LS RESEARCH, LLC
WIRELESS PRODUCT DEVELOPMENT
ACCREDITED
Testing Cert. 1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

TEST REPORT #: TR 312260 A
LSR Job #: C- 1574

Compliance Testing of:
TekTone Pendant Transmitter

Test Date(s):
October 19th to 24th 2012

Prepared For:
TekTone Sound and Signal Mfg., Inc.
Attn: Johnny Henson
277 Industrial Park Drive
Franklin, NC 28734

This Test Report is issued under the Authority of:
Khairul Aidi Zainal, Senior EMC Engineer

Signature: Date: 11/8/12

Test Report Reviewed by:	Project Engineer:
Shane D. Rismeyer, EMC Engineer	Khairul Aidi Zainal, Senior EMC Engineer.
Signature: Date: 11/7/12	Signature: Date: 11/2/12

TABLE OF CONTENTS

EXHIBIT 1. INTRODUCTION

1.1 - Scope

References:	FCC Part 15, Subpart C, Section 15.247 RSS GEN issue 3 and RSS 210 issue 8 Annex 8
Title:	FCC : Telecommunication – Code of Federal Regulations, CFR 47, Part 15. IC : Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment
Purpose of Test:	To gain FCC and IC Certification Authorization for Low-Power License-Exempt Transmitters.
Test Procedures:	FCC KDB 558074 D01 DTS Measurement Guidance v02
Environmental Classification:	Commercial or Business Residential

1.2 – Normative References

Publication	Year	Title
FCC CFR Parts 0-15	2011	Code of Federal Regulations – Telecommunications
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
RSS-210 Annex 8	2010	Low-power License-exempt Radio communication Devices (All Frequency Bands): Category I Equipment
RSS-GEN Issue 3	2010	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
FCC KDB 558074 D01 DTS Meas Guidance v02	2012	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

1.3 - LS Research, LLC Test Facility

TESTING CERT #1255.01

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) as conforming to ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.

LS Research, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted.

1.4 – Location of Testing

All testing was performed at the following location utilizing the facilities listed below, unless otherwise noted.

LS Research, LLC
W66 N220 Commerce Court
Cedarburg, Wisconsin, 53012 USA,

List of Facilities Located at LS Research, LLC:

Compact Chamber
Semi-Anechoic Chamber
Open Area Test Site (OATS)

1.5 – Test Equipment Utilized

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated by a calibration laboratory accredited to the requirements of ISO/IEC 17025, and traceable to the SI standard.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 – Client Information

Manufacturer Name:	TekTone Sound and Signal Mfg., Inc.
Address:	277 Industrial Park Road Franklin, NC 28734
Contact Name:	Johnny Henson

2.2 - Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	Pendant Transmitter
Model Number:	SF551
Serial Number:	12250259 : Radiated measurements 12250254 : Conducted measurements.

2.3 - Associated Antenna Description

The antenna associated with the product is a PCB trace loop antenna.

2.4 - EUT'S Technical Specifications

EUT Frequency Range (in MHz)	906 MHz to 924 MHz
RF Power in Watts	☒ *Conducted Measurement* ☐ *EIRP*
Minimum:	0.0062 Watts
Maximum:	0.0065 Watts
Occupied Bandwidth	*6 dB: 846.5 kHz* *99%: 1319.4 kHz* *20dB: 1215.0 kHz*
Type of Modulation	O-QPSK
Emission Designator	1M32G1D
Transmitter Spurious (worst case) at 3 meters	23.9 dBµV/m at 3664MHz (Duty cycle corrected value)
Stepped (Y/N)	No
Step Value:	N/A
Frequency Tolerance %, Hz, ppm	Better than 100ppm
Microprocessor Model # (if applicable)	TI MSP430F5310IRGC
Antenna Information	
Detachable/non-detachable	Non-detacheable
Type	PCB trace loop antenna
Gain	-3.4 dBi (based on field strength measurements over conducting ground plane)
EUT will be operated under FCC Rule Part(s)	*Title 47 part 15.247*
EUT will be operated under RSS Rule Part(s)	*RSS 210*
Modular Filing	☐ *Yes* ☒ *No*
Portable or Mobile?	Portable

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
	X	SAR Evaluation: Body-worn Device
		RF Evaluation

If RF Evaluation checked above, test engineer to complete the following:

Evaluated against exposure limits: ☐ General Public Use ☐ Controlled Use
Duty Cycle used in evaluation: 100 %
Standard used for evaluation: OET 65
Measurement Distance:
RF Value: ☐ V/m ☐ A/m ☐ W/m^2
☐ Measured ☐ Computed ☐ Calculated

Since the maximum effective isotropic radiated power (EIRP) is 2.95mW and is less than the applicable section limit, the Product is exempt from SAR Evaluation

2.5 - Product Description

A patient worn transmitter to be used in a Nurse Call System. Calls are initiated by the patient by a button press and communicated over the 900MHz radio link to the Nurse Call Station.

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 - Climate Test Conditions

Temperature:	70 -71° F
Humidity:	32-42%
Pressure:	728-741mmHg

3.2 - Applicability & Summary Of EMC Emission Test Results

FCC and IC Paragraph	Test Requirements	Compliance (Yes/No)
FCC : 15.207 IC : RSS GEN sect. 7.2.2	Power Line Conducted Emissions Measurements	N/A
FCC : 15.247 (a)(1) IC : RSS 210 A8.1 (a)	20 dB Bandwidth	N/A
FCC : 15.247(b) & 1.1310 IC : RSS 210 A8.4	Maximum Output Power	Yes
FCC : 15.247(i), 1.1307, 1.1310, 2.1091 & 2.1093 IC : RSS 102	RF Exposure Limit	Yes
FCC :15.247(d) IC : RSS 210 A8.5	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
FCC:15.247 (a)(2) IC: RSS 210 A8.2 (a)	6 dB Bandwidth of a Digital Modulation System	Yes
FCC:15.247 (d) IC: RSS 210 A8.2 (b)	Power Spectral Density of a Digital Modulation System	Yes
FCC : 15.247(c), 15.209 & 15.205 IC : RSS 210 A8.2(b), section 2.2, 2.6 and 2.7	Transmitter Radiated Emissions	Yes
The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices (RSS GEN and RSS 210 of IC) and the associated Radio Receiver has also been tested and found to comply with Part 15, Subpart B – Radio Receivers (RSS GEN and RSS 210 of IC). The Receiver Test Report is available upon request.		

