

8.8 FCC 15.407(g) and RSS-247 Dynamic Frequency Selection (DFS)

8.8.1 Definition and limits

Title 47 → Chapter I → Subchapter A → Part 15 → Subpart C → §15.407(2)

KDB 905462 D02

Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. Operators shall only use equipment with a DFS mechanism that is turned on when operating in these bands. The device must sense for radar signals at 100 percent of its emission bandwidth. The minimum DFS detection threshold for devices with a maximum e.i.r.p. of 200 mW to 1 W is -64 dBm. For devices that operate with less than 200 mW e.i.r.p. and a power spectral density of less than 10 dBm in a 1 MHz band, the minimum detection threshold is -62 dBm. The detection threshold is the received power averaged over 1 microsecond referenced to a 0 dBi antenna. For the initial channel setting, the manufacturers shall be permitted to provide for either random channel selection or manual channel selection.

Table 3: DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP ≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density ≤ 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.
Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.
Note 3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

Table 4: DFS Response Requirement Values

Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.

Note 1: *Channel Move Time* and the *Channel Closing Transmission Time* should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.
Note 2: The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate a *Channel* move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.
Note 3: During the *U-NII Detection Bandwidth* detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

8.8.2 Test summary

Verdict	Pass		
Test date	July 19, 2022; July 20, 2022	Temperature	23 °C; 25 °C
Test engineer	Martha Espinoza, Wireless Test Engineer	Air pressure	1003 mbar; 1005 mbar
Test location	Wireless bench	Relative humidity	57 %; 59%

8.8.3 Notes

This test is a conducted test, and it was performed in Tx mode with the EUT transmitting on a fixed channel. One channel of band U-NII-2A and one channel in U-NII-2C band were tested. The test was performed using the Radar type 0. Only one bandwidth was declared by manufacturer.

U-NII-2A band: 5250-5350 MHz → CH 100 5500 MHz IEEE 802.11n MCS7
 U-NII-2C band: 5470-5725 MHz → CH 52 5260 MHz IEEE 802.11n MCS5

By manufacturer declaration, the device under investigation in this document, it is a client without radar detection, so, according to table 2 of KDB 905462 D02 only Channel closing transmission time test and channel move time are required.

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

8.8.4 Setup details

Receiver settings

Resolution bandwidth	1% to 5% of the OBW
Video bandwidth	≥ 3 x RBW
Span	1.5 time to 5.0 times the OBW
Detector mode	Peak
Trace mode	Max Hold

8.8.5 Test data

Test	Channel frequency	OBW	Result
Channel closing transmission time	5260 MHz and 5500 MHz	20 MHz	PASS
Channel move time	5260 MHz and 5500 MHz	20 MHz	PASS
Channel loading*	5260 MHz and 5500 MHz	20 MHz	PASS

*Channel loading shall be at least 17%

Table 8.8-1: Summary of testing.

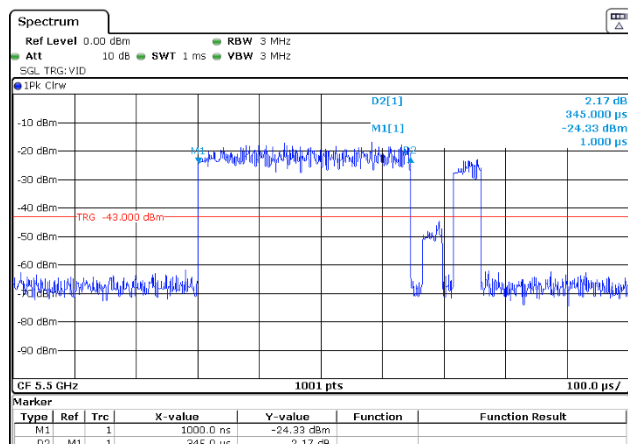


Figure 8.8-1: Pulse one to calculate channel loading.

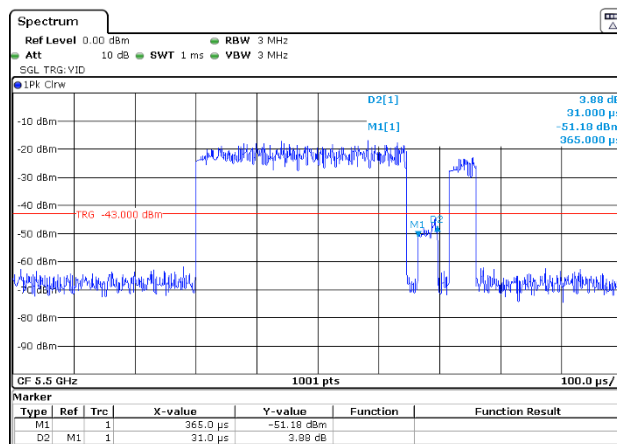


Figure 8.8-2: Pulse two to calculate channel loading.

