
FCC ID: CCXTS100

Prepared for:

TRIMBLE NAVIGATION (LIMITED)

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By:

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Submitted to:

**Federal Communications Commission
Equipment Authorization Division,
Applications Processing Branch**

7435 Oakland Mills Road
Columbia, Maryland 21048

February 1999

**FCC Type Acceptance Test Report
for an Intentional Radiator**

TRIMBLE NAVIGATION (LIMITED)

TS100

**Mode C ATCRBS Transponder
(Transmitter Portion)**

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THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF PROFESSIONAL TESTING (EMI), INC.



Certificate of Compliance

Applicant: Trimble Navigation (Limited), Inc.

Applicant's Address: 2105 Donley Drive
Austin, Texas 7758

Model: TS100 Mode C ATCRBS Transponder

Serial Number: ENG0001

Project Number: 99-410

Test Dates: May 19 through August 26, 1998

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measurement data and this report. I believe them to be true and accurate. The **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** was tested and found to be in compliance with FCC Parts 15 and 87 for Intentional Radiators.

Jeffrey A. Lenk
President



1.0 Equipment Under Test (EUT) Description

The **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** is a Mode C navigation transponder. The TS100 is intended for use in general aviation aircraft. The device responds to Mode C compliant radar navigation interrogations with a 127 watt peak code pulse. Altitude of the aircraft is automatically reported as part of the interrogation response with the aircraft ID code. This equipment is not marketed with an antenna or associated wiring or adapters.

The **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** is designed for use in general aviation aircraft. The **TS100** transmits at 1090 MHz when interrogated and is intended for operation under 47 CFR 87, Subpart D, E and F. Specific test requirements include the following:

47 CFR 87.131	Power and Emissions
47 CFR 2.989 & 47 CFR 87.135	Occupied Bandwidth
47 CFR 87.139	Out of Band Emissions - Conducted
47 CFR 87.139	Out of Band Emissions - Radiated
47 CFR 87.147	FAA Notification Requirement
47 CFR 87.141	Modulation Requirements
47 CFR 87.143	Transmitter Controls
47 CFR 2.995(a) & 47 CFR 87.133	Frequency Stability vs. Temperature
47 CFR 2.995(d) (1) & 47 CFR 87.133	Frequency Stability vs. DC Input Power

The system tested consisted of the following components:

EUT

<u>Manufacturer & Model</u>	<u>Serial #</u>	<u>FCC ID #</u>	<u>Description</u>
Trimble Navigation (Limited) TS100 P/N 82595-00	ENG0001	CCXTS100	Mode C ATCRBS Transponder

Support Equipment

<u>Manufacturer & Model</u>	<u>Serial #</u>	<u>FCC ID #</u>	<u>Description</u>
Power Design Model 4050	2648	N/A	DC Power Supply
IFR ATC-1200Y3	800272	N/A	ATCRBS Test Set
High Frequency Patch Antenna	N/A	N/A	Aircraft Type Patch Antenna
Bird Model 8073-1	542	N/A	50 ohm Load

Cables

Multiconductor Signal and Power Cable, 6 feet long, 1 each
 Double Shielded 50 ohm coaxial cable, 6 feet long, 1 each

The equipment within this report was tested to verify its compliance with FCC Rule Parts 2, 15 and 87, for Intentional Radiators. A separate verification report pursuant to Part 15, Subpart B has been prepared for the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** as a Digital Device.

2.0 Power and Emission Measurements and Requirements

Measurements were made on the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** to verify compliance with the power and emission requirements of §87.131.

2.1 Test Procedure

Conducted output power measurements were made at Trimble Navigation (Limited)'s Austin, Texas facility. Data from this test was verified by Professional Testing (EMI) Inc. personnel following the test.

2.2 Test Criteria

Section 87.131 of the Rules contains a table listing the allowed frequencies, emission types and power levels for aircraft related transmitter signals. The **TS100** falls under the category of Radionavigation devices, which states that the requirements for this signal will be set based on other standards during the certification process.

