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TEST REPORT

Capella AtoN (Aid to Navigation) AIS OEM Module

tested to

IEC 62320-2 Edition 1.0 2008

Maritime navigation and radiocommunication equipment and systems – Automatic Identification System (AIS) – Part 2: AIS AtoN Stations – Operational and performance requirements, methods of test andrequired results

for

Vesper Marine Ltd

This Test Report is issued with the authority of:

Andrew Cutler - General Manager

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1. COMPLIANCE STATEMENT

The **Capella AtoN (Aid to Navigation) AIS OEM Module** complies with IEC 62320-2, First Edition, 2008-03

2. RESULT SUMMARY

The results from testing carried out in September and October 2013, are summarised as follows:

Clause	Test Performed	Result
7	AIS AtoN station tests	Noted
7.1	RF tests (transmitter and receiver)	Noted
7.1.1	TDMA Transmitter	Noted
7.1.1.1	Frequency error	Complies
7.1.1.2	Carrier power	Complies
7.1.1.3	Modulation spectrum slotted transmission	Complies
7.1.1.4	Transmitter test sequence and modulation accuracy	Complies
7.1.1.5	Transmitter output power versus time function	Complies
7.1.2	TDMA receivers (Types 2 and 3)	Refer report no 100715. Receiver identical.
7.1.3	Conducted emissions at the antenna	Noted
7.1.3.1	Spurious emissions from the receiver	Refer report no 100715. Receiver identical.
7.1.3.2	Spurious emissions from the transmitter	Complies

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 report replaces report number 130909.1 to correct a typographical error.

4. CLIENT INFORMATION

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

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Vesper
Model Number	Capella100
Product	AtoN (Aid to Navigation) AIS OEM Module.
Manufacturer	Vesper Marine Ltd
Manufactured in	New Zealand
Serial Numbers	VV0000X

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 °C 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 Vdc 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

7.1.1.1 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 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	-250.0	500.0
+12.0		161.5000	-250.0	500.0
+24.0		161.5000	-250.0	500.0
+31.2		161.5000	-250.0	500.0
+10.8	+20°C	162.0250	-250.0	500.0
+12.0		162.0250	-250.0	500.0
+24.0		162.0250	-250.0	500.0
+31.2		162.0250	-250.0	500.0
+10.8	+55°C	161.5000	-300.0	1000.0
+12.0		161.5000	-300.0	1000.0
+24.0		161.5000	-300.0	1000.0
+31.2		161.5000	-300.0	1000.0
+10.8	+55°C	162.0250	-300.0	1000.0
+12.0		162.0250	-300.0	1000.0
+24.0		162.0250	-300.0	1000.0
+31.2		162.0250	-300.0	1000.0
+10.8	-25°C	161.5000	-300.0	1000.0
+12.0		161.5000	-300.0	1000.0
+24.0		161.5000	-300.0	1000.0
+31.2		161.5000	-300.0	1000.0
+10.8	-25°C	162.0250	-300.0	1000.0
+12.0		162.0250	-300.0	1000.0
+24.0		162.0250	-300.0	1000.0
+31.2		162.0250	-300.0	1000.0

Result: Complies.
Measurement Uncertainty: ± 30 Hz

7.1.1.2 Carrier Power

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

The transmitter has a rated power of 12.5 watts (+41.0 dBm)

Testing was carried out with the device transmitting on 161.5000 MHz and 162.0250 MHz when modulated with test signal number 1, 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	40.14	39.5 - 42.5
+12.0		161.5000	40.61	39.5 - 42.5
+24.0		161.5000	40.76	39.5 - 42.5
+31.2		161.5000	40.60	39.5 - 42.5
+10.8	+20°C	162.0250	40.30	39.5 - 42.5
+12.0		162.0250	40.63	39.5 - 42.5
+24.0		162.0250	40.74	39.5 - 42.5
+31.2		162.0250	40.61	39.5 - 42.5
+10.8	+55°C	161.5000	40.00	38.0 - 44.0
+12.0		161.5000	40.19	38.0 - 44.0
+24.0		161.5000	40.32	38.0 - 44.0
+31.2		161.5000	40.30	38.0 - 44.0
+10.8	+55°C	162.0250	40.00	38.0 - 44.0
+12.0		162.0250	40.20	38.0 - 44.0
+24.0		162.0250	40.16	38.0 - 44.0
+31.2		162.0250	40.00	38.0 - 44.0
+10.8	-25°C	161.5000	41.10	38.0 - 44.0
+12.0		161.5000	41.20	38.0 - 44.0
+24.0		161.5000	41.20	38.0 - 44.0
+31.2		161.5000	41.00	38.0 - 44.0
+10.8	-25°C	162.0250	41.00	38.0 - 44.0
+12.0		162.0250	41.20	38.0 - 44.0
+24.0		162.0250	41.30	38.0 - 44.0
+31.2		162.0250	41.10	38.0 - 44.0

The device is required to be within +/- 1.5 dB of the rated nominal power under normal conditions and +/- 3 dB of the rated nominal power under extreme conditions.

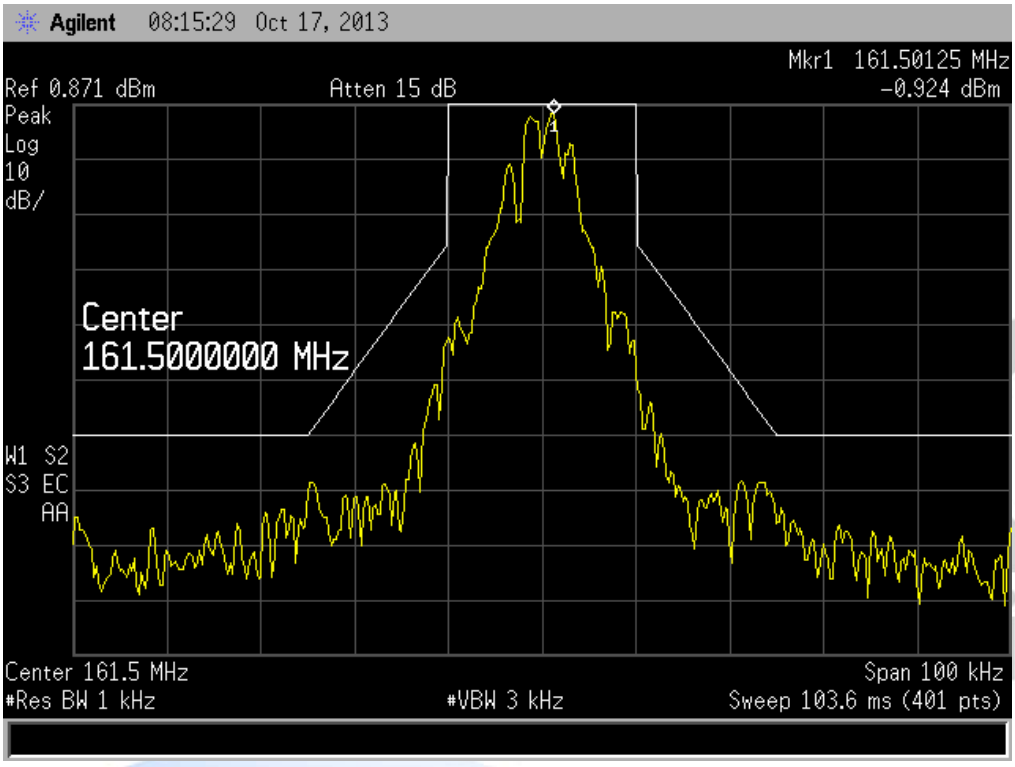
Result: Complies.
Measurement Uncertainty: ± 0.5 dB

7.1.1.3 Modulation spectrum slotted transmission

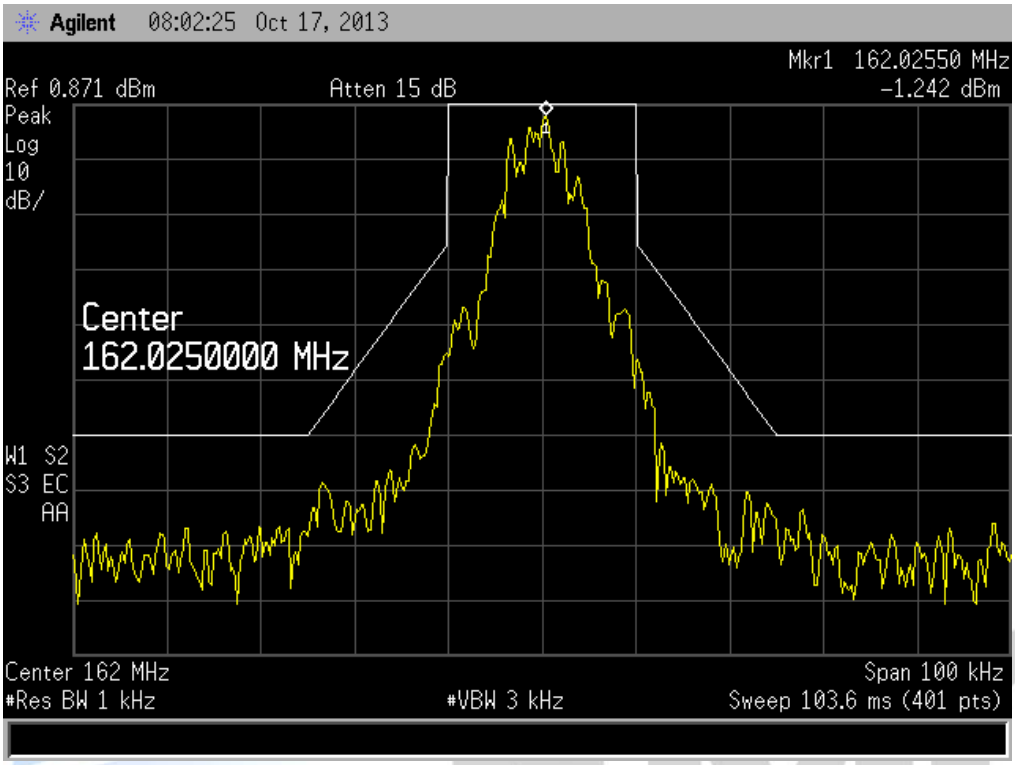
Testing was carried out using a spectrum analyser that had a 40 dB attenuator attached to the input.

Testing was carried out with the device transmitting on 161.5000 MHz and 162.0250 MHz when modulated with test signal number 3 transmitting for approximately 2 seconds with the spectrum analyser operating in peak hold mode.

161.5000 MHz



162.0250 MHz



Result: Complies.
Measurement Uncertainty: ± 0.5 dB

7.1.1.4 Transmitter test sequence and modulation accuracy

Modulation accuracy measurements were made using a modulation analyser and a digital storage oscilloscope.

Testing was carried out using single packets of data using either test signal 1 or 2 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 from a calibrated signal generator.

Peak positive and negative frequency deviation levels were then recorded when test signals 1 and 2 were used while the transmitter was transmitting continuously.

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 1 on 161.500 MHz and 162.025 MHz

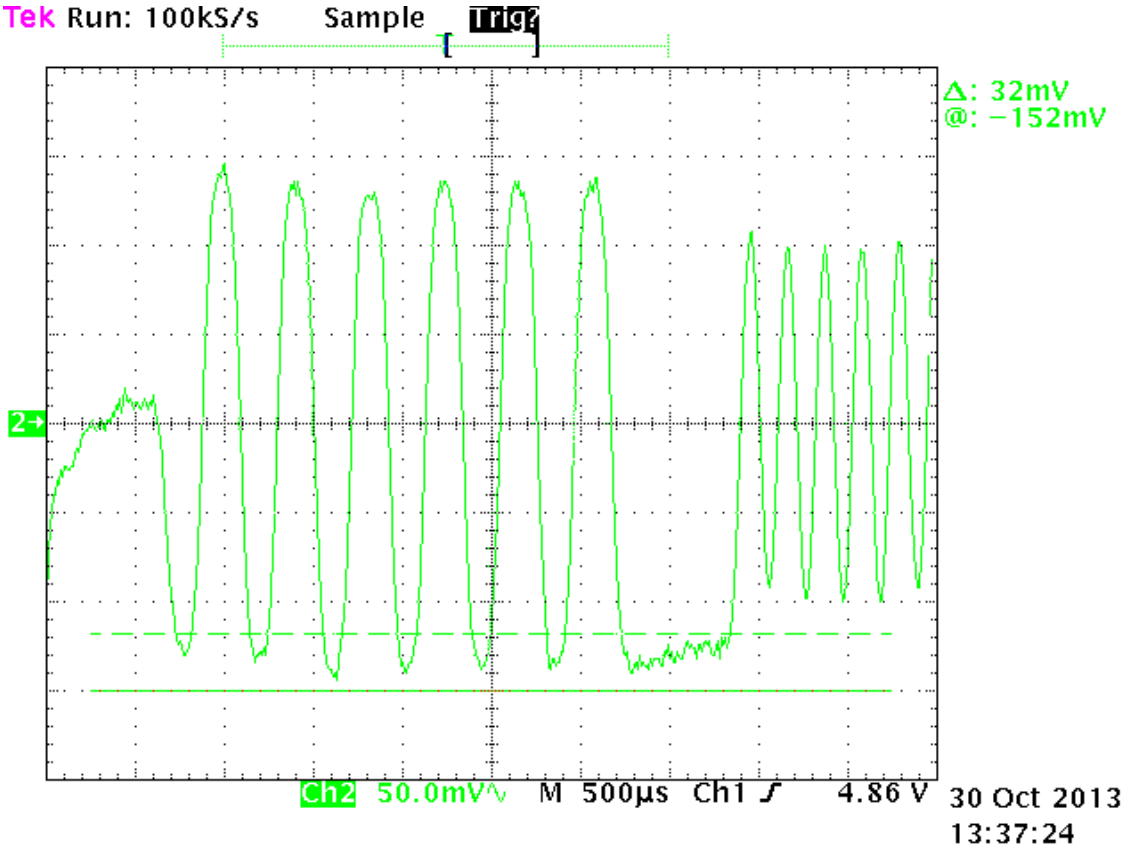
Bit	**-25.0** °C	**Ambient**	**+55.0** °C
0 to1	Complies	Complies	Complies
2 to 3	Complies	Complies	Complies
4 to 31	Complies	Complies	Complies
32 to 199	Complies	Complies	Complies

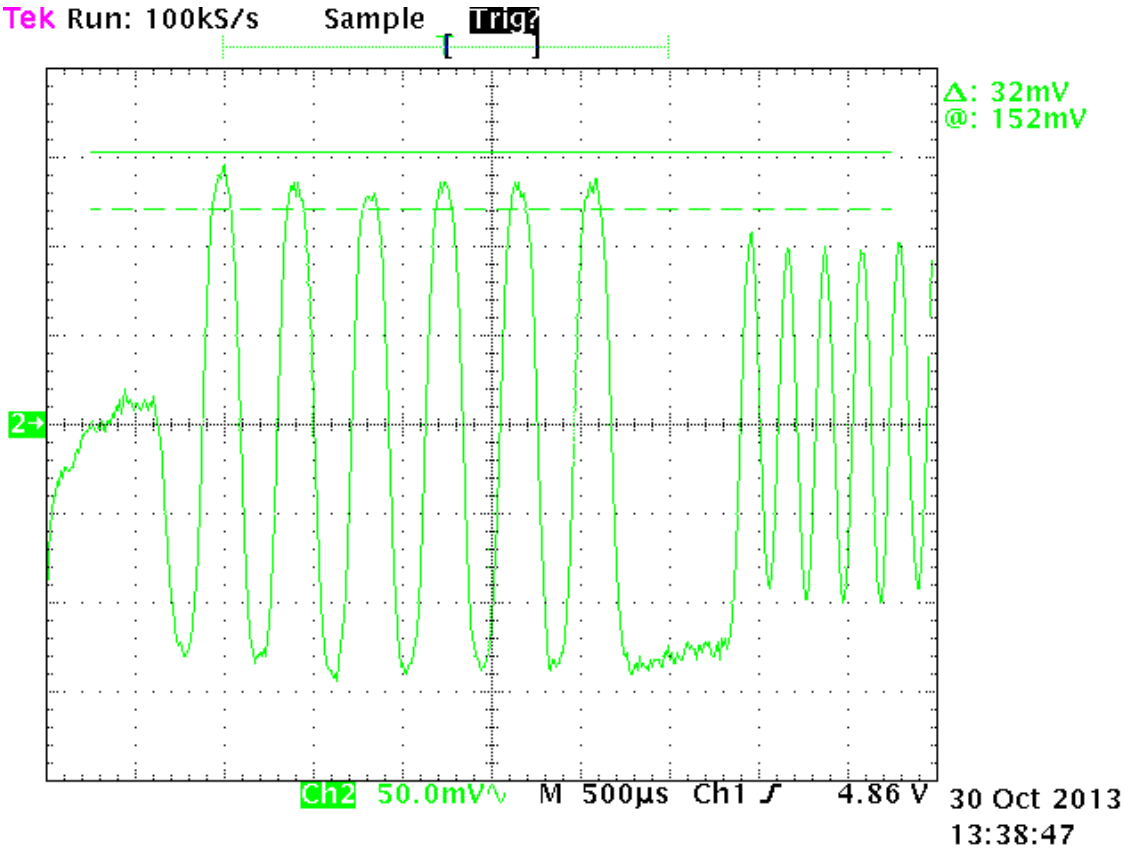
Test signal 2 on 161.500 MHz and 162.025 MHz

