ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Applicant:	Sharp Corporation, Mobile Communication B.U. 2-13-1, Hachihonmatsu-Iida, Higashi-hiroshima-shi, Hiroshima 739-0192, Japan
Manufacturer:	Sharp Corporation 1 Takumi-cho, Sakai-ku, Sakai-Shi, Osaka 590-8522, Japan
Product Name:	Smart Phone
Report Number:	ER/2018/30051
FCC ID:	APYHRO00261
FCC Rule Part	Part 15.225
Issue Date:	Apr. 13, 2018
Date of Test:	Mar. 20, 2018 ~ Apr. 02, 2018
Date of EUT Received:	Mar. 20, 2018

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 15.225.

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

Tested By: Marcus Tseng

Marcus Tseng / Sr. Engineer

Approved By: Jim Chang

Jim Chang / Manager

ilac-MRA

TAF
Testing Laboratory
0513

Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
ER/2018/30051	Rev.00	Initial creation of document	All	Apr. 13, 2018	Tiffany Kao

Contents

1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	Smart Phone	
Hardware Version:	DVT	
Software Version:	N/A	
Power Supply:	3.85V from Rechargeable Li-ion Battery	
	Battery:	Model No.: UBATIA287AFN2, Supplier: SCUD (FUJIAN) Electronics Co., Ltd.

NFC:

Operating Frequency	13.56MHz
Transmit Power	< 123dBuV/m at 3m.
Number of Channels	1
Antenna Type	Loop Antenna
Modulation Type	ASK

1.2 Test Methodology

FCC Part 15, Subpart C §15.225

ANSI C63.10:2013
Note: All test items have been performed and record as per the above standards.

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 Number and Designation number are: 509634 / TW0001

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.
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

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

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.

2.4 Limitation

(1) 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.		

(2) Radiated Emission

a. The field strength of any emission within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
b. Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
c. Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
d. The field strength of any emissions appearing outside of the 13.110-14.010 MHz shall not exceed the general radiated emission limits in section 15.209 as below.

Frequency (MHz)	Field strength μV/m	Distance (m)	Field strength at 3m dBμV/m
1.705-30	30	30	69.54
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

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 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) = 69.54dBuV/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.

(3) Frequency Tolerance

The frequency tolerance of the carrier signal shall be maintained within +/- 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.

2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission

Fig. 2-2 AC Power Line 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	Tera Term	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	T440	P0000564	Shielded	Unshielded

3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	Compliant
§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

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 H position was reported.

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

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 : **Vertical**)	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB

Measurement uncertainty (Polarization : **Horizontal**)	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.

6 CONDUCTED EMISSIONS TEST

6.1 Standard Applicable

Frequency within 150 kHz 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.		

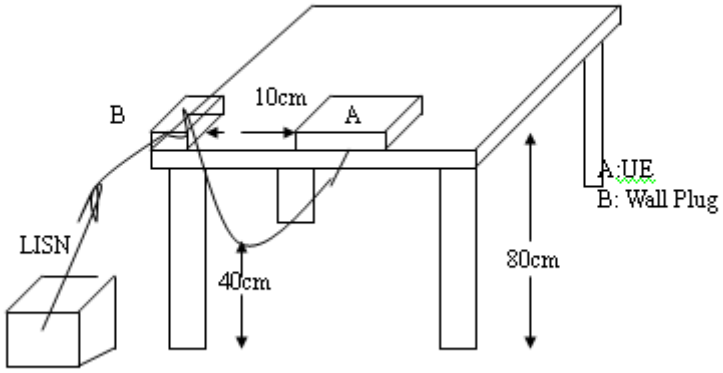
6.2 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	2017/06/06	2018/06/05
Coaxial Cables	N/A	WK CE Cable	N/A	2018/01/02	2019/01/01
Notebook	Lenovo	T440P	P0000564	N/A	N/A
LISN	SCHWARZBECK	NSLK 8127	8127-649	2017/05/22	2018/05/21

6.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
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.

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.

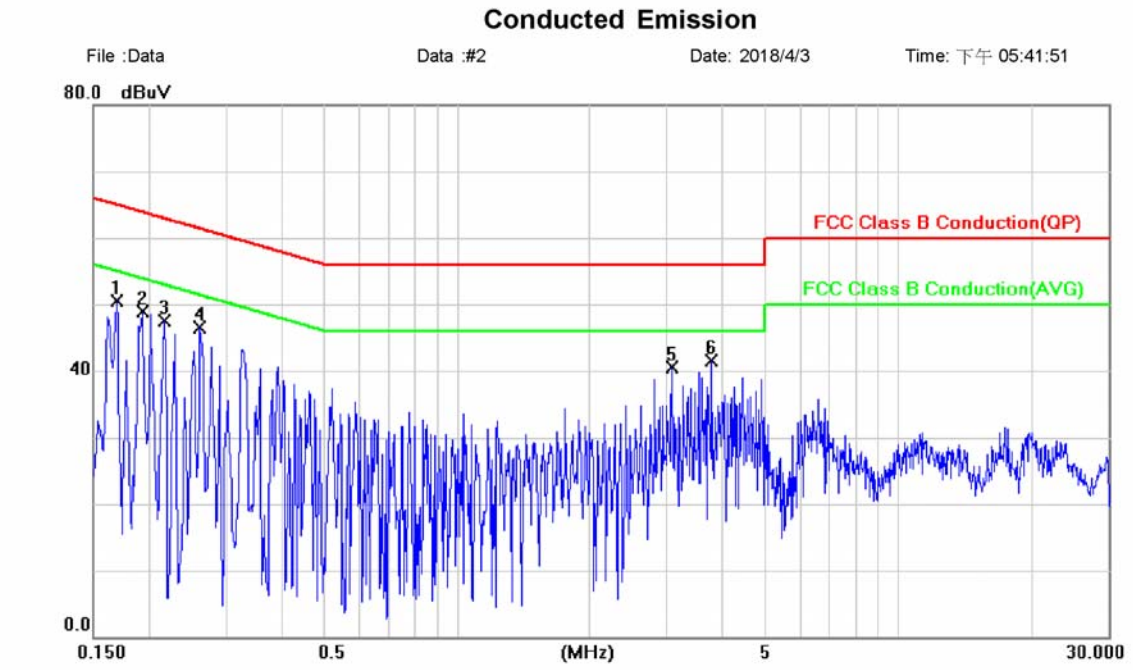
6.6 Measurement Result:

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit

AC POWER LINE CONDUCTED EMISSION TEST DATA

Site Conduction Room	Phase:	*L1*	Temperature: 20 ℃
Limit: FCC Class B Conduction(QP)	Power:	AC 120V/60Hz	Humidity: 58 %
Mode: Operation			
Note:			

