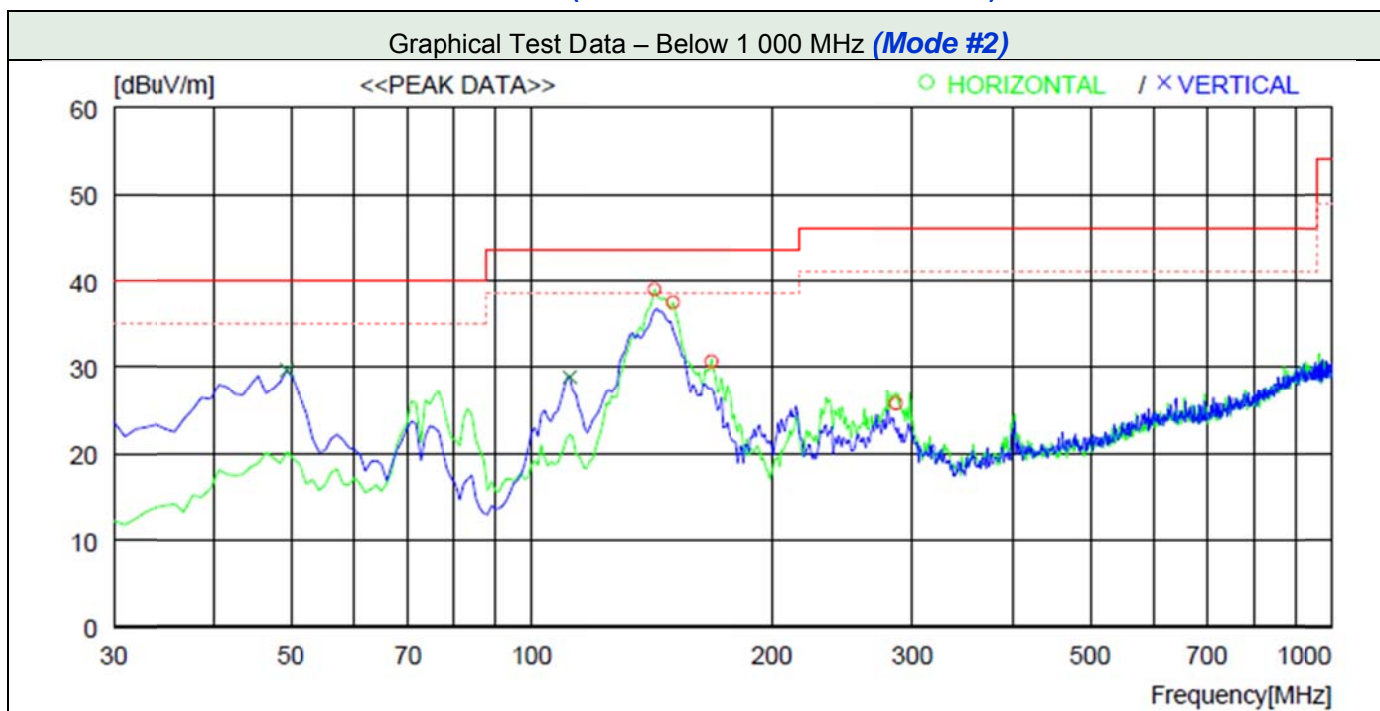


Tabulated Test Data under 15.205(a), 15.209

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
45.52	40.6	Peak	V	13.7	25.5	28.8	40.0	11.2	100	359
111.48*	42.1	Peak	V	10.2	24.6	27.7	43.5	15.8	100	92
142.52	54.4	Peak	H	7.7	24.4	37.7	43.5	5.8	200	71
146.40	53.4	Peak	H	7.8	24.3	36.9	43.5	6.6	200	359
284.14	42.7	Peak	H	13.2	23.2	32.7	46.0	13.3	100	0
310.33	41.0	Peak	H	13.7	23.0	31.7	46.0	14.3	100	0

Note: "H" means Horizontal polarity, "V" means Vertical polarity

5.1.6.4 Test Data from 30 MHz to 1 GHz (Client: Elements™ IC Backfill)




Tabulated Test Data under 15.205(a), 15.209

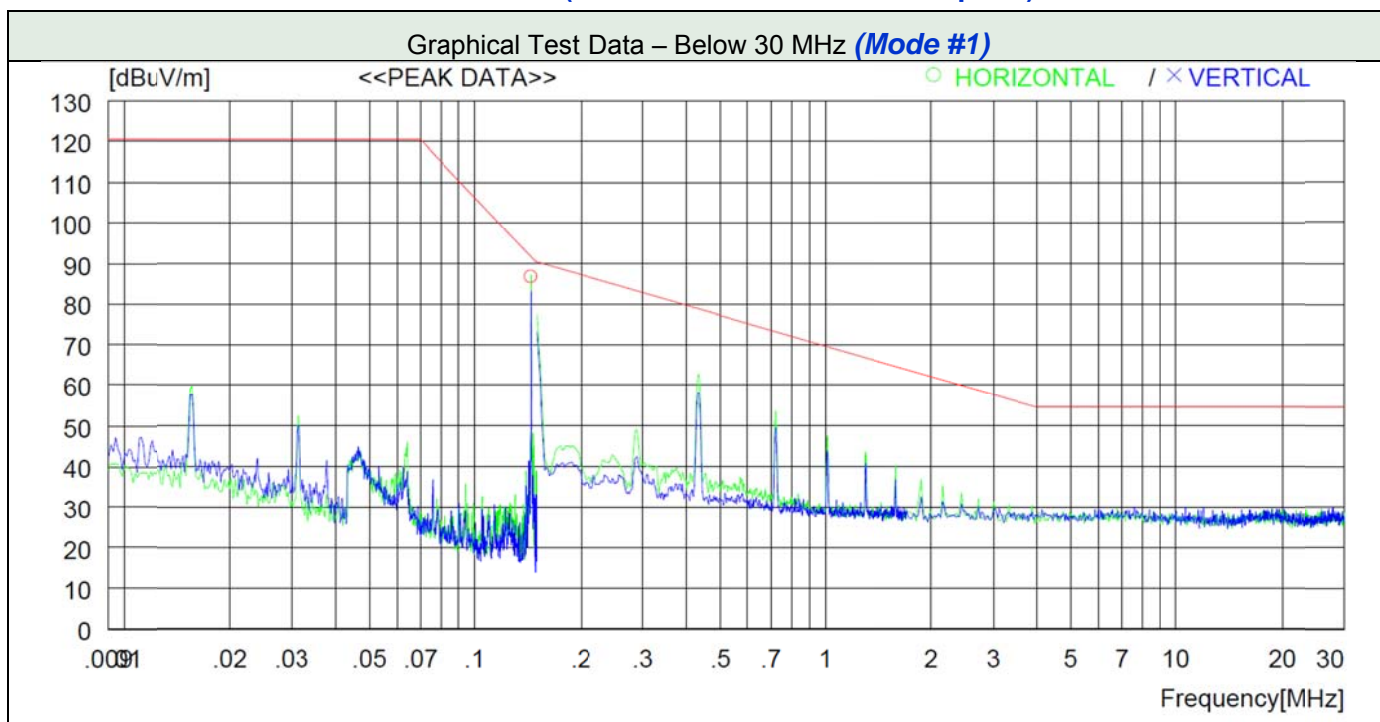
Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
49.40	40.9	Peak	V	14.2	25.4	29.7	40.0	10.3	100	359
111.48*	43.3	Peak	V	10.2	24.6	28.9	43.5	14.6	100	359
142.52	55.7	Peak	H	7.7	24.4	39.0	43.5	4.5	200	0
150.28	53.8	Peak	H	8.0	24.3	37.5	43.5	6.0	200	0
167.74*	46.4	Peak	H	8.7	24.4	30.7	43.5	12.8	100	260
286.08	37.0	Peak	H	13.2	24.4	25.8	46.0	20.2	100	33

Note: “H” means Horizontal polarity, “V” means Vertical polarity

5.1.7 ISED Test Data

Date of Test	2018-11-28 to 2018-12-03	Temperature	(17.5 ± 2.0) °C		
		Relative humidity	(49.0 ± 1.9) % R.H.		
Measurement Frequency Range		9 kHz ~ 1 GHz			
Test Result	PASS	Tested By	In Yong, Song 		
Frequency range	Detector Mode	Resolution BW	Video BW	Video Filtering	Measurement distance
9 kHz - 150 kHz	Peak or Q.P.	200 Hz	1 kHz	-	3 m
150 kHz - 30 MHz	Peak or Q.P.	9 kHz	30 kHz	-	3 m
30 MHz ~ 1 000 MHz	Peak or Q.P.	100 kHz	300 kHz	-	3 m

