RADIO SPECTRUM MANAGEMENT

Adding new usages to the General User Radio Licence for Short Range Devices in frequencies below 30 MHz

Technical Consultation - August 2018

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
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New Zealand Government

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Glossary

Abbreviation/Term	Meaning
AM	Amplitude Modulation (for radio broadcasting)
GURL	General user radio licence
SRD	Short range device
GURL SRD	Radiocommunications Regulations (General User Radio Licence for Short Range Devices) Notice
ITU-R	Radiocommunication Sector of the International Telecommunication Union
MPIS	Maximum permitted interfering signal
PIB 39	Public Information Brochure 39: Spectrum Licence Certification Rules for Crown Management Rights
The Act	Radiocommunications Act 1989
The Crown	Her Majesty the Queen, acting through the Chief Executive of the Ministry of Business, Innovation and Employment
The Ministry	Ministry of Business, Innovation and Employment
The Regulations	Radiocommunications Regulations 2001
Radio Standards Notice	Radiocommunications Regulations (Radio Standards) Notice
WPT	Wireless power transfer

Invitation for submissions

Interested parties are invited to comment on the content of this document, in particular the questions posed, and on any related issues. Comments should be submitted in writing, no later than **5pm on Friday 14 September 2018** to:

By email: *(preferred option)*

Radio.Spectrum@mbie.govt.nz

Subject line: "Adding new usages to General User Radio Licence for Short Range Devices below 30 MHz"

Or

By post:

Adding new usages to General User Radio Licence for Short Range Devices below 30 MHz
Radio Spectrum Management Policy and Planning
Ministry of Business, Innovation and Employment
PO Box 2847
WELLINGTON 6140

Any party wishing to discuss the proposals with Ministry officials should email, in the first instance Radio.Spectrum@mbie.govt.nz

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1 Executive summary

The proliferation of portable electrical appliances and mobile devices, such as smart phones and watches, has driven interest in wireless charging. This technology has two components, a wireless power transfer (WPT) system and an inductive loop system, and this requires the use of radio spectrum, especially in sub 30 MHz frequency range.

The WPT and inductive loop systems should be accommodated within the definition of short range devices, and thus should be covered by the *General User Radio Licence for Short Range Devices* (GURL SRD)[1].

WPT systems operate in several frequency ranges that fall within the current provisions of the GURL SRD. Although WPT systems may implicitly operate under those provisions, the existing provisions in the GURL SRD would need to be modified, for reasons of clarity, to explicitly allow WPT usages.

Inductive loop systems operate within the frequency range 0.1485-30 MHz at a very low power. This is quite a wide range, and it spans across many provisions within the GURL SRD. To permit such inductive loops systems, there is a need to add a new provision to the GURL SRD covering this entire frequency range.

The Ministry conducted studies on incorporating WPT and inductive loop systems into the GURL SRD. This includes the impact of a proposed new provision covering the entire frequency range 0.1485-30 MHz in the GURL SRD that would encroach on spectrum allocated to other radiocommunication usages.

Considering that the proposed power limit for inductive loop system is −56 dBW, which is equivalent to the unwanted emission limits for all other radio products under the *Radiocommunications Regulations (Radio Standards) Notice* (Radio Standards Notice)[2], our studies revealed that if induction loop systems are added to the GURL SRD, the risk of increased interference to other existing services would be negligible. This is because inductive loop systems, which are designed for use within domestic households, are not generating additional levels of interference than what would already be experienced by these services in the presence of short range devices (currently complying with unwanted emission limit in Table 2 of the Radio Standards Notice).

In regard to the technical compatibility between inductive loop systems and AM radio reception in the frequency range 0.521-1.612 MHz, it is considered that inductive loop systems, which comply with international standard, are technically compatible with AM receivers when they are separated by 10 metres. For less than 10 metres, any actual interference experienced by AM receivers as a result of emission from inductive loop systems, is most likely due to self-interference caused by the owner of both pieces of equipment. However, the probability of such interference is relatively low considering that several adverse conditions need to be present at the same time.

We have outlined our proposals within this consultation document and seek feedback on our suggested modifications to the GURL SRD.

[1] https://www.rsm.govt.nz/about-rsm/spectrum-policy/gazette/gurl/short-range-devices
[2] https://www.rsm.govt.nz/about-rsm/spectrum-policy/gazette/product-compliance

2 Introduction

There is a variety of devices that transmit electric power wirelessly. Inductive chargers are one example of such technology. These devices are increasingly popular overseas in applications for portable electrical appliances and in mobile devices such as smart phones and watches. This trend will continue as reliance on handheld equipment rises.

