



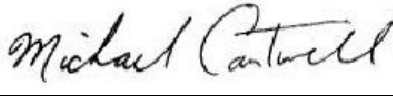
NVLAP Lab Code 100426-0

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Test Report issued under the responsibility of:



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TEST REPORT	
FCC Part 15 Radio Frequency Devices Subpart C – Intentional Radiators	RSS 210, Issue 8 Licence-exempt Radio Apparatus: Category I Equipment
FCC ID..... : QYUM411	IC ID: 4571A-M411
Report Reference No..... : 191036_TRF_USA_CAN	
Compiled by (+ signature)	David Light 
Approved by (+ signature)	Mike Cantwell 
Date of issue	20-Jan-12
Report Revision	0
Total number of pages	87
Testing Laboratory	Nemko USA, Inc. (Dallas)
Address	802 N. Kealy Ave. Lewisville, TX 75057 USA
	Tel: +1 972 436 9600 Fax: +1 972 436 2667
Applicant's name	Nike, Inc.
Address.....	EDO-1 Building, One Bowerman Drive Beaverton, Oregon USA 97005
Model(s) Tested.....	Nike+ FuelBand (small, medium, and large sizes)
Test specification:	
Standard	FCC Part 15, Subpart C & RSS 210, Issue 8
Test procedure	ANSI C63.4:2003 and DA 00-705:2000
Non-standard test method	N/A
TRF Revision	18-Nov-11

Revision History

#	Description	Date
0	Original Report Release	20-Jan-12

Notices:

1. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
2. The test results presented in this report relate only to the object tested.
3. The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.
4. "(see Enclosure #)" refers to additional information appended to the report.
5. Throughout this report a point is used as the decimal separator.
6. Dimensions in English units for convenience only, metric units prevail.

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Normative References

The following document(s) have been appropriately considered in the performance of the test results detailed in this report.

CFR Title 47, Part 15

Radio Frequency Devices

ANSI C63.4:2003

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 C63.10:2009

Testing Unlicensed Wireless Devices

DA 00-705:2000

Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

RSS 210, Issue 8

License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

RSS-Gen, Issue 3:2010

General Requirements and Information for the Certification of Radio Apparatus

RSP 100, Issue 9

Radio Equipment Certification Procedure

RSS 210, Issue 8 Test Report Cover Sheet

This document provides supplemental information relating to the technical specifications of the product to be certified. This shall be completed in full and signed by the personnel responsible for the testing of the product. This form or the original from RSP-100 Appendix B may be used.

1. PRODUCT DETAILS

Company Number	4571A
Equipment Model Number	Nike+ FuelBand
Manufacturer	Nike, Inc.
Open Area Test Site Industry Canada Number	2040C-3
Tested to Radio Standards Specification (RSS) No.:	RSS 210, Issue 8
Frequency Range	2402 – 2480 MHz
RF Power in Watts	0.003
Field Strength (and at what distance)	N/A
Occupied Bandwidth (99% BW)	1.1 MHz (GFSK) 1.2 MHz (pi/4DPSK and 8DPSK)
Type of Modulation	GFSK, pi/4DPSK, 8DPSK
Emission Designator (TRC-43)	1M20F1D
Transmitter Spurious (worst case)	50 dBµV/m @ 3m
Receiver Spurious (worst case)	N/A

2. ATTESTATION

DECLARATION OF COMPLIANCE: I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.	
Signature:	
Date:	16-Jan-12
NAME and TITLE (Please print or type): David Light, Wireless Test Engineer	

FCC Technical Specifications

Frequency in MHz		Rated RF Power Output (watts)	Frequency Tolerance		Emission Designator	FCC Rule Parts
Low Frequency	High Frequency		%, Hz, ppm			
2402	2480	0.003	-	-	-	15.247

Equipment Under Test (EUT)

Details:

Test item description:

Model : Nike+ FuelBand

Serial Number : None

Production Status : ☒ Production ☐ Pre-Production ☐ Prototype

Other Status Info : Test sample provided

EUT Received Date : 14-Nov-11

Ratings : 5VDC ☐ 1 ϕ ☐ 3 ϕ ☒ Battery

General product description:

The device tested is a wrist band that contains a radio transceiver. There are three sizes: small, medium, and large. The antenna design is slightly different for each size.

Modifications to the EUT required for compliance:

There have been no modifications to the EUT as a result of this evaluation.

Deviations from Test Methodology:

There have been no deviations, additions to, or exclusions from the specified test standard.

Engineering Judgements:

No engineering judgments based on the results in this test report have been made.

Approved by (+ signature) : [Click here to enter text.](#)

Table 1 – EUT Internal Operating Frequencies

Frequency (MHz)	Description	Frequency (MHz)	Description
24 MHz	Processor crystal clock		
26 MHz	Radio module crystal clock		

Table 2 – EUT Operating Modes

Mode #	Description
1	Device with rf connector connected to laptop computer.
2	
3	

EUT Configuration

A minimum representative configuration, as defined by the manufacturer, has been used for the testing performed herein. The selection of hardware (including interface ports), software, and cables were chosen by the manufacturer as being representative of the product's intended use. The interconnection of various articles of equipment and the types of cables used has also been defined by the manufacturer.

The placement of the equipment under test has been, to the extent practical, arranged to maximize emissions.

Cables, of the type and length specified by the manufacturer, were connected to at least one of each type of interface port provided by the EUT and if practical, were terminated by a device typical of actual usage. For multiple ports of the same type, the addition of cables did not significantly affect the emission level (i.e. < 2dB variation).

The arrangement of external power supply units was as follows:

- If the mains input cable of the external power supply unit is greater than 0,8 m, the external power supply unit shall be placed on the tabletop, with a nominal 0,1 m separation from the host unit.
- If the external power supply unit has a mains input cable that is less than 0,8 m, the external power supply unit shall be placed at a height above the ground plane such that its power cable is fully extended in the vertical direction.
- If the external power supply unit is incorporated into the mains power plug, it shall be placed on the tabletop. An extension cable shall be used between the external power supply unit and the source of power. The extension cable should be connected in a manner such that it takes the most direct path between the external power supply unit and the source of power.

Figure 1 - EUT Configuration Diagram

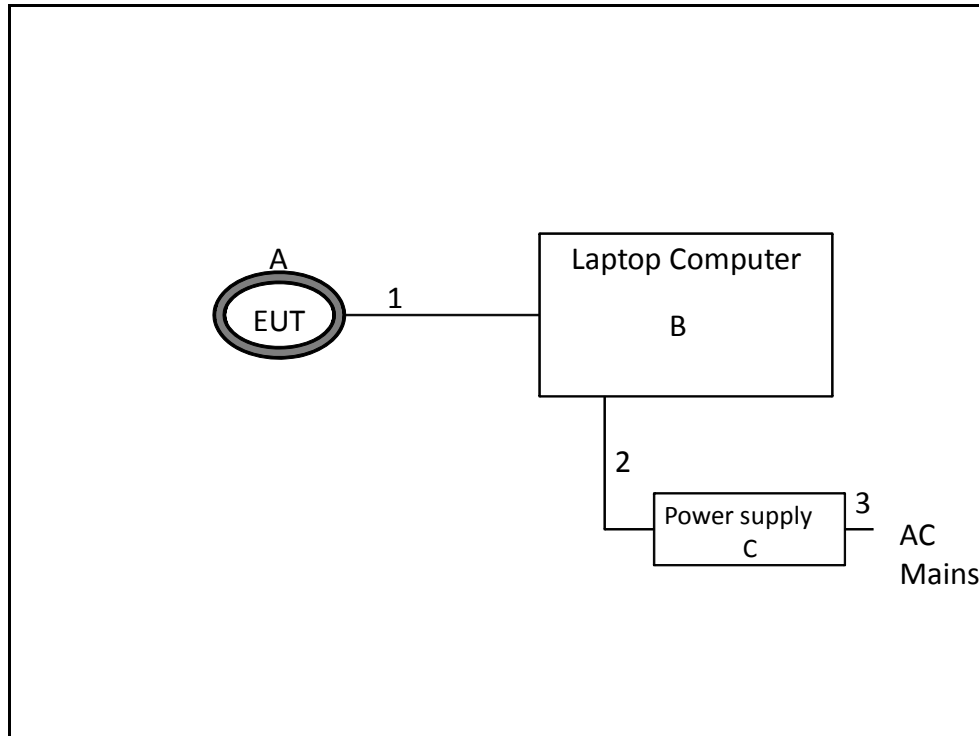


Table 3 – EUT & Auxilliary Equipment List

Item	Use*	Product Type	Manufacturer	Model	Serial No.
A	EUT	Wrist Band	Nike	WM0074	None
B	AE	Laptop computer	Dell	PP17L	None
C	AE	AC Adapter	Dell	FA90PS0-00	None

Note:
* Use = EUT - Equipment Under Test,
AE - Auxiliary/Associated Equipment, or
SIM - Simulator (Not Subjected to Test)

Table 4 - Interconnecting Cables List

Item	Use*	Cable Type
1	I/O	1 meter USB cable
2	DC	1 meter DC cord. Permanently attached to power supply
3	AC	1 meter AC cord, 2 conductor

EUT Photo(s)

Photo 1	EUT Photo – Front/Top View	
		
Supplemental Information:		

Photo 2	EUT Photo – Rear/Side View	
		
Supplemental Information:		

Photo 3

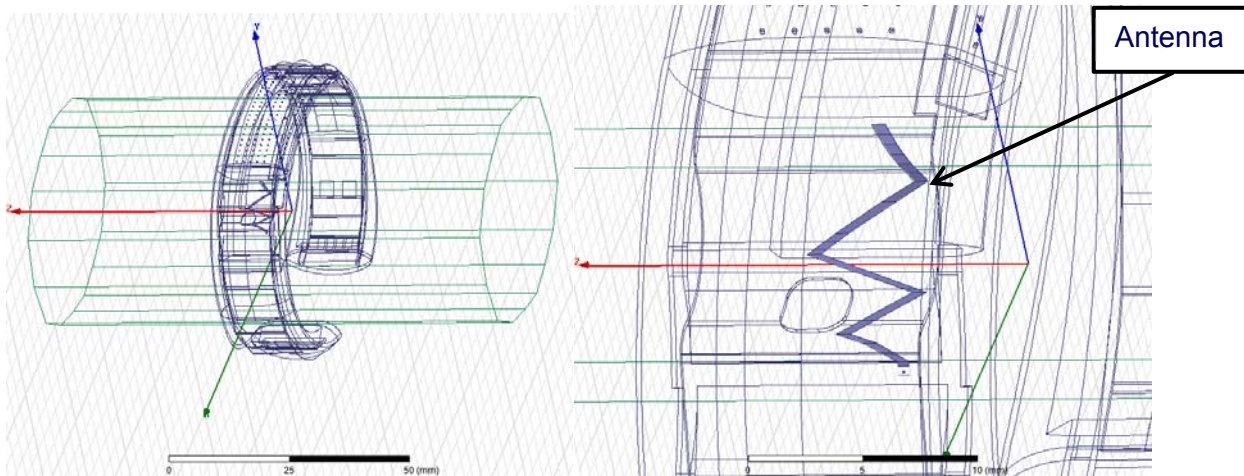
EUT Photo – With USB interface cable



Supplemental Information:

Photo 4

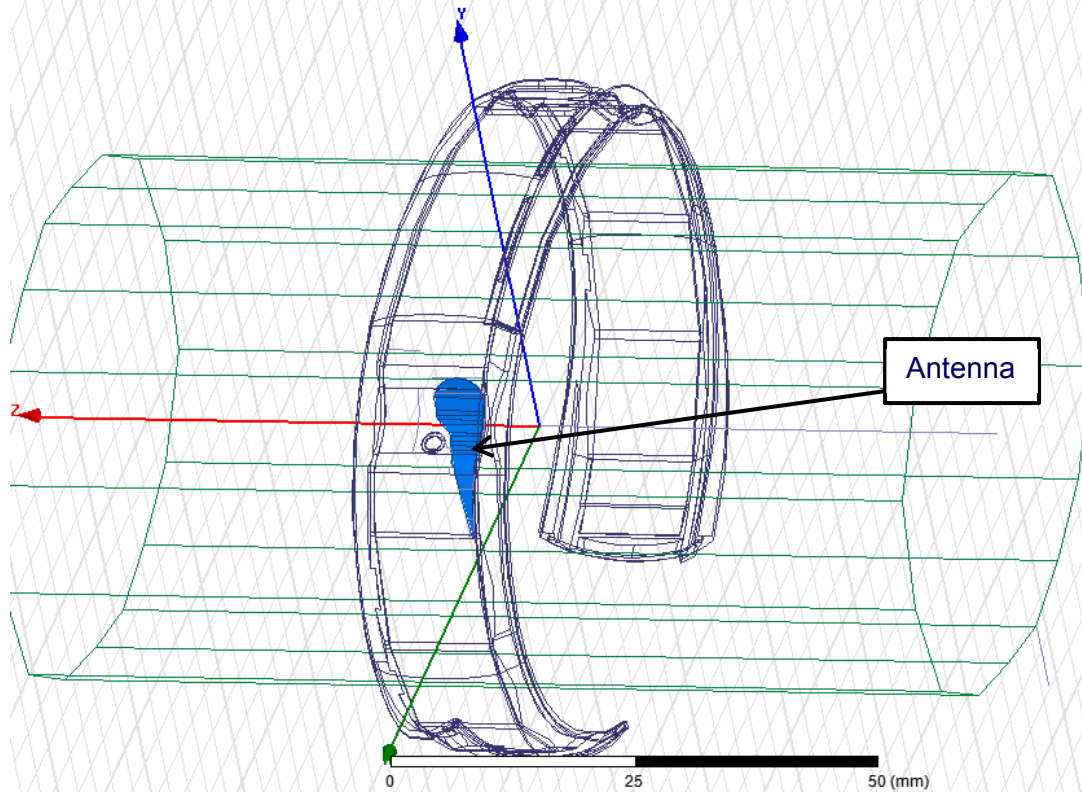
EUT Photo – Small Antenna



Supplemental Information:

Photo 4

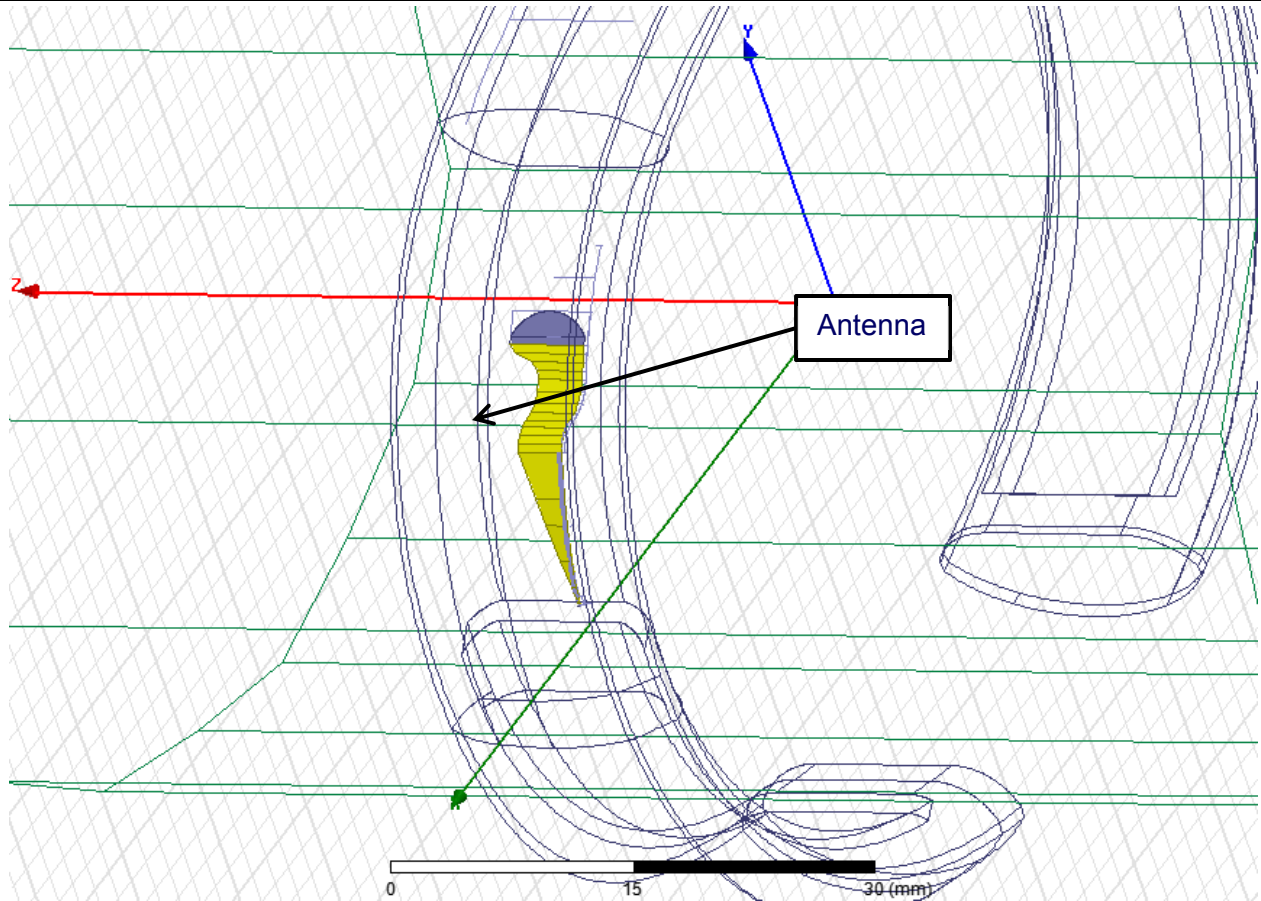
EUT Photo – Medium Antenna



Supplemental Information:

Photo 4

EUT Photo – Large Antenna



Supplemental Information:

Summary of Testing

Possible test case verdicts:

- test case does not apply to the test object : N/A
- test object does meet the requirement: P (Pass)
- test object does not meet the requirement : F (Fail)
- not tested (not part of this evaluation): NT

Date(s) of performance of tests: 14 – 16 Nov-2011

Clause	Test Description	Verdict	Comment
United States: 47 CFR			
15.203	Antenna Requirement	P	
15.207	Conducted Emissions - Mains	P	
15.209	Radiated Emissions – Restricted Bands	P	
15.247(a)(1)	Channel Separation	P	
15.247(a)(1)	Pseudorandom Hopping Sequence	P	
15.247(a)(1)	Receiver Bandwidth and Hopping	P	
15.247(a)(1)	20 dB Occupied Bandwidth	P	
15.247(a)(1)	Number of Hopping Frequencies	P	
15.247(a)(1)	Average Time of Occupancy	P	
15.247(b)	Peak RF Output Power	P	
15.247(d)	Spurious Emissions	P	
15.247(e)	RF Exposure	P	SAR not required
Canada: RSS 210			
RSS GEN 7.2.4	Conducted Emissions - Mains	P	
RSS GEN 7.2.2	Radiated Emissions – Restricted Bands	P	
A8.1	Channel Separation	P	
A8.1	20 dB Occupied Bandwidth	P	
A8.1	Number of Hopping Frequencies	P	
A8.1	Average Time of Occupancy	P	
A8.4	Peak RF Output Power	P	
A8.5	Spurious Emissions	P	
RSS GEN 5.6	RF Exposure	P	SAR not required

Notes:

General remarks:

Summary of compliance with national requirements:

Compliance with these standards provides a means of conformity to be used for United States Federal Communication Commission (FCC) and Industry Canada (IC) certification. Submissions required.

Testing Location	
Testing Laboratory:	Nemko USA, Inc. (Dallas)
Testing location/ address.....	802 N. Kealy Ave. Lewisville, TX 75057 USA
Testing procedure: TMP	
Tested by (name + signature) :	
Approved by (+ signature) :	
Testing location/ address.....	
Supplemental Information:	
Testing results contained herein were performed at the location(s) listed above.	

Procedural Requirements

The following requirements are taken from the appropriate rules, other rules may apply and the manufacturer should consult the full text of the appropriate laws prior to marketing any device.

United States

Mandated procedures for digital devices are defined in 47 CFR 15.201, *Equipment authorization requirement*. Details of the authorization procedures (verification, declaration of conformity, and certification) can be found in 47 CFR, Part 2, Subpart J, *Equipment Authorization Procedures*.

Canada

Industry Canada standard RSS-GEN and RSP 100 contain the procedural requirements.

Information to the User and Labeling Requirements

The following requirements are taken from the appropriate rules, other rules may apply and the manufacturer should consult the full text of the appropriate laws prior to marketing any device.

United States

Labeling

47 CFR 2.925(a) (1) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following: FCC Identifier consisting of the two elements in the exact order

specified in §2.926. The FCC Identifier shall be preceded by the term *FCC ID* in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

FCC ID XXX123

Where XXX = Grantee Code
and 123 = Equipment Product Code (up to 14 characters)

47 CFR 15.19 (a) (3) In addition to the requirements in part 2 of this chapter, a device subject to certification, or verification shall be labeled as follows: All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

47 CFR 15.19(b)(2) Label text and information should be in a size of type large enough to be readily legible, consistent with the dimensions of the equipment and the label. However, the type size for the text is not required to be larger than eight point.

47 CFR 15.19(b)(3): When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (b)(1) of this section on it, such as for a CPU board or a plug-in circuit board peripheral device, the text associated with the logo may be placed in a prominent location in the instruction manual or pamphlet supplied to the user. However, the unique identification (trade name and model number) and the logo must be displayed on the device.

47 CFR 15.19(b)(4): The label shall not be a stick-on, paper label. The label on these products shall be permanently affixed to the product and shall be readily visible to the purchaser at the time of purchase, as described in §2.925(d) of this chapter. "Permanently affixed" means that the label is etched, engraved, stamped, silkscreened, indelibly printed, or otherwise permanently marked on a permanently attached part of the equipment or on a nameplate of metal, plastic, or other material fastened to the equipment by welding, riveting, or a permanent adhesive. The label must be designed to last the expected lifetime of the equipment in the environment in which the equipment may be operated and must not be readily detachable.

Information to User

47 CFR 15.21: The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that:

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

Canada

Labeling

RSS –GEN 5.2: Every unit of Category I radio apparatus certified for marketing and use in Canada shall bear a permanent label on which is indelibly displayed the model number and Industry Canada certification number of

the equipment model (transmitter, receiver, or inseparable combination thereof). Each model shall be identified by a unique combination of a model number and a certification number, which are assigned as described below in this section. The label shall be securely affixed to a permanently attached part of the device, in a location where it is visible or easily accessible to the user, and shall not be readily detachable. The label shall be sufficiently durable to remain fully legible and intact on the device in all normal conditions of use throughout the device's expected lifetime. These requirements may be met either by a separate label or nameplate permanently attached to the device or by permanently imprinting or impressing the label directly onto the device.

The label text shall be legible without the aid of magnification, but is not required to be larger than 8-point font size. If the device is too small to meet this condition, the label information may be included in the user manual upon agreement with Industry Canada.

The model number is assigned by the applicant and shall be unique to each model of radio apparatus under that applicant's responsibility. The model number shall be displayed on the label preceded by the text: "Model:", so it appears as follows:

Model: model number assigned by applicant

The certification number is made up of a Company Number (CN) assigned by Industry Canada's Certification and Engineering Bureau followed by the Unique Product Number (UPN), assigned by the applicant.

The certification number shall appear as follows:

IC: XXXXXX-YYYYYYYYYYY

where:

- XXXXXX-YYYYYYYYYYY is the certification number;
- XXXXXX is the Company Number (CN) assigned by Industry Canada, made of at most 6 alphanumeric characters (A-Z, 0-9), including a letter at the end of the CN to distinguish between different company addresses;
- YYYYYYYYYYY is the Unique Product Number (UPN) assigned by the applicant, made of at most 11 alphanumeric characters (A-Z, 0-9); and the letters "IC" (Industry Canada) are to indicate the Industry Canada certification number, but are not part of the certification number.

Permitted alphanumerical characters used in the CN and UPN are limited to capital letters (A-Z) and numerals (0-9). Example: A company has been assigned a CN of "21A" and wishes to use a UPN of "WILAN3" for one of its products. The full Industry Canada certification number of this product would thus be: IC: 21A-WILAN3.

Category I equipment that is not labeled with the model number and the certification number as described above is not considered certified in Canada.

Notices to the User

RSS-GEN 5.3: Radio apparatus shall comply with the requirements to include required notices or statements to the user of equipment with each unit of equipment model offered for sale.

The required notices are specified in the RSS documents (including RSS-Gen) applicable to the equipment model. These notices are required to be shown in a conspicuous location in the user manual for the equipment, or to be displayed on the equipment model. If more than one notice is required, the equipment model(s) to which each notice pertains should be identified. Suppliers of radio apparatus shall provide notices and user information in both English and French.

RSS-GEN 7.1.3: User manuals for licence-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both.

This device complies with Industry Canada licence-exempt RSS standard(s).
Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

User manuals for transmitters shall display the following notice in a conspicuous location:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (*identify the device by certification number, or model number if Category II*) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi) and required impedance for each.

Technical Requirements

The testing requirements, as appropriate, were derived from ANSI C63.4; 47 CFR, Subpart A; RSS 210; and RSS GEN.

Conducted Emissions

The mains cable of the EUT or EUT host unit was connected to the LISN defined in this standard and is bonded to the reference plane. Where applicable, remaining auxiliary equipment was powered through an additional LISN (also bonded to the reference plane), using a multi-socket outlet strip if necessary. The LISNs were at least 0.8m away from the EUT. A vertical ground plane was used while the table-top EUTs were placed on a wooden table 0.8m high. Floor-standing EUTs were insulated from the ground plane and grounded according to the manufacturer's instructions.

Signal cables were positioned for their entire lengths, as far as possible, at a nominal distance of 0.4 m from the ground reference plane. Where the mains cable supplied by the manufacturer was longer than 1 m, the excess was folded at the center into a bundle no longer than 0.4 m, so that its length is shortened to 1 m. If the 1 m cable length cannot be achieved owing to physical limitations of the EUT arrangement, the cable length shall be as near to 1 m as possible.

All telecommunication and signal ports were correctly terminated using either appropriate associated equipment or a representative termination during the measurement of the conducted disturbances at the

mains. If an ISN is connected to a telecommunications port during the measurement of conducted disturbances at the mains port, then the ISN receiver port was terminated in 50Ω. The ISNs were at least 0.8m away from the EUT.

Mains

Any power cable(s) from the equipment under test that were directly connected to the AC Mains have been tested. In the event that the equipment under test had no direct connection to the Mains, that is, it was connected to a Host unit (example: USB powered); then conducted emissions was performed on the Mains of the Host unit. Battery powered equipment was not tested for conducted emissions; however, if the equipment makes provisions for connections to a battery charger that is connected to the Mains, then conducted emissions were performed on the battery charger.

Table 5 – Class B Conducted Emissions Limits - Mains

Frequency	Limits (dBμV)	
	Quasi-peak	Average
150 kHz – 500 kHz	66 - 56	5-46
500 kHz – 5 MHz	56	46
5 MHz – 30 MHz	60	50
NOTE 1: The lower limit shall apply at the transition frequency. NOTE 2: The limit decreases linearly with the logarithm of the frequency in the range 150 kHz to 500 kHz.		

Radiated Emissions

Restricted Bands

The arrangement of the equipment is typical of a normal installation practice and as was practical, the arrangement was varied and emissions investigated for maximum amplitude. Final measurements were performed in a semi-anechoic chamber or on an open area test site (OATS). The equipment was rotated 360° and the antenna height has been varied between 1m and 4m. Measurements were taken at both horizontal and vertical antenna polarities. The receiver bandwidth was set to 120 kHz for measurements below 1 GHz, and 1 MHz for measurements above 1 GHz. A peak detector is used to detect an emission; a quasi-peak detector may be used to record a final measurement below 1 GHz and an average detector may be used above 1 GHz. An inverse proportionality factor of 20 dB/decade (10 dB) was used, as noted in 15.31(f)(1), to normalize the measured data to the specified test distance for determining compliance.

