EMC Technologies (NZ) Ltd

Test Report No **100715.2**
Report date: 12 October 2010

TEST REPORT

Vesper WMX850 AIS WatchMate Transciever

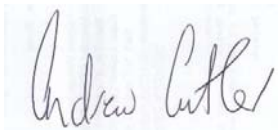
tested to

IEC 62287
Maritime navigation and radiocommunication equipment and systems – Class B shipborne equipment of the Automatic Identification System (AIS) using CSTDMA techniques – Operational and performance requirements, methods of test and required results

for

Vesper Marine Ltd

This Test Report is issued with the authority of:



Andrew Cutler - General Manager

EMC Technologies (NZ) Ltd

STREET ADDRESS - 47 MacKelvie Street, Grey Lynn, Auckland, NZ Ph: +64 9 360 0862 Fax: +64 9 360 0861
POSTAL ADDRESS - PO Box 68 307, Newton, Auckland, New Zealand E-mail: aucklab@ihug.co.nz

Table of Contents

1. COMPLIANCE STATEMENT

The **Vesper WMX850 AIS WatchMate Transceiver** complies with IEC 62287-1, First Edition, 2006-03

2. RESULT SUMMARY

The results from testing are summarised as follows:

Clause	Test Performed	Result
11.1	TDMA Transmitter	
11.1.1	Frequency error	Complies
11.1.2	Carrier power	Complies
11.1.3	Transmission spectrum	Complies
11.1.4	Modulation accuracy	Complies
11.1.5	Transmitter output power versus time function	Complies
11.2	TDMA Receiver	
11.2.1	Sensitivity	Complies
11.2.2	Error behaviour at high input levels	Complies
11.2.3	Co-channel rejection	Complies
11.2.4	Adjacent channel selectivity	Complies
11.2.5	Spurious response rejection	Complies
11.2.6	Intermodulation response rejection	Complies
11.2.7	Blocking or desensitisation	Complies
11.3	Conducted spurious emissions	
11.3.1	Spurious emissions from the receiver	Complies
11.3.2	Spurious emissions from the transmitter	Complies
Annex C.4	DSC Receiver tests	Not applicable. Waiver applied

3. INTRODUCTION

This report describes the tests and measurements for the purpose of determining compliance with the specification under the following conditions:

The test sample was selected by the client.

This report relates only to the sample tested.

This report contains no corrections or erasures.

Measurement uncertainties with statistical confidence intervals of 95% are shown below test results. Both class A and Class B uncertainties have been accounted for, as well as influence uncertainties where appropriate.

This test report replaces report number 100715.1 dated September 2010 with the following changes having been made:

- Section 3 Introduction has been added to the report showing the changes to the report and as result the page number has been changed and the headers incremented accordingly

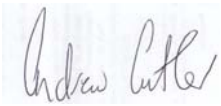
- On page 44 a typographical error has been corrected with the Channel B LOL frequency being corrected to show 134.625 MHz instead of 134.025 MHz as reported.

- On page 44 and 45, with regard test 11.2.5, tables and calculations has been included showing the frequencies of interest for channels A and B when the spurious response receiver test was carried out.

- On page 46, with regard test 11.2.6, the title of the second table has been changed from channel A to correctly show that it applies to channel B

- The result summary table on page 3 has had a statement included with regard Annex C4 and the DSC receiver requirements

- Annex C4 statements have been included in the report on page 53



Andrew Cutler
General Manger

4. CLIENT INFORMATION

Company Name	Vesper Marine Ltd
Address	PO Box 91164 St Marys Bay
City	Auckland
Country	New Zealand
Contact	Mr Carl Omundsen

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Vesper
Model Number	WMX850
Product	AIS WatchMate Transceiver
Manufacturer	Vesper Marine Ltd
Manufactured in	New Zealand
Serial Numbers	GZ24151
Version Number	A5.04.1338.1339M

6. TEST CONDITIONS

Test Power Source

The test power source used for this report is identified in the equipment list at the end of this report.

The test voltage was measured at the point of connection of the power cable to the test sample equipment.

Normal test conditions

Standard Temperature and Humidity

Temperature: +20°C ± 4° maintained.
Relative Humidity: 60% ± 10% observed.

Standard Test Power Source

The equipment is powered using an external DC supply.

Other Power Source

Standard Test Voltages: 12.0 V dc to 24 Vdc.

Extreme Test Conditions as defined in EN 60945

Extreme Temperature

High Temperature: + 55°C maintained.
Low Temperature: - 25°C maintained.

Extreme Voltage

High Voltage: 31.2 Vdc
Low Voltage: 10.8 Vdc

7. TEST RESULTS

11.1.1 Frequency Error

Testing was carried out using a spectrum analyser that had a 30 dB attenuator attached to the input.

Testing was carried out with the device transmitting an unmodulated carrier on 161.5000 MHz and 162.0250 MHz

Voltage (Vdc)	Temp	Transmit Frequency (MHz)	Frequency Error (Hz)	Limit (+/-Hz)
+10.8	+20°C	161.5000	+295.0	500.0
+12.0		161.5000	+290.0	500.0
+24.0		161.5000	+295.0	500.0
+31.2		161.5000	+295.0	500.0
+10.8	+20°C	162.0250	+300.0	500.0
+12.0		162.0250	+300.0	500.0
+24.0		162.0250	+300.0	500.0
+31.2		162.0250	+300.0	500.0
+10.8	+55°C	161.5000	+312.0	1000.0
+12.0		161.5000	+312.0	1000.0
+24.0		161.5000	+312.0	1000.0
+31.2		161.5000	+312.0	1000.0
+10.8	+55°C	162.0250	+325.0	1000.0
+12.0		162.0250	+325.0	1000.0
+24.0		162.0250	+325.0	1000.0
+31.2		162.0250	+325.0	1000.0
+10.8	-25°C	161.5000	+320.0	1000.0
+12.0		161.5000	+320.0	1000.0
+24.0		161.5000	+320.0	1000.0
+31.2		161.5000	+320.0	1000.0
+10.8	-25°C	162.0250	+320.0	1000.0
+12.0		162.0250	+320.0	1000.0
+24.0		162.0250	+320.0	1000.0
+31.2		162.0250	+320.0	1000.0

Result: Complies
Measurement Uncertainty: ±30 Hz

11.1.2 Carrier Power

Testing was carried out using a spectrum analyser that had a 30 dB attenuator attached to the input.

Testing was carried out with the device transmitting on 161.5000 MHz and 162.0250 MHz when modulated with test signal number 4, with a 1 second interval between packets, when the spectrum analyser was being operated in peak hold mode.

Voltage (Vdc)	Temp	Transmit Frequency (MHz)	Transmitter Power (dBm)	Limit Range (dBm)
+10.8	+20°C	161.5000	33.2	30.0 – 36.0
+12.0		161.5000	33.4	31.5 – 34.5
+24.0		161.5000	33.4	31.5 – 34.5
+31.2		161.5000	33.4	30.0 – 36.0
+10.8	+20°C	162.0250	33.2	30.0 – 36.0
+12.0		162.0250	33.3	31.5 – 34.5
+24.0		162.0250	33.4	31.5 – 34.5
+31.2		162.0250	33.3	30.0 – 36.0
+10.8	+55°C	161.5000	32.5	30.0 – 36.0
+12.0		161.5000	32.6	30.0 – 36.0
+24.0		161.5000	32.6	30.0 – 36.0
+31.2		161.5000	32.6	30.0 – 36.0
+10.8	+55°C	162.0250	32.6	30.0 – 36.0
+12.0		162.0250	32.6	30.0 – 36.0
+24.0		162.0250	32.6	30.0 – 36.0
+31.2		162.0250	32.6	30.0 – 36.0
+10.8	-25°C	161.5000	30.3	30.0 – 36.0
+12.0		161.5000	30.3	30.0 – 36.0
+24.0		161.5000	30.4	30.0 – 36.0
+31.2		161.5000	30.5	30.0 – 36.0
+10.8	-25°C	162.0250	30.3	30.0 – 36.0
+12.0		162.0250	30.4	30.0 – 36.0
+24.0		162.0250	30.4	30.0 – 36.0
+31.2		162.0250	30.4	30.0 – 36.0

Result: Complies

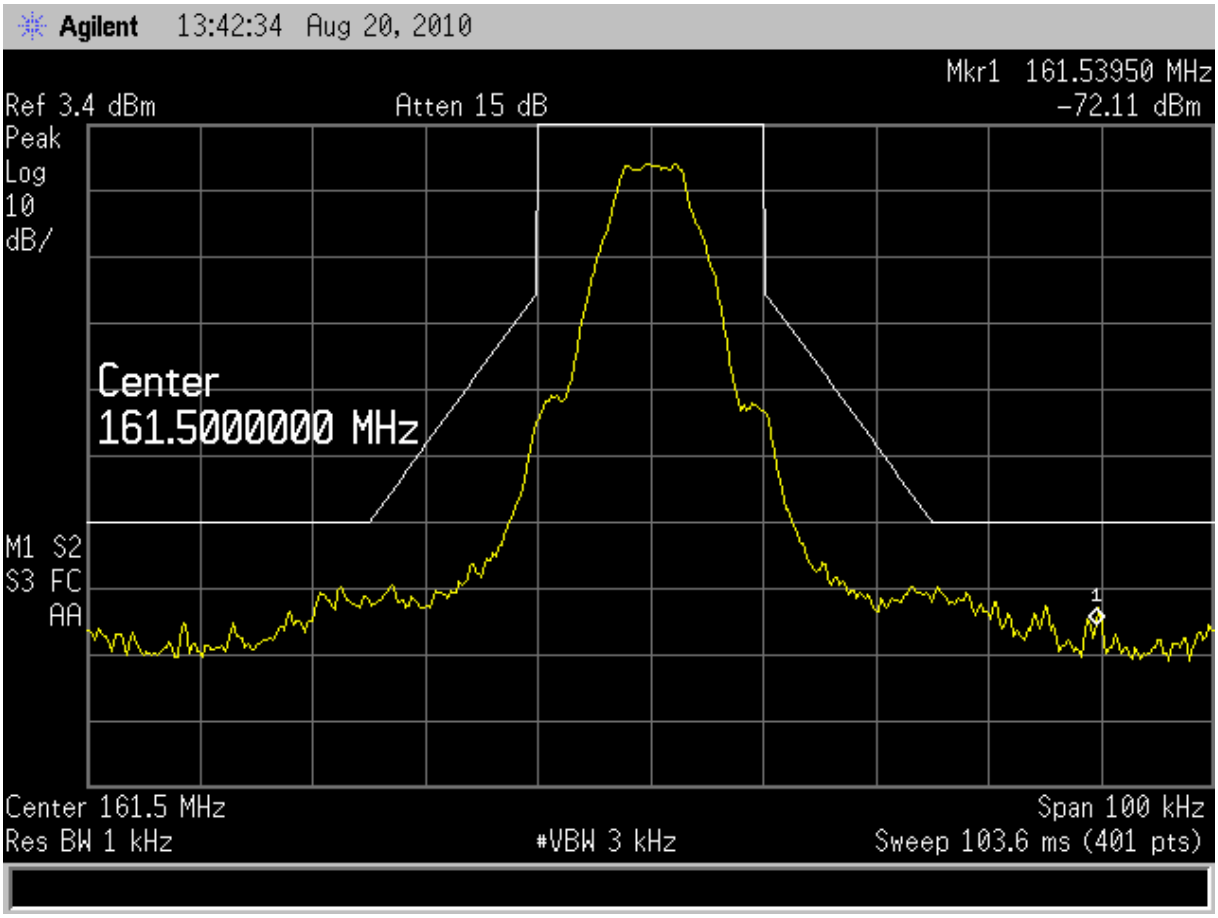
Measurement Uncertainty: ±30 Hz

11.1.3 Transmission spectrum

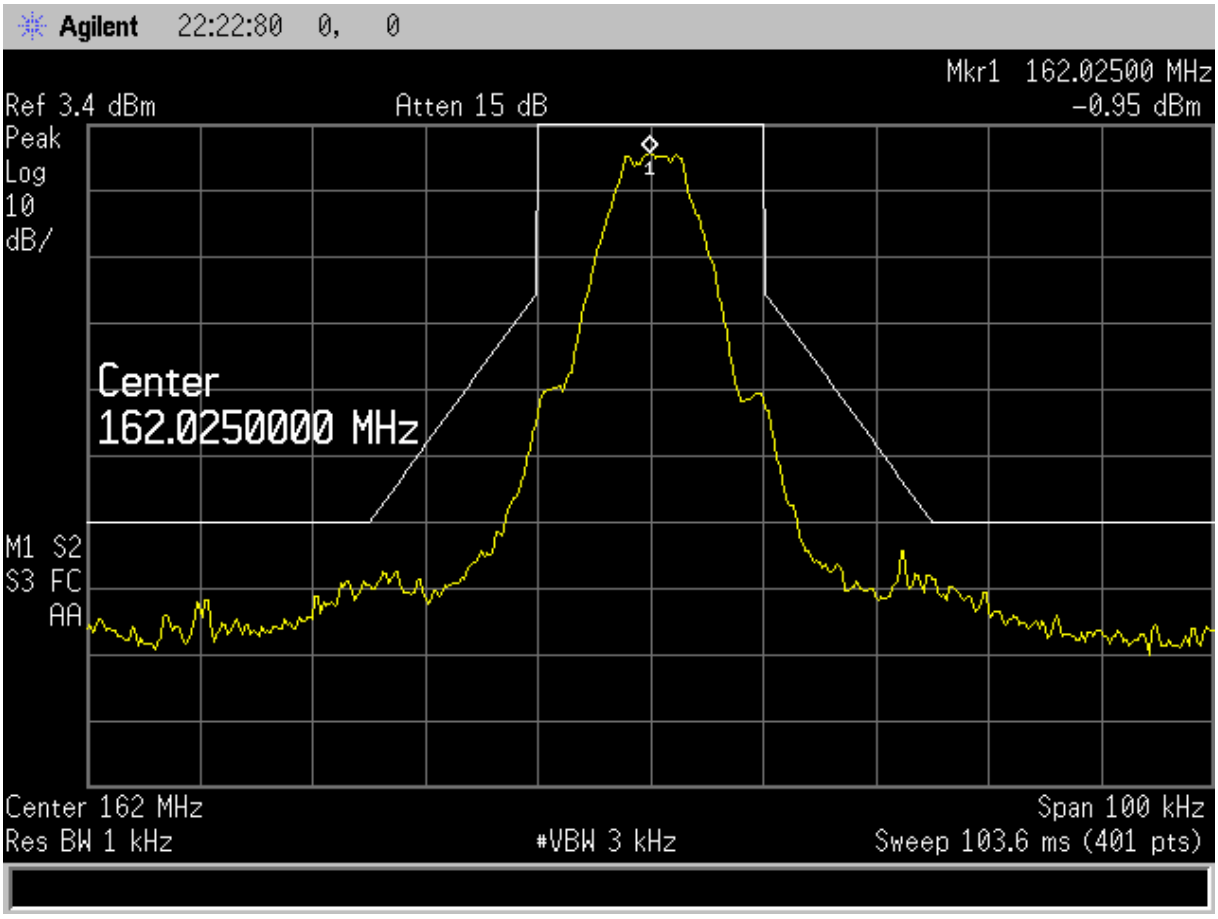
Testing was carried out using a spectrum analyser that had a 30 dB attenuator attached to the input.

Testing was carried out with the device transmitting on 161.5000 MHz and 162.0250 MHz when modulated with test signal number 4 continuously when the spectrum analyser was being operated in peak hold mode.

161.5000 MHz



162.0250 MHz



Result: Complies

Measurement Uncertainty: ±0.5 dB

11.1.4 Modulation accuracy

Modulation accuracy measurements were made using a modulation analyser and a digital storage oscilloscope that was triggered using a 5 volt TTL output from the transmitter

Testing was carried out using single packets of data using either test signal 2 or 3 when the transmitter was tuned to operate on 161.500 MHz or 162.025 MHz

The oscilloscope was calibrated using the modulation analyser frequency deviation indication when using a 10 Hz high pass filter and a 23 kHz low pass filter.

Peak positive and negative frequency deviation levels were then recorded when test signals 2 and 3 were used while the transmitter was transmitting continuously.

Limit lines were then determined using the deviations levels observed and the steady state levels observed on the oscilloscope.

The peak positive and negative deviation levels for each frequency and for each signal type were determined at each temperature with the limit lines being determined each time.