3.3 - Modifications Incorporated In The EUT For Compliance Purposes

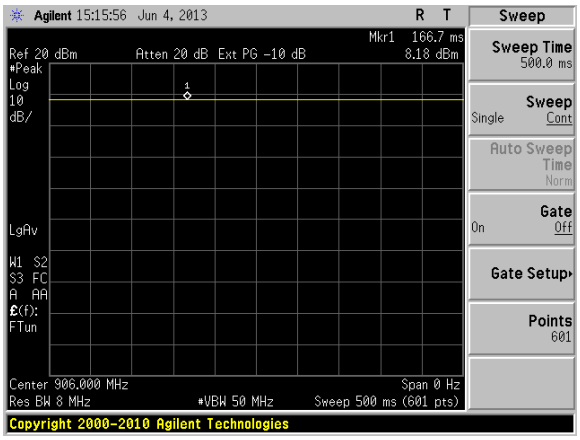
☒ None ☐ Yes (explain below)

3.4 - Deviations & Exclusions From Test Specifications

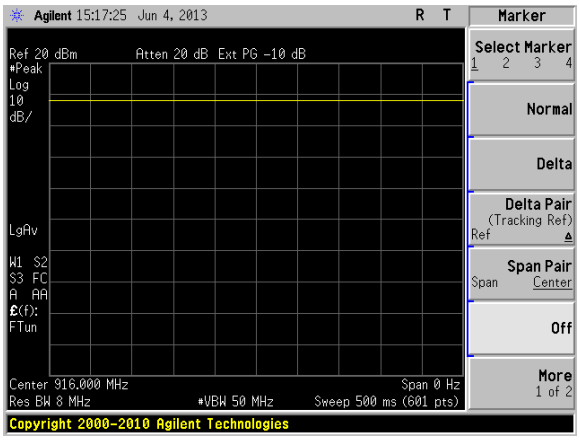
☒ None ☐ Yes (explain below)

3.5 – EUT Duty Cycle during testing:

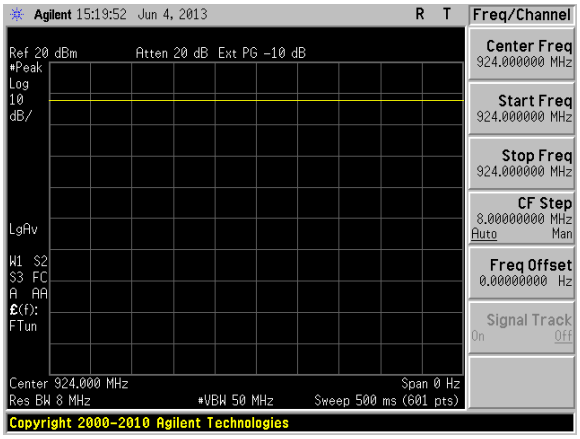
EUT was operated at 100% duty cycle during testing. Please refer to plots below:



Channel 1 (906MHz)



Channel 6 (916MHz)



Channel 10 (924MHz)

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247, and Industry Canada RSS-210, Issue 8 (2010), Annex 8.

Note: If some emissions are seen to be within 3 dB of their respective limits; as these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

EXHIBIT 5. RADIATED EMISSIONS TEST

5.1 - Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15, RSS GEN and ANSI C63.4-2003. The EUT was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber. The EUT was operated in 100% duty cycle, continuous transmit mode for final testing using power as provided by coin cell batteries. The unit has the capability to operate on 3 channels, controllable via instructions on 'Hyperterminal'.

The applicable limits apply at a 3 meter distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment. The test sample was operated on one of three (3) standard channels: low (906MHz), middle (916MHz) and high (924MHz) to comply with FCC Part 15.31(m). The unit has the capability to operate on 3 channels, controllable via instructions on 'Hyperterminal'.

5.2 - Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 30 MHz to 10000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double-Ridged Waveguide Horn Antenna was used from 1 GHz to 10 GHz. The maximum radiated RF emissions between 30MHz to 4 GHz were found by raising and lowering the sense antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities. Between 4GHz to 10GHz, the sense antenna was raised and lowered between 1 and 1.8 meters in height.

The EUT was positioned in 3 orthogonal orientations.

5.3 - Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at a calibration laboratory accredited to ISO 17025, and are traceable to the SI standard. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and an EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. As a result, the data taken from the EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz).

5.4 - Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.247 and Canada RSS-210, Issue 8 (2010), Annex 8 for a DTS transmitter. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

5.5 - Calculation of Radiated Emissions Limits and reported data.

Reported data:

For both fundamental and spurious emissions measurement, the data reported includes all necessary correction factors. These correction factors are loaded onto the EMI receiver when measurements are performed.

Reported Measurement data = Raw receiver measurement (dBµV/m) + Antenna correction Factor + Cable factor (dB) + Miscellaneous factors when applicable (dB) – amplification factor when applicable (dB).

Generic example of reported data at 200 MHz:

Reported Measurement data = 18.2 (raw receiver measurement) + 15.8 (antenna factor) + 1.45 (cable factor) = 35.45 (dBµV/m).

As specified in 15.247 (d) and RSS 210 A8.5, radiated emissions that fall within the restricted band described in 15.205(c) for FCC and section 2.2 of RSS 210 for IC, must comply with the general emissions limit.

The following table depicts the general radiated emission limits above 30 MHz. These limits are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to any signals found in the 15.205 restricted bands. The mentioned limits correspond to those limits listed in RSS GEN.

Frequency (MHz)	3 m Limit µV/m	3 m Limit (dBµV/m)	1 m Limit (dBµV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-24,000	500	54.0	63.5

Sample conversion of field strength (µV/m to dBµV/m):
dBµV/m = 20 $\log_{10}$ (100)= 40 dBµV/m (from 30-88 MHz)

5.6 - Radiated Emissions Test Data Chart

Manufacturer:	TekTone Sound and Signal Mfg.					
Date(s) of Test:	10/19/12-10/24/12					
Project Engineer(s):	Khairul Aidi Zainal					
Test Engineer(s):	Aidi Zainal, Adam Alger, Mike Hintzke					
Voltage:	3.0 VDC					
Operation Mode:	continuous transmit, modulated (100% duty cycle).					
Environmental Conditions in the Lab:	Temperature: 71˚F Relative Humidity: 30%					
EUT Power:		Single Phase 120VAC		3 Phase ___VAC		
	X	Battery		Other:		
EUT Placement:	X	80cm non-conductive pedestal		10cm Spacers		
EUT Test Location:	X	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary	X	Final
Detectors Used:	X	Peak	X	Quasi-Peak	X	Average

RADIATED EMISSIONS DATA CHART (continued)

The following table depicts the level of radiated emissions of channel 906 MHz in the restricted band:

Frequency (MHz)	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	DC Corrected (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
3624	100.0	311	53.8	21.3	52.1	54.0	32.8	Horizontal	Flat
4530	100.0	23	52.9	20.4	45.4	63.5	43.2	Horizontal	Side
5436	108.3	41	54.0	21.5	48.4	63.5	42.0	Horizontal	Side
9060	100.0	36	49.5	17.0	42.8	63.5	46.5	Horizontal	Side

Notes:

1. Measurements above 4 GHz were made at 1 meters of separation from the EUT. The limits were adjusted to reflect this measurement distance.
2. H: Horizontal, V: Vertical, S: Side, F: Flat.
3. Refer to exhibit 5.5 on explanation of how data is reported.
4. Duty cycle correction was applied to the peak measurements of the spurious emissions. The duty cycle is 710µs/30ms = 0.02367. The duty cycle correction is therefore 20*log(0.02367) = -32.5 dB. The justification for the duty cycle correction can be found in Appendix D.

