Test Report

Bluetooth Supplemental Report

Project Number: **3071804**

Report Number: **3071804EMC04A** **Revision Level:** **0**

Client: **Airo Wireless, Inc.**

Equipment Under Test: **Intrinsically Safe Cellular Phone**

Model: **I-SAFE™28**

Applicable Standards: **RSS 210: Issue 8**

Frequency Hopping Requirements

Report issued on: **10 December 2013**

Test Result: **Compliant**

Tested by: _____
Jeremy O. Pickens, Senior EMC Engineer

Reviewed by: _____
David Schramm, EMC Manager

Remarks:
This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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1 Summary of Test Results

Test Description	Test Specification	Test Result
Pseudo-Random Hop Sequence	RSS-210 A8.1(a)	Compliant(1)
Channel Separation	RSS-210 A8.1(b)	Compliant
Number of Hopping Channels	RSS-210 A8.1(d)	Compliant
Dwell Time	RSS-210 A8.1(d)	Compliant

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name: Airo Wireless, Inc
Address: 12 Piedmont Center, Suite 205
City, State, Zip, Country: Atlanta, GA 30035, USA

2.2 *Test Laboratory*

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

2.3 *General Information of EUT*

Type of Product: Intrinsically Safe Cellular Phone
Model: I-SAFE™ 28
Serial Number: Not Labeled
FCC ID: QDL-ISAFE28
Frequency Range: 2402 to 2480 MHz
Number of channels: 79
Modulation type: GFSK, EDR 2, EDR 3
Channel spacing: 1 MHz
Antenna: Integral

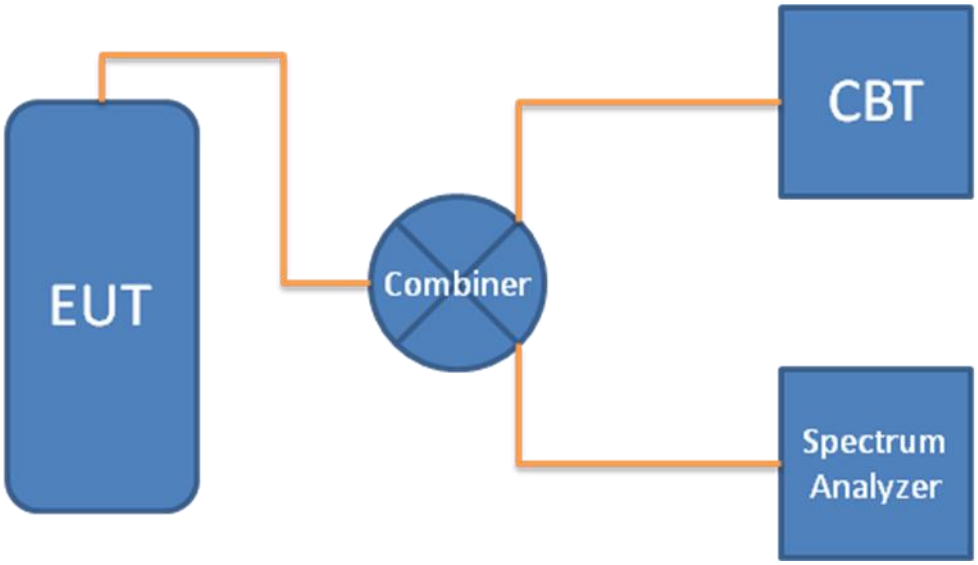
Rated Voltage: 3.7 VDC Internal Battery

Sample Received Date: 03 July 2013
Dates of testing: 10 December 2013

Operating Modes and Conditions

The EUT was placed into test mode and controlled by the Bluetooth Tester for Hopping Sequence, Data Rates and Packet Types.

2.4 *EUT Connection Block Diagram*



2.5 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
EUT	Airo Wireless	Intrinsically Safe Cell Phone		Not Labeled
CBT	R&S	Bluetooth Tester	CBT	See Equipment List
Spectrum Analyzer	R&S	Spectrum Analyzer	FSV	See Equipment List

3 Pseudo-Random Hop Sequence

3.1 *Test Result*

Test Description	Test Specification	Test Result
Pseudo-Random Hop Sequence	RSS-210 A8.1(a)	Compliant(1)

Note (1): The theory of operation states that the device is Bluetooth and operates using a pseudo-random hopping technique.

3.2 *Test Method*

Compliance is demonstrated by Manufacturer's declaration or is stated in the Theory of Operation.

Requirement
The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.

4 Channel Separation

4.1 *Test Result*

Test Description	Test Specification	Test Result
Number of Hopping Channels	RSS-210 A8.1(b)	Compliant

4.2 *Test Method*

The test data was measured using a spectrum analyzer with Peak detector (max hold) and a resolution bandwidth of 100 kHz. The trace was allowed to stabilize until all channels were displayed.

Requirement
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the -20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

4.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

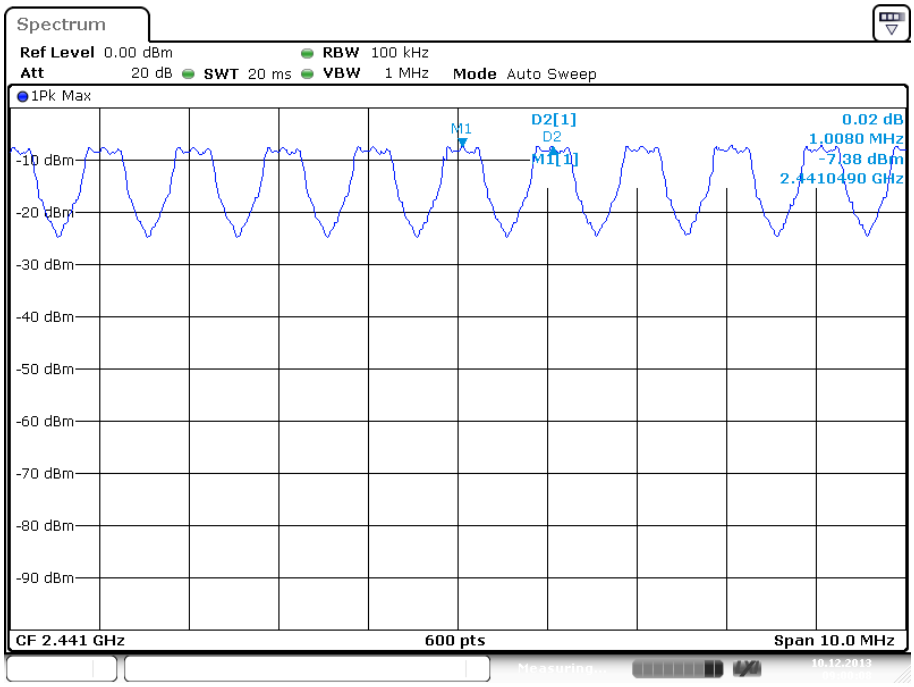
Environmental Conditions
Temperature: 22.7 °C
Relative Humidity: 37.8 %

4.4 *Test Equipment*

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV 30	R&S	101595	28 Aug 2014
Bluetooth Tester	CBT	R&S	100011	CNR

Note: The calibration period equipment is 1 year.