8.8.1 Test data

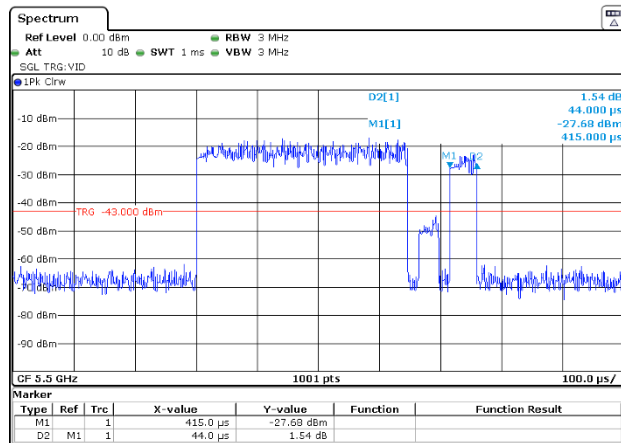


Figure 8.8-3: Pulse three to calculate channel loading.

Pulse 1= 345 μs
 Pulse 2= 31 μs
 Pulse 3= 44 μs

Total time = 345 μs+31 μs+44 μs = 420 μs

Channel loading = ((420 μs)/1 ms)*100

Channel loading = 42%

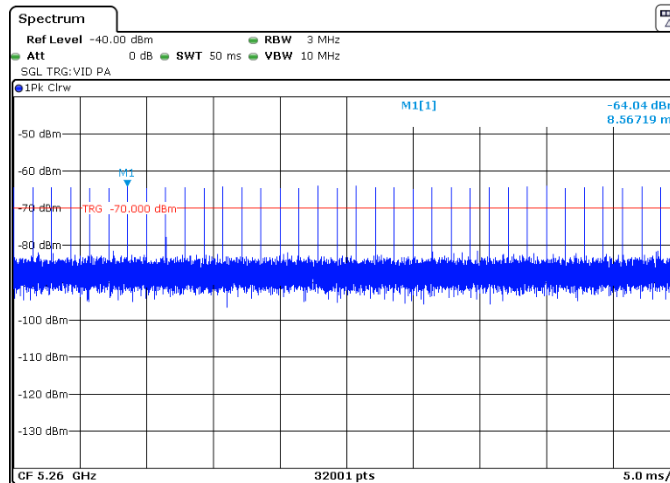


Figure 8.8-4: Radar level verification at 5260 MHz channel.

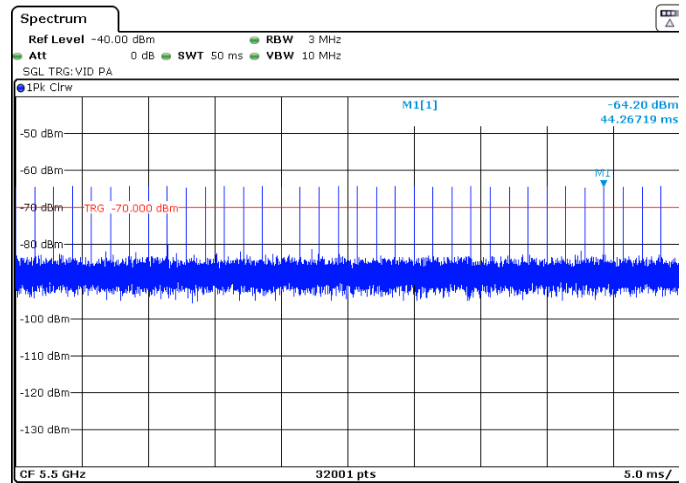


Figure 8.8-5: Radar level verification at 5500 MHz channel.

