

Exhibit 6d1: Bluetooth Requirements -- Pursuant to 47 CFR 15.247

This plan is based on recommendations from FCC document DA 00-705 Released March 30, 2000 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems).

Part 15.247 of the FCC Rules provides for operation of frequency hopping spread spectrum transmitters. The FCC has no established test procedure for frequency hopping spread spectrum devices. Such tests are to be performed following the general guidance in Section 15.31 of the FCC Rules, using good engineering practice.

Equipment used:

Rohde and Schwarz Spectrum Analyzer FSEM30
cal Date: April 18, 2006
ser # 835533/014

Section 15.203:

The EUT Bluetooth antenna is permanently attached.

Section 15.204:

The Bluetooth radio uses an Inverted Folded type Antenna (IFA). It is printed on the radio printed-circuit-board (PCB). The gain is -3.5 dBi or -3.51 dB with reference to an isotropic radiator.

Section 15.247(a):

Carrier Frequency Separation

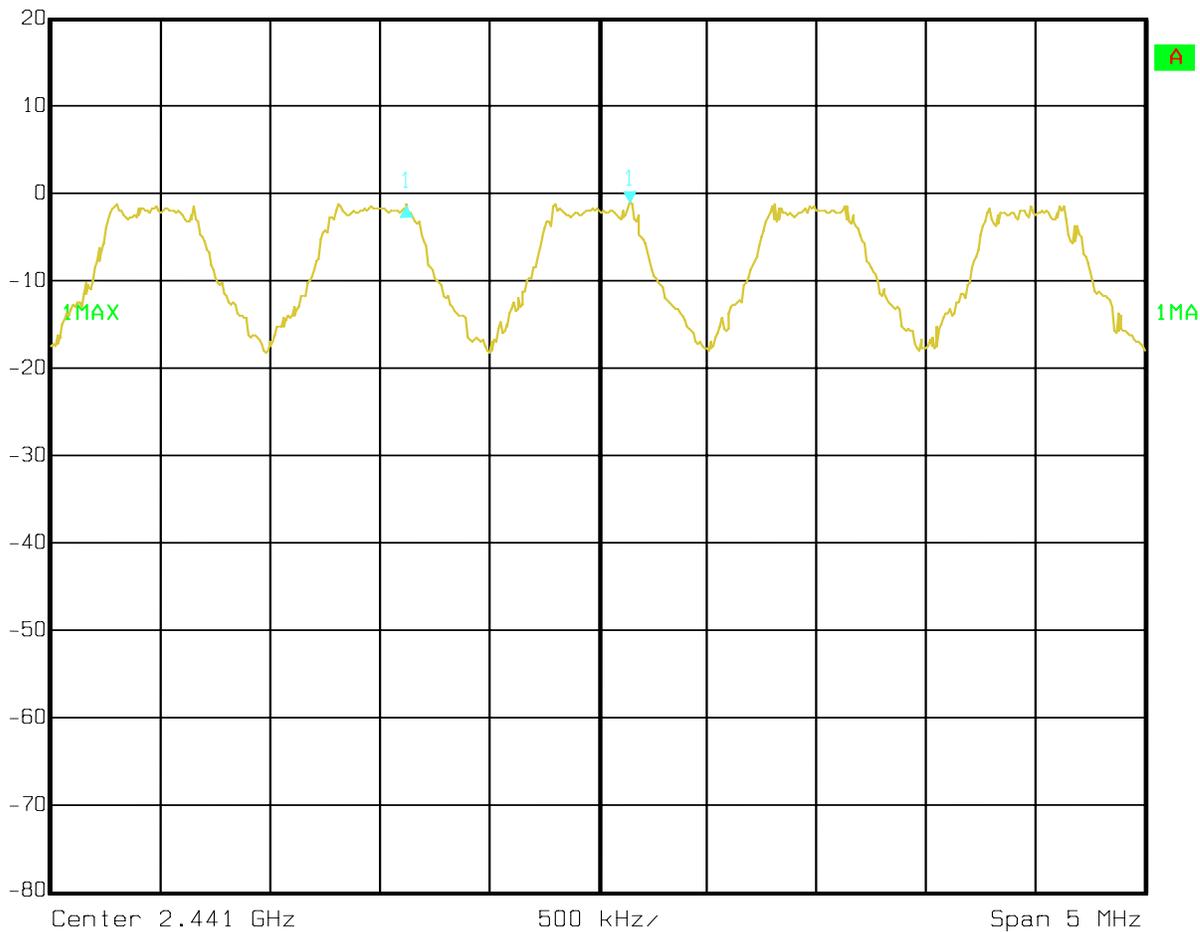
The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector. A power supply is used for the supply voltage. The EUT has its hopping function enabled. The following spectrum analyzer settings are used:

Span = 5 MHz (wide enough to capture the peaks of two adjacent channels)
Resolution (or IF) Bandwidth (RBW) = 100 kHz ($\geq 1\%$ of the span)
Video (or Average) Bandwidth (VBW) = 300 kHz (\geq RBW)
Sweep = auto
Detector function = peak
Trace = max hold

The trace was allowed to stabilize. The marker-delta function was used to determine the separation between the peaks of the adjacent channels. The limit is specified in subparagraph (1) of this section to be greater than the 20 dB bandwidth of the hopping channel. The measurement shows a carrier frequency separation of 1.022 MHz, which is greater than the measured 20 dB bandwidth of 957.92 kHz.



Delta 1 [T1] RBW 100 kHz RF Att 50 dB
Ref Lvl -0.30 dB VBW 300 kHz
20 dBm -1.02204409 MHz SWT 5 ms Unit dBm



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Number of Hopping Frequencies

The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector. A power supply is used for the supply voltage. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

