ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name:	**Rugged Handheld Computer**
Brand Name:	**unitech**
Model No.:	**PA730**
Model Different:	**N/A**
FCC ID:	**HLEPA730BTNFL**
Report No.:	**ER/2017/70088**
Issue Date:	**Aug. 04, 2017**
FCC Rule Part:	**§15.225**
Prepared for:	**unitech electronics co., ltd. 5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan**
Prepared by:	**SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803**

Testing Laboratory
0513

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VERIFICATION OF COMPLIANCE

Applicant:	unitech electronics co., ltd. 5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan
Product Name:	Rugged Handheld Computer
Brand Name:	unitech
Model No.:	PA730
Model Difference:	N/A
FCC ID:	HLEPA730BTNFL
File Number:	ER/2017/70088
Date of test:	Jul. 18, 2017 ~ Jul. 28, 2017
Date of EUT Received:	Jul. 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 15.225.
The test results of this report relate only to the tested sample identified in this report.

Test By:	Curry Chen	*Date:*	Aug. 04, 2017
	Curry Chen / Engineer		
Prepared By:	Yuri Tsai	*Date:*	Aug. 04, 2017
	Yuri Tsai / Clerk		
Approved By	Jim Chang	*Date:*	Aug. 04, 2017
	Jim Chang / Asst. Manager		

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Revision History

Report Number	Revision	Description	Issue Date
ER/2017/70088	Rev.00	Initial creation of document	Aug. 04, 2017

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1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	Rugged Handheld Computer	
Brand Name:	unitech	
Model No.:	PA730	
Model Difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
USB Cable:	Model No.: 3C10-00000583, Supplier: Bitatek	
Power Supply:	3.7Vdc from Rechargeable Li-polymer Battery or 5V from AC/DC Adapter	
	Battery:	1. Model No.: BTBAT2, Supplier: Leung's Communication & Electric Products (Guangzhou) LTD. 2. Model No.: BTBAT1, Supplier: Leung's Communication & Electric Products (Guangzhou) LTD.
	Adapter:	Model No.: S018BDU0900200, Supplier: Ten Pao Industrial Co., Ltd.

NFC:

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

This report complies with FCC regulatory radio rule with respect to RFID that operates on 13.56MHz.

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1.2 Test Methodology

FCC Part 15, Supbpart 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.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333 (TAF code 0513)
FCC Registration Numbers are: 735305

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.

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.

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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.

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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

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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 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 ξ 15.205 and RSS-Gen 7.2.5 Table 3.
6. The general radiated emission limits in ξ 15.209 and RSS-Gen 7.2.5 Table 5 and Table 6 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.

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2.5 Configuration of Tested System

Fig. 2-1 Emission test set up configuration

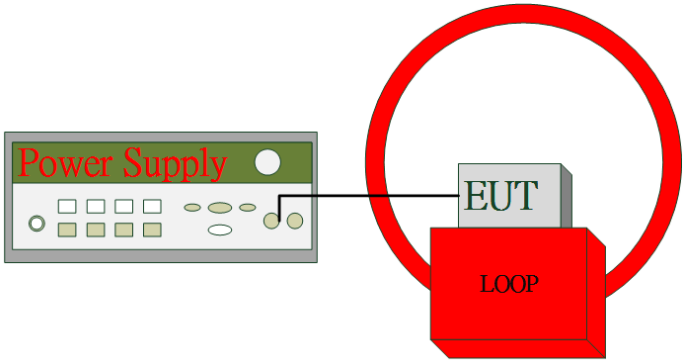

Fig. 2-2 Conduction test set up configuration

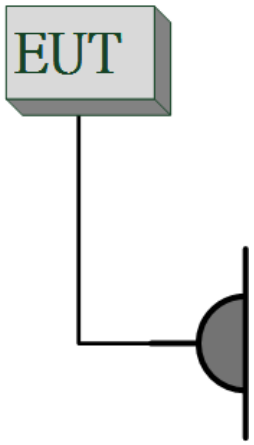

Table 2-1 Equipment Used in Tested System

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	E3640A	KR93300208	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
§15.225 (a)-(d)	Radiated Emission	Compliant
§15.209	Radiated Emission Limits, general requirement	Compliant
§15.225 (e)	Frequency Stability	Compliant
§2.1049 §15.215 (c)	99% & 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) for Bluetooth Transmitter for channel Low, Mid and High the worst case H 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 : **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 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.

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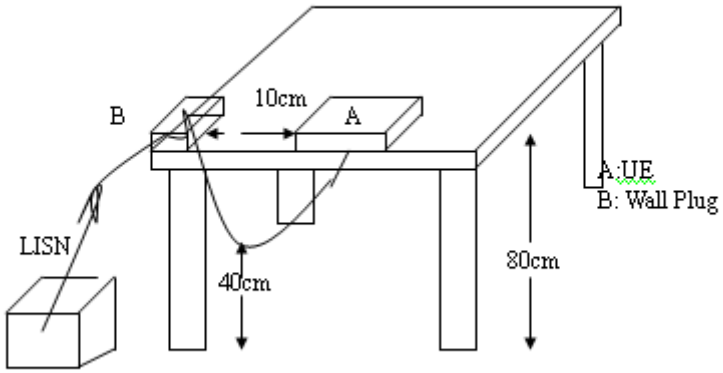
6.2 Test SET-UP (Block Diagram of Configuration)



6.3 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
EMI Test Receiver	R&S	ESCI7	100760	05/11/2017	05/10/2018
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/22/2017	05/21/2018
LISN	MESS TEC	FCC-LISN-50/250-25-2-01	4034	03/19/2017	03/18/2018
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2016	11/25/2017

6.4 Measurement Result:

Note: Refer to next page for measurement data and plots.
Note2: The * reveals the worst-case results that closet to the limit