The following table depicts the level of significant radiated emissions of channel 916 MHz in the restricted band:

Frequency (MHz)	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	DC Corrected (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
3664	100.0	43	56.4	23.9	54.9	54.0	30.1	Horizontal	Side
4580	111.2	43	49.4	16.9	43.6	63.5	46.6	Horizontal	Side
7328	100.0	338	51.4	18.9	45.1	63.5	44.6	Horizontal	Side
9160	100.0	45	52.1	19.6	44.1	63.5	43.9	Horizontal	Side

Notes:

1. Measurements above 4 GHz were made at 1 meters of separation from the EUT. The limits were adjusted to reflect this measurement distance.
2. H: Horizontal, V: Vertical, S: Side, F: Flat.
3. Refer to exhibit 5.5 on explanation of how data is reported.
4. Duty cycle correction was applied to the peak measurements of the spurious emissions. The duty cycle is 710µs/30ms = 0.02367. The duty cycle correction is therefore 20*log(0.02367) = -32.5 dB. The justification for the duty cycle correction can be found in Appendix D.

The following table depicts the level of significant radiated emissions of channel 924 MHz in the restricted band:

Frequency (MHz)	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	DC Corrected (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
3696	100.0	43	56.8	24.3	54.9	54.0	29.7	Horizontal	Side
4620	100.0	310	51.5	19.0	45.8	63.5	44.5	Horizontal	Side
7392	100.0	52	51.4	18.9	43.9	63.5	44.6	Horizontal	Side
8316	LOW	0	0.0	-32.5	0.0	63.5	96.0	Horizontal	Vertical

Notes:

1. Measurements above 4 GHz were made at 1 meters of separation from the EUT. The limits were adjusted to reflect this measurement distance.
2. H: Horizontal, V: Vertical, S: Side, F: Flat.
3. Refer to exhibit 5.5 on explanation of how data is reported.
4. Duty cycle correction was applied to the peak measurements of the spurious emissions. The duty cycle is 710µs/30ms = 0.02367. The duty cycle correction is therefore 20*log(0.02367) = -32.5 dB. The justification for the duty cycle correction can be found in Appendix D.

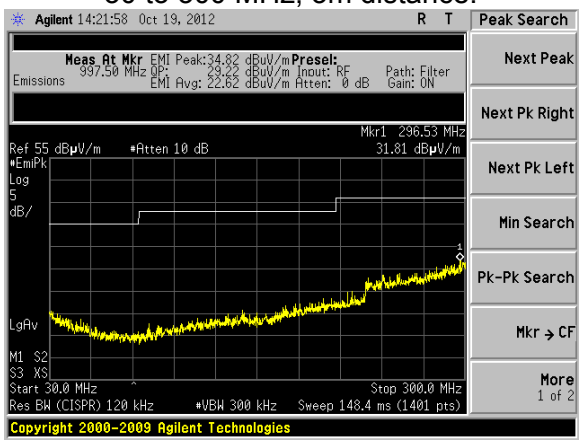
5.7 - Test Setup Photo(s) – Radiated Emissions Test

This section is not available.

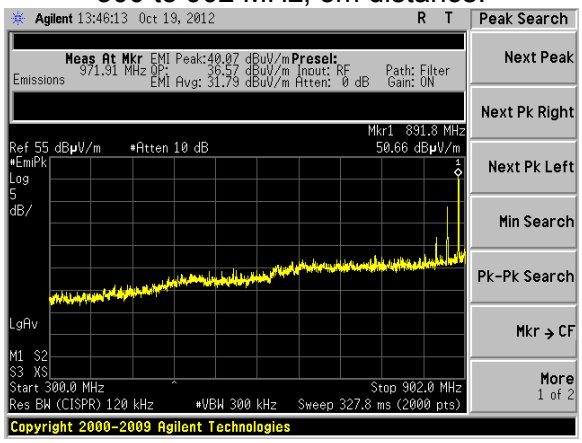
5.8 – Screen Captures.

The screen captures below are those using the Peak detector of the analyzer.

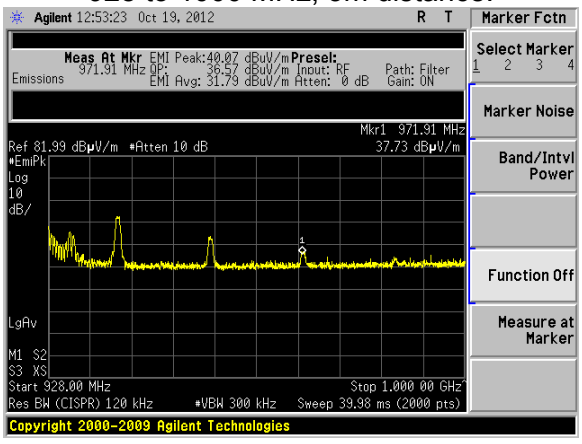
30 to 300 MHz, 3m distance.



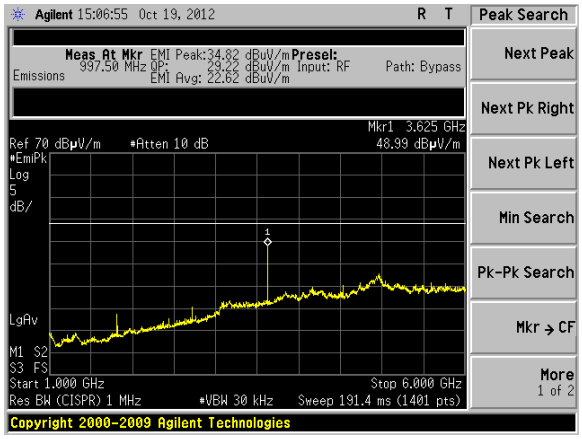
300 to 902 MHz, 3m distance.



928 to 1000 MHz, 3m distance.



1000 to 6000 MHz, 3m distance.



4000 to 10000 MHz, 1m distance.