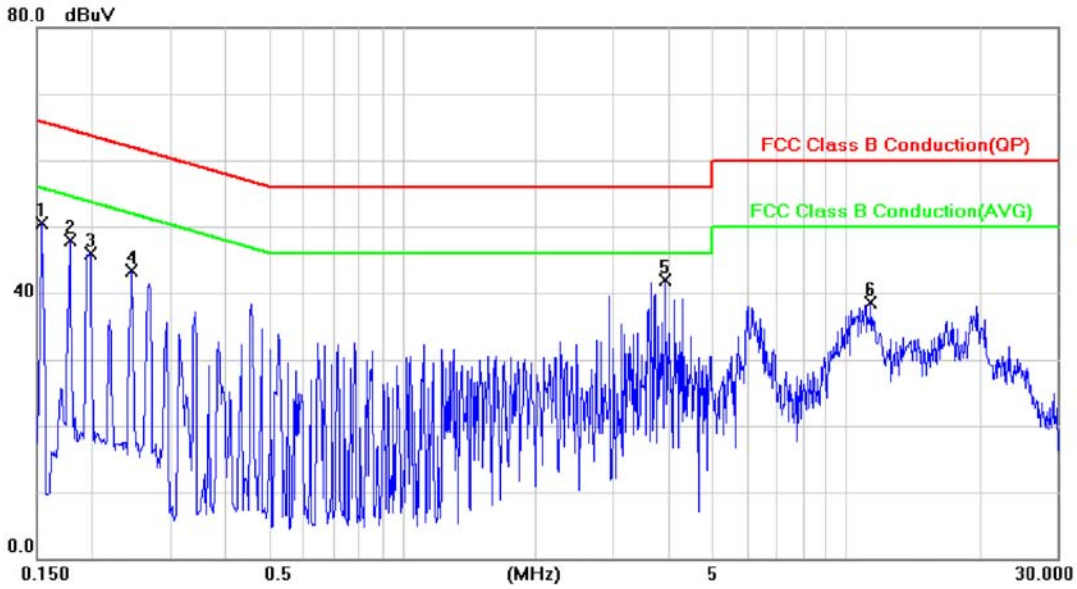


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1700	50.49	0.07	50.56	64.96	-14.40	peak	
2		0.1940	48.79	0.07	48.86	63.86	-15.00	peak	
3		0.2180	47.46	0.07	47.53	62.89	-15.36	peak	
4		0.2620	46.44	0.07	46.51	61.37	-14.86	peak	
5		3.0780	40.32	0.17	40.49	56.00	-15.51	peak	
6		3.7940	41.28	0.20	41.48	56.00	-14.52	peak	

Site Conduction Room	Phase: *N*	Temperature: 20 ℃
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 58 %
Mode: Operation		
Note:		

Conducted Emission

File :Data Data :#1 Date: 2018/4/3 Time: 下午 05:40:48



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1540	50.49	0.07	50.56	65.78	-15.22	peak	
2		0.1780	47.78	0.07	47.85	64.58	-16.73	peak	
3		0.1980	45.85	0.07	45.92	63.69	-17.77	peak	
4		0.2460	43.28	0.07	43.35	61.89	-18.54	peak	
5	*	3.9140	41.67	0.20	41.87	56.00	-14.13	peak	
6		11.4180	38.06	0.37	38.43	60.00	-21.57	peak	

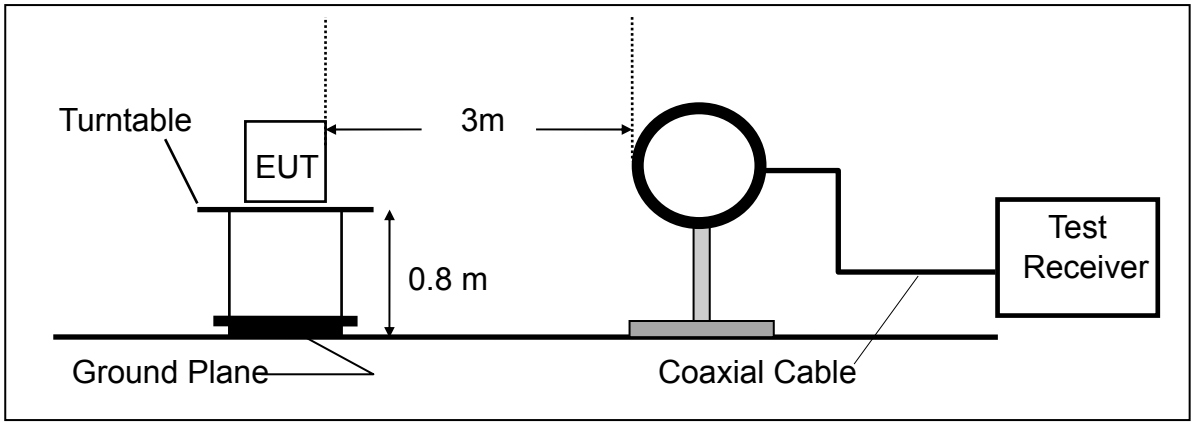
7 RADIATED EMISSION TEST

7.1 Measurement Procedure

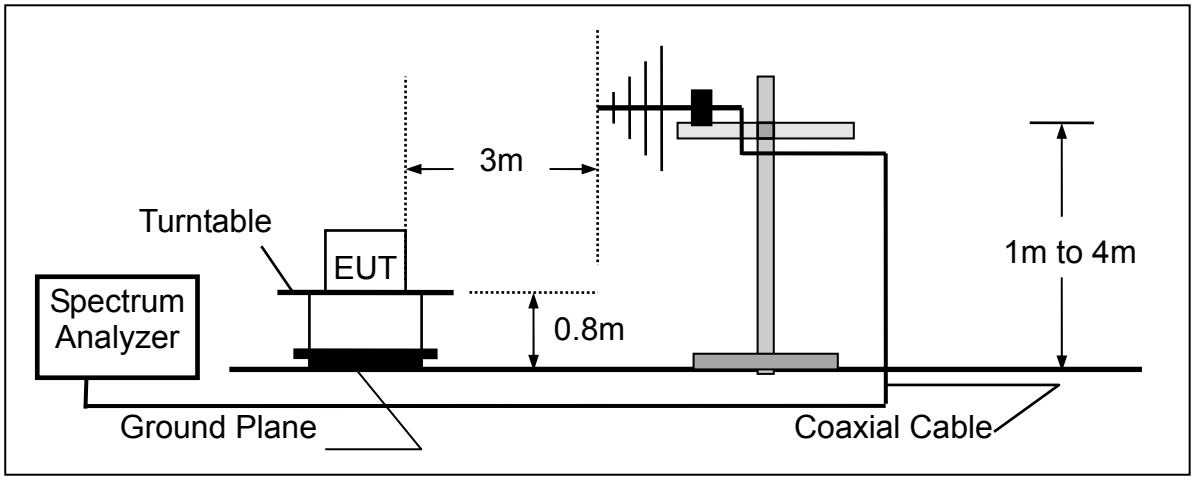
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

