Certification Application Report
FCC Part 15.225 & ISED RSS-210

Test Lab:		Applicant:	
Rhein Tech Laboratories, Inc. Phone: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 E-Mail: atcbinfo@rheintech.com		Honeywell International Inc. 9680 Old Bailes Road Fort Mill, SC 29707	
FCC ID/ IC	HD5-TAP1000-01/ 1693B-TAP100001	**Test Report Date**	June 15, 2018
Platform	N/A	**RTL Work Order #**	2018064
Model Model #/HVINs	A700x TAP1010-01, TAP1020-01, TAP1030-01	**RTL Quote #**	QRTL18-064A
American National Standard Institute	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
FCC Classification	DXX – Part 15 Low Power Communication Device Transmitter		
FCC Rule Part(s)	Part 15.225: Operation within the band 13.110-14.010 MHz (10-01-17)		
ISED Standards	RSS-210 Issue 9: License-Exempt Radio Apparatus: Category I Equipment RSS-Gen: Issue 5: General Requirements for Compliance of Radio Apparatus		
Frequency Range (MHz)	**Output Power (W)**	**Frequency Tolerance**	**Emission Designator**
13.56	N/A	N/A	2M20A1D

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, ANSI C63.10, and ISED RSS-210 and RSS-Gen.

Signature: _____ Date: June 15, 2018

Typed/Printed Name: Desmond A. Fraser Position: President

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANAB. Refer to certificate and scope of accreditation AT-1445.

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1 General Information

1.1 Scope

Applicable Standards:

- FCC Part 15.225: Operation within the band 13.110-14.010 MHz
- ISED RSS-210: Low Power License-Exempt Communications Devices
- ISED RSS-Gen: Issue 5: General Requirements for Compliance of Radio Apparatus

1.2 Description of EUT

Equipment Under Test	Body-worn transmitter
Model/HVIN	A700x
Power Supply	Internal rechargeable 3.7VDC Li-Ion Battery
Modulation Type	ASK
Frequency Range	13.56 MHz
Antenna Type	Internal

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.10-2013).

1.4 Related Submittal(s)/Grant(s)

This is an original certification application for Honeywell International Inc. Model A700x, FCC ID: HD5-TAP1000-01, IC: 1693B-TAP100001. The ISED application includes a family certification for three HVINs: TAP1010-01, TAP1020-01, and TAP1030-01. These 3 HVINs are electrically identical.

1.5 Modifications

No modifications were made to the equipment during testing in order to achieve compliance with these standards.

2 Test Information

2.1 Description of Test Modes

Table 2-1: Channels Tested

Frequency (MHz)
13.56

2.2 Exercising the EUT

The EUT was supplied with test firmware programmed with modulation types and rates. The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted.

2.3 Test Result Summary

Table 2-2: Test Result Summary – FCC Part 15; ISED RSS-210, RSS-Gen

Test	FCC Reference	ISED Reference	Result
AC Power Conducted Emissions	15.207	RSS-Gen 8.8	N/A
Radiated Emissions	15.209	RSS-Gen	Pass
Field Strength of Fundamental and Harmonics	15.225(a), (d)	RSS-210	Pass
99% Bandwidth	N/A	RSS-Gen 6.7	N/A
Frequency Stability	2.1055, 15.225(e)	RSS-210 B.6	Pass

2.4 Test System Details

The test samples were received on June 5, 2018. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following table. The BT transceiver models are electrically identical.

Table 2-3: Equipment Under Test

Part	Manufacturer	Model #/ HVIN	Serial Number	FCC ID	Cable Description	RTL Bar Code
BT Transceiver (conducted)	Honeywell International Inc.	TAP1020-01	7518200122	HD5-TAP1000-01	N/A	22944
BT Transceiver	Honeywell International Inc.	TAP1020-01	7518200106	HD5-TAP1000-01	N/A	22942
BT Transceiver	Honeywell International Inc.	TAP1010-01	7418200070	HD5-TAP1000-01	N/A	22940
3.7V Lithium Ion Battery	Honeywell International Inc.	BT-901	351747034705	N/A	N/A	22950
3.7V Lithium Ion Battery	Honeywell International Inc.	TBA901-01	351747030105	N/A	N/A	22955
3.7V Lithium Ion Battery	Honeywell International Inc.	BT-902	351741029405	N/A	N/A	22952

2.5 Configuration of Tested System

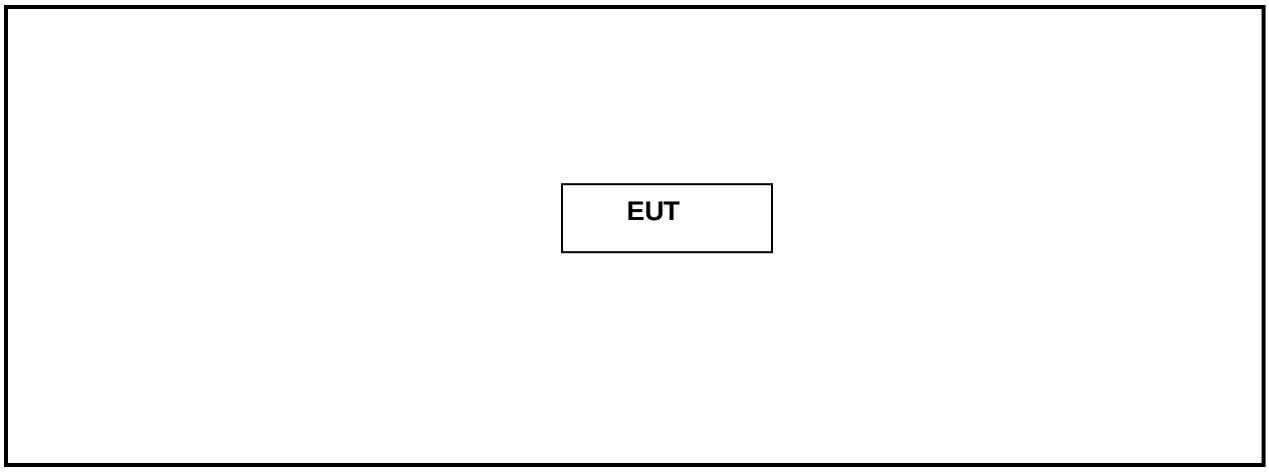


Figure 2-1: Configuration of System Under Test

3 Radiated Emissions – FCC 15.209, 15.225(a) & (d); ISED RSS-210 B.6, RSS-Gen

3.1 Limits of Radiated Emissions Measurement

Table 3-1: Radiated Emission Limits

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector however, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 99% under any circumstances of modulation.

