

Test Report



INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C AND INDUSTRY CANADA REQUIREMENTS

Equipment Under Test:	RFID reader unit
Type:	MIFCM 2.10 12VDC
Customer / Manufacturer:	Idesco Oy Teknologiantie 9 FI-90570 Oulu Finland
FCC Rule Part:	15.209: 2018 15.225: 2018
IC Rule Part:	RSS-210, Issue 9, 2016 RSS-GEN, Issue 5, Amendment 1, 2019

Date: 27 March 2020

Issued by:

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Date: 27 March 2020

Checked by:

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Equipment Under Test (EUT)

MIFARE (Idesco MIFCM) RFID reader module and antenna used in Thermo Fisher TCAutomation modules.

	EUT1	EUT2
Product:	RFID reader unit	RFID reader unit
Type:	MIFCM 2.10 12VDC	MIFCM 2.10 12VDC
Serial Number:	706952	706953
Software version:	S00629	S00629

Classification of the device

Fixed device	☒
Mobile Device (Human body distance > 20cm)	☐
Portable Device (Human body distance < 20cm)	☐

Description of the EUT

13.56 MHz circuit board RFID reader unit. Two different RF antenna holder types to mount antenna to TCA modules.

EUT1 has a round shaped plastic holder with antenna grounding wire attached to a metal plate.

EUT2 has a rectangular metallic holder with antenna grounding via metal holder.

Ratings and declarations, HF

Operating Frequency Range (OFR):	13.56 MHz
Channels:	1 transmit channel
Effective radiated or conducted power:	-
Modulation:	-
Antenna:	-

Power Supply

Operating voltage (module):	11.5 – 12.5 VDC
Operating voltage (AC/DC power supply):	input 115 V 60 Hz, output 24 VDC for the host unit
type: TDK-Lambda, model HWS300-24	(used in conducted emissions 150 kHz – 30 MHz test)
type: SINPRO, model MPU60A-108	(used in all other tests)

Cables

Cable:	Length:	Type:
Data cable	0.7 m	unshielded cable, 4 x 0.25 mm ²
Antenna cable	0.6 m	shielded triaxial cable
Ethernet	2.0 m	shielded, CAT6

Mechanical size of the EUT

Height: 14 mm	Width: 110 mm	Length: 55 mm	Weight: 0.040 kg
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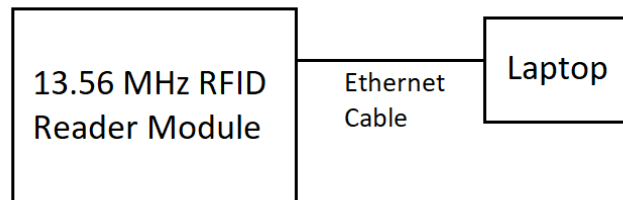
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Summary of Testing

Test Specification	Description of Test	Result
§15.207, RSS-210, RSS-GEN	Conducted Emissions 150 kHz to 30 MHz	PASS
§15.209, RSS-210, RSS-GEN	Radiated Emissions 9 kHz to 1 GHz	PASS
§15.225, RSS-210	Operation within the band 13.110-14.010 MHz	PASS
§15.225, RSS-210	Frequency Stability	PASS
RSS-GEN	Occupied Bandwidth	PASS

Block Diagram



EUT Test Conditions During Testing

Configuration of the EUT was made to correspond to the actual assembling conditions as far as possible. During tests the EUT was connected to AC/DC power supply and to a test laptop with an ethernet cable.

Table 1. Normal and extreme test conditions

Test conditions:		Temperature [°C]:	Voltage [V]:	Frequency [Hz]:
Normal		20 – 25	115 V _{AC}	60
Extreme	Minimum	-20	97.75 V _{AC}	
	Maximum	+50	132.25 V _{AC}	

Test Facility

Testing Laboratory / address: FCC designation number: FI0002 ISED CAB identifier: T004	SGS Fimko Ltd Takomotie 8 FI-00380, HELSINKI FINLAND
Test Site:	☒ K10LAB, ISED Canada registration number: 8708A-1 ☒ K5LAB, ISED Canada registration number: 8708A-2 ☐ T10LAB

Conducted Emissions In The Frequency Range 150 kHz – 30 MHz

Standard: ANSI C63.10
Tested by: JSU
Date: 26 March 2020
Temperature: 20 °C
Humidity: 27 %RH
Measurement uncertainty ± 2.9 dB

Level of confidence 95 % (k = 2)

FCC Rule: 15.207 (a)

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with 4.5 kHz steps and a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Test results

EUT1

Full Spectrum

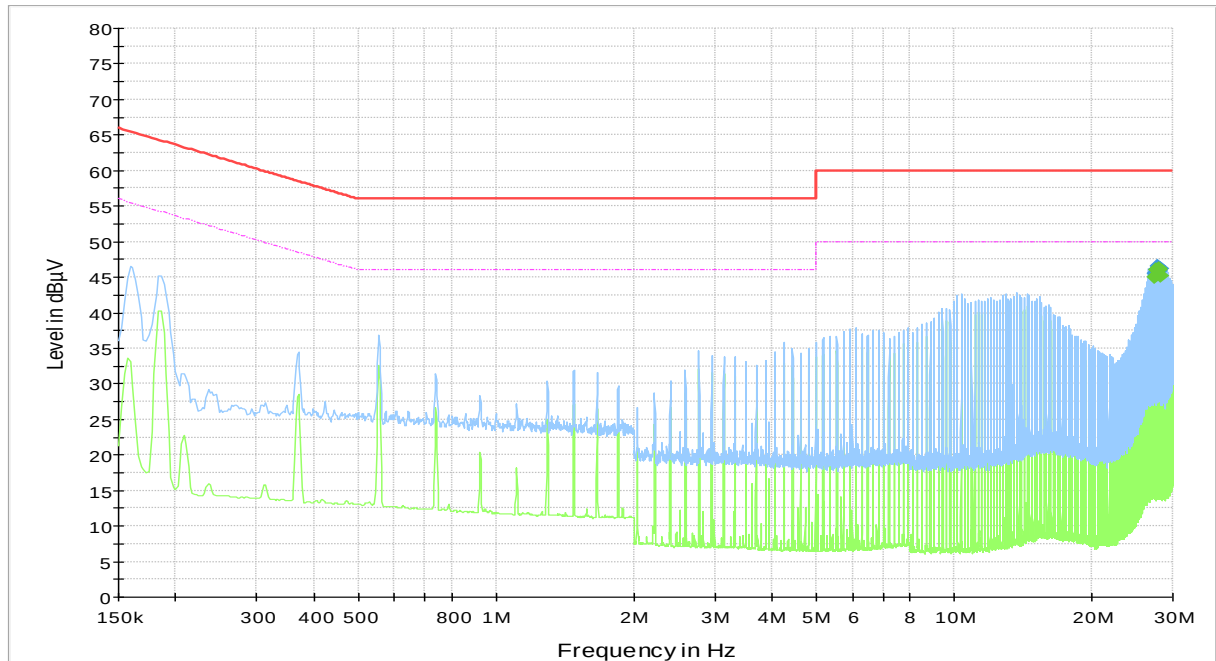


Figure 1: The measured curves with peak- and average detector

Table 2: Final QuasiPeak measurements from the worst frequencies

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
27.354750	45.53	1000.0	9.000	GND	L1	11.5	14.47	60.00
27.541500	46.07	1000.0	9.000	GND	L1	11.5	13.93	60.00
27.726000	46.47	1000.0	9.000	GND	L1	11.5	13.53	60.00
27.910500	46.22	1000.0	9.000	GND	L1	11.5	13.78	60.00
28.095000	45.86	1000.0	9.000	GND	L1	11.5	14.14	60.00
28.279500	46.18	1000.0	9.000	GND	L1	11.5	13.82	60.00

