[1]

see additional document "Declaration unintentional PCMCIA" and test report F0003b/00

[3] Section 15.207, AC line conducted tests

The test was performed according ANSI C63.4.
The frequency range was 450 kHz – 30 MHz.
A 50µH/50 Ohm LISN and a EMI receiver was used.
As measuring the EMI software ES-K1 from Rohde & Schwarz was used.

Analyser settings:
Bandwidth: 10 kHz
Stepsize:5 kHz
Measuring time: 20 ms /frequency
Detector: Peak

Both plots show the maximum of both AC lines.

Figure 1 shows the results while the EUT is transmitting on 2402 MHz and figure 2 while the EUT is transmitting on2480 MHz.

The test was performed in a typical configuration of use:
Inserted in the PCMCIA slot of a laptop which was supplied via its standard power supply (no battery operation).

- Laptop, HP Omnibook XE2, S/N: TW95994702
- Power Supply, AC/DC Adapter HP F1454A S/N: 99464626

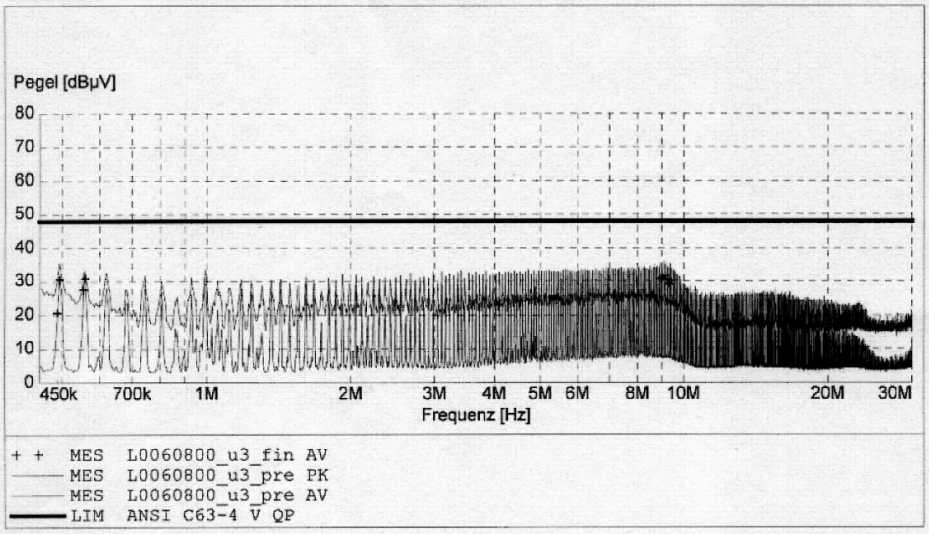
The emission of the EUT are below the limit of 48 dBµV.

7Layers, Ratingen

EUT: Bluetooth PCMCIA Dongle
Hersteller: Digianswer A.S.
Betriebsbedingungen: TX on 2402 MHz
Testort:
Durchgeführt von: cm
Spezifikationen: FCC 15.247
Kommentar:
Start of Test: 04.08.00 / 10:29:46

SCANTABELLE: "Stör-U ESHS Imp"

Start-Frequenz	Stop-Frequenz	Schritt-weite	Detektor	Meß-zeit	ZF-Bandbr.	Transducer
9.0 kHz	150.0 kHz	100.0 Hz	MaxPeak Average	50.0 ms	200 Hz	ESH3Z2 Imp.begr.
150.0 kHz	30.0 MHz	5.0 kHz	MaxPeak Average	20.0 ms	10 kHz	ESH3Z2 Imp.begr.



MEßERGEBNIS: "L0060800_u3_fin AV"

04.08.00 10:51

Frequenz MHz	Pegel dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.490000	20.00	10.0	1000.0	######	L1	GND
0.495000	29.80	10.0	1000.0	######	N	GND
0.555000	26.80	10.0	1000.0	######	N	GND
0.560000	30.20	10.0	1000.0	######	N	GND
8.955000	30.00	10.0	1000.0	######	N	GND
9.015000	30.30	10.0	1000.0	######	N	GND
9.140000	30.80	10.0	1000.0	######	N	GND
9.265000	29.90	10.0	1000.0	######	N	GND
9.325000	28.60	10.0	1000.0	######	N	GND
9.390000	29.40	10.0	1000.0	######	L1	GND

Seite 1/1 04.08.00 11:30 L0060800_u3

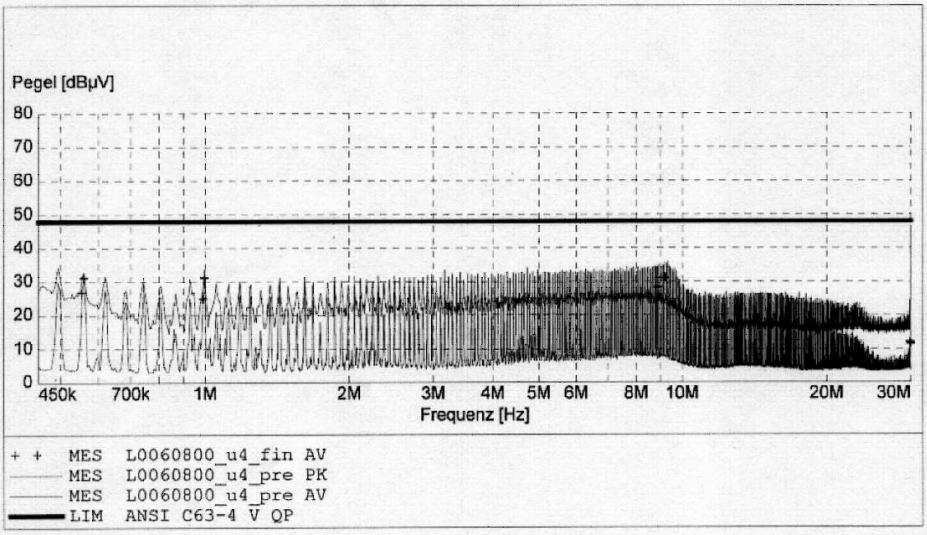
Figure 1: AC Mains results, Transmitting at 2402MHz

7Layers, Ratingen

EUT: Bluetooth PCMCIA Dongle
Hersteller: Digianswer A.S.
Betriebsbedingungen: TX on 2480 MHz
Testort:
Durchgeführt von: cm
Spezifikationen: FCC 15.247
Kommentar:
Start of Test: 04.08.00 / 10:53:47

SCANTABELLE: "Stör-U ESHS Imp"

Start-Frequenz	Stop-Frequenz	Schritt-weite	Detektor	Meß-zeit	ZF-Bandbr.	Transducer
9.0 kHz	150.0 kHz	100.0 Hz	MaxPeak Average	50.0 ms	200 Hz	ESH3Z2 Imp.begr.
150.0 kHz	30.0 MHz	5.0 kHz	MaxPeak Average	20.0 ms	10 kHz	ESH3Z2 Imp.begr.



MEßERGEBNIS: "L0060800_u4_fin AV"

04.08.00 11:14

Frequenz MHz	Pegel dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.555000	26.10	10.0	1000.0	######	L1	GND
0.560000	30.40	10.0	1000.0	######	L1	GND
0.990000	24.10	10.0	1000.0	######	N	GND
0.995000	30.40	10.0	1000.0	######	N	GND
8.895000	27.60	10.0	1000.0	######	N	GND
9.020000	30.30	10.0	1000.0	######	N	GND
9.145000	30.40	10.0	1000.0	######	N	GND
9.205000	30.30	10.0	1000.0	######	N	GND
29.925000	11.20	10.0	1000.0	######	L1	GND
30.000000	10.80	10.0	1000.0	######	N	GND

Seite 1/1 04.08.00 11:30 L0060800_u4

Figure 1: AC Mains results, Transmitting at 2480MHz

[4] Output power

Due to the fact that the conducted output power [max. on 2402MHz, 16.36 dBm (43.25mW), see test report 4-F0003a/00] will be authorised in the grant, please change the output power in our application to

44 mW

[5] Frequency range

Hereby we declare that the maximum frequency of this card is: **2402 – 2480 MHz**.