Test signal 3 on 162.025 MHz and 161.500 MHz

Bit	-25.0	Ambient	+55.0
0 to1	Complies	Complies	Complies
2 to 3	Complies	Complies	Complies
4 to 31	Complies	Complies	Complies
32 to 199	Complies	Complies	Complies

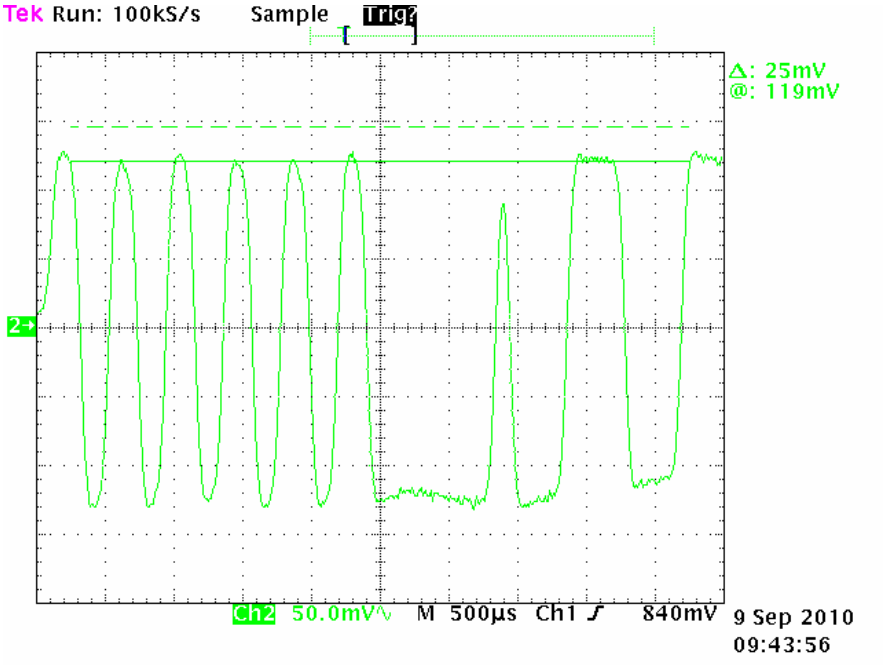
Test signal 2 on 162.025 MHz and 161.500 MHz

Bit	-25.0	Ambient	+55.0
0 to1	Complies	Complies	Complies
2 to 3	Complies	Complies	Complies
4 to 31	Complies	Complies	Complies
32 to 199	Complies	Complies	Complies

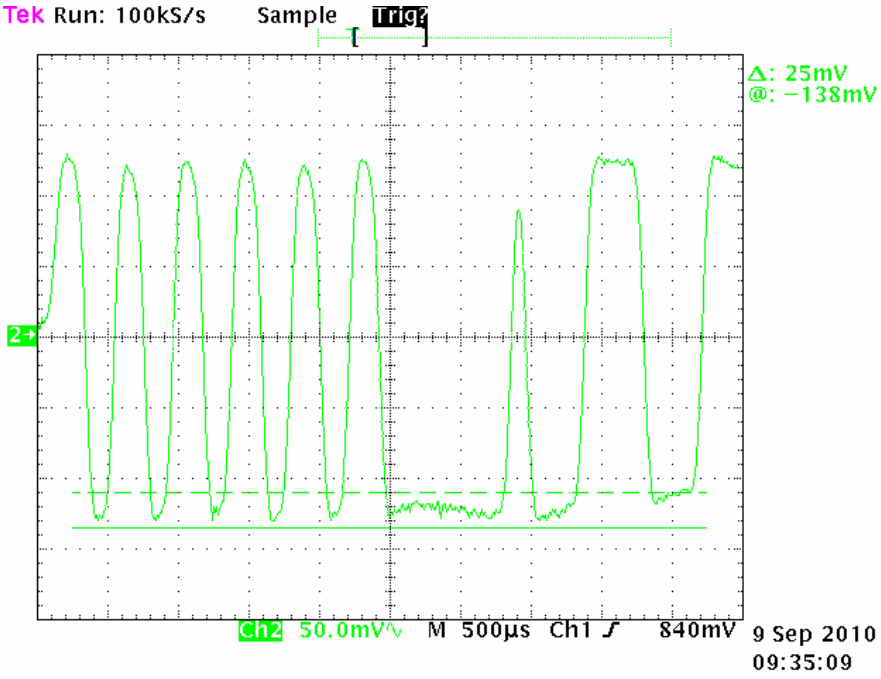
Result: Complies

TEST SIGNAL 3

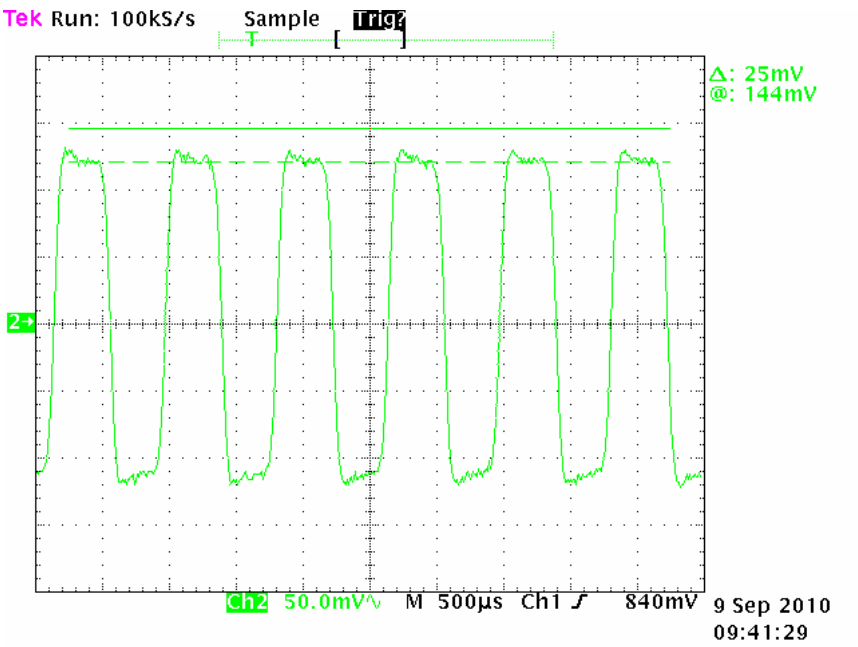
Test signal 3 at ambient showing bit 0 to 31 on 162.025 MHz with the upper limit shown



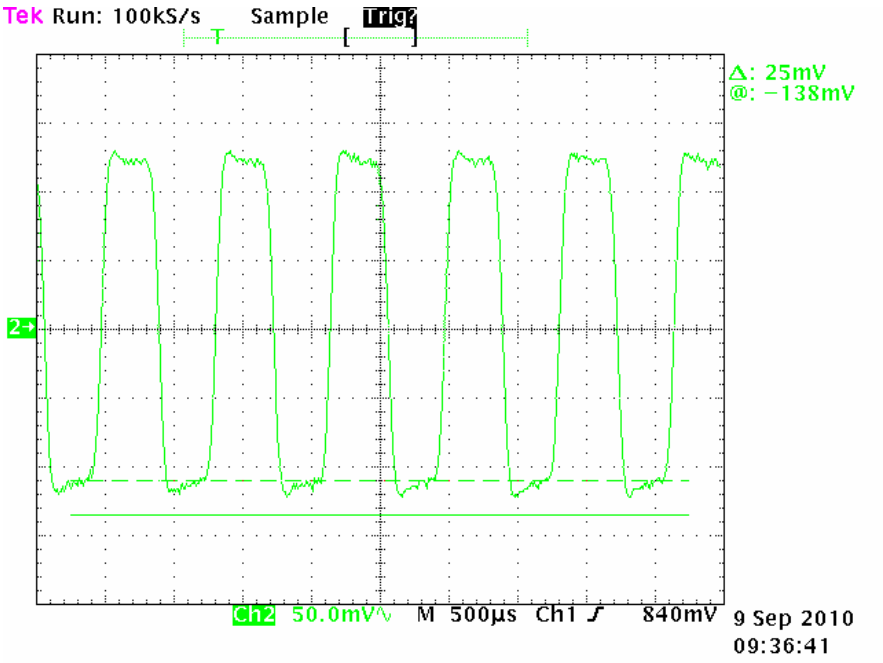
Test signal 3 at ambient showing bit 0 to 31 on 162.025 MHz with the lower limit shown



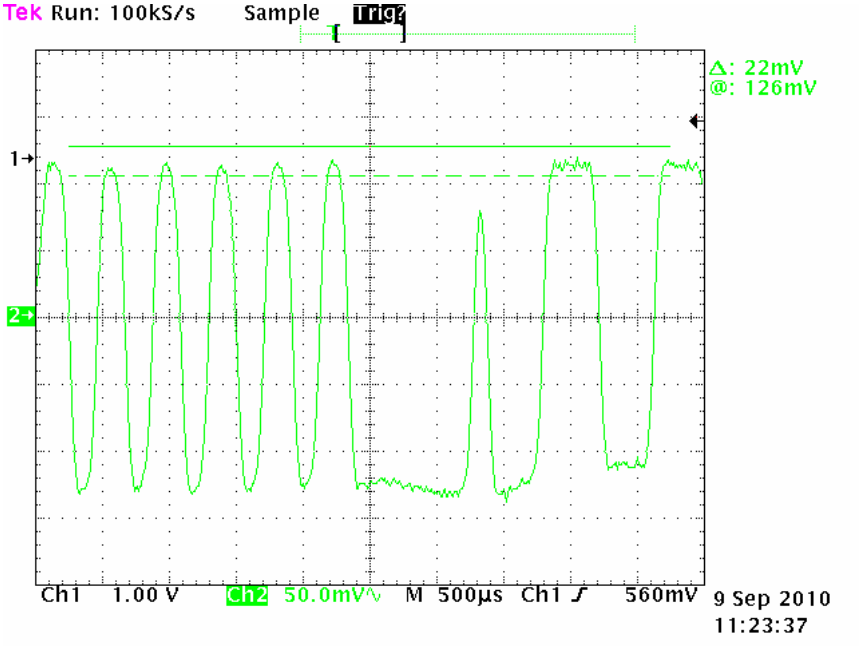
Test signal 3 at ambient showing a sample between bit 32 and bit 199 on 162.025 MHz with the upper limit



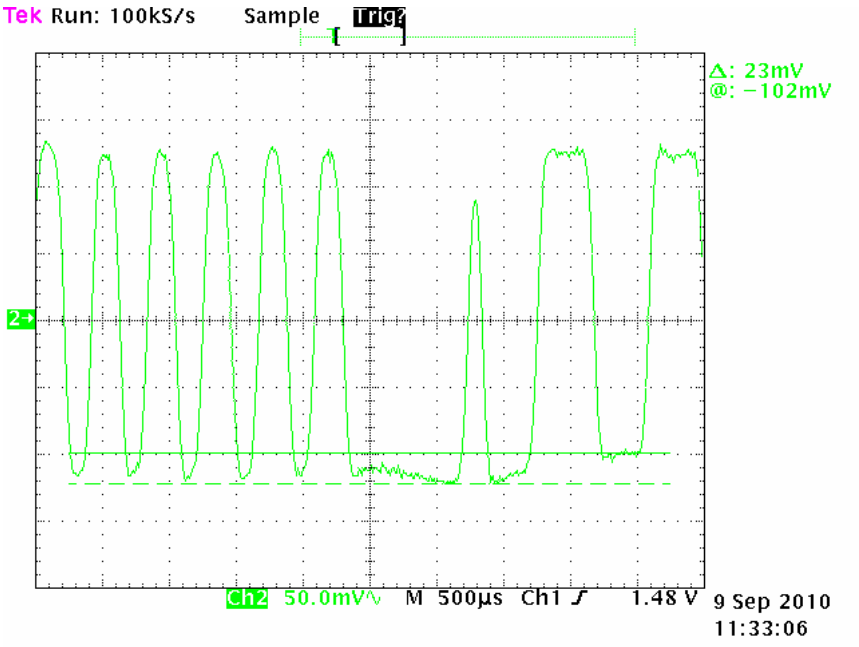
Test signal 3 at ambient showing a sample between bit 32 and bit 199 on 162.025 MHz with the lower limit



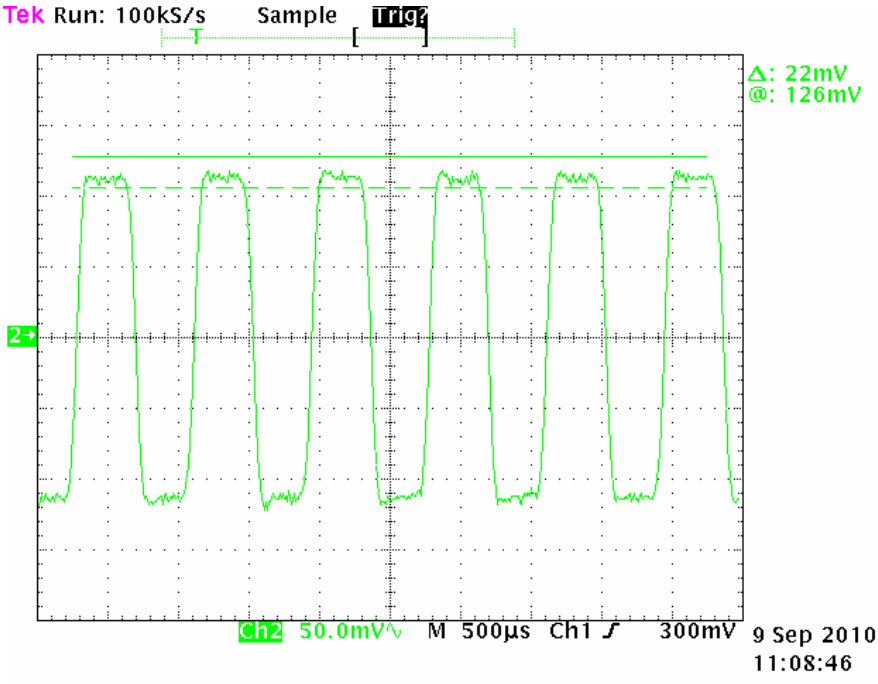
Test signal 3 at ambient showing bit 0 to 31 on 161.500 MHz with the upper limit shown



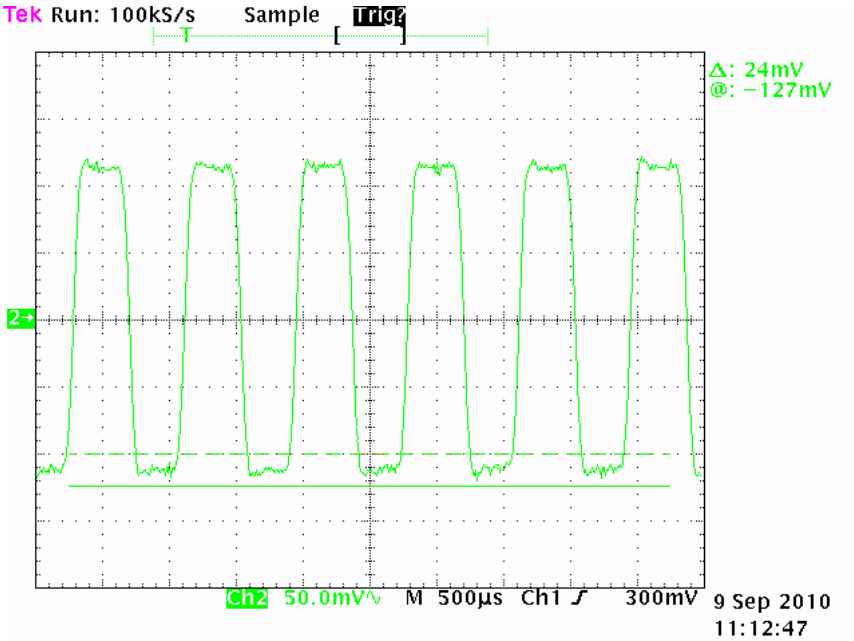
Test signal 3 at ambient showing bit 0 to 31 on 161.500 MHz with the lower limit shown



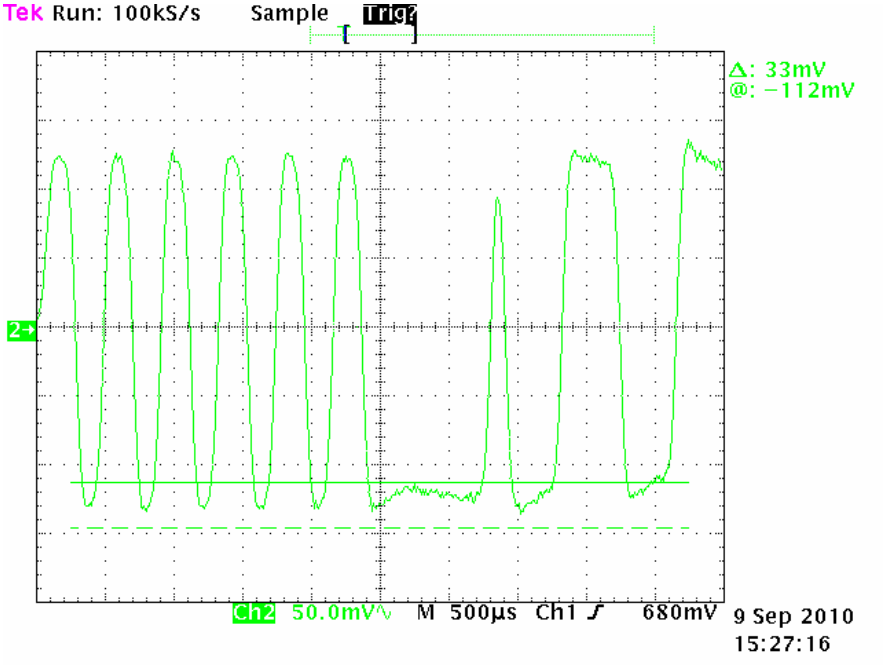
Test signal 3 at ambient showing a sample between bit 32 and bit 199 on 161.500 MHz with the upper limit



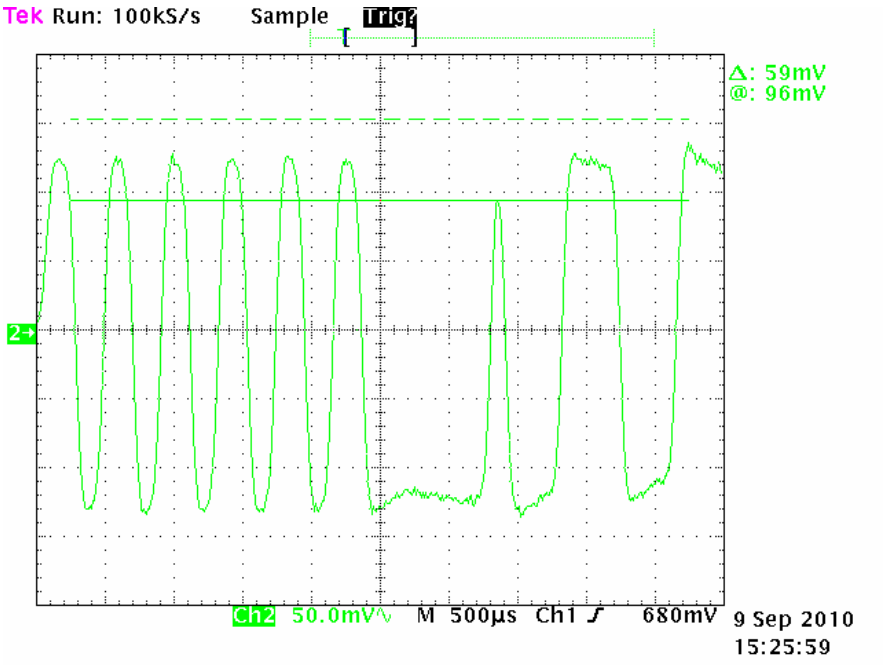
Test signal 3 at ambient showing a sample between bit 32 and bit 199 on 161.500 MHz with the lower limit



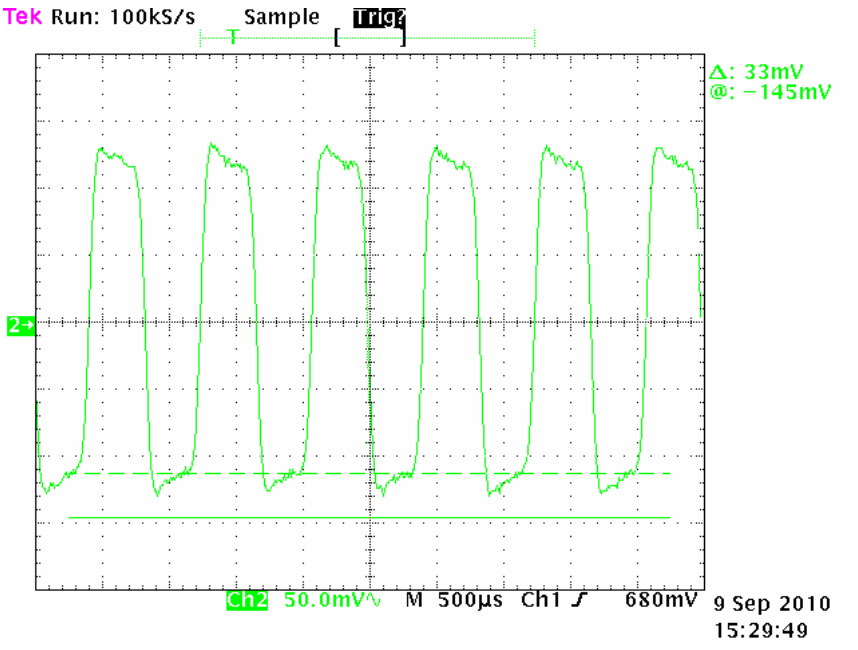
Test signal 3 at +55 degrees showing bit 0 to 31 on 161.500 MHz with the lower limit shown



