

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name:	Mobile Phone
Brand Name:	Sony
Type No.:	PM-0850-BV
Model Difference:	N/A
FCC ID:	PY7-PM0850
Report No.:	ER/2014/B0014
Issue Date:	Jan. 09, 2015
FCC Rule Part:	§15.225
Prepared for:	Sony Mobile Communications AB Nya Vattentorget 22188 Lund/ Sweden
Prepared by:	SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803



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VERIFICATION OF COMPLIANCE

Applicant: Sony Mobile Communications AB
Nya Vattentornet 22188 Lund/Sweden

Product Name: Mobile Phone

Brand Name: Sony

Type No.: PM-0850-BV

Model Difference: N/A

FCC ID: PY7-PM0850

File Number: ER/2014/B0014

Date of test: Nov. 06, 2014 ~ Nov. 21, 2014

Date of EUT Received: Nov. 06, 2014

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 C63.4:2009 & ANSI C63.10:2009 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:

Marcus Tseng

Date:

Jan. 09, 2015

Marcus Tseng / Engineer

Prepared By:

Tiffany Kao

Date:

Jan. 09, 2015

Tiffany Kao / Clerk

Approved By

Jim Chang

Date:

Jan. 09, 2015

Jim Chang / Supervisor

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Revision History

Report Number	Revision	Description	Issue Date
ER/2014/B0014	Rev.00	Initial creation of document	Nov. 25, 2014
ER/2014/B0014	Rev.01	Updated HW, SW, and internal photo	Jan. 09, 2015

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1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	Mobile Phone	
Brand Name:	Sony	
Type No.:	PM-0850-BV	
Model Difference:	N/A	
Data Cable (USB):	Model No.: EC450, Supplier: K-one Type No.: AI-0700, Length: 100 cm	
Simple Hands-Free (SHF-White):	Model No.: MH410c, Supplier: Foster Electric Type No.: AG-1100	
Car Charger:	Model No.: AN400, Supplier: Salcomp Type No.: CAA-0003013	
BT PHF:	Model No.: SBH20, Supplier: Sony Type No.: RD-0010 coupling with Simple Hands Free (Model No.: MH755, Supplier: BALDA, Type No.: AG-0503)	
Hardware Version:	A	
Software Version:	25.0.A.0.33	
Power Supply:	3.8Vdc	
	Battery:	Model No.: LIS1574ERPC, Supplier: Sony Type No.: N/A
	Adapter:	Model No.: EP800, Supplier: Salcomp Type No.: CAA-0002016-US

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Bluetooth BR+EDR:

Bluetooth Version:	V4.1 dual mode + HS
Channel number:	79 channels
Modulation type:	Frequency Hopping Spread Spectrum
Transmit Power:	5.38dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	<= 0.4s
Antenna Designation:	PIFA Antenna, Gain: 2.52dBi

Bluetooth Low Energy:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V4.1 dual mode + HS
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	-1.49dBm (Peak)
Antenna Designation:	PIFA Antenna, Gain: 2.52dBi

NFC:

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

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WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Rated Power	Modulation Technology
11b/g	2412-2462	11	b: 18.87dBm g: 22.66dBm	DSSS, OFDM
11n	HT20 2412-2462	11	HT20: 21.09dBm	OFDM
11n	HT40 2422-2452	7	HT40: 22.22dBm	OFDM
Antenna Designation:		PIFA Antenna, Gain: 2.52dBi		
Modulation type:		CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM		
Transition Rate:		802.11 b: 1/2/5.5/11 Mbps; 802.11 g: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 72.2Mbps 802.11 n_40MHz: 13.5 – 135Mbps		

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WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Avg. Power	Modulation Technology
11a	5150~5250	4	13.96dBm	OFDM
	5250~5350	4	13.99dBm	
	5470~5725	8	13.96dBm	
	5725-5850	5	13.79dBm	
11n	HT20 5150~5250	4	HT20: 12.99dBm	OFDM
	HT20 5250~5350	4	HT20: 12.95dBm	
	HT20 5470~5725	8	HT20: 12.99dBm	
	HT20 5725-5850	5	HT20: 12.79dBm	
11n	HT40 5150~5250	2	HT40: 11.95dBm	OFDM
	HT40 5250~5350	2	HT40: 11.93dBm	
	HT40 5470~5725	3	HT40: 11.96dBm	
	HT40 5725-5850	2	HT40: 11.98dBm	
Antenna Designation	PIFA Antenna, 5GHz Gain: -0.54dBi (5150MHz-5250MHz) 5GHz Gain: -0.89dBi (5250MHz-5350MHz) 5GHz Gain: -0.34dBi (5470MHz-5725MHz) 5GHz Gain: -0.19dBi (5725MHz-5850MHz)			
Modulation type	64QAM, 16QAM, QPSK, BPSK for OFDM			
Transition Rate:	802.11 a: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 65.0Mbps 802.11 n_40MHz: 13.5 – 135.0Mbps			

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GSM / WCDMA/ LTE:

Cellular Phone Standards Frequency Range and Power	Operating Frequency		Rated Power
	GSM/GPRS 850, Class 12	824.2 MHz– 848.8 MHz	33dBm
	EDGE 850, Class 12	824.2 MHz– 848.8 MHz	27dBm
	GSM/GPRS 1900, Class 12	1850.2MHz – 1909.8MHz	30dBm
	EDGE 1900, Class 12	1850.2MHz – 1909.8MHz	26dBm
	WCDMA/HSUPA/HSDPA /HSPA+ Band II	1852.4MHz – 1907.6MHz	24dBm
	WCDMA/HSUPA/HSDPA /HSPA+ Band V	826.4MHz - 846.6MHz	24dBm
	1.4MHz BW LTE-Band 2	1850.7MHz– 1909.3MHz	23dBm
	3MHz BW LTE-Band 2	1851.5MHz – 1908.5MHz	23dBm
	5MHz BW LTE-Band 2	1852.5MHz – 1907.5MHz	23dBm
	10MHz BW LTE-Band 2	1855.0MHz – 1905.0MHz	23dBm
	15MHz BW LTE-Band 2	1857.5MHz – 1902.5MHz	23dBm
	20MHz BW LTE-Band 2	1860.0MHz – 1900.0MHz	23dBm
	1.4MHz BW LTE-Band 5	824.7MHz – 848.3MHz	23dBm
	3MHz BW LTE-Band 5	825.5MHz – 848.3MHz	23dBm
	5MHz BW LTE-Band 5	826.5MHz – 846.5MHz	23dBm
	10MHz BW LTE-Band 5	829.0MHz – 844.0MHz	23dBm
	5MHz BW LTE-Band 7	2502.5MHz – 2567.5MHz	23dBm
	10MHz BW LTE-Band 7	2505.0MHz –2565.0MHz	23dBm
	15MHz BW LTE-Band 7	2507.5MHz –2562.5MHz	23dBm
	15MHz BW LTE-Band 7	2510.0MHz –2560.0MHz	23dBm

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Type of Emission:	GSM 850: 250KGXW, GSM 1900: 248KGXW GPRS 850: 250KGXW, GPRS 1900: 247KGXW EDGE 850: 250KG7W, EDGE 1900: 253KG7W WCDMA Band II: 4M23F9W, WCDMA Band V: 4M23F9W HSDPA Band II: 4M20F9W, HSDPA Band V: 4M22F9W HSUPA Band II: 4M21F9W, HSUPA Band V: 4M22F9W 1.4MHz BW LTE-Band 2 QPSK: 1M10G7D 1.4MHz BW LTE-Band 2 16QAM: 1M10D7W 3MHz BW LTE-Band 2 QPSK: 2M71G7D 3MHz BW LTE-Band 2 16QAM: 2M71D7W 5MHz BW LTE-Band 2 QPSK: 4M55G7D 5MHz BW LTE-Band 2 16QAM: 4M53D7W 10MHz BW LTE-Band 2 QPSK: 8M98G7D 10MHz BW LTE-Band 2 16QAM: 8M99D7W 15MHz BW LTE-Band 2 QPSK: 13M53G7D 15MHz BW LTE-Band 2 16QAM: 13M52D7W 20MHz BW LTE-Band 2 QPSK: 18M00G7D 20MHz BW LTE-Band 2 16QAM: 18M00D7W 1.4MHz BW LTE-Band 5 QPSK: 1M10G7D 1.4MHz BW LTE-Band 5 16QAM: 1M10D7W 3MHz BW LTE-Band 5 QPSK: 2M70G7D 3MHz BW LTE-Band 5 16QAM: 2M71D7W 5MHz BW LTE-Band 5 QPSK: 4M54G7D 5MHz BW LTE-Band 5 16QAM: 4M53D7W 10MHz BW LTE-Band 5 QPSK: 9M03G7D 10MHz BW LTE-Band 5 16QAM: 9M05D7W 5MHz BW LTE-Band 7 QPSK: 4M53G7D 5MHz BW LTE-Band 7 16QAM: 4M53D7W 10MHz BW LTE-Band 7 QPSK: 9M23G7D 10MHz BW LTE-Band 7 16QAM: 9M22D7W 15MHz BW LTE-Band 7 QPSK: 13M93G7D 15MHz BW LTE-Band 7 16QAM: 13M95D7W 20MHz BW LTE-Band 7 QPSK: 18M72G7D 20MHz BW LTE-Band 7 16QAM: 18M70D7W
IMEI:	00440245353087

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

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1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **PY7-PM0850** filing to comply with Section 15.225 of the FCC Part 15, Subpart C Rules.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4:2009 & ANSI C63.10:2009. Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2009 & ANSI C63.10:2009. FCC Registration Numbers are: 990257, Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 455997.

1.5 Special Accessories

There is no special accessory used while test was conducted.

1.6 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 plane. According to the general criterion in Section 7.1 of ANSI C63.4:2009 & 6.2 ANSI 63.10:2009 and RSS-Gen:2010. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz, and the measurement procedure 7.3 in ANSI 63.4:2009 & 6.2.2, and 6.2.3 in ANSI 63.10:2009 is followed to carry out the test. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107

2.3.2 Radiated Emissions

The EUT is placed on a turn table which is 0.8 m above 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 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 according to the requirements in Section 8 and 13 and of ANSI C63.4:2009 & Section 6.3, 6.4, 6.5, and 6.6 of ANSI 63.10:2009. ANSI C63.10:2009.

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2.4 Limitation

(1) Conducted Emission

According to section 15.207(a) and 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

- The field strength of any emission within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
- 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.
- 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.
- 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 (Intentional Radiators general limit).as below.

Frequency (MHz)	Field strength $\mu\text{V/m}$	Distance (m)	Field strength at 3m $\text{dB}\mu\text{V/m}$
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 = $20 \log (\mu\text{V/m})$
 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
 3. Distance extrapolation factor = $40 \log (\text{required distance} / \text{test distance})$ (dB);
 4. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.
Ex. $20 * \log(30) + 40 * \log(30/3) = 69.54 \text{ dBuV/m}$
 5. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205.
 6. The general radiated emission limits in § 15.209 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 Radiated Emission

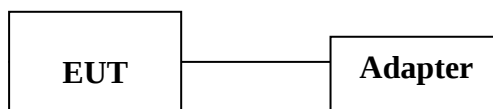


Fig. 2-2 Conducted (Antenna Port) Configuration



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	N/A	N/A	N/A	N/A	N/A

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Fig. 2-3 AC Power Line Conducted Emission

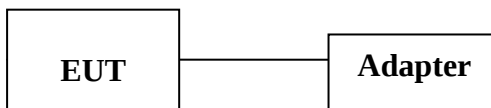


Table 2-2 Equipment Used in Tested System

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

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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)	20 dB OCCUPIED BANDWIDTH	Compliant
§15.203	Antenna Requirement	Compliant

4 Description of test modes

The EUT stay in continuous transmitting mode. The frequency 13.56 MHz 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 E1 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 (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.

