ENGINEERING TEST REPORT

Yapalong5000
Model: Yapalong5000
FCC ID: UJW-5000

Applicant:

Nautic Devices Inc.
7895 Tranmere Drive, Unit 13
Mississauga, Ontario
Canada L5S 1V9

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247
Digital Modulation Systems (DTS) Operating in 902-928 MHz Band

UltraTech's File No.: 18NAT010_FCC15C247

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: December 14, 2018	
Report Prepared by: Dan Huynh Issued Date: December 14, 2018	Tested by: Hung Trinh Test Dates: July 23 - August 23, 2018

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APEC TEL CA0001 | 1309 | CA 0001/2049 | AT-1945 | SL2-IN-E-1119R | Korea KCC-RRA CA2049

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.247
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15 – Radio Frequency Devices
Purpose of Test:	Equipment Certification
Test Procedures:	▪ ANSI C63.4 ▪ ANSI C63.10 ▪ FCC KDB Publication No. 558074 D01 DTS Meas Guidance v04
Environmental Classification:	[x] Commercial, industrial or business environment [x] Residential environment

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2018	Code of Federal Regulations (CFR), Title 47 – Telecommunication
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
FCC, KDB Publication No. 558074 D01 DTS Meas Guidance v04	2017	Guidance for Performing Compliance Measurements for Digital Transmission Systems (DTS) Operating Under Section 15.247

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

Applicant	
Name:	Nautic Devices Inc.
Address:	7895 Tranmere Drive, Unit 13 Mississauga, Ontario Canada L5S 1V9
Contact Person:	Mr. Shawn Zhou Phone #: 905-405-0300 Fax #: N/A Email Address: szhou@nauticdevices.com

Manufacturer	
Name:	Nautic Devices Inc.
Address:	7895 Tranmere Drive, Unit 13 Mississauga, Ontario Canada L5S 1V9
Contact Person:	Mr. Shawn Zhou Phone #: 905-405-0300 Fax #: N/A Email Address: szhou@nauticdevices.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Nautic Devices Inc.
Product Name:	Yapalong5000
Model:	Yapalong5000
Serial Number:	Test Sample
Type of Equipment:	Digital Transmission System (DTS)
Input Power Supply Type:	3.7 V Lithium-Ion Battery / 5V 2A via AC/DC adapter
Primary User Functions of EUT:	Radio communication

2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	Portable
Intended Operating Environment:	▪ Commercial, industrial or business environment ▪ Residential environment
Power Supply Requirement:	3.7 V Lithium-Ion Battery / 5V 2A via AC/DC adapter
RF Output Power Rating:	25.75 dBm (375.84 mW) Average Power
Operating Frequency Range:	903.401 to 926.651 MHz
RF Output Impedance:	50 Ω
Duty Cycle:	8.3 % for normal mode of operation 85% for testing purpose
Modulation Type:	FSK
Antenna Connector Types:	Integral

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

Manufacturer:	LPC Electronics, Inc. California, USA
Type:	Internal PCB Antenna
Model:	Y5000 Rev.3
Frequency Range:	902 - 928 MHZ
Gain (dBi):	1 dBi

2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Dual Audio Jack – 3.5 mm	1	Audio Jack	1.0 meter, shielded
2	Dual Audio Jack – 2.5 mm	1	Audio Jack	1.0 meter, shielded
3	Power Jack	1	DC Power Jack	1.0 meter, non-shielded

2.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

1) Nautic Device Inc. headset
2) KYT AC/DC adapter, Model KYT050200UU-01

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21 to 23 °C
Humidity:	45 to 58%
Pressure:	102 kPa
Power Input Source:	3.7 V Lithium-Ion Battery / 5V 2A via AC/DC adapter

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements.
Special Test Software:	Test software provided by the Applicant to operate the EUT at each channel frequency continuously and in the range of typical modes of operation.
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	903.401 to 926.651 MHz
Frequency(ies) Tested:	903.401 MHz, 915.401 MHz and 926.651MHz
RF Power Output: (measured maximum output power at antenna terminals)	25.75 dBm (375.84 mW)
Normal Test Modulation:	FSK
Modulating Signal Source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with ANAB File No.: AT-1945.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	Yes
15.207(a)	AC Power Line Conducted Emissions	Yes
15.247(a)(2)	6 dB Bandwidth	Yes
15.247(b)(3)	Peak Conducted Output Power	Yes
15.247(d)	Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	N/A
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated and Band-Edge Emissions	Yes
15.247(e)	Power Spectral Density	Yes
15.247(i), 1.1307, 1.1310, 2.1093	RF Exposure	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

5.1. POWER LINE CONDUCTED EMISSIONS [§15.207(a)]

5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

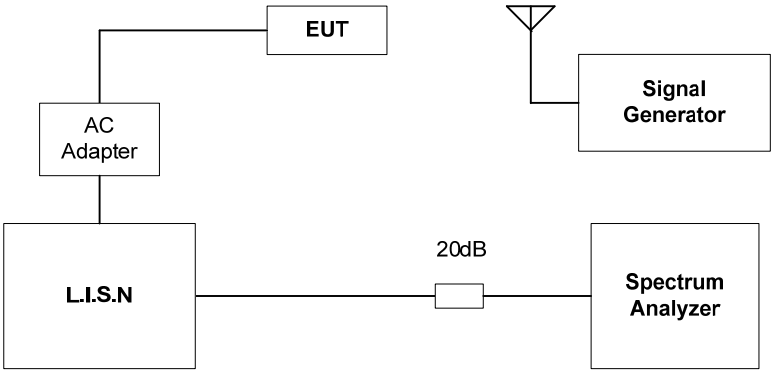
Frequency of emission (MHz)	Conducted Limits (dBμV)	
	Quasi-peak	Average
0.15–0.5 .....……..	66 to 56*	56 to 46*
0.5–5 .....……..	56	46
5-30 ……..	60 ...……..	50

*Decreases linearly with the logarithm of the frequency

5.1.2. Method of Measurements

ANSI C63.4

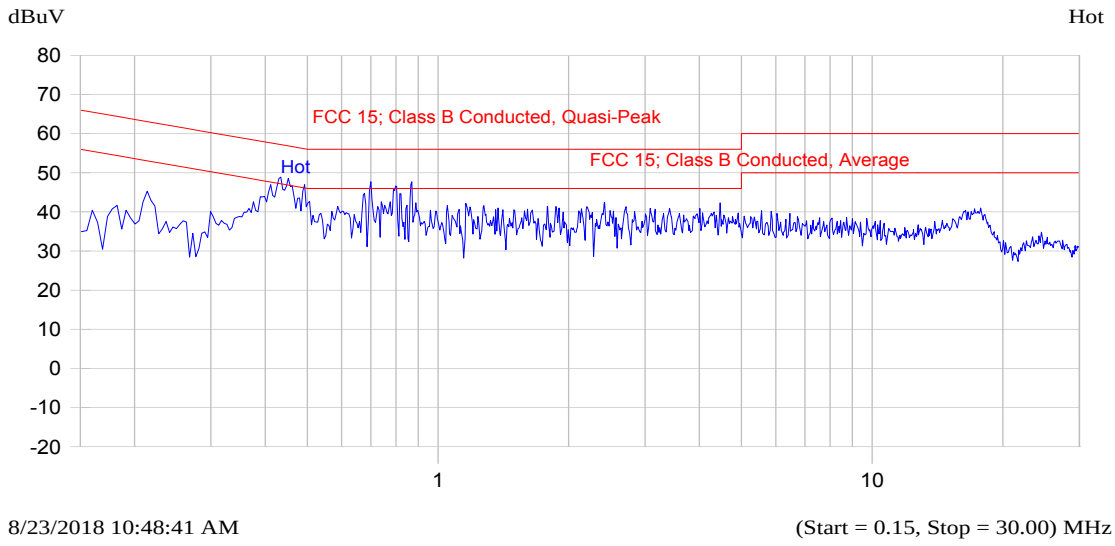
5.1.3. Test Arrangement



5.1.4. Test Data

Plot 5.1.4.1. Power Line Conducted Emissions (Tx Mode)
Line Voltage: 120 VAC; Line Tested: Hot

Current Graph

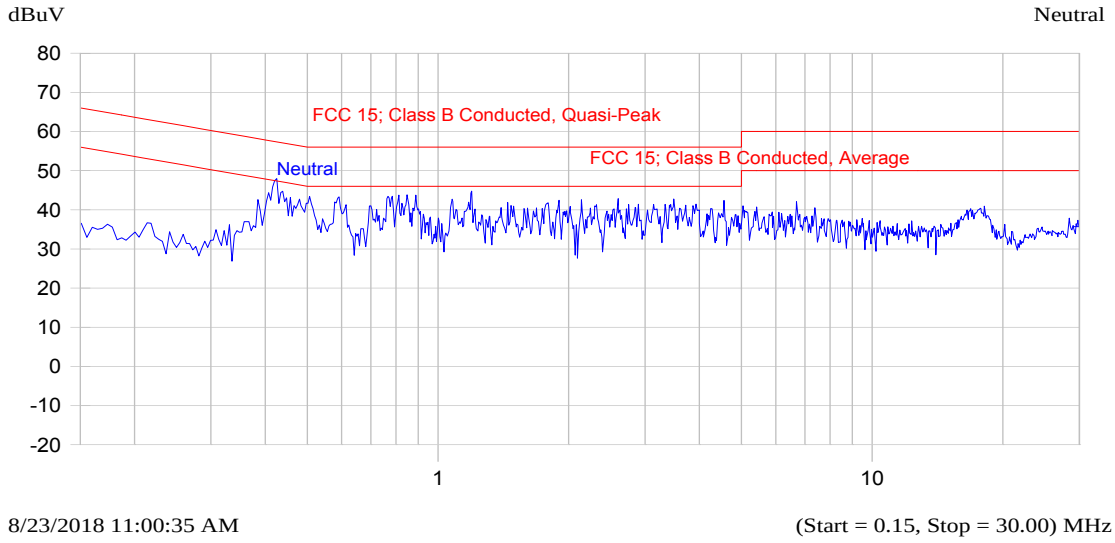


Current List

Frequency MHz	Peak dBuV	QP dBuV	QP-QP Limit dB	Avg dBuV	Avg-Avg Limit dB	Trace Name
0.210	44.8	40.0	-23.2	31.6	-21.6	Hot
0.429	54.1	48.7	-8.6	38.6	-8.7	Hot
0.484	47.3	41.0	-15.3	30.8	-15.5	Hot
0.694	46.6	40.2	-15.8	28.4	-17.6	Hot
0.801	48.2	41.5	-14.5	30.8	-15.2	Hot
0.866	46.8	40.8	-15.2	30.4	-15.6	Hot
4.468	40.3	35.3	-20.7	24.3	-21.7	Hot
17.778	41.0	35.8	-24.2	26.1	-23.9	Hot

Plot 5.1.4.2. Power Line Conducted Emissions (Tx Mode)
Line Voltage: 120 VAC Line Tested: Neutral

