

Carestream Dental LLC

RF TEST REPORT

Report Type:

FCC Part 15.225 & ISED RSS-210 RF report

Model:

RFID Reader (Scan & Go Device)

REPORT NUMBER:

190201132SHA-001

ISSUE DATE:

April 03, 2019

DOCUMENT CONTROL NUMBER:

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FCC ID : 2ASFG-SCANGODEVICE

IC : 24914-SCANGO

SUMMARY:

The equipment complies with the requirements according to the following standard(s) or Specification:

47CFR Part 15 (2018): Radio Frequency Devices (Subpart C)

ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

RSS-210 Issue 9 (August 2016): Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

RSS-Gen Issue 5 (April 2018): General Requirements for Compliance of Radio Apparatus

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TEST REPORT

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Revision History

Report No.	Version	Description	Issued Date
190201132SHA-001	Rev. 01	Initial issue of report	April 03, 2019

Measurement result summary

TEST ITEM	FCC REFERENCE	IC REFERENCE	RESULT
20dB Bandwidth&99% Bandwidth	15.215(c) 2.1049	RSS-Gen Issue 5 Clause 6.7	Pass
Fundamental Field Strength and Emission Mask	15.205 & 15.225(a) (b) (c)	RSS-210 Issue 9 Annex B.6	Pass
Emission outside the frequency band	15.225(d) /15.209	RSS-Gen Issue 5 Clause 8.9&8.10	Pass
Power line conducted emission	15.207	RSS-Gen Issue 5 Clause 8.8	Pass
Frequency Stability	15.225(e)	RSS-Gen Issue 5 Clause 8.11	Pass
Antenna requirement	15.203	-	Pass

Notes: 1: NA =Not Applicable

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name:	RFID Reader (Scan & Go Device)
Type/Model:	Scan & Go Device
Description of EUT:	<p>The EUT is called Scan & Go Device which is an optional device (accessory) to be used with the CS 7600 Scanner. A RFID module operated near 13.56MHz is contained in this EUT.</p> <p>With this EUT, it will be enabled to link the imaging plate to a specific exam acquisition (for example, patient) prior to acquisition. When the plate is inserted into the scanner, the information which was tagged onto the plate is retrieved by the scanner and the imaging plate is scanned automatically according to this information. Scanned images are then routed automatically to the correct workstation, associated to the correct exam acquisition and placed in the correct frame in the CS 7600 image Acquisition interface.</p>
Rating:	Powered by USB port: 5Vdc, 0.5A
EUT type:	<input checked="" type="checkbox"/> Table top <input type="checkbox"/> Floor standing
Software Version:	/
Hardware Version:	/
Sample received date:	February 25, 2019
Date of test:	February 25, 2019

1.2 Technical Specification

Operation Frequency Band:	13.556 ~ 13.567MHz
Normal Working Frequency:	13.56MHz
Channel Number:	1
Type of Modulation:	ASK
Product Type:	<input checked="" type="checkbox"/> Table top <input type="checkbox"/> Floor standing
Antenna Designation:	Fixed Internal Loop Antenna

TEST REPORT**1.3 Description of Test Facility**

Name:	Intertek Testing Services Shanghai
Address:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L0139
	FCC Accredited Lab Designation Number: CN1175
	IC Registration Lab Registration code No.: CN0051
	VCCI Registration Lab Registration No.: R-14243, G10845, C-14723, T-12252
	A2LA Accreditation Lab Certificate Number: 3309.02

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2018)
 ANSI C63.10 (2013)
 RSS-210 Issue 9 (August 2016)
 RSS-Gen Issue 5 (April 2018)

2.2 Mode of operation during the test

Within this test report, EUT was tested with modulation and tested under its rating voltage and frequency.

The EUT is a handheld device, so three axes (X, Y, Z) were observed while the test receiver worked as “max hold” continuously and the highest reading among the whole test procedure was recorded.

The EUT was set to continuously transmit at 13.56MHz. This was performed using manufacturer software loaded on the PC to allow for continuous transmission.

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
1	Laptop computer	DELL 5480	100-240V AC, 50/60Hz
2	USB Adaptor	HNBC050100UE	100-240V AC, 50/60Hz

2.5 Test environment condition:

Test items	Temperature	Humidity
20dB Bandwidth & 99% Bandwidth	22°C	55% RH
Fundamental field strength and emission mask	22°C	54% RH
Emission outside the frequency band	22°C	55% RH
Frequency Stability	22°C	54% RH
Power line conducted emission	22°C	54% RH