During a series of conversations with Mr. Tim Paulwitz of the Spectrum Engineering Division of the FAA, the output signal parameters of the **TS100** were set as the following:

- (1) Output Power: Less than or equals to 200 watts peak
- (2) Transmit Frequency: 1090.0 MHz (only transmits on interrogation)
- (3) Emission Designator: 15M5ØM1D

2.3 Test Results

Measurements were performed utilizing a wideband power meter capable of measuring pulse radar waveforms. Conducted power measurements were made directly on the antenna port of the EUT. The maximum peak power detected during this test was 211.2 watts.

Data for output power testing is located in Appendix A of this report. **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** met the §87.131 output power requirements.

3.0 Occupied Bandwidth Measurements

Measurements were made on **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** to determine the occupied bandwidth in accordance with Part 2.989.

3.1 Test Procedure

All measurements were performed in a controlled laboratory environment. The occupied bandwidth of the **TS100** was measured using a Hewlett Packard 8591E Spectrum Analyzer. The EUT was put into a constant transmit mode with the output power set to the highest setting. An internal test pattern, which simulates a typical page, was used as the modulation for the device. The occupied bandwidth was plotted with the marker for the plot set to the emission bandwidth. The occupied bandwidth was measured based on the emission width 20 dB below the peak emission level.

3.2 Test Criteria

Section 2.989 requires that the occupied bandwidth for Type Accepted units be measured and reported as part of the device filing.

3.3 Test Results

Measurements were performed utilizing a spectrum analyzer IF/video bandwidth of 100 kHz/300 kHz. The frequency span was set for 30 MHz and was centered on the peak of the output signal.

Data for occupied bandwidth testing is located in Appendix B of this report. **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** has a worst case occupied bandwidth of 15.3 MHz based on the 20 dBc criteria. This figure is within the 15.5 MHz bandwidth referenced by the FAA for this product.

4.0 Out of Band Emissions - Conducted

Conducted emissions measurements were made to determine out of band radiated noise produced by the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** transmitter. All measurements were performed in a controlled laboratory environment.

4.1 Test Procedure

The EUT was tested in a controlled laboratory environment. Measurement of the conducted antenna emissions from the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** were performed with the device being interrogated by the ATCRBS test set. A directional coupler and attenuator were used to sample the output from the EUT and provide the interrogation signal to the EUT.

All recorded data was taken using a peak detector. The final measurements provided were determined by using the following formula:

$$\text{Corrected Level} = \text{Recorded Level} + \text{Cable Loss} + \text{Coupler Loss}$$

4.2 Test Criteria

Based on the out of band emission criteria of §87.139(a), transmitter related emissions for the **TS100** shall be reduced by the following amount with respect to the level of the fundamental:

Spacing From Fundamental	Attenuation Below Fundamental (dB)
50 to 100 % of the Authorized Bandwidth	25
100 to 250 % of the Authorized Bandwidth	35
250 % of the Authorized Bandwidth to 10 th Harmonic of the Fundamental	40 for Aircraft Stations 43 +10 Log(P) for Aeronautical Stations

The **TS100** is an aircraft station, defining the last attenuation requirement as 40 dBc.

4.3 Test Results

Conducted emission data sheets are contained in Appendix C of this report. The **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** met the §87.139 conducted emission requirements.

5.0 Out of Band Emissions - Radiated

Radiated emissions measurements were made to determine out of band radiated noise produced by the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** transmitter. Radiated Emissions measurements were made at the Professional Testing Round Rock, Texas laboratory. All measurements were made in a semi-anechoic chamber at a distance of 3 meters.

5.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a turntable which allows 360 degree rotation. A measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. The radiated emissions were optimized to a height of 1 meter. Since the EUT is not marketed with an antenna, a sample antenna was attached to the EUT to obtain a reference level then replaced with a shielded 50 ohm resistive load (same impedance as the antenna) for measurement of spurious case radiation.

