

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

**Product Name:** Leaf  
**Brand Name:** Teforia  
**Model No.:** TE-RF-2015  
**Model Difference:** N/A  
**FCC ID:** 2AIOZHTWV01  
**Report No.:** ER/2016/50102  
**Issue Date:** Jun. 15, 2016  
**FCC Rule** §15.225  
**Prepared for:** Teforia Company  
465 Fairchild Drive, Suite 127, Mountain View,  
CA 94043, USA  
SGS Taiwan Ltd.  
Electronics & Communication Laboratory  
**Prepared by:** No.134, Wu Kung Road, New Taipei  
Industrial Park, Wuku District, New Taipei  
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## VERIFICATION OF COMPLIANCE

**Applicant:** Teforia Company  
465 Fairchild Drive, Suite 127, Mountain View, CA 94043, USA

**Product Name:** Leaf

**Brand Name:** Teforia

**Model No.:** TE-RF-2015

**Model Difference:** N/A

**FCC ID:** 2AIOZHTWV01

**File Number:** ER/2016/50102

**Date of test:** May 23, 2016 ~ Jun. 08, 2016

**Date of EUT Received:** May 23, 2016

**We hereby certify that:**

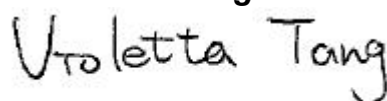
The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in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

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

**Test By:****Date:**

Jun. 15, 2016

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*Tin Lin / Engineer***Prepared By:****Date:**

Jun. 15, 2016

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*Violetta Tang / Clerk***Approved By:****Date:**

Jun. 15, 2016

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*Jim Chang / Asst. Manager*

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## Revision History

Report Number	Revision	Description	Issue Date
ER/2016/50102	Rev.00	Initial creation of document	Jun. 15, 2016

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# 1 GENERAL INFORMATION

## 1.1 Product Description

General:

Product Name:	Leaf
Brand Name:	Teforia
Model No.:	TE-RF-2015
Model Difference:	N/A
Hardware Version:	1.0.0
Software Version:	1.0.0
Power Supply:	3Vdc from Power Supply

NFC:

Operating Frequency:	13.56MHz
Transmit Power:	< 123.90dBuV/m at 3m.
Number of Channels:	1
Antenna Type:	PCB Antenna
Modulation Type:	ASK

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## 1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.225

KDB648474 D03 Wireless Chargers Battery Cover

ANSI C63.10:2013

Note:

1. All test items have been performed and record as per the above standards.
2. The composite system (digital device) is compliance with FCC Subpart B is authorized under the certification procedure.

## 1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803 (TAF code 0513)

FCC Registration Numbers are: 509634

IC Registration Numbers are: 4260A-5

## 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.

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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

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plan. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. 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 placed on a turn table which is 0.8 m above ground plan. 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 hand-held 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.

### 2.4 Measurement Results Explanation Example

#### For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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## 2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission & Conducted Emission

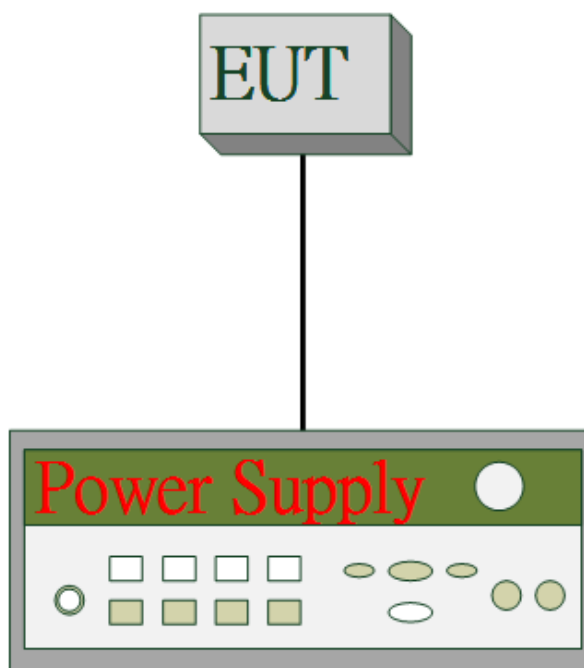


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model / Type No.	Series No.	Data Cable	Power Cord
1.	NFC Test Software	N/A	N/A	N/A	N/A	N/A
2.	DC Power Supply	Topward	3303D	981327	N/A	N/A

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### 3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	N/A
§15.225 (a)-(d)	Radiated Emission	Compliant
§15.209	Radiated Emission Limits, general requirement	Compliant
§15.225 (e)	Frequency Stability	Compliant
§2.1049 §15.215 (c)	20 dB OCCUPIED BANDWIDTH	Compliant
§15.203	Antenna Requirement	Compliant

### 4 DESCRIPTION OF TEST MODES

#### 4.1 The Worst Test Modes and Channel Details

1. The EUT stay in continuous transmitting mode.
2. The frequency 13.56 MHz is the default channel to test, where it is the only manipulative channel as this application supports.
3. Investigation has been done on all the possible configurations for searching the worst case.

RADIATED EMISSION TEST			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK
FREQUENCY STABILITY			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK
20dB BANDWIDTH			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK

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

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## 5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Frequency Stability	+/- 51.33 Hz
20 dB OCCUPIED BANDWIDTH	+/- 51.33 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

Radiated Spurious Emission:

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 EMISSION TEST

### 6.1 Standard Applicable:

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

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 Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESC17	100760	05/10/2016	05/09/2017
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/16/2016	05/15/2017
LISN	FCC	FCC-LISN-50/250 -25-2-01	4034	05/16/2016	05/15/2017
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2015	11/25/2016

### 6.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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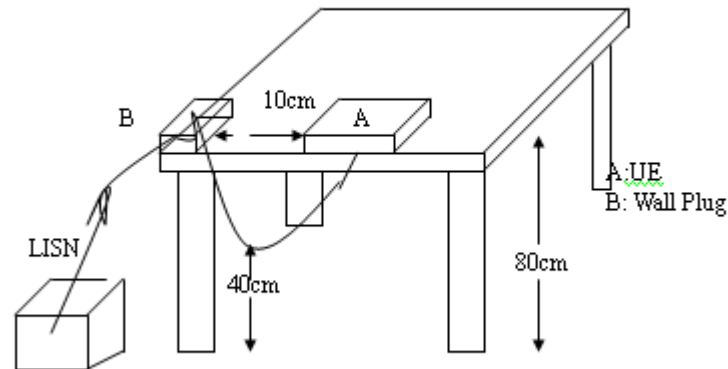
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#### 6.4 Test SET-UP (Block Diagram of Configuration)



#### 6.5 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plan.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

#### 6.6 Measurement Result:

N/A, the device is powered by DC 3V Power Supply.