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6 Conducted Emissions Test

6.1 Standard Applicable:

According to §15.207, 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	ESCI7	100760	05/26/2014	05/25/2015
LISN	Rolf-Heine	NNB-2/16Z	99012	03/26/2014	03/25/2015
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	03/19/2014	03/18/2015
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2013	11/25/2014

6.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-2009 & ANSI C63.10:2009.
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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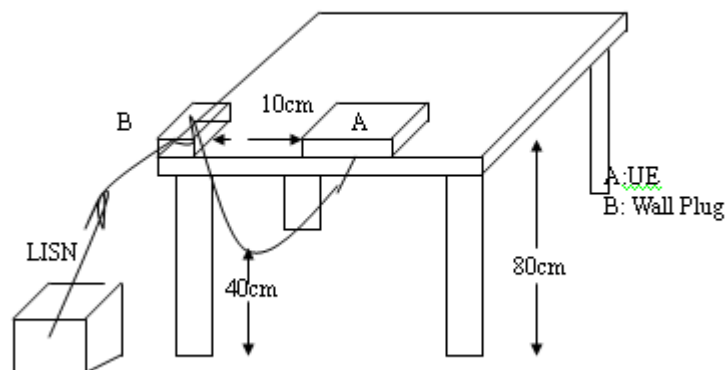
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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
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

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Nov. 21, 2014
Temperature:	26	Humidity:	60 %	Test By:	Tin
Model No.:	EP800				

Site: ConductionRoom Phase: L1 Temperature: 24 °C
Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 66%
Mode: Operation
Note: Adapter:3113W 22 608033

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1660	29.45	0.05	29.50	65.16	-35.66	peak	
2		0.1740	28.02	0.05	28.07	64.77	-36.70	peak	
3		0.1980	27.23	0.06	27.29	63.69	-36.40	peak	
4		0.2140	27.56	0.06	27.62	63.05	-35.43	peak	
5		0.2420	25.82	0.06	25.88	62.03	-36.15	peak	
6 *		3.7260	20.68	0.17	20.85	56.00	-35.15	peak	

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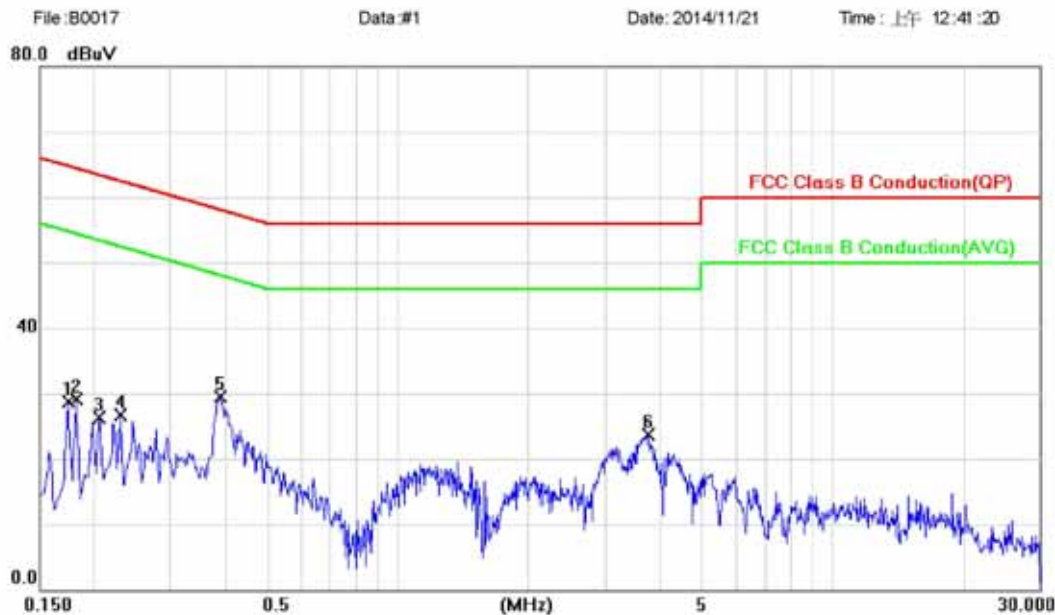
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Site: ConductionRoom
Limit: FCC Class B Conduction(QP)
Mode: Operation
Note: Adapter:3113W 22 608033

Phase: **N**
Power: AC 120V/60Hz

Temperature: 24 °C
Humidity: 66%

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1740	28.73	0.05	28.78	64.77	-35.99	peak	
2		0.1820	29.13	0.06	29.19	64.39	-35.20	peak	
3		0.2060	26.22	0.06	26.28	63.37	-37.09	peak	
4		0.2300	26.62	0.06	26.68	62.45	-35.77	peak	
5 *		0.3900	29.53	0.07	29.60	58.06	-28.46	peak	
6		3.7620	23.48	0.17	23.65	56.00	-32.35	peak	