This is in line with the Bluetooth Core Specification V 1.0B for devices which will be operated in the USA.

Other frequency ranges (e.g. for Spain, France, Japan) which are allowed according the Core Specification are **not** supported by this card.

[6] Section 15.247 (b)4, RF safety requirements

Our declaration is provided in the additional document **"PCM SAR declaration FCC.pdf"** which has submitted together with this document.

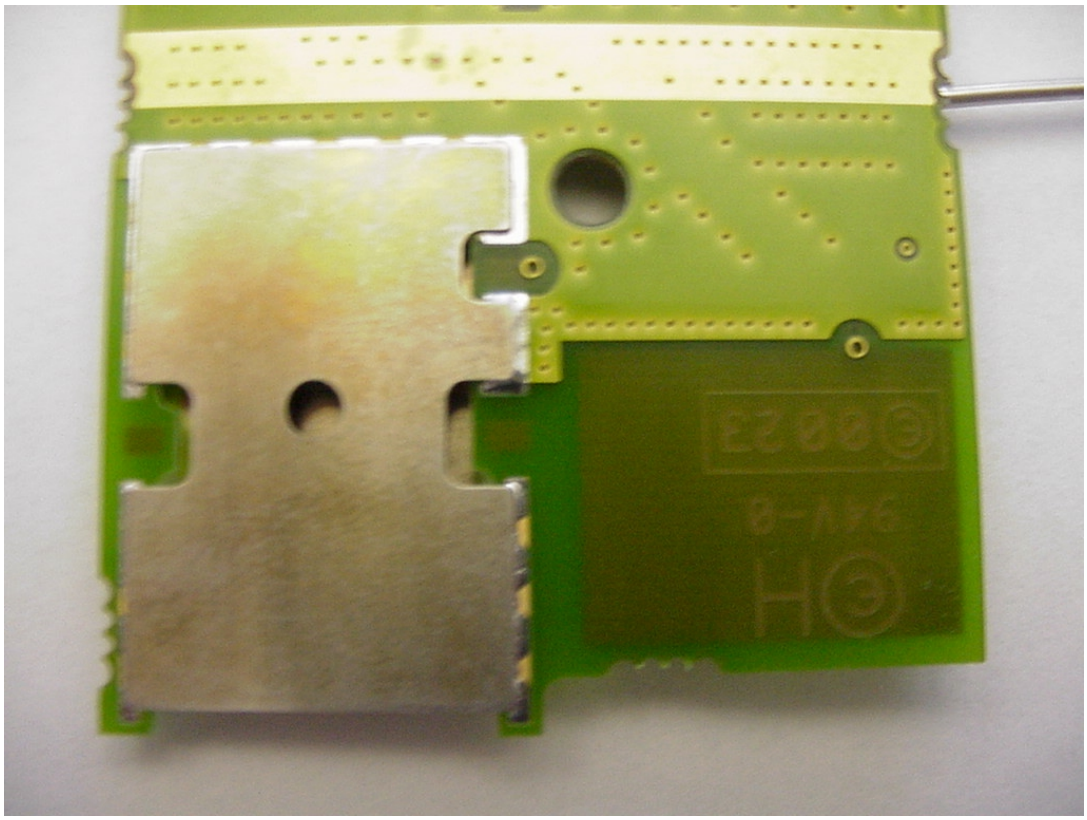
[7], compliance with section 15.203

This item was successfully answered in our last correspondence.

[8] Antenna photos, Spurious emissions radiated

Picture 1 and 2 show the detail view of the two integral antennas.

Picture 1: Frontside



Picture 2: Rearside

Spurious Emission Radiated

The test was repeated with the second antenna (patch antenna, gain 2.15 dBi) activated.

A identical test procedure, test set-up and configuration as described in the test report F-0003b/00 was used.
Measurements results:

Op-mode 1: TX frequency 2402 MHz

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit QP/AV dBµV/m	Limit Peak dBµV/m	Delta to AV/QP Limit/dB	Delta to Peak Limit/dB
		QP	Peak	AV				
Horizontal	240.00	39.6	-	-	46.0	-	6.4	-
Horizontal	245.76	41.3	-	-	46.0	-	4.7	-
Horizontal	258.06	40.7	-	-	46.0	-	3.3	-
Horizontal	270.06	39.6	-	-	46.0	-	6.4	-
Horizontal	282.06	42.2	-	-	46.0	-	3.8	-
Horizontal	331.78	40.4	-	-	46.0	-	3.6	-
Horizontal	1128	-	48.9	35.3	54.0	74.0	18.7	25.1
Horizontal	1173	-	44.5	38.8	54.0	74.0	15.2	29.5
Horizontal	1208	-	53.1	37.1	54.0	74.0	16.9	20.9
Horizontal	4583	-	55.2	45.7	54.0	74.0	8.3	18.8
Horizontal	4666	-	53.1	44.4	54.0	74.0	9.6	20.9
Horizontal	4692	-	53.4	44.3	54.0	74.0	9.7	20.6
Horizontal	4694	-	53.7	45.6	54.0	74.0	8.4	20.3
Horizontal	4804	-	63.8	53.8	54.0	74.0	0.2	10.2
Horizontal	4826	-	54.0	47.3	54.0	74.0	6.7	20.0
Horizontal	4830	-	57.9	52.2	54.0	74.0	1.8	16.1

Op-mode 1: TX frequency 2441 MHz

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit QP/AV dBµV/m	Limit Peak dBµV/m	Delta to AV/QP Limit/dB	Delta to Peak Limit/dB
		QP	Peak	AV				
Horizontal	240.00	37.5	-	-	46.0	-	8.5	-
Horizontal	245.76	41.3	-	-	46.0	-	4.7	-
Horizontal	258.06	42.5	-	-	46.0	-	3.5	-
Horizontal	270.06	39.8	-	-	46.0	-	6.2	-
Horizontal	282.06	42.3	-	-	46.0	-	3.7	-
Horizontal	331.78	42.0	-	-	46.0	-	4.0	-
Horizontal	1128	-	46.9	35.3	54.0	74.0	18.7	27.1
Horizontal	1173	-	42.0	38.8	54.0	74.0	15.2	32
Horizontal	1208	-	46.5	36.5	54.0	74.0	17.5	37.5
Horizontal	4583,5	-	51.5	42.9	54.0	74.0	11.1	22.5
Horizontal	4691	-	51.8	44.8	54.0	74.0	9.2	22.2
Horizontal	4696	-	52.1	44.2	54.0	74.0	9.8	21.9
Horizontal	4858	-	53.8	44.7	54.0	74.0	9.3	20.2
Horizontal	4881.5	-	59.9	47.8	54.0	74.0	6.2	14.1
Horizontal	7320	-	58.5	42.5	54.0	74.0	11.5	15.5

Op-mode 2: TX frequency 2480 MHz

Polarisation	Frequency MHz	Corrected value dBµV/m			Limit QP/AV dBµV/m	Limit Peak dBµV/m	Delta to AV/QP Limit/dB	Delta to Peak Limit/dB
		QP	Peak	AV				
Horizontal	240.00	39.40	-	-	46.00	-	6.60	-
Horizontal	258.06	40.40	-	-	46.00	-	5.60	-
Horizontal	270.06	38.80	-	-	46.00	-	7.20	-
Horizontal	282.06	40.90	-	-	46.00	-	5.10	-
Horizontal	331.78	40.80	-	-	46.00	-	5.20	-
Horizontal	1208	-	53.1	41.2	54.0	74.0	12.8	20.9
Horizontal	4569.8	-	55.3	45.7	54.0	74.0	8.3	18.7
Horizontal	4706	-	53.8	46.8	54.0	74.0	7.2	20.2
Horizontal	4710	-	53.2	46.4	54.0	74.0	7.6	20.8
Horizontal	4959.5	-	58.5	45.3	54.0	74.0	8.7	15.5
Horizontal	7320	-	59.7	46.3	54.0	74.0	7.7	14.3

No other spurious emissions found above noise level
The EUT is below the limit of section 15.209.