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



7.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Bi-log Antenna	SCHWAZBECK	VULB9168	378	2017/12/29	2018/12/28
Loop Antenna	ETS.LINDGREN	6502	148045	2017/09/26	2018/09/25
Spectrum Analyzer	Agilent	E4446A	MY51100003	2017/05/10	2018/05/09
EMI Test Receiver	R&S	ESCI7	100760	2017/06/06	2018/06/05
Pre-Amplifier	HP	8447D	2944A07676	2018/01/02	2019/01/01
Low Loss Cable	Huber Suhner	966_RX	9	2018/01/02	2019/01/01

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

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 123.90dBuV/m by offsetting the distance extrapolation factor as measurement distance is taken place at 3 meters.

Distance extrapolation = 40 *log (30/3) = 40 dB

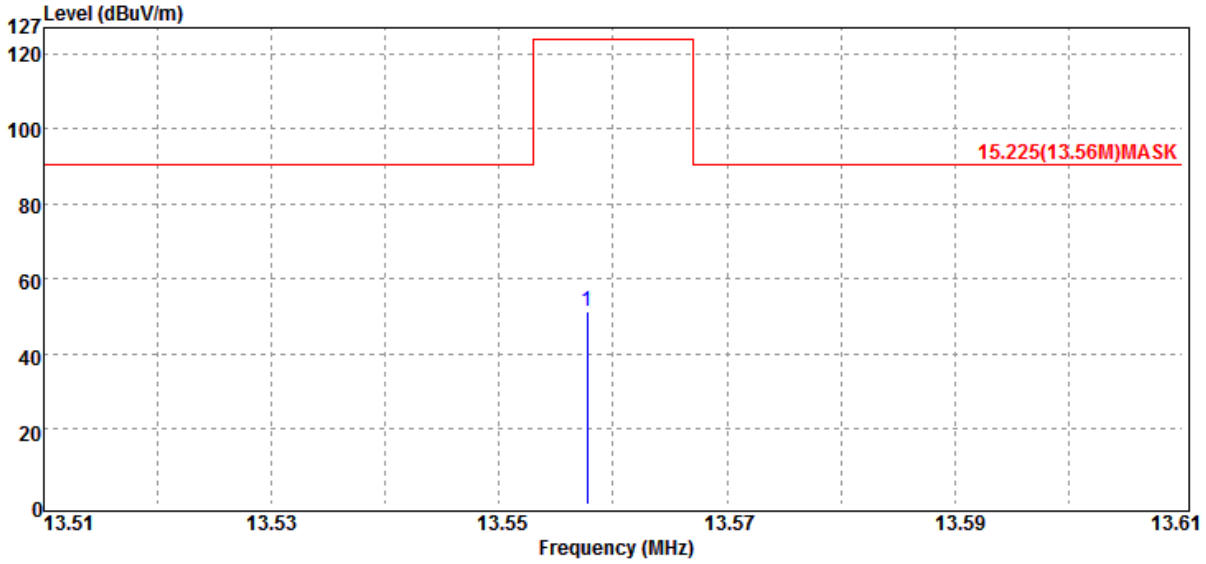
Limit is re-adjusted in terms of limit taken in 3m = 20 *log (15848 uV/m) + 40 = 124.00dBuV/m

Note:
Actual FS(dBμV/m) = Spectrum. 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.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

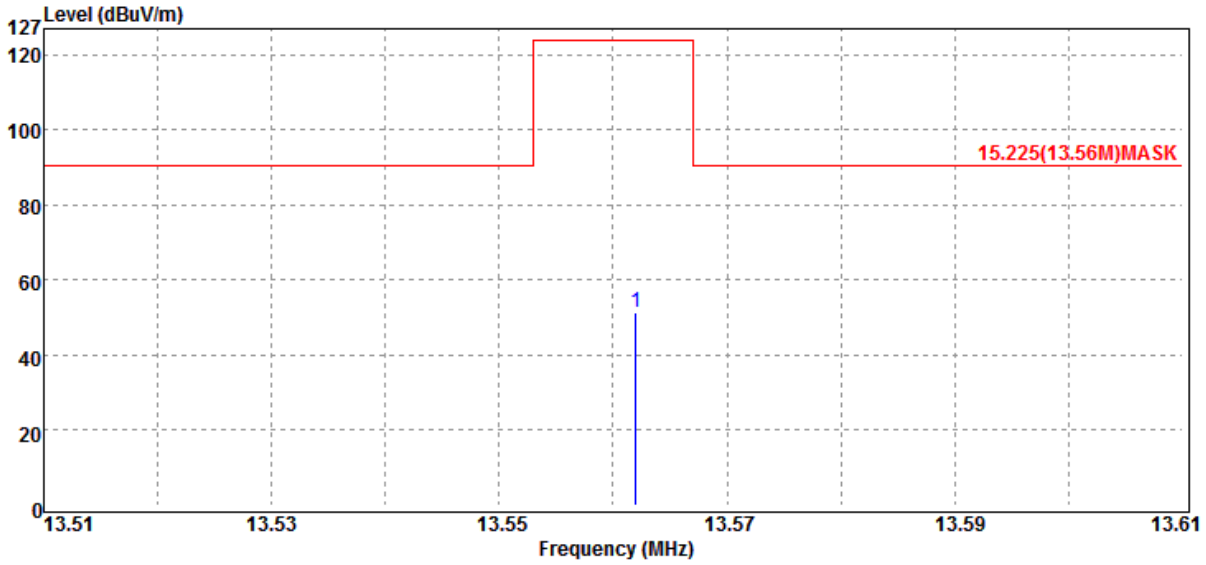
7.5.2 Field Strength of Fundamental Emission Measurement Result

Operation Band	:NFC	Test Date	:2018-04-02
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:MAIN	Engineer	:Tin
EUT Pol.	:H Plane	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	Safe Margin dB
13.56	F	Peak	39.69	11.52	51.21	123.90	-72.69

Operation Band	:NFC	Test Date	:2018-04-02
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:MAIN	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
13.56	F	Peak	39.80	11.52	51.32	123.90	-72.58