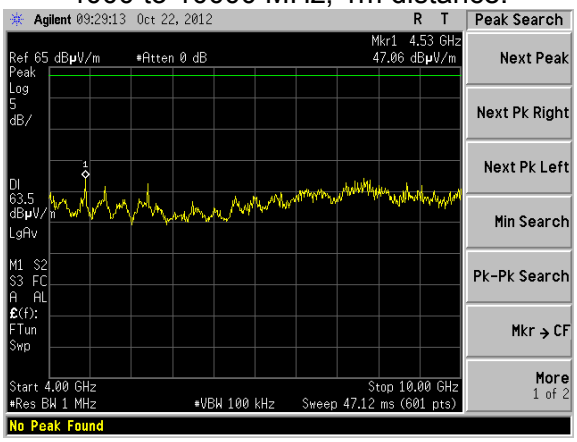


EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE

THIS SECTION IS NOT APPLICABLE SINCE THE EUT IS BATTERY POWERED

EXHIBIT 7. OCCUPIED BANDWIDTH

Test Engineer(s): Khairul Aidi Zainal

7.1 - Limits

For a DTS system operating in the 902 to 928 MHz band, the minimum 6dB emission bandwidth limit is 500 kHz.

7.2 - Method of Measurements

Industry Canada (IC RSS GEN 4.6.1) also requires the measurement of the 99% bandwidth in addition to the 6dB emission bandwidth. For this portion of the tests, a direct measurement of the transmitted signal was performed at the antenna port of the EUT, via a cable connection to a spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings there by allowing direct measurements, without the need for any further corrections. The EUT was configured to run in a 100% duty cycle, continuous transmit mode, while being supplied with typical data as a modulation source. A bandwidth measurement function that is built into the spectrum analyzer was used to measure the 99 % and 6dB bandwidth.

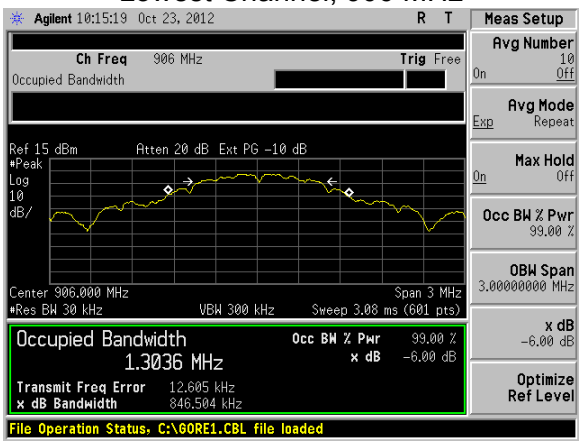
7.3 - Test Data

Occupied bandwidth (kHz)

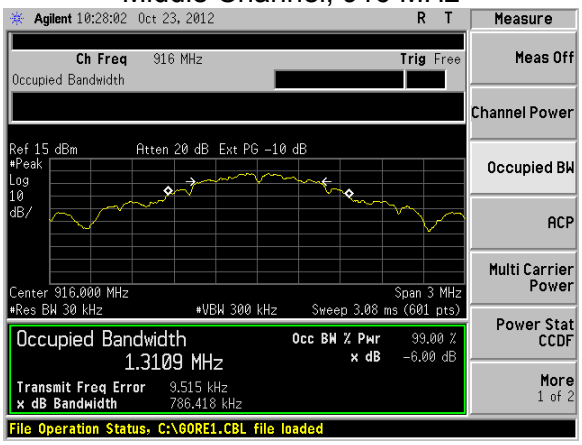
Channel	99%	6dB	20dB	26dB
906.0	**1303.6**	846.5	1215.0	2138.0
916.0	**1310.9**	786.4	1210.0	2143.0
924.0	**1319.4**	789.7	1205.0	2065.0

7.4 – Screen Captures

Lowest Channel, 906 MHz



Middle Channel, 916 MHz



Highest Channel, 924 MHz

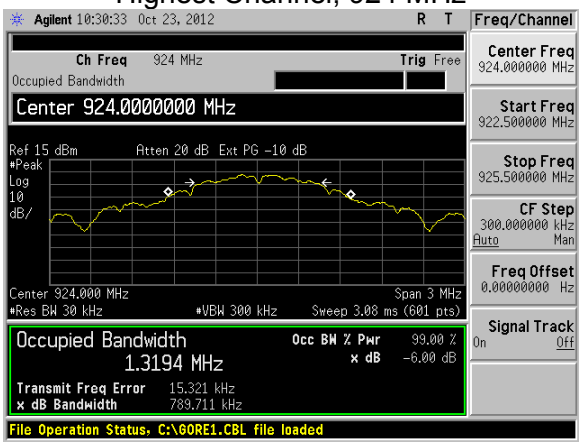


EXHIBIT 8. BAND EDGE MEASUREMENTS

Test Engineer(s): Khairul Aidi Zainal and Shane Rismeyer.

8.1 - Method of Measurements

FCC 15.247(d) require a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band-Edges where the intentional radiator operates. Also, RSS 210 Section 2.2 requires that unwanted emissions meet limits listed in RSS GEN and also to the limits in the applicable annex. The following screen captures demonstrate compliance of the intentional radiator at the 902 - 928 MHz Band-Edges. The EUT was operated in 100% duty cycle continuous transmit mode with continuous modulation, with internally generated data as the modulating source. The EUT was operated at the lowest channel for the investigation of the lower Band-Edge, and at the highest channel for the investigation of the higher Band-Edge.

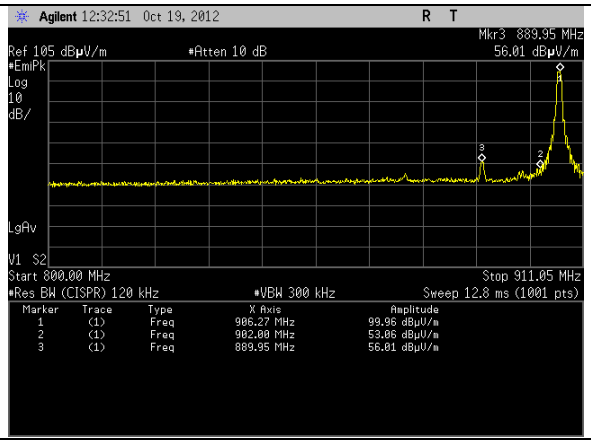
The Band-edge measurements were performed conducted and radiated. The measurement of band-edge was performed to satisfy FCC 15.247(d).

Conducted measurements of the spurious emission were performed with a measurement bandwidth of 100kHz.