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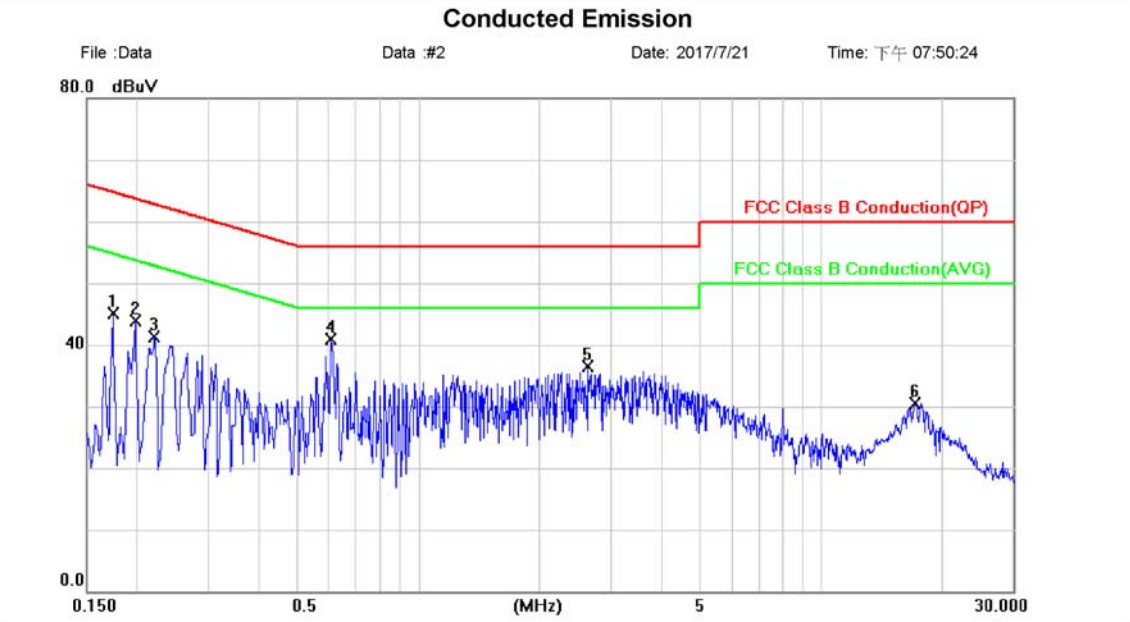
AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation Mode	Model No.:	L1A

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		0.1740	45.00	0.07	45.07	64.77	-19.70	peak	
2		0.1980	43.77	0.07	43.84	63.69	-19.85	peak	
3		0.2220	41.32	0.07	41.39	62.74	-21.35	peak	
4	*	0.6060	40.78	0.08	40.86	56.00	-15.14	peak	
5		2.6420	36.33	0.14	36.47	56.00	-19.53	peak	
6		17.1940	30.00	0.46	30.46	60.00	-29.54	peak	

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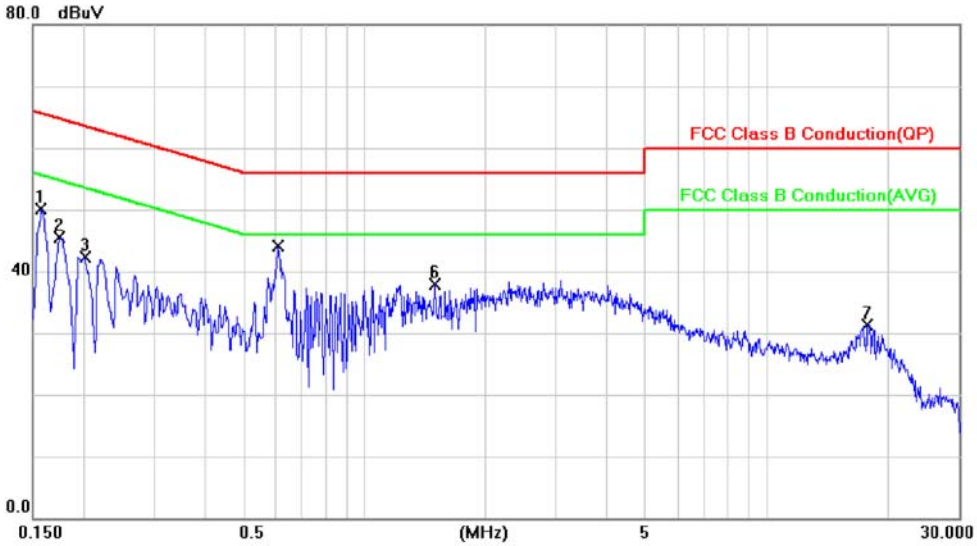
Site Conduction Room	Phase: N	Temperature: 20 ℃
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 58 %
Mode: Operation		
Note:		

Conducted Emission

File :Data Data :#1 Date: 2017/7/21 Time: 下午 07:48:26



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1580	50.06	0.07	50.13	65.57	-15.44	peak	
2		0.1740	45.45	0.07	45.52	64.77	-19.25	peak	
3		0.2020	42.16	0.07	42.23	63.53	-21.30	peak	
4		0.6100	41.40	0.08	41.48	56.00	-14.52	QP	
5	*	0.6100	32.00	0.08	32.08	46.00	-13.92	AVG	
6		1.4980	37.90	0.10	38.00	56.00	-18.00	peak	
7		17.8220	30.89	0.47	31.36	60.00	-28.64	peak	