4.5 *Test Data*



Date: 10.DEC.2013 09:00:09

5 Number of Hopping Channels

5.1 *Test Result*

Test Description	Test Specification	Test Result
Number of Hopping Channels	RSS-210 A8.1(d)	Compliant

5.2 *Test Method*

The test data was measured using a spectrum analyzer with Peak detector (max hold) and a resolution bandwidth of 30 kHz. The trace was allowed to stabilize until all channels were displayed.

Requirement
Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 22.7 °C
Relative Humidity: 37.8 %

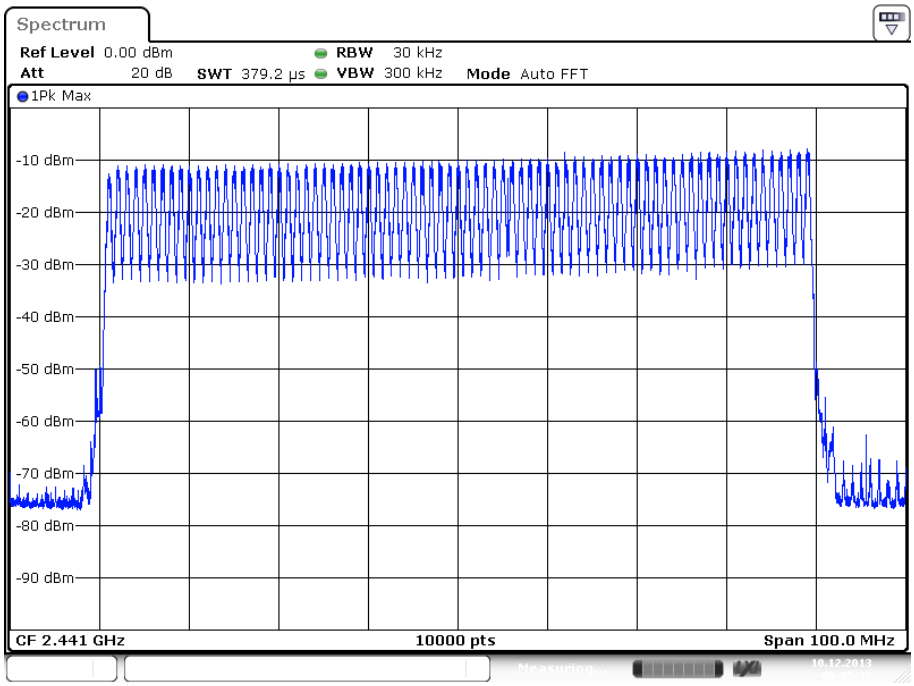
5.4 *Test Equipment*

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV 30	R&S	101595	28 Aug 2014
Bluetooth Tester	CBT	R&S	100011	CNR

Note: The calibration period equipment is 1 year.

5.5 *Test Data*

There are 79 Channel.



Date: 10.DEC.2013 09:05:35

6 Dwell Time

6.1 *Test Result*

Test Description	Test Specification	Test Result
Dwell Time	RSS-210 A8.1(d)	Compliant

6.2 *Test Method*

The EUT was set to test mode which allowed it to be controlled by the Bluetooth Tester. The Bluetooth Tester was then set to operate on US/EU Hopping Scheme with pseudo-random data. For each packet type and data rate, the pulse width of the packet was measured and the number of pulses were counted over the total observation period.

Requirement
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 21.7 °C
Relative Humidity: 46.9 %

6.4 *Test Equipment*

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV 30	R&S	101595	28 Aug 2014
Bluetooth Tester	CBT	R&S	100011	CNR

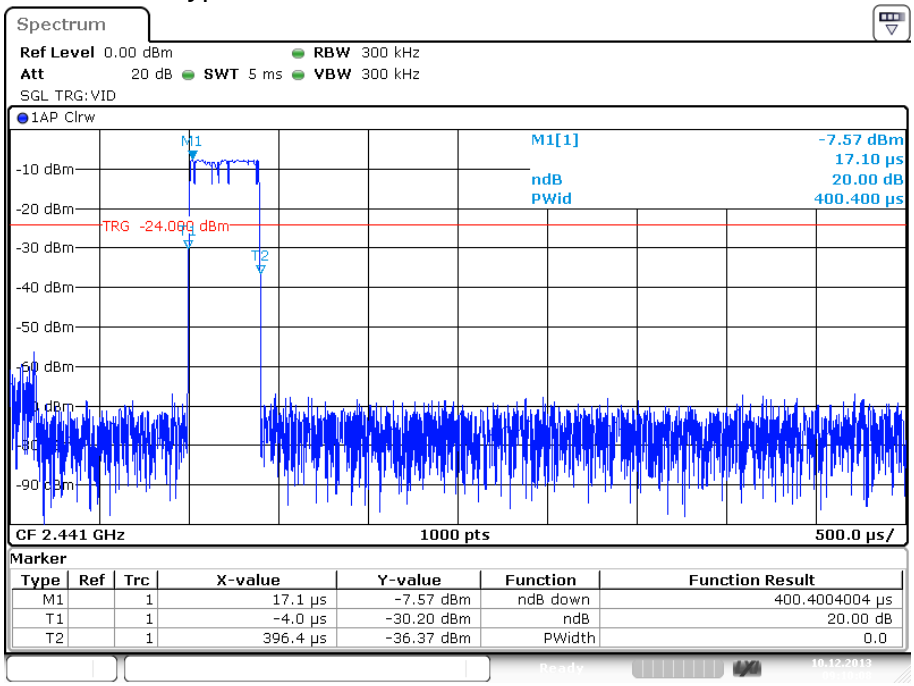
Note: The calibration period equipment is 1 year.

