



Electromagnetic Compatibility Tests on an AXT200 Axient Handheld Frequency Diversity Transmitter with Zigbee Transceiver

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Specification : FCC "Code of Federal Regulations"
Title 47 Part 74
Industry Canada RSS-123
Industry Canada RSS-Gen

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REPORT REVISION HISTORY

Revision	Date	Description
--	June 15, 2011	Initial release



Electromagnetic Compatibility Tests on an Axient Handheld Frequency Diversity Transmitter with Zigbee Transceiver, Model No. AXT200

1. INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a Shure Incorporated Axient Handheld Frequency Diversity Transmitter with Zigbee Transceiver, Model No. AXT200, Serial No. None Assigned, (hereinafter referred to as the EUT). The EUT was manufactured and submitted for testing by Shure Incorporated located in Niles, IL.

The EUT can transmit simultaneously on two independent UHF channels in the following bands using a removable spiral antenna:

Group	Frequency (MHz)	Band	Output Power (mW)
1	470 – 530	G1	10, 50
2	518 – 578	H4	10, 50
3	578 – 638	J5	10, 50
4	638 – 698	L3	10, 50

The EUT also contained a digital modulation Zigbee transceiver. The transceiver was designed to transmit and receive in the 2400-2483.5 MHz band using the same removable spiral antenna that the UHF transmitter uses. The EUT contained a 0 IF (intermediate frequency) super-heterodyne type receiver.

See Elite Electronic Engineering, Inc. Engineering Test Report No. 1003369-03 for compliance testing on the Zigbee transceiver.

1.2 Purpose

The test series was performed to determine if the EUT would meet selected requirements of the FCC Part 74 for low power auxiliary station bands and Industry Canada RSS-123 and RSS-Gen for Licensed Low-Power Radio Apparatus.

1.3 Deviations, Additions, and Exclusions

There were no deviations, additions to, or exclusions from the test specification during this test series.

1.4 EMC Laboratory Identification

The electromagnetic compatibility tests were performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois.

1.5 Laboratory Conditions

The temperature at the time of the test was 22°C and the relative humidity was 31%.

2. APPLICABLE DOCUMENTS

The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 74, dated

1 October 2010

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 2, dated 1 October 2010
- RSS-Gen, "Radio Standards Specification General Requirements and Information for the Certification of Radio Apparatus", Issue 3, December 2010
- RSS-123, "Radio Standards Specification Licensed Low-Power Radio Apparatus" Issue 2, February 2011
- TIA-603-C-2004, "Land Mobile FM or PM Communications Equipment Measurement and Performance Standard"

3. TEST ITEM SET-UP AND OPERATION

3.1 General Description

The EUT is an Axient Handheld Frequency Diversity Transmitter with Zigbee Transceiver, Model No. AXT200. A block diagram of the test item set-up is shown as Figure 1.

3.1.1 Power Input

The EUT was powered by 3.6VDC from a removable, rechargeable lithium-ion battery, Shure Model AXT920.

3.1.2 Peripheral Equipment

The following peripheral equipment was submitted with the EUT:

Item	Description
Vocal Microphone Shure Model SM58	Connected to the EUT for all radiated emissions tests.

3.1.3 Signal Input/Output Leads

No interconnect cables were submitted with the EUT.

3.1.4 Grounding

The EUT was not grounded during testing.

3.1.5 Frequency of EUT

Per CFR Title 47, Section 2, part 1057, for spurious emissions measurements at the antenna terminal and for spurious radiated emissions measurements, the frequency spectrum shall be investigated up to at least the tenth harmonic of the highest fundamental frequency.

3.2 Operational Mode

All emissions tests were performed separately in the following modes:

G1:

Tx @ 470MHz, 10mW; Tx @ 470MHz, 100mW
Tx @ 500MHz, 10mW; Tx @ 500MHz, 100mW
Tx @ 530MHz, 10mW; Tx @ 530MHz, 100mW

H4:

Tx @ 418MHz, 10mW; Tx @ 418MHz, 100mW
Tx @ 548MHz, 10mW; Tx @ 548MHz, 100mW
Tx @ 578MHz, 10mW; Tx @ 578MHz, 100mW

J5:

Tx @ 578MHz, 10mW; Tx @ 578MHz, 100mW
Tx @ 608MHz, 10mW; Tx @ 608MHz, 100mW
Tx @ 638MHz, 10mW; Tx @ 638MHz, 100mW

L3:

Tx @ 638MHz, 10mW; Tx @ 638MHz, 100mW
Tx @ 668MHz, 10mW; Tx @ 668MHz, 100mW
Tx @ 698MHz, 10mW; Tx @ 698MHz, 100mW

For intermodulation tests, the unit was programmed to operate in one of the following modes:

G1:

- Transmit at 470.125MHz and 470.525MHz (minimum signal separation)
- Transmit at 470.125MHz and 529.875MHz (maximum signal separation)
- Transmit at 470MHz, 530MHz, and 2480MHz (worst case UHF intermodulation & worst case Zigbee emissions)

H4:

- Transmit at 518MHz and 518.4MHz (minimum signal separation)
- Transmit at 518MHz and 578MHz (maximum signal separation)
- Transmit at 518MHz, 578MHz, and 2480MHz (worst case UHF intermodulation & worst case Zigbee emissions)

J5:

- Transmit at 578MHz and 578.4MHz (minimum signal separation)
- Transmit at 578MHz and 638MHz (maximum signal separation)
- Transmit at 578MHz, 638MHz, and 2480MHz (worst case UHF intermodulation & worst case Zigbee emissions)

L3:

- Transmit at 638MHz and 697.875MHz (minimum signal separation)
- Transmit at 697.875MHz and 697.475MHz (maximum signal separation)
- Transmit at 638MHz, 698MHz, and 2480MHz (worst case UHF intermodulation & worst case Zigbee emissions)

3.3 EUT Modifications

No modifications were required for compliance.