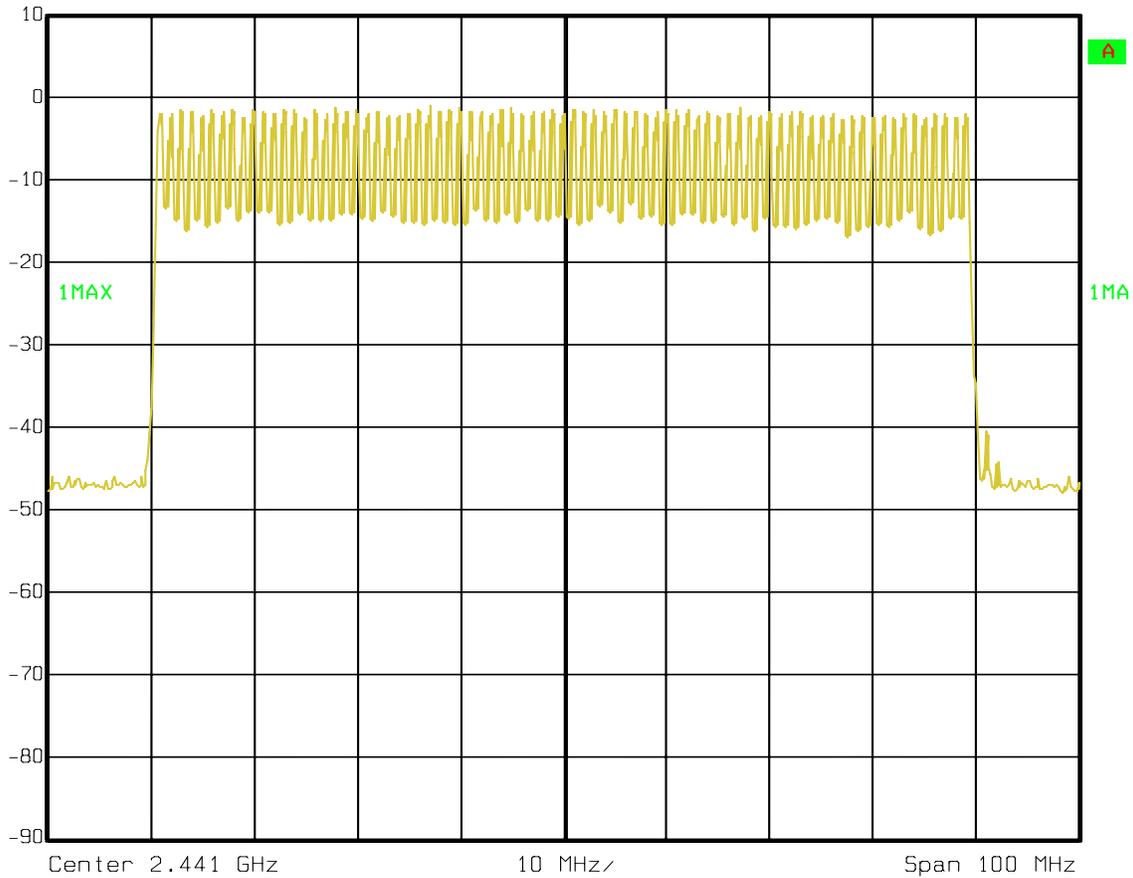
Span = 100 MHz (the frequency band of operation)
RBW = 100 kHz ($\geq 1\%$ of the span)
VBW = 100 kHz (\geq RBW)
Sweep = auto
Detector function = peak
Trace = max hold

The trace was allowed to stabilize. The limit is specified as a minimum of 15 non-overlapping channels over a total span of at least 75 MHz in subparagraph (1)(iii) of this Section. The measurement shows 79 non-overlapping channels over a span of 79 MHz.



Ref Lvl
10 dBm

RBW 100 kHz RF Att 40 dB
VBW 100 kHz
SWT 25 ms Unit dBm



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Time of Occupancy (Dwell Time)

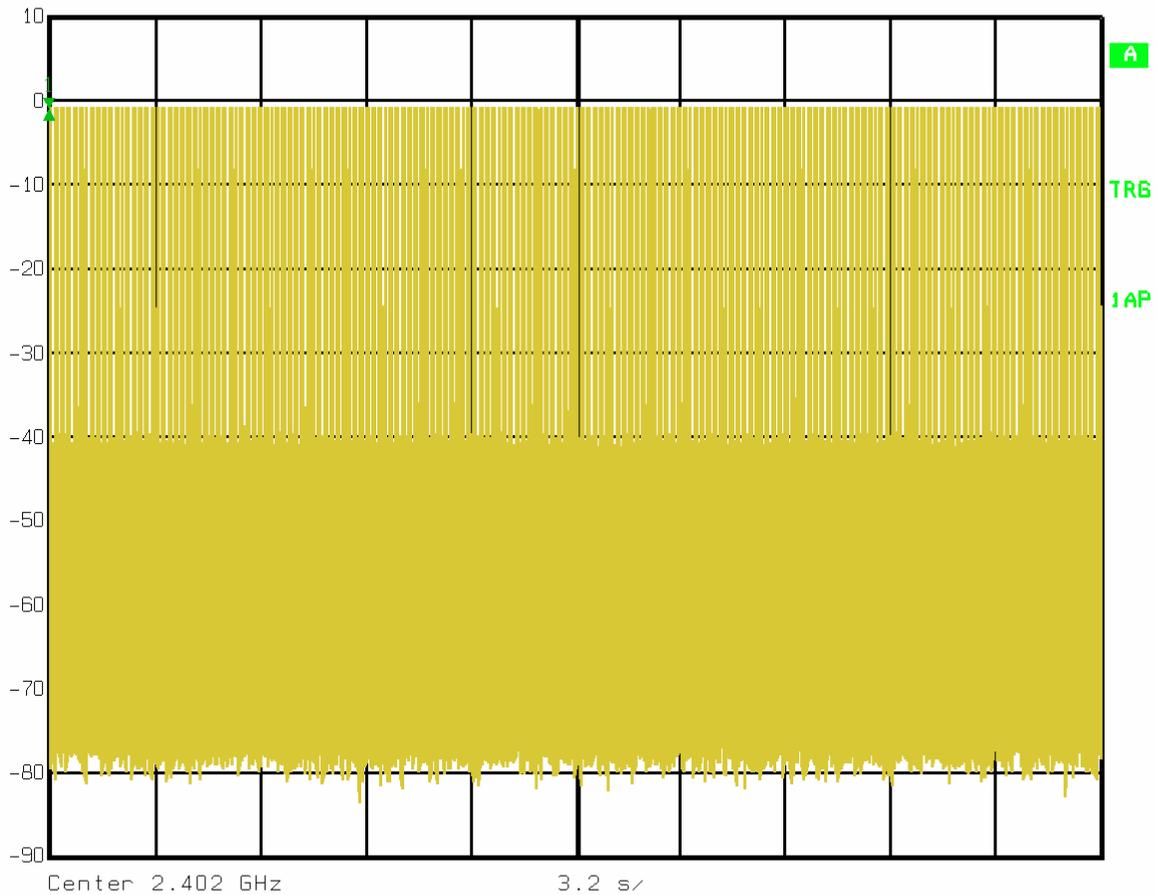
The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector. A power supply is used for the supply voltage. The EUT has its hopping function enabled. The following spectrum analyzer settings are used:

- Span = zero span, centered on a hopping channel
- RBW = 1 MHz
- VBW \geq RBW
- Sweep = as necessary to capture the entire dwell time per hopping channel
- Detector function = peak
- Trace = max hold

Use the marker-delta function to determine the dwell time. Subparagraph (1)(iii) of this section states "The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed." This equates to a time period of 31.6 seconds. The first plot shows a sweep over a 31.6 second period. It is clear that a measurement cannot be made here due to the coarse resolution in the time domain.