6.5 *Test Data*

	Packet Type	Pulse Width ms	Pulses per 31.6 sec	Dwell Time Sec	Limit	Result
BR	DH1	0.4004	303	0.121	0.4	PASS
	DH3	1.652	157	0.259	0.4	PASS
	DH5	2.898	109	0.316	0.4	PASS
EDR2	DH1	0.4104	334	0.137	0.4	PASS
	DH3	1.662	175	0.291	0.4	PASS
	DH5	2.908	124	0.361	0.4	PASS
EDR3	DH1	0.4104	317	0.130	0.4	PASS
	DH3	1.657	163	0.270	0.4	PASS
	DH5	2.904	113	0.328	0.4	PASS

6.6 *Plots*

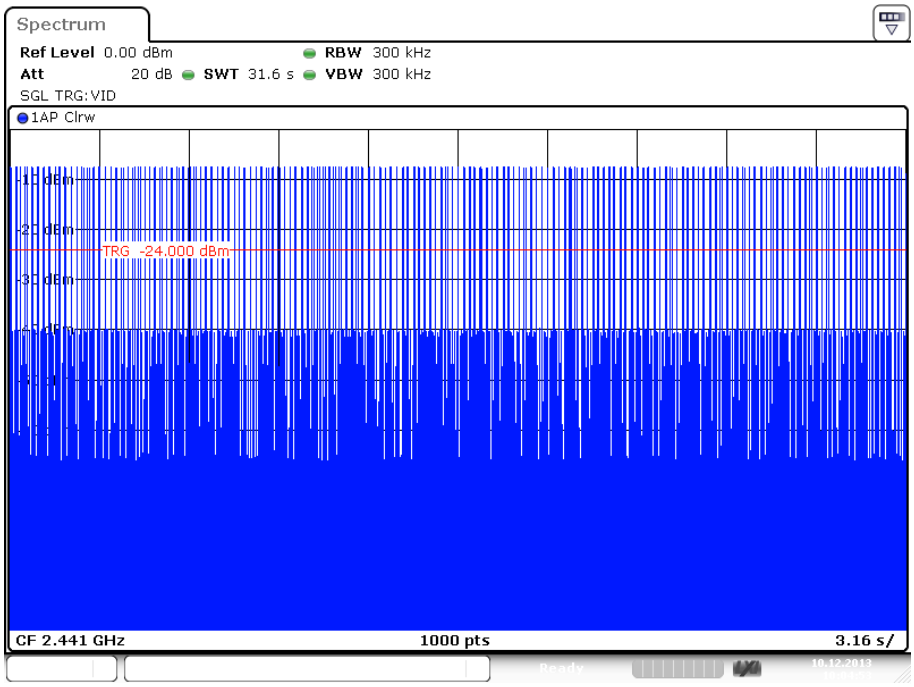
DH1 Packet Type, Basic Rate



Marker

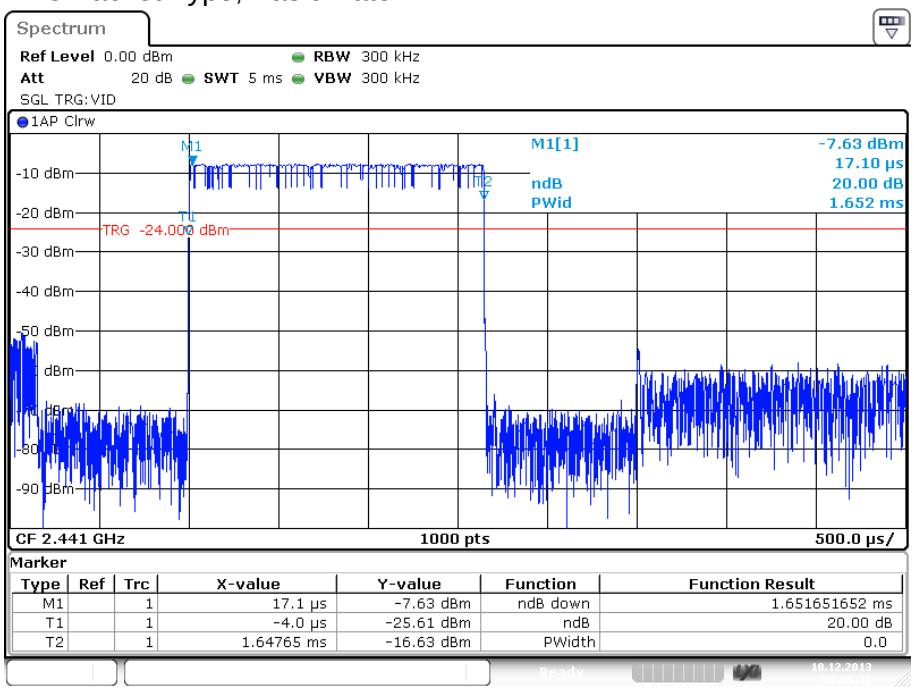
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	17.1 µs	-7.57 dBm	ndB down	400.4004004 µs
T1		1	-4.0 µs	-30.20 dBm	ndB	20.00 dB
T2		1	396.4 µs	-36.37 dBm	PWidth	0.0