Table 3: Final Average measurements from the worst frequencies

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
27.354750	44.93	1000.0	9.000	GND	L1	11.5	5.07	50.00
27.541500	46.03	1000.0	9.000	GND	L1	11.5	3.97	50.00
27.726000	46.11	1000.0	9.000	GND	L1	11.5	3.89	50.00
27.910500	46.09	1000.0	9.000	GND	L1	11.5	3.91	50.00
28.095000	46.16	1000.0	9.000	GND	L1	11.5	3.84	50.00
28.279500	45.24	1000.0	9.000	GND	L1	11.5	4.76	50.00

The correction factor in the final result table contains the sum of the transducers (transient limiter + cables).
The result value is the measured value corrected with the correction factor.

EUT2

Full Spectrum

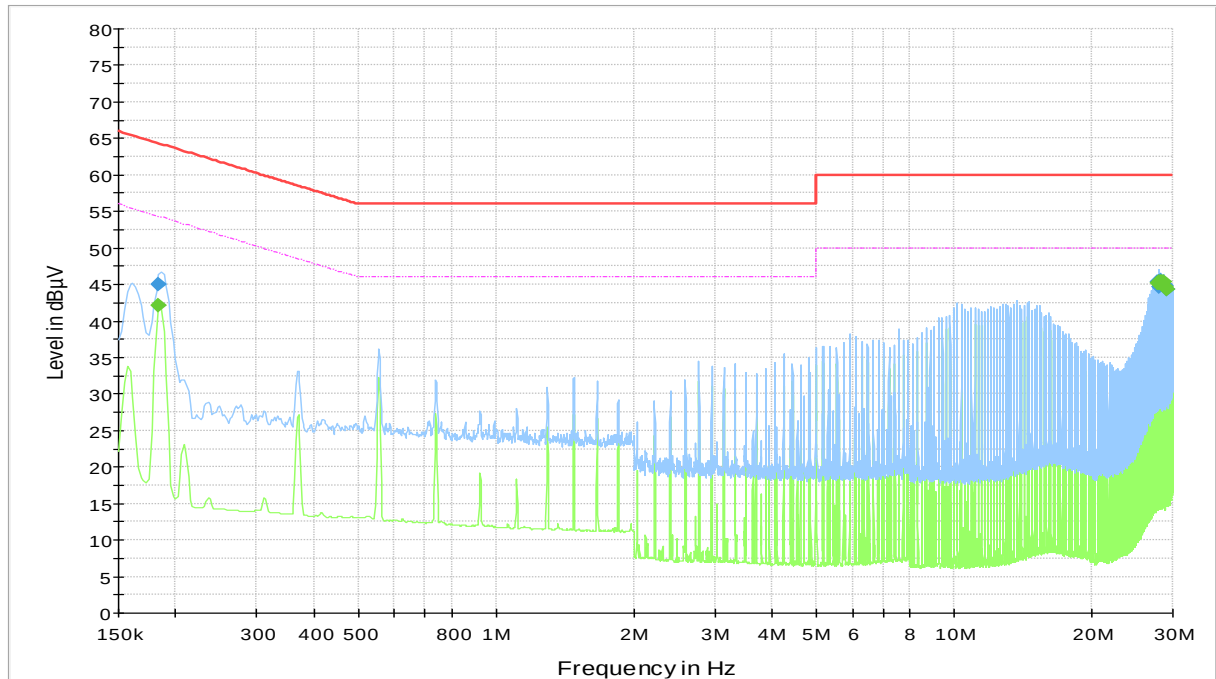


Figure 2: The measured curves with peak- and average detector

Table 4: Final QuasiPeak measurements from the worst frequencies

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.183750	45.08	1000.0	9.000	GND	L1	10.0	19.23	64.31
27.723750	45.34	1000.0	9.000	GND	L1	11.5	14.66	60.00
27.906000	44.64	1000.0	9.000	GND	L1	11.5	15.36	60.00
28.092750	45.43	1000.0	9.000	GND	L1	11.5	14.57	60.00
28.277250	45.55	1000.0	9.000	GND	L1	11.5	14.45	60.00
28.461750	45.34	1000.0	9.000	GND	L1	11.5	14.66	60.00
28.648500	45.02	1000.0	9.000	GND	N	11.5	14.98	60.00
28.833000	44.77	1000.0	9.000	GND	N	11.5	15.23	60.00
29.017500	44.37	1000.0	9.000	GND	N	11.5	15.63	60.00

Table 5: Final Average measurements from the worst frequencies

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.183750	42.10	1000.0	9.000	GND	L1	10.0	12.21	54.31
27.723750	45.10	1000.0	9.000	GND	L1	11.5	4.90	50.00
27.910500	45.25	1000.0	9.000	GND	L1	11.5	4.75	50.00
28.095000	45.34	1000.0	9.000	GND	L1	11.5	4.66	50.00
28.279500	45.40	1000.0	9.000	GND	L1	11.5	4.60	50.00
28.464000	45.43	1000.0	9.000	GND	L1	11.5	4.57	50.00
28.648500	45.28	1000.0	9.000	GND	L1	11.5	4.72	50.00
28.833000	44.66	1000.0	9.000	GND	L1	11.5	5.34	50.00
29.017500	44.29	1000.0	9.000	GND	L1	11.5	5.71	50.00

The correction factor in the final result table contains the sum of the transducers (transient limiter + cables).

The result value is the measured value corrected with the correction factor.

Radiated Emissions In The Frequency Range 9 kHz – 1 GHz

Standard: ANSI C63.10
Tested by: HEM
Date: 25 April 2019
Temperature: 21 °C
Humidity: 41 % RH
Measurement uncertainty ± 4.5 dB

Level of confidence 95 % (k = 2)

FCC Rule: 15.209

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100 **	3
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

According to ANSI C63.10 (clause 5.3.2) and RSS-Gen (Clause 4.11) the measurements below 30 MHz can be performed at a closer distance than the EUT limit distance, the results shall be extrapolated to limit distance by using the square of an inverse linear distance extrapolation factor (40 dB/ decade). This method was used when performing measurements at a distance of 3 m instead of limit distances 300 m or 30 m.