Table 6 - Frequency range of radiated measurements (15.33(a))

Operating frequency of intentional radiator	Lowest frequency searched	Highest frequency searched
Below 10 GHz	9 kHz or lowest operating frequency generated in the device, whichever is highest	10 th harmonic of highest fundamental frequency or 40 GHz, whichever is lower
10 – 30 GHz	9 kHz or lowest operating frequency generated in the device, whichever is highest	5 th harmonic of highest fundamental frequency or 100 GHz, whichever is lower
At or above 30 GHz	9 kHz or lowest operating frequency generated in the device, whichever is highest	5 th harmonic of highest fundamental frequency or 200 GHz, whichever is lower

Table 7 – Restricted Bands (47 CFR 15.205)

MHz	MHz	MHz	GHz
0.090-0.110	16.42–16.423	399.9–410	4.5–5.15
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	2690–2900	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	
13.36–13.41			

Table 8 – Restricted Bands (RSS-GEN)

MHz	MHz	MHz	GHz
0.090-0.110	12.57675-12.57725	960-1427	9.0-9.2
2.1735-2.1905	13.36-13.41	1435-1626.5	9.3-9.5
3.020-3.026	16.42-16.423	1645.5-1646.5	10.6-12.7
4.125-4.128	16.69475-16.69525	1660-1710	13.25-13.4
4.17725-4.17775	16.80425-16.80475	1718.8-1722.2	14.47-14.5
4.20725-4.20775	25.5-25.67	2200-2300	15.35-16.2
5.677-5.683	37.5-38.25	2310-2390	17.7-21.4
6.125-6.218	73-74.6	2655-2900	22.01-23.12
6.6775-6.26825	74.8-75.2	3260-3267	23.6-24.0
6.31175-6.31225	108-138	3332-3339	31.2-31.8
8.291-8.294	156.52475-156.52525	3345.8-3358	36.43-36.5
8.362-8.366	156.7-156.9	3500-4400	Above 38.6
8.37625-8.38675	240-285	4500-5150	
8.41425-8.41475	322-335.4	5350-5460	
12.29-12.293	399.9-410	7250-7750	
12.51975-12.52025	608-614	8025-8500	

Radiated Emission Limit

Reading on the measuring receiver showing fluctuations close to the limit, were observed for at least 15 s at each measurement frequency; the highest reading was recorded.

Table 9 – Radiated Emissions Limits per 47 CFR 15.209(a) & RSS-GEN 7.2.5

Frequency Range	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance (m)
9 kHz – 490 kHz	2400/F(kHz)	48.5 – 13.8	300
490 kHz – 1.705 MHz	24000/F(kHz)	33.6 – 23.0	30
1.705 MHz – 30 MHz	30	29.5	30
30 MHz – 88 MHz	100	40.0	3
88 MHz – 216 MHz	150	43.5	3
216 MHz – 960 MHz	200	46.0	3
Above 960 MHz	500	54.0	3

Channel Separation

15.247(a)(1) and RSS 210 A8.1(b): 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 2400 – 2483.5 MHz band 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 the systems operate with an output power no greater than 125 mW.

EUT configuration	The EUT is set to normal hopping mode
Spectrum analyzer settings	
Span	wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW)	≥ 1% of the span
Video (or Average) Bandwidth (VBW)	≥ RBW
Sweep	Auto
Detector Function	Peak
Trace	Max Hold

Pseudorandom Hopping

15.247(a)(1) and RSS 210 A8.1(a): The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter.

The pseudorandom hopping sequence is verified through an evaluation of a sample hop table and a description of the hopping algorithm provided by the manufacturer.

Receiver Bandwidth and Hopping

15.247(a)(1) and RSS 210 A8.1(a): The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Receiver bandwidth and hopping is verified through a technical description provided by the manufacturer.

20 dB Occupied Bandwidth

15.247(a)(1)(i) and RSS 210 A8.1(c): The maximum 20 dB occupied bandwidth for frequency hopping transmitters operating in the 902 – 928 MHz band is 500 kHz.

15.247(a)(1)(ii) and RSS 210 A8.1(e): The maximum 20 dB bandwidth of the hopping channel is 1 MHz for frequency hopping systems operating in the 5725 – 5850 MHz.

The 20 dB Occupied Bandwidth is measured at low, mid, and high channels and with each modulation mode.

Spectrum analyzer settings	:	
Span	:	~ 2 to 3 times the 20 dB bandwidth, centered on a hopping channel wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW)	:	≥ 1% of the 20 dB bandwidth
Video (or Average) Bandwidth (VBW)	:	≥ RBW
Sweep	:	Auto
Detector Function	:	Peak
Trace	:	Max Hold

Number of Hopping Channels

15.247(a)(1)(i) and RSS 210 A8.1(c): For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies

15.247(a)(1)(ii) and RSS 210 A8.1(e): Frequency hopping systems operating in the 5725–5850 MHz band shall use at least 75 hopping frequencies.

15.247(a)(1)(iii) and RSS 210 A9.1(d): Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

EUT configuration	:	The EUT is set in its normal hopping mode
Spectrum analyzer settings	:	
Span	:	The frequency band of operation
Resolution (or IF) Bandwidth (RBW)	:	≥ 1% of the span
Video (or Average) Bandwidth (VBW)	:	≥ RBW
Sweep	:	Auto
Detector Function	:	Peak
Trace	:	Max Hold

Average Time of Occupancy

15.247(a)(1)(i) and RSS 210 A8.1(c): For frequency hopping systems operating in the 902-928 MHz:

20 dB bandwidth	Minimum number of channels	Average time of occupancy
<250 kHz	50	Not greater than 0.4 sec. within 20 sec. period
≥250 kHz	25	Not greater than 0.4 sec. within 10 sec. period

15.247(a)(1)(ii) and RSS 210 A8.1(e): For frequency hopping systems operating in the 5725–5850 MHz band:

20 dB bandwidth	Minimum number of channels	Average time of occupancy
≤1 MHz	75	Not greater than 0.4 sec. within 30 sec. period

15.247(a)(1)(iii) and RSS 210 A8.1(d): For frequency hopping systems operating in the 2400 – 2483.5 MHz band:

Minimum number of channels	Average time of occupancy
15	Not greater than 0.4 sec. within (0.4 x no. of hopping channels) sec. period

Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

EUT configuration	The EUT is set in its normal hopping mode
Spectrum analyzer settings	
Span	zero span, centered on a hopping channel
Resolution (or IF) Bandwidth (RBW)	≥ 1 MHz
Video (or Average) Bandwidth (VBW)	≥ RBW
Sweep	as necessary to capture the entire dwell time per hopping channel
Detector Function	Peak
Trace	Max Hold

Table 10 – Peak RF Output Power per 15.247(2)(b)(1) and RSS 210 A8.4(2) and (3)

Frequency Band	Minimum No. of Non-Overlapping Hopping Channels	Maximum Peak RF Power at antenna
2400-2483.5 MHz	75	1 watt
2400-2483.5 MHz	All other	0.125 watt
5725-5850 MHz	-	1 watt

For frequency hopping systems operating in the 902–928 MHz band:

Table 11 - Peak RF Output Power per 15.247(2)(b)(2) and RSS 210 A8.4(4)

Frequency Band	Minimum No. of Non-Overlapping Hopping Channels	Maximum Peak RF Power at antenna
902-928 MHz	50	1 watt
902-928 MHz	<50 but at least 25	0.250 watt

EUT test mode: The peak rf output power shall be measured at low, mid, and high channels and for each modulation mode. The input voltage shall be varied to determine if the rf power output changes as a result. If the device is battery powered the test is performed with a fully charged or new battery.

EUT configuration	Transmit at low, middle, and high channel with each modulation
Spectrum analyzer settings	
Span	~5 times the 20 dB bandwidth, centered on a hopping channel
Resolution (or IF) Bandwidth (RBW)	> the 20 dB bandwidth of the emission being measured
Video (or Average) Bandwidth (VBW)	≥ RBW
Sweep	Auto
Detector Function	Peak
Trace	Max Hold

Spurious Emissions

15.247(d) and RSS 210 A8.5: 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, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits is not required. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits specified.

EUT configuration	
Spectrum analyzer settings	
Span	Wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10 th harmonic. Typically, several plots are required to cover this entire span.
Resolution (or IF) Bandwidth (RBW)	100 kHz
Video (or Average) Bandwidth (VBW)	≥ RBW
Sweep	Auto
Detector Function	Peak
Trace	Max Hold

Band edge spurious emissions

EUT configuration	:	
Measurement shall be made in these bands ..	:	2310 – 2390 MHz 2483.5 – 2500 MHz
Span	:	Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
Resolution (or IF) Bandwidth (RBW)	:	≥ 1% of the span
Video (or Average) Bandwidth (VBW)	:	≥ RBW
Sweep	:	Auto
Detector Function	:	Peak
Trace	:	Max Hold

Measurement Uncertainty

Determining compliance with the limits in these standards was based on the results of the measurement, and does not take into account the measurement instrumentation uncertainty.

Measurement	Expanded Uncertainty
Conducted Emissions – AC Mains	± 3.46 dB
Radiated Emissions	± 4.90 dB
RF Power – Antenna Conducted	± 1.34 dB
RF Spurious Emissions – Antenna Conducted	± 1.34 dB
Occupied Bandwidth	± 1.15 kHz

List of Test Equipment

The following test equipment was used in the performance of the testing herein.

Table 12 – Test Equipment Used

Asset Tag	Description	Manufacturer	Model	Serial Number	Cal. Date	Cal. Due
674	Limiter	Hewlett Packard	11947A	3107A02200	01-Nov-2011	01-Nov-2012
703	LISN	Rohde & Schwarz	ESH2-Z5	871884/048	13-Jul-2011	13-Jul-2012
749	Cable, 4.8m	Nemko USA, Inc.	RG223	None	25-Feb-2011	25-Feb-2012
1025	Preamplifier, 25dB	Nemko USA, Inc.	LNA25	399	23-Feb-2011	23-Feb-2012
1659	Spectrum Analyzer	Rohde & Schwartz	FSP	973353	27-Sep-2010	27-Sep-2012
1763	Antenna, Bilog	Schaffner	CBL 6111D	22926	11-Feb-2011	11-Feb-2012
1767	Receiver, EMI Test 20Hz - 26.5 GHz	Rohde & Schwartz	ESIB26	837491/0002	01-Dec-2010	01-Dec-2011
1783	Cable Assy, 3m Chamber	Nemko	Chamber	None	26-Sep-2011	26-Sep-2012
1482	High Pass Filter	K&L Microwave	11SH10- 4000/T12000- 0	2	N/R	N/R

Test Results – Antenna Requirement

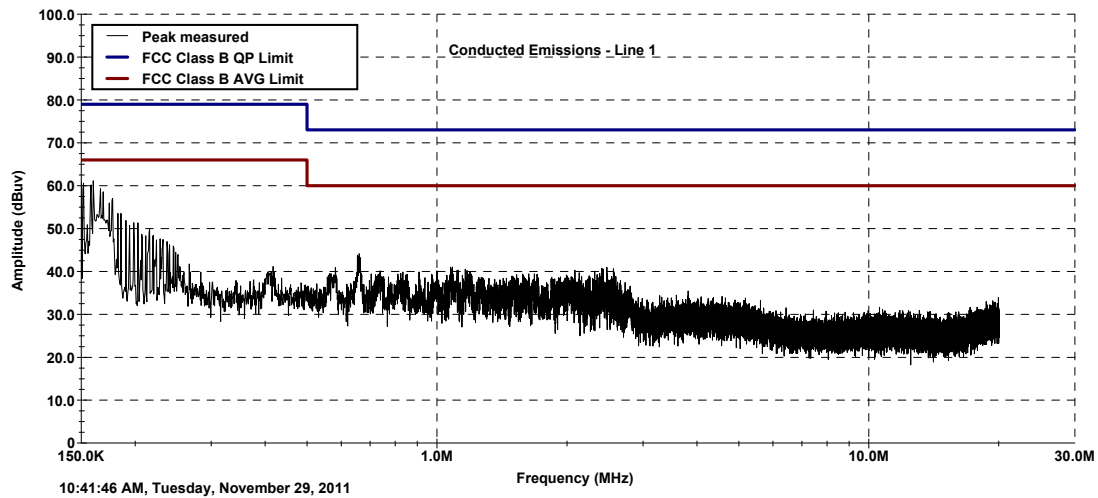


Table No. 1	Antenna requirement	Verdict
Type of antenna connection Type of unique connector Method of permanent connection Antenna gain	☒ Integral antenna ☐ Permanently attached ☐ Unique connector No rf connector PCB antenna Small antenna: 0.35 dBi Medium antenna: 0.70 dBi Large antenna: 0.58 dBi	P
Supplemental Information:		
Antennas are an integral part of the device. There are three sizes and designs: one for each size of band.		
Tested by (+ signature): David Light 		

Test Results – Conducted Emissions - Mains

Table No. 2	Conducted Emissions - Mains	Verdict
		P

Frequency Range: 150 kHz to 30 MHz Test Location: Lab 3
 Test Method.....: ANSI C63.4
 EUT Configuration: Plugged into USB port. Transmit channel 59 PL 17
 Power Input.....: 120VAC 50/60 Hz ☒ 1 ϕ ☐ 3 ϕ Line Tested .: Neutral
 Test Date: 29-Nov-11
 Temperature: 23°C Relative Humidity: 25 %
 Test Equipment Asset Tag List : 0703,1659,0674,0749



Detector	Frequency (MHz)	Receiver Reading (dB μ V)	Site Correction Factor (dB)	Emission Level (dB μ V)	Quasi-Peak		Average		Pass/Fail
					Limit (dB μ V)	Margin (dB)	Limit (dB μ V)	Margin (dB)	
QPk	0.1532	48.0	9.8	57.8	79.0	21.2	66.0	8.2	Pass
QPk	0.1595	47.4	9.8	57.2	79.0	21.8	66.0	8.8	Pass
QPk	0.1603	47.0	9.8	56.8	79.0	22.2	66.0	9.2	Pass
QPk	0.1751	43.0	9.9	52.9	79.0	26.1	66.0	13.1	Pass
QPk	0.1792	41.0	9.9	50.8	79.0	28.2	66.0	15.2	Pass
QPk	0.1836	40.4	9.9	50.3	79.0	28.7	66.0	15.7	Pass

(5) = (3) + (4) (7) = (6) – (5) (9) = (8) – (5)

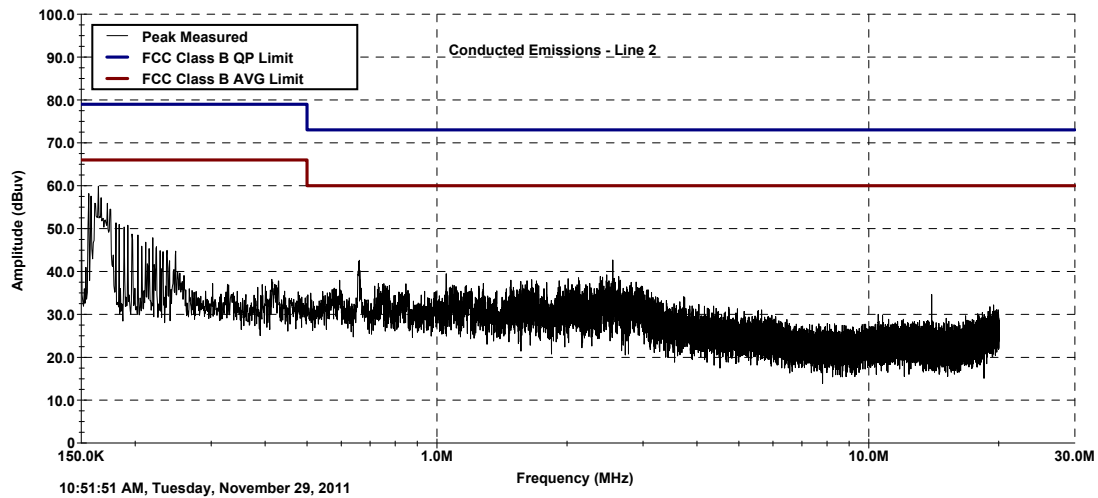
Supplemental Information:

Testing was performed on the laptop host with the EUT plugged into the USB port of the host.

Tested by (+ signature): David Light

Table No. 3	Conducted Emissions - Mains	Verdict
		P

Frequency Range: 150 kHz to 30 MHz Test Location: Lab 3
 Test Method.....: ANSI C63.4
 EUT Configuration: Plugged into USB port. Transmit channel 59 PL 17
 Power Input.....: 20VAC 50/60 Hz ☒ 1 ϕ ☐ 3 ϕ Line Tested .: Phase A
 Test Date: 29-Nov-11
 Temperature: 23°C Relative Humidity: 25 %
 Test Equipment Asset Tag List : 0703,1659,0674,0749



Detector	Frequency (MHz)	Receiver Reading (dB μ V)	Site Correction Factor (dB)	Emission Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Limit (dB μ V)	Margin (dB)	Pass/Fail
QPk	0.1566	48.0	9.8	57.8	79.0	21.2	66.0	8.2	Pass
QPk	0.1575	46.9	9.8	56.7	79.0	22.3	66.0	9.3	Pass
QPk	0.1660	45.4	9.8	55.2	79.0	23.8	66.0	10.8	Pass

(5) = (3) + (4) (7) = (6) - (5) (9) = (8) - (5)

Supplemental Information:

Testing was performed on the laptop host with the EUT plugged into the USB port of the host.

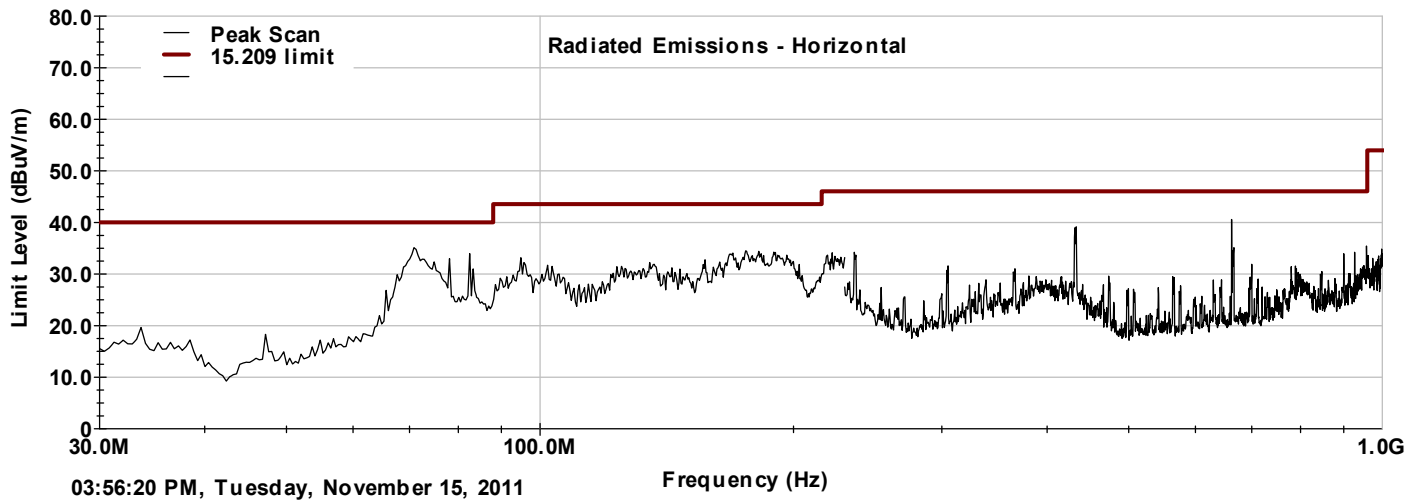
Tested by (+ signature)

David Light

Test Results – Radiated Emissions – Restricted Bands

Table No. 4	Radiated Emissions – Restricted Bands – Horizontal	Verdict
		P

Frequency Range : 30 MHz to 1 GHz Test Location : 3m Chamber
 Test Method..... : ANSI C63.4 and DA 00-705
 Test Distance : 3m
 EUT Configuration : Transmit PL 14 on channels 0, 59, and 39
 Test Date : 15-Nov-11
 Temperature : 24°C Relative Humidity : 32 %
 Test Equipment Asset Tag List : 1767, 1763, 1783, 1025, 1482



(1)	(2)	(3)	(6)	(7)	(8)	(9)	(10)	(11)
Antenna Polarity (H/V)	Detector	Frequency (MHz)	Receiver Reading (dBμV/m)	Site Correction Factor (dB/m)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pass/Fail
H	QPk	33.8272	26.8	-10.3	16.5	40.0	23.5	Pass
H	QPk	71.1618	51.4	-20.5	31.0	40.0	9.0	Pass
H	QPk	175.4710	48.2	-16.7	31.5	43.5	12.0	Pass

$$(8) = (6) + (7) \quad (10) = (9) - (8)$$

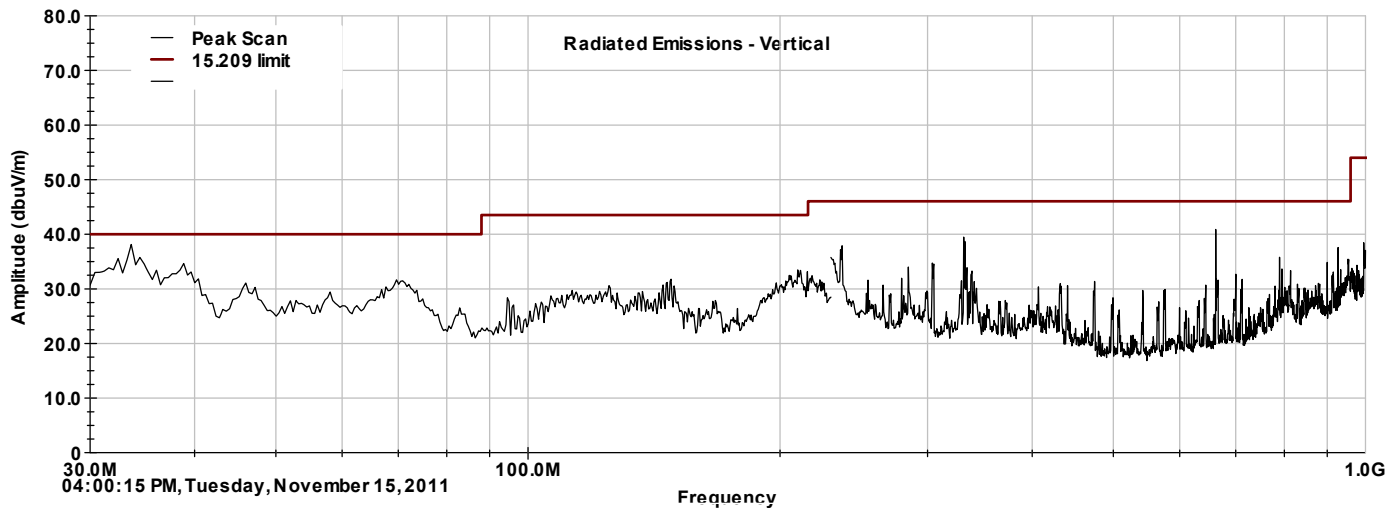
Supplemental Information:

The spectrum was searched from 30 MHz up to 10 x the highest fundamental transmit frequency.
 The above graph is the emission measurement with peak detector using 120 kHz RBW/300 kHz VBW.
 Testing was performed on low, mid, and high channels.
 The EUT was rotated in three orthogonal axis to determine worst-case orientation.

Tested by (+ signature): David Light

Table No. 5	Radiated Emissions – Restricted Bands – Vertical	Verdict
		P

Frequency Range : 30 MHz to 1 GHz Test Location : 3m Chamber
 Test Method..... : ANSI C63.4 and DA 00-705
 Test Distance : 3m
 EUT Configuration : Transmit PL 14 on channels 0, 59, and 39
 Test Date : 15-Nov-11
 Temperature : 24°C Relative Humidity : 32 %
 Test Equipment Asset Tag List : 1767, 1763, 1783, 1025, 1482



(1)	(2)	(3)	(6)	(7)	(8)	(9)	(10)	(11)
Antenna Polarity (H/V)	Detector	Frequency (MHz)	Receiver Reading (dBμV/m)	Site Correction Factor (dB/m)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pass/Fail
V	QPk	33.8272	46.2	-10.3	35.8	40.0	4.2	Pass
V	QPk	210.3600	47.8	-15.9	31.9	43.5	11.6	Pass

$$(8) = (6) + (7) \quad (10) = (9) - (8)$$

Supplemental Information:

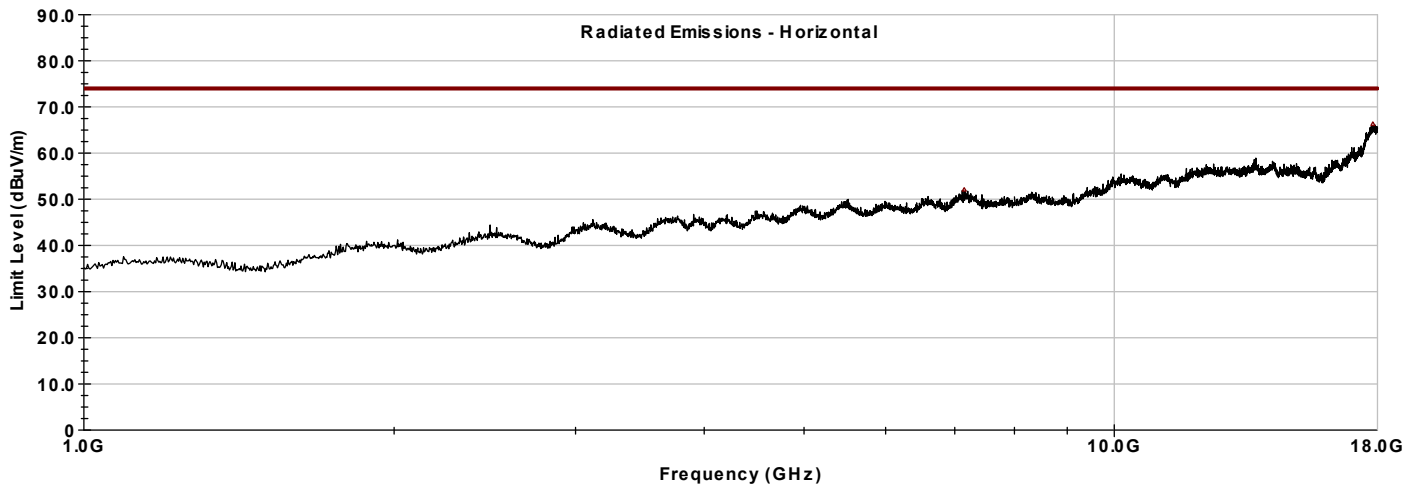
The spectrum was searched from 30 MHz up to 10 x the highest fundamental transmit frequency.
 The above graph is the emission measurement with peak detector using 120 kHz RBW/300 kHz VBW.
 Testing was performed on low, mid, and high channels.
 The EUT was rotated in three orthogonal axis to determine worst-case orientation.