Date: 10.DEC.2013 09:10:08



Date: 10.DEC.2013 10:04:53

DH3 Packet Type, Basic Rate



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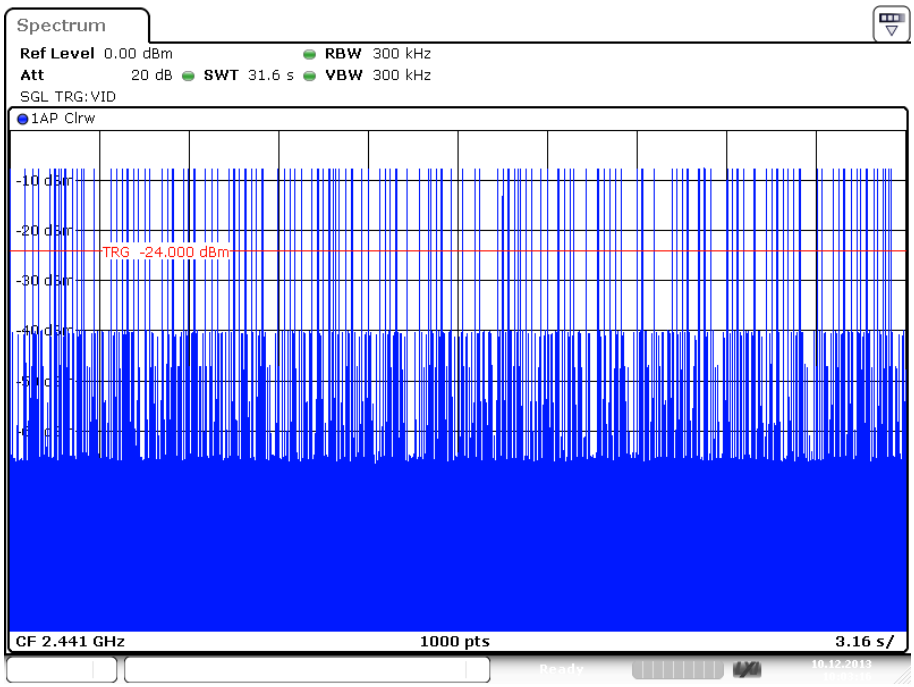
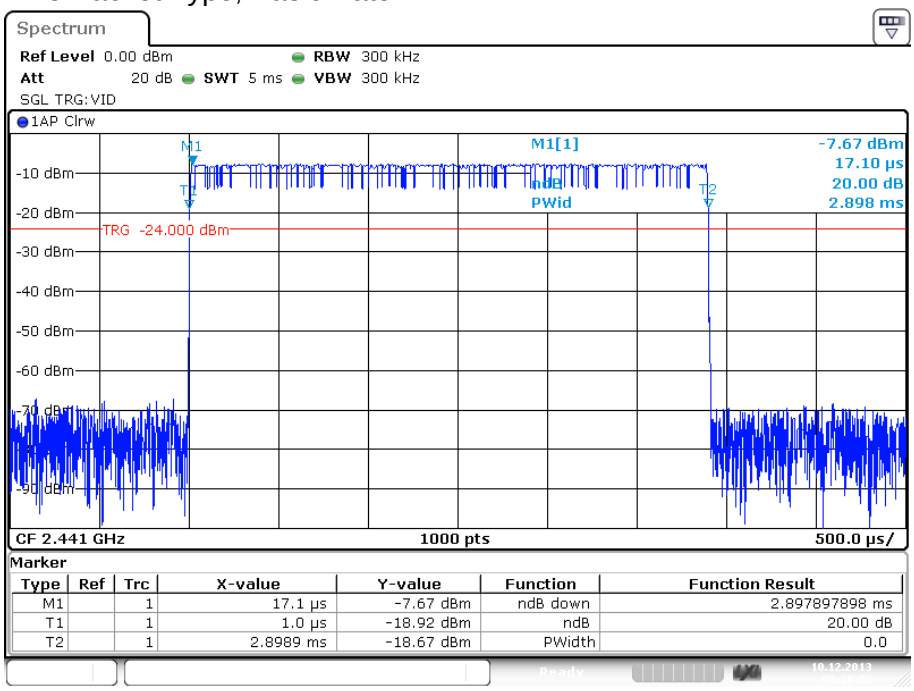


Date: 10.DEC.2013 10:03:16

DH5 Packet Type, Basic Rate



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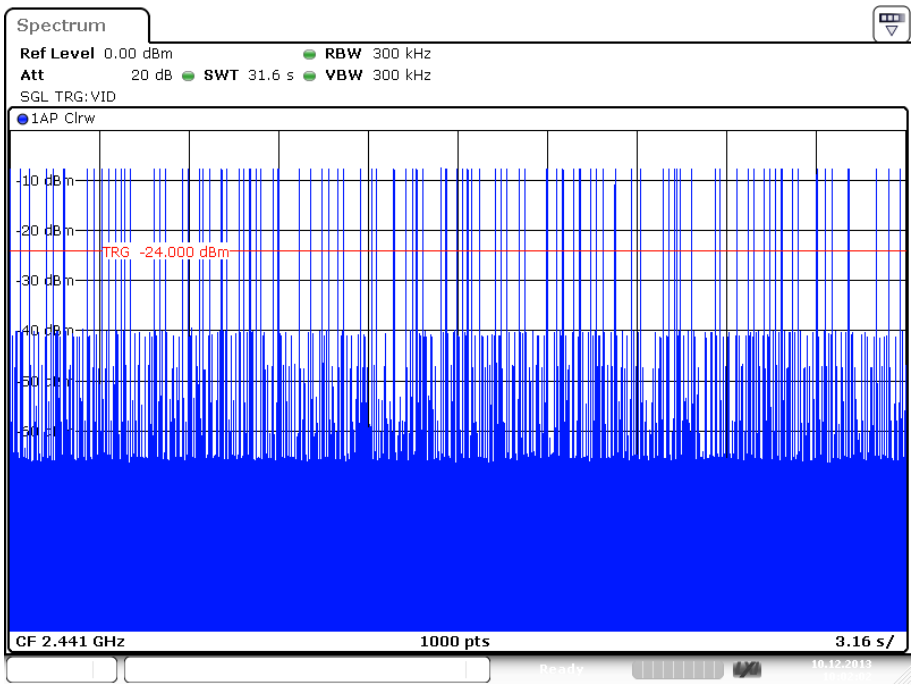
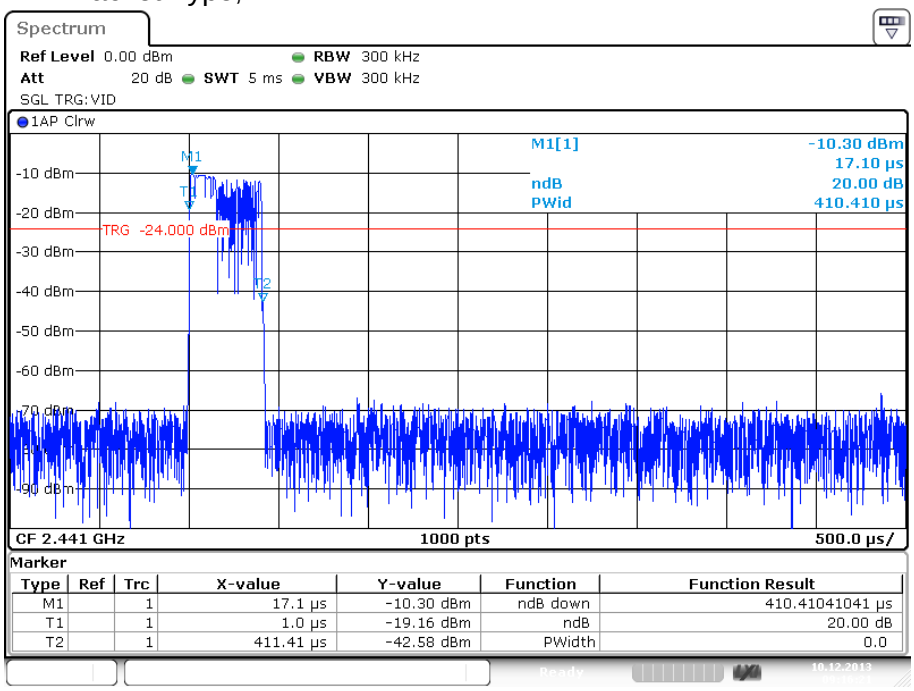