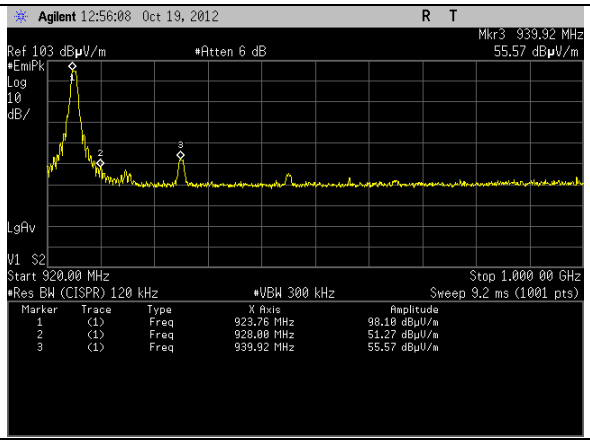
8.2. Band edge captures.

Radiated Band-edge:

A. Continuously transmitting and modulated.



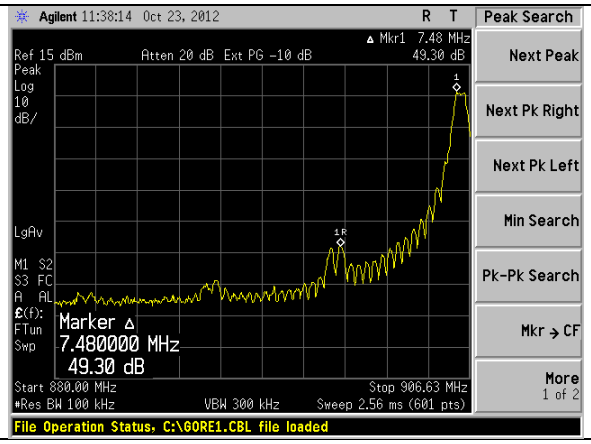
Lower band edge Peak



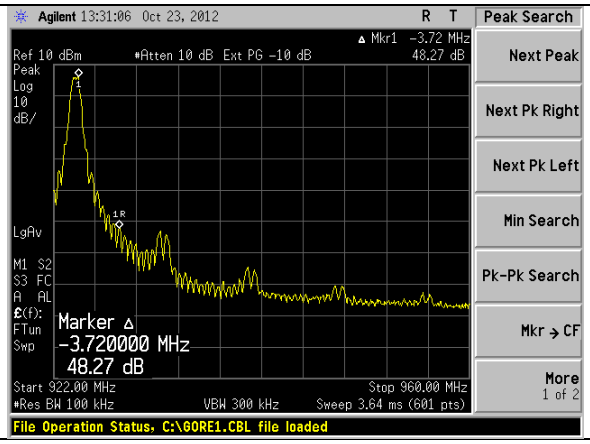
Upper band edge Peak

Conducted Band-edge:

A. Continuously transmitting and modulated.



Lower band edge



Upper band edge

EXHIBIT 9. POWER OUTPUT (CONDUCTED)

Test Engineer(s): Khairul Aidi Zainal

9.1 - Method of Measurements

The conducted RF output power of the EUT was measured at the antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings there by allowing direct measurements without the need for any further corrections. The unit was configured to run in a 100% duty cycle, continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with the appropriate resolution bandwidth, with measurements from a peak detector presented in the chart below.

The measurement method per KDB 558074 D01 DTS Measurement Guide v02 was option 1 (Section 8.1.1).

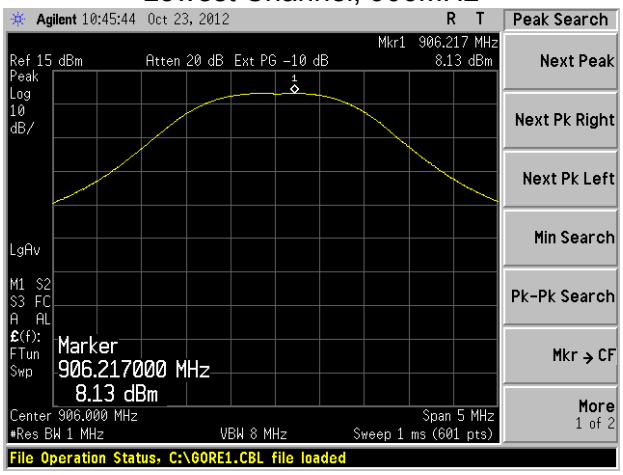
9.2 - Test Data

Maximum Peak Conducted output power

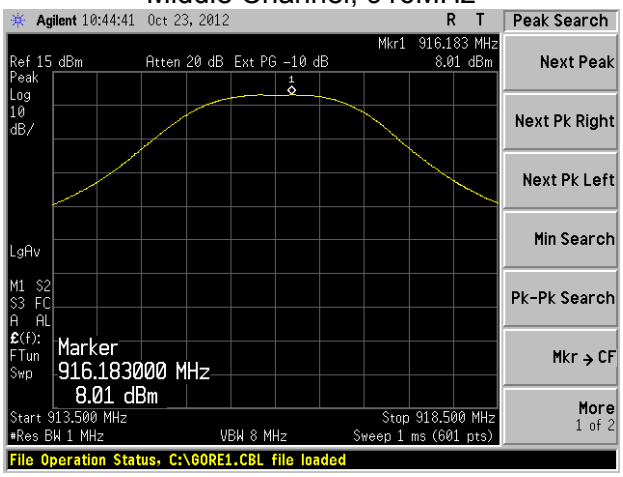
Channel	Power (dBm)	Limit	Margin
906.0	8.1	30.0	21.9
916.0	8.0	30.0	22.0
924.0	7.9	30.0	22.1

9.3 – Screen Captures.

Lowest Channel, 906MHz



Middle Channel, 916MHz



Highest Channel, 924MHz

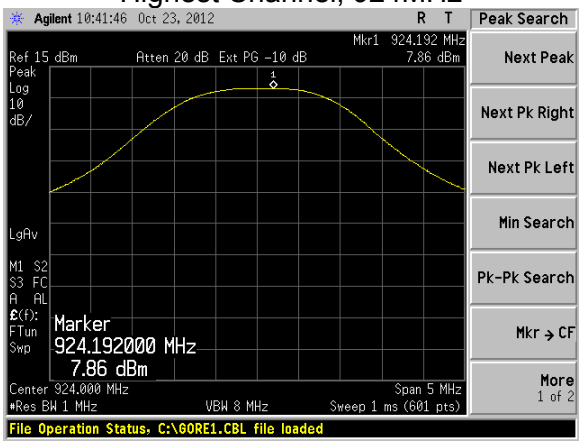


EXHIBIT 10. CONDUCTED SPURIOUS EMISSIONS

Test Engineer(s): Khairul Aidi Zainal

10.1 - Limits

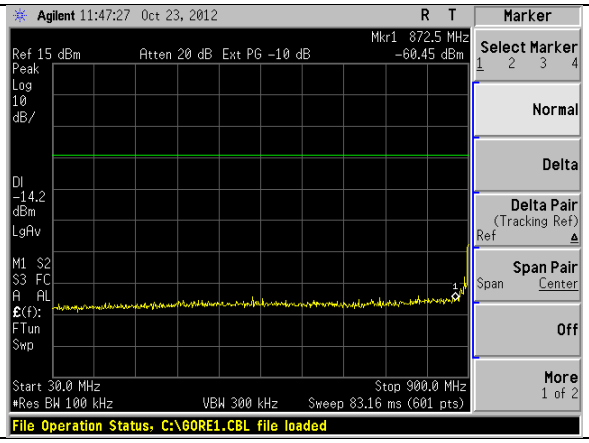
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 db below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