[9A]

Bluetooth units which want to communicate with other units must be organised in a structure called piconet. This piconet consist of max. 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from it's BD address which is unique for every Bluetooth device, additional masters intending to establish new piconets will always use different hop sequences.

[9B]

Example of a 79 hopping sequence in data mode:

40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67,
56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59,
72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75,
09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06,
01, 51, 03, 55, 05, 04

[9C]

The generation of the hopping sequence in connection mode depends essentially on two input values:
1. LAP/UAP of the master of the connection
2. Internal master clock

The LAP (lower address part) are the 24 LSBs of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit.
The UAP (upper address part) are the 24 MSBs of the 48 BD_ADDRESS.

The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronisation with other units only offset are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5 µs. The clock has a cycle of about one day (23h30). In most case it is implemented as 28 bit counter.

For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSBs (4 bits) (Input 1) and the 27 MSBs of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following behaviour:
The first connection between the two devices is established, a hopping sequence was generated. For transmitting the wanted data the complete hopping sequence was not used. The connection ended.
The second connection will be established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value, because the period between the two transmission is longer (and it cannot be shorter) than the minimum resolution of the clock (312.5 µs). The hopping sequence will always differ from the first one.

[9d]

This item was successfully answered in our last correspondence.

[10a - Section 15.247(g),]

The processing gain for this EUT is 17.4 dB.

The EUT fulfils the requirements of this clause.

For details see the file **"PG_PCMCIA.pdf"** which has been submitted together with this document.

[10b - Section 15.247(g),]

Dwell time

Inquiry mode:

Figure 3 shows a sweep which contains a complete inquiry on one frequency (2442 MHz).
There are two blocks of 2.56 seconds. That means this channel is active in the inquiry for 2* 2.56 seconds.

Figure 4 shows the repetition rate of the same channel. Every 10 ms is a transmission.

In figure 5 one single burst is recorded. The burst has a duration of 110 µseconds.

With this single values the active time on the channel is calculated as follows:

Active time = 2 * 2.56 s / 10 ms * 110 µs = 56.83 ms. This is below the maximum limit of 400 ms.