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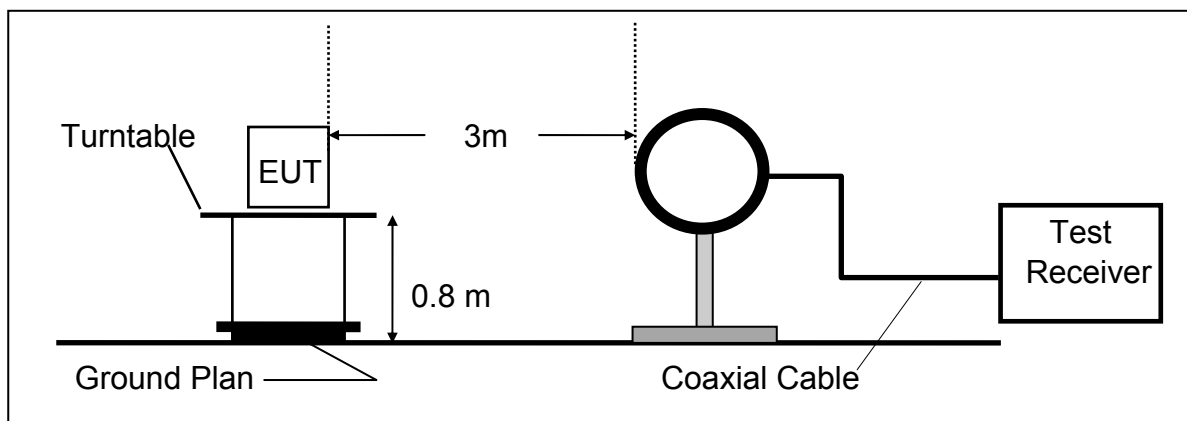
## 7 RADIATED TEST ITEMS

### 7.1 Measurement Procedure

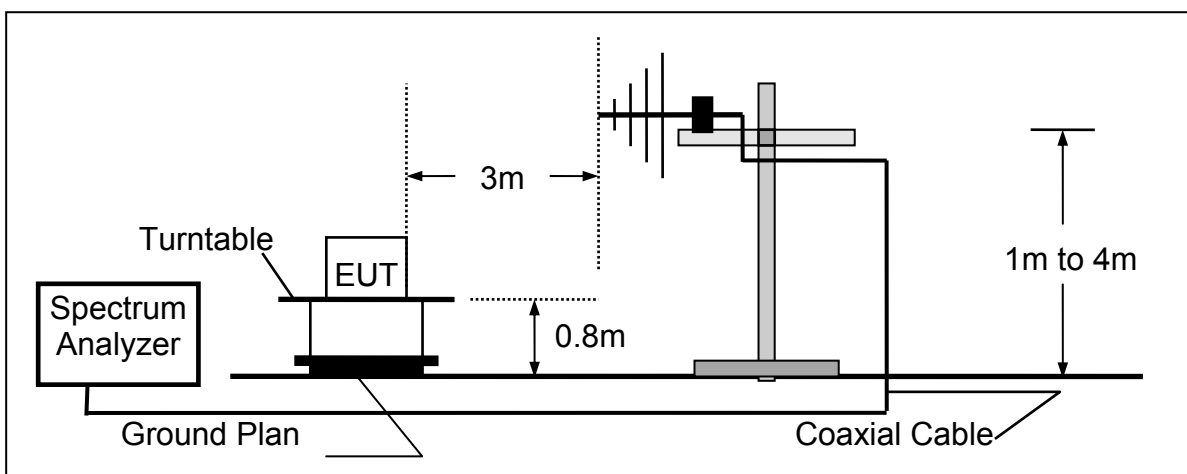
1. Configure the EUT according to ANSI C63.10:2013.
2. The EUT was placed on a turn table which is 0.8m above ground plan.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all default test channel measured were complete

### 7.2 Test SET-UP

#### (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 SAC-III					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	05/10/2016	05/09/2017
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/28/2016	01/27/2017
Loop Antenna	ETS.LINDGREN	6502	148045	09/07/2015	09/06/2016
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/14/2015	12/13/2016
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/10/2015	08/09/2016
Pre-Amplifier	Agilent	8447D	2944A07676	01/02/2016	01/01/2017
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/02/2016	01/01/2017
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_RX	9	01/02/2016	01/01/2017
3m Site NSA	SGS	966 chamber	N/A	07/02/2015	07/01/2016
Low Loss Cable	Huber Suhner	966 TX	1	01/02/2016	01/01/2017

Note: N.C.R refers to Not Calibrated Required.

### 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	

The limit of the emission level is expressed in dBuV/m, which converts  $20 \cdot \log(\mu V/m)$

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)

#### Note :

“F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

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## 7.5 Field Strength of Fundamental Emissions and Mask Measurement

### 7.5.1 Standard Applicable

Limit:

Rules and specifications	CFR 47 Part 15 section 15.225(a)-(d)		
Frequency of Emission (MHz)	Field Strength (μV/m) at 30m	Field Strength (dBμV/m) at 30m	Field Strength (dBμV/m) at 3m
1.705~13.110	30	29.5	69.5
13.110~13.410	106	40.5	80.5
13.410~13.553	334	50.5	90.47
13.553~13.567	15848	84	123.9
13.567~13.710	334	50.5	90.47
13.710~14.010	106	40.5	80.5
14.010~30.00	30	29.5	69.5

Field strength of fundamental emissions limit:

The field strength of fundamental emissions shall not exceed 15848 micorvolts/meter at 30 meters. The Limit is converted to 124.00dBuV/m by offsetting the distance extrapolation factor as measurement distance is taken place at 3 meters.