10.2 – Conducted Harmonic And Spurious RF Measurements

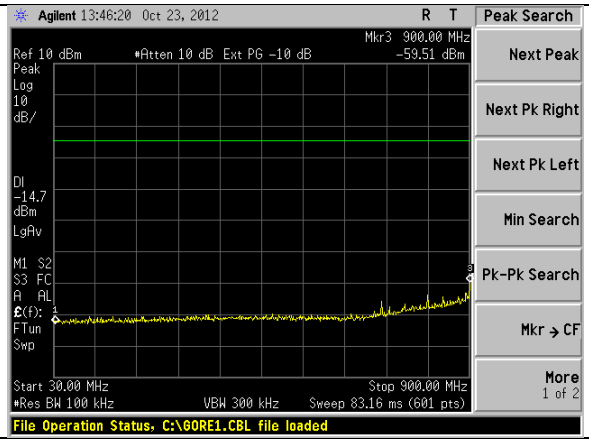
FCC Part 15.247(d) and IC RSS 210 A8.5 both require a measurement of conducted harmonic and spurious RF emission levels, as reference to the carrier level when measured in a 100 kHz bandwidth. For this test, the spurious and harmonic RF emissions from the EUT were measured at the EUT antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct readings of the measurements made without the need for any further corrections. A spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with measurements from a peak detector presented in the chart below. Screen captures were acquired and any noticeable spurious and harmonic signals were identified and measured.

10.3 - Test Data

30 MHz to 900 MHz

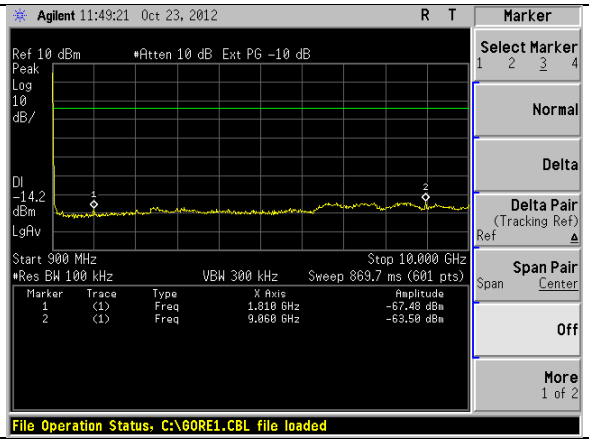


Low channel

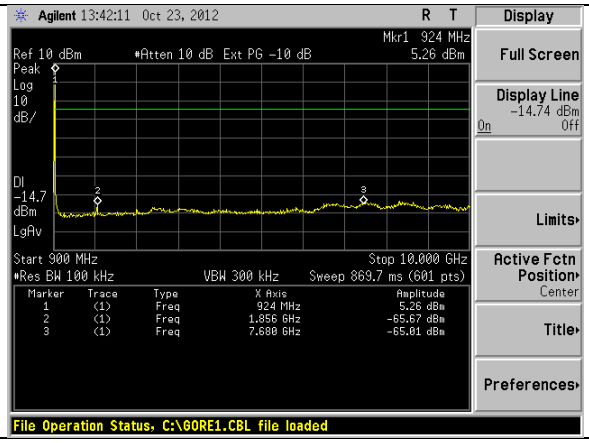


High channel

900 MHZ to 10000 MHz



Low channel



High channel

EXHIBIT 11. POWER SPECTRAL DENSITIES: 15.247(e)

11.1 Limits

For digitally modulate systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

The measurement method per KDB 558074 D01 DTS Measurement Guide v02 was option 1 (Section 9.1).

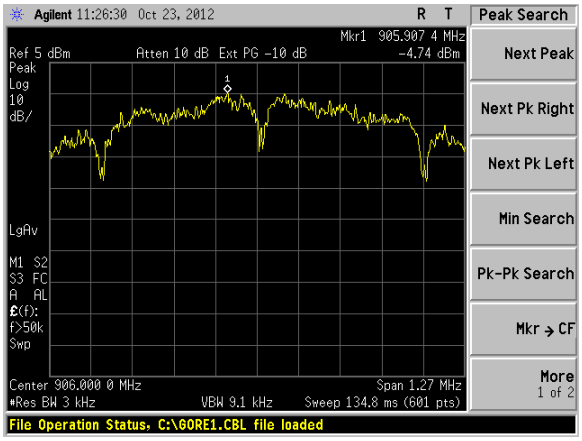
In accordance with FCC Part 15.247(e) and RSS 210 A8.2(b), the peak power spectral density should not exceed +8 dBm in any 3 kHz band. This measurement was performed along with the conducted power output readings performed as described in previous sections. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed. The highest density was found to be no greater than -4.2 dBm, which is under the allowable limit by 12.2 dB.

11.2 Test Data

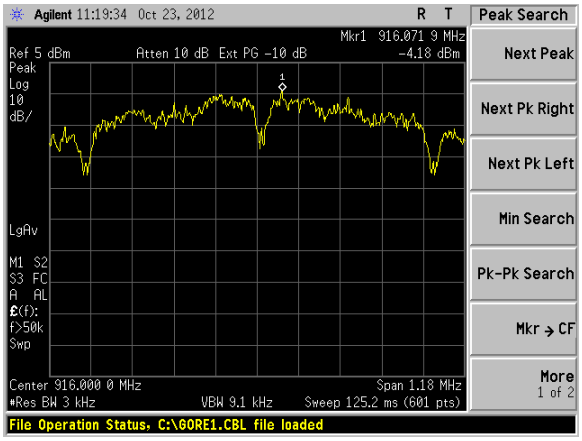
CHANNEL (MHz)	PSD IN 3kHz (dBm)	LIMIT (dBm)	MARGIN (dB)
906.0	-4.7	8.0	12.7
916.0	-4.2	8.0	12.2
924.0	-4.2	8.0	12.2