Tested by (+ signature)

David Light

Table No. 6	Radiated Emissions – Restricted Bands - Horizontal	Verdict
		P

Frequency Range : Above 1 GHz Test Location : 3m Chamber
 Test Method..... : ANSI C63.4 and DA 00-705
 Test Distance : 3m
 EUT Configuration : Medium band - TX PL 14 on channel 0
 Test Date : 15-Nov-11
 Temperature : 24°C Relative Humidity : 32 %
 Test Equipment Asset Tag List : 1767, 1763, 1783, 1025, 1482



(1)	(2)	(3)	(6)	(7)	(8)	(9)	(10)	(11)
Antenna Polarity (H/V)	Detector	Frequency (MHz)	Receiver Reading (dBμV/m)	Site Correction Factor (dB/m)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pass/Fail
H	Avg	7,150.0000	25.5	15.9	41.4	54.0	12.6	Pass

(8) = (6) + (7) (10) = (9) – (8)

Supplemental Information:

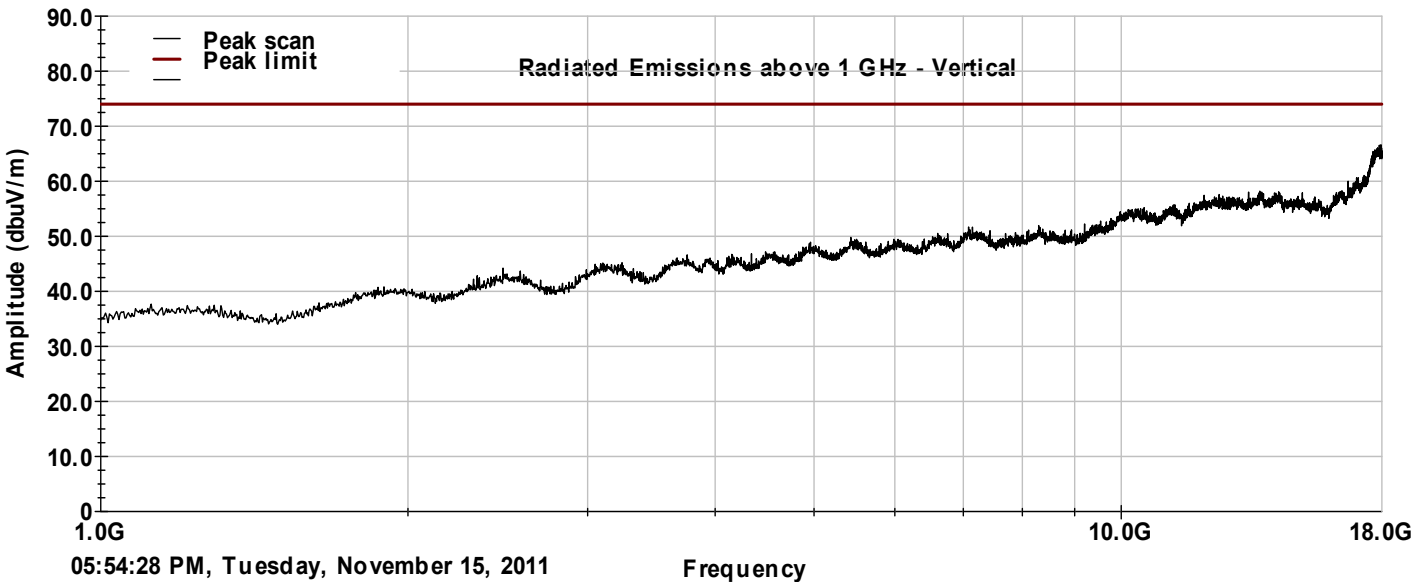
Testing was performed on low, mid, and high channels.
 The EUT was rotated in three orthogonal axis to determine worst-case orientation.
 The spectrum was searched from 30 MHz up to 10 x the highest fundamental transmit frequency.
 The above graph is the emission measurement with peak detector using 1 MHz RBW/1MHz VBW.
 Average emission levels are measured with peak detector using 1 MHz RBW.10 Hz VBW
 Emissions in **bold** font are reduced an additional 10.9 dB to allow for duty cycle correction.

Tested by (+ signature): David Light



Table No. 7	Radiated Emissions – Restricted Bands - Vertical	Verdict P
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Frequency Range : Above 1 GHz Test Location : 3m Chamber
 Test Method..... : ANSI C63.4 and DA 00-705
 Test Distance : 3m
 EUT Configuration : Medium band - TX PL 14 on channel 0
 Test Date : 15-Nov-11
 Temperature : 24°C Relative Humidity : 32 %
 Test Equipment Asset Tag List : 1767, 1763, 1783, 1025, 1482



(1)	(2)	(3)	(6)	(7)	(8)	(9)	(10)	(11)
Antenna Polarity (H/V)	Detector	Frequency (MHz)	Receiver Reading (dBμV/m)	Site Correction Factor (dB/m)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pass/Fail
H	Avg	7,086.0000	25.6	15.9	41.5	54.0	12.5	Pass

(8) = (6) + (7) (10) = (9) – (8)

Supplemental Information:

Testing was performed on low, mid, and high channels.
 The EUT was rotated in three orthogonal axis to determine worst-case orientation.
 The spectrum was searched from 30 MHz up to 10 x the highest fundamental transmit frequency.
 The above graph is the emission measurement with peak detector using 1 MHz RBW/1MHz VBW.
 Average emission levels are measured with peak detector using 1 MHz RBW.10 Hz VBW
 Emissions in **bold** font are reduced an additional 10.9 dB to allow for duty cycle correction.

Tested by (+ signature)

David Light





Table No. 8	Radiated Emissions	Verdict
		P

Frequency Range : Above 1 GHz Test Location : 3m Chamber

Test Method..... : ANSI C63.4

EUT Configuration : Small band – TX PL 14 – Highest channel

Test Date : 13-Dec-11

Temperature : 25°C

Relative Humidity : 37 %

Test Equipment Asset Tag List : 1767, 1763, 1783, 1025, 1482

Detector	Frequency (MHz)	Ant. Pol.	Receiver Reading (dBµV/m)	Site Correction Factor (dB/m)	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pass/Fail
Peak	2,483.5000	H	34.5	3.6	38.1	74.0	35.9	Pass
Average	2,483.5000	H	24.5	3.6	28.1	54.0	25.9	Pass
Peak	2,483.5000	V	34.7	3.6	38.3	74.0	35.7	Pass
Average	2,483.5000	V	24.3	3.6	27.9	54.0	26.1	Pass
Peak	4,882.0000	H	44.0	10.9	54.9	74.0	19.1	Pass
Average	4,882.0000	H	31.0	10.9	41.9	54.0	12.1	Pass
Peak	4,882.0000	V	45.0	10.9	55.9	74.0	18.1	Pass
Average	4,882.0000	V	35.3	10.9	46.2	54.0	7.8	Pass
Peak	7,323.0000	H	44.2	16.4	60.6	74.0	13.4	Pass
Average	7,323.0000	H	33.0	16.4	49.4	54.0	4.6	Pass
Peak	7,323.0000	V	42.0	16.4	58.4	74.0	15.6	Pass
Average	7,323.0000	V	32.8	16.4	49.2	54.0	4.8	Pass
Peak	9,764.0000	H	42.8	17.0	59.8	74.0	14.2	Pass
Average	9,764.0000	H	30.5	17.0	47.5	54.0	6.5	Pass
Peak	9,764.0000	V	42.8	17.0	59.8	74.0	14.2	Pass
Average	9,764.0000	V	30.5	17.0	47.5	54.0	6.5	Pass
Peak	12,205.0000	H	41.2	21.7	62.9	74.0	11.1	Pass
Average	12,205.0000	H	25.0	21.7	46.7	54.0	7.3	Pass
Peak	12,205.0000	V	41.2	21.7	62.9	74.0	11.1	Pass
Average	12,205.0000	V	25.0	21.7	46.7	54.0	7.3	Pass

Supplemental Information:

Testing was performed on low, mid, and high channels.

The EUT was rotated in three orthogonal axis to determine worst-case orientation.

The spectrum was searched from 30 MHz up to 10 x the highest fundamental transmit frequency.

The above graph is the emission measurement with peak detector using 1 MHz RBW/1MHz VBW.

Average emission levels are measured with peak detector using 1 MHz RBW.10 Hz VBW

Emissions in **bold** font are reduced an additional 10.9 dB to allow for duty cycle correction.

Tested by

David Light



Table No. 9	Radiated Emissions	Verdict
		P

Frequency Range : Above 1 GHz Test Location : 3m Chamber
 Test Method..... : ANSI C63.4
 EUT Configuration : Large with transmitter operating at PL13 pi/4DPSK modulation
 Test Date : 10-Jan-12
 Temperature : 25°C Relative Humidity : 37 %
 Test Equipment Asset Tag List : 1767, 1763, 1783, 1025, 1482

Detector	Frequency (MHz)	Ant. Pol.	Receiver Reading (dBµV/m)	Site Correction Factor (dB/m)	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pass/Fail
Peak	2,483.5000	H	34.5	2.7	37.2	74.0	36.8	Pass
Average	2,483.5000	H	24.5	2.7	27.2	54.0	26.8	Pass
Peak	2,483.5000	V	34.7	2.7	37.4	74.0	36.6	Pass
Average	2,483.5000	V	24.3	2.7	27.0	54.0	27.0	Pass
Peak	4,882.0000	H	55.4	7.7	63.1	74.0	10.9	Pass
Average	4,882.0000	H	42.3	7.7	50.0	54.0	4.0	Pass
Peak	4,882.0000	V	54.6	7.7	62.3	74.0	11.7	Pass
Average	4,882.0000	V	42.3	7.7	50.0	54.0	4.0	Pass
Peak	7,323.0000	H	43.0	10.6	53.6	74.0	20.4	Pass
Average	7,323.0000	H	31.5	10.6	42.1	54.0	11.9	Pass
Peak	7,323.0000	V	42.2	10.6	52.8	74.0	21.2	Pass
Average	7,323.0000	V	38.2	10.6	48.8	54.0	5.2	Pass
Peak	9,764.0000	H	42.8	10.0	52.8	74.0	21.2	Pass
Average	9,764.0000	H	30.5	10.0	40.5	54.0	13.5	Pass
Peak	9,764.0000	V	44.3	10.0	54.3	74.0	19.7	Pass
Average	9,764.0000	V	31.5	10.0	41.5	54.0	12.5	Pass
Peak	12,205.0000	H	41.2	14.5	55.7	74.0	18.3	Pass
Average	12,205.0000	H	25.0	14.5	39.5	54.0	14.5	Pass
Peak	12,205.0000	V	41.2	14.5	55.7	74.0	18.3	Pass
Average	12,205.0000	V	25.0	14.5	39.5	54.0	14.5	Pass

Supplemental Information:

Testing was performed on low, mid, and high channels.
 The EUT was rotated in three orthogonal axis to determine worst-case orientation.
 The spectrum was searched from 30 MHz up to 10 x the highest fundamental transmit frequency.
 The above graph is the emission measurement with peak detector using 1 MHz RBW/1MHz VBW.
 Average emission levels are measured with peak detector using 1 MHz RBW.10 Hz VBW
 Emissions in **bold** font are reduced an additional 10.9 dB to allow for duty cycle correction.

Tested by

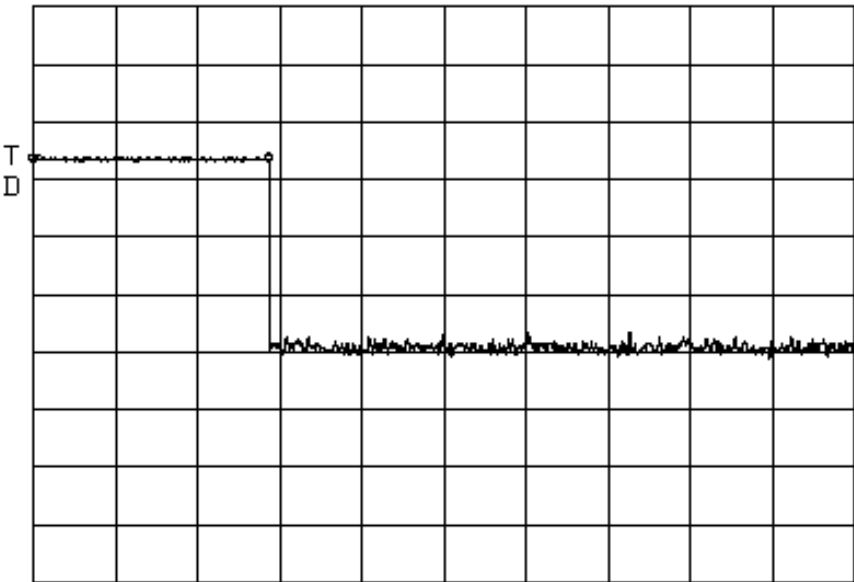
David Light

Table No. 10	Duty Cycle Correction	Verdict
		P

Frequency Range : Above 1 GHz Test Location : 3m Chamber
 Test Method : ANSI C63.4 and DA 00-705
 Test Distance : 3m
 EUT Configuration : Transmit normal hopping sequence
 Test Date : 15-Nov-11
 Temperature : 24°C Relative Humidity : 32 %
 Test Equipment Asset Tag List : 1767, 1763, 1783, 1025, 1482

*ATTEN 0dB
RL -10.0dBm 10dB/

ΔMKR 0dB
28.67ms



Duty cycle
 28.67 ms in 100 ms
 $20 \log(0.2867) = -10.9 \text{ dB}$

CENTER 2.441000000GHz

SPAN 0Hz

*RBW 1.0MHz

*VBW 100kHz

*SWP 100ms

Duty cycle calculation:

$$20 \log \left(\frac{TX \text{ on (msec.)}}{100 \text{ msec.}} \right) = \text{Duty cycle correction factor}$$

Supplemental Information:

Tested by (+ signature) :

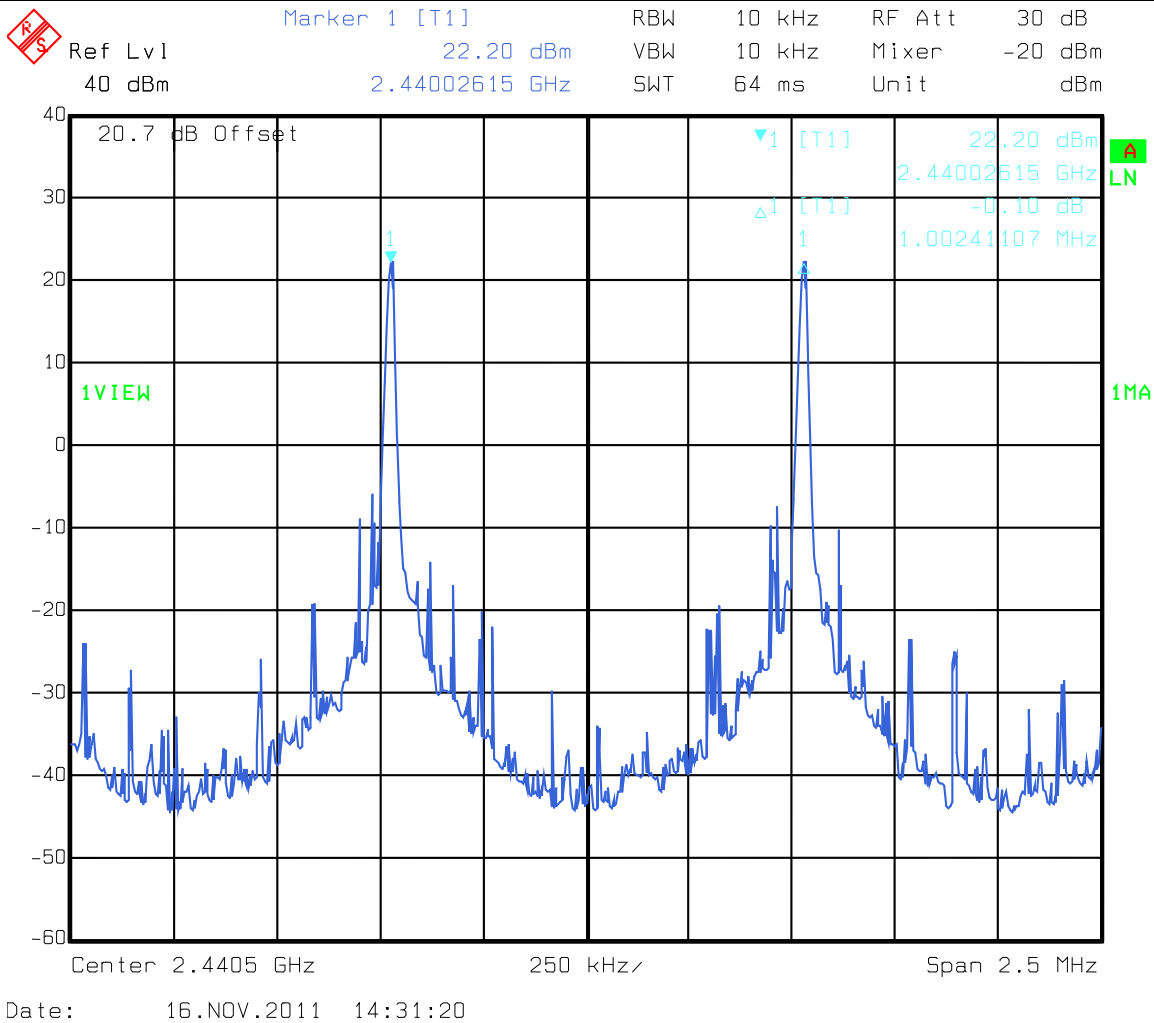
David Light



Test Results – Channel Separation

Table No. 11	Channel Separation	Verdict
		P

Measured channel separation.: 1.00 MHz
 20 dB Occupied Bandwidth...: 1.11 MHz is the minimum measured 20 dB occupied bandwidth
 Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: No modulation, normal hop sequence
 Power Input.....: 5VDC ☐ 1φ ☐ 3φ Line Tested .: Neutral
 Test Date: 16-Nov-11
 Temperature: 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List : 1767



Supplemental Information:

Channel separation is at least 2/3 of the minimum 20 dB occupied bandwidth and peak power is less than 125 mW, therefore the device under test meets the requirements of 15.247(a)(1) and RSS 210 A8.1(b).

Tested by (+ signature)

David Light

David Light

Test Results - 20 dB Occupied Bandwidth

Table No. 12	20 dB Occupied Bandwidth – Lowest Channel	Verdict
		P

Measured 20 dB Occupied BW: 1.11 MHz

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: GFSK modulation

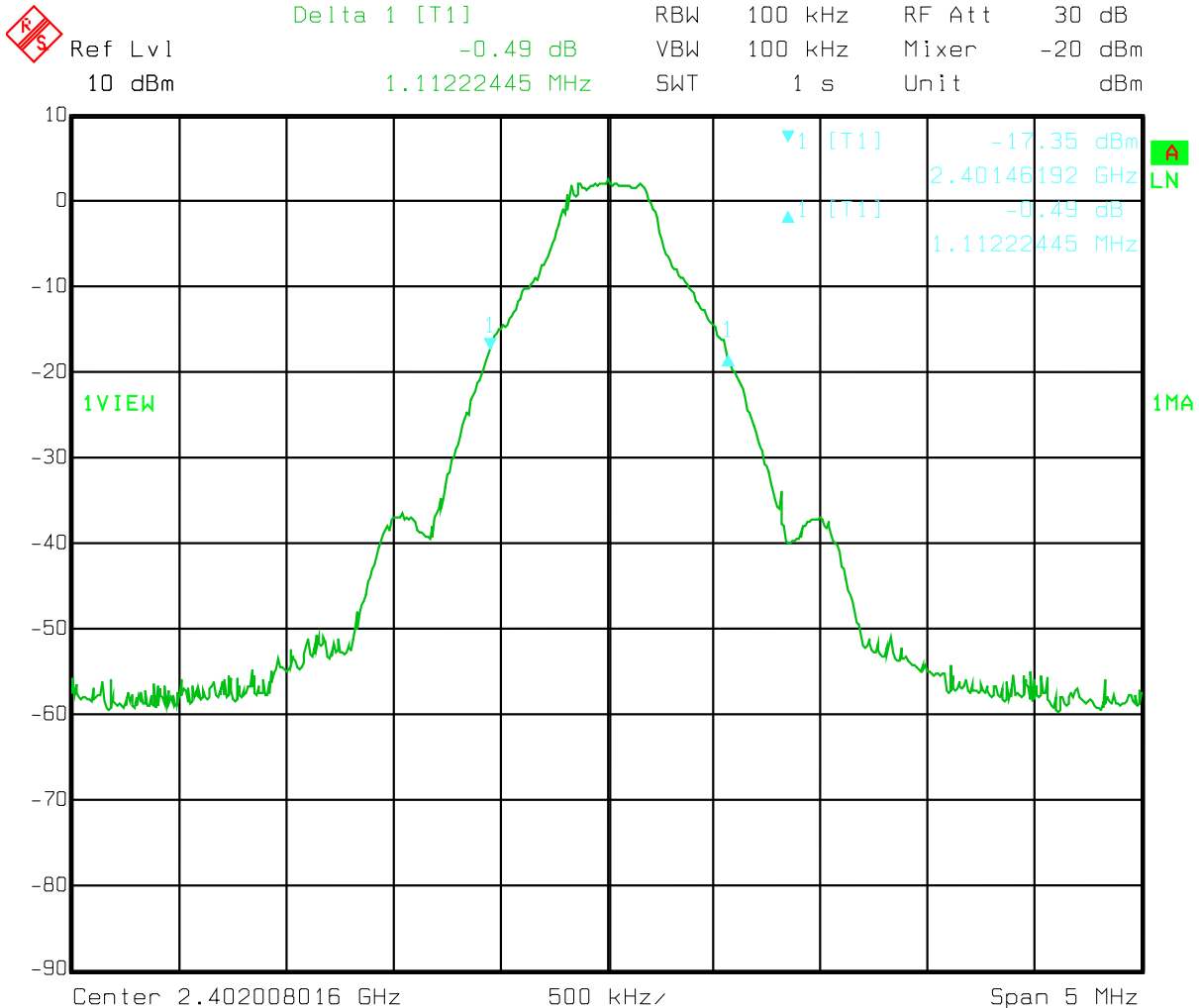
Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ

Test Date: 14-Nov-11

Temperature: 25°C

Relative Humidity: 31 %

Test Equipment Asset Tag List : 1767



Date: 14.NOV.2011 17:31:39

Supplemental Information:

Tested by (+ signature)

David Light



Table No. 13	20 dB Occupied Bandwidth – Middle Channel	Verdict
		P

Measured 20 dB Occupied BW: 1.12 MHz

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: GFSK modulation

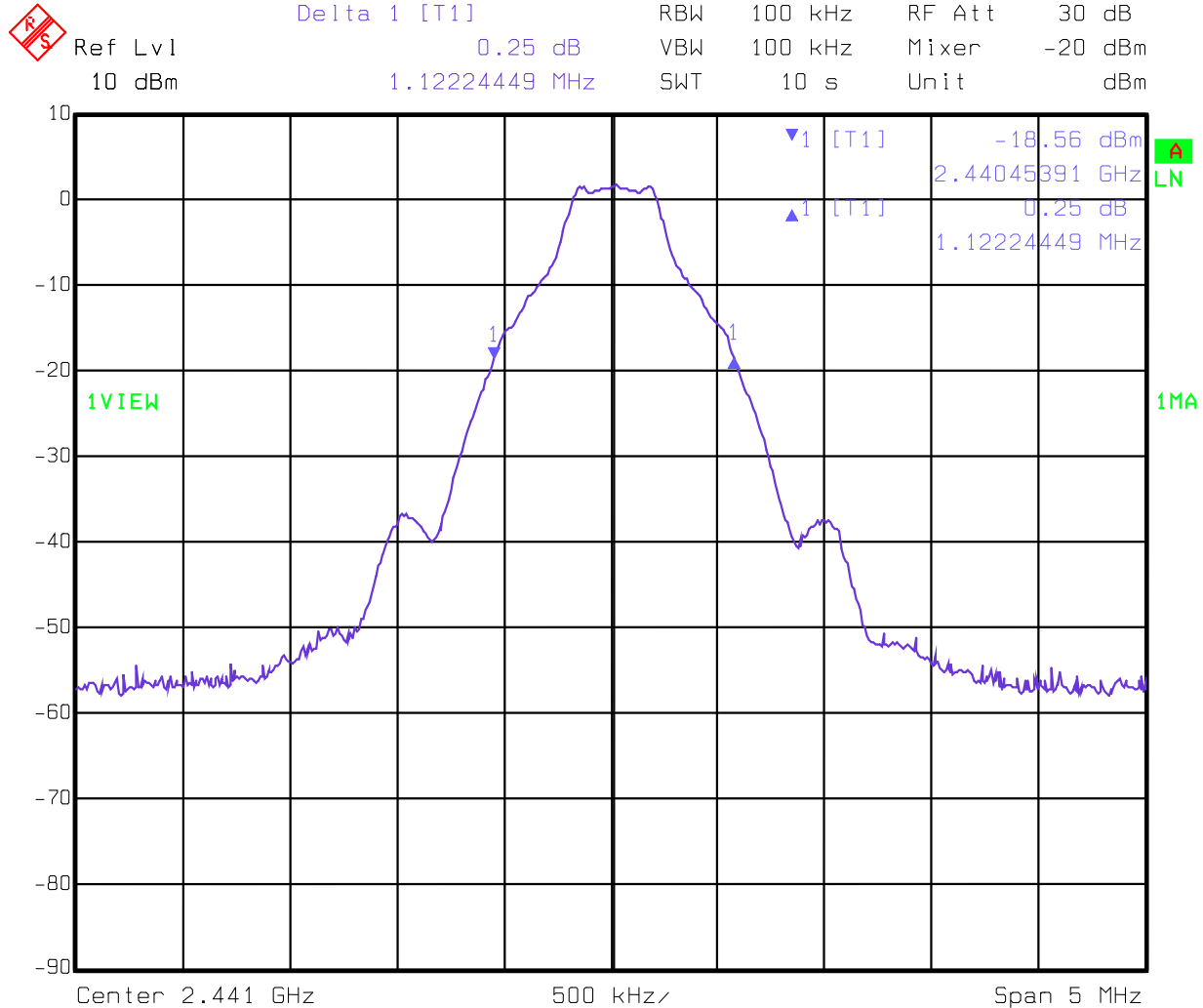
Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ

Test Date: 16-Nov-11

Temperature: 25°C

Relative Humidity: 31%

Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 15:41:39

Supplemental Information:

Tested by (+ signature)

David Light



Table No. 14	20 dB Occupied Bandwidth – Highest Channel	Verdict
		P

Measured 20 dB Occupied BW : 1.12 MHz

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: GFSK modulation

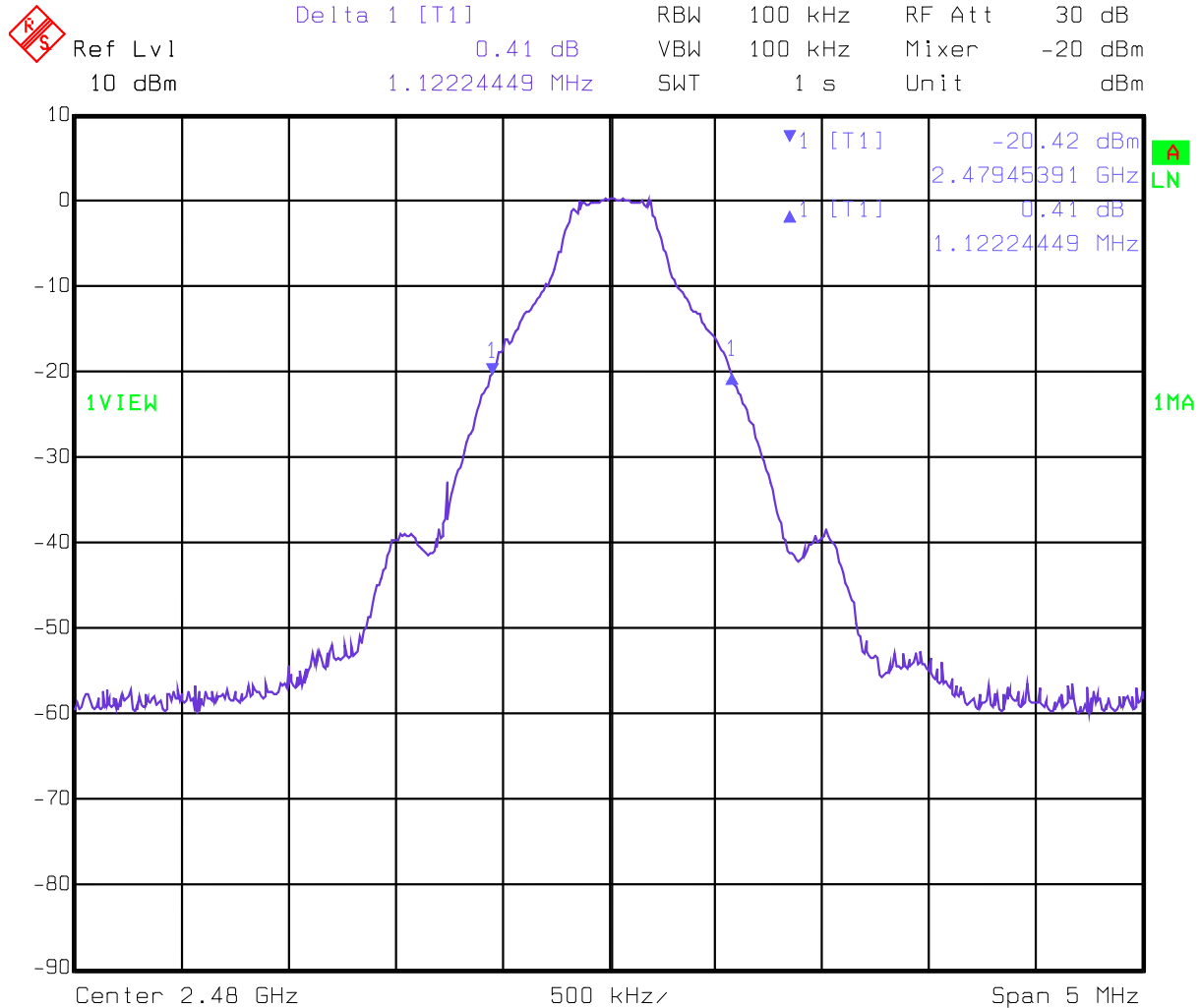
Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ

Test Date: 16-Nov-11

Temperature: 25°C

Relative Humidity: 31 %

Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 14:41:16

Supplemental Information:

Tested by (+ signature)

David Light



Table No. 15	20 dB Occupied Bandwidth – Lowest Channel	Verdict
		P

Measured 20 dB Occupied BW : 1.46 MHz

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: Pi/4DPSK modulation

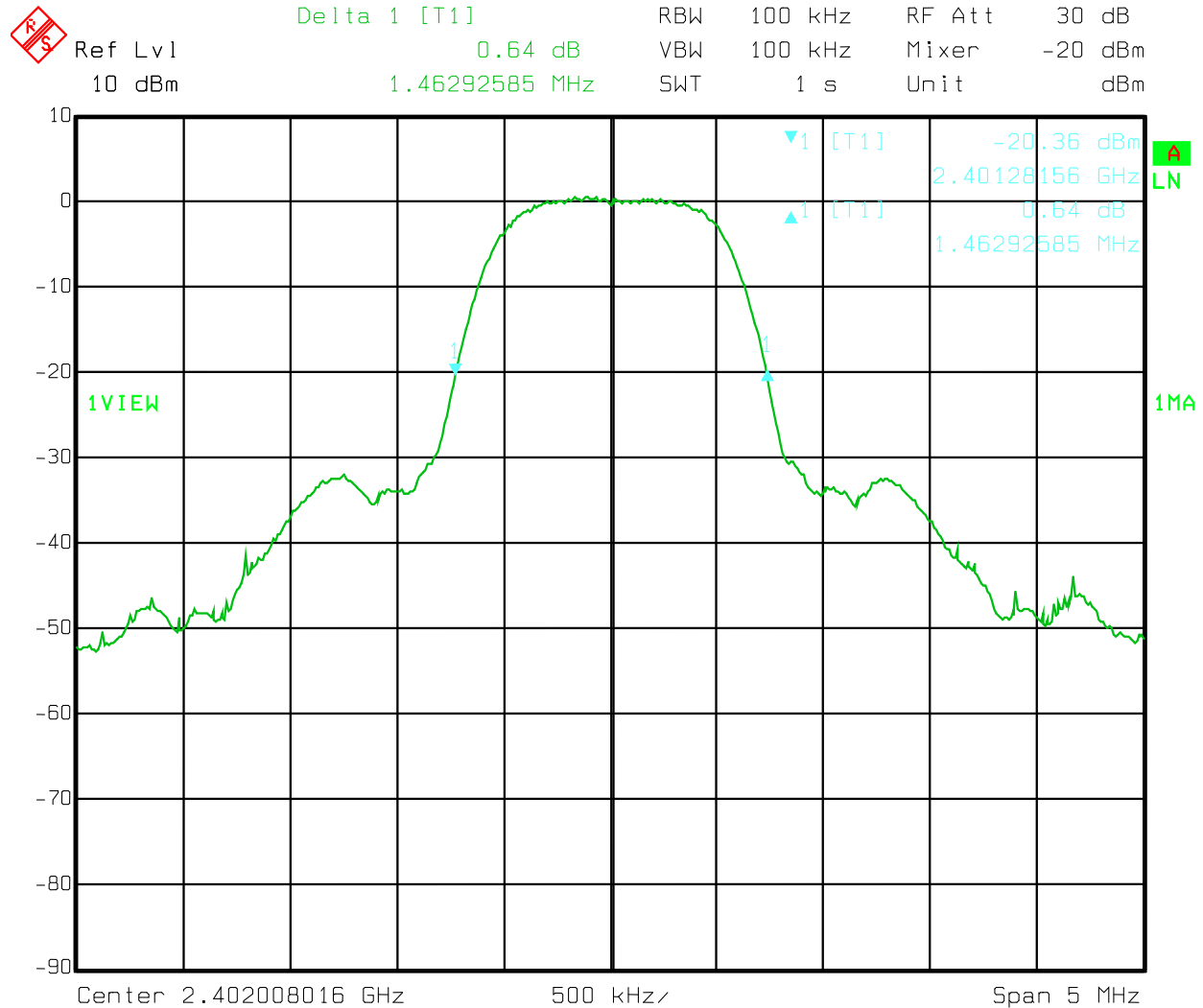
Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ

Test Date: 14-Nov-11

Temperature: 25°C

Relative Humidity: 31 %

Test Equipment Asset Tag List : 1767



Date: 14.NOV.2011 17:38:37

Supplemental Information:

Tested by (+ signature)

David Light



Table No. 16	20 dB Occupied Bandwidth – Middle Channel	Verdict
		P

Measured 20 dB Occupied BW : 1.12 MHz

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: Pi/4DPSK modulation

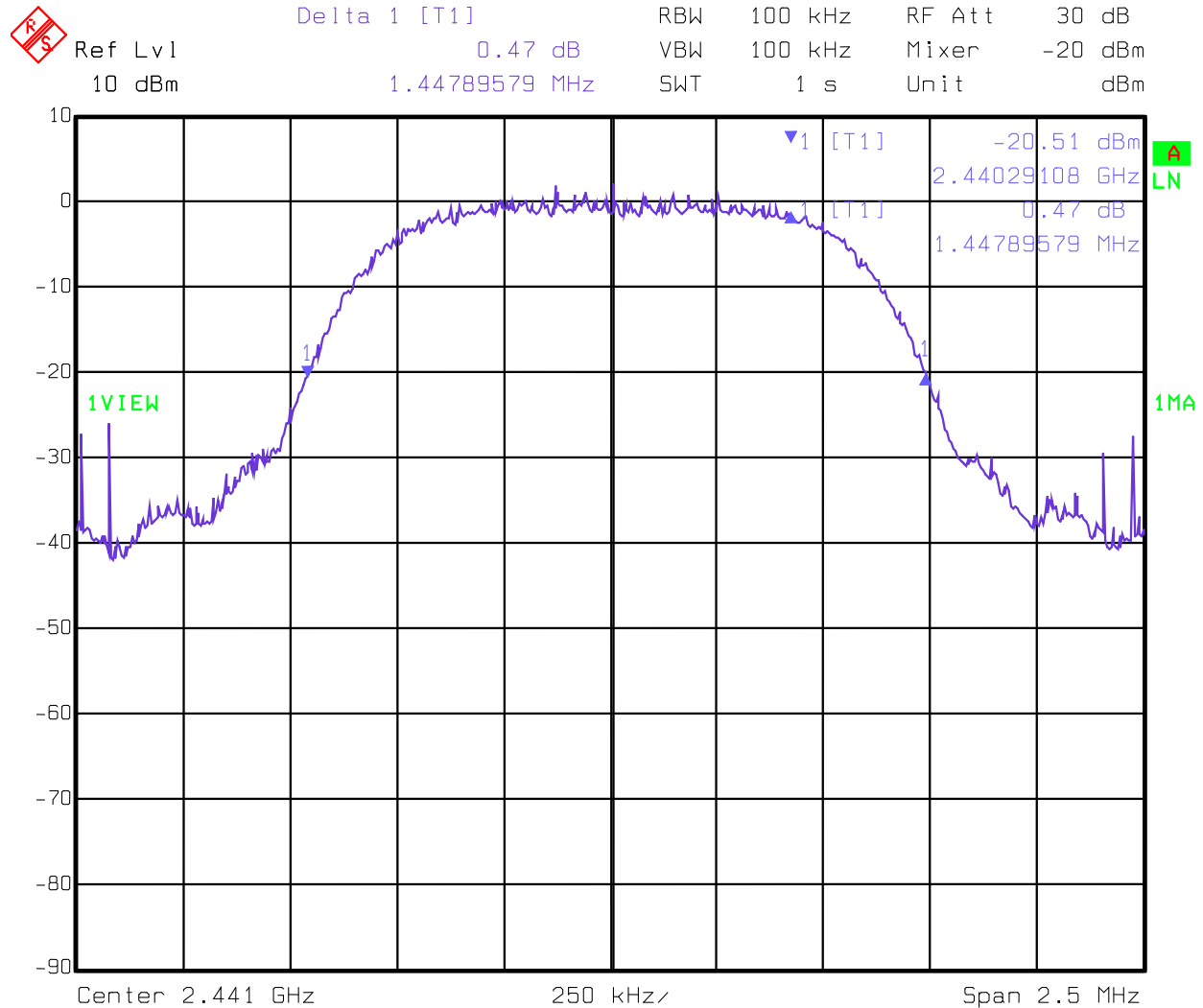
Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ

Test Date: 16-Nov-11

Temperature: 25°C

Relative Humidity: 31 %

Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 15:36:00

Supplemental Information:

Tested by (+ signature)

David Light



Table No. 17	20 dB Occupied Bandwidth – Highest Channel	Verdict
		P

Measured 20 dB Occupied BW : 1.47 MHz

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: Pi/4DPSK modulation

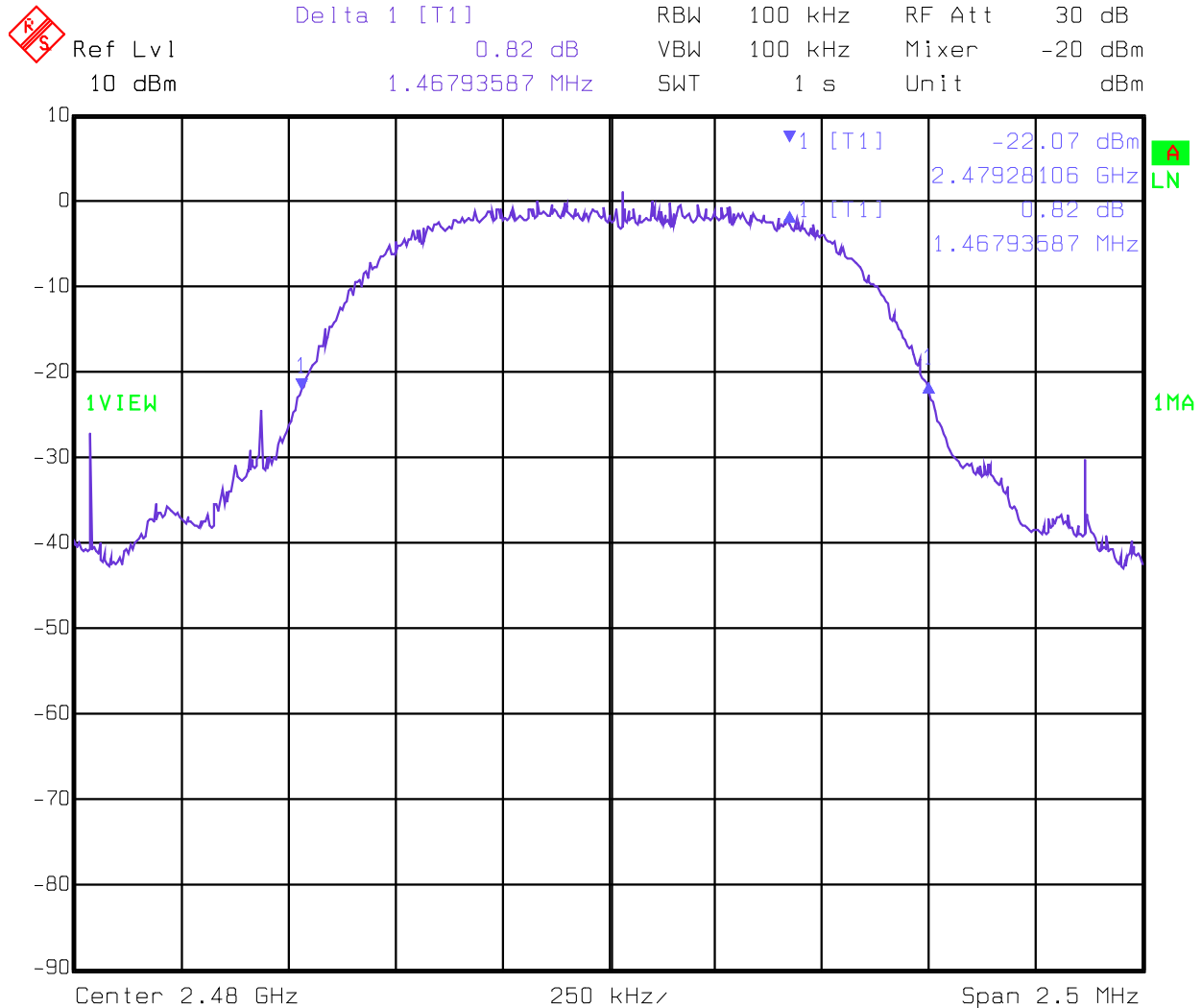
Power Input.....: 5VDC ☐ 1φ ☐ 3φ

Test Date: 16-Nov-11

Temperature: 25°C

Relative Humidity: 31 %

Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 15:19:44

Supplemental Information:

Tested by (+ signature)

David Light

Table No. 18	20 dB Occupied Bandwidth – Lowest Channel	Verdict
		P

Measured 20 dB Occupied BW : 1.45 MHz

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: 8DPSK modulation

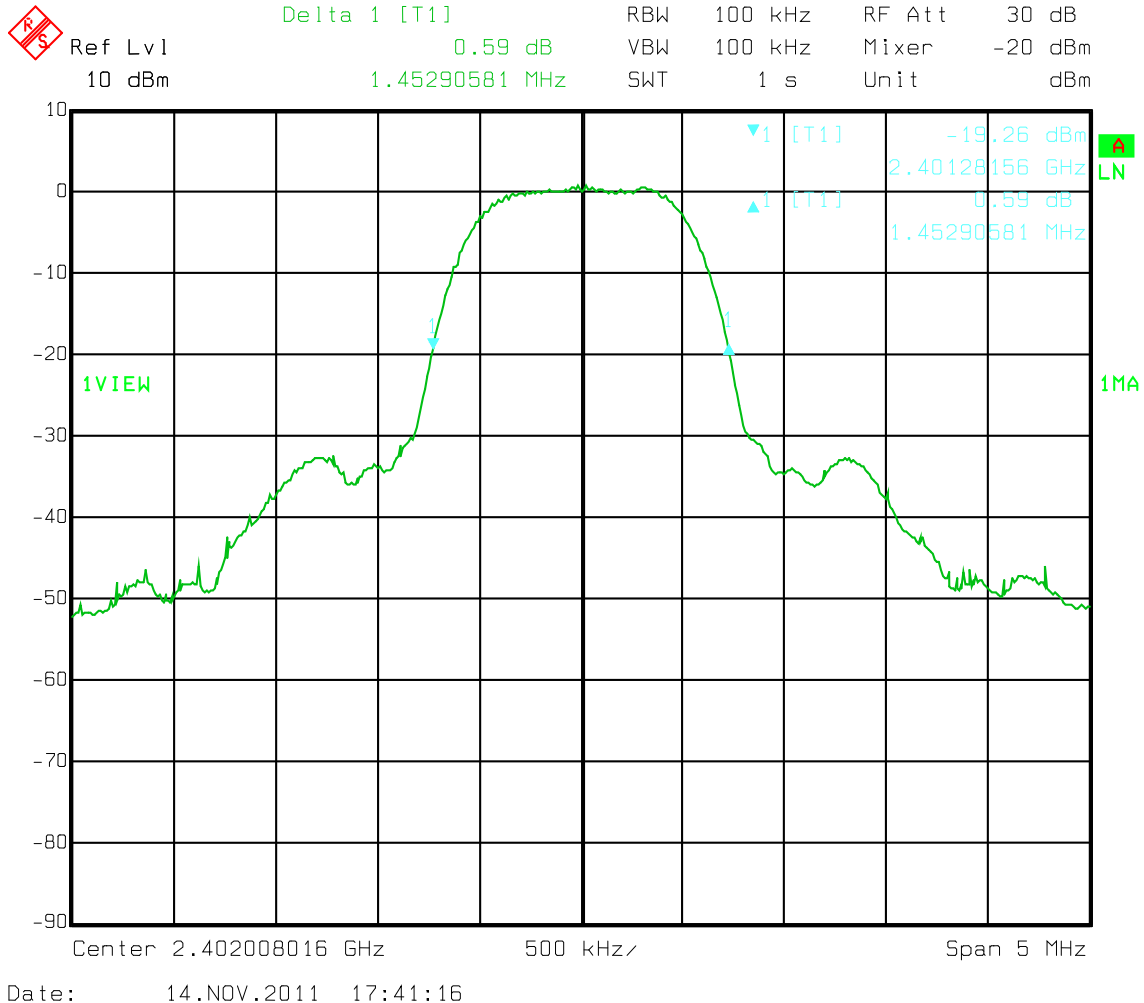
Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ

Test Date: 14-Nov-11

Temperature: 25°C

Relative Humidity: 31 %

Test Equipment Asset Tag List : 1767



Supplemental Information:

Tested by (+ signature)

David Light



Table No. 19	20 dB Occupied Bandwidth – Middle Channel	Verdict
		P

Measured 20 dB Occupied BW : 1.46 MHz

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: 8DPSK modulation

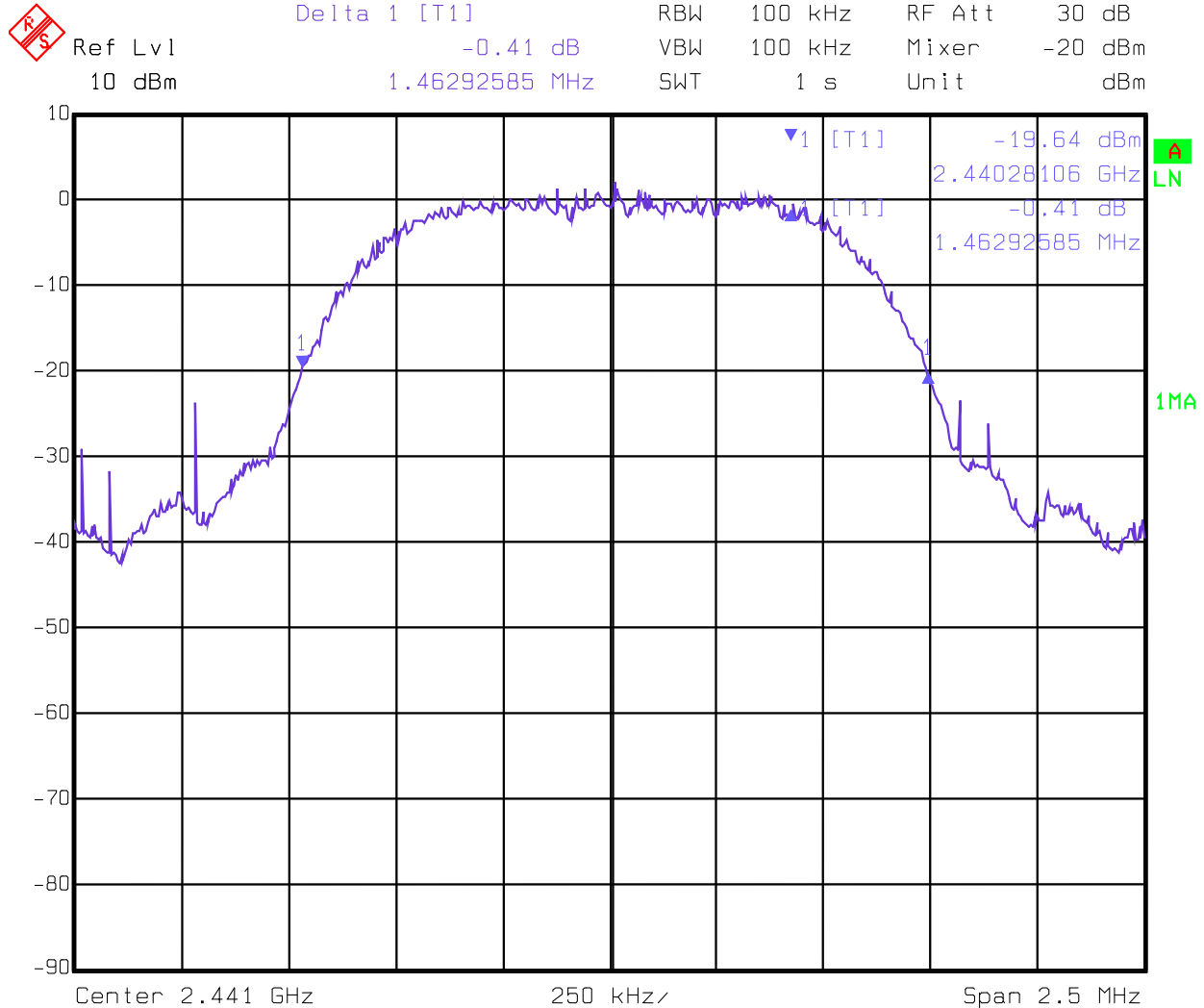
Power Input.....: 5VDC ☐ 1φ ☐ 3φ

Test Date: 16-Nov-11

Temperature: 25°C

Relative Humidity: 31 %

Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 15:30:12

Supplemental Information:

Tested by (+ signature)

David Light



Table No. 20	20 dB Occupied Bandwidth – Highest Channel	Verdict
		P

Measured 20 dB Occupied BW : 1.44 MHz

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: 8DPSK modulation

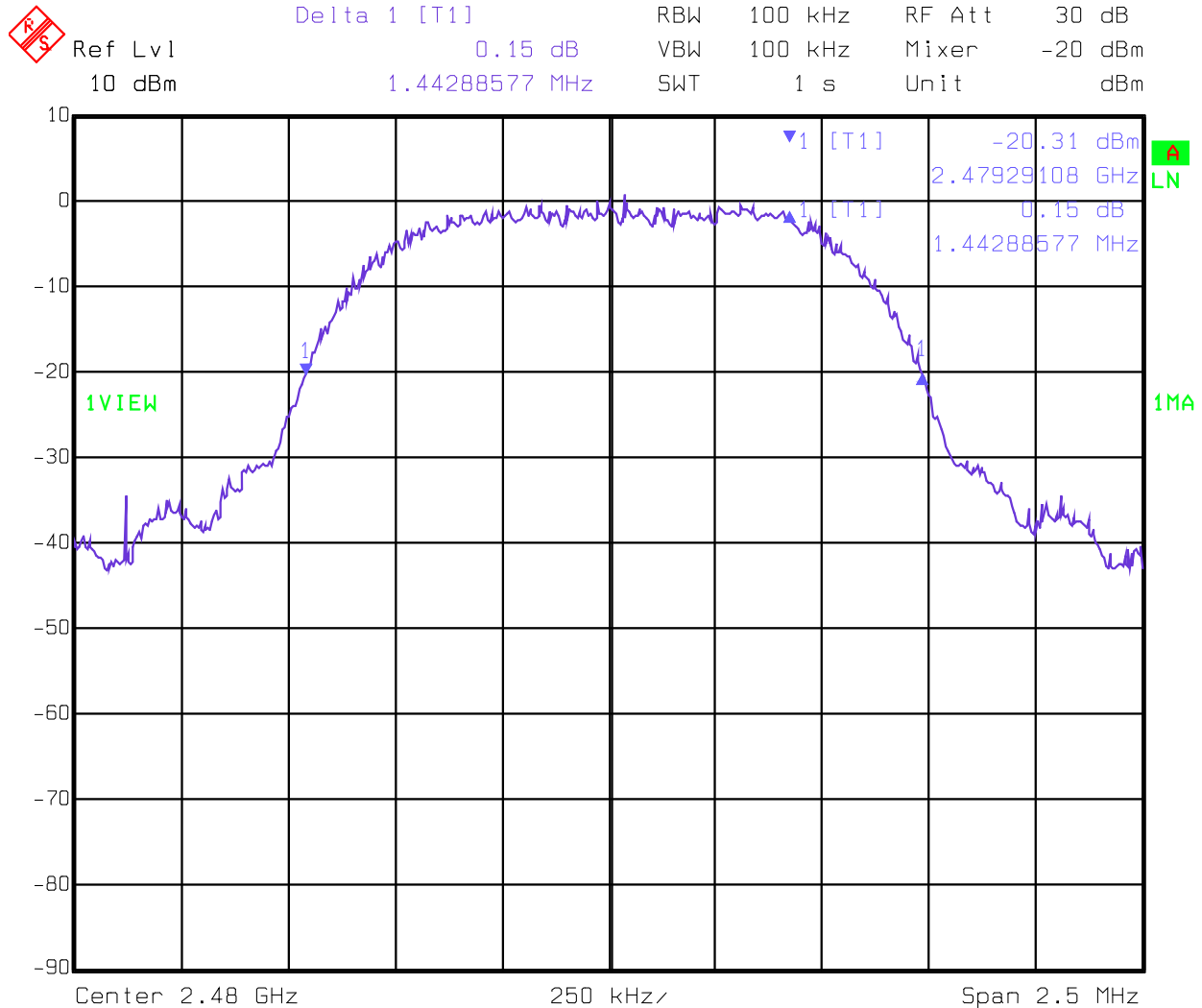
Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ

Test Date: 16-Nov-11

Temperature: 25°C

Relative Humidity: 31 %

Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 15:24:37

Supplemental Information:

Tested by (+ signature)

David Light



Test Results - Number of Hopping Channels

Table No. 21	Number of Hopping Channels	Verdict
		P

Measured Number of Channels: 79

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: Normal hopping sequence

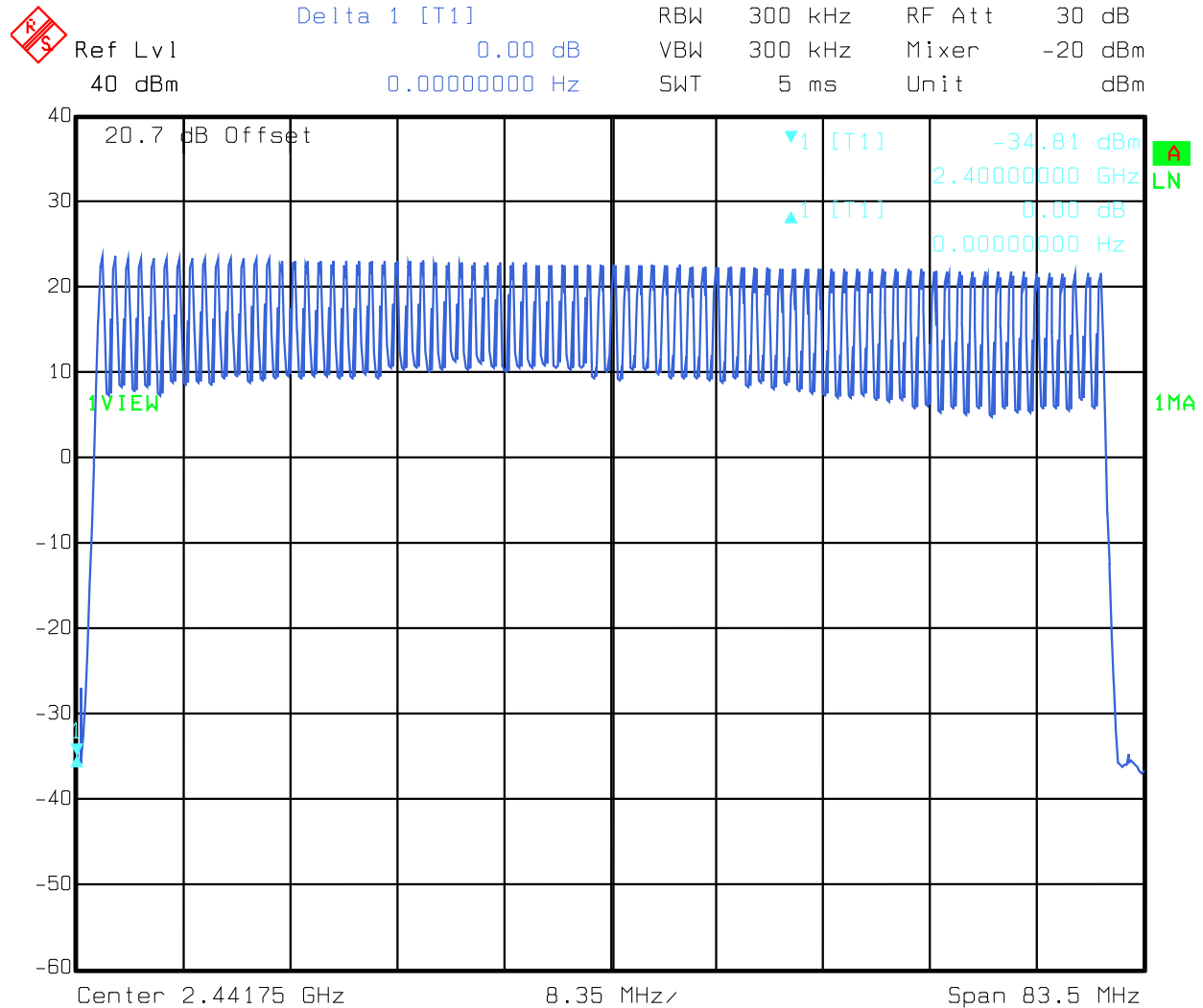
Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ

Test Date: 16-Nov-11

Temperature: 25°C

Relative Humidity: 31 %

Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 14:26:19

Supplemental Information:

Tested by (+ signature)

David Light



Test Results - Average Time of Occupancy

Table No. 22	Average Time of Occupancy – Dwell time during one hop sequence	Verdict
		P

Dwell time in one hop sequence : 28.66 ms

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: Normal hop sequence

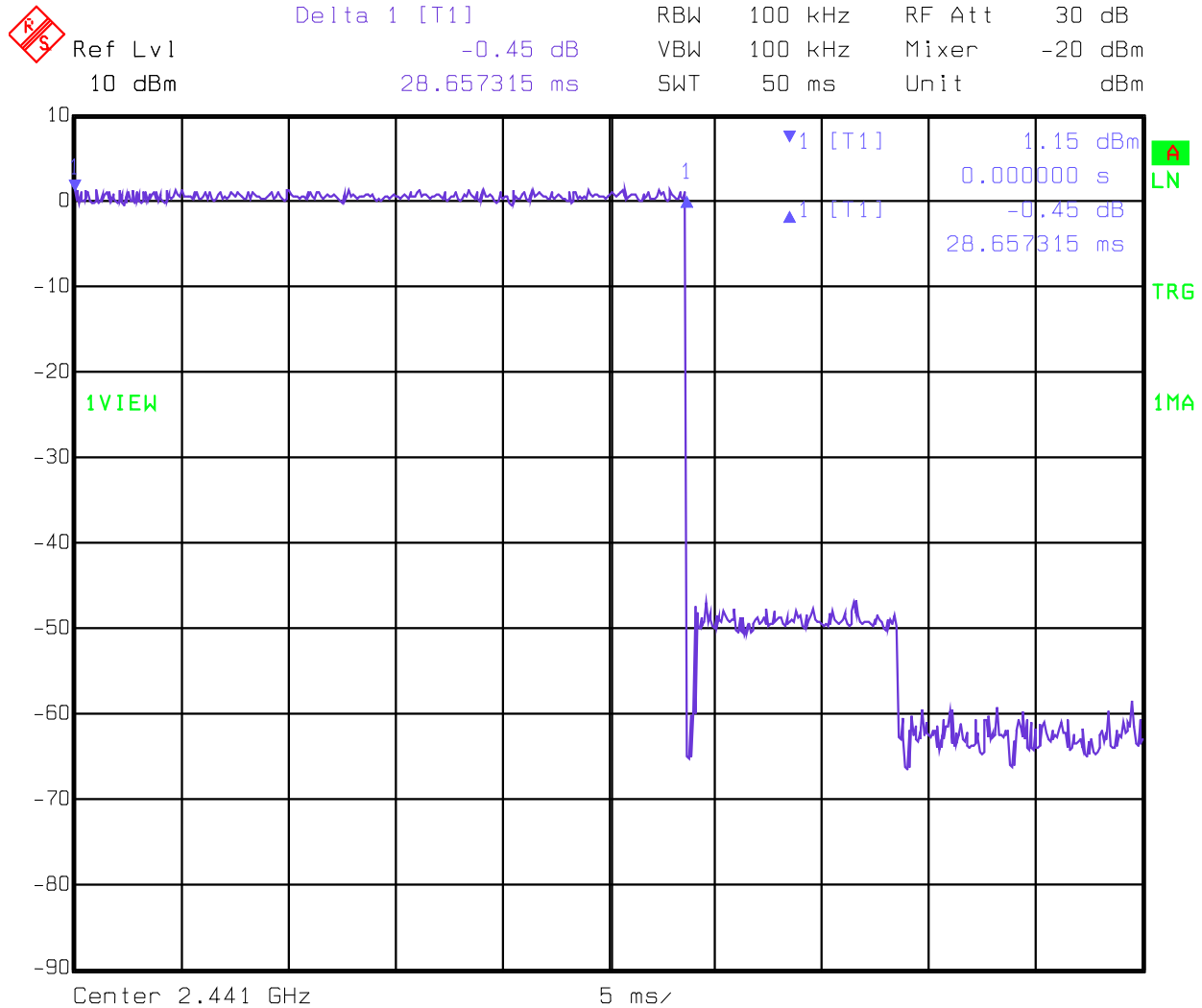
Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ

Test Date: 16-Nov-11

Temperature: 25°C

Relative Humidity:31 %

Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 15:50:21

Supplemental Information:

Tested by (+ signature)

David Light

David Light

Table No. 23	Average Time of Occupancy in 12.5 sec.	Verdict
		P

Measured Time of Occupancy : 28.6ms x 5 = 143.3ms in 12.5 s

Test Method.....: ANSI C63.4 and DA 00-705

EUT Configuration: Normal hop sequence

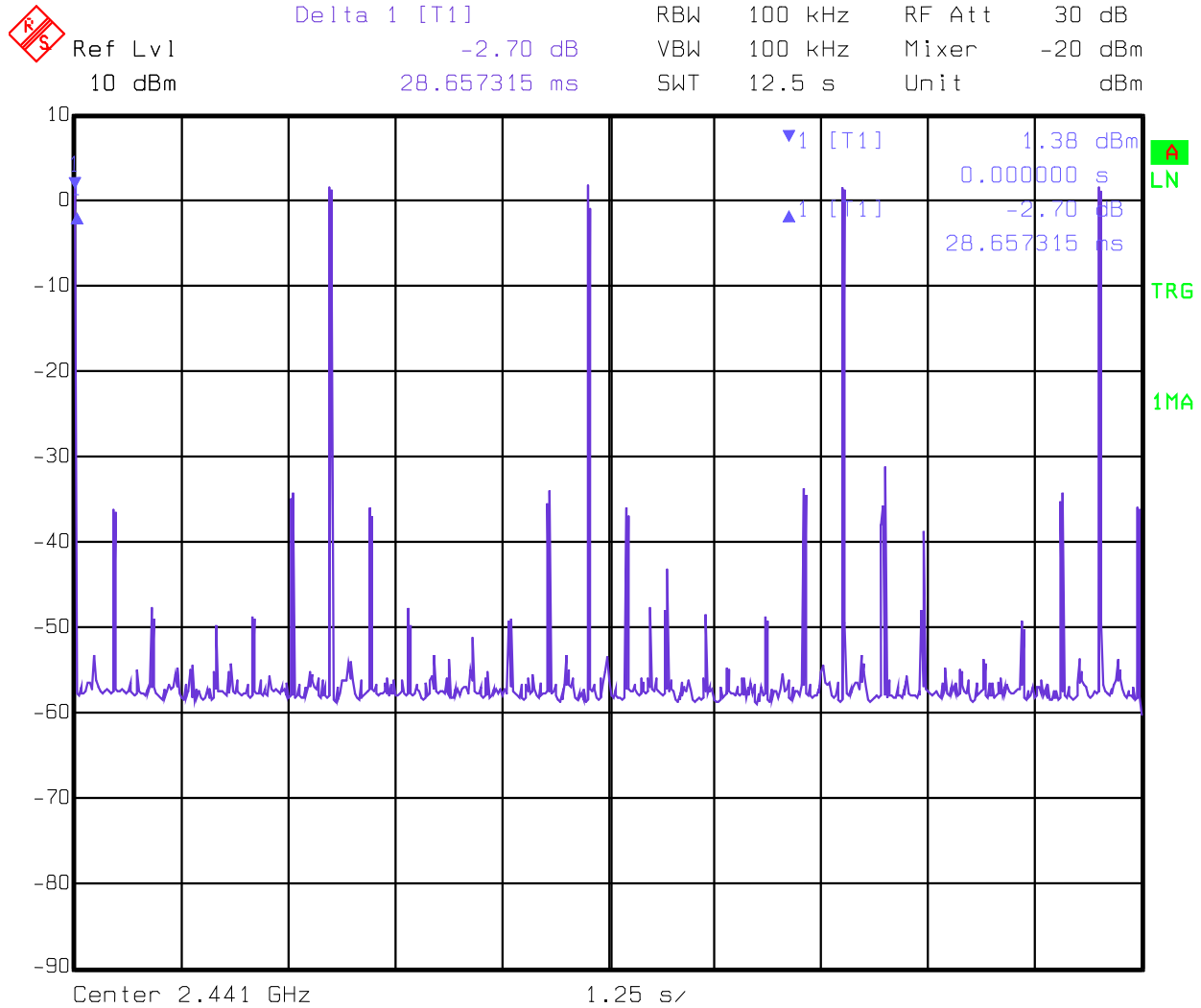
Power Input.....: 5VDC ☐ 1φ ☐ 3φ

Test Date: 16-Nov-11

Temperature: 25°C

Relative Humidity:31 %

Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 15:55:16

Supplemental Information:

Tested by (+ signature)

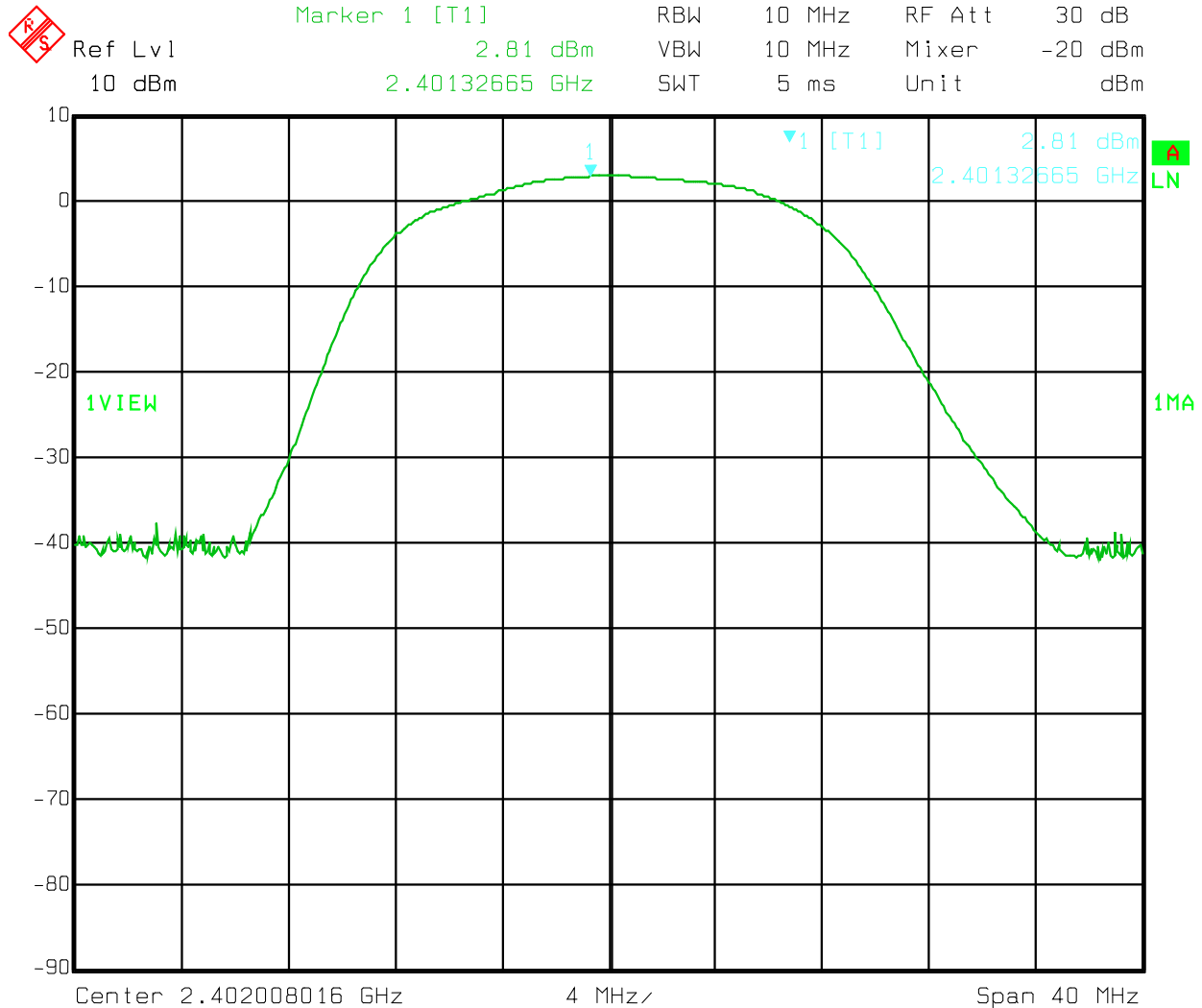
David Light



Test Results - Peak RF Output Power

Table No. 24	Peak RF Output Power – Lowest Channel	Verdict
		P

Measured Peak Power at Antenna Connector. : +2.81 dBm
 Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: GFSK modulation
 Power Input.....: 5VDC ☐ 1φ ☐ 3φ
 Test Date: 14-Nov-11
 Temperature: 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List: 1767



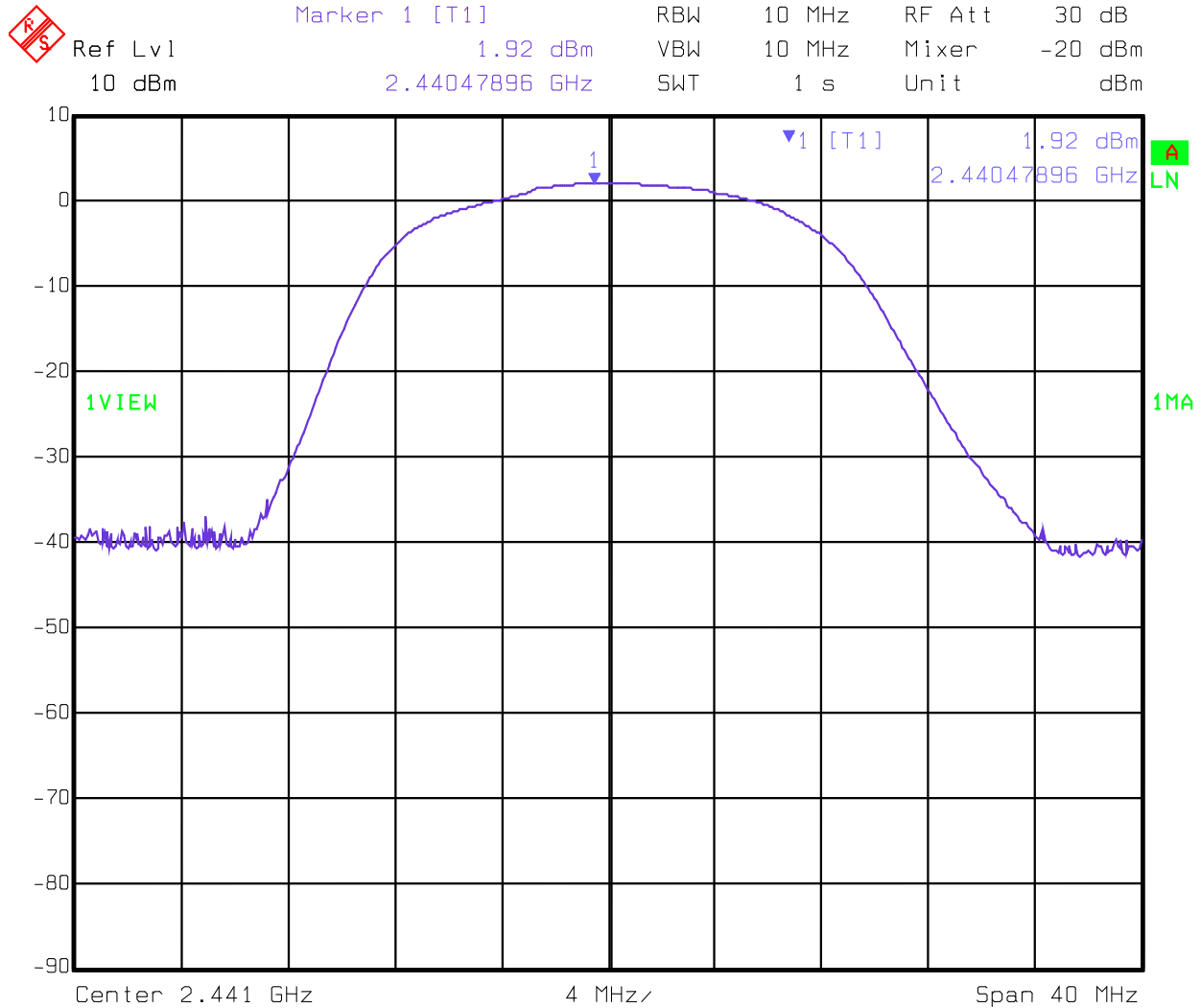
Date: 14.NOV.2011 17:28:31

Supplemental Information:

Tested by (+ signature): David Light

Table No. 25	Peak RF Output Power – Middle Channel	Verdict
		P

Measured Peak Power at Antenna Connector...: +1.92 dBm
 Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: GFSK modulation
 Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date: 16-Nov-11
 Temperature: 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List: 1767



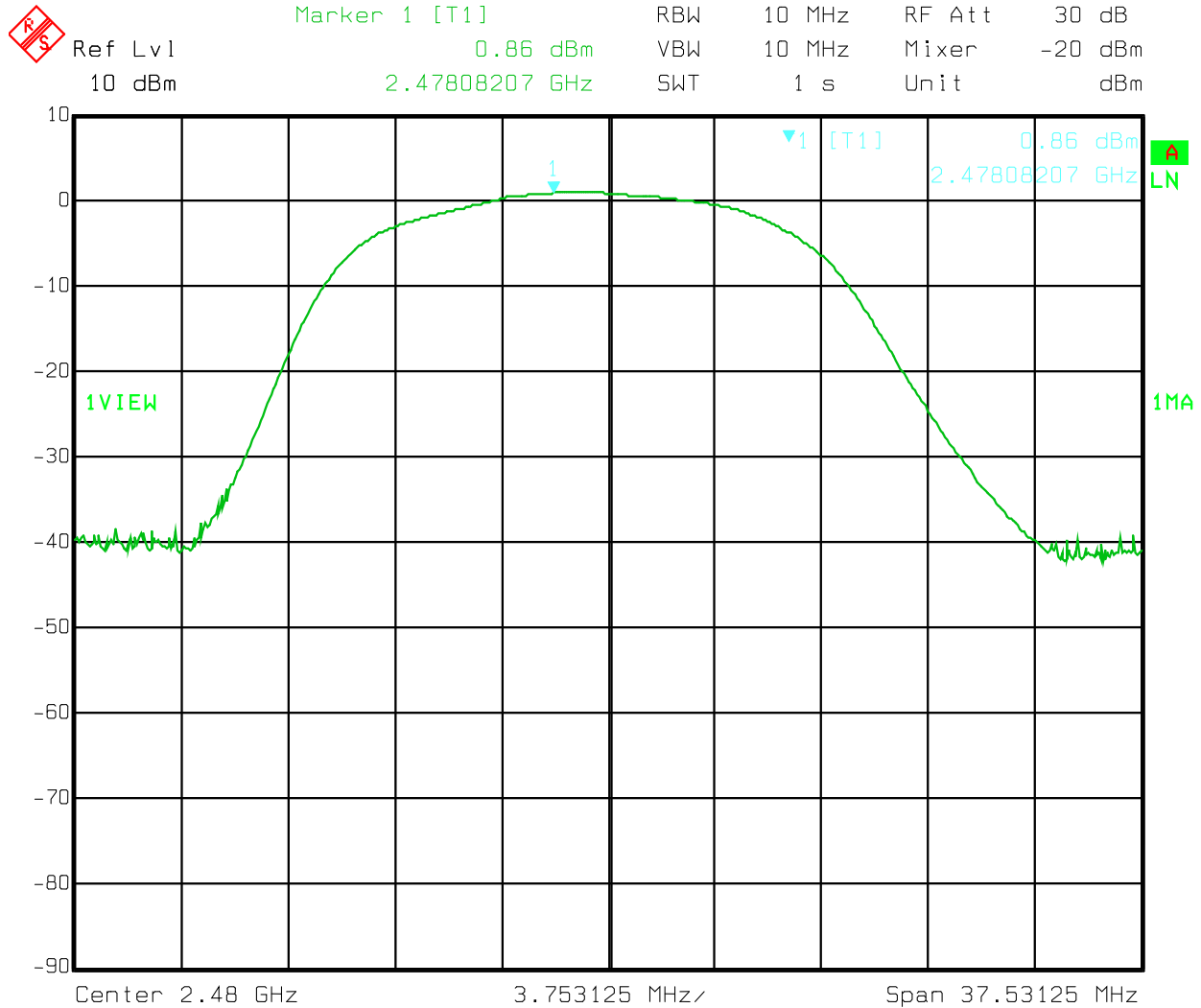
Date: 16.NOV.2011 15:39:07

Supplemental Information:

Tested by (+ signature): David Light 

Table No. 26	Peak RF Output Power – Highest Channel	Verdict
		P

Measured Peak Output at Antenna Connector : +0.86 dBm
 Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: GFSK modulation
 Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date: 14-Nov-11
 Temperature: 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List: 1767



Date: 14.NOV.2011 18:31:48

Supplemental Information:

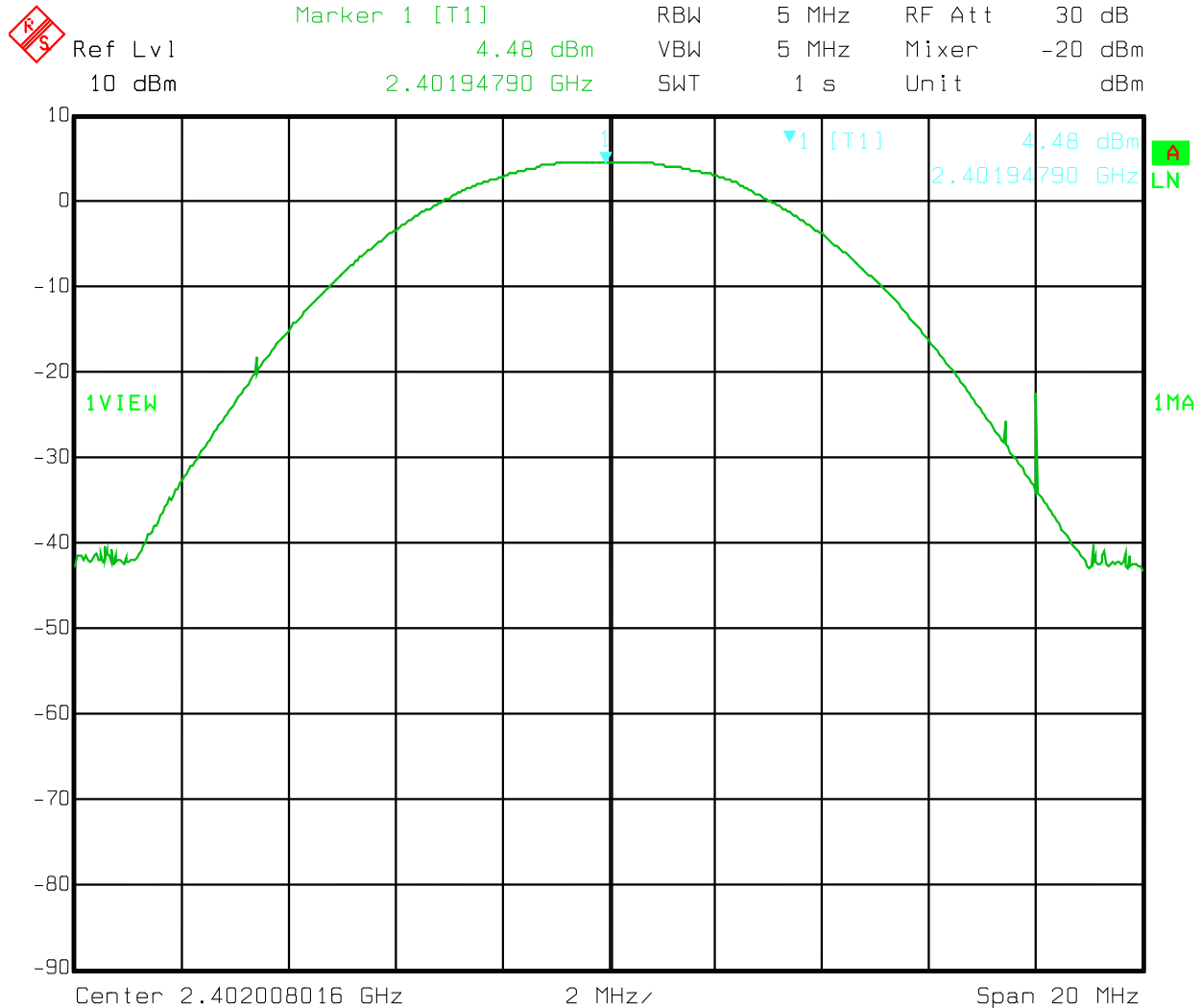
Tested by (+ signature)

David Light



Table No. 27	Peak RF Output Power – Lowest Channel	Verdict
		P

Measured Peak Power at Antenna Connector. : +4.48 dBm
 Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: Pi/4DPSK modulation
 Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date: 14-Nov-11
 Temperature: 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List: 1767