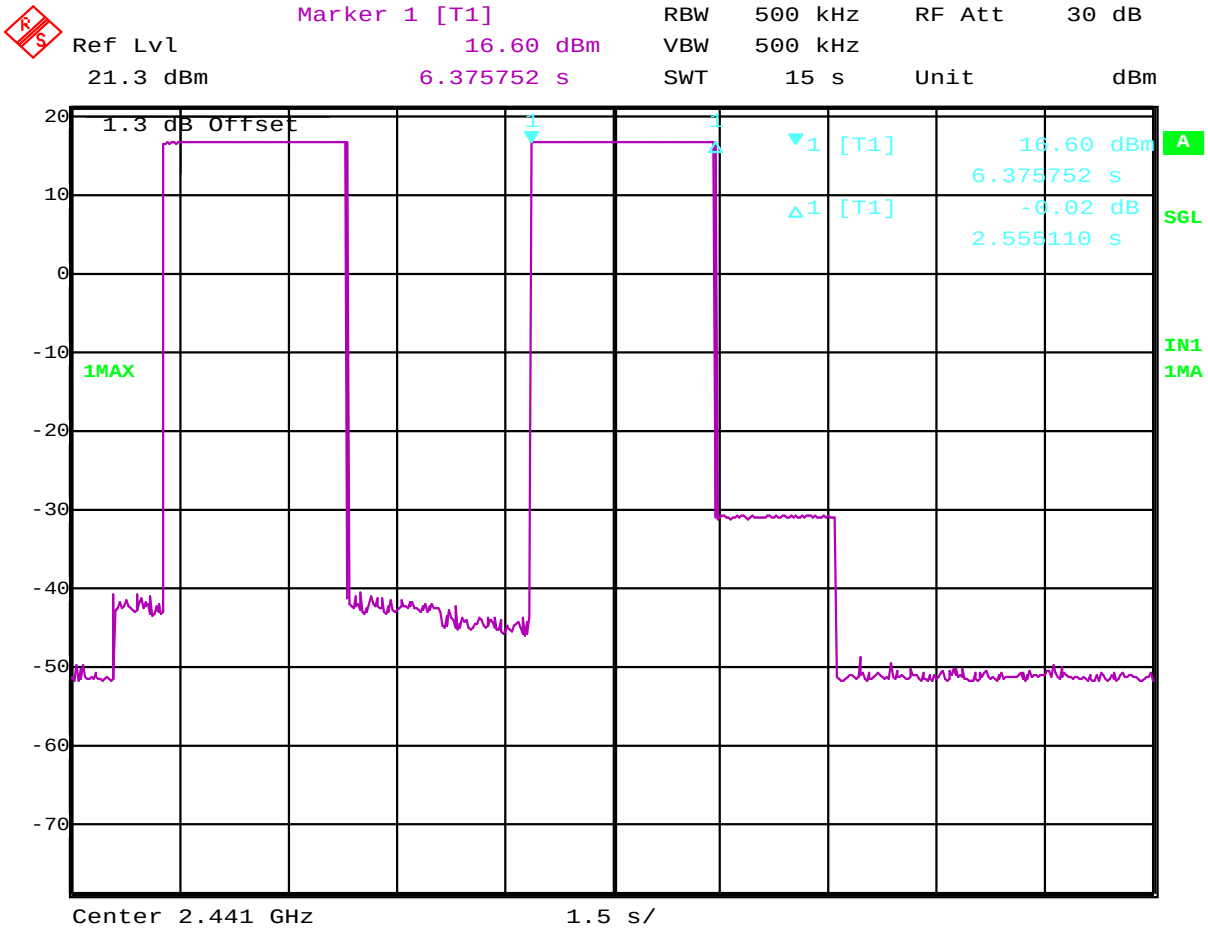


Figure 3: 15 seconds sweep for a complete inquiry

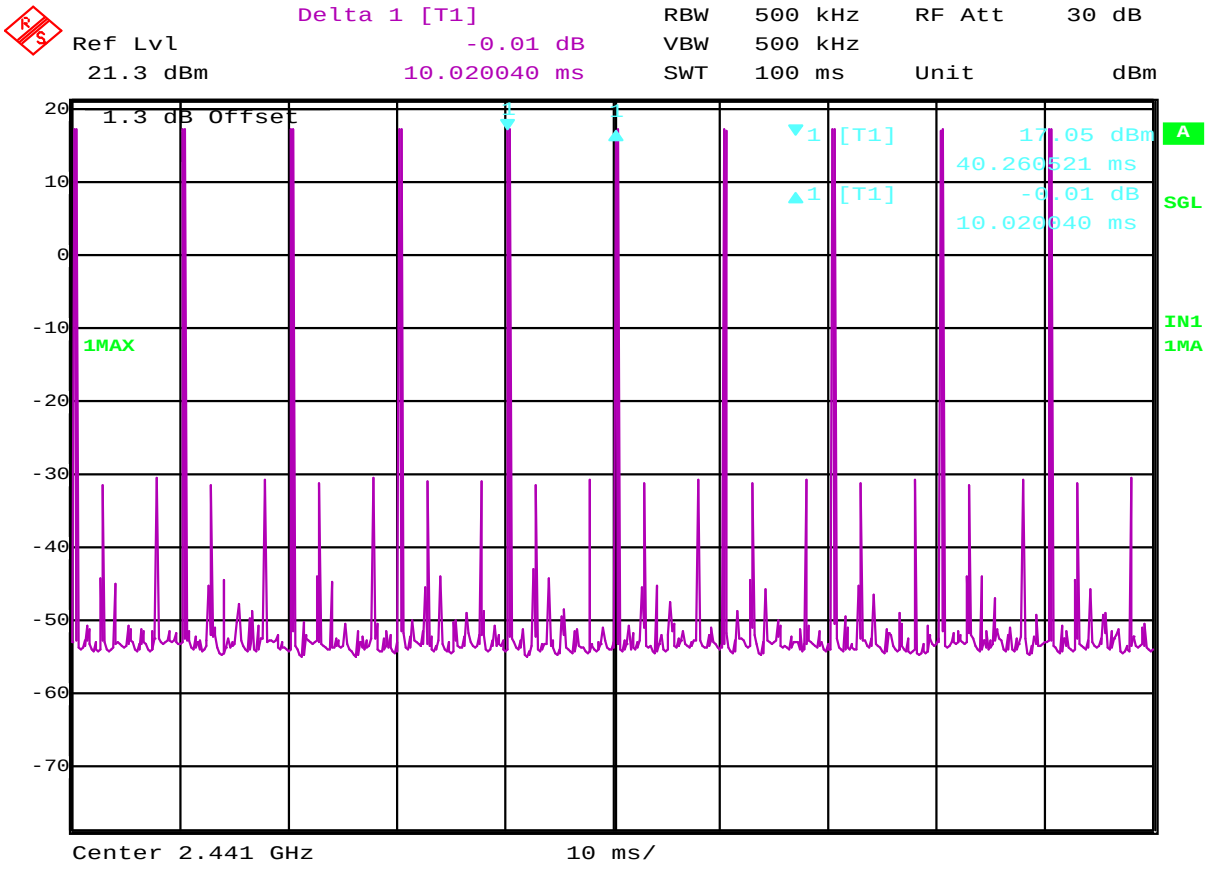


Figure 4: 100 ms sweep of a channel, to determine repetition frequency

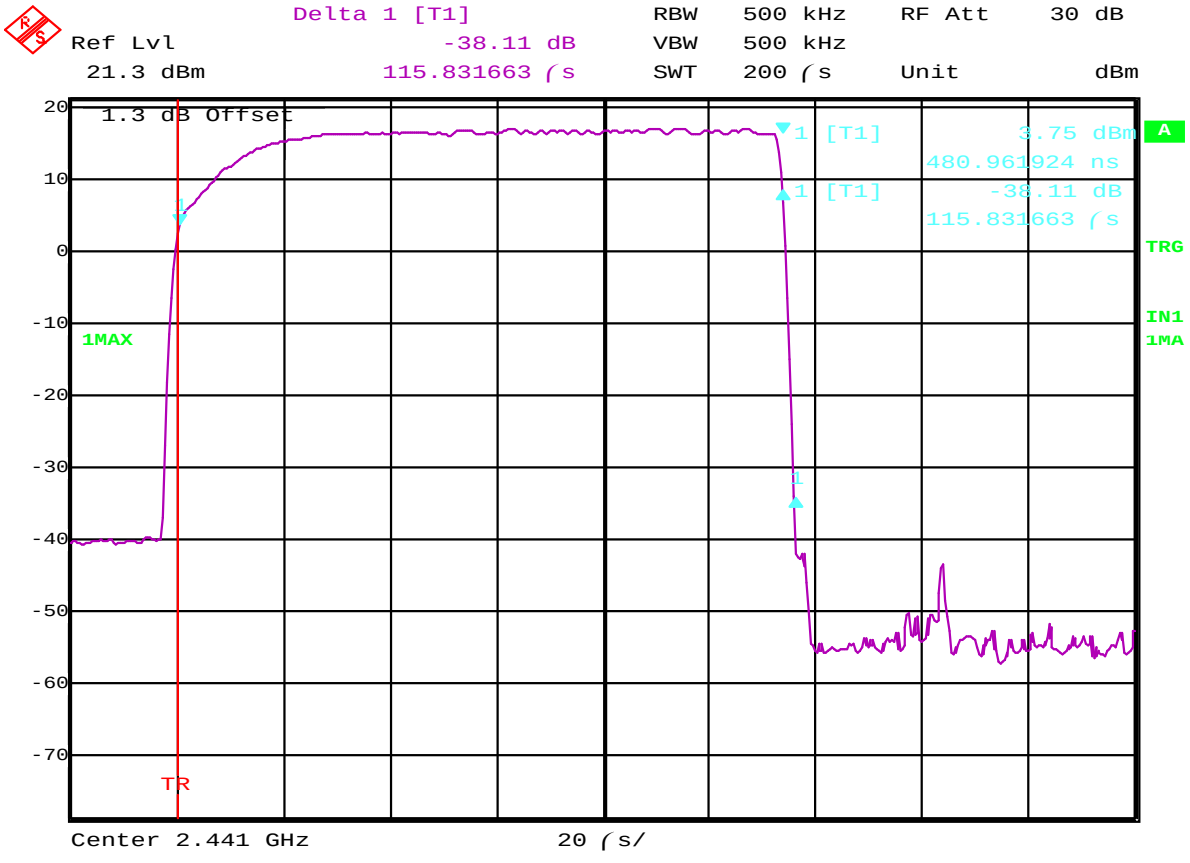


Figure 5: 200 µs sweep for a complete burst

Paging mode:

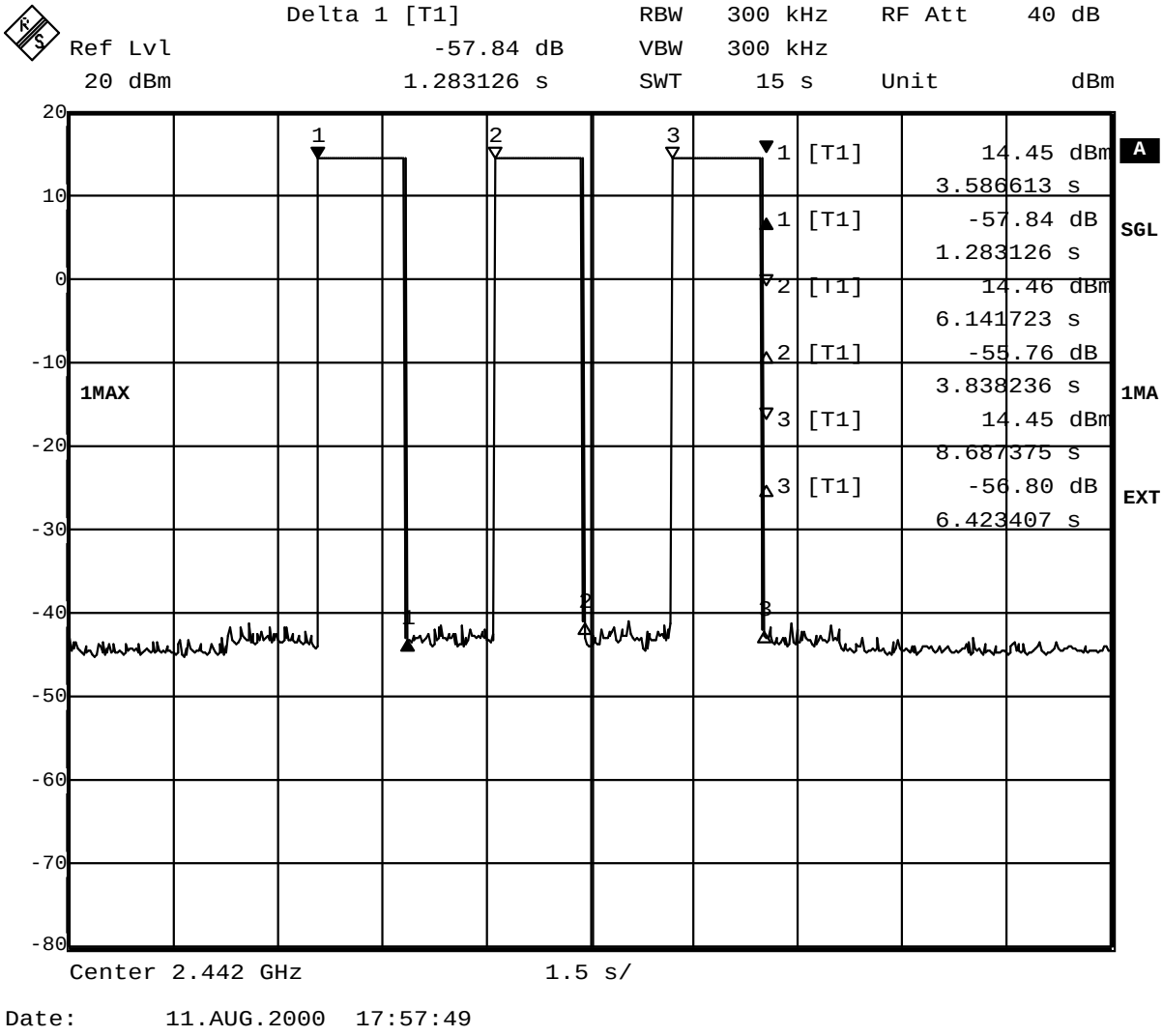
Figure 6 shows a sweep which contains a complete paging on one frequency (2442 Mhz).
There is one block of 9.33 seconds. That means this channel is active in the paging for 1* 9.56 seconds.

