

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT INDUSTRY CANADA RSS-210

OF

Product Name: PDA Phone
Brand Name: Sony
Model No.: C2004
Type No.: PM-0481-BV
Model Difference: N/A
FCC ID: PY7PM-0481
IC: 4170B-PM0481
Report No.: EH/2013/70022
Issue Date: Aug. 05, 2013
FCC Rule Part: §15.225
IC Rule Part: RSS-210 issue 8: 2010, Annex 2 A2.6

Prepared for: Sony Mobile Communications AB
Nya Vattentornet 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: PDA Phone

Brand Name: Sony

Model No.: C2004

Type No.: PM-0481-BV

Model Difference: N/A

FCC ID: PY7PM-0481

IC : 4170B-PM0481

File Number: EH/2013/70022

Date of test: Apr. 01, 2013 ~ Jul. 23, 2013

Date of EUT Received: Apr. 01, 2013

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 and RSS-210 issue 8: 2010 Annex 2 A2.6.

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

Test By:

Nick Lin

Date:

Aug. 05, 2013

Nick Lin / Engineer

Prepared By:

Violetta Tang

Date:

Aug. 05, 2013

Violetta Tang / Clerk

Approved By

Jim Chang

Date:

Aug. 05, 2013

Jim Chang / Supervisor

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Revision History

Report Number	Revision	Description	Issue Date
EH/2013/70022	Rev.01	Initial creation of document	Jul. 26, 2013
EH/2013/70022	Rev.02	Incorporate the supplemental information with regards to loop antenna on page 12, Delete the imprecise information of the test channel on page 17	Aug. 05, 2013

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1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	PDA Phone	
Brand Name:	Sony	
Model No.:	C2004	
Type No.:	PM-0481-BV	
Model Difference:	N/A	
Data Cable (USB):	Model No.: EC450, Supplier: K-one Part No.: 1242-6715.3, Length: 100 cm	
Simple Hands-Free (SHF-White):	Model No.: MH410c, Supplier: Foster Electric Type No.: AG-1100	
Simple Hands-Free (SHF-Black):	Model No.: MH410c, Supplier: Foster Electric Type No.: CCA-0004017	
Car Charger:	Model No.: AN400, Supplier: Salcomp Type No.: CAA-0003013	
Hi-Fi Wireless Headset:	Model No.: MW600, Supplier: BALDA Type No.: DDA-0002029.B coupling with Simple Hands Free (Model No.: MH755, Supplier: BALDA Type No.: AG-0502)	
Hardware Version:	A	
Software Version:	15.2.A.0.17	
Power Supply:	3.7Vdc	
	Battery:	Model No.: BA900, Supplier: Sony Type No.: AB-0500
	Adapter:	Model No.: EP800, Supplier: Salcomp Type No.: CAA-0002016-US

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Bluetooth BR+EDR:

Bluetooth Version:	V3.0+HS
Channel number:	79 channels
Modulation type:	Frequency Hopping Spread Spectrum
Transmit Power:	10.11dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	<= 0.4s
Antenna Designation:	PIFA Antenna, Gain: 2.55dBi
Type of Emission:	915KF7D (GFSK) / 1M15G7D ($\pi/4$ DQPSK) / 1M20G7D (8DPSK)

Bluetooth Low Energy:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V4.0 Dual mode
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	1.24dBm (Peak)
Antenna Designation:	PIFA Antenna, Gain: 2.55dBi
Type of Emission:	1M05F7D

NFC:

Operating Frequency:	13.56MHz
Transmit Power:	< 123dBuV/m at 3m.
Number of Channels:	1
Antenna Type:	Loop Antenna
Modulation Type:	ASK, BPSK
Type of Emission:	15K0F1D

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WLAN 2.4GHz+5.7GHz:

Wi-Fi	Frequency Range	Channels	Rated Power	Modulation Technology	Type of Emission
11b/g	2412-2462	11	b: 17.27dBm g: 20.82dBm	DSSS, OFDM	b: 13M5G1D g: 16M6D1D
11n	HT20 2412-2462	11	HT20: 20.84dBm	OFDM	n: 17M8D1D
11a	5725-5850	5	a: 19.54dBm	OFDM	a: 16M7D1D
11n (5GHz)	HT20 5725-5850	5	HT20: 19.62dBm		n_20HT:17M8D1D
11n (5GHz)	HT40 5725-5850	2	HT40: 19.18dBm		n_40HT:36M0D1D
Antenna Designation:		PIFA Antenna, 2.4GHz Gain: 2.55dBi 5GHz Gain: 1.66dBi (5725MHz-5850MHz)			
Modulation type:		CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM			
Transition Rate:		802.11 a: 6/9/12/18/24/36/48/54 Mbps 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 – 65.0Mbps 802.11 n_40MHz: 13.5 – 135.0Mbps			

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WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Rated Power (Avg)	Rated Power (EIRP)	Modulation Technology	Type of Emission
11a	5150~5250	4	12.77dBm	12.03dBm	OFDM	16M7D1D
	5250~5350	4	12.78dBm	13.79dBm		16M7D1D
	5470~5725	11	12.87dBm	15.57dBm		16M6D1D
11n	HT20 5150~5250	4	HT20: 12.85dBm	HT20: 12.11dBm	OFDM	17M7D1D
	HT20 5250~5350	4	HT20: 12.84dBm	HT20: 13.85dBm		17M8D1D
	HT20 5470~5725	8	HT20: 12.88dBm	HT20: 15.58dBm		17M7D1D
11n	HT40 5150~5250	2	HT40: 11.76dBm	HT40: 11.05dBm	OFDM	36M1D1D
	HT40 5250~5350	2	HT40: 11.79dBm	HT40: 12.80dBm		36M1D1D
	HT40 5470~5725	3	HT40: 11.87dBm	HT40: 14.57dBm		36M0D1D
Antenna Designation:		PIFA Antenna, 5GHz Gain: -0.74dBi (5150MHz-5250MHz) 5GHz Gain: 1.01dBi (5250MHz-5350MHz) 5GHz Gain: 2.70dBi (5470MHz-5725MHz)				
Modulation type:		CCK, DQPSK, DBPSK for DSSS 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:

Cellular Phone Standards Frequency Range and Power:	Operating Frequency		Rated Power
		GSM/GPRS 850, Class 12	824.2 MHz– 848.8 MHz
	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 IV	1712.4MHz - 1752.6MHz	24dBm
	WCDMA/HSUPA/HSDPA /HSPA+ Band V	826.4MHz - 846.6MHz	24dBm
Type of Emission:	GSM 850: 248KGXW, GSM 1900: 247KGXW GPRS 850: 247KGXW, GPRS 1900: 247KGXW EDGE 850: 244KG7W, EDGE 1900: 242KG7W WCDMA Band II: 4M20F9W, WCDMA Band IV: 4M16F9W, WCDMA Band V: 4M26F9W HSDPA Band II: 4M22F9W, HSDPA Band IV: 4M23F9W, HSDPA Band V: 4M17F9W HSUPA Band II: 4M20F9W, HSUPA Band IV: 4M25F9W, HSUPA Band V: 4M27F9W		
IMEI:	004402146722479		

This report complies with FCC/IC 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: **PY7PM-0481** filing to comply with Section 15.225 of the FCC Part 15, Subpart C Rules and IC: **4170B-PM0481** filing to comply with Industry Canada RSS-210 issue 8: 2010 Annex 2.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4:2009. & ANSI C63.10:2009 and RSS-Gen: 2010. 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, Wuku Industrial Zone, Taipei County, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2009. & ANSI C63.10:2009. FCC Registration Number is: 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. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 94644.