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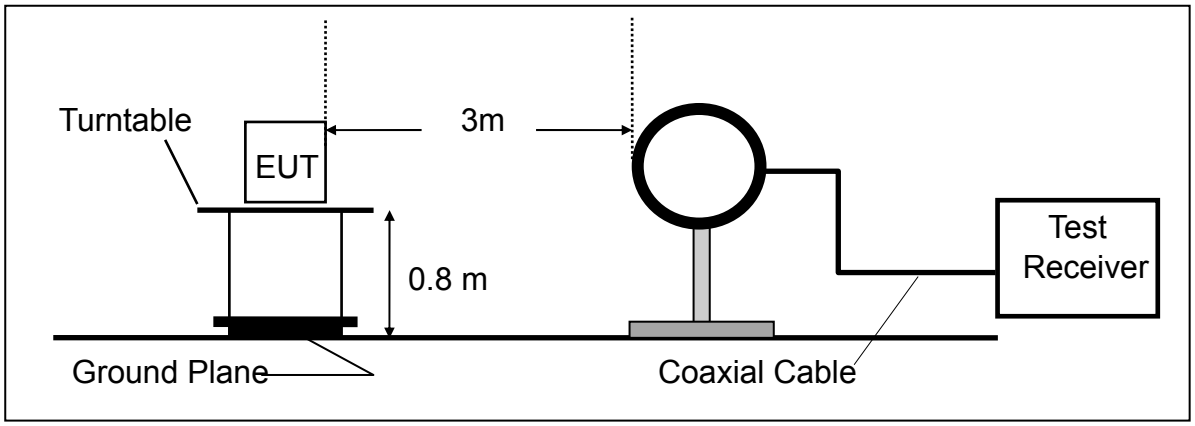
7 RADIATED EMISSION TEST

7.1 Measurement Procedure

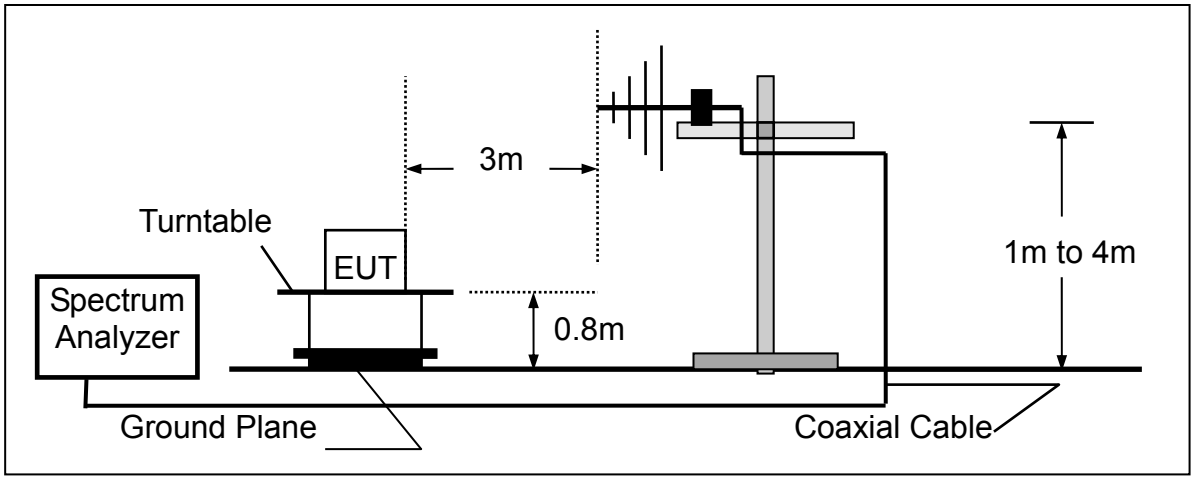
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

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 SAC-III					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
EMI Test Receiver	R&S	ESCI7	100760	05/11/2017	05/10/2018
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/25/2017	04/24/2018
Loop Antenna	ETS-Lindgren	6502	148045	09/20/2016	09/19/2017
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/19/2016	12/18/2017
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/01/2016	07/31/2017
Pre-Amplifier	Agilent	8447D	2944A07676	01/05/2017	01/04/2018
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/05/2017	01/04/2018
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	01/05/2017	01/04/2018
3m Site NSA	SGS	966 chamber	N/A	07/01/2017	06/30/2018
Low Loss Cable	Huber Suhner	966 TX	1	01/05/2017	01/04/2018
Horn Antenna	Schwarzbeck	BBHA9170	184	12/12/2016	12/11/2017
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/05/2017	01/04/2018

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

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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	

The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/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:
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.

7.5 Field Strength of Fundamental Emissions and Mask Measurement

7.5.1 Standard Applicable
Limit:

Rules and specifiactions	**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

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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 *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

1. Emission level in dBuV/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.

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.
(d) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 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

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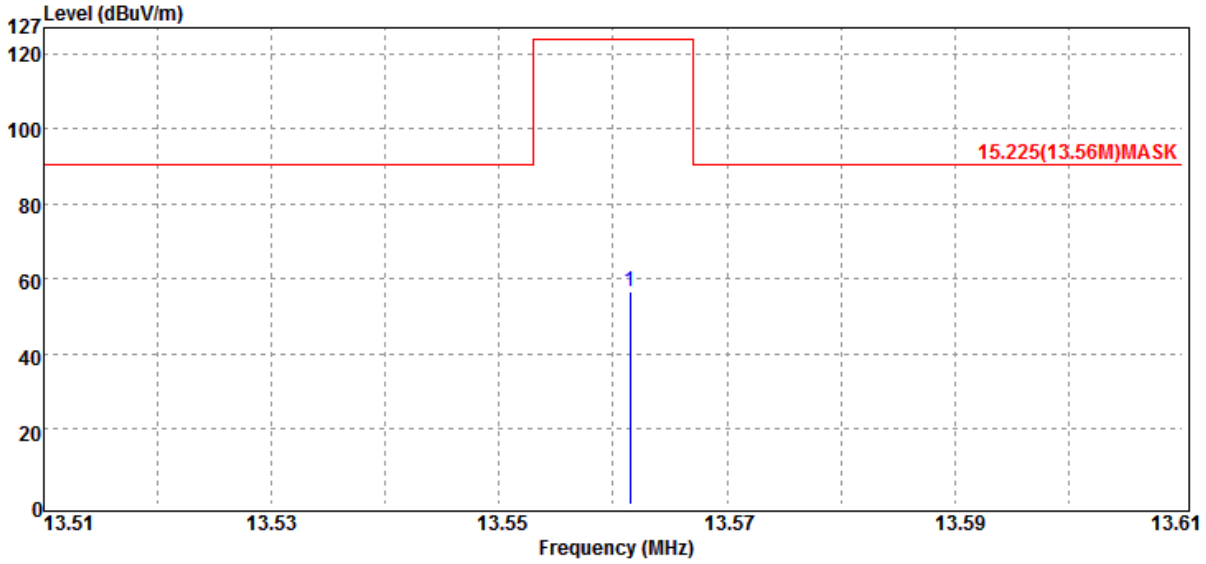
Field Strength of Fundamental Emission Measurement Result