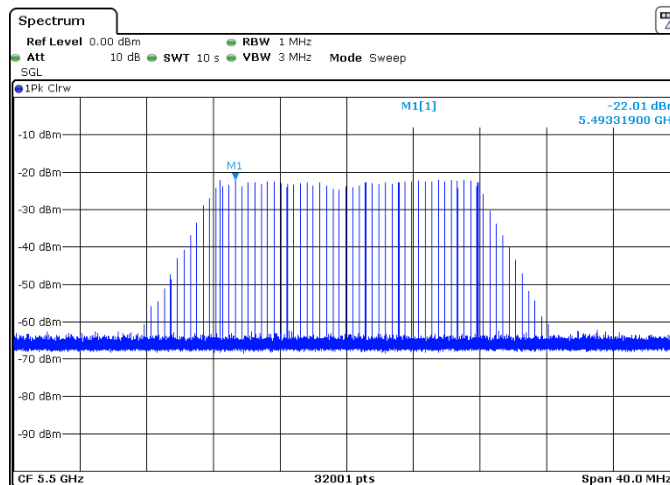


Figure 8.8-6: Connection and traffic verification, without master traffic

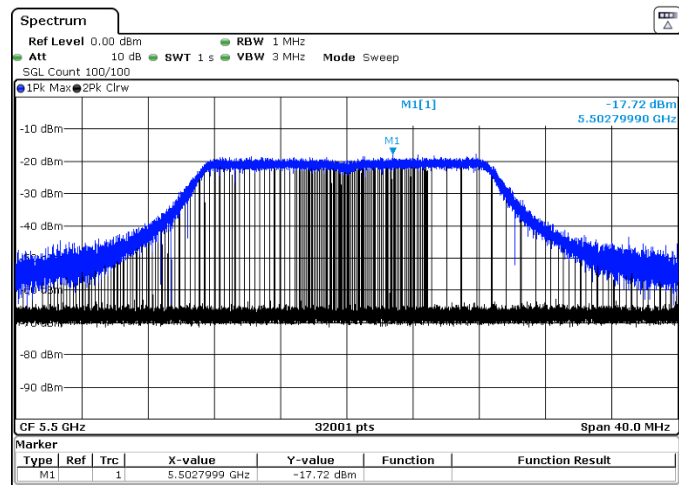


Figure 8.8-7: Connection and traffic verification, with master traffic

8.8.1 Test data, continued