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

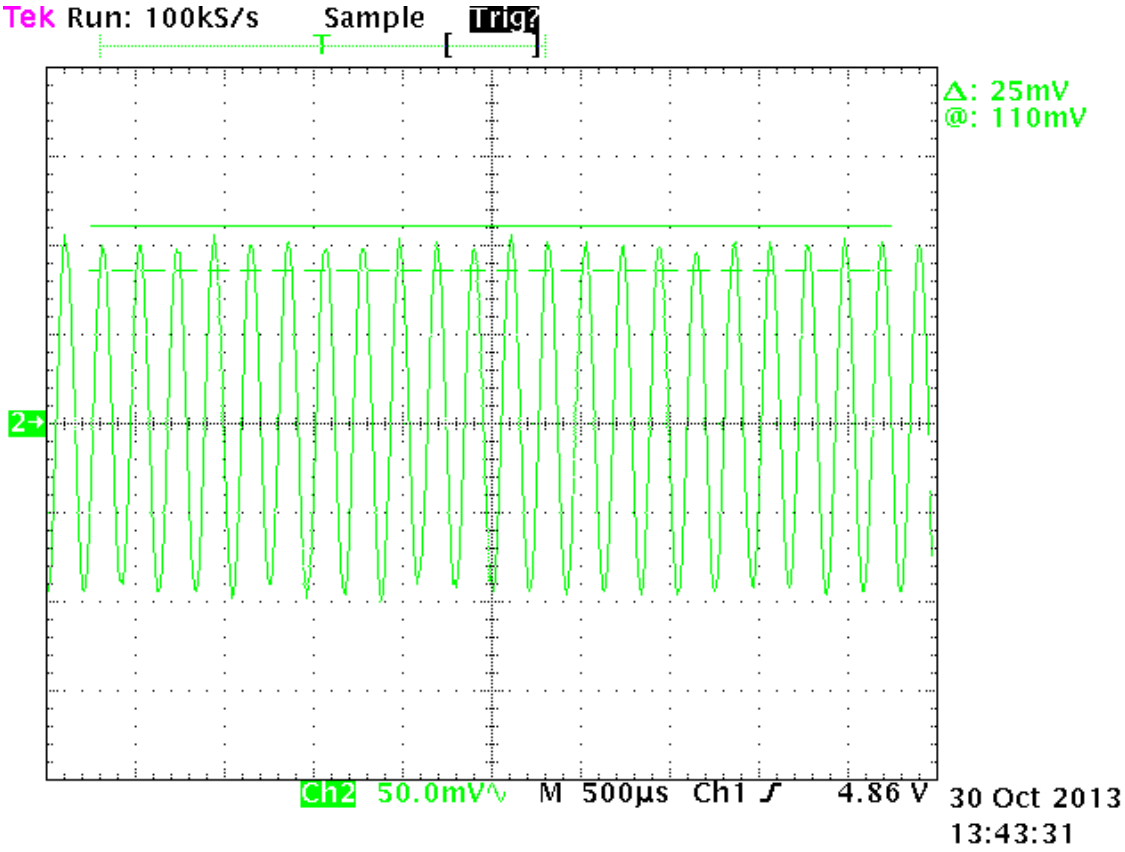
Result: Complies.

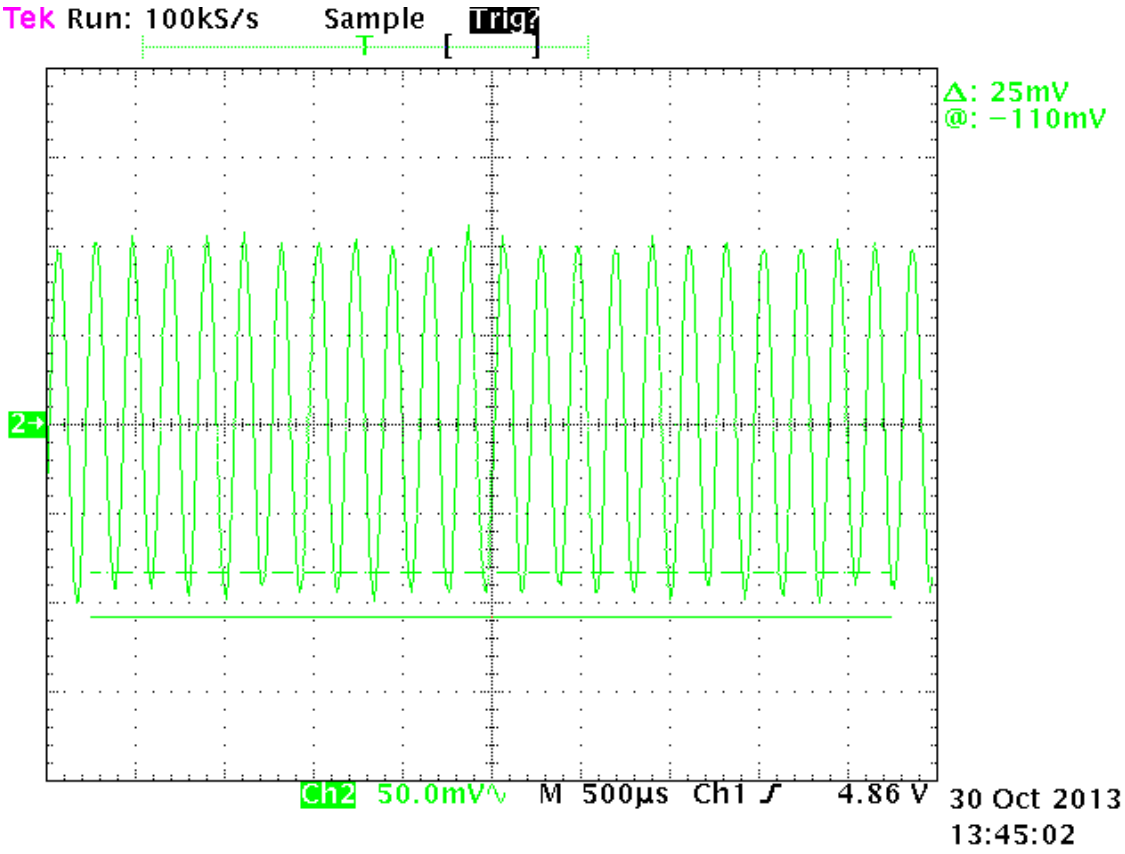
161.500 MHz Ambient - Test signal 1 showing bit 0 to 31



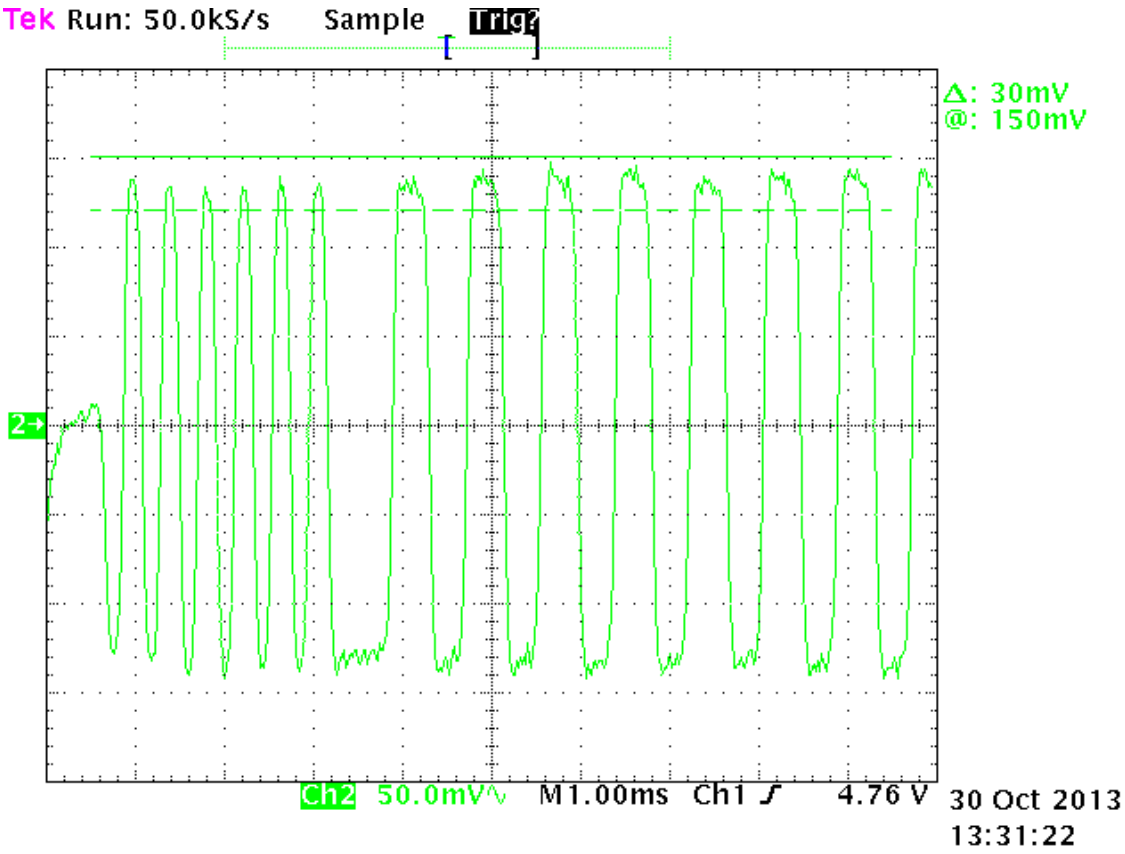


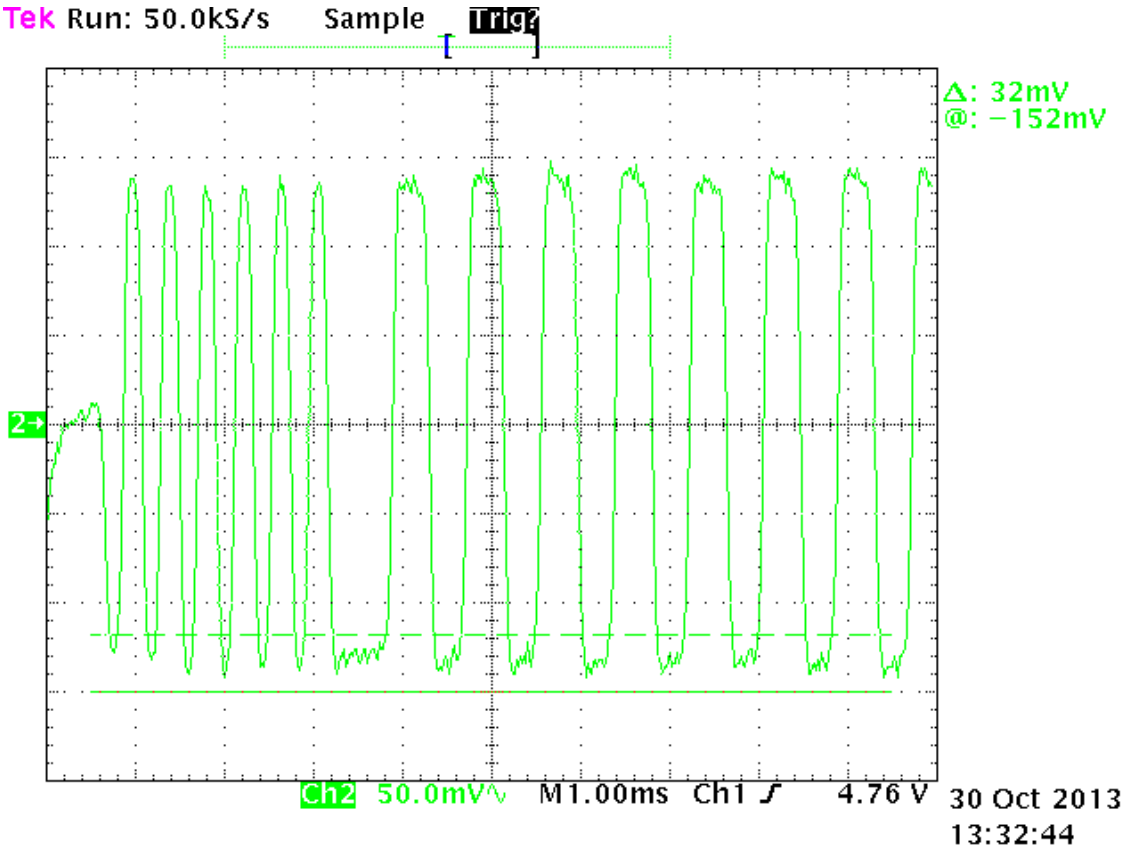
Test signal 1 showing bit 31 to 199



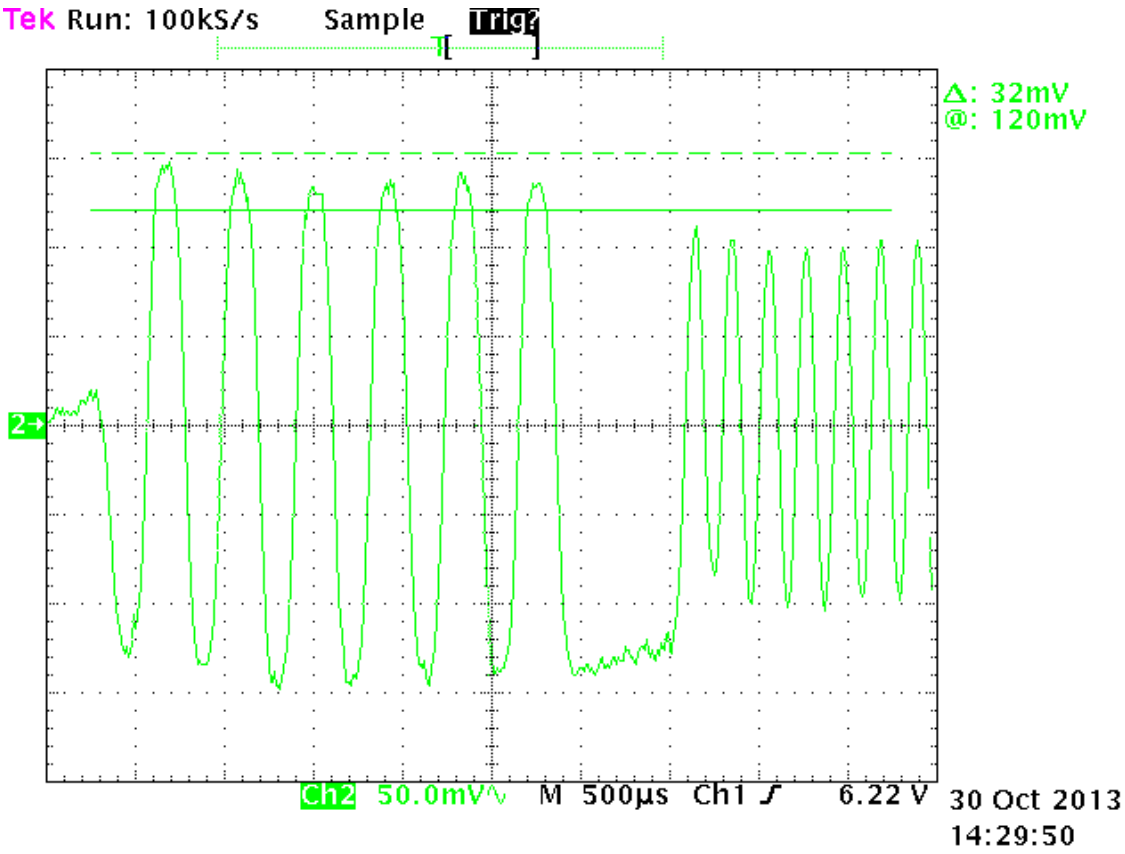


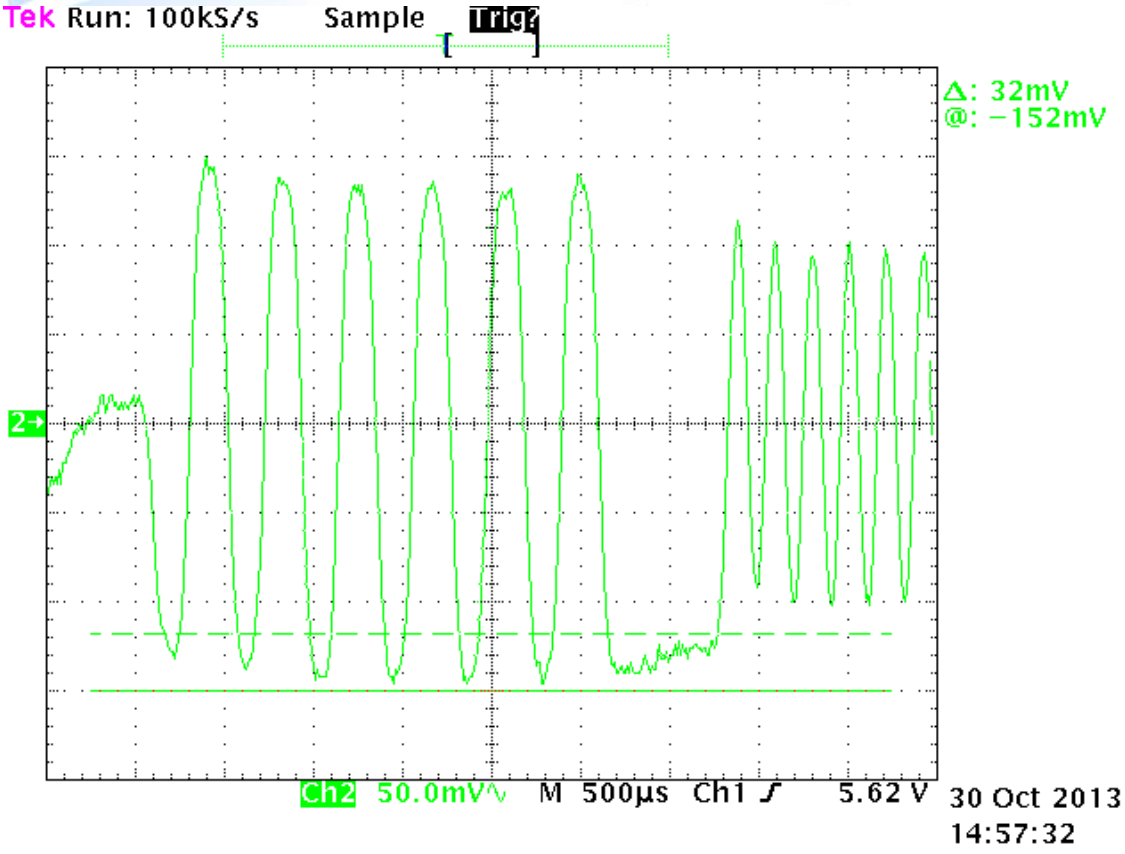
161.500 MHz Ambient - Test signal 2 showing bit 0 to 199