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 a placed on as 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. 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 a placed on as 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.

While performing the measurement in the frequency range of 9 kHz to 30 MHz, loop antenna is being employed. It is positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1m above the ground. The position of antenna referencing to the feed point is adjusted in order to measure the polarity of horizontal, and vertical, respectively, according to section 8 of ANSI 63.4: 2009

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2.4 Limitation

(1) Conducted Emission

According to section 15.207(a) and RSS-Gen 7.2.4 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 and RSS-210 7.2.5 Table 5 and Table 6 (Intentional Radiators general limit).as below.

Frequency (MHz)	Field strength $\mu\text{V}/\text{m}$	Distance (m)	Field strength at 3m $\text{dB}\mu\text{V}/\text{m}$
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. $20 \cdot \log(30) + 40 \cdot \log(30/3) = 69.54 \text{ dBuV/m}$
 5. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205 and RSS-Gen 7.2.5 Table 3.
 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

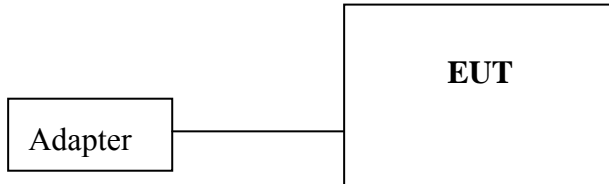


Fig. 2-2 Conducted (Antenna Port) Configuration

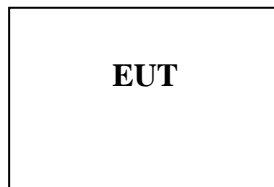


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	NFC Test Software	N/A	NxpSecureElement	N/A	N/A	N/A

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Fig. 2-3 AC Power Line Conducted Emission

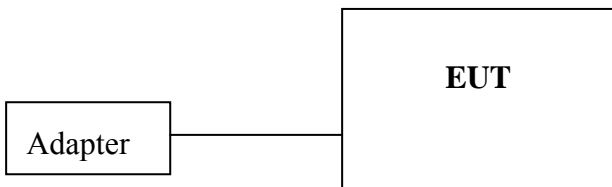


Table 2-2 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	NFC Test Software	N/A	NxpSecureElement	N/A	N/A	N/A

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3 Summary of Test Results

FCC / IC Rules	Description Of Test	Result
§15.207 RSS-Gen §7.2.4	AC Power Line Conducted Emission	Compliant
§15.225 (a)-(d) RSS210 Annex 2 A2.6	Radiated Emission	Compliant
§15.209 RSS-Gen §7.2.5	Radiated Emission Limits, general requirement	Compliant
§15.225 (e) RSS210 Annex 2 A2.6	Frequency Stability	Compliant
§2.1049 §15.215 (c) RSS-Gen §4.6.1	99% & 20 dB OCCUPIED BANDWIDTH	Compliant
§15.203 RSS-GEN §7.1.2,	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). The worst case E1 position was reported.

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

The given application is dual SIM build of certified product, PY7PM-0480, 4170B-PM-0480. It differs only in the mental shield covering the portion of slot space that is preserved in the built applicable PY7PM-0480, and 4170B-PM-0480. Except for the change as aforementioned above, all hardware, software relevant to RF Parameter of Physical layer, I/O signal remains unchanged, and the data as measured in the authorization of PY7M-0480, 4170B-PM-0480, and remains, and entails representative.

This test report only demonstrates the result of spot-check on Radiated Spurious Emission in order to reveal of the evidence of compliance record proving the implementation of dual SIM built causes no degradation as compared to build, PY7PM-0480/4170B-PM-0480.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Frequency Stability	+/- 123.36 Hz
99% & 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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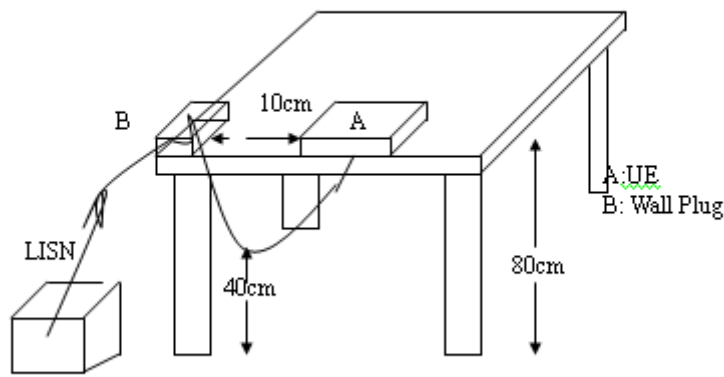
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6 Conducted Emissions Test

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.

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	100759	05/20/2011	05/19/2013
EMI Receiver	R&S	ESCS 30	828985/004	09/23/2012	09/22/2013
LISN	Rolf-Heine	NNB-2/16Z	99012	03/23/2013	03/22/2014
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	03/23/2013	03/22/2014
Coaxial Cables	N/A	WK CE Cable	N/A	01/05/2013	01/04/2014