Distance extrapolation =  $40 \cdot \log(30/3) = 40 \text{ dB}$

Limit is re-adjusted in terms of limit taken in 3m =  $20 \cdot \log(15848 \text{ uV/m}) + 40 = 124.00\text{dBuV/m}$

1. Emission level in dBuV/m =  $20 \log(\mu\text{V/m})$
2. Distance extrapolation factor =  $40 \log(\text{required distance}/\text{test distance}) \text{ (dB)}$
3. The lower limit shall apply at the transition frequencies.
4. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.

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**Radiated Mask for RSS 210 Annex 2 A2.6**

- (a) 15.848 millivolts/m (84 dB $\mu$ V/m) at 30 m, within the band 13.553-13.567 MHz.
- (b) 334 microvolts/m (50.5 dB $\mu$ V/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz.
- (c) 106 microvolts/m (40.5 dB $\mu$ V/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz.

Distance extrapolation =  $40 \cdot \log(30/3) = 40 \text{ dB}$

Limit is re-adjusted in terms of limit taken in 3m for the following frequency segment of the interest:

- a)  $20 \cdot \log(15848 \text{ uV/m}) + 40 \text{ dB} = 124.00 \text{ dBuV/m}$
- b)  $20 \cdot \log(334 \text{ uV/m}) + 40 \text{ dB} = 90.47 \text{ dBuV/m}$
- c)  $20 \cdot \log(106 \text{ uV/m}) + 40 \text{ dB} = 80.50 \text{ dBuV/m}$

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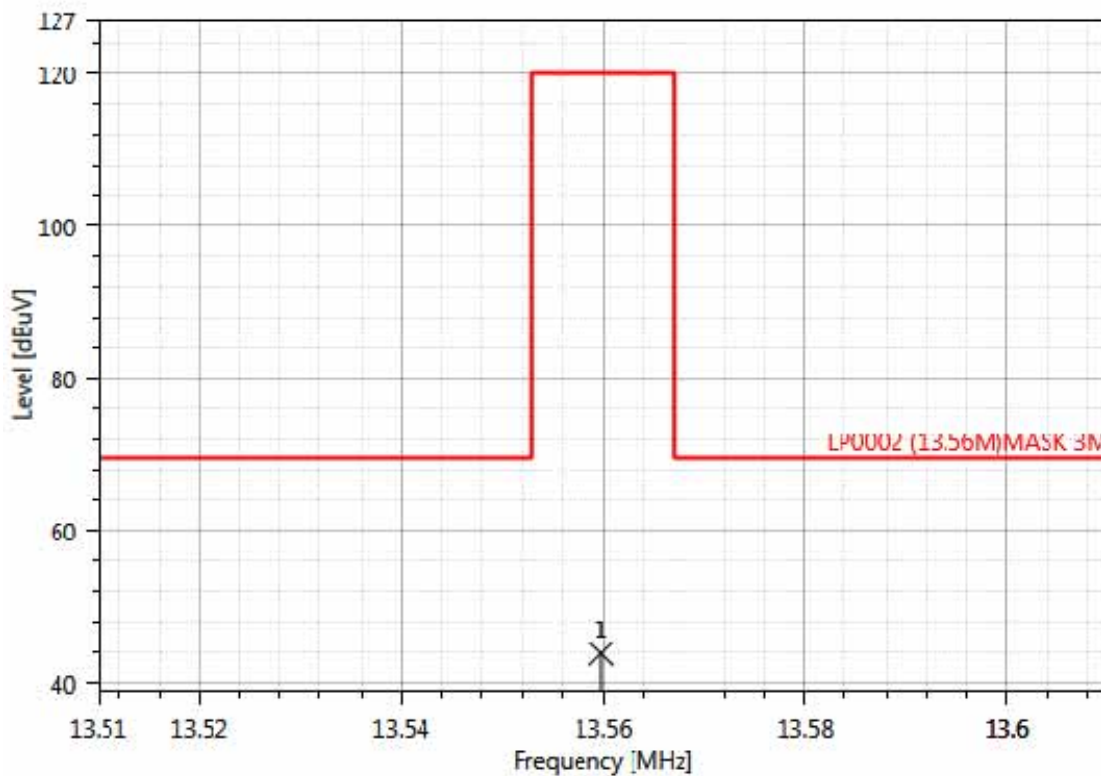
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## 7.5.2 Field Strength of Fundamental Emission Measurement Result

Operation Mode :	RFID	Test Date :	05/25/2016 10:36:34
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Main	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	VERTICAL



Freq.	Note	Decetor Mode	Actual Reading Level	Spectrum FS	Factor	Limit @3m	Margin
MHz	F/H/E/S	QP/AV/PK	dBuV/m	dBuV/m	dB	dBuV/m	dB
13.56	F	Peak	43.82	32.39	11.44	120.00	-76.18

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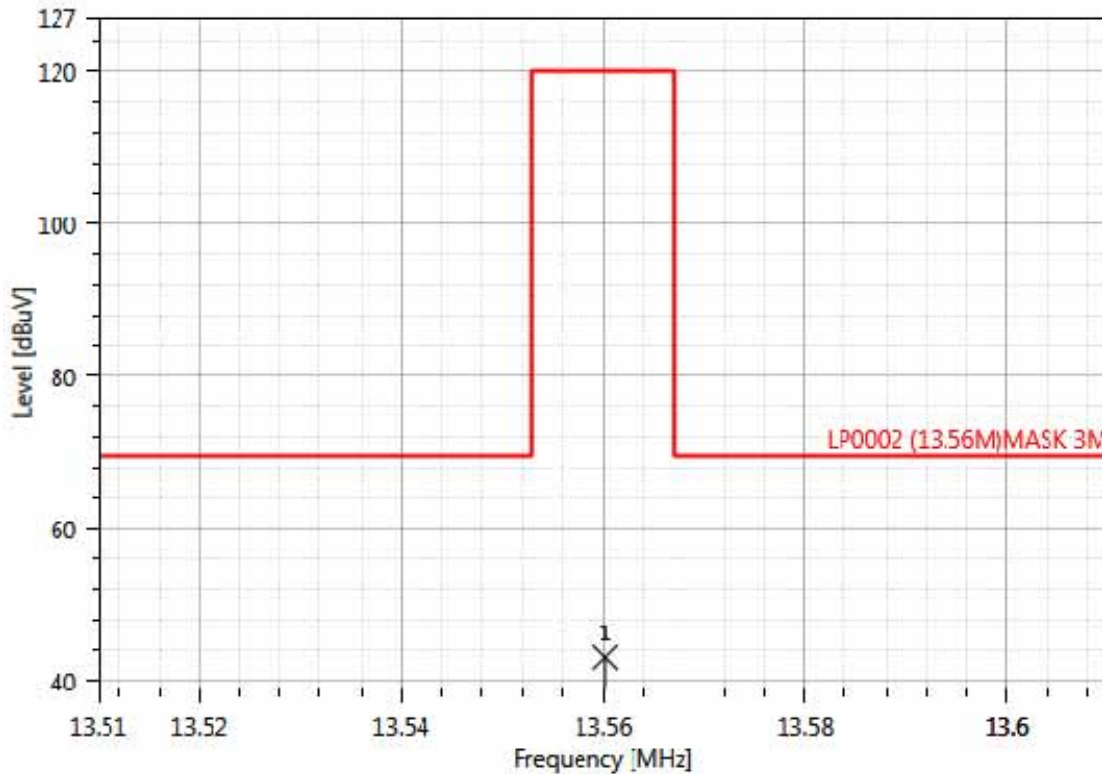
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Operation Mode :	RFID	Test Date :	05/25/2016 10:32:01
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Main	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	FS	dB	@3m dBuV/m	dB
13.56	F	Peak	43.04	31.60	11.44	120.00	-76.96