Operation Band	:NFC	Test Date	:2017-07-24
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	45.34	11.43	56.77	123.90	-67.13

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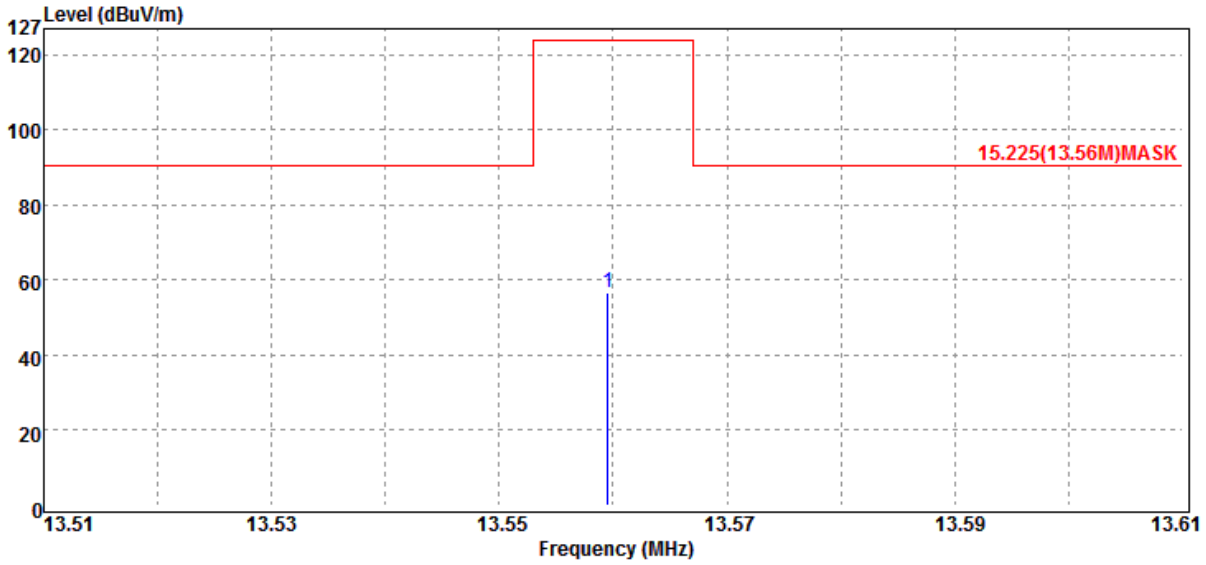
Operation Band	:NFC	Test Date	:2017-07-24
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:MAIN	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



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	45.35	11.43	56.78	123.90	-67.12

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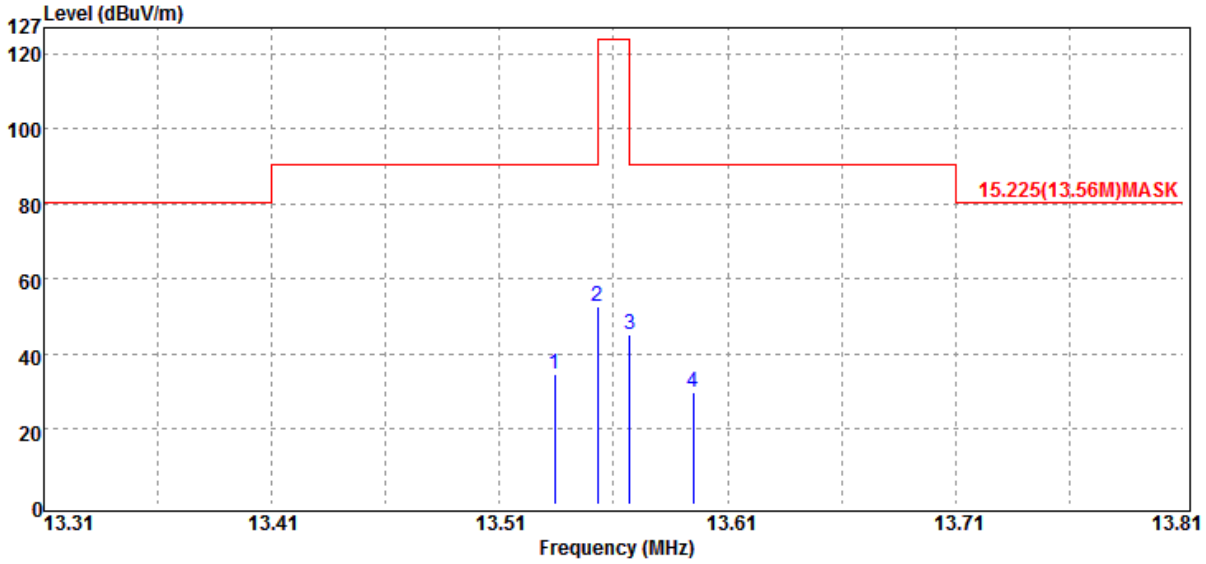
Mask Measurement Result

Operation Band	:NFC	Test Date	:2017-07-24
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
13.53	S	Peak	23.20	11.43	34.63	90.47	-55.84
13.55	S	Peak	41.41	11.43	52.84	90.47	-37.63
13.57	S	Peak	33.94	11.43	45.37	90.47	-45.10
13.60	S	Peak	18.43	11.43	29.86	90.47	-60.61