Current Graph

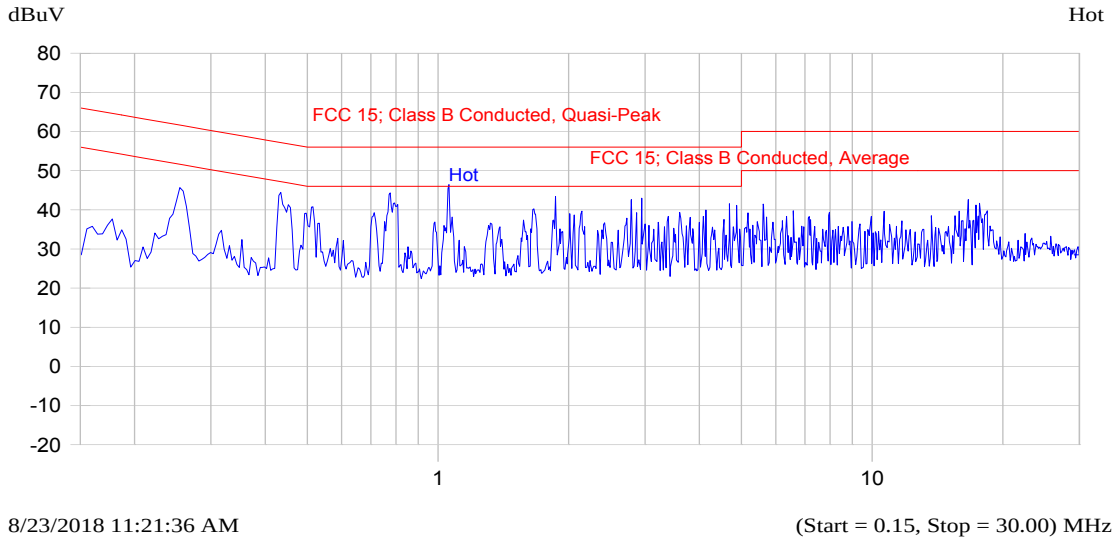


Current List

Frequency MHz	Peak dBuV	QP dBuV	QP-QP Limit dB	Avg dBuV	Avg-Avg Limit dB	Trace Name
0.430	52.9	47.3	-9.9	35.9	-11.4	Neutral
0.601	43.0	37.3	-18.7	26.2	-19.8	Neutral
1.188	43.4	38.0	-18.0	27.5	-18.5	Neutral
4.558	42.1	35.7	-20.3	24.5	-21.5	Neutral
18.124	39.8	35.0	-25.0	26.1	-23.9	Neutral

Plot 5.1.4.3. Power Line Conducted Emissions (Rx Mode)
Line Voltage: 120 VAC; Line Tested: Hot

Current Graph

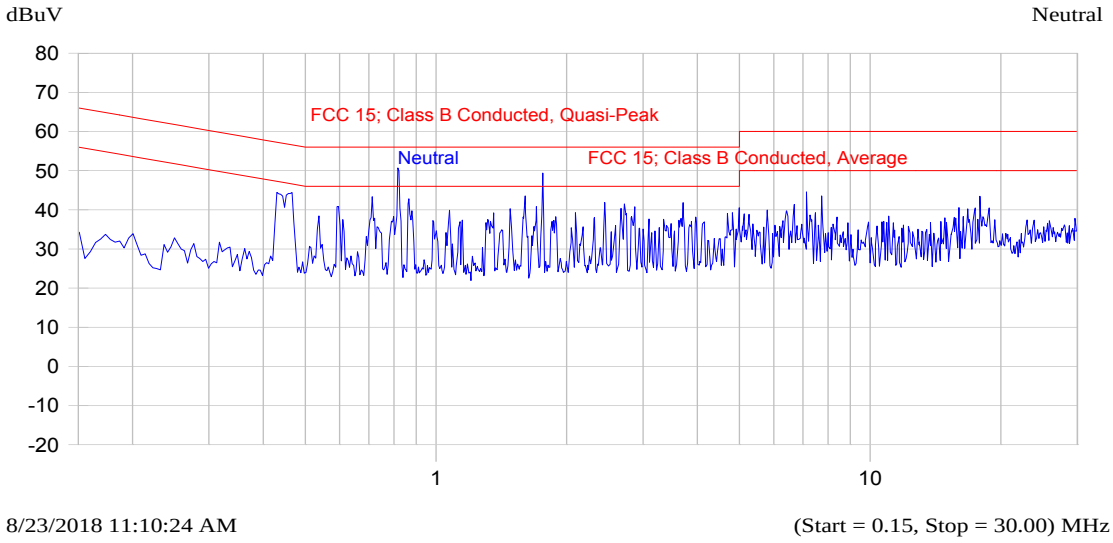


Current List

Frequency MHz	Peak dBuV	QP dBuV	QP-QP Limit dB	Avg dBuV	Avg-Avg Limit dB	Trace Name
0.259	40.8	34.3	-27.1	21.2	-30.2	Hot
0.433	49.9	42.1	-15.1	24.2	-23.0	Hot
0.783	48.7	38.0	-18.0	19.8	-26.2	Hot
1.070	44.4	34.8	-21.2	17.9	-28.1	Hot
1.862	42.3	33.9	-22.1	17.2	-28.8	Hot
2.946	41.4	33.7	-22.3	16.7	-29.3	Hot
4.702	41.1	31.6	-24.4	16.3	-29.7	Hot
16.631	38.5	31.2	-28.8	15.9	-34.1	Hot

Plot 5.1.4.4. Power Line Conducted Emissions (Rx Mode)
Line Voltage: 120 VAC; Line Tested: Neutral

Current Graph



Current List

Frequency MHz	Peak dBuV	QP dBuV	QP-QP Limit dB	Avg dBuV	Avg-Avg Limit dB	Trace Name
0.436	49.2	40.7	-16.5	23.0	-24.2	Neutral
0.718	45.4	36.0	-20.0	19.2	-26.8	Neutral
0.817	45.4	36.6	-19.4	18.5	-27.5	Neutral
1.604	41.8	34.2	-21.8	17.2	-28.8	Neutral
1.760	41.9	35.6	-20.4	17.9	-28.1	Neutral
7.144	40.3	31.1	-28.9	15.6	-34.4	Neutral
17.879	41.2	32.5	-27.5	17.4	-32.6	Neutral

5.2. OCCUPIED BANDWIDTH [§ 15.247(a)(2)]

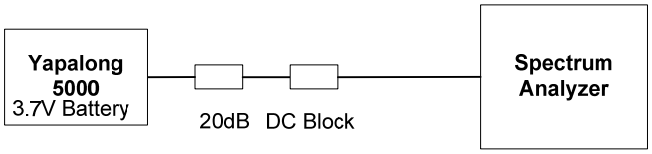
5.2.1. Limit(s)

The minimum 6 dB bandwidth shall be at least 500 kHz.

5.2.2. Method of Measurements

KDB 558074 D01 DTS Meas Guidance v04, Section 8.2 Option 2

5.2.3. Test Arrangement

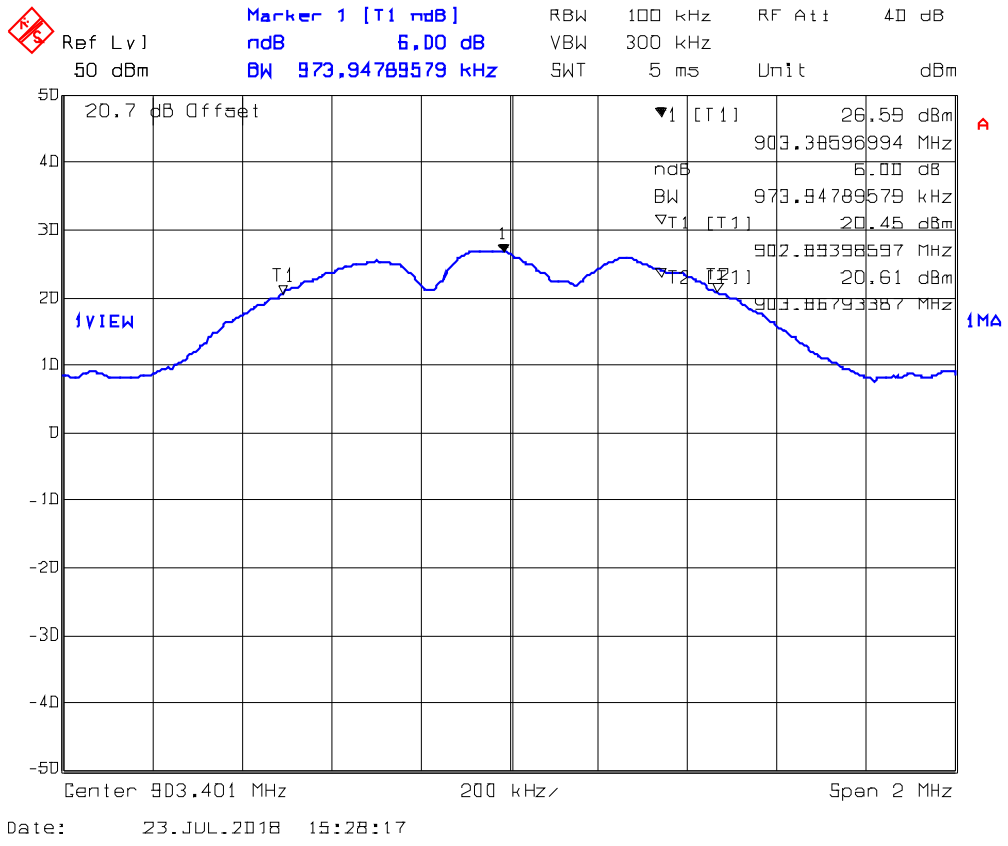


5.2.4. Test Data

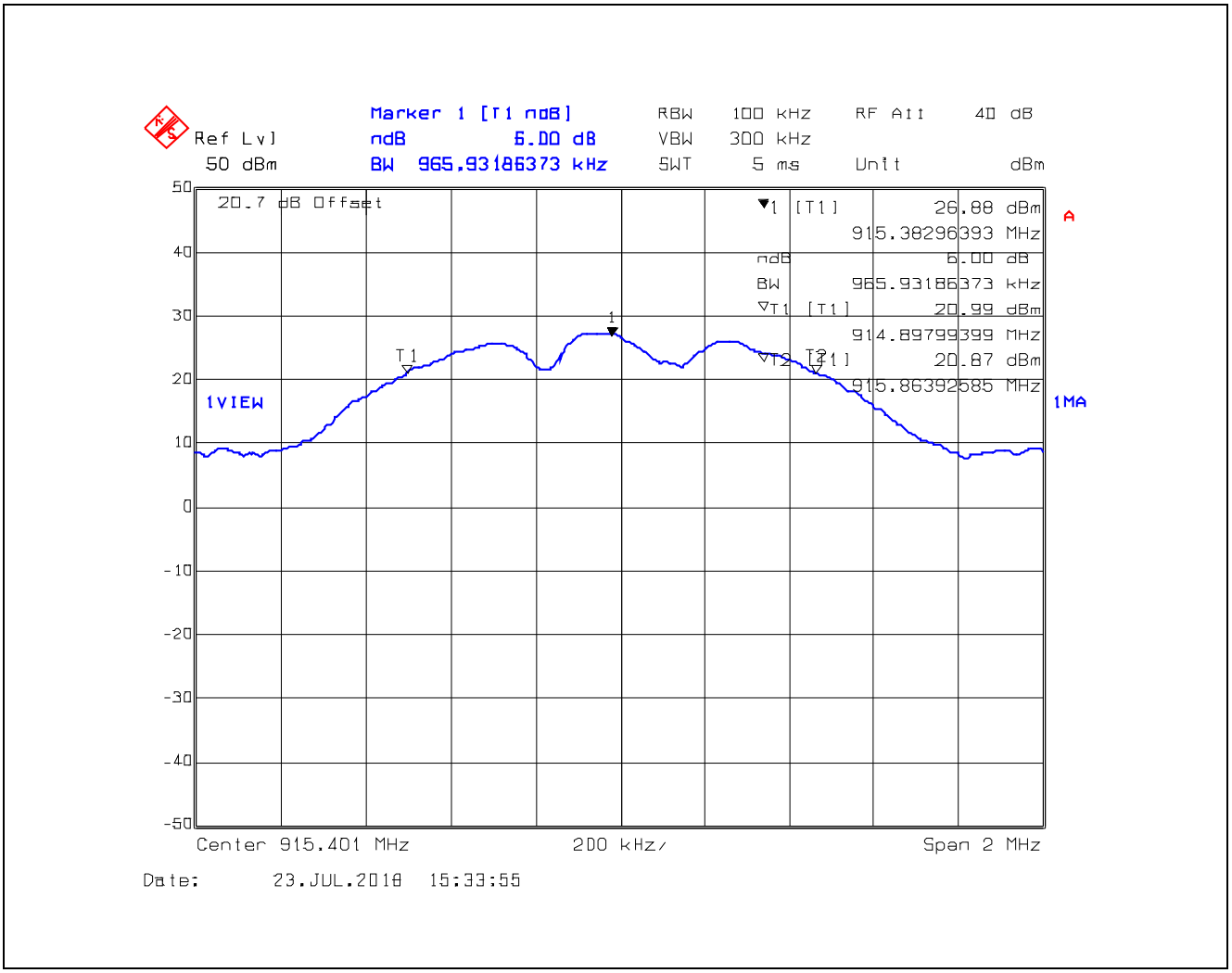
Modulation	Frequency (MHz)	6dB BW (kHz)	99% Occupied Bandwidth (MHz)
FSK	903.401	973.948	1.876
	915.401	965.932	1.858
	926.651	977.956	1.888

See the following plots for detailed measurements.