4. TEST FACILITY AND TEST INSTRUMENTATION

4.1 Shielded Enclosure

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

4.2 Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 10-1.

4.3 Calibration Traceability

Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

4.4 Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

The measurement uncertainty for these tests is presented below:

Conducted Emission Measurements		
Combined Standard Uncertainty	1.07	-1.07
Expanded Uncertainty (95% confidence)	2.1	-2.1

Radiated Emission Measurements		
Combined Standard Uncertainty	2.26	-2.18
Expanded Uncertainty (95% confidence)	4.5	-4.4

5. TEST PROCEDURES

5.1 RF POWER OUTPUT MEASUREMENTS

5.1.1 Requirements

In accordance with paragraph 74.861(e)(1)(ii), for low power auxiliary stations operating in the bands allocated for TV broadcasting, the power of the measured unmodulated carrier power at the output of the transmitter power amplifier (antenna input power) may not exceed 250 milliwatts in the 470-608 and 614-806MHz bands. In accordance with paragraph 74.861(d)(1), for low power auxiliary stations operating in the bands other than those allocated for TV broadcasting, the maximum transmitter power which will be authorized is 1 watt.

For certification to paragraph 4.2 of the Industry Canada's RSS-123 requirement, the RF power output must not exceed 250 milliwatts average power as listed in Table 1.

5.1.2 Procedures

The output from the antenna port of the EUT was connected to a spectrum analyzer through 40dB of attenuation. The output power of each EUT was then measured.

5.1.3 Results

The output power measurements are presented on pages 20 through 23. As can be seen from the data, the power output of each transmitter is within the requirements of Part 74.861 and RSS-123. A photograph of the test set-up is shown in Figure 2.

5.2 FREQUENCY STABILITY

5.2.1 Requirements

In accordance with paragraph 74.861(e)(4) and section 4 of RSS-123 Table 1, for low power auxiliary stations operating in the bands allocated for TV broadcasting, the frequency tolerance of the transmitter shall be 0.005 percent.

5.2.2 Procedures

The EUT was connected to a frequency counter through the antenna output of each transmitter. The EUT

was then placed in a humidity temperature chamber.

- a) The nominal frequency of the transmitter was measured and recorded.
- b) The temperature chamber was then set to -30°C.
- c) Once the temperature had reached -30°C the EUT was allowed to soak for 30 minutes.
- d) After soaking at -30°C for thirty minutes the EUT was turned on and the transmit frequency was measured and recorded.
- e) Steps (b) through (d) were repeated for each temperature in 10°C steps from -20°C to +50°C.

5.2.3 Results

The frequency stability measurements are presented on pages 23 through 27. As can be seen from the data the test frequency deviation was within the 0.005 percent limit. A photograph of the test set-up is shown in Figure 2.

5.3 FIELD STRENGTH OF SPURIOUS EMISSIONS

5.3.1 Requirements

In accordance with paragraph 74.861 of CFR 47, the power of any emission on any frequency removed from the operating frequency by more than 250 % of the authorized bandwidth shall be attenuated by at least $43 + 10 \log (P)$ dB.

In accordance with RSS-123 paragraph 5.5.1, the power of any emission on any frequency removed from the carrier frequency by more than 250% of the authorized bandwidth shall be attenuated by at least $55 + 10 \log (P)$ dB.

5.3.2 Procedures

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4 2003 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

1. Preliminary radiated measurements were performed to determine the frequencies where the significant emissions might be found. With the EUT at one set position and the measurement antenna at a set height (i.e. without maximizing), the radiated emissions were measured using a peak detector and automatically plotted. The broadband measuring antenna was positioned at a 3 meter distance from the EUT. This data was then automatically plotted. All preliminary tests were performed separately with the EUT operating in the modes listed in Para. 3.2.
2. All significant broadband and narrowband signals found in the preliminary sweeps were then measured using a peak detector at a test distance of 3 meters. The measurements were made with a bilog antenna over the frequency range of 30MHz to 1GHz, and a double ridged waveguide antenna was used for frequencies above 1GHz.
3. To ensure that maximum emission levels were measured, the following steps were taken:
 - a. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
 - b. Since the measuring antennas are linearly polarized, both horizontal and vertical field components were measured.

- c. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, another antenna was set in place of the test item and connected to a calibrated signal generator. (A tuned dipole was used for all measurements below 1GHz and a double ridged waveguide antenna was used for all measurements above 1GHz.) The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was corrected to compensate for cable loss, as required, and for frequencies above 1GHz, increased by the gain of the waveguide.

5.3.3 Results

The preliminary plots peak levels are presented on pages 28 through 123. Factors for the antennas and cables were added to the data before it was plotted. This data is only presented for a reference, and is not used as official data. All significant radiated emissions were subsequently measured using the substitution method.

