

TEST REPORT

Report No.: 20050070HKG-001

Harman Becker Automotive Systems

Application For Certification
(Original Grant)

FCC ID: T8GWCME125

Transmitter

Prepared and Checked by:

Approved by:

Signed On File
Lee For Yiu, Florey
Assistant Engineer

Wong Kwok Yeung, Kenneth
Senior Lead Engineer
Date: May 28, 2020

Intertek's standard Terms and Conditions can be obtained at our website <http://www.intertek.com/terms/>.

The test report only allows to be revised within the retention period unless further standard or the requirement was noticed.

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

© 2017 Intertek

TEST REPORT

GENERAL INFORMATION

Grantee:	Harman Becker Automotive Systems
Grantee Address:	Becker-Göring-Strasse 16 Karlsbad-Ittersbach 76307 Germany
Contact Person:	Alexandru Costin Neacsu
Tel:	+40728861116
Fax:	N/A
e-mail:	costinalexandru.neacsu@harman.com
Brand Name:	Harman Becker
Model:	E125
Type of EUT:	Transmitter
Description of EUT:	Automotive Wireless Charger Module to be installed in cars, with the following features: Qi
Serial Number:	N/A
FCC ID:	T8GWCME125
Date of Sample Submitted:	May 05, 2020
Date of Test:	May 05, 2020 to May 13, 2020
Report No.:	20050070HKG-001
Report Date:	May 28, 2020
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%
Conclusion:	Test was conducted by client submitted sample. The submitted sample as received complied with the 47 CFR Part 15 Certification.

TEST REPORT

SUMMARY OF TEST RESULT

Test Specification	Reference	Results
Radiated Emission	15.209	Pass
Radiated Emission on the Bandedge		

The equipment under test is found to be complying with the following standards:
FCC Part 15, October 1, 2019 Edition

Note: 1. The EUT uses a permanently attached antenna which, in accordance to section 15.203, is considered sufficient to comply with the provisions of this section.
2. Pursuant to FCC part 15 Section 15.215(c), the 20 dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered.

TEST REPORT

TABLE OF CONTENTS

1.0	GENERAL DESCRIPTION	5
1.1	Product Description	5
1.2	Related Submittal(s) Grants	5
1.3	Test Methodology.....	5
1.4	Test Facility	5
2.0	SYSTEM TEST CONFIGURATION.....	6
2.1	Justification	6
2.2	EUT Exercising Software.....	6
2.3	Special Accessories	6
2.4	Measurement Uncertainty.....	6
2.5	Support Equipment List and Description.....	6
3.0	EMISSION RESULTS.....	7
3.1	Field Strength Calculation	7
3.2	Radiated Emission Configuration Photograph.....	8
3.3	Radiated Emission Data	8
4.0	EQUIPMENT PHOTOGRAPHS	15
5.0	PRODUCT LABELLING.....	15
6.0	TECHNICAL SPECIFICATIONS	15
7.0	INSTRUCTION MANUAL.....	15
8.0	MISCELLANEOUS INFORMATION	16
8.1	Measured Bandwidth	16
8.2	Discussion of Pulse Desensitization.....	17
8.3	Calculation of Average Factor	17
8.4	Emissions Test Procedures.....	18
9.0	CONFIDENTIALITY REQUEST	21
10.0	EQUIPMENT LIST	21

TEST REPORT

1.0 GENERAL DESCRIPTION

1.1 Product Description

The equipment under test is a qi wireless charger which is operated at 120 – 127.7kHz. The EUT is powered by DC12.0V Car battery. The EUT is embedded and installed into a vehicle for mobile phone charging. Maximum radio-frequency power transmitted in the frequency band(s) in which the radio equipment operates:

Frequency Range	
120kHz	15W
127.7 kHz	7.5W

Antenna Type: Internal, Integral

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

1.2 Related Submittal(s) Grants

This is a single application for certification of a transmitter.

1.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). All radiated measurements were performed in an 3m Chamber. Preliminary scans were performed in the 3m Chamber only to determine worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the “**Justification Section**” of this Application.

1.4 Test Facility

The 3m Chamber used to collect the radiated data is located at Workshop No. 3, G/F., World-Wide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, N.T., Hong Kong SAR, China. This test facility and site measurement data have been placed on file with the FCC.

TEST REPORT

2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2013).

The device was powered by fully charge of 12.0VDC (1 x 12.0V Car Battery).

