

## ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO  
FCC PART 15 SUBPART C REQUIREMENT

OF

**Applicant:** BQT Solutions (Australia) Pty Ltd  
Unit 29, 1 Talavera Road. North Ryde NSW 2113.  
Australia

**Product Name:** Dual Frequency 13.56MHz and 125KHz Smart Card Reader

**Brand Name:** BQT Solutions

**Model No.:** BT953

**Model Difference:** N/A

**Report Number:** E2/2017/90070

**FCC ID** QVL-BT953

**FCC Rule Part** Part 15C

**Issue Date:** Oct. 17, 2017

**Date of Test:** Oct. 11, 2017

**Date of EUT Received:** Sep. 18, 2017

**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15C.

The test results of this report relate only to the tested sample identified in this report.



**Prepared By:** \_\_\_\_\_  
**Allen Tsai / Engineer**



**Approved By:** \_\_\_\_\_  
**Jim Chang / Asst. Manager**

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## Revision History

Report Number	Revision	Description	Issue Date
E2/2017/90070	Rev.00	Initial creation of document	Oct. 17, 2017

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## 1 GENERAL INFORMATION

### 1.1 Product Description

General:

Product Name:	Dual Frequency 13.56MHz and 125KHz Smart Card Reader
Brand Name:	BQT Solutions
Model No.:	BT953
Model Difference:	N/A
Hardware Version:	B01006-01R15
Software Version:	B01221-00R09
Power Supply:	12V DC from Power supply.

NFC:

Operating Frequency	125 kHz
Transmit Power	< 123dBuV/m at 3m.
Number of Channels	1
Antenna Type	Loop Antenna
Modulation Type	PSK

This report complies with FCC regulatory radio rule with respect to RFID that operates on 125 kHz.

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## 1.2 Test Methodology

FCC Part 15, Subpart C

ANSI C63.10:2013

Note: All test items have been performed and recorded as per the above standards..

## 1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd.,  
Guishan District, Taoyuan City, Taiwan 333 (TAF code 0513)

FCC Registration Number and Designation number are: 735305 / TW0002

## 1.4 Special Accessories

There is no special accessory used while test was conducted.

## 1.5 Equipment Modifications

There was no modification incorporated into the EUT.

## 1.6 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m\*9m\*6m semi-anechoic chamber,  
the measurements correspond to those obtained at an open-field test site.

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## 2 SYSTEM TEST CONFIGURATION

### 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### 2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. the Tx frequency was fixed which was for the purpose of the measurements.

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions (Not apply in the report)

The EUT is a placed on as turn table which is 0.8m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz,. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

#### 2.3.2 Radiated Emissions

The EUT is a placed on as turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m above the reference ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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Remark 1. Emission level in dBuV/m=20 log (uV/m)

: 2. Measurement was performed at an antenna to the closed point of EUT distance of 3 meters.

3. Distance extrapolation factor = 40 log (required distance/ test distance) (dB);

4. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.  
Ex.  $20 \log(30) + 40 \log(30/3) = 69.54 \text{ dBuV/m}$

5. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of §15.205.

6. The general radiated emission limits in §15.209 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.

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## 2.4 Configuration of Tested System

Fig. 2-1 Emission test set up configuration

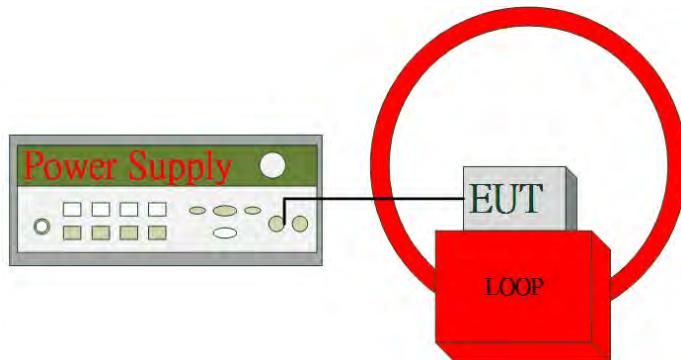


Fig. 2-2 Conduction test set up configuration

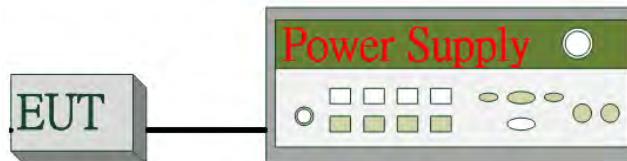


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	NFC Test software	Tera Term	N/A	N/A	N/A	N/A
2.	DC Power Supply	Agilent	E3634A	MY53180030	N/A	Unshielded

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### 3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	Compliant
§15.209	Radiated Emission Limits, general requirement	Compliant
§15.215 (c)	20 dB OCCUPIED BANDWIDTH	Compliant
§15.203	Antenna Requirement	Compliant

### 4 DESCRIPTION OF TEST MODES

The EUT stay in continuous transmitting mode. The frequency 13.56MHz is the default channel to test, where it is the only manipulative channel as this application supports.

The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode), the worst case E2 position was reported.

The data rate as the lowest supported is selected while tests are conducted.

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## 5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Frequency Stability	+/- 123.36 Hz
20 dB OCCUPIED BANDWIDTH	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC=+/- 0.2%

### Radiated Spurious Emission:

Measurement uncertainty	9kHz - 30MHz: +/- 2.3dB
Measurement uncertainty (Polarization : <b>Vertical</b> )	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
Measurement uncertainty (Polarization : <b>Horizontal</b> )	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB

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

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## 6 CONDUCTED EMISSIONS TEST

### 6.1 Limitation

#### Conducted Emission

According to section 15.207(a) Conducted Emission Limits is as following.

Frequency range MHz	Limits dB (uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

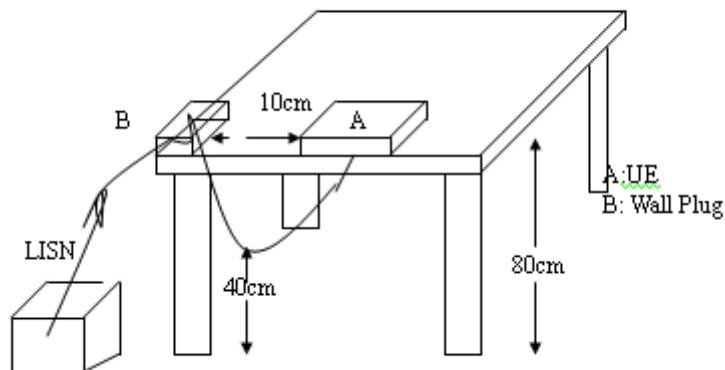
**Note**

1. The lower limit shall apply at the transition frequencies  
 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### 6.2 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Sweep frequency starting from 150 kHz to 30 MHz for phase L1.
4. Repeating the measurement as lists above for phase neutral.

### 6.3 Test SET-UP (Block Diagram of Configuration)



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#### 6.4 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI 7	100950	12/12/2016	12/11/2017
Coaxial Cables	N/A	N30N30-1042-15 0cm	N/A	08/30/2017	08/29/2018
LISN	Schwarzbeck	NSLK 8127	8127-648	06/18/2017	06/17/2018
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

#### 6.5 Measurement Result:

N/A, this device is supplied with battery power.

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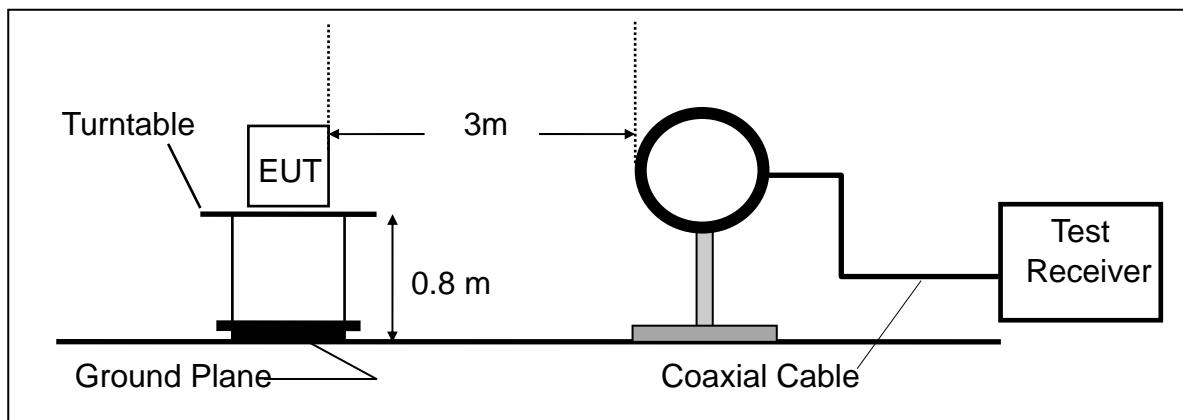
## 7 RADIATED EMISSION TEST

### 7.1 Measurement Procedure

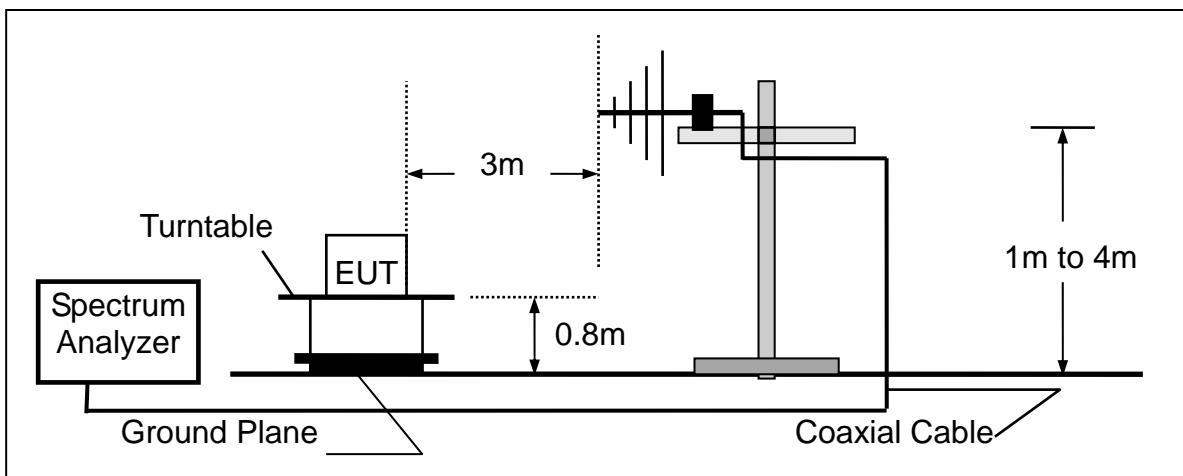
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

### 7.2 Test SET-UP (Block Diagram of Configuration)

#### (A) Radiated Emission Test Set-Up, Frequency Below 30MHz



#### (B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



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### 7.3 Measurement Equipment Used:

SGS 966 Chamber No.C

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESU 40	100363	04/18/2017	04/17/2018
Loop Antenna	ETS-Lindgren	6502	00143303	12/23/2016	12/22/2017
Broadband Antenna	TESEQ	CBL 6112D	35240	11/03/2016	11/02/2017
Horn Antenna	ETS-Lindgren	3117	00143272	12/15/2016	12/16/2017
Horn Antenna	Schwarzbeck	BBHA9170	185	08/01/2017	07/31/2018
Pre Amplifier	EMC Instruments	EMC330	980096	12/12/2016	12/11/2017
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/12/2016	12/11/2017
Pre Amplifier	R&S	SCU-18	10204	12/12/2016	12/11/2017
Pre Amplifier	R&S	SCU-26	100780	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF27	12/12/2016	12/11/2017
Site NSA	SGS	966 Chamber C	SAC-C	03/02/2017	03/01/2018
Site VSWR	SGS	966 Chamber C	SAC-C	03/02/2017	03/01/2018
DC Power Supply	HOLA	DP-3003	D7070035	05/04/2017	05/03/2018
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.

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## 7.4 Field Strength Calculation

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

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

## 7.5 Field Strength of Fundamental Emission

### 7.5.1 Limit

#### Below 30MHz

Frequency (MHz)	Limit ( $\mu$ V/m)	Measurement distance (meters)	Remark
0.009-0.490	2400/F(kHz)	300	Quasi-Peak Value
0.490-1.705	24000/F(kHz)	30	Quasi-Peak Value
1.705-30.0	30	30	Quasi-Peak Value

#### Above 30MHz

Frequency (MHz)	Limit ( $\text{dB}\mu\text{V}/\text{m}$ @ 3m)	Remark
30-88	40	Quasi-Peak Value
88-216	43.5	Quasi-Peak Value
216-960	46	Quasi-Peak Value
Above 960	54	Quasi-Peak Value
Above 1GHz	54	Average Value
	74	Peak Value

#### Note:

1. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement. Ex. $20*\log(30)+40*\log(30/3) = 69.54\text{dB}\mu\text{V}/\text{m}$
2. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
3. Actual  $FS(\text{dB}\mu\text{V}/\text{m}) = \text{Spectrum. Reading level}(\text{dB}\mu\text{V}) + \text{Factor(dB)}$   
 $\text{Factor(dB)} = \text{Antenna Factor}(\text{dB}\mu\text{V}/\text{m}) + \text{Cable Loss(dB)} - \text{Pre}_\text{Amplifier Gain(dB)}$   
 "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.  
 "E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

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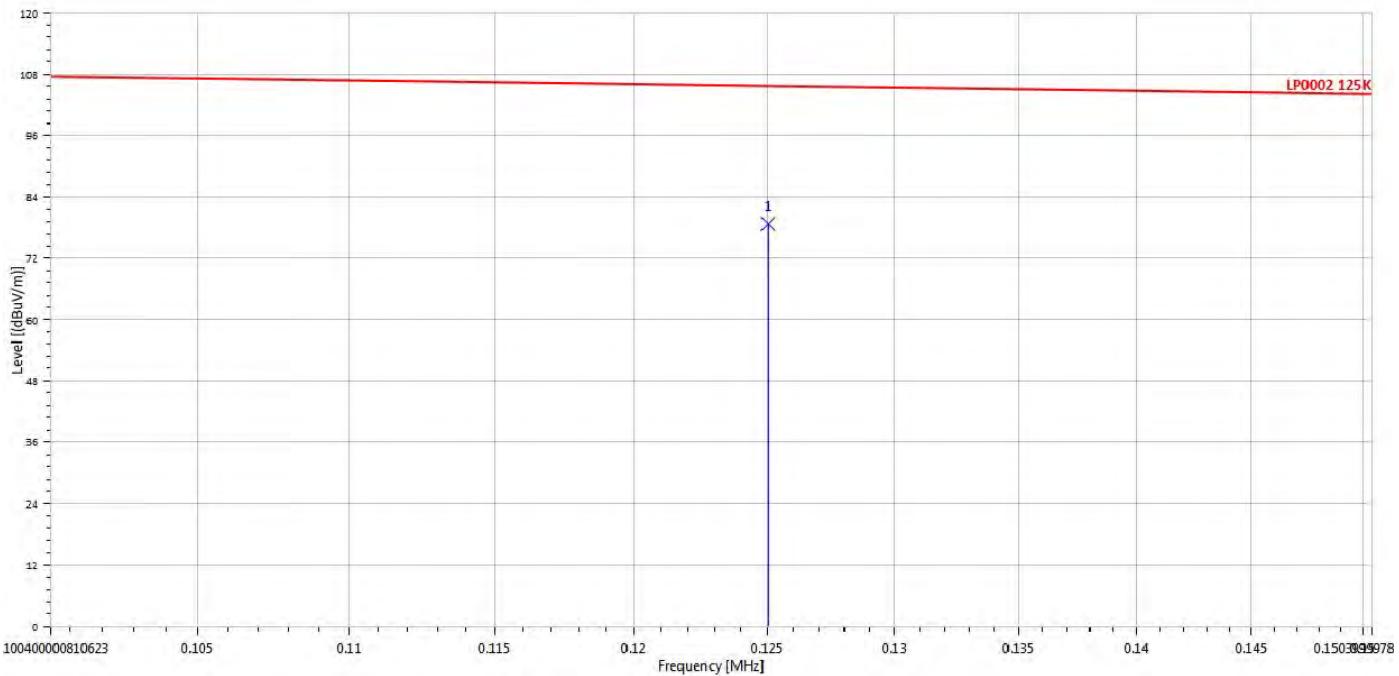
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## 7.5.2 Below 30 MHz test result

Operation Mode : NFC      Test Date : 2017/10/11  
 Fundamental Frequency : 125K      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : Main      Test Engineer : Enzo  
 EUT Pol. : E2      Measurement Antenna Pol. : Vertical



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
0.13	F	Peak	67.07	11.60	78.67	105.6668	-27.00

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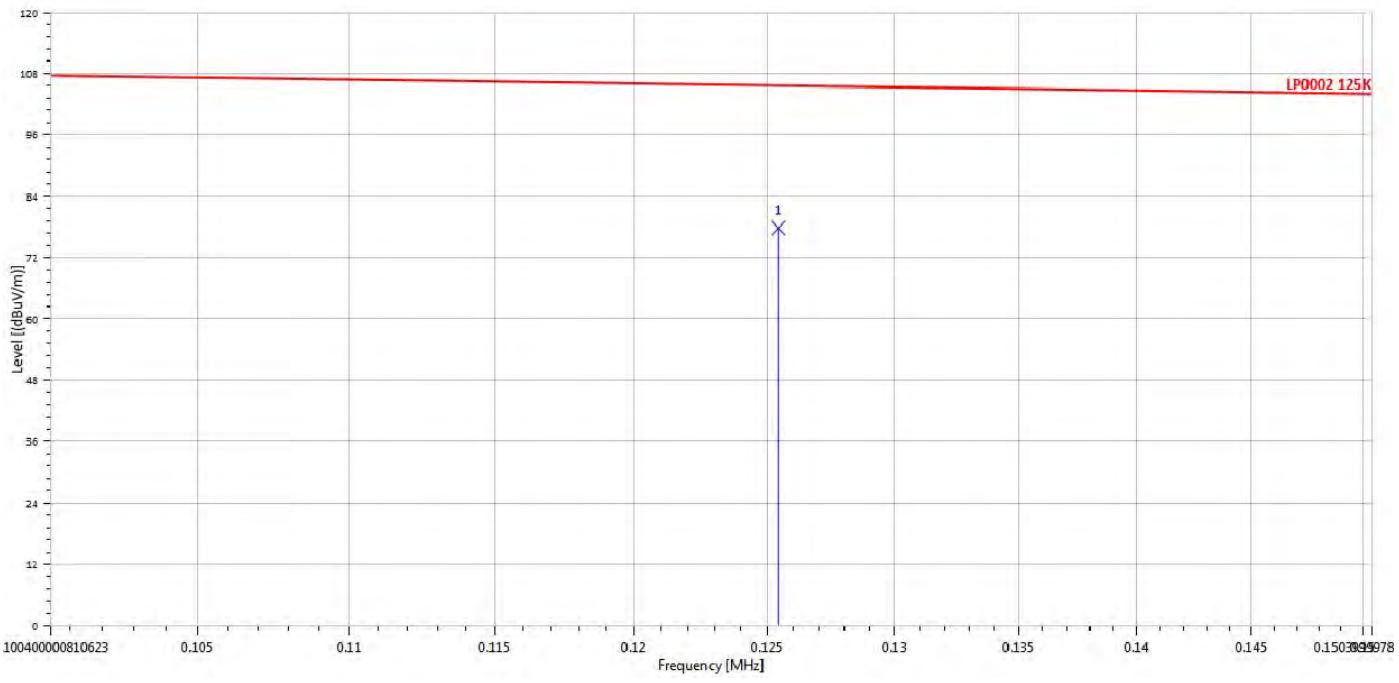
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Operation Mode : NFC      Test Date : 2017/10/11  
 Fundamental Frequency : 125K      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : Main      Test Engineer : Enzo  
 EUT Pol. : E2      Measurement Antenna Pol. : Horizontal



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
0.13	F	Peak	66.19	11.60	77.79	105.6414	-27.85

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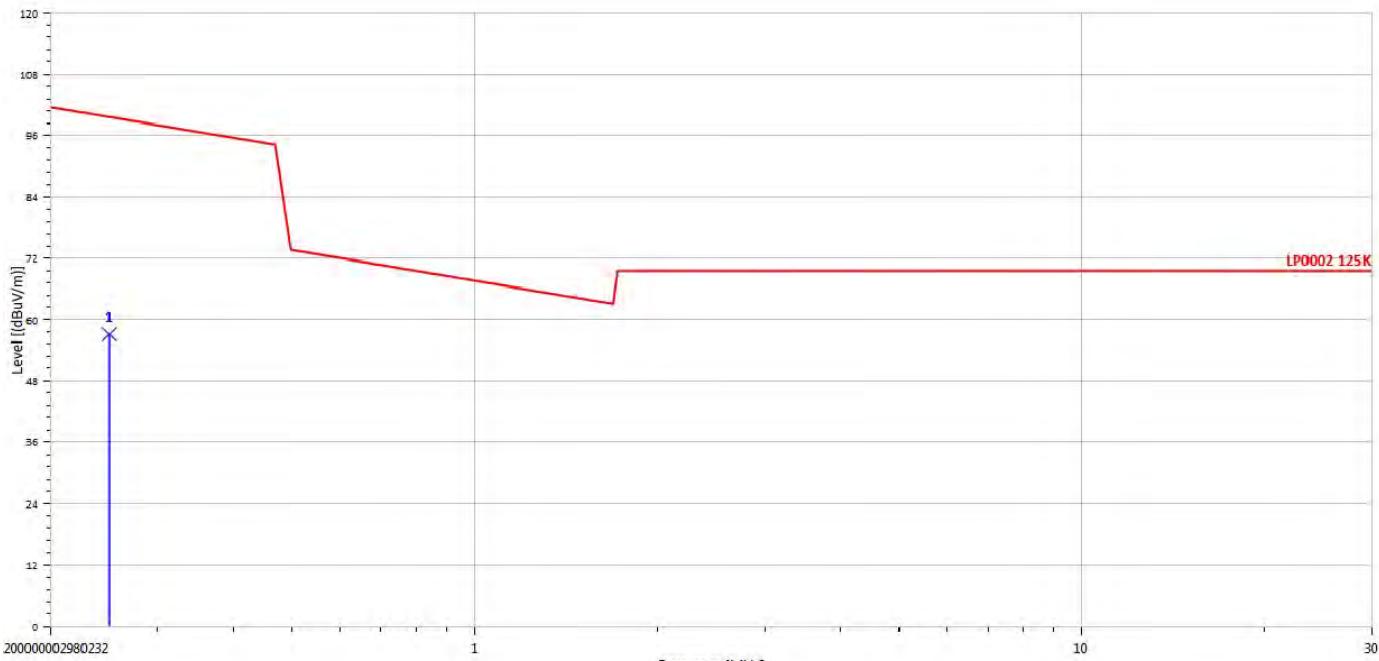
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## 7.5.3 Above 30MHz test result

Operation Mode : NFC      Test Date : 2017/10/11  
 Fundamental Frequency : 125K      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH MID      Test Engineer : Enzo  
 EUT Pol. : E2      Measurement Antenna Pol. : Vertical



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
0.25	H	Peak	45.57	11.54	57.11	99.65	-42.54

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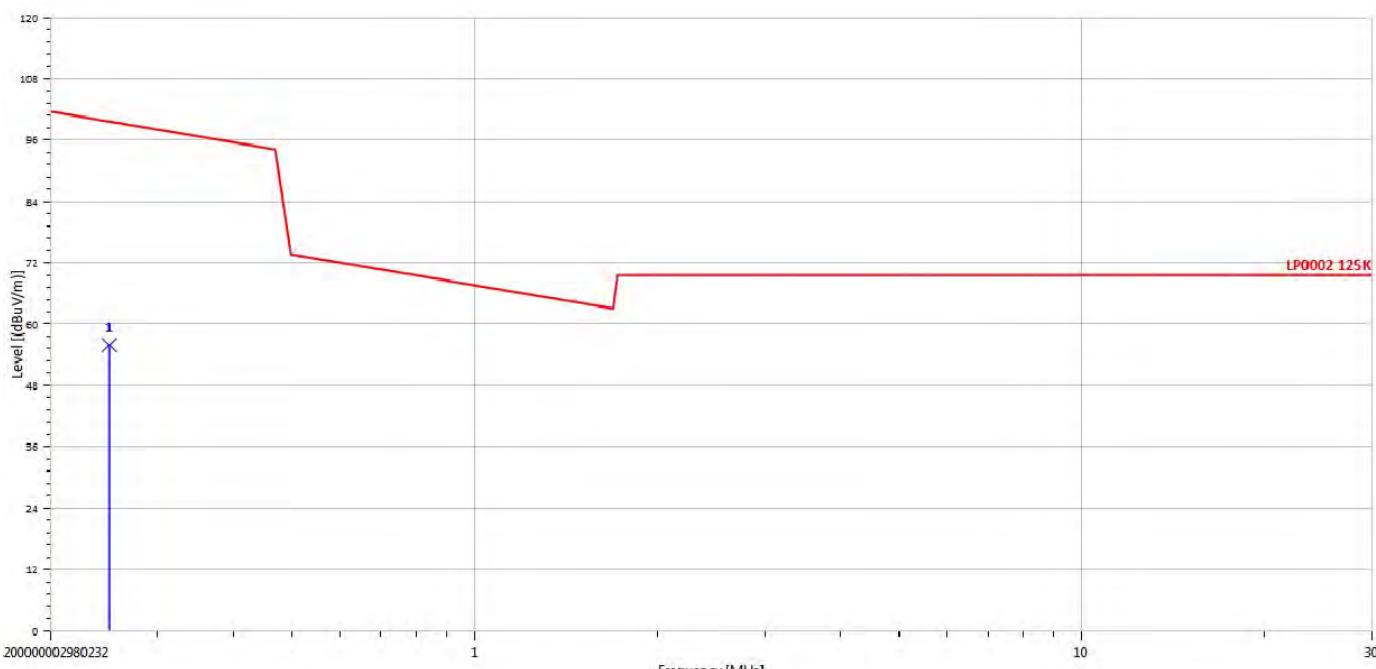
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Operation Mode : NFC      Test Date : 2017/10/11  
 Fundamental Frequency : 125K      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH MID      Test Engineer : Enzo  
 EUT Pol. : E2      Measurement Antenna Pol. : Horizontal



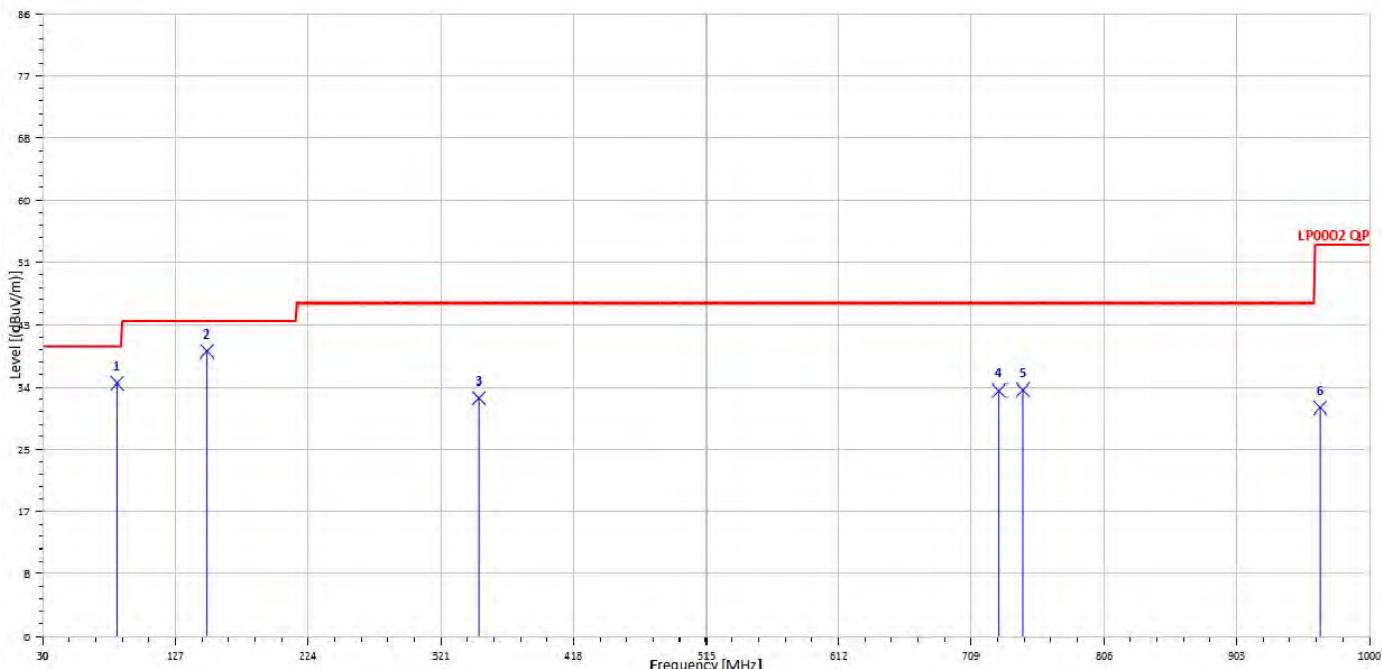
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
0.25	H	Peak	44.37	11.54	55.91	99.65	-43.74

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Operation Mode : NFC      Test Date : 2017/10/11  
 Fundamental Frequency : 125K      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH MID      Test Engineer : Enzo  
 EUT Pol. : E2      Measurement Antenna Pol. : Vertical



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
84.32	S	Peak	56.76	-21.82	34.93	40	-5.07
150.28	S	Peak	55.14	-15.81	39.33	43.5	-4.17
349.13	S	Peak	47.14	-14.27	32.88	46	-13.12
729.37	S	Peak	41.64	-7.72	33.92	46	-12.08
746.83	S	Peak	41.06	-7.04	34.02	46	-11.98
964.11	S	Peak	35.83	-4.30	31.53	54	-22.47

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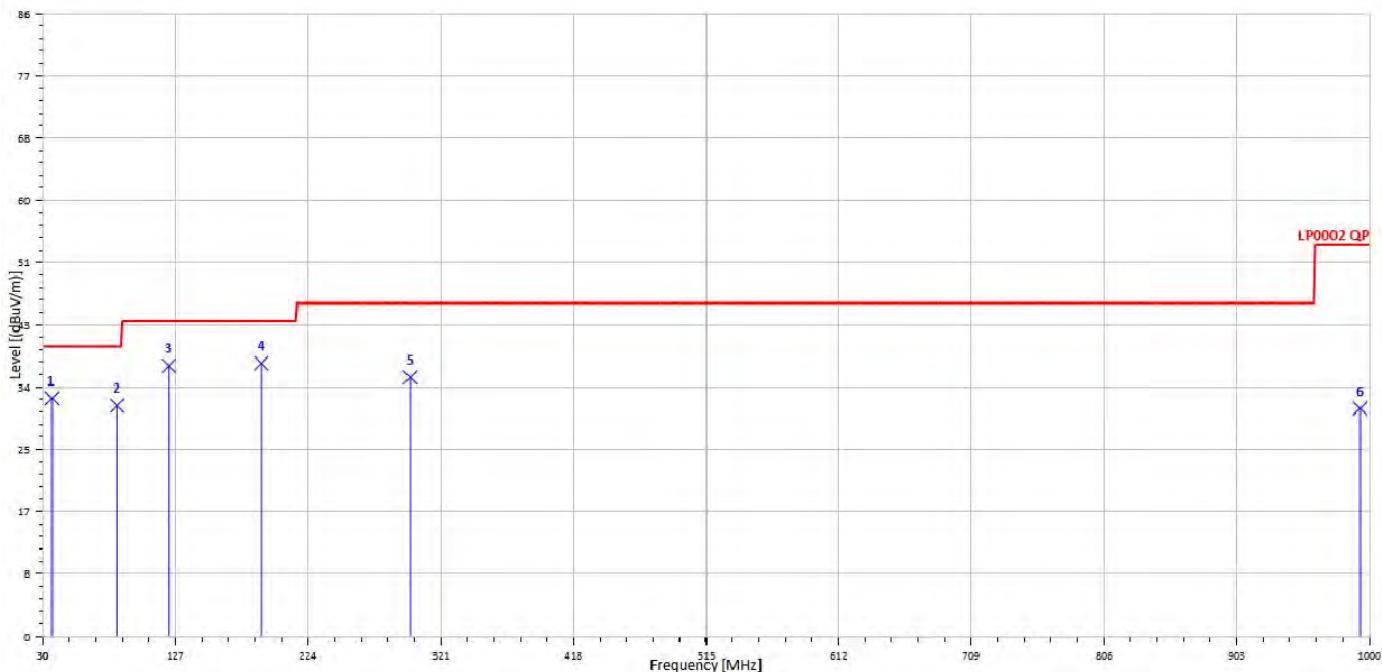
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Operation Mode : NFC      Test Date : 2017/10/11  
 Fundamental Frequency : 125K      Temp. / Humi. : 22.7deg\_C/57RH  
 Operation Band : TX CH MID      Test Engineer : Enzo  
 EUT Pol. : E2      Measurement Antenna Pol. : Horizontal



Freq.	Note	Detector Mode	Spectrum Reading	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	Level dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
36.79	S	Peak	50.53	-17.69	32.84	40	-7.16
84.32	S	Peak	53.63	-21.82	31.80	40	-8.20
122.15	S	Peak	55.82	-18.48	37.34	43.5	-6.16
190.05	S	Peak	56.40	-18.73	37.67	43.5	-5.83
298.69	S	Peak	51.10	-15.38	35.72	46	-10.28
993.21	S	Peak	35.41	-3.97	31.44	54	-22.56

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## 8 20 dB OCCUPIED BANDWIDTH MEASUREMENT

### 8.1 Standard Applicable:

§2.1049 & §15.215 (c)

### 8.2 Limit:

None

### 8.3 Test Set-up

Refer to section 6.2 in this report

### 8.4 Measurement Procedure

20dB bandwidth

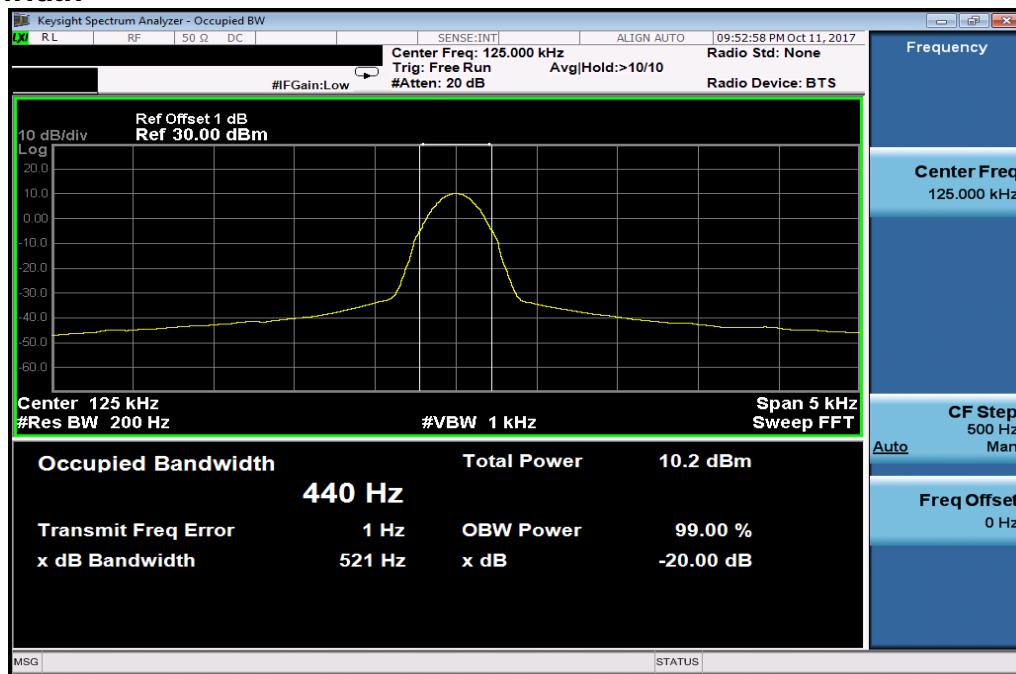
1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak mode.
2. 20dB Bandwidth the resolution bandwidth of 200 Hz and the video bandwidth of 1 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.

### 8.5 Measurement Equipment Used:

Refer to section 8.3 in this report

### 8.6 Measurement Result

#### -20dB Bandwidth



20dB Bandwidth	Limit
521 Hz	No requirement

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## 9 ANTENNA REQUIREMENT

### 9.1 Standard Applicable:

According to §15.203, 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. 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.

### 9.2 Antenna Connected Construction:

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo and antenna spec. for details.

*~ End of Report ~*

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