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2.6 Instrument list

Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Test Receiver	R&S	ESIB 26	EC 3045	2019-09-12
<input checked="" type="checkbox"/>	Active loop antenna	Schwarzbeck	FMZB1519	EC 5345	2020-01-23
<input checked="" type="checkbox"/>	Bilog Antenna	TESEQ	CBL 6112D	EC 4206	2019-06-10
<input type="checkbox"/>	Horn antenna	R&S	HF 906	EC 3049	2019-11-16
<input type="checkbox"/>	Horn antenna	ETS	3117	EC 4792-1	2020-01-09
<input type="checkbox"/>	Horn antenna	TOYO	HAP18-26W	EC 4792-3	2020-07-09
<input type="checkbox"/>	Pre-amplifier	R&S	AFS42-00101 800-25-S-42	EC5262	2019-06-10
<input checked="" type="checkbox"/>	Semi-anechoic chamber	Albatross project	-	EC 3048	2019-09-14
RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	PXA Signal Analyzer	Keysight	N9030A	EC 5338	2020-03-05
<input type="checkbox"/>	Power sensor	Agilent	U2021XA	EC 5338-1	2020-03-05
<input type="checkbox"/>	Vector Signal Generator	Agilent	N5182B	EC 5175	2020-03-05
<input type="checkbox"/>	MXG Analog Signal Generator	Agilent	N5181A	EC 5338-2	2020-03-05
<input type="checkbox"/>	Mobile Test System	Litepoint	Iqxel	EC 5176	2020-01-08
<input type="checkbox"/>	Test Receiver	R&S	ESCI 7	EC 4501	2019-09-12
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3783	2020-02-28
<input checked="" type="checkbox"/>	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 2122	2020-03-11
<input checked="" type="checkbox"/>	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3326	2020-03-28
<input checked="" type="checkbox"/>	Pressure meter	YM3	Shanghai Mengde	EC 3320	2019-07-01

2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Test item	Measurement uncertainty
Radiated Emissions in restricted frequency bands below 1GHz	$\pm 4.90\text{dB}$
Radiated Emissions in restricted frequency bands above 1GHz	$\pm 5.02\text{dB}$
Emission outside the frequency band	$\pm 2.89\text{dB}$
Power line conducted emission	$\pm 3.19\text{dB}$

3 20dB Bandwidth & 99% Bandwidth

Test result: Pass

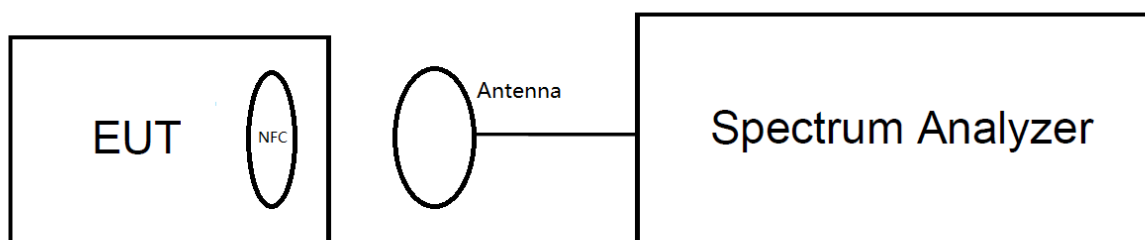
3.1 Limit

The bandwidth at 20dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequency.

3.2 Measurement Procedure

1. Spectrum analyzer frequency is set to the nominal EUT channel center frequency.
2. RBW = 1~ 5% OBW, VBW \geq 3 x RBW
3. Reference level set to keep signal from exceeding maximum input mixer level for linear operation.
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. Using the Instrument function to determine the “-20dB down amplitude”.