For maximizing emissions below 30 MHz, the EUT was rotated through 360°, the centre of the loop antenna was placed 1 meter above the ground, and the antenna polarization was changed. For maximizing emission at and above 30 MHz, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data report in Exhibit 3.0.

The unit was operated standalone and placed in the center of the turntable.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a plastic stand if necessary and placed on the wooden turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

2.2 EUT Exercising Software

There was no special software to exercise the device. Once the unit is powered up, it transmits the RF signal continuously.

2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

2.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Uncertainty and Compliance - Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value.

2.5 Support Equipment List and Description

1. Software: LIN_MessageIntertek.linproj
2. 15W Specific Loader of Demoboard 15W with phones (Samsung S8) connected to phone's GND
(Provided by Applicant)
3. iPhone8 (Provided by Intertek)
4. LIN/ DC supply cable with 5.7m long (Provided by Applicant)

TEST REPORT

3.0 EMISSION RESULTS

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any), Average Factor (optional) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG - AV$$

where FS = Field Strength in dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

AV = Average Factor in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

$$FS = RR + LF$$

where

FS = Field Strength in dB μ V/m

RR = RA - AG - AV in dB μ V

LF = CF + AF in dB

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29 dB and average factor of 5 dB are subtracted, giving a field strength of 27 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V/m}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$AV = 5.0 \text{ dB}$$

$$FS = RR + LF$$

$$FS = 18 + 9 = 27 \text{ dB}\mu\text{V/m}$$

$$RR = 18.0 \text{ dB}\mu\text{V}$$

$$LF = 9.0 \text{ dB}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(27 \text{ dB}\mu\text{V/m})/20] = 22.4 \mu\text{V/m}$$

TEST REPORT

3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 0.166 MHz

For electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Passed by 4.8 dB

TEST REPORT

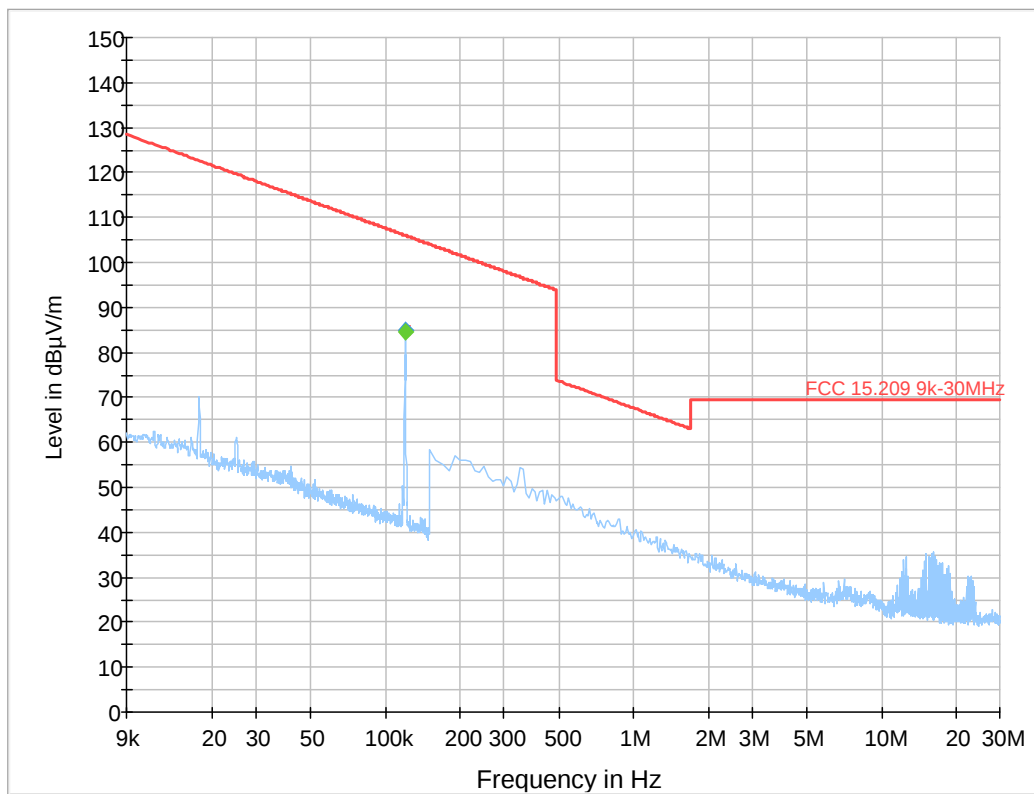
RADIATED EMISSIONS

Model: E125

Date of Test: May 13, 2020

Worst-Case Operating Mode: 120kHz – 15W wireless charging (Specific loader of 15W Demoboard with S8)