Date: 10.DEC.2013 10:02:02

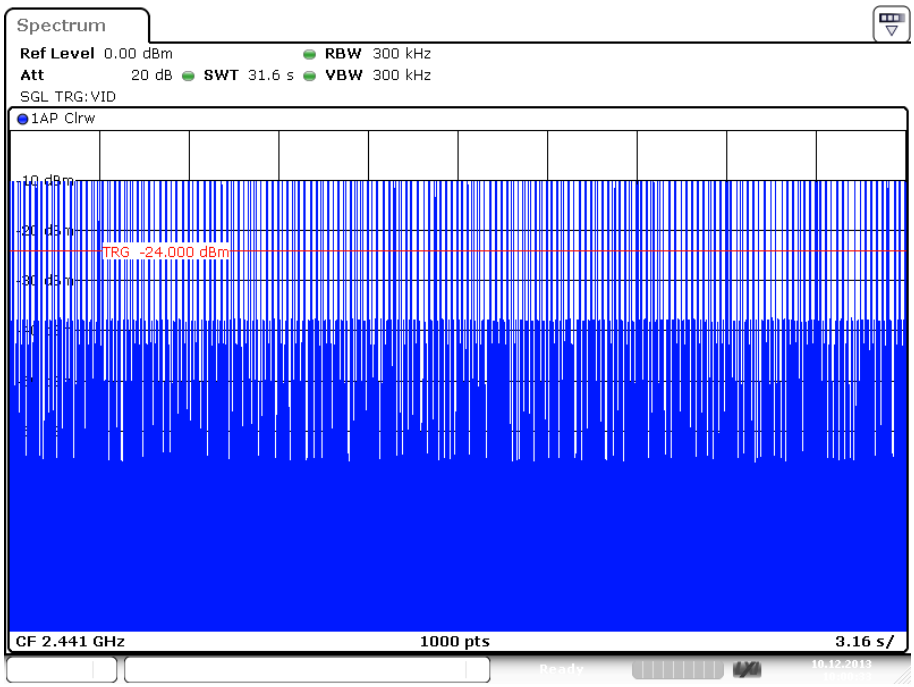
DH1 Packet Type, EDR 2



Marker

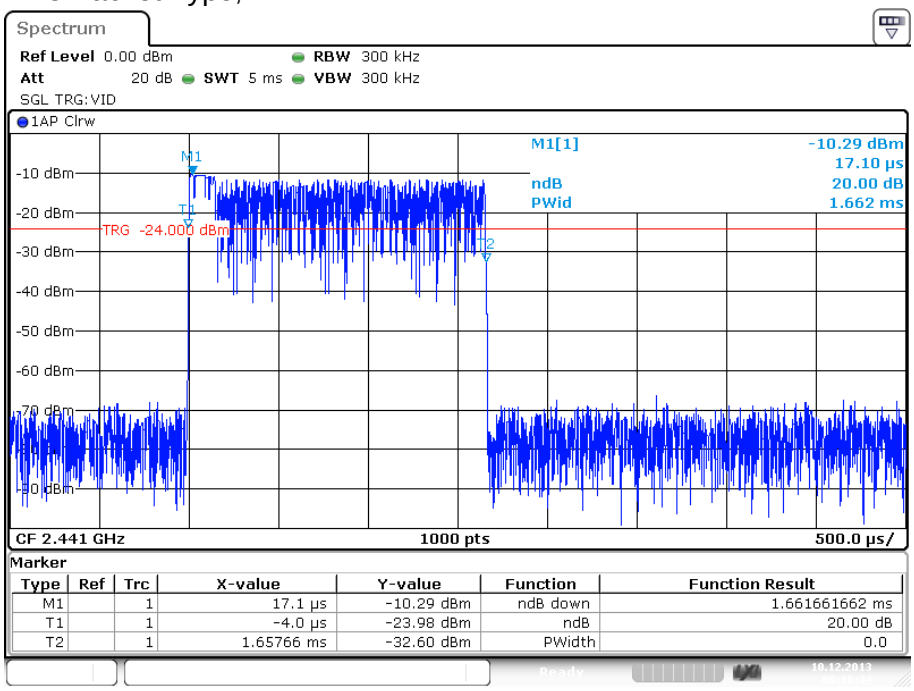
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	17.1 µs	-10.30 dBm	ndB down	410.41041041 µs
T1		1	1.0 µs	-19.16 dBm	ndB	20.00 dB
T2		1	411.41 µs	-42.58 dBm	PWidth	0.0