5.1.7.1 Test Data from 9 kHz to 30 MHz (Client: Elements™ IC Downpack)

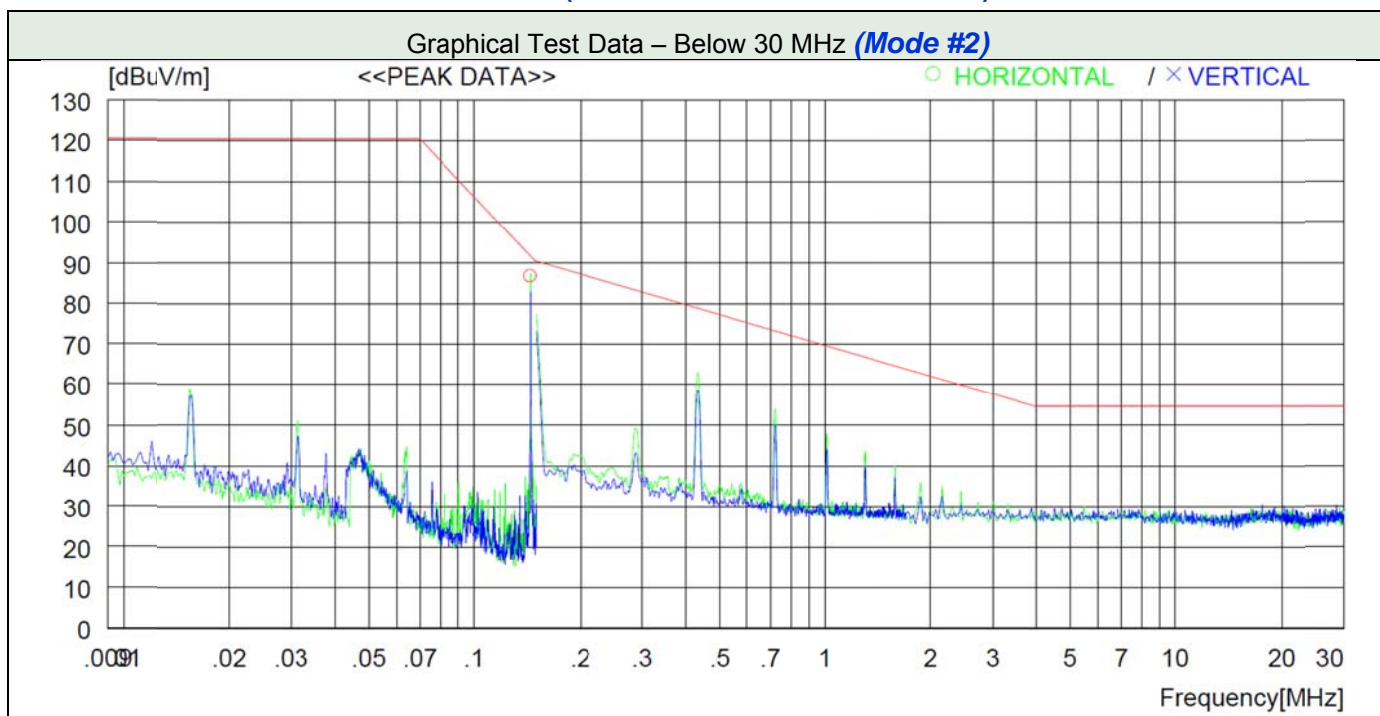


Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
0.144	100.0	Peak	H	19.4	32.8	86.6	91.7	5.1	100	192

The EUT met the requirements for Restricted bands acc. to FCC 15.205 and RSS -216 section 6.2.3.

Note: “H” means Horizontal polarity, “V” means Vertical polarity

5.1.7.2 Test Data from 9 kHz to 30 MHz (Client: Elements™ IC Backfill)



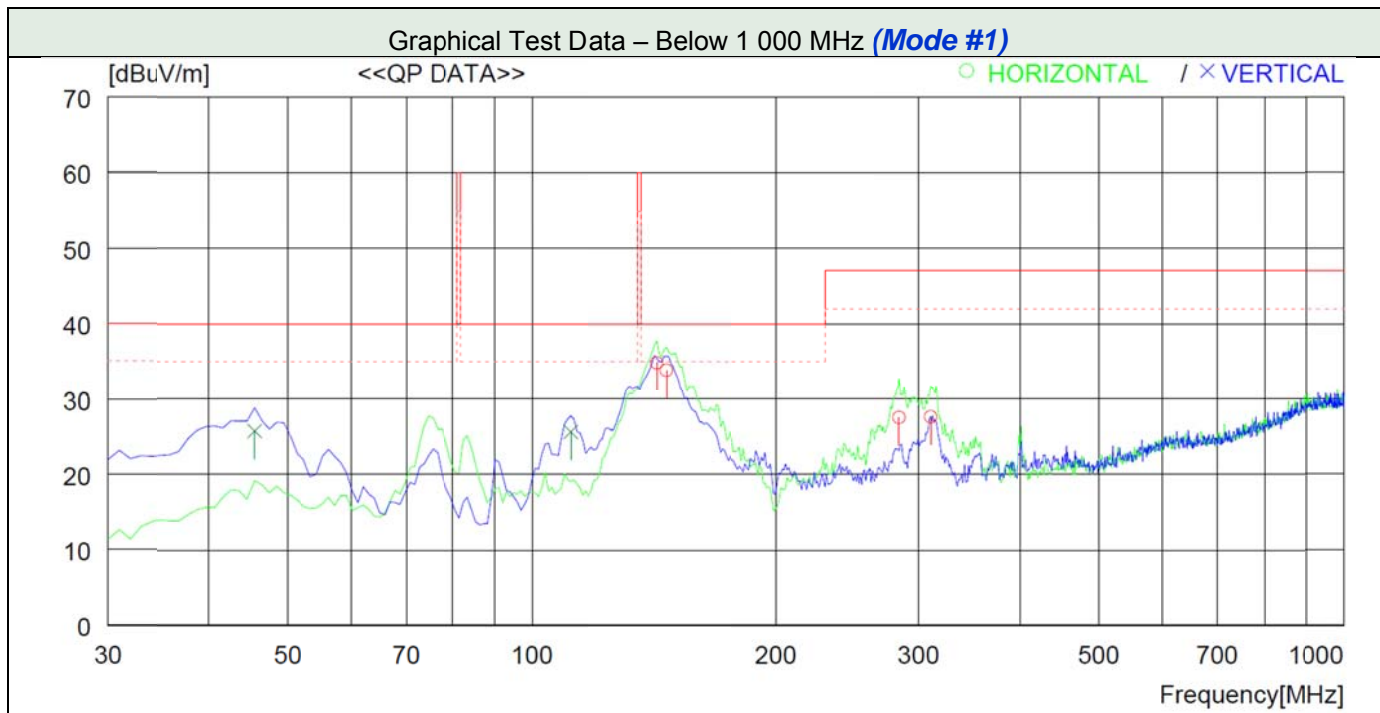
Tabulated Test Data under ICES-001 Issued 4

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
0.144	101.6	Peak	H	19.4	32.8	88.2	91.7	3.5	100	359

The EUT met the requirements for Restricted bands acc. to FCC 15.205 and RSS -216 section 6.2.3.