Table 1
Pursuant to FCC Part 15 Section 15.209 Requirement



Frequency (MHz)	QuasiPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.119624	---	84.66	106.04	-21.38	3000.0	0.200	100.0	O	275.0	11.9
0.119624	84.75	---	106.04	21.29	3000.0	0.200	100.0	O	275.0	11.9

NOTES:

1. All measurements were made at 3 meters.
2. Negative sign in the column shows value below limit.
3. Loop antenna is used for the emissions below 30MHz.
4. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

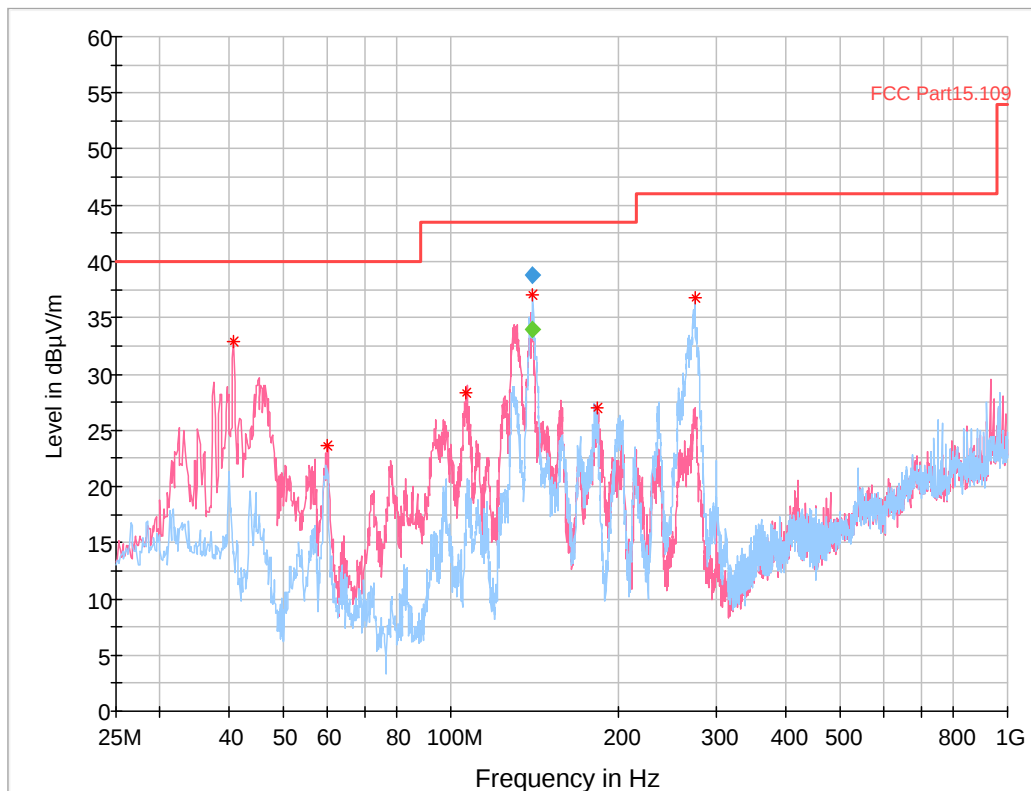
TEST REPORT

Model: E125

Date of Test: May 13, 2020

Worst-Case Operating Mode: 120kHz – 15W wireless charging (Specific loader of 15W Demoboard with S8)

Table 2
Pursuant to FCC Part 15 Section 15.209 Requirement



Frequency (MHz)	MaxPeak (dBμV/m)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
140.349025	---	34.00	43.50	-9.50	3000.0	100.000	142.0	H	348.0	-18.8
140.349025	38.82	---	43.50	-4.68	3000.0	100.000	142.0	H	348.0	-18.8

- NOTES:
1. All measurements were made at 3 meters.
 2. Negative sign in the column shows value below limit.
 3. Loop antenna is used for the emissions below 30MHz.
 4. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