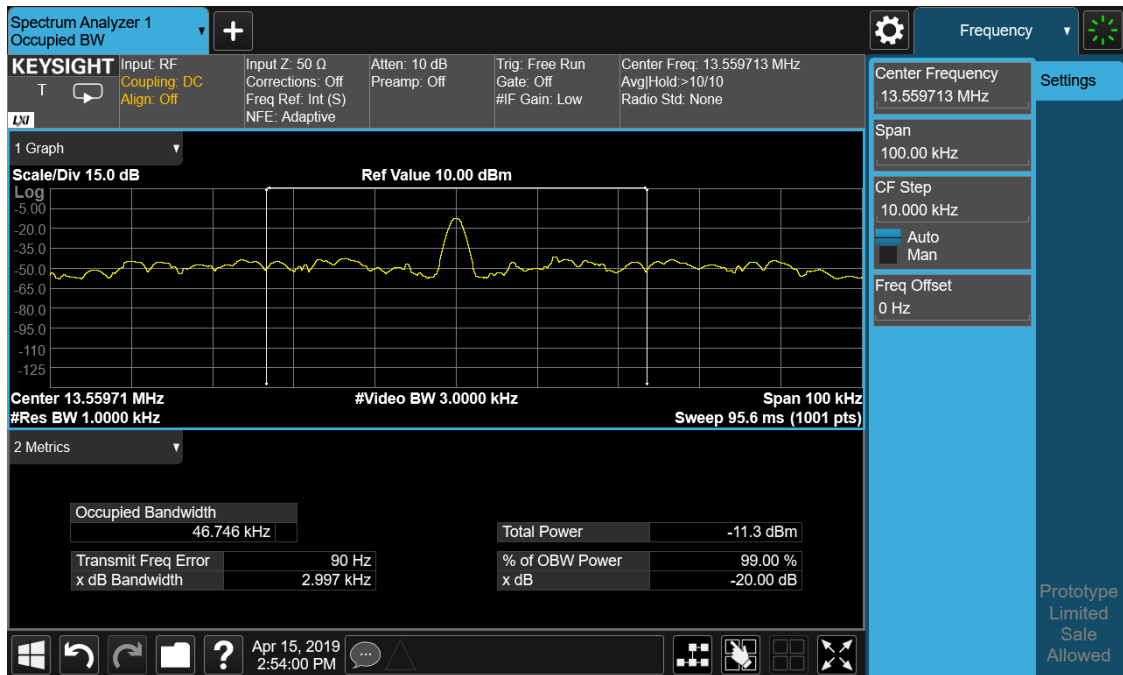
3.3 Test Configuration



3.4 Test Result

Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
13.56	46.746	2.997

Test Plots:



4 FUNDAMENTAL FIELD STRENGTH AND EMISSION MASK

Test result: Pass

4.1 Limit

All in-band emissions appearing in a restricted band as specified in Section 15.225 of the Title 47 CFR must not exceed the limits shown below:

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Measured Distance (Meters)
13.553-13.567 MHz	15848	30
13.410-13.553 MHz and 13.567-13.710 MHz	343	30
13.110-13.410 MHz	106	30

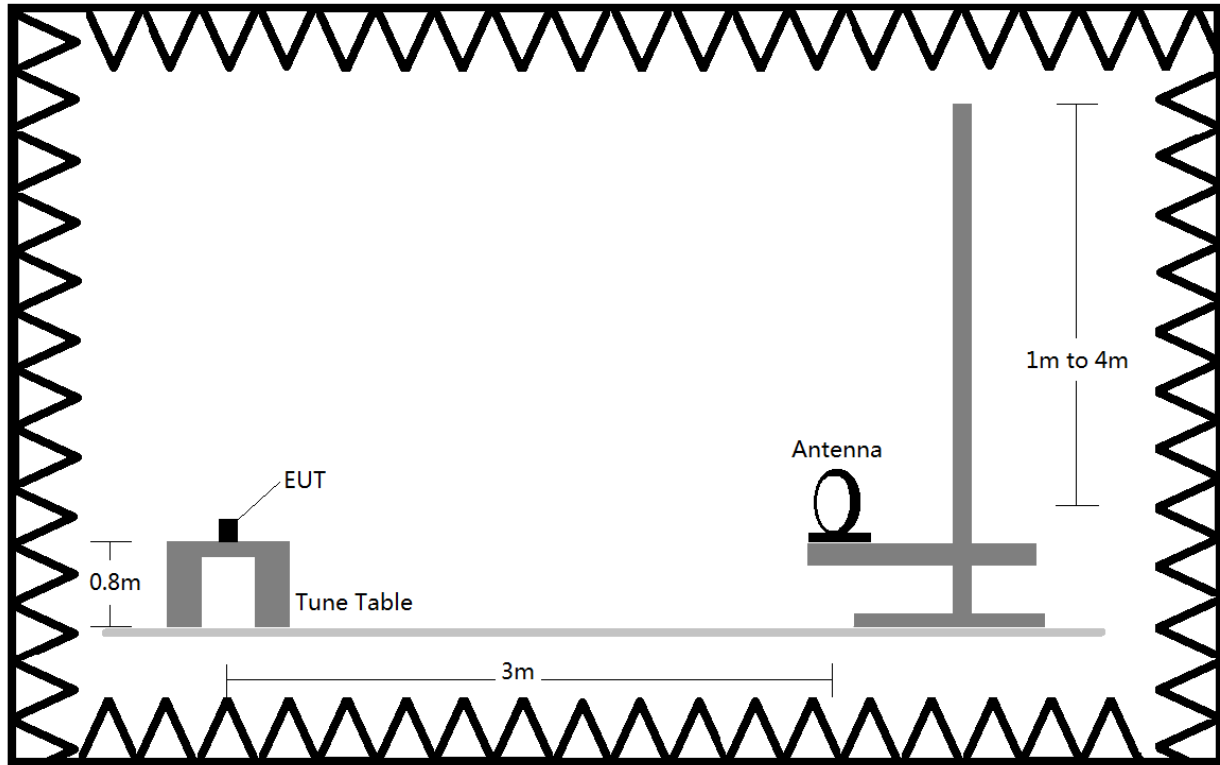
Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level ($\text{dB}\mu\text{V}/\text{m}$) = $20 \log$ Emission level ($\mu\text{V}/\text{m}$).
3. For Below 30MHz, the measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

Field strength limit for 13.56MHz = 15848 $\mu\text{V}/\text{m}$ at 30m
 = 84 $\text{dB}\mu\text{V}/\text{m}$ at 30m
 = 84 $\text{dB}\mu\text{V}/\text{m}$ + $40\log(30/3)$ dB at 3m
 = 124 $\text{dB}\mu\text{V}/\text{m}$ at 3m