Note: “H” means Horizontal polarity, “V” means Vertical polarity

5.1.7.3 Test Data from 30 MHz to 1 GHz (Client: Elements™ IC Downpack)

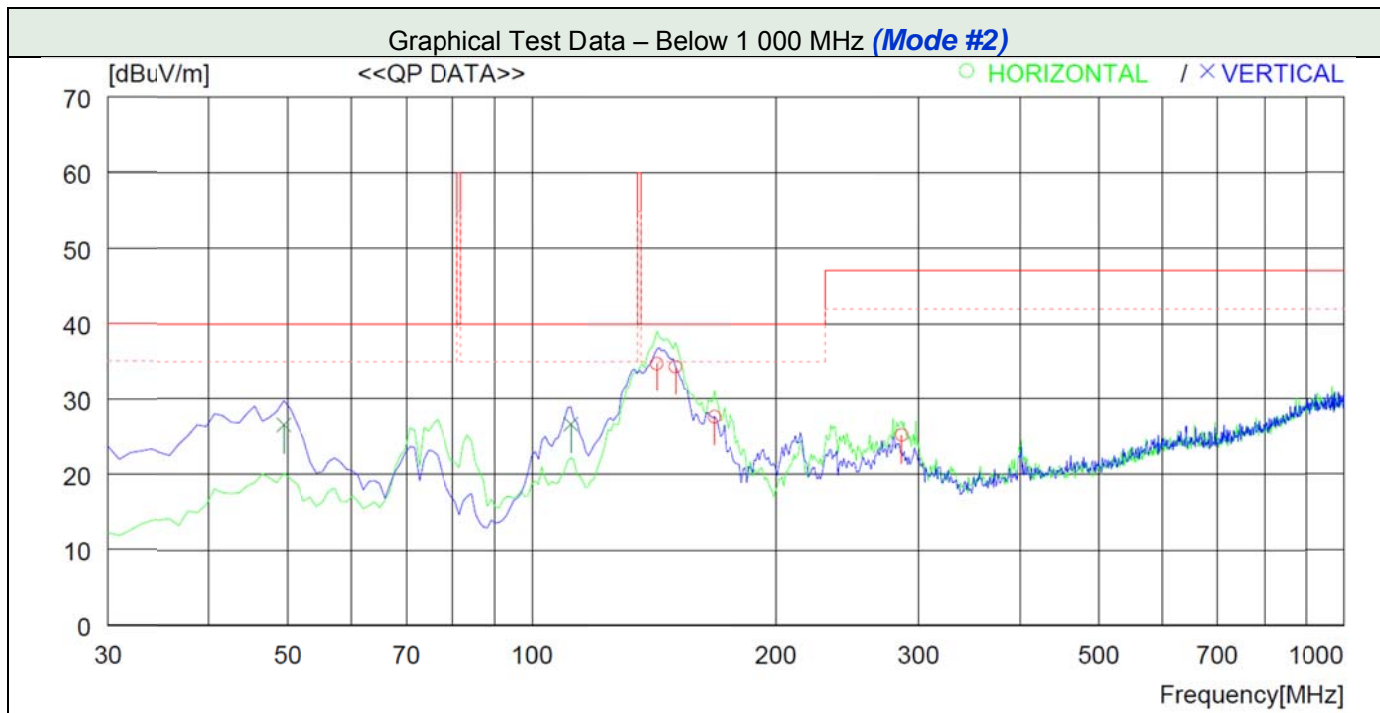


Tabulated Test Data under ICES-001 Issued 4

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
45.52	37.5	Q.P.	V	13.7	25.5	25.7	40.0	14.3	100	359
111.48	40.0	Q.P.	V	10.2	24.6	25.6	40.0	14.4	100	92
142.52	51.5	Q.P.	H	7.7	24.4	34.8	40.0	5.2	200	71
146.40	50.3	Q.P.	H	7.8	24.3	33.8	40.0	6.2	200	359
284.14	37.5	Q.P.	H	13.2	23.2	27.5	47.0	19.5	100	0
310.33	36.9	Q.P.	H	13.7	23.0	27.6	47.0	19.4	100	0

Note: “H” means Horizontal polarity, “V” means Vertical polarity

5.1.7.4 Test Data from 30 MHz to 1 GHz (Client: Elements™ IC Backfill)



Tabulated Test Data under ICES-001 Issued 4

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
49.40	37.7	Q.P.	V	14.2	25.4	26.5	40.0	13.5	100	359
111.48	41.0	Q.P.	V	10.2	24.6	26.6	40.0	13.4	100	359
142.52	51.4	Q.P.	H	7.7	24.4	34.7	40.0	5.3	200	0
150.28	50.6	Q.P.	H	8	24.3	34.3	40.0	5.7	200	0
167.74	43.0	Q.P.	H	8.7	24.4	27.6	40.0	12.4	100	260
286.08	35.2	Q.P.	H	13.2	24.4	25.2	47.0	21.8	100	33

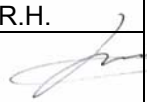
Note: “H” means Horizontal polarity, “V” means Vertical polarity

5.2 20 dB bandwidth

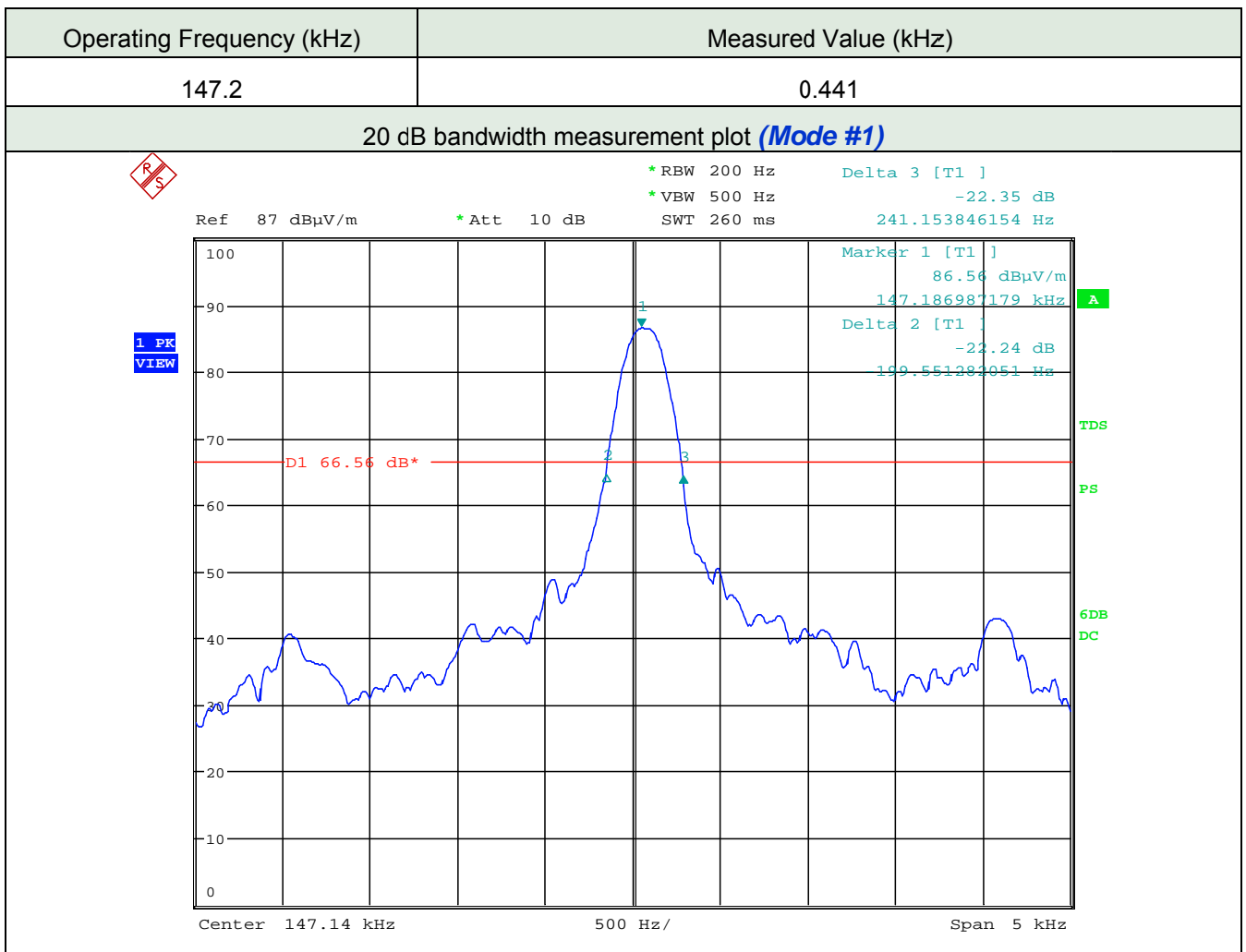
5.2.1 Method of Measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution is set to 200 Hz, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.

5.2.2 Test Data

Date of Test	2018-12-01	Temperature	(17.5 ± 2.0) °C
		Relative humidity	(49.0 ± 1.9) % R.H.
Test Result	PASS	Tested by	In Yong, Song 

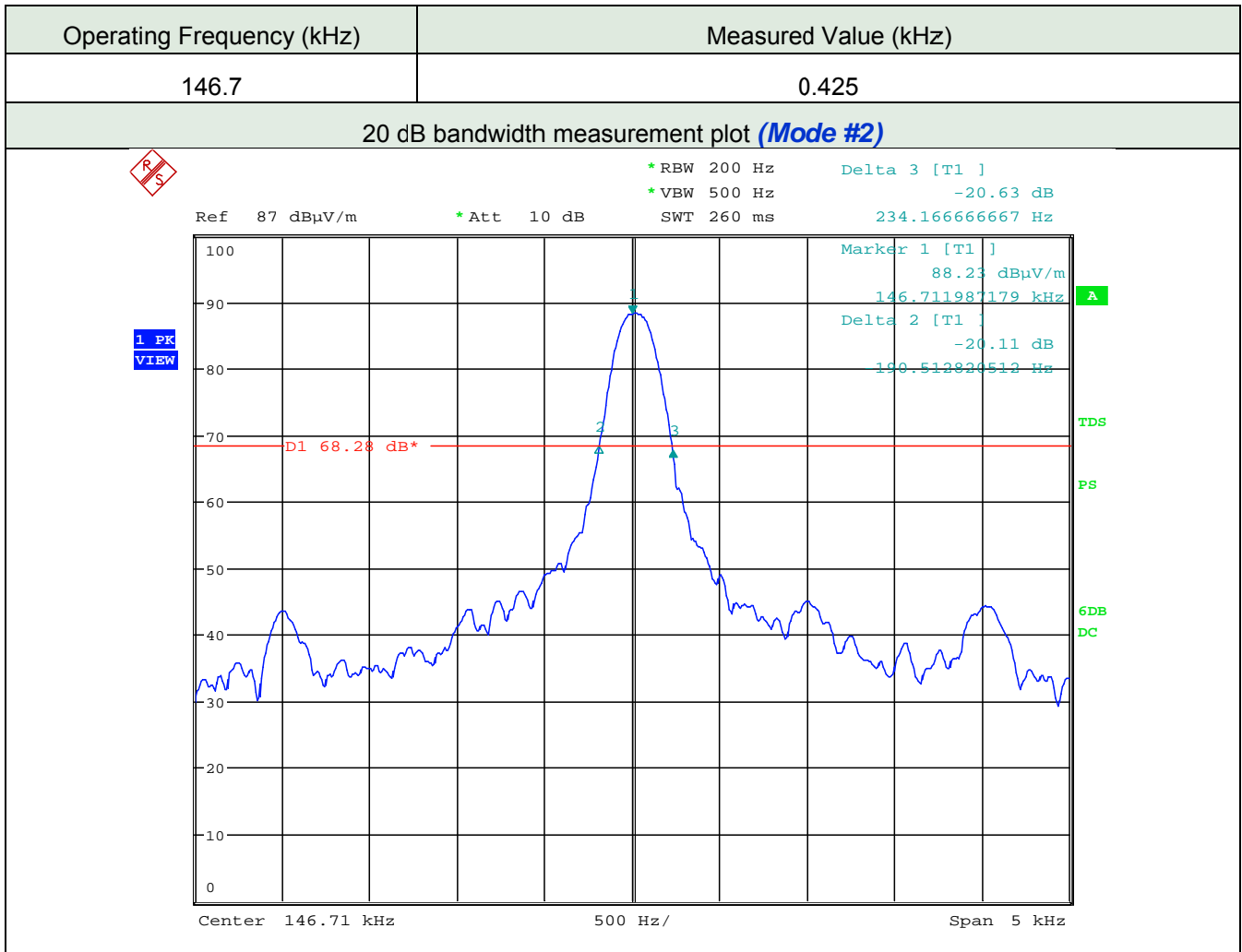
5.2.2.1 Test Data from 20 dB bandwidth (Client: Elements™ IC Downpack)