Inductive chargers have two components, namely, WPT systems and inductive loop systems. Both use radio spectrum to operate and so must comply with New Zealand's radiocommunications regime. This document is a technical overview of how to enable their use in New Zealand.

2.1 WPT systems

Most of the common WPT systems are covered under international standard ETSI EN 303 417 (V1.1.1)[3]. WPT systems have two parts:

1. A power transmitter. This transmitter has communications capability for controlling the inductive charge function as well as for the device's receiving parts.
2. A power receiver. This supplies energy to the portable electrical appliances and mobile device. It also performs the control function to determine the device's status and to activate the charge function.

ETSI EN 303 417 provides the frequency ranges in which WPT systems operate. These are shown below:

	WPT frequency range	Frequency Bands	Applications
Transmit and Receive	1	19 kHz to 21 kHz	WPT systems
Transmit and Receive	2	59 kHz to 61 kHz	WPT systems
Transmit and Receive	3	79 kHz to 90 kHz	WPT systems
Transmit and Receive	4	100 kHz to 119 kHz	WPT systems
Transmit and Receive		119 kHz to 140 kHz	WPT systems
Transmit and Receive		140 kHz to 148,5 kHz	WPT systems
Transmit and Receive		148,5 kHz to 300 kHz	WPT systems
Transmit and Receive	5	6 765 kHz to 6 795 kHz	WPT systems

Table 1 WPT frequency ranges

The standard also specifies the magnetic (otherwise known as H-field) field strength limits for these frequency bands. These are reproduced below:

[3] http://www.etsi.org/deliver/etsi_en/303400_303499/303417/01.01.01_60/en_303417v010101p.pdf

Frequency range [MHz]	H-field strength limit [dBµA/m at 10 m]	Comments
0,019 ≤ f < 0,021	72	
0,059 ≤ f < 0,061	69,1 descending 10 dB/dec above 0,059 MHz	See note 1
0,079 ≤ f < 0,090	67,8 descending 10 dB/dec above 0,079 MHz	See note 2
0,100 ≤ f < 0,119	42	
0,119 ≤ f < 0,135	66 descending 10 dB/dec above 0,119 MHz	See note 1
0,135 ≤ f < 0,140	42	
0,140 ≤ f < 0,1485	37,7	
0,1485 ≤ f < 0,30	-5	
6,765 ≤ f < 6,795	42	
NOTE 1: Limit is 42 dBµA/m for the following spot frequencies: 60 kHz ± 250 Hz and 129,1 kHz ± 500 Hz. NOTE 2: At the time of preparation of the present document the feasibility of increased limits for high power wireless power transmission systems to charge vehicles [i.4] was prepared. New specific requirements for such systems (e.g. higher H-field emission limits in the 79 - 90 kHz band) will be reflected within a future revision of the present document.		

Table 2 Magnetic field strength limits for WPT frequency ranges

Q1. Should other international standards also be considered for equipment conformance in relation to WPT systems?

2.2 Inductive loop systems

Another international standard ETSI EN 300 330 (V2.1.1)[4] provides the technical specifications for inductive loop systems that operate within the frequency range 0.1485-30 MHz. The standard also contains the magnetic (otherwise known as H-field) field strength limits of these systems as found below:

Frequency range MHz	Total H-field strength at 10 m dBµA/m	H-field strength density at 10 m in a 10 kHz resolution bandwidth dBµA/m
0,1485 to 30,0	-5 (note 1)	-15 (note 2)
NOTE 1: Without transmitter modulation. NOTE 2: With transmitter modulation.		

Table 3 Magnetic field strength limits for inductive loop system frequency range

The magnetic field strength of –15 dBµA/m for inductive loop systems when converted to electric field strength[5] is 36.5 dBµV/m. This level is measured at 10 metres in a 10 kHz resolution bandwidth as is ordinary practice under the standard.

For frequencies below 30 MHz, a distance from the radiating source of the order of 10 metres or less is considered operating in a near-field environment. Under the characteristics of normal radiowave propagation that are typically modelled in far-field environment, it is quite difficult to accurately derive power level, magnetic field strength or electric field strength for frequencies below 30 MHz when in closer proximity (i.e. less than 10 metres).

Q2. Should other international standards also be considered for equipment conformance in relation to inductive loop systems below 30 MHz?