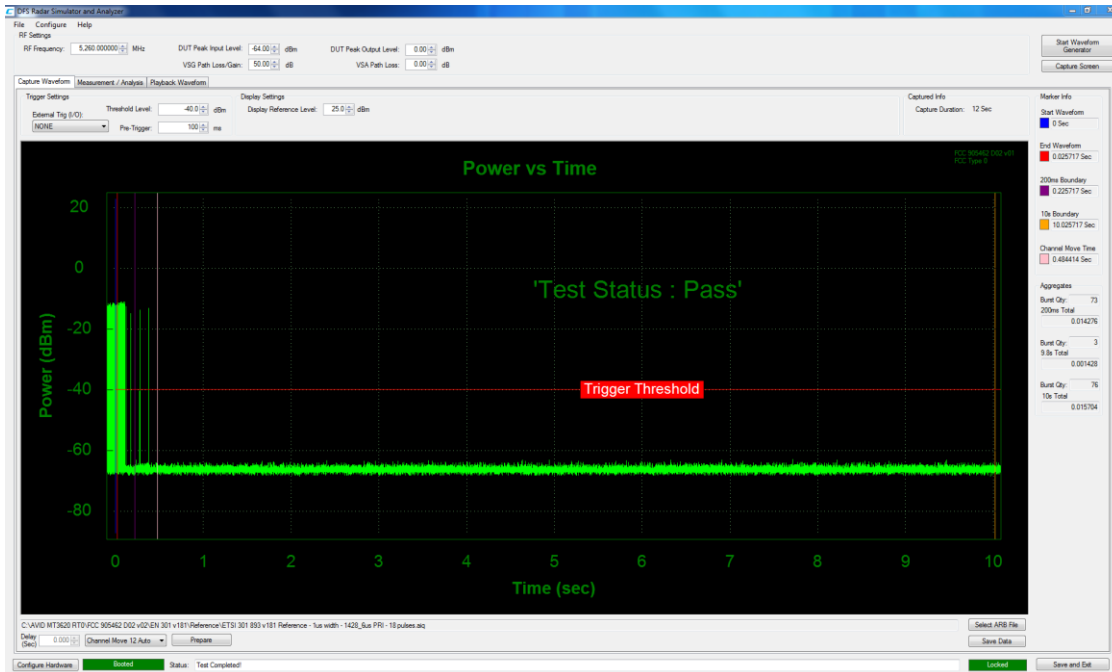


Figure 8.8-8: Channel move time (10s) at CH52 5260 MHz

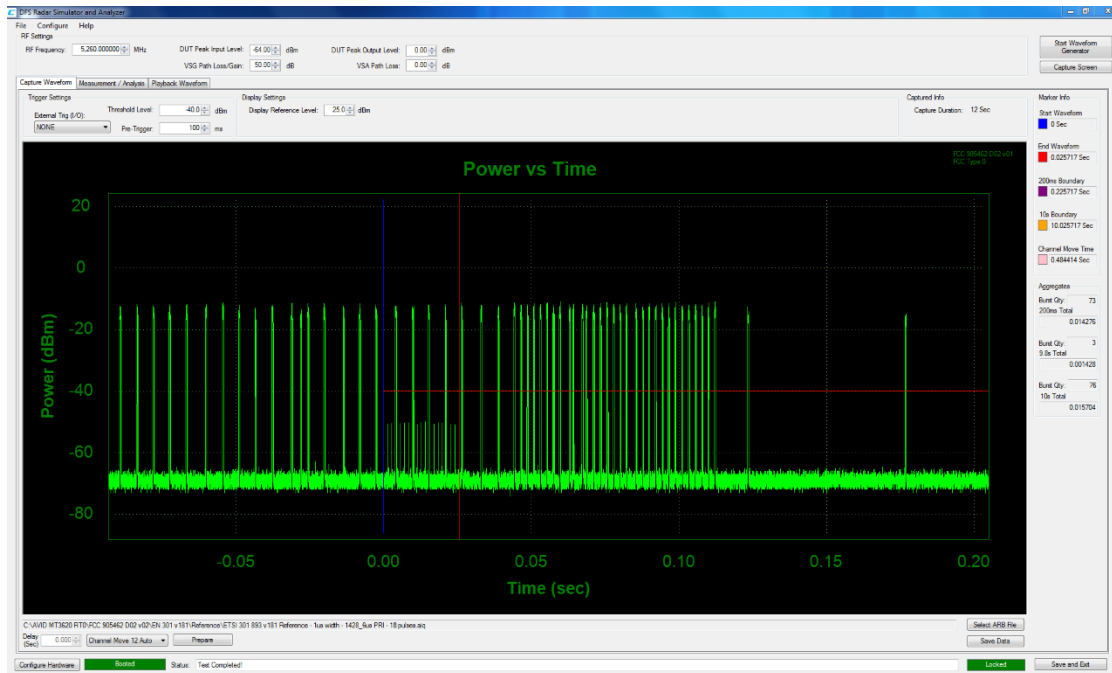


Figure 8.8-8: Channel closing transmission time (200 ms) at CH52 5260 MHz

CCT Time	CCT Time Limit
225.717 ms	260 ms (60 ms extra over remaining 10s)