A Hewlett Packard Spectrum Analyzer utilizing peak detection was used during the determination of worst-case orientation. All recorded data was taken using a peak detector. The final measurements provided were determined by using the following formula:

$$\text{Corrected Level} = \text{Recorded Level} - \text{Pre-Amp Gain} + \text{Antenna Factor} + \text{Cable Loss}$$

5.2 Test Criteria

Based on the out of band emission criteria of §87.139(a), transmitter related emissions for the **TS100** shall be reduced by the following amount with respect to the level of the fundamental:

Spacing From Fundamental	Attenuation Below Fundamental (dB)
50 to 100 % of the Authorized Bandwidth	25
100 to 250 % of the Authorized Bandwidth	35
250 % of the Authorized Bandwidth to 10 th Harmonic of the Fundamental	40 for Aircraft Stations 43 +10 Log(P) for Aeronautical Stations

The **TS100** is an aircraft station, defining the last attenuation requirement as 40 dBc.

5.3 Test Results

Radiated emission data sheets are contained in Appendix D of this report. The **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** met the §87.139 spurious radiated emission requirements.

6.0 FAA Notification Requirement

Notification and coordination with the FAA was performed for the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** in order to meet the requirements of Section 87.147.

6.1 Evaluation Procedure

An official notice of pending FCC filing was forwarded to the Spectrum Engineering Division of the FAA on October 28, 1998. A copy of this letter is included as an exhibit with this application. This was followed by a series of phone conversations with Mr. Tim Paulowitz of this office in December of 1998 and January 1999. During these communications, Mr. Paulowitz reviewed the specifications of this device, including a plot of the bandwidth spectrum.

Final conversations with the FAA were made on January 5, 1999. During this conversation with Mr. Paulowitz, he stated that the emission designator for the device should be 15M5ØM1D and that no further information or communication with the FAA should be needed on this matter. He did indicate that if more information or coordination was needed, he may be contacted at (202) 267-9739.

6.2 Evaluation Results

Notification of the filing of the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** with the FCC was provided to the Spectrum Engineering Division of the FAA on October 28, 1998. This was followed by a series of phone conversations with Mr. Tim Paulowitz of this office in December 1998 and January 1999. With the official filing date of the **TS100** being later February/early March of 1999, the 30 day notice requirement with the FAA is satisfied. The **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** therefore meets FAA notice requirements of §87.147.

7.0 Modulation Requirements

An evaluation was performed to verify that the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** is compliant with the modulation requirements of Section 87.141.

7.1 Evaluation Procedure

Section 87.141 states the modulation parametrics that are allowed for specific types of earth and aircraft stations. The majority of this section deals with voice or data link type devices (not radar or radar transponders). In order to obtain guidance regarding the type of modulation that was allowed, the FAA was consulted. As indicated in other portions of this report, the FAA stated that the correct modulation type for this device is MID. In addition, recognition of the reply from the TS100 by a recognized test set indicates compliance with this modulation scheme (as well as the accepted ATCRBS code structure).

7.2 Evaluation Results

All testing of the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** was performed with interrogations from an IFR series ATCRBS test set. The test set not only sent out the interrogation request, but also verified the data sent by the **TS100**. For all tests described in this document, the EUT provided the correct reply.

Since the EUT met all the test requirements with this test pattern running, the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** meets the modulation requirements of §87.141.

8.0 Transmitter Control Requirements

An evaluation was performed to verify that the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** is compliant with the transmitter control requirements of Section 87.143.

8.1 Evaluation Procedure

Section 87.143 states the device must meet the following requirements:

- (1) Limit access to controls for the device to only person(s) authorized to operate the equipment.
- (2) Device must have a control point at the location of the transmitting equipment.
- (3) Device must have an indicator which indicates that the device is transmitting.
- (4) If the device is computer controlled, it must shut down automatically after 3 minutes of continual transmission.