11.4 Screen Captures – Power Spectral Density

Low Channel



Middle Channel



High Channel

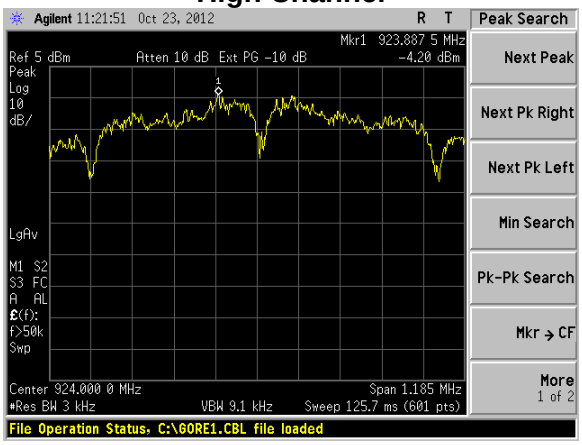


EXHIBIT 12. FREQUENCY & POWER STABILITY OVER VOLTAGE VARIATIONS

Test Engineer(s): Khairul Aidi Zainal

The power and frequency stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the power and frequency at the appropriate frequency markers. Power was supplied by an external bench-type DC power supply and was varied ±15% from the nominal.

2.55 VDC		3.0 VDC		3.45 VDC	
Power (dBm)	Frequency (Hz)	Power (dBm)	Frequency (Hz)	Power (dBm)	Frequency (Hz)
8.0	906011712	**7.9**	906011845	**8.0**	906012187
7.9	916011684	**8.0**	916011651	**7.9**	916011584
8.0	924011710	**8.1**	924011640	**8.0**	924011640

Channel	max	min	freq drift (Hz)
Low	906012187	906011712	475
Middle	916011684	916011584	100
High	924011710	924011640	70

The EUT has better than 100 PPM frequency stability.

The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characteristics were well behaved, and the system returned to the same state of operation as before the power cycle.

APPENDIX A – Test Equipment List

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 19-Oct-2012 Type Test: Conducted Measurements Job #: C-1574

Prepared By: Aidi Customer: TekTone Sound and Signal Quote #: 312260

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/9/2012	5/9/2013	Active Calibration
2	AA 960143	Phaseflex	Gore	EKDD1D01048.0	5546519	6/1/2011	6/1/2013	Active Calibration

Project Engineer: Aidi Quality Assurance: Shane

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 19-Oct-2012 Type Test: Radiated measurements. Job #: C-1574

Prepared By: Adam Customer: TekTone Sound and Signal Quote #: 312260

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960156	100MHz-1GHz Analog Signal Generator	Agilent	N5181A	MY 49060062	6/30/2012	6/30/2013	Active Calibration
2	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY 48250225	6/29/2012	6/29/2013	Active Calibration
3	EE 960158	RF Preselecter	Agilent	N9039A	MY 46520110	6/29/2012	6/29/2013	Active Calibration
4	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	11/15/2011	11/15/2012	Active Calibration
5	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	5/16/2012	5/16/2013	Active Calibration
6	AA 960005	Biconical Antenna	EMCO	93110B	9601-2280	6/26/2012	6/26/2013	Active Calibration
7	EE 960160	0.8-21GHz LNA	Mini-Circuits	ZVA-213X-S+	977711030	9/17/2012	9/17/2013	Active Calibration
8	AA 960155	900MHz High Pass Filter	KWM	HPF-L-14185	7272-03	3/5/2012	3/5/2013	Active Calibration
9	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/9/2012	5/9/2013	Active Calibration
10	EE 960147	Pre-Amp	Adv. Micro	WLA 612	123101	1/6/2012	1/6/2013	Active Calibration
11	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	1/6/2012	1/6/2013	Active Calibration
12	AA 960144	Phaseflex	Gore	EKDD1D01072D	5800373	6/1/2011	6/1/2013	Active Calibration

Project Engineer: Aidi Quality Assurance: Aidi

APPENDIX B – Test Standards: CURRENT PUBLICATION DATES RADIO

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2003		
ANSI C63.10	2009		
FCC 47 CFR, Parts 0-15, 18, 90, 95	2012		
RSS GEN	2010		
RSS 210	2010		

APPENDIX C - Uncertainty Statement

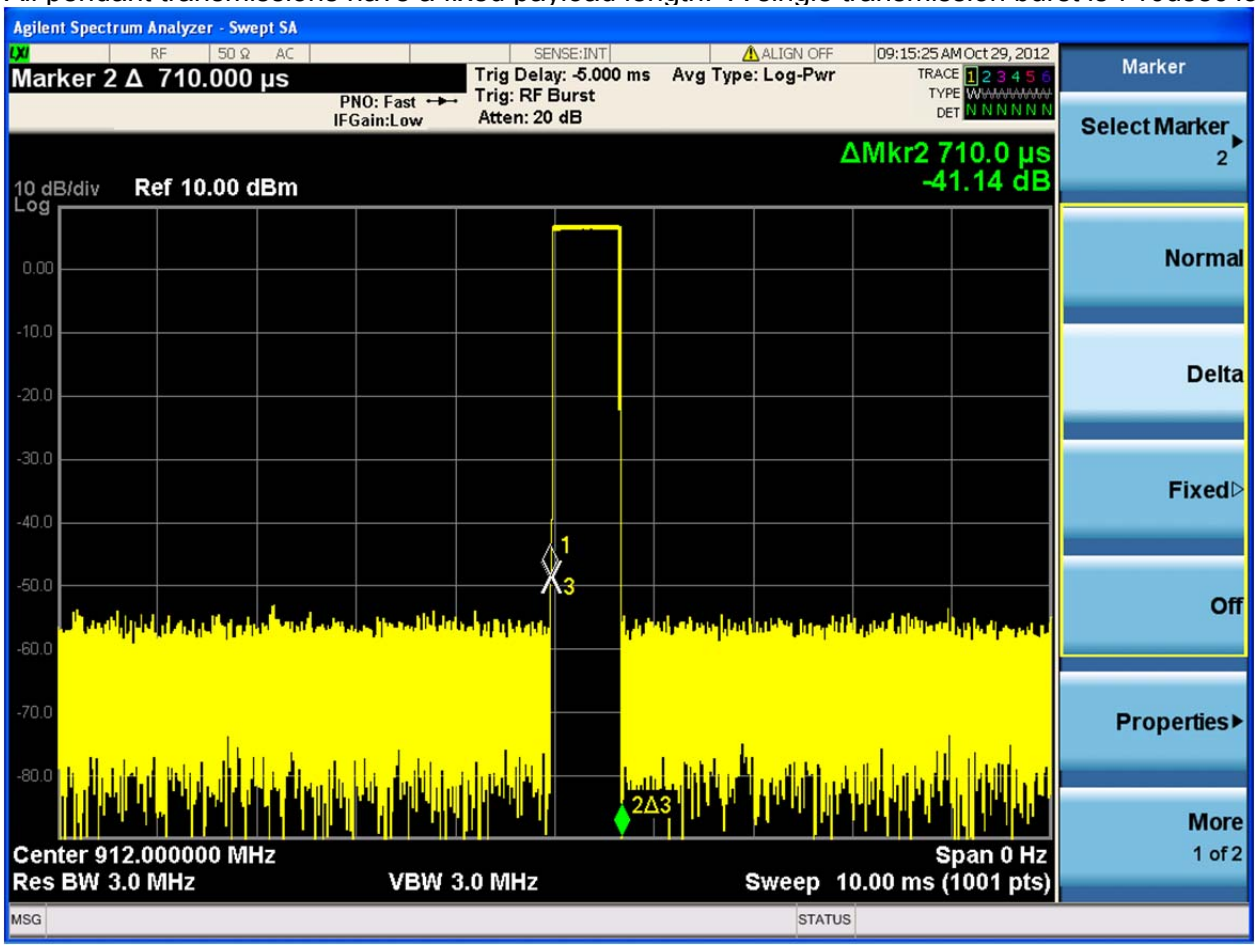
Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	*Particular Configuration*	*Uncertainty Values*
Radiated Emissions	*3 – Meter chamber, Biconical Antenna*	*4.82 dB*
Radiated Emissions	*3-Meter Chamber, Log Periodic Antenna*	*4.88 dB*
Radiated Emissions	*3-Meter Chamber, Horn Antenna*	*4.85 dB*
Radiated Emissions	*10-Meter OATS, Biconical Antenna*	*4.32 dB*
Radiated Emissions	*10-Meter OATS, Log Periodic Antenna*	*3.63 dB*
Absolute Conducted Emissions	*Agilent PSA/ESA Series*	*1.38 dB*
AC Line Conducted Emissions	*Shielded Room/EMCO LISN*	*3.20 dB*
Temperature/Humidity	*Thermo-hygrometer*	*0.64° / 2.88 %RH*