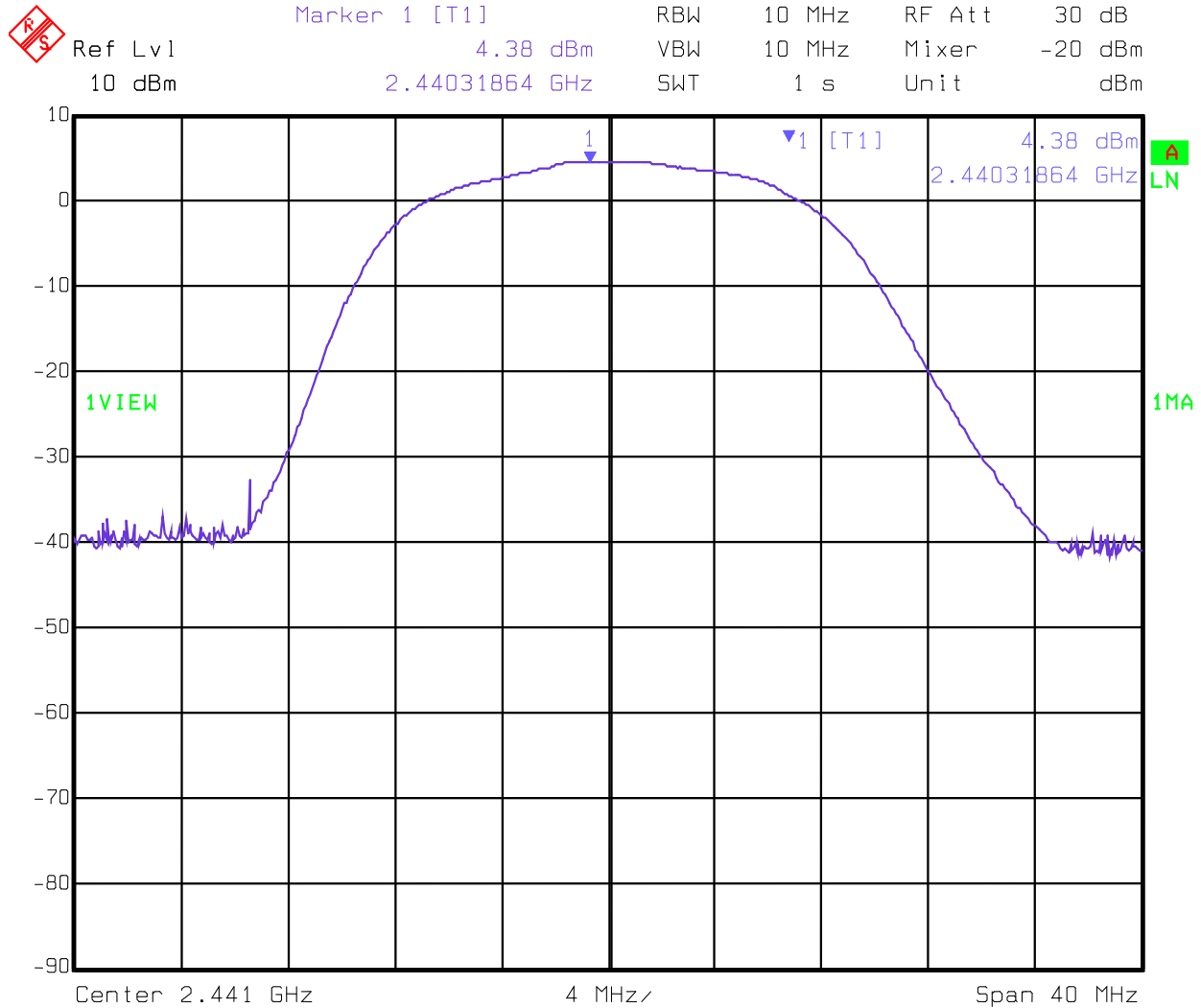
Date: 14.NOV.2011 17:45:54

Supplemental Information:

Tested by (+ signature): David Light

Table No. 28	Peak RF Output Power – Middle Channel	Verdict
		P

Measured Peak Power at Antenna Connector...: +4.38 dBm
 Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: Pi/4DPSK modulation
 Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date: 16-Nov-11
 Temperature: 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List: 1767



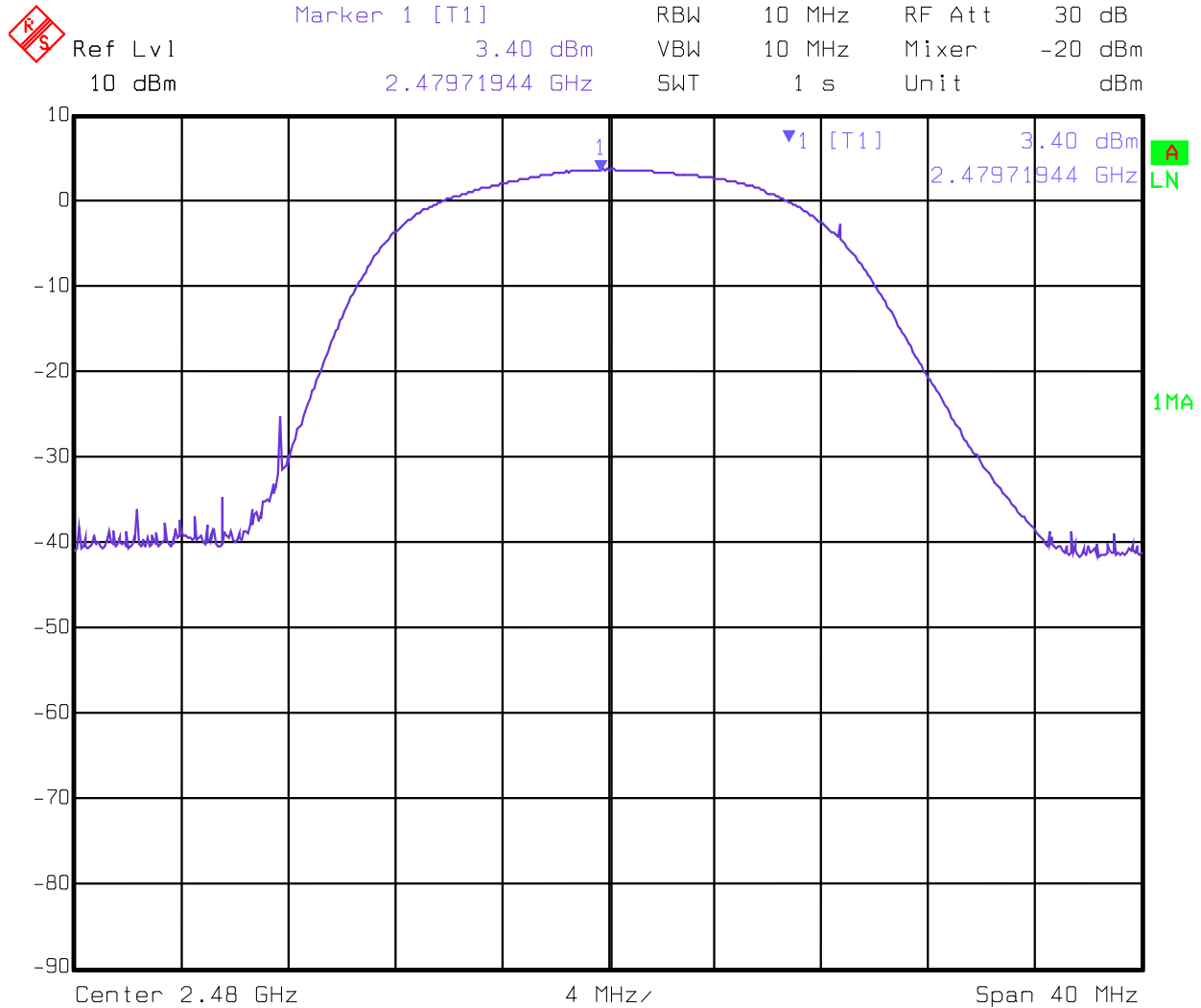
Date: 16.NOV.2011 15:38:04

Supplemental Information:

Tested by (+ signature) : David Light 

Table No. 29	Peak RF Output Power – Highest Channel	Verdict
		P

Measured Peak Output at Antenna Connector : +3.40 dBm
 Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: Pi/4DPSK modulation
 Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date: 16-Nov-11
 Temperature: 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List: 1767



Date: 16.NOV.2011 15:21:12

Supplemental Information:

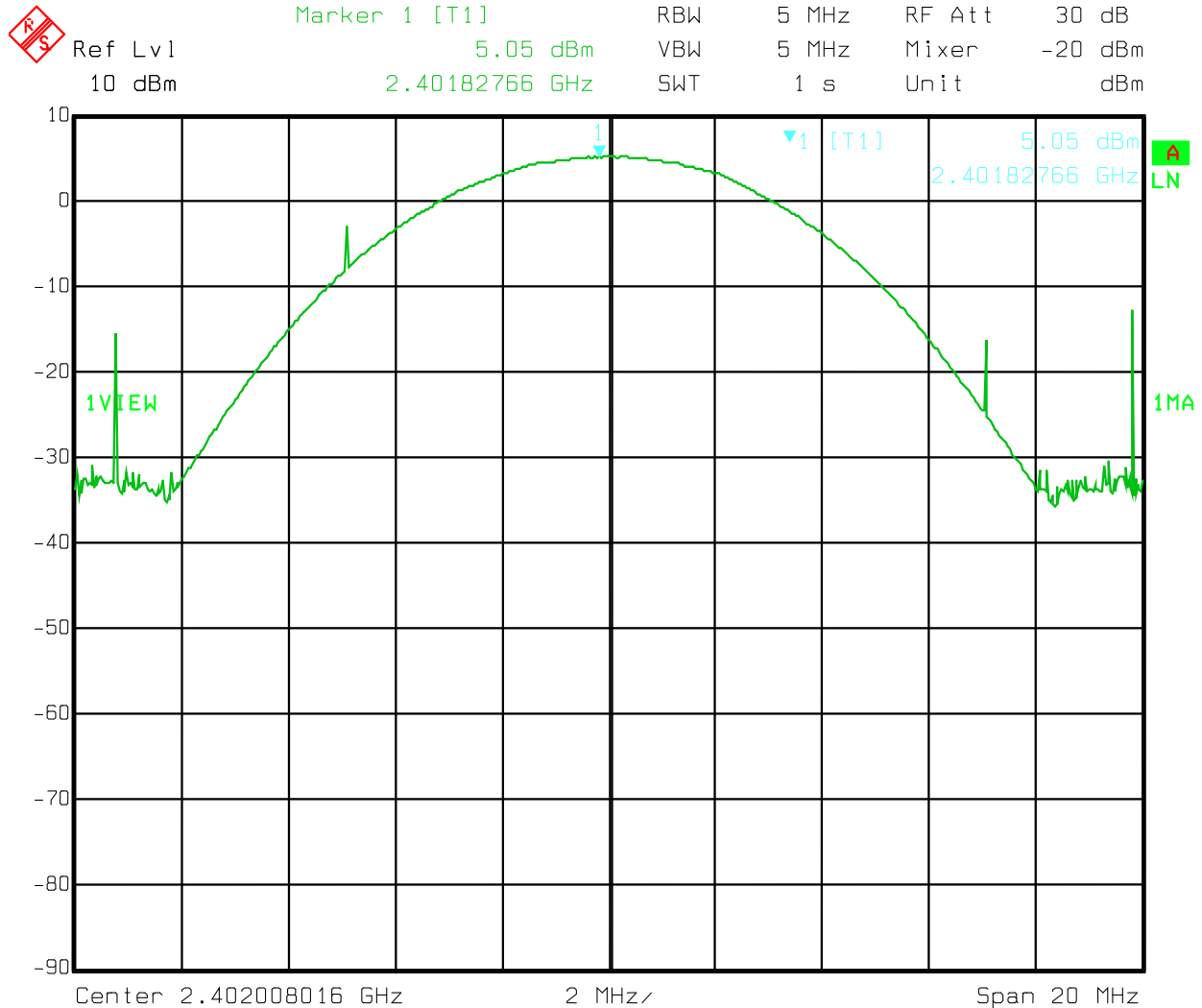
Tested by (+ signature)

David Light



Table No. 30	Peak RF Output Power – Lowest Channel	Verdict
		P

Measured Peak Power at Antenna Connector. : +5.05 dBm
 Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: 8DPSK modulation
 Power Input.....: 5VDC ☐ 1φ ☐ 3φ
 Test Date: 14-Nov-11
 Temperature: 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List: 1767



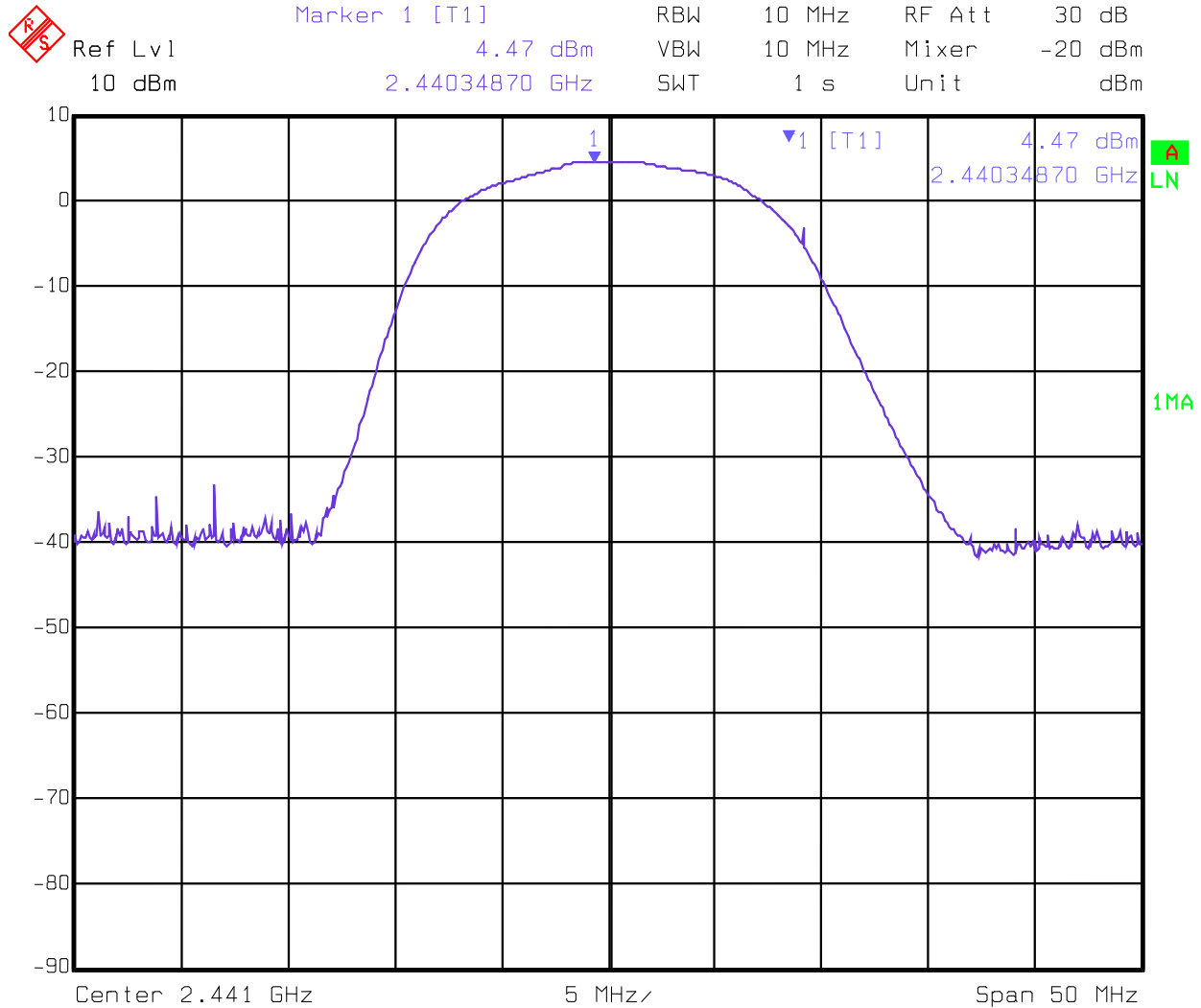
Date: 14.NOV.2011 17:44:18

Supplemental Information:

Tested by (+ signature): David Light

Table No. 31	Peak RF Output Power – Middle Channel	Verdict
		P

Measured Peak Power at Antenna Connector...: +4.47 dBm
 Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: 8DPSK modulation
 Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date: 16-Nov-11
 Temperature: 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List: 1767



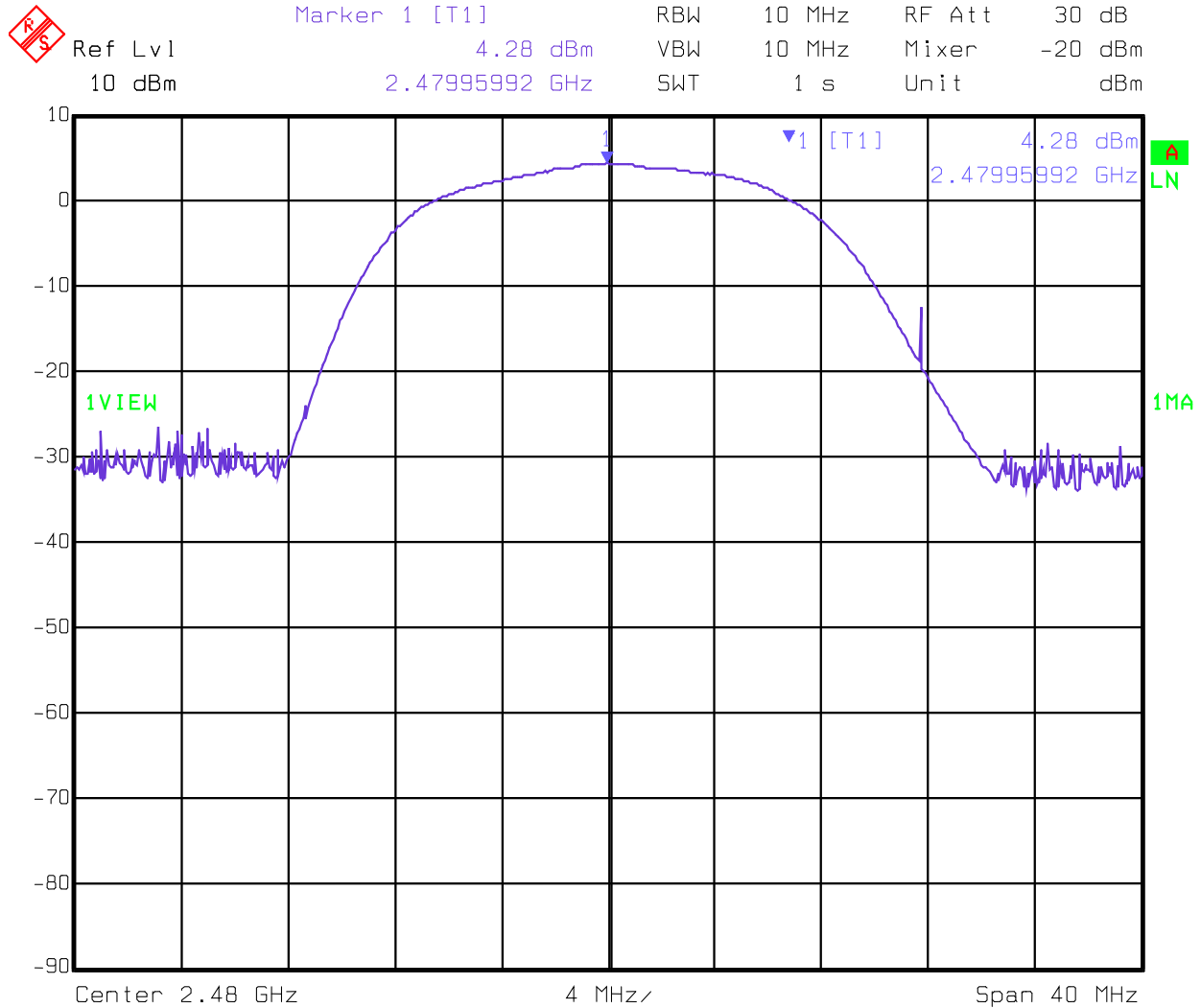
Date: 16.NOV.2011 15:34:00

Supplemental Information:

Tested by (+ signature) : David Light

Table No. 32	Peak RF Output Power – Highest Channel	Verdict
		P

Measured Peak Output at Antenna Connector : +4.28 dBm
 Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: 8DPSK modulation
 Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date: 16-Nov-11
 Temperature: 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List: 1767



Date: 16.NOV.2011 15:22:23

Supplemental Information:

Tested by (+ signature)

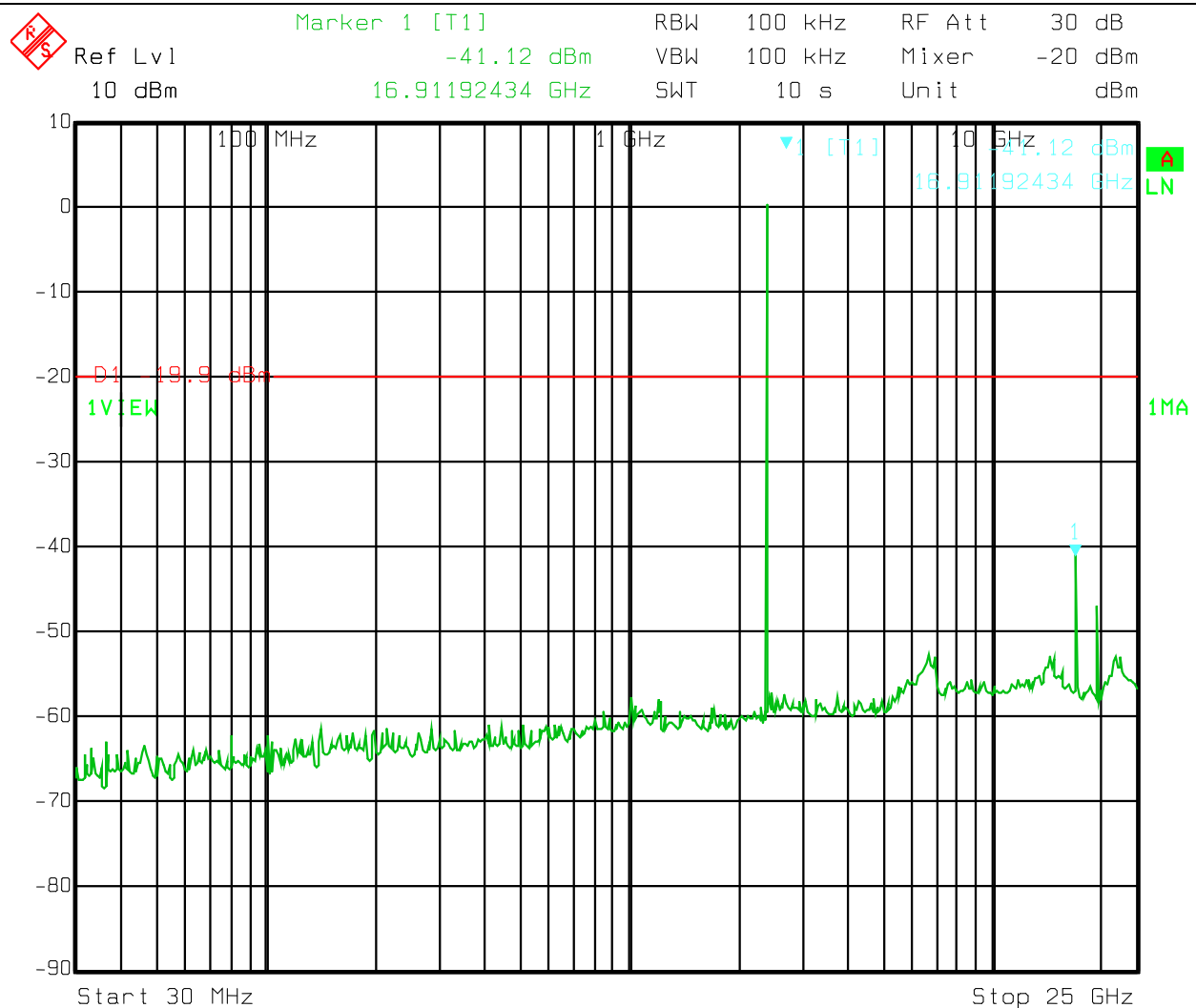
David Light



Test Results - Spurious Emissions

Table No. 33	Spurious Emissions – Lowest Channel	Verdict
		P

Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: GFSK modulation, Channel 0
 Power Input.....: 5VDC ☐ 1φ ☐ 3φ
 Test Date: 14-Nov-11
 Temperature: 25°C Relative Humidity :31 %
 Test Equipment Asset Tag List: 1767



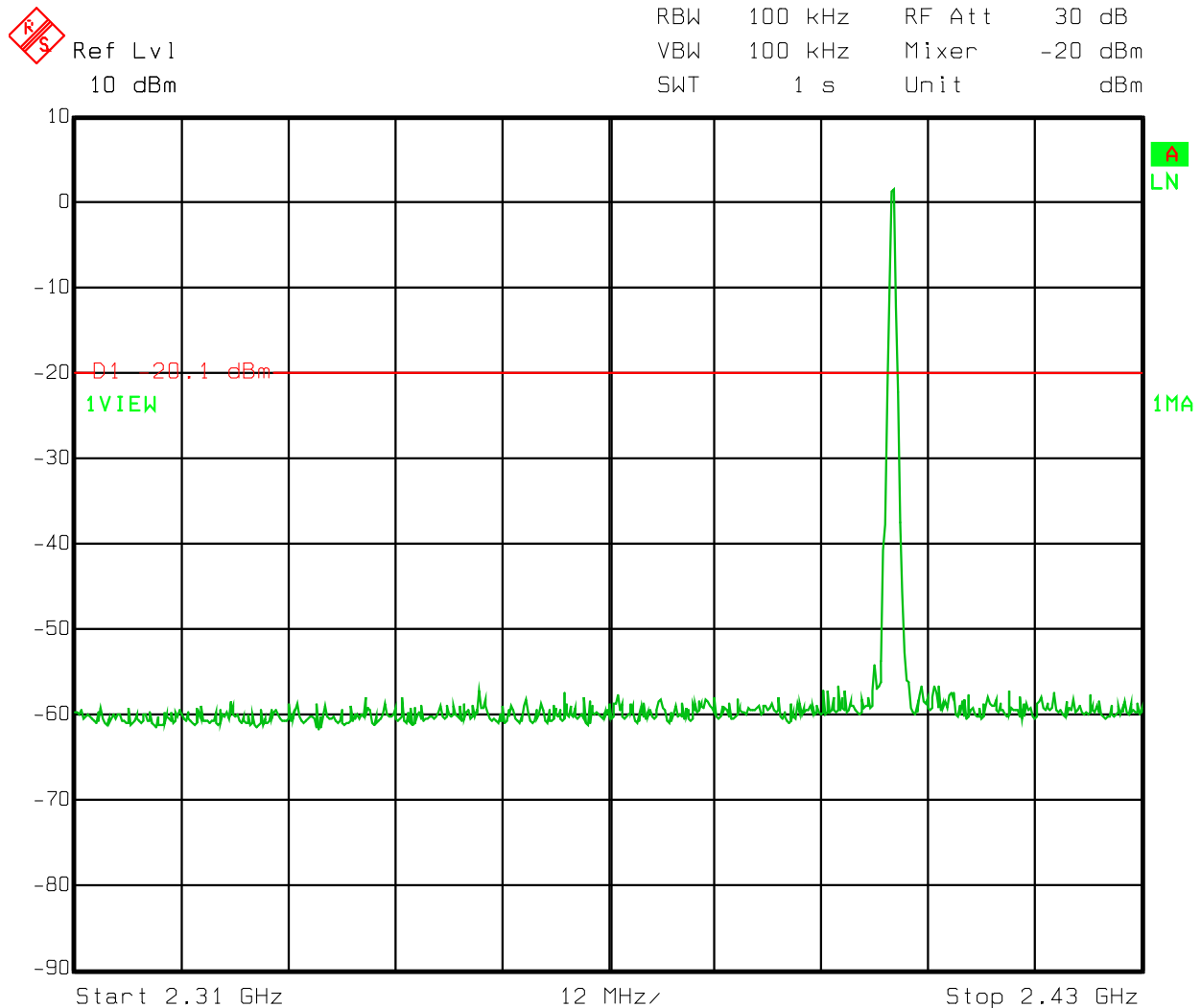
Date: 14.NOV.2011 18:07:41

Supplemental Information:

Tested by (+ signature): David Light

Table No. 34	Spurious Emissions – Lowest Channel – 2310 – 2390 MHz	Verdict
		P

Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: GFSK modulation, lowest channel
 Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date: 14-Nov-11
 Temperature: 25°C Relative Humidity :31 %
 Test Equipment Asset Tag List: 1767