Delta 1 [T1] RBW 1 MHz RF Att 40 dB
Ref Lvl 0.00 dB VBW 1 MHz
10 dBm 410.821643 μ s SWT 32 s Unit dBm



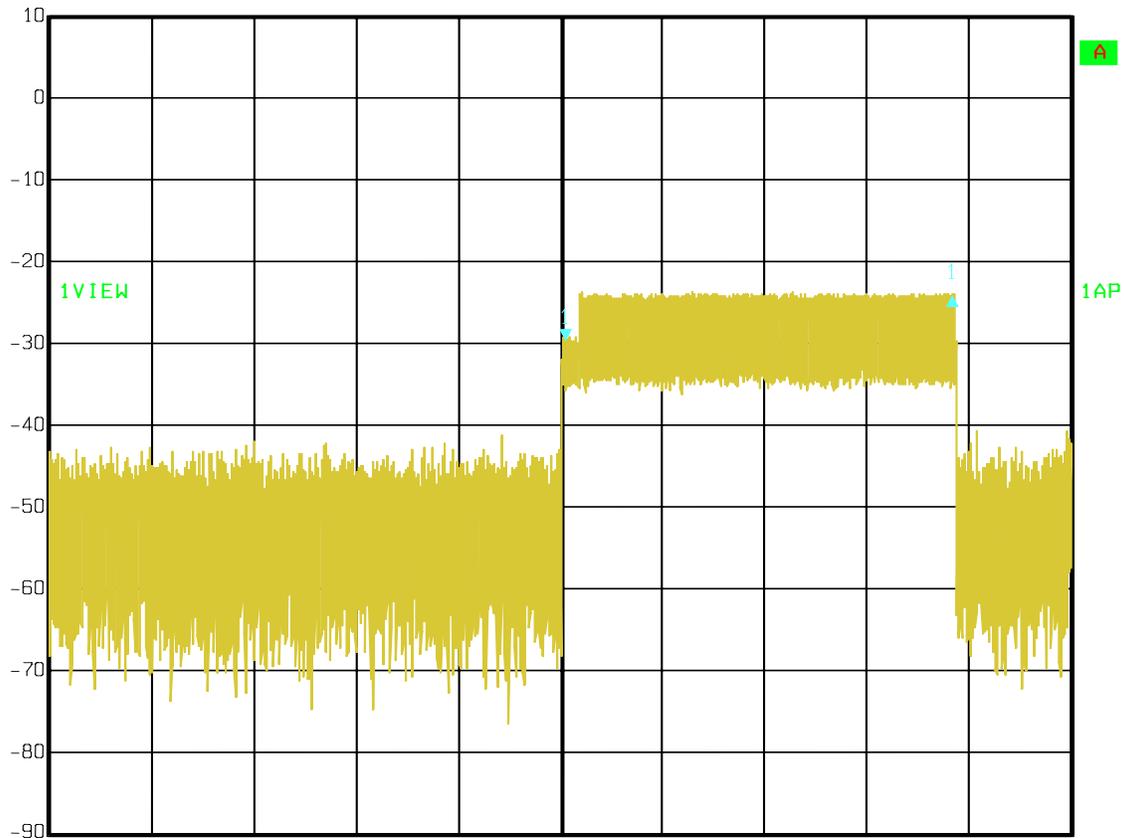
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A second measurement is made with a sweep time of 7.6 ms and the transmit time of a DH-5 packet is shown to be 2.88 ms. The Bluetooth specification defines the FH hop rate to be 1600 hops/sec with DH-5 packets needing 5 time slots for transmit and 1 time slot for receive. This equates to 266.67 hops/sec on 79 channels, or 3.37 times per channel per second.

$$31.6 * 3.37 * 2.88E-3 = .307 \text{sec dwell time per 31.6 sec}$$



Delta 1 [T1] RBW 1 MHz RF Att 40 dB
Ref Lvl 5.53 dB VBW 1 MHz
10 dBm 2.878557 ms SWT 7.6 ms Unit dBm