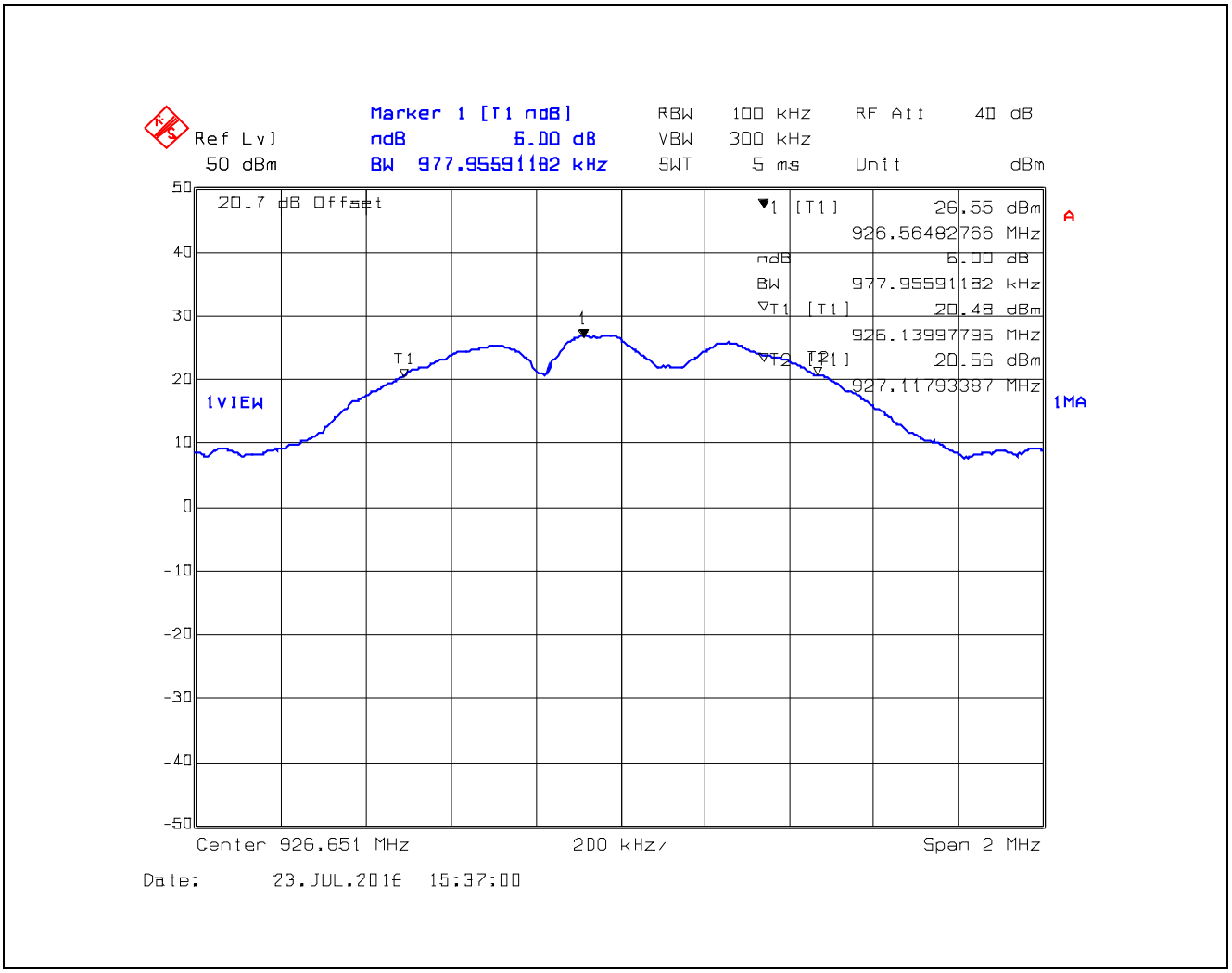
Plot 5.2.4.1. 6 dB Bandwidth, 903.401 MHz, FSK modulation



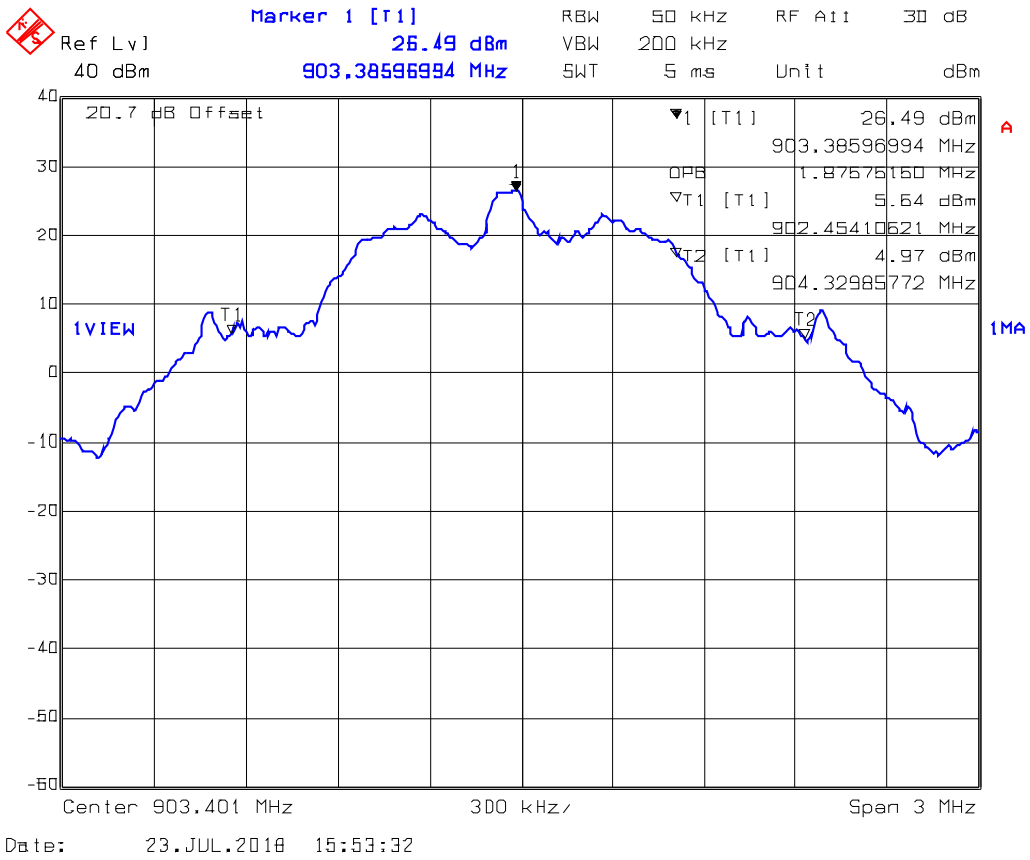
Plot 5.2.4.2. 6 dB Bandwidth, 915.401 MHz, FSK modulation



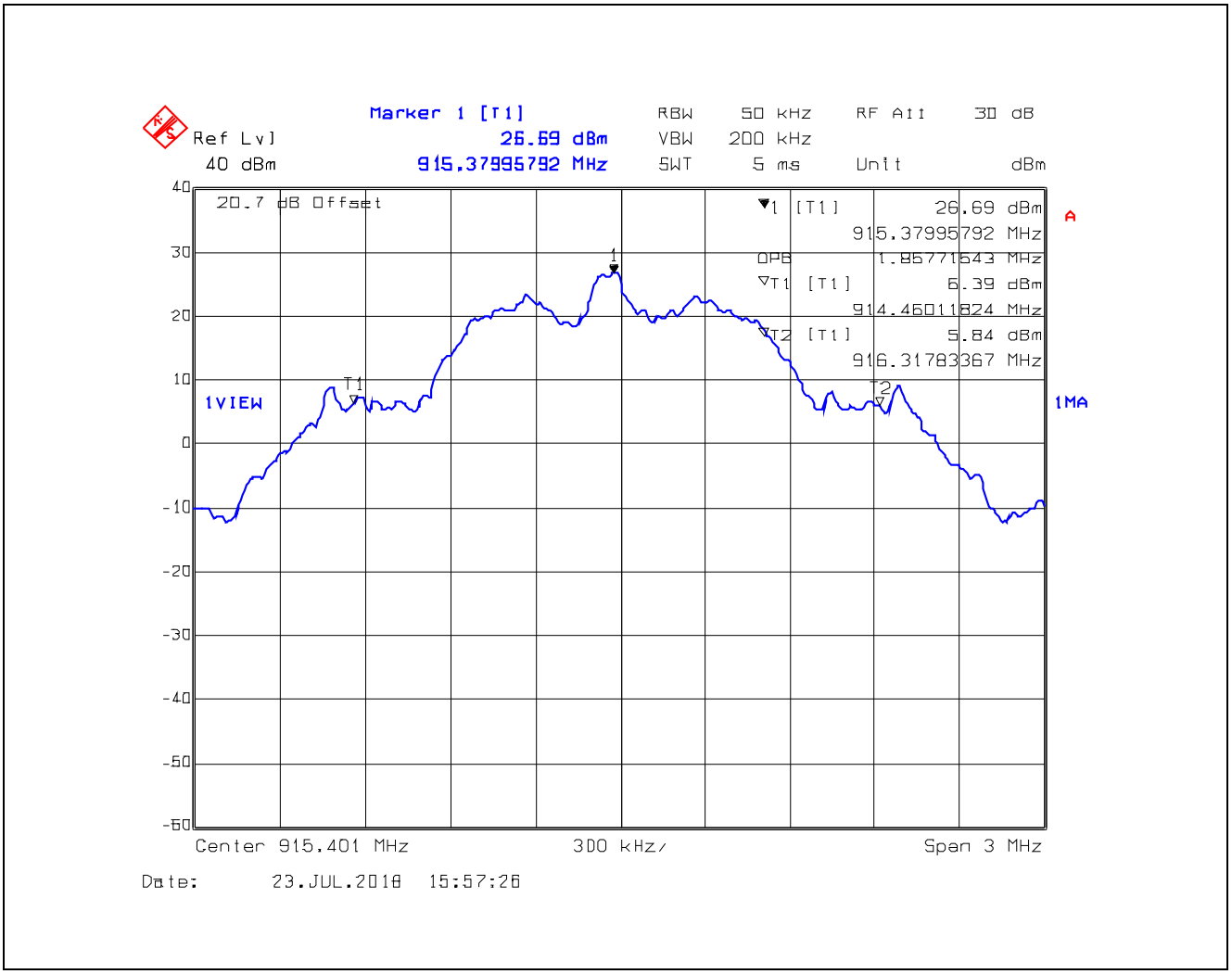
Plot 5.2.4.3. 6 dB Bandwidth, 926.651 MHz, FSK modulation