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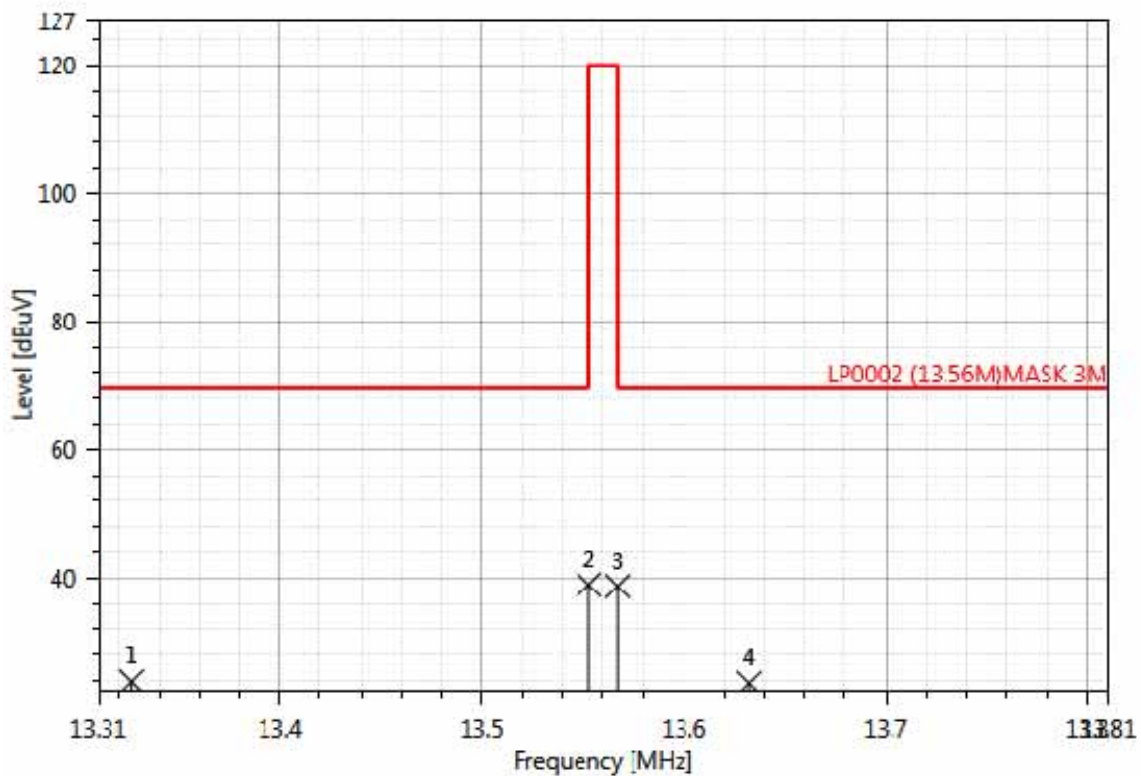
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### 7.5.3 Mask Measurement Result

Operation Mode :	RFID	Test Date :	05/25/2016 10:38:33
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Mask	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBuV/m	Spectrum FS dBuV/m	Factor dB	Limit @3m dBuV/m	Margin dB
13.33	S	Peak	23.89	12.46	11.43	69.54	-45.65
13.55	S	Peak	38.96	27.52	11.44	69.54	-30.58
13.57	S	Peak	38.72	27.29	11.44	69.54	-30.82
13.63	S	Peak	23.64	12.20	11.44	69.54	-45.90