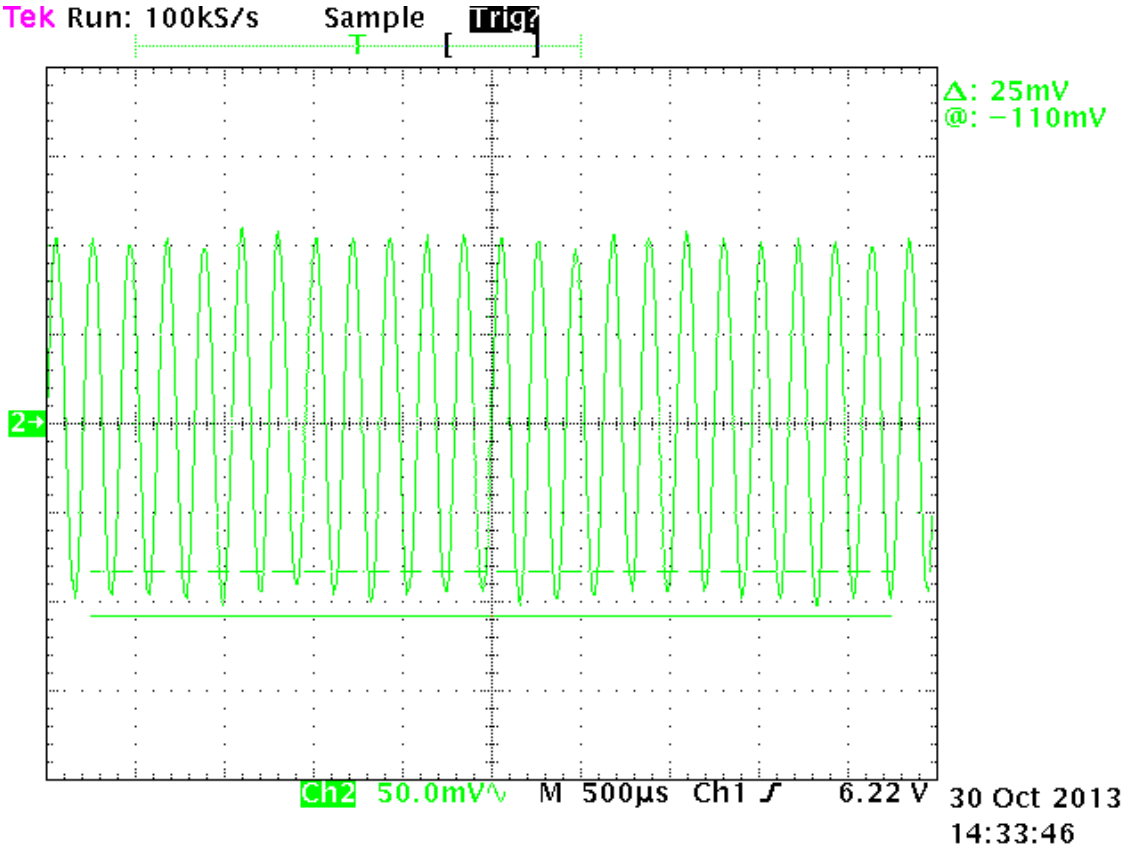


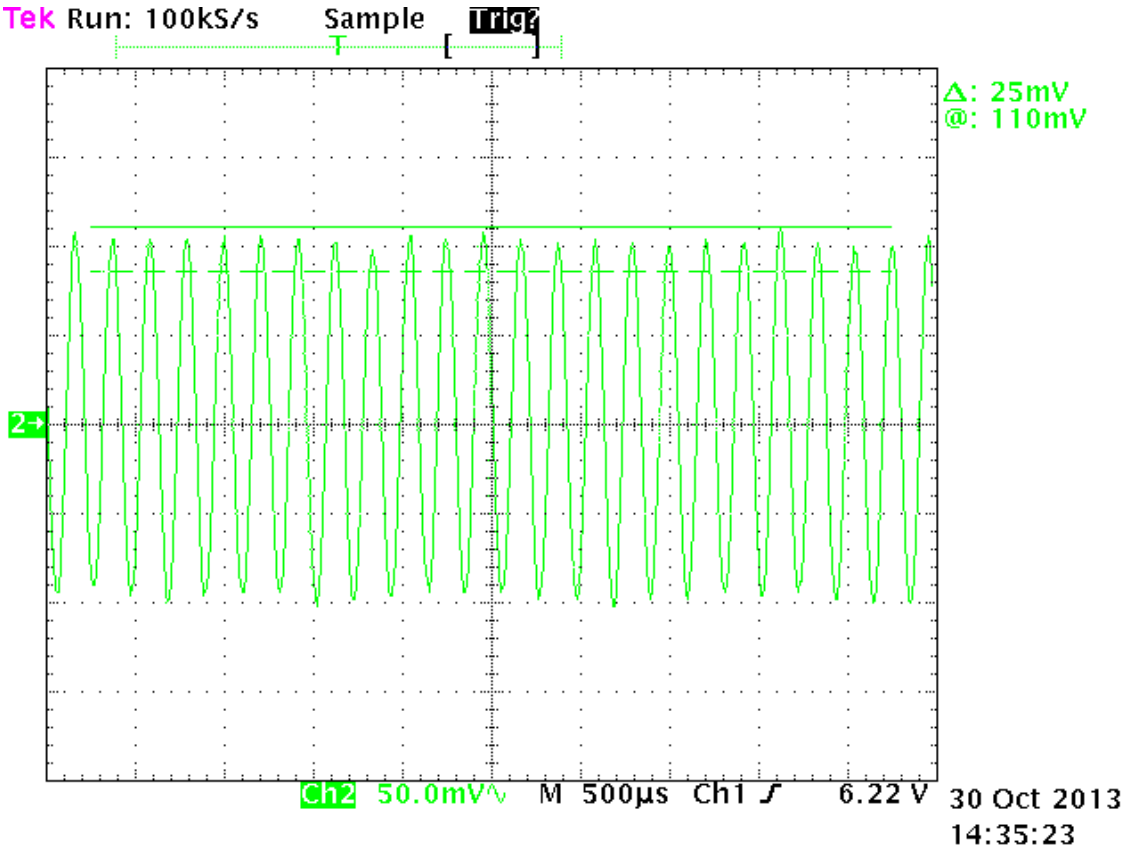
162.025 MHz Ambient - Test signal 1 showing bit 0 to 31