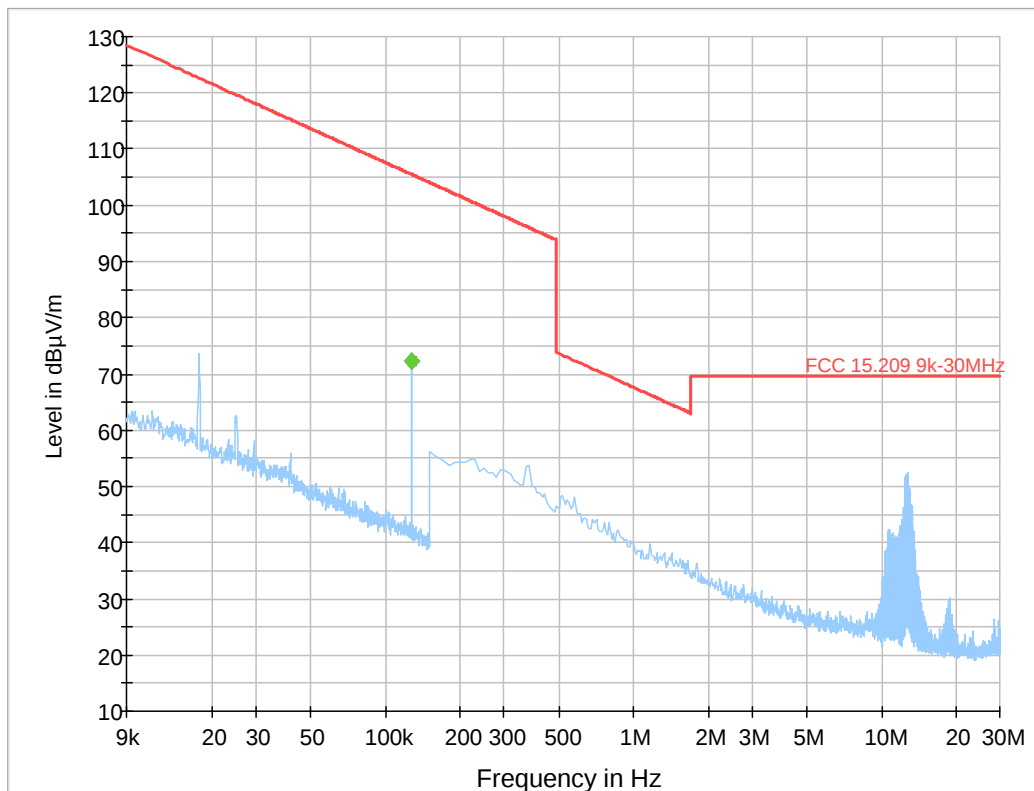
TEST REPORT

Model: E125

Date of Test: May 13, 2020

Worst-Case Operating Mode: 127.7kHz – 7.5W wireless charging (iPhone 8)

Table 3
Pursuant to FCC Part 15 Section 15.209 Requirement



Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.127516	---	72.27	105.49	-33.22	3000.0	0.200	100.0	O	106.0	11.9
0.127516	72.23	---	105.49	-33.26	3000.0	0.200	100.0	O	106.0	11.9

- NOTES:
1. All measurements were made at 3 meters.
 2. Negative sign in the column shows value below limit.
 3. Loop antenna is used for the emissions below 30MHz.
 4. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