Note: F_L : Lowest frequency at 20 dB bandwidth

F_H : Highest frequency at 20 dB bandwidth

5.2.2.2 Test Data from 20 dB bandwidth (Client: Elements™ IC Backfill)



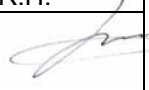
Note: F_L : Lowest frequency at 20 dB bandwidth
 F_H : Highest frequency at 20 dB bandwidth

5.3 99% Power bandwidth

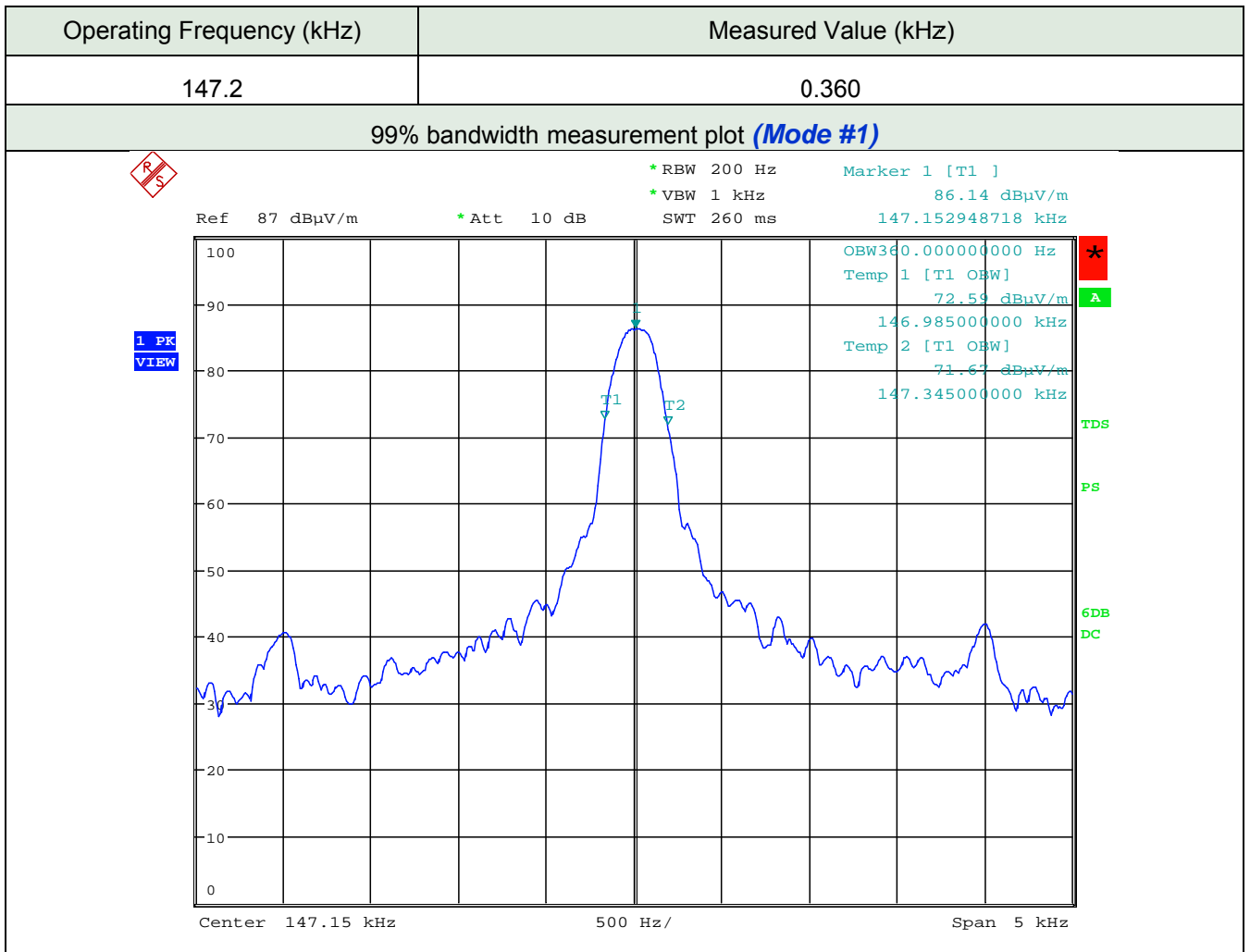
5.3.1 Method of Measurement

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

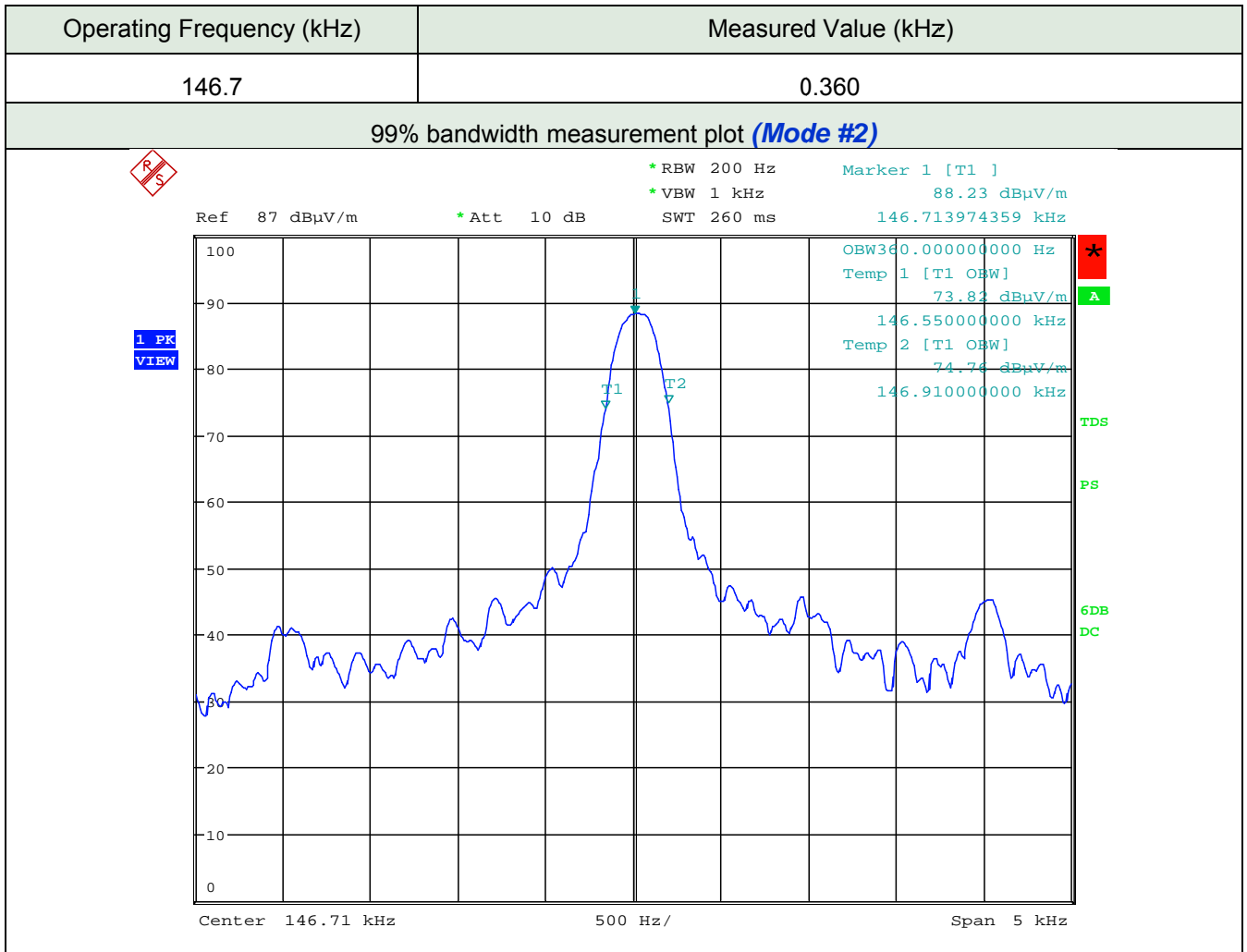
5.3.2 Test Data

Date of Test	2018-11-28	Temperature	(17.5 ± 2.0) °C
		Relative humidity	(49.0 ± 1.9) % R.H.
Test Result	PASS	Tested by	In Yong, Song 

5.3.2.1 Test Data from 99 % bandwidth (Client: Elements™ IC Downpack)



5.3.2.2 Test Data from 99 % bandwidth (Client: Elements™ IC Backfill)



5.4 AC Power Line Conducted Emission

5.4.1 FCC LIMIT

Acc. to section 15.207 (a), following table shall be applied.