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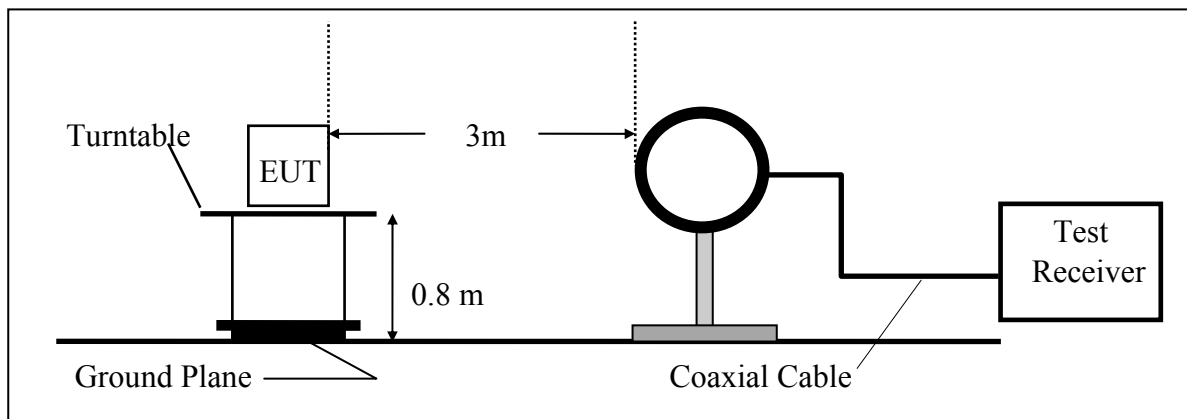
7 Radiated Emission Test

7.1 Measurement Procedure

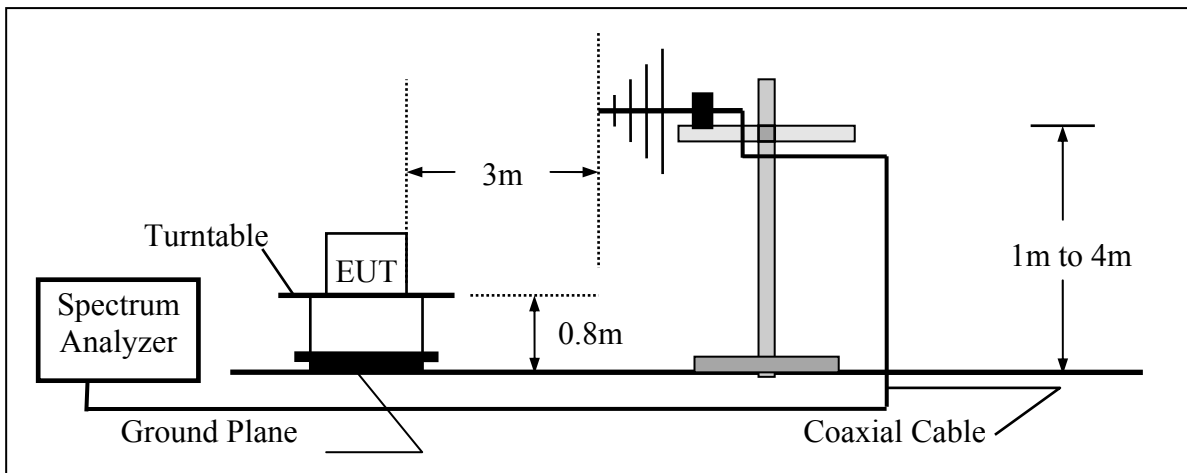
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

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:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESC17	100760	05/26/2014	05/25/2015
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/19/2014	05/18/2015
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	01/20/2014	01/19/2015
Bilog Antenna	SCHWAZBECK	VULB9168	378	01/02/2014	01/01/2015
Loop Antenna	ETS.LINDGREN	6502	00148045	07/03/2014	07/02/2015
Pre-Amplifier	Agilent	8447D	2944A07676	01/03/2014	01/02/2015
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	HD	MA240-N	240/657	N.C.R	N.C.R
Controller	HD	HD100	N/A	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_Rx	9	01/03/2014	01/02/2015
3m Site NSA	SGS	966 chamber	N/A	07/15/2014	07/14/2015

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	

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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.

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

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

Note:

$$\text{Actual FS(dB}\mu\text{V/m)} = \text{Spectrum. Reading level(dB}\mu\text{V)} + \text{Factor(dB)}$$

$$\text{Factor(dB)} = \text{Antenna Factor(dB}\mu\text{V/m)} + \text{Cable Loss(dB)} - \text{Pre_Amplifier Gain(dB)}$$

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.

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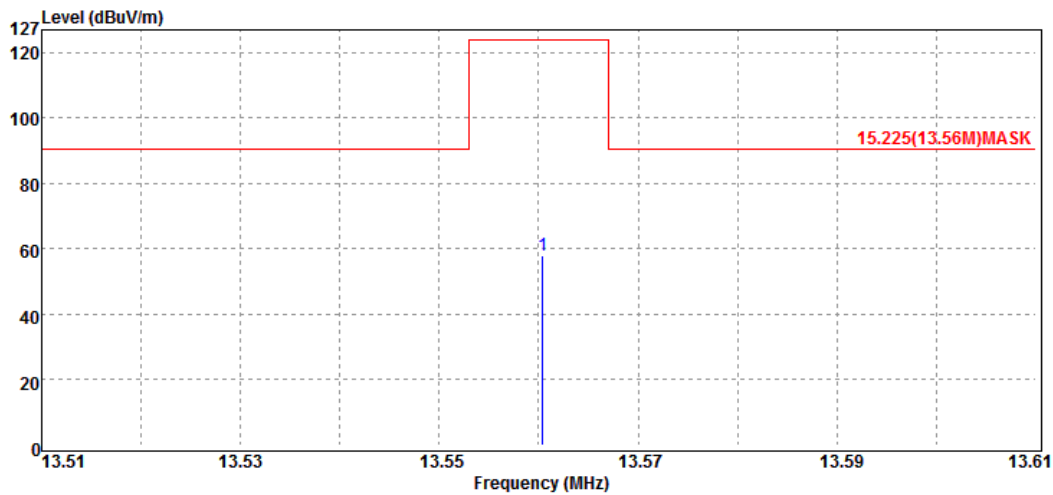
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Operation Band	:NFC	Test Date	:2014-11-07
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:23 deg_C / 58 RH
Operation Mode	:MAIN	Engineer	:Tin
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBμV		dBμV / m	dBμV / m	
13.56	F	Peak	46.48	11.72	58.20	123.90	-65.70



