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Report On

FCC Testing of the Sharp Quad-band LTE (B1/ B3/ B17/ B26), Dual-band WCDMA (FDD I / V) , Quad-band GSM (850/900/1800/1900) & WiMAX2+ (TDD41) multi mode Smart phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS

In accordance with FCC 47 CFR Part 15C (FeliCa)

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FCC ID: APYHRO00243

Document 75935599 Report 19 Issue 1

September 2016

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REPORT ON

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Sharp Quad-band LTE (B1/ B3/ B17/ B26), Dual-band WCDMA
(FDD I / V) , Quad-band GSM (850/900/1800/1900) & WiMAX2+ (TDD41)
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SRD(NFC,FeliCa) and GPS
In accordance with FCC 47 CFR Part 15C (FeliCa)

Document 75935599 Report 19 Issue 1

September 2016

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DATED

23 September 2016

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);


D Ralley


G Lawler





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SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp Quad-band LTE (B1/ B3/ B17/ B26), Dual-band WCDMA (FDD I / V) , Quad-band GSM
(850/900/1800/1900) & WiMAX2+ (TDD41) multi mode Smart phone with Bluetooth, WLAN,
SRD(NFC,FeliCa) and GPS
In accordance with FCC 47 CFR Part 15C (FeliCa)



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1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC Testing of the Sharp Quad-band LTE (B1/ B3/ B17/ B26), Dual-band WCDMA (FDD I / V) , Quad-band GSM (850/900/1800/1900) & WiMAX2+ (TDD41) multi mode Smart phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS to the requirements of FCC 47 CFR Part 15C.

Objective	To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Sharp Corporation
Serial Number(s)	IMEI 004401115905487
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C (2015)
Disposal	Held Pending Disposal
Reference Number	Not Applicable
Date	Not Applicable
Order Number	10879
Date	18 July 2016
Start of Test	22 August 2016
Finish of Test	08 September 2016
Name of Engineer(s)	D Ralley G Lawler
Related Document(s)	ANSI C63.10: 2013



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
FeliCa				
2.1	15.225 and 15.215 (c)	20 dB Bandwidth	Pass	
2.2	15.225 (a)(b)(c)(d)	Field Strength of any Emission	Pass	
2.3	15.225 (e)	Frequency Tolerance Under Temperature Variations	Pass	



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1.3 PRODUCT TECHNICAL DESCRIPTION

Refer to Model Description APYHRO00243 Rev 4.0 document.

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp Quad-band LTE (B1/ B3/ B17/ B26), Dual-band WCDMA (FDD I / V) , Quad-band GSM (850/900/1800/1900) & WiMAX2+ (TDD41) multi mode Smart phone with Bluetooth, WLAN, SRD(NFC,FeliCa) and GPS. A full technical description can be found in the manufacturer's documentation.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 4.0 V DC supply.

FCC Measurement Facility Registration Number
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard or test plan were made during testing.

1.7 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.



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SECTION 2

TEST DETAILS

FCC Testing of the
Sharp Quad-band LTE (B1/ B3/ B17/ B26), Dual-band WCDMA (FDD I / V) , Quad-band GSM
(850/900/1800/1900) & WiMAX2+ (TDD41) multi mode Smart phone with Bluetooth, WLAN,
SRD(NFC,FeliCa) and GPS
In accordance with FCC 47 CFR Part 15C (FeliCa)



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2.1 20 dB BANDWIDTH**2.1.1 Specification Reference**

FCC 47 CFR Part 15C, Clause 15.225 and 15.215 (c)

2.1.2 Equipment Under Test and Modification State

S/N: IMEI 004401115905487 - Modification State 0

2.1.3 Date of Test

2 September 2016

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

The test was performed in accordance with ANSI C63.10, clause 6.9.2.

Remarks

EUT was placed on an antenna jig.

The antenna jig was connected to the signal analyser.