7.5.3 Radiated Mask

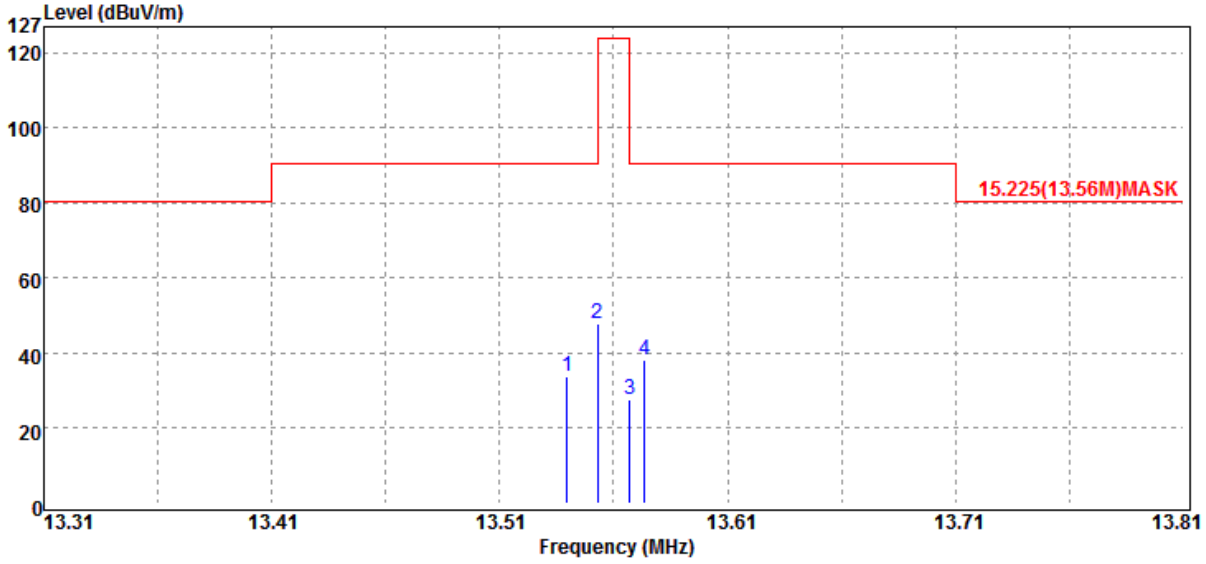
(a) 15.848 millivolts/m (84 dBμV/m) at 30 m, within the band 13.553-13.567 MHz.
(b) 334 microvolts/m (50.5 dBμV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz.
(c) 106 microvolts/m (40.5 dBμV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz.

Distance extrapolation = 40 *log (30/3) = 40 dB

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

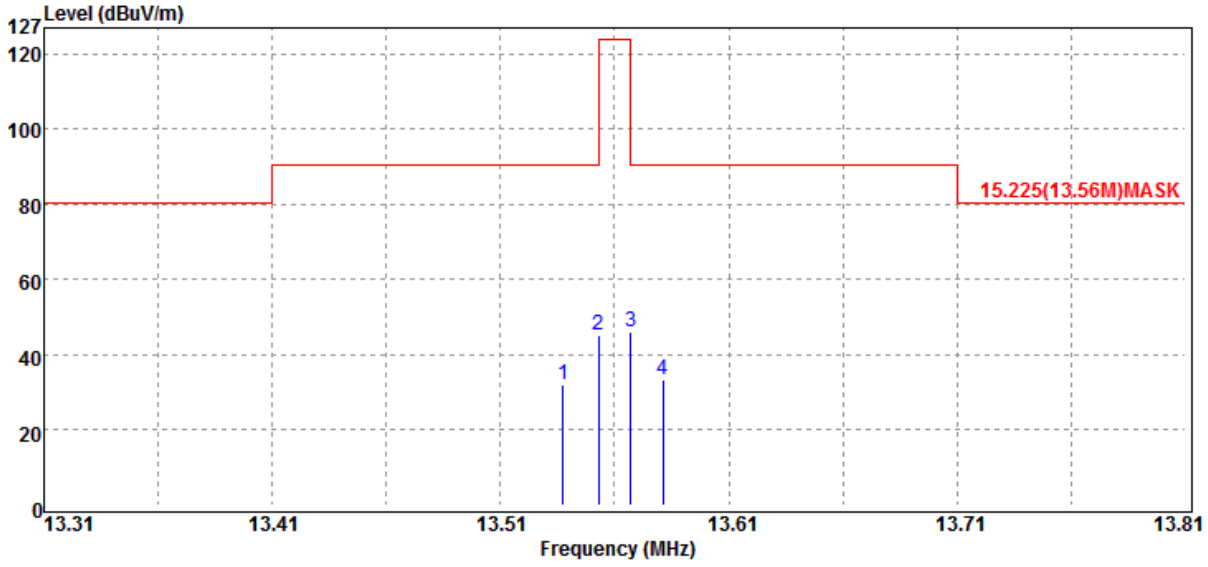
a) 20 *log (15848uV/m) + 40dB = 124.00dBuV/m
b) 20 *log(334uV/m) + 40dB = 90.47dBuV/m
c) 20*log(106uV/m) + 40dB = 80.50dBuV/m

Operation Band	:NFC	Test Date	:2018-04-02
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:MASK	Engineer	:Tin
EUT Pol.	:H Plane	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
13.54	S	Peak	22.14	11.52	33.66	90.47	-56.81
13.55	S	Peak	36.32	11.52	47.84	90.47	-42.63
13.57	S	Peak	16.23	11.52	27.75	90.47	-62.72
13.57	S	Peak	26.56	11.52	38.08	90.47	-52.39

Operation Band	:NFC	Test Date	:2018-04-02
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:MASK	Engineer	:Tin
EUT Pol.	:H Plane	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	dBµV	dB	dBµV/m	dBµV/m	dB
13.54	S	Peak	20.51	11.52	32.03	90.47	-58.44
13.55	S	Peak	33.90	11.52	45.42	90.47	-45.05
13.57	S	Peak	34.54	11.52	46.06	90.47	-44.41
13.58	S	Peak	21.84	11.52	33.36	90.47	-57.11

7.5.4 Radiated Emission –

Limit:

§15.225

(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 taken place at 3m.