The correction factor in the final result table contains the sum of the transducers (antenna + cables + distance). The result value is the measured value corrected with the correction factor.

Test results

EUT1

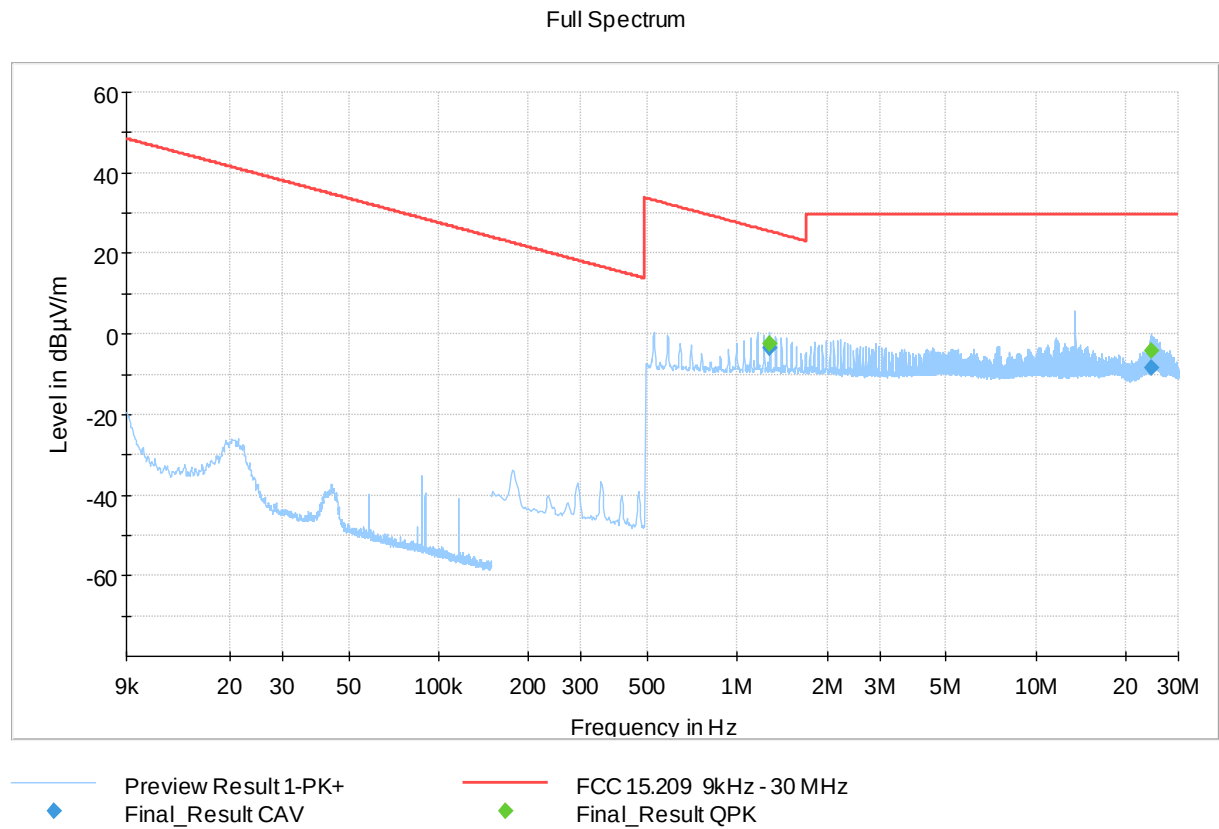


Figure 3. EUT1 TX radiated emission 9 kHz to 30MHz

Final measurements from the worst frequencies

Table 6. The final results with quasi-peak detector

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
1.285250	-2.46	25.45	27.91	1000.0	9.000	V	154.0	-20.3
24.316750	-4.02	29.50	33.52	1000.0	9.000	V	180.0	-19.5