[4] http://www.etsi.org/deliver/etsi_en/300300_300399/300330/02.01.01_60/en_300330v020101p.pdf

[5] Magnetic H-field strength in dBµA/m should be increased by 51.5 dB when converted to electric E-field strength in dBµV/m

2.3 **Scope**

The GURL SRD is the most appropriate licensing instrument to amend to include provisions for permitting WPT and inductive loop systems. This is because this licence is used to provide short range wireless services.

All existing provisions of the GURL SRD in frequencies below 30 MHz are outlined as follows:

Low (MHz)	High (MHz)	Reference Frequency (MHz)	Maximum Power dBW e.i.r.p.	Remarks
0.0090	0.0900	0.0495	9.0	Special conditions 1 and 25
0.0900	0.2050	0.1475	–20.0	Special conditions 1 and 25
0.1190	0.1350	0.1270	3.0	Special conditions 1 and 25
0.3150	0.4300	0.3725	–67.0	Special conditions 1 and 25
3.1550	3.4000	3.2775	–50.0	Special conditions 2 and 20
3.6400	4.0400	3.8400	–76.0	Special conditions 2 and 20
6.7650	6.7950	6.7800	–20.0	
7.4000	8.8000	8.1000	–54.0	Special condition 19
10.4400	10.7600	10.6000	–76.0	Special conditions 2 and 20
13.5530	13.5670	13.5600	–10.0	
26.9500	27.3000	27.1250	0.0	
29.7000	30.0000	29.8500	–10.0	

Special conditions:

1. Use is limited to determination, telemetry or telecommand.
2. Use is limited to auditory aids.
19. In the band 7.4-8.8 MHz, use is restricted to inductive systems where the magnetic field strength from devices must not exceed 9 dBµA/m at a distance of 10 metres.
20. In the band 3.155-3.400 MHz, the maximum permitted field strength is 13.5 dBµA/m measured in a 10 kHz bandwidth at a distance of 10 metres. In the bands 3.64-4.04 MHz and 10.44-10.76 MHz, the maximum permitted field strengths are –15 dBµA/m and –20 dBµA/m, respectively, both measured in a 10 kHz bandwidth at 10 metres.
25 In the band 0.009-0.090 MHz, the magnetic field strength from devices must not exceed 72 dBµA/m at a distance of 10 metres. In the band 0.090-0.205 MHz, the magnetic field strength from devices must not exceed 43 dBµA/m at a distance of 10 metres, except in the band 0.119-0.135 MHz, where the magnetic field strength from devices must not exceed 66 dBµA/m at a distance of 10 metres. In the band 0.3150-0.430 MHz, the magnetic field strength from devices must not exceed –5 dBµA/m at a distance of 10 metres.

Table 4 Current provisions in GURL SRD in frequency ranges below 30 MHz

Most of the WPT frequency ranges fall within the existing provisions of the GURL SRD, except for the frequency range 0.1485-0.3 MHz, which is only partially covered. Currently, WPT systems may implicitly operate under those provisions. For reasons of clarity, existing provisions in the GURL SRD would need to be modified to explicitly allow WPT usages.

However, the GURL SRD is less conducive for the technical specifications for low power inductive loop systems with swept carriers in frequencies below 30 MHz. Consequently, a new provision would need to be added to the frequency range 0.1485-30 MHz in order to facilitate their use in New Zealand.

The table below shows the overlap between the frequency ranges within existing provisions in GURL SRD and the relevant frequency ranges for WPT systems and inductive loop systems:

Frequency range (MHz)	Magnetic field strength limit (dBµA/m at 10 m) as per international standards	Existing provisions in GURL SRD	Proposed actions
0.019-0.021	72	0.009-0.090 MHz (Special Condition 25)	Edit the text in GURL SRD to permit WPT
0.059-0.061	69.1		
0.079-0.090	67.8		
0.100-0.0119	42	0.090-0.205 MHz (Special Condition 25)	
0.119-0.135	66	0.119-0.135 MHz (Special Condition 25)	
0.135-0.140	42	0.090-0.205 MHz (Special Condition 25)	
0.140-0.1485	37.7		
0.1485-0.300	–5	Partly covered by 0.090-0.205 MHz (Special Condition 25)	Remaining portion not covered would be considered in conjunction with the inductive loop systems in 0.1485-30 MHz
6.765-6.795	42	6.765-6.795 MHz	Unrestrictive use in GURL SRD, no further action is required
0.1485-30.000	–15	Mostly not covered	Add a new provision for inductive loop systems in GURL SRD

Table 5 Overlap between GURL SRD, WPT and inductive loop systems

Q3. Do you agree that GURL SRD is the most appropriate licensing instrument to permit WPT and inductive loop systems in the frequencies below 30 MHz?