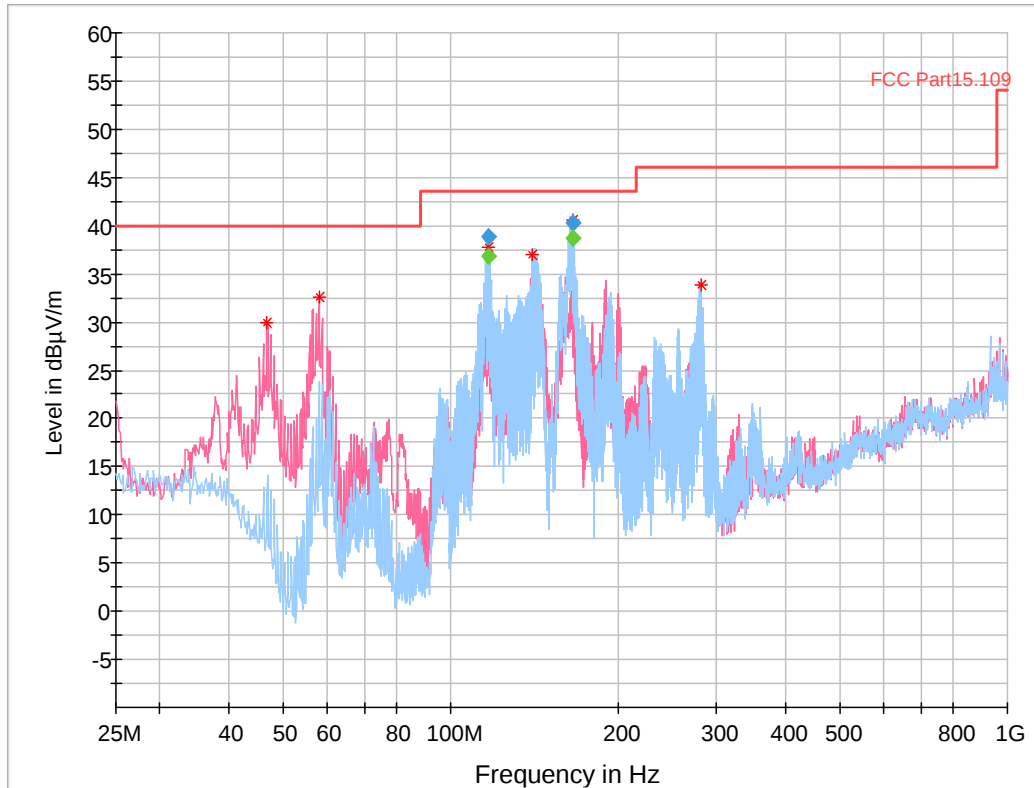
TEST REPORT

Model: E125

Date of Test: May 13, 2020

Worst-Case Operating Mode: 127.7kHz – 7.5W wireless charging (iPhone 8)

Table 3
Pursuant to FCC Part 15 Section 15.209 Requirement



Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
116.528400	---	36.79	43.50	-6.71	3000.	100.000	274.0	H	86.0	-19.4
116.528400	38.93	---	43.50	-4.57	3000.	100.000	274.0	H	86.0	-19.4
166.002375	---	38.70	43.50	-4.80	3000.	100.000	206.0	H	268.0	-17.1
166.002375	40.25	---	43.50	-3.25	3000.	100.000	206.0	H	268.0	-17.1

- NOTES:
1. All measurements were made at 3 meters.
 2. Negative sign in the column shows value below limit.
 3. Loop antenna is used for the emissions below 30MHz.
 4. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