15.225(a) states "The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters."

20log(15,848)=84 dBμV/m at 30 m

3.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10th harmonic of the highest fundamental transmitter frequency (135.6 MHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

3.3 Radiated Emissions Test Data

Table 3-2: Radiated Emissions Test Data (Fundamental)

Technology Type	Emission Frequency (MHz)	Quasi-Peak Reading (dBµV/m)	Site Correction Factor (dB/m)	Quasi-Peak Corrected (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Quasi-Peak Margin (dB)
A	13.56	15.1	21.5	36.6	84.0	-47.4
B	13.56	14.4	21.5	35.9	84.0	-48.1
F	13.56	13.8	21.5	35.3	84.0	-48.7

Note: Levels were extrapolated to 30 m from 10 m (-19.1 dB)

Part 15.225(a) and (d) state:

> The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
>
> The field strength of any emissions appearing outside of the 13.110– 14.010 MHz band shall not exceed the general radiated emission limits in §15.209

The 30 meter readings were interpolated from 10 meters by subtracting 40 log (30m / 10m) from the field strength.

The corrected measured fundamental levels in Table 3-2 are less than Part 15.225(a) and (d).

3.4 Radiated Emissions Harmonics/Spurious Test Data

Table 3-3: Radiated Emissions Harmonics/Spurious: Type A

Emission Frequency (MHz)	Analyzer Reading (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)
27.12	-37.6	23.6	-14.0	29.5	-43.5
40.68	-37.1	14.1	-23.0	40.0	-63.0
54.24	-31.4	8.0	-23.4	40.0	-63.4
67.80	-37.4	7.0	-30.4	40.0	-70.4
81.36	-36.1	8.6	-27.5	40.0	-67.5
94.92	-21.0	11.5	-9.5	43.5	-53.0
108.48	-35.2	13.4	-21.8	43.5	-65.3
122.04	-34.8	13.5	-21.3	43.5	-64.8
135.60	-38.6	12.7	-25.9	43.5	-69.4

Table 3-4: Radiated Emissions Harmonics/Spurious: Type B

Emission Frequency (MHz)	Analyzer Reading (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)
27.12	-36.6	23.6	-13.0	29.5	-42.5
40.68	-36.7	14.1	-22.6	40.0	-62.6
54.24	-30.9	8.0	-22.9	40.0	-62.9
67.80	-37.2	7.0	-30.2	40.0	-70.2
81.36	-35.4	8.6	-26.8	40.0	-66.8
94.92	-20.1	11.5	-8.6	43.5	-52.1
108.48	-34.6	13.4	-21.2	43.5	-64.7
122.04	-34.4	13.5	-20.9	43.5	-64.4
135.60	-38.1	12.7	-25.4	43.5	-68.9

Table 3-5: Radiated Emissions Harmonics/Spurious: Type F

Emission Frequency (MHz)	Analyzer Reading (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)
27.12	-37.5	23.6	-13.9	29.5	-43.4
40.68	-36.3	14.1	-22.2	40.0	-62.2
54.24	-30.5	8.0	-22.5	40.0	-62.5
67.80	-37.0	7.0	-30.0	40.0	-70.0
81.36	-35.3	8.6	-26.7	40.0	-66.7
94.92	-20.9	11.5	-9.4	43.5	-52.9
108.48	-34.6	13.4	-21.2	43.5	-64.7
122.04	-34.3	13.5	-20.8	43.5	-64.3
135.60	-38.6	12.7	-25.9	43.5	-69.4

3.5 Radiated Emissions Digital Test Data

Table 3-6: Digital Radiated Emissions Test Data

Temperature: 72.4°F Humidity: 55%										
Emission Frequency (MHz)	**Test Detector**	**Antenna Polarity (H/V)**	**Turntable Azimuth (°)**	**Antenna Height (m)**	**Analyzer Reading (dBµV)**	**Site Correction Factor (dB/m)**	**Emission Level (dBµV/m)**	**Limit (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
51.04	QP	H	90	1.0	-47.3	9.0	-38.3	40.0	-78.3	PASS
150.50	QP	H	90	1.0	-56.0	11.5	-44.5	43.5	-88.0	PASS
192.39	QP	H	90	1.0	-59.5	10.3	-49.2	43.5	-92.7	PASS
207.42	QP	H	90	1.0	-42.2	10.5	-31.7	43.5	-75.2	PASS
556.91	QP	H	90	1.0	-54.8	21.0	-33.8	46.0	-79.8	PASS
767.94	QP	H	90	1.0	-55.3	22.5	-32.8	46.0	-78.8	PASS

Note: Levels were extrapolated to 30 m from 1 m (-59.1 dB)

Part 15.225(a) and (d) state:

> The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.
>
> The field strength of any emissions appearing outside of the 13.110– 14.010 MHz band shall not exceed the general radiated emission limits in §15.209

The 30 meter readings were interpolated from 10 meters by subtracting 40 log (30m / 1m) from the field strength.

The corrected measured fundamental levels in Table 3-2 are less than Part 15.225(a) and (d).

Result: **PASS**

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty = ±4 dB.