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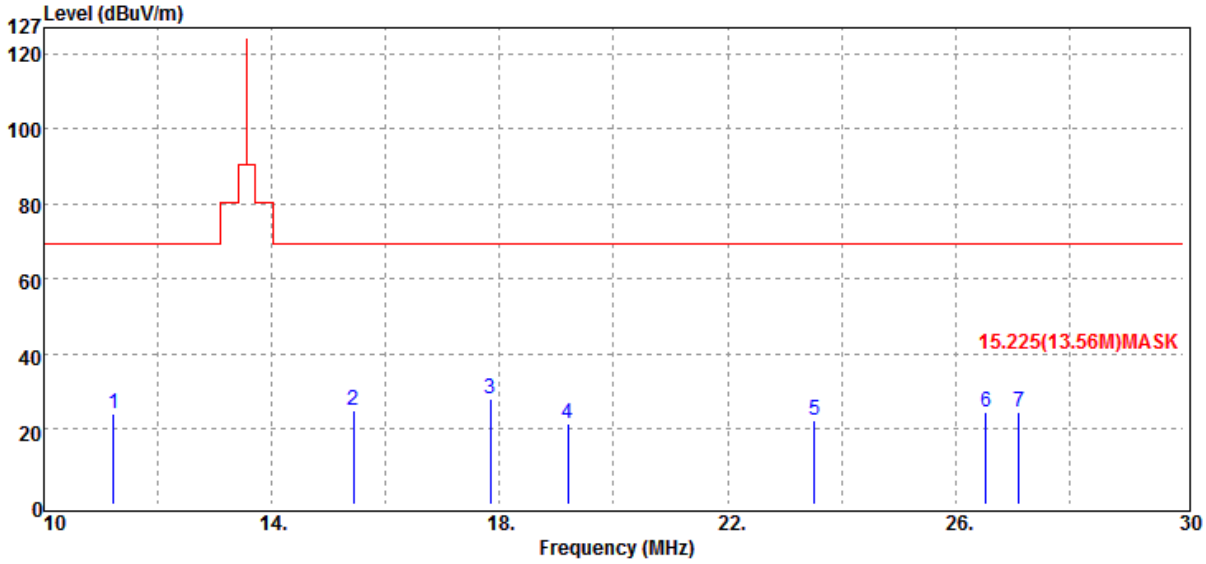
(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

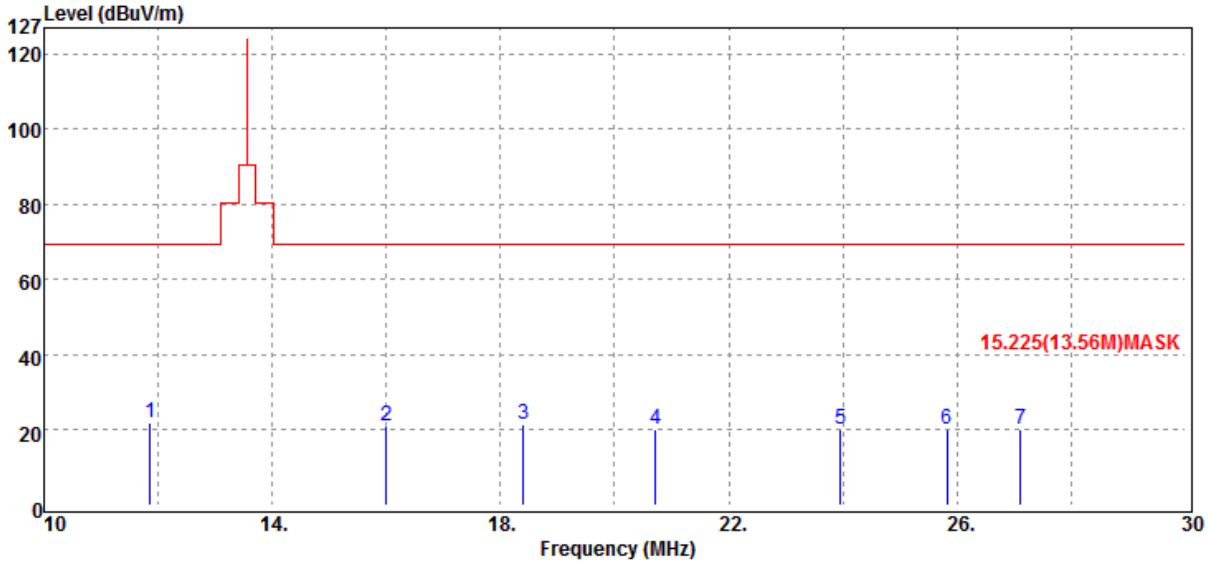
a) 20*log(30uV/m) + 40dB = 69.54 dBuV/m

Operation Band	:NFC	Test Date	:2018-04-02
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



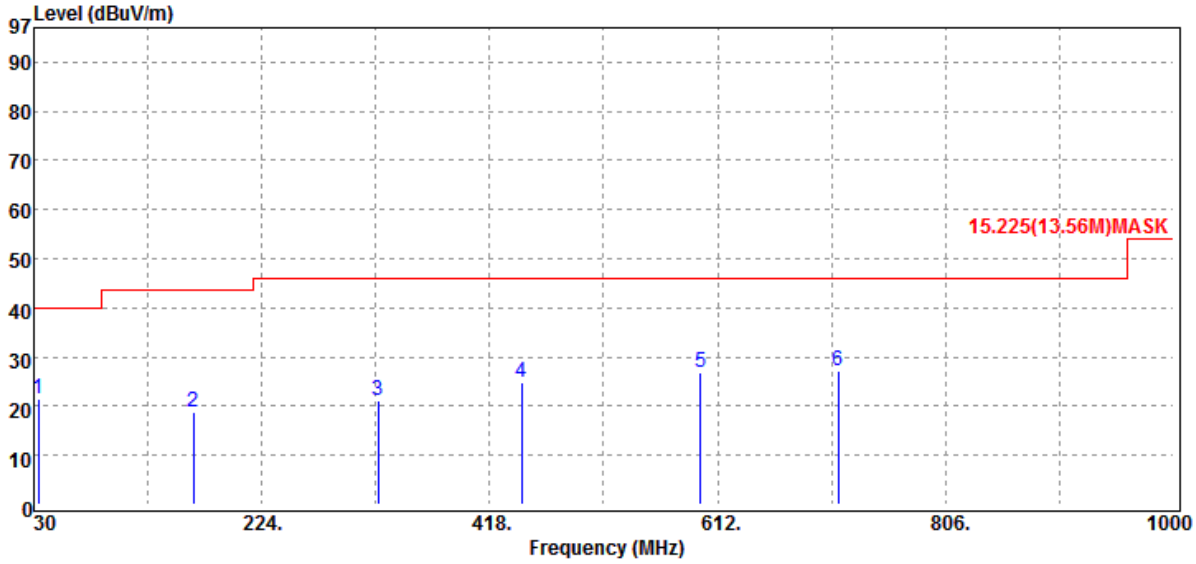
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
11.22	S	Peak	12.85	11.47	24.32	69.54	-45.22
15.44	S	Peak	13.40	11.56	24.96	69.54	-44.58
17.84	S	Peak	16.30	11.62	27.92	69.54	-41.62
19.20	S	Peak	10.06	11.65	21.71	69.54	-47.83
23.52	S	Peak	11.80	10.73	22.53	69.54	-47.01
26.54	S	Peak	14.60	10.07	24.67	69.54	-44.87
27.12	H	Peak	14.57	9.94	24.51	69.54	-45.03