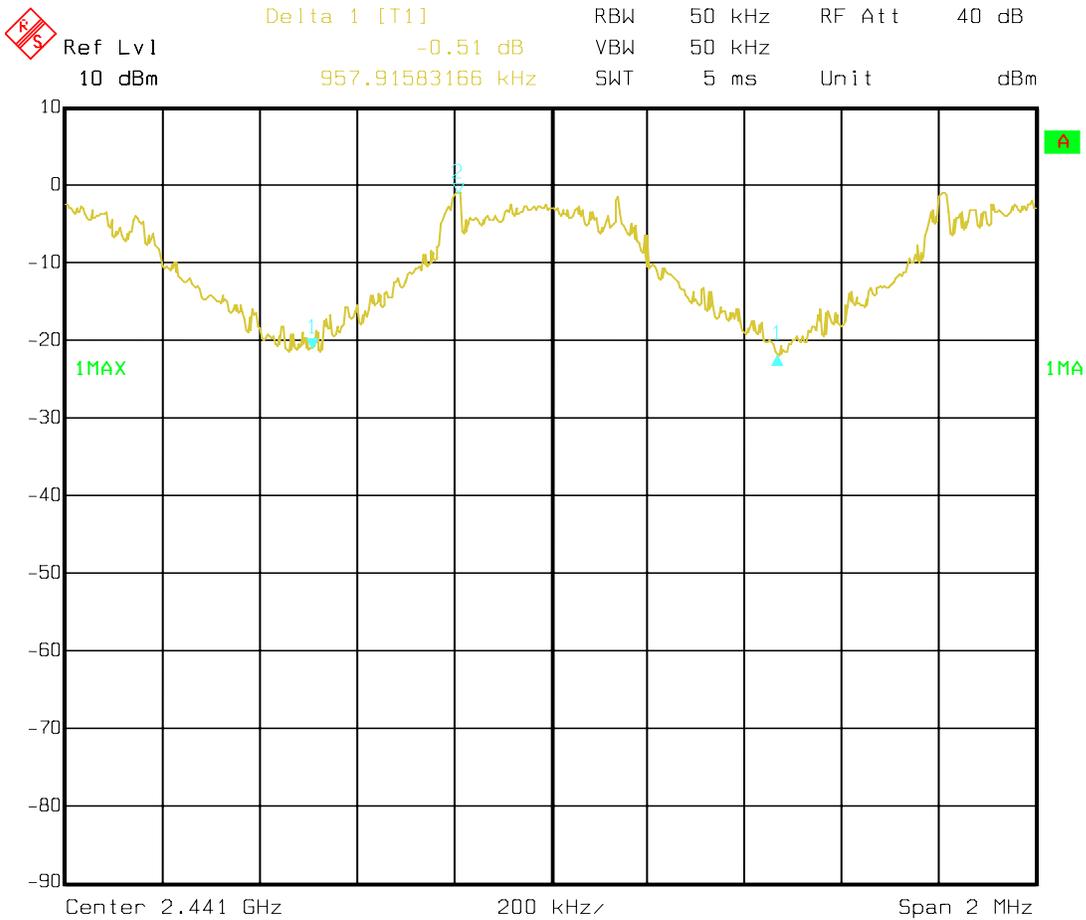
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20 dB Bandwidth

The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector. A power supply is used for the supply voltage. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = 2 MHz (approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel)
RBW = 50 kHz (\geq 1% of the 20 dB bandwidth)
VBW = 50 kHz (\geq RBW)
Sweep = auto
Detector function = peak
Trace = max hold

The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize. The marker-to-peak function was used to set the marker to the peak of the emission. The marker-delta function was used to measure 20 dB down one side of the emission. The marker-delta function was reset and the marker was moved to the other side of the emission, until it was (as close as possible to) even with the reference marker level. The marker-delta reading at this point is 957.92 kHz, which is the 20 dB bandwidth of the emission. The limit is specified as a maximum of 1 MHz in subparagraph (1)(ii) of this Section.



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Section 15.247(b):

Peak Output Power

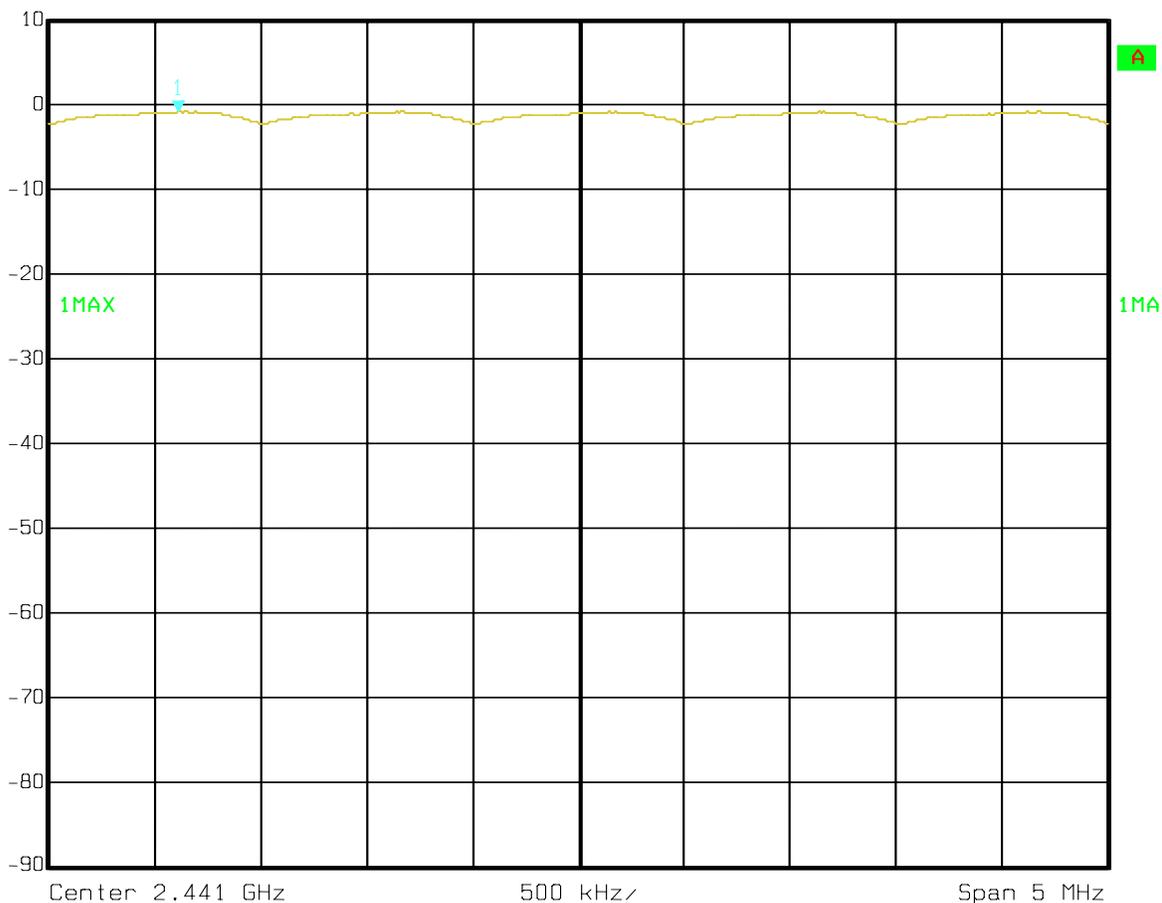
The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector. A power supply is used for the supply voltage. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

- Span = 5 MHz (approximately 5 times the 20 dB bandwidth, centered on a hopping channel)
- RBW = 1 MHz (> the 20 dB bandwidth of the emission being measured)
- VBW = 1 MHz (≥ RBW)
- Sweep = auto
- Detector function = peak
- Trace = max hold

+The trace was allowed to stabilize. The marker-to-peak function was used to set the marker to the peak of the emission. The indicated level is the peak output power. The limit is specified as 1 Watt in subparagraph (1) of this Section. The measurement was -0.97 dBm, which is equivalent to 0.8 mW.