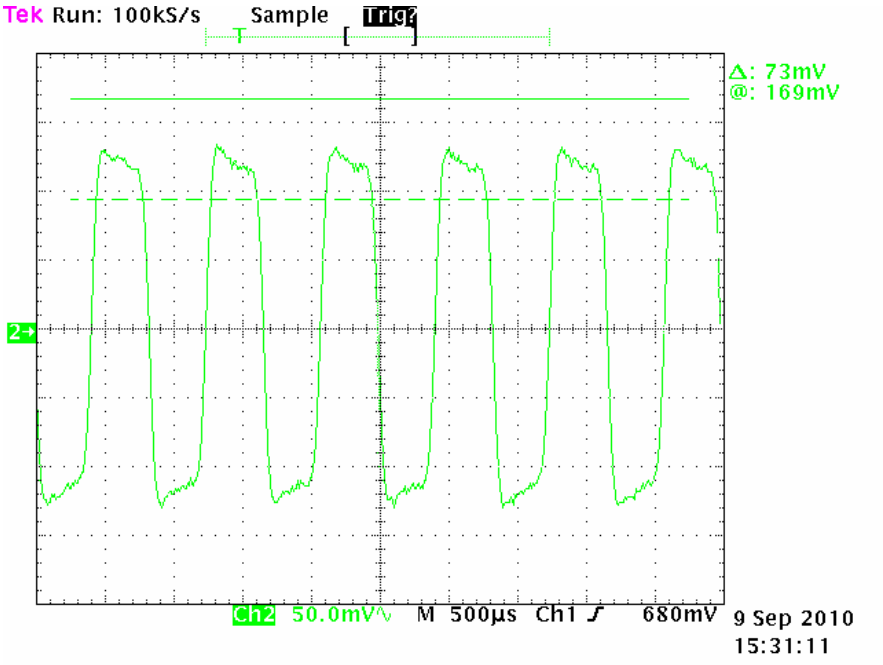
Test signal 3 at +55 degrees showing bit 0 to 31 on 161.500 MHz with the upper limit shown



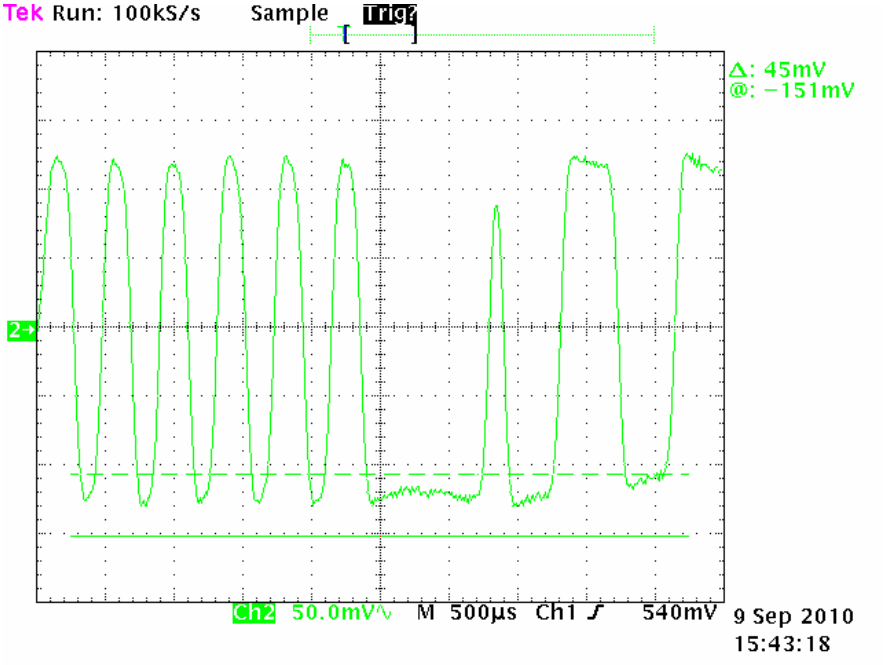
Test signal 3 at +55 degrees showing a sample between bit 32 and bit 199 on 161.500 MHz with the lower limit



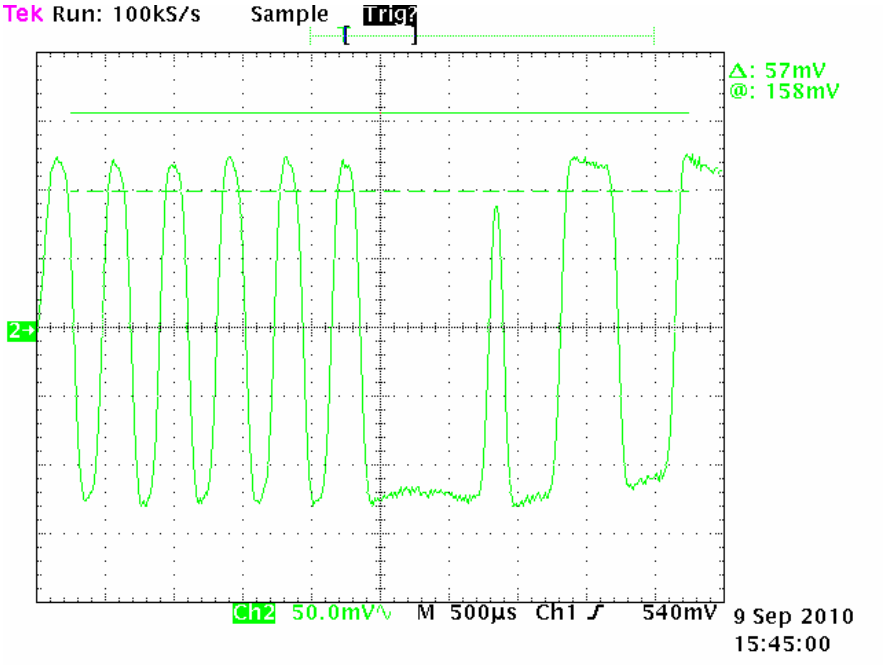
Test signal 3 at +55 degrees showing a sample between bit 32 and bit 199 on 161.500 MHz with the upper limit



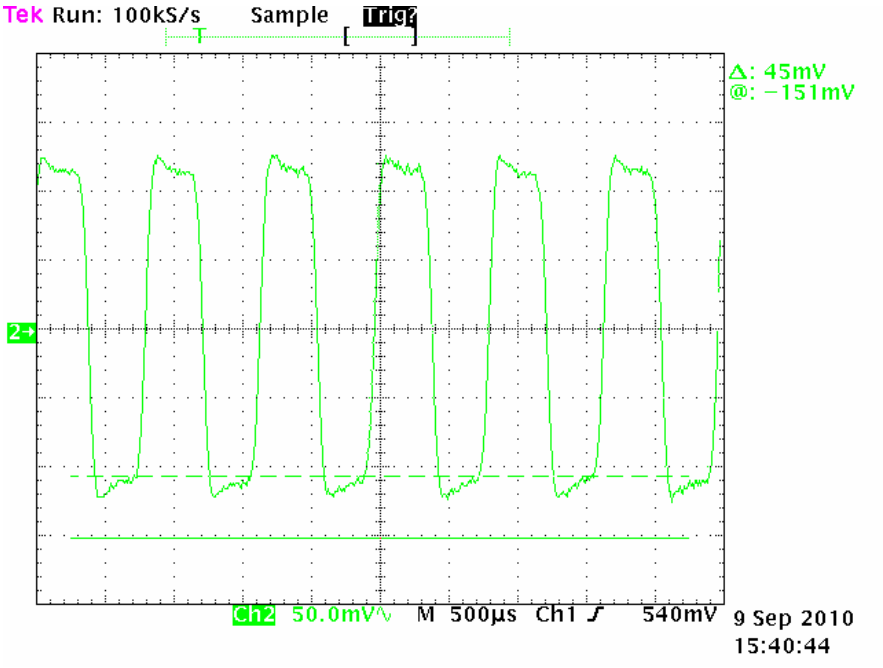
Test signal 3 at +55 degrees showing bit 0 to 31 on 162.025 MHz with the lower limit shown



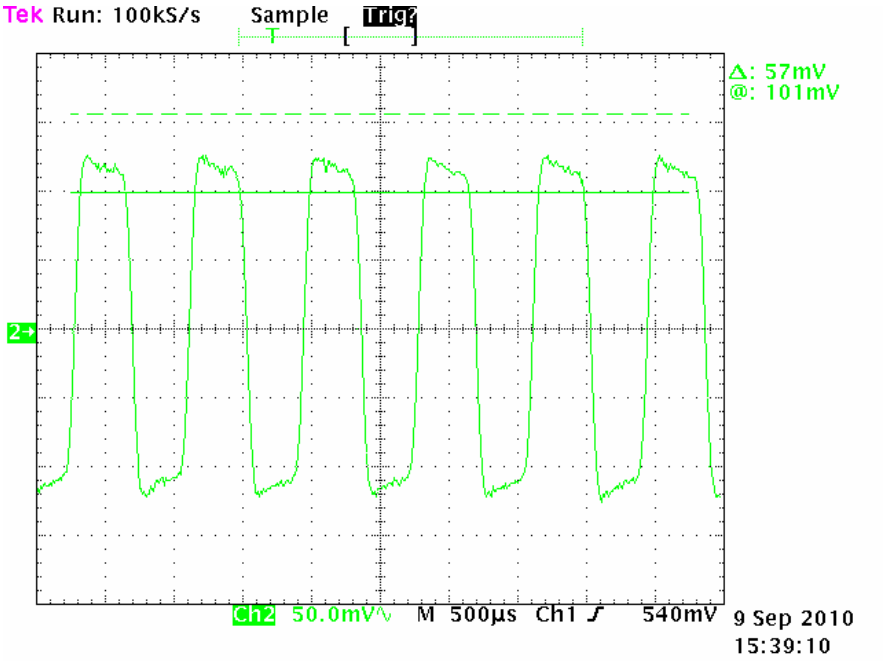
Test signal 3 at +55 degrees showing bit 0 to 31 on 162.025 MHz with the upper limit shown



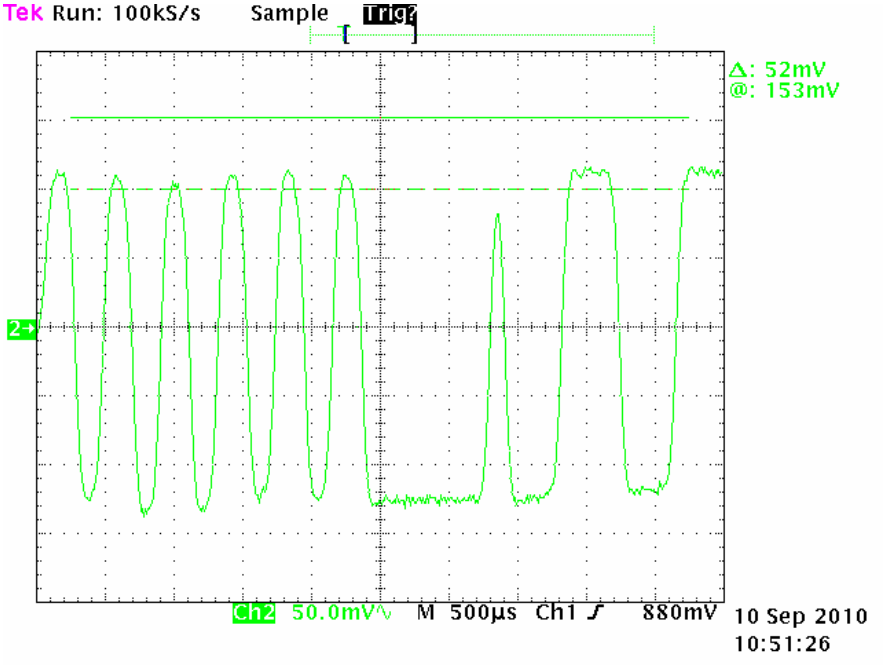
Test signal 3 at +55 degrees showing a sample between bit 32 and bit 199 on 162.025 MHz with the lower limit



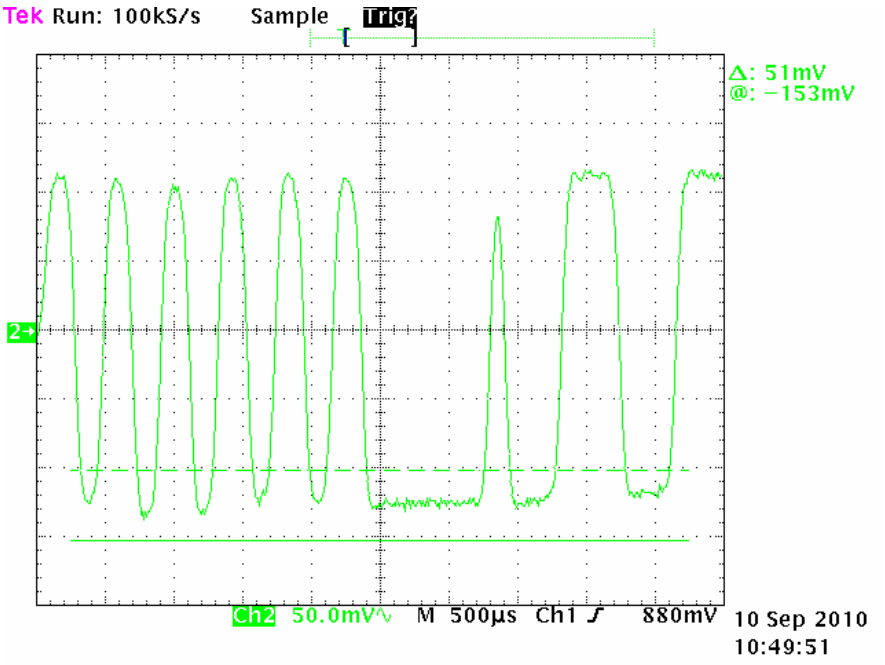
Test signal 3 at +55 degrees showing a sample between bit 32 and bit 199 on 162.025 MHz with the lower limit



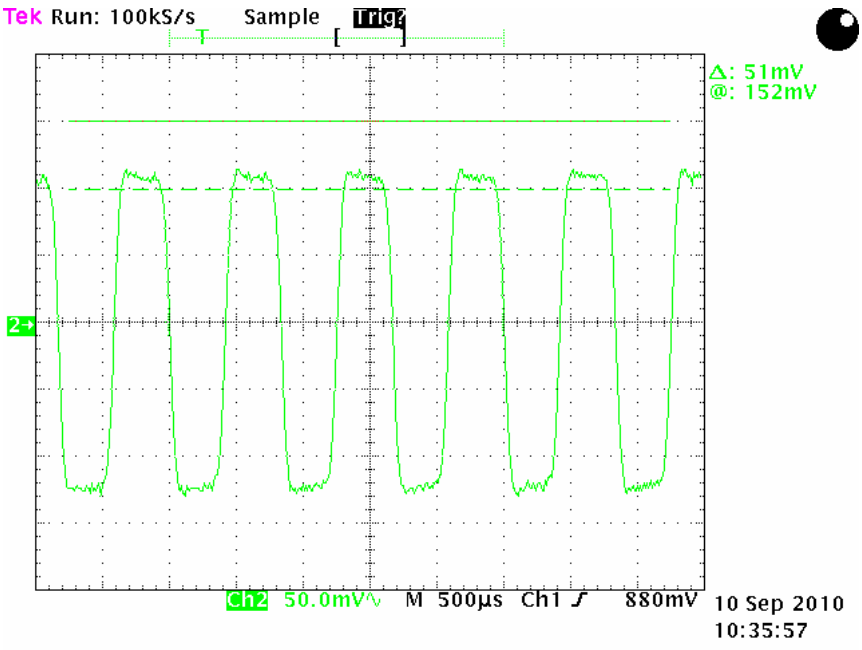
Test signal 3 at -25 degrees showing bit 0 to 31 on 161.500 MHz with the upper limit shown



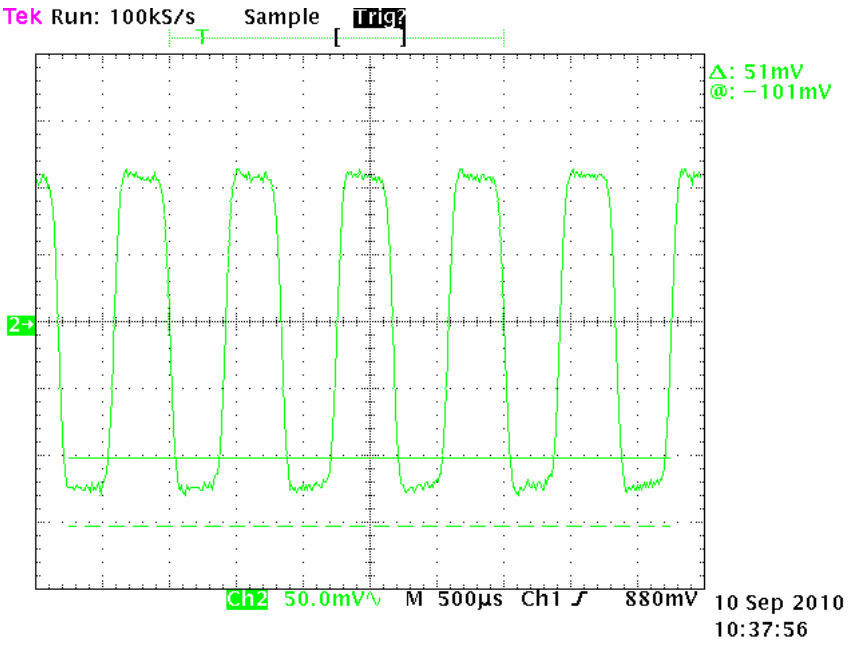
Test signal 3 at -25 degrees showing bit 0 to 31 on 161.500 MHz with the lower limit shown