The final radiated levels are presented on pages 124 through 147. The radiated emissions were measured through the 10th harmonic. All emissions measured from the EUT were within the specification limits. Photographs of the test set-up are shown in Figure 3 and Figure 4.

5.4 INTERMODULATION – ANTENNA CONDUCTED EMISSIONS

5.4.1 Requirements

Per a response to Inquiry to FCC (tracking number 294618), intermodulation testing must be performed in three configurations in each band:

- 1) Simultaneous transmission of the two UHF signals at minimum separation (Zigbee Off)
- 2) Simultaneous transmission of the two UHF signals at maximum separation (Zigbee Off)
- 3) Simultaneous testing with the Part 15 (Zigbee) transmitter and the two UHF signals. This test should be performed with the worst case Part 15 (Zigbee) frequency and the worst case intermodulation configuration of the two UHF signals (as determined in steps 1 and 2 listed above).

Any intermodulation of the two UHF signals must meet the appropriate requirements of 74.861 of CFR 47 for spurious emissions. Any intermodulation of the UHF transmitter and the Part 15 (Zigbee) transmitter must meet the appropriate requirements of 15.247 and the appropriate requirements of 74.861 of CFR 47 for spurious emissions. (See Elite Electronic Engineering, Inc. Engineering Test Report No. 1003369-01 for more information on the Zigbee transmitter.)

In accordance with paragraph 74.861 of CFR 47, the power of any emission on any frequency removed from the operating frequency by more than 250 % of the authorized bandwidth shall be attenuated by at least $43 + 10 \log (P)$ dB.

Per section 15.247(c), the spurious emissions in any 100 kHz BW outside the frequency band must be at least 20dB below the highest 100 kHz BW level measured within the band.

5.4.2 Procedure

5.4.2.1 Simultaneous transmission of the two UHF signals

The output of the EUT was connected to the spectrum analyzer through 40dB of attenuation. The resolution bandwidth (RBW) was set to 100kHz. The peak detector and 'Max-Hold' function were engaged. The emissions in the frequency range from 30MHz to at least the 10th harmonic of the higher

UHF signal were observed and plotted. Next the frequency range was reduced so that just the two UHF signals and any 2nd order intermodulation products were observed and plotted. These tests were performed twice in each band, one with simultaneous transmission of the two UHF signals at minimum separation (Zigbee Off) and one with simultaneous transmission of the two UHF signals at maximum separation (Zigbee Off).

5.4.2.2 Simultaneous transmission of the two UHF signals and the Zigbee transmitter

The output of the EUT was connected to the spectrum analyzer through 40dB of attenuation (20dB of attenuation above 18GHz). The resolution bandwidth (RBW) was set to 100kHz. The peak detector and 'Max-Hold' function were engaged. The emissions in the frequency range from 30MHz to 25GHz were observed and plotted with the EUT transmitting at the worst case intermodulation configuration of the two UHF signals and the worst case Part 15 (Zigbee) transmitter frequency simultaneously.

5.4.3 Results

The plots of the antenna conducted intermodulation emissions levels are presented on pages 148 through 263. These plots show that the spurious emissions were attenuated by at least $43 + 10 \log (P)$ dB (= -13dBm).

5.5 INTERMODULATION – RADIATED EMISSIONS

5.5.1 Requirements

Per a response to Inquiry to FCC (tracking number 294618), intermodulation testing must be performed in three configurations in each band:

- 1) Simultaneous transmission of the two UHF signals at minimum separation (Zigbee Off)
- 2) Simultaneous transmission of the two UHF signals at maximum separation (Zigbee Off)
- 3) Simultaneous testing with the Part 15 (Zigbee) transmitter and the two UHF signals.

This test should be performed with the worst case Part 15 (Zigbee) frequency and the worst case intermodulation configuration of the two UHF signals (as determined in steps 1 and 2 listed above).

Any intermodulation of the two UHF signals must meet the appropriate requirements of 74.861 of CFR 47 for spurious emissions. Any intermodulation of the UHF transmitter and the Part 15 (Zigbee) transmitter must meet the appropriate requirements of 15.247 and the appropriate requirements of 74.861 of CFR 47 for spurious emissions. (See Elite Electronic Engineering, Inc. Engineering Test Report No. 1003369-01 for more information on the Zigbee transmitter.)

In accordance with paragraph 74.861 of CFR 47, the power of any emission on any frequency removed from the operating frequency by more than 250 % of the authorized bandwidth shall be attenuated by at least $43 + 10 \log (P)$ dB.

Per section 15.247(c), the spurious emissions in any 100 kHz BW outside the frequency band must be at least 20dB below the highest 100 kHz BW level measured within the band.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Paragraph 15.209(a) has the following radiated emission limits:

Frequency MHz	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30.0-88.0	100	3
88.0-216.0	150	3
216.0-960.0	200	3
Above 960	500	3

5.5.2 Procedures

5.5.2.1 Simultaneous transmission of the two UHF signals

Radiated measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

1. Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to at least the 10th harmonic of the higher UHF signal was investigated using a peak detector function.
2. All significant broadband and narrowband signals found in the preliminary sweeps were then measured using a peak detector at a test distance of 3 meters. The measurements were made with a bilog antenna over the frequency range of 30MHz to 1GHz, and a double ridged waveguide antenna was used for frequencies above 1GHz.
3. To ensure that maximum emission levels were measured, the following steps were taken:
 - a. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
 - b. Since the measuring antennas are linearly polarized, both horizontal and vertical field components were measured.
 - c. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

These tests were performed twice in each band, one with simultaneous transmission of the two UHF signals at minimum separation (Zigbee Off) and one with simultaneous transmission of the two UHF signals at maximum separation (Zigbee Off).