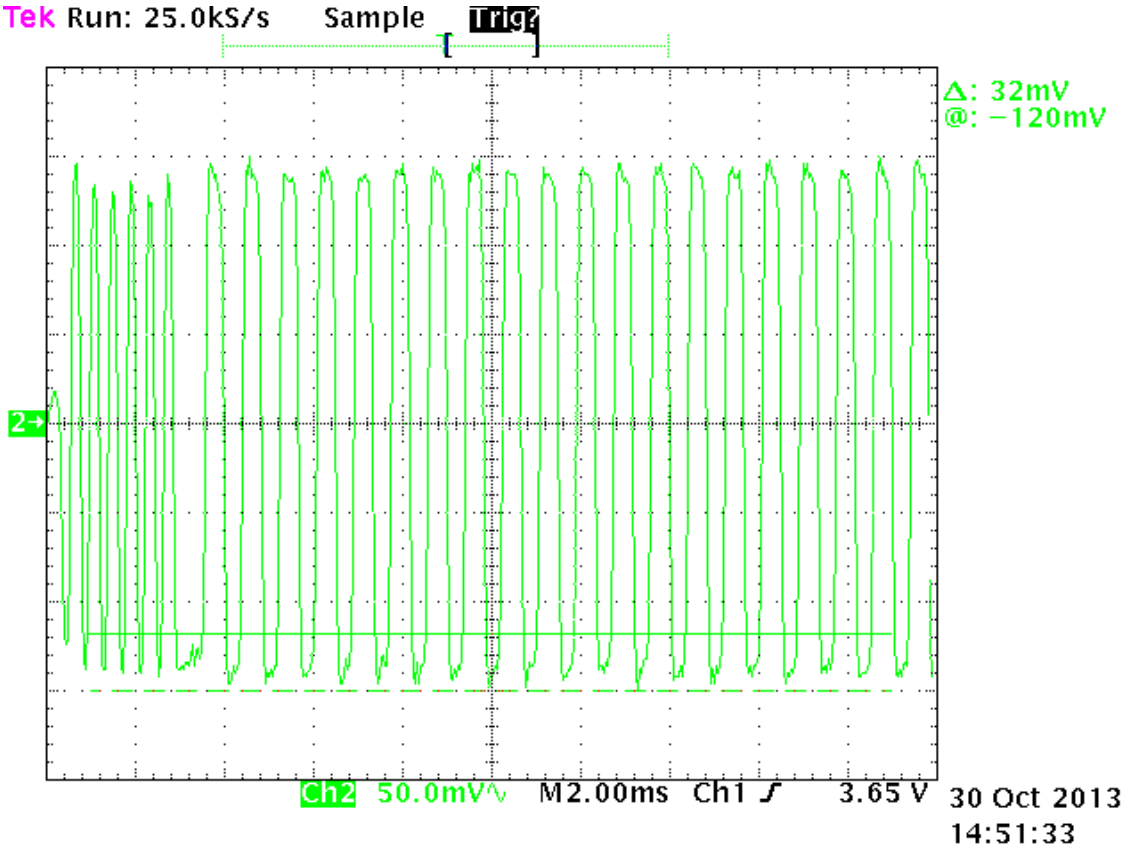


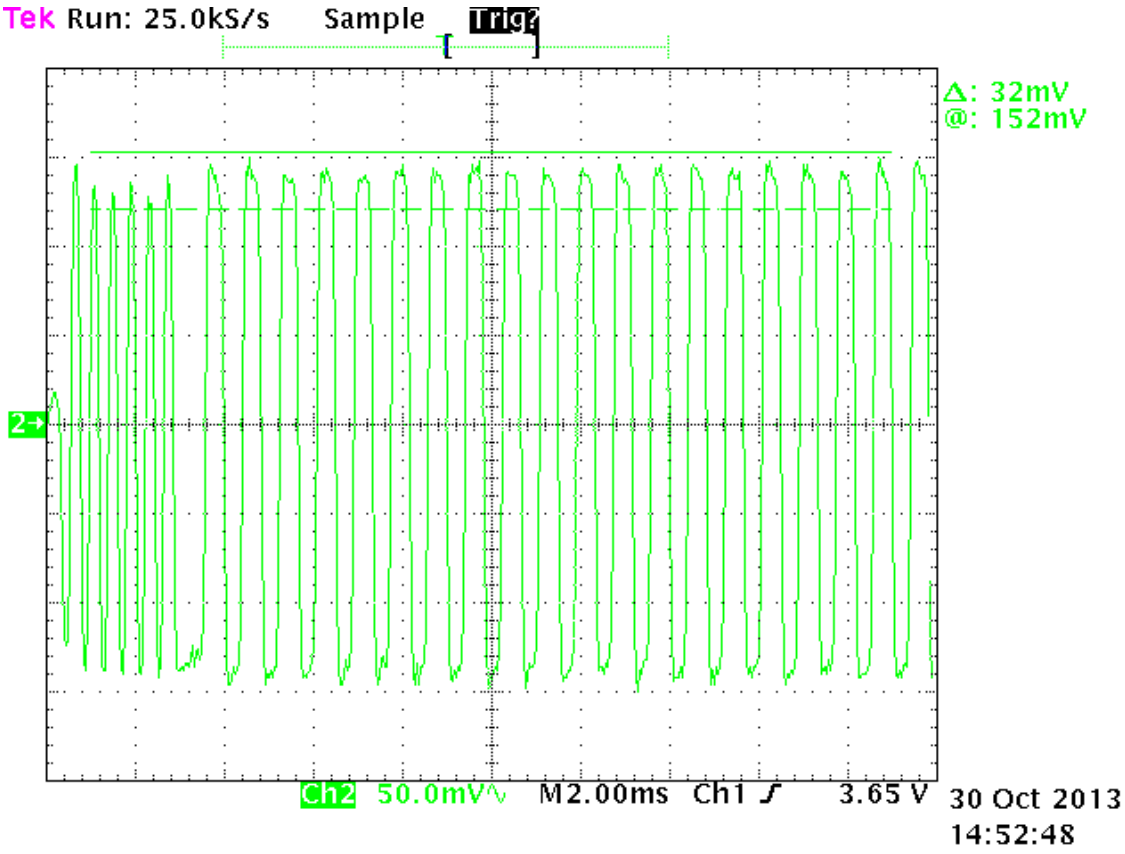
Test signal 1 showing bit 31 to 199



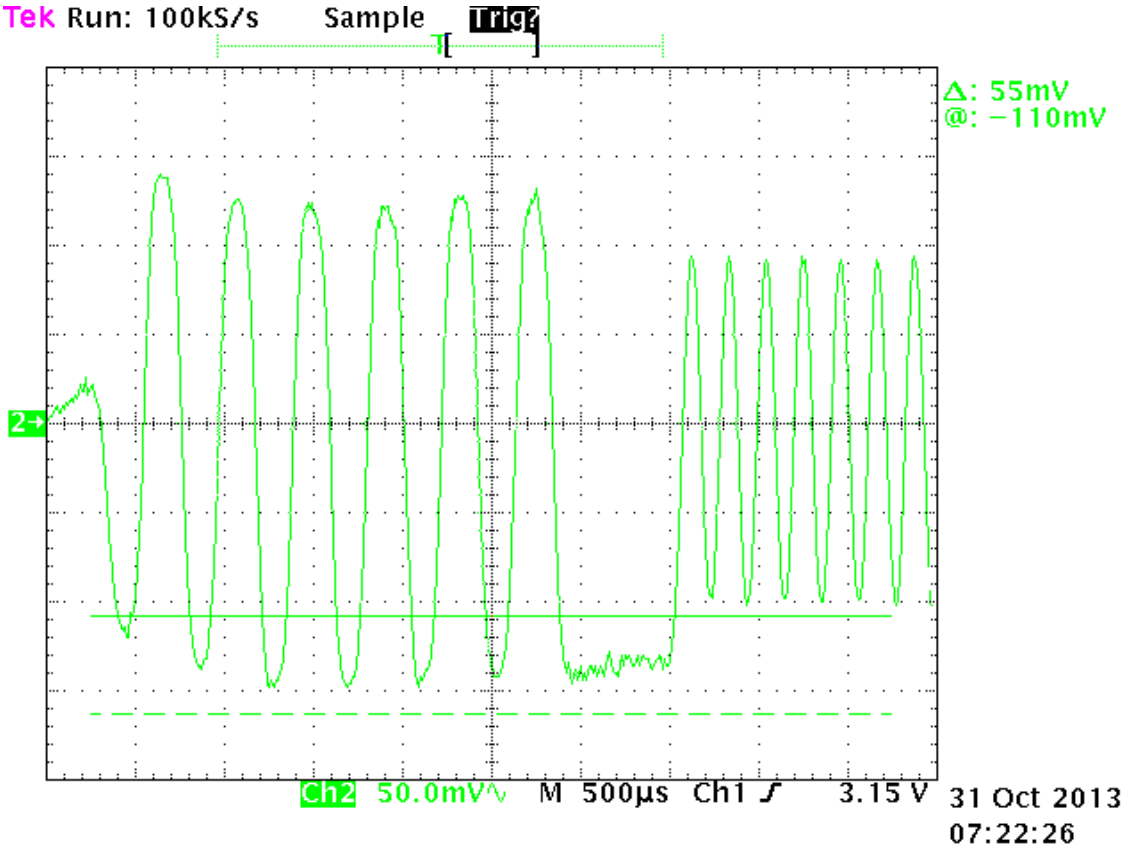


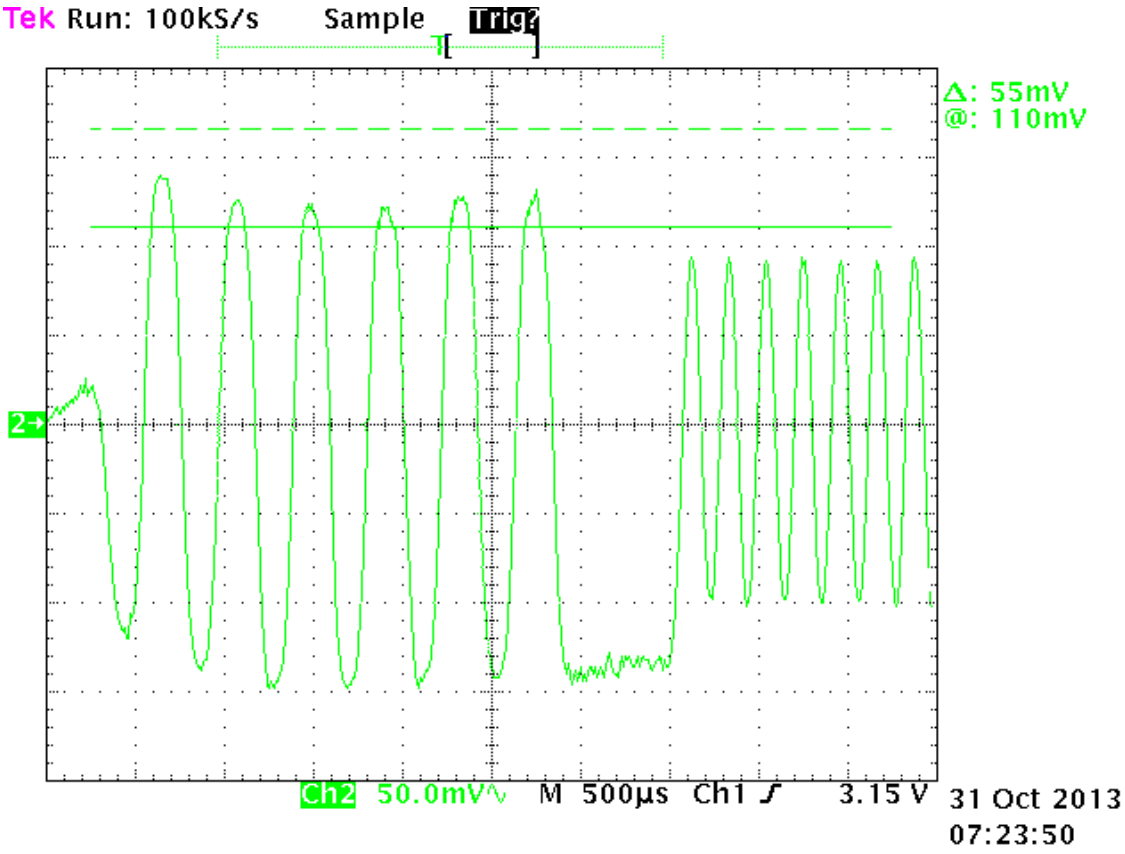
162.025 MHz Ambient - Test signal 2 showing bit 0 to 199



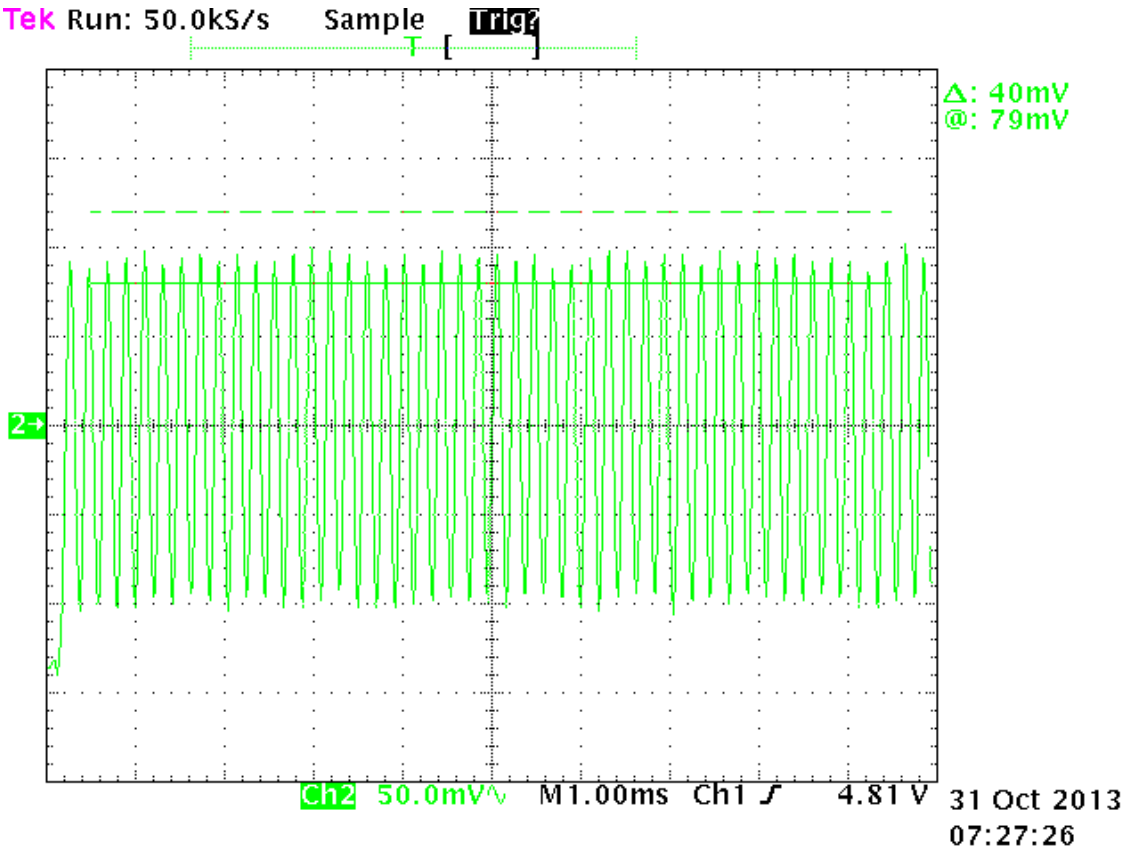


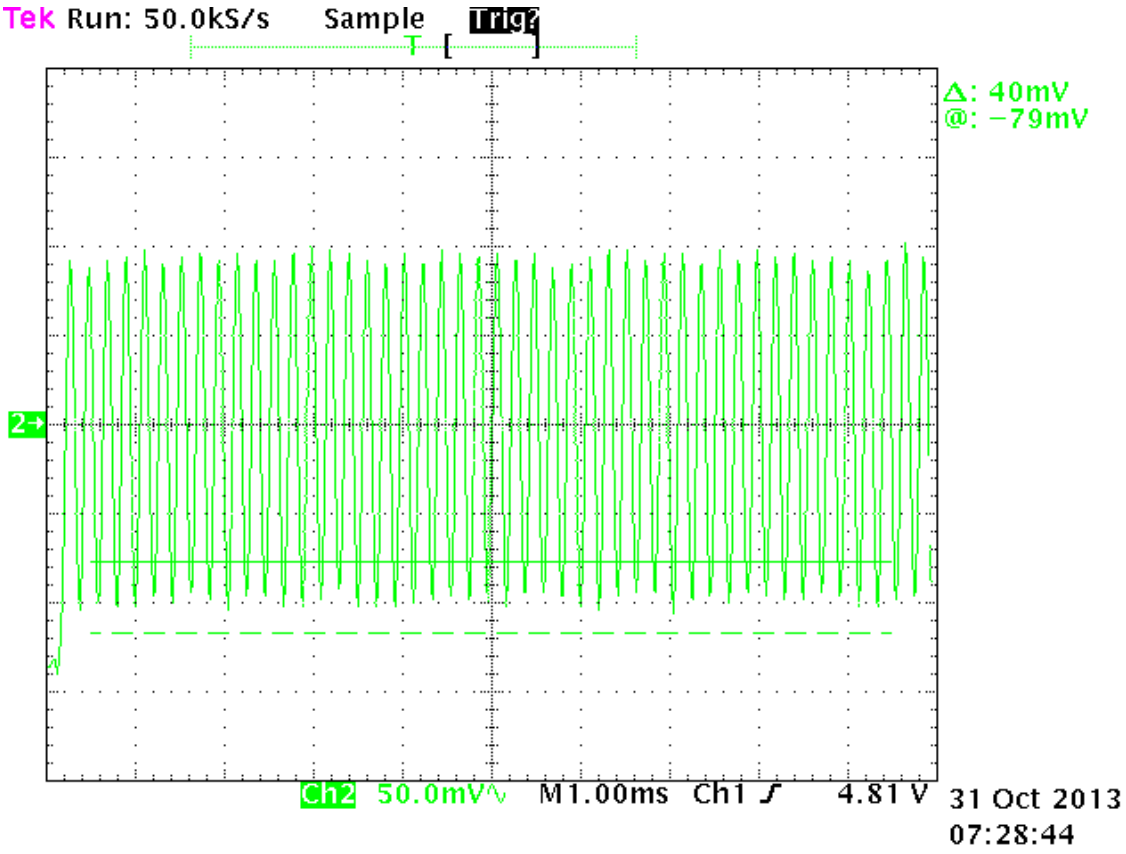
161.500 MHz Extreme +55 degrees - Test signal 1 bit 0 to 31