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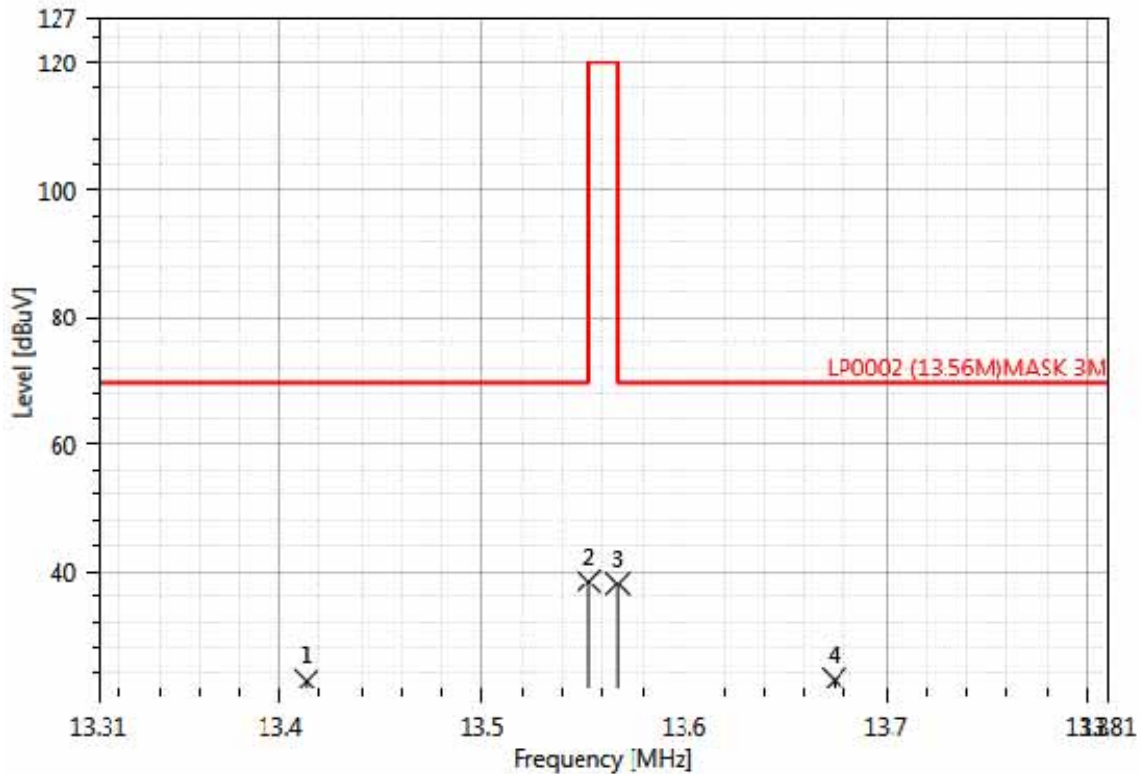
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Operation Mode :	RFID	Test Date :	05/25/2016 10:30:29
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Mask	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBuV/m	Spectrum FS dBuV/m	Factor dB	Limit @3m dBuV/m	Margin dB
13.41	S	Peak	22.77	11.34	11.43	69.54	-46.77
13.55	S	Peak	38.39	26.95	11.44	69.54	-31.15
13.57	S	Peak	38.02	26.58	11.44	69.54	-31.52
13.67	S	Peak	22.93	11.49	11.44	69.54	-46.61

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## 7.6 Radiated Emission Measurement

### 7.6.1 Standard Applicable

The field strength of any emission which appear outside of 13.553~13.567MHz Band shall not exceed the general radiated emissions limits.

Frequency (MHz)	Field strength (μV/m)	Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

#### Note:

1. Emission level in dBμV/m=20 log (μV/m)
2. Distance extrapolation factor = 40 log (required distance/ test distance) (dB)
3. The lower limit shall apply at the transition frequencies.
4. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.

According to § RSS-210 A2.6

(d) 30 microvolts/m (29.4 dBμV/m) at 30 m, outside the band 13.110-14.010 MHz.

Limit is converted by adding the distance extrapolation factor as the measurement distance was to place at 3m.

$$a) 20 \cdot \log(30 \mu\text{V/m}) + 40\text{dB} = 69.54 \text{ dBuV/m}$$

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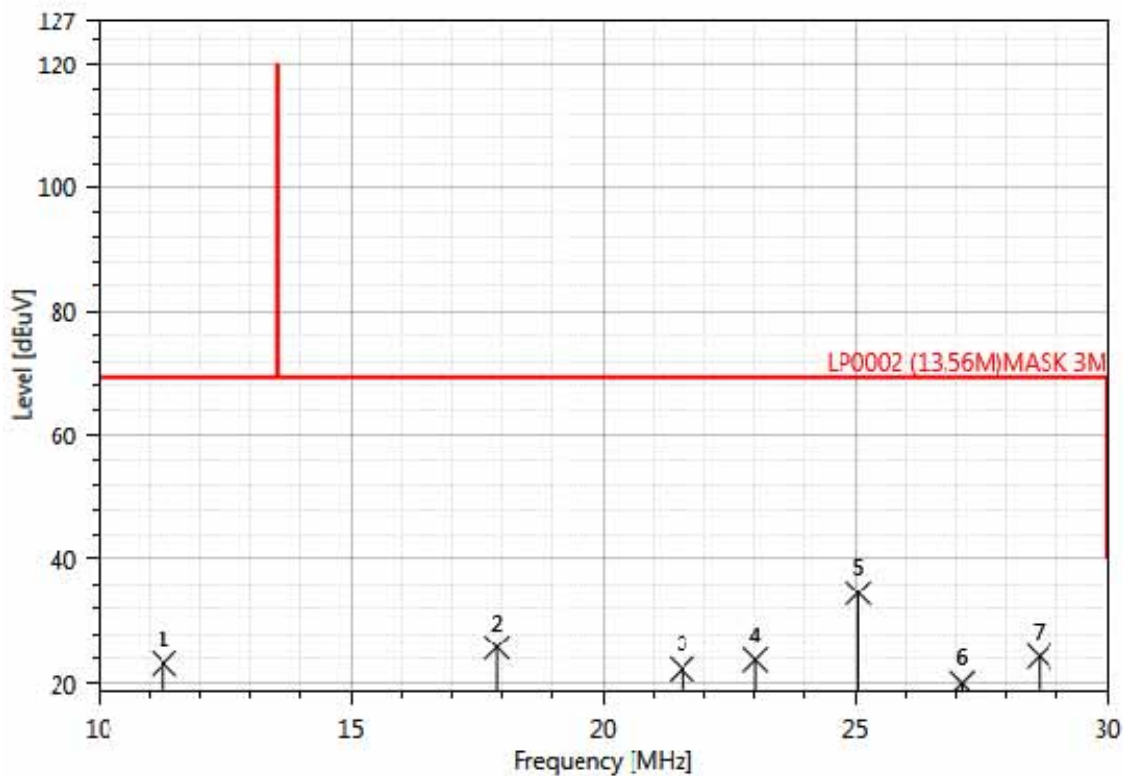
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## Radiated Emission Measurement Result

Operation Mode :	RFID	Test Date :	05/25/2016 10:40:35
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Tx CH MID	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	VERTICAL



Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	FS		@3m	
		QP/AV/PK	dBμV/m	dBμV/m	dB	dBμV/m	dB
11.30	S	Peak	23.14	11.76	11.38	69.54	-46.40
17.90	S	Peak	25.73	14.20	11.53	69.54	-43.81
21.56	S	Peak	22.28	11.18	11.11	69.54	-47.26
23.02	S	Peak	23.73	13.03	10.70	69.54	-45.81
25.06	S	Peak	34.53	24.35	10.18	69.54	-35.01
27.12	H	Peak	20.04	10.35	9.70	69.54	-49.50
28.64	S	Peak	24.30	14.94	9.36	69.54	-45.24