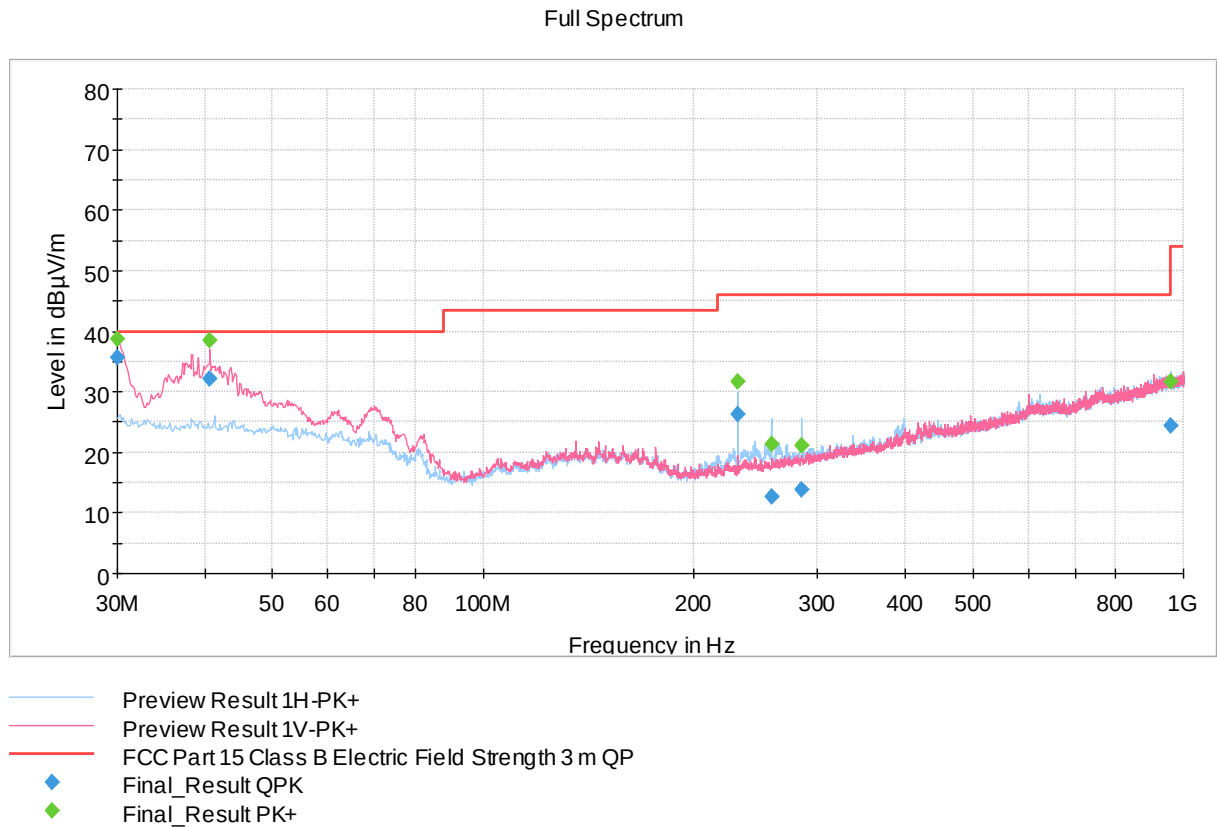


Figure 4. EUT1 TX radiated emission 30 MHz to 1000 MHz

Final measurements from the worst frequencies

Table 7. The final results with quasi-peak detector

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
30.040000	35.75	40.00	4.25	1000.0	120.000	V	114.0	16.9
40.645000	32.13	40.00	7.87	1000.0	120.000	V	59.0	18.1
230.515000	26.19	46.00	19.81	1000.0	120.000	H	329.0	16.0
257.745000	12.67	46.00	33.33	1000.0	120.000	H	1.0	17.7
284.835000	13.83	46.00	32.17	1000.0	120.000	H	326.0	18.8
957.695000	24.46	46.00	21.54	1000.0	120.000	H	190.0	31.3

EUT2

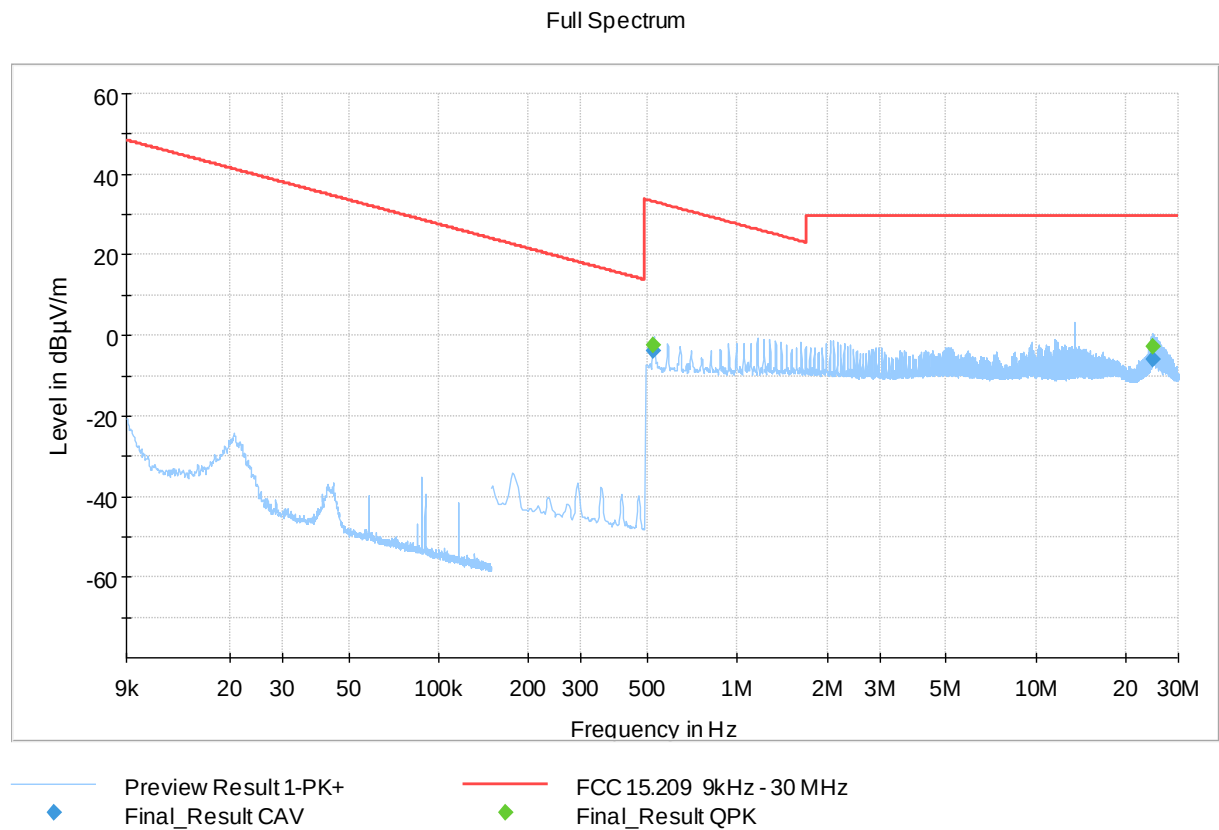


Figure 5. EUT2 TX radiated emission 9 kHz to 30MHz

Final measurements from the worst frequencies

Table 8. The final results with quasi-peak detector

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
0.524750	-2.48	33.21	35.69	1000.0	9.000	V	143.0	-20.3
24.615000	-2.63	29.50	32.13	1000.0	9.000	V	250.0	-19.5