Figure 7 shows the repetition rate of the same channel. Every 20 ms is a transmission.

In figure 8 one single burst is recorded. The burst has a duration of 110 µseconds.

With this single values the active time on the channel is calculated as follows:

Active time = 3 * 1.28 s / 10 ms * 113.6 µs = 43.62 ms. This is below the maximum limit of 400 ms.



Date: 11.AUG.2000 17:57:49
Figure 6: 15 seconds sweep for a complete paging

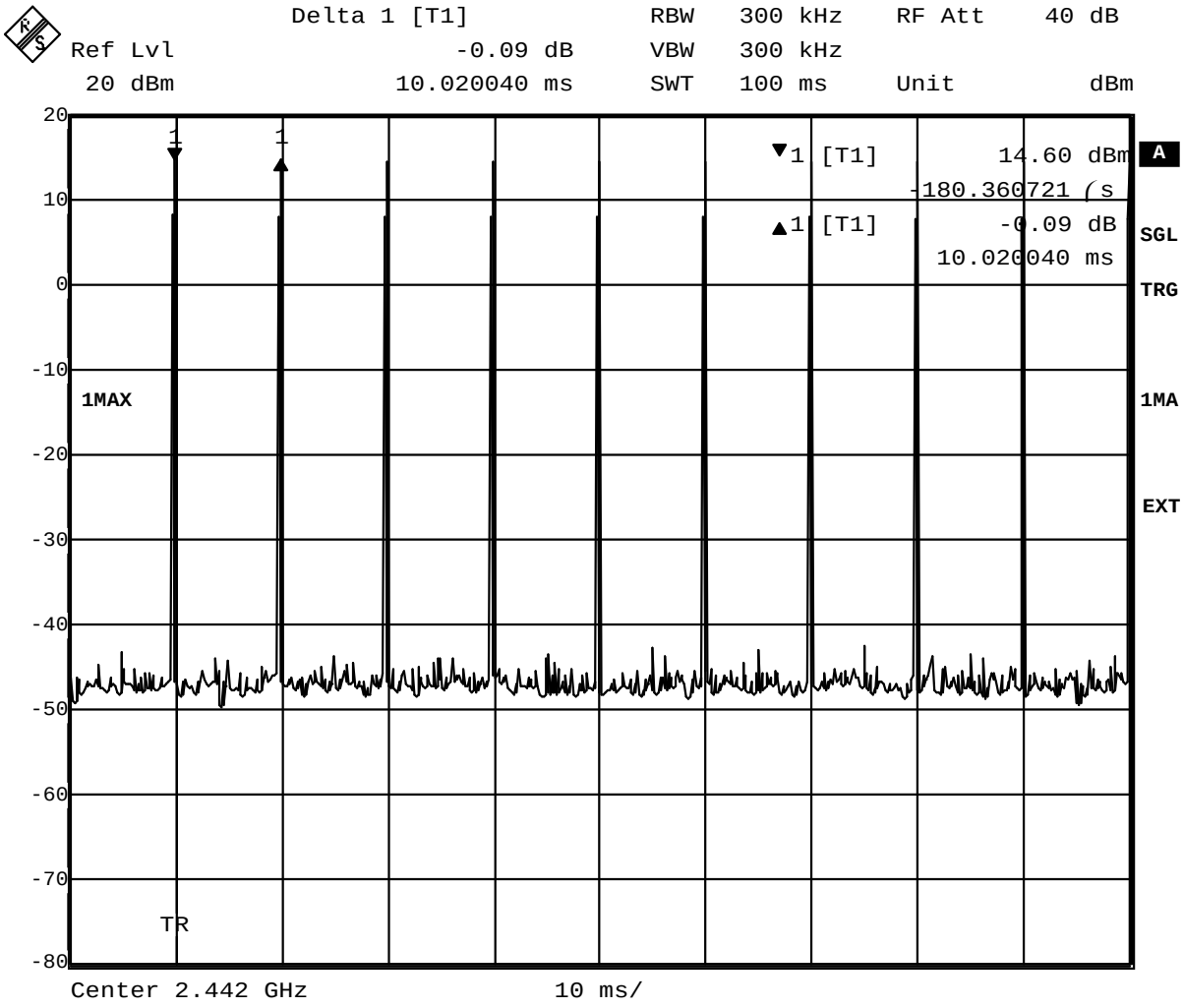


Figure 7: 100 ms sweep of a channel, to determine repetition frequency

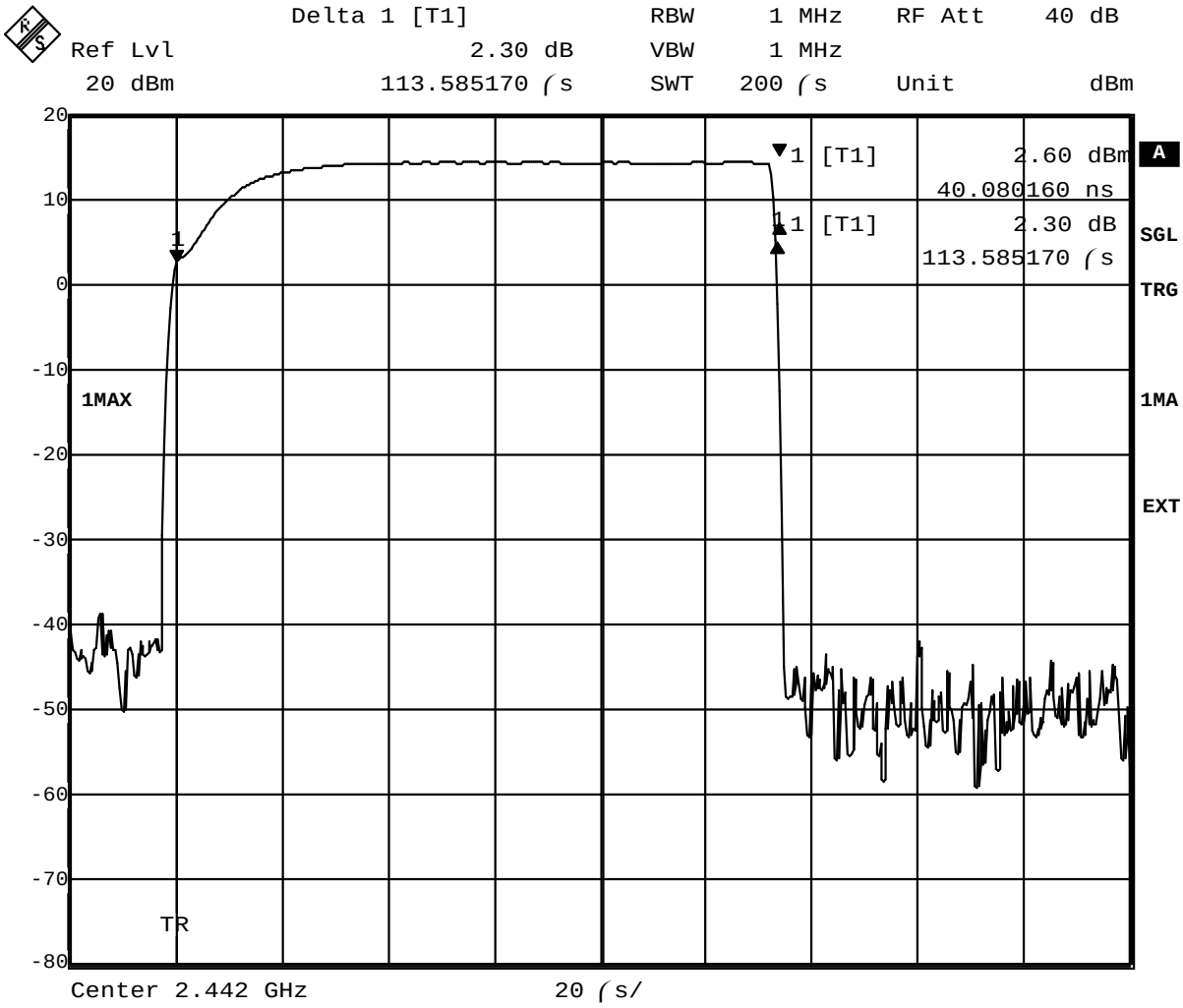


Figure 8: 200 µs sweep for a complete burst

[10c - Section 15.247(g),]