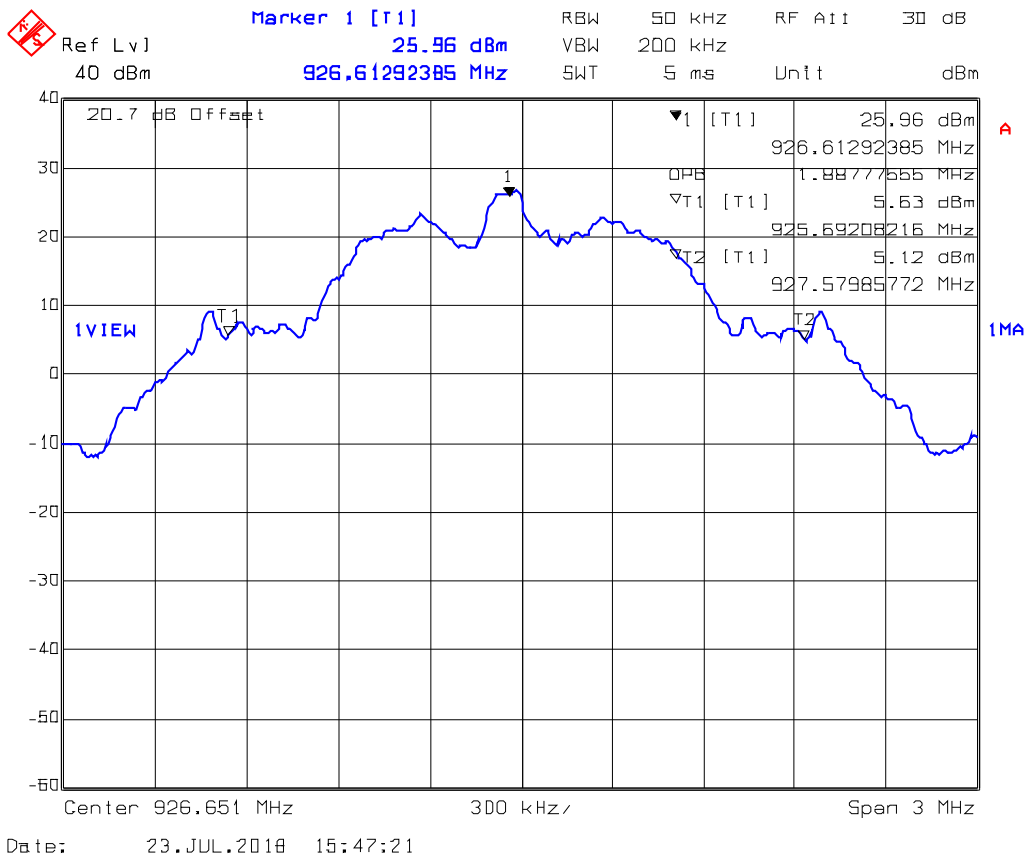
Plot 5.2.4.4. 99% Occupied Bandwidth, 903.401 MHz, FSK modulation



Plot 5.2.4.5. 99% Occupied Bandwidth, 915.401 MHz, FSK modulation



Plot 5.2.4.6. 99% Occupied Bandwidth, 926.651 MHz, FSK modulation



5.3. MAXIMUM CONDUCTED OUTPUT POWER - DTS [§ 15.247(b)(3)]

5.3.1. Limit(s)

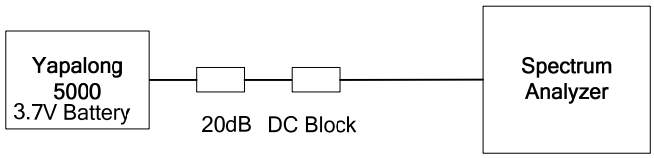
§ 15.247(b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

§ 15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.3.2. Method of Measurements & Test Arrangement

KDB 558074 D01 DTS Meas Guidance v04, Section 9.2.2.4 Method AVGSA-2

5.3.3. Test Arrangement



5.3.4. Test Data

Remarks:
- Duty cycle for test mode is 84.5% < 98%, Duty Cycle Factor = 10*log (1/x) = 10*log (1/0.845) = 0.73 dB

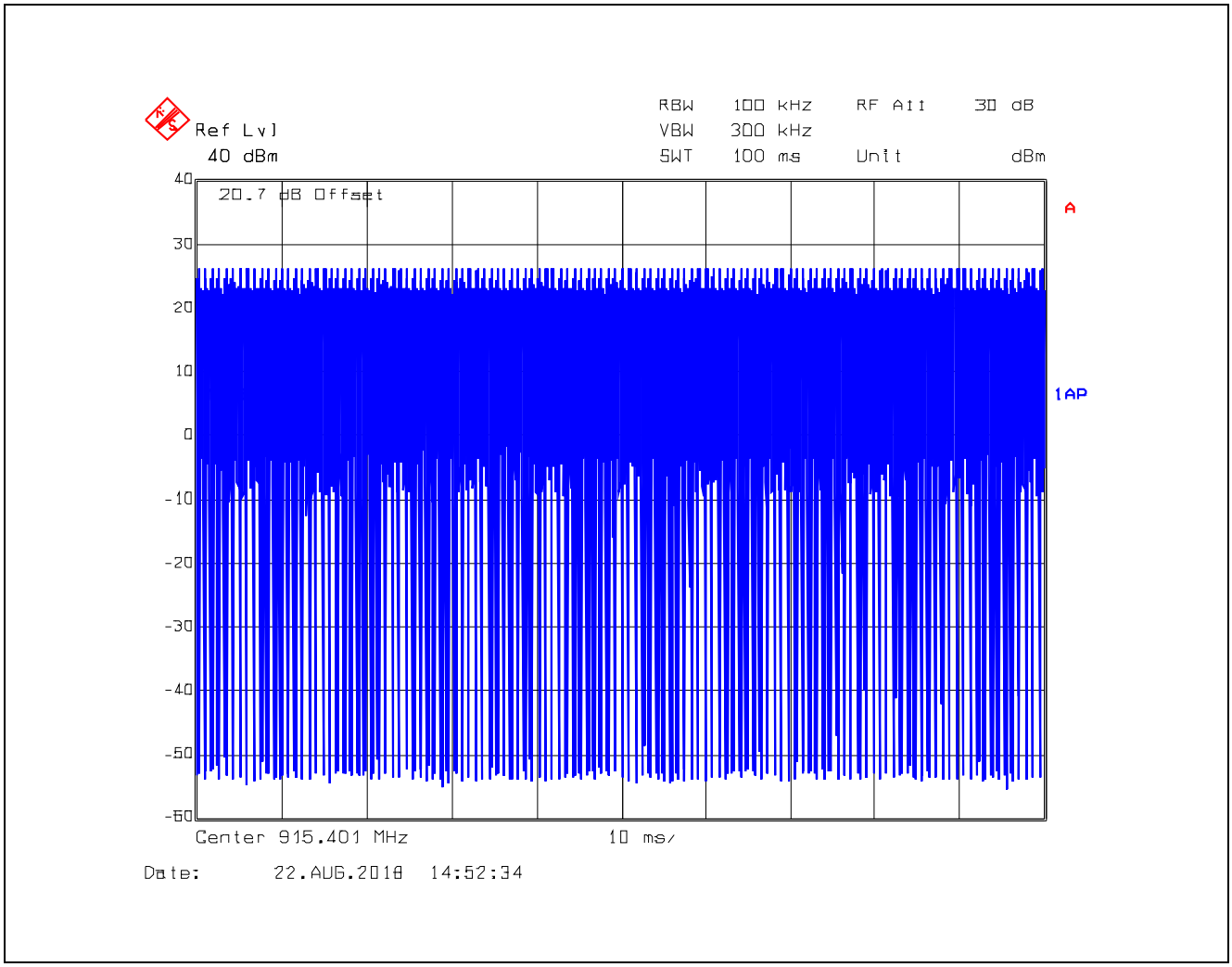
Computation of duty-cycle factor

Sub-Pulse	Duration (ms)	Number of pulses	Sub-Pulse "On Time" (ms)
1	84.48	124	0.8448
		TOTAL ON TIME:	0.8448
Duty cycle factor: 10*log (1/x) = 10*log (1/0.845) = 0.73 dB			

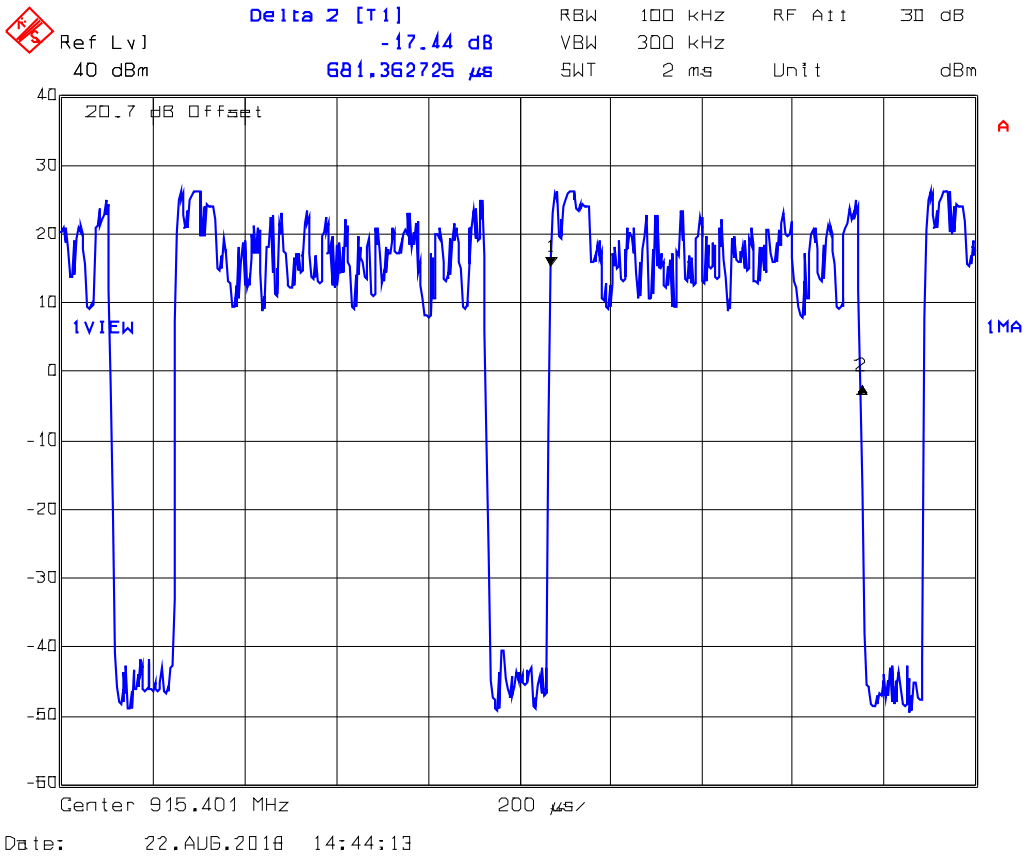
Modulation	Frequency (MHz)	*Maximum Conducted Average Output Power (dBm)	Limit (dBm)
FSK	903.401	25.38	30
	915.401	25.75	30
	926.651	25.24	30
* Maximum Conducted Average Output Power = Measured Power (CH PWR) + Duty Cycle Factor			

See the following test data plots for measurements of duty cycle and power

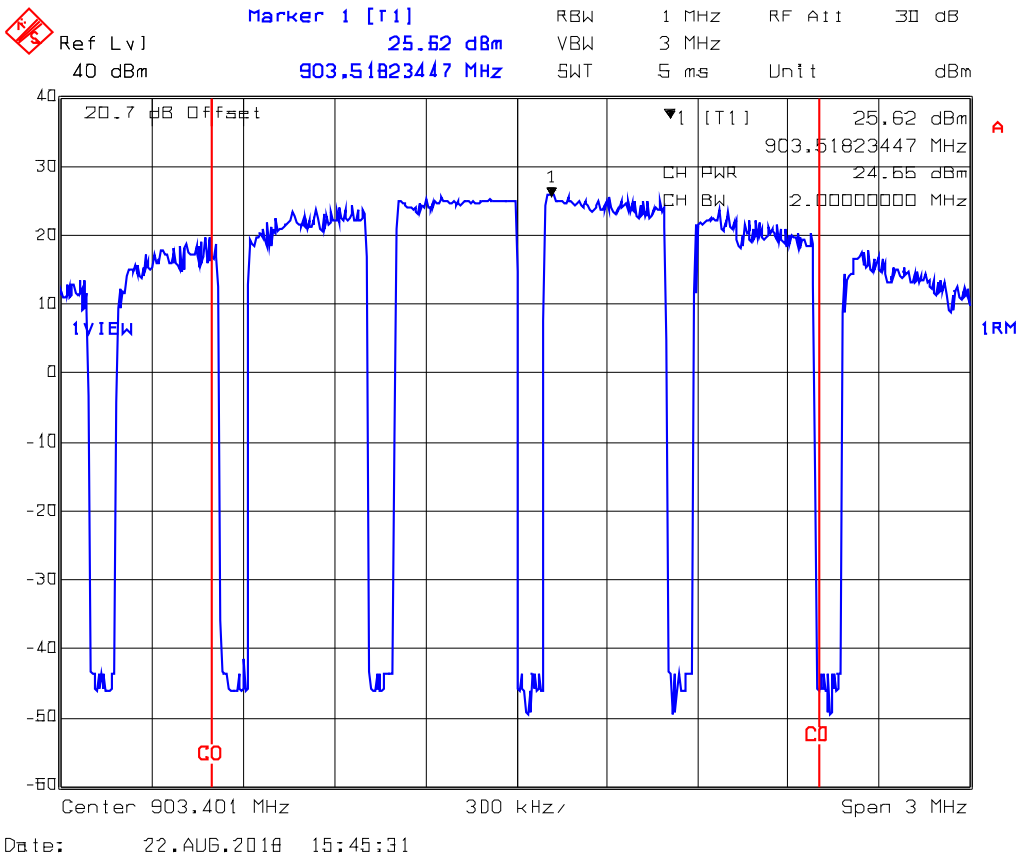
Plot 5.3.4.1. Duty Cycle (in 100ms)