Q4. Do you agree that the proposed actions would sufficiently cover the new usages for WPT and inductive loop systems?

3 Issues with permitting inductive loop systems in 0.1485-30 MHz

Adding inductive loop systems into the GURL SRD to cover the entire frequency range in 0.1485-30 MHz may create a minor risk of interference with other uses in different parts of this frequency range.

Since the frequency range 0.1485-30 MHz overlaps with an existing Management Right (i.e. MR 206 in 0.521-1.612 MHz), several technical matters also need to be taken into account before a new licence can be registered under the Radiocommunications Act 1989 (the Act). As part of this, the management right holder (in this case the Crown) is prevented from creating spectrum licences that contravene the maximum permitted interfering signal (MPIS) of existing spectrum licences[6]. The Act, on the other hand, also allows radio licences (including a general

[6] S 59 of the *Radiocommunications Amendment Act 2000.*

user radio licence) to be registered within the frequency boundaries of a management right when emissions are below the power floor specified for that management right, or below a default –50 dBW if no power floor is specified[7].

The Radiocommunications Regulations 2001 (the Regulations) impose several obligations concerning the creation of new licences. Under Regulation 12 (1)(b), any determination of whether to grant a licence must take into account the technical compatibility of this new licence with existing radio and spectrum licences.

Before a proposed provision covering the entire frequency range in 0.1485-30 MHz could be included in GURL SRD, the risk of interference posed by inductive loop systems needs to be assessed by demonstrating that such systems are technically compatible with other existing services in the same frequency range.

The table below provides a summary of the current licensed usages below 30 MHz:

Usage	Licence type	Frequency range (MHz)
Fixed and mobile services (e.g. aeronautical, maritime and government fixed and land mobile)	Radio licence	Dispersed throughout 0.205-30.000
Amateur	Radio Licence and General User Radio Licence	Dispersed throughout 0.130-30.000
Radio beacons (e.g. non-directional beacons, maritime buoys)	Radio licence	0.205-0.415
		1.612-2.000
Broadcasting (AM systems)	Spectrum licence	0.521-1.612
Emergency transmitters (e.g. avalanche beacons, survival craft radio transmitters)	General User Radio Licence	0.457 (avalanche beacon)
		2.1875 (SCRTs)
		8.4145 (SCRTs)
Distress, safety and calling (e.g. aeronautical and maritime purposes)	General User Radio Licence	2.182, 4.125, 6.215, 8.291, 12.290, 16.420
Other services (e.g. paging, telemetry and telecommand	Radio licence	26.175-26.225
		26.950-27.300
		29.800-30.000

Table 6 Current usages within the frequency range 0.1485-30 MHz

Q5. Are there any other usages in the frequency range 0.1485-30 MHz that have been omitted from the scope of this technical consultation?

3.1 Likely impact to radio licence

All radio products that operate under a radio licence must comply with an applicable standard as prescribed in the Radio Standards Notice. In the absence of an applicable standard, there is a general unwanted emission limit of −56 dBW e.i.r.p., or an equivalent electric field strength limit of 59 dBµV/m at 10 metres, imposed on radio products under Table 2 of the Radio Standards Notice.

[7] S 110 of the *Radiocommunications Act 1989*

The magnetic field strength of −15 dBµA/m for inductive loop systems when converted to electric field strength is 36.5 dBµV/m as measured at 10 metres in a 10 kHz resolution bandwidth. This level falls below the general unwanted emission limit as prescribed in the Radio Standards Notice.

As a result, we consider that existing radio licences below 30 MHz are not likely to be exposed to interference additional to the current levels of unwanted emissions already produced by existing radio products in the same or adjacent frequency bands.

Detailed assessment can be found in Section 4 of this document.

3.2 Likely impact to spectrum licence

The AM licences that operate within the frequency range 0.521-1.612 MHz are subject to a receive protection requirement in the form of the maximum permitted interfering signal (MPIS).

Interfering signals are typically measured from the AM receiver within its protected coverage area. Notably, the obligation in measuring interfering signals does not detail the geographic distance from the source of the interfering signal. Instead, it is generally assumed that the level of interference is measured from the victim receiver (i.e. no separation between interfering source and victim receiver) and that this level of interference should not exceed the MPIS.