Table 3-7: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900791	Chase	CBL6111B	Bilog Antenna (30 MHz–2000 MHz)	N/A	10/4/20
900878	Rhein Tech Laboratories, Inc.	AM3-1197-0005	3 meter Antenna mast, polarizing	OATS1	Not Required
900905	Rhein Tech Laboratories, Inc.	PR-1040	OATS 1 Preamplifier 40 dB (30 MHz–2 GHz)	1006	8/18/18
901242	Rhein Tech Laboratories, Inc.	WRT-000-0003	Wood rotating table	N/A	Not Required
901581	Rohde and Schwarz	FSU 1166.1660.50	Spectrum Analyzer (20 Hz – 50 GHz)	200106	4/26/20
901663	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz-30 MHz)	827525/019	5/1/19

Test Personnel:

Khue N. Do		June 13, 2018
Test Engineer	Signature	Date of Test

4 AC Conducted Emissions - FCC 15.207; ISED RSS-Gen 8.8: AC Power-line Conducted Emissions Limits

Device is battery operated. AC line conducted emissions measurements are not required.

5 Occupied Bandwidth – ISED RSS-Gen 6.7

5.1 99% Bandwidth Test Procedure

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

• The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

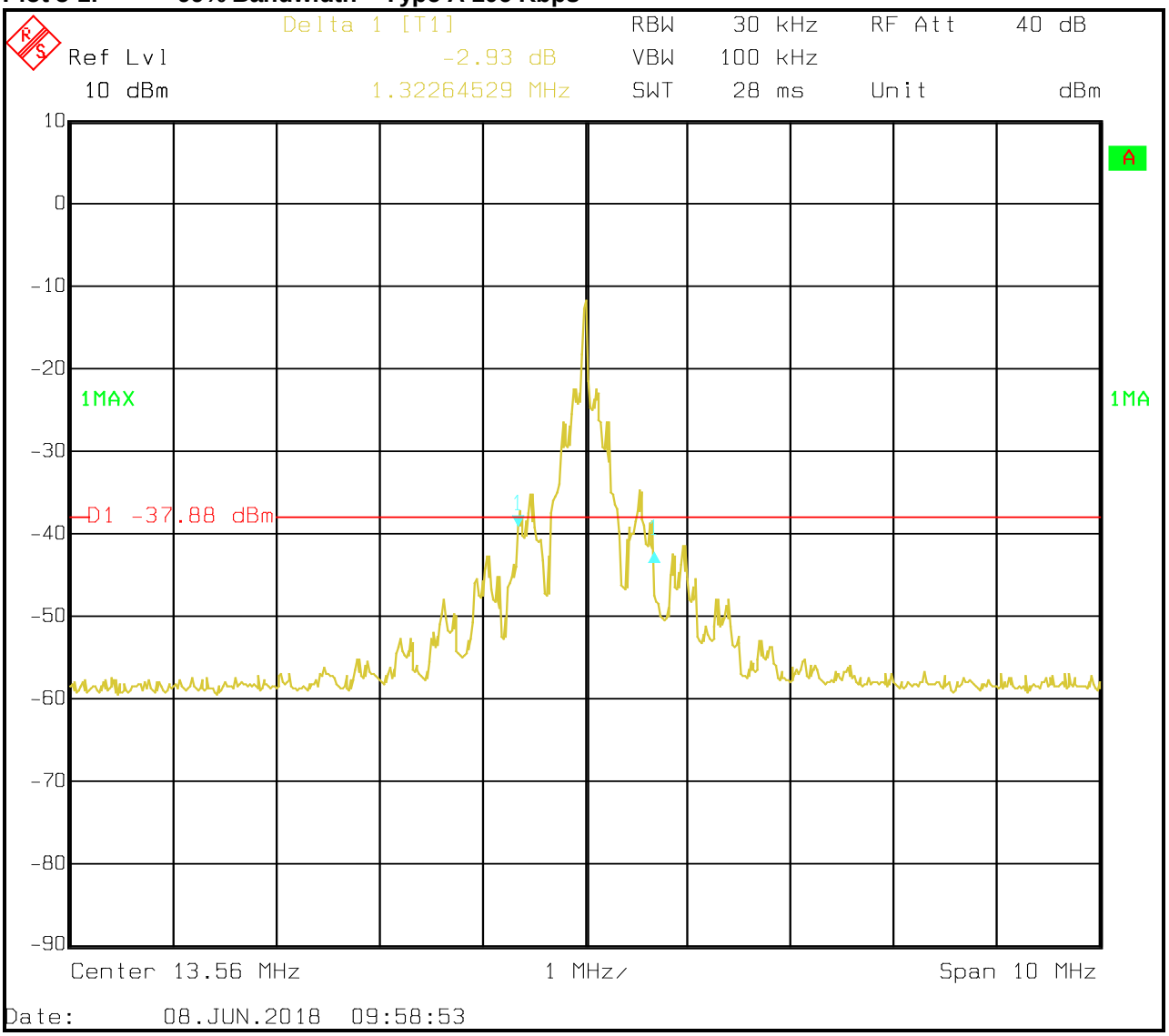
5.2 99% Bandwidth Test Data

Table 5-1: 99% Bandwidth Test Data

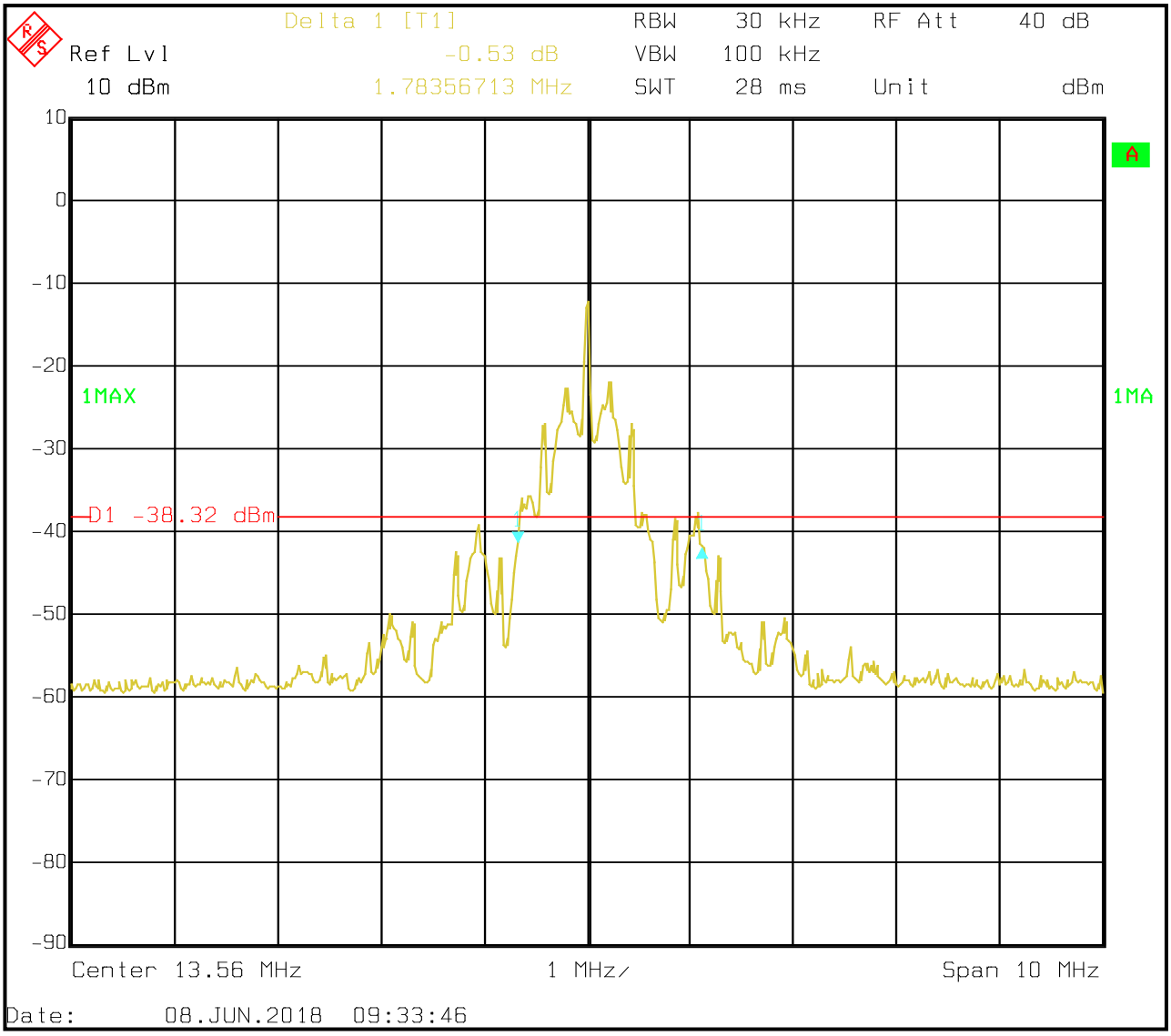
Mode	99% Bandwidth (MHz)
Type A – 10	1.32
Type A – 21	1.78
Type A – 42	2.20
Type B – 10	0.200
Type B – 21	0.281
Type B – 42	0.481
Type F – 21	0.521
Type F – 42	0.921

5.3 99% Bandwidth Plots

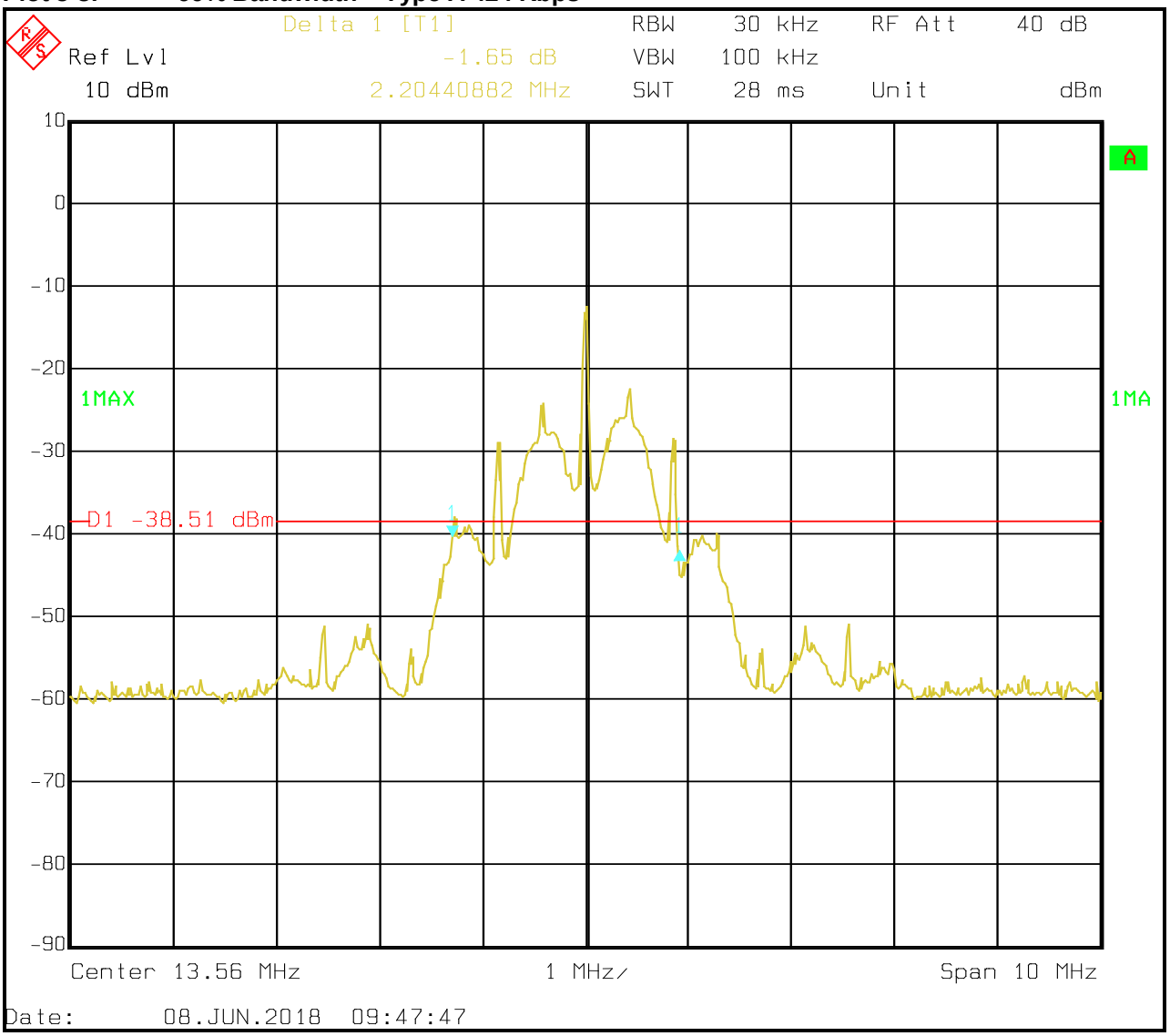
Plot 5-1: 99% Bandwidth – Type A 106 Kbps