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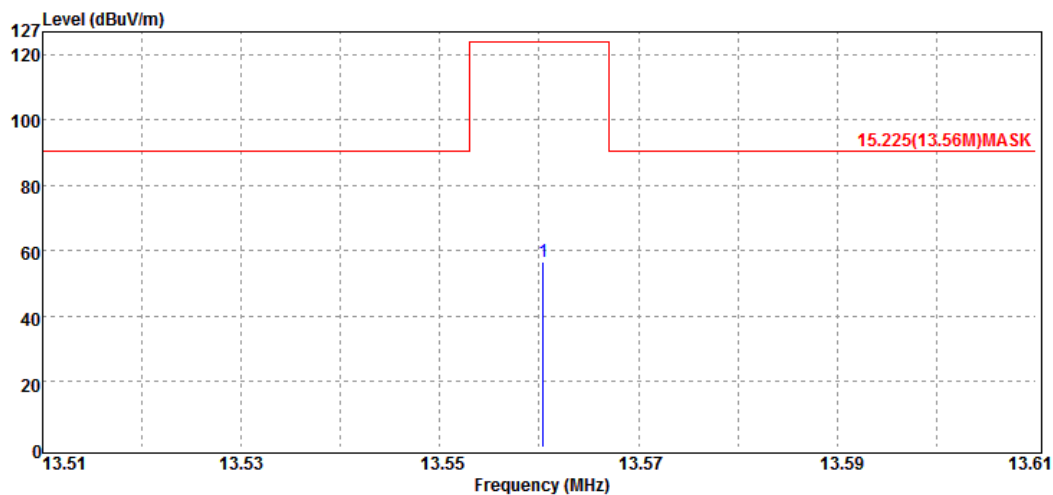
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Operation Band	:NFC	Test Date	:2014-11-07
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:23 deg_C / 58 RH
Operation Mode	:MAIN	Engineer	:Tin
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:HORIZONTAL

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
13.56	F	Peak	45.18	11.72	56.90	123.90	-67.00



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7.5.2 Radiated Mask

- (a) 15.848 millivolts/m (84 dB μ V/m) at 30 m, within the band 13.553-13.567 MHz.
- (b) 334 microvolts/m (50.5 dB μ 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 μ V/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) $20 * \log(15848 \mu\text{V/m}) + 40\text{dB} = 124.00\text{dB}\mu\text{V/m}$
- b) $20 * \log(334 \mu\text{V/m}) + 40\text{dB} = 90.47\text{dB}\mu\text{V/m}$
- c) $20 * \log(106 \mu\text{V/m}) + 40\text{dB} = 80.50\text{dB}\mu\text{V/m}$

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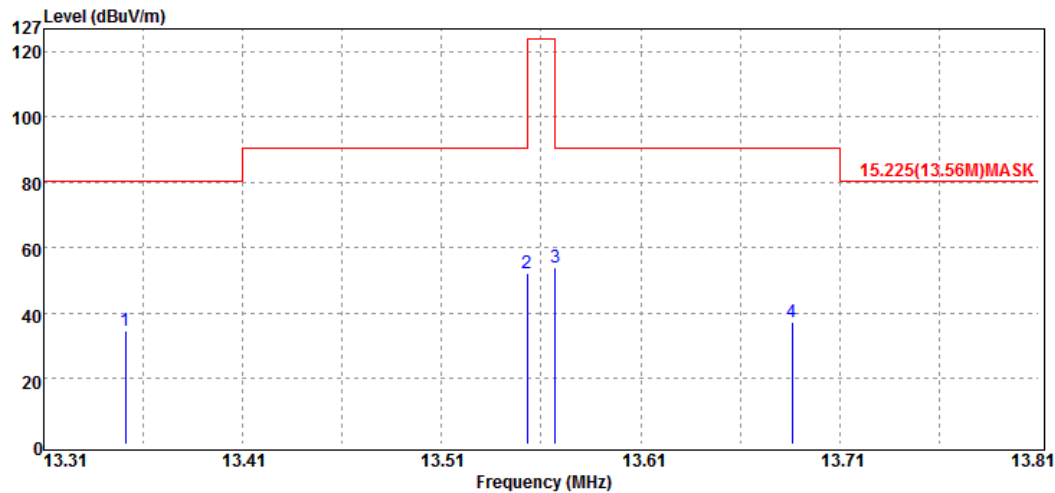
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Operation Band	:NFC	Test Date	:2014-11-07
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:23 deg_C / 58 RH
Operation Mode	:MASK	Engineer	:Tin
EUT Pol.	:E1 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBuV	dB	dBuV / m	dBuV / m	dB
13.35	S	Peak	23.10	11.74	34.84	80.50	-45.66
13.55	S	Peak	40.40	11.72	52.12	90.47	-38.35
13.57	S	Peak	42.21	11.72	53.93	90.47	-36.54
13.69	S	Peak	25.78	11.71	37.49	90.47	-52.98