Ref Lvl 10 dBm
 Marker 1 [T1] -0.97 dBm
 2.43911122 GHz
 RBW 1 MHz
 RF Att 40 dB
 VBW 1 MHz
 SWT 5 ms
 Unit dBm



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De Facto EIRP Limit

The gain of the antenna used by the EUT is less than the 6 dBi limit described in 15.247 (b)(4) and the conducted output power of the EUT complies with the 1 W limit described in 15.247 (b)(1), thus the EUT complies with the *de facto* EIRP limit for the antenna proposed for use with the EUT.

Section 15.247(c):

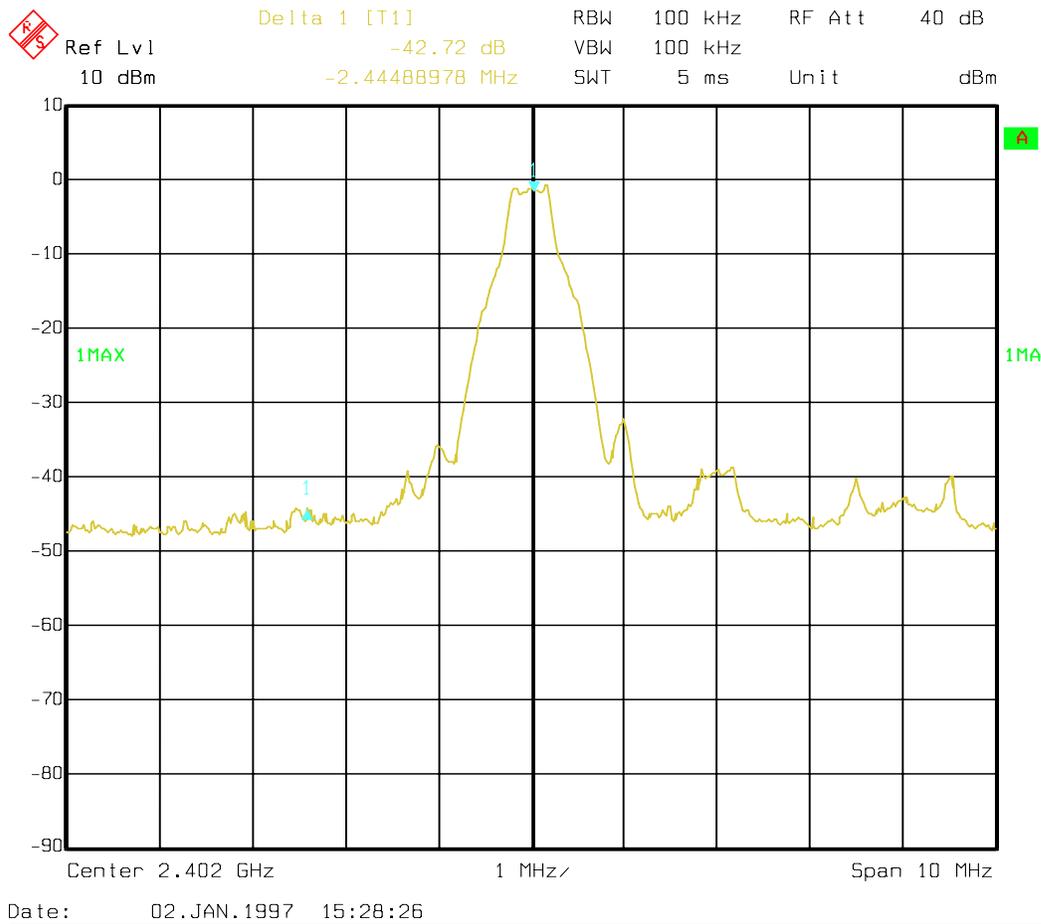
Band-edge Compliance of RF Conducted Emissions

The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector. A power supply is used for the supply voltage. The following spectrum analyzer settings are used:

- Span = 10 MHz (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)
- RBW = 100 kHz ($\geq 1\%$ of the span)
- VBW = 100 kHz (\geq RBW)
- Sweep = auto
- Detector function = peak
- Trace = max hold

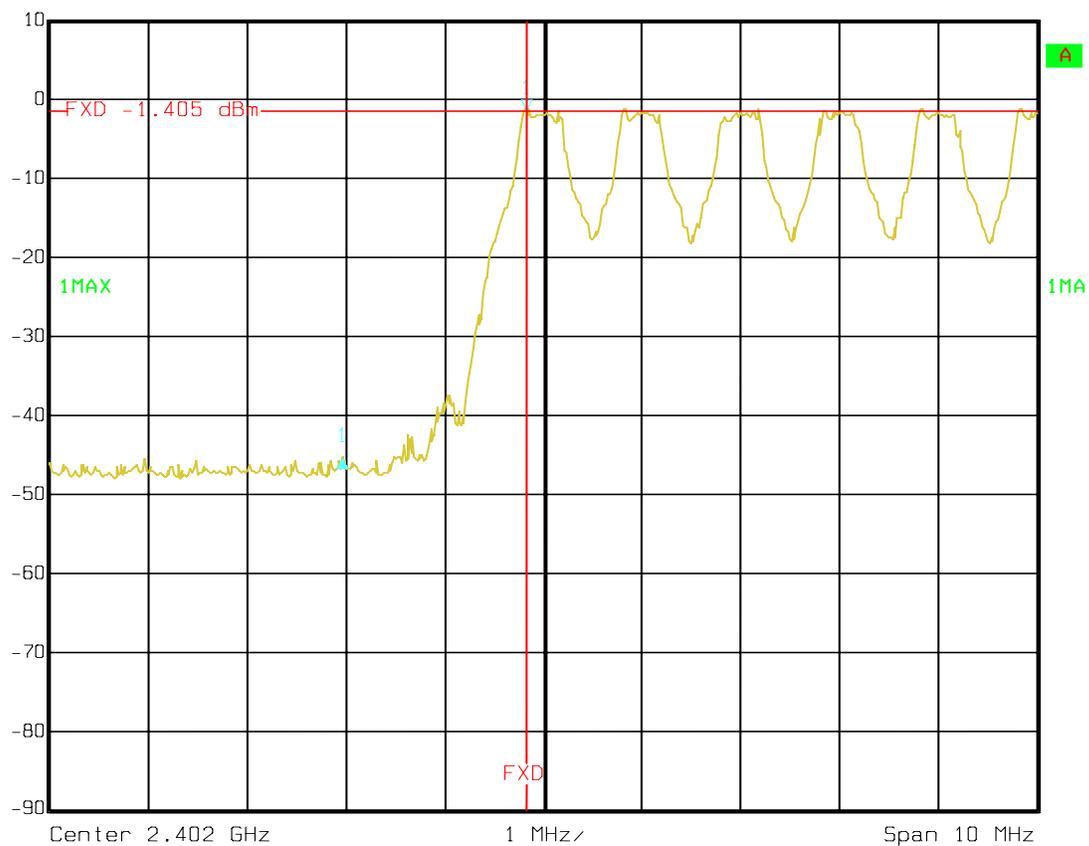
The trace was allowed to stabilize. The marker was set on the emission at the band edge, or on the highest modulation product outside of the band, if this level was greater than that at the band edge. The marker-delta function was enabled and then the marker-to-peak function was used to move the marker to the peak of the in-band emission. The marker-delta value displayed must be greater than the 20 dB limit specified in this Section. The measurement shows 42.72 dB at the lower band edge and 40.22 dB at the upper band edge.