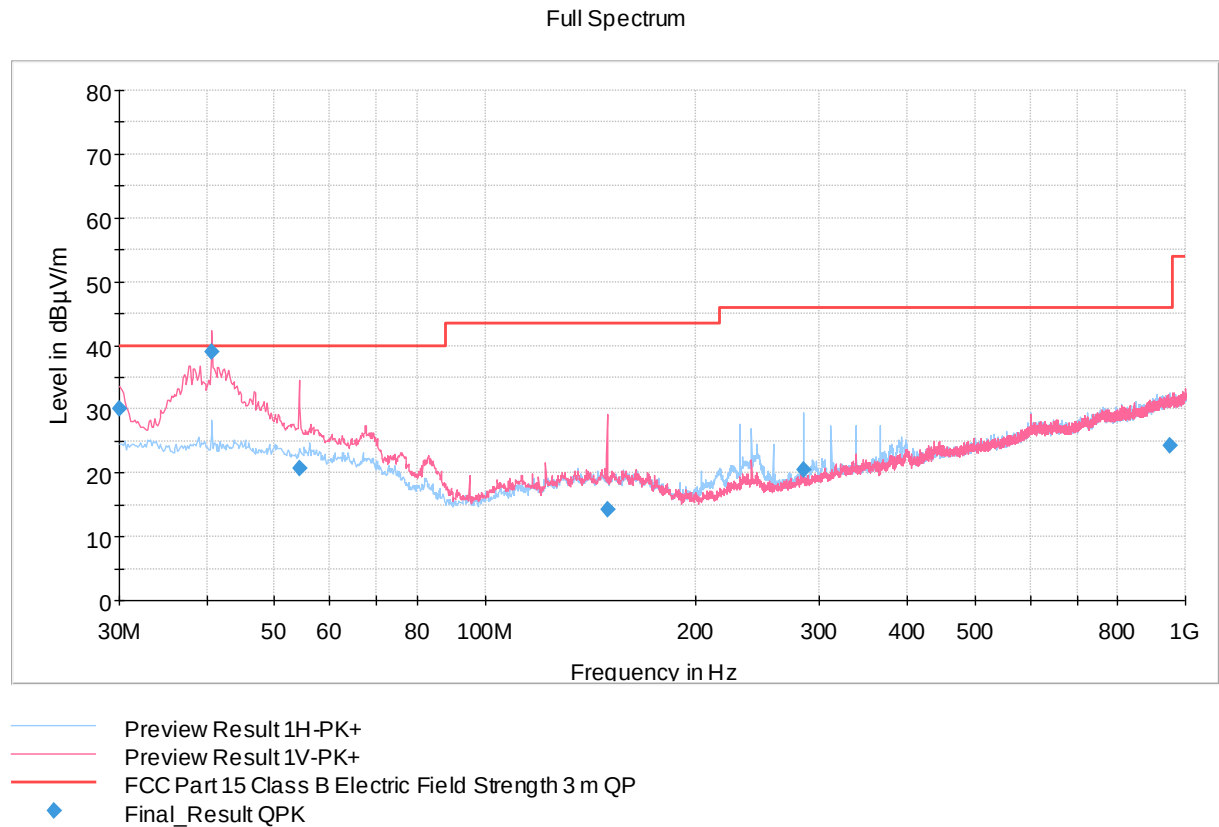


Figure 6. EUT2 TX radiated emission 30 MHz to 1000 MHz

Final measurements from the worst frequencies

Table 9. The final results with quasi-peak detector

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
30.000000	30.16	40.00	9.84	1000.0	120.000	V	32.0	16.9
40.705000	39.09	40.00	0.91	1000.0	120.000	V	199.0	18.1
54.365000	20.73	40.00	19.27	1000.0	120.000	V	222.0	18.5
149.295000	14.21	43.50	29.29	1000.0	120.000	V	204.0	18.6
284.695000	20.53	46.00	25.47	1000.0	120.000	H	107.0	18.8
948.625000	24.37	46.00	21.63	1000.0	120.000	H	58.0	31.3

Operation within the band 13.110 – 14.010 MHz

Standard: ANSI C63.10
Tested by: HEM
Date: 25 April 2019
Temperature: 21 °C
Humidity: 41 % RH
Measurement uncertainty ± 4.5 dB

Level of confidence 95 % (k = 2)

FCC Rule: 15.225

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (dBμV/m)	Measurement Distance (m)
13.110 – 13.410	40.5	30
13.410 – 13.553	50.5	30
13.553 – 13.567	84.0	30
13.567 – 13.710	50.5	30
13.710 – 14.010	40.5	30

Test results

EUT1

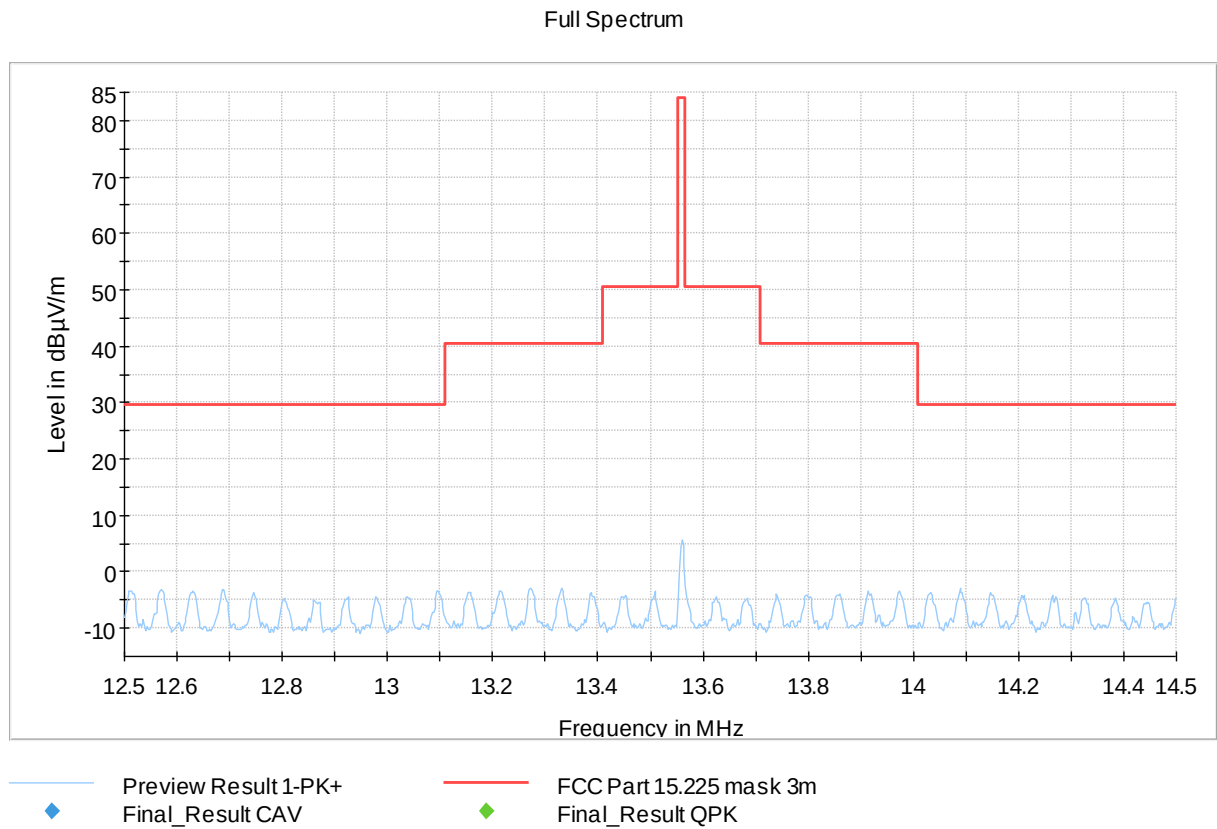


Figure 7. EUT1 TX radiated emission within the band 13.110 to 14.010 MHz

No final measurements were made due to the margin being more than 20 dB.