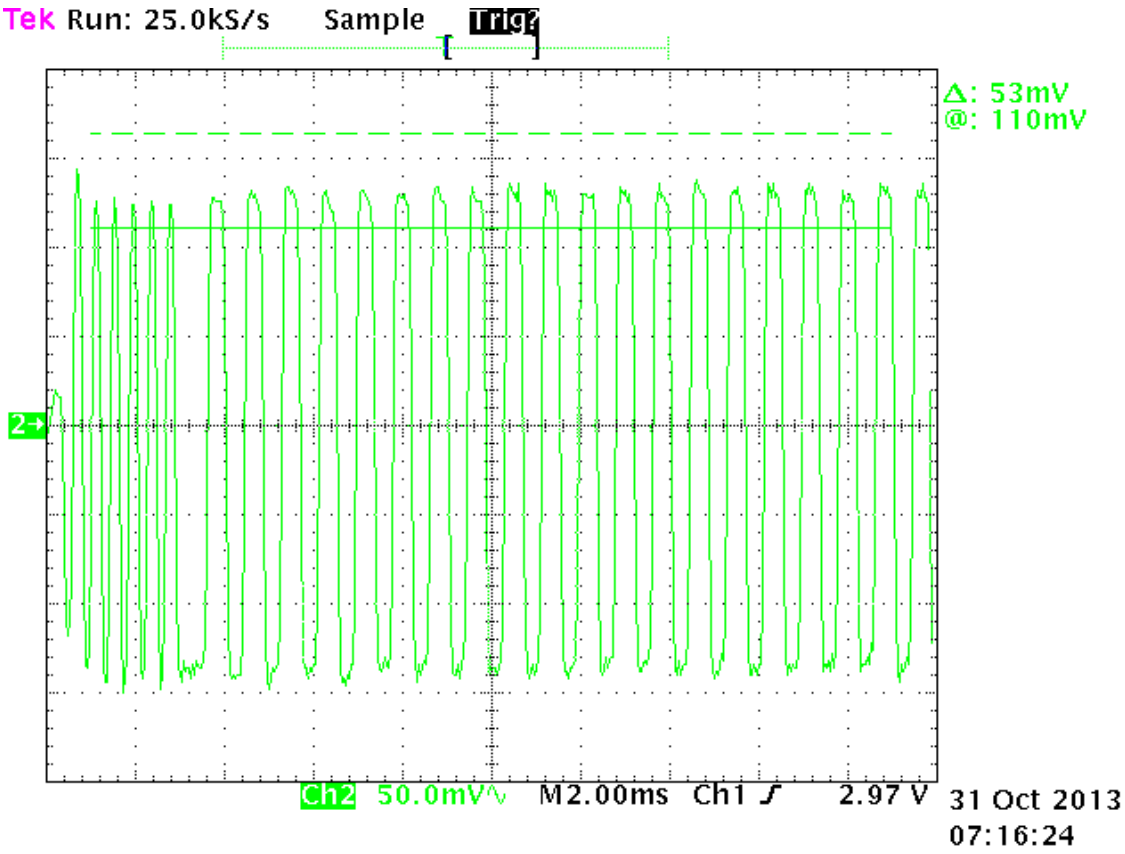


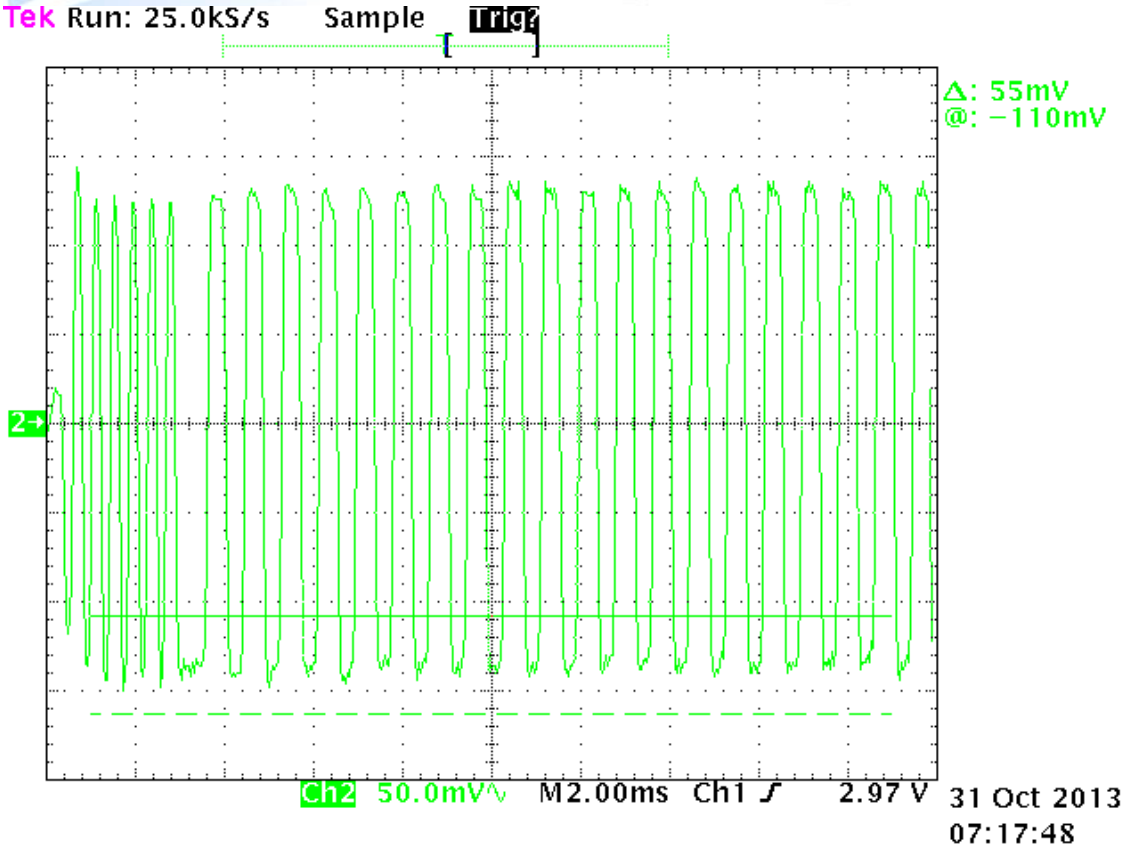
Test signal 1 showing bit 31 to 199



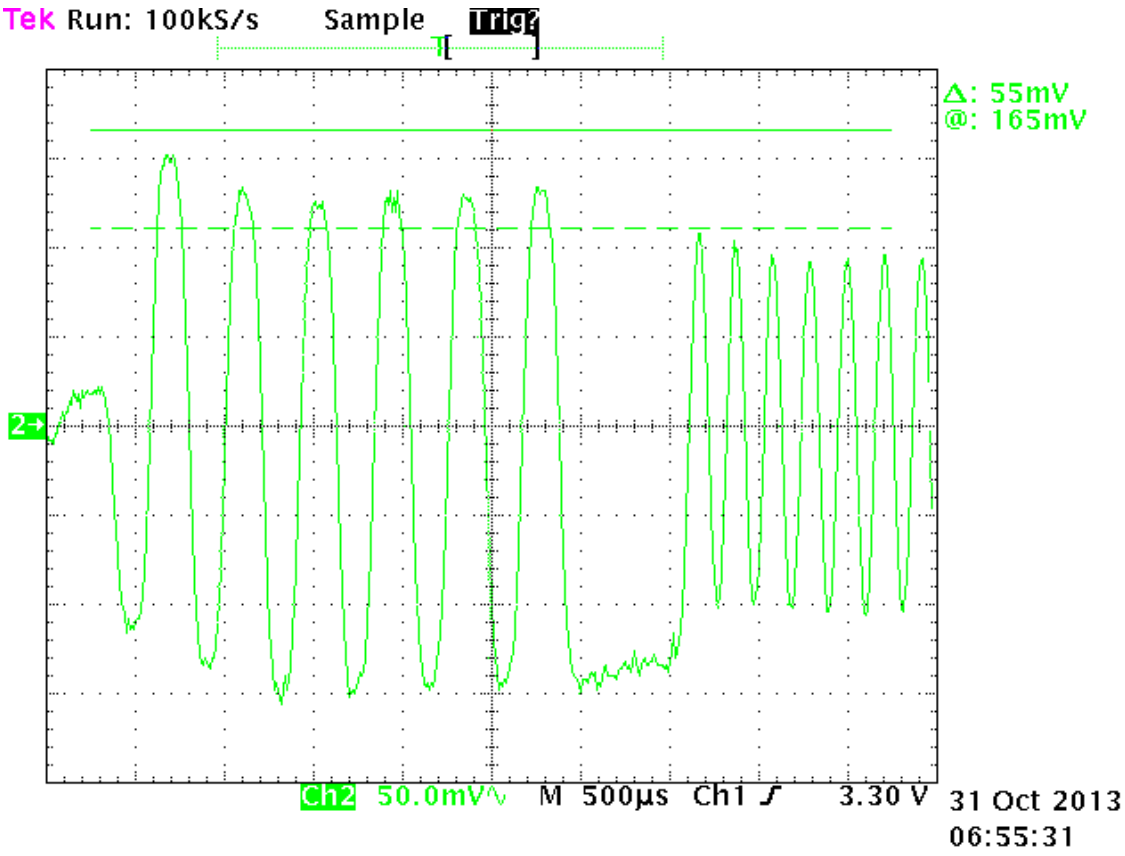


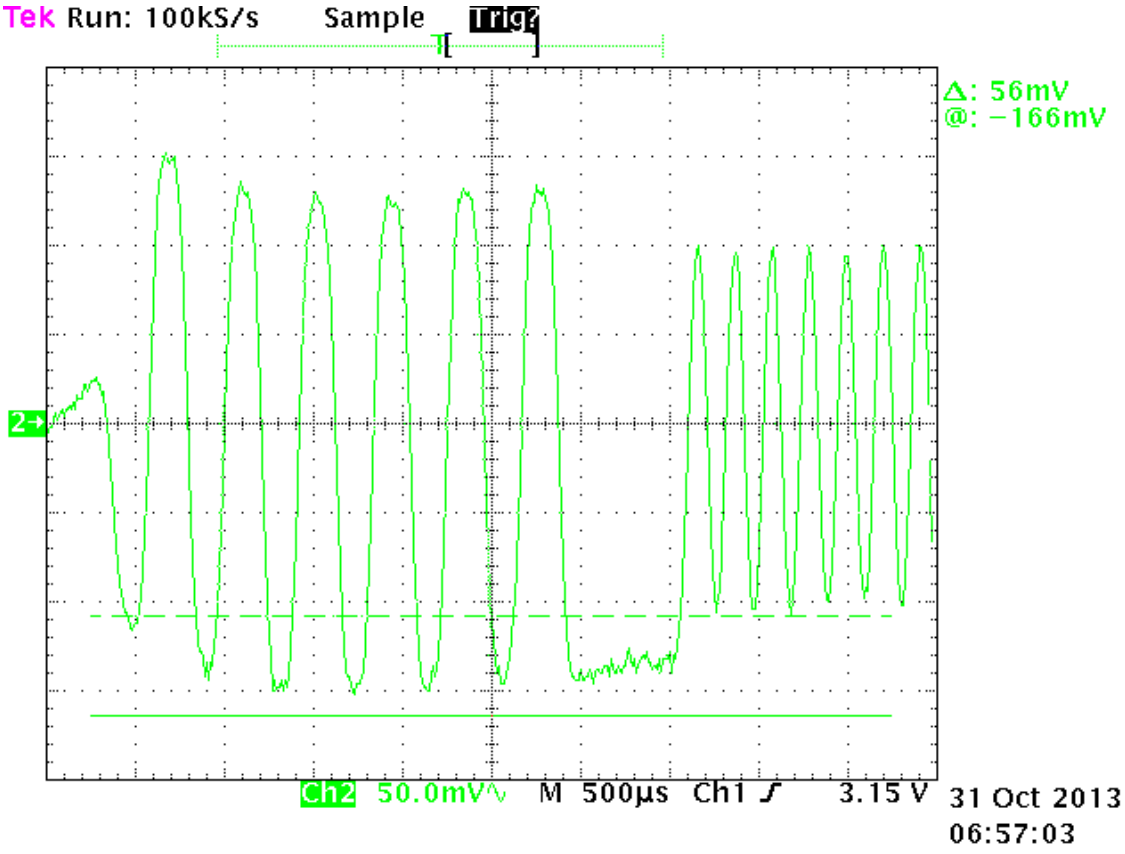
161.500 MHz Extreme +55 degrees - Test signal 2 showing bit 0 to 199



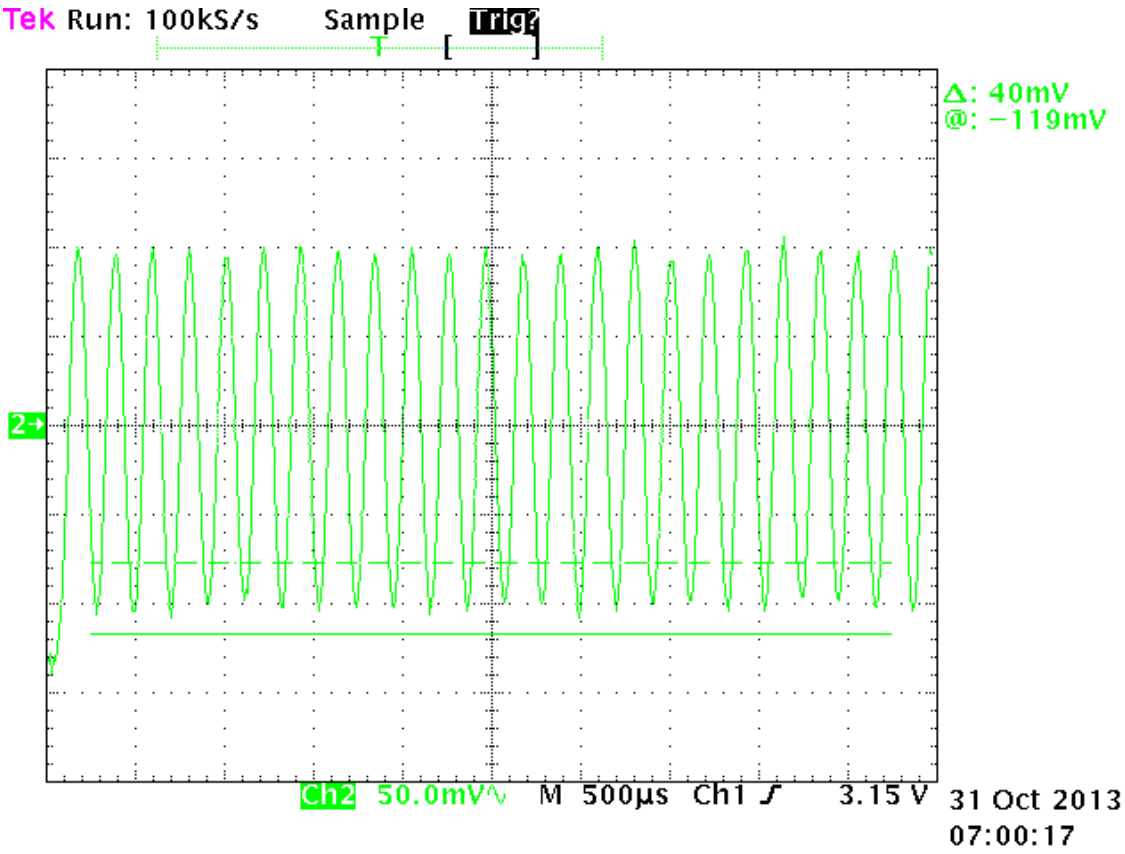


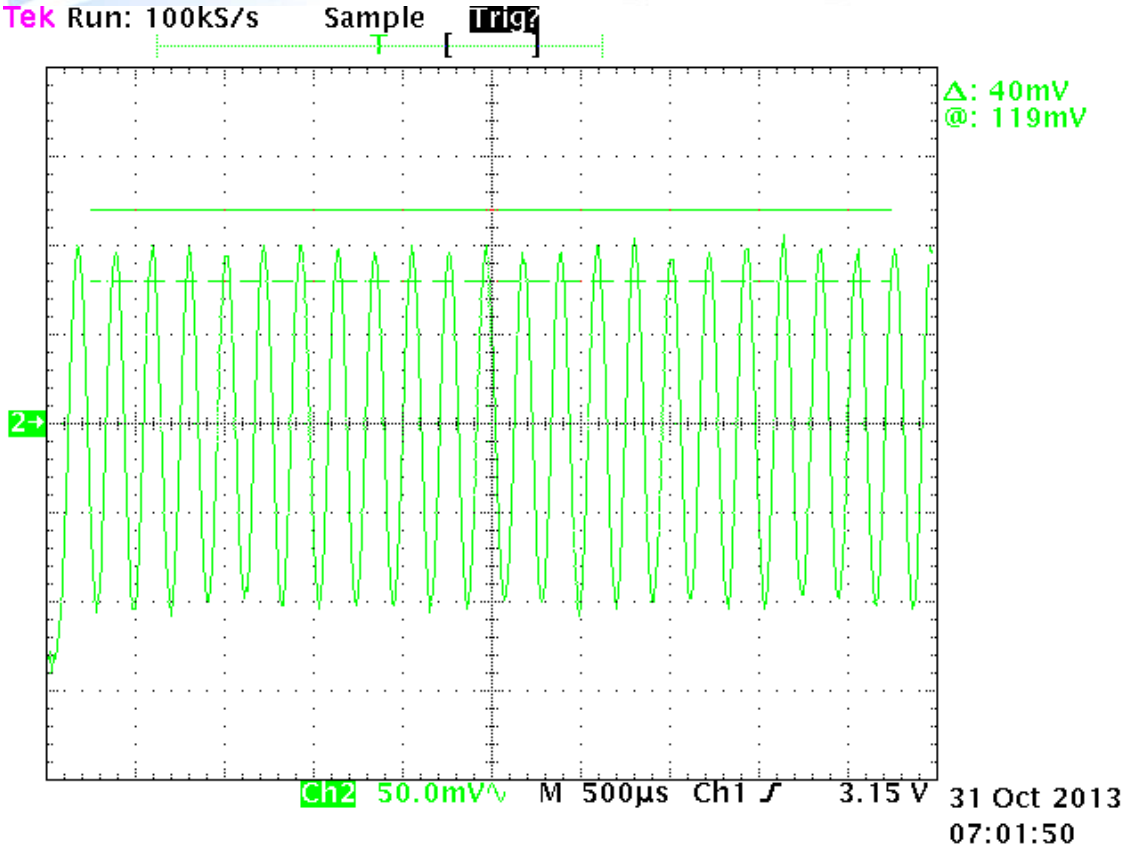
162.025 MHz - Extreme +55 degrees - Test signal 1 showing bit 0 to 31