An analysis of the documentation, intended use, intended installation and the hardware itself was performed to determine compliance with this specification.

8.2 Evaluation Results

The **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** has limited operator control features. The frequency and output power of the device cannot be modified by the operator. The type of traffic (Mode C or S) and aircraft ID code can be controlled by the operator, but this will not affect the output power or total bandwidth of the device. In addition, the location of the **TS100** is immediately in front of the pilot, which limits the operation of the EUT to the person that is authorized to operate the aircraft. The **TS100** has a display which indicates that when the device is transmitting

and has a control panel which can be used to turn the device off. The **TS100** replies automatically to interrogations, but immediately shuts off once the reply is transmitted.

Based on the design and installation location of the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder**, this device meets the transmitter control requirements of §87.143.

9.0 Frequency Stability

9.1 Frequency Stability versus Temperature

Measurements were made on the **TS100** to verify compliance with the frequency stability requirements of §2.995(a) and §87.133. Under this specification, the EUT is tested to verify satisfactory frequency stability versus changes in the ambient temperature.

9.1.1 Test Procedure

The tests were performed in a temperature and humidity test chamber. The EUT was powered constantly during this test and was interrogated at regular intervals from the test set. Constant transmitting of the EUT is not possible due to the power handling capability of the components inside the EUT. The TS100 is not intended for continuous transmission.

The temperature for the EUT was varied from -30 °C to +50 °C at 10 °C intervals. The EUT was allowed to soak at each temperature a minimum of 45 minutes prior to taking the frequency reading. The maximum frequency error was recorded at each data point.

9.1.2 Test Criteria

Section 87.133 indicates that the frequency for which maximum emission occurs for pulsed radar transmitters (the EUT is a pulsed radar transponder) must not be closer than $1.5/T$ (where T is the pulse duration in microseconds) MHz to the upper or lower limits of the band edge. For this device, the pulse duration is 0.5 microseconds, which means that the fundamental emission must be no closer than 3 MHz to the band edge during this test.

Based on the FAA's statement that the emission designator for this device shall be 15M5ØM1D, the allowed bandwidth of the device is 15.5 MHz. Using a fundamental emission frequency of 1090 MHz, the combination of the band edge restriction and the bandwidth of the device translates to a frequency tolerance of +/- 6.25 MHz for the fundamental.

9.1.3 Test Results

The **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** meets the frequency stability requirements for frequency stability versus temperature variation based on the criteria listed above. Data for this test is located in Appendix E of this report.

9.2 Frequency Stability versus DC Input Power

Measurements were made on the **TS100** to verify compliance with the frequency stability requirements of §2.995(d)(1) and §87.133. Under these specifications, the EUT is tested to verify satisfactory frequency stability versus changes in the amplitude of the primary power for operation from the DC input source.

9.2.1 Test Procedure

The tests were performed in a laboratory environment. The EUT was powered constantly during this test and was interrogated at regular intervals from the test set. Constant transmitting of the EUT is not possible due to the power handling capability of the components inside the EUT. The TS100 is not intended for continuous transmission.

Power to the input terminals of the EUT were varied from 10 to 32 VDC. The nominal DC input power can be from 14 to 28 VDC. The maximum frequency error was recorded at 2 volt intervals as the input voltage was varied from 10 to 32 AVDC. The response of the EUT was monitored as the line voltage was changed.

9.2.2 Test Criteria

Section 87.133 indicates that the frequency for which maximum emission occurs for pulsed radar transmitters (the EUT is a pulsed radar transponder) must not be closer than $1.5/T$ (where T is the pulse duration in microseconds) MHz to the upper or lower limits of the band edge. For this device, the pulse duration is 0.5 microseconds, which means that the fundamental emission must be no closer than 3 MHz to the band edge during this test.