6.4 Measurement Result:

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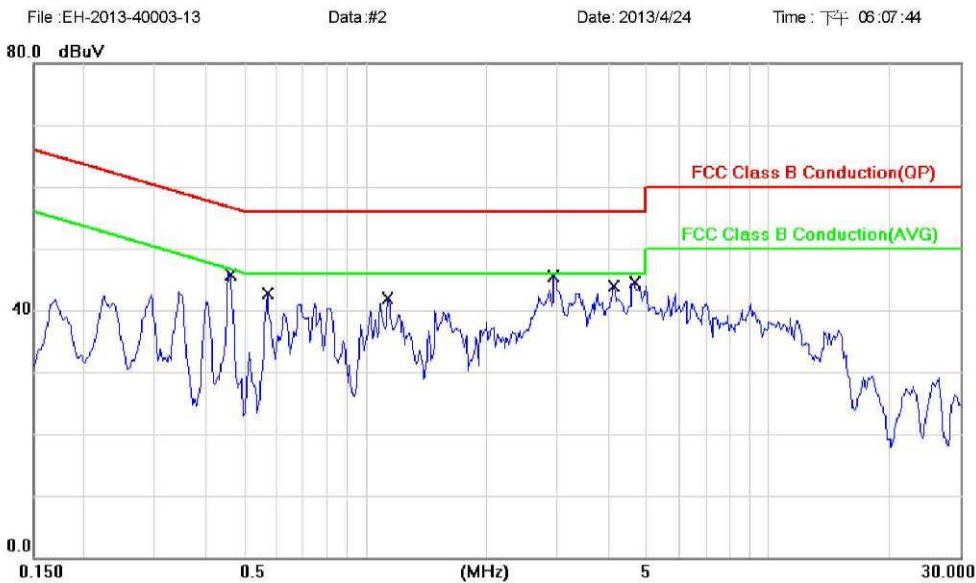
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode	Test Date:	Apr. 24, 2013
Temperature:	26 °C	Humidity:	60 %
		Test By:	Marcus

Site: ConductionRoom	Phase: L1	Temperature: 26 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 60%
EUT: PDA Phone	Distance:	
M/N: C2004	Mode: Operationmode	
Note		

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.4681	37.79	0.07	37.86	56.55	-18.69	QP	
2		0.4681	27.37	0.07	27.44	46.55	-19.11	AVG	
3		0.5703	22.96	0.08	23.04	56.00	-32.96	QP	
4		0.5703	18.65	0.08	18.73	46.00	-27.27	AVG	
5	*	1.1406	41.78	0.08	41.86	56.00	-14.14	QP	
6		2.9336	31.45	0.10	31.55	56.00	-24.45	QP	
7		2.9336	20.71	0.10	20.81	46.00	-25.19	AVG	
8		4.1406	33.27	0.12	33.39	56.00	-22.61	QP	
9		4.1406	21.85	0.12	21.97	46.00	-24.03	AVG	
10		4.6523	33.13	0.13	33.26	56.00	-22.74	QP	
11		4.6523	23.59	0.13	23.72	46.00	-22.28	AVG	

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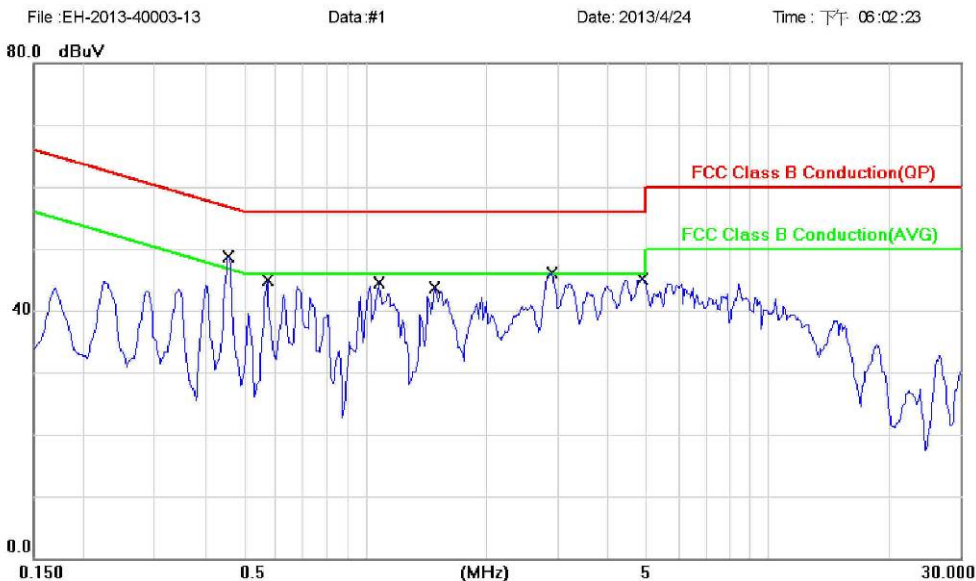
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Site: ConductionRoom
Limit: FCC Class B Conduction(QP)
EUT: PDA Phone
M/N: C2004
Note:

Phase: N
Power: AC 120V/60Hz
Distance:
Mode: Operationmode

Temperature: 26 °C
Humidity: 60%

Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.4586	47.21	0.12	47.33	56.72	-9.39	QP	
2	*	0.4586	41.62	0.12	41.74	46.72	-4.98	AVG	
3		0.5703	42.78	0.14	42.92	56.00	-13.08	QP	
4		0.5703	37.22	0.14	37.36	46.00	-8.64	AVG	
5		1.0781	38.71	0.16	38.87	56.00	-17.13	QP	
6		1.0781	30.31	0.16	30.47	46.00	-15.53	AVG	
7		1.4805	38.88	0.16	39.04	56.00	-16.96	QP	
8		1.4805	29.48	0.16	29.64	46.00	-16.36	AVG	
9		2.9141	40.99	0.17	41.16	56.00	-14.84	QP	
10		2.9141	31.72	0.17	31.89	46.00	-14.11	AVG	
11		4.8711	38.96	0.20	39.16	56.00	-16.84	QP	
12		4.8711	29.23	0.20	29.43	46.00	-16.57	AVG	

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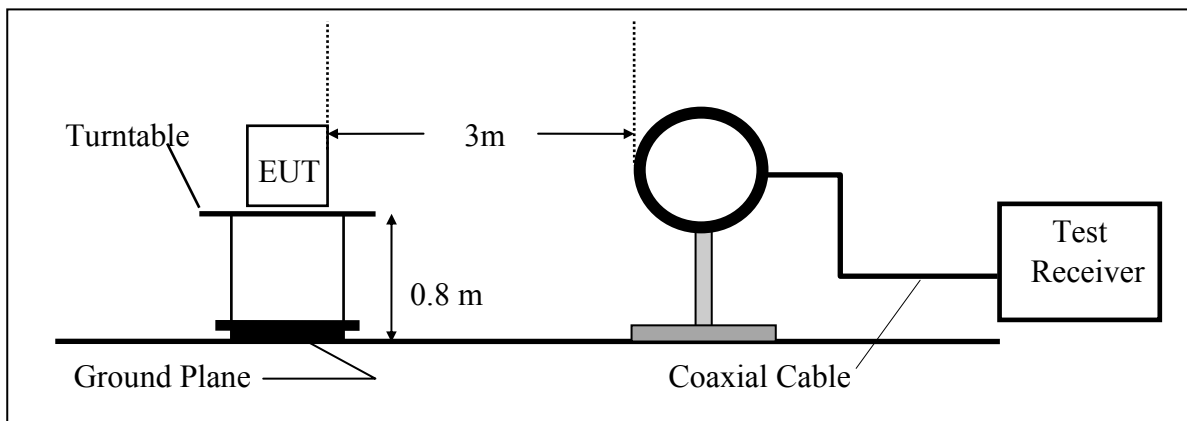
7 Radiated Emission Test