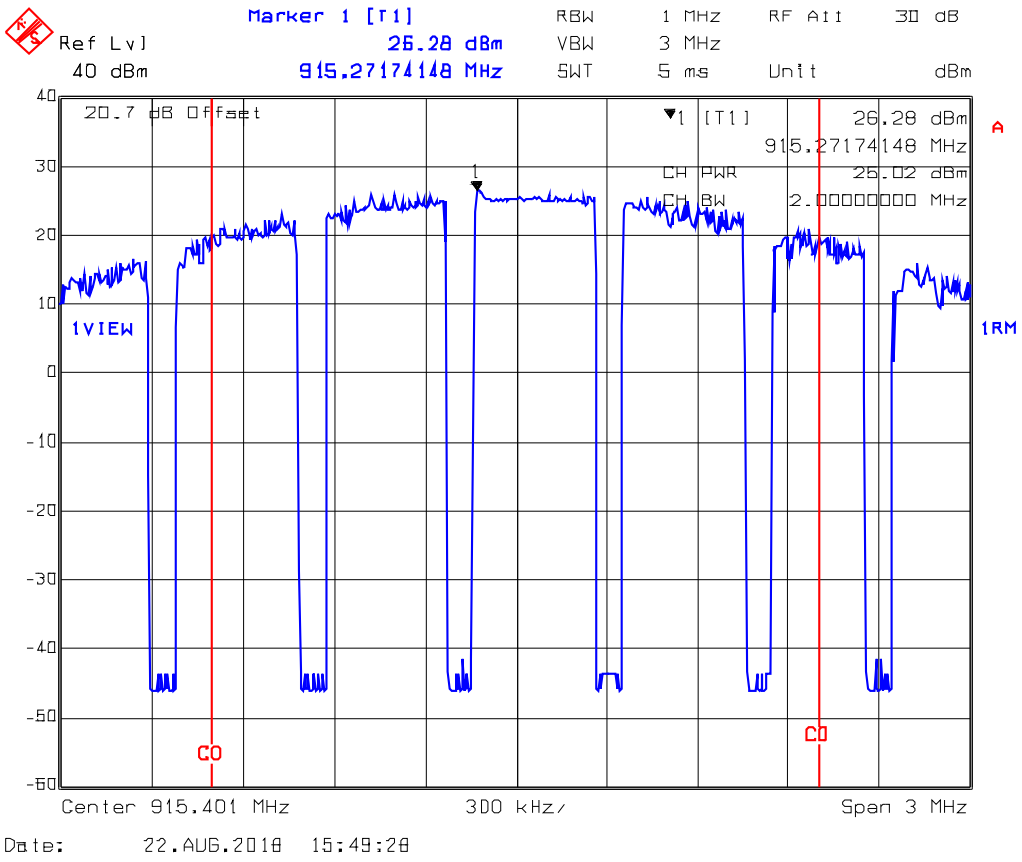
Plot 5.3.4.2. Duty Cycle (Pulse 1)



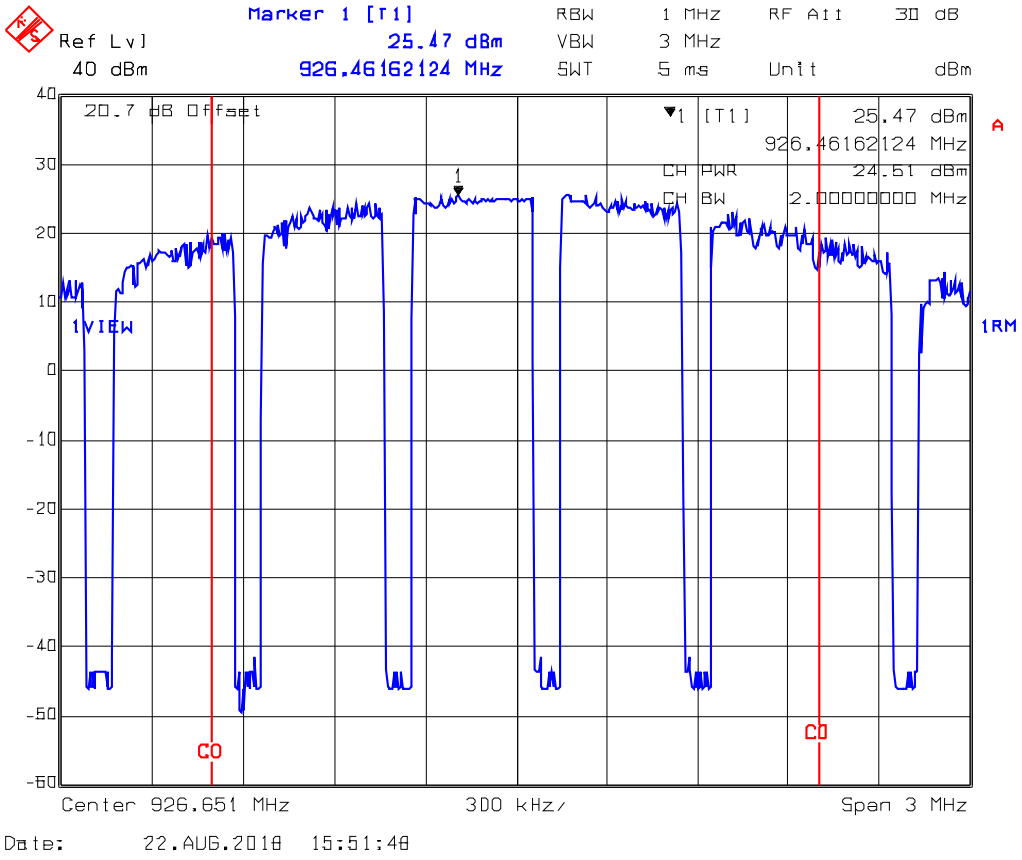
Plot 5.3.4.3. Measured Power (CH PWR), 903.401 MHz, FSK modulation



Plot 5.3.4.4. Measured Power (CH PWR), 915.401 MHz, FSK modulation



Plot 5.3.4.5. Measured Power (CH PWR), 926.651 MHz, FSK Modulation



5.4. TRANSMITTER SPURIOUS RADIATED EMISSIONS AT 3 METERS [§§ 15.247(d), 15.209 & 15.205]

5.4.1. Limit(s)

§ 15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Section 15.205(a) - Restricted Bands of Operation

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	[2]
13.36–13.41.			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2] Above 38.6

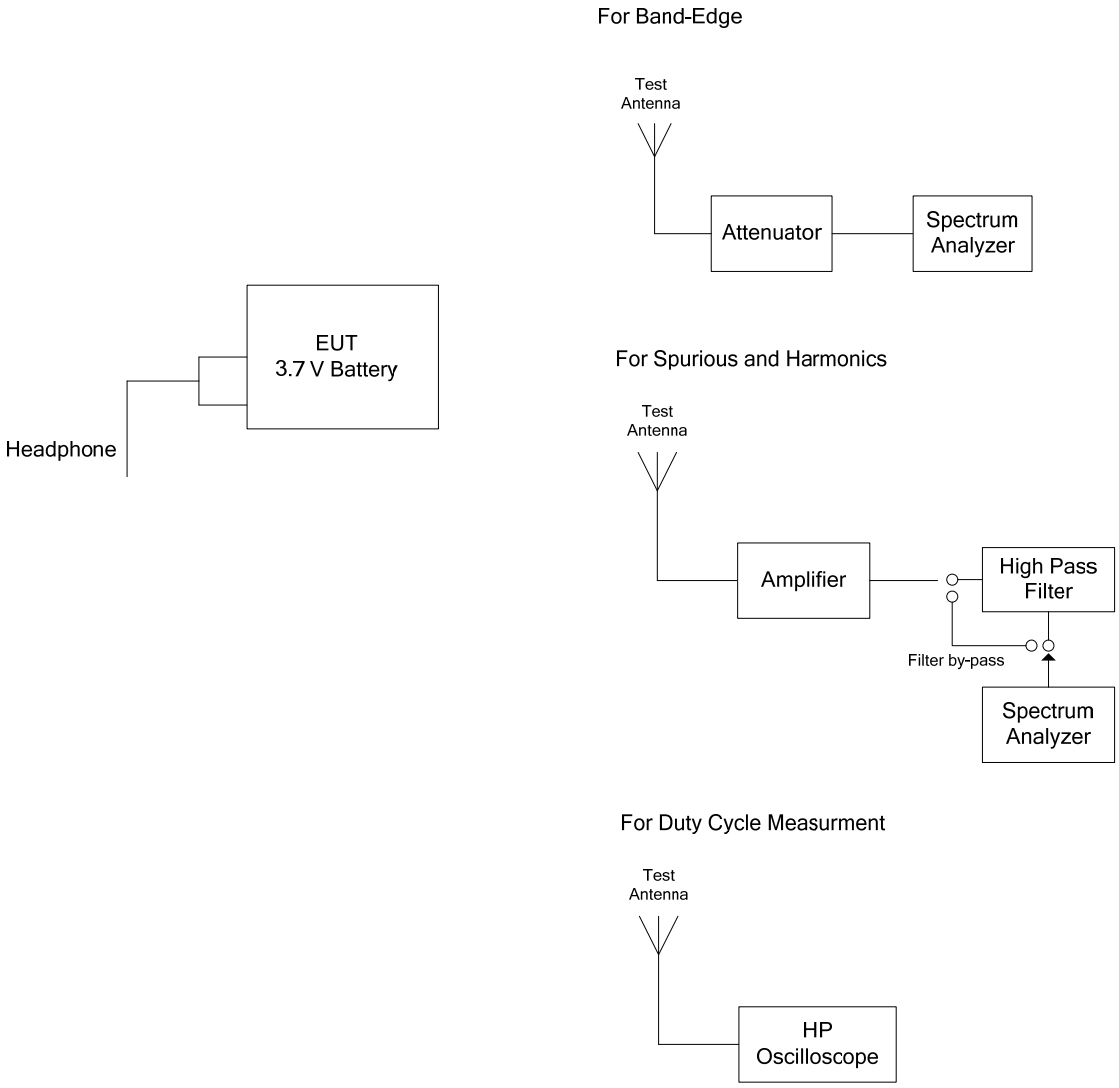
Section 15.209(a) - Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 - 1.705	24,000 / 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

5.4.2. Method of Measurements

ANSI C63.10-2013
KDB 558074 D01 DTS Meas Guidance V04, Section 13, ANSI C63.10-2013 Section 11.13

5.4.3. Test Arrangement



5.4.4. Test Data

Remark(s):

- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT shall be tested in three orthogonal positions.
- The EUT is unable to be configured for 100 % duty cycle, it was configured for the longest duration duty cycle supported by the system at 85 % duty cycle.
- Under normal mode of operation the duty cycle is 8.3 %, a duty cycle correction factor of -21.57 dB, as computed in section 5.4.4.1.1 were applied to a measurement made with an average detector.