A proprietary NFC FeliCa transmission test application was used to generate the required signal. The mode set on the application was Type F 212 kbps; polling; 100,000 transmissions.

2.1.6 Environmental Conditions

Ambient Temperature	24.1°C
Relative Humidity	60.7%



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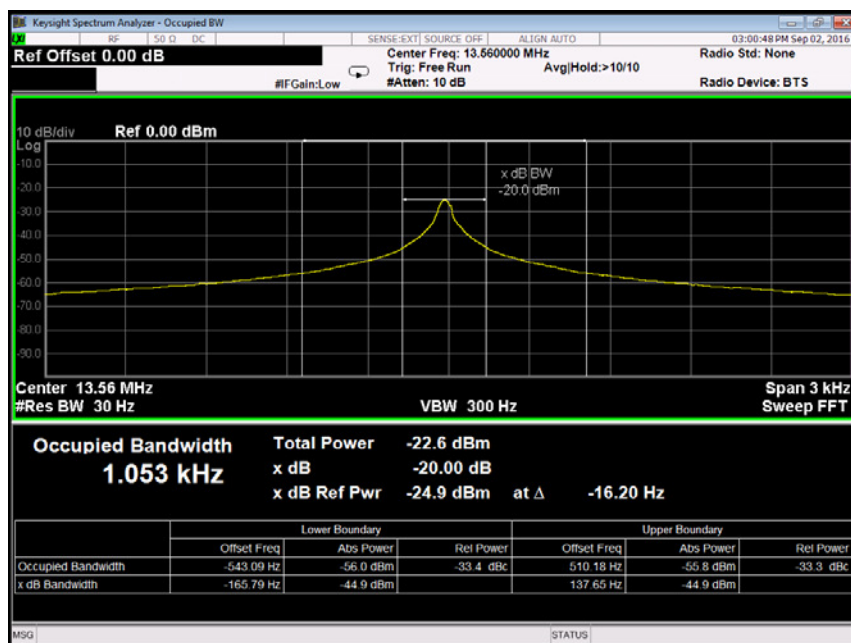
2.1.7 Test Results

4.0 V DC Supply

FeliCa, 20 dB Bandwidth Result

Frequency (MHz)	20 dB Bandwidth (Hz)
13.56	303.44

FeliCa, 20 dB Bandwidth Plot



FCC 47 CFR Part 15, Limit Clause 15.215 (c)

The 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.



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2.2 FIELD STRENGTH OF ANY EMISSION

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.225 (a)(b)(c)(d)

2.2.2 Equipment Under Test and Modification State

S/N: IMEI 004401115905487 - Modification State 0

2.2.3 Date of Test

22 August 2016 & 4 September 2016

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Procedure

The test was performed in accordance with ANSI C63.10, clause 6.3, 6.4 and 6.5.

Remarks

Modulation Type V was proven to be the worst case modulation scheme available.

The level at 30m was calculated using the field strength measurement at 3m and extrapolating this result to produce a level at 30m in accordance with ANSI C63.10, clause 6.4.4.2. This value was then converted to uV/m.

Note: Limits lines displayed on the plots are extrapolated values to the 3 m measurement distance.