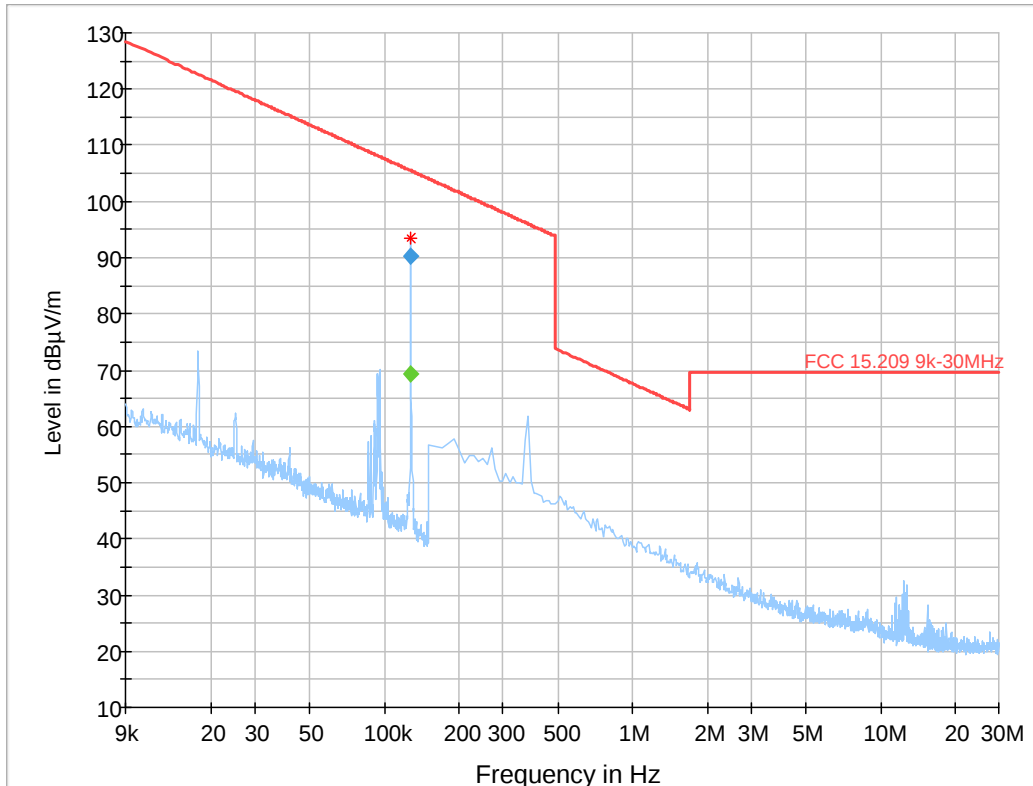
TEST REPORT

Model: E125

Date of Test: May 13, 2020

Worst-Case Operating Mode: 127.7kHz – standby without client device

Table 3
Pursuant to FCC Part 15 Section 15.209 Requirement



Frequency (MHz)	QuasiPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.127501	---	69.36	105.49	-36.13	3000.0	0.200	100.0	O	338.0	11.9
0.127501	90.24	---	105.49	-15.25	3000.0	0.200	100.0	O	338.0	11.9

- NOTES:
1. All measurements were made at 3 meters.
 2. Negative sign in the column shows value below limit.
 3. Loop antenna is used for the emissions below 30MHz.
 4. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

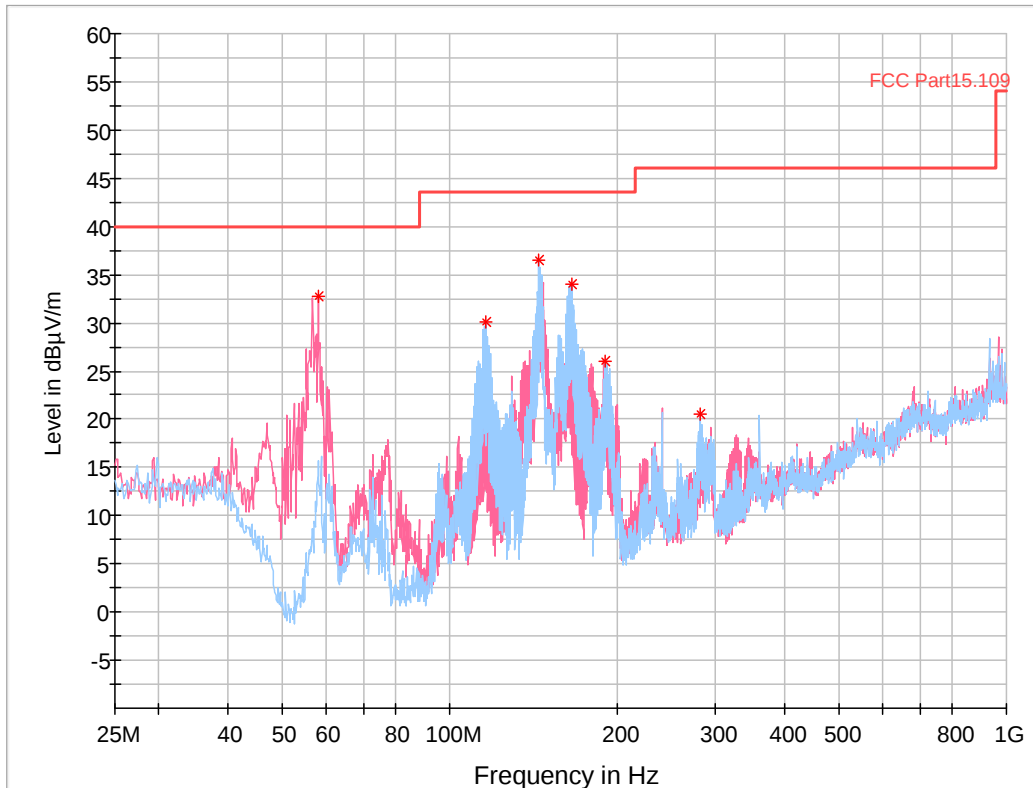
TEST REPORT

Model: E125

Date of Test: May 13, 2020

Worst-Case Operating Mode: 127.7kHz – standby without client device

Table 3
Pursuant to FCC Part 15 Section 15.209 Requirement



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
58.028125	32.75	40.00	-7.25	3000.	100.000	100.0	V	151.0	-21.0
116.040625	30.06	43.50	-13.44	3000.	100.000	200.0	H	110.0	-19.4
144.681250	36.47	43.50	-7.03	3000.	100.000	200.0	H	110.0	-18.2
165.643750	33.94	43.50	-9.56	3000.	100.000	200.0	H	258.0	-17.1
190.018750	26.03	43.50	-17.47	3000.	100.000	200.0	H	265.0	-16.9
280.937500	20.52	46.00	-25.48	3000.	100.000	100.0	H	106.0	-13.4

- NOTES:
1. All measurements were made at 3 meters.
 2. Negative sign in the column shows value below limit.
 3. Loop antenna is used for the emissions below 30MHz.
 4. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

TEST REPORT

4.0 EQUIPMENT PHOTOGRAPHS

For electronic filing, the photographs are saved with filename: external photos.pdf and internal photos.pdf.