Operation Band	:NFC	Test Date	:2018-04-02
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



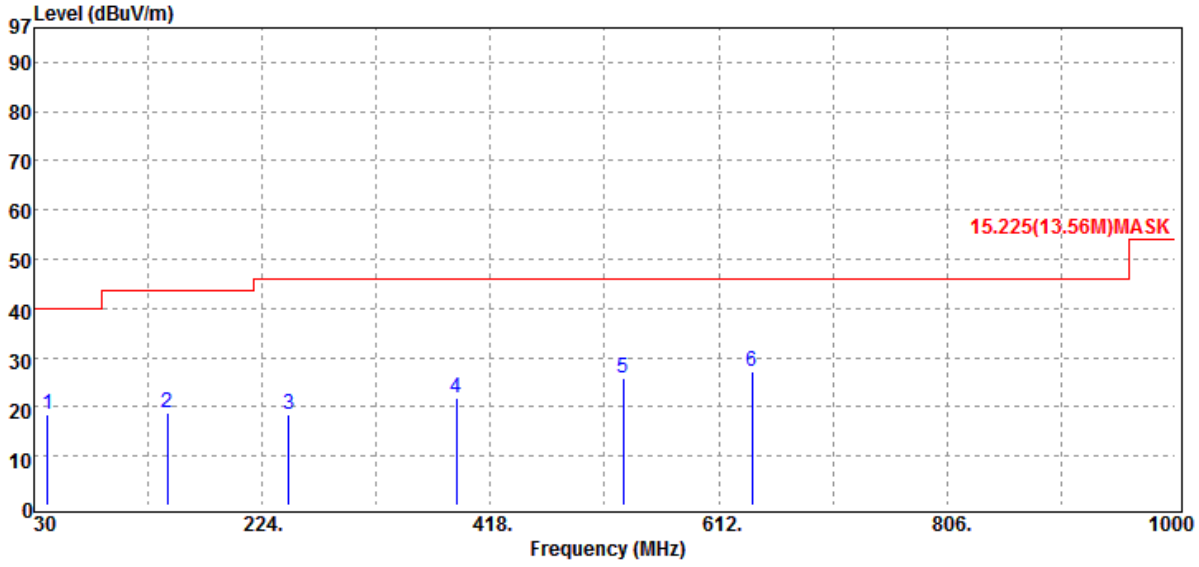
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
11.86	S	Peak	10.53	11.48	22.01	69.54	-47.53
16.00	S	Peak	9.69	11.58	21.27	69.54	-48.27
18.40	S	Peak	10.00	11.64	21.64	69.54	-47.90
20.72	S	Peak	8.58	11.46	20.04	69.54	-49.50
23.96	S	Peak	9.66	10.63	20.29	69.54	-49.25
25.82	S	Peak	9.88	10.22	20.10	69.54	-49.44
27.12	H	Peak	10.19	9.94	20.13	69.54	-49.41

Operation Band	:NFC	Test Date	:2018-04-02
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	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
33.88	S	Peak	30.12	-8.78	21.34	40.00	-18.66
165.80	S	Peak	26.01	-7.32	18.69	43.50	-24.81
322.94	S	Peak	26.30	-5.07	21.23	46.00	-24.77
445.16	S	Peak	27.77	-2.88	24.89	46.00	-21.11
597.45	S	Peak	27.19	-0.36	26.83	46.00	-19.17
714.82	S	Peak	25.96	1.37	27.33	46.00	-18.67

Operation Band	:NFC	Test Date	:2018-04-02
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



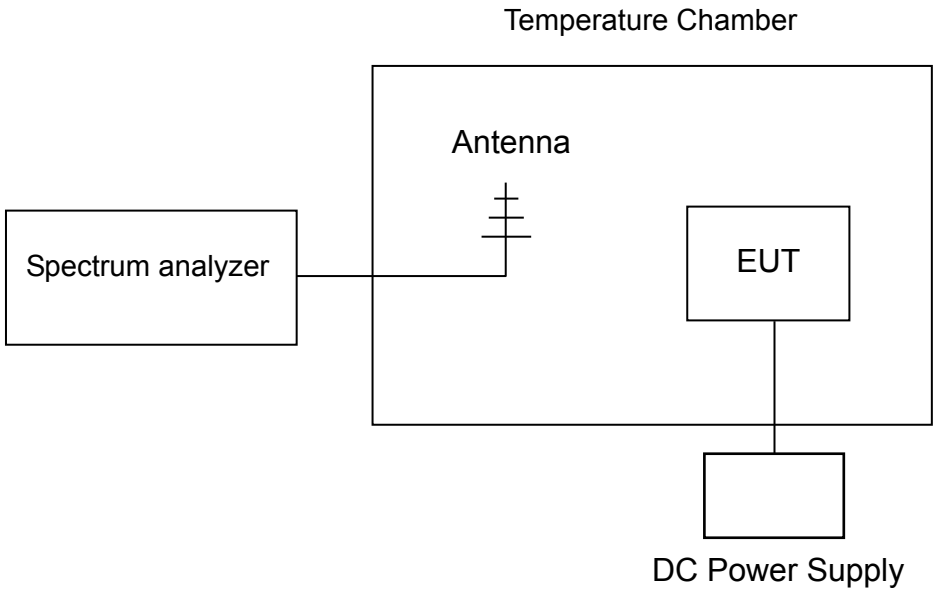
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
41.64	S	Peak	26.73	-8.12	18.61	40.00	-21.39
143.49	S	Peak	26.43	-7.77	18.66	43.50	-24.84
246.31	S	Peak	25.77	-7.47	18.30	46.00	-27.70
388.90	S	Peak	25.40	-3.71	21.69	46.00	-24.31
530.52	S	Peak	26.98	-1.23	25.75	46.00	-20.25
640.13	S	Peak	26.35	0.88	27.23	46.00	-18.77

8 FREQUENCY TOLERANCE

8.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 10kHz, Span =100kHz.
4. Set SPA Max hold. Mark peak.