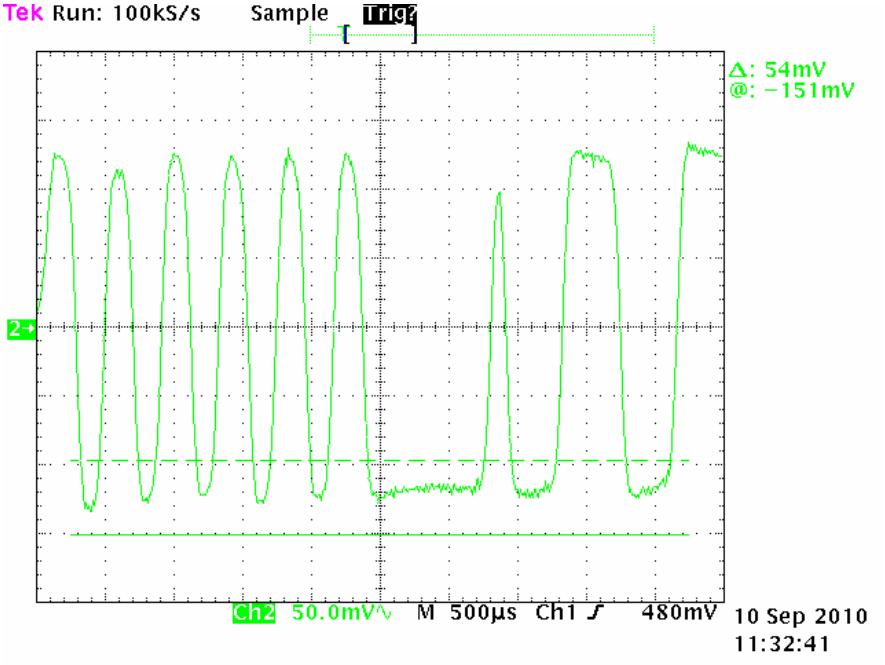
Test signal 3 at -25 degrees showing a sample between bit 32 and bit 199 on 161.500 MHz with the upper limit



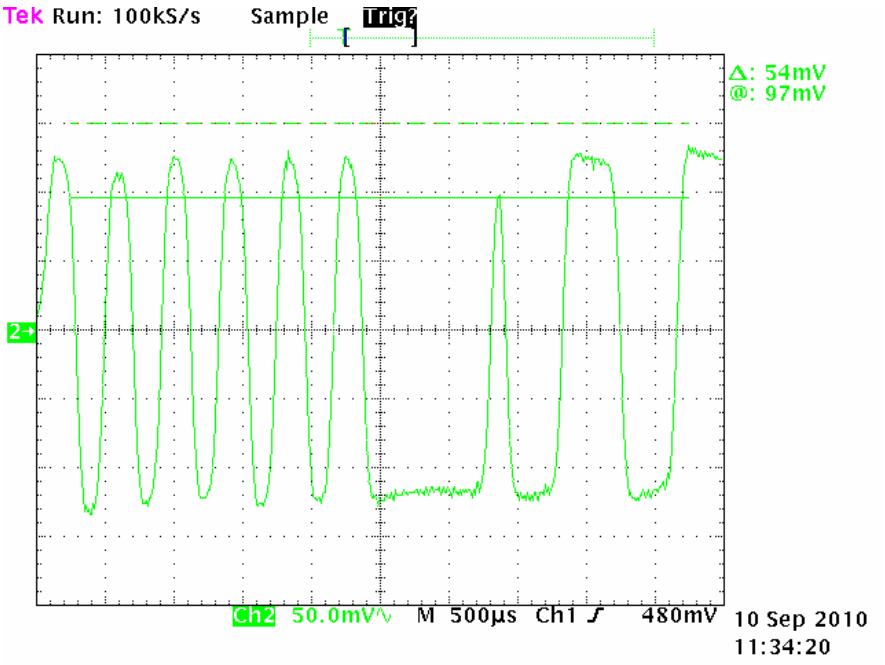
Test signal 3 at -25 degrees showing a sample between bit 32 and bit 199 on 161.500 MHz with the lower limit



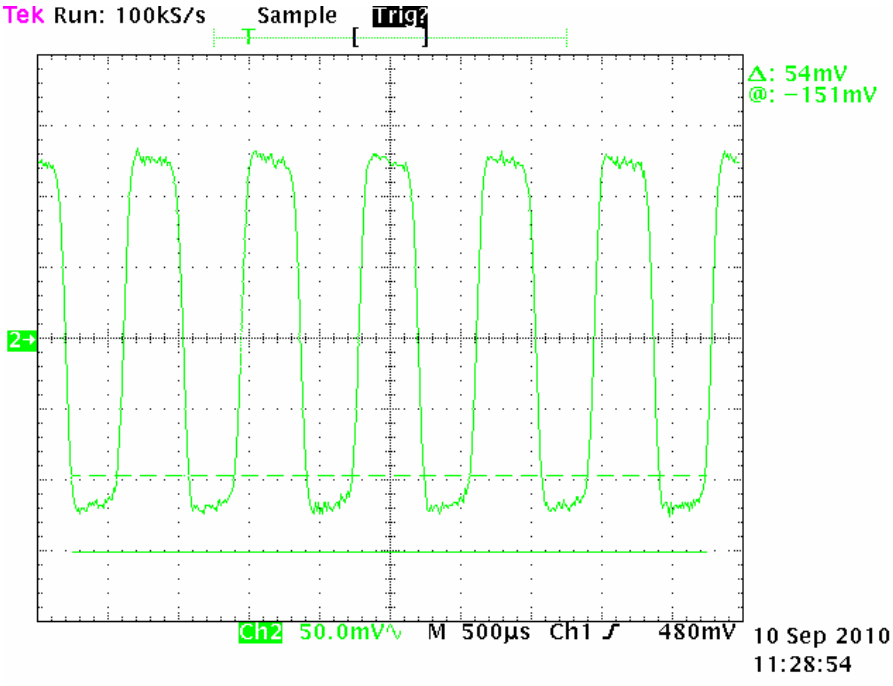
Test signal 3 at -25 degrees showing bit 0 to 31 on 162.025 MHz with the lower limit shown



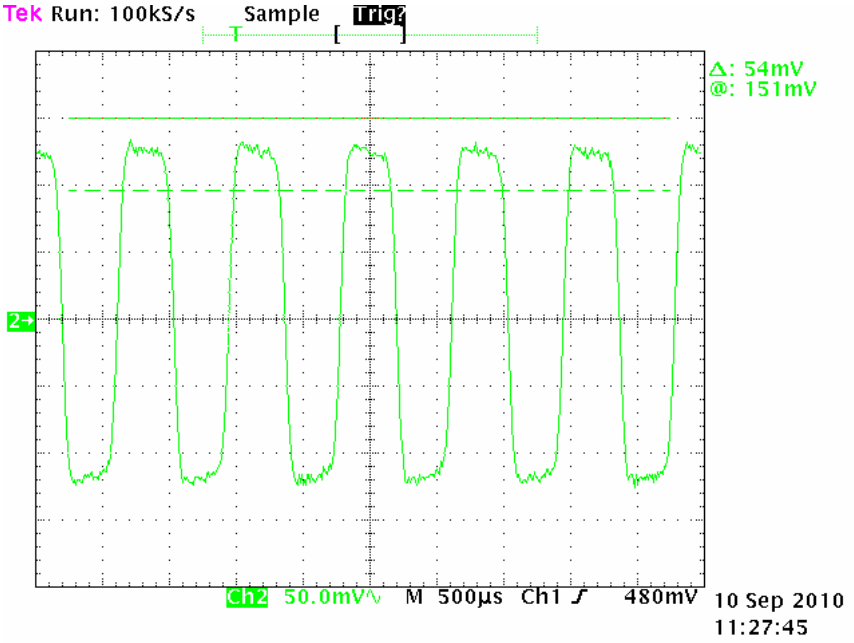
Test signal 3 at -25 degrees showing bit 0 to 31 on 161.500 MHz with the upper limit shown



Test signal 3 at -25 degrees showing a sample between bit 32 and bit 199 on 162.025 MHz with the lower limit

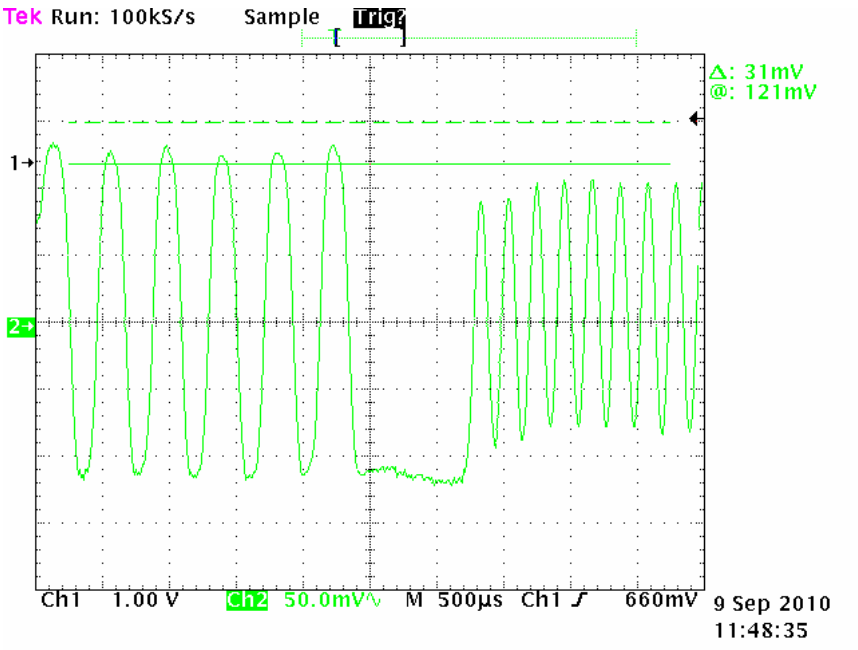


Test signal 3 at -25 degrees showing a sample between bit 32 and bit 199 on 162.025 MHz with the upper limit

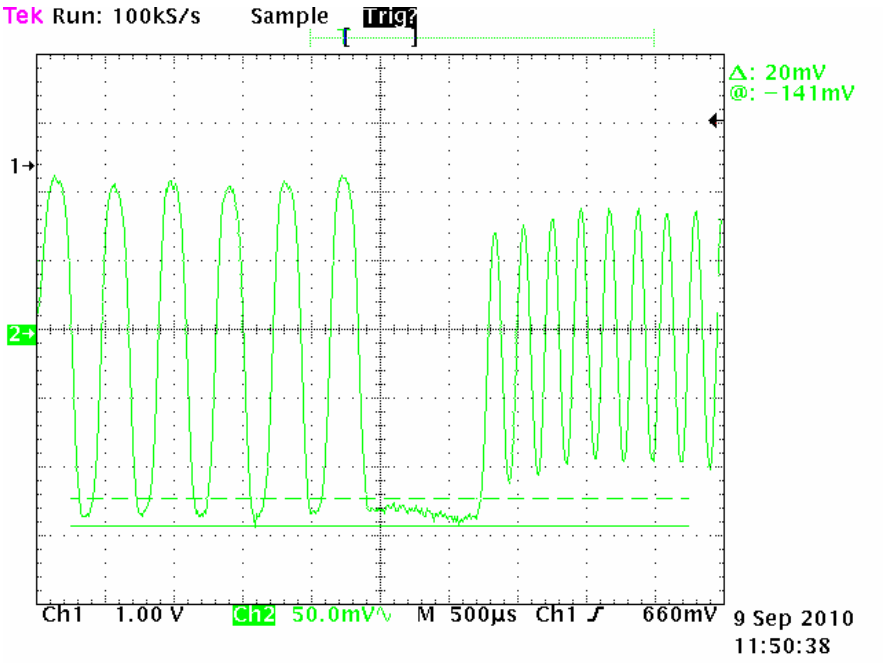


TEST SIGNAL 2

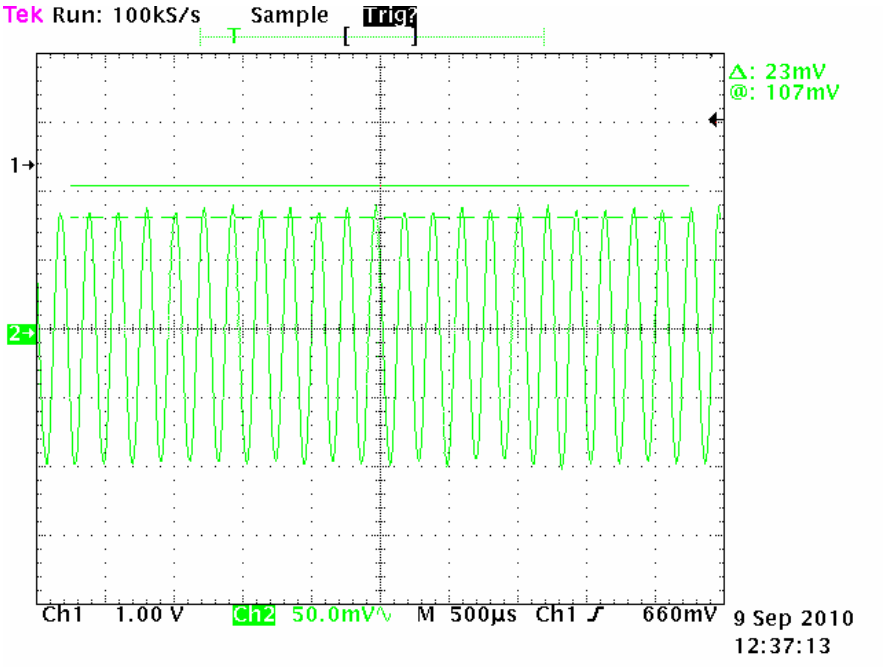
Test signal 2 at ambient between bit 0 and bit 31 on 161.500 MHz with the upper limit



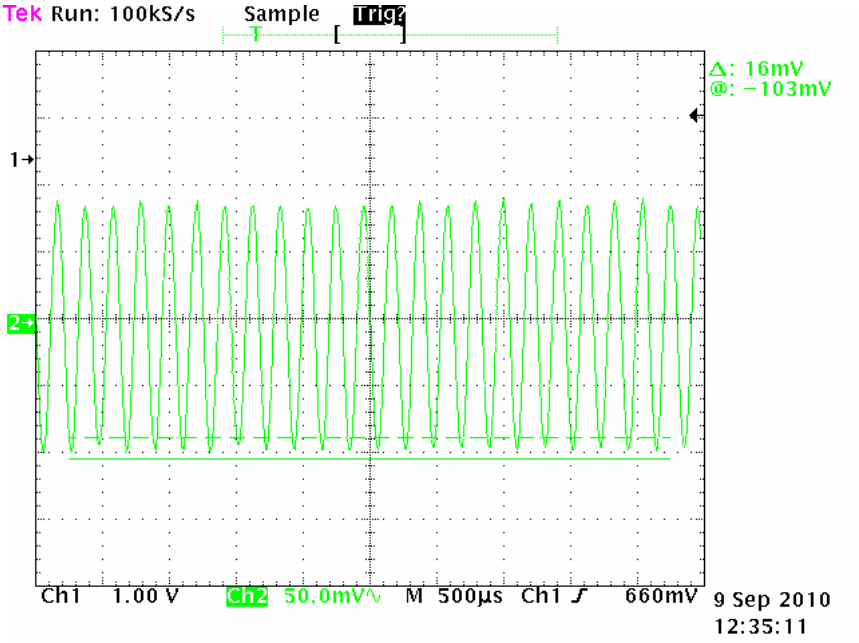
Test signal 2 at ambient between bit 0 and bit 31 on 161.500 MHz with the lower limit



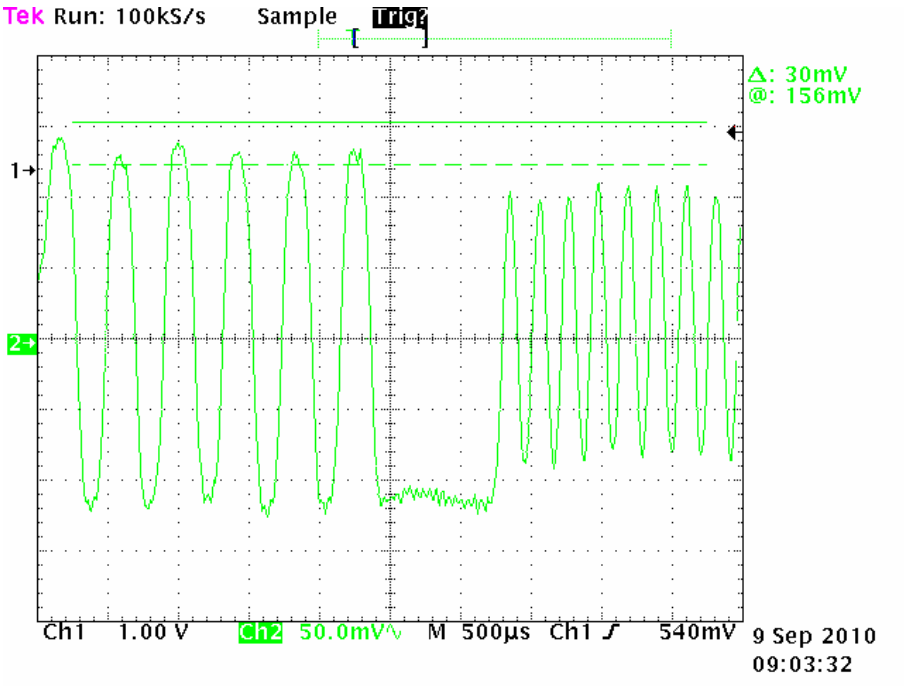
Test signal 2 at ambient between bit 32 and bit 199 on 161.500 MHz with the upper limit



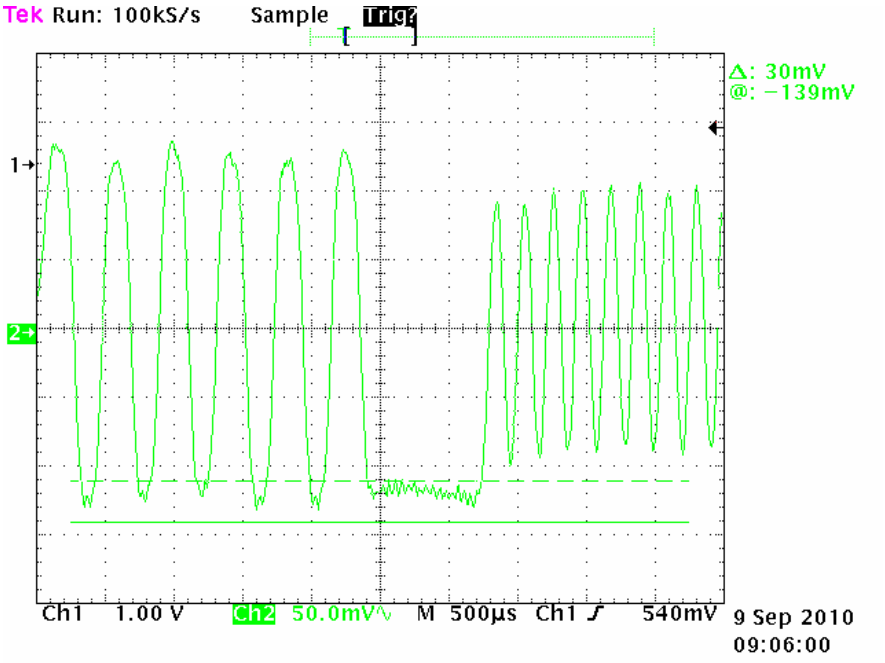
Test signal 2 at ambient between bit 32 and bit 199 on 161.500 MHz with the lower limit