5.4.4.1. Spurious Radiated Emissions

Fundamental Frequency:	903.401 MHz						
Frequency Test Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
903.401	127.27	--	V	--	--	--	--
903.401	127.43	--	H	--	--	--	--
2710.203	72.81	35.05	V	54.0	97.4	-19.0	Pass*
2710.203	72.84	35.29	H	54.0	97.4	-18.7	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

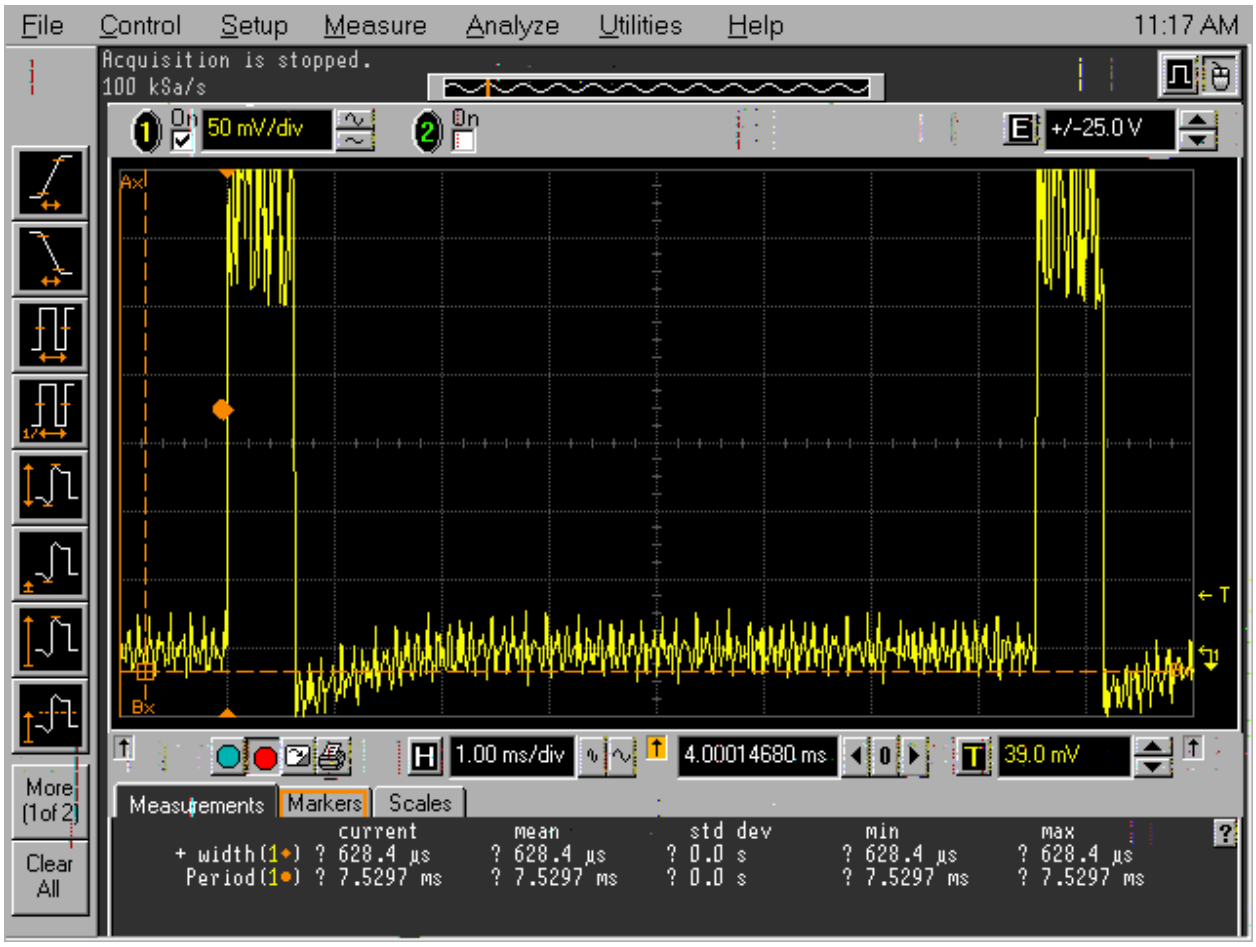
Fundamental Frequency:	915.401 MHz						
Frequency Test Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
915.401	127.15	--	V	--	--	--	--
915.401	128.06	--	H	--	--	--	--
2746.203	73.42	35.44	V	54.0	98.1	-18.6	Pass*
2746.203	72.46	34.38	H	54.0	98.1	-19.6	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	926.651 MHz						
Frequency Test Range:	30 MHz – 10 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
926.651	127.21	--	V	--	--	--	--
926.651	128.84	--	H	--	--	--	--
30 - 10000	*	*	V/H	*	*	*	*
*All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

5.4.4.1.1. Duty-Cycle Correction Factor

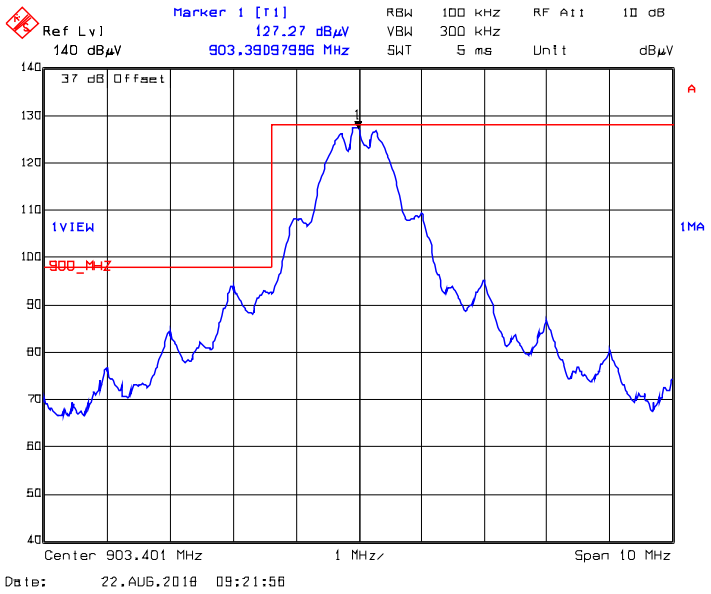
Plot 5.4.4.1.1.1. Duty Cycle Calculation



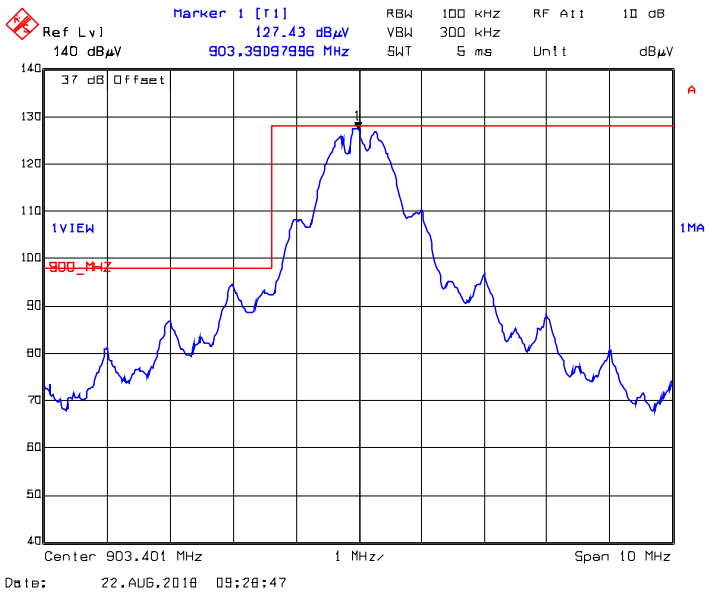
Duty Cycle Correction Factor = 20*log (0.6284/7.5297) = -21.57 dB

5.4.4.2. Band –Edge RF Radiated Emissions

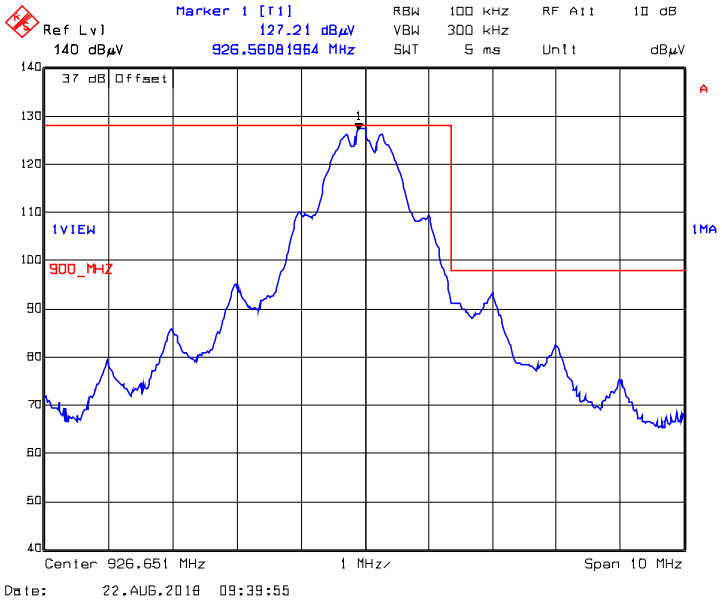
Plot 5.4.4.2.1. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band, 903.401 MHz FSK Modulation



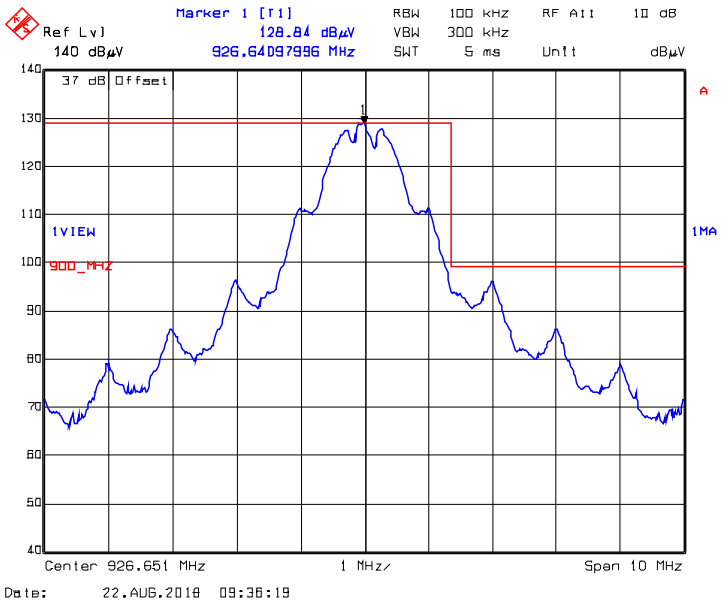
Plot 5.4.4.2.2. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band, 903.401 MHz FSK Modulation



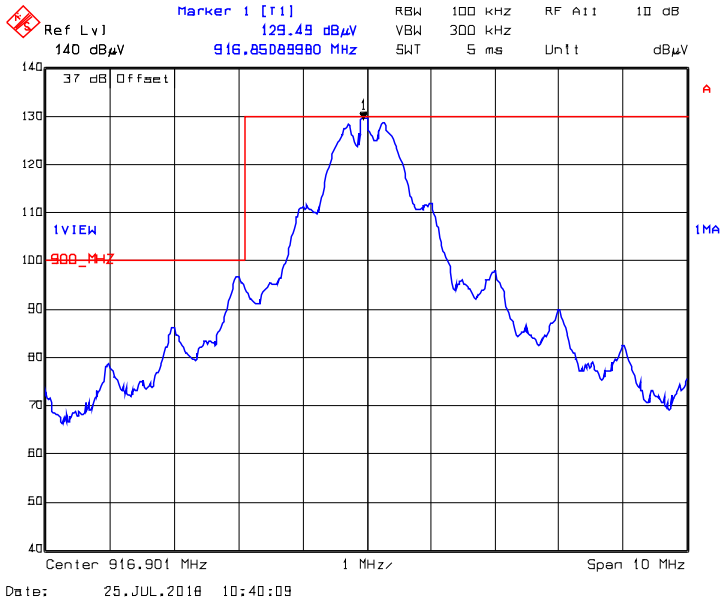
Plot 5.4.4.2.3. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High of Frequency Band, 926.651 MHz FSK Modulation