8.8.1 Test data, continued

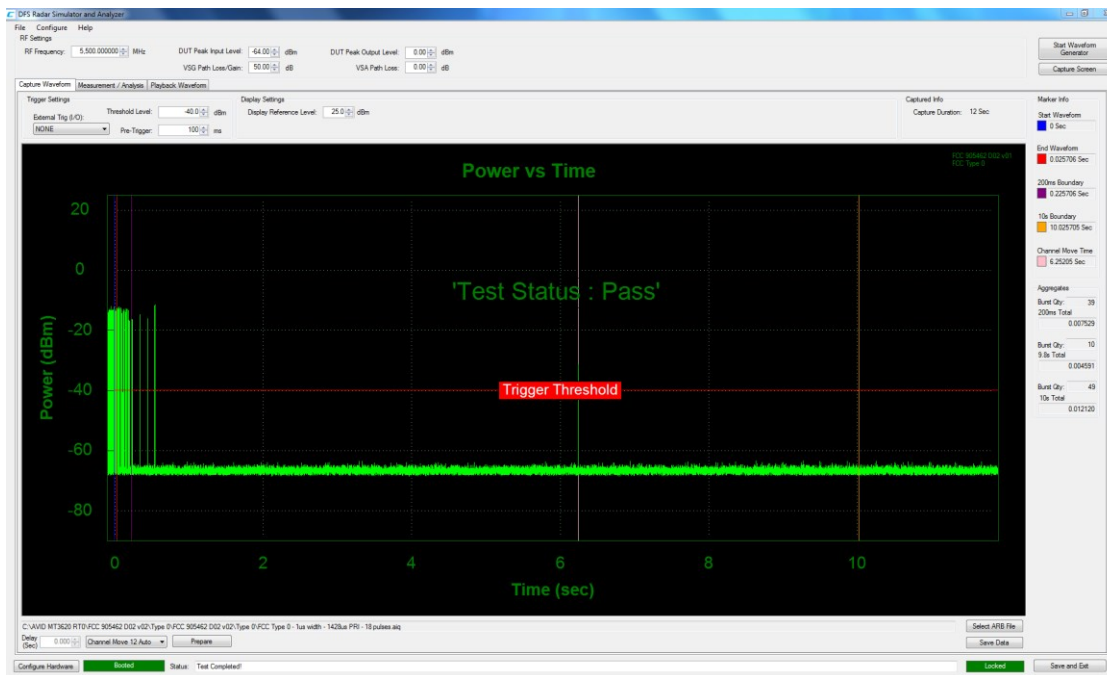


Figure 8.8-8: Channel move time (10s) at CH100 5500 MHz

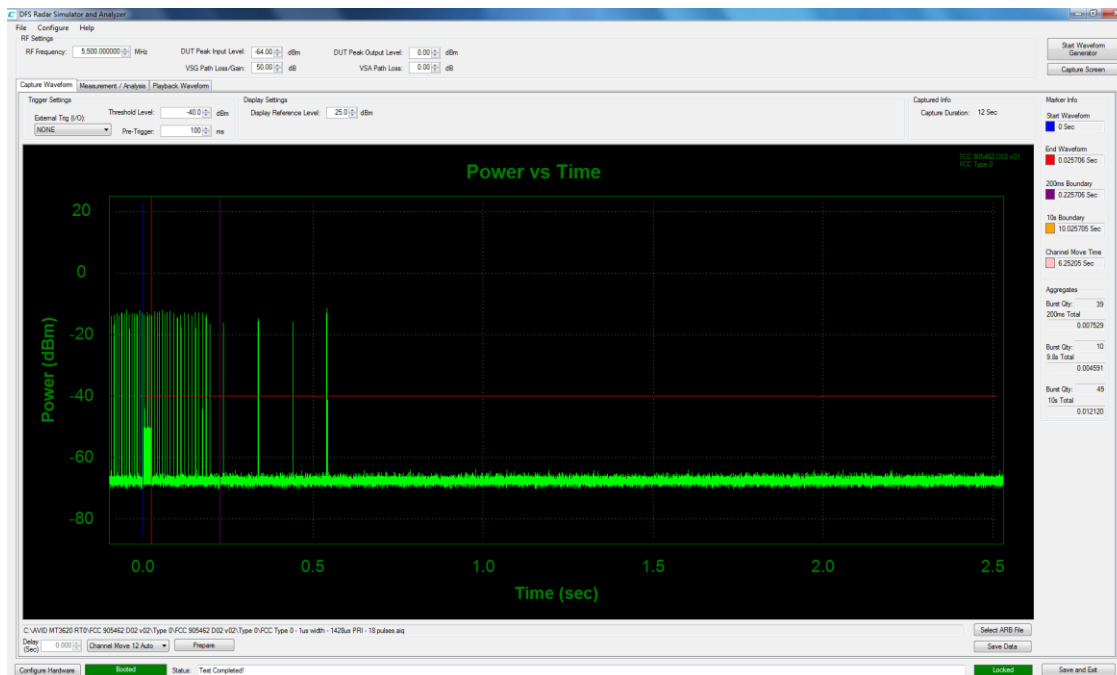


Figure 8.8-8: Channel closing transmission time (200 ms) at CH100 5500 MHz

CCT Time	CCT Time Limit
225.706 ms	260 ms (60 ms extra over remaining 10s)