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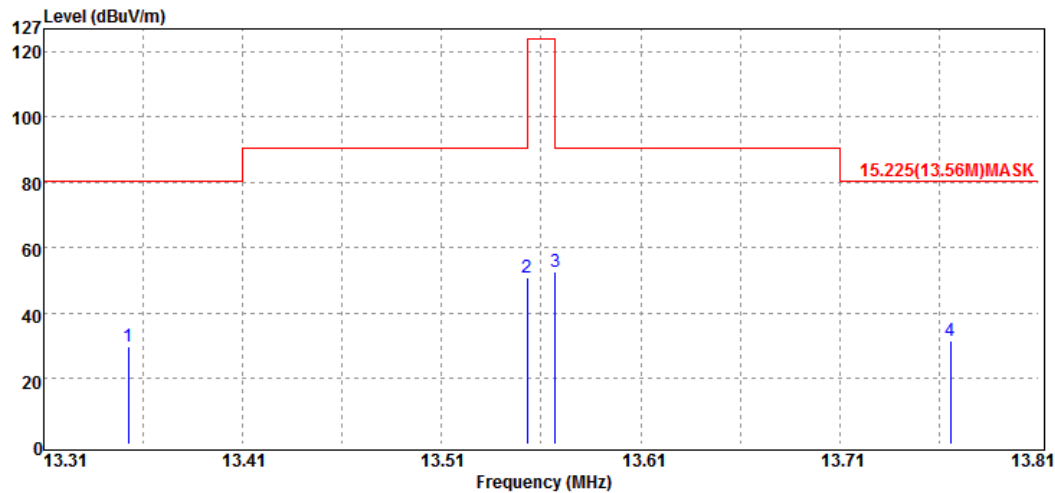
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Operation Band	:NFC	Test Date	:2014-11-07
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:23 deg_C / 58 RH
Operation Mode	:MASK	Engineer	:Tin
EUT Pol.	:E1 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
		PK/QP/AV	dBμV	dB	dBμV / m	dBμV / m	dB
13.35	S	Peak	18.13	11.74	29.87	80.50	-50.63
13.55	S	Peak	39.24	11.72	50.96	90.47	-39.51
13.57	S	Peak	40.97	11.72	52.69	90.47	-37.78
13.77	S	Peak	20.01	11.70	31.71	80.50	-48.79

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7.5.3 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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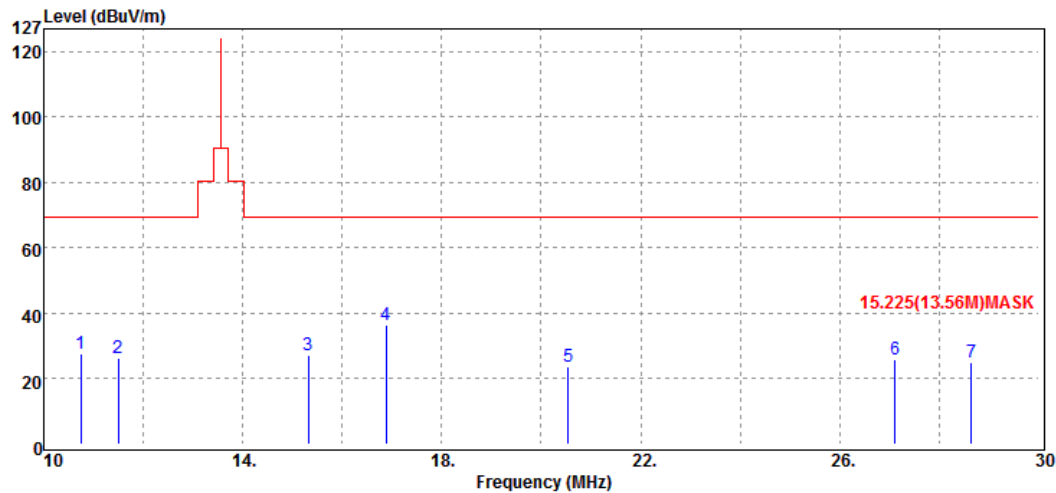
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Operation Band	:NFC	Test Date	:2014-11-07
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:23 deg_C / 58 RH
Operation Mode	:TX	Engineer	:Tin
EUT Pol.	:E1 Plane	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV / m	dBμV / m	dB
10.74	S	Peak	15.52	11.95	27.47	69.54	-42.07
11.50	S	Peak	14.60	11.88	26.48	69.54	-43.06
15.32	S	Peak	15.63	11.60	27.23	69.54	-42.31
16.88	S	Peak	25.12	11.51	36.63	69.54	-32.91
20.54	S	Peak	12.44	11.18	23.62	69.54	-45.92
27.12	H	Peak	16.49	9.53	26.02	69.54	-43.52
28.64	S	Peak	16.02	9.22	25.24	69.54	-44.30



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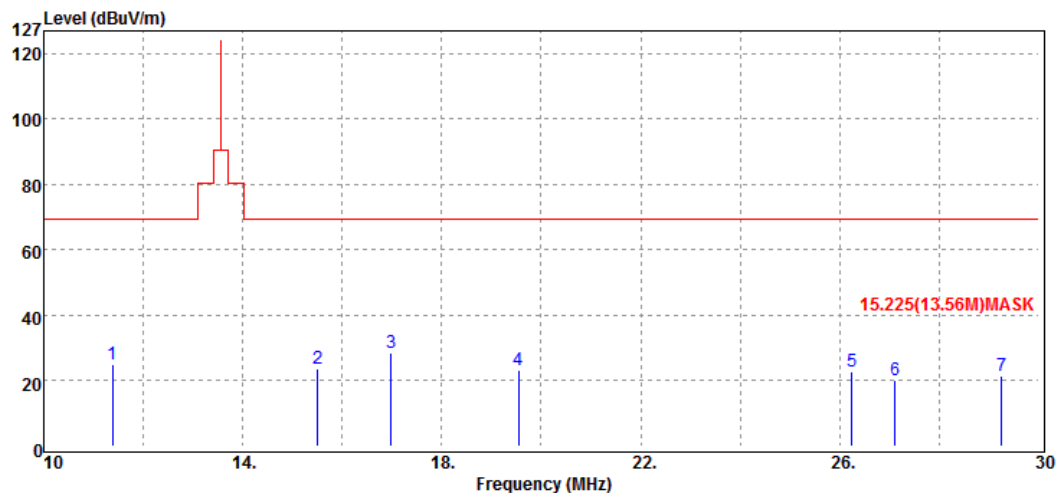
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Fundamental Frequency	:13.56 MHz	Temp./Humi.	:23 deg_C / 58 RH
Operation Mode	:TX	Engineer	:Tin
EUT Pol.	:E1 Plane	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV / m	dBμV / m	dB
11.38	S	Peak	13.27	11.89	25.16	69.54	-44.38
15.50	S	Peak	12.12	11.58	23.70	69.54	-45.84
16.98	S	Peak	16.87	11.50	28.37	69.54	-41.17
19.54	S	Peak	11.93	11.36	23.29	69.54	-46.25
26.24	S	Peak	13.17	9.74	22.91	69.54	-46.63
27.12	H	Peak	10.71	9.53	20.24	69.54	-49.30
29.26	S	Peak	12.52	9.08	21.60	69.54	-47.94