Section 15.247(g), power density

Inquiry mode

Figure 9 shows the power density in inquiry mode

The analyser settings are according 15.247 (d), RBW = VBW = 3 kHz.
The measured maximum power density in the channel (3.83 dBm / 3 kHz) is below the limit 8 dBm / 3 kHz.

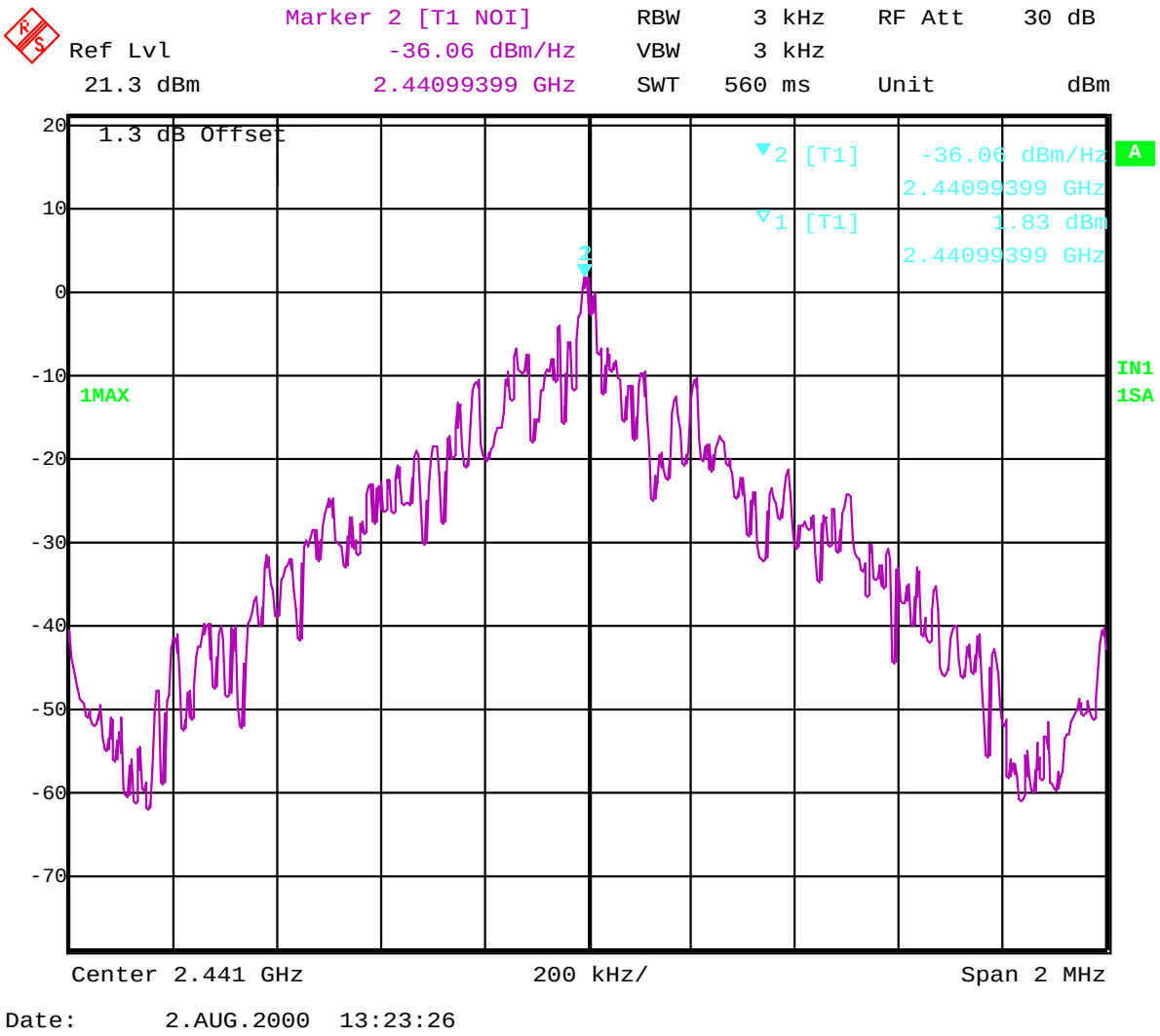


Figure 9: Power density in inquiry mode

Paging mode

Figure 10 shows the power density in paging mode

The analyser settings are according 15.247 (d), RBW = VBW = 3 kHz.
The measured maximum power density in the channel (-0,91 dBm / 3 kHz) is below the limit 8 dBm / 3 kHz.