Based on the FAA's statement that the emission designator for this device shall be 15M5ØM1D, the allowed bandwidth of the device is 15.5 MHz. Using a fundamental emission frequency of 1090 MHz, the combination of the band edge restriction and the bandwidth of the device translates to a frequency tolerance of +/- 6.25 MHz for the fundamental.

9.2.3 Test Results

The **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** meets the frequency stability requirements for frequency stability versus DC input power variation based on the criteria listed above. Data for this test is located in Appendix E of this report.

10.0 Form 731 Information

The following information is provided for inclusion in the FCC Form 731 for **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder**.

10.1 Emission Designator

The emission designator for the **Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder** was specified by the FAA Spectrum Engineering Division as:

15M5ØM1D

This designator implies the following parametrics for the transmit signal:

Bandwidth: 15.5 MHz

Emission Designator:: M1D

The modulation characteristics based on this designator are

Symbol Position	Parameter	Description	Resulting Symbol
1	Type of Modulation	Pulse Modulation using phase or position	M
2	Nature of Symbol(s) Modulating the Carrier	Single Channel containing Digital data excluding TDM	1
3	Type of Information Being Transmitted	Digital Data	D

10.2 Output Power

The rated output power of the **TS100** is 196.7 watts. This is based on manufacturers data and test data for the power and emission requirements testing.

10.3 Frequency Band of Operation

The **TS100** operates at a single frequency of 1090.0 MHz. No other versions of this device are available.

10.4 Frequency Stability

Based on the frequency stability criteria for this device as described in Section 9.1.2 and 9.2.2 of this report, the frequency stability of the **TS100** can be expressed as:

$$\begin{aligned}
 \text{Frequency Tolerance in Percent} &= (\text{Allowed Drift/Intended TX Frequency}) * 100 \\
 &= (6.25 \text{ MHz} / 1090.0 \text{ MHz}) * 100 \\
 &= 0.57 \%
 \end{aligned}$$

11.0 List of Test Equipment

A list of the test equipment utilized to perform the conducted and radiated emission measurements is given below. The date of calibration is given for each.

<u>Device</u>	<u>Description</u>	<u>Date Last Calibrated</u>	<u>Calibration Due</u>
HP 8566B	Spectrum Analyzer	09/22/97	09/22/98
HP 85650A	Quasi Peak Adapter	09/22/97	09/22/99
MITEQ AFS4-00101800-40-10P-N	Preamplifier	05/22/98	05/22/99
EMCO 3115	Double Ridged Horn Antenna	05/22/98	05/22/99
HP 8591E	Spectrum Analyzer	05/22/98	05/22/99
HP 437B	Wideband Power Meter	02/18/98	02/19/99
HP34401	Digital Multimeter	03/24/98	03/24/99
Inmet Model 18N20W	30 dB Attenuator	Calibrated to Test	Prior to Test
Inmet Model 6N10W	20 dB Attenuator	Calibrated to Test	Prior to Test
Narda Model 3293-1	10 dB Directional Coupler	Calibrated to Test	Prior to Test
NJE SVC 60-14	Adjustable DC Power Supply	Not Required	Not Required
Thermotron SM-32	Environmental Chamber	11/19/97	11/19/98

**Output Power
Test Data**

Appendix A

Output Power Data Sheet

**Trimble Navigation (Limited)
TS100 Mode C ATCRBS Transponder**

SERIAL #: ENG0001

PROJECT #: 99-410

DATE: November 10 1998

Frequency (MHz)	Recorded Level (watts)	Cable Loss (dB)	Corrected Level (dBm)	Corrected Level (Watts)
1090.00	127.00	1.90	52.94	196.700

COMMENT #1: Measurements made by Trimble Navigation (Limited) personnel and data reviewed by Profession Testing (EMI) Inc. personnel.