The issue concerning AM spectrum licence is that an MPIS over a 20 kHz occupied bandwidth is typically taken as 36 dBµV/m (for day time operation) or 44 dBµV/m (for night time operation), in accordance with PIB 39. In comparison, the electric field strength as envisioned for inductive loop systems is 36.5 dBµV/m when measured at 10 metres, in accordance with ETSI EN 300 330. Therefore, AM licensees' MPIS would be exceeded by 0.5 dB.

It is important to note that the derivation of an MPIS at 36 dBµV/m (for day time operation) is based on a 30 dB margin from the day-time minimum usable field strength at 66 dBµV/m. An interfering signal exceeding this MPIS would not necessarily cause interference to AM receivers if the surrounding area is within AM coverage and is where the wanted field strength is higher than the minimum usable field strength.

Detailed assessment can be found in Section 5 of this document.

4 Coexistence study between inductive loop systems and radio licences in frequencies below 30 MHz

4.1 Analysis

The magnetic field strength of inductive loop system in 0.1485-30 MHz is −15 dBμA/m measured over 10 kHz, or this can be expressed as electric field strength of 36.5 dBμV/m. When converted to a radiated power, this field strength level would approximately equate to:

- −56 dBW over 10 kHz (when operating at the lower frequency boundary);
- −100 dBW over 10 kHz (when operating at the upper frequency boundary).

In general, we consider that an inductive loop system within 0.1485-30 MHz would radiate power at a level less than −56 dBW, which is also the general unwanted emission limit as specified for all radio products in Radio Standards Notice.

This section aims to outline the analytical study on the coexistence of inductive loop system as an interferer with other radiocommunication services operating below 30 MHz as victim.

Instead of performing a relatively large number of calculations for each radio licence in the frequency range 0.1485-30 MHz, we have grouped these services into several common categories as shown in Table 6 and use nominal parameters that are the most representative for each category.

The modelling of our study follows the methodology as outlined in Annex 1 of Recommendation ITU-R SM.2028 "*Protection distance calculation between inductive systems and radiocommunication services using frequencies below 30 MHz*".

This methodology models the effective radiated power level of inductive loop systems from the measured magnetic field strength at a certain distance. This magnetic field strength level is then converted to electric field strength as the source of interference. The calculations prescribed in Recommendation ITU-R SM.2028 would determine the required protection distance to ensure the electric field strength produced by an inductive loop system is less than the interference limit of electric field strength of a victim service.

This methodology also cross-references Recommendation ITU-R P.372 "*Radio Noise"* when deriving electric field strength for victim receivers since radio noise sets a limit to the performance of radio systems, including the effect of atmospheric and man-made noise.

Note that all cases assessed in this study would fall inside the near-field environment.

Q6.	***Do you agree with the use Recommendation ITU-R SM.2028 for assessing technical compatibility between inductive loop systems and radio licences in frequencies below 30 MHz?***

4.2 **Results**

The results of protection distances are summarised as below:

Usage	Frequency range (MHz)	Nominal frequency (MHz)	Nominal bandwidth (kHz)	Protection distance (metres)
Fixed and mobile (e.g. aeronautical, maritime and government fixed and land mobile services)	Below 1	0.4	0.1	20.98
	1-3	2	2.8	27.10
	3-10	5	2.8	27.02
	10-30	20	2.8	16.22
Amateur	Below 1	0.4	0.1	20.98
	1-10	7	3.0	22.40
	10-30	14	3.0	16.82
Radio beacons (e.g. non-directional beacons, maritime buoys)	0.205-0.415	0.3	2	21.38
	1.612-2.000	1.6	2	25.88
Emergency transmitters (e.g. avalanche beacons, survival craft radio transmitters)	0.457 (avalanche beacon)	0.457	0.1	19.32
	2.1875 (SCRTs)	2.1875	2.8	26.41
	8.4145 (SCRTs)	8.4145	2.8	19.99
Distress, safety and calling channels	2.182, 4.125, 6.215, 8.291, 12.290, 16.420	8.291	2.8	20.03
Other services (e.g. paging, telemetry and telecommand	26.175-26.225	26	50	11.72
	26.950-27.300	27	25	12.84
	29.800-30.000	29	10	14.83

Table 7 Protection distances for radio services operating under radio licences in frequencies below 30 MHz

Fixed and mobile (e.g. aeronautical, maritime and government fixed and land mobile services)

These services are spread across the frequency range 0.205-30 MHz.