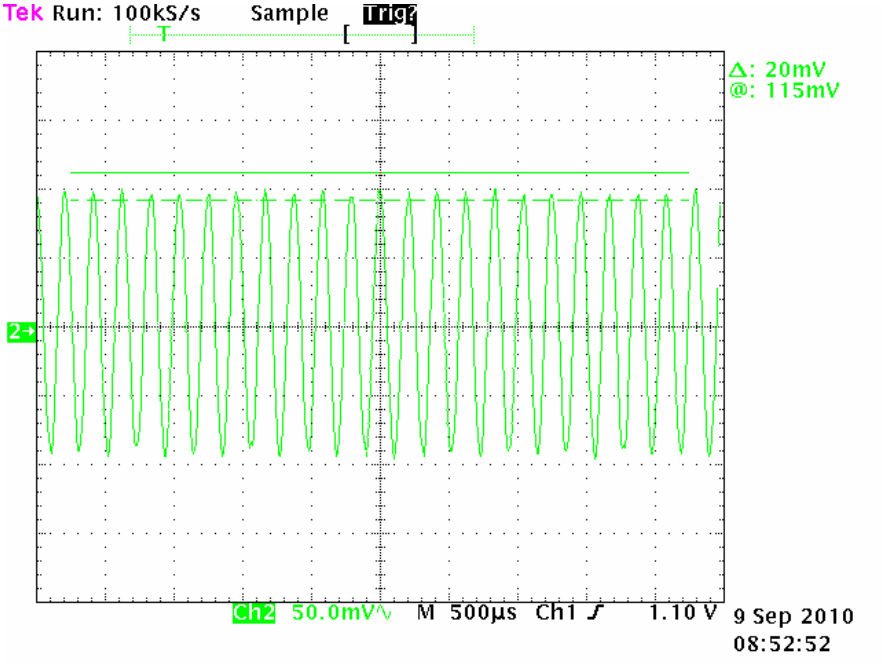
Test signal 2 at ambient between bit 0 and bit 31 on 162.025 MHz with the upper limit



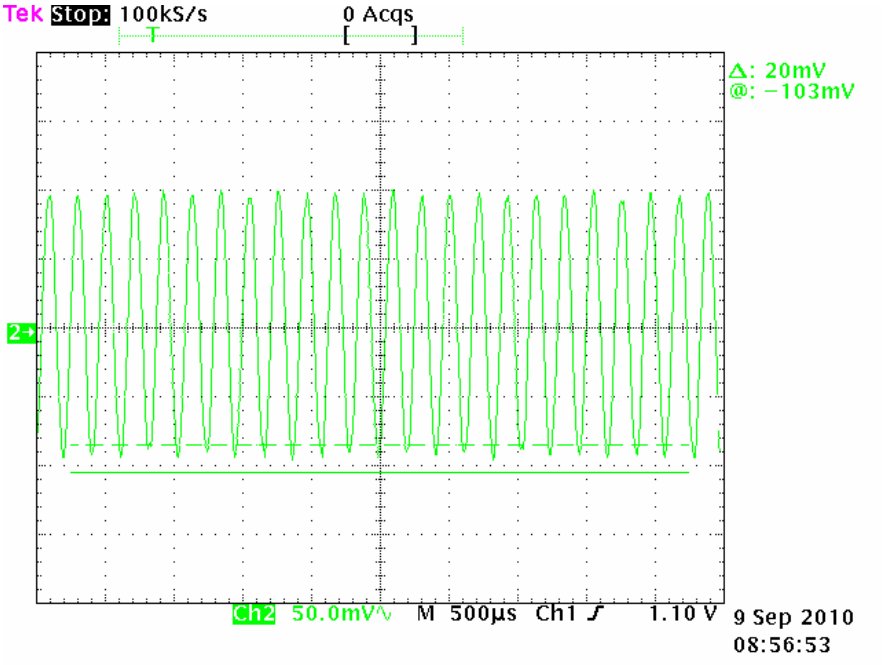
Test signal 2 at ambient between bit 0 and bit 31 on 162.025 MHz with the lower limit



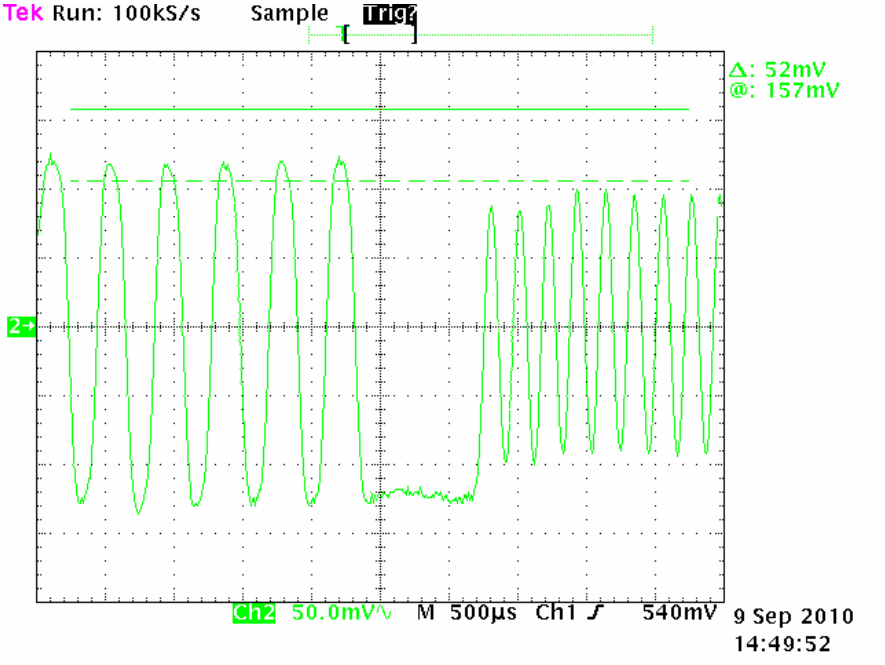
Test signal 2 at ambient between bit 32 and bit 199 on 162.025 MHz with the upper limit



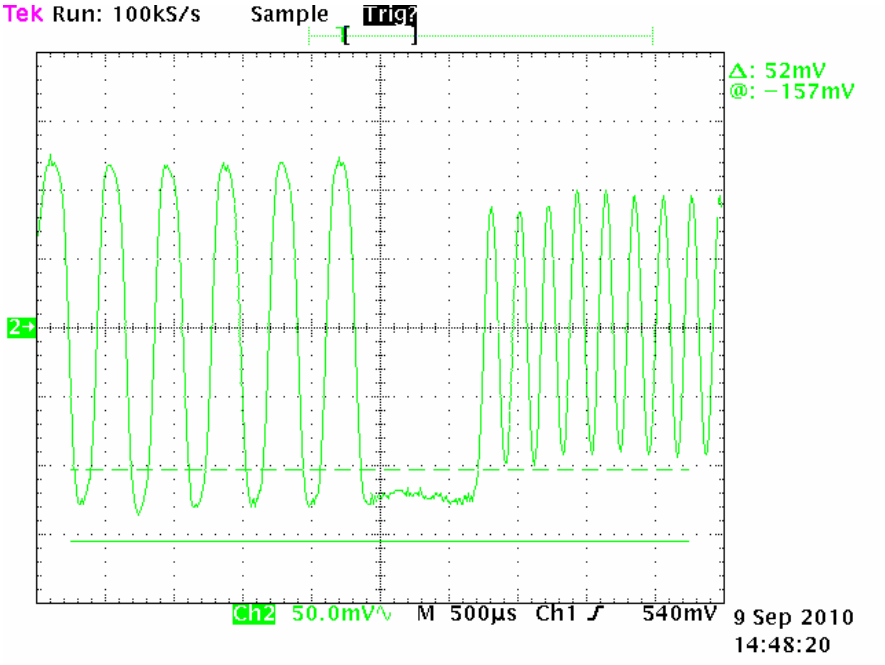
Test signal 2 at ambient between bit 32 and bit 199 on 162.025 MHz with the lower limit



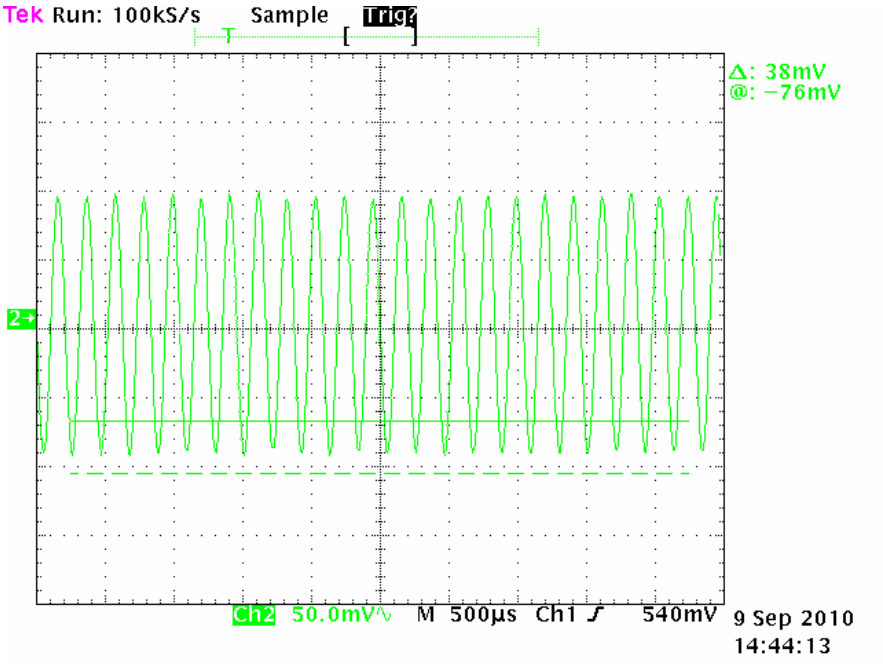
Test signal 2 at +55 degrees between bit 0 and bit 31 on 161.500 MHz with the upper limit



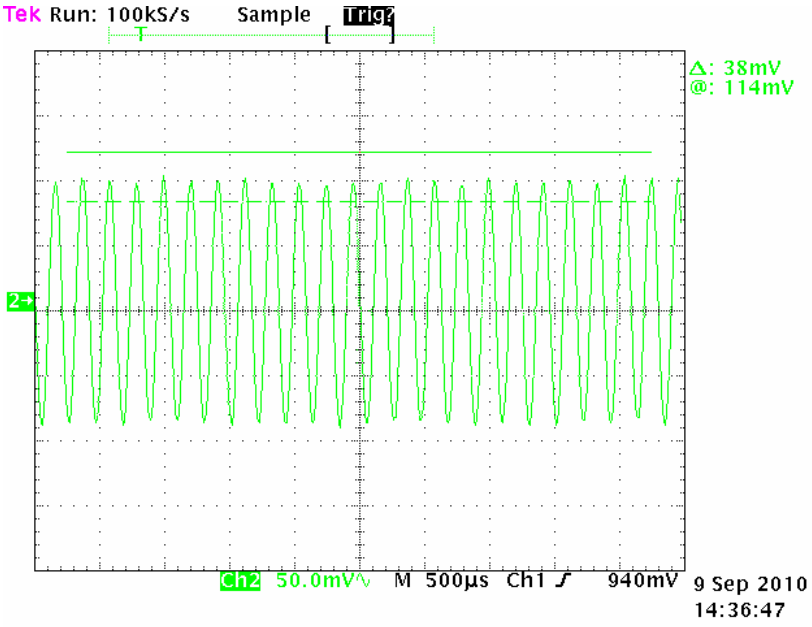
Test signal 2 at +55 degrees between bit 0 and bit 31 on 161.500 MHz with the lower limit



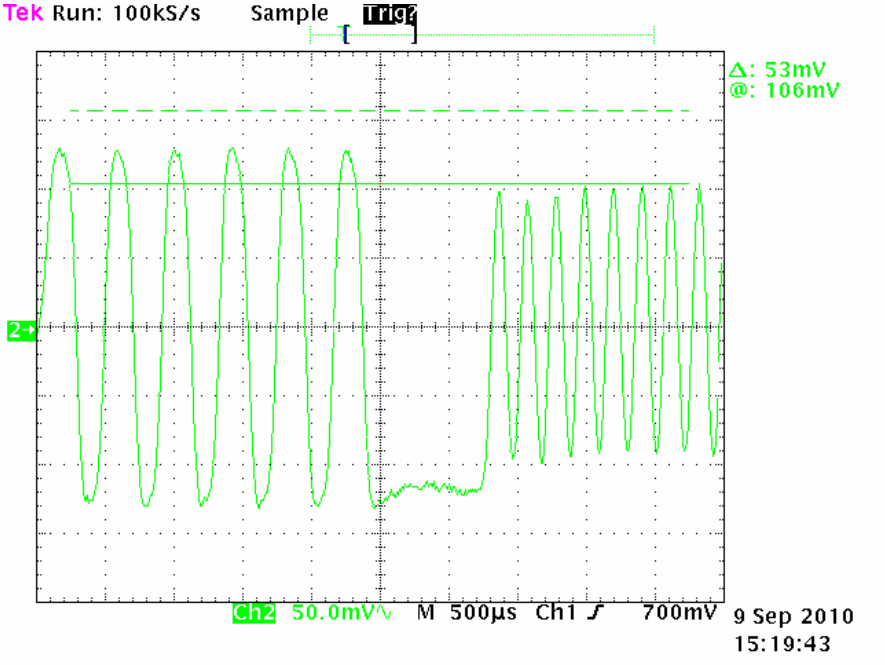
Test signal 2 at +55 degrees with a sample between bit 32 and 199 on 161.500 MHz with the lower.



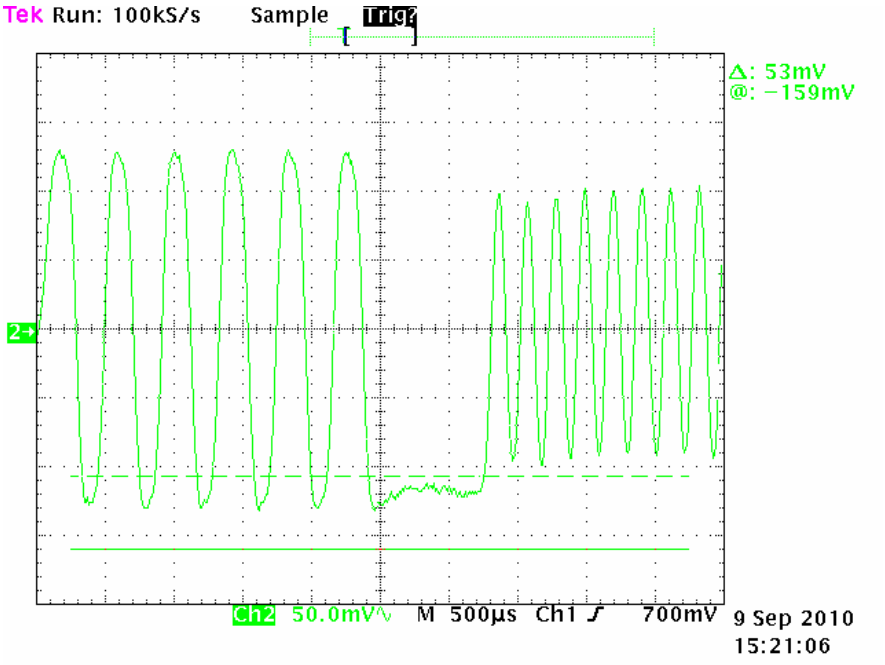
Test signal 2 at +55 degrees with a sample between bit 32 and 199 on 161.500 MHz with the upper limit



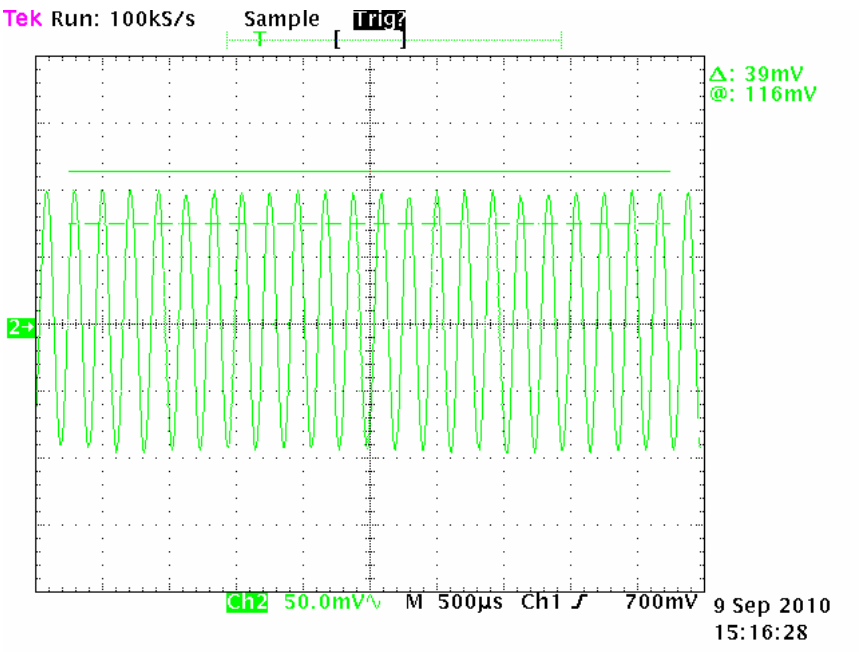
Test signal 2 at +55 degrees between bit 0 and bit 31 on 162.025 MHz with the upper limit