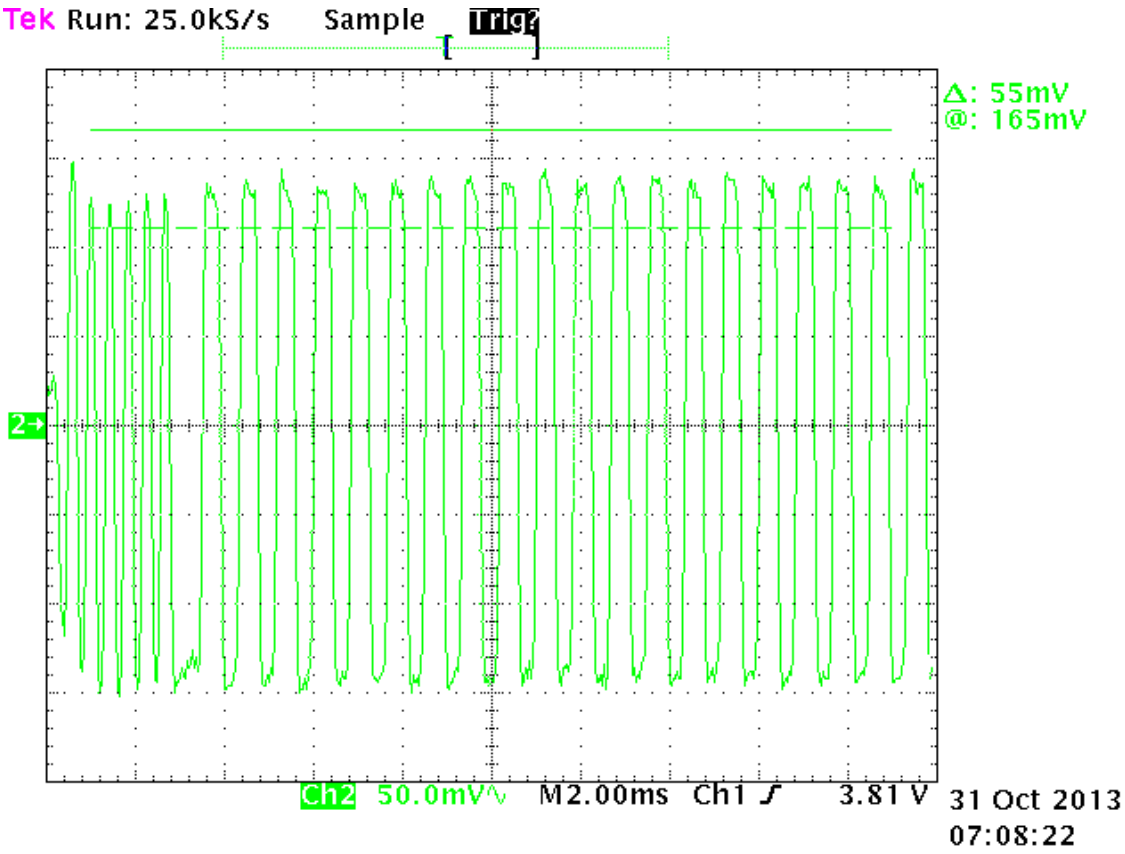


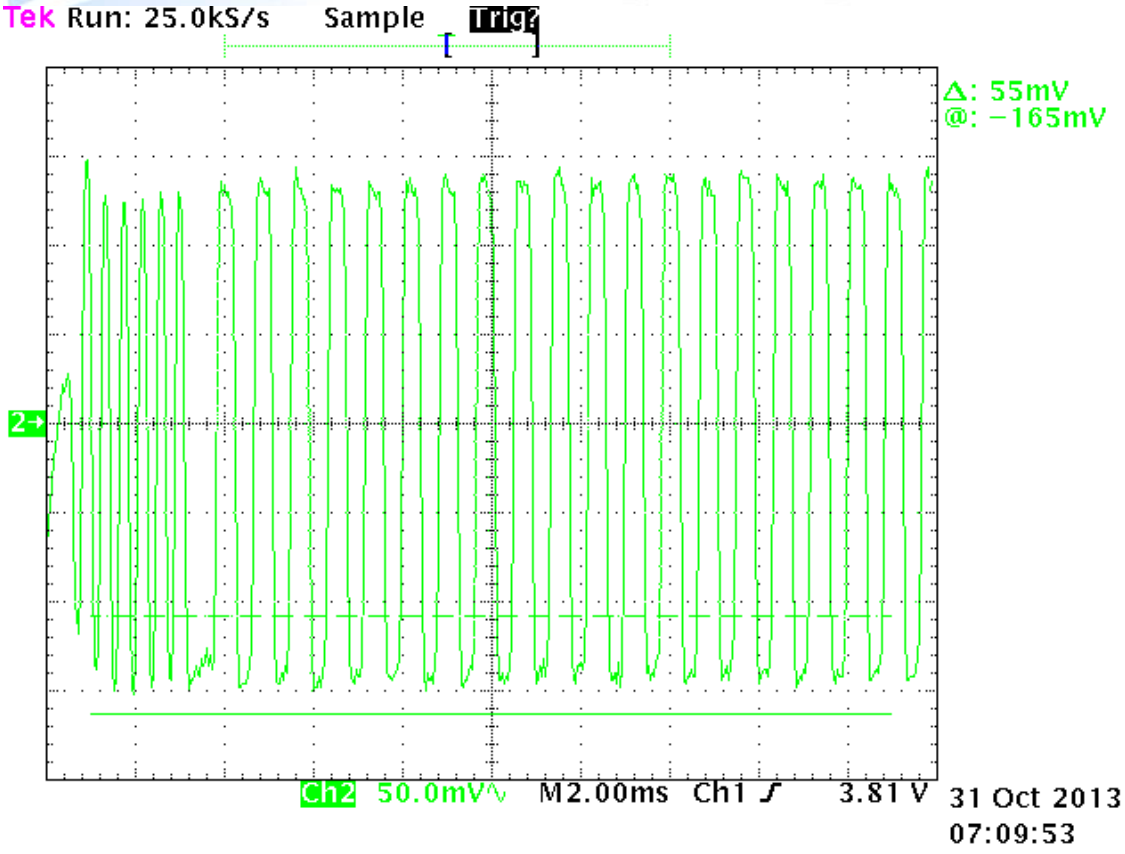
Test signal 1 showing bit 31 to 199



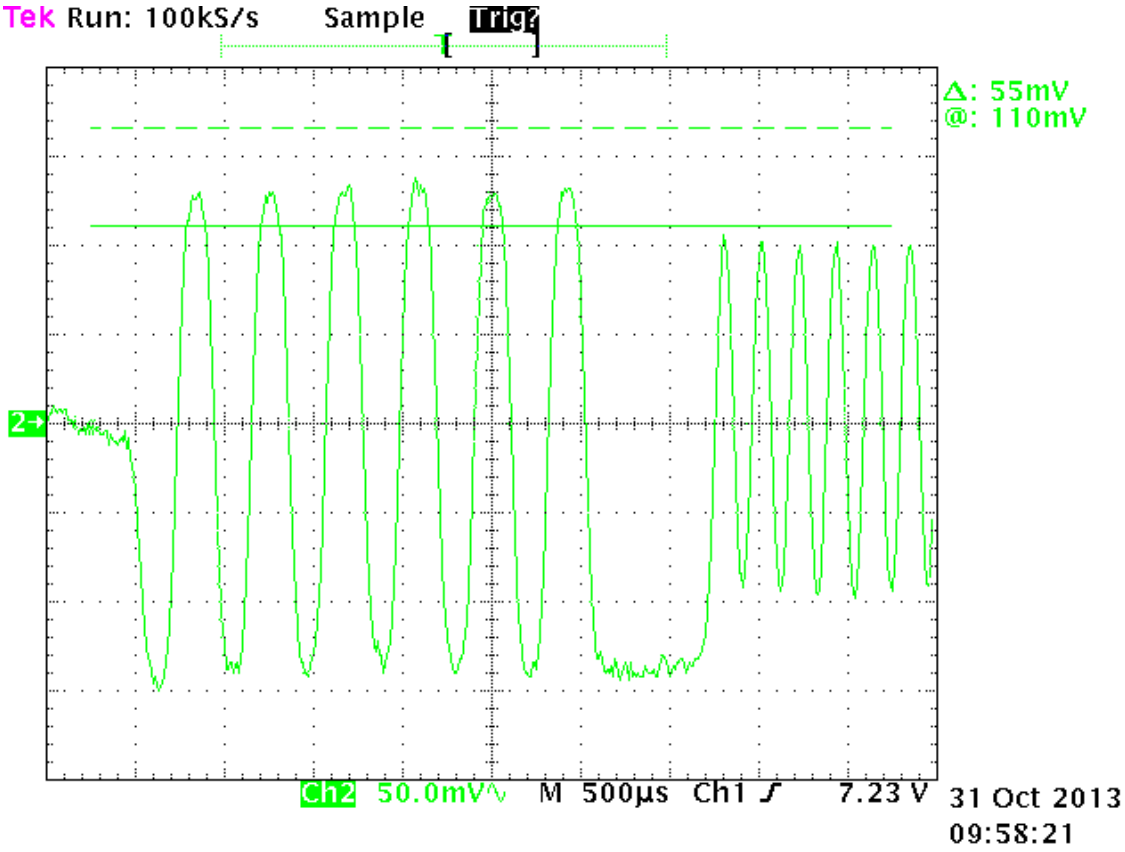


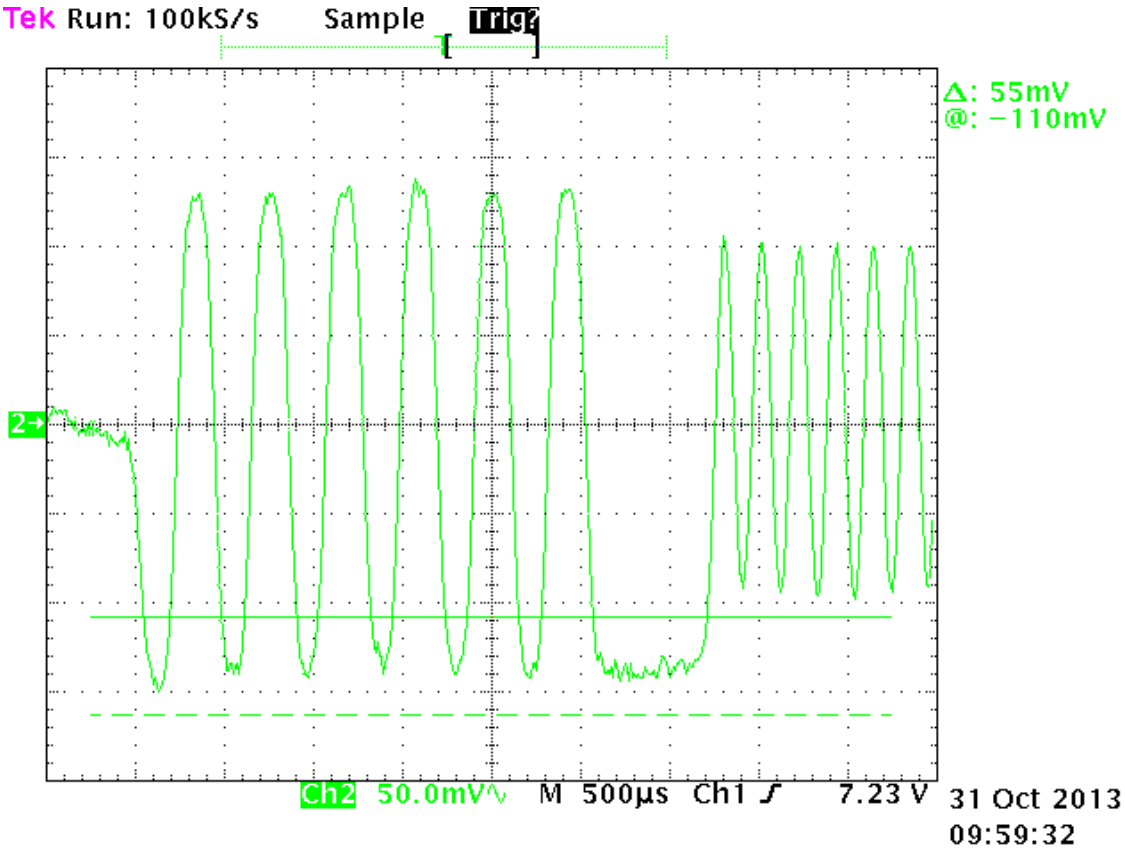
162.025 MHz - Extreme +55 degrees - Test signal 2 showing bit 0 to 31



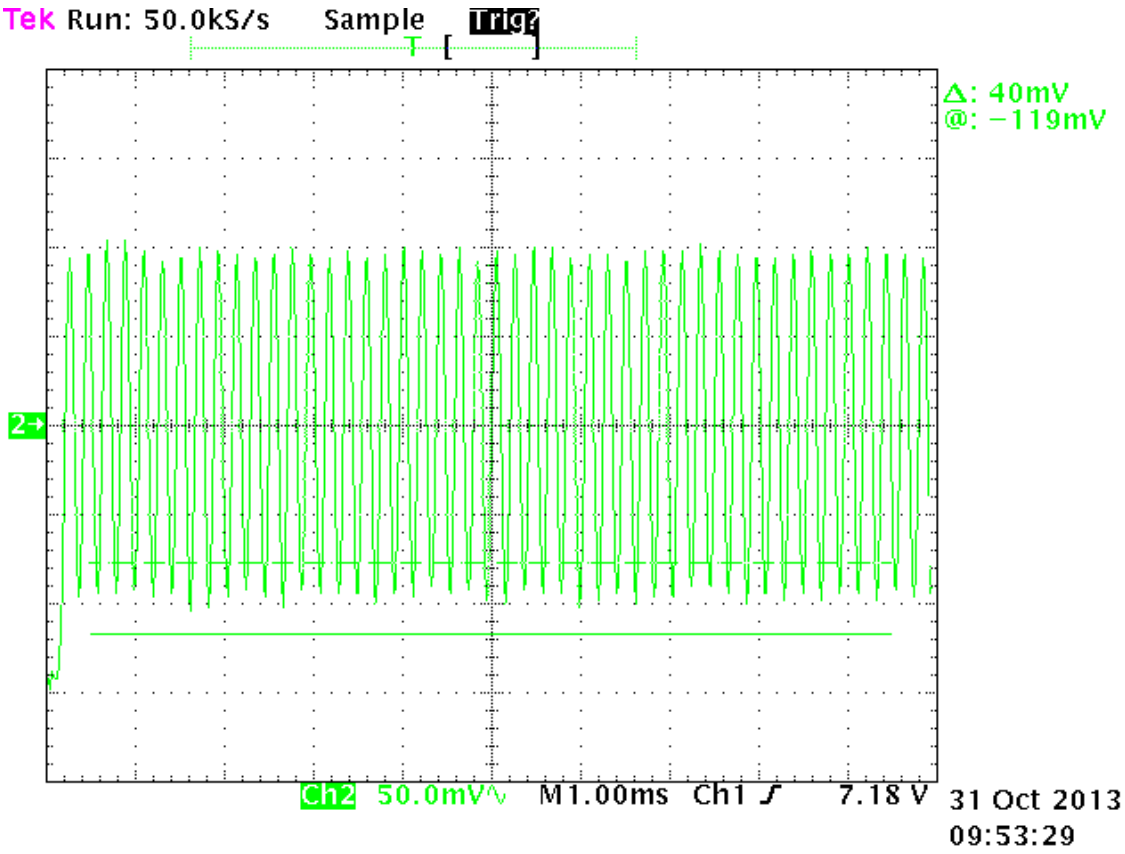


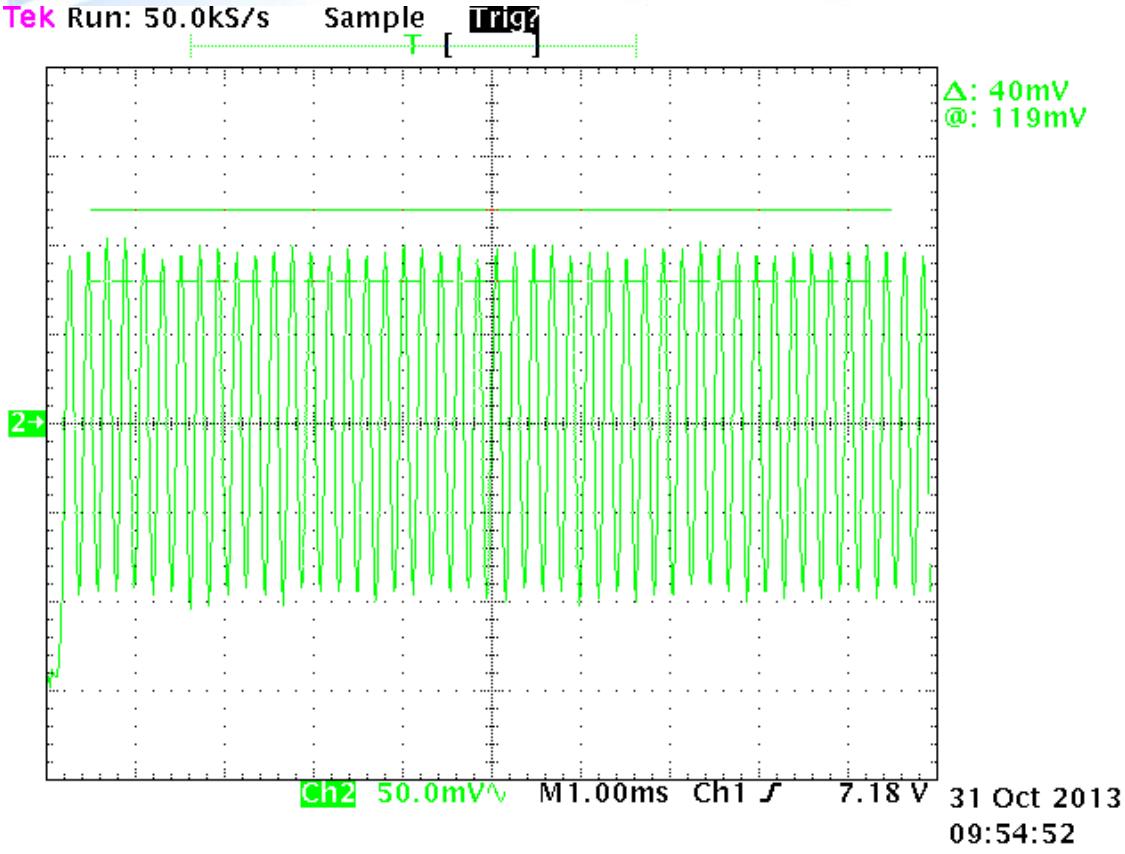
161.500 MHz - Extreme -25 degrees - Test signal 1 showing bit 0 to 31