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, another antenna was set in place of the test item and connected to a calibrated signal generator. (A tuned dipole was used for all measurements below 1GHz and a double ridged waveguide antenna was used for all measurements above 1GHz.) The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was corrected to compensate for cable loss, as required, and for frequencies above 1GHz, increased by the gain of the waveguide.

5.5.2.2 Simultaneous transmission of the two UHF signals and the Zigbee transmitter

Radiated measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

1. Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 25GHz was investigated using a peak detector function.
2. All significant broadband and narrowband signals found in the preliminary sweeps were then measured using a peak detector at a test distance of 3 meters. The measurements were made with a bilog antenna over the frequency range of 30MHz to 1GHz, and a double ridged waveguide antenna was used for frequencies above 1GHz.
3. To ensure that maximum emission levels were measured, the following steps were taken:
 - a. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
 - b. Since the measuring antennas are linearly polarized, both horizontal and vertical field components were measured.
 - c. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, another antenna was set in place of the test item and connected to a calibrated signal generator. (A tuned dipole was used for all measurements below 1GHz and a double ridged waveguide antenna was used for all measurements above 1GHz.) The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was corrected to compensate for cable loss, as required, and for frequencies above 1GHz, increased by the gain of the waveguide.

5.5.3 Results

Preliminary intermodulation radiated emissions plots are shown on pages 264 through 359. Final radiated emissions data are presented on data pages 360 through 363. As can be seen from the data, all radiated intermodulation emissions measured from the EUT were within the specification limits. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figures 3 through 4.

6. OTHER TEST CONDITIONS

6.1 Test Personnel and Witnesses

All EMC tests were performed by qualified personnel from Elite Electronic Engineering Incorporated. The test series was partially witnessed by Shure Incorporated personnel.

6.2 Disposition of the EUT

The EUT and all associated equipment were returned to Shure Incorporated upon completion of the tests.



7. CONCLUSION

It was found that the Shure Incorporated, Model AXT200 Axient Handheld Frequency Diversity Transmitter with Zigbee Transceiver, did comply with the RF power output, the frequency stability, and the field strength of spurious emissions requirements of FCC Part 74 for low power auxiliary station bands and Industry Canada RSS-123 Low Power Licensed Radio communication Devices. It was also determined that the Shure Incorporated, Model AXT200 Axient Handheld Frequency Diversity Transmitter with Zigbee Transceiver, did comply with the intermodulation requirements stated in the response to Inquiry to FCC (tracking number 294618) for Part 74 UHF transmitters and Part 15 Zigbee transmitters.

8. CERTIFICATION

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specification. The data presented in this test report pertains only to the EUT at the test date. Any electrical or mechanical modification made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

9. ENDORSEMENT DISCLAIMER

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.



10. EQUIPMENT LIST

Table 10-1

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	8/27/2010	8/27/2011
CDW3	COMPUTER			004		N/A	
CMA1	Controllers	EMCO	2090	9701-1213	---	N/A	
GBX0	SYNTHESIZED SWEEPER	HEWLETT PACKARD	83630A	3420A00976	10MHZ-26.5GHZ	4/7/2011	4/7/2012
MFC0	MICROWAVE FREQ. COUNTER	HEWLETT PACKARD	5343A	2133A00591	10HZ-26GHZ	8/19/2010	8/19/2011
NDQ0	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	311	400-1000MHZ	4/5/2011	4/5/2012
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	6/7/2010	7/7/2011
NWF0	RIDGED WAVE GUIDE	EMCO	3105	2035	1-12.4GHZ	1/29/2011	1/29/2012
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	8/31/2010	8/31/2011
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	3/9/2011	3/9/2012
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/24/2011	3/24/2012
SES1	24VDC POWER SUPPLY	P TRANS	FS-32024-1M	002	18-27VDC	NOTE 1	
T1P0	10dB ATTENUATOR (40GHz)	WEINSCHEL	89-10-12	254	DC-40GHz	1/7/2011	1/7/2012
T2D7	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-43	AY9246	DC-18GHZ	8/9/2010	8/9/2011
T2DJ	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BS0923	DC-18GHZ	8/9/2010	8/9/2011
T2S3	20DB 25W ATTENUATOR	WEINSCHEL	46-20-34	BV3544	DC-18GHZ	1/3/2011	1/3/2012
T2S8	20DB 25W ATTENUATOR	WEINSCHEL	46-20-34	BV3541	DC-18GHZ	1/3/2011	1/3/2012
XPU1	HIGH PASS FILTER (1000MHz)	MINI-CIRCUITS	NHP-1000+	849	DC-3GHz	NOTE 1	