Frequency Range (MHz)	Quasi-Peak (dBuV)	Average (dBuV)
0.15 - 0.5	66 to 56	56 to 46
0.5 - 5	56	46
5 -30	60	50

5.4.2 ISED Canada LIMIT

Acc. to RSS-216 section 6.2.2.1, following table shall be applied.

Frequency Range (MHz)	Quasi-Peak (dBuV)	Average (dBuV)
0.009 - 0.050	110	--
0.050 - 0.1485	90 to 80	-
0.1485 - 0.5	66 to 56	56 to 46
0.5 - 5	56	46
5 -30	60	50

5.4.2 Method of Measurement

The EUT was placed on a wooden table, 0.8 m height above the horizontal ground plane and 40 cm from the vertical ground plane. Power was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

The test was performed for both Neutral and Hot lines.

5.4.3 Measurement Uncertainty

Measurement uncertainties were not taken into account and following uncertainty levels have been estimated for tests performed on the apparatus. The measurement uncertainties are given with at least 95 % confidence.

Frequency Range	Uncertainty	Frequency Range	Uncertainty
9 kHz ~ 150 kHz	± 2.00 dB	150 kHz ~ 30 MHz	± 2.00 dB

5.4.4 Sample Calculated Example

At 5.3 MHz

QP Limit = 60.0 dBuV

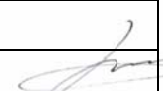
QuasiPeak or CAverage = Receiver reading value + Corr. (dB) = 30 dBuV

Where, Correction Factor (Corr. (dB)) = Insertion loss of LISN + Pulse Limiter factor + Cable loss

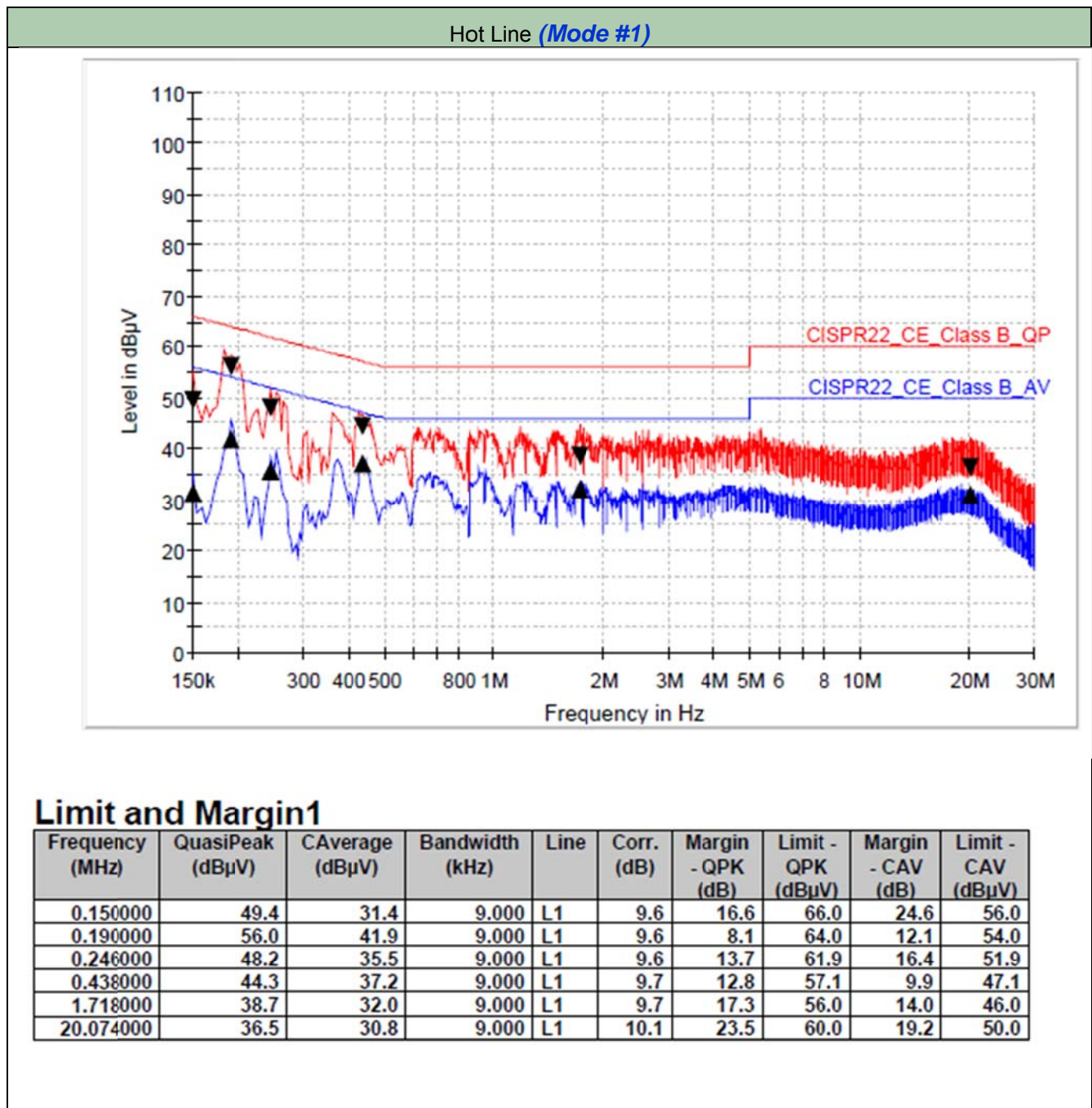
Margin (dB) = Limit (dBuV) – QuasiPeak or CAverage (dBuV) = 60 – 30 = 30

So, the EUT has 30.0 dB margins at 5.3 MHz.

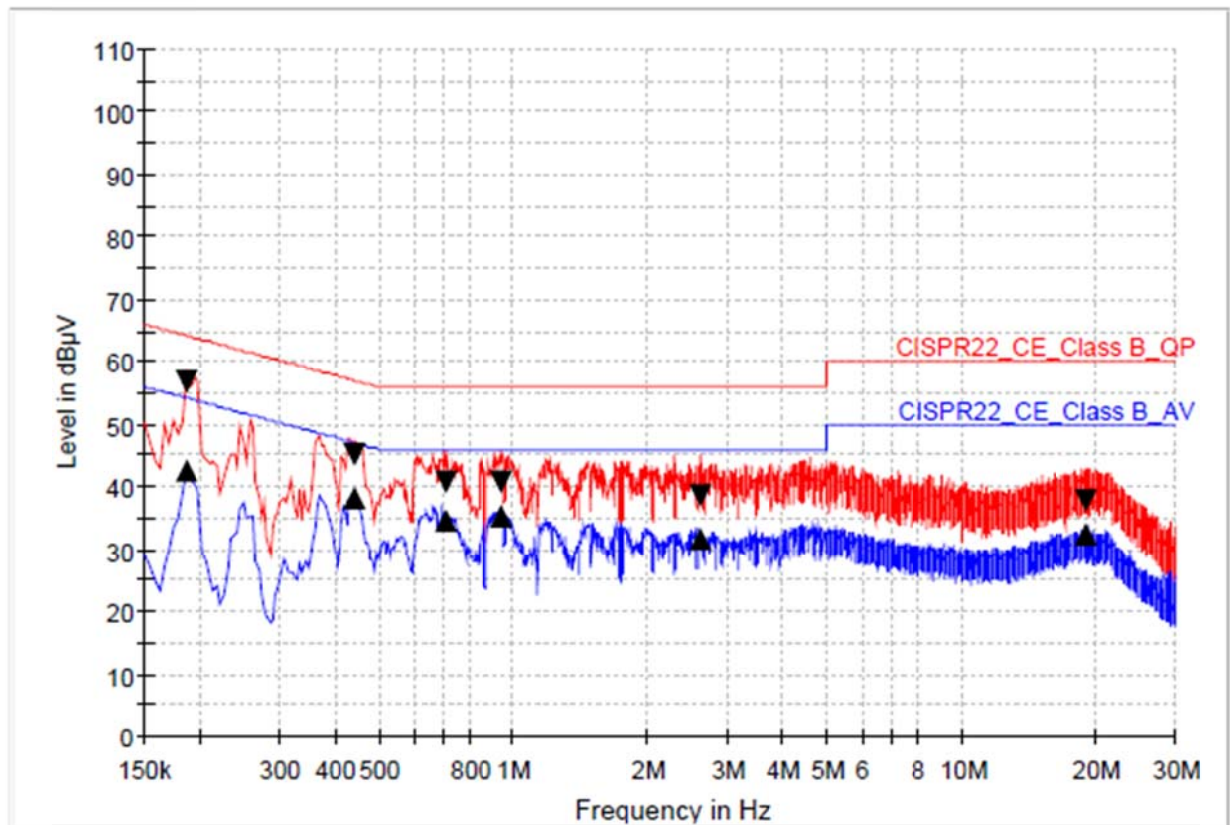
5.4.5 Test Data for FCC

Date of Test	2018-11-29	Temperature	(18.6 ± 1.0) °C
		Relative humidity	(46.2 ± 1.0) % R.H.
Measurement Frequency Range		150 kHz ~ 30 MHz	
Test Result	PASS	Tested By	In Yong, Song 