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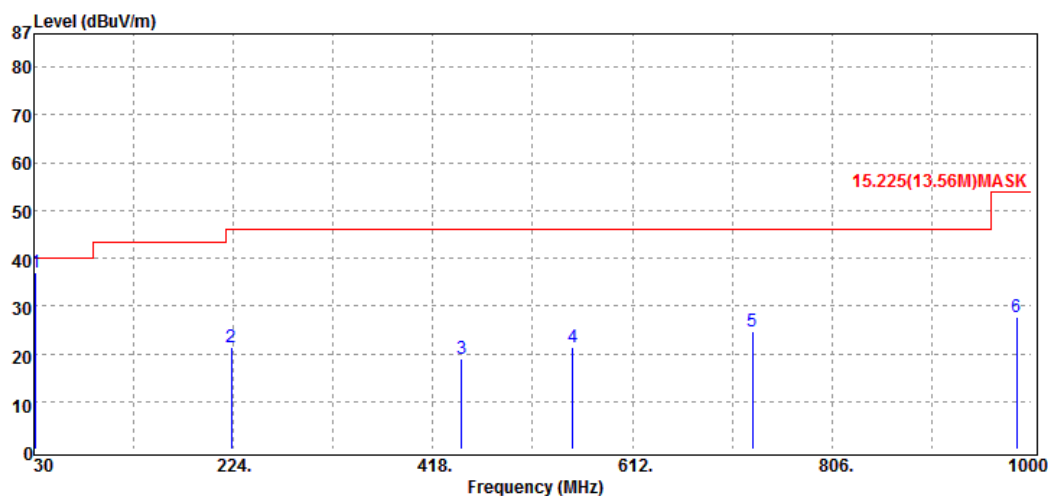
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Operation Band	:NFC	Test Date	:2014-11-07
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:23 deg_C / 58 RH
Operation Mode	:TX	Engineer	:Tin
EUT Pol.	:E1 Plane	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV / m	dBμV / m	dB
31.94	S	Peak	50.81	-13.88	36.93	40.00	-3.07
40.68	H	---					
54.24	H	---					
67.80	H	---					
81.36	H	---					
94.92	H	---					
108.48	H	---					
122.04	H	---					
135.60	H	---					
222.06	S	Peak	35.71	-14.27	21.44	46.00	-24.56
446.13	S	Peak	27.26	-8.38	18.88	46.00	-27.12
553.80	S	Peak	28.33	-6.92	21.41	46.00	-24.59
728.40	S	Peak	28.28	-3.71	24.57	46.00	-21.43
985.45	S	Peak	27.55	0.29	27.84	54.00	-26.16



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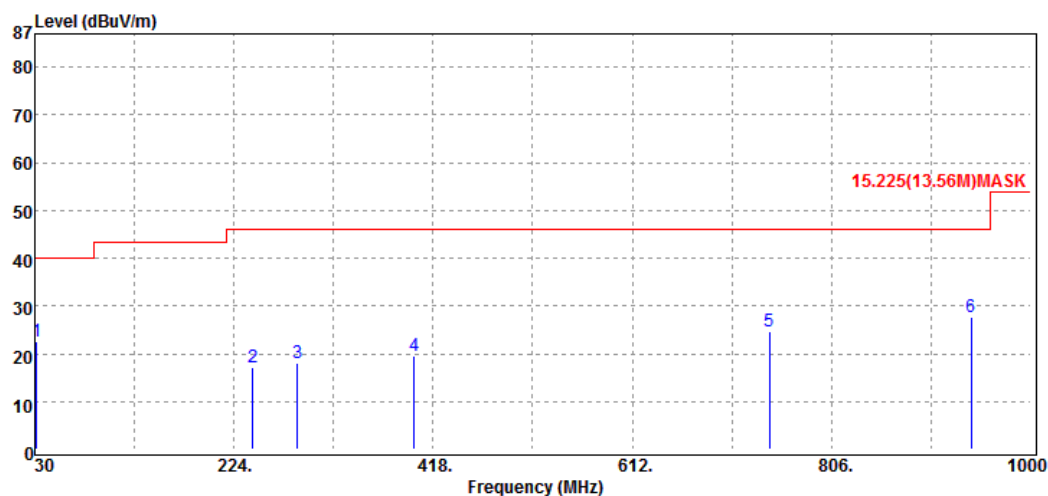
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Fundamental Frequency	:13.56 MHz	Temp./Humi.	:23 deg_C / 58 RH
Operation Mode	:TX	Engineer	:Tin
EUT Pol.	:E1 Plane	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV / m	dBμV / m	dB
31.94	S	Peak	36.31	-13.88	22.43	40.00	-17.57
40.68	H	---					
54.24	H	---					
67.80	H	---					
81.36	H	---					
94.92	H	---					
108.48	H	---					
122.04	H	---					
135.60	H	---					
242.43	S	Peak	30.42	-13.20	17.22	46.00	-28.78
286.08	S	Peak	29.49	-11.51	17.98	46.00	-28.02
399.57	S	Peak	28.65	-9.08	19.57	46.00	-26.43
745.86	S	Peak	27.28	-2.68	24.60	46.00	-21.40
941.80	S	Peak	27.41	0.16	27.57	46.00	-18.43