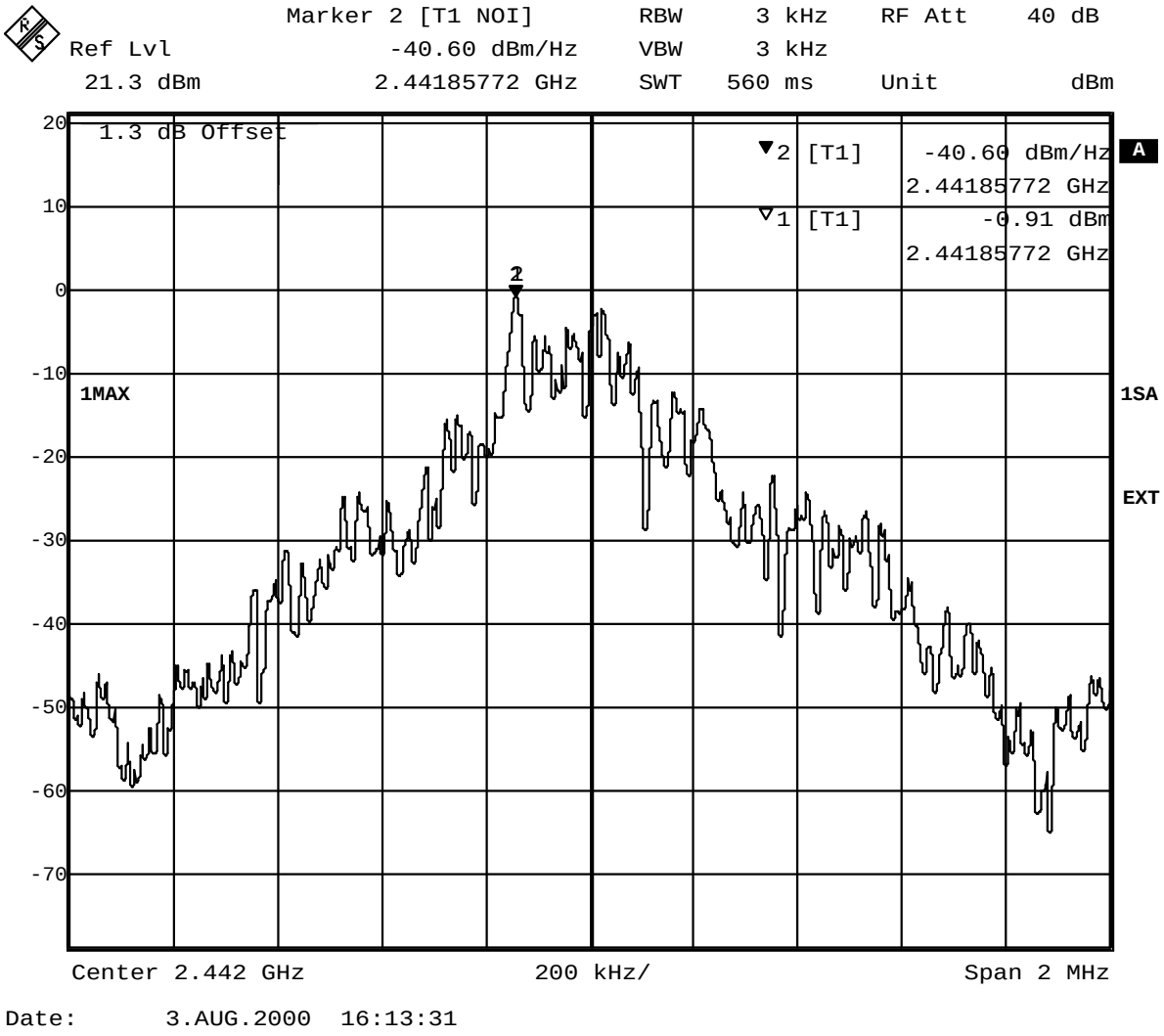


Figure 10: Power density in page mode

[10a - Section 15.247(a1),]

20dB bandwidth

Inquiry mode:

Figure 11 shows the 20 dB bandwidth of a channel in inquiry mode

The measured 20 dB bandwidth of the channel (559 kHz) is below the limit of 1 MHz.

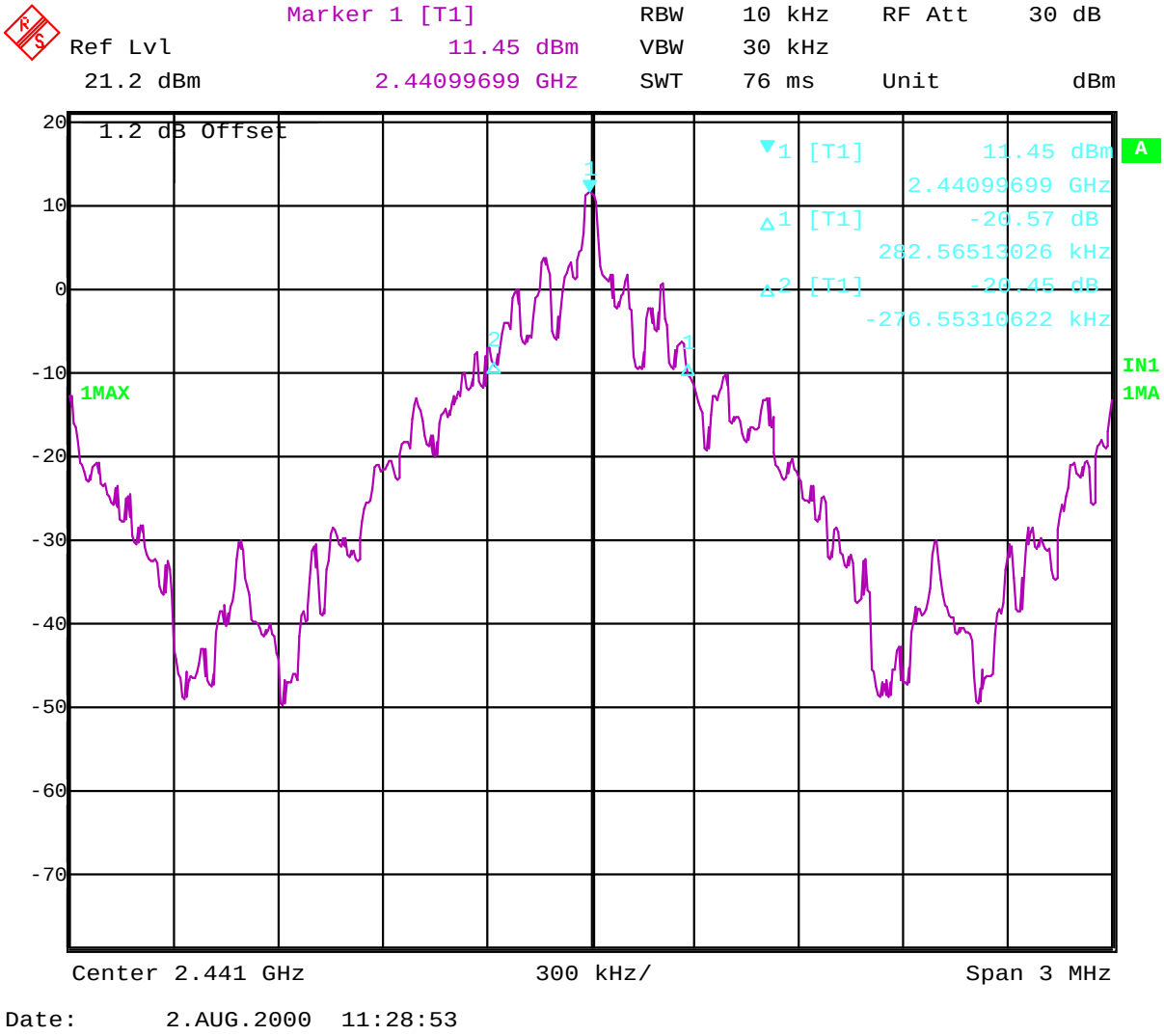


Figure 11: 20 dB bandwidth in inquiry mode

Paging mode:

Figure 12 shows the 20 dB bandwidth of a channel in paging mode

The measured 20 dB bandwidth of the channel (541 kHz) is below the limit of 1 MHz.