2.2.6 Environmental Conditions

Ambient Temperature	20.9 - 21.1°C
Relative Humidity	62.0 - 65.0%



Product Service

2.2.7 Test Results

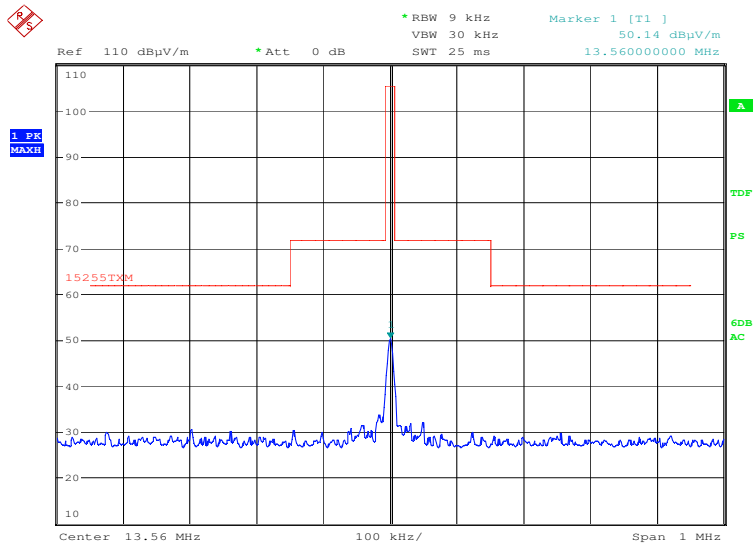
4.0 V DC Supply

FeliCa, Carrier Results

Frequency (MHz)	Quasi-Peak Level (dBµV/m) at 3m	Quasi-Peak Level (dBµV/m) at 30m*	Quasi-Peak Level (µV/m) at 30m*	Quasi-Peak Level (µV/m) at 3m	Angle (°)	Height (m)	Polarisation
13.56	48.28	26.89	22.11	259.42	81	1.00	Face

*The level at 30m was calculated using the dBµV/m measurement at 3m and extrapolating this result to produce a level at 30m. This value was then converted to obtain the value in µV/m.

FeliCa, Carrier Plot



Date: 22.AUG.2016 22:29:45



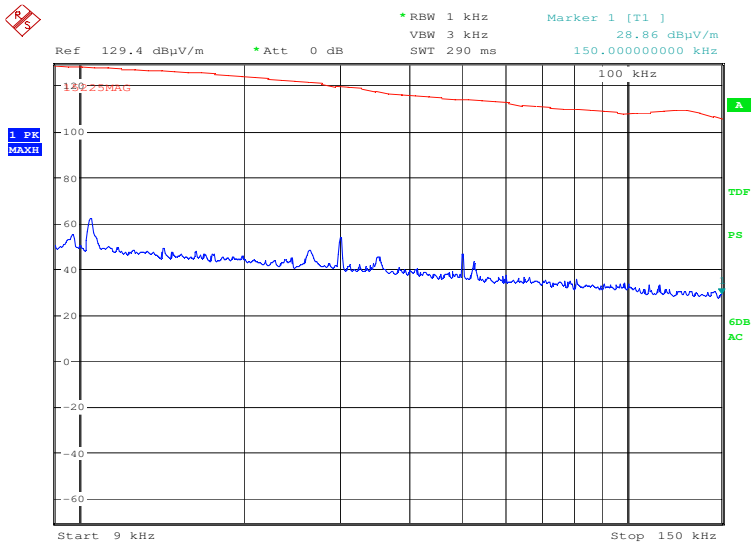
Product Service

FeliCa, 9 kHz to 30 MHz, Field Strength of any Emission Results

Frequency (MHz)	Quasi-Peak Level (dBµV/m) at 3m	Quasi-Peak Level (dBµV/m) at 30m	Quasi-Peak Level (µV/m) at 3m	Quasi-Peak Level (µV/m) at 30m	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dB of the limit.