5.0 PRODUCT LABELLING

For electronics filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

6.0 TECHNICAL SPECIFICATIONS

For electronic filing, the block diagram and schematic of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

7.0 INSTRUCTION MANUAL

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

TEST REPORT

8.0 MISCELLANEOUS INFORMATION

The miscellaneous information includes details of the test procedure and measured bandwidth

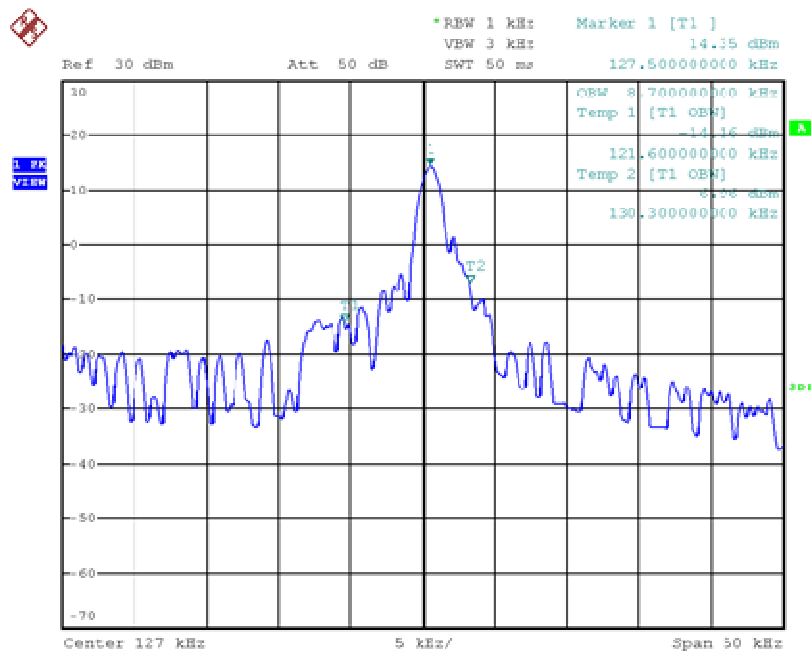
8.1 Measured Bandwidth

Pursuant to FCC Part 15 Section 15.215(c), the 20dB bandwidth of the emission was contained within the frequency band designed (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over expected variations in temperature and supply voltage were considered.

Occupied Bandwidth Results:

Occupied Bandwidth (kHz)	
120kHz	2.28
127.7kHz	8.70

The worst case is shown as below



TEST REPORT

8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. Since the transmitter transmits the RF signal continuously.

8.3 Calculation of Average Factor

The average factor is not applicable for this device as the transmitted signal is a continuously signal.

TEST REPORT

8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services Hong Kong Ltd. in the measurements of transmitter operating under the Part 15, Subpart C rules.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately 0.8m in height above the ground plane for emission measurement at or below 1GHz and 1.5m in height above the ground plane for emission measurement above 1GHz. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axis to obtain maximum emission levels. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

TEST REPORT

8.4 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements were made as described in ANSI C63.10 (2013).