7.1 Measurement Procedure

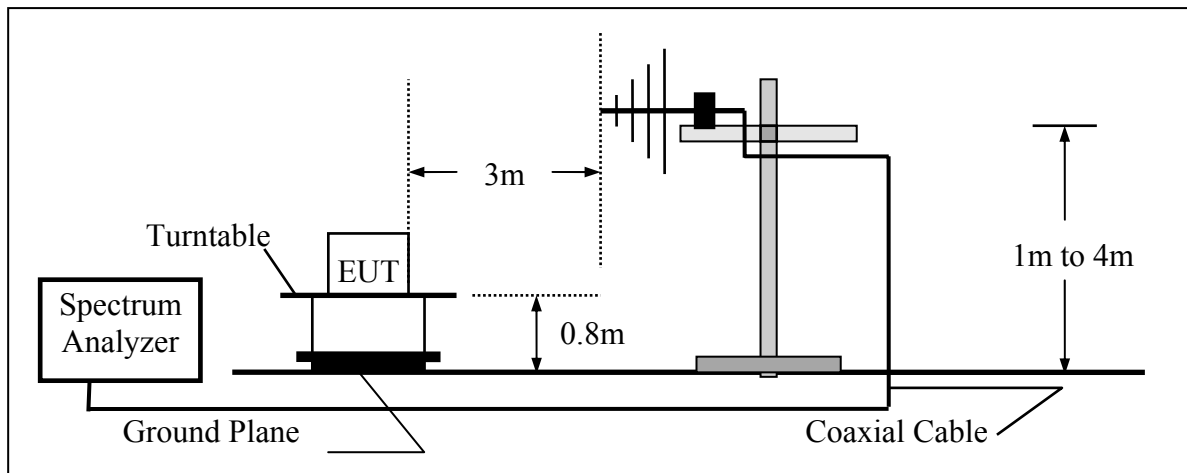
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

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	100759	02/08/2013	02/07/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2013	04/14/2014
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	02/06/2013	02/07/2014
Bilog Antenna	SCHWAZBECK	VULB9168	378	01/10/2012	01/09/2014
Loop Antenna	ETS.LINDGREN	6502	00148045	06/09/2012	06/08/2014
Pre-Amplifier	Agilent	8447D	2944A07676	01/04/2013	01/03/2014
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	01/04/2013	01/03/2014
3m Site NSA	SGS	966 chamber	N/A	07/15/2013	07/14/2014

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	

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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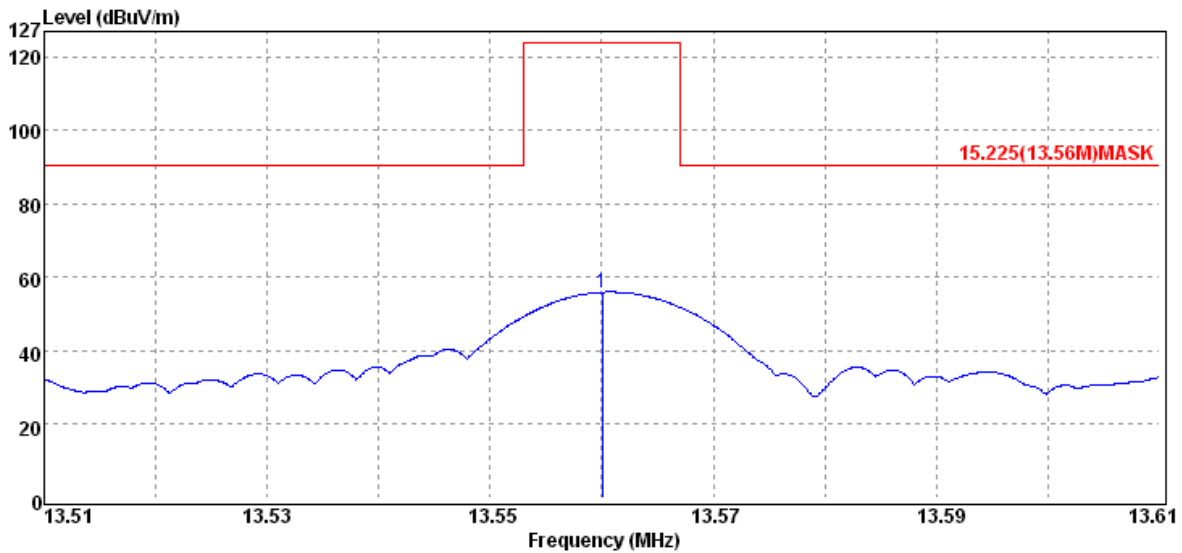
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Operation Band	:NFC	Test Date	:2013-07-15
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:26deg_C /60 RH
Operation Mode	:TX MAIN	Engineer	:Louis
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
13.56	F	Peak	45.33	10.66	55.99	123.90	-67.91



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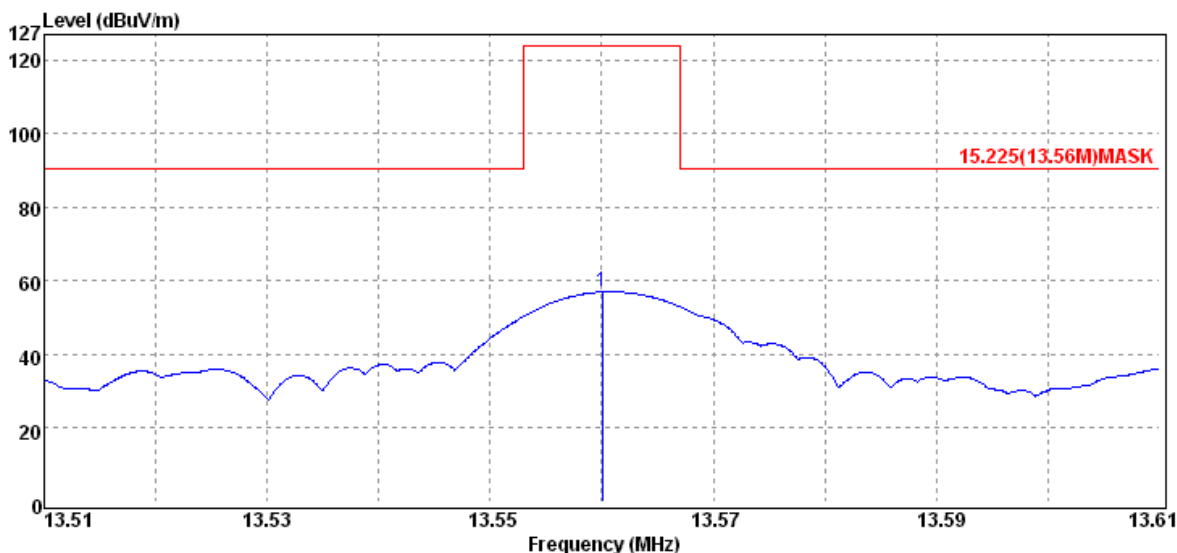
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Operation Band	:NFC	Test Date	:2013-07-15
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:26deg_C /60 RH
Operation Mode	:TX MAIN	Engineer	:Louis
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
13.56	F	Peak	46.36	10.66	57.02	123.90	-66.88