4.2 Test Configuration



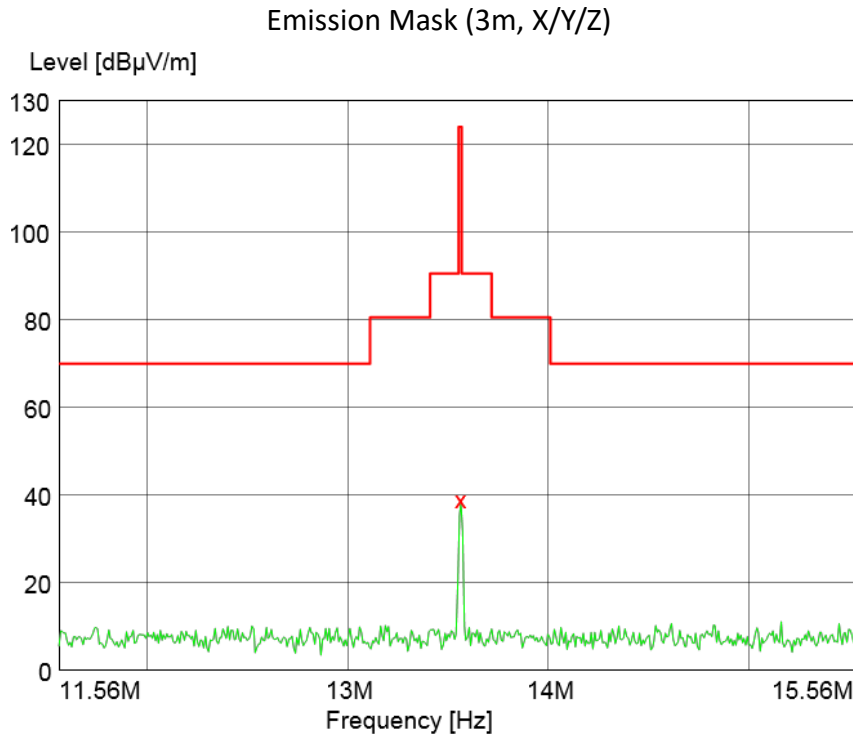
TEST REPORT**4.3 Measurement Procedure**

The EUT was tested from 13.110 – 14.010 MHz. All in-band radiated spurious emissions are measured with a spectrum analyzer connected to a loop antenna while the EUT is operating at appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All measurements were performed using a loop antenna. The antenna was positioned in three orthogonal positions (X front, Y side, Z top) and the position with the highest emission level was recorded.

1. RBW = 10kHz,
2. VBW \geq 3 x RBW,
3. Detector = peak,
4. Sweep time = auto couple,
5. Trace mode = max hold,
6. Trace was allowed to stabilize.

4.4 Test Results



Test data:

Frequency (MHz)	Result (dBµV/m) (3m)	Limit (dBµV/m) (3m)	Polarization
13.56	39.50	124	X/Y/Z

5 Emission outside the frequency band

Test result: Pass

5.1 Limit

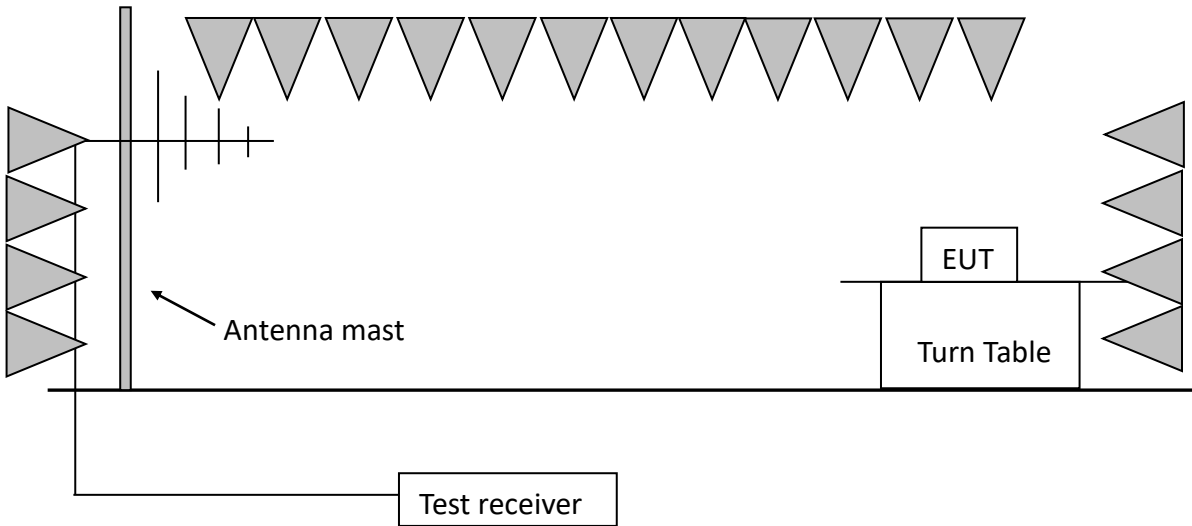
The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) shown as below:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