I/O: Initial Only

N/A: Not Applicable

Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

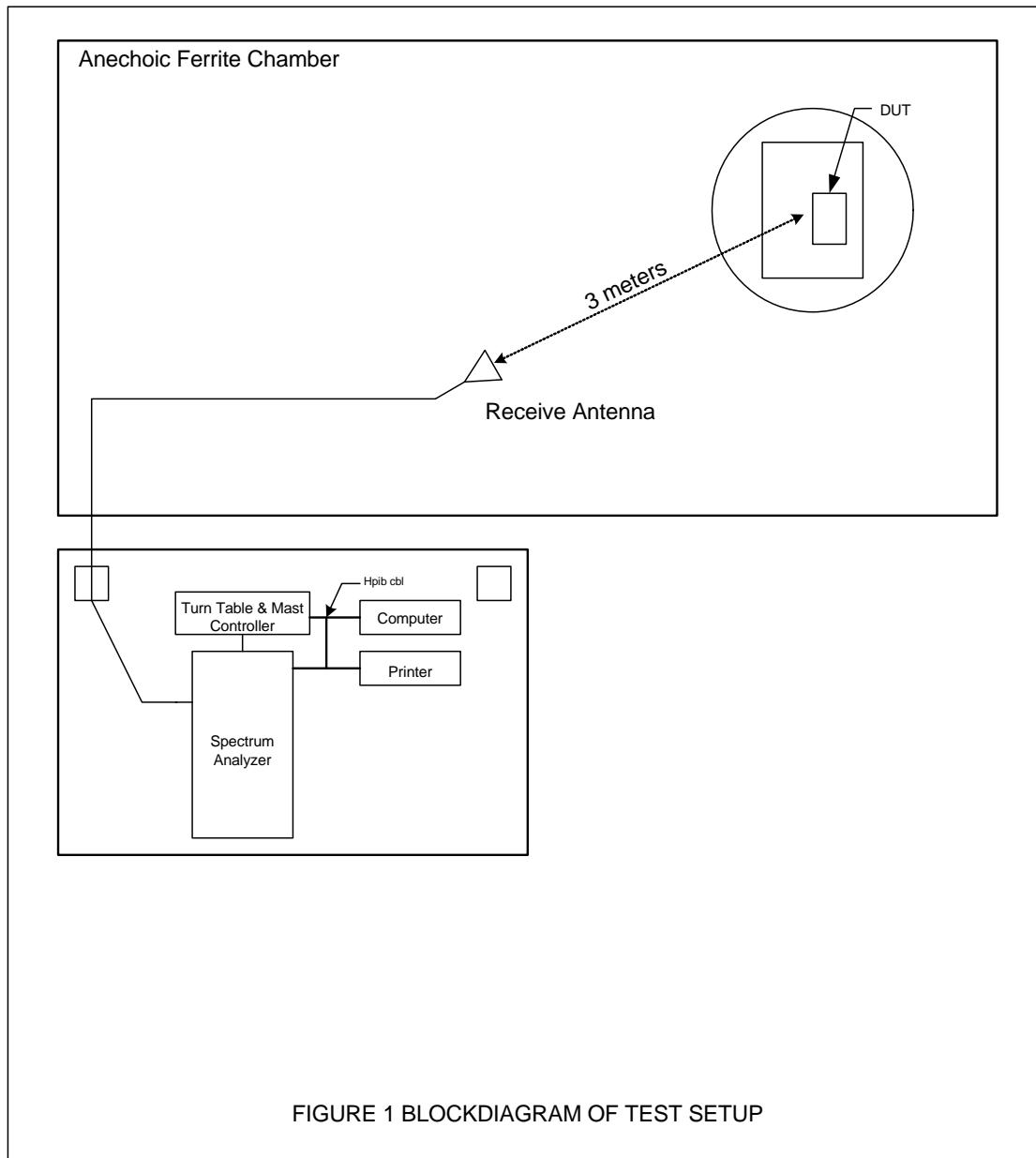


Figure 2

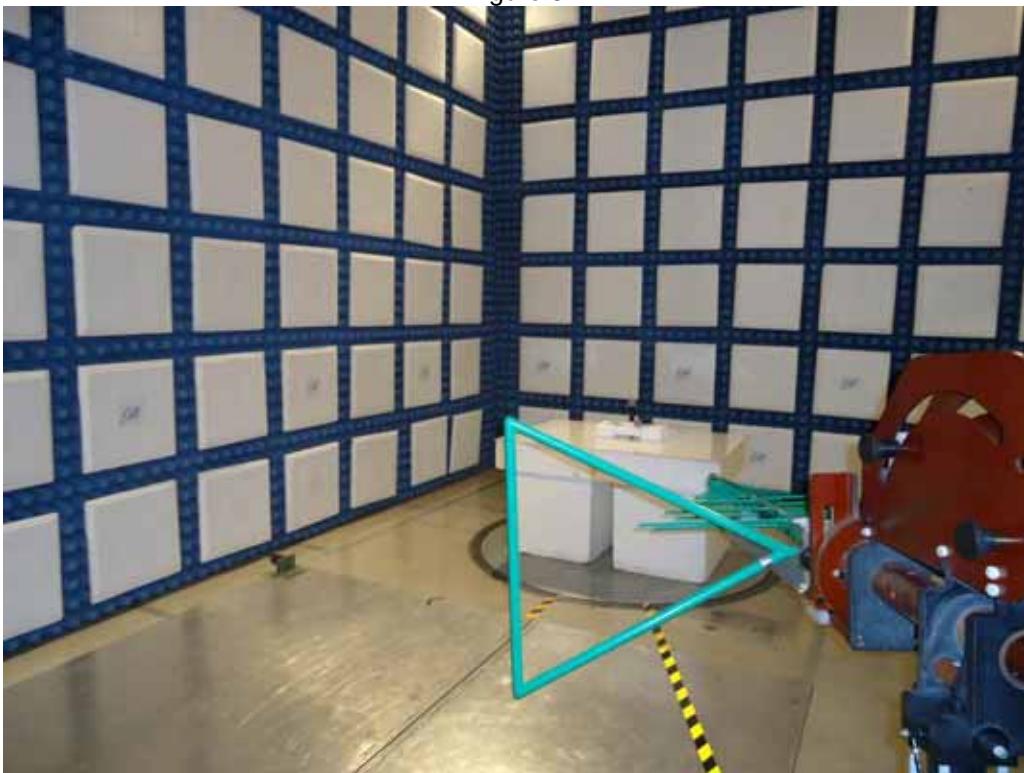


Test Set-up for RF Power Output Test



Test Set-up for Frequency Stability Test

Figure 3



Test Set-up for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization



Test Set-up for Radiated Emissions, 30MHz to 1GHz – Vertical Polarization

Figure 4



Test Set-up for Radiated Emissions, Above 1GHz – Horizontal Polarization



Test Set-up for Radiated Emissions, Above 1GHz – Vertical Polarization



MANUFACTURER : Shure Incorporated
MODEL : AXT200 G1
SPECIFICATION : FCC-74 and RSS-123 RF Power Output
DATE : March 23, 2011
MODE : Transmit, single UHF, Zigbee off
UNIT : Group G1
EQUIPMENT USED : RBA0, T2S8, T2DJ
NOTES : Attenuators measured 39.6 dB insertion loss

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
470.125	10	9.5	250	250
470.125	50	44.7	250	250

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
500	10	12.0	250	250
500	50	53.7	250	250

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
529.875	10	9.5	250	250
529.875	50	46.8	250	250

Checked By:

Craig M. Dinsmore



MANUFACTURER : Shure Incorporated
MODEL : AXT200 H4
SPECIFICATION : FCC-74 and RSS-123 RF Power Output
DATE : March 23, 2011
MODE : Transmit, single UHF, Zigbee off
UNIT : Group H4
EQUIPMENT USED : RBA0, T2S8, T2DJ
NOTES : Attenuators measured 39.6 dB insertion loss

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
518	10	8.5	250	250
518	50	45.7	250	250

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
548	10	9.1	250	250
548	50	46.8	250	250

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
578	10	8.7	250	250
578	50	42.6	250	250

Checked By:

Craig M. Dinsmore



MANUFACTURER : Shure Incorporated
MODEL : AXT200 J5
SPECIFICATION : FCC-74 and RSS-123 RF Power Output
DATE : March 23, 2011
MODE : Transmit, single UHF, Zigbee off