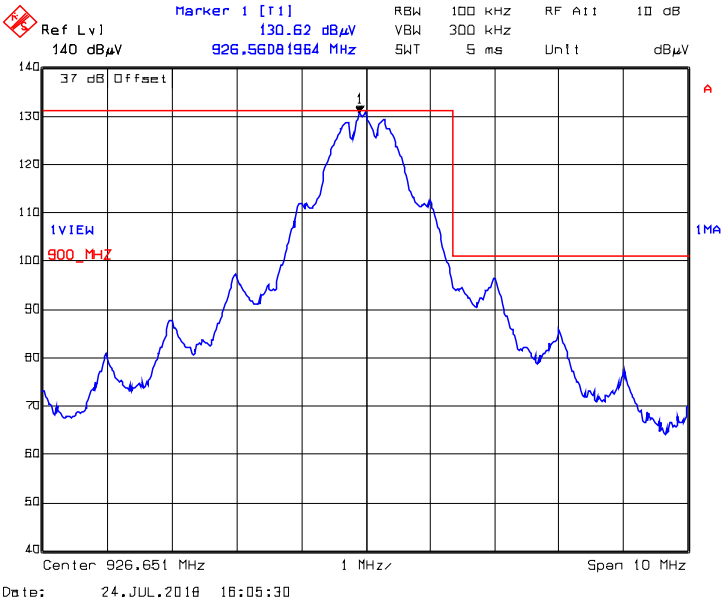
Plot 5.4.4.2.4. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High of Frequency Band, 926.651 MHz FSK Modulation



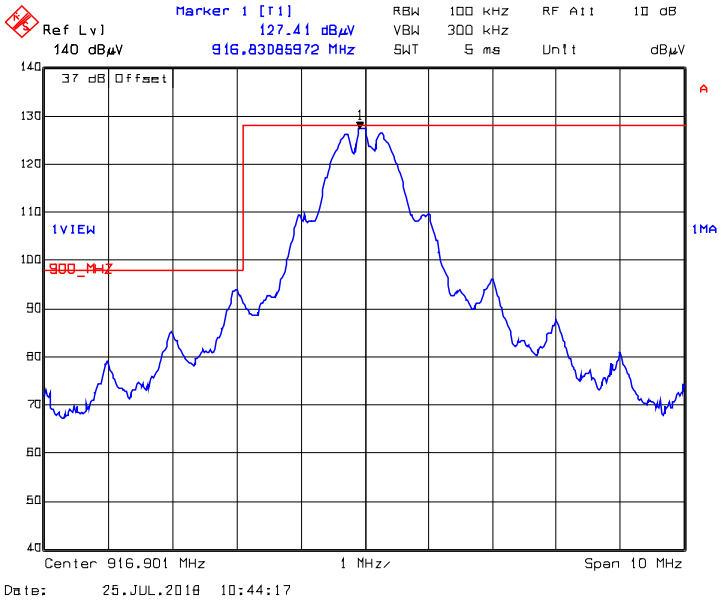
Plot 5.4.4.2.5. Band-Edge RF Radiated Emissions at 3 m for Australia Band 915 – 928 MHz , 916.901 MHz
Horizontal Polarization, Low End of Frequency Band



Plot 5.4.4.2.6. Band-Edge RF Radiated Emissions at 3 m for Australia Band 915 – 928 MHz, 926.651 MHz
Horizontal Polarization, High End of Frequency Band

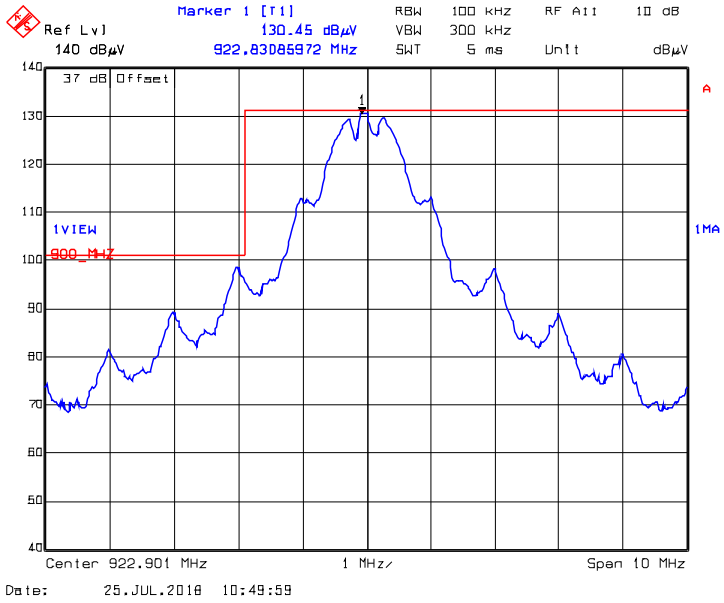


Plot 5.4.4.2.7. Band-Edge RF Radiated Emissions at 3 m for Australia Band 915 – 928 MHz , 916.901 MHz
Vertical Polarization, Low End of Frequency Band

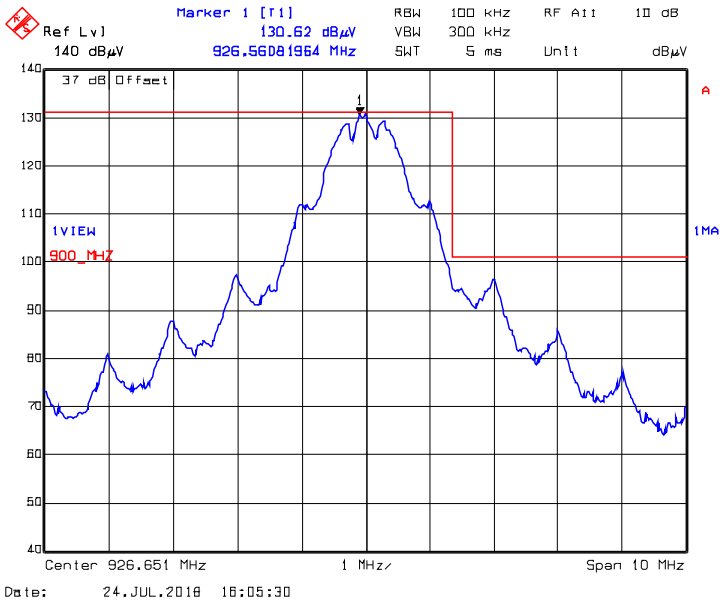


Plot 5.4.4.2.8. Band-Edge RF Radiated Emissions at 3 m for Australia Band 915 – 928 MHz, 926.651 MHz
Vertical Polarization, High End of Frequency Band

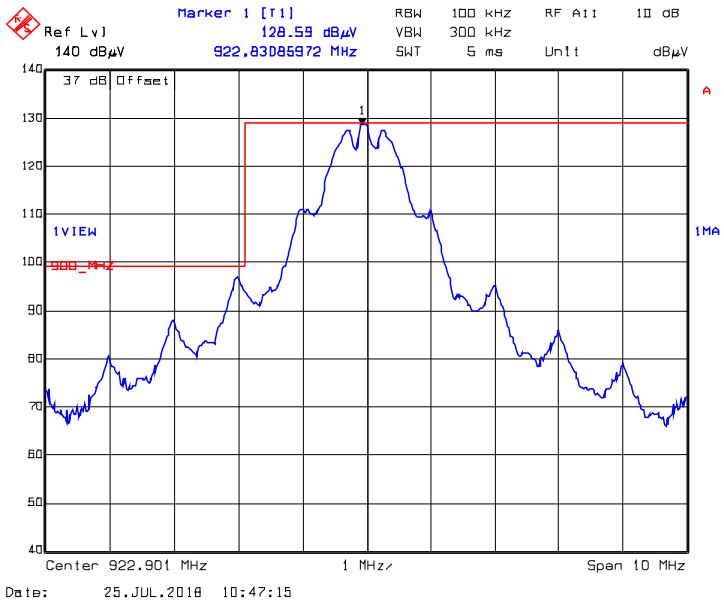
Plot 5.4.4.2.9. Band-Edge RF Radiated Emissions at 3 m for New Zealand Band 921 – 928 MHz , 922.901 MHz Horizontal Polarization, Low End of Frequency Band



Plot 5.4.4.2.10. Band-Edge RF Radiated Emissions at 3 m for New Zealand Band 921 – 928 MHz, 926.651 MHz Horizontal Polarization, High End of Frequency Band



Plot 5.4.4.2.11. Band-Edge RF Radiated Emissions at 3 m for New Zealand Band 921 – 928 MHz , 922.901 MHz Vertical Polarization, Low End of Frequency Band



Plot 5.4.4.2.12. Band-Edge RF Radiated Emissions at 3 m for New Zealand Band 921 – 928 MHz, 926.651 MHz Vertical Polarization, High End of Frequency Band

5.5. POWER SPECTRAL DENSITY [§ 15.247(e)]

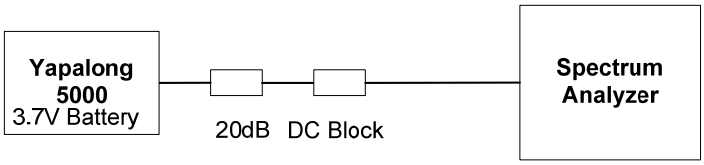
5.5.1. Limit(s)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.5.2. Method of Measurements