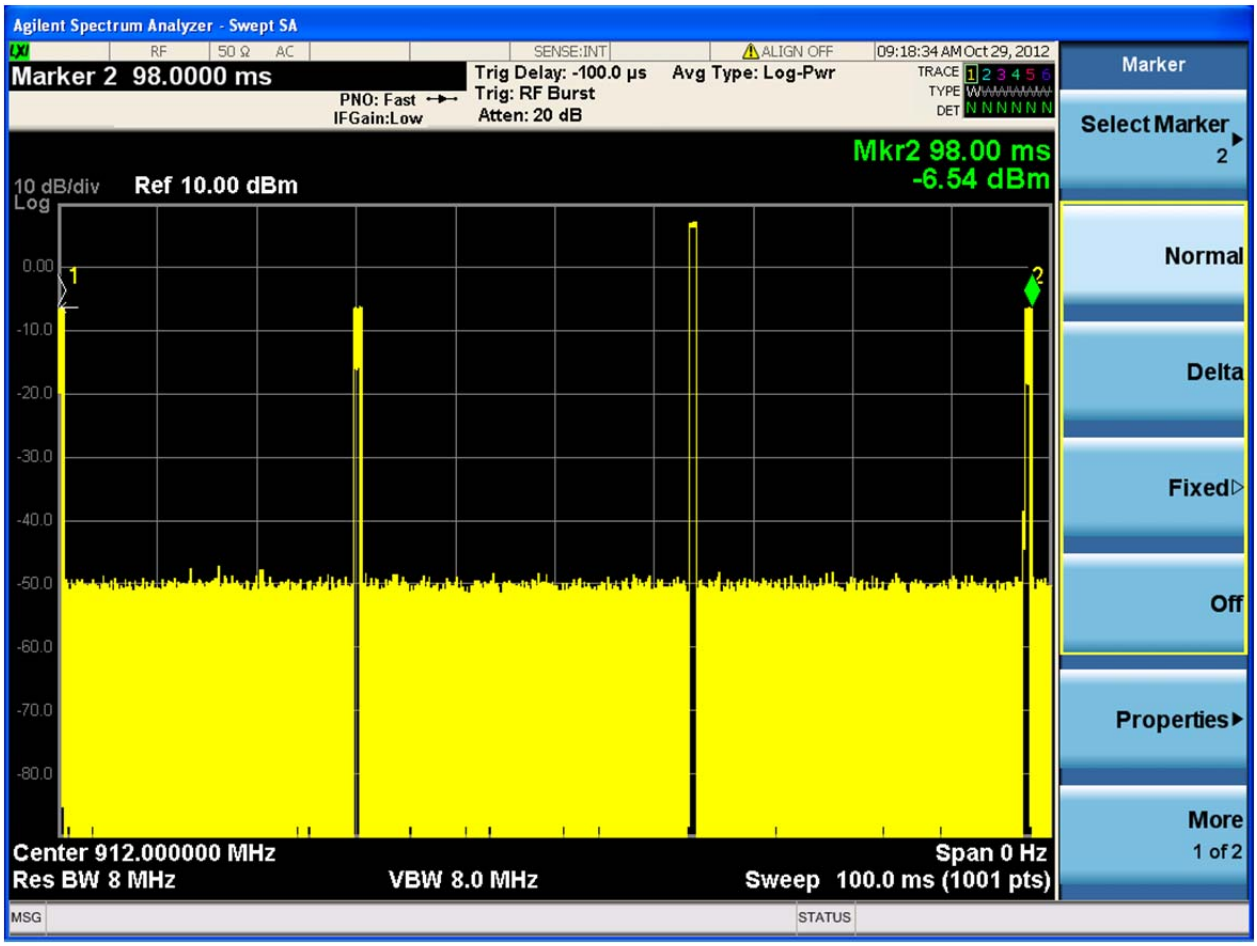
APPENDIX D – Duty Cycle Correction Justification.

Note: This section was provided by the manufacturer.

TekTone Pendant Relaxation Factor
All pendant transmissions have a fixed payload length. A single transmission burst is 710usec long.



The worst case operation for a pendant transmitter will be when it is sending alarm messages and does not receive an acknowledgement. The transmitter will continue to send the alarm message burst on 3 transmitter channels until an acknowledgement is received. These bursts are a minimum of 30msec apart as indicated in the following trace (note the lower power levels are transmissions on the other two frequencies).



Therefore the duty cycle is 710µs/30ms = 0.02367
The duty cycle correction is 20*log(0.02367) = -32.5 dB.