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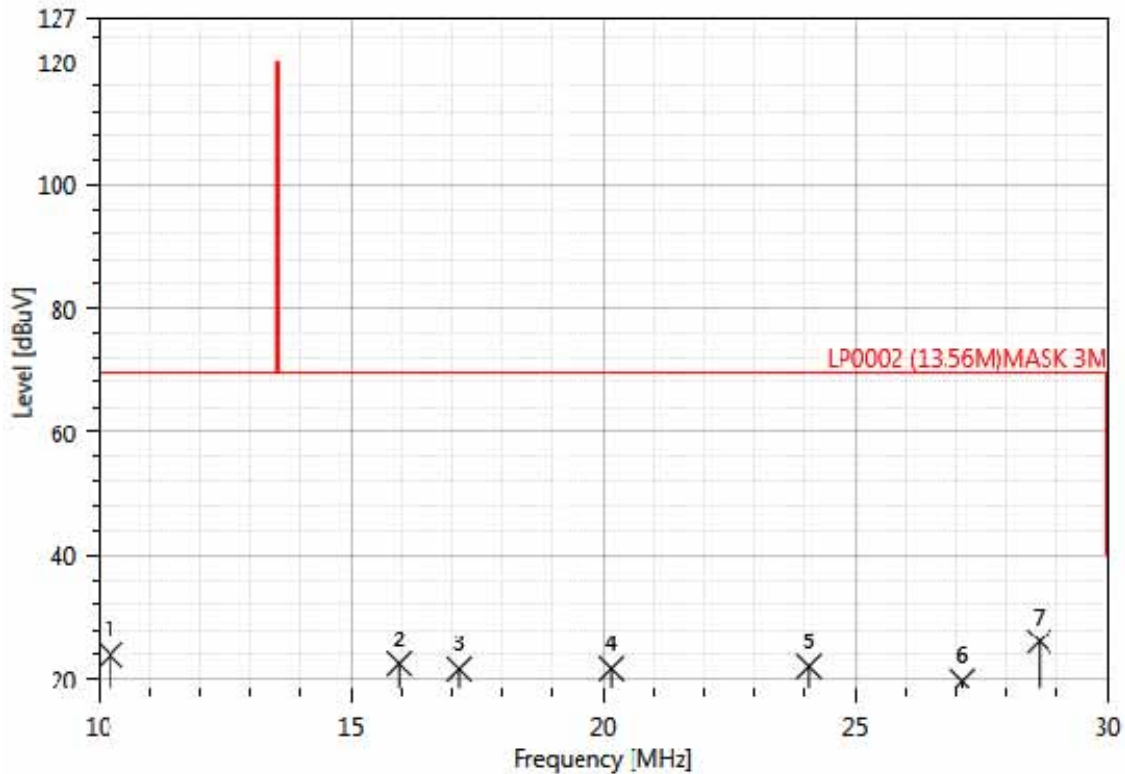
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Operation Mode :	RFID	Test Date :	05/25/2016 10:28:23
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Tx CH MID	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq.	Note	Decetor	Actual	Spectrum	Factor	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	FS	dB	@3m	dB
		QP/AV/PK	dBuV/m	dBuV/m		dBuV/m	
10.24	S	Peak	23.85	12.51	11.34	69.54	-45.69
15.96	S	Peak	22.50	11.01	11.49	69.54	-47.04
17.14	S	Peak	21.64	10.13	11.51	69.54	-47.90
20.16	S	Peak	21.72	10.19	11.53	69.54	-47.82
24.08	S	Peak	22.06	11.64	10.42	69.54	-47.48
27.12	H	Peak	19.73	10.03	9.70	69.54	-49.81
28.64	S	Peak	26.07	16.70	9.36	69.54	-43.47

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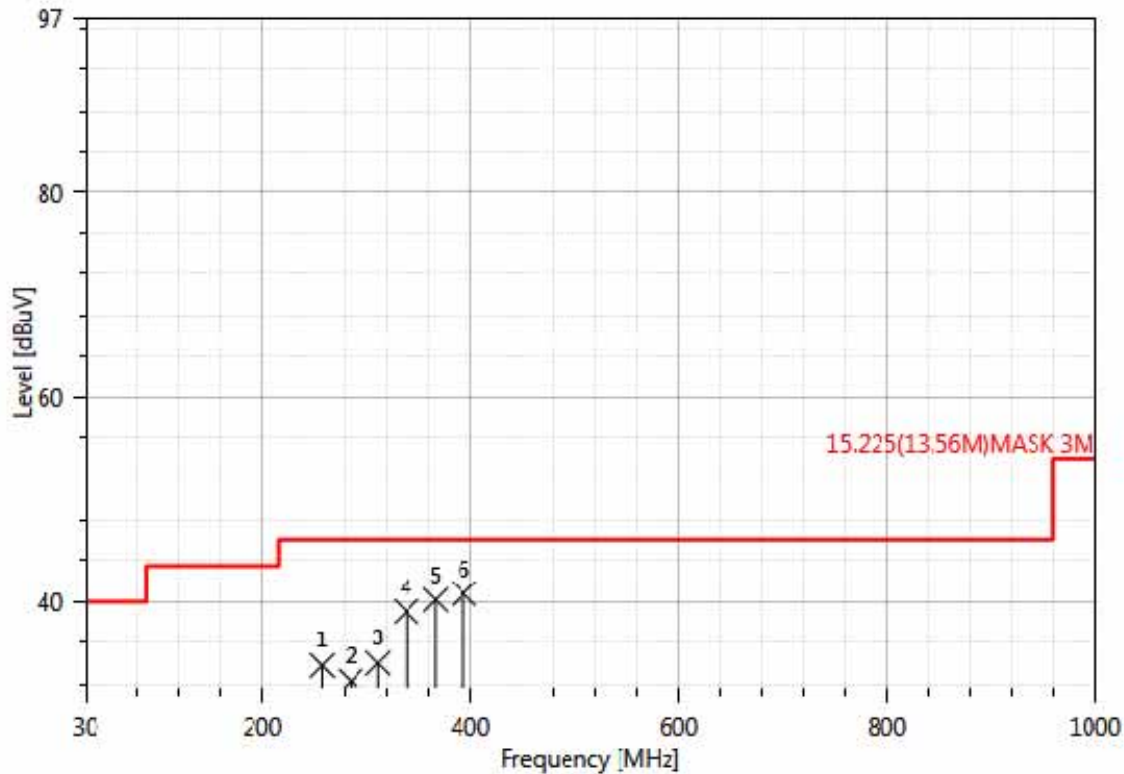
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Operation Mode :	RFID	Test Date :	05/25/2016 10:11:03
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Tx CH MID	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBuV/m	Spectrum FS dBuV/m	Factor dB	Limit @3m dBuV/m	Margin dB
257.64	H	Peak	33.82	41.19	-7.38	46.00	-12.18
284.76	H	Peak	32.31	38.55	-6.24	46.00	-13.69
311.88	H	Peak	34.04	39.49	-5.45	46.00	-11.96
339.00	H	Peak	39.08	44.29	-5.21	46.00	-6.92
366.12	H	Peak	40.20	44.92	-4.72	46.00	-5.80
393.24	H	Peak	40.81	44.99	-4.18	46.00	-5.19