UNIT : Group J5
EQUIPMENT USED : RBA0, T2S8, T2DJ
NOTES : Attenuators measured 39.6 dB insertion loss

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
578	10	8.3	250	250
578	50	44.7	250	250

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
607.875	10	8.5	250	250
607.875	50	41.7	250	250

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
638	10	9.1	250	250
638	50	40.7	250	250

Checked By:


Craig M. Dinsmore

Craig M. Dinsmore



MANUFACTURER : Shure Incorporated
MODEL : AXT200 L3
SPECIFICATION : FCC-74 and RSS-123 RF Power Output
DATE : March 23, 2011
MODE : Transmit, single UHF, Zigbee off
UNIT : Group L3
EQUIPMENT USED : RBA0, T2S8, T2DJ
NOTES : Attenuators measured 39.6 dB insertion loss

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
638	10	9.5	250	250
368	50	42.6	250	250

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
668	10	9.3	250	250
668	50	45.7	250	250

Frequency MHz	Nominal Power mW	Measured Power mW	FCC-74 Limit mW	RSS-123 Limit mW
697.875	10	8.7	250	250
697.875	50	41.7	250	250

Checked By:


Craig M. Dinsmore

MANUFACTURER : Shure Incorporated



MODEL : AXT200 G1
SPECIFICATION : FCC-74 and RSS-123 RF Frequency Stability over temp range
DATE : April 15-18, 2011
MODE : Transmit, single UHF, Zigbee off High Power only
UNIT : Group G1
EQUIPMENT USED : RBA0, T2S8, T2DJ, MFC0
NOTES : Attenuators measured 39.6 dB insertion loss

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	470.125	DID NOT POWER UP AT THIS TEMPERATURE					PASS
-20	470.125	470.124676	-0.0000682	0.005	-324	23506.25	PASS
-10	470.125	470.124704	-0.0000630	0.005	-296	23506.25	PASS
0	470.125	470.124849	-0.0000328	0.005	-151	23506.25	PASS
10	470.125	470.124994	-0.0000013	0.005	-6	23506.25	PASS
20	470.125	470.124935	-0.0000138	0.005	-65	23506.25	PASS
30	470.125	470.124925	-0.0000160	0.005	-75	23506.25	PASS
40	470.125	470.124407	-0.0001261	0.005	-593	23506.25	PASS
50	470.125	470.124122	-0.0001868	0.005	-878	23506.25	PASS