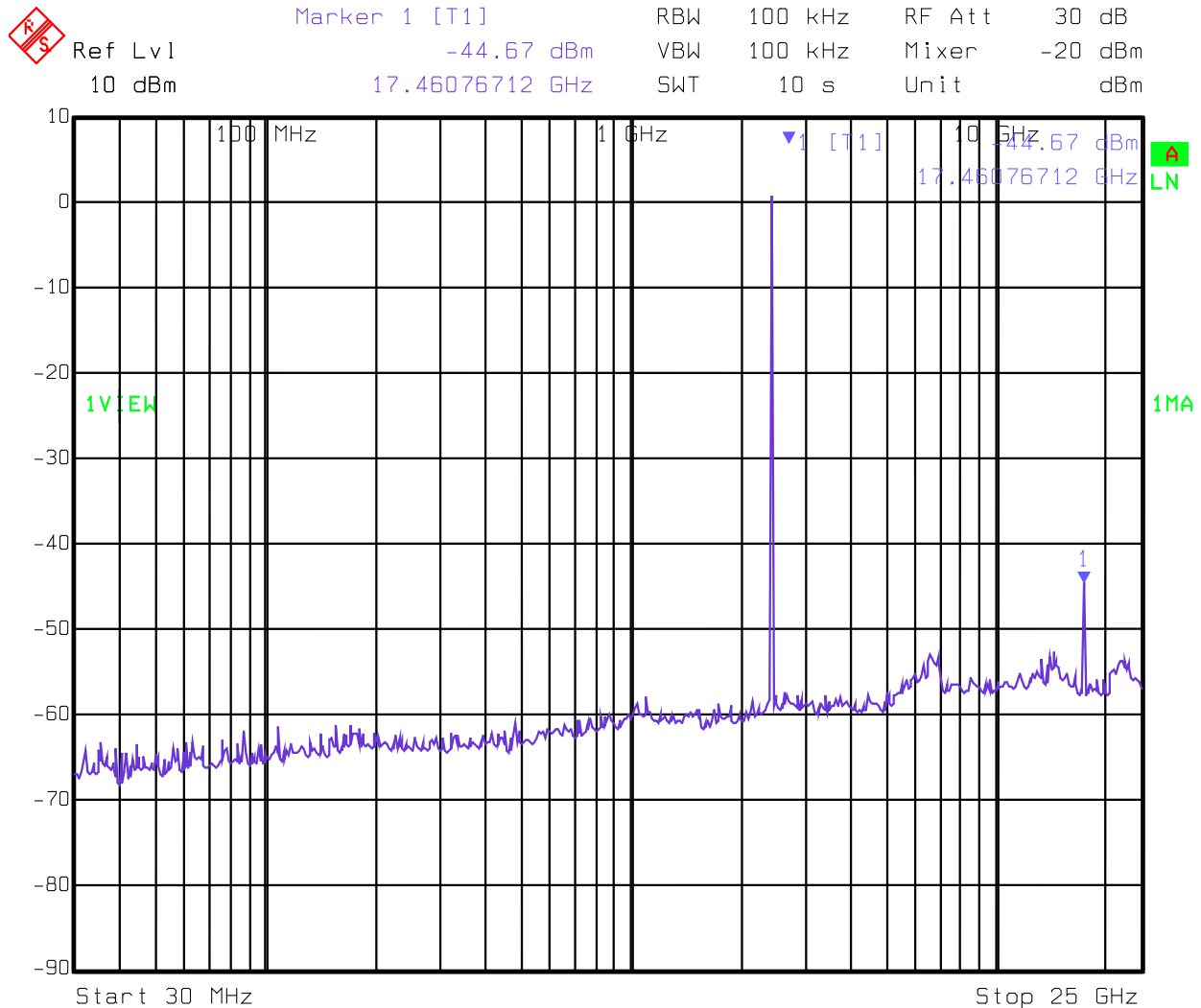
Date: 14.NOV.2011 18:00:23

Supplemental Information:

Tested by (+ signature): David Light

Table No. 35	Spurious Emissions – Middle Channel	Verdict
		P

Test Method..... : ANSI C63.4 and DA 00-705
 EUT Configuration : GFSK modulation, channel 59
 Power Input..... : 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date : 16-Nov-11
 Temperature : 25°C Relative Humidity :31 %
 Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 15:40:17

Supplemental Information:

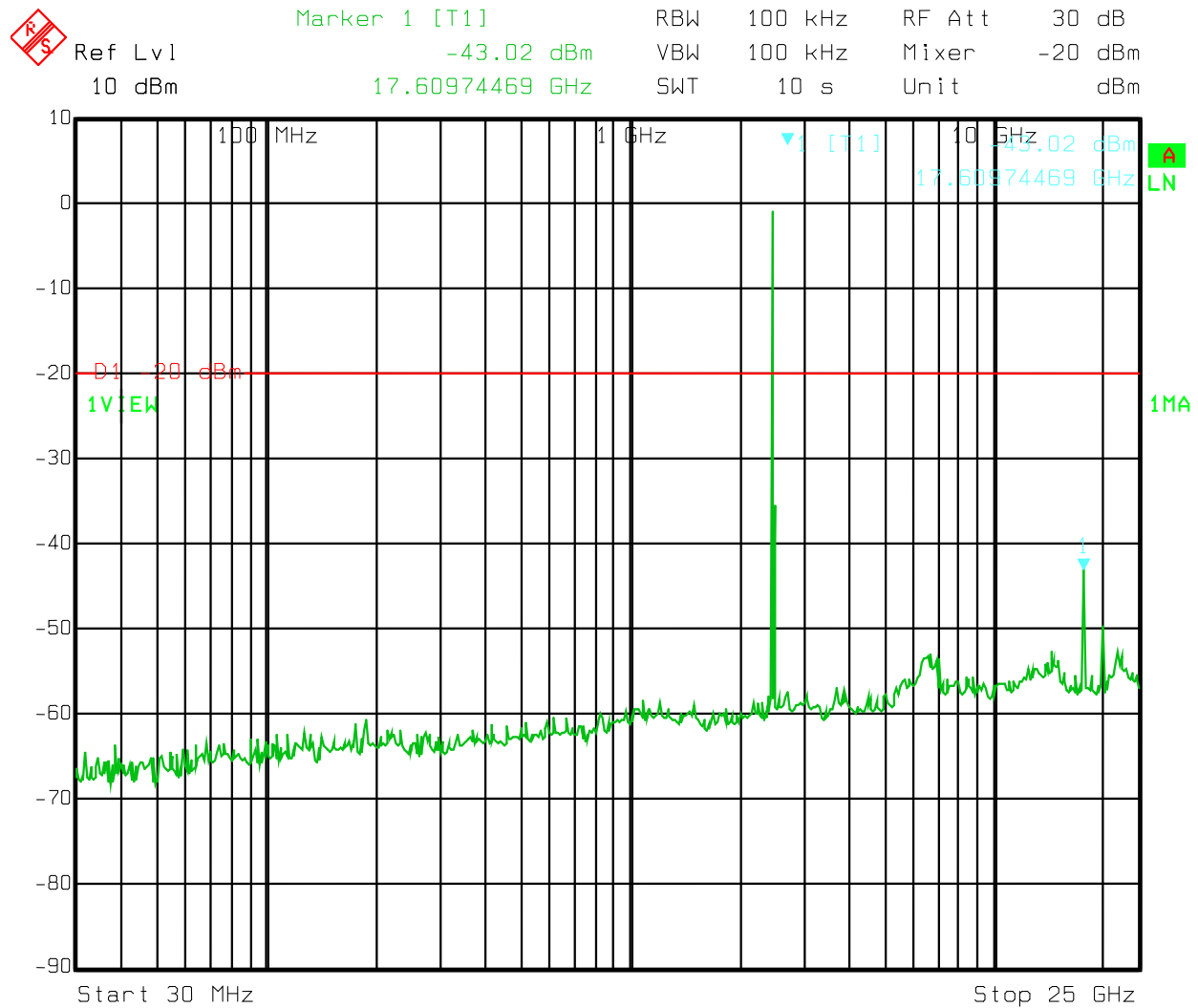
Tested by (+ signature)

David Light

David Light

Table No. 36	Spurious Emissions – High Channel	Verdict
		P

Test Method..... : ANSI C63.4 and DA 00-705
 EUT Configuration : GFSK modulation, channel 39
 Power Input..... : 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date : 14-Nov-11
 Temperature : 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List : 1767



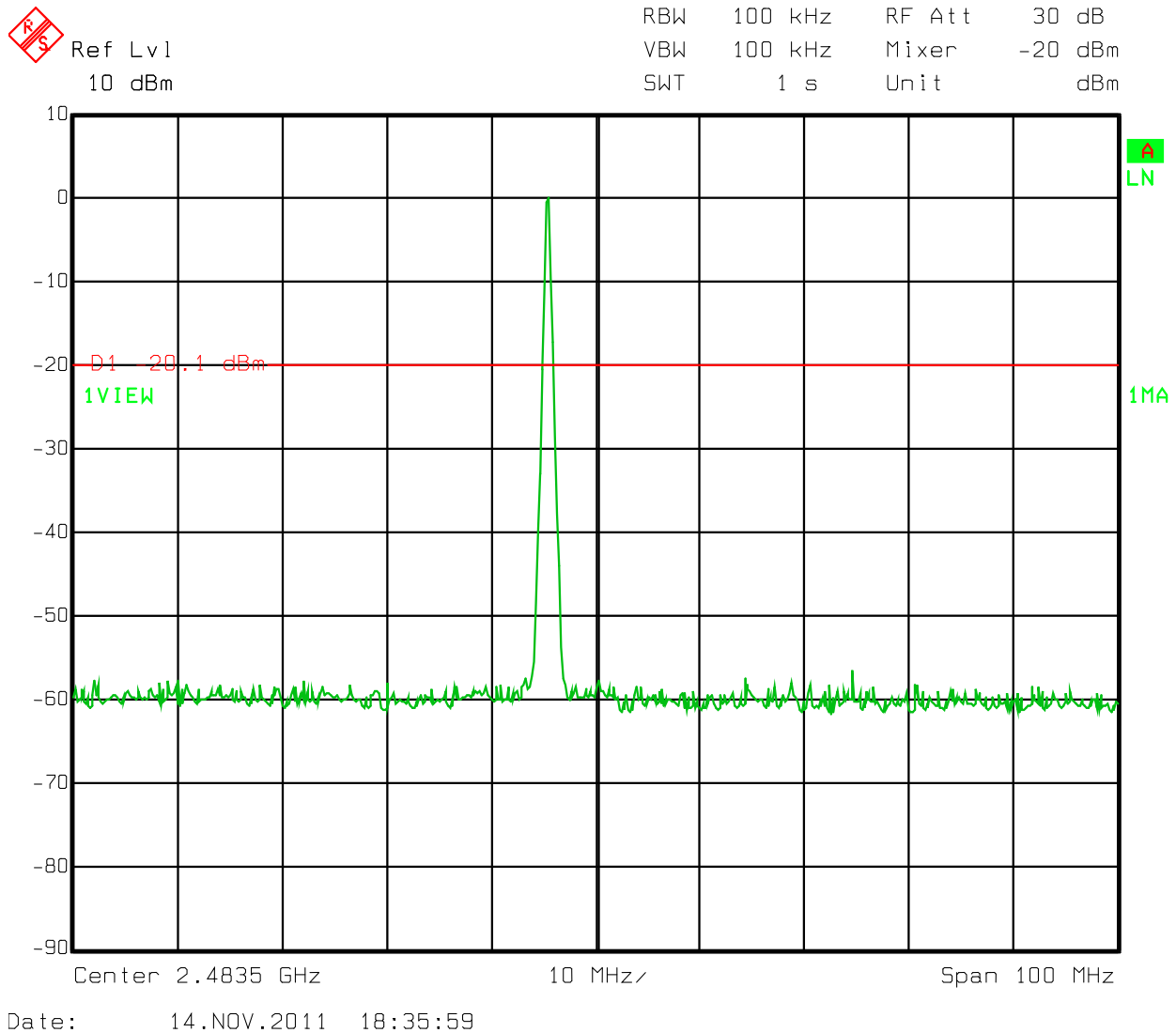
Date: 14.NOV.2011 18:37:41

Supplemental Information:

Tested by (+ signature) : David Light

Table No. 37	Spurious Emissions – Highest Channel – Upper Band Edge	Verdict
		P

Test Method..... : ANSI C63.4 and DA 00-705
 EUT Configuration : GFSK modulation
 Power Input..... : 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date : 14-Nov-11
 Temperature : 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List : 1767



Supplemental Information:

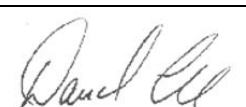
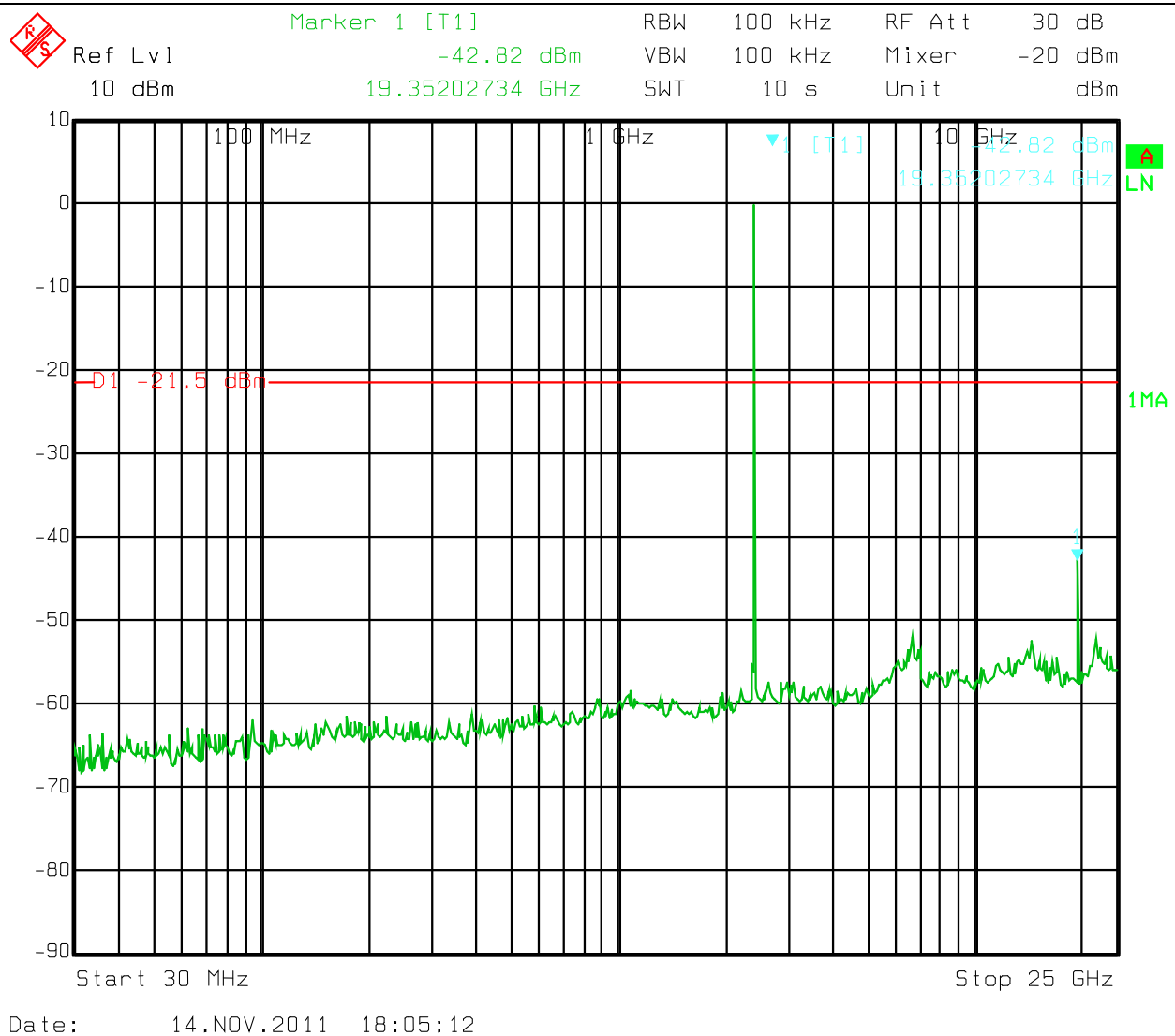
Tested by (+ signature) : David Light 

Table No. 38	Spurious Emissions – Lowest Channel	Verdict
		P

Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: 8DPSK modulation, Channel 0
 Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date: 14-Nov-11
 Temperature: 25°C Relative Humidity :31 %
 Test Equipment Asset Tag List: 1767

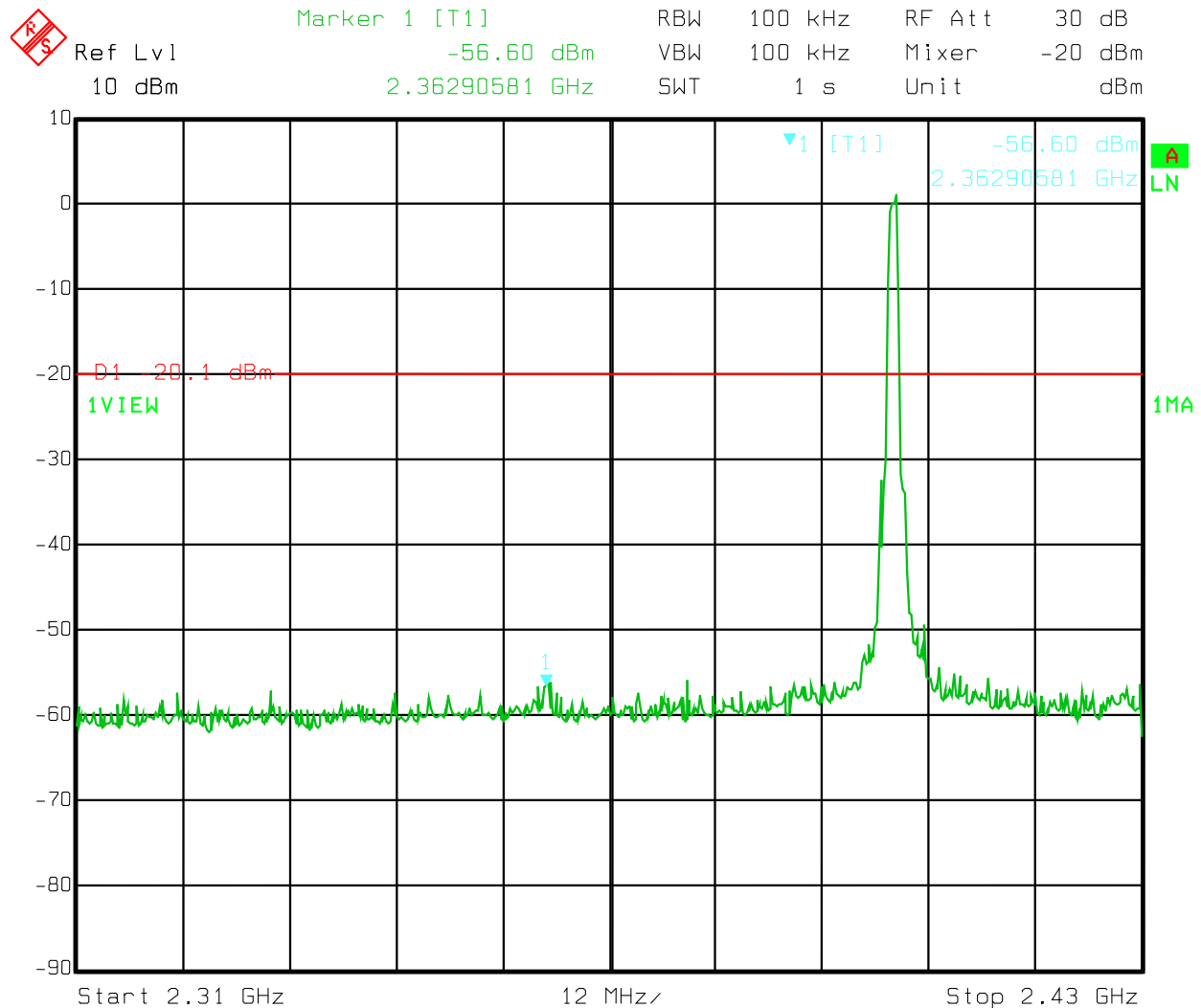


Supplemental Information:

Tested by (+ signature): David Light

Table No. 39	Spurious Emissions – Lowest Channel – 2310 – 2390 MHz	Verdict P
--------------	---	--------------

Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: 8DPSK modulation, Channel 0
 Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date: 14-Nov-11
 Temperature: 25°C Relative Humidity :31 %
 Test Equipment Asset Tag List: 1767



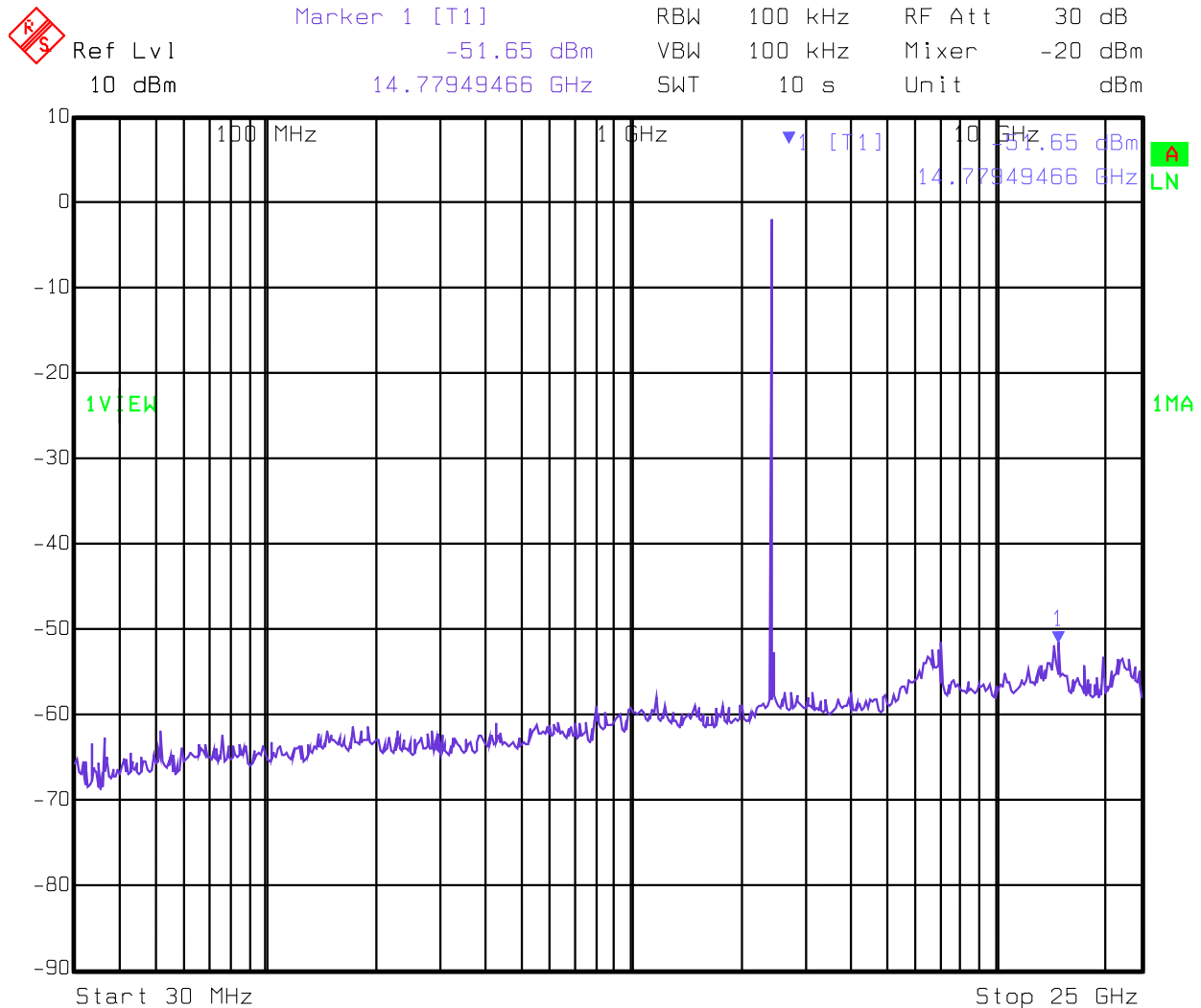
Date: 14.NOV.2011 18:03:38

Supplemental Information:

Tested by (+ signature) : David Light

Table No. 40	Spurious Emissions – Middle Channel	Verdict
		P

Test Method..... : ANSI C63.4 and DA 00-705
 EUT Configuration : 8DPSK modulation, Channel 59
 Power Input..... : 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date : 16-Nov-11
 Temperature : 25°C Relative Humidity :31 %
 Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 15:31:39

Supplemental Information:

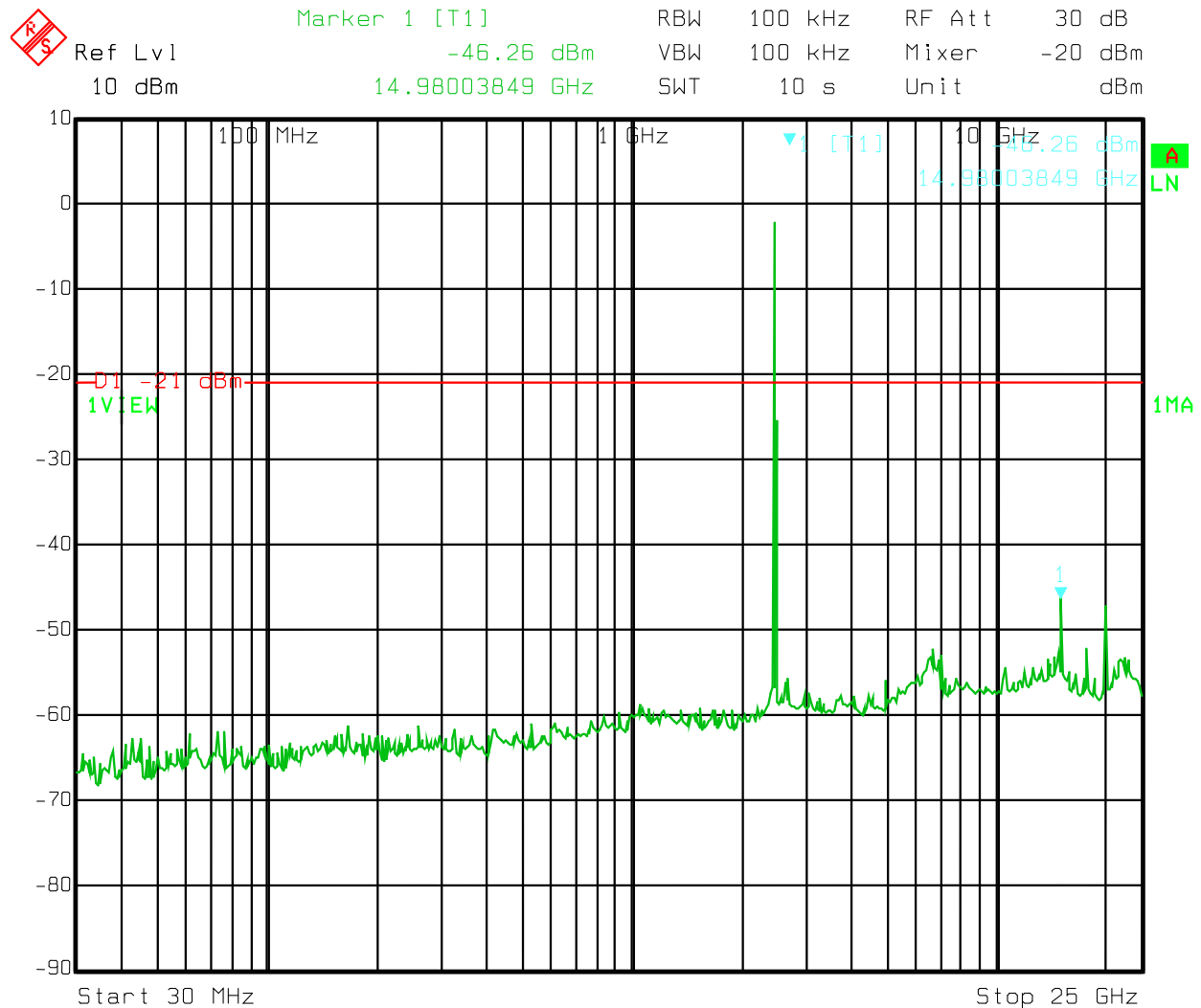
Tested by (+ signature)