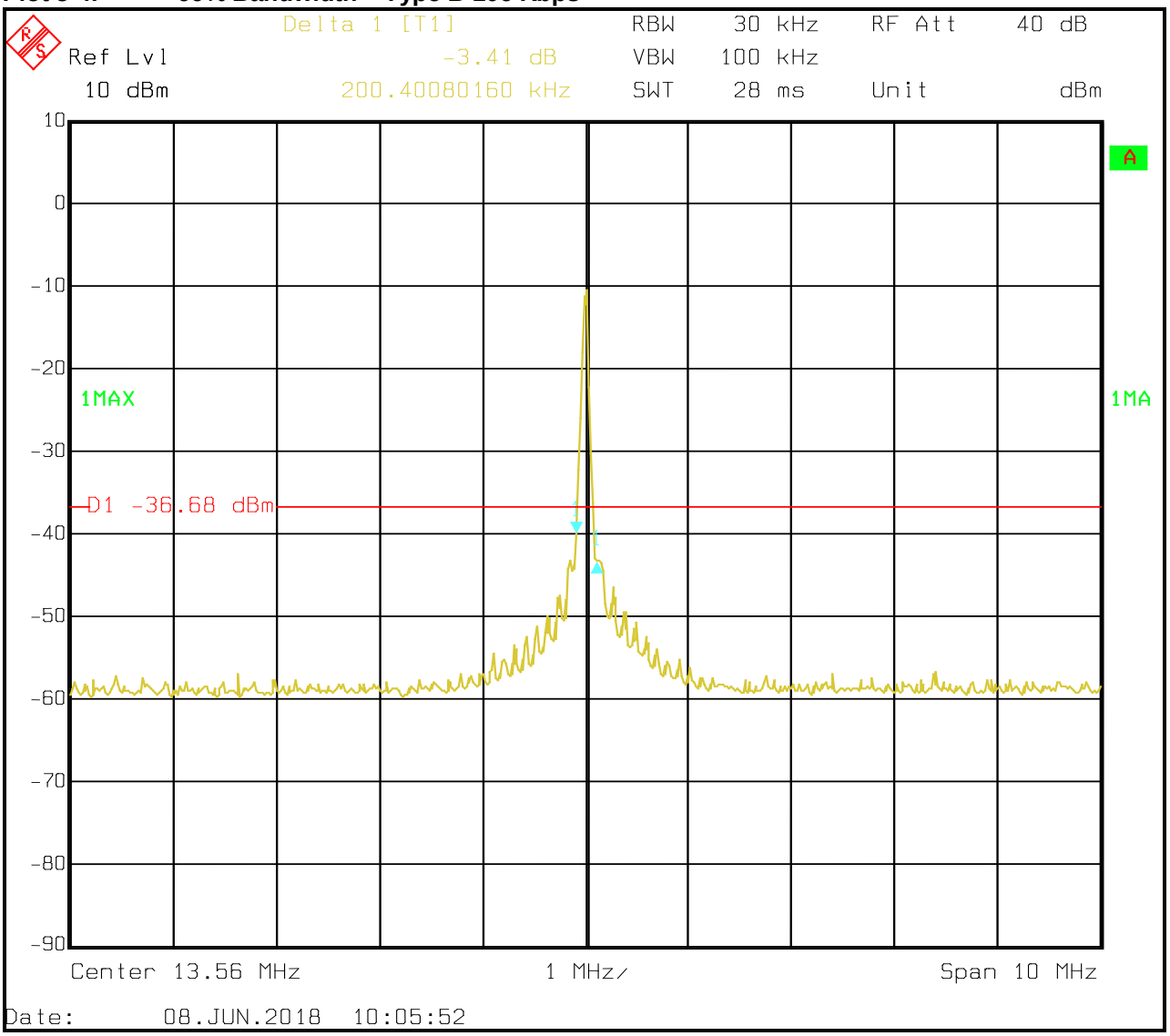
Plot 5-2: 99% Bandwidth – Type A 212 Kbps