Now, using the same instrument settings, the hopping function of the EUT was enabled. The trace was allowed to stabilize. The same procedure listed above was followed to determine if any spurious emissions caused by the hopping function also comply with the specified limit. The measurement shows 44.04 dB at the lower band edge and 42.03 dB at the upper band edge.





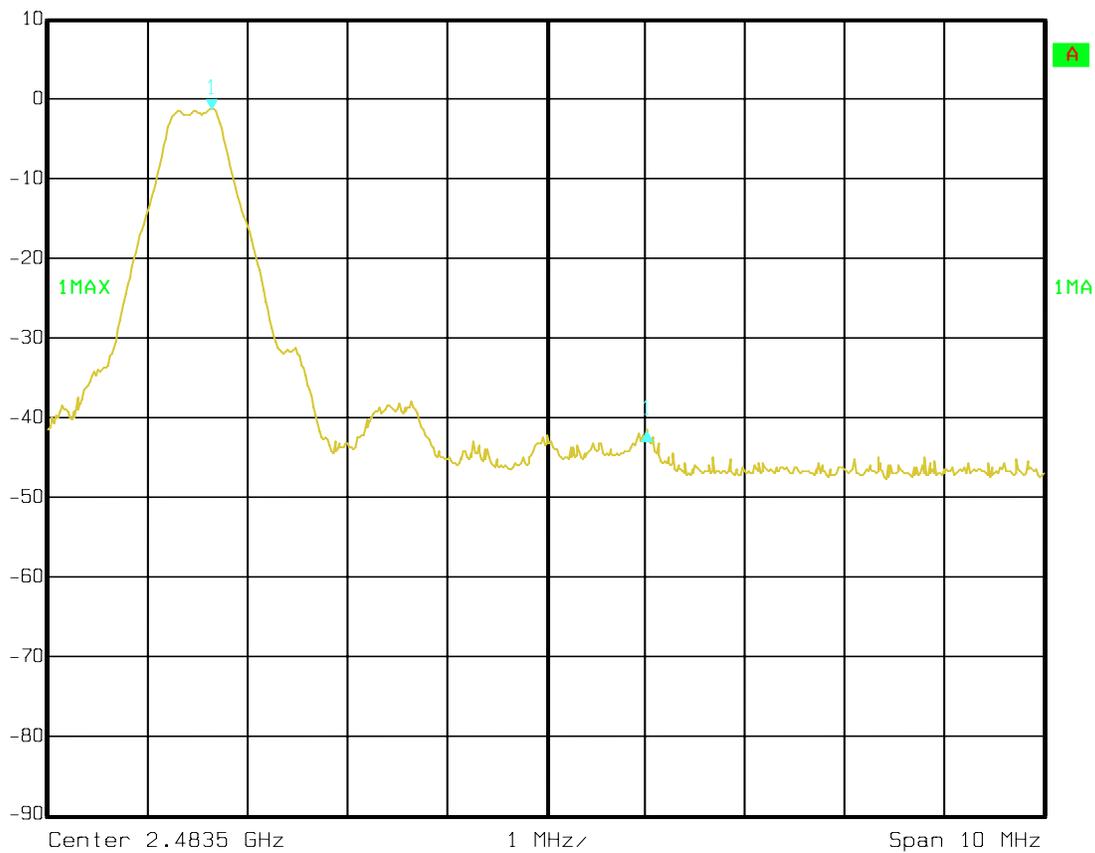
Delta 1 [T1 FXD] RBW 100 kHz RF Att 40 dB
Ref Lvl -44.04 dB VBW 100 kHz
10 dBm -1.86372745 MHz SWT 5 ms Unit dBm