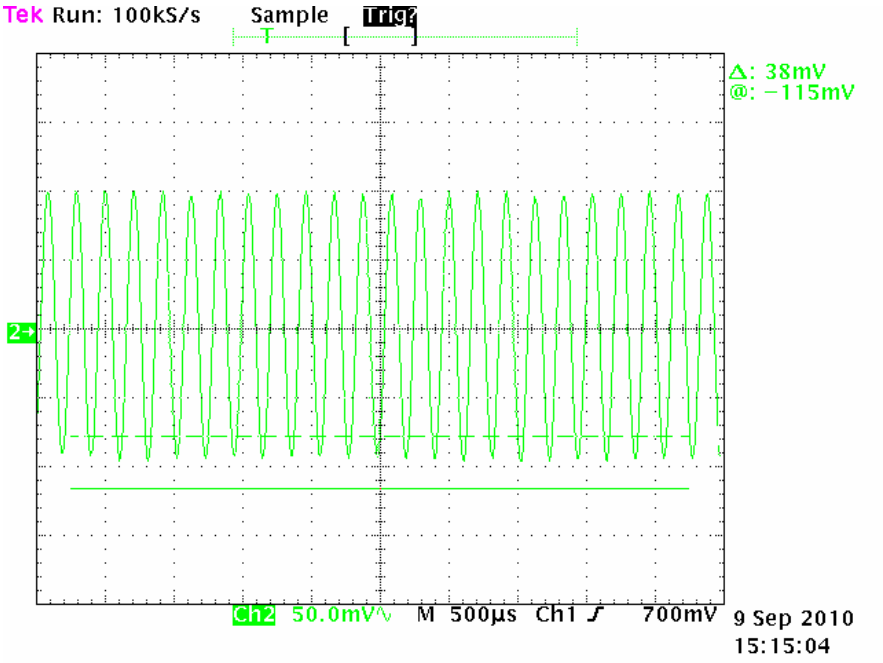
Test signal 2 at +55 degrees between bit 0 and bit 31 on 162.025 MHz with the lower limit



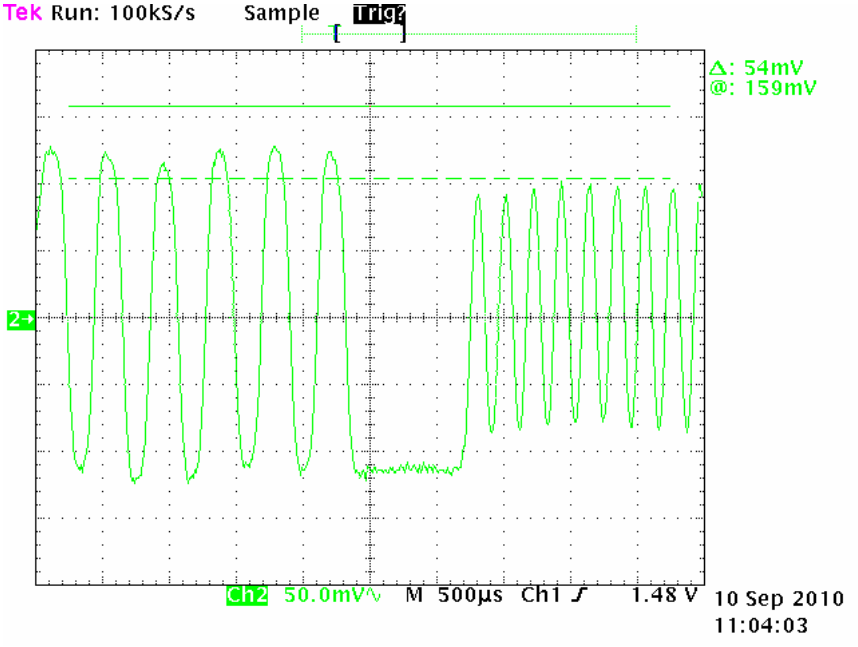
Test signal 2 at +55 degrees with a sample between bit 32 and 199 on 162.025 MHz with the upper limit



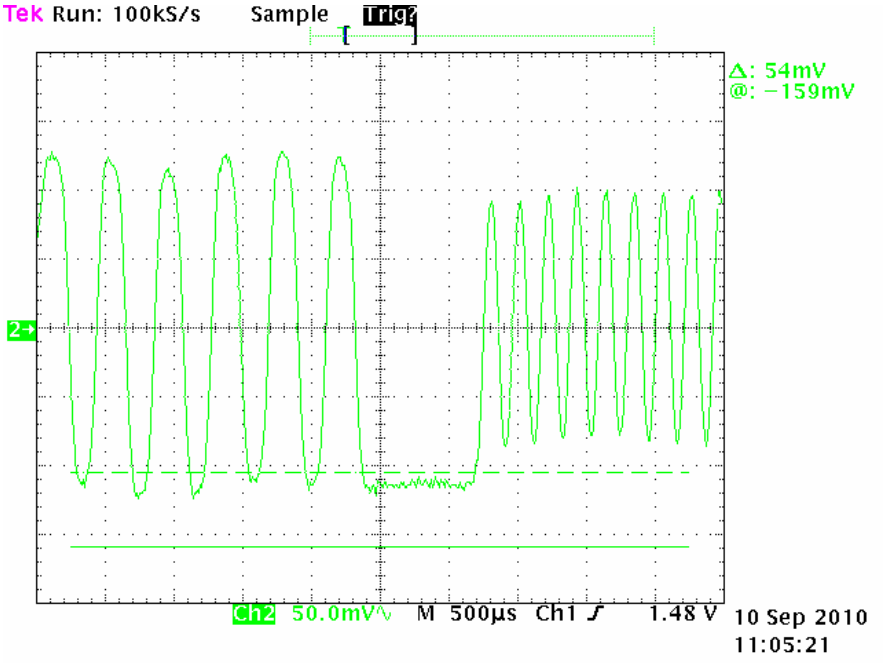
Test signal 2 at +55 degrees with a sample between bit 32 and 199 on 162.025 MHz with the lower limit



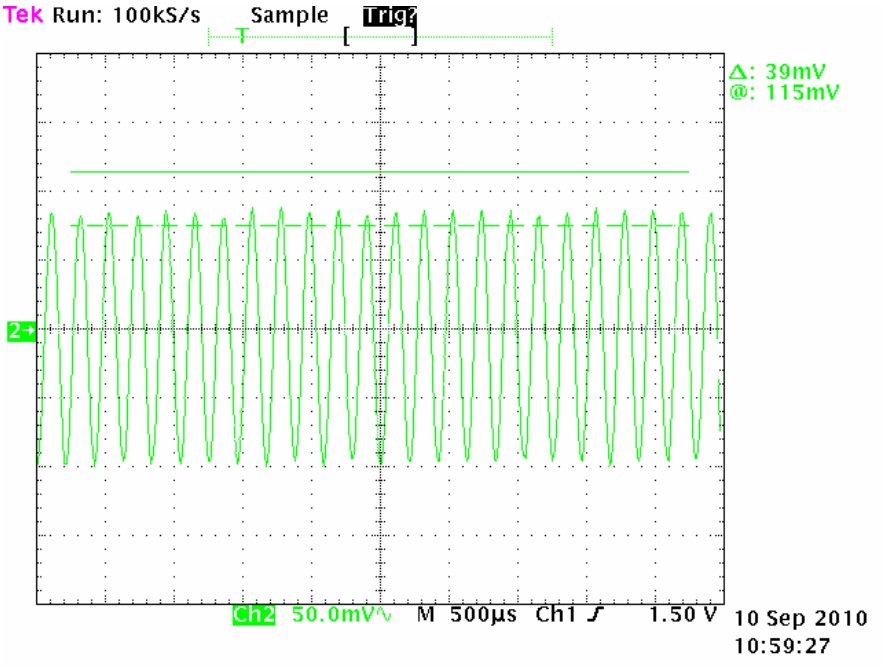
Test signal 2 at -25 degrees between bit 0 and bit 31 on 161.500 MHz with the upper limit



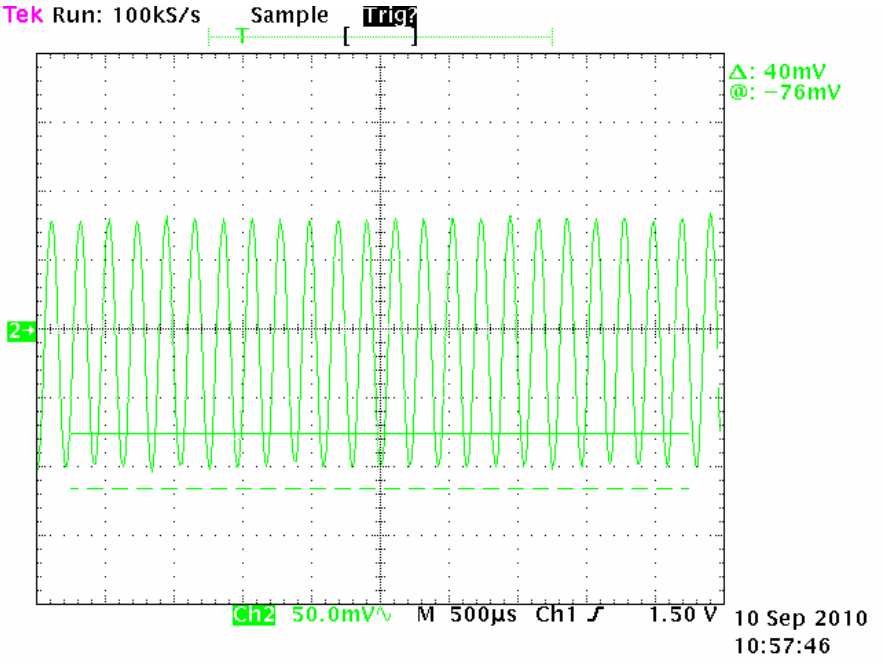
Test signal 2 at -25 degrees between bit 0 and bit 31 on 161.500 MHz with the lower limit



Test signal 2 at -25 degrees with a sample between bit 32 and 199 on 161.500 MHz with the upper limit



Test signal 2 at -25 degrees with a sample between bit 32 and 199 on 161.500 MHz with the lower limit



11.1.5 Transmitter output power versus time function

Testing was carried out using a spectrum analyser that was attached to the output of the transmitter using a 30 dB power attenuator.

The spectrum analyser was operated with a 0 Hz span and a resolution bandwidth and video bandwidth of 1 MHz

The spectrum analyser was triggered using a TTL dc voltage supplied from the device under test with test signal number 2 being used.

Test was carried out on 161.5000 MHz and 162.0250 MHz with Pss being determined as the steady state power as detailed using marker 1 with all measurements being made as relative measurements to this power level.

+30 dB needs to be added to the spectrum analyser values to account for the external attenuator that has been used.

The following measurements were made with regard figure 3 and the associated timings in table 6.

161.500 MHz

Ref	Time	Measured	Limit	Result
To	0 ms	-	-	-
Ta	2.083 ms	-60.231 dB	-50 dB of Pss	Pass
Tb1	2.396 ms	-1.386 dB	-3.0 to +1.5 dB of Pss	Pass
Tb2	2.604 ms	-0.945 dB	-1.0 to +1.5 dB of Pss	Pass
Te	25.833 ms	-0.233 dB	-1.0 to +1.5 dB of Pss	Pass
Tf	26.146 ms	-59.161 dB	-50 dB of Pss	Pass

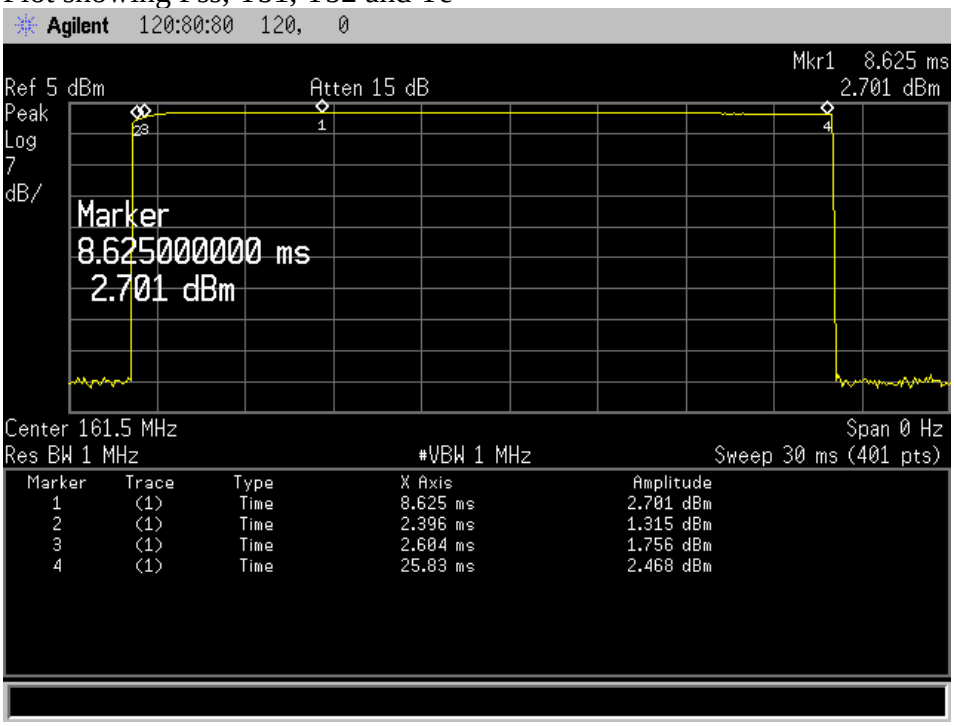
162.025 MHz

Ref	Time	Measured	Limit	Result
To	0 ms	-	-	-
Ta	2.083 ms	-60.573 dB	-50 dB of Pss	Pass
Tb1	2.396 ms	-1.497 dB	-3.0 to +1.5 dB of Pss	Pass
Tb2	2.604 ms	-0.998 dB	-1.0 to +1.5 dB of Pss	Pass
Te	25.833 ms	-0.210 dB	-1.0 to +1.5 dB of Pss	Pass
Tf	26.146 ms	-59.463 dB	-50 dB of Pss	Pass

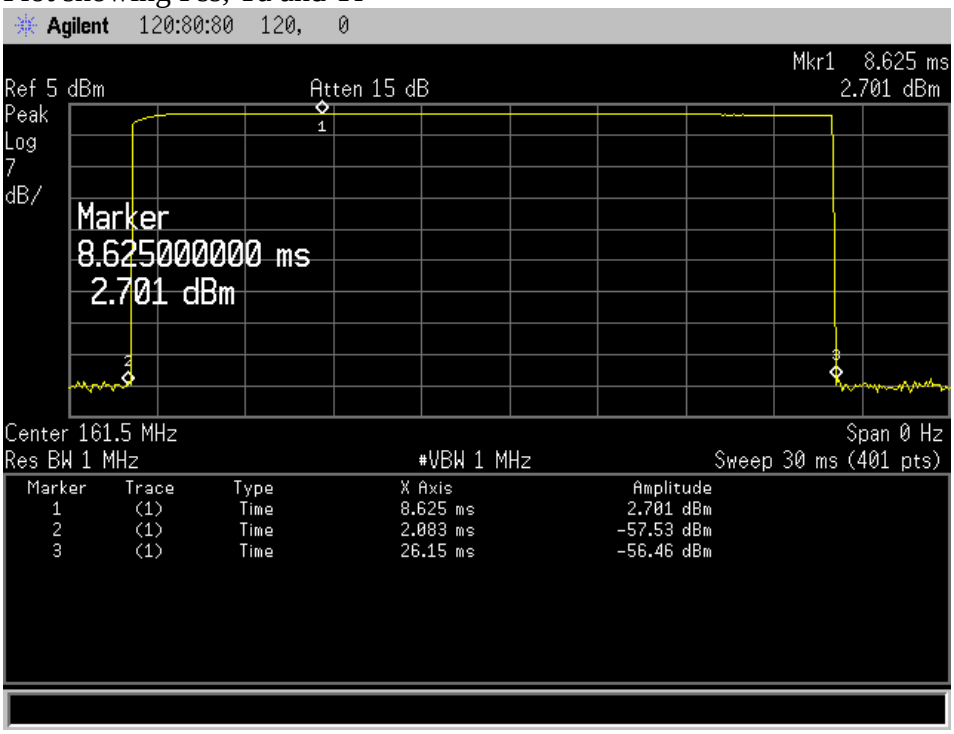
Result: Complies

Below is the spectrum analyser plot of the transmitter output where time reference is taken from the left hand edge of the plot

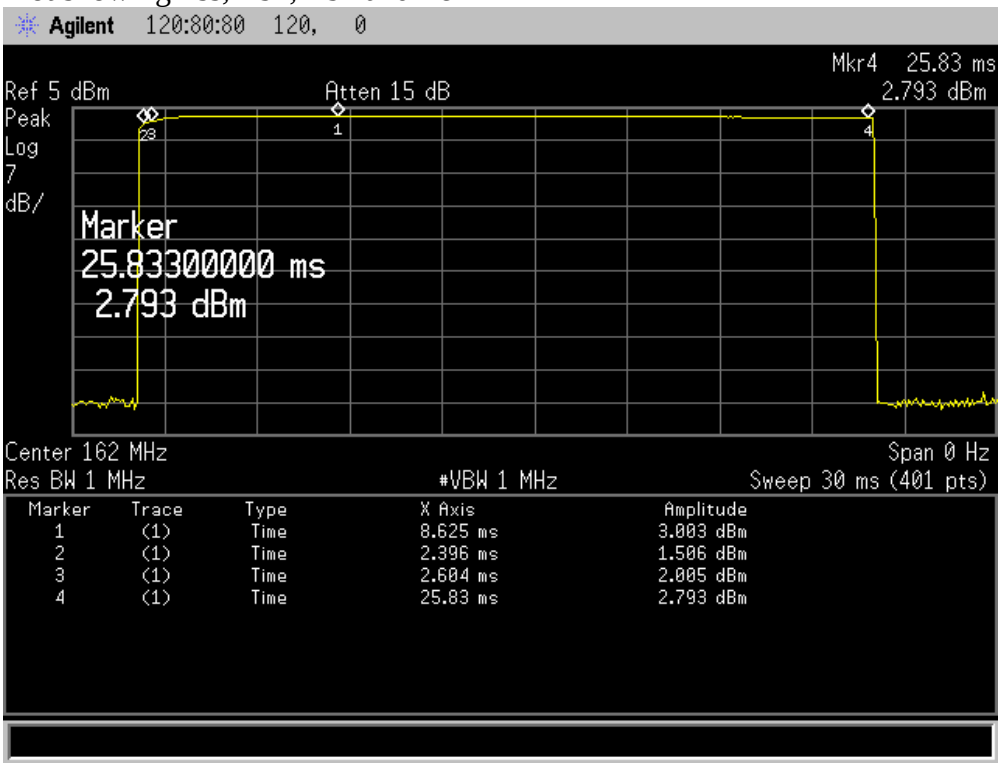
Plot showing Pss, Tb1, Tb2 and Te



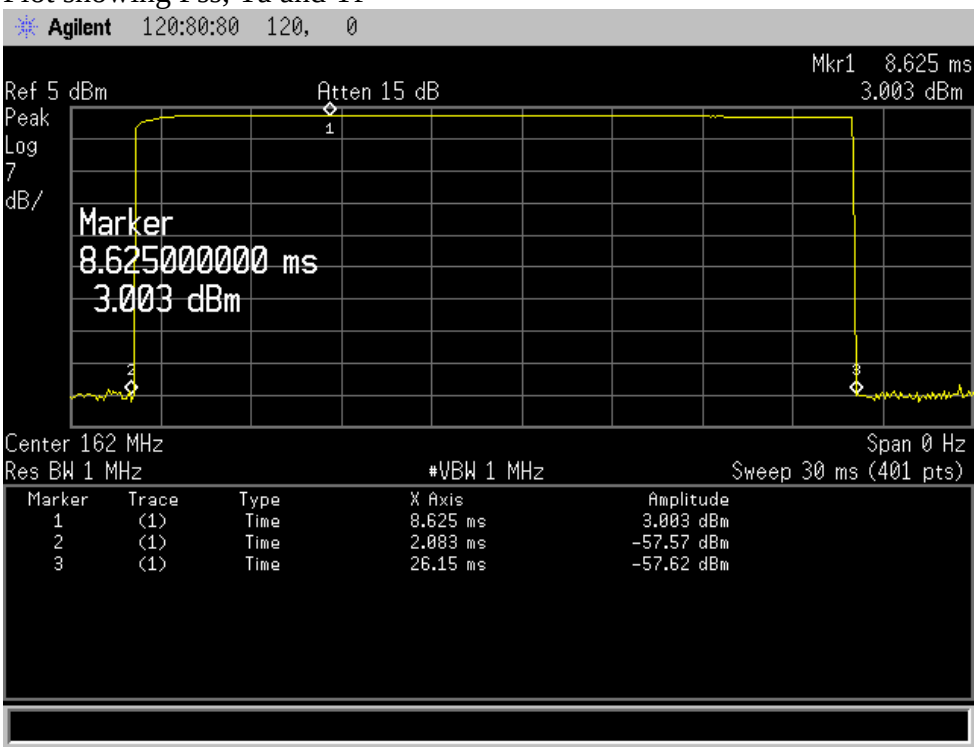
Plot showing Pss, Ta and Tf



Plot showing Pss, Tb1, Tb2 and Te



Plot showing Pss, Ta and Tf



11.2 TMDA Receivers

11.2.1 Sensitivity

Testing carried out in accordance with Figure 12 in the specification.