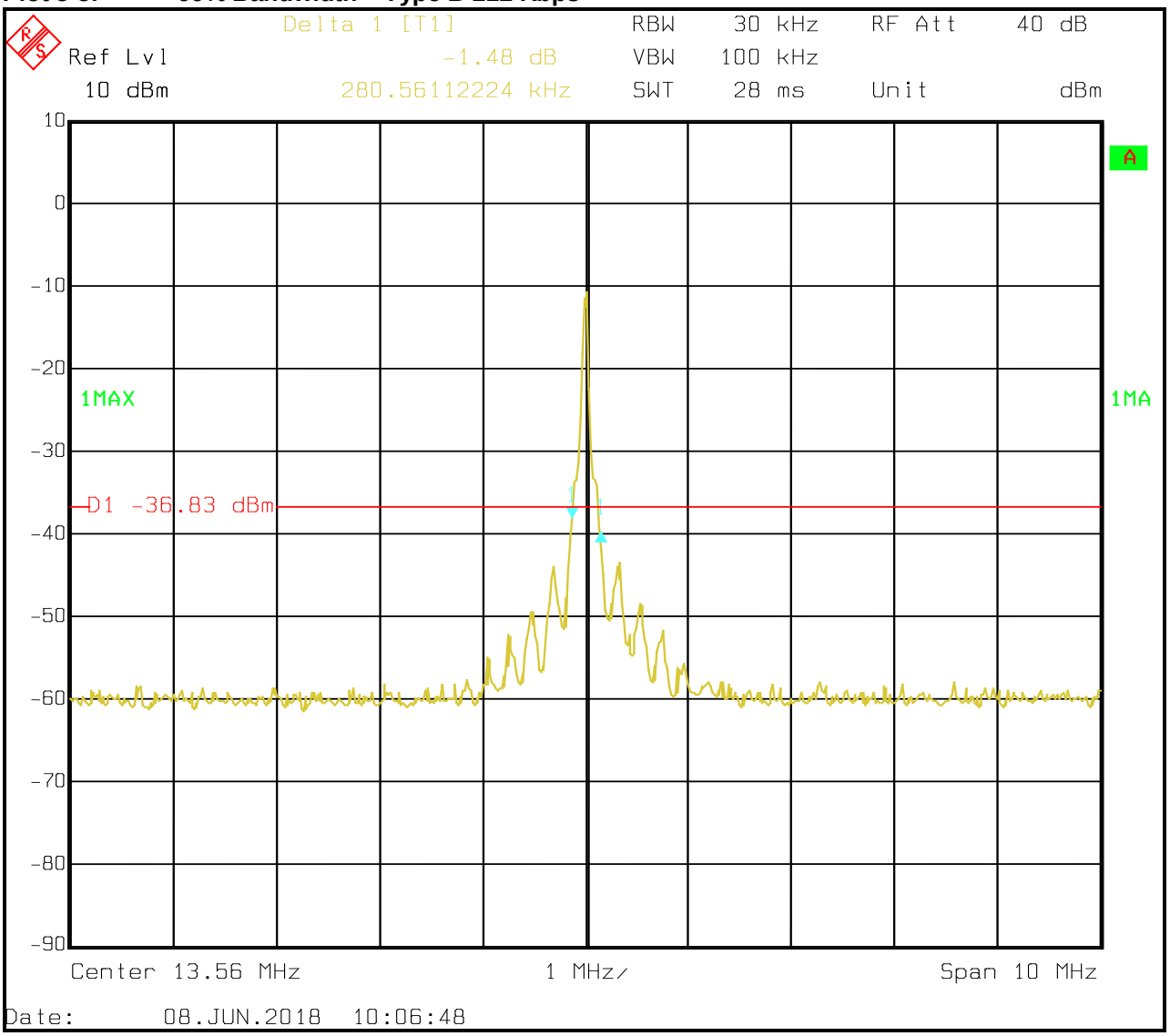
Plot 5-3: 99% Bandwidth – Type A 424 Kbps



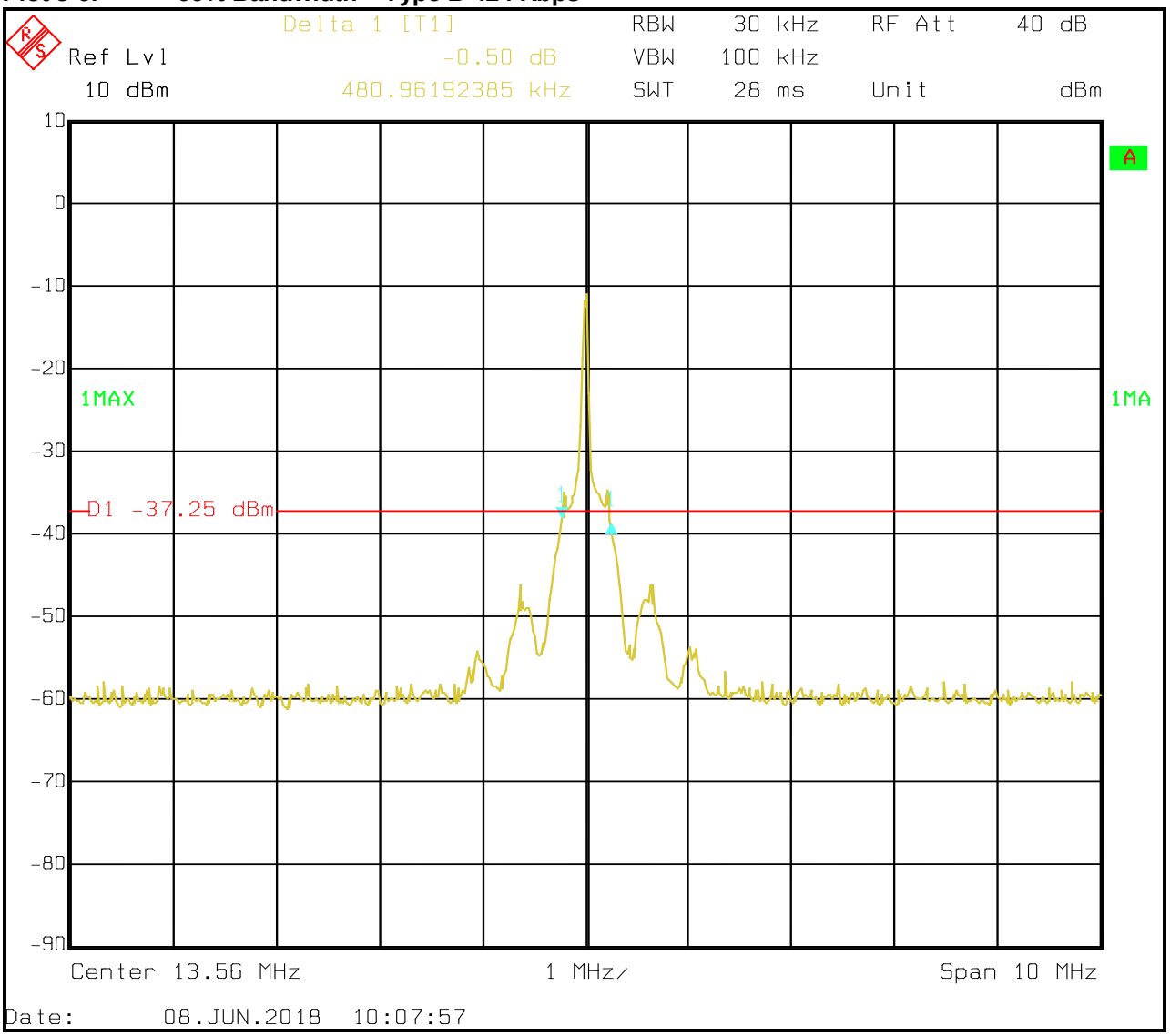
Plot 5-4: 99% Bandwidth – Type B 106 Kbps