COMMENT #2:

TEST ENGINEER: _____ APPROVED BY: _____
 John O'Brien Jeffrey Lenk

Appendix B

Occupied Bandwidth Test Data

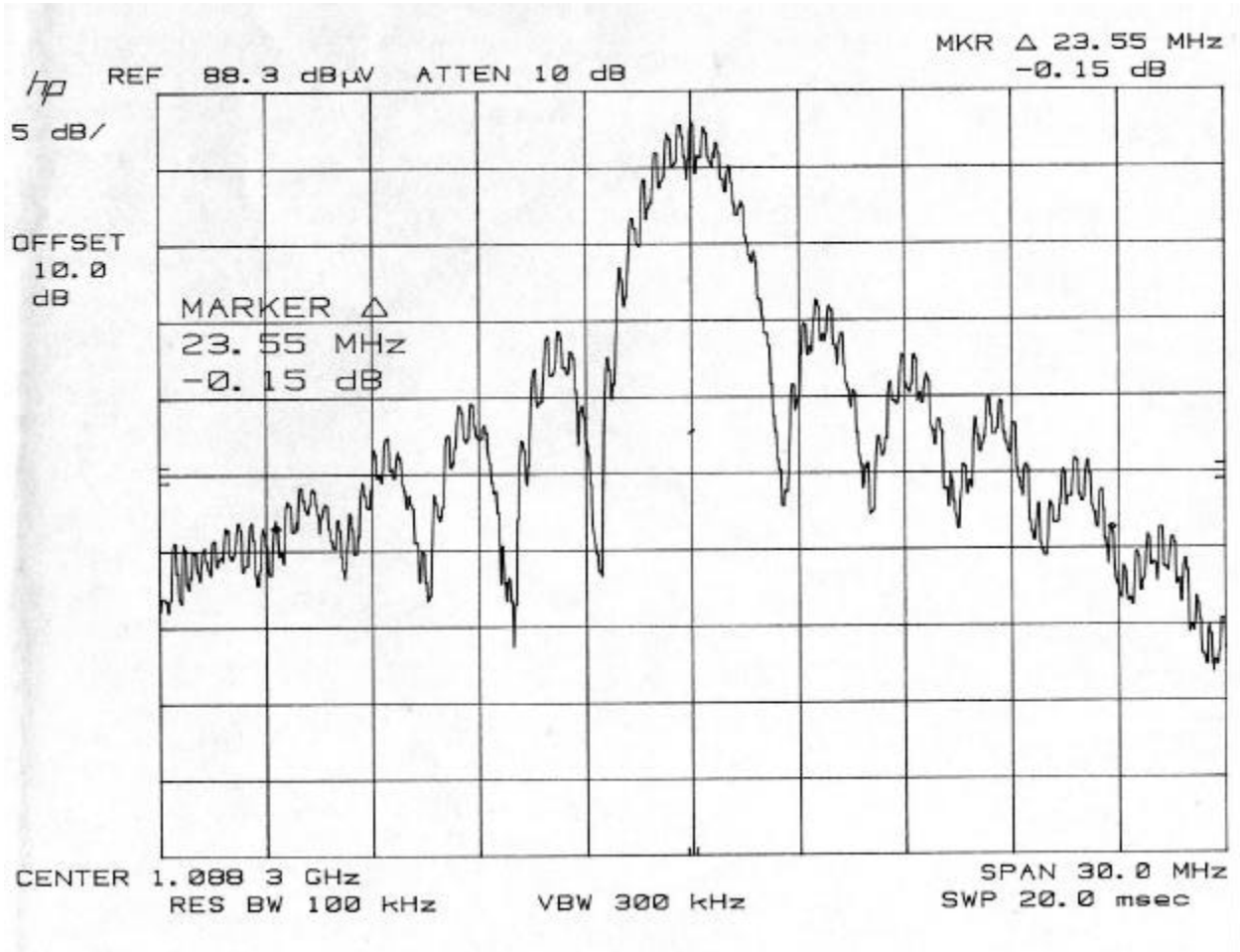
Occupied Bandwidth Data Sheet

**Trimble Navigation (Limited)
TS100 Mode C ATCRBS Transponder**

SERIAL #: ENG0001

PROJECT #: 99-410

DATE: August 8, 1998



COMMENT #1: 20 dB Bandwidth = 15.3 MHz

COMMENT #2: Use of 20 dBc criteria confirmed by the FAA

TEST ENGINEER: _____ APPROVED BY: _____
 John O'Brien Jeffery Lenk

**Out Of Band Emissions
Conducted Test Data**

Appendix C

Conducted Spurious Emissions Data Sheet

Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder

SERIAL #: ENG0001

PROJECT #: 99-410

DATE: August 8, 1998

Freq. (MHz)	Recorded Level (dBm)	Cable Loss (dB)	Corrected Level (dBm)	Limit (dBm)	Margin (dB)
1089.400	44.1	1.0	45.1	Ref	Ref
1097.150	8.0	1.0	9.0	20.1	-11.1
1104.900	2.0	1.0	3.0	10.1	-7.1
1128.150	-10.0	1.0	-9.0	5.1	-14.1
2178.800	-32.5	1.5	-31.0	5.1	-36.1
3268.200	-29.6	1.9	-27.7	5.1	-32.8
4357.600	-37.4	2.5	-34.9	5.1	-40.0
5447.000	-31.3	3.7	-27.6	5.1	-32.7
6536.400	-25.4	3.5	-21.9	5.1	-27.0
7625.800	-25.2	3.8	-21.4	5.1	-26.5
8715.200	-23.9	3.9	-20.0	5.1	-25.1
9804.600	-26.4	3.7	-22.7	5.1	-27.8
10894.000	-30.5	3.3	-27.2	5.1	-32.3