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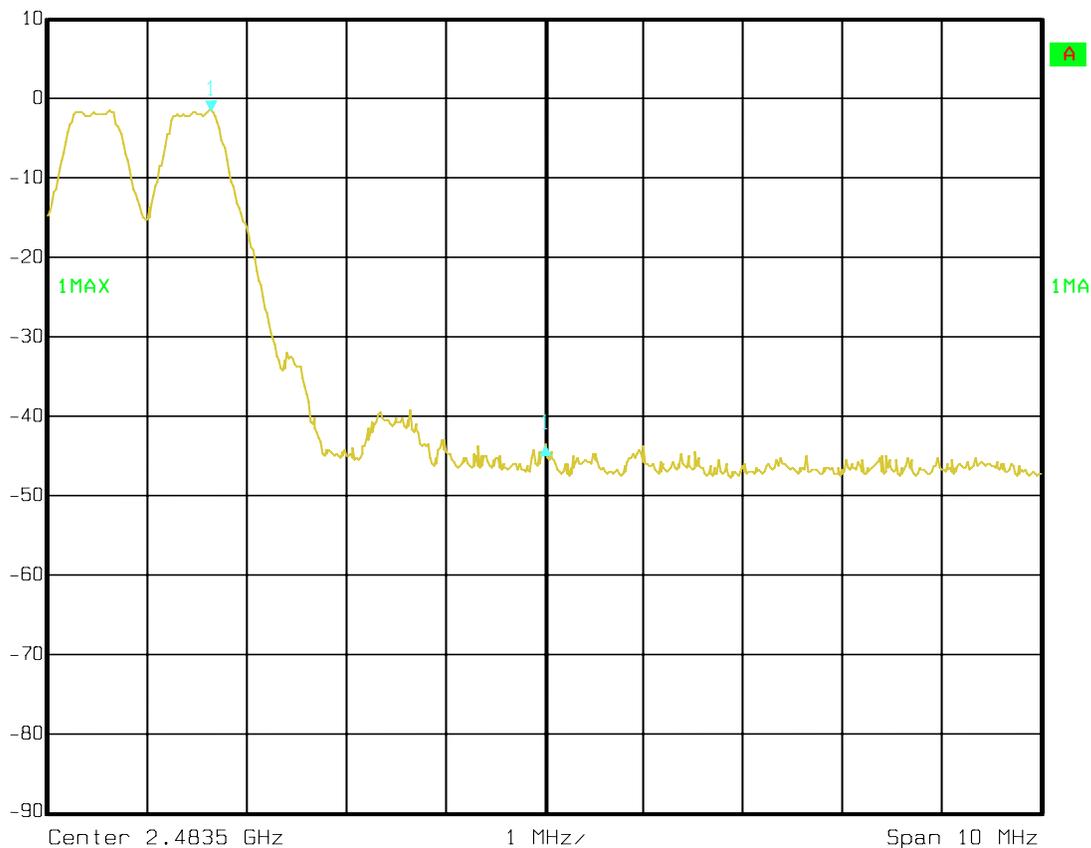
Delta 1 [T1] RBW 200 kHz RF Att 40 dB
Ref Lvl -40.22 dB VBW 200 kHz
10 dBm 4.36873747 MHz SWT 5 ms Unit dBm



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Delta 1 [T1] RBW 200 kHz RF Att 40 dB
Ref Lvl -42.03 dB VBW 200 kHz
10 dBm 3.36673347 MHz SWT 5 ms Unit dBm



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Spurious RF Conducted Emissions

The RF output port of the Equipment Under Test was directly coupled to the input of the EMC analyzer through a specialized RF connector. A power supply was used for the supply voltage. The following spectrum analyzer settings were used:

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 10th harmonic. Several plots are required to cover this entire span.

RBW = 100 kHz

VBW = 100 kHz (\geq RBW)