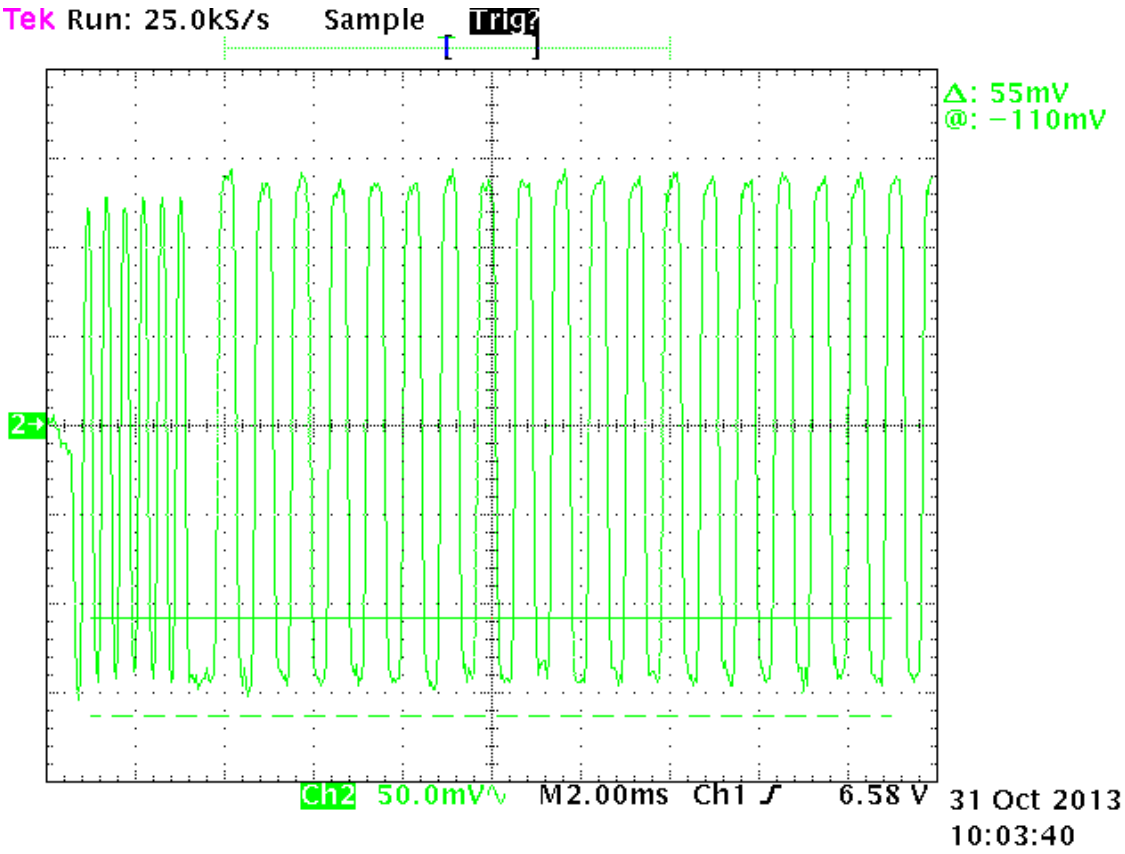


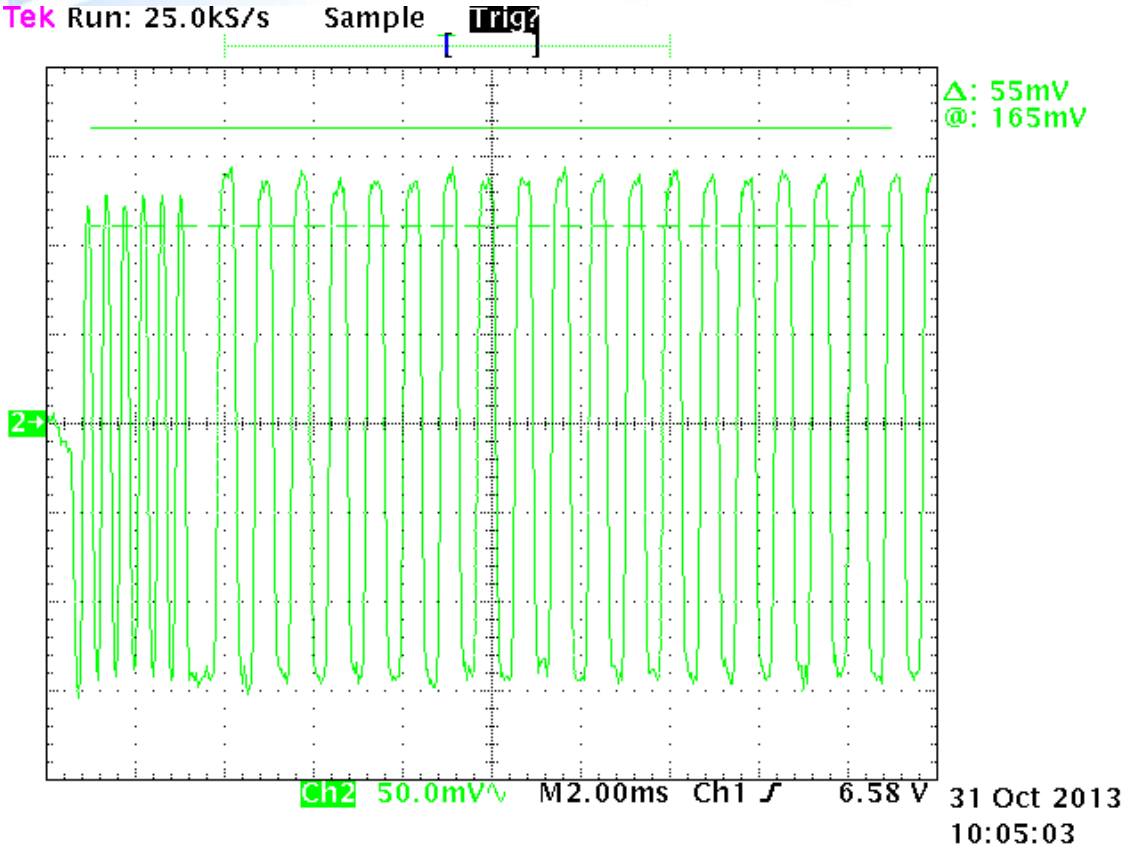
Test signal 1 showing bit 31 to 199



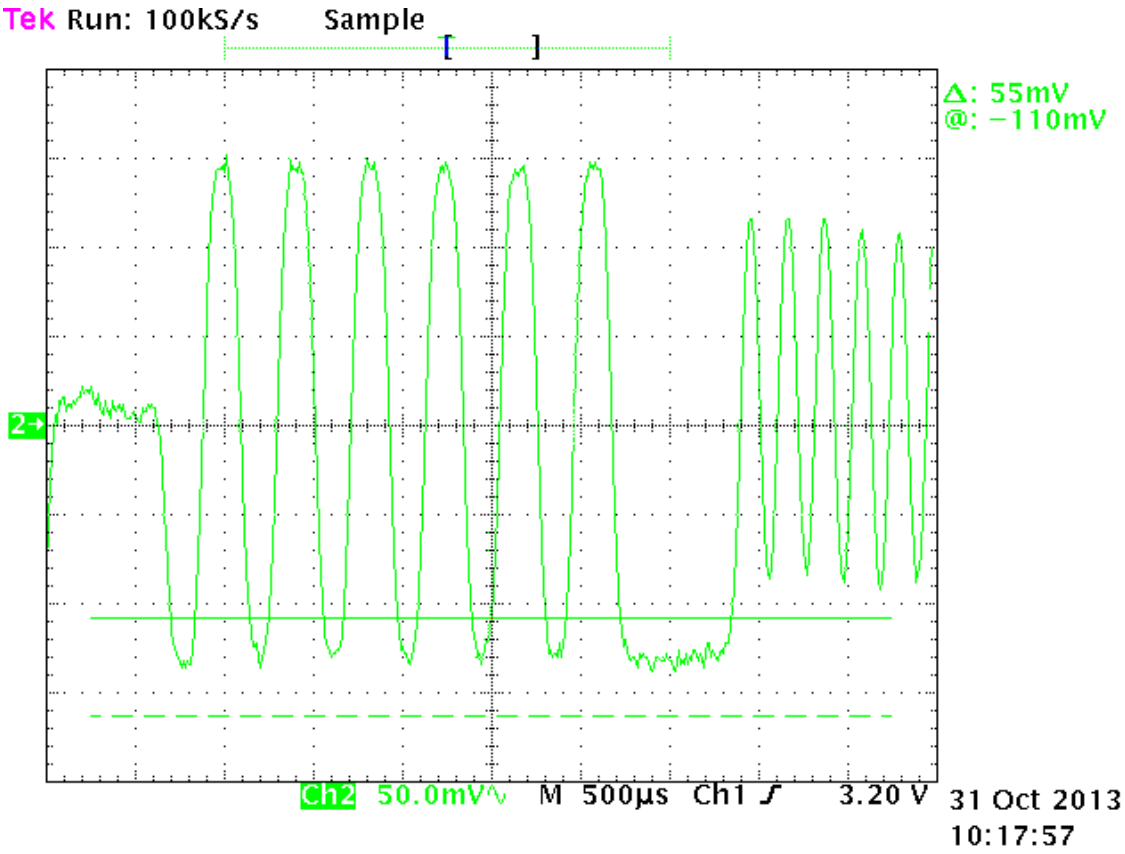


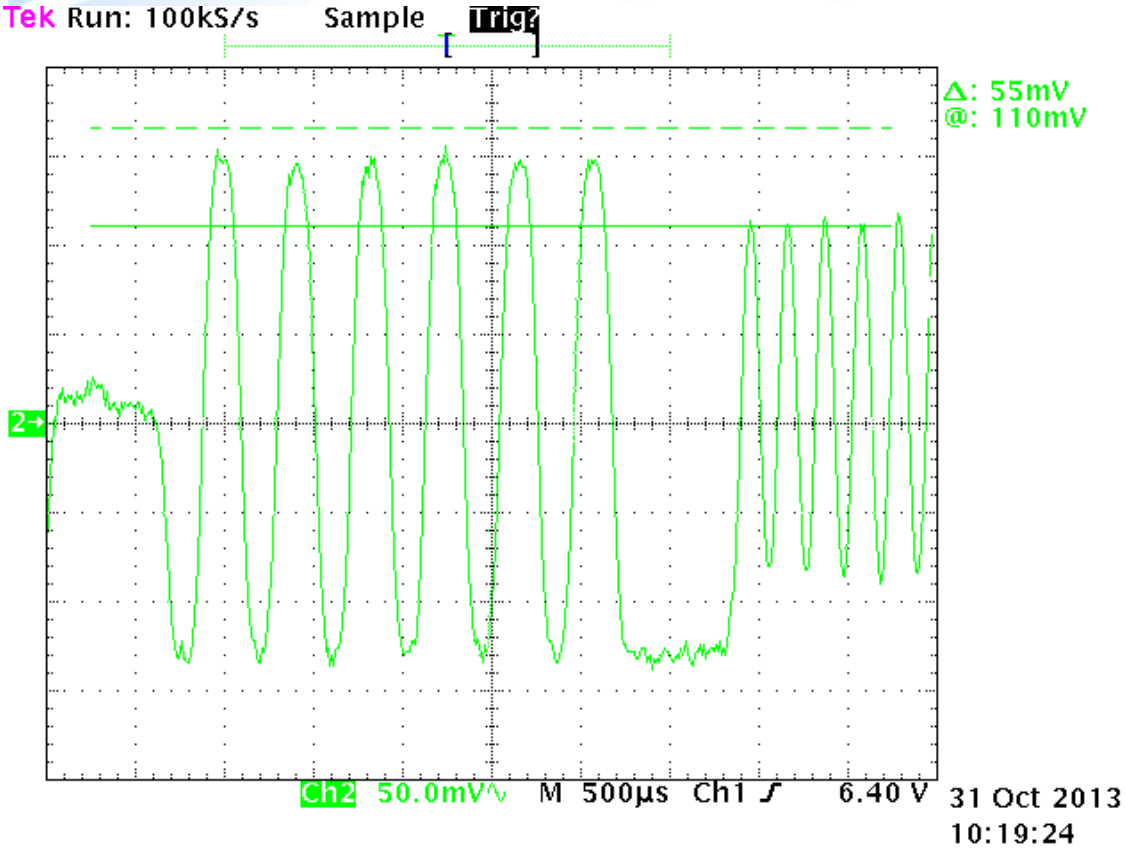
161.500 MHz - Extreme -25 degrees - Test signal 2 showing bit 0 to 199



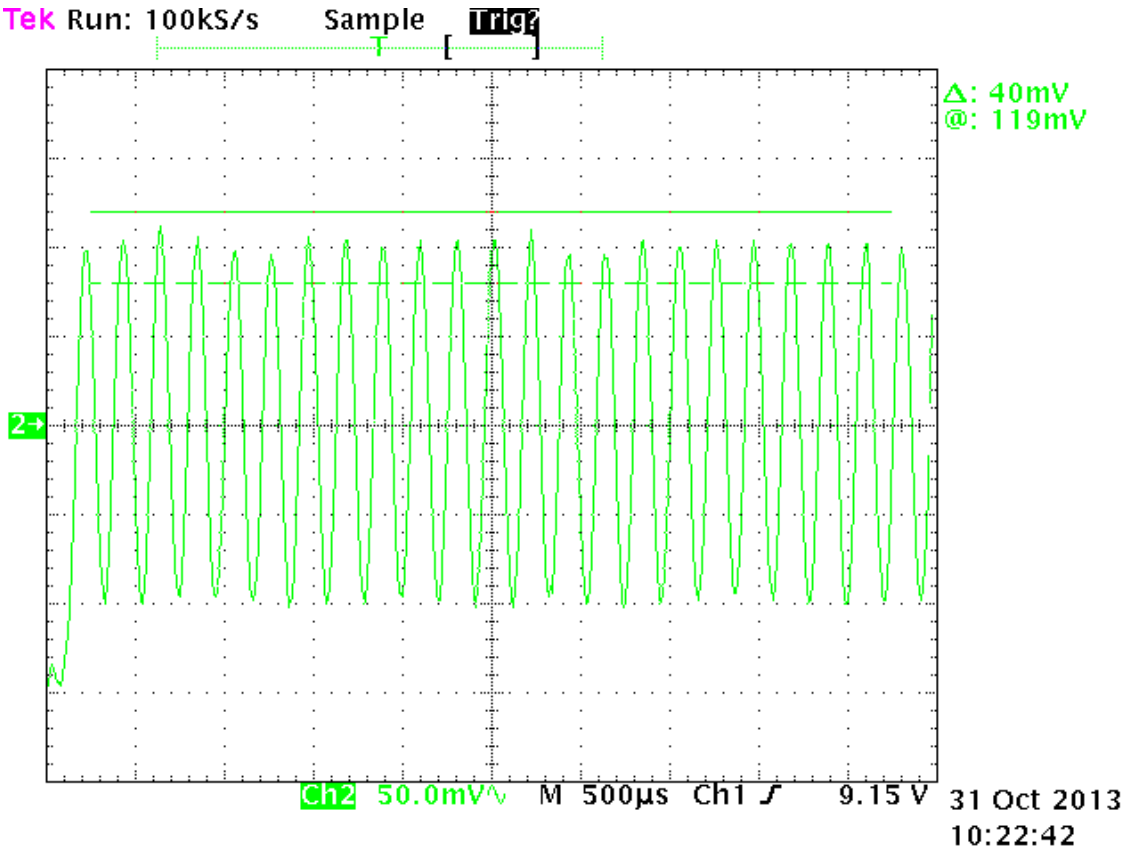


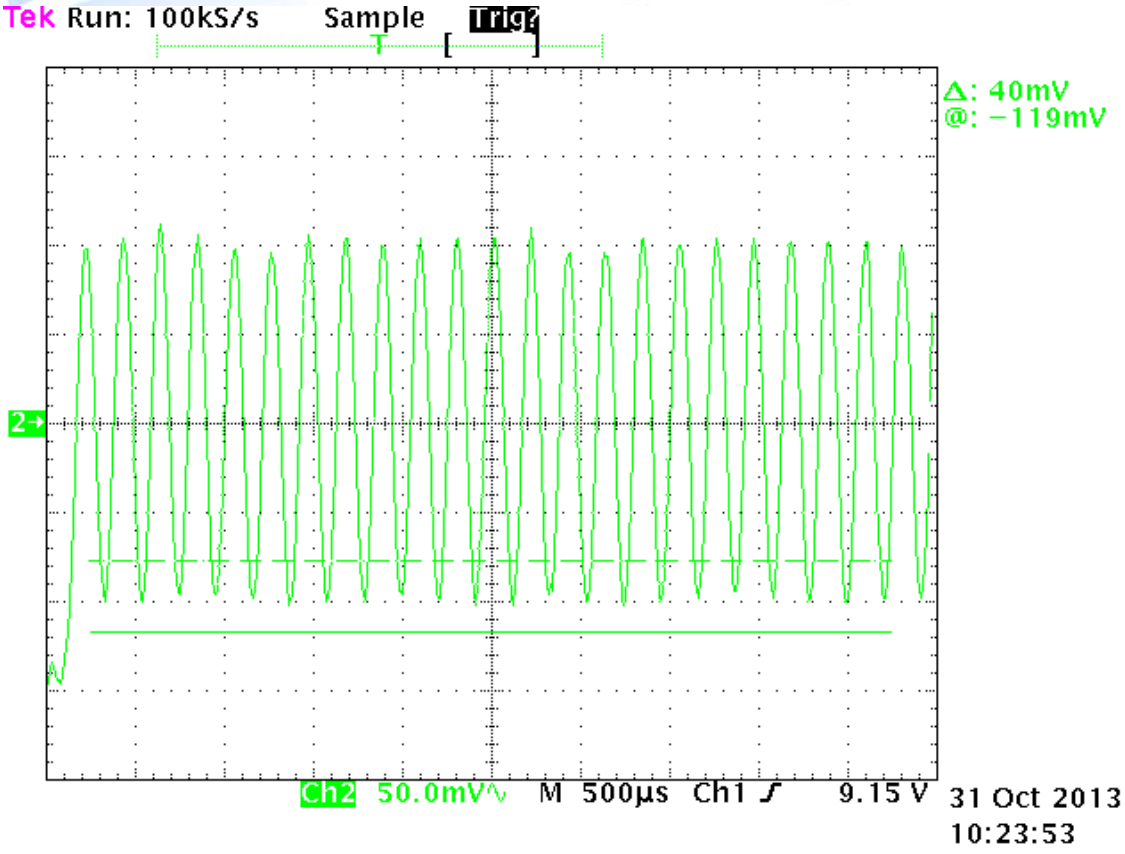
162.025 MHz - Extreme -25 degrees - Test signal 1 showing bit 0 to 31



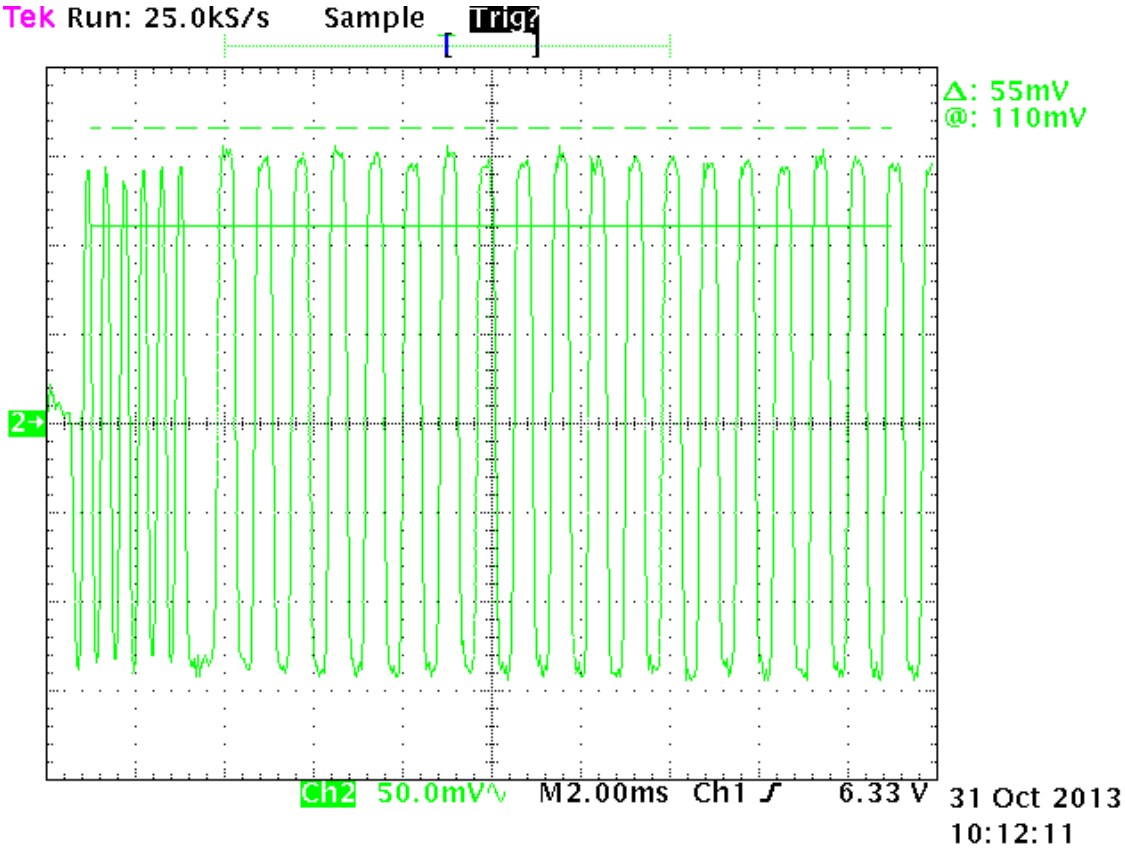


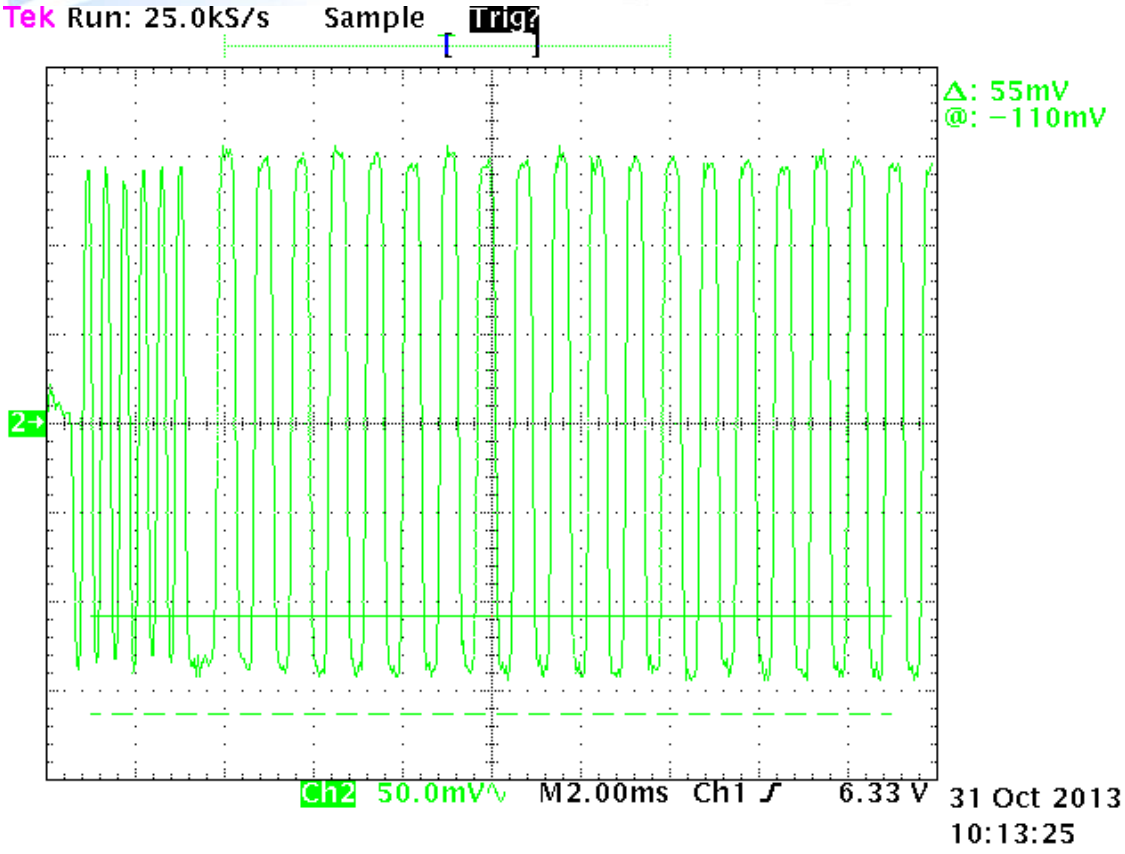
Test signal 1 showing bit 31 to 199





162.025 MHz - Extreme -25 degrees - Test signal 2 showing bit 0 to 199





7.1.1.5 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 40 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 1 being used.