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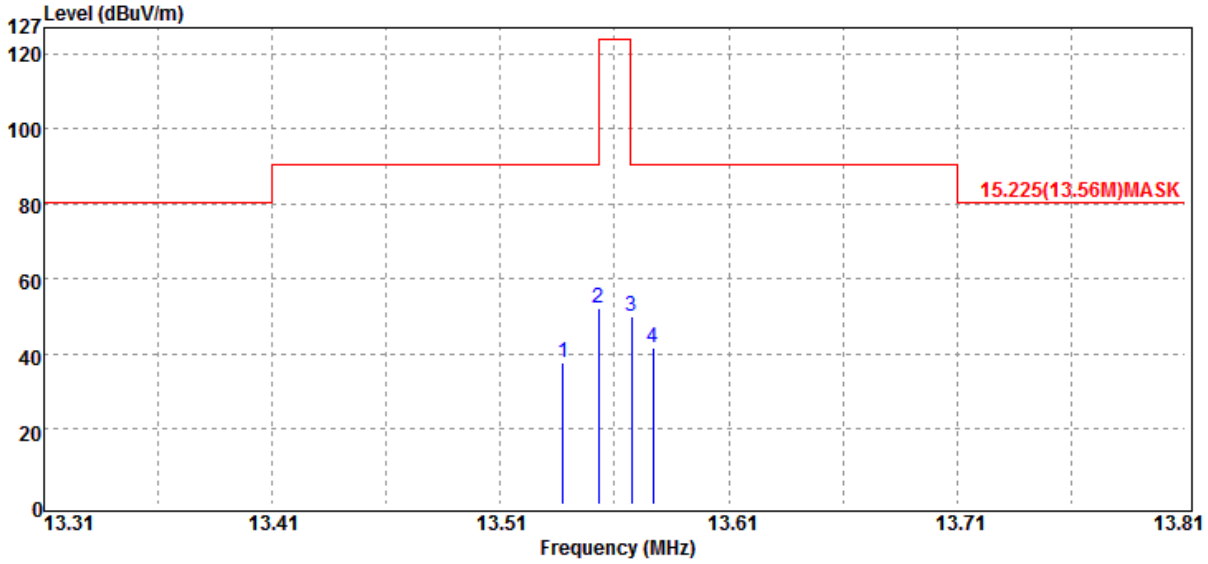
Operation Band	:NFC	Test Date	:2017-07-24
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:MASK	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. 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
13.54	S	Peak	26.16	11.43	37.59	90.47	-52.88
13.55	S	Peak	40.92	11.43	52.35	90.47	-38.12
13.57	S	Peak	38.78	11.43	50.21	90.47	-40.26
13.58	S	Peak	30.25	11.43	41.68	90.47	-48.79

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7.6 Radiated Emission –

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.

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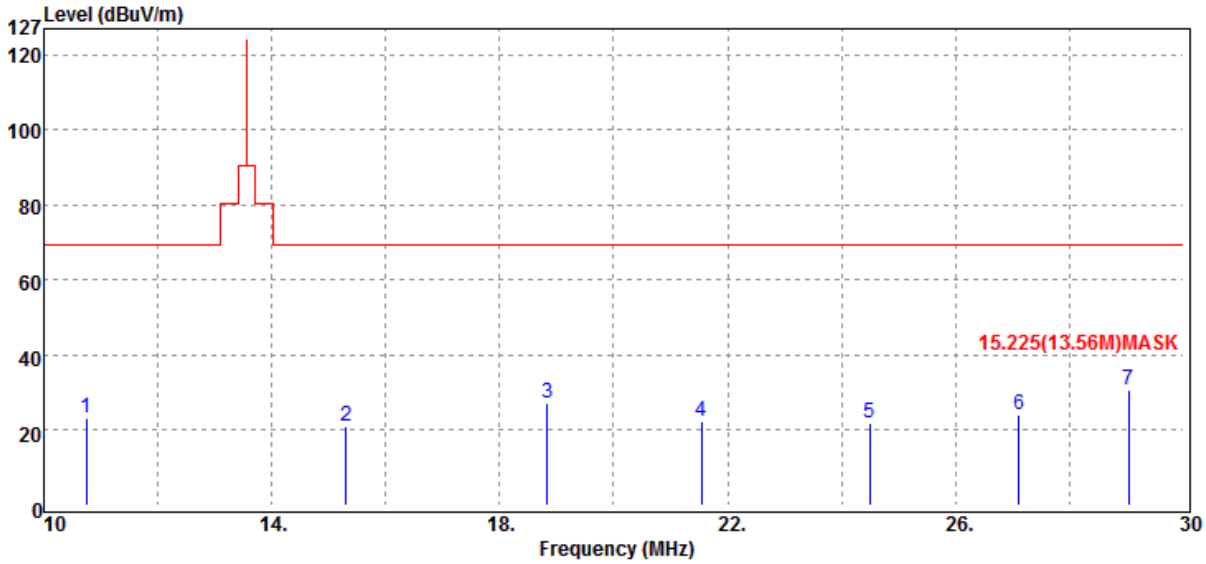
Radiated Emission Measurement Result

Operation Band	:NFC	Test Date	:2017-07-24
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
10.74	S	Peak	11.84	11.36	23.20	69.54	-46.34
15.30	S	Peak	9.69	11.47	21.16	69.54	-48.38
18.84	S	Peak	15.79	11.55	27.34	69.54	-42.20
21.54	S	Peak	11.41	11.11	22.52	69.54	-47.02
24.50	S	Peak	11.76	10.32	22.08	69.54	-47.46
27.12	H	Peak	14.50	9.70	24.20	69.54	-45.34
29.04	S	Peak	21.39	9.28	30.67	69.54	-38.87