5.4.5.1 Test Data from AC Power Line Conducted Emissions (Client: Elements™ IC Downpack)



Neutral Line (Mode #1)

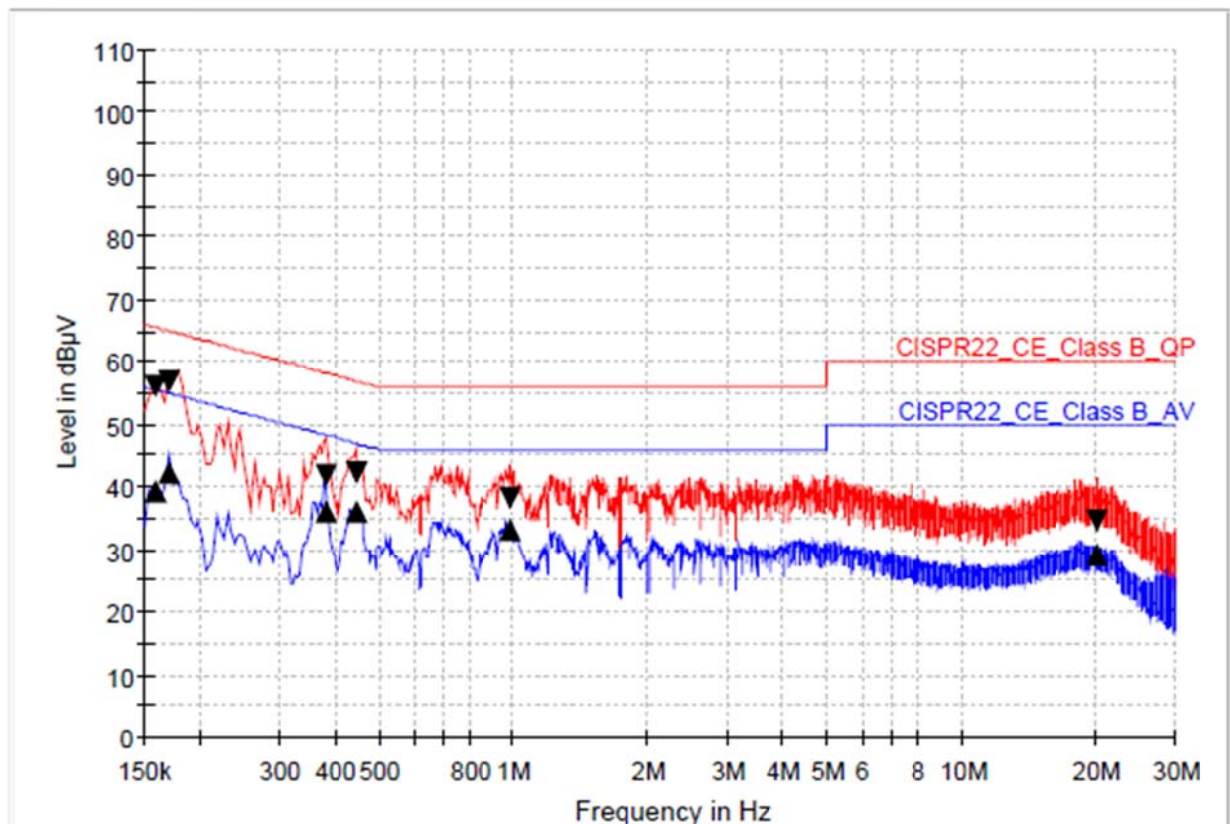


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.186000	56.8	42.5	9.000	N	9.6	7.4	64.2	11.7	54.2
0.442000	45.3	38.2	9.000	N	9.7	11.7	57.0	8.8	47.0
0.710000	41.0	34.6	9.000	N	9.7	15.0	56.0	11.4	46.0
0.934000	40.8	35.3	9.000	N	9.7	15.2	56.0	10.7	46.0
2.634000	38.6	31.8	9.000	N	9.7	17.4	56.0	14.2	46.0
18.990000	37.8	32.4	9.000	N	10.0	22.2	60.0	17.6	50.0

5.4.5.2 Test Data from AC Power Line Conducted Emissions (Client: Elements™ IC Backfill)

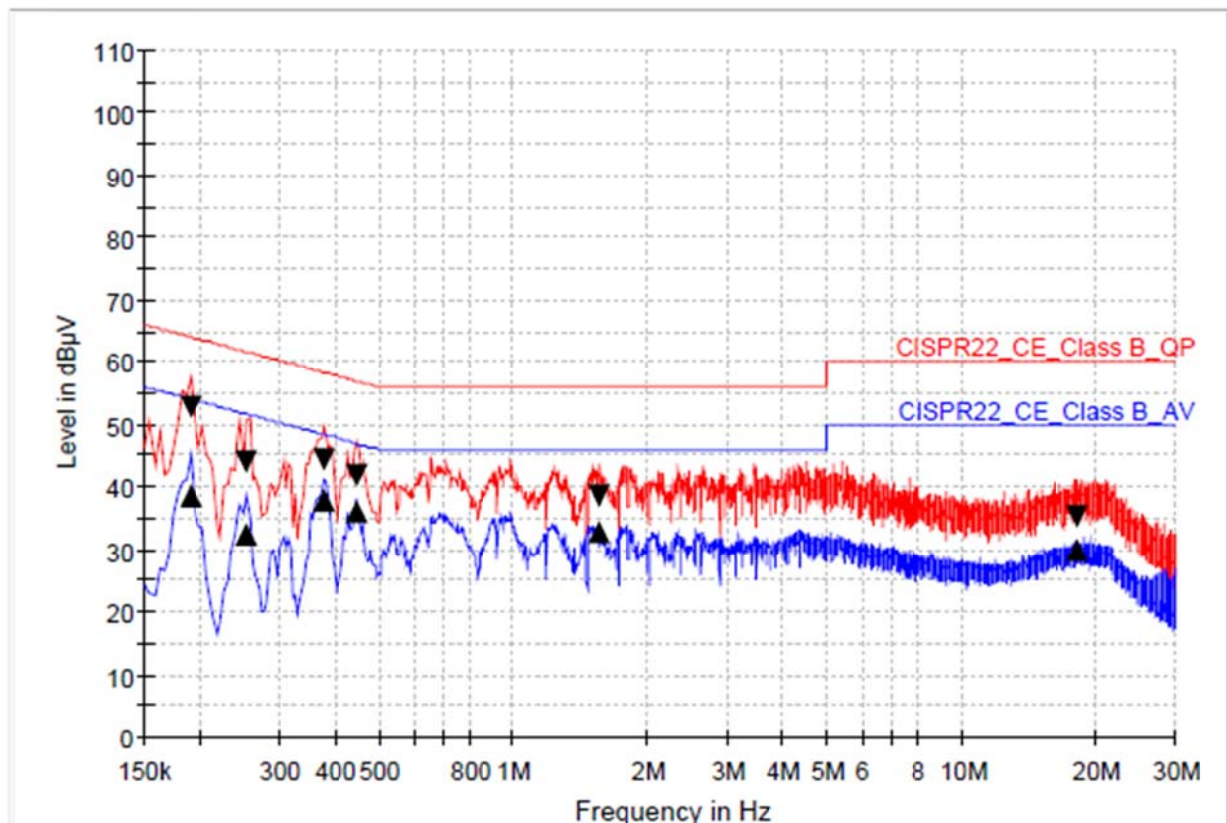
Hot Line (Mode #2)



Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.158000	56.2	39.5	9.000	L1	9.6	9.4	65.6	16.0	55.6
0.170000	56.8	42.3	9.000	L1	9.6	8.2	65.0	12.6	55.0
0.382000	41.7	36.0	9.000	L1	9.7	16.5	58.2	12.3	48.2
0.450000	42.1	36.1	9.000	L1	9.7	14.8	56.9	10.8	46.9
0.982000	38.4	33.1	9.000	L1	9.7	17.6	56.0	12.9	46.0
20.230000	34.7	29.3	9.000	L1	10.1	25.3	60.0	20.8	50.0