Table 10. The preliminary results with peak detector

Frequency (MHz)	Peak (dBμV/m)	QuasiPeak Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
13.56	5.771	84.0	-	-	-	-	-	-

EUT2

Full Spectrum

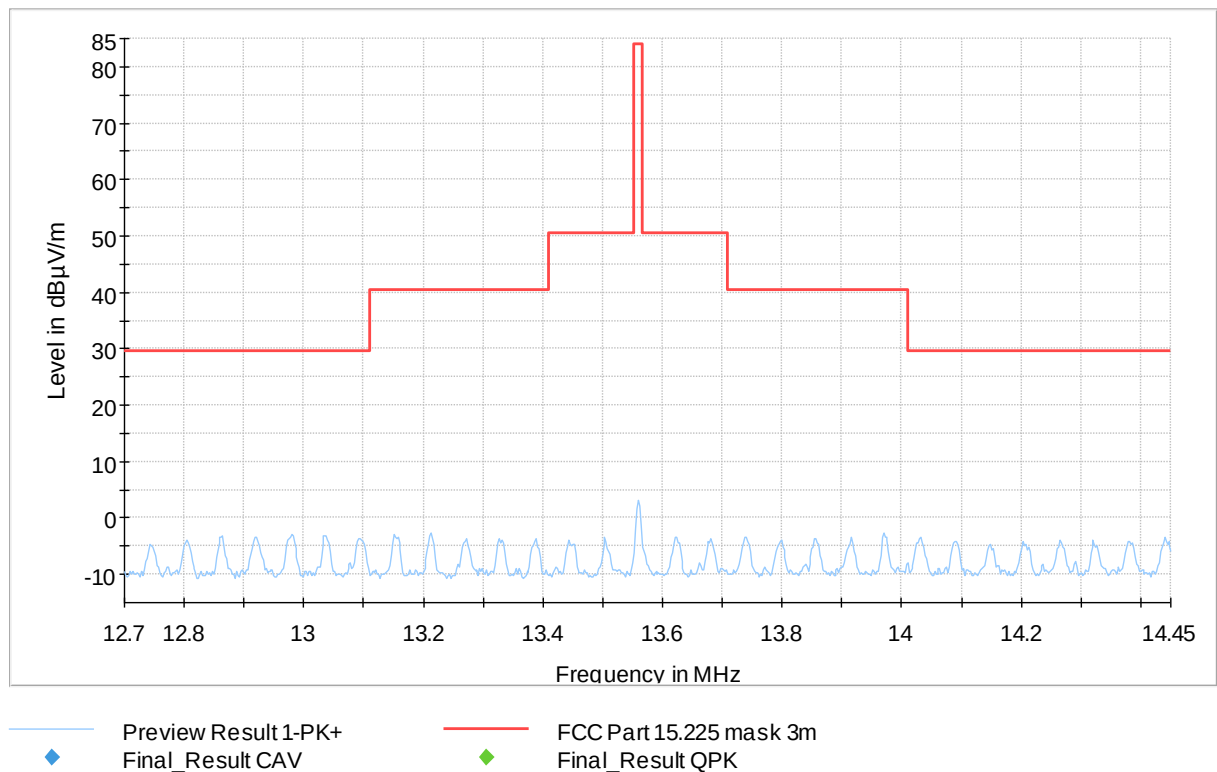


Figure 8. EUT2 TX radiated emission within the band 13.110 to 14.010 MHz

No final measurements were made due to the margin being more than 20 dB.

Table 11. The preliminary results with peak detector

Frequency (MHz)	Peak (dBμV/m)	QuasiPeak Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
13.56	3.153	84.0	-	-	-	-	-	-

Frequency Stability

Standard:	ANSI C63.10	
Tested by:	HEM	
Date:	26 April 2019	29 April 2019
Temperature:	22 °C	22 °C
Humidity:	30 % RH	23 % RH

FCC Rule: 15.225©

IC Rule: RSS-210, RS-GEN (6.11)

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20°C . For battery operated equipment, the equipment tests shall be performed using a new battery.

Test results

EUT1

Table 12. Frequency stability test, extreme conditions

Test conditions		Frequency (MHz)	deviation from nominal (%)	Result
Temperature	Voltage			
-20 °C	115 V _{AC}	13.56012300	0.00090708	PASS
-10 °C	115 V _{AC}	13.56013750	0.00101401	PASS
0 °C	115 V _{AC}	13.56013020	0.00096018	PASS
+10 °C	115 V _{AC}	13.56010130	0.00074705	PASS
+20 °C	97.75 V _{AC}	13.56005070	0.00037389	PASS
+20 °C	115 V _{AC}	13.56005790	0.00042699	PASS
+20 °C	132.25 V _{AC}	13.56005070	0.00037389	PASS
+30 °C	115 V _{AC}	13.56000720	0.00005310	PASS
+40 °C	115 V _{AC}	13.55995660	-0.00032006	PASS
+50 °C	115 V _{AC}	13.55991320	-0.00064012	PASS

EUT2

Table 13. Frequency stability test, extreme conditions

Test conditions		Frequency (MHz)	deviation from nominal (%)	Result
Temperature	Voltage			
-20 °C	115 V _{AC}	13.56015200	0.00112109	PASS
-10 °C	115 V _{AC}	13.56017370	0.00128097	PASS
0 °C	115 V _{AC}	13.56016640	0.00122713	PASS
+10 °C	115 V _{AC}	13.56014470	0.00106711	PASS
+20 °C	97.75 V _{AC}	13.56010130	0.00074705	PASS
+20 °C	115 V _{AC}	13.56010130	0.00074705	PASS
+20 °C	132.25 V _{AC}	13.56010130	0.00074705	PASS
+30 °C	115 V _{AC}	13.56005790	0.00042699	PASS
+40 °C	115 V _{AC}	13.56000720	0.00005310	PASS
+50 °C	115 V _{AC}	13.55997110	-0.00021313	PASS

Occupied Bandwidth

Standard:
Tested by: HEM
Date: 24 May 2019
Temperature: 22 °C
Humidity: 39 %RH

FCC Rule: 15.215©

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Sections 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule.