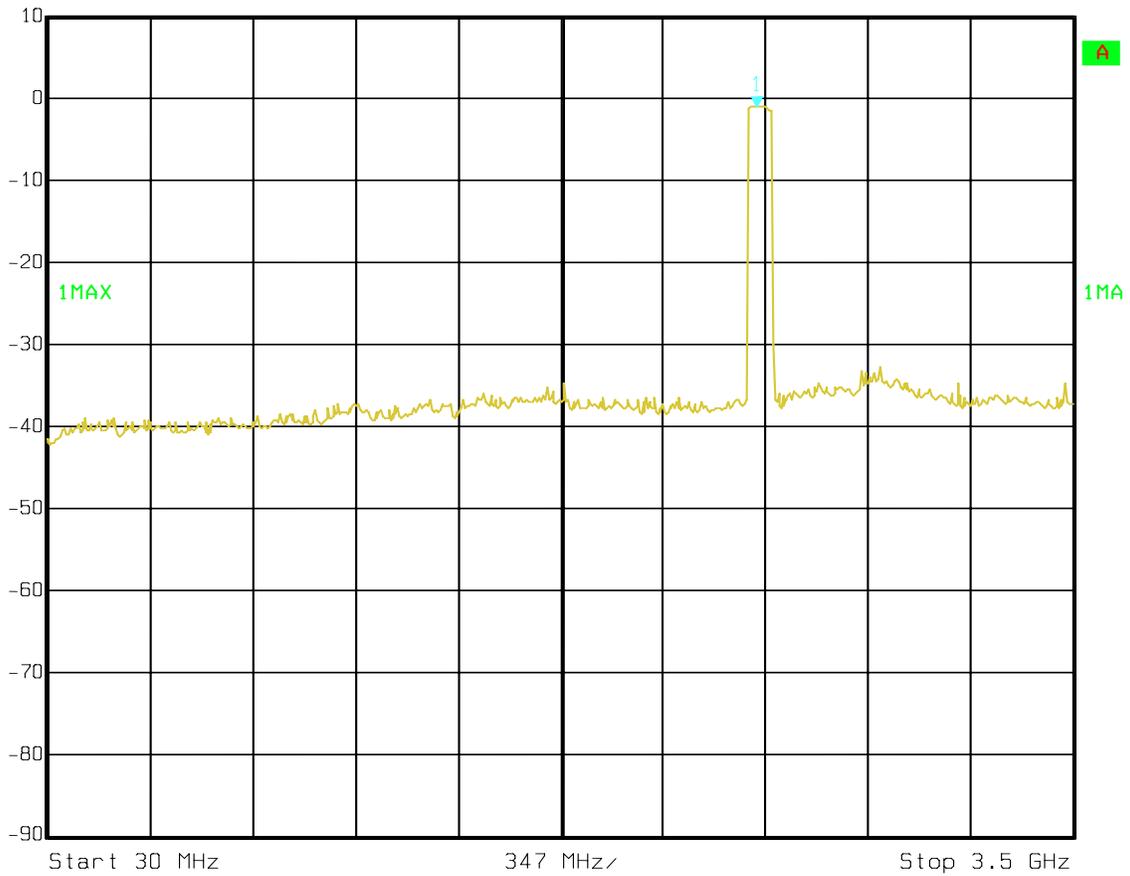
Sweep = auto

Detector function = peak

Trace = max hold



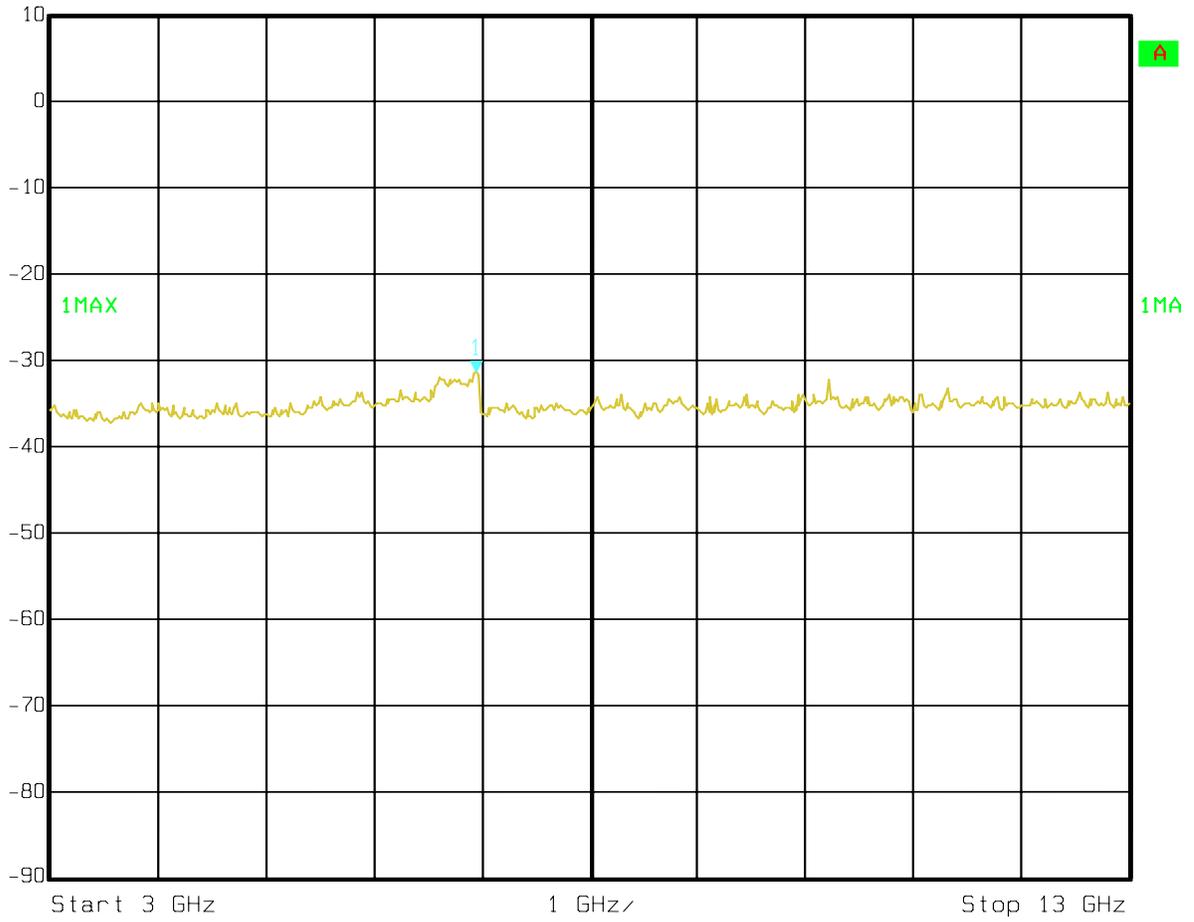
Ref Lvl 10 dBm
Marker 1 [T1] -1.09 dBm
2.42909820 GHz
RBW 3 MHz RF Att 40 dB
VBW 3 MHz
SWT 5 ms Unit dBm



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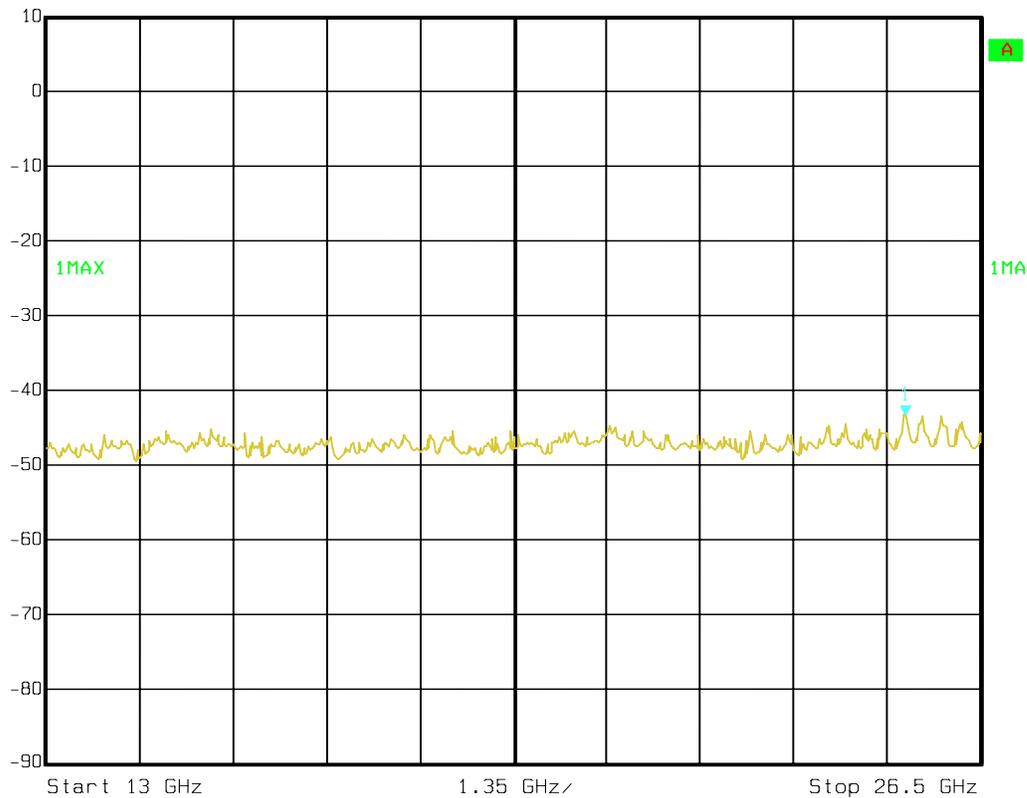
Ref Lvl 10 dBm
Marker 1 [T1] -31.33 dBm
6.94789579 GHz
RBW 100 kHz RF Att 40 dB
VBW 100 kHz
SWT 2.5 s Unit dBm



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Ref Lvl 10 dBm
Marker 1 [T1] -43.43 dBm
25.41783567 GHz
RBW 100 kHz RF Att 40 dB
VBW 100 kHz
SWT 3.4 s Unit dBm



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The trace was allowed to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in 15.247 (c). 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. Data must be taken from 30 MHz to 26.5 GHz. Our emissions are below 30 dBc at all frequencies outside the band.