COMMENT #1: 1MHz/1 MHz BW used for all tests

COMMENT #2: Recorded Level corrected for attenuator.

TEST ENGINEER: _____ APPROVED BY: _____
 John O'Brien Jeffery Lenk

**Out Of Band Emissions
Radiated Test Data**

Appendix D

Radiated Spurious Emissions Data Sheet

Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder

SERIAL #: ENG0001
DATE: July 1, 1998

PROJECT #: 99-410
POLARIZATION: Vertical

Freq. (MHz)	EUT Direction (Deg)	Recorded Level (dBuV)	Cable Loss (dB)	Antenna Factor (dBuV/m)	Corrected Level (dBuV/m)	Limit (dBm)	Margin (dB)
1089.400	180.0	108.3	1.0	23.4	132.7	Ref	Ref
1097.150	180.0	78.8	1.0	23.4	103.2	107.7	-4.5
1104.900	180.0	62.4	1.0	23.4	86.8	97.7	-10.9
1128.150	180.0	44.5	1.0	23.4	68.9	82.7	-13.8
2178.800	180.0	41.9	1.5	26.2	69.6	82.7	-13.1
3268.200	180.0	40.0	1.9	31.4	73.3	82.7	-9.4
4357.600	180.0	40.3	2.5	32.4	75.2	82.7	-7.5
5447.000	180.0	36.6	3.7	35.2	75.5	82.7	-7.2
6536.400	180.0	32.6	3.5	35.0	71.1	82.7	-11.6
7625.800	180.0	33.7	3.8	36.2	73.7	82.7	-9.0
8715.200	180.0	32.8	3.9	37.4	74.1	82.7	-8.6
9804.600	180.0	31.6	3.7	38.2	73.5	82.7	-9.2
10894.000	180.0	32.2	3.3	38.6	74.1	82.7	-8.6

COMMENT #1: EUT antenna in vertical polarization (worst case)

COMMENT #2: All measurements above 2 GHz are ambients (receiver noise floor).