Date: 10.DEC.2013 09:16:22



Date: 10.DEC.2013 10:00:33

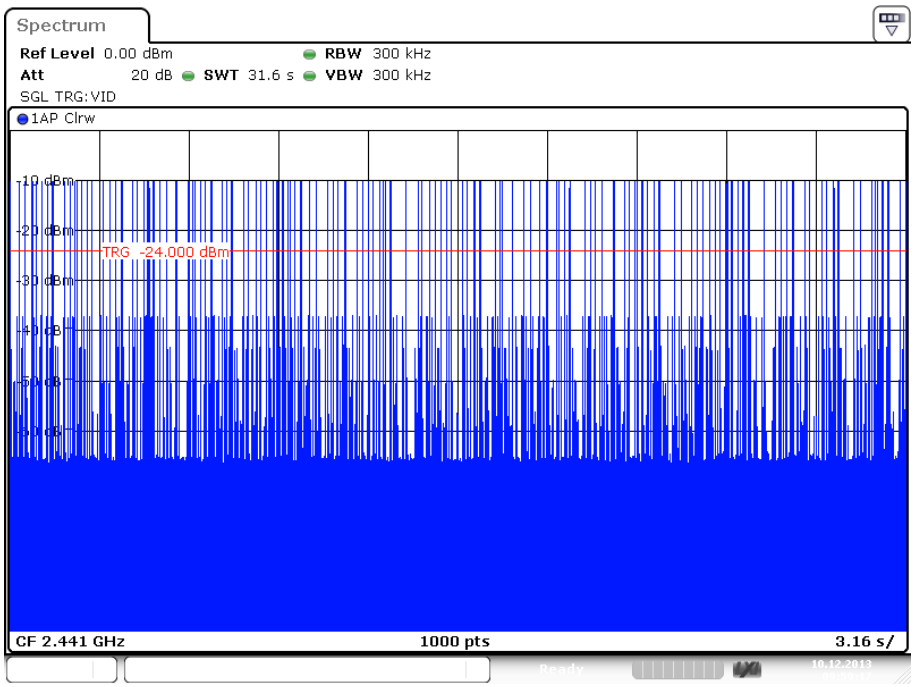
DH3 Packet Type, EDR 2



Marker

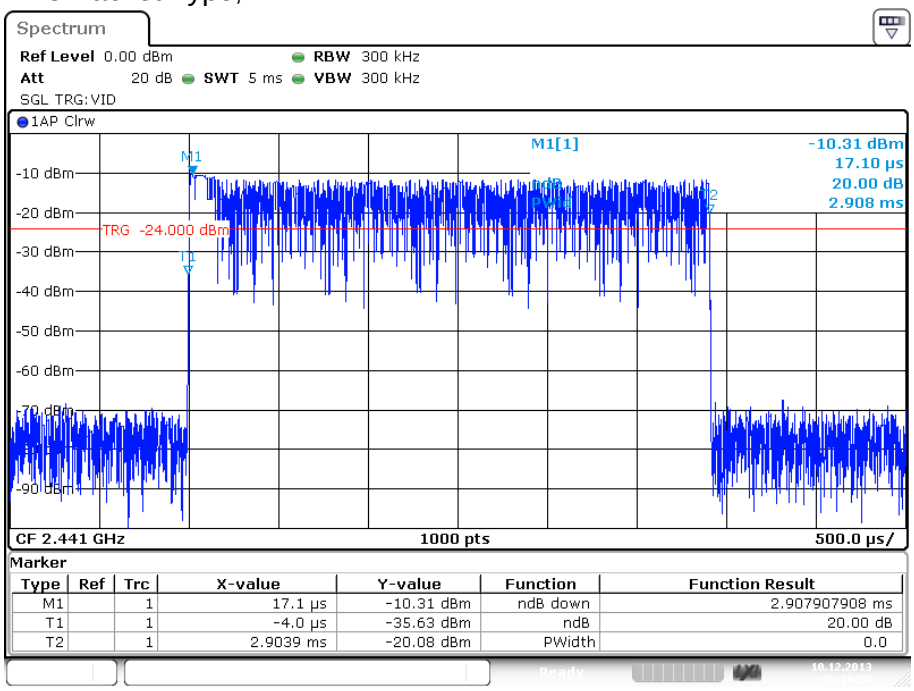
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	17.1 µs	-10.29 dBm	ndB down	1.661661662 ms
T1		1	-4.0 µs	-23.98 dBm	ndB	20.00 dB
T2		1	1.65766 ms	-32.60 dBm	PWidth	0.0