Neutral Line (Mode #2)



Limit and Margin1

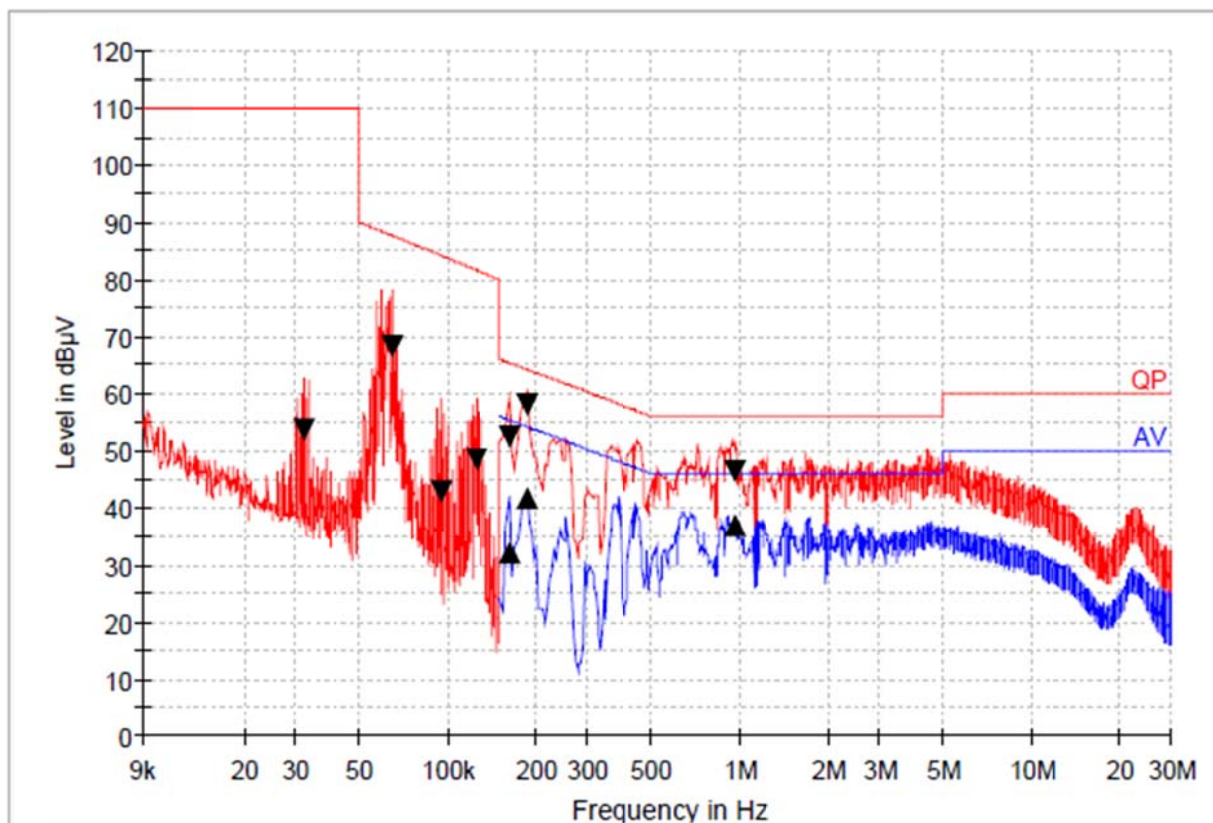
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.190000	52.9	38.4	9.000	N	9.6	11.1	64.0	15.6	54.0
0.254000	43.9	32.6	9.000	N	9.6	17.7	61.6	19.1	51.6
0.378000	44.6	37.7	9.000	N	9.7	13.7	58.3	10.6	48.3
0.446000	41.8	36.1	9.000	N	9.7	15.1	56.9	10.8	46.9
1.558000	38.5	32.9	9.000	N	9.7	17.5	56.0	13.1	46.0
18.158000	35.4	30.0	9.000	N	10.0	24.6	60.0	20.0	50.0

5.4.6 Test Data for ISED Canada

Date of Test	2018-11-29	Temperature	(18.6 ± 1.0) °C
		Relative humidity	(46.2 ± 1.0) % R.H.
Measurement Frequency Range		9 kHz ~ 30 MHz	
Test Result	PASS	Tested By	In Yong, Song 

5.4.5.1 Test Data from AC Power Line Conducted Emissions (Client: Elements™ IC Downpack)

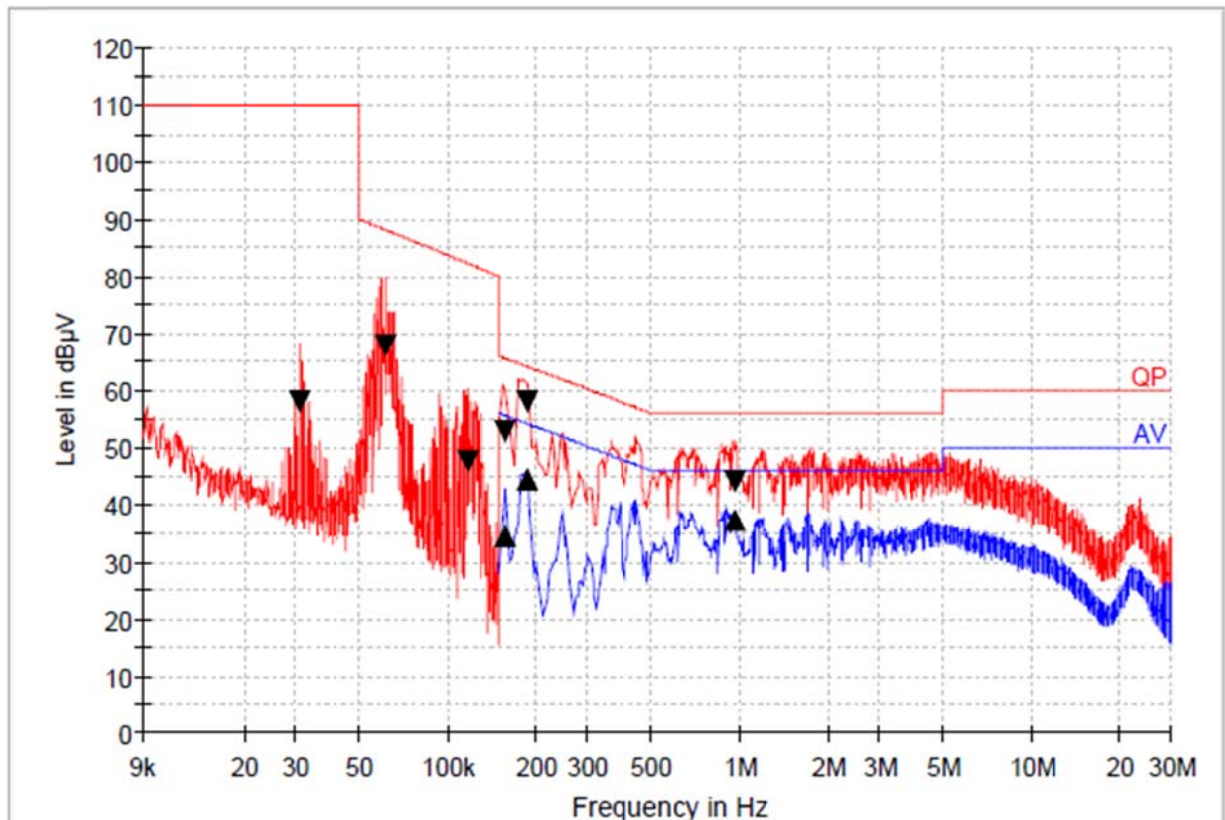
Hot Line (Mode #1)



Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.032040	53.4	---	0.200	L1	0.1	56.6	110.0	---	---
0.064360	68.4	---	0.200	L1	0.1	19.3	87.7	---	---
0.095000	43.0	---	0.200	L1	0.1	41.2	84.2	---	---
0.126040	48.4	---	0.200	L1	0.1	33.2	81.6	---	---
0.162000	52.3	32.1	9.000	L1	0.1	13.1	65.4	23.2	55.4
0.186000	57.8	41.8	9.000	L1	0.1	6.4	64.2	12.4	54.2
0.970000	46.6	37.1	9.000	L1	0.1	9.4	56.0	8.9	46.0

Neutral Line (Mode #1)