KDB 558074 D01 DTS Meas Guidance v04, Section 10.5 Method AVGPSD-2

5.5.3. Test Arrangement

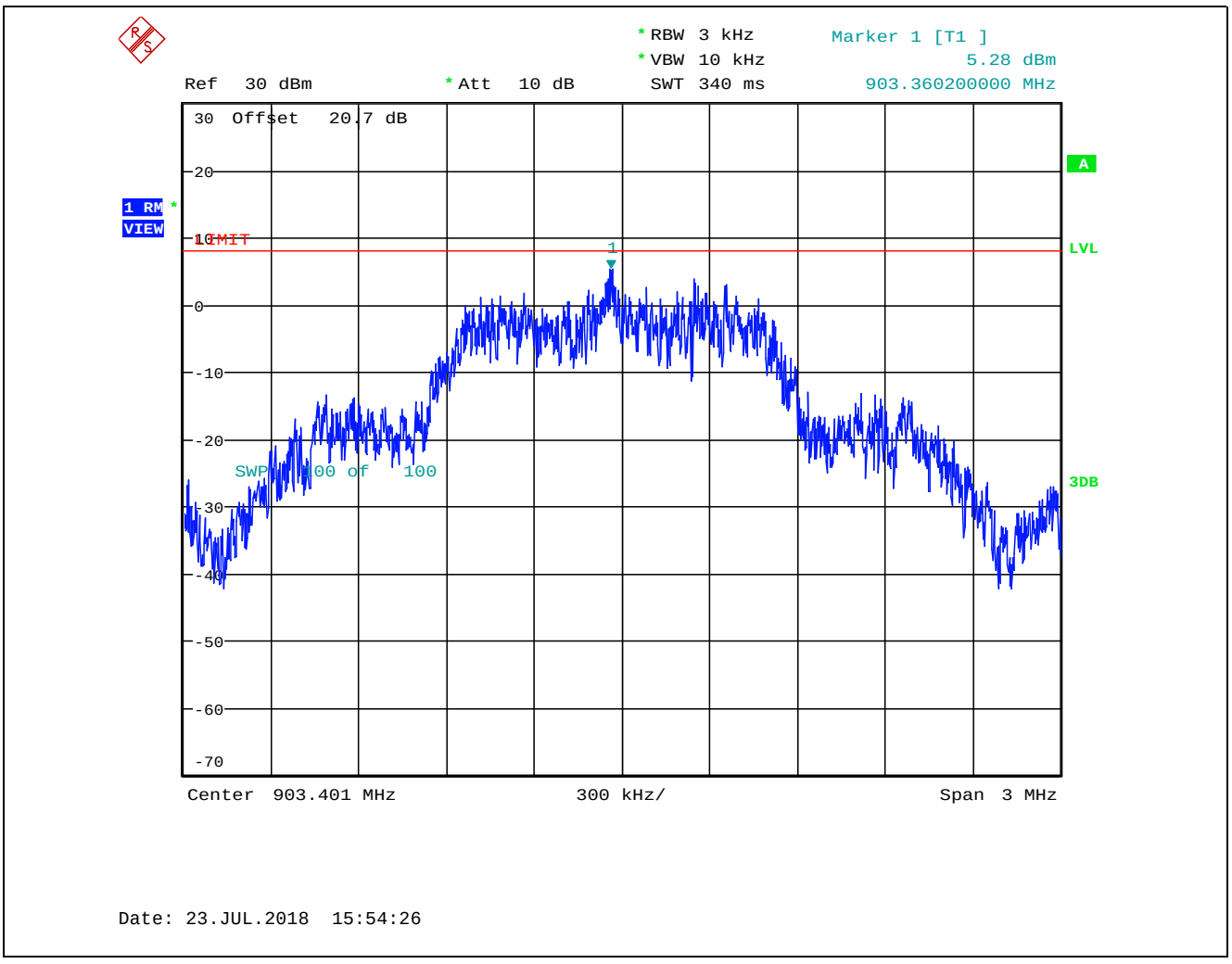


5.5.4. Test Data

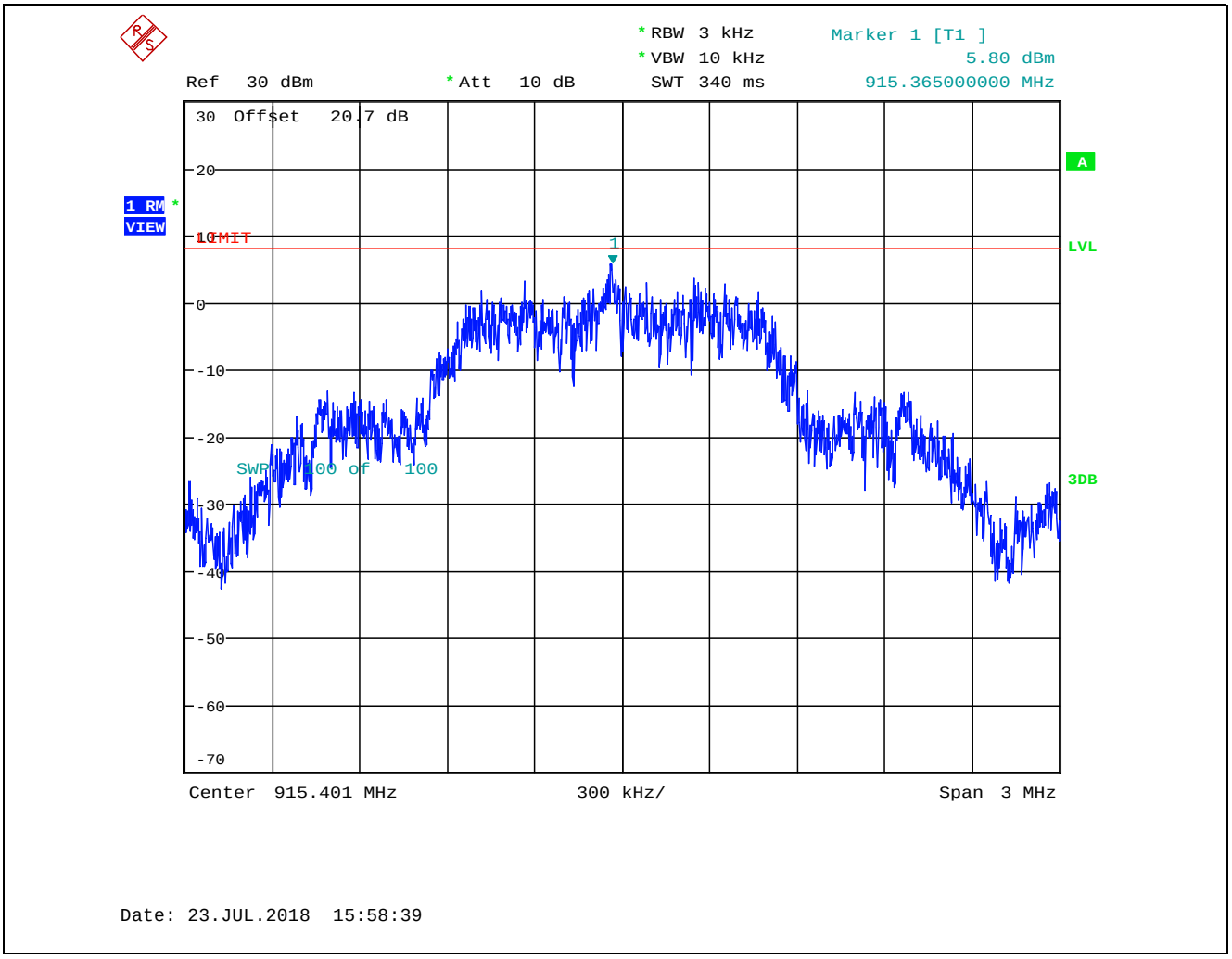
Modulation	Frequency (MHz)	Measured PSD (dBm)	Duty Cycle Correction (dB)	*Computed Average PSD	Limit (dBm)	Margin (dBm)
FSK	903.401	5.28	0.73	6.01	8	-1.99
	915.401	5.80	0.73	6.53	8	-1.47
	926.651	5.39	0.73	6.12	8	-1.88

* Computed Average PSD = Measured PSD + Duty Cycle Correction

Plot 5.5.4.1. Power Spectral Density, 903.401 MHz, FSK modulation
Detector RMS, Video Trace Averaging with 100 Traces, Sweep Points 5000 ≥ 2*Span/RBW



Plot 5.5.4.2. Power Spectral Density, 915.401 MHz, FSK Modulation
Detector RMS, Video Trace Averaging with 100 Traces, Sweep Points 5000 ≥ 2*Span/RBW



Plot 5.5.4.3. Power Spectral Density, 926.651 MHz, FSK Modulation
Detector RMS, Video Trace Averaging with 100 Traces, Sweep Points 5000 ≥ 2*Span/RBW

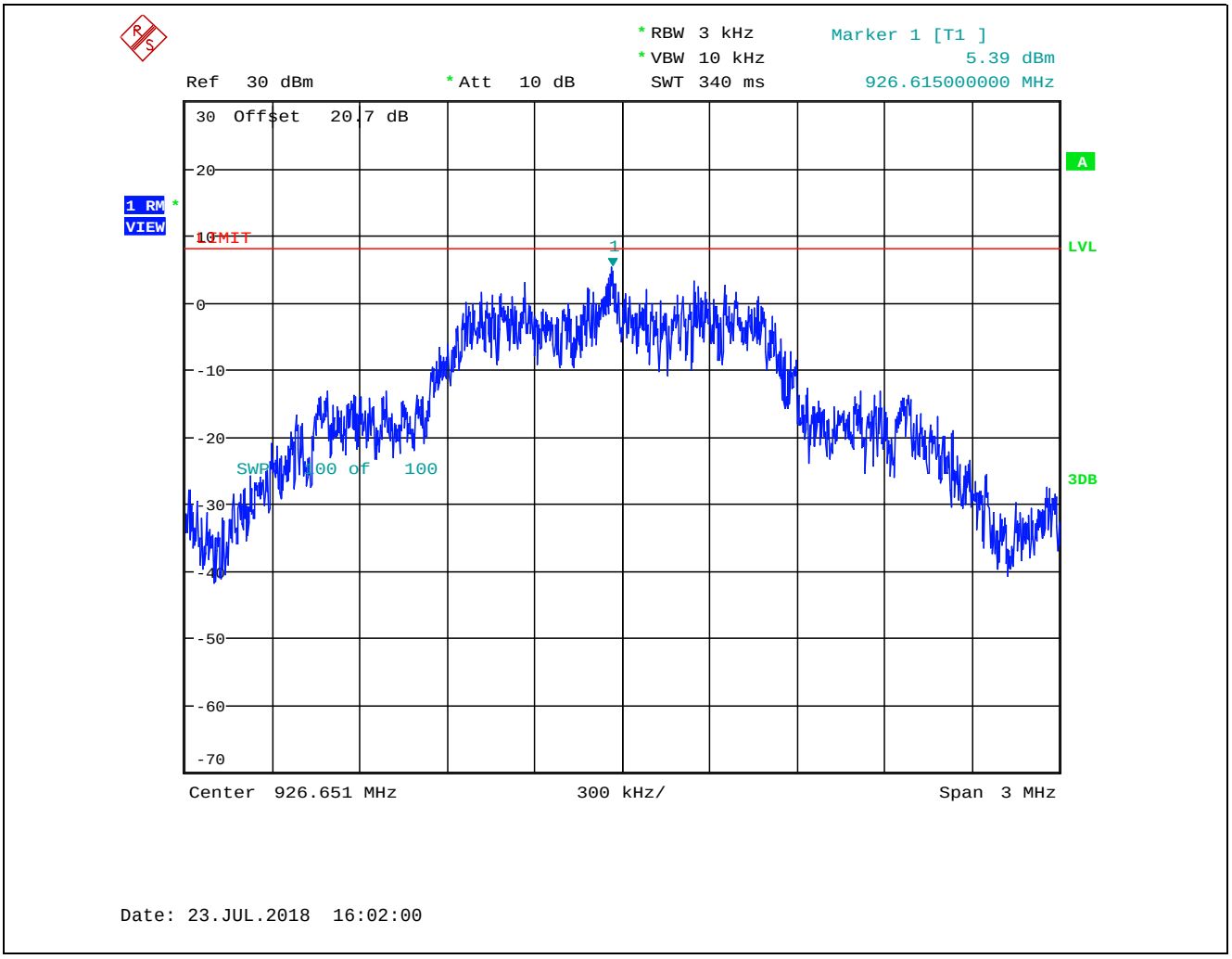


EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Signal Generator	IFR	2025	202304/141	9 kHz – 2.51 GHz	04 May 2019
Spectrum Analyzer	Agilent	E7405A	US39440181	9 kHz–26.5 GHz	04 Feb 2019
Attenuator	Pasternack	PE7010-20	ATT13	DC–2 GHz	21 Mar 2019
LISN Used	EMCO	3825/2R	1165	10 kHz–30 MHz	03 Nov 2018
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20Hz–40 GHz	05 Dec 2018
DC Block	Hewlett Packard	11742A	12460	0.045–26.5 GHz	See Note 1
Attenuator	Pasternack	PE7024-20	6	DC–26.5 GHz	See Note 1
EMI Receiver	Rohde & Schwarz	ESU40	100037	20Hz–40 GHz	04 May 2019
RF Amplifier	Com-Power	PAM-0118A	551016	0.5 – 18 GHz	09 Mar 2019
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	04 Oct 2018
Biconilog	EMCO	3142C	00026873	26-3000 MHz	27 Apr 2019
Horn Antenna	EMCO	3155	6570	1 – 18 GHz	13 Oct 2018
Horn Antenna	ETS-Lindgren	3160-09	001183858	18 – 26.5 GHz	11 Oct 2018
High Pass Filter	K & L	11SH10-1500/T8000	2	Cut off 900 MHz	See Note 1
Band Reject Filter	Micro-Tronics	BRC50722	001	Cut off 902-928 MHz	See Note 1
Attenuator	Pasternack	PE7024-10	4	DC–26.5 GHz	See Note 1
Spectrum Analyzer	Rohde & Schwarz	FSU26	100398	20Hz–26.5 GHz	06 Oct 2019
Oscilloscope	Hewlett Packard	54801A	US38380192	DC-500 MHz	06 Sep 2019
Test Antenna for Oscilloscope	Microhard	MHS031070	--	900 MHz Band	See Note 1
Note 1: Internal Verification/Calibration check					

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (9 kHz – 30 MHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	± 1.44	± 1.8
U	Expanded uncertainty U: $U = 2u_c(y)$	± 2.89	± 3.6

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	Measured (dB)	Limit (dB)
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	± 2.39	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.79	± 5.2

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	Measured (dB)	Limit (dB)
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	± 2.39	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.78	± 5.2

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	Measured (dB)	Limit (dB)
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	± 1.87	Under consideration
U	Expanded uncertainty U: $U = 2u_c(y)$	± 3.75	Under consideration