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

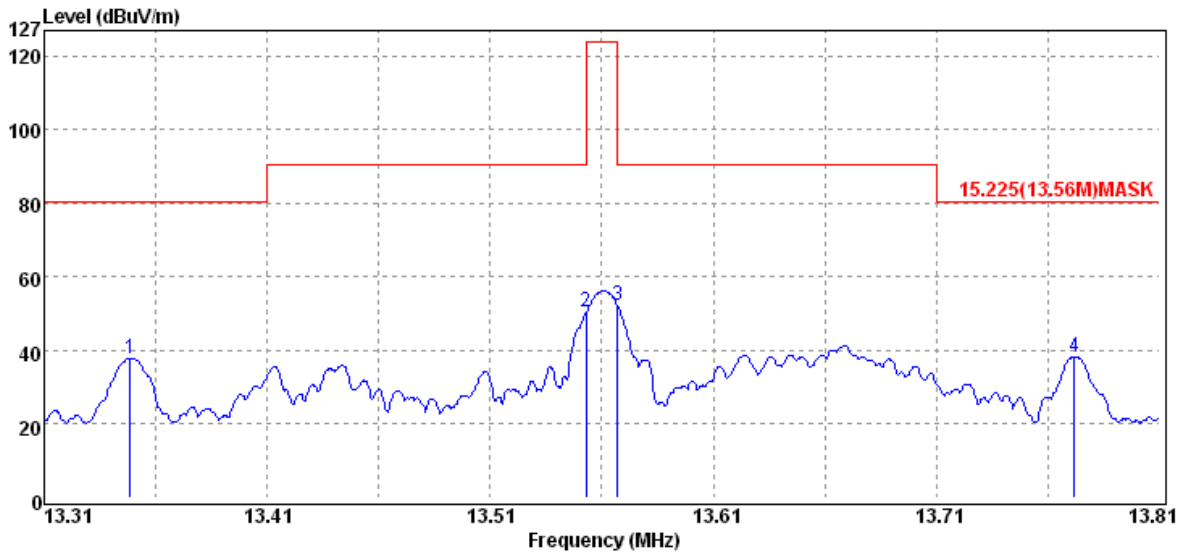
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Operation Band	:NFC	Test Date	:2013-07-15
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:26deg_C /60 RH
Operation Mode	:TX MASK	Engineer	:Louis
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
13.35	S	Peak	27.34	10.67	38.01	80.50	-42.49
13.55	S	Peak	39.75	10.66	50.41	90.47	-40.06
13.57	S	Peak	41.72	10.66	52.38	90.47	-38.09
13.77	S	Peak	27.71	10.64	38.35	80.50	-42.15

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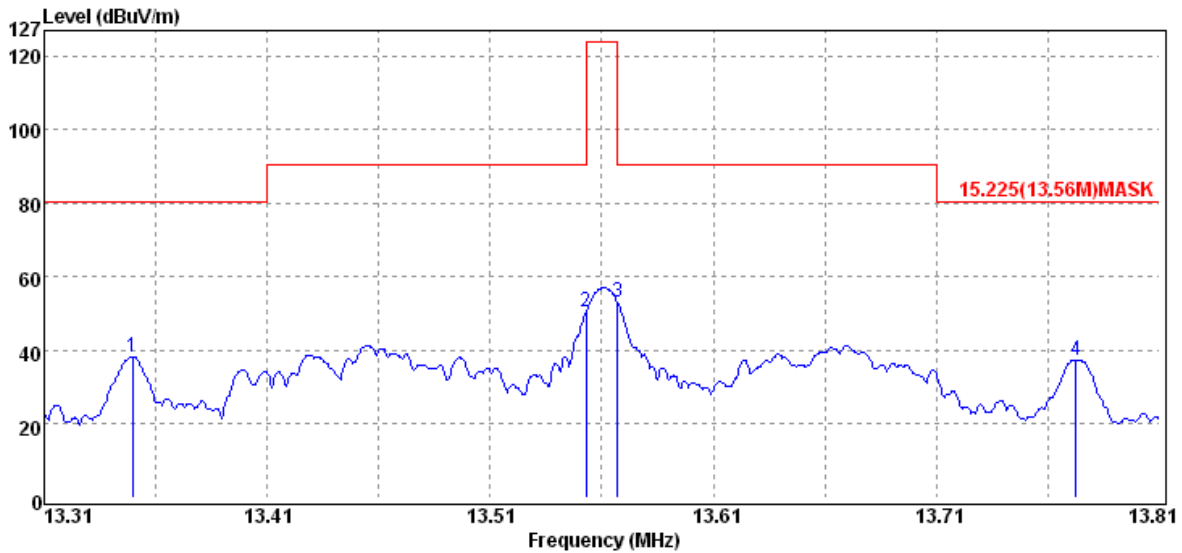
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Operation Band	:NFC	Test Date	:2013-07-15
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:26deg_C /60 RH
Operation Mode	:TX MASK	Engineer	:Louis
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
13.35	S	Peak	27.74	10.66	38.40	80.50	-42.10
13.55	S	Peak	39.98	10.66	50.64	90.47	-39.83
13.57	S	Peak	42.53	10.66	53.19	90.47	-37.28
13.77	S	Peak	26.71	10.64	37.35	80.50	-43.15

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7.5.3 Radiated Emission –

Limit:

§ 15.225

(d) 30 microvolts/m (29.4 dB μ V/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.