5.2 Test procedure and test setup

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotating table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
7. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest, RBW = 9kHz for emissions below 30MHz and 100kHz for emissions between 30MHz and 1GHz. VBW $\geq 3 \times$ RBW, Detector = peak, Sweep time = auto couple, Trace mode = max hold, Trace was allowed to stabilize
8. The radiation measurements are performed in X, Y, Z axis positioning. And found the Y axis positioning which it is worse case, only the test worst case mode is recorded in the report.

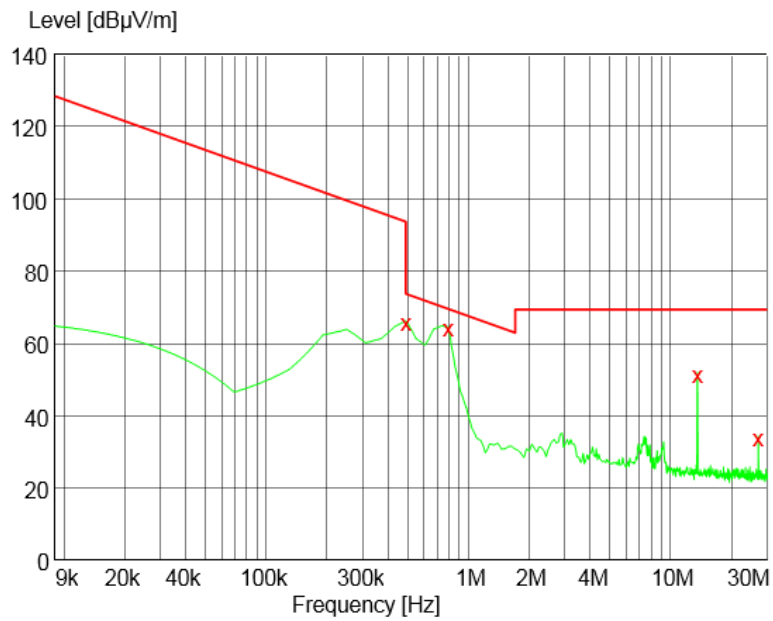
5.3 Test Configuration



Note: This test configuration is used for above 30MHz, when measure the result of below 30MHz please refer section 4.2 test configuration.

5.4 The results

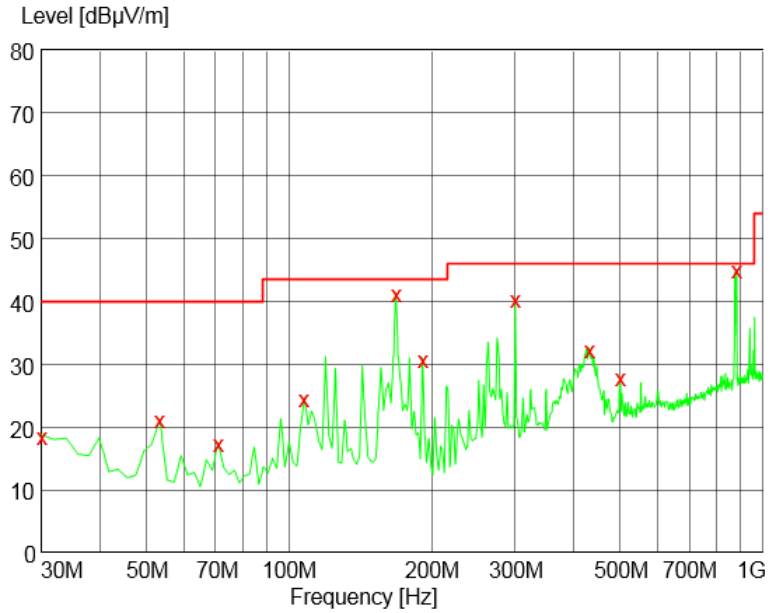
9 KHz ~ 30 MHz at 3 meters (X/Y/Z)