In terms of quantity, this category comprises 75% of radio licences with systems operating in frequencies below 30 MHz. The bandwidths of these systems are mostly 2.8 kHz with some radio licences in frequencies below 1 MHz having a bandwidth as low as 100 Hz.

According to our calculations, the required protection distances are on average around 20 metres. Considering the intended receive antenna location of these services would be at airports, coast stations or hilltop radio transmission sites, we consider that inductive loop systems that are designed for use within domestic households would easily meet this separation distance.

Amateur

The amateur radio operators are permitted to operate at various amateur bands in the frequency range 0.13-30 MHz, either through General User Radio Licence or an individual radio licence. It is noted that some amateur bands below 30 MHz permitted under General User Radio Licence are subject to shared use, where amateur operators would expect to accept interference from other services (including Industrial, Scientific and Medical applications and short range devices) within those frequency ranges.

Three amateur bands were selected for this study, namely 472-479 kHz, 7 MHz (amateur 40-metre band) and 14 MHz (amateur 20-metre band). The required protection distances rounded to the nearest integer are 21 metres, 22 metres and 17 metres, respectively.

We consider that inductive loop systems that are designed for use within domestic households would either meet these separation distances, or are not generating additional levels of interference than what would already be experienced by amateur usages below 30 MHz in the presence of other short range devices currently complying with the unwanted emission limit in Table 2 of the Radio Standards Notice.

Radio beacons (e.g. non-directional beacon, maritime buoys)

Non-directional beacons operate in the frequency range 0.205-0.415 MHz. The receivers of these beacons can be found on-board small aircraft and recreational aircraft, which are less likely to be equipped with advanced global navigational-satellite systems.

Maritime buoys that could be used to mark hazards or special landmarks near coastal areas operate in the frequency range 1.616-2 MHz. A more advanced and accurate version of such use (e.g. Automated Identification Systems) would operate in higher frequencies within the VHF band. The receivers of these beacons can be found on-board ship or vessel.

Our calculations show that the required protection distances would be around 21 metres for non-directional beacons and 26 metres for maritime buoys. Since the intended receive antenna location of these beacons are mounted outside an aircraft or a ship, we consider that inductive loop systems that are designed for use within domestic households would easily meet this separation distance.

Although it may be possible that passengers may use an inductive loop system while on-board an aircraft (or a ship), we expect the fuselage of this aircraft (or body of this ship) would attenuate the signals to the extent where interference is not likely to occur, even with a separation distance less than our calculations.

Distress, safety and calling channels

A number of international distress, safety and calling channels, such as 2.182 MHz, 4.125 MHz, 6.215 MHz, 8.291 MHz, 12.290 MHz and 16.420 MHz, are monitored around-the-clock by the Rescue Coordination Centre of New Zealand (RCCNZ). The receive antennas are mounted on a remote location site in the middle of the North Island.

Our calculation shows that the required protection distance at a nominal 8.291 MHz would be around 20 metres. We expect channels with frequencies below 8.291 MHz would require slightly larger distances than 20 metres, whereas frequencies above 8.291 MHz would require slightly smaller distances than 20 metres. Nevertheless, we consider that inductive loop systems that are designed for use within domestic households would easily meet these separation distances.

Other services (e.g. paging, telemetry and telecommand)

A number of channel plans in the frequency ranges within 26-30 MHz are designated for radio paging, telemetry and telecommand use. A portion of these channel plans are also subject to shared use with applications such as citizen band radio and short range devices.

Our calculation shows that the required protection distances rounded to the nearest integer would be around 12 to 15 metres. We consider that inductive loop systems that are designed for use within domestic households are not generating additional levels of interference than

what would already be experienced by these services in the presence of short range devices currently complying with unwanted emission limit in Table 2 of the Radio Standards Notice.

Q7.	***Do you agree with the results of technical compatibility between inductive loop systems and radio licences in frequencies below 30 MHz? If not, what other assessments should the Ministry consider?***

5 Coexistence study between inductive loop systems and spectrum licences in AM Band 0.521-1.612 MHz

5.1 Analysis

An AM spectrum licence typically records a MPIS at 36 dBμV/m over 20 kHz occupied bandwidth at multiple points signifying the receive protection locations. In comparison, the electric field strength as envisioned for inductive loop systems is 36.5 dBμV/m when measured at 10 metres in a 10 kHz resolution bandwidth, in accordance with ETSI EN 300 330. Therefore, AM licensees' MPIS would be exceeded by 0.5 dB.