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

The following measurements were made with regard figure 12 and the associated timings in table 18.

162.025 MHz – Pss: +40.6 dBm

Ref	Time	Measured	Limit	Result
To	0 ms	-	-	-
To –Ta	0.6240 ms	0.0 ms	-50 dB of Pss	Pass
Tb1	0.6240 ms	+40.4 dBm	-3.0 to +1.5 dB of Pss	Pass
Tb2	0.8324 ms	+40.6 dBm	-1.0 to +1.5 dB of Pss	Pass
Te	24.024 ms	+40.5 dBm	-1.0 to +1.5 dB of Pss	Pass
Tf	26.146 ms	-17.2 dBm	-50 dB of Pss	Pass
Tg	26.624 ms	-	Next transmission period	-

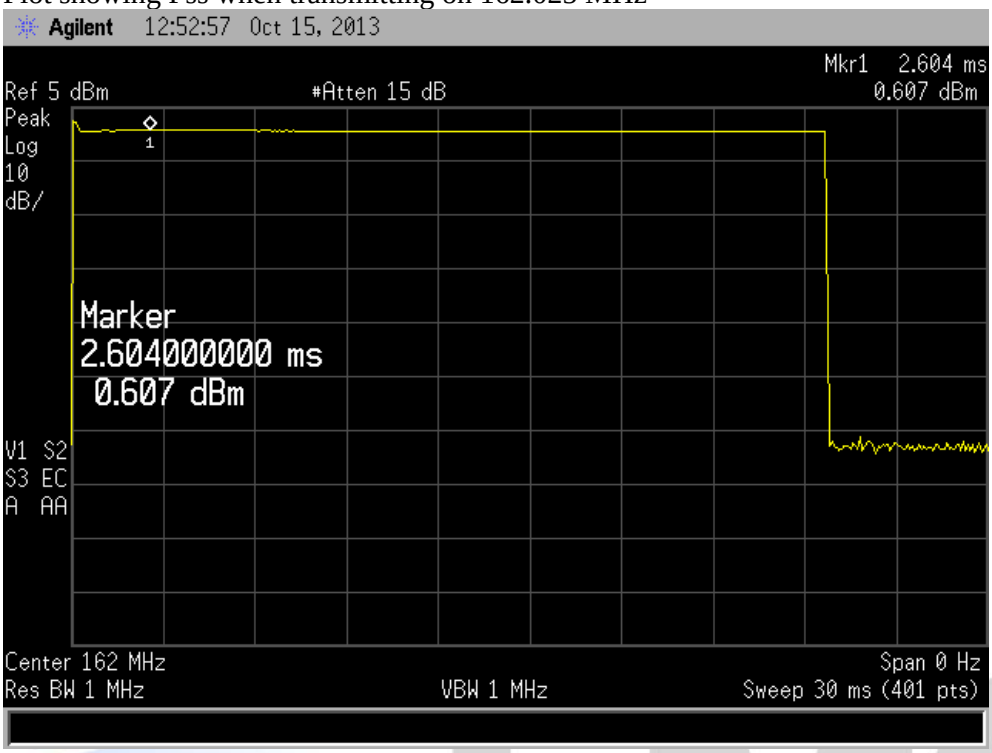
161.500 MHz – Pss: +40.9 dBm

Ref	Time	Measured	Limit	Result
To	0 ms	-	-	-
To –Ta	0.6240ms	0.0 ms	-50 dB of Pss	Pass
Tb1	0.6240 ms	+40.7 dBm	-3.0 to +1.5 dB of Pss	Pass
Tb2	0.8324 ms	+40.9 dBm	-1.0 to +1.5 dB of Pss	Pass
Te	24.024 ms	+40.7 dBm	-1.0 to +1.5 dB of Pss	Pass
Tf	26.146 ms	-18.6 dBm	-50 dB of Pss	Pass
Tg	26.624 ms	-	Next transmission period	-

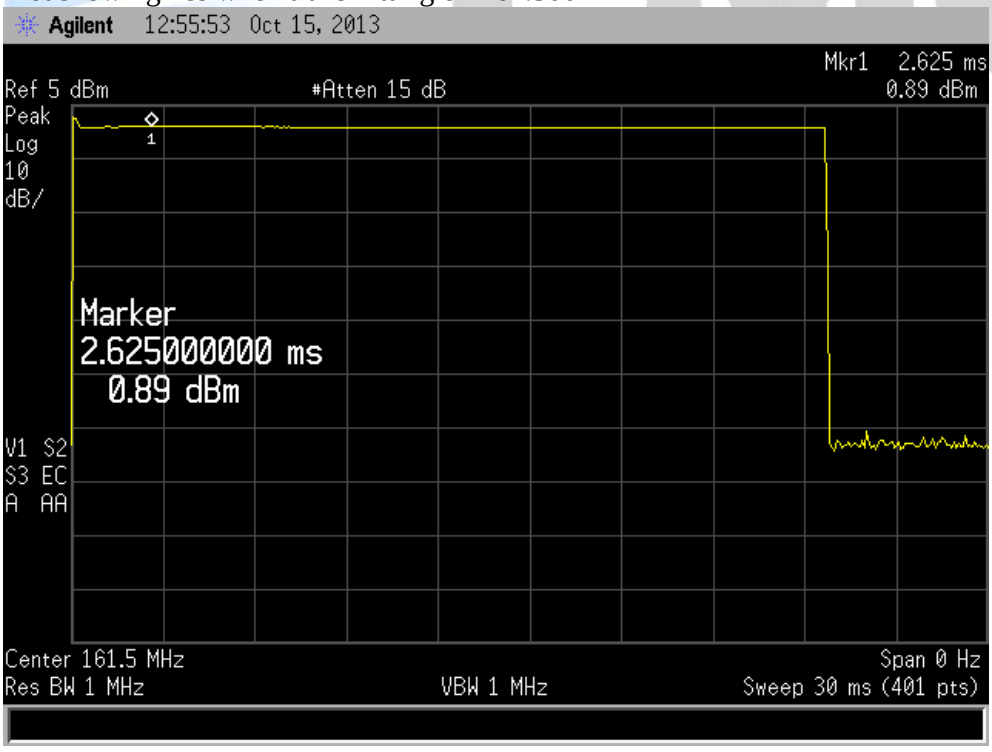
Unable to determine Tg as the device was operating in a test mode that only allowed transmissions once every second

Result: Complies.

Plot showing Pss when transmitting on 162.025 MHz



Plot showing Pss when transmitting on 161.500 MHz



7.1.3.2 Transmitter Conducted Spurious Emissions

Testing was carried out using a spectrum analyser that had a 20 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 -60 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	-51.5	-36.0
+12.0 / +24.0		484.5000	-56.8	-36.0
+12.0 / +24.0		646.0000	-56.8	-36.0
+12.0 / +24.0		807.5000	< 60.0	-36.0
+12.0 / +24.0		969.0000	< 60.0	-36.0
+12.0 / +24.0		1453.5000	< 60.0	-30.0
+12.0 / +24.0		1938.0000	< 60.0	-30.0
+12.0 / +24.0		2422.5040	< 60.0	-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	-52.2	-36.0
+12.0 / +24.0		486.0750	-60.4	-36.0
+12.0 / +24.0		648.1000	-58.8	-36.0
+12.0 / +24.0		810.1250	< 60.0	-36.0
+12.0 / +24.0		972.1500	< 60.0	-36.0
+12.0 / +24.0		1458.2250	< 60.0	-30.0
+12.0 / +24.0		1782.2780	< 60.0	-30.0
+12.0 / +24.0		1944.3036	< 60.0	-30.0
+12.0 / +24.0		2106.3293	< 60.0	-30.0
+12.0 / +24.0		2268.3546	< 60.0	-30.0
+12.0 / +24.0		2430.3791	< 60.0	-30.0
+12.0 / +24.0		2592.4043	< 60.0	-30.0

Result: Complies.
Measurement Uncertainty: ± 3.3 dB

8. TEST EQUIPMENT

Instrument	Manufacturer	Model	Serial #	Asset
DC Power Supply	DSE	Q1760	30501563	-
Environmental Chamber	Contherm	M180F	-	E1129
Modulation Analyzer	Rohde & Schwarz	FMA	837807/020	E1552
Storage Oscilloscope	Tektronix	TDS 745A	B010643	E1569
Spectrum Analyser	Hewlett Packard	E7405A	US39150142	3776
Thermometer	DSIR	RT200	35	E1409

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 62320-2 EMC Technologies (NZ) Ltd is accredited to a number of standards that call up similar test methods to those detailed.

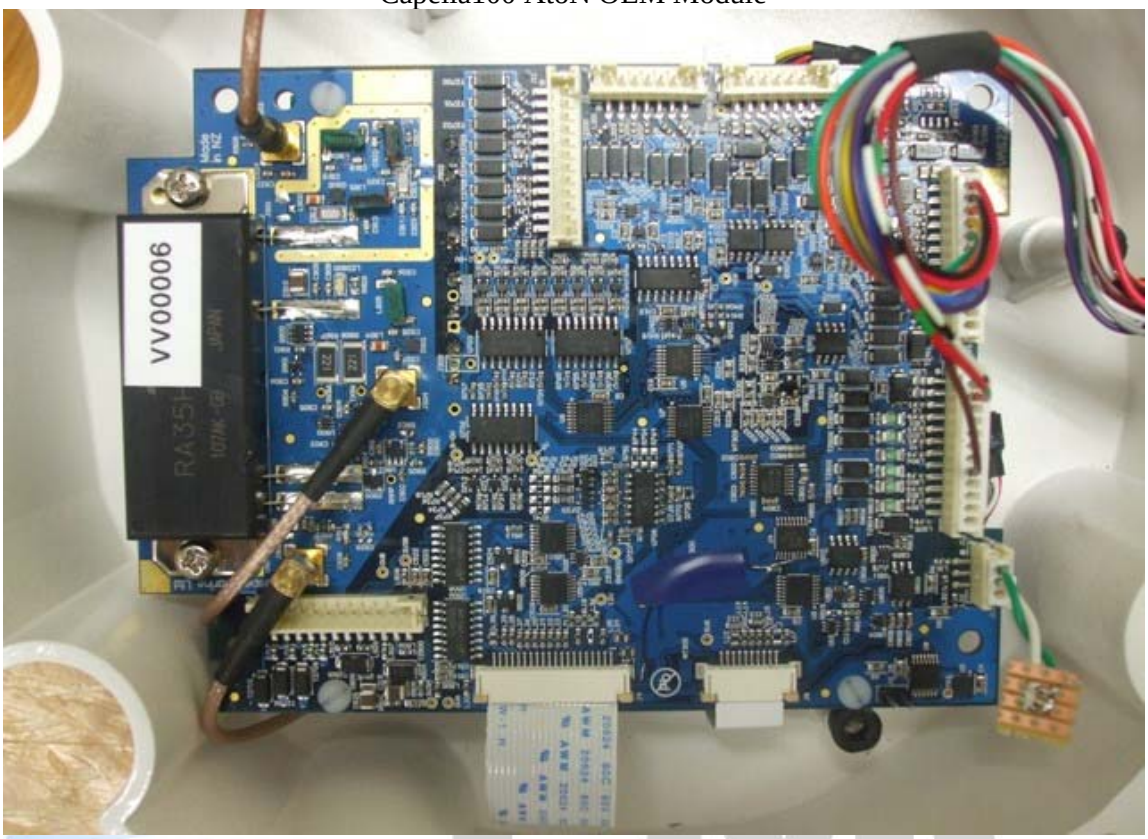
Similar standards that EMC Technologies (NZ) Ltd are IANZ accredited to carryout include EN 300 113, EN 300 086, FCC part 90, AS/NZS 4295 and AS/NZS 4415.

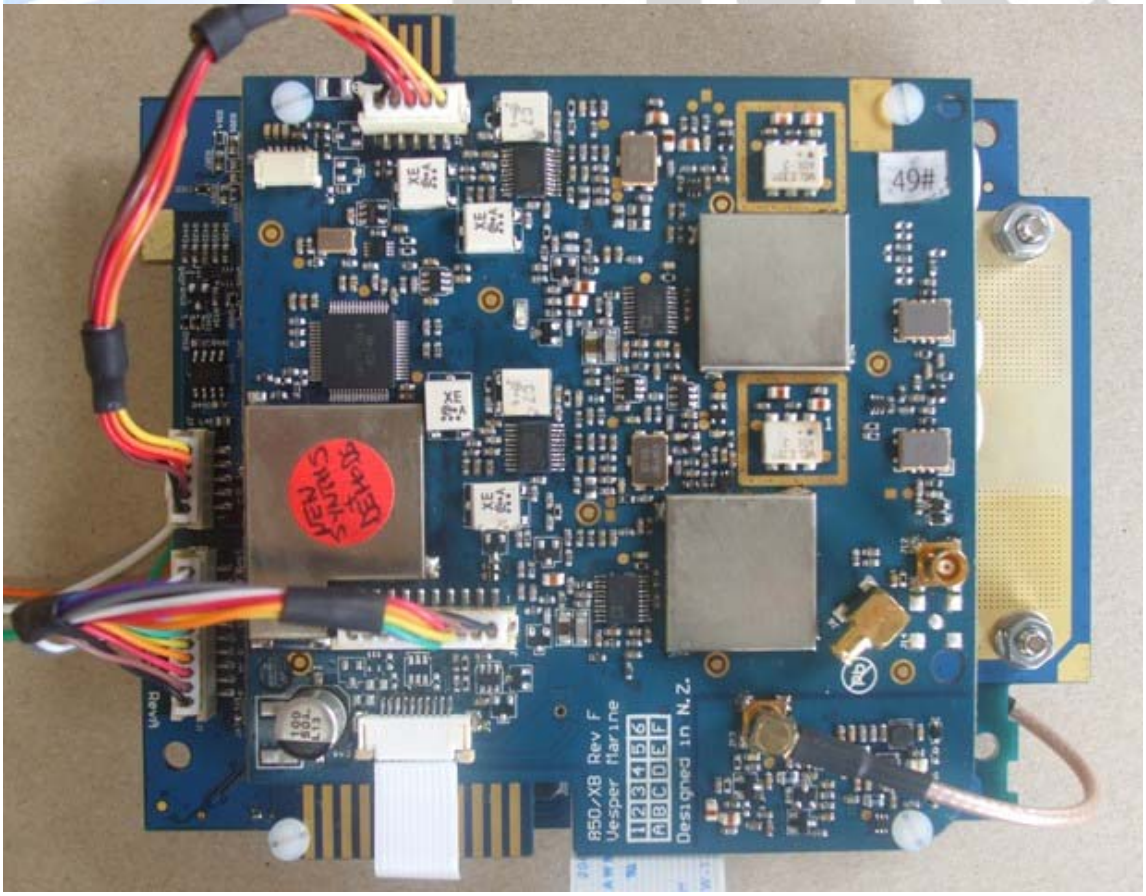
All measurement equipment has been calibrated in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/IEC/ ISO 17025.

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. PHOTOGRAPHS

VAIS Housing





Alternative Enclosure