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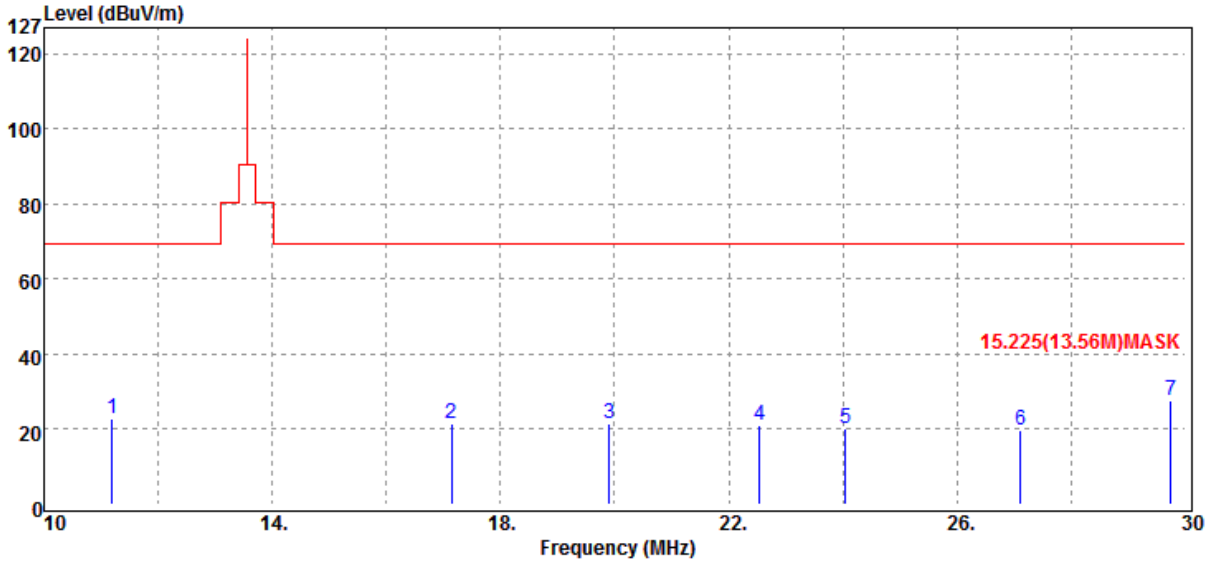
Operation Band	:NFC	Test Date	:2017-07-24
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. 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
11.20	S	Peak	11.50	11.38	22.88	69.54	-46.66
17.14	S	Peak	10.08	11.52	21.60	69.54	-47.94
19.90	S	Peak	9.83	11.58	21.41	69.54	-48.13
22.54	S	Peak	10.26	10.83	21.09	69.54	-48.45
24.04	S	Peak	9.92	10.43	20.35	69.54	-49.19
27.12	H	Peak	9.98	9.70	19.68	69.54	-49.86
29.74	S	Peak	18.39	9.13	27.52	69.54	-42.02

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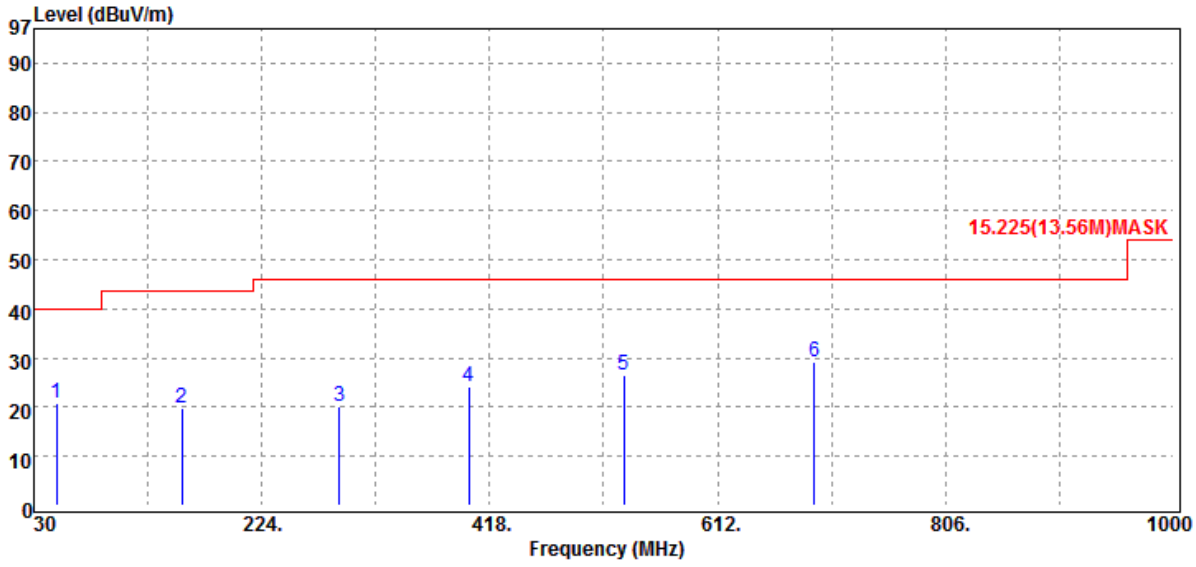
Operation Band	:NFC	Test Date	:2017-07-19
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



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
49.40	S	Peak	28.40	-7.74	20.66	40.00	-19.34
156.10	S	Peak	27.26	-7.61	19.65	43.50	-23.85
289.96	S	Peak	26.22	-6.07	20.15	46.00	-25.85
400.54	S	Peak	28.06	-3.94	24.12	46.00	-21.88
532.46	S	Peak	28.09	-1.68	26.41	46.00	-19.59
694.45	S	Peak	27.93	1.36	29.29	46.00	-16.71