Test results

EUT1

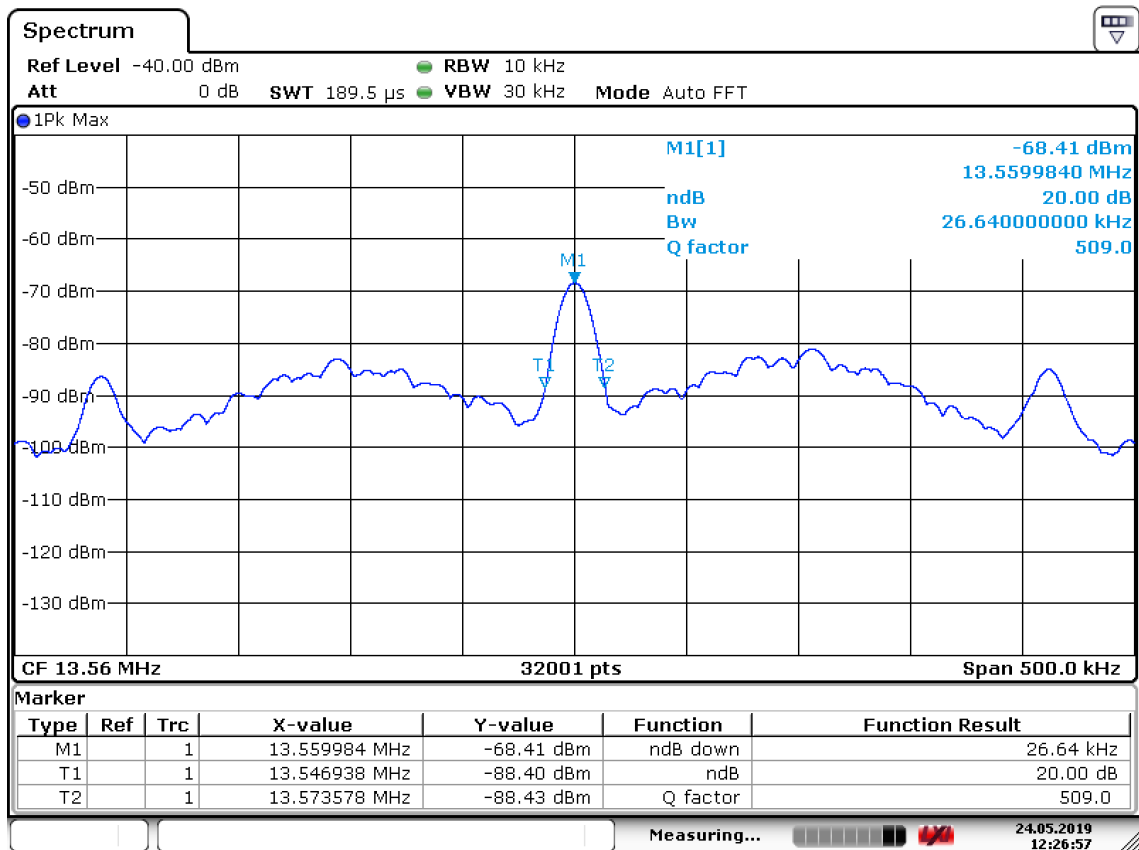


Figure 9: The EUT1 20 dB bandwidth

The obtained 20 dB bandwidth is 26.64 kHz, and is contained within the frequency band 13.110–14.010 MHz.

EUT2

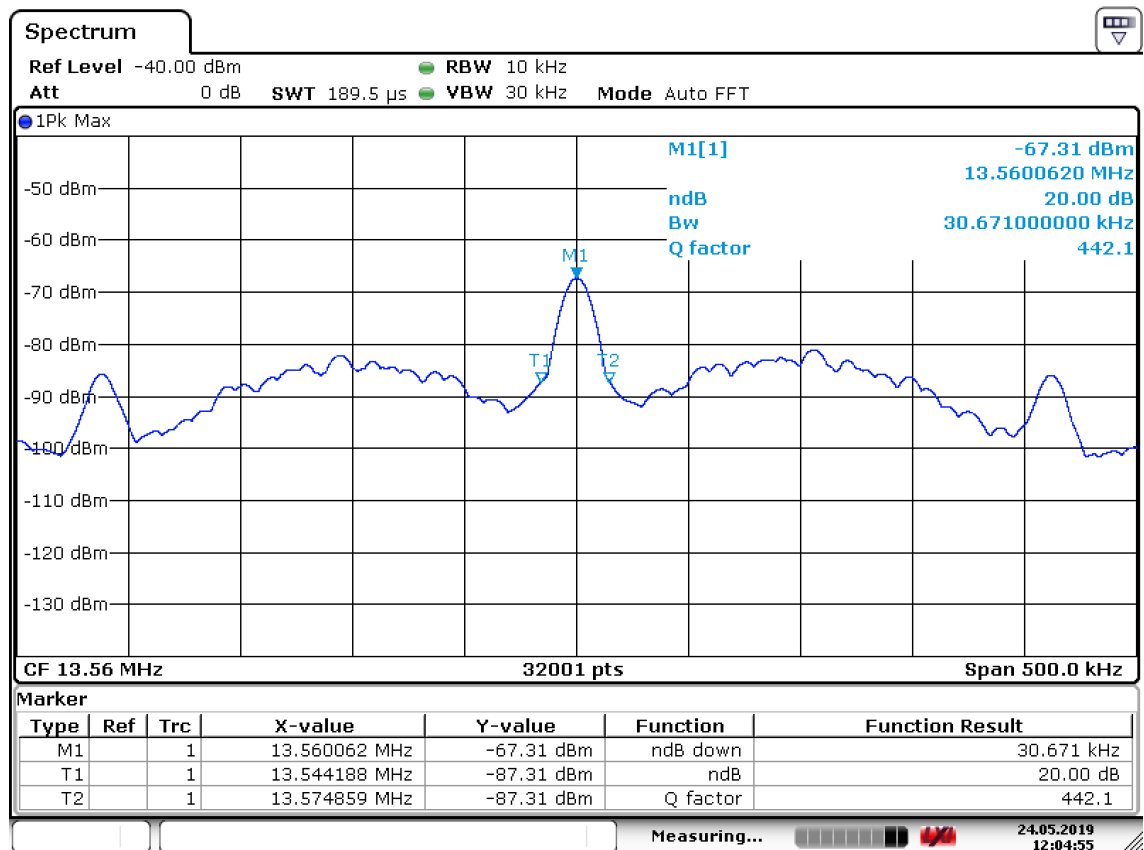


Figure 10: The EUT2 20 dB bandwidth

The obtained 20 dB bandwidth is 30.671 kHz, and is contained within the frequency band 13.110–14.010 MHz.

99% Power Bandwidth

Standard:	RSS-GEN
Tested by:	HEM
Date:	24 May 2019
Temperature:	22 °C
Humidity:	39 %RH

IC Rule: RSS-GEN (6.7)

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value.

Test results

EUT1

Table 14. EUT1 99% Power Bandwidth

99% Power Bandwidth	Resolution Bandwidth	Video Bandwidth
428.408 kHz	10 kHz	30 kHz