Testing was carried out using test signal 5 which was supplied to the external modulation input on the SMHU signal generator that was configured to supply an appropriate output level with a frequency deviation of 2.4 kHz.

Channel A: Sensitivity at ambient and temperature extremes. +/- 500 Hz tests at ambient.

Voltage (Vdc)	Temp	Frequency (MHz)	Level (dBm)	PER (%)	Limit (%)
+12.0	+20°C	156.0250	-107.0	3.0	20.0
+12.0		162.0250	-107.0	2.0	20.0
+12.0		162.2550	-104.0	3.0	20.0
+12.0		162.2450	-104.0	2.0	20.0
+12.0		156.0255	-104.0	3.0	20.0
+12.0		156.0245	-104.0	3.0	20.0
+24.0	+20°C	156.0250	-107.0	3.0	20.0
+24.0		162.0250	-107.0	1.0	20.0
+24.0		162.2550	-104.0	2.0	20.0
+24.0		162.2450	-104.0	3.0	20.0
+24.0		156.0255	-104.0	3.0	20.0
+24.0		156.0245	-104.0	3.0	20.0
+10.8	+55°C	156.0250	-107.0	2.0	20.0
+12.0		156.0250	-107.0	3.0	20.0
+24.0		156.0250	-107.0	3.0	20.0
+31.2		156.0250	-107.0	3.0	20.0
+10.8	+55°C	162.0250	-107.0	2.0	20.0
+12.0		162.0250	-107.0	3.0	20.0
+24.0		162.0250	-107.0	3.0	20.0
+31.2		162.0250	-107.0	2.0	20.0
+10.8	-25°C	156.0250	-107.0	2.0	20.0
+12.0		156.0250	-107.0	3.0	20.0
+24.0		156.0250	-107.0	3.0	20.0
+31.2		156.0250	-107.0	5.0	20.0
+10.8	-25°C	162.0250	-107.0	6.0	20.0
+12.0		162.0250	-107.0	4.0	20.0
+24.0		162.0250	-107.0	6.0	20.0
+31.2		162.0250	-107.0	4.0	20.0

Channel A: +/- 500 Hz tests at extremes of temperature and voltage

Voltage (Vdc)	Temp	Frequency (MHz)	Level (dBm)	PER (%)	Limit (%)
+10.8	+55°C	162.2550	-101.0	4.0	20.0
+10.8		162.2450	-101.0	3.0	20.0
+12.0		162.2550	-101.0	2.0	20.0
+12.0		162.2450	-101.0	1.0	20.0
+24.0		162.2550	-101.0	3.0	20.0
+24.0		162.2450	-101.0	4.0	20.0
+31.2		162.2550	-101.0	3.0	20.0
+31.2		162.2450	-101.0	2.0	20.0
+10.8	+55°C	156.0255	-101.0	4.0	20.0
+10.8		156.0245	-101.0	3.0	20.0
+12.0		156.0255	-101.0	4.0	20.0
+12.0		156.0245	-101.0	2.0	20.0
+24.0		156.0255	-101.0	2.0	20.0
+24.0		156.0245	-101.0	4.0	20.0
+31.2		156.0255	-101.0	2.0	20.0
+31.2		156.0245	-101.0	3.0	20.0
+10.8	-20°C	162.2550	-101.0	3.0	20.0
+10.8		162.2450	-101.0	2.0	20.0
+12.0		162.2550	-101.0	3.0	20.0
+12.0		162.2450	-101.0	1.0	20.0
+24.0		162.2550	-101.0	3.0	20.0
+24.0		162.2450	-101.0	2.0	20.0
+31.2		162.2550	-101.0	2.0	20.0
+31.2		162.2450	-101.0	3.0	20.0
+10.8	-20°C	156.0255	-101.0	4.0	20.0
+10.8		156.0245	-101.0	3.0	20.0
+12.0		156.0255	-101.0	3.0	20.0
+12.0		156.0245	-101.0	4.0	20.0
+24.0		156.0255	-101.0	3.0	20.0
+24.0		156.0245	-101.0	2.0	20.0
+31.2		156.0255	-101.0	2.0	20.0
+31.2		156.0245	-101.0	1.0	20.0

Channel B: Sensitivity at ambient and temperature extremes. +/- 500 Hz tests at ambient.

Voltage (Vdc)	Temp	Frequency (MHz)	Level (dBm)	PER (%)	Limit (%)
+12.0	+20°C	156.0250	-107.0	1.0	20.0
+12.0		162.0250	-107.0	2.0	20.0
+12.0		162.2550	-104.0	0.0	20.0
+12.0		162.2450	-104.0	0.0	20.0
+12.0		156.0255	-104.0	1.0	20.0
+12.0		156.0245	-104.0	2.0	20.0
+24.0	+20°C	156.0250	-107.0	2.0	20.0
+24.0		162.0250	-107.0	3.0	20.0
+24.0		162.2550	-104.0	2.0	20.0
+24.0		162.2450	-104.0	0.0	20.0
+24.0		156.0255	-104.0	2.0	20.0
+24.0		156.0245	-104.0	1.0	20.0
+10.8	+55°C	156.0250	-107.0	3.0	20.0
+12.0		156.0250	-107.0	5.0	20.0
+24.0		156.0250	-107.0	4.0	20.0
+31.2		156.0250	-107.0	6.0	20.0
+10.8	+55°C	162.0250	-107.0	6.0	20.0
+12.0		162.0250	-107.0	6.0	20.0
+24.0		162.0250	-107.0	4.0	20.0
+31.2		162.0250	-107.0	5.0	20.0
+10.8	-25°C	156.0250	-107.0	3.0	20.0
+12.0		156.0250	-107.0	1.0	20.0
+24.0		156.0250	-107.0	1.0	20.0
+31.2		156.0250	-107.0	2.0	20.0
+10.8	-25°C	162.0250	-107.0	4.0	20.0
+12.0		162.0250	-107.0	5.0	20.0
+24.0		162.0250	-107.0	3.0	20.0
+31.2		162.0250	-107.0	2.0	20.0

Channel B: +/- 500 Hz tests at extremes of temperature and voltage

Voltage (Vdc)	Temp	Frequency (MHz)	Level (dBm)	PER (%)	Limit (%)
+10.8	+55°C	162.2550	-101.0	4.0	20.0
+10.8		162.2450	-101.0	3.0	20.0
+12.0		162.2550	-101.0	3.0	20.0
+12.0		162.2450	-101.0	2.0	20.0
+24.0		162.2550	-101.0	1.0	20.0
+24.0		162.2450	-101.0	1.0	20.0
+31.2		162.2550	-101.0	1.0	20.0
+31.2		162.2450	-101.0	2.0	20.0
+10.8	+55°C	156.0255	-101.0	2.0	20.0
+10.8		156.0245	-101.0	2.0	20.0
+12.0		156.0255	-101.0	4.0	20.0
+12.0		156.0245	-101.0	3.0	20.0
+24.0		156.0255	-101.0	3.0	20.0
+24.0		156.0245	-101.0	1.0	20.0
+31.2		156.0255	-101.0	1.0	20.0
+31.2		156.0245	-101.0	2.0	20.0
+10.8	-20°C	162.2550	-101.0	3.0	20.0
+10.8		162.2450	-101.0	1.0	20.0
+12.0		162.2550	-101.0	2.0	20.0
+12.0		162.2450	-101.0	2.0	20.0
+24.0		162.2550	-101.0	2.0	20.0
+24.0		162.2450	-101.0	1.0	20.0
+31.2		162.2550	-101.0	2.0	20.0
+31.2		162.2450	-101.0	1.0	20.0
+10.8	-20°C	156.0255	-101.0	5.0	20.0
+10.8		156.0245	-101.0	1.0	20.0
+12.0		156.0255	-101.0	1.0	20.0
+12.0		156.0245	-101.0	2.0	20.0
+24.0		156.0255	-101.0	3.0	20.0
+24.0		156.0245	-101.0	1.0	20.0
+31.2		156.0255	-101.0	2.0	20.0
+31.2		156.0245	-101.0	3.0	20.0

Result: Complies

11.2.2 Error Level at High Input Levels

Testing carried out in accordance with Figure 12 in the specification.

Testing was carried out using test signal 5 which was supplied to the external modulation input on the SMHU signal generator that was configured to supply an appropriate level with a frequency deviation of 2.4 kHz.

Channel A

Voltage (Vdc)	Temp	Frequency (MHz)	Level (dBm)	PER (%)	Limit (%)
+12.0	+20°C	156.0250	-77.0	1.0	2.0
		162.0250	-77.0	2.0	2.0
		156.0250	-7.0	3.0	10.0
		162.0250	-7.0	3.0	10.0
+24.0	+20°C	156.0250	-77.0	2.0	2.0
		162.0250	-77.0	2.0	2.0
		156.0250	-7.0	2.0	10.0
		162.0250	-7.0	3.0	10.0

Channel B

Voltage (Vdc)	Temp	Frequency (MHz)	Level (dBm)	PER (%)	Limit (%)
+12.0	+20°C	156.0250	-77.0	1.0	2.0
		162.0250	-77.0	2.0	2.0
		156.0250	-7.0	0.0	10.0
		162.0250	-7.0	1.0	10.0
+24.0	+20°C	156.0250	-77.0	0.0	2.0
		162.0250	-77.0	1.0	2.0
		156.0250	-7.0	1.0	10.0
		162.0250	-7.0	1.0	10.0

Result: Complies

11.2.3 Co-Channel Rejection

Testing carried out in accordance with Figure 13 in the specification.

Testing was carried out using test signal 5 which was supplied to the external modulation input on the SMHU signal generator at a level of -101 dBm with a frequency deviation of 2.4 kHz.

Test signal 4 was supplied to the external modulation input on the Hewlett Packard signal generator at a level of -111 dBm with a frequency deviation of 2.4 kHz

Channel A and B

Voltage (Vdc)	Temp	Frequency (MHz)	PER (%)	Limit (%)
+12.0	+20°C	156.0250	9.0	20.0
+12.0		162.0250	2.0	20.0
+12.0		156.0260	4.0	20.0
+12.0		156.0240	3.0	20.0
+12.0		162.0260	2.0	20.0
+12.0		162.0240	2.0	20.0
+24.0	+20°C	156.0250	7.0	20.0
+24.0		162.0250	4.0	20.0
+24.0		156.0260	3.0	20.0
+24.0		156.0240	2.0	20.0
+24.0		162.0260	2.0	20.0
+24.0		162.0240	3.0	20.0

Result: Complies

11.2.4 Adjacent Channel Selectivity

Testing carried out in accordance with Figure 13 in the specification.

Testing was carried out using test signal 5 which was supplied to the external modulation input on the SMHU signal generator that was configured to supply a level of -101 dBm with a frequency deviation of 2.4 kHz (Signal Generator A).

Signal generator B was modulated using a 400 Hz tone and a deviation of +/- 3 kHz at a level of -31 dBm

Testing was carried out with signal generator B being varied +/- 25 kHz about the nominal receive frequency

Channel A

Voltage (Vdc)	Temp	Frequency (MHz)	PER (%)	Limit (%)
+12.0	+20°C	156.0500	13.0	20.0
+12.0		156.0000	9.0	20.0
+12.0		162.0500	15.0	20.0
+12.0		162.0000	14.0	20.0
+24.0	+20°C	156.0500	18.0	20.0
+24.0		156.0000	17.0	20.0
+24.0		162.0500	14.0	20.0
+24.0		162.0000	14.0	20.0

Channel B

Voltage (Vdc)	Temp	Frequency (MHz)	PER (%)	Limit (%)
+12.0	+20°C	156.0500	8.0	20.0
+12.0		156.0000	5.0	20.0
+12.0		162.0500	9.0	20.0
+12.0		162.0000	4.0	20.0
+24.0	+20°C	156.0500	6.0	20.0
+24.0		156.0000	3.0	20.0
+24.0		162.0500	8.0	20.0
+24.0		162.0000	6.0	20.0

Result: Complies.

11.2.5 Spurious response rejection

Testing carried out in accordance with Figure 15 in the specification.

Testing was carried out using test signal 5 which was supplied to the external modulation input on the SMHU signal generator that was configured to supply a level of -101 dBm with a frequency deviation of 2.4 kHz (Signal Generator A).

Signal generator B was modulated using a 400 Hz tone and a deviation of +/- 3 kHz at a level of -31 dBm

Testing was carried out with signal generator B being varied +/- 50 kHz about the nominal receive frequency and generator C being varied +/ 50 kHz about the nominal receive frequency.

The receiver was programmed to operate on Channel A and Channel B.

The receiver has the following characteristics:

A switching range of 6 MHz between Channel A and Channel B

Testing was carried out in 5 kHz steps over the limited range of 62.570 MHz to 165.480 MHz and at a number of specific frequencies

The formula from the specification was applied to IF1 as follows where:

SFI1 = (K * LOH) + IF1 and SFI2 = (K * LOL) – IF1 for each band where K is an integer from 2 to 4

On Channel A the receiver has an IF1 of 45.0 MHz.

When tuned to 156.025 MHz the LOL = 111.025 MHz and when tuned to 162.025 MHz the LOH = 117.025 MHz

On Channel B the receiver has an IF1 of 21.4 MHz

When tuned to 156.025 MHz the LOL = 134.625 MHz and when tuned to 162.025 MHz the LOH = 140.625 MHz

The following frequencies of interest were investigated

K factor	Band	Frequency (MHz)	SFI2 (MHz)	Frequency (MHz)	SFI1 (MHz)
2	A	156.025	177.050	162.025	279.050
3	A	156.025	288.075		396.075
4	A	156.025	399.100		513.100
2	B	156.025	247.850	162.025	302.650
3	B	156.025	382.475		443.275
4	B	156.025	517.100		583.900

Spurious responses were observed on the following frequencies

Only frequencies with a PER exceeding 5% have been recorded.

Channel A

Voltage (Vdc)	Temp	Receive (MHz	Interferer (MHz)	Relationship	PER (%)	Limit (%)
12.0	+20°C	156.0250	155.1150	Fc – 2*IF2	6.0	20.0
	+20°C	162.0250	161.1150	Fc – 2*IF2	18.0	20.0
24.0	+20°C	156.0250	155.1150	Fc – 2*IF2	5.0	20.0
	+20°C	162.0250	161.1150	Fc – 2*IF2	16.0	20.0
12.0	+20°C	162.0250	139.5250	Fc – 0.5*IF1	6.0	20.0
24.0	+20°C	162.0250	139.5250	Fc – 0.5*IF1	6.0	20.0

Channel B

Voltage (Vdc)	Temp	Receive (MHz	Interferer (MHz)	Relationship	PER (%)	Limit (%)
12.0	+20°C	156.0250	155.1150	Fc – 2*IF2	2.0	20.0
	+20°C	162.0250	161.1150	Fc – 2*IF2	3.0	20.0
24.0	+20°C	156.0250	155.1150	Fc – 2*IF2	3.0	20.0
	+20°C	162.0250	161.1150	Fc – 2*IF2	3.0	20.0

Result: Complies

11.2.6 Inter-modulation response rejection

Testing carried out in accordance with Figure 15 in the specification.

Testing was carried out using test signal 5 which was supplied to the external modulation input on the SMHU signal generator that was configured to supply a level of -101 dBm with a frequency deviation of 2.4 kHz (Signal Generator A).

Signal generator B was not modulated at a level of -36 dBm

Signal generator C was modulated using a 400 Hz tone and a deviation of +/- 3 kHz at a level of -36 dBm

Testing was carried out with signal generator B being varied +/- 50 kHz about the nominal receive frequency and generator C being varied +/ 50 kHz about the nominal receive frequency.

Channel A

Voltage (Vdc)	Temp	Frequency (MHz)	Interferer	PER (%)	Limit (%)
+12.0	+20°C	156.0250	+50/+100 kHz	2.0	20.0
+12.0		156.0250	-50/-100 kHz	3.0	20.0
+12.0		162.0250	+50/+100 kHz	3.0	20.0
+12.0		162.0250	-50/-100 kHz	2.0	20.0
+24.0	+20°C	156.0250	+50/+100 kHz	2.0	20.0
+24.0		156.0250	-50/-100 kHz	3.0	20.0
+24.0		162.0250	+50/+100 kHz	2.0	20.0
+24.0		162.0250	-50/-100 kHz	3.0	20.0

Channel B

Voltage (Vdc)	Temp	Frequency (MHz)	Interferer	PER (%)	Limit (%)
+12.0	+20°C	156.0250	+50/+100 kHz	3.0	20.0
+12.0		156.0250	-50/-100 kHz	0.0	20.0
+12.0		162.0250	+50/+100 kHz	4.0	20.0
+12.0		162.0250	-50/-100 kHz	4.0	20.0
+24.0	+20°C	156.0250	+50/+100 kHz	3.0	20.0
+24.0		156.0250	-50/-100 kHz	3.0	20.0
+24.0		162.0250	+50/+100 kHz	4.0	20.0
+24.0		162.0250	-50/-100 kHz	4.0	20.0

Result: Complies.