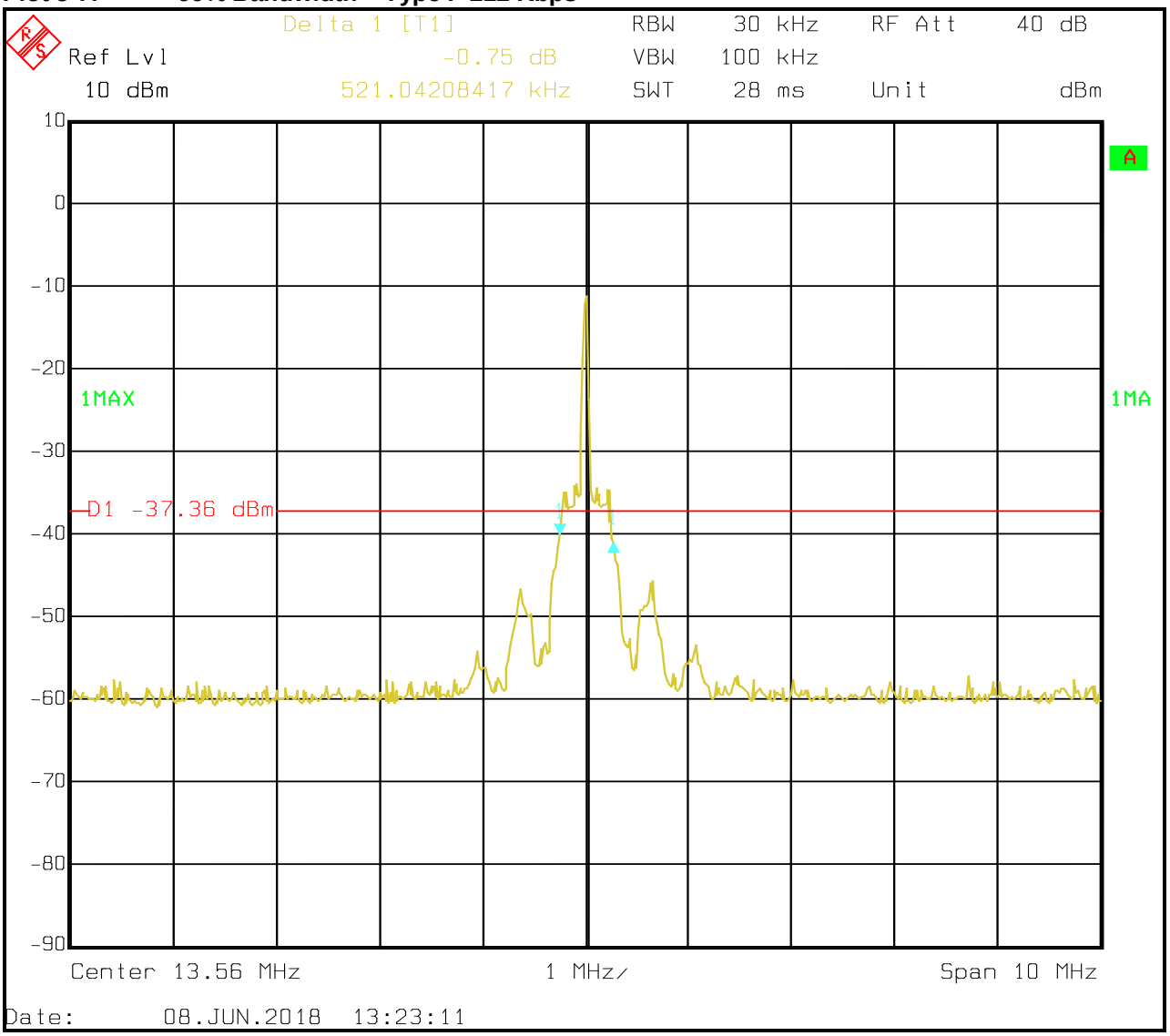
Plot 5-5: 99% Bandwidth – Type B 212 Kbps