Issue A - Exceedance of 0.5 dB in the MPIS of AM licences

In New Zealand, the derivation of a MPIS at 36 dBμV/m (for day-time operation) is based on a co-channel protection ratio of 30 dB from the day-time minimum usable field strength at 66 dBμV/m. This 30 dB co-channel protection ratio is a conservative planning parameter adopted back in 1975[8]. A lower protection ratio of 26 dB subsequently adopted by other countries in 1981[9] was considered sufficient. This implies that the MPIS at 36 dBμV/m already accommodates an additional margin to tolerate interference.

Furthermore, it is important to consider that the international standards for radio products are generally set as the minimum performance benchmark. It is often the case that radio products conforming to international standards would usually perform better than the minimal prescribed limit.

Although the limits in ETSI EN 300 330 would exceed the MPIS level stipulated in the spectrum licences by 0.5 dB, the Ministry considers that radio products made to meet ETSI EN 300 330 would very likely meet the MPIS level when measured at 10 metres in practice.

Issue B - Risk of interference when inductive loop systems operates beyond 10 metres of AM receivers

Based on the planning approach in PIB 39, it is assumed that any unwanted emission lower than the MPIS level is not expected to cause interference to AM receivers within the receive protection locations of the respective spectrum licences.

When an inductive loop system is operating a swept carrier, which is a co-channel to the wanted signal of AM receiver at a distance more than 10 metres away, the additional distance in excess of this 10 metres would allow the electric field strength to roll-off by at least 0.5 dB.

[8] Regional Administrative LF/MF Broadcasting Conference (Regions 1 and 3), Geneva, 1975
[9] Regional Administrative MF Broadcasting Conference (Region 2), Rio de Janeiro, 1981

Consequently, the level of unwanted emissions generated by inductive loop systems are expected to be equal or lower than the MPIS at 36 dBµV/m.

Therefore this is a non-issue, as the Ministry considers the likelihood of interference caused by inductive loop systems to AM receivers when operating beyond 10 metres of each other is negligible.

Issue C - Risk of interference when inductive loop systems operates within 10 metres of AM receivers between neighbours' property boundaries

When the inductive loop system is used within 10 metres to an AM receiver, there is a higher likelihood of interference as the separation distance reduces. However, calculating the extent of this risk involves making several assumptions.

The non-linear characteristic of electromagnetic fields in a near-field environment means that it is quite difficult to accurately derive power levels, or magnetic and electric field strengths in a closer proximity (less than 10 metres). We can only assume that the field strength increases as the interfering inductive loop system and victim AM receiver get closer together.

In an urban setting, it is possible that an inductive loop system is used in a domestic household where a 10-metre distance would extend to the boundary of the adjacent neighbour(s). We consider that there is only a remote possibility of interference among the two uses. This is because the wall between each dwelling would add an extra barrier to mitigate the interference.

Furthermore, AM coverage in urban centres would usually result in higher wanted field strength than the minimum usable field strength (MUFS) of 66 dBµV/m. This additional field strength could provide a buffer to ensure that an inductive loop system emitting at a level approximately equivalent to MPIS (i.e. 36 dBµV/m or so) would not cause interference to the reception of AM radio at neighbours' property boundaries.

We expect that the above analysis also applies in a suburban/rural context, despite the fact that AM coverage could be weaker in a rural area. This is because the risk of interference with neighbouring users in this context is even more remote given the reduced population density. Since property boundaries are further away in rural areas typically exceeding tens if not hundreds of metres, there is a low likelihood of interference occurring across property boundaries.

Irrespective of urban, suburban or rural environment, we expect that there is a possibility of self-interference when an inductive loop system is used while an AM receiver is also used within the same property. However, the probability of such interference is relatively low considering that several adverse conditions need to be present at the same time:

- an inductive loop system is operating a swept carrier overlapping on the same frequency as the desired AM radio channel being picked up by an AM receiver, noting that AM broadcast band is merely 3% out of the entire possible frequency tuning range of the inductive loop system (in comparison, one AM radio channel is 0.067% of the entire tuning range); and
- the inductive loop system is placed at a distance much shorter than 10 metres of the AM receiver; and
- the property is located on the fringe of AM receive-protection locations where the AM signal for this particular channel is expected at the minimum usable field strength of 66 dBµV/m.