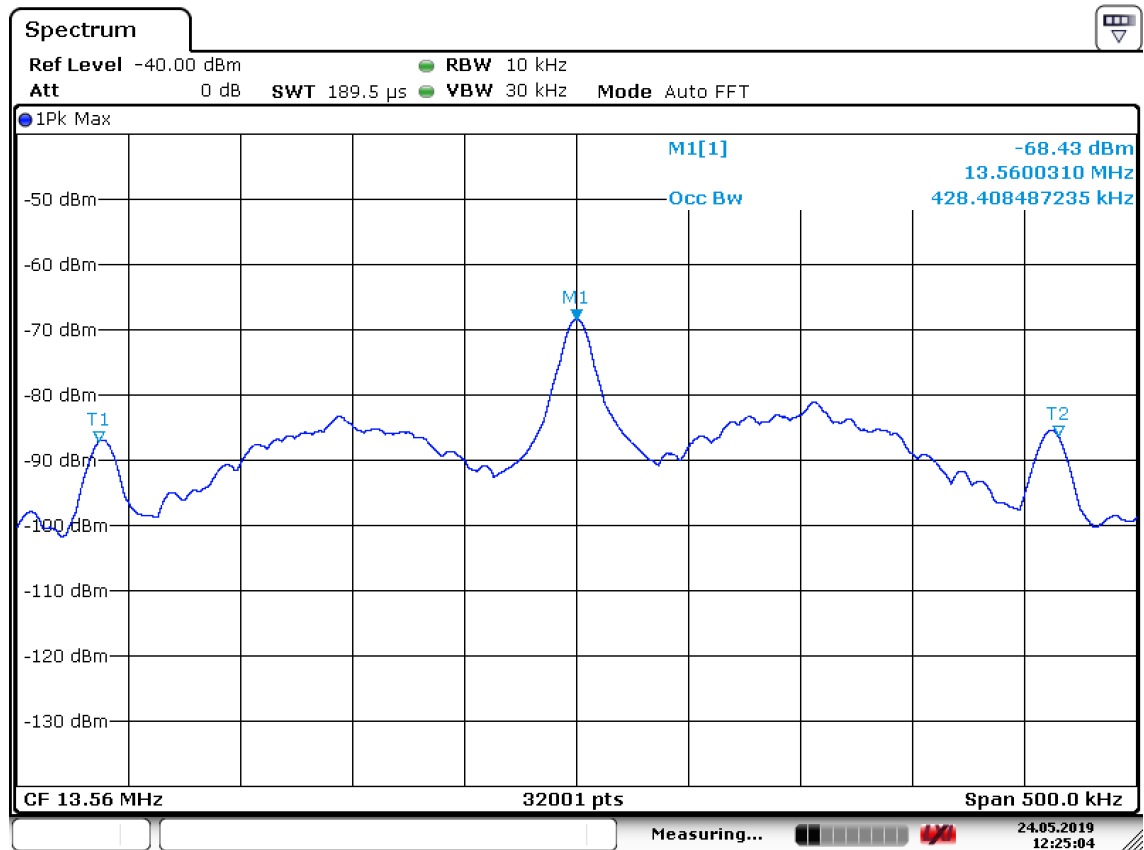


Figure 11. EUT1 99% Power Bandwidth

EUT2

Table 15. EUT2 99% Power Bandwidth

99% Power Bandwidth	Resolution Bandwidth	Video Bandwidth
427.971 kHz	10 kHz	30 kHz

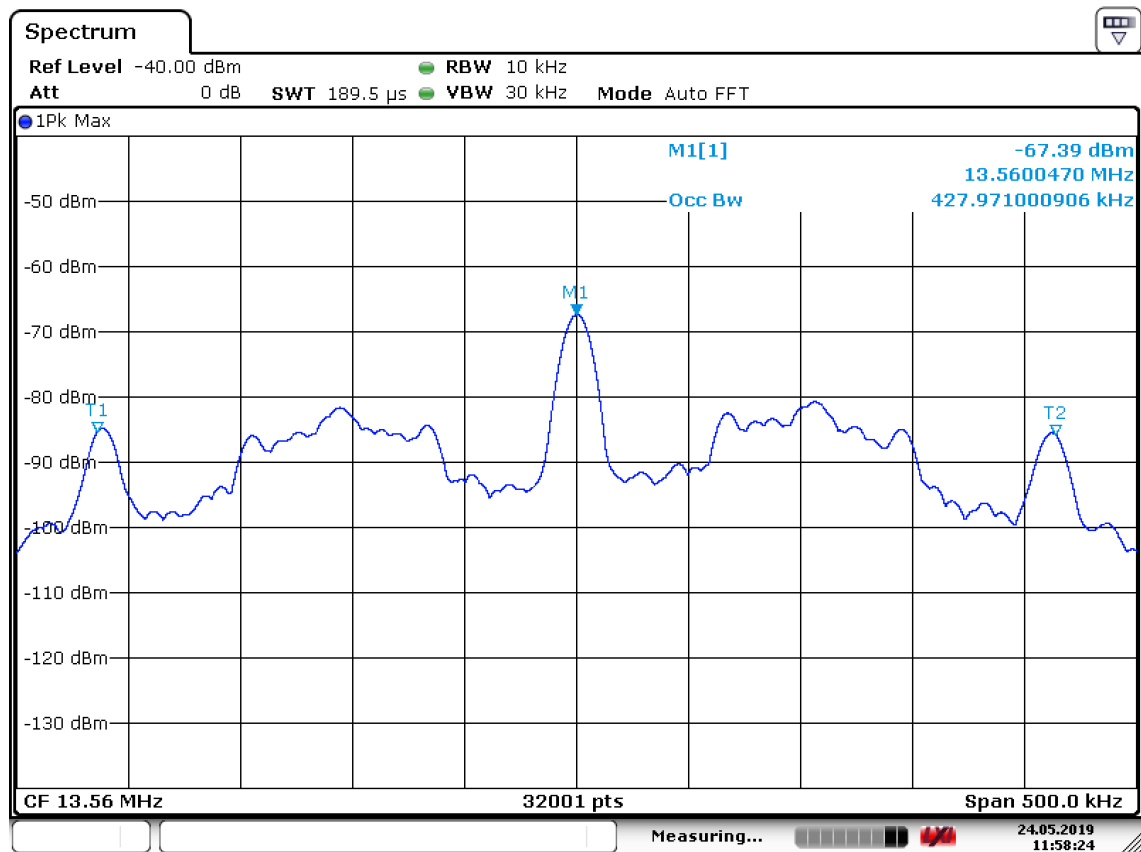


Figure 12. EUT2 99% Power Bandwidth

TEST EQUIPMENT

EQUIPMENT	MANUFACTURER	TYPE	INV OR SERIAL	PREV. CALIB.	NEXT CALIB.
POWER SUPPLY	CALIFORNIA INSTR.	5001 iX Series II	inv:7826	-	-
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2	inv:8013	2018-03-23	2020-03-23
ANTENNA	SCHWARZBECK	VULB 9168	inv:8911	2018-10-25	2020-10-25
TURNTABLE	MATURO	DS430 UPGRADED	inv:10182	-	-
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv:10183	-	-
ANTENNA MAST	MATURO	TAM 4.0E	inv:10181	-	-
ATTENUATOR	PASTERNAK	PE 7004-4	inv:10126	-	-
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv:10679	2018-06-26	2019-06-26
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU 26	inv:8453	2019-06-26	2020-06-25
LISN	ROHDE & SCHWARZ	ESH3-Z5	inv:7923	2019-05-28	2020-05-28
LISN	ROHDE & SCHWARZ	ESH3-Z5	inv:7971	2019-05-28	2020-05-28
TRANSIENT LIMITER	ROHDE & SCHWARZ	ESH3-Z2	inv:10967	2019-08-09	2020-08-09
SIGNAL ANALYZER	ROHDE & SCHWARZ	FSV40	inv:9093	2018-06-28	2020-06-28
TEMPERATURE/ HUMIDITY METER	VAISALA	HMT 333	inv:8638	2019-04-10	2020-04-10
TEMPERATURE CHAMBER	VÖTSCH	VC4033	inv:10412	-	-
NEAR-FIELD PROBE	ROHDE & SCHWARZ	HZ-14 1026.7744.02	inv:7883	-	-