TEST ENGINEER: _____ APPROVED BY: _____
John O'Brien
Jeffery Lenk

Radiated Spurious Emissions Data Sheet

Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder

SERIAL #: ENG0001
DATE: July 1, 1998

PROJECT #: 99-410
POLARIZATION: Horizontal

Freq. (MHz)	EUT Direction (Deg)	Recorded Level (dBuV)	Cable Loss (dB)	Antenna Factor (dBuV/m)	Corrected Level (dBuV/m)	Limit (dBm)	Margin (dB)
1089.400	180.0	95.2	1.0	23.4	119.6	Ref	Ref
1097.150	180.0	73.4	1.0	23.4	97.8	107.7	-9.9
1104.900	180.0	61.4	1.0	23.4	85.8	97.7	-11.9
1128.150	180.0	42.4	1.0	23.4	66.8	82.7	-15.9
2178.800	180.0	40.6	1.5	26.2	68.3	82.7	-14.4
3268.200	180.0	39.8	1.9	31.4	73.1	82.7	-9.6
4357.600	180.0	41.2	2.5	32.4	76.1	82.7	-6.6
5447.000	180.0	37.4	3.7	35.2	76.3	82.7	-6.4
6536.400	180.0	31.6	3.5	35.0	70.1	82.7	-12.6
7625.800	180.0	34.2	3.8	36.2	74.2	82.7	-8.5
8715.200	180.0	33.8	3.9	37.4	75.1	82.7	-7.6
9804.600	180.0	32.9	3.7	38.2	74.8	82.7	-7.9
10894.000	180.0	32.2	3.3	38.6	74.1	82.7	-8.6

COMMENT #1: EUT antenna in vertical polarization (worst case)

COMMENT #2: All measurements above 2 GHz are ambients (receiver noise floor).

TEST ENGINEER: _____ APPROVED BY: _____
John O'Brien
Jeffery Lenk

Appendix E

Frequency Stability Test Data

Frequency Stability Versus Temperature Data Sheet

Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder

SERIAL #: ENG0001
DATE: May 19, 1998

PROJECT #: 99-410

Temperature (Degrees C)	Measured Frequency (MHz)	Frequency Deviation (MHz)	Deviation vs Limit (MHz)
50	1090.23800	0.23800	-6.11
40	1089.98500	-0.01500	-6.33
30	1089.68800	-0.31200	-6.04
20	1089.38800	-0.61200	-5.74
10	1089.52000	-0.48000	-5.87
0	1089.93000	-0.07000	-6.28
-10	1090.02300	0.02300	-6.33
-20	1090.05500	0.05500	-6.29
-30	1090.11000	0.11000	-6.24

COMMENT #1: Reference Limit = 6.25 MHz

COMMENT #2: 45 minute soak at each temperature

TEST ENGINEER: _____ APPROVED BY: _____
John O'Brien
Jeffrey Lenk

Frequency Stability Versus DC Power Data Sheet

Trimble Navigation (Limited) TS100 Mode C ATCRBS Transponder

SERIAL #: ENG0001

PROJECT #: 99-410

DATE: May 19, 1998

Input Voltage (DC Volts)	Measured Frequency (MHz)	Frequency Deviation (MHz)	Deviation vs Limit (MHz)
32	1089.69800	-0.30200	-6.05
30	1089.69800	-0.30200	-6.05
28	1089.70000	-0.30000	-6.05
26	1089.70000	-0.30000	-6.05
24	1089.70300	-0.29700	-6.05
22	1089.70000	-0.30000	-6.05
20	1089.70300	-0.29700	-6.05
18	1089.70500	-0.29500	-6.05
16	1089.70500	-0.29500	-6.05
14	1089.70800	-0.29200	-6.06
12	1089.70800	-0.29200	-6.06
10	N/A	N/A	Ceased Operation

COMMENT #1: Reference Limit = 6.25 MHz

COMMENT #2: Nominal Input Voltage = 14 to 28 VDC

TEST ENGINEER: _____ APPROVED BY: _____
 John O'Brien Jeffrey Lenk