8.2 Test SET-UP (Block Diagram of Configuration)



8.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4446A	MY51100003	2017/05/10	2018/05/09
Loop Antenna	ETS.LINDGREN	6502	148045	2017/09/26	2018/09/25
DC Power Supply	Anritsu	E3640A	MY52410006	2017/11/28	2018/11/27

8.4 Measurement Results

Startup:

A. Temperature Variation

Power Supply Vdc	Environment Temperature (°C)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.85	-20	13.5601946	-194.60000	+/- 1.356
3.85	-10	13.5601958	-195.80000	+/- 1.356
3.85	0	13.5601963	-196.30000	+/- 1.356
3.85	10	13.5601838	-183.80000	+/- 1.356
3.85	20	13.56	0.00000	+/- 1.356
3.85	30	13.56002125	-21.25300	+/- 1.356
3.85	40	13.56002542	-25.42000	+/- 1.356
3.85	50	13.56002649	-26.49000	+/- 1.356

B. Supply Voltage Variation

Power Supply Vdc	Environment Temperature (°C)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.27	20	13.56019424	-194.24000	+/- 1.356
3.85	20	13.56	0.00000	+/- 1.356
4.43	20	13.56019625	-196.25000	+/- 1.356

2 Minutes:

A. Temperature Variation 2 minutes

Power Supply Vdc	Environment Temperature (°C)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.85	-20	13.56001837	181.15800	+/- 1.356
3.85	-10	13.56001893	180.59800	+/- 1.356
3.85	0	13.56001853	180.99770	+/- 1.356
3.85	10	13.56001935	180.18500	+/- 1.356
3.85	20	13.56019953	0.00000	+/- 1.356
3.85	30	13.56013725	62.28000	+/- 1.356
3.85	40	13.56013456	64.96670	+/- 1.356
3.85	50	13.56013856	60.96650	+/- 1.356

B. Supply Voltage Variation 2 minutes

Power Supply Vdc	Environment Temperature (°C)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.27	20	13.56019543	4.10000	+/- 1.356
3.85	20	13.56019953	0.00000	+/- 1.356
4.43	20	13.56019632	3.21000	+/- 1.356

5 Minutes:

A. Temperature Variation 5 minutes

Power Supply Vdc	Environment Temperature (°C)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.85	-20	13.5601335	-133.50000	+/- 1.356
3.85	-10	13.56013453	-134.53000	+/- 1.356
3.85	0	13.56013354	-133.54000	+/- 1.356
3.85	10	13.5601365	-136.50000	+/- 1.356
3.85	20	13.56	0.00000	+/- 1.356
3.85	30	13.56013846	-138.46350	+/- 1.356
3.85	40	13.56013786	-137.85950	+/- 1.356
3.85	50	13.56013785	-137.85430	+/- 1.356

B. Supply Voltage Variation 5 minutes

Power Supply Vdc	Environment Temperature (°C)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.27	20	13.56001987	-19.87000	+/- 1.356
3.85	20	13.56	0.00000	+/- 1.356
4.43	20	13.56001933	-19.33000	+/- 1.356

10 Minutes:

A. Temperature Variation 10 minutes

Power Supply Vdc	Environment Temperature (°C)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.85	-20	13.56013423	0.19000	+/- 1.356
3.85	-10	13.56013646	-2.04000	+/- 1.356
3.85	0	13.56013635	-1.93000	+/- 1.356
3.85	10	13.56013845	-4.03000	+/- 1.356
3.85	20	13.56013442	0.00000	+/- 1.356
3.85	30	13.56013483	-0.41000	+/- 1.356
3.85	40	13.56013553	-1.11000	+/- 1.356
3.85	50	13.56012995	4.47000	+/- 1.356

B. Supply Voltage Variation 10 minutes

Power Supply Vdc	Environment Temperature (°C)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.27	20	13.56012984	5.49000	+/- 1.356
3.85	20	13.56013533	0.00000	+/- 1.356
4.43	20	13.56013433	1.00000	+/- 1.356

9 20 dB OCCUPIED BANDWIDTH MEASUREMENT

9.1 Standard Applicable:

§2.1049 & §15.215 (c)

9.2 Limit:

None

9.3 Test Set-up

Refer to section 6.2 in this report

9.4 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 1 kHz and the video bandwidth of 3 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.
4. Because the measured signal is CW adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.

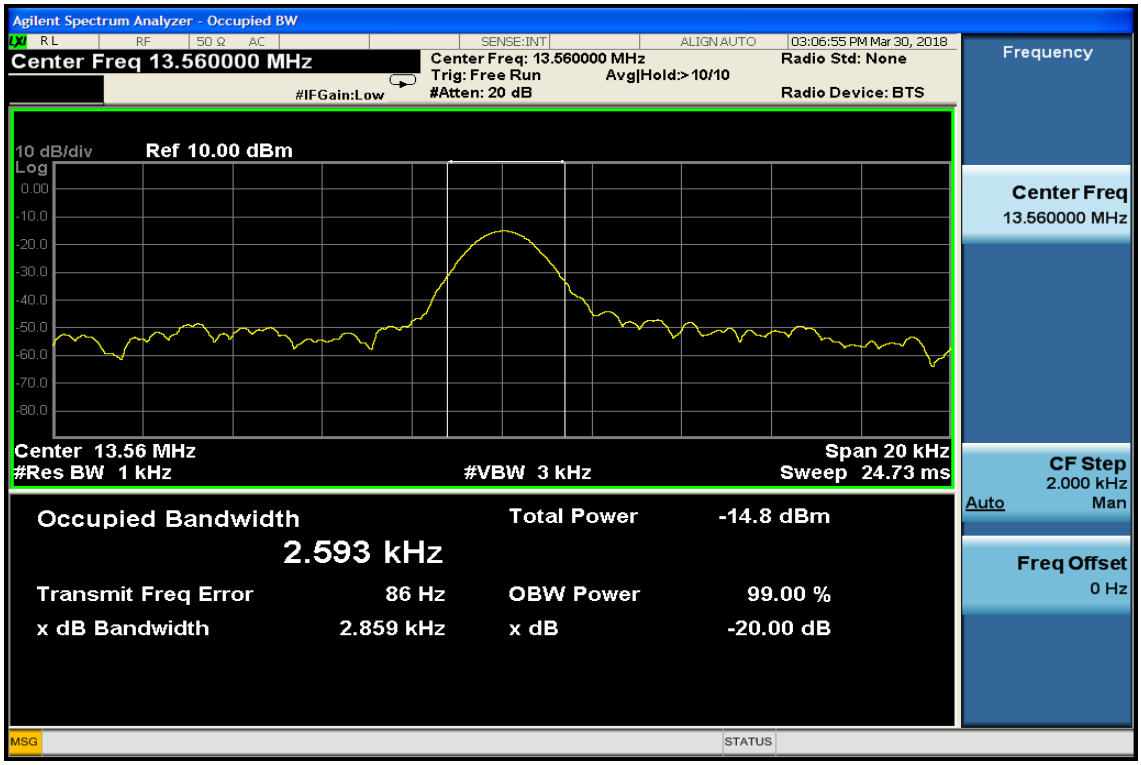
9.5 Measurement Equipment Used:

Refer to section 8.3 in this report

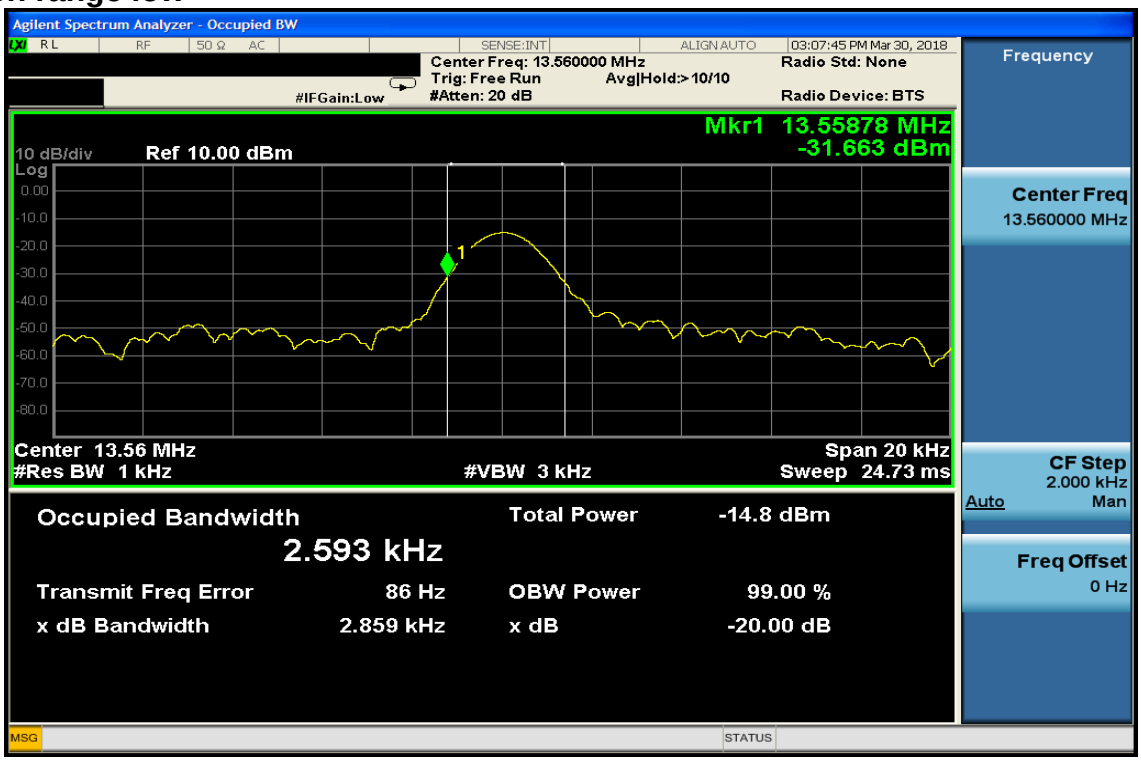
9.6 Measurement Result

20dB Bandwidth	Operation Range	Frequency (MHz)	Limit (MHz)
(kHz)	Low	13.559028	>13.11
2.499	High	13.561108	<14.01

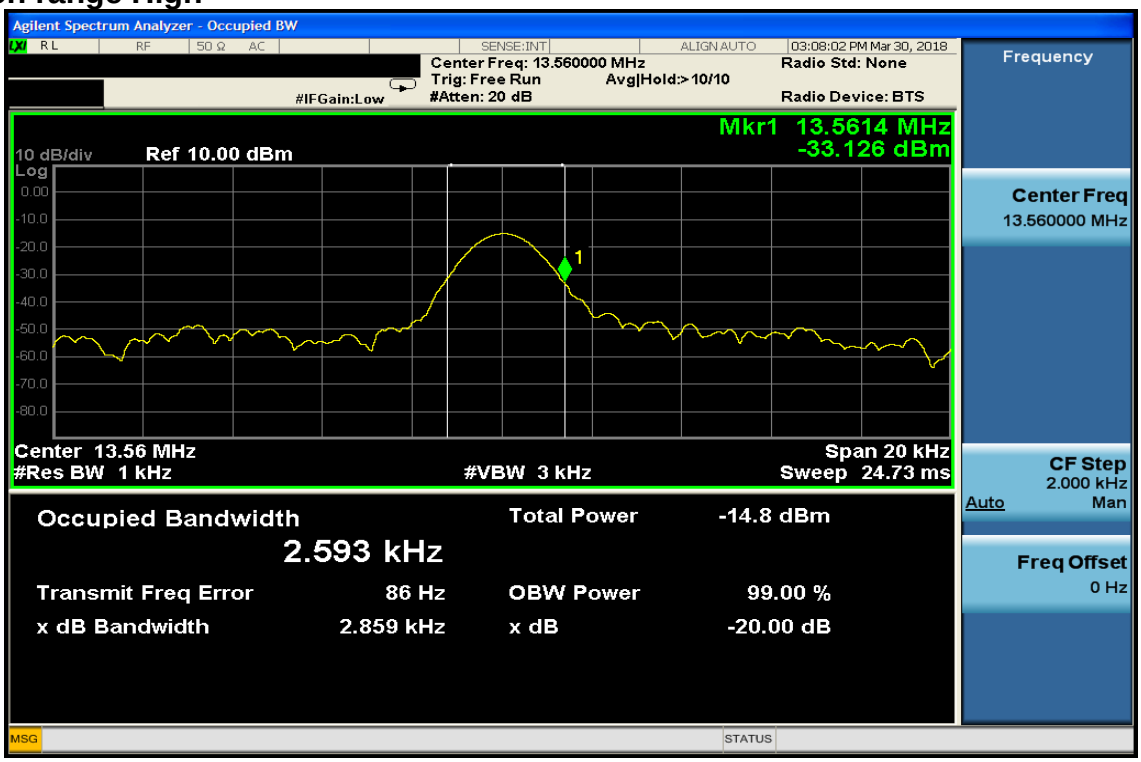
-20dB Bandwidth



Operation range low



Operation range High



10 ANTENNA REQUIREMENT

10.1 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.

10.2 Antenna Connected Construction:

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