§ RSS-210 A2.6

(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.

$$a) 20*\log(30\mu\text{V/m}) + 40\text{dB} = 69.40 \text{ dBuV/m}$$

Operation Band	:NFC	Test Date	:2013-07-15
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:26deg_C /60 RH
Operation Mode	:TX	Engineer	:Louis
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
11.08	S	Peak	12.84	11.01	23.85	69.50	-45.65
13.98	S	Peak	20.11	10.64	30.75	69.50	-38.75
17.68	S	Peak	11.54	10.61	22.15	69.50	-47.35
20.88	S	Peak	10.92	10.23	21.15	69.50	-48.35
23.44	S	Peak	11.99	9.81	21.80	69.50	-47.70
27.02	S	Peak	12.63	9.27	21.90	69.50	-47.60
27.12	H	Peak	9.31	9.24	18.55	69.50	-50.95

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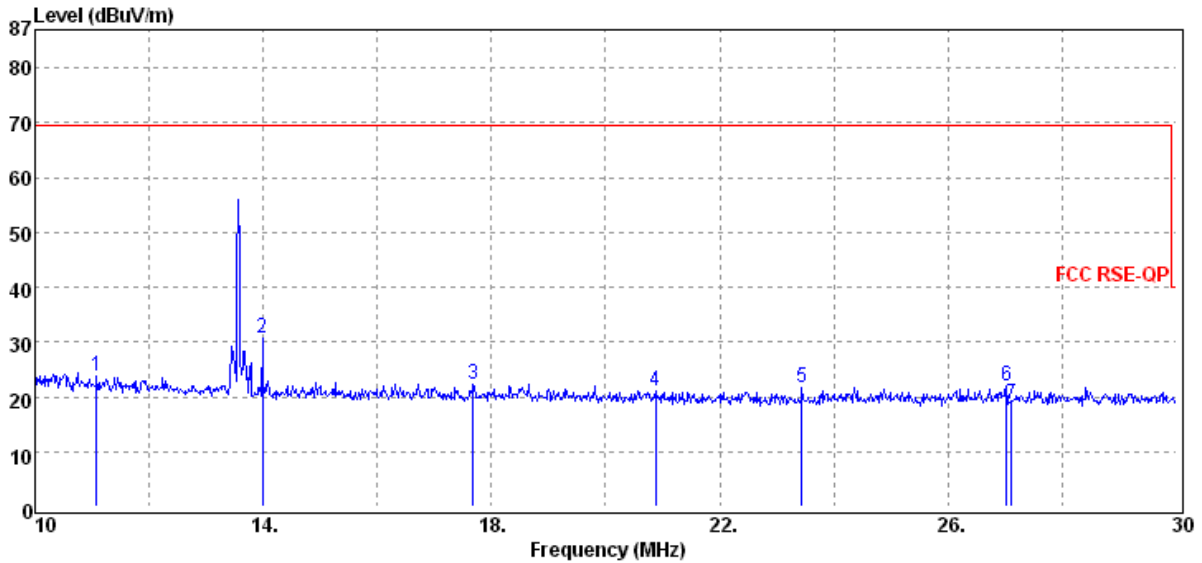
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Measurement Plot



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Operation Band	:NFC	Test Date	:2013-07-15
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:26deg_C /60 RH
Operation Mode	:TX	Engineer	:Louis
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	dB μ V	dB	dB μ V/m	dB μ V/m	dB
11.10	S	Peak	12.83	11.01	23.84	69.50	-45.66
12.16	S	Peak	13.57	10.81	24.38	69.50	-45.12
13.78	S	Peak	27.37	10.64	38.01	69.50	-31.49
16.44	S	Peak	12.18	10.65	22.83	69.50	-46.67
22.16	S	Peak	13.75	9.99	23.74	69.50	-45.76
27.12	H	Peak	10.93	9.24	20.17	69.50	-49.33
27.28	S	Peak	12.26	9.21	21.47	69.50	-48.03

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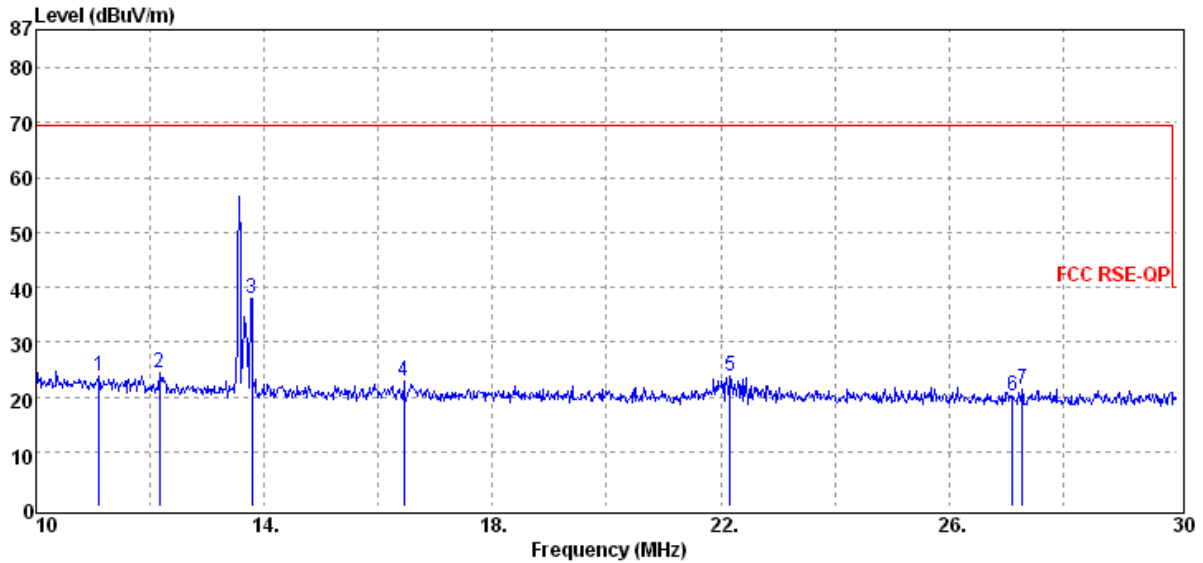
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Measurement Plot



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Operation Band	:NFC	Test Date	:2013-07-15
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:26deg_C /60 RH
Operation Mode	:TX	Engineer	:Louis
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
128.94	S	Peak	29.89	-13.97	15.92	43.50	-27.58
385.99	S	Peak	26.71	-11.20	15.51	46.00	-30.49
589.69	S	Peak	29.00	-7.77	21.23	46.00	-24.77
671.17	S	Peak	27.60	-6.17	21.43	46.00	-24.57
804.06	S	Peak	28.88	-4.14	24.74	46.00	-21.26
904.94	S	Peak	26.79	-2.70	24.09	46.00	-21.91