FeliCa, 9 kHz to 150 kHz, Field Strength of any Emission Plot

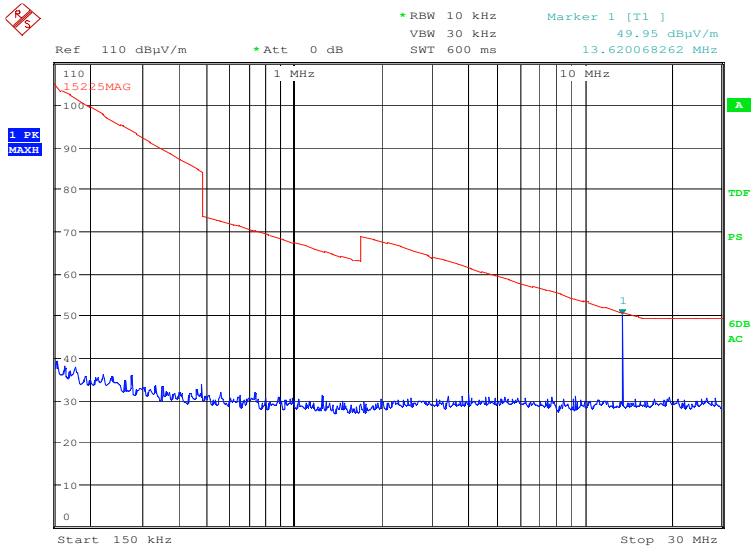


Date: 22.AUG.2016 22:37:46



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FeliCa, 150 kHz to 30 MHz, Field Strength of any Emission Plot



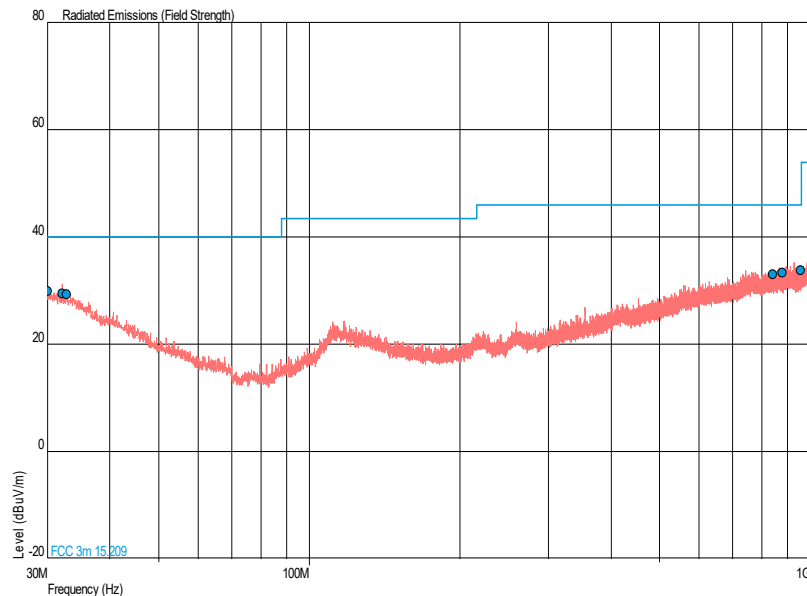
Date: 22.AUG.2016 22:40:59



FeliCa, 30 MHz to 1 GHz, Field Strength of any Emission Results

Frequency (MHz)	Quasi-Peak Level (dBμV/m)	Quasi-Peak Level (μV/m)	Quasi-Peak Margin (dμV/m)	Quasi-Peak Margin (μV/m)	Angle (°)	Height (m)	Polarisation
30.049	29.9	31.3	-10.1	-68.7	270	1.00	Vertical
32.183	29.5	29.9	-10.5	-70.1	270	1.00	Vertical
32.813	29.3	29.2	-10.7	-70.8	90	1.00	Horizontal
841.599	33.0	44.7	-13.0	-155.3	180	1.00	Vertical
879.041	33.4	46.8	-12.6	-153.2	180	1.00	Horizontal
956.352	33.8	49.0	-12.2	-151.0	180	1.00	Horizontal

FeliCa, 30 MHz to 1 GHz, Field Strength of any Emission Plot



FCC 47 CFR Part 15, Limit Clause 15.225 (a)(b)(c)(d)

- (a) The field strength of any emissions 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 band shall not exceed the general radiated emission limits in § 15.209.