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	500.000000	499.999952	-0.0000096	0.005	-48.000000	25000	PASS
-20	500.000000	499.999754	-0.0000492	0.005	-246.000000	25000	PASS
-10	500.000000	499.999744	-0.0000512	0.005	-256.000000	25000	PASS
0	500.000000	499.999828	-0.0000344	0.005	-172.000000	25000	PASS
10	500.000000	499.999895	-0.0000210	0.005	-105.000000	25000	PASS
20	500.000000	500.000104	0.0000208	0.005	104.000000	25000	PASS
30	500.000000	500.000054	0.0000108	0.005	54.000000	25000	PASS
40	500.000000	499.999823	-0.0000354	0.005	-177.000000	25000	PASS
50	500.000000	499.999549	-0.0000902	0.005	-451.000000	25000	PASS

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	529.875000	529.874863	-0.0000259	0.005	-137.000000	26493.75	PASS
-20	529.875000	529.87472	-0.0000528	0.005	-280.000000	26493.75	PASS
-10	529.875000	529.874753	-0.0000466	0.005	-247.000000	26493.75	PASS
0	529.875000	529.874835	-0.0000311	0.005	-165.000000	26493.75	PASS
10	529.875000	529.874927	-0.0000138	0.005	-73.000000	26493.75	PASS
20	529.875000	529.875121	0.0000228	0.005	121.000000	26493.75	PASS
30	529.875000	529.875044	0.0000083	0.005	44.000000	26493.75	PASS
40	529.875000	529.874833	-0.0000315	0.005	-167.000000	26493.75	PASS
50	529.875000	529.874519	-0.0000908	0.005	-481.000000	26493.75	PASS

Checked By:


Craig M. Dinsmore



MANUFACTURER : Shure Incorporated
MODEL : AXT200 H4
SPECIFICATION : FCC-74 and RSS-123 RF Frequency Stability over temp range
DATE : April 15-18, 2011
MODE : Transmit, single UHF, Zigbee off High Power only
UNIT : Group H4
EQUIPMENT USED : RBA0, T2S8, T2DJ, MFC0
NOTES : Attenuators measured 39.6 dB insertion loss

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	518.000000	517.99524	-0.0009189	0.005	-4760.000000	25900	PASS
-20	518.000000	517.999563	-0.0000844	0.005	-437.000000	25900	PASS
-10	518.000000	517.999527	-0.0000913	0.005	-473.000000	25900	PASS
0	518.000000	517.999524	-0.0000919	0.005	-476.000000	25900	PASS
10	518.000000	517.99957	-0.0000830	0.005	-430.000000	25900	PASS
20	518.000000	517.999746	-0.0000490	0.005	-254.000000	25900	PASS
30	518.000000	517.999744	-0.0000494	0.005	-256.000000	25900	PASS
40	518.000000	517.999681	-0.0000616	0.005	-319.000000	25900	PASS
50	518.000000	517.999611	-0.0000751	0.005	-389.000000	25900	PASS

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	548.000000	547.999538	-0.0000843	0.005	-462.000000	27400	PASS
-20	548.000000	547.999555	-0.0000812	0.005	-445.000000	27400	PASS
-10	548.000000	547.9995	-0.0000912	0.005	-500.000000	27400	PASS
0	548.000000	547.999495	-0.0000922	0.005	-505.000000	27400	PASS
10	548.000000	547.999565	-0.0000794	0.005	-435.000000	27400	PASS
20	548.000000	547.999725	-0.0000502	0.005	-275.000000	27400	PASS
30	548.000000	547.999728	-0.0000496	0.005	-272.000000	27400	PASS
40	548.000000	547.999671	-0.0000600	0.005	-329.000000	27400	PASS
50	548.000000	547.999581	-0.0000765	0.005	-419.000000	27400	PASS

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	578.000000	577.99953	-0.0000813	0.005	-470.000000	28900	PASS
-20	578.000000	577.999544	-0.0000789	0.005	-456.000000	28900	PASS
-10	578.000000	577.999474	-0.0000910	0.005	-526.000000	28900	PASS
0	578.000000	577.999458	-0.0000938	0.005	-542.000000	28900	PASS
10	578.000000	577.999562	-0.0000758	0.005	-438.000000	28900	PASS
20	578.000000	577.999704	-0.0000512	0.005	-296.000000	28900	PASS
30	578.000000	577.999714	-0.0000495	0.005	-286.000000	28900	PASS
40	578.000000	577.999653	-0.0000600	0.005	-347.000000	28900	PASS
50	578.000000	577.999568	-0.0000747	0.005	-432.000000	28900	PASS

Checked By:

Craig M. Dinsmore



MANUFACTURER : Shure Incorporated
MODEL : AXT200 J5
SPECIFICATION : FCC-74 and RSS-123 RF Frequency Stability over temp range
DATE : April 15-18, 2011
MODE : Transmit, single UHF, Zigbee off High Power only
UNIT : Group H4
EQUIPMENT USED : RBA0, T2S8, T2DJ, MFC0
NOTES : Attenuators measured 39.6 dB insertion loss