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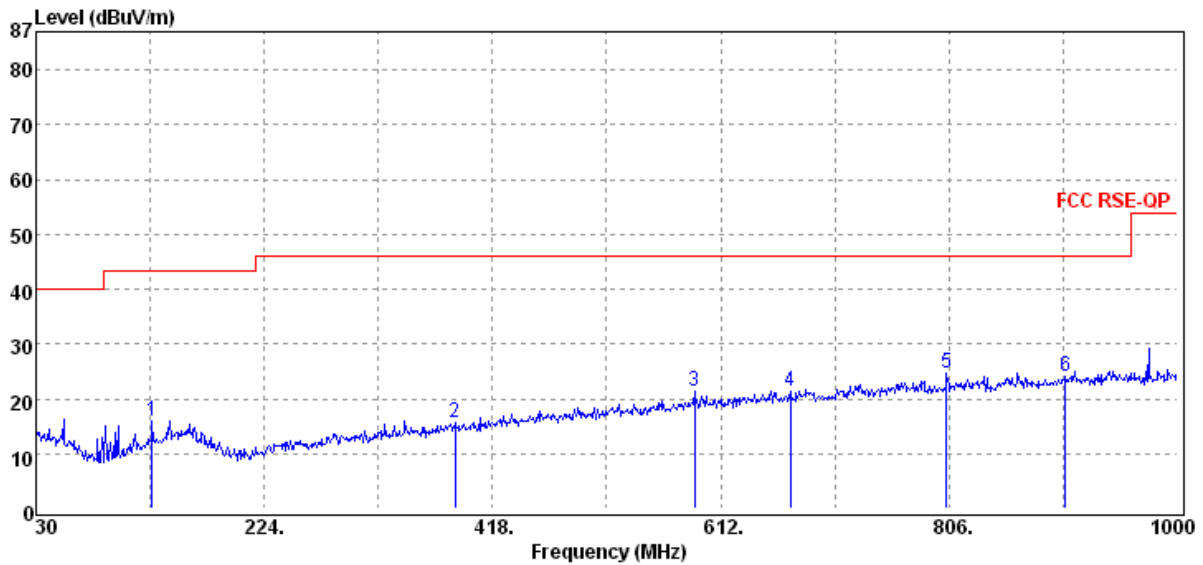
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Operation Band	:NFC	Test Date	:2013-07-15
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:26deg_C /60 RH
Operation Mode	:TX	Engineer	:Louis
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
151.25	S	Peak	27.35	-12.34	15.01	43.50	-28.49
321.97	S	Peak	26.52	-12.04	14.48	46.00	-31.52
451.95	S	Peak	27.31	-10.01	17.30	46.00	-28.70
579.02	S	Peak	28.35	-8.01	20.34	46.00	-25.66
763.32	S	Peak	27.70	-4.74	22.96	46.00	-23.04
954.41	S	Peak	27.37	-2.09	25.28	46.00	-20.72

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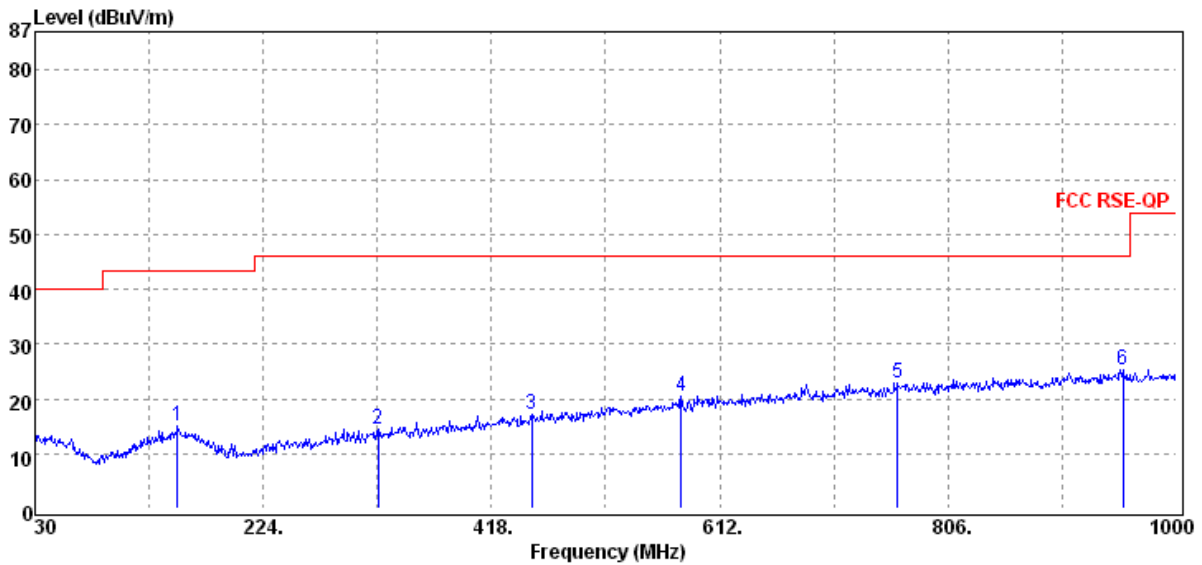
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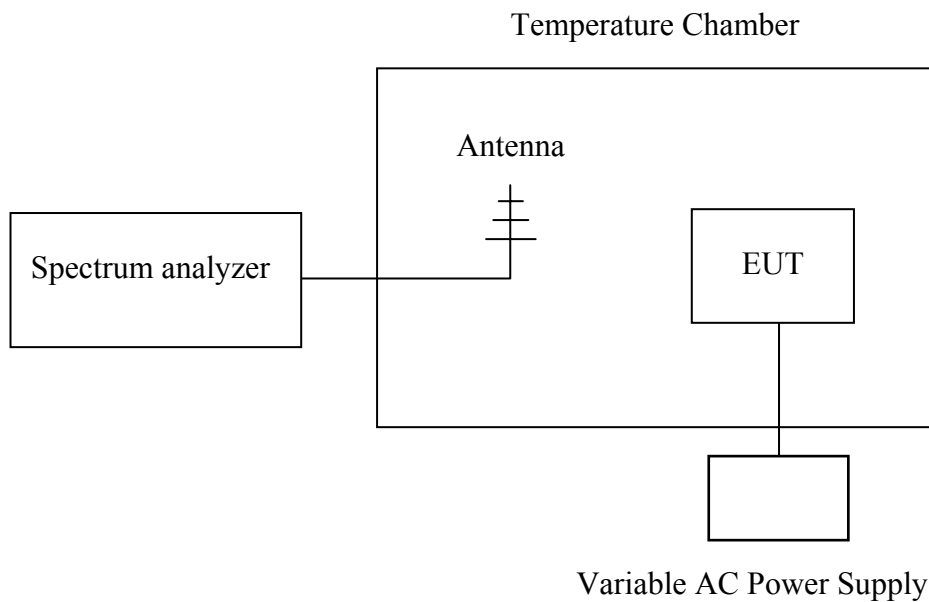
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8 Frequency Tolerance