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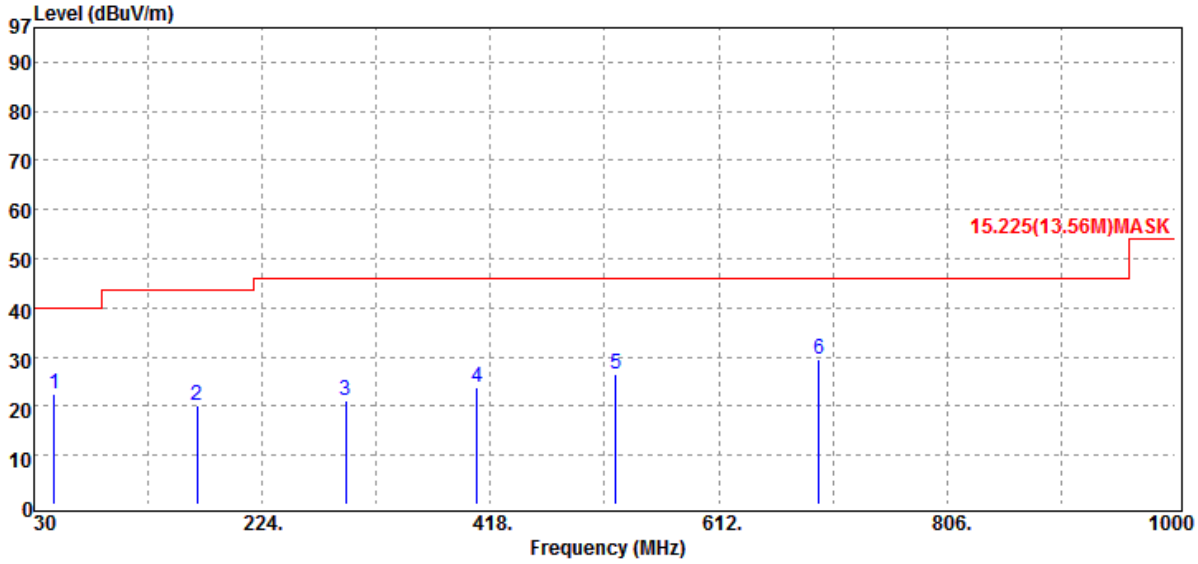
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. 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
47.46	S	Peak	30.49	-7.85	22.64	40.00	-17.36
168.71	S	Peak	27.62	-7.52	20.10	43.50	-23.40
294.81	S	Peak	27.07	-6.02	21.05	46.00	-24.95
406.36	S	Peak	27.33	-3.59	23.74	46.00	-22.26
524.70	S	Peak	28.10	-1.68	26.42	46.00	-19.58
697.36	S	Peak	28.26	1.36	29.62	46.00	-16.38

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8 FREQUENCY TOLERANCE

8.1 Standard Applicable

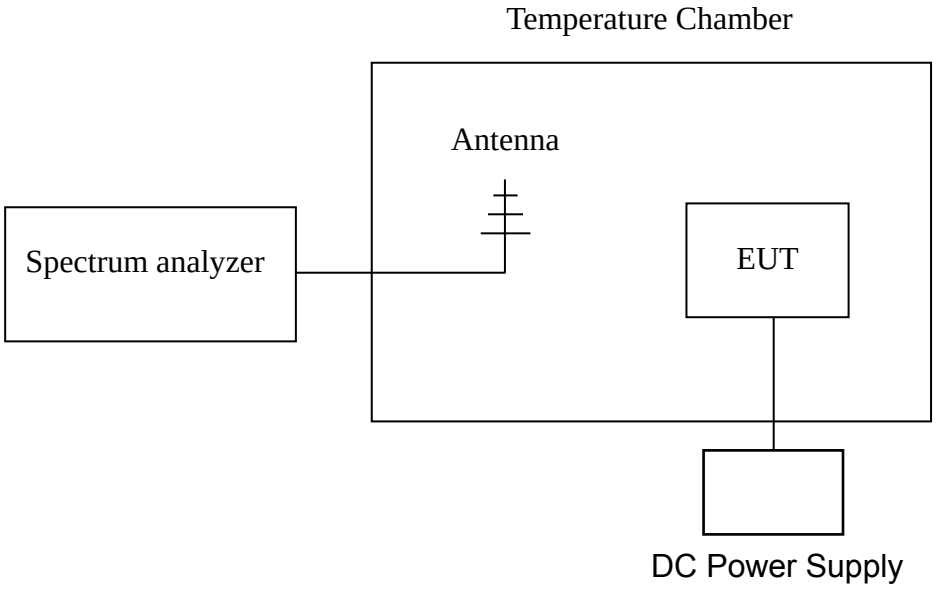
The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature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

Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).
For licence-exempt radio apparatus, the frequency stability shall be measured at temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°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:

SGS Conducted Room					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018

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8.5 Measurement Results

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (Hz)	Limit (KHz)
Vdc	Temperature (℃)	(MHz)		
3.7	-20	13.55942984	570.16500	+/- 1.356
3.7	-10	13.55962938	370.62000	+/- 1.356
3.7	0	13.56027431	-274.31000	+/- 1.356
3.7	10	13.56014374	-143.74000	+/- 1.356
3.7	20	13.56	0.00000	+/- 1.356
3.7	30	13.56018372	-183.72000	+/- 1.356
3.7	40	13.56088538	-885.38000	+/- 1.356
3.7	50	13.56022983	-229.83000	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (Hz)	Limit (KHz)
Vdc	Temperature (℃)	(MHz)		
3.33	20	13.56015998	-159.98230	+/- 1.356
3.7	20	13.56	0.00000	+/- 1.356
4.07	20	13.56018423	-184.23321	+/- 1.356

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2 minutes:

A. Temperature Variation 2 minutes

Power Supply	Environment	Frequency	Delta (Hz)	Limit (KHz)
Vdc	Temperature (℃)	(MHz)		
3.7	-20	13.55995575	168.39100	+/- 1.356
3.7	-10	13.55975830	365.83600	+/- 1.356
3.7	0	13.56013326	-9.12000	+/- 1.356
3.7	10	13.56022192	-97.78700	+/- 1.356
3.7	20	13.56012414	0.00000	+/- 1.356
3.7	30	13.56012239	1.74600	+/- 1.356
3.7	40	13.56064511	-520.97400	+/- 1.356
3.7	50	13.56016117	-37.03400	+/- 1.356