Date: 10.DEC.2013 09:16:45



Date: 10.DEC.2013 09:59:17

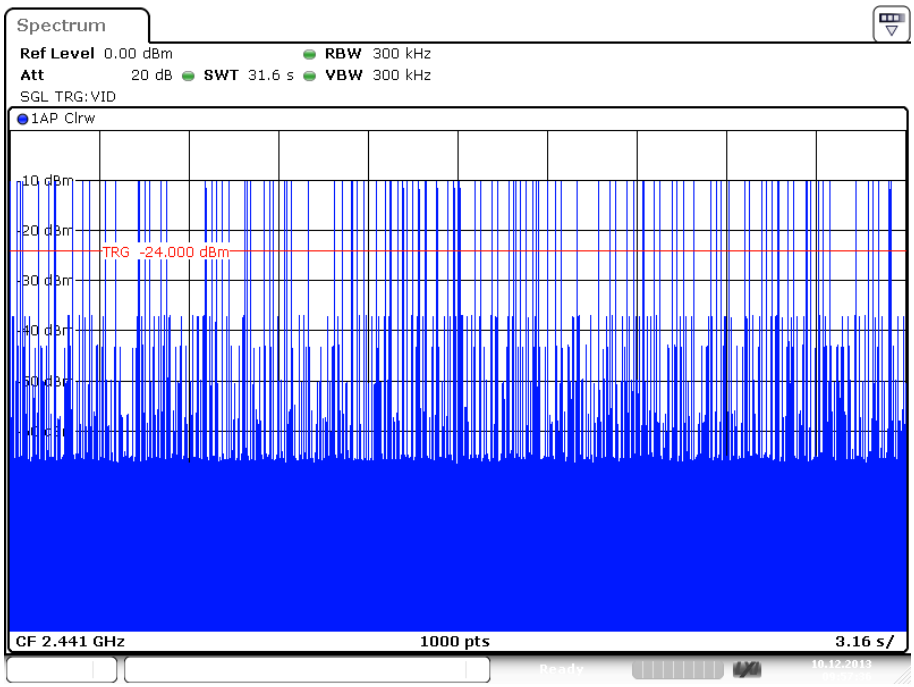
DH5 Packet Type, EDR 2



Marker

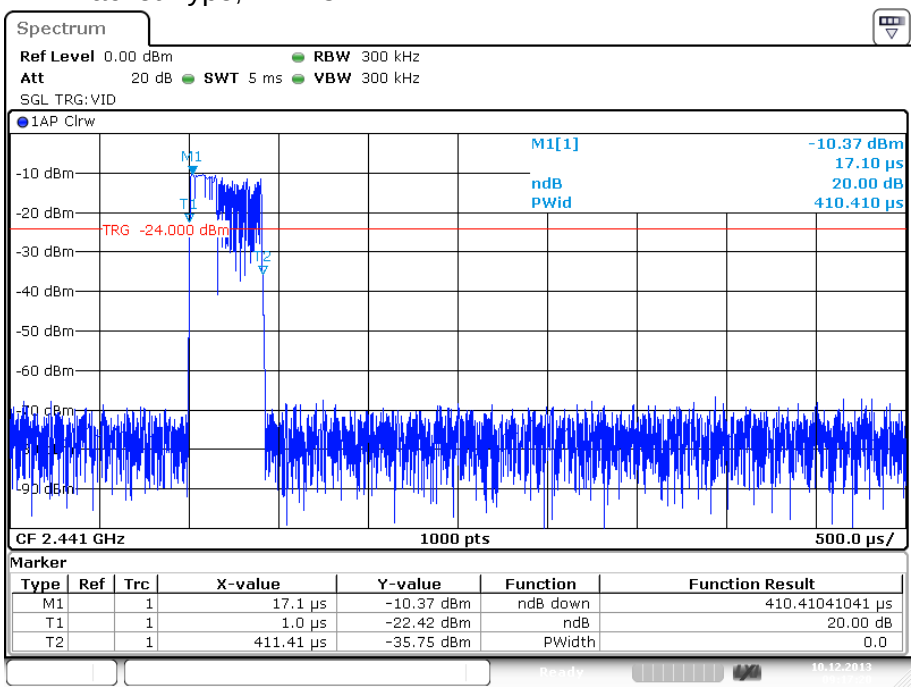
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	17.1 µs	-10.31 dBm	ndB down	2.907907908 ms
T1		1	-4.0 µs	-35.63 dBm	ndB	20.00 dB
T2		1	2.9039 ms	-20.08 dBm	PWidth	0.0

Date: 10.DEC.2013 09:17:00



Date: 10.DEC.2013 09:57:37

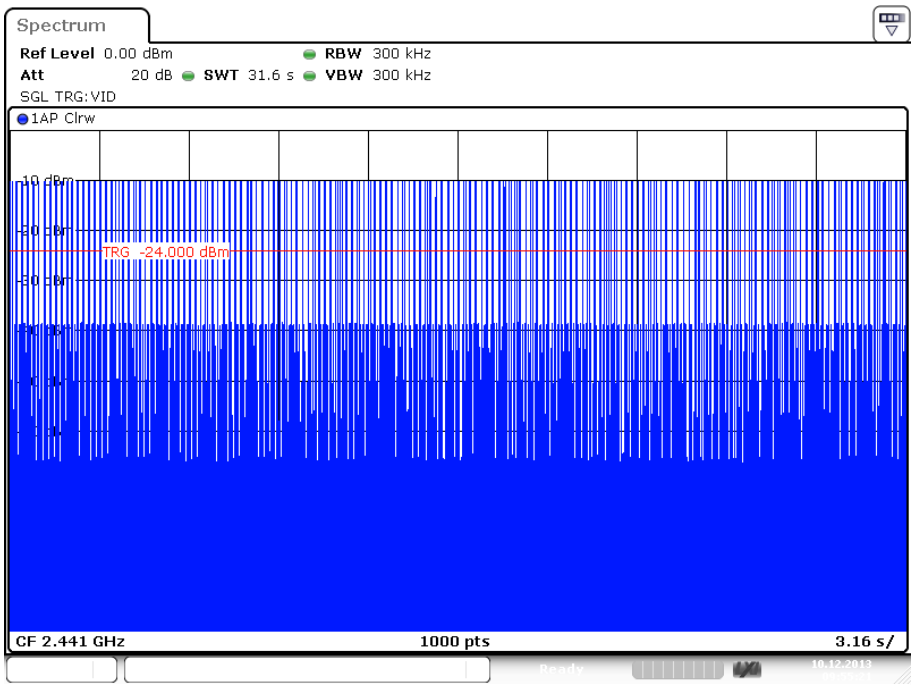
DH1 Packet Type, EDR 3



Marker

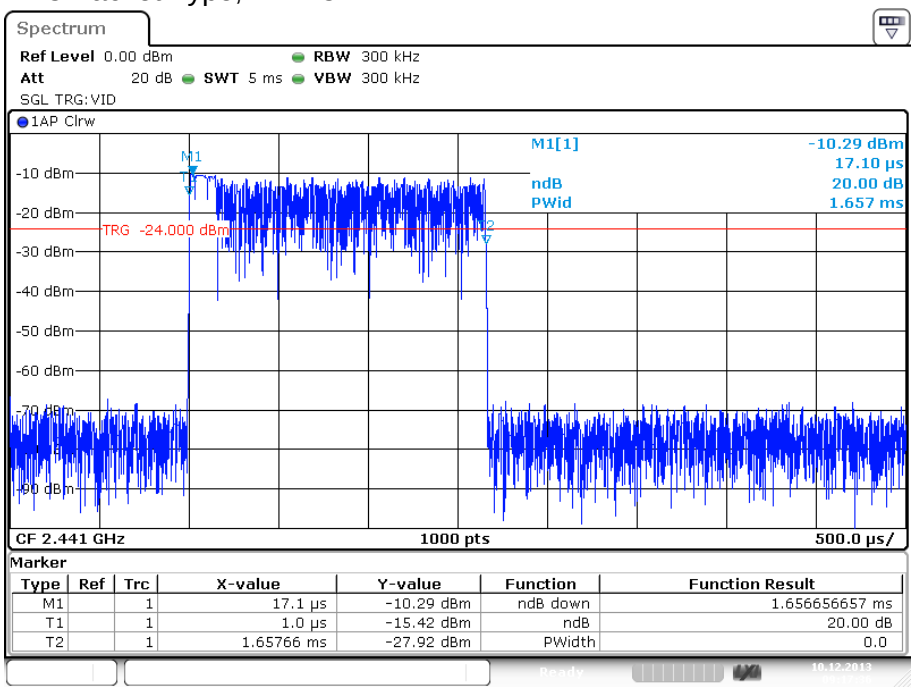
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	17.1 µs	-10.37 dBm	ndB down	410.41041041 µs
T1		1	1.0 µs	-22.42 dBm	ndB	20.00 dB
T2		1	411.41 µs	-35.75 dBm	PWidth	0.0