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	04/15/2011	04/14/2014
Temperature Chamber	TERCHY	MHG-120LF	911009	04/16/2012	04/15/2014
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 (°C)	(MHz)		
3.7	-20	13.560451	-296.00	+/- 1.356
3.7	-10	13.560387	-232.00	+/- 1.356
3.7	0	13.560314	-159.00	+/- 1.356
3.7	10	13.560238	-83.00	+/- 1.356
3.7	20	13.560155	0.00	+/- 1.356
3.7	30	13.560232	-77.00	+/- 1.356
3.7	40	13.560301	-146.00	+/- 1.356
3.7	50	13.560375	-220.00	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (Hz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
4.2	20	13.560175	-14.00	+/- 1.356
3.7	20	13.560161	0.00	+/- 1.356
3.2	20	13.560149	12.00	+/- 1.356

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9 99% & 20 dB OCCUPIED BANDWIDTH MEASUREMENT

9.1 Standard Applicable:

§2.1049 & RSS-Gen 4.6.1 §15.215 (c)

9.2 Limit:

None

9.3 Test Set-up

Refer to section 6.2 in this report

9.4 Measurement Procedure

99% bandwidth

The EUT's output RF connector was connected with a short cable to the spectrum analyzer, RBW (10KHz) was set to about 1% of span, VBW= 3 times RBW(10KHz), -26dBc display line was placed on the screen (or 99%), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

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:

Refer to section 6.3 in this report

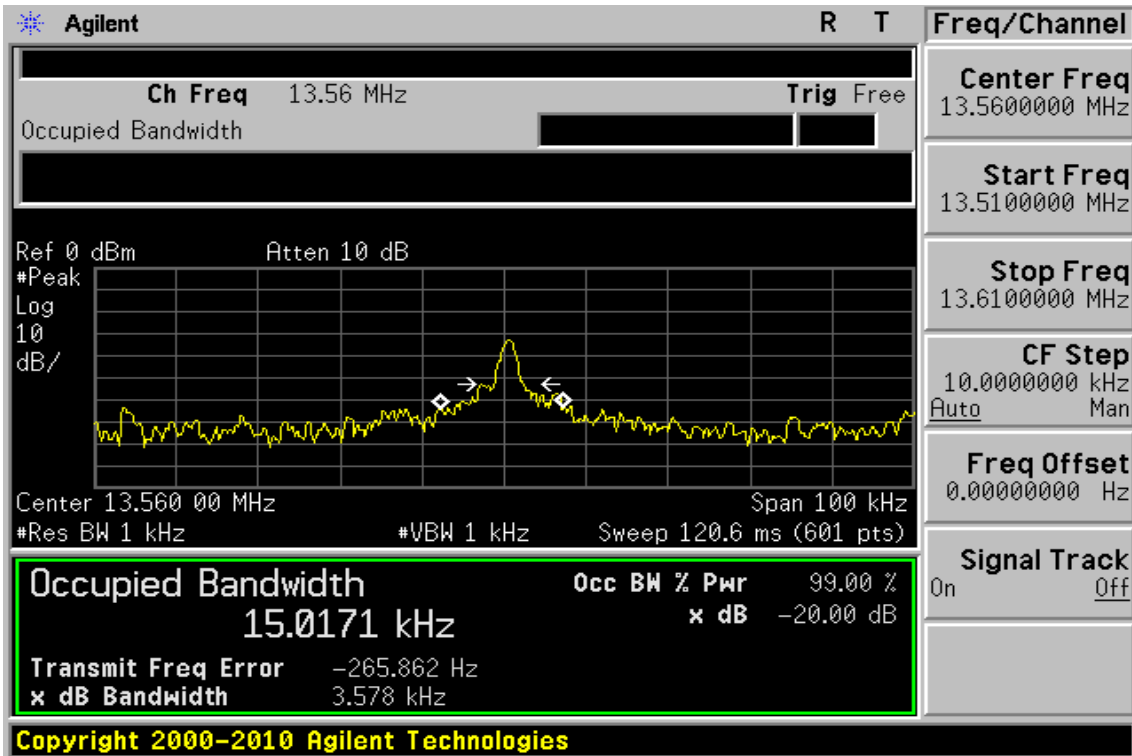
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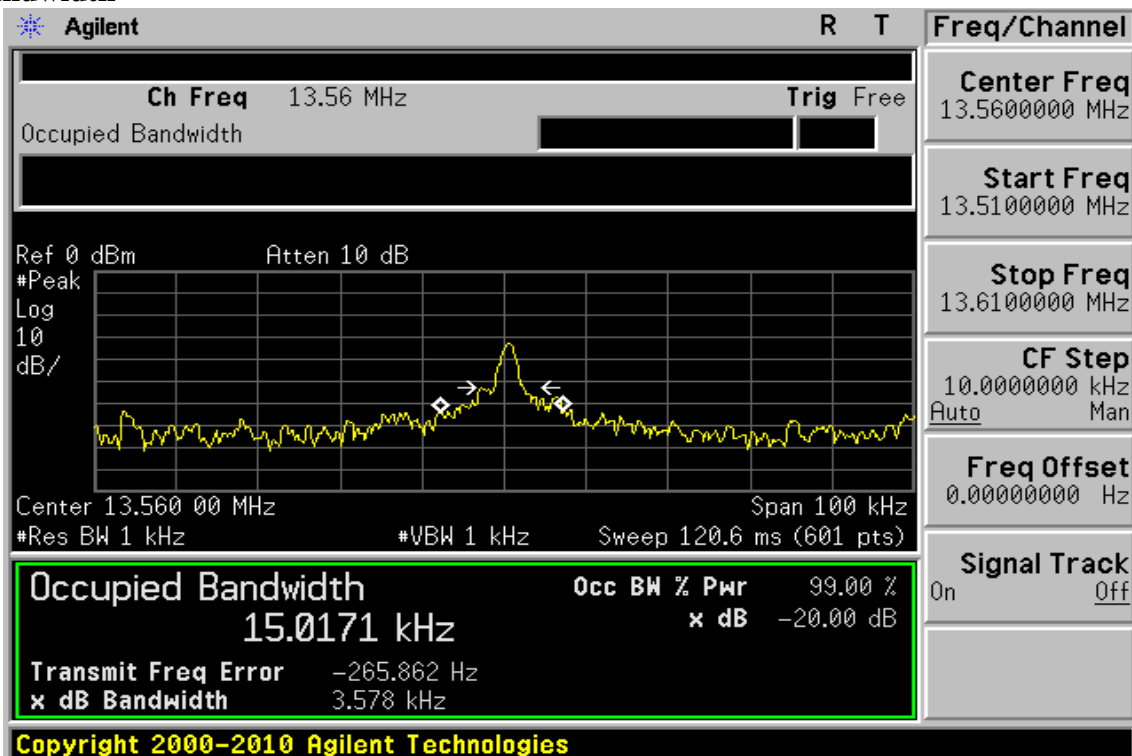
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99% Bandwidth



-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.

According to RSS-GEN 7.1.2, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

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

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

10.2. Antenna Connected Construction:

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

~ End of Report ~

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