David Light

David Light

Table No. 41	Spurious Emissions – High Channel	Verdict
		P

Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: 8DPSK modulation, Channel 39
 Power Input.....: 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date: 14-Nov-11
 Temperature: 25°C Relative Humidity: 31 %
 Test Equipment Asset Tag List: 1767



Date: 14.NOV.2011 18:50:45

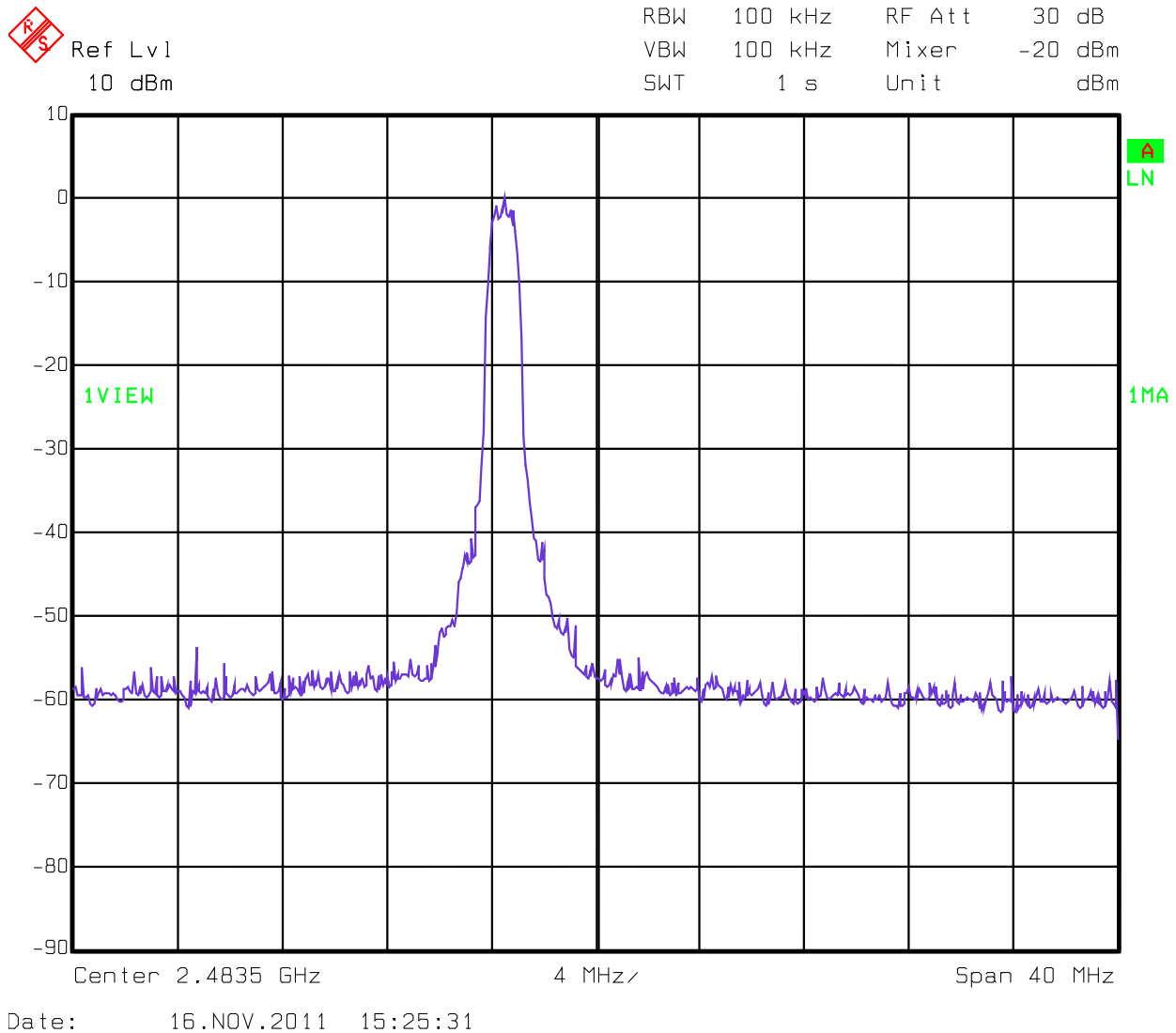
Supplemental Information:

Tested by (+ signature): David Light

David Light

Table No. 42	Spurious Emissions – Highest Channel – Upper Band Edge	Verdict
		P

Test Method..... : ANSI C63.4 and DA 00-705
 EUT Configuration : GFSK modulation
 Power Input..... : 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date : 14-Nov-11
 Temperature : 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List : 1767



Supplemental Information:

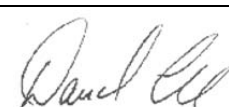
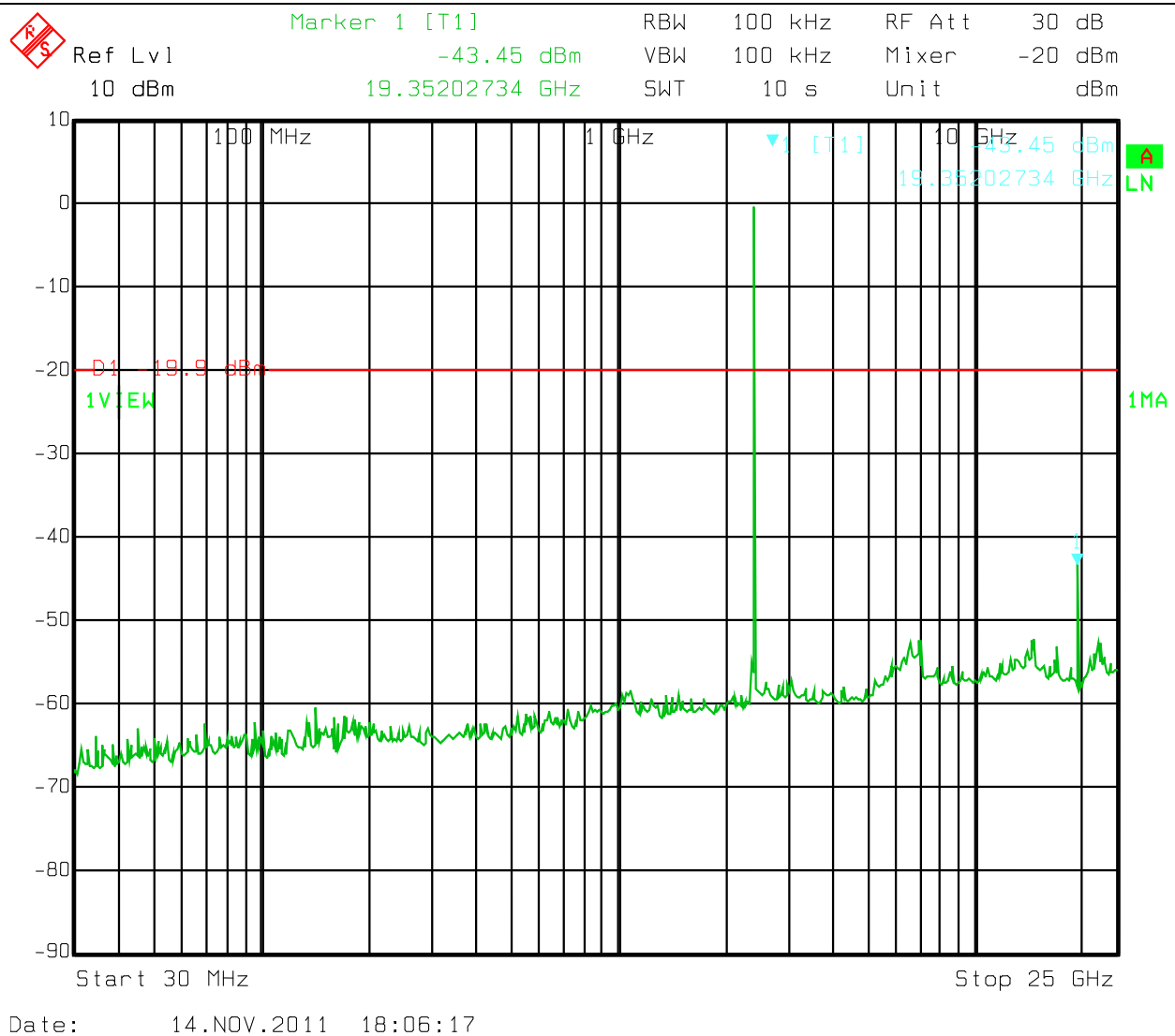
Tested by (+ signature) : David Light 

Table No. 43	Spurious Emissions – Lowest Channel	Verdict
		P

Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: Pi/4DPSK modulation, Channel 0
 Power Input.....: 5VDC ☐ 1φ ☐ 3φ
 Test Date: 14-Nov-11
 Temperature: 25°C Relative Humidity :31 %
 Test Equipment Asset Tag List: 1767

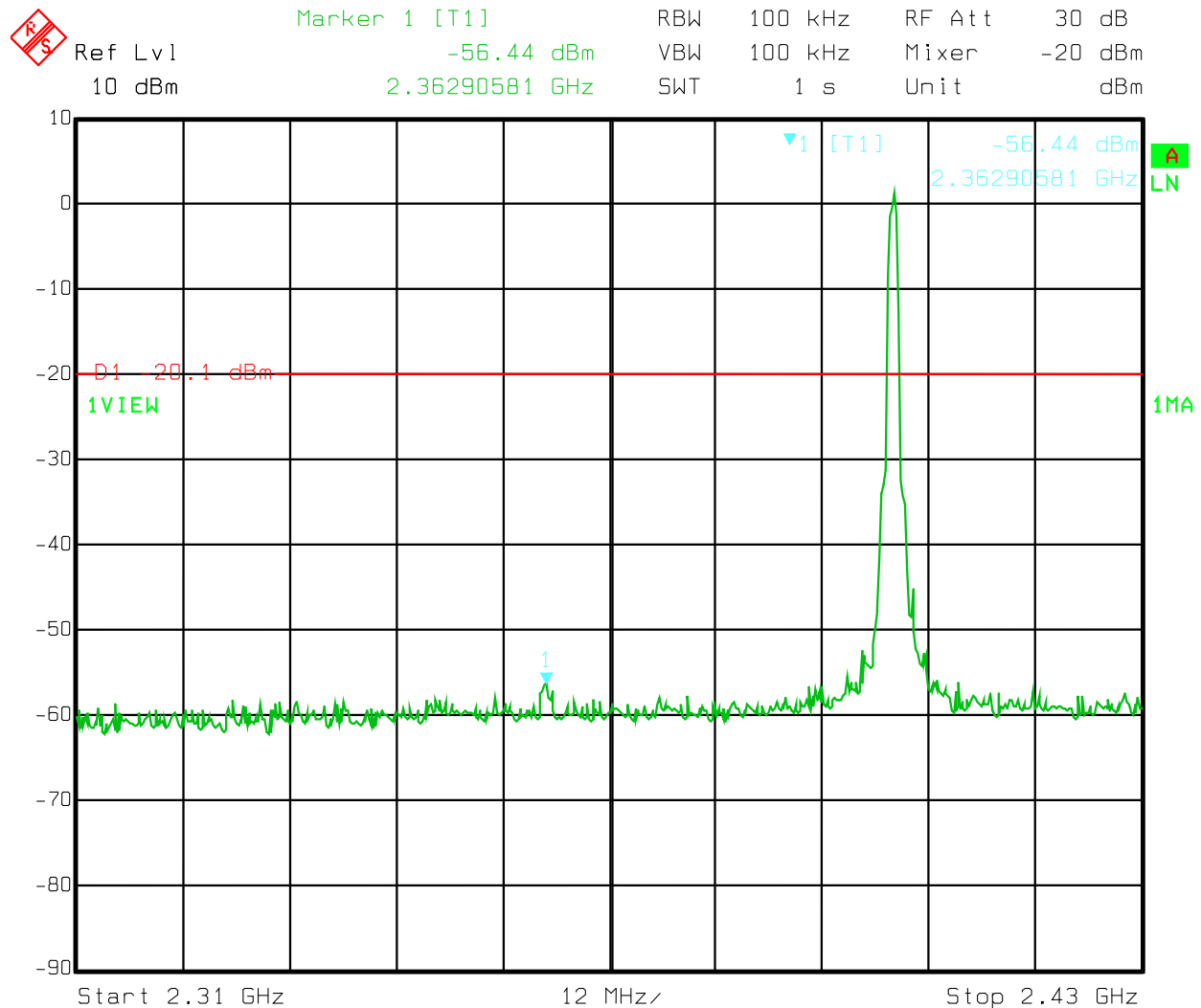


Supplemental Information:

Tested by (+ signature): David Light

Table No. 44	Spurious Emissions – Lowest Channel – 2310 – 2390 MHz	Verdict
		P

Test Method.....: ANSI C63.4 and DA 00-705
 EUT Configuration: Pi/4DPSK modulation, Channel 0
 Power Input.....: 5VDC ☐ 1φ ☐ 3φ
 Test Date: 14-Nov-11
 Temperature: 25°C Relative Humidity :31 %
 Test Equipment Asset Tag List: 1767



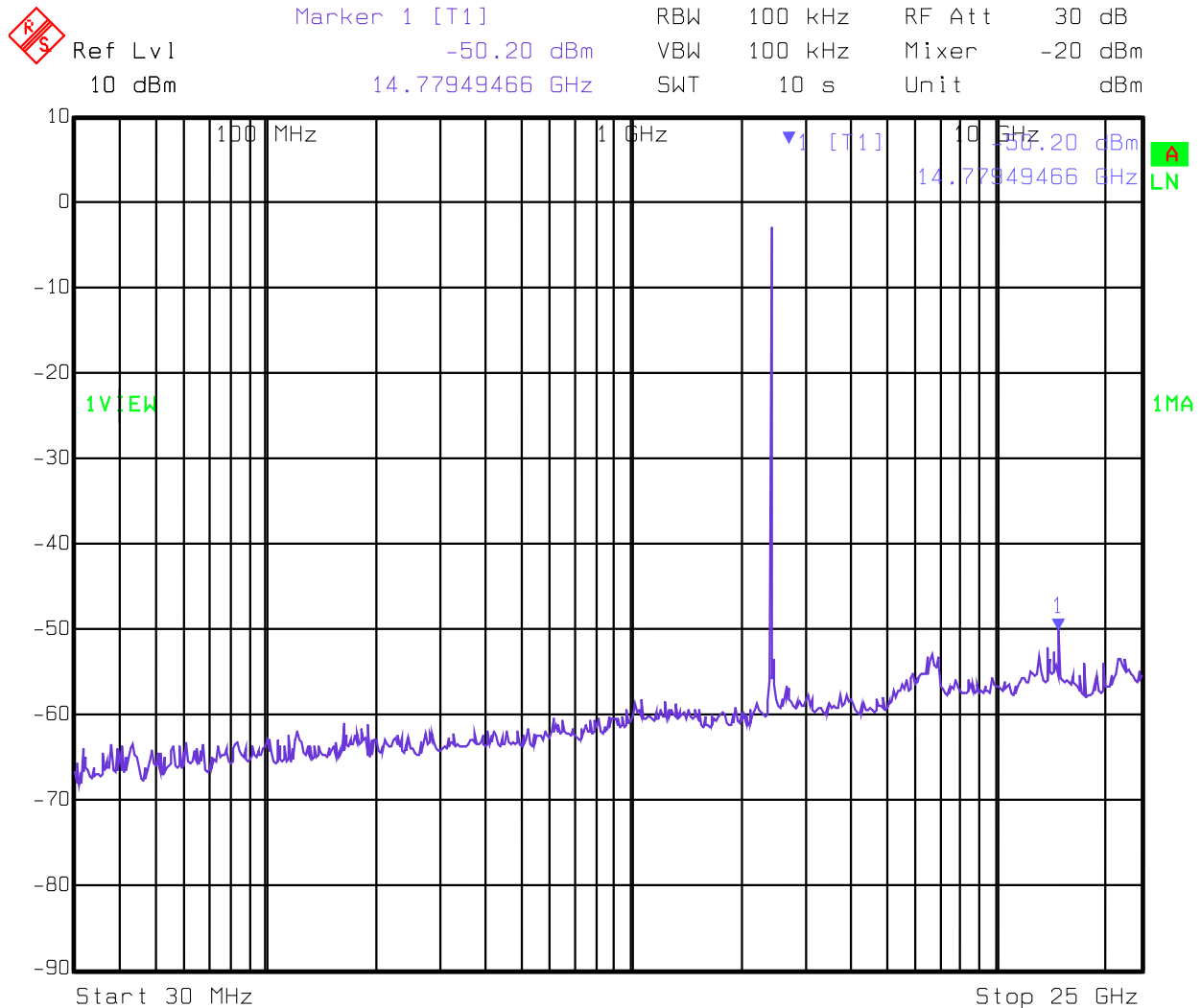
Date: 14.NOV.2011 18:02:17

Supplemental Information:

Tested by (+ signature) : David Light

Table No. 45	Spurious Emissions – Middle Channel	Verdict
		P

Test Method..... : ANSI C63.4 and DA 00-705
 EUT Configuration : Pi/4DPSK modulation, Channel 59
 Power Input..... : 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date : 16-Nov-11
 Temperature : 25°C Relative Humidity :31 %
 Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 15:32:58

Supplemental Information:

Tested by (+ signature)

David Light

David Light

Test Method.....	ANSI C63.4 and DA 00-705	
EUT Configuration	8DPSK modulation, Channel 39	
Power Input.....	5VDC ☐ 1 ϕ ☐ 3 ϕ	
Test Date	14-Nov-11	
Temperature	25°C	Relative Humidity:31 %
Test Equipment Asset Tag List	1767	



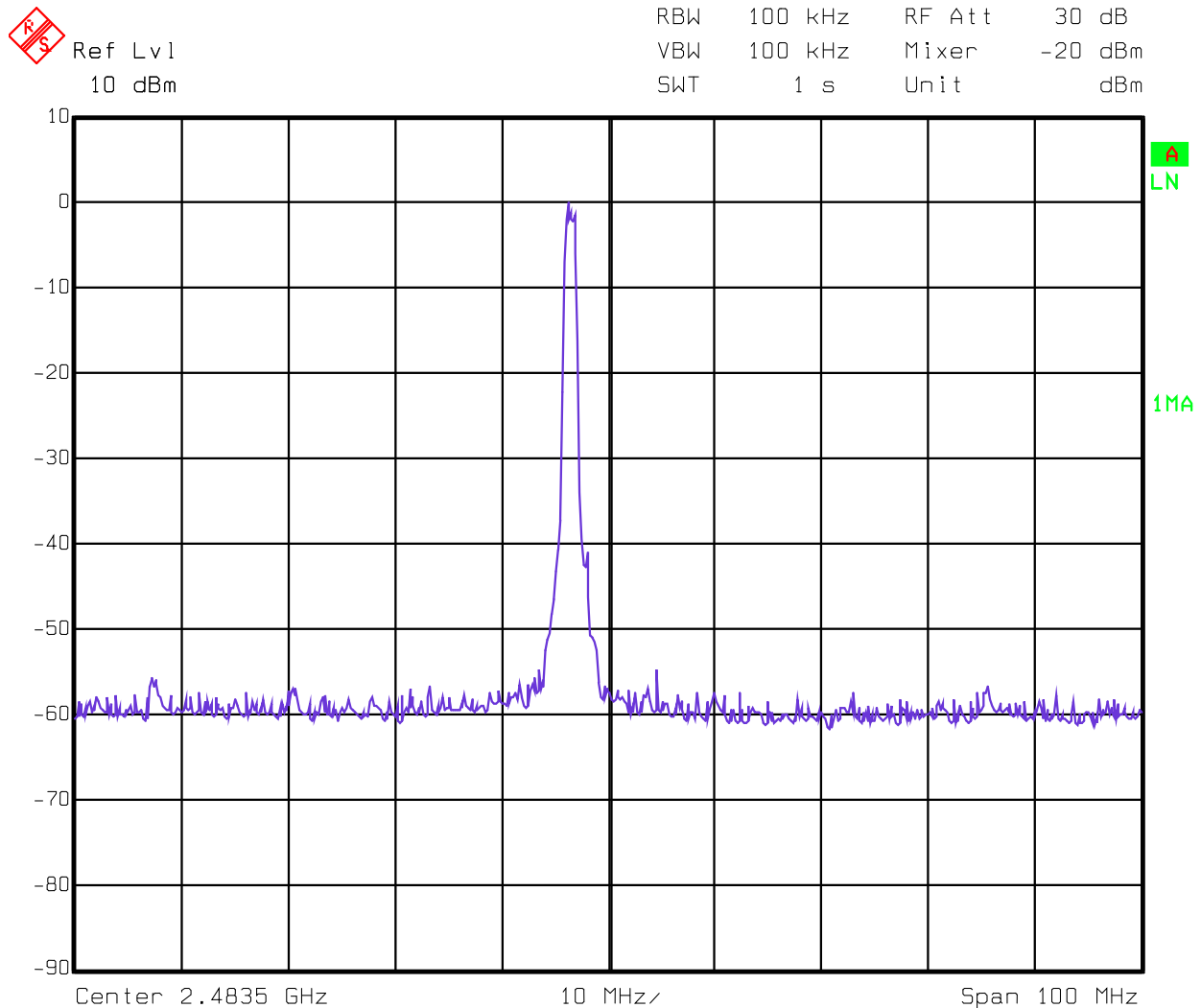
Tested by (+ signature)

David Light

Paul C.

Table No. 47	Spurious Emissions – Highest Channel – Upper Band Edge	Verdict
		P

Test Method..... : ANSI C63.4 and DA 00-705
 EUT Configuration : 8DPSK modulation, Channel 39
 Power Input..... : 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date : 14-Nov-11
 Temperature : 25°C Relative Humidity:31 %
 Test Equipment Asset Tag List : 1767



Date: 16.NOV.2011 15:15:37

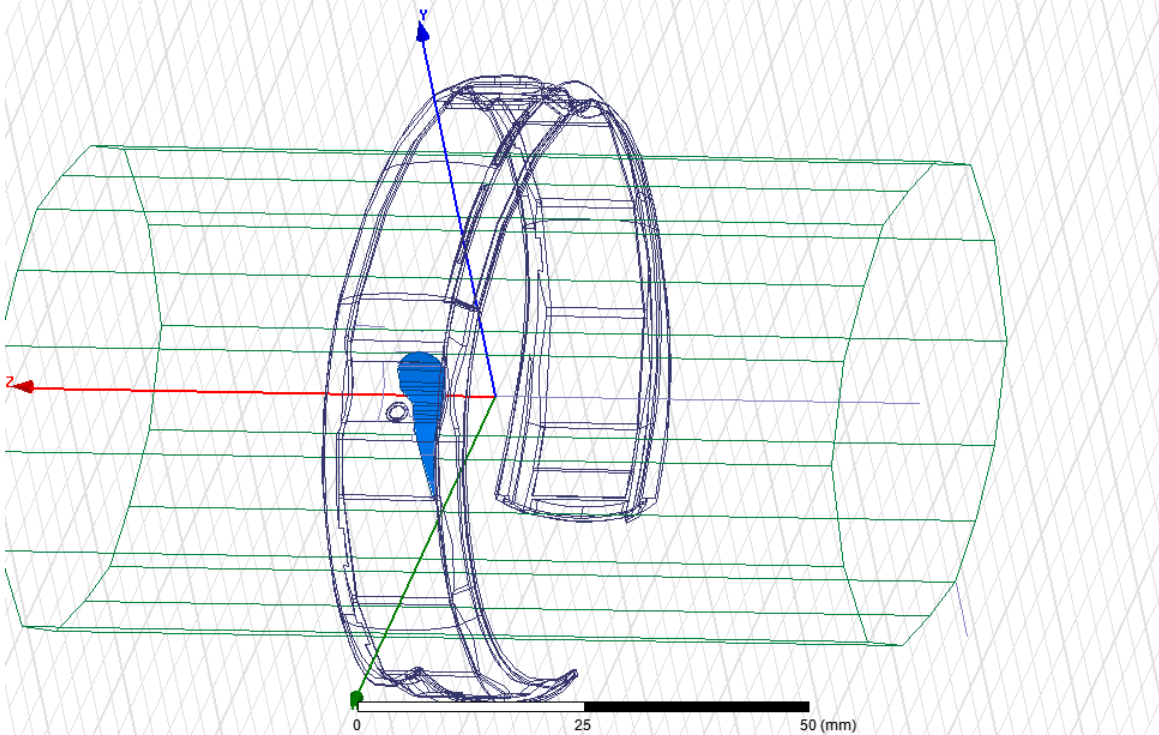
Supplemental Information:

Tested by (+ signature) : David Light 

Test Results - RF Exposure

Table No. 48	Maximum Permissible Exposure	Verdict
		NT

Test Method..... : ANSI C.95 and Safety Code 6
 EUT Exposure Category : Portable - extremities
 Power Input..... : 5VDC ☐ 1 ϕ ☐ 3 ϕ
 Test Date : 16-Nov-11
 Antenna peak gain : 0.7 dBi Highest gain antenna (medium band)
Peak eirp = 5.05 dBm + 0.7 dBi = +5.75 dBm or 3.75 mW



Supplemental Information:
 This device is worn on the wrist and may be operated at a distance closer than 5 cm from the hand and body. According to FCC Bulletin D01 Mobile Portable RF Exposure v03r03:
 Hand SAR is required for hand-held and hand-operated devices with output power $> 1000 \cdot [f(\text{GHz})]^{-0.5}$ mW that are designed with the hand operating closer than 5 cm from the antenna during normal use. At 2.4 GHz this threshold value would be 645.5 mW.
 Body SAR is required for hand-held and hand-operated or wrist, feet and ankle worn devices that operate closer than 5 cm to the body and the output power is $> 300 \cdot [f(\text{GHz})]^{-0.5}$ mW. At 2.4 GHz this threshold value would be 193.7 mW.
 Conclusion: Hand and Body SAR are not required for this device according to FCC Bulletin D01 Mobile Portable RF Exposure v03r03.

Tested by (+ signature) :  David Light

Setup Photos

Photo 4

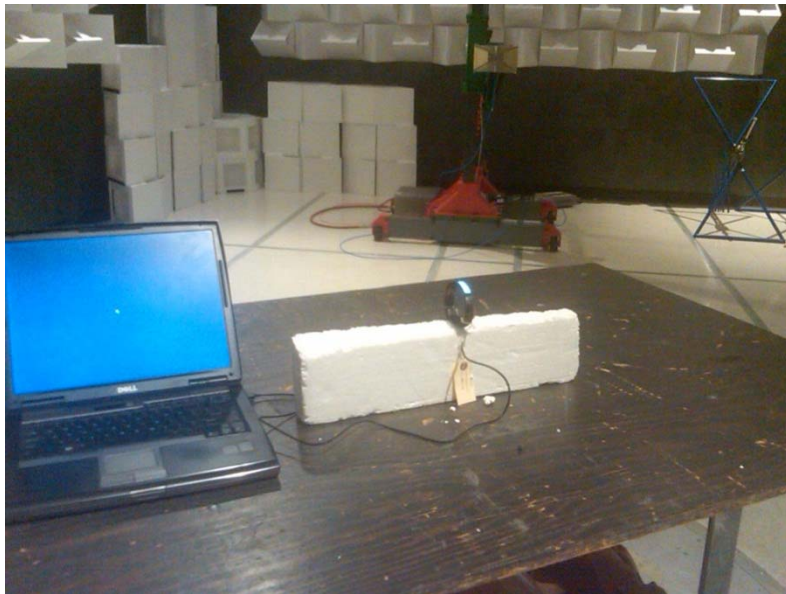
Test Setup – Radiated Emissions



Supplemental Information:

Photo 5

Test Setup – Radiated Emissions



Supplemental Information:

Photo 6	Test Setup – Conducted Emissions - MAINS	
		
Supplemental Information:		

Photo 7	Test Setup –Conducted Emissions - MAINS	
		
Supplemental Information:		