Date: 10.DEC.2013 09:17:21



Date: 10.DEC.2013 09:55:22

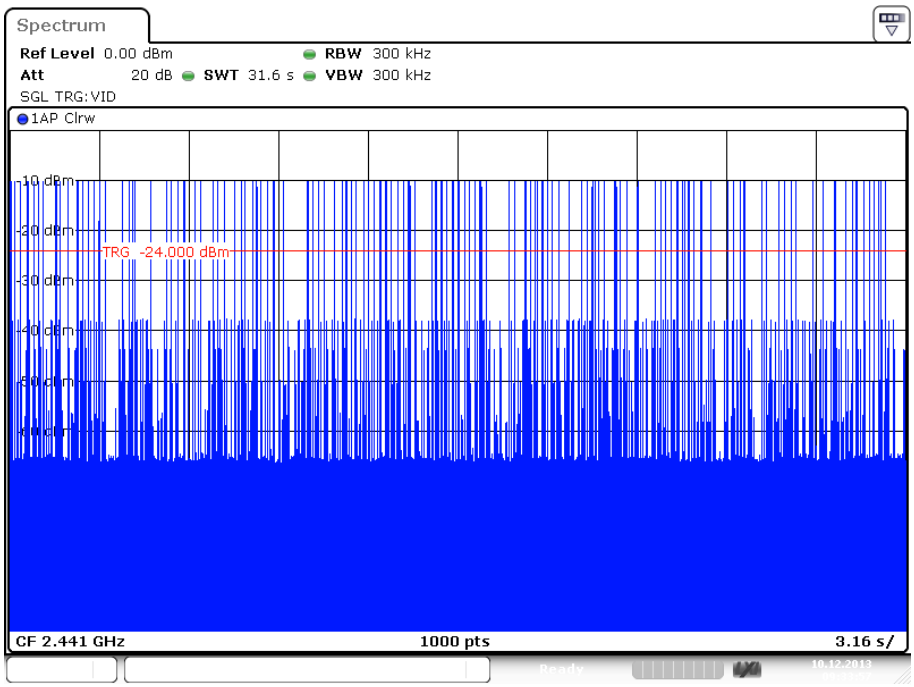
DH3 Packet Type, EDR 3



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	17.1 µs	-10.29 dBm	ndB down	1.656656657 ms
T1		1	1.0 µs	-15.42 dBm	ndB	20.00 dB
T2		1	1.65766 ms	-27.92 dBm	PWidth	0.0

Date: 10.DEC.2013 09:17:37



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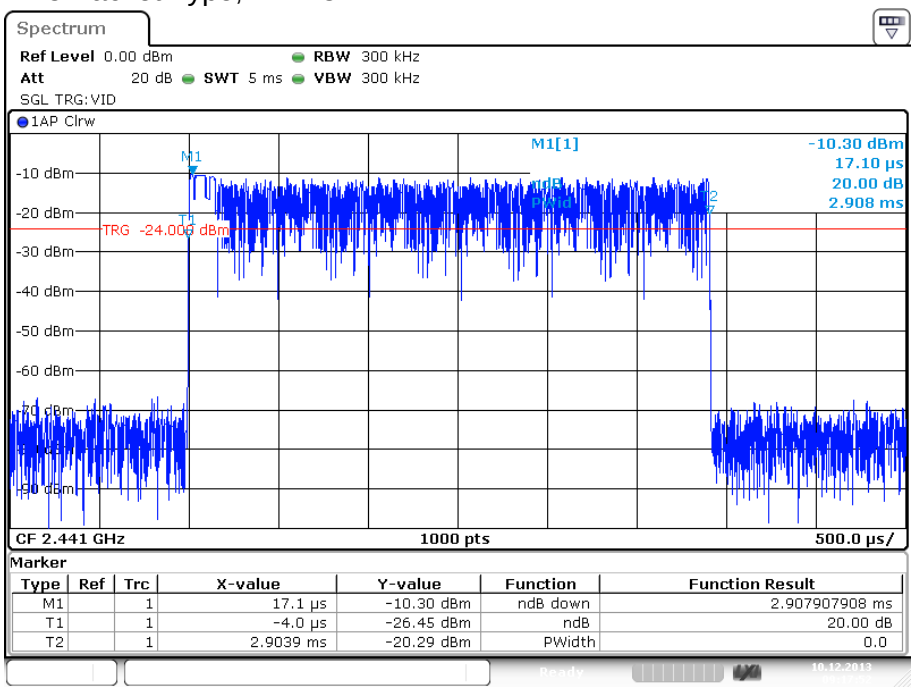
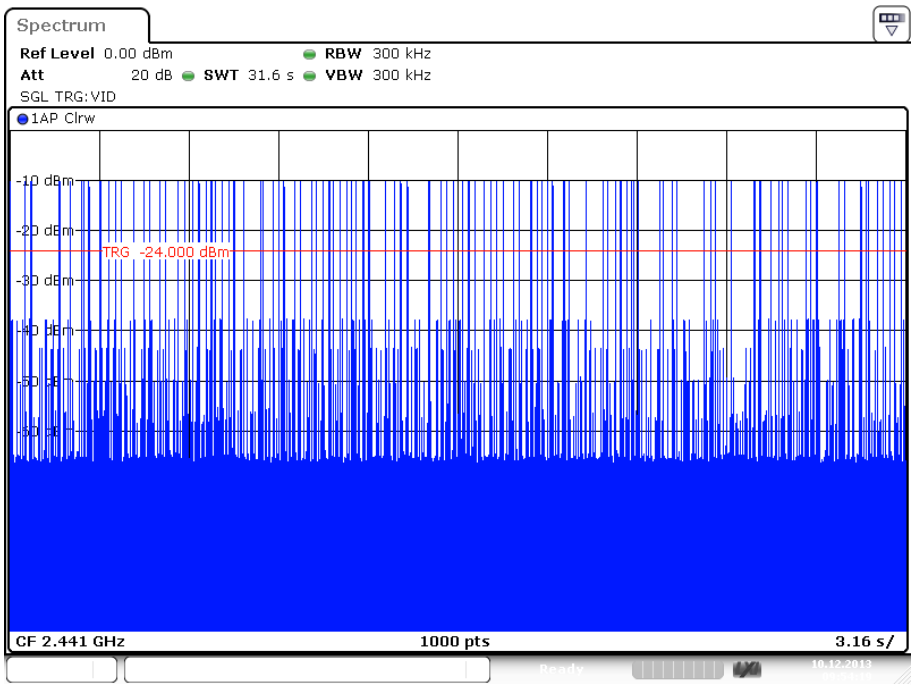
DH5 Packet Type, EDR 3



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	17.1 µs	-10.30 dBm	ndB down	2.907907908 ms
T1		1	-4.0 µs	-26.45 dBm	ndB	20.00 dB
T2		1	2.9039 ms	-20.29 dBm	PWidth	0.0

Date: 10.DEC.2013 09:17:52



Date: 10.DEC.2013 09:54:20

7 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	10 Dec 2013