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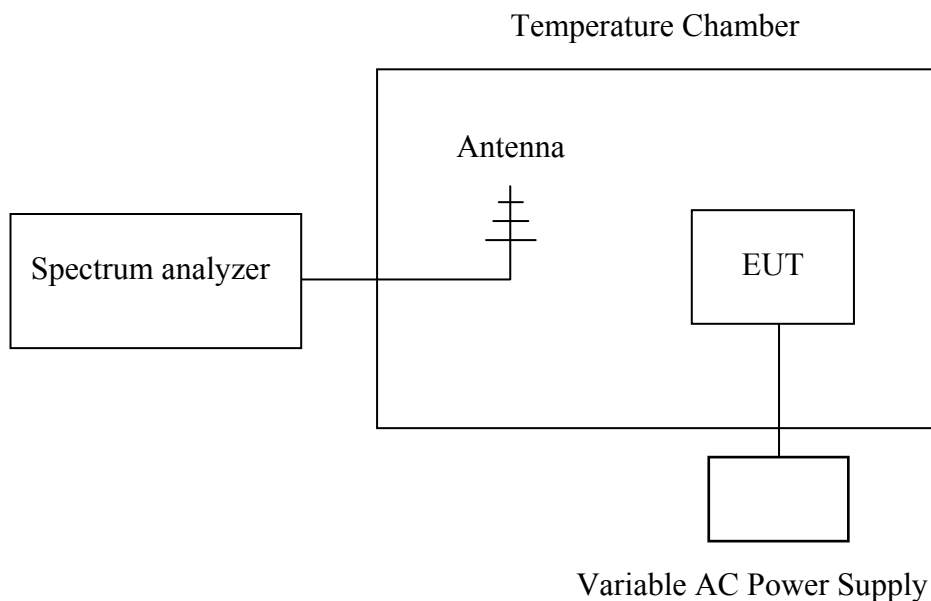
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8 Frequency Tolerance

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:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/19/2014	05/18/2015
Temperature Chamber	TERCHY	MHG-120LF	911009	05/07/2014	05/06/2015
AC Power Supply	APW-105N	887592	All Power	N/A	N/A

8.4 Measurement Results

Refer to attached data chart.

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A. Temperature Variation

Power Supply	Environment	Frequency	Delta (Hz)	Limit (KHz)
Vdc	Temperature ()	(MHz)		
3.8	-20	13.56012	510.00	+/- 1.356
3.8	-10	13.56044	190.00	+/- 1.356
3.8	0	13.56051	120.00	+/- 1.356
3.8	10	13.56058	50.00	+/- 1.356
3.8	20	13.56063	0.00	+/- 1.356
3.8	30	13.56077	-140.00	+/- 1.356
3.8	40	13.56079	-160.00	+/- 1.356
3.8	50	13.56083	-200.00	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (Hz)	Limit (KHz)
Vdc	Temperature ()	(MHz)		
4.35	20	13.56075	-120.00	+/- 1.356
3.8	20	13.56063	0.00	+/- 1.356
3.4	20	13.56056	70.00	+/- 1.356

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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.

9.5 Measurement Equipment Used:

Refer to section 6.3 in this report

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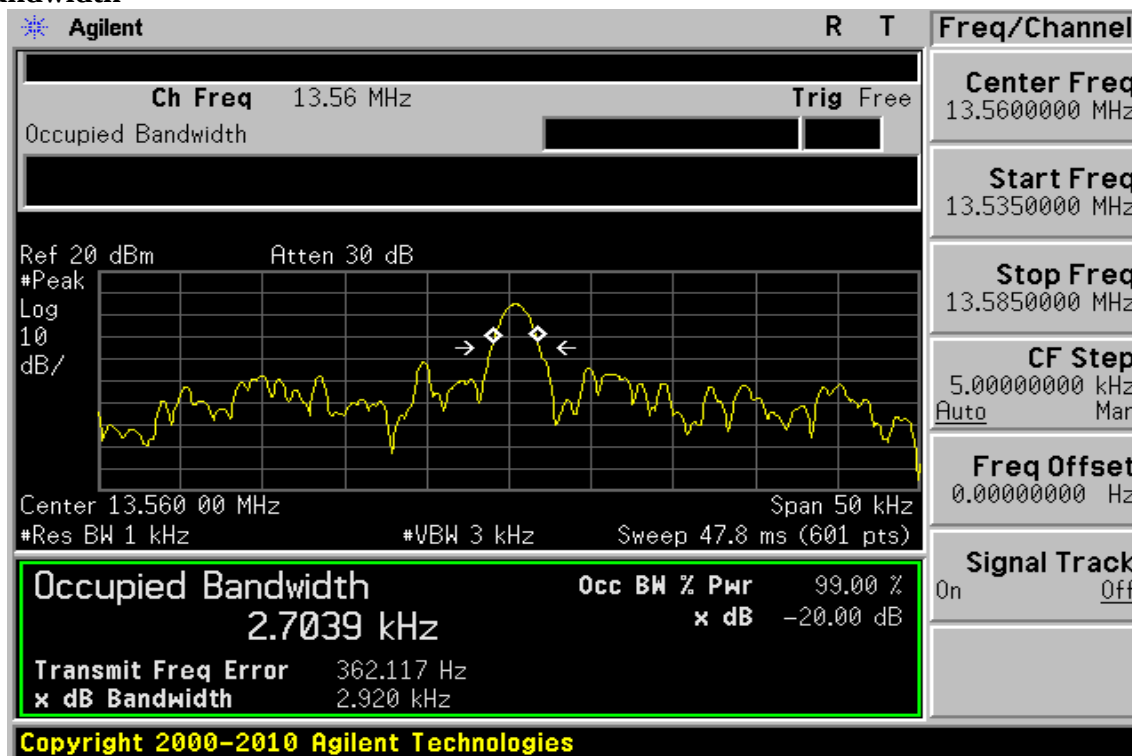
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-20dB Bandwidth



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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.

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.

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