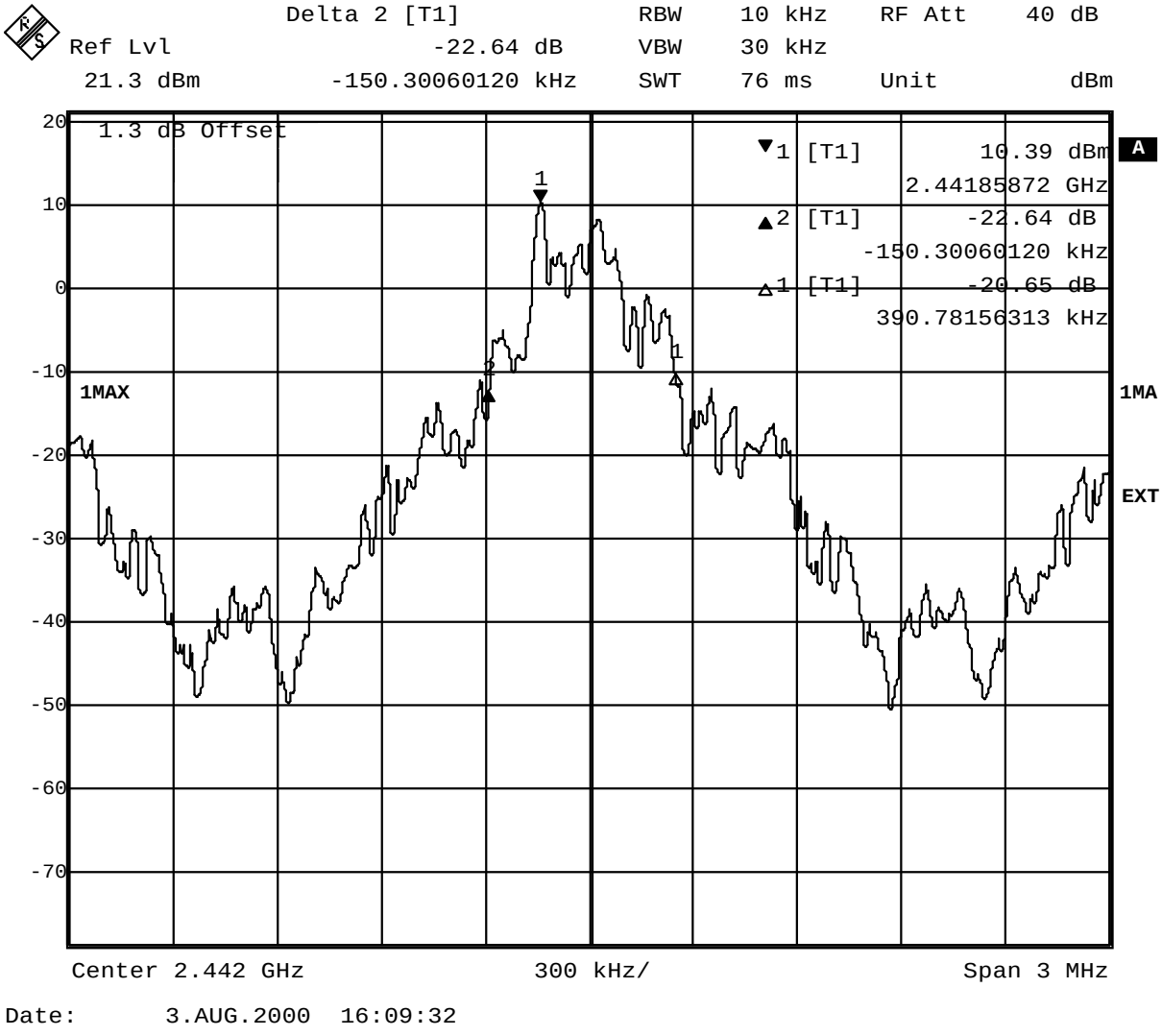


Figure 12: 20 dB bandwidth in page mode

[10b - Section 15.247(a1),]

Channel Separation

The nominal channel spacing of the Bluetooth system is 1Mhz.

The maximum "initial carrier frequency tolerance" which is allowed for Bluetooth is fcenter ± 75 kHz.
We have performed this tests on three frequencies (2402, 2441, 2480 MHz).

The PCMCIA Card is within the limits

Additionally an example for the channel separation

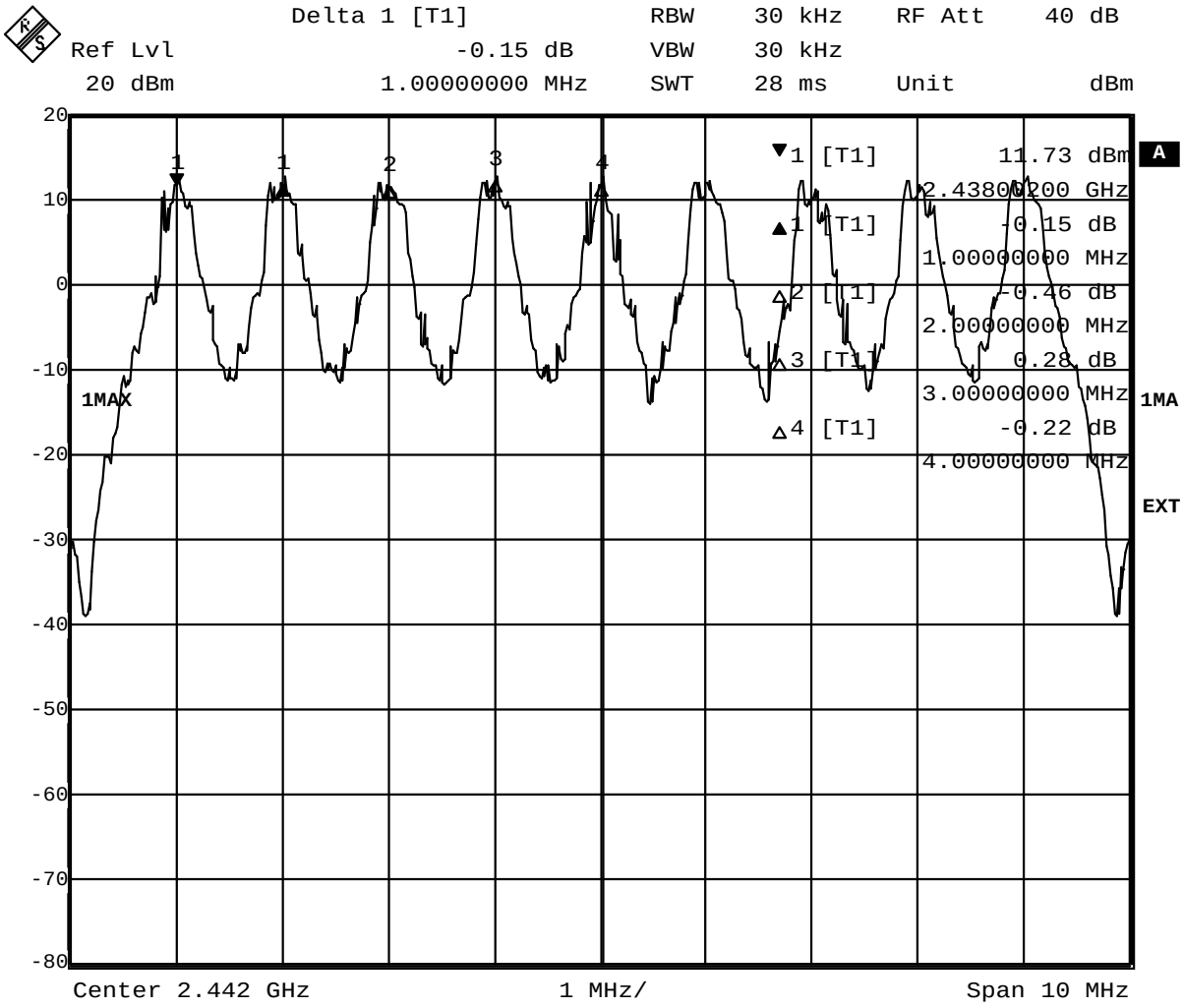


Figure 13: Channel separation

[10c + d - Section 15.247(a1),]

For the generation of the inquiry and page hop sequences the same procedures as described for the data mode are used, but this time with different input vectors:

- For the inquiry hop sequence, a predefined fixed address is always used. This results in the same 32 frequencies used by all devices doing an inquiry but every time with a different start frequency and phase in this sequence.
- For the page hop sequence, the device address of the paged unit is used as input vector. This results in the use of a subset of 32 frequencies which is specific for that initial state of the connection establishment between the two units. A page to different devices would result in a different subset of 32 frequencies.

Example of a hopping sequence in inquiry mode:
48, 50, 09, 13, 52, 54,41, 45, 56, 58, 11, 15, 60, 62, 43, 47, 00, 02, 64, 68, 04, 06, 17, 21, 08, 10, 66, 70, 12, 14, 19, 23

Example of a hopping sequence in paging mode:
08, 57, 68, 70, 51, 02, 42, 40, 04, 61, 44, 46, 63, 14, 50, 48, 16, 65, 52, 54, 67, 18, 58, 56, 20, 53, 60, 62, 55, 06, 66, 64

[10e - Section 15.247(a1),]

The receiver input bandwidth is the same as in the data mode (1 MHz).

When two Bluetooth devices establish contact for the first time, one device sends an inquiry access code, the other device is scanning for this inquiry access code.
If two devices have been connected previously and want to start a new transmission, a similar procedure takes place. The only difference is, instead of the inquiry access code, an special access code, derived from the BD_ADDRESS of the paged device will be, will be sended by the master of this connection.
Due to the fact that both units have been connected before (in the inquiry procedure) the paging unit has timing and frequency information about the page scan of the paged unit. For this reason the time to establish the connection is reduced considerable.

[10f - Section 15.247(a1),]

The Spread rate / Data rate in inquiry and paging mode can be defined via the access code. The access code is the only criterion for the system to check if there is a valid transmission or not. If you regard the presence of a valid access code as one bit of information, and compare it with the length of the access code of 68 bits,
the Spread rate / Data rate will be 68/1.