Other considerations

It is important to be reminded that AM receivers are already experiencing increased radio noise from other sources within domestic households. For example:

- an induction cooking appliance, as an unintended radiator, would emit unwanted emission into the AM frequency range (0.521-1.612 MHz) at a level equivalent to magnetic field strength of 20 dBμA/m measured at 3 metres, which is around electric field strength of 71.5 dBμV/m. This level is significantly greater than the MPIS of 36 dBμV/m.
- The presence of other short range devices operating in frequency bands above or below the AM frequency range would likely to generate an unwanted emission limit into the AM frequency range at a level equivalent to electric field strength of 59 dBμV/m measured at 10 metres, as per Table 2 of the Radio Standards Notice, in the absence of an appropriate applicable standard. This level is also higher than the MPIS of 36 dBμV/m.

The inductive loop systems are well within the unwanted emission limit per Table 2 of the Ratio Standards Notice. We consider that the risk of increased interference would be negligible since the inductive loop systems are not generating levels of interference in addition to what would be experienced by AM receivers in the presence of other radio products currently complying with unwanted emission limit in Table 2 of the Radio Standards Notice.

5.2 **Results**

In light of the above analysis, the Ministry proposes that the special condition for permitting the use of inductive loop systems would require inductive loop systems to comply with international standard ETSI EN 300 330 while recommending users to observe 10-metre separation distance when operating in the presence of AM receivers.

We believe this is justified on the basis that:

- Inductive loop systems that comply with ETSI EN 300 330 are technically compatible with AM receivers when they are separated by 10 metres. Additionally, this separation distance could be reduced where walls or other physical obstacles occupy the space between inductive loop systems and AM receivers.
- Operationally, inductive loop systems operating in a carrier that is a co-channel or a channel adjacent to AM receivers would not generate levels of interference in addition to what would already be experienced by these AM receivers in the presence of unintentional radiators like induction cooking appliances and other radio products currently complying with unwanted emission limit in Table 2 of the Radio Standards Notice.
- Practically, the prospect of interference experienced by AM receivers as a result of emission from inductive loop systems is most likely due to self-interference caused by the owner of both pieces of equipment.

Q8.	***Do you agree with the results of technical compatibility between inductive loop systems and spectrum licences in the AM band 0.521-1.612 MHz? If not, what other assessments should the Ministry consider?***

6 Proposals

We propose applying the following changes to GURL SRD:

Proposed modifications to existing provisions within 0.009 - 0.205 MHz				
Low (MHz)	**High (MHz)**	**Reference Frequency (MHz)**	**Maximum Power dBW e.i.r.p.**	**Remarks**
0.0090	0.0900	0.0495	9.0	RETAIN special conditions 1 and 25 ADD special condition *New_1*
0.0900	0.2050	0.1475	–20.0	
0.1190	0.1350	0.1270	3.0	
Proposed new provision for 0.1485 - 30 MHz				
Low (MHz)	**High (MHz)**	**Reference Frequency (MHz)**	**Maximum Power dBW e.i.r.p.**	**Remarks**
0.1485	30.0000	14.92575	–56.0	ADD special conditions *New_2 and New_3*

Special Conditions:

1. Use is limited to determination, telemetry or telecommand.

25. In the band 0.009- 0.090 MHz, the magnetic field strength from devices must not exceed 72 dBµA/m at a distance of 10 metres. In the band 0.090-0.205 MHz, the magnetic field strength from devices must not exceed 43 dBµA/m at a distance of 10 metres, except in the band 0.119-0.135 MHz, where the magnetic field strength from devices must not exceed 66 dBµA/m at a distance of 10 metres. In the band 0.3150-0.430 MHz, the magnetic field strength from devices must not exceed –5 dBµA/m at a distance of 10 metres.

New_1 Transmissions are permitted for wireless power transfer systems.

New_2 Transmissions are permitted for inductive loop systems.

New_3 In the band 0.1485-30.000 MHz, the magnetic field strength from devices must not exceed –15 dBµA/m measured in a 10 kHz bandwidth at a distance of 10 metres. User is also encouraged not to operate these devices within 10 metres of an AM radio intended for the reception of AM radio broadcasts, wherever practicable.

Table 8 Proposed modifications to GURL SRD

In conjunction with the proposed changes to GURL SRD, we also propose to add the two international standards ETSI EN 303 417 (V1.1.1) and ETSI EN 300 330 (V2.1.1) as the applicable standards for WPT and inductive loop systems in an updated version of Radio Standards Notice.

Q9. Do you agree with the proposed changes to GURL SRD and Radio Standards Notice?

Q10. Do you have any other comments?