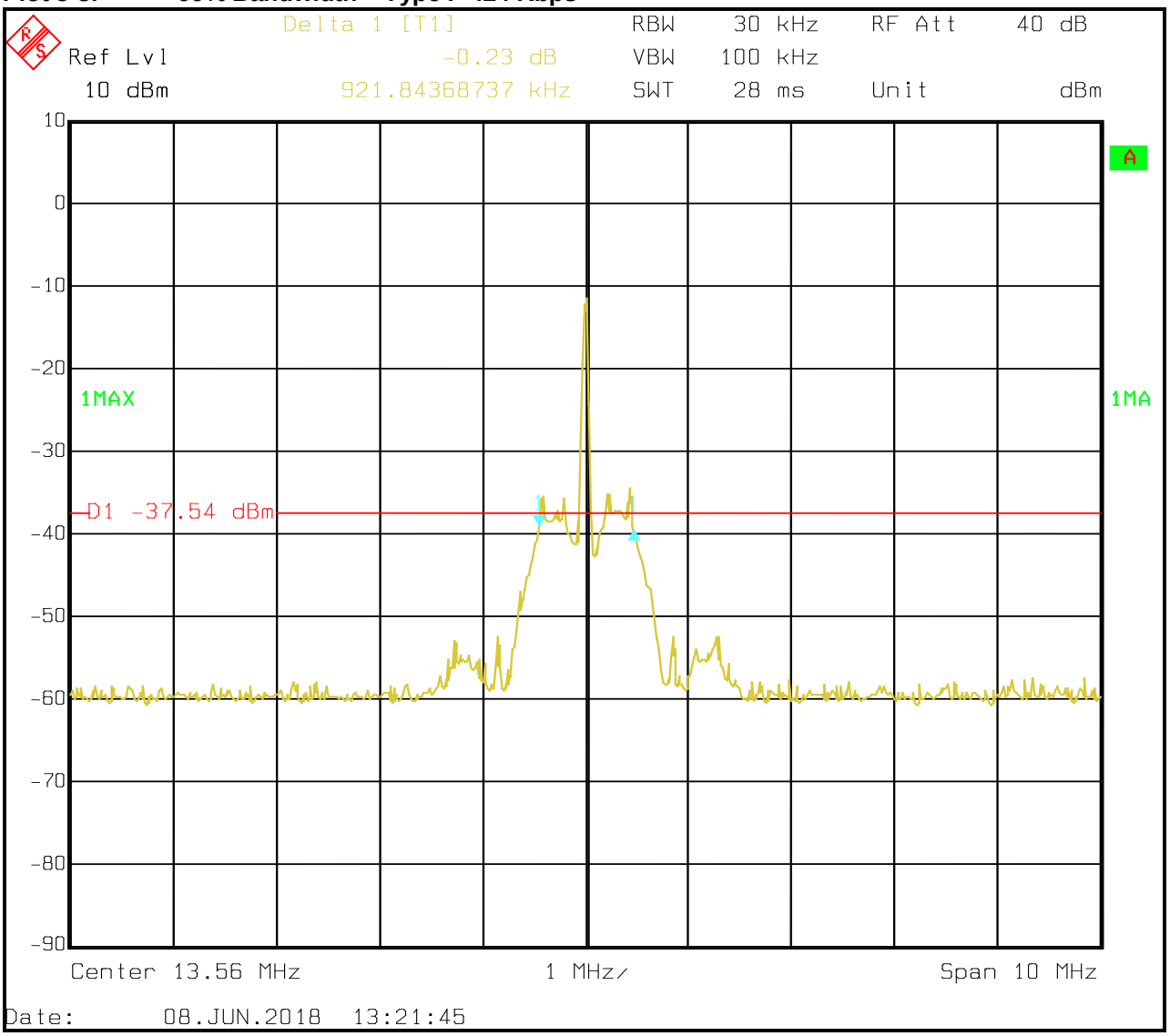
Plot 5-6: 99% Bandwidth – Type B 424 Kbps



Plot 5-7: 99% Bandwidth – Type F 212 Kbps



Plot 5-8: 99% Bandwidth – Type F 424 Kbps



Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty = ±2 dB.

Table 5-2: 99% Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901672	Rhode & Schwarz	FSEM 30: 1079.8500	Spectrum Analyzer (20 Hz – 26.5 GHz)	833063/13	4/17/19

Test Personnel:

Dan Baltzell		June 8, 2018
Test Engineer	Signature	Date of Test

6 Frequency Stability – FCC 2.1055, 15.225(e): Frequency Stability; ISED RSS-210 B.6 Transmitter Frequency Stability

6.1 Test Procedure

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

15.255(e): The frequency tolerance of the carrier signal shall be maintained within ± .01% of the operating frequency over a temperature variation of -20°C to +50°C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20°C. For battery-operated equipment, the equipment tests shall be performed using a new battery.

ISED RSS-210 B.6: Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

The EUT was evaluated over the temperature range -20°C to +50°C.

The temperature was initially set to -20°C and a 1-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 °rees centigrade through the range. A ½-hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied +/-15% nominal input voltage.

6.2 Test Data

Table 6-1: Temperature Frequency Stability

Temperature (°C)	Measured Frequency (MHz)	Percent of Operating Frequency
-20	13.560053	0.0004%
-10	13.560053	0.0004%
0	13.560053	0.0004%
10	13.560027	0.0002%
20 (reference)	13.560000	0.0000%
30	13.560000	0.0000%
40	13.560000	0.0000%
50	13.560013	0.0001%

Table 6-2: External Voltage Frequency Stability at 20°C

Voltage (TVDD)	Measured Frequency (MHz)	Percent of Operating Frequency
3.145	13.560000	0.0000%
3.7 (reference)	13.560000	0.0000%
4.255	13.560000	0.0000%

Result: **PASS**

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty = ±2 dB.

Table 6-3: Frequency Stability Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	3/26/19
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20
901627	Meterman	34XR-A	Multimeter	040402802	4/19/19
901635	Hewlett Packard	6024A	DC Power Supply	1912A00331	N/A
901672	Rhode & Schwarz	FSEM 30: 1079.8500	Spectrum Analyzer (20 Hz – 26.5 GHz)	833063/13	4/17/19

Test Personnel:

Daniel Baltzell		June 11, 2018
Test Engineer	Signature	Date of Tests

7 Conclusion

The data in this measurement report shows that the EUT as tested, Honeywell International Inc. Model A700x, FCC ID: HD5-TAP1000-01, IC: 1693B-TAP100001, complies with all the applicable requirements of FCC Part 15 and ISED RSS-210 and RSS-Gen.