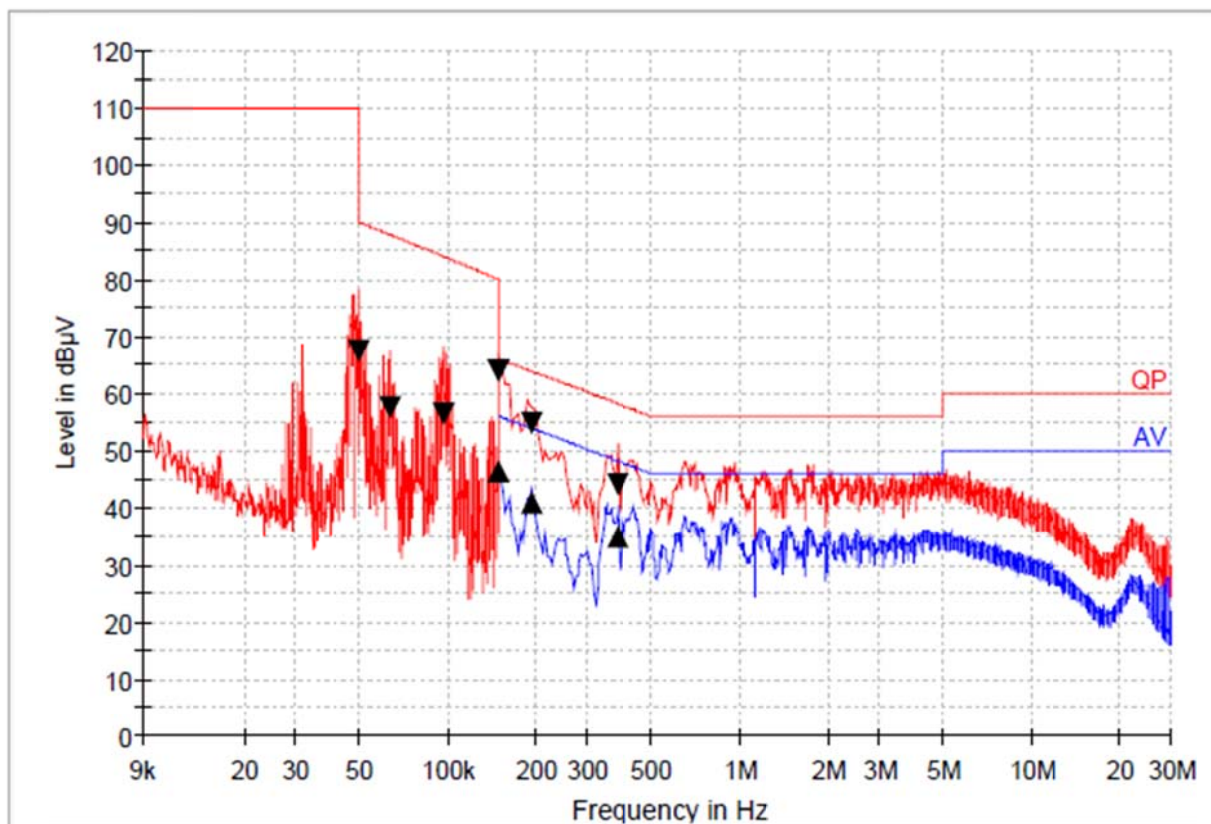


Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.031240	58.1	---	0.200	N	0.1	51.9	110.0	---	---
0.061160	68.1	---	0.200	N	0.1	20.1	88.2	---	---
0.116520	47.6	---	0.200	N	0.1	34.7	82.3	---	---
0.158000	52.9	34.5	9.000	N	0.1	12.6	65.6	21.1	55.6
0.186000	57.9	44.7	9.000	N	0.1	6.3	64.2	9.6	54.2
0.970000	44.0	37.2	9.000	N	0.1	12.0	56.0	8.8	46.0

5.4.5.2 Test Data from AC Power Line Conducted Emissions (Client: Elements™ IC Backfill)

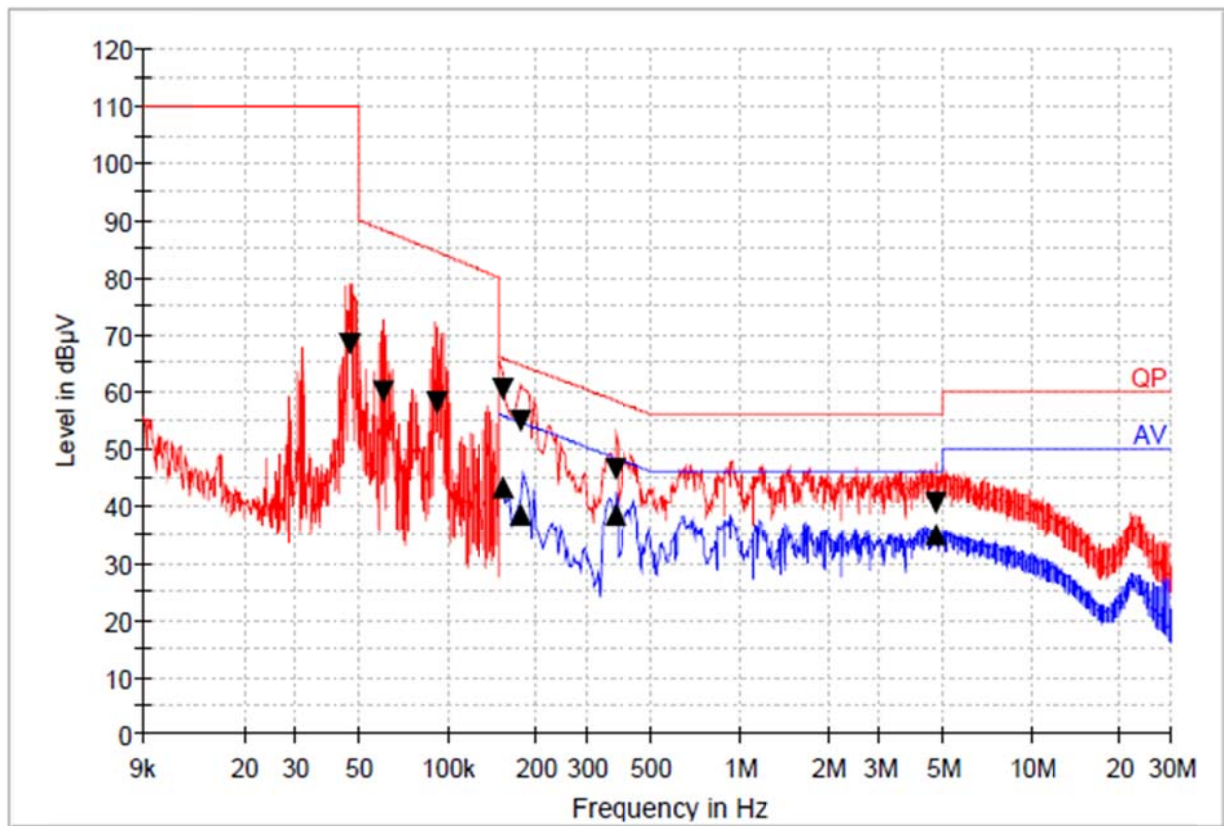
Hot Line (Mode #2)



Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.049560	67.7	---	0.200	L1	0.1	42.3	110.0	---	---
0.063480	57.7	---	0.200	L1	0.1	30.1	87.8	---	---
0.095720	56.4	---	0.200	L1	0.1	27.7	84.1	---	---
0.150000	64.1	46.5	9.000	L1	0.1	1.9	66.0	9.5	56.0
0.194000	54.8	40.9	9.000	L1	0.1	9.0	63.9	12.9	53.9
0.386000	44.2	35.2	9.000	L1	0.1	14.0	58.1	13.0	48.1

Neutral Line (Mode #2)



Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.046760	68.5	---	0.200	N	0.1	41.5	110.0	---	---
0.060760	60.1	---	0.200	N	0.1	28.1	88.2	---	---
0.091560	58.0	---	0.200	N	0.1	26.5	84.5	---	---
0.154000	60.4	43.2	9.000	N	0.1	5.3	65.8	12.6	55.8
0.178000	54.7	38.6	9.000	N	0.1	9.9	64.6	16.0	54.6
0.378000	46.5	38.5	9.000	N	0.1	11.8	58.3	9.9	48.3
4.686000	40.6	35.1	9.000	N	0.2	15.4	56.0	10.9	46.0

Appendix I – Test Instrumentation

Description	Model No.	Serial No.	Manufacturer.	Due for Cal Date
Signal & Spectrum Analyzer	FSW 43	100578	Rohde & Schwarz	2019-04-26
Attenuator	56-10	58769	WEINSCHTEL	2020-01-22
Test Receiver	ESU 26	100303	Rohde & Schwarz	2020-01-18
Loop Antenna	HFH2-Z2	100341	Rohde & Schwarz	2019-04-21
TRILOG Broadband Antenna	VULB9163	9163.799	Schwarzbeck	2019-09-14
Attenuator	6dB	272.4110.50	Rohde & Schwarz	2020-01-18
Pre-Amplifier	310N	344015	Sonoma Instrument	2020-01-18
Slidacs	DSD-1105	M06-117	DIGITAK POWER	N/A
Turn Table	DT3000-3t	1310814	INNCO SYSTEM	N/A
Antenna Master	MA4000-EP	4600814	INNCO SYSTEM	N/A
Camera Controller	HDCon4102	6531445048	PONTIS	N/A
CO3000 Controller	Co3000-4Port	CO3000/806/ 34130814/L	INNCO SYSTEM	N/A
LISN	ENV216	100110	Rohde & Schwarz	2019-07-27
LISN	LS16C	16011403310	AFJ	2019-07-27

The measuring equipment utilized to perform the tests documented in this test report has been calibrated in accordance with manufacturer's recommendations, and is traceable to recognized national standards.