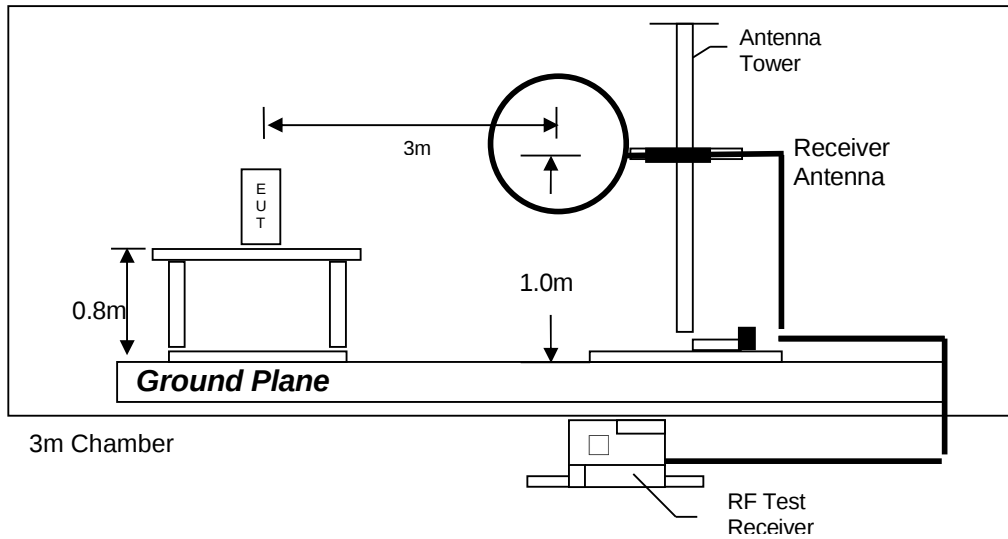
The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.1). Above 1000 MHz, a resolution bandwidth of 3 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, unless otherwise reported. Measurements taken at a closer distance are so marked.

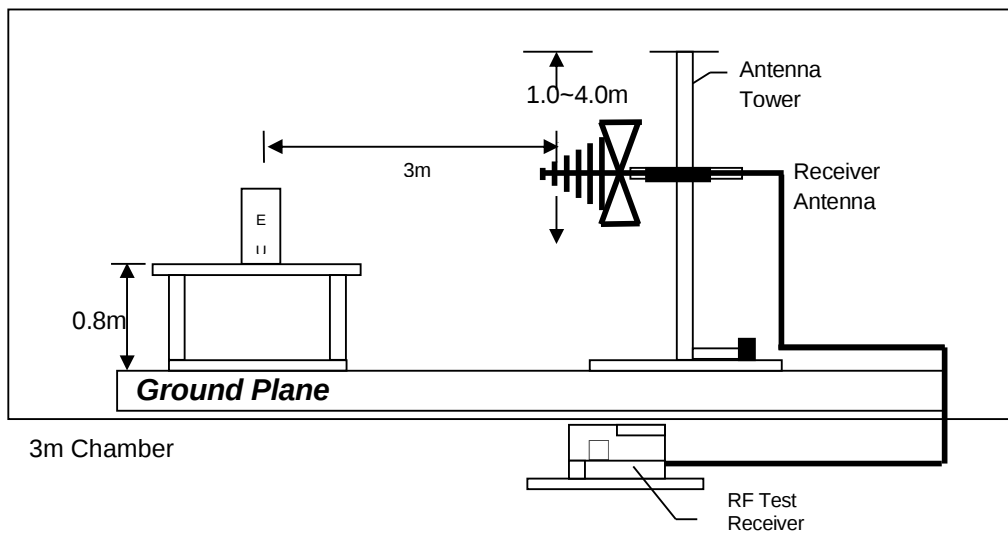
TEST REPORT

8.4.1 Radiated Emission Test Setup

The figure below shows the test setup, which is utilized to make these measurements.



Test setup of radiated emissions up to 30MHz



Test setup of radiated emissions upto 1GHz

TEST REPORT

9.0 CONFIDENTIALITY REQUEST

For electronic filing, a preliminary copy of the confidentiality request is saved with filename: request.pdf.

10.0 EQUIPMENT LIST

1) Radiated Emissions Test

Equipment	EMI Test Receiver	Biconical Antenna	14m Double Shield RF Cable
Registration No.	EW-3156	EW-0571	EW-2528
Manufacturer	R&S	EMCO	RADIALL
Model No.	ESR26	3104C	nm / br5d / sma 14m
Calibration Date	August 1, 2019	July 23, 2019	September 30, 2019
Calibration Due Date	August 1, 2020	January 23, 2021	September 30, 2020

Equipment	Active Loop H-field (9kHz to 30MHz)	Log Periodic Antenna
Registration No.	EW-2313	EW-0447
Manufacturer	ELECTROMETRI	EMCO
Model No.	EM-6876	3146
Calibration Date	December 17, 2019	September 25, 2019
Calibration Due Date	June 17, 2021	March 25, 2021

2) OBW Measurement

Equipment	Spectrum Analyzer
Registration No.	EW-2666
Manufacturer	R&S
Model No.	ESCI7
Calibration Date	August 28, 2019
Calibration Due Date	August 28, 2020

END OF TEST REPORT