11.2.7 Blocking or Desensitisation

Testing was carried out using test signal 5 which was supplied to the external modulation input on the SMHU signal generator that was configured to supply a level of -101 dBm with a frequency deviation of 2.4 kHz (Signal Generator A).

Signal generator B was not modulated at a level of -23 dBm or -15 dBm.

Testing was carried out with signal generator B at +/- 500 kHz, +/- 1 MHz, +/- 2 MHz, +/- 5 MHz and +/- 10 MHz

Channel A

Voltage (Vdc)	Temp	Frequency (MHz)	Level (dBm)	(MHz)	PER (%)	(MHz)	PER (%)	Limit (%)
+12.0	+20°C	156.0250	-23.0	- 0.5	3.0	+ 0.5	3.0	20.0
+12.0			-23.0	-1.0	2.0	+1.0	3.0	20.0
+12.0			-23.0	-2.0	2.0	+2.0	2.0	20.0
+12.0			-15.0	-5.0	2.0	+5.0	2.0	20.0
+12.0			-15.0	-10.0	2.0	+10.0	2.0	20.0
+12.0	+20°C	162.0250	-23.0	- 0.5	4.0	+ 0.5	3.0	20.0
+12.0			-23.0	-1.0	2.0	+1.0	1.0	20.0
+12.0			-23.0	-2.0	2.0	+2.0	2.0	20.0
+12.0			-15.0	-5.0	1.0	+5.0	3.0	20.0
+12.0			-15.0	-10.0	1.0	+10.0	1.0	20.0
+24.0	+20°C	156.0250	-23.0	- 0.5	6.0	+ 0.5	4.0	20.0
+24.0			-23.0	-1.0	2.0	+1.0	2.0	20.0
+24.0			-23.0	-2.0	2.0	+2.0	2.0	20.0
+24.0			-15.0	-5.0	2.0	+5.0	3.0	20.0
+24.0			-15.0	-10.0	2.0	+10.0	3.0	20.0
+24.0	+20°C	162.0250	-23.0	- 0.5	6.0	+ 0.5	7.0	20.0
+24.0			-23.0	-1.0	2.0	+1.0	1.0	20.0
+24.0			-23.0	-2.0	2.0	+2.0	2.0	20.0
+24.0			-15.0	-5.0	2.0	+5.0	3.0	20.0
+24.0			-15.0	-10.0	3.0	+10.0	2.0	20.0

Channel B

Voltage (Vdc)	Temp	Frequency (MHz)	Level (dBm)	(MHz)	PER (%)	(MHz)	PER (%)	Limit (%)
+12.0	+20°C	156.0250	-23.0	- 0.5	2.0	+ 0.5	2.0	20.0
+12.0			-23.0	-1.0	2.0	+1.0	3.0	20.0
+12.0			-23.0	-2.0	2.0	+2.0	2.0	20.0
+12.0			-15.0	-5.0	2.0	+5.0	2.0	20.0
+12.0			-15.0	-10.0	2.0	+10.0	2.0	20.0
+12.0	+20°C	162.0250	-23.0	- 0.5	1.0	+ 0.5	1.0	20.0
+12.0			-23.0	-1.0	2.0	+1.0	1.0	20.0
+12.0			-23.0	-2.0	2.0	+2.0	2.0	20.0
+12.0			-15.0	-5.0	1.0	+5.0	3.0	20.0
+12.0			-15.0	-10.0	1.0	+10.0	1.0	20.0
+24.0	+20°C	156.0250	-23.0	- 0.5	3.0	+ 0.5	2.0	20.0
+24.0			-23.0	-1.0	2.0	+1.0	2.0	20.0
+24.0			-23.0	-2.0	2.0	+2.0	2.0	20.0
+24.0			-15.0	-5.0	2.0	+5.0	3.0	20.0
+24.0			-15.0	-10.0	2.0	+10.0	3.0	20.0
+24.0	+20°C	162.0250	-23.0	- 0.5	1.0	+ 0.5	2.0	20.0
+24.0			-23.0	-1.0	2.0	+1.0	1.0	20.0
+24.0			-23.0	-2.0	2.0	+2.0	2.0	20.0
+24.0			-15.0	-5.0	2.0	+5.0	3.0	20.0
+24.0			-15.0	-10.0	3.0	+10.0	2.0	20.0

Result: Complies.

11.3 Receiver Conducted Spurious Emissions

A spectrum analyser was connected directly to the receiver antenna port with measurements being attempted over the range of 9 kHz to 4 GHz.

Test carried out when receiving on 156.025 MHz and 162.025 MHz when operating using Channel A or Channel B.

The highest 5 emissions on each receive frequency have been recorded

Channel A

Voltage (Vdc)	Temp	Receive Frequency (MHz)	Emission Frequency (MHz)	Level (dBm)	Limit (dBm)
+12.0 / +24.0	+20°C	156.025	111.025	-60.7	-57.0
+12.0 / +24.0			333.075	-73.6	-57.0
+12.0 / +24.0			999.250	-79.9	-57.0
+12.0 / +24.0			1221.275	-74.3	-47.0
+12.0 / +24.0			1332.300	-81.0	-47.0
+12.0 / +24.0	+20°C	162.025	117.025	-60.9	-57.0
+12.0 / +24.0			351.075	-74.1	-57.0
+12.0 / +24.0			936.200	-76.2	-57.0
+12.0 / +24.0			1053.225	-77.3	-57.0
+12.0 / +24.0			1287.275	-76.3	-57.0

Channel B

Voltage (Vdc)	Temp	Receive Frequency (MHz)	Emission Frequency (MHz)	Level (dBm)	Limit (dBm)
+12.0 / +24.0	+20°C	156.025	134.625	-84.9	-57.0
+12.0 / +24.0			269.250	-91.6	-57.0
+12.0 / +24.0			403.875	-91.7	-57.0
+12.0 / +24.0			538.500	-88.6	-47.0
+12.0 / +24.0			673.125	-89.3	-47.0
+12.0 / +24.0	+20°C	162.025	140.625	-83.6	-57.0
+12.0 / +24.0			281.250	-88.0	-57.0
+12.0 / +24.0			421.875	-92.6	-57.0
+12.0 / +24.0			562.500	-88.1	-57.0
+12.0 / +24.0			703.125	-92.3	-57.0

Result: Complies

11.3.2 Transmitter Conducted Spurious Emissions

Testing was carried out using a spectrum analyser that had a 30 dB attenuator attached to the input.

Testing was carried out with the device transmitting on 161.5000 MHz and 162.0250 MHz with an unmodulated carrier.

Emissions less than -55 dBm, that were observed, have not been reported.

161.5000 MHz Harmonic emissions

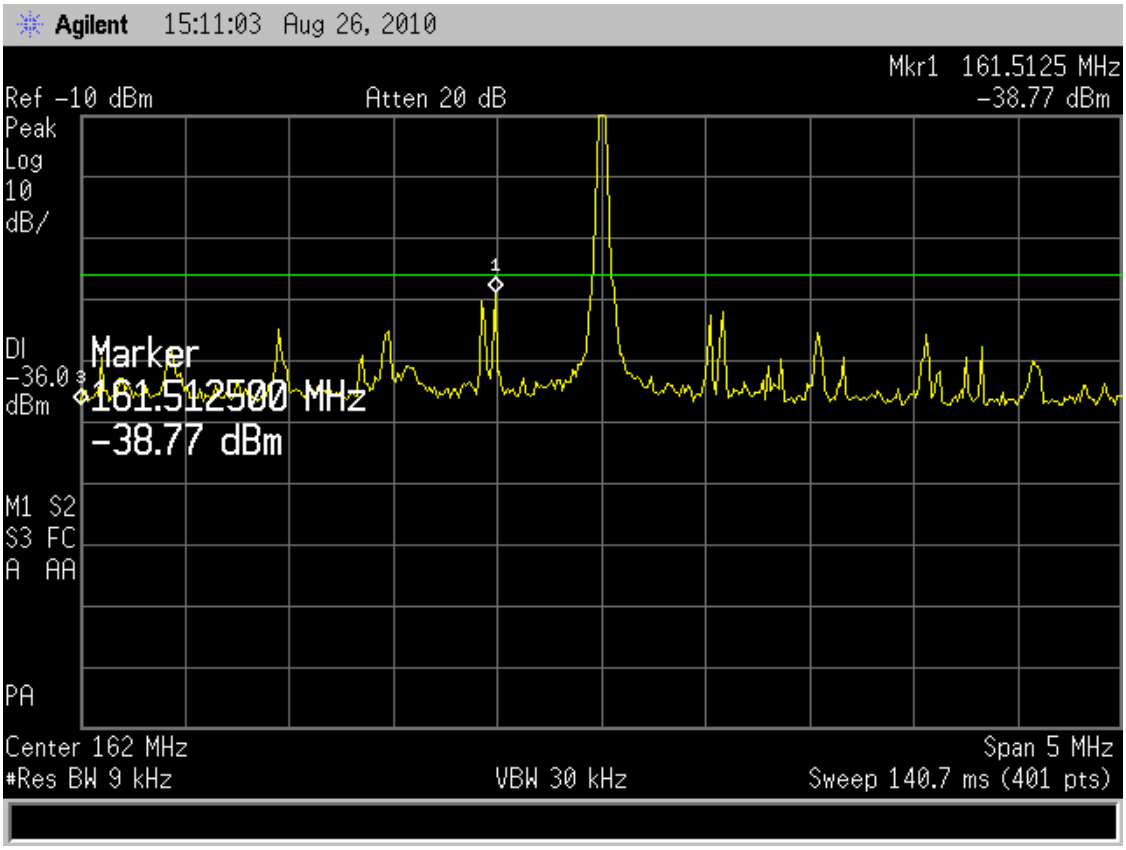
Voltage (Vdc)	Temp	Emission Frequency (MHz)	Level (dBm)	Limit (dBm)
+12.0 / +24.0	+20°C	323.0000	-39.5	-36.0
+12.0 / +24.0		484.5000	-63.5	-36.0
+12.0 / +24.0		646.0000	-53.8	-36.0
+12.0 / +24.0		807.5000	-48.8	-36.0
+12.0 / +24.0		969.0000	-53.1	-36.0
+12.0 / +24.0		1453.5000	-50.9	-30.0
+12.0 / +24.0		1938.0000	-39.1	-30.0
+12.0 / +24.0		2422.5040	-38.6	-30.0

162.0250 MHz Harmonic Emissions

Voltage (Vdc)	Temp	Emission Frequency (MHz)	Level (dBm)	Limit (dBm)
+12.0 / +24.0	+20°C	324.0500	-39.9	-36.0
+12.0 / +24.0		486.0750	-64.2	-36.0
+12.0 / +24.0		648.1000	-53.2	-36.0
+12.0 / +24.0		810.1250	-52.9	-36.0
+12.0 / +24.0		972.1500	-53.5	-36.0
+12.0 / +24.0		1458.2250	-51.3	-30.0
+12.0 / +24.0		1782.2780	-45.7	-30.0
+12.0 / +24.0		1944.3036	-38.6	-30.0
+12.0 / +24.0		2106.3293	-41.6	-30.0
+12.0 / +24.0		2268.3546	-40.1	-30.0
+12.0 / +24.0		2430.3791	-39.4	-30.0
+12.0 / +24.0		2592.4043	-46.4	-30.0

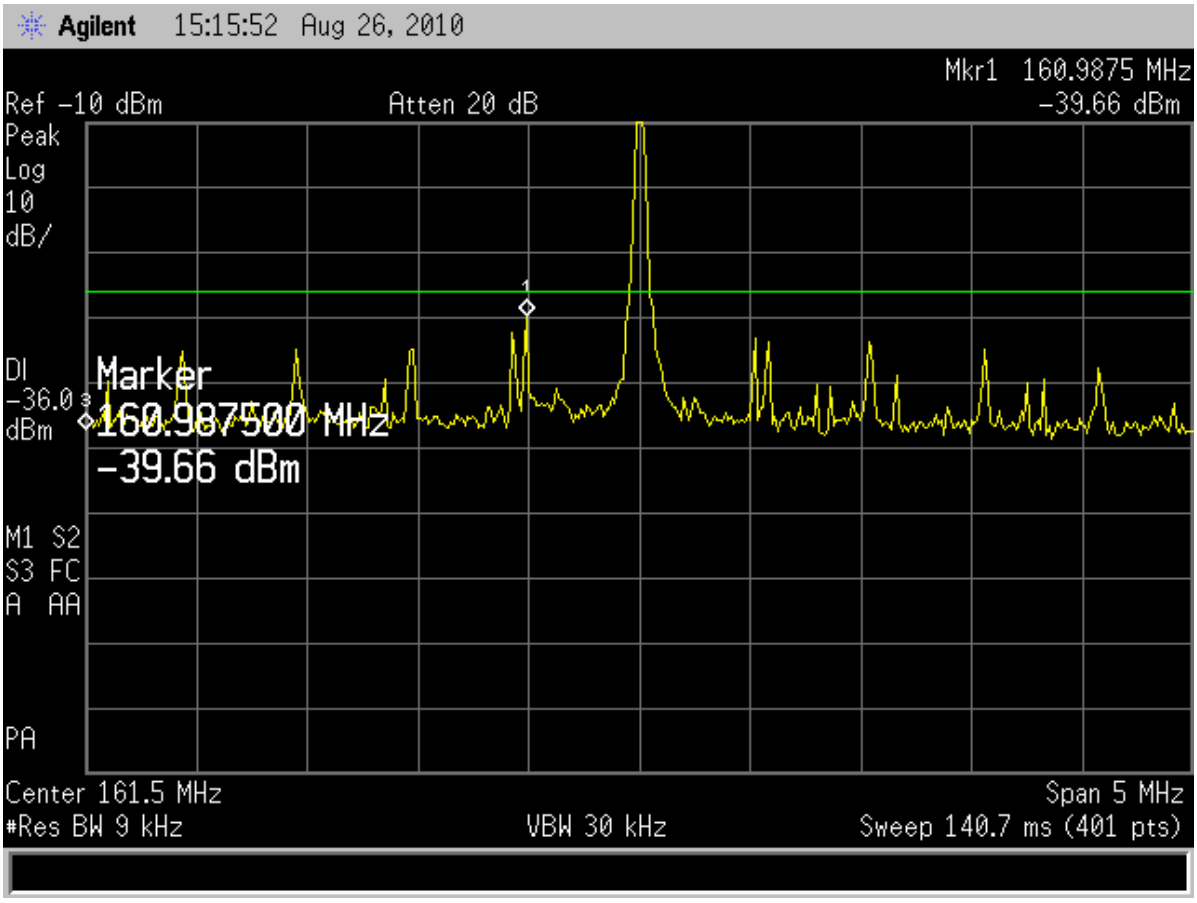
162.0250 MHz close in emissions

Voltage (Vdc)	Temp	Emission Frequency (MHz)	Level (dBm)	Limit (dBm)
+12.0 / +24.0	+20°C	159.9625	-48.0	-36.0
+12.0 / +24.0		160.4750	-44.7	-36.0
+12.0 / +24.0		161.0000	-45.1	-36.0
+12.0 / +24.0		161.4500	-40.6	-36.0
+12.0 / +24.0		161.5125	-38.7	-36.0
+12.0 / +24.0		162.0625	-45.4	-36.0
+12.0 / +24.0		162.5500	-42.7	-36.0
+12.0 / +24.0		162.6125	-42.0	-36.0
+12.0 / +24.0		163.5870	-45.6	-36.0



162.0250 MHz close up emissions

Voltage (Vdc)	Temp	Emission Frequency (MHz)	Level (dBm)	Limit (dBm)
+12.0 / +24.0	+20°C	159.4375	-45.2	-36.0
		159.9500	-44.8	-36.0
		160.4750	-44.8	-36.0
		160.9250	-42.2	-36.0
		160.9875	-39.6	-36.0
		162.0250	-43.1	-36.0
		162.0875	-43.7	-36.0
		162.5375	-43.8	-36.0
		163.0625	-44.9	-36.0
		163.5750	-47.7	-36.0



Result: Complies

Measurement Uncertainty: ±3.3 dB

Annex C DSC Channel Management

C.4 DSC receiver tests

As detailed in IEC 62287-1 Annex C, clause C.4, if the DSC receiver is time shared with an AIS receiver then tests defined in C.4.1 to C.4.7 maybe waived

The client, Vesper Marine Ltd, has declared that the DSC receiver within the WMX850 is time shared with the AIS receiver and therefore the tests described have been waived and are therefore not included in this report.

8. TEST EQUIPMENT

Instrument	Manufacturer	Model	Serial #	Asset
DC Power Supply	Hewlett Packard	HP6032A	2743A-02859	E1069
DC Power Supply	DSE	Q1760	30501563	E1129
Environmental Chamber	Contherm	M180F	-	E1129
Modulation Analyzer	Rohde & Schwarz	FMA	837807/020	E1552
Storage Oscilloscope	Tektronix	TDS 745A	B010643	E1569
Rubidium Oscillator	Ball Efratom	FRS - C	4287	E1053
Signal Generator	Hewlett Packard	HP8642B	2624A00853	E1067
Signal Generator	Hewlett Packard	HP8657B	2911U00162	E1045
Signal Generator	Rohde & Schwarz	SMHU.58	838723/028	E1493
Spectrum Analyser	Hewlett Packard	E7405A	US39150142	3776
Thermometer	DSIR	RT200	35	E1409
AIS Test Transponder	Vesper Marine	No 1	-	-

9. ACCREDITATIONS

EMC Technologies (NZ) Ltd is accredited by International Accreditation New Zealand (IANZ) Accreditation to NZS/IEC/ ISO 17025 to carryout a range of EMC and Radio tests to various local, regional and international standards.

While not being specifically accredited to test to IEC 62287, EMC Technologies (NZ) Ltd is accredited to a number of standards that call up similar test methods to those detailed.

Similar standards that EMC Technologies (NZ) Ltd are IANZ accredited to carryout include EN 300 113, EN 300 086, FCC part 90, AS/NZS 4295 and AS/NZS 4415.

All measurement equipment has been calibrated in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/IEC/ ISO 17025.

International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied on request

10. PHOTOGRAPH (S)