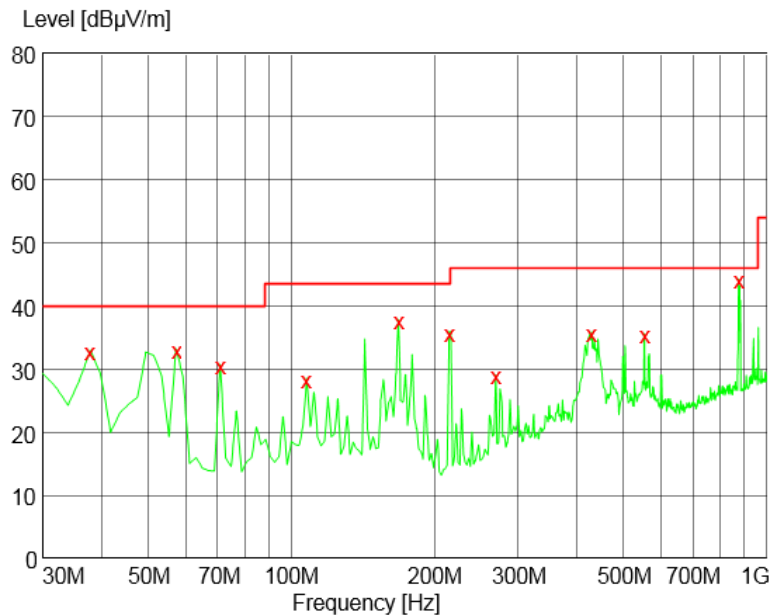
Frequency (MHz)	Polarization	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)
27.12	Z	34.50	5.40	28.30	69.50

The worst waveform from 30MHz to 1000MHz is listed as below:

Horizontal



Vertical



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Test data 30MHz~1GHz:

Polarization	Frequency (MHz)	Measured level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
H	30.00	18.80	40.00	21.2	PK
	53.33	21.40	40.00	18.6	PK
	70.82	17.60	40.00	22.4	PK
	107.76	24.90	43.50	18.6	PK
	168.02	41.50	43.50	2.0	PK
	191.34	31.10	43.50	12.4	PK
	300.20	40.60	46.00	5.4	PK
	430.44	32.60	46.00	13.4	PK
	500.42	28.20	46.00	17.8	PK
	881.42	45.20	46.00	0.8	PK
V	37.78	33.00	40.00	7.0	PK
	57.21	33.30	40.00	6.7	PK
	70.82	30.80	40.00	9.2	PK
	107.76	28.60	43.50	14.9	PK
	168.02	37.90	43.50	5.6	PK
	214.67	35.90	43.50	7.6	PK
	269.10	29.20	46.00	16.8	PK
	428.50	35.90	46.00	10.1	PK
	552.91	35.60	46.00	10.4	PK
	873.65	44.30	46.00	1.7	PK

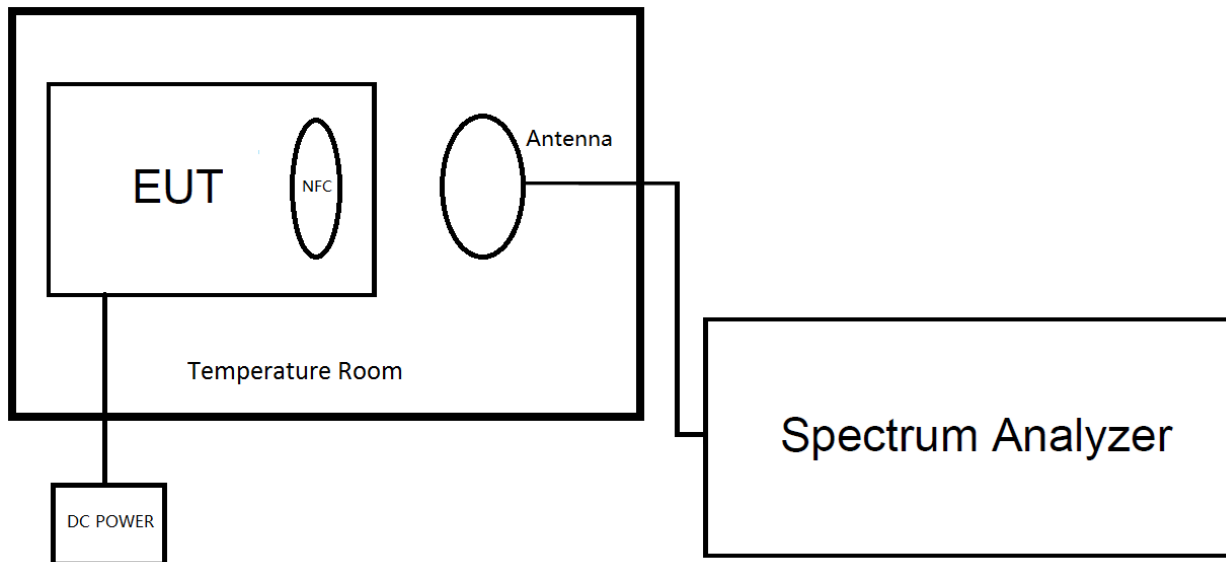
6 Frequency Stability

Test result: Pass

6.1 Test limit

For Part 15.225, the frequency stability of the transmitter shall be maintained within $\pm 0.01\%$ of the center frequency.