Section 9 Block diagrams of test set-ups

9.1 Radiated emissions set-up

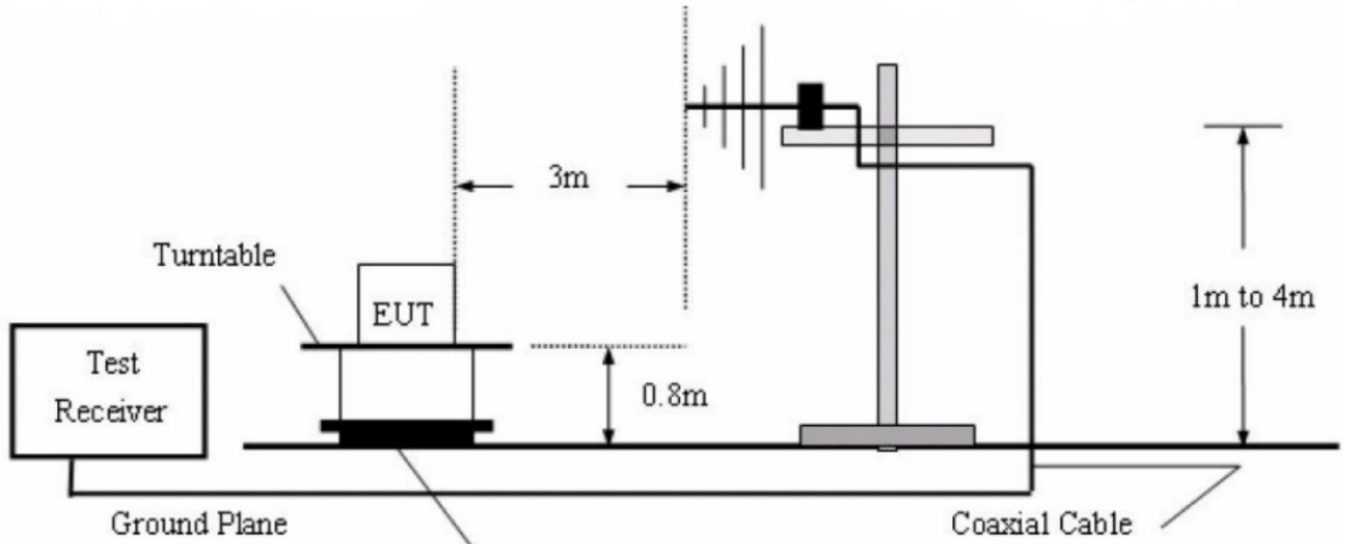


Figure 9.1-1: 30 MHz - 1000 MHz Setup

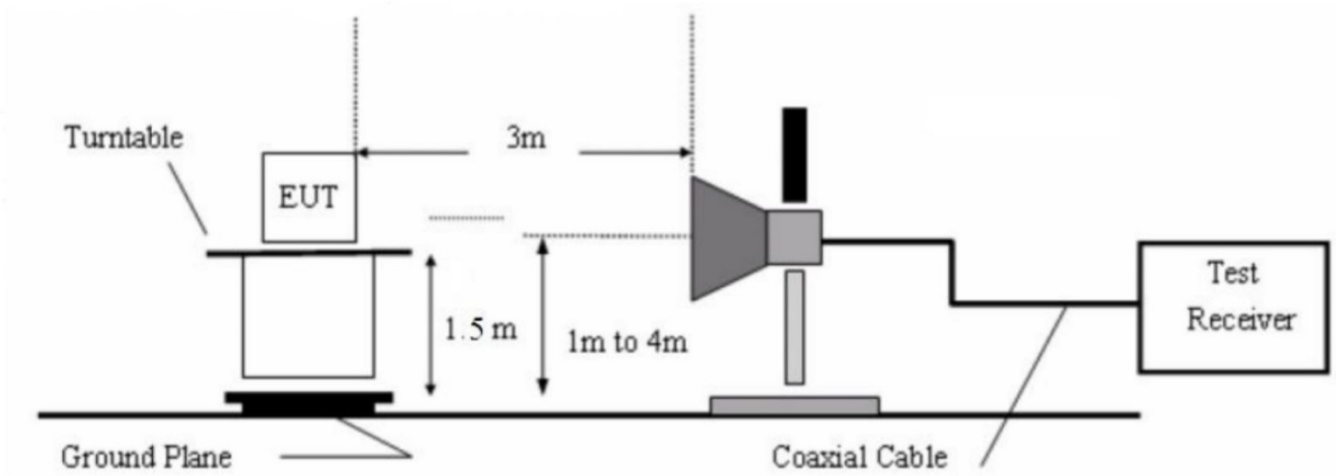


Figure 9.1-2: 1 GHz - 40 GHz Setup