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FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
0.009 to 0.490	2400/F (kHz)	300
0.490 to 1.705	24000/F (kHz)	30
1.705 to 30	30	30
30 to 88	100**	3
88 to 216	150**	3
216 to 960	200**	3
Above 960	500	5



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2.3 FREQUENCY TOLERANCE UNDER TEMPERATURE VARIATIONS

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.225 (e)

2.3.2 Equipment Under Test and Modification State

S/N: IMEI 004401115905487 - Modification State 0

2.3.3 Date of Test

8 September 2016

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Procedure

The test was performed in accordance with ANSI C63.10, clause 6.8.

Remarks

The EUT battery was fully charged prior to commencement.

The EUT was placed on an antenna jig.

Carrier frequency was measured using a single marker on a signal analyser

The EUT was powered off and the chamber allowed to stabilise at each temperature level. The EUT was then powered on and a proprietary NFC application used to set the data rate and transmissions.

Worst case measurements from initialisation; 2 minutes, 5 minutes and 10 minutes of temperature exposure were used for % error calculations.

2.3.6 Environmental Conditions

Ambient Temperature	22.9 - 23.7°C
Relative Humidity	51.9 - 53.4%



2.3.7 Test Results

FeliCa, Type F 424 kbps, Frequency Tolerance Under Temperature Variations Results

Temperature Interval	Voltage	Fundamental Frequency (MHz)	Fundamental Frequency Deviation (%)
-20 °C	4.0 V DC	13.56	-0.00029
-10 °C	4.0 V DC	13.56	0.00007
0 °C	4.0 V DC	13.56	0.00015
+10 °C	4.0 V DC	13.56	0.00012
+20 °C	4.0 V DC	13.56	-0.00009
+30 °C	4.0 V DC	13.56	-0.00030
+40 °C	4.0 V DC	13.56	-0.00044
+50 °C	4.0 V DC	13.56	-0.00053

FCC 47 CFR Part 15, Limit Clause 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % of the operating frequency.



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SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 – 20 dB Bandwidth					
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	3-Sep-2016
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	3-Sep-2016
2 metre SMA Cable	Florida Labs	SMS-235SP-78.8-SMS	4518	12	16-Feb-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	8-Oct-2016
Section 2.2- Field Strength of any Emission					
Antenna (Active Loop, 9kHz-30MHz)	Rohde & Schwarz	HFH2-Z2	333	24	28-Nov-2016
Antenna (Dish/Tripod/Adaptor, 1GHz-18GHz)	Rohde & Schwarz	AC-008	334	-	TU
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	11-Jun-2017
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	2-Nov-2016
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	maturo GmbH	NCD	3917	-	TU
Digital thermo Hygrometer	Radio Spares	1260	4300	12	23-Aug-2017
Hygropalm Temperature and Humidity Meter	Rotronic	HP21	4410	12	27-Apr-2017
2 metre SMA Cable	Florida Labs	SMS-235SP-78.8-SMS	4517	12	16-Feb-2017
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	-	TU
Section 2.3 - Frequency Tolerance Under Temperature Variations					
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	5-Mar-2017
Climatic Chamber	TAS	Micro 225	2892	-	O/P Mon
Variac Transformer	Zenith	Z-710-R	3169	-	O/P Mon
Thermocouple Thermometer	Fluke	51	3174	12	9-Dec-2016
Hygrometer	Rotronic	I-1000	3220	12	23-Aug-2017
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	5-Mar-2017
Digital Multi-meter	Iso-tech	IDM93N	4435	12	25-Aug-2017
2 metre SMA Cable	Florida Labs	SMS-235SP-78.8-SMS	4518	12	16-Feb-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	8-Oct-2016

TU – Traceability Unscheduled

O/P MON – Output Monitored with Calibrated Equipment



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3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	MU
Field Strength of any Emission	9 kHz to 1 GHz: ± 5.1 dB
20 dB Bandwidth	± 16.74 kHz
Frequency Tolerance Under Temperature Variations	± 3.54 Hz



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SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

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