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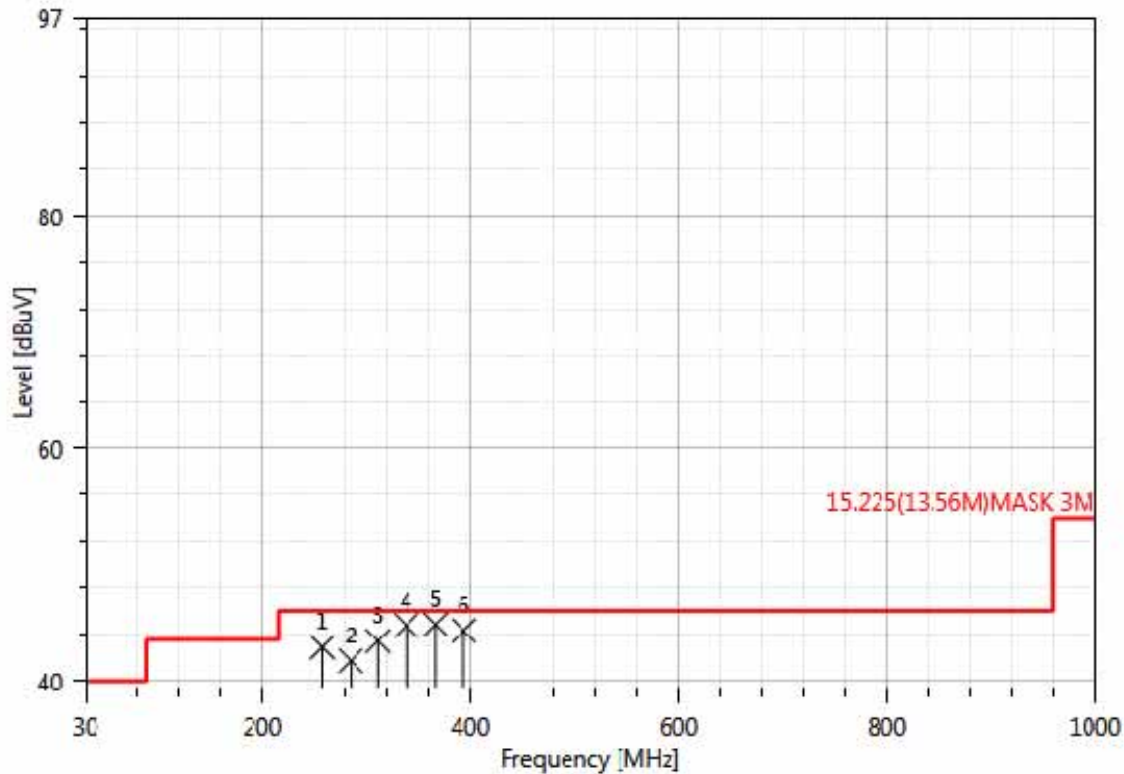
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Operation Mode :	RFID	Test Date :	05/25/2016 10:11:11
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Tx CH MID	Test Engineer :	Edward
EUT Pol. :	E2 Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBuV/m	Spectrum FS dBuV/m	Factor dB	Limit @3m dBuV/m	Margin dB
257.64	H	Peak	42.88	50.25	-7.38	46.00	-3.12
284.76	H	Peak	41.71	47.95	-6.24	46.00	-4.29
311.88	H	Peak	43.41	48.86	-5.45	46.00	-2.59
339.00	H	Peak	44.75	49.96	-5.21	46.00	-1.25
366.12	H	Peak	44.85	49.57	-4.72	46.00	-1.15
393.24	H	Peak	44.31	48.48	-4.18	46.00	-1.69

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## 8 FREQUENCY STABILITY

### 8.1 Standard Applicable

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $+50$  degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

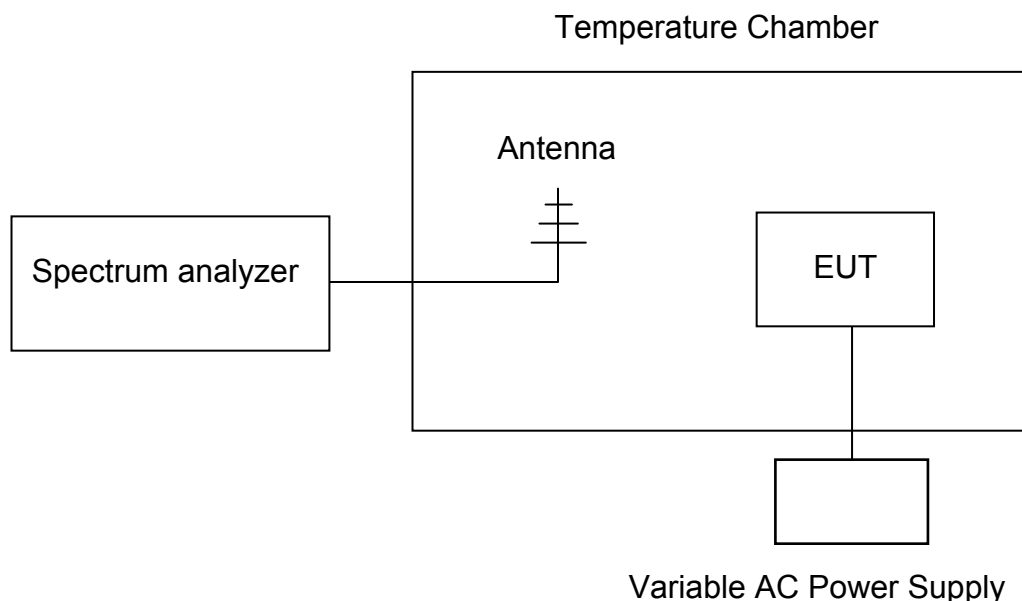
Carrier frequency stability shall be maintained to  $\pm 0.01\%$  ( $\pm 100$  ppm).