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	578.000000	577.998859	-0.0001974	0.005	-1141.000000	28900	PASS
-20	578.000000	577.998821	-0.0002040	0.005	-1179.000000	28900	PASS
-10	578.000000	577.999027	-0.0001683	0.005	-973.000000	28900	PASS
0	578.000000	577.999031	-0.0001676	0.005	-969.000000	28900	PASS
10	578.000000	577.999367	-0.0001095	0.005	-633.000000	28900	PASS
20	578.000000	577.999751	-0.0000431	0.005	-249.000000	28900	PASS
30	578.000000	577.999839	-0.0000279	0.005	-161.000000	28900	PASS
40	578.000000	577.999501	-0.0000863	0.005	-499.000000	28900	PASS
50	578.000000	577.999443	-0.0000964	0.005	-557.000000	28900	PASS

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	607.875000	607.873765	-0.0002032	0.005	-1235.000000	30393.75	PASS
-20	607.875000	607.873791	-0.0001989	0.005	-1209.000000	30393.75	PASS
-10	607.875000	607.873928	-0.0001764	0.005	-1072.000000	30393.75	PASS
0	607.875000	607.874035	-0.0001587	0.005	-965.000000	30393.75	PASS
10	607.875000	607.872482	-0.0004142	0.005	-2518.000000	30393.75	PASS
20	607.875000	607.874741	-0.0000426	0.005	-259.000000	30393.75	PASS
30	607.875000	607.874714	-0.0000470	0.005	-286.000000	30393.75	PASS
40	607.875000	607.874583	-0.0000686	0.005	-417.000000	30393.75	PASS
50	607.875000	607.874407	-0.0000976	0.005	-593.000000	30393.75	PASS

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	638.000000	637.998683	-0.0002064	0.005	-1317.000000	31900	PASS
-20	638.000000	637.998761	-0.0001942	0.005	-1239.000000	31900	PASS
-10	638.000000	637.998831	-0.0001832	0.005	-1169.000000	31900	PASS
0	638.000000	637.999041	-0.0001503	0.005	-959.000000	31900	PASS
10	638.000000	637.999927	-0.0000114	0.005	-73.000000	31900	PASS
20	638.000000	637.999728	-0.0000426	0.005	-272.000000	31900	PASS
30	638.000000	637.999026	-0.0001527	0.005	-974.000000	31900	PASS
40	638.000000	637.999556	-0.0000696	0.005	-444.000000	31900	PASS
50	638.000000	637.999469	-0.0000832	0.005	-531.000000	31900	PASS

Checked By:

Craig M. Dinsmore



MANUFACTURER : Shure Incorporated
MODEL : AXT200 J5
SPECIFICATION : FCC-74 and RSS-123 RF Frequency Stability over temp range
DATE : April 15-18, 2011
MODE : Transmit, single UHF, Zigbee off High Power only
UNIT : Group H4
EQUIPMENT USED : RBA0, T2S8, T2DJ, MFC0
NOTES : Attenuators measured 39.6 dB insertion loss

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	578.000000	577.998859	-0.0001974	0.005	-1141.000000	28900	PASS
-20	578.000000	577.998821	-0.0002040	0.005	-1179.000000	28900	PASS
-10	578.000000	577.999027	-0.0001683	0.005	-973.000000	28900	PASS
0	578.000000	577.999031	-0.0001676	0.005	-969.000000	28900	PASS
10	578.000000	577.999367	-0.0001095	0.005	-633.000000	28900	PASS
20	578.000000	577.999751	-0.0000431	0.005	-249.000000	28900	PASS
30	578.000000	577.999839	-0.0000279	0.005	-161.000000	28900	PASS
40	578.000000	577.999501	-0.0000863	0.005	-499.000000	28900	PASS
50	578.000000	577.999443	-0.0000964	0.005	-557.000000	28900	PASS

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	607.875000	607.873765	-0.0002032	0.005	-1235.000000	30393.75	PASS
-20	607.875000	607.873791	-0.0001989	0.005	-1209.000000	30393.75	PASS
-10	607.875000	607.873928	-0.0001764	0.005	-1072.000000	30393.75	PASS
0	607.875000	607.874035	-0.0001587	0.005	-965.000000	30393.75	PASS
10	607.875000	607.872482	-0.0004142	0.005	-2518.000000	30393.75	PASS
20	607.875000	607.874741	-0.0000426	0.005	-259.000000	30393.75	PASS
30	607.875000	607.874714	-0.0000470	0.005	-286.000000	30393.75	PASS
40	607.875000	607.874583	-0.0000686	0.005	-417.000000	30393.75	PASS
50	607.875000	607.874407	-0.0000976	0.005	-593.000000	30393.75	PASS

Temp °C	Nominal Frequency	Measured Frequency	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass Or Fail
-30	638.000000	637.998683	-0.0002064	0.005	-1317.000000	31900	PASS
-20	638.000000	637.998761	-0.0001942	0.005	-1239.000000	31900	PASS
-10	638.000000	637.998831	-0.0001832	0.005	-1169.000000	31900	PASS
0	638.000000	637.999041	-0.0001503	0.005	-959.000000	31900	PASS
10	638.000000	637.999927	-0.0000114	0.005	-73.000000	31900	PASS
20	638.000000	637.999728	-0.0000426	0.005	-272.000000	31900	PASS
30	638.000000	637.999026	-0.0001527	0.005	-974.000000	31900	PASS
40	638.000000	637.999556	-0.0000696	0.005	-444.000000	31900	PASS
50	638.000000	637.999469	-0.0000832	0.005	-531.000000	31900	PASS

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