B. Supply Voltage Variation 2 minutes

Power Supply	Environment	Frequency	Delta (Hz)	Limit (KHz)
Vdc	Temperature (℃)	(MHz)		
3.33	20	13.56016153	-37.39610	+/- 1.356
3.7	20	13.56012414	0.00000	+/- 1.356
4.07	20	13.56017252	-48.38760	+/- 1.356

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5 minutes:

A. Temperature Variation 5 minutes

Power Supply Vdc	Environment Temperature (℃)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.7	-20	13.55971341	286.58700	+/- 1.356
3.7	-10	13.55976981	230.18800	+/- 1.356
3.7	0	13.56002338	-23.38100	+/- 1.356
3.7	10	13.56021931	-219.31100	+/- 1.356
3.7	20	13.56	0.00000	+/- 1.356
3.7	30	13.56007359	-73.59400	+/- 1.356
3.7	40	13.56021379	-213.79000	+/- 1.356
3.7	50	13.56011097	-110.97000	+/- 1.356

B. Supply Voltage Variation 5 minutes

Power Supply Vdc	Environment Temperature (℃)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.33	20	13.56005114	-51.13540	+/- 1.356
3.7	20	13.56	0.00000	+/- 1.356
4.07	20	13.56008435	-84.34697	+/- 1.356

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10 minutes:

A. Temperature Variation 10 minutes

Power Supply Vdc	Environment Temperature (℃)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.7	-20	13.55937514	656.33200	+/- 1.356
3.7	-10	13.55979973	231.74100	+/- 1.356
3.7	0	13.56017193	-140.45900	+/- 1.356
3.7	10	13.56014493	-113.45900	+/- 1.356
3.7	20	13.56003147	0.00000	+/- 1.356
3.7	30	13.56015159	-120.12000	+/- 1.356
3.7	40	13.56029591	-264.44000	+/- 1.356
3.7	50	13.56028398	-252.50900	+/- 1.356

B. Supply Voltage Variation 10 minutes

Power Supply Vdc	Environment Temperature (℃)	Frequency (MHz)	Delta (Hz)	Limit (KHz)
3.33	20	13.56014814	-116.67130	+/- 1.356
3.7	20	13.56003147	0.00000	+/- 1.356
4.07	20	13.56007732	-45.84420	+/- 1.356

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9 20 dB OCCUPIED BANDWIDTH MEASUREMENT

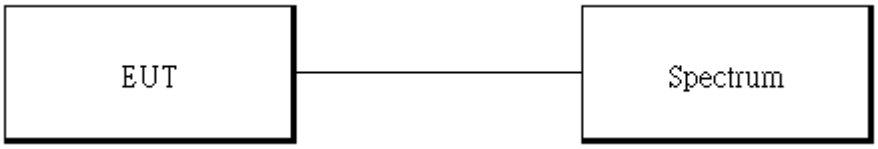
9.1 Standard Applicable:

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

9.2 Limit:

None

9.3 Test Set-up



9.4 Measurement Procedure

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 1 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.

9.5 Measurement Equipment Used:

SGS Conducted Room					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018

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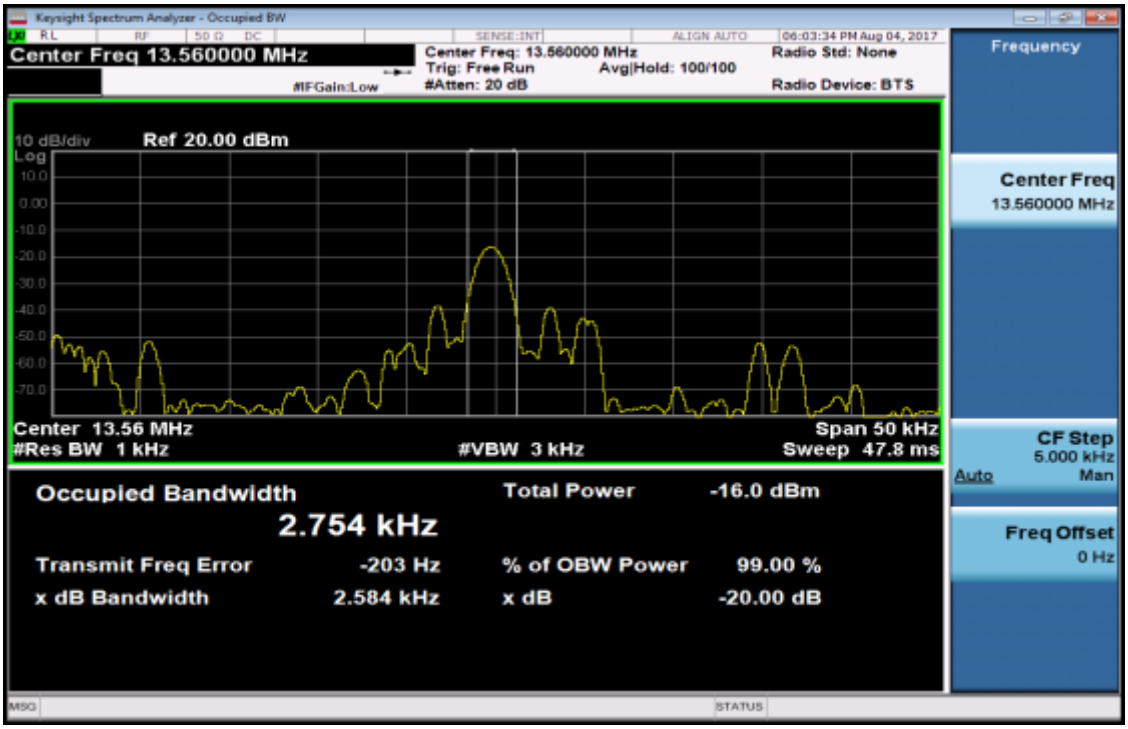
9.6 Measurement Result
20dB Bandwidth



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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 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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