6.2 Test Configuration



TEST REPORT

6.3 Test procedure and test setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made from -20°C to +50°C.

6.4 Test protocol

Temperature, °C	Voltage, V	Frequency, MHz				Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	2 nd min	5 th min	10 th min	Positive	Negative			
-20	nominal	13.558711	13.558711	13.558712	13.558712	40	0	1356	-1315	Pass
20	nominal +15%	13.558671	13.558671	13.558672	13.558671	0	0		-1355	
20	nominal	13.558677	13.558672	13.558671	13.558671*	6	0		-1350	
20	nominal -15%	13.558671	13.558672	13.558672	13.558672	0	0		-1355	
50	nominal	13.558657	13.558653	13.558654	13.558653	0	-18		-1338	

* - Reference frequency

7 Power line conducted emission

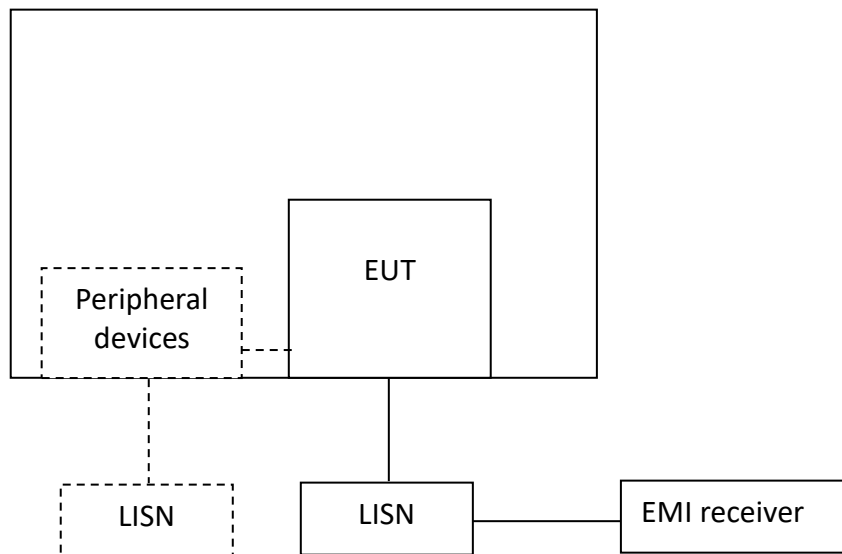
Test result: Pass

7.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

7.2 Test configuration



For table top equipment, wooden support is 0.8m height table

For floor standing equipment, wooden support is 0.1m height rack.

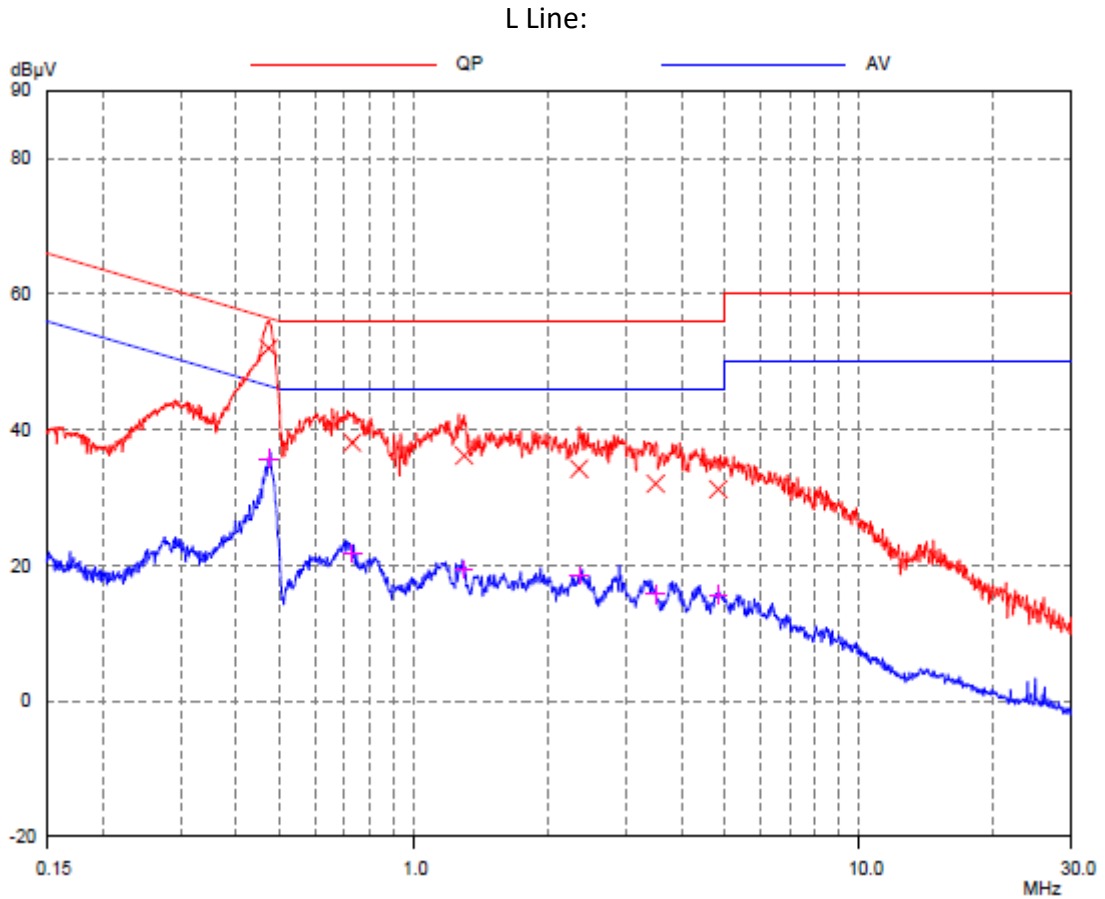
TEST REPORT**7.3 Test procedure and test set up**

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

7.4 Test protocol

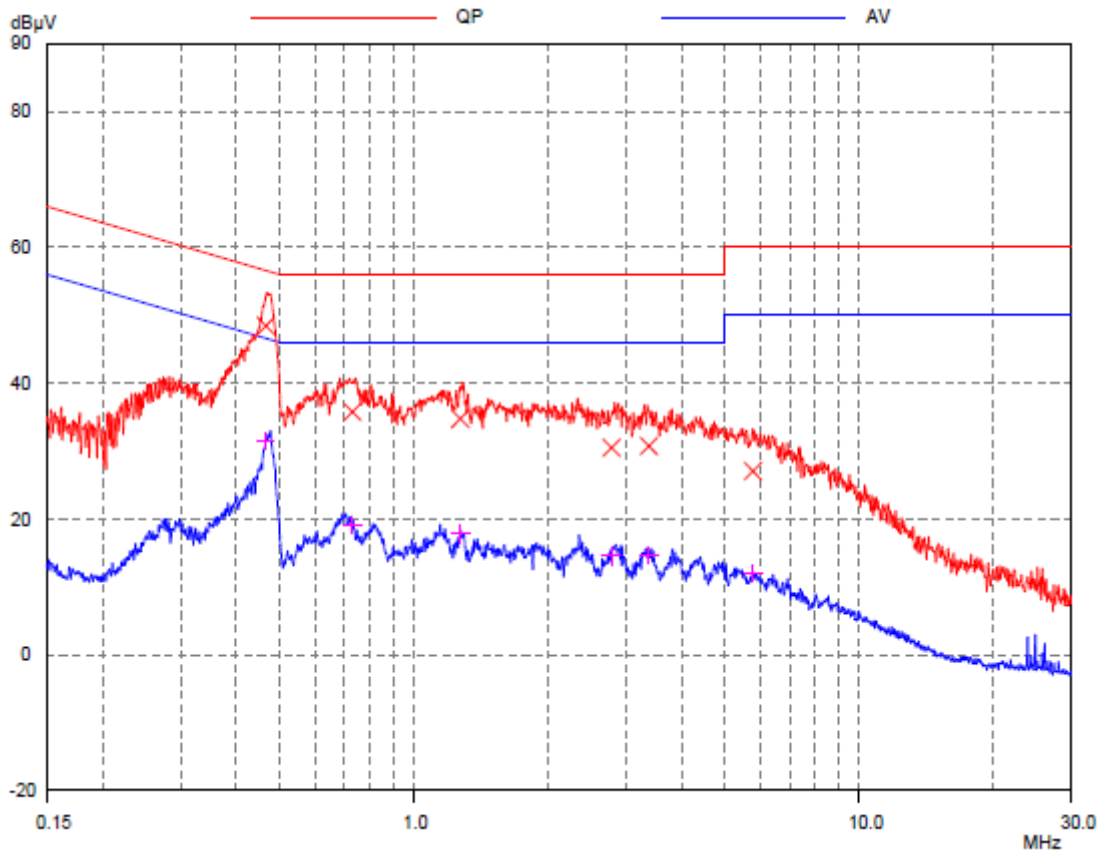


Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(µV)	Limit dB(µV)	Margin (dB)	level dB(µV)	limit dB(µV)	Margin (dB)
0.47	52.02	56.45	4.43	35.75	46.45	10.70
0.73	38.07	56.00	17.93	21.74	46.00	24.26
1.30	36.18	56.00	19.82	19.44	46.00	26.56
2.36	34.23	56.00	21.77	18.46	46.00	27.54
3.50	32.03	56.00	23.97	15.77	46.00	30.23
4.84	31.25	56.00	24.75	15.62	46.00	30.38

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N line:



Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(µV)	Limit dB(µV)	Margin (dB)	level dB(µV)	limit dB(µV)	Margin (dB)
0.47	48.42	56.58	8.16	31.50	46.58	15.08
0.73	35.75	56.00	20.25	19.16	46.00	26.84
1.27	34.76	56.00	21.24	17.82	46.00	28.18
2.79	30.50	56.00	25.50	14.58	46.00	31.42
3.38	30.74	56.00	25.26	14.70	46.00	31.30
5.79	27.05	60.00	32.95	12.01	50.00	37.99

8 Antenna Requirement

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 provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The EUT used permanently attached antenna, so fulfill these requirements