For licence-exempt radio apparatus, the frequency stability shall be measured at temperatures of  $-20^{\circ}\text{C}$  ( $-4^{\circ}\text{F}$ ),  $+20^{\circ}\text{C}$  ( $+68^{\circ}\text{F}$ ) and  $+50^{\circ}\text{C}$  ( $+122^{\circ}\text{F}$ ).

### 8.2 Measurement Procedure

1. The EUT was placed inside temperature chamber and powered and powered by nominal DC voltage.
2. Set EUT as normal operation.
3. Turn the EUT on and couple its output to spectrum.
4. Turn the EUT off and set the chamber to the highest temperature specified.
5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT and measure the operating frequency.
6. Repeat step with the temperature chamber set to the lowest temperature.
7. Set spectrum Center Frequency = fundamental frequency, RBW, VBW= 10 kHz, Span =100 kHz, Detector =Max hold, Mark peak.

### 8.3 Test SET-UP



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## 8.4 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	12/09/2015	12/08/2016
Power Sensor	Anritsu	MA2411B	917032	12/09/2015	12/08/2016
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017

## 8.5 Measurement Results

### A. Temperature Variation

Power Supply	Environment	Frequency	Delta (Hz)	Limit (KHz)
Vdc	Temperature ( )	(MHz)		
3	-20	13.55983	0.00	+/- 1.356
3	-10	13.55983	0.00	+/- 1.356
3	0	13.55967	160.00	+/- 1.356
3	10	13.55983	0.00	+/- 1.356
3	20	13.55983	0.00	+/- 1.356
3	30	13.55983	0.00	+/- 1.356
3	40	13.55983	0.00	+/- 1.356
3	50	13.55983	0.00	+/- 1.356

### B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (Hz)	Limit (KHz)
Vdc	Temperature ( )	(MHz)		
3.3	20	13.55983	0.00	+/- 1.356
3	20	13.55983	0.00	+/- 1.356
2.7	20	13.55983	0.00	+/- 1.356

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## 9 20 dB OCCUPIED BANDWIDTH MEASUREMENT

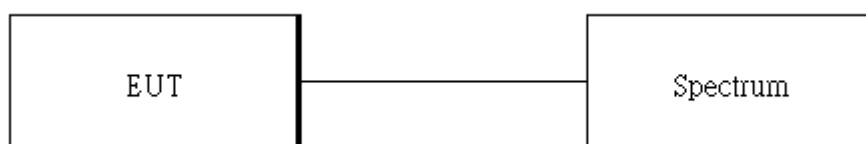
### 9.1 Standard Applicable:

The 20 dB bandwidth shall be specified in operating frequency band.

### 9.2 Limit:

None

### 9.3 Test Set-up



### 9.4 Measurement Procedure

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

### 9.5 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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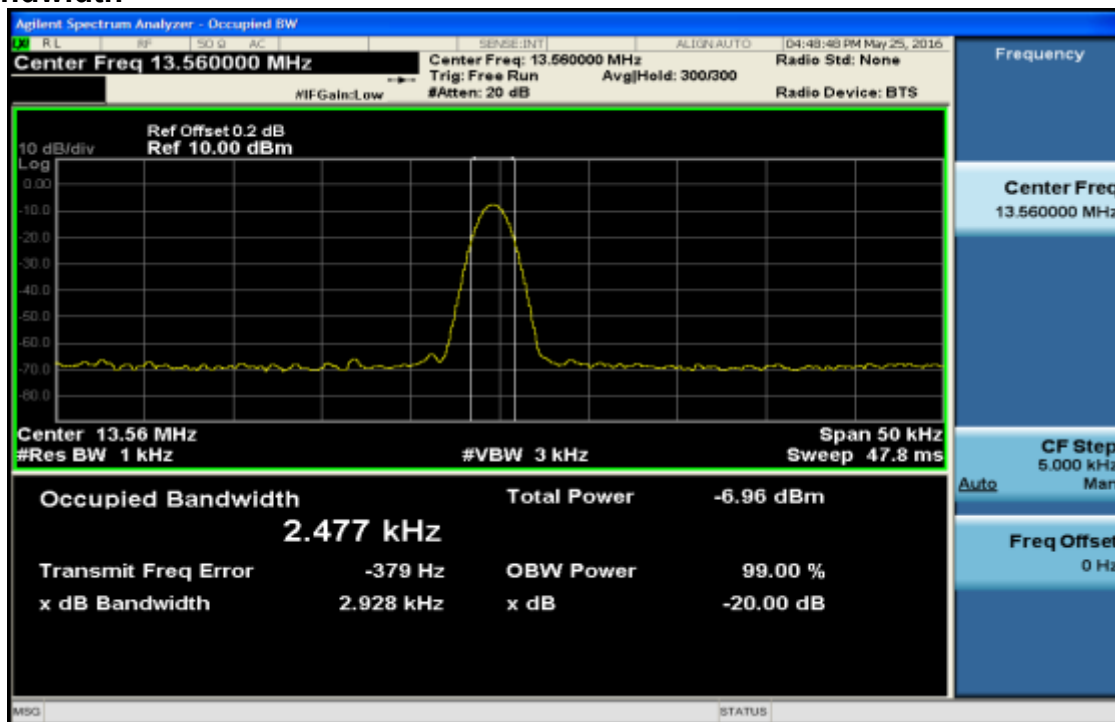
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## 9.6 Measurement Result 20dB Bandwidth



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## 10 ANTENNA REQUIREMENT

### 10.1. Standard Applicable

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.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer.

For transmitters of RF output power of 10 milliwatts or less, only the portion of the antenna gain that is in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power to demonstrate compliance with the radiated power limits specified in the applicable standard. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power limits.

### 10.2. Antenna